2015

Quality/Level of Service Training

Planning Level Analysis

Handout Slides

March 2015

Orlando

Centennial FDOT 1915 ★ 2015

2015

Quality/Level of Service Training

Planning Level Analysis

March 2015

Centennial FDOT 1915 ★ 2015

INTRODUCTION

Introductions

- Andrew Young
- Martin Guttenplan
- Gina Bonyani
- Nathan Hicks

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INTRODUCTION

Housekeeping

- Questions—ask lots of them at any time!

Restrooms

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INTRODUCTION

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

Download PDF of Q/LOS Handbook

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

Notice the Page Curls

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INTRODUCTION

Agenda – Day One

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

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INTRODUCTION

Agenda – Day Two

8:30 AM	9 Multimodal LOS Review	Martin
9:00 AM	10 ARTPLAN – Bus Analysis	Martin
9:40 AM	11 Monroe Street Video Data Collection	Martin & Gina
◄ 10:10 AM Break		
10:25 AM	12 Monroe Street ARTPLAN analysis	Martin & Gina
◄ 11:45 AM Lunch		
1:00 PM	13 FREEPLAN – Freeway analysis	Gina
◄ 2:30 PM Break		
2:45 PM	14 Future Year Analysis, LOS Applications	Martin
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

FDOT 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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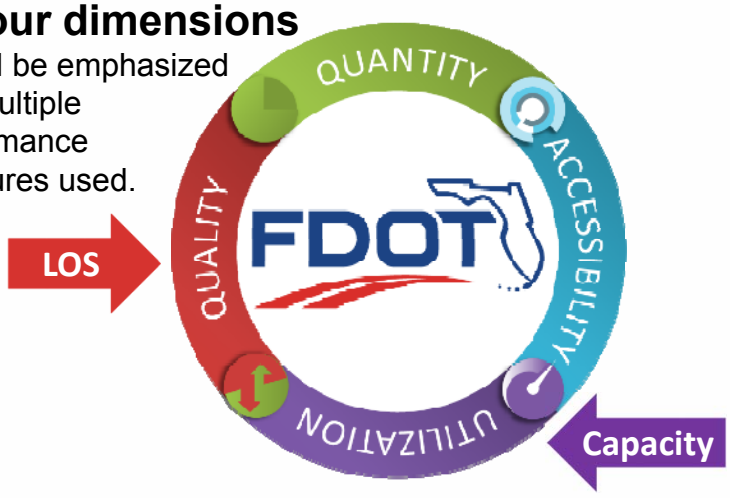
INTRODUCTION

4 Dimensions of Mobility

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



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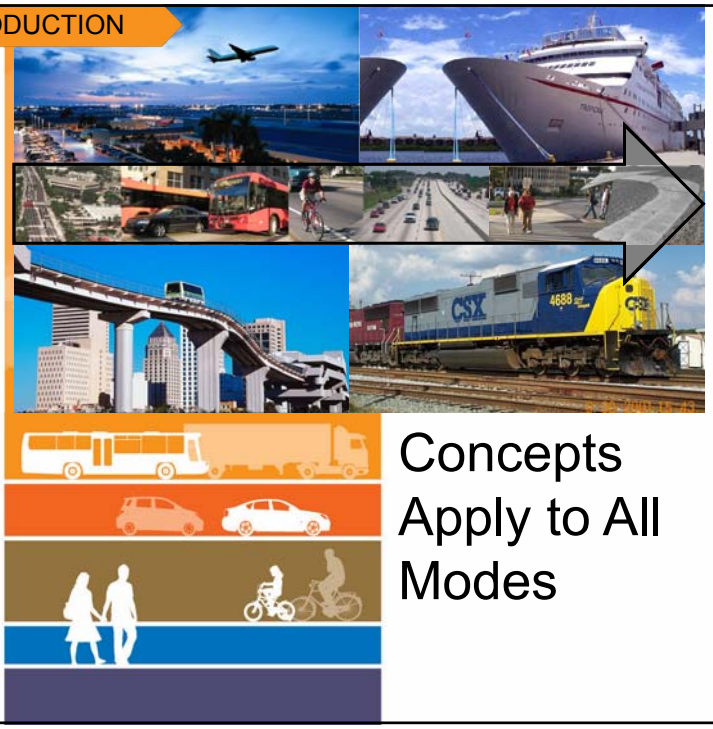
INTRODUCTION



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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INTRODUCTION

Five Important Definitions

Quality of Service

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

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INTRODUCTION

Five Important Definitions

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

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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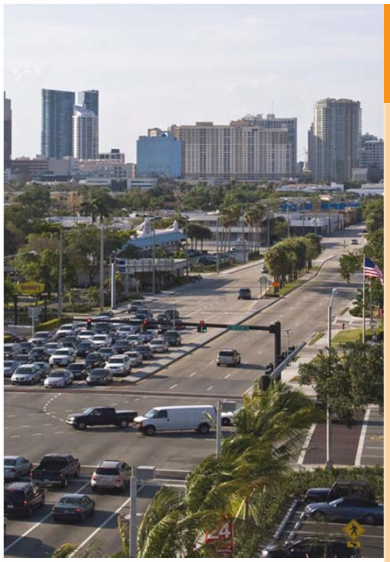
INTRODUCTION

Five Important Definitions



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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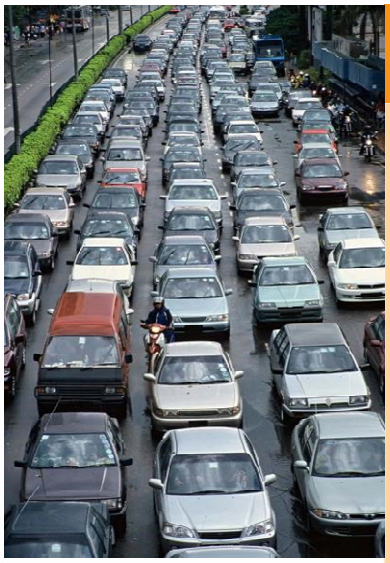
INTRODUCTION

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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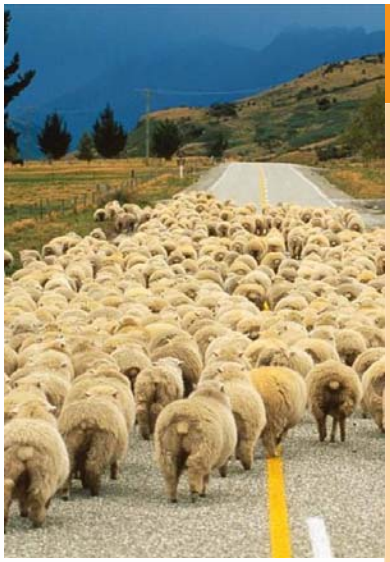
INTRODUCTION

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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INTRODUCTION

Five Important Definitions

Multimodal

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

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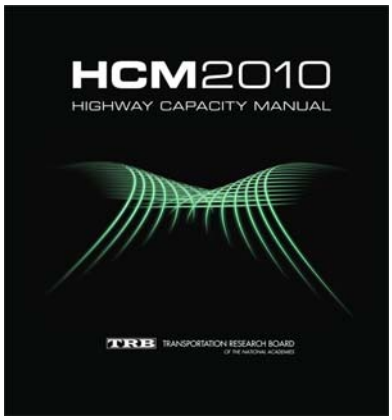
INTRODUCTION

TRB's Highway Capacity Manual is **"The National Document"**



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INTRODUCTION

Positive Aspects and Limitations of the HCM

- Benchmark for highway quality of service and capacity analyses
- Consensus of expert opinion

- Too detailed / not detailed enough
- Does not cover other important mobility issues
  - Travel demand (Quantity)
  - Land use

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INTRODUCTION

Types of Analyses

Planning	Operational	Design
• Default values for nearly all of the model inputs • Limited data requirements, general results	• All or nearly all of the required model inputs • More data, more precise results	• To establish the detailed physical features

This course will focus on planning-level analysis

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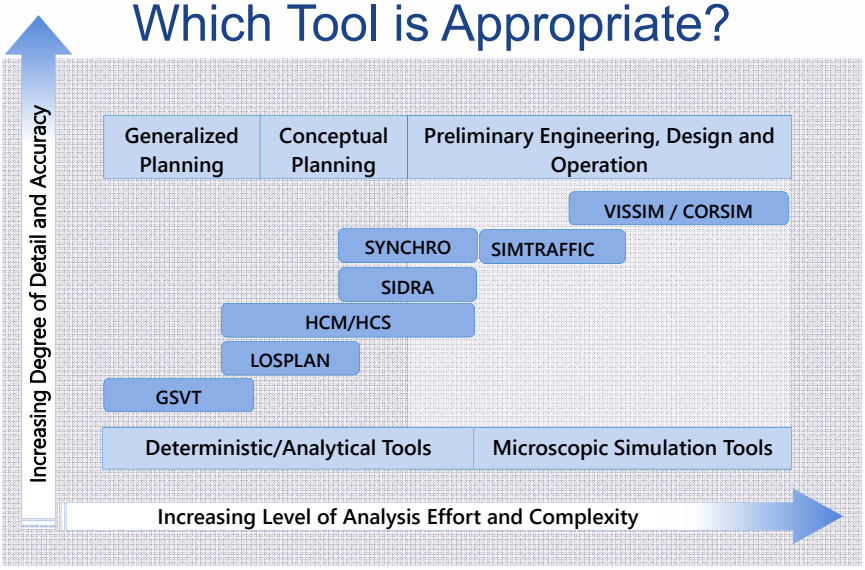
INTRODUCTION

Which Tool is Appropriate?



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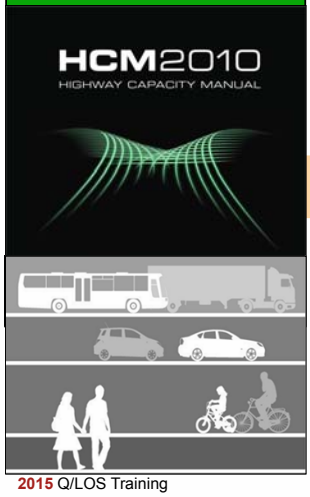
Traffic Analysis Handbook 21

INTRODUCTION

LOS - Operational, Conceptual and Generalized Planning Techniques

Operational



TCQSM

BLOS

PLOS

Conceptual and Generalized Planning

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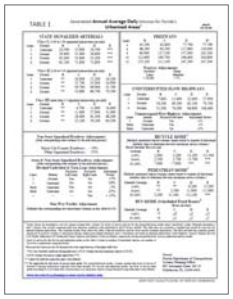
INTRODUCTION

LOS Planning Analysis Tools

Conceptual Software

Generalized Planning Tables



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

INTRODUCTION

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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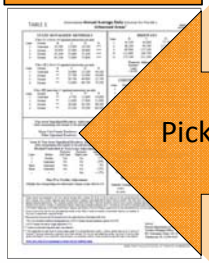
INTRODUCTION

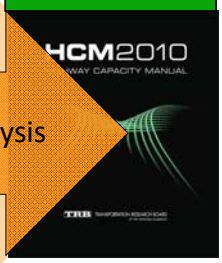
FDOT Guidance on Applying Capacity and LOS Tools

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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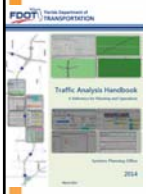

Traffic Analysis Handbook

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
	Preliminary Engineering and Design	Determining capacity of the weaving segment or ramp merge/diverge	Density, speed, LOS	HCS
		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
	Preliminary Engineering and Design	Determining how the facility will operate	Speed	HCS
		Optimizing signals	Control delay, queue, V/C ratio	SYNCHRO/SIMTRAFFIC

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INTRODUCTION

Highway System Structure


Arterials


Freeways


Highways


Segment


Point

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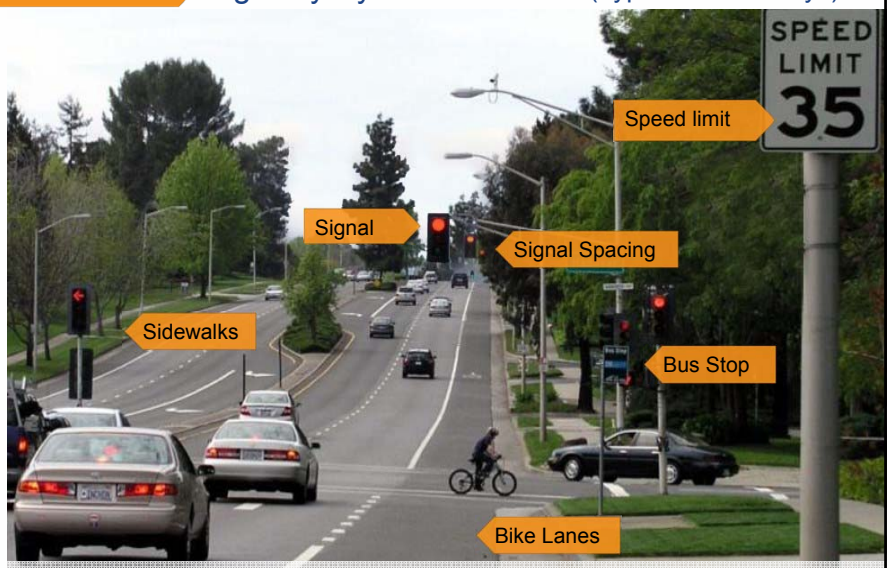
INTRODUCTION

Highway System Structure (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 Highway System Structure (Types of Roadways)

Uninterrupted Flow Highway Rural Two Lane

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 System Structure (Types of Roadways)

Uninterrupted Flow Highway Multilane Rural

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

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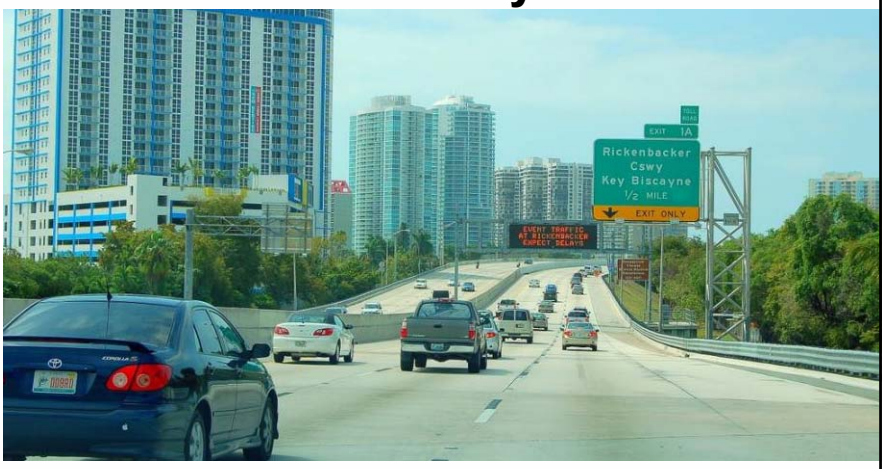
INTRODUCTION

Highway System Structure (Types of Roadways)

Freeway



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

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INTRODUCTION

Highway System Structure (Types of Roadways)

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	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

Based on

- Driver perception
- Highway system structure

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INTRODUCTION

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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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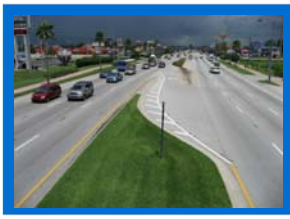
INPUT VARIABLES

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 variables

- Control Type
- Green time
- Cycle length

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INPUT VARIABLES

Key Factors Which Highly Influence Results

- Avoid using defaults with these factors

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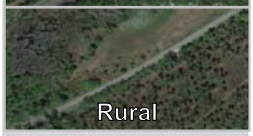
INPUT VARIABLES

Key Factors Which Highly Influence Results

Area Type

Urbanized

Transitioning/Urban



Rural

Auto

- Number of lanes
- Left turn lanes
- AADT
- K
- D
- Signal spacing
- g/C

Multimodal

- Paved shoulder/ bicycle lane
- Sidewalk
- Bus frequency

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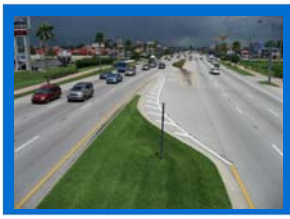
ROADWAY

Key Factors Affecting LOS and Capacity



Roadway variables

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

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ROADWAY Area Type

Large Urbanized
1,000,000+

Other Urbanized
50,000 - 1,000,000

Transitioning
Urban fringe, urbanized within 20 years

Urban
5,000 – 50,000

Rural Developed
< 5,000 with dev.

Rural Undeveloped
Little to no dev.

