

2015

Quality/Level of Service Training

Planning Level Analysis

Handout Slides

April 2015

Tampa





2015
Quality/Level of Service Training

Planning Level Analysis

April 2015

Centennial
FDOT
1915 ★ 2015

INTRODUCTION

Introductions

- Martin Guttenplan
- Gina Bonyani
- Nathan Hicks

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INTRODUCTION

Housekeeping

- Questions—ask lots of them at any time!
 - Acronyms – ask if you do not understand them

Restrooms

3

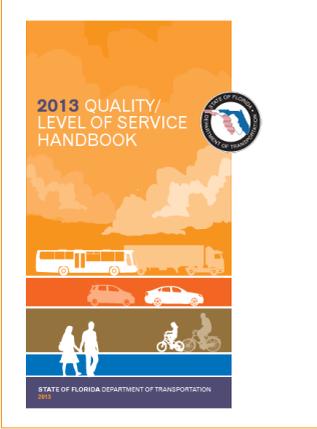


Set phones to vibrate/silent



INTRODUCTION

www.dot.state.fl.us/planning/systems/programs/sm/los/



2013 QUALITY/ LEVEL OF SERVICE HANDBOOK

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION
2013

[Download PDF of Q/LOS Handbook](http://www.dot.state.fl.us/planning/systems/programs/SM/los/pdfs/2013%20QLOS%20Handbook.pdf)

www.dot.state.fl.us/planning/systems/programs/SM/los/pdfs/2013%20QLOS%20Handbook.pdf

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INTRODUCTION

Overview of Course Material

1. Traffic Concepts and Key Variables Affecting Level of Service (LOS)
2. Data Sources
3. Generalized Service Volume Tables
4. LOSPLAN
5. Monroe St. Video Data & QLOS Analysis
6. Freeway Analysis
7. Applications of QLOS & Wrap-Up



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Notice the Page Curls #

INTRODUCTION

Agenda – Day One

8:30 AM	1 Introductions and Key Concepts
9:00 AM	2 Input Variables
9:40 AM	3 Data Sources
◀ 10:10 AM Break	
10:25 AM	4 Generalized Service Volume Tables
11:00 AM	5 Introduction to LOSPLAN
◀ 11:45 AM Lunch	
1:00 PM	6 HIGHPLAN
1:30 PM	7 ARTPLAN Introduction
◀ 2:15 PM Break	
2:30 PM	8 ARTPLAN – Intermediate & Multimodal
◀ 4:30 PM Adjourn	



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Agenda – Day Two

8:30 AM	9 Multimodal LOS Review
9:00 AM	10 ARTPLAN – Bus Analysis
9:40 AM	11 Monroe Street Video Data Collection
◀ 10:10 AM Break	
10:25 AM	12 Monroe Street ARTPLAN analysis
◀ 11:45 AM Lunch	
1:00 PM	13 FREEPLAN – Freeway analysis
◀ 2:30 PM Break	
2:45 PM	14 Future Year Analysis, LOS Applications
4:00 PM	15 Wrap-Up
◀ 4:30 PM Adjourn	

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INTRODUCTION

Course Objectives

- 

Move from understanding basic traffic concepts to hands-on capacity and quality of service analysis
- 

Gain proficiency in planning analysis
- 

Gain proficiency in multimodal QOS
- 

Understand the factors that have the greatest impact on the results
- 

Identify key differences between LOSPLAN and other tools

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INTRODUCTION

Quality/Level of Service

Introduction and Key Concepts

Agenda Item 1

- Name
- Agency
- Experience with Q/LOS



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INTRODUCTION



Mission Statement

The department will provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity and preserves the quality of our environment and communities.

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INTRODUCTION



Importance of Mobility



“Ensuring **mobility** for people and goods is transportation’s most essential function.”

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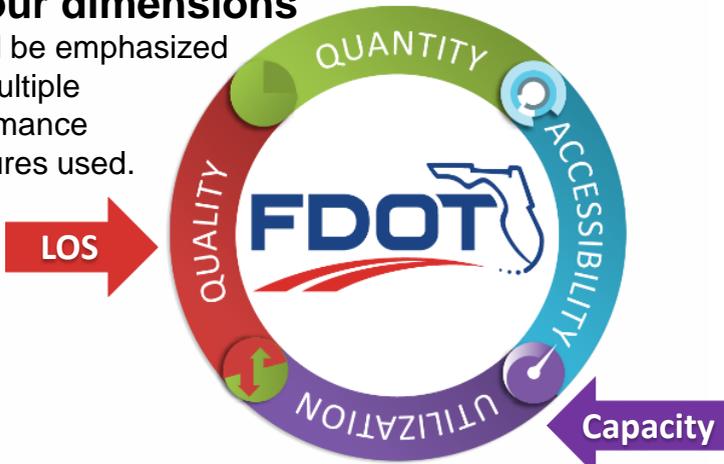


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4 Dimensions of Mobility

To adequately address mobility, **all four dimensions** should be emphasized and multiple performance measures used.



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Concepts Apply to All Modes

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INTRODUCTION

Quality of Service and Capacity Analyses

LOS → **Quality of service and capacity analyses are at the heart of "ensuring mobility of people and goods."** ← **Capacity**

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INTRODUCTION

Five Important Definitions

	Quality of Service
	Level of Service
	Highway
	Multimodal
	Capacity

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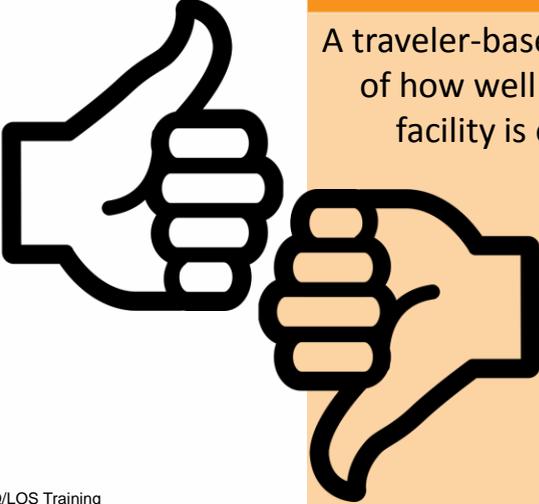
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Five Important Definitions

Quality of Service

A traveler-based assessment of how well a service or facility is operating



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Five Important Definitions

LOS A-F should not be thought of as school grades.

A young girl with braided hair, wearing a pink long-sleeved shirt, is looking down at a white report card. A large red 'X' is superimposed over the report card, indicating that Level of Service (LOS) should not be compared to school grades. The report card has some text visible, including 'DISCARD', 'MATH', 'SCIENCE', 'PHYS. ED.', and 'ARTS'.

Level of Service

A quantitative stratification of the “quality of service” of a service or facility into six letter grade levels with “A” describing the highest quality and “F” describing the lowest quality

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Five Important Definitions

An aerial photograph of a multi-lane highway. The highway has several lanes, a paved shoulder, and a sidewalk. There are cars, a bus, and a van on the road. In the background, there are several tall buildings and a city skyline.

Highway

Roadway with all transportation facilities (e.g., lanes, bus pull-outs, paved shoulders, sidewalks, signals) within the right of way

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Five Important Definitions



Capacity

The maximum number of vehicles that can pass a point during a specified time period under prevailing roadway, traffic, and control conditions

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INTRODUCTION

Five Important Definitions



Capacity

The maximum number of vehicles that can pass a point during a specified time period under prevailing roadway, traffic, and control conditions

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Five Important Definitions

Multimodal

More than one highway mode (auto, bicycle, bus, pedestrian, truck)

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TRB’s Highway Capacity Manual is “The National Document”

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INTRODUCTION

Positive Aspects and Limitations of the HCM







<ul style="list-style-type: none"> ▪ Benchmark for highway quality of service and capacity analyses ▪ Consensus of expert opinion 	<ul style="list-style-type: none"> ▪ Too detailed / not detailed enough ▪ Does not cover other important mobility issues <ul style="list-style-type: none"> ▪ Travel demand (Quantity) ▪ Land use
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Types of Analyses

		
Planning	Operational	Design
<ul style="list-style-type: none"> • Default values for nearly all of the model inputs • Limited data requirements, general results 	<ul style="list-style-type: none"> • All or nearly all of the required model inputs • More data, more precise results 	<ul style="list-style-type: none"> • To establish the detailed physical features

24 This course will focus on planning-level analysis

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Which Tool is Appropriate?

Planning Stage	Analysis Tools
Generalized Planning	GSVT
Generalized Planning / Conceptual Planning	LOSPLAN
Conceptual Planning	HCM/HCS
Conceptual Planning / Preliminary Engineering, Design and Operation	SYNCHRO, SIDRA
Preliminary Engineering, Design and Operation	SIMTRAFFIC, VISSIM / CORSIM

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INTRODUCTION

LOS - Operational, Conceptual and Generalized Planning Techniques

Operational

HCM2010
HIGHWAY CAPACITY MANUAL

TCQSM

BLOS

PLOS

Conceptual and Generalized Planning

2013 QUALITY/LEVEL OF SERVICE HANDBOOK

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

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INTRODUCTION

LOS Planning Analysis Tools

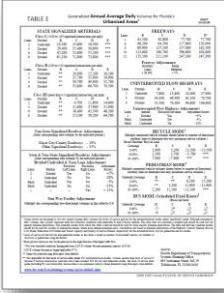
Q/LOS Handbook



Conceptual Software



Generalized Planning Tables



27 <http://www.dot.state.fl.us/planning/systems/programs/sm/los/default.shtm>

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LOS and Capacity

LOS	Automobile	Bicycle	Pedestrian	Bus
A/B				>4 buses/hour
C/D				2 to 4 buses/hour
E/F				≤ 1 bus/hour

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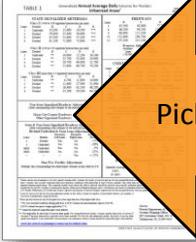
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FDOT Guidance on Applying Capacity and LOS Tools

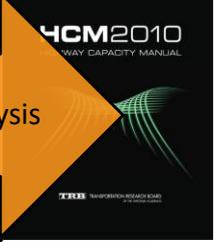
Conceptual and Generalized Planning

Decide on type of analysis

Operational



Pick the right capacity/LOS tool for analysis



Keep inputs comparable to the analysis and tool

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Traffic Analysis Handbook

Table 4-2 Traffic Analysis Software by System Element

Facility	Level of Analysis	Project Need	Performance MOE	Recommended Software
Limited Access	Generalized Planning	Determining a need for additional capacity	LOS	GSVT, LOSPLAN
	Conceptual Planning	Determining number of lanes	LOS	LOSPLAN, HCS
	Preliminary Engineering and Design	Determining how the facility will operate	LOS, density, speed, Travel time	HCS, CORSIM, VISSIM
	Operational	Determining how well the facility operates	LOS, density, speed, Travel time	HCS, CORSIM, VISSIM
Interchanges	Conceptual Planning	Determining capacity of the weaving segment	Flow rate, LOS	HCS
		Determining capacity of the weaving segment or ramp merge/diverge	Density, speed, LOS	HCS
	Preliminary Engineering and Design	Evaluating effect of a queue backup from the ramp terminal to the weaving operation	Queue length	SYNCHRO, VISSIM, CORSIM
		Analyzing weaving from ramp terminal to the nearest signalized intersection	Speed, density	VISSIM/CORSIM
		Evaluating the operation of the entire interchange	Density, speed,	SYNCHRO, CORSI, VISSIM
	Operational	Evaluating weaving operation	LOS, density	HCS, SYNCHRO, VISSIM, CORSIM
Urban Arterials	Generalized Planning	Determining a need for additional capacity	LOS	GSVT, LOSPLAN
	Conceptual Planning	Determining number of lanes	LOS	LOSPLAN, HCM/HCS
Urban Arterials	Preliminary Engineering and Design	Determining how the facility will operate	Speed	HCS
	Operational	Optimizing signals	Control delay, queue, V/C ratio	SYNCHRO/SIMTRAFFIC

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Types of Roadways

Arterials

Freeways

Highways

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INTRODUCTION **Arterial (Types of Roadways)**

Street interrupted by traffic control devices (e.g. signals, STOP signs, or YIELD signs)
Average signalized intersection spacing less than or equal to two miles

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INTRODUCTION Freeway (Types of Roadways)



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A fully access-controlled, divided highway with a minimum of two lanes (and typically more) in each direction



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INTRODUCTION Highway (Types of Roadways)

Uninterrupted Flow Highway Rural Two Lane



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Generally uninterrupted flow roadways (may have driveways and isolated traffic signals) which may be further categorized as two-lane or multilane



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INTRODUCTION Highway (Types of Roadways)

Uninterrupted Flow Highway Multilane Rural



Average signalized intersection spacing greater than two miles and are not freeways

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INTRODUCTION Highway System Structure

Generalized HCM Highway System Structure

Point		A boundary between links, usually a signalized intersection
Link		A length of roadway between two points
Segment		A portion of roadway extending from one point to another
Section		A length of roadway consisting of groups of segments having common characteristics
Facility		A length of roadway consisting of points and segments having different characteristics

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INTRODUCTION Highway System Structure (Types of Roadways)

Segmentation

Section		<p>A length of roadway consisting of groups of segments having common characteristics</p>
Facility		<p>A length of roadway consisting of points and segments having different characteristics</p>

This is based on:

- Driver perception
- Highway system structure

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INPUT VARIABLES

- ROADWAY
- TRAFFIC
- CONTROL

Input Variables

Agenda Item 2

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INPUT VARIABLES **Affecting LOS and Capacity**

- Roadway variables
- Traffic variables
- Control variables

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INPUT VARIABLES Key Factors Affecting LOS and Capacity



Roadway variables

- Area Type
- Laneage
- Turn lanes
- Sidewalks
- Bicycle lanes

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INPUT VARIABLES Key Factors Affecting LOS and Capacity



Traffic variables

- Daily/Hourly aspects
- Directional aspects
- Bus frequency

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INPUT VARIABLES **Key Factors Affecting LOS and Capacity**



- Control Type
- Green time
- Cycle length

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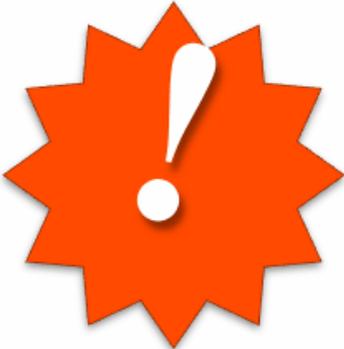
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INPUT VARIABLES

Key Factors Which Highly Influence Results

- Avoid using defaults with these factors



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INPUT VARIABLES

Key Factors Which Highly Influence Results



Area Type	Auto	Multimodal
 <p>Urbanized</p>  <p>Transitioning/Urban</p>  <p>Rural</p>	 <ul style="list-style-type: none"> • Number of lanes • Left turn lanes • AADT • K • D • Signal spacing • g/C 	 <ul style="list-style-type: none"> • Paved shoulder/ bicycle lane • Sidewalk • Bus frequency

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ROADWAY Key Factors Affecting LOS and Capacity



Roadway variables

- Area Type
- Laneage
- Turn lanes
- Sidewalks
- Bicycle lanes

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ROADWAY Area Type



Urbanized Area

- Large Urbanized*
1,000,000+
- Other Urbanized*
50,000 - 1,000,000



Transitioning Area

- Transitioning*
Urban fringe,
urbanized within 20
years



Urban Area

- Urban*
5,000 – 50,000



Rural Area

- Rural Developed*
< 5,000 with dev.
- Rural Undeveloped*
Little to no dev.

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ROADWAY Area Type




Orlando Large Urbanized

- 1,000,000+ population
- Covered by MPOs

1. Ft. Lauderdale
2. Jacksonville
3. Miami
4. Orlando
5. St. Petersburg
6. Tampa
7. West Palm Beach



Tallahassee Other Urbanized

- Population: 50,000 - 1,000,000
- Covered by MPOs other than those overseeing large urbanized areas

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ROADWAY Area Type



Transitioning

- Area outside of, but contiguous to, an urbanized area
- Expected to be urbanized or urban within the next 20 years based on growth characteristics

Example Transitioning Area from Metro Plan Orlando

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ROADWAY Area Type



Historic Downtown Marianna

Urban

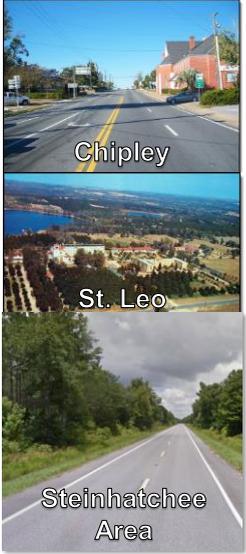
- Areas with populations between 5,000 - 50,000 and not an urbanized area

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ROADWAY Area Type





Chipley

St. Leo

Steinhatchee Area

Rural Developed

- Population less than 5,000
- Exhibit some development, such as small cities

Rural Undeveloped

- Contain little to no development

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ROADWAY Number of Through Lanes






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ROADWAY Exclusive Turn Lanes

Turn lanes from which a turning-movement must be made, designated by solid line striping



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ROADWAY Median

A separating barrier between opposing directions of traffic



- **Restrictive**
 - A raised or grassed area at least 10' wide



- **Non-restrictive**
 - A painted at-grade area at least 10' wide
 - “Undivided” refers to no median
 - “Divided” can include either a restrictive or non-restrictive median

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ROADWAY **Bicycles**




Paved Shoulder / Bicycle Lane

- A bicycling area typically four feet wide or greater and separated from the outer motorized vehicle through lane by a solid pavement marking

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ROADWAY **Pedestrians**



Sidewalk

- Paved walkway at the side of a roadway, typically 5 feet in width (**on the directional side of the arterial being analyzed**)

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TRAFFIC **Key Factors Affecting LOS and Capacity**



Traffic variables

- Daily/Hourly aspects
- Directional aspects
- Bus frequency

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TRAFFIC **Annual Average Daily Traffic**



Total traffic volume in both directions on a highway segment for one year divided by the number of days in a year

AADT



Most used of all traffic parameters

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TRAFFIC K-factor

The proportion of AADT that occurs during the peak hour

Morning Peak:
 $.065 * 10000 = 650$

Evening Peak:
 $.086 * 10000 = 860$

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TRAFFIC K-factor

Standard K

- FDOT policy sets the K-factor as a fixed parameter rather than a variable
- It is set based on area type and facility type

Standard K-Factor						
Roadway Type	Urbanized		Transitioning/Urban		Rural	
	Large	Other	Transitioning	Urban	Developed	Undeveloped
Arterials	0.08-0.09	0.09	0.09	0.09	0.095	
Freeways	0.08-0.09	0.09	0.09	0.09	0.095	
Highways	0.08-0.09	0.09	0.09	0.105	0.105	

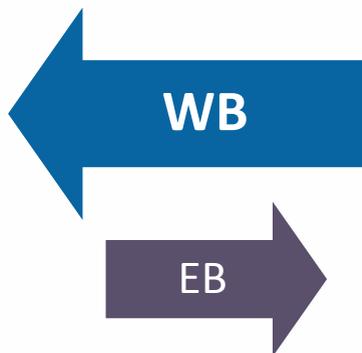
*Core freeways have a lower K-factor

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TRAFFIC **D-factor**

The proportion of traffic moving in the peak direction of travel on a given roadway during the peak hour



- The minimum allowable D-factor is **0.51** for all area types
- The D-factor has a sensitivity such that a **1% increase** in D-factor produces a **2% decrease** in allowable daily service volume

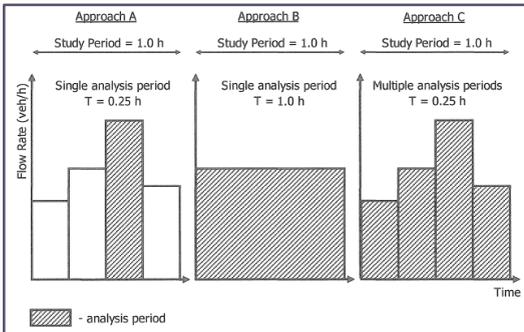
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TRAFFIC **Peak Hour Factor (PHF)**

A measure of traffic demand fluctuation within the analysis hour.



1.0 FDOT recommends using a PHF of 1.0 for all planning level analyses

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TRAFFIC Percent (%) Heavy Vehicles

The percent of trucks and other heavy vehicles with more than four wheels touching the pavement during normal operation.



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TRAFFIC Local Adjustment Factor



Drivers exiting Florida's Turnpike see two signs for International Drive.

Accounts for driver aggression, hurriedness, and familiarity with the facility. It reflects lower capacities for different area types.

*Input in FREEPLAN and HIGPLAN

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TRAFFIC **Bus Frequency**

- The number of scheduled fixed route buses which can stop on a given roadway segment in one direction of flow in a one-hour time period.
- Express buses with no potential of stopping along a roadway are not included.



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CONTROL **Key Factors Affecting LOS and Capacity**



Control variables

- Control Type
- Green time
- Cycle length

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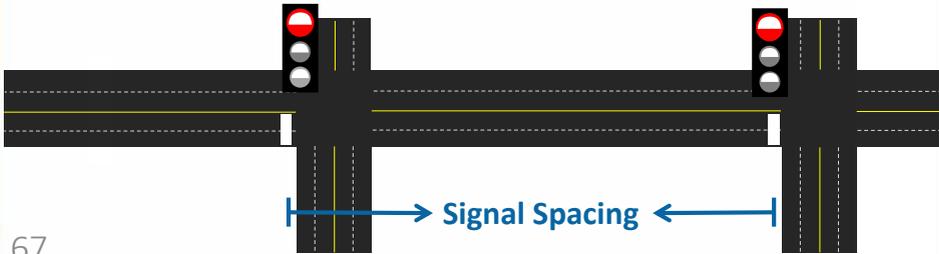
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CONTROL **Number of Signalized Intersections**



Signal Spacing

- The distance between consecutive traffic signals along a facility, measured from stop bar to stop bar in the direction of analysis

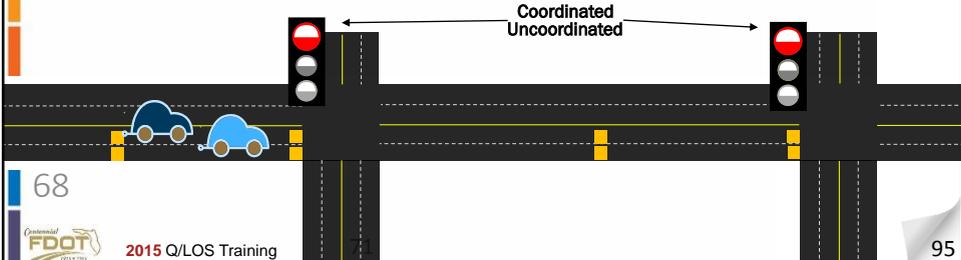


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CONTROL **Arrival Type**

- A generalized categorization of the quality of progression between signalized intersections, ranging from 1 to 6
- Uncoordinated signals are represented by arrival type 3, and coordinated signals are represented by arrival type 4 or higher



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CONTROL **Signal Type**



- **Pretimed**
 - Uses a preset sequence of phase times with no use of vehicle detection
- **Coordinated Actuated**
 - Uses a fixed cycle length while the amount of green time for the main street through phase varies, utilizing unused time from the minor phases.
- **Fully Actuated**
 - Uses vehicle detection for all signal phases on both the main and side street approaches

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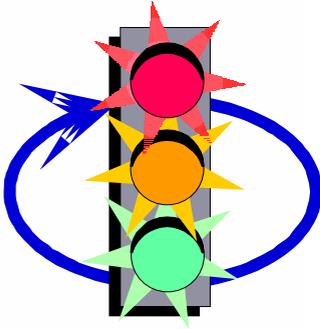


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CONTROL **Cycle Length**

- **The total time for the signal to complete one complete sequence of indications**



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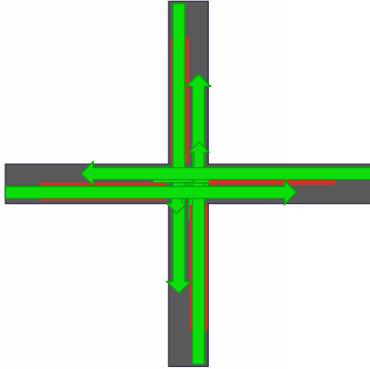
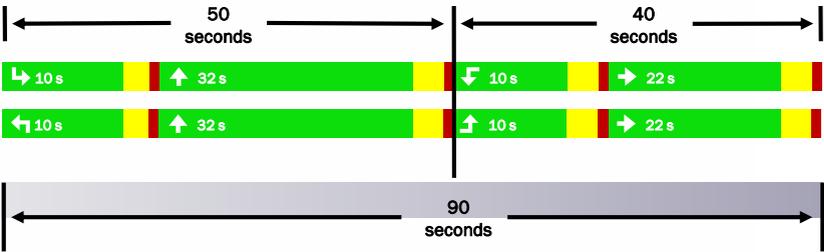


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CONTROL **Cycle Length**

- The amount of time (in seconds) that is provided to service all movements at a signalized intersection

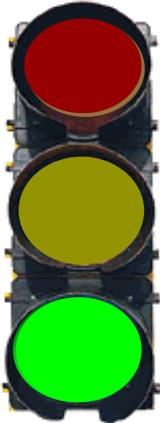



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CONTROL **Green Time**

- Green Time**
 - the amount of time within a given phase during which the green indication is present (G)

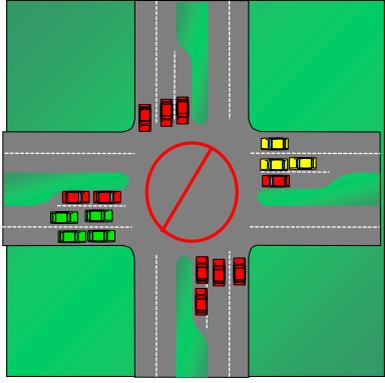


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CONTROL Basic Signal Operations Terms

- Lost Time** - The amount of time during which the intersection is not used effectively. (L). Default is 4 seconds per movement.



