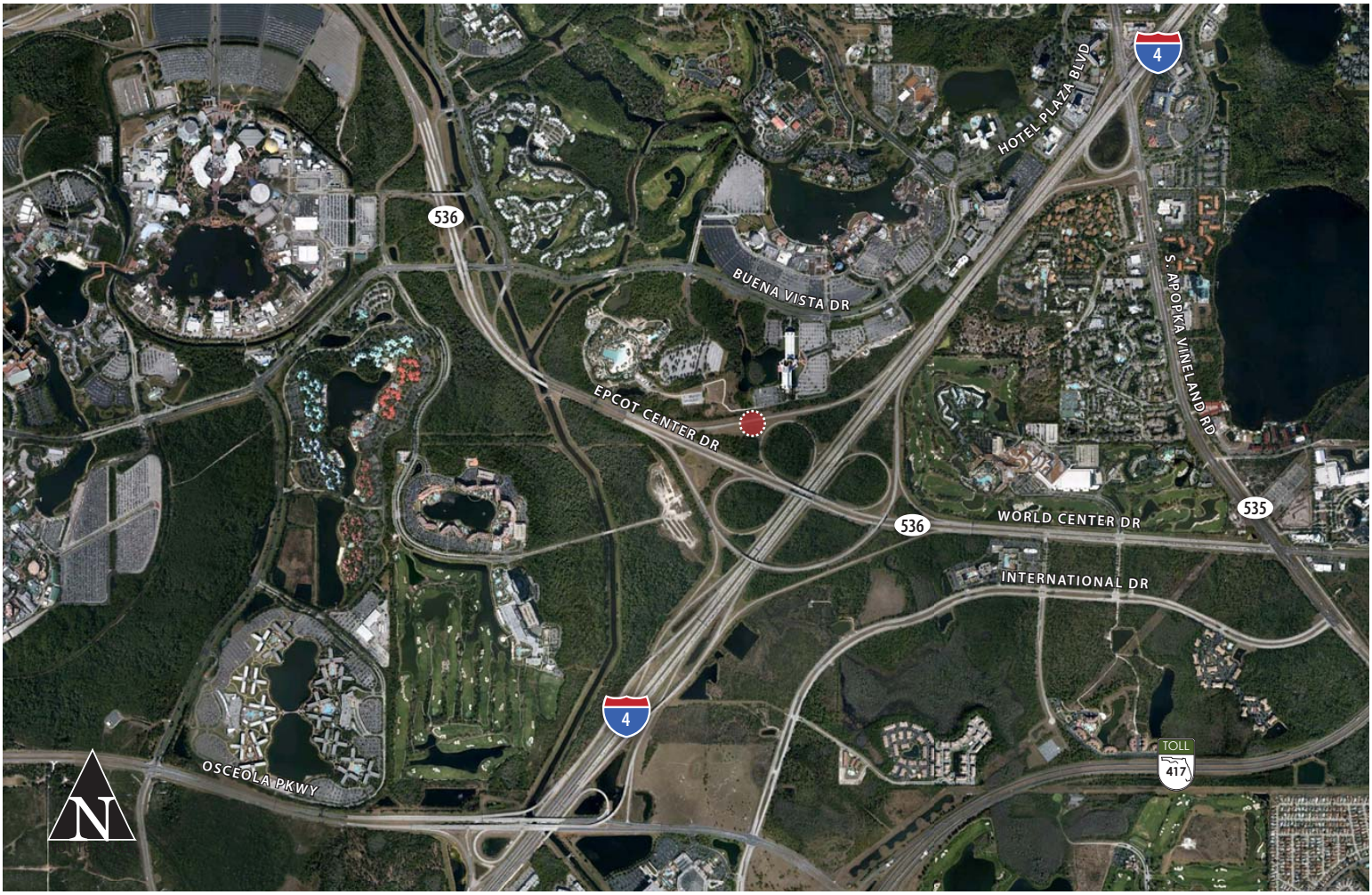




Interstate 4 and SR 536 Off-Ramp

Draft Interchange Modification Report

AUGUST 2014

Prepared for: FDOT

Table of Contents

1.0 Executive Summary vi
2.0 Introduction 1
2.1 General Background 1
2.2 Purpose and Need 1
2.3 Project Location 2
2.4 Project Description 2
2.5 Area of Influence 3
3.0 Methodology 7
3.1 Overview 7
3.2 Analysis Years 7
3.3 Data Collection 7
3.4 Traffic Forecasts 7
3.5 Traffic Operations Analysis 7
4.0 Existing Conditions 8
4.1 Existing Land Use 8
4.2 Existing Roadway Network 8
4.3 Existing Public Transit System 8
4.4 Adjacent Interchanges 8
4.5 Operational Analysis 8
4.5.1 Basic Freeway Segment Analysis 10
4.5.2 Ramp Merge/Diverge Analysis 10
4.5.3 Weave Segment Analysis 11
4.5.4 Intersection Analysis 11
4.5.5 Queuing Analysis 13
4.6 Crash Analysis 15
4.7 Existing Conditions Summary 21
5.0 Future Traffic 22
5.1 Future Transportation Network 22
5.1.1 FHWA Approved Concepts in Analysis Year 2020 and 2030 22
5.1.2 Parking Structures and Transit Improvements 23

Table of Contents (continued)

5.2 No Build Traffic Forecasts 23
5.2.1 Peak Hour Traffic Development 30
5.3 Traffic Diversion due to Proposed Ramp Spur 35
5.3.1 Inbound Traffic 35
5.3.2 Outbound Traffic 35
5.4 Build Traffic Forecasts 36
6.0 Alternative Analysis 40
6.1 Description of Alternatives 40
6.1.1 No Build Alternative 40
6.1.2 TSM Alternative 40
6.1.3 Alternative Travel Modes 41
6.1.4 Build Alternative 41
6.2 Operational Analysis 41
6.2.1 Basic Freeway Segment Analysis 43
6.2.2 Ramp Merge/Diverge Analysis 44
6.2.3 Weave Segment Analysis 44
6.2.4 Intersection Analysis 45
6.2.5 Queuing Analysis 53
6.3 Proposed Ramp Spur - Microsimulation Analyses 59
6.3.1 Existing Year (2011) VISSIM Model Development: 59
6.3.2 Year 2030 No Build and Build VISSIM Models: 59
6.3.3 Year 2030 No Build and Build Operating Conditions: 60
7.0 Conceptual Funding Plan 66
8.0 Consistency with Other Plans/Projects 67
9.0 Environmental Considerations 68
10.0 Conceptual Signage Plan 69
11.0 Conclusion 70
Appendices 71

Appendix A – Approved MLOU

Appendix B – Existing Traffic Data

Appendix C – Existing Conditions Operational Analysis Outputs

Appendix D – FDOT DDHVs and Peak-Period to Peak Hour Approach

Appendix E – Future Conditions Operational Analysis Outputs

Appendix F – RCID Coordination

Appendix G – Environmental Analysis Supporting Documentation

Appendix H – Conceptual Signage Plan

List of Figures

Figure ES-1 | Proposed SR 536 Ramp Spur vii
Figure 2-1 | Project Location Map 4
Figure 2-2 | Proposed SR 536 Ramp Spur and On-going Downtown Disney Projects 5
Figure 2-3 | Area of Influence 6
Figure 4-1 | Existing Year (2011) AM & PM Peak Hour Traffic Volumes 9
Figure 4-2 | Existing Year (2011) Level of Service 14
Figure 4-3 | I-4 Mainline Crash Summary (Page 1 of 3) 17
Figure 4-3 | I-4 Mainline Crash Summary (Page 2 of 3) 18
Figure 4-3 | I-4 Mainline Crash Summary (Page 3 of 3) 19
Figure 4-4 | SR 535 and CR 535 Crash Summary 20
Figure 5-1 | Year 2016 No Build AM & PM Peak Period (4 Hour) Forecasts 24
Figure 5-2 | Year 2020 No Build AM & PM Peak Period (4 Hour) Forecasts 25
Figure 5-3 | Year 2030 No Build AM & PM Peak Period (4 Hour) Forecasts 26
Figure 5-4 | Year 2016 Build AM & PM Peak Period (4 Hour) Forecasts 27
Figure 5-5 | Year 2020 Build AM & PM Peak Period (4 Hour) Forecasts 28
Figure 5-6 | Year 2030 Build AM & PM Peak Period (4 Hour) Forecasts 29
Figure 5-7 | Year 2016 No Build AM & PM Peak Hour (1 Hour) Forecasts 32
Figure 5-8 | Year 2020 No Build AM & PM Peak Hour (1 Hour) Forecasts 33
Figure 5-9 | Year 2030 No Build AM & PM Peak Hour (1 Hour) Forecasts 34
Figure 5-10 | Year 2016 Build AM & PM Peak Hour (1 Hour) Forecasts 37
Figure 5-11 | Year 2020 Build AM & PM Peak Hour (1 Hour) Forecasts 38
Figure 5-12 | Year 2030 Build AM & PM Peak Hour (1 Hour) Forecasts 39
Figure 6-1 | Proposed SR 536 Ramp Spur 42
Figure 6-2 | AM 2016 Level of Service 55
Figure 6-3 | AM 2020 Level of Service 56
Figure 6-4 | PM 2016 Level of Service 57
Figure 6-5 | PM 2020 Level of Service 58
Figure 6-6 | No Build Year 2030 AM Density Plot 63
Figure 6-7 | Build Year 2030 AM Density Plot 63
Figure 6-8 | No Build Year 2030 PM Density Plot 64
Figure 6-9 | Build Year 2030 PM Density Plot 64

List of Tables

Table 4-1 | Existing Year (2011) Freeway Operations 10
Table 4-2 | Existing Year (2011) Ramp Operations 10
Table 4-3 | Existing Year (2011) Weave Segments Operations 11
Table 4-4 | Existing Year (2011) Peak Hour Intersection Operations 12
Table 4-5 | Existing Year (2011) Peak Hour Queues 13
Table 4-6 | I-4 Segments Crash Summary (2008 to 2012) 15
Table 4-7 | SR 535 Segments Crash Summary (2008 to 2012) 16
Table 4-8 | CR 535 Segment Crash Summary (2009 to 2011) 16
Table 4-9 | Predominant Crash Type by the Segment 16
Table 5-1 | Peak Spreading Factors for AM and PM Conditions 31
Table 5-2 | Origin-Destination Field Review Summary 35
Table 5-3 | Inbound Diversion in Traffic for Analysis Years 2016, 2020 and 2030 36
Table 6-1 | No Build Alternative Description by Analysis Year 40
Table 6-2 | Year 2016 Freeway Operations 43
Table 6-3 | Year 2020 Freeway Operations 43
Table 6-4 | Year 2016 Ramp Operations 44
Table 6-5 | Year 2020 Ramp Operations 44
Table 6-6 | Year 2016 and 2020 Weave Segments Operations 45
Table 6-7 | Year 2016 AM Peak Hour Intersection Operations 46
Table 6-8 | Year 2016 PM Peak Hour Intersection Operations 47
Table 6-9 | Year 2020 AM Peak Hour Intersection Operations 48
Table 6-10 | Year 2020 PM Peak Hour Intersection Operations 49
Table 6-11 | Year 2030 AM Peak Hour Intersection Operations 50
Table 6-12 | Year 2030 PM Peak Hour Intersection Operations 51
Table 6-13| Year (2016) Peak Hour Queues 53
Table 6-14 | Year (2020) Peak Hour Queues 53
Table 6-15 | Year (2030) Peak Hour Queues 54
Table 6-16 | Year 2030 Network-wide MOEs 60
Table 6-17 | Year 2030 Proposed Ramp Spur Intersection Node Evaluation 62
Table 6-18 | Year 2030 Proposed Ramp Spur Link Evaluation 65
Table 7-1 | Conceptual Funding Plan 66

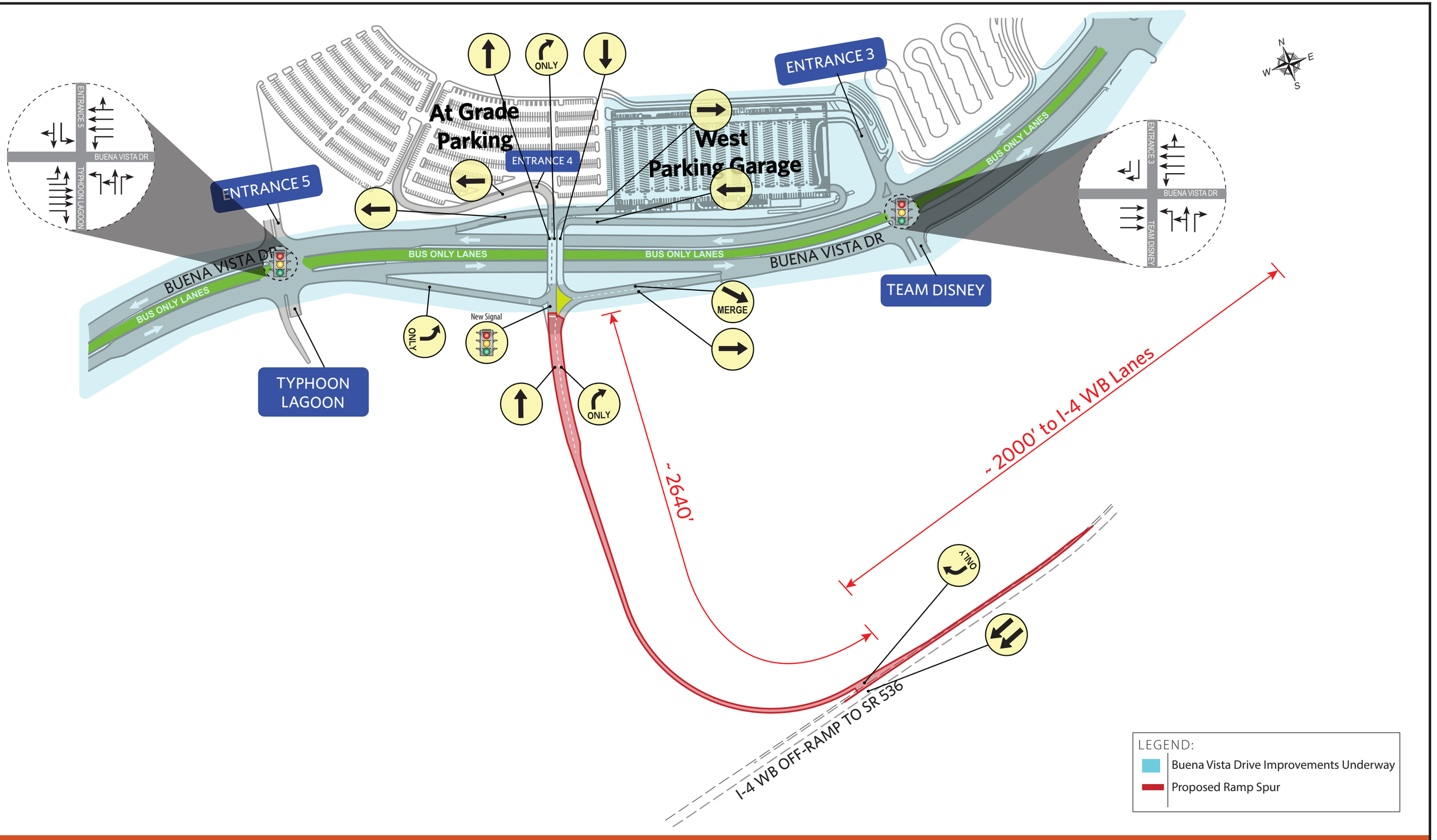
1.0 Executive Summary

The requestor, Florida Department of Transportation (FDOT) District Five, is seeking Federal Highway Administration (FHWA) approval of the Interchange Modification Report (IMR) for the proposed ramp spur from the I-4 westbound off-ramp to northbound SR 536. The purpose of this IMR is to provide required the technical documentation needed to obtain FHWA approval.

According to Forbes Magazine, Orlando is ranked as the most visited city in United States of America. Walt Disney World Resort forms the backbone for Orlando's tourism industry. Located in the heart of Walt Disney World Resort, Downtown Disney is a 120-acre entertainment, dining and shopping complex. Downtown Disney, located along Buena Vista Drive, is open to the public, requires no admission fee and offers complimentary parking and transportation to/from all Disney-operated Walt Disney World resorts. Currently, Downtown Disney is in the process of a multi-year transformation that will create Disney Springs. Disney Springs proposes to feature more than 150 shopping, dining and entertainment venues. The Reedy Creek Improvement District (RCID) is the governing jurisdiction for the Walt Disney World Resort.

Westbound I-4 traffic can exit at the SR 535 or SR 536 interchanges to access the Buena Vista Drive commercial area including Downtown Disney. Much of the westbound traffic uses the I-4/SR 535 interchange as it is as it is the first one encountered for traffic coming westbound on I-4. This is reinforced by Global Positioning Systems (GPS) traffic routing which shows this as the first option. The I-4/SR 535 interchange is located east of the I-4/SR 536 interchange. SR 535 is a constrained facility operating at or near capacity. The congestion at SR 535 ramp terminals can potentially cause traffic to back up onto I-4, negatively impacting other interchanges along I-4. Due to both current congestion levels and the proposed further development of Downtown Disney (Disney Springs), user travel times will continue to increase for the area's residents, visitors, and employees. RCID is proposing direct access to the Buena Vista Drive corridor and Downtown Disney via a spur from the existing I-4 westbound off-ramp at SR 536. By allowing direct access to Buena Vista Drive and Downtown Disney, the proposed improvement will reduce travel times for the area's residents, visitors, and employees throughout the network and those destined for Downtown Disney.

The proposed spur is a single lane ramp (approximately 0.5 miles in length) that diverges from the existing westbound SR 536 off-ramp approximately 2000 feet west of the westbound I-4 mainline ramp gore, and terminates at Buena Vista Drive near the existing intersection of Buena Vista Drive and Downtown Disney's West Side (Entrance 4). The existing at-grade intersection at Buena Vista Drive is currently being replaced by a grade-separated intersection by the RCID. This ramp terminal intersection will provide direct access to a new west parking garage, existing at-grade parking as well as Buena Vista Drive. This west parking garage is one of two new proposed garages and is currently under construction. The second parking garage, located to the east of Entrance 4, will have approximately 2100 spaces while the west parking garage will have approximately 4200 spaces. Traffic on the ramp intersection is controlled by a signal with a two phase operations. The proposed ramp spur is shown in detail in **Figure ES-1**.


ENTRANCE 5
BUENA VISTA DR
TYPHOON LAGOON
ENTRANCE 4
At Grade Parking
West Parking Garage
ENTRANCE 3
BUS ONLY LANES
BUENA VISTA DR
TEAM DISNEY
ONLY
MERGE
New Signal
TYPHOON LAGOON
~ 2640'
~ 2000' to I-4 WB Lanes
I-4 WB OFF-RAMP TO SR 536
N
S
E
W
LEGEND:
Buena Vista Drive Improvements Underway
Proposed Ramp Spur

The methodology applied for the IMR is documented in the Methodology Letter of Understanding (MLOU). The MLOU outlines the criteria, assumptions, processes, analyses and documentation requirements for the project. The MLOU was prepared in accordance with the FDOT's Interchange Handbook and related standards. During the MLOU coordination meeting with FHWA on April 11, 2014, it was agreed to expand the area of influence to include the SR 536 and SR 535 interchanges (including ramp merge/diverge areas and weaving areas) and intersections within 0.5 miles on both sides of interchanges within the area of influence. Considering the off-system circulation network and the proposed modification to the SR 536 off-ramp, it is unnecessary to study the Osceola Pkwy interchange immediately downstream from SR 536. The proposed modification to the SR 536 off-ramp has no impact on travel patterns or volumes at I-4/Osceola Parkway interchange. The MLOU was approved by FHWA on April 30, 2014. The spur from the SR 536 westbound off-ramp is expected to open to traffic in 2016. Therefore, it was decided during the MLOU coordination meeting to perform analyses for the years 2016, 2020 and 2030 for both No-Build (without ramp) and Build (with ramp) alternatives. The Central Florida Regional Planning Model (CFRPM) version 5.01 was used to develop traffic projections within the area of influence, as it is still the latest approved model for District Five. The unique characteristics of the western segment of the I-4 SAMR re-evaluation project, including the area of influence of this project, required special attention in the development of traffic projections. This is due to the presence of attractions such as Disney World (including its four parks and Downtown Disney), Sea World, and Universal Studios in the vicinity. Therefore, Directional Design Hourly Volumes (DDHVs) were developed for the extended peak period hours, consistent with western segment of I-4 SAMR re-evaluation.

A detailed operational analysis was performed for both No-Build (without ramp) and Build (with ramp) alternatives for all analysis years for both AM and PM peak periods. The No Build alternative includes the existing transportation network and any funded, planned or programmed improvements open to traffic in each analysis year. For the 2016 opening year, the No Build transportation network includes the Buena Vista Drive improvements that are currently underway. For the 2020 and 2030 analysis years, the No Build transportation network includes the 2026 no-build improvements, which are consistent with the I-4 Beyond the Ultimate (BtU) PD&E Study Update (FM# 432100-1). A detailed operational analysis was conducted using the latest version of HCS and Synchro software which utilize the latest version of the Highway Capacity Manual (HCM) 2010 Methodology for the analysis years 2016 and 2020. A Sub Area VISSIM model consisting of the I-4/SR 535 and I-4/SR 536 interchanges and Buena Vista Drive was constructed and validated to 2011 existing conditions per FHWA guidelines. A 2030 VISSIM Sub Area model was developed with the aforementioned network assumptions for the year 2030 for evaluation of future operations. Calibration parameters from the existing conditions VISSIM models were carried forward to the 2030 models (both AM and PM). Consistent with the MLOU, a safety analysis was conducted using existing crash data for I-4 in the study area for the past three years. A queue analysis for the proposed ramp and westbound SR 535 off-ramp was performed for both Build and No Build alternatives to ensure there is no backup onto I-4.

The primary purpose of the proposed ramp spur is to provide a more direct and safe access to the Buena Vista Drive Corridor with Downtown Disney as the major traffic generator. The direct access should

reduce vehicle travel times within the entire network and for vehicles destined for Downtown Disney. This will enable for Downtown Disney to continue to grow and keep being an important economic generator. The ramp spur will also help to reduce congestion that currently exists on SR 535 and at the SR 535 and I-4 westbound ramp area. The purpose of this report is to provide the required documentation for obtaining Federal Highway Administration (FHWA) approval to modify the I-4/SR 536 interchange. The RCID has agreed to fund all phases of the improvement, including design and construction.

The following summary demonstrates that the Interstate and SR 536 IMR study meets the eight (8) FHWA requirements for approval of new or modified access to the Interstate highway system as published in August 2009.

FHWA 8 INTERSTATE ACCESS POLICY CONSIDERATIONS AND REQUIREMENTS FOR INTERSTATE 4 AND SR 536 IMR.

1. **The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands (23 CFR 625.2(a)).**

   Response:

   The need for the project cannot be adequately addressed by improvements to other existing interchanges and/or local streets. The No Build alternative maximized the improvements to adjacent interchanges and local improvements and it still did not adequately meet the need of the proposed improvement. The primary need being addressed by the project is to provide a safer more direct access to a major commercial area, Buena Vista Drive, including Downtown Disney (which is experiencing growth as it turns into Disney Springs). This will meet the mobility needs for the general public and support continued economic growth in the area. The project provides shorter travel times for vehicles destined for Downtown Disney and for all vehicles in the peak period (all while allowing more vehicles in the network to reach their destinations). It also does not significantly impact operations anywhere in the Interstate System.

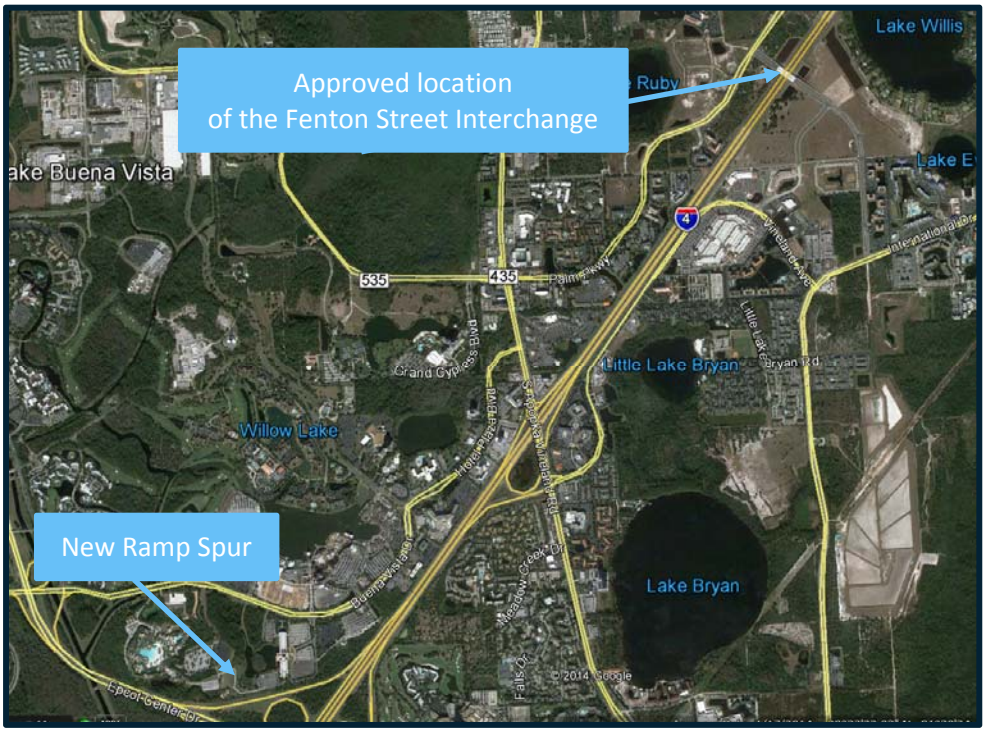
   The RCID Buena Vista Drive widening project, a local street improvement to accommodate anticipated growth for the Disney Springs which began in May 2014, includes a number of operational improvements within the area of influence, including the widening of Buena Vista Drive from six to eight lanes with dedicated bus lanes. The proposed ramp spur connects to the Buena Vista Drive improvements replacing the at-grade intersection at Downtown Disney Entrance Four to further improve operations. The proposed improvement is a part of a comprehensive and coordinated effort to improve traffic circulation and safety in the area.

Every reasonable improvement in the area of Buena Vista Drive is being completed including pedestrian bridges and dedicated bus lanes. There are no other local street improvements programmed within the area of influence with the exception of FDOT resurfacing improvements listed in Section 5.1. The proposed ramp spur is the only way to provide a more direct connection to the high traffic-generating destinations along the Buena Vista Drive Corridor and at Downtown Disney.

Other corridors and intersections in the area are already constrained and operating near capacity conditions, such as SR 535 and the westbound I-4 off ramp to SR 535. The I-4/SR 535 interchange provides access to Walt Disney World including Downtown Disney and is located east of the I-4/SR 536 interchange. SR 535 is a constrained facility operating at or near capacity. The operational analysis conducted in this study for SR 535 indicates that the operations of SR 535 and its key intersections with Hotel Plaza Boulevard and the westbound off ramp intersection with SR 535 are improved as a result of the proposed ramp spur. The queuing experienced on the westbound I-4 SR 535 off ramp is also reduced as a result of the proposed ramp spur.

FDOT is currently working on I-4 Beyond the Ultimate (BtU) PD&E study. This BtU study involves the build-out of I-4 to its ultimate condition through Central Florida, including segments in Osceola, Orange, Seminole, and Volusia counties. The concept design proposes the addition of two (2) new express lanes in each direction, resulting in a total of ten (10) lanes and re-evaluates FHWA approved design concepts for all interchanges within the I-4 BtU study area including the SR 535 and the SR 536 interchanges in order to meet future traffic demands. The opening year for the I-4 improvement in the PD&E Study is 2020. As part of the alternative analysis for the SR 535 and SR 536 interchanges at I-4, a collector-distributor system between the two interchanges in the westbound direction will be evaluated. This PD&E Study also includes an FHWA-approved interchange at Fenton Street, located east of SR 535, which will further relieve congestion from the SR 535 interchange from the project opening year 2020.

One of the benefits of the proposed SR 536 off ramp spur is to provide an improvement to the adjacent SR 535 westbound ramp intersection and reduce the potential for backups onto the I-4 mainline via an alternative route for drivers to directly access Buena Vista Drive. Global Positioning Systems (GPS) are most likely to route unfamiliar drivers to use the first access point they encounter. Drivers are reluctant to divert beyond their destination and then backtrack using local streets. The total distance of this trip is approximately 1.4 miles longer by using SR 536 Interchange to access SR 536 and then continue Buena Vista Drive and then route back to Downtown Disney rather than using SR 535 and Hotel Plaza Boulevard to access Downtown Disney. The spur provides a slightly shorter trip than using SR 535 to the anticipated destination. The result is an increase in trip diversion removing those trips from the congested corridor of SR 535 and the pedestrian-oriented corridor along Hotel Plaza Boulevard.



2. **The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23 CFR 625.2(a)).**

   Response:

   RCID's Transportation Systems Management (TSM) projects along Buena Vista Drive with are currently underway. This project includes a number of operational improvements, including widening Buena Vista Drive from six to eight lanes, including two dedicated bus lanes. The existing at-grade intersection at Buena Vista Drive and Downtown Disney's West Side is currently being reconstructed as a grade-separated intersection by RCID, which the proposed ramp spur will tie into. The widening project also includes several projects outside the area of influence. The signalized intersection at Buena Vista Drive and SunTrust will be eliminated with right-in/right-out access only. Pedestrian bridges will be built at the Buena Hotel Plaza Blvd and Team Disney intersections.

   These TSM projects alone do not provide adequate relief to the operational issues along Buena Vista Drive, SR 535 and I-4 in the influence area of the SR 535 Interchange. FDOT's intent is that this improvement, along with the ongoing I-4 BtU Study, will provide an ultimate solution for the entire area of influence. The proposed ramp spur is expected to provide an improvement for SR 535 and contribute to the overall ultimate I-4 Improvement and provide more direct access to traffic generators along the Buena Vista Drive corridor.

3. **An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that [[Page 43745]] the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).**

   Response:

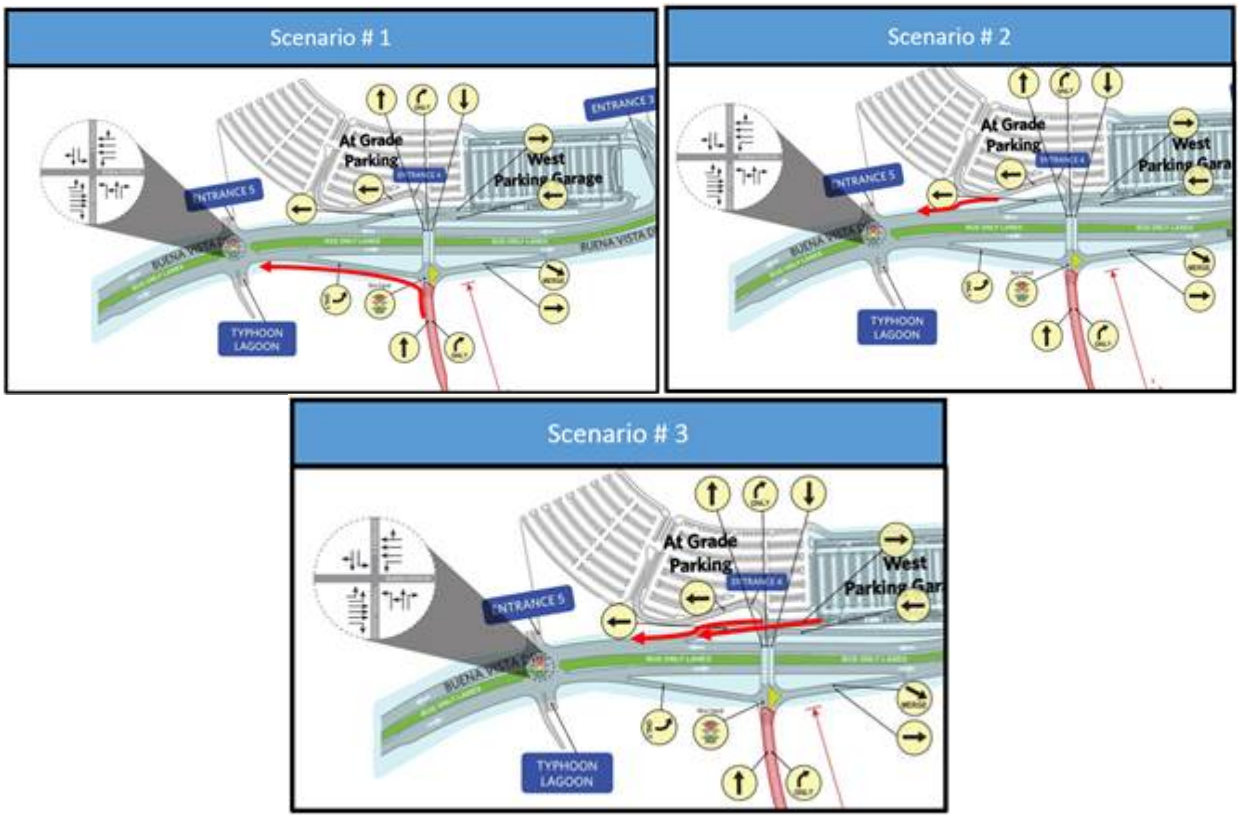
   This IMR for the proposed improvements includes traffic analyses for the Existing Year (2011), Opening Year (2016), Interim Year (2020) and Design Year (2030) conditions. The future year analyses were conducted for both the No Build and Build conditions. Analyses were conducted for the mainline freeway segments, ramp junctions (merges and diverges) and intersections at the ramp terminals and crossroads within the area of influence. Based on the operational analysis conducted for this study, the proposed improvement will not compromise the operations of the Interstate system and will not have an adverse impact on the operation of the interstate and ramp merge diverge operations. The increase in westbound traffic volume between the SR 535 and SR 536 interchanges due to the diversion is slight and will not result in a LOS letter grade change for the freeway peak hour operations for all the analysis years. The intersections of SR 535 with the I-4 westbound off-ramp and SR 535 and Hotel Plaza Boulevard will operate better in the Build scenario compared to No Build. Additionally, queue analysis indicates that the traffic diversion due to the proposed ramp will reduce the queue for the southwest (westbound) right turn movement at the I-4 westbound off-ramp at SR 535 in the Opening Year 2016. Based on the supporting documentation addressing potential environmental and social impacts, there are no substantive issues that would preclude the construction of the interchange modification at SR 536.

4. **The proposed access connects to a public road only and will provide for all traffic movements. Less than ``full interchanges'' may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride**

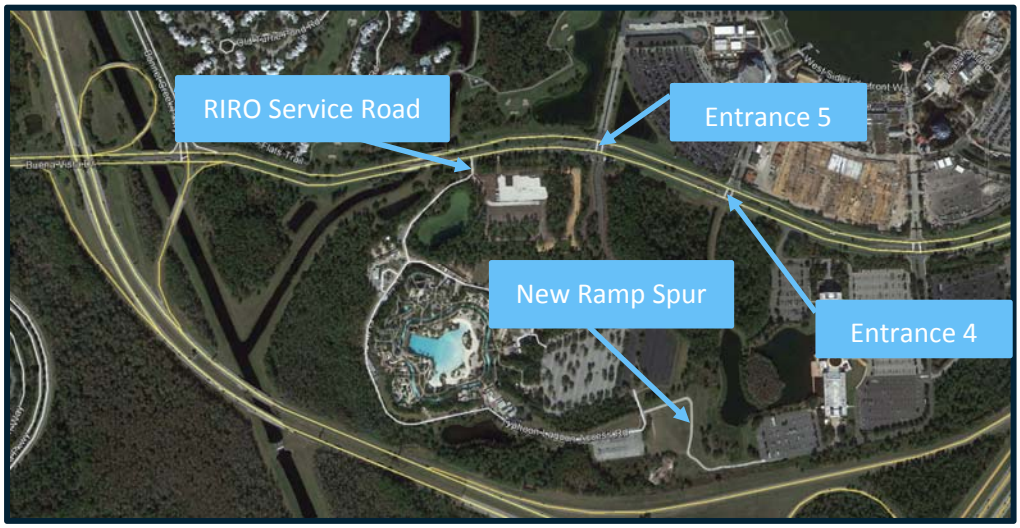
lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)).

Response:

The proposed modification seeks to add a connection to northbound Buena Vista Drive. Access to the southbound direction was also considered, but determined to lack functional significance. Alternative configurations shown below were considered. Each required either an additional phase or pushed additional traffic through the signal at Entrance 5, degrading the level of service of the intersection. Scenario 1 was determined to be unfeasible due to the potential for wrong way drivers. Of the remaining scenarios, neither provides access to Typhoon Lagoon due to the lack of weaving distance to enter the left turn lane.



Without access to Typhoon Lagoon, drivers are directed back to the intersection with SR 536, as there are no other alternative destinations west of Entrance 5. Drivers would take a longer trip and pass through an additional signalized intersection to arrive at their destination in the best case. The connection would degrade the function of the signal at Entrance 5 without providing any benefit to the public.



The proposed modification to the existing I-4/SR 536 interchange offers a new choice to drivers, pulling trips from the I-4/SR 535 westbound off-ramp. The proposed ramp terminal intersection shown in **Figure ES-1** forms a grade separated partial interchange configuration with Buena Vista Drive, where drivers can only go north to the parking garages or to Buena Vista Drive in eastbound direction. The following points summarize concerns related to the partial configuration at the ramp terminal intersection.

- Wrong way driving: Safety concerns, such as wrong way driving that are sometimes associated with one-way ramps, are being mitigated for this ramp by connecting it to a divided roadway and through the use of a barrier wall to separate two-way traffic. The design standards comply with Green Book recommendations for preventing wrong way driving.
- Return movement: Extensive trailblazing signage is provided to get drivers back to the interstate as efficiently as possible. Driver confusion will not be a significant obstacle. The Buena Vista Drive widening project is designed to expedite the peak traffic volumes exiting the Downtown Disney as well as the bus traffic serving Downtown Disney.
- Buena Vista Blvd westbound access need: The only entity that might need Buena Vista Blvd westbound access via the proposed ramp spur is Disney's Typhoon Lagoon Water Park, located south of Entrance 5. Currently, the SR 536/Lake Buena Vista Drive intersection provides access to Typhoon Lagoon. Due to design constraints and potential weaving issues, access to westbound Buena Vista Drive is not being provided.

5. **The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan**

Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.

Response:

FDOT coordinated with MetroPlan Orlando and RCID regarding planning consistency. The ordinance/resolution for amending the 5 Year Schedule of Capital Improvements to update all current projects including the I-4 ramp is included in **Appendix F**. The amendment maintaining operational mobility is consistent with the regional Long Range Transportation Plan (LRTP) goals. After RCID adoption, this improvement was adopted into RCID's Capital Improvement Program and Transportation Plan. It is also is currently included in MetroPlan Orlando's Transportation Improvement Project (TIP) under Locally Funded Highway Projects. The MetroPlan Orlando region is currently guided by the 2030 LRTP, and work on the long range plan for the year 2040 is under way. MetroPlan Orlando LRTP amendment (2030 LRTP Amendment July 11, 2012) includes the I-4 Beyond the Ultimate PD&E study (FM# 432100-1). MetroPlan Orlando believes that the ramp modification is consistent with the adopted LRTP as it improves routing along I-4.

6. **In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111).**

   Response:

   No new interchanges are included in the long term plan for the I-4 corridor within the area of influence. Hence, a comprehensive corridor or network study is not necessary. The proposed interchange at Fenton Street, located east of SR 535, is planned and accounted for in the analysis.

7. **When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).**

   Response:

   The RCID land use assumptions were coordinated with FDOT.

8. **The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).**

   Response:

   Environmental issues for the proposed improvement were investigated in a separate study through the I-4 BtU PD&E study. The supporting documentation for the environmental coordination is provided in **Appendix G**. **Appendix G** consists of a copy of Historical Resource concurrence letter dated January 2, 1992 and the conceptual environmental resource permits that were renewed in 2012 by the United States Army Corps of Engineers (USACOE). In addition, a final approval for the proposed ramp impacts from USACOE dated April 30, 2014 is included in **Appendix G**. USACOE coordination indicates that this project will have minimal environmental impacts. FDOT District Five has also reviewed the environmental impact of the proposed improvement, consistent with the PD&E manual and the Partnership Agreement. Accordingly, District Five has determined the class of action as a programmatic categorical exclusion consistent with the established FHWA delegation authority to the Department.

2.0 Introduction

2.1 General Background

Florida Department of Transportation (FDOT) District Five is the Requestor for this Interchange Modification Report (IMR).

According to the Forbes Magazine, Orlando is ranked as the most visited city in United States of America. Walt Disney World Resort forms the backbone for Orlando's tourism industry. Located in the heart of Walt Disney World Resort, Downtown Disney is a 120-acre entertainment, dining and shopping complex. Downtown Disney, which is located along Buena Vista Drive, is open to the public, requires no admission fee, and offers complimentary parking and transportation to all Disney-operated Walt Disney World resorts. Currently, Downtown Disney is in the process of a multi-year transformation into Disney Springs. Disney Springs proposes to feature more than 150 shopping, dining and entertainment venues. The Reedy Creek Improvement District (RCID) is the governing jurisdiction for the Walt Disney World Resort.

Interstate 4 (I-4) is an integral part of Central Florida's transportation system. This Interstate carries the greatest number of people and vehicles of any transportation facility in the region and serves many of the area's primary activity centers. Since its opening in 1965, I-4 has served intrastate and interstate travel by providing a critical link between the east and west coasts of Central Florida. Today, I-4 also serves as the primary link between hotel/motel complexes and tourist attractions such as Walt Disney World including Downtown Disney, Universal Studios, Sea World, and the International Drive resort area. In addition, since I-4 is the only north-south limited access facility that is centrally located between predominant employment centers and major suburbs to the north, it has become the primary commuting corridor in the Central Florida metropolitan area.

FDOT District Five is conducting a re-evaluation of the Systems Access Modification Report (SAMR) for two sections of I-4. Section A is west of the I-4 Ultimate initial operating segment and Section B is east of the I-4 Ultimate initial operating segment. The limits of the initial operating segment for the I-4 Ultimate Project is from west of Kirkman Road to east of SR 434. The limits of Section A are from US 27 in Polk County to west of Kirkman Road in Orange County. The limits of Section B are from SR 434 in Seminole County to SR 472 in Volusia County. The purpose of the I-4 SAMR Re-evaluation is to ensure that the improvements to the I-4 corridor can safely and efficiently meet the long-term multi-modal transportation needs of the region.

2.2 Purpose and Need

The purpose of this project is to provide an alternate and more direct route into Walt Disney World's Downtown Disney and Disney Springs resort area that reduces congestion on the existing interchanges and routes that feed into the area.

Central Florida and the Walt Disney World Resort is in the process of continuing economic growth. Excessive traffic congestion and overly circuitous routing will limit future development. The I-4

interchanges at SR 535 and SR 536 provide access to Walt Disney World including Downtown Disney. Currently, a significant amount of the of the westbound I-4 traffic destined for Downtown Disney, which is a major traffic generator, uses SR 535 and then Hotel Plaza Boulevard to access Downtown Disney. For many tourists who are unfamiliar with the area, this is the route recommended by GPS units and other navigational devices. SR 535 is a constrained facility operating at or near capacity, and Hotel Plaza Boulevard is a pedestrian-oriented gateway to the Walt Disney World Resort. Traffic using this new route via the SR 536 ramp spur helps to reduce the volumes on SR 535 and Hotel Plaza Blvd, and assist with keeping Hotel Plaza Blvd pedestrian-oriented.

The proposed ramp spur will not only provides a more direct route alternative to help reduce congestion that currently exists on SR 535 at the SR 535 Interchange; the proposed ramp spur is expected 1) to reduce congestion by diverting some of the existing background traffic from SR 535 and 2) to divert (and consequently reduce congestion) new traffic generated by Disney Springs that would have used SR 535 in the absence of the proposed spur from the SR 536 westbound off-ramp. The primary purpose of this improvement is to reduce overall network congestion and enable traffic to more directly, safely and efficiently reach its destinations.

The proposed ramp spur is to meet the following needs:

- Meet the mobility requirements for the general public and area development.
- Provide a shorter more direct route to the major traffic generator of Downtown Disney.
- Help to reduce congestion on SR 535 and queues at the I-4 westbound off ramp and SR 535 intersection.
- Reduce overall network travel times and the delays per vehicle being served in the network.
- Serve more vehicles in the network, enabling more vehicles to arrive at their destinations within the peak periods.
- Be consistent and supportive of the Buena Vista Drive Improvements that are underway by the RCID.
- Achieve the above needs through a cost feasible plan.

The purpose of this report is to provide the required documentation for obtaining Federal Highway Administration (FHWA) approval to modify the I-4/SR 536 interchange. The proposed ramp spur also provides a shorter trip than using SR 535 to the anticipated destination resulting in travel time savings for the drivers.

2.3 Project Location

The I-4/SR 536 interchange is located on I-4 in Orange County, Florida between the SR 535 interchange to the north (Roadway Section #75280000, milepost 68.107) and the Osceola Parkway interchange to the south (milepost 65.32). The proposed ramp spur from the I-4 westbound off-ramp at SR 536 is shown in **Figure 2-1**.

2.4 Project Description

The proposed ramp spur is a single lane ramp (approximately 0.5 miles in length) that begins diverging from the existing westbound SR 536 off-ramp approximately 2000 feet west of the westbound I-4 mainline ramp gore and terminates at Buena Vista Drive near the existing intersection with Buena Vista

Drive and Downtown Disney West Side (entrance 4). Existing at-grade intersection at entrance 4 will be removed and replaced by a grade separated intersection providing direct access to two parking areas: a new west parking garage and an existing at-grade parking lot. Additionally, a channelized right turn from the ramp terminal intersection will provide access to the Buena Vista Drive and also to the new east parking garage. The west parking garage is one of two new garages that are currently under construction and will have approximately 4200 spaces, in addition to 1400 parking spaces for the existing at-grade parking. The new east parking garage, located to the east of Entrance 4, will have approximately 2100 spaces. Traffic at the ramp terminal intersection is controlled by a signal with a two phase operation. This signal is equipped with Intelligent Transportation System (ITS) to efficiently guide visitors to the appropriate parking garages. The proposed ramp spur and Downtown Disney project which is currently underway are shown in **Figure 2-2**.

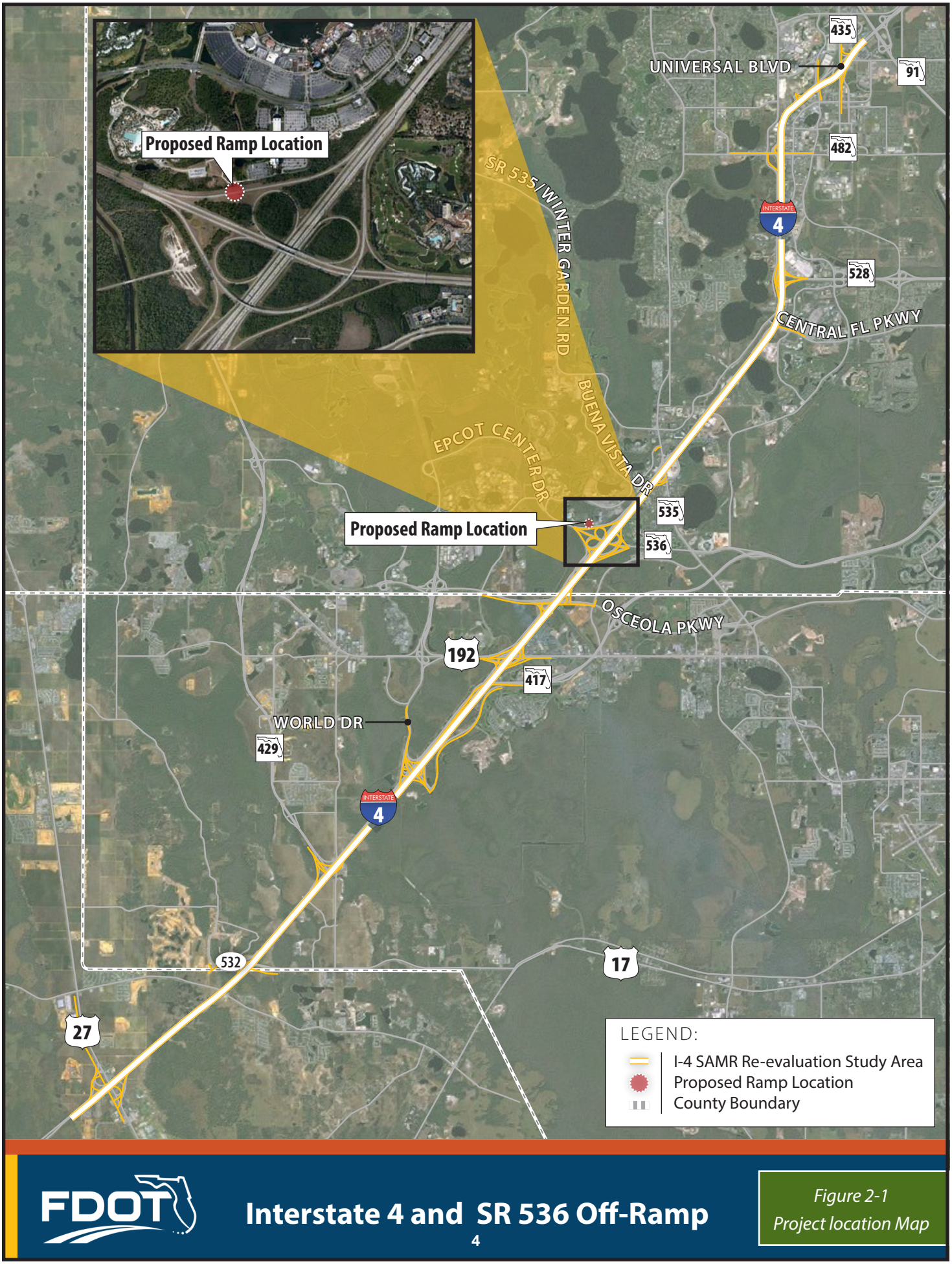
2.5 Area of Influence

The area of influence of the proposed interchange modification, as illustrated in **Figure 2-3**, is consistent with the signed Methodology Letter of Understanding (MLOU). The area of influence consists of the following interchanges (including ramp merge/diverge and weaving areas):

- I-4 and SR 536
- I-4 and SR 535

The intersections within the area of influence are listed below:

- SR 535 at Palm Parkway
- SR 535 at Hotel Plaza Boulevard
- SR 535 at I-4 Westbound
- SR 535 at I-4 Eastbound
- SR 535 at Meadow Creek Drive
- Buena Vista Drive at Typhoon Lagoon
- Buena Vista Drive at Downtown Disney's West Side (proposed grade separation)
- Buena Vista Drive at Team Disney/AMC Theaters



FDOT

Interstate 4 and SR 536 Off-Ramp

Figure 2-1
Project location Map

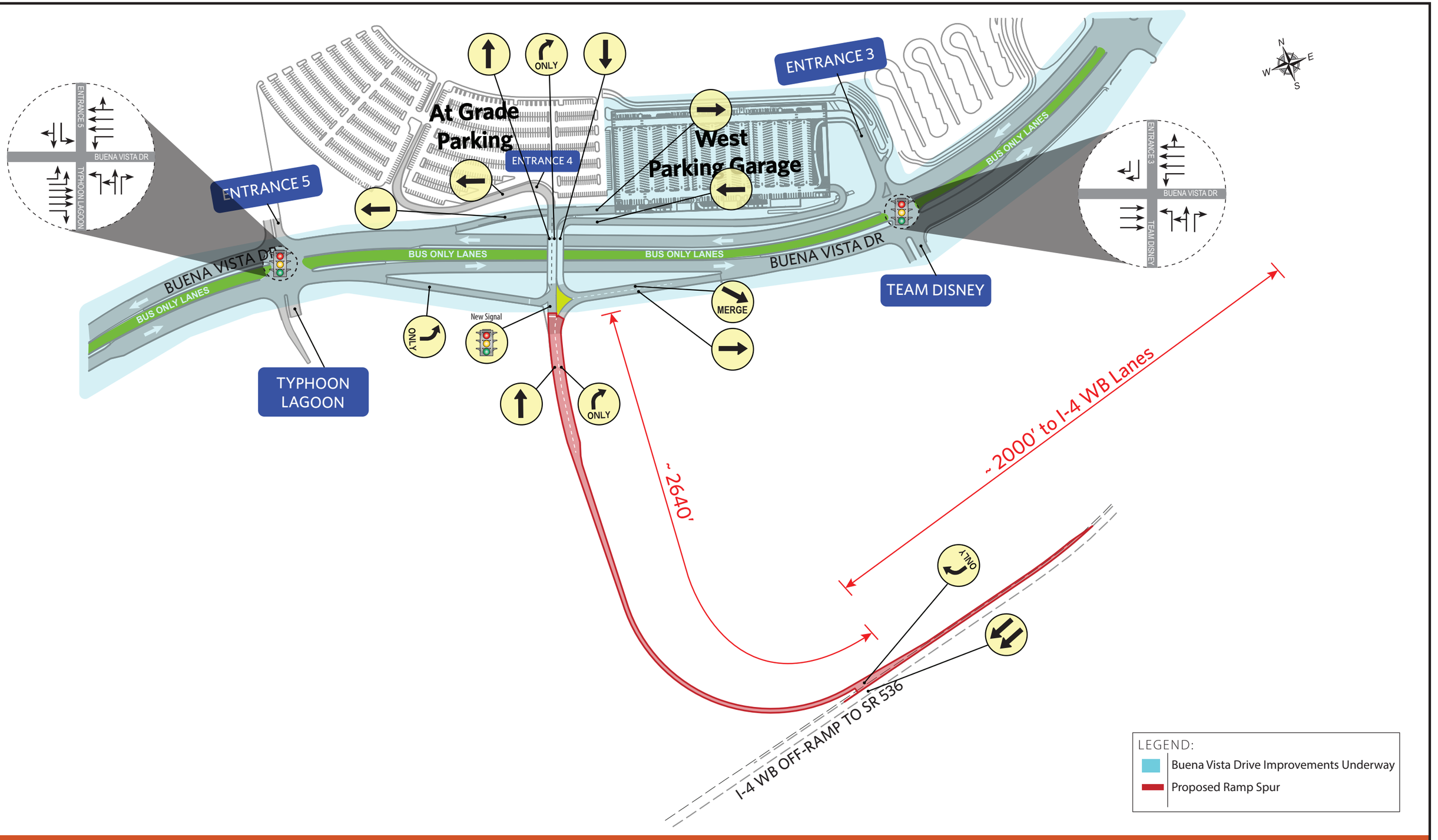
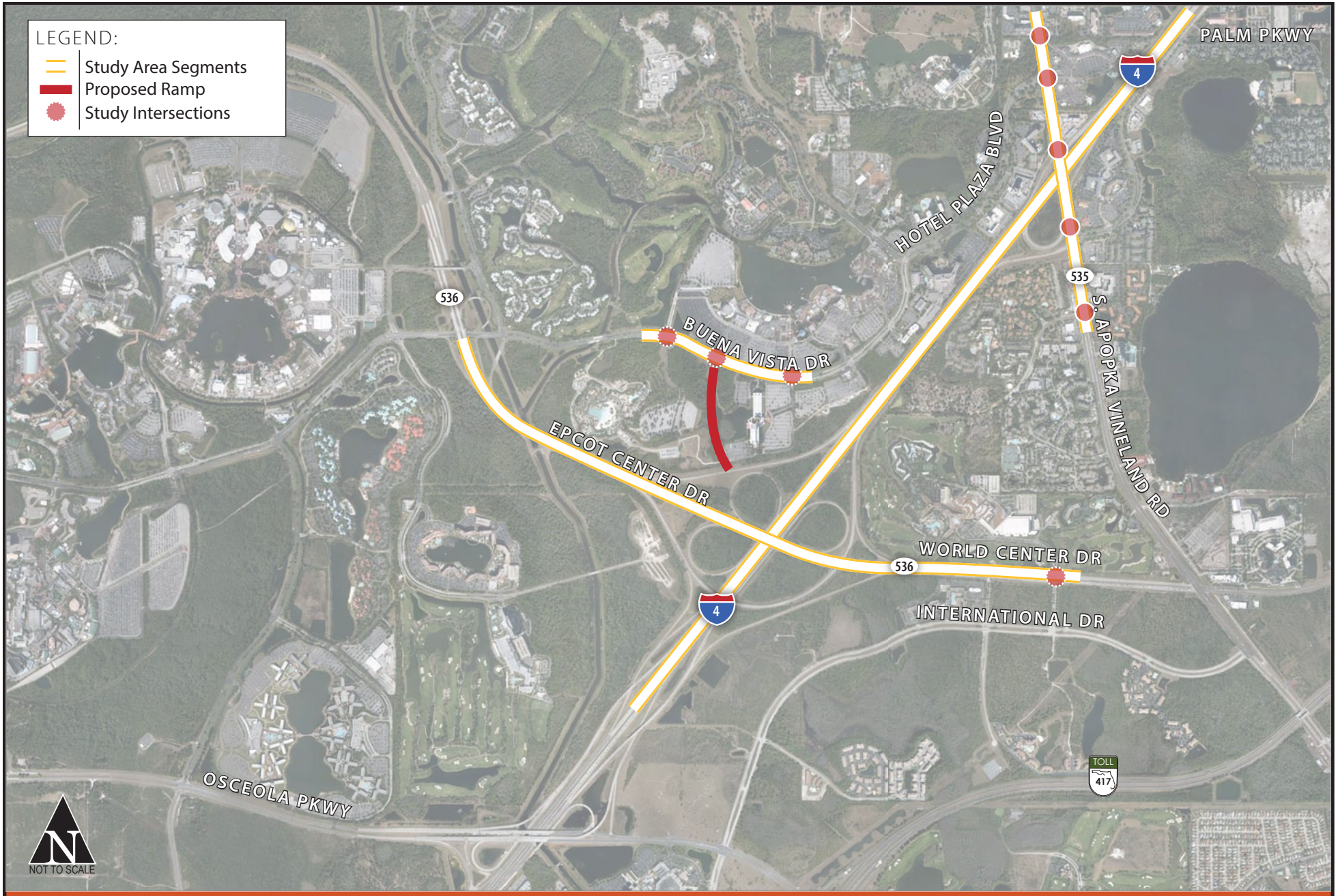


Figure 2-2
Proposed SR 536 Ramp Spur and On-going Downtown Disney Projects



Interstate 4 and SR 536 Off-Ramp

Figure 2-3
Area of Influence

3.0 Methodology

3.1 Overview

The methodology for this IMR has been developed in accordance with the FDOT Policy No. 000-525-015-g: Approval of New or Modified Access to Limited Access facilities, FDOT Procedure No. 525-030-160-h: 2013 Interchange Access Request Users Guide, and the 2014 FDOT Traffic Forecasting Handbook. The methodology was formalized through meetings and correspondence with the FDOT and FHWA. A copy of the approved MLOU is attached in **Appendix A.**

3.2 Analysis Years

The analysis years to be used in this study include the following: Existing Year – 2011, Opening Year – 2016, Interim Year – 2020 and Design Year – 2030 as agreed upon in the MLOU.

3.3 Data Collection

Existing traffic data including turning movement counts, speed, and signal timing were obtained for 2011 from various sources including FDOT, RCID, Orange County, Osceola County and other agencies, in addition to field collected data. Freeway and ramp volumes were obtained from the 2011 Florida Traffic Information (FTI) DVD. The signal timing plans for signalized intersections were obtained from Orange County, Osceola County, and RCID. Raw traffic count data is included in **Appendix B**.

3.4 Traffic Forecasts

The traffic forecasts for the analysis years 2016, 2020 and 2030 were obtained from FDOT and are included in **Appendix D**.

3.5 Traffic Operations Analysis

Traffic operations analyses were conducted for the analysis years using the existing volumes and future traffic projections in the Opening Year (2016), Interim Year (2020) and Design Year (2030) for the No Build (without ramp spur) and Build (without ramp spur) conditions. All analyses were conducted using the procedures outlined in the 2010 Highway Capacity Manual (HCM) and microsimulation analysis as documented in the MLOU. Operational analyses were performed for both AM and PM peak periods. Opening Year (2016) and Interim Year (2020) Operational Analyses (Basic Freeway Analysis, Freeway Weaving Analysis, Ramp Merge and Diverge Analysis, Queuing Analysis and Intersection Analysis) were performed using the latest version of the HCS and Synchro software. For the Design Year (2030), a comprehensive microscopic simulation model was developed for the study area consisting of SR 536, Buena Vista Drive, Hotel Plaza Boulevard, and SR 535. VISSIM, Version 5.4 was utilized to perform the following analyses:

- Basic Freeway Analysis
- Freeway Weaving Analysis
- Ramp Merge and Diverge Analysis
- Queuing Analysis of the proposed ramp spur
- Intersection Analysis

4.0 Existing Conditions

4.1 Existing Land Use

Existing land uses surrounding the I-4/SR 536 interchange primarily consist of residential, commercial/ entertainment and office properties primarily catering to the tourists.

4.2 Existing Roadway Network

The existing I-4 corridor within the study area is classified as an urban principal interstate and is located in Orange County (north of the Osceola County Line). Within the study area, I-4 is a six-lane divided freeway with auxiliary lanes. The Level of Service (LOS) standard for I-4 is D.

The I-4/SR 535 interchange (located northeast of the I-4/SR 536 interchange) provides access to Walt Disney World including Downtown Disney. Currently, westbound I-4 traffic predominately uses the SR 535 interchange to access Downtown Disney/Disney Springs. SR 535 is a six-lane divided roadway from Palm Parkway/CR 435 to Meadow Creek Drive with five signalized locations along this study segment. The LOS standard for SR 535 is D.

SR 536 is a six-lane divided arterial within the study area except within the interchange ramp limits where it is a four-lane divided roadway. There is one signalized location on the SR 536 study segment at International Avenue. The LOS standard for SR 536 is D.

Buena Vista Drive is a six-lane divided arterial within the study limits. Within the area of influence on Buena Vista Drive, there are three signalized intersections. The LOS standard for Buena Vista Drive is D.

4.3 Existing Public Transit System

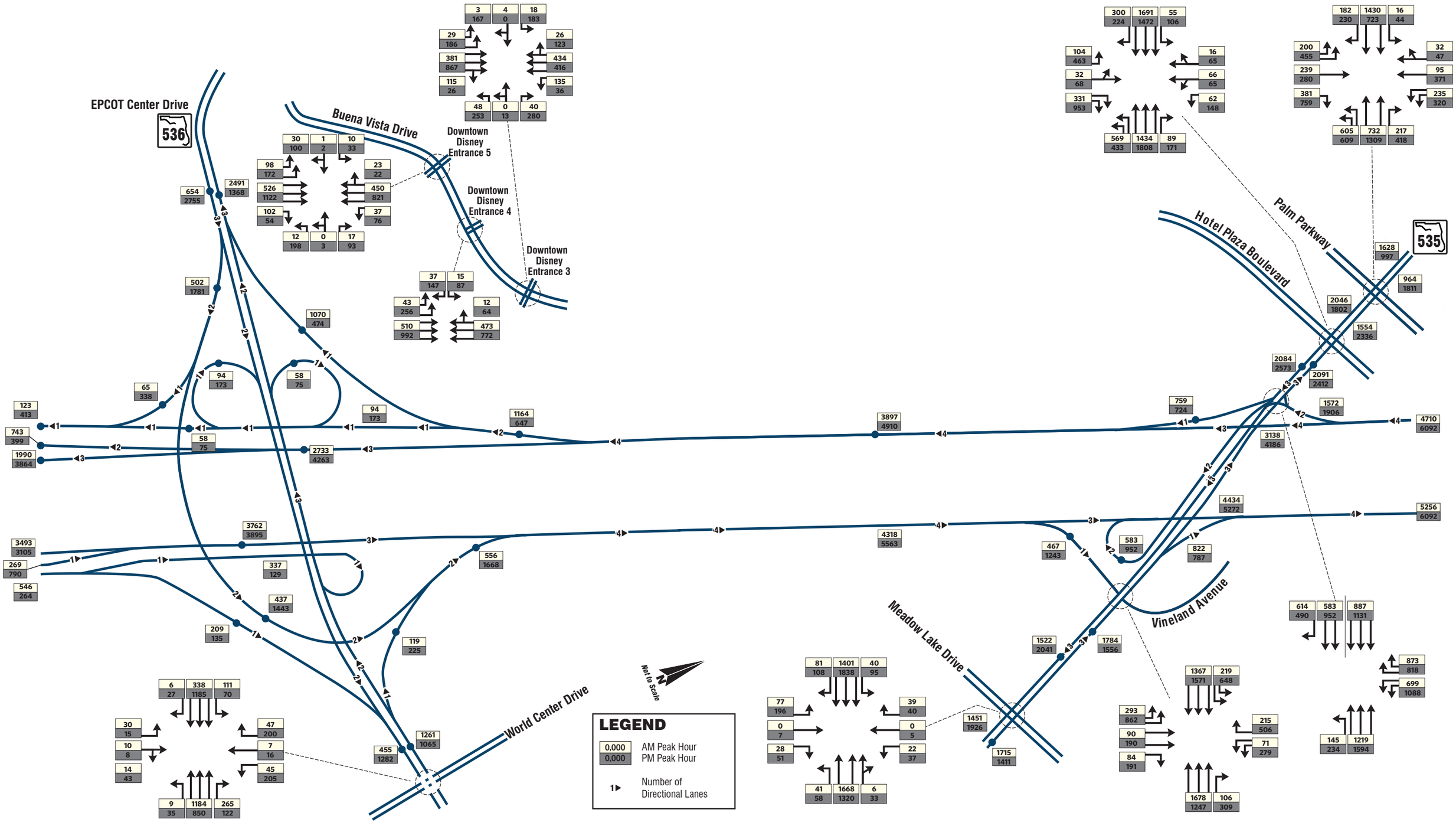
Lynx, Central Florida's Public Transit System, operates several bus routes (50, 300, 301, 302, 303, 304, 305 & 306) along I-4, SR 535, SR 536, Osceola Parkway and Buena Vista Drive within the area of influence. Lynx also has a super stop location at Downtown Disney.

4.4 Adjacent Interchanges

The I-4/SR 535 interchange is a diamond configuration with one loop ramp in the southeast quadrant for SR 535 to eastbound I-4 movements. The SR 536 interchange is a cloverleaf interchange with a direct flyover ramp in the southeast quadrant for eastbound SR 536 to eastbound I-4 movements. No additional interchanges are planned along I-4 within the area of influence.

4.5 Operational Analysis

Existing Year (2011) peak hour traffic data was provided by FDOT for use in the analysis and is included in **Appendix B**, and the peak hour traffic is graphically shown in **Figure 4-1**. Operational analyses were conducted for the mainline freeway segments, ramp junctions, weave segments and intersections within the area of influence. The analysis outputs are included in **Appendix C**.



Interstate 4 and SR 536 Off-Ramp

Figure 4-1
Existing Year (2011) AM & PM Peak Hour Traffic Volumes

4.5.1 Basic Freeway Segment Analysis

The basic freeway segment analysis was conducted using HCS 2010. The results of the freeway segment analysis are summarized in **Table 4-1**.

Table 4-1 | Existing Year (2011) Freeway Operations

ID #	Roadway/Segment		LOS Standard/ Density Threshold	AM Peak Hour		PM Peak Hour	
	From	To		Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
	I-4 Eastbound						
1	Osceola Parkway Off Ramp	SR 536 Off Ramp		24.3	C	19.1	C
2	SR 536 Off Ramp	On Ramp from Osceola Parkway		20.2	C	17.4	B
3	On Ramp from Osceola Parkway	On Ramp from SR 536		22.1	C	22.8	C
4	On Ramp from SR 536	SR 535 Off Ramp		18.4	C	25.0	C
5	SR 535 Off Ramp	On Ramp from SR 535 EB		22.8	C	26.3	D
7	On Ramp from SR 535 EB	On Ramp from SR 535 WB	D /	27.8	D	36.8	E
8	On Ramp from SR 535 WB	Central Florida Parkway Off Ramp	35	23.5	C	28.4	D
	I-4 Westbound		(pc/mi/ln)				
10	On Ramp from Central Florida Parkway	SR 535 Off Ramp		20.4	C	28.6	D
12	SR 535 Off Ramp	On Ramp from SR 535		17.8	B	25.2	C
14	On Ramp from SR 535	SR 536 Off Ramp		16.5	B	21.2	C
15	SR 536 Off Ramp	Osceola Parkway Off Ramp		15.3	B	25.8	C
16	Osceola Parkway Off Ramp	On Ramp from SR 536		11.1	B	22.6	C
18	On Ramp from SR 536	US 192 Off Ramp		8.9	A	18.0	C

Note : All assumptions and calculations can be found in Appendix E

The I-4 segment (ID# 7) between the on-ramp from SR 535 eastbound and the on-Ramp from SR 535 westbound is operating at LOS E in PM peak hour conditions and below adopted LOS D.

4.5.2 Ramp Merge/Diverge Analysis

The ramp merge/diverge analysis was conducted using HCS 2010 and the results are presented in **Table 4-2**.

Table 4-2 | Existing Year (2011) Ramp Operations

ID #	Freeway Ramp	Lane add/drop at Ramp	LOS Standard/ Density Threshold	AM Peak Hour				PM Peak Hour			
				Density	LOS	v/c Ratio **	Under/Over Capacity	Density	LOS	v/c Ratio **	Under/Over Capacity
	I-4 Eastbound										
20	SR 536 Off Ramp	Yes		-	-	0.14	UC	-	-	0.07	UC
21	On Ramp from Osceola Parkway			19.8	B	-	-	22.2	C	-	-
22	On Ramp from SR 536	Yes		-	-	0.13	UC	-	-	0.41	UC
23	SR 535 Off Ramp	Yes		-	-	0.14	UC	-	-	0.62	UC
24	On Ramp from SR 535 WB			15.3	B	-	-	21.4	C	-	-
25	On Ramp from SR 535 EB	Yes	D / 35 (pc/mi/ln)	-	-	0.14	UC	-	-	0.37	UC
	I-4 Westbound										
28	SR 535 Off Ramp	Yes		-	-	0.41	UC	-	-	0.50	UC
29	On Ramp from SR 535	Yes		-	-	0.36	UC	-	-	0.34	UC
30	SR 536 Off Ramp	Yes		-	-	0.31	UC	-	-	0.17	UC
31	Osceola Pkwy Off Ramp			-5.0	A	-	-	3.6	A	-	-
32	On Ramp from SR 536	Yes		-	-	0.06	UC	-	-	0.20	UC

*** LOS calculation not applicable in lane add/drop conditions at Ramps*

As shown in **Table 4-2**, all analysis ramps are operating satisfactorily in existing conditions.

4.5.3 Weave Segment Analysis

The weave analysis was conducted using HCS 2010 and the results are presented in **Table 4-3**.

Table 4-3 | Existing Year (2011) Weave Segments Operations

ID #	Weaving Segment	Time Period	2011 Existing	
			v/c Ratio	LOS
35	I-4 EB from SR 536 on ramp to SR 535 off ramp	AM	0.62	C
36	I-4 WB from SR 535 on ramp to SR 536 off ramp		0.68	C
35	I-4 EB from SR 536 on ramp to SR 535 off ramp	PM	1.50	F
36	I-4 WB from SR 535 on ramp to SR 536 off ramp		0.67	D

The analysis indicates that the I-4 eastbound segment between SR 536 on-ramp and SR 535 off-ramp (ID #35) is operating at LOS F in the PM peak hour.

4.5.4 Intersection Analysis

The intersection analysis for existing conditions was completed using the latest Synchro 8 software and HCM 2010 Methodology. The existing signal timing plans were utilized to perform the intersection analysis. The signal timing plans are included in **Appendix B**. The existing conditions intersection analysis is summarized in **Table 4-4**.

The analysis indicates that the following intersections operate below the adopted LOS Standard D:

- SR 535 and Palm Parkway (ID# 41) operates at LOS F in the AM peak hour
- SR 535 and I-4 Eastbound Ramps (ID# 44) operates at LOS F in the PM peak hour

Table 4-4 | Existing Year (2011) Peak Hour Intersection Operations

ID #	Primary Road	Secondary Road	LOS Standard / Delay Threshold	Approach	2011 AM				2011 PM			
					Approach		Intersection		Approach		Intersection	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
40	SR 536	World Center Dr	D / 55 sec	EB	22.1	C	18.8	B	22.1	C	30.4	C
				NB	63.3	E			85.1	F		
				SB	64.3	E			72.4	E		
				WB	13	B			19.8	B		
41	SR 535	Palm Parkway		EB	54.7	D	95	F	67.3	E	42.2	D
				NB	50.3	D			17	B		
				SB	155.9	F			56	E		
				WB	65.6	E			68.3	E		
42	SR 535	Hotel Plaza		EB	45.9	D	23.3	C	59.9	E	51	D
				NB	25.1	C			51.3	D		
				SB	13	B			38.1	D		
				WB	69	E			84.6	F		
43	SR 535	I-4 West Ramps		NB	28.1	C	31.6	C	37.4	D	42.5	D
				SB	14.1	B			24.3	C		
				SW	50.9	D			67.2	E		
44	SR 535	I-4 East Ramps		EB	71.2	E	28.8	C	226.5	F	126.5	F
				NB	0.7	A			45.7	D		
				SB	14.2	B			33.6	C		
				WB	78.6	E			198.4	F		
45	SR 535	Meadow Creek		EB	47.5	D	13.3	B	80.3	F	33.4	C
				NB	12.1	B			27.7	C		
				SB	11.1	B			30.7	C		
				WB	43.1	D			53.3	D		
46	Buena Vista Drive	Downtown Disney Entrance #3 / Team Disney		EB	27.2	C	25	C	42.8	D	43.2	D
				NB	28.4	C			44	D		
				SB	31.5	C			48.3	D		
				WB	22.4	C			40.2	D		
47	Buena Vista Drive	Downtown Disney Entrance #4		EB	1.1	A	5.8	A	2.4	A	8.9	A
				SB	19.8	B			26.1	C		
				WB	9.6	A			13.9	B		
48	Buena Vista Drive	Downtown Disney Entrance #5 / Typhoon Lagoon		EB	17.9	B	16	B	29	C	31.3	C
				NB	26.1	C			44.5	D		
				SB	27	C			43.6	D		
				WB	12	B			30.1	C		

4.5.5 Queuing Analysis

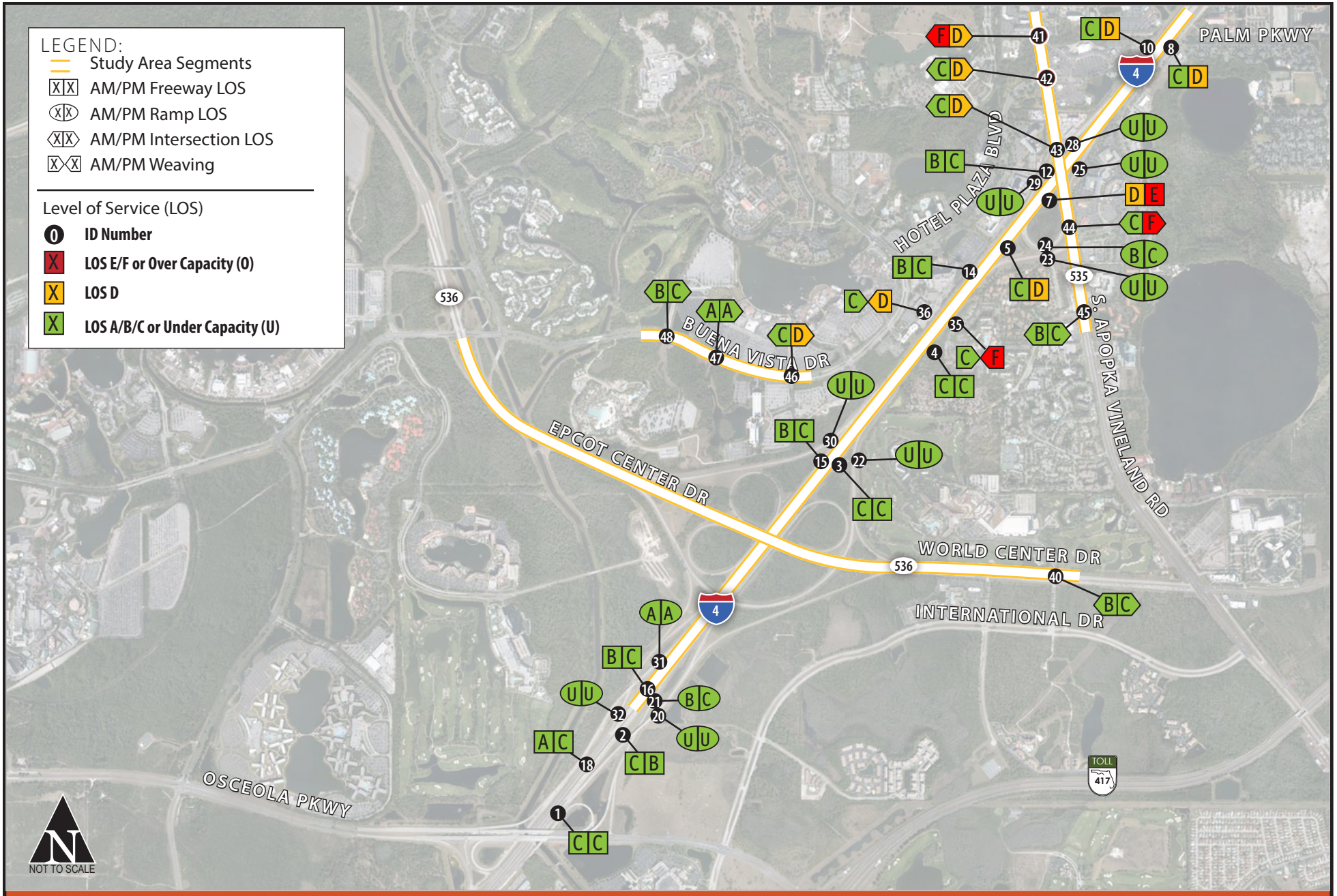
The existing conditions storage analysis was performed for the I-4 westbound ramp at the intersection with SR 535 using Synchro. The analysis is summarized in **Table 4-5**.

Table 4-5 | Existing Year (2011) Peak Hour Queues

	2011 Existing			
Movement	**95th Percentile Queue Length (ft)**	**Required Storage (ft)**	**Available Storage (ft)**	**Queue Exceeds Storage?**
	AM Peak-Hour SR 535 & I-4 West Ramps - Signalized Intersection			
Westbound Left	367	375	650	No
Westbound Right	618	625	1,200	No
	PM Peak-Hour SR 535 & I-4 West Ramps - Signalized Intersection			
Westbound Left	817	825	650	YES
Westbound Right	639	650	1,200	No

The 95th percentile queue was compared with the available storage and the analysis shows that the westbound left turn movement queue exceeds the storage length available in the PM peak hour conditions.

The Existing Year (2011) LOS summary for mainline freeway segments, ramp junctions, weave segments and intersections within the area of influence is shown graphically in **Figure 4-2**.



Interstate 4 and SR 536 Off-Ramp

Figure 4-2
Existing Year (2011)
Level of Service

4.6 Crash Analysis

Crash data for FDOT roadway segments within the area of influence were obtained from FDOT and analyzed during a 5-year period from 2008 through 2012. Crash data for the CR 535 segment, north of SR 535 limits to Hotel Plaza Boulevard was obtained from RCID and analyzed during a 3-year period from 2009 through 2011. The crash rate is calculated from the total number of crashes in a year, daily traffic volume and the length of segment under study. The expression for crash rate is as follows:

Actual Crash Rate = (Number of crashes per year x 1,000,000) / (ADT x 365 x segment length)

The crash rate was calculated from the above expression for the I-4, SR 535, and/CR 535 study segments and is summarized in **Tables 4-6, 4-7 and 4-8**, respectively.

Table 4-6 | I-4 Segments Crash Summary (2008 to 2012)

Road Name & Direction	From	To	Functional Classification	Number of Lanes	Length (miles)	Average AADT (2008-2012)	Total Number of Crashes (2008-2012)	Average Annual Number of Crashes	Crash Rate (MVMT)	Average District 5 Crash Rate for Similar Facilities (2008-2012)
I-4 EB	Osceola County Line	SR 536	UPA-I	6	1.1	53,000	54	11	**0.517**	0.474
	SR 536	SR 535	UPA-I	6	1.55	83,000	192	52	**1.107**	0.474
	SR 535	Central Florida Parkway	UPA-I	6	2.88	92,000	162	32	**0.331**	0.474
I-4 WB	Central Florida Parkway	SR 535	UPA-I	6	2.88	92,375	236	47	**0.484**	0.474
	SR 535	SR 536	UPA-I	6	1.55	59,000	82	17	**0.509**	0.474
	SR 536	Osecola County Line	UPA-I	6	1.1	59,200	27	5	**0.210**	0.474

As shown in **Table 4-6**, the following I-4 segments exhibit a higher crash rate than the District Five average crash rate for similar facilities:

I-4 Eastbound

- Osceola County Line to SR 536
- SR 536 to SR 535

I-4 Westbound

- Central Florida Parkway to SR 535
- SR 535 to SR 536

Table 4-7 | SR 535 Segments Crash Summary (2008 to 2012)

Road Name & Direction	From	To	Functional Classification	Number of Lanes	Length (miles)	Average AADT (2008-2012)	Total Number of Crashes (2008-2012)	Average Annual Number of Crashes	Crash Rate (MVMT)	Average District 5 Crash Rate for Similar Facilities (2008-2012)
SR 535 NB	Meadow Creek Drive	I-4 WB Ramps	UMA	6	0.64	27,100	188	38	**6.003**	2.225
SR 535 SB	I-4 WB Ramps	Meadow Creek Drive	UMA	6	0.64	27,550	118	24	**3.729**	2.225

As shown in **Table 4-7**, the SR 535 segment between Meadow Creek Drive and I-4 westbound exhibits a higher crash rate than the District Five average crash rate in both northbound and southbound directions.

Table 4-8 | CR 535 Segment Crash Summary (2009 to 2011)

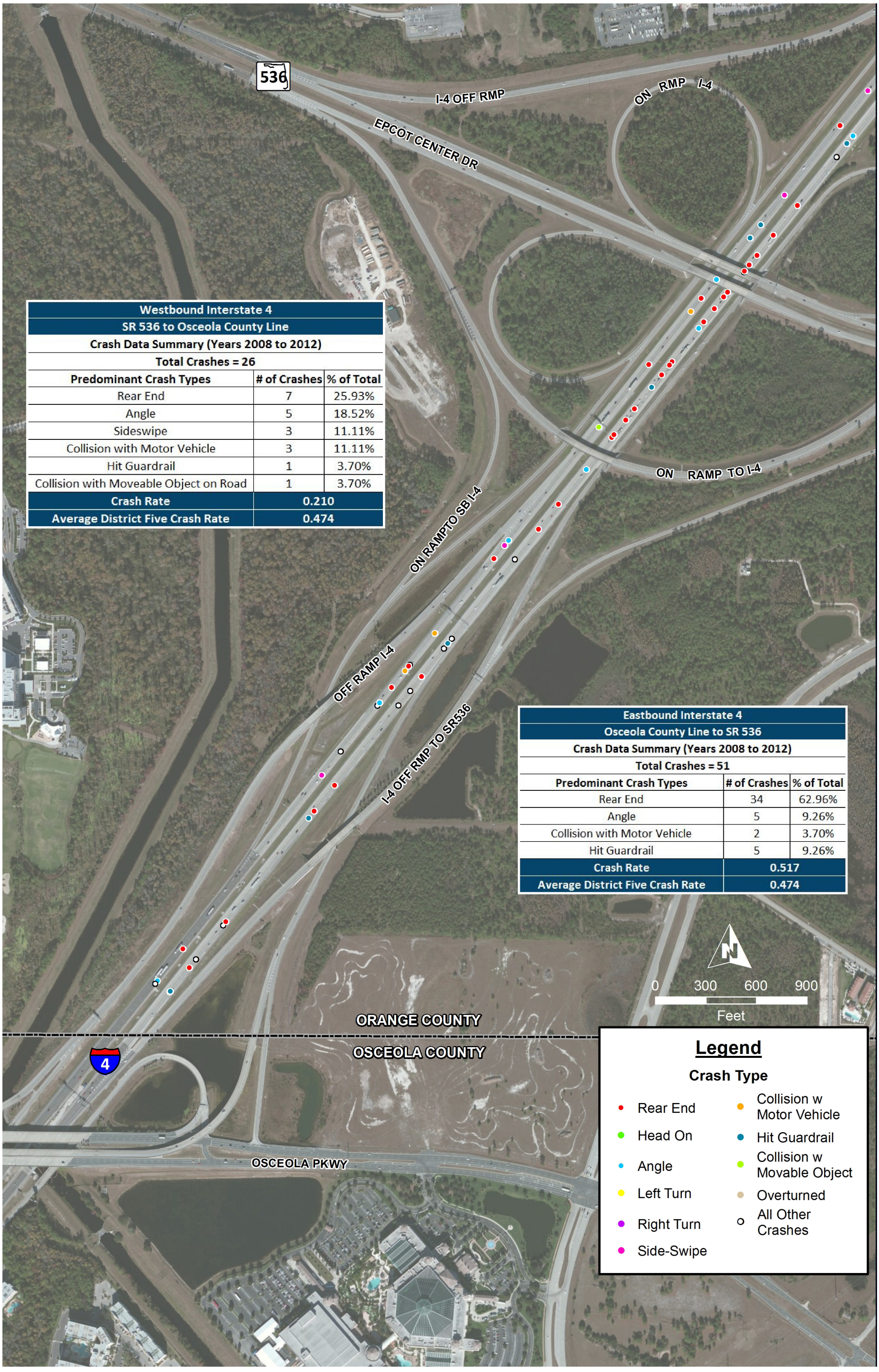
Road Name & Direction	From	To	Functional Classification	Number of Lanes	Length (miles)	Average AADT (2012)	Total Number of Crashes (2009-2011)	Average Annual Number of Crashes	Crash Rate (MVMT)	Average District 5 Crash Rate for Similar Facilities (2009-2011)
CR 535 NB	I-4 WB Ramps	Hotel Plaza Blvd	UMA	6	0.22	32,500	26	9	**3.449**	2.250
CR 535 SB	Hotel Plaza Blvd	I-4 WB Ramps	UMA	6	0.22	32,000	28	9	**3.502**	2.250

As shown in **Table 4-8**, the CR 535 segment between I-4 westbound and Hotel Plaza Boulevard exhibits a higher crash rate than the District Five average crash rate in both northbound and southbound directions.

With the anticipated traffic growth in the area, the number of crashes will likely increase as traffic volumes continue to grow. The crash analysis and crash rates are summarized in **Figures 4-3 and 4-4**. Predominant crash type by the segment reported in **Figures 4-3 and 4-4** is summarized in **Table 4-9**. Table 4-9 indicates that majority of crashes are rear end crashes, indicating congestion in all the study segments. Both crash rate and the predominant crash type for the I-4 westbound segment from SR 535 to SR 536 indicate that the segment is not as congested relative to other I-4 segments.

Table 4-9 | Predominant Crash Type by the Segment

Roadway	Segment	Segment Crash Rate	Average District Five Crash Rate	Predominant Crash Type	% of Total Crashes
Westbound Interstate 4	Central Florida Pkwy to SR 535	0.484	0.474	Rear End	44.07%
Westbound Interstate 4	SR 535 to SR 536	0.509	0.474	Rear End	28.05%
Westbound Interstate 4	SR 536 to Osceola County Line	0.210	0.474	Rear End	25.93%
Eastbound Interstate 4	SR 535 to Central Florida Pkwy	0.331	0.474	Rear End	26.54%
Eastbound Interstate 4	SR 536 to SR 535	0.331	0.474	Rear End	48.44%
Eastbound Interstate 4	Osceola County Line to SR 536	0.517	0.474	Rear End	62.96%
Southbound SR 535	I-4 WB Ramps to Meadow Creek Drive	3.729	2.225	Rear End	32.20%
Northbound SR 535	Meadow Creek Drive to I-4 WB Ramps	6.003	2.225	Rear End	53.72%
Southbound CR 535 (Apopka-Vineland Road)	Hotel Plaza Blvd to I-4 WB Ramps	3.502	2.250	Rear End	32.14%
Northbound CR 535 (Apopka-Vineland Road)	I-4 WB Ramps to Hotel Plaza Blvd	3.449	2.250	Rear End	42.31%



Westbound Interstate 4		
SR 536 to Osceola County Line		
Crash Data Summary (Years 2008 to 2012)		
Total Crashes = 26		
Predominant Crash Types	**# of Crashes**	**% of Total**
Rear End	7	25.93%
Angle	5	18.52%
Sideswipe	3	11.11%
Collision with Motor Vehicle	3	11.11%
Hit Guardrail	1	3.70%
Collision with Moveable Object on Road	1	3.70%
Crash Rate	**0.210**	
Average District Five Crash Rate	**0.474**	

Eastbound Interstate 4		
Osceola County Line to SR 536		
Crash Data Summary (Years 2008 to 2012)		
Total Crashes = 51		
Predominant Crash Types	**# of Crashes**	**% of Total**
Rear End	34	62.96%
Angle	5	9.26%
Collision with Motor Vehicle	2	3.70%
Hit Guardrail	5	9.26%
Crash Rate	**0.517**	
Average District Five Crash Rate	**0.474**	

Legend

Crash Type

- Rear End
- Head On
- Angle
- Left Turn
- Right Turn
- Side-Swipe
- Collision w Motor Vehicle
- Hit Guardrail
- Collision w Movable Object
- Overturned
- All Other Crashes

Interstate 4 and SR 536 Off-Ramp

Figure 4-3
I-4 Mainline Crash Summary (Page 1 of 3)

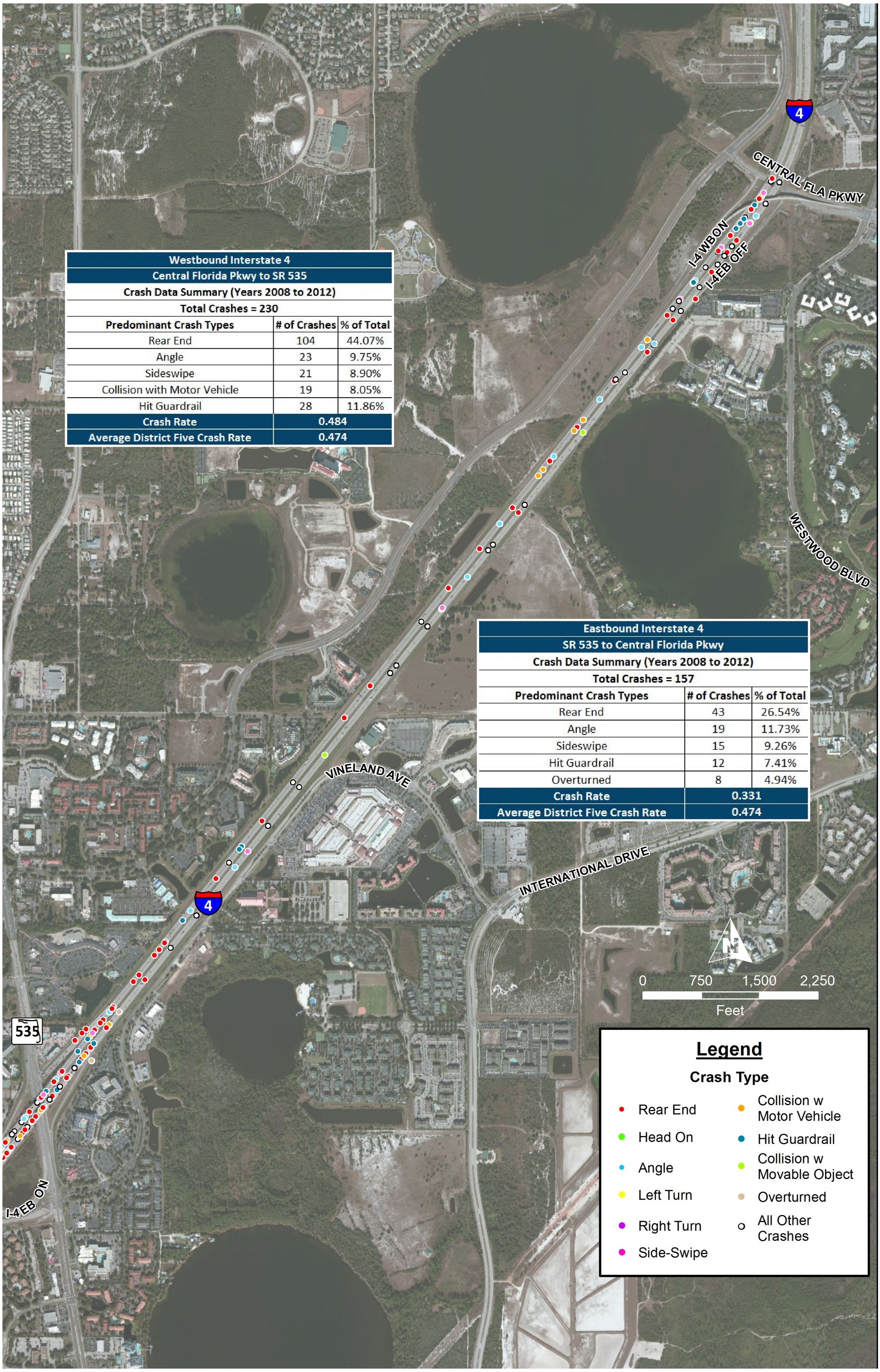


Westbound Interstate 4		
SR 535 to SR 536		
Crash Data Summary (Years 2008 to 2012)		
Total Crashes = 80		
Predominant Crash Types	**# of Crashes**	**% of Total**
Rear End	23	28.05%
Angle	14	17.07%
Sideswipe	7	8.54%
Collision with Motor Vehicle	6	7.32%
Hit Guardrail	7	8.54%
Crash Rate	**0.509**	
Average District Five Crash Rate	**0.474**	

Eastbound Interstate 4		
SR 536 to SR 535		
Crash Data Summary (Years 2008 to 2012)		
Total Crashes = 179		
Predominant Crash Types	**# of Crashes**	**% of Total**
Rear End	93	48.44%
Angle	23	11.98%
Collision with Motor Vehicle	16	8.33%
Hit Guardrail	10	5.21%
Crash Rate	**1.107**	
Average District Five Crash Rate	**0.474**	

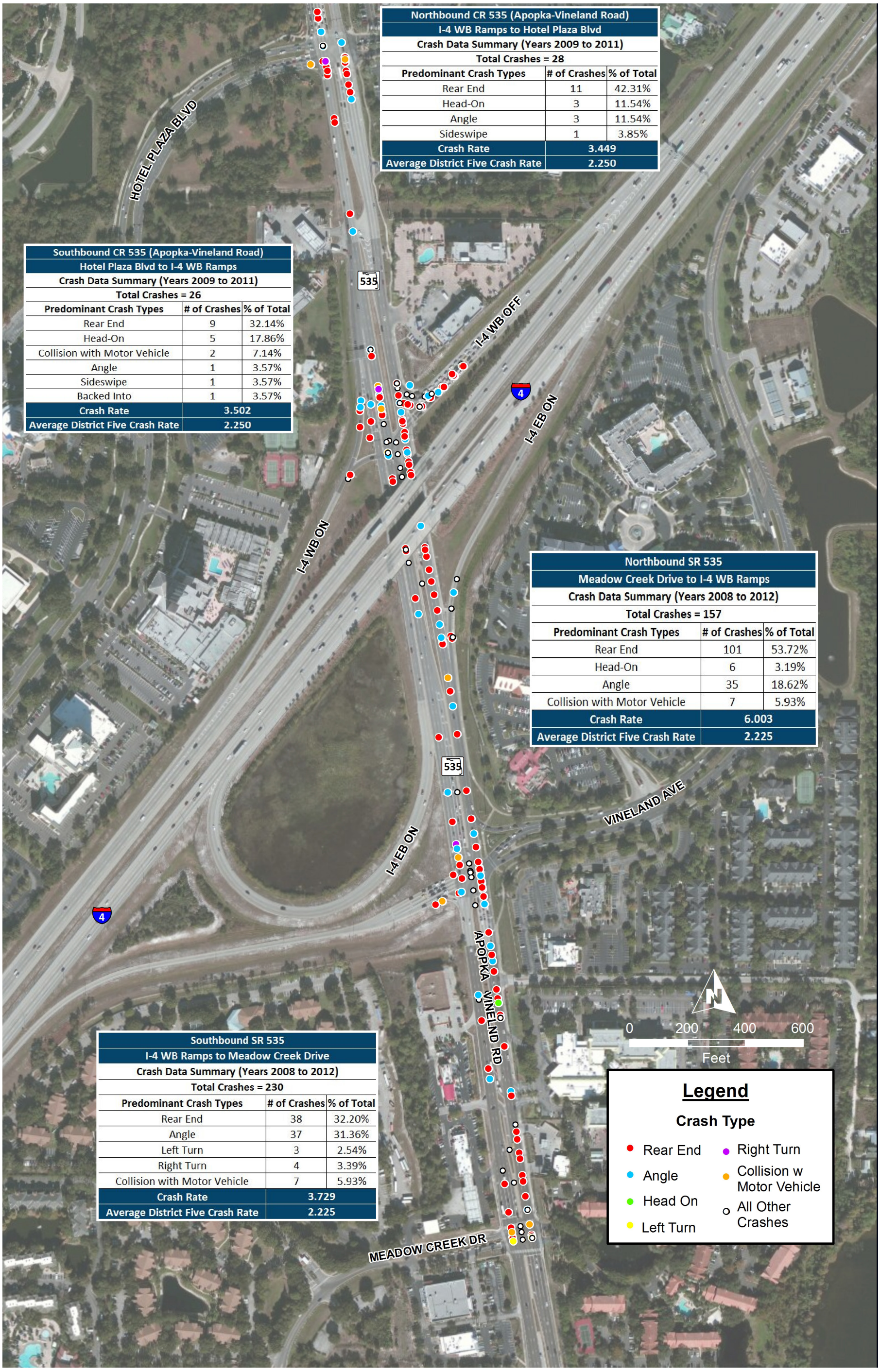
Interstate 4 and SR 536 Off-Ramp

Figure 4-3
I-4 Mainline Crash Summary (Page 2 of 3)



Westbound Interstate 4		
Central Florida Pkwy to SR 535		
Crash Data Summary (Years 2008 to 2012)		
Total Crashes = 230		
Predominant Crash Types	**# of Crashes**	**% of Total**
Rear End	104	44.07%
Angle	23	9.75%
Sideswipe	21	8.90%
Collision with Motor Vehicle	19	8.05%
Hit Guardrail	28	11.86%
Crash Rate	**0.484**	
Average District Five Crash Rate	**0.474**	

Eastbound Interstate 4		
SR 535 to Central Florida Pkwy		
Crash Data Summary (Years 2008 to 2012)		
Total Crashes = 157		
Predominant Crash Types	**# of Crashes**	**% of Total**
Rear End	43	26.54%
Angle	19	11.73%
Sideswipe	15	9.26%
Hit Guardrail	12	7.41%
Overturned	8	4.94%
Crash Rate	**0.331**	
Average District Five Crash Rate	**0.474**	



Northbound CR 535 (Apopka-Vineland Road)		
I-4 WB Ramps to Hotel Plaza Blvd		
Crash Data Summary (Years 2009 to 2011)		
Total Crashes = 28		
Predominant Crash Types	# of Crashes	% of Total
Rear End	11	42.31%
Head-On	3	11.54%
Angle	3	11.54%
Sideswipe	1	3.85%
Crash Rate	3.449	
Average District Five Crash Rate	2.250	

Southbound CR 535 (Apopka-Vineland Road)		
Hotel Plaza Blvd to I-4 WB Ramps		
Crash Data Summary (Years 2009 to 2011)		
Total Crashes = 26		
Predominant Crash Types	# of Crashes	% of Total
Rear End	9	32.14%
Head-On	5	17.86%
Collision with Motor Vehicle	2	7.14%
Angle	1	3.57%
Sideswipe	1	3.57%
Backed Into	1	3.57%
Crash Rate	3.502	
Average District Five Crash Rate	2.250	

Northbound SR 535		
Meadow Creek Drive to I-4 WB Ramps		
Crash Data Summary (Years 2008 to 2012)		
Total Crashes = 157		
Predominant Crash Types	# of Crashes	% of Total
Rear End	101	53.72%
Head-On	6	3.19%
Angle	35	18.62%
Collision with Motor Vehicle	7	5.93%
Crash Rate	6.003	
Average District Five Crash Rate	2.225	

Southbound SR 535		
I-4 WB Ramps to Meadow Creek Drive		
Crash Data Summary (Years 2008 to 2012)		
Total Crashes = 230		
Predominant Crash Types	# of Crashes	% of Total
Rear End	38	32.20%
Angle	37	31.36%
Left Turn	3	2.54%
Right Turn	4	3.39%
Collision with Motor Vehicle	7	5.93%
Crash Rate	3.729	
Average District Five Crash Rate	2.225	

Legend

Crash Type

- Rear End
- Angle
- Head On
- Left Turn
- Right Turn
- Collision w Motor Vehicle
- All Other Crashes

4.7 Existing Conditions Summary

- The LOS standard for the freeway segments and arterial segments within the area of influence is D.
- The basic freeway segment analysis was conducted using HCS 2010 and shows that the I-4 segment between the eastbound on-ramp from SR 535 and the westbound on-ramp from SR 535 (ID# 7) is operating at LOS E in PM peak hour conditions and below adopted LOS D.
- The ramp merge/diverge analysis was conducted using HCS 2010, and all analysis ramps are operating satisfactorily in existing conditions.
- The weave segments analysis indicates that the segment of eastbound I-4 between the SR 536 on-ramp and SR 535 off-ramp (ID# 35) operates at LOS F in PM peak hour.
- The intersection analysis was conducted using Synchro 8 utilizing HCM 2010 methodology. The list of intersections operating deficiently are:
    - SR 535 and Palm Parkway (ID# 41) (operates at LOS F in AM peak hour)
    - SR 535 and I-4 eastbound ramps (ID# 44) (operates at LOS F in PM peak hour)
- The queue analysis was conducted for the I-4 westbound ramps at the intersection with SR 535 and the analysis shows that the westbound left turn movement 95th percentile queue exceeds the storage length available in the PM peak hour conditions.
- The crash analysis demonstrates that the crash rate on the following roadway segments is higher than the District Five average crash rate for a similar facility:
    - I-4 Eastbound
        - Osceola County Line to SR 536
        - SR 536 to SR 535
    - I-4 Westbound
        - Central Florida Parkway to SR 535
        - SR 535 to SR 536
    - SR 535
        - Meadow Creek Drive to I-4 westbound ramps in both directions
    - CR 535/Apopka-Vineland Rd
        - I-4 westbound ramps to Hotel Plaza Boulevard in both directions
- Majority of crashes are rear end crashes, indicating congestion in all the study segments. However, both crash rate and the predominant crash type for the I-4 westbound segment from SR 535 to SR 536 indicate that the segment is not as congested relative to other I-4 segments.

5.0 Future Traffic

5.1 Future Transportation Network

The future transportation network includes the existing transportation network and any funded, planned or programmed improvements**.** The RCID Comprehensive Plan includes the Buena Vista Drive widening project, which began in May 2014. This project includes a number of operational improvements within the area of influence, including the widening of Buena Vista Drive from six to eight lanes with dedicated bus lanes. The existing at grade intersection along Buena Vista Drive at Downtown Disney Entrance Four will be removed and replaced by a grade-separated intersection.

The widening project also includes several projects outside the area of influence. The signalized intersection at Buena Vista Drive and SunTrust will also be replaced with right-in/right-out only access. Pedestrian bridges will be built at the Buena Vista Drive and Hotel Plaza Blvd intersection and at the Buena Vista Drive and Team Disney intersection. The Buena Vista Drive improvements allow for optimized bus flow and access to Downtown Disney and adjacent office land uses.

Further improvements from the FDOT work program are listed below:

- Resurfacing of I-4/SR 400 from SR 536 from west of ramp 750004 to SR 535 (FM# 430671-1)
- Resurfacing of I-4/SR 400 from the Osceola County Line to east of SR 536 (FM# 429079-1)
- Resurfacing of I-4/SR 400 from east of SR 536 to west of SR 528 (FM# 430644-1)

The recently adopted MetroPlan Orlando Transportation Improvement Program (TIP) includes the proposed improvement under the Locally Funded Highway Projects (Project# RCID-1). The MetroPlan region is currently guided by the 2030 LRTP, and work on the long range plan for the year 2040 is currently under way. The MetroPlan Orlando LRTP amendment (2030 LRTP Amendment July 11, 2012) includes a PD&E (FM# 432100-1) on I-4 from Polk/Osceola County Line to west of Kirkman Road and from one mile east of SR 434 to 0.5 miles east of SR 472. MetroPlan Orlando believes that the ramp modification is consistent with the adopted LRTP as it improves routing along I-4.

5.1.1 FHWA Approved Concepts in Analysis Year 2020 and 2030

FDOT District Five is conducting a re-evaluation of the Systems Access Modification Report (SAMR) in support of the I-4 BtU PD&E study. The opening year for the I-4 SAMR Re-evaluation is 2020. The concept design in the re-evaluation proposes the addition of two (2) new express lanes in each direction, resulting in a total of ten (10) lanes and re-evaluates FHWA approved design concepts for all interchanges within the I-4 SAMR study area including the SR 535 and the SR 536 interchanges in order to meet future traffic demands. As part of the alternative analysis for the SR 535 and SR 536 interchanges at I-4, a Collector-Distributor system between the two interchanges in the westbound direction will be evaluated. This PD&E Study also includes a new Fenton Street interchange, located east of the SR 535, which will further relieve congestion at the SR 535 interchange from the project opening year 2020. This interchange was approved by FHWA. All FHWA approved design concepts are included in analysis years 2020 and 2030 for both Build and No Build conditions within the area of influence of this IMR.

5.1.2 Parking Structures and Transit Improvements

There are several proposed access changes in the Downtown Disney area that will alter the travel patterns through the area. The geometric improvements will also change the operation of several of the existing intersections along Buena Vista Drive.

Two new parking garage structures are planned in the Downtown Disney which will alter the configurations of the intersections of Driveways 2, 3, and 4 with Buena Vista Drive.

The east garage will have approximately 2100 spaces and be located between Entrance 1 and Entrance 2. This garage will be accessed by westbound right turns at Entrance1 and eastbound left turns at Entrance 2. Exits from this garage will occur as southbound left- and right-turn movements at Entrance 1 only. The west garage will have approximately 4200 spaces and be located between Entrance 3 and Entrance 4. This garage will be accessed by westbound right turns at Entrance 3 and from the proposed ramp spur.

A new bus transfer facility is planned for the existing parking area between Entrances 2 and 3, and Entrance 2 will be the access point for the new facility. Eastbound and westbound Bus Rapid Transit (BRT) lanes are proposed on Buena Vista Drive to provide access to the new bus transfer facility. The lanes will run between Entrance 2 and Bonnet Creek Parkway. The proposed BRT lanes will consist of one exclusive bus lane in each direction, and are proposed to run in the median of the general use lanes along Buena Vista Drive. The westbound bus lane would terminate with a queue jump lane at the intersection of BVD and Bonnet Creek Parkway. The eastbound bus lane would begin east of the intersection with Bonnet Creek Parkway.

5.2 No Build Traffic Forecasts

The proposed ramp spur is expected to open in the year 2016. During the MLOU coordination meeting with FHWA on April 11, 2014, both FHWA and FDOT agreed to conduct the analysis for the analysis years 2016, 2020 and 2030.

The traffic forecasts for the analysis years 2016, 2020 and 2030 were obtained from FDOT. Detailed memorandums documenting the traffic forecasting are included in **Appendix D**. These forecasts were developed for four hour analysis periods which is consistent with the traffic forecasts developed for the south section of the I-4 SAMR Re-evaluation study for both AM and PM peak periods. **Figures 5-1 through 5-6** show both No Build (without the proposed ramp spur) and Build (with the proposed ramp spur) four hour traffic for the analysis years 2016, 2020 and 2030.

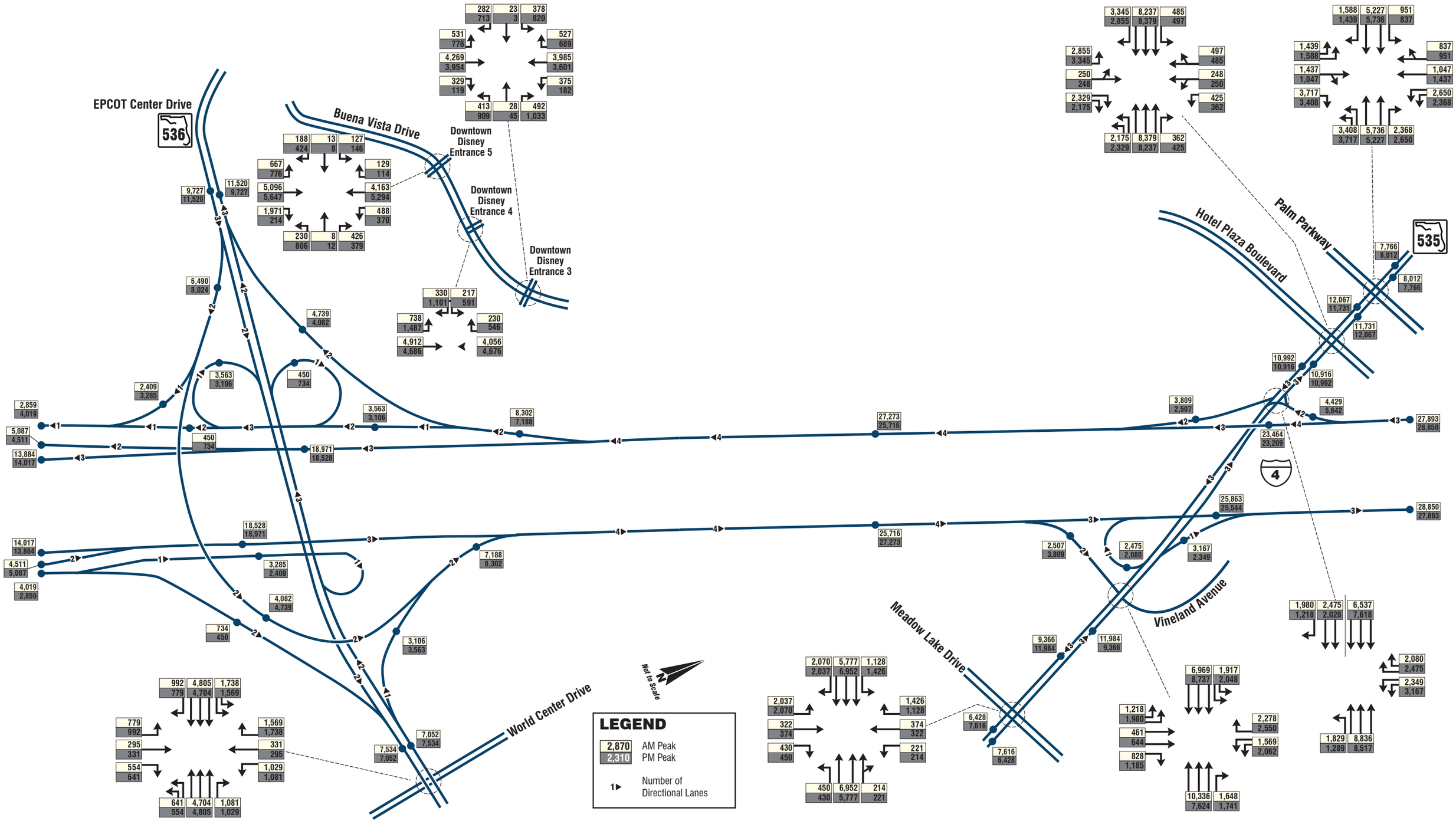
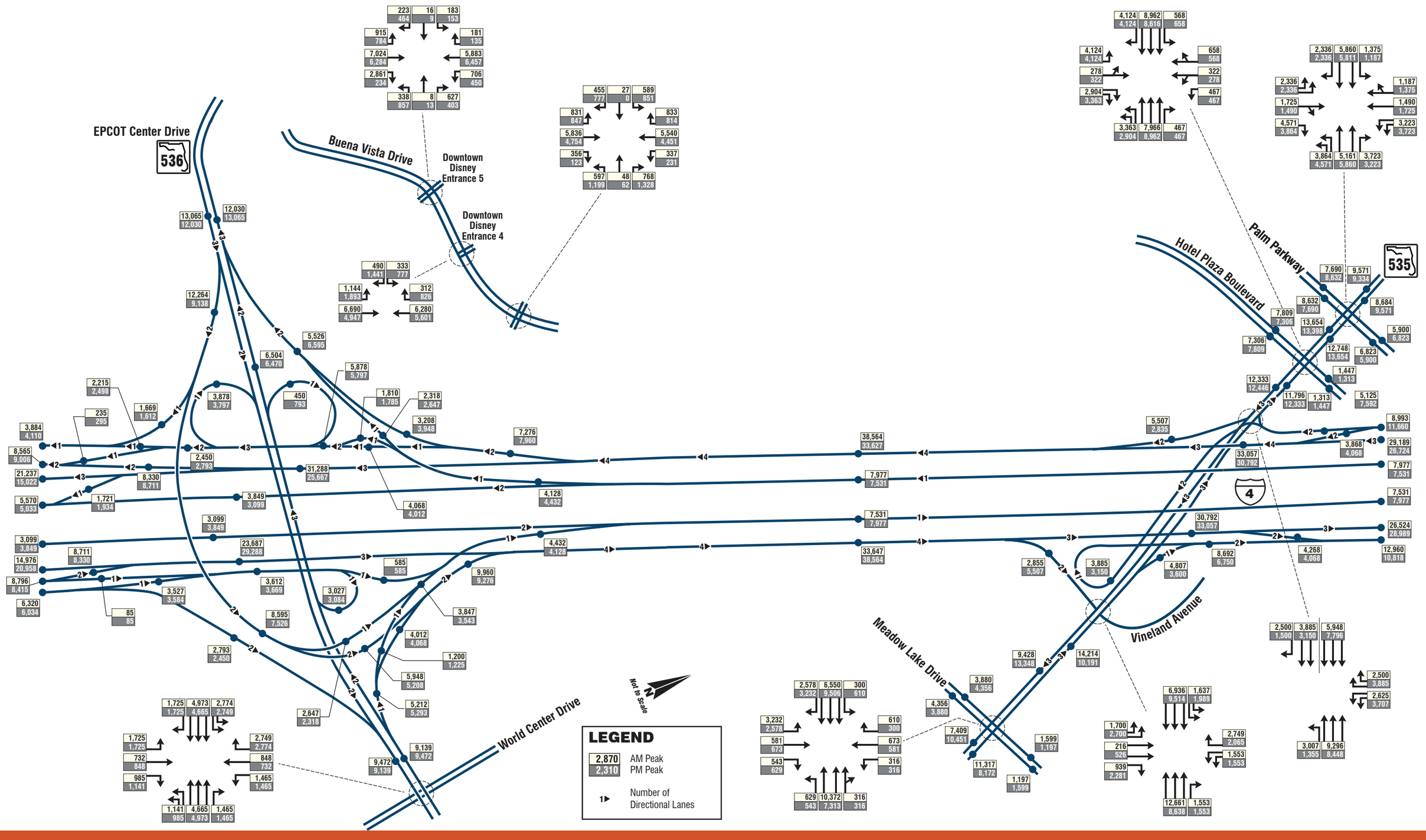
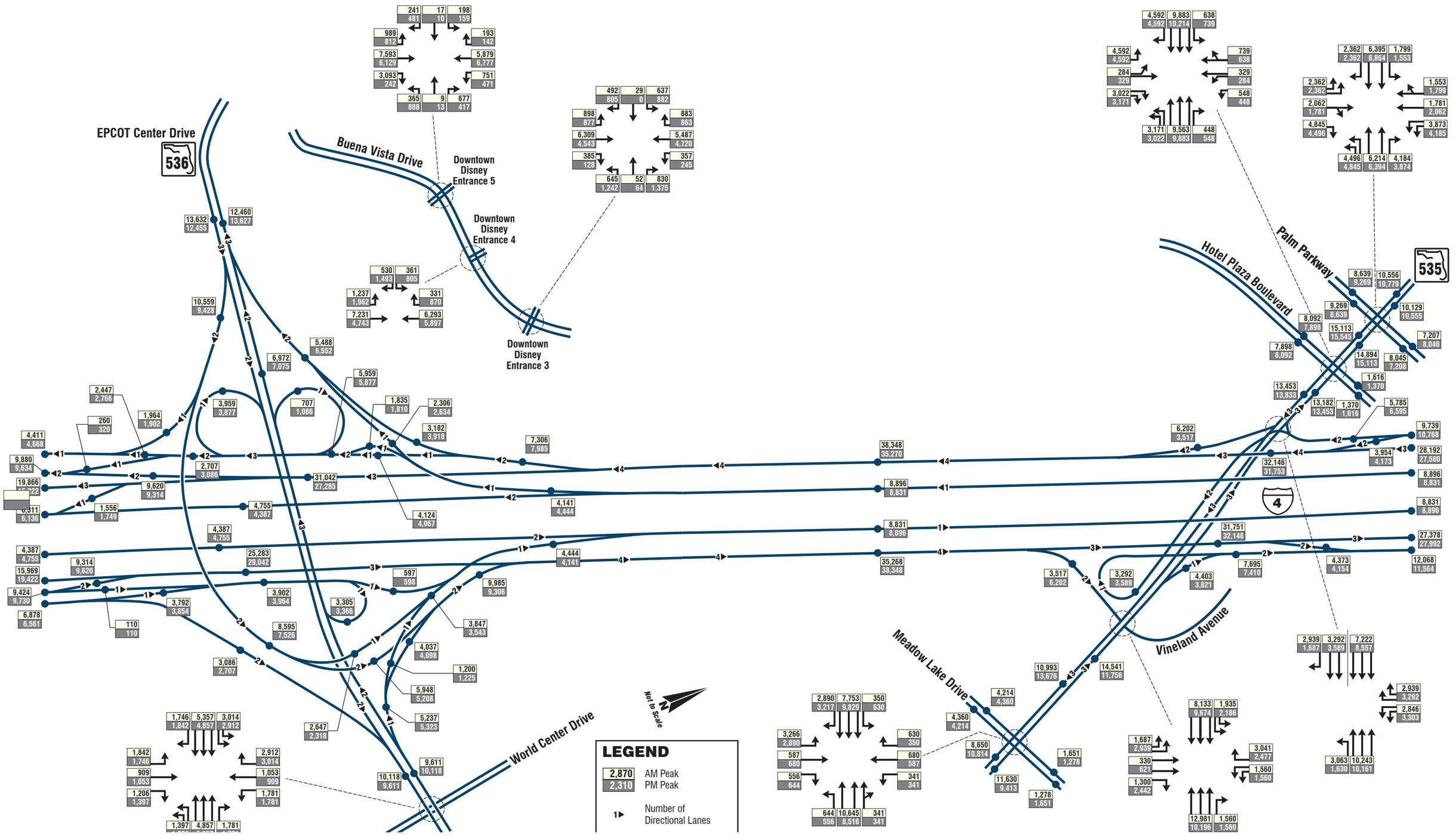
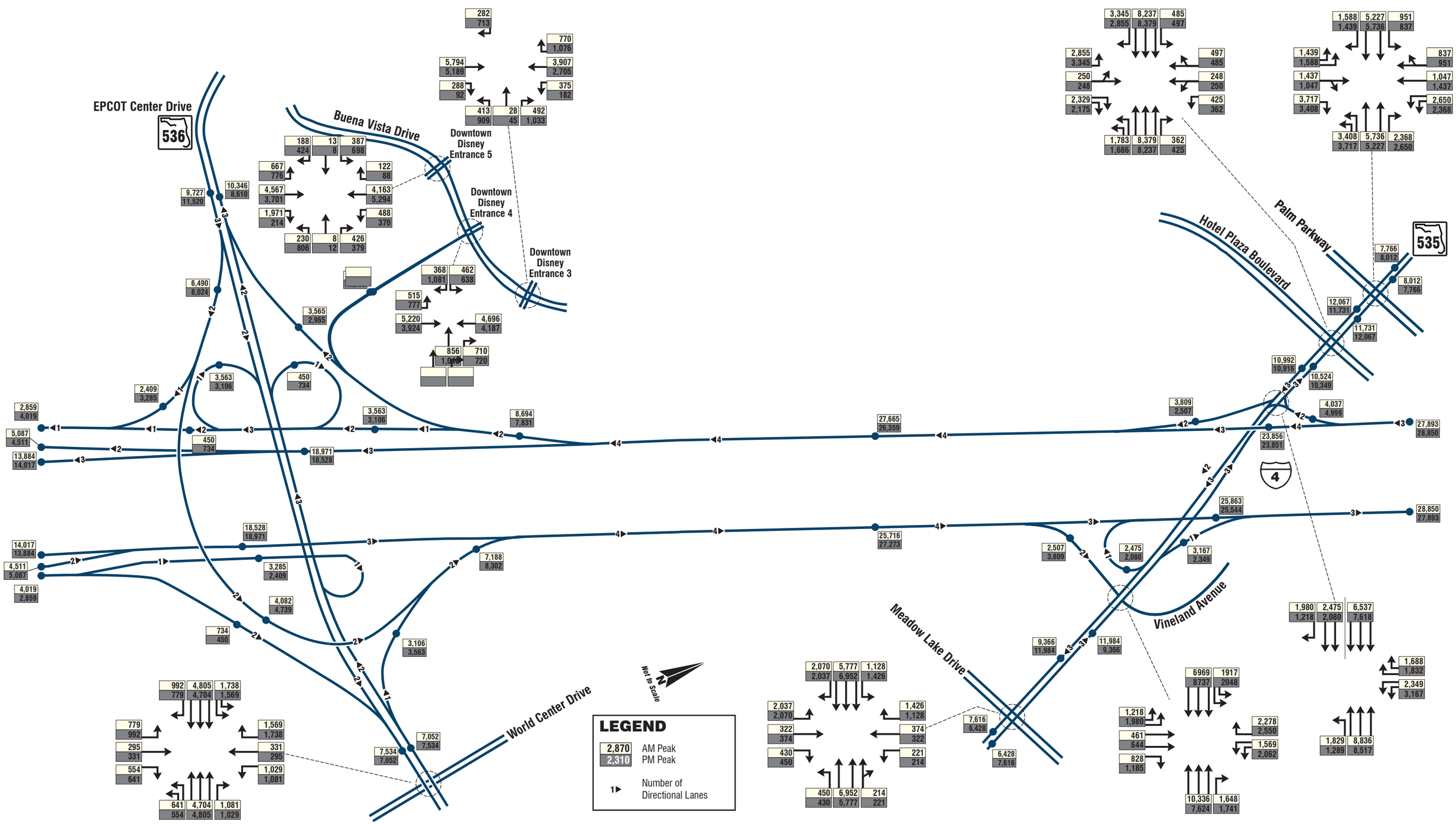


Figure 5-1
Year 2016 No-Build AM & PM
Peak Period (4 Hour) Forecasts

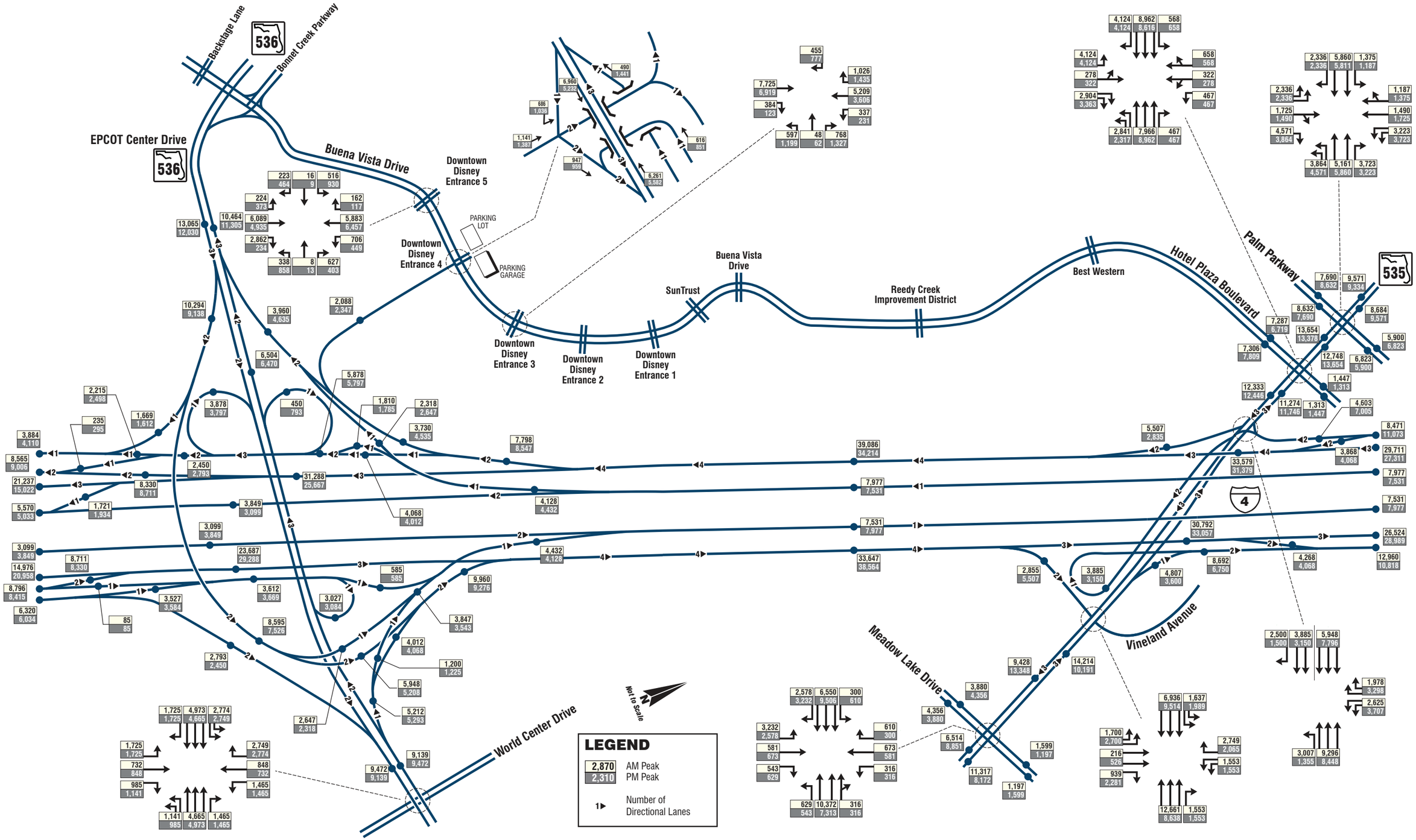

EPCOT Center Drive
536
Buena Vista Drive
Downtown Disney Entrance 5
Downtown Disney Entrance 4
Palm Parkway
Hotel Plaza Boulevard
535
4
Meadow Lake Drive
Vineland Avenue
World Center Drive
Not to Scale
LEGEND
2,870 AM Peak
2,310 PM Peak
1▶ Number of Directional Lanes


EPCOT Center Drive
536
Buena Vista Drive
Downtown Disney Entrance 5
Downtown Disney Entrance 4
Downtown Disney Entrance 3
Palm Parkway
Hotel Plaza Boulevard
535
4
Meadow Lake Drive
Vineland Avenue
World Center Drive
Not to Scale
LEGEND
2,870 AM Peak
2,310 PM Peak
1▶ Number of Directional Lanes



Interstate 4 and SR 536 Off-Ramp

Figure 5-4
Year 2016 Build AM & PM
Peak Period (4 Hour) Forecasts


Backstage Lane
536
Bonnet Creek Parkway
EPCOT Center Drive
536
Buena Vista Drive
Downtown Disney Entrance 5
Downtown Disney Entrance 4
PARKING LOT
PARKING GARAGE
Downtown Disney Entrance 3
Downtown Disney Entrance 2
Downtown Disney Entrance 1
SunTrust
Buena Vista Drive
Reedy Creek Improvement District
Best Western
Hotel Plaza Boulevard
Palm Parkway
535
4
Vineland Avenue
Meadow Lake Drive
World Center Drive
Not to Scale
LEGEND
2,870 AM Peak
2,310 PM Peak
1▶ Number of Directional Lanes

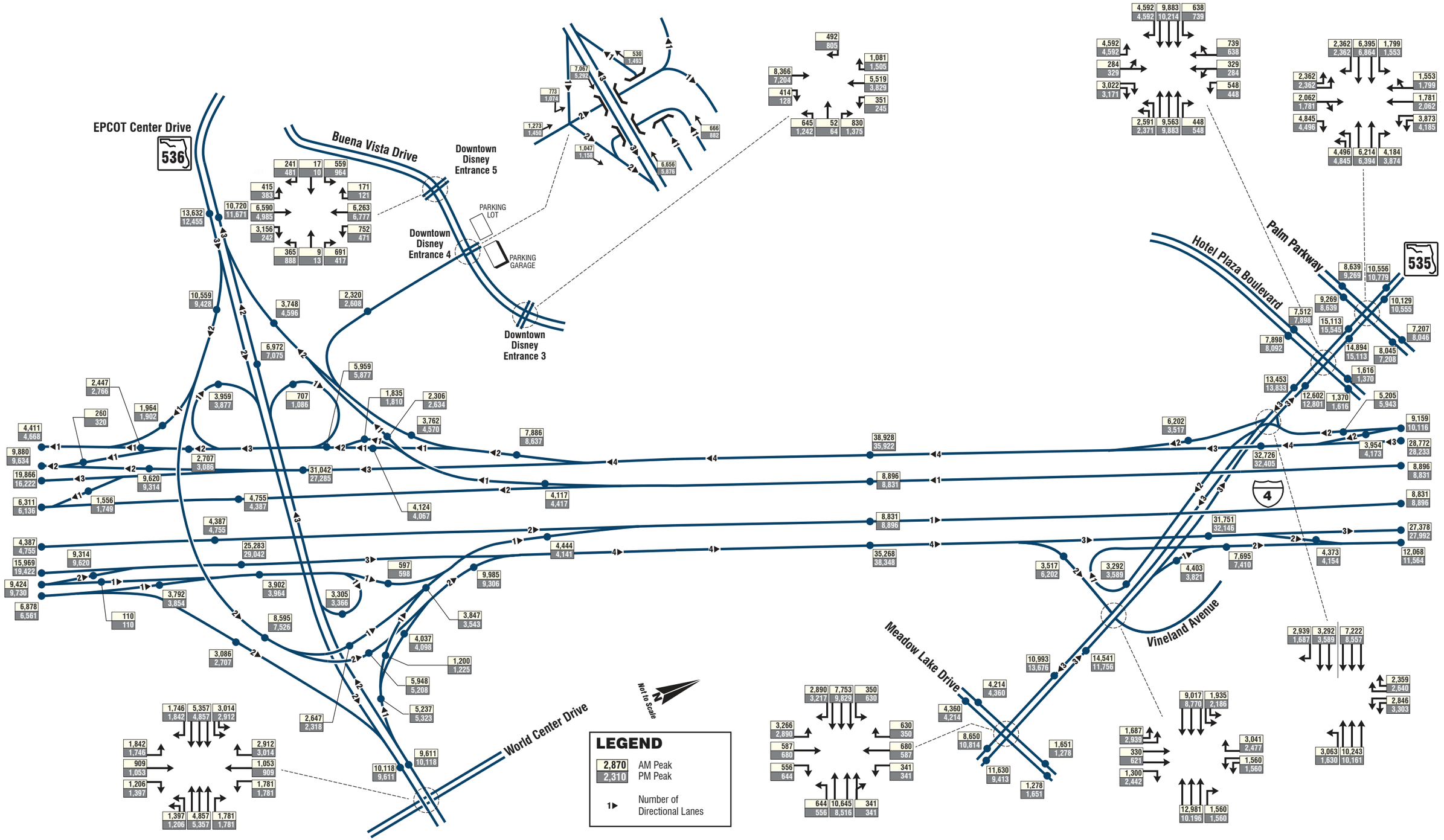


Figure 5-6
Year 2030 Build AM & PM
Peak Period (4 Hour) Forecasts

5.2.1 Peak Hour Traffic Development

The four hour peak period traffic is further converted to peak hour traffic using peak spreading factors developed for FDOT District Five and is included in the Appendix D.

Preliminary calculations were performed on the four hour DDHVs to spread traffic into hour peak hours based on the level of congestion experienced on each of the crossing corridors. It was observed that the demand is well over the capacity for the four hour period. Since the Dynamic Traffic Assignment (DTA) model is still undergoing pilot testing in Florida, it was not used for this project. The effect of DTA in this corridor would be to reduce the demand numbers produced by the demand model due to the capacity restrictions of the network. The peak hour traffic input into the operational analysis was developed in an effort to replicate conditions that would be considered by a DTA. Therefore, rather than reducing the K value by a fixed factor across the model, an interchange by interchange evaluation was conducted. Each interchange's demand traffic is reduced until its peak hour reaches or slightly exceeds capacity. This ensures that the model is saturated during the peak hour. The remaining peak period demand is applied on the shoulder hours. This way, corridors with more demand will recover more slowly, while those with lower demand will recover more quickly. The analysis shows that traffic demand still exceeds the capacity that can be provided even with this peak spreading. In order to mimic the behavior of the DTA approach, the analysis period is lengthened to five hours by holding the traffic constant, and the demand is diluted by a factor less than 20%. **Table 5-1** summarizes hourly peak spreading factors for both the AM and PM with the application of this spreading approach.

Figures 5-7 through **5-9** show No Build (without the proposed ramp spur) peak hour traffic for the analysis years 2016, 2020 and 2030 that will be used for freeway and intersection analysis using HCS and Synchro. The process of developing balanced one hour traffic for analysis is shown below.