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ROADWAY Area Type

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

Other Urbanized

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

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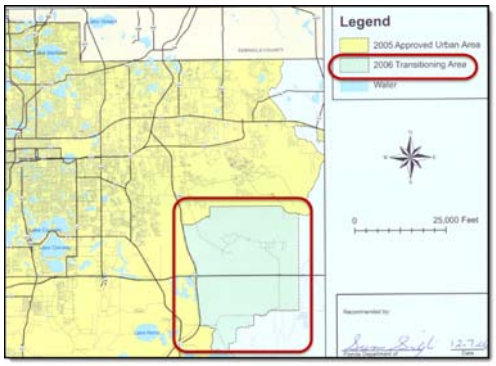
ROADWAY Area Type



Example Transitioning Area from Metro Plan Orlando

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

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ROADWAY Area Type

Urban

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

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ROADWAY

Area Type

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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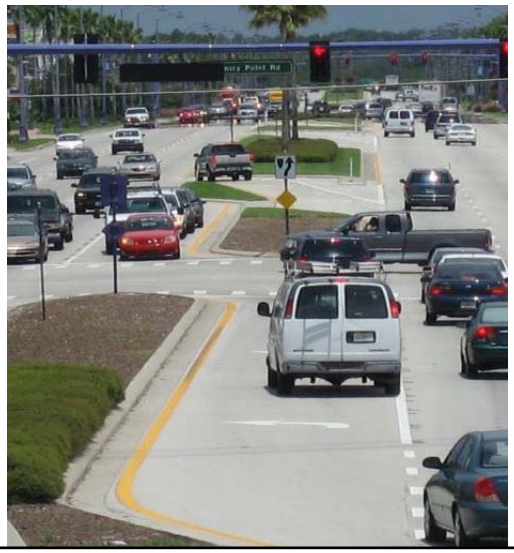
ROADWAY

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

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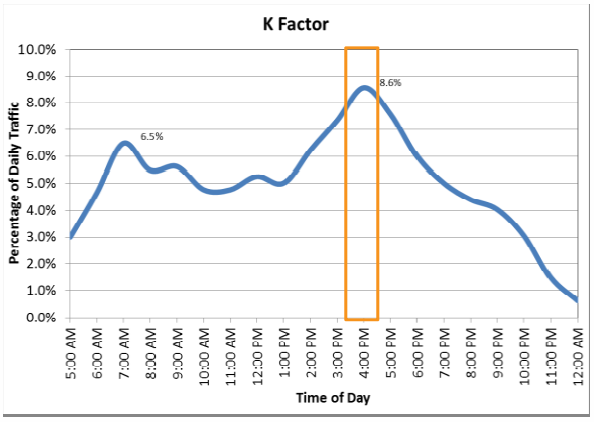
- Most used of all traffic parameters

TRAFFIC

K-factor

The proportion of AADT that occurs during the peak hour



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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

WB

EB

- 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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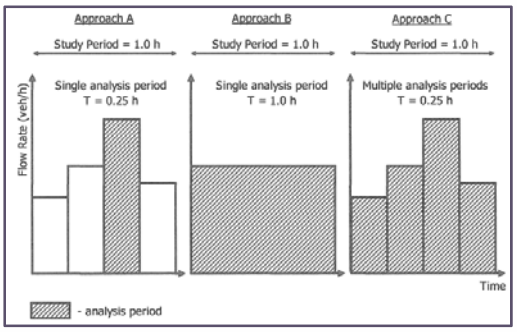
TRAFFIC

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 is used to reflect 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 have a potential to 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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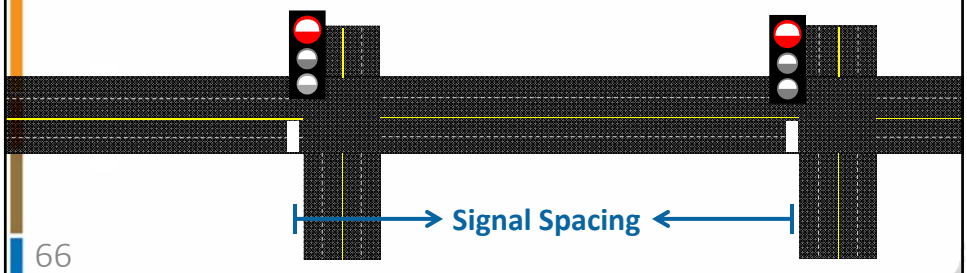
CONTROL

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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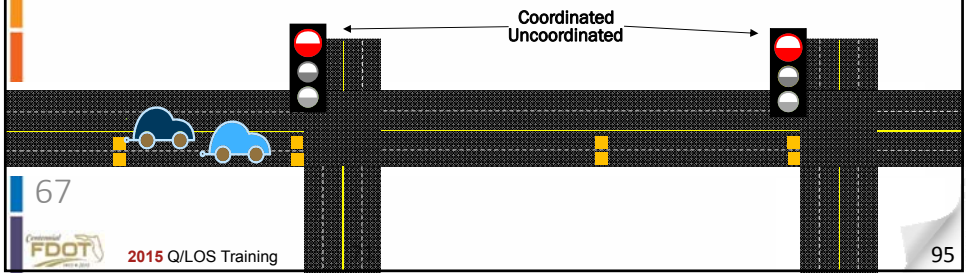
CONTROL

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**

– Use of a preset sequence of phase times with no use of vehicle detection

- **Coordinated Actuated**

– Use of 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**

– Use of vehicle detection for all signal phases on both the main and side street approaches

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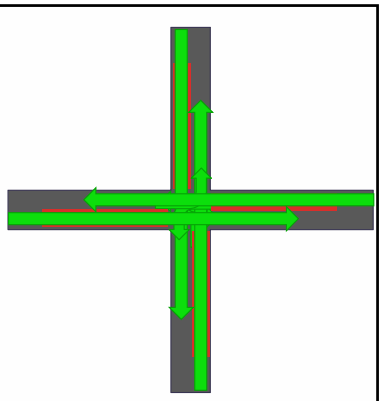
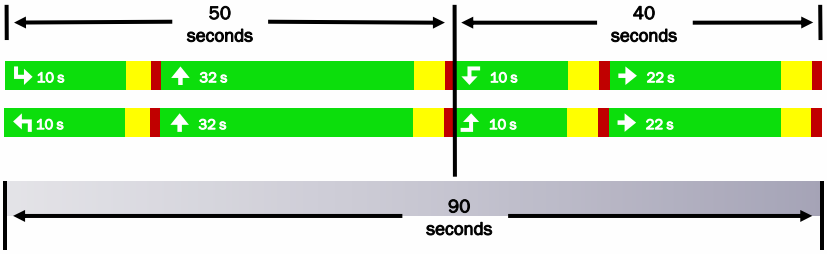
CONTROL

Cycle Length

- The amount of time (in seconds) that is provided to service all movements at a signalized intersection; a cycle length should provide sufficient capacity at the critical intersection(s) and provide progression through the system





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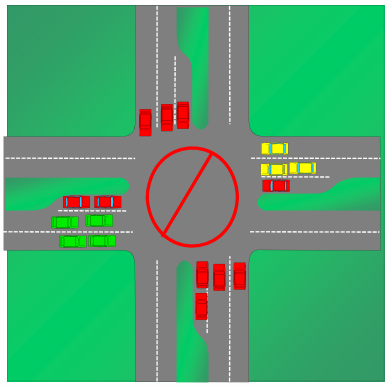
CONTROL

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.



70

CONTROL

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	Actuated Signals
g/C ≈ G/C	g/C ≈ (G+4)/C

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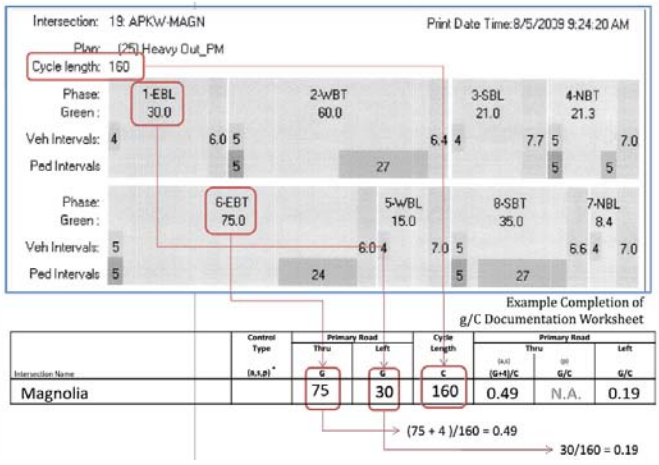
CONTROL **Signal Timing**

- **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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2015 Q/LOS Training

Data Sources

Agenda Item 3

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2015 Q/LOS Training

Data Sources

Data Sources

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

→ using free online 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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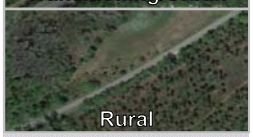
Data Sources

Most Important Variables - Reminder

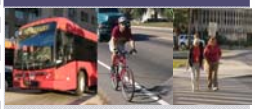
Area Type



Auto

- Number of lanes
- Left turn lanes
- AADT
- K
- D
- Signal spacing
- g/C

Multimodal



- 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 using Florida's MPO Website (http://www.mpoac.org/mpos/)
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

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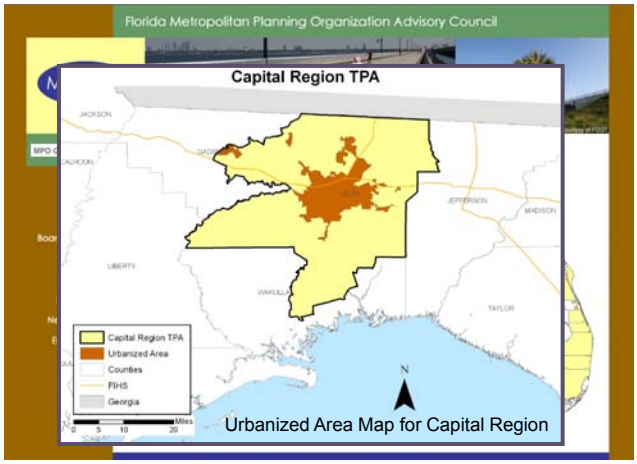
Data Sources

Area Type (MPOAC.org)

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



Appears to be within the urbanized area, but use TransPort to check

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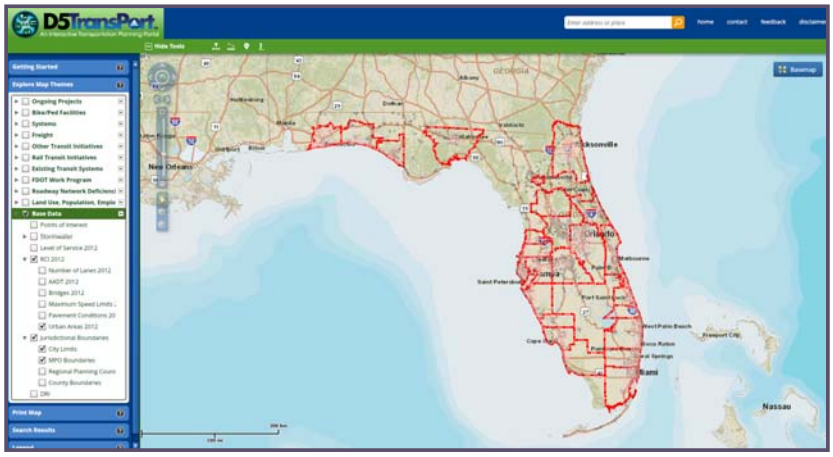
Data Sources

Area Type (TransPort)

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



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Show FTI video

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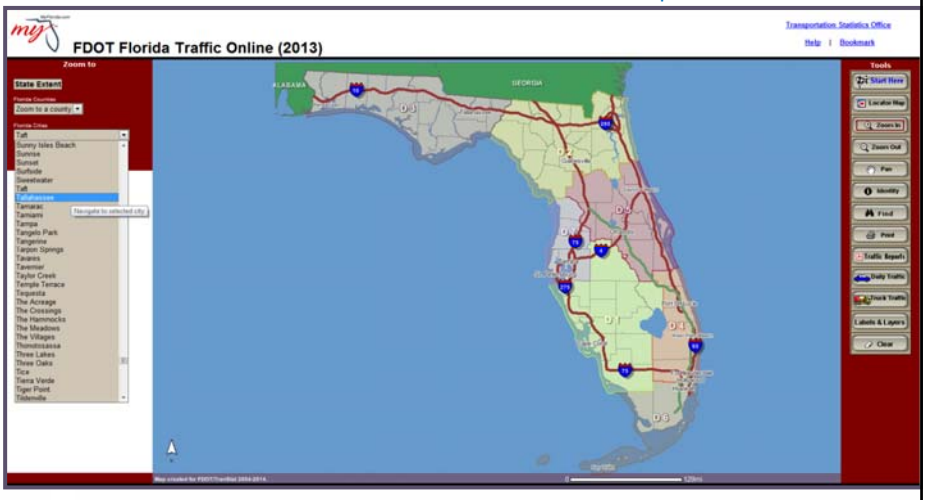
Data Sources

AADT, K-Factor, D-Factor

Florida Traffic Online **OR** Florida Transportation Information DVD



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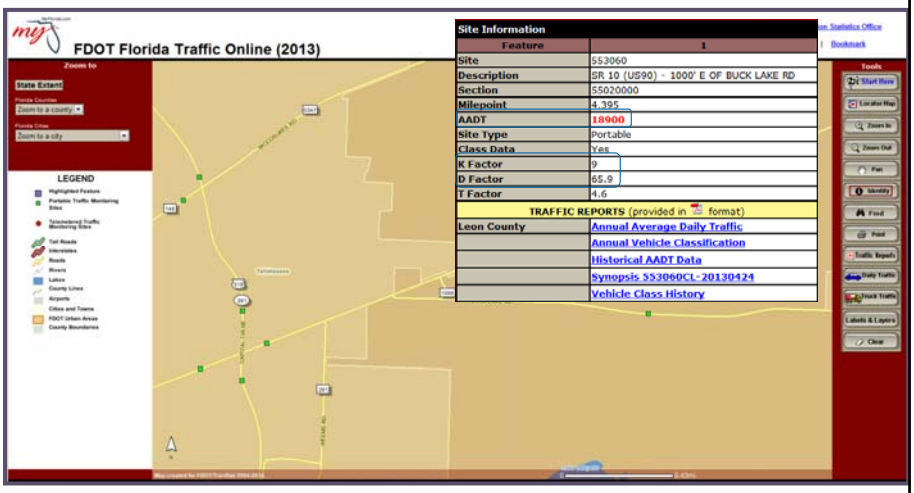
Data Sources

AADT, K-Factor, D-Factor

(Florida Traffic Online)



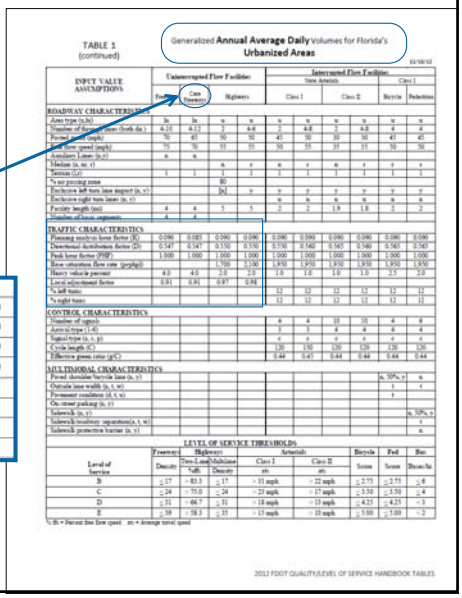
85

Data Sources

Percent Heavy Vehicles *(From back of GSVTs)*

Example for a core freeway in an urbanized area

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				



86

% Heavy Vehicles = 4.0

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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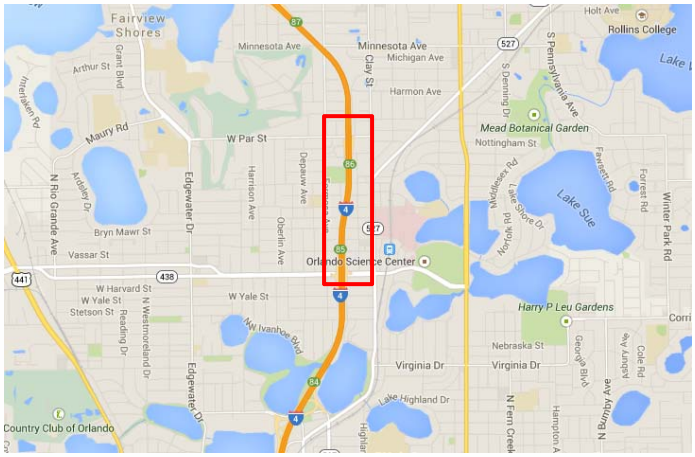
Data Sources

Example 1

Area Type



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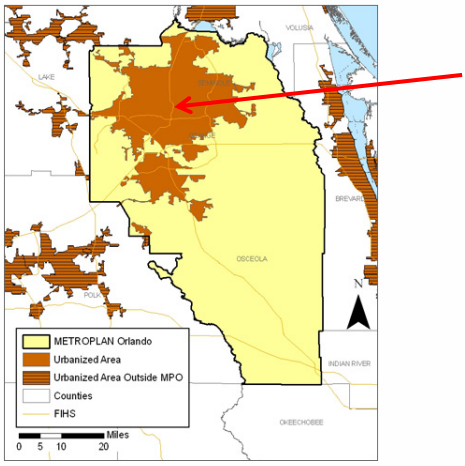
Data Sources

Example 1

Area Type

- The study roadway is in Orlando, FL:



89

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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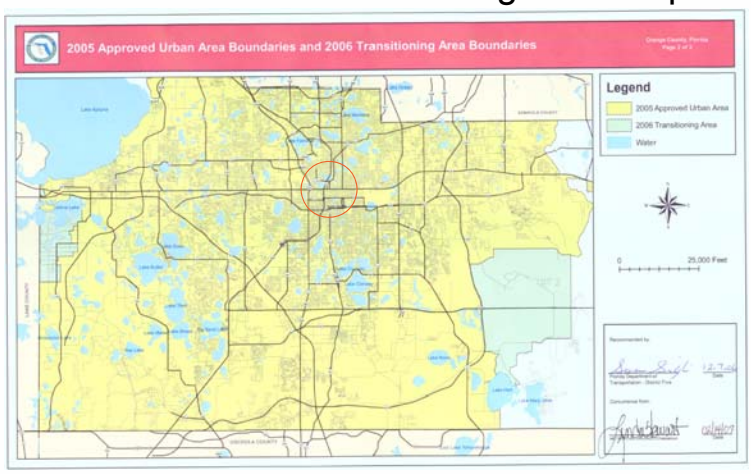
Data Sources