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CONTROL Basic Signal Operations Terms

Effective Green Ratio (g/C)

- The ratio of the effective green time of a phase to the cycle length

Indicates the proportion of the cycle length that traffic may move through the intersection for a particular movement

Pretimed Signals $g/C \approx G/C$	Actuated Signals $g/C \approx (G+4)/C$
---------------------------------------	---

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CONTROL Signal Timing

Intersection: 19. APKW-MAGN Print Date Time: 8/5/2019 9:24:20 AM

Plan: (25) Heavy Out_PM

Cycle length: 160

Phase:	1-EBL	2-WBT	3-SBL	4-NBT
Green:	30.0	60.0	21.0	21.3
Veh Intervals:	4	6.0 5	6.4 4	7.7 5 7.0
Ped Intervals:		5	27	5 5
Phase:	6-EBT	5-WBL	8-SBT	7-NBL
Green:	75.0	15.0	35.0	8.4
Veh Intervals:	5	6.0 4	7.0 5	6.6 4 7.0
Ped Intervals:	5	24	5	27

Example Completion of g/C Documentation Worksheet

Intersection Name	Control Type (a,s,p) *	Primary Road		Cycle Length	Primary Road		
		Thru	Left		(a,s) (G+Y)/C	(s) G/C	G/C
Magnolia		75	30	160	0.49	N.A.	0.19

$(75 + 4) / 160 = 0.49$
 $30 / 160 = 0.19$

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- Through g/C
- Left g/C

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CONTROL Left-Turn Phasing

- **Protected turn** – Green arrow
- **Permissive turn** – Green ball (or flashing yellow arrow) where left turns have to yield to oncoming traffic
- **Protected + Permissive turn** – Starts as green arrow, changes to green ball (or vice versa)

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INPUT VARIABLES

- ROADWAY
- TRAFFIC
- CONTROL

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Data Sources

Agenda Item 3

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Data Sources

The goal of this segment of training is to successfully locate the key input parameters for a given roadway

➔ **using free sources** ⬅

- Florida Traffic Online
<http://www2.dot.state.fl.us/FloridaTrafficOnline/viewer.html>
- Florida Transportation Information DVD
- Google
- Google Maps / Google Earth
- Road Characteristics Inventory
<http://www.dot.state.fl.us/planning/statistics/gis/>

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Data Sources

Most Important Variables - Reminder 

Area Type	Auto	Multimodal
 Urbanized  Transitioning/Urban  Rural	 <ul style="list-style-type: none"> Number of lanes Left turn lanes AADT K D Signal spacing g/C 	 <ul style="list-style-type: none"> Paved shoulder/ bicycle Lane Sidewalk Bus frequency

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Data Sources

Area Type

- **Transitioning areas** are adjacent and contiguous to an urbanized area and may become urbanized in the next 20 years based on growth characteristics
- **Urban areas** are developed cities that are not within contiguous to an urbanized area, and have a population between 5,000-50,000

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Data Sources

Area Type

If the population is less than 5,000:

- View the area on an aerial software (Google Maps or Earth)
- If there is little or no development present, the area type is **rural undeveloped**
- If the area appears to be developed with residential or commercial developments, the area type is **rural developed**

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Data Sources

Area Type

1. Ask District LOS Coordinator - particularly for transitioning area
2. If available, obtain area type GIS data
3. Determine if your study roadway is within the urbanized boundary of an MPO
4. If within MPO but outside the urbanized boundary, confirm location using this interactive MPO/Urban area map (<http://transport.cfgis.org/>). Turn on Urban areas 2012 and MPO Boundaries under RCI 2012 and Jurisdictional Boundaries, found under the base data tab

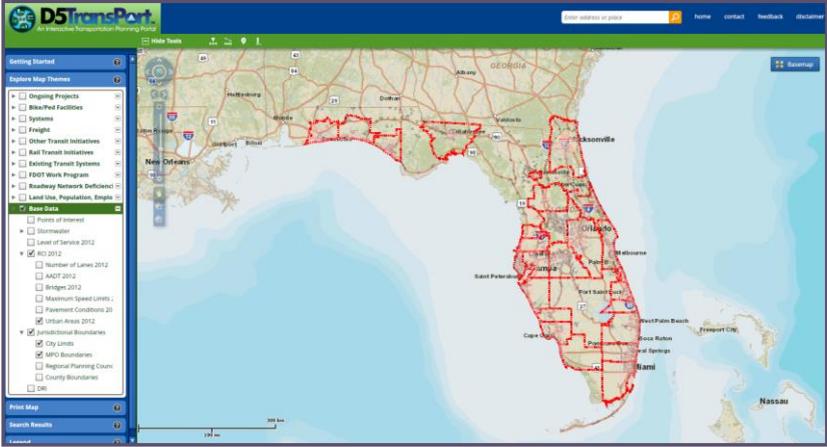
83

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Data Sources

Area Type (TransPort)

Example: Mahan Dr. & Dempsey Mayo Rd. (Tallahassee)



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Data Sources

Area Type (TransPort)

Example: Mahan Dr. & Dempsey Mayo Rd. (Tallahassee)

Intersection is within the urban/urbanized boundary (pink)

Area type is other urbanized

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Florida Transportation Information (FTI) video

FTI 2013 Tutorial

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● Data Sources

Example 1

Find the following parameters for Interstate I-4 in Orlando (D5) between Princeton St and Par St:

- Area Type
- Peak Direction
- AADT
- K-Factor
- D-Factor
- % Heavy Vehicles

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● Data Sources

Example 1

Area Type

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Data Sources

Example 1

Area Type

- The study roadway is in Orlando, FL:

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Data Sources

Example 1

Area Type

- The study roadway (I-4) is within the urbanized area of the map

→ **Orlando is classified as an urbanized area**

Side note: Orlando is one of the 7 urbanized areas the State of Florida considers a "Large Urbanized" area

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● Data Sources

Example 1

District 5 Urban/Transitioning Area Maps

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● Data Sources

Example 1

Determine:

- AADT
- K-Factor
- D-Factor
- Peak Direction
- % Heavy Vehicles

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Data Sources Example 1

The screenshot shows the 'Florida Transportation Information 2013 (8.3.1.29)' application. The main map displays the state of Florida with major roads and six numbered regions: 1 (Orlando area), 2 (Jacksonville area), 3 (Tallahassee area), 4 (Miami area), 5 (Tampa area), and 6 (Pensacola area). A 'Find City' dialog box is open, with 'Orlando' selected in the dropdown menu. The right-hand panel, titled 'TTMS/PTMS stations 2013', contains search filters for County, Site, Roadway ID, Milepoint, AADT, K, D, T 24 (Daily), Site Type, and Class. A legend at the bottom right identifies road types: Interstate (red line), Toll Roads (green line), Continuous Unit (red dot), and Portable Unit (green square). A zoom slider is set to 'No Zoom' with a 50.00 mi scale. The bottom status bar includes the text 'Click on county to zoom to' and 'Description'.

Data Sources Example 1

This screenshot shows the same software application but zoomed into the Orlando area. A red box highlights a specific location on the map. A red arrow points to the search icon in the top toolbar. The right-hand panel is identical to the previous screenshot. The legend at the bottom right is also present. The zoom slider is now set to 'No Zoom' with a 0.53 mi scale. The bottom status bar shows 'Ready to Pan' and 'Description Orlando'.

Data Sources **Example 1**

Florida Transportation Information 2013 (8.3.1.29)

File View Reports My Views Find Tools Help

TTMS/PTMS stations 2013

County 75
 Site 3061
 Roadway ID 75280000
 Milepoint 20.060
 AADT 183500
 K 8.00
 D 52.30
 T 24 (Daily) 5.50
 Site Type Portable
 Class Yes

Ready to Pan Description Orlando

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Data Sources **Example 1**

TrafficInfo -- Report Print Preview

Print Page Setup Prev Next 100% Save Close

Florida Department of Transportation
 Transportation Statistics Office
 2013 Historical AADT Report

County: 75 - ORANGE

Site: 3061 - ON I-4, 0.121 MI. NE OF SR-438 (UCLP)

Year	AADT	Direction 1	Direction 2	*K Factor	D Factor
2013	183500 C	E 84500	W 99000	8.00	52.30
2012	196000 C	E 97500	W 98500	8.00	51.80
2011	168000 S	E 85000	W 83000	8.00	53.10
2010	164000 F	E 83000	W 81000	7.77	53.41
2009	159500 C	E 80500	W 79000	8.65	52.77
2008	182500 C	E 92500	W 90000	8.20	
2007	200000 C	E 100000	W 100000	7.80	

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Data Sources

TRAFFIC CHARACTERISTICS				
Planning analysis hour factor (K)	0.090	0.085	0.090	0.090
Directional distribution factor (D)	0.547	0.547	0.550	0.550
Peak hour factor (PHF)	1.000	1.000	1.000	1.000
Base saturation flow rate (pcphpl)			1,700	2,100
Heavy vehicle percent	4.0	4.0	2.0	2.0
Local adjustment factor	0.91	0.91	0.97	0.98
% left turns				
% right turns				

% Heavy Vehicles = 4.0

Example 1

Generalized Annual Average Daily Volumes for Florida's Urbanized Areas

TABLE 1 (continued)

INPUT VALUE ASSUMPTIONS	Uninterrupted Flow Facilities			Interrupted Flow Facilities			
	Freeway	Highways	Class I	Class II	Bicycle	Pedestrian	Class I
ROADWAY CHARACTERISTICS							
Area (sq. mi.)	50	50	50	50	50	50	50
Number of through lanes (both dir.)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Posted speed (mph)	50	50	50	45	50	50	45
Free flow speed (mph)	75	70	70	50	55	55	50
Auxiliary Lane (in. y)	n	n	n	n	r	n	r
Median (in. ft)	1	1	1	1	1	1	1
TRAFFIC CHARACTERISTICS							
Planning analysis hour factor (K)	0.090	0.085	0.090	0.090	0.090	0.090	0.090
Directional distribution factor (D)	0.547	0.547	0.550	0.550	0.547	0.547	0.547
Peak hour factor (PHF)	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Base saturation flow rate (pcphpl)			1,700	2,100			
Heavy vehicle percent	4.0	4.0	2.0	2.0	1.0	1.0	2.0
Local adjustment factor	0.91	0.91	0.97	0.98			
% left turns					12	12	12
% right turns					12	12	12
CONTROL CHARACTERISTICS							
Number of lanes			4	4	10	10	4
Shoulder (ft. w)			4	3	4	4	4
Super-elev. (ft. c)			e	e	e	e	e
Cycle length (C)			120	120	120	120	120
Effective green time (g/C)			0.44	0.45	0.44	0.44	0.44
MULTIMODAL CHARACTERISTICS							
Partial blockage (in. w)					n	50%	n
Preempt condition (C, s, w)							r
On-street parking (in. y)							n
Sidewalk (in. y)							n
Sidewalk/shoulder separation (L, ft)							n
Sidewalk protection barrier (in. y)							n
LEVEL OF SERVICE THRESHOLDS							
Level of Service	Freeway	Highway	Arterial		Bicycle	Ped.	Bus
	Density	Two-lane/shoulder	Class I	Class II	Score	Score	Bus/In.
B	< 17	< 17	< 17	< 22 mph	> 2.75	> 2.75	< 6
C	< 24	< 24	< 24	< 23 mph	> 3.50	> 3.50	< 4
D	< 31	< 31	< 31	< 18 mph	> 4.25	> 4.25	< 3
E	< 38	< 38	< 35	< 15 mph	> 5.00	> 5.00	< 2

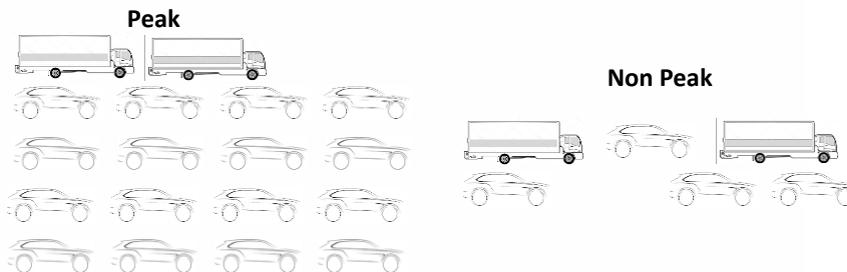
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Why do we recommend 1/2 of daily trucks?

- During Peak Hour
 - More passenger vehicles
 - Same or slightly fewer trucks



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● Data Sources

Example 1

Answers

- Area Type = _____
- AADT = _____
- K-Factor = _____
- D-Factor = _____
- Peak Direction = _____
- % Heavy Vehicles = _____

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2015 Q/LOS Training

● Data Sources

Workshop 1

SR 699

- Between Park Blvd and SR 666
- Redington Beach (D7 – north of Madera Beach)

Identify:

- Area Type
- AADT, K-Factor, D-Factor
- Peak Direction
- % Heavy Vehicles

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Data Sources **Workshop 1**

Florida Transportation Information 2013

File View Reports My Views Find Tools Help

TTMS/PTMS stations 2013

No reportable items selected

County

Site

Roadway ID

Milepoint

AADT

K

D

T 24 (Daily)

Site Type

Class

- Toll Roads
- Continuous Unit
- Portable Unit

No Zoom

0 0.19 mi 0.38 mi

Click on a feature to identify Description Madeira Beach

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Data Sources **Workshop 1**

Florida Transportation Information 2013 (8.3.1.29)

File View Reports My Views Find Tools Help

TTMS/PTMS stations 2013

No reportable items selected

County

Site

Roadway ID

Milepoint

AADT

K

D

T 24 (Daily)

Site Type

Class

- Toll Roads
- Continuous Unit
- Portable Unit

No Zoom

0 0.33 mi 0.67 mi

Ready to Pan Description

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FDOT 2015 Q/LOS Training

Workshop 1

Data Sources

County	15
Site	0066
Roadway ID	15140000
Milepoint	3.221
AADT	16647
K	9.00
D	52.30
T 24 (Daily)	2.70
Site Type	Telemetered
Class	Yes

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Workshop 1

Data Sources

TrafficInfo -- Report Print Preview

Florida Department of Transportation
 Transportation Statistics Office
 2013 Historical AADT Report

County: 15 - PINELLAS

Site: 0066 - SR-699(GULF BLVD),110' N OF 183 AVE W,PINELLAS CO.

Year	AADT	Direction 1	Direction 2	*K Factor	D Factor
2013	16647 C	N 8475	S 8172	9.00	52.30
2012	16868 C	N 8550	S 8318	9.00	52.30
2011	16693 C	N 8461	S 8232	9.00	53.00
2010	17247 C	N 8756	S 8491	10.72	54.73
2009	16700 C	N 8461	S 8239	10.72	54.73
2008	16302 C	N 8247	S 8055	10.68	52.60
2007	17677 C	N 8943	S 8734	10.11	59.91

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Data Sources

Workshop 1

Answers

- Area Type = _____
- AADT = _____
- K-Factor = _____
- D-Factor = _____
- Peak Direction = _____
- % Heavy Vehicles = _____

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Format of the Training Modules

- Explain the program's uses
- Identify strengths and limitations
- Identify when other tools should be used
- Required inputs
- Example problem(s)
 - Sensitivity example
- Workshops

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2015 Q/LOS Training

Generalized Service Volume Tables

Generalized Service Volume Tables

Agenda Item 4

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2015 Q/LOS Training

Generalized Service Volume Tables

Generalized Service Volume Tables

- Provide a rough estimate of capacity and LOS
- Use the same rules as LOSPLAN software and the Q/LOS Handbook
- FDOT supported and statewide acceptable for **PLANNING** only

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2015 Q/LOS Training

TABLE 1 Generalized Annual Average Daily Volumes for Florida's Urbanized Areas¹

		STATE SIGNALIZED ARTERIALS				FREEWAYS			
		Class I (6.00+ signalized intersections per mile)				Class II (2.00+ signalized intersections per mile)			
Level	Grade	A	B	C	D	A	B	C	D
2	Unimproved	10,300	15,600	16,500	***	8	66,200	94,500	117,700
4	Unimproved	29,400	35,600	36,600	***	8	139,900	172,100	157,600
6	Unimproved	45,200	53,600	55,200	***	10	112,600	140,700	196,600
8	Unimproved	61,100	71,800	73,800	***	12	125,100	211,100	247,500

		UNINTERRUPTED FLOW HIGHWAYS			
Level	Grade	A	B	C	D
2	Unimproved	7,800	15,400	22,000	27,900
4	Unimproved	24,500	49,500	63,100	76,700
6	Unimproved	51,500	78,300	94,800	104,400

		BICYCLE MODE ²			
Level	Grade	A	B	C	D
2	Unimproved	1,900	3,200	3,500	13,500
4	Unimproved	2,500	5,700	5,700	13,500
6	Unimproved	7,000	7,000	7,000	13,500

Generalized Service Volume Tables

Generalized Service Volume Tables

Provide **estimates** of maximum service volumes for various Florida roadway types

Represent **average** roadway conditions for the state

Allow analysts to **quickly** and easily estimate LOS from volumes and estimate capacity

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Generalized Service Volume Tables

Generalized Service Volume Tables

Limitations

Results are rough estimates

Simplified planning level assumptions are made, therefore the tables must not be used for actual design or operation of facilities

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Generalized Service Volume Tables

Assumptions

Reflect typical conditions on Florida roadways

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Rural freeways based on UF Research

- Two class system
- Average travel speed

Threshold Differences

Percent base free flow speed

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Continental FDOT 2015 Q/LOS Training

Generalized Service Volume Tables

LOS Thresholds

Urbanized and Transitioning/Urban

Level of Service	LEVEL OF SERVICE THRESHOLDS							
	Freeways	Highways		Arterials		Bicycle	Ped	Bus
	Density	Two-Lane %ffs	Multilane Density	Class I ats	Class II ats	Score	Score	Buses/hr.
B	≤ 17	> 83.3	≤ 17	> 31 mph	> 22 mph	≤ 2.75	≤ 2.75	≤ 6
C	≤ 24	> 75.0	≤ 24	> 23 mph	> 17 mph	≤ 3.50	≤ 3.50	≤ 4
D	≤ 31	> 66.7	≤ 31	> 18 mph	> 13 mph	≤ 4.25	≤ 4.25	< 3
E	≤ 39	> 58.3	≤ 35	> 15 mph	> 10 mph	≤ 5.00	≤ 5.00	< 2

% ffs = Percent free flow speed ats = Average travel speed

Rural

Level of Service	LEVEL OF SERVICE THRESHOLDS							
	Freeways	Highways					Bicycle	Pedestrian
		Two-Lane %tsf	Two-Lane ru ats	Two-Lane rd %ffs	Multilane ru Density	Multilane rd Density		
B	≤ 14	≤ 50	≤ 55	> 83.3	≤ 14	≤ 2.75	≤ 2.75	
C	≤ 22	≤ 65	≤ 50	> 75.0	≤ 22	≤ 3.50	≤ 3.50	
D	≤ 29	≤ 80	≤ 45	> 66.7	≤ 29	≤ 4.25	≤ 4.25	
E	≤ 36	> 80	≤ 40	> 58.3	≤ 34	≤ 5.00	≤ 5.00	

Level of Service	Arterials Major City/Co.(ats)	Bicycle Score	Pedestrian Score
B	> 31 mph	≤ 2.75	≤ 2.75
C	> 23 mph	≤ 3.50	≤ 3.50
D	> 18 mph	≤ 4.25	≤ 4.25
E	> 15 mph	≤ 5.00	≤ 5.00

%tsf = Percent time spent following %ffs = Percent of free flow speed ats = Average travel speed ru = Rural undeveloped rd = Rural developed

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Generalized Service Volume Tables

Table Format

Tables 1-3

```

graph TD
    AADT[AADT] --> Urbanized[Urbanized]
    AADT --> Transitioning[Transitioning/Urban]
    AADT --> Rural[Rural]
            
```

Tables 4-6

```

graph TD
    PH2W[Peak Hour Two-Way] --> Urbanized[Urbanized]
    PH2W --> Transitioning[Transitioning/Urban]
    PH2W --> Rural[Rural]
            
```

Tables 7-9

```

graph TD
    PHD[Peak Hour Directional] --> Urbanized[Urbanized]
    PHD --> Transitioning[Transitioning/Urban]
    PHD --> Rural[Rural]
            
```

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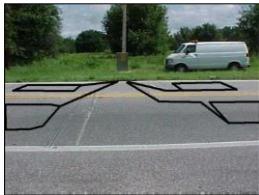
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Generalized Service Volume Tables

How the Tables Were Developed

Collect Traffic Data

From roadways around the state

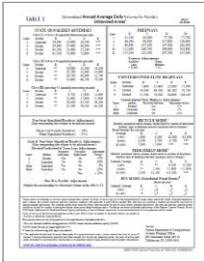


Calculate Values

Using LOSPLAN and generalized assumed values for variables



Publish Tables



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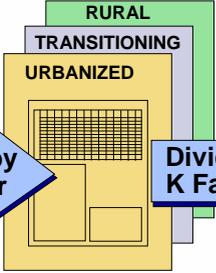
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Organization of the Tables

Peak Hour Directional Volumes



Two-Way Peak Hour Volumes



Two-Way AADT Volumes



Divide by D Factor Divide by K Factor

The sets of Generalized Tables are internally consistent; all are based on peak hour peak direction analysis

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Generalized Service Volume Tables

Most Important Generalized Assumptions

Standard K

**Peak Hour Factor
(PHF) = 1.0**

**Directional
Distribution Factor
(D)**

- Urbanized and Transitioning Area Standard K = 0.09
- except* core freeways = 0.085
- Rural Area Standard K = 0.095
- except* rural freeways = 0.105

- Ranges from .547 for urbanized freeways to .555 in rural areas
- Ranges from .57 for transitioning arterials to .55 elsewhere.

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Generalized Service Volume Tables

Table Footnote Abbreviations

Level of Service	Arterials	Bicycle	Pedestrian
	Major City/Co. (ats)	Score	Score
B	> 31 mph	≤ 2.75	≤ 2.75
C	> 23 mph	≤ 3.50	≤ 3.50
D	> 18 mph	≤ 4.25	≤ 4.25
E	> 15 mph	≤ 5.00	≤ 5.00

%tsf = Percent time spent following
%ffs = Percent of free flow speed
ats = Average travel speed
ru = Rural undeveloped
rd = Rural developed

% tsf = Percent time spent following

% ffs = Percent of free flow speed

ats = Average travel speed

ru = Rural undeveloped

rd = Rural developed

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Generalized Service Volume Tables

Table Footnote Abbreviations

Level of Service	Arterials
	Major City/Co.(ats)
B	> 31 mph
C	> 23 mph
D	> 18 mph
E	> 15 mph

% tsf = Percent time spent following
 % ffs = Percent of free flow speed
 ats = Average travel speed
 ru = Rural undeveloped
 rd = Rural developed

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Generalized Service Volume Tables

Table Footnote Abbreviations

Bicycle	Pedestrian
Score	Score
≤ 2.75	≤ 2.75
≤ 3.50	≤ 3.50
≤ 4.25	≤ 4.25
≤ 5.00	≤ 5.00

% tsf = Percent time spent following
 % ffs = Percent of free flow speed
 ats = Average travel speed
 ru = Rural undeveloped
 rd = Rural developed

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Generalized Service Volume Tables

Roadway Variables

Num. of Lanes (both dir.) **2** Left Turn/Blockage Impact

Terrain **Level** **Median**

Posted Speed **55** Passing Lanes

Free-Flow Speed **60** Passing Lane Length **0.0**

Segment Length **10.0** % No Passing Zones **20**

Traffic Variables

AADT **7000** Peak Dir. Hr. Vol. **366**

K factor (%) **9.5** Off-peak Dir. Hr. Vol. **299**

D factor (%) **55.0** % Heavy Vehicles **5.0**

PHF **1.000**

For the variables highlighted in blue, local values apply.

TABLE 3 Generalized Annual Average Daily Volumes for Florida's Rural Undeveloped Areas and Developed Areas Less Than 5,000 Population

INPUT VALUE ASSUMPTIONS	Uninterrupted Flow Facilities				Interrupted Flow Facilities			
	Freeways	Highways	Arterials	Bicycle	Arterials	Bicycle	Arterials	Arterials
ROADWAY CHARACTERISTICS	Rural Undeveloped							
Area type (ru, rd)	rural	ru	ru	rd	rd			
Number of through lanes (both dir.)	4-8	2	4-6	2	4-6			
Posted speed (mph)	70	55	65	50	55			
Free flow speed (mph)	75	60	70	55	60			
Auxiliary lanes (n,y)	n	n	r	n	r			
Median (n, nr, r)		n	r	n	r			
Terrain (1,r)	1	1	1	1	1			
% no passing zone		20		60				
Exclusive left turn lanes (n, y)		[n]	y	[n]	y			
Exclusive right turn lanes (n, y)								
Facility length (mi)	14	10	10	5	5			
Number of basic segments	4							

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INPUT VALUE ASSUMPTIONS	Uninterrupted Flow Facilities			
	Freeways	Highways		
ROADWAY CHARACTERISTICS	Rural Undeveloped			
Area type (ru, rd)	rural	ru	ru	rd
Number of through lanes (both dir.)	4-8	2	4-6	2
Posted speed (mph)	70	55	65	50
Free flow speed (mph)	75	60	70	55
Auxiliary lanes (n,y)	n	n	r	n
Median (n, nr, r)		n	r	n
Terrain (1,r)	1	1	1	1
% no passing zone		20		60
Exclusive left turn lanes (n, y)		[n]	y	[n]
Exclusive right turn lanes (n, y)				
Facility length (mi)	14	10	10	5
Number of basic segments	4			

Generalized Service Volume Tables

Service Volumes From HIGHPLAN

Lanes	Annual Average Daily Traffic				
	A	B	C	D	E
2	2600	4700	8400	14300	28600

TABLE 3 Generalized Annual Average Daily Volumes for Florida's Rural Undeveloped Areas and Developed Areas Less Than 5,000 Population

UNINTERRUPTED FLOW FACILITIES					FREIGHTWAYS				
Lanes	Median	STATE SIGNALIZED ARTERIALS			Lanes	Median	FREIGHTWAYS		
		B	C	D			B	C	D
2	Undivided	4,700	8,400	14,300	2	Undivided	4,700	8,400	14,300
4	Divided	25,700	40,300	51,000	4	Divided	25,700	40,300	51,000
6	Divided	38,800	60,400	76,700	6	Divided	38,800	60,400	76,700

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UNINTERRUPTED FLOW HIGHWAYS

Rural Undeveloped

Lanes	Median	B	C	D	E
2	Undivided	4,700	8,400	14,300	28,600
4	Divided	25,700	40,300	51,000	57,900
6	Divided	38,800	60,400	76,700	86,800

Generalized Service Volume Tables

Asterisks on the Tables

TABLE 1 Urb

INTERRUPTED FLOW FACILITIES					
STATE SIGNALIZED ARTERIALS					
Class I (40 mph or higher posted speed limit)					
Lanes	Median	B	C	D	E
2	Undivided	*	16,800	17,700	**
4	Divided	*	37,900	39,800	**
6	Divided	*	58,400	59,900	**
8	Divided	*	78,800	80,100	**

* Cannot be achieved using table input value defaults.

** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

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Generalized Service Volume Tables

Process for Using Tables

- Annual Average Daily
- Peak Hour Two-Way
- Peak Hour Directional

- Urbanized
- Transitioning/Urban
- Rural
 - Developed
 - Undeveloped

- Automobile
- Bicycle
- Pedestrian
- Bus

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Generalized Service Volume Tables

Process for Using Tables

 Automobile Mode	 Bicycle Mode	 Pedestrian Mode	 Bus Mode
Key Variables <ul style="list-style-type: none"> Facility Type Number and type of lanes 	Key Variables <ul style="list-style-type: none"> Paved shoulder/ bicycle lane coverage Number of motorized vehicles 	Key Variables <ul style="list-style-type: none"> Sidewalk coverage Number of motorized vehicles 	Key Variables <ul style="list-style-type: none"> Bus frequency Sidewalk coverage

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Generalized Service Volume Tables

Example 1.A

Determine the max. service volume for LOS E:

- In terms of AADT
- In a core urbanized area
- For a 8-lane freeway

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I-4 Through Orlando, FL

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Generalized Service Volume Tables

Example 1.A

Determine the max. service volume for LOS E:

- In terms of AADT
- In a core urbanized area
- For a 8-lane freeway

FREEWAYS				
Core Urbanized				
Lanes	B	C	D	E
4	47,400	64,000	77,900	84,600
6	69,900	95,200	116,600	130,600
8	92,500	126,400	154,300	176,600
10	115,100	159,700	194,500	222,700
12	162,400	216,700	256,600	268,900

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Generalized Service Volume Tables

Freeways

FREEWAYS					
Core Urbanized					
Lanes	B	C	D	E	
4	47,400	64,000	77,900	84,600	
6	69,900	95,200	116,600	130,600	
8	92,500	126,400	154,300	176,600	
10	115,100	159,700	194,500	222,700	
12	162,400	216,700	256,600	268,900	

FREEWAYS					
Urbanized					
Lanes	B	C	D	E	
4	45,800	61,500	74,400	79,900	
6	68,100	93,500	111,800	123,300	
8	91,500	123,500	148,700	166,800	
10	114,800	156,000	187,100	210,300	

Freeway Adjustments

Auxiliary Lanes Present in Both Directions	Ramp Metering
+20,000	+5%

Generalized Annual Average Daily Volumes for Florida's Urbanized Areas											
STATE SIGNALIZED ARTERIALS						UNINTERRUPTED FLOW FACILITIES					
Class I (10 mph or higher posted speed limit)						Class II (10 mph or lower posted speed limit)					
Lanes	Median	B	C	D	E	Lanes	Median	B	C	D	E
2	Undivided	16,800	17,700	**	**	4	Undivided	47,400	64,000	77,900	84,600
4	Divided	37,600	39,800	**	**	6	Divided	69,900	95,200	116,600	130,600
6	Divided	58,400	60,900	**	**	8	Divided	92,500	126,400	154,300	176,600
8	Divided	78,800	81,900	**	**	10	Divided	115,100	159,700	194,500	222,700
						12	Divided	162,400	216,700	256,600	268,900

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Generalized Service Volume Tables

Example 1.B

Determine the max. service volume for LOS E:

- In terms of AADT
- In a core urbanized area
- For a 8-lane freeway
- Auxiliary lanes in both directions

FREEWAYS					
Core Urbanized					
Lanes	B	C	D	E	
4	47,400	64,000	77,900	84,600	
6	69,900	95,200	116,600	130,600	
8	92,500	126,400	154,300	176,600	
10	115,100	159,700	194,500	222,700	
12	162,400	216,700	256,600	268,900	

Freeway Adjustments

Auxiliary Lanes Present in Both Directions	Ramp Metering
+20,000	+5%

Generalized Annual Average Daily Volumes for Florida's Urbanized Areas											
STATE SIGNALIZED ARTERIALS						UNINTERRUPTED FLOW FACILITIES					
Class I (10 mph or higher posted speed limit)						Class II (10 mph or lower posted speed limit)					
Lanes	Median	B	C	D	E	Lanes	Median	B	C	D	E
2	Undivided	16,800	17,700	**	**	4	Undivided	47,400	64,000	77,900	84,600
4	Divided	37,600	39,800	**	**	6	Divided	69,900	95,200	116,600	130,600
6	Divided	58,400	60,900	**	**	8	Divided	92,500	126,400	154,300	176,600
8	Divided	78,800	81,900	**	**	10	Divided	115,100	159,700	194,500	222,700
						12	Divided	162,400	216,700	256,600	268,900

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Generalized Service Volume Tables

Example 2.A

Determine the auto LOS:

- In terms of peak hour directional volumes
- In a rural undeveloped area
- For an uninterrupted flow highway with:
 - 2 lanes (one in each direction)
 - No median/undivided
 - No passing lanes
 - Peak hour directional volume is 440

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Generalized Service Volume Tables

Example 2.A

Determine the auto LOS:

- In terms of peak hour directional volumes
- In a rural undeveloped area
- For an uninterrupted flow highway with:
 - 2 lanes (one in each direction)
 - No median/undivided
 - No passing lanes
 - Peak hour directional volume is 450

UNINTERRUPTED FLOW HIGHWAYS

		Rural Undeveloped			
Lanes	Median	B	C	D	E
1	Undivided	240	430	740	1,490
2	Divided	1,340	2,100	2,660	3,020
3	Divided	2,020	3,150	4,000	4,530

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Generalized Service Volume Tables

Example 2.B

Determine the auto LOS:

- In terms of peak hour directional volumes
- In a rural undeveloped area
- For an uninterrupted flow highway with:
 - 2 lanes (one in each direction)
 - 20% passing lane
 - No median/undivided
 - Peak hour directional volume is 450

UNINTERRUPTED FLOW HIGHWAYS

		Rural Undeveloped			
Lanes	Median	B	C	D	E
1	Undivided	240	430	740	1,490
2	Divided	1,340	2,100	2,660	3,020
3	Divided	2,020	3,150	4,000	4,530

Passing Lane Adjustments

Alter LOS B-D volumes in proportion to the passing lane length to the highway segment length

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Generalized Service Volume Tables

Uninterrupted Flow Highways

Lanes	Median	B	C	D	E
2	Undivided	8,600	17,000	24,200	33,300
4	Divided	36,700	51,800	65,600	72,600
6	Divided	55,000	77,700	98,300	108,800

Lanes	Median	Exclusive left lanes	Adjustment factors
2	Divided	Yes	+5%
Multi	Undivided	Yes	-5%
Multi	Undivided	No	-25%

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TABLE 1 Generalized Annual Average Daily Volumes for Florida's Urbanized Areas

INTERRUPTED FLOW FACILITIES						UNINTERRUPTED FLOW FACILITIES					
STATE SIGNALIZED ARTERIALS						FREEWAYS					
Class I (40 mph or higher posted speed limit)						Class II (35 mph or slower posted speed limit)					
Lanes	Median	B	C	D	E	Lanes	Median	B	C	D	E
2	Undivided	14,800	17,000	24,200	33,300	4	45,800	65,500	74,400	79,900	84,800
4	Divided	37,900	51,800	65,600	72,600	6	69,900	95,200	116,600	136,600	156,600
6	Divided	54,400	76,900	98,300	108,800	8	82,200	126,400	154,100	174,600	194,600
8	Divided	78,800	98,300	118,800	128,800	10	113,100	159,700	194,500	221,700	237,700
						12	162,400	216,700	256,600	288,800	308,800

Generalized Service Volume Tables

Other Adjustments

- Non-State Signalized Roadways
- Divided/ Undivided
- Turn Lanes
- One-Way

Lanes	Median	Exclusive Left Lanes	Exclusive Right Lanes	Adjustment Factors
2	Divided	Yes	No	+5%
2	Undivided	No	No	-20%
Multi	Undivided	Yes	No	-5%
Multi	Undivided	No	No	-25%
-	-	-	Yes	+5%

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Adjustments for State and Non-State Signalized Roadways

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TABLE 1 Generalized Annual Average Daily Volumes for Florida's Urbanized Areas

INTERRUPTED FLOW FACILITIES						UNINTERRUPTED FLOW FACILITIES					
STATE SIGNALIZED ARTERIALS						FREEWAYS					
Class I (40 mph or higher posted speed limit)						Class II (35 mph or slower posted speed limit)					
Lanes	Median	B	C	D	E	Lanes	Median	B	C	D	E
2	Undivided	14,800	17,000	24,200	33,300	4	45,800	65,500	74,400	79,900	84,800
4	Divided	37,900	51,800	65,600	72,600	6	69,900	95,200	116,600	136,600	156,600
6	Divided	54,400	76,900	98,300	108,800	8	82,200	126,400	154,100	174,600	194,600
8	Divided	78,800	98,300	118,800	128,800	10	113,100	159,700	194,500	221,700	237,700
						12	162,400	216,700	256,600	288,800	308,800

Generalized Service Volume Tables

Example 3

Determine the auto LOS:

- In terms of peak hour directional volumes
- In an urban/transitioning area
- For a non-state signalized roadway with:
 - 45 mph speed limit
 - 6 lanes (3 in each direction)
 - Peak hour directional volume of 2,500

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Generalized Service Volume Tables

Example 3

Determine the auto LOS:

- In terms of peak hour directional volumes
- In an urban/transitioning area
- For a non-state signalized roadway with:
 - 45 mph speed limit
 - 6 lanes (3 in each direction)
 - Peak hour directional volume of 2,500

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STATE SIGNALIZED ARTERIALS					
Class I (40 mph or higher posted speed limit)					
Lanes	Median	B	C	D	E
1	Undivided	*	710	800	**
2	Divided	*	1,740	1,820	**
3	Divided	*	2,670	2,740	**

Non-State Signalized Roadway Adjustments
 (Alter corresponding state volumes by the indicated percent.)
 Non-State Signalized Roadways - 10%



Generalized Service Volume Tables

Multimodal LOS

Bicycle Mode

Based on:

- Paved shoulder/bicycle lane coverage
- Number of motorized vehicles

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Generalized Service Volume Tables

Multimodal LOS

Pedestrian Mode

Based on:

- Sidewalk coverage
- Number of motorized vehicles

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Generalized Service Volume Tables

Example 4.A

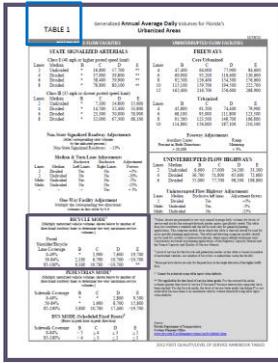
Determine the bicycle LOS:

- In terms of AADT
- In an urbanized area
- For a state signalized arterial with:
 - 2 lanes
 - AADT=13,000
 - 3 buses/hour
 - 90% bike lane coverage
 - 40% sidewalk coverage

BICYCLE MODE²

(Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Paved Shoulder/Bicycle Lane Coverage	B	C	D	E
0-49%	*	2,900	7,600	19,700
50-84%	2,100	6,700	19,700	>19,700
85-100%	9,300	19,700	>19,700	**



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Generalized Service Volume Tables

Example 4.B

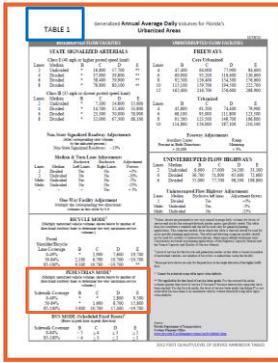
Determine the pedestrian LOS:

- In terms of AADT
- In an urbanized area
- For a state signalized arterial with:
 - 2 lanes
 - AADT=13,000
 - 3 buses/hour
 - 90% bike lane coverage
 - 40% sidewalk coverage

PEDESTRIAN MODE²

(Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Sidewalk Coverage	B	C	D	E
0-49%	*	*	2,800	9,500
50-84%	*	1,600	8,700	15,800
85-100%	3,800	10,700	17,400	>19,700



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Generalized Service Volume Tables

Example 4.C

Determine the bus LOS:

- In terms of AADT
- In an urbanized area
- For a state signalized arterial with:
 - 2 lanes
 - AADT=13,000
 - 3 buses/hour
 - 90% bike lane coverage
 - 40% sidewalk coverage

TABLE 1 Generalized Annual Average Daily Volumes for Florida's Urbanized Areas

BUS MODE (Scheduled Fixed Route)³
(Buses in peak hour in peak direction)

Sidewalk Coverage	B	C	D	E
0-84%	> 5	≥ 4	≥ 3	≥ 2
85-100%	> 4	≥ 3	≥ 2	≥ 1

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Generalized Service Volume Tables

Example 5

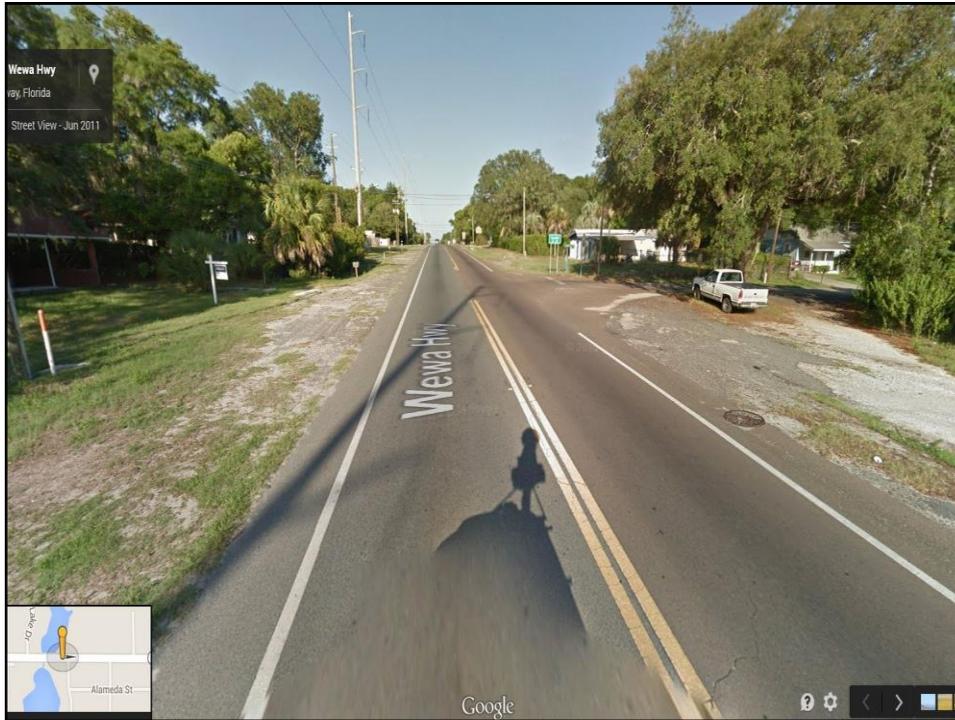
Determine the auto LOS:

- In terms of AADT
- In an urban/transitioning area (pop. 12,000)
- For an undivided state arterial with:
 - 30 mph speed limit
 - 2 lanes
 - 6,000 AADT
 - No left turn lanes

TABLE 1 Generalized Annual Average Daily Volumes for Florida's Urbanized Areas

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Generalized Service Volume Tables

Example 5

Determine the auto LOS:

- In terms of AADT
- In an urban/transitioning area (pop. 12,000)
- For an undivided state arterial with:
 - 30 mph speed limit
 - No left turn lanes
 - 2 lanes
 - 6,000 AADT

Class II (35 mph or slower posted speed limit)					
Lanes	Median	B	C	D	E
2	Undivided	*	6,500	13,300	14,200
4	Divided	*	9,900	28,800	31,600
6	Divided	*	16,000	44,900	47,600

Median & Turn Lane Adjustments				
Lanes	Median	Exclusive Left Lanes	Exclusive Right Lanes	Adjustment Factors
2	Divided	Yes	No	+5%
2	Undivided	No	No	-20%
Multi	Undivided	Yes	No	-5%
Multi	Undivided	No	No	-25%
-	-	-	Yes	+5%

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Generalized Service Volume Tables

Example 6

Determine the auto LOS:

- In terms of AADT
- In an urban/transitioning area
- For a state signalized arterial with:
 - 4 lanes
 - No median
 - 35 mph speed limit
 - Exclusive left turn lanes
 - AADT of 28,000

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Generalized Service Volume Tables

Example 6

Determine the auto LOS:

- In terms of AADT
- In an urban/transitioning area
- For a state signalized arterial with:
 - 4 lanes
 - No median
 - 35 mph speed limit
 - Exclusive left turn lanes
 - AADT of 28,000

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Class II (35 mph or slower posted speed limit)					
Lanes	Median	B	C	D	E
2	Undivided	*	6,500	13,300	14,200
4	Divided	*	9,900	28,800	31,600
6	Divided	*	16,000	44,900	47,600

TABLE 2 Generalized Average Daily Volume for Traffic Operating Area and Area Over 5,000 feet to Adjacent Area					
STATE SIGNALIZED ARTERIALS			FREEWAYS		
Lane	Median	ADT	Lane	ADT	ADT
2	Undivided	6,500	2	2,000	11,500
2	Divided	9,900	2	2,000	11,500
4	Divided	16,000	3	3,000	17,000
4	Divided	28,800	3	3,000	17,000
6	Divided	44,900	4	4,000	22,000
6	Divided	47,600	4	4,000	22,000

Median & Turn Lane Adjustments				
Lanes	Median	Exclusive Left Lanes	Exclusive Right Lanes	Adjustment Factors
2	Divided	Yes	No	+5%
2	Undivided	No	No	-20%
Multi	Undivided	Yes	No	-5%
Multi	Undivided	No	No	-25%
—	—	—	Yes	+5%

Generalized Service Volume Tables

Example 7

Determine the max. service volume for LOS E:

- In terms of AADT
- In an urbanized area
- For a state signalized arterial with
 - One-way 30 mph speed limit
 - 2 lanes in travel direction

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Generalized Service Volume Tables

Example 7

Determine the max. service volume for LOS E:

- In terms of AADT
- In an urbanized area
- For a state signalized arterial with
 - One-way 30 mph speed limit
 - 2 lanes in travel direction

Class II (35 mph or slower posted speed limit)

Lanes	Median	B	C	D	E
2	Undivided	*	7,300	14,800	15,600
4	Divided	*	14,500	32,400	33,800
6	Divided	*	23,300	50,000	50,900
8	Divided	*	32,000	67,300	68,100

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One-Way Facility Adjustment
 Multiply the corresponding two-directional volumes in this table by 0.6

Generalized Service Volume Tables

Local Government can Create Own Tables

- Lookup table for local system
- Lee County

Lee County
Generalized Peak Hour Directional Service Volumes
Urbanized Areas

Sept. 2013 c:\input4

Uninterrupted Flow Highway						
Level of Service						
Lane	Divided	A	B	C	D	E
1	Undivided	120	420	840	1,190	1,640
2	Divided	1,060	1,810	2,560	3,240	3,590
3	Divided	1,600	2,720	3,840	4,860	5,380

Arterials						
Class I (40 mph or higher posted speed limit)						
Level of Service						
Lane	Divided	A	B	C	D	E
1	Undivided	*	140	800	860	860
2	Divided	*	260	1,840	1,960	1,960
3	Divided	*	410	2,840	2,940	2,940
4	Divided	*	550	3,840	3,940	3,940

Class II (35 mph or slower posted speed limit)						
Level of Service						
Lane	Divided	A	B	C	D	E
1	Undivided	*	*	330	710	780
2	Divided	*	*	710	1,590	1,660
3	Divided	*	*	1,150	2,450	2,500
4	Divided	*	*	1,580	3,310	3,340

Controlled Access Facilities						
Level of Service						
Lane	Divided	A	B	C	D	E
1	Undivided	*	160	880	940	940
2	Divided	*	270	1,970	2,100	2,100
3	Divided	*	430	3,050	3,180	3,180

Collectors						
Level of Service						
Lane	Divided	A	B	C	D	E
1	Undivided	*	*	310	670	740
1	Divided	*	*	330	710	780
2	Undivided	*	*	740	1,460	1,460
2	Divided	*	*	780	1,530	1,530

Note: the service volumes for I-75 (freeway), bicycle mode, pedestrian mode, and bus mode should be from FDOT's most current version of LOS Handbook.

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Generalized Service Volume Tables

The Tables Are Not Biased

Overstates Deficiencies
Understates Deficiencies

Conservative Liberal
Realistic

Theoretically, **50%** of roads have higher service volumes while **50%** have lower service volumes

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LOSPLAN



FREEPLAN 2012

Freeway
Level of Service Analysis
For Conceptual Planning and Preliminary Engineering
Version Date: 12/12/2012

Startup Options
Would you like to...
 or





HIGHPLAN 2012

Multilane and Two-Lane Highway
Level of Service Analysis
For Conceptual Planning and Preliminary Engineering
Version Date: 12/12/2012

Startup Options
Would you like to...
 or



Agenda Item 5

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ARTPLAN 2012

Multimodal Arterial
Level of Service Analysis
For Conceptual Planning and Preliminary Engineering
Version Date: 12/12/2012

Startup Options
Would you like to...
 or

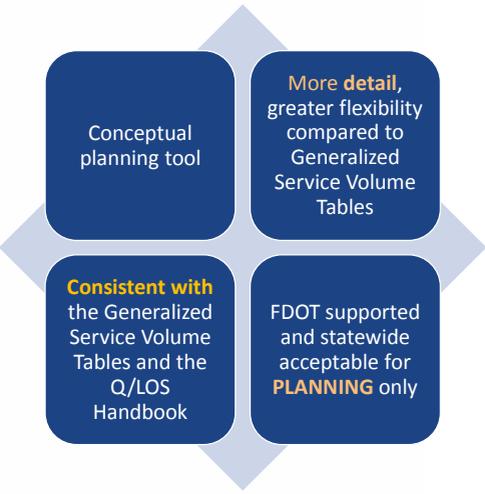




LOSPLAN







Conceptual
planning tool

More **detail**,
greater flexibility
compared to
Generalized
Service Volume
Tables

Consistent with
the Generalized
Service Volume
Tables and the
Q/LOS
Handbook

FDOT supported
and statewide
acceptable for
PLANNING only

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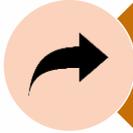
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Capabilities

- 

Allows for planning-level multimodal LOS and capacity analysis with minimal input requirements
- 

Allows "what if" comparisons showing the interactions of modes upon each other
- 

Provides facility specific service volume tables for auto, bike, pedestrian, and bus based on model inputs

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Limitations

Although considered good generalized and conceptual planning tools

➔

The software programs are not detailed enough for PD&E traffic analysis, final design, or operational analysis work, and should not be used for those purposes

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Key Differences Between Other Tools

ARTPLAN

- Requires significantly fewer inputs than other tools such as HCS, TRANSYT-7F, and CORSIM
- Uses average travel speed rather than percent base free flow speed as the primary service measure

NUMBER OF INPUTS COMPARISON:

Input	HCS Streets 2010	ARTPLAN
Turning Movements/Volume	12	3
Signal Timing Parameters	75+	5

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Key Differences Between Other Tools

HIGHPLAN

- Uses two classes of two-lane highways rather than three, as HCS uses
- Uses a modified version of the multilane speed-flow curves developed for the HCM, extending beyond the 60 mph maximum
- Approximately the same number of inputs as HCS, but simplified approximation of free flow speed

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Key Differences Between Other Tools

FREEPLAN

- Includes extensions to the HCM methodology for planning purposes
- Relies on revised density thresholds differing from the HCM density thresholds
- Basic segments in FREEPLAN require 9 inputs as opposed to 11 in HCS facilities

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LOSPLAN DEFINITIONS

Study Period – The time frame for which the traffic demand on the roadway is being studied

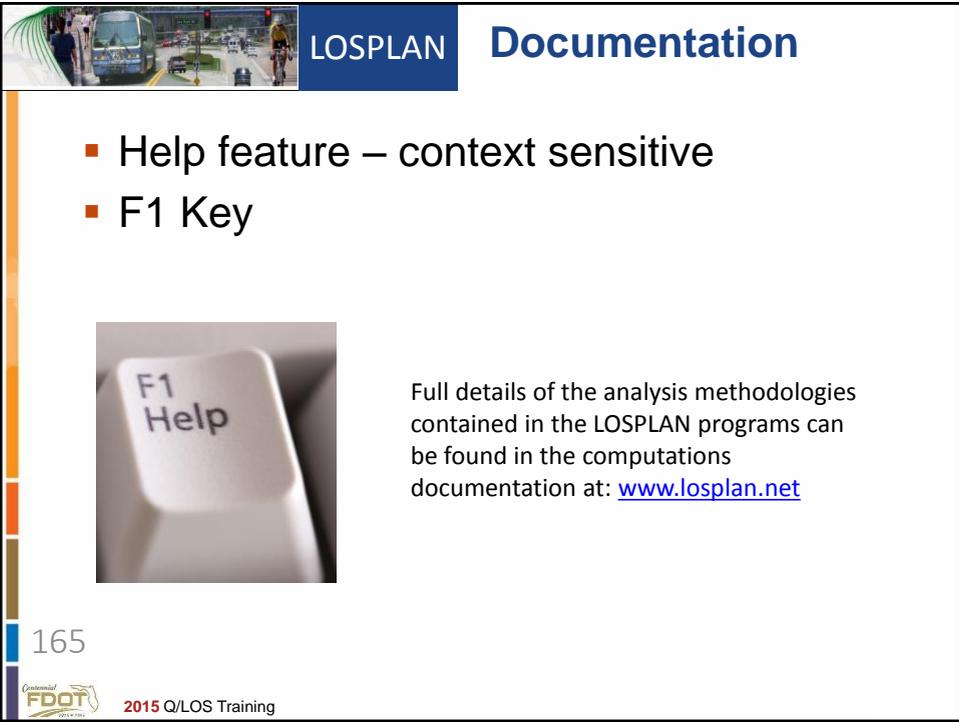
- LOSPLAN offers three options for the study period:
 - *Standard K*
 - Florida’s Standard K-factor based on area type and facility type
 - K_{other}
 - A study period other than that represented by Florida’s Standard K-Factor
 - *Dir Hr Demand Vol*
 - Allows the analyst to enter directional hourly demand volumes

Provide documentation if using K_{other} or *Dir Hr Demand Vol*

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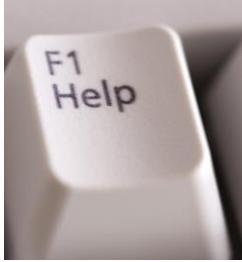


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LOSPLAN Documentation

- Help feature – context sensitive
- F1 Key



Full details of the analysis methodologies contained in the LOSPLAN programs can be found in the computations documentation at: www.losplan.net

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HIGHPLAN 2012



Agenda Item 6

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HIGHPLAN 2012

Uses

- Roadways with average signalized intersection spacing greater than 2 - 3 miles
- Can perform three types of highway analysis:
 - Two-Lane Segment
 - Multilane Segment
 - Two-Lane Facility

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HIGHPLAN 2012

Strengths

- Requires only basic geometry and volume information for LOS estimation
- Incorporates Florida specific adjustments

Limitations

- Only supports analysis of multilane segments, not multilane facilities
- Not capable of non-automobile LOS evaluation

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HIGHPLAN 2012

When to use other tools

- When conducting operational or design level analysis
- Multimodal analysis

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HIGHPLAN 2012

Number of Lanes

- Number of through lanes in both directions for the entire roadway cross-section; exclude left turn lanes and center two-way left turn lanes.