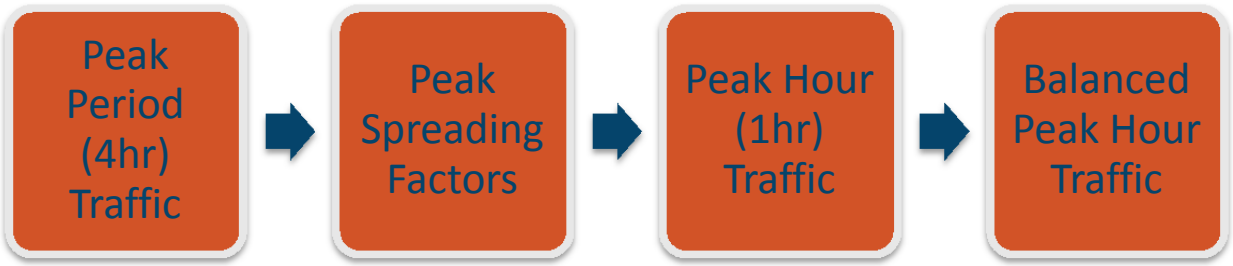
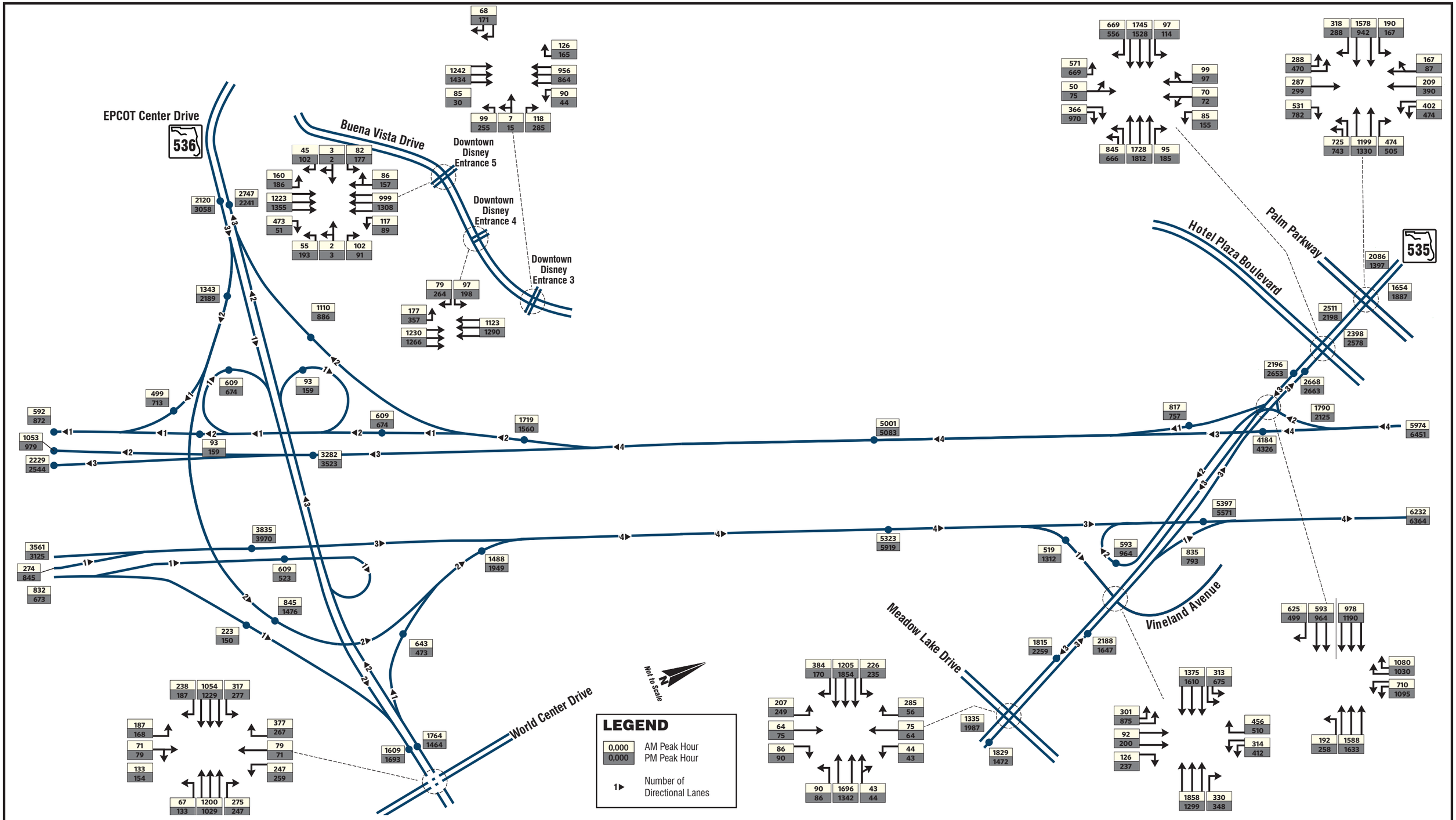


Table 5-1 | Peak Spreading Factors for AM and PM Conditions

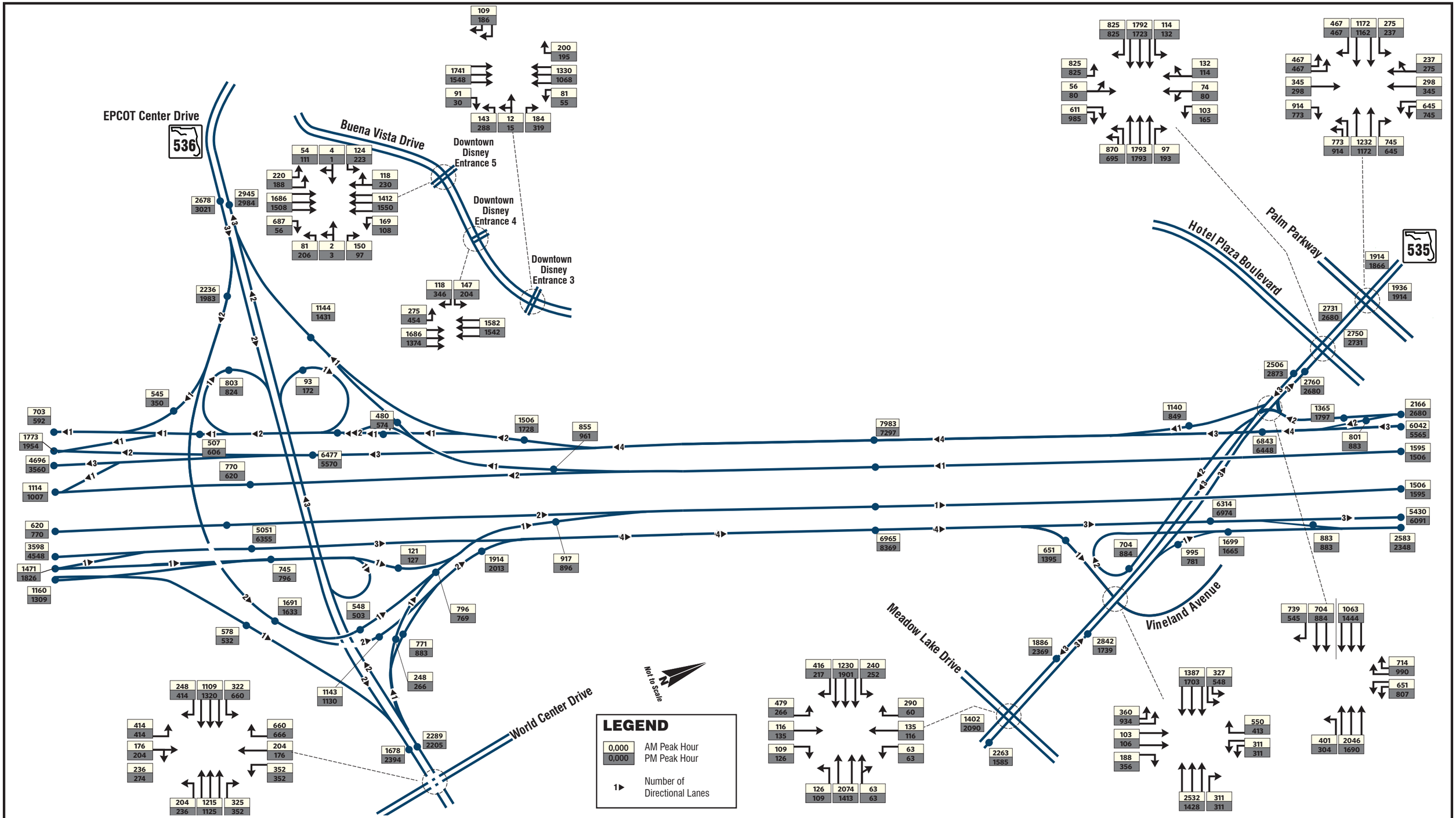
AM								
Entry Volume	Facility Type	No.of Through Lanes	Spread Type	630-730	730-830	830-930	930-1030	1030-1130
I-4 WB	Freeway	3		20.1%	20.9%	20.0%	19.9%	19.1%
I-4 ML WB	Freeway	2		20.1%	20.7%	20.1%	19.9%	19.1%
I-4 EB	Arterial	2	Extreme	20.1%	20.0%	20.9%	19.9%	19.1%
I-4 ML EB	Arterial	2	Extreme	20.1%	20.7%	20.1%	19.9%	19.1%
SR 535 NB	Arterial	3	Congested	20.0%	20.0%	20.0%	20.0%	20.0%
SR 535 SB	Arterial	3	Congested	20.0%	20.0%	20.0%	20.0%	20.0%
SR 536 WB	Arterial	3	Disney	18.0%	24.0%	24.0%	18.0%	16.0%
SR 536 EB	Freeway	3	Disney	18.0%	24.0%	24.0%	18.0%	16.0%

PM								
Entry Volume	Facility Type	No.of Through Lanes	Spread Type	1345-1445	1445-1545	1545-1645	1645-1745	1745-1845
I-4 WB	Freeway	3		18.6%	20.4%	21.7%	21.3%	18.0%
I-4 ML WB	Freeway	2		18.6%	20.4%	21.7%	21.3%	18.0%
I-4 EB	Arterial	2	Extreme	18.6%	20.4%	21.7%	21.3%	18.0%
I-4 ML EB	Arterial	2	Extreme	18.6%	20.4%	21.7%	21.3%	18.0%
SR 535 NB	Arterial	3	Extreme	20.0%	20.0%	20.0%	20.0%	20.0%
SR 535 SB	Arterial	3	Extreme	20.0%	20.0%	20.0%	20.0%	20.0%
SR 536 WB	Arterial	3	Disney PM IB	20.0%	23.0%	24.0%	17.0%	16.0%
SR 536 EB	Arterial	3	Disney PM OB	21.0%	20.0%	19.0%	21.0%	19.0%



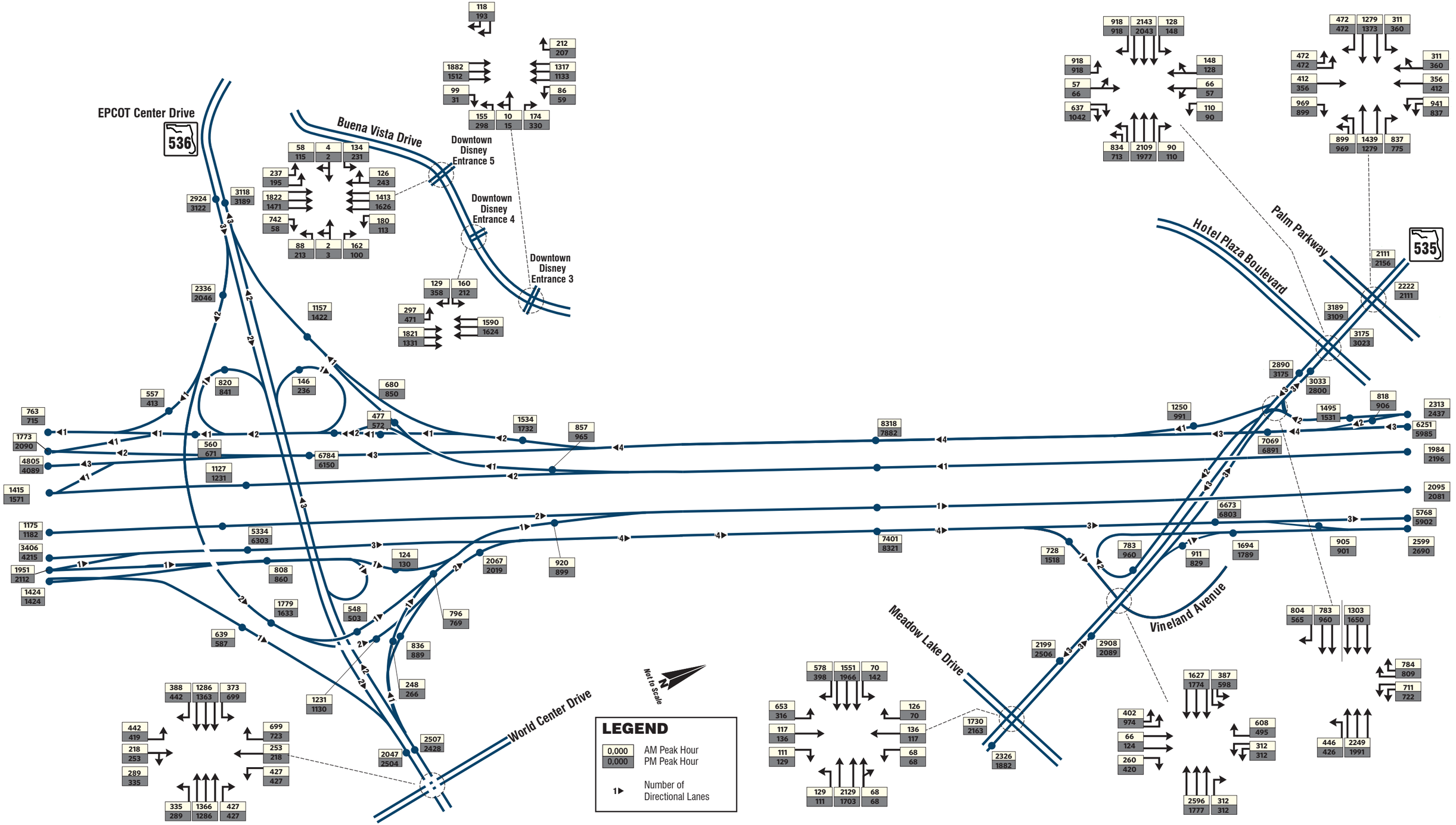
Interstate 4 and SR 536 Off-Ramp

Figure 5-7
Year 2016 No-Build AM & PM Peak Hour (1 Hour) Forecasts



Interstate 4 and SR 536 Off-Ramp

Figure 5-8
Year 2020 No-Build AM & PM Peak Hour (1 Hour) Forecasts



Interstate 4 and SR 536 Off-Ramp

Figure 5-9
Year 2030 No-Build AM & PM Peak Hour (1 Hour) Forecasts

5.3 Traffic Diversion due to Proposed Ramp Spur

5.3.1 Inbound Traffic

I-4 westbound traffic currently destined to Downtown Disney at the following two existing traffic movements will be diverted to the proposed ramp spur when completed:

- Traffic exiting I-4 westbound at SR 535 and turning left onto Hotel Plaza Blvd (diversion movement 1)
- Traffic exiting I-4 westbound at SR 536 and turning right onto Buena Vista Drive (diversion movement 2)

The traffic from diversion movement 2 listed above was obtained from the FDOT traffic forecasts. To determine the traffic from diversion movement 1, an Origin-Destination (O-D) field review was performed on June 19, 2014 for a period of two hours in the PM peak period in the study area to determine the number of vehicles exiting I-4 westbound at SR 535 and eventually arriving at Downtown Disney. A vehicle count was performed for this purpose to determine the number of vehicles exiting I-4 westbound at SR 535 and subsequently making a left turn onto Hotel Plaza Blvd. This count was then reduced using the existing volume distributions shown in **Figure 4-1** to determine the amount of traffic that continued on from Hotel Plaza Blvd to Buena Vista Dr. **Table 5-2** summarizes the O-D field data.

Table 5-2 | Origin-Destination Field Review Summary

Time Period	Traffic from I-4 Westbound to Hotel Plaza Blvd (veh)	Traffic from I-4 Westbound to Hotel Plaza Blvd continuing onto Downtown Disney (veh)
PM Peak Hour 1	297	227
PM Peak Hour 2	274	210

AM peak hour numbers were obtained using the PM to AM peak hour ratios and daily traffic profile data from the Florida Traffic Information (FTI) traffic data. The traffic diversion for peak hour volumes for the analysis years 2016, 2020 and 2030 were obtained from the background growth and potential Disney Springs traffic from the DDHVs provided in **Appendix D**. **Table 5-3** summarizes inbound diverted traffic for the analysis years 2016, 2020 and 2030 for both AM and PM peak hours.

5.3.2 Outbound Traffic

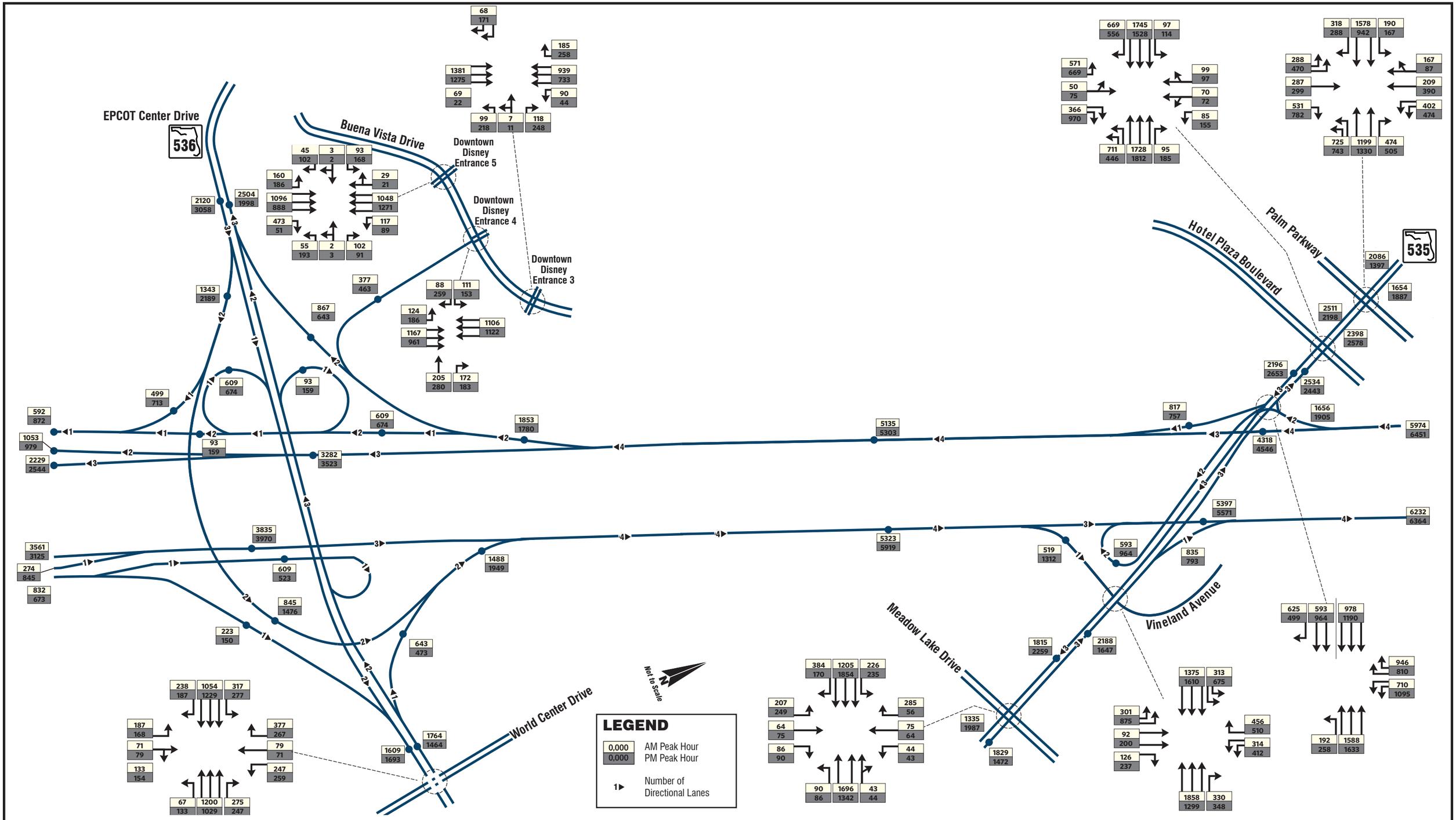
Outbound traffic from the Downtown Disney is generally highest when the restaurants and entertainment activities close. The traffic distribution developed and discussed in section 5.1.2 for traffic leaving (outbound) Downtown Disney accounts for the access modifications as a result of the Buena Vista Drive widening project. Outbound traffic continues to follow existing traffic patterns even after the proposed ramp spur is built. Hence, a separate outbound traffic diversion distribution was not performed.

Table 5-3 | Inbound Diversion in Traffic for Analysis Years 2016, 2020 and 2030

Analysis Year	Diversion Movement	AM Peak Hour	PM Peak Hour
2016	1	134	220
	2	243	243
2020	1	200	225
	2	324	425
2030	1	365	238
	2	450	782

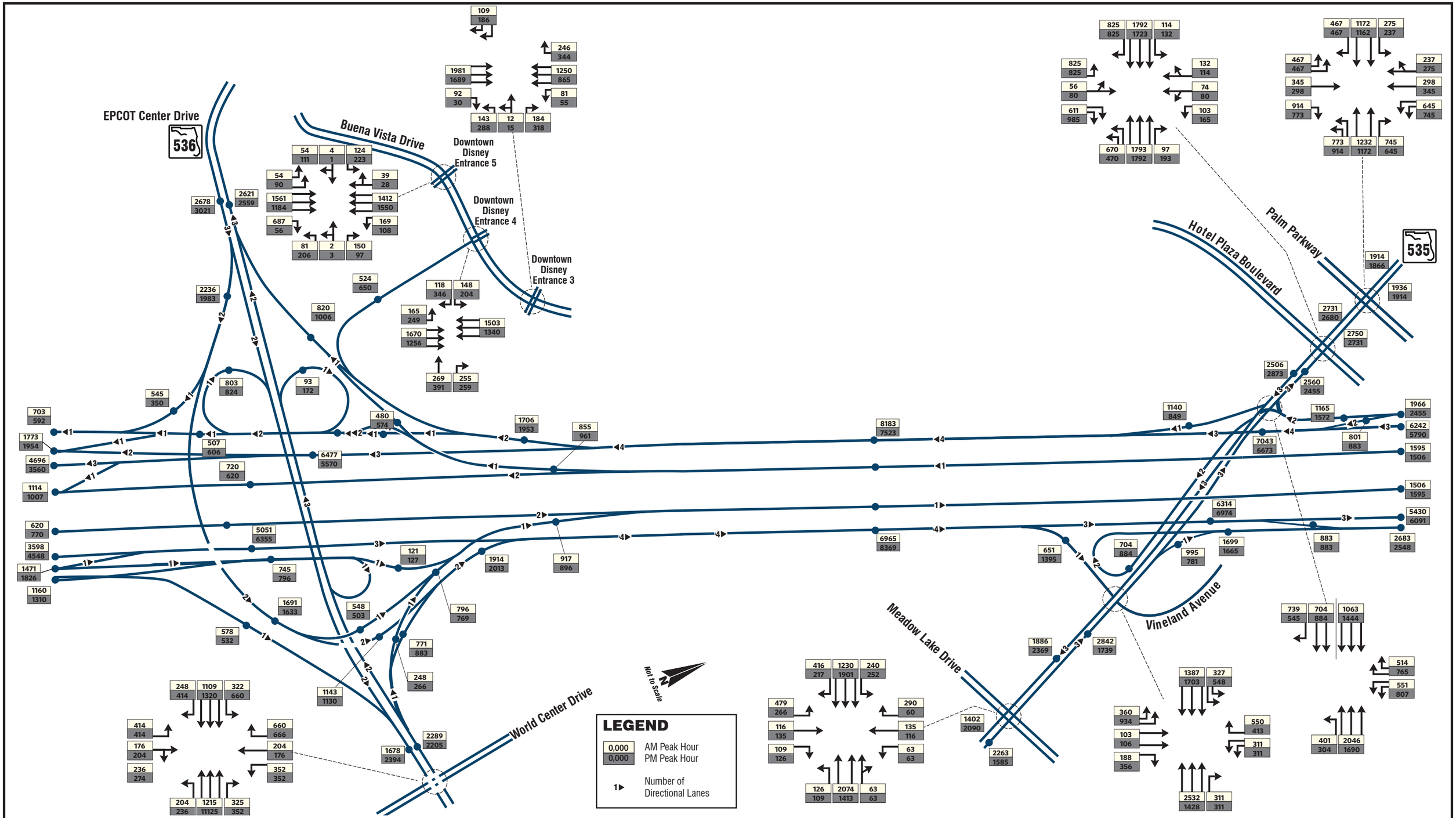
5.4 Build Traffic Forecasts

The traffic forecasts for Build conditions for the analysis years 2016, 2020 and 2030 were obtained from FDOT traffic forecasts and also by applying diverted traffic from the SR 535 westbound off-ramp as discussed in Section 5.3. **Figures 5-10 through 5-12** show Build (with the proposed ramp spur) peak hour traffic for the analysis years 2016 , 2020 and 2030 that will be used for freeway and arterial analysis using HCS and Synchro.



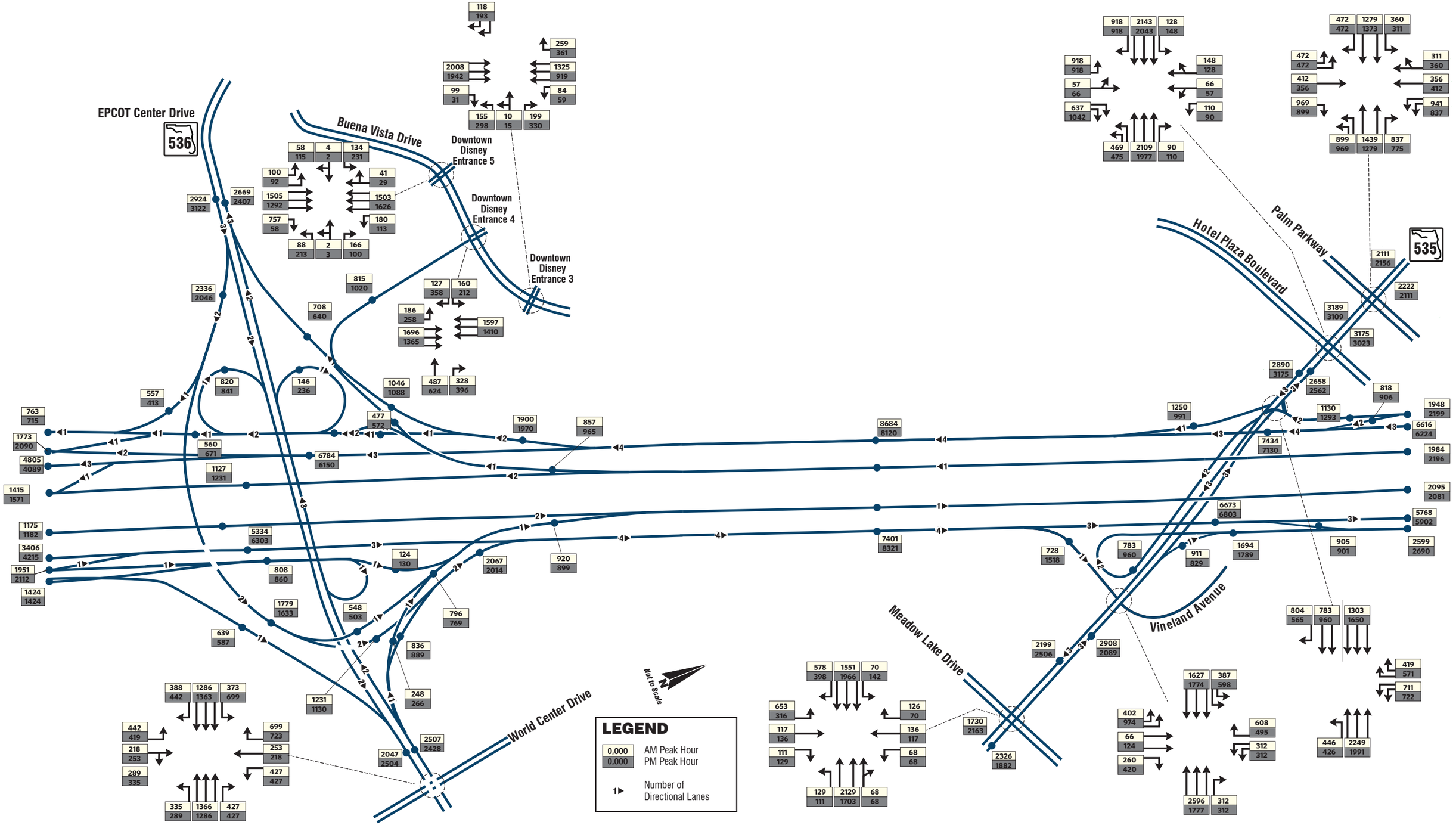
Interstate 4 and SR 536 Off-Ramp

Figure 5-10
Year 2016 Build AM & PM
Peak Hour (1 Hour) Forecasts



Interstate 4 and SR 536 Off-Ramp

Figure 5-11
Year 2020 Build AM & PM Peak Hour (1 Hour) Forecasts



Interstate 4 and SR 536 Off-Ramp

Figure 5-12
Year 2030 Build AM & PM
Peak Hour (1 Hour) Forecasts

6.0 Alternative Analysis

This section defines the No Build Alternative, Transportation System Management (TSM) Alternative, and the Build Alternative, and presents the analysis results for each.

6.1 Description of Alternatives

6.1.1 No Build Alternative

The No Build alternative includes the existing transportation network and any funded, planned or programmed improvements open to traffic in each analysis year (see **Table 6-1**).

Table 6-1 | No Build Alternative Description by Analysis Year

Analysis Year	Projects included in No Build Alternative
2016	Widening of Buena Vista Drive from six to eight lanes including dedicated bus lanes. Elimination of at grade intersection at the location of the proposed ramp (with signal control) with an overpass.
2020	2016 No Build plus improvements included in I-4 BtU PD&E Study Update from the Polk County Line to SR 472 in Volusia County (FM# 432100-1).
2030	

The PD&E study update for I-4 from Polk County Line to SR 472 in Volusia County involves the build-out of I-4 to its ultimate condition through Central Florida, including segments in Osceola, Orange, Seminole, and Volusia counties. The concept design proposes the addition of two (2) new express lanes in each direction, resulting in a total of ten (10) lanes.

6.1.2 TSM Alternative

Transportation Systems Management (TSM) alternatives are low capital cost transportation improvements designed to maximize the use and efficiency of the existing transportation facility through improved system management. Various forms of TSM improvements can include:

- Traffic signal improvements
- Intersection/interchange improvements
- Widening of parallel routes
- Ridesharing programs
- HOV lanes
- Reversible lanes
- Transit
- Intelligent Transportation System (ITS)
- Auxiliary lanes

The adjacent interchange at SR 535 is currently operating deficiently in PM conditions at the intersection with I-4 westbound ramps. The traffic operations on SR 535 are projected to degrade over the years. SR 535 is a constrained facility and TSM strategies would be ineffective in fully addressing congestion along the corridor. The conditions proposed in the on-going I-4 SAMR Re-evaluation study with an Opening Year of 2020 are expected help improve provide the SR 535 corridor. Although signal timings were optimized for SR 535 intersections for the No Build condition analysis, other specific TSM strategies could not be identified and were not considered for SR 535.

6.1.3 Alternative Travel Modes

This alternative typically considers the needs of transit along limited-access facilities, as well as pedestrian, bicycle and transit needs along the crossroads. The Buena Vista Drive project includes a number of operational improvements in addition to widening. The additional lanes will be dedicated to transit. Pedestrian bridges will be built at the Hotel Plaza Blvd and Team Disney intersections. The Buena Vista Drive improvements allow for optimized bus flow and access to Downtown Disney and adjacent attractions. Therefore, no additional analysis related to alternative travel modes has been conducted since all reasonable improvements are incorporated in the Buena Vista Drive widening project.

6.1.4 Build Alternative

The Build alternative consists of a proposed ramp spur. The proposed improvement is a single lane ramp spur (approximately 0.5 miles in length) that begins at the existing westbound SR 536 off-ramp, approximately 2000 feet west of the westbound I-4 mainline ramp gore, and ends at a grade-separated intersection at Buena Vista Drive. The Build configuration of proposed ramp is depicted in **Figure 6-1**.

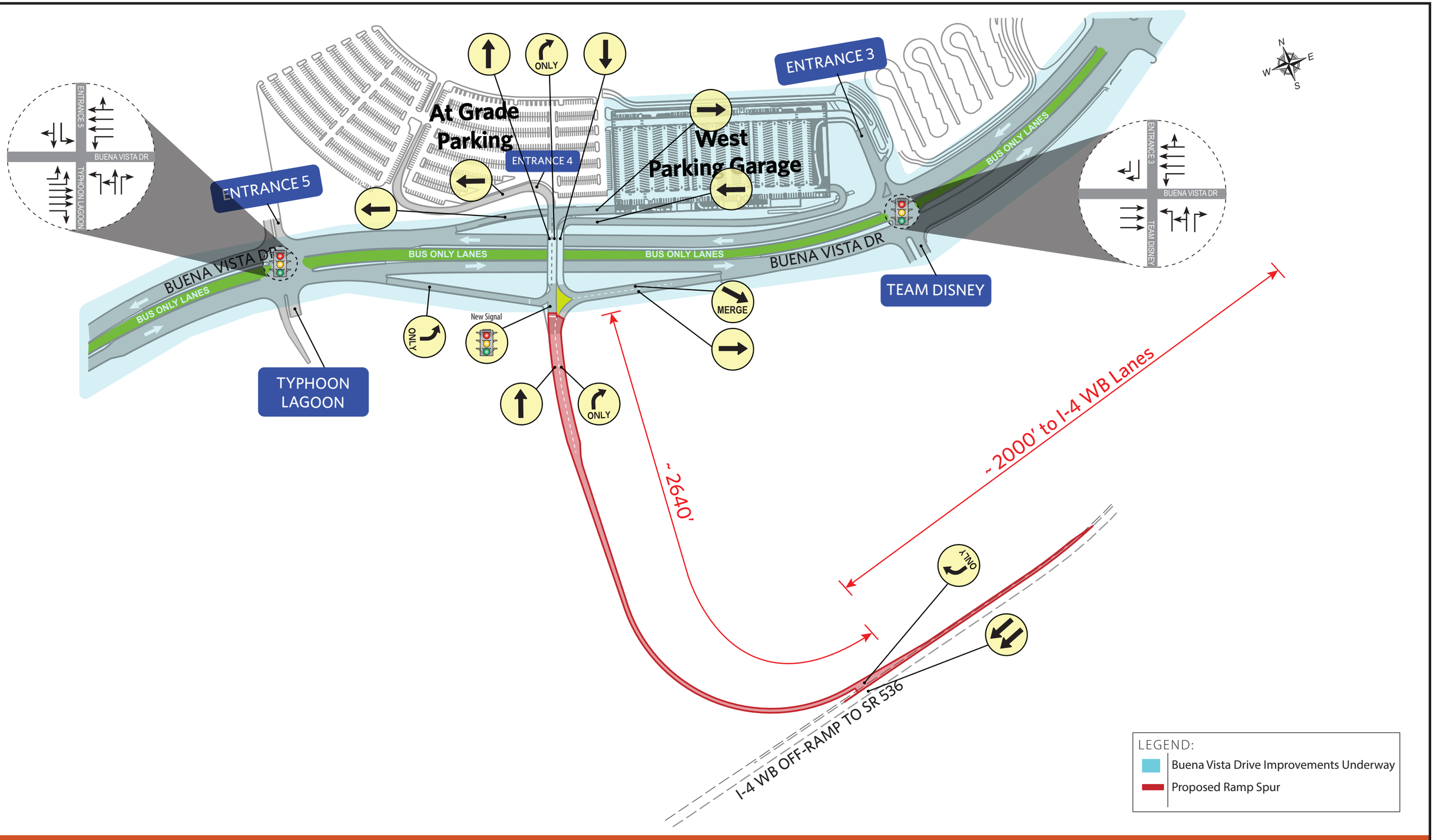
6.2 Operational Analysis

Consistent with the MLOU, the operational analysis was conducted assuming the Level of Service standard D for freeway and arterial intersections within the area of influence. The following sections present the operational analysis results for the mainline freeway segments, ramp junctions, weave segments and intersections within the area of influence.

Year 2020 and 2030 transportation network, as discussed in Section 5.1.1, include the following FHWA approved design changes as part of the original I-4 SAMR.

- Two (2) new express lanes in each direction, resulting in a total of ten (10) through lanes
- A collector/distributor system between SR 535 and a new and approved Fenton Street interchange
- The approved Fenton Street interchange north of SR 535

As part of the alternative analysis for the SR 535 and SR 536 interchanges at I-4, a collector/distributor system between the two interchanges in the westbound direction will be evaluated in the ongoing I-4 SAMR re-evaluation in support of I-4 BtU PD&E study, in addition to all interchanges within the I-4 BtU study area including the SR 535 and the SR 536 interchanges in order to meet future traffic demands. The operational analysis for the years 2020 and 2030 incorporated above mentioned network improvements.


ENTRANCE 5
BUENA VISTA DR
TYPHOON LAGOON
ENTRANCE 5
BUS ONLY LANES
BUENA VISTA DR
TYPHOON LAGOON
At Grade Parking
ONLY
ENTRANCE 4
West Parking Garage
ENTRANCE 3
BUS ONLY LANES
BUS ONLY LANES
BUS ONLY LANES
BUENA VISTA DR
ENTRANCE 3
BUENA VISTA DR
TEAM DISNEY
TEAM DISNEY
MERGE
ONLY
New Signal
ONLY
~ 2640'
~ 2000' to I-4 WB Lanes
ONLY
I-4 WB OFF-RAMP TO SR 536
N
E
W
S
LEGEND:
Buena Vista Drive Improvements Underway
Proposed Ramp Spur

6.2.1 Basic Freeway Segment Analysis

A Basic Freeway Segment analysis was conducted for both the Build and No Build conditions using HCS 2010 and the results are presented in **Table 6-2** and **Table 6-3**.

Table 6-2 | Year 2016 Freeway Operations

ID #	Roadway/Segment		LOS Standard/ Density Threshold	2016 AM Peak Hour				2016 PM Peak Hour			
				No Build		Build		No Build		Build	
	From	To		Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
	I-4 Eastbound										
1	Osceola Parkway Off Ramp	SR 536 Off Ramp		27.4	D	27.4	D	22.1	C	22.1	C
2	SR 536 Off Ramp	On Ramp from Osceola Parkway		20.6	C	20.6	C	17.5	B	17.5	B
3	On Ramp from Osceola Parkway	On Ramp from SR 536		22.7	C	22.7	C	23.4	C	23.4	C
4	On Ramp from SR 536	SR 535 Off Ramp		23.9	C	23.9	C	27.4	D	27.4	D
5	SR 535 Off Ramp	On Ramp from SR 535 EB		31.6	D	31.6	D	29.0	D	29.0	D
7	On Ramp from SR 535 EB	On Ramp from SR 535 WB	D /	39.4	E	39.4	E	41.2	E	41.2	E
8	On Ramp from SR 535 WB	Central Florida Parkway Off Ramp	35	30.2	D	30.2	D	30.7	D	30.7	D
	I-4 Westbound		(pc/mi/ln)								
10	On Ramp from Central Florida Parkway	SR 535 Off Ramp		28.2	D	28.2	D	31.4	D	31.4	D
12	SR 535 Off Ramp	On Ramp from SR 535		25.5	C	26.7	D	26.4	D	28.4	D
14	On Ramp from SR 535	SR 536 Off Ramp		22.0	C	22.8	C	22.2	C	23.4	C
15	SR 536 Off Ramp	Osceola Parkway Off Ramp		18.7	C	18.7	C	20.1	C	20.1	C
16	Osceola Parkway Off Ramp	On Ramp from SR 536		12.5	B	12.5	B	14.1	B	14.0	B
18	On Ramp from SR 536	US 192 Off Ramp		11.8	B	11.8	B	14.2	B	14.2	B

Table 6-3 | Year 2020 Freeway Operations

ID #	Roadway/Segment		LOS Standard/ Density Threshold	2020 AM Peak Hour				2020 PM Peak Hour			
				No Build		Build		No Build		Build	
	From	To		Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
	I-4 Eastbound										
1	Osceola Parkway Off Ramp	SR 536 Off Ramp		31.1	D	31.1	D	47.6	F	47.6	F
2	SR 536 Off Ramp	On Ramp from Osceola Parkway		20.9	C	20.9	C	28.9	D	28.9	D
3	On Ramp from Osceola Parkway	On Ramp from SR 536		34.6	D	34.6	D	60.0	F	60.0	F
4	On Ramp from SR 536	SR 535 Off Ramp		36.9	E	36.9	E	57.7	F	57.7	F
6	SR 535 Off Ramp	Off Ramp to CD System		58.7	F	58.7	F	85.7	F	85.7	F
9	Off Ramp to CD System	Central Florida Parkway Off Ramp		39.9	E	39.9	E	52.8	F	52.8	F
	I-4 SUL Eastbound										
50	Osceola Parkway Off Ramp	SR 536 Off Ramp	D /	5.2	A	5.2	A	6.5	A	6.5	A
51	Off Ramp to CD System	Central Florida Parkway Off Ramp	35	12.7	B	12.7	B	13.5	B	13.5	B
	I-4 Westbound		(pc/mi/ln)								
11	On Ramp from Central Florida Parkway	On Ramp from CD System		51.7	F	56.7	F	42.1	E	46.2	F
13	On Ramp from CD System	On Ramp from SR 535		78.7	F	89.8	F	62.9	F	71.2	F
14	On Ramp from SR 535	SR 536 Off Ramp		50.4	F	53.9	F	40.6	E	43.5	E
15	SR 536 Off Ramp	Osceola Parkway Off Ramp		63.9	F	63.9	F	42.2	E	42.2	E
17	Osceola Parkway Off Ramp	Slip Ramp to Express Lane		34.6	D	34.6	D	23.8	C	23.8	C
	I-4 SUL Westbound										
52	On Ramp from Central Florida Parkway	SR 535 Off Ramp		13.5	B	13.5	B	12.7	B	12.7	B
53	On Ramp from Central Florida Parkway	On Ramp from CD System		6.5	A	6.5	A	5.2	A	5.2	A
54	SR 535 Off Ramp	On Ramp from SR 535		9.4	A	9.4	A	8.5	A	8.5	A

As shown in **Table 6-2**, under the ID # 14, the proposed ramp spur has a negligible impact on I-4 mainline operations in 2016, with only one segment (ID# 12) showing a change in LOS in 2016. This is due to some vehicles now continuing past the SR 535 exit to SR 536 to access the new ramp spur. Similarly, as seen in **Table 6-3**, the proposed ramp spur has negligible impact on I-4 mainline operations in 2020 with only negligible changes shown on segment ID#s 11, 13 and 14. This is due to the aforementioned reason related to the 2016 analysis.

6.2.2 Ramp Merge/Diverge Analysis

The ramp merge/diverge analysis was conducted for both the Build and No Build conditions using HCS 2010 and the results are presented in **Table 6-4** and **Table 6-5** for 2016 and 2020, respectively.

Table 6-4 | Year 2016 Ramp Operations

				2016 AM Peak Hour								2016 PM Peak Hour							
				No Build				Build				No Build				Build			
ID #	Freeway Ramp	Lane add/drop at Ramp	LOS Standard/ Density Threshold	Density	LOS	v/c Ratio **	Under/Over Capacity	Density	LOS	v/c Ratio **	Under/Over Capacity	Density	LOS	v/c Ratio **	Under/Over Capacity	Density	LOS	v/c Ratio **	Under/Over Capacity
	I-4 Eastbound																		
20	SR 536 Off Ramp	Yes		-	-	0.22	UC	-	-	0.22	UC	-	-	0.18	UC	-	-	0.18	UC
21	On Ramp from Osceola Parkway			20.2	C	-	-	20.2	C	-	-	22.8	C	-	-	22.8	C	-	-
22	On Ramp from SR 536	Yes		-	-	0.36	UC	-	-	0.36	UC	-	-	0.48	UC	-	-	0.48	UC
23	SR 535 Off Ramp	Yes		-	-	0.26	UC	-	-	0.26	UC	-	-	0.66	UC	-	-	0.66	UC
24	On Ramp from SR 535 WB			20.8	C	-	-	20.8	C	-	-	23.1	C	-	-	23.1	C	-	-
25	On Ramp from SR 535 EB	Yes	D / 35 (pc/mi/ln)	-	-	0.40	UC	-	-	0.40	UC	-	-	0.38	UC	-	-	0.38	UC
	I-4 Westbound																		
28	SR 535 Off Ramp	Yes		-	-	0.47	UC	-	-	0.44	UC	-	-	0.56	UC	-	-	0.50	UC
29	On Ramp from SR 535	Yes		-	-	0.39	UC	-	-	0.39	UC	-	-	0.36	UC	-	-	0.36	UC
30	SR 536 Off Ramp	Yes		-	-	0.45	UC	-	-	0.49	UC	-	-	0.41	UC	-	-	0.47	UC
31	Osceola Pkwy Off Ramp			-0.5	A	-	-	-0.5	A	-	-	0.2	A	-	-	0.2	A	-	-
32	On Ramp from SR 536	Yes		-	-	0.28	UC	-	-	0.28	UC	-	-	0.42	UC	-	-	0.42	UC

Table 6-5 | Year 2020 Ramp Operations

				2020 AM Peak Hour								2020 PM Peak Hour							
				No Build				Build				No Build				Build			
ID #	Freeway Ramp	Lane add/drop at Ramp	LOS Standard/ Density Threshold	Density	LOS	v/c Ratio **	Under/Over Capacity	Density	LOS	v/c Ratio **	Under/Over Capacity	Density	LOS	v/c Ratio **	Under/Over Capacity	Density	LOS	v/c Ratio **	Under/Over Capacity
	I-4 Eastbound																		
20	SR 536 Off Ramp	Yes		-	-	0.31	UC	-	-	0.31	UC	-	-	0.34	UC	-	-	0.34	UC
21	On Ramp from Osceola Parkway			31.3	D	-	-	31.3	D	-	-	40.4	F	-	-	40.4	F	-	-
22	On Ramp from SR 536	Yes		-	-	0.47	UC	-	-	0.47	UC	-	-	0.49	UC	-	-	0.49	UC
23	SR 535 Off Ramp	Yes		-	-	0.17	UC	-	-	0.17	UC	-	-	0.37	UC	-	-	0.37	UC
26	CD System Off Ramp			24.8	F*	-	-	24.8	F*	-	-	31.9	F*	-	-	31.9	F*	-	-
	I-4 SUL Eastbound		D /																
55	SR 536 Off Ramp		35 (pc/mi/ln)	9.5	A	-	-	9.5	A	-	-	9.9	A	-	-	9.9	A	-	-
	I-4 Westbound																		
27a	SR 535 Off Ramp to CD			6.2	A											6.4			
27	CD System On Ramp			32.2	F*	-	-	34.2	F*	-	-	28.3	F*	-	-	30.5	F*	-	-
29	On Ramp from SR 535	Yes		-	-	0.28	UC	-	-	0.28	UC	-	-	0.21	UC	-	-	0.21	UC
30	SR 536 Off Ramp	Yes		-	-	0.40	UC	-	-	0.45	UC	-	-	0.45	UC	-	-	0.51	UC
31	Osceola Pkwy Off Ramp			24.0	F*	-	-	24.0	F*	-	-	14.2	B	-	-	14.2	B	-	-
	I-4 SUL Westbound																		
56	CD System On Ramp			5.3	A	-	-	5.3	A	-	-	5.3	A	-	-	5.3	A	-	-
57	On Ramp from SR 536			5.3	A	-	-	5.3	A	-	-	4.8	A	-	-	4.8	A	-	-

As shown in **Table 6-4**, the proposed ramp spur only has negligible impact on ramp v/c ratios with only a negligible increase observed for the I-4 westbound off-ramp to SR 536 (ID# 30). However, the I-4 westbound off-ramp to SR 535 (ID# 28) shows a slight reduction in the v/c ratio. The 2020 Ramp Operations shows the same impact for the I-4 westbound off-ramp to SR 536.

6.2.3 Weave Segment Analysis

The freeway weave analysis was conducted for both Build and No Build using HCS 2010 and the results are presented in **Table 6-6**.

Table 6-6 | Year 2016 and 2020 Weave Segments Operations

ID #	Weaving Segment	Time Period	2016 No Build		2016 Build		2020 No Build		2020 Build	
			v/c Ratio	LOS	v/c Ratio	LOS	v/c Ratio	LOS	v/c Ratio	LOS
35	I-4 EB from SR 536 on ramp to SR 535 off ramp	AM	1.03	F	1.03	F	1.32	F	1.32	F
36	I-4 WB from SR 535 on ramp to SR 536 off ramp		0.90	D	0.95	D	1.11	F	1.15	F
35	I-4 EB from SR 536 on ramp to SR 535 off ramp	PM	1.69	F	1.69	F	1.76	F	1.76	F
36	I-4 WB from SR 535 on ramp to SR 536 off ramp		0.82	D	0.90	D	1.02	F	1.06	F

The results indicate that the traffic diversion due to the proposed ramp spur will have minimal impact on the operation of the weaving segments. When compared to No Build conditions, the volume to capacity (v/c) ratio of the I-4 westbound segment from the SR 535 on-ramp to the SR 536 off-ramp increases by only five and ten percent in the analysis year 2016 for AM and PM peak conditions, respectively, in the Build conditions and will not result in a LOS letter grade change. Similarly, the increase in v/c ratio is less than four percent in the year 2020 for the subject westbound I-4 weave segment in both AM and PM peak hours and also will not result in a LOS letter grade change.

6.2.4 Intersection Analysis

Intersection analyses were performed using the Synchro and 2010 Highway Capacity Manual (HCM 2010) module for both Build and No Build conditions and the results are presented in **Table 6-7** through **Table 6-12**. The existing signal timings for the study intersections are optimized for the No Build conditions, resulting in improved performance at the intersection of SR 535 and I-4 eastbound. The Build condition intersection analysis is performed utilizing No Build analysis and applying traffic diversion due to proposed spur.

Table 6-7 | Year 2016 AM Peak Hour Intersection Operations

ID #	Primary Road	Secondary Road	LOS Standard / Delay Threshold	Approach	2016 AM No Build				2016 AM Build			
					Approach		Intersection		Approach		Intersection	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
40	SR 536	World Center Dr	D / 55 Sec	EB	38.1	D	61.8	E	38.1	D	61.8	E
				NB	84.1	F			84.1	F		
				SB	119.2	F			119.2	F		
				WB	54.7	D			54.7	D		
41	SR 535	Palm Parkway		EB	84.8	F	141.5	F	84.8	F	141.5	F
				NB	126.6	F			126.6	F		
				SB	163.8	F			163.8	F		
				WB	169.4	F			169.4	F		
42	SR 535	Hotel Plaza		EB	85.9	F	51.1	D	85.9	F	41.7	D
				NB	57.2	E			34.1	C		
				SB	25.4	C			25.4	C		
				WB	106.8	F			106.8	F		
43	SR 535	I-4 West Ramps		NB	42.7	D	43.5	D	37.2	D	37.0	D
				SB	28.9	C			22.9	C		
				SW	57.1	E			50.1	D		
44	SR 535	I-4 East Ramps		EB	76.6	E	20.0	B	76.6	E	20.0	B
				NB	0.2	A			0.2	A		
				SB	23.6	C			23.6	C		
				WB	67.2	E			67.2	E		
45	SR 535	Meadow Creek		EB	218.9	F	75.6	E	218.9	F	75.6	E
				NB	81.2	F			81.2	F		
				SB	47.3	D			47.3	D		
				WB	51	D			51	D		
46	Buena Vista Drive	Downtown Disney Entrance #3/ Team Disney		EB	3	A	11.0	B	6.4	A	11.8	B
				NB	47	D			42.3	D		
				SB	49.1	D			44.1	D		
				WB	10.8	B			10.7	B		
47	Buena Vista Drive Off Ramp	Downtown Disney Entrance #4/ Proposed Ramp Spur		EB	-	-	-	-	13.2	B	6.8	A
				NB	-	-			4.7	A		
48	Buena Vista Drive	Downtown Disney Entrance #5/ Typhoon Lagoon		EB	31.4	C	32.4	C	31.4	C	32.2	C
				NB	42.2	D			37.2	D		
				SB	53.3	D			48.8	D		
				WB	30.2	C			30.7	C		

Table 6-8 | Year 2016 PM Peak Hour Intersection Operations

ID #	Primary Road	Secondary Road	LOS Standard / Delay Threshold	Approach	2016 PM No Build				2016 PM Build			
					Approach		Intersection		Approach		Intersection	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
40	SR 536	World Center Dr	D / 55 Sec	EB	46.7	D	54.4	D	46.7	D	54.4	D
				NB	73.7	E			73.7	E		
				SB	62.9	E			62.9	E		
				WB	54.6	D			54.6	D		
41	SR 535	Palm Parkway		EB	105.1	F	81.0	F	105.1	F	81.0	F
				NB	44.6	D			44.6	D		
				SB	104.3	F			104.3	F		
				WB	113.6	F			113.6	F		
42	SR 535	Hotel Plaza		EB	75.1	E	64.5	E	77.8	E	52.8	D
				NB	74.7	E			44.2	D		
				SB	38.4	D			35.6	D		
				WB	102.3	F			102.3	F		
43	SR 535	I-4 West Ramps		NB	41.9	D	54.7	D	41	D	45.8	D
				SB	30.2	C			28.9	C		
				SW	90.9	F			69.7	E		
44	SR 535	I-4 East Ramps		EB	71.7	E	47.6	D	71.7	E	47.6	D
				NB	40	D			40	D		
				SB	36.7	D			36.7	D		
				WB	76	E			76	E		
45	SR 535	Meadow Creek		EB	119	F	59.8	E	119	F	59.8	E
				NB	56.8	E			56.8	E		
				SB	51.5	D			51.5	D		
				WB	51	D			51	D		
46	Buena Vista Drive	Downtown Disney Entrance #3/ Team Disney		EB	7.7	A	19.6	B	9.4	A	19.1	B
				NB	52.1	D			48.9	D		
				SB	58.2	E			53.1	D		
				WB	13	B			11.8	B		
47	Buena Vista Drive Off Ramp	Downtown Disney Entrance #4/ Proposed Ramp Spur		EB	-	-	-	-	12	B	7.5	A
				NB	-	-			5.8	A		
48	Buena Vista Drive	Downtown Disney Entrance #5/ Typhoon Lagoon		EB	42.8	D	46.7	D	40.3	D	43.8	D
				NB	58.1	E			51.5	D		
				SB	69	E			59.8	E		
				WB	44.5	D			42	D		

Table 6-9 | Year 2020 AM Peak Hour Intersection Operations

ID #	Primary Road	Secondary Road	LOS Standard / Delay Threshold	Approach	2020 AM No Build				2020 AM Build			
					Approach		Intersection		Approach		Intersection	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
40	SR 536	World Center Dr	D / 55 Sec	EB	68.9	E	143.7	F	68.9	E	143.7	F
				NB	200.6	F			200.6	F		
				SB	282.5	F			282.5	F		
				WB	91.9	F			91.9	F		
41	SR 535	Palm Parkway		EB	129.3	F	139.8	F	129.3	F	139.8	F
				NB	109.6	F			109.6	F		
				SB	162.6	F			162.6	F		
				WB	170.7	F			170.7	F		
42	SR 535	Hotel Plaza		EB	96.7	F	88.3	F	96.7	F	70.3	E
				NB	101.6	F			52.8	D		
				SB	66.3	E			66.4	E		
				WB	121.7	F			121.7	F		
43	SR 535	I-4 West Ramps		NB	31.2	C	49.1	D	29.6	C	36.6	D
				SB	16.5	B			14.4	B		
				SW	123.5	F			85.3	F		
44	SR 535	I-4 East Ramps		EB	114.2	F	30.8	C	114.2	F	30.8	C
				NB	13.3	B			13.3	B		
				SB	29	C			29	C		
				WB	77	E			77	E		
45	SR 535	Meadow Creek		EB	627.3	F	241.0	F	627.3	F	241.0	F
				NB	256.8	F			256.8	F		
				SB	129.1	F			129.1	F		
				WB	42.9	D			42.9	D		
46	Buena Vista Drive	Downtown Disney Entrance #3/ Team Disney		EB	3	A	15.5	B	6.8	A	13.6	B
				NB	80.4	F			54.1	D		
				SB	82.9	F			52.8	D		
				WB	11.5	B			11.2	B		
47	Buena Vista Drive Off Ramp	Downtown Disney Entrance #4/ Proposed Ramp Spur		EB	-	-	-	-	12.3	B	7.2	A
				NB	-	-			5.6	A		
48	Buena Vista Drive	Downtown Disney Entrance #5/ Typhoon Lagoon		EB	44.6	D	46.8	D	44.1	D	40.1	D
				NB	77.9	E			47.9	D		
				SB	89.7	F			63.5	E		
				WB	41.2	D			30.6	C		

Table 6-10 | Year 2020 PM Peak Hour Intersection Operations

ID #	Primary Road	Secondary Road	LOS Standard / Delay Threshold	Approach	2020 PM No Build				2020 PM Build			
					Approach		Intersection		Approach		Intersection	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
40	SR 536	World Center Dr	D / 55 Sec	EB	114.8	F	216.1	F	114.8	F	216.1	F
				NB	257.5	F			257.5	F		
				SB	435	F			435	F		
				WB	183.4	F			183.4	F		
41	SR 535	Palm Parkway		EB	118.5	F	159.0	F	118.5	F	159.0	F
				NB	134.9	F			134.9	F		
				SB	169	F			169	F		
				WB	208.4	F			208.4	F		
42	SR 535	Hotel Plaza		EB	84.4	F	87.0	F	84.4	F	67.7	E
				NB	116.4	F			61	E		
				SB	55.5	E			55.7	E		
				WB	116.6	F			116.6	F		
43	SR 535	I-4 West Ramps		NB	37.4	D	57.2	E	36.5	D	41.1	D
				SB	24.1	C			22.6	C		
				SW	122.1	F			74.2	E		
44	SR 535	I-4 East Ramps		EB	70	E	41.1	D	70	E	41.1	D
				NB	21.1	C			21.1	C		
				SB	37.4	D			37.4	D		
				WB	82.9	F			82.9	F		
45	SR 535	Meadow Creek		EB	400.5	F	100.4	F	400.5	F	100.4	F
				NB	67	E			67	E		
				SB	59.6	E			59.6	E		
				WB	65.9	E			65.9	E		
46	Buena Vista Drive	Downtown Disney Entrance #3/ Team Disney		EB	7.6	A	24.3	C	11.9	B	21.8	C
				NB	69.6	E			54.7	D		
				SB	77.2	E			58.2	E		
				WB	15.5	B			13.6	B		
47	Buena Vista Drive Off Ramp	Downtown Disney Entrance #4/ Proposed Ramp Spur		EB	-	-	-	-	12	B	7.9	A
				NB	-	-			6.3	A		
48	Buena Vista Drive	Downtown Disney Entrance #5/ Typhoon Lagoon		EB	52.1	D	61.3	E	40.9	D	45.5	D
				NB	97.6	F			59.5	E		
				SB	90.3	F			64.9	E		
				WB	58.8	E			42.7	D		

Table 6-11 | Year 2030 AM Peak Hour Intersection Operations

ID #	Primary Road	Secondary Road	LOS Standard / Delay Threshold	Approach	2030 AM No Build				2030 AM Build			
					Approach		Intersection		Approach		Intersection	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
40	SR 536	World Center Dr	D / 55 Sec	EB	114.4	F	199.1	F	114.4	F	199.1	F
				NB	300.9	F			300.9	F		
				SB	276.7	F			276.7	F		
				WB	184.9	F			184.9	F		
41	SR 535	Palm Parkway		EB	157.9	F	247.4	F	157.9	F	247.4	F
				NB	264.7	F			264.7	F		
				SB	256.4	F			256.4	F		
				WB	262.2	F			262.2	F		
42	SR 535	Hotel Plaza		EB	118.2	F	119.8	F	118.2	F	77.8	E
				NB	170.2	F			54	D		
				SB	69.5	E			69.5	E		
				WB	153.1	F			153.1	F		
43	SR 535	I-4 West Ramps		NB	35.4	D	59.0	E	34.6	C	40.9	D
				SB	23.6	C			22.5	C		
				SW	151	F			90	F		
44	SR 535	I-4 East Ramps		EB	124.8	F	33.7	C	124.8	F	33.7	C
				NB	15.8	B			15.8	B		
				SB	30.3	C			30.3	C		
				WB	86.1	F			86.1	F		
45	SR 535	Meadow Creek		EB	420.1	F	244.0	F	420.1	F	244.0	F
				NB	260.5	F			260.5	F		
				SB	187.5	F			187.5	F		
				WB	33.9	C			33.9	C		
46	Buena Vista Drive	Downtown Disney Entrance #3/ Team Disney		EB	3.1	A	15.8	B	5.8	A	16.6	B
				NB	80.6	F			80.2	F		
				SB	83	F			83	F		
				WB	12	B			11.9	B		
47	Buena Vista Drive Off Ramp	Downtown Disney Entrance #4/ Proposed Ramp Spur		EB	-	-	-	-	14.4	B	7.5	A
				NB	-	-			5.9	A		
48	Buena Vista Drive	Downtown Disney Entrance #5/ Typhoon Lagoon		EB	47	D	49.4	D	43.4	D	43.0	D
				NB	78.9	E			77.8	E		
				SB	96.2	F			89.5	F		
				WB	43.7	D			32.1	C		

Table 6-12 | Year 2030 PM Peak Hour Intersection Operations

ID #	Primary Road	Secondary Road	LOS Standard / Delay Threshold	Approach	2030 PM No Build				2030 PM Build			
					Approach		Intersection		Approach		Intersection	
					Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
40	SR 536	World Center Dr	D / 55 Sec	EB	142.1	F	260.2	F	142.1	F	260.2	F
				NB	353.9	F			353.9	F		
				SB	346.2	F			346.2	F		
				WB	302.2	F			302.2	F		
41	SR 535	Palm Parkway		EB	158.3	F	224.1	F	158.3	F	224.1	F
				NB	189.6	F			189.6	F		
				SB	247.3	F			247.3	F		
				WB	281.7	F			281.7	F		
42	SR 535	Hotel Plaza		EB	107.4	F	100.7	F	107.4	F	77.1	E
				NB	134.6	F			64.3	E		
				SB	63.2	E			63.3	E		
				WB	128.7	F			128.7	F		
43	SR 535	I-4 West Ramps		NB	33.6	C	62.0	E	33.6	C	43.1	D
				SB	23.9	C			23.9	C		
				SW	171.7	F			99.5	F		
44	SR 535	I-4 East Ramps		EB	114.3	F	51.8	D	114.3	F	51.8	D
				NB	22.8	C			22.8	C		
				SB	43	D			43	D		
				WB	92.3	F			92.3	F		
45	SR 535	Meadow Creek		EB	422.4	F	113.3	F	422.4	F	113.3	F
				NB	71.8	E			71.8	E		
				SB	77.8	E			77.8	E		
				WB	63.5	E			63.5	E		
46	Buena Vista Drive	Downtown Disney Entrance #3/ Team Disney		EB	10	A	27.0	C	16.2	B	24.3	C
				NB	74.4	E			62	E		
				SB	81.6	F			58.3	E		
				WB	16.5	B			13.2	B		
47	Buena Vista Drive Off Ramp	Downtown Disney Entrance #4/ Proposed Ramp Spur		EB	-	-	-	-	16.8	B	9.2	A
				NB	-	-			7.3	A		
48	Buena Vista Drive	Downtown Disney Entrance #5/ Typhoon Lagoon		EB	53.7	D	64.9	E	44.7	D	48.2	D
				NB	113.9	F			60.7	E		
				SB	96.9	F			68	E		
				WB	61.1	E			44.8	D		

Based on the intersection analysis:

- In 2016 comparison between No Build and Build conditions,
  - The average delay at the SR 535 and Hotel Plaza Blvd intersection (ID# 42) decreases/improves
    - from 51.1 sec/veh to 41.7 sec/veh in the AM peak hour and
    - from 64.5 sec/veh to 52.8 sec/veh in the PM peak hour
  - The average delay at the SR 535 and I-4 westbound intersection (ID# 43) decreases/improves
    - from 43.5 sec/veh to 37.0 sec/veh in the AM peak hour and
    - from 64.5 sec/veh to 52.8 sec/veh in the PM peak hour
- In 2020 comparison between No Build and Build conditions,
  - The average delay and LOS at the SR 535 and Hotel Plaza Blvd intersection (ID #42) decreases/improves
    - from 88.3 sec/veh and LOS F to 70.3 sec/veh and LOS E in the AM peak hour and
    - from 87.0 sec/veh and LOS F to 67.7 sec/veh and LOS E in the PM peak hour
  - The average delay and LOS at the SR 535 and I-4 westbound intersection (ID# 43) decreases/improves
    - from 49.1 sec/veh to 36.6 sec/veh in the AM peak hour and
    - from 57.2 sec/veh and LOS E to 41.1 sec/veh and LOS D in the PM peak hour
- In 2030 comparison between No Build and Build conditions,
  - The average delay and LOS at the SR 535 and Hotel Plaza Blvd intersection (ID #42) decreases/improves
    - from 119.8 sec/veh and LOS F to 77.8 sec/veh and LOS E in the AM peak hour and
    - from 100.7 sec/veh and LOS F to 77.1 sec/veh and LOS E in the PM peak hour
  - The average delay and LOS at the SR 535 and I-4 westbound intersection (ID# 43) decreases/improves
    - from 59.0 sec/veh and LOS E to 40.9 sec/veh and LOS D in the AM peak hour and
    - from 62.0 sec/veh and LOS E to 43.1 sec/veh and LOS D in the PM peak hour

In summary, the two intersections on SR 535 at Hotel Plaza Boulevard and I-4 westbound show a decrease in overall intersection delay in years 2016, 2020 and 2030 in both the AM and PM peak hours in the Build conditions compared to the No Build conditions. In addition, these two intersections' LOS is also projected to improve by one letter grade (improve from LOS F to LOS E or LOS E to LOS D) in years 2020 and 2030 in both AM and PM peak hours.

6.2.5 Queuing Analysis

The results of the queuing analysis for the intersections of SR 535 with I-4 westbound and the proposed ramp spur with Buena Vista Drive/Entrance Four and are summarized in **Table 6-13**, **Table 6-14**, and **Table 6-15** for years 2016, 2020 and 2030, respectively.

Table 6-13| Year (2016) Peak Hour Queues

	2016 No-Build				2016 Build			
Movement	**95th Percentile Queue Length(ft)**	**Req. Storage (ft)**	**Available Storage (ft)**	**Queue Exceeds Storage?**	**95th Percentile Queue Length(ft)**	**Req. Storage (ft)**	**Available Storage (ft)**	**Queue Exceeds Storage?**
	AM Peak-Hour							
	SR 535 & I-4 West Ramps - Signalized Intersection							
Westbound Left	382	375	650	No	382	375	650	No
Westbound Right	881	875	1,200	No	680	675	1,200	No
	Proposed Ramp Spur & Buena Vista Drive/Entrance Four - Signalized Intersection							
Northbound Thru	-	-	-	-	46	50	2,000	No
	PM Peak-Hour							
	SR 535 & I-4 West Ramps - Signalized Intersection							
Westbound Left	860	850	650	YES	827	825	650	YES
Westbound Right	1,002	1,000	1,200	No	436	425	1,200	No
	Proposed Ramp Spur & Buena Vista Drive/Entrance Four - Signalized Intersection							
Northbound Thru	-	-	-	-	63	75	2,000	No

Table 6-14 | Year (2020) Peak Hour Queues

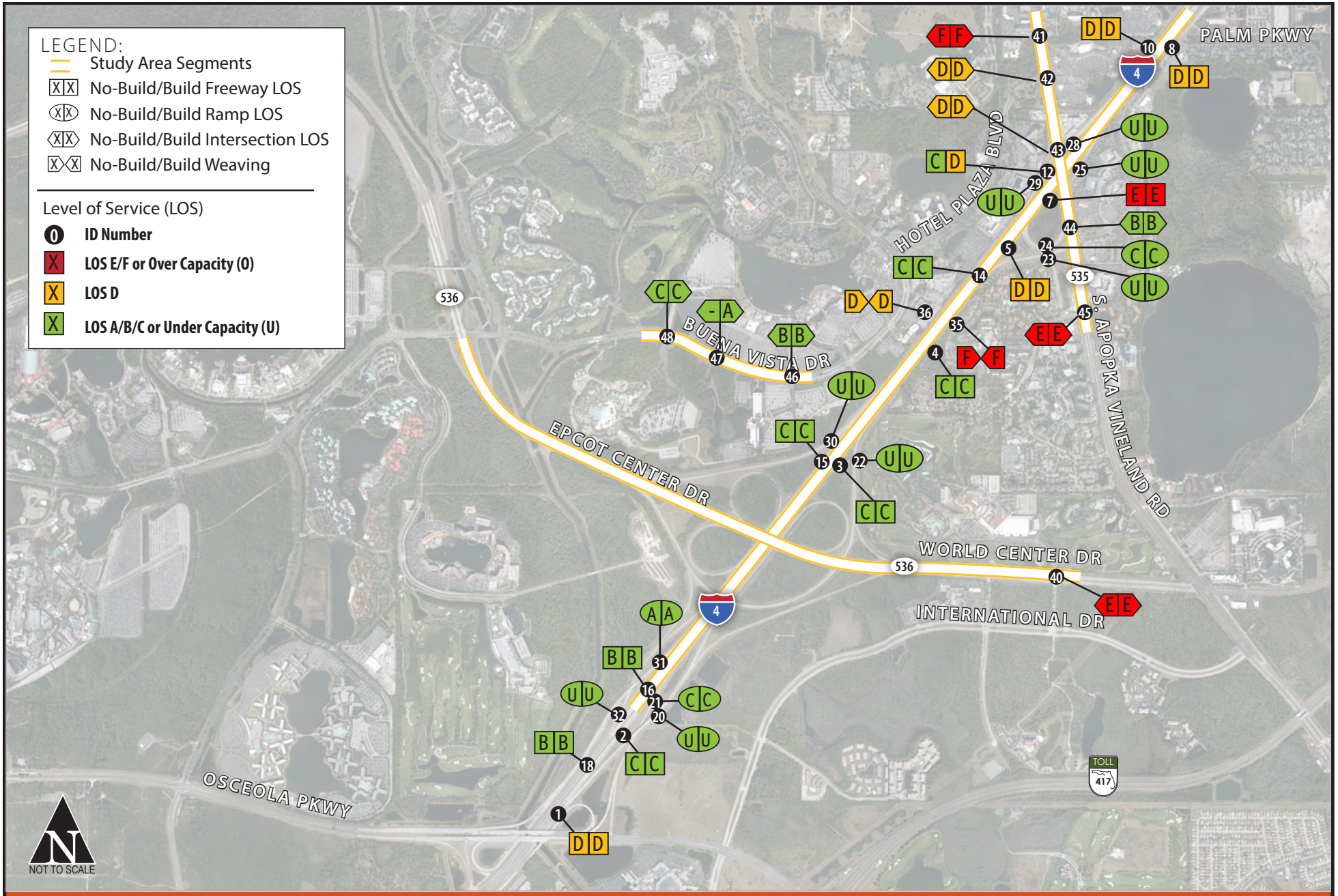
	2020 No-Build				2020 Build			
Movement	**95th Percentile Queue Length(ft)**	**Req. Storage (ft)**	**Available Storage (ft)**	**Queue Exceeds Storage?**	**95th Percentile Queue Length(ft)**	**Req. Storage (ft)**	**Available Storage (ft)**	**Queue Exceeds Storage?**
	AM Peak-Hour							
	SR 535 & I-4 West Ramps - Signalized Intersection							
Westbound Left	516	525	650	No	443	450	650	No
Westbound Right	777	775	1,200	No	276	275	1,200	No
	Proposed Ramp Spur & Buena Vista Drive/Entrance Four - Signalized Intersection							
Northbound Thru	-	-	-		60	50	2,000	No
	PM Peak-Hour							
	SR 535 & I-4 West Ramps - Signalized Intersection							
Westbound Left	593	600	650	No	601	600	650	No
Westbound Right	1,048	1,050	1,200	No	697	700	1,200	No
	Proposed Ramp Spur & Buena Vista Drive/Entrance Four - Signalized Intersection							
Northbound Thru	-	-	-		92	100	2,000	No

Table 6-15 | Year (2030) Peak Hour Queues

Movement	2030 No-Build				2030 Build			
	95th Percentile Queue Length(ft)	Req. Storage (ft)	Available Storage (ft)	Queue Exceeds Storage?	95th Percentile Queue Length(ft)	Req. Storage (ft)	Available Storage (ft)	Queue Exceeds Storage?
	AM Peak-Hour							
	SR 535 & I-4 West Ramps - Signalized Intersection							
Westbound Left	648	650	650	No	648	650	650	No
Westbound Right	954	950	1,200	No	393	400	1,200	No
	Proposed Ramp Spur & Buena Vista Drive/Entrance Four - Signalized Intersection							
Northbound Thru	-	-	-		115	125	2,000	No
	PM Peak-Hour							
	SR 535 & I-4 West Ramps - Signalized Intersection							
Westbound Left	657	650	650	No	657	650	650	No
Westbound Right	972	975	1,200	No	577	575	1,200	No
	Proposed Ramp Spur & Buena Vista Drive/Entrance Four - Signalized Intersection							
Northbound Thru	-	-	-		232	225	2,000	No

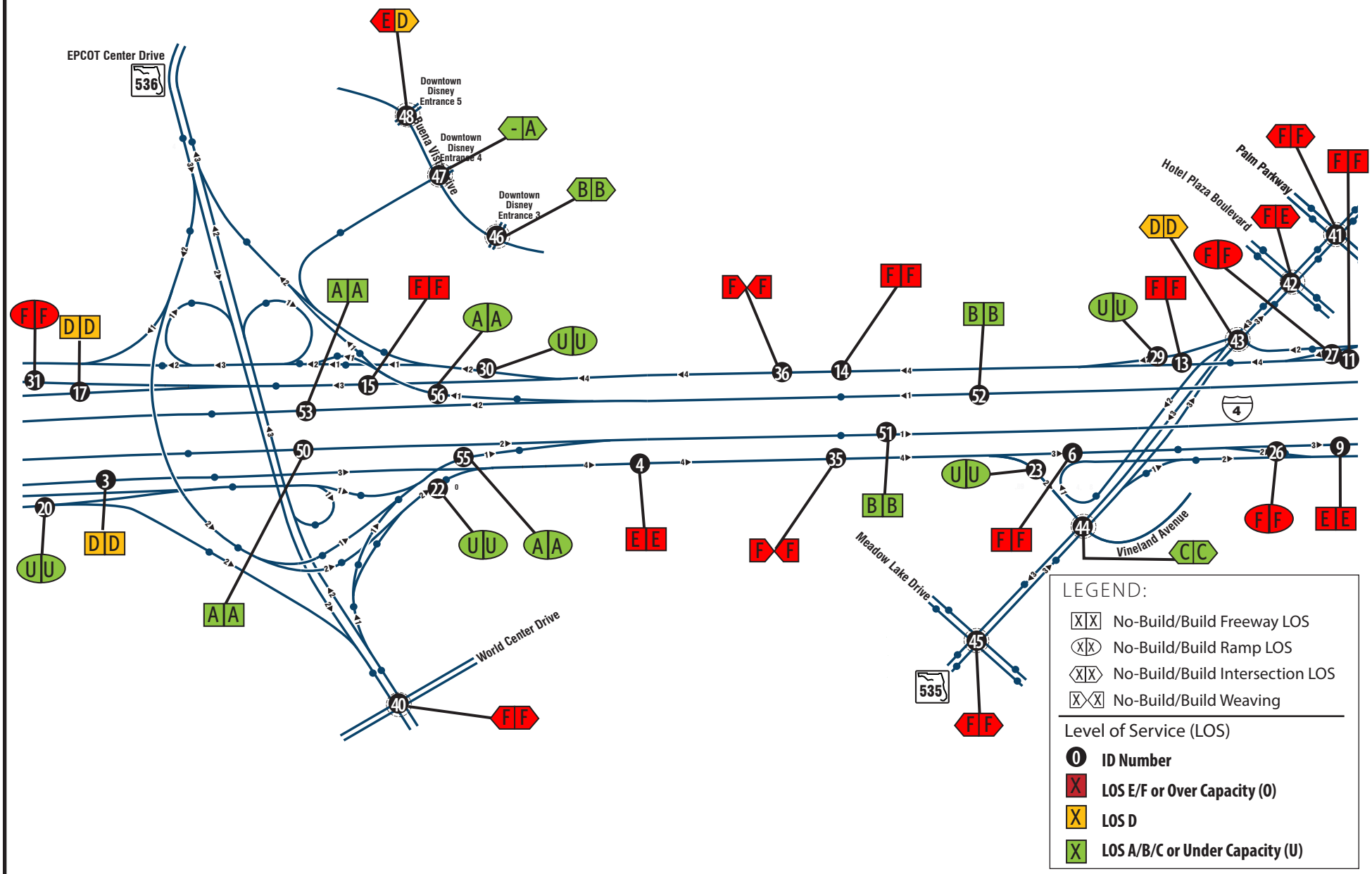
The results indicate that the traffic diversion due to the proposed ramp spur reduces the queue for the westbound right turn movement for both the AM and PM conditions for the analysis years 2016, 2020 and 2030. The results also indicate that queues on the proposed ramp spur at the intersection with Buena Vista Drive are less than 225 feet in all analysis years 2016, 2020 and 2030 in the AM and PM peak hours.

The LOS summary for mainline freeway segments, ramp junctions, weave segments and intersections within the area of influence for years 2016 and 2020 are shown graphically in **Figures 6-2 thru 6-5**. **Appendix E** contains all the HCS 2010 and Synchro output sheets for analysis years 2016, 2020 and 2030.



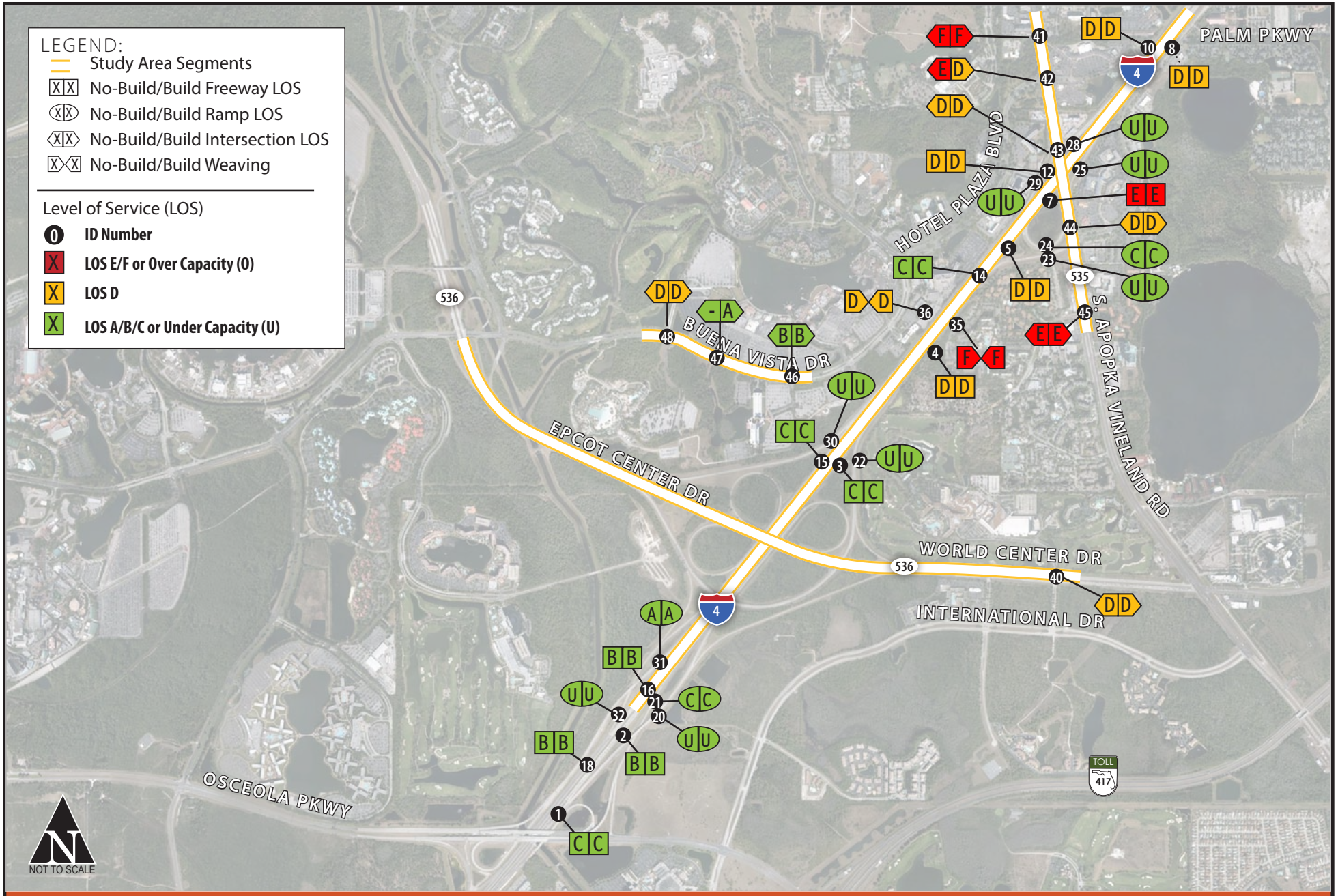
Interstate 4 and SR 536 Off-Ramp

Figure 6-2
AM 2016
Level of Service



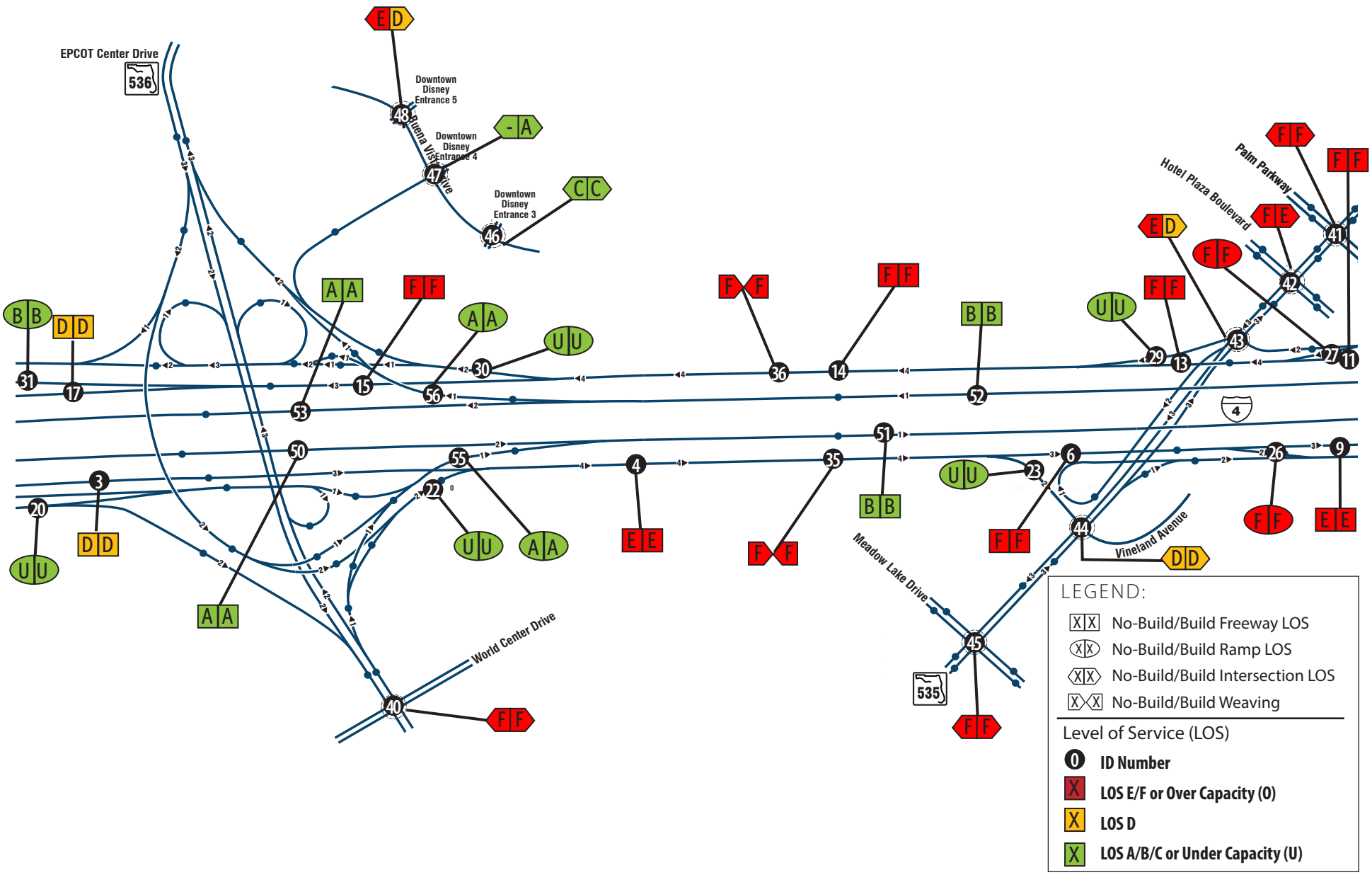
Interstate 4 and SR 536 Off-Ramp

Figure 6-3
AM 2020
Level of Service



Interstate 4 and SR 536 Off-Ramp

Figure 6-4
PM 2016
Level of Service



Interstate 4 and SR 536 Off-Ramp

Figure 6-5
PM 2020
Level of Service

6.3 Proposed Ramp Spur - Microsimulation Analyses

Due to the geometric complexities of the study corridor and oversaturated conditions on some segments, the discrete HCM analyses presented in the previous sections are inadequate for accurately assessing the overall operational performance of the Build alternative versus the No Build alternative. Therefore, microsimulation analyses were conducted in order to provide a comprehensive comparison between the Build alternative and the No Build alternative for the design year 2030. The microsimulation analyses were performed using VISSIM software as documented in the MLOU.

6.3.1 Existing Year (2011) VISSIM Model Development:

Existing Year (2011) models were developed for one-hour time periods during both AM (7:30 to 8:30) and PM (4:45 to 5:45) peak hours. Aerial photography was utilized to establish lane configurations and horizontal curvature. The information collected from the aerial photography was verified during field surveys. The desired speeds were based on the posted speeds in the field and the speed distributions were coded as plus five miles per hour from the posted speed as the average speed with a distribution over and under. Reduced speed areas were strategically placed in locations where vehicles need to reduce their speed due to the roadway alignment or for turning at intersections. The timing and phasing assumptions used by the various agencies were used as the base for each signalized intersection within the study area using VISSIM's RBC controllers.

VISSIM models were developed and calibrated for the study area following the FHWA's Traffic Analysis Toolbox Volume IV, the Oregon Department of Transportation (ODOT) VISSIM Protocol and the 2014 FDOT Traffic Analysis Handbook. Visual checking of the animation files was performed to cross check the coding of the network. Abnormal driving behaviors or irregular queuing within the network were examined in order to identify potential geometry coding errors prior to beginning the calibration process. The volumes that were collected from ten VISSIM model runs were compared with the existing counts. Simulation output volumes from an average of ten simulation runs were matched using the GEH statistic. The congestion for a freeway segment is measured based on travel speed, in miles per hour (mph). The travel speed is the average speed from the simulation runs. The average travel speed was obtained using the link evaluation feature of VISSIM. Both the simulation travel speeds and the simulation volumes are within the calibration target ranges specified in the approved MLOU. The report documenting the VISSIM model development and the calibration process is included in the **Appendix C.**

6.3.2 Year 2030 No Build and Build VISSIM Models:

Development of the 2030 No Build VISSIM alternative involved applying applicable modifications to the 2011 Base Model to reflect the 2030 network and 2030 volumes. The 2030 models maintained all the global calibration parameters per the 2011 Base Model. VISSIM microsimulation analysis was conducted for the analysis year 2030 for both AM and PM conditions. The 2030 volumes utilized for simulations were shown in **Figure 5-3 and Figure 5-6**. The 2030 VISSIM models were developed to cover a total five hour time period during both AM (6:30 to 11:30) and PM (13:45 to 18:45) peaks. Analyses were conducted using one hour-time intervals. One hour interval traffic volumes were estimated based on the peak spreading factors described in the Section 5.2.1.

Development of the 2030 Build VISSIM alternative involved addition of the proposed ramp spur to the 2030 No Build Base Model to reflect the network changes. Appropriate routing and input parameters were changed to reflect the traffic diversion due to the proposed ramp spur.

6.3.3 Year 2030 No Build and Build Operating Conditions:

The color coded graphics depict the approximate density range for the peak hour of the peak period analysis along the segments of the network. The graphics include approximate LOS conditions per HCM LOS thresholds.

Table 6-16 | Year 2030 Network-wide MOEs

I-4 and SR 536 Sub Area - AM Peak			
Parameter	**No Build**	**Build**	**Build Improvement**
Total Travel Time (hr)	27,249	25,870	5%
Total Travel Time per Vehicle (min)	9.1	8.8	3%
Total Delay Time (hr)	17,222	15,932	7%
Average Delay Time (sec/veh)	335	316	6%
Latent Delay Time (hr)	12,616	12,945	-3%
Number of Arrived Vehicles	180,085	176,562	-2%
Latent Vehicles	26,388	26,874	-2%
Average Delay per Arrived Vehicle (sec/veh)	344	325	6%
Total Delay + Latent Delay (hr)	29,838	28,877	3%
Total Delay + Latent Delay (min) per Vehicle	8.7	8.5	2%

I-4 and SR 536 Sub Area - PM Peak			
Parameter	**No Build**	**Build**	**Build Improvement**
Total Travel Time (hr)	30,413	31,744	-4%
Total Travel Time per Vehicle (min)	11.2	11.2	0%
Total Delay Time (hr)	21,214	22,059	-4%
Average Delay Time (sec/veh)	449	449	0%
Latent Delay Time (hr)	22,177	17,027	23%
Number of Arrived Vehicles	163,024	169,867	-4%
Latent Vehicles	46,576	35,639	23%
Average Delay per Arrived Vehicle (sec/veh)	468	467	0%
Total Delay + Latent Delay (hr)	43,391	39,086	10%
Total Delay + Latent Delay (min) per Vehicle	12.4	11.4	8%

- **Table 6-16** compares network-wide measures of effectiveness (MOEs) for both the No Build and Build alternatives. The results indicate that Build subarea shows following improvements
  - Reduction in overall network travel times and the delays per vehicle being served in the network.
  - Serves more vehicles in the network, enabling more vehicles to arrive at their destinations within the peak periods.

- The density **Figures 6-6** through **6-9** indicate that oversaturated conditions are expected along I-4 during both AM and PM peak periods. The figures show that the density of westbound I-4 around the SR 536 interchange is the same with or without the proposed ramp spur; this is partially due to the fact that the SR 535 is oversaturated.
- A node evaluation for the proposed ramp spur intersection is summarized in **Table 6-17**. Analysis indicates that the proposed ramp spur intersection is operating within LOS standards and ramp queues do not extend to the I-4 mainline.
- Link evaluation for selected segments in I-4 westbound direction is provided in **Table 6-18**. The average speeds by segment indicate speed drops marginally from No Build conditions. Additionally, the average speeds on the proposed ramp are approximately 35 mph in both AM and PM peak conditions.

Table 6-17 | Year 2030 Proposed Ramp Spur Intersection Node Evaluation

				2030 AM No-Build					2030 AM Build					2030 PM No-Build					2030 PM Build				
				Approach			Intersection		Approach			Intersection		Approach			Intersection		Approach			Intersection	
Primary Road	Secondary Road	LOS Standard/ Delay Threshold	Approach	Delay (sec)	Max Queue (ft)	LOS	Delay (sec)	LOS	Delay (sec)	Max Queue (ft)	LOS	Delay (sec)	LOS	Delay (sec)	Max Queue (ft)	LOS	Delay (sec)	LOS	Delay (sec)	Max Queue (ft)	LOS	Delay (sec)	LOS
SR 536	World Center Dr	D/55 Sec	EB	157.8	7149.0	F	135.6	F	120.4	4096.4	F	125.5	F	47.5	8109.8	D	483.6	F	129.5	4994.4	F	384.5	F
			NB	233.5	865.4	F			241.0	862.9	F			893.6	865.1	F			306.2	863.7	F		
			SB	164.8	1950.5	F			165.2	1950.3	F			2708.1	1943.2	F			1142.8	1952.4	F		
			WB	57.5	858.0	E			67.6	965.0	E			2033.4	2104.0	F			689.6	2112.7	F		
SR 535	Palm Parkway		EB	322.9	2773.2	F	237.5	F	218.0	2494.7	F	216.8	F	55.8	974.5	E	171.5	F	119.4	1085.7	F	188.3	F
			NB	130.0	1483.6	F			129.6	1483.3	F			139.2	1483.8	F			138.7	1483.6	F		
			SB	287.8	3603.9	F			285.0	3603.2	F			244.8	3603.6	F			256.9	3604.0	F		
			WB	283.2	1700.2	F			309.2	1701.4	F			335.0	1699.8	F			291.2	1699.8	F		
SR 535	Hotel Plaza		EB	257.6	1189.9	F	162.5	F	255.5	1193.7	F	162.2	F	228.6	1196.7	F	150.0	F	281.6	1195.2	F	161.6	F
			NB	174.3	1442.0	F			182.7	1442.4	F			197.4	1442.3	F			197.1	1441.6	F		
			SB	110.7	1495.9	F			106.7	1477.5	F			85.4	1354.7	F			85.8	1448.9	F		
			WB	61.9	287.1	E			60.1	303.3	E			51.2	199.4	D			50.5	202.0	D		
SR 535	I-4 West Ramps		NB	187.6	1608.3	F	216.6	F	216.7	1610.4	F	148.0	F	244.2	1611.7	F	215.5	F	268.1	1610.4	F	248.8	F
			SB	24.0	1173.2	C			23.5	1098.1	C			29.6	1277.6	C			29.9	1298.3	C		
			WB	1104.4	9719.9	F			294.3	2294.6	F			662.8	9718.4	F			864.6	9718.1	F		
SR 535	I-4 East Ramps		EB	63.5	271.5	E	135.3	F	74.2	291.3	E	142.8	F	1077.0	10032.5	F	289.7	F	635.2	4810.0	F	266.1	F
			NB	136.7	1284.3	F			166.9	1284.9	F			255.9	1287.5	F			209.8	1288.7	F		
			SB	21.2	336.9	C			21.8	443.0	C			24.0	421.0	C			23.8	406.5	C		
			WB	604.0	1132.6	F			691.8	1133.0	F			352.2	1132.1	F			1112.6	1126.5	F		
SR 535	Meadow Creek		EB	197.9	832.7	F	213.4	F	255.8	836.6	F	235.6	F	391.3	834.0	F	292.5	F	276.9	837.3	F	262.5	F
			NB	372.1	1977.6	F			442.7	1976.5	F			628.6	1977.6	F			527.8	1976.3	F		
			SB	48.0	550.6	D			50.7	655.0	D			48.9	667.6	D			49.1	632.0	D		
			WB	115.1	264.9	F			144.6	266.6	F			185.9	264.7	F			166.8	265.4	F		
Buena Vista Drive	Downtown Disney Entrance #3/ Team Disney		EB	6.8	149.7	A	12.2	B	7.5	174.3	A	12.2	B	9.3	160.6	A	16.5	B	11.2	170.7	B	17.1	B
			NB	23.5	124.8	C			23.2	125.7	C			24.4	225.8	C			23.9	217.5	C		
			SB	40.7	95.6	D			40.1	93.5	D			38.9	115.8	D			38.9	113.8	D		
			WB	14.3	191.6	B			13.7	167.4	B			17.6	206.1	B			17.0	171.0	B		
Buena Vista Drive	Downtown Disney Entrance #4/Garage Entrance		EB	12.6	298.3	B	14.5	B	11.0	239.3	B	13.7	B	13.5	320.1	B	19.6	B	12.4	246.9	B	19.0	B
			NB	21.0	99.3	C			20.2	95.8	C			28.8	160.8	C			27.7	167.6	C		
			SB	40.8	94.7	D			40.4	90.2	D			64.3	186.8	E			50.9	165.9	D		
			WB	13.4	219.1	B			13.0	187.3	B			14.8	271.4	B			14.6	251.6	B		
Buena Vista Drive	Downtown Disney Entrance #5/ Typhoon Lagoon		EB	0.0	0.0	A			12.0	168.7	B			0.0	0.0	A			14.7	231.5	B		
			NB	0.0	0.0	A			6.5	171.9	A	7.1	A	0.0	0.0	A			8.2	274.4	A	8.8	A
			SB	0.0	0.0	A			1.2	0.0	A			0.0	0.0	A			1.4	0.0	A		

Figure 6-6 | No Build Year 2030 AM Density Plot

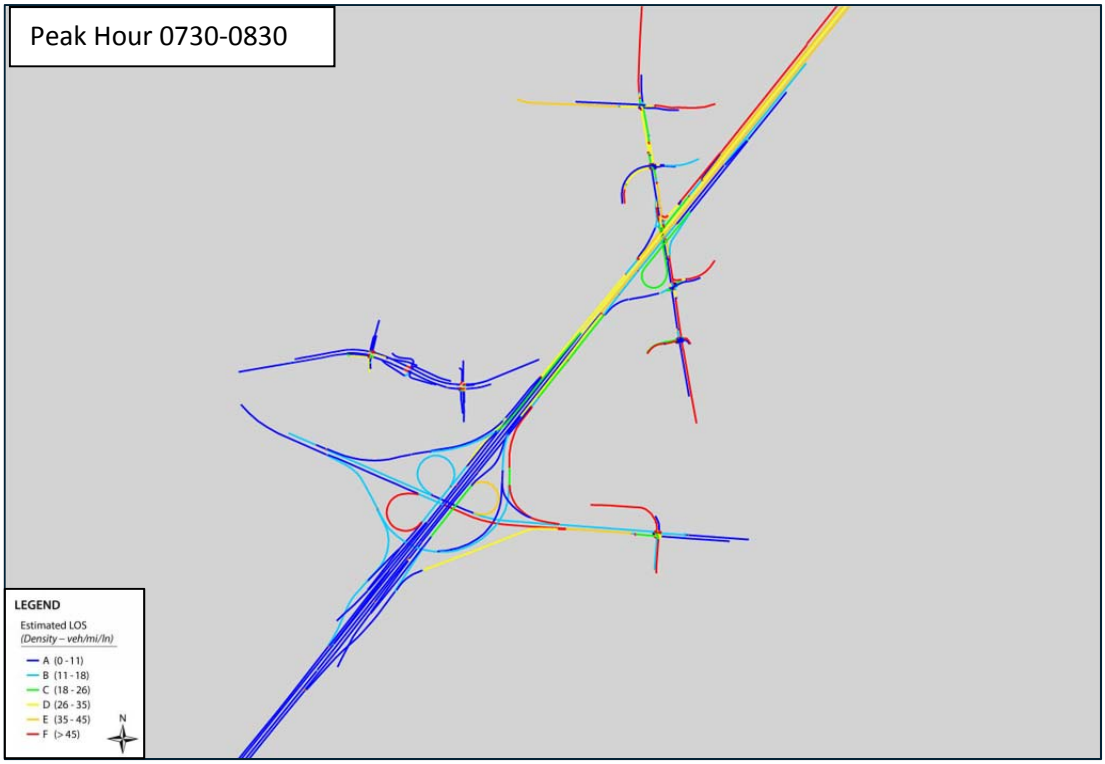


Figure 6-7 | Build Year 2030 AM Density Plot

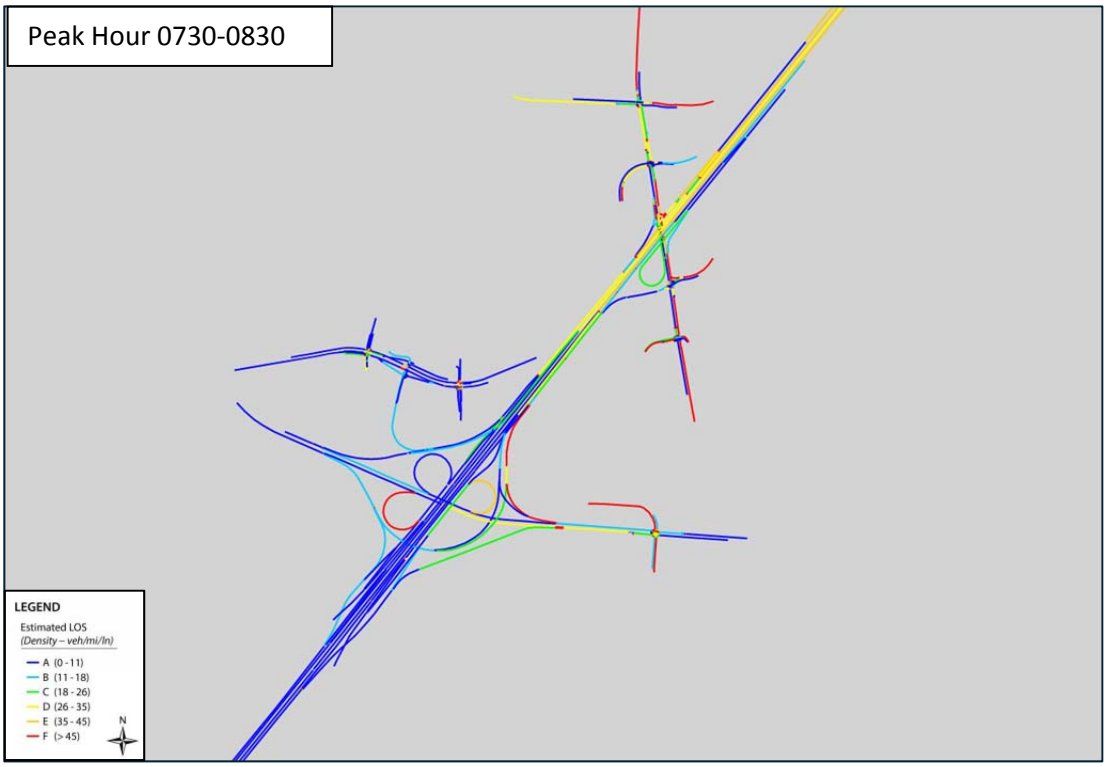


Figure 6-8 | No Build Year 2030 PM Density Plot

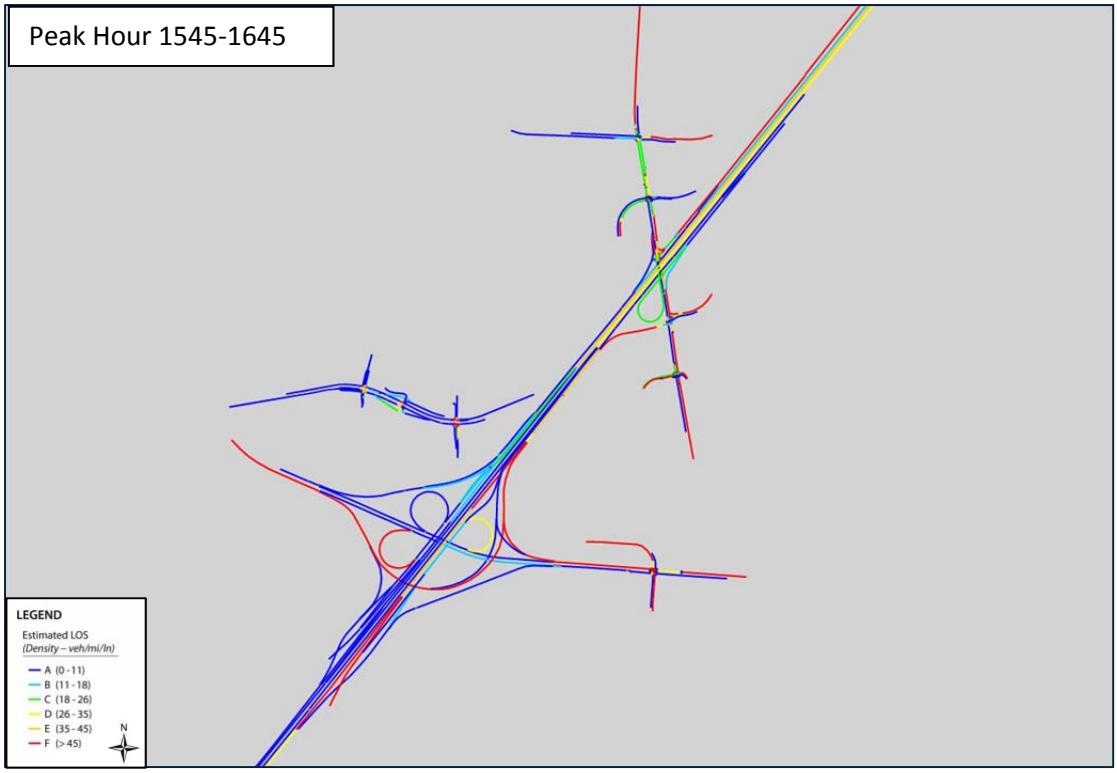


Figure 6-9 | Build Year 2030 PM Density Plot



Table 6-18 | Year 2030 Proposed Ramp Spur Link Evaluation

Segment Name	No Build AM	Build AM	AM Improvement	No Build PM	Build PM	PM Improvement
	AvgVelocity	AvgVelocity	AvgVelocity	AvgVelocity	AvgVelocity	AvgVelocity
I-4 WB off-ramp to SR 536 WB	58.8	58.8	0.0	58.6	55.3	-3.3
I-4 WB south of SR536	63.8	63.9	0.1	63.9	63.8	-0.1
I-4 WB on-ramp from SR536	46.7	46.8	0.0	47.5	47.0	-0.5
SR536 WB off-ramp	25.6	23.6	-2.0	0.8	3.7	2.9
SR535 NB between Hotel Plaza and Palm Pkwy	18.0	18.0	0.0	17.4	17.3	-0.1
SR535 SB between Hotel Plaza and Palm Pkwy	6.5	6.7	0.2	7.9	7.8	-0.1
SR535 SB north of Palm Pkwy	5.9	5.9	0.0	6.2	6.1	-0.1
SR535 NB north of Palm Pkwy	36.0	36.1	0.1	35.9	35.9	0.0
SR536 NB north between I-4 and Hotel Plaza	11.2	11.1	-0.1	11.8	11.2	-0.6
SR535 NB south of Meadow Creek	3.4	2.8	-0.6	2.1	2.4	0.3
SR535 SB south of Meadow Creek	36.3	36.3	0.0	36.3	36.3	0.0
SR535 NB off-ramp to I-4 WB frontage	36.4	36.5	0.1	37.1	36.3	-0.7
SR535 NB between Vineland Ave and I-4	8.5	7.5	-1.1	7.4	6.3	-1.1
SR535 SB south of SR536 EB off-ramps	18.8	18.5	-0.3	16.9	16.3	-0.7
SR535 SB off-ramp to I-4 WB frontage	17.3	17.3	0.1	17.1	16.9	-0.2
SR 535 SB at I-4	31.5	29.9	-1.6	29.9	29.9	0.0
SR 535 NB at I-4	5.8	5.1	-0.7	5.5	4.1	-1.4
Proposed Ramp Spur to BVD	0.0	36.0	36.0	0.0	35.3	35.3
I-4 WB on-ramp from SR535	29.3	28.7	-0.6	43.3	38.9	-4.4
SR535 SB off-ramp to I-4 WB	34.3	34.3	0.0	34.5	34.6	0.1

7.0 Conceptual Funding Plan

The construction of the ramp spur will be funded by RCID with funds available in fiscal year 2014/15.. The conceptual funding plan included in MetroPlan Orlando's TIP is shown below in **Table 7-1**.

Table 7-1 | Conceptual Funding Plan

Project Number	Project Name or Designation	Project Description				2030 LRTP Reference	Historic Cost Prior to 2014/15 ($000's)	2014/15-2018/19 Project Status and Cost ($000's)						Estimated Future Cost After 2018/19 ($000's)	Total Project Cost ($000's)	Responsible Agency
		From	To	Length (Miles)	Work Description			2014/15	2015/16	2016/17	2017/18	2018/19	Funding Sources	Project Phases			
RCID-1	SR 536 Slip Ramp	SR 536 W of I-4	Buena Vista Dr.	0.59	New Single Lane Ramp	Not in LRTP		2,172	0	0	0	0	RCID	CST			RCID
							1,207	2,172	0	0	0	0	Total		0	3,379	

8.0 Consistency with Other Plans/Projects

FDOT coordinated with MetroPlan Orlando and RCID regarding planning consistency. The ordinance/resolution for amending the 5 Year Schedule of Capital Improvements to update all current projects including the I-4 ramp is included in Appendix F. The amendment maintaining operational mobility is consistent with the regional Long Range Transportation Plan (LRTP) goals. After RCID adoption, this improvement was adopted into RCID's Capital Improvement Program and Transportation Plan. It is also is currently included in MetroPlan Orlando's Transportation Improvement Project (TIP) under Locally Funded Highway Projects. The MetroPlan Orlando region is currently guided by the 2030 LRTP, and work on the long range plan for the year 2040 is currently under way. MetroPlan Orlando LRTP amendment (2030 LRTP Amendment July 11, 2012) includes the I-4 BtU PD&E. MetroPlan Orlando believes that the ramp modification is consistent with the adopted LRTP as it improves routing along I-4.

9.0 Environmental Considerations

Environmental issues were investigated in a separate study through the I-4 BtU study. The supporting documentation for the environmental coordination is provided in **Appendix G**, which **c**onsists of a copy of a Historical Resource concurrence letter dated January 2, 1992 and the conceptual environmental resource permits that were renewed in 2012 by United States Army Corps of Engineers (USACOE). Additionally, a final approval for the proposed ramp impacts from ACOE dated April 30, 2014 is included in **Appendix G**. USACOE coordination indicates that this project will have minimal environmental impacts. FDOT District Five has also reviewed the environmental impact of the proposed improvement, consistent with the PD&E Manual and the Partnership Agreement. FDOT District Five has determined the class of action as a Programmatic Categorical Exclusion consistent with the established FHWA delegation authority to the Department.

10.0 Conceptual Signage Plan

The conceptual signage plan for the proposed improvement is shown in **Appendix H** for both year 2016 conditions and for 2020 conditions with I-4 BtU PD&E study conditions.

11.0 Conclusion

FDOT is currently conducting the I-4 BtU PD&E study. This PD&E study is expected to further improve operations of the SR 535 interchange and I-4. This IMR summarizes comparative analysis of Build and No Build conditions of the proposed ramp spur. The traffic data was provided by FDOT for use in the operational analysis for this study.

Based on the operational analysis conducted using basic freeway, ramp merge/diverge, weave, intersection and microsimulation analyses, the proposed improvement will provide better overall operating conditions. Key findings that serve the purpose and need of the ramp spur are:

- Crash data analysis shows that the majority of crashes are rear end crashes, indicating congestion in all the study segments. However, both crash rate and the predominant crash type for the I-4 westbound segment from SR 535 to SR 536 indicate that this segment is not as congested as other I-4 segments. Addition of diverted trips from the SR 535 interchange will not adversely impact safety due to the proposed ramp spur.
- The intersections of SR 535 with the I-4 westbound off-ramp and SR 535 and Hotel Plaza Boulevard will operate better under the Build alternative compared to No Build.
- The queue analysis results indicates following:
    - The traffic diversion due to the proposed ramp spur reduces the queue for the westbound right turn movement at the westbound I-4 offramp to SR 535 for both the AM and PM conditions for the analysis years 2016, 2020 and 2030.
    - Queues on the proposed ramp spur at the intersection with Buena Vista Drive are less than 225 feet in all analysis years 2016, 2020 and 2030 in the AM and PM peak hours. This is well below the available storage.
- The weave analysis indicates that the traffic diversion due to the proposed ramp spur will have minimal impact on the operation of the weaving segments in the study area in both 2016 and 2020 analysis years.
- Year 2030 VISSIM analysis indicates the following:
    - Reduction in overall network travel times and the delays per vehicle being served in the network.
    - Serves more vehicles in the network, enabling more vehicles to arrive at their destinations within the peak periods.
- Based on the supporting documentation from potential environmental and social impacts, there are no substantive issues that would preclude the construction of the interchange modification at SR 536.

Therefore, proposed ramp spur will not compromise the operations of the Interstate system. The proposed ramp spur is consistent with and complements the improvements to Buena Vista Drive that are currently underway. The proposed ramp spur will also meet the identified need of a safe direct access to the Buena Vista Drive commercial area and Downtown Disney. It will meet the mobility requirements for the general public and area development. The proposed ramp spur can be completed as a part of the existing cost feasible plan. After consideration of the data and analyses presented in this IMR, the Build alternative is recommended for approval.

Appendices

Appendices

Appendix A – Approved MLOU

Florida Department of Transportation
Methodology Letter of Understanding (MLOU)

Project Title: I-4 and SR 536 Off-Ramp Interchange Modification Report, April 29, 2014

Type of request: ☐ IJR ☐ SIJR ☒ IMR ☐ SIMR ☐ IOAR ☐ SAMR Re-evaluation

- *Coordination of assumptions, procedures, data, networks, and outputs for project traffic review during the access request process will be maintained throughout the evaluation process.*
- *Full compliance with all MLOU requirements does not obligate the Acceptance Authorities to accept/approve the interchange access request.*

Requestor — Beata Stys-Palasz, District Five I-4 PD&E Project Manager — 4/29/14 *Date*

☒ *Interchange Review Coordinator* — John Zielinski, District Five Interchange Coordinator — 4/29/14 *Date*

☒ *State Interchange Review Coordinator* — Martha Hodgson, Systems Planning Office – Central Office — 4/29/14 *Date*

☒ *Federal Highway Administration* — Nicholas Finch, Associate Division Administrator — 4/30/14 *Date*

1.0 Project Description

Provide background or supporting information that explains the basis for the request.

This document serves as the Methodology Letter of Understanding (MLOU) between Florida Department of Transportation (FDOT) District Five (requestor), Interchange Review Coordinator (IRC), FDOT Central Systems Planning Office (SPO), and the Federal Highway Administration (FHWA) regarding preparation of the Interchange Modification Report (IMR), for the proposal of an extension to the Interstate-4 (I-4) WB Off Ramp to SR 536 in Orange County, FL. The methodology described in the following sections is in accordance with the FDOT Policy No. 000-525-015-f Approval of New or Modified Access to Limited Access Facilities; The Interchange Handbook, FDOT Procedure No. 525-030-160-i; and the FDOT Project Traffic Forecasting Handbook (Procedure No. 525-030-120).

Ranked as the most visited city in United States of America, according to the Forbes magazine, Orlando's famous attractions such as Walt Disney World Resort form the backbone of its tourism industry. Located in the heart of this Walt Disney World Resort, Downtown Disney is a 120-acre entertainment, dining and shopping complex. Downtown Disney, which is located along Buena Vista Drive, is open to the public, requires no admission fee, and offers complimentary parking and transportation to all Disney-operated Walt Disney World resorts. Currently, Downtown Disney is in the process of a multi-year transformation into Disney Springs. Disney Springs proposes to feature more than 150 shopping, dining and entertainment venues. The Reedy Creek Improvement District (RCID) is the governing jurisdiction for the entire area of the Walt Disney World Resort.

I-4 is an integral part of Central Florida's transportation system. This Interstate carries the greatest number of people and vehicles of any transportation facility in the region and serves many of the area's primary activity centers. Since its opening in 1965, I-4 has served intrastate and interstate travel by providing a critical link between the east and west coasts of Central Florida. Today, I-4 also serves as the primary link between hotel/motel complexes and tourist attractions such as Walt Disney World including Downtown Disney, Universal Studios, Sea World, the International Drive Resort Area and downtown Orlando. In addition, since I-4 is the only north-south limited access facility that is centrally located between the predominant employment centers and the major suburbs to the north, it has become the primary commuting corridor in the Central Florida metropolitan area.

The Department is conducting the I-4 Systems Access Modification Report (SAMR) Re-evaluation on two sections. Section A is west of the I-4 Ultimate initial operating segment and Section B is east of the I-4 Ultimate initial operating segment. The limits of Section A are the I-4/US 27 interchange in Polk County and the I-4/SR 435 interchange in Orange County. The limits of Section B are the I-4/SR 434 interchange in Seminole County and the I-4/Orange Camp Road interchange in Volusia County. The purpose of the I-4 SAMR Re-evaluation is to ensure that the improvements to the I-4 corridor are responsive to changing conditions. This MLOU documents the operational analysis methodology to be used for evaluating the SR 536 off ramp extension for a direct connection to Buena Vista Drive (BVD). The operational analysis for this project will utilize the same data from the I-4 SAMR Re-evaluation project to maintain consistency.

A. *Purpose and Need Statement*
Provide the Purpose, the Need, and the Goals and Objectives.

The purpose of the operational improvements is to increase safety by reducing the queuing along the I-4 mainline at the adjacent SR 535 interchange to the north. There is an opportunity to divert traffic from the SR 535 interchange to the downstream interchange at SR 536 by leveraging the Reedy Creek Improvement District's proposal to extend the I-4 WB off-ramp at I-4/SR 536.

The SR 535 interchange provides access to Walt Disney World including Downtown Disney and is located north of the SR 536 interchange. Currently most of the westbound I-4 traffic uses SR 535 to access Downtown Disney/Disney Springs. SR 535 is a constrained facility operating at or near capacity. The congestion along SR 535 causes traffic to back up on I-4 negatively impacting other interchanges along I-4. Additionally in recent years, congestion on I-4 has extended well beyond normal peak hours resulting in traffic congestion throughout the metropolitan area. Due to these congested conditions, user travel times will continue to increase for the area's residents, visitors, and employees.

Hence, RCID is proposing an extension to the I-4 WB Off-Ramp at SR 536. This off-ramp extension will provide direct access to the BVD commercial corridor that includes Downtown Disney/Disney Springs. The proposed improvement, by allowing a direct access to Downtown Disney/Disney Springs, will reduce congestion on the I-4 mainline and at the upstream SR 535 interchange with I-4.

B. *Project Location*
Provide a description and map of the IAR study area.

The portions of I-4 included in this project are in Sections Nos. 92130000 and 75280000. The SR 536 interchange with I-4 is located between the interchanges at Osceola Parkway to the south (milepost 65.32) and SR 535 to the north (milepost 68.107). The proposed improvement is a single lane ramp (approximately 0.5 mile in length) that begins on the existing westbound (WB) SR 536 off-ramp approximately 2000 feet west of the westbound I-4 mainline ramp gore and bridges over BVD; thus, eliminating the at grade intersection at Downtown Disney West Side. This proposed ramp provides tourist access to two parking garages on the north side of BVD and staff access to various buildings along BVD via connecting ramps. Currently, one of the two parking garages is under construction. Please note that traffic from both visitors and the staff is spread over multiple hours during the day in the Downtown Disney area.

This project is for one of the interchanges that falls within the western segment of the I-4 SAMR Re-evaluation. The project location with respect to the I-4 SAMR western segment is shown in Figure 1.

See Figure # 1

C. *Area of Influence*
Provide a description of the area of influence along the main line and cross street.

Along mainline: The anticipated Area of Influence (AOI) of the proposed interchange ramp extension, as defined in The Interchange Handbook, is a minimum of one interchange on both sides of the subject interchange and one-half mile on the cross streets on all three interchanges. During the MLOU coordination meeting with FHWA on April 11, 2014, the project team decided to include following interchanges (including ramp merge/diverge areas and weaving areas) in the AOI:

I-4 and SR 536
I-4 and SR 535

Along cross streets: Intersections will be evaluated on the cross streets within one-half mile on both sides of three interchanges, or to the nearest signalized intersection if no signalized intersection exists within one-half mile. The intersections within the AOI are listed below for each corridor.

- SR 536 at World Center Drive
- SR 535 at Palm Parkway
- SR 535 at Hotel Plaza Boulevard
- SR 535 at I-4 Westbound ramps
- SR 535 at I-4 Eastbound ramps
- SR 535 at Meadow Creek Drive
- Buena Vista Drive at Typhoon Lagoon
- Buena Vista Drive at Downtown Disney West side
- Buena Vista Drive at Team Disney / AMC Theaters

See Figure # 2

D. *Project Schedule*
Identify the schedule of production activities consistent with a proposed conceptual funding plan and opening year.

The anticipated opening year for the project is year 2016. All subsequent phases of this project including construction will be funded by RCID.

2.0 Analysis Years

A. *Traffic Forecasting*

- Base year — Central Florida Regional Planning Model (CFRPM 5.01)- 2005
- Horizon year — CFRPM - 2035

B. *Traffic Operational Analysis*

- Existing year 2011

During the MLOU coordination meeting between FDOT and FHWA on April 11, 2014, the analysis years were agreed upon from this group discussion.

- Opening year 2016
- Interim year(s) 2020
- Design year 2030

3.0 Alternatives

Alternatives		Year of Analysis			
		Existing	*Opening*	*Interim*	*Design*
No Build		☒	☒	☒	☒
Build	Preferred Alternative	☐	☒	☒	☒
	Other Alternatives	☐	☐	☐	☐

The Build concept of the proposed ramp will be evaluated and compared with No-Build conditions for all the analysis years.

A. Requester has developed specific alternative(s) at this point and the alternative(s) are described below.

Design concepts will be evaluated for SR 536. Preliminary concept is shown in Figure 3.

Figure # 3

B. Build alternatives that were eliminated from consideration or evaluated under prior studies and discarded will be documented as to why they were not carried forward.

N/A

4.0 Data Collection

The type of data that may be used should be identified.

A. *Transportation System Data*

Data will be obtained from various sources including FDOT, RCID, Orange County, Osceola County, and other agencies in addition to the field collected data. Field visits will be conducted to collect information on existing geometry, storage lengths, traffic signal heads, and to determine/verify

signal phasing information, such as protected/permitted left-turn operation, right-turn-on-red restrictions, phase overlaps, etc. The signal timing plans for signalized intersections will be obtained from Orange County, Osceola County, and RCID and coded into the model.

For microsimulation analysis, turning movement counts in the AM and PM peak-hours will be obtained for all ramp intersections and at the adjacent side street signalized intersections within ½ mile of each I-4 interchange as mentioned previously in the AOI. Freeway and ramp volumes will be obtained from the 2011 Florida Traffic Information (FTI) DVD. All traffic counts will be normalized to year 2011 and balanced throughout the network. Aerial photography (MrSID files) will be utilized to establish lane configurations and horizontal curvature. The information collected from the aerial photography will be verified during field surveys. Wavetronix, SmartSensor detector data will be obtained from the FDOT for vehicle composition.

B. *Existing and Historical Traffic Data*

Existing (2011) traffic counts will be collected for the I-4 mainline, I-4 ramps and the cross streets from the FDOT FTI database and county count programs. The following resources will be utilized for this effort:

- Florida Traffic Information CD
- Orange County Traffic Counts
- Osceola County Traffic Counts

C. *Land Use Data*

The 2040 land use dataset will be extrapolated from the adopted 2035 land use data set.

D. *Environmental Data*

Environmental data and issues will be investigated in the on-going PD&E update FM 432100-1.

E. *Planned and Programmed Projects*

This study will consider the following programmed PD&E projects.

- 201210-2 - US 27 to CR 532 PD&E Update, FY 12/13
- 432100-1 - CR 532 to SR 472 PD&E Update, FY 12/13

5.0 Travel Demand Forecasting

The CFRPM version 5.01 model used for the 2010 I-4 Systems Access Management Report (SAMR) is still the latest approved model for District Five. The CFRPM version 5.01 contains model data sets for the base year of 2005, interim years of 2015, 2020, 2025, 2030 and horizon year 2035.

A. *Project Traffic Forecast Development Methodology*
Describe the methodology and assumptions in developing the future year traffic volumes (AADT and DDHV)

The travel demand forecasting methodology for this sub area will be consistent with I-4 SAMR Re-evaluation project for consistency purposes. The Peak Season Weekday Average Daily Traffic (PSWADT) produced from the CFRPM will be converted to Annual Average Daily Traffic (AADT) by applying the Model Output Conversion Factor (MOCF) for I-4 and the arterials. Directional Design Hour Volumes (DDHVs) will be developed from AADT for both the No-Build and Build conditions for the years 2020 and 2030.

This operational improvement is expected to open in the year 2016. Four options, listed below, were discussed with FHWA to develop the traffic for the Opening Year.

- Option #1: Use the most current counts available (2011) and the 2020 traffic and interpolate the 2016 opening year count in addition to 2020, 2030, and 2040 analysis.
- Option #2: Use the 2020, 2030, and 2040 volumes to generate an overall growth rate. Regress 2020 traffic to 2016 in addition to 2020, 2030, and 2040 analysis.
- Option #3: Use the 2020, 2030, and 2040 volumes to generate an overall growth rate. Grow from most current counts (2011) to 2016 in addition to 2020, 2030, and 2040 analysis.
- Option #4: Consider this an interim safety condition. Using current traffic only across the build and no build. Allow the I-4 SAMR to determine the configuration for the PD&E improvement.

During the MLOU coordination meeting with FHWA on April 11, 2014, FHWA preferred Option #1 with the analysis year 2016, 2020 and 2030.

The unique characteristics of the western segment of I-4 SAMR Re-evaluation project including the area of influence of this project required special attention in the development of traffic projections due the presence of attractions such as Disney World (including its four parks and Downtown Disney), Sea World, and Universal Studios within the vicinity. Therefore, DDHVs will be developed for peak-period for extended hours, consistent with westerns segment of I-4 SAMR Re-evaluation.

B. *Validation Methodology*
Describe the methodology using current FDOT procedures in data collection procedure

Identify how modifications to the travel demand forecasting model will be made, including modifications to the facility type and area type for links, modifications to socio-economic data and all input and output modeling files for review.

Study area land use, network coding, travel patterns, etc. will be checked for reasonableness and the model outputs will be compared with observed data.

C. *Adjustment Procedures*
Identify the process used to adjust modeled future year traffic to the defined analysis years. Discuss how trends/growth-rates will be factored into this.

The CFRPM 5.01 forecasts will be used to develop 2020 and 2030. The CFRPM 2020 and 2030 socioeconomic data sets will be used for the opening and interim years. Traffic growth rates will be developed for each facility based on the results of the travel demand models and will be compared to historical traffic growth rates and projected land use growth rates for reasonableness.

6.0 Traffic Operational Analysis

The area type, traffic conditions, and analysis tools to be used are summarized in this section.

A. *Existing Area Type/Traffic Conditions*

Area Type	Conditions	
	Under-saturated	*Saturated*
Rural	☐	☐
Urban Areas/Transitioning Urbanized Areas	☐	☐
Urbanized Areas/Central Business District (CBD)	☒	☒

B. *Traffic Analysis Software Used*

Software		System Component					
		Freeways				Cross Road	
Name	Version	Basic Segment	Weaving	Ramp Merge	Ramp Diverge	Arterials	Intersections
LOSPLAN		☐	☐	☐	☐	☐	☐
HCS/HCM		☒	☒	☒	☒	☐	☐
Synchro		☐	☐	☐	☐	☐	☒
SimTraffic		☐	☐	☐	☐	☐	☐
Corsim		☐	☐	☐	☐	☐	☐
Vissim		☒	☒	☒	☒	☒	☒
Other		☐	☐	☐	☐	☐	☐

Detailed operational analyses will be performed for future No-Build (without ramp), Build alternatives (with ramp), for all analysis years. Operational analyses will be performed for both AM and PM peak periods.

Opening Year (2016) and Interim Year (2020) Operational Analyses: Following analyses will be conducted utilizing the design traffic forecasts.

- Basic Freeway Analysis
- Freeway Weaving Analysis
- Ramp Merge and Diverge Analysis
- Queuing Analysis
- Intersection Analysis

The operational analysis will be conducted using latest version of HCS and Synchro software utilizing the latest version of the Highway Capacity Manual (HCM) 2010 Methodology.

Design Year Operational Analyses (2030): A Sub Area VISSIM model for I-4 consisting of SR 536, Buena Vista Drive and adjacent interchange, SR 535, will be utilized to perform following analyses for the Design Year.

- Basic Freeway Analysis
- Freeway Weaving Analysis
- Ramp Merge and Diverge Analysis
- Queuing Analysis of the proposed ramp including any impacts from parking garages on to I-4 mainline will be performed
- Intersection Analysis

C. *Calibration*

- Calibration methodology and parameters utilized will be documented. Any deviations will be justified.

A Sub Area VISSIM model for I-4 consisting of SR 536, Buena Vista Drive, Hotel Plaza Boulevard, and two adjacent interchanges; Osceola Pkwy and SR 535 will be developed for existing conditions. VISSIM models will be constructed and validated to 2011 existing conditions. The Federal Highway Administration's (FHWA's) Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software will be used as a guideline for the development of the project VISSIM models.
The table below shows the calibration criteria and acceptable targets as documented in FHWA Traffic Analysis Toolbox Volume III.

Calibration Criteria and Acceptance Targets

Facility	Measure	Criteria	Calibration Acceptance Targets
Freeway	Speed	**Model Versus Observed**	Average link speeds will be within the ±10 mph of field-measured speeds on at least 85% of all network links.
	Volume	**Hourly Flows, Model Versus Observed**	
		Individual Link Flows	
		Within 15%, for 700 veh/h < Flow < 2700 veh/h	> 85% of cases
		Within 100 veh/h, for Flow < 700 veh/h	> 85% of cases
		Within 400 veh/h, for Flow > 2700 veh/h	> 85% of cases
		Sum of All Link Flows	Within 5% of sum of all link counts
		GEH Statistic < 5 for Individual Link Flows	> 85% of cases
		GEH Statistic for Sum of All Link Flows	GEH < 4 for sum of all link counts
Arterial	Queue	Model Versus Observed, through movement queue lengths	within 30 % of observed Queues

D. *Selection of Measures of Effectiveness (MOE)*

Both qualitative and quantitative measures of performance or effectiveness (MOE's) will be used to differentiate between the alternatives. The MOEs that will be assessed from the VISSIM models include the following:

- Node Evaluation: volume, delay, and maximum queue length for the study area intersections
- Link Evaluation Segments: volume, speed, and density information for the study area.
- Network-wide Output: total travel time, total delay time, vehicle-miles of travel, latent volume, latent delay, etc.

The MOEs that will be assessed from the HCS and Synchro analyses will include the following:

- Freeway and Ramp Merge/Diverge Analysis: speed, density and LOS.
- Intersection Analysis: total delay and LOS

7.0 Safety Analysis

- A comparison of the I-4 main line queuing in the build and no-build will be conducted. Crash analysis will be conducted for I-4 in the study area for the past three years.

8.0 Consistency with Other Plans/Projects

- FDOT coordinated with MetroPlan Orlando and RCID regarding planning consistency. MetroPlan Orlando Long Range Transportation Plan (LRTP) amendment (2030 LRTP Amendment July 11, 2012) includes a PD&E (FM# 432100-1) for the I-4 from Polk/Osceola County Line to West of Kirkman Road and from 1 mile east of SR 434 to ½ miles east of SR 472. MetroPlan Orlando believes that the ramp modification is consistent with the adopted LRTP as it improves routing along I-4. However, MetroPlan Orlando indicated that that the procedures for amendments to the LRTP state that projects originating from the private sector need to be sponsored by the local government of jurisdiction, in this case RCID. The procedures also states that locally funded projects are included in the Transportation Improvement Project (TIP) for information and may be amended anytime by the local government or transportation agency. RCID is currently in the process of amending RCID's Five Year Schedule of Capital Improvements. Maintaining operational mobility is consistent with the regional LRTP goals. After adoption this could be transmitted to MetroPlan Orlando for their inclusion in TIP.

9.0 Environmental Considerations

Environmental issues will be investigated in a separate study and will be included with the final report.

10.0 Coordination

Yes	No	N/A	
☒	☐	☐	An appropriate effort of coordination will be made with appropriate proposed developments in the area.
☒	☐	☐	Request will identify and include (if applicable) a commitment to complete the other non-interchange/non-intersection improvements that are necessary for the interchange/intersection to function as proposed.
☒	☐	☐	Request will document whether the project requires financial or infrastructure commitments from other agencies, organizations, or private entities.
☒	☐	☐	Request will document any pre-condition contingencies required in regards to the timing of other improvements and their inclusion in a TIP/STIP/LRTP prior to the Interstate access acceptance (final approval of NEPA document).
☒	☐	☐	Request will document the funding and phasing.

11.0 Anticipated Design Exceptions and Variations

☒ Design exceptions/variations are not anticipated, but if an exception/variation should arise it will be processed per FHWA and FDOT standards.

☐ The following exceptions/variations to FDOT, AASHTO or FHWA rules, policies, standards, criteria or procedures have been identified:

12.0 Conceptual Signing Plan

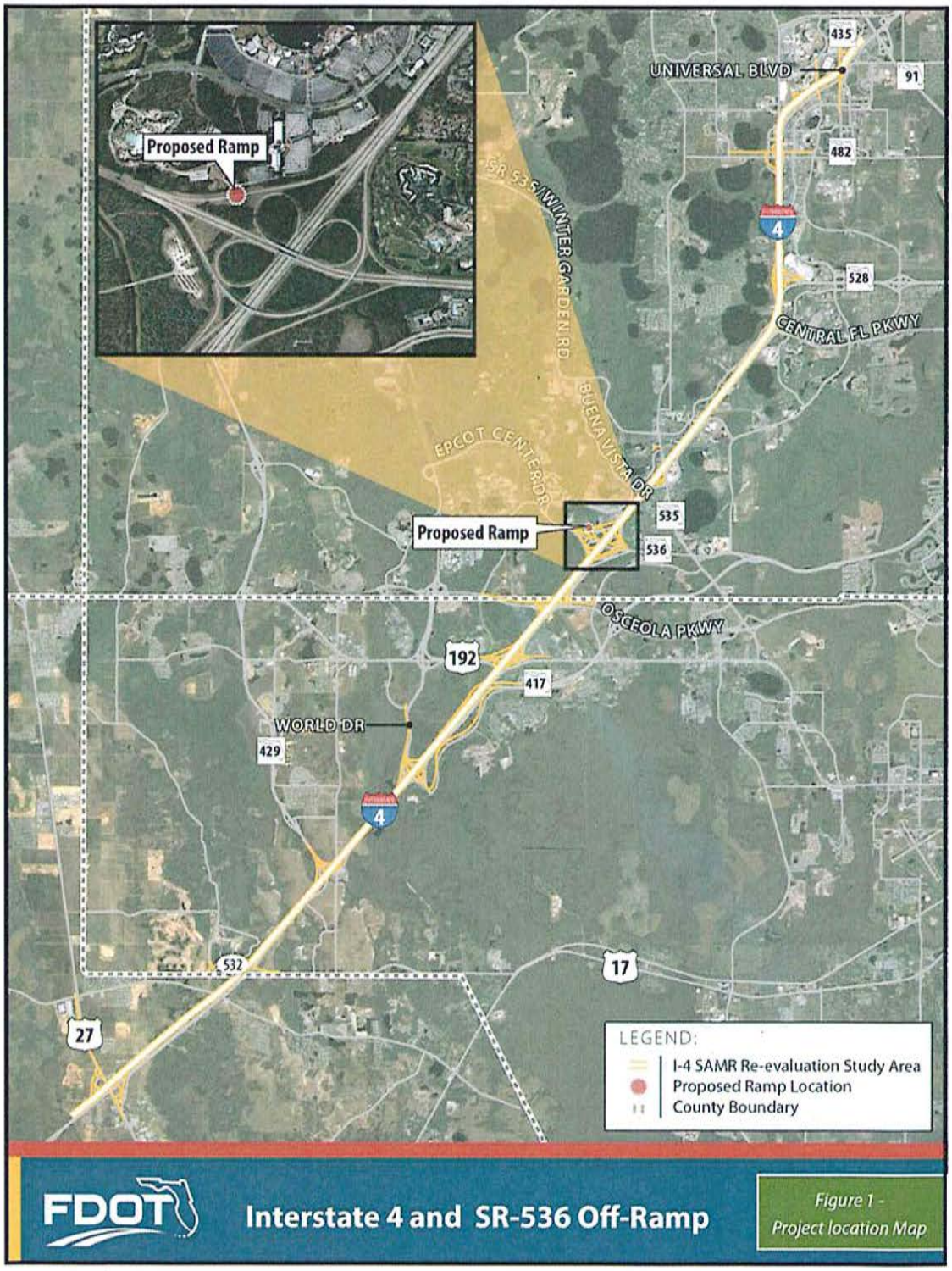
A conceptual signing plan will be prepared and included.

13.0 Access Management Plan

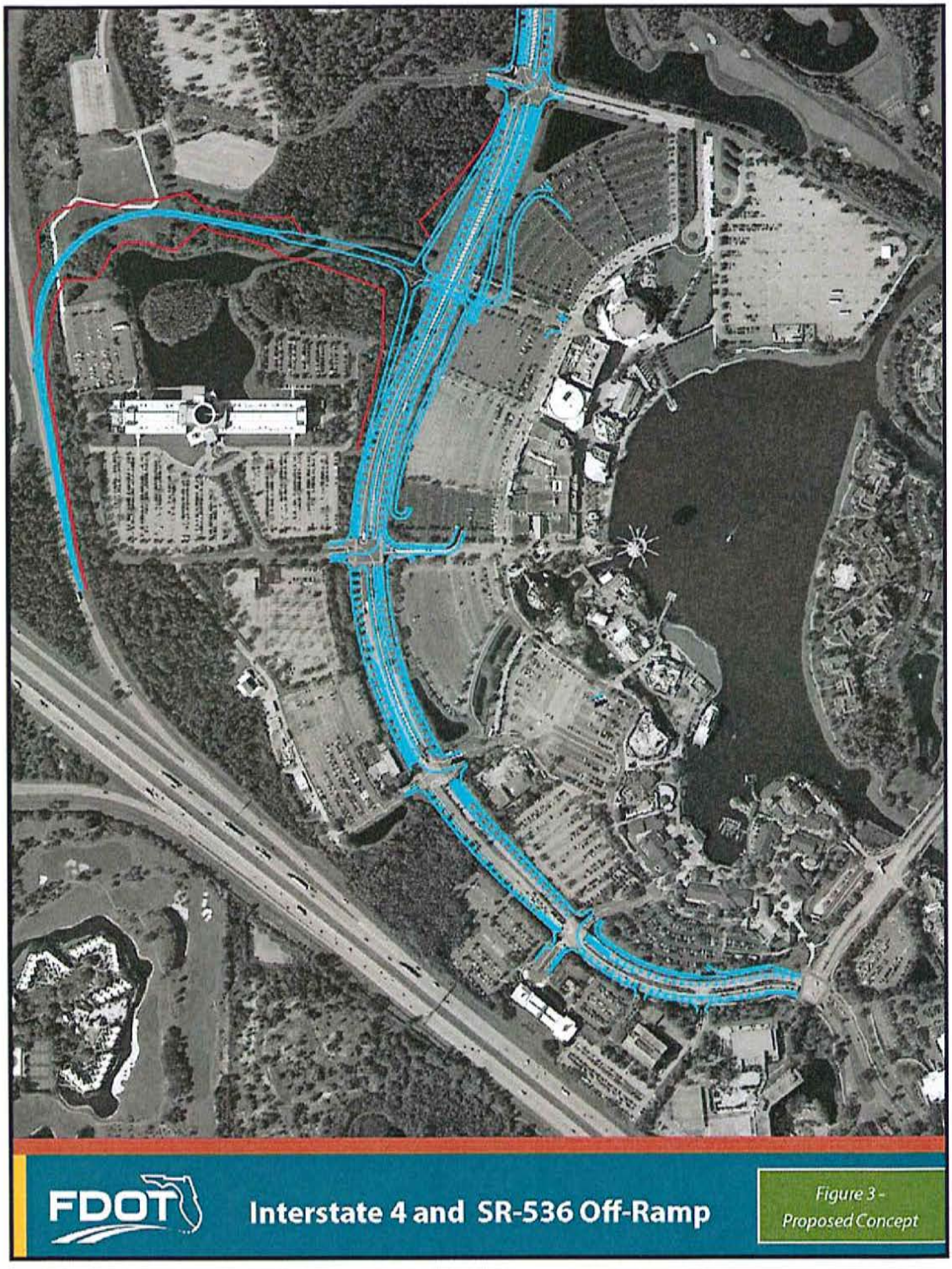
An access management plan for BVD will be prepared and included.

14.0 FHWA Policy Points

The FHWA 8 Policy Points will be addressed within the request.