Example 1

District 5 Urban/Transitioning Area Maps



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Data Sources

Example 1

Determine:

- Peak Direction
- AADT
- K-Factor
- D-Factor

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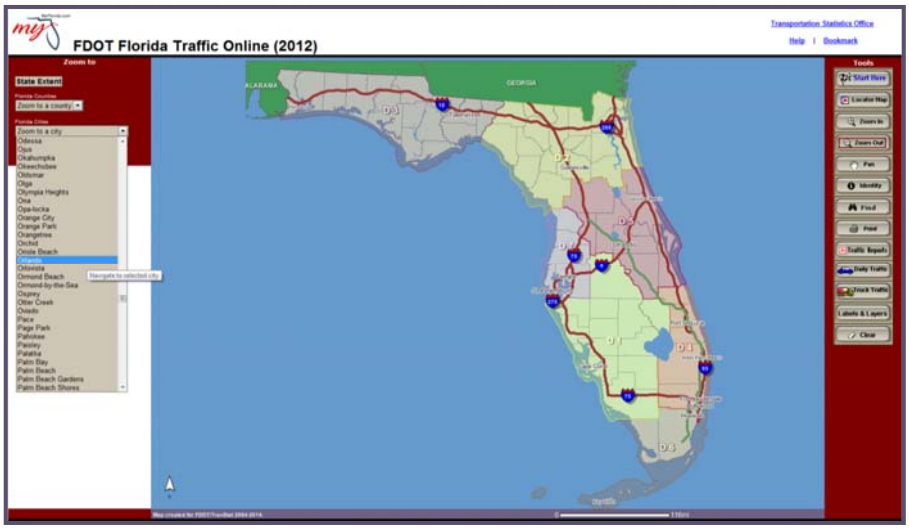
Data Sources

Example 1



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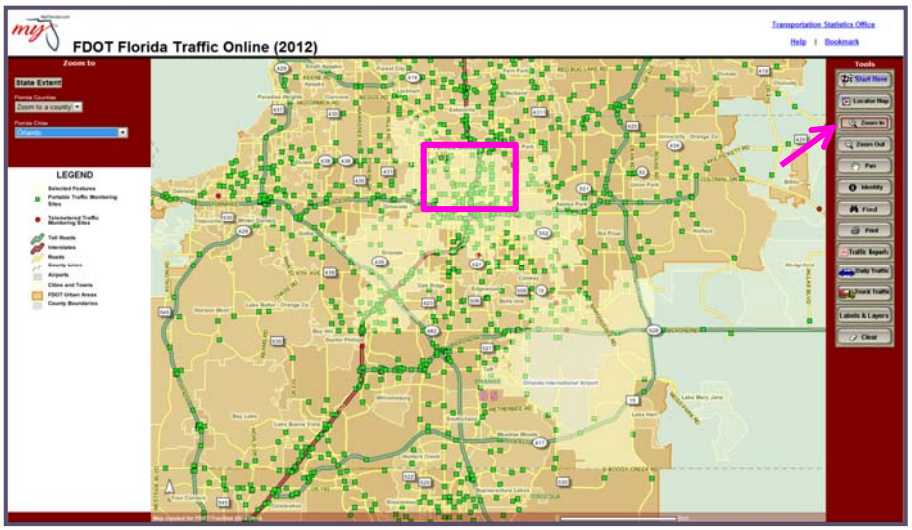
Data Sources

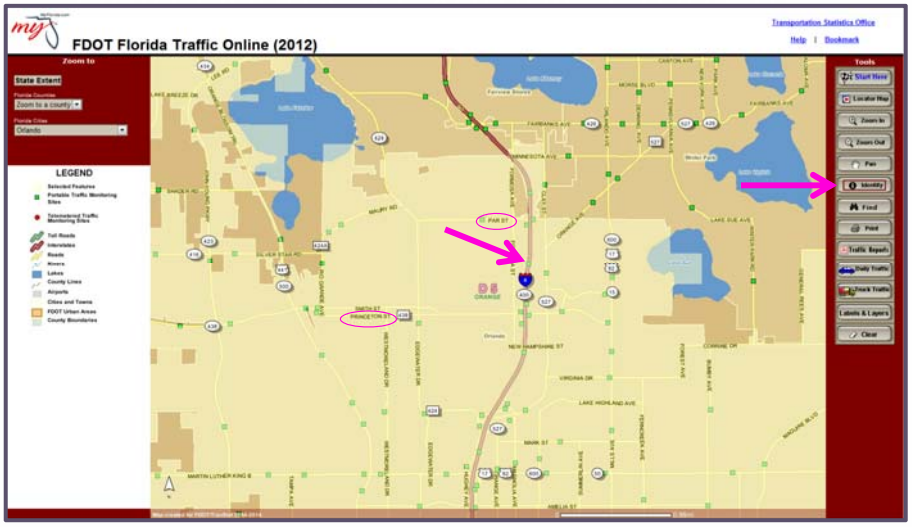
Example 1



94

Data Sources

Example 1



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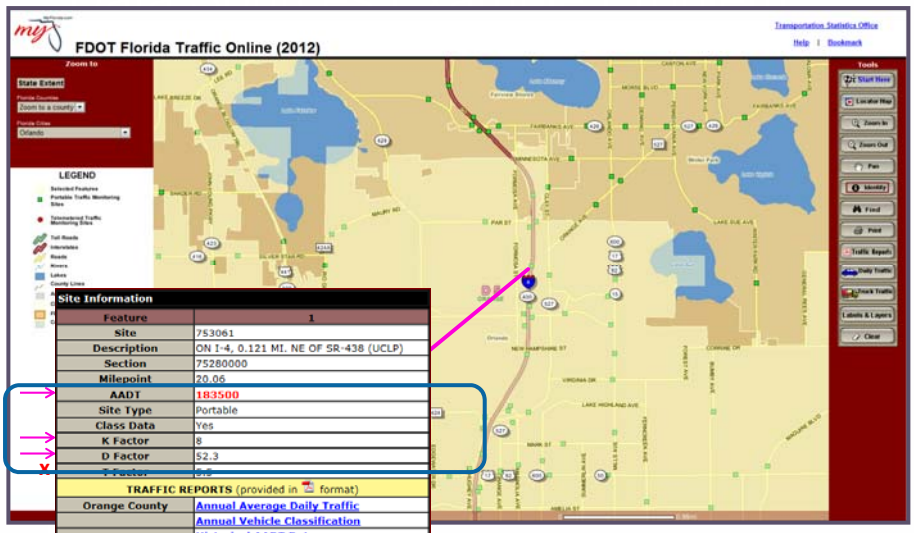
2015 Q/LOS Training

Data Sources

Example 1



Site Information	
Feature	1
Site	753061
Description	ON I-4, 0.121 MI. NE OF SR-438 (UCLP)
Section	75280000
Milepoint	20.06
AADT	183500
Site Type	Portable
Class Data	Yes
K Factor	8
D Factor	52.3

TRAFFIC REPORTS (provided in format)	
Orange County	Annual Average Daily Traffic
	Annual Vehicle Classification
	Historical AADT Data
	Synopsis 753061CL-20130326
	Vehicle Class History

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COUNTY: 75
STATION: 3061
DESCRIPTION: ON I-4, 0.121 MI. NE OF SR-438 (UCLP)
START DATE: 03/26/2013
START TIME: 0000

TIME	DIRECTION: E 1ST	2ND	3RD	4TH	TOTAL	DIRECTION: W 1ST	2ND	3RD	4TH	TOTAL	COMBINED TOTAL
0000	383	377	328	325	1413	219	258	199	145	821	2234
0100	258	215	206	184	863	131	141	120	102	494	1357
0200	176	168	166	147	657	100	113	118	89	420	1077
0300	148	139	131	139	557	91	139	138	156	524	1081
0400	115	148	169	175	607	195	241	317	349	1102	1709
0500	169	271	330	439	1209	339	548	766	900	2553	3762
0600	406	687	869	959	2921	1036	1375	1751	1748	5910	8831
0700	1065	1545	1489	1342	5441	1676	1888	1928	1855	7347	12788
0800	1139	1137	1199	1610	5085	1813	1842	1783	1633	7071	12156
0900	1437	1276	1275	1307	5295	1587	1650	1721	1724	6682	11977
1000	1041	1080	1142	1170	4433	1595	1587	1618	1598	6398	10831
1100	1089	1242	1157	1259	4747	1501	1511	1527	1570	6109	10856
1200	1200	1249	1354	1263	5066	1416	1529	1474	1567	5986	11052
1300	1189	1285	1328	1334	5136	1500	1543	1507	1470	6020	11156
1400	1306	1384	1289	1440	5419	1583	1464	1456	1353	5856	11275
1500	1422	1433	1473	1398	5726	1529	1590	1545	1599	6263	11989
1600	1301	1294	1332	1200	5127	1527	1584	1549	1564	6224	11351
1700	1366	1268	1155	1139	4928	1439	1570	1576	1777	6362	11290
1800	1293	1381	1433	1318	5425	1501	1610	1351	1221	5683	11108
1900	1341	1156	1094	1037	4628	1055	1079	975	846	3955	8583
2000	1045	1000	904	932	3881	833	873	854	805	3365	7246
2100	872	861	955	1006	3694	786	840	717	702	3045	6739
2200	815	674	709	617	2815	667	647	488	464	2266	5081
2300	571	586	483	447	2087	402	433	362	296	1493	3580
24-HOUR TOTALS:					87160					101949	189109

PEAK VOLUME INFORMATION

	DIRECTION: E HOUR	VOLUME	DIRECTION: W HOUR	VOLUME	COMBINED DIRECTIONS HOUR	VOLUME
A.M.	845	5598	715	7484	715	12999
P.M.	1445	5768	1730	6464	1500	11989
DAILY	1445	5768	715	7484	715	12999
TRUCK PERCENTAGE	5.05		5.81		5.46	

CLASSIFICATION SUMMARY DATABASE

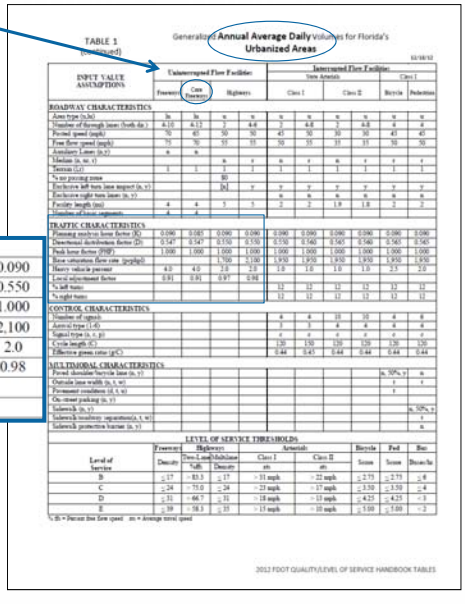
DIR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTTRK	TOTVOL
E	417	70089	12209	412	1759	190	22	878	846	215	40	15	28	0	40	4405	87160
W	202	79299	16517	389	2253	216	37	724	2120	84	58	36	8	0	6	5925	101949

Data Sources

Example 1

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

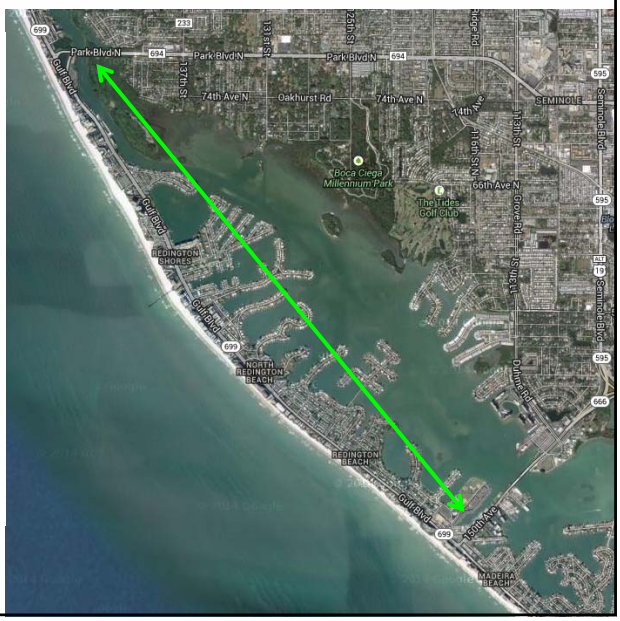


Data Sources

Workshop 1

SR 699
- Between Park Blvd and SR 666
- Redington Beach (D7)

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



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2015 Q/LOS Training

Data Sources

Workshop 1

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

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2015 Q/LOS Training

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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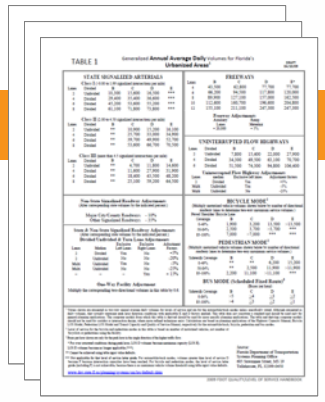
Generalized Service Volume Tables

Generalized Service Volume Tables



Agenda Item 4

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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

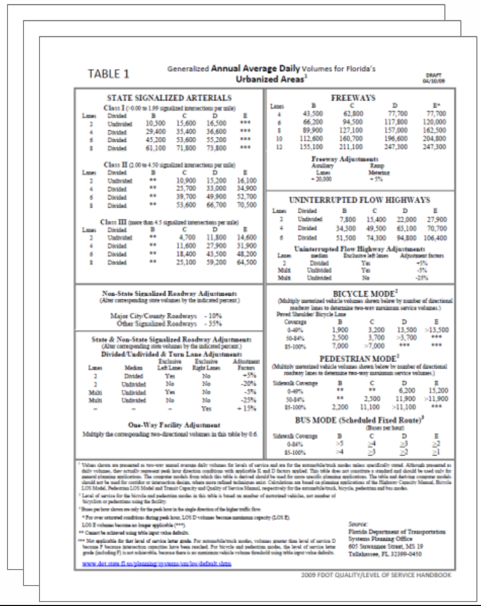

TABLE 1 Generalized **Annual Average Daily** Volumes for Florida's **Urbanized Areas**[1] DRAFT 04/10/09

STATE SIGNALIZED ARTERIALS

Class I (>0.00 to 1.99 signalized intersections per mile)

Lanes	Divided	B	C	D	E
2	Undivided	10,300	15,600	16,500	***
4	Divided	29,400	35,400	36,600	***
6	Divided	45,200	53,600	55,200	***
8	Divided	61,100	71,800	73,800	***

Class II (2.00 to 4.50 signalized intersections per mile)

Lanes	Divided	B	C	D	E
2	Undivided	**	10,900	15,200	16,100
4	Divided	**	25,700	33,000	34,900
6	Divided	**	39,700	49,900	52,700
8	Divided	**	53,600	66,700	70,500

Class III (more than 4.5 signalized intersections per mile)

Lanes	Divided	B	C	D	E
2	Undivided	**	4,700	11,800	14,600
4	Divided	**	11,600	27,900	31,900
6	Divided	**	18,400	43,500	48,200
8	Divided	**	25,100	59,200	64,500

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

Major City/County Roadways - 10%
Other Signalized Roadways - 35%

State & Non-State Signalized Roadway Adjustments
(Alter corresponding state volumes by the indicated percent.)
Divided/Undivided & 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	+ 15%

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

FREEWAYS

Lanes	B	C	D	E*
4	43,500	62,800	77,700	77,700
6	66,200	94,500	117,800	120,000
8	89,900	127,100	157,000	162,500
10	112,600	160,700	196,600	204,800
12	155,100	211,100	247,300	247,300

Freeway Adjustments

Auxiliary Lanes	Ramp Metering
+ 20,000	+ 5%

UNINTERRUPTED FLOW HIGHWAYS

Lanes	Divided	B	C	D	E
2	Undivided	7,800	15,400	22,000	27,900
4	Divided	34,300	49,500	63,100	70,700
6	Divided	51,500	74,300	94,800	106,400

Uninterrupted Flow Highway Adjustments

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

BICYCLE MODE[2]
(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%	1,900	3,200	13,500	>13,500
50-84%	2,500	3,700	>3,700	***
85-100%	7,000	>7,000	***	***

PEDESTRIAN MODE[2]
(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%	**	**	6,200	15,200
50-84%	**	2,500	11,900	>11,900
85-100%	2,200	11,100	>11,100	***

BUS MODE (Scheduled Fixed Route)[3]
(Buses per hour)

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

[1] Values shown are presented as two-way annual average daily volumes for levels of service and are for the automobile/truck modes unless specifically stated. Although presented as daily volumes, they actually represent peak hour direction conditions with applicable K and D factors applied. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the Highway Capacity Manual, Bicycle LOS Model, Pedestrian LOS Model and Transit Capacity and Quality of Service Manual, respectively for the automobile/truck, bicycle, pedestrian and bus modes.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of motorized vehicles, not number of bicyclists or pedestrians using the facility.

[3] Buses per hour shown are only for the peak hour in the single direction of the higher traffic flow.