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HIGHPLAN 2012

Percent No Passing Zones

- Percent of a two-lane highway where passing is prohibited in the analysis direction



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HIGHPLAN 2012

Passing Lane

- Short lane (approximately 1 mile) added to provide passing opportunities in one direction of travel on a two-lane highway



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HIGH PLAN 2012

Example 1 Two-Lane Segment

SR 24 between US 19/US 98 & SR 500, near Gainesville

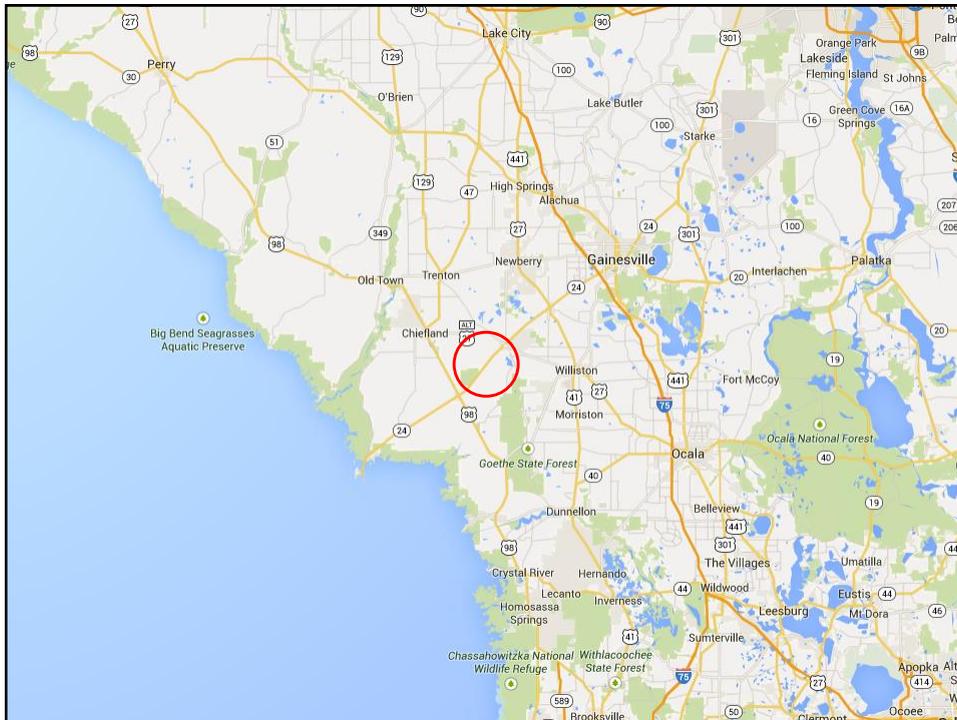
- Rural undeveloped area type
- EB peak direction
- 45 mph posted speed limit
- 11.3 mile segment
- 4% no passing zones
- No median

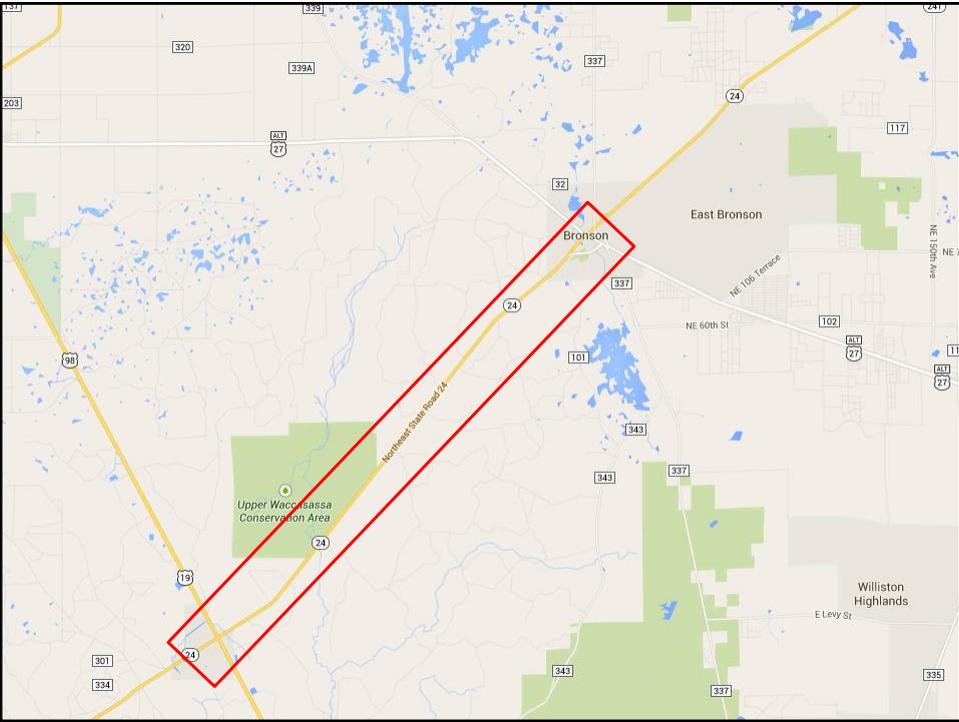
AADT	D-Factor	% Heavy Vehicles	Local Adjustment Factor
1,200	55.3	5.0	0.84

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HIGHPLAN 2012

Example 1 *Two-Lane Segment*

SR 24 between US 19/US 98 & SR 500, near Gainesville

- Rural undeveloped area type
- EB peak direction
- 45 mph posted speed limit
- 11.3 mile segment
- 4% no passing zones
- No median

AADT	D-Factor	% Heavy Vehicles	Local Adjustment Factor
1,200	55.3	5.0	0.84

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HIGHPLAN 2012

Workshop 1 *Two-Lane Segment*

SR 62 between Saffold Rd & SR 37, Parrish/Wauchula

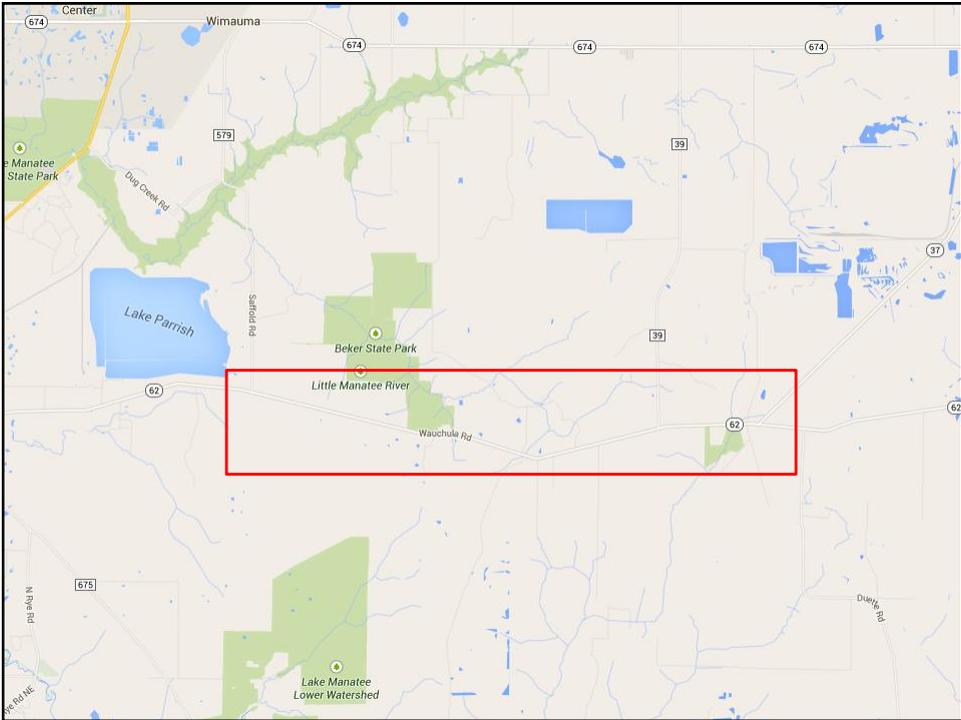
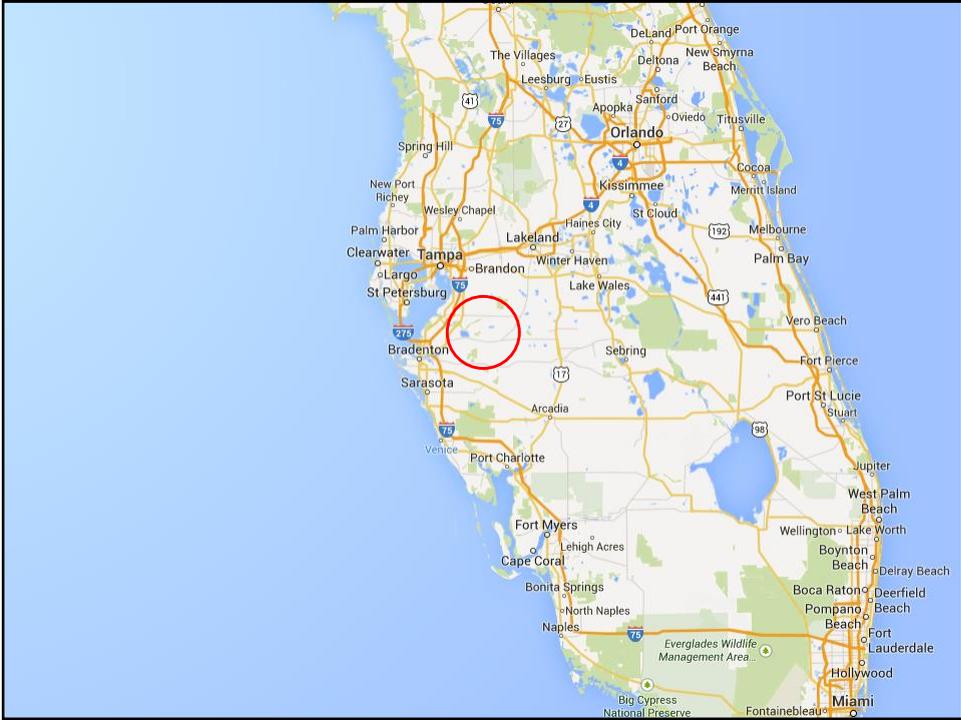
- Rural undeveloped area type
- EB peak direction
- 60 mph posted speed limit
- 10.9 mile segment
- 11% no passing zones
- No median

AADT	D-Factor	% Heavy Vehicles	Local Adjustment Factor
3,500	55.8	5.0	0.84

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2015 Q/LOS Training





HIGHPLAN 2012

Workshop 1 Two-Lane Segment

SR 62 between Saffold Rd & SR 37, Parrish/Wauchula

- Rural undeveloped area type
- EB peak direction
- 60 mph posted speed limit
- 10.9 mile segment
- 11% no passing zones
- No median

AADT	D-Factor	% Heavy Vehicles	Local Adjustment Factor
3,500	55.8	5.0	0.84

182



2015 Q/LOS Training



HIGH PLAN 2012

Workshop 2 Multilane Segment

US 19/27 between Avalon Rd & CR 14, Lamont

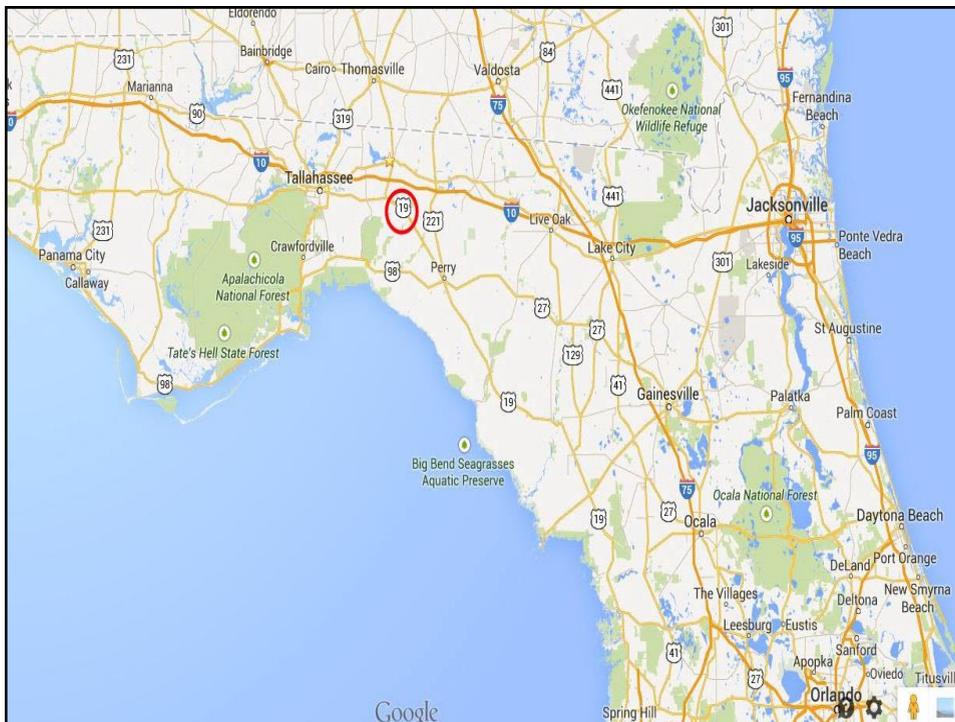
- Rural undeveloped area type
- NB peak direction
- 4-lane highway
- 65 mph posted speed limit
- 12.6 mile segment
- Median present

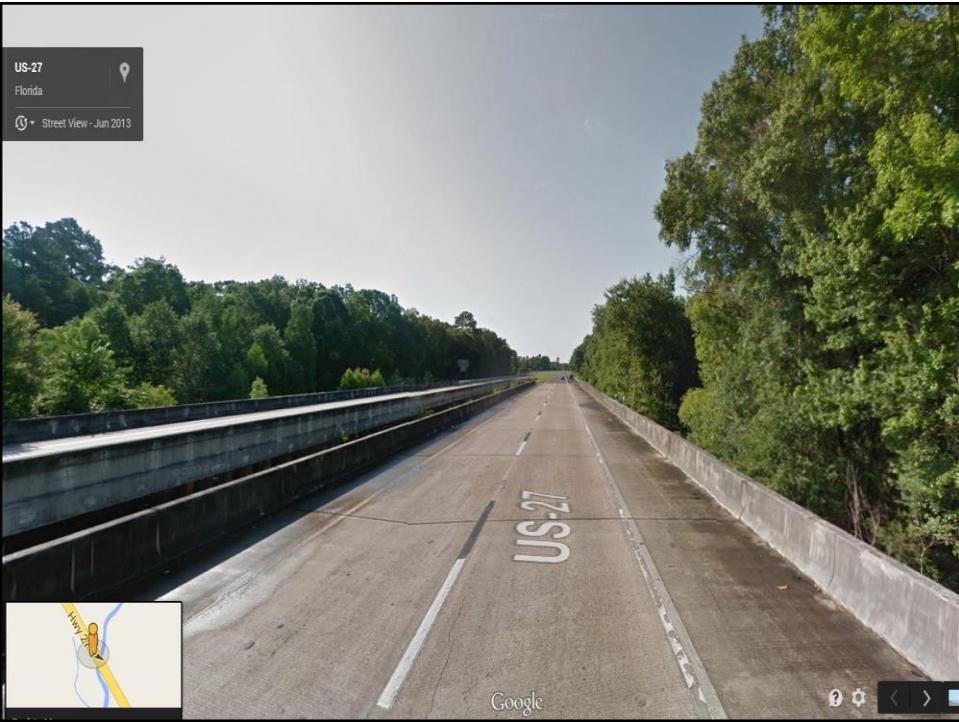
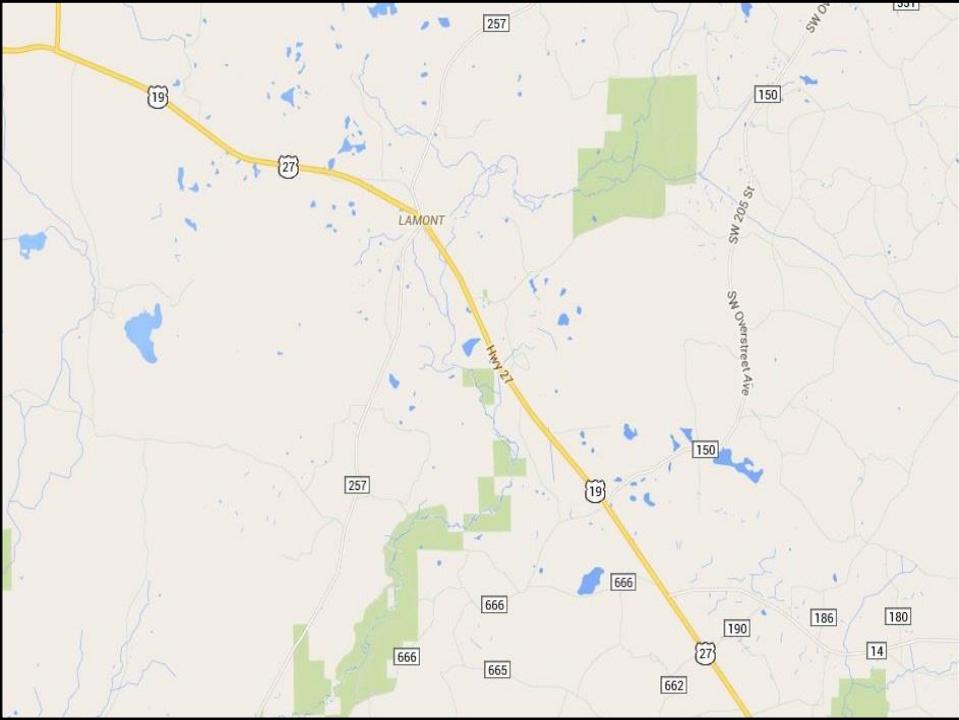
AADT	D-Factor	% Heavy Vehicles	Local Adjustment Factor
5,056	55.8	12.0	0.76

183



2015 Q/LOS Training







HIGHPLAN 2012

Workshop 2 Multilane Segment

US 19/27 between Avalon Rd & CR 14, Lamont

- Rural undeveloped area type
- NB peak direction
- 4-lane highway
- 65 mph posted speed limit
- 12.6 mile segment
- Median present

AADT	D-Factor	% Heavy Vehicles	Local Adjustment Factor
5,056	55.8	12.0	0.76

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2015 Q/LOS Training



ARTPLAN 2012

Agenda Item 7

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2015 Q/LOS Training



ARTPLAN 2012

Uses

- Can perform three types of arterial analysis:
 - Single Intersection
 - Segments
 - Facilities

- Provides LOS for four modes:
 - Auto
 - Bicycle
 - Pedestrian
 - Bus

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2015 Q/LOS Training



ARTPLAN 2012

Strengths

- Much fewer inputs than HCS Streets

- Input data is easy to obtain

- Provides multimodal analysis with limited required information

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2015 Q/LOS Training



Multimodal Analysis

Input	HCS Streets 2010	ARTPLAN
Pedestrian Parameters	76	16
Bicycle Parameters	42	6
Bus Parameters	24	4



Number of
Pedestrian/Bicycle/Bus
Inputs

191

2015 Q/LOS Training



- **Roadway Class**
 - **Class 1** – Arterials with a posted speed of **40 mph** or greater
 
 - **Class 2** – Arterials with a posted speed of **35 mph** or less
 

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2015 Q/LOS Training

Importance of Signalized Intersections



Getting signalized intersection data correct is critical for capacity and LOS analyses

193



2015 Q/LOS Training

ARTPLAN 2012



Number of through lanes

- In ARTPLAN and FREEPLAN, the number of through lanes in the analysis direction is an input



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2015 Q/LOS Training

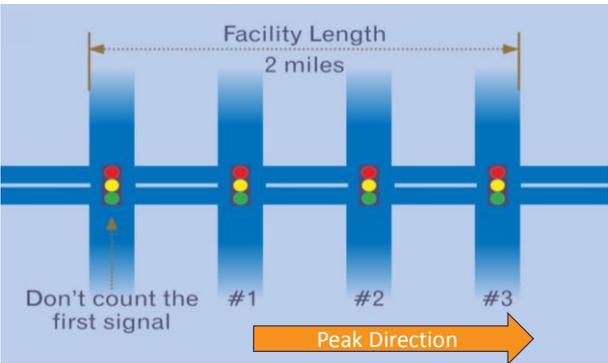
61



ARTPLAN 2012

Number of Signalized Intersections

- Only one intersection at the ends of the facility should be counted



Facility Length
2 miles

Don't count the first signal #1 #2 #3

Peak Direction

195



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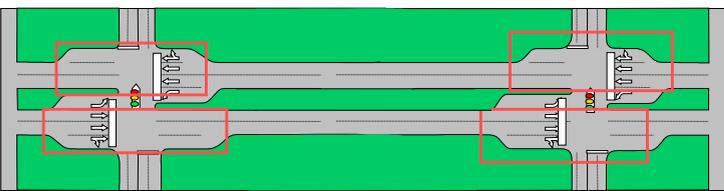
93



ARTPLAN 2012

Number of Through Lanes

- Arterials
 - Counted at signalized intersections, **Not** mid-block
 - Through and shared-right-turn lanes



Add-on / Drop-off lanes must be of reasonable lengths

- Freeways – Counted “mid-block”

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ROADWAY

Turn Lanes

- **Number of Left/Right Turn Only Lanes**
- **Percent Left/Right Turns** – percentage of vehicles performing a left or right-turning movement on the approach to a signalized intersection
- **Total Left Turn Storage** – The total amount of storage length in feet for exclusive left turn lanes



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2015 Q/LOS Training



- **On-Street Parking**
 - Impacts both link running time as well as bicycle and pedestrian LOS
- **Parking Activity**
 - Low
 - Medium
 - High



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ARTPLAN 2012

Inputting g/C

Through g/C

Left g/C

ARTPLAN requires two inputs for g/C:

199

2015 Q/LOS Training

Computing Percent Turns

10% Left

100

500

1,000

500

400

400

100

10% Right

$$\frac{100}{1,000} = 10\%$$



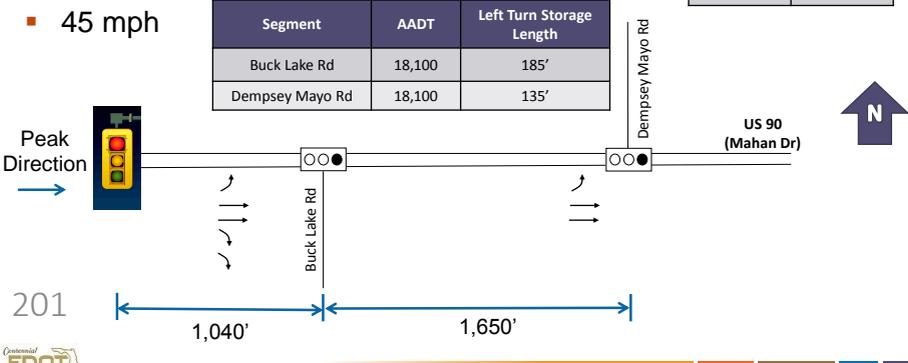
ARTPLAN 2012

Example 1 *Planning-Level Inputs, Auto Only*
 Mahan Drive and Dempsey Mayo Road, Tallahassee

- Fully actuated signal, protected only phasing
- Percent turns (L = 5%)
- Restrictive median
- 45 mph

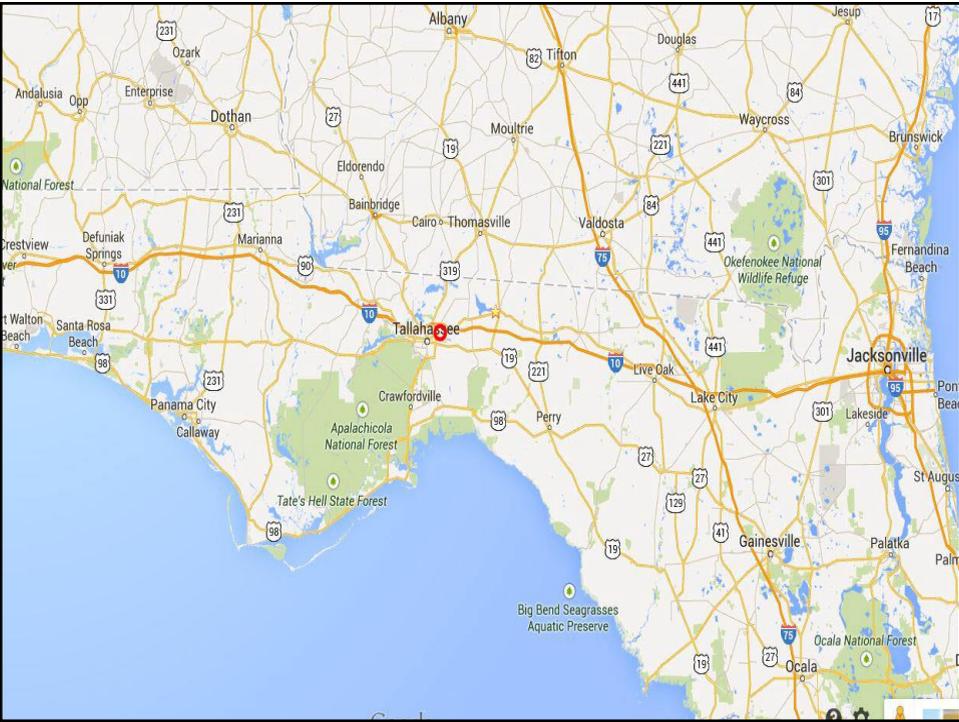
D-Factor	% Hvy Vhcls
71.3	1.0

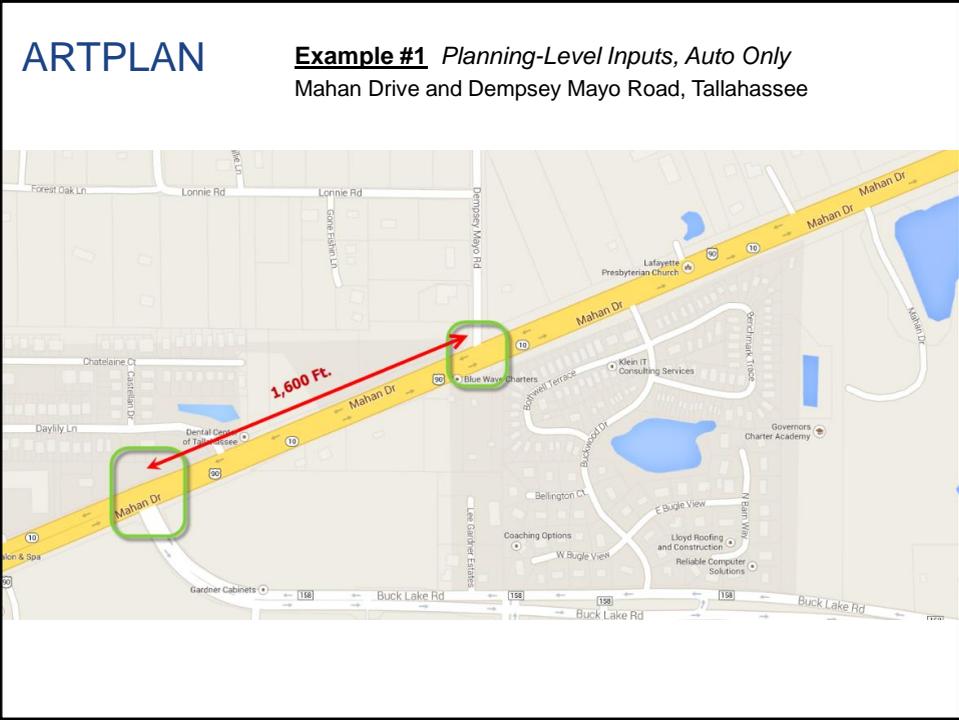
Segment	AADT	Left Turn Storage Length
Buck Lake Rd	18,100	185'
Dempsey Mayo Rd	18,100	135'



The diagram shows a north-south road layout. A signal is located at the intersection with US 90 (Mahan Dr). The segment from the signal to Buck Lake Rd is 1,040' long. The segment from Buck Lake Rd to Dempsey Mayo Rd is 1,650' long. A north arrow is shown to the right of the road. The number 201 is written below the road on the left side.