Proposed Ramp
UNIVERSAL BLVD
435
91
482
528
SR 535/WINTER GARDEN RD
CENTRAL FL PKWY
BUENA VISTA DR
EPCOT CENTER DR
Proposed Ramp
535
536
OSCEOLA PKWY
192
417
WORLD DR
429
4
532
17
27
LEGEND:
I-4 SAMR Re-evaluation Study Area
Proposed Ramp Location
County Boundary
FDOT
Interstate 4 and SR-536 Off-Ramp
Figure 1 -
Project location Map


LEGEND:
Study Area Segments
Proposed Ramp
Study Intersections
PALM PKWY
MOTEL PLAZA BLVD
S APOPKA VINELAND RD
BUENA VISTA DR
EPCOT CENTER DR
WORLD CENTER DR
INTERNATIONAL DR
OSCEOLA PKWY
536
535
4
NOT TO SCALE
FDOT
Interstate 4 and SR-536 Off-Ramp
Figure 2 -
Area of Influence


FDOT
Interstate 4 and SR-536 Off-Ramp
Figure 3 -
Proposed Concept

Appendix B – Existing Traffic Data and Crash Data

Traffic Data

Phase Vehicle Basic Timing Data

Date 10/18/2012 Time 11:34:56

Intersection Name BVD & Backstage Ln

Source Database

Phase	1	2	3	4	5	6	7	8
Minimum Green	7	30	0	7	7	30	0	7
Passage	3.0	4.0	0.0	3.0	3.0	2.5	0.0	3.0
Maximum 1	25	45	0	15	30	45	0	30
Maximum 2	14	78	0	19	30	61	0	13
Yellow Change	4.0	4.5	4.0	4.0	4.0	4.5	4.0	4.0
Red Clearance	2.5	2.5	0.0	3.0	2.0	2.5	0.0	2.5

Phase	9	10	11	12	13	14	15	16
Minimum Green	0	0	0	0	0	0	0	0
Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum 1	0	0	0	0	0	0	0	0
Maximum 2	0	0	0	0	0	0	0	0
Yellow Change	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Red Clearance	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Phase Vehicle Basic Timing Data

Date 10/18/2012 Time 11:35:32

Intersection Name BVD & Bonnet Creek

Source Database

Phase	1	2	3	4	5	6	7	8
Minimum Green	6	15	6	6	0	15	0	0
Passage	3.0	3.0	3.0	3.0	0.0	3.0	0.0	0.0
Maximum 1	40	60	35	30	0	60	0	0
Maximum 2	30	30	30	30	0	30	0	0
Yellow Change	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Red Clearance	1.0	2.0	2.0	2.0	0.0	2.0	0.0	0.0

Phase	9	10	11	12	13	14	15	16
Minimum Green	0	0	0	0	0	0	0	0
Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum 1	0	0	0	0	0	0	0	0
Maximum 2	0	0	0	0	0	0	0	0
Yellow Change	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Red Clearance	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Phase Vehicle Basic Timing Data

Date 10/18/2012 Time 11:36:24

Intersection Name BVD & Typhoon Lagoon

Source Database

Phase	1	2	3	4	5	6	7	8
Minimum Green	8	15	0	15	8	15	0	8
Passage	3.0	3.0	0.0	4.0	3.0	3.0	0.0	4.0
Maximum 1	50	65	0	50	50	65	0	50
Maximum 2	50	65	0	120	50	65	0	50
Yellow Change	4.0	4.0	3.0	5.0	4.0	4.0	3.0	5.0
Red Clearance	2.0	2.0	0.0	2.0	2.0	2.0	0.0	2.0

Phase	9	10	11	12	13	14	15	16
Minimum Green	0	0	0	0	0	0	0	0
Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum 1	0	0	0	0	0	0	0	0
Maximum 2	0	0	0	0	0	0	0	0
Yellow Change	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Red Clearance	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Phase Vehicle Basic Timing Data

Date 10/18/2012 Time 11:36:44

Intersection Name BVD & Entertainment District

Source Database

Phase	1	2	3	4	5	6	7	8
Minimum Green	15	15	0	0	0	15	0	8
Passage	3.0	3.0	0.0	0.0	0.0	3.0	0.0	3.0
Maximum 1	40	60	0	0	0	60	0	55
Maximum 2	30	50	30	50	30	50	30	50
Yellow Change	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Red Clearance	2.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0

Phase	9	10	11	12	13	14	15	16
Minimum Green	0	0	0	0	0	0	0	0
Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum 1	0	0	0	0	0	0	0	0
Maximum 2	0	0	0	0	0	0	0	0
Yellow Change	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Red Clearance	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Phase Vehicle Basic Timing Data

Date 10/18/2012 Time 11:36:55

Intersection Name BVD & Team Disney

Source Database

Phase	1	2	3	4	5	6	7	8
Minimum Green	15	15	8	3	15	15	0	8
Passage	4.0	4.0	4.0	3.0	4.0	4.0	0.0	5.0
Maximum 1	30	70	35	10	60	70	0	50
Maximum 2	30	70	35	10	30	70	0	90
Yellow Change	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0
Red Clearance	2.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0

Phase	9	10	11	12	13	14	15	16
Minimum Green	0	0	0	0	0	0	0	0
Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum 1	0	0	0	0	0	0	0	0
Maximum 2	0	0	0	0	0	0	0	0
Yellow Change	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Red Clearance	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Phase Vehicle Basic Timing Data

Date 10/18/2012 Time 11:37:10

Intersection Name BVD & PI\Hess

Source Database

Phase	1	2	3	4	5	6	7	8
Minimum Green	15	20	10	5	15	20	0	15
Passage	3.0	2.5	3.0	3.0	3.0	2.5	0.0	3.0
Maximum 1	45	60	30	0	25	60	0	40
Maximum 2	60	60	38	0	30	60	0	60
Yellow Change	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0
Red Clearance	1.0	2.0	2.0	0.0	1.0	2.0	0.0	2.0

Phase	9	10	11	12	13	14	15	16
Minimum Green	0	0	0	0	0	0	0	0
Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum 1	0	0	0	0	0	0	0	0
Maximum 2	0	0	0	0	0	0	0	0
Yellow Change	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Red Clearance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Phase Vehicle Basic Timing Data

Date 10/18/2012 Time 11:37:20

Intersection Name BVD & Casting Parking

Source Database

Phase	1	2	3	4	5	6	7	8
Minimum Green	5	15	5	1	5	15	0	5
Passage	3.0	2.5	3.0	3.0	3.0	2.5	0.0	3.0
Maximum 1	35	45	25	0	25	45	0	36
Maximum 2	10	45	25	0	25	45	0	36
Yellow Change	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0
Red Clearance	1.0	2.0	2.0	0.0	1.0	2.0	0.0	2.0

Phase	9	10	11	12	13	14	15	16
Minimum Green	0	0	0	0	0	0	0	0
Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum 1	0	0	0	0	0	0	0	0
Maximum 2	0	0	0	0	0	0	0	0
Yellow Change	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Red Clearance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Phase Vehicle Basic Timing Data

Date 10/18/2012 Time 11:37:33

Intersection Name BVD & Sun Bank

Source Database

Phase	1	2	3	4	5	6	7	8
Minimum Green	7	15	0	7	15	15	0	0
Passage	0.0	3.0	0.0	4.0	3.0	3.0	0.0	0.0
Maximum 1	0	40	0	25	25	40	0	0
Maximum 2	0	40	0	25	25	40	0	0
Yellow Change	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0
Red Clearance	0.0	1.0	0.0	1.0	1.0	1.0	0.0	0.0

Phase	9	10	11	12	13	14	15	16
Minimum Green	0	0	0	0	0	0	0	0
Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum 1	0	0	0	0	0	0	0	0
Maximum 2	0	0	0	0	0	0	0	0
Yellow Change	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Red Clearance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Phase Vehicle Basic Timing Data

Date 10/18/2012 Time 11:39:57

Intersection Name BVD & Hotel Plaza Bl

Source Database

Phase	1	2	3	4	5	6	7	8
Minimum Green	7	15	15	1	0	15	0	0
Passage	3.0	2.5	4.0	1.0	0.0	2.5	0.0	0.0
Maximum 1	25	40	25	0	0	40	0	0
Maximum 2	25	75	35	0	0	75	0	0
Yellow Change	3.0	4.0	4.0	3.0	3.0	4.0	4.0	3.0
Red Clearance	1.0	1.0	1.0	0.0	0.0	1.0	0.0	0.0

Phase	9	10	11	12	13	14	15	16
Minimum Green	0	0	0	0	0	0	0	0
Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum 1	0	0	0	0	0	0	0	0
Maximum 2	0	0	0	0	0	0	0	0
Yellow Change	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Red Clearance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Phase Vehicle Basic Timing Data

Date 10/18/2012 Time 11:40:14

Intersection Name Hotel Plaza Bl & RCID

Source Database

Phase	1	2	3	4	5	6	7	8
Minimum Green	6	15	0	6	6	15	0	6
Passage	3.0	4.0	0.0	3.0	3.0	4.0	0.0	3.0
Maximum 1	15	45	0	20	15	45	0	20
Maximum 2	25	45	0	30	25	45	0	30
Yellow Change	3.5	4.0	4.0	4.0	3.5	4.0	4.0	4.0
Red Clearance	0.5	1.0	0.0	1.0	0.5	1.0	0.0	1.0

Phase	9	10	11	12	13	14	15	16
Minimum Green	0	0	0	0	0	0	0	0
Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum 1	0	0	0	0	0	0	0	0
Maximum 2	0	0	0	0	0	0	0	0
Yellow Change	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Red Clearance	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Phase Vehicle Basic Timing Data

Date 10/18/2012 Time 11:40:23

Intersection Name Hotel Plaza Bl & Best Western

Source Database

Phase	1	2	3	4	5	6	7	8
Minimum Green	5	15	0	8	5	15	0	8
Passage	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Maximum 1	20	45	0	15	20	45	0	15
Maximum 2	30	50	30	50	30	50	30	50
Yellow Change	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Red Clearance	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Phase	9	10	11	12	13	14	15	16
Minimum Green	0	0	0	0	0	0	0	0
Passage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum 1	0	0	0	0	0	0	0	0
Maximum 2	0	0	0	0	0	0	0	0
Yellow Change	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Red Clearance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ORANGE COUNTY TRAFFIC SIGNAL TIMING

Intersection: SR 535 & MEADOW CREEK DR - LAKE VINING DR **Node: 511** **Port:**
Equipment: EAGLE **Date: 5/3/2011** **Address:**

BASIC TIMING

Phase	1	2	3	4	5	6	7	8
Direction	NBL	SB		EB/WB	SBL	NB		
Min Green (sec)	5	15		5	5	15		
Vehicle Gap (sec)	1.8	3.0		2.3	1.8	3.0		
Max Green 1 (sec)	15.0	45.0		15.0	15.0	45.0		
Max Green 2 (sec)	15.0	45.0		15.0	15.0	45.0		
Yellow (sec)	4.3	4.3		3.6	4.3	4.3		
All-Red (sec)	2.5	1.8		2.9	2.6	1.8		
Walk (sec)		7		7		7		
Flash Don't Walk (sec)		25		35		29		
Recall/Memory	NL	SF/LK		NL	NL	SF/LK		
Detector Delay (sec)								
Detector Switching								
Dual Entry		Y				Y		
Overlap								
Flash	R	Y		R	R	Y		
Speed (mph)	45	45		35	45	45		
Vehicular Crossing Distance (ft)	110	100		127	113	97		
Pedestrian Crossing Distance (ft)		85		122		101		
Ped Clearence (sec)		25		35		29		

COORDINATION PLANS

Coordination Pattern	1/1/1	2/1/1	3/1/1	4/1/1		Day	Time	Pattern
Cycle	150	160	180	160		1	0:00	FREE
Split 1	20	20	20	31		1	7:00	4/1/1
Split 2	77	88	108	75		1	22:00	FREE
Split 3						2	0:00	FREE
Split 4	53	52	52	54		2	6:30	1/1/1
Split 5	20	20	24	30		2	9:00	2/1/1
Split 6	77	88	104	76		2	15:00	3/1/1
Split 7						2	20:00	4/1/1
Split 8						2	22:00	FREE
Offset	6	9	11	153				
Lagging Phases				0/0/5/0				
Source Day	**Equate 1**	**Equate 2**	**Equate 3**	**Equate 4**	**Equate 5**			
1	7							
2	3	4	5	6				

Notes:
Alt. Seq.04 = Reverse Phases 5 & 6

ORANGE COUNTY TRAFFIC SIGNAL TIMING

Intersection: SR 535 & I-4 EB OFF RAMP - VINELAND AVE **Node: 513** **Port:**
Equipment: EAGLE **Date: 5/3/2011** **Address:**

BASIC TIMING

Phase	1	2	3	4	5	6	7	8
Direction	SBL	NB	WBL	EB				
Min Green (sec)	10	15	5	5				
Vehicle Gap (sec)	3.0	3.0	2.3	2.3				
Max Green 1 (sec)	20.0	50.0	30.0	40.0				
Max Green 2 (sec)	20.0	50.0	30.0	40.0				
Yellow (sec)	3.9	3.9	3.6	3.0				
All-Red (sec)	3.2	2.6	4.3	4.0				
Walk (sec)		7						
Flash Don't Walk (sec)		15						
Recall/Memory	SF/NL	SF/LK	NL	NL				
Detector Delay (sec)	CD 2							
Detector Switching								
Dual Entry								
Overlap	C	C	D	D				
Flash	R	Y	R	R				
Speed (mph)	40	40	35	25				
Vehicular Crossing Distance (ft)	122	135	138	127				
Pedestrian Crossing Distance (ft)		50						
Ped Clearence (sec)		15						

COORDINATION PLANS

Coordination Pattern	1/1/1	2/1/1	3/1/1	4/1/1		Day	Time	Pattern
Cycle	150	160	180	160		1	0:00	FREE
Split 1	26	40	41	30		1	7:00	4/1/1
Split 2	82	73	67	55		1	22:00	FREE
Split 3	25	20	38	23		2	0:00	FREE
Split 4	17	27	34	52		2	6:30	1/1/1
Split 5						2	9:00	2/1/1
Split 6						2	15:00	3/1/1
Split 7						2	20:00	4/1/1
Split 8						2	22:00	FREE
Offset	18	33	34	154				
Lagging Phases				1/3/0/0				
Source Day	Equate 1	Equate 2	Equate 3	Equate 4	Equate 5			
1	7							
2	3	4	5	6				

Notes:
OLC=SB, OLD=EBL NBR connected to Phase 3
Yield Mode
Yield Period = 10 sec, Max Dwell = 50
Alt. Seq. 3 = Reverse phase 1 & 2 and 3 & 4

ORANGE COUNTY TRAFFIC SIGNAL TIMING

Intersection: SR 535 & I-4 WB OFF RAMP **Node: 512** **Port:**
Equipment: EAGLE **Date: 5/3/2011** **Address:**

BASIC TIMING

Phase	1	2	3	4	5	6	7	8
Direction	NBL	SB		WBL				
Min Green (sec)	5	15		5				
Vehicle Gap (sec)	3.0	3.0		2.3				
Max Green 1 (sec)	30.0	50.0		70.0				
Max Green 2 (sec)	30.0	50.0		70.0				
Yellow (sec)	3.9	3.9		3.6				
All-Red (sec)	4.6	3.5		5.9				
Walk (sec)		7						
Flash Don't Walk (sec)		20						
Recall/Memory	NL	SF/LK		NL				
Detector Delay (sec)								
Detector Switching								
Dual Entry								
Overlap	C	CD		D				
Flash	R	Y		R				
Speed (mph)	40	40		35				
Vehicular Crossing Distance (ft)	185	185		195				
Pedestrian Crossing Distance (ft)		37						
Ped Clearence (sec)		11						

COORDINATION PLANS

Coordination Pattern	1/1/1	2/1/1	3/1/1	4/1/1		Day	Time	Pattern
Cycle	150	160	180	160		1	0:00	FREE
Split 1	35	47	44	38		1	7:00	4/1/1
Split 2	50	53	61	39		1	22:00	FREE
Split 3						2	0:00	FREE
Split 4	65	60	75	83		2	6:30	1/1/1
Split 5						2	9:00	2/1/1
Split 6						2	15:00	3/1/1
Split 7						2	20:00	4/1/1
Split 8						2	22:00	FREE
Offset	108	130	5	18				
Lagging Phases			1/0/0/0	1/0/0/0				

Source Day	Equate 1	Equate 2	Equate 3	Equate 4	Equate 5
1	7				
2	3	4	5	6	

Notes:
OLC = NB, OLD = SB Thru to I-4
Yield Mode
Yield Period = 10 sec, Max Dwell = 50
Alt. Seq. 1 = Reverse phase 1 & 2

CDI 2-15-10 DR

ORANGE COUNTY TRAFFIC SIGNAL TIMING

Hazem El-Assar, P.E. [redacted]

Intersection: CR 535 - Apopka Vineland Rd & Hotel Plaza Blvd Node: 536 Port:
Equipment: Eagle Date: 2/15/10 Address:

BASIC TIMING

Phase	1	2	3	4	5	6	7	8
Direction	NBL	SB	EB	WB	SBL	NB	WBL	
Min Green (sec)	5	15	5	5	5	15	5	
Vehicle Gap (sec)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Max Green 1 (sec)	80	60	50	40	25	60	40	
Max Green 2 (sec)	80	40	50	40	25	60	40	
Yellow (sec)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red (sec)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Walk (sec)				7		7		
Flash Don't Walk (sec)				30		26		
Recall/Memory	LK	SF/LK	NL	NL	LK	SF/LK	NL	
Detector Delay (sec)				DRT 5				
Detector Switching							7>4	
Dual Entry		Y		Y		Y	Y	
Overlap	A		A					
Flash	R	Y	R	R	R	Y	R	
Speed (mph)	40	40	35	35	40	40	35	
Crossing Distance (ft)		129.0		140.0		122.0		
Ped Clearance (sec)		32		35		31		

COORDINATION PLANS

Coordination Pattern	1/1/1	2/1/1	3/1/1	4/1/1	5/1/1
Cycle	150	160	180	0	0
Split 1	42	38	49		
Split 2	45	47	48		
Split 3	20	32	40		
Split 4	43	43	43		
Split 5	25	28	30		
Split 6	62	57	67		
Split 7	43	43	43		
Split 8					
Offset	148	152	106		
Lagging Phases	1/0/0/0	1/0/0/0	1/0/0/0		
Source Day	Equate 1	Equate 2	Equate 3	Equate 4	Equate 5
1	7				
2	3	4	5	6	

Day	Time	Pattern
1	0:00	FREE
1	7:00	2/1/1
1	22:00	FREE
2	0:00	FREE
2	6:00	1/1/1
2	9:00	2/1/1
2	15:00	3/1/1
2	19:00	2/1/1
2	22:00	FREE

Notes:
OLA = EBR
Sequential Side Street, Ring Structure Altered, Phase 4 then 3
Alt. Seq. 01 = Reverse Phases 1 & 2

ORANGE COUNTY TRAFFIC SIGNAL TIMING

Location: Apopka Vineland Rd & CR 535 - Palm Py **Node: 22** **Port:**
Equipment: Eagle **Date: 03/19/12** **Address:**

BASIC TIMING

Phase	1	2	3	4	5	6	7	8
Direction	NBL	SB	EBL	WB	SBL	NB	WBL	EB
Min Green (sec)	5	15	5	5	5	15	5	5
Vehicle Gap (sec)	1.6	3.0	2.0	2.7	1.6	3.0	2.7	2.0
Max Green 1 (sec)	30	45	21	33	20	45	21	33
Max Green 2 (sec)	30	45	21	33	20	45	21	33
Yellow (sec)	4.7	4.7	3.9	3.2	4.7	4.7	3.2	3.9
All-Red (sec)	1.8	2.2	2.7	3.5	2.2	1.8	3.5	2.7
Walk (sec)		7		7		7		7
Flash Don't Walk (sec)		25		28		25		26
Recall/Memory	LK	SF/LK	NL	NL	LK	SF/LK	NL	NL
Delay (sec)								
Detector Switching								
Dual Entry		Y		Y		Y		Y
Overlap								
Flash	R	R	R	R	R	R	R	R
Speed (mph)	50	50	40	30	50	50	30	40
Veh Distance (ft)	111	143	136	135	143	111	135	136
Ped Distance (ft)		87.0		98.0		88.0		92.0
Ped Clearence (sec)		25		28		25		26

COORDINATION PLANS

Coordination Pattern	1/1/1	2/1/1	3/1/1	4/1/1		Day	Time	Pattern
Cycle	150	160	180			1	0:01	FREE
Split 1	31	40	43			1	7:00	2/1/1
Split 2	54	43	51			1	22:00	FREE
Split 3	22	29	41			2	0:01	FREE
Split 4	43	48	45			2	6:30	1/1/1
Split 5	15	22	21			2	9:00	2/1/1
Split 6	70	61	73			2	15:00	3/1/1
Split 7	26	31	31			2	20:00	2/1/1
Split 8	39	46	55			2	22:00	FREE
Offset	63	129	19					
Lagging Phases	1/3/5/7	1/3/0/7	1/3/0/7					
Source Day	Equate 1	Equate 2	Equate 3	Equate 4	Equate 5			
1	7							
2	3	4	5	6				

Notes:
Alt Seq 15 for 1/1/1 = Reverse: Ph1 & Ph2, Ph3 & Ph4, Ph5 & Ph6, Ph 7 & Ph8
Alt Seq 11for 2/1/1 and 3/1/1 = Reverse: Ph1 & Ph2, Ph3 & Ph4, Ph 7 & Ph8

ORANGE COUNTY TRAFFIC SIGNAL TIMING

Intersection: WORLD CENTER PKWY (SR 536) AT WORLD CENTER DR **Node: 478** **Port:**
Equipment: EAGLE **(WORLD GATEWAY DR)** **Date: 5/3/2011** **Address:**

BASIC TIMING

Phase	1	2	3	4	5	6	7	8
Direction	WBL	EB	NBL	SB	EBL	WB	SBL	NB
Min Green (sec)	5	15	5	5	5	15	5	5
Vehicle Gap (sec)	1.5	3.0	3.0	3.0	1.5	3.0	3.0	3.0
Max Green 1 (sec)	20.0	120.0	20.0	20.0	20.0	120.0	20.0	20.0
Max Green 2 (sec)	20.0	120.0	20.0	20.0	20.0	120.0	20.0	20.0
Yellow (sec)	5.0	5.0	3.6	3.0	5.0	5.0	3.0	3.6
All-Red (sec)	2.0	2.0	3.1	4.5	2.1	2.0	4.5	3.1
Walk (sec)		7						
Flash Don't Walk (sec)		28						
Recall/Memory	NL	SF/LK	NL	NL	NL	SF/LK	NL	NL
Detector Delay (sec)								
Detector Switching			Y				Y	
Dual Entry		Y		Y		Y		Y
Overlap								
Flash	R	Y		R	R	Y		R
Speed (mph)	55	55	35	25	55	55	25	35
Vehicular Crossing Distance (ft)	120	105	140	145	119	111	145	140
Pedestrian Crossing Distance (ft)		97						
Ped Clearence (sec)		28						

COORDINATION PLANS

Coordination Pattern	1/1/1	2/1/1	3/1/1			Day	Time	Pattern
Cycle	150	160	180			1	0:00	FREE
Split 1	20	20	20			2	0:00	FREE
Split 2	95	104	105			2	6:30	1/1/1
Split 3	15	20	15			2	9:00	2/1/1
Split 4	20	16	40			2	15:00	3/1/1
Split 5	25	20	22			2	20:00	FREE
Split 6	90	104	103					
Split 7	15	20	35					
Split 8	20	16	20					
Offset	133	146	28					
Lagging Phases	1/0/0/0		1/0/0/0					
Source Day	**Equate 1**	**Equate 2**	**Equate 3**	**Equate 4**	**Equate 5**			
1	7							
2	3	4	5	6				

Notes: DO NOT DIM
Alt. Seq. 1 = Reverse phase 1 & 2

Crash Data

COMMENT: USERID: SF945BJ

CC - CRASH RATE CATEGORY CODE DESCRIPTIONS	AVG/YEAR	$/CRASH@CRA	C-NO-INJ	C-POSSIBLE	C-N-INCAP	C-INCAP	C-FATAL	C-NT-FATAL
I/A CRASH CRASHES MV MILES CRASH RATE	CL MILES	$/CRASH@INJ	P-NO-INJ	P-POSSIBLE	P-N-INCAP	P-INCAP	P-FATAL	P-NT-FATAL

DETAIL PRINT LINE LEGEND - REFER TO SHORT TITLES IN THE HEADING LINES ABOVE

CC - CRASH RATE CATEGORY CODE AND DESCRIPTION
CRASHES - TOTAL NUMBER OF CRASHES
I/A CRASH - TOTAL NUMBER OF "INLUENCE AREA" CRASHES
MV MILES - MILLION VEHICLE MILES
CRASH RATE - AVERAGE SEGMENT CRASH RATE
CL MILES - ROADWAY CENTER LINE MILES
$ PER CRASH - AVERAGE ECONOMIC LOSS PER CRASH
C-NO-INJ - CRASHES WITH PROPERTY DAMAGE ONLY
C-POSSIBLE - CRASHES WITH POSSIBLE INJURIES
C-N-INCAP - CRASHES WITH NON-INCAPACITATE INJURIES
C-INCAP - CRASHES WITH INCAPACITATE INJURIES
C-FATAL - CRASHES WITH FATALITIES
C-NT-FATAL - CRASHES WITH NON-TRAFFIC FATALITIES
$ PER INJRY - AVERAGE ECONOMIC LOSS PER INJURY
P-NO-INJ - PEOPLE WITH NO INJURIES
P-POSS-INJ - PEOPLE WITH POSSIBLE INJURIES
P-N-INCAP - PEOPLE WITH NON-INCAPACITATING INJURIES
P-INCAP - PEOPLE WITH INCAPACITATING INJURIES
P-FATAL - FATALITIES
P-NT-FATAL - NON-TRAFFIC FATAILITES

CURRENT BASE CALENDAR YEAR: 2011
CARPJ81 CRASH EXTRACT DATE: 2012-11-05 21:00:12
CARPJ82 FREEZE BREAK EXTRACT DATE: 2012-11-05 21:11:48
CARPJ84 YEARLY ROLLUPS AND WEIGHTS DATE: 2012-11-05 21:12:31

CRASH DOLLAR VALUE WEIGHTS 1 THROUGH 6:	6,500	67,890	111,228	557,752	6,820,000	6,500
INJURY DOLLAR VALUE WEIGHTS 1 THROUGH 6:	0	45,260	85,560	429,040	6,200,000	0

AVAILABLE YEARS	2011	2010	2009	2008	2007
1 YEAR RATES	X	X	X	_	_
2 YEAR RATES	_	_	_	_	
3 YEAR RATES	_	_	_		
4 YEAR RATES	_	_			
5 YEAR RATES	_				

STATE WIDE: X STATE WIDE _ BY DISTRICT _ BY COUNTY

DISTRICTS: 5 _ _ _ _ _ _ _ BY DISTRICT _ BY COUNTY

COUNTIES: __ __ __ __ __ __ __ __ __ __ __ __ __ __ __



CC - CRASH RATE CATEGORY CODE DESCRIPTIONS	AVG/YEAR	$/CRASH@CRA	C-NO-INJ	C-POSSIBLE	C-N-INCAP	C-INCAP	C-FATAL	C-NT-FATAL
I/A CRASH CRASHES MV MILES CRASH RATE	CL MILES	$/CRASH@INJ	P-NO-INJ	P-POSSIBLE	P-N-INCAP	P-INCAP	P-FATAL	P-NT-FATAL
01 - INTERSTATE URBAN		202,944	1,037	591	455	117	43	4
2 2,245 4,909.116 0.457	183.463	211,694	4,239	1,085	690	163	48	5
02 - INTERSTATE RURAL		169,139	280	104	114	59	6	1
5 559 1,542.395 0.365	95.706	245,026	975	247	196	98	11	1
03 - TOLL ROAD URBAN		108,221	228	112	127	16	3	0
6 480 1,356.434 0.358	92.201	144,837	683	194	180	21	6	1
04 - TOLL ROAD RURAL		141,490	50	23	38	7	1	0
0 119 344.203 0.345	29.777	152,337	217	61	57	10	1	0
05 - URBAN OTHER LIMITED ACCESS		485,629	24	14	5	3	3	0
0 49 145.419 0.336	12.030	594,845	108	26	17	4	4	0
06 - RURAL OTHER LIMITED ACCESS		0	0	0	0	0	0	0
0 0 0.000 0.000	0.000	0	0	0	0	0	0	0
07 - RAMP URBAN		104,943	247	138	96	34	2	0
451 66 0.539 0.000	8.254	96,247	894	210	130	39	2	0
08 - RAMP RURAL		132,884	1,073	613	442	121	20	1
1,499 771 203.485 0.000	199.260	143,764	4,322	1,051	612	152	26	4
10 - URBAN 2-3LN 2WY DIVD RASD		253,888	20	9	6	3	1	0
11 28 21.472 1.816	4.291	232,356	76	14	11	3	1	0
11 - URBAN 2-3LN 2WY DIVD PAVD		125,501	69	28	23	8	1	0
31 98 60.085 2.146	12.119	107,197	279	36	30	8	1	0
12 - URBAN 2-3LN 2WY UNDIVD		78,474	61	31	27	8	0	0
60 67 69.426 1.829	29.783	76,133	275	47	38	10	0	0
13 - SUBURBAN 2-3LN 2WY DIVD RASD		58,227	35	15	22	1	0	0
15 58 38.301 1.905	7.547	63,435	146	21	38	1	0	0
14 - SUBURBAN 2-3LN 2WY DIVD PAVD		134,330	156	96	81	35	2	0
64 306 326.824 1.132	69.338	131,057	733	180	116	42	2	0
15 - SUBURBAN 2-3LN 2WY UNDIVD		327,621	128	63	77	40	10	0
30 288 629.838 0.504	189.111	346,431	622	124	119	61	11	0
16 - RURAL 2-3LN 2WY DIVD RASD		120,149	2	3	6	1	0	0
5 7 9.568 1.254	2.371	104,521	17	5	7	1	0	0

CC - CRASH RATE CATEGORY CODE DESCRIPTIONS	AVG/YEAR	$/CRASH@CRA	C-NO-INJ	C-POSSIBLE	C-N-INCAP	C-INCAP	C-FATAL	C-NT-FATAL
I/A CRASH CRASHES MV MILES CRASH RATE	CL MILES	$/CRASH@INJ	P-NO-INJ	P-POSSIBLE	P-N-INCAP	P-INCAP	P-FATAL	P-NT-FATAL
01 - INTERSTATE URBAN		151,701	1,375	686	509	176	31	3
14 2,766 5,355.967 0.519	183.525	168,385	6,310	1,287	753	256	38	3
02 - INTERSTATE RURAL		241,996	255	113	132	78	11	0
0 589 1,501.290 0.392	95.706	252,706	1,208	253	217	118	11	0
03 - TOLL ROAD URBAN		102,744	198	159	136	22	2	0
6 511 1,530.063 0.337	92.201	100,847	915	278	182	27	2	0
04 - TOLL ROAD RURAL		138,556	48	30	27	6	1	0
0 112 393.857 0.284	29.777	134,540	237	54	45	6	1	0
05 - URBAN OTHER LIMITED ACCESS		669,399	17	14	8	4	4	0
0 47 151.896 0.309	12.030	636,805	77	30	14	6	4	0
06 - RURAL OTHER LIMITED ACCESS		0	0	0	0	0	0	0
0 0 0.000 0.000	0.000	0	0	0	0	0	0	0
07 - RAMP URBAN		99,559	340	171	139	48	2	0
544 156 0.618 0.000	7.680	92,514	1,291	280	168	59	2	0
08 - RAMP RURAL		112,958	1,160	683	479	123	15	2
1,600 862 206.388 0.000	196.023	111,081	5,370	1,109	643	161	16	2
10 - URBAN 2-3LN 2WY DIVD RASD		44,334	25	7	4	1	0	0
6 31 19.846 1.864	4.119	39,060	99	13	5	1	0	0
11 - URBAN 2-3LN 2WY DIVD PAVD		199,450	79	47	31	12	3	0
33 139 59.768 2.877	11.664	189,673	357	75	44	16	3	0
12 - URBAN 2-3LN 2WY UNDIVD		202,369	76	29	39	7	3	0
65 89 56.834 2.709	19.593	180,762	297	47	48	7	3	0
13 - SUBURBAN 2-3LN 2WY DIVD RASD		242,670	39	20	13	4	2	0
12 66 41.216 1.892	8.297	237,444	146	50	15	6	2	0
14 - SUBURBAN 2-3LN 2WY DIVD PAVD		186,383	173	112	102	33	6	0
65 361 315.402 1.350	69.944	191,981	866	220	159	49	6	1
15 - SUBURBAN 2-3LN 2WY UNDIVD		200,852	151	91	90	46	5	0
44 339 605.574 0.632	186.310	202,945	725	180	130	64	5	0
16 - RURAL 2-3LN 2WY DIVD RASD		163,937	4	3	5	3	0	0
7 8 9.576 1.566	2.371	135,118	23	5	6	3	0	0

CC - CRASH RATE CATEGORY CODE DESCRIPTIONS I/A CRASH	CRASHES	MV MILES	CRASH RATE	AVG/YEAR CL MILES	$/CRASH@CRA $/CRASH@INJ	C-NO-INJ P-NO-INJ	C-POSSIBLE P-POSSIBLE	C-N-INCAP P-N-INCAP	C-INCAP P-INCAP	C-FATAL P-FATAL	C-NT-FATAL P-NT-FATAL
01 - INTERSTATE URBAN					183,800	1,147	645	539	174	38	0
8	2,535	5,331.054	0.477	183.525	195,328	5,294	1,334	800	265	41	2
02 - INTERSTATE RURAL					246,424	256	130	110	67	12	1
0	576	1,516.260	0.379	95.706	279,666	999	295	208	115	13	1
03 - TOLL ROAD URBAN					168,062	189	160	144	21	7	0
6	515	1,591.830	0.327	92.201	158,902	831	259	203	24	7	0
04 - TOLL ROAD RURAL					92,740	53	27	32	10	0	0
4	118	383.828	0.317	29.415	116,961	270	71	54	15	0	1
05 - URBAN OTHER LIMITED ACCESS					240,024	25	9	11	7	1	0
2	51	150.028	0.353	12.030	257,007	141	20	21	11	1	0
06 - RURAL OTHER LIMITED ACCESS					0	0	0	0	0	0	0
0	0	0.000	0.000	0.000	0	0	0	0	0	0	0
07 - RAMP URBAN					141,475	259	180	144	30	6	0
487	132	0.000	0.000	7.680	129,550	1,115	276	191	33	6	0
08 - RAMP RURAL					124,144	916	607	482	110	15	0
1,379	751	56.426	0.000	189.993	121,734	4,439	1,107	661	139	15	0
10 - URBAN 2-3LN 2WY DIVD RASD					45,456	29	7	7	1	0	0
14	30	17.252	2.550	3.567	67,213	98	18	10	3	0	0
11 - URBAN 2-3LN 2WY DIVD PAVD					42,540	68	33	16	1	0	0
22	96	55.707	2.118	11.401	33,947	269	45	18	1	0	0
12 - URBAN 2-3LN 2WY UNDIVD					132,953	64	36	23	10	1	0
54	80	57.876	2.315	19.730	139,268	295	48	30	18	1	0
13 - SUBURBAN 2-3LN 2WY DIVD RASD					261,100	36	18	19	8	2	0
19	64	43.512	1.907	7.766	276,243	174	47	33	13	2	0
14 - SUBURBAN 2-3LN 2WY DIVD PAVD					116,252	188	115	91	30	2	0
77	349	336.140	1.267	68.266	114,887	829	245	127	34	2	0
15 - SUBURBAN 2-3LN 2WY UNDIVD					229,355	134	81	88	42	6	0
28	323	655.226	0.535	188.108	226,865	673	159	136	55	6	0
16 - RURAL 2-3LN 2WY DIVD RASD					125,480	8	5	4	3	0	0
6	14	10.418	1.919	2.674	147,684	26	16	6	4	0	0

Appendix C – Existing Conditions Operational Analysis Outputs

HCS – Basic Freeway Outputs

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*7/15/2014 3:04:24 PM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*2 Osceola Parkway Off Ramp to SR 536 Off Ramp*
Jurisdiction	*R 536 Off Ramp*
Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4039*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1692*	pc/h/ln
S	*69.7*	mph
D = v_p / S	*24.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*7/15/2014 3:04:24 PM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*3 SR 536 Off Ramp to I-4 On Ramp from Osceola Parkway*
Jurisdiction	*p from Osceola Parkway*
Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3493*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1464*	pc/h/ln
S	*72.6*	mph
D = v_p / S	*20.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*4 I-4 On Ramp from Osceola Parkway to I-4 On Ramp from SR 536*
Date Performed	*7/15/2014 3:04:24 PM*	Jurisdiction	*way to I-4 On Ramp from SR 536*
Analysis Time Period	*AM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3762*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1576*	pc/h/ln
S	*71.3*	mph
D = v_p / S	*22.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*7/15/2014 3:04:24 PM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*5 I-4 On Ramp from SR 536 to SR 535 Off Ramp*
Jurisdiction	*535 Off Ramp*
Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4318*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1357*	pc/h/ln
S	*73.6*	mph
D = v_p / S	*18.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*7/15/2014 3:04:24 PM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*6 SR 535 Off Ramp to I-4 On Ramp from SR 535 EB*
Jurisdiction	*p from SR 535 EB*
Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3851*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1614*	pc/h/ln
S	*70.8*	mph
D = v_p / S	*22.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*7/15/2014 3:04:24 PM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*7 I-4 On Ramp from SR 535 EB to I-4 On Ramp from SR 535 WB*
Jurisdiction	*I-4 On Ramp from SR 535 WB*
Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4434*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1858*	pc/h/ln
S	*66.9*	mph
D = v_p / S	*27.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*8 I-4 On Ramp from SR 535 WB to Central Florida Parkway Off Ramp*
Date Performed	*7/15/2014 3:04:24 PM*	Jurisdiction	*Central Florida Parkway Off Ramp*
Analysis Time Period	*mp*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5256*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1652*	pc/h/ln
S	*70.3*	mph
D = v_p / S	*23.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*9 I-4 On Ramp from Central Florida Parkway to SR 535 Off Ramp*
Date Performed	*7/15/2014 3:04:24 PM*	Jurisdiction	*ida Parkway to SR 535 Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4710*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1480*	pc/h/ln
S	*72.4*	mph
D = v_p / S	*20.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*7/15/2014 3:04:24 PM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*10 SR 535 Off Ramp to I-4 On Ramp from SR 535*
Jurisdiction	*mp from SR 535*
Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3138*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1315*	pc/h/ln
S	*73.9*	mph
D = v_p / S	*17.8*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*7/15/2014 3:04:24 PM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*11 I-4 On Ramp from SR 535 to SR 536 Off Ramp*
Jurisdiction	*R 536 Off Ramp*
Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3897*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1225*	pc/h/ln
S	*74.4*	mph
D = v_p / S	*16.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*12 SR 536 Off Ramp to Osceola Parkway Off Ramp*
Date Performed	*7/15/2014 3:04:24 PM*	Jurisdiction	*arkway Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2733*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1145*	pc/h/ln
S	*74.8*	mph
D = v_p / S	*15.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*7/15/2014 3:04:24 PM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*13 Osceola Parkway Off Ramp to I-4 On Ramp from SR 536*
Jurisdiction	*I-4 On Ramp from SR 536*
Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1990*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*834*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*11.1*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*7/15/2014 3:04:24 PM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*14 I-4 On Ramp from SR 536 to US 192 Off Ramp*
Jurisdiction	*S 192 Off Ramp*
Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2113*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*664*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*8.9*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*2 Osceola Parkway Off Ramp to SR 536 Off Ramp*
Date Performed	*6/18/2014 2:11:33 PM*	Jurisdiction	*R 536 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3369*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1397*	pc/h/ln
S	*73.3*	mph
D = v_p / S	*19.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*3 SR 536 Off Ramp to I-4 On Ramp from Osceola Parkway*
Date Performed	*6/18/2014 2:11:33 PM*	Jurisdiction	*p from Osceola Parkway*
Analysis Time Period	*PM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3105*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1287*	pc/h/ln
S	*74.1*	mph
D = v_p / S	*17.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*4 I-4 On Ramp from Osceola Parkway to I-4 On Ramp from SR 536*
Date Performed	*6/18/2014 2:11:33 PM*	Jurisdiction	*way to I-4 On Ramp from SR 536*
Analysis Time Period	*PM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3895*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1615*	pc/h/ln
S	*70.8*	mph
D = v_p / S	*22.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*5 I-4 On Ramp from SR 536 to SR 535 Off Ramp*
Date Performed	*6/18/2014 2:11:33 PM*	Jurisdiction	*535 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5563*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1730*	pc/h/ln
S	*69.1*	mph
D = v_p / S	*25.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*6 SR 535 Off Ramp to I-4 On Ramp from SR 535 EB*
Date Performed	*6/18/2014 2:11:33 PM*	Jurisdiction	*p from SR 535 EB*
Analysis Time Period	*PM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4320*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1791*	pc/h/ln
S	*68.1*	mph
D = v_p / S	*26.3*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*6/18/2014 2:11:33 PM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*7 I-4 On Ramp from SR 535 EB to I-4 On Ramp from SR 535 WB*
Jurisdiction	*I-4 On Ramp from SR 535 WB*
Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5272*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2186*	pc/h/ln
S	*59.4*	mph
D = v_p / S	*36.8*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*6/18/2014 2:11:33 PM*
Analysis Time Period	*mp*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*8 I-4 On Ramp from SR 535 WB to Central Florida Parkway Off Ramp*
Jurisdiction	*Central Florida Parkway Off Ramp*
Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6059*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1884*	pc/h/ln
S	*66.3*	mph
D = v_p / S	*28.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*9 I-4 On Ramp from Central Florida Parkway to SR 535 Off Ramp*
Date Performed	*6/18/2014 2:11:33 PM*	Jurisdiction	*ida Parkway to SR 535 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6092*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1894*	pc/h/ln
S	*66.2*	mph
D = v_p / S	*28.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*10 SR 535 Off Ramp to I-4 On Ramp from SR 535*
Date Performed	*6/18/2014 2:11:33 PM*	Jurisdiction	*mp from SR 535*
Analysis Time Period	*PM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4186*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1736*	pc/h/ln
S	*69.0*	mph
D = v_p / S	*25.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*11 I-4 On Ramp from SR 535 to SR 536 Off Ramp*
Date Performed	*6/18/2014 2:11:33 PM*	Jurisdiction	*R 536 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4910*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1527*	pc/h/ln
S	*71.9*	mph
D = v_p / S	*21.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*12 SR 536 Off Ramp to Osceola Parkway Off Ramp*
Date Performed	*6/18/2014 2:11:33 PM*	Jurisdiction	*arkway Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4263*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1768*	pc/h/ln
S	*68.5*	mph
D = v_p / S	*25.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*6/18/2014 2:11:33 PM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*13 Osceola Parkway Off Ramp to I-4 On Ramp from SR 536*
Jurisdiction	*I-4 On Ramp from SR 536*
Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3864*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1602*	pc/h/ln
S	*71.0*	mph
D = v_p / S	*22.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*14 I-4 On Ramp from SR 536 to US 192 Off Ramp*
Date Performed	*6/18/2014 2:11:33 PM*	Jurisdiction	*S 192 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2011*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4277*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1330*	pc/h/ln
S	*73.8*	mph
D = v_p / S	*18.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

HCS – Ramp Merge/Diverge Outputs

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	2 SR 536 Off Ramp
Date Performed	7/15/2014 3:04:24 PM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 4039	
	Ramp Volume, V_R: 546	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4039	0.95	Level	3	0	0.985	0.85	5077
Ramp	546	0.95	Level	3	0	0.985	0.85	686
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2662 pc/h

V_3 or V_{av34} 2415 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2901 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5077	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4391	Exhibit 13-8	7050	No
V_R	686	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2662	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 2.2 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.490 (Exhibit 13-12)

S_R= 53.7 mph (Exhibit 13-12)

S_0= 66.7 mph (Exhibit 13-12)

S = 58.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	3 I-4 On Ramp from Osceola ParkFDOT
Date Performed	7/15/2014 3:04:24 PM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☐ No ☑ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = 5752 ft	Acceleration Lane Length, L_A: 1500	L_{down} = ft
V_u = 546 veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3493	
	Ramp Volume, V_R: 269	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3493	0.95	Level	3	0	0.985	0.85	4391
Ramp	269	0.95	Level	3	0	0.985	0.85	338
UpStream	546	0.95	Level	3	0	0.985	0.85	686
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1891.01 (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2720 pc/h

V_3 or V_{av34} 1671 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4729	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3058	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 19.8 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.254 (Exibit 13-11)

S_R= 59.2 mph (Exhibit 13-11)

S_0= 60.8 mph (Exhibit 13-11)

S = 59.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	4 I-4 On Ramp from SR 536
Date Performed	7/15/2014 3:04:24 PM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3762	
	Ramp Volume, V_R: 556	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3762	0.95	Level	3	0	0.985	0.85	4729
Ramp	556	0.95	Level	3	0	0.985	0.85	699
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2625 pc/h

V_3 or V_{av34} = 2104 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2702 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5428	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3401	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 14.8 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.168 (Exibit 13-11)

S_R = 61.1 mph (Exhibit 13-11)

S_0 = 59.5 mph (Exhibit 13-11)

S = 60.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	5 SR 535 Off Ramp
Date Performed	7/15/2014 3:04:24 PM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☑ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☐ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = 1627 ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = 556 veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 4318	
	Ramp Volume, V_R: 467	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4318	0.95	Level	3	0	0.985	0.85	5428
Ramp	467	0.95	Level	3	0	0.985	0.85	587
UpStream	556	0.95	Level	3	0	0.985	0.85	699
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 2698 pc/h

V_3 or V_{av34} 1365 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5428	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	4841	Exhibit 13-8	9400	No
V_R	587	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2698	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 14.0 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.481 (Exhibit 13-12)

S_R= 53.9 mph (Exhibit 13-12)

S_0= 69.9 mph (Exhibit 13-12)

S = 60.9 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

HCS2010™ Version 6.41 Generated: 7/29/2014 1:49 PM

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	5 SR 535 Off Ramp
Date Performed	7/15/2014 3:04:24 PM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☑ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☑ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = 2725 ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = 583 veh/h
	Freeway Volume, V_F: 4318	
	Ramp Volume, V_R: 467	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4318	0.95	Level	3	0	0.985	0.85	5428
Ramp	467	0.95	Level	3	0	0.985	0.85	587
UpStream								
DownStream	583	0.95	Level	3	0	0.985	0.85	733

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 2698 pc/h

V_3 or V_{av34} 1365 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5428	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	4841	Exhibit 13-8	9400	No
V_R	587	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2698	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 14.0 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.481 (Exhibit 13-12)

S_R= 53.9 mph (Exhibit 13-12)

S_0= 69.9 mph (Exhibit 13-12)

S = 60.9 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	6 I-4 On Ramp from SR 535 EB
Date Performed	7/15/2014 3:04:24 PM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 975	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3851	
	Ramp Volume, V_R: 583	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3851	0.95	Level	3	0	0.985	0.85	4841
Ramp	583	0.95	Level	3	0	0.985	0.85	733
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2687 pc/h

V_3 or V_{av34} = 2154 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2766 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5574	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3499	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 15.3 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.178 (Exibit 13-11)

S_R = 60.9 mph (Exhibit 13-11)

S_0 = 59.3 mph (Exhibit 13-11)

S = 60.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} = pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	7 I-4 On Ramp from SR 535 WB
Date Performed	7/15/2014 3:04:24 PM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1500	L_{down} = 4664 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 483 veh/h
	Freeway Volume, V_F: 4434	
	Ramp Volume, V_R: 822	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4434	0.95	Level	3	0	0.985	0.85	5573
Ramp	822	0.95	Level	3	0	0.985	0.85	1033
UpStream								
DownStream	483	0.95	Level	3	0	0.985	0.85	607

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 3452 pc/h

V_3 or V_{av34} 2121 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6606	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4485	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 30.6 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.517 (Exibit 13-11)

S_R= 53.1 mph (Exhibit 13-11)

S_0= 59.2 mph (Exhibit 13-11)

S = 54.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	8 SR 535 Off Ramp
Date Performed	7/15/2014 3:04:24 PM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 4710	
	Ramp Volume, V_R: 1572	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4710	0.95	Level	3	0	0.985	0.85	5920
Ramp	1572	0.95	Level	3	0	0.985	0.85	1976
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3001 pc/h

V_3 or V_{av34} 1459 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5920	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	3944	Exhibit 13-8	9400	No
V_R	1976	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3001	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 3.1 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.606 (Exhibit 13-12)

S_R = 51.1 mph (Exhibit 13-12)

S_0 = 69.5 mph (Exhibit 13-12)

S = 58.8 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

HCS2010™ Version 6.41 Generated: 7/29/2014 1:50 PM

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	9 I-4 On Ramp from SR 535
Date Performed	7/15/2014 3:04:24 PM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1500	L_{down} = 3067 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 1164 veh/h
	Freeway Volume, V_F: 3138	
	Ramp Volume, V_R: 759	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3138	0.95	Level	3	0	0.985	0.85	3944
Ramp	759	0.95	Level	3	0	0.985	0.85	954
UpStream								
DownStream	1164	0.95	Level	3	0	0.985	0.85	1463

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2443 pc/h

V_3 or V_{av34} 1501 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4898	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3397	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.1 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.288 (Exibit 13-11)

S_R = 58.4 mph (Exhibit 13-11)

S_0 = 61.4 mph (Exhibit 13-11)

S = 59.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	10 SR 536 Off Ramp
Date Performed	7/15/2014 3:04:24 PM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2011
Project Description	I-4 SAMR Re-Eval		

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 3897	
	Ramp Volume, V_R: 1164	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3897	0.95	Level	3	0	0.985	0.85	4898
Ramp	1164	0.95	Level	3	0	0.985	0.85	1463
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 2356 pc/h

V_3 or V_{av34} 1271 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4898	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	3435	Exhibit 13-8	9400	No
V_R	1463	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2356	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = -2.5 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.560 (Exhibit 13-12)

S_R = 52.1 mph (Exhibit 13-12)

S_0 = 70.2 mph (Exhibit 13-12)

S = 60.2 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

HCS2010™ Version 6.41 Generated: 7/29/2014 1:50 PM

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	11 Osceola Pkwy Off Ramp
Date Performed	7/15/2014 3:04:24 PM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 2733	
	Ramp Volume, V_R: 743	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2733	0.95	Level	3	0	0.985	0.85	3435
Ramp	743	0.95	Level	3	0	0.985	0.85	934
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2059 pc/h

V_3 or V_{av34} 1376 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3435	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	2501	Exhibit 13-8	7050	No
V_R	934	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2059	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = -5.0 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.512 (Exhibit 13-12)

S_R = 53.2 mph (Exhibit 13-12)

S_0 = 69.8 mph (Exhibit 13-12)

S = 58.8 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

HCS2010™ Version 6.41 Generated: 7/29/2014 1:51 PM

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	12 I-4 On Ramp from SR 536
Date Performed	7/15/2014 3:04:24 PM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1500	L_{down} = 2766 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 63 veh/h
	Freeway Volume, V_F: 1990	
	Ramp Volume, V_R: 123	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1990	0.95	Level	3	0	0.985	0.85	2501
Ramp	123	0.95	Level	3	0	0.985	0.85	155
UpStream								
DownStream	63	0.95	Level	3	0	0.985	0.85	79

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 1549 pc/h

V_3 or V_{av34} 952 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2656	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1704	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 9.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.192 (Exibit 13-11)

S_R= 60.6 mph (Exhibit 13-11)

S_0= 63.4 mph (Exhibit 13-11)

S = 61.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	2 SR 536 Off Ramp
Date Performed	5/22/2014 10:04:52 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 3369	
	Ramp Volume, V_R: 264	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3369	0.95	Level	3	0	0.985	0.85	4235
Ramp	264	0.95	Level	3	0	0.985	0.85	332
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2088 pc/h

V_3 or V_{av34} 2147 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2420 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4235	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	3903	Exhibit 13-8	7050	No
V_R	332	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2088	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = -1.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.458 (Exhibit 13-12)

S_R= 54.5 mph (Exhibit 13-12)

S_0= 68.1 mph (Exhibit 13-12)

S = 59.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	3 I-4 On Ramp from Osceola ParkFDOT
Date Performed	6/20/2014 4:00:05 PM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☐ No ☑ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = 5752 ft	Acceleration Lane Length, L_A: 1500	L_{down} = ft
V_u = 264 veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3105	
	Ramp Volume, V_R: 790	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3105	0.95	Level	3	0	0.985	0.85	3903
Ramp	790	0.95	Level	3	0	0.985	0.85	993
UpStream	264	0.95	Level	3	0	0.985	0.85	332
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1926.74 (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2418 pc/h

V_3 or V_{av34} 1485 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4896	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3411	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 22.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.289 (Exibit 13-11)

S_R= 58.3 mph (Exhibit 13-11)

S_0= 61.5 mph (Exhibit 13-11)

S = 59.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	3 I-4 On Ramp from Osceola ParkFDOT
Date Performed	6/20/2014 4:00:05 PM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1500	L_{down} = 2604 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 1668 veh/h
	Freeway Volume, V_F: 3105	
	Ramp Volume, V_R: 790	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3105	0.95	Level	3	0	0.985	0.85	3903
Ramp	790	0.95	Level	3	0	0.985	0.85	993
UpStream								
DownStream	1668	0.95	Level	3	0	0.985	0.85	2097

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2418 pc/h

V_3 or V_{av34} 1485 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4896	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3411	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.289 (Exibit 13-11)

S_R= 58.3 mph (Exhibit 13-11)

S_0= 61.5 mph (Exhibit 13-11)

S = 59.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	4 I-4 On Ramp from SR 536
Date Performed	6/20/2014 4:00:05 PM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3895	
	Ramp Volume, V_R: 1668	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3895	0.95	Level	3	0	0.985	0.85	4896
Ramp	1668	0.95	Level	3	0	0.985	0.85	2097
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2717 pc/h

V_3 or V_{av34} = 2179 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2797 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6993	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4894	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 25.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.572 (Exibit 13-11)

S_R = 51.9 mph (Exhibit 13-11)

S_0 = 59.2 mph (Exhibit 13-11)

S = 53.9 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} = pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	5 SR 535 Off Ramp
Date Performed	6/20/2014 4:00:05 PM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☑ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☐ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = 1627 ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = 1668 veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 5563	
	Ramp Volume, V_R: 1243	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5563	0.95	Level	3	0	0.985	0.85	6993
Ramp	1243	0.95	Level	3	0	0.985	0.85	1562
UpStream	1668	0.95	Level	3	0	0.985	0.85	2097
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3930 pc/h

V_3 or V_{av34} 1531 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6993	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5431	Exhibit 13-8	9400	No
V_R	1562	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3930	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 24.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.569 (Exhibit 13-12)

S_R= 51.9 mph (Exhibit 13-12)

S_0= 69.2 mph (Exhibit 13-12)

S = 58.3 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

HCS2010™ Version 6.41 Generated: 7/29/2014 1:54 PM

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	5 SR 535 Off Ramp
Date Performed	6/20/2014 4:00:05 PM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☑ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☑ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = 2725 ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = 952 veh/h
	Freeway Volume, V_F: 5563	
	Ramp Volume, V_R: 1243	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5563	0.95	Level	3	0	0.985	0.85	6993
Ramp	1243	0.95	Level	3	0	0.985	0.85	1562
UpStream								
DownStream	952	0.95	Level	3	0	0.985	0.85	1197

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3930 pc/h

V_3 or V_{av34} 1531 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6993	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5431	Exhibit 13-8	9400	No
V_R	1562	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3930	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 24.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.569 (Exhibit 13-12)

S_R= 51.9 mph (Exhibit 13-12)

S_0= 69.2 mph (Exhibit 13-12)

S = 58.3 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	6 I-4 On Ramp from SR 535 EB
Date Performed	6/20/2014 4:00:05 PM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 975	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 4320	
	Ramp Volume, V_R: 952	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4320	0.95	Level	3	0	0.985	0.85	5430
Ramp	952	0.95	Level	3	0	0.985	0.85	1197
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 3014 pc/h

V_3 or V_{av34} = 2416 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3102 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6627	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4299	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 21.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.336 (Exibit 13-11)

S_R = 57.3 mph (Exhibit 13-11)

S_0 = 58.3 mph (Exhibit 13-11)

S = 57.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} = pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	7 I-4 On Ramp from SR 535 WB
Date Performed	6/20/2014 4:00:05 PM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1500	L_{down} = 4664 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 495 veh/h
	Freeway Volume, V_F: 5272	
	Ramp Volume, V_R: 787	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5272	0.95	Level	3	0	0.985	0.85	6627
Ramp	787	0.95	Level	3	0	0.985	0.85	989
UpStream								
DownStream	495	0.95	Level	3	0	0.985	0.85	622

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 4105 pc/h

V_3 or V_{av34} = 2522 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7616	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5094	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 35.3 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.807 (Exibit 13-11)

S_R = 46.4 mph (Exhibit 13-11)

S_0 = 57.1 mph (Exhibit 13-11)

S = 49.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} = pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	8 SR 535 Off Ramp
Date Performed	6/20/2014 4:00:05 PM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 6092	
	Ramp Volume, V_R: 1906	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6092	0.95	Level	3	0	0.985	0.85	7657
Ramp	1906	0.95	Level	3	0	0.985	0.85	2396
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3764 pc/h

V_3 or V_{av34} 1946 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7657	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5261	Exhibit 13-8	9400	No
V_R	2396	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3764	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 9.6 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.644 (Exhibit 13-12)

S_R = 50.2 mph (Exhibit 13-12)

S_0 = 67.6 mph (Exhibit 13-12)

S = 57.8 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

HCS2010™ Version 6.41 Generated: 7/29/2014 1:54 PM

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	9 I-4 On Ramp from SR 535
Date Performed	6/20/2014 4:00:05 PM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1500	L_{down} = 3067 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 647 veh/h
	Freeway Volume, V_F: 4186	
	Ramp Volume, V_R: 724	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4186	0.95	Level	3	0	0.985	0.85	5262
Ramp	724	0.95	Level	3	0	0.985	0.85	910
UpStream								
DownStream	647	0.95	Level	3	0	0.985	0.85	813

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 3260 pc/h

V_3 or V_{av34} 2002 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6172	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4170	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 28.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.423 (Exibit 13-11)

S_R= 55.3 mph (Exhibit 13-11)

S_0= 59.6 mph (Exhibit 13-11)

S = 56.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	10 SR 536 Off Ramp
Date Performed	5/22/2014 10:04:52 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 4910	
	Ramp Volume, V_R: 647	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4910	0.95	Level	3	0	0.985	0.85	6172
Ramp	647	0.95	Level	3	0	0.985	0.85	813
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 3225 pc/h

V_3 or V_{av34} 2947 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 3526 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6172	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	5359	Exhibit 13-8	7050	No
V_R	813	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3225	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 7.6 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.501 (Exhibit 13-12)

S_R= 53.5 mph (Exhibit 13-12)

S_0= 64.9 mph (Exhibit 13-12)

S = 57.8 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

HCS2010™ Version 6.41 Generated: 7/29/2014 1:55 PM

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	11 Osceola Pkwy Off Ramp
Date Performed	6/20/2014 4:00:05 PM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 4263	
	Ramp Volume, V_R: 399	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4263	0.95	Level	3	0	0.985	0.85	5358
Ramp	399	0.95	Level	3	0	0.985	0.85	502
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2687 pc/h

V_3 or V_{av34} 2671 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 3061 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5358	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4856	Exhibit 13-8	7050	No
V_R	502	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2687	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 3.6 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.473 (Exhibit 13-12)

S_R= 54.1 mph (Exhibit 13-12)

S_0= 66.2 mph (Exhibit 13-12)

S = 58.7 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	12 I-4 On Ramp from SR 536
Date Performed	6/20/2014 4:00:05 PM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1500	L_{down} = 2766 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 1394 veh/h
	Freeway Volume, V_F: 3864	
	Ramp Volume, V_R: 413	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3864	0.95	Level	3	0	0.985	0.85	4857
Ramp	413	0.95	Level	3	0	0.985	0.85	519
UpStream								
DownStream	1394	0.95	Level	3	0	0.985	0.85	1752

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 3009 pc/h

V_3 or V_{av34} = 1848 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5376	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3528	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 23.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.304 (Exibit 13-11)

S_R = 58.0 mph (Exhibit 13-11)

S_0 = 60.1 mph (Exhibit 13-11)

S = 58.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} = pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	13 US 192 Off Ramp
Date Performed	6/20/2014 4:00:05 PM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2011

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 4277	
	Ramp Volume, V_R: 1394	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4277	0.95	Level	3	0	0.985	0.85	5376
Ramp	1394	0.95	Level	3	0	0.985	0.85	1752
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 2694 pc/h

V_3 or V_{av34} 1341 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5376	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	3624	Exhibit 13-8	9400	No
V_R	1752	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2694	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 0.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.586 (Exhibit 13-12)

S_R = 51.5 mph (Exhibit 13-12)

S_0 = 70.0 mph (Exhibit 13-12)

S = 59.3 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

HCS2010™ Version 6.41 Generated: 7/29/2014 1:55 PM

HCS – Weaving Output

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2011 AM

Site Information

Freeway/Dir of Travel	Eastbound
Weaving Segment Location	SR 536 On Ramp to SR 535 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2616ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3315	0.95	3	0	1.5	1.2	0.985	0.85	4167
V_{RF}	536	0.95	3	0	1.5	1.2	0.985	0.85	674
V_{FR}	447	0.95	3	0	1.5	1.2	0.985	0.85	562
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	4192							V =	5428
V_W	1236								
VR	0.228								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1236 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1695 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1511 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3206 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	768

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5428 pc/h	Weaving intensity factor, W	0.265
Weaving segment capacity, c_w	7306 veh/h	Weaving segment speed, S	50.6 mph
Weaving segment v/c ratio	0.622	Average weaving speed, S_W	54.5 mph
Weaving segment density, D	26.8 pc/mi/ln	Average non-weaving speed, S_{NW}	49.6 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	4821 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2011 AM

Site Information

Freeway/Dir of Travel	Westbound
Weaving Segment Location	SR 535 On Ramp to SR 536 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3081ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	1994	0.95	3	0	1.5	1.2	0.985	0.85	2506
V_{RF}	739	0.95	3	0	1.5	1.2	0.985	0.85	929
V_{FR}	1144	0.95	3	0	1.5	1.2	0.985	0.85	1438
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	2531							V =	4898
V_W	2367								
VR	0.483								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	929 lc/h
Interchange density, ID	0.5 int/mi	Weaving lane changes, LC_W	1384 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1421 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	2805 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	390

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	4898 pc/h	Weaving intensity factor, W	0.210
Weaving segment capacity, c_w	6065 veh/h	Weaving segment speed, S	54.2 mph
Weaving segment v/c ratio	0.676	Average weaving speed, S_W	56.3 mph
Weaving segment density, D	22.6 pc/mi/ln	Average non-weaving speed, S_{NW}	52.4 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	6065 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2011 PM

Site Information

Freeway/Dir of Travel	Eastbound
Weaving Segment Location	SR 536 On Ramp to SR 535 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2616ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2672	0.95	3	0	1.5	1.2	0.985	0.85	3359
V_{RF}	1648	0.95	3	0	1.5	1.2	0.985	0.85	2071
V_{FR}	1223	0.95	3	0	1.5	1.2	0.985	0.85	1537
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	3384							V =	6992
V_W	3608								
VR	0.516								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6992 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	3895 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.503	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	8014 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2011 PM

Site Information

Freeway/Dir of Travel	Westbound
Weaving Segment Location	SR 535 On Ramp to SR 536 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3081ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3559	0.95	3	0	1.5	1.2	0.985	0.85	4474
V_{RF}	704	0.95	3	0	1.5	1.2	0.985	0.85	885
V_{FR}	627	0.95	3	0	1.5	1.2	0.985	0.85	788
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	4499							V =	6172
V_W	1673								
VR	0.271								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	885 lc/h
Interchange density, ID	0.5 int/mi	Weaving lane changes, LC_W	1340 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1826 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	3166 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	693

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6172 pc/h	Weaving intensity factor, W	0.231
Weaving segment capacity, c_w	7711 veh/h	Weaving segment speed, S	52.3 mph
Weaving segment v/c ratio	0.670	Average weaving speed, S_W	55.6 mph
Weaving segment density, D	29.5 pc/mi/ln	Average non-weaving speed, S_{NW}	51.2 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	3710 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

Synchro - Intersection Analysis Outputs

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	111	338	6	9	1184	265	30	10	14	45	7	47
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1827	1863	1863	1845	1863	1845	1755	1900	1743	1863	1827
Adj Flow Rate, veh/h	121	367	7	10	1287	288	33	11	15	49	8	51
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	145	3308	1050	79	3150	991	150	25	34	142	99	82
Arrive On Green	0.08	0.66	0.66	0.04	0.63	0.63	0.03	0.04	0.04	0.04	0.05	0.05
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	674	919	1660	1863	1553
Grp Volume(v), veh/h	121	367	7	10	1287	288	33	0	26	49	8	51
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1593	1660	1863	1553
Q Serve(g_s), s	8.9	3.5	0.1	0.7	17.1	11.0	2.4	0.0	2.1	3.7	0.5	4.3
Cycle Q Clear(g_c), s	8.9	3.5	0.1	0.7	17.1	11.0	2.4	0.0	2.1	3.7	0.5	4.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.58	1.00		1.00
Lane Grp Cap(c), veh/h	145	3308	1050	79	3150	991	150	0	59	142	99	82
V/C Ratio(X)	0.84	0.11	0.01	0.13	0.41	0.29	0.22	0.00	0.44	0.35	0.08	0.62
Avail Cap(c_a), veh/h	239	3308	1050	174	3150	991	213	0	150	176	176	146
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	60.0	8.1	2.9	60.9	12.5	11.4	59.3	0.0	62.5	58.7	59.8	61.5
Incr Delay (d2), s/veh	5.3	0.1	0.0	0.3	0.4	0.7	0.7	0.0	5.0	1.4	0.3	7.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	1.7	0.1	0.4	8.0	5.0	1.2	0.0	1.0	1.8	0.3	2.0
LnGrp Delay(d),s/veh	65.3	8.2	2.9	61.1	12.9	12.1	60.0	0.0	67.5	60.1	60.1	68.9
LnGrp LOS	E	A	A	E	B	B	E		E	E	E	E
Approach Vol, veh/h		495			1585			59			108	
Approach Delay, s/veh		22.1			13.0			63.3			64.3	
Approach LOS		C			B			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	30.3	95.0	10.2	14.5	17.9	107.3	12.3	12.4
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	13.0	88.0	8.3	12.5	17.9	83.0	7.5	* 13
Max Q Clear Time (g_c+I1), s	2.7	5.5	4.4	6.3	10.9	19.1	5.7	4.1
Green Ext Time (p_c), s	6.1	2.3	0.0	0.1	0.0	12.6	0.0	0.1

Intersection Summary	
HCM 2010 Ctrl Delay	18.8
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	200	239	381	235	95	32	605	732	217	16	1430	182
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1810	1863	1900	1827	1863	1776	1776	1863	1863
Adj Flow Rate, veh/h	220	263	0	258	104	35	665	804	0	18	1571	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	659	296	251	314	159	51	618	1709	729	104	1267	567
Arrive On Green	0.19	0.16	0.00	0.09	0.06	0.06	0.31	0.81	0.00	0.06	0.36	0.00
Sat Flow, veh/h	3442	1863	1583	3343	2632	850	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	220	263	0	258	69	70	665	804	0	18	1571	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1713	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	7.3	18.2	0.0	10.0	5.0	5.3	24.1	9.3	0.0	1.3	47.1	0.0
Cycle Q Clear(g_c), s	7.3	18.2	0.0	10.0	5.0	5.3	24.1	9.3	0.0	1.3	47.1	0.0
Prop In Lane	1.00		1.00	1.00		0.50	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	659	296	251	314	107	103	618	1709	729	104	1267	567
V/C Ratio(X)	0.33	0.89	0.00	0.82	0.64	0.68	1.08	0.47	0.00	0.17	1.24	0.00
Avail Cap(c_a), veh/h	659	473	402	465	488	473	618	1709	729	104	1267	567
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.85	0.85	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	45.9	54.2	0.0	58.5	60.4	60.6	45.6	7.5	0.0	58.5	42.2	0.0
Incr Delay (d2), s/veh	0.1	7.7	0.0	6.7	5.4	6.6	55.4	0.8	0.0	0.3	114.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	10.0	0.0	4.9	2.6	2.7	15.8	4.5	0.0	0.6	43.1	0.0
LnGrp Delay(d),s/veh	46.0	61.9	0.0	65.2	65.8	67.1	101.1	8.3	0.0	58.8	157.0	0.0
LnGrp LOS	D	E		E	E	E	F	A		E	F	
Approach Vol, veh/h		483			397			1469			1589	
Approach Delay, s/veh		54.7			65.6			50.3			155.9	
Approach LOS		D			E			D			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	49.5	54.0	31.9	14.6	33.5	70.0	19.0	27.5
Change Period (Y+Rc), s	* 6.9	* 6.9	* 6.7	* 6.7	* 6.9	* 6.5	* 6.7	* 6.6
Max Green Setting (Gmax), s	* 24	* 47	* 15	* 36	* 8.1	* 64	* 18	* 33
Max Q Clear Time (g_c+I1), s	26.1	49.1	9.3	7.3	3.3	11.3	12.0	20.2
Green Ext Time (p_c), s	0.0	0.0	0.7	0.6	0.6	6.2	0.4	0.7

Intersection Summary	
HCM 2010 Ctrl Delay	95.0
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	104	32	331	62	66	16	569	1434	89	55	1691	300
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1827	1792	1845	1770	1900	1827	1827	1863	1776	1845	1845
Adj Flow Rate, veh/h	109	34	348	65	69	17	599	1509	94	58	1780	316
Adj No. of Lanes	1	1	2	1	2	0	2	3	1	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	7	4	6	3	4	4	4	4	2	7	3	3
Cap, veh/h	154	166	854	107	164	39	768	2788	885	74	1889	588
Arrive On Green	0.09	0.09	0.09	0.06	0.06	0.06	0.46	1.00	1.00	0.09	0.75	0.75
Sat Flow, veh/h	1691	1827	2682	1757	2696	642	3375	4988	1583	1691	5036	1568
Grp Volume(v), veh/h	109	34	348	65	42	44	599	1509	94	58	1780	316
Grp Sat Flow(s),veh/h/ln	1691	1827	1341	1757	1681	1656	1688	1663	1583	1691	1679	1568
Q Serve(g_s), s	6.5	1.8	0.0	3.7	2.5	2.6	15.5	0.0	0.0	3.5	31.3	8.8
Cycle Q Clear(g_c), s	6.5	1.8	0.0	3.7	2.5	2.6	15.5	0.0	0.0	3.5	31.3	8.8
Prop In Lane	1.00		1.00	1.00		0.39	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	154	166	854	107	102	101	768	2788	885	74	1889	588
V/C Ratio(X)	0.71	0.21	0.41	0.61	0.41	0.44	0.78	0.54	0.11	0.79	0.94	0.54
Avail Cap(c_a), veh/h	220	238	959	617	590	581	1162	2788	885	308	1889	588
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	0.99	0.99	0.99	1.00	1.00	1.00	0.69	0.69	0.69	0.22	0.22	0.22
Uniform Delay (d), s/veh	45.8	43.7	27.7	47.5	46.9	47.0	26.1	0.0	0.0	46.9	12.0	9.2
Incr Delay (d2), s/veh	5.9	0.6	0.3	5.5	2.6	3.0	1.4	0.5	0.2	4.1	3.0	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.3	0.9	3.9	2.0	1.2	1.3	7.3	0.1	0.0	1.7	14.1	3.7
LnGrp Delay(d),s/veh	51.7	44.3	28.0	53.0	49.6	49.9	27.4	0.5	0.2	51.0	15.0	10.0
LnGrp LOS	D	D	C	D	D	D	C	A	A	D	B	A
Approach Vol, veh/h		491			151			2202			2154	
Approach Delay, s/veh		34.4			51.2			7.8			15.3	
Approach LOS		C			D			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	76.2	45.0		12.9	10.6	110.6		15.9
Change Period (Y+Rc), s	* 6.3	6.1		6.6	* 6.1	6.3		6.5
Max Green Setting (Gmax), s	* 36	38.9		36.4	* 19	55.7		13.5
Max Q Clear Time (g_c+I1), s	17.5	33.3		5.7	5.5	2.0		8.5
Green Ext Time (p_c), s	6.1	4.8		0.6	0.1	22.1		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	15.0
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	145	1219	0	0	1470	614	0	0	0	699	0	873
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	0	0	1863	1863				1810	0	1845
Adj Flow Rate, veh/h	153	1283	0	0	1547	0				736	0	919
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	178	2691	0	0	2798	587				1189	0	981
Arrive On Green	0.10	0.53	0.00	0.00	0.74	0.00				0.36	0.00	0.36
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	153	1283	0	0	1547	0				736	0	919
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	12.5	23.3	0.0	0.0	13.2	0.0				26.7	0.0	47.2
Cycle Q Clear(g_c), s	12.5	23.3	0.0	0.0	13.2	0.0				26.7	0.0	47.2
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	178	2691	0	0	2798	587				1189	0	981
V/C Ratio(X)	0.86	0.48	0.00	0.00	0.55	0.00				0.62	0.00	0.94
Avail Cap(c_a), veh/h	321	2691	0	0	2798	587				1265	0	1044
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.58	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	65.0	21.7	0.0	0.0	13.6	0.0				39.0	0.0	45.6
Incr Delay (d2), s/veh	11.4	0.6	0.0	0.0	0.5	0.0				0.7	0.0	14.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.7	11.1	0.0	0.0	5.3	0.0				12.5	0.0	19.9
LnGrp Delay(d),s/veh	76.3	22.4	0.0	0.0	14.1	0.0				39.7	0.0	59.9
LnGrp LOS	E	C			B					D		E
Approach Vol, veh/h		1436			1547						1655	
Approach Delay, s/veh		28.1			14.1						50.9	
Approach LOS		C			B						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	23.2	65.1		61.7		88.3		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	26.5	42.6		55.5		77.6		
Max Q Clear Time (g_c+I1), s	14.5	15.2		49.2		25.3		
Green Ext Time (p_c), s	0.3	22.4		3.0		36.7		

Intersection Summary	
HCM 2010 Ctrl Delay	31.6
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	293	90	84	71	0	215	0	1678	106	219	1367	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1667	1681	1776	0	1792	0	1863	1681	1827	1845	0
Adj Flow Rate, veh/h	326	100	0	79	0	0	0	1864	118	243	1519	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	377	145	65	122	0	0	0	3129	933	300	3814	0
Arrive On Green	0.11	0.05	0.00	0.04	0.00	0.00	0.00	1.00	1.00	0.09	0.76	0.00
Sat Flow, veh/h	3408	3167	1429	3281	79		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	326	100	0	79	67.1		0	1864	118	243	1519	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	E		0	1695	1429	1688	1679	0
Q Serve(g_s), s	12.6	4.2	0.0	3.2			0.0	0.0	0.0	9.5	14.0	0.0
Cycle Q Clear(g_c), s	12.6	4.2	0.0	3.2			0.0	0.0	0.0	9.5	14.0	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	377	145	65	122			0	3129	933	300	3814	0
V/C Ratio(X)	0.86	0.69	0.00	0.65			0.00	0.60	0.13	0.81	0.40	0.00
Avail Cap(c_a), veh/h	435	236	107	419			0	3129	933	476	3814	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.85	0.85	1.00	1.00	0.00
Uniform Delay (d), s/veh	58.6	63.0	0.0	63.6			0.0	0.0	0.0	59.9	5.7	0.0
Incr Delay (d2), s/veh	14.0	3.6	0.0	3.5			0.0	0.7	0.2	5.5	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.7	1.9	0.0	1.5			0.0	0.2	0.1	4.7	6.6	0.0
LnGrp Delay(d),s/veh	72.6	66.6	0.0	67.1			0.0	0.7	0.2	65.5	6.0	0.0
LnGrp LOS	E	E		E				A	A	E	A	
Approach Vol, veh/h		426						1982			1762	
Approach Delay, s/veh		71.2						0.7			14.2	
Approach LOS		E						A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	19.0	104.9	12.9	13.1		124.0	26.0	
Change Period (Y+Rc), s	* 7.1	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	* 19	75.5	17.1	10.0		101.5	17.1	
Max Q Clear Time (g_c+I1), s	11.5	2.0	5.2	6.2		16.0	14.6	
Green Ext Time (p_c), s	0.5	58.8	0.1	0.1		66.1	0.2	

Intersection Summary	
HCM 2010 Ctrl Delay	14.6
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	77	0	28	22	0	39	41	1668	6	40	1401	81
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1610	1473	1900	1900	1863	1900	1776	1863	1900	1845	1712	1667
Adj Flow Rate, veh/h	85	0	31	24	0	43	45	1833	7	44	1540	89
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	174	0	161	97	19	127	58	3436	13	60	3073	931
Arrive On Green	0.13	0.00	0.13	0.13	0.00	0.13	0.03	0.66	0.66	0.03	0.66	0.66
Sat Flow, veh/h	1174	0	1252	405	148	991	1691	5229	20	1757	4673	1417
Grp Volume(v), veh/h	85	0	31	67	0	0	45	1188	652	44	1540	89
Grp Sat Flow(s),veh/h/ln	1174	0	1252	1543	0	0	1691	1695	1859	1757	1558	1417
Q Serve(g_s), s	7.7	0.0	2.4	0.6	0.0	0.0	2.8	20.0	20.0	2.7	18.2	2.5
Cycle Q Clear(g_c), s	11.6	0.0	2.4	4.0	0.0	0.0	2.8	20.0	20.0	2.7	18.2	2.5
Prop In Lane	1.00		1.00	0.36		0.64	1.00		0.01	1.00		1.00
Lane Grp Cap(c), veh/h	174	0	161	243	0	0	58	2227	1221	60	3073	931
V/C Ratio(X)	0.49	0.00	0.19	0.28	0.00	0.00	0.78	0.53	0.53	0.74	0.50	0.10
Avail Cap(c_a), veh/h	529	0	539	697	0	0	207	2227	1221	213	3073	931
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.90	0.90	0.90
Uniform Delay (d), s/veh	48.0	0.0	42.0	42.7	0.0	0.0	51.7	9.8	9.8	51.7	9.4	6.8
Incr Delay (d2), s/veh	1.3	0.0	0.4	0.4	0.0	0.0	8.0	0.9	1.7	5.9	0.5	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	0.0	0.8	1.8	0.0	0.0	1.5	9.5	10.7	1.4	7.9	1.0
LnGrp Delay(d),s/veh	49.3	0.0	42.4	43.1	0.0	0.0	59.6	10.7	11.4	57.5	10.0	6.9
LnGrp LOS	D		D	D			E	B	B	E	A	A
Approach Vol, veh/h		116			67			1885			1673	
Approach Delay, s/veh		47.5			43.1			12.1			11.1	
Approach LOS		D			D			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.5	119.1		20.4	10.6	119.1		20.4
Change Period (Y+Rc), s	6.8	* 6.1		6.5	6.9	* 6.1		6.5
Max Green Setting (Gmax), s	13.2	* 71		46.5	13.1	* 71		46.5
Max Q Clear Time (g_c+I1), s	4.8	20.2		6.0	4.7	22.0		13.6
Green Ext Time (p_c), s	0.0	42.5		0.7	0.0	41.2		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	13.3
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	29	381	115	135	434	26	48	0	40	18	4	3
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1787	1900	1900	1656	1900	1545	1900	1267	1712	1665	1900
Adj Flow Rate, veh/h	32	414	125	147	472	28	52	0	43	20	4	3
Adj No. of Lanes	2	3	0	1	3	0	1	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	5	7	7	0	15	15	23	0	50	11	0	0
Cap, veh/h	742	905	263	402	1052	62	152	197	112	78	42	32
Arrive On Green	0.07	0.08	0.08	0.22	0.24	0.24	0.10	0.00	0.10	0.05	0.05	0.05
Sat Flow, veh/h	3343	3756	1092	1810	4368	257	1471	1900	1077	1630	884	663
Grp Volume(v), veh/h	32	356	183	147	325	175	52	0	43	20	0	7
Grp Sat Flow(s),veh/h/ln	1672	1626	1595	1810	1507	1611	1471	1900	1077	1630	0	1548
Q Serve(g_s), s	0.6	6.5	6.8	4.3	5.7	5.8	2.0	0.0	2.3	0.7	0.0	0.3
Cycle Q Clear(g_c), s	0.6	6.5	6.8	4.3	5.7	5.8	2.0	0.0	2.3	0.7	0.0	0.3
Prop In Lane	1.00		0.68	1.00		0.16	1.00		1.00	1.00		0.43
Lane Grp Cap(c), veh/h	742	784	384	402	726	388	152	197	112	78	0	74
V/C Ratio(X)	0.04	0.45	0.48	0.37	0.45	0.45	0.34	0.00	0.39	0.26	0.00	0.09
Avail Cap(c_a), veh/h	806	1202	589	610	1404	750	284	366	208	262	0	249
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.99	0.99	0.99	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	22.7	24.7	24.9	20.5	20.1	20.1	25.9	0.0	26.1	28.6	0.0	28.3
Incr Delay (d2), s/veh	0.0	1.9	4.2	0.8	2.0	3.7	1.9	0.0	3.1	3.6	0.0	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	3.1	3.5	2.2	2.5	2.9	0.9	0.0	0.8	0.4	0.0	0.1
LnGrp Delay(d),s/veh	22.7	26.6	29.0	21.3	22.1	23.8	27.8	0.0	29.1	32.2	0.0	29.5
LnGrp LOS	C	C	C	C	C	C	C		C	C		C
Approach Vol, veh/h		571			647			95			27	
Approach Delay, s/veh		27.2			22.4			28.4			31.5	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	47.6	21.0		12.5	47.6	21.0		9.0
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s	15.0	29.0		12.0	21.0	23.0		10.0
Max Q Clear Time (g_c+I1), s	2.6	7.8		4.3	6.3	8.8		2.7
Green Ext Time (p_c), s	0.6	4.4		0.2	0.7	4.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	25.0
HCM 2010 LOS	C

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	43	510	473	12	15	37
Number	1	6	2	12	3	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1827	1644	1900	1357	1532
Adj Flow Rate, veh/h	47	554	514	13	16	40
Adj No. of Lanes	2	3	3	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	4	16	16	40	24
Cap, veh/h	509	3158	1555	39	117	118
Arrive On Green	0.30	1.00	0.46	0.46	0.09	0.09
Sat Flow, veh/h	3408	5152	4649	113	1293	1302
Grp Volume(v), veh/h	47	554	341	186	16	40
Grp Sat Flow(s),veh/h/ln	1704	1663	1496	1623	1293	1302
Q Serve(g_s), s	0.4	0.0	3.2	3.2	0.5	1.3
Cycle Q Clear(g_c), s	0.4	0.0	3.2	3.2	0.5	1.3
Prop In Lane	1.00			0.07	1.00	1.00
Lane Grp Cap(c), veh/h	509	3158	1033	561	117	118
V/C Ratio(X)	0.09	0.18	0.33	0.33	0.14	0.34
Avail Cap(c_a), veh/h	1491	6892	2411	1309	536	540
HCM Platoon Ratio	2.00	2.00	1.33	1.33	1.00	1.00
Upstream Filter(I)	0.99	0.99	0.99	0.99	1.00	1.00
Uniform Delay (d), s/veh	13.1	0.0	8.5	8.5	18.2	18.5
Incr Delay (d2), s/veh	0.1	0.1	0.8	1.6	0.5	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	1.4	1.6	0.2	0.5
LnGrp Delay(d),s/veh	13.2	0.1	9.4	10.1	18.7	20.2
LnGrp LOS	B	A	A	B	B	C
Approach Vol, veh/h		601	527		56	
Approach Delay, s/veh		1.1	9.6		19.8	
Approach LOS		A	A		B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	59.1	21.0				80.1		9.9
Change Period (Y+Rc), s	6.0	6.0				6.0		6.0
Max Green Setting (Gmax), s	19.0	35.0				60.0		18.0
Max Q Clear Time (g_c+I1), s	2.4	5.2				2.0		3.3
Green Ext Time (p_c), s	3.6	3.7				4.6		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	5.8
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	98	526	102	37	450	23	12	0	17	10	1	30
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1377	1667	1810	1792	1591	1900	1900	1624	1242	1357	1398	1900
Adj Flow Rate, veh/h	107	572	111	40	489	25	13	0	0	11	1	33
Adj No. of Lanes	2	3	1	1	3	0	0	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	38	14	5	6	19	19	0	0	53	40	0	0
Cap, veh/h	301	1265	427	202	1176	60	76	0	52	94	3	84
Arrive On Green	0.12	0.28	0.28	0.24	0.56	0.56	0.05	0.00	0.00	0.07	0.07	0.07
Sat Flow, veh/h	2544	4550	1538	1707	4233	215	1547	0	1056	1293	35	1158
Grp Volume(v), veh/h	107	572	111	40	333	181	13	0	0	11	0	34
Grp Sat Flow(s),veh/h/ln	1272	1517	1538	1707	1448	1553	1547	0	1056	1293	0	1194
Q Serve(g_s), s	2.1	5.6	3.0	1.0	3.6	3.6	0.4	0.0	0.0	0.4	0.0	1.5
Cycle Q Clear(g_c), s	2.1	5.6	3.0	1.0	3.6	3.6	0.4	0.0	0.0	0.4	0.0	1.5
Prop In Lane	1.00		1.00	1.00		0.14	1.00		1.00	1.00		0.97
Lane Grp Cap(c), veh/h	301	1265	427	202	805	432	76	0	52	94	0	87
V/C Ratio(X)	0.36	0.45	0.26	0.20	0.41	0.42	0.17	0.00	0.00	0.12	0.00	0.39
Avail Cap(c_a), veh/h	471	1855	627	285	1126	604	458	0	313	407	0	376
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.99	0.99	0.99	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.9	16.1	15.2	18.5	9.5	9.5	24.6	0.0	0.0	23.4	0.0	23.9
Incr Delay (d2), s/veh	0.7	1.2	1.5	0.5	1.6	2.9	1.5	0.0	0.0	0.8	0.0	4.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	2.5	1.4	0.5	1.6	1.9	0.2	0.0	0.0	0.2	0.0	0.6
LnGrp Delay(d),s/veh	22.6	17.3	16.6	19.0	11.0	12.4	26.1	0.0	0.0	24.2	0.0	27.9
LnGrp LOS	C	B	B	B	B	B	C			C		C
Approach Vol, veh/h		790			554			13			45	
Approach Delay, s/veh		17.9			12.0			26.1			27.0	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.4	57.0		9.7	48.4	21.0		10.9
Change Period (Y+Rc), s	6.0	6.0		7.0	6.0	6.0		7.0
Max Green Setting (Gmax), s	10.0	21.0		16.0	9.0	22.0		17.0
Max Q Clear Time (g_c+I1), s	4.1	5.6		2.4	3.0	7.6		3.5
Green Ext Time (p_c), s	0.1	3.1		0.0	1.7	3.8		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	16.0
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	70	1185	27	35	850	122	15	8	43	205	16	200
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1827	1863	1863	1845	1863	1845	1768	1900	1743	1863	1827
Adj Flow Rate, veh/h	76	1288	29	38	924	133	16	9	47	223	17	217
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	94	2963	941	74	2931	922	129	13	66	291	331	276
Arrive On Green	0.05	0.59	0.59	0.04	0.58	0.58	0.02	0.05	0.05	0.14	0.18	0.18
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	247	1292	1660	1863	1553
Grp Volume(v), veh/h	76	1288	29	38	924	133	16	0	56	223	17	217
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1540	1660	1863	1553
Q Serve(g_s), s	7.0	23.3	0.9	3.5	15.5	6.3	1.4	0.0	5.9	20.5	1.2	22.0
Cycle Q Clear(g_c), s	7.0	23.3	0.9	3.5	15.5	6.3	1.4	0.0	5.9	20.5	1.2	22.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.84	1.00		1.00
Lane Grp Cap(c), veh/h	94	2963	941	74	2931	922	129	0	78	291	331	276
V/C Ratio(X)	0.81	0.43	0.03	0.52	0.32	0.14	0.12	0.00	0.72	0.77	0.05	0.79
Avail Cap(c_a), veh/h	160	2963	941	140	2931	922	189	0	117	339	367	306
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	77.3	18.3	7.9	77.4	17.7	15.7	72.5	0.0	77.1	61.1	56.3	64.8
Incr Delay (d2), s/veh	6.1	0.5	0.1	2.1	0.3	0.3	0.4	0.0	11.5	8.6	0.1	11.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	10.7	0.5	1.7	7.3	2.9	0.7	0.0	2.8	10.1	0.6	10.3
LnGrp Delay(d),s/veh	83.4	18.8	8.0	79.5	17.9	16.1	73.0	0.0	88.6	69.7	56.3	76.5
LnGrp LOS	F	B	A	E	B	B	E		F	E	E	E
Approach Vol, veh/h		1393			1095			72			457	
Approach Delay, s/veh		22.1			19.8			85.1			72.4	
Approach LOS		C			B			F			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	28.9	105.0	9.3	36.8	15.8	118.0	30.2	15.9
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	13.0	98.0	8.3	32.5	14.9	96.0	27.5	* 13
Max Q Clear Time (g_c+I1), s	5.5	25.3	3.4	24.0	9.0	17.5	22.5	7.9
Green Ext Time (p_c), s	3.0	11.0	0.0	0.7	0.0	7.2	0.3	0.5

Intersection Summary	
HCM 2010 Ctrl Delay	30.4
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	455	280	759	320	371	47	609	1309	418	44	723	230
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1810	1863	1900	1827	1863	1776	1776	1863	1863
Adj Flow Rate, veh/h	500	308	0	352	408	52	669	1438	0	48	795	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	572	339	288	463	486	62	714	1653	705	61	1032	461
Arrive On Green	0.17	0.18	0.00	0.14	0.15	0.15	0.42	0.93	0.00	0.04	0.29	0.00
Sat Flow, veh/h	3442	1863	1583	3343	3161	401	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	500	308	0	352	227	233	669	1438	0	48	795	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1792	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	21.4	24.5	0.0	15.3	18.9	19.1	28.7	21.6	0.0	4.3	31.1	0.0
Cycle Q Clear(g_c), s	21.4	24.5	0.0	15.3	18.9	19.1	28.7	21.6	0.0	4.3	31.1	0.0
Prop In Lane	1.00		1.00	1.00		0.22	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	572	339	288	463	272	275	714	1653	705	61	1032	461
V/C Ratio(X)	0.87	0.91	0.00	0.76	0.84	0.84	0.94	0.87	0.00	0.79	0.77	0.00
Avail Cap(c_a), veh/h	780	596	506	537	448	454	814	1653	705	158	1032	461
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.09	0.09	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	61.5	60.7	0.0	62.7	62.2	62.3	42.7	3.4	0.0	72.4	49.0	0.0
Incr Delay (d2), s/veh	6.6	5.2	0.0	5.1	6.1	6.7	2.1	0.6	0.0	8.2	5.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.7	13.2	0.0	7.4	9.7	10.0	13.5	8.7	0.0	2.1	16.0	0.0
LnGrp Delay(d),s/veh	68.2	65.9	0.0	67.9	68.3	69.0	44.8	4.0	0.0	80.5	54.6	0.0
LnGrp LOS	E	E		E	E	E	D	A		F	D	
Approach Vol, veh/h		808			812			2107			843	
Approach Delay, s/veh		67.3			68.3			17.0			56.0	
Approach LOS		E			E			B			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	67.2	51.0	31.8	30.0	12.3	105.9	27.7	34.1
Change Period (Y+Rc), s	* 6.5	* 6.9	* 6.7	* 6.7	* 6.9	* 6.5	* 6.7	* 6.6
Max Green Setting (Gmax), s	* 37	* 44	* 34	* 38	* 14	* 67	* 24	* 48
Max Q Clear Time (g_c+I1), s	30.7	33.1	23.4	21.1	6.3	23.6	17.3	26.5
Green Ext Time (p_c), s	1.4	3.9	1.7	2.1	0.0	16.0	1.4	1.0

Intersection Summary	
HCM 2010 Ctrl Delay	42.2
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	463	68	953	148	65	65	433	1808	171	106	1472	224
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1776	1827	1792	1845	1689	1900	1827	1827	1863	1776	1845	1845
Adj Flow Rate, veh/h	487	72	1003	156	68	68	456	1903	180	112	1549	236
Adj No. of Lanes	1	1	2	1	2	0	2	3	1	1	3	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	7	4	6	3	4	4	4	4	2	7	3	3
Cap, veh/h	384	415	1019	191	175	155	516	2054	652	134	1698	529
Arrive On Green	0.23	0.23	0.23	0.11	0.11	0.11	0.31	0.82	0.82	0.08	0.34	0.34
Sat Flow, veh/h	1691	1827	2682	1757	1609	1432	3375	4988	1583	1691	5036	1568
Grp Volume(v), veh/h	487	72	1003	156	68	68	456	1903	180	112	1549	236
Grp Sat Flow(s),veh/h/ln	1691	1827	1341	1757	1604	1436	1688	1663	1583	1691	1679	1568
Q Serve(g_s), s	33.5	4.7	33.5	12.8	5.8	6.6	18.9	41.8	3.8	9.6	43.4	17.3
Cycle Q Clear(g_c), s	33.5	4.7	33.5	12.8	5.8	6.6	18.9	41.8	3.8	9.6	43.4	17.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	384	415	1019	191	174	156	516	2054	652	134	1698	529
V/C Ratio(X)	1.27	0.17	0.98	0.82	0.39	0.44	0.88	0.93	0.28	0.83	0.91	0.45
Avail Cap(c_a), veh/h	384	415	1019	434	396	355	978	2054	652	274	1698	529
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	0.83	0.83	0.83	1.00	1.00	1.00	0.66	0.66	0.66	0.72	0.72	0.72
Uniform Delay (d), s/veh	56.9	45.8	45.2	64.3	61.2	61.5	49.9	11.3	8.0	66.9	46.8	38.1
Incr Delay (d2), s/veh	136.3	0.2	21.8	8.4	1.4	1.9	3.6	6.1	0.7	9.4	6.8	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	30.1	2.4	23.2	6.7	2.6	2.7	9.0	19.2	1.8	4.9	21.2	7.8
LnGrp Delay(d),s/veh	193.2	46.0	67.0	72.6	62.6	63.4	53.5	17.5	8.7	76.3	53.6	40.1
LnGrp LOS	F	D	E	E	E	E	D	B	A	E	D	D
Approach Vol, veh/h		1562			292			2539			1897	
Approach Delay, s/veh		105.4			68.2			23.3			53.3	
Approach LOS		F			E			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	28.8	88.6		22.6	17.8	99.6		40.0
Change Period (Y+Rc), s	6.3	* 6.3		6.6	* 6.1	6.3		6.5
Max Green Setting (Gmax), s	42.7	* 42		36.4	* 24	60.7		33.5
Max Q Clear Time (g_c+I1), s	20.9	45.4		14.8	11.6	43.8		35.5
Green Ext Time (p_c), s	1.6	0.0		1.2	0.2	16.1		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	54.8
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	234	1594	0	0	2083	490	0	0	0	1088	0	818
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	0	0	1863	1863				1810	0	1845
Adj Flow Rate, veh/h	246	1678	0	0	2193	0				1145	0	861
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	267	2780	0	0	2629	552				1199	0	990
Arrive On Green	0.15	0.55	0.00	0.00	0.70	0.00				0.36	0.00	0.36
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	246	1678	0	0	2193	0				1145	0	861
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	24.4	39.9	0.0	0.0	37.6	0.0				59.6	0.0	51.9
Cycle Q Clear(g_c), s	24.4	39.9	0.0	0.0	37.6	0.0				59.6	0.0	51.9
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	267	2780	0	0	2629	552				1199	0	990
V/C Ratio(X)	0.92	0.60	0.00	0.00	0.83	0.00				0.95	0.00	0.87
Avail Cap(c_a), veh/h	353	2780	0	0	2629	552				1226	0	1012
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.30	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	74.8	27.4	0.0	0.0	23.3	0.0				55.8	0.0	53.4
Incr Delay (d2), s/veh	24.5	1.0	0.0	0.0	1.0	0.0				15.8	0.0	7.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.8	18.9	0.0	0.0	15.4	0.0				30.1	0.0	20.8
LnGrp Delay(d),s/veh	99.3	28.4	0.0	0.0	24.3	0.0				71.6	0.0	61.3
LnGrp LOS	F	C			C					E		E
Approach Vol, veh/h		1924			2193						2006	
Approach Delay, s/veh		37.4			24.3						67.2	
Approach LOS		D			C						E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	35.4	71.1		73.6		106.4		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	35.5	53.6		65.5		97.6		
Max Q Clear Time (g_c+I1), s	26.4	39.6		61.6		41.9		
Green Ext Time (p_c), s	0.5	13.6		2.4		50.7		

Intersection Summary	
HCM 2010 Ctrl Delay	42.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	862	190	191	279	0	506	0	1247	309	648	1571	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1667	1681	1776	0	1792	0	1863	1681	1827	1845	0
Adj Flow Rate, veh/h	958	211	0	310	0	0	0	1386	343	720	1746	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	673	266	120	361	0	0	0	2018	724	750	3352	0
Arrive On Green	0.20	0.08	0.00	0.11	0.00	0.00	0.00	0.27	0.27	0.22	0.67	0.00
Sat Flow, veh/h	3408	3167	1429	3281	310		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	958	211	0	310	70.4		0	1386	343	720	1746	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	E		0	1695	1429	1688	1679	0
Q Serve(g_s), s	30.1	10.0	0.0	14.2			0.0	37.3	26.2	32.2	27.1	0.0
Cycle Q Clear(g_c), s	30.1	10.0	0.0	14.2			0.0	37.3	26.2	32.2	27.1	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	673	266	120	361			0	2018	724	750	3352	0
V/C Ratio(X)	1.42	0.79	0.00	0.86			0.00	0.69	0.47	0.96	0.52	0.00
Avail Cap(c_a), veh/h	673	561	253	648			0	2018	724	750	3352	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	0.67	0.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.82	0.82	1.00	1.00	0.00
Uniform Delay (d), s/veh	61.2	68.5	0.0	66.7			0.0	47.5	30.4	58.6	13.0	0.0
Incr Delay (d2), s/veh	199.4	3.3	0.0	3.8			0.0	1.6	1.8	23.3	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	32.7	4.5	0.0	6.6			0.0	17.8	10.7	17.4	12.6	0.0
LnGrp Delay(d),s/veh	260.6	71.9	0.0	70.4			0.0	49.1	32.2	81.9	13.6	0.0
LnGrp LOS	F	E		E				D	C	F	B	
Approach Vol, veh/h		1169						1729			2466	
Approach Delay, s/veh		226.5						45.7			33.6	
Approach LOS		F						D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	41.0	94.5	24.7	19.8		135.5	44.5	
Change Period (Y+Rc), s	* 7.1	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	* 34	60.5	30.1	27.0		101.5	30.1	
Max Q Clear Time (g_c+I1), s	34.2	39.3	16.2	12.0		29.1	32.1	
Green Ext Time (p_c), s	0.0	19.4	0.6	0.8		55.9	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	79.0
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	196	7	51	37	5	40	58	1320	33	95	1838	108
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1610	1512	1900	1900	1863	1900	1776	1863	1900	1845	1712	1667
Adj Flow Rate, veh/h	215	8	56	41	5	44	64	1451	36	104	2020	119
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	261	43	298	178	30	171	79	2854	71	122	2722	825
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.05	0.56	0.56	0.07	0.58	0.58
Sat Flow, veh/h	1167	164	1146	572	116	657	1691	5104	127	1757	4673	1417
Grp Volume(v), veh/h	215	0	64	90	0	0	64	964	523	104	2020	119
Grp Sat Flow(s),veh/h/ln	1167	0	1310	1345	0	0	1691	1695	1840	1757	1558	1417
Q Serve(g_s), s	32.1	0.0	6.7	5.9	0.0	0.0	6.6	30.7	30.7	10.3	55.7	6.7
Cycle Q Clear(g_c), s	44.7	0.0	6.7	12.6	0.0	0.0	6.6	30.7	30.7	10.3	55.7	6.7
Prop In Lane	1.00		0.88	0.46		0.49	1.00		0.07	1.00		1.00
Lane Grp Cap(c), veh/h	261	0	340	379	0	0	79	1895	1029	122	2722	825
V/C Ratio(X)	0.82	0.00	0.19	0.24	0.00	0.00	0.81	0.51	0.51	0.85	0.74	0.14
Avail Cap(c_a), veh/h	261	0	340	379	0	0	127	1895	1029	172	2722	825
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.73	0.73	0.73
Uniform Delay (d), s/veh	70.8	0.0	50.4	53.1	0.0	0.0	82.7	23.8	23.8	80.5	26.9	16.7
Incr Delay (d2), s/veh	18.4	0.0	0.2	0.2	0.0	0.0	7.4	1.0	1.8	13.8	1.4	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.7	0.0	2.4	3.6	0.0	0.0	3.2	14.6	16.1	5.5	24.1	2.7
LnGrp Delay(d),s/veh	89.1	0.0	50.6	53.3	0.0	0.0	90.1	24.8	25.6	94.4	28.2	16.9
LnGrp LOS	F		D	D			F	C	C	F	C	B
Approach Vol, veh/h		279			90			1551			2243	
Approach Delay, s/veh		80.3			53.3			27.7			30.7	
Approach LOS		F			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	15.0	113.0		52.0	19.1	108.9		52.0
Change Period (Y+Rc), s	6.8	* 6.1		6.5	6.9	* 6.1		6.5
Max Green Setting (Gmax), s	13.2	* 1E2		45.5	17.1	* 98		45.5
Max Q Clear Time (g_c+I1), s	8.6	57.7		14.6	12.3	32.7		46.7
Green Ext Time (p_c), s	0.0	39.1		1.3	0.0	54.6		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	33.4
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	186	867	26	36	416	123	253	13	280	183	0	167
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1844	1900	1900	1727	1900	1881	1900	1881	1863	1881	1900
Adj Flow Rate, veh/h	202	942	28	39	452	134	275	14	304	199	0	182
Adj No. of Lanes	2	3	0	1	3	0	1	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	3	0	13	13	1	0	1	2	0	0
Cap, veh/h	602	1275	38	191	682	196	390	414	348	261	0	235
Arrive On Green	0.06	0.08	0.08	0.11	0.19	0.19	0.22	0.22	0.22	0.15	0.00	0.15
Sat Flow, veh/h	3510	5025	149	1810	3642	1044	1792	1900	1599	1774	0	1599
Grp Volume(v), veh/h	202	629	341	39	388	198	275	14	304	199	0	182
Grp Sat Flow(s),veh/h/ln	1755	1678	1818	1810	1571	1543	1792	1900	1599	1774	0	1599
Q Serve(g_s), s	4.8	15.9	15.9	1.7	9.9	10.4	12.3	0.5	16.0	9.4	0.0	9.5
Cycle Q Clear(g_c), s	4.8	15.9	15.9	1.7	9.9	10.4	12.3	0.5	16.0	9.4	0.0	9.5
Prop In Lane	1.00		0.08	1.00		0.68	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	602	851	461	191	589	289	390	414	348	261	0	235
V/C Ratio(X)	0.34	0.74	0.74	0.20	0.66	0.68	0.70	0.03	0.87	0.76	0.00	0.77
Avail Cap(c_a), veh/h	606	927	502	312	868	426	433	459	386	327	0	294
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.97	0.97	0.97	0.97	0.97	0.97	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	36.2	37.0	37.0	35.5	32.7	32.9	31.4	26.8	32.8	35.6	0.0	35.7
Incr Delay (d2), s/veh	0.4	5.5	9.9	0.7	5.5	12.0	5.2	0.0	18.8	11.7	0.0	13.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	8.0	9.3	0.9	4.8	5.4	6.7	0.3	8.8	5.4	0.0	5.1
LnGrp Delay(d),s/veh	36.7	42.5	46.9	36.3	38.2	45.0	36.6	26.8	51.6	47.3	0.0	49.4
LnGrp LOS	D	D	D	D	D	D	D	C	D	D		D
Approach Vol, veh/h		1172			625			593			381	
Approach Delay, s/veh		42.8			40.2			44.0			48.3	
Approach LOS		D			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	34.0	22.3		24.9	15.1	41.2		18.8
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0
Max Green Setting (Gmax), s	15.0	24.0		21.0	15.0	24.0		16.0
Max Q Clear Time (g_c+I1), s	6.8	12.4		18.0	3.7	17.9		11.5
Green Ext Time (p_c), s	5.3	3.9		1.0	0.1	4.1		1.2

Intersection Summary		
HCM 2010 Ctrl Delay		43.2
HCM 2010 LOS		D

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	256	992	772	64	87	147
Number	1	6	2	12	3	18
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1754	1900	1881	1881
Adj Flow Rate, veh/h	278	1078	839	70	95	160
Adj No. of Lanes	2	3	3	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	3	9	9	1	1
Cap, veh/h	911	3274	1286	107	250	223
Arrive On Green	0.52	1.00	0.57	0.57	0.14	0.14
Sat Flow, veh/h	3510	5202	4664	375	1792	1599
Grp Volume(v), veh/h	278	1078	593	316	95	160
Grp Sat Flow(s),veh/h/ln	1755	1679	1596	1688	1792	1599
Q Serve(g_s), s	2.6	0.0	7.2	7.3	2.8	5.5
Cycle Q Clear(g_c), s	2.6	0.0	7.2	7.3	2.8	5.5
Prop In Lane	1.00			0.22	1.00	1.00
Lane Grp Cap(c), veh/h	911	3274	911	482	250	223
V/C Ratio(X)	0.31	0.33	0.65	0.65	0.38	0.72
Avail Cap(c_a), veh/h	1291	5822	2181	1153	690	616
HCM Platoon Ratio	2.00	2.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	0.79	0.79	0.75	0.75	1.00	1.00
Uniform Delay (d), s/veh	10.8	0.0	10.3	10.3	22.3	23.5
Incr Delay (d2), s/veh	0.1	0.2	2.7	5.2	0.9	4.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.1	3.4	3.9	1.4	2.7
LnGrp Delay(d),s/veh	10.9	0.2	13.0	15.5	23.3	27.7
LnGrp LOS	B	A	B	B	C	C
Approach Vol, veh/h		1356	909		255	
Approach Delay, s/veh		2.4	13.9		26.1	
Approach LOS		A	B		C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	63.7	22.3				86.0		14.0
Change Period (Y+Rc), s	6.0	6.0				6.0		6.0
Max Green Setting (Gmax), s	21.0	39.0				66.0		22.0
Max Q Clear Time (g_c+I1), s	4.6	9.3				2.0		7.5
Green Ext Time (p_c), s	8.0	7.0				12.3		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	8.9
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	172	1122	54	76	821	22	198	3	93	33	2	100
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1759	1881	1792	1131	1833	1900	1900	1536	1743	1696	1670	1900
Adj Flow Rate, veh/h	187	1220	59	83	892	24	215	3	0	36	2	109
Adj No. of Lanes	2	3	1	1	3	0	0	1	1	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	8	1	6	68	3	3	0	0	9	12	0	0
Cap, veh/h	509	1590	472	92	1194	32	264	4	271	165	3	143
Arrive On Green	0.16	0.31	0.31	0.17	0.48	0.48	0.18	0.18	0.00	0.10	0.10	0.10
Sat Flow, veh/h	3250	5136	1524	1077	5012	135	1444	20	1482	1616	26	1398
Grp Volume(v), veh/h	187	1220	59	83	594	322	218	0	0	36	0	111
Grp Sat Flow(s),veh/h/ln	1625	1712	1524	1077	1668	1810	1464	0	1482	1616	0	1424
Q Serve(g_s), s	4.2	17.5	2.3	6.1	11.8	11.8	11.6	0.0	0.0	1.7	0.0	6.2
Cycle Q Clear(g_c), s	4.2	17.5	2.3	6.1	11.8	11.8	11.6	0.0	0.0	1.7	0.0	6.2
Prop In Lane	1.00		1.00	1.00		0.07	0.99		1.00	1.00		0.98
Lane Grp Cap(c), veh/h	509	1590	472	92	795	431	268	0	271	165	0	146
V/C Ratio(X)	0.37	0.77	0.13	0.90	0.75	0.75	0.81	0.00	0.00	0.22	0.00	0.76
Avail Cap(c_a), veh/h	509	1831	543	146	1231	668	342	0	346	298	0	263
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.94	0.94	0.94	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	30.7	25.4	20.2	33.4	19.3	19.3	31.9	0.0	0.0	33.5	0.0	35.5
Incr Delay (d2), s/veh	0.4	3.6	0.5	32.2	6.0	10.6	12.6	0.0	0.0	0.9	0.0	11.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	8.8	1.0	2.6	6.0	7.1	5.6	0.0	0.0	0.8	0.0	2.9
LnGrp Delay(d),s/veh	31.1	29.0	20.7	65.6	25.3	29.9	44.5	0.0	0.0	34.4	0.0	46.6
LnGrp LOS	C	C	C	E	C	C	D			C		D
Approach Vol, veh/h		1466			999			218			147	
Approach Delay, s/veh		29.0			30.1			44.5			43.6	
Approach LOS		C			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	37.4	25.4		21.9	31.6	31.2		15.3
Change Period (Y+Rc), s	6.0	6.0		7.0	6.0	6.0		7.0
Max Green Setting (Gmax), s	10.0	30.0		19.0	11.0	29.0		15.0
Max Q Clear Time (g_c+I1), s	6.2	13.8		13.6	8.1	19.5		8.2
Green Ext Time (p_c), s	0.3	5.6		0.7	0.1	5.7		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	31.3
HCM 2010 LOS	C

Synchro – Queue Analysis Outputs

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	246	1678	2193	516	1145	861
v/c Ratio	0.85	0.60	0.86	0.64	0.96	0.87
Control Delay	59.2	51.1	68.6	27.3	73.5	64.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	59.2	51.1	68.6	27.3	73.5	64.3
Queue Length 50th (ft)	295	702	510	130	677	535
Queue Length 95th (ft)	m274	m605	#699	375	#817	639
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	349	2783	2538	802	1213	1004
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.60	0.86	0.64	0.94	0.86

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	153	1283	1547	646	736	919
v/c Ratio	0.71	0.48	0.58	0.66	0.62	0.93
Control Delay	67.1	40.2	11.2	8.9	42.3	63.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.1	40.2	11.2	8.9	42.3	63.2
Queue Length 50th (ft)	153	436	177	302	298	481
Queue Length 95th (ft)	m209	489	182	m659	367	#618
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	312	2701	2663	976	1233	1021
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.48	0.58	0.66	0.60	0.90

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Existing VISSIM Calibration

April 2014

Technical Memorandum

I-4 and SR 536 Off-ramp Calibration Report



Table of Contents

1 Project Description and Background 3

2 Study Area 5

3 BASE Model Development 7

3.1 Traffic Data Sources and Time Period Selection 7

3.2 VISUM Model Development 7

3.3 VISUM Assignment Analysis 8

3.4 VISSIM Model Development 10

3.4.1 Geometrics and Vehicle Type 10

3.4.2 Desired Speed and Reduced Speed Areas 10

3.4.3 Priority Rule / Conflict Area 11

3.4.4 Signal Operations and Stop Signs 11

4 Validation / Calibration of VISSIM Model 11

4.1 Visual Checking and Error Correction 11

4.2 Confidence Interval 12

4.3 Volume Validation 12

5 Validation / Calibration Results 12

5.1 Validation Results 12

5.1.1 Lane Change Distances, Emergency Stop and Headway 13

6 Next Steps 14

List of Figures

Figure 1: Area of Influence 6
Figure 5 T-Flow Fuzzy Flow Diagram 8
Figure 6 Section A AM Assignment Analysis Chart 9
Figure 7 Section A PM Assignment Analysis Chart 10

List of Tables

Table 5—1 Comparison of Traffic Volumes 13

1 PROJECT DESCRIPTION AND BACKGROUND

Florida Department of Transportation (FDOT) District Five is the Applicant for this (Interchange Modification Report) IMR.

Ranked as the most visited city in United States of America, according to the Forbes magazine, Orlando's famous attractions such as Walt Disney World Resort form the backbone of its tourism industry. Located in the heart of this Walt Disney World Resort, Downtown Disney is a 120-acre entertainment, dining and shopping complex. Downtown Disney, which is located along Buena Vista Drive, is open to the public, requires no admission fee, and offers complimentary parking and transportation to all Disney-operated Walt Disney World resorts. Currently, Downtown Disney is in the process of a multi-year transformation into Disney Springs. Disney Springs proposes to feature more than 150 shopping, dining and entertainment venues. The Reedy Creek Improvement District (RCID) is the governing jurisdiction for the entire area of the Walt Disney World Resort.

I-4 is an integral part of Central Florida's transportation system. This Interstate carries the greatest number of people and vehicles of any transportation facility in the region and serves many of the area's primary activity centers. Since its opening in 1965, I-4 has served intrastate and interstate travel by providing a critical link between the east and west coasts of Central Florida. Today, I-4 also serves as the primary link between hotel/motel complexes and tourist attractions such as Walt Disney World including Downtown Disney, Universal Studios, Sea World, the International Drive Resort Area and downtown Orlando. In addition, since I-4 is the only north-south limited access facility that is centrally located between the predominant employment centers and the major suburbs to the north, it has become the primary commuting corridor in the Central Florida metropolitan area.

The Department is conducting the I-4 Systems Access Modification Report (SAMR) Re-evaluation on two sections. Section A is west of the I-4 Ultimate initial operating segment and Section B is east of the I-4 Ultimate initial operating segment. The limits of Section A are the I-4/US 27 interchange in Polk County and the I-4/SR 435 interchange in Orange County. The limits of Section B are the I-4/SR 434 interchange in Seminole County and the I-4/Orange Camp Road interchange in Volusia County. The purpose of the I-4 SAMR Re-evaluation is to ensure that the improvements to the I-4 corridor are responsive to changing conditions.

The SR 535 interchange provides access to Walt Disney World including Downtown Disney and is located north of the SR 536 interchange. Currently most of the westbound I-4 traffic uses SR 535 to access Downtown Disney/Disney Springs. SR 535 is a constrained facility operating at or near capacity. The congestion along SR 535 causes traffic to back up on I-4 negatively impacting other interchanges along I-4. Additionally in recent years, congestion on I-4 has extended well beyond normal peak hours resulting in traffic congestion throughout the metropolitan area. Due to these congested conditions, user travel times will continue to increase for the area's residents, visitors, and employees. This proposed off-ramp extension to the I-4 WB Off-Ramp at SR 536 will provide direct access to the BVD commercial corridor that includes Downtown Disney/Disney Springs. The proposed improvement, by allowing a direct access to Downtown Disney/Disney Springs, will reduce congestion on the I-4 mainline and at the upstream SR 535 interchange with I-4.

The purpose of the operational improvements is to increase safety by reducing the queuing along the I-4 mainline at the adjacent SR 535 interchange to the north. There is an opportunity to divert traffic from the SR 535 interchange to the downstream interchange at SR 536 by leveraging the Reedy Creek Improvement District's proposal to extend the I-4 WB off-ramp at I-4/SR 536. The purpose of this report is to document calibration efforts of the subarea network for the existing conditions (2011).

2 STUDY AREA

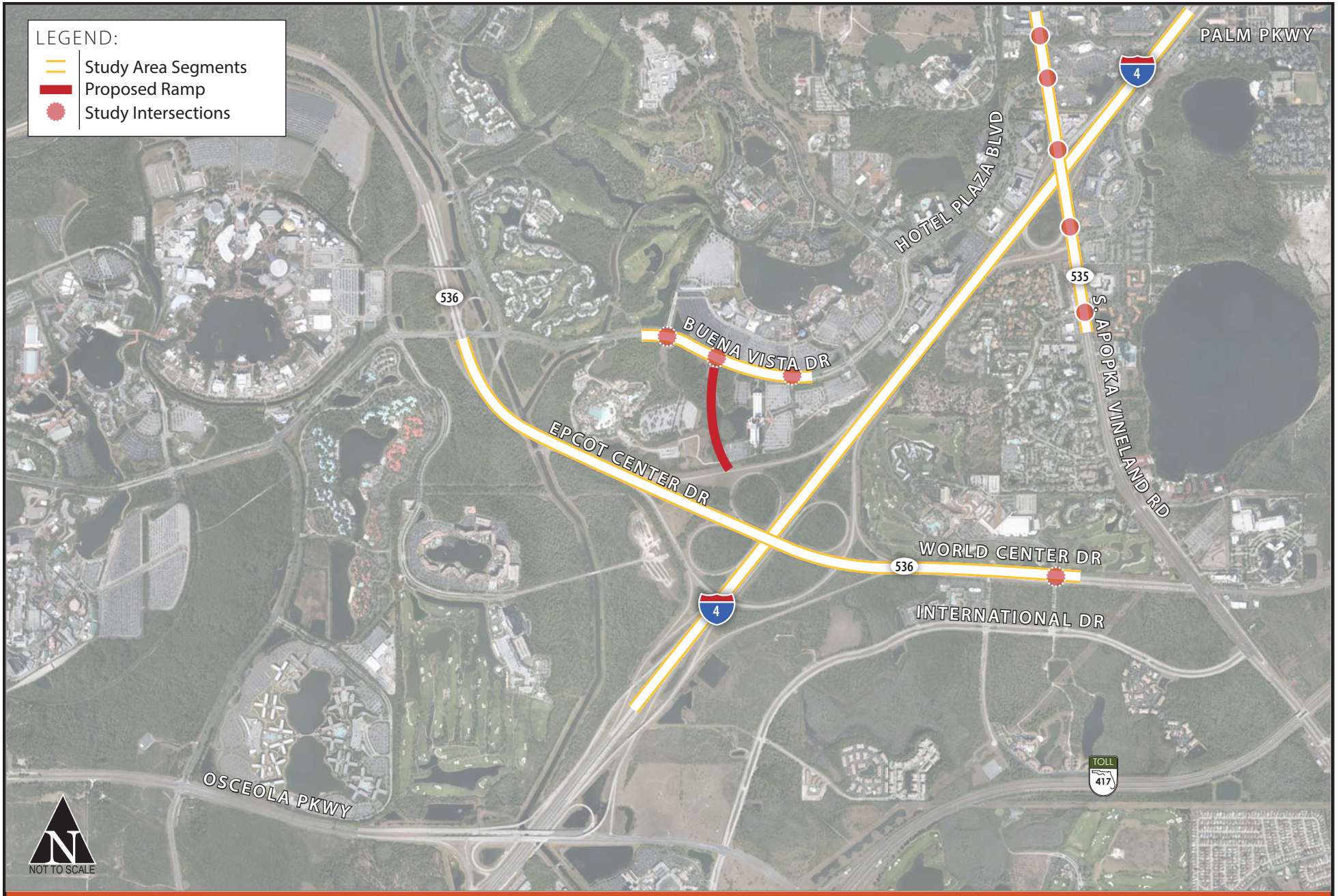
The area of influence, as illustrated in Figure 1-1, is consistent with signed Methodology Letter of Understanding (MLOU).

The AOI consists of following interchanges (including ramp merge/diverge areas and weaving areas):

- I-4 and SR 536
- I-4 and SR 535

The intersections within the AOI are listed below for each corridor:

- SR 536 at World Center Drive
- SR 535 at Palm Parkway
- SR 535 at Hotel Plaza Boulevard
- SR 535 at I-4 Westbound ramps
- SR 535 at I-4 Eastbound ramps
- SR 535 at Meadow Creek Drive
- Buena Vista Drive at Typhoon Lagoon
- Buena Vista Drive at Downtown Disney West side
- Buena Vista Drive at Team Disney / AMC Theaters



FDOT

Interstate 4 and SR 536 Off-Ramp

Figure 1
Area of Influence

3 BASE MODEL DEVELOPMENT

Model assumptions and calibration techniques that were incorporated into the models are discussed below. Parameters are discussed in detail in the following sections. All assumptions are based on the traffic data that was collected.

3.1 Traffic Data Sources and Time Period Selection

Existing traffic data including turning movement counts, speed, and signal timing were obtained for year 2011 from various sources including FDOT, RCID, Orange County, Osceola County, and other agencies in addition to the field collected data. Freeway and ramp volumes were obtained from the 2011 Florida Traffic Information (FTI) DVD. The signal timing plans for signalized intersections were obtained from Orange County, Osceola County, and RCID.

Turning movement counts for the study intersections were provided by FDOT. Freeway and ramp volumes were obtained from the 2011 Florida Traffic Information (FTI) DVD. Older counts were adjusted to reflect 2011 conditions and balanced throughout the network.

The AM and PM peak hour condition was selected as 7:30 AM to 8:30 AM and 4:45 PM to 5:45 PM as they represent highest traffic volumes along I-4. The model has a 30 minute seeding period which was coded using volumes that were 100 percent of the actual analysis hour. The seeding period allows for vehicles to be loaded into the network before beginning any data collection.

3.2 VISUM Model Development

Vehicle routing in VISSIM specifies vehicle distribution and is typically achieved by assigning routes between every decision (merge/diverge) point. However, the size and specific nature of this approach results in numerous decision points within the study area and a more automated approach was utilized, resulting in just over 830 complete routes. A VISUM model was developed in order to generate origin-destination (OD) matrices and routing.

The node and link numbers are consistent across VISUM and VISSIM, thus making data interchange within time periods an efficient process. Additional network elements including vehicle inputs, roadway geometry, conflict areas, and desired speed decisions were transferred to VISSIM.

3.3 VISUM Assignment Analysis

The goal of this approach is to assign a complete route for each vehicle to its destination upon entering the network. Assigning routes in this manner allows for improved lane utilization within the model because each vehicle has a general idea on where it wishes to end its trip and improves the validity of weaving operations within the model.

The challenge is to determine the distribution of the vehicles as they first enter the network. This task was achieved through the use of an OD matrix. The OD matrix estimation was executed using VISUM's T-Flow Fuzzy module and calibrated using link and turn counts to reflect the balanced traffic counts. This matrix was reviewed for reasonability of turns movements and travel patterns within the microsimulation study area. Figure 2 shows a flow diagram of the T-Flow Fuzzy process. Figure 3 and 7 illustrate the count vs. model value for each scenario.

Figure 2 T-Flow Fuzzy Flow Diagram



Figure 3 Subarea AM Assignment Analysis Chart

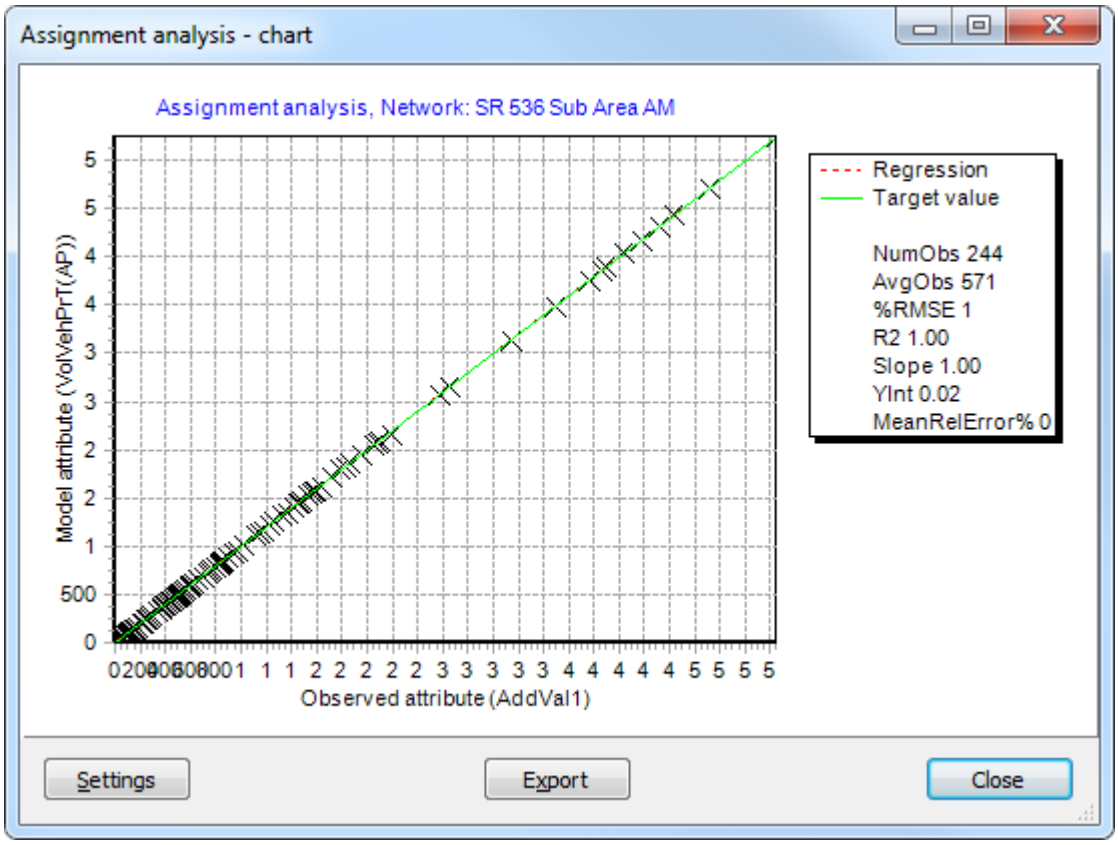
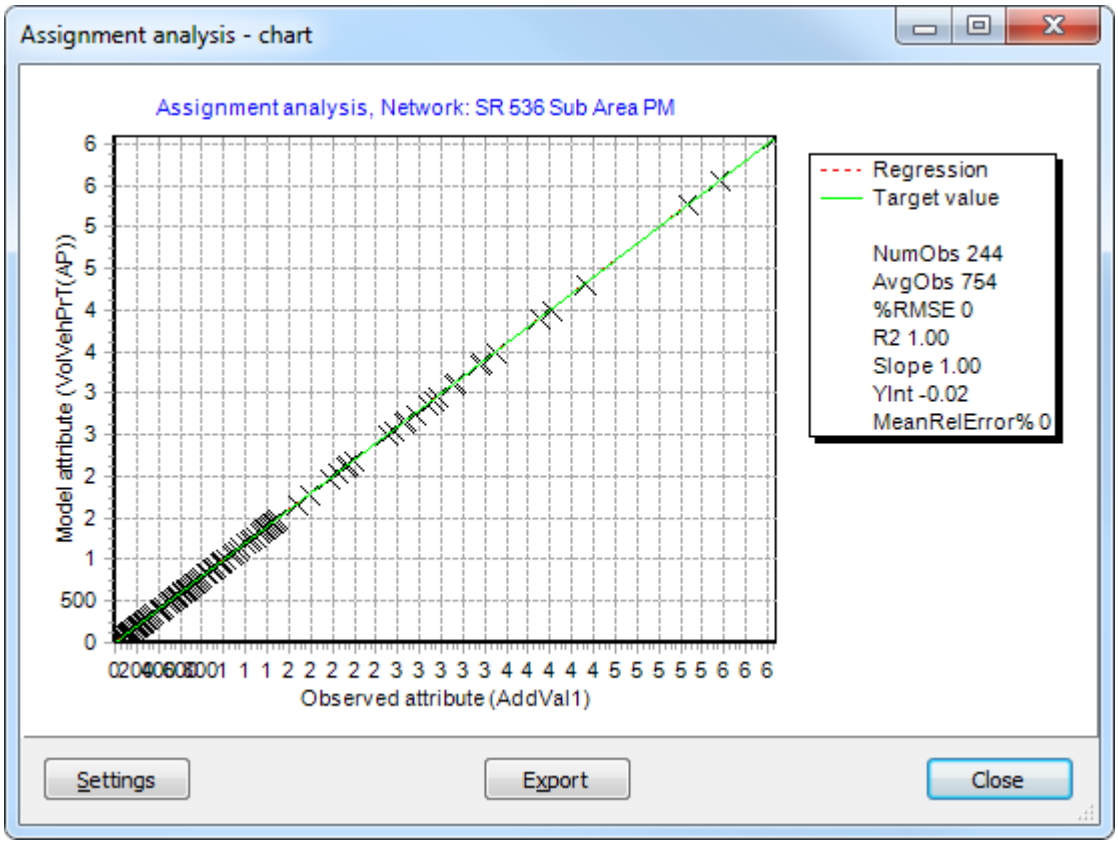


Figure 4 Subarea PM Assignment Analysis Chart



3.4 VISSIM Model Development

3.4.1 Geometrics and Vehicle Type

Aerial photography was utilized to establish lane configurations and horizontal curvature. The information collected from the aerial photography was verified during field surveys. This step included coding number of lanes, lane widths, link behavior type and link lengths over the aerial. The freeway was coded with VISSIM's default "freeway" link behavior type and the local street network was coded with VISSIM's default "urban" link behavior type.

Passenger cars, heavy trucks and buses were included in the model. A vehicle composition of 97.5% cars and 2.5% trucks for freeway and 98.0% and 2.0% for arterial were assumed. A vehicle composition of 91.0% cars, 2.0% trucks and 7.0 % buses were assumed on BVD.

3.4.2 Desired Speed and Reduced Speed Areas

The desired speeds were based on the posted speeds in the field and the speed distributions were coded as plus five miles per hour from the posted speed as the average speed with a distribution over and under.

Reduced speed areas were strategically placed in locations where vehicles need to reduce their speed due to roadway alignment or for turning at intersections. The non-intersection reduced speed areas were placed at system interchange ramps.

3.4.3 Priority Rule / Conflict Area

Priority rules and conflict areas make vehicles with conflicting movements recognize each other. Conflict areas are an alternative to priority rules and are defined wherever two links/connectors overlap. The yielding driver decides which gap to use, taking into account the situation behind the conflict area. Conflict areas are good for when the conflict area is one lane, such as the right-turn movement at an intersection.

Priority rules were set for the left-turns conflicts at the intersections whereas conflict areas were used for the right turn conflicts at the intersections. Headways and gaps were based on reasonable driver behavior to avoid collisions within the animation.

3.4.4 Signal Operations and Stop Signs

The timing and phasing assumptions used by the various Agencies were used as the base for each signalized intersection within the study area using VISSIM's RBC controllers. Right turns on red were coded where allowed in the field using VISSIM's right turn on red feature. Stop signs were coded at the intersections that are stop controlled using the VISSIM default stop parameters.

4 VALIDATION / CALIBRATION OF VISSIM MODEL

The calibration process used for the VISSIM model followed Federal Highway Administration (FHWA) guidelines for determining the acceptability of model results as compared to existing freeway operations. A synopsis of the calibration process follows, with emphasis placed on identifying the key points and major decisions and assumptions made in the refinement process.

4.1 Visual Checking and Error Correction

Visual checking of the animation files were performed to check the coding of the network. Abnormal driving behaviors or irregular queuing within the network were examined in order to identify potential geometry coding errors prior to beginning the calibration process. This step helped determine locations where conflict points or priority rules might be missing, where signals may not be operating correctly, or any other locations where general coded parameters might have been overlooked.

VISSIM produces an error file with various error types. This can include vehicle removal, signal issues, end of link errors, and various others. These errors were accounted for and corrected during this step.

4.2 Confidence Interval

FHWA guidelines require multiple runs of the same model because results vary depending on the random number seed used for each run. The random seed is used to select the numerous decisions throughout the simulation i.e. when vehicle is loaded into the network, timid or aggressive driver, etc. Each run will be different but the results will be close to the average. The methodology to compute the minimum number of repetition requires a desired confidence level, usually of 95 percent, and desired confidence interval for the measured parameter. The parameter used was the network parameter of "average delay time per vehicle [s], All vehicle types" for the peak hour period with an initial sample size of 10 runs. Using a 95 percent confidence level the resulting number of runs required is ten.

4.3 Volume Validation

The volumes that were collected from ten VISSIM model runs were compared with the existing counts. Simulation output volumes from an average of ten simulation runs were matched using the GEH statistic.

The GEH statistic compares two sets of traffic volumes. Most often, it compares expected or measured volumes with volume output from the microsimulation model. The formula for GEH is:

$$GEH = \sqrt{\frac{2\,(E-V)^2}{(E+V)}}$$

Where:

E = model estimated volume
V = field count

Using GEH instead of difference percentages allows for a better acceptance over a wider range of volumes. The reason for this is that GEH is not linear and places less importance on links with low expected volumes but it also allows for variation for high volume locations. Common calibration criteria states 85 percent of all link flows have a GEH less than 5. GEH values higher than a 5 should warrant investigation and values over 10 indicate there may be an error with the model.

5 VALIDATION / CALIBRATION RESULTS

5.1 Validation Results

Table 5—1 compare the freeway traffic volumes from the field counts with the volumes that were collected in the simulation model (after 10 model runs) at the same locations for the peak period. The full volume comparison tables are found in Appendix A. The traffic volumes from the VISSIM simulation model correlated with the field counts. Any GEH value less than 5 is acceptable, and 100 percent of AM and PM links are less than 5.

Table 5—1 Comparison of Traffic Volumes

Primary Road	Secondary Road	AM Peak-Hour			PM Peak-Hour		
		Count[1]	Model[2]	GEH	Count[1]	Model[2]	GEH
WB I-4	SR 535 SB - Diverge	1572	1570	0.1	2967	2947	0.4
EB I-4	SR 535 NB - Diverge	467	456	0.5	1243	1209	1.0
EB I-4	SR 536 NB - Diverge	546	521	1.1	264	256	0.5
WB I-4	SR 536 SB - Diverge	1324	1391	1.8	647	689	1.6

[1]Source: 2011 Traffic Count

[2]Source: VISSIM Model Output

5.1.1 Lane Change Distances, Emergency Stop and Headway

The VISSIM connector lane change or "look-back" distance defines the distance at which vehicles attempt to change lanes. The longer the distance, the "smarter" the drivers are, thus impacting lane utilization. Lane change distances were initially set at 2,000 feet at freeway service ramps, and adjusted if necessary to calibrate congestion levels and lane utilization on the freeway. In many cases for freeway ramps, distances were increased. Arterial and freeway mainline lane change distances were also adjusted at locations where drop lanes occur. Known decision making patterns and engineering judgment were also used to assess the assumptions and modifications were made where applicable.

Mainline look-back distances were determined for those locations where lane drops occur. In these cases, a reasonable distance was established to allow for lane changes. Weaving areas were set to be long enough so that through vehicles did not make unnecessary lane changes nor use the weaving zone to bypass congestion.

Emergency stop is the last possible position where a vehicle can change lanes. The default value for emergency stops is 16.4 feet and was increased to 30 feet at the freeway service ramps during calibration.

6 NEXT STEPS

With the establishment of a calibrated base year microsimulation model, the next step is to develop a model for 2030 conditions. Calibration parameters from the existing conditions VISSIM models will be carried forward to the future conditions models and the results from the future conditions models would be considered valid. Once developed, 2030 VISSIM microsimulation models will serve for evaluation of future operations with planned improvements within the study area. The future year models will provide FDOT District Five with the ability to accurately assess the impacts (as well as identify potential solutions) of the Build alternative.