* For over saturated conditions during peak hour, LOS D volumes become maximum capacity (LOS E). LOS E volumes become no longer applicable (***).

** Cannot be achieved using table input value defaults.

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

Source:
Florida Department of Transportation
Systems Planning Office
605 Suwannee Street, MS 19
Tallahassee, FL 32399-0450

www.dot.state.fl.us/planning/systems/sm/los/default.shtm

2009 FDOT QUALITY/LEVEL OF SERVICE HANDBOOK

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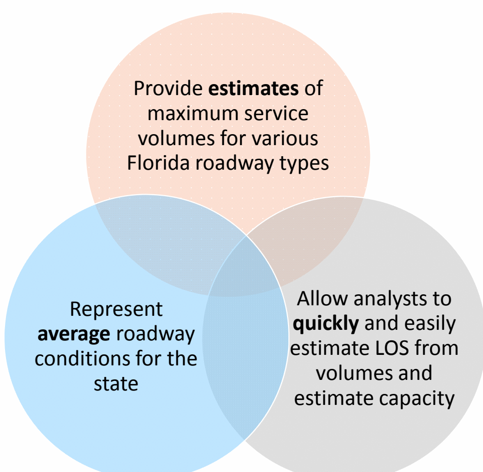
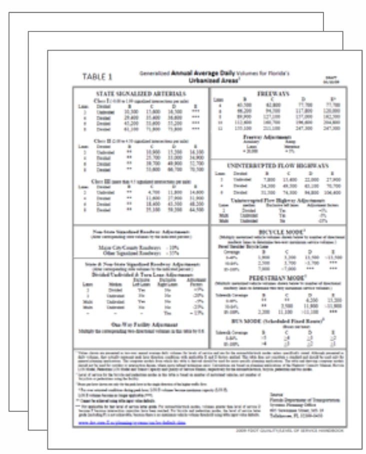
2015 Q/LOS Training

Generalized Service Volume Tables

Generalized Service Volume Tables





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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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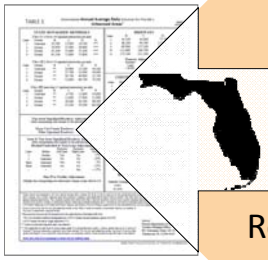
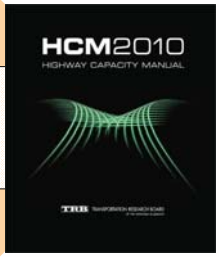
Generalized Service Volume Tables



Assumptions



Reflect typical conditions on Florida roadways

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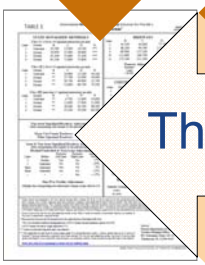
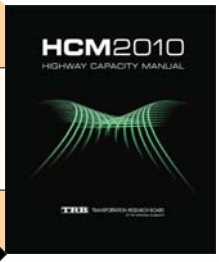
2015 Q/LOS Training

Rural freeways based on UF Research

- two class system
- average travel speed



Threshold Differences



percent
base free flow speed

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Generalized Service Volume Tables

LOS Thresholds

- **Urbanized and Transitioning/Urban**

LEVEL OF SERVICE THRESHOLDS

Level of Service	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 THRESHOLDS

Level of Service	Freeways	Highways				
		Two-Lane ru		Two-Lane rd	Multilane ru	Multilane rd
	Density	%tsf	ats	%ffs	Density	Density
B	≤ 14	≤ 50	≤ 55	> 83.3	≤ 14	≤ 14
C	≤ 22	≤ 65	≤ 50	> 75.0	≤ 22	≤ 22
D	≤ 29	≤ 80	≤ 45	> 66.7	≤ 29	≤ 29
E	≤ 36	> 80	≤ 40	> 58.3	≤ 34	≤ 34

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

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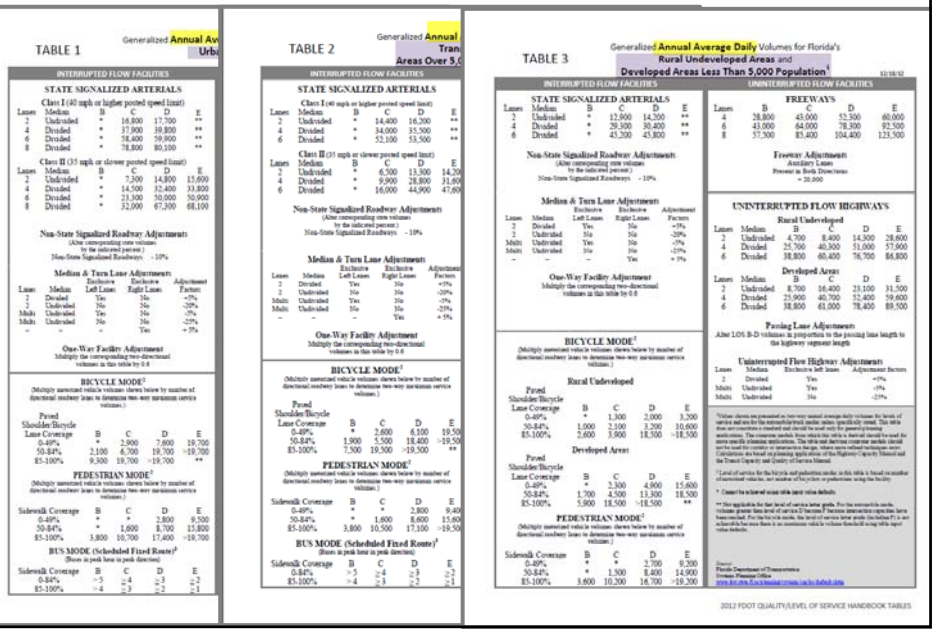
Generalized Service Volume Tables

Table Format

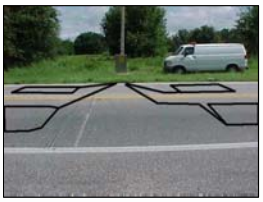


Generalized Service Volume Tables

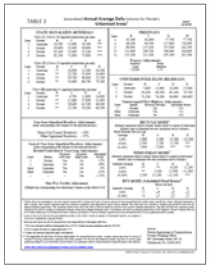
How the Tables Were Developed

Collect Traffic Data → Calculate Values → Publish Tables

From roadways around the state



Using LOSPLAN and generalized assumed values for variables



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

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

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

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 value

TABLE 3 (continued) 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				
	Freeways	Highways			
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				
Median (n, nr, r)		n	r	n	r
Terrain (l,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				

Generalized Service Volume Tables

Service Volumes From **HIGH**PLAN

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 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

Determine time period of traffic volumes

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

Determine area type

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

Determine mode

- Automobile
- Bicycle
- Pedestrian
- Bus

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Generalized Service Volume Tables

Process for Using Tables

Automobile Mode

Key Variables

- Facility Type
- Number and type of lanes

Bicycle Mode

Key Variables

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

Pedestrian Mode

Key Variables

- Sidewalk coverage
- Number of motorized vehicles

Bus Mode

Key Variables

- 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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Generalized Service Volume Tables

Example 1.A

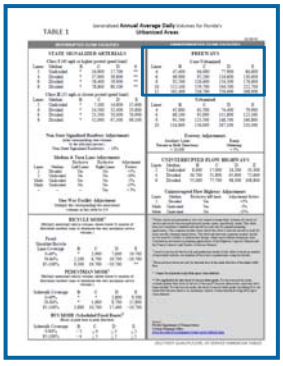
Determine the max. service volume for LOS E:

- 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

Urbanized

Lanes	B	C	D	E
4	45,800	61,500	74,400	79,900
6	68,100	93,000	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%

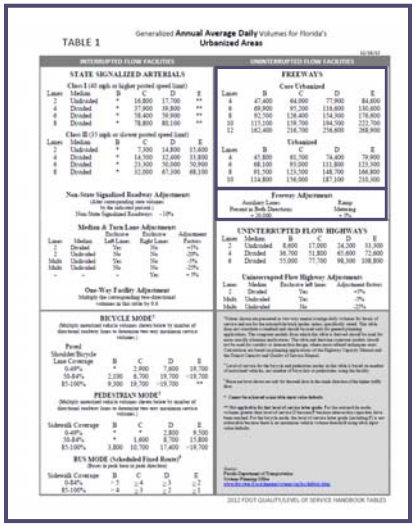
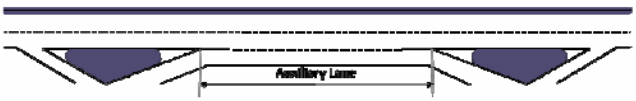


TABLE 1

Generalized Annual Average Daily Volumes for Florida's Urbanized Areas



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

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%

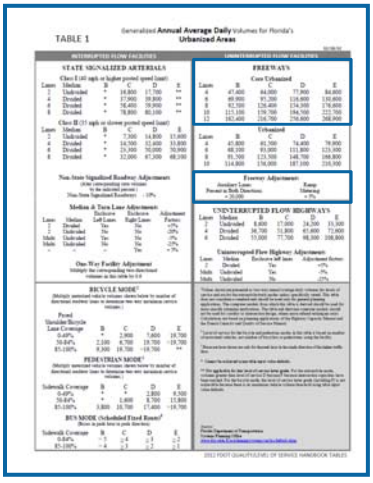


TABLE 1

Generalized Annual Average Daily Volumes for Florida's Urbanized Areas

Generalized Service Volume Tables

Example 2.A

Determine the auto LOS:

- In terms of peak hour directional volumes
- In an undeveloped rural 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

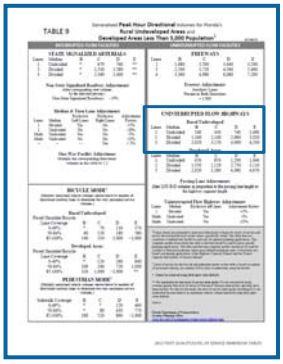
Determine the auto LOS:

- In terms of peak hour directional volumes
- In an undeveloped rural 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

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

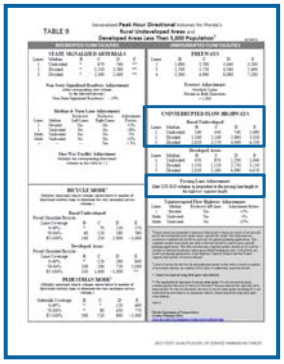
Determine the auto LOS:

- In terms of peak hour directional volumes
- In an undeveloped rural area
- For an uninterrupted flow highway with
  - 2 lanes (one in each direction)
  - 20% passing lane
  - No median/undivided
  - Peak hour directional volume is 440

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

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

Uninterrupted Flow Highway Adjustments

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

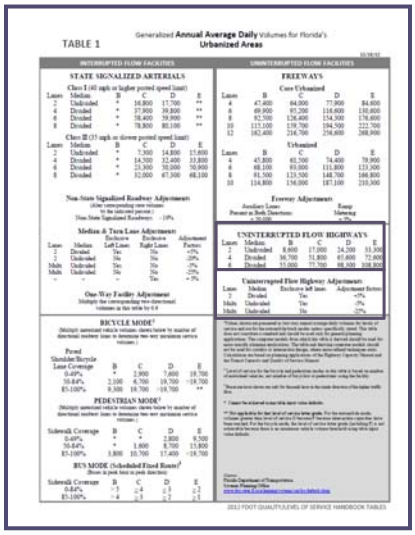
TABLE 1
Generalized Annual Average Daily Volumes for Florida's Urbanized Areas

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Generalized Service Volume Tables

Other Adjustments

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

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

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%

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

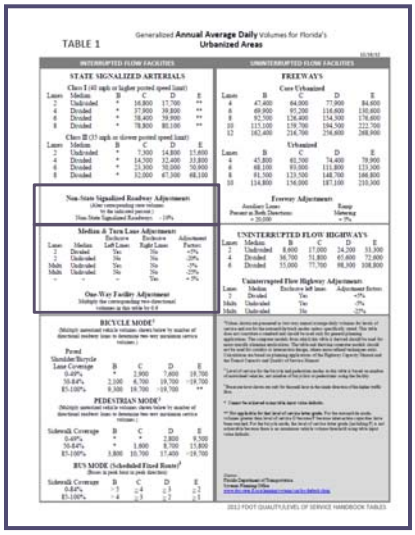
TABLE 1
Generalized Annual Average Daily Volumes for Florida's Urbanized Areas

Adjustments for State and Non-State Signalized Roadways

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Generalized Service Volume Tables

Example 3

Determine the auto LOS:

- In terms of peak hour directional volumes
- In an urban 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

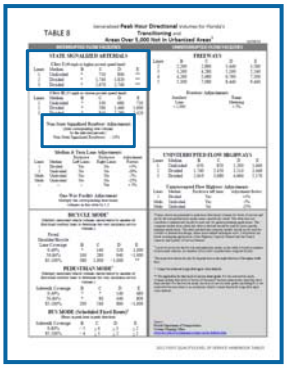
Determine the auto LOS:

- In terms of peak hour directional volumes
- In an urban 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

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	**



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

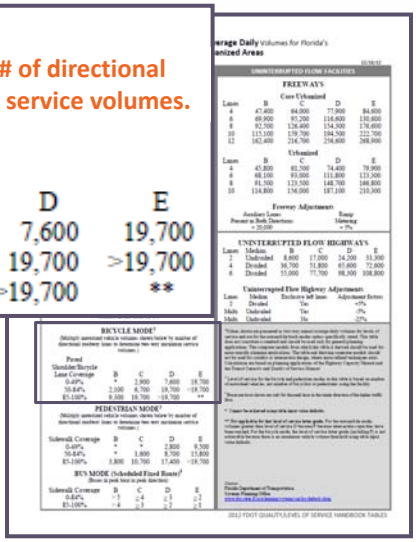
Generalized Service Volume Tables

Multimodal LOS

BICYCLE MODE[2]

Multiply motorized vehicle volumes by # of directional roadway lanes to determine 2-way max 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	**



Bicycle Mode

Based on:

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

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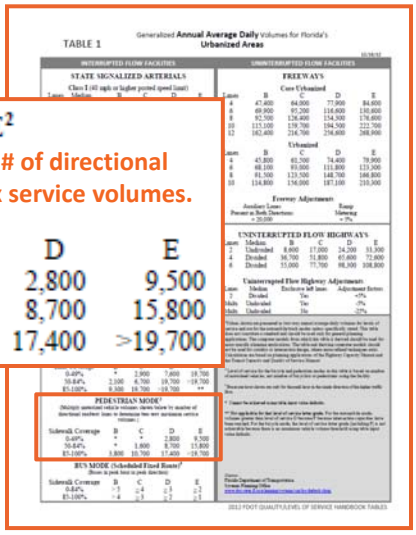
Generalized Service Volume Tables

Multimodal LOS

PEDESTRIAN MODE[2]

Multiply motorized vehicle volumes by # of directional roadway lanes to determine 2-way max 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



Pedestrian Mode

Based on:

- Sidewalk coverage
- Number of motorized vehicles

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Generalized Service Volume Tables

Multimodal LOS

Bus Mode

Based on:

- Bus frequency
- Sidewalk coverage

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

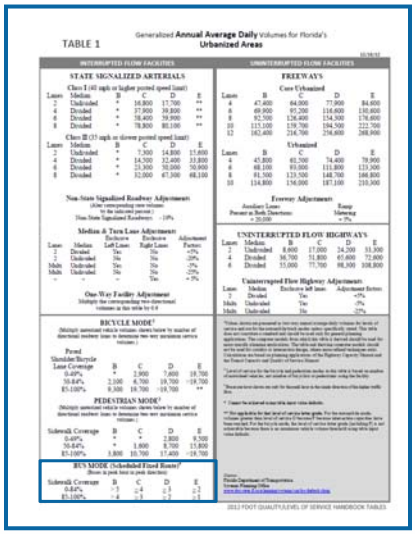
TABLE 1
Generalized Annual Average Daily Volumes for Florida's Urbanized Areas

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Generalized Service Volume Tables

Example 4

Determine the bicycle, pedestrian, and 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

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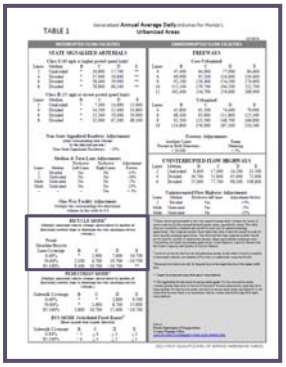
Generalized Service Volume Tables

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 MODE[2]

(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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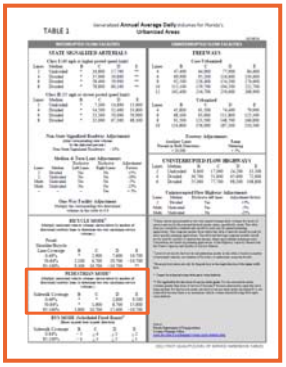
Generalized Service Volume Tables

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 MODE[2]

(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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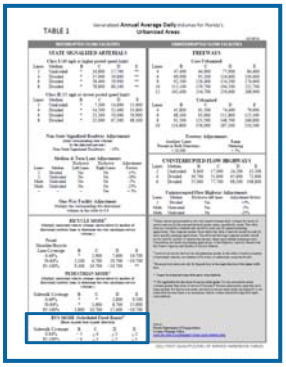
Generalized Service Volume Tables

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



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 area (pop. 12,000)
- For an undivided state arterial with
  - 30 mph speed limit
  - 2 lanes
  - 6,000 AADT