2015 Q/LOS Training







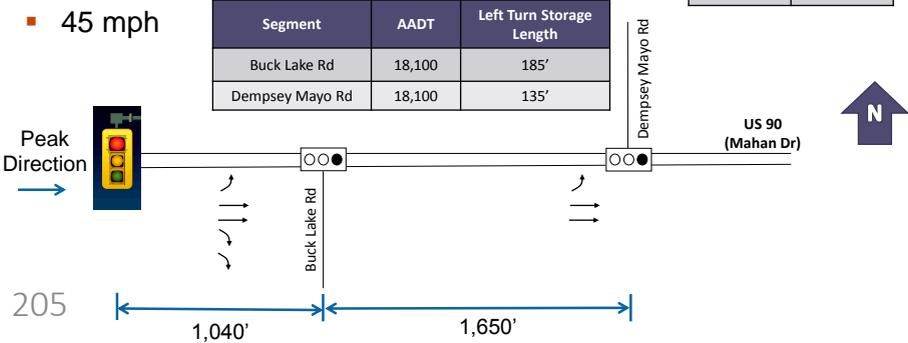
ARTPLAN 2012

Example 1 *Planning-Level Inputs, Auto Only*
 Mahan Drive and Dempsey Mayo Road, Tallahassee

- Fully actuated signal, protected only phasing
- Percent turns (L = 5%)
- Restrictive median
- 45 mph

D-Factor	% Hvy Vhcls
71.3	1.0

Segment	AADT	Left Turn Storage Length
Buck Lake Rd	18,100	185'
Dempsey Mayo Rd	18,100	135'



205

1,040' 1,650'

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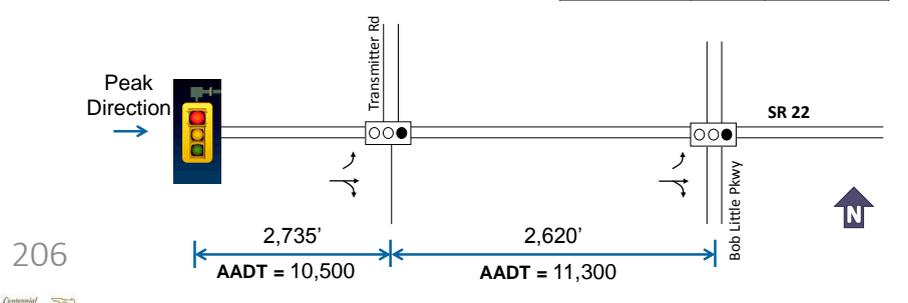


ARTPLAN 2012

Workshop 1 *Planning-Level Inputs, Auto Only*
 SR 22 between Transmitter Rd & Bob Little Rd

- Fully actuated signal, protected lefts only
- Posted speed = 45 mph
- No median

Segment	AADT	Left Turn Storage Length
Transmitter Rd	10,500	325'
Bob Little Pkwy	11,300	125'

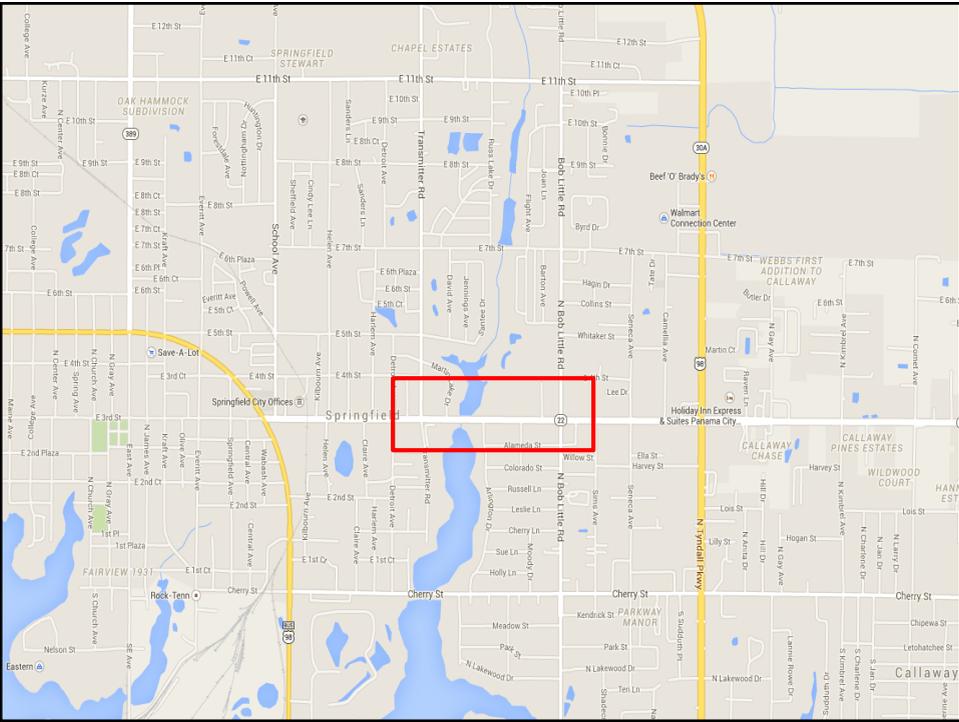
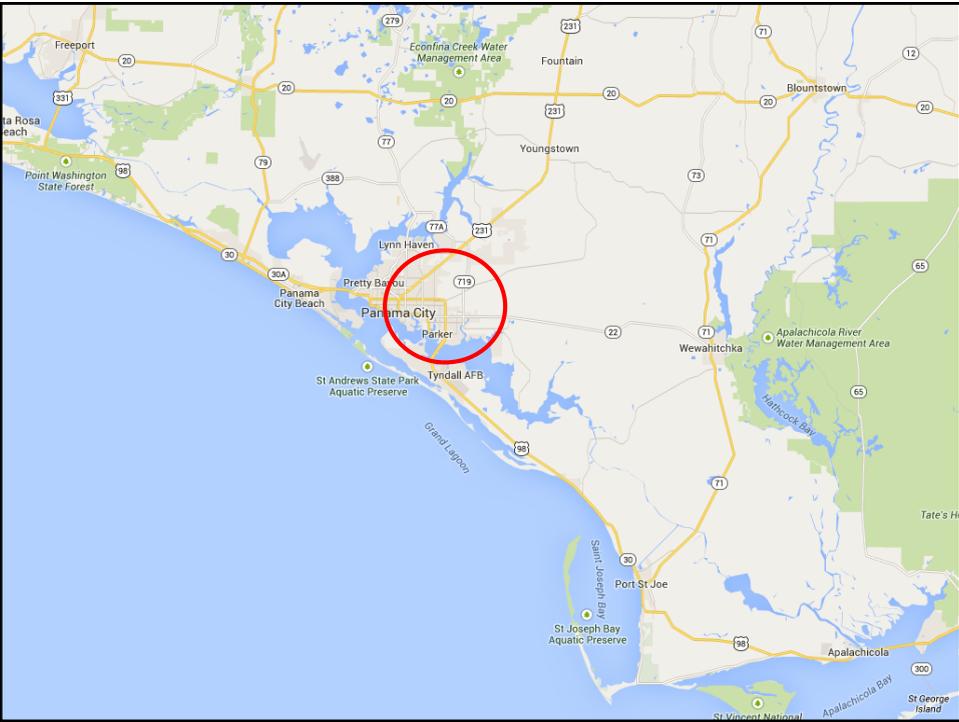


206

2,735' 2,620'

AADT = 10,500 AADT = 11,300

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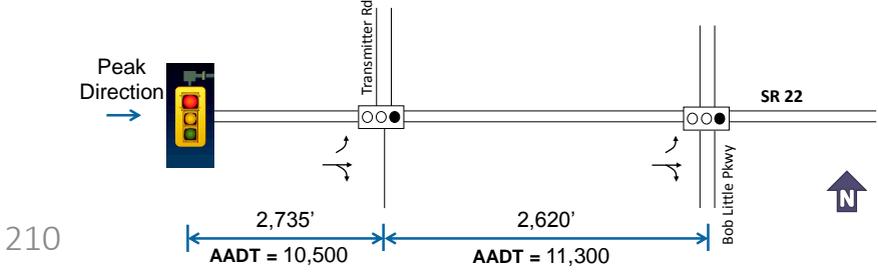
ARTPLAN 2012

Workshop 1 *Planning-Level Inputs, Auto Only*

SR 22 between Transmitter Rd & Bob Little Rd

- Fully actuated signal, protected lefts only
- Posted speed = 45 mph
- No median

Segment	AADT	Left Turn Storage Length
Transmitter Rd	10,500	325'
Bob Little Pkwy	11,300	125'





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ARTPLAN 2012

Workshop 2 Planning-Level Inputs, Auto Only

SR 222 between SR 121 & US 441/SR 441

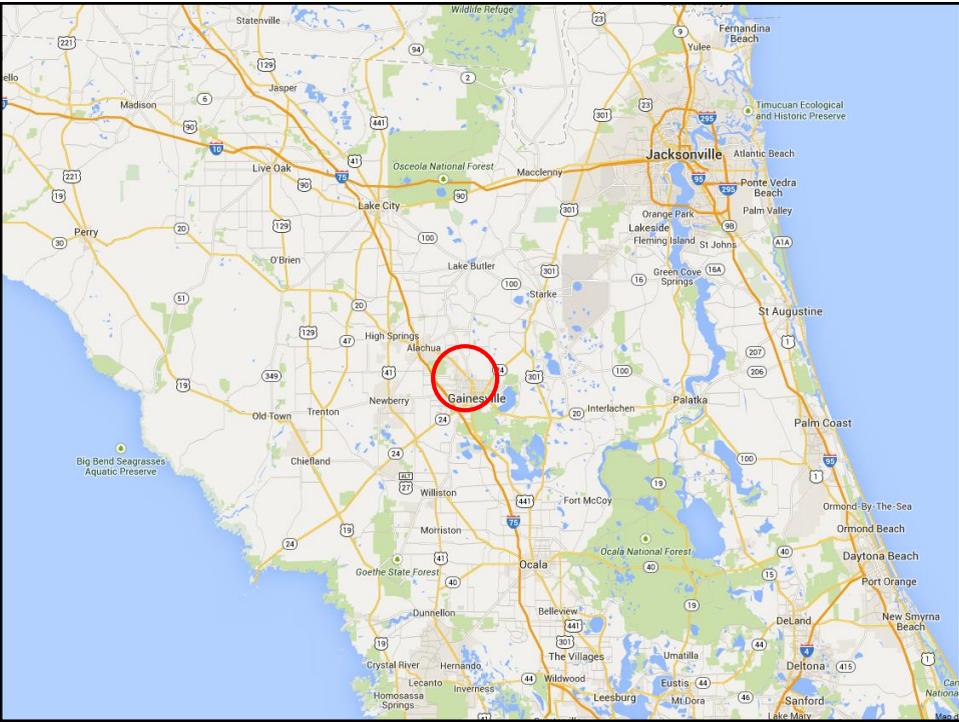
- Coordinated/actuated
- Posted speed = 45 mph
- Bounded by major intersections on each end
- Non-restrictive median

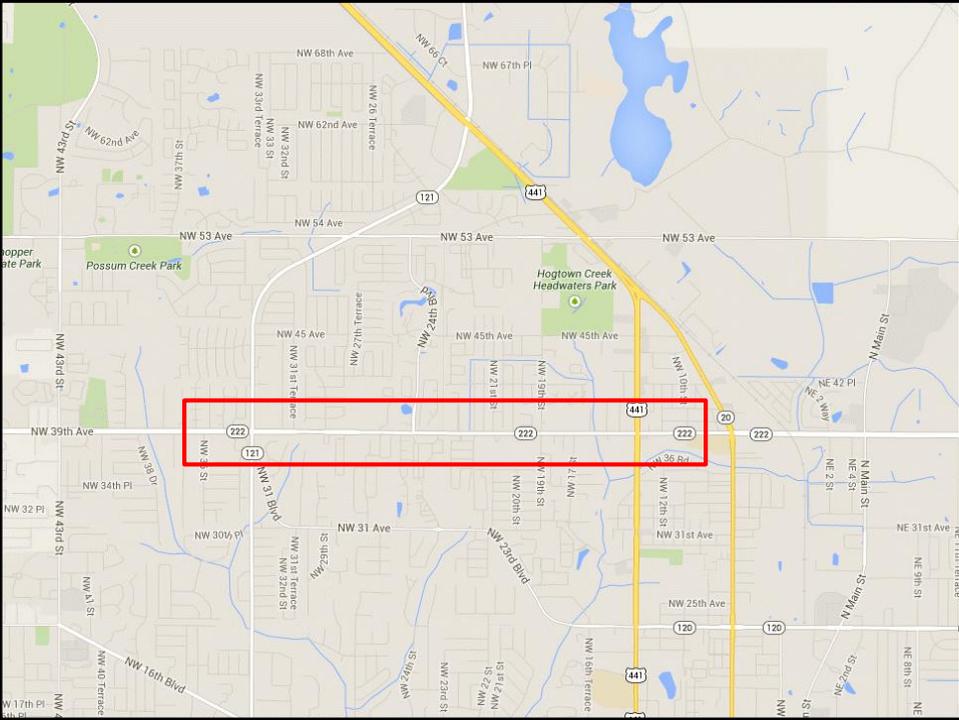
Segment	% Left Turns	% Right Turns	Left Turn Storage	AADT
SR 121	12	12	510'	27,000
29 th Terr.	5	5	150'	27,000
24 th Blvd.	5	5	175'	25,000
19 th St.	5	5	150'	25,000
US 441	10	12	135'	25,500

Segment lengths: 5,270', 2,020', 2,415', 3,500', 2,625'

Intersections: SR 121, 29th Terr., 24th Blvd., 19th St., US 441/SR 25

Peak Direction: North





ARTPLAN 2012
Workshop 2 Planning-Level Inputs, Auto Only
 SR 222 between SR 121 & US 441/SR 441

- Coordinated/actuated
- Posted speed = 45 mph
- Bounded by major intersections on each end
- Non-restrictive median

Segment	% Left Turns	% Right Turns	Left Turn Storage	AADT
SR 121	12	12	510'	27,000
29 th Terr.	5	5	150'	27,000
24 th Blvd.	5	5	175'	25,000
19 th St.	5	5	150'	25,000
US 441	10	12	135'	25,500

Peak Direction →

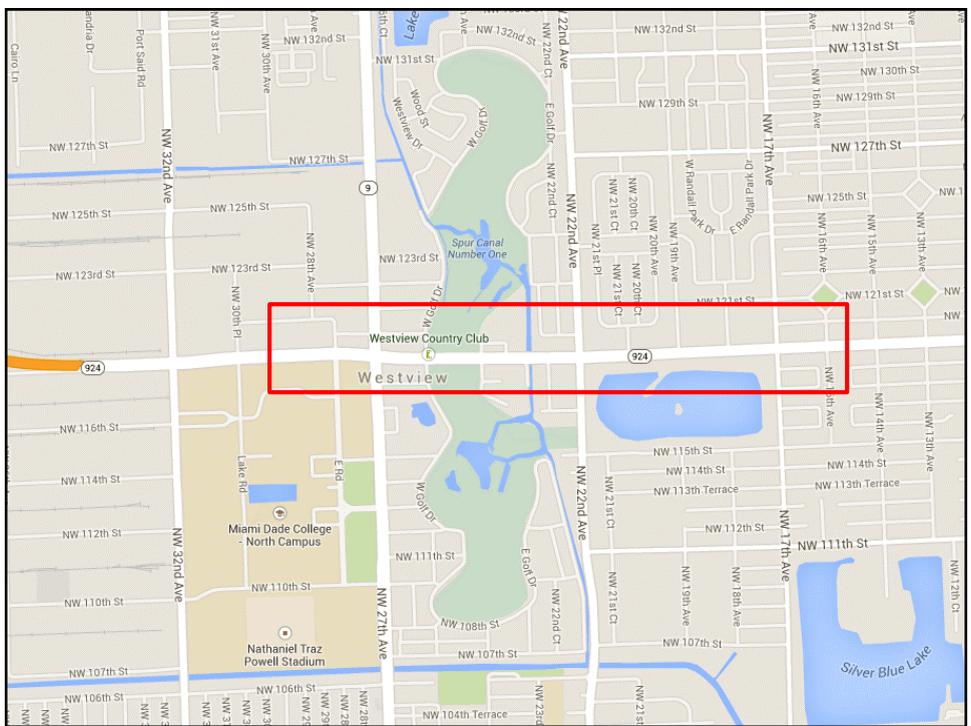
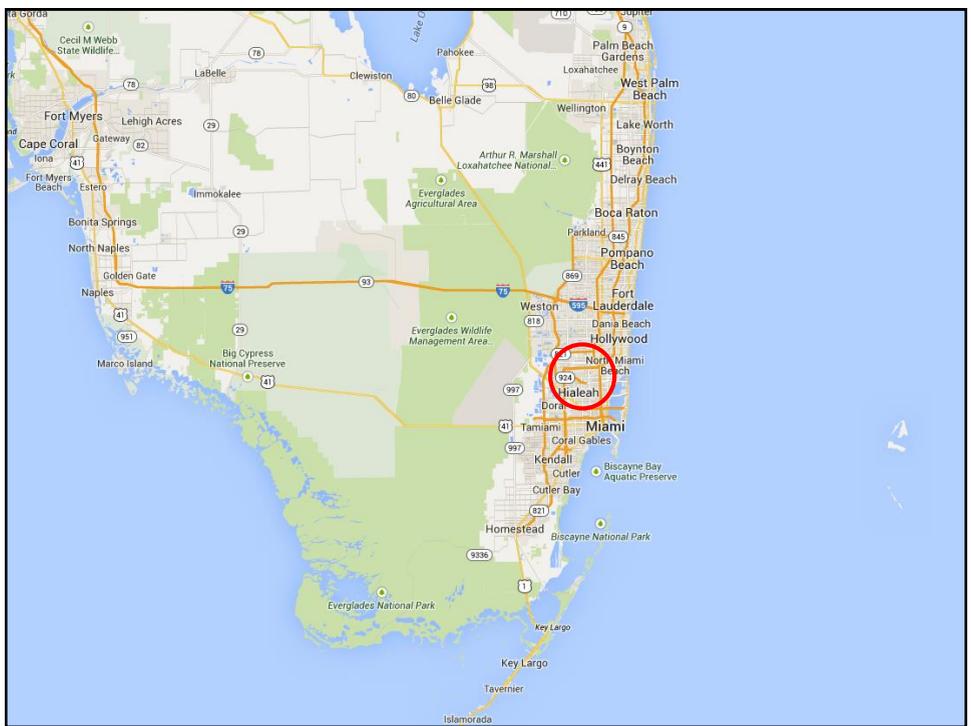
ARTPLAN 2012
Workshop 3 Known Inputs & Multimodal Analysis
 State Route 924 between NW 27th Ave & NW 17th Ave, Miami

Save data file for multimodal analysis in next unit

- Non-restrictive median west of 27th Ave
- 40 mph posted speed limit

Segment	AADT	% Left Turns	% Right Turns	Left Turn Storage
NW 27 th Ave	41,500	8	12	195'
Westview CC	41,500	5	0	155'
NW 22 nd Ave	41,500	5	12	185'
NW 17 th Ave	41,500	12	12	450'

Peak Direction →







ARTPLAN 2012

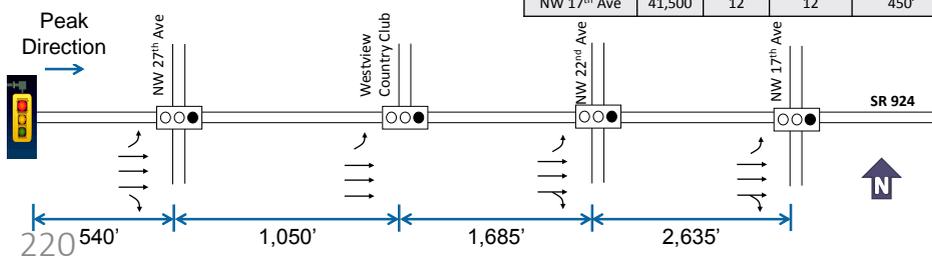
Save data file for multimodal analysis in next unit

Workshop 3 *Known Inputs & Multimodal Analysis*

State Route 924 between NW 27th Ave & NW 17th Ave, Miami

- Non-restrictive median west of 27th Ave
- 40 mph posted speed limit

Segment	AADT	% Left Turns	% Right Turns	Left Turn Storage
NW 27 th Ave	41,500	8	12	195'
Westview CC	41,500	5	0	155'
NW 22 nd Ave	41,500	5	12	185'
NW 17 th Ave	41,500	12	12	450'





2015 Q/LOS Training

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Centennial FDOT 2015 Q/LOS Training

MULTIMODAL LOS

Agenda Item 8

222

Centennial FDOT 2015 Q/LOS Training



Is the purpose of the roadway to serve automobiles or people?



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Mode	Automobile	Bicycle	Pedestrian	Bus
Major Inputs	Volume and Lanes	Bicycle Lane	Sidewalk	Bus Frequency
	Volume and Lanes			
	Other Traffic and Roadway Characteristics			
	Arterial Running Speed			
	Arterial Running Time		Sidewalk	
	Control Characteristics			
	Control Delay			
Service Measure	Average Travel Speed	Bicycle LOS Score	Pedestrian LOS Score	Adjusted Bus Frequency
LOS Determinator	HCM LOS Criteria	HCM LOS Criteria	HCM LOS Criteria	TCQSM LOS Criteria
				

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Bicycle/Pedestrian/Bus Level of Service Analyses



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Bicycle LOS



**What's the
LOS?**

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Bicycle LOS

- Outside Lane Width** - Width, in feet, of a roadway's outside motorized vehicle through lane, not including the gutter

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FDOT 2015 Q/LOS Training



Bicycle LOS



- **Paved Shoulder / Bicycle Lane** – A bicycling area at least three feet wide* and separated from the outer motorized vehicle through lane by a solid pavement marking

* ARTPLAN assumes a width of 5' if selected




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Andy Hamilton, PBIC

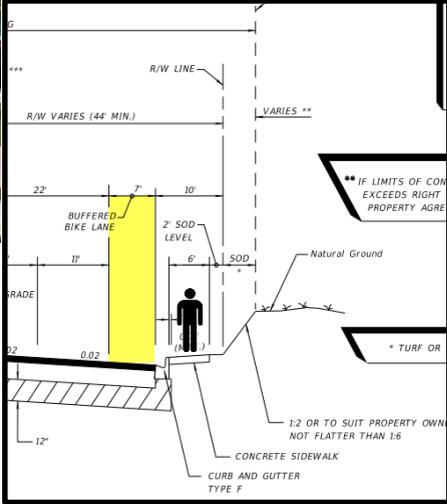


2015 Q/LOS Training

7 ft. Bike Lane



Gainesville, FL



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Bicycle LOS

- **Pavement Condition** - classification of the roadway surface where bicycling usually occurs
 - **Desirable** - new or recently resurfaced
 - **Typical** - light gray color, the surface appears worn, and may have some cracks; however, the ride for the bicyclist is fairly smooth
 - **Undesirable** - noticeable cracks, broken pavement, or ruts



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Bicycle LOS

- **Side Path** - Off-street dedicated bicycle and pedestrian path (ARTPLAN analyzes bicycles only)
- **Side Path Separation** - distance between the side path and the outside edge of the roadway



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2015 Q/LOS Training

 Bicycle LOS



235

 2015 Q/LOS Training

 Bicycle LOS

- Developed in Tampa in 1996
- Now applied to more than 200,000 miles throughout U.S.
- Published by TRB (# 1578)



A/B



C/D



E/F

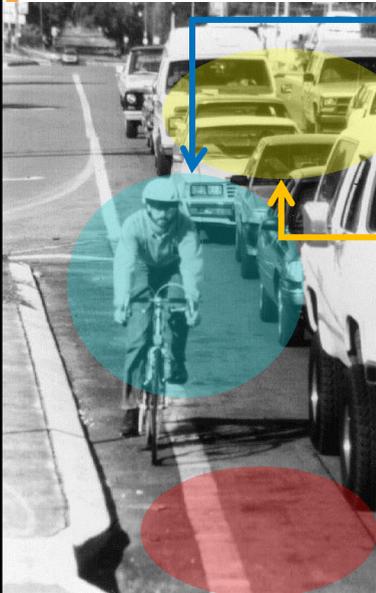
236

 2015 Q/LOS Training



Bicycle LOS

Factors Affecting Bicycling Quality of Service



Proximity of bicyclists to motorized vehicles

- Paved shoulder
- Bicycle lane

Motorized vehicle

- Volume
- Speed
- Type

Pavement condition

On-street parking



Bicycle LOS

BLOS = $0.507 \ln(\text{Vol}_{15}/L) + 0.199\text{SP}_t (1 + 10.38\text{HV})^2 + 7.066(1/\text{PR}_5)^2 - 0.005(\text{W}_e)^2 + 0.760$

Where:

BLOS = Bicycle level of service score

ln = Natural log

Vol₁₅ = Volume of directional motorized vehicles in the peak 15 minute time period

L = Total number of directional thru lanes

SP_t = Effective speed factor = 1.1199 ln(SP_p - 20) + 0.8103

SP_p = Posted speed limit (a surrogate for average running speed)

HV = percentage of heavy vehicles

PR₅ = FHWA's five point pavement surface condition rating

W_e = Average effective width of outside thru lane

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Bicycle LOS

LOS	Score
A	≤ 2.0
B	≤ 2.75
C	≤ 3.5
D	≤ 4.25
E	≤ 5.0
F	> 5.0

HCM 2010 Exhibit 17-4
LOS Criteria: Bicycle Mode

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2015 Q/LOS Training
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Bicycle LOS

Conceptual Planning Level of Analysis

- Input factors
 - Paved shoulder/bicycle lane (y/n)
 - Outside lane width
 - Traffic volume
 - Motorized vehicle speed
 - Motorized vehicle mix
 - Pavement condition

Bicycle LOS is an integrated module in ARTPLAN



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 Bicycle LOS

Is the Bicycle Lane/Paved Shoulder at least 3 feet?



 Bicycle LOS

Outside Lane Width

12 Feet – (Typical)



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Bicycle LOS

Pavement Condition



Desirable



Typical



Undesirable

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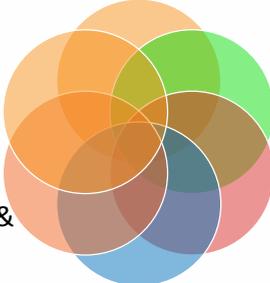
Bicycle LOS

Potential Applications of Bicycle LOS

Projects Funding
Priority

Travel Demand
Modeling

Facility
Alternatives
Testing



Corridor Selection &
Suitability Maps

Bicycle Network
Planning

Comprehensive
Planning

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Bicycle LOS

Ohio Bicycle Trunk Routes

Criteria

- Shoulder Width
- Lane width
- Pavement conditions
- Speed limits
- Car and truck volumes
- Existing bike facilities



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Bicycle LOS

ARTPLAN: Bicycle LOS Example

Instructions

Open a new ARTPLAN file and input the variables on the following slide

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Bicycle LOS

Example 1

What is the Bike LOS?

LOS = >

What is the Bike LOS if a bike lane were added?

LOS = >

If the speed limit were changed to 25 mph (no bike lane)?

LOS = >

- Area type: Large Urbanized
 - Class 2 arterial
- ARTPLAN defaults
- 3 Signals, 2 segments
- Through g/C: .44
- Facility: 4-lane divided
- K Factor: .09
- D Factor: .55
- AADT: 30,000
- Bike lanes : None



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Pedestrian LOS





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Pedestrian LOS

Factors Affecting Pedestrian Quality of Service

- Presence of a sidewalk
- Lateral separation of pedestrians and motorized vehicles
 - Includes presence of barriers and buffers, i.e. parked cars, trees
- Motorized vehicle
 - Volume
 - Speed





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Pedestrian LOS

Input Variables

- **Sidewalk** - paved walkway at the side of a roadway, typically 5 feet in width (on the directional side of the arterial being analyzed)
- **Sidewalk Protective Barrier** - Physical barriers of at least 3' high and spacing of 20' or less that separate pedestrians from vehicles, such as planted trees and on-street parking.




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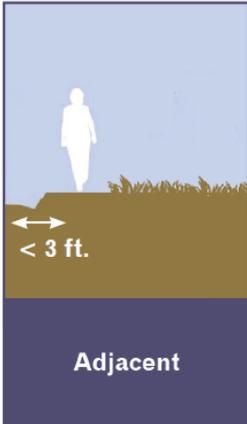
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Pedestrian LOS

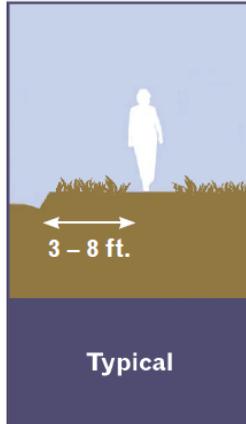
Input Variables

- **Sidewalk/Roadway Separation**
 - lateral distance in feet from the outside edge of pavement (before the gutter pan) to the inside edge of the sidewalk



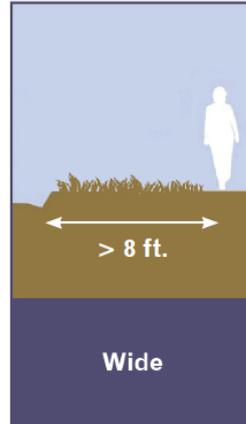
< 3 ft.

Adjacent



3 - 8 ft.

Typical



> 8 ft.