Appendix A

SR536
AM - Existing Geometry

Int ID	Primary Road	Secondary Road	Dir/Mvmt	VISSIM LINK ID	Demand Volume	Served Volume	Difference		
							vph	%	GEH
16	SR 535	Palm Pkwy	EBL	10412	200	173	-27	-14%	2.0
			EBR	10415	381	366	-15	-4%	0.8
			EBT	10418	239	283	44	18%	2.7
			NBL	10420	605	605	0	0%	0.0
			NBR	10417	217	218	1	0%	0.1
			NBT	10410	732	735	3	0%	0.1
			SBL	10416	16	14	-2	-13%	0.5
			SBR	10419	182	196	14	8%	1.0
			SBT	10413	1430	1437	7	0%	0.2
			WBL	10414	235	252	17	7%	1.1
			WBR	10411	32	36	4	13%	0.7
			WBT	10423	95	76	-19	-20%	2.1
17	SR 535	Hotel Plaza	EBL	10429	104	82	-22	-21%	2.3
			EBR	10426	331	338	7	2%	0.4
			EBT	10432	32	32	0	0%	0.0
			NBL	10119	569	531	-38	-7%	1.6
			NBR	10430	89	98	9	10%	0.9
			NBT	10273	1434	1468	34	2%	0.9
			SBL	10431	55	81	26	47%	3.2
			SBR	10174	300	329	29	10%	1.6
			SBT	10424	1691	1636	-55	-3%	1.3
			WBL	10425	62	75	13	21%	1.6
			WBR	10428	16	9	-7	-44%	2.0
			WBT	10175	66	59	-7	-11%	0.9
18	SR 535	I-4 WB Ramps	NBL	10176	145	181	36	25%	2.8
			NBT	10437	1219	1173	-46	-4%	1.3
			SBR	10875	614	636	22	4%	0.9
			SBT	10879	583	590	7	1%	0.3
			SBT2	10440	887	831	-56	-6%	1.9
			SWL	10439	699	677	-22	-3%	0.8
			SWR	10436	873	901	28	3%	0.9
9739	SR 535	I-4 EB Ramps	NWT	10634	1364	1364	0	0%	0.0
			NWR	10633	822	789	-33	-4%	1.2
19	SR 535	I-4 EB Ramps	EBL	10443	293	258	-35	-12%	2.1
			EBR	10447	84	109	25	30%	2.5
			EBT	10450	90	93	3	3%	0.3
			NBR	10449	106	101	-5	-5%	0.5
			NBT	10441	1678	1663	-15	-1%	0.4
			SBL	10448	219	249	30	14%	2.0
			SBT	10444	1367	1255	-112	-8%	3.1
			WBL	10445	71	53	-18	-25%	2.3
			WBR	10442	215	228	13	6%	0.9
20	SR 535	Meadow Creek	EBL	10453	77	68	-9	-12%	1.1
			EBR	10456	28	35	7	25%	1.2
			EBT	10459	0	0	0	0%	0.0
			NBL	10461	41	45	4	10%	0.6
			NBR	10458	6	4	-2	-33%	0.9
			NBT	10451	1668	1661	-7	0%	0.2
			SBL	10457	40	25	-15	-38%	2.6
			SBR	10460	81	72	-9	-11%	1.0
			SBT	10454	1401	1324	-77	-5%	2.1
			WBL	10455	22	28	6	27%	1.2
			WBR	10452	39	29	-10	-26%	1.7
			WBT	10462	0	1	1	0%	1.4
9673	Buena Vista Drive	Bonnet Creek Pkwy	EBL	10173	167	144	-23	-14%	1.8
			EBT	10172	253	279	26	10%	1.6
			NBL	10163	261	252	-9	-3%	0.6
			NBR	10123	400	448	48	12%	2.3
			NBT	10138	132	92	-40	-30%	3.8
			SBL	10169	73	74	1	1%	0.1
			SBR	10170	290	288	-2	-1%	0.1
			WBR	10137	154	154	0	0%	0.0
			WBT	10162	338	330	-8	-2%	0.4
9676	Buena Vista Drive	Tyhpoon Lagoon	EBL	30093	98	106	8	8%	0.8
			EBR	30084	102	94	-8	-8%	0.8
			EBT	10008	526	589	63	12%	2.7
			NBL	30126	12	22	10	83%	2.4
			NBR	10053	17	7	-10	-59%	2.9
			NBT	10056	0	0	0	0%	0.0
			SBL	10054	10	11	1	10%	0.3
			SBR	10039	30	31	1	3%	0.2
			SBT	10059	1	0	-1	-100%	1.4
			WBL	10061	37	19	-18	-49%	3.4
			WBR	10058	23	35	12	52%	2.2
			WBT	10064	450	430	-20	-4%	1.0
9681	Buena Vista Drive	Entrance 4	EBL	30094	43	39	-4	-9%	0.6
			EBT	10048	510	564	54	11%	2.3
			SBL	10047	15	18	3	20%	0.7
			SBR	10049	37	32	-5	-14%	0.9
			WBR	10052	12	24	12	100%	2.8
			WBT	10050	473	455	-18	-4%	0.8
9687	Buena Vista Drive	Team Disney	EBL	10055	29	31	2	7%	0.4
			EBR	10042	115	159	44	38%	3.8
			EBT	10045	381	391	10	3%	0.5
			NBL	10037	48	50	2	4%	0.3
			NBR	10046	40	32	-8	-20%	1.3
			NBT	10019	0	4	4	0%	2.8
			SBL	10063	18	13	-5	-28%	1.3
			SBR	10035	3	0	-3	-100%	2.4
			SBT	10041	4	11	7	175%	2.6

SR536
AM - Existing Geometry

Int ID	Primary Road	Secondary Road	Dir/Mvmt	VISSIM LINK ID	Demand Volume	Served Volume	Difference		
							vph	%	GEH
			WBL	10043	135	111	-24	-18%	2.2
			WBR	10034	26	13	-13	-50%	2.9
			WBT	10036	434	427	-7	-2%	0.3
9693	Buena Vista Drive	Hess	NBL	10022	25	26	1	4%	0.2
			NBR	10023	44	44	0	0%	0.0
			NBT	10024	12	9	-3	-25%	0.9
			NEL	10009	51	55	4	8%	0.5
			NER	10030	44	42	-2	-5%	0.3
			NET	10025	344	339	-5	-1%	0.3
			SBL	10027	20	17	-3	-15%	0.7
			SBR	10029	18	14	-4	-22%	1.0
			SBT	10028	5	10	5	100%	1.8
			SWL	10020	72	59	-13	-18%	1.6
			SWR	10021	34	34	0	0%	0.0
			SWT	10003	552	509	-43	-8%	1.9
9698	Buena Vista Drive	Entrance 1	NEL	10032	23	14	-9	-39%	2.1
			NER	10014	16	24	8	50%	1.8
			NET	10011	369	368	-1	0%	0.1
			NWL	10038	7	4	-3	-43%	1.3
			NWR	10012	6	9	3	50%	1.1
			NWT	10033	2	0	-2	-100%	2.0
			SEL	10016	33	38	5	15%	0.8
			SER	10044	19	13	-6	-32%	1.5
			SET	10040	1	0	-1	-100%	1.4
			SWL	10165	36	55	19	53%	2.8
			SWR	10051	71	52	-19	-27%	2.4
			SWT	30001	632	579	-53	-8%	2.2
9700	Buena Vista Drive	Sun Bank	NBR	10069	22	27	5	23%	1.0
			NBT	10065	386	385	-1	0%	0.1
			SBL	10077	104	107	3	3%	0.3
			SBT	10067	733	681	-52	-7%	2.0
			WBL	10166	6	4	-2	-33%	0.9
			WBR	10068	17	17	0	0%	0.0
9703	Hotel Plaza Blvd	Buena Vista Drive	NBL	10017	116	134	18	16%	1.6
			NBT	10075	287	270	-17	-6%	1.0
			SBR	10074	310	279	-31	-10%	1.8
			SBT	10071	544	499	-45	-8%	2.0
			SEL	10076	185	185	0	0%	0.0
			SER	10072	293	293	0	0%	0.0
9711	Hotel Plaza Blvd	Reedy Creek	NEL	30085	20	18	-2	-10%	0.5
			NER	30100	15	22	7	47%	1.6
			NET	30099	437	408	-29	-7%	1.4
			NWL	30096	6	1	-5	-83%	2.7
			NWR	30088	16	20	4	25%	0.9
			NWT	30089	0	0	0	0%	0.0
			SEL	30101	2	0	-2	-100%	2.0
			SER	30097	8	8	0	0%	0.0
			SET	30098	0	0	0	0%	0.0
			SWL	30091	33	28	-5	-15%	0.9
			SWR	30102	16	27	11	69%	2.4
			SWT	30083	840	785	-55	-7%	1.9
9714	Hotel Plaza Blvd	Lake Buena Vista	EBL	30115	7	6	-1	-14%	0.4
			EBR	30113	3	2	-1	-33%	0.6
			EBT	30114	0	0	0	0%	0.0
			NBL	30105	5	5	0	0%	0.0
			NBR	30107	15	7	-8	-53%	2.4
			NBT	30106	435	417	-18	-4%	0.9
			SBL	30110	33	41	8	24%	1.3
			SBR	30112	29	36	7	24%	1.2
			SBT	30111	873	827	-46	-5%	1.6
			WBL	10118	13	15	2	15%	0.5
			WBR	30116	25	27	2	8%	0.4
			WBT	10117	4	0	-4	-100%	2.8
11	Osceola Pkwy	Victory Way	EBL	10370	177	134	-43	-24%	3.4
			EBT	10380	277	321	44	16%	2.5
			EBR	10373	84	89	5	6%	0.5
			NBL	10376	25	24	-1	-4%	0.2
			NBR	10379	20	21	1	5%	0.2
			NBT	10369	20	17	-3	-15%	0.7
			SBL	10378	101	84	-17	-17%	1.8
			SBR	10375	86	109	23	27%	2.3
			SBT	10372	30	26	-4	-13%	0.8
			WBL	10374	95	96	1	1%	0.1
			WBR	10371	257	253	-4	-2%	0.3
			WBT	10377	818	799	-19	-2%	0.7
9618	Osceola Pkwy	EB to I-4 WB On-Ramp	EBR	10607	109	107	-2	-2%	0.2
			EBT	10606	289	317	28	10%	1.6
9620	Osceola Pkwy	I-4 WB Off Ramp	WBL	10610	65	59	-6	-9%	0.8
			SWR	10609	542	513	-29	-5%	1.3
			WBT	10608	628	615	-13	-2%	0.5
9617	Osceola Pkwy	I-4 WB On-Ramp from EB/WB	SBT	10616	65	57	-8	-12%	1.0
			SER	10615	109	107	-2	-2%	0.2
9642	Osceola Pkwy	I-4 WB Off-Ramp to EB/WB	SWL	10612	201	225	24	12%	1.6
			SWT	10611	542	518	-24	-4%	1.0
9621	Osceola Pkwy	I-4 WB Off-Ramp to EB	EBR	10621	163	187	24	15%	1.8
			EBT	10623	126	130	4	3%	0.4
			EBL	10622	201	227	26	13%	1.8
12	Osceola Pkwy	I-4E Ramps	SBR	10382	39	17	-22	-56%	4.2
			SBL	10151	98	68	-30	-31%	3.3
			WBT	10383	654	658	4	1%	0.2

SR536
AM - Existing Geometry

Int ID	Primary Road	Secondary Road	Dir/Mvmt	VISSIM LINK ID	Demand Volume	Served Volume	Difference		
							vph	%	GEH
			EBT	10385	364	410	46	13%	2.3
9633	Osceola Pkwy	WB to I-4 EB On-Ramp	WBR	10620	143	114	-29	-20%	2.6
			WBT	10619	654	658	4	1%	0.2
9643	Osceola Pkwy	WB/EB to I-4 EB On-Ramp	NBT	10624	143	114	-29	-20%	2.6
			NEL	10625	126	130	4	3%	0.4
14	Osceola Pkwy	International Drive	EBL	10388	26	40	14	54%	2.4
			EBR	10391	200	191	-9	-5%	0.6
			EBT	10394	236	247	11	5%	0.7
			NBL	10396	172	173	1	1%	0.1
			NBR	10393	29	33	4	14%	0.7
			NBT	10386	46	41	-5	-11%	0.8
			SBL	10392	17	28	11	65%	2.3
			SBR	10395	138	108	-30	-22%	2.7
			SBT	10389	112	129	17	15%	1.5
			WBL	10390	108	107	-1	-1%	0.1
			WBT	10397	487	485	-2	0%	0.1
			WBR	10387	6	11	5	83%	1.7
9657	SR 536	I-4 WB Off Ramp / I-4 EB On-Ramp	EBT	10868	152	128	-24	-16%	2.0
			EBR	10867	502	519	17	3%	0.8
9656	SR 536	I-4 WB Off Ramp	NWL	10745	1421	1377	-44	-3%	1.2
			WBT	10744	1230	1257	27	2%	0.8
9649	SR 536	EB I-4 to EB/WB split on-ramp	SBL	10747	437	451	14	3%	0.7
			SBT	10746	65	66	1	2%	0.1
9644	SR536	On-ramps to I-4 WB	SWT	10798	65	65	0	0%	0.0
			WBL	10797	58	58	0	0%	0.0
9650	SR 536	WB to I-4 WB On-Ramp / I-4 WB Off-Ramp to EB	EBT	10870	94	127	33	35%	3.1
			SEL	10869	152	126	-26	-17%	2.2
9651	SR 536	WB to I-4 WB On-Ramp / I-4 WB Off-Ramp to EB	WBT	10743	1421	1376	-45	-3%	1.2
			WBR	10742	58	58	0	0%	0.0
9652	SR 536	WB CD from WB	SBR	10635	58	57	-1	-2%	0.1
			SWT	10636	94	125	31	33%	3.0
9648	SR 536	WB CD to EB	SWR	10652	94	126	32	34%	3.1
			SWT	10651	58	57	-1	-2%	0.1
9654	SR 536	I-4 EB Off-Ramp to WB	NWL	10741	1142	1093	-49	-4%	1.5
			WBT	10740	337	346	9	3%	0.5
9659	SR 536	WB to I-4 EB On-Ramp / I-4 EB Off-Ramp to EB	EBT	10871	246	254	8	3%	0.5
			NER	10872	209	168	-41	-20%	3.0
			WBR	10614	119	121	2	2%	0.2
			WBT	10613	1142	1099	-43	-4%	1.3
9658	SR 536	I-4 EB On-Ramps	NBT	10805	437	447	10	2%	0.5
			NWR	10806	119	120	1	1%	0.1
15	SR 536	World Center Dr	EBL	10398	111	121	10	9%	0.9
			EBR	10401	6	15	9	150%	2.8
			EBT	10404	338	288	-50	-15%	2.8
			NBL	10408	30	23	-7	-23%	1.4
			NBR	10406	14	20	6	43%	1.5
			NBT	10399	10	10	0	0%	0.0
			SBL	10405	45	49	4	9%	0.6
			SBR	10407	47	44	-3	-6%	0.4
			SBT	10402	7	5	-2	-29%	0.8
			WBL	10403	9	20	11	122%	2.9
			WBR	10400	265	282	17	6%	1.0
			WBT	10409	1184	1152	-32	-3%	0.9
261	I-4 East to Osceola Pkwy NB - Diverge		NBR	10785	137	135	-2	-1%	0.2
			NBT	10786	4039	4036	-3	0%	0.0
263	I-4 East to SR 536 NB - Diverge		NBR	10787	546	521	-25	-5%	1.1
			NBT	10788	3493	3526	33	1%	0.6
9645	I-4 EB off-ramps to SR536 EB/WB		NEL	10795	337	352	15	4%	0.8
			NET	10796	209	165	-44	-21%	3.2
267	Osceola Pkwy NB to I-4 East - Merge		NBR	10793	269	244	-25	-9%	1.6
			NET	10794	3493	3524	31	1%	0.5
273	SR 536 NB to I-4 East - Merge		NBR	10801	556	563	7	1%	0.3
			NET	10802	3762	3752	-10	0%	0.2
274	I-4 East to SR 535 NB - Diverge		NER	10803	467	456	-11	-2%	0.5
			NET	10804	3851	3850	-1	0%	0.0
278	SR 535 EB to I-4 East - Merge		NBR	10812	583	585	2	0%	0.1
			NET	10811	3851	3859	8	0%	0.1
94	SR 535 WB to I-4 East - Merge		NBR	10626	822	791	-31	-4%	1.1
			NET	10627	4434	4468	34	1%	0.5
280	I-4 West to SR 535 SB - Diverge		SBR	10813	1572	1570	-2	0%	0.1
			SBT	10814	3138	3131	-7	0%	0.1
276	SR 535 SB to I-4 West - Merge		SBR	10808	759	810	51	7%	1.8
			SWT	10807	3138	3127	-11	0%	0.2
271	I-4 West to SR 536 SB - Diverge		SBR	10799	1324	1391	67	5%	1.8
			SBT	10800	2573	2542	-31	-1%	0.6
9665	I-4 WB off-ramp split to SR536 EB/WB		SWL	10809	94	124	30	32%	2.9
			SWT	10810	1230	1262	32	3%	0.9
9601	I-4 WB off-ramp to Osceola Pkwy		SBR	10846	743	747	4	1%	0.1
			SBT	10845	1830	1802	-28	-2%	0.7
265	SR 536 SB to I-4 West - Merge		SBR	10789	123	124	1	1%	0.1
			SWT	10790	1830	1794	-36	-2%	0.8
259	I-4 West to US 192 SB - Diverge		SWR	10783	841	821	-20	-2%	0.7
			SWT	10784	1112	1091	-21	-2%	0.6

PM - Existing Geometry

Int ID	Primary Road	Secondary Road	Dir/Mvmt	VISSIM LINK ID	Demand Volume	Served Volume	Difference		
							vph	%	GEH
16	SR 535	Palm Pkwy	EBL	10412	274	264	-10	-4%	0.6
			EBR	10415	113	144	31	27%	2.7
			EBT	10418	138	121	-17	-12%	1.5
			NBL	10420	520	486	-34	-7%	1.5
			NBR	10417	345	335	-10	-3%	0.5
			NBT	10410	1793	1762	-31	-2%	0.7
			SBL	10416	70	50	-20	-29%	2.6
			SBR	10419	57	64	7	12%	0.9
			SBT	10413	844	850	6	1%	0.2
			WBL	10414	279	259	-20	-7%	1.2
			WBR	10411	52	55	3	6%	0.4
			WBT	10423	309	321	12	4%	0.7
17	SR 535	Hotel Plaza	EBL	10429	445	422	-23	-5%	1.1
			EBR	10426	971	937	-34	-4%	1.1
			EBT	10432	68	89	21	31%	2.4
			NBL	10119	512	523	11	2%	0.5
			NBR	10430	184	170	-14	-8%	1.1
			NBT	10273	2177	2109	-68	-3%	1.5
			SBL	10431	99	109	10	10%	1.0
			SBR	10174	148	157	9	6%	0.7
			SBT	10424	989	986	-3	0%	0.1
			WBL	10425	149	148	-1	-1%	0.1
			WBR	10428	36	51	15	42%	2.3
			WBT	10175	62	50	-12	-19%	1.6
18	SR 535	I-4 WB Ramps	NBL	10176	322	346	24	7%	1.3
			NBT	10437	1814	1733	-81	-4%	1.9
			SBR	10875	558	596	38	7%	1.6
			SBT	10879	952	974	22	2%	0.7
			SWL	10439	1908	1875	-33	-2%	0.8
			SWR	10436	1059	1059	0	0%	0.0
9739	SR 535	I-4 EB Ramps	NWR	10634	2136	2082	-54	-3%	1.2
			NWR2	10633	787	816	29	4%	1.0
19	SR 535	I-4 EB Ramps	EBL	10443	862	821	-41	-5%	1.4
			EBR	10447	88	87	-1	-1%	0.1
			EBT	10450	293	282	-11	-4%	0.6
			NBR	10449	244	216	-28	-11%	1.8
			NBT	10441	1937	1975	38	2%	0.9
			SBL	10448	416	396	-20	-5%	1.0
			SBT	10444	2091	1994	-97	-5%	2.1
			WBL	10445	489	503	14	3%	0.6
			WBR	10442	124	103	-21	-17%	2.0
20	SR 535	Meadow Creek	EBL	10453	196	201	5	3%	0.4
			EBR	10456	51	45	-6	-12%	0.9
			EBT	10459	7	13	6	86%	1.9
			NBL	10461	58	56	-2	-3%	0.3
			NBR	10458	33	26	-7	-21%	1.3
			NBT	10451	1945	1955	10	1%	0.2
			SBL	10457	95	104	9	9%	0.9
			SBR	10460	108	94	-14	-13%	1.4
			SBT	10454	2465	2385	-80	-3%	1.6
			WBL	10455	37	44	7	19%	1.1
			WBR	10452	40	28	-12	-30%	2.1
			WBT	10462	5	9	4	80%	1.5
9673	Buena Vista Drive	Bonnet Creek Pkwy	EBL	10173	258	236	-22	-9%	1.4
			EBT	10172	725	747	22	3%	0.8
			NBL	10163	169	195	26	15%	1.9
			NBR	10123	465	406	-59	-13%	2.8
			NBT	10138	98	115	17	17%	1.6
			SBL	10169	158	188	30	19%	2.3
			SBR	10170	355	320	-35	-10%	1.9
			WBR	10137	194	177	-17	-9%	1.2
			WBT	10162	925	980	55	6%	1.8
9676	Buena Vista Drive	Tyhpoon Lagoon	EBL	30093	172	159	-13	-8%	1.0
			EBR	30084	54	50	-4	-7%	0.6
			EBT	10008	1122	1146	24	2%	0.7
			NBL	30126	198	191	-7	-4%	0.5
			NBR	10053	93	105	12	13%	1.2
			NBT	10056	3	2	-1	-33%	0.6
			SBL	10054	33	33	0	0%	0.0
			SBR	10039	100	98	-2	-2%	0.2
			SBT	10059	2	1	-1	-50%	0.8
			WBL	10061	76	61	-15	-20%	1.8
			WBR	10058	22	17	-5	-23%	1.1
			WBT	10064	821	849	28	3%	1.0
9681	Buena Vista Drive	Entrance 4	EBL	30094	256	293	37	14%	2.2
			EBT	10048	992	983	-9	-1%	0.3
			SBL	10047	87	73	-14	-16%	1.6
			SBR	10049	147	162	15	10%	1.2
			WBR	10052	64	84	20	31%	2.3
			WBT	10050	772	754	-18	-2%	0.7
9687	Buena Vista Drive	Team Disney	EBL	10055	186	200	14	8%	1.0
			EBR	10042	26	18	-8	-31%	1.7
			EBT	10045	867	867	0	0%	0.0
			NBL	10037	253	248	-5	-2%	0.3
			NBR	10046	280	286	6	2%	0.4
			NBT	10019	13	9	-4	-31%	1.2
			SBL	10063	183	176	-7	-4%	0.5
			SBR	10035	167	169	2	1%	0.2
			SBT	10041	0	0	0	0%	0.0
			WBL	10043	36	42	6	17%	1.0
			WBR	10034	123	137	14	11%	1.2

PM - Existing Geometry

Int ID	Primary Road	Secondary Road	Dir/Mvmt	VISSIM LINK ID	Demand Volume	Served Volume	Difference		
							vph	%	GEH
			WBT	10036	416	442	26	6%	1.3
9693	Buena Vista Drive	Hess	NBL	10022	81	66	-15	-19%	1.7
			NBR	10023	144	162	18	13%	1.5
			NBT	10024	19	17	-2	-11%	0.5
			NEL	10009	155	143	-12	-8%	1.0
			NER	10030	36	32	-4	-11%	0.7
			NET	10025	1139	1134	-5	0%	0.1
			SBL	10027	96	96	0	0%	0.0
			SBR	10029	117	128	11	9%	1.0
			SBT	10028	14	7	-7	-50%	2.2
			SWL	10020	71	80	9	13%	1.0
			SWR	10021	156	169	13	8%	1.0
			SWT	10003	377	404	27	7%	1.4
9698	Buena Vista Drive	Entrance 1	NEL	10032	161	168	7	4%	0.5
			NER	10014	5	3	-2	-40%	1.0
			NET	10011	1213	1233	20	2%	0.6
			NWL	10038	40	31	-9	-23%	1.5
			NWR	10012	50	61	11	22%	1.5
			NWT	10033	9	10	1	11%	0.3
			SEL	10016	171	147	-24	-14%	1.9
			SER	10044	102	126	24	24%	2.2
			SET	10040	4	0	-4	-100%	2.8
			SWL	10165	16	2	-14	-88%	4.7
			SWR	10051	275	298	23	8%	1.4
			SWT	30001	462	501	39	8%	1.8
9700	Buena Vista Drive	Sun Bank	NBR	10069	15	9	-6	-40%	1.7
			NBT	10065	1419	1453	34	2%	0.9
			SBL	10077	28	21	-7	-25%	1.4
			SBT	10067	740	777	37	5%	1.3
			WBL	10166	13	24	11	85%	2.6
			WBR	10068	68	55	-13	-19%	1.7
9703	Hotel Plaza Blvd	Buena Vista Drive	NBL	10017	286	283	-3	-1%	0.2
			NBT	10075	1201	1217	16	1%	0.5
			SBR	10074	220	228	8	4%	0.5
			SBT	10071	474	445	-29	-6%	1.4
			SEL	10076	269	224	-45	-17%	2.9
			SER	10072	294	339	45	15%	2.5
9711	Hotel Plaza Blvd	Reedy Creek	NEL	30085	9	8	-1	-11%	0.3
			NER	30100	15	10	-5	-33%	1.4
			NET	30099	1446	1424	-22	-2%	0.6
			NWL	30096	14	19	5	36%	1.2
			NWR	30088	12	6	-6	-50%	2.0
			NWT	30089	0	0	0	0%	0.0
			SEL	30101	18	21	3	17%	0.7
			SER	30097	6	0	-6	-100%	3.5
			SET	30098	0	0	0	0%	0.0
			SWL	30091	21	9	-12	-57%	3.1
			SWR	30102	1	0	-1	-100%	1.4
			SWT	30083	674	675	1	0%	0.0
9714	Hotel Plaza Blvd	Lake Buena Vista	EBL	30115	13	13	0	0%	0.0
			EBR	30113	6	2	-4	-67%	2.0
			EBT	30114	0	0	0	0%	0.0
			NBL	30105	11	11	0	0%	0.0
			NBR	30107	19	27	8	42%	1.7
			NBT	30106	1446	1436	-10	-1%	0.3
			SBL	30110	27	53	26	96%	4.1
			SBR	30112	20	20	0	0%	0.0
			SBT	30111	675	655	-20	-3%	0.8
			WBL	10118	15	14	-1	-7%	0.3
			WBR	30116	25	22	-3	-12%	0.6
			WBT	10117	0	0	0	0%	0.0
11	Osceola Pkwy	Victory Way	EBL	10370	122	118	-4	-3%	0.4
			EBR	10380	1070	1074	4	0%	0.1
			EBR2	10373	11	6	-5	-45%	1.7
			NBL	10376	15	13	-2	-13%	0.5
			NBR2	10379	24	23	-1	-4%	0.2
			NBT	10369	3	6	3	100%	1.4
			SBL	10378	358	381	23	6%	1.2
			SBR	10375	147	125	-22	-15%	1.9
			SBT	10372	10	11	1	10%	0.3
			WBL	10374	33	18	-15	-45%	3.0
			WBR	10371	100	115	15	15%	1.4
			WBT	10377	633	654	21	3%	0.8
9618	Osceola Pkwy	EB to I-4 WB On-Ramp	EBR	10607	35	18	-17	-49%	3.3
			EBT	10606	1417	1465	48	3%	1.3
9620	Osceola Pkwy	I-4 WB Off Ramp	WBL	10610	112	111	-1	-1%	0.1
			SWR	10609	208	210	2	1%	0.1
			WBT	10608	558	576	18	3%	0.8
9617	Osceola Pkwy	I-4 WB On-Ramp from EB/WB	SBT	10616	112	111	-1	-1%	0.1
			SER	10615	35	18	-17	-49%	3.3
9642	Osceola Pkwy	I-4 WB Off-Ramp to EB/WB	SWL	10612	191	211	20	10%	1.4
			SWT	10611	208	210	2	1%	0.1
9621	Osceola Pkwy	I-4 WB Off-Ramp to EB	EBR	10621	770	795	25	3%	0.9
			EBT	10623	647	662	15	2%	0.6
			NER2	10622	191	212	21	11%	1.5
12/13	Osceola Pkwy	I-4E Ramps	12-SBR	10382	16	23	7	44%	1.6
			12-SBT	10151	108	112	4	4%	0.4
			12-WBT	10383	654	667	13	2%	0.5
			13-EBT	10385	961	996	35	4%	1.1
9633	Osceola Pkwy	WB to I-4 EB On-Ramp	WBR	10620	143	138	-5	-3%	0.4
			WBT	10619	654	668	14	2%	0.5

PM - Existing Geometry

Int ID	Primary Road	Secondary Road	Dir/Mvmt	VISSIM LINK ID	Demand Volume	Served Volume	Difference		
							vph	%	GEH
9643	Osceola Pkwy	WB/EB to I-4 EB On-Ramp	NBT	10624	143	138	-5	-3%	0.4
			NEL	10625	647	661	14	2%	0.5
14	Osceola Pkwy	International Drive	EBL	10388	110	113	3	3%	0.3
			EBR	10391	215	231	16	7%	1.1
			EBT	10394	744	752	8	1%	0.3
			NBL	10396	160	145	-15	-9%	1.2
			NBR	10393	123	120	-3	-2%	0.3
			NBT	10386	120	134	14	12%	1.2
			SBL	10392	15	21	6	40%	1.4
			SBR2	10395	72	80	8	11%	0.9
			SBT	10389	106	95	-11	-10%	1.1
			WBL	10390	76	59	-17	-22%	2.1
			WBR	10397	565	585	20	4%	0.8
			WBR2	10387	22	22	0	0%	0.0
9657	SR 536	I-4 WB Off Ramp / I-4 EB On-Ramp	EBR	10868	974	970	-4	0%	0.1
			EBR2	10867	1781	1773	-8	0%	0.2
9656	SR 536	I-4 WB Off Ramp	NWL	10745	894	842	-52	-6%	1.8
			WBT	10744	474	507	33	7%	1.5
9649	SR 536	EB I-4 to EB/WB split on-ramp	SBL	10747	1443	1446	3	0%	0.1
			SBT	10746	338	335	-3	-1%	0.2
9644	SR536	On-ramps to I-4 WB	SWT	10798	338	332	-6	-2%	0.3
			WBL	10797	75	68	-7	-9%	0.8
9650	SR 536	WB to I-4 WB On-Ramp / I-4 WB Off-Ramp to EB	EBT	10870	173	184	11	6%	0.8
			SEL	10869	974	972	-2	0%	0.1
9651	SR 536	WB to I-4 WB On-Ramp / I-4 WB Off-Ramp to EB	WBR	10743	894	840	-54	-6%	1.8
			WBR2	10742	75	71	-4	-5%	0.5
9652	SR 536	WB CD from WB	SBR	10635	75	67	-8	-11%	0.9
			SWT	10636	173	184	11	6%	0.8
9648	SR 536	WB CD to EB	SWR	10652	173	184	11	6%	0.8
			SWT	10651	75	67	-8	-11%	0.9
9654	SR 536	I-4 EB Off-Ramp to WB	NWL	10741	840	777	-63	-8%	2.2
			WBT	10740	129	136	7	5%	0.6
9659	SR 536	WB to I-4 EB On-Ramp / I-4 EB Off-Ramp to EB	EBT	10871	1147	1151	4	0%	0.1
			NER	10872	135	126	-9	-7%	0.8
			WBR	10614	225	285	60	27%	3.8
			WBT	10613	840	785	-55	-7%	1.9
9658	SR 536	I-4 EB On-Ramps	NBT	10805	1443	1455	12	1%	0.3
			NWR	10806	225	293	68	30%	4.2
15	SR 536	World Center Dr	EBL	10398	70	75	5	7%	0.6
			EBR	10401	27	22	-5	-19%	1.0
			EBT	10404	1185	1167	-18	-2%	0.5
			NBL	10408	15	14	-1	-7%	0.3
			NBR	10406	43	42	-1	-2%	0.2
			NBT	10399	8	10	2	25%	0.7
			SBL	10405	205	199	-6	-3%	0.4
			SBR	10407	200	198	-2	-1%	0.1
			SBT	10402	16	13	-3	-19%	0.8
			WBL	10403	35	20	-15	-43%	2.9
			WBR	10400	122	134	12	10%	1.1
			WBT	10409	850	851	1	0%	0.0
261	I-4 East to Osceola Pkwy NB - Diverge		NBR	10785	124	137	13	10%	1.1
			NBT	10786	3369	3384	15	0%	0.3
263	I-4 East to SR 536 NB - Diverge		NBR	10787	264	256	-8	-3%	0.5
			NBT	10788	3105	3124	19	1%	0.3
9645	I-4 EB off-ramps to SR536 EB/WB		NEL	10795	129	134	5	4%	0.4
			NET	10796	135	125	-10	-7%	0.9
267	Osceola Pkwy NB to I-4 East - Merge		NBR	10793	790	789	-1	0%	0.0
			NET	10794	3105	3121	16	1%	0.3
273	SR 536 NB to I-4 East - Merge		NBR	10801	1668	1747	79	5%	1.9
			NET	10802	3895	3915	20	1%	0.3
274	I-4 East to SR 535 NB - Diverge		NER	10803	1243	1209	-34	-3%	1.0
			NET	10804	4320	4428	108	3%	1.6
278	SR 535 EB to I-4 East - Merge		NBR	10812	952	950	-2	0%	0.1
			NET	10811	4320	4419	99	2%	1.5
94	SR 535 WB to I-4 East - Merge		NBR	10626	787	813	26	3%	0.9
			NET	10627	5272	5376	104	2%	1.4
280	I-4 West to SR 535 SB - Diverge		SBR	10813	2967	2947	-20	-1%	0.4
			SBT	10814	3125	3092	-33	-1%	0.6
276	SR 535 SB to I-4 West - Merge		SBR	10808	880	940	60	7%	2.0
			SWT	10807	3125	3090	-35	-1%	0.6
271	I-4 West to SR 536 SB - Diverge		SBR	10799	647	689	42	6%	1.6
			SBT	10800	3358	3336	-22	-1%	0.4
9665	I-4 WB off-ramp split to SR536 EB/WB		SWL	10809	173	186	13	8%	1.0
			SWT	10810	474	509	35	7%	1.6
9601	I-4 WB off-ramp to Osceola Pkwy		SBR	10846	399	424	25	6%	1.2
			SBT	10845	2959	2922	-37	-1%	0.7
265	SR 536 SB to I-4 West - Merge		SBR	10789	413	397	-16	-4%	0.8
			SWT	10790	2959	2918	-41	-1%	0.8
259	I-4 West to US 192 SB - Diverge		SWR	10783	1394	1350	-44	-3%	1.2
			SWT	10784	1978	1959	-19	-1%	0.4

Appendix D – FDOT DDHVs and Peak-Period to Peak Hour Approach

HDR | ONE COMPANY *Many Solutions℠*

Memo

To: Jeremy Dilmore	
From: Hari Salkapuram	Project: I-4 SAMR Re-evaluation
CC:	
Date: 3/20/2014	Job No:

Traffic Methodology:

The CFRPM version 5.01 model is still the latest approved model for FDOT District Five and is used in the development of the traffic numbers for I-4 SIMR Re-evaluation. The PSWADT produced from the CFRPM were converted to AADT by applying the MOCF factors for I-4 and the arterials. In January of 2013 DDHVs for both the No-Build and Build conditions for the years 2020, 2030 and 2040 were produced using FDOT standard procedures. Model Scenarios were created for the years 2020 and 2040 for both the Build and No-Build conditions. The 2030 DDHVs were interpolated from the 2020 and 2040 DDHVs.

The DDHVs for the western segment that were produced using the FDOT procedures showed volume to capacity ratios approaching 1.8 in some locations. Parallel roadways were also shown to be well over capacity. Additionally, the unique characteristics of the western segment required special attention in the development of traffic projections due the presence of attractions such as Disney World (including its four parks and Downtown Disney), Sea World, and Universal Studios within the vicinity. Therefore, daily traffic profiles for the each of the stations for the western segment were analyzed to establish a peak-period (shown in Figure 1). It was observed from Figure 1 that the AM peak-period and PM peak-period varies four to five hours between 7 am and 12 pm and 2 pm and 7 pm, respectively.

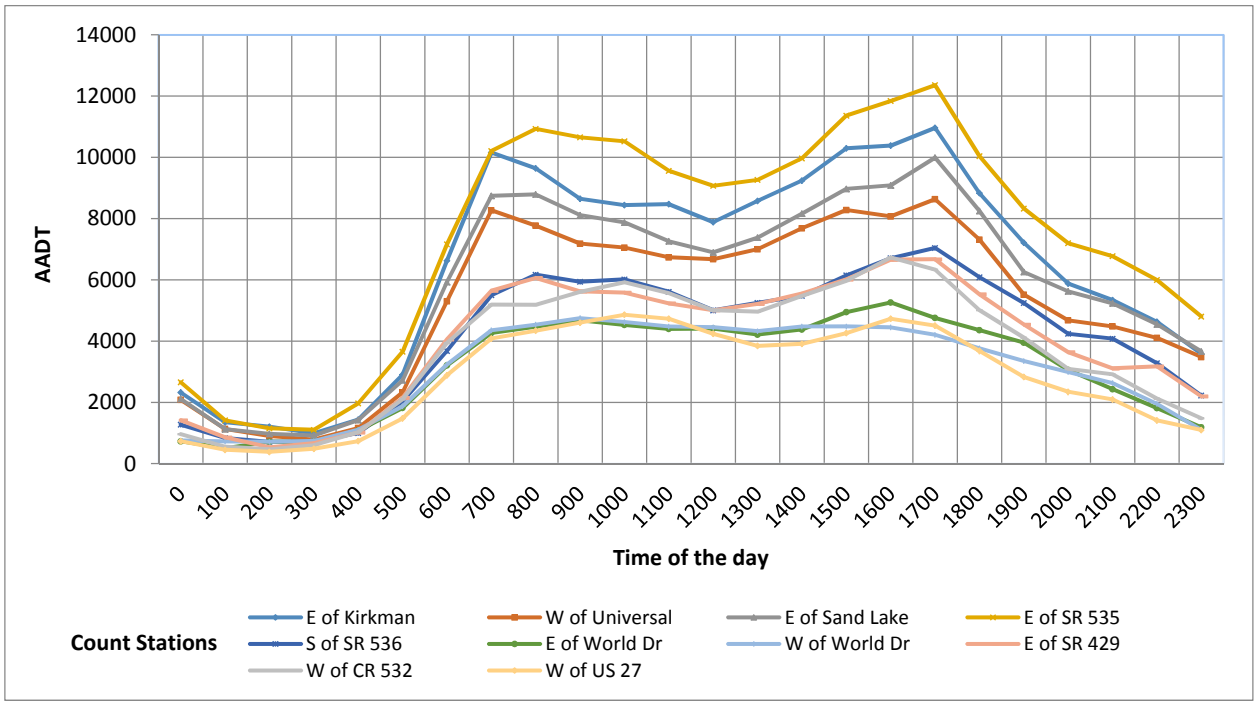


Figure 1: 2012 Daily Traffic Profile of the Count Station along Western Segment

CFRPM travel demand model runs were conducted again to generate DDHVs for a four hour peak-period. Preliminary calculations were performed on the DDHVs to spread four hour peak-period traffic based on the level of congestion experienced on each of the crossing corridors (presented in Table 1). It was observed that the demand is well over the capacity for the four hour period.

Since the Dynamic Traffic Assignment (DTA) model is still undergoing pilot testing in Florida, the development of a subarea travel demand model using DTA would require more time and money than necessary given the immediate nature of the improvement type. The effect of DTA in this corridor would be to reduce the demand numbers produced by the demand model due to the capacity restricts of the network.

Rather than reducing the K value by a fix factor across the model, an interchange by interchange evaluation was done. Each interchange demand traffic is reduced until its peak hour reaches or slightly exceeds capacity. This insures that the model is saturated during the peak hour. The remaining peak period demand is applied on the shoulder hours. In this way corridors with more demand will recover more slowly, while though with lower demand will recover more quickly. The tables below shows the application of the peak period to this increased spreading approach.

Table 1: AM Peak Period Demand Volumes – Four Hour

Entry Volume	Facility Type	Total FOUR Hour Demand	No.of Through Lanes	Spread Type	Directional Capacity		Adjusted Demand (Hourly Flow)				Total
					per lane	Total	700-800	800-900	900-1000	1000-1100	
I-4 WB	Freeway	32,403	3		1,900	5,700	8,101	8,101	8,101	8,101	32,403
I-4 ML WB	Freeway	8,191	2		1,900	3,800	2,130	2,457	1,884	1,720	8,191
Kirkman WB	Arterial	7,618	2	Extreme	800	1,600	1,905	1,905	1,905	1,905	7,618
Kirkman EB	Arterial	11,290	2	Extreme	800	1,600	2,823	2,823	2,823	2,823	11,290
Universal WB	Arterial	6,026	2	Uncongested	800	1,600	1,567	1,627	1,507	1,326	6,026
Universal EB	Arterial	6,540	2	Uncongested	800	1,600	1,700	1,766	1,635	1,439	6,540
Sandlake WB	Arterial	9,373	2	Extreme	500	1,000	2,343	2,343	2,343	2,343	9,373
Sandlake EB	Arterial	10,829	2	Extreme	500	1,000	2,707	2,707	2,707	2,707	10,829
SR 528 WB	Freeway	12,257	3	Uncongested	1,900	5,700	3,187	3,677	2,819	2,574	12,257
SR 528 ML WB	Freeway	4,191	1	Uncongested	1,900	1,900	1,090	1,257	964	880	4,191
CFL Pkwy WB	Arterial	10,457	2	Congested	900	1,800	2,614	2,614	2,614	2,614	10,457
CFL Pkwy EB	Arterial	8,500	2	Congested	900	1,800	2,125	2,125	2,125	2,125	8,500
Lake WB	Arterial	7,271	2	Uncongested	700	1,400	1,818	1,818	1,818	1,818	7,271
Lake EB	Arterial	6,434	2	Uncongested	700	1,400	1,609	1,609	1,609	1,609	6,434
SR 535 NB	Arterial	13,803	3	Congested	700	2,100	3,451	3,451	3,451	3,451	13,803
SR 535 SB	Arterial	14,572	3	Congested	700	2,100	3,643	3,643	3,643	3,643	14,572
SR 536 WB	Arterial	10,082	3	Disney	1,000	3,000	2,016	2,521	3,025	2,521	10,082
SR 536 EB	Freeway	14,112	3	Disney	1,900	5,700	2,822	3,528	4,234	3,528	14,112
Osceola WB	Freeway	10,982	3	Disney	1,900	5,700	2,196	2,746	3,295	2,746	10,982
Osceola EB	Freeway	8,009	3	Disney	1,900	5,700	1,602	2,002	2,403	2,002	8,009
US 192 WB	Arterial	12,176	3	Congested	1,000	3,000	3,044	3,044	3,044	3,044	12,176
US 192 EB	Arterial	13,075	3	Congested	1,000	3,000	3,269	3,269	3,269	3,269	13,075
SR 417	Freeway	4,452	2	Uncongested	1,900	3,800	1,158	1,336	1,024	935	4,452
World SB	Freeway	6,484	3	Disney	1,900	5,700	1,621	1,945	1,491	1,426	6,484
World NB	Freeway	4,791	2	Disney	1,900	3,800	958	1,533	1,341	958	4,791
SR 429	Freeway	10,454	2	Uncongested	1,900	3,800	2,718	3,136	2,404	2,195	10,454
Champions WB	Arterial	3,466	2	Congested	800	1,600	797	1,005	936	728	3,466
Champions EB	Arterial	5,787	2	Congested	800	1,600	1,331	1,678	1,562	1,215	5,787
Central Polk	Freeway	8,765	2	Uncongested	1,900	3,800	2,279	2,630	2,016	1,841	8,765
US 27 NB	Arterial	13,064	3	Congested	1,000	3,000	3,266	3,266	3,266	3,266	13,064
US 27 SB	Arterial	7,459	3	Uncongested	1,000	3,000	1,939	2,238	1,716	1,566	7,459

Table 2: PM Peak Period Demand Volumes – Four Hour

Entry Volume	Facility Type	Total FOUR Hour Demand	No.of Through Lanes	Spread Type	Directional Capacity		Adjusted Demand (Hourly Flow)				Total
					per lane	Total	1500-1600	1600-1700	1700-1800	1800-1900	
I-4 WB	Freeway	35,577	3		1,900	5,700	8,894	8,894	8,894	8,894	35,577
I-4 ML WB	Freeway	9,073	2		1,900	3,800	1,815	2,178	2,903	2,178	9,073
Kirkman WB	Arterial	7,045	2	Extreme	800	1,600	1,761	1,761	1,761	1,761	7,045
Kirkman EB	Arterial	11,537	2	Extreme	800	1,600	2,884	2,884	2,884	2,884	11,537
Universal WB	Arterial	6,492	2	Extreme	800	1,600	1,623	1,623	1,623	1,623	6,492
Universal EB	Arterial	6,068	2	Extreme	800	1,600	1,517	1,517	1,517	1,517	6,068
Sandlake WB	Arterial	10,003	2	Extreme	500	1,000	2,501	2,501	2,501	2,501	10,003
Sandlake EB	Arterial	10,105	2	Extreme	500	1,000	2,526	2,526	2,526	2,526	10,105
SR 528 WB	Freeway	10,443	3	Uncongested	1,900	5,700	2,089	2,506	3,342	2,506	10,443
SR 528 ML WB	Freeway	3,571	1	Uncongested	1,900	1,900	714	857	1,143	857	3,571
CFL Pkwy WB	Arterial	9,625	2	Congested	900	1,800	2,406	2,406	2,406	2,406	9,625
CFL Pkwy EB	Arterial	9,176	2	Congested	900	1,800	2,294	2,294	2,294	2,294	9,176
Lake WB	Arterial	7,907	2	Extreme	700	1,400	1,977	1,977	1,977	1,977	7,907
Lake EB	Arterial	5,893	2	Extreme	700	1,400	1,473	1,473	1,473	1,473	5,893
SR 535 NB	Arterial	12,357	3	Extreme	700	2,100	3,089	3,089	3,089	3,089	12,357
SR 535 SB	Arterial	14,570	3	Extreme	700	2,100	3,643	3,643	3,643	3,643	14,570
SR 536 WB	Arterial	10,762	3	Disney PM IB	1,000	3,000	3,013	2,798	2,583	2,368	10,762
SR 536 EB	Arterial	12,804	3	Disney PM OB	1,900	5,700	3,073	3,329	3,585	2,817	12,804
Osceola WB	Freeway	11,785	3	Disney PM IB	1,900	5,700	3,300	3,064	2,828	2,593	11,785
Osceola EB	Freeway	8,009	3	Disney PM OB	1,900	5,700	1,922	2,082	2,243	1,762	8,009
US 192 WB	Arterial	13,042	3	Congested	1,000	3,000	3,261	3,261	3,261	3,261	13,042
US 192 EB	Arterial	11,819	2	Congested	1,000	2,000	2,955	2,955	2,955	2,955	11,819
SR 417	Freeway	5,328	2	Uncongested	1,900	3,800	1,066	1,279	1,705	1,279	5,328
World SB	Freeway	5,973	3	Disney PM OB	1,900	5,700	1,434	1,553	1,672	1,314	5,973
World NB	Freeway	5,162	2	Disney PM IB	1,900	3,800	1,445	1,342	1,239	1,136	5,162
SR 429	Freeway	8,966	2	Uncongested	1,900	3,800	1,793	2,152	2,869	2,152	8,966
Champions WB	Arterial	4,247	2	Congested	800	1,600	849	1,019	1,359	1,019	4,247
Champions EB	Arterial	5,023	2	Congested	800	1,600	1,005	1,206	1,607	1,206	5,023
Central Polk	Freeway	9,333	2	Uncongested	1,900	3,800	2,053	2,613	2,800	1,867	9,333
US 27 NB	Arterial	11,966	3	Congested	1,000	3,000	2,393	2,872	3,829	2,872	11,966
US 27 SB	Arterial	8,128	3	Uncongested	1,000	3,000	1,626	1,951	2,601	1,951	8,128

The tables show that traffic demand will exceed the capacity that can be provided even with this peak spreading. Further spreading reaches the level of being unrealistic. Instead a reduce factor to the demand traffic proposed. This in effect mimic the behavior of a DTA approach but allows the modeler to control the outcome. By holding the traffic constant but lengthening the period to 5 hours, the demand is dilute by a factor less than 20%. The result is shown in the tables below.

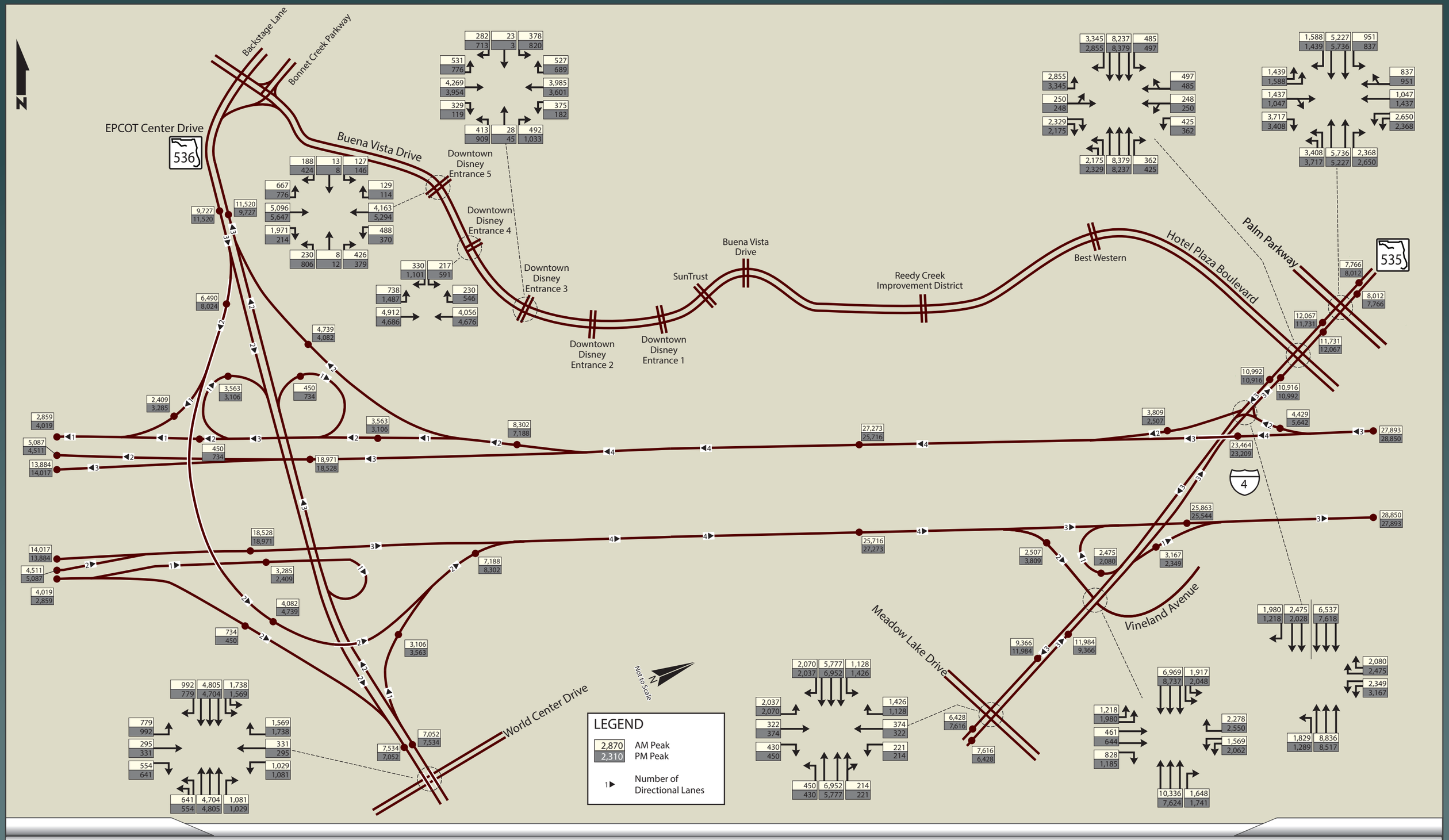
Table 3: AM Peak Period Demand Volumes – Five Hour

Entry Volume	Facility Type	Total Five Hour Demand	No.of Through Lanes	Spread Type	Directional Capacity		Adjusted Demand (Hourly Flow)					Total
					per lane	Total	700-800	800-900	900-1000	1000-1100	1100-1200	
I-4 WB	Freeway	32,403	3		1,900	5,700	6,513	6,707	6,513	6,448	6,189	32,371
I-4 ML WB	Freeway	8,191	2		1,900	3,800	1,646	1,696	1,646	1,630	1,564	8,183
Kirkman WB	Arterial	7,618	2	Extreme	800	1,600	1,409	1,638	1,638	1,524	1,409	7,618
Kirkman EB	Arterial	11,290	2	Extreme	800	1,600	2,258	2,258	2,258	2,258	2,258	11,290
Universal WB	Arterial	6,026	2	Uncongested	800	1,600	1,265	1,326	1,205	1,145	1,085	6,026
Universal EB	Arterial	6,540	2	Uncongested	800	1,600	1,373	1,439	1,308	1,243	1,177	6,540
Sandlake WB	Arterial	9,373	2	Extreme	500	1,000	1,875	1,875	1,875	1,875	1,875	9,373
Sandlake EB	Arterial	10,829	2	Extreme	500	1,000	2,166	2,166	2,166	2,166	2,166	10,829
SR 528 WB	Freeway	12,257	3	Uncongested	1,900	5,700	2,574	2,697	2,451	2,329	2,206	12,257
SR 528 ML WB	Freeway	4,191	1	Uncongested	1,900	1,900	880	922	838	796	754	4,191
CFL Pkwy WB	Arterial	10,457	2	Congested	900	1,800	2,091	2,091	2,091	2,091	2,091	10,457
CFL Pkwy EB	Arterial	8,500	2	Congested	900	1,800	1,615	1,785	1,785	1,700	1,615	8,500
Lake WB	Arterial	7,271	2	Uncongested	700	1,400	1,527	1,600	1,454	1,381	1,309	7,271
Lake EB	Arterial	6,434	2	Uncongested	700	1,400	1,351	1,415	1,287	1,222	1,158	6,434
SR 535 NB	Arterial	13,803	3	Congested	700	2,100	2,761	2,761	2,761	2,761	2,761	13,803
SR 535 SB	Arterial	14,572	3	Congested	700	2,100	2,914	2,914	2,914	2,914	2,914	14,572
SR 536 WB	Arterial	10,082	3	Disney	1,000	3,000	1,613	1,815	2,420	2,420	1,815	10,082
SR 536 EB	Freeway	14,112	3	Disney	1,900	5,700	2,258	2,540	3,387	3,387	2,540	14,112
Osceola WB	Freeway	10,982	3	Disney	1,900	5,700	1,757	1,977	2,636	2,636	1,977	10,982
Osceola EB	Freeway	8,009	3	Disney	1,900	5,700	1,281	1,442	1,922	1,922	1,442	8,009
US 192 WB	Arterial	12,176	3	Congested	1,000	3,000	2,313	2,557	2,557	2,435	2,313	12,176
US 192 EB	Arterial	13,075	3	Congested	1,000	3,000	2,484	2,746	2,746	2,615	2,484	13,075
SR 417	Freeway	4,452	2	Uncongested	1,900	3,800	935	979	890	846	801	4,452
World SB	Freeway	6,484	3	Disney	1,900	5,700	1,037	1,556	1,426	1,297	1,167	6,484
World NB	Freeway	4,791	2	Disney	1,900	3,800	958	1,150	1,054	862	767	4,791
SR 429	Freeway	10,454	2	Uncongested	1,900	3,800	2,195	2,300	2,091	1,986	1,882	10,454
Champions WB	Arterial	3,466	2	Congested	800	1,600	728	763	693	659	624	3,466
Champions EB	Arterial	5,787	2	Congested	800	1,600	1,215	1,273	1,157	1,100	1,042	5,787
Central Polk	Freeway	8,765	2	Uncongested	1,900	3,800	1,841	1,928	1,753	1,665	1,578	8,765
US 27 NB	Arterial	13,064	3	Congested	1,000	3,000	2,482	2,743	2,743	2,613	2,482	13,064
US 27 SB	Arterial	7,459	3	Uncongested	1,000	3,000	1,566	1,641	1,492	1,417	1,343	7,459

Table 4: PM Peak Period Demand Volumes – Five Hour

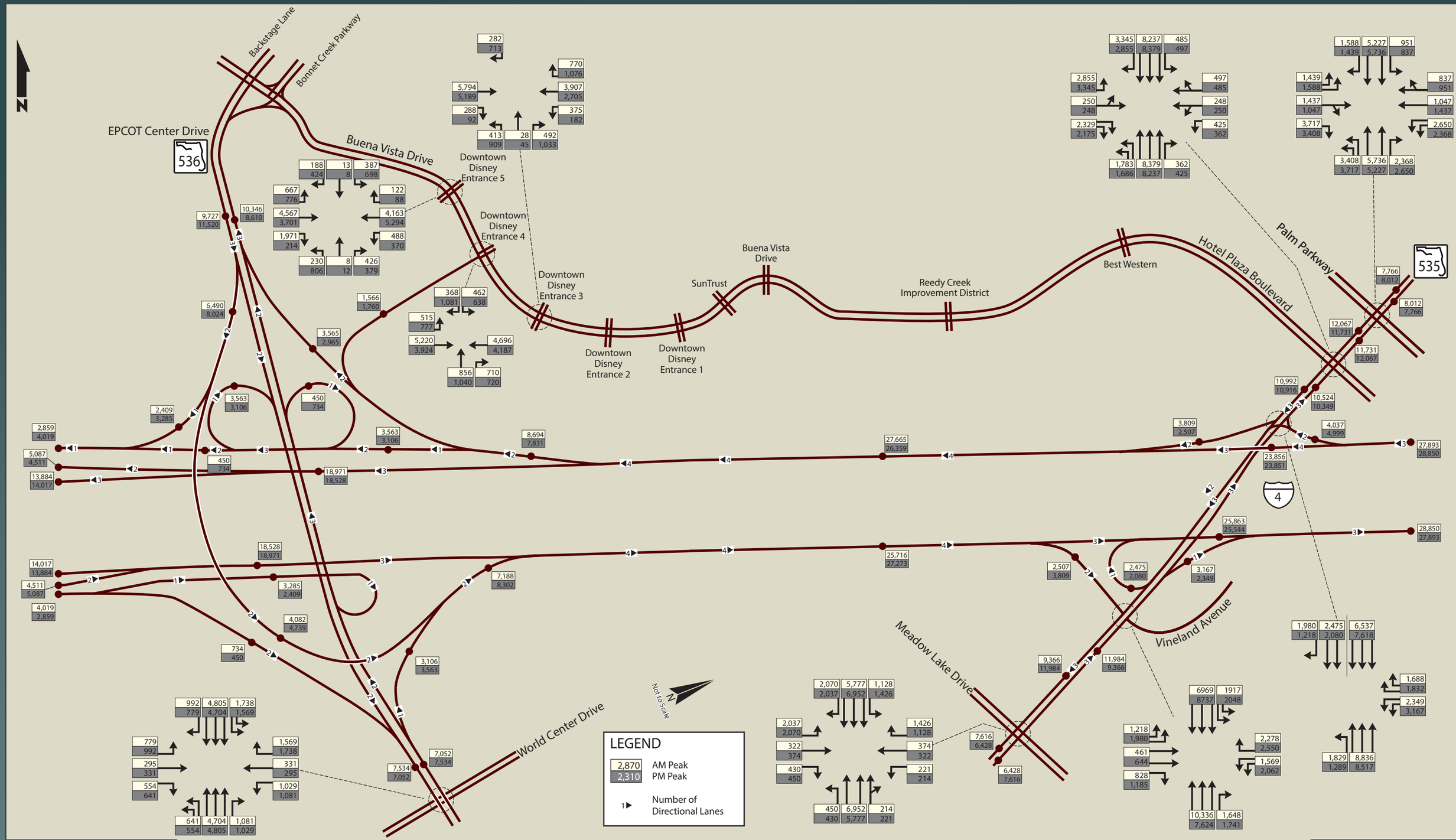
Entry Volume	Facility Type	Total Five Hour Demand	No.of Through Lanes	Spread Type	Directional Capacity		Adjusted Demand (Hourly Flow)					Total
					per lane	Total	1400-1500	1500-1600	1600-1700	1700-1800	1800-1900	
I-4 WB	Freeway	35,577	3		1,900	5,700	6,617	7,258	7,613	7,720	6,404	35,613
I-4 ML WB	Freeway	9,073	2		1,900	3,800	1,688	1,851	1,942	1,969	1,633	9,082
Kirkman WB	Arterial	7,045	2	Extreme	800	1,600	1,339	1,409	1,409	1,479	1,409	7,045
Kirkman EB	Arterial	11,537	2	Extreme	800	1,600	2,307	2,307	2,307	2,307	2,307	11,537
Universal WB	Arterial	6,492	2	Extreme	800	1,600	1,298	1,298	1,298	1,298	1,298	6,492
Universal EB	Arterial	6,068	2	Extreme	800	1,600	1,214	1,214	1,214	1,214	1,214	6,068
Sandlake WB	Arterial	10,003	2	Extreme	500	1,000	2,001	2,001	2,001	2,001	2,001	10,003
Sandlake EB	Arterial	10,105	2	Extreme	500	1,000	2,021	2,021	2,021	2,021	2,021	10,105
SR 528 WB	Freeway	10,443	3	Uncongested	1,900	5,700	1,880	1,984	2,141	2,297	2,141	10,443
SR 528 ML WB	Freeway	3,571	1	Uncongested	1,900	1,900	643	678	732	786	732	3,571
CFL Pkwy WB	Arterial	9,625	2	Congested	900	1,800	1,829	1,925	1,925	2,021	1,925	9,625
CFL Pkwy EB	Arterial	9,176	2	Congested	900	1,800	1,743	1,835	1,835	1,927	1,835	9,176
Lake WB	Arterial	7,907	2	Extreme	700	1,400	1,581	1,581	1,581	1,581	1,581	7,907
Lake EB	Arterial	5,893	2	Extreme	700	1,400	1,179	1,179	1,179	1,179	1,179	5,893
SR 535 NB	Arterial	12,357	3	Extreme	700	2,100	2,471	2,471	2,471	2,471	2,471	12,357
SR 535 SB	Arterial	14,570	3	Extreme	700	2,100	2,914	2,914	2,914	2,914	2,914	14,570
SR 536 WB	Arterial	10,762	3	Disney PM IB	1,000	3,000	2,152	2,583	2,368	1,937	1,722	10,762
SR 536 EB	Arterial	12,804	3	Disney PM OB	1,900	5,700	2,689	2,561	2,433	2,689	2,433	12,804
Osceola WB	Freeway	11,785	3	Disney PM IB	1,900	5,700	2,357	2,828	2,593	2,121	1,886	11,785
Osceola EB	Freeway	8,009	3	Disney PM OB	1,900	5,700	1,682	1,602	1,522	1,682	1,522	8,009
US 192 WB	Arterial	13,042	3	Congested	1,000	3,000	2,478	2,608	2,608	2,739	2,608	13,042
US 192 EB	Arterial	11,819	2	Congested	1,000	2,000	2,246	2,364	2,364	2,482	2,364	11,819
SR 417	Freeway	5,328	2	Uncongested	1,900	3,800	1,119	1,172	1,066	1,012	959	5,328
World SB	Freeway	5,973	3	Disney PM OB	1,900	5,700	1,254	1,195	1,135	1,254	1,135	5,973
World NB	Freeway	5,162	2	Disney PM IB	1,900	3,800	1,032	1,239	1,136	929	826	5,162
SR 429	Freeway	8,966	2	Uncongested	1,900	3,800	1,614	1,704	1,838	1,973	1,838	8,966
Champions WB	Arterial	4,247	2	Congested	800	1,600	807	849	849	892	849	4,247
Champions EB	Arterial	5,023	2	Congested	800	1,600	954	1,005	1,005	1,055	1,005	5,023
Central Polk	Freeway	9,333	2	Uncongested	1,900	3,800	1,680	1,773	1,913	2,053	1,913	9,333
US 27 NB	Arterial	11,966	3	Congested	1,000	3,000	2,274	2,393	2,393	2,513	2,393	11,966
US 27 SB	Arterial	8,128	3	Uncongested	1,000	3,000	1,463	1,544	1,666	1,788	1,666	8,128

With the reduce factor to the demand traffic applied by extending the duration of the peak period but only applying the 4 hour traffic and adjusting K by interchange, the demand traffic saturates the model during the peak hour as expected, and has shoulder hours. The shoulder hour intensity varies across the model. The magnitude is dependent on the model drive demand.



SR 536 at I-4 Off-Ramp Extension

Figure 2
Directional Design 4 Hour Traffic Volumes
2016 (No Build)



SR 536 at I-4 Off-Ramp Extension

Figure 3
Directional Design 4 Hour Traffic Volumes
2016 (Build)

Florida Department of
TRANSPORTATION

SR 536 INTERCHANGE MODIFICATION REPORT

Design Traffic Technical Report

July 2014

www.dot.state.fl.us

CERTIFICATION

BY

ATKINS, NA

SR 536 Interchange Modification Report – Design Traffic Technical Report June 2014

I, Scott A. Zornek, Florida P.E. Number 61248, have prepared and reviewed the Design Traffic estimates for the above referenced FLORIDA DEPARTMENT OF TRANSPORTATION project. I have specifically followed the "Design Traffic (Traffic Forecasting Procedure" as adopted by the Florida Department of Transportation. Based on traffic count information, general data sources, and other pertinent information, the Design Traffic estimates have been prepared using current traffic engineering, transportation planning, and Florida Department of Transportation practices and procedures.

Atkins, NA
482 South Keller Road
Orlando, FL 32810

Scott A. Zornek, P.E. #61248

Date 7/23/14

Table of Contents

Section — Pages

Introduction 2

1. Travel Demand Forecasting Methodology 3
1.1. Travel Demand Model Selection 3
1.2. Travel Demand Model Modifications 3

2. Traffic Factors 3
2.1. Model Output Conversion Factor (MOCF) 3
2.2. Adopted K Factor 4
2.3. Adopted D Factors 5

3. Design Traffic Methodology & Design Traffic 6
3.1. Methodology 6
3.2. Design Traffic 6

Tables
Table 1. 2005 MOCFs 4
Table 2. Adopted K Factors 5
Table 3. Adopted D Factors 5

Figures
Figure 1. Segment 1 – 2020 No-Build AADT 7
Figure 2. Segment 1 – 2030 No-Build AADT 8
Figure 3. Segment 1 – 2040 No-Build AADT 9
Figure 4. Segment 1 – 2020 Build AADT 10
Figure 5. Segment 1 – 2030 Build AADT 11
Figure 6. Segment 1 – 2040 Build AADT 12
Figure 7. Segment 1 – 2020 No-Build Directional Design 4-Hour Traffic Volumes 13
Figure 8. Segment 1 – 2030 No-Build Directional Design 4-Hour Traffic Volumes 14
Figure 9. Segment 1 – 2040 No-Build Directional Design 4-Hour Traffic Volumes 15
Figure10 Segment 1 – 2020 Build Directional Design 4-Hour Traffic Volumes 16
Figure11 Segment 1 – 2030 Build Directional Design 4-Hour Traffic Volumes 17
Figure12 Segment 1 – 2040 Build Directional Design 4-Hour Traffic Volumes 18

Appendices
Appendix A. Model Files (Electronic)

Appendix B. SR 536 Ramp Configuration

Appendix C. Traffic Count Data (Electronic)

Appendix D. TURNS5 Files (Electronic)

Introduction

This document follows the *I-4 SAMR Update – Design Traffic Tech Memo January 2013* document and *the I-4 SIMR Update - Traffic Technical Report March 2014*. The January 2013 document included 2 segments of analysis. Segment 1 of I-4 goes from west of U.S. 27 in Polk County to west of the Florida Turnpike in Orange County and Segment 2 goes from west of S.R. 434 in Seminole County to east of S.R. 472 in Volusia County. The need for this document was precipitated by the modification of access points in both segments due to the analysis of the originally proposed access locations from an earlier study that were deemed by the Florida Department of Transportation (FDOT) to not meet current FDOT standards.

It was also deemed necessary to create a new methodology for the development of the Directional Peak Period Traffic (DPPT) and analysis period for Segment 1. The analysis period of a single design hour was found to be insufficient and therefore a multi-hour analysis period was created. The January 2013 report also documents new access points for all segments, the new DPPT methodology for Segment 1, and the production of the Opening year 2020, Interim year 2030, and Design Year 2040 DPPT for Build Scenarios for both segments and the No-Build for Segment 1.

The March 2014 report updated both segments traffic as a result of additional and modified access locations.

1. Travel Demand Forecasting Methodology

The model study area consists of I-4 from west of U.S. 27 in Polk County to west of the Florida Turnpike in Orange County which matches the I-4 Beyond the Ultimate Segment 1 area.

1.1. Travel Demand Model Selection

The Central Florida Regional Planning Model (CFRPM) version 5.01 used for the previous work was also used for this effort for consistency purposes. The model files are contained in Appendix A.

1.2. Travel Demand Model Modifications

The only adjustment made to the model from the I-4 SIMR Update was the addition of a new ramp off of I-4/SR 536 interchange into downtown Disney. The configuration of the ramp is shown in Appendix B.

1.2.1. Model Network Modifications

Segment 1 access locations were modified per the FDOT request. The modified access locations were coded into the travel demand model for the Build scenarios and then the models were rerun. These locations are shown in Appendix A.

2. Traffic Factors

This section of the report details the traffic factors that were used to develop the DPPT for this project.

2.1. Model Output Conversion Factor (MOCF)

The MOCF is used to convert the traffic volumes generated by a traffic demand model from Peak Season Weekday Average Daily Traffic (PSWADT) to Annual Average Daily Traffic (AADT). The MOCF is the average of the 13 consecutive weeks during which the highest weekday volumes occur and when the sum of Seasonal Factors (SF) for those 13 weeks are the lowest. The MOCF(s) used in validation to convert PSWADT to AADT for the base year model network should be used for adjusting future year model volume. The Base year for the CFRPM is 2005. The MOCFs used for this study came from the FDOT 2005 Florida Traffic Information DVD and are shown in Table 1 below.

Table 1. 2005 MOCFs

Segment	MOCF
Segment 1 – Orange I-4	0.98
Segment 1 – Orange I-4 Disney	0.97
Segment 1 – Orange Arterials	0.98
Segment 1 – Osceola I-4/Disney	0.97
Segment 1 – Osceola Arterials	0.97
Segment 1 – Polk I-4	0.95
Segment 1 – Polk Arterials	0.92

2.2. Adopted K Factor

The K Factor is the ratio of the traffic volume in the study hour to the AADT. FDOT currently utilizes standard K factors based on the type of roadway classifications; however, this segment of the study was allowed to use facility specific K factors in the previous analysis.

The original K factors did not accurately take into account the multi-hour peak of the area so a new methodology was created to deal with this issue.

2.2.1. Background Information

Segment 1 goes primarily through the heavy tourist area of Orlando, which includes access points to Disney World (including its four parks and Downtown Disney), Sea World, and Universal Studios. This generates a significant amount of tourist traffic as well as “shift work” trips along this section of I-4. These types of trips do not have the same peaking characteristics as the more traditional residential and commercial areas which are directional in nature and typically peak in the morning and afternoon commute time periods. The tourist and shift work trips are more spread out and balanced in their peaks and thus generate a longer peak with more total traffic as compared to directional traffic.

In January of 2013, updated Directional Design Hour Volumes (DDHVs) for both the No-Build and Build conditions for the years 2020, 2030 and 2040 were produced using FDOT standard procedures. The approach that was used began with the coding of the Build condition (managed lanes) into the CFRPM version 5.01. Model Scenarios were created for the years 2020 and 2040 for both the Build and No-Build conditions. The 2030 DDHVs were interpolated from the 2020 and 2040 DDHVs. The DDHVs were then put into VISSIM for the purposes of traffic operations analysis.

The DDHVs for the western segment that were produced using the FDOT procedures showed volume to capacity ratios approaching 1.8 in some locations. The DDHVs were reevaluated and found to be reasonable based on the standard FDOT procedures. Further investigation revealed the cause of the high volume to capacity ratio was partly due to the analysis tools. The Travel Demand model is just that, a model based on demand. While there is capacity restraint in the travel demand model, there is no capacity limit in the Travel Demand model. Due to this, Travel Demand models can produce volumes that are over the available capacity.

In practice, these high volumes lead to expanding peak periods over time which is known as peak spreading. This effect is not captured in the FDOT standard design traffic procedure due to the use of “standard K” or the facility specific approach that was used previously since they only include a single hour. Segment 1 of I-4 currently experiences congestion in periods rather than just at specific hours in the morning and afternoon.

This is due to the tourist demand and shift work trips which provide more midday and late evening traffic than in residential areas.

Because of these issues, a new methodology to develop the traffic is proposed that is described in detail in section 2.2.2.

2.2.2. Directional Peak Period Traffic Development Methodology

This approach used the same starting point as before with the coding of the Build condition (managed lanes) into the CFRPM version 5.01. The modeling was be revised as access locations have changed since the last model runs were performed on the Segment 1. Model Scenarios were recreated for the years 2020 and 2040 for both the Build and No-Build conditions.

To create the new DPPT, an analysis of existing FDOT count stations along the I-4 corridor was done to ascertain the peak period of the day. Several counts stations were used to accomplish this task.

Project and period specific K factors were created and applied to the AADT using the count stations in the study area on I-4 to obtain the percentage of daily traffic that occurs in the established peak period.

The PSWADT produced from the CFRPM was converted to AADT by applying the MOCF factors for I-4 and the cross streets using the 2005 (Model Base year) factors from the FDOT 2005 Traffic Information DVD.

Table 2 below shows the adopted K Factors for the project, based on the new methodology.

Table 2. Adopted K Factors

Segment	K Factor
Segment 1 – Osceola/Polk Counties	26.00
Segment 1 – Orange County	24.64
Segment 1 – Disney Area	27.25

2.3. Adopted D Factors

The D Factor is the proportion of traffic based on the median (average) for the design hour of the design year traveling in the peak direction. The Segment 1 factors were derived from all the count stations in Orange, Osceola and Polk counties for I-4 and the Arterials.

The adopted D Factors for the project are shown in Table 3.

Table 3. Adopted D Factors

Segment	D Factor
Segment 1 – I-4	52.92
Segment 1 – Tolled Roads	56.35
Segment 1 – Arterials	53.66

3. Design Traffic Methodology & Design Traffic

The 2012 FDOT Project Traffic Forecasting Handbook and the Project Forecasting Procedure Topic No. 525-030-120 were used to develop the Design Traffic for this project, except as noted above in section 2. The Design Traffic is produced by applying the K and D factors to AADT projections from the CFRPM. Intersection or interchange turning movements can be calculated manually or using several other methods, including the TURNS5 methodology which was used for this project.

3.1. Methodology

TURNS5 was used to generate the Design Traffic for the intersections and interchanges for this project.

The TURNS5-V02 program is an excel spreadsheet that enables the user to easily operate it. The only Required Input Data for TURNS5 is:

- Model year AADTs
- K and D factors for mainline and side streets
- “First guess” turning movement proportions for AADTs (Can come from Counts or the Model) Counts were used for this project.

TURNS5 produces the following output:

- Balanced daily and design hour turning movement forecasts
- Base (Existing) year, opening (first) year, mid (second) year and
- Design (third) year forecasts

For this project, model year AADTs for 2020 and 2040 for the No-Build and Build scenarios were entered into TURNS5 along with the calculated K and D factors and the percentage of turns from either the traffic counts in Appendix C or the model turning movements. The 2030 DPPTs were interpolated between the 2020 and 2040 DPPTs.

The Buena Vista Drive traffic was developed using a combination of the CFRPM model and existing traffic provided by RCID and shown in Appendix C. As Buena Vista Drive resides outside the limits of the CFRPM historical data was relied upon to distribute traffic along the corridor. Traffic entering and exiting Hotel Plaza Boulevard to the east and Buena Vista Drive to the west was developed based on the CFRPM output with turning movements through Turns5. Upon establishing traffic movements to and from the corridor, manual distribution techniques were used to determine the turning volumes for the full length of the BVD corridor from SR 535 to EPCOT Center Drive. After determining the distribution of traffic for the corridor, the final design traffic was focused to the project limits of the proposed ramp.

3.2. Design Traffic

The resulting AADT and Design Traffic for Segment 1 for all years and scenarios are shown in Figures 1 through 12 beginning on the next page.

Figure 1. Segment 1 – 2020 No-Build DPPT

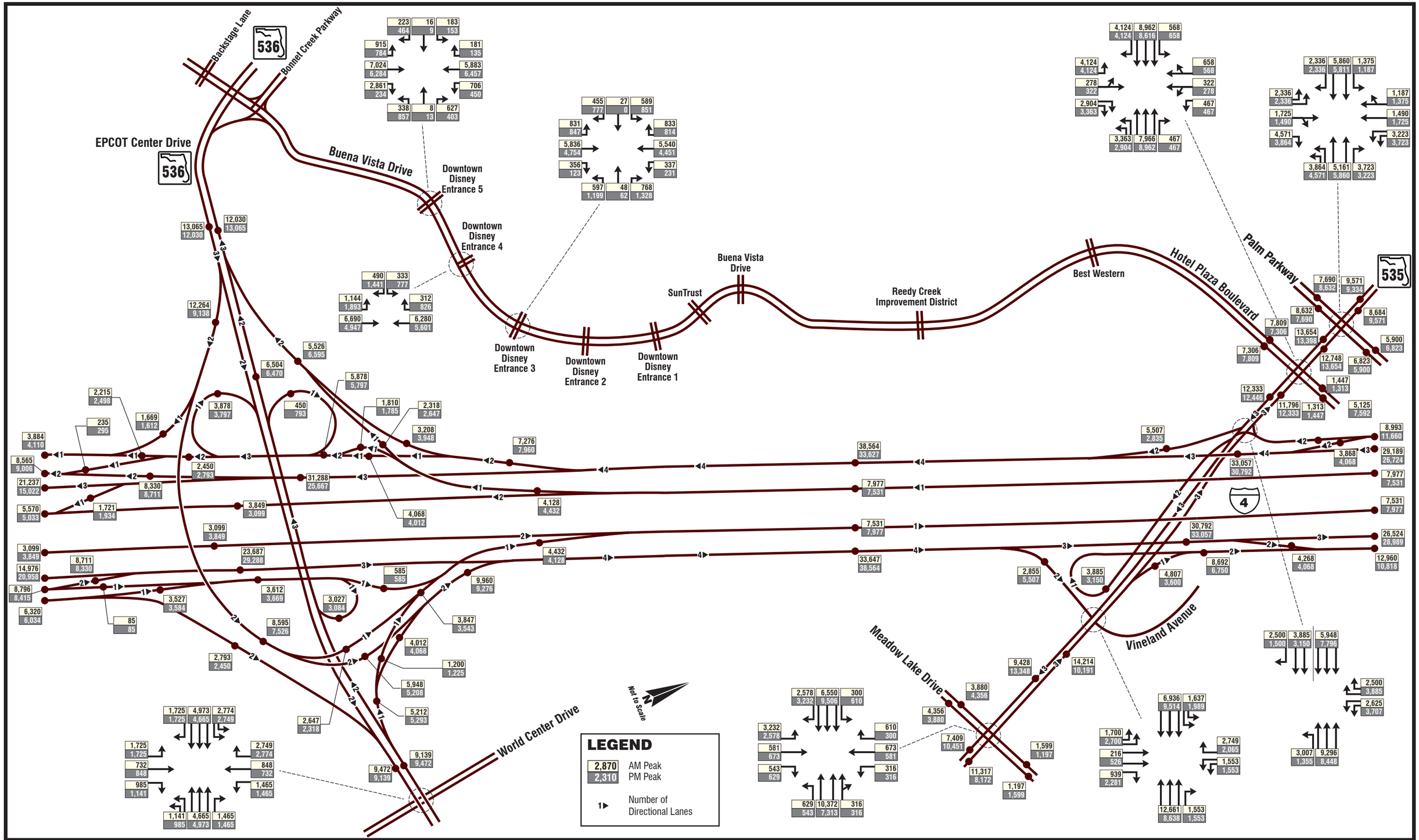
Figure 2. Segment 1 – 2030 No-Build DPPT

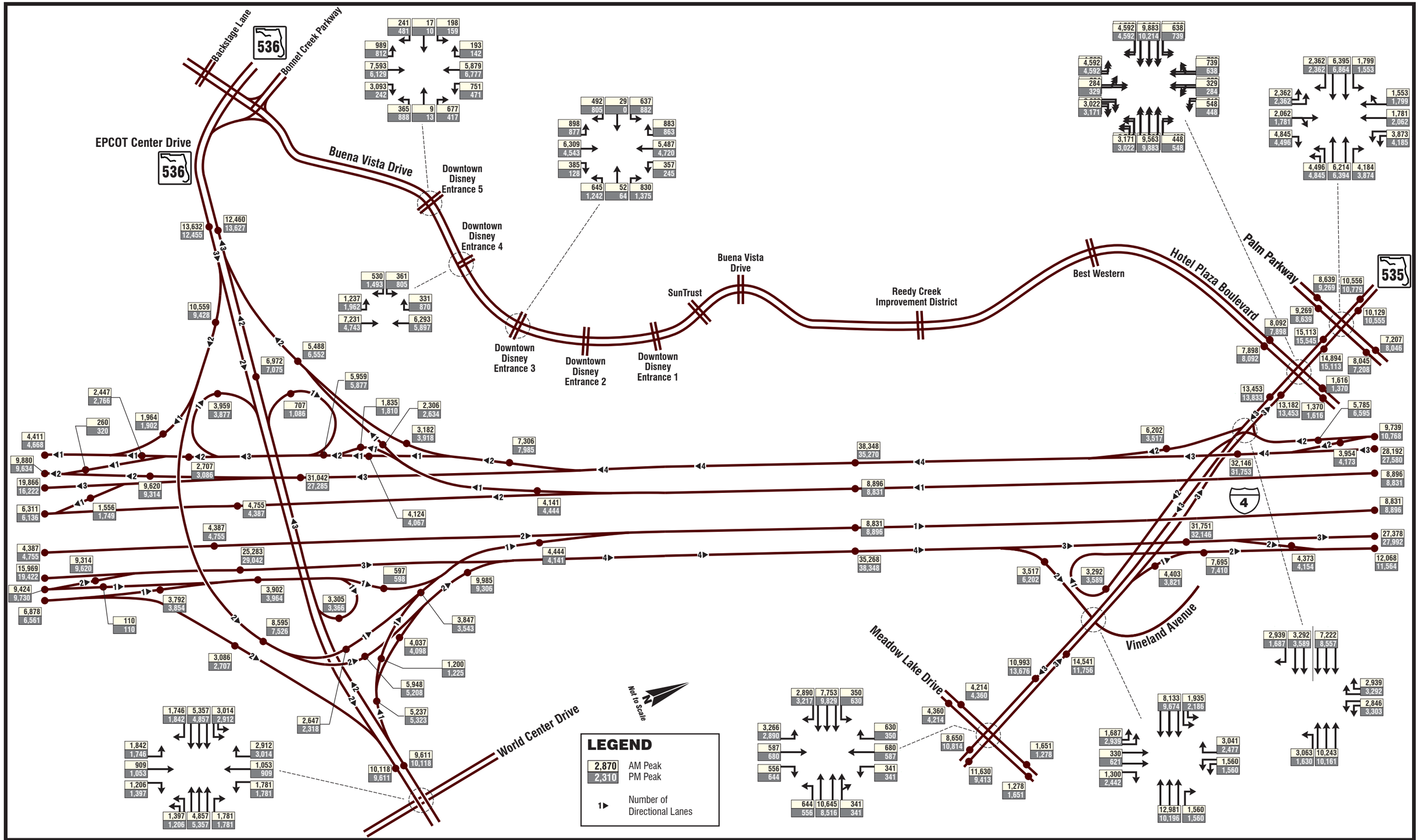
Figure 3. Segment 1 – 2040 No-Build DPPT

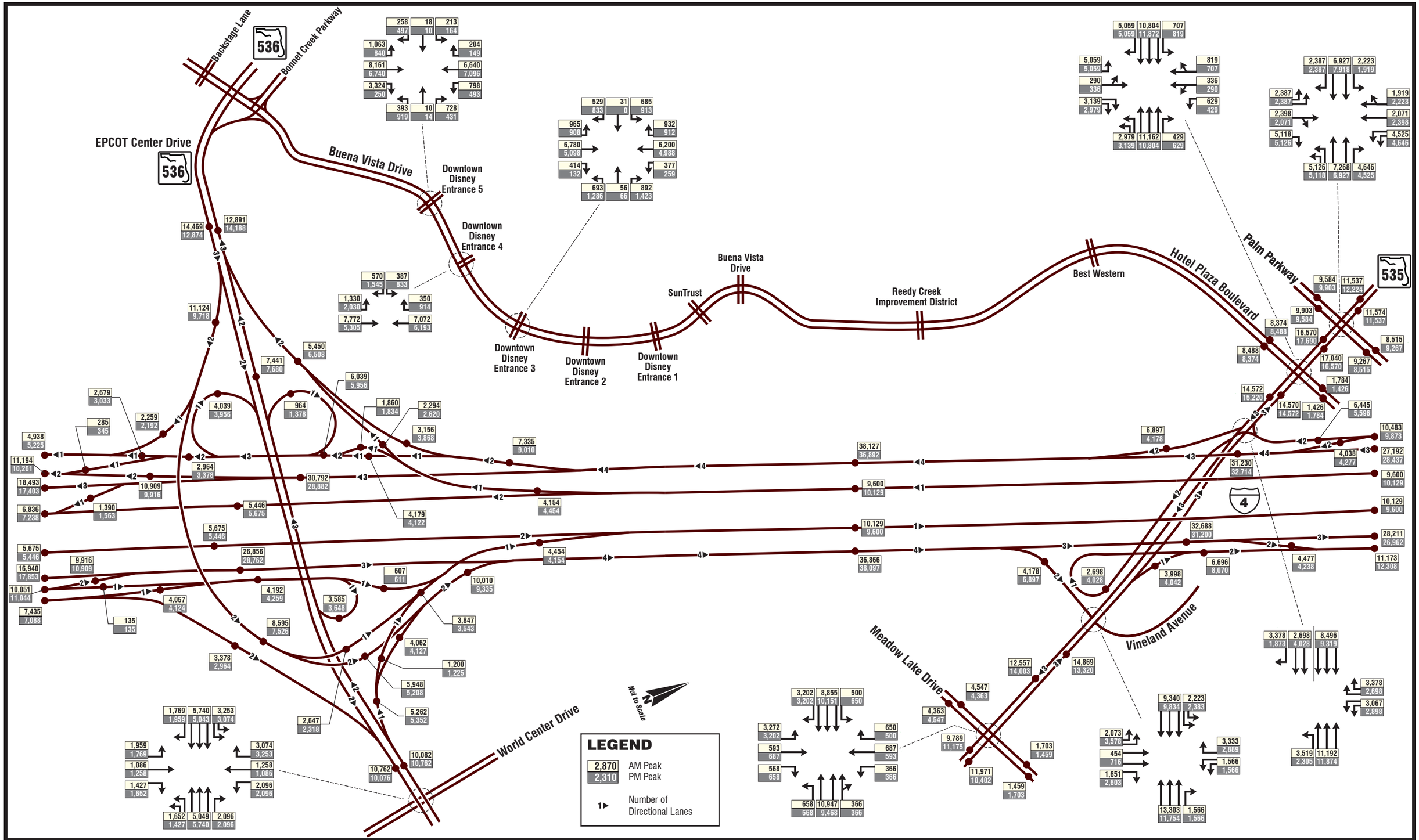
Figure 4. Segment 1 – 2020 Build DPPT

Figure 5. Segment 1 – 2030 Build DPPT

Figure 6. Segment 1 – 2040 Build DPPT


Backstage Lane
Bonnet Creek Parkway
536
EPCOT Center Drive
536
Buena Vista Drive
Downtown Disney Entrance 5
Downtown Disney Entrance 4
Downtown Disney Entrance 3
Downtown Disney Entrance 2
Downtown Disney Entrance 1
SunTrust
Buena Vista Drive
Reedy Creek Improvement District
Best Western
Hotel Plaza Boulevard
Palm Parkway
535
4
World Center Drive
Meadow Lake Drive
Vineland Avenue
Not to Scale
LEGEND
2,870 AM Peak
2,310 PM Peak
1▶ Number of Directional Lanes

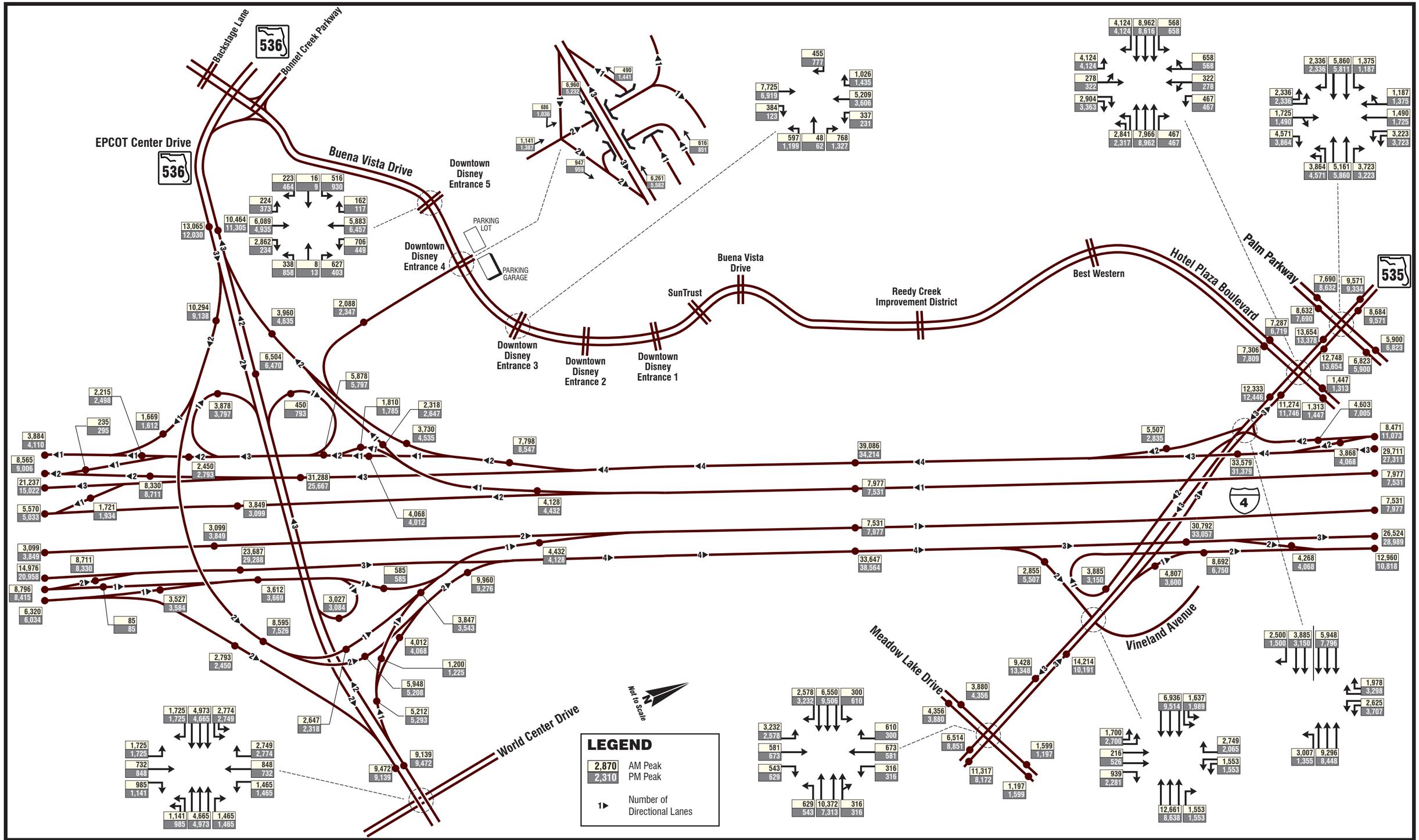

Backstage Lane
Bonnet Creek Parkway
536
EPCOT Center Drive
536
Buena Vista Drive
Downtown Disney Entrance 5
Downtown Disney Entrance 4
Downtown Disney Entrance 3
Downtown Disney Entrance 2
Downtown Disney Entrance 1
SunTrust
Buena Vista Drive
Reedy Creek Improvement District
Best Western
Hotel Plaza Boulevard
Palm Parkway
535
4
World Center Drive
Meadow Lake Drive
Vineland Avenue
Not to Scale
LEGEND
2,870 AM Peak
2,310 PM Peak
1▶ Number of Directional Lanes



FDOT I-4 SIMR Update Design Traffic

Segment 1 - 2040 No-Build - Directional Design 4-Hour Traffic Volumes

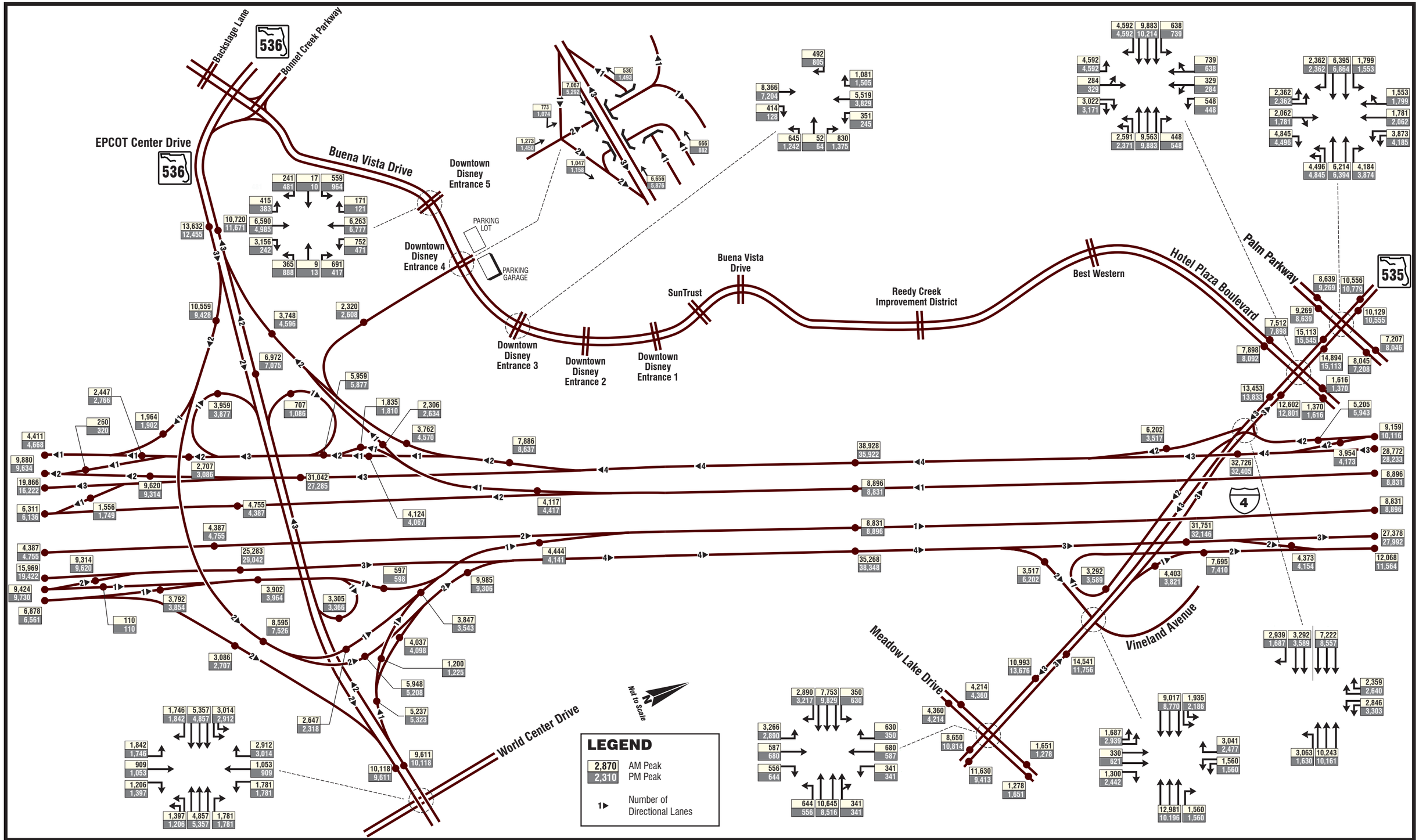
Figure 9



FDOT I-4 SIMR Update Design Traffic

Segment 1 - 2020 Build - Directional Design 4-Hour Traffic Volumes

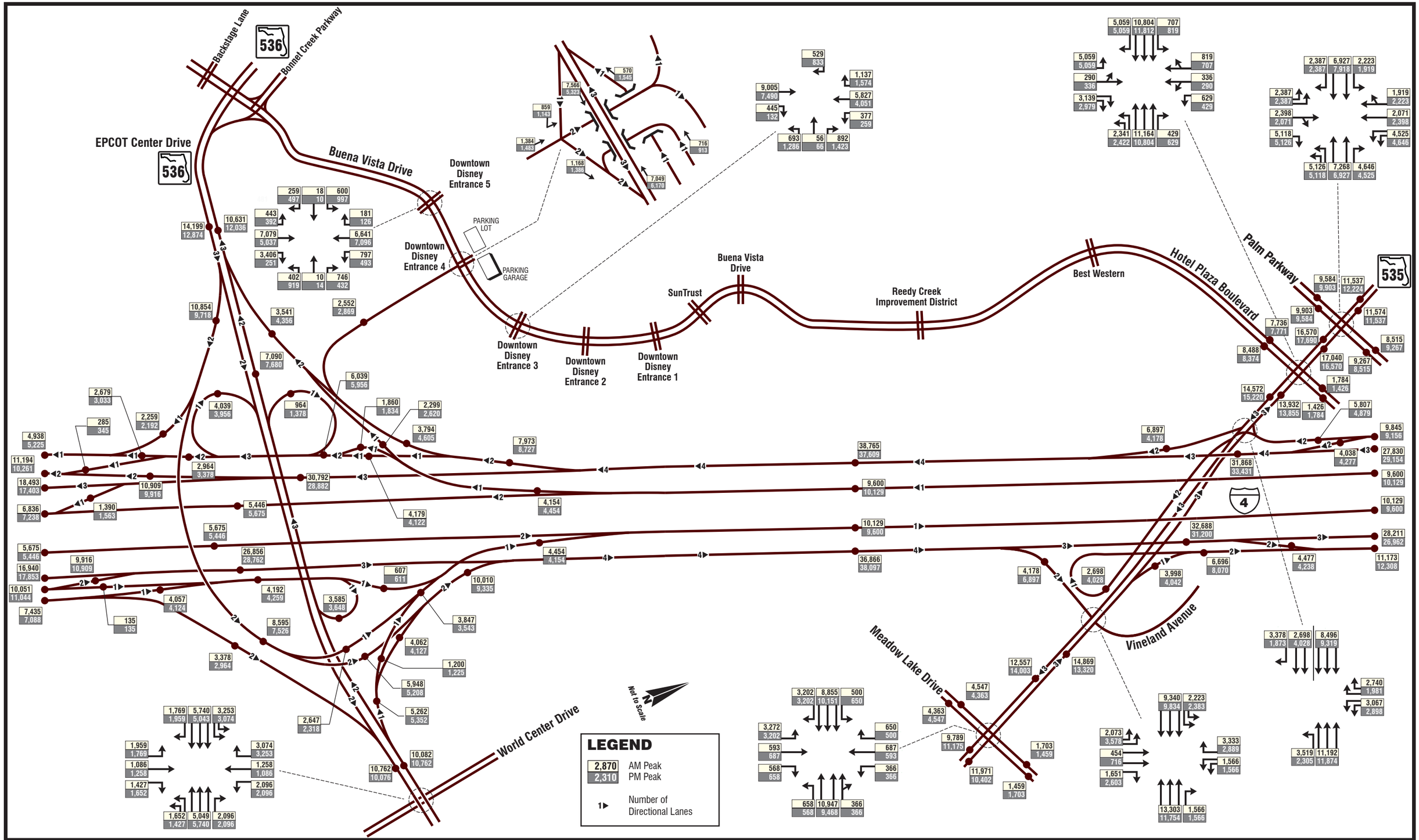
Figure 10



FDOT I-4 SIMR Update Design Traffic

Segment 1 - 2030 Build - Directional Design 4-Hour Traffic Volumes

Figure 11



FDOT I-4 SIMR Update Design Traffic

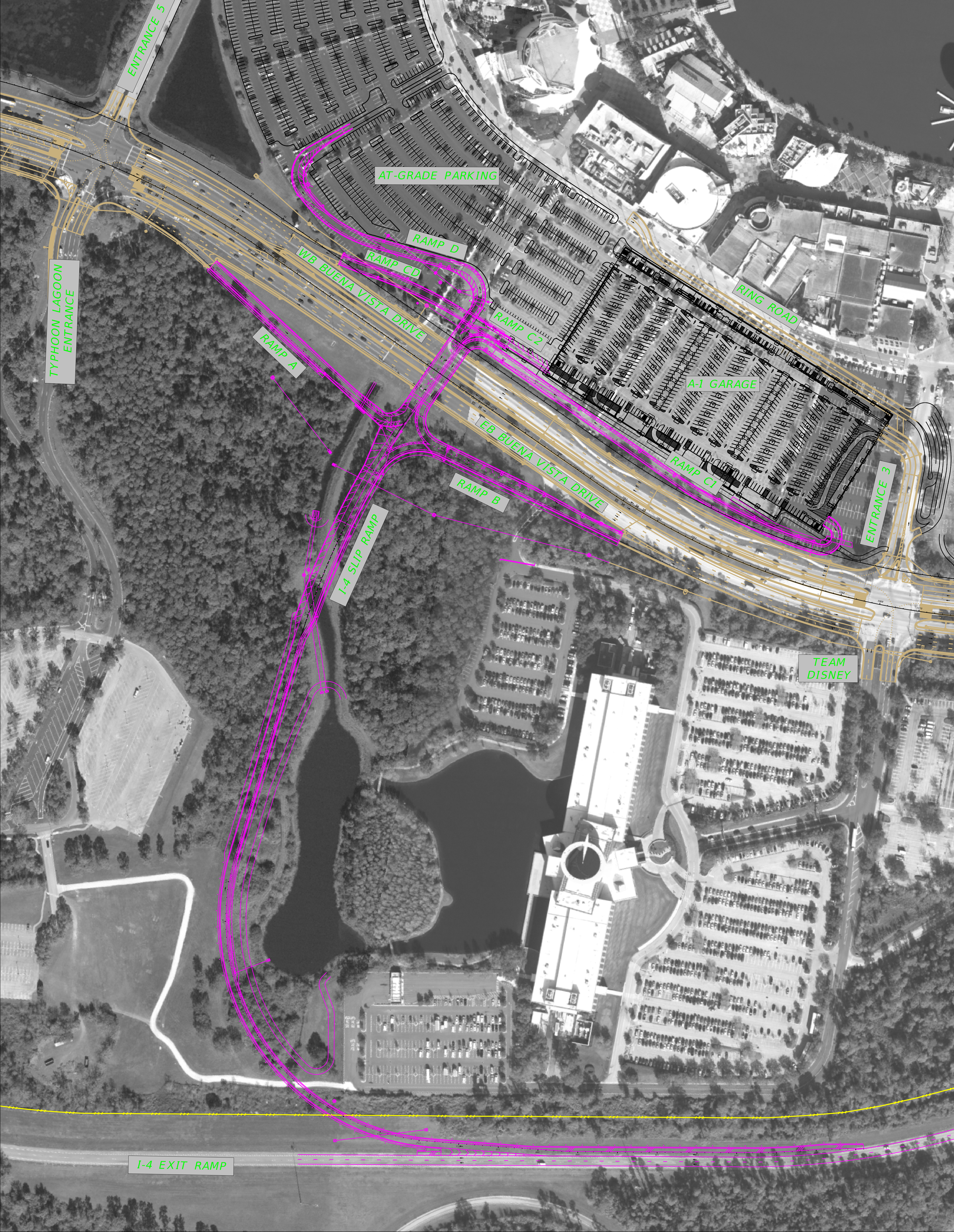
Segment 1 - 2040 Build - Directional Design 4-Hour Traffic Volumes

Figure 12

Appendices

Appendix A. Model Files (Electronic)

Appendix B. SR 536 Proposed Ramp Configuration


ENTRANCE 5
AT-GRADE PARKING
RAMP D
RAMP CD
WB BUENA VISTA DRIVE
TYPHOON LAGOON ENTRANCE
RAMP A
RAMP C2
RING ROAD
A-1 GARAGE
EB BUENA VISTA DRIVE
RAMP C1
ENTRANCE 3
RAMP B
I-4 SLIP RAMP
TEAM DISNEY
I-4 EXIT RAMP

Appendix C. Traffic Counts (Electronic)

Appendix D. TURNS5 Files (Electronic)

Appendix E – Future Conditions Operational Analysis Outputs

HCS – Basic Freeway Outputs

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*1 I-4 On Ramp from US 192 to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*ceola Parkway Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5220*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2187*	pc/h/ln
S	*59.4*	mph
D = v_p / S	*36.8*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*86 HOV Off north of Osceola Parkway to HOV On from Osceola Parkway-SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*kway to HOV On from Osceola Parkway-SR 536*
Analysis Time Period	*kway-SR 536*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*620*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.33*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.3*	mph
FFS	*74.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*393*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*5.2*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB 87 HOV On from Osceola Parkway-SR 536 to Street B On*
Agency or Company	*HDR Inc.*	From/To	
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*SR 536 to Street B On*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1506*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*956*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*12.7*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 Off Ramp to CD System to Edge of Study Area*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*ge of Study Area*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5430*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2275*	pc/h/ln
S	*57.0*	mph
D = v_p / S	*39.9*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from Osceola Parkway to I-4 On Ramp from SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*y to I-4 On Ramp from SR 536*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5051*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2116*	pc/h/ln
S	*61.2*	mph
D = v_p / S	*34.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*I-4 On Ramp from SR 536 to SR 535 Off Ramp*
Jurisdiction	*35 Off Ramp*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6965*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2189*	pc/h/ln
S	*59.4*	mph
D = v_p / S	*36.9*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*Osceola Parkway Off Ramp to SR 536 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*536 Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4758*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1994*	pc/h/ln
S	*64.1*	mph
D = v_p / S	*31.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 535 Off Ramp to Off Ramp to CD System*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*CD System*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6314*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2645*	pc/h/ln
S	*45.0*	mph
D = v_p / S	*58.7*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 536 Off Ramp to I-4 On Ramp from Osceola Parkway*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*from Osceola Parkway*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3598*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1508*	pc/h/ln
S	*72.1*	mph
D = v_p / S	*20.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*101 HOV Off to Street B to HOV Off at SR 536*
Jurisdiction	*Off at SR 536*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1595*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*5*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*0.85*		E_R	*1.2*
E_T	*1.5*		$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1012*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*13.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*102 HOV Off at SR 536 to HOV On at SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*at SR 536*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*770*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.33*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.3*	mph
FFS	*74.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*489*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*6.5*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*103 HOV On at SR 536 to HOV Off north of World Drive*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*north of World Drive*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1114*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.33*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.3*	mph
FFS	*74.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*707*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*9.4*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*15 US 192 Off Ramp to I-4 On Ramp from Osceola Parkway*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*mp from Osceola Parkway*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*841*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*352*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*4.7*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*Edge of Study Area to I-4 On Ramp from CD System*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*mp from CD System*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6242*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2615*	pc/h/ln
S	*46.1*	mph
D = v_p / S	*56.7*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from CD System to I-4 On Ramp from SR 535*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*-4 On Ramp from SR 535*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7043*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2951*	pc/h/ln
S	*32.9*	mph
D = v_p / S	*89.8*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*I-4 On Ramp from SR 535 to SR 536 Off Ramp*
Jurisdiction	*36 Off Ramp*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8183*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2571*	pc/h/ln
S	*47.7*	mph
D = v_p / S	*53.9*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*Osceola Parkway Off Ramp to Edge of Study Area*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*e of Study Area*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5053*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2117*	pc/h/ln
S	*61.2*	mph
D = v_p / S	*34.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*SR 536 Off Ramp to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*way Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6477*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2714*	pc/h/ln
S	*42.5*	mph
D = v_p / S	*63.9*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*1 I-4 On Ramp from US 192 to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*ceola Parkway Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5220*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2187*	pc/h/ln
S	*59.4*	mph
D = v_p / S	*36.8*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*86 HOV Off north of Osceola Parkway to HOV On from Osceola Parkway-SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*kway to HOV On from Osceola Parkway-SR 536*
Analysis Time Period	*kway-SR 536*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*770*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.33*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.3*	mph
FFS	*74.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*489*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*6.5*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*87 HOV On from Osceola Parkway-SR 536 to Street B On*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*SR 536 to Street B On*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1595*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1012*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*13.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 Off Ramp to CD System to Edge of Study Area*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*ge of Study Area*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6091*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2552*	pc/h/ln
S	*48.3*	mph
D = v_p / S	*52.8*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from Osceola Parkway to I-4 On Ramp from SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*y to I-4 On Ramp from SR 536*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6356*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2663*	pc/h/ln
S	*44.4*	mph
D = v_p / S	*60.0*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 536 to SR 535 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*35 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8369*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2630*	pc/h/ln
S	*45.6*	mph
D = v_p / S	*57.7*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*Osceola Parkway Off Ramp to SR 536 Off Ramp*
Jurisdiction	*536 Off Ramp*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5858*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2454*	pc/h/ln
S	*51.6*	mph
D = v_p / S	*47.6*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 535 Off Ramp to Off Ramp to CD System*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*CD System*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6974*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2922*	pc/h/ln
S	*34.1*	mph
D = v_p / S	*85.7*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 536 Off Ramp to I-4 On Ramp from Osceola Parkway*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*from Osceola Parkway*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4548*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1906*	pc/h/ln
S	*65.9*	mph
D = v_p / S	*28.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*101 HOV Off to Street B to HOV Off at SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*Off at SR 536*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1506*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*956*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*12.7*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*102 HOV Off at SR 536 to HOV On at SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*at SR 536*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*620*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.33*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.3*	mph
FFS	*74.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*393*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*5.2*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*103 HOV On at SR 536 to HOV Off north of World Drive*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*north of World Drive*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1007*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.33*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.3*	mph
FFS	*74.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*639*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*8.5*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*15 US 192 Off Ramp to I-4 On Ramp from Osceola Parkway*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*mp from Osceola Parkway*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*841*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*352*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*4.7*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*Edge of Study Area to I-4 On Ramp from CD System*
Jurisdiction	*mp from CD System*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5790*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2426*	pc/h/ln
S	*52.5*	mph
D = v_p / S	*46.2*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from CD System to I-4 On Ramp from SR 535*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*-4 On Ramp from SR 535*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6673*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2796*	pc/h/ln
S	*39.3*	mph
D = v_p / S	*71.2*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 535 to SR 536 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*36 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7522*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2364*	pc/h/ln
S	*54.4*	mph
D = v_p / S	*43.5*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*Osceola Parkway Off Ramp to Edge of Study Area*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*e of Study Area*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3980*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1668*	pc/h/ln
S	*70.1*	mph
D = v_p / S	*23.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*SR 536 Off Ramp to Osceola Parkway Off Ramp*
Jurisdiction	*way Off Ramp*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5570*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2334*	pc/h/ln
S	*55.3*	mph
D = v_p / S	*42.2*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*1 I-4 On Ramp from US 192 to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*ceola Parkway Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5220*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2187*	pc/h/ln
S	*59.4*	mph
D = v_p / S	*36.8*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from Osceola Parkway to I-4 On Ramp from SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*y to I-4 On Ramp from SR 536*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3835*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1607*	pc/h/ln
S	*70.9*	mph
D = v_p / S	*22.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*I-4 On Ramp from SR 535 EB to I-4 On Ramp from SR 535 WB*
Jurisdiction	*-4 On Ramp from SR 535 WB*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5397*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*	
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*	

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2261*	pc/h/ln
S	*57.4*	mph
D = v_p / S	*39.4*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 535 WB to Central Florida Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*entral Florida Parkway Off Ramp*
Analysis Time Period		Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6232*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1958*	pc/h/ln
S	*64.8*	mph
D = v_p / S	*30.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*I-4 On Ramp from SR 536 to SR 535 Off Ramp*
Jurisdiction	*35 Off Ramp*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5323*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1673*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*23.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*Osceola Parkway Off Ramp to SR 536 Off Ramp*
Jurisdiction	*536 Off Ramp*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4393*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1841*	pc/h/ln
S	*67.2*	mph
D = v_p / S	*27.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 535 Off Ramp to I-4 On Ramp from SR 535 EB*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*from SR 535 EB*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4804*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2013*	pc/h/ln
S	*63.6*	mph
D = v_p / S	*31.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*SR 536 Off Ramp to I-4 On Ramp from Osceola Parkway*
Jurisdiction	*from Osceola Parkway*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3561*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1492*	pc/h/ln
S	*72.3*	mph
D = v_p / S	*20.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*15 US 192 Off Ramp to I-4 On Ramp from Osceola Parkway*
Jurisdiction	*mp from Osceola Parkway*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*841*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*352*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*4.7*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from Central Florida Parkway to SR 535 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*a Parkway to SR 535 Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5974*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1877*	pc/h/ln
S	*66.5*	mph
D = v_p / S	*28.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*I-4 On Ramp from SR 535 to SR 536 Off Ramp*
Jurisdiction	*36 Off Ramp*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5001*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1572*	pc/h/ln
S	*71.4*	mph
D = v_p / S	*22.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*I-4 On Ramp from SR 536 to US 192 Off Ramp*
Jurisdiction	*92 Off Ramp*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2821*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*886*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*11.8*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*Osceola Parkway Off Ramp to I-4 On Ramp from SR 536*
Jurisdiction	*On Ramp from SR 536*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2229*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*934*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*12.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*SR 535 Off Ramp to I-4 On Ramp from SR 535*
Jurisdiction	*from SR 535*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4184*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1753*	pc/h/ln
S	*68.7*	mph
D = v_p / S	*25.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*SR 536 Off Ramp to Osceola Parkway Off Ramp*
Jurisdiction	*way Off Ramp*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3282*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1375*	pc/h/ln
S	*73.4*	mph
D = v_p / S	*18.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*1 I-4 On Ramp from US 192 to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*ceola Parkway Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3493*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1448*	pc/h/ln
S	*72.8*	mph
D = v_p / S	*19.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from Osceola Parkway to I-4 On Ramp from SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*y to I-4 On Ramp from SR 536*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3970*	veh/h	Peak-Hour Factor, PHF	*0.96*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*	
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*	

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1646*	pc/h/ln
S	*70.4*	mph
D = v_p / S	*23.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 535 EB to I-4 On Ramp from SR 535 WB*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*-4 On Ramp from SR 535 WB*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5571*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2310*	pc/h/ln
S	*56.0*	mph
D = v_p / S	*41.2*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 535 WB to Central Florida Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*entral Florida Parkway Off Ramp*
Analysis Time Period		Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6364*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1979*	pc/h/ln
S	*64.4*	mph
D = v_p / S	*30.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*I-4 On Ramp from SR 536 to SR 535 Off Ramp*
Jurisdiction	*35 Off Ramp*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5919*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1841*	pc/h/ln
S	*67.2*	mph
D = v_p / S	*27.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*Osceola Parkway Off Ramp to SR 536 Off Ramp*
Jurisdiction	*536 Off Ramp*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3797*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1574*	pc/h/ln
S	*71.4*	mph
D = v_p / S	*22.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 535 Off Ramp to I-4 On Ramp from SR 535 EB*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*from SR 535 EB*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4607*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1910*	pc/h/ln
S	*65.8*	mph
D = v_p / S	*29.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 536 Off Ramp to I-4 On Ramp from Osceola Parkway*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*from Osceola Parkway*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3125*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1296*	pc/h/ln
S	*74.0*	mph
D = v_p / S	*17.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*15 US 192 Off Ramp to I-4 On Ramp from Osceola Parkway*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*mp from Osceola Parkway*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1978*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*820*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*10.9*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from Central Florida Parkway to SR 535 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*a Parkway to SR 535 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6451*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2006*	pc/h/ln
S	*63.8*	mph
D = v_p / S	*31.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 535 to SR 536 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*36 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5083*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1581*	pc/h/ln
S	*71.3*	mph
D = v_p / S	*22.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 536 to US 192 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*92 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3416*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1062*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*14.2*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*Osceola Parkway Off Ramp to I-4 On Ramp from SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*On Ramp from SR 536*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2544*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1055*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*14.1*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*SR 535 Off Ramp to I-4 On Ramp from SR 535*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*from SR 535*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4326*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1794*	pc/h/ln
S	*68.0*	mph
D = v_p / S	*26.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*SR 536 Off Ramp to Osceola Parkway Off Ramp*
Jurisdiction	*way Off Ramp*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3523*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1461*	pc/h/ln
S	*72.6*	mph
D = v_p / S	*20.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*1 I-4 On Ramp from US 192 to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*ceola Parkway Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5220*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2187*	pc/h/ln
S	*59.4*	mph
D = v_p / S	*36.8*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*I-4 On Ramp from Osceola Parkway to I-4 On Ramp from SR 536*
Jurisdiction	*y to I-4 On Ramp from SR 536*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3835*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1607*	pc/h/ln
S	*70.9*	mph
D = v_p / S	*22.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from Osceola Parkway to I-4 On Ramp from SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*y to I-4 On Ramp from SR 536*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3835*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1607*	pc/h/ln
S	*70.9*	mph
D = v_p / S	*22.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 535 WB to Central Florida Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*entral Florida Parkway Off Ramp*
Analysis Time Period		Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6232*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1958*	pc/h/ln
S	*64.8*	mph
D = v_p / S	*30.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*I-4 On Ramp from SR 536 to SR 535 Off Ramp*
Jurisdiction	*35 Off Ramp*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5323*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1673*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*23.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*Osceola Parkway Off Ramp to SR 536 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*536 Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4393*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1841*	pc/h/ln
S	*67.2*	mph
D = v_p / S	*27.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*SR 535 Off Ramp to I-4 On Ramp from SR 535 EB*
Jurisdiction	*from SR 535 EB*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4804*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2013*	pc/h/ln
S	*63.6*	mph
D = v_p / S	*31.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 536 Off Ramp to I-4 On Ramp from Osceola Parkway*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*from Osceola Parkway*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3561*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1492*	pc/h/ln
S	*72.3*	mph
D = v_p / S	*20.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*15 US 192 Off Ramp to I-4 On Ramp from Osceola Parkway*
Jurisdiction	*mp from Osceola Parkway*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*841*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*352*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*4.7*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from Central Florida Parkway to SR 535 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*a Parkway to SR 535 Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5974*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1877*	pc/h/ln
S	*66.5*	mph
D = v_p / S	*28.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 535 to SR 536 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*36 Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5135*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1614*	pc/h/ln
S	*70.8*	mph
D = v_p / S	*22.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 536 to US 192 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*92 Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2821*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*886*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*11.8*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*Osceola Parkway Off Ramp to I-4 On Ramp from SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*On Ramp from SR 536*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2229*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*934*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*12.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*SR 535 Off Ramp to I-4 On Ramp from SR 535*
Jurisdiction	*from SR 535*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4318*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1809*	pc/h/ln
S	*67.8*	mph
D = v_p / S	*26.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*SR 536 Off Ramp to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*way Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3282*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1375*	pc/h/ln
S	*73.4*	mph
D = v_p / S	*18.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*1 I-4 On Ramp from US 192 to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*ceola Parkway Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3493*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1448*	pc/h/ln
S	*72.8*	mph
D = v_p / S	*19.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from Osceola Parkway to I-4 On Ramp from SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*y to I-4 On Ramp from SR 536*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3970*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1646*	pc/h/ln
S	*70.4*	mph
D = v_p / S	*23.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 535 EB to I-4 On Ramp from SR 535 WB*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*-4 On Ramp from SR 535 WB*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5571*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2310*	pc/h/ln
S	*56.0*	mph
D = v_p / S	*41.2*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*I-4 On Ramp from SR 535 WB to Central Florida Parkway Off Ramp*
Jurisdiction	*entral Florida Parkway Off Ramp*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6364*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1979*	pc/h/ln
S	*64.4*	mph
D = v_p / S	*30.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 536 to SR 535 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*35 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5919*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1841*	pc/h/ln
S	*67.2*	mph
D = v_p / S	*27.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*Osceola Parkway Off Ramp to SR 536 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*536 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3797*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1574*	pc/h/ln
S	*71.4*	mph
D = v_p / S	*22.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 535 Off Ramp to I-4 On Ramp from SR 535 EB*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*from SR 535 EB*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4607*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1910*	pc/h/ln
S	*65.8*	mph
D = v_p / S	*29.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 536 Off Ramp to I-4 On Ramp from Osceola Parkway*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*from Osceola Parkway*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3125*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1296*	pc/h/ln
S	*74.0*	mph
D = v_p / S	*17.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*15 US 192 Off Ramp to I-4 On Ramp from Osceola Parkway*
Jurisdiction	*mp from Osceola Parkway*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1978*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*820*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*10.9*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from Central Florida Parkway to SR 535 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*a Parkway to SR 535 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6451*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2006*	pc/h/ln
S	*63.8*	mph
D = v_p / S	*31.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*I-4 On Ramp from SR 535 to SR 536 Off Ramp*
Jurisdiction	*36 Off Ramp*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5303*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1649*	pc/h/ln
S	*70.3*	mph
D = v_p / S	*23.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*I-4 On Ramp from SR 536 to US 192 Off Ramp*
Jurisdiction	*92 Off Ramp*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3416*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1062*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*14.2*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*Osceola Parkway Off Ramp to I-4 On Ramp from SR 536*
Jurisdiction	*On Ramp from SR 536*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2544*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1055*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*14.1*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*SR 535 Off Ramp to I-4 On Ramp from SR 535*
Jurisdiction	*from SR 535*
Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4546*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1885*	pc/h/ln
S	*66.3*	mph
D = v_p / S	*28.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*SR 536 Off Ramp to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*way Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2016*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3523*	veh/h	Peak-Hour Factor, PHF	*0.96*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1461*	pc/h/ln
S	*72.6*	mph
D = v_p / S	*20.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*1 I-4 On Ramp from US 192 to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*ceola Parkway Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5220*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2187*	pc/h/ln
S	*59.4*	mph
D = v_p / S	*36.8*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*86 HOV Off north of Osceola Parkway to HOV On from Osceola Parkway-SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*kway to HOV On from Osceola Parkway-SR 536*
Analysis Time Period	*kway-SR 536*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*620*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.33*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.3*	mph
FFS	*74.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*393*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*5.2*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*87 HOV On from Osceola Parkway-SR 536 to Street B On*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*SR 536 to Street B On*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1506*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*956*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*12.7*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 Off Ramp to CD System to Edge of Study Area*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*ge of Study Area*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5430*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2275*	pc/h/ln
S	*57.0*	mph
D = v_p / S	*39.9*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from Osceola Parkway to I-4 On Ramp from SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*y to I-4 On Ramp from SR 536*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5051*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2116*	pc/h/ln
S	*61.2*	mph
D = v_p / S	*34.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 536 to SR 535 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*35 Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6965*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2189*	pc/h/ln
S	*59.4*	mph
D = v_p / S	*36.9*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*Osceola Parkway Off Ramp to SR 536 Off Ramp*
Jurisdiction	*536 Off Ramp*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4758*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1994*	pc/h/ln
S	*64.1*	mph
D = v_p / S	*31.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 535 Off Ramp to Off Ramp to CD System*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*CD System*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6314*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2645*	pc/h/ln
S	*45.0*	mph
D = v_p / S	*58.7*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 536 Off Ramp to I-4 On Ramp from Osceola Parkway*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*from Osceola Parkway*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3598*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1508*	pc/h/ln
S	*72.1*	mph
D = v_p / S	*20.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*101 HOV Off to Street B to HOV Off at SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*Off at SR 536*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1595*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1012*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*13.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*102 HOV Off at SR 536 to HOV On at SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*at SR 536*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*770*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.33*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.3*	mph
FFS	*74.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*489*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*6.5*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*103 HOV On at SR 536 to HOV Off north of World Drive*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*north of World Drive*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1114*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.33*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.3*	mph
FFS	*74.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*707*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*9.4*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*15 US 192 Off Ramp to I-4 On Ramp from Osceola Parkway*
Jurisdiction	*mp from Osceola Parkway*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*841*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*352*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*4.7*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*Edge of Study Area to I-4 On Ramp from CD System*
Jurisdiction	*mp from CD System*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6042*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2532*	pc/h/ln
S	*49.0*	mph
D = v_p / S	*51.7*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from CD System to I-4 On Ramp from SR 535*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*-4 On Ramp from SR 535*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6843*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2867*	pc/h/ln
S	*36.4*	mph
D = v_p / S	*78.7*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from SR 535 to SR 536 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*36 Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7983*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2509*	pc/h/ln
S	*49.8*	mph
D = v_p / S	*50.4*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*Osceola Parkway Off Ramp to Edge of Study Area*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*e of Study Area*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5053*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2117*	pc/h/ln
S	*61.2*	mph
D = v_p / S	*34.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*SR 536 Off Ramp to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*way Off Ramp*
Analysis Time Period	*AM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6477*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2714*	pc/h/ln
S	*42.5*	mph
D = v_p / S	*63.9*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*1 I-4 On Ramp from US 192 to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*ceola Parkway Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5220*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2187*	pc/h/ln
S	*59.4*	mph
D = v_p / S	*36.8*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*86 HOV Off north of Osceola Parkway to HOV On from Osceola Parkway-SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*kway to HOV On from Osceola Parkway-SR 536*
Analysis Time Period	*kway-SR 536*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*770*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*5*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.33*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.3*	mph
FFS	*74.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*489*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*6.5*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*87 HOV On from Osceola Parkway-SR 536 to Street B On*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*SR 536 to Street B On*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1595*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1012*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*13.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 Off Ramp to CD System to Edge of Study Area*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*ge of Study Area*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6091*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2552*	pc/h/ln
S	*48.3*	mph
D = v_p / S	*52.8*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*I-4 On Ramp from Osceola Parkway to I-4 On Ramp from SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*y to I-4 On Ramp from SR 536*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6356*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2663*	pc/h/ln
S	*44.4*	mph
D = v_p / S	*60.0*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*I-4 On Ramp from SR 536 to SR 535 Off Ramp*
Jurisdiction	*35 Off Ramp*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8369*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2630*	pc/h/ln
S	*45.6*	mph
D = v_p / S	*57.7*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*Osceola Parkway Off Ramp to SR 536 Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*536 Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5858*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2454*	pc/h/ln
S	*51.6*	mph
D = v_p / S	*47.6*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 EB*
From/To	*SR 535 Off Ramp to Off Ramp to CD System*
Jurisdiction	*CD System*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6974*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2922*	pc/h/ln
S	*34.1*	mph
D = v_p / S	*85.7*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 EB*
Agency or Company	*HDR Inc.*	From/To	*SR 536 Off Ramp to I-4 On Ramp from Osceola Parkway*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*from Osceola Parkway*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4548*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1906*	pc/h/ln
S	*65.9*	mph
D = v_p / S	*28.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*101 HOV Off to Street B to HOV Off at SR 536*
Jurisdiction	*Off at SR 536*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1506*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*5*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*0.85*		E_R	*1.2*
E_T	*1.5*		$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*956*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*12.7*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*102 HOV Off at SR 536 to HOV On at SR 536*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*at SR 536*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*620*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.33*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.3*	mph
FFS	*74.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*393*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*5.2*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*103 HOV On at SR 536 to HOV Off north of World Drive*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*north of World Drive*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1007*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*5*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.976*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*2*	
Total Ramp Density, TRD	*0.33*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.3*	mph
FFS	*74.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*639*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*8.5*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*15 US 192 Off Ramp to I-4 On Ramp from Osceola Parkway*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*mp from Osceola Parkway*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*841*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*352*	pc/h/ln
S	*75.0*	mph
D = v_p / S	*4.7*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*Edge of Study Area to I-4 On Ramp from CD System*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*mp from CD System*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5565*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2332*	pc/h/ln
S	*55.4*	mph
D = v_p / S	*42.1*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*I-4 On Ramp from CD System to I-4 On Ramp from SR 535*
Jurisdiction	*-4 On Ramp from SR 535*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6448*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2702*	pc/h/ln
S	*42.9*	mph
D = v_p / S	*62.9*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*I-4 On Ramp from SR 535 to SR 536 Off Ramp*
Jurisdiction	*36 Off Ramp*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7297*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD	*0.50*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*1.8*	mph
FFS	*73.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2293*	pc/h/ln
S	*56.5*	mph
D = v_p / S	*40.6*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	*SP*
Agency or Company	*HDR Inc.*
Date Performed	*8/21/2014 11:27:50 AM*
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-4 WB*
From/To	*Osceola Parkway Off Ramp to Edge of Study Area*
Jurisdiction	*e of Study Area*
Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3980*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.83*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.8*	mph
FFS	*72.6*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1668*	pc/h/ln
S	*70.1*	mph
D = v_p / S	*23.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst	*SP*	Highway/Direction of Travel	*I-4 WB*
Agency or Company	*HDR Inc.*	From/To	*SR 536 Off Ramp to Osceola Parkway Off Ramp*
Date Performed	*8/21/2014 11:27:50 AM*	Jurisdiction	*way Off Ramp*
Analysis Time Period	*PM*	Analysis Year	*2020*

Project Description *I-4 SAMR Re-Eval*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5570*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*0.85*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Side Lat. Clearance	*6.0*	ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD	*0.67*	ramps/mi
FFS (measured)		mph
Base free-flow Speed, BFFS	*75.4*	mph

Calc Speed Adj and FFS

f_{LW}	*0.0*	mph
f_{LC}	*0.0*	mph
TRD Adjustment	*2.3*	mph
FFS	*73.1*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2334*	pc/h/ln
S	*55.3*	mph
D = v_p / S	*42.2*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Copyright © 2012 University of Florida, All Rights Reserved

HCS – Ramp Merge/Diverge Outputs

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	1 Osceola Parkway Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	1853 ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	775 veh/h	Freeway Volume, V_F	3493	V_D =	veh/h
		Ramp Volume, V_R	304		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3493	0.95	Level	3	0	0.985	0.85	4391
Ramp	304	0.95	Level	3	0	0.985	0.85	382
UpStream	775	0.95	Level	3	0	0.985	0.85	974
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 6813.05 (Equation 13-12 or 13-13)

P_{FD} = 0.633 using Equation (Exhibit 13-7)

V_{12} = 2918 pc/h

V_3 or V_{av34} 1473 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4391	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4009	Exhibit 13-8	7050	No
V_R	382	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2918	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 15.8 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.462 (Exhibit 13-12)

S_R= 54.4 mph (Exhibit 13-12)

S_0= 69.5 mph (Exhibit 13-12)

S = 58.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1500	☑ No	☐ Off
L_{up} =	5752 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	672 veh/h	Freeway Volume, V_F	3125	V_D =	veh/h
		Ramp Volume, V_R	845		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3125	0.95	Level	3	0	0.985	0.85	3928
Ramp	845	0.95	Level	3	0	0.985	0.85	1062
UpStream	672	0.95	Level	3	0	0.985	0.85	845
DownStream								

Merge Areas | **Diverge Areas**

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1946.86 (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2433 pc/h

V_3 or V_{av34} 1495 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	4990	Exhibit 13-8		No

Diverge Areas

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3495	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

Merge Areas

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 22.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Diverge Areas

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

Merge Areas

M_S = 0.300 (Exibit 13-11)

Diverge Areas

D_s = (Exhibit 13-12)

S_R=	58.1 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	61.4 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	59.1 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1500	L_{down} = 2604 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 1949 veh/h
	Freeway Volume, V_F: 3125	
	Ramp Volume, V_R: 845	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3125	0.95	Level	3	0	0.985	0.85	3928
Ramp	845	0.95	Level	3	0	0.985	0.85	1062
UpStream								
DownStream	1949	0.95	Level	3	0	0.985	0.85	2450

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2433 pc/h

V_3 or V_{av34} 1495 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4990	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3495	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 22.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.300 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	58.1 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	61.4 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	59.1 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-4 EB
Junction	I-4 On Ramp from SR 535 EB
Jurisdiction	FDOT
Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	5571
Ramp Volume, V_R	793
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 4664 ft

V_D = 495 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5571	0.95	Level	3	0	0.985	0.85	7003
Ramp	793	0.95	Level	3	0	0.985	0.85	997
UpStream								
DownStream	495	0.95	Level	3	0	0.985	0.85	622

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 4338 pc/h

V_3 or V_{av34} 2665 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8000	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5335	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 37.2 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.980 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	42.5 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.3 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	46.2 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535 WB
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 975	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 4607	
	Ramp Volume, V_R: 964	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4607	0.95	Level	3	0	0.985	0.85	5791
Ramp	964	0.95	Level	3	0	0.985	0.85	1212
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 3214 pc/h

V_3 or V_{av34} 2577 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 3309 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7003	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4521	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 23.1 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.407 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	55.6 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	57.4 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	56.2 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3970	
	Ramp Volume, V_R: 1949	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3970	0.95	Level	3	0	0.985	0.85	4990
Ramp	1949	0.95	Level	3	0	0.985	0.85	2450
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2769 pc/h

V_3 or V_{av34} 2221 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2851 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7440	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5301	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 28.8 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.833 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	45.8 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	49.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway / Ramp Inputs		Downstream Adj Ramp	
☑ Yes	☑ On	Freeway Number of Lanes, N	4	☐ Yes	☐ On
☐ No	☐ Off	Ramp Number of Lanes, N	1	☑ No	☐ Off
L_{up} =	1627 ft	Acceleration Lane Length, L_A		L_{down} =	ft
V_u =	1949 veh/h	Deceleration Lane Length L_D	1500	V_D =	veh/h
		Freeway Volume, V_F	5919		
		Ramp Volume, V_R	1312		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5919	0.95	Level	3	0	0.985	0.85	7440
Ramp	1312	0.95	Level	3	0	0.985	0.85	1649
UpStream	1949	0.95	Level	3	0	0.985	0.85	2450
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 4174 pc/h

V_3 or V_{av34} 1633 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7440	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5791	Exhibit 13-8	9400	No
V_R	1649	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4174	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 26.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.576 (Exhibit 13-12)

S_R= 51.7 mph (Exhibit 13-12)

S_0= 68.8 mph (Exhibit 13-12)

S = 58.1 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☑ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☑ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = 2725 ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = 964 veh/h
	Freeway Volume, V_F: 5919	
	Ramp Volume, V_R: 1312	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5919	0.95	Level	3	0	0.985	0.85	7440
Ramp	1312	0.95	Level	3	0	0.985	0.85	1649
UpStream								
DownStream	964	0.95	Level	3	0	0.985	0.85	1212

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 4174 pc/h

V_3 or V_{av34} 1633 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7440	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5791	Exhibit 13-8	9400	No
V_R	1649	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4174	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 26.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.576 (Exhibit 13-12)

S_R= 51.7 mph (Exhibit 13-12)

S_0= 68.8 mph (Exhibit 13-12)

S = 58.1 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3797	V_D =	veh/h
		Ramp Volume, V_R	672		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3797	0.95	Level	3	0	0.985	0.85	4773
Ramp	672	0.95	Level	3	0	0.985	0.85	845
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2613 pc/h

V_3 or V_{av34} 2160 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2727 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4773	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	3928	Exhibit 13-8	7050	No
V_R	845	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2613	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$$

D_R = 0.7 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.504 (Exhibit 13-12)

S_R= 53.4 mph (Exhibit 13-12)

S_0= 67.2 mph (Exhibit 13-12)

S = 58.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	13 US 192 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 3416	
	Ramp Volume, V_R: 493	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3416	0.95	Level	3	0	0.985	0.85	4294
Ramp	493	0.95	Level	3	0	0.985	0.85	620
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 1575 pc/h

V_3 or V_{av34} 1359 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 1717 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4294	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	3674	Exhibit 13-8	9400	No
V_R	620	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1575	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$$

D_R = -8.0 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.484 (Exhibit 13-12)

S_R= 53.9 mph (Exhibit 13-12)

S_0= 70.2 mph (Exhibit 13-12)

S = 62.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-4 WB
Junction	
Jurisdiction	FDOT
Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 3556 ft

V_u = 493 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	857
Deceleration Lane Length L_D	
Freeway Volume, V_F	2923
Ramp Volume, V_R	147
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2923	0.95	Level	3	0	0.985	0.85	3674
Ramp	147	0.95	Level	3	0	0.985	0.85	185
UpStream	493	0.95	Level	3	0	0.985	0.85	620
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1419.33 (Equation 13-6 or 13-7)

P_{FM} = 0.601 using Equation (Exhibit 13-6)

V_{12} = 2210 pc/h

V_3 or V_{av34} 1464 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3859	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2395	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 18.7 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.278 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	58.6 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	61.5 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	59.7 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-4 WB
Junction	
Jurisdiction	FDOT
Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	857
Deceleration Lane Length L_D	
Freeway Volume, V_F	2923
Ramp Volume, V_R	147
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 6162 ft

V_D = 485 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2923	0.95	Level	3	0	0.985	0.85	3674
Ramp	147	0.95	Level	3	0	0.985	0.85	185
UpStream								
DownStream	485	0.95	Level	3	0	0.985	0.85	610

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.601 using Equation (Exhibit 13-6)

V_{12} = 2210 pc/h

V_3 or V_{av34} 1464 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3859	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2395	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 18.7 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.278 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	58.6 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	61.5 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	59.7 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	4326
Ramp Volume, V_R	757
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 3067 ft
V_D = 1560 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4326	0.95	Level	3	0	0.985	0.85	5438
Ramp	757	0.95	Level	3	0	0.985	0.85	952
UpStream								
DownStream	1560	0.95	Level	3	0	0.985	0.85	1961

Merge Areas | **Diverge Areas**

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.619 using Equation (Exhibit 13-6)
V_{12} = 3369 pc/h
V_3 or V_{av34} 2069 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6390	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4321	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 29.3 (pc/mi/ln)
LOS = D (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.465 (Exibit 13-11)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	54.3 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.4 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	55.9 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-4 WB
Junction	I-4 On Ramp from SR 536
Jurisdiction	FDOT
Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	2544
Ramp Volume, V_R	872
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 2766 ft

V_D = 493 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2544	0.95	Level	3	0	0.985	0.85	3198
Ramp	872	0.95	Level	3	0	0.985	0.85	1096
UpStream								
DownStream	493	0.95	Level	3	0	0.985	0.85	620

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 1981 pc/h

V_3 or V_{av34} 1217 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4294	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3077	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 19.6 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.256 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	59.1 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	62.4 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	60.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	Osceola Pkwy Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	3523
Ramp Volume, V_R	979
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3523	0.95	Level	3	0	0.985	0.85	4428
Ramp	979	0.95	Level	3	0	0.985	0.85	1231
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R = mph (Exhibit 13-11)
S_0 = mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 2670 pc/h
V_3 or V_{av34} 1758 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4428	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	3197	Exhibit 13-8	7050	No
V_R	1231	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2670	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 0.2 (pc/mi/ln)
LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.539 (Exhibit 13-12)
S_R = 52.6 mph (Exhibit 13-12)
S_0 = 68.3 mph (Exhibit 13-12)
S = 57.9 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	4
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	6451
Ramp Volume, V_R	2125
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6451	0.95	Level	3	0	0.985	0.85	8109
Ramp	2125	0.95	Level	3	0	0.985	0.85	2671
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.260 using Equation (Exhibit 13-7)
V_{12} = 4085 pc/h
V_3 or V_{av34} 2012 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8109	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5438	Exhibit 13-8	9400	No
V_R	2671	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4085	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 12.4 (pc/mi/ln)
LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.668 (Exhibit 13-12)
S_R= 49.6 mph (Exhibit 13-12)
S_0= 67.4 mph (Exhibit 13-12)
S = 57.1 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 5083	
	Ramp Volume, V_R: 1560	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5083	0.95	Level	3	0	0.985	0.85	6389
Ramp	1560	0.95	Level	3	0	0.985	0.85	1961
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3112 pc/h

V_3 or V_{av34} 1638 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6389	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	4428	Exhibit 13-8	9400	No
V_R	1961	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3112	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 4.0 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.604 (Exhibit 13-12)

S_R = 51.1 mph (Exhibit 13-12)

S_0 = 68.8 mph (Exhibit 13-12)

S = 58.9 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	1 Osceola Parkway Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway / Ramp		Downstream Adj Ramp	
☑ Yes	☑ On	Freeway Number of Lanes, N	3	☐ Yes	☐ On
☐ No	☐ Off	Ramp Number of Lanes, N	1	☑ No	☐ Off
L_{up} =	1853 ft	Acceleration Lane Length, L_A		L_{down} =	ft
V_u =	1133 veh/h	Deceleration Lane Length L_D	1500	V_D =	veh/h
		Freeway Volume, V_F	5357		
		Ramp Volume, V_R	964		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5357	0.95	Level	3	0	0.985	0.85	6734
Ramp	964	0.95	Level	3	0	0.985	0.85	1212
UpStream	1133	0.95	Level	3	0	0.985	0.85	1424
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = 10645.14 (Equation 13-12 or 13-13)

P_{FD} = 0.536 using Equation (Exhibit 13-7)

V_{12} = 4171 pc/h

V_3 or V_{av34} 2563 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6734	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	5522	Exhibit 13-8	7050	No
V_R	1212	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4171	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$$

D_R = 26.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.537 (Exhibit 13-12)

S_R= 52.6 mph (Exhibit 13-12)

S_0= 65.2 mph (Exhibit 13-12)

S = 56.8 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-4 EB
Junction	
Jurisdiction	FDOT
Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 5752 ft

V_u = 832 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	3561
Ramp Volume, V_R	274
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3561	0.95	Level	3	0	0.985	0.85	4476
Ramp	274	0.95	Level	3	0	0.985	0.85	344
UpStream	832	0.95	Level	3	0	0.985	0.85	1046
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1910.48 (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2773 pc/h

V_3 or V_{av34} 1703 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4820	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3117	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 20.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.259 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	59.0 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	60.7 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	59.6 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-4 EB
Junction	
Jurisdiction	FDOT
Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	3561
Ramp Volume, V_R	274
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 2604 ft

V_D = 1488 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3561	0.95	Level	3	0	0.985	0.85	4476
Ramp	274	0.95	Level	3	0	0.985	0.85	344
UpStream								
DownStream	1488	0.95	Level	3	0	0.985	0.85	1870

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2773 pc/h

V_3 or V_{av34} 1703 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4820	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3117	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 20.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.259 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	59.0 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	60.7 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	59.6 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535 EB
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1500	L_{down} = 4664 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 483 veh/h
	Freeway Volume, V_F: 5397	
	Ramp Volume, V_R: 835	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5397	0.95	Level	3	0	0.985	0.85	6784
Ramp	835	0.95	Level	3	0	0.985	0.85	1050
UpStream								
DownStream	483	0.95	Level	3	0	0.985	0.85	607

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 4203 pc/h

V_3 or V_{av34} 2581 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7834	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5253	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 36.6 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.916 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	43.9 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.8 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	47.5 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535 WB
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 975	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 4804	
	Ramp Volume, V_R: 593	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4804	0.95	Level	3	0	0.985	0.85	6038
Ramp	593	0.95	Level	3	0	0.985	0.85	745
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 3351 pc/h

V_3 or V_{av34} 2687 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3450 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6783	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4195	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 20.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.307 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	57.9 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.7 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	57.5 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3835	
	Ramp Volume, V_R: 1488	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3835	0.95	Level	3	0	0.985	0.85	4820
Ramp	1488	0.95	Level	3	0	0.985	0.85	1870
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2675 pc/h

V_3 or V_{av34} 2145 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2754 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6690	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4624	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 23.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.448 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	54.7 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.4 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	56.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway / Ramp		Downstream Adj Ramp	
☑ Yes	☑ On	Freeway Number of Lanes, N	4	☐ Yes	☐ On
☐ No	☐ Off	Ramp Number of Lanes, N	1	☑ No	☐ Off
L_{up} =	1627 ft	Acceleration Lane Length, L_A		L_{down} =	ft
V_u =	1488 veh/h	Deceleration Lane Length L_D	1500	V_D =	veh/h
		Freeway Volume, V_F	5323		
		Ramp Volume, V_R	519		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5323	0.95	Level	3	0	0.985	0.85	6691
Ramp	519	0.95	Level	3	0	0.985	0.85	652
UpStream	1488	0.95	Level	3	0	0.985	0.85	1870
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3285 pc/h

V_3 or V_{av34} 1703 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6691	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	6039	Exhibit 13-8	9400	No
V_R	652	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3285	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$$

D_R = 19.0 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.487 (Exhibit 13-12)

S_R= 53.8 mph (Exhibit 13-12)

S_0= 68.6 mph (Exhibit 13-12)

S = 60.4 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☑ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☑ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = 2725 ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = 593 veh/h
	Freeway Volume, V_F: 5323	
	Ramp Volume, V_R: 519	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5323	0.95	Level	3	0	0.985	0.85	6691
Ramp	519	0.95	Level	3	0	0.985	0.85	652
UpStream								
DownStream	593	0.95	Level	3	0	0.985	0.85	745

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3285 pc/h

V_3 or V_{av34} 1703 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6691	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	6039	Exhibit 13-8	9400	No
V_R	652	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3285	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 19.0 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.487 (Exhibit 13-12)

S_R= 53.8 mph (Exhibit 13-12)