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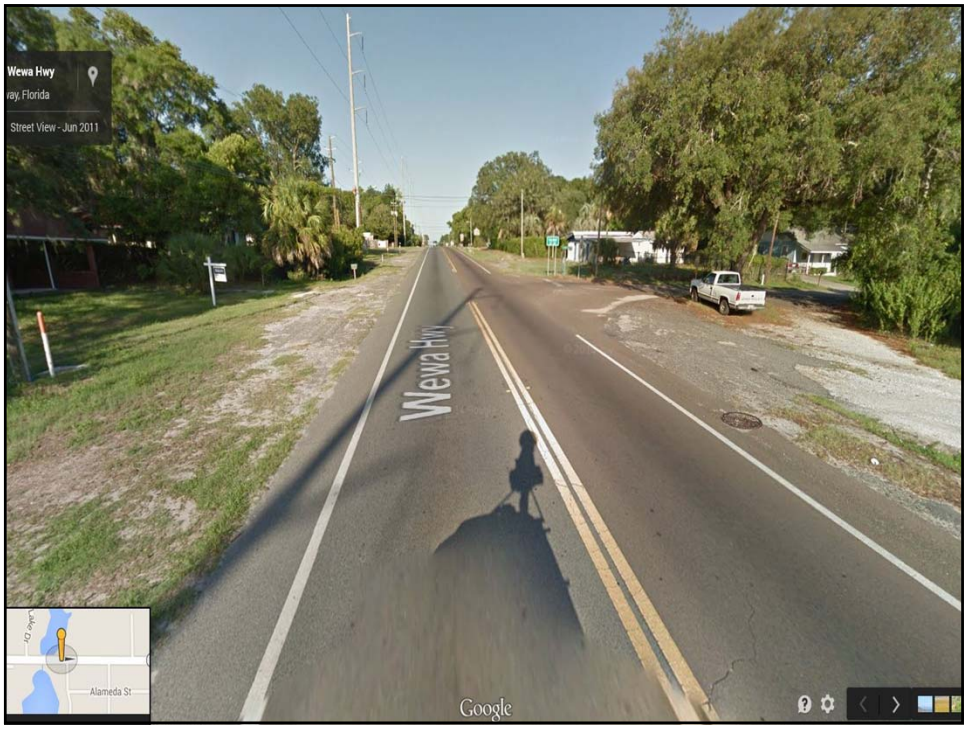
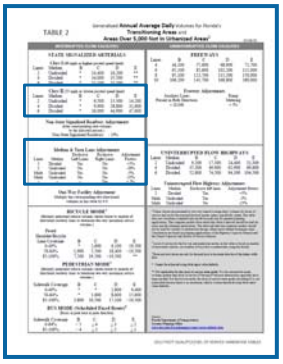


Generalized Service Volume Tables

Example 5

Determine the auto LOS:

- In terms of AADT
- In an urban area (pop. 12,000)
- For an undivided state arterial with
  - 30 mph speed limit
  - 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 a transitioning area
- For a state signalized arterial with
  - 4 lanes
  - No median
  - 35 mph speed limit
  - Exclusive left turn lanes
  - AADT of 28,000

141

Generalized Service Volume Tables

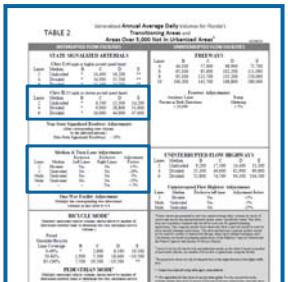
Example 6

Determine the auto LOS:

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

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 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

143

Generalized Service Volume Tables

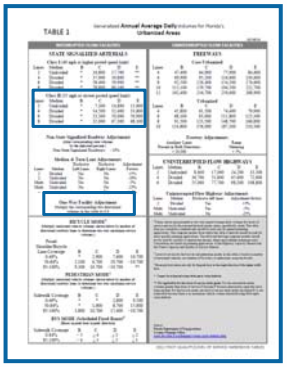
Example 7

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



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

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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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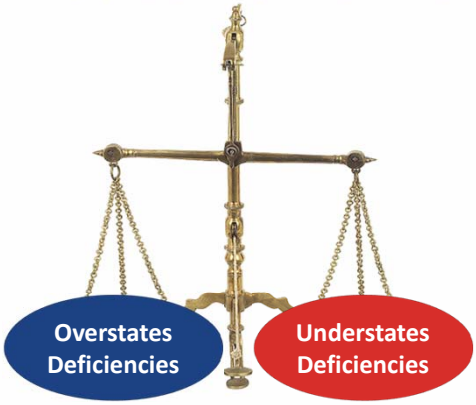
Generalized Service Volume Tables

The Tables Are Not Biased



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

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LOSPLAN
ARTPLAN 2012
Multimodal Arterial
Level of Service Analysis
For Conceptual Planning and Preliminary Engineering
Version Date: 12/12/2012
Agenda Item 5
147
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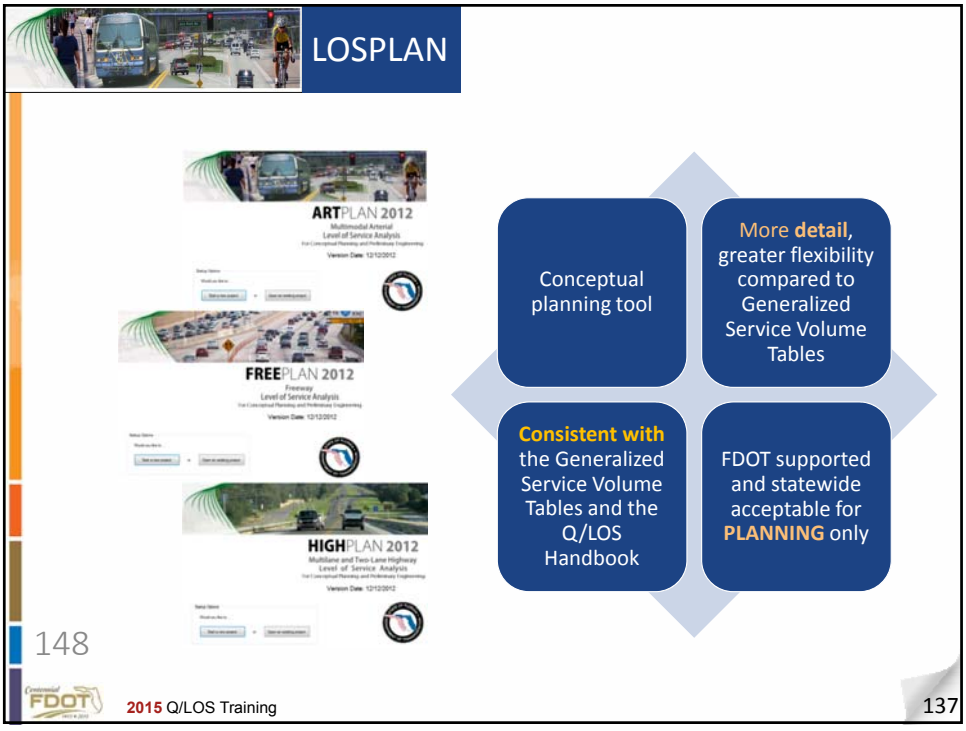
LOSPLAN
ARTPLAN 2012
FREEPLAN 2012
HIGHPLAN 2012
Conceptual planning tool
More detail, greater flexibility compared to Generalized Service Volume Tables
Consistent with the Generalized Service Volume Tables and the Q/LOS Handbook
FDOT supported and statewide acceptable for PLANNING only
148
2015 Q/LOS Training
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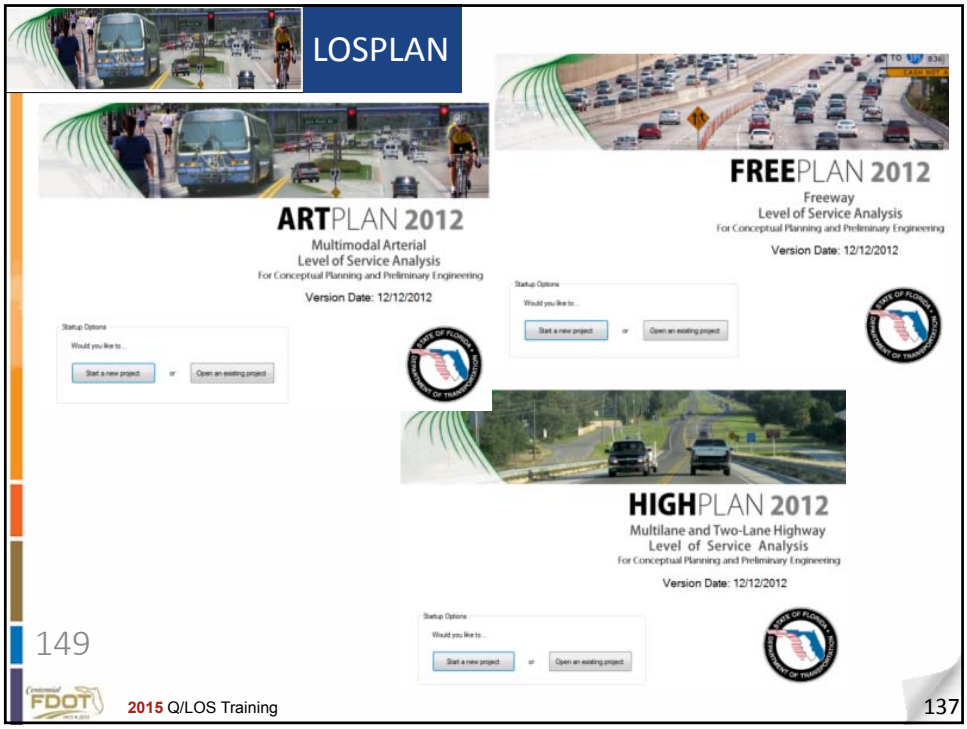
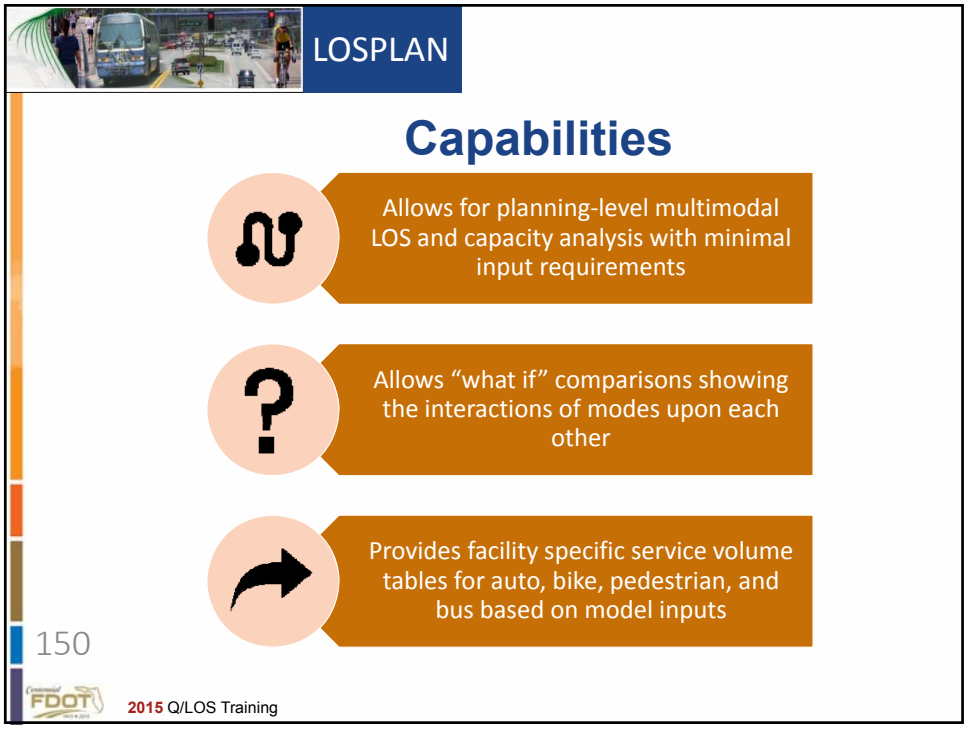

LOSPLAN
ARTPLAN 2012
Multimodal Arterial
Level of Service Analysis
For Conceptual Planning and Preliminary Engineering
Version Date: 12/12/2012
FREEPLAN 2012
Freeway
Level of Service Analysis
For Conceptual Planning and Preliminary Engineering
Version Date: 12/12/2012
HIGHPLAN 2012
Multilane and Two-Lane Highway
Level of Service Analysis
For Conceptual Planning and Preliminary Engineering
Version Date: 12/12/2012
149
2015 Q/LOS Training
137


LOSPLAN
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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LOSPLAN

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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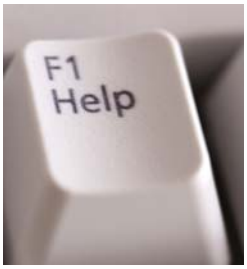
LOSPLAN

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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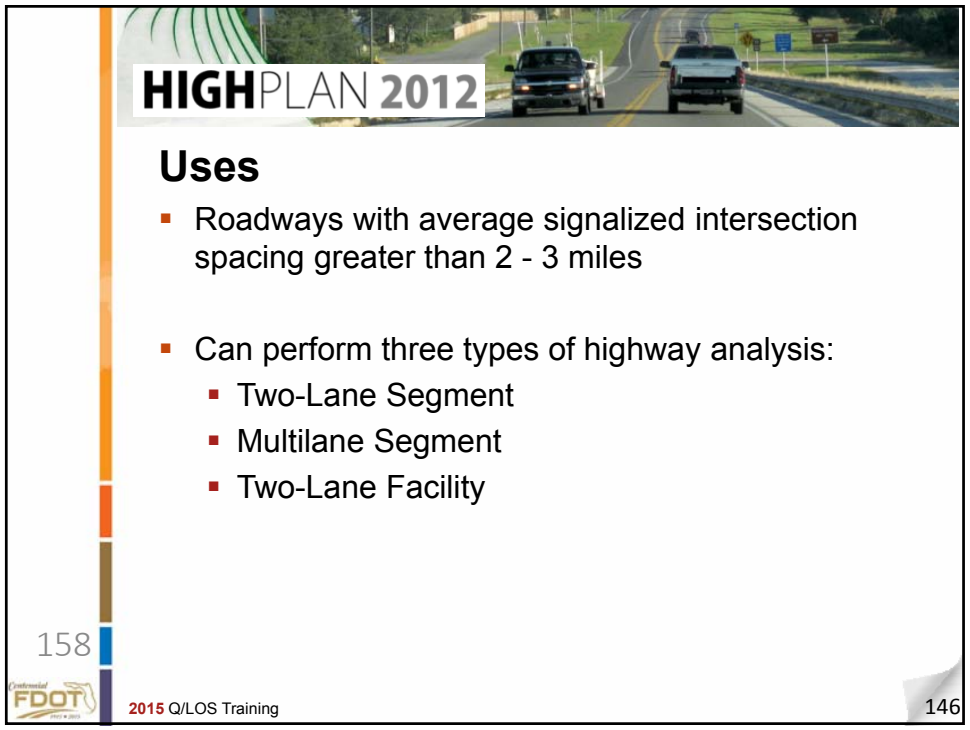
HIGHPLAN 2012
Agenda Item 6
157
2015 Q/LOS Training


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
158
2015 Q/LOS Training
146

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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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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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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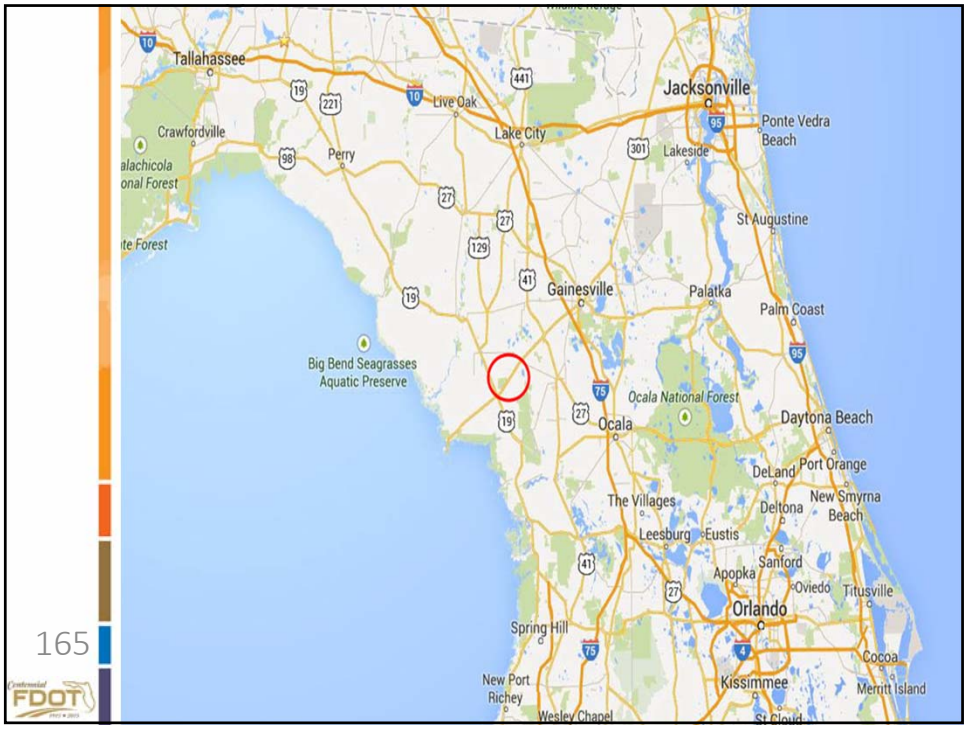
Example 1 *Two-Lane Segment*