Wide

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Pedestrian LOS

- Model developed in 2000 from FDOT sponsored research in Pensacola



A/B



C/D



E/F

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2015 Q/LOS Training

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Pedestrian LOS

Ped LOS = $-1.2276 \ln(W_{ol} + W_l + f_p \times \%OSP + f_b \times W_b + f_{sw} \times W_s) + 0.0091(\text{Vol}_{15}/L) + 0.004\text{SPD}^2 + 6.0468$

Where:

- PLOS = Pedestrian level of service score
- ln* = Natural log
- W_{ol} = Width of outside lane
- W_l = Width of shoulder or bicycle lane
- f_p = On-street parking effect coefficient (=0.20)
- %OSP = Percent of segment with occupied on-street parking
- f_b = Buffer area barrier coefficient
(=5.37 for trees spaced 20 feet on center)
- W_b = Buffer width
(distance between edge of pavement and sidewalk, feet)
- f_{sw} = Sidewalk presence coefficient (= 6 - 0.3Ws)
- W_s = Width of sidewalk
- Vol_{15} = Volume of motorized vehicles in the peak 15 minute period
- L = Total number of directional thru lanes
- SPD = Average running speed of motorized vehicles traffic (mi/hr)

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Pedestrian LOS

LOS	Score
A	≤ 2.0
B	≤ 2.75
C	≤ 3.5
D	≤ 4.25
E	≤ 5.0
F	> 5.0

HCM 2010 Exhibit 17-3
LOS Criteria: Pedestrian Mode

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Pedestrian LOS

- **Input factors**
 - **Sidewalk (y/n)**
 - Sidewalk/roadway separation
 - Sidewalk/roadway separation barrier
 - Traffic volume
 - Motorized vehicle speed

Pedestrian
LOS is an
integrated
module in
ARTPLAN



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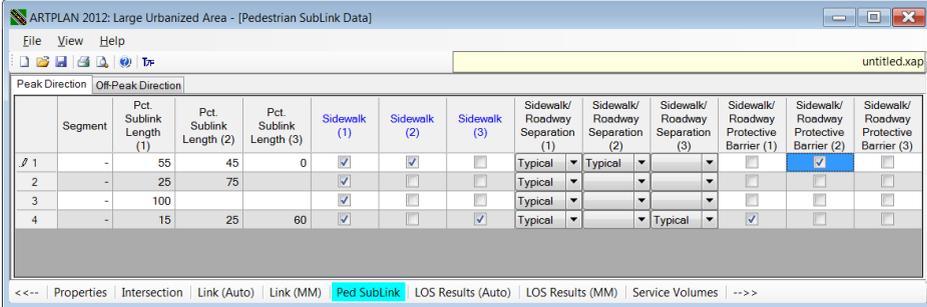
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Pedestrian LOS

Pedestrian Sub Link Screen

- **Allows for coding changes in sidewalks along a segment**

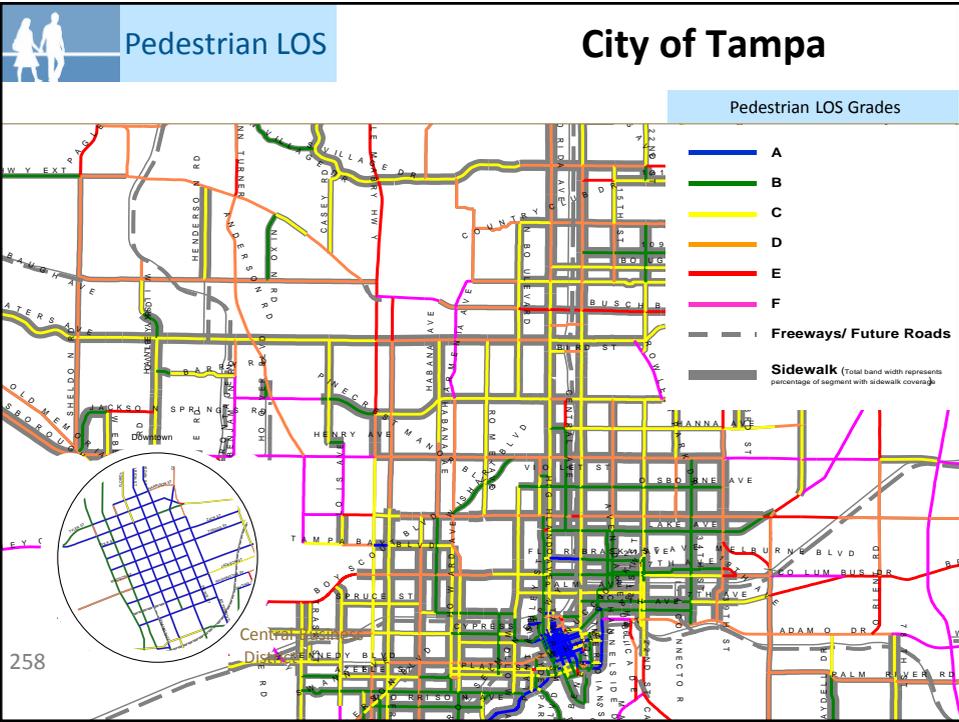
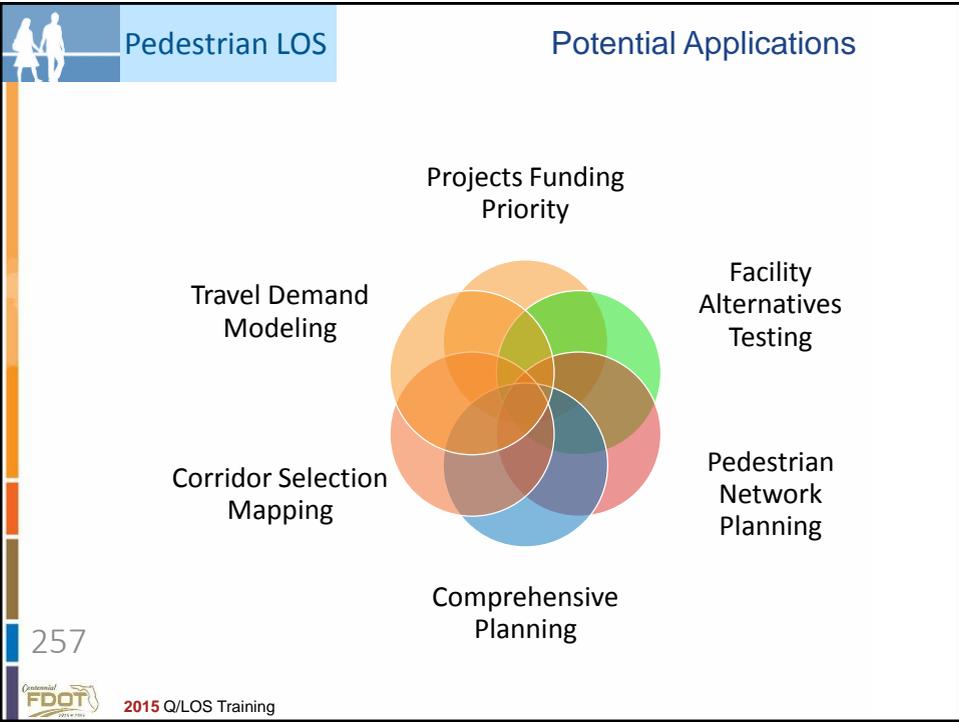


Segment	Pct. Sublink Length (1)	Pct. Sublink Length (2)	Pct. Sublink Length (3)	Sidewalk (1)	Sidewalk (2)	Sidewalk (3)	Sidewalk/Roadway Separation (1)	Sidewalk/Roadway Separation (2)	Sidewalk/Roadway Separation (3)	Sidewalk/Roadway Protective Barrier (1)	Sidewalk/Roadway Protective Barrier (2)	Sidewalk/Roadway Protective Barrier (3)
1	55	45	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Typical	Typical			<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	25	75		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Typical				<input type="checkbox"/>	<input type="checkbox"/>
3	100			<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Typical				<input type="checkbox"/>	<input type="checkbox"/>
4	15	25	60	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Typical		Typical	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

256



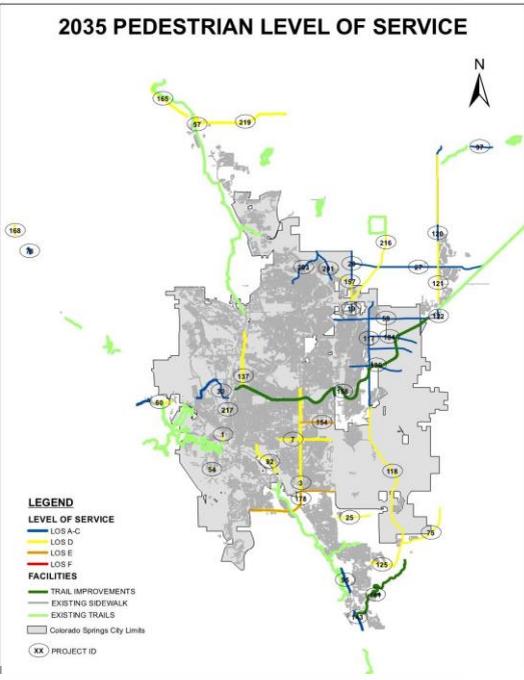
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Pedestrian LOS

2035 PEDESTRIAN LEVEL OF SERVICE



Colorado Springs MPO LRTP Networks

- PLOS changes from 2005 to 2035 model roadway network

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2015 Q/LOS Training



Pedestrian LOS

ARTPLAN: Pedestrian LOS Example

Instructions

Open a new ARTPLAN file and input the variables on the following slide

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Pedestrian LOS

Example 1

- **What is the pedestrian LOS?**
- **What is the pedestrian LOS if a sidewalk with typical separation were added to the**
 - **2nd segment only?**
 - **Whole facility?**

LOS

2nd Seg.

Whole fac.

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- Area type: Large Urbanized
- Opening ARTPLAN defaults
- Facility:
 - Class 2 arterial
- Number of Signals: 3
- Through g/C: .44
- 4-lane divided
- K Factor: .09
- D Factor: .565
- AADT of 34,000
- Sidewalk : None

Agenda – Day Two

8:30 AM		9	Multimodal LOS Review
9:00 AM		10	ARTPLAN – Bus Analysis
9:40 AM		11	Monroe Street Video Data Collection
	◀ 10:10 AM Break		
10:25 AM		12	Monroe Street ARTPLAN analysis
	◀ 11:45 AM Lunch		
1:00 PM		13	FREEPLAN – Freeway analysis
	◀ 2:30 PM Break		
2:45 PM		14	Future Year Analysis, LOS Applications
4:00 PM		15	Wrap-Up
	◀ 4:30 PM Adjourn		

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2015 Q/LOS Training

ARTPLAN – Bus Analysis



Agenda Item 10

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Bus LOS



A/B



C/D



E/F

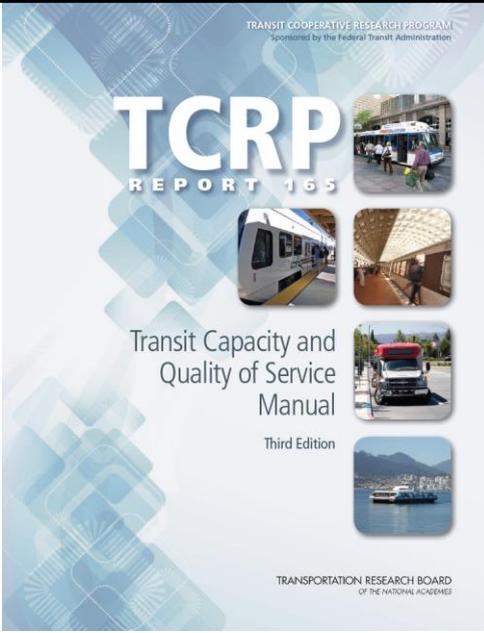
264



Bus LOS



2015 Q/LOS Training



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Bus LOS







Key Factors Affecting Transit QOS

- Availability (bus frequency)
 - Passenger loading
- Pedestrian LOS (accessibility)
 - Mid-block crossing difficulty
- Bus Stop Amenities

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Bus LOS

Conceptual Planning

- **Performance measure**
 - Adjusted bus frequency
- **Input factors**
 - Bus frequency
 - Passenger Loading
 - Bus stop type and amenities
 - Pedestrian access factors
 - Pedestrian LOS (calculated within ARTPLAN)
 - Crossing difficulty (calculated within ARTPLAN)

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2015 Q/LOS Training

Bus LOS is an integrated module in ARTPLAN





Bus LOS

Headways

Level of Service	Adjusted Service Frequency (Vehicles/hour)	Headway (minutes)	Comments
A	>6.0	<10	Passengers do not need schedules
B	4.01 to 6.0	10 to 14	Frequent service, passengers consult schedules
C	3.0 to 4.0	15 to 20	Maximum desirable time to wait if transit vehicle missed
D	2.0 to 2.99	21 to 30	Service unattractive to choice riders
E	1.0 to 1.99	31 to 60	Service available during hour
F	<1.0	>60	Service unattractive to all riders

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2015 Q/LOS Training



Bus LOS

Bus Frequency Adjustments

Pedestrian LOS	Adjustment Factor
Pedestrian LOS A	1.15
Pedestrian LOS B	1.10
Pedestrian LOS C	1.05
Pedestrian LOS D	1.00
Pedestrian LOS E	0.80
Pedestrian LOS F	0.55

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Bus LOS

Input Variables

- **Bus Stop Amenities**
 - **Excellent** – Shelter and bench
 - **Good** – Shelter, no bench
 - **Fair** – Bench, no shelter
 - **Poor** – No bench or shelter

- **Bus Stop Type**
 - **Typical** – Dwell time approximately 15 s
 - **Major** – Dwell time approximately 35 s







Bus Stop Amenities	Adjustment Factor
Excellent	1.1
Good	1.0
Fair	1.0
Poor	0.9

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2015 Q/LOS Training

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Bus LOS

Input Variables

- Passenger Load Factor
 - Passengers divided by seats (0 - 300%)



Passenger Load Factor	Adjustment Factor
<30%	1.05
<70%	1.00
≤100%	0.95
>100%	0.85

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2015 Q/LOS Training

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Bus LOS

Example 1

- Area type: Large Urbanized
- Opening ARTPLAN defaults
- Facility:
 - 4-lane divided Class 1 arterial
- AADT of 34,000
- K Factor: .09
- D Factor: .565
- Number of Signals: 4
- Through g/C: .45
- Bus frequency: 3
- Bus Stop Amenities: Excellent
- Speed = 45mph

What is Bus LOS?

LOS =

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2015 Q/LOS Training



Bus LOS

Workshop 4.A



With inputs from Bus LOS Example #1 and the following bus inputs: What is the Bus Level of Service for each segment and the facility as a whole?

	From	To	Buses/Hr in peak direction	Existence of Sidewalk	Passenger Load	Stop Amenities
Freq. = <input style="width: 50px;" type="text"/>	Easy	First	3	Yes	50%	Excellent
Freq. = <input style="width: 50px;" type="text"/>	First	Second	2	Yes	60%	Excellent
Freq. = <input style="width: 50px;" type="text"/>	Second	Third	2	No	60%	Excellent
Freq. = <input style="width: 50px;" type="text"/>	Third	Mulberry	1	No	75%	Excellent

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2015 Q/LOS Training

Overall LOS =



Bus LOS

Workshop 4.B



With inputs from Bus LOS Example #1 and the following bus inputs: What is the Bus Level of Service for each segment and the facility as a whole?

	From	To	Buses/Hr in peak direction	Existence of Sidewalk	Passenger Load	Stop Amenities
Freq. = <input style="width: 50px;" type="text"/>	Easy	First	2	Yes	110%	Excellent
Freq. = <input style="width: 50px;" type="text"/>	First	Second	2	Yes	80%	Excellent
Freq. = <input style="width: 50px;" type="text"/>	Second	Third	2	No	80%	Excellent
Freq. = <input style="width: 50px;" type="text"/>	Third	Mulberry	2	No	110%	Excellent

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2015 Q/LOS Training

Overall LOS =



Bus LOS

Workshop 4.C



With inputs from Bus LOS Example #1 and the following bus inputs: What is the Bus Level of Service for each segment and the facility as a whole?

	From	To	Buses/Hr in peak direction	Existence of Sidewalk	Passenger Load	Stop Amenities
Freq. =	Easy	First	3	Yes	50%	Excellent
Freq. =	First	Second	2	Yes	60%	Good
Freq. =	Second	Third	2	No	60%	Fair
Freq. =	Third	Mulberry	1	No	75%	Poor

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2015 Q/LOS Training

Overall LOS =



Bus LOS

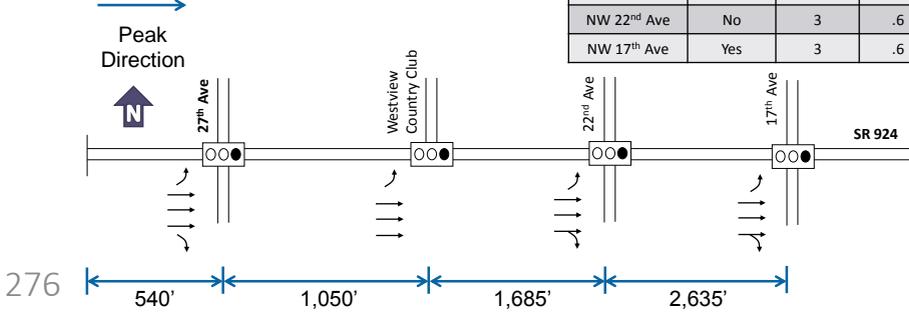
Use data file saved from Workshop 3 in ARTPLAN unit for the following Workshop 5

Workshop 5 *Known Inputs & Multimodal Analysis*

State Route 924 between 27th Ave & 17th Ave, Miami

- Non-restrictive median west of 27th Ave
- 40 mph posted speed limit

Segment	Sidewalk	Buses per hour	Load Factor
NW 27 th Ave	Yes	2	.8
Westview CC	Yes	2	.8
NW 22 nd Ave	No	3	.6
NW 17 th Ave	Yes	3	.6



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2015 Q/LOS Training







Bus LOS

Use data file saved from
Workshop 3 in ARTPLAN unit
for the following Workshop 5

Workshop 5 Known Inputs & Multimodal Analysis
State Route 924 between 27th Ave & 17th Ave, Miami

- Non-restrictive median west of 27th Ave
- 40 mph posted speed limit

Segment	Sidewalk	Buses per hour	Load Factor
NW 27 th Ave	Yes	2	.8
Westview CC	Yes	2	.8
NW 22 nd Ave	No	3	.6
NW 17 th Ave	Yes	3	.6



2015 Q/LOS Training



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2015 Q/LOS Training

Monroe Street data collection

Agenda 11

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2015 Q/LOS Training

Table Workshop

North Monroe

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2015 Q/LOS Training

Data Collection Sheet

Road Name: _____

Area Type:				*Thru Movement Signalization				Time <input type="text"/> <input type="text"/>	Date <input type="text"/> <input type="text"/>
Large Urbanized	Other Urbanized	Transitioning/Urban	Rural Developed	Signal Type	Actuated	Coordinated Actuated	Pretimed		
1,000,000+	50,000+	5,000+	<5,000	g/C	(G+4)/C	(G+4)/C	G/C		

Analysis Hour: Standard K Weekday
If not, indicate time _____

1st Cross Street:

Intersection #1	Cycle Length:	Thru g:	Thru g/C*:	# Directional Thru Lanes (signal):	# Left Lanes:	Left Turn Storage Length:	Left g:	Left g/C:	Excl. Right:
Segment #1	Length:	AADT:	# Directional Thru Lanes (midblock):	Poised Speed:	Median:	none	restrictive	non-restrictive	
	Auto Outside Lane Width: <input type="text"/> ft <input type="text"/> in	Pavement: <input type="text"/> ft <input type="text"/> in	Bike Lane/Paved Shoulder <input type="checkbox"/>	Sidewalk: <input type="checkbox"/>	Sidewalk Separation: <input type="text"/> ft <input type="text"/> in	Bus Freq:	Stop Amenities:	Shelter Bench	Major Minor

2nd Cross Street:

Intersection #2	Cycle Length:	Thru g:	Thru g/C*:	# Directional Thru Lanes (signal):	# Left Lanes:	Left Turn Storage Length:	Left g:	Left g/C:	Excl. Right:
Segment #2	Length:	AADT:	# Directional Thru Lanes (midblock):	Poised Speed:	Median:	none	restrictive	non-restrictive	
	Auto Outside Lane Width: <input type="text"/> ft <input type="text"/> in	Pavement: <input type="text"/> ft <input type="text"/> in	Bike Lane/Paved Shoulder <input type="checkbox"/>	Sidewalk: <input type="checkbox"/>	Sidewalk Separation: <input type="text"/> ft <input type="text"/> in	Bus Freq:	Stop Amenities:	Shelter Bench	Major Minor

3rd Cross Street:

Intersection #3	Cycle Length:	Thru g:	Thru g/C*:	# Directional Thru Lanes (signal):	# Left Lanes:	Left Turn Storage Length:	Left g:	Left g/C:	Excl. Right:
Segment #3	Length:	AADT:	# Directional Thru Lanes (midblock):	Poised Speed:	Median:	none	restrictive	non-restrictive	
	Auto Outside Lane Width: <input type="text"/> ft <input type="text"/> in	Pavement: <input type="text"/> ft <input type="text"/> in	Bike Lane/Paved Shoulder <input type="checkbox"/>	Sidewalk: <input type="checkbox"/>	Sidewalk Separation: <input type="text"/> ft <input type="text"/> in	Bus Freq:	Stop Amenities:	Shelter Bench	Major Minor

4th Cross Street:

Intersection #4	Cycle Length:	Thru g:	Thru g/C*:	# Directional Thru Lanes (signal):	# Left Lanes:	Left Turn Storage Length:	Left g:	Left g/C:	Excl. Right:
Segment #4	Length:	AADT:	# Directional Thru Lanes (midblock):	Poised Speed:	Median:	none	restrictive	non-restrictive	
	Auto Outside Lane Width: <input type="text"/> ft <input type="text"/> in	Pavement: <input type="text"/> ft <input type="text"/> in	Bike Lane/Paved Shoulder <input type="checkbox"/>	Sidewalk: <input type="checkbox"/>	Sidewalk Separation: <input type="text"/> ft <input type="text"/> in	Bus Freq:	Stop Amenities:	Shelter Bench	Major Minor

5th Cross Street:

Intersection #5	Cycle Length:	Thru g:	Thru g/C*:	# Directional Thru Lanes (signal):	# Left Lanes:	Left Turn Storage Length:	Left g:	Left g/C:	Excl. Right:
Segment #5	Length:	AADT:	# Directional Thru Lanes (midblock):	Poised Speed:	Median:	none	restrictive	non-restrictive	
	Auto Outside Lane Width: <input type="text"/> ft <input type="text"/> in	Pavement: <input type="text"/> ft <input type="text"/> in	Bike Lane/Paved Shoulder <input type="checkbox"/>	Sidewalk: <input type="checkbox"/>	Sidewalk Separation: <input type="text"/> ft <input type="text"/> in	Bus Freq:	Stop Amenities:	Shelter Bench	Major Minor

6th Cross Street:

Intersection #6	Cycle Length:	Thru g:	Thru g/C*:	# Directional Thru Lanes (signal):	# Left Lanes:	Left Turn Storage Length:	Left g:	Left g/C:	Excl. Right:
	Length:	AADT:	# Directional Thru Lanes (midblock):	Poised Speed:	Median:	none	restrictive	non-restrictive	
	Auto Outside Lane Width: <input type="text"/> ft <input type="text"/> in	Pavement: <input type="text"/> ft <input type="text"/> in	Bike Lane/Paved Shoulder <input type="checkbox"/>	Sidewalk: <input type="checkbox"/>	Sidewalk Separation: <input type="text"/> ft <input type="text"/> in	Bus Freq:	Stop Amenities:	Shelter Bench	Major Minor

* Thru g/C - Use Thru Movement Signalization in upper right corner | Collected and calculate g/C for left turn at major intersections.
Auto Outside Lane Width: narrow, typical, wide | Bike Pavement Condition: desirable, typical, undesirable | Sidewalk/Positive Separation: adjacent, typical, wide

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Monroe Street ARTPLAN ANALYSIS

AGENDA ITEM 12

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2015 Q/LOS Training

Freeway Capacity and LOS Analysis

AGENDA ITEM 13

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FREEPLAN 2012

- **Strengths**
 - Requires only basic geometry and volume information for LOS estimation
 - Includes extensions of HCM methodology for planning use
 - Incorporates Florida specific adjustments

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FREEPLAN 2012

When to use other tools

- When conducting operational or design level analysis

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FREEPLAN 2012

- **Point**
 - Off ramp gore
- **Subsegment**
 - Off ramp influence area
 - Overpass/underpass
 - On ramp influence area
- **Segment**
 - Basic
 - Interchange influence area
- **Section**
 - Basic segment + next interchange influence area
- **Facility**
 - Combination of segments/sections



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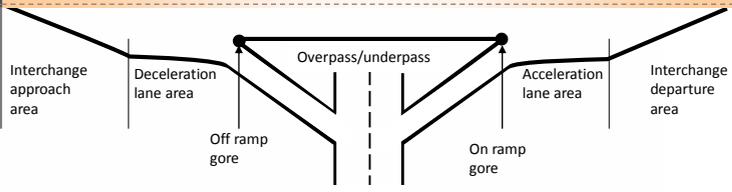
FREEPLAN 2012

Basic Segment

Basic Segment > 528'

Interchange Influence Area (1 mi) ±

Off ramp influence area 1500'	Overpass/underpass Area ± 2280'	On ramp influence area 1500'
----------------------------------	------------------------------------	---------------------------------

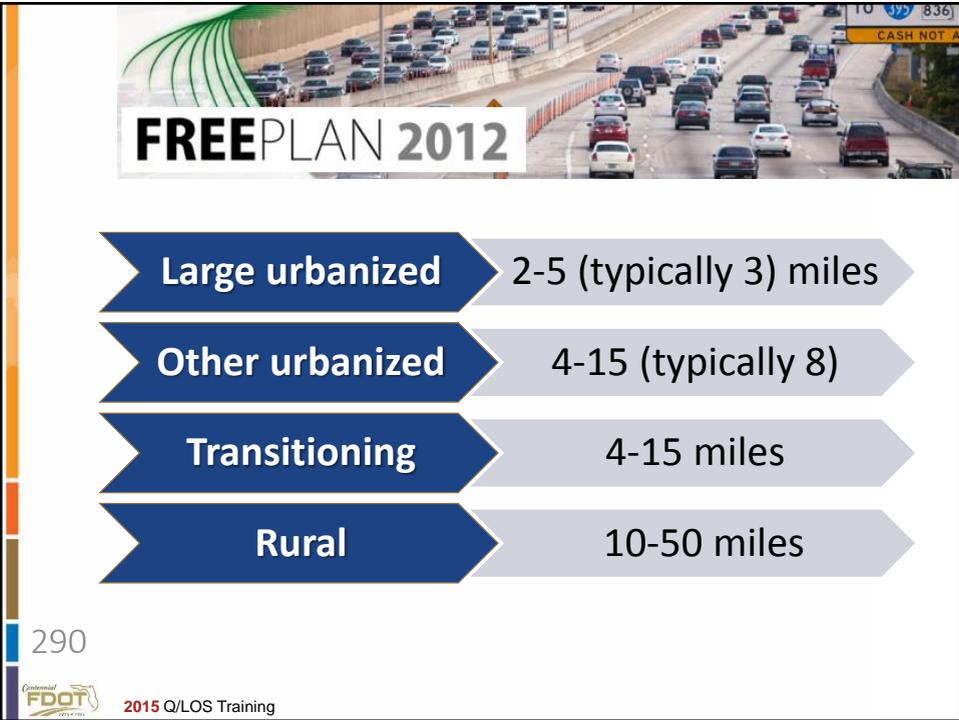
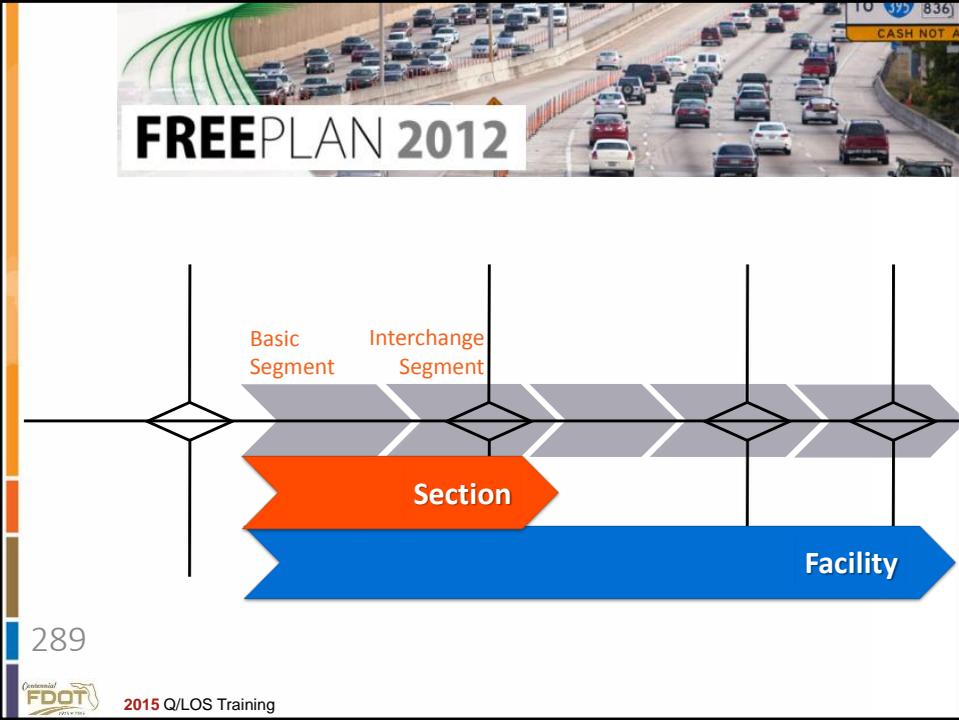


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Freeway Level of Service Analysis

FREEPLAN 2012
Freeway
Level of Service Analysis
For Conceptual Planning and Preliminary Engineering
Version Date: 12/12/2012

Startup Options
Would you like to...

or

291

2015 Q/LOS Training

Developed for planning applications

- Calculates LOS for design concept and scope
- Determines maximum service volumes
- Identifies "hot spots"

Directly applicable to Florida

- Matches well with Florida freeway capacities
- Warnings if values are out of line

HCM Based

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FREEPLAN 2012

- **Freeway operational features**
 - **Auxiliary lanes**
 - Extensions of ramp acceleration and deceleration lanes
 - Ramp metering
 - Ramp terminal capacity check

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This slide features a photograph of a multi-lane freeway with traffic. A white box with the text 'FREEPLAN 2012' is overlaid on the top left of the image. To the right of the image is a bulleted list of freeway operational features. The word 'Auxiliary lanes' is highlighted in orange. At the bottom left, the number '293' is displayed. At the bottom center, there is the FDOT logo and the text '2015 Q/LOS Training'. A vertical decorative bar with orange, brown, and blue segments is on the left side of the slide.