S_0= 68.6 mph (Exhibit 13-12)

S = 60.4 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway / Ramp Inputs		Downstream Adj Ramp	
☐ Yes	☐ On	Freeway Number of Lanes, N	3	☐ Yes	☐ On
☑ No	☐ Off	Ramp Number of Lanes, N	2	☑ No	☐ Off
L_{up} =	ft	Acceleration Lane Length, L_A		L_{down} =	ft
V_u =	veh/h	Deceleration Lane Length L_D	1500	V_D =	veh/h
		Freeway Volume, V_F	4393		
		Ramp Volume, V_R	832		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4393	0.95	Level	3	0	0.985	0.85	5522
Ramp	832	0.95	Level	3	0	0.985	0.85	1046
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 3060 pc/h

V_3 or V_{av34} 2462 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3155 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5522	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4476	Exhibit 13-8	7050	No
V_R	1046	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3060	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$$

D_R = 4.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.522 (Exhibit 13-12)

S_R = 53.0 mph (Exhibit 13-12)

S_0 = 66.0 mph (Exhibit 13-12)

S = 57.9 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	13 US 192 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 2821	
	Ramp Volume, V_R: 771	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2821	0.95	Level	3	0	0.985	0.85	3546
Ramp	771	0.95	Level	3	0	0.985	0.85	969
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 1639 pc/h

V_3 or V_{av34} 953 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3546	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	2577	Exhibit 13-8	9400	No
V_R	969	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1639	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = -8.7 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.515 (Exhibit 13-12)

S_R = 53.2 mph (Exhibit 13-12)

S_0 = 71.3 mph (Exhibit 13-12)

S = 61.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-4 WB
Junction	I-4 On Ramp from SR 535
Jurisdiction	FDOT
Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	4318
Ramp Volume, V_R	817
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 3067 ft

V_D = 1853 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4318	0.95	Level	3	0	0.985	0.85	5428
Ramp	817	0.95	Level	3	0	0.985	0.85	1027
UpStream								
DownStream	1853	0.95	Level	3	0	0.985	0.85	2329

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 3363 pc/h

V_3 or V_{av34} 2065 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6455	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4390	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 29.8 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.485 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	53.8 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.4 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	55.5 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-4 WB
Junction	I-4 On Ramp from SR 536
Jurisdiction	FDOT
Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	2229
Ramp Volume, V_R	592
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 2766 ft

V_D = 771 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2229	0.95	Level	3	0	0.985	0.85	2802
Ramp	592	0.95	Level	3	0	0.985	0.85	744
UpStream								
DownStream	771	0.95	Level	3	0	0.985	0.85	969

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 1736 pc/h

V_3 or V_{av34} 1066 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3546	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2480	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 15.1 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.218 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.0 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	63.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	60.9 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	Osceola Pkwy Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 3282	
	Ramp Volume, V_R: 1053	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3282	0.95	Level	3	0	0.985	0.85	4125
Ramp	1053	0.95	Level	3	0	0.985	0.85	1324
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2584 pc/h

V_3 or V_{av34} 1541 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4125	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	2801	Exhibit 13-8	7050	No
V_R	1324	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2584	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = -0.5 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.547 (Exhibit 13-12)

S_R = 52.4 mph (Exhibit 13-12)

S_0 = 69.2 mph (Exhibit 13-12)

S = 57.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway / Ramp Inputs		Downstream Adj Ramp	
☐ Yes	☐ On	Freeway Number of Lanes, N	4	☐ Yes	☐ On
☑ No	☐ Off	Ramp Number of Lanes, N	2	☑ No	☐ Off
L_{up} =	ft	Acceleration Lane Length, L_A		L_{down} =	ft
V_u =	veh/h	Deceleration Lane Length L_D	1500	V_D =	veh/h
		Freeway Volume, V_F	5974		
		Ramp Volume, V_R	1656		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5974	0.95	Level	3	0	0.985	0.85	7509
Ramp	1656	0.95	Level	3	0	0.985	0.85	2082
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3493 pc/h

V_3 or V_{av34} 2008 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7509	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5427	Exhibit 13-8	9400	No
V_R	2082	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3493	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 7.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.615 (Exhibit 13-12)

S_R = 50.8 mph (Exhibit 13-12)

S_0 = 67.4 mph (Exhibit 13-12)

S = 58.5 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway / Ramp Inputs		Downstream Adj Ramp	
☐ Yes	☐ On	Freeway Number of Lanes, N	4	☐ Yes	☐ On
☑ No	☐ Off	Ramp Number of Lanes, N	2	☑ No	☐ Off
L_{up} =	ft	Acceleration Lane Length, L_A		L_{down} =	ft
V_u =	veh/h	Deceleration Lane Length L_D	1500	V_D =	veh/h
		Freeway Volume, V_F	5135		
		Ramp Volume, V_R	1853		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5135	0.95	Level	3	0	0.985	0.85	6455
Ramp	1853	0.95	Level	3	0	0.985	0.85	2329
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3402 pc/h

V_3 or V_{av34} 1526 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6455	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	4126	Exhibit 13-8	9400	No
V_R	2329	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3402	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$$

D_R = 6.5 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.638 (Exhibit 13-12)

S_R = 50.3 mph (Exhibit 13-12)

S_0 = 69.3 mph (Exhibit 13-12)

S = 57.8 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	1 Osceola Parkway Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	1853 ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	775 veh/h	Freeway Volume, V_F	3493	V_D =	veh/h
		Ramp Volume, V_R	304		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3493	0.95	Level	3	0	0.985	0.85	4391
Ramp	304	0.95	Level	3	0	0.985	0.85	382
UpStream	775	0.95	Level	3	0	0.985	0.85	974
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 6813.05 (Equation 13-12 or 13-13)

P_{FD} = 0.633 using Equation (Exhibit 13-7)

V_{12} = 2918 pc/h

V_3 or V_{av34} 1473 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4391	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4009	Exhibit 13-8	7050	No
V_R	382	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2918	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 15.8 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.462 (Exhibit 13-12)

S_R= 54.4 mph (Exhibit 13-12)

S_0= 69.5 mph (Exhibit 13-12)

S = 58.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1500	☑ No	☐ Off
L_{up} =	5752 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	672 veh/h	Freeway Volume, V_F	3125	V_D =	veh/h
		Ramp Volume, V_R	845		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3125	0.95	Level	3	0	0.985	0.85	3928
Ramp	845	0.95	Level	3	0	0.985	0.85	1062
UpStream	672	0.95	Level	3	0	0.985	0.85	845
DownStream								

Merge Areas | **Diverge Areas**

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1946.86 (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2433 pc/h

V_3 or V_{av34} 1495 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	4990	Exhibit 13-8		No

Diverge Areas

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3495	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

Merge Areas

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 22.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Diverge Areas

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

Merge Areas

M_S = 0.300 (Exibit 13-11)

Diverge Areas

D_s = (Exhibit 13-12)

S_R=	58.1 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	61.4 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	59.1 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	3125
Ramp Volume, V_R	845
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 2604 ft

V_D = 1949 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3125	0.95	Level	3	0	0.985	0.85	3928
Ramp	845	0.95	Level	3	0	0.985	0.85	1062
UpStream								
DownStream	1949	0.95	Level	3	0	0.985	0.85	2450

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2433 pc/h

V_3 or V_{av34} 1495 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4990	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3495	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 22.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.300 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	58.1 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	61.4 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	59.1 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535 EB
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1500	L_{down} = 4664 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 495 veh/h
	Freeway Volume, V_F: 5571	
	Ramp Volume, V_R: 793	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5571	0.95	Level	3	0	0.985	0.85	7003
Ramp	793	0.95	Level	3	0	0.985	0.85	997
UpStream								
DownStream	495	0.95	Level	3	0	0.985	0.85	622

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 4338 pc/h

V_3 or V_{av34} 2665 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8000	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5335	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 37.2 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.980 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	42.5 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.3 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	46.2 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535 WB
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	975
Deceleration Lane Length L_D	
Freeway Volume, V_F	4607
Ramp Volume, V_R	964
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4607	0.95	Level	3	0	0.985	0.85	5791
Ramp	964	0.95	Level	3	0	0.985	0.85	1212
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.555 using Equation (Exhibit 13-6)
V_{12} = 3214 pc/h
V_3 or V_{av34} 2577 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes,V_{12a} = 3309 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7003	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4521	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 23.1 (pc/mi/ln)
LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.407 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	55.6 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	57.4 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	56.2 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3970	
	Ramp Volume, V_R: 1949	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3970	0.95	Level	3	0	0.985	0.85	4990
Ramp	1949	0.95	Level	3	0	0.985	0.85	2450
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2769 pc/h

V_3 or V_{av34} 2221 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2851 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7440	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5301	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 28.8 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.833 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	45.8 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	49.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	1627 ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	1949 veh/h	Freeway Volume, V_F	5919	V_D =	veh/h
		Ramp Volume, V_R	1312		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5919	0.95	Level	3	0	0.985	0.85	7440
Ramp	1312	0.95	Level	3	0	0.985	0.85	1649
UpStream	1949	0.95	Level	3	0	0.985	0.85	2450
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 4174 pc/h

V_3 or V_{av34} 1633 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7440	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5791	Exhibit 13-8	9400	No
V_R	1649	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4174	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 26.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.576 (Exhibit 13-12)

S_R= 51.7 mph (Exhibit 13-12)

S_0= 68.8 mph (Exhibit 13-12)

S = 58.1 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☑ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☑ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = 2725 ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = 964 veh/h
	Freeway Volume, V_F: 5919	
	Ramp Volume, V_R: 1312	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5919	0.95	Level	3	0	0.985	0.85	7440
Ramp	1312	0.95	Level	3	0	0.985	0.85	1649
UpStream								
DownStream	964	0.95	Level	3	0	0.985	0.85	1212

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 4174 pc/h

V_3 or V_{av34} 1633 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7440	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5791	Exhibit 13-8	9400	No
V_R	1649	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4174	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 26.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.576 (Exhibit 13-12)

S_R= 51.7 mph (Exhibit 13-12)

S_0= 68.8 mph (Exhibit 13-12)

S = 58.1 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	3797	V_D =	veh/h
		Ramp Volume, V_R	672		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3797	0.95	Level	3	0	0.985	0.85	4773
Ramp	672	0.95	Level	3	0	0.985	0.85	845
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2613 pc/h

V_3 or V_{av34} 2160 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2727 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4773	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	3928	Exhibit 13-8	7050	No
V_R	845	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2613	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$$

D_R = 0.7 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.504 (Exhibit 13-12)

S_R= 53.4 mph (Exhibit 13-12)

S_0= 67.2 mph (Exhibit 13-12)

S = 58.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	13 US 192 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 3416	
	Ramp Volume, V_R: 493	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3416	0.95	Level	3	0	0.985	0.85	4294
Ramp	493	0.95	Level	3	0	0.985	0.85	620
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 1575 pc/h

V_3 or V_{av34} 1359 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 1717 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4294	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	3674	Exhibit 13-8	9400	No
V_R	620	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1575	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = -8.0 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.484 (Exhibit 13-12)

S_R= 53.9 mph (Exhibit 13-12)

S_0= 70.2 mph (Exhibit 13-12)

S = 62.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	4546
Ramp Volume, V_R	757
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 3067 ft
V_D = 1780 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4546	0.95	Level	3	0	0.985	0.85	5714
Ramp	757	0.95	Level	3	0	0.985	0.85	952
UpStream								
DownStream	1780	0.95	Level	3	0	0.985	0.85	2237

Merge Areas | **Diverge Areas**

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.619 using Equation (Exhibit 13-6)
V_{12} = 3540 pc/h
V_3 or V_{av34} 2174 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6666	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4492	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 30.7 (pc/mi/ln)
LOS = D (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.519 (Exibit 13-11)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	53.1 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	54.9 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	2544
Ramp Volume, V_R	872
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2766 ft
V_D = 493 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2544	0.95	Level	3	0	0.985	0.85	3198
Ramp	872	0.95	Level	3	0	0.985	0.85	1096
UpStream								
DownStream	493	0.95	Level	3	0	0.985	0.85	620

Merge Areas | **Diverge Areas**

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.619 using Equation (Exhibit 13-6)
V_{12} = 1981 pc/h
V_3 or V_{av34} 1217 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	4294	Exhibit 13-8		No

Diverge Areas

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3077	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

Merge Areas

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 19.6 (pc/mi/ln)
LOS = B (Exhibit 13-2)

Diverge Areas

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

Merge Areas

M_S = 0.256 (Exibit 13-11)

Diverge Areas

D_s = (Exhibit 13-12)

S_R=	59.1 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	62.4 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	60.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	Osceola Pkwy Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 3523	
	Ramp Volume, V_R: 979	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3523	0.95	Level	3	0	0.985	0.85	4428
Ramp	979	0.95	Level	3	0	0.985	0.85	1231
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2670 pc/h

V_3 or V_{av34} 1758 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4428	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	3197	Exhibit 13-8	7050	No
V_R	1231	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2670	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 0.2 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.539 (Exhibit 13-12)

S_R = 52.6 mph (Exhibit 13-12)

S_0 = 68.3 mph (Exhibit 13-12)

S = 57.9 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	6451	V_D =	veh/h
		Ramp Volume, V_R	1905		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6451	0.95	Level	3	0	0.985	0.85	8109
Ramp	1905	0.95	Level	3	0	0.985	0.85	2395
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3881 pc/h

V_3 or V_{av34} 2114 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8109	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5714	Exhibit 13-8	9400	No
V_R	2395	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3881	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$$

D_R = 10.6 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.644 (Exhibit 13-12)

S_R = 50.2 mph (Exhibit 13-12)

S_0 = 67.0 mph (Exhibit 13-12)

S = 57.7 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 5303	
	Ramp Volume, V_R: 1780	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5303	0.95	Level	3	0	0.985	0.85	6666
Ramp	1780	0.95	Level	3	0	0.985	0.85	2237
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3389 pc/h

V_3 or V_{av34} 1638 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6666	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	4429	Exhibit 13-8	9400	No
V_R	2237	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3389	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 6.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.629 (Exhibit 13-12)

S_R = 50.5 mph (Exhibit 13-12)

S_0 = 68.8 mph (Exhibit 13-12)

S = 58.1 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	1 Osceola Parkway Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	1853 ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	1133 veh/h	Freeway Volume, V_F	5357	V_D =	veh/h
		Ramp Volume, V_R	964		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5357	0.95	Level	3	0	0.985	0.85	6734
Ramp	964	0.95	Level	3	0	0.985	0.85	1212
UpStream	1133	0.95	Level	3	0	0.985	0.85	1424
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 10645.14 (Equation 13-12 or 13-13)

P_{FD} = 0.536 using Equation (Exhibit 13-7)

V_{12} = 4171 pc/h

V_3 or V_{av34} 2563 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6734	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	5522	Exhibit 13-8	7050	No
V_R	1212	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4171	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 26.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.537 (Exhibit 13-12)

S_R= 52.6 mph (Exhibit 13-12)

S_0= 65.2 mph (Exhibit 13-12)

S = 56.8 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-4 EB
Junction	
Jurisdiction	FDOT
Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 5752 ft

V_u = 832 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	3561
Ramp Volume, V_R	274
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3561	0.95	Level	3	0	0.985	0.85	4476
Ramp	274	0.95	Level	3	0	0.985	0.85	344
UpStream	832	0.95	Level	3	0	0.985	0.85	1046
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1910.48 (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2773 pc/h

V_3 or V_{av34} 1703 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4820	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3117	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 20.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.259 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	59.0 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	60.7 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	59.6 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-4 EB
Junction	
Jurisdiction	FDOT
Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	3561
Ramp Volume, V_R	274
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 2604 ft

V_D = 1488 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3561	0.95	Level	3	0	0.985	0.85	4476
Ramp	274	0.95	Level	3	0	0.985	0.85	344
UpStream								
DownStream	1488	0.95	Level	3	0	0.985	0.85	1870

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2773 pc/h

V_3 or V_{av34} 1703 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4820	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3117	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 20.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.259 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	59.0 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	60.7 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	59.6 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535 EB
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1500	L_{down} = 4664 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 483 veh/h
	Freeway Volume, V_F: 5397	
	Ramp Volume, V_R: 835	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5397	0.95	Level	3	0	0.985	0.85	6784
Ramp	835	0.95	Level	3	0	0.985	0.85	1050
UpStream								
DownStream	483	0.95	Level	3	0	0.985	0.85	607

Merge Areas | **Diverge Areas**

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 4203 pc/h

V_3 or V_{av34} 2581 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	7834	Exhibit 13-8		Yes

Diverge Areas

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5253	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

Merge Areas

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 36.6 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Diverge Areas

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

Merge Areas

M_S = 0.916 (Exibit 13-11)

Diverge Areas

D_s = (Exhibit 13-12)

S_R=	43.9 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.8 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	47.5 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535 WB
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 975	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 4804	
	Ramp Volume, V_R: 593	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4804	0.95	Level	3	0	0.985	0.85	6038
Ramp	593	0.95	Level	3	0	0.985	0.85	745
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 3351 pc/h

V_3 or V_{av34} 2687 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3450 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6783	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4195	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 20.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.307 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	57.9 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.7 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	57.5 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 3835	
	Ramp Volume, V_R: 1488	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3835	0.95	Level	3	0	0.985	0.85	4820
Ramp	1488	0.95	Level	3	0	0.985	0.85	1870
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2675 pc/h

V_3 or V_{av34} 2145 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2754 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6690	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4624	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 23.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.448 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	54.7 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.4 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	56.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway / Ramp Inputs		Downstream Adj Ramp	
☑ Yes	☑ On	Freeway Number of Lanes, N	4	☐ Yes	☐ On
☐ No	☐ Off	Ramp Number of Lanes, N	1	☑ No	☐ Off
L_{up} =	1627 ft	Acceleration Lane Length, L_A		L_{down} =	ft
V_u =	1488 veh/h	Deceleration Lane Length L_D	1500	V_D =	veh/h
		Freeway Volume, V_F	5323		
		Ramp Volume, V_R	519		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5323	0.95	Level	3	0	0.985	0.85	6691
Ramp	519	0.95	Level	3	0	0.985	0.85	652
UpStream	1488	0.95	Level	3	0	0.985	0.85	1870
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3285 pc/h

V_3 or V_{av34} 1703 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6691	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	6039	Exhibit 13-8	9400	No
V_R	652	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3285	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 19.0 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.487 (Exhibit 13-12)

S_R= 53.8 mph (Exhibit 13-12)

S_0= 68.6 mph (Exhibit 13-12)

S = 60.4 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☑ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☑ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = 2725 ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = 593 veh/h
	Freeway Volume, V_F: 5323	
	Ramp Volume, V_R: 519	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5323	0.95	Level	3	0	0.985	0.85	6691
Ramp	519	0.95	Level	3	0	0.985	0.85	652
UpStream								
DownStream	593	0.95	Level	3	0	0.985	0.85	745

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3285 pc/h

V_3 or V_{av34} 1703 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6691	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	6039	Exhibit 13-8	9400	No
V_R	652	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3285	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 19.0 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.487 (Exhibit 13-12)

S_R= 53.8 mph (Exhibit 13-12)

S_0= 68.6 mph (Exhibit 13-12)

S = 60.4 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	4393	V_D =	veh/h
		Ramp Volume, V_R	832		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4393	0.95	Level	3	0	0.985	0.85	5522
Ramp	832	0.95	Level	3	0	0.985	0.85	1046
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 3060 pc/h

V_3 or V_{av34} 2462 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 3155 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5522	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4476	Exhibit 13-8	7050	No
V_R	1046	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3060	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$$

D_R = 4.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.522 (Exhibit 13-12)

S_R= 53.0 mph (Exhibit 13-12)

S_0= 66.0 mph (Exhibit 13-12)

S = 57.9 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	13 US 192 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 2821	
	Ramp Volume, V_R: 771	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2821	0.95	Level	3	0	0.985	0.85	3546
Ramp	771	0.95	Level	3	0	0.985	0.85	969
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 1639 pc/h

V_3 or V_{av34} 953 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3546	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	2577	Exhibit 13-8	9400	No
V_R	969	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1639	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = -8.7 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.515 (Exhibit 13-12)

S_R = 53.2 mph (Exhibit 13-12)

S_0 = 71.3 mph (Exhibit 13-12)

S = 61.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1500	L_{down} = 3067 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 1719 veh/h
	Freeway Volume, V_F: 4184	
	Ramp Volume, V_R: 817	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4184	0.95	Level	3	0	0.985	0.85	5259
Ramp	817	0.95	Level	3	0	0.985	0.85	1027
UpStream								
DownStream	1719	0.95	Level	3	0	0.985	0.85	2161

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 3258 pc/h

V_3 or V_{av34} 2001 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6286	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4285	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 29.0 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.454 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	54.6 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.6 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	56.1 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	2229
Ramp Volume, V_R	592
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2766 ft
V_D = 771 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2229	0.95	Level	3	0	0.985	0.85	2802
Ramp	592	0.95	Level	3	0	0.985	0.85	744
UpStream								
DownStream	771	0.95	Level	3	0	0.985	0.85	969

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.619 using Equation (Exhibit 13-6)
V_{12} = 1736 pc/h
V_3 or V_{av34} 1066 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3546	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2480	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 15.1 (pc/mi/ln)
LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.218 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.0 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	63.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	60.9 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	Osceola Pkwy Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 3282	
	Ramp Volume, V_R: 1053	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3282	0.95	Level	3	0	0.985	0.85	4125
Ramp	1053	0.95	Level	3	0	0.985	0.85	1324
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 2584 pc/h

V_3 or V_{av34} 1541 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4125	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	2801	Exhibit 13-8	7050	No
V_R	1324	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2584	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = -0.5 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.547 (Exhibit 13-12)

S_R = 52.4 mph (Exhibit 13-12)

S_0 = 69.2 mph (Exhibit 13-12)

S = 57.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	5974	V_D =	veh/h
		Ramp Volume, V_R	1790		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5974	0.95	Level	3	0	0.985	0.85	7509
Ramp	1790	0.95	Level	3	0	0.985	0.85	2250
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3617 pc/h

V_3 or V_{av34} 1946 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7509	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5259	Exhibit 13-8	9400	No
V_R	2250	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3617	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 8.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.631 (Exhibit 13-12)

S_R= 50.5 mph (Exhibit 13-12)

S_0= 67.6 mph (Exhibit 13-12)

S = 58.1 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2016

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	5001	V_D =	veh/h
		Ramp Volume, V_R	1719		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5001	0.95	Level	3	0	0.985	0.85	6286
Ramp	1719	0.95	Level	3	0	0.985	0.85	2161
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3233 pc/h

V_3 or V_{av34} 1526 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6286	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	4125	Exhibit 13-8	9400	No
V_R	2161	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3233	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 5.1 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.622 (Exhibit 13-12)

S_R= 50.7 mph (Exhibit 13-12)

S_0= 69.3 mph (Exhibit 13-12)

S = 58.3 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	1 Osceola Parkway Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	1853 ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	1133 veh/h	Freeway Volume, V_F	5357	V_D =	veh/h
		Ramp Volume, V_R	599		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5357	0.95	Level	3	0	0.985	0.85	6734
Ramp	599	0.95	Level	3	0	0.985	0.85	753
UpStream	1133	0.95	Level	3	0	0.985	0.85	1424
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 8443.32 (Equation 13-12 or 13-13)

P_{FD} = 0.557 using Equation (Exhibit 13-7)

V_{12} = 4084 pc/h

V_3 or V_{av34} 2650 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6734	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	5981	Exhibit 13-8	7050	No
V_R	753	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4084	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 25.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.496 (Exhibit 13-12)

S_R= 53.6 mph (Exhibit 13-12)

S_0= 64.9 mph (Exhibit 13-12)

S = 57.5 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	84 HOV On from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{up} = 1000 ft
V_u = 174 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1320
Deceleration Lane Length L_D	
Freeway Volume, V_F	620
Ramp Volume, V_R	886
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	620	0.95	Level	10	0	0.952	0.85	806
Ramp	886	0.95	Level	10	0	0.952	0.85	1152
UpStream	174	0.94	Level	0	0	1.000	0.85	218
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.614 using Equation (Exhibit 13-6)
V_{12} = 495 pc/h
V_3 or V_{av34} 311 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1958	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1647	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 9.5 (pc/mi/ln)
LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.209 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.2 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	60.9 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-4 EB
Junction	84 HOV On from SR 536
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1320
Deceleration Lane Length L_D	
Freeway Volume, V_F	620
Ramp Volume, V_R	886
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 0 ft

V_D = 0 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	620	0.95	Level	10	0	0.952	0.85	806
Ramp	886	0.95	Level	10	0	0.952	0.85	1152
UpStream								
DownStream	0	0.94	Level	0	0	1.000	0.85	0

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.614 using Equation (Exhibit 13-6)

V_{12} = 495 pc/h

V_3 or V_{av34} 311 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1958	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1647	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 9.5 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.209 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.2 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	60.9 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	CD System Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 975	V_D = veh/h
	Freeway Volume, V_F: 6314	
	Ramp Volume, V_R: 884	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6314	0.95	Level	3	0	0.985	0.85	7936
Ramp	884	0.95	Level	3	0	0.985	0.85	1111
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4182 pc/h

V_3 or V_{av34} 3754 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 5236 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7936	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	6825	Exhibit 13-8	7050	No
V_R	1111	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4182	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$$

D_R = 24.8 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.528 (Exhibit 13-12)

S_R= 52.9 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 56.4 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1500	☑ No	☐ Off
L_{up} =	5752 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	1160 veh/h	Freeway Volume, V_F	3598	V_D =	veh/h
		Ramp Volume, V_R	1453		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3598	0.95	Level	3	0	0.985	0.85	4523
Ramp	1453	0.95	Level	3	0	0.985	0.85	1826
UpStream	1160	0.95	Level	3	0	0.985	0.85	1458
DownStream								

Merge Areas | **Diverge Areas**

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 2237.69 (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2802 pc/h

V_3 or V_{av34} 1721 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6349	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4628	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 31.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.570 (Exibit 13-11)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	51.9 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	60.6 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	54.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-4 EB
Junction	
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	3598
Ramp Volume, V_R	1453
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 2604 ft

V_D = 1914 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3598	0.95	Level	3	0	0.985	0.85	4523
Ramp	1453	0.95	Level	3	0	0.985	0.85	1826
UpStream								
DownStream	1914	0.95	Level	3	0	0.985	0.85	2406

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2802 pc/h

V_3 or V_{av34} 1721 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6349	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4628	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 31.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.570 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	51.9 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	60.6 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	54.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 5051	
	Ramp Volume, V_R: 1914	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5051	0.95	Level	3	0	0.985	0.85	6349
Ramp	1914	0.95	Level	3	0	0.985	0.85	2406
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 1327 pc/h

V_3 or V_{av34} 2511 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2539 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8755	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4945	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 26.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.599 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	51.2 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.9 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	54.7 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☑ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☐ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = 4352 ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = 1914 veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 6965	
	Ramp Volume, V_R: 651	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6965	0.95	Level	3	0	0.985	0.85	8755
Ramp	651	0.95	Level	3	0	0.985	0.85	818
UpStream	1914	0.95	Level	3	0	0.985	0.85	2406
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4390 pc/h

V_3 or V_{av34} 4365 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 6055 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8755	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	7937	Exhibit 13-8	7050	Yes
V_R	818	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4390	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 29.3 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.502 (Exhibit 13-12)

S_R= 53.5 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 56.5 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☐ No ☑ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = 1000 ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = 884 veh/h
	Freeway Volume, V_F: 6965	
	Ramp Volume, V_R: 651	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6965	0.95	Level	3	0	0.985	0.85	8755
Ramp	651	0.95	Level	3	0	0.985	0.85	818
UpStream								
DownStream	884	0.95	Level	3	0	0.985	0.85	1111

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4390 pc/h

V_3 or V_{av34} 4365 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 6055 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8755	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	7937	Exhibit 13-8	7050	Yes
V_R	818	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4390	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 29.3 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.502 (Exhibit 13-12)

S_R= 53.5 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 56.5 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	2	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	4758	V_D =	veh/h
		Ramp Volume, V_R	1160		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4758	0.95	Level	3	0	0.985	0.85	5981
Ramp	1160	0.95	Level	3	0	0.985	0.85	1458
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 3493 pc/h

V_3 or V_{av34} 2488 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5981	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4523	Exhibit 13-8	7050	No
V_R	1458	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3493	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 7.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.559 (Exhibit 13-12)

S_R= 52.1 mph (Exhibit 13-12)

S_0= 65.5 mph (Exhibit 13-12)

S = 57.0 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	13 US 192 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	5053
Ramp Volume, V_R	3003
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5053	0.95	Level	3	0	0.985	0.85	6351
Ramp	3003	0.95	Level	3	0	0.985	0.85	3775
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R = mph (Exhibit 13-11)
S_0 = mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 4934 pc/h
V_3 or V_{av34} 1417 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6351	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	2576	Exhibit 13-8	7050	No
V_R	3775	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4934	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 19.7 (pc/mi/ln)
LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.768 (Exhibit 13-12)
S_R = 47.3 mph (Exhibit 13-12)
S_0 = 69.7 mph (Exhibit 13-12)
S = 51.0 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	98 HOV Off at SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway / Ramp		Downstream Adj Ramp	
☑ Yes	☑ On	Freeway Number of Lanes, N	4	☐ Yes	☐ On
☐ No	☐ Off	Ramp Number of Lanes, N	1	☑ No	☐ Off
L_{up} =	9400 ft	Acceleration Lane Length, L_A		L_{down} =	ft
V_u =	0 veh/h	Deceleration Lane Length L_D	1320	V_D =	veh/h
		Freeway Volume, V_F	1595		
		Ramp Volume, V_R	825		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1595	0.95	Level	10	0	0.952	0.85	2074
Ramp	825	0.95	Level	10	0	0.952	0.85	1073
UpStream	0	0.94	Level	0	0	1.000	0.85	0
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 1509 pc/h

V_3 or V_{av34} 282 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2074	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	1001	Exhibit 13-8	9400	No
V_R	1073	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1509	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 5.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.525 (Exhibit 13-12)

S_R= 52.9 mph (Exhibit 13-12)

S_0= 71.3 mph (Exhibit 13-12)

S = 56.9 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	98 HOV Off at SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☑ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	1320	L_{down} =	0 ft
V_u =	veh/h	Freeway Volume, V_F	1595	V_D =	344 veh/h
		Ramp Volume, V_R	825		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1595	0.95	Level	10	0	0.952	0.85	2074
Ramp	825	0.95	Level	10	0	0.952	0.85	1073
UpStream								
DownStream	344	0.95	Level	10	0	0.952	0.85	447

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 1509 pc/h

V_3 or V_{av34} 282 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2074	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	1001	Exhibit 13-8	9400	No
V_R	1073	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1509	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 5.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.525 (Exhibit 13-12)

S_R= 52.9 mph (Exhibit 13-12)

S_0= 71.3 mph (Exhibit 13-12)

S = 56.9 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	99 HOV On S of SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1320	☑ No	☐ Off
L_{up} =	1000 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	825 veh/h	Freeway Volume, V_F	770	V_D =	veh/h
		Ramp Volume, V_R	344		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	770	0.95	Level	10	0	0.952	0.85	1001
Ramp	344	0.95	Level	10	0	0.952	0.85	447
UpStream	825	0.95	Level	10	0	0.952	0.85	1073
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1108.95 (Equation 13-6 or 13-7)

P_{FM} = 0.608 using Equation (Exhibit 13-6)

V_{12} = 608 pc/h

V_3 or V_{av34} 393 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1448	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1055	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 5.2 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.200 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.4 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	61.6 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	99 HOV On S of SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1320	L_{down} = 9400 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 0 veh/h
	Freeway Volume, V_F: 770	
	Ramp Volume, V_R: 344	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	770	0.95	Level	10	0	0.952	0.85	1001
Ramp	344	0.95	Level	10	0	0.952	0.85	447
UpStream								
DownStream	0	0.94	Level	0	0	1.000	0.85	0

Merge Areas | **Diverge Areas**

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.614 using Equation (Exhibit 13-6)

V_{12} = 615 pc/h

V_3 or V_{av34} 386 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	1448	Exhibit 13-8		No

Diverge Areas

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1062	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

Merge Areas

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 5.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Diverge Areas

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

Merge Areas

M_S = 0.200 (Exibit 13-11)

Diverge Areas

D_s = (Exhibit 13-12)

S_R=	60.4 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	61.6 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	CD System On Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	6042
Ramp Volume, V_R	801
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6042	0.95	Level	3	0	0.985	0.85	7595
Ramp	801	0.95	Level	3	0	0.985	0.85	1007
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.555 using Equation (Exhibit 13-6)
V_{12} = 4215 pc/h
V_3 or V_{av34} 3380 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 4895 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8602	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5902	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 32.2 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

M_S = 1.447 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	31.7 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	36.7 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 2940 ft
V_u = 801 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	6843
Ramp Volume, V_R	1140
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6843	0.95	Level	3	0	0.985	0.85	8601
Ramp	1140	0.95	Level	3	0	0.985	0.85	1433
UpStream	801	0.95	Level	3	0	0.985	0.85	1007
DownStream								

Merge Areas | **Diverge Areas**

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.555 using Equation (Exhibit 13-6)
V_{12} = 4774 pc/h
V_3 or V_{av34} 3827 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 5901 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10034	Exhibit 13-8		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	7334	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 43.2 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = 5.994 (Exibit 13-11)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	-72.9 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-4 WB
Junction	I-4 On Ramp from SR 535
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	6843
Ramp Volume, V_R	1140
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 3067 ft

V_D = 1506 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6843	0.95	Level	3	0	0.985	0.85	8601
Ramp	1140	0.95	Level	3	0	0.985	0.85	1433
UpStream								
DownStream	1506	0.95	Level	3	0	0.985	0.85	1893

Merge Areas | **Diverge Areas**

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 4774 pc/h

V_3 or V_{av34} 3827 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 5901 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10034	Exhibit 13-8		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	7334	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 43.2 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 5.994 (Exibit 13-11)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	-72.9 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	Osceola Pkwy Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 6477	
	Ramp Volume, V_R: 1424	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6477	0.95	Level	3	0	0.985	0.85	8141
Ramp	1424	0.95	Level	3	0	0.985	0.85	1790
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4648 pc/h

V_3 or V_{av34} 3493 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 5441 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8141	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	6351	Exhibit 13-8	7050	No
V_R	1790	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4648	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$$

D_R = 24.0 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.589 (Exhibit 13-12)

S_R= 51.5 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 55.2 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 7983	
	Ramp Volume, V_R: 1506	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	7983	0.95	Level	3	0	0.985	0.85	10034
Ramp	1506	0.95	Level	3	0	0.985	0.85	1893
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 5556 pc/h

V_3 or V_{av34} 4478 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 7334 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10034	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	8141	Exhibit 13-8	7050	Yes
V_R	1893	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5556	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$$

D_R = 40.3 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.598 (Exhibit 13-12)

S_R= 51.2 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 54.3 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	1 Osceola Parkway Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	1853 ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	1133 veh/h	Freeway Volume, V_F	5357	V_D =	veh/h
		Ramp Volume, V_R	501		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5357	0.95	Level	3	0	0.985	0.85	6734
Ramp	501	0.95	Level	3	0	0.985	0.85	630
UpStream	1133	0.95	Level	3	0	0.985	0.85	1424
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 7999.91 (Equation 13-12 or 13-13)

P_{FD} = 0.563 using Equation (Exhibit 13-7)

V_{12} = 4065 pc/h

V_3 or V_{av34} 2669 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6734	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	6104	Exhibit 13-8	7050	No
V_R	630	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4065	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 25.7 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.485 (Exhibit 13-12)

S_R= 53.9 mph (Exhibit 13-12)

S_0= 64.8 mph (Exhibit 13-12)

S = 57.7 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	84 HOV On from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A	1320	☑ No	☐ Off
L_{up} =	1000 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	174 veh/h	Freeway Volume, V_F	770	V_D =	veh/h
		Ramp Volume, V_R	825		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	770	0.95	Level	10	0	0.952	0.85	1001
Ramp	825	0.95	Level	10	0	0.952	0.85	1073
UpStream	174	0.94	Level	0	0	1.000	0.85	218
DownStream								

Merge Areas | **Diverge Areas**

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.614 using Equation (Exhibit 13-6)

V_{12} = 615 pc/h

V_3 or V_{av34} 386 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	2074	Exhibit 13-8		No

Diverge Areas

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1688	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

Merge Areas

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 9.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Diverge Areas

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

Merge Areas

M_S = 0.210 (Exibit 13-11)

Diverge Areas

D_s = (Exhibit 13-12)

S_R=	60.2 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	61.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-4 EB
Junction	84 HOV On from SR 536
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1320
Deceleration Lane Length L_D	
Freeway Volume, V_F	770
Ramp Volume, V_R	825
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 0 ft

V_D = 0 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	770	0.95	Level	10	0	0.952	0.85	1001
Ramp	825	0.95	Level	10	0	0.952	0.85	1073
UpStream								
DownStream	0	0.94	Level	0	0	1.000	0.85	0

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.614 using Equation (Exhibit 13-6)

V_{12} = 615 pc/h

V_3 or V_{av34} 386 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2074	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1688	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 9.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.210 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.2 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	61.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	CD System Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 975	V_D = veh/h
	Freeway Volume, V_F: 6974	
	Ramp Volume, V_R: 883	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6974	0.95	Level	3	0	0.985	0.85	8766
Ramp	883	0.95	Level	3	0	0.985	0.85	1110
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4555 pc/h

V_3 or V_{av34} 4211 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 6066 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8766	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	7656	Exhibit 13-8	7050	Yes
V_R	1110	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4555	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$$

D_R = 31.9 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.528 (Exhibit 13-12)

S_R= 52.9 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 56.0 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-4 EB
Junction	
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 5752 ft

V_u = 1310 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	4548
Ramp Volume, V_R	1808
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4548	0.95	Level	3	0	0.985	0.85	5717
Ramp	1808	0.95	Level	3	0	0.985	0.85	2273
UpStream	1310	0.95	Level	3	0	0.985	0.85	1647
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 2588.86 (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 3542 pc/h

V_3 or V_{av34} 2175 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7990	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5815	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 40.4 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 1.479 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	31.0 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	35.6 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	4548
Ramp Volume, V_R	1808
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 2604 ft

V_D = 2013 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4548	0.95	Level	3	0	0.985	0.85	5717
Ramp	1808	0.95	Level	3	0	0.985	0.85	2273
UpStream								
DownStream	2013	0.95	Level	3	0	0.985	0.85	2530

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 3542 pc/h

V_3 or V_{av34} 2175 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7990	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5815	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 40.4 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 1.479 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	31.0 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	35.6 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 6356	
	Ramp Volume, V_R: 2013	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6356	0.95	Level	3	0	0.985	0.85	7989
Ramp	2013	0.95	Level	3	0	0.985	0.85	2530
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 1670 pc/h

V_3 or V_{av34} 3159 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 3195 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10519	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5725	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 32.0 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 1.246 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	36.3 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	57.9 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	43.8 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp: ☑ Yes ☑ On ☐ No ☐ Off

L_{up} = 4352 ft

V_u = 2013 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	8369
Ramp Volume, V_R	1395
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	8369	0.95	Level	3	0	0.985	0.85	10520
Ramp	1395	0.95	Level	3	0	0.985	0.85	1753
UpStream	2013	0.95	Level	3	0	0.985	0.85	2530
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 5698 pc/h

V_3 or V_{av34} 4822 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 7820 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10520	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	8767	Exhibit 13-8	7050	Yes
V_R	1753	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5698	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 44.5 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.586 (Exhibit 13-12)

S_R= 51.5 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 54.4 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	8369
Ramp Volume, V_R	1395
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 1000 ft
V_D = 883 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	8369	0.95	Level	3	0	0.985	0.85	10520
Ramp	1395	0.95	Level	3	0	0.985	0.85	1753
UpStream								
DownStream	883	0.95	Level	3	0	0.985	0.85	1110

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 5698 pc/h
V_3 or V_{av34} 4822 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 7820 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10520	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	8767	Exhibit 13-8	7050	Yes
V_R	1753	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5698	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 44.5 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.586 (Exhibit 13-12)
S_R= 51.5 mph (Exhibit 13-12)
S_0= 64.7 mph (Exhibit 13-12)
S = 54.4 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 5858	
	Ramp Volume, V_R: 1310	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5858	0.95	Level	3	0	0.985	0.85	7363
Ramp	1310	0.95	Level	3	0	0.985	0.85	1647
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4219 pc/h

V_3 or V_{av34} 3144 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 4663 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7363	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	5716	Exhibit 13-8	7050	No
V_R	1647	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4219	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 17.4 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.576 (Exhibit 13-12)

S_R = 51.7 mph (Exhibit 13-12)

S_0 = 64.7 mph (Exhibit 13-12)

S = 55.8 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	13 US 192 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 3980	
	Ramp Volume, V_R: 1930	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3980	0.95	Level	3	0	0.985	0.85	5003
Ramp	1930	0.95	Level	3	0	0.985	0.85	2426
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 3586 pc/h

V_3 or V_{av34} 1417 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5003	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	2577	Exhibit 13-8	7050	No
V_R	2426	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3586	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 8.1 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.646 (Exhibit 13-12)

S_R = 50.1 mph (Exhibit 13-12)

S_0 = 69.7 mph (Exhibit 13-12)

S = 54.5 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	98 HOV Off at SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	9400 ft	Deceleration Lane Length L_D	1320	L_{down} =	ft
V_u =	0 veh/h	Freeway Volume, V_F	1506	V_D =	veh/h
		Ramp Volume, V_R	886		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1506	0.95	Level	10	0	0.952	0.85	1958
Ramp	886	0.95	Level	10	0	0.952	0.85	1152
UpStream	0	0.94	Level	0	0	1.000	0.85	0
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 1503 pc/h

V_3 or V_{av34} 227 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1958	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	806	Exhibit 13-8	9400	No
V_R	1152	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1503	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 5.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.532 (Exhibit 13-12)

S_R= 52.8 mph (Exhibit 13-12)

S_0= 71.3 mph (Exhibit 13-12)

S = 56.2 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	98 HOV Off at SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = 0 ft
V_u = veh/h	Deceleration Lane Length L_D: 1320	V_D = 387 veh/h
	Freeway Volume, V_F: 1506	
	Ramp Volume, V_R: 886	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1506	0.95	Level	10	0	0.952	0.85	1958
Ramp	886	0.95	Level	10	0	0.952	0.85	1152
UpStream								
DownStream	387	0.95	Level	10	0	0.952	0.85	503

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 1503 pc/h

V_3 or V_{av34} 227 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1958	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	806	Exhibit 13-8	9400	No
V_R	1152	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1503	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$$

D_R = 5.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.532 (Exhibit 13-12)

S_R= 52.8 mph (Exhibit 13-12)

S_0= 71.3 mph (Exhibit 13-12)

S = 56.2 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-4 WB
Junction	99 HOV On S of SR 536
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 1000 ft

V_u = 886 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1320
Deceleration Lane Length L_D	
Freeway Volume, V_F	620
Ramp Volume, V_R	387
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	620	0.95	Level	10	0	0.952	0.85	806
Ramp	387	0.95	Level	10	0	0.952	0.85	503
UpStream	886	0.95	Level	10	0	0.952	0.85	1152
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1079.21 (Equation 13-6 or 13-7)

P_{FM} = 0.609 using Equation (Exhibit 13-6)

V_{12} = 491 pc/h

V_3 or V_{av34} 315 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1309	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	994	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 4.7 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.200 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.4 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	61.5 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	99 HOV On S of SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1320
Deceleration Lane Length L_D	
Freeway Volume, V_F	620
Ramp Volume, V_R	387
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 9400 ft
V_D = 0 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	620	0.95	Level	10	0	0.952	0.85	806
Ramp	387	0.95	Level	10	0	0.952	0.85	503
UpStream								
DownStream	0	0.94	Level	0	0	1.000	0.85	0

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.614 using Equation (Exhibit 13-6)
V_{12} = 495 pc/h
V_3 or V_{av34} 311 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1309	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	998	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 4.8 (pc/mi/ln)
LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.200 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.4 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	61.4 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	CD System On Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	5565
Ramp Volume, V_R	883
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5565	0.95	Level	3	0	0.985	0.85	6995
Ramp	883	0.95	Level	3	0	0.985	0.85	1110
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.555 using Equation (Exhibit 13-6)
V_{12} = 3882 pc/h
V_3 or V_{av34} 3113 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 4295 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8105	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5405	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 28.3 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

M_S = 0.889 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	44.6 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	47.8 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☐ No ☑ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = 2940 ft	Acceleration Lane Length, L_A: 1500	L_{down} = ft
V_u = 883 veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 6448	
	Ramp Volume, V_R: 849	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6448	0.95	Level	3	0	0.985	0.85	8105
Ramp	849	0.95	Level	3	0	0.985	0.85	1067
UpStream	883	0.95	Level	3	0	0.985	0.85	1110
DownStream								

Merge Areas | **Diverge Areas**

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 4498 pc/h

V_3 or V_{av34} 3607 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 5405 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9172	Exhibit 13-8		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	6472	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 36.7 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 2.543 (Exibit 13-11)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	6.5 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	8.8 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	6448
Ramp Volume, V_R	849
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 3067 ft
V_D = 1727 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6448	0.95	Level	3	0	0.985	0.85	8105
Ramp	849	0.95	Level	3	0	0.985	0.85	1067
UpStream								
DownStream	1727	0.95	Level	3	0	0.985	0.85	2171

Merge Areas | **Diverge Areas**

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.555 using Equation (Exhibit 13-6)
V_{12} = 4498 pc/h
V_3 or V_{av34} 3607 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 5405 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9172	Exhibit 13-8		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	6472	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 36.7 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = 2.543 (Exibit 13-11)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	6.5 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	8.8 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	Osceola Pkwy Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 5570	
	Ramp Volume, V_R: 1590	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5570	0.95	Level	3	0	0.985	0.85	7001
Ramp	1590	0.95	Level	3	0	0.985	0.85	1999
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4250 pc/h

V_3 or V_{av34} 2751 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 4301 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7001	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	5002	Exhibit 13-8	7050	No
V_R	1999	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4250	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$$

D_R = 14.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.608 (Exhibit 13-12)

S_R= 51.0 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 55.5 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	7297
Ramp Volume, V_R	1727
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	7297	0.95	Level	3	0	0.985	0.85	9172
Ramp	1727	0.95	Level	3	0	0.985	0.85	2171
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 5321 pc/h
V_3 or V_{av34} 3851 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 6472 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9172	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	7001	Exhibit 13-8	7050	No
V_R	2171	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5321	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 32.9 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.623 (Exhibit 13-12)
S_R= 50.7 mph (Exhibit 13-12)
S_0= 64.7 mph (Exhibit 13-12)
S = 54.1 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp to CD
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period		Analysis Year	2020 NB

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 6745	
	Ramp Volume, V_R: 1180	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6745	0.95	Level	3	0	0.985	0.85	8478
Ramp	1180	0.95	Level	3	0	0.985	0.85	1483
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3302 pc/h

V_3 or V_{av34} 2588 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3391 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8478	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	6995	Exhibit 13-8	9400	No
V_R	1483	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3302	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 6.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.561 (Exhibit 13-12)

S_R = 52.1 mph (Exhibit 13-12)

S_0 = 65.3 mph (Exhibit 13-12)

S = 59.3 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	1 Osceola Parkway Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	1853 ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	1133 veh/h	Freeway Volume, V_F	5357	V_D =	veh/h
		Ramp Volume, V_R	599		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5357	0.95	Level	3	0	0.985	0.85	6734
Ramp	599	0.95	Level	3	0	0.985	0.85	753
UpStream	1133	0.95	Level	3	0	0.985	0.85	1424
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 8443.32 (Equation 13-12 or 13-13)

P_{FD} = 0.557 using Equation (Exhibit 13-7)

V_{12} = 4084 pc/h

V_3 or V_{av34} 2650 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6734	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	5981	Exhibit 13-8	7050	No
V_R	753	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4084	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 25.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.496 (Exhibit 13-12)

S_R= 53.6 mph (Exhibit 13-12)

S_0= 64.9 mph (Exhibit 13-12)

S = 57.5 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-4 EB
Junction	84 HOV On from SR 536
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{up} = 1000 ft

V_u = 174 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1320
Deceleration Lane Length L_D	
Freeway Volume, V_F	620
Ramp Volume, V_R	886
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	620	0.95	Level	10	0	0.952	0.85	806
Ramp	886	0.95	Level	10	0	0.952	0.85	1152
UpStream	174	0.94	Level	0	0	1.000	0.85	218
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.614 using Equation (Exhibit 13-6)

V_{12} = 495 pc/h

V_3 or V_{av34} 311 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1958	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1647	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 9.5 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.209 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.2 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	60.9 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	84 HOV On from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1320	L_{down} = 0 ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = 0 veh/h
	Freeway Volume, V_F: 620	
	Ramp Volume, V_R: 886	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	620	0.95	Level	10	0	0.952	0.85	806
Ramp	886	0.95	Level	10	0	0.952	0.85	1152
UpStream								
DownStream	0	0.94	Level	0	0	1.000	0.85	0

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.614 using Equation (Exhibit 13-6)

V_{12} = 495 pc/h

V_3 or V_{av34} 311 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1958	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1647	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 9.5 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.209 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.2 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	60.9 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	CD System Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	975
Freeway Volume, V_F	6314
Ramp Volume, V_R	884
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6314	0.95	Level	3	0	0.985	0.85	7936
Ramp	884	0.95	Level	3	0	0.985	0.85	1111
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 4182 pc/h
V_3 or V_{av34} 3754 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 5236 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7936	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	6825	Exhibit 13-8	7050	No
V_R	1111	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4182	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 24.8 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.528 (Exhibit 13-12)
S_R= 52.9 mph (Exhibit 13-12)
S_0= 64.7 mph (Exhibit 13-12)
S = 56.4 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1500	☑ No	☐ Off
L_{up} =	5752 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	1160 veh/h	Freeway Volume, V_F	3598	V_D =	veh/h
		Ramp Volume, V_R	1453		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	3598	0.95	Level	3	0	0.985	0.85	4523
Ramp	1453	0.95	Level	3	0	0.985	0.85	1826
UpStream	1160	0.95	Level	3	0	0.985	0.85	1458
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 2237.69 (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 2802 pc/h

V_3 or V_{av34} 1721 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6349	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4628	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 31.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.570 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	51.9 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	60.6 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	54.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	3598
Ramp Volume, V_R	1453
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 2604 ft
V_D = 1914 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3598	0.95	Level	3	0	0.985	0.85	4523
Ramp	1453	0.95	Level	3	0	0.985	0.85	1826
UpStream								
DownStream	1914	0.95	Level	3	0	0.985	0.85	2406

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.619 using Equation (Exhibit 13-6)
V_{12} = 2802 pc/h
V_3 or V_{av34} 1721 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6349	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4628	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 31.3 (pc/mi/ln)
LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.570 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	51.9 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	60.6 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	54.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 5051	
	Ramp Volume, V_R: 1914	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5051	0.95	Level	3	0	0.985	0.85	6349
Ramp	1914	0.95	Level	3	0	0.985	0.85	2406
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 1327 pc/h

V_3 or V_{av34} 2511 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2539 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8755	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4945	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 26.0 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.599 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	51.2 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.9 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	54.7 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp: ☑ Yes ☑ On ☐ No ☐ Off

L_{up} = 4352 ft

V_u = 1914 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	6965
Ramp Volume, V_R	651
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6965	0.95	Level	3	0	0.985	0.85	8755
Ramp	651	0.95	Level	3	0	0.985	0.85	818
UpStream	1914	0.95	Level	3	0	0.985	0.85	2406
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4390 pc/h

V_3 or V_{av34} 4365 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 6055 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8755	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	7937	Exhibit 13-8	7050	Yes
V_R	818	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4390	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 29.3 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.502 (Exhibit 13-12)

S_R= 53.5 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 56.5 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	6965
Ramp Volume, V_R	651
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 1000 ft
V_D = 884 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6965	0.95	Level	3	0	0.985	0.85	8755
Ramp	651	0.95	Level	3	0	0.985	0.85	818
UpStream								
DownStream	884	0.95	Level	3	0	0.985	0.85	1111

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 4390 pc/h
V_3 or V_{av34} 4365 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 6055 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8755	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	7937	Exhibit 13-8	7050	Yes
V_R	818	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4390	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 29.3 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.502 (Exhibit 13-12)
S_R= 53.5 mph (Exhibit 13-12)
S_0= 64.7 mph (Exhibit 13-12)
S = 56.5 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	4758
Ramp Volume, V_R	1160
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4758	0.95	Level	3	0	0.985	0.85	5981
Ramp	1160	0.95	Level	3	0	0.985	0.85	1458
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 3493 pc/h
V_3 or V_{av34} 2488 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5981	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4523	Exhibit 13-8	7050	No
V_R	1458	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3493	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 7.3 (pc/mi/ln)
LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.559 (Exhibit 13-12)
S_R= 52.1 mph (Exhibit 13-12)
S_0= 65.5 mph (Exhibit 13-12)
S = 57.0 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	13 US 192 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 5053	
	Ramp Volume, V_R: 3003	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5053	0.95	Level	3	0	0.985	0.85	6351
Ramp	3003	0.95	Level	3	0	0.985	0.85	3775
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4934 pc/h

V_3 or V_{av34} 1417 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6351	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	2576	Exhibit 13-8	7050	No
V_R	3775	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4934	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 19.7 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.768 (Exhibit 13-12)

S_R = 47.3 mph (Exhibit 13-12)

S_0 = 69.7 mph (Exhibit 13-12)

S = 51.0 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	98 HOV Off at SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp: ☑ Yes ☑ On ☐ No ☐ Off; L_{up} = 9400 ft; V_u = 0 veh/h

Freeway Number of Lanes, N	4
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1320
Freeway Volume, V_F	1595
Ramp Volume, V_R	825
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{down} = ft; V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1595	0.95	Level	10	0	0.952	0.85	2074
Ramp	825	0.95	Level	10	0	0.952	0.85	1073
UpStream	0	0.94	Level	0	0	1.000	0.85	0
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 1509 pc/h

V_3 or V_{av34} 282 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2074	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	1001	Exhibit 13-8	9400	No
V_R	1073	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1509	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 5.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.525 (Exhibit 13-12)

S_R= 52.9 mph (Exhibit 13-12)

S_0= 71.3 mph (Exhibit 13-12)

S = 56.9 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	98 HOV Off at SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway/Ramp Inputs		Downstream Adj Ramp	
☐ Yes	☐ On	Freeway Number of Lanes, N	4	☑ Yes	☑ On
☑ No	☐ Off	Ramp Number of Lanes, N	1	☐ No	☐ Off
L_{up} =	ft	Acceleration Lane Length, L_A		L_{down} =	0 ft
V_u =	veh/h	Deceleration Lane Length L_D	1320	V_D =	344 veh/h
		Freeway Volume, V_F	1595		
		Ramp Volume, V_R	825		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1595	0.95	Level	10	0	0.952	0.85	2074
Ramp	825	0.95	Level	10	0	0.952	0.85	1073
UpStream								
DownStream	344	0.95	Level	10	0	0.952	0.85	447

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 1509 pc/h

V_3 or V_{av34} 282 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2074	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	1001	Exhibit 13-8	9400	No
V_R	1073	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1509	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 5.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.525 (Exhibit 13-12)

S_R= 52.9 mph (Exhibit 13-12)

S_0= 71.3 mph (Exhibit 13-12)

S = 56.9 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	99 HOV On S of SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1320	☑ No	☐ Off
L_{up} =	1000 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	825 veh/h	Freeway Volume, V_F	770	V_D =	veh/h
		Ramp Volume, V_R	344		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	770	0.95	Level	10	0	0.952	0.85	1001
Ramp	344	0.95	Level	10	0	0.952	0.85	447
UpStream	825	0.95	Level	10	0	0.952	0.85	1073
DownStream								

Merge Areas | **Diverge Areas**

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1108.95 (Equation 13-6 or 13-7)

P_{FM} = 0.608 using Equation (Exhibit 13-6)

V_{12} = 608 pc/h

V_3 or V_{av34} 393 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	1448	Exhibit 13-8		No

Diverge Areas

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1055	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

Merge Areas

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 5.2 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Diverge Areas

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

Merge Areas

M_S = 0.200 (Exibit 13-11)

Diverge Areas

D_s = (Exhibit 13-12)

S_R=	60.4 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	61.6 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-4 WB
Junction	99 HOV On S of SR 536
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1320
Deceleration Lane Length L_D	
Freeway Volume, V_F	770
Ramp Volume, V_R	344
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 9400 ft

V_D = 0 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	770	0.95	Level	10	0	0.952	0.85	1001
Ramp	344	0.95	Level	10	0	0.952	0.85	447
UpStream								
DownStream	0	0.94	Level	0	0	1.000	0.85	0

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.614 using Equation (Exhibit 13-6)

V_{12} = 615 pc/h

V_3 or V_{av34} 386 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1448	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1062	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 5.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.200 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.4 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	61.6 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	CD System On Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	6242
Ramp Volume, V_R	801
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6242	0.95	Level	3	0	0.985	0.85	7846
Ramp	801	0.95	Level	3	0	0.985	0.85	1007
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.555 using Equation (Exhibit 13-6)
V_{12} = 4355 pc/h
V_3 or V_{av34} 3491 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 5146 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8853	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	6153	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 34.2 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

M_S = 1.854 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	22.3 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	27.4 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 2940 ft
V_u = 801 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	7043
Ramp Volume, V_R	1140
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	7043	0.95	Level	3	0	0.985	0.85	8853
Ramp	1140	0.95	Level	3	0	0.985	0.85	1433
UpStream	801	0.95	Level	3	0	0.985	0.85	1007
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.555 using Equation (Exhibit 13-6)
V_{12} = 4913 pc/h
V_3 or V_{av34} 3940 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 6153 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10286	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	7586	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 45.2 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

M_S = 7.706 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	-112.2 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-4 WB
Junction	I-4 On Ramp from SR 535
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	7043
Ramp Volume, V_R	1140
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 3067 ft

V_D = 1706 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7043	0.95	Level	3	0	0.985	0.85	8853
Ramp	1140	0.95	Level	3	0	0.985	0.85	1433
UpStream								
DownStream	1706	0.95	Level	3	0	0.985	0.85	2144

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 4913 pc/h

V_3 or V_{av34} 3940 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 6153 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10286	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	7586	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 45.2 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 7.706 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	-112.2 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	Osceola Pkwy Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 6477	
	Ramp Volume, V_R: 1424	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6477	0.95	Level	3	0	0.985	0.85	8141
Ramp	1424	0.95	Level	3	0	0.985	0.85	1790
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4648 pc/h

V_3 or V_{av34} 3493 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 5441 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8141	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	6351	Exhibit 13-8	7050	No
V_R	1790	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4648	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$$

D_R = 24.0 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.589 (Exhibit 13-12)

S_R= 51.5 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 55.2 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 8183	
	Ramp Volume, V_R: 1706	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	8183	0.95	Level	3	0	0.985	0.85	10286
Ramp	1706	0.95	Level	3	0	0.985	0.85	2144
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 5808 pc/h

V_3 or V_{av34} 4478 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 7586 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10286	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	8142	Exhibit 13-8	7050	Yes
V_R	2144	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5808	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 42.5 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.621 (Exhibit 13-12)

S_R= 50.7 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 53.8 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp to CD
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	AM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 6699	
	Ramp Volume, V_R: 457	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6699	0.95	Level	3	0	0.985	0.85	8420
Ramp	457	0.95	Level	3	0	0.985	0.85	574
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 2614 pc/h

V_3 or V_{av34} 2903 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3368 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8420	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	7846	Exhibit 13-8	9400	No
V_R	574	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2614	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 6.2 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.480 (Exhibit 13-12)

S_R = 54.0 mph (Exhibit 13-12)

S_0 = 65.4 mph (Exhibit 13-12)

S = 60.3 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	1 Osceola Parkway Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	1853 ft	Deceleration Lane Length L_D	1500	L_{down} =	ft
V_u =	1133 veh/h	Freeway Volume, V_F	5357	V_D =	veh/h
		Ramp Volume, V_R	501		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5357	0.95	Level	3	0	0.985	0.85	6734
Ramp	501	0.95	Level	3	0	0.985	0.85	630
UpStream	1133	0.95	Level	3	0	0.985	0.85	1424
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = 7999.91 (Equation 13-12 or 13-13)

P_{FD} = 0.563 using Equation (Exhibit 13-7)

V_{12} = 4065 pc/h

V_3 or V_{av34} 2669 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6734	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	6104	Exhibit 13-8	7050	No
V_R	630	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4065	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 25.7 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.485 (Exhibit 13-12)

S_R= 53.9 mph (Exhibit 13-12)

S_0= 64.8 mph (Exhibit 13-12)

S = 57.7 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	84 HOV On from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A	1320	☑ No	☐ Off
L_{up} =	1000 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	174 veh/h	Freeway Volume, V_F	770	V_D =	veh/h
		Ramp Volume, V_R	825		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	770	0.95	Level	10	0	0.952	0.85	1001
Ramp	825	0.95	Level	10	0	0.952	0.85	1073
UpStream	174	0.94	Level	0	0	1.000	0.85	218
DownStream								

Merge Areas | **Diverge Areas**

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.614 using Equation (Exhibit 13-6)

V_{12} = 615 pc/h

V_3 or V_{av34} 386 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2074	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1688	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 9.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.210 (Exibit 13-11)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.2 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	61.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-4 EB
Junction	84 HOV On from SR 536
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1320
Deceleration Lane Length L_D	
Freeway Volume, V_F	770
Ramp Volume, V_R	825
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 0 ft

V_D = 0 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	770	0.95	Level	10	0	0.952	0.85	1001
Ramp	825	0.95	Level	10	0	0.952	0.85	1073
UpStream								
DownStream	0	0.94	Level	0	0	1.000	0.85	0

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.614 using Equation (Exhibit 13-6)

V_{12} = 615 pc/h

V_3 or V_{av34} 386 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2074	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1688	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 9.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.210 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.2 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	61.0 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	CD System Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 975	V_D = veh/h
	Freeway Volume, V_F: 6974	
	Ramp Volume, V_R: 883	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6974	0.95	Level	3	0	0.985	0.85	8766
Ramp	883	0.95	Level	3	0	0.985	0.85	1110
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$$V_{12} = V_R + (V_F - V_R)P_{FD}$$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4555 pc/h

V_3 or V_{av34} 4211 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 6066 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8766	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	7656	Exhibit 13-8	7050	Yes
V_R	1110	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4555	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$$

D_R = 31.9 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.528 (Exhibit 13-12)

S_R= 52.9 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 56.0 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{up} = 5752 ft
V_u = 1310 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	4548
Ramp Volume, V_R	1808
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4548	0.95	Level	3	0	0.985	0.85	5717
Ramp	1808	0.95	Level	3	0	0.985	0.85	2273
UpStream	1310	0.95	Level	3	0	0.985	0.85	1647
DownStream								

Merge Areas | **Diverge Areas**

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = 2588.86 (Equation 13-6 or 13-7)
P_{FM} = 0.619 using Equation (Exhibit 13-6)
V_{12} = 3542 pc/h
V_3 or V_{av34} 2175 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7990	Exhibit 13-8		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5815	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = 40.4 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = 1.479 (Exibit 13-11)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	31.0 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	35.6 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-4 EB
Junction	
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	4548
Ramp Volume, V_R	1808
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 2604 ft

V_D = 2013 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4548	0.95	Level	3	0	0.985	0.85	5717
Ramp	1808	0.95	Level	3	0	0.985	0.85	2273
UpStream								
DownStream	2013	0.95	Level	3	0	0.985	0.85	2530

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.619 using Equation (Exhibit 13-6)

V_{12} = 3542 pc/h

V_3 or V_{av34} 2175 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7990	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5815	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 40.4 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 1.479 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	31.0 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	59.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	35.6 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 600	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 6356	
	Ramp Volume, V_R: 2013	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6356	0.95	Level	3	0	0.985	0.85	7989
Ramp	2013	0.95	Level	3	0	0.985	0.85	2530
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 1670 pc/h

V_3 or V_{av34} 3159 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3195 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10519	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5725	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 32.0 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = 1.246 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	36.3 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	57.9 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	43.8 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp: ☑ Yes ☑ On ☐ No ☐ Off; L_{up} = 4352 ft; V_u = 2013 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	8369
Ramp Volume, V_R	1395
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off; L_{down} = ft; V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	8369	0.95	Level	3	0	0.985	0.85	10520
Ramp	1395	0.95	Level	3	0	0.985	0.85	1753
UpStream	2013	0.95	Level	3	0	0.985	0.85	2530
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 5698 pc/h

V_3 or V_{av34} 4822 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 7820 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10520	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	8767	Exhibit 13-8	7050	Yes
V_R	1753	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5698	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 44.5 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.586 (Exhibit 13-12)

S_R= 51.5 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 54.4 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	8369
Ramp Volume, V_R	1395
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☑ Yes ☐ On
☐ No ☑ Off
L_{down} = 1000 ft
V_D = 883 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	8369	0.95	Level	3	0	0.985	0.85	10520
Ramp	1395	0.95	Level	3	0	0.985	0.85	1753
UpStream								
DownStream	883	0.95	Level	3	0	0.985	0.85	1110

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 5698 pc/h
V_3 or V_{av34} 4822 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 7820 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10520	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	8767	Exhibit 13-8	7050	Yes
V_R	1753	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5698	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 44.5 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.586 (Exhibit 13-12)
S_R= 51.5 mph (Exhibit 13-12)
S_0= 64.7 mph (Exhibit 13-12)
S = 54.4 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 EB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	5858
Ramp Volume, V_R	1310
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5858	0.95	Level	3	0	0.985	0.85	7363
Ramp	1310	0.95	Level	3	0	0.985	0.85	1647
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 4219 pc/h
V_3 or V_{av34} 3144 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 4663 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7363	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	5716	Exhibit 13-8	7050	No
V_R	1647	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4219	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 17.4 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.576 (Exhibit 13-12)
S_R= 51.7 mph (Exhibit 13-12)
S_0= 64.7 mph (Exhibit 13-12)
S = 55.8 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	13 US 192 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 3980	
	Ramp Volume, V_R: 1930	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3980	0.95	Level	3	0	0.985	0.85	5003
Ramp	1930	0.95	Level	3	0	0.985	0.85	2426
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 3586 pc/h

V_3 or V_{av34} 1417 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5003	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	2577	Exhibit 13-8	7050	No
V_R	2426	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3586	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 8.1 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.646 (Exhibit 13-12)

S_R = 50.1 mph (Exhibit 13-12)

S_0 = 69.7 mph (Exhibit 13-12)

S = 54.5 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	98 HOV Off at SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	9400 ft	Deceleration Lane Length L_D	1320	L_{down} =	ft
V_u =	0 veh/h	Freeway Volume, V_F	1506	V_D =	veh/h
		Ramp Volume, V_R	886		
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	35.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1506	0.95	Level	10	0	0.952	0.85	1958
Ramp	886	0.95	Level	10	0	0.952	0.85	1152
UpStream	0	0.94	Level	0	0	1.000	0.85	0
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 1503 pc/h

V_3 or V_{av34} 227 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1958	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	806	Exhibit 13-8	9400	No
V_R	1152	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1503	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 5.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.532 (Exhibit 13-12)

S_R= 52.8 mph (Exhibit 13-12)

S_0= 71.3 mph (Exhibit 13-12)

S = 56.2 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	98 HOV Off at SR 536
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☑ Yes ☑ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☐ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = 0 ft
V_u = veh/h	Deceleration Lane Length L_D: 1320	V_D = 387 veh/h
	Freeway Volume, V_F: 1506	
	Ramp Volume, V_R: 886	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1506	0.95	Level	10	0	0.952	0.85	1958
Ramp	886	0.95	Level	10	0	0.952	0.85	1152
UpStream								
DownStream	387	0.95	Level	10	0	0.952	0.85	503

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 1503 pc/h

V_3 or V_{av34} 227 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1958	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	806	Exhibit 13-8	9400	No
V_R	1152	Exhibit 13-10	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1503	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 5.3 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.532 (Exhibit 13-12)

S_R= 52.8 mph (Exhibit 13-12)

S_0= 71.3 mph (Exhibit 13-12)

S = 56.2 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-4 WB
Junction	99 HOV On S of SR 536
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{up} = 1000 ft

V_u = 886 veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1320
Deceleration Lane Length L_D	
Freeway Volume, V_F	620
Ramp Volume, V_R	387
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	620	0.95	Level	10	0	0.952	0.85	806
Ramp	387	0.95	Level	10	0	0.952	0.85	503
UpStream	886	0.95	Level	10	0	0.952	0.85	1152
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1079.21 (Equation 13-6 or 13-7)

P_{FM} = 0.609 using Equation (Exhibit 13-6)

V_{12} = 491 pc/h

V_3 or V_{av34} 315 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1309	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	994	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 4.7 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.200 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.4 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	61.5 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst	SP
Agency or Company	HDR Inc.
Date Performed	8/21/2014 11:27:50 AM
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-4 WB
Junction	99 HOV On S of SR 536
Jurisdiction	FDOT
Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1320
Deceleration Lane Length L_D	
Freeway Volume, V_F	620
Ramp Volume, V_R	387
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{down} = 9400 ft

V_D = 0 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	620	0.95	Level	10	0	0.952	0.85	806
Ramp	387	0.95	Level	10	0	0.952	0.85	503
UpStream								
DownStream	0	0.94	Level	0	0	1.000	0.85	0

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.614 using Equation (Exhibit 13-6)

V_{12} = 495 pc/h

V_3 or V_{av34} 311 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1309	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	998	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 4.8 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.200 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	60.4 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	65.0 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	61.4 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	CD System On Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	5790
Ramp Volume, V_R	883
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5790	0.95	Level	3	0	0.985	0.85	7278
Ramp	883	0.95	Level	3	0	0.985	0.85	1110
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.555 using Equation (Exhibit 13-6)
V_{12} = 4039 pc/h
V_3 or V_{av34} 3239 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 4578 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8388	Exhibit 13-8		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5688	Exhibit 13-8	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 30.5 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

M_S = 1.173 (Exibit 13-11)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	38.0 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	42.4 mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☑ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☐ No ☑ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = 2940 ft	Acceleration Lane Length, L_A: 1500	L_{down} = ft
V_u = 883 veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 6673	
	Ramp Volume, V_R: 849	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6673	0.95	Level	3	0	0.985	0.85	8388
Ramp	849	0.95	Level	3	0	0.985	0.85	1067
UpStream	883	0.95	Level	3	0	0.985	0.85	1110
DownStream								

Merge Areas | **Diverge Areas**

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 4655 pc/h

V_3 or V_{av34} 3733 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 5688 pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

Merge Areas

	Actual	Capacity		LOS F?
V_{FO}	9455	Exhibit 13-8		Yes

Diverge Areas

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	6755	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

Merge Areas

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 38.9 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Diverge Areas

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

Merge Areas

M_S = 3.369 (Exibit 13-11)

Diverge Areas

D_s = (Exhibit 13-12)

S_R=	-12.5 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	I-4 On Ramp from SR 535
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	6673
Ramp Volume, V_R	849
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp
☑ Yes ☑ On
☐ No ☐ Off
L_{down} = 3067 ft
V_D = 1952 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6673	0.95	Level	3	0	0.985	0.85	8388
Ramp	849	0.95	Level	3	0	0.985	0.85	1067
UpStream								
DownStream	1952	0.95	Level	3	0	0.985	0.85	2454

Merge Areas | **Diverge Areas**

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = 0.555 using Equation (Exhibit 13-6)
V_{12} = 4655 pc/h
V_3 or V_{av34} 3733 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 5688 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = using Equation (Exhibit 13-7)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9455	Exhibit 13-8		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	6755	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 38.9 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = 3.369 (Exibit 13-11)

Speed Determination

D_s = (Exhibit 13-12)

S_R=	-12.5 mph (Exhibit 13-11)	S_R=	mph (Exhibit 13-12)
S_0=	56.1 mph (Exhibit 13-11)	S_0=	mph (Exhibit 13-12)
S =	mph (Exhibit 13-13)	S =	mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	Osceola Pkwy Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 5570	
	Ramp Volume, V_R: 1590	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5570	0.95	Level	3	0	0.985	0.85	7001
Ramp	1590	0.95	Level	3	0	0.985	0.85	1999
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 using Equation (Exhibit 13-7)

V_{12} = 4250 pc/h

V_3 or V_{av34} 2751 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = 4301 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7001	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	5002	Exhibit 13-8	7050	No
V_R	1999	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4250	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 14.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_s = 0.608 (Exhibit 13-12)

S_R= 51.0 mph (Exhibit 13-12)

S_0= 64.7 mph (Exhibit 13-12)

S = 55.5 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 536 Off Ramp
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Freeway Number of Lanes, N	3
Ramp Number of Lanes, N	2
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	1500
Freeway Volume, V_F	7522
Ramp Volume, V_R	1952
Freeway Free-Flow Speed, S_{FF}	65.0
Ramp Free-Flow Speed, S_{FR}	35.0

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	7522	0.95	Level	3	0	0.985	0.85	9455
Ramp	1952	0.95	Level	3	0	0.985	0.85	2454
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)
P_{FM} = using Equation (Exhibit 13-6)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)
S_R= mph (Exhibit 13-11)
S_0= mph (Exhibit 13-11)
S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)
P_{FD} = 0.450 using Equation (Exhibit 13-7)
V_{12} = 5604 pc/h
V_3 or V_{av34} 3851 pc/h (Equation 13-14 or 13-17)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = 6755 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9455	Exhibit 13-8	7050	Yes
$V_{FO} = V_F - V_R$	7001	Exhibit 13-8	7050	No
V_R	2454	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5604	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 35.3 (pc/mi/ln)
LOS = F (Exhibit 13-2)

Speed Determination

D_s = 0.649 (Exhibit 13-12)
S_R= 50.1 mph (Exhibit 13-12)
S_0= 64.7 mph (Exhibit 13-12)
S = 53.5 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	SP	Freeway/Dir of Travel	I-4 WB
Agency or Company	HDR Inc.	Junction	SR 535 Off Ramp to CD
Date Performed	8/21/2014 11:27:50 AM	Jurisdiction	FDOT
Analysis Time Period	PM	Analysis Year	2020 B

Project Description I-4 SAMR Re-Eval

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 2	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A:	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D: 1500	V_D = veh/h
	Freeway Volume, V_F: 6745	
	Ramp Volume, V_R: 955	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 35.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6745	0.95	Level	3	0	0.985	0.85	8478
Ramp	955	0.95	Level	3	0	0.985	0.85	1200
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.260 using Equation (Exhibit 13-7)

V_{12} = 3092 pc/h

V_3 or V_{av34} 2693 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3391 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8478	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	7278	Exhibit 13-8	9400	No
V_R	1200	Exhibit 13-10	4000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3092	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 6.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

D_s = 0.536 (Exhibit 13-12)

S_R = 52.7 mph (Exhibit 13-12)

S_0 = 65.3 mph (Exhibit 13-12)

S = 59.6 mph (Exhibit 13-13)

Copyright © 2012 University of Florida, All Rights Reserved

HCS – Weaving Output

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2020 B AM

Site Information

Freeway/Dir of Travel	Eastbound
Weaving Segment Location	SR 536 On Ramp to SR 535 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2616ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4420	0.95	3	0	1.5	1.2	0.985	0.85	5556
V_{RF}	1894	0.95	3	0	1.5	1.2	0.985	0.85	2381
V_{FR}	631	0.95	3	0	1.5	1.2	0.985	0.85	793
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	5581							V =	8755
V_W	3174								
VR	0.363								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	8755 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5544 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.322	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6264 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2020 NB AM

Site Information

Freeway/Dir of Travel	Westbound
Weaving Segment Location	SR 535 On Ramp to SR 536 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3081ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	5357	0.95	3	0	1.5	1.2	0.985	0.85	6734
V_{RF}	1120	0.95	3	0	1.5	1.2	0.985	0.85	1408
V_{FR}	1486	0.95	3	0	1.5	1.2	0.985	0.85	1868
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	6759							V =	10035
V_W	3276								
VR	0.326								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	10035 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	7557 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.112	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	4303 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2020 B PM

Site Information

Freeway/Dir of Travel	Eastbound
Weaving Segment Location	SR 536 On Ramp to SR 535 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2616ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4980	0.95	3	0	1.5	1.2	0.985	0.85	6260
V_{RF}	1993	0.95	3	0	1.5	1.2	0.985	0.85	2505
V_{FR}	1375	0.95	3	0	1.5	1.2	0.985	0.85	1728
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	6285							V =	10518
V_W	4233								
VR	0.402								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	10518 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	4994 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.764	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6709 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2020 NB PM

Site Information

Freeway/Dir of Travel	Westbound
Weaving Segment Location	SR 535 On Ramp to SR 536 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3081ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4741	0.95	3	0	1.5	1.2	0.985	0.85	5959
V_{RF}	829	0.95	3	0	1.5	1.2	0.985	0.85	1042
V_{FR}	1707	0.95	3	0	1.5	1.2	0.985	0.85	2146
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	5984							V =	9172
V_W	3188								
VR	0.348								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9172 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	7500 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.024	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	4534 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2020 B AM

Site Information

Freeway/Dir of Travel	Eastbound
Weaving Segment Location	SR 536 On Ramp to SR 535 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2616ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4420	0.95	3	0	1.5	1.2	0.985	0.85	5556
V_{RF}	1894	0.95	3	0	1.5	1.2	0.985	0.85	2381
V_{FR}	631	0.95	3	0	1.5	1.2	0.985	0.85	793
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	5581							V =	8755
V_W	3174								
VR	0.363								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	8755 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5544 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.322	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6264 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2020 B AM

Site Information

Freeway/Dir of Travel	Westbound
Weaving Segment Location	SR 535 On Ramp to SR 536 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3081ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	5357	0.95	3	0	1.5	1.2	0.985	0.85	6734
V_{RF}	1120	0.95	3	0	1.5	1.2	0.985	0.85	1408
V_{FR}	1686	0.95	3	0	1.5	1.2	0.985	0.85	2119
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	6759							V =	10286
V_W	3527								
VR	0.343								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	10286 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	7513 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.147	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	4483 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2020 B PM

Site Information

Freeway/Dir of Travel	Eastbound
Weaving Segment Location	SR 536 On Ramp to SR 535 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2616ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4980	0.95	3	0	1.5	1.2	0.985	0.85	6260
V_{RF}	1993	0.95	3	0	1.5	1.2	0.985	0.85	2505
V_{FR}	1375	0.95	3	0	1.5	1.2	0.985	0.85	1728
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	6285							V =	10518
V_W	4233								
VR	0.402								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	10518 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	4994 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.764	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6709 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2020 B PM

Site Information

Freeway/Dir of Travel	Westbound
Weaving Segment Location	SR 535 On Ramp to SR 536 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3081ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4740	0.95	3	0	1.5	1.2	0.985	0.85	5958
V_{RF}	829	0.95	3	0	1.5	1.2	0.985	0.85	1042
V_{FR}	1933	0.95	3	0	1.5	1.2	0.985	0.85	2430
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	5983							V =	9455
V_W	3472								
VR	0.367								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9455 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	7443 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.064	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	4750 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2016 NB AM

Site Information

Freeway/Dir of Travel	Eastbound
Weaving Segment Location	SR 536 On Ramp to SR 535 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2616ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3336	0.95	3	0	1.5	1.2	0.985	0.85	4193
V_{RF}	1468	0.95	3	0	1.5	1.2	0.985	0.85	1845
V_{FR}	499	0.95	3	0	1.5	1.2	0.985	0.85	627
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	4218							V =	6690
V_W	2472								
VR	0.370								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6690 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5439 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.030	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6341 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2016 NB AM

Site Information

Freeway/Dir of Travel	Westbound
Weaving Segment Location	SR 535 On Ramp to SR 536 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3081ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2485	0.95	3	0	1.5	1.2	0.985	0.85	3124
V_{RF}	797	0.95	3	0	1.5	1.2	0.985	0.85	1002
V_{FR}	1699	0.95	3	0	1.5	1.2	0.985	0.85	2136
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	3149							V =	6287
V_W	3138								
VR	0.499								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	1002 lc/h
Interchange density, ID	0.5 int/mi	Weaving lane changes, LC_W	1457 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1548 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	3005 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	485

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6287 pc/h	Weaving intensity factor, W	0.222
Weaving segment capacity, c_w	5872 veh/h	Weaving segment speed, S	52.9 mph
Weaving segment v/c ratio	0.897	Average weaving speed, S_W	55.9 mph
Weaving segment density, D	29.7 pc/mi/ln	Average non-weaving speed, S_{NW}	50.2 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	6250 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2016 B PM

Site Information

Freeway/Dir of Travel	Eastbound
Weaving Segment Location	SR 536 On Ramp to SR 535 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2616ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2678	0.95	3	0	1.5	1.2	0.985	0.85	3366
V_{RF}	1929	0.95	3	0	1.5	1.2	0.985	0.85	2425
V_{FR}	1292	0.95	3	0	1.5	1.2	0.985	0.85	1624
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	3391							V =	7440
V_W	4049								
VR	0.544								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	7440 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	3693 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.687	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	8348 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2016 NB PM

Site Information

Freeway/Dir of Travel	Westbound
Weaving Segment Location	SR 535 On Ramp to SR 536 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3081ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2786	0.95	3	0	1.5	1.2	0.985	0.85	3502
V_{RF}	737	0.95	3	0	1.5	1.2	0.985	0.85	926
V_{FR}	1540	0.95	3	0	1.5	1.2	0.985	0.85	1936
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	3527							V =	6389
V_W	2862								
VR	0.448								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	926 lc/h
Interchange density, ID	0.5 int/mi	Weaving lane changes, LC_W	1381 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1626 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	3007 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	543

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6389 pc/h	Weaving intensity factor, W	0.222
Weaving segment capacity, c_w	6543 veh/h	Weaving segment speed, S	52.9 mph
Weaving segment v/c ratio	0.818	Average weaving speed, S_W	55.9 mph
Weaving segment density, D	30.2 pc/mi/ln	Average non-weaving speed, S_{NW}	50.7 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5658 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2016 B AM

Site Information

Freeway/Dir of Travel	Eastbound
Weaving Segment Location	SR 536 On Ramp to SR 535 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2616ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3336	0.95	3	0	1.5	1.2	0.985	0.85	4193
V_{RF}	1468	0.95	3	0	1.5	1.2	0.985	0.85	1845
V_{FR}	499	0.95	3	0	1.5	1.2	0.985	0.85	627
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	4218							V =	6690
V_W	2472								
VR	0.370								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6690 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5439 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.030	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6341 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2016 B AM

Site Information

Freeway/Dir of Travel	Westbound
Weaving Segment Location	SR 535 On Ramp to SR 536 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3081ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2485	0.95	3	0	1.5	1.2	0.985	0.85	3124
V_{RF}	797	0.95	3	0	1.5	1.2	0.985	0.85	1002
V_{FR}	1833	0.95	3	0	1.5	1.2	0.985	0.85	2304
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	3149							V =	6455
V_W	3306								
VR	0.512								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	1002 lc/h
Interchange density, ID	0.5 int/mi	Weaving lane changes, LC_W	1457 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1548 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	3005 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	485

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6455 pc/h	Weaving intensity factor, W	0.222
Weaving segment capacity, c_w	5723 veh/h	Weaving segment speed, S	52.9 mph
Weaving segment v/c ratio	0.945	Average weaving speed, S_W	55.9 mph
Weaving segment density, D	30.5 pc/mi/ln	Average non-weaving speed, S_{NW}	50.0 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	6403 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2016 B PM

Site Information

Freeway/Dir of Travel	Eastbound
Weaving Segment Location	SR 536 On Ramp to SR 535 Off
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2616ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2678	0.95	3	0	1.5	1.2	0.985	0.85	3366
V_{RF}	1929	0.95	3	0	1.5	1.2	0.985	0.85	2425
V_{FR}	1292	0.95	3	0	1.5	1.2	0.985	0.85	1624
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	3391							V =	7440
V_W	4049								
VR	0.544								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	7440 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	3693 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.687	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	8348 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

FREEWAY WEAVING WORKSHEET

General Information

Analyst	AR
Agency/Company	HDR
Date Performed	6/19/2014
Analysis Time Period	2016 B PM

Site Information

Freeway/Dir of Travel	Westbound
Weaving Segment Location	V
Analysis Year	

Project Description

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3081ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2786	0.95	3	0	1.5	1.2	0.985	0.85	3502
V_{RF}	737	0.95	3	0	1.5	1.2	0.985	0.85	926
V_{FR}	1760	0.95	3	0	1.5	1.2	0.985	0.85	2212
V_{RR}	20	0.95	3	0	1.5	1.2	0.985	0.85	25
V_{NW}	3527							V =	6665
V_W	3138								
VR	0.471								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	926 lc/h
Interchange density, ID	0.5 int/mi	Weaving lane changes, LC_W	1381 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1626 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	3007 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	543

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6665 pc/h	Weaving intensity factor, W	0.222
Weaving segment capacity, c_w	6225 veh/h	Weaving segment speed, S	52.8 mph
Weaving segment v/c ratio	0.897	Average weaving speed, S_W	55.9 mph
Weaving segment density, D	31.5 pc/mi/ln	Average non-weaving speed, S_{NW}	50.3 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5921 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

Copyright © 2012 University of Florida, All Rights Reserved

Synchro - Intersection Analysis Outputs

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	277	1229	187	133	1029	247	168	79	154	259	71	267
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	182.7	186.3	186.3	184.5	186.3	184.5	175.9	190.0	174.3	186.3	182.7
Adj Flow Rate, veh/h	301	1336	203	145	1118	268	183	86	167	282	77	290
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	321	1978	628	170	1565	492	392	95	185	316	440	367
Arrive On Green	0.18	0.40	0.40	0.10	0.31	0.31	0.10	0.18	0.18	0.15	0.24	0.24
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	536	1040	1660	1863	1553
Grp Volume(v), veh/h	301	1336	203	145	1118	268	183	0	253	282	77	290
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1575	1660	1863	1553
Q Serve(g_s), s	27.0	35.6	10.0	13.0	31.7	22.7	13.6	0.0	25.4	21.8	5.3	28.3
Cycle Q Clear(g_c), s	27.0	35.6	10.0	13.0	31.7	22.7	13.6	0.0	25.4	21.8	5.3	28.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.66	1.00		1.00
Lane Grp Cap(c), veh/h	321	1978	628	170	1565	492	392	0	280	316	440	367
V/C Ratio(X)	0.94	0.68	0.32	0.86	0.71	0.54	0.47	0.00	0.90	0.89	0.18	0.79
Avail Cap(c_a), veh/h	428	1978	628	264	1565	492	394	0	308	390	554	462
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	65.2	40.1	16.5	71.9	49.3	46.1	47.4	0.0	65.0	45.1	49.1	57.9
Incr Delay (d2), s/veh	21.7	1.9	1.4	9.4	2.8	4.3	0.9	0.0	27.1	19.3	0.2	7.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.2	16.7	5.7	6.8	15.1	10.5	6.7	0.0	13.2	11.6	2.8	12.9
LnGrp Delay(d),s/veh	86.9	42.0	17.8	81.2	52.1	50.4	48.3	0.0	92.1	64.3	49.3	65.0
LnGrp LOS	F	D	B	F	D	D	D		F	E	D	E
Approach Vol, veh/h		1840			1531			436			649	
Approach Delay, s/veh		46.7			54.6			73.7			62.9	
Approach LOS		D			D			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	41.1	71.0	22.3	45.6	36.3	75.8	31.8	36.1
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	24.0	64.0	15.8	48.0	38.9	49.0	31.5	* 31.5
Max Q Clear Time (g_c+I1), s	15.0	37.6	15.6	30.3	29.0	33.7	23.8	27.4
Green Ext Time (p_c), s	0.5	10.4	0.0	2.9	0.2	6.9	0.5	1.2

Intersection Summary	
HCM 2010 Ctrl Delay	54.4
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	470	299	782	474	390	87	743	1330	505	167	942	288
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	181.0	186.3	190.0	182.7	186.3	177.6	177.6	186.3	186.3
Adj Flow Rate, veh/h	516	329	0	521	429	96	816	1462	0	184	1035	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	576	333	283	514	474	105	794	1479	631	184	1032	462
Arrive On Green	0.17	0.18	0.00	0.15	0.16	0.16	0.47	0.84	0.00	0.11	0.29	0.00
Sat Flow, veh/h	3442	1863	1583	3343	2880	639	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	516	329	0	521	262	263	816	1462	0	184	1035	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1750	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	27.9	33.5	0.0	29.2	27.6	28.0	44.7	74.1	0.0	20.7	55.4	0.0
Cycle Q Clear(g_c), s	27.9	33.5	0.0	29.2	27.6	28.0	44.7	74.1	0.0	20.7	55.4	0.0
Prop In Lane	1.00		1.00	1.00		0.37	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	576	333	283	514	291	288	794	1479	631	184	1032	462
V/C Ratio(X)	0.90	0.99	0.00	1.01	0.90	0.91	1.03	0.99	0.00	1.00	1.00	0.00
Avail Cap(c_a), veh/h	576	333	283	514	326	322	794	1479	631	184	1032	462
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.35	0.35	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	77.5	77.8	0.0	80.4	77.8	78.0	50.3	15.2	0.0	84.6	67.3	0.0
Incr Delay (d2), s/veh	16.1	45.5	0.0	43.3	24.6	26.9	26.4	11.5	0.0	65.9	28.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.5	21.5	0.0	16.6	15.5	15.7	23.6	36.5	0.0	13.0	31.2	0.0
LnGrp Delay(d),s/veh	93.5	123.3	0.0	123.7	102.4	104.9	76.7	26.6	0.0	150.5	96.0	0.0
LnGrp LOS	F	F		F	F	F	F	C		F	F	
Approach Vol, veh/h		845			1046			2278			1219	
Approach Delay, s/veh		105.1			113.6			44.6			104.3	
Approach LOS		F			F			D			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	51.2	62.3	38.5	38.0	27.6	85.9	35.9	40.6
Change Period (Y+Rc), s	* 6.5	6.8999996	6.6999998	6.6999998	6.8999996	* 6.5	6.6999998	6.6000004
Max Green Setting (Gmax), s	* 44.7	55.4000015	28.100002	* 32	20.7000027	79.4000015	29.200001	* 34
Max Q Clear Time (g_c+I1), s	46.7	57.4	29.9	30.0	22.7	76.1	31.2	35.5
Green Ext Time (p_c), s	0.0	0.0	0.0	1.2	0.0	2.7	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	81.0
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	669	75	970	155	72	97	666	1812	185	114	1528	556
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Lane Util. Factor	0.95	0.95	0.88	0.91	0.91		0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1603	1631	2682	1595	2859		3367	4988	1583	1687	5036	1568
Flt Permitted	0.95	0.96	1.00	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1603	1631	2682	1595	2859		3367	4988	1583	1687	5036	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	704	79	1021	163	76	102	701	1907	195	120	1608	585
RTOR Reduction (vph)	0	0	33	0	81	0	0	0	52	0	0	376
Lane Group Flow (vph)	387	396	988	117	143	0	701	1907	143	120	1608	209
Heavy Vehicles (%)	7%	4%	6%	3%	4%	21%	4%	4%	2%	7%	3%	3%
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8	1	4	4		1	6		5	2	
Permitted Phases			8						6			2
Actuated Green, G (s)	48.9	48.9	80.7	15.9	15.9		31.8	83.6	83.6	16.1	67.9	67.9
Effective Green, g (s)	48.9	48.9	80.7	15.9	15.9		31.8	83.6	83.6	16.1	67.9	67.9
Actuated g/C Ratio	0.26	0.26	0.42	0.08	0.08		0.17	0.44	0.44	0.08	0.36	0.36
Clearance Time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	412	419	1139	133	239		563	2194	696	142	1799	560
v/s Ratio Prot	0.24	c0.24	0.15	c0.07	0.05		c0.21	c0.38		0.07	0.32	
v/s Ratio Perm			0.22						0.09			0.13
v/c Ratio	0.94	0.95	0.87	0.88	0.60		1.25	0.87	0.21	0.85	0.89	0.37
Uniform Delay, d1	69.1	69.2	49.8	86.1	84.0		79.1	48.2	32.8	85.7	57.6	45.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.09	0.62	0.39	1.31	0.47	0.84
Incremental Delay, d2	29.1	30.1	7.2	43.5	4.0		119.0	3.0	0.4	20.3	4.0	1.0
Delay (s)	98.2	99.4	57.0	129.6	88.0		205.2	33.0	13.0	132.5	31.2	38.9
Level of Service	F	F	E	F	F		F	C	B	F	C	D
Approach Delay (s)		75.1			102.3			74.7			38.4	
Approach LOS		E			F			E			D	

Intersection Summary			
HCM 2000 Control Delay	64.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	190.0	Sum of lost time (s)	25.5
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	258	1633	0	0	2154	499	0	0	0	1095	0	1030
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	0.0	0.0	186.3	186.3				181.0	0.0	184.5
Adj Flow Rate, veh/h	272	1719	0	0	2267	0				1153	0	1084
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	290	2773	0	0	2545	534				1223	0	1009
Arrive On Green	0.16	0.55	0.00	0.00	0.67	0.00				0.37	0.00	0.37
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	272	1719	0	0	2267	0				1153	0	1084
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	28.8	44.1	0.0	0.0	46.6	0.0				63.4	0.0	69.5
Cycle Q Clear(g_c), s	28.8	44.1	0.0	0.0	46.6	0.0				63.4	0.0	69.5
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	290	2773	0	0	2545	534				1223	0	1009
V/C Ratio(X)	0.94	0.62	0.00	0.00	0.89	0.00				0.94	0.00	1.07
Avail Cap(c_a), veh/h	313	2773	0	0	2545	534				1223	0	1009
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.39	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	78.6	29.7	0.0	0.0	28.1	0.0				58.3	0.0	60.3
Incr Delay (d2), s/veh	34.1	1.1	0.0	0.0	2.1	0.0				14.1	0.0	50.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.9	21.0	0.0	0.0	19.4	0.0				31.7	0.0	33.6
LnGrp Delay(d),s/veh	112.7	30.7	0.0	0.0	30.2	0.0				72.4	0.0	110.6
LnGrp LOS	F	C			C					E		F
Approach Vol, veh/h		1991			2267						2237	
Approach Delay, s/veh		41.9			30.2						90.9	
Approach LOS		D			C						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	39.5	71.5		79.0		111.0		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	33.5	61.6		69.5		103.6		
Max Q Clear Time (g_c+I1), s	30.8	48.6		71.5		46.1		
Green Ext Time (p_c), s	0.2	12.8		0.0		52.9		

Intersection Summary		
HCM 2010 Ctrl Delay		54.7
HCM 2010 LOS		D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	875	200	237	412	0	510	0	1299	348	675	1610	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	184.5	166.7	168.1	177.6	0.0	179.2	0.0	186.3	168.1	182.7	184.5	0.0
Adj Flow Rate, veh/h	972	222	0	458	0	0	0	1443	387	750	1789	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	1013	307	139	509	0	0	0	1678	693	790	3071	0
Arrive On Green	0.30	0.10	0.00	0.16	0.00	0.00	0.00	0.44	0.44	0.23	0.61	0.00
Sat Flow, veh/h	3408	3167	1429	3281	458		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	972	222	0	458	76.0		0	1443	387	750	1789	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	E		0	1695	1429	1688	1679	0
Q Serve(g_s), s	43.4	10.5	0.0	21.2			0.0	39.6	28.3	33.9	33.3	0.0
Cycle Q Clear(g_c), s	43.4	10.5	0.0	21.2			0.0	39.6	28.3	33.9	33.3	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	1013	307	139	509			0	1678	693	790	3071	0
V/C Ratio(X)	0.96	0.72	0.00	0.90			0.00	0.86	0.56	0.95	0.58	0.00
Avail Cap(c_a), veh/h	1036	875	395	663			0	1678	693	804	3071	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.59	0.59	1.00	1.00	0.00
Uniform Delay (d), s/veh	53.5	67.9	0.0	64.3			0.0	40.2	23.3	58.4	18.3	0.0
Incr Delay (d2), s/veh	18.6	2.0	0.0	11.7			0.0	3.7	1.9	20.3	0.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	23.0	4.7	0.0	10.5			0.0	19.0	11.4	18.1	15.6	0.0
LnGrp Delay(d),s/veh	72.1	69.9	0.0	76.0			0.0	43.9	25.2	78.7	19.1	0.0
LnGrp LOS	E	E		E				D	C	E	B	
Approach Vol, veh/h		1194						1830			2539	
Approach Delay, s/veh		71.7						40.0			36.7	
Approach LOS		E						D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	43.4	92.7	31.9	22.0		136.0	54.0	
Change Period (Y+Rc), s*	7.1	7.1	6.5	7.9	7.0	6.5	7.9	
Max Green Setting (Gmax), s	36.3	85.6	25.0	14.9		129.5	46.1	
Max Q Clear Time (g_c+I1), s	35.9	41.6	23.2	12.5		35.3	45.4	
Green Ext Time (p_c), s	0.4	8.6	0.8	1.1		49.3	0.6	

Intersection Summary	
HCM 2010 Ctrl Delay	47.6
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	249	75	90	43	64	56	86	1342	44	235	1854	170
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	161.0	162.7	190.0	190.0	186.3	190.0	177.6	186.3	190.0	184.5	171.2	166.7
Adj Flow Rate, veh/h	274	82	99	47	70	62	95	1475	48	258	2037	187
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	248	231	279	127	187	153	111	2001	65	275	2275	690
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.07	0.40	0.40	0.16	0.49	0.49
Sat Flow, veh/h	1083	672	812	298	544	446	1691	5059	165	1757	4673	1417
Grp Volume(v), veh/h	274	0	181	179	0	0	95	988	535	258	2037	187
Grp Sat Flow(s),veh/h/ln	1083	0	1484	1287	0	0	1691	1695	1834	1757	1558	1417
Q Serve(g_s), s	36.2	0.0	17.1	11.2	0.0	0.0	10.4	46.7	46.7	27.2	74.4	14.6
Cycle Q Clear(g_c), s	64.5	0.0	17.1	28.3	0.0	0.0	10.4	46.7	46.7	27.2	74.4	14.6
Prop In Lane	1.00		0.55	0.26		0.35	1.00		0.09	1.00		1.00
Lane Grp Cap(c), veh/h	248	0	510	467	0	0	111	1341	725	275	2275	690
V/C Ratio(X)	1.11	0.00	0.35	0.38	0.00	0.00	0.85	0.74	0.74	0.94	0.90	0.27
Avail Cap(c_a), veh/h	248	0	510	467	0	0	133	1341	725	319	2275	690
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.59	0.59	0.59
Uniform Delay (d), s/veh	78.5	0.0	46.0	50.7	0.0	0.0	86.7	48.4	48.4	78.2	43.8	28.5
Incr Delay (d2), s/veh	88.7	0.0	0.3	0.3	0.0	0.0	30.2	3.7	6.6	21.4	3.7	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	18.9	0.0	7.1	7.5	0.0	0.0	5.8	22.5	24.9	14.9	32.7	5.8
LnGrp Delay(d),s/veh	167.1	0.0	46.2	51.0	0.0	0.0	116.9	52.0	55.0	99.6	47.5	29.0
LnGrp LOS	F		D	D			F	D	D	F	D	C
Approach Vol, veh/h		455			179			1618			2482	
Approach Delay, s/veh		119.0			51.0			56.8			51.5	
Approach LOS		F			D			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	19.2	99.8		71.0	36.3	82.7		71.0
Change Period (Y+Rc), s	6.6	6.1000004		6.5	6.6	6.1000004		6.5
Max Green Setting (Gmax), s	14.8	91.300003		64.5	34.7	71.900002		64.5
Max Q Clear Time (g_c+I1), s	12.4	76.4		30.3	29.2	48.7		66.5
Green Ext Time (p_c), s	0.0	14.3		2.7	0.1	21.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	59.8
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1434	30	44	864	165	255	15	285	0	0	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00			0.88
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (prot)		4848	1553	1805	4510	1468	1394	1434	1077			2137
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (perm)		4848	1553	1805	4510	1468	1394	1434	1077			2137
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1559	33	48	939	179	277	16	310	0	0	186
RTOR Reduction (vph)	0	0	17	0	0	66	0	0	258	0	0	175
Lane Group Flow (vph)	0	1559	16	48	939	113	147	146	52	0	0	11
Heavy Vehicles (%)	5%	7%	4%	0%	15%	10%	23%	0%	50%	11%	0%	33%
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	Perm			Perm
Protected Phases		6		5	2		4	4				
Permitted Phases			6			2			4			8
Actuated Green, G (s)		64.2	64.2	12.0	82.2	82.2	21.8	21.8	21.8			8.0
Effective Green, g (s)		64.2	64.2	12.0	82.2	82.2	21.8	21.8	21.8			8.0
Actuated g/C Ratio		0.49	0.49	0.09	0.63	0.63	0.17	0.17	0.17			0.06
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Vehicle Extension (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			5.0
Lane Grp Cap (vph)		2394	766	166	2851	928	233	240	180			131
v/s Ratio Prot		c0.32		0.03	c0.21		c0.11	0.10				
v/s Ratio Perm			0.01			0.08			0.05			c0.01
v/c Ratio		0.65	0.02	0.29	0.33	0.12	0.63	0.61	0.29			0.09
Uniform Delay, d1		24.5	16.8	55.0	11.1	9.5	50.4	50.1	47.3			57.6
Progression Factor		0.26	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Incremental Delay, d2		1.0	0.0	1.3	0.3	0.3	6.1	5.0	1.2			0.6
Delay (s)		7.5	16.9	56.3	11.4	9.8	56.5	55.1	48.5			58.2
Level of Service		A	B	E	B	A	E	E	D			E
Approach Delay (s)		7.7			13.0			52.1			58.2	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM 2000 Control Delay	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	186	1355	51	89	1308	157	193	3	91	177	2	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1308	4550	1538	1703	5360		1466	1477	1056	1289	1188	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1308	4550	1538	1703	5360		1466	1477	1056	1289	1188	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	202	1473	55	97	1422	171	210	3	99	192	2	111
RTOR Reduction (vph)	0	0	33	0	16	0	0	0	87	0	92	0
Lane Group Flow (vph)	202	1473	22	97	1577	0	107	106	12	192	21	0
Heavy Vehicles (%)	38%	14%	5%	6%	19%	28%	17%	0%	53%	40%	0%	37%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6						4			
Actuated Green, G (s)	22.6	52.6	52.6	13.7	43.7		15.5	15.5	15.5	22.2	22.2	
Effective Green, g (s)	22.6	52.6	52.6	13.7	43.7		15.5	15.5	15.5	22.2	22.2	
Actuated g/C Ratio	0.17	0.40	0.40	0.11	0.34		0.12	0.12	0.12	0.17	0.17	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	227	1841	622	179	1801		174	176	125	220	202	
v/s Ratio Prot	0.15	c0.32		0.06	c0.29		c0.07	0.07		c0.15	0.02	
v/s Ratio Perm			0.01						0.01			
v/c Ratio	0.89	0.80	0.04	0.54	0.88		0.61	0.60	0.09	0.87	0.10	
Uniform Delay, d1	52.5	34.1	23.4	55.2	40.6		54.4	54.3	51.0	52.5	45.5	
Progression Factor	1.00	1.00	1.00	0.96	0.93		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	31.6	3.8	0.1	3.2	6.1		7.2	6.6	0.4	30.1	0.3	
Delay (s)	84.1	37.8	23.5	56.2	43.9		61.6	60.9	51.4	82.6	45.8	
Level of Service	F	D	C	E	D		E	E	D	F	D	
Approach Delay (s)		42.8			44.6			58.1			69.0	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	46.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	317	1054	238	67	1200	275	187	71	133	247	79	377
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	182.7	186.3	186.3	184.5	186.3	184.5	175.9	190.0	174.3	186.3	182.7
Adj Flow Rate, veh/h	345	1146	259	73	1304	299	203	77	145	268	86	410
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	366	2249	714	101	1517	477	315	80	151	301	414	345
Arrive On Green	0.21	0.45	0.45	0.06	0.30	0.30	0.08	0.15	0.15	0.15	0.22	0.22
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	547	1030	1660	1863	1553
Grp Volume(v), veh/h	345	1146	259	73	1304	299	203	0	222	268	86	410
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1577	1660	1863	1553
Q Serve(g_s), s	28.0	24.0	10.8	5.9	35.7	23.8	11.3	0.0	20.5	19.5	5.5	32.5
Cycle Q Clear(g_c), s	28.0	24.0	10.8	5.9	35.7	23.8	11.3	0.0	20.5	19.5	5.5	32.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.65	1.00		1.00
Lane Grp Cap(c), veh/h	366	2249	714	101	1517	477	315	0	231	301	414	345
V/C Ratio(X)	0.94	0.51	0.36	0.72	0.86	0.63	0.64	0.00	0.96	0.89	0.21	1.19
Avail Cap(c_a), veh/h	411	2249	714	145	1517	477	315	0	231	311	414	345
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	57.2	28.6	12.5	67.9	48.2	44.1	50.3	0.0	62.1	43.7	46.4	56.9
Incr Delay (d2), s/veh	27.7	0.8	1.4	3.7	6.6	6.1	4.5	0.0	48.7	25.1	0.2	110.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.6	11.2	6.0	3.0	17.5	11.2	7.3	0.0	12.1	11.0	2.9	24.5
LnGrp Delay(d),s/veh	84.9	29.5	13.9	71.6	54.8	50.2	54.8	0.0	110.8	68.9	46.7	167.3
LnGrp LOS	F	C	B	E	D	D	D		F	E	D	F
Approach Vol, veh/h		1750			1676			425			764	
Approach Delay, s/veh		38.1			54.7			84.1			119.2	
Approach LOS		D			D			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.0	73.0	18.0	40.0	37.3	54.7	29.1	28.9
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	12.0	66.0	11.3	32.5	33.9	44.0	22.5	* 20.5
Max Q Clear Time (g_c+I1), s	7.9	26.0	13.3	34.5	30.0	37.7	21.5	22.5
Green Ext Time (p_c), s	1.0	10.0	0.0	0.0	0.1	4.2	0.1	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	61.8
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	288	287	531	402	209	167	725	1199	474	190	1578	318
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	181.0	186.3	190.0	182.7	186.3	177.6	177.6	186.3	186.3
Adj Flow Rate, veh/h	316	315	0	442	230	184	797	1318	0	209	1734	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	453	337	286	326	279	214	567	1522	649	224	1386	620
Arrive On Green	0.13	0.18	0.00	0.10	0.15	0.15	0.17	0.43	0.00	0.13	0.39	0.00
Sat Flow, veh/h	3442	1863	1583	3343	1910	1464	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	316	315	0	442	212	202	797	1318	0	209	1734	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1604	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	14.7	27.9	0.0	16.3	19.5	20.5	28.1	56.6	0.0	20.5	65.5	0.0
Cycle Q Clear(g_c), s	14.7	27.9	0.0	16.3	19.5	20.5	28.1	56.6	0.0	20.5	65.5	0.0
Prop In Lane	1.00		1.00	1.00		0.91	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	453	337	286	326	259	234	567	1522	649	224	1386	620
V/C Ratio(X)	0.70	0.94	0.00	1.36	0.82	0.86	1.41	0.87	0.00	0.94	1.25	0.00
Avail Cap(c_a), veh/h	453	368	312	326	401	364	567	1522	649	224	1386	620
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.56	0.56	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	69.4	67.5	0.0	75.5	69.3	69.7	69.6	43.3	0.0	71.9	50.9	0.0
Incr Delay (d2), s/veh	4.0	28.8	0.0	179.1	6.8	11.0	188.2	4.0	0.0	41.9	119.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.2	17.0	0.0	15.6	10.0	9.9	27.9	28.5	0.0	12.2	54.9	0.0
LnGrp Delay(d),s/veh	73.4	96.3	0.0	254.6	76.1	80.8	257.8	47.3	0.0	113.8	169.9	0.0
LnGrp LOS	E	F		F	E	F	F	D		F	F	
Approach Vol, veh/h		631			856			2115			1943	
Approach Delay, s/veh		84.8			169.4			126.6			163.8	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	37.8	72.4	28.7	31.1	31.8	78.4	23.0	36.8
Change Period (Y+Rc), s	* 6.8999996	6.8999996	6.6999998	6.6999998	6.8999996	* 6.5	6.6999998	6.6000004
Max Green Setting (Gmax), s	* 28.1	* 65.5	* 11.3	17.900002	* 22.7	11.900002	26.299999	* 33
Max Q Clear Time (g_c+I1), s	30.1	67.5	16.7	22.5	22.5	58.6	18.3	29.9
Green Ext Time (p_c), s	0.0	0.0	0.0	1.9	0.0	7.4	0.0	0.3

Intersection Summary	
HCM 2010 Ctrl Delay	141.5
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	571	50	366	85	70	99	711	1728	95	97	1745	669
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Lane Util. Factor	0.95	0.95	0.88	0.91	0.91		0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1603	1626	2682	1595	2788		3367	4988	1583	1687	5036	1568
Flt Permitted	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1603	1626	2682	1595	2788		3367	4988	1583	1687	5036	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	601	53	385	89	74	104	748	1819	100	102	1837	704
RTOR Reduction (vph)	0	0	58	0	98	0	0	0	49	0	0	307
Lane Group Flow (vph)	325	329	327	80	89	0	748	1819	51	102	1837	397
Heavy Vehicles (%)	7%	4%	6%	3%	4%	21%	4%	4%	2%	7%	3%	3%
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8	1	4	4		1	6		5	2	
Permitted Phases			8						6			2
Actuated Green, G (s)	34.5	34.5	72.2	9.1	9.1		37.7	85.9	85.9	15.0	63.2	63.2
Effective Green, g (s)	34.5	34.5	72.2	9.1	9.1		37.7	85.9	85.9	15.0	63.2	63.2
Actuated g/C Ratio	0.20	0.20	0.42	0.05	0.05		0.22	0.51	0.51	0.09	0.37	0.37
Clearance Time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	325	329	1139	85	149		746	2520	799	148	1872	582
v/s Ratio Prot	c0.20	0.20	0.06	c0.05	0.03		c0.22	0.36		0.06	c0.36	
v/s Ratio Perm			0.06						0.03			0.25
v/c Ratio	1.00	1.00	0.29	0.94	0.59		1.00	0.72	0.06	0.69	0.98	0.68
Uniform Delay, d1	67.8	67.8	32.0	80.2	78.6		66.2	32.7	21.5	75.2	52.8	45.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.74	0.51	0.32	1.08	0.37	0.52
Incremental Delay, d2	49.9	49.6	0.1	77.8	6.2		27.6	1.2	0.1	1.2	3.3	0.6
Delay (s)	117.7	117.4	32.2	158.0	84.9		76.8	18.0	7.0	82.7	22.7	24.0
Level of Service	F	F	C	F	F		E	B	A	F	C	C
Approach Delay (s)		85.9			106.8			34.1			25.4	
Approach LOS		F			F			C			C	

Intersection Summary			
HCM 2000 Control Delay	41.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	25.5
Intersection Capacity Utilization	97.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	192	1588	0	0	1571	625	0	0	0	710	0	946
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	0.0	0.0	186.3	186.3				181.0	0.0	184.5
Adj Flow Rate, veh/h	202	1672	0	0	1654	0				747	0	996
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	224	2578	0	0	2473	519				1297	0	1071
Arrive On Green	0.13	0.51	0.00	0.00	0.66	0.00				0.39	0.00	0.39
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	202	1672	0	0	1654	0				747	0	996
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	18.1	38.9	0.0	0.0	21.6	0.0				28.3	0.0	55.6
Cycle Q Clear(g_c), s	18.1	38.9	0.0	0.0	21.6	0.0				28.3	0.0	55.6
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	224	2578	0	0	2473	519				1297	0	1071
V/C Ratio(X)	0.90	0.65	0.00	0.00	0.67	0.00				0.58	0.00	0.93
Avail Cap(c_a), veh/h	292	2578	0	0	2473	519				1485	0	1226
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.37	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	69.3	29.1	0.0	0.0	22.4	0.0				38.8	0.0	47.2
Incr Delay (d2), s/veh	24.4	1.3	0.0	0.0	0.5	0.0				0.3	0.0	11.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.4	18.4	0.0	0.0	9.0	0.0				13.1	0.0	22.8
LnGrp Delay(d),s/veh	93.7	30.4	0.0	0.0	22.9	0.0				39.1	0.0	58.3
LnGrp LOS	F	C			C					D		E
Approach Vol, veh/h		1874			1654						1743	
Approach Delay, s/veh		37.2			22.9						50.1	
Approach LOS		D			C						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	28.8	69.2		72.0		98.0		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	26.5	46.6		71.5		81.6		
Max Q Clear Time (g_c+I1), s	20.1	23.6		57.6		40.9		
Green Ext Time (p_c), s	0.3	20.9		4.8		34.9		

Intersection Summary	
HCM 2010 Ctrl Delay	37.0
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	301	92	126	314	0	456	0	1858	330	313	1375	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	184.5	166.7	168.1	177.6	0.0	179.2	0.0	186.3	168.1	182.7	184.5	0.0
Adj Flow Rate, veh/h	334	102	0	349	0	0	0	2064	367	348	1528	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	381	151	68	403	0	0	0	2593	905	396	3412	0
Arrive On Green	0.11	0.05	0.00	0.12	0.00	0.00	0.00	1.00	1.00	0.12	0.68	0.00
Sat Flow, veh/h	3408	3167	1429	3281	349		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	334	102	0	349	67.2		0	2064	367	348	1528	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	E		0	1695	1429	1688	1679	0
Q Serve(g_s), s	13.6	4.5	0.0	14.7			0.0	0.0	0.0	14.3	19.8	0.0
Cycle Q Clear(g_c), s	13.6	4.5	0.0	14.7			0.0	0.0	0.0	14.3	19.8	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	381	151	68	403			0	2593	905	396	3412	0
V/C Ratio(X)	0.88	0.68	0.00	0.87			0.00	0.80	0.41	0.88	0.45	0.00
Avail Cap(c_a), veh/h	413	602	272	612			0	2593	905	429	3412	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.09	0.09	1.00	1.00	0.00
Uniform Delay (d), s/veh	61.7	66.0	0.0	60.7			0.0	0.0	0.0	61.2	10.5	0.0
Incr Delay (d2), s/veh	17.2	3.2	0.0	6.6			0.0	0.2	0.1	17.7	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.3	2.0	0.0	7.1			0.0	0.1	0.0	7.6	9.2	0.0
LnGrp Delay(d),s/veh	78.8	69.2	0.0	67.2			0.0	0.2	0.1	78.9	10.9	0.0
LnGrp LOS	E	E		E				A	A	E	B	
Approach Vol, veh/h		436						2431			1876	
Approach Delay, s/veh		76.6						0.2			23.6	
Approach LOS		E						A			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	23.6	107.4	25.2	13.7		131.0	39.0	
Change Period (Y+Rc), s*	7.1000004	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	* 17.9	70.5	26.3	26.8		95.5	17.1	
Max Q Clear Time (g_c+I1), s	16.3	2.0	16.7	6.5		21.8	15.6	
Green Ext Time (p_c), s	0.2	60.2	0.6	0.4		64.2	0.1	

Intersection Summary	
HCM 2010 Ctrl Delay	20.0
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	207	64	86	44	75	285	90	1696	43	226	1205	384
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	161.0	161.6	190.0	190.0	186.3	190.0	177.6	186.3	190.0	184.5	171.2	166.7
Adj Flow Rate, veh/h	227	70	95	48	82	313	99	1864	47	248	1324	422
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	148	230	313	73	122	412	117	1876	47	259	2087	633
Arrive On Green	0.37	0.37	0.37	0.37	0.37	0.37	0.07	0.37	0.37	0.15	0.45	0.45
Sat Flow, veh/h	852	622	845	134	329	1113	1691	5102	129	1757	4673	1417
Grp Volume(v), veh/h	227	0	165	443	0	0	99	1238	673	248	1324	422
Grp Sat Flow(s),veh/h/ln	852	0	1467	1576	0	0	1691	1695	1840	1757	1558	1417
Q Serve(g_s), s	21.0	0.0	13.6	28.3	0.0	0.0	9.8	61.9	62.0	23.8	37.2	39.9
Cycle Q Clear(g_c), s	62.9	0.0	13.6	41.9	0.0	0.0	9.8	61.9	62.0	23.8	37.2	39.9
Prop In Lane	1.00		0.58	0.11		0.71	1.00		0.07	1.00		1.00
Lane Grp Cap(c), veh/h	148	0	543	607	0	0	117	1246	676	259	2087	633
V/C Ratio(X)	1.54	0.00	0.30	0.73	0.00	0.00	0.85	0.99	0.99	0.96	0.63	0.67
Avail Cap(c_a), veh/h	148	0	543	607	0	0	187	1246	676	259	2087	633
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.79	0.79	0.79
Uniform Delay (d), s/veh	77.5	0.0	38.0	46.8	0.0	0.0	78.2	53.5	53.6	71.9	36.3	37.1
Incr Delay (d2), s/veh	272.7	0.0	0.2	4.1	0.0	0.0	9.9	24.0	33.3	37.8	1.2	4.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	18.1	0.0	5.5	18.9	0.0	0.0	4.9	33.0	37.7	14.3	16.2	16.4
LnGrp Delay(d),s/veh	350.2	0.0	38.2	51.0	0.0	0.0	88.1	77.5	86.9	109.7	37.5	41.5
LnGrp LOS	F		D	D			F	E	F	F	D	D
Approach Vol, veh/h		392			443			2010			1994	
Approach Delay, s/veh		218.9			51.0			81.2			47.3	
Approach LOS		F			D			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.6	82.0		69.4	32.0	68.6		69.4
Change Period (Y+Rc), s	6.6	6.1000004		6.5	6.6	6.1000004		6.5
Max Green Setting (Gmax), s	18.6	68.900002		62.9	25.1	* 62.5		62.9
Max Q Clear Time (g_c+I1), s	11.8	41.9		43.9	25.8	64.0		64.9
Green Ext Time (p_c), s	0.0	24.6		4.3	0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	75.6
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1379	69	90	938	185	99	7	118	0	0	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00			0.88
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (prot)		4848	1553	1805	4510	1468	1394	1444	1077			2137
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (perm)		4848	1553	1805	4510	1468	1394	1444	1077			2137
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1499	75	98	1020	201	108	8	128	0	0	74
RTOR Reduction (vph)	0	0	40	0	0	71	0	0	114	0	0	69
Lane Group Flow (vph)	0	1499	35	98	1020	130	58	58	14	0	0	5
Heavy Vehicles (%)	5%	7%	4%	0%	15%	10%	23%	0%	50%	11%	0%	33%
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	Perm			Perm
Protected Phases		6		5	2		4	4				
Permitted Phases			6			2			4			8
Actuated Green, G (s)		46.9	46.9	12.0	64.9	64.9	10.7	10.7	10.7			6.4
Effective Green, g (s)		46.9	46.9	12.0	64.9	64.9	10.7	10.7	10.7			6.4
Actuated g/C Ratio		0.47	0.47	0.12	0.65	0.65	0.11	0.11	0.11			0.06
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Vehicle Extension (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			5.0
Lane Grp Cap (vph)		2273	728	216	2926	952	149	154	115			136
v/s Ratio Prot		c0.31		c0.05	0.23		c0.04	0.04				
v/s Ratio Perm			0.02			0.09			0.01			c0.00
v/c Ratio		0.66	0.05	0.45	0.35	0.14	0.39	0.38	0.12			0.03
Uniform Delay, d1		20.4	14.4	40.9	8.0	6.8	41.6	41.5	40.4			43.9
Progression Factor		0.23	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Incremental Delay, d2		1.3	0.1	2.1	0.3	0.3	2.3	2.1	0.6			0.2
Delay (s)		6.0	14.5	43.0	8.3	7.1	43.9	43.6	41.0			44.1
Level of Service		A	B	D	A	A	D	D	D			D
Approach Delay (s)		6.4			10.7			42.3			44.1	
Approach LOS		A			B			D			D	

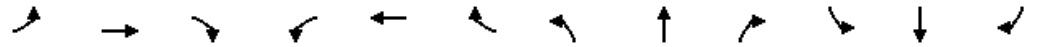
Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	1096	473	117	1047	29	55	2	102	93	3	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1308	4550	1538	1703	5459		1466	1488	1056	1289	1210	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (perm)	1308	4550	1538	1703	5459		1466	1488	1056	1289	1210	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	1191	514	127	1138	32	60	2	111	101	3	49
RTOR Reduction (vph)	0	0	328	0	3	0	0	0	94	0	43	0
Lane Group Flow (vph)	174	1191	186	127	1167	0	31	31	17	101	9	0
Heavy Vehicles (%)	38%	14%	5%	6%	19%	28%	17%	0%	53%	40%	0%	37%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6						4			
Actuated Green, G (s)	16.7	36.2	36.2	11.0	30.5		15.0	15.0	15.0	11.8	11.8	
Effective Green, g (s)	16.7	36.2	36.2	11.0	30.5		15.0	15.0	15.0	11.8	11.8	
Actuated g/C Ratio	0.17	0.36	0.36	0.11	0.30		0.15	0.15	0.15	0.12	0.12	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	218	1647	556	187	1664		219	223	158	152	142	
v/s Ratio Prot	0.13	c0.26		0.07	c0.21		c0.02	0.02		c0.08	0.01	
v/s Ratio Perm			0.12						0.02			
v/c Ratio	0.80	0.72	0.33	0.68	0.70		0.14	0.14	0.11	0.66	0.06	
Uniform Delay, d1	40.0	27.6	23.2	42.8	30.7		36.9	36.9	36.7	42.2	39.2	
Progression Factor	1.00	1.00	1.00	0.89	0.86		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	18.1	2.8	1.6	9.1	2.4		0.4	0.4	0.4	11.4	0.3	
Delay (s)	58.2	30.4	24.8	47.4	28.9		37.3	37.3	37.1	53.6	39.4	
Level of Service	E	C	C	D	C		D	D	D	D	D	
Approach Delay (s)		31.4			30.7			37.2			48.8	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	32.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	58.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	124	0	0	0	0	0	0	207	170	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4							6.2	6.2			
Lane Util. Factor	1.00							1.00	1.00			
Frt	1.00							1.00	0.85			
Flt Protected	0.95							1.00	1.00			
Satd. Flow (prot)	1770							1863	1583			
Flt Permitted	0.95							1.00	1.00			
Satd. Flow (perm)	1770							1863	1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	135	0	0	0	0	0	0	225	185	0	0	0
RTOR Reduction (vph)	114	0	0	0	0	0	0	0	88	0	0	0
Lane Group Flow (vph)	21	0	0	0	0	0	0	225	97	0	0	0
Turn Type	Prot							NA	Perm			
Protected Phases	7							2				
Permitted Phases									2			
Actuated Green, G (s)	5.7							19.0	19.0			
Effective Green, g (s)	5.7							19.0	19.0			
Actuated g/C Ratio	0.16							0.52	0.52			
Clearance Time (s)	5.4							6.2	6.2			
Vehicle Extension (s)	3.5							3.5	3.5			
Lane Grp Cap (vph)	277							975	828			
v/s Ratio Prot	c0.01							c0.12				
v/s Ratio Perm									0.06			
v/c Ratio	0.08							0.23	0.12			
Uniform Delay, d1	13.1							4.7	4.4			
Progression Factor	1.00							1.00	1.00			
Incremental Delay, d2	0.1							0.1	0.1			
Delay (s)	13.2							4.8	4.5			
Level of Service	B							A	A			
Approach Delay (s)		13.2			0.0			4.7			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.20		
Actuated Cycle Length (s)	36.3	Sum of lost time (s)	11.6
Intersection Capacity Utilization	27.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	277	1229	187	133	1029	247	168	79	154	259	71	267
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	182.7	186.3	186.3	184.5	186.3	184.5	175.9	190.0	174.3	186.3	182.7
Adj Flow Rate, veh/h	301	1336	203	145	1118	268	183	86	167	282	77	290
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	321	1978	628	170	1565	492	392	95	185	316	440	367
Arrive On Green	0.18	0.40	0.40	0.10	0.31	0.31	0.10	0.18	0.18	0.15	0.24	0.24
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	536	1040	1660	1863	1553
Grp Volume(v), veh/h	301	1336	203	145	1118	268	183	0	253	282	77	290
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1575	1660	1863	1553
Q Serve(g_s), s	27.0	35.6	10.0	13.0	31.7	22.7	13.6	0.0	25.4	21.8	5.3	28.3
Cycle Q Clear(g_c), s	27.0	35.6	10.0	13.0	31.7	22.7	13.6	0.0	25.4	21.8	5.3	28.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.66	1.00		1.00
Lane Grp Cap(c), veh/h	321	1978	628	170	1565	492	392	0	280	316	440	367
V/C Ratio(X)	0.94	0.68	0.32	0.86	0.71	0.54	0.47	0.00	0.90	0.89	0.18	0.79
Avail Cap(c_a), veh/h	428	1978	628	264	1565	492	394	0	308	390	554	462
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	65.2	40.1	16.5	71.9	49.3	46.1	47.4	0.0	65.0	45.1	49.1	57.9
Incr Delay (d2), s/veh	21.7	1.9	1.4	9.4	2.8	4.3	0.9	0.0	27.1	19.3	0.2	7.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.2	16.7	5.7	6.8	15.1	10.5	6.7	0.0	13.2	11.6	2.8	12.9
LnGrp Delay(d),s/veh	86.9	42.0	17.8	81.2	52.1	50.4	48.3	0.0	92.1	64.3	49.3	65.0
LnGrp LOS	F	D	B	F	D	D	D		F	E	D	E
Approach Vol, veh/h		1840			1531			436			649	
Approach Delay, s/veh		46.7			54.6			73.7			62.9	
Approach LOS		D			D			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	41.1	71.0	22.3	45.6	36.3	75.8	31.8	36.1
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	24.0	64.0	15.8	48.0	38.9	49.0	31.5	* 31.5
Max Q Clear Time (g_c+I1), s	15.0	37.6	15.6	30.3	29.0	33.7	23.8	27.4
Green Ext Time (p_c), s	0.5	10.4	0.0	2.9	0.2	6.9	0.5	1.2

Intersection Summary	
HCM 2010 Ctrl Delay	54.4
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	470	299	782	474	390	87	743	1330	505	167	942	288
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	181.0	186.3	190.0	182.7	186.3	177.6	177.6	186.3	186.3
Adj Flow Rate, veh/h	516	329	0	521	429	96	816	1462	0	184	1035	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	576	333	283	514	474	105	794	1479	631	184	1032	462
Arrive On Green	0.17	0.18	0.00	0.15	0.16	0.16	0.47	0.84	0.00	0.11	0.29	0.00
Sat Flow, veh/h	3442	1863	1583	3343	2880	639	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	516	329	0	521	262	263	816	1462	0	184	1035	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1750	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	27.9	33.5	0.0	29.2	27.6	28.0	44.7	74.1	0.0	20.7	55.4	0.0
Cycle Q Clear(g_c), s	27.9	33.5	0.0	29.2	27.6	28.0	44.7	74.1	0.0	20.7	55.4	0.0
Prop In Lane	1.00		1.00	1.00		0.37	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	576	333	283	514	291	288	794	1479	631	184	1032	462
V/C Ratio(X)	0.90	0.99	0.00	1.01	0.90	0.91	1.03	0.99	0.00	1.00	1.00	0.00
Avail Cap(c_a), veh/h	576	333	283	514	326	322	794	1479	631	184	1032	462
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.35	0.35	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	77.5	77.8	0.0	80.4	77.8	78.0	50.3	15.2	0.0	84.6	67.3	0.0
Incr Delay (d2), s/veh	16.1	45.5	0.0	43.3	24.6	26.9	26.4	11.5	0.0	65.9	28.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.5	21.5	0.0	16.6	15.5	15.7	23.6	36.5	0.0	13.0	31.2	0.0
LnGrp Delay(d),s/veh	93.5	123.3	0.0	123.7	102.4	104.9	76.7	26.6	0.0	150.5	96.0	0.0
LnGrp LOS	F	F		F	F	F	F	C		F	F	
Approach Vol, veh/h		845			1046			2278			1219	
Approach Delay, s/veh		105.1			113.6			44.6			104.3	
Approach LOS		F			F			D			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	51.2	62.3	38.5	38.0	27.6	85.9	35.9	40.6
Change Period (Y+Rc), s	* 5.5	6.8999996	6.6999998	6.6999998	6.8999996	* 5.5	6.6999998	6.6000004
Max Green Setting (Gmax), s	* 44.7	55.4000015	28.100002	* 32	20.7000027	79.4000015	29.200001	* 34
Max Q Clear Time (g_c+I1), s	46.7	57.4	29.9	30.0	22.7	76.1	31.2	35.5
Green Ext Time (p_c), s	0.0	0.0	0.0	1.2	0.0	2.7	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	81.0
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	669	75	970	155	72	97	446	1812	185	114	1528	556
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Lane Util. Factor	0.95	0.95	0.88	0.91	0.91		0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1603	1631	2682	1595	2859		3367	4988	1583	1687	5036	1568
Flt Permitted	0.95	0.96	1.00	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1603	1631	2682	1595	2859		3367	4988	1583	1687	5036	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	704	79	1021	163	76	102	469	1907	195	120	1608	585
RTOR Reduction (vph)	0	0	34	0	81	0	0	0	52	0	0	368
Lane Group Flow (vph)	387	396	987	117	143	0	469	1907	143	120	1608	217
Heavy Vehicles (%)	7%	4%	6%	3%	4%	21%	4%	4%	2%	7%	3%	3%
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8	1	4	4		1	6		5	2	
Permitted Phases			8						6			2
Actuated Green, G (s)	48.9	48.9	78.2	15.9	15.9		29.3	83.6	83.6	16.1	70.4	70.4
Effective Green, g (s)	48.9	48.9	78.2	15.9	15.9		29.3	83.6	83.6	16.1	70.4	70.4
Actuated g/C Ratio	0.26	0.26	0.41	0.08	0.08		0.15	0.44	0.44	0.08	0.37	0.37
Clearance Time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	412	419	1103	133	239		519	2194	696	142	1865	580
v/s Ratio Prot	0.24	c0.24	0.14	c0.07	0.05		c0.14	c0.38		0.07	0.32	
v/s Ratio Perm			0.23						0.09			0.14
v/c Ratio	0.94	0.95	0.90	0.88	0.60		0.90	0.87	0.21	0.85	0.86	0.37
Uniform Delay, d1	69.1	69.2	52.1	86.1	84.0		79.0	48.2	32.8	85.7	55.3	43.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.13	0.60	0.40	1.31	0.46	0.78
Incremental Delay, d2	29.1	30.1	9.6	43.5	4.0		14.6	3.7	0.5	20.3	2.9	0.9
Delay (s)	98.2	99.4	61.6	129.6	88.0		104.0	32.7	13.5	132.5	28.5	35.2
Level of Service	F	F	E	F	F		F	C	B	F	C	D
Approach Delay (s)		77.8			102.3			44.2			35.6	
Approach LOS		E			F			D			D	

Intersection Summary			
HCM 2000 Control Delay	52.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	190.0	Sum of lost time (s)	25.5
Intersection Capacity Utilization	90.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	258	1633	0	0	2154	499	0	0	0	1095	0	810
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	0.0	0.0	186.3	186.3				181.0	0.0	184.5
Adj Flow Rate, veh/h	272	1719	0	0	2267	0				1153	0	853
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	290	2796	0	0	2575	540				1206	0	995
Arrive On Green	0.16	0.55	0.00	0.00	0.68	0.00				0.36	0.00	0.36
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	272	1719	0	0	2267	0				1153	0	853
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	28.6	43.3	0.0	0.0	45.1	0.0				63.4	0.0	53.9
Cycle Q Clear(g_c), s	28.6	43.3	0.0	0.0	45.1	0.0				63.4	0.0	53.9
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	290	2796	0	0	2575	540				1206	0	995
V/C Ratio(X)	0.94	0.61	0.00	0.00	0.88	0.00				0.96	0.00	0.86
Avail Cap(c_a), veh/h	315	2796	0	0	2575	540				1233	0	1018
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.41	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	77.9	28.9	0.0	0.0	26.9	0.0				58.8	0.0	55.8
Incr Delay (d2), s/veh	33.6	1.0	0.0	0.0	2.0	0.0				16.0	0.0	7.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.8	20.5	0.0	0.0	18.6	0.0				32.0	0.0	21.5
LnGrp Delay(d),s/veh	111.5	29.9	0.0	0.0	28.9	0.0				74.8	0.0	62.8
LnGrp LOS	F	C			C					E		E
Approach Vol, veh/h		1991			2267						2006	
Approach Delay, s/veh		41.0			28.9						69.7	
Approach LOS		D			C						E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	39.3	73.3		77.5		112.5		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	33.5	61.6		69.5		103.6		
Max Q Clear Time (g_c+I1), s	30.6	47.1		65.4		45.3		
Green Ext Time (p_c), s	0.2	14.2		2.5		53.6		

Intersection Summary	
HCM 2010 Ctrl Delay	45.8
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	875	200	237	412	0	510	0	1299	348	675	1610	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	184.5	166.7	168.1	177.6	0.0	179.2	0.0	186.3	168.1	182.7	184.5	0.0
Adj Flow Rate, veh/h	972	222	0	458	0	0	0	1443	387	750	1789	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	1013	307	139	509	0	0	0	1678	693	790	3071	0
Arrive On Green	0.30	0.10	0.00	0.16	0.00	0.00	0.00	0.44	0.44	0.23	0.61	0.00
Sat Flow, veh/h	3408	3167	1429	3281	458		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	972	222	0	458	76.0		0	1443	387	750	1789	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	E		0	1695	1429	1688	1679	0
Q Serve(g_s), s	43.4	10.5	0.0	21.2			0.0	39.6	28.3	33.9	33.3	0.0
Cycle Q Clear(g_c), s	43.4	10.5	0.0	21.2			0.0	39.6	28.3	33.9	33.3	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	1013	307	139	509			0	1678	693	790	3071	0
V/C Ratio(X)	0.96	0.72	0.00	0.90			0.00	0.86	0.56	0.95	0.58	0.00
Avail Cap(c_a), veh/h	1036	875	395	663			0	1678	693	804	3071	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.59	0.59	1.00	1.00	0.00
Uniform Delay (d), s/veh	53.5	67.9	0.0	64.3			0.0	40.2	23.3	58.4	18.3	0.0
Incr Delay (d2), s/veh	18.6	2.0	0.0	11.7			0.0	3.7	1.9	20.3	0.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	23.0	4.7	0.0	10.5			0.0	19.0	11.4	18.1	15.6	0.0
LnGrp Delay(d),s/veh	72.1	69.9	0.0	76.0			0.0	43.9	25.2	78.7	19.1	0.0
LnGrp LOS	E	E		E				D	C	E	B	
Approach Vol, veh/h		1194						1830			2539	
Approach Delay, s/veh		71.7						40.0			36.7	
Approach LOS		E						D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	43.4	92.7	31.9	22.0		136.0	54.0	
Change Period (Y+Rc), s*	7.1	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	36.3	86.2	24.0	15.0		129.5	46.1	
Max Q Clear Time (g_c+I1), s	35.9	41.6	23.2	12.5		35.3	45.4	
Green Ext Time (p_c), s	0.4	8.6	0.8	1.1		49.3	0.6	

Intersection Summary	
HCM 2010 Ctrl Delay	47.6
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