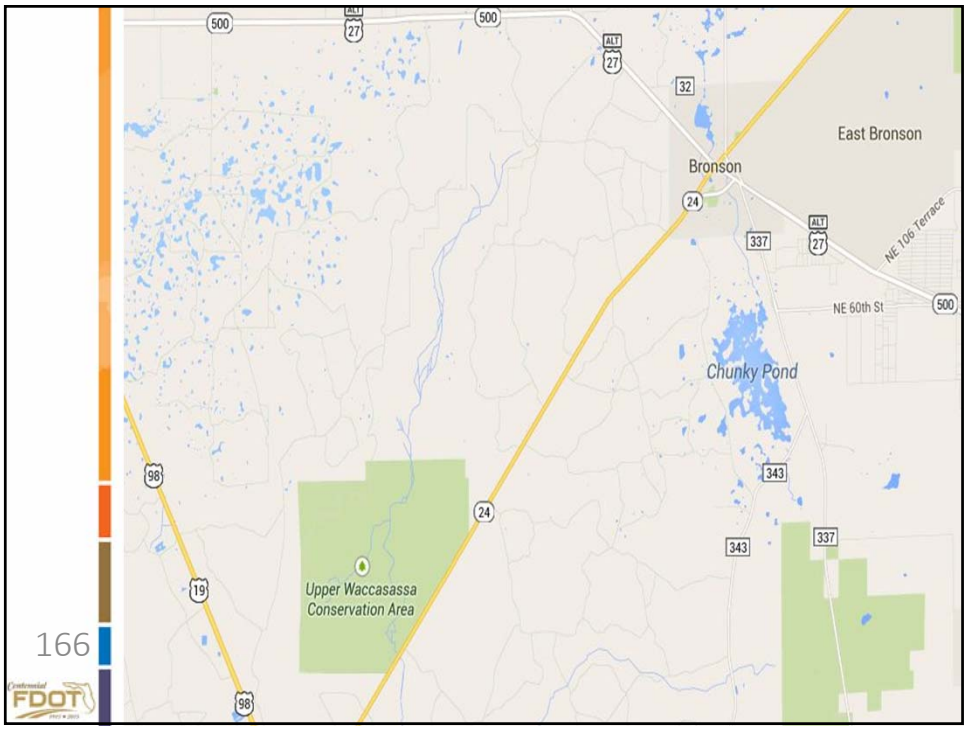
SR 24 between US 19/US 98 & SR 500, near Gainesville

- 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

164


Tallahassee
Live Oak
Lake City
Jacksonville
Ponte Vedra Beach
Lakeside
Crawfordville
Perry
St Augustine
Gainesville
Palatka
Palm Coast
Big Bend Seagrasses Aquatic Preserve
Ocala National Forest
Ocala
Daytona Beach
DeLand
Port Orange
The Villages
Deltona
New Smyrna Beach
Leesburg
Eustis
Sanford
Apopka
Oviedo
Titusville
Orlando
Spring Hill
Cocoa
Kissimmee
Merritt Island
New Port Richey
Wesley Chapel
165


East Bronson
Bronson
NE 106 Terrace
NE 60th St
Chunky Pond
Upper Waccasassa Conservation Area
166

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

168

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Workshop 1 *Two-Lane Segment*

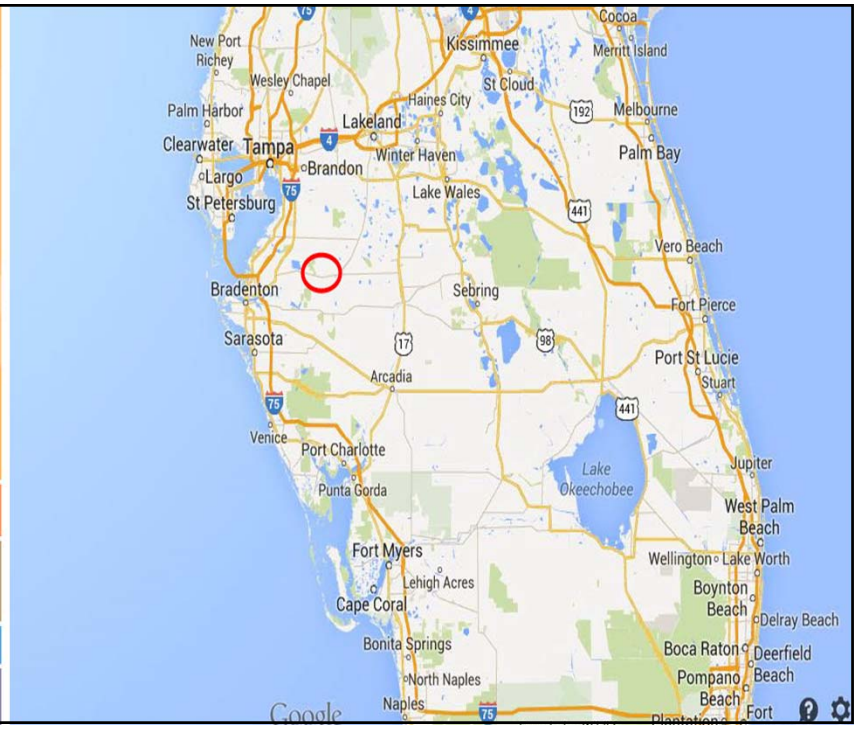
SR 62 between Saffold Rd & SR 37, Parrish/Wauchula

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

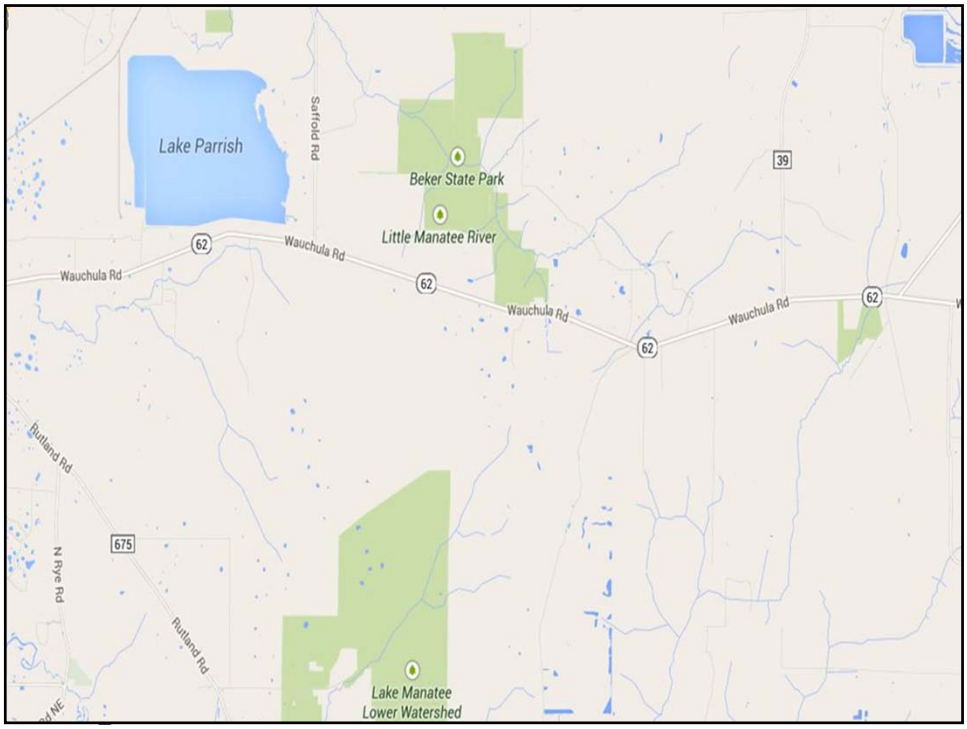
AADT	D-Factor	% Heavy Vehicles	Local Adjustment Factor
3,500	55.8	5.0	0.84

169

2015 Q/LOS Training



170


Lake Parrish
Saffold Rd
Beker State Park
Little Manatee River
39
62
Wauchula Rd
Wauchula Rd
62
Wauchula Rd
62
Wauchula Rd
62
Rutland Rd
675
N Rye Rd
Rutland Rd
Lake Manatee
Lower Watershed


FL-62
Florida
Street View - May 2014
FL-62
Wauchula Rd
Google

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

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

174

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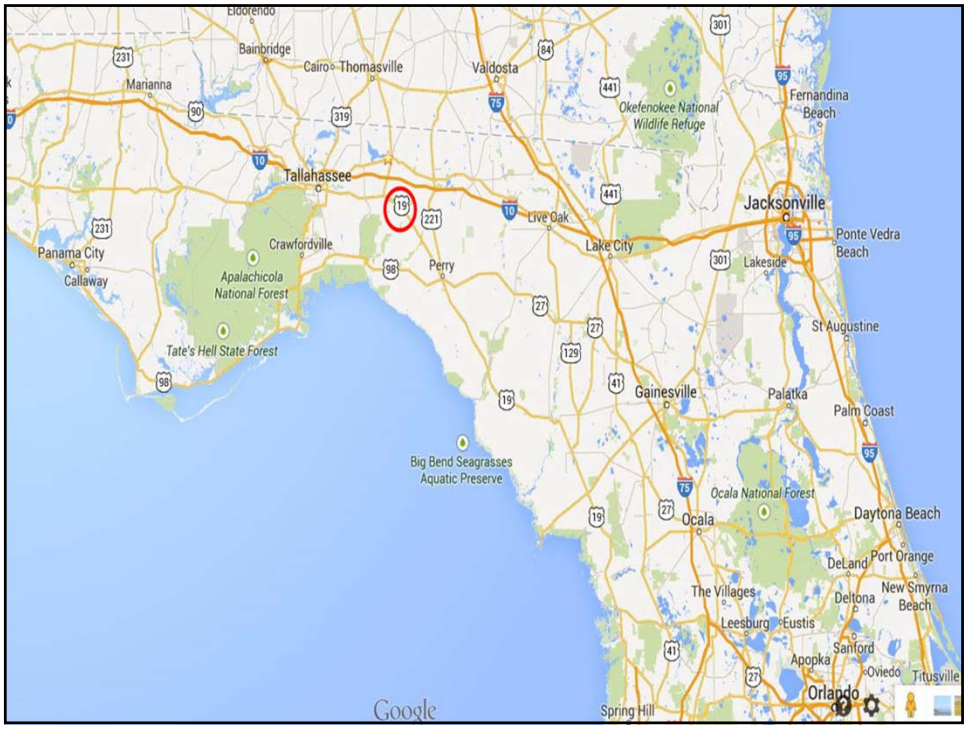
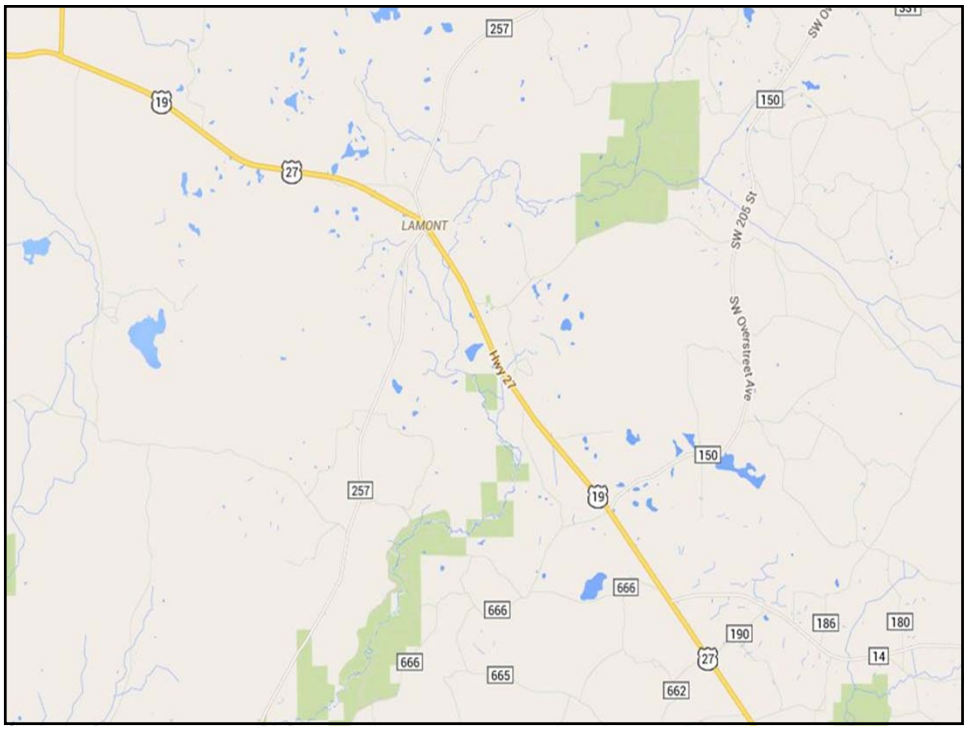
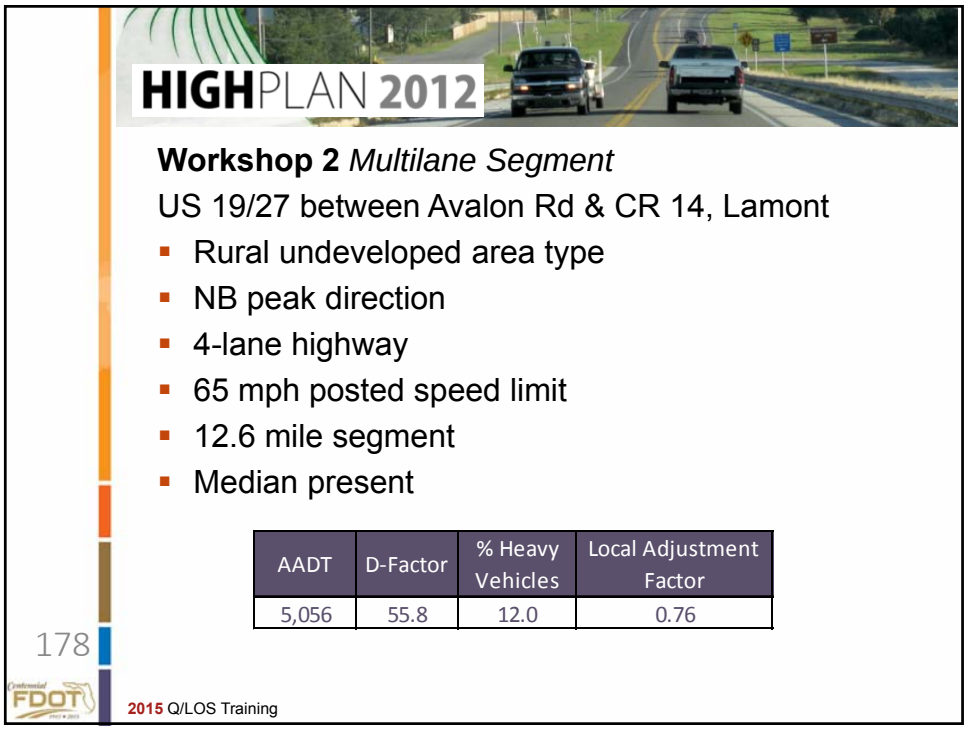

Eldorendo
Bainbridge
Cairo
Thomasville
Valdosta
Marianna
Okefenokee National Wildlife Refuge
Fernandina Beach
Tallahassee
Live Oak
Jacksonville
Crawfordville
Lake City
Ponte Vedra Beach
Panama City
Callaway
Apalachicola National Forest
Perry
Lakeside
St Augustine
Tate's Hell State Forest
Gainesville
Palatka
Palm Coast
Big Bend Seagrasses Aquatic Preserve
Ocala National Forest
Ocala
Daytona Beach
DeLand
Port Orange
The Villages
Deltona
New Smyrna Beach
Leesburg
Eustis
Sanford
Apopka
Oviedo
Titusville
Orlando
Spring Hill
Google


LAMONT
Hwy 27
SW 205 St
SW 0th Street Ave


US-27
Florida
Street View - Jun 2013
US-27
Google


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
178
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Agenda Item 7

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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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Strengths

- Much fewer inputs than HCS Streets
- Input data is easy to obtain
- Provides multimodal analysis with limited required information

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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

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- **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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Importance of Signalized Intersections

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

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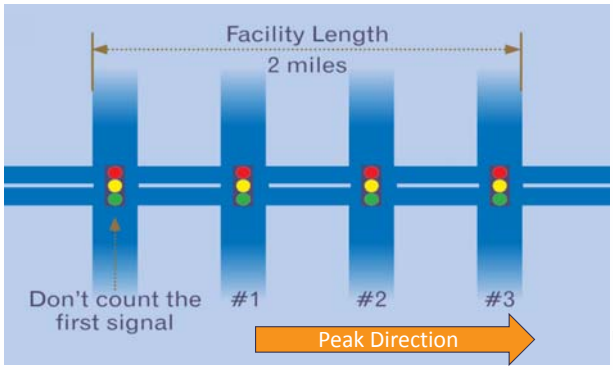
Number of through lanes