FREEPLAN 2012

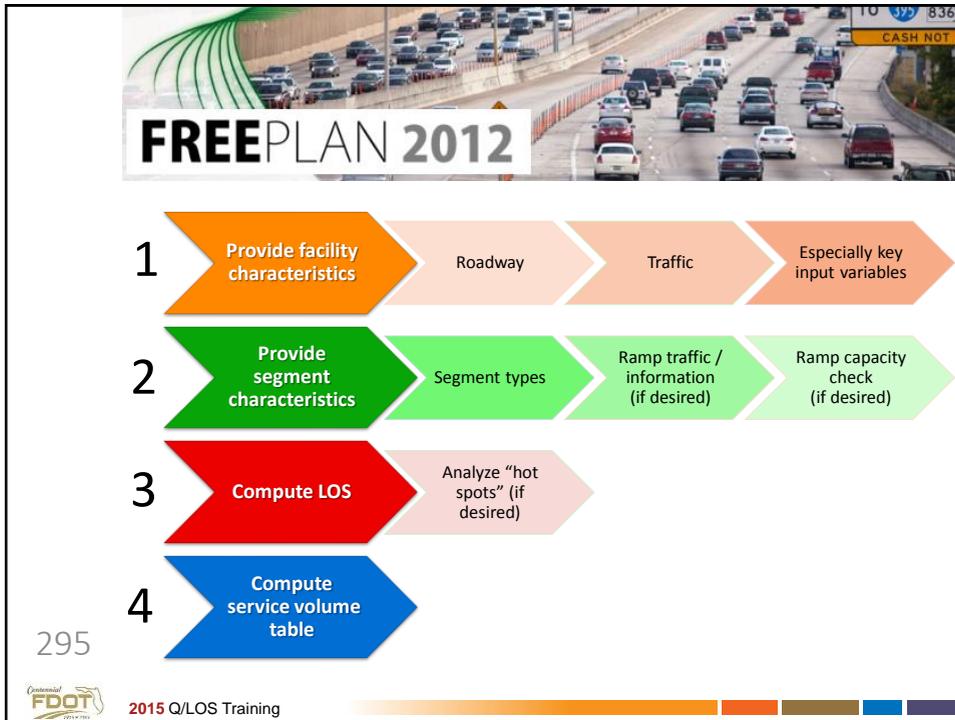
Auxiliary Lane

Auxiliary Lane

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 2015 Q/LOS Training

This slide features a photograph of a freeway with traffic, similar to the one on slide 293. A white box with the text 'FREEPLAN 2012' is overlaid on the top left. Below the photograph is a technical diagram of a road cross-section. The diagram shows a central section labeled 'Auxiliary Lane' with a double-headed arrow indicating its width. On either side of this section are trapezoidal shapes representing the shoulders or ramps. The word 'Auxiliary Lane' is written in blue text below the diagram. At the bottom left, the number '294' is displayed. At the bottom center, there is the FDOT logo and the text '2015 Q/LOS Training'. A horizontal decorative bar with orange, brown, and blue segments is at the bottom of the slide.



Segment Types

- Basic
- On-Ramp
- Off-Ramp
- Ramp Overlap
- Weaving
- Toll Plaza

Input Segment Type

- Basic Segment
- Basic Segment
- On-Ramp
- Off-Ramp
- Weaving
- Ramp Overlap
- Toll Plaza

Segment Length

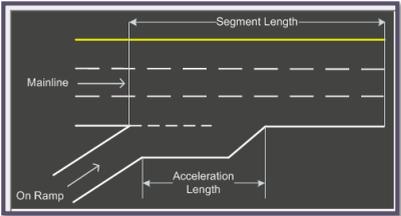
Default Segments	Length (in feet)
Basic Segment	5280
On-Ramp Segment	1500
Off-Ramp Segment	1500
Ramp Overlap Segment	500
Weaving Segment	3000
Toll Plaza Segment	3000

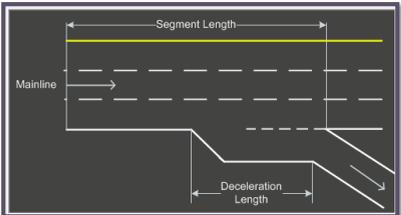
Default Values

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FDOT 2015 Q/LOS Training

FREEPLAN Definitions

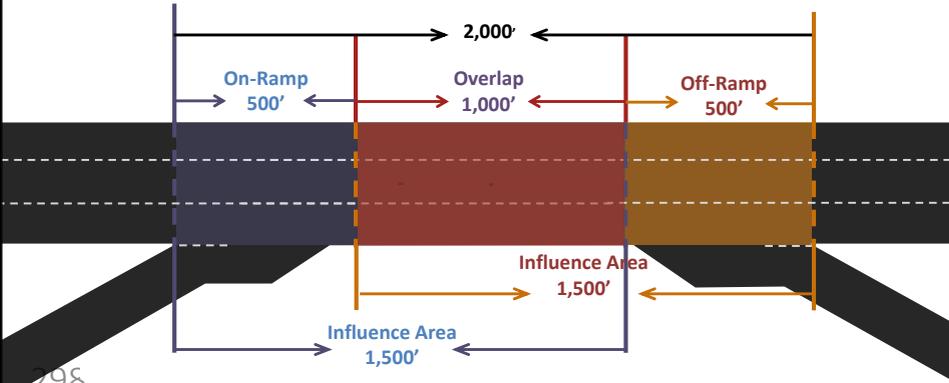
- **Acceleration Length** – Measured from on-ramp gore to the end of the taper; Typically 1,000’
 

- **Deceleration Length** – Measured from beginning of taper to off-ramp gore; typically 450’
 

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FREEPLAN Definitions

- **Ramp Overlap** - occurs when the influence area of an on-ramp and the influence area of an off-ramp extend into one another, creating an overlap in the influence areas; typically 3,000’ minus gore to gore distance
 

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FREEPLAN Definitions

- **Ramp Metering** – used to control the flow of vehicles entering the freeway from on-ramps, in an effort to reduce the turbulence in the merge area and delay the onset of a potential breakdown.



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2015 Q/LOS Training



FREEPLAN

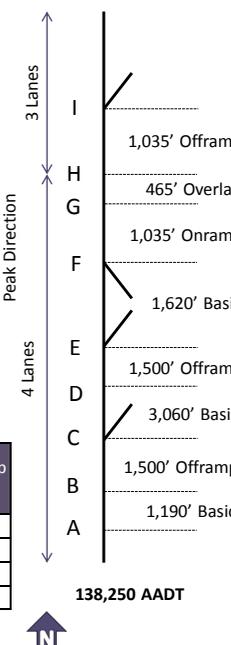
Example 1

Basic/Ramps/Ramp Overlap
I-4 between Princeton St & Lee Rd, Orlando

- Large urbanized area type
- Core freeway – K-factor of 8.0 (K_{other})
- 50 mph posted speed limit

D-Factor	% Heavy Vehicles	Local Adjustment Factor
51.8	4.0	0.98

Segment	Segment Name	Type	Ramp Demand	# of Ramp Lanes	Ramp % Heavy Vehicles	Acc/Dec Length [ft]	Ramp FFS
2	B-C	Off-Ramp	486	1	4.0	740	40
4	D-E	Off-Ramp	720	1	4.0	600	40
6	F-G	On-Ramp	486	1	4.0	600	40
8	H-I	Off-Ramp	945	1	4.0	1,500	40



Peak Direction ↑

3 Lanes (I, H, G)

4 Lanes (F, E, D, C)

1,035' Offramp (I-H)

465' Overlap (H-G)

1,035' Onramp (G-F)

1,620' Basic (F-E)

1,500' Offramp (E-D)

3,060' Basic (D-C)

1,500' Offramp (C-B)

1,190' Basic (B-A)

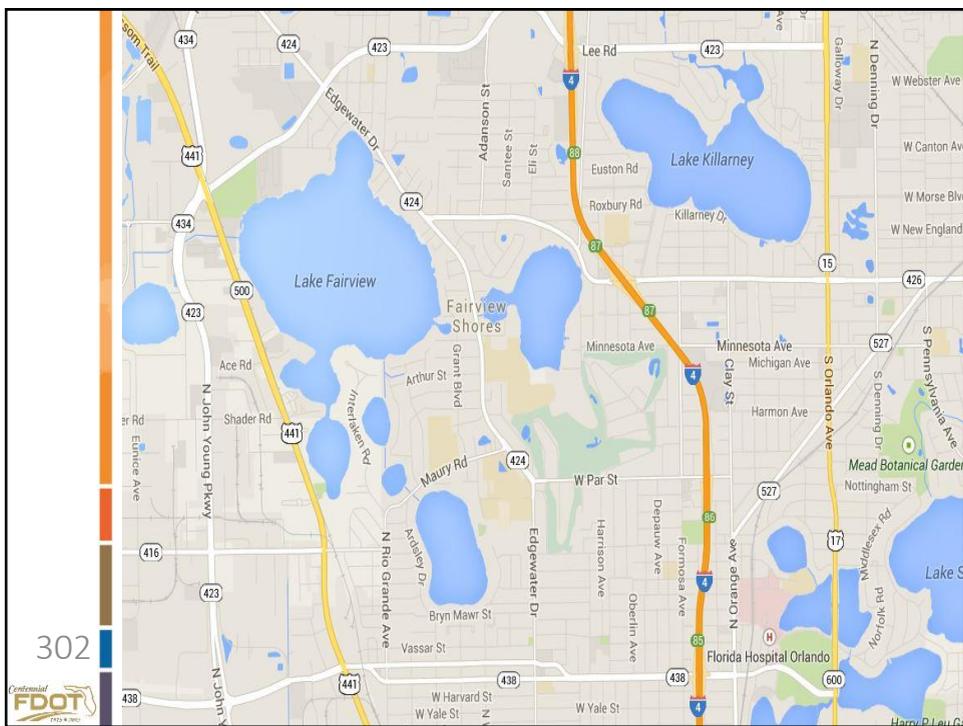
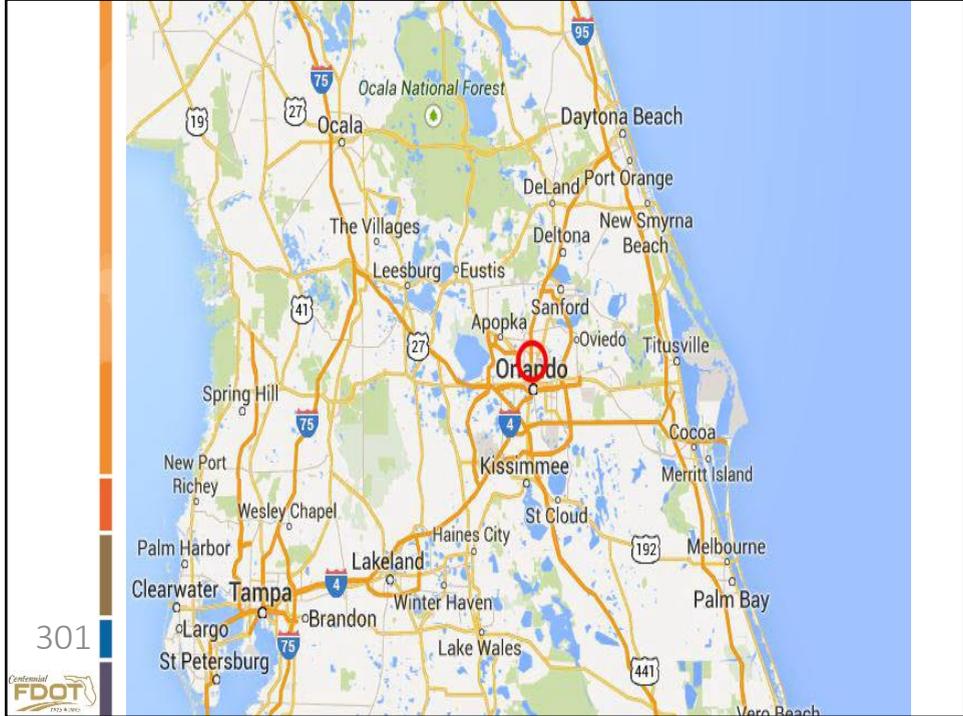
138,250 AADT

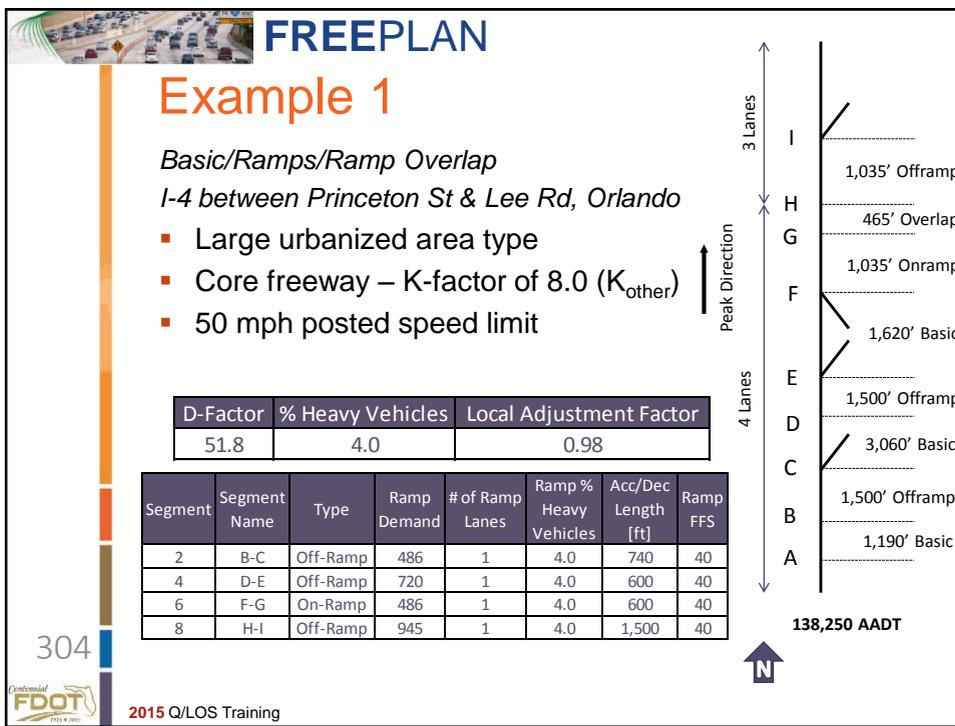
↑ N

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2015 Q/LOS Training







FREEPLAN

75,000 AADT 2 Lanes

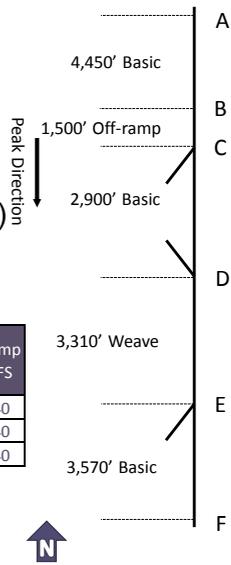
Workshop 1 Basic/Ramps/Weave
I-295 between St. Johns Bluff Rd & Town Center Pkwy, Jacksonville

- Large urbanized area type
- 65 mph posted speed limit
- One sided weave (Ramp to Ramp = 5%)

Show Aerial of I-4

D-Factor	% Heavy Vehicles	Local Adjustment Factor
57.9	4.0	0.98

Peak Direction ↓



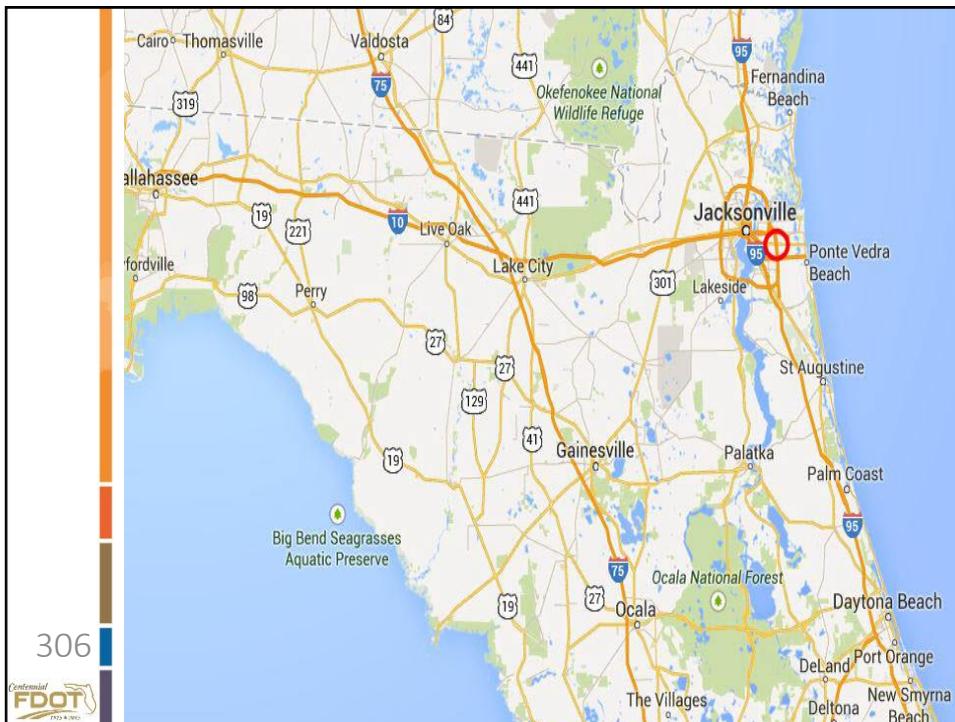
Segment	Segment Name	Type	Ramp Demand	# of Ramp Lanes	Ramp % Heavy Vehicles	Acc/Dec Length [ft]	Ramp FFS
2	B-C	Off-Ramp	621	1	4.0	220	40
4	D-E	Weave On	801	1	4.0	-	40
4	D-E	Weave Off	567	1	4.0	-	40

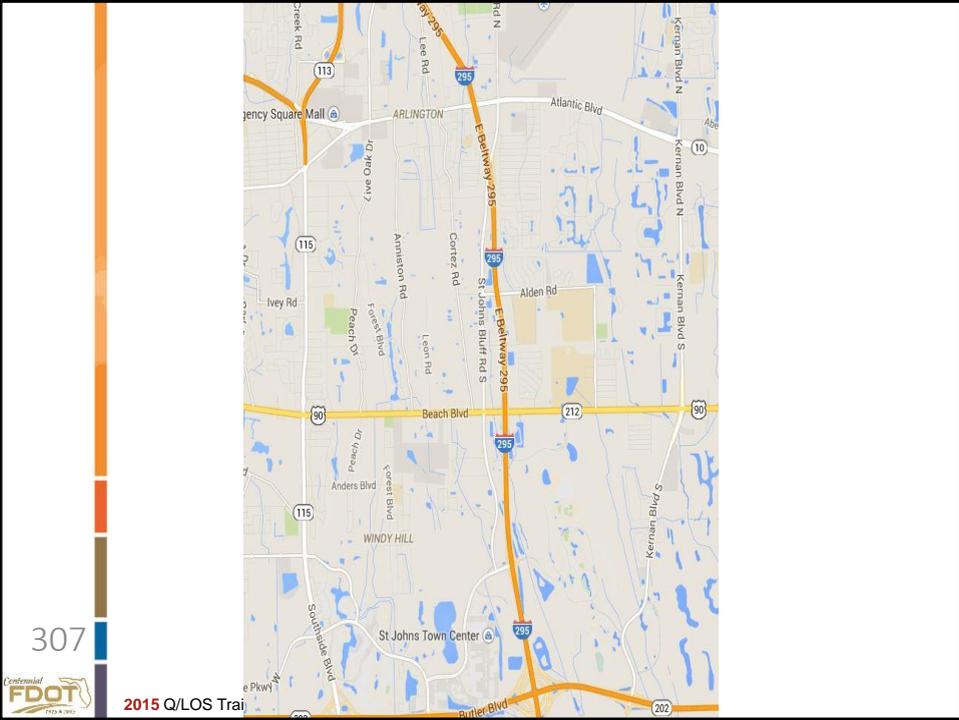
Min. Lane Changes				
Short Length	# Weaving Lanes	Freeway-Ramp	Ramp-Freeway	Ramp-Ramp
2,800	2	1	1	-

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FREEPLAN

75,000 AADT 2 Lanes

Workshop 1 Basic/Ramps/Weave
I-295 between St. Johns Bluff Rd & Town Center Pkwy, Jacksonville

- Large urbanized area type
- 65 mph posted speed limit
- One sided weave (Ramp to Ramp = 5%)

D-Factor	% Heavy Vehicles	Local Adjustment Factor
57.9	4.0	0.98

Segment	Segment Name	Type	Ramp Demand	# of Ramp Lanes	Ramp % Heavy Vehicles	Acc/Dec Length [ft]	Ramp FFS
2	B-C	Off-Ramp	621	1	4.0	220	40
4	D-E	Weave On	801	1	4.0	-	40
4	D-E	Weave Off	567	1	4.0	-	40

Min. Lane Changes				
Short Length	# Weaving Lanes	Freeway-Ramp	Ramp-Freeway	Ramp-Ramp
2,800	2	1	1	-

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2015 Q/LOS Training

↑ N

FREEPLAN

35,351 AADT 2 Lanes

Workshop 2 Basic/Ramps
I-75 between CR 673 & CR 470, Bushnell

- Rural area type
- 70 mph posted speed limit

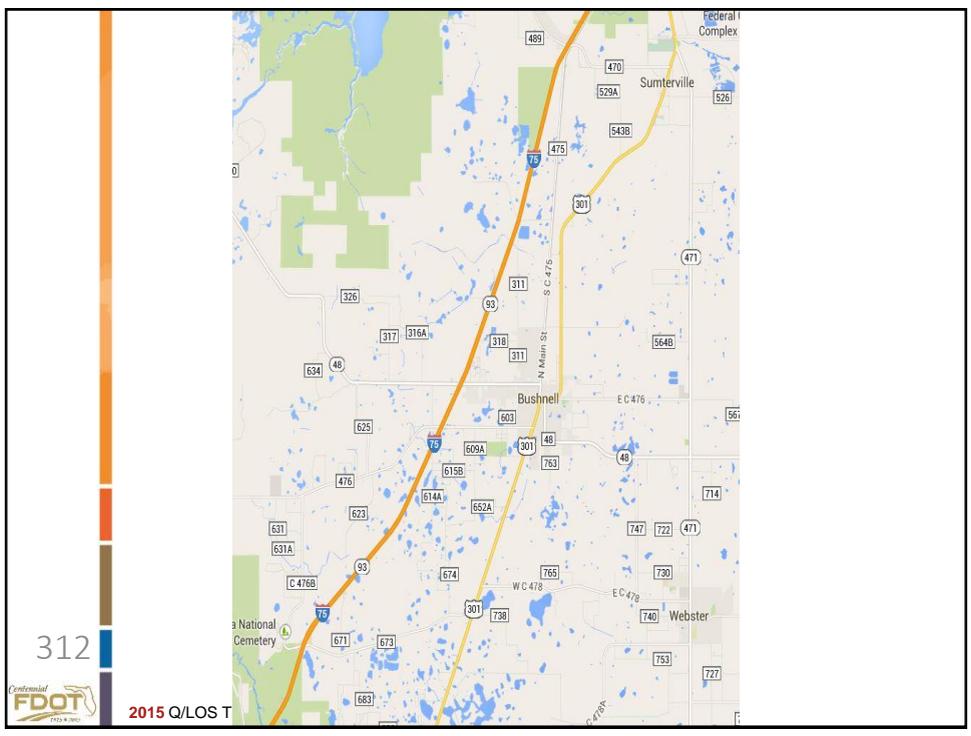
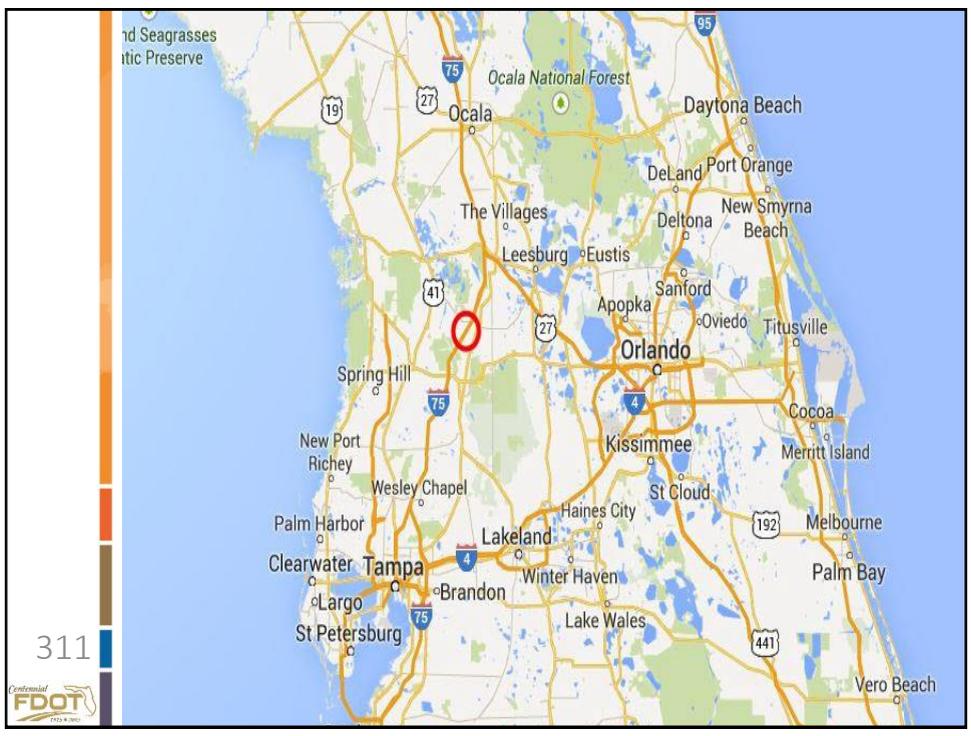
D-Factor	% Heavy Vehicles	Local Adjustment Factor
56.1	12.0	0.90