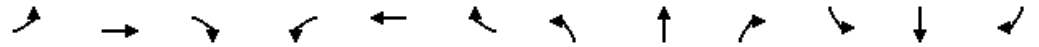
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	249	75	90	43	64	56	86	1342	44	235	1854	170
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	161.0	162.7	190.0	190.0	186.3	190.0	177.6	186.3	190.0	184.5	171.2	166.7
Adj Flow Rate, veh/h	274	82	99	47	70	62	95	1475	48	258	2037	187
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	248	231	279	127	187	153	111	2001	65	275	2275	690
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.07	0.40	0.40	0.16	0.49	0.49
Sat Flow, veh/h	1083	672	812	298	544	446	1691	5059	165	1757	4673	1417
Grp Volume(v), veh/h	274	0	181	179	0	0	95	988	535	258	2037	187
Grp Sat Flow(s),veh/h/ln	1083	0	1484	1287	0	0	1691	1695	1834	1757	1558	1417
Q Serve(g_s), s	36.2	0.0	17.1	11.2	0.0	0.0	10.4	46.7	46.7	27.2	74.4	14.6
Cycle Q Clear(g_c), s	64.5	0.0	17.1	28.3	0.0	0.0	10.4	46.7	46.7	27.2	74.4	14.6
Prop In Lane	1.00		0.55	0.26		0.35	1.00		0.09	1.00		1.00
Lane Grp Cap(c), veh/h	248	0	510	467	0	0	111	1341	725	275	2275	690
V/C Ratio(X)	1.11	0.00	0.35	0.38	0.00	0.00	0.85	0.74	0.74	0.94	0.90	0.27
Avail Cap(c_a), veh/h	248	0	510	467	0	0	133	1341	725	319	2275	690
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.59	0.59	0.59
Uniform Delay (d), s/veh	78.5	0.0	46.0	50.7	0.0	0.0	86.7	48.4	48.4	78.2	43.8	28.5
Incr Delay (d2), s/veh	88.7	0.0	0.3	0.3	0.0	0.0	30.2	3.7	6.6	21.4	3.7	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	18.9	0.0	7.1	7.5	0.0	0.0	5.8	22.5	24.9	14.9	32.7	5.8
LnGrp Delay(d),s/veh	167.1	0.0	46.2	51.0	0.0	0.0	116.9	52.0	55.0	99.6	47.5	29.0
LnGrp LOS	F		D	D			F	D	D	F	D	C
Approach Vol, veh/h		455			179			1618			2482	
Approach Delay, s/veh		119.0			51.0			56.8			51.5	
Approach LOS		F			D			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	19.2	99.8		71.0	36.3	82.7		71.0
Change Period (Y+Rc), s	6.6	6.1000004		6.5	6.6	6.1000004		6.5
Max Green Setting (Gmax), s	14.8	91.300003		64.5	34.7	71.900002		64.5
Max Q Clear Time (g_c+I1), s	12.4	76.4		30.3	29.2	48.7		66.5
Green Ext Time (p_c), s	0.0	14.3		2.7	0.1	21.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	59.8
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	186	0	0	0	0	0	0	278	185	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4							6.2	6.2			
Lane Util. Factor	1.00							1.00	1.00			
Frt	1.00							1.00	0.85			
Flt Protected	0.95							1.00	1.00			
Satd. Flow (prot)	1770							1863	1583			
Flt Permitted	0.95							1.00	1.00			
Satd. Flow (perm)	1770							1863	1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	202	0	0	0	0	0	0	302	201	0	0	0
RTOR Reduction (vph)	162	0	0	0	0	0	0	0	105	0	0	0
Lane Group Flow (vph)	40	0	0	0	0	0	0	302	96	0	0	0
Turn Type	Prot							NA	Perm			
Protected Phases	7							2				
Permitted Phases									2			
Actuated Green, G (s)	7.1							17.2	17.2			
Effective Green, g (s)	7.1							17.2	17.2			
Actuated g/C Ratio	0.20							0.48	0.48			
Clearance Time (s)	5.4							6.2	6.2			
Vehicle Extension (s)	3.5							3.5	3.5			
Lane Grp Cap (vph)	350							892	758			
v/s Ratio Prot	c0.02							c0.16				
v/s Ratio Perm									0.06			
v/c Ratio	0.11							0.34	0.13			
Uniform Delay, d1	11.8							5.8	5.2			
Progression Factor	1.00							1.00	1.00			
Incremental Delay, d2	0.2							0.3	0.1			
Delay (s)	12.0							6.1	5.3			
Level of Service	B							A	A			
Approach Delay (s)		12.0			0.0			5.8			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	35.9	Sum of lost time (s)	11.6
Intersection Capacity Utilization	33.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1277	22	44	733	258	218	11	248	0	0	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00			0.88
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (prot)		4848	1553	1805	4510	1468	1394	1429	1077			2137
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (perm)		4848	1553	1805	4510	1468	1394	1429	1077			2137
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1388	24	48	797	280	237	12	270	0	0	186
RTOR Reduction (vph)	0	0	12	0	0	103	0	0	229	0	0	174
Lane Group Flow (vph)	0	1388	12	48	797	177	123	126	41	0	0	12
Heavy Vehicles (%)	5%	7%	4%	0%	15%	10%	23%	0%	50%	11%	0%	33%
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	Perm			Perm
Protected Phases		6		5	2		4	4				
Permitted Phases			6			2			4			8
Actuated Green, G (s)		57.8	57.8	12.0	75.8	75.8	18.2	18.2	18.2			8.0
Effective Green, g (s)		57.8	57.8	12.0	75.8	75.8	18.2	18.2	18.2			8.0
Actuated g/C Ratio		0.48	0.48	0.10	0.63	0.63	0.15	0.15	0.15			0.07
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Vehicle Extension (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			5.0
Lane Grp Cap (vph)		2335	748	180	2848	927	211	216	163			142
v/s Ratio Prot		c0.29		0.03	c0.18		c0.09	0.09				
v/s Ratio Perm			0.01			0.12			0.04			c0.01
v/c Ratio		0.59	0.02	0.27	0.28	0.19	0.58	0.58	0.25			0.09
Uniform Delay, d1		22.6	16.2	49.9	9.9	9.3	47.4	47.4	44.9			52.6
Progression Factor		0.36	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Incremental Delay, d2		1.0	0.0	1.1	0.2	0.5	4.8	4.7	1.1			0.6
Delay (s)		9.3	16.3	51.0	10.1	9.7	52.2	52.1	46.0			53.1
Level of Service		A	B	D	B	A	D	D	D			D
Approach Delay (s)		9.4			11.8			48.9			53.1	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	19.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	186	888	51	89	1271	21	193	3	91	168	2	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1308	4550	1538	1703	5472		1466	1477	1056	1289	1188	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1308	4550	1538	1703	5472		1466	1477	1056	1289	1188	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	202	965	55	97	1382	23	210	3	99	183	2	111
RTOR Reduction (vph)	0	0	36	0	1	0	0	0	86	0	92	0
Lane Group Flow (vph)	202	965	19	97	1404	0	107	106	13	183	21	0
Heavy Vehicles (%)	38%	14%	5%	6%	19%	28%	17%	0%	53%	40%	0%	37%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6						4			
Actuated Green, G (s)	21.3	42.3	42.3	15.7	36.7		15.4	15.4	15.4	20.6	20.6	
Effective Green, g (s)	21.3	42.3	42.3	15.7	36.7		15.4	15.4	15.4	20.6	20.6	
Actuated g/C Ratio	0.18	0.35	0.35	0.13	0.31		0.13	0.13	0.13	0.17	0.17	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	232	1603	542	222	1673		188	189	135	221	203	
v/s Ratio Prot	c0.15	0.21		0.06	c0.26		c0.07	0.07		c0.14	0.02	
v/s Ratio Perm			0.01						0.01			
v/c Ratio	0.87	0.60	0.04	0.44	0.84		0.57	0.56	0.09	0.83	0.10	
Uniform Delay, d1	48.0	31.9	25.5	48.1	38.9		49.2	49.1	46.1	48.0	41.9	
Progression Factor	1.00	1.00	1.00	0.98	0.94		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	28.0	1.7	0.1	1.3	5.1		4.7	4.6	0.4	22.7	0.3	
Delay (s)	76.0	33.6	25.6	48.5	41.5		53.9	53.7	46.6	70.7	42.2	
Level of Service	E	C	C	D	D		D	D	D	E	D	
Approach Delay (s)		40.3			42.0			51.5			59.8	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM 2000 Control Delay	43.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	60.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	317	1054	238	67	1200	275	187	71	133	247	79	377
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	182.7	186.3	186.3	184.5	186.3	184.5	175.9	190.0	174.3	186.3	182.7
Adj Flow Rate, veh/h	345	1146	259	73	1304	299	203	77	145	268	86	410
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	366	2249	714	101	1517	477	315	80	151	301	414	345
Arrive On Green	0.21	0.45	0.45	0.06	0.30	0.30	0.08	0.15	0.15	0.15	0.22	0.22
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	547	1030	1660	1863	1553
Grp Volume(v), veh/h	345	1146	259	73	1304	299	203	0	222	268	86	410
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1577	1660	1863	1553
Q Serve(g_s), s	28.0	24.0	10.8	5.9	35.7	23.8	11.3	0.0	20.5	19.5	5.5	32.5
Cycle Q Clear(g_c), s	28.0	24.0	10.8	5.9	35.7	23.8	11.3	0.0	20.5	19.5	5.5	32.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.65	1.00		1.00
Lane Grp Cap(c), veh/h	366	2249	714	101	1517	477	315	0	231	301	414	345
V/C Ratio(X)	0.94	0.51	0.36	0.72	0.86	0.63	0.64	0.00	0.96	0.89	0.21	1.19
Avail Cap(c_a), veh/h	411	2249	714	145	1517	477	315	0	231	311	414	345
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	57.2	28.6	12.5	67.9	48.2	44.1	50.3	0.0	62.1	43.7	46.4	56.9
Incr Delay (d2), s/veh	27.7	0.8	1.4	3.7	6.6	6.1	4.5	0.0	48.7	25.1	0.2	110.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.6	11.2	6.0	3.0	17.5	11.2	7.3	0.0	12.1	11.0	2.9	24.5
LnGrp Delay(d),s/veh	84.9	29.5	13.9	71.6	54.8	50.2	54.8	0.0	110.8	68.9	46.7	167.3
LnGrp LOS	F	C	B	E	D	D	D		F	E	D	F
Approach Vol, veh/h		1750			1676			425			764	
Approach Delay, s/veh		38.1			54.7			84.1			119.2	
Approach LOS		D			D			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	19.0	73.0	18.0	40.0	37.3	54.7	29.1	28.9
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	12.0	66.0	11.3	32.5	33.9	44.0	22.5	* 20.5
Max Q Clear Time (g_c+I1), s	7.9	26.0	13.3	34.5	30.0	37.7	21.5	22.5
Green Ext Time (p_c), s	1.0	10.0	0.0	0.0	0.1	4.2	0.1	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	61.8
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	288	287	531	402	209	167	725	1199	474	190	1578	318
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	181.0	186.3	190.0	182.7	186.3	177.6	177.6	186.3	186.3
Adj Flow Rate, veh/h	316	315	0	442	230	184	797	1318	0	209	1734	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	453	337	286	326	279	214	567	1522	649	224	1386	620
Arrive On Green	0.13	0.18	0.00	0.10	0.15	0.15	0.17	0.43	0.00	0.13	0.39	0.00
Sat Flow, veh/h	3442	1863	1583	3343	1910	1464	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	316	315	0	442	212	202	797	1318	0	209	1734	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1604	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	14.7	27.9	0.0	16.3	19.5	20.5	28.1	56.6	0.0	20.5	65.5	0.0
Cycle Q Clear(g_c), s	14.7	27.9	0.0	16.3	19.5	20.5	28.1	56.6	0.0	20.5	65.5	0.0
Prop In Lane	1.00		1.00	1.00		0.91	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	453	337	286	326	259	234	567	1522	649	224	1386	620
V/C Ratio(X)	0.70	0.94	0.00	1.36	0.82	0.86	1.41	0.87	0.00	0.94	1.25	0.00
Avail Cap(c_a), veh/h	453	368	312	326	401	364	567	1522	649	224	1386	620
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.56	0.56	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	69.4	67.5	0.0	75.5	69.3	69.7	69.6	43.3	0.0	71.9	50.9	0.0
Incr Delay (d2), s/veh	4.0	28.8	0.0	179.1	6.8	11.0	188.2	4.0	0.0	41.9	119.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.2	17.0	0.0	15.6	10.0	9.9	27.9	28.5	0.0	12.2	54.9	0.0
LnGrp Delay(d),s/veh	73.4	96.3	0.0	254.6	76.1	80.8	257.8	47.3	0.0	113.8	169.9	0.0
LnGrp LOS	E	F		F	E	F	F	D		F	F	
Approach Vol, veh/h		631			856			2115			1943	
Approach Delay, s/veh		84.8			169.4			126.6			163.8	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	37.8	72.4	28.7	31.1	31.8	78.4	23.0	36.8
Change Period (Y+Rc), s	* 6.8	6.8	6.7	6.7	6.8	* 6.5	6.7	6.6
Max Green Setting (Gmax), s	* 28.1	* 65.5	* 11.3	17.9	* 22.7	11.9	26.3	* 33
Max Q Clear Time (g_c+I1), s	30.1	67.5	16.7	22.5	22.5	58.6	18.3	29.9
Green Ext Time (p_c), s	0.0	0.0	0.0	1.9	0.0	7.4	0.0	0.3

Intersection Summary	
HCM 2010 Ctrl Delay	141.5
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	571	50	366	85	70	99	845	1728	95	97	1745	669
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Lane Util. Factor	0.95	0.95	0.88	0.91	0.91		0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1603	1626	2682	1595	2788		3367	4988	1583	1687	5036	1568
Flt Permitted	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1603	1626	2682	1595	2788		3367	4988	1583	1687	5036	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	601	53	385	89	74	104	889	1819	100	102	1837	704
RTOR Reduction (vph)	0	0	58	0	98	0	0	0	49	0	0	305
Lane Group Flow (vph)	325	329	327	80	89	0	889	1819	51	102	1837	399
Heavy Vehicles (%)	7%	4%	6%	3%	4%	21%	4%	4%	2%	7%	3%	3%
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8	1	4	4		1	6		5	2	
Permitted Phases			8						6			2
Actuated Green, G (s)	34.5	34.5	72.2	9.1	9.1		37.7	85.9	85.9	15.0	63.2	63.2
Effective Green, g (s)	34.5	34.5	72.2	9.1	9.1		37.7	85.9	85.9	15.0	63.2	63.2
Actuated g/C Ratio	0.20	0.20	0.42	0.05	0.05		0.22	0.51	0.51	0.09	0.37	0.37
Clearance Time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	325	329	1139	85	149		746	2520	799	148	1872	582
v/s Ratio Prot	c0.20	0.20	0.06	c0.05	0.03		c0.26	0.36		0.06	c0.36	
v/s Ratio Perm			0.06						0.03			0.25
v/c Ratio	1.00	1.00	0.29	0.94	0.59		1.19	0.72	0.06	0.69	0.98	0.69
Uniform Delay, d1	67.8	67.8	32.0	80.2	78.6		66.2	32.7	21.5	75.2	52.8	45.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.74	0.52	0.40	1.08	0.37	0.52
Incremental Delay, d2	49.9	49.6	0.1	77.8	6.2		94.1	1.0	0.1	1.2	3.3	0.6
Delay (s)	117.7	117.4	32.2	158.0	84.9		142.8	18.1	8.6	82.7	22.7	23.9
Level of Service	F	F	C	F	F		F	B	A	F	C	C
Approach Delay (s)		85.9			106.8			57.2			25.4	
Approach LOS		F			F			E			C	

Intersection Summary			
HCM 2000 Control Delay	51.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	25.5
Intersection Capacity Utilization	101.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	192	1588	0	0	1571	625	0	0	0	710	0	1080
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	0.0	0.0	186.3	186.3				181.0	0.0	184.5
Adj Flow Rate, veh/h	202	1672	0	0	1654	0				747	0	1137
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	223	2443	0	0	2299	483				1405	0	1159
Arrive On Green	0.13	0.48	0.00	0.00	0.61	0.00				0.42	0.00	0.42
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	202	1672	0	0	1654	0				747	0	1137
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	19.1	43.2	0.0	0.0	25.9	0.0				28.3	0.0	69.0
Cycle Q Clear(g_c), s	19.1	43.2	0.0	0.0	25.9	0.0				28.3	0.0	69.0
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	223	2443	0	0	2299	483				1405	0	1159
V/C Ratio(X)	0.91	0.68	0.00	0.00	0.72	0.00				0.53	0.00	0.98
Avail Cap(c_a), veh/h	277	2443	0	0	2299	483				1407	0	1162
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.37	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	73.3	34.2	0.0	0.0	28.1	0.0				36.8	0.0	48.6
Incr Delay (d2), s/veh	27.4	1.6	0.0	0.0	0.7	0.0				0.3	0.0	21.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.1	20.6	0.0	0.0	10.8	0.0				13.1	0.0	29.7
LnGrp Delay(d),s/veh	100.7	35.7	0.0	0.0	28.9	0.0				37.0	0.0	70.3
LnGrp LOS	F	D			C					D		E
Approach Vol, veh/h		1874			1654						1884	
Approach Delay, s/veh		42.7			28.9						57.1	
Approach LOS		D			C						E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	29.8	59.3		80.9		89.1		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	26.5	46.6		71.5		81.6		
Max Q Clear Time (g_c+I1), s	21.1	27.9		71.0		45.2		
Green Ext Time (p_c), s	0.2	17.3		0.3		31.7		

Intersection Summary	
HCM 2010 Ctrl Delay	43.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	301	92	126	314	0	456	0	1858	330	313	1375	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	184.5	166.7	168.1	177.6	0.0	179.2	0.0	186.3	168.1	182.7	184.5	0.0
Adj Flow Rate, veh/h	334	102	0	349	0	0	0	2064	367	348	1528	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	381	151	68	403	0	0	0	2593	905	396	3412	0
Arrive On Green	0.11	0.05	0.00	0.12	0.00	0.00	0.00	1.00	1.00	0.12	0.68	0.00
Sat Flow, veh/h	3408	3167	1429	3281	349		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	334	102	0	349	67.2		0	2064	367	348	1528	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	E		0	1695	1429	1688	1679	0
Q Serve(g_s), s	13.6	4.5	0.0	14.7			0.0	0.0	0.0	14.3	19.8	0.0
Cycle Q Clear(g_c), s	13.6	4.5	0.0	14.7			0.0	0.0	0.0	14.3	19.8	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	381	151	68	403			0	2593	905	396	3412	0
V/C Ratio(X)	0.88	0.68	0.00	0.87			0.00	0.80	0.41	0.88	0.45	0.00
Avail Cap(c_a), veh/h	413	602	272	612			0	2593	905	429	3412	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.09	0.09	1.00	1.00	0.00
Uniform Delay (d), s/veh	61.7	66.0	0.0	60.7			0.0	0.0	0.0	61.2	10.5	0.0
Incr Delay (d2), s/veh	17.2	3.2	0.0	6.6			0.0	0.2	0.1	17.7	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.3	2.0	0.0	7.1			0.0	0.1	0.0	7.6	9.2	0.0
LnGrp Delay(d),s/veh	78.8	69.2	0.0	67.2			0.0	0.2	0.1	78.9	10.9	0.0
LnGrp LOS	E	E		E				A	A	E	B	
Approach Vol, veh/h		436						2431			1876	
Approach Delay, s/veh		76.6						0.2			23.6	
Approach LOS		E						A			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	23.6	107.4	25.2	13.7		131.0	39.0	
Change Period (Y+Rc), s*	7.1000004	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	* 17.9	70.5	26.3	26.8		95.5	17.1	
Max Q Clear Time (g_c+I1), s	16.3	2.0	16.7	6.5		21.8	15.6	
Green Ext Time (p_c), s	0.2	60.2	0.6	0.4		64.2	0.1	

Intersection Summary	
HCM 2010 Ctrl Delay	20.0
HCM 2010 LOS	B

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	207	64	86	44	75	285	90	1696	43	226	1205	384
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	161.0	161.6	190.0	190.0	186.3	190.0	177.6	186.3	190.0	184.5	171.2	166.7
Adj Flow Rate, veh/h	227	70	95	48	82	313	99	1864	47	248	1324	422
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	148	230	313	73	122	412	117	1876	47	259	2087	633
Arrive On Green	0.37	0.37	0.37	0.37	0.37	0.37	0.07	0.37	0.37	0.15	0.45	0.45
Sat Flow, veh/h	852	622	845	134	329	1113	1691	5102	129	1757	4673	1417
Grp Volume(v), veh/h	227	0	165	443	0	0	99	1238	673	248	1324	422
Grp Sat Flow(s),veh/h/ln	852	0	1467	1576	0	0	1691	1695	1840	1757	1558	1417
Q Serve(g_s), s	21.0	0.0	13.6	28.3	0.0	0.0	9.8	61.9	62.0	23.8	37.2	39.9
Cycle Q Clear(g_c), s	62.9	0.0	13.6	41.9	0.0	0.0	9.8	61.9	62.0	23.8	37.2	39.9
Prop In Lane	1.00		0.58	0.11		0.71	1.00		0.07	1.00		1.00
Lane Grp Cap(c), veh/h	148	0	543	607	0	0	117	1246	676	259	2087	633
V/C Ratio(X)	1.54	0.00	0.30	0.73	0.00	0.00	0.85	0.99	0.99	0.96	0.63	0.67
Avail Cap(c_a), veh/h	148	0	543	607	0	0	187	1246	676	259	2087	633
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.79	0.79	0.79
Uniform Delay (d), s/veh	77.5	0.0	38.0	46.8	0.0	0.0	78.2	53.5	53.6	71.9	36.3	37.1
Incr Delay (d2), s/veh	272.7	0.0	0.2	4.1	0.0	0.0	9.9	24.0	33.3	37.8	1.2	4.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	18.1	0.0	5.5	18.9	0.0	0.0	4.9	33.0	37.7	14.3	16.2	16.4
LnGrp Delay(d),s/veh	350.2	0.0	38.2	51.0	0.0	0.0	88.1	77.5	86.9	109.7	37.5	41.5
LnGrp LOS	F		D	D			F	E	F	F	D	D
Approach Vol, veh/h		392			443			2010			1994	
Approach Delay, s/veh		218.9			51.0			81.2			47.3	
Approach LOS		F			D			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.6	82.0		69.4	32.0	68.6		69.4
Change Period (Y+Rc), s	6.6	6.1000004		6.5	6.6	6.1000004		6.5
Max Green Setting (Gmax), s	18.6	68.900002		62.9	25.1	* 62.5		62.9
Max Q Clear Time (g_c+I1), s	11.8	41.9		43.9	25.8	64.0		64.9
Green Ext Time (p_c), s	0.0	24.6		4.3	0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	75.6
HCM 2010 LOS	E

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1242	85	90	956	126	99	7	118	0	0	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00			0.88
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (prot)		4848	1553	1805	4510	1468	1394	1444	1077			2137
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (perm)		4848	1553	1805	4510	1468	1394	1444	1077			2137
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1350	92	98	1039	137	108	8	128	0	0	74
RTOR Reduction (vph)	0	0	45	0	0	44	0	0	115	0	0	70
Lane Group Flow (vph)	0	1350	47	98	1039	93	58	58	13	0	0	4
Heavy Vehicles (%)	5%	7%	4%	0%	15%	10%	23%	0%	50%	11%	0%	33%
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	Perm			Perm
Protected Phases		6		5	2		4	4				
Permitted Phases			6			2			4			8
Actuated Green, G (s)		56.3	56.3	12.0	74.3	74.3	11.3	11.3	11.3			6.4
Effective Green, g (s)		56.3	56.3	12.0	74.3	74.3	11.3	11.3	11.3			6.4
Actuated g/C Ratio		0.51	0.51	0.11	0.68	0.68	0.10	0.10	0.10			0.06
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Vehicle Extension (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			5.0
Lane Grp Cap (vph)		2481	794	196	3046	991	143	148	110			124
v/s Ratio Prot		c0.28		c0.05	0.23		c0.04	0.04				
v/s Ratio Perm			0.03			0.06			0.01			c0.00
v/c Ratio		0.54	0.06	0.50	0.34	0.09	0.41	0.39	0.12			0.03
Uniform Delay, d1		18.2	13.5	46.2	7.5	6.2	46.2	46.1	44.8			48.9
Progression Factor		0.14	0.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Incremental Delay, d2		0.7	0.1	2.7	0.3	0.2	2.6	2.3	0.7			0.2
Delay (s)		3.2	0.1	48.9	7.8	6.4	48.8	48.5	45.5			49.1
Level of Service		A	A	D	A	A	D	D	D			D
Approach Delay (s)		3.0			10.8			47.0			49.1	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	11.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	1223	473	117	999	86	55	2	102	82	3	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1308	4550	1538	1703	5395		1466	1488	1056	1289	1210	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00	0.95	1.00	
Satd. Flow (perm)	1308	4550	1538	1703	5395		1466	1488	1056	1289	1210	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	1329	514	127	1086	93	60	2	111	89	3	49
RTOR Reduction (vph)	0	0	307	0	11	0	0	0	96	0	44	0
Lane Group Flow (vph)	174	1329	207	127	1168	0	31	31	15	89	8	0
Heavy Vehicles (%)	38%	14%	5%	6%	19%	28%	17%	0%	53%	40%	0%	37%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6						4			
Actuated Green, G (s)	18.4	44.3	44.3	13.0	38.9		15.0	15.0	15.0	11.7	11.7	
Effective Green, g (s)	18.4	44.3	44.3	13.0	38.9		15.0	15.0	15.0	11.7	11.7	
Actuated g/C Ratio	0.17	0.40	0.40	0.12	0.35		0.14	0.14	0.14	0.11	0.11	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	218	1832	619	201	1907		199	202	144	137	128	
v/s Ratio Prot	0.13	c0.29		0.07	c0.22		c0.02	0.02		c0.07	0.01	
v/s Ratio Perm			0.13						0.01			
v/c Ratio	0.80	0.73	0.33	0.63	0.61		0.16	0.15	0.11	0.65	0.06	
Uniform Delay, d1	44.0	27.7	22.7	46.2	29.3		41.9	41.9	41.6	47.2	44.2	
Progression Factor	1.00	1.00	1.00	0.93	0.91		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	18.1	2.5	1.5	6.2	1.4		0.5	0.5	0.4	11.3	0.3	
Delay (s)	62.1	30.3	24.1	49.3	28.1		42.4	42.4	42.1	58.5	44.5	
Level of Service	E	C	C	D	C		D	D	D	E	D	
Approach Delay (s)		31.4			30.2			42.2			53.3	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	32.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	321	1109	248	204	1215	325	414	176	236	352	204	660
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	182.7	186.3	186.3	184.5	186.3	184.5	175.5	190.0	174.3	186.3	182.7
Adj Flow Rate, veh/h	349	1205	270	222	1321	353	450	191	257	383	222	717
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	306	1496	475	225	1276	401	367	143	192	330	477	398
Arrive On Green	0.17	0.30	0.30	0.13	0.25	0.25	0.13	0.21	0.21	0.17	0.26	0.26
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	679	914	1660	1863	1553
Grp Volume(v), veh/h	349	1205	270	222	1321	353	450	0	448	383	222	717
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1593	1660	1863	1553
Q Serve(g_s), s	25.9	33.5	14.8	18.7	38.0	32.1	19.4	0.0	31.5	25.5	15.1	38.4
Cycle Q Clear(g_c), s	25.9	33.5	14.8	18.7	38.0	32.1	19.4	0.0	31.5	25.5	15.1	38.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.57	1.00		1.00
Lane Grp Cap(c), veh/h	306	1496	475	225	1276	401	367	0	335	330	477	398
V/C Ratio(X)	1.14	0.81	0.57	0.99	1.04	0.88	1.23	0.00	1.34	1.16	0.47	1.80
Avail Cap(c_a), veh/h	306	1496	475	225	1276	401	367	0	335	330	477	398
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	62.0	48.5	20.8	65.4	56.0	53.8	46.6	0.0	59.3	47.1	47.1	55.8
Incr Delay (d2), s/veh	94.6	4.7	4.9	56.4	34.8	23.1	124.2	0.0	171.4	100.3	0.7	371.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.7	16.1	8.4	12.7	21.7	16.6	18.4	0.0	29.8	22.9	7.9	57.5
LnGrp Delay(d),s/veh	156.6	53.2	25.6	121.7	90.8	76.9	170.7	0.0	230.6	147.4	47.8	427.3
LnGrp LOS	F	D	C	F	F	E	F		F	F	D	F
Approach Vol, veh/h		1824			1896			898			1322	
Approach Delay, s/veh		68.9			91.9			200.6			282.5	
Approach LOS		E			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	26.0	52.0	26.1	45.9	33.0	45.0	33.0	39.0
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	19.0	45.0	19.4	38.4	25.9	38.0	25.5	* 31.5
Max Q Clear Time (g_c+I1), s	20.7	35.5	21.4	40.4	27.9	40.0	27.5	33.5
Green Ext Time (p_c), s	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	143.7
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	467	345	914	645	298	237	773	1232	745	275	1172	467
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	181.0	186.3	190.0	182.7	186.3	177.6	177.6	186.3	186.3
Adj Flow Rate, veh/h	513	379	0	709	327	260	849	1354	0	302	1288	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	546	337	287	551	354	276	659	1332	568	232	1120	501
Arrive On Green	0.16	0.18	0.00	0.16	0.19	0.19	0.33	0.63	0.00	0.14	0.32	0.00
Sat Flow, veh/h	3442	1863	1583	3343	1896	1476	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	513	379	0	709	305	282	849	1354	0	302	1288	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1602	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	28.0	34.4	0.0	31.3	32.2	33.0	37.1	71.5	0.0	26.1	60.1	0.0
Cycle Q Clear(g_c), s	28.0	34.4	0.0	31.3	32.2	33.0	37.1	71.5	0.0	26.1	60.1	0.0
Prop In Lane	1.00		1.00	1.00		0.92	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	546	337	287	551	330	299	659	1332	568	232	1120	501
V/C Ratio(X)	0.94	1.12	0.00	1.29	0.92	0.94	1.29	1.02	0.00	1.30	1.15	0.00
Avail Cap(c_a), veh/h	546	337	287	551	338	306	659	1332	568	232	1120	501
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.35	0.35	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	79.0	77.8	0.0	79.3	75.9	76.3	64.0	35.3	0.0	82.0	64.9	0.0
Incr Delay (d2), s/veh	24.3	86.8	0.0	142.6	29.5	36.1	133.8	18.9	0.0	162.8	78.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.2	25.8	0.0	25.4	18.5	17.7	29.5	38.0	0.0	22.7	41.6	0.0
LnGrp Delay(d),s/veh	103.3	164.6	0.0	221.9	105.4	112.4	197.8	54.2	0.0	244.8	143.3	0.0
LnGrp LOS	F	F		F	F	F	F	F		F	F	
Approach Vol, veh/h		892			1296			2203			1590	
Approach Delay, s/veh		129.3			170.7			109.6			162.6	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	44.0	67.0	36.8	42.2	33.0	78.0	38.0	41.0
Change Period (Y+Rc), s	* 6.8	6.8	6.7	6.7	6.8	* 6.5	6.7	6.6
Max Green Setting (Gmax), s	* 37	60.1	29.3	35.6	* 26.1	* 71.5	31.3	34.4
Max Q Clear Time (g_c+I1), s	39.1	62.1	30.0	35.0	28.1	73.5	33.3	36.4
Green Ext Time (p_c), s	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	139.8
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	825	56	611	103	74	132	870	1793	97	114	1792	825
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Lane Util. Factor	0.95	0.95	0.88	0.91	0.91		0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1603	1622	2682	1595	2742		3367	4988	1583	1687	5036	1568
Flt Permitted	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1603	1622	2682	1595	2742		3367	4988	1583	1687	5036	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	868	59	643	108	78	139	916	1887	102	120	1886	868
RTOR Reduction (vph)	0	0	49	0	128	0	0	0	51	0	0	379
Lane Group Flow (vph)	460	467	594	97	100	0	916	1887	51	120	1886	489
Heavy Vehicles (%)	7%	4%	6%	3%	4%	21%	4%	4%	2%	7%	3%	3%
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8	1	4	4		1	6		5	2	
Permitted Phases			8						6			2
Actuated Green, G (s)	50.3	50.3	87.1	11.4	11.4		36.8	86.4	86.4	16.4	66.0	66.0
Effective Green, g (s)	50.3	50.3	87.1	11.4	11.4		36.8	86.4	86.4	16.4	66.0	66.0
Actuated g/C Ratio	0.26	0.26	0.46	0.06	0.06		0.19	0.45	0.45	0.09	0.35	0.35
Clearance Time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	424	429	1229	95	164		652	2268	719	145	1749	544
v/s Ratio Prot	0.29	c0.29	0.09	c0.06	0.04		c0.27	0.38		0.07	c0.37	
v/s Ratio Perm			0.13						0.03			0.31
v/c Ratio	1.08	1.09	0.48	1.02	0.61		1.40	0.83	0.07	0.83	1.08	0.90
Uniform Delay, d1	69.8	69.8	35.8	89.3	87.1		76.6	45.4	29.2	85.4	62.0	58.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.82	0.69	0.46	1.10	0.73	0.44
Incremental Delay, d2	68.5	69.5	0.3	98.2	6.6		188.0	2.4	0.1	3.6	36.5	2.5
Delay (s)	138.3	139.3	36.1	187.5	93.7		250.9	33.9	13.7	98.0	81.6	28.7
Level of Service	F	F	D	F	F		F	C	B	F	F	C
Approach Delay (s)		96.7			121.7			101.6			66.3	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	88.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	190.0	Sum of lost time (s)	25.5
Intersection Capacity Utilization	111.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	401	2046	0	0	1767	739	0	0	0	651	0	714
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	0.0	0.0	186.3	186.3				181.0	0.0	184.5
Adj Flow Rate, veh/h	422	2154	0	0	1860	0				685	0	752
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	442	3442	0	0	2890	606				783	0	646
Arrive On Green	0.25	0.68	0.00	0.00	0.77	0.00				0.23	0.00	0.23
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	422	2154	0	0	1860	0				685	0	752
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	44.5	45.1	0.0	0.0	21.6	0.0				37.5	0.0	44.5
Cycle Q Clear(g_c), s	44.5	45.1	0.0	0.0	21.6	0.0				37.5	0.0	44.5
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	442	3442	0	0	2890	606				783	0	646
V/C Ratio(X)	0.95	0.63	0.00	0.00	0.64	0.00				0.87	0.00	1.16
Avail Cap(c_a), veh/h	500	3442	0	0	2890	606				783	0	646
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.24	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	70.3	17.2	0.0	0.0	16.2	0.0				70.1	0.0	72.8
Incr Delay (d2), s/veh	27.6	0.9	0.0	0.0	0.3	0.0				10.6	0.0	89.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	25.2	21.2	0.0	0.0	8.7	0.0				18.5	0.0	25.0
LnGrp Delay(d),s/veh	97.9	18.1	0.0	0.0	16.5	0.0				80.6	0.0	162.6
LnGrp LOS	F	B			B					F		F
Approach Vol, veh/h		2576			1860						1437	
Approach Delay, s/veh		31.2			16.5						123.5	
Approach LOS		C			B						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	55.8	80.2		54.0		136.0		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	53.5	66.6		44.5		128.6		
Max Q Clear Time (g_c+I1), s	46.5	23.6		46.5		47.1		
Green Ext Time (p_c), s	0.8	40.4		0.0		72.9		

Intersection Summary	
HCM 2010 Ctrl Delay	49.1
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	360	103	188	311	0	550	0	2532	311	327	1387	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	184.5	166.7	168.1	177.6	0.0	179.2	0.0	186.3	168.1	182.7	184.5	0.0
Adj Flow Rate, veh/h	400	114	0	346	0	0	0	2813	346	363	1541	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	388	160	72	394	0	0	0	2733	940	380	3498	0
Arrive On Green	0.11	0.05	0.00	0.12	0.00	0.00	0.00	1.00	1.00	0.11	0.69	0.00
Sat Flow, veh/h	3408	3167	1429	3281	346		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	400	114	0	346	77.0		0	2813	346	363	1541	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	E		0	1695	1429	1688	1679	0
Q Serve(g_s), s	18.1	5.6	0.0	16.5			0.0	0.0	0.0	17.0	21.4	0.0
Cycle Q Clear(g_c), s	18.1	5.6	0.0	16.5			0.0	0.0	0.0	17.0	21.4	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	388	160	72	394			0	2733	940	380	3498	0
V/C Ratio(X)	1.03	0.71	0.00	0.88			0.00	1.03	0.37	0.96	0.44	0.00
Avail Cap(c_a), veh/h	388	589	266	588			0	2733	940	380	3498	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.09	0.09	1.00	1.00	0.00
Uniform Delay (d), s/veh	70.5	74.4	0.0	68.8			0.0	0.0	0.0	70.2	10.7	0.0
Incr Delay (d2), s/veh	54.0	3.6	0.0	8.1			0.0	14.9	0.1	34.7	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.4	2.5	0.0	7.9			0.0	3.8	0.0	9.8	10.0	0.0
LnGrp Delay(d),s/veh	124.5	77.9	0.0	77.0			0.0	14.9	0.1	104.9	11.1	0.0
LnGrp LOS	F	E		E				F	A	F	B	
Approach Vol, veh/h		514						3159			1904	
Approach Delay, s/veh		114.2						13.3			29.0	
Approach LOS		F						B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	25.0	122.9	27.0	15.0		147.9	42.1	
Change Period (Y+Rc), s*	7.1000004	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	* 17.9	85.5	28.5	29.6		110.5	18.1	
Max Q Clear Time (g_c+I1), s	19.0	2.0	18.5	7.6		23.4	20.1	
Green Ext Time (p_c), s	0.0	79.8	0.6	0.5		83.1	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	30.8
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	479	116	109	63	135	290	126	2074	63	240	1230	416
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	161.0	165.0	190.0	190.0	186.3	190.0	177.6	186.3	190.0	184.5	171.2	166.7
Adj Flow Rate, veh/h	526	127	120	69	148	319	138	2279	69	264	1352	457
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	187	389	367	102	215	434	146	1599	48	149	1468	445
Arrive On Green	0.50	0.50	0.50	0.50	0.50	0.50	0.09	0.32	0.32	0.08	0.31	0.31
Sat Flow, veh/h	797	782	739	162	432	873	1691	5073	153	1757	4673	1417
Grp Volume(v), veh/h	526	0	247	536	0	0	138	1520	828	264	1352	457
Grp Sat Flow(s),veh/h/ln	797	0	1520	1466	0	0	1691	1695	1836	1757	1558	1417
Q Serve(g_s), s	35.6	0.0	18.5	40.3	0.0	0.0	15.4	59.9	59.9	16.1	53.0	59.7
Cycle Q Clear(g_c), s	94.5	0.0	18.5	58.9	0.0	0.0	15.4	59.9	59.9	16.1	53.0	59.7
Prop In Lane	1.00		0.49	0.13		0.60	1.00		0.08	1.00		1.00
Lane Grp Cap(c), veh/h	187	0	756	751	0	0	146	1069	579	149	1468	445
V/C Ratio(X)	2.81	0.00	0.33	0.71	0.00	0.00	0.95	1.42	1.43	1.77	0.92	1.03
Avail Cap(c_a), veh/h	187	0	756	751	0	0	146	1069	579	149	1468	445
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.79	0.79	0.79
Uniform Delay (d), s/veh	80.8	0.0	28.7	40.0	0.0	0.0	86.4	65.1	65.1	86.9	62.9	65.1
Incr Delay (d2), s/veh	827.6	0.0	0.2	2.9	0.0	0.0	57.5	195.6	203.4	368.7	9.0	44.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	52.9	0.0	7.8	23.4	0.0	0.0	9.5	57.1	63.1	23.1	24.0	28.9
LnGrp Delay(d),s/veh	908.4	0.0	28.8	42.9	0.0	0.0	143.8	260.7	268.5	455.6	71.9	110.0
LnGrp LOS	F		C	D			F	F	F	F	E	F
Approach Vol, veh/h		773			536			2486			2073	
Approach Delay, s/veh		627.3			42.9			256.8			129.1	
Approach LOS		F			D			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	23.2	65.8		101.0	23.0	66.0		101.0
Change Period (Y+Rc), s	6.8	6.1000004		6.5	6.8	6.1000004		6.5
Max Green Setting (Gmax), s	16.4	59.700001		94.5	16.2	59.900002		94.5
Max Q Clear Time (g_c+I1), s	17.4	61.7		60.9	18.1	61.9		96.5
Green Ext Time (p_c), s	0.0	0.0		9.2	0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	241.0
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1741	91	81	1330	200	143	12	184	0	0	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00			0.88
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (prot)		4848	1553	1805	4510	1468	1394	1450	1077			2137
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (perm)		4848	1553	1805	4510	1468	1394	1450	1077			2137
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1892	99	88	1446	217	155	13	200	0	0	118
RTOR Reduction (vph)	0	0	34	0	0	53	0	0	180	0	0	113
Lane Group Flow (vph)	0	1892	65	88	1446	164	84	84	20	0	0	5
Heavy Vehicles (%)	5%	7%	4%	0%	15%	10%	23%	0%	50%	11%	0%	33%
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	Perm			Perm
Protected Phases		6		5	2		4	4				
Permitted Phases			6			2			4			8
Actuated Green, G (s)		112.3	112.3	18.0	136.3	136.3	17.7	17.7	17.7			8.0
Effective Green, g (s)		112.3	112.3	18.0	136.3	136.3	17.7	17.7	17.7			8.0
Actuated g/C Ratio		0.62	0.62	0.10	0.76	0.76	0.10	0.10	0.10			0.04
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Vehicle Extension (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			5.0
Lane Grp Cap (vph)		3024	968	180	3415	1111	137	142	105			94
v/s Ratio Prot		c0.39		c0.05	0.32		c0.06	0.06				
v/s Ratio Perm			0.04			0.11			0.02			c0.00
v/c Ratio		0.63	0.07	0.49	0.42	0.15	0.61	0.59	0.19			0.06
Uniform Delay, d1		20.9	13.3	76.6	7.8	6.0	77.9	77.7	74.5			82.4
Progression Factor		0.12	0.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Incremental Delay, d2		0.7	0.1	2.8	0.4	0.3	9.0	7.5	1.2			0.5
Delay (s)		3.2	0.1	79.5	8.2	6.3	86.9	85.2	75.7			82.9
Level of Service		A	A	E	A	A	F	F	E			F
Approach Delay (s)		3.0			11.5			80.4			82.9	
Approach LOS		A			B			F			F	

Intersection Summary			
HCM 2000 Control Delay	15.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	220	1686	687	169	1412	118	81	2	150	124	4	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1308	4550	1538	1703	5398		1466	1482	1056	1289	1213	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1308	4550	1538	1703	5398		1466	1482	1056	1289	1213	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	239	1833	747	184	1535	128	88	2	163	135	4	59
RTOR Reduction (vph)	0	0	380	0	6	0	0	0	149	0	51	0
Lane Group Flow (vph)	239	1833	367	184	1657	0	45	45	14	135	12	0
Heavy Vehicles (%)	38%	14%	5%	6%	19%	28%	17%	0%	53%	40%	0%	37%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6						4			
Actuated Green, G (s)	37.0	88.5	88.5	26.0	77.5		15.8	15.8	15.8	23.7	23.7	
Effective Green, g (s)	37.0	88.5	88.5	26.0	77.5		15.8	15.8	15.8	23.7	23.7	
Actuated g/C Ratio	0.21	0.49	0.49	0.14	0.43		0.09	0.09	0.09	0.13	0.13	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	268	2237	756	245	2324		128	130	92	169	159	
v/s Ratio Prot	0.18	c0.40		0.11	c0.31		c0.03	0.03		c0.10	0.01	
v/s Ratio Perm			0.24						0.01			
v/c Ratio	0.89	0.82	0.49	0.75	0.71		0.35	0.35	0.16	0.80	0.07	
Uniform Delay, d1	69.6	38.9	30.6	73.9	42.1		77.3	77.2	75.9	75.8	68.5	
Progression Factor	1.00	1.00	1.00	0.89	0.84		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	28.7	3.5	2.2	11.5	1.8		2.3	2.2	1.1	23.7	0.3	
Delay (s)	98.3	42.4	32.8	77.3	37.2		79.5	79.4	77.0	99.5	68.8	
Level of Service	F	D	C	E	D		E	E	E	F	E	
Approach Delay (s)		44.6			41.2			77.9			89.7	
Approach LOS		D			D			E			F	

Intersection Summary			
HCM 2000 Control Delay	46.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	660	1320	414	236	1125	352	414	204	274	352	176	666
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	182.7	186.3	186.3	184.5	186.3	184.5	175.5	190.0	174.3	186.3	182.7
Adj Flow Rate, veh/h	717	1435	450	257	1223	383	450	222	298	383	191	724
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	512	1607	510	286	979	308	377	142	190	284	388	324
Arrive On Green	0.29	0.32	0.32	0.16	0.19	0.19	0.15	0.21	0.21	0.15	0.21	0.21
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	680	913	1660	1863	1553
Grp Volume(v), veh/h	717	1435	450	257	1223	383	450	0	520	383	191	724
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1594	1660	1863	1553
Q Serve(g_s), s	51.9	49.3	32.2	25.6	35.0	35.0	27.3	0.0	37.5	26.5	16.3	37.5
Cycle Q Clear(g_c), s	51.9	49.3	32.2	25.6	35.0	35.0	27.3	0.0	37.5	26.5	16.3	37.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.57	1.00		1.00
Lane Grp Cap(c), veh/h	512	1607	510	286	979	308	377	0	332	284	388	324
V/C Ratio(X)	1.40	0.89	0.88	0.90	1.25	1.24	1.19	0.00	1.57	1.35	0.49	2.24
Avail Cap(c_a), veh/h	512	1607	510	286	979	308	377	0	332	284	388	324
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	64.1	58.0	25.5	74.1	72.5	72.5	51.9	0.0	71.3	58.6	62.9	71.3
Incr Delay (d2), s/veh	192.3	8.0	19.3	28.2	120.6	134.2	109.9	0.0	269.0	177.6	1.0	566.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	52.8	23.8	17.9	14.8	27.2	26.8	26.3	0.0	41.3	28.2	8.5	67.1
LnGrp Delay(d),s/veh	256.4	66.1	44.8	102.3	193.1	206.7	161.8	0.0	340.3	236.2	63.8	638.2
LnGrp LOS	F	E	D	F	F	F	F		F	F	E	F
Approach Vol, veh/h		2602			1863			970			1298	
Approach Delay, s/veh		114.8			183.4			257.5			435.0	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	36.0	65.0	34.0	45.0	59.0	42.0	34.0	45.0
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	29.0	58.0	27.3	37.5	51.9	35.0	26.5	* 37.5
Max Q Clear Time (g_c+I1), s	27.6	51.3	29.3	39.5	53.9	37.0	28.5	39.5
Green Ext Time (p_c), s	1.1	4.9	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	216.1
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	467	298	773	745	345	275	914	1172	645	237	1162	467
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	181.0	186.3	190.0	182.7	186.3	177.6	177.6	186.3	186.3
Adj Flow Rate, veh/h	513	327	0	819	379	302	1004	1288	0	260	1277	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	531	324	275	586	366	288	712	1295	552	245	1052	471
Arrive On Green	0.15	0.17	0.00	0.18	0.19	0.19	0.35	0.61	0.00	0.14	0.30	0.00
Sat Flow, veh/h	3442	1863	1583	3343	1886	1485	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	513	327	0	819	355	326	1004	1288	0	260	1277	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1601	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	28.1	33.0	0.0	33.3	36.9	36.9	40.1	68.6	0.0	27.5	56.5	0.0
Cycle Q Clear(g_c), s	28.1	33.0	0.0	33.3	36.9	36.9	40.1	68.6	0.0	27.5	56.5	0.0
Prop In Lane	1.00		1.00	1.00		0.93	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	531	324	275	586	344	311	712	1295	552	245	1052	471
V/C Ratio(X)	0.97	1.01	0.00	1.40	1.03	1.05	1.41	0.99	0.00	1.06	1.21	0.00
Avail Cap(c_a), veh/h	531	324	275	586	344	311	712	1295	552	245	1052	471
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.21	0.21	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	79.9	78.5	0.0	78.3	76.5	76.6	61.5	36.8	0.0	81.3	66.8	0.0
Incr Delay (d2), s/veh	30.4	52.8	0.0	189.2	57.6	64.0	186.0	10.4	0.0	74.9	104.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.6	21.7	0.0	30.8	23.5	21.8	37.0	35.0	0.0	17.9	43.0	0.0
LnGrp Delay(d),s/veh	110.3	131.3	0.0	267.5	134.2	140.5	247.5	47.2	0.0	156.2	171.7	0.0
LnGrp LOS	F	F		F	F	F	F	D		F	F	
Approach Vol, veh/h		840			1500			2292			1537	
Approach Delay, s/veh		118.5			208.4			134.9			169.0	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	47.0	63.4	36.0	43.6	34.4	76.0	40.0	39.6
Change Period (Y+Rc), s	* 6.8999996	6.8999996	6.6999998	6.6999998	6.8999996	* 6.6	6.6999998	6.6000004
Max Green Setting (Gmax), s	* 40.099998	* 56.5	29.299999	36.900002	* 27.5	* 69.5	33.299999	* 33
Max Q Clear Time (g_c+I1), s	42.1	58.5	30.1	38.9	29.5	70.6	35.3	35.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	159.0
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	825	80	985	165	80	114	695	1792	193	132	1723	825
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Lane Util. Factor	0.95	0.95	0.88	0.91	0.91		0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1603	1628	2682	1595	2838		3367	4988	1583	1687	5036	1568
Flt Permitted	0.95	0.96	1.00	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1603	1628	2682	1595	2838		3367	4988	1583	1687	5036	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	868	84	1037	174	84	120	732	1886	203	139	1814	868
RTOR Reduction (vph)	0	0	52	0	91	0	0	0	55	0	0	424
Lane Group Flow (vph)	477	475	985	129	158	0	732	1886	148	139	1814	444
Heavy Vehicles (%)	7%	4%	6%	3%	4%	21%	4%	4%	2%	7%	3%	3%
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8	1	4	4		1	6		5	2	
Permitted Phases			8						6			2
Actuated Green, G (s)	54.5	54.5	82.4	15.6	15.6		27.9	77.7	77.7	16.7	66.5	66.5
Effective Green, g (s)	54.5	54.5	82.4	15.6	15.6		27.9	77.7	77.7	16.7	66.5	66.5
Actuated g/C Ratio	0.29	0.29	0.43	0.08	0.08		0.15	0.41	0.41	0.09	0.35	0.35
Clearance Time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	459	466	1163	130	233		494	2039	647	148	1762	548
v/s Ratio Prot	c0.30	0.29	0.12	c0.08	0.06		c0.22	0.38		0.08	c0.36	
v/s Ratio Perm			0.24						0.09			0.28
v/c Ratio	1.04	1.02	0.85	0.99	0.68		1.48	0.92	0.23	0.94	1.03	0.81
Uniform Delay, d1	67.8	67.8	48.2	87.1	84.8		81.0	53.4	36.6	86.1	61.8	56.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.92	0.88	1.13	0.71	0.66
Incremental Delay, d2	52.5	46.7	5.9	76.3	7.6		222.8	5.2	0.5	10.8	16.0	1.2
Delay (s)	120.3	114.4	54.1	163.4	92.4		299.7	54.3	32.8	108.0	59.8	38.2
Level of Service	F	F	D	F	F		F	D	C	F	E	D
Approach Delay (s)		84.4			116.6			116.4			55.5	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	87.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	190.0	Sum of lost time (s)	25.5
Intersection Capacity Utilization	106.4%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	304	1690	0	0	2328	545	0	0	0	807	0	990
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	0.0	0.0	186.3	186.3				181.0	0.0	184.5
Adj Flow Rate, veh/h	320	1779	0	0	2451	0				849	0	1042
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	337	3040	0	0	2739	575				1047	0	864
Arrive On Green	0.19	0.60	0.00	0.00	0.73	0.00				0.31	0.00	0.31
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	320	1779	0	0	2451	0				849	0	1042
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	33.9	41.1	0.0	0.0	48.3	0.0				44.4	0.0	59.5
Cycle Q Clear(g_c), s	33.9	41.1	0.0	0.0	48.3	0.0				44.4	0.0	59.5
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	337	3040	0	0	2739	575				1047	0	864
V/C Ratio(X)	0.95	0.59	0.00	0.00	0.89	0.00				0.81	0.00	1.21
Avail Cap(c_a), veh/h	359	3040	0	0	2739	575				1047	0	864
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.17	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	76.0	23.6	0.0	0.0	23.2	0.0				60.1	0.0	65.3
Incr Delay (d2), s/veh	33.4	0.8	0.0	0.0	0.9	0.0				4.7	0.0	103.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	19.7	19.3	0.0	0.0	19.7	0.0				21.2	0.0	35.1
LnGrp Delay(d),s/veh	109.4	24.5	0.0	0.0	24.1	0.0				64.8	0.0	168.8
LnGrp LOS	F	C			C					E		F
Approach Vol, veh/h		2099			2451						1891	
Approach Delay, s/veh		37.4			24.1						122.1	
Approach LOS		D			C						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	44.6	76.4		69.0		121.0		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	38.5	66.6		59.5		113.6		
Max Q Clear Time (g_c+I1), s	35.9	50.3		61.5		43.1		
Green Ext Time (p_c), s	0.3	16.0		0.0		65.8		

Intersection Summary	
HCM 2010 Ctrl Delay	57.2
HCM 2010 LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	934	105	356	311	0	413	0	1428	311	548	1703	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	184.5	166.7	168.1	177.6	0.0	179.2	0.0	186.3	168.1	182.7	184.5	0.0
Adj Flow Rate, veh/h	1038	117	0	346	0	0	0	1587	346	609	1892	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	1081	488	220	391	0	0	0	1809	679	649	2984	0
Arrive On Green	0.32	0.15	0.00	0.12	0.00	0.00	0.00	0.71	0.71	0.19	0.59	0.00
Sat Flow, veh/h	3408	3167	1429	3281	346		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	1038	117	0	346	82.9		0	1587	346	609	1892	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	F		0	1695	1429	1688	1679	0
Q Serve(g_s), s	47.7	5.2	0.0	16.6			0.0	38.2	17.6	28.4	39.1	0.0
Cycle Q Clear(g_c), s	47.7	5.2	0.0	16.6			0.0	38.2	17.6	28.4	39.1	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	1081	488	220	391			0	1809	679	649	2984	0
V/C Ratio(X)	0.96	0.24	0.00	0.89			0.00	0.88	0.51	0.94	0.63	0.00
Avail Cap(c_a), veh/h	1113	997	450	492			0	1809	679	665	2984	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.38	0.38	1.00	1.00	0.00
Uniform Delay (d), s/veh	53.5	59.2	0.0	69.2			0.0	20.3	11.9	63.5	21.2	0.0
Incr Delay (d2), s/veh	17.8	0.2	0.0	13.7			0.0	2.6	1.0	21.0	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	25.2	2.3	0.0	8.2			0.0	17.8	6.9	15.2	18.3	0.0
LnGrp Delay(d),s/veh	71.2	59.4	0.0	82.9			0.0	22.9	13.0	84.5	22.3	0.0
LnGrp LOS	E	E		F				C	B	F	C	
Approach Vol, veh/h		1155						1933			2501	
Approach Delay, s/veh		70.0						21.1			37.4	
Approach LOS		E						C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	37.8	93.7	26.9	31.6		131.5	58.5	
Change Period (Y+Rc), s*	7.1000004	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	* 31.4	56.0	23.9	50.2		94.5	52.1	
Max Q Clear Time (g_c+I1), s	30.4	40.2	18.6	7.2		41.1	49.7	
Green Ext Time (p_c), s	0.3	15.2	0.4	0.6		47.2	0.9	

Intersection Summary	
HCM 2010 Ctrl Delay	41.1
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	266	135	126	63	116	60	109	1413	63	252	1901	217
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	161.0	165.2	190.0	190.0	186.3	190.0	177.6	186.3	190.0	184.5	171.2	166.7
Adj Flow Rate, veh/h	292	148	138	69	127	66	120	1553	69	277	2089	238
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	122	280	261	106	190	92	132	1874	83	293	2172	658
Arrive On Green	0.36	0.36	0.36	0.36	0.36	0.36	0.08	0.38	0.38	0.17	0.46	0.46
Sat Flow, veh/h	1024	788	734	231	536	258	1691	4992	222	1757	4673	1417
Grp Volume(v), veh/h	292	0	286	262	0	0	120	1055	567	277	2089	238
Grp Sat Flow(s),veh/h/ln	1024	0	1522	1025	0	0	1691	1695	1824	1757	1558	1417
Q Serve(g_s), s	15.5	0.0	28.3	23.6	0.0	0.0	13.4	53.6	53.6	29.6	82.2	20.5
Cycle Q Clear(g_c), s	67.5	0.0	28.3	52.0	0.0	0.0	13.4	53.6	53.6	29.6	82.2	20.5
Prop In Lane	1.00		0.48	0.26		0.25	1.00		0.12	1.00		1.00
Lane Grp Cap(c), veh/h	122	0	541	388	0	0	132	1273	685	293	2172	658
V/C Ratio(X)	2.40	0.00	0.53	0.68	0.00	0.00	0.91	0.83	0.83	0.95	0.96	0.36
Avail Cap(c_a), veh/h	122	0	541	388	0	0	132	1273	685	297	2172	658
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.52	0.52	0.52
Uniform Delay (d), s/veh	89.7	0.0	48.6	61.8	0.0	0.0	86.9	53.8	53.8	78.3	49.2	32.7
Incr Delay (d2), s/veh	654.8	0.0	0.7	4.1	0.0	0.0	51.3	6.3	11.1	24.5	7.6	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	28.5	0.0	12.0	13.1	0.0	0.0	8.1	26.2	29.1	16.4	36.9	8.2
LnGrp Delay(d),s/veh	744.4	0.0	49.3	65.9	0.0	0.0	138.2	60.1	64.9	102.9	56.8	33.5
LnGrp LOS	F		D	E			F	E	E	F	E	C
Approach Vol, veh/h		578			262			1742			2604	
Approach Delay, s/veh		400.5			65.9			67.0			59.6	
Approach LOS		F			E			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	21.6	94.4		74.0	38.6	77.4		74.0
Change Period (Y+Rc), s	6.6	6.1000004		6.5	6.6	6.1000004		6.5
Max Green Setting (Gmax), s	14.8	88.300003		67.5	32.1	70.900002		67.5
Max Q Clear Time (g_c+I1), s	15.4	84.2		54.0	31.6	55.6		69.5
Green Ext Time (p_c), s	0.0	4.0		3.3	0.0	14.8		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	100.4
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1548	30	55	1068	195	288	15	319	0	0	186
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00			0.88
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (prot)		4848	1553	1805	4510	1468	1394	1430	1077			2137
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (perm)		4848	1553	1805	4510	1468	1394	1430	1077			2137
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1683	33	60	1161	212	313	16	347	0	0	202
RTOR Reduction (vph)	0	0	14	0	0	71	0	0	261	0	0	191
Lane Group Flow (vph)	0	1683	19	60	1161	141	163	166	86	0	0	11
Heavy Vehicles (%)	5%	7%	4%	0%	15%	10%	23%	0%	50%	11%	0%	33%
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	Perm			Perm
Protected Phases		6		5	2		4	4				
Permitted Phases			6			2			4			8
Actuated Green, G (s)		95.4	95.4	12.0	113.4	113.4	29.4	29.4	29.4			9.2
Effective Green, g (s)		95.4	95.4	12.0	113.4	113.4	29.4	29.4	29.4			9.2
Actuated g/C Ratio		0.56	0.56	0.07	0.67	0.67	0.17	0.17	0.17			0.05
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Vehicle Extension (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			5.0
Lane Grp Cap (vph)		2720	871	127	3008	979	241	247	186			115
v/s Ratio Prot		c0.35		c0.03	0.26		c0.12	0.12				
v/s Ratio Perm			0.01			0.10			0.08			c0.01
v/c Ratio		0.62	0.02	0.47	0.39	0.14	0.68	0.67	0.46			0.10
Uniform Delay, d1		25.1	16.6	76.0	12.7	10.4	65.8	65.8	63.2			76.4
Progression Factor		0.27	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Incremental Delay, d2		0.7	0.0	3.7	0.4	0.3	8.0	7.6	2.5			0.8
Delay (s)		7.5	16.6	79.7	13.1	10.7	73.8	73.4	65.7			77.2
Level of Service		A	B	E	B	B	E	E	E			E
Approach Delay (s)		7.6			15.5			69.6			77.2	
Approach LOS		A			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	24.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	188	1508	56	108	1550	230	206	3	97	223	1	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1308	4550	1538	1703	5334		1466	1477	1056	1289	1183	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1308	4550	1538	1703	5334		1466	1477	1056	1289	1183	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	1639	61	117	1685	250	224	3	105	242	1	121
RTOR Reduction (vph)	0	0	34	0	15	0	0	0	95	0	97	0
Lane Group Flow (vph)	204	1639	27	117	1920	0	114	113	10	242	25	0
Heavy Vehicles (%)	38%	14%	5%	6%	19%	28%	17%	0%	53%	40%	0%	37%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6						4			
Actuated Green, G (s)	28.2	75.1	75.1	19.1	66.0		15.8	15.8	15.8	34.0	34.0	
Effective Green, g (s)	28.2	75.1	75.1	19.1	66.0		15.8	15.8	15.8	34.0	34.0	
Actuated g/C Ratio	0.17	0.44	0.44	0.11	0.39		0.09	0.09	0.09	0.20	0.20	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	216	2010	679	191	2070		136	137	98	257	236	
v/s Ratio Prot	c0.16	0.36		0.07	c0.36		c0.08	0.08		c0.19	0.02	
v/s Ratio Perm			0.02						0.01			
v/c Ratio	0.94	0.82	0.04	0.61	0.93		0.84	0.82	0.10	0.94	0.11	
Uniform Delay, d1	70.1	41.4	27.0	71.9	49.7		75.8	75.7	70.6	67.0	55.6	
Progression Factor	1.00	1.00	1.00	1.04	0.99		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	45.4	3.8	0.1	5.5	8.5		35.2	32.7	0.6	40.6	0.3	
Delay (s)	115.6	45.2	27.1	80.0	57.5		111.1	108.4	71.2	107.7	55.9	
Level of Service	F	D	C	F	E		F	F	E	F	E	
Approach Delay (s)		52.1			58.8			97.6			90.3	
Approach LOS		D			E			F			F	

Intersection Summary			
HCM 2000 Control Delay	61.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	660	1320	414	236	1125	352	414	204	274	352	176	666
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	182.7	186.3	186.3	184.5	186.3	184.5	175.5	190.0	174.3	186.3	182.7
Adj Flow Rate, veh/h	717	1435	450	257	1223	383	450	222	298	383	191	724
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	512	1607	510	286	979	308	377	142	190	284	388	324
Arrive On Green	0.29	0.32	0.32	0.16	0.19	0.19	0.15	0.21	0.21	0.15	0.21	0.21
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	680	913	1660	1863	1553
Grp Volume(v), veh/h	717	1435	450	257	1223	383	450	0	520	383	191	724
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1594	1660	1863	1553
Q Serve(g_s), s	51.9	49.3	32.2	25.6	35.0	35.0	27.3	0.0	37.5	26.5	16.3	37.5
Cycle Q Clear(g_c), s	51.9	49.3	32.2	25.6	35.0	35.0	27.3	0.0	37.5	26.5	16.3	37.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.57	1.00		1.00
Lane Grp Cap(c), veh/h	512	1607	510	286	979	308	377	0	332	284	388	324
V/C Ratio(X)	1.40	0.89	0.88	0.90	1.25	1.24	1.19	0.00	1.57	1.35	0.49	2.24
Avail Cap(c_a), veh/h	512	1607	510	286	979	308	377	0	332	284	388	324
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	64.1	58.0	25.5	74.1	72.5	72.5	51.9	0.0	71.3	58.6	62.9	71.3
Incr Delay (d2), s/veh	192.3	8.0	19.3	28.2	120.6	134.2	109.9	0.0	269.0	177.6	1.0	566.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	52.8	23.8	17.9	14.8	27.2	26.8	26.3	0.0	41.3	28.2	8.5	67.1
LnGrp Delay(d),s/veh	256.4	66.1	44.8	102.3	193.1	206.7	161.8	0.0	340.3	236.2	63.8	638.2
LnGrp LOS	F	E	D	F	F	F	F		F	F	E	F
Approach Vol, veh/h		2602			1863			970			1298	
Approach Delay, s/veh		114.8			183.4			257.5			435.0	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	36.0	65.0	34.0	45.0	59.0	42.0	34.0	45.0
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	29.0	58.0	27.3	37.5	51.9	35.0	26.5	* 37.5
Max Q Clear Time (g_c+I1), s	27.6	51.3	29.3	39.5	53.9	37.0	28.5	39.5
Green Ext Time (p_c), s	1.1	4.9	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	216.1
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	467	298	773	745	345	275	914	1172	645	237	1162	467
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	181.0	186.3	190.0	182.7	186.3	177.6	177.6	186.3	186.3
Adj Flow Rate, veh/h	513	327	0	819	379	302	1004	1288	0	260	1277	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	531	324	275	586	366	288	712	1295	552	245	1052	471
Arrive On Green	0.15	0.17	0.00	0.18	0.19	0.19	0.35	0.61	0.00	0.14	0.30	0.00
Sat Flow, veh/h	3442	1863	1583	3343	1886	1485	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	513	327	0	819	355	326	1004	1288	0	260	1277	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1601	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	28.1	33.0	0.0	33.3	36.9	36.9	40.1	68.6	0.0	27.5	56.5	0.0
Cycle Q Clear(g_c), s	28.1	33.0	0.0	33.3	36.9	36.9	40.1	68.6	0.0	27.5	56.5	0.0
Prop In Lane	1.00		1.00	1.00		0.93	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	531	324	275	586	344	311	712	1295	552	245	1052	471
V/C Ratio(X)	0.97	1.01	0.00	1.40	1.03	1.05	1.41	0.99	0.00	1.06	1.21	0.00
Avail Cap(c_a), veh/h	531	324	275	586	344	311	712	1295	552	245	1052	471
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.21	0.21	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	79.9	78.5	0.0	78.3	76.5	76.6	61.5	36.8	0.0	81.3	66.8	0.0
Incr Delay (d2), s/veh	30.4	52.8	0.0	189.2	57.6	64.0	186.0	10.4	0.0	74.9	104.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.6	21.7	0.0	30.8	23.5	21.8	37.0	35.0	0.0	17.9	43.0	0.0
LnGrp Delay(d),s/veh	110.3	131.3	0.0	267.5	134.2	140.5	247.5	47.2	0.0	156.2	171.7	0.0
LnGrp LOS	F	F		F	F	F	F	D		F	F	
Approach Vol, veh/h		840			1500			2292			1537	
Approach Delay, s/veh		118.5			208.4			134.9			169.0	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	47.0	63.4	36.0	43.6	34.4	76.0	40.0	39.6
Change Period (Y+Rc), s	* 6.8999996	6.8999996	6.6999998	6.6999998	6.8999996	* 6.6	6.6999998	6.6000004
Max Green Setting (Gmax), s	* 40.099998	* 56.5	29.299999	36.900002	* 27.5	* 69.5	33.299999	* 33
Max Q Clear Time (g_c+I1), s	42.1	58.5	30.1	38.9	29.5	70.6	35.3	35.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	159.0
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	825	80	985	165	80	114	470	1792	193	132	1723	825
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Lane Util. Factor	0.95	0.95	0.88	0.91	0.91		0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1603	1628	2682	1595	2838		3367	4988	1583	1687	5036	1568
Flt Permitted	0.95	0.96	1.00	0.95	0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1603	1628	2682	1595	2838		3367	4988	1583	1687	5036	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	868	84	1037	174	84	120	495	1886	203	139	1814	868
RTOR Reduction (vph)	0	0	52	0	91	0	0	0	55	0	0	426
Lane Group Flow (vph)	477	475	985	129	158	0	495	1886	148	139	1814	442
Heavy Vehicles (%)	7%	4%	6%	3%	4%	21%	4%	4%	2%	7%	3%	3%
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8	1	4	4		1	6		5	2	
Permitted Phases			8						6			2
Actuated Green, G (s)	54.5	54.5	82.4	15.6	15.6		27.9	77.7	77.7	16.7	66.5	66.5
Effective Green, g (s)	54.5	54.5	82.4	15.6	15.6		27.9	77.7	77.7	16.7	66.5	66.5
Actuated g/C Ratio	0.29	0.29	0.43	0.08	0.08		0.15	0.41	0.41	0.09	0.35	0.35
Clearance Time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	459	466	1163	130	233		494	2039	647	148	1762	548
v/s Ratio Prot	c0.30	0.29	0.12	c0.08	0.06		0.15	c0.38		0.08	c0.36	
v/s Ratio Perm			0.24						0.09			0.28
v/c Ratio	1.04	1.02	0.85	0.99	0.68		1.00	0.92	0.23	0.94	1.03	0.81
Uniform Delay, d1	67.8	67.8	48.2	87.1	84.8		81.0	53.4	36.6	86.1	61.8	55.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.90	0.86	0.74	1.13	0.71	0.67
Incremental Delay, d2	52.5	46.7	5.9	76.3	7.6		34.7	6.5	0.6	10.8	16.0	1.2
Delay (s)	120.3	114.4	54.1	163.4	92.4		108.0	52.3	27.5	108.0	59.8	38.6
Level of Service	F	F	D	F	F		F	D	C	F	E	D
Approach Delay (s)		84.4			116.6			61.0			55.7	
Approach LOS		F			F			E			E	

Intersection Summary			
HCM 2000 Control Delay	67.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	190.0	Sum of lost time (s)	25.5
Intersection Capacity Utilization	100.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	304	1690	0	0	2328	545	0	0	0	807	0	765
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	0.0	0.0	186.3	186.3				181.0	0.0	184.5
Adj Flow Rate, veh/h	320	1779	0	0	2451	0				849	0	805
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	338	3069	0	0	2776	583				1026	0	847
Arrive On Green	0.19	0.60	0.00	0.00	0.74	0.00				0.31	0.00	0.31
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	320	1779	0	0	2451	0				849	0	805
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	33.5	40.2	0.0	0.0	46.1	0.0				44.4	0.0	53.7
Cycle Q Clear(g_c), s	33.5	40.2	0.0	0.0	46.1	0.0				44.4	0.0	53.7
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	338	3069	0	0	2776	583				1026	0	847
V/C Ratio(X)	0.95	0.58	0.00	0.00	0.88	0.00				0.83	0.00	0.95
Avail Cap(c_a), veh/h	363	3069	0	0	2776	583				1057	0	872
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.17	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	75.3	22.8	0.0	0.0	21.8	0.0				60.6	0.0	63.9
Incr Delay (d2), s/veh	32.8	0.8	0.0	0.0	0.8	0.0				5.2	0.0	19.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	19.5	19.0	0.0	0.0	18.9	0.0				21.3	0.0	22.7
LnGrp Delay(d),s/veh	108.1	23.6	0.0	0.0	22.6	0.0				65.8	0.0	83.0
LnGrp LOS	F	C			C					E		F
Approach Vol, veh/h		2099			2451						1654	
Approach Delay, s/veh		36.5			22.6						74.2	
Approach LOS		D			C						E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	44.3	78.4		67.3		122.7		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	38.5	66.6		59.5		113.6		
Max Q Clear Time (g_c+I1), s	35.5	48.1		55.7		42.2		
Green Ext Time (p_c), s	0.3	18.1		2.0		66.7		

Intersection Summary	
HCM 2010 Ctrl Delay	41.1
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	934	105	356	311	0	413	0	1428	311	548	1703	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	184.5	166.7	168.1	177.6	0.0	179.2	0.0	186.3	168.1	182.7	184.5	0.0
Adj Flow Rate, veh/h	1038	117	0	346	0	0	0	1587	346	609	1892	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	1081	488	220	391	0	0	0	1809	679	649	2984	0
Arrive On Green	0.32	0.15	0.00	0.12	0.00	0.00	0.00	0.71	0.71	0.19	0.59	0.00
Sat Flow, veh/h	3408	3167	1429	3281	346		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	1038	117	0	346	82.9		0	1587	346	609	1892	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	F		0	1695	1429	1688	1679	0
Q Serve(g_s), s	47.7	5.2	0.0	16.6			0.0	38.2	17.6	28.4	39.1	0.0
Cycle Q Clear(g_c), s	47.7	5.2	0.0	16.6			0.0	38.2	17.6	28.4	39.1	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	1081	488	220	391			0	1809	679	649	2984	0
V/C Ratio(X)	0.96	0.24	0.00	0.89			0.00	0.88	0.51	0.94	0.63	0.00
Avail Cap(c_a), veh/h	1113	997	450	492			0	1809	679	665	2984	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.38	0.38	1.00	1.00	0.00
Uniform Delay (d), s/veh	53.5	59.2	0.0	69.2			0.0	20.3	11.9	63.5	21.2	0.0
Incr Delay (d2), s/veh	17.8	0.2	0.0	13.7			0.0	2.6	1.0	21.0	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	25.2	2.3	0.0	8.2			0.0	17.8	6.9	15.2	18.3	0.0
LnGrp Delay(d),s/veh	71.2	59.4	0.0	82.9			0.0	22.9	13.0	84.5	22.3	0.0
LnGrp LOS	E	E		F				C	B	F	C	
Approach Vol, veh/h		1155						1933			2501	
Approach Delay, s/veh		70.0						21.1			37.4	
Approach LOS		E						C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	37.8	93.7	26.9	31.6		131.5	58.5	
Change Period (Y+Rc), s*	7.1000004	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	* 31.4	56.0	23.9	50.2		94.5	52.1	
Max Q Clear Time (g_c+I1), s	30.4	40.2	18.6	7.2		41.1	49.7	
Green Ext Time (p_c), s	0.3	15.2	0.4	0.6		47.2	0.9	

Intersection Summary	
HCM 2010 Ctrl Delay	41.1
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	266	135	126	63	116	60	109	1413	63	252	1901	217
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	161.0	165.2	190.0	190.0	186.3	190.0	177.6	186.3	190.0	184.5	171.2	166.7
Adj Flow Rate, veh/h	292	148	138	69	127	66	120	1553	69	277	2089	238
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	122	280	261	106	190	92	132	1874	83	293	2172	658
Arrive On Green	0.36	0.36	0.36	0.36	0.36	0.36	0.08	0.38	0.38	0.17	0.46	0.46
Sat Flow, veh/h	1024	788	734	231	536	258	1691	4992	222	1757	4673	1417
Grp Volume(v), veh/h	292	0	286	262	0	0	120	1055	567	277	2089	238
Grp Sat Flow(s),veh/h/ln	1024	0	1522	1025	0	0	1691	1695	1824	1757	1558	1417
Q Serve(g_s), s	15.5	0.0	28.3	23.6	0.0	0.0	13.4	53.6	53.6	29.6	82.2	20.5
Cycle Q Clear(g_c), s	67.5	0.0	28.3	52.0	0.0	0.0	13.4	53.6	53.6	29.6	82.2	20.5
Prop In Lane	1.00		0.48	0.26		0.25	1.00		0.12	1.00		1.00
Lane Grp Cap(c), veh/h	122	0	541	388	0	0	132	1273	685	293	2172	658
V/C Ratio(X)	2.40	0.00	0.53	0.68	0.00	0.00	0.91	0.83	0.83	0.95	0.96	0.36
Avail Cap(c_a), veh/h	122	0	541	388	0	0	132	1273	685	297	2172	658
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.52	0.52	0.52
Uniform Delay (d), s/veh	89.7	0.0	48.6	61.8	0.0	0.0	86.9	53.8	53.8	78.3	49.2	32.7
Incr Delay (d2), s/veh	654.8	0.0	0.7	4.1	0.0	0.0	51.3	6.3	11.1	24.5	7.6	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	28.5	0.0	12.0	13.1	0.0	0.0	8.1	26.2	29.1	16.4	36.9	8.2
LnGrp Delay(d),s/veh	744.4	0.0	49.3	65.9	0.0	0.0	138.2	60.1	64.9	102.9	56.8	33.5
LnGrp LOS	F		D	E			F	E	E	F	E	C
Approach Vol, veh/h		578			262			1742			2604	
Approach Delay, s/veh		400.5			65.9			67.0			59.6	
Approach LOS		F			E			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	21.6	94.4		74.0	38.6	77.4		74.0
Change Period (Y+Rc), s	6.6	6.1000004		6.5	6.6	6.1000004		6.5
Max Green Setting (Gmax), s	14.8	88.300003		67.5	32.1	70.900002		67.5
Max Q Clear Time (g_c+I1), s	15.4	84.2		54.0	31.6	55.6		69.5
Green Ext Time (p_c), s	0.0	4.0		3.3	0.0	14.8		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	100.4
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1689	30	55	865	344	288	15	319	0	0	186
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00			0.88
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (prot)		4848	1553	1805	4510	1468	1394	1430	1077			2137
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (perm)		4848	1553	1805	4510	1468	1394	1430	1077			2137
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1836	33	60	940	374	313	16	347	0	0	202
RTOR Reduction (vph)	0	0	17	0	0	139	0	0	262	0	0	190
Lane Group Flow (vph)	0	1836	16	60	940	235	163	166	85	0	0	12
Heavy Vehicles (%)	5%	7%	4%	0%	15%	10%	23%	0%	50%	11%	0%	33%
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	Perm			Perm
Protected Phases		6		5	2		4	4				
Permitted Phases			6			2			4			8
Actuated Green, G (s)		63.7	63.7	12.0	81.7	81.7	22.3	22.3	22.3			8.0
Effective Green, g (s)		63.7	63.7	12.0	81.7	81.7	22.3	22.3	22.3			8.0
Actuated g/C Ratio		0.49	0.49	0.09	0.63	0.63	0.17	0.17	0.17			0.06
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Vehicle Extension (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			5.0
Lane Grp Cap (vph)		2375	760	166	2834	922	239	245	184			131
v/s Ratio Prot		c0.38		0.03	c0.21		c0.12	0.12				
v/s Ratio Perm			0.01			0.16			0.08			c0.01
v/c Ratio		0.77	0.02	0.36	0.33	0.25	0.68	0.68	0.46			0.09
Uniform Delay, d1		27.2	17.1	55.4	11.3	10.7	50.5	50.5	48.5			57.6
Progression Factor		0.36	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Incremental Delay, d2		2.2	0.0	1.8	0.3	0.7	8.4	7.9	2.5			0.7
Delay (s)		11.8	17.1	57.2	11.7	11.4	58.9	58.4	51.0			58.2
Level of Service		B	B	E	B	B	E	E	D			E
Approach Delay (s)		11.9			13.6			54.7			58.2	
Approach LOS		B			B			D			E	

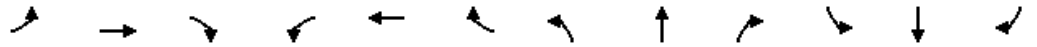
Intersection Summary			
HCM 2000 Control Delay	21.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	1185	56	108	1550	28	206	3	97	223	2	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1308	4550	1538	1703	5471		1466	1477	1056	1289	1187	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1308	4550	1538	1703	5471		1466	1477	1056	1289	1187	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	1288	61	117	1685	30	224	3	105	242	2	121
RTOR Reduction (vph)	0	0	38	0	2	0	0	0	92	0	95	0
Lane Group Flow (vph)	98	1288	23	117	1713	0	114	113	13	242	28	0
Heavy Vehicles (%)	38%	14%	5%	6%	19%	28%	17%	0%	53%	40%	0%	37%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6						4			
Actuated Green, G (s)	12.8	48.7	48.7	12.0	47.9		15.6	15.6	15.6	27.7	27.7	
Effective Green, g (s)	12.8	48.7	48.7	12.0	47.9		15.6	15.6	15.6	27.7	27.7	
Actuated g/C Ratio	0.10	0.37	0.37	0.09	0.37		0.12	0.12	0.12	0.21	0.21	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	128	1704	576	157	2015		175	177	126	274	252	
v/s Ratio Prot	0.07	c0.28		0.07	c0.31		c0.08	0.08		c0.19	0.02	
v/s Ratio Perm			0.01						0.01			
v/c Ratio	0.77	0.76	0.04	0.75	0.85		0.65	0.64	0.10	0.88	0.11	
Uniform Delay, d1	57.1	35.5	25.8	57.5	37.8		54.6	54.5	50.9	49.6	41.2	
Progression Factor	1.00	1.00	1.00	0.98	0.96		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	23.5	3.2	0.1	16.8	4.6		9.3	8.2	0.5	27.2	0.3	
Delay (s)	80.6	38.6	25.9	72.8	40.7		63.9	62.7	51.4	76.8	41.5	
Level of Service	F	D	C	E	D		E	E	D	E	D	
Approach Delay (s)		40.9			42.7			59.5			64.9	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	45.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	249	0	0	0	0	0	0	391	259	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4							6.2	6.2			
Lane Util. Factor	1.00							1.00	1.00			
Frt	1.00							1.00	0.85			
Flt Protected	0.95							1.00	1.00			
Satd. Flow (prot)	1770							1863	1583			
Flt Permitted	0.95							1.00	1.00			
Satd. Flow (perm)	1770							1863	1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	271	0	0	0	0	0	0	425	282	0	0	0
RTOR Reduction (vph)	218	0	0	0	0	0	0	0	148	0	0	0
Lane Group Flow (vph)	53	0	0	0	0	0	0	425	134	0	0	0
Turn Type	Prot							NA	Perm			
Protected Phases	7							2				
Permitted Phases									2			
Actuated Green, G (s)	7.0							16.9	16.9			
Effective Green, g (s)	7.0							16.9	16.9			
Actuated g/C Ratio	0.20							0.48	0.48			
Clearance Time (s)	5.4							6.2	6.2			
Vehicle Extension (s)	3.5							3.5	3.5			
Lane Grp Cap (vph)	349							886	753			
v/s Ratio Prot	c0.03							c0.23				
v/s Ratio Perm									0.08			
v/c Ratio	0.15							0.48	0.18			
Uniform Delay, d1	11.8							6.3	5.3			
Progression Factor	1.00							1.00	1.00			
Incremental Delay, d2	0.2							0.5	0.1			
Delay (s)	12.0							6.8	5.5			
Level of Service	B							A	A			
Approach Delay (s)		12.0			0.0			6.3			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	35.5	Sum of lost time (s)	11.6
Intersection Capacity Utilization	42.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	321	1109	248	204	1215	325	414	176	236	352	204	660
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	182.7	186.3	186.3	184.5	186.3	184.5	175.5	190.0	174.3	186.3	182.7
Adj Flow Rate, veh/h	349	1205	270	222	1321	353	450	191	257	383	222	717
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	306	1496	475	225	1276	401	367	143	192	330	477	398
Arrive On Green	0.17	0.30	0.30	0.13	0.25	0.25	0.13	0.21	0.21	0.17	0.26	0.26
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	679	914	1660	1863	1553
Grp Volume(v), veh/h	349	1205	270	222	1321	353	450	0	448	383	222	717
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1593	1660	1863	1553
Q Serve(g_s), s	25.9	33.5	14.8	18.7	38.0	32.1	19.4	0.0	31.5	25.5	15.1	38.4
Cycle Q Clear(g_c), s	25.9	33.5	14.8	18.7	38.0	32.1	19.4	0.0	31.5	25.5	15.1	38.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.57	1.00		1.00
Lane Grp Cap(c), veh/h	306	1496	475	225	1276	401	367	0	335	330	477	398
V/C Ratio(X)	1.14	0.81	0.57	0.99	1.04	0.88	1.23	0.00	1.34	1.16	0.47	1.80
Avail Cap(c_a), veh/h	306	1496	475	225	1276	401	367	0	335	330	477	398
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	62.0	48.5	20.8	65.4	56.0	53.8	46.6	0.0	59.3	47.1	47.1	55.8
Incr Delay (d2), s/veh	94.6	4.7	4.9	56.4	34.8	23.1	124.2	0.0	171.4	100.3	0.7	371.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.7	16.1	8.4	12.7	21.7	16.6	18.4	0.0	29.8	22.9	7.9	57.5
LnGrp Delay(d),s/veh	156.6	53.2	25.6	121.7	90.8	76.9	170.7	0.0	230.6	147.4	47.8	427.3
LnGrp LOS	F	D	C	F	F	E	F		F	F	D	F
Approach Vol, veh/h		1824			1896			898			1322	
Approach Delay, s/veh		68.9			91.9			200.6			282.5	
Approach LOS		E			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	26.0	52.0	26.1	45.9	33.0	45.0	33.0	39.0
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	19.0	45.0	19.4	38.4	25.9	38.0	25.5	* 31.5
Max Q Clear Time (g_c+I1), s	20.7	35.5	21.4	40.4	27.9	40.0	27.5	33.5
Green Ext Time (p_c), s	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	143.7
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	467	345	914	645	298	237	773	1232	745	275	1172	467
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	181.0	186.3	190.0	182.7	186.3	177.6	177.6	186.3	186.3
Adj Flow Rate, veh/h	513	379	0	709	327	260	849	1354	0	302	1288	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	546	337	287	551	354	276	659	1332	568	232	1120	501
Arrive On Green	0.16	0.18	0.00	0.16	0.19	0.19	0.33	0.63	0.00	0.14	0.32	0.00
Sat Flow, veh/h	3442	1863	1583	3343	1896	1476	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	513	379	0	709	305	282	849	1354	0	302	1288	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1602	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	28.0	34.4	0.0	31.3	32.2	33.0	37.1	71.5	0.0	26.1	60.1	0.0
Cycle Q Clear(g_c), s	28.0	34.4	0.0	31.3	32.2	33.0	37.1	71.5	0.0	26.1	60.1	0.0
Prop In Lane	1.00		1.00	1.00		0.92	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	546	337	287	551	330	299	659	1332	568	232	1120	501
V/C Ratio(X)	0.94	1.12	0.00	1.29	0.92	0.94	1.29	1.02	0.00	1.30	1.15	0.00
Avail Cap(c_a), veh/h	546	337	287	551	338	306	659	1332	568	232	1120	501
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.35	0.35	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	79.0	77.8	0.0	79.3	75.9	76.3	64.0	35.3	0.0	82.0	64.9	0.0
Incr Delay (d2), s/veh	24.3	86.8	0.0	142.6	29.5	36.1	133.8	18.9	0.0	162.8	78.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.2	25.8	0.0	25.4	18.5	17.7	29.5	38.0	0.0	22.7	41.6	0.0
LnGrp Delay(d),s/veh	103.3	164.6	0.0	221.9	105.4	112.4	197.8	54.2	0.0	244.8	143.3	0.0
LnGrp LOS	F	F		F	F	F	F	F		F	F	
Approach Vol, veh/h		892			1296			2203			1590	
Approach Delay, s/veh		129.3			170.7			109.6			162.6	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	44.0	67.0	36.8	42.2	33.0	78.0	38.0	41.0
Change Period (Y+Rc), s	* 6.8	6.8	6.7	6.7	6.8	* 6.5	6.7	6.6
Max Green Setting (Gmax), s	* 37	60.1	29.3	35.6	* 26.1	* 71.5	31.3	34.4
Max Q Clear Time (g_c+I1), s	39.1	62.1	30.0	35.0	28.1	73.5	33.3	36.4
Green Ext Time (p_c), s	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	139.8
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	825	56	611	103	74	132	670	1793	97	114	1792	825
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Lane Util. Factor	0.95	0.95	0.88	0.91	0.91		0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1603	1622	2682	1595	2742		3367	4988	1583	1687	5036	1568
Flt Permitted	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1603	1622	2682	1595	2742		3367	4988	1583	1687	5036	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	868	59	643	108	78	139	705	1887	102	120	1886	868
RTOR Reduction (vph)	0	0	49	0	128	0	0	0	51	0	0	380
Lane Group Flow (vph)	460	467	594	97	100	0	705	1887	51	120	1886	488
Heavy Vehicles (%)	7%	4%	6%	3%	4%	21%	4%	4%	2%	7%	3%	3%
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8	1	4	4		1	6		5	2	
Permitted Phases			8						6			2
Actuated Green, G (s)	50.3	50.3	87.1	11.4	11.4		36.8	86.4	86.4	16.4	66.0	66.0
Effective Green, g (s)	50.3	50.3	87.1	11.4	11.4		36.8	86.4	86.4	16.4	66.0	66.0
Actuated g/C Ratio	0.26	0.26	0.46	0.06	0.06		0.19	0.45	0.45	0.09	0.35	0.35
Clearance Time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	424	429	1229	95	164		652	2268	719	145	1749	544
v/s Ratio Prot	0.29	c0.29	0.09	c0.06	0.04		c0.21	0.38		0.07	c0.37	
v/s Ratio Perm			0.13						0.03			0.31
v/c Ratio	1.08	1.09	0.48	1.02	0.61		1.08	0.83	0.07	0.83	1.08	0.90
Uniform Delay, d1	69.8	69.8	35.8	89.3	87.1		76.6	45.4	29.2	85.4	62.0	58.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.79	0.64	0.24	1.10	0.73	0.45
Incremental Delay, d2	68.5	69.5	0.3	98.2	6.6		54.8	2.8	0.1	3.6	36.5	2.4
Delay (s)	138.3	139.3	36.1	187.5	93.7		115.1	32.0	7.1	98.0	81.6	28.9
Level of Service	F	F	D	F	F		F	C	A	F	F	C
Approach Delay (s)		96.7			121.7			52.8			66.4	
Approach LOS		F			F			D			E	

Intersection Summary			
HCM 2000 Control Delay	70.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	190.0	Sum of lost time (s)	25.5
Intersection Capacity Utilization	105.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	401	2046	0	0	1767	739	0	0	0	651	0	514
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	0.0	0.0	186.3	186.3				181.0	0.0	184.5
Adj Flow Rate, veh/h	422	2154	0	0	1860	0				685	0	541
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	443	3500	0	0	2967	623				740	0	611
Arrive On Green	0.25	0.69	0.00	0.00	0.79	0.00				0.22	0.00	0.22
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	422	2154	0	0	1860	0				685	0	541
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	43.8	42.8	0.0	0.0	19.4	0.0				37.5	0.0	35.5
Cycle Q Clear(g_c), s	43.8	42.8	0.0	0.0	19.4	0.0				37.5	0.0	35.5
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	443	3500	0	0	2967	623				740	0	611
V/C Ratio(X)	0.95	0.62	0.00	0.00	0.63	0.00				0.93	0.00	0.89
Avail Cap(c_a), veh/h	508	3500	0	0	2967	623				796	0	657
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.24	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	69.0	15.8	0.0	0.0	14.2	0.0				71.2	0.0	70.5
Incr Delay (d2), s/veh	26.8	0.8	0.0	0.0	0.2	0.0				15.7	0.0	12.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	24.8	20.2	0.0	0.0	7.8	0.0				18.9	0.0	14.6
LnGrp Delay(d),s/veh	95.9	16.6	0.0	0.0	14.4	0.0				86.9	0.0	83.2
LnGrp LOS	F	B			B					F		F
Approach Vol, veh/h		2576			1860						1226	
Approach Delay, s/veh		29.6			14.4						85.3	
Approach LOS		C			B						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	55.1	84.0		50.9		139.1		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	53.5	66.6		44.5		128.6		
Max Q Clear Time (g_c+I1), s	45.8	21.4		39.5		44.8		
Green Ext Time (p_c), s	0.8	42.4		1.9		74.7		

Intersection Summary	
HCM 2010 Ctrl Delay	36.6
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	360	103	188	311	0	550	0	2532	311	327	1387	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	184.5	166.7	168.1	177.6	0.0	179.2	0.0	186.3	168.1	182.7	184.5	0.0
Adj Flow Rate, veh/h	400	114	0	346	0	0	0	2813	346	363	1541	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	388	160	72	394	0	0	0	2733	940	380	3498	0
Arrive On Green	0.11	0.05	0.00	0.12	0.00	0.00	0.00	1.00	1.00	0.11	0.69	0.00
Sat Flow, veh/h	3408	3167	1429	3281	346		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	400	114	0	346	77.0		0	2813	346	363	1541	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	E		0	1695	1429	1688	1679	0
Q Serve(g_s), s	18.1	5.6	0.0	16.5			0.0	0.0	0.0	17.0	21.4	0.0
Cycle Q Clear(g_c), s	18.1	5.6	0.0	16.5			0.0	0.0	0.0	17.0	21.4	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	388	160	72	394			0	2733	940	380	3498	0
V/C Ratio(X)	1.03	0.71	0.00	0.88			0.00	1.03	0.37	0.96	0.44	0.00
Avail Cap(c_a), veh/h	388	589	266	588			0	2733	940	380	3498	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.09	0.09	1.00	1.00	0.00
Uniform Delay (d), s/veh	70.5	74.4	0.0	68.8			0.0	0.0	0.0	70.2	10.7	0.0
Incr Delay (d2), s/veh	54.0	3.6	0.0	8.1			0.0	14.9	0.1	34.7	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.4	2.5	0.0	7.9			0.0	3.8	0.0	9.8	10.0	0.0
LnGrp Delay(d),s/veh	124.5	77.9	0.0	77.0			0.0	14.9	0.1	104.9	11.1	0.0
LnGrp LOS	F	E		E				F	A	F	B	
Approach Vol, veh/h		514						3159			1904	
Approach Delay, s/veh		114.2						13.3			29.0	
Approach LOS		F						B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	25.0	122.9	27.0	15.0		147.9	42.1	
Change Period (Y+Rc), s*	7.1000004	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	* 17.9	85.5	28.5	29.6		110.5	18.1	
Max Q Clear Time (g_c+I1), s	19.0	2.0	18.5	7.6		23.4	20.1	
Green Ext Time (p_c), s	0.0	79.8	0.6	0.5		83.1	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	30.8
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	479	116	109	63	135	290	126	2074	63	240	1230	416
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	161.0	165.0	190.0	190.0	186.3	190.0	177.6	186.3	190.0	184.5	171.2	166.7
Adj Flow Rate, veh/h	526	127	120	69	148	319	138	2279	69	264	1352	457
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	187	389	367	102	215	434	146	1599	48	149	1468	445
Arrive On Green	0.50	0.50	0.50	0.50	0.50	0.50	0.09	0.32	0.32	0.08	0.31	0.31
Sat Flow, veh/h	797	782	739	162	432	873	1691	5073	153	1757	4673	1417
Grp Volume(v), veh/h	526	0	247	536	0	0	138	1520	828	264	1352	457
Grp Sat Flow(s),veh/h/ln	797	0	1520	1466	0	0	1691	1695	1836	1757	1558	1417
Q Serve(g_s), s	35.6	0.0	18.5	40.3	0.0	0.0	15.4	59.9	59.9	16.1	53.0	59.7
Cycle Q Clear(g_c), s	94.5	0.0	18.5	58.9	0.0	0.0	15.4	59.9	59.9	16.1	53.0	59.7
Prop In Lane	1.00		0.49	0.13		0.60	1.00		0.08	1.00		1.00
Lane Grp Cap(c), veh/h	187	0	756	751	0	0	146	1069	579	149	1468	445
V/C Ratio(X)	2.81	0.00	0.33	0.71	0.00	0.00	0.95	1.42	1.43	1.77	0.92	1.03
Avail Cap(c_a), veh/h	187	0	756	751	0	0	146	1069	579	149	1468	445
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.79	0.79	0.79
Uniform Delay (d), s/veh	80.8	0.0	28.7	40.0	0.0	0.0	86.4	65.1	65.1	86.9	62.9	65.1
Incr Delay (d2), s/veh	827.6	0.0	0.2	2.9	0.0	0.0	57.5	195.6	203.4	368.7	9.0	44.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	52.9	0.0	7.8	23.4	0.0	0.0	9.5	57.1	63.1	23.1	24.0	28.9
LnGrp Delay(d),s/veh	908.4	0.0	28.8	42.9	0.0	0.0	143.8	260.7	268.5	455.6	71.9	110.0
LnGrp LOS	F		C	D			F	F	F	F	E	F
Approach Vol, veh/h		773			536			2486			2073	
Approach Delay, s/veh		627.3			42.9			256.8			129.1	
Approach LOS		F			D			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	23.2	65.8		101.0	23.0	66.0		101.0
Change Period (Y+Rc), s	6.8	6.1000004		6.5	6.8	6.1000004		6.5
Max Green Setting (Gmax), s	16.4	59.700001		94.5	16.2	59.900002		94.5
Max Q Clear Time (g_c+I1), s	17.4	61.7		60.9	18.1	61.9		96.5
Green Ext Time (p_c), s	0.0	0.0		9.2	0.0	0.0		0.0

Intersection Summary		
HCM 2010 Ctrl Delay	241.0	
HCM 2010 LOS	F	

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1981	92	81	1250	246	143	12	184	0	0	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00			0.88
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (prot)		4848	1553	1805	4510	1468	1394	1450	1077			2137
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (perm)		4848	1553	1805	4510	1468	1394	1450	1077			2137
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2153	100	88	1359	267	155	13	200	0	0	118
RTOR Reduction (vph)	0	0	47	0	0	85	0	0	180	0	0	110
Lane Group Flow (vph)	0	2153	53	88	1359	182	84	84	20	0	0	8
Heavy Vehicles (%)	5%	7%	4%	0%	15%	10%	23%	0%	50%	11%	0%	33%
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	Perm			Perm
Protected Phases		6		5	2		4	4				
Permitted Phases			6			2			4			8
Actuated Green, G (s)		63.8	63.8	12.0	81.8	81.8	12.2	12.2	12.2			8.0
Effective Green, g (s)		63.8	63.8	12.0	81.8	81.8	12.2	12.2	12.2			8.0
Actuated g/C Ratio		0.53	0.53	0.10	0.68	0.68	0.10	0.10	0.10			0.07
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Vehicle Extension (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			5.0
Lane Grp Cap (vph)		2577	825	180	3074	1000	141	147	109			142
v/s Ratio Prot		c0.44		0.05	c0.30		c0.06	0.06				
v/s Ratio Perm			0.03			0.12			0.02			c0.00
v/c Ratio		0.84	0.06	0.49	0.44	0.18	0.60	0.57	0.19			0.06
Uniform Delay, d1		23.7	13.6	51.1	8.7	6.9	51.5	51.4	49.4			52.5
Progression Factor		0.20	0.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Incremental Delay, d2		2.3	0.1	2.8	0.5	0.4	7.7	6.3	1.1			0.3
Delay (s)		7.1	0.1	53.9	9.2	7.3	59.2	57.7	50.5			52.8
Level of Service		A	A	D	A	A	E	E	D			D
Approach Delay (s)		6.8			11.2			54.1			52.8	
Approach LOS		A			B			D			D	

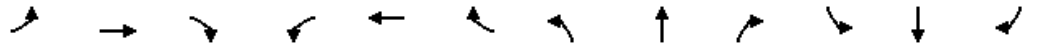
Intersection Summary			
HCM 2000 Control Delay	13.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	54	1561	687	169	1412	39	81	2	150	124	4	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1308	4550	1538	1703	5459		1466	1482	1056	1289	1213	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1308	4550	1538	1703	5459		1466	1482	1056	1289	1213	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	59	1697	747	184	1535	42	88	2	163	135	4	59
RTOR Reduction (vph)	0	0	456	0	3	0	0	0	143	0	51	0
Lane Group Flow (vph)	59	1697	291	184	1574	0	45	45	20	135	12	0
Heavy Vehicles (%)	38%	14%	5%	6%	19%	28%	17%	0%	53%	40%	0%	37%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6						4			
Actuated Green, G (s)	8.7	46.7	46.7	16.2	54.2		15.0	15.0	15.0	16.1	16.1	
Effective Green, g (s)	8.7	46.7	46.7	16.2	54.2		15.0	15.0	15.0	16.1	16.1	
Actuated g/C Ratio	0.07	0.39	0.39	0.13	0.45		0.12	0.12	0.12	0.13	0.13	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	94	1770	598	229	2465		183	185	132	172	162	
v/s Ratio Prot	0.05	c0.37		c0.11	0.29		c0.03	0.03		c0.10	0.01	
v/s Ratio Perm			0.19						0.02			
v/c Ratio	0.63	0.96	0.49	0.80	0.64		0.25	0.24	0.15	0.78	0.07	
Uniform Delay, d1	54.1	35.7	27.6	50.4	25.4		47.4	47.4	46.8	50.3	45.4	
Progression Factor	1.00	1.00	1.00	1.00	0.99		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	12.4	13.6	2.8	17.0	1.2		1.0	0.9	0.7	21.6	0.3	
Delay (s)	66.5	49.3	30.4	67.5	26.3		48.4	48.3	47.6	71.9	45.7	
Level of Service	E	D	C	E	C		D	D	D	E	D	
Approach Delay (s)		44.1			30.6			47.9			63.5	
Approach LOS		D			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	40.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	165	0	0	0	0	0	0	269	255	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4							6.2	6.2			
Lane Util. Factor	1.00							1.00	1.00			
Frt	1.00							1.00	0.85			
Flt Protected	0.95							1.00	1.00			
Satd. Flow (prot)	1770							1863	1583			
Flt Permitted	0.95							1.00	1.00			
Satd. Flow (perm)	1770							1863	1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	179	0	0	0	0	0	0	292	277	0	0	0
RTOR Reduction (vph)	144	0	0	0	0	0	0	0	142	0	0	0
Lane Group Flow (vph)	35	0	0	0	0	0	0	292	135	0	0	0
Turn Type	Prot							NA	Perm			
Protected Phases	7							2				
Permitted Phases									2			
Actuated Green, G (s)	7.1							17.9	17.9			
Effective Green, g (s)	7.1							17.9	17.9			
Actuated g/C Ratio	0.19							0.49	0.49			
Clearance Time (s)	5.4							6.2	6.2			
Vehicle Extension (s)	3.5							3.5	3.5			
Lane Grp Cap (vph)	343							911	774			
v/s Ratio Prot	c0.02							c0.16				
v/s Ratio Perm									0.09			
v/c Ratio	0.10							0.32	0.18			
Uniform Delay, d1	12.1							5.7	5.2			
Progression Factor	1.00							1.00	1.00			
Incremental Delay, d2	0.2							0.2	0.1			
Delay (s)	12.3							5.9	5.4			
Level of Service	B							A	A			
Approach Delay (s)		12.3			0.0			5.6			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	36.6	Sum of lost time (s)	11.6
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	699	1363	442	289	1286	427	419	253	335	427	218	723
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	182.7	186.3	186.3	184.5	186.3	184.5	175.5	190.0	174.3	186.3	182.7
Adj Flow Rate, veh/h	760	1482	480	314	1398	464	455	275	364	464	237	786
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	472	1662	528	217	951	299	330	154	204	303	512	427
Arrive On Green	0.27	0.33	0.33	0.12	0.19	0.19	0.11	0.22	0.22	0.16	0.28	0.28
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	686	908	1660	1863	1553
Grp Volume(v), veh/h	760	1482	480	314	1398	464	455	0	639	464	237	786
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1594	1660	1863	1553
Q Serve(g_s), s	47.9	50.7	37.4	22.0	34.0	34.0	20.3	0.0	40.5	28.5	19.0	49.5
Cycle Q Clear(g_c), s	47.9	50.7	37.4	22.0	34.0	34.0	20.3	0.0	40.5	28.5	19.0	49.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.57	1.00		1.00
Lane Grp Cap(c), veh/h	472	1663	528	217	951	299	330	0	359	303	512	427
V/C Ratio(X)	1.61	0.89	0.91	1.45	1.47	1.55	1.38	0.00	1.78	1.53	0.46	1.84
Avail Cap(c_a), veh/h	472	1663	528	217	951	299	330	0	359	303	512	427
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	66.1	56.9	29.5	79.0	73.0	73.0	55.4	0.0	69.8	59.5	54.2	65.3
Incr Delay (d2), s/veh	284.2	7.7	22.2	225.6	217.1	264.1	188.1	0.0	362.7	255.5	0.7	387.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	60.7	24.5	19.5	24.4	34.9	36.8	23.8	0.0	54.0	36.6	9.9	67.2
LnGrp Delay(d),s/veh	350.2	64.6	51.7	304.6	290.1	337.1	243.4	0.0	432.5	315.0	54.9	452.5
LnGrp LOS	F	E	D	F	F	F	F		F	F	D	F
Approach Vol, veh/h		2722			2176			1094			1487	
Approach Delay, s/veh		142.1			302.2			353.9			346.2	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	29.0	67.0	27.0	57.0	55.0	41.0	36.0	48.0
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	22.0	60.0	20.3	49.5	47.9	34.0	28.5	* 40.5
Max Q Clear Time (g_c+I1), s	24.0	52.7	22.3	51.5	49.9	36.0	30.5	42.5
Green Ext Time (p_c), s	0.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	260.2
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	472	356	899	837	412	360	969	1279	775	311	1373	472
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	181.0	186.3	190.0	182.7	186.3	177.6	177.6	186.3	186.3
Adj Flow Rate, veh/h	519	391	0	920	453	396	1065	1405	0	342	1509	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	490	339	288	573	377	329	643	1354	577	221	1134	507
Arrive On Green	0.14	0.18	0.00	0.17	0.21	0.21	0.32	0.64	0.00	0.13	0.32	0.00
Sat Flow, veh/h	3442	1863	1583	3343	1793	1564	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	519	391	0	920	447	402	1065	1405	0	342	1509	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1587	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	28.5	36.4	0.0	34.3	42.1	42.1	38.1	76.5	0.0	26.1	64.1	0.0
Cycle Q Clear(g_c), s	28.5	36.4	0.0	34.3	42.1	42.1	38.1	76.5	0.0	26.1	64.1	0.0
Prop In Lane	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	490	339	288	573	373	334	643	1354	577	221	1134	507
V/C Ratio(X)	1.06	1.15	0.00	1.60	1.20	1.20	1.66	1.04	0.00	1.55	1.33	0.00
Avail Cap(c_a), veh/h	490	339	288	573	373	334	643	1354	577	221	1134	507
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.13	0.13	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	85.8	81.8	0.0	82.8	78.9	79.0	68.2	36.1	0.0	86.9	67.9	0.0
Incr Delay (d2), s/veh	56.9	97.3	0.0	280.1	113.2	116.5	296.2	21.0	0.0	268.5	154.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	17.4	27.9	0.0	38.2	32.3	29.3	44.2	40.9	0.0	28.7	55.7	0.0
LnGrp Delay(d),s/veh	142.7	179.1	0.0	363.0	192.1	195.4	364.4	57.1	0.0	355.5	222.7	0.0
LnGrp LOS	F	F		F	F	F	F	F		F	F	
Approach Vol, veh/h		910			1769			2470			1851	
Approach Delay, s/veh		158.3			281.7			189.6			247.3	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	45.0	71.0	35.2	48.8	33.0	83.0	41.0	43.0
Change Period (Y+Rc), s	* 6.8999996	6.8999996	6.6999998	6.6999998	6.8999996	* 6.5	6.6999998	6.6000004
Max Green Setting (Gmax), s	* 38.1	64.099998	* 28.5	42.099998	* 26.1	* 76.5	34.299999	36.400002
Max Q Clear Time (g_c+I1), s	40.1	66.1	30.5	44.1	28.1	78.5	36.3	38.4
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	224.1
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	918	66	1042	90	57	128	713	1977	110	148	2043	918
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Lane Util. Factor	0.95	0.95	0.88	0.91	0.91		0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1603	1623	2682	1595	2700		3367	4988	1583	1687	5036	1568
Flt Permitted	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1603	1623	2682	1595	2700		3367	4988	1583	1687	5036	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	966	69	1097	95	60	135	751	2081	116	156	2151	966
RTOR Reduction (vph)	0	0	50	0	127	0	0	0	49	0	0	414
Lane Group Flow (vph)	512	523	1047	85	78	0	751	2081	67	156	2151	552
Heavy Vehicles (%)	7%	4%	6%	3%	4%	21%	4%	4%	2%	7%	3%	3%
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8	1	4	4		1	6		5	2	
Permitted Phases			8						6			2
Actuated Green, G (s)	57.5	57.5	84.2	10.4	10.4		26.7	87.9	87.9	18.7	79.9	79.9
Effective Green, g (s)	57.5	57.5	84.2	10.4	10.4		26.7	87.9	87.9	18.7	79.9	79.9
Actuated g/C Ratio	0.29	0.29	0.42	0.05	0.05		0.13	0.44	0.44	0.09	0.40	0.40
Clearance Time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	460	466	1129	82	140		449	2192	695	157	2011	626
v/s Ratio Prot	0.32	c0.32	0.12	c0.05	0.03		c0.22	0.42		0.09	c0.43	
v/s Ratio Perm			0.27						0.04			0.35
v/c Ratio	1.11	1.12	0.93	1.04	0.56		1.67	0.95	0.10	0.99	1.07	0.88
Uniform Delay, d1	71.2	71.2	55.0	94.8	92.6		86.7	53.9	32.8	90.6	60.0	55.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.89	0.81	0.70	1.09	0.58	0.77
Incremental Delay, d2	76.5	79.6	12.8	109.8	4.7		308.1	6.6	0.2	19.9	32.5	1.9
Delay (s)	147.7	150.8	67.8	204.6	97.3		385.0	50.5	23.0	118.3	67.6	44.7
Level of Service	F	F	E	F	F		F	D	C	F	E	D
Approach Delay (s)		107.4			128.7			134.6			63.2	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	100.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	200.0	Sum of lost time (s)	25.5
Intersection Capacity Utilization	113.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	426	1991	0	0	2610	565	0	0	0	722	0	809
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	0.0	0.0	186.3	186.3				181.0	0.0	184.5
Adj Flow Rate, veh/h	448	2096	0	0	2747	0				760	0	852
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	462	3471	0	0	2864	601				779	0	643
Arrive On Green	0.26	0.68	0.00	0.00	0.76	0.00				0.23	0.00	0.23
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	448	2096	0	0	2747	0				760	0	852
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	50.0	44.5	0.0	0.0	64.5	0.0				45.1	0.0	46.6
Cycle Q Clear(g_c), s	50.0	44.5	0.0	0.0	64.5	0.0				45.1	0.0	46.6
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	462	3471	0	0	2864	601				779	0	643
V/C Ratio(X)	0.97	0.60	0.00	0.00	0.96	0.00				0.98	0.00	1.33
Avail Cap(c_a), veh/h	466	3471	0	0	2864	601				779	0	643
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.09	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	73.2	17.1	0.0	0.0	22.7	0.0				76.1	0.0	76.7
Incr Delay (d2), s/veh	33.8	0.8	0.0	0.0	1.2	0.0				26.2	0.0	156.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	28.9	21.0	0.0	0.0	26.1	0.0				23.7	0.0	31.8
LnGrp Delay(d),s/veh	107.0	17.9	0.0	0.0	23.9	0.0				102.3	0.0	233.6
LnGrp LOS	F	B			C					F		F
Approach Vol, veh/h		2544			2747						1612	
Approach Delay, s/veh		33.6			23.9						171.7	
Approach LOS		C			C						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	60.6	83.3		56.1		143.9		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	52.5	75.5		46.6		136.5		
Max Q Clear Time (g_c+I1), s	52.0	66.5		48.6		46.5		
Green Ext Time (p_c), s	0.1	9.0		0.0		87.1		

Intersection Summary		
HCM 2010 Ctrl Delay		62.0
HCM 2010 LOS		E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	974	124	420	312	0	495	0	1777	312	598	1774	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	184.5	166.7	168.1	177.6	0.0	179.2	0.0	186.3	168.1	182.7	184.5	0.0
Adj Flow Rate, veh/h	1082	138	0	347	0	0	0	1974	347	664	1971	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	982	407	184	386	0	0	0	1995	729	645	3151	0
Arrive On Green	0.29	0.13	0.00	0.12	0.00	0.00	0.00	0.78	0.78	0.19	0.63	0.00
Sat Flow, veh/h	3408	3167	1429	3281	347		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	1082	138	0	347	92.3		0	1974	347	664	1971	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	F		0	1695	1429	1688	1679	0
Q Serve(g_s), s	48.1	6.6	0.0	17.4			0.0	62.5	13.7	31.9	40.2	0.0
Cycle Q Clear(g_c), s	48.1	6.6	0.0	17.4			0.0	62.5	13.7	31.9	40.2	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	982	407	184	386			0	1995	729	645	3151	0
V/C Ratio(X)	1.10	0.34	0.00	0.90			0.00	0.99	0.48	1.03	0.63	0.00
Avail Cap(c_a), veh/h	982	994	448	426			0	1995	729	645	3151	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.23	0.23	1.00	1.00	0.00
Uniform Delay (d), s/veh	59.5	66.3	0.0	72.7			0.0	17.7	8.3	67.6	19.2	0.0
Incr Delay (d2), s/veh	60.9	0.3	0.0	19.6			0.0	7.6	0.5	43.3	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	30.9	2.9	0.0	9.0			0.0	29.4	5.2	18.7	18.9	0.0
LnGrp Delay(d),s/veh	120.4	66.6	0.0	92.3			0.0	25.2	8.8	110.8	20.2	0.0
LnGrp LOS	F	E		F				C	A	F	C	
Approach Vol, veh/h		1220						2321			2635	
Approach Delay, s/veh		114.3						22.8			43.0	
Approach LOS		F						C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	39.0	105.0	27.5	28.5		144.0	56.0	
Change Period (Y+Rc), s*	7.1000004	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	* 31.9	65.5	21.7	52.4		104.5	48.1	
Max Q Clear Time (g_c+I1), s	33.9	64.5	19.4	8.6		42.2	50.1	
Green Ext Time (p_c), s	0.0	1.0	0.2	0.7		57.9	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	51.8
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	316	136	129	68	117	70	111	1703	68	142	1966	398
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	161.0	165.0	190.0	190.0	186.3	190.0	177.6	186.3	190.0	184.5	171.2	166.7
Adj Flow Rate, veh/h	347	149	142	75	129	77	122	1871	75	156	2160	437
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	145	301	287	120	203	113	121	2094	84	171	2075	629
Arrive On Green	0.39	0.39	0.39	0.39	0.39	0.39	0.07	0.42	0.42	0.10	0.44	0.44
Sat Flow, veh/h	1012	778	741	251	523	292	1691	5017	201	1757	4673	1417
Grp Volume(v), veh/h	347	0	291	281	0	0	122	1264	682	156	2160	437
Grp Sat Flow(s),veh/h/ln	1012	0	1519	1065	0	0	1691	1695	1827	1757	1558	1417
Q Serve(g_s), s	21.6	0.0	29.0	26.9	0.0	0.0	14.3	69.2	69.5	17.6	88.8	49.6
Cycle Q Clear(g_c), s	77.5	0.0	29.0	55.9	0.0	0.0	14.3	69.2	69.5	17.6	88.8	49.6
Prop In Lane	1.00		0.49	0.27		0.27	1.00		0.11	1.00		1.00
Lane Grp Cap(c), veh/h	145	0	589	436	0	0	121	1415	763	171	2075	629
V/C Ratio(X)	2.39	0.00	0.49	0.65	0.00	0.00	1.01	0.89	0.89	0.91	1.04	0.69
Avail Cap(c_a), veh/h	145	0	589	436	0	0	121	1415	763	171	2075	629
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.45	0.45	0.45
Uniform Delay (d), s/veh	91.9	0.0	46.4	60.7	0.0	0.0	92.8	54.1	54.2	89.4	55.6	44.7
Incr Delay (d2), s/veh	645.5	0.0	0.4	2.8	0.0	0.0	84.3	8.9	15.2	25.0	25.7	2.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	34.1	0.0	12.3	14.2	0.0	0.0	9.5	34.2	38.3	9.7	43.2	19.9
LnGrp Delay(d),s/veh	737.4	0.0	46.8	63.5	0.0	0.0	177.1	63.0	69.3	114.4	81.3	47.6
LnGrp LOS	F		D	E			F	E	E	F	F	D
Approach Vol, veh/h		638			281			2068			2753	
Approach Delay, s/veh		422.4			63.5			71.8			77.8	
Approach LOS		F			E			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	21.1	94.9		84.0	26.4	89.6		84.0
Change Period (Y+Rc), s	6.6	6.1000004		6.5	6.6	6.1000004		6.5
Max Green Setting (Gmax), s	14.5	88.800003		77.5	19.5	* 83.5		77.5
Max Q Clear Time (g_c+I1), s	16.3	90.8		57.9	19.6	71.5		79.5
Green Ext Time (p_c), s	0.0	0.0		4.2	0.0	11.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	113.3
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1512	31	59	1133	207	298	15	330	0	0	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00			0.88
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (prot)		4848	1553	1805	4510	1468	1394	1429	1077			2137
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (perm)		4848	1553	1805	4510	1468	1394	1429	1077			2137
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1643	34	64	1232	225	324	16	359	0	0	210
RTOR Reduction (vph)	0	0	15	0	0	75	0	0	256	0	0	198
Lane Group Flow (vph)	0	1643	19	64	1232	150	168	172	103	0	0	12
Heavy Vehicles (%)	5%	7%	4%	0%	15%	10%	23%	0%	50%	11%	0%	33%
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	Perm			Perm
Protected Phases		6		5	2		4	4				
Permitted Phases			6			2			4			8
Actuated Green, G (s)		99.3	99.3	15.0	120.3	120.3	31.8	31.8	31.8			9.9
Effective Green, g (s)		99.3	99.3	15.0	120.3	120.3	31.8	31.8	31.8			9.9
Actuated g/C Ratio		0.55	0.55	0.08	0.67	0.67	0.18	0.18	0.18			0.06
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Vehicle Extension (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			5.0
Lane Grp Cap (vph)		2674	856	150	3014	981	246	252	190			117
v/s Ratio Prot		c0.34		0.04	c0.27		c0.12	0.12				
v/s Ratio Perm			0.01			0.10			0.10			c0.01
v/c Ratio		0.61	0.02	0.43	0.41	0.15	0.68	0.68	0.54			0.10
Uniform Delay, d1		27.4	18.3	78.4	13.6	11.0	69.4	69.4	67.5			80.8
Progression Factor		0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Incremental Delay, d2		0.8	0.0	2.7	0.4	0.3	8.2	8.0	3.9			0.8
Delay (s)		9.8	18.3	81.1	14.0	11.4	77.6	77.4	71.4			81.6
Level of Service		A	B	F	B	B	E	E	E			F
Approach Delay (s)		10.0			16.5			74.4			81.6	
Approach LOS		A			B			E			F	

Intersection Summary			
HCM 2000 Control Delay	27.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	1471	58	113	1626	243	213	3	100	231	2	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1308	4550	1538	1703	5333		1466	1477	1056	1289	1187	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1308	4550	1538	1703	5333		1466	1477	1056	1289	1187	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	1599	63	123	1767	264	232	3	109	251	2	125
RTOR Reduction (vph)	0	0	35	0	15	0	0	0	99	0	100	0
Lane Group Flow (vph)	212	1599	28	123	2016	0	118	117	10	251	27	0
Heavy Vehicles (%)	38%	14%	5%	6%	19%	28%	17%	0%	53%	40%	0%	37%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6						4			
Actuated Green, G (s)	30.5	80.5	80.5	21.0	71.0		16.0	16.0	16.0	36.5	36.5	
Effective Green, g (s)	30.5	80.5	80.5	21.0	71.0		16.0	16.0	16.0	36.5	36.5	
Actuated g/C Ratio	0.17	0.45	0.45	0.12	0.39		0.09	0.09	0.09	0.20	0.20	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	221	2034	687	198	2103		130	131	93	261	240	
v/s Ratio Prot	c0.16	0.35		0.07	c0.38		c0.08	0.08		c0.19	0.02	
v/s Ratio Perm			0.02						0.01			
v/c Ratio	0.96	0.79	0.04	0.62	0.96		0.91	0.89	0.10	0.96	0.11	
Uniform Delay, d1	74.1	42.4	28.0	75.7	53.1		81.3	81.2	75.4	71.1	58.6	
Progression Factor	1.00	1.00	1.00	0.96	0.91		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	48.4	3.1	0.1	5.7	11.7		52.0	48.4	0.7	45.2	0.3	
Delay (s)	122.6	45.6	28.1	78.6	60.1		133.3	129.6	76.1	116.2	58.8	
Level of Service	F	D	C	E	E		F	F	E	F	E	
Approach Delay (s)		53.7			61.1			113.9			96.9	
Approach LOS		D			E			F			F	

Intersection Summary			
HCM 2000 Control Delay	64.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	373	1286	388	335	1366	427	442	218	289	427	253	699
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	182.7	186.3	186.3	184.5	186.3	184.5	175.5	190.0	174.3	186.3	182.7
Adj Flow Rate, veh/h	405	1398	422	364	1485	464	480	237	314	464	275	760
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	306	1330	422	260	1209	380	336	149	197	341	528	440
Arrive On Green	0.17	0.27	0.27	0.15	0.24	0.24	0.12	0.22	0.22	0.18	0.28	0.28
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	686	909	1660	1863	1553
Grp Volume(v), veh/h	405	1398	422	364	1485	464	480	0	551	464	275	760
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1594	1660	1863	1553
Q Serve(g_s), s	25.9	40.0	28.7	22.0	36.0	36.0	17.3	0.0	32.5	26.5	18.6	42.5
Cycle Q Clear(g_c), s	25.9	40.0	28.7	22.0	36.0	36.0	17.3	0.0	32.5	26.5	18.6	42.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.57	1.00		1.00
Lane Grp Cap(c), veh/h	306	1330	422	260	1209	380	336	0	345	341	528	440
V/C Ratio(X)	1.32	1.05	1.00	1.40	1.23	1.22	1.43	0.00	1.60	1.36	0.52	1.73
Avail Cap(c_a), veh/h	306	1330	422	260	1209	380	336	0	345	341	528	440
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	62.0	55.0	28.4	64.0	57.0	57.0	47.2	0.0	58.8	47.4	45.2	53.8
Incr Delay (d2), s/veh	166.0	39.3	43.7	201.2	110.4	121.0	208.9	0.0	281.1	179.8	0.9	336.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	26.8	23.2	17.9	25.3	29.0	28.5	25.0	0.0	41.3	31.2	9.7	59.4
LnGrp Delay(d),s/veh	228.1	94.3	72.0	265.2	167.4	178.0	256.1	0.0	339.9	227.1	46.1	390.5
LnGrp LOS	F	F	E	F	F	F	F		F	F	D	F
Approach Vol, veh/h		2225			2313			1031			1499	
Approach Delay, s/veh		114.4			184.9			300.9			276.7	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	29.0	47.0	24.0	50.0	33.0	43.0	34.0	40.0
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	22.0	40.0	17.3	42.5	25.9	36.0	26.5	* 32.5
Max Q Clear Time (g_c+I1), s	24.0	42.0	19.3	44.5	27.9	38.0	28.5	34.5
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	199.1
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	472	412	969	941	356	311	899	1439	837	360	1279	472
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	181.0	186.3	190.0	182.7	186.3	177.6	177.6	186.3	186.3
Adj Flow Rate, veh/h	519	453	0	1034	391	342	988	1581	0	396	1405	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	551	367	312	642	411	356	612	1188	507	250	1063	476
Arrive On Green	0.16	0.20	0.00	0.19	0.23	0.23	0.24	0.45	0.00	0.15	0.30	0.00
Sat Flow, veh/h	3442	1863	1583	3343	1798	1559	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	519	453	0	1034	385	348	988	1581	0	396	1405	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1588	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	31.3	41.4	0.0	40.3	45.0	45.5	38.1	70.5	0.0	31.1	63.1	0.0
Cycle Q Clear(g_c), s	31.3	41.4	0.0	40.3	45.0	45.5	38.1	70.5	0.0	31.1	63.1	0.0
Prop In Lane	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	551	367	312	642	404	363	612	1188	507	250	1063	476
V/C Ratio(X)	0.94	1.23	0.00	1.61	0.95	0.96	1.61	1.33	0.00	1.58	1.32	0.00
Avail Cap(c_a), veh/h	551	367	312	642	409	367	612	1188	507	250	1063	476
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.09	0.09	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	87.2	84.3	0.0	84.8	79.9	80.1	79.7	58.1	0.0	89.4	73.4	0.0
Incr Delay (d2), s/veh	24.4	126.6	0.0	282.4	32.1	36.4	276.7	149.3	0.0	279.8	151.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.8	34.2	0.0	43.8	25.6	23.7	41.3	59.1	0.0	34.0	53.2	0.0
LnGrp Delay(d),s/veh	111.6	210.9	0.0	367.3	111.9	116.4	356.3	207.4	0.0	369.2	224.6	0.0
LnGrp LOS	F	F		F	F	F	F	F		F	F	
Approach Vol, veh/h		972			1767			2569			1801	
Approach Delay, s/veh		157.9			262.2			264.7			256.4	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	45.0	70.0	40.3	54.7	38.0	77.0	47.0	48.0
Change Period (Y+Rc), s	* 6.8999996	6.8999996	6.6999998	6.6999998	6.8999996	* 6.5	6.6999998	6.6000004
Max Green Setting (Gmax), s	* 38.1	63.0999983	33.100002	* 48.5	* 31.1	* 70.5	40.2999991	41.400002
Max Q Clear Time (g_c+I1), s	40.1	65.1	33.3	47.5	33.1	72.5	42.3	43.4
Green Ext Time (p_c), s	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	247.4
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	918	57	637	110	66	148	469	2109	90	128	2143	918
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Lane Util. Factor	0.95	0.95	0.88	0.91	0.91		0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1603	1621	2682	1595	2700		3367	4988	1583	1687	5036	1568
Flt Permitted	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1603	1621	2682	1595	2700		3367	4988	1583	1687	5036	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	966	60	671	116	69	156	494	2220	95	135	2256	966
RTOR Reduction (vph)	0	0	48	0	109	0	0	0	45	0	0	401
Lane Group Flow (vph)	512	514	623	104	128	0	494	2220	50	135	2256	565
Heavy Vehicles (%)	7%	4%	6%	3%	4%	21%	4%	4%	2%	7%	3%	3%
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8	1	4	4		1	6		5	2	
Permitted Phases			8						6			2
Actuated Green, G (s)	58.5	58.5	86.2	12.4	12.4		27.7	96.6	96.6	17.0	85.9	85.9
Effective Green, g (s)	58.5	58.5	86.2	12.4	12.4		27.7	96.6	96.6	17.0	85.9	85.9
Actuated g/C Ratio	0.28	0.28	0.41	0.06	0.06		0.13	0.46	0.46	0.08	0.41	0.41
Clearance Time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	446	451	1100	94	159		444	2294	728	136	2059	641
v/s Ratio Prot	c0.32	0.32	0.07	c0.07	0.05		c0.15	0.45		0.08	c0.45	
v/s Ratio Perm			0.16						0.03			0.36
v/c Ratio	1.15	1.14	0.57	1.11	0.80		1.11	0.97	0.07	0.99	1.10	0.88
Uniform Delay, d1	75.8	75.8	47.5	98.8	97.6		91.2	55.2	31.6	96.4	62.0	57.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.70	0.51	0.08	1.02	0.46	0.94
Incremental Delay, d2	89.8	86.5	0.7	124.5	24.7		71.3	10.1	0.1	21.3	43.9	1.8
Delay (s)	165.6	162.3	48.2	223.3	122.3		135.5	38.1	2.7	120.0	72.4	55.8
Level of Service	F	F	D	F	F		F	D	A	F	E	E
Approach Delay (s)		118.2			153.1			54.0			69.5	
Approach LOS		F			F			D			E	

Intersection Summary			
HCM 2000 Control Delay	77.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	210.0	Sum of lost time (s)	25.5
Intersection Capacity Utilization	109.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	446	2249	0	0	2086	804	0	0	0	711	0	419
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	0.0	0.0	186.3	186.3				181.0	0.0	184.5
Adj Flow Rate, veh/h	469	2367	0	0	2196	0				748	0	441
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	485	3477	0	0	2787	585				786	0	649
Arrive On Green	0.27	0.68	0.00	0.00	0.74	0.00				0.24	0.00	0.24
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	469	2367	0	0	2196	0				748	0	441
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	54.4	57.4	0.0	0.0	38.0	0.0				46.0	0.0	30.3
Cycle Q Clear(g_c), s	54.4	57.4	0.0	0.0	38.0	0.0				46.0	0.0	30.3
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	485	3477	0	0	2787	585				786	0	649
V/C Ratio(X)	0.97	0.68	0.00	0.00	0.79	0.00				0.95	0.00	0.68
Avail Cap(c_a), veh/h	515	3477	0	0	2787	585				810	0	668
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.13	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	74.8	19.5	0.0	0.0	22.1	0.0				78.6	0.0	72.6
Incr Delay (d2), s/veh	30.4	1.1	0.0	0.0	0.3	0.0				20.2	0.0	2.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	30.8	27.1	0.0	0.0	15.6	0.0				23.5	0.0	11.8
LnGrp Delay(d),s/veh	105.2	20.6	0.0	0.0	22.5	0.0				98.8	0.0	75.0
LnGrp LOS	F	C			C					F		E
Approach Vol, veh/h		2836			2196						1189	
Approach Delay, s/veh		34.6			22.5						90.0	
Approach LOS		C			C						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	65.6	85.9		58.5		151.5		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	60.5	73.6		50.5		142.6		
Max Q Clear Time (g_c+I1), s	56.4	40.0		48.0		59.4		
Green Ext Time (p_c), s	0.6	33.0		1.1		79.2		

Intersection Summary	
HCM 2010 Ctrl Delay	40.9
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	402	66	260	312	0	608	0	2596	312	387	1627	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	184.5	166.7	168.1	177.6	0.0	179.2	0.0	186.3	168.1	182.7	184.5	0.0
Adj Flow Rate, veh/h	447	73	0	347	0	0	0	2884	347	430	1808	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	426	112	50	391	0	0	0	2784	952	437	3621	0
Arrive On Green	0.12	0.04	0.00	0.12	0.00	0.00	0.00	1.00	1.00	0.13	0.72	0.00
Sat Flow, veh/h	3408	3167	1429	3281	347		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	447	73	0	347	86.1		0	2884	347	430	1808	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	F		0	1695	1429	1688	1679	0
Q Serve(g_s), s	21.1	3.8	0.0	17.6			0.0	0.0	0.0	21.5	26.6	0.0
Cycle Q Clear(g_c), s	21.1	3.8	0.0	17.6			0.0	0.0	0.0	21.5	26.6	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	426	112	50	391			0	2784	952	437	3621	0
V/C Ratio(X)	1.05	0.65	0.00	0.89			0.00	1.04	0.36	0.98	0.50	0.00
Avail Cap(c_a), veh/h	426	761	343	515			0	2784	952	437	3621	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.09	0.09	1.00	1.00	0.00
Uniform Delay (d), s/veh	73.9	80.5	0.0	73.3			0.0	0.0	0.0	73.4	10.4	0.0
Incr Delay (d2), s/veh	57.5	3.9	0.0	12.7			0.0	17.7	0.1	38.4	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.3	1.7	0.0	8.7			0.0	4.6	0.0	12.4	12.4	0.0
LnGrp Delay(d),s/veh	131.4	84.4	0.0	86.1			0.0	17.7	0.1	111.8	10.9	0.0
LnGrp LOS	F	F		F				F	A	F	B	
Approach Vol, veh/h		520						3231			2238	
Approach Delay, s/veh		124.8						15.8			30.3	
Approach LOS		F						B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	29.0	140.0	28.0	13.0		169.0	41.0	
Change Period (Y+Rc), s*	7.1000004	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	* 21.9	92.5	26.5	40.6		121.5	21.1	
Max Q Clear Time (g_c+I1), s	23.5	2.0	19.6	5.8		28.6	23.1	
Green Ext Time (p_c), s	0.0	87.9	0.5	0.3		90.2	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	33.7
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	653	117	111	68	136	126	129	2129	68	70	1551	578
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	161.0	165.0	190.0	190.0	186.3	190.0	177.6	186.3	190.0	184.5	171.2	166.7
Adj Flow Rate, veh/h	718	129	122	75	149	138	142	2340	75	77	1704	635
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	349	422	399	165	326	290	90	1685	54	59	1466	445
Arrive On Green	0.54	0.54	0.54	0.54	0.54	0.54	0.05	0.33	0.33	0.03	0.31	0.31
Sat Flow, veh/h	940	781	739	267	603	536	1691	5063	162	1757	4673	1417
Grp Volume(v), veh/h	718	0	251	362	0	0	142	1563	852	77	1704	635
Grp Sat Flow(s),veh/h/ln	940	0	1520	1405	0	0	1691	1695	1834	1757	1558	1417
Q Serve(g_s), s	70.4	0.0	19.1	24.0	0.0	0.0	11.2	69.9	69.9	7.1	65.9	65.9
Cycle Q Clear(g_c), s	113.5	0.0	19.1	43.1	0.0	0.0	11.2	69.9	69.9	7.1	65.9	65.9
Prop In Lane	1.00		0.49	0.21		0.38	1.00		0.09	1.00		1.00
Lane Grp Cap(c), veh/h	349	0	822	780	0	0	90	1128	611	59	1466	445
V/C Ratio(X)	2.05	0.00	0.31	0.46	0.00	0.00	1.57	1.39	1.39	1.30	1.16	1.43
Avail Cap(c_a), veh/h	349	0	822	780	0	0	90	1128	611	59	1466	445
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.68	0.68	0.68
Uniform Delay (d), s/veh	73.3	0.0	26.6	33.6	0.0	0.0	99.4	70.1	70.1	101.4	72.0	72.1
Incr Delay (d2), s/veh	484.4	0.0	0.1	0.3	0.0	0.0	304.8	179.0	187.5	194.8	78.4	201.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	67.3	0.0	8.0	14.0	0.0	0.0	12.9	60.8	67.2	6.7	39.0	50.7
LnGrp Delay(d),s/veh	557.7	0.0	26.7	33.9	0.0	0.0	404.2	249.1	257.5	296.2	150.5	273.6
LnGrp LOS	F		C	C			F	F	F	F	F	F
Approach Vol, veh/h		969			362			2557			2416	
Approach Delay, s/veh		420.1			33.9			260.5			187.5	
Approach LOS		F			C			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.0	72.0		120.0	14.0	76.0		120.0
Change Period (Y+Rc), s	6.6.1000004			6.5	6.6.1000004			6.5
Max Green Setting (Gmax), s	11.45.900002			113.5	7.69.900002			113.5
Max Q Clear Time (g_c+I1), s	13.2	67.9		45.1	9.1	71.9		115.5
Green Ext Time (p_c), s	0.0	0.0		8.7	0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	244.0
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↱	↰	↑↑↑	↱	↰	↕	↱			↱↱
Volume (vph)	0	2008	99	84	1325	259	155	10	199	0	0	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00			0.88
Frpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (prot)		4848	1553	1805	4510	1468	1394	1439	1077			2137
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (perm)		4848	1553	1805	4510	1468	1394	1439	1077			2137
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2183	108	91	1440	282	168	11	216	0	0	128
RTOR Reduction (vph)	0	0	34	0	0	70	0	0	194	0	0	122
Lane Group Flow (vph)	0	2183	74	91	1440	212	89	90	22	0	0	6
Confl. Peds. (#/hr)										103		
Heavy Vehicles (%)	5%	7%	4%	0%	15%	10%	23%	0%	50%	11%	0%	33%
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	Perm			Perm
Protected Phases		6		5	2		4	4				
Permitted Phases			6			2			4			8
Actuated Green, G (s)		112.5	112.5	17.0	135.5	135.5	18.5	18.5	18.5			8.0
Effective Green, g (s)		112.5	112.5	17.0	135.5	135.5	18.5	18.5	18.5			8.0
Actuated g/C Ratio		0.62	0.62	0.09	0.75	0.75	0.10	0.10	0.10			0.04
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Vehicle Extension (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			5.0
Lane Grp Cap (vph)		3030	970	170	3395	1105	143	147	110			94
v/s Ratio Prot		c0.45		c0.05	0.32		c0.06	0.06				
v/s Ratio Perm			0.05			0.14			0.02			c0.00
v/c Ratio		0.72	0.08	0.54	0.42	0.19	0.62	0.61	0.20			0.06
Uniform Delay, d1		23.0	13.3	77.7	8.1	6.4	77.4	77.3	74.0			82.4
Progression Factor		0.22	0.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Incremental Delay, d2		1.2	0.1	4.1	0.4	0.4	9.2	8.4	1.2			0.6
Delay (s)		6.2	0.2	81.8	8.5	6.8	86.6	85.7	75.2			83.0
Level of Service		A	A	F	A	A	F	F	E			F
Approach Delay (s)		5.9			11.9			80.2			83.0	
Approach LOS		A			B			F			F	

Intersection Summary			
HCM 2000 Control Delay	16.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	73.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	1505	757	180	1506	41	88	2	166	134	4	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1308	4550	1538	1703	5459		1466	1481	1056	1289	1211	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1308	4550	1538	1703	5459		1466	1481	1056	1289	1211	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	1636	823	196	1637	45	96	2	180	146	4	63
RTOR Reduction (vph)	0	0	401	0	2	0	0	0	164	0	54	0
Lane Group Flow (vph)	109	1636	422	196	1680	0	49	49	16	146	13	0
Heavy Vehicles (%)	38%	14%	5%	6%	19%	28%	17%	0%	53%	40%	0%	37%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6						4			
Actuated Green, G (s)	19.6	84.6	84.6	28.0	93.0		16.2	16.2	16.2	25.2	25.2	
Effective Green, g (s)	19.6	84.6	84.6	28.0	93.0		16.2	16.2	16.2	25.2	25.2	
Actuated g/C Ratio	0.11	0.47	0.47	0.16	0.52		0.09	0.09	0.09	0.14	0.14	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	142	2138	722	264	2820		131	133	95	180	169	
v/s Ratio Prot	0.08	c0.36		c0.12	0.31		c0.03	0.03		c0.11	0.01	
v/s Ratio Perm			0.27						0.02			
v/c Ratio	0.77	0.77	0.58	0.74	0.60		0.37	0.37	0.17	0.81	0.08	
Uniform Delay, d1	78.0	39.5	34.8	72.6	30.4		77.1	77.1	75.7	75.1	67.3	
Progression Factor	1.00	1.00	1.00	0.89	0.86		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	21.6	2.7	3.4	10.1	0.9		2.4	2.3	1.2	24.5	0.3	
Delay (s)	99.6	42.2	38.3	74.4	26.9		79.6	79.4	76.9	99.6	67.5	
Level of Service	F	D	D	E	C		E	E	E	F	E	
Approach Delay (s)		43.4			31.8			77.8			89.5	
Approach LOS		D			C			E			F	

Intersection Summary			
HCM 2000 Control Delay	42.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	80.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	186	0	0	0	0	0	0	487	328	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4							6.2	6.2			
Lane Util. Factor	1.00							1.00	1.00			
Frt	1.00							1.00	0.85			
Flt Protected	0.95							1.00	1.00			
Satd. Flow (prot)	1770							1863	1583			
Flt Permitted	0.95							1.00	1.00			
Satd. Flow (perm)	1770							1863	1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	202	0	0	0	0	0	0	529	357	0	0	0
RTOR Reduction (vph)	167	0	0	0	0	0	0	0	163	0	0	0
Lane Group Flow (vph)	35	0	0	0	0	0	0	529	194	0	0	0
Turn Type	Prot							NA	Perm			
Protected Phases	7							2				
Permitted Phases									2			
Actuated Green, G (s)	7.1							22.2	22.2			
Effective Green, g (s)	7.1							22.2	22.2			
Actuated g/C Ratio	0.17							0.54	0.54			
Clearance Time (s)	5.4							6.2	6.2			
Vehicle Extension (s)	3.5							3.5	3.5			
Lane Grp Cap (vph)	307							1011	859			
v/s Ratio Prot	c0.02							c0.28				
v/s Ratio Perm									0.12			
v/c Ratio	0.11							0.52	0.23			
Uniform Delay, d1	14.2							6.0	4.9			
Progression Factor	1.00							1.00	1.00			
Incremental Delay, d2	0.2							0.6	0.2			
Delay (s)	14.4							6.5	5.0			
Level of Service	B							A	A			
Approach Delay (s)		14.4			0.0			5.9			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	40.9	Sum of lost time (s)	11.6
Intersection Capacity Utilization	44.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	699	1363	442	289	1286	427	419	253	335	427	218	723
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	182.7	186.3	186.3	184.5	186.3	184.5	175.5	190.0	174.3	186.3	182.7
Adj Flow Rate, veh/h	760	1482	480	314	1398	464	455	275	364	464	237	786
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	472	1662	528	217	951	299	330	154	204	303	512	427
Arrive On Green	0.27	0.33	0.33	0.12	0.19	0.19	0.11	0.22	0.22	0.16	0.28	0.28
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	686	908	1660	1863	1553
Grp Volume(v), veh/h	760	1482	480	314	1398	464	455	0	639	464	237	786
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1594	1660	1863	1553
Q Serve(g_s), s	47.9	50.7	37.4	22.0	34.0	34.0	20.3	0.0	40.5	28.5	19.0	49.5
Cycle Q Clear(g_c), s	47.9	50.7	37.4	22.0	34.0	34.0	20.3	0.0	40.5	28.5	19.0	49.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.57	1.00		1.00
Lane Grp Cap(c), veh/h	472	1663	528	217	951	299	330	0	359	303	512	427
V/C Ratio(X)	1.61	0.89	0.91	1.45	1.47	1.55	1.38	0.00	1.78	1.53	0.46	1.84
Avail Cap(c_a), veh/h	472	1663	528	217	951	299	330	0	359	303	512	427
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	66.1	56.9	29.5	79.0	73.0	73.0	55.4	0.0	69.8	59.5	54.2	65.3
Incr Delay (d2), s/veh	284.2	7.7	22.2	225.6	217.1	264.1	188.1	0.0	362.7	255.5	0.7	387.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	60.7	24.5	19.5	24.4	34.9	36.8	23.8	0.0	54.0	36.6	9.9	67.2
LnGrp Delay(d),s/veh	350.2	64.6	51.7	304.6	290.1	337.1	243.4	0.0	432.5	315.0	54.9	452.5
LnGrp LOS	F	E	D	F	F	F	F		F	F	D	F
Approach Vol, veh/h		2722			2176			1094			1487	
Approach Delay, s/veh		142.1			302.2			353.9			346.2	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	29.0	67.0	27.0	57.0	55.0	41.0	36.0	48.0
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	22.0	60.0	20.3	49.5	47.9	34.0	28.5	* 40.5
Max Q Clear Time (g_c+I1), s	24.0	52.7	22.3	51.5	49.9	36.0	30.5	42.5
Green Ext Time (p_c), s	0.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	260.2
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	472	356	899	837	412	360	969	1279	775	311	1373	472
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	181.0	186.3	190.0	182.7	186.3	177.6	177.6	186.3	186.3
Adj Flow Rate, veh/h	519	391	0	920	453	396	1065	1405	0	342	1509	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	490	339	288	573	377	329	643	1354	577	221	1134	507
Arrive On Green	0.14	0.18	0.00	0.17	0.21	0.21	0.32	0.64	0.00	0.13	0.32	0.00
Sat Flow, veh/h	3442	1863	1583	3343	1793	1564	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	519	391	0	920	447	402	1065	1405	0	342	1509	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1587	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	28.5	36.4	0.0	34.3	42.1	42.1	38.1	76.5	0.0	26.1	64.1	0.0
Cycle Q Clear(g_c), s	28.5	36.4	0.0	34.3	42.1	42.1	38.1	76.5	0.0	26.1	64.1	0.0
Prop In Lane	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	490	339	288	573	373	334	643	1354	577	221	1134	507
V/C Ratio(X)	1.06	1.15	0.00	1.60	1.20	1.20	1.66	1.04	0.00	1.55	1.33	0.00
Avail Cap(c_a), veh/h	490	339	288	573	373	334	643	1354	577	221	1134	507
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.13	0.13	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	85.8	81.8	0.0	82.8	78.9	79.0	68.2	36.1	0.0	86.9	67.9	0.0
Incr Delay (d2), s/veh	56.9	97.3	0.0	280.1	113.2	116.5	296.2	21.0	0.0	268.5	154.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	17.4	27.9	0.0	38.2	32.3	29.3	44.2	40.9	0.0	28.7	55.7	0.0
LnGrp Delay(d),s/veh	142.7	179.1	0.0	363.0	192.1	195.4	364.4	57.1	0.0	355.5	222.7	0.0
LnGrp LOS	F	F		F	F	F	F	F		F	F	
Approach Vol, veh/h		910			1769			2470			1851	
Approach Delay, s/veh		158.3			281.7			189.6			247.3	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	45.0	71.0	35.2	48.8	33.0	83.0	41.0	43.0
Change Period (Y+Rc), s	* 6.8999996	6.8999996	6.6999998	6.6999998	6.8999996	* 6.5	6.6999998	6.6000004
Max Green Setting (Gmax), s	* 38.1	64.099998	* 28.5	42.099998	* 26.1	* 76.5	34.299999	36.400002
Max Q Clear Time (g_c+I1), s	40.1	66.1	30.5	44.1	28.1	78.5	36.3	38.4
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	224.1
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	918	66	1042	90	57	128	475	1977	110	148	2043	918
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Lane Util. Factor	0.95	0.95	0.88	0.91	0.91		0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1603	1623	2682	1595	2700		3367	4988	1583	1687	5036	1568
Flt Permitted	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1603	1623	2682	1595	2700		3367	4988	1583	1687	5036	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	966	69	1097	95	60	135	500	2081	116	156	2151	966
RTOR Reduction (vph)	0	0	50	0	127	0	0	0	49	0	0	415
Lane Group Flow (vph)	512	523	1047	85	78	0	500	2081	67	156	2151	551
Heavy Vehicles (%)	7%	4%	6%	3%	4%	21%	4%	4%	2%	7%	3%	3%
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8	1	4	4		1	6		5	2	
Permitted Phases			8						6			2
Actuated Green, G (s)	57.5	57.5	84.2	10.4	10.4		26.7	87.9	87.9	18.7	79.9	79.9
Effective Green, g (s)	57.5	57.5	84.2	10.4	10.4		26.7	87.9	87.9	18.7	79.9	79.9
Actuated g/C Ratio	0.29	0.29	0.42	0.05	0.05		0.13	0.44	0.44	0.09	0.40	0.40
Clearance Time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	460	466	1129	82	140		449	2192	695	157	2011	626
v/s Ratio Prot	0.32	c0.32	0.12	c0.05	0.03		c0.15	0.42		0.09	c0.43	
v/s Ratio Perm			0.27						0.04			0.35
v/c Ratio	1.11	1.12	0.93	1.04	0.56		1.11	0.95	0.10	0.99	1.07	0.88
Uniform Delay, d1	71.2	71.2	55.0	94.8	92.6		86.7	53.9	32.8	90.6	60.0	55.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.84	0.74	0.41	1.09	0.58	0.77
Incremental Delay, d2	76.5	79.6	12.8	109.8	4.7		71.5	8.2	0.2	19.9	32.5	1.8
Delay (s)	147.7	150.8	67.8	204.6	97.3		144.1	48.0	13.7	118.3	67.6	44.8
Level of Service	F	F	E	F	F		F	D	B	F	E	D
Approach Delay (s)		107.4			128.7			64.3			63.3	
Approach LOS		F			F			E			E	

Intersection Summary			
HCM 2000 Control Delay	77.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	200.0	Sum of lost time (s)	25.5
Intersection Capacity Utilization	107.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	426	1991	0	0	2610	565	0	0	0	722	0	571
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	0.0	0.0	186.3	186.3				181.0	0.0	184.5
Adj Flow Rate, veh/h	448	2096	0	0	2747	0				760	0	601
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	462	3471	0	0	2864	601				779	0	643
Arrive On Green	0.26	0.68	0.00	0.00	0.76	0.00				0.23	0.00	0.23
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	448	2096	0	0	2747	0				760	0	601
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	50.0	44.5	0.0	0.0	64.5	0.0				45.1	0.0	42.7
Cycle Q Clear(g_c), s	50.0	44.5	0.0	0.0	64.5	0.0				45.1	0.0	42.7
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	462	3471	0	0	2864	601				779	0	643
V/C Ratio(X)	0.97	0.60	0.00	0.00	0.96	0.00				0.98	0.00	0.93
Avail Cap(c_a), veh/h	466	3471	0	0	2864	601				779	0	643
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.09	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	73.2	17.1	0.0	0.0	22.7	0.0				76.1	0.0	75.2
Incr Delay (d2), s/veh	33.8	0.8	0.0	0.0	1.2	0.0				26.2	0.0	20.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	28.9	21.0	0.0	0.0	26.1	0.0				23.7	0.0	18.1
LnGrp Delay(d),s/veh	107.0	17.9	0.0	0.0	23.9	0.0				102.3	0.0	96.0
LnGrp LOS	F	B			C					F		F
Approach Vol, veh/h		2544			2747						1361	
Approach Delay, s/veh		33.6			23.9						99.5	
Approach LOS		C			C						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	60.6	83.3		56.1		143.9		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	52.5	75.5		46.6		136.5		
Max Q Clear Time (g_c+I1), s	52.0	66.5		47.1		46.5		
Green Ext Time (p_c), s	0.1	9.0		0.0		87.1		

Intersection Summary	
HCM 2010 Ctrl Delay	43.1
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	974	124	420	312	0	495	0	1777	312	598	1774	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	184.5	166.7	168.1	177.6	0.0	179.2	0.0	186.3	168.1	182.7	184.5	0.0
Adj Flow Rate, veh/h	1082	138	0	347	0	0	0	1974	347	664	1971	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	982	407	184	386	0	0	0	1995	729	645	3151	0
Arrive On Green	0.29	0.13	0.00	0.12	0.00	0.00	0.00	0.78	0.78	0.19	0.63	0.00
Sat Flow, veh/h	3408	3167	1429	3281	347		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	1082	138	0	347	92.3		0	1974	347	664	1971	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	F		0	1695	1429	1688	1679	0
Q Serve(g_s), s	48.1	6.6	0.0	17.4			0.0	62.5	13.7	31.9	40.2	0.0
Cycle Q Clear(g_c), s	48.1	6.6	0.0	17.4			0.0	62.5	13.7	31.9	40.2	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	982	407	184	386			0	1995	729	645	3151	0
V/C Ratio(X)	1.10	0.34	0.00	0.90			0.00	0.99	0.48	1.03	0.63	0.00
Avail Cap(c_a), veh/h	982	994	448	426			0	1995	729	645	3151	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.23	0.23	1.00	1.00	0.00
Uniform Delay (d), s/veh	59.5	66.3	0.0	72.7			0.0	17.7	8.3	67.6	19.2	0.0
Incr Delay (d2), s/veh	60.9	0.3	0.0	19.6			0.0	7.6	0.5	43.3	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	30.9	2.9	0.0	9.0			0.0	29.4	5.2	18.7	18.9	0.0
LnGrp Delay(d),s/veh	120.4	66.6	0.0	92.3			0.0	25.2	8.8	110.8	20.2	0.0
LnGrp LOS	F	E		F				C	A	F	C	
Approach Vol, veh/h		1220						2321			2635	
Approach Delay, s/veh		114.3						22.8			43.0	
Approach LOS		F						C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	39.0	105.0	27.5	28.5		144.0	56.0	
Change Period (Y+Rc), s*	7.1000004	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	* 31.9	65.5	21.7	52.4		104.5	48.1	
Max Q Clear Time (g_c+I1), s	33.9	64.5	19.4	8.6		42.2	50.1	
Green Ext Time (p_c), s	0.0	1.0	0.2	0.7		57.9	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	51.8
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	316	136	129	68	117	70	111	1703	68	142	1966	398
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	161.0	165.0	190.0	190.0	186.3	190.0	177.6	186.3	190.0	184.5	171.2	166.7
Adj Flow Rate, veh/h	347	149	142	75	129	77	122	1871	75	156	2160	437
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	145	301	287	120	203	113	121	2094	84	171	2075	629
Arrive On Green	0.39	0.39	0.39	0.39	0.39	0.39	0.07	0.42	0.42	0.10	0.44	0.44
Sat Flow, veh/h	1012	778	741	251	523	292	1691	5017	201	1757	4673	1417
Grp Volume(v), veh/h	347	0	291	281	0	0	122	1264	682	156	2160	437
Grp Sat Flow(s),veh/h/ln	1012	0	1519	1065	0	0	1691	1695	1827	1757	1558	1417
Q Serve(g_s), s	21.6	0.0	29.0	26.9	0.0	0.0	14.3	69.2	69.5	17.6	88.8	49.6
Cycle Q Clear(g_c), s	77.5	0.0	29.0	55.9	0.0	0.0	14.3	69.2	69.5	17.6	88.8	49.6
Prop In Lane	1.00		0.49	0.27		0.27	1.00		0.11	1.00		1.00
Lane Grp Cap(c), veh/h	145	0	589	436	0	0	121	1415	763	171	2075	629
V/C Ratio(X)	2.39	0.00	0.49	0.65	0.00	0.00	1.01	0.89	0.89	0.91	1.04	0.69
Avail Cap(c_a), veh/h	145	0	589	436	0	0	121	1415	763	171	2075	629
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.45	0.45	0.45
Uniform Delay (d), s/veh	91.9	0.0	46.4	60.7	0.0	0.0	92.8	54.1	54.2	89.4	55.6	44.7
Incr Delay (d2), s/veh	645.5	0.0	0.4	2.8	0.0	0.0	84.3	8.9	15.2	25.0	25.7	2.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	34.1	0.0	12.3	14.2	0.0	0.0	9.5	34.2	38.3	9.7	43.2	19.9
LnGrp Delay(d),s/veh	737.4	0.0	46.8	63.5	0.0	0.0	177.1	63.0	69.3	114.4	81.3	47.6
LnGrp LOS	F		D	E			F	E	E	F	F	D
Approach Vol, veh/h		638			281			2068			2753	
Approach Delay, s/veh		422.4			63.5			71.8			77.8	
Approach LOS		F			E			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	21.1	94.9		84.0	26.4	89.6		84.0
Change Period (Y+Rc), s	6.6	6.1000004		6.5	6.6	6.1000004		6.5
Max Green Setting (Gmax), s	14.5	88.800003		77.5	19.5	* 83.5		77.5
Max Q Clear Time (g_c+I1), s	16.3	90.8		57.9	19.6	71.5		79.5
Green Ext Time (p_c), s	0.0	0.0		4.2	0.0	11.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	113.3
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1942	31	59	919	361	298	15	330	0	0	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00			0.88
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (prot)		4848	1553	1805	4510	1468	1394	1429	1077			2137
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (perm)		4848	1553	1805	4510	1468	1394	1429	1077			2137
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2111	34	64	999	392	324	16	359	0	0	210
RTOR Reduction (vph)	0	0	17	0	0	141	0	0	252	0	0	197
Lane Group Flow (vph)	0	2111	17	64	999	251	168	172	107	0	0	13
Heavy Vehicles (%)	5%	7%	4%	0%	15%	10%	23%	0%	50%	11%	0%	33%
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	Perm			Perm
Protected Phases		6		5	2		4	4				
Permitted Phases			6			2			4			8
Actuated Green, G (s)		65.1	65.1	12.0	83.1	83.1	20.9	20.9	20.9			8.0
Effective Green, g (s)		65.1	65.1	12.0	83.1	83.1	20.9	20.9	20.9			8.0
Actuated g/C Ratio		0.50	0.50	0.09	0.64	0.64	0.16	0.16	0.16			0.06
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Vehicle Extension (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			5.0
Lane Grp Cap (vph)		2427	777	166	2882	938	224	229	173			131
v/s Ratio Prot		c0.44		0.04	c0.22		c0.12	0.12				
v/s Ratio Perm			0.01			0.17			0.10			c0.01
v/c Ratio		0.87	0.02	0.39	0.35	0.27	0.75	0.75	0.62			0.10
Uniform Delay, d1		28.7	16.4	55.5	10.9	10.2	52.1	52.1	50.8			57.6
Progression Factor		0.37	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Incremental Delay, d2		3.9	0.0	2.0	0.3	0.7	13.9	13.7	7.4			0.7
Delay (s)		14.6	16.4	57.6	11.2	10.9	66.0	65.8	58.2			58.3
Level of Service		B	B	E	B	B	E	E	E			E
Approach Delay (s)		14.7			13.2			62.0			58.3	
Approach LOS		B			B			E			E	

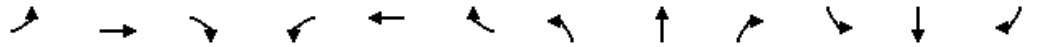
Intersection Summary			
HCM 2000 Control Delay	23.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	68.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	92	1292	58	113	1626	29	213	3	100	231	2	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1308	4550	1538	1703	5470		1466	1477	1056	1289	1187	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1308	4550	1538	1703	5470		1466	1477	1056	1289	1187	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	1404	63	123	1767	32	232	3	109	251	2	125
RTOR Reduction (vph)	0	0	39	0	2	0	0	0	96	0	98	0
Lane Group Flow (vph)	100	1404	24	123	1797	0	118	117	13	251	29	0
Heavy Vehicles (%)	38%	14%	5%	6%	19%	28%	17%	0%	53%	40%	0%	37%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6						4			
Actuated Green, G (s)	11.8	48.5	48.5	12.0	48.7		15.6	15.6	15.6	27.9	27.9	
Effective Green, g (s)	11.8	48.5	48.5	12.0	48.7		15.6	15.6	15.6	27.9	27.9	
Actuated g/C Ratio	0.09	0.37	0.37	0.09	0.37		0.12	0.12	0.12	0.21	0.21	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	118	1697	573	157	2049		175	177	126	276	254	
v/s Ratio Prot	0.08	c0.31		0.07	c0.33		c0.08	0.08		c0.19	0.02	
v/s Ratio Perm			0.02						0.01			
v/c Ratio	0.85	0.83	0.04	0.78	0.88		0.67	0.66	0.10	0.91	0.11	
Uniform Delay, d1	58.2	37.0	25.9	57.7	37.9		54.8	54.7	51.0	49.8	41.1	
Progression Factor	1.00	1.00	1.00	0.99	0.98		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	39.9	4.8	0.1	21.1	5.4		10.7	9.8	0.5	31.7	0.3	
Delay (s)	98.1	41.7	26.1	78.3	42.4		65.4	64.4	51.5	81.5	41.4	
Level of Service	F	D	C	E	D		E	E	D	F	D	
Approach Delay (s)		44.7			44.7			60.7			68.0	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	48.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	258	0	0	0	0	0	0	624	396	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.4							6.2	6.2			
Lane Util. Factor	1.00							1.00	1.00			
Frt	1.00							1.00	0.85			
Flt Protected	0.95							1.00	1.00			
Satd. Flow (prot)	1770							1863	1583			
Flt Permitted	0.95							1.00	1.00			
Satd. Flow (perm)	1770							1863	1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	280	0	0	0	0	0	0	678	430	0	0	0
RTOR Reduction (vph)	194	0	0	0	0	0	0	0	187	0	0	0
Lane Group Flow (vph)	86	0	0	0	0	0	0	678	243	0	0	0
Turn Type	Prot							NA	Perm			
Protected Phases	7							2				
Permitted Phases									2			
Actuated Green, G (s)	9.0							26.8	26.8			
Effective Green, g (s)	9.0							26.8	26.8			
Actuated g/C Ratio	0.19							0.57	0.57			
Clearance Time (s)	5.4							6.2	6.2			
Vehicle Extension (s)	3.5							3.5	3.5			
Lane Grp Cap (vph)	336							1053	895			
v/s Ratio Prot	c0.05							c0.36				
v/s Ratio Perm									0.15			
v/c Ratio	0.25							0.64	0.27			
Uniform Delay, d1	16.3							7.0	5.3			
Progression Factor	1.00							1.00	1.00			
Incremental Delay, d2	0.5							1.4	0.2			
Delay (s)	16.8							8.5	5.5			
Level of Service	B							A	A			
Approach Delay (s)		16.8			0.0			7.3			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	47.4	Sum of lost time (s)	11.6
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	373	1286	388	335	1366	427	442	218	289	427	253	699
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	182.7	186.3	186.3	184.5	186.3	184.5	175.5	190.0	174.3	186.3	182.7
Adj Flow Rate, veh/h	405	1398	422	364	1485	464	480	237	314	464	275	760
Adj No. of Lanes	1	3	1	1	3	1	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	4	2	2	3	2	3	10	10	9	2	4
Cap, veh/h	306	1330	422	260	1209	380	336	149	197	341	528	440
Arrive On Green	0.17	0.27	0.27	0.15	0.24	0.24	0.12	0.22	0.22	0.18	0.28	0.28
Sat Flow, veh/h	1774	4988	1583	1774	5036	1583	1757	686	909	1660	1863	1553
Grp Volume(v), veh/h	405	1398	422	364	1485	464	480	0	551	464	275	760
Grp Sat Flow(s),veh/h/ln	1774	1663	1583	1774	1679	1583	1757	0	1594	1660	1863	1553
Q Serve(g_s), s	25.9	40.0	28.7	22.0	36.0	36.0	17.3	0.0	32.5	26.5	18.6	42.5
Cycle Q Clear(g_c), s	25.9	40.0	28.7	22.0	36.0	36.0	17.3	0.0	32.5	26.5	18.6	42.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.57	1.00		1.00
Lane Grp Cap(c), veh/h	306	1330	422	260	1209	380	336	0	345	341	528	440
V/C Ratio(X)	1.32	1.05	1.00	1.40	1.23	1.22	1.43	0.00	1.60	1.36	0.52	1.73
Avail Cap(c_a), veh/h	306	1330	422	260	1209	380	336	0	345	341	528	440
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	62.0	55.0	28.4	64.0	57.0	57.0	47.2	0.0	58.8	47.4	45.2	53.8
Incr Delay (d2), s/veh	166.0	39.3	43.7	201.2	110.4	121.0	208.9	0.0	281.1	179.8	0.9	336.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	26.8	23.2	17.9	25.3	29.0	28.5	25.0	0.0	41.3	31.2	9.7	59.4
LnGrp Delay(d),s/veh	228.1	94.3	72.0	265.2	167.4	178.0	256.1	0.0	339.9	227.1	46.1	390.5
LnGrp LOS	F	F	E	F	F	F	F		F	F	D	F
Approach Vol, veh/h		2225			2313			1031			1499	
Approach Delay, s/veh		114.4			184.9			300.9			276.7	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	29.0	47.0	24.0	50.0	33.0	43.0	34.0	40.0
Change Period (Y+Rc), s	7.0	7.0	6.7	7.5	7.1	7.0	7.5	* 7.5
Max Green Setting (Gmax), s	22.0	40.0	17.3	42.5	25.9	36.0	26.5	* 32.5
Max Q Clear Time (g_c+I1), s	24.0	42.0	19.3	44.5	27.9	38.0	28.5	34.5
Green Ext Time (p_c), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	199.1
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	472	412	969	941	356	311	899	1439	837	360	1279	472
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	186.3	181.0	186.3	190.0	182.7	186.3	177.6	177.6	186.3	186.3
Adj Flow Rate, veh/h	519	453	0	1034	391	342	988	1581	0	396	1405	0
Adj No. of Lanes	2	1	1	2	2	0	2	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	5	2	2	4	2	7	7	2	2
Cap, veh/h	551	367	312	642	411	356	612	1188	507	250	1063	476
Arrive On Green	0.16	0.20	0.00	0.19	0.23	0.23	0.24	0.45	0.00	0.15	0.30	0.00
Sat Flow, veh/h	3442	1863	1583	3343	1798	1559	3375	3539	1509	1691	3539	1583
Grp Volume(v), veh/h	519	453	0	1034	385	348	988	1581	0	396	1405	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1672	1770	1588	1688	1770	1509	1691	1770	1583
Q Serve(g_s), s	31.3	41.4	0.0	40.3	45.0	45.5	38.1	70.5	0.0	31.1	63.1	0.0
Cycle Q Clear(g_c), s	31.3	41.4	0.0	40.3	45.0	45.5	38.1	70.5	0.0	31.1	63.1	0.0
Prop In Lane	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	551	367	312	642	404	363	612	1188	507	250	1063	476
V/C Ratio(X)	0.94	1.23	0.00	1.61	0.95	0.96	1.61	1.33	0.00	1.58	1.32	0.00
Avail Cap(c_a), veh/h	551	367	312	642	409	367	612	1188	507	250	1063	476
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	0.09	0.09	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	87.2	84.3	0.0	84.8	79.9	80.1	79.7	58.1	0.0	89.4	73.4	0.0
Incr Delay (d2), s/veh	24.4	126.6	0.0	282.4	32.1	36.4	276.7	149.3	0.0	279.8	151.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.8	34.2	0.0	43.8	25.6	23.7	41.3	59.1	0.0	34.0	53.2	0.0
LnGrp Delay(d),s/veh	111.6	210.9	0.0	367.3	111.9	116.4	356.3	207.4	0.0	369.2	224.6	0.0
LnGrp LOS	F	F		F	F	F	F	F		F	F	
Approach Vol, veh/h		972			1767			2569			1801	
Approach Delay, s/veh		157.9			262.2			264.7			256.4	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	45.0	70.0	40.3	54.7	38.0	77.0	47.0	48.0
Change Period (Y+Rc), s	* 6.8999996	6.8999996	6.6999998	6.6999998	6.8999996	* 6.5	6.6999998	6.6000004
Max Green Setting (Gmax), s	* 38	63.099998	33.100002	* 48.5	* 31.1	* 70.5	40.299999	41.400002
Max Q Clear Time (g_c+I1), s	40.1	65.1	33.3	47.5	33.1	72.5	42.3	43.4
Green Ext Time (p_c), s	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	247.4
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	918	57	637	110	66	148	834	2109	90	128	2143	918
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Lane Util. Factor	0.95	0.95	0.88	0.91	0.91		0.97	0.91	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1603	1621	2682	1595	2700		3367	4988	1583	1687	5036	1568
Flt Permitted	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1603	1621	2682	1595	2700		3367	4988	1583	1687	5036	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	966	60	671	116	69	156	878	2220	95	135	2256	966
RTOR Reduction (vph)	0	0	48	0	109	0	0	0	45	0	0	400
Lane Group Flow (vph)	512	514	623	104	128	0	878	2220	50	135	2256	566
Heavy Vehicles (%)	7%	4%	6%	3%	4%	21%	4%	4%	2%	7%	3%	3%
Turn Type	Split	NA	pm+ov	Split	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	8	8	1	4	4		1	6		5	2	
Permitted Phases			8						6			2
Actuated Green, G (s)	58.5	58.5	86.2	12.4	12.4		27.7	96.6	96.6	17.0	85.9	85.9
Effective Green, g (s)	58.5	58.5	86.2	12.4	12.4		27.7	96.6	96.6	17.0	85.9	85.9
Actuated g/C Ratio	0.28	0.28	0.41	0.06	0.06		0.13	0.46	0.46	0.08	0.41	0.41
Clearance Time (s)	6.5	6.5	6.3	6.6	6.6		6.3	6.3	6.3	6.1	6.1	6.1
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	446	451	1100	94	159		444	2294	728	136	2059	641
v/s Ratio Prot	c0.32	0.32	0.07	c0.07	0.05		c0.26	0.45		0.08	c0.45	
v/s Ratio Perm			0.16						0.03			0.36
v/c Ratio	1.15	1.14	0.57	1.11	0.80		1.98	0.97	0.07	0.99	1.10	0.88
Uniform Delay, d1	75.8	75.8	47.5	98.8	97.6		91.2	55.2	31.6	96.4	62.0	57.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.76	0.60	0.33	1.02	0.46	0.94
Incremental Delay, d2	89.8	86.5	0.7	124.5	24.7		444.2	8.0	0.1	21.3	43.9	1.8
Delay (s)	165.6	162.3	48.2	223.3	122.3		513.7	41.1	10.6	120.0	72.4	55.6
Level of Service	F	F	D	F	F		F	D	B	F	E	E
Approach Delay (s)		118.2			153.1			170.2			69.5	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	119.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	210.0	Sum of lost time (s)	25.5
Intersection Capacity Utilization	119.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (veh/h)	446	2249	0	0	2086	804	0	0	0	711	0	784
Number	1	6	16	5	2	12				7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00				1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	186.3	186.3	0.0	0.0	186.3	186.3				181.0	0.0	184.5
Adj Flow Rate, veh/h	469	2367	0	0	2196	0				748	0	825
Adj No. of Lanes	1	3	0	0	5	1				2	0	2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95				0.95	0.95	0.95
Percent Heavy Veh, %	2	2	0	0	2	2				5	0	3
Cap, veh/h	485	3453	0	0	2755	578				804	0	664
Arrive On Green	0.27	0.68	0.00	0.00	0.73	0.00				0.24	0.00	0.24
Sat Flow, veh/h	1774	5253	0	0	7898	1583				3343	0	2760
Grp Volume(v), veh/h	469	2367	0	0	2196	0				748	0	825
Grp Sat Flow(s),veh/h/ln	1774	1695	0	0	1509	1583				1672	0	1380
Q Serve(g_s), s	54.8	58.7	0.0	0.0	39.5	0.0				46.0	0.0	50.5
Cycle Q Clear(g_c), s	54.8	58.7	0.0	0.0	39.5	0.0				46.0	0.0	50.5
Prop In Lane	1.00		0.00	0.00		1.00				1.00		1.00
Lane Grp Cap(c), veh/h	485	3453	0	0	2755	578				804	0	664
V/C Ratio(X)	0.97	0.69	0.00	0.00	0.80	0.00				0.93	0.00	1.24
Avail Cap(c_a), veh/h	511	3453	0	0	2755	578				804	0	664
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00				1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	0.13	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	75.4	20.2	0.0	0.0	23.3	0.0				78.0	0.0	79.8
Incr Delay (d2), s/veh	30.8	1.1	0.0	0.0	0.3	0.0				17.0	0.0	121.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	31.1	27.8	0.0	0.0	16.1	0.0				23.2	0.0	30.5
LnGrp Delay(d),s/veh	106.1	21.4	0.0	0.0	23.6	0.0				95.1	0.0	201.6
LnGrp LOS	F	C			C					F		F
Approach Vol, veh/h		2836			2196						1573	
Approach Delay, s/veh		35.4			23.6						151.0	
Approach LOS		D			C						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	65.9	84.1		60.0		150.0		
Change Period (Y+Rc), s	8.5	7.4		9.5		7.4		
Max Green Setting (Gmax), s	60.5	73.6		50.5		142.6		
Max Q Clear Time (g_c+I1), s	56.8	41.5		52.5		60.7		
Green Ext Time (p_c), s	0.6	31.5		0.0		78.0		

Intersection Summary		
HCM 2010 Ctrl Delay		59.0
HCM 2010 LOS		E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	402	66	260	312	0	608	0	2596	312	387	1627	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	184.5	166.7	168.1	177.6	0.0	179.2	0.0	186.3	168.1	182.7	184.5	0.0
Adj Flow Rate, veh/h	447	73	0	347	0	0	0	2884	347	430	1808	0
Adj No. of Lanes	2	2	1	2	0	1	0	3	1	2	3	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	14	13	7	0	6	0	2	13	4	3	0
Cap, veh/h	426	112	50	391	0	0	0	2784	952	437	3621	0
Arrive On Green	0.12	0.04	0.00	0.12	0.00	0.00	0.00	1.00	1.00	0.13	0.72	0.00
Sat Flow, veh/h	3408	3167	1429	3281	347		0	5253	1429	3375	5202	0
Grp Volume(v), veh/h	447	73	0	347	86.1		0	2884	347	430	1808	0
Grp Sat Flow(s),veh/h/ln	1704	1583	1429	1640	F		0	1695	1429	1688	1679	0
Q Serve(g_s), s	21.1	3.8	0.0	17.6			0.0	0.0	0.0	21.5	26.6	0.0
Cycle Q Clear(g_c), s	21.1	3.8	0.0	17.6			0.0	0.0	0.0	21.5	26.6	0.0
Prop In Lane	1.00		1.00	1.00			0.00		1.00	1.00		0.00
Lane Grp Cap(c), veh/h	426	112	50	391			0	2784	952	437	3621	0
V/C Ratio(X)	1.05	0.65	0.00	0.89			0.00	1.04	0.36	0.98	0.50	0.00
Avail Cap(c_a), veh/h	426	761	343	515			0	2784	952	437	3621	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00			1.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00			0.00	0.09	0.09	1.00	1.00	0.00
Uniform Delay (d), s/veh	73.9	80.5	0.0	73.3			0.0	0.0	0.0	73.4	10.4	0.0
Incr Delay (d2), s/veh	57.5	3.9	0.0	12.7			0.0	17.7	0.1	38.4	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.3	1.7	0.0	8.7			0.0	4.6	0.0	12.4	12.4	0.0
LnGrp Delay(d),s/veh	131.4	84.4	0.0	86.1			0.0	17.7	0.1	111.8	10.9	0.0
LnGrp LOS	F	F		F				F	A	F	B	
Approach Vol, veh/h		520						3231			2238	
Approach Delay, s/veh		124.8						15.8			30.3	
Approach LOS		F						B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	
Phs Duration (G+Y+Rc), s	29.0	140.0	28.0	13.0		169.0	41.0	
Change Period (Y+Rc), s*	7.1000004	6.5	7.9	7.0		6.5	7.9	
Max Green Setting (Gmax), s	* 21.9	92.5	26.5	40.6		121.5	21.1	
Max Q Clear Time (g_c+I1), s	23.5	2.0	19.6	5.8		28.6	23.1	
Green Ext Time (p_c), s	0.0	87.9	0.5	0.3		90.2	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	33.7
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	653	117	111	68	136	126	129	2129	68	70	1551	578
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	161.0	165.0	190.0	190.0	186.3	190.0	177.6	186.3	190.0	184.5	171.2	166.7
Adj Flow Rate, veh/h	718	129	122	75	149	138	142	2340	75	77	1704	635
Adj No. of Lanes	1	1	0	0	1	0	1	3	0	1	3	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	18	2	2	2	2	2	7	2	2	3	11	14
Cap, veh/h	349	422	399	165	326	290	90	1685	54	59	1466	445
Arrive On Green	0.54	0.54	0.54	0.54	0.54	0.54	0.05	0.33	0.33	0.03	0.31	0.31
Sat Flow, veh/h	940	781	739	267	603	536	1691	5063	162	1757	4673	1417
Grp Volume(v), veh/h	718	0	251	362	0	0	142	1563	852	77	1704	635
Grp Sat Flow(s),veh/h/ln	940	0	1520	1405	0	0	1691	1695	1834	1757	1558	1417
Q Serve(g_s), s	70.4	0.0	19.1	24.0	0.0	0.0	11.2	69.9	69.9	7.1	65.9	65.9
Cycle Q Clear(g_c), s	113.5	0.0	19.1	43.1	0.0	0.0	11.2	69.9	69.9	7.1	65.9	65.9
Prop In Lane	1.00		0.49	0.21		0.38	1.00		0.09	1.00		1.00
Lane Grp Cap(c), veh/h	349	0	822	780	0	0	90	1128	611	59	1466	445
V/C Ratio(X)	2.05	0.00	0.31	0.46	0.00	0.00	1.57	1.39	1.39	1.30	1.16	1.43
Avail Cap(c_a), veh/h	349	0	822	780	0	0	90	1128	611	59	1466	445
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.68	0.68	0.68
Uniform Delay (d), s/veh	73.3	0.0	26.6	33.6	0.0	0.0	99.4	70.1	70.1	101.4	72.0	72.1
Incr Delay (d2), s/veh	484.4	0.0	0.1	0.3	0.0	0.0	304.8	179.0	187.5	194.8	78.4	201.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	67.3	0.0	8.0	14.0	0.0	0.0	12.9	60.8	67.2	6.7	39.0	50.7
LnGrp Delay(d),s/veh	557.7	0.0	26.7	33.9	0.0	0.0	404.2	249.1	257.5	296.2	150.5	273.6
LnGrp LOS	F		C	C			F	F	F	F	F	F
Approach Vol, veh/h		969			362			2557			2416	
Approach Delay, s/veh		420.1			33.9			260.5			187.5	
Approach LOS		F			C			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.0	72.0		120.0	14.0	76.0		120.0
Change Period (Y+Rc), s	6.6.1000004			6.5	6.6.1000004			6.5
Max Green Setting (Gmax), s	11.45.900002			113.5	7.69.900002			113.5
Max Q Clear Time (g_c+I1), s	13.2	67.9		45.1	9.1	71.9		115.5
Green Ext Time (p_c), s	0.0	0.0		8.7	0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	244.0
HCM 2010 LOS	F

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↱	↰	↑↑↑	↱	↰	↕	↱			↱↱
Volume (vph)	0	1882	99	86	1317	212	155	10	194	0	0	118
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Lane Util. Factor		0.91	1.00	1.00	0.91	1.00	0.95	0.95	1.00			0.88
Frpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85			0.85
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (prot)		4848	1553	1805	4510	1468	1394	1439	1077			2137
Flt Permitted		1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00			1.00
Satd. Flow (perm)		4848	1553	1805	4510	1468	1394	1439	1077			2137
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2046	108	93	1432	230	168	11	211	0	0	128
RTOR Reduction (vph)	0	0	34	0	0	57	0	0	190	0	0	122
Lane Group Flow (vph)	0	2046	74	93	1432	173	89	90	21	0	0	6
Confl. Peds. (#/hr)										103		
Heavy Vehicles (%)	5%	7%	4%	0%	15%	10%	23%	0%	50%	11%	0%	33%
Turn Type		NA	Perm	Prot	NA	Perm	Split	NA	Perm			Perm
Protected Phases		6		5	2		4	4				
Permitted Phases			6			2			4			8
Actuated Green, G (s)		112.7	112.7	17.0	135.7	135.7	18.3	18.3	18.3			8.0
Effective Green, g (s)		112.7	112.7	17.0	135.7	135.7	18.3	18.3	18.3			8.0
Actuated g/C Ratio		0.63	0.63	0.09	0.75	0.75	0.10	0.10	0.10			0.04
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			6.0
Vehicle Extension (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0			5.0
Lane Grp Cap (vph)		3035	972	170	3400	1106	141	146	109			94
v/s Ratio Prot		c0.42		c0.05	0.32		c0.06	0.06				
v/s Ratio Perm			0.05			0.12			0.02			c0.00
v/c Ratio		0.67	0.08	0.55	0.42	0.16	0.63	0.62	0.20			0.06
Uniform Delay, d1		21.8	13.2	77.8	8.0	6.2	77.6	77.5	74.1			82.4
Progression Factor		0.12	0.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00
Incremental Delay, d2		0.7	0.1	4.4	0.4	0.3	9.9	8.6	1.2			0.6
Delay (s)		3.3	0.1	82.3	8.4	6.5	87.5	86.1	75.3			83.0
Level of Service		A	A	F	A	A	F	F	E			F
Approach Delay (s)		3.1			12.0			80.6			83.0	
Approach LOS		A			B			F			F	

Intersection Summary			
HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	237	1822	742	180	1413	126	88	2	162	134	4	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.86		0.95	0.95	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1308	4550	1538	1703	5392		1466	1481	1056	1289	1211	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1308	4550	1538	1703	5392		1466	1481	1056	1289	1211	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	258	1980	807	196	1536	137	96	2	176	146	4	63
RTOR Reduction (vph)	0	0	364	0	8	0	0	0	161	0	55	0
Lane Group Flow (vph)	258	1980	443	196	1665	0	49	49	15	146	12	0
Heavy Vehicles (%)	38%	14%	5%	6%	19%	28%	17%	0%	53%	40%	0%	37%
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases			6						4			
Actuated Green, G (s)	38.8	89.9	89.9	25.0	76.1		15.2	15.2	15.2	23.9	23.9	
Effective Green, g (s)	38.8	89.9	89.9	25.0	76.1		15.2	15.2	15.2	23.9	23.9	
Actuated g/C Ratio	0.22	0.50	0.50	0.14	0.42		0.08	0.08	0.08	0.13	0.13	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		4.0	4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)	281	2272	768	236	2279		123	125	89	171	160	
v/s Ratio Prot	0.20	c0.44		c0.12	0.31		c0.03	0.03		c0.11	0.01	
v/s Ratio Perm			0.29						0.01			
v/c Ratio	0.92	0.87	0.58	0.83	0.73		0.40	0.39	0.17	0.85	0.08	
Uniform Delay, d1	69.0	39.9	31.7	75.4	43.4		78.1	78.0	76.5	76.3	68.4	
Progression Factor	1.00	1.00	1.00	0.89	0.84		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	32.6	4.9	3.1	20.2	2.0		2.9	2.8	1.2	32.5	0.3	
Delay (s)	101.7	44.9	34.8	87.6	38.5		80.9	80.8	77.7	108.8	68.7	
Level of Service	F	D	C	F	D		F	F	E	F	E	
Approach Delay (s)		47.0			43.7			78.9			96.2	
Approach LOS		D			D			E			F	

Intersection Summary			
HCM 2000 Control Delay	49.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Synchro – Queue Analysis Outputs

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	202	1672	1654	658	747	1137
v/c Ratio	0.84	0.68	0.74	0.71	0.53	0.98
Control Delay	64.2	25.3	27.7	15.9	38.7	71.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.2	25.3	27.7	15.9	38.7	71.0
Queue Length 50th (ft)	202	601	437	497	319	706
Queue Length 95th (ft)	m199	m605	m465	m534	382	#881
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	275	2448	2223	930	1402	1160
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.68	0.74	0.71	0.53	0.98

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	272	1719	2267	525	1153	1084
v/c Ratio	0.92	0.62	0.90	0.66	0.95	1.07
Control Delay	74.8	17.2	43.8	5.9	73.7	106.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.8	17.2	43.8	5.9	73.7	106.0
Queue Length 50th (ft)	341	519	650	46	722	~850
Queue Length 95th (ft)	m298	m427	652	m55	#860	#1002
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	312	2772	2513	790	1219	1009
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.87	0.62	0.90	0.66	0.95	1.07

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	202	1672	1654	658	747	996
v/c Ratio	0.84	0.65	0.69	0.69	0.57	0.92
Control Delay	66.9	22.2	24.4	14.4	41.7	61.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.9	22.2	24.4	14.4	41.7	61.9
Queue Length 50th (ft)	202	600	405	497	328	585
Queue Length 95th (ft)	m199	m605	m465	m534	382	680
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	275	2573	2408	953	1402	1160
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.65	0.69	0.69	0.53	0.86

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

18: I-4 WB on-ramp from SR 535 /I-4 WB off-ramp to SR 535 & SR 535

8/22/2014

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	272	1719	2267	525	1153	853
v/c Ratio	0.92	0.61	0.89	0.66	0.96	0.86
Control Delay	74.2	16.6	43.7	5.9	76.6	66.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.2	16.6	43.7	5.9	76.6	66.0
Queue Length 50th (ft)	341	519	650	46	722	557
Queue Length 95th (ft)	m298	m427	652	m62	#860	660
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	312	2798	2552	796	1219	1009
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.87	0.61	0.89	0.66	0.95	0.85

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



Lane Group	EBL	NBT	NBR
Lane Group Flow (vph)	135	225	185
v/c Ratio	0.15	0.21	0.19
Control Delay	0.4	6.3	1.9
Queue Delay	0.0	0.0	0.0
Total Delay	0.4	6.3	1.9
Queue Length 50th (ft)	0	22	0
Queue Length 95th (ft)	0	46	17
Internal Link Dist (ft)		996	
Turn Bay Length (ft)			500
Base Capacity (vph)	1282	1863	1583
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.11	0.12	0.12

Intersection Summary



Lane Group	EBL	NBT	NBR
Lane Group Flow (vph)	202	302	201
v/c Ratio	0.25	0.34	0.23
Control Delay	0.8	7.3	2.0
Queue Delay	0.0	0.0	0.0
Total Delay	0.8	7.3	2.0
Queue Length 50th (ft)	0	32	0
Queue Length 95th (ft)	0	63	18
Internal Link Dist (ft)		899	
Turn Bay Length (ft)			500
Base Capacity (vph)	1226	1851	1574
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.16	0.16	0.13

Intersection Summary

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	422	2154	1860	778	685	752
v/c Ratio	0.93	0.63	0.66	0.82	0.88	1.16
Control Delay	62.4	8.2	25.1	17.4	79.3	145.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.4	8.2	25.1	17.4	79.3	145.7
Queue Length 50th (ft)	458	438	455	715	430	~629
Queue Length 95th (ft)	m309	m231	m470	m665	#516	#777
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	498	3441	2826	954	781	646
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.63	0.66	0.82	0.88	1.16

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	320	1779	2451	574	849	1042
v/c Ratio	0.94	0.59	0.90	0.69	0.81	1.21
Control Delay	70.7	9.4	37.7	2.9	67.5	156.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.7	9.4	37.7	2.9	67.5	156.9
Queue Length 50th (ft)	361	370	624	20	507	~895
Queue Length 95th (ft)	m319	m298	m617	m14	593	#1048
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	358	3040	2712	834	1044	864
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.89	0.59	0.90	0.69	0.81	1.21

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	422	2154	1860	778	685	541
v/c Ratio	0.93	0.62	0.64	0.81	0.92	0.88
Control Delay	63.6	7.4	24.0	16.6	86.4	83.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.6	7.4	24.0	16.6	86.4	83.8
Queue Length 50th (ft)	458	438	455	715	430	370
Queue Length 95th (ft)	m309	m231	m470	m665	#516	455
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	498	3497	2909	965	781	646
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.62	0.64	0.81	0.88	0.84

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

18: I-4 WB on-ramp from SR 535 /I-4 WB off-ramp to SR 535 & SR 535

8/22/2014

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	320	1779	2451	574	849	805
v/c Ratio	0.94	0.58	0.89	0.68	0.83	0.95
Control Delay	71.7	8.9	36.6	2.8	69.5	85.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.7	8.9	36.6	2.8	69.5	85.3
Queue Length 50th (ft)	361	370	624	20	507	557
Queue Length 95th (ft)	m319	m298	m617	m14	593	#697
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	358	3076	2765	843	1044	864
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.89	0.58	0.89	0.68	0.81	0.93

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



Lane Group	EBL	NBT	NBR
Lane Group Flow (vph)	179	292	277
v/c Ratio	0.22	0.32	0.30
Control Delay	0.6	7.1	2.0
Queue Delay	0.0	0.0	0.0
Total Delay	0.6	7.1	2.0
Queue Length 50th (ft)	0	30	0
Queue Length 95th (ft)	0	60	21
Internal Link Dist (ft)		971	
Turn Bay Length (ft)			500
Base Capacity (vph)	1222	1826	1557
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.15	0.16	0.18

Intersection Summary



Lane Group	EBL	NBT	NBR
Lane Group Flow (vph)	271	425	282
v/c Ratio	0.39	0.48	0.31
Control Delay	2.1	8.4	1.9
Queue Delay	0.0	0.0	0.0
Total Delay	2.1	8.4	1.9
Queue Length 50th (ft)	0	48	0
Queue Length 95th (ft)	9	92	21
Internal Link Dist (ft)		1208	
Turn Bay Length (ft)			500
Base Capacity (vph)	1170	1863	1583
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.23	0.23	0.18

Intersection Summary

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	469	2367	2196	846	748	825
v/c Ratio	0.96	0.69	0.80	0.91	0.93	1.24
Control Delay	60.8	14.2	38.4	27.2	96.6	183.3
Queue Delay	0.0	0.0	0.0	1.0	0.0	0.0
Total Delay	60.8	14.2	38.4	28.2	96.6	183.3
Queue Length 50th (ft)	576	990	708	904	529	~801
Queue Length 95th (ft)	m368	m397	m676	m792	#648	#954
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	509	3452	2729	933	801	663
Starvation Cap Reductn	0	0	0	16	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.69	0.80	0.92	0.93	1.24

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	448	2096	2747	595	760	852
v/c Ratio	0.98	0.60	0.96	0.71	0.98	1.33
Control Delay	67.6	5.7	44.1	5.4	102.0	211.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.6	5.7	44.1	5.4	102.0	211.7
Queue Length 50th (ft)	546	350	906	117	519	~820
Queue Length 95th (ft)	m379	m186	m876	m120	#657	#972
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	464	3470	2872	838	777	643
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.97	0.60	0.96	0.71	0.98	1.33

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	469	2367	2196	846	748	441
v/c Ratio	0.96	0.68	0.79	0.90	0.95	0.68
Control Delay	61.4	13.6	37.6	26.7	100.5	78.8
Queue Delay	0.0	0.0	0.0	0.9	0.0	0.0
Total Delay	61.4	13.6	37.6	27.5	100.5	78.8
Queue Length 50th (ft)	576	990	708	904	529	318
Queue Length 95th (ft)	m368	m397	m676	m792	#648	393
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	509	3476	2765	938	801	663
Starvation Cap Reductn	0	0	0	16	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.68	0.79	0.92	0.93	0.67

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

18: I-4 WB on-ramp from SR 535 /I-4 WB off-ramp to SR 535 & SR 535

8/22/2014

Lane Group	NBL	NBT	SBT	SBR	SWL	SWR
Lane Group Flow (vph)	448	2096	2747	595	760	601
v/c Ratio	0.98	0.60	0.96	0.71	0.98	0.93
Control Delay	67.6	5.7	44.1	5.4	102.0	96.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.6	5.7	44.1	5.4	102.0	96.9
Queue Length 50th (ft)	546	350	906	117	519	447
Queue Length 95th (ft)	m379	m186	m876	m120	#657	#577
Internal Link Dist (ft)		655	1299			
Turn Bay Length (ft)	300			350	900	
Base Capacity (vph)	464	3470	2872	838	777	643
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.97	0.60	0.96	0.71	0.98	0.93

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



Lane Group	EBL	NBT	NBR
Lane Group Flow (vph)	202	529	357
v/c Ratio	0.35	0.53	0.35
Control Delay	2.0	8.2	1.7
Queue Delay	0.0	0.0	0.0
Total Delay	2.0	8.2	1.7
Queue Length 50th (ft)	0	65	0
Queue Length 95th (ft)	7	115	21
Internal Link Dist (ft)		971	
Turn Bay Length (ft)			500
Base Capacity (vph)	1031	1816	1552
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.20	0.29	0.23

Intersection Summary



Lane Group	EBL	NBT	NBR
Lane Group Flow (vph)	280	678	430
v/c Ratio	0.53	0.65	0.40
Control Delay	9.6	10.6	1.8
Queue Delay	0.0	0.0	0.0
Total Delay	9.6	10.6	1.8
Queue Length 50th (ft)	9	95	0
Queue Length 95th (ft)	73	232	28
Internal Link Dist (ft)		1208	
Turn Bay Length (ft)			500
Base Capacity (vph)	904	1650	1451
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.31	0.41	0.30

Intersection Summary

Appendix F – RCID Coordination

ORDINANCE/RESOLUTION NO. 554

AN ORDINANCE/RESOLUTION OF THE REEDY CREEK IMPROVEMENT DISTRICT, FLORIDA, MODIFYING THE 5-YEAR SCHEDULE OF CAPITAL IMPROVEMENTS OF THE CAPITAL IMPROVEMENTS ELEMENT OF THE COMPREHENSIVE PLAN AS REQUIRED BY SECTION 163.3177(3)(b), FLORIDA STATUTES; PROVIDING AN EFFECTIVE DATE.

WHEREAS, the Reedy Creek Improvement District proposes to update the 5-Year Schedule of Capital Improvements of the Capital Improvements Element of its Comprehensive Plan in accordance with Section 163.3177(3)(b), Florida Statutes; and

WHEREAS, the modifications are not deemed to be an amendment to the Comprehensive Plan; and

WHEREAS, the Reedy Creek Improvement District further considered all oral and written comments received prior to and during public hearings.

NOW, THEREFORE, BE IT RESOLVED AND ORDAINED by the Board of Supervisors of the Reedy Creek Improvement District, on this 25th day of June, 2014, as follows:

SECTION ONE: This Ordinance/Resolution is enacted to carry out the purpose and intent of, and exercise the authority set out in Chapters 163 and 166, Florida Statutes, and the provisions of the Reedy Creek Improvement District Comprehensive Plan.

SECTION TWO: The attached Exhibit “A” is the 5-Year Schedule of Capital Improvements of the Capital Improvements Element of the Comprehensive Plan.

SECTION THREE: The 5-Year Schedule of Capital Improvements is hereby amended.

SECTION FOUR: If any provision or portion of this Ordinance/Resolution is declared by any court of competent jurisdiction to be void, unconstitutional, or unenforceable, then all remaining provisions and portions of this Ordinance/Resolution remain in full force and effect.

SECTION FIVE: A certified copy of this enacting Ordinance/Resolution as well as certified copies of Exhibit “A” shall be filed with the Clerk of the Reedy Creek Improvement District.

SECTION SIX: Effective Date. This Resolution shall become effective immediately upon final passage and adoption.

REEDY CREEK IMPROVEMENT DISTRICT

By: _____
Donald R. Greer
President of the Board of Supervisors

ATTESTED:

By: _____
Bill Warren
District Administrator and
Secretary of the Board of Supervisors

Passed and Adopted on 1st Reading _____
Publication After 1st Reading _____
Passed and Adopted on 2nd Reading _____
Final Publication _____
Effective Date: _____

EXHIBIT "A"

Table 9-8: Five Year Schedule of Capital Improvements for Roads (in thousands)

Project Description	Funding Source	2014	2015	2016	2017	2018	2019	Total	Consistency with Other Plan Elements
RCID Projects									
1 **Buena Vista Drive (BVD) Corridor** Roadway improvements including the widening of BVD between Downtown Disney/Disney Springs intersection 2 and Bonnet Creek Parkway from of a six-lane divided urban road to an eight-lane urban road with two lanes serving as bus lanes.	Bond Funds (On Hand)	15,026	27,653	21,464	6,506	0	0	70,649	Transportation Element Policies 2.1 and 5.1
I-4 Ramp and Grade Separated Interchange at BVD Construction of a new slip ramp off of the existing I-4 westbound 536 ramp and a grade separated interchange over BVD with access from eastbound BVD, access to and from the parking garage, and access to eastbound BVD.	Bond Funds (On Hand)	6,035	27,817	2,746	0	0	0	36,598	Transportation Element Policies 2.1 and 5.1
Epcot Center Drive Interchange Capacity improvements at the Buena Vista Drive and Epcot Center Drive Interchange.	Bond Funds (On Hand)	250	7,653	57,936	34,161	0	0	100,000	Transportation Element Policies 2.1 and 5.1
Total Roads		**$21,311**	**$63,123**	**$82,146**	**$40,667**			**$207,247**	
FDOT Five Year Work Program									
I-4 Orange County Master Plan Advance Right-of-Way Acquisition	Local Funds, R/W and Bridge Bonds, State 100%, Federal	24,462	28,373	0	0	0	0	52,835	
I-4 From West of CR 532 to East of SR 522 (Osceola Parkway) Add lanes and reconstruct – PE Consultant	Federal	0	1,870	2,920	0	0	0	4,790	
Total Roads		**$24,462**	**$30,243**	**$2,920**	**$0**	**$0**		**$57,625**	

Table 9-9: Five Year Schedule of Capital Improvements for Potable and Reuse Water (in thousands)

#	Project Description	Funding Source	2014	2015	2016	2017	2018	2019	Total	Consistency with Other Plan Elements
Flamingo Crossings (Potable Water) Extension of distribution mains for Phase 2B and Phase 3. $390,000 moved from 2014 to 2020		Bond Funds.(On Hand) or Net Revenues	0	0	0		0	0	0	Infrastructure Element Policies 1.2. 1.3, and 1.4
PS-D 2MG Reservoir – (Potable Water) installation of in-ground tank. Moved from 2013 to 2017		Bond Funds.(On Hand) or Net Revenues	0	0	0	2,000	0	0	2,000	Infrastructure Element Policies 1.2. 1.3, and 1.4
Alternative Water Supply Share of regional supply project		Bond Funds.(On Hand) or Net Revenues	0	0	5,000	0	0	0	5,000	Infrastructure Element Policies 4.9
Reclaimed Water Conversions (WSFWP) Installation or extension of distribution mains. Rescheduled to commence in 2016 rather than in 2011. (1,000 LF of 8-inch main on 7 Seas Dr., 4-inch & 6-inch mains on Buena Vista Dr.,6-inch main extensions on World Dr., 12-inch main along Epcot Resorts Blvd. from World Dr., 4-inch, 6-inch, & 8-inch main extensions on Hotel Plaza Blvd., 16-inch main on Vacation Club Way, and 8-inch main extension on Golf Dr.		Bond Funds.(On Hand) or Net Revenues	0	0	3,040	100	800	0	3,940	Infrastructure Element Policy 5.1, 5.2 and 5.5
Flamingo Crossings (Reuse) Extension of distribution mains. $320,000 moved from 2014 to 2020.		Bond Funds.(On Hand) or Net Revenues	0	0	0	0	0	0	0	Infrastructure Element Policy 5.1 and 5.2
Total Potable and Reuse Water			**$0**	**$0**	**$8,040**	**$2,100**	**$800**	**$0**	**$10,940**	

Table 9-10: Five Year Schedule of Capital Improvements for Sanitary Sewer (in thousands)

Project Description	Funding Source	2014	2015	2016	2017	2018	2019	Total	Consistency with Other Plan Elements
Flamingo Crossings Extension of distribution mains for Phase 2B and Phase 3. $420,000 moved from 2014 to 2020	Bond Funds.(On Hand) or Net Revenues	0	0	0	0	0	0	0	Infrastructure Element Policies 6.2. and 6.3
Lift Station 1 Replacement		1,400						1,400	Infrastructure Element Policies 6.2. and 6.3
Wastewater Treatment Plant Expansion Increase plant capacity from 15 MGD to 20 MGD. The commencement of this project has been delayed from 2012 to 2013 due to a current lack of need/demand for services.	Bond Funds	6,000	0	0	0	0	0	6,000	Infrastructure Element Policies 6.2. and 5.3
Total Sanitary Sewer		**$7,400**	**$0**	**$0**	**$0**	**$0**	**$0**	**$7,400**	

Table 9-11: Five Year Schedule of Capital Improvements for Solid Waste (in thousands)

For the period 2014 through 2019, no new capital improvement projects are needed in order to provide adequate service and maintain the adopted level of service standard for solid waste.

Project Description	Funding Source	2014	2015	2016	2017	2018	2019	Total	Consistency with Other Plan Elements
N/A	N/A	0	0	0	0	0	0	0	N/A
Total Solid Waste		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	

Table 9-12: Five Year Schedule of Capital Improvements for Stormwater Management (in thousands)

For the period 2014 through 2019, no new capital improvement projects are needed in order to provide adequate service and maintain the adopted level of service standard for stormwater management.

Project Description	Funding Source	2014	2015	2016	2017	2018	2019	Total	Consistency with Other Plan Elements
N/A	N/A	0	0	0	0	0	0	0	N/A
Total Stormwater Management		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	

MetroPlan Orlando

Transportation Improvement Program

Locally Funded Highway Projects

Reedy Creek Improvement District

Project Number	Project Name or Designation	Project Description				2030 LRTP Reference	Historic Cost Prior to 2014/15 ($000's)	2014/15-2018/19 Project Status and Cost ($000's)							Estimated Future Cost After 2018/19 ($000's)	Total Project Cost ($000's)	Responsible Agency
		From	To	Length (Miles)	Work Description			2014/15	2015/16	2016/17	2017/18	2018/19	Funding Sources	Project Phases			
RCID-1	SR 536 Slip Ramp	SR 536 W of I-4	Buena Vista Dr.	0.59	New Single Lane Ramp	Not in LRTP		2,172	0	0	0	0	RCID	CST			RCID
							1,207	2,172	0	0	0	0	Total		0	3,379	

Appendix G – Environmental Analysis Supporting Documentation

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
400 HIGH POINT DRIVE, SUITE 600
COCOA, FLORIDA 32926

REPLY TO
ATTENTION OF

April 30, 2014

Regulatory Division
North Permits Branch
Cocoa Permits Section
SAJ-1991-01901 (SP-TSD)
Modification # 82

Walt Disney Imagineering
C/o Mr. Jim Yawn
PO Box 10321
Lake Buena Vista, FL 32830-0321
Email address: Jim.Yawn@disney.com

Dear Mr. Yawn:

The U.S. Army Corps of Engineers (Corps) has completed the review and evaluation of your modification request received on April 18, 2014, in which you asked for a modification to the Walt Disney World (WDW) Company permit SAJ-1991-01901, Long Term Permit (LTP).

Modification # 82 is identified as BVD Corridor Project. Modification # 82 authorizes 1.11 acres of wetland impact to Wetland 9.70, for the construction of an electric substation in association with the improvements associated with BVD Corridor Project. Modification # 82 also includes 1.33 acres of impact to Wetland 9.78, 1.91 acres of wetland impact to Wetland 9.80A, and 1.12 acres of surface water impact to the L-101Canal for the construction of the I-4 Slip Ramp and Pond B Stormwater Pond expansion associated with the Buena Vista Drive Widening Projects. Mitigation to offset the 4.35 acres of forested wetland impacts has been accounted for in the Disney Long Term Permit (LTP). Specifically, Modification # 77 authorized the trade of 22.87 acres of wetland impacts that are not going to be utilized in exchange for future wetland impacts associated with the Disney LTP.

Wetland type:	Acreage Traded in Mod 77	Mod 79 W 1.6G	Mod 80 W 9.65	Mod 81 W1.6G	Mod 82 W9.70, W9.78 W9.80A	Remaining Acreage available
618 Shrub wetland	4.29			1.3	2.46	0.53
622 Pond Pine	0.44			0.44		0
630 Wetland Forested Mixed	16.28	3.68	3.86	6.99	1.73	0.02
641 Freshwater Marsh	1.86			1.70	0.16	0
Total Acreage	22.87					0.55

The project described above and in the attached exhibits has been evaluated and found to have minimal environmental impact. The permit is hereby modified in accordance with your request. You should attach this letter and the attached modified exhibits to the permit. All other conditions of the permit remain in full force and effect. If you have any questions concerning this permit modification, please contact Tamy Dabu at the letterhead address, by telephone at 321-504-3771 extension 11 or by electronic mail at tamy.s.dabu@usace.army.mil .

Thank you for your cooperation with our permit program. The Corps Jacksonville District Regulatory Division is committed to improving service to our customers. We strive to perform our duty in a friendly and timely manner while working to preserve our environment. We invite you to take a few minutes to visit the following link and complete our automated Customer Service Survey:

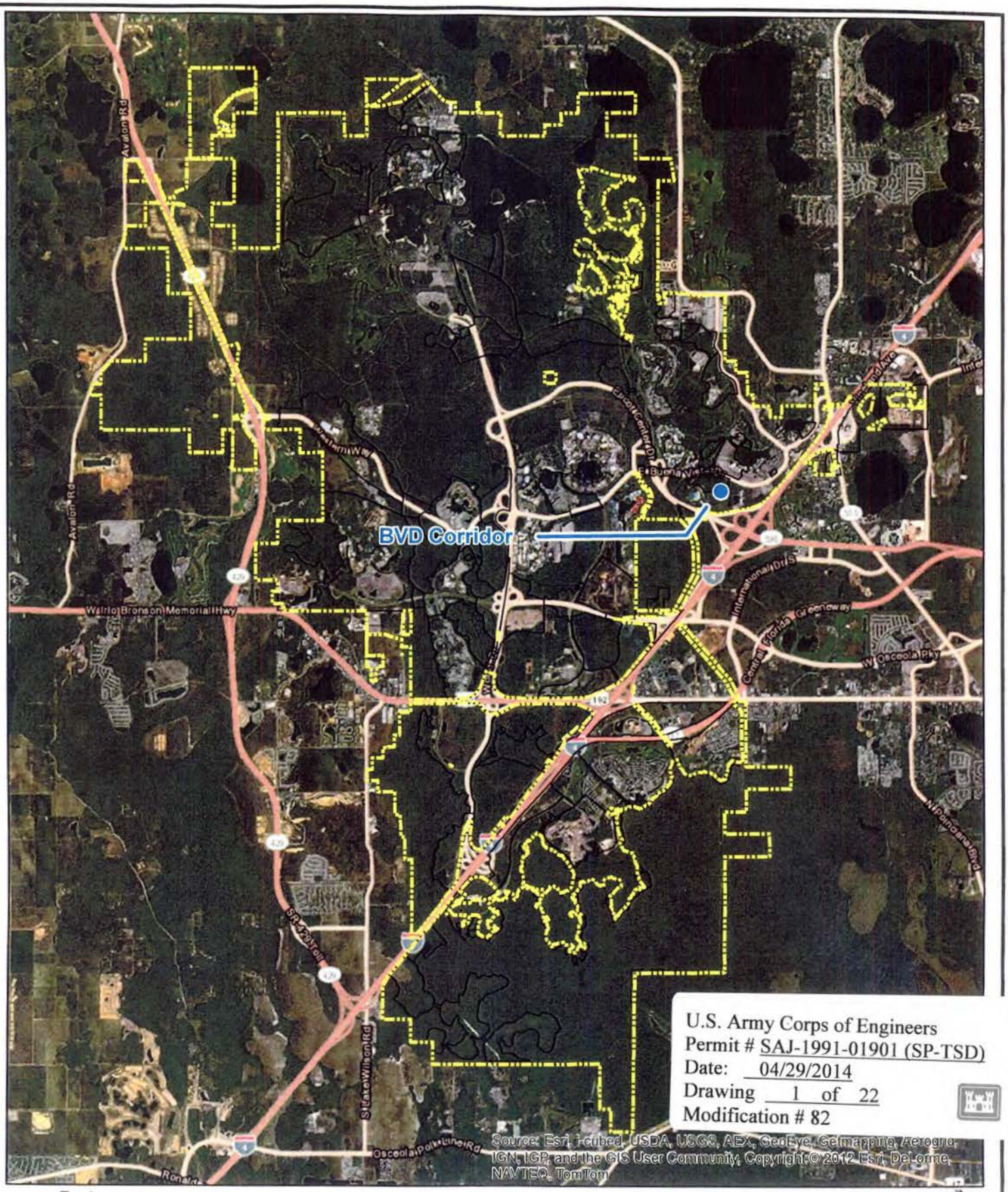
http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey

Your input is appreciated – favorable or otherwise.

BY AUTHORITY OF THE SECRETARY OF THE ARMY:

for Alan M. Dodd.
Colonel, U.S. Army
District Commander

Enclosures.
Copy Furnished: CESAJ-RD-PE



U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 1 of 22
Modification # 82

ATKINS
Walt Disney Imagineering

WDW ACOE
Permit No. 19910190I
Modification No. 82
Exhibit Date: 4/4/14

BVD Corridor
PROJECT LOCATION MAP

EXHIBIT
1

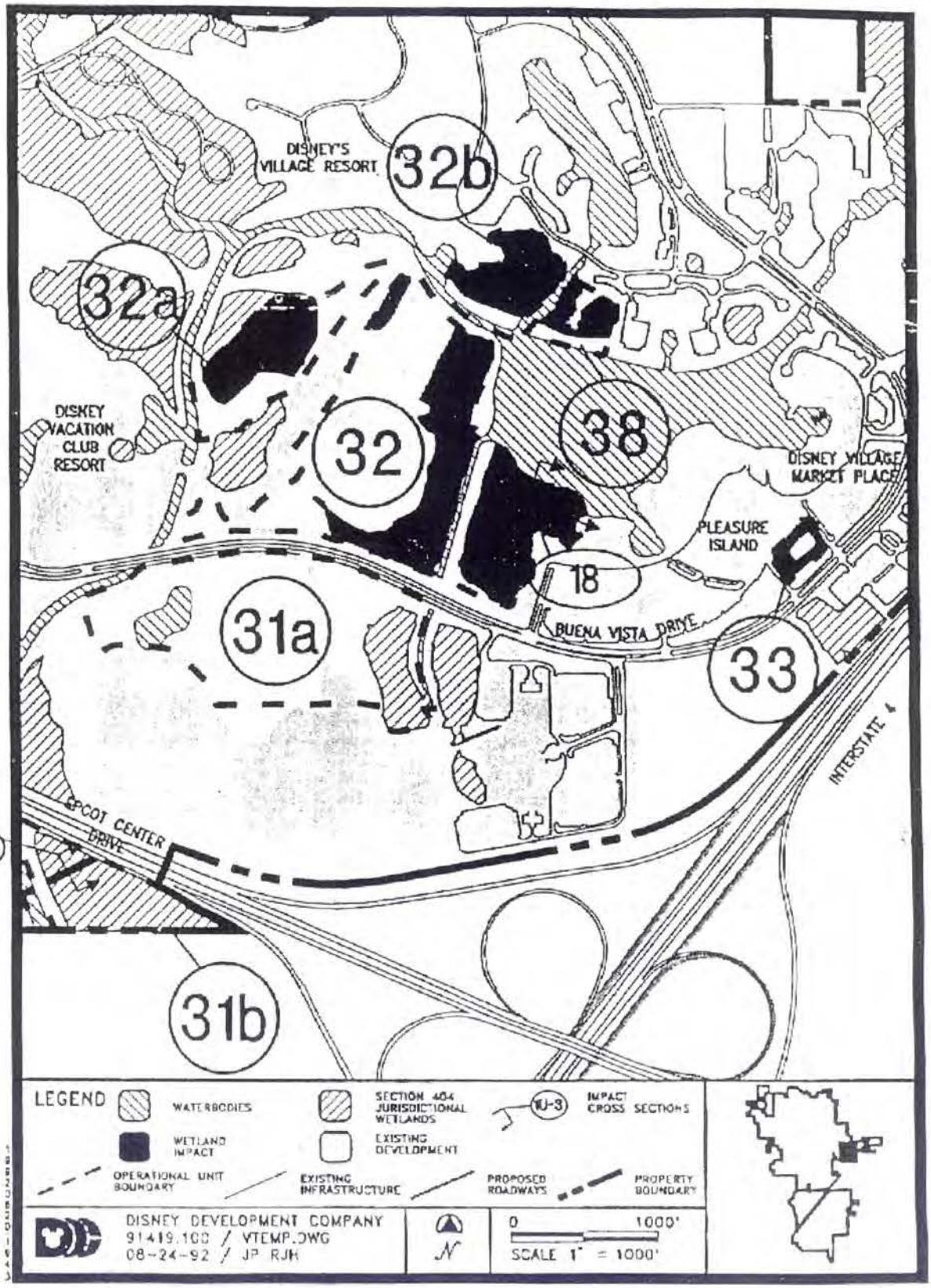
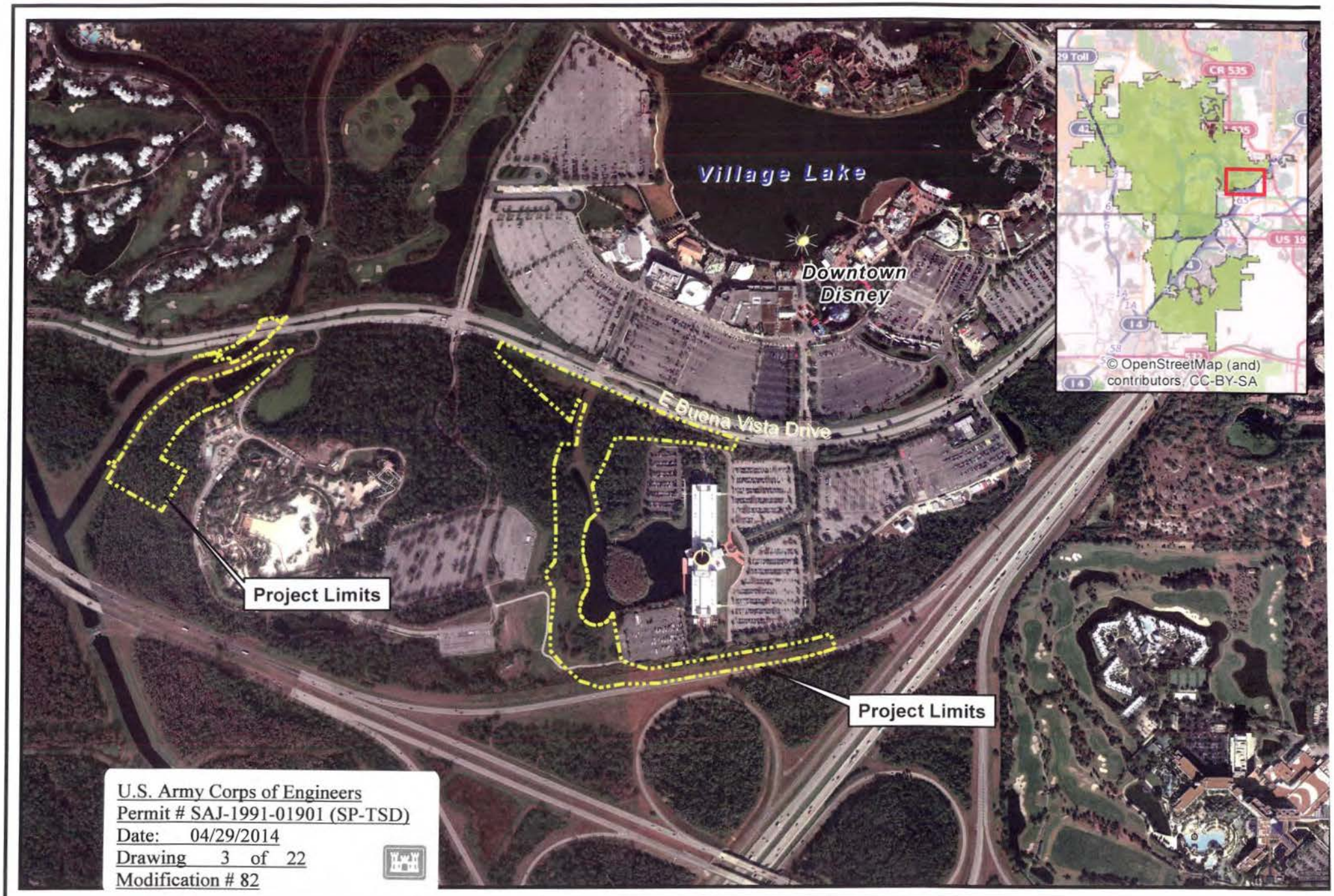


FIGURE #25C

J.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 2 of 22

PROPOSED SECTION 404 JURISDICTIONAL IMPACTS.
REFERENCING OPERATIONAL UNITS 31a, 31b, 32, 38.
ACOE INFORMATION SUBMITTAL, AUGUST 24, 1992.

Department of the Army



U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 3 of 22
Modification # 82

ATKINS
Walt Disney Imagineering

WDW ACOE
Permit No. 199101901
Notification No. 82
Exhibit Date: 4/4/14

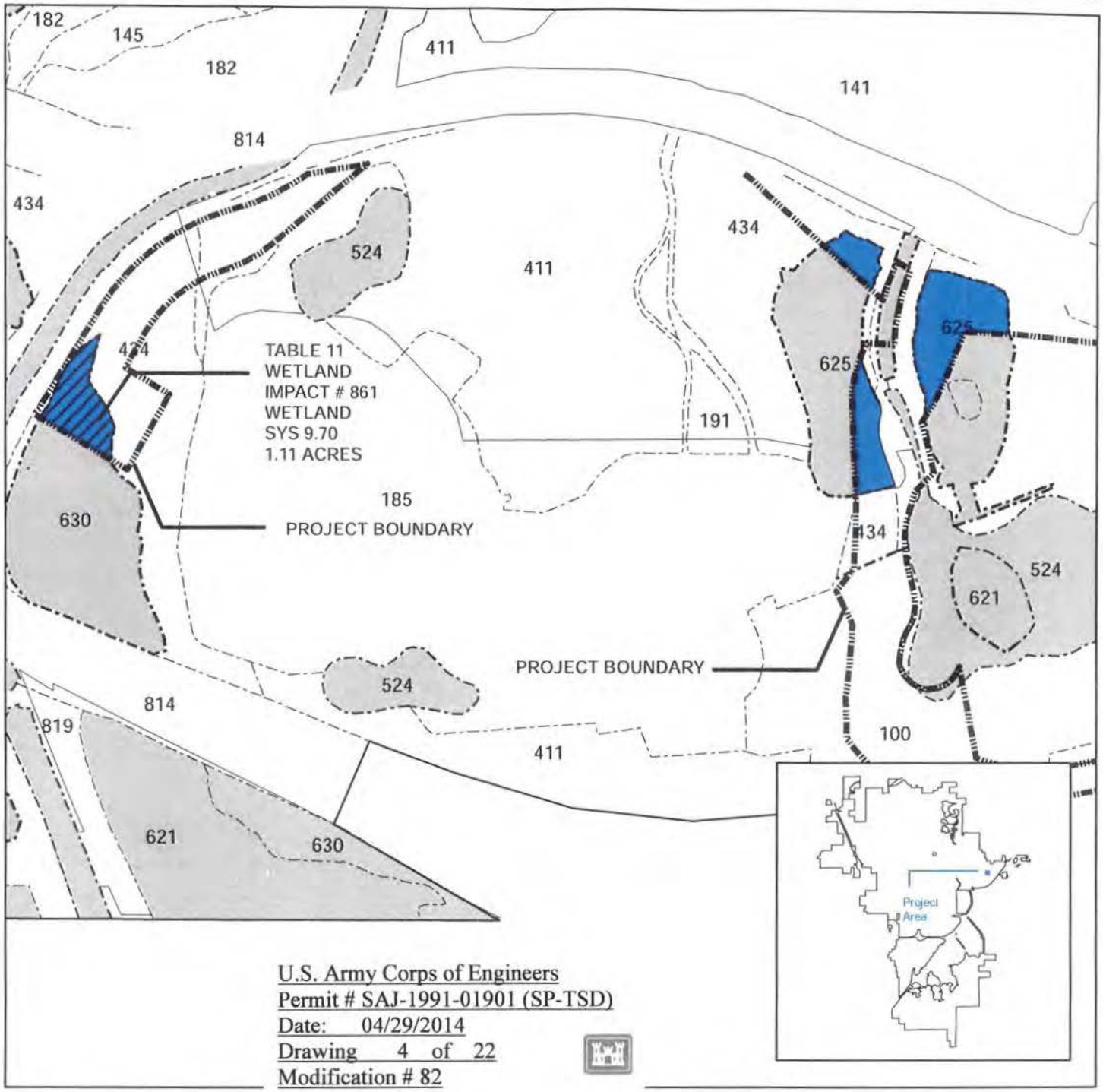
APR 2 8 2014

BVD Corridor

PROJECT SITE MAP

0 200 400 800 1,200 1,600
Feet

EXHIBIT 3



WETLAND IMPACT # 861					PREVIOUS IMPACT
WETLAND SYS No.	LTP IMPACT (PER TABLE 11)	ACTUAL IMPACT	REMAINING IMPACT	OU No.	
9.70	0.00 AC	1.11 AC	0.0 AC	N/A	NONE

LEGEND
- Photo Interpreted
- Survey
- OU Limits
- Vegetation
- Present Impact
- Approved/Taking
- Approved/Not Taking
- Not Approved/Taking
- Wetland Area
- 630 Cover Type

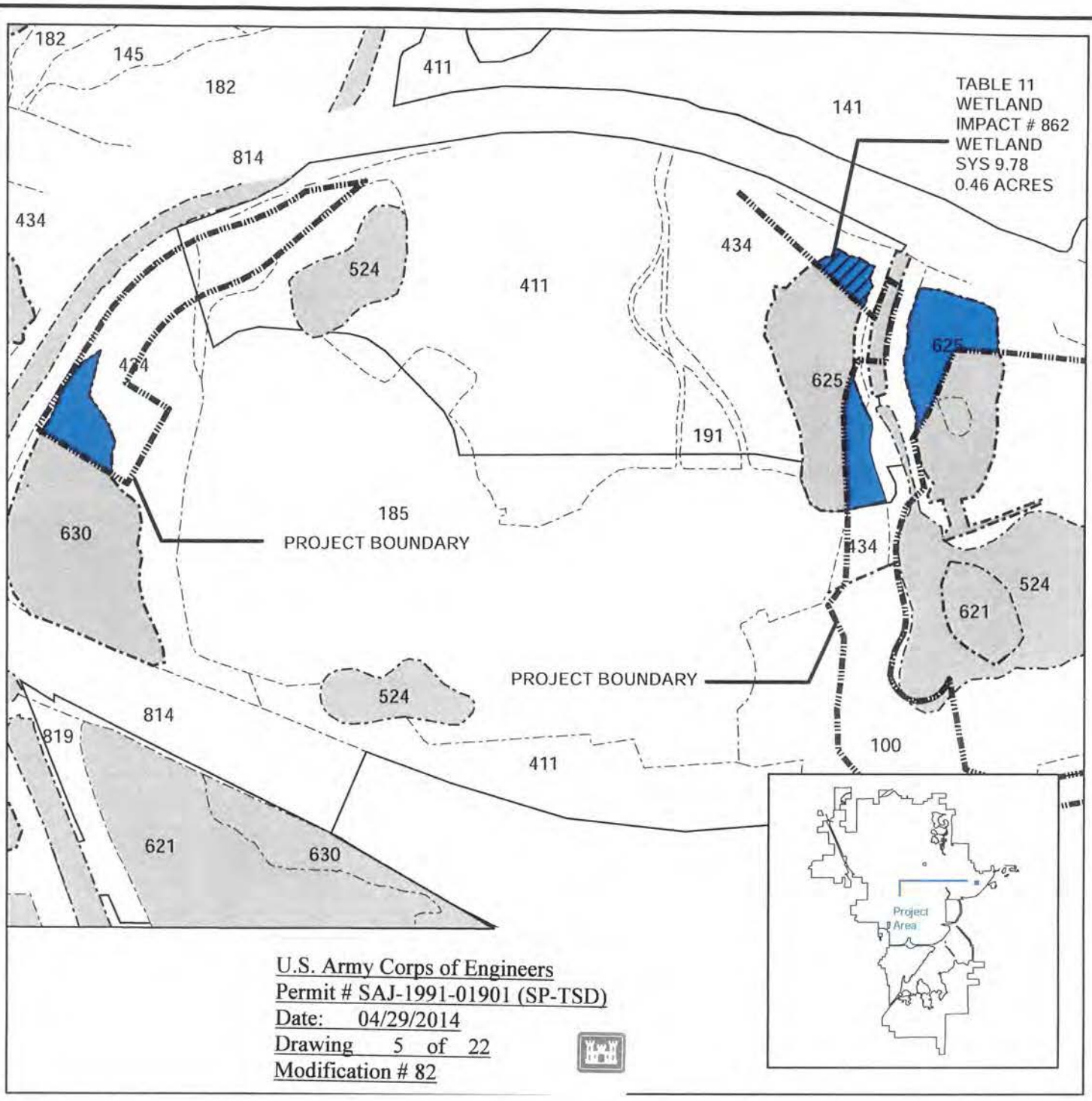
AGENCY A.C.O.E. PERMIT NO. 199101901 MODIFICATION NO. 82	PHOTO INTERP Y / (N) SURVEYED (Y) / N	EXHIBIT DATE 4/9/2014

ATKINS
Walt Disney Imagineering

NOTE:
THIS EXHIBIT IS TO BE USED IN CONJUNCTION WITH TABLE 11.

BVD Corridor
COMPARISON OF ACTUAL VERSUS PERMITTED WETLAND IMPACT ACREAGE

EXHIBIT 5



WETLAND IMPACT # 862					PREVIOUS IMPACT
WETLAND SYS No.	LTP IMPACT (PER TABLE 11)	ACTUAL IMPACT	REMAINING IMPACT	OU No.	
9.78	0.00 AC	0.46 AC	0.0 AC	N/A	NONE

LEGEND
- Photo Interpreted
- Survey
- OU Limits
- Vegetation
- Present Impact
- Approved/Taking
- Approved/Not Taking
- Not Approved/Taking
- Wetland Area
- 630 Cover Type

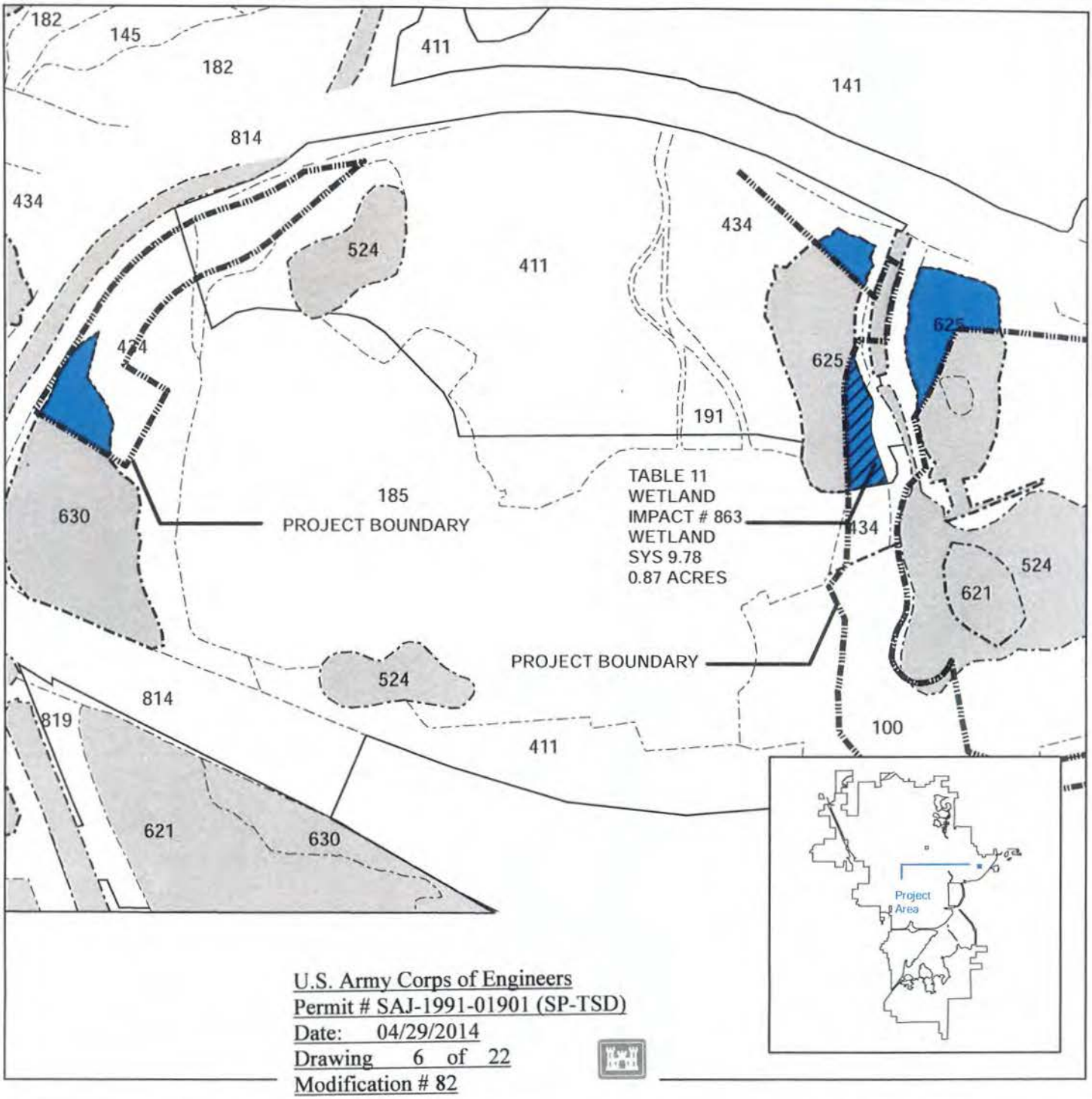
AGENCY A.C.O.E. PERMIT NO. 199101901 MODIFICATION NO. 82	PHOTO INTERP Y / (N) SURVEYED (Y) / N	EXHIBIT DATE 4/9/2014

ATKINS
Walt Disney Imagineering

NOTE:
THIS EXHIBIT IS TO BE USED IN CONJUNCTION WITH TABLE 11.

BVD Corridor
COMPARISON OF ACTUAL VERSUS PERMITTED WETLAND IMPACT ACREAGE

EXHIBIT 6



U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 6 of 22
Modification # 82

WETLAND IMPACT # 863					PREVIOUS IMPACT
WETLAND SYS No.	LTP IMPACT (PER TABLE 11)	ACTUAL IMPACT	REMAINING IMPACT	OU No.	
9.78	0.00 AC	0.87 AC	0.0 AC	N/A	NONE

LEGEND
- Photo Interpreted
- Survey
- OU Limits
- Vegetation
- Present Impact
- Approved/Taking
- Approved/Not Taking
- Not Approved/Taking
- Wetland Area
- 630 Cover Type

AGENCY A.C.O.E.
PERMIT NO. 199101901 MODIFICATION NO. 82

PHOTO INTERP (Y) / N
SURVEYED (Y) / N

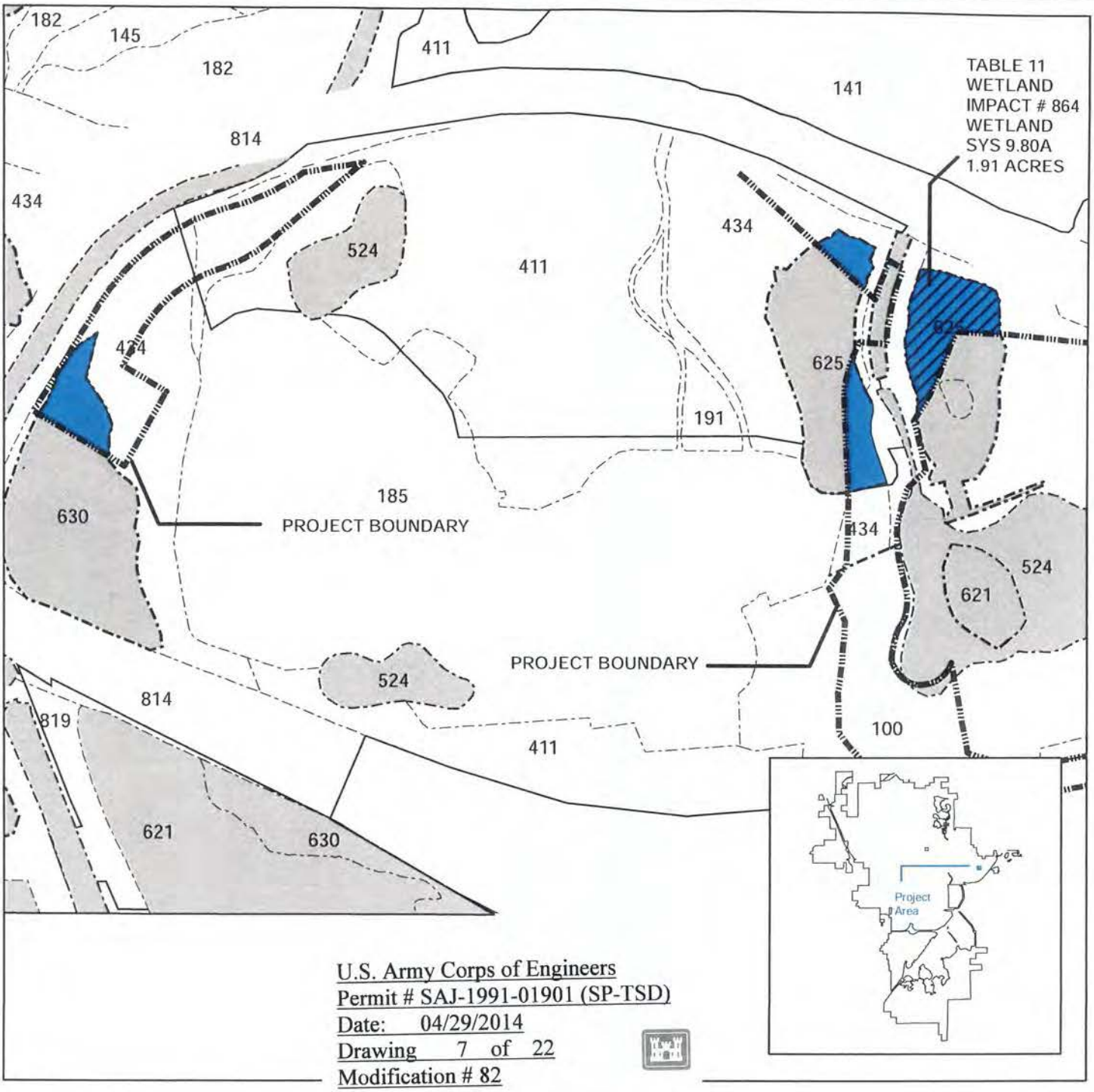
EXHIBIT DATE 4/9/2014

ATKINS
Walt Disney Imagineering

NOTE:
THIS EXHIBIT IS TO BE USED IN CONJUNCTION WITH TABLE 11.

BVD Corridor
COMPARISON OF ACTUAL VERSUS PERMITTED WETLAND IMPACT ACREAGE

EXHIBIT 7



U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 7 of 22
Modification # 82

WETLAND IMPACT # 864					PREVIOUS IMPACT
WETLAND SYS No.	LTP IMPACT (PER TABLE 11)	ACTUAL IMPACT	REMAINING IMPACT	OU No.	
9.80A	0.00 AC	1.91 AC	0.0 AC	N/A	NONE

LEGEND
- Photo Interpreted
- Survey
- OU Limits
- Vegetation
- Present Impact
- Approved/Taking
- Approved/Not Taking
- Not Approved/Taking
- Wetland Area
- 630 Cover Type

AGENCY A.C.O.E.
PERMIT NO. 199101901 MODIFICATION NO. 82

PHOTO INTERP SURVEYED Y / (N) (Y) / N

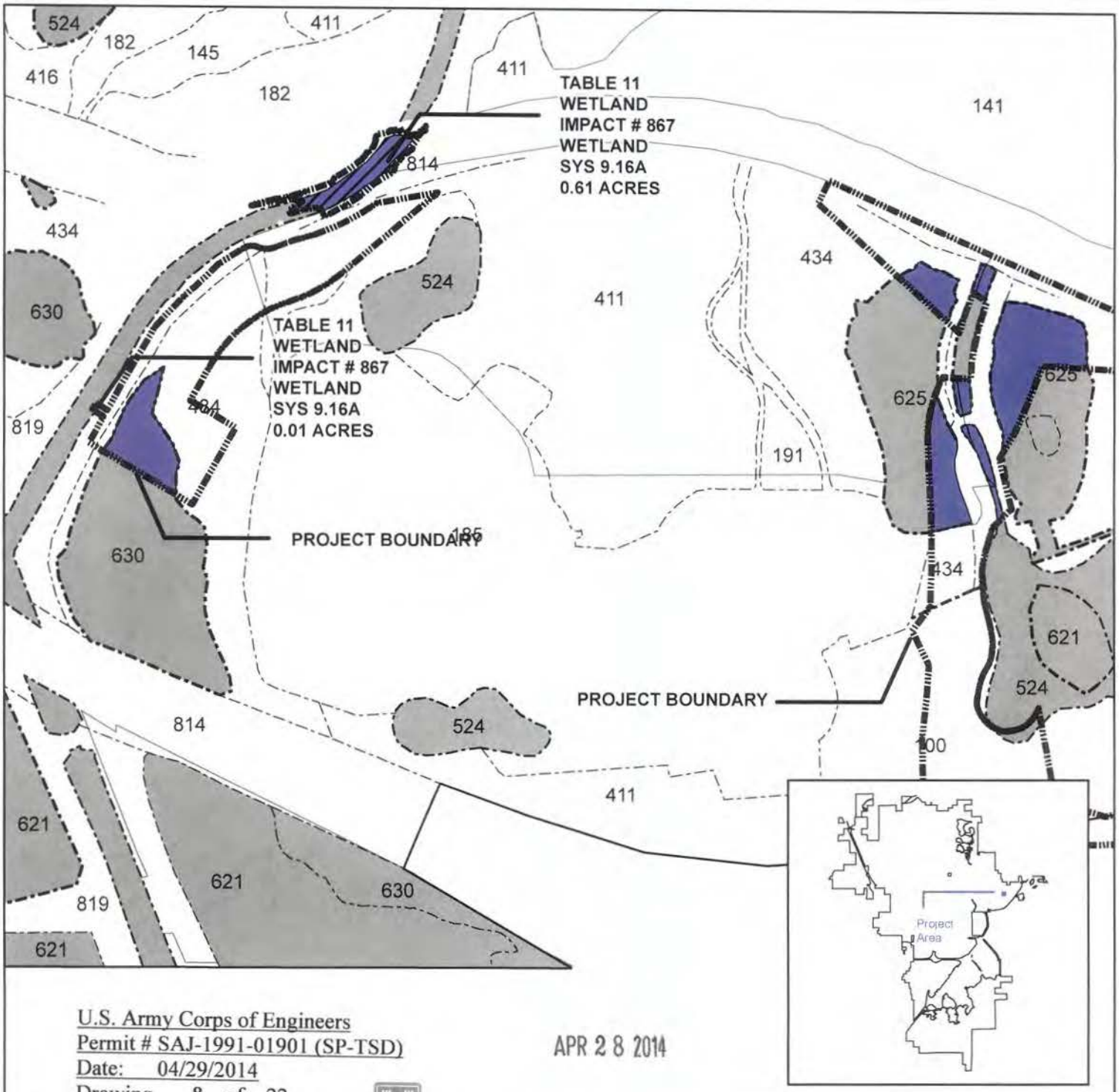
EXHIBIT DATE 4/9/2014

ATKINS
Walt Disney Imagineering

NOTE:
THIS EXHIBIT IS TO BE USED IN CONJUNCTION WITH TABLE 11.

BVD Corridor
COMPARISON OF ACTUAL VERSUS PERMITTED WETLAND IMPACT ACREAGE

EXHIBIT 8



U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 8 of 22
Modification # 82

APR 2 8 2014

WETLAND IMPACT # 867					PREVIOUS IMPACT
WETLAND SYS No.	LTP IMPACT (PER TABLE 11)	ACTUAL IMPACT	REMAINING IMPACT	OU No.	
9.16A	0.00 AC	0.61 AC	0.0 AC	N/A	NONE
9.16A	0.00 AC	0.01 AC	0.0 AC	N/A	NONE

LEGEND
- Photo Interpreted
- Survey
- OU Limits
- Vegetation
- Present Impact
- Approved/Taking
- Approved/Not Taking
- Not Approved/Taking
- Wetland Area
- 630 Cover Type

AGENCY A.C.O.E.
PERMIT NO. 199101901 MODIFICATION NO. 82

PHOTO INTERP Y / (N)
SURVEYED (Y) / N

EXHIBIT DATE 4/28/2014

ATKINS
Walt Disney Imagineering

NOTE:
THIS EXHIBIT IS TO BE USED IN CONJUNCTION WITH TABLE 11

BVD Corridor
COMPARISON OF ACTUAL VERSUS PERMITTED WETLAND IMPACT ACREAGE

EXHIBIT 10a



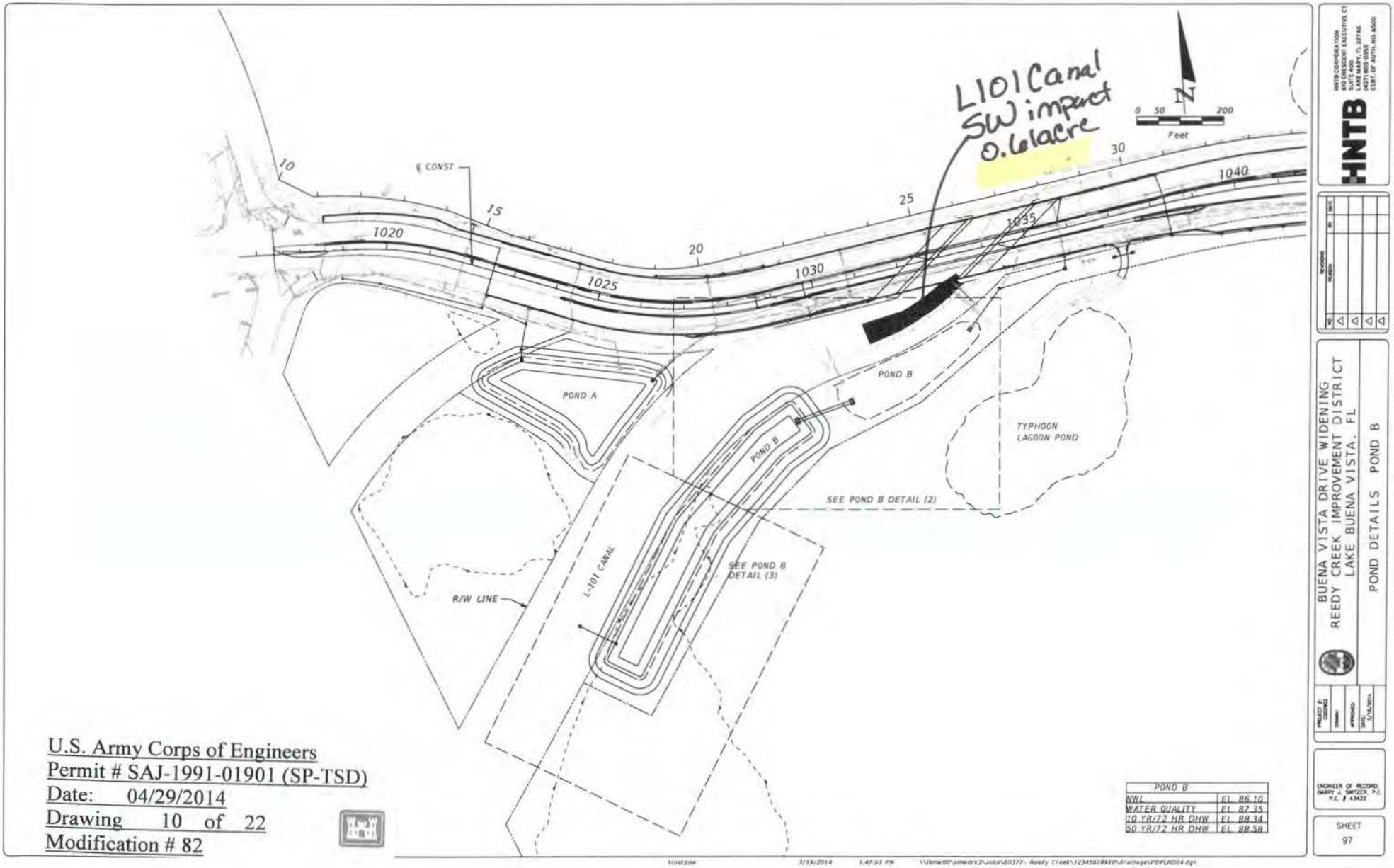
ATKINS | WDW ACOE
Permit No. 199101901
Notification No. 82
Exhibit Date: 4/9/14

BVD Corridor
ELECTRIC SUBSTATION PLANS

0 100 200 400 600 800 1,000 1,200
Feet

EXHIBIT 4

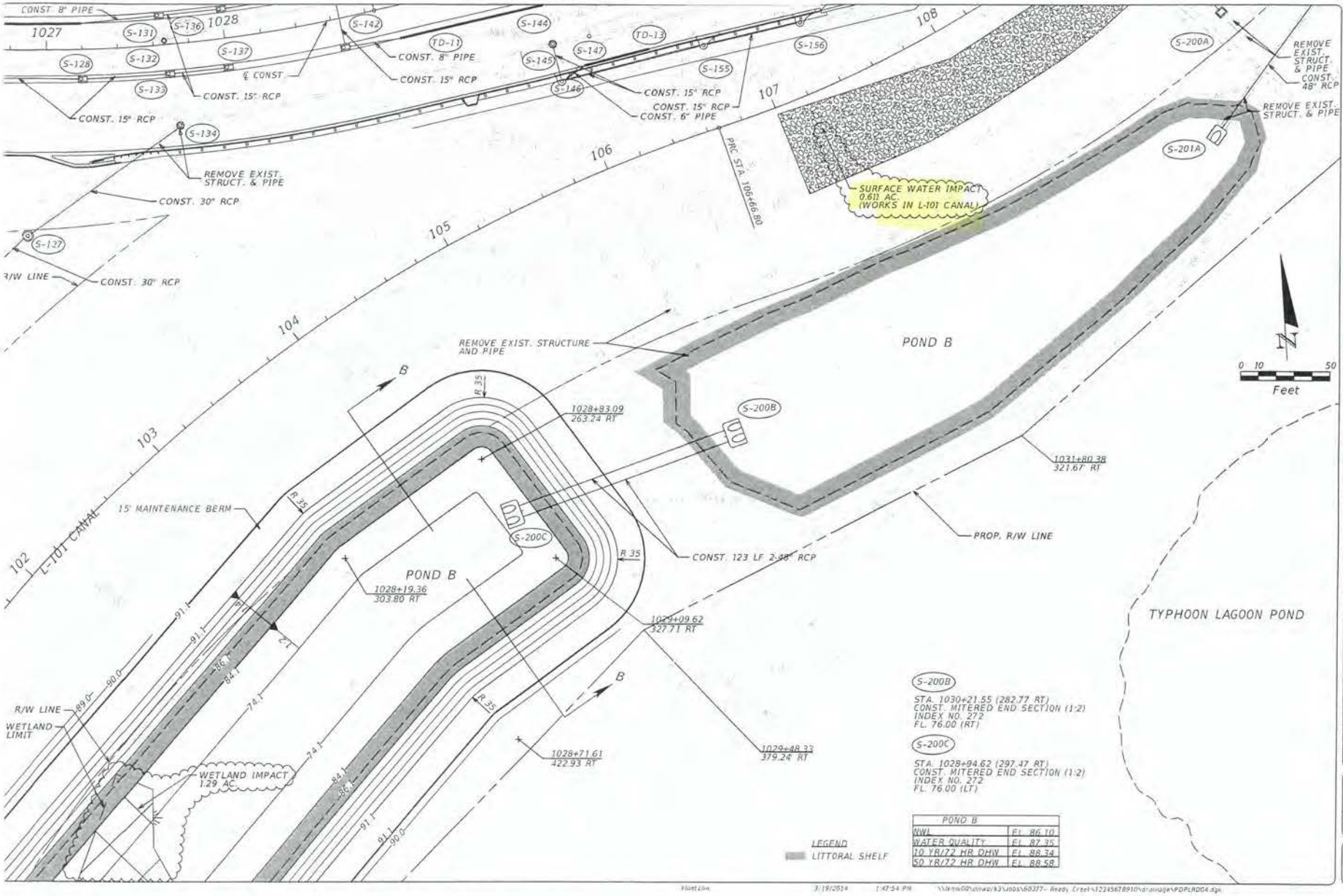
S. Army Corps of Engineers
ermit # SAJ-1991-01901 (SP-TSD)
ate: 04/29/2014
rawing 9 of 22
odification # 82



POND B	
NWL	EL. 86.10
WATER QUALITY	EL. 87.35
10 YR/72 HR DHW	EL. 88.34
50 YR/72 HR DHW	EL. 88.58

U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 10 of 22
Modification # 82

U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 11 of 22
Modification # 82



HNTB CORPORATION
610 CRESCENT EXECUTIVE CT
SUITE 400
LAKE MARY, FL 32746
(407) 688-2900
CERT. OF AUTH. NO. 6500

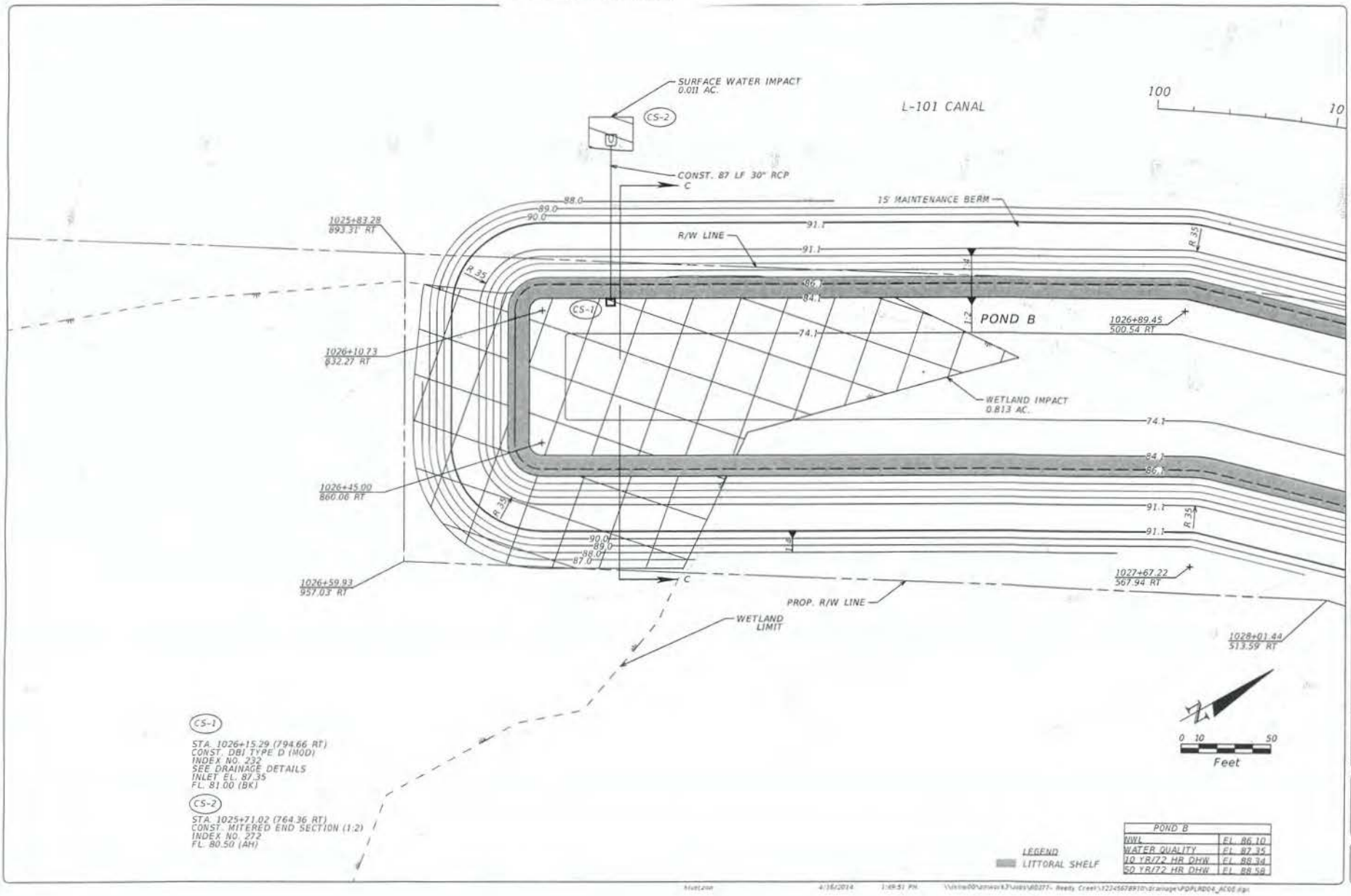
BUENA VISTA DRIVE WIDENING
REEDY CREEK IMPROVEMENT DISTRICT
LAKE BUENA VISTA, FL
POND DETAILS POND B (2)

ENGINEER OF RECORD
HARRY J. SWITZER, P.E.
P.E. # 43422

SHEET
98

Fluet Elm 3/19/2014 1:47:54 PM \\bma60\common\k3\Jobs\60377- Reedy Creek\12345678910\drainage\PDPLR004.dgn

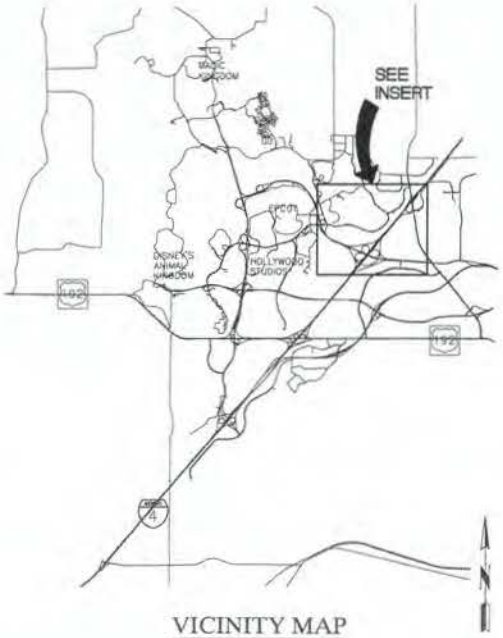
U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 12 of 22
Modification # 82



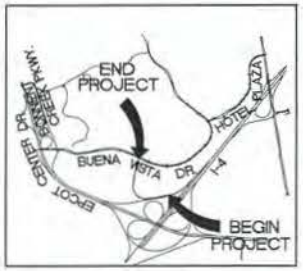
HNTB
BUENA VISTA DRIVE WIDENING
REEDY CREEK IMPROVEMENT DISTRICT
LAKE BUENA VISTA, FL
POND DETAILS POND B (3)
ENGINEER OF RECORD: BARRY J. SMITZER, P.E. P.E. # 43422
SHEET

I-4 SLIP RAMP

Reedy Creek Improvement District
Lake Buena Vista, Florida



VICINITY MAP
N.T.S.



INSERT
N.T.S.

INDEX OF DRAWINGS

DWG NO.	DESCRIPTION
1	TITLE AND INDEX OF DRAWINGS
2	GENERAL NOTES
3- 5	TYPICAL SECTIONS
6	SURVEY CONTROL POINTS
7	COORDINATE AND CURVE DATA
8	PROJECT LAYOUT
9	DRAINAGE MAP
10-15	PLAN SHEETS
16-21	PROFILE SHEETS
22	RAMP TEMINAL DETAIL
23-44	CROSS SECTIONS
45	TRAFFIC CONTROL NOTES

U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 13 of 22
Modification # 82

TLP Engineering Consultants, Inc.
11486 CORPORATE BLVD., SUITE 151
ORLANDO, FL 32817
407-901-5060

REVISIONS

NO.	REVISION	BY	DATE
△			
△			
△			
△			

I-4 SLIP RAMP
REEDY CREEK IMPROVEMENT DISTRICT
LAKE BUENA VISTA, FL

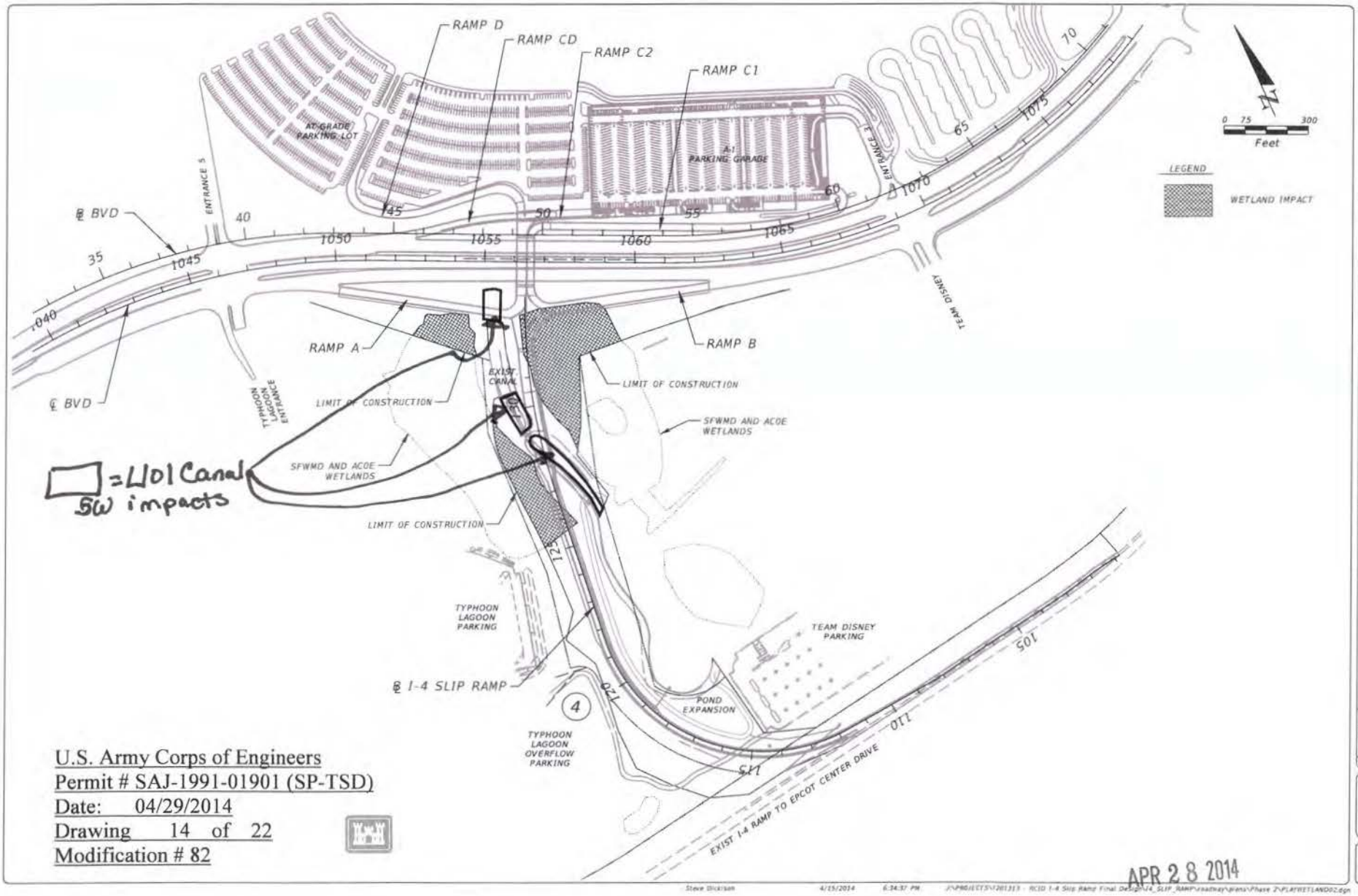
TITLE AND INDEX OF DRAWINGS

PROJECT # 7201313
DRAWN: SAH
APPROVED: SWD
DATE: 03/03/2014

STEPHEN W. DICKISON, P.E.
P.E.# 56129
AUTHORIZATION# 27205

SHEET
1

Steve Dickison 3/17/2014 12:12:39 PM I:\PROJECTS\7201313 - RCID I-4 Slip Ramp Final Design\I4_SLIP_RAMP\Plans\Phase 2\Sheets\802.dgn



U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 14 of 22
Modification # 82

APR 2 8 2014

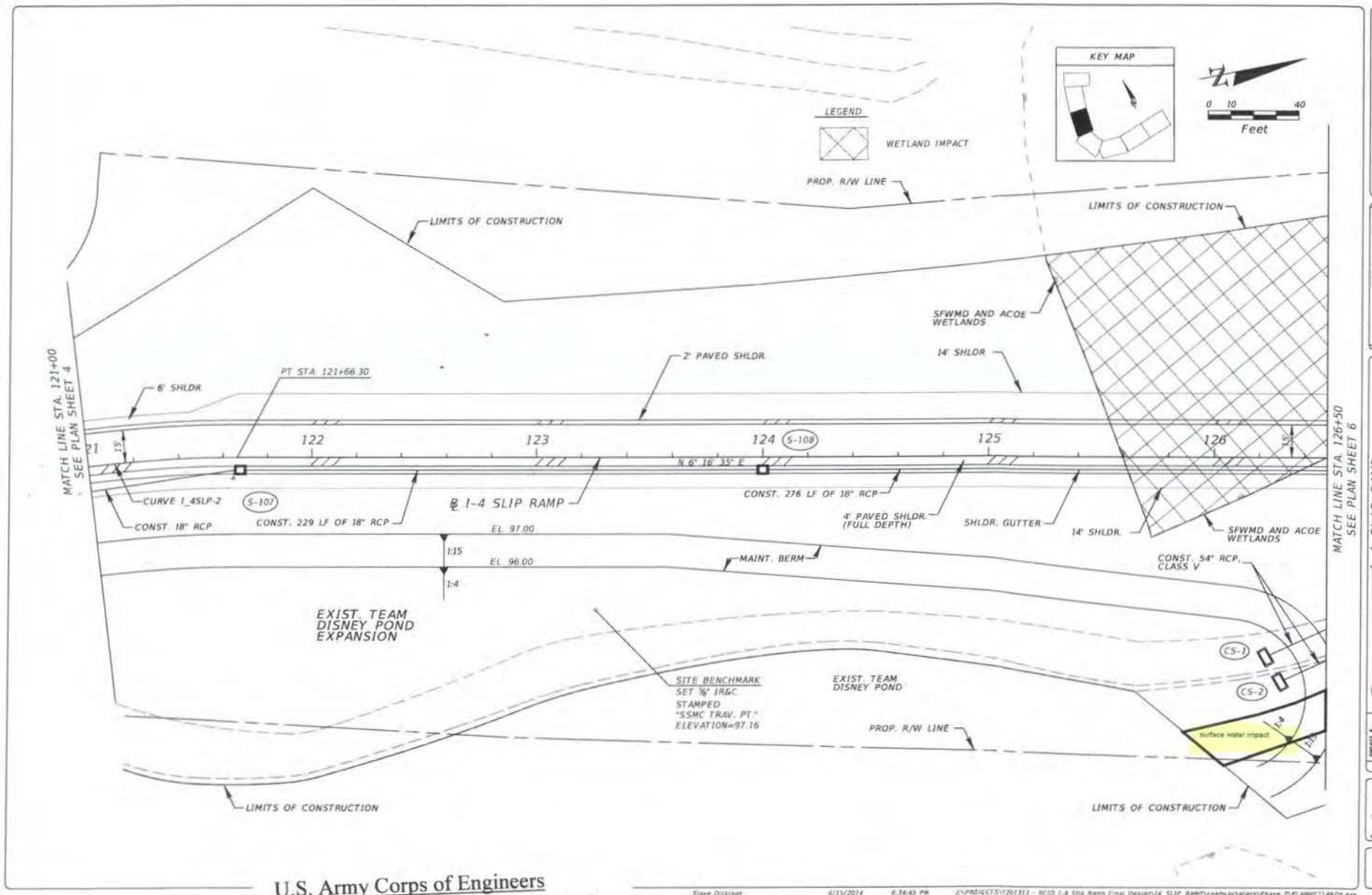
Engineering Consultants, Inc.
11486 CORPORATE BLVD., SUITE 151
ORLANDO, FL. 32817
407.901.5060

I-4 SLIP RAMP
REEDY CREEK IMPROVEMENT DISTRICT
LAKE BUENA VISTA, FL
PROJECT LAYOUT

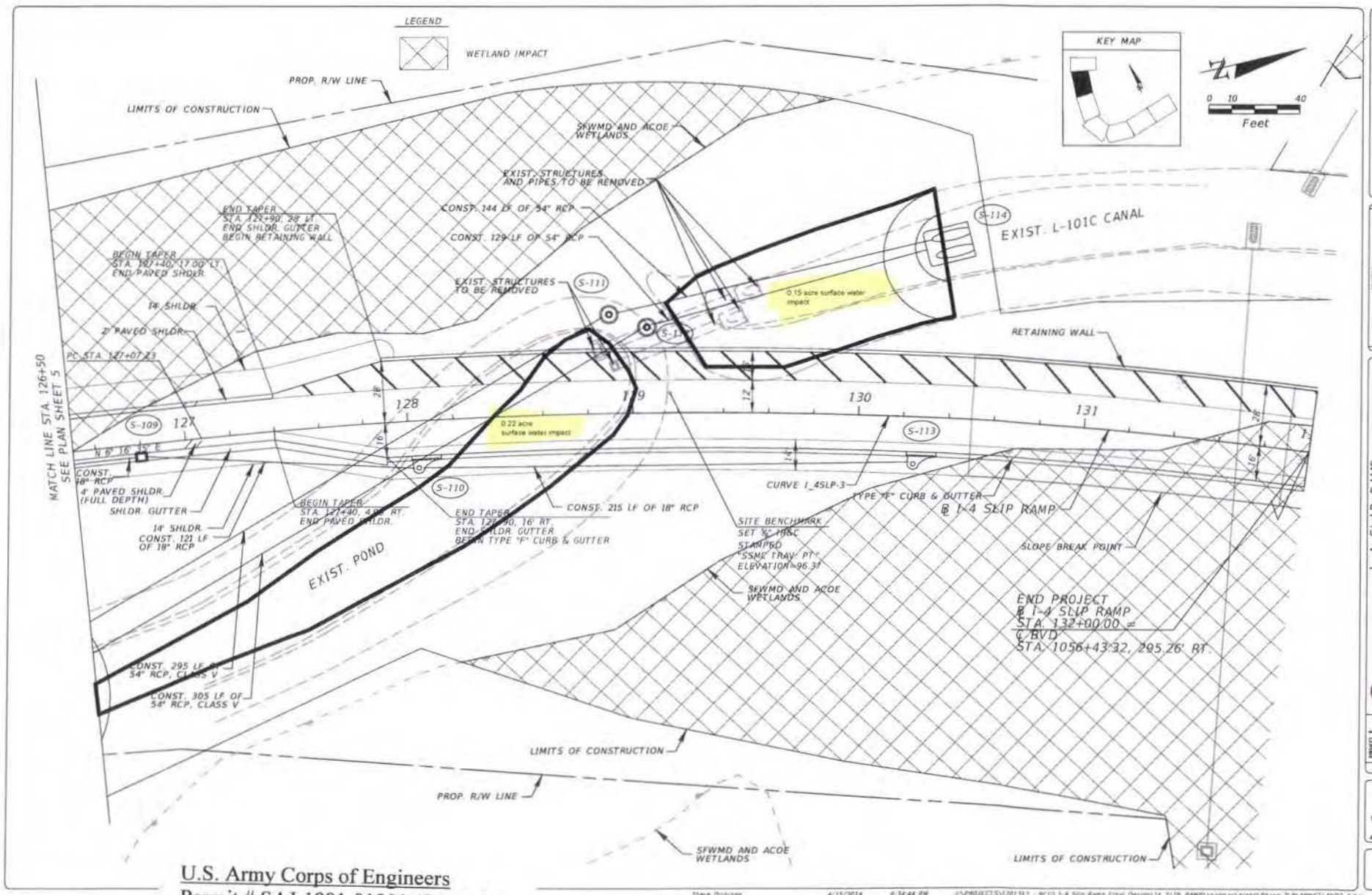
STEPHEN W. DICKISON, P.E.
P.E.# 56129
AUTHORIZATION# 27205

SHEET 8

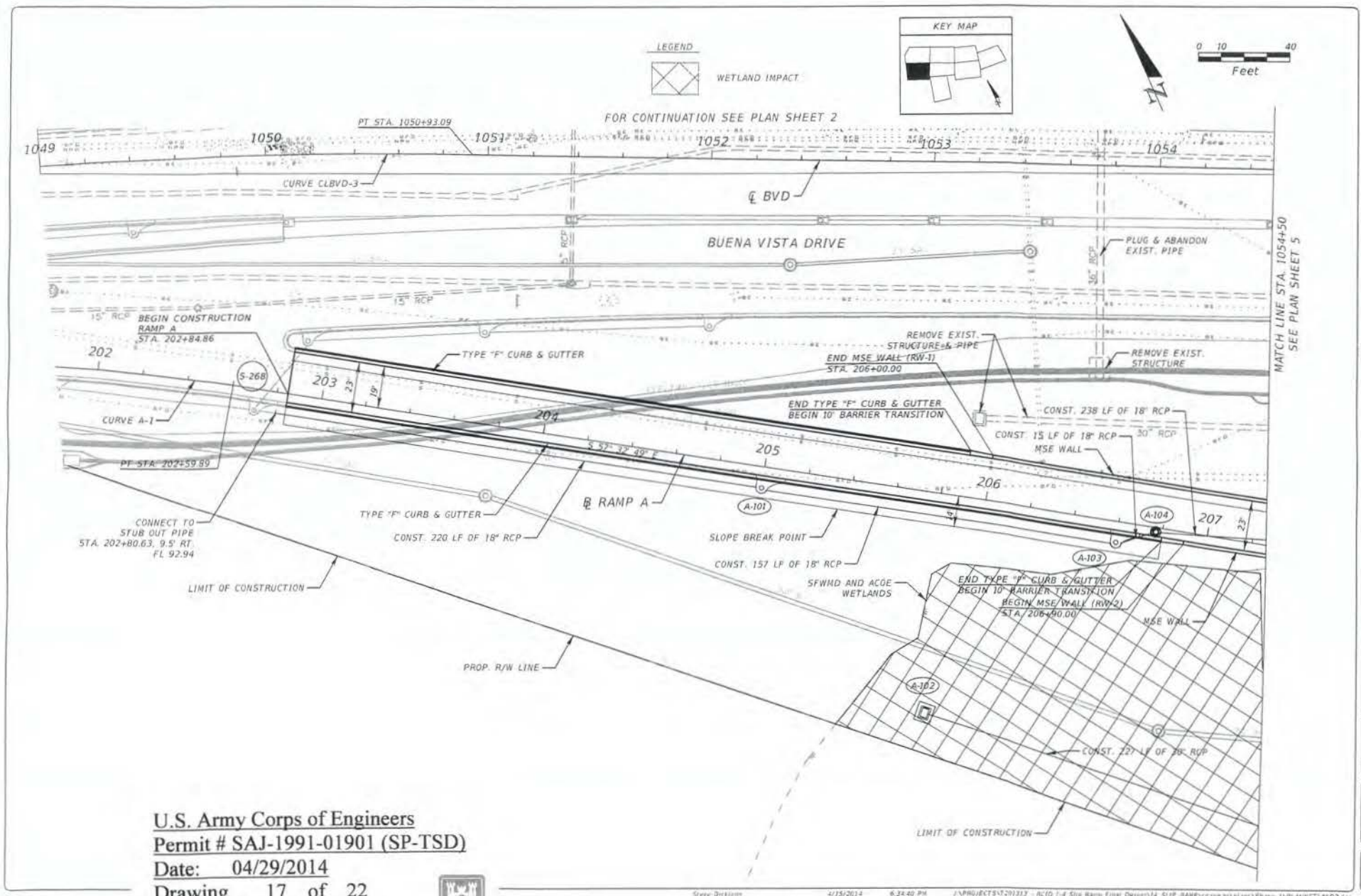
Steve Dickison 4/15/2014 6:34:37 PM J:\PROJECTS\701313 - RCID I-4 Slip Ramp Final Design\14_SLIP_RAMP\roadway\plans\Phase 2\PLAYWETLAND02.dgn



U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 15 of 22
Modification # 82



U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 16 of 22
Modification # 82



U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 17 of 22
Modification # 82

Steve Dickson 4/15/2014 6:34:40 PM J:\PROJECTS\7201313 - ACID I-4 Slip Ramp Final Design\14_SLIP_RAMP\roadway\plans\Phase 1\PLANWETLAND2.dgn

Engineering Consultants, Inc.
11486 CORPORATE BLVD., SUITE 151
ORLANDO, FL. 32817
407-901-5060

REVISIONS

NO.	DESCRIPTION	BY	DATE
1			
2			
3			
4			

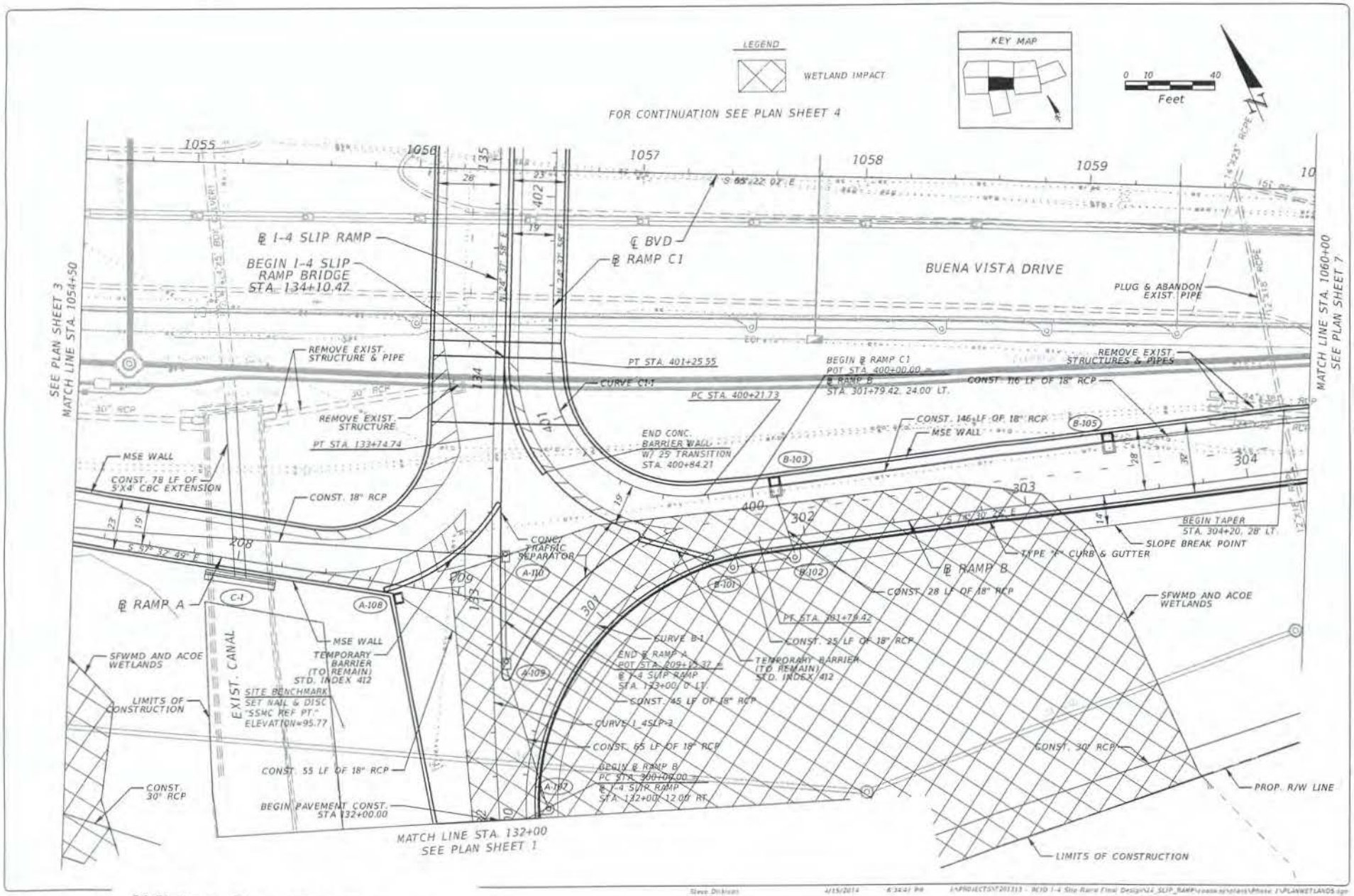
I-4 SLIP RAMP AND BVD INTERCHANGE
REEDY CREEK IMPROVEMENT DISTRICT
LAKE BUENA VISTA, FL

PLAN SHEET 3

PROJECT # 7201313
DRAWN: Steve Dickson
APPROVED: SMD
DATE: 4/15/2014

STEPHEN M. DICKSON, P.E.
P.E.# 56129
AUTHORIZATION# 27205

SHEET
16



Engineering Consultants, Inc.
11486 CORPORATE BLVD., SUITE 151
ORLANDO, FL. 32817
407-901-5060

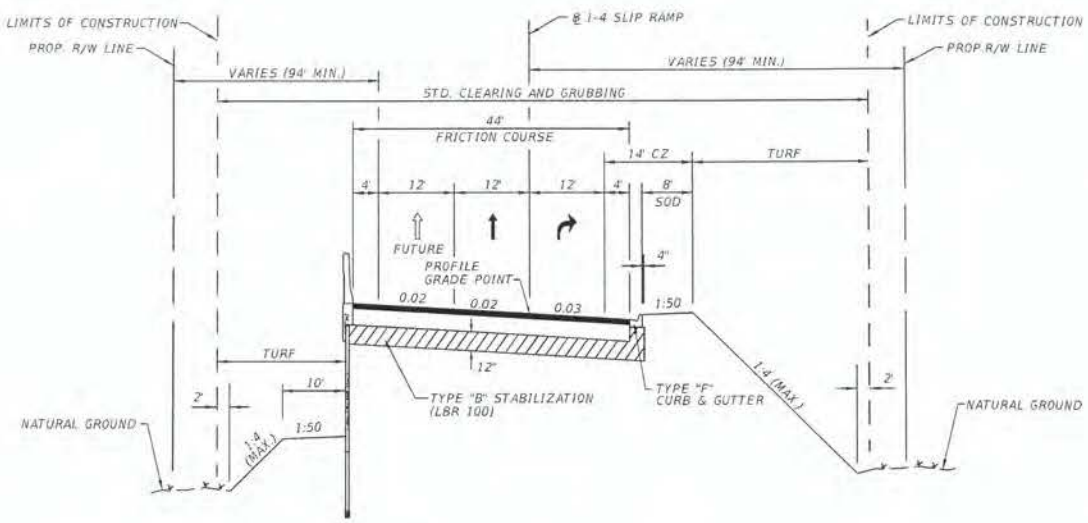
I-4 SLIP RAMP AND BVD INTERCHANGE
REEDY CREEK IMPROVEMENT DISTRICT
LAKE BUENA VISTA, FL

PLAN SHEET 5

STEPHEN M. DICKSON, P.E.
P.E.# 56129
AUTHORIZATION# 27205

SHEET 18

U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 18 of 22
Modification # 82



TYPICAL SECTION
STA. 128+50.00 TO 132+00.00

TRAFFIC DATA

ESTIMATED OPENING YEAR = 2016 AADT = 9,700
ESTIMATED DESIGN YEAR = 2036 AADT = 13,800
DESIGN HOUR T = 4%
DESIGN SPEED = 45 MPH

NEW CONSTRUCTION

10" LIMEROCK BASE WITH
TYPE SP STRUCTURAL COURSE (TRAFFIC C) (3 ½") (PG 76-22)
AND FRICTION COURSE FC-12.5 (TRAFFIC C) (1 ¾") (PG 76-22)

U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 19 of 22
Modification # 82

Engineering Consultants, Inc.
11486 CORPORATE BLVD., SUITE 151
ORLANDO, FL 32817
407-901-5060

REVISIONS
NO. | BY | DATE
1 | | |
2 | | |
3 | | |

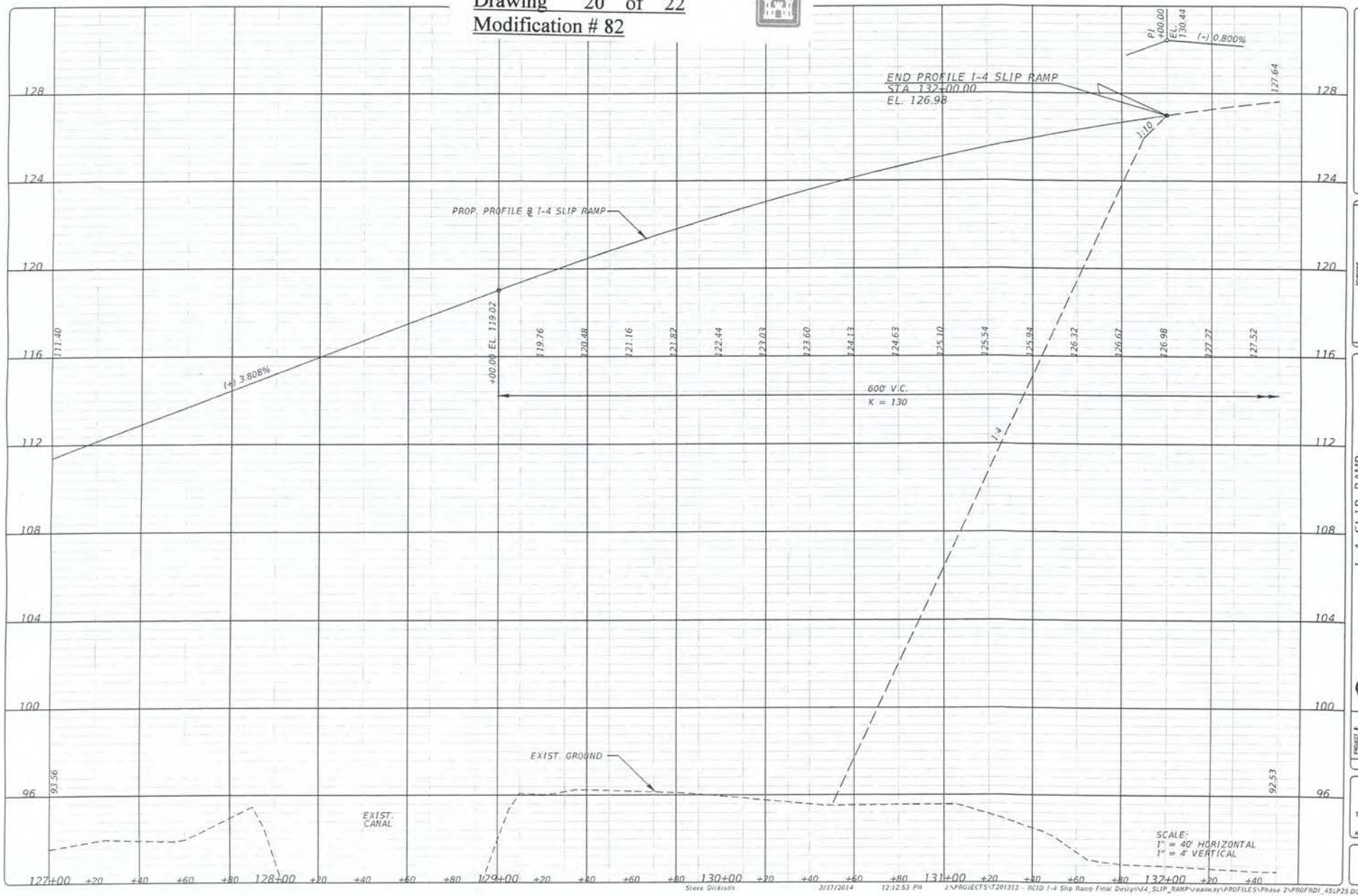
I-4 SLIP RAMP
REEDY CREEK IMPROVEMENT DISTRICT
LAKE BUENA VISTA, FL
TYPICAL SECTIONS

PROJECT # 1201313
DRAWN SWI
APPROVED SWD
DATE 03/03/2014

STEPHEN W. DICKISON, P.E.
P.E.# 56129
AUTHORIZATION # 27305

SHEET
5

U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 20 of 22
Modification # 82



Steve Dickison 3/17/2014 12:12:53 PM J:\PROJECTS\T201313 - RCID I-4 Slip Ramp Final Design\I4_SLIP_RAMP\roadway\PROFILES\Phase 2\PROFRDI_4SLP25.DGN

Engineering Consultants, Inc.
11486 CORPORATE BLVD., SUITE 151
ORLANDO, FL. 32817
407-901-5060

NO.	REVISIONS	BY	DATE
△			
△			
△			

I-4 SLIP RAMP
REEDY CREEK IMPROVEMENT DISTRICT
LAKE BUENA VISTA, FL

I-4 SLIP RAMP - PROFILE SHEETS

PROJECT # 7201308
DRAWN: SWI
APPROVED: SWD
DATE: 01/01/2014

STEPHEN W. DICKISON, P.E.
P.E.# 56129
AUTHORIZATION# 27205

SHEET
20

Exhibit 12. BVD Corridor - ACOE Impact Summary

O.U. Number	Impact Number	ACOE Wetland System Number	Landuse	FLUCCS Description	Wetlands				Remaining Permitted Impact/Created Acreage	
					Permitted Wetland Impact per O.U.	Actual Wetland Impact Acreage	Traded Acreage	Previous Impact		
	861	Wetland 9.70	630	WETLAND FORESTED MIXED	0.00	1.11	1.11	0.00	0.00	0%
	862	Wetland 9.78	625	WET PINELANDS - HYDRIC PINE	0.00	0.46	0.46	0.00	0.00	0%
	863	Wetland 9.78	625	WET PINELANDS - HYDRIC PINE	0.00	0.87	0.87	0.00	0.00	0%
	864	Wetland 9.80A	625	WET PINELANDS - HYDRIC PINE	0.00	1.91	1.91	0.00	0.00	0%
31a	865	Wetland 9.79B	524	LAKES LESS THAN 10 ACRES	0.00	0.03	0.00	0.00	0.00	0%
	865	Wetland 9.79B	524	LAKES LESS THAN 10 ACRES	0.00	0.19	0.00	0.00	0.00	0%
31a	866	Wetland 9.77	513	CANALS	0.00	0.08	0.00	0.00	0.00	0%
	866	Wetland 9.77	513	CANALS	0.00	0.20	0.00	0.00	0.00	0%
	867	Wetland 9.16A	513	CANALS	0.00	0.62	0.00	0.00	0.00	0%

APR 2 8 2014

U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 21 of 22
Modification # 82

Exhibit 12: BVD Corridor - ACOE Mitigation Summary

SW Utility Surplus Mitigation (MOD #77)					Project Impacts					
Impact Number	ACOE Wetland System Number	Landuse	FLUCCS Description	Permitted Wetland Impact per O.U. (AC)	Project	Impact Number(s)	ACOE Wetland System Number	Landuse	Wetland Impact	Acreage Remaining
287	Wetland 24.1B	630	WETLAND FORESTED MIXED	2.13	Cast Parking Expansion (MOD #79)	858	Wetland 1.6G	630	2.13	0.00
287	Wetland 24.1Q1	641	FRESHWATER MARSH	0.12	NSA Drainage Imp. (MOD #81)	860	Wetland 1.6G	630	0.12	0.00
287	Wetland 24.1Q2	641	FRESHWATER MARSH	0.25	NSA Drainage Imp. (MOD #81)	860	Wetland 1.6G	630	0.25	0.00
288	Wetland 24.1B	630	WETLAND FORESTED MIXED	1.39	Cast Parking Expansion (MOD #79)	858	Wetland 1.6G	630	1.39	0.00
					Cast Parking Expansion (MOD #79)	858	Wetland 1.6G	630	0.16	
290	Wetland 24.1B	630	WETLAND FORESTED MIXED	0.91	BVD Corridor Stormwater Project (MOD #80)	859	Wetland 9.65	630	0.75	0.00
291	Wetland 24.1B	630	WETLAND FORESTED MIXED	3.06	BVD Corridor Stormwater Project (MOD #80)	859	Wetland 9.65	630	3.06	0.00
					BVD Corridor Stormwater Project (MOD #80)	859	Wetland 9.65	630	0.05	
293	Wetland 24.1B	630	WETLAND FORESTED MIXED	2.55	NSA Drainage Imp. (MOD #81)	860	Wetland 1.6G	630	2.50	0.00
293	Wetland 24.1R	622	POND PINE	0.44	NSA Drainage Imp. (MOD #81)	860	Wetland 1.6G	630	0.44	0.00
295	Wetland 24.3	641	FRESHWATER MARSH	0.19	NSA Drainage Imp. (MOD #81)	860	Wetland 1.6G	630	0.19	0.00
297	Wetland 24.1B	630	WETLAND FORESTED MIXED	3.05	NSA Drainage Imp. (MOD #81)	860	Wetland 1.6G	630	3.05	0.00
298	Wetland 24.5A	630	WETLAND FORESTED MIXED	1.44	NSA Drainage Imp. (MOD #81)	860	Wetland 1.6G	630	1.44	0.00
					NSA Drainage Imp. (MOD #81)	860	Wetland 1.6G	630	1.30	
298	Wetland 24.5B	618	SHRUB WETLAND	1.38	**BVD Corridor (MOD #82)**	**861**	**Wetland 9.70**	**630**	**0.08**	**0.00**
					NSA Drainage Imp. (MOD #81)	860	Wetland 1.6G	630	1.14	
298	Wetland 24.5C	641	FRESHWATER MARSH	1.30	**BVD Corridor (MOD #82)**	**861**	**Wetland 9.70**	**630**	**0.16**	**0.00**
					BVD Corridor (MOD #82)	**861**	**Wetland 9.70**	**630**	**0.87**	
					BVD Corridor (MOD #82)	**862**	**Wetland 9.78**	**625**	**0.46**	
					BVD Corridor (MOD #82)	**863**	**Wetland 9.78**	**625**	**0.87**	
298	Wetland 24.5D	618	SHRUB WETLAND	2.38	**BVD Corridor (MOD #82)**	**864**	**Wetland 9.80A**	**625**	**0.18**	**0.00**
298	Wetland 24.5E	630	WETLAND FORESTED MIXED	0.74	**BVD Corridor (MOD #82)**	**864**	**Wetland 9.80A**	**625**	**0.74**	**0.00**
298	Wetland 24.5F	630	WETLAND FORESTED MIXED	0.99	**BVD Corridor (MOD #82)**	**864**	**Wetland 9.80A**	**625**	**0.99**	**0.00**
298	Wetland 24.5G	618	SHRUB WETLAND	0.53						0.53
298	Wetland 24.6A	630	WETLAND FORESTED MIXED	0.02						0.02
			Total Surplus	**22.87**				**Total Remaining**		**0.55**

U.S. Army Corps of Engineers
Permit # SAJ-1991-01901 (SP-TSD)
Date: 04/29/2014
Drawing 22 of 22
Modification # 82



RECEIVED
JAN 25 2010

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
COCOA REGULATORY OFFICE
400 HIGH POINT DR., SUITE 600
COCOA, FL 32926

REPLY TO
ATTENTION OF

Regulatory Division
North Permits Branch
Cocoa Regulatory Field Office
199101901(IP-GS)
Modification 69
LTP Time Extension

January 21, 2011

Mr. Jim Yawn
Senior Manager, Environmental Planning
Walt Disney Imagineering
Post Office Box 10215
Lake Buena Vista, Florida 32830-0215

Dear Mr. Yawn:

Reference is made to your letter dated September 30, 2009, requesting 20 year time extension of the original Department of the Army (DA) permit SAJ-1991-1901(IP-GS) issued to Walt Disney World (WDW) Company on December 21, 1992.

We have reviewed your request and have no objection to your proposed work schedule; therefore, the expiration date of your permit is hereby extended, as requested, for 20 years. The new expiration date of the DA permit is December 21, 2032. All other conditions of the permit remain in effect. You should attach this letter to the permit.

By letter dated November 23, 2009, to the U.S. Fish and Wildlife Service (FWS) the Corps stated that the request for time extension contains no modifications to the project reviewed under the existing Biological Opinions provided on December 4, 1991, and May 10, 1994. For this reason the Corps determined re-initiation of consultation is not required for the species considered in the two original Biological Opinions.

By letter dated November 23, 2009, the Corps requested informal consultation on the wood stork. The Corps determined the proposed work "may affect but is not likely to adversely affect" listed species i.e. wood stork that occurs in the project area. The determination was based on the mitigation provided at

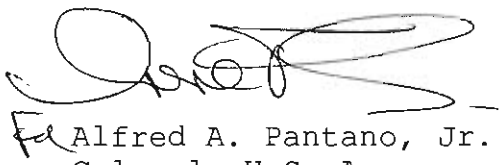
the Disney Wilderness Preserve/Walker Ranch managed by The Nature Conservancy. By letter dated January 19 2010, the FWS concurred with the Corps determination that the project as permitted "may affect but is not likely to adversely affect" wood storks. The FWS also concurred with the Corps determination that re-initiation of consultation of the existing Biological Opinions dated 4 December 1991, and 10 May 1994 is not required.

If you have any question, please contact Stephen Brooker at the Cocoa Regulatory Field Office, 400 High Point Drive, Suite 600, Cocoa, Florida 32926, or phone number 321-504-3771, extension 17.

The project described above and in the attached materials has been evaluated and found to have minimal environmental impact. The permit is hereby modified in accordance with your request provided the work is accomplished in accordance with the enclosed drawings and description above. All other conditions, limitations, and stipulations of DA permit number SAJ-1991-1901(IP-GS) are not specifically changed by this modification and remain in effect.

Thank you for your cooperation with our permit program.

BY AUTHORITY OF THE SECRETARY OF THE ARMY:



Alfred A. Pantano, Jr.
Colonel, U.S. Army
District Engineer

Enclosures

United States Department of the Interior
U. S. FISH AND WILDLIFE SERVICE
7915 BAYMEADOWS WAY, SUITE 200
JACKSONVILLE, FLORIDA 32256-7517

IN REPLY REFER TO:
FWS Log No. 2010-41910-I-0121

January 19, 2010

RECEIVED
JAN 25 2010
JACKSONVILLE DISTRICT
USACE

David S. Hobbie
Chief, Regulatory Division
Department of the Army
Jacksonville District Corps of Engineers
Cocoa Regulatory Office
400 High Point Drive, Suite 600
Cocoa, FL 32926

Re: SAJ-1991-1901 (IP-TSB)
Walt Disney World Company
20-year Extension to Existing SAJ Permit

Dear Chief Hobbie:

On December 7, 2009, Mike Dennis and Rob Bittner with Breedlove, Dennis & Associates, Inc. and James Yawn with Walt Disney Imagineering met with Paula Sisson and Heath Rauschenberger of my office to discuss the proposed extension to the existing Walt Disney World Company (WDW) Department of the Army permit SAJ-1991-1901 (IP-TSB). The extension is necessary to complete the build out of the project as previously permitted and would lengthen the life of the permit until December 21, 2032. As stated in your letter received on December 14, 2009, no modifications to permit conditions, wetland jurisdiction, impact acreages, or the mitigation plan are proposed as part of this request.

In addition to the request for an extension to the permit, it was noted at the meeting that a section of the project lies within the core foraging area of the wood stork (*Mycteria Americana*). However, according to the completed September 2008 Wood Stork Effect Determination Key (E.) that was included in your letter, this project "may affect but is not likely to adversely affect" the wood stork. Further discussion on December 7 observed that all mitigation for the project has been completed including the protection and enhancement of 8,480 acres of wetlands and uplands at the Disney Wildlife Preserve as well as 2000 acres of wetlands at the Walker Ranch consisting of significant areas of open marsh used by the wood stork.

Based on our discussion and the information received, the Fish and Wildlife Service would not object to the requested extension of Department of the Army permit SAJ-1991-1901 (IP-TSB) for WDW to complete their project plans. In addition, we concur with your determination that the proposed action may affect but is not likely to adversely affect the wood stork due to the results of the 2008 Wood Stork Effect Determination Key and the fulfillment of mitigation requirements. If you have any questions regarding this response, please contact Paula Sisson at (904)731-3134.

Sincerely,

for David L. Hankla
Field Supervisor

CC: Rob Bittner
Breedlove, Dennis, & Associates, Inc.
30 East Liberty Street
Brooksville, Florida 34601

James Yawn
Walt Disney Imagineering
215 Celebration Place, Suite 500
Celebration, Florida 34747

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
COCOA REGULATORY OFFICE
400 HIGH POINT DR., SUITE 600
COCOA, FL 32926

REPLY TO
ATTENTION OF

Regulatory Division
North Permits Branch
Cocoa Regulatory Field Office
SAJ-1991-1901(IP-TSB)
Walt Disney World Company (WDW)

November 23, 2009

Mr. Dave Hankla
U.S. Fish and Wildlife Service
7915 Baymeadows Way, Suite 200
Jacksonville, Florida 32256-7517

Dear Mr. Hankla:

Walt Disney World Company has applied for a 20-year extension of the existing Department of the Army (DA) permit number SAJ-1991-1901(IP-TSB). The requested time extension would extend the life of the Department of the Army permit until December 21, 2032. The time extension is required to complete the anticipated build out the WDW project as previously permitted. No modifications to permit conditions, wetland jurisdiction, impact acreages, or the mitigation plan are proposed as part of this time extension request. Wetland impacts remain consistent with the permit drawings for the overall WDW project. To date, approximately 50% of the permitted wetland impacts have been completed.

The authorized project is described in the attached public notice. The notice also summarizes the status of the required mitigation and previous Biological Opinion (BO) issued by the U.S. Fish and Wildlife Service (FWS).

Consultation with the FWS was previously conducted pursuant to Section 7 of the Endangered Species Act (ESA) as part of the review and approval of DA permit SAJ-1991-1901(IP-GS) issued for the WDW project. The Corps determined the proposed project "may affect, but was not likely to adversely affect" the following federally-listed animal species at the time of permit issuance: American alligator (*Alligator mississippiensis*), eastern indigo snake (*Drymarchon corais couperi*), sand skink (*Neoseps [=Plestiodon] reynoldsi*), bluetail mole skink (*Eumeces [=Plestiodon] egregius lividus*), and Florida scrub-jay (*Aphelocoma*

coerulescens), all listed by the FWS as threatened; and the bald eagle (*Haliaeetus leucocephalus*), listed by the FWS as endangered at the time of permit issuance. A determination of "may affect, but not likely to adversely affect" was also made for the following federally-listed plant species: Florida bonamia (*Bonamia grandiflora*), scrub buckwheat (*Eriogonum longifolium* var. *gnaphalifolium*), and papery whitlow-wort (*Paronychia chartacea*), all listed by the FWS as threatened; and scrub lupine (*Lupinus aridorum*), Britton's beargrass (*Nolina brittoniana*), and sandlace (*Polygonella myriophylla*), all listed by the FWS as endangered.

The Corps previously received FWS concurrence with the above determinations pursuant to Section 7 of the ESA. On December 4, 1991, the FWS issued a BO which references the Florida scrub-jay and the bald eagle. The BO indicated that no more than one Florida scrub-jay family is anticipated to be taken as a result of the WDW project and incidental take for one family is authorized. One family of Florida scrub-jay has been relocated and reports provided to FWS and FWC.

WDW established a primary protection zone of 1,500 feet with a secondary protection zone of 750 feet around bald eagle Nest Number OS-92 located within WDW property. No relocation of bald eagles has occurred and site activities have adhered to the approved management plan, as modified, to discontinue seasonal construction activities over a certain land area after it was learned that the eagle nest was no longer in the location where it had been originally mapped.

On May 10, 1994, the USFWS issued a revised BO to include species not addressed in the 1991 BO, including references to eastern indigo snake, sand skink, bluetail mole skink, and all of the aforementioned federally-listed plant species. If an eastern indigo snake is observed, the snake will be relocated to one of several conservation areas on WDW property.

The BO authorized the incidental take of sand skinks and their habitat within the small area of WDW property located on the Lake Wales Ridge. As mitigation for the potential take of sand skinks, WDW agreed to initiate and fund six specific research proposals on general biology and management of sand skinks. The FWC requested further mitigation effort to include relocation of sand skinks and funding to research the efficiency of relocation as a conservation method. WDW established eight sand skink preserves within suitable and restored sand skink habitat on WDW property and obtained FWC Permit No. OSC-TSR-1 authorizing relocation of sand skinks, eastern indigo snakes, and short-tailed snakes (*Stilosoma extenuatum*) on WDW property. To date, four relocation projects have been performed, resulting in the capture and relocation of 316 skinks to preserves within WDW

property. The sand skink preserves are also being used as recipient sites for relocation of gopher tortoises within WDW property.

In compliance with the Little Lake Bryan Development of Regional Impact (DRI), WDW agreed to designate a scrub lupine conservation area of 35 acres on WDW property to be managed for all aforementioned scrub plants, including scrub lupine. The First Amended Development Order (DO) for the Little Lake Bryan DRI issued November 30, 1999 (Findings of Fact 9.a.) determined that under the original DO, the Lupine Evaluation Area was abolished and development was permitted in that part of the northeast corner of the site not covered by the Lupine Preserve. The Second Amended DO for the Little Lake Bryan DRI issued on June 19, 2001 (Findings of Fact 3.a.) deleted reference to a Lupine Preserve Site (LPS) and abandoned the conservation easement covering the LPS because it did not sustain a population of scrub lupine. This area is now decommissioned and the conservation area vacated in accordance with Orange County and the Department of Community Affairs.

The BO indicated that the following species were not confirmed to occur within the WDW project site and therefore will not be affected by the WDW project: bluetail mole skink, pygmy fringe-tree (*Chionanthus pygmaeus*), scrub blazing star (*Liatris ohlingerae*), and scrub plum (*Prunus geniculata*).

Since no modifications are proposed to the project that was reviewed under the BO(s) provided on December 4, 1991, and May 10, 1994, the Corps has determined re-initiation of consultation is not required for the species considered in the two BO(s).

The existing BO(s) did not address the wood stork (*Mycteria americana*). Based on the 2004 Florida Wood Stork Nesting Colonies Map, part of the project is within the core foraging area (CFA) federally listed wildlife species, wood storks (*Mycteria americana*). The mitigation previously performed preserved 446 acres of wetlands on-site and 8,480 acres of wetlands and uplands located off-site at the Disney Wilderness Preserve/Walker Ranch. The Walker Ranch is managed by The Nature Conservancy. Various wetland enhancements have been successfully completed at the Walker Ranch. The completed mitigation has protected and enhanced significant areas of open marsh used by the wood stork. Over five wood stork colonies core foraging areas overlap the Disney Wilderness Preserve/Walker Ranch properties. Attached are summaries of the major wetland enhancement activities located within Disney Wilderness Preserve/Walker Ranch. A full report of the activities (actions, monitoring, and success determinations) at the Disney Wilderness Preserve/Walker Ranch is available upon request.

We have completed our evaluation and have determined that the proposed work (may effect but is not likely to adversely affect) listed species i.e. wood stork that occurs in the project area. This determination is based on the mitigation provided at the Disney Wilderness Preserve/Walker Ranch managed by The Nature Conservancy. This determination was made based on information provided by the applicant.

Therefore, pursuant to Section 7 of the Endangered Species Act of 1973, as amended, the Jacksonville District is requesting your concurrence with our determination on the wood stork. If you have any questions regarding this project and these determinations, please contact Stephen Brooker at the Cocoa Regulatory Field Office, 400 High Point Drive, Suite 400, Cocoa, Florida 32926, or phone number 321-504-3771, extension 17.

Sincerely,

S Brooker /for

David S. Hobbie
Chief, Regulatory Division

Enclosures

WOOD STORK KEY

Although designed primarily for use by Corps Project Managers in the Regulatory and Planning Divisions, and State Regulatory agencies or their designees, project permit applicants and co-sponsors of civil works projects may find this key and its supporting documents useful in identifying potential project impacts to wood storks, and planning how best to avoid, minimize, or compensate for any identified adverse effects.

A. Project within 2,500 feet of an active colony site[1].....*May affect*

Project more than 2,500 feet from a colony site.....go to B

B. Project does not affect suitable foraging habitat[2] (SFH).....*no effect*

Project impacts SFH[2].....go to C

C. Project impacts to SFH are less than or equal to 0.5 acre[3].....*NLAA*[4]

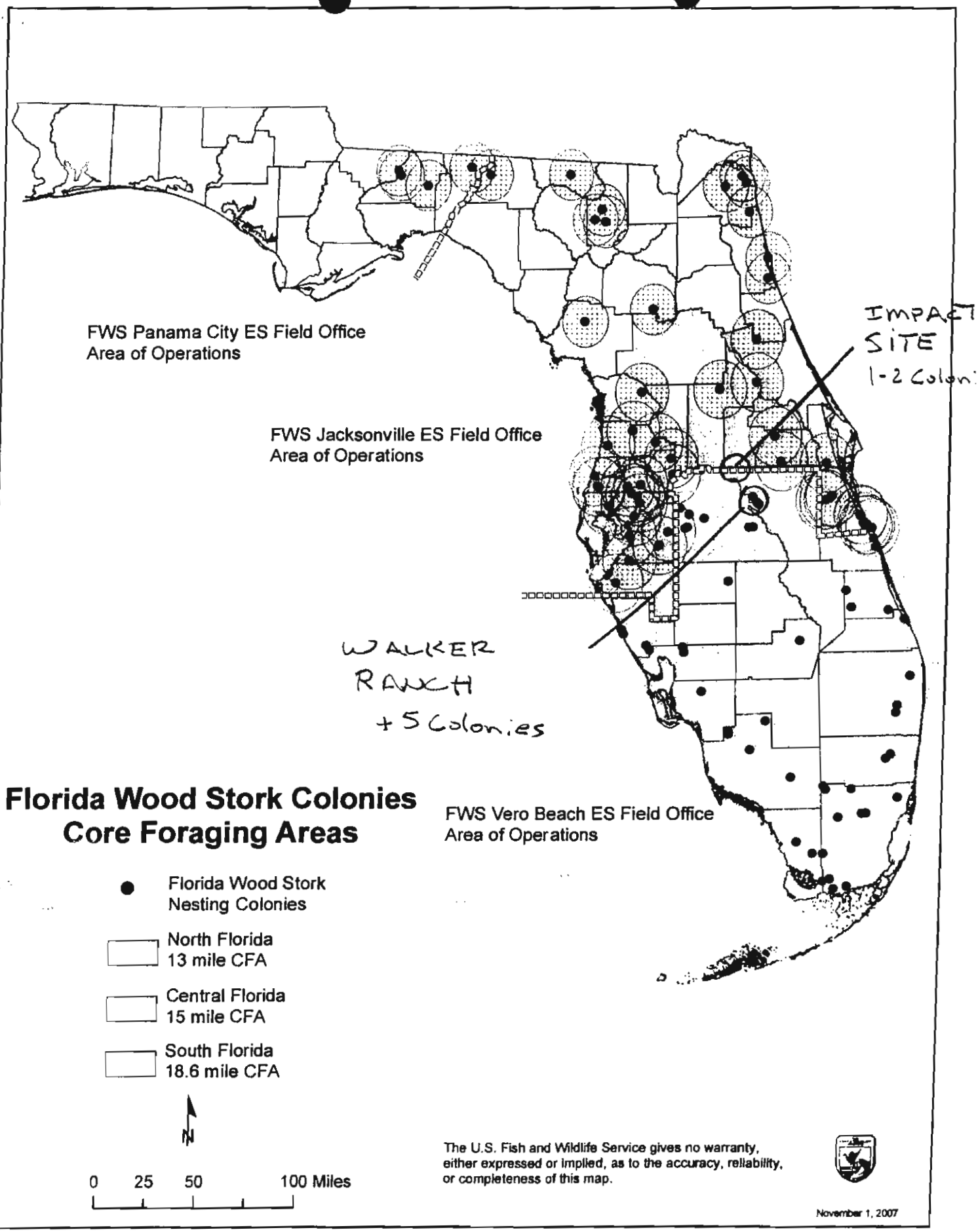
Project impacts to SFH are greater than or equal to 0.5 acre.....go to D

D. Project impacts to SFH not within a Core Foraging Area[5] (see attached map) of a colony site, and no wood storks have been documented foraging on site.....NLAA[4]

Project impacts to SFH are within the CFA of a colony site, or wood storks have been documented foraging on a project site outside the CFA .....go to E

E. Project provides SFH compensation within the Service Area of a Service-approved wetland mitigation bank or wood stork conservation bank preferably within the CFA, or consists of SFH compensation within the CFA consisting of enhancement, restoration or creation in a project phased approach that provides an amount of habitat and foraging function equivalent to that of impacted SFH (see *Wood Stork Foraging Habitat Assessment Procedure*[6] for guidance), is not contrary to the Service's *Habitat Management Guidelines For The Wood Stork In The Southeast Region* and in accordance with the CWA section 404(b)(1) guidelines...*NLAA*[4]

Project does not satisfy these elements.....*May affect*


FWS Panama City ES Field Office
Area of Operations
FWS Jacksonville ES Field Office
Area of Operations
FWS Vero Beach ES Field Office
Area of Operations
IMPACT
SITE
1-2 Colon
WALKER
RANCH
+5 Colonies
Florida Wood Stork Colonies
Core Foraging Areas
Florida Wood Stork
Nesting Colonies
North Florida
13 mile CFA
Central Florida
15 mile CFA
South Florida
18.6 mile CFA
N
0 25 50 100 Miles
The U.S. Fish and Wildlife Service gives no warranty, either expressed or implied, as to the accuracy, reliability, or completeness of this map.
November 1, 2007

United States Department of the Interior

FISH AND WILDLIFE SERVICE
6620 Southpoint Drive, South
Suite 310
Jacksonville, Florida 32216-0912

MAY 10 1994

Colonel Terrence C. Salt
District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

FWS Log No: 4-1-92-065C
Application No: 199101901 (IP-GS)
Applicant: Walt Disney World Company
County: Orange

Attn: Regulatory Division

Dear Colonel Salt:

This represents the revised Biological Opinion of the U.S. Fish and Wildlife Service (Service) in accordance with Section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq.*). This revised Biological Opinion satisfies the consultation requirements of Section 7(a)(2) of the Act. It does not address the requirements of other environmental statutes, such as the National Environmental Policy Act. A complete administrative record of this consultation is on file in this office.

PROJECT DESCRIPTION

A complete description of the project, as permitted on December 21, 1992, is summarized in the Service's December 4, 1991, Biological Opinion to the Corps.

CONSULTATION HISTORY

The Corps issued the public notice on November 7, 1991. On December 4, 1991, the Service provided a Biological Opinion to the Corps with reference to the bald eagle and Florida scrub jay. Subsequent to issuance of the opinion and Corps' permit, the applicant determined that there are additional federally listed threatened and endangered species that were not considered during the Section 7 consultation on the project site. The confirmed species are: sand skink *(Neoseps reynoldsi)*, eastern indigo snake (*Drymarchon corais couperi)*, Florida bonamia (*Bonamia grandiflora)*, scrub buckwheat (*Erigonum longifolium*

var. *gnaphalifolium*), scrub lupine (*Lupinus aridorum)*, scrub beargrass (*Nolina brittoniana)*, paper-like nailwort (*Paronychia chartacea)*, and woody wireweed (*Polygonella myriophylla)*. Species not confirmed are blue-tailed mole skink (*Eumeces egregius lividis)*, pygmy fringetree (*Chionanthus pygmaea)*, scrub blazing star, (*Liatris ohlingerae)* and scrub plum (*Prunus geniculata)*. As a result of this new information, on March 28, 1994, the Corps reinitiated Section 7 consultation on this project. The applicant has provided a report (March 18, 1994) summarizing the results of the surveys and proposing compensation to reduce and minimize the impact to several listed species.

BIOLOGICAL OPINION

EASTERN INDIGO SNAKE

During the initial review, this species was inadvertently omitted from the December 4, 1991, Biological Opinion. There have been 13 recorded sightings of this species on the Walt Disney World (WDW) site.

The development of this property may result in the incidental take of eastern indigo snakes. To compensate for wetland loss and wildlife impacts including the incidental take of Florida scrub jays, the applicant purchased Walker Ranch, 8,500 acres, in Osceola County. The eastern indigo snake has been reported on the ranch.

The applicant will instruct construction personnel on the WDW property about this species and its protected status. If an eastern indigo snake is found, the snake will be relocated to one of several conservation areas on the WDW property.

After review of the best available scientific and commercial information, it is our Biological Opinion that the project is not likely to jeopardize the continued existence of the eastern indigo snake. The snake is found throughout Florida in a variety of habitats. The acquisition of Walker Ranch (Disney Wilderness Preserve) will assist in the recovery of this species.

INCIDENTAL TAKE

Section 9 of the Endangered Species Act, as amended (Act), makes it illegal to "take" an endangered species of fish or wildlife. "Take" (as defined in the Act) means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or to attempt to engage in any such conduct. "Harm" and "harass" are further defined in Service regulations (50 CFR 17.3). "Harass" is defined as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns, which include, but are not limited to, breeding, feeding or sheltering. "Harm" is defined as an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

Under the terms of Section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement. The measures described below are nondiscretionary, and must by implemented by the agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in Section 7(o)(2) to apply.

The Federal agency has a continuing responsibility to regulate the activity that is covered by this incidental take statement. If the agency fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7(o)(2) may lapse.

The Service has reviewed the biological information for this species, information presented by the applicant's representative, and other available information relevant to this action, and based on our review, incidental take in the form of harass or harm is anticipated and authorized for all eastern indigo snakes on the project site.

When providing an incidental take statement, the Service is required to give reasonable and prudent measures it considers necessary or appropriate to minimize the take along with terms and conditions that must be complied with to implement the reasonable and prudent measures. The Service must also specify procedures to be used to handle or dispose of any individuals taken. The Service believes the following reasonable and prudent measure is necessary and appropriate to reduce the take:

> The applicant shall post information exhibits at construction sites to inform construction personnel about the eastern indigo snake.

To implement the above reasonable and prudent measure, the Service has outlined the following terms and conditions for incidental take. In accordance with the Interagency Cooperation Regulation (50 CFR 402), these terms and conditions must be complied with to implement the reasonable and prudent measures for incidental take.

1. The information exhibit shall, at a minimum, provide a picture of the eastern indigo snake and a physical description. The exhibit shall inform construction personnel that this species is protected by both federal and state laws, and if observed, should not be injured or killed.

2. If an eastern indigo snake is observed, the animal should be relocated to one of the conservation areas on WDW.

3. If a dead eastern indigo snake is found, the specimen should be frozen and the Jacksonville Field Office contacted (904-232-2580).

SAND SKINK

During the initial surveys, the sand skink had not been observed on the property. There had been no documented occurrence of this species on WDW. However, subsequent surveys revealed the presence of this species on the western edge of the project site, within habitats associated with the Lake Wales Ridge. All documented sightings in Florida have occurred in habitats that are at least 100 feet above sea level. A detailed description of trapping methodology is provided in the report submitted for reinitiation of consultation.

Sand skinks were documented at nine stations on the project site, north of US Highway 192 and west of Reedy Creek. All of the sites occupied by sand skinks were above the 100-foot contour and contiguous with the Lake Wales Ridge. The proposed project will result in the incidental take of sand skinks. However, only a small area of the project site is located on the Lake Wales Ridge, the population center for this species. Based on our review of this project, it is the Service's Biological Opinion that the small reduction of sand skink habitat on the eastern edge of its range is not likely to jeopardize the continued existence of this species.

To compensate for the incidental take of sand skinks, the applicant has proposed funding to initiate research on general biological and management issues affecting this species. The applicant has developed proposals for six specific projects. The research will be conducted by scientists knowledgeable about sand skinks. A draft contract has been prepared, and reviewed by the Service. Objectives and time tables are included in the contract. The six research proposals are:

1.0 Develop an annotated bibliography for the sand skink.

2.0 Comparative sampling efficiency of four methods (pitfall-drift fences, plywood shelters, surface raking and track counting) at detecting skinks.

3.0 Macrodistribution of sand skinks at Walt Disney World.

4.0 Microhabitat selection.

5.0 Age structure.

6.0 Response of sand skinks to land management practices.

A detailed description of each research proposal and objectives is outlined in the report (March 18, 1994) submitted for reinitiation of Section 7 consultation. On April 13, 1994, the Service received a letter from the applicant's consultant with a copy of a letter from the scientists who will conduct the research, elaborating on the proposed work. In addition to the work outlined in the March 18 report, several changes have been made. Regarding project 2.0, the sampling period has been extended for one year, and a control will be

established to measure efficacy of the different trapping techniques. Project 6.0 will include roller chopping as a land management practice.

The April 13 letter enclosed a copy of the research proposals, including dates in which interim and final reports will be completed. Quarterly reports will be submitted for proposals 2.0, 3.0, 4.0, and 5.0 with a final report by December 1995. Biannual reports will be submitted for proposal 6.0 with a final report completed by December 1997.

INCIDENTAL TAKE

See introductory explanation of incidental take under "Eastern indigo snake".

The Service has reviewed the biological information for this species, information presented by the applicant's representative, and other available information relevant to this action. Based on our review, incidental take in the form of harass or harm is anticipated for sand skinks on the project site. The Service is unable to specify the amount of take to occur. The Service, therefore, anticipates take for all sand skinks found within the project site.

When providing an incidental take statement, the Service is required to give reasonable and prudent measures it considers necessary or appropriate to minimize the take along with terms and conditions that must be complied with, to implement the reasonable and prudent measures. Furthermore, the Service must also specify procedures to be used to handle or dispose of any individuals taken. The Service believes the following reasonable and prudent measure is necessary and appropriate to reduce the take.

> The Corps should include as a special condition in the permit a requirement that the applicant complete the six research proposals outlined in the March 18, 1994, report, and modified April 13, 1994. The applicant should provide the Corps and Service a copy of the signed contract for the six research proposals.

To implement the above reasonable and prudent measure, the Service has outlined the following terms and conditions for incidental take. In accordance with the Interagency Cooperation Regulation (50 CFR 402), these terms and conditions must be complied with to implement the reasonable and prudent measure for incidental take.

1. If it is necessary to modify a study proposal, the applicant shall request prior concurrence from the Corps and Service.

2. The Corps and Service shall receive all quarterly and biannual reports, as well as the final reports.

3. If a dead sand skink is found, it should be frozen and the Jacksonville Field Office notified for further guidance (904-232-2580).

BLUE-TAILED MOLE SKINK

The project site is outside of this species' known range. Throughout the ongoing sand skink trapping effort, three mole skinks have been trapped, but were not identified as the blue-tailed mole skink. Currently, the presence of the blue-tailed mole skink has not been confirmed on WDW; therefore, the Service believes the project will not affect this species.

PLANTS

Based on plant surveys conducted for the WDW property, the following plants were observed on site: Florida bonamia, scrub buckwheat, scrub lupine, scrub beargrass, paper-like nailwort, and woody wireweed. Except for the scrub lupine, which is seriously in danger of extinction, these species are still locally abundant in at least portions of their ranges (usually the Lake Wales Ridge in Highlands and Polk Counties; for Florida bonamia, the Ocala National Forest). All of these species thrive in bare, sunny areas of scrub vegetation that are not shaded by shrubs or sand pines. As a result, scrub vegetation that is actively managed to reduce (or periodically eliminate) shrubs and sand pine cover can support these species permanently on relatively small sites. Because these plants maintain dormant seed in the soil, they are likely to appear when shrubs are removed.

The Service has previously coordinated with the applicant regarding the scrub lupine with reference to the Little Lake Bryan Development of Regional Impact (DRI). The Development Order issued for this DRI called for either designating a scrub lupine conservation area (35 acres) on WDW or an off-site area if appropriate.

The remaining plant species are restricted to the western edge of the property. The applicant has placed 35.3 acres of scrub habitat under conservation easements, which will be managed for scrub plants. The preserves are established at six sites, west of Reedy Creek. Most of the sites are currently not suitable for these plants, but through active management, to which the applicant has agreed, these sites should become suitable. It is assumed there is an adequate seed source of these plants to repopulate the preserve areas.

Based on our review, it is the Service's Biological Opinion this project is not likely to jeopardize the continued existence of the above referenced plants.

CONSERVATION RECOMMENDATION

Conservation recommendations are suggestions of the Service regarding discretionary measures to reduce or avoid adverse effects of a proposed action on listed species. Conservation recommendations may also include suggestions on ways for the Federal agency to meet its responsibility to conserve listed species under Section 7(a)(1) of the Act.

We recommend that if there is no evidence that the above listed plants are growing in the preservation areas on WDW after two years post-management, the applicant should attempt to introduce these plants into the sites.

This concludes consultation under Section 7 of the Act. If modifications are made in the project, or if additional information becomes available relating to threatened or endangered species, such as the occurrence of the blue-tailed mole skink on WDW, reinitiation of consultation may be necessary.

Sincerely yours,

Michael M. Bentzien

Michael M. Bentzien
Assistant Field Supervisor

— Don Palmer —

cc
Charles Bazemore

Steve Godley
Biological Research Associates, Inc.
3910 US Highway 301 North, Suite 180
Tampa, Florida 33619

DOS LOOS

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
3100 University Blvd. South
Suite 120
Jacksonville, Florida 32216

December 4, 1991

RECEIVED
DEC 09 1991

Bob Boos, BHB, WMD, MWC, PF, PN
Brenda Eckair 91419100

Colonel Terrence C. Salt
District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

FWS Log No:4-1-92-065C
Application No: 199101901 (IP-GS)
Applicant: Walt Disney World Company
County: Orange
Date: November 7, 1991

Dear Colonel Salt:

This represents the Biological Opinion of the Fish and Wildlife Service, pursuant to Section 7 of the Endangered Species Act of 1973, as amended, and provides our comments with reference to the Fish and Wildlife Coordination Act. A complete administrative record of this consultation is on file in this office.

Project Description

The applicant, Walt Disney World Company, has requested a 20-year permit for dredge and fill activities associated with the company's complete buildout of their property. The purpose of the project is to provide expanded entertainment, recreation, accommodations, education, shopping, office space, residential, and transportation facilities in one cohesive proposal to meet the demand for these activities at Walt Disney World (WDW) over the next 20 years. The projects call for filling 24.8 acres of open water and 533.6 acres of wetlands. The proposed dredge and fill work north of State Road (SR) 192 will be to enlarge the entertainment complexes and create two new theme parks. The work south of SR 192 will be associated with Celebration, a mixed use residential and commercial development. Due to the long-term nature of the proposal, only conceptual plans exist for many of the components of the project; however, the applicant has provided specific locations for roadways and the infrastructure necessary to serve areas proposed for future development.

RECEIVED
DEC 10 1991
ROBERT BOOS

To mitigate for the wetland loss, the applicant proposes to enhance approximately 250 acres of stressed forested wetlands adjacent to EPCOT through rehydration, and purchase a 8,500-acre tract, known as Walker Ranch, in Osceola County. The applicant proposes to place Walker Ranch under a conservation easement over the next 20 years and will restore 692 acres of wetlands on the property through rehydration. The applicant proposes that Walker Ranch be conserved and managed pursuant to a plan under the review and guidance of a "Walker Ranch Advisory Board" (WRAB) made up of representatives from the permitting and review agencies, scientists, environmental groups and the Disney Development Company.

Consultation History

The Corps issued the public notice on November 7, 1991. The Fish and Wildlife Service has been aware of this project, and has had several preapplication meetings with the applicant. There are two federally listed threatened and endangered species found within the influence of this project, the bald eagle (*Haliaeetus leucocephalus*) and the Florida scrub jay (*Aphelocoma coerulescens coerulescens*). We believe the project will have an impact on both species, therefore, this report represents the Biological Opinion of the Service.

Biological Opinion

Florida Scrub Jay

The Florida scrub jay is found throughout portions of its historic range in Florida. This species has been extirpated in extreme northeast and southwest Florida as well as much of its east and west coast range. The major population centers for scrub jays are the Ocala National Forest, the Kennedy Space Center/Canaveral Air Force Station, and the Lake Wales Ridge. Scrub jays are found in Orange County; however, their detailed distribution and status remains unknown. Since most of the land is under private ownership, its occurrence is unknown unless the landowner proposes to develop the property, at which time, threatened and endangered species surveys are required. Orange County is not within one of the population centers of the scrub jay.

On WDW property, there are several small patches of scrub habitat found north of SR 192. These small areas have been surveyed using recorded scrub jay calls, and the only group of scrub jays found is in Operational Unit (OU) 16. The scrub habitat is confined to a small ridge along both sides of a secondary road. Based on the surveys, two adult birds have been observed using this area, and one inactive scrub jay nest was found in a small live oak on the edge of the improved pasture. Areas north of the road are vegetated in longleaf pine/wire grass, intermixed with small herbaceous wetlands surrounded by titi. The scrub habitat is sparse under the longleaf pine. The development plan for OU 16 calls for a theme park. This development will eliminate this patch of scrub and result in the loss of one family of scrub jays. It is the Service's Biological Opinion, however, that the loss of one family of scrub jays on WDW is not likely to jeopardize the continued existence of this species.

Bald Eagle

In Orange County, there are approximately 14 active bald eagle nesting territories. On WDW property, one active territory is found south of SR 192, deep within the Reedy Creek drainage area. The Florida Game and Fresh Water Fish Commission has worked with the applicant to reduce the impact of Celebration on this territory. The applicant has agreed to maintain a primary zone of 1500 feet, with a secondary zone of an additional 750 feet. The Service believes these zones are adequate to protect the integrity of this territory; therefore, it is the Service's Biological Opinion this action is not likely to jeopardize the continued existence of the bald eagle.

Incidental Take

Florida Scrub Jay

Section 9 of the Act prohibits the taking of listed species without a special exemption. Taking is defined to mean harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Taking can only be authorized through special provisions. Under the terms of Sections 7(b)(4) and 7(O)(2), taking that is incidental to and not intended as part of the agency action is not considered taking within the incidental take statement.

The Service has reviewed the biological information and other available information relevant to this action, and based on our review, we anticipate that no more than one family of scrub jays will be taken as a result of the construction of this facility. The actual number of individuals may vary, depending on the time of year land clearing occurs. Walt Disney World Company is authorized, therefore, to take up to a maximum one family of Florida scrub jays in OU 16 on WDW for the purpose of constructing a theme park.

When providing an incidental take statement, the Service is required to give reasonable and prudent measures it considers necessary or appropriate to reduce the take, along with terms and conditions that must be complied with to implement the reasonable and prudent measures. Furthermore, the Service must also specify procedures to be used to handle or dispose of individual species taken.

The applicant has proposed to purchase 8,500 acres of undeveloped property in Osceola County to compensate/mitigate for wetlands on WDW that will be dredged and filled. On Walker Ranch there are 26 families of scrub jays. The applicant, with guidance from the WRAB, will manage and enhance this property for scrub jays, as well as other endangered species, such as bald eagles and red-cockaded woodpeckers.

Reasonable and Prudent measure

The applicant will purchase Walker Ranch and establish the WRAB as soon as possible.

Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the Endangered Species Act, the following terms and conditions, which implement the reasonable and prudent measure described above must be met.

1. As a part of the negotiated agreement between the agencies and applicant, Walker Ranch will be placed under a conservation easement at the time of purchase or use the ratio described in the application.

2. The WRAB shall convene within 60 days after the property is purchased to begin the process of developing management objectives for Walker Ranch.

3. Thirty days prior to construction in OU 16, the applicant will survey the scrub habitat to determine the status of scrub jays. If more than one family of scrub jays are observed, the applicant shall notify the Jacksonville Field Office (904-791-2580). If only one family continues to use the area, the applicant is free to initiate land clearing.

4. If in the course of the operational phase of the project a dead scrub jay is found, the remains should be frozen immediately, and our office contacted within 24 hours for disposition.

Bald Eagle

In meeting the provisions for incidental take in Section 7 (b)(4) of the Endangered Species Act, we have reviewed the Biological Opinion and all available information relevant to this permit action. Based on our review, incidental take is not authorized for the bald eagle during implementation of this project. If an incident involving a bald eagle occurs, all work should cease and our office notified immediately (904-791-2580).

This concludes consultation pursuant to Section 7 of the Endangered Species Act. If modifications are made in the project, such as the Walker Ranch not being purchased, or if additional information on threatened or endangered species becomes available, reinitiation of consultation may be necessary.

Fish and Wildlife Coordination Act Comments

The Service has reviewed the complete application describing in detail the conceptual plan of development, need for the project, wetland conditions, and the mitigation plan. Reviewing and permitting agencies have requested in the past that the applicant provide a complete plan of development for the WDW property. As a result, the applicant has submitted a total plan of development for the next 20 years, and has requested a 20-year permit to carry out the work. While the applicant has not provided a detailed project description for each OU, the applicant has identified those wetlands that will be dredged or filled. The applicant has requested authorization to fill approximately 533 acres of

wetlands, but acknowledges that once final plans are developed, less acreage may be impacted.

In the application, the applicant provided a detailed description of wetlands in each OU, and classified each wetland from functional to highly degraded. During the November 19, on-site inspection, the applicant showed the Service representative wetlands and explained the rating rationale. We agreed with their rationale, however, classifying a wetland is subjective. While we may disagree with some calls, overall, we do not have further comments on this particular issue.

A majority of the wetlands north of SR 192 have been severely impacted because of past efforts to drain the wetlands. The canals excavated during the 1960's have been very successful in dewatering the wetlands, which has resulted in soil subsidence and oxidation. The wetland functions have been destroyed as a result of this drainage effort.

South of SR 192, the applicant will develop Celebration, a mixed residential/commercial community. Of the 14 OU's within this development, the one that will have the most impact is OU 45. This unit is proposed for a regional mall. Within OU 45, there are isolated wetlands and some that are contiguous to Reedy Creek. These contiguous wetlands and the majority of the isolated wetlands will be filled for the mall. Other than this unit, the applicant has minimized the fill. Majority of the fill in the remaining wetlands south of SR 192 is for widening Interstate 4, constructing interchanges, and the road network system for Celebration. To develop the roadway network, it will be necessary to cross Reedy Creek at several points. The applicant will bridge these crossings. No fill will be required for the residential portion of this development.

To mitigate for wetland impacts, the applicant will restore approximately 250 acres of stressed wetlands north of EPCOT, purchase Walker Ranch in Osceola County and restore approximately 600 acres of stressed wetlands on the property. The applicant proposes to establish a conservation easement on Walker Ranch and convene a "Walker Ranch Advisory Board". The board will be responsible for developing a management plan for the property.

The Service is satisfied that the applicant has avoided and minimized wetland fill for most of the project. As discussed during the field inspection, we remain concerned about the extent of fill within OU 45. We suggested the applicant continue to evaluate alternative designs for the mall to avoid impacting the two wetland strands contiguous to Reedy Creek.

The Service supports the mitigation proposed for this project. The applicant has not completed the plans for the on-site restoration, but anticipates the final plans will be completed shortly after the end of the comment period. As discussed during the on-site inspection, we requested that rather then establishing the conservation easement using a ratio system, the applicant place the easement over the entire property immediately after the permit is issued. We want to continue to encourage the applicant to place the entire Walker Ranch under conservation easement immediately.

Based on our review of this project, the proposed mitigation, and the effort the applicant has expended to minimize the fill in wetlands, the Service does not object to issuance of this long-term permit.

This represents the views of Department of Interior.

Sincerely yours,

David J. Wesley
Field Supervisor

cc

Breedlove, Dennis & Associates, Inc.
Mark Christopher

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
COCOA REGULATORY OFFICE
400 HIGH POINT DR., SUITE 600
COCOA, FL 32926

REPLY TO
ATTENTION OF

Regulatory Division
North Permits Branch
Atlantic Permits Section
Cocoa Regulatory Office

November 18, 2009

PUBLIC NOTICE

Permit Application No. SAJ-1991-1901(IP-TSB)

TO WHOM IT MAY CONCERN: This district has received an application for a Department of the Army, Corps of Engineers (ACOE) permit extension pursuant to Section 404 of the Clean Water Act (33 U.S.C. §1344) as described below:

APPLICANT: Walt Disney World Company
Post Office Box 10000
Lake Buena Vista, Florida 32830

WATERWAY & LOCATION: Components of the Walt Disney World (WDW) project are located within canals C-1, C-2, L-404, and the West Perimeter Canal of the Reedy Creek Improvement District (RCID) Water Control Plan, in addition to wetlands adjacent to Reedy Creek, and other isolated wetlands contained within WDW property (Sections 1-4, 8-18, 21-27, and 33-36, Township 24 South, Range 27 East; Sections 6-8, 17-23, and 27-31, Township 24 South, Range 28 East; Sections 1, 2, 11-14, and 23-26, Township 25 South, Range 27 East; and Sections 5-9, 16-20, 30, and 31, Township 25 South, Range 28 East) in Orange and Osceola Counties, Florida.

The project has both on-site and off-site mitigation components which are unchanged from the original permit. The off-site mitigation component associated with the permitted project [i.e., The Nature Conservancy's Disney Wilderness Preserve (DWP) (formerly Walker Ranch)] is located approximately 12 miles south of the WDW project site within Sections 20, 21, 27-29, and 32-35, Township 27 South, Range 29 East and Sections 3, 4, 9, 10, 14-17, 21, 22, and 23, Township 28 South, Range 29 East in Osceola and Polk Counties, Florida.

Directions to the sites are as follows:

To WDW property, take I-4 to Exit 64, U.S. Hwy 192. The project extends northwest, southwest, and southeast of this intersection.

To the DWP, Take I-4 to Exit 64, U.S. Hwy 192; turn east on U.S. Hwy 192 toward Kissimmee. Continue east on U.S Hwy 192; turn south on Airport Rd/Hoagland Blvd and continue south as road becomes Pleasant Hill Rd. Continue south on Pleasant Hill Rd approximately 9.7 miles; turn east on Scrub Jay Trl. Follow Scrub Jay Trl approximately 0.4 mile to DWP entrance.

The impact and mitigation wetlands are both located within the Kissimmee Watershed (HUC 03090101), and more specifically within the Reedy Creek Basin which discharges into Lake Hatchineha.

LATITUDE & LONGITUDE: Latitude 28.4120° North
Longitude -81.5830° West

PROJECT PURPOSE:

Basic: The basic project purpose is commercial development.

Overall: The overall project purpose remains unchanged from the original permit, to build out the WDW project. WDW's primary business is providing entertainment and recreational activities focused on theme-park attractions. As an outgrowth, WDW has moved into businesses providing ancillary support services such as hotels, restaurants, associated infrastructure, et cetera. Additional project purposes include commercial and residential development.

The purpose of this modification request is to obtain a 20-year extension of the existing Department of the Army (DA) permit number SAJ-1991-1901(IP-TSB) from the date of expiration until December 21, 2032 in order to build out the WDW project as previously permitted. No other modifications are proposed as part of this time extension request.

PROPOSED WORK: On December 21, 1992, WDW Company secured a long-term (20-year) permit for the build out of WDW property encompassing approximately 31,000 acres. At the time of issuance, the WDW long-term permit was the first comprehensive permit of its kind. The history and success of the WDW long term permit and associated on-site and off-site mitigation plans

demonstrate a model planning and mitigation program. The WDW long-term permit is scheduled to expire on December 21, 2012. The applicant seeks to obtain a 20-year extension of the permit expiration date, until December 21, 2032, in order to build out the WDW project as currently permitted. No modifications to permit conditions, wetland jurisdiction, impact acreages, or the mitigation plan are proposed as part of this time extension request.

The work authorized for the WDW project under DA permit SAJ-1991-1901 (IP-TSB) remains the same as originally permitted: the discharge of fill material into, and mechanized land clearing of, approximately 446 acres of wetlands and 71 acres of open water to build out the WDW project including construction of theme parks, hotels, roads, trolley systems, commercial and residential development in the Celebration project, expansion of the Bay Lake/Seven Seas Lagoon by constructing a new canal and two new lakes, new utility corridors for overhead transmission lines and underground gas lines, improvements to existing canals, widening of existing roads, and constructing a corridor for a future mass transit system.

Wetland impacts remain consistent with the permit drawings for the overall WDW project. To date, approximately 50% of the permitted wetland impacts have been completed. No modifications to the area of impact as authorized by the existing permit are being requested as part of this time extension request.

The mitigation plan remains the same as currently permitted and incorporates both on-site and off-site mitigation components. On-site mitigation consisted of preservation of portions of the Reedy Creek corridor and associated wetlands within WDW property totaling approximately 7,983 acres. On-site mitigation also included a 410-acre of preservation (which included 227 acres of forested enhancement) as authorized by Florida Department of Environmental Protection (FDEP) [f.k.a. the Department of Environmental Regulation (DER)] Permit No. 48&492020489 and DA permit number SAJ-1991-1531 (IP-TSB) and SAJ-1991-1901 (IP-GS). The last mitigation monitoring report prepared for the on-site enhancement area has been completed, deemed successful, and the corresponding monitoring requirements have been released by the respective agencies.

Off-site mitigation included enhancement, restoration, and maintenance of the 8,480-acre Disney Wilderness Preserve (DWP) and placement of the DWP property under a conservation easement in perpetuity. Ownership of the DWP has been deeded to The

Nature Conservancy (TNC). Agency correspondence has been received documenting the successful completion of Phases 1, 2, and a portion of 3 of the 3-Phase Restoration Plan. The DWP has served as a catalyst for land conservation actions in this region, resulting in thousands of acres of contiguous conservation lands preserved in the Kissimmee River watershed.

Avoidance and Minimization Information: The applicant has provided the following information to summarize previous efforts to avoid and/or minimize impacts to the aquatic environment as currently permitted:

The previously permitted WDW project incorporated a comprehensive planning process to avoid, minimize, and compensate for wetland and surface water impacts to the greatest extent practicable by adoption of the Natural Areas Conservation Management Plan (NACMP). The stated goals of the NACMP were to: identify all jurisdictional wetlands within the WDW property, evaluate the wetland functions of each wetland area, incorporate this information as planning criteria for the siting of future projects, analyze existing wetland functions and planned developments within the context of the overall development and environmental setting, and site and design projects so that significant wetland resource values of the WDW property were maintained and/or improved. These planning objectives were accomplished during the original permitting effort through analysis and coordination between WDW Company and the Corps to evaluate avoidance, minimization, and compensation alternatives for wetland and surface water impacts associated with the development of theme-park attractions, hotel/restaurant/support services, transportation/utility infrastructure, and commercial/residential areas. Avoidance (site selection) was not considered a practicable alternative for the WDW project site by the Corps for a variety of reasons, including WDW's need for integrated attractions to efficiently serve its guests and a lack of alternative project sites requiring fewer environmental impacts. Minimization efforts were incorporated in many areas on the WDW project site to significantly decrease and fully minimize wetland impacts, particularly to wetlands associated with the Reedy Creek corridor and other wetland systems identified as important resources due to size, quality, or location.

Compensatory Mitigation: The applicant has offered the following summary of the previously permitted compensatory mitigation plan to offset unavoidable functional loss to the aquatic environment:

The previously permitted mitigation plan incorporated both on-site and off-site mitigation components which provided sufficient compensatory mitigation to off-set the permitted wetland and surface water impacts. The mitigation plan as currently permitted will remain unchanged and included the following:

> On-site preservation of portions of Reedy Creek and associated wetlands within WDW property totaling approximately 7,983 acres. [to include a 410-acre on-site forested wetland enhancement and preservation area authorized by FDEP (f.k.a. DER) Permit No. 48 & 492020489 and DA permits SAJ-1991-1531(IP-GS) and SAJ-1991-1901(IP-GS)].
>
> Off-site enhancement, restoration, and maintenance of the 8,480-acre DWP located approximately 12 miles south of the WDW project site within the same Reedy Creek drainage basin.

The majority of the permitted mitigation plan has been implemented and/or completed. The following documents the status of the mitigation plan as permitted:

> On-Site Mitigation: All permitted mitigation activities have been successfully completed. The last mitigation monitoring report prepared for the on-site enhancement area has been completed, deemed successful, and the corresponding monitoring requirements have been released by the respective agencies.
>
> Off-Site Mitigation: The entire DWP has been placed under a perpetual conservation easement and complete ownership of the DWP has been deeded to TNC, which manages 100% of the DWP. Agency correspondence has been received documenting the successful completion of Phases 1, 2, and a portion of 3 of the 3-Phase Restoration Plan.

No modifications to the permitted on-site or off-site mitigation areas are proposed as part of this time extension request.

EXISTING CONDITIONS: The WDW property as permitted consists of approximately 31,000 acres and contains approximately 11,350 acres of freshwater wetlands and water bodies subject to Section 404 regulation (as determined during the original review period). The WDW property lies within the northern sub-basin of

Reedy Creek, which is part of the Kissimmee River drainage basin. This area is characterized as a patchwork of flatwoods, swamps, and marshes, with a few upland ridges and knolls. Reedy Creek originates just outside the northwest corner of WDW property and flows south through the western half of the property. Bonnet Creek enters WDW property on the ncrtheast corner and flows south along the east side of the property. The majority of WDW property is located within the RCID.

Surrounding land uses include: S.R. 535 to the northeast; Osceola Polk Line Road and U.S. 17-92 to the south; I-4, U.S. 192, and S.R. 417 to the east; U.S.192 and S.R. 429 to the west; and I-4 to the southwest; and existing commercial and residential development, agricultural land, and undeveloped land.

ENDANGERED SPECIES: Consultation with the U.S. Fish and Wildlife Service (FWS) was previously conducted pursuant to Section 7 of the Endangered Species Act (ESA) as part of the review and approval of DA permit SAJ-1991-1901(IP-GS) issued for the WDW project. The Corps determined the proposed project "may affect, but was not likely to adversely affect" the following federally-listed animal species at the time of permit issuance: American alligator (*Alligator mississippiensis*), eastern indigo snake (*Drymarchon corais couperi*), sand skink (*Neoseps [=Plestiodon] reynoldsi*), bluetail mole skink (*Eumeces [=Plestiodon] egregius lividus*), and Florida scrub-jay (*Aphelocoma coerulescens*), all listed by the FWS as threatened; and the bald eagle (*Haliaeetus leucocephalus*), listed by the FWS as endangered at the time of permit issuance. A determination of "may affect, but not likely to adversely affect" was also made for the following federally-listed plant species: Florida bonamia (*Bonamia grandiflora*), scrub buckwheat (*Eriogonum longifolium* var. *gnaphalifolium*), and papery whitlow-wort (*Paronychia chartacea*), all listed by the FWS as threatened; and scrub lupine (*Lupinus aridorum*), Britton's beargrass (*Nolina brittoniana*), and sandlace (*Polygonella myriophylla*), all listed by the USFWS as endangered.

The Corps previously received FWS concurrence with the above determinations pursuant to Section 7 of the ESA. On December 4, 1991, the FWS issued a Biological Opinion (BO) which references the Florida scrub-jay and the bald eagle. The BO indicated that no more than one Florida scrub-jay family is anticipated to be taken as a result of the WDW project and incidental take for one family is authorized. One family of Florida scrub-jay has been relocated and reports provided to FWS and FWC.

WDW established a primary protection zone of 1,500 feet with a secondary protection zone of 750 feet around bald eagle Nest Number OS-92 located within WDW property. No relocation of bald eagles has occurred and site activities have adhered to the approved management plan, as modified, to discontinue seasonal construction activities over a certain land area after it was learned that the eagle nest was no longer in the location where it had been originally mapped.

On May 10, 1994, the USFWS issued a revised BO to include species not addressed in the 1991 BO, including references to eastern indigo snake, sand skink, bluetail mole skink, and all of the aforementioned federally-listed plant species. If an eastern indigo snake is observed, the snake will be relocated to one of several conservation areas on WDW property.

The BO authorized the incidental take of sand skinks and their habitat within the small area of WDW property located on the Lake Wales Ridge. As mitigation for the potential take of sand skinks, WDW agreed to initiate and fund six specific research proposals on general biology and management of sand skinks. The FWC requested further mitigation effort to include relocation of sand skinks and funding to research the efficiency of relocation as a conservation method. WDW established eight sand skink preserves within suitable and restored sand skink habitat on WDW property and obtained FWC Permit No. OSC-TSR-1 authorizing relocation of sand skinks, eastern indigo snakes, and short-tailed snakes (*Stilosoma extenuatum*) on WDW property. To date, four relocation projects have been performed, resulting in the capture and relocation of 316 skinks to preserves within WDW property. The sand skink preserves are also being used as recipient sites for relocation of gopher tortoises within WDW property.

In compliance with the Little Lake Bryan Development of Regional Impact (DRI), WDW agreed to designate a scrub lupine conservation area of 35 acres on WDW property to be managed for all aforementioned scrub plants, including scrub lupine. The First Amended Development Order (DO) for the Little Lake Bryan DRI issued November 30, 1999 (Findings of Fact 9.a.) determined that under the original DO, the Lupine Evaluation Area was abolished and development was permitted in that part of the northeast corner of the site not covered by the Lupine Preserve. The Second Amended DO for the Little Lake Bryan DRI issued on June 19, 2001 (Findings of Fact 3.a.) deleted reference to a Lupine Preserve Site (LPS) and abandoned the conservation

easement covering the LPS because it did not sustain a population of scrub lupine. This area is now decommissioned and the conservation area vacated in accordance with Orange County and the Department of Community Affairs.

The BO indicated that the following species were not confirmed to occur within the WDW project site and therefore will not be affected by the WDW project: bluetail mole skink, pygmy fringe-tree (*Chionanthus pygmaeus*), scrub blazing star (*Liatris ohlingerae*), and scrub plum (*Prunus geniculata*).

The existing BO did not address the wood stork (*Mycteria americana*). Based on the 2004 Florida Wood Stork Nesting Colonies Map, part of the project is within the core foraging area (CFA) federally listed wildlife species, wood storks (*Mycteria americana*). The mitigation previously performed preserved 446 acres of wetlands on-site and 8,480 acres of wetlands and uplands located off-site at the Walker Ranch. The Walker Ranch is managed by The Nature Conservancy. Various wetland enhancements have been successfully completed at the Walker Ranch. The completed mitigation has protected significant areas of open marsh used by the wood stork. The U.S. Army Corps of Engineers has made a determination that the proposed work "may effect but is not likely to adversely affect" the wood stork and is currently requesting informal consultation as defined under Section 7 of the Endangered Species Act with the U.S. Fish and Wildlife Service, by separate letter.

ESSENTIAL FISH HABITAT (EFH): Consultation with the National Marine Fisheries Service (NMFS) was previously conducted as part of the review and approval of DA permit SAJ-1991-1901(IP-GS) issued for the WDW project. By letter dated November 19, 1991, the NMFS indicated that any adverse effects that may occur to marine and anadromous fishery resources as a result of the WDW project would be minimal and that the NMFS does not object to permit issuance for the WDW project.

NOTE: This public notice is being issued based on information included in the previously issued DA permit SAJ-1991-1901(IP-GS) and information furnished by the applicant as part of the pending time extension request. This information has not been verified or evaluated to ensure compliance with laws and regulation governing the regulatory program.

The jurisdictional wetland lines for the entire WDW property were verified by Jurisdictional Determination No. 91JF-41057 on July 22, 1991. No modifications to the jurisdictional wetland

lines as previously approved and permitted are being requested as part of this time extension request.

AUTHORIZATION FROM OTHER AGENCIES: The FDEP (f.k.a. DER) issued Permit No. 48, 49 & 532039239 on December 8, 1992 for the WDW project site. On September 15, 1992, the South Florida Water Management District (SFWMD) issued long-term conceptual Management and Storage of Surface Waters (MSSW) Permit No. 48-00714-S for the WDW project site. The applicant is coordinating with the SFWMD to re-issue the Conceptual Permit under the ERP rules, which would satisfy the Water Quality Certification requirements for the Corps.

Comments regarding the application should be submitted in writing to the District Engineer at the above address within 30 days from the date of this notice. During the comment period, any person may request, in writing, that a public hearing be held to consider the application. Pursuant to 33 C.F.R. Section 325.3(a)(15), requests for public hearings shall state, with particularity, the reasons for holding a public hearing.

If you have any questions concerning this application, you may contact Mr. Stephen Brooker at the letterhead address, by electronic mail at Stephen.Brooker@usace.army.mil, by fax at 321-504-3803, or by telephone at 321-504-3771, extension 17.

The decision whether to issue or deny this request for permit time extension will be based on the information received from this public notice and the evaluation of the probable impact to the associated wetlands. This is based on an analysis of the applicant's avoidance and minimization efforts for the project, as well as the compensatory mitigation proposed.

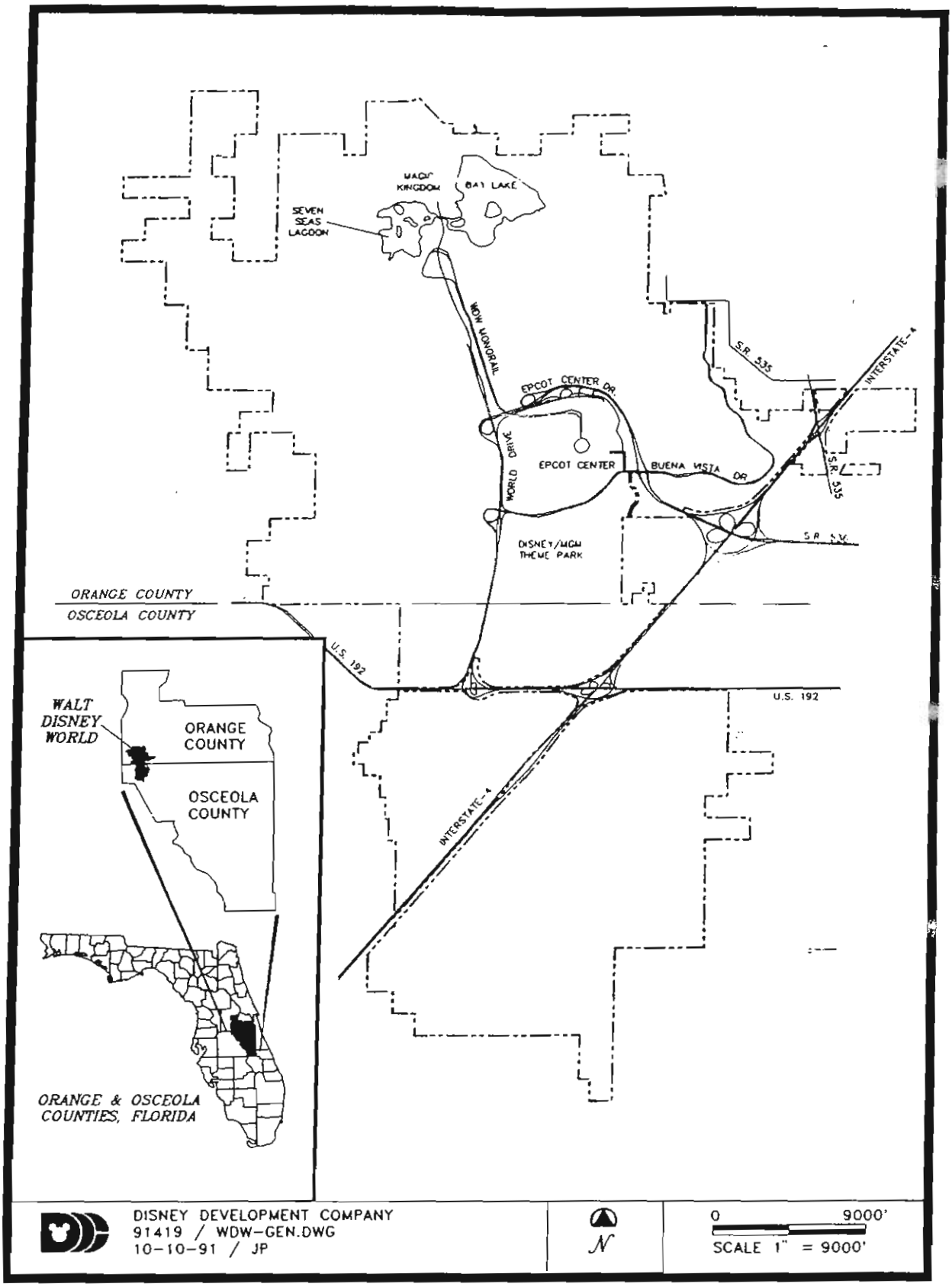
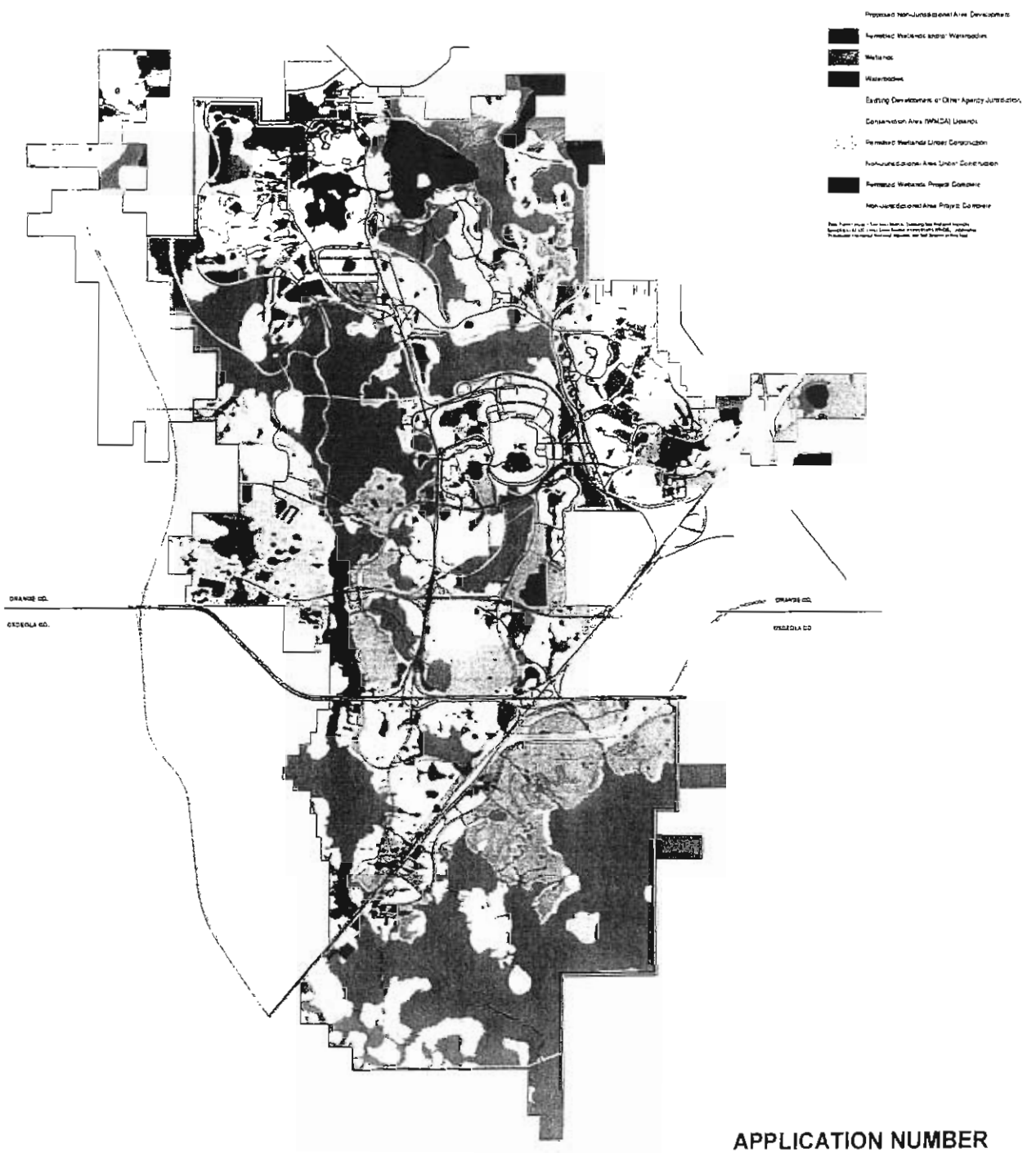


FIGURE 1. LOCATION OF WALT DISNEY WORLD, ORANGE & OSCEOLA COUNTIES, FLORIDA.

WALT DISNEY WORLD CO.
LONG TERM PERMIT

UNITED STATES ARMY CORPS OF ENGINEERS
WETLAND IMPACT TRACKING MAP
AUGUST 2009



APPLICATION NUMBER
SAJ-1991-1901 (SP-TSB)
DATE November 3, 2009
PAGE 2 of 12

WALT DISNEY WORLD
SECTION 404 WETLANDS
AND WATER BODIES

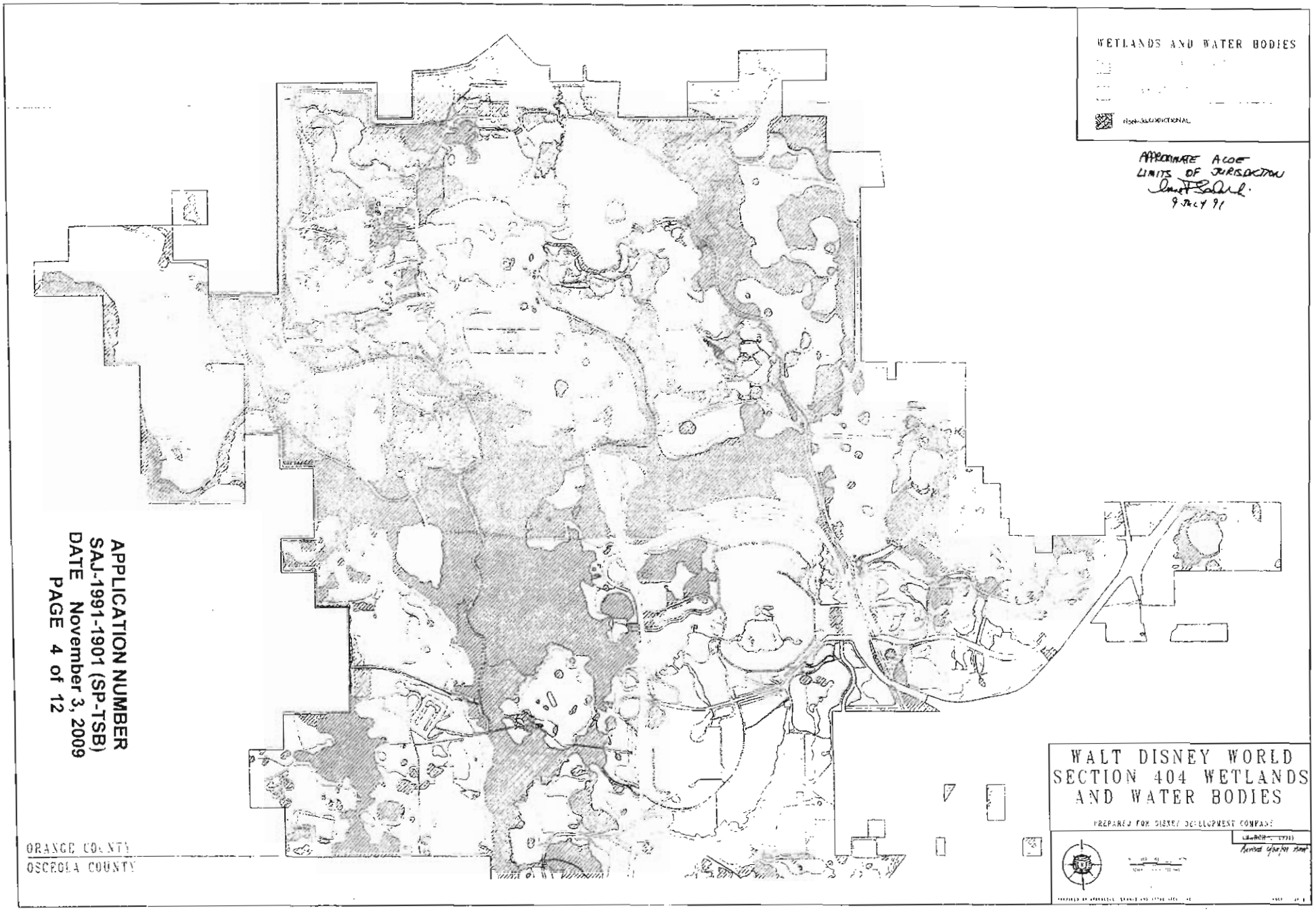
PREPARED FOR DISNEY DEVELOPMENT COMPANY

WETLANDS AND WATER BODIES

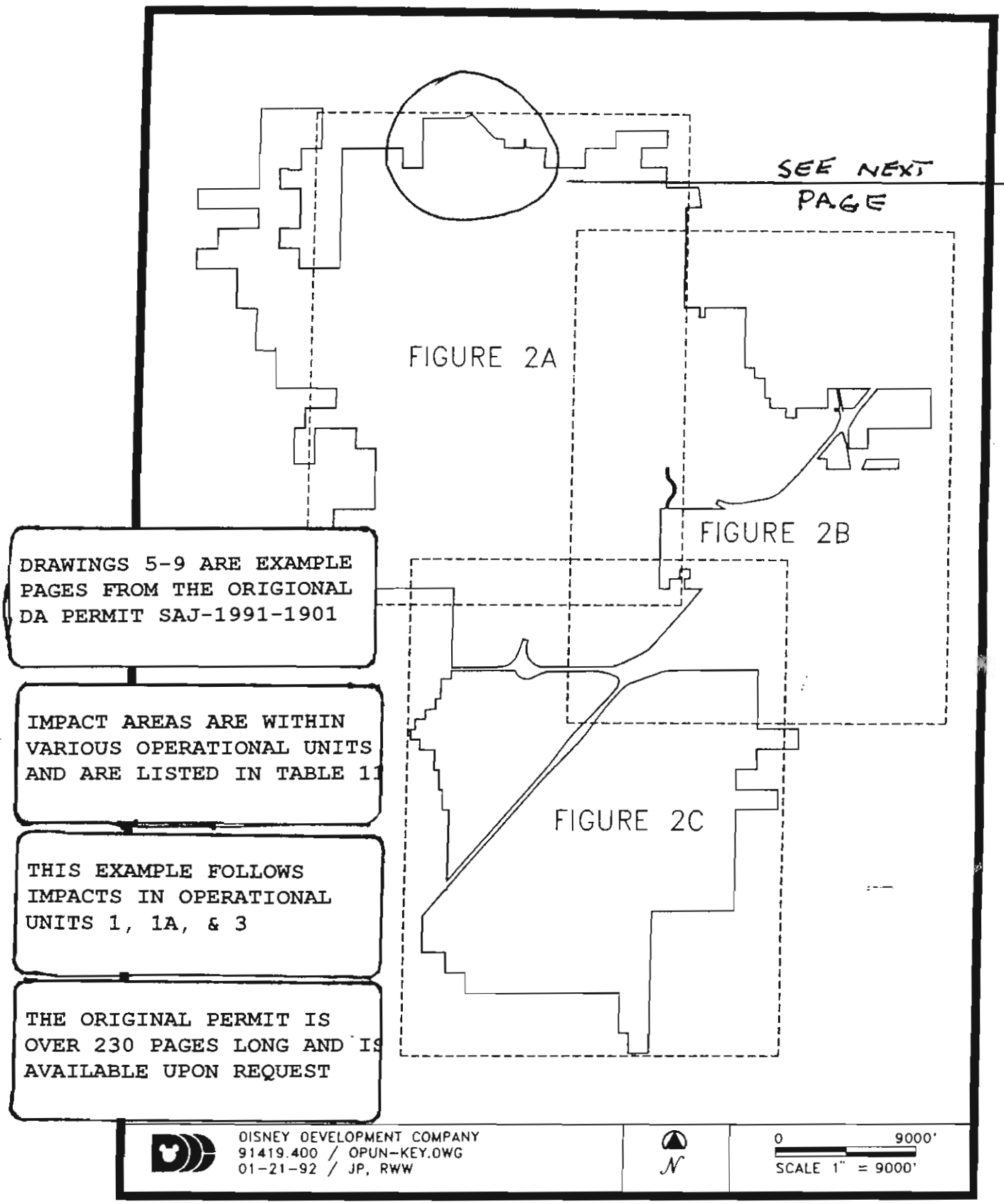
APPROXIMATE ACOE LIMITS OF JURISDICTION

ORANGE COUNTY
OSCEOLA COUNTY

APPLICATION NUMBER
SAJ-1991-1901 (SP-TSB)
DATE November 3, 2009
PAGE 3 of 12



APPLICATION NUMBER
SAJ-1991-1901 (SP-TSB)
DATE November 3, 2009
PAGE 4 of 12



REVISED FIGURE 2. DISTRIBUTION OF OPERATIONAL UNITS WITHIN WALT DISNEY WORLD, ORANGE AND OSCEOLA COUNTIES, FLORIDA

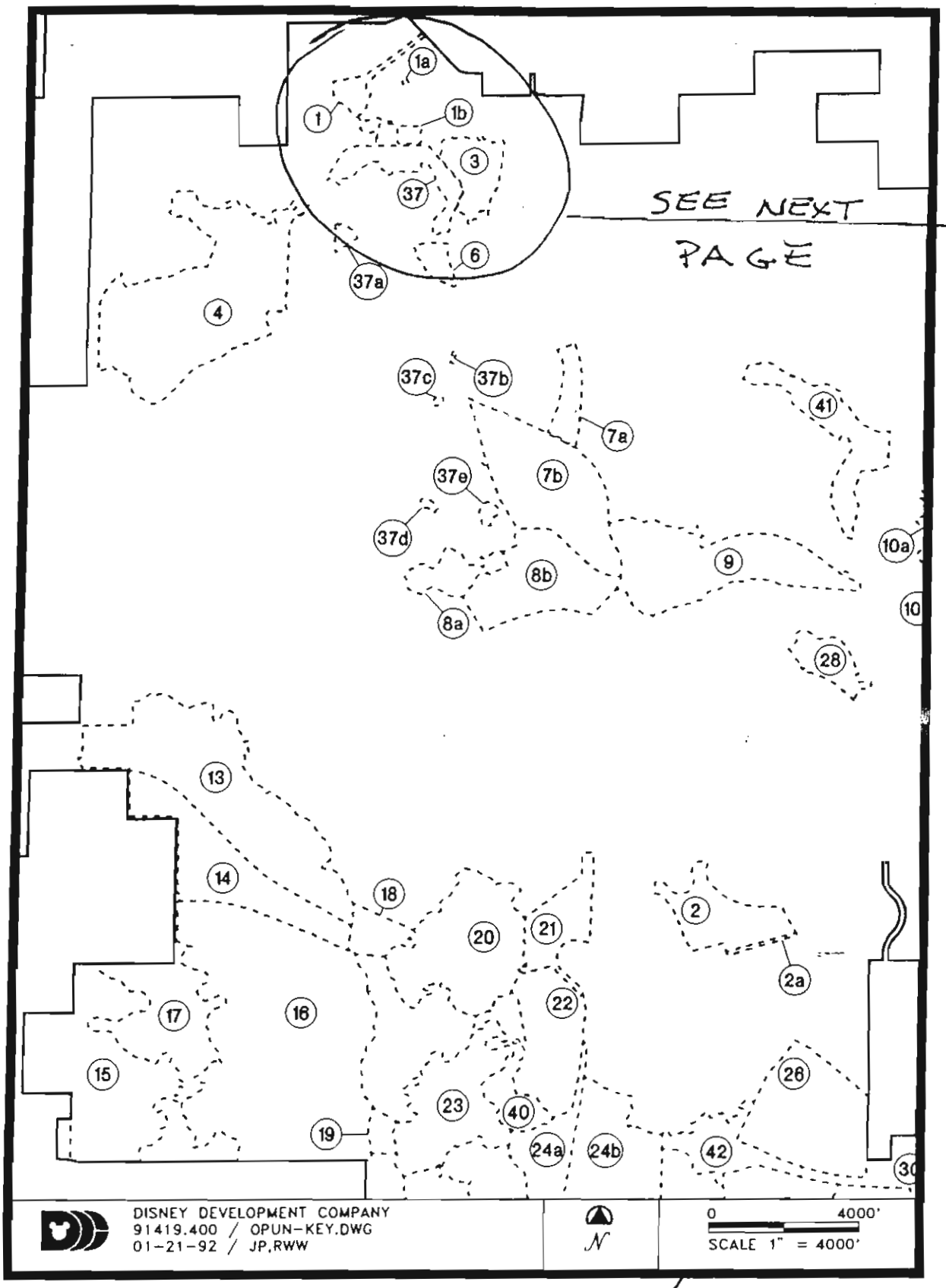
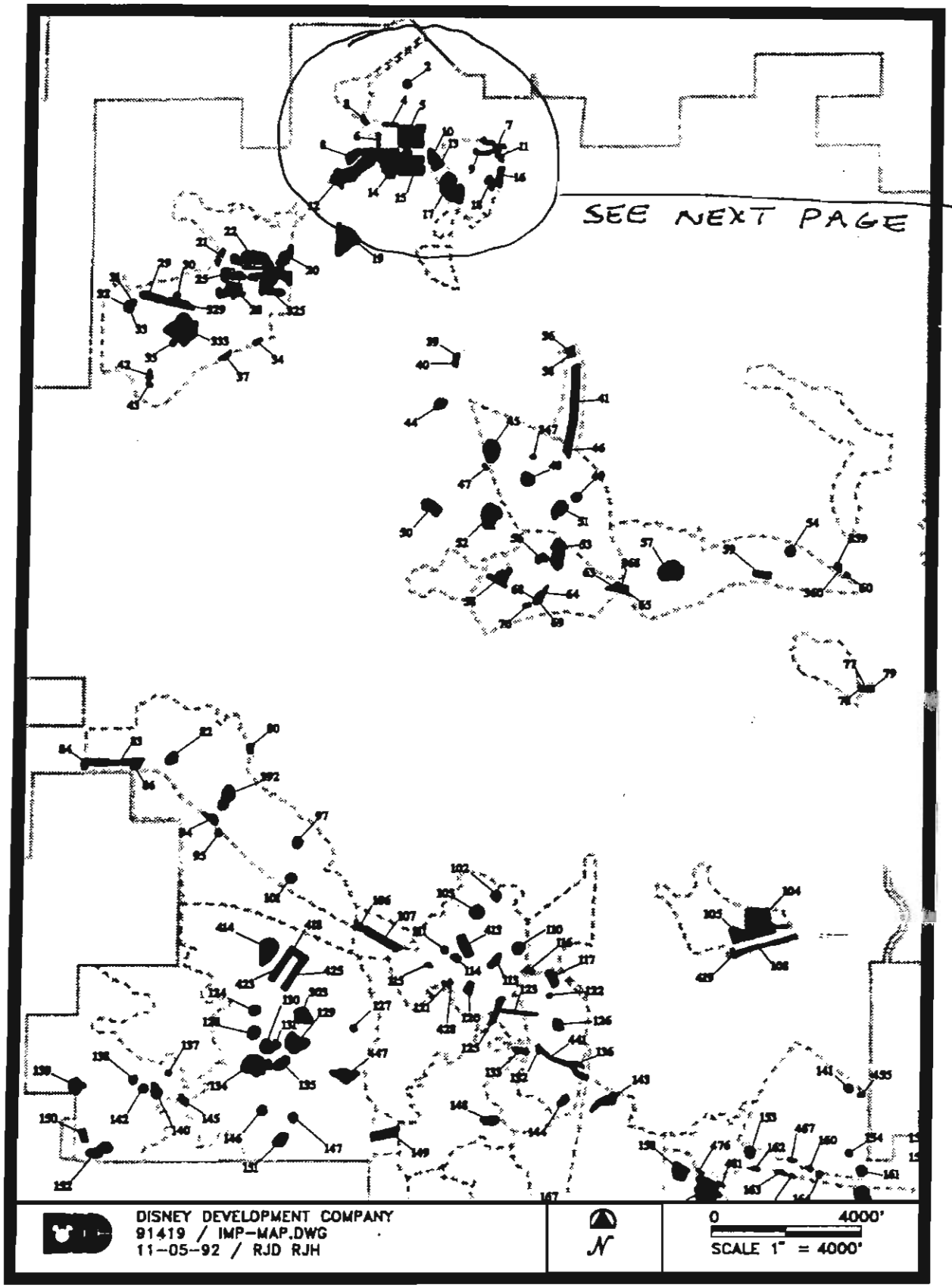


FIGURE 2A DISTRIBUTION OF OPERATIONAL UNITS WITHIN WALT DISNEY WORLD, ORANGE AND OSCEOLA COUNTIES, FLORIDA.



ACOE IMPACT NUMBER KEY MAP (A).

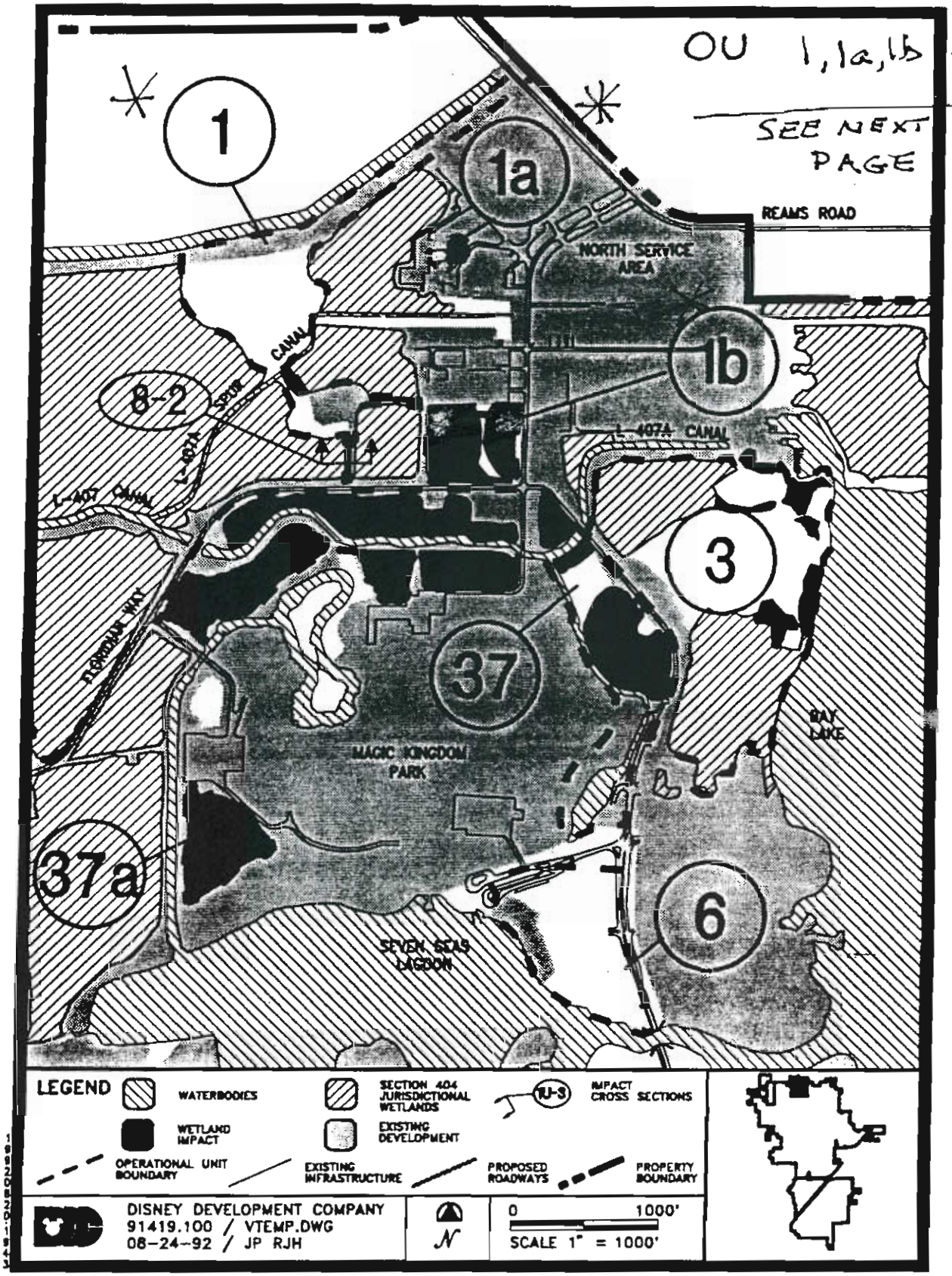


FIGURE #14C

PROPOSED SECTION 404 JURISDICTIONAL IMPACTS.
REFERENCING OPERATIONAL UNITS 1, 1a, 1b, 3,
ACOE INFORMATION SUBMITTAL, AUGUS

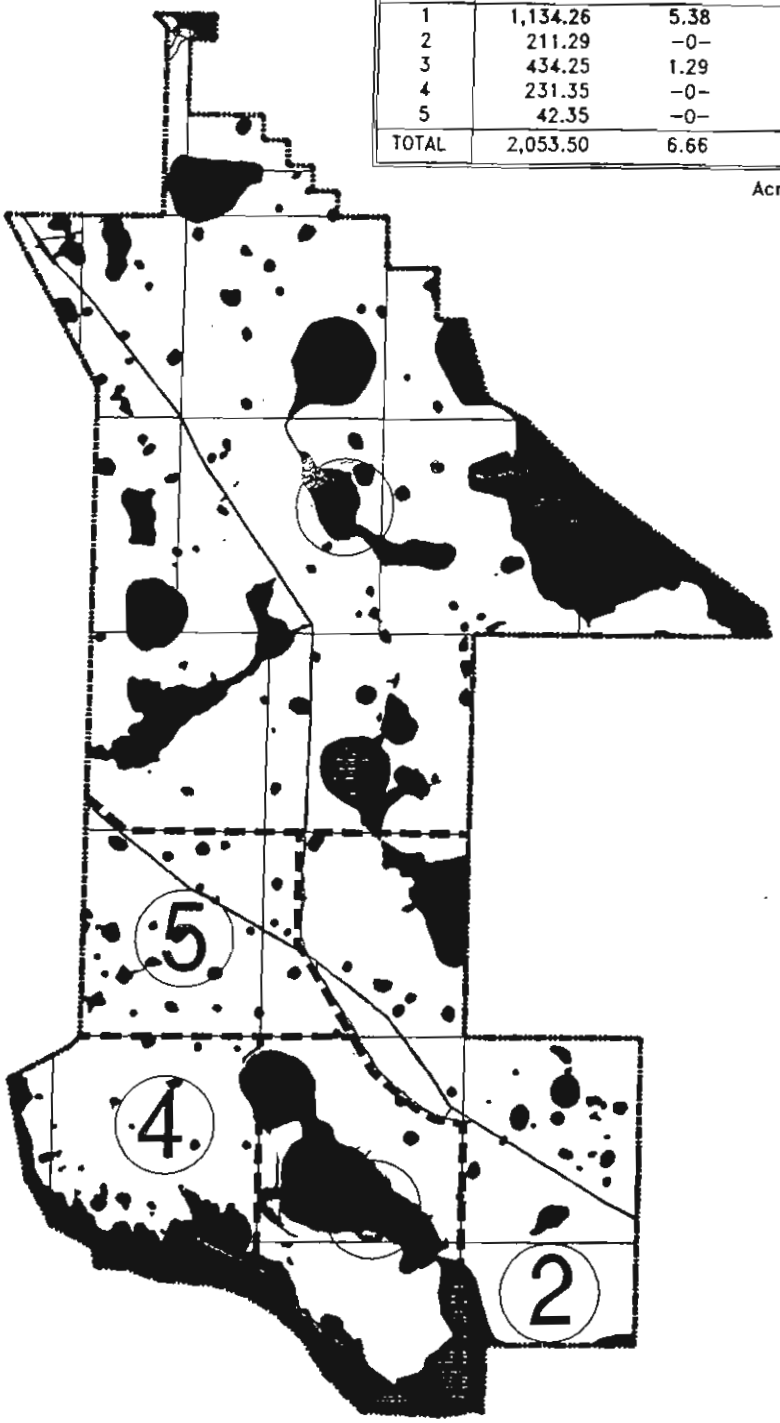
APPLICATION NUMBER
SAJ-1991-1901 (SP-TSB)
DATE November 3, 2009

Table 11. Section 404 Impacts Cross Referenced by OU Number, Impact Number, Wetland Number, and Landuse, WDW

1	2	3	4	5	6	7
Operational Unit	Impact Number	Wetland System Number	Landuse	Total Operational Unit Acreage	Wetland Impact per Operational Unit	Waterbody Impact per Operational Unit
1A	2	Wetland 1.7	563	0.49	-	0.48
1A	**TOTALS**					**0.48**
1B	5	Wetland 1.6H2	6182	7.24	0.05	-
	5	Wetland 1.6H3	6113		1.18	-
	5	Wetland 1.6H1	6313		5.30	-
1B	**TOTALS**				**6.53**	**0.00**
1	3	Wetland 1.6F	6314	28.78	0.33	-
	4	Wetland 1.6F	6314		0.23	-
	6	Wetland 1.6D	6314		0.24	-
1	**TOTALS**				**0.80**	**0.00**
2A	108	Wetland 12.1A2	6313	4.15	1.57	-
	419	Wetland 12.3	513		-	0.09
2A	**TOTALS**				**1.57**	**0.09**
2	104	Wetland 11.15B	6134	95.83	4.71	-
	105	Wetland 11.15A	6134		6.96	-
	108	Wetland 12.1A2	6313		0.01	-
	419	Wetland 12.3	513		-	0.09
2	**TOTALS**				**11.67**	**0.09**
3	7	Wetland 3.2A	6313	60.58	1.38	-
	9	Wetland 3.1	6313		0.49	-
	11	Wetland 3.2B	6313		0.29	-
	16	Wetland 3.3B	6313		0.49	-
	16	Wetland 3.3C	6412		0.69	-
	18	Wetland 3.3A	6182		1.13	-
3	**TOTALS**				**4.47**	**0.00**
4	20	Wetland 5.4	6212	389.54	2.27	-
	21	Wetland 5.2B	6314		0.56	-
	22	Wetland 5.2E	6314		0.43	-
	22	Wetland 5.2B	6314		1.05	-
	22	Wetland 5.5	6314		1.31	-
	22	Wetland 5.2D	6214		1.54	-
	22	Wetland 5.7	563		-	2.09
	22	Wetland 5.6	521		-	7.05
	25	Wetland 5.2B	6314		2.41	-
	28	Wetland 5.2C	6314		3.26	-
	29	Wetland 5.13	6214		1.92	-
	30	Wetland 5.14	6214		0.31	-
	31	Wetland 5.12	6412		0.23	-
	32	Wetland 5.10	6412		0.29	-
	33	Wetland 5.11	6412		0.14	-
	34	Wetland 5.34A	6312		0.21	-
	35	Wetland 5.19	6414		0.23	-
	37	Wetland 5.34A	6312		0.44	-
	42	Wetland 5.23	6314		0.28	-

ZONE	WETLANDS	WATERBODY	UPLANDS	TOTAL
1	1,134.26	5.38	3,398.47	4,538.11
2	211.29	-0-	1,228.16	1,439.45
3	434.25	1.29	540.33	975.86
4	231.35	-0-	569.47	800.82
5	42.35	-0-	683.90	726.25
TOTAL	2,053.50	6.66	6,420.33	8,480.48

Acreages are approximate.

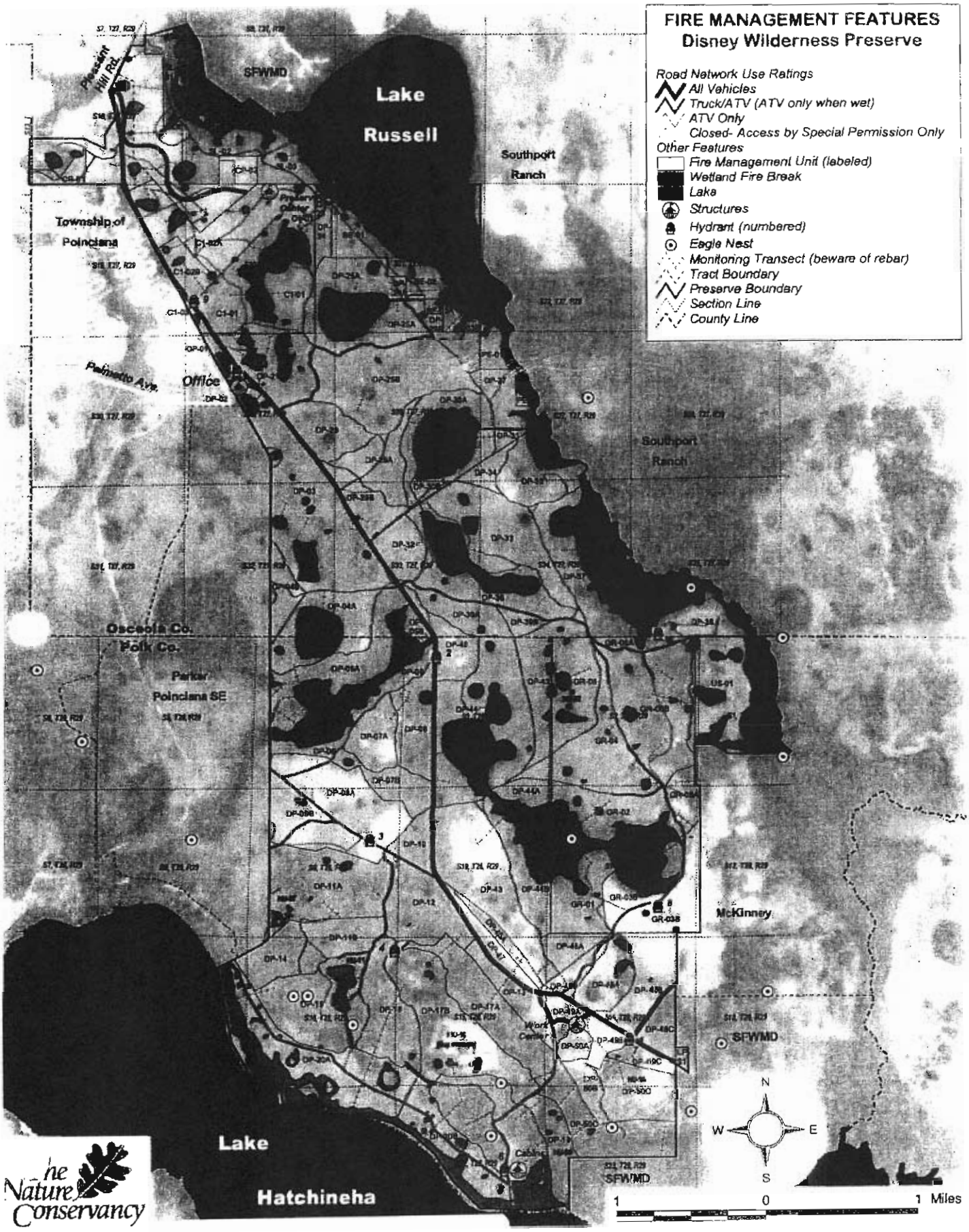


DISNEY DEVELOPMENT COMPANY
91-419.100 / MITIG.DWG
09-21-92 / RWW JP

N

0 5,000'
SCALE 1" = 5,000'

WALKER RANCH
SCHEDULE OF TITLE CONVEYANCE.



The Nature Conservancy

WALKER RANCH
DISNEY WILDERNESS PRESERVE
THE NATURE CONSERVANCY

APPLICATION NUMBER
SAJ-1991-1901 (SP-TSB)
DATE November 3, 2009
PAGE 11 of 12

WALKER RANCH
DISNEY WILDERNESS PRESERVE
THE NATURE CONSERVANCY

Table 1. Status of mitigation permits and restoration units on the Disney Wilderness Preserve, March 2009.

Project (Tracts)	Restoration Units	SFWMD Permit	SFWMD Application	SFWMD Permit Date	SFWMD Signoff	DEP Permit	DEP Signoff	ACOE Permit	ACOE Signoff	Status
DWP* - Phase I	HUs 2, 3, 8, 11	48-00714-S	930405-5	8/12/93	11/1/00	48-, 49- & 53- 2039239	8/10/01	199101901	12/18/01	Long-term monitoring
DWP* - Phase II	HUs 1, 4, 6, 7	48-00714-S	950317-5	12/14/95	8/13/03	48-, 49- & 53- 2039239	10/22/03	199101901	10/22/04	Long-term monitoring
DWP* - HU 5	HU 5	48-00714-S	950317-5 050407-13	5/25/05		48-, 49- & 53- 2039239		199101901		Active restoration
DWP* - Phase III	HUs 9, 10, 12	48-00714-S	970916-7	2/10/00		48-, 49- & 53- 2039239		199101901	HU9/10 11/30/07	HU 12-Active restoration
Graves/Candler Wetland Restoration	HUs 21-24, 31-34	48-00063-S	940223-2	2/9/95	10/5/05	48-2047639	8/31/06	198900232	10/27/06	Long-term monitoring
Candler I West Upland Restoration	URUs CIWA, CIWB	48-00063-S	001211-15	05/31/01	Pending	NA	NA	NA	NA	Compliance
Graves/Candler Upland Restoration	URUs CIN, CIE, WR, HN, HS, GVI	48-00063-S	020624-24	08/21/02		NA	NA	NA	NA	Active restoration
BRENSOLA	HU 41	48-00063-S	941114-4	8/10/95	10/5/05	48-1621969	Pending easement	198900232, 199002680	8/13/07	Long-term monitoring
PHPCII Wetland Restoration	HUs 51-53	48-00063-S	960124-4	2/13/97	Pending easement	48-1621969	Pending easement	198900232, 199002680	11/30/07	Long-term monitoring

*Disney SFWMD conceptual permit issued 9/10/92, Disney DEP long-term permit issued 12/8/92, Disney ACOE master permit issued 12/21/92.

APPLICATION NUMBER
SAJ-1991-1901 (SP-TSB)
DATE November 3, 2009
PAGE 12 of 12

CESAJ-RD-NA-M (1145b) **January 21, 2011**
SAJ-1991-01901 (IP-TSB)
Modification 69
20 Year Time Extension

MEMORANDUM FOR RECORD

SUBJECT: Department of the Army Environmental Assessment and Statement of Findings for the Above-Numbered Permit Application

1. **Applicant: Walt Disney World Project Site**
Disney Development Company

2. **Location, Project Description, Existing Conditions:**

a. Location: The Walt Disney World (WDW) project comprises approximately 31,000 acres located northwest, southwest and southeast of the intersection of Interstate 4 and US Highway 192. The project area subject to this modification request is consistent with the area previously permitted under ACOE IP No. SAJ-1991-01901 (IP-TSB); as previously permitted. The project is more specifically located within Sections 1-4, 8-18, 21-27, and 33-36 Township 24 South, Range 27 East, Sections 6-8, 17-23, and 27-31, Township 24 South, Range 28 East, Sections 1, 2, 11-14 and 23-26, Township 25 South, Range 27 East, Sections 5-9, 16-20, 30, and 31, Township 25 South, Range 28 East in Orange and Osceola Counties, Florida. The off-site mitigation component associated with the permit [i.e., Walker Ranch (The Nature Conservancy's Disney Wilderness Preserve)] is located approximately 2 miles south of SR 531 and bounded on the south by Lake Hatchineha. The off-site mitigation component of the permitted project is located within Sections 20, 21, 27-29, 32-34, and 35 Township 27 South, Range 29 East and Sections 3, 4, 9, 10, 14-17, 21, 22 and 23 Township 28 South, Range 29 East in Osceola and Polk Counties, Florida.

b. Latitude/Longitude: Center point 28.383611°; -81.569722°

c. Existing Site Conditions: The Walt Disney World Project Site is approximately 31,000 acres in size lying within the northern sub-basin of Reedy Creek, which is part of the Kissimmee River Drainage. Previously permitted development activities associated with the approximately 31,000-acre WDW project site are anticipated to result in approximately 446 acres of unavoidable wetland impacts and 71 acres of open water impacts. To date, approximately 50% of permitted wetland impacts have been completed. Wetland impacts remain

consistent with the permit drawings for the overall WDW project; no modifications to the area of impact as authorized by the existing permit are being requested as part of this time extension request.

d. Project Description: The proposed long term build out of the Walt Disney World Project Site includes the construction of theme parks, hotels, roads, trolley system, commercial, and residential development and expansion of the Bay Lake/Seven Seas Lagoon, new utility corridors for overhead electric transmission lines and underground gas lines, improvements to existing canals, widening of existing roads, and construction of a corridor for a mass transit system. With the modifications to the project made during the initial permitting the total build out will impact approximately 446 acres of jurisdictional wetlands and 71.26 acres of open water. To date approximately 50% of the proposed impacts to waters of the United States have occurred.

e. Changes to Project: Under this Modification 69, there are no changes to the proposed project as originally permitted and subsequently modified, with the exception of the requested 20 Year Time Extension. The original WDW Long Term Permit was issued on 21 December 1992. A twenty year time extension will extend the expiration date until 21 December 2032.

f. Modifications 1-68: The original permit was authorized as a long term 20 year conceptual permit. The permit anticipated a series of modifications which functioned as reporting documents. These modifications contained more specific configurations of the impacts. The greater detail was provided when specific designs were developed with construction level details required for state level permitting and contracting. There have been 68 modifications since issuance in 21 December 1992. The modifications included reporting of work performed as provided in the original drawings and some areas that were slightly modified to accommodate minor changes in designs as required.

3. Project Purpose:

a. Basic: The basic project purpose is commercial development.

b. Overall: The overall project purpose remains unchanged from the original statement of findings and permit, to build out the WDW project. WDW's primary business is providing entertainment and recreational activities focused on theme-park attractions. As an outgrowth, WDW has moved into businesses providing ancillary support services such as hotels, restaurants, associated infrastructure, et cetera. Additional project purposes include commercial and residential development.

The purpose of this modification request is to obtain a 20-year extension of the existing Department of the Army (DA) permit number SAJ-1991-1901(IP-TSB) from the date of expiration until 21 December 2032 in order to build out the WDW project as previously permitted. No other modifications are proposed as part of this time extension request.

4. **Scope of Analysis:** The scope of analysis for this project is the Walt Disney World Project Site. The original scope of analysis dated 21 December 1992, considered lands surrounding the original Disney World project for the expansion of the facility.

5. **Statutory Authority:** Section 404 of the Clean Water Act (33 U.S.C. 1344).

6. **Other Federal, State, and Local Authorizations Obtained or Required and Pending:**

a. State Permit/Certification: The Florida Department of Environmental Protection (FDEP) issued permit 48, 49 and 532039239 in 1992 and the South Florida Water Management District (SFWMD) issued a long term conceptual permit for the Management and Storage of Surface Waters on September 15, 1992 (Permit No. 49-00714-S). FDEP permit 48, 49 and 532039239 was a 20 year permit and remains active. The SFWMD long term conceptual permit has no expiration date and remains active. The FDEP and SFWMD permits constituted Section 401 State Water Quality Certification for ACOE permit Number SAJ-1991-01901 (IP-GS). An application for reissuance of the 1992 SFWMD conceptual permit under current Environmental Resource Permit rules has been submitted (Application No. 100212-12). Since State Water Quality Certification was provided for the 1992 ACOE permit (SAJ-

1991-01901 (IP-GS)), the current water quality certification remains valid until 8 December 2012, and the current Department of the Army application is solely a request for time extension, no changes to water quality are expected. Therefore, the Corps is issuing this permit extension contingent upon issuance of SFWMD permit (Permit No. 49-00714-S, Application No. 100212-12) on or before 8 December 2012. A copy of the SFWMD permit, when issued, must be submitted to the Corps and is hereby incorporated into this permit extension. No reissuance of the FDEP permit is required since, pursuant to the 1994 delegation agreement between the SFWMD and FDEP, the SFWMD processes and reviews all aspects of the surface water management system for this project including wetland impacts.

b. Coastal Zone Management (CZM) consistency/permit: There is no evidence or indication from the State of Florida that the project is inconsistent with the Florida CZM. Issuance of a DEP/SFWMD permit certifies that the project is consistent with the CZM plan.

c. Other Authorizations: No information has been received regarding any other authorizations that may be required.

7. Date of Public Notice and Summary of Comments: A public notice was issued on 18 November 2009. The purpose of the notice was to solicit comments on the proposed modification request by WDW to obtain a 20-year time extension of the existing Department of the Army (DA) permit number SAJ-1991-1901(IP-TSB) from the date of expiration until 21 December 2032 in, order to build out the WDW project as previously permitted under the original DA permit and 68 modifications.

a. Preapplication Meeting(s):

i. The Corps met with representatives of the WDW Company (Imagineering) to discuss a process for extending the long term permit. A process was outlined which included a new public notice and coordination with the Federal Resource Agencies.

ii. The application was received on 30 September 2009 and additional information was provided on 8 December 2009, at which time the application was considered complete. A public notice was issued on 18 November 2009, and sent to all interested parties including appropriate State and Federal agencies. All

comments received on this application have been reviewed and are summarized below.

(1) Federal agencies:

(a) Environmental Protection Agency (EPA): The EPA did not respond to the public notice. It is assumed that this is pursuant to their letter of 25 May 1994 which stated that the EPA would "...no longer routinely provide written responses to public notices for which we have no comment or no objection."

(b) U.S. Fish and Wildlife Service (FWS) (19 January 2010): By letter dated 23 November 2009, the Corps stated that the request for time extension contains no modifications to the project reviewed under the existing BO(s) provided on 4 December 1991, and 10 May 1994. For this reason the Corps has determined re-initiation of consultation is not required for the species considered in the two BO(s).

The 23 November 2009, letter requested informal consultation on the wood stork. The Corps determined the proposed work "may affect but is not likely to adversely affect" listed species i.e. wood stork that occurs in the project area. The determination is based on the mitigation provided at the Disney Wilderness Preserve/Walker Ranch managed by The Nature Conservancy. The Service submitted correspondence on 19 January 2010 to the Corps expressing no objection to the requested permit extension further concurring with the applicant's determination that, in accordance with the 2008 Wood Stork Key, the project as permitted "may effect but is not likely to adversely affect" wood storks. The FWS also concurred that re-initiation of consultation of the two referenced BO is not required.

(c) National Marine Fisheries Service (NMFS): By letter dated 7 December 2009, NMFS indicated the resources involved are not ones for which NOAA Fisheries is responsible and provided no comment regarding the proposal.

(2) State agencies:

(a) Florida State Historic Preservation Officer (SHPO) (December 6, 1991): As a condition of the 1991 permit the

Disney Development Company, along with the Department of State, Division of Historic Resources (DHR) developed a comprehensive historical resource assessment program to create an archaeological site database, sensitivity map, a location predictive model for the WDW project site. That program has been implemented and has functioned so as to protect cultural resources. No changes to the project or specific conditions related to historic or cultural resources are proposed as part of this modification. The project is also consistent with Florida's Coastal concerns.

(3) Local agencies: No comments received.

(4) Organizations and groups: A letter was received on 20 November 2009 from the Seminole Tribe of Florida requesting cultural resource surveys. Digital copies of cultural resource assessment reports for lands associated with the permit application, and Florida Department of Historical Resources letters concurring with those reports were provided on 24 December 2009.

(5) Individuals: No comments received.

(6) Internal Coordination (EN, Con-Ops, Real Estates, etc): Coordination no required and no comments were received.

(7) Other: No adverse comments were received from any other State or Local agencies, organizations, individuals, or other interested party.

b. Applicant's response to the comments: The comments received in response to the public notice were not coordinated with the applicant since no adverse comments were received.

c. Further coordination:

(1) The application is for a time extension, no changes to the project are proposed, therefore no further coordination was required. Modifications to authorized impacts and other specific elements of original permit have been addressed through a series of 68 separate permit modifications. The process was outlined in the original permit language.

8. Alternatives: No changes to the project as originally permitted are proposed therefore, no further analysis of alternatives is required.

a. Avoidance No changes to the project as originally permitted are proposed therefore, no further analysis of avoidance is required. The original scope of analysis provided in the 21 December 1992 Statement of Findings remains valid. Since original review and issuance, infrastructure that supports the WDW facility has improved future supporting this specific project location.

b. Minimization (modified project designs, etc.): No changes to the project as originally permitted are proposed therefore, no further analysis of minimization is required. The majority of WDW designs and development envelops have remained within the boundaries reviewed and authorized in the 1992 authorization. Some very minor impact variations that extend beyond the originally authorized development envelop have been reviewed and authorized under several modifications.

c. Compensatory Mitigation (Wetland enhancement, creations, etc): No changes to the project as originally permitted are proposed therefore, no further analysis of mitigation is required.

(1) Description of impacts: There are no changes to the project as permitted, therefore impacts remain as originally permitted and subsequently modified.

(2) Compensation: There are no changes to the project as permitted, therefore compensation to offset impacts to waters of the United States remain as originally permitted.

The mitigation plan remains the same as currently permitted and incorporates both on-site and off-site mitigation components. The last mitigation monitoring report prepared for the on-site enhancement area has been completed, deemed successful, and the corresponding monitoring requirements have been released by the respective agencies. Regarding the off-site mitigation, agency correspondence has been received documenting the successful completion of Phases 1, 2, and a portion of 3 of the 3-Phase Restoration Plan.

The preservation of the Walker Ranch and numerous enhancements to aquatic resources on the parcel has been very successful. The transfer of the Ranch to The Nature Conservancy was authorized by Modification to the DA permit. Under The Nature Conservancy significant research and academic activities that have occurred over the years that have contributed to improved restoration efforts by other groups throughout Central Florida.

d. Conclusions of Alternative Analysis: The Corps finds there have been no significant changes to the project as permitted, and mitigation is sufficient to offset the loss of wetland functions resulting from the proposed analysis. Thus, the alternative analysis provided in the December 1991 Statement of Findings for DA permit SAJ-1991-1901, remains appropriate.

9. Evaluation of the 404(b)(1) Guidelines: There are no changes to the project as originally permitted, therefore further analysis in accordance with the 404(b)(1) Guidelines is not necessary. It has been demonstrated, through the review process, that the project is the least environmentally damaging practicable alternative considering costs, existing technology, and logistics. It would not cause or contribute to violations of State Water quality standards, jeopardize the existence of any endangered species or impact a marine sanctuary. No significant degradation would be expected and all appropriate and practicable steps have been taken to minimize impacts.

10. Public Interest Review: All public interest factors were reviewed under the original permit evaluation, including but not limited to the effects the work might have on conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, land use, flood hazards, floodplain values, navigation, shore erosion and accretion, recreation, water quality, energy needs, safety, food and fiber productions, mineral needs, and consideration of property ownership. The original evaluation of each public interest factor was reviewed and reconsidered in this evaluation. There have been no significant changes in the status of each public interest factor since the original 1991 evaluation. The Crops has concluded the requested 20 year permit extension will not adversely impact any of the public interest factors.

(1) Conservation: Significant preservation areas have been protected both on-site and off-site. On-site approximately 8,000 acres have been placed under preservation easement. Following

the initial purchase of the ranch and the start of restoration/enhancement projects on the ranch, the Greater Orlando Aviation Authority (GOAA) purchased eight additional tracts of lands contiguous to or adjacent to the Preserve, six of which have been incorporated into the Preserve (2,978 acres), the other two have been deeded to the South Florida Water Management District (SFWMD) for conservation (1,987 acres). Restoration and enhancement of wetlands and uplands on these parcels have been completed and all are now in long term management by TNC or SFWMD. The Corps original evaluation of this public interest factor in the 21 December 1992 Statement of Findings (SOF), remains valid.

(2) Economics: WDW continues to be a significant economic growth element in the entire Central Florida area. The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, factor remains valid.

(3) Esthetics: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(4) General Environmental Concerns: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(5) Wetlands: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(6) Historic Properties: The project description in the Public Notice was coordinated with the SHPO and the Seminole Tribes of Florida (the Tribes). No comments were received from the SHPO. The Tribes requested the opportunity to review all cultural resource surveys over the WDW properties. WDW provided The Tribes with the information and no additional responses have been received. The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(7) Fish and Wildlife Values: The Corps re-initiated consultation under the ESA with the FWS. Results of that coordination are found under sections 7(1)(b) and 10(e) of this SOF. The general discussion of Fish and Wildlife Values provided under the Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(8) Flood Hazards: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(9) Floodplain Values: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(10) Land Use: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(11) Navigation: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(12) Shore Erosion and Accretion: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(13) Recreation: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(14) Water Supply and Conservation: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(15) Water Quality: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(16) Energy Needs: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(17) Safety: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(18) Food and Fiber Production: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(19) Mineral Needs: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

(20) Considerations of Property Ownership: The Corps original evaluation of this public interest factor in the 21 December 1992 SOF, remains valid.

b. Describe the relative extent of the public and private need for the proposed structure or work: Public benefits include employment opportunities and a potential increase in the local tax base. Private benefits include land use and economic return on the property. WDW has generated significant economic growth in the entire central Florida area.

c. Describe the practicability of using reasonable alternative locations and methods to accomplish the objective of the proposed work where there are unresolved conflicts as to resource use: There are no unresolved conflicts regarding resource use.

d. Describe the extent and permanence of the beneficial and/or detrimental effects which the proposed work is likely to have on the public and private uses to which the area is suited: Detrimental impacts are expected to be minimal although they would be permanent in the construction area. The beneficial effects realized through utilization of the property would be permanent.

e. Threatened or Endangered Species: The proposed project will not jeopardize the continued existence or critical habitat of any threatened or endangered species.

By letter dated 23 November 2009, the Corps stated that the request for time extension contains no modifications to the project reviewed under the existing BO(s) provided on 4 December 1991, and 10 May 1994. For this reason the Corps has determined re-initiation of consultation is not required for the species considered in the two BO(s). The Biological Opinions evaluated the projects affects on the following Federally listed species:

American alligator (*Alligator mississippiensis*), eastern indigo snake (*Drymarchon corais couperi*), sand skink (*Neoseps [=Plestiodon] reynoldsi*), bluetail mole skink (*Eumeces [=Plestiodon] egregius lividus*), Florida scrub-jay (*Aphelocoma coerulescens*), bald eagle (*Haliaeetus leucocephalus*), Florida bonamia (*Bonamia grandiflora*), scrub buckwheat (*Eriogonum longifolium* var. *gnaphalifolium*), and papery whitlow-wort (*Paronychia chartacea*), scrub lupine (*Lupinus aridorum*), Britton's beargrass (*Nolina brittoniana*), and sandlace (*Polygonella myriophylla*).

By letter dated 23 November 2009, the Corps requested informal consultation on the wood stork. The Corps determined the proposed work "may affect but is not likely to adversely affect" listed species i.e. wood stork that occurs in the project area. The determination is based on the mitigation provided at the Disney Wilderness Preserve/Walker Ranch managed by The Nature Conservancy. The Service submitted correspondence on 19 January 2010 to the Corps expressing no objection to the requested permit extension further concurring with the applicant's determination that, in accordance with the 2008 Wood Stork Key, the project as permitted "may affect but is not likely to adversely affect" wood storks.

f. Essential Fish Habitat: Based on the upstream location of the project site the Corps concluded the project would not affect essential fish habitat and did not consider Essential Fish Habitat (EFH) consultation required.

g. Corps Wetland Policy: The proposed wetland alteration is necessary to realize the project purpose and should result in minimal adverse environmental impacts. The benefits of the project would outweigh the minimal detrimental impacts. Therefore the project is in accordance with the Corps wetland policy.

h. Cumulative and Secondary Impacts: The original 21 December 1992, Statement of Findings discussed the secondary and cumulative impacts of the WDW build out condition. At the request of the Corps, WDW provided conceptual designs for Phase V, considered total build out of WDW land holdings. The Corps cumulative and secondary impacts analysis did not consider cumulative and secondary impacts beyond the immediate WDW land holdings. The Statement of Findings simply stated "The secondary impacts to general environmental concerns expected to result from the expansion should be adequately addressed by the comprehensive planning requirements of the State's Growth Management Act.

It is difficult at this point in the development of the WDW properties to alter either the WDW development plans or local planning surrounding the WDW properties. The cumulative secondary impacts that may have been assessed and considered in 1992 have either occurred or are being planned. Assessment of cumulative and secondary impacts of the WDW Phase V, DA permit should include both the impacts site and the mitigation site (Walker Ranch). Development at the WDW site (impact site) began

in the 1960, when there were no Federal regulations governing the development of the initial work and impacts to wetlands. The land investments and development investments were firmly established at that time. The findings of a cumulative and secondary impacts analysis meeting today's standard would be of little value given the previous irretrievable commitment of resources that have occurred.

The mitigation provided by the purchase, preservation and management of Walker Ranch has acted as a catalyst for positive cumulative and secondary effects in the Walker Ranch area. The Disney Wilderness Preserve (Preserve), located in the Upper Kissimmee River Basin in Osceola County and operated by The Nature Conservancy, is an 11,500 acre regionally significant mitigation project. Walker Ranch comprised the initial 8,480 acres of the Preserve and was purchased by Walt Disney World Companies who also provided funding for restoration/enhancement projects as well as environmental monitoring. This initial investment in conservation in this region has provided a catalyst to expanding conservation projects in this region resulting in an extensive network of projects providing an important component of environmental conservation in the Upper Kissimmee River Basin watershed.

Following the initial purchase of the ranch and the start of restoration/enhancement projects on the ranch, the Greater Orlando Aviation Authority (GOAA) purchased eight additional tracts of lands contiguous to or adjacent to the Preserve, six of which have been incorporated into the Preserve (2,978 acres), the other two have been deeded to the South Florida Water Management District (SFWMD) for conservation (1,987 acres). Restoration and enhancement of wetlands and uplands on these parcels have been completed and all are now in long term management by TNC or SFWMD.

In addition to other conservation lands in this watershed (e.g. Upper Lakes Basin Watershed, Allen David Broussard Catfish Creek Preserve State Park, Kissimmee Chain of Lakes, Kissimmee State Park), two mitigation banks have recently been permitted in this region (Southport Mitigation Bank - 3316 acres; Hatchineha Mitigation Bank - 4783 acres) and a third has a permit pending (Bullfrog Bay - 425 acres). These mitigation projects complement the region's conservation corridor which is a part of a very high priority greenway corridor connecting the everglades to the Perdido River in the panhandle.

e. Public Hearing Request: There have been no requests for a pubic hearing.

PREPARED BY:

THOMAS STEPHEN BROOKER
Project Manager

APPROVED BY:

ALFRED A. PANTANO, JR.
Colonel, Corps of Engineers
Commanding

CF:
CESAJ-RD-E

FLORIDA DEPARTMENT OF STATE
Jim Smith
Secretary of State

DIVISION OF HISTORICAL RESOURCES
R.A. Gray Building
500 South Bronough
Tallahassee, Florida 32399-0250
Director's Office (904) 488-1480
Telecopier Number (FAX) (904) 488-3353

2 January, 1992

Mr. Richard Estabrook
Piper Archaelogy/Janus Research
P.O. Box 919
St. Petersburg, Florida 33731

In Reply Refer To:
Susan Hammersten
Historic Sites
Specialist
(904) 487-2333
Project File No. 913317

Re: Cultural Resource Assessment Review Request
Research Plan for Walt Disney World's
Twenty Year Buildout Plan
Osceola and Orange Counties, Florida

Dear Mr. Estabrook:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Protection of Historic Properties"), we have reviewed the above referenced research plan and survey recommendations and have the following comments.

This office has reviewed both the research plan and the shaded quad maps indicating archaeologically sensitive areas. We find the research plan and the sensitivity maps to be complete and sufficient. This office concurs with the survey and monitoring recommendations outlined in the research plan. The use of the sensitivity maps and research plan have been incorporated into this agency's recommendations for conditions on the fifteen year buildout permit currently under review by the USACOE.

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest in protecting Florida's archaeological and historic resources is appreciated.

Sincerely,

Suzanne P. Walker

for George W. Percy, Director
Division of Historical Resources
and
State Historic Preservation Officer

GWP/Hsh

RECEIVED
OCT 27 2010

Disney Resort
Real Estate Development

September 17, 2010

RECEIVED
BUREAU OF
HISTORIC PRESERVATION
2010 SEP 20 P 12:0

Ms. Laura A. Kammerer
Deputy State Historic Preservation Officer for
Review and Compliance
Division of Historical Resources
500 South Bronough Street - Room 423
Tallahassee, Florida 32399-0250

RE: Update to Preliminary Cultural Resource Assessment of Reedy Creek Improvement District and Walt Disney World Properties, in Osceola and Orange Counties, FL

Dear Ms. Kammerer:

Please find enclosed a copy of the report for the above-referenced project for your review and comment. Janus Research conducted a cultural resources assessment survey in association with the above-referenced project on behalf of Disney Resort Real Estate Development. Fieldwork was conducted from April through June of 2010. The objective of this investigation was to identify cultural resources, assess their eligibility for listing in the National Register of Historic Places (NRHP), and evaluate any potential impacts to cultural resources listed or eligible for listing on the NRHP.

The current project is the culmination of many years of previous research. Archaeologically sensitive areas within the Reedy Creek Improvement District and Walt Disney World properties were initially identified by Piper Archaeology/Janus Research in 1990 and 1991. Since this time, several archaeological surveys have been conducted within the Reedy Creek/Disney properties in areas that were slated for development. The current report presents research associated with those remaining un-surveyed archaeologically sensitive areas that are planned for development.

Methodology for the current project is consistent with all previous Reedy Creek/Disney archaeological surveys. This methodology was established during consultation with the Division of Historical Resources (DHR) in the early 1990's and re-affirmed during recent consultation with your office. At your request, some additional background research on historic roads and trails was conducted for the current project.

P.O. Box 10215, Lake Buena Vista, FL 32830-0215
Tel 407.566.1900 Fax 407.566.4221

© Disney

A total of nine, separate, previously un-surveyed properties were included in the current study. Specifically, these properties are located in Sections 1-3, 10, 15, 22 and 36 of Township 24 South, Range 27 E, Sections 6, 13, 18, 19, 24 and 31 of Township 24 South, Range 28 East, Section 6 of Township 25 South, Range 28 East and Sections 1 and 26 of Township 25 South, Range 27 East on the Windermere (1980) and Intercession City (1970) USGS Quadrangles in Orange and Osceola Counties, Florida. The archaeologically sensitive areas within these nine properties consist of approximately 857.3 acres.

This survey complied with Section 106 of the National Historic Preservation Act (NHPA) of 1966 (Public Law 89-655, as amended), as implemented by 36 CFR Part 800 (Protection of Historic Properties, effective January 2001) and Chapter 267, Florida Statutes. The investigations also complied with the standards of the Florida Division of Historical Resources' (FDHR) Cultural Resource Management Standards and Operational Manual (February 2003); and Chapter 1A-46 (Archaeological and Historical Report Standards and Guidelines), Florida Administrative Code.

The Principal Investigator, James Pepe, M.A., R.P.A, meets the minimum qualifications for archaeology, history, architecture, architectural history, or historic architecture contained in 36 CFR 61 (Procedures for Approved State and Local Historic Preservation Programs, Appendix A, Professional Qualifications Standards). Archaeological field investigations were conducted under the direction of Cliff Jenks, M.A. and Adam Schieffer (M.A. in progress).

The present CRAS resulted in identifying and documenting three new archaeological sites (8OR9984, 8OR9985 and 8OR9986) and seven archaeological occurrences (A.O. Nos. 1-7). The sparse number of artifacts, lack of encountered cultural features and limited distribution of materials recorded at all three sites suggest that they represent low density campsites. As such, sites 8OR9984, 8OR9985 and 8OR9986, are recommended as ineligible for listing in the NRHP. No additional testing of these sites is recommended.

© Disney

This update report together with prior reports documents the cultural resource surveys recommended by Janus Research, consistent with DHR-approved methodology. These reports support the WDW Long Term Permits and the extensions of these permits that are currently in process.

If you have questions, please contact James Pepe at (813) 636-8200, or me at (407) 566-4057. Thank you for your help and attention on this effort.

Sincerely,

Jim Yawn, CEP, LEED AP
Senior Manager - Environmental

Enclosures

cc: Kathryn Kolbo, Reedy Creek Improvement District
James Pepe, Janus Research

Please sign below if you concur with the recommendations outlined in the subject report and this letter.

Laura A. Kammerer

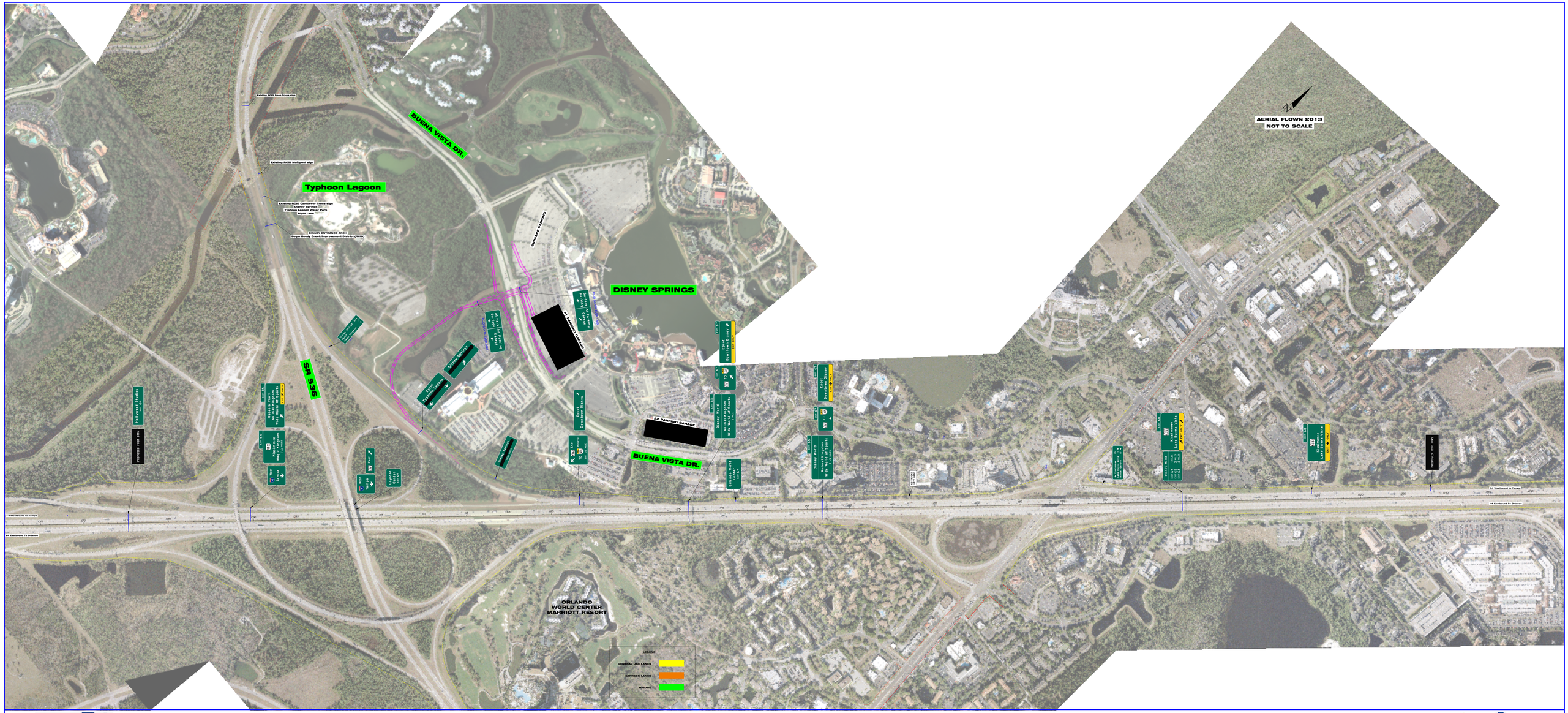
Laura Kammerer
Deputy SHPO, Florida Division of Historical Resources

10.25.2010
Date

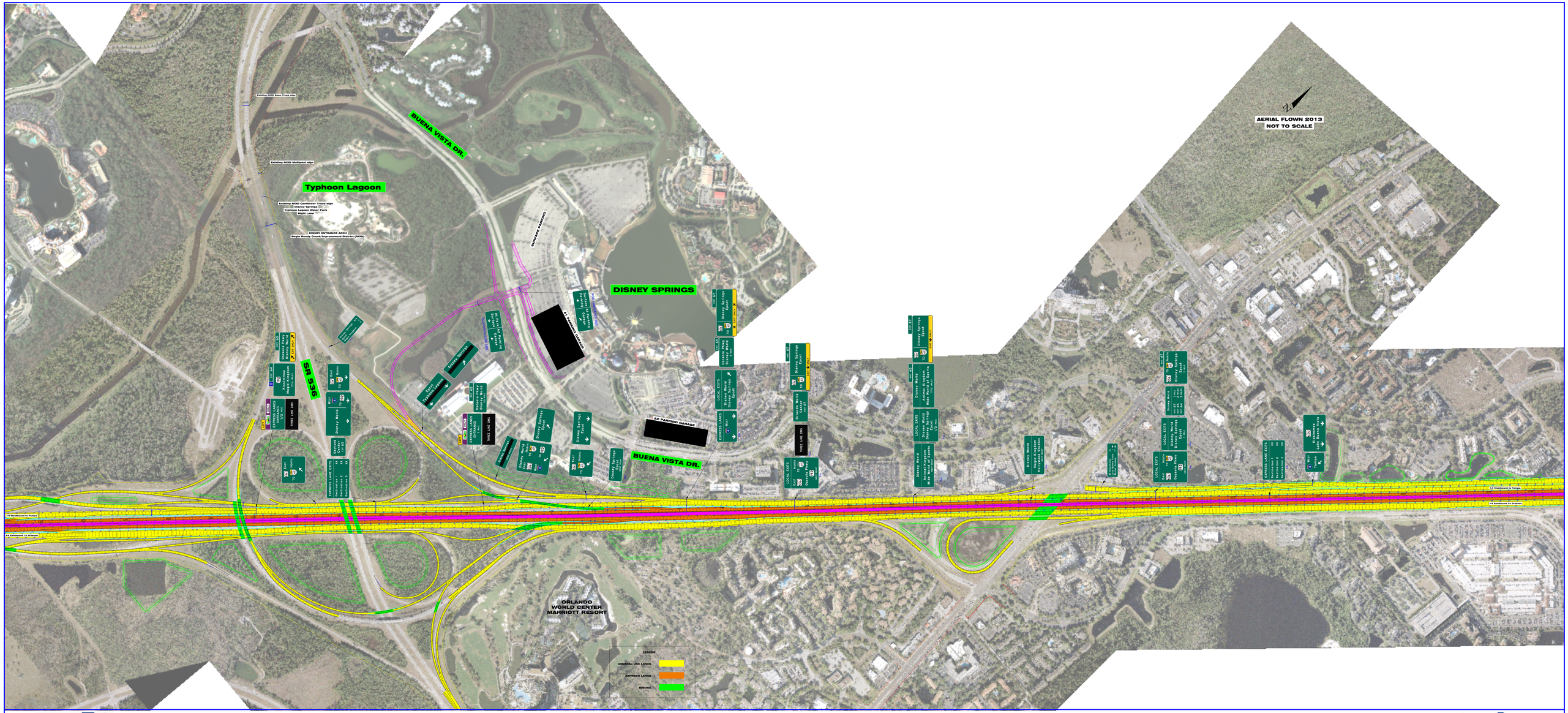
DHR# : 2010-04426

© Disney

Appendix H – Conceptual Signage Plan



SR-400 (I-4) Segment 1
SR 536 / I-4 INTERCHANGE (Westbound signing to SR 536 Only)



FDOT

SR-400 (I-4) Segment 1
SR 536 / I-4 INTERCHANGE (Westbound signing to SR 536 Only)

4 EXPRESS