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

185

Number of Signalized Intersections

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



186

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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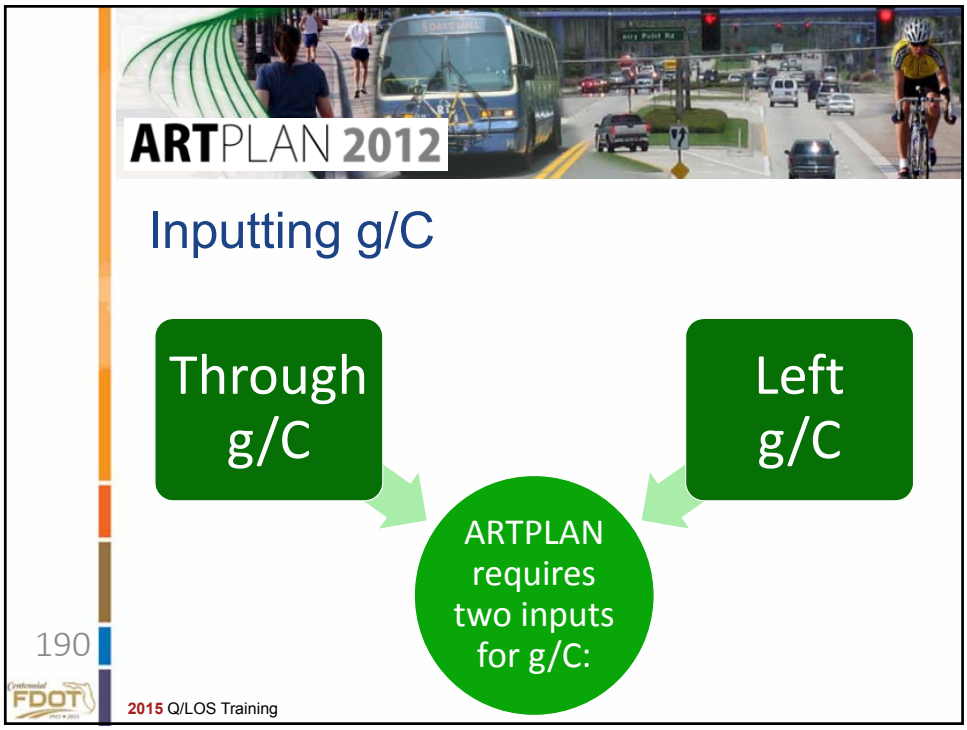
ARTPLAN 2012
On-Street Parking
Impacts both link running time as well as bicycle and pedestrian LOS
Parking Activity
Low
Medium
High
189


ARTPLAN 2012
Inputting g/C
Through g/C
Left g/C
ARTPLAN requires two inputs for g/C:
190
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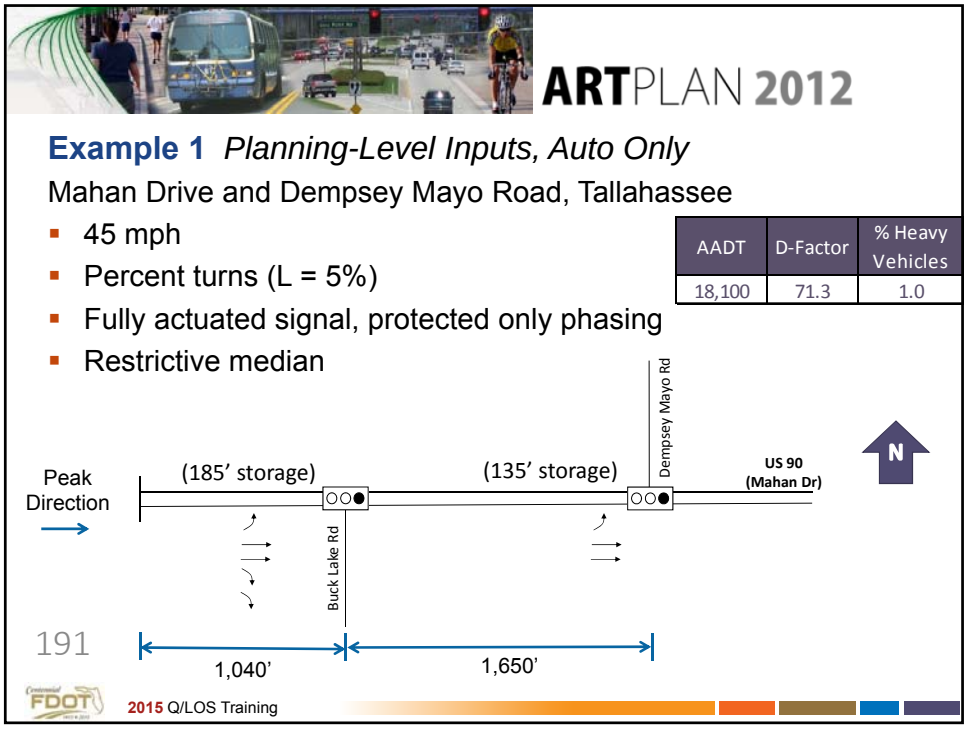
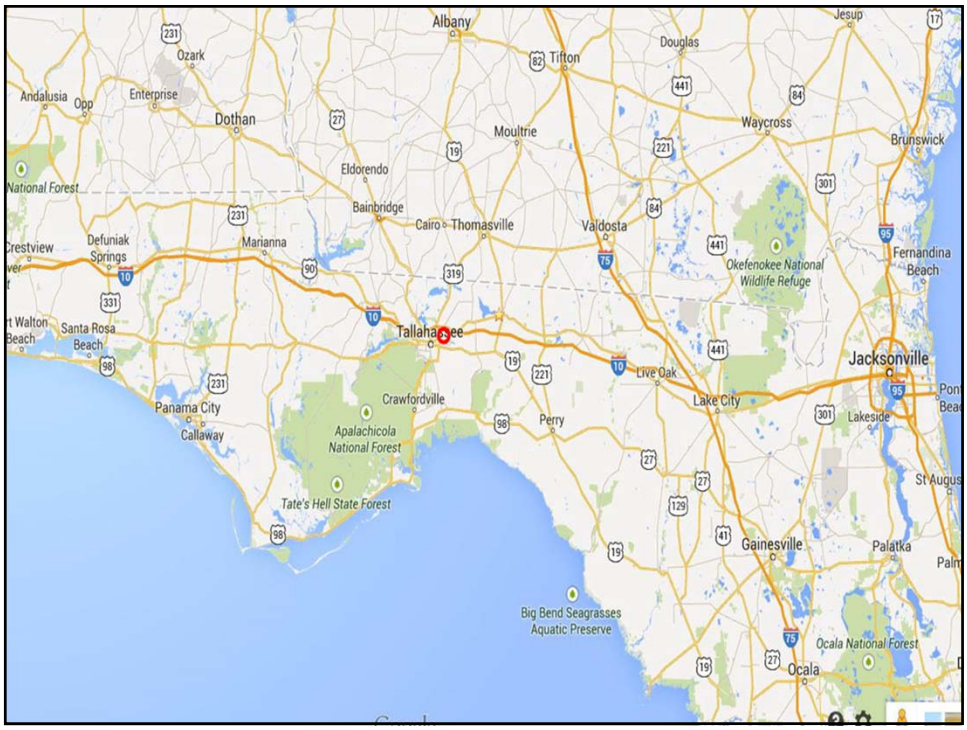
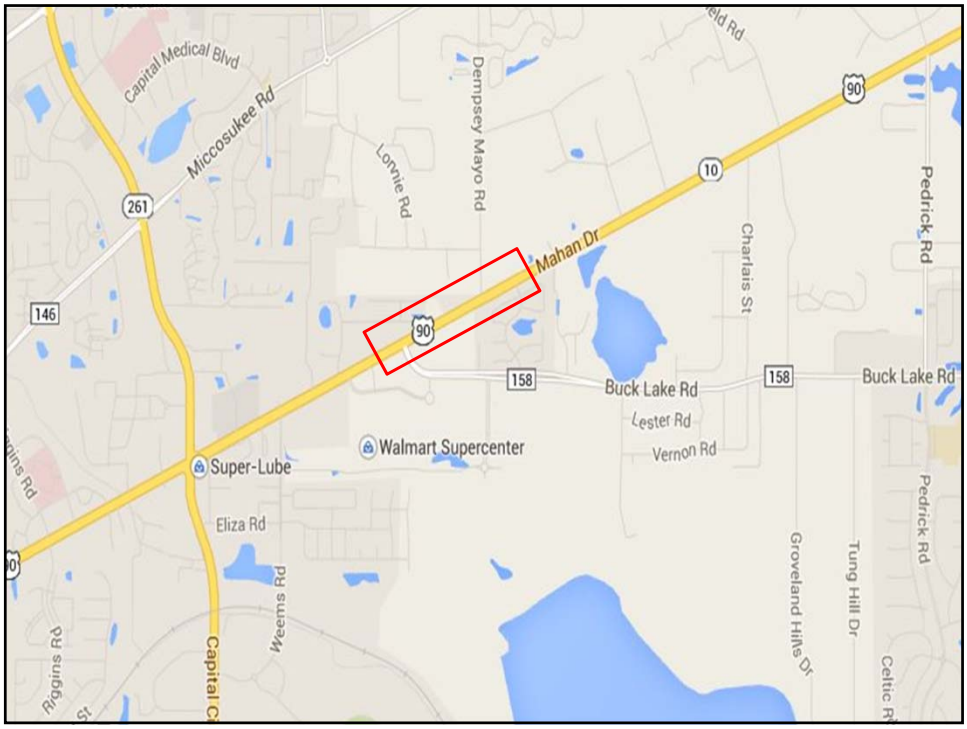
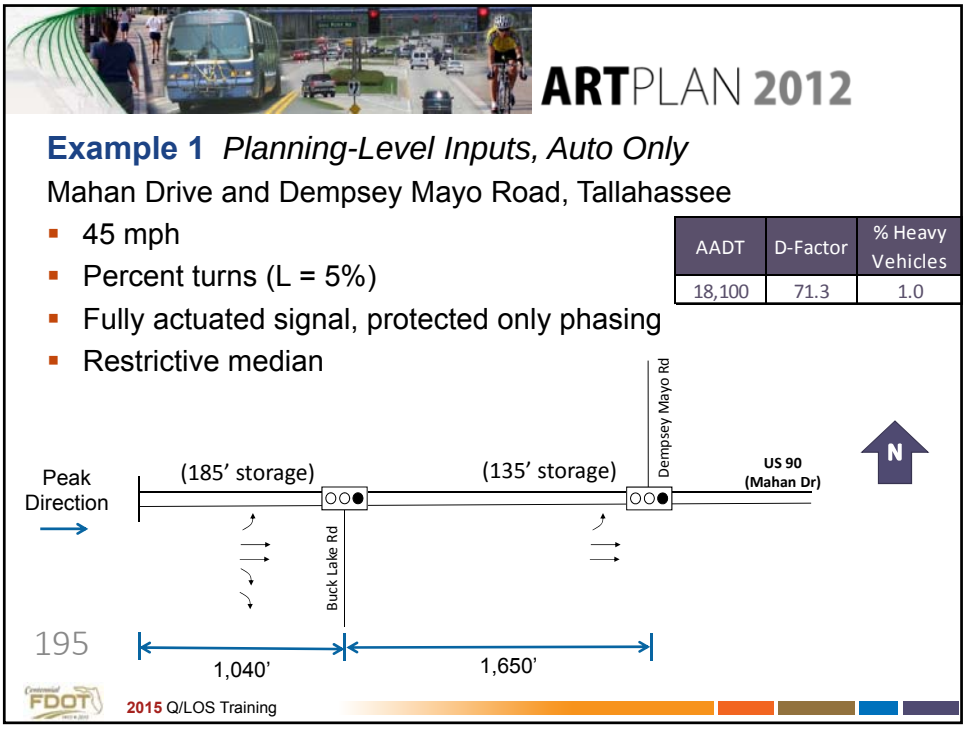
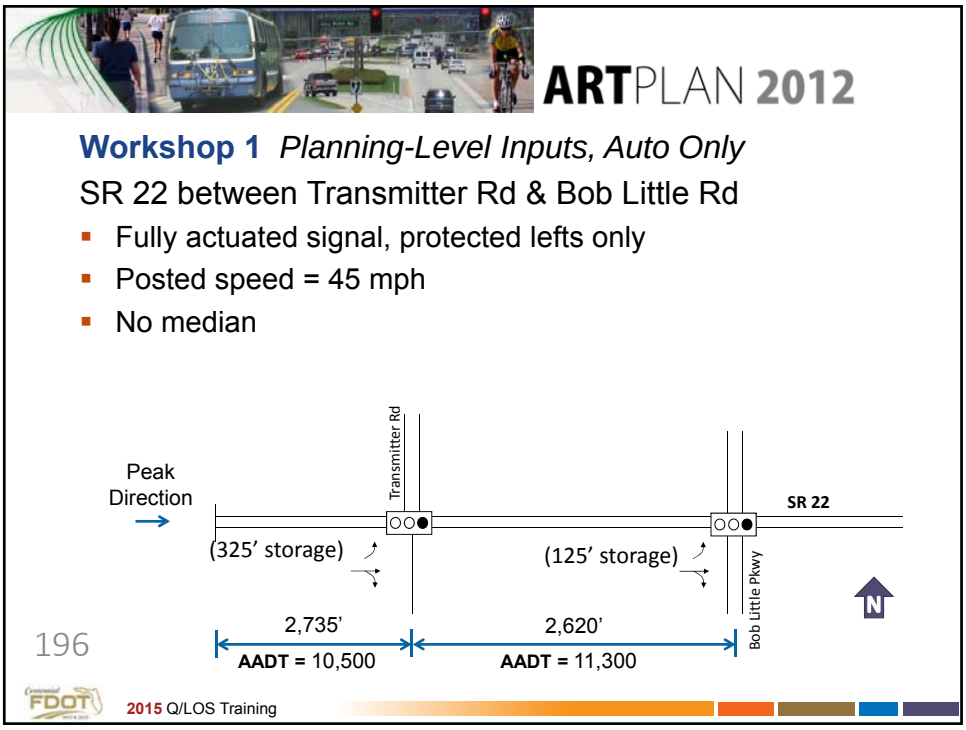

ARTPLAN 2012
Example 1 Planning-Level Inputs, Auto Only
Mahan Drive and Dempsey Mayo Road, Tallahassee
45 mph
Percent turns (L = 5%)
Fully actuated signal, protected only phasing
Restrictive median
AADT
D-Factor
% Heavy Vehicles
18,100
71.3
1.0
Peak Direction
(185' storage)
(135' storage)
Dempsey Mayo Rd
US 90 (Mahan Dr)
N
Buck Lake Rd
191
1,040'
1,650'
2015 Q/LOS Training

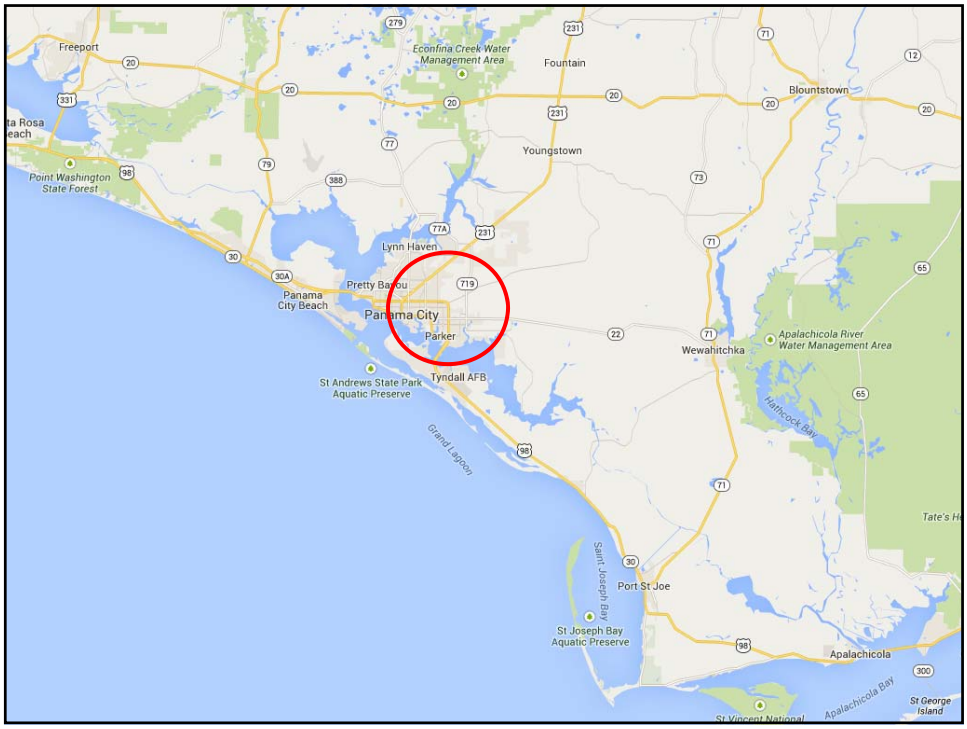

Albany
Douglas
Tifton
Ozark
Andalusia
Opp
Enterprise
Dothan
Moultrie
Waycross
Brunswick
Eldorendo
National Forest
Bainbridge
Cairo
Thomasville
Valdosta
Defuniak Springs
Crestview
Marianna
Okefenokee National Wildlife Refuge
Fernandina Beach
Santa Rosa Beach
Tallahassee
Live Oak
Jacksonville
Panama City
Callaway
Crawfordville
Lake City
Perry
Lakeside
Apalachicola National Forest
Tate's Hell State Forest
Gainesville
Palatka
Big Bend Seagrasses Aquatic Preserve
Ocala National Forest
Ocala

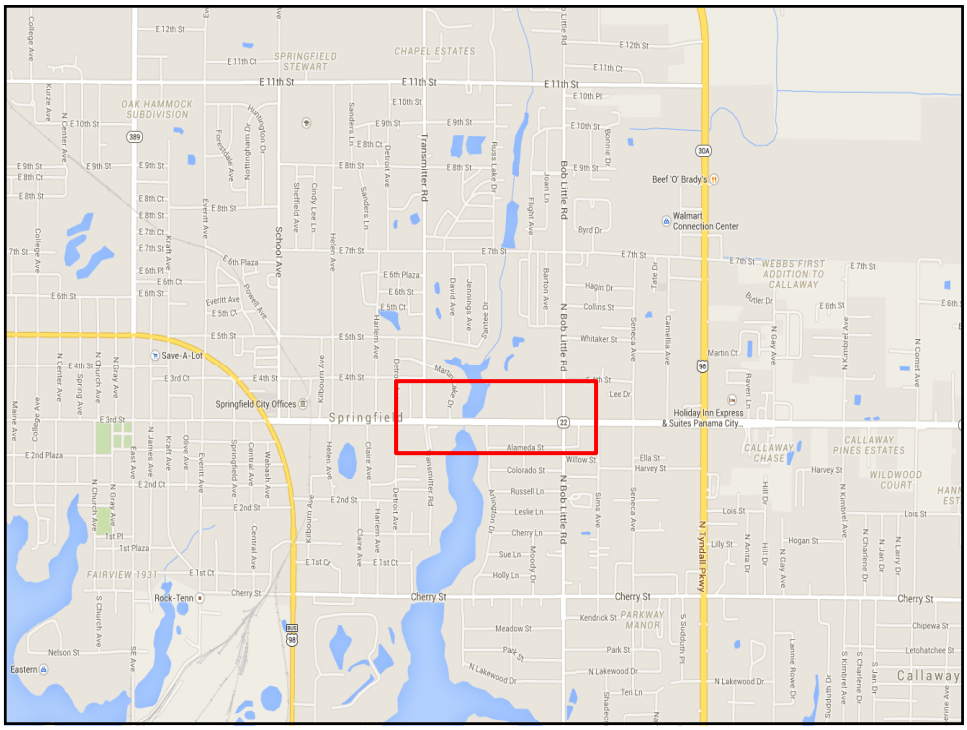

Capital Medical Blvd
Miccosukee Rd
Dempsey Mayo Rd
Lonnie Rd
Mahan Dr
Charlais St
Pedrick Rd
261
146
90
10
158
Buck Lake Rd
Lester Rd
Vernon Rd
Walmart Supercenter
Super-Lube
Eliza Rd
Weems Rd
Capital Cir
Groveland Hills Dr
Tung Hill Dr
Celtic Rd


Street View - May 2013
FL-10
Google

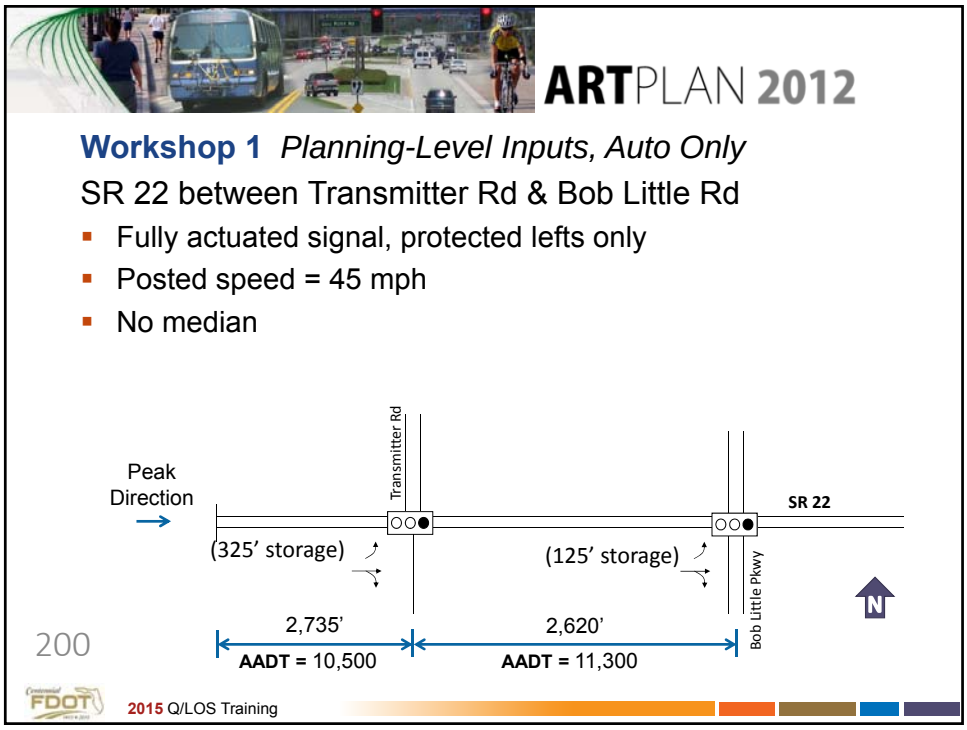

ARTPLAN 2012
Example 1 Planning-Level Inputs, Auto Only
Mahan Drive and Dempsey Mayo Road, Tallahassee
45 mph
Percent turns (L = 5%)
Fully actuated signal, protected only phasing
Restrictive median
AADT
D-Factor
% Heavy Vehicles
18,100
71.3
1.0
Peak Direction
(185' storage)
(135' storage)
Dempsey Mayo Rd
US 90 (Mahan Dr)
N
Buck Lake Rd
195
1,040'
1,650'
2015 Q/LOS Training


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
Peak Direction
Transmitter Rd
SR 22
(325' storage)
(125' storage)
Bob Little Pkwy
N
196
2,735'
2,620'
AADT = 10,500
AADT = 11,300
2015 Q/LOS Training


Freeport
Econfina Creek Water Management Area
Fountain
Blountstown
Youngstown
Point Washington State Forest
Lynn Haven
Pretty Bayou
Panama City Beach
Panama City
Parker
Tyndall AFB
St Andrews State Park Aquatic Preserve
Wewahitchka
Apalachicola River Water Management Area
Grand Lagoon
Port St Joe
St Joseph Bay Aquatic Preserve
Apalachicola
St George Island
Apalachicola Bay


SPRINGFIELD STEWART
CHAPEL ESTATES
OAK HAMMOCK SUBDIVISION
E 11th St
Transmitter Rd
Bob Little Rd
N Bob Little Rd
Beef 'O' Brady's
Walmart Connection Center
WEBBS' FIRST ADDITION TO CALLAWAY
School Ave
Springfield City Offices
Springfield
Holiday Inn Express & Suites Panama City...
CALLAWAY CHASE
CALLAWAY PINES ESTATES
WILDWOOD COURT
FAIRVIEW 1931
Rock-Tenn
Cherry St
N Tyndall Pkwy
PARKWAY MANOR
Callaway
Eastern


Wewa Hwy
Callaway, Florida
Street View - Apr 2011
Walgreens
Google


ARTPLAN 2012
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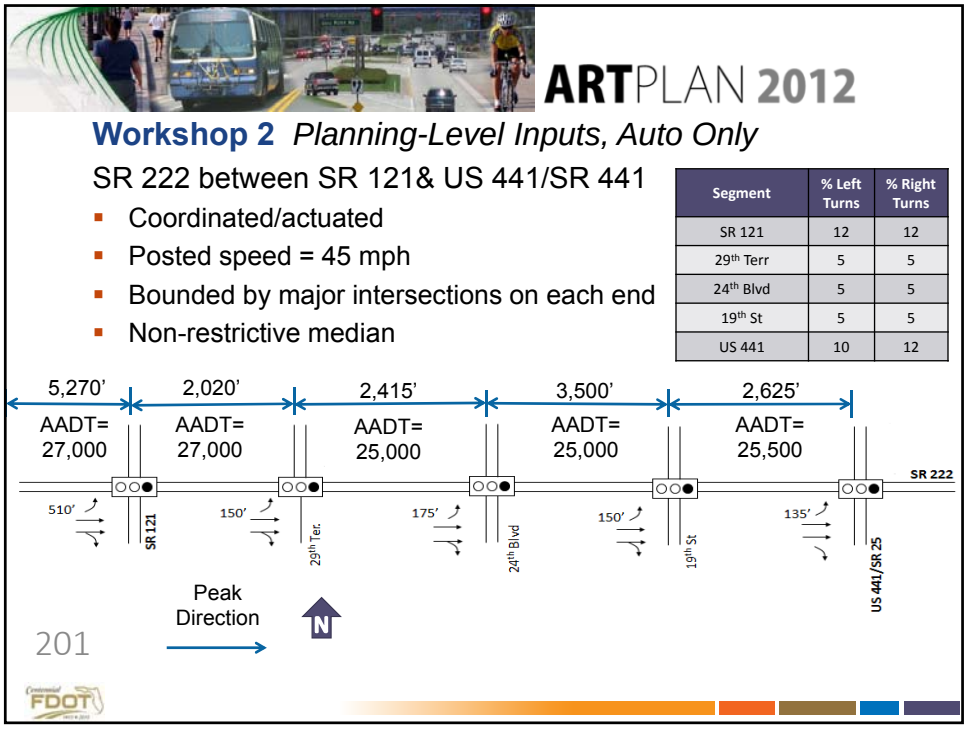
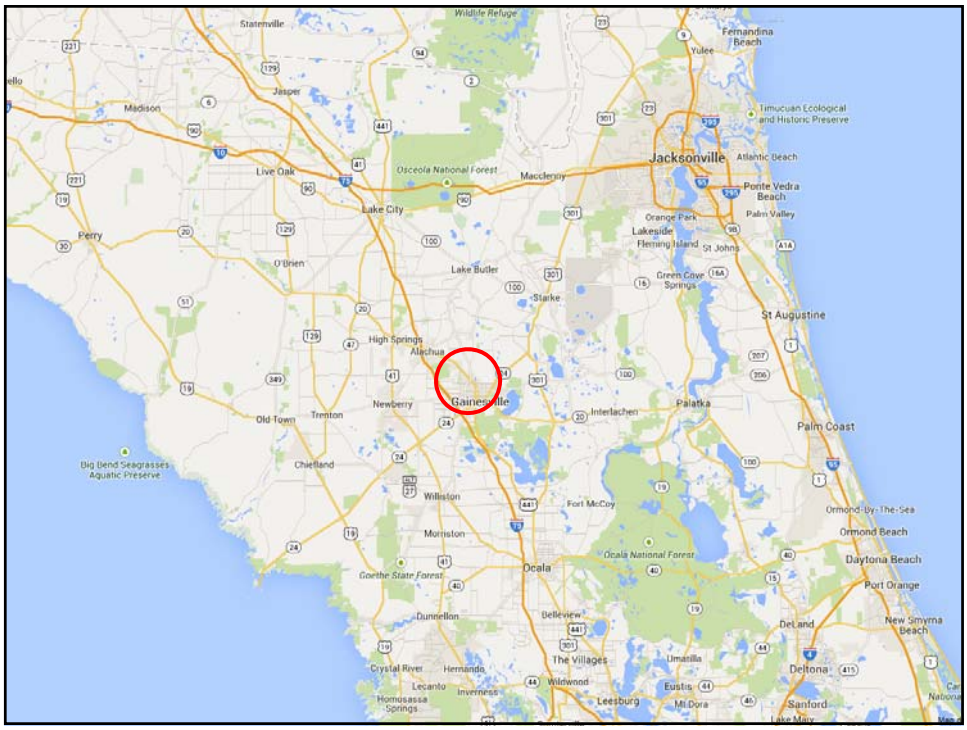
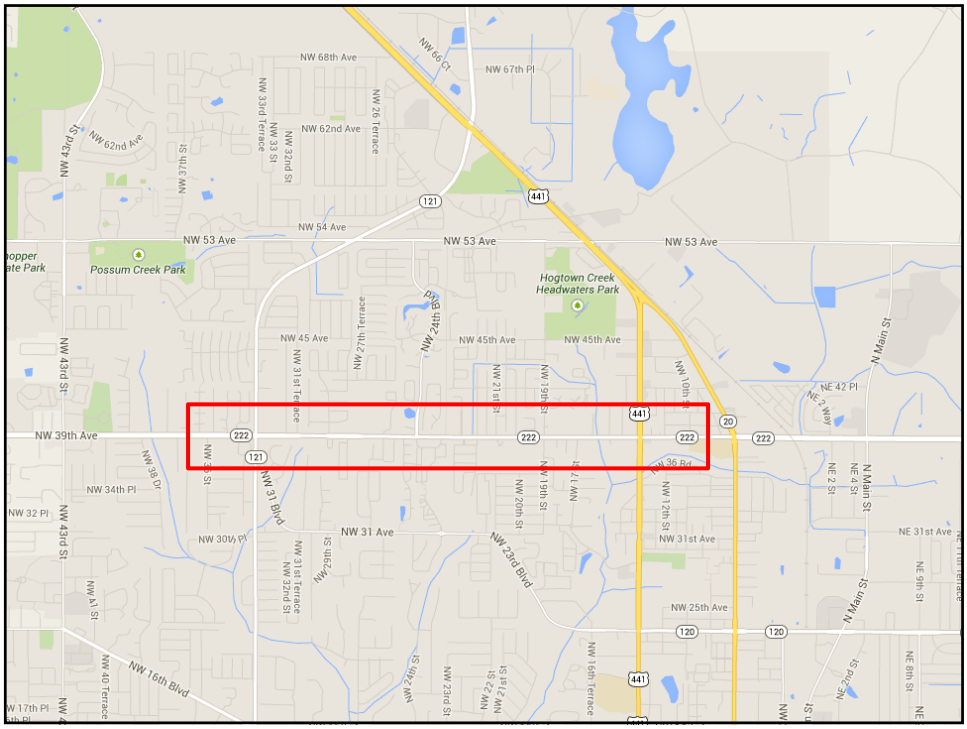
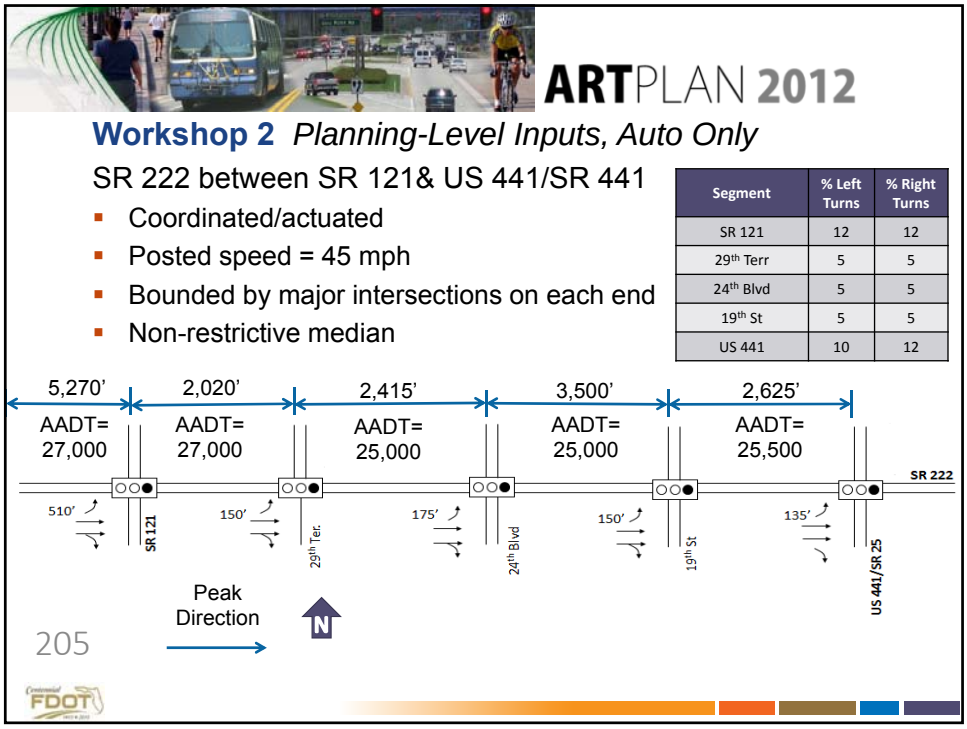
Fully actuated signal, protected lefts only
Posted speed = 45 mph
No median
Peak Direction
Transmitter Rd
SR 22
(325' storage)
(125' storage)
Bob Little Pkwy
N
2,735'
2,620'
AADT = 10,500
AADT = 11,300
200
2015 Q/LOS Training


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
SR 121 | 12 | 12
29th Terr | 5 | 5
24th Blvd | 5 | 5
19th St | 5 | 5
US 441 | 10 | 12
5,270'
2,020'
2,415'
3,500'
2,625'
AADT= 27,000
AADT= 27,000
AADT= 25,000
AADT= 25,000
AADT= 25,500
SR 222
510'
150'
175'
150'
135'
SR 121
29th Ter.
24th Blvd
19th St
US 441/SR 25
Peak Direction
N
201


Jacksonville
Gainesville
Ocala
St Augustine
Palm Coast
Daytona Beach
Lake City
Live Oak
Madison
Perry
Jasper
Starke
Palatka
Williston
Dunnellon
The Villages
Leesburg
Sanford
Deltona
DeLand
Ormond Beach
Port Orange
Chiefland
Trenton
Newberry
High Springs
Alachua
Lake Butler
Osceola National Forest
Ocala National Forest
Goethe State Forest
Big Bend Seagrasses Aquatic Preserve
Fernandina Beach
Yulee
Atlantic Beach
Ponte Vedra Beach
Palm Valley
Orange Park
Lakeside
Fleming