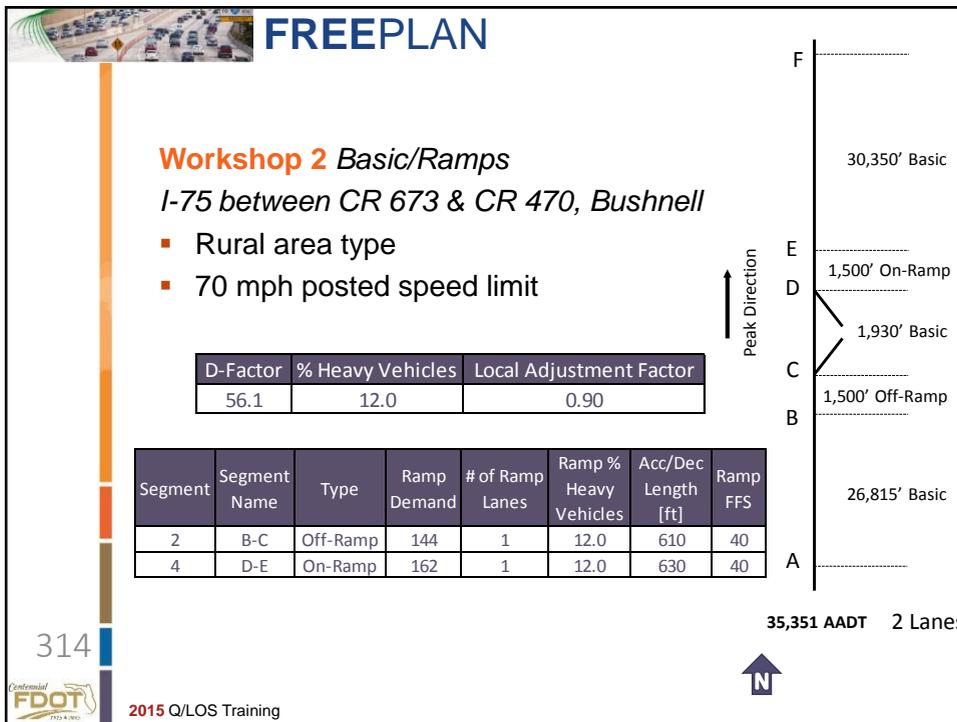
Segment	Segment Name	Type	Ramp Demand	# of Ramp Lanes	Ramp % Heavy Vehicles	Acc/Dec Length [ft]	Ramp FFS
2	B-C	Off-Ramp	144	1	12.0	610	40
4	D-E	On-Ramp	162	1	12.0	630	40

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2015 Q/LOS Training

↑ N







FREEPLAN

Workshop 3 Basic/Ramps
I-95 between FL 104 & FL 102, Jacksonville

- Large urbanized area type
- 70 mph posted speed limit

D-Factor	% Heavy Vehicles	Local Adjustment Factor
54.5	4.0	0.98

Segment	Segment Name	Type	Ramp Demand	# of Ramp Lanes	Ramp % Heavy Vehicles	Acc/Dec Length [ft]	Ramp FFS
2	B-C	Off-Ramp	387	1	4.0	260	45
4	D-E	Off-Ramp	234	1	4.0	830	45
6	F-G	On-Ramp	828	2	4.0	975	45

Peak Direction ↑

4 Lanes

3 Lanes

Peak Direction ↓

H

3,000' Basic

G

1,500' On ramp

F

1,670' Basic

E

1,500' Off ramp

D

340' Basic

C

1,500' Off ramp

B

5,100' Basic

A

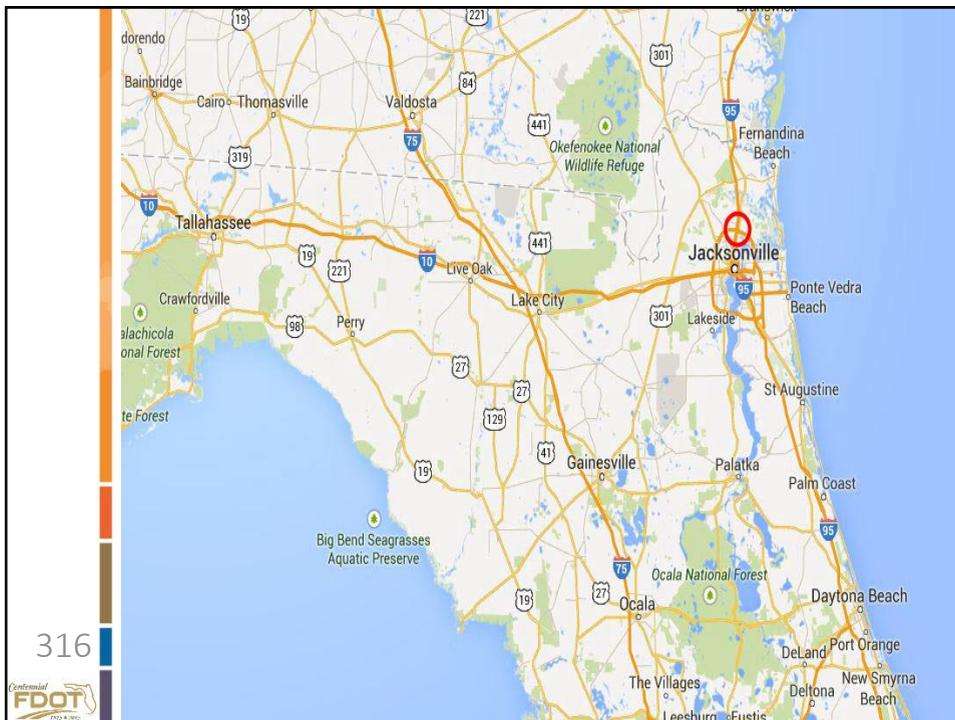
72,500 AADT

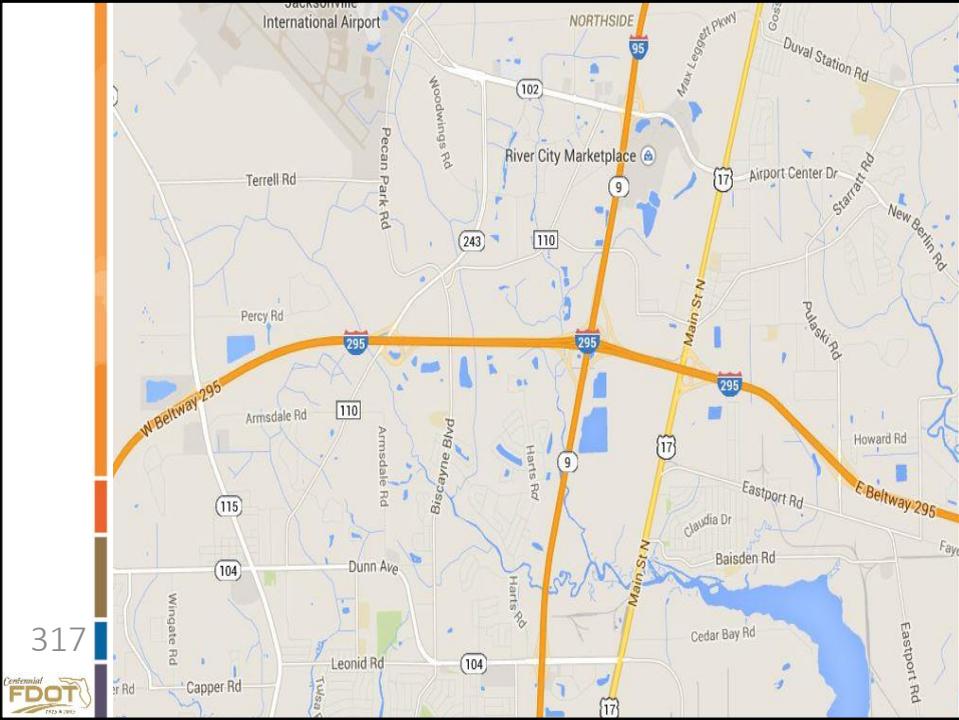
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2015 Q/LOS Training







FREEPLAN

Workshop 3 Basic/Ramps
I-95 between FL 104 & FL 102, Jacksonville

- Large urbanized area type
- 70 mph posted speed limit

D-Factor	% Heavy Vehicles	Local Adjustment Factor
54.5	4.0	0.98

Segment	Segment Name	Type	Ramp Demand	# of Ramp Lanes	Ramp % Heavy Vehicles	Acc/Dec Length [ft]	Ramp FFS
2	B-C	Off-Ramp	387	1	4.0	260	45
4	D-E	Off-Ramp	234	1	4.0	830	45
6	F-G	On-Ramp	828	2	4.0	975	45

72,500 AADT

↑ N

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2015 Q/LOS Training

FREEPLAN

Workshop 4 Basic/Ramps
I-75 between Royal Palm Blvd & Sheridan St, Weston

- Large urbanized area type
- 70 mph posted speed limit

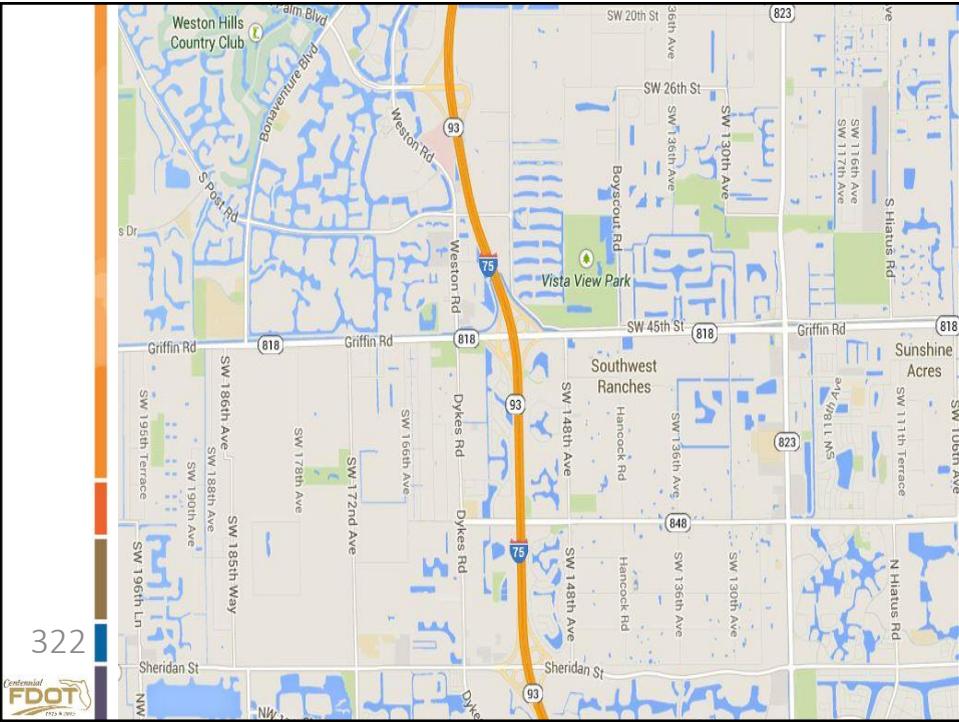
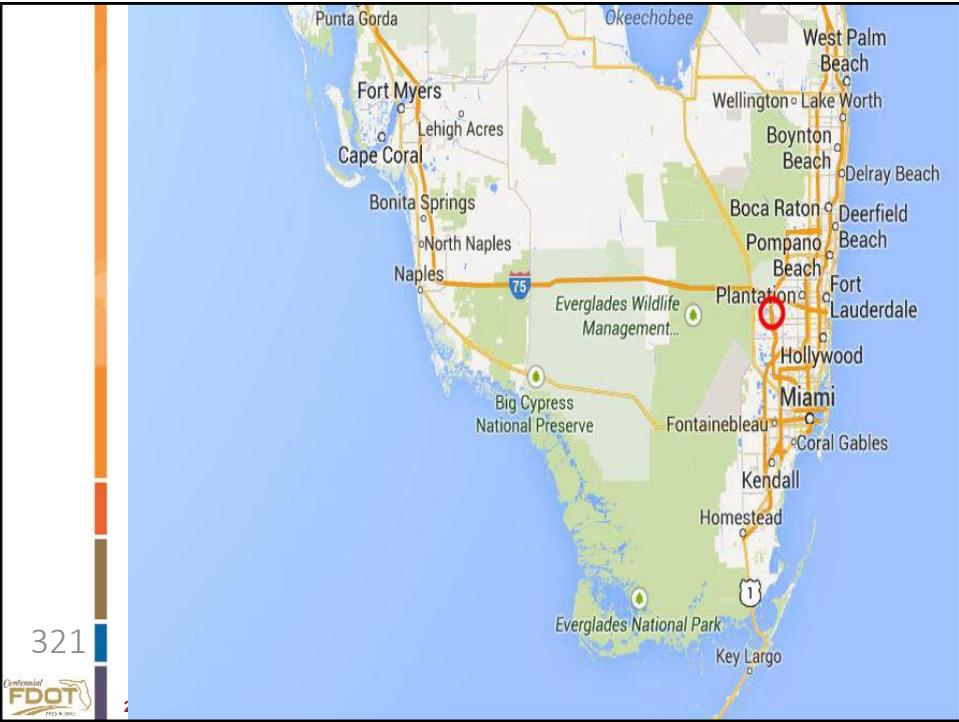
D-Factor	% Heavy Vehicles	Local Adjustment Factor
54.4	4.0	0.98

Segment	Segment Name	Type	Ramp Demand	# of Ramp Lanes	Ramp % Heavy Vehicles	Acc/Dec Length [ft]	Ramp FFS
2	B-C	Off-Ramp	504	1	4.0	460	35
4	D-E	Off-Ramp	288	1	4.0	1,500	30
6	F-G	On-Ramp	1,125	1	4.0	1,500	35

150,250 AADT

↓ N

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2015 Q/LOS Training







FREEPLAN

150,250 AADT

4 Lanes

Workshop 4 Basic/Ramps
I-75 between Royal Palm Blvd & Sheridan St, Weston

- Large urbanized area type
- 70 mph posted speed limit

D-Factor	% Heavy Vehicles	Local Adjustment Factor
54.4	4.0	0.98

Segment	Segment Name	Type	Ramp Demand	# of Ramp Lanes	Ramp % Heavy Vehicles	Acc/Dec Length [ft]	Ramp FFS
2	B-C	Off-Ramp	504	1	4.0	460	35
4	D-E	Off-Ramp	288	1	4.0	1,500	30
6	F-G	On-Ramp	1,125	1	4.0	1,500	35

Peak Direction ↓

A
1,950' Basic

B
1,500' Off ramp

C
940' Basic

D
1,500' Off ramp

E
2,190' Basic

F
1,500' On ramp

G
4,030' Basic

H



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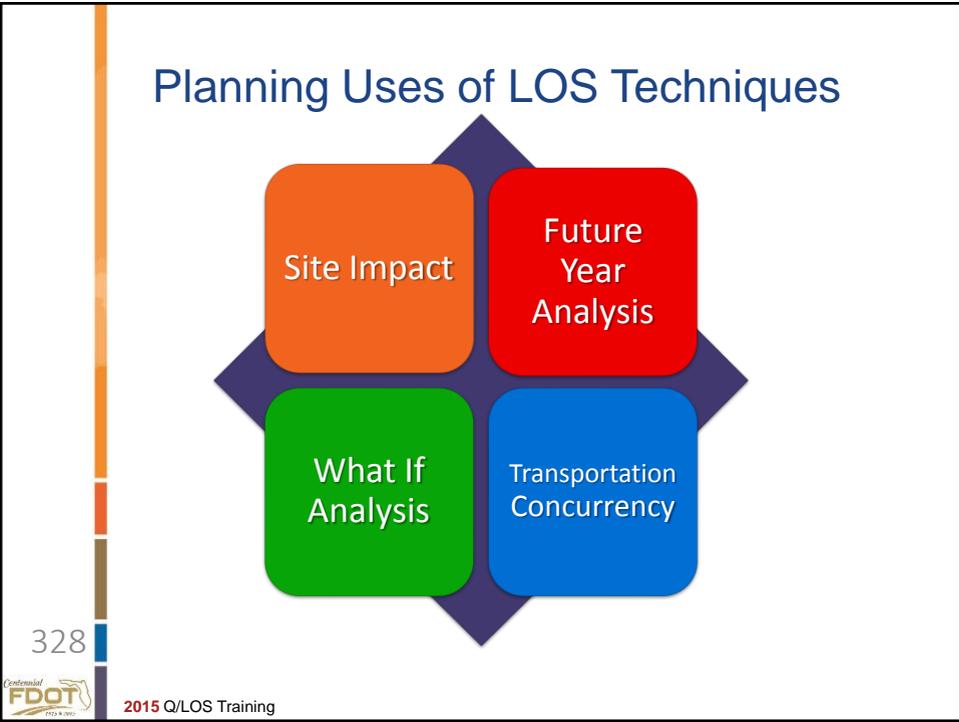

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Applications

AGENDA ITEM 14

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Future Year Analysis

AADT K

D Control variables

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Future Year Analysis

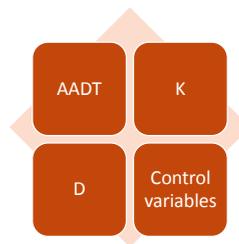
 Roadway variables	<p>Conditions change – what should we do?</p> <p>Good Assumptions = Good Results</p>
 Traffic variables	
 Control variables	

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Future Year Analysis

Refer to QLOS Handbook and District LOS Coordinators

- General rules of thumb
 - Area type remains the same unless development enters new phase
 - Through g/C typically goes down to .40 at major intersections
 - Signal density usually increases



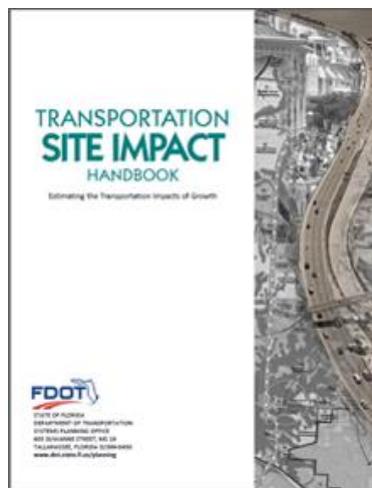
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Transportation Impact Handbook



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Transportation Impact Handbook Website

HOME

Welcome to the FDOT Transportation Site Impact Handbook Site!

We are proud to announce the 2014 update to the Transportation Site Impact Handbook!

We've renamed the document to Transportation Site Impact Handbook to help differentiate between other traffic analysis guides.

[TSIH_April_201404.pdf](#)

The Florida Department of Transportation (FDOT) has developed these guidelines to assist FDOT staff in their review of developments. While this handbook is primarily for FDOT staff, it is available to local governments and other transportation partners in an effort to communicate the FDOT's guidance for reviewing various documents.

The purpose of this document is to guide the professional through the current generally accepted professional practice. This should assist in making better decisions for the study of the transportation impacts of new developments.

OPEN HANDBOOK CURRENT VERSION April 4, 2014

We recommend saving the handbook to your computer. The hyperlinks will open documents in a separate browser window, allowing you to easily toggle between the Handbook and the resources.

The purpose of this document is to guide the professional through the current generally accepted professional practice. It should also help the professional understand the existing statutes, rules, and policies of FDOT. However, unless a rule, statute, or standard is referenced, the material inside is to be used for guidance by professionals. This should assist in making better decisions for the study of the transportation impacts of new developments.

This website structure was updated 4/08/2014

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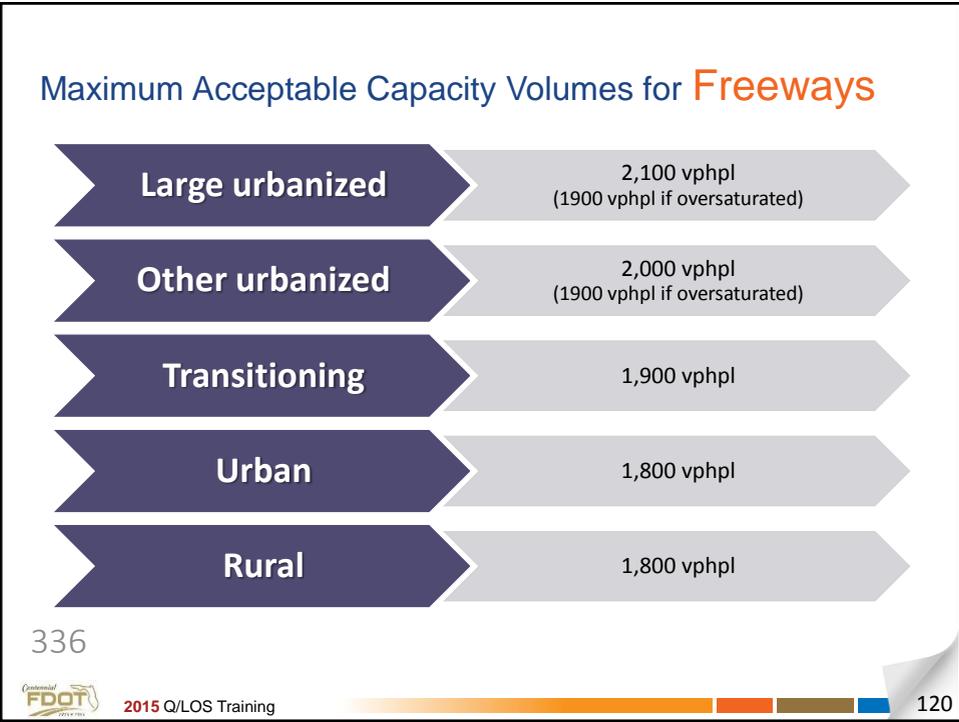
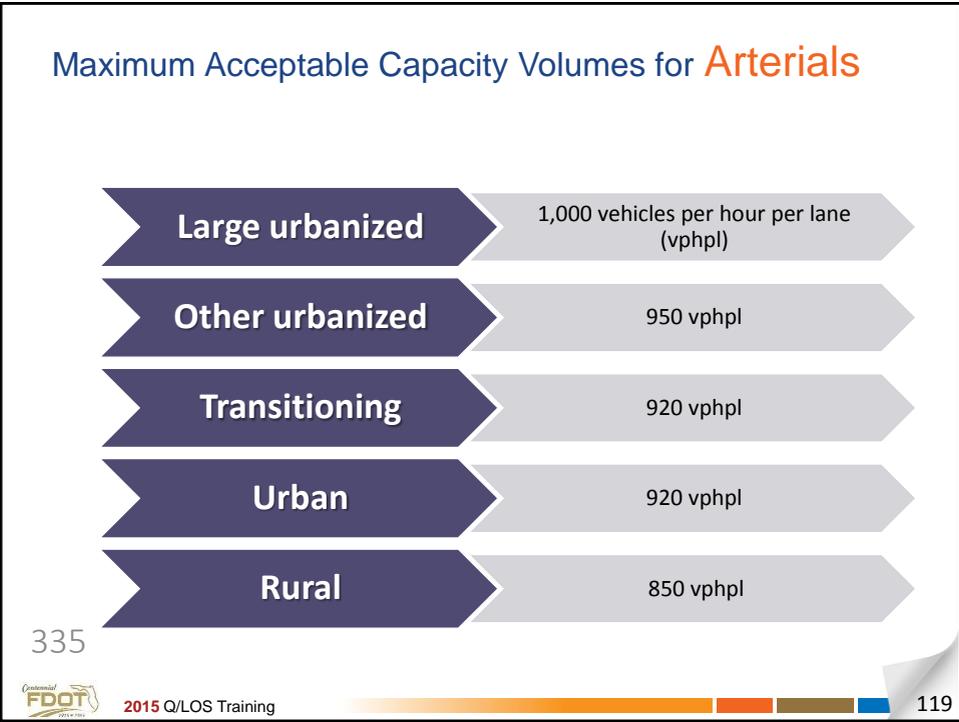
Maximum Acceptable Capacity Volumes

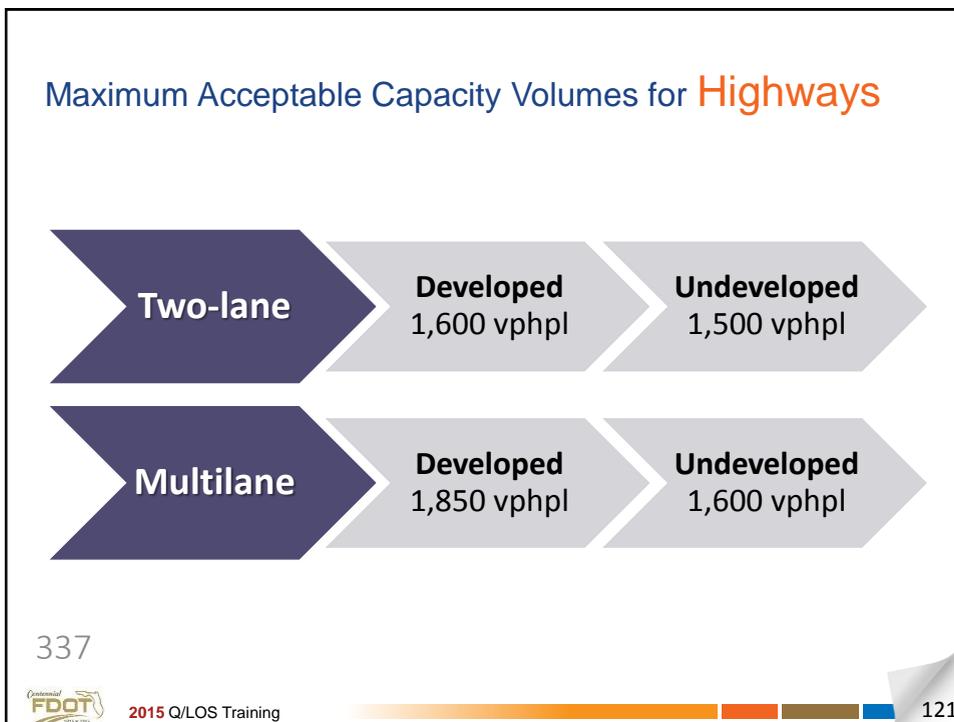
- Values higher than the following slides are seldom seen in Florida
- Values should be demand volumes
- Values should be based on an hourly analysis
- Supporting documentation should be provided

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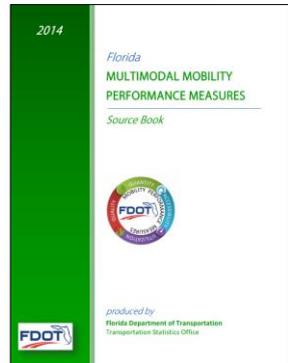
- ## Precursor to HCM Analysis
- LOSPLAN or Generalized Tables screening.
 - If facilities show problems then a more detailed analysis can follow
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- 2015 Q/LOS Training



SIS Deficiencies/Priorities

Performance Measures Using LOS

- Map 21
 - % Travel Meeting LOS Criteria (peak hour, peak period, daily)
- FDOT Mobility Performance Measures
 - Average Travel Speed
 - % Miles Severely Congested
 - Pedestrian LOS
 - Bicycle LOS



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WRAP-UP

AGENDA ITEM 15

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2015 Q/LOS Training

Course Objectives

-  Move from understanding basic traffic concepts to hands-on capacity and quality of service analysis
-  Gain proficiency in planning analysis
-  Gain proficiency in multimodal QOS
-  Understand the factors that have the greatest impact on the results
-  Identify key differences between LOSPLAN and other tools

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Wrap-Up

- What did you learn that was particularly useful?
- Do you have any suggestions for improving the training course?

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Complete Evaluation Form

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Wrap-Up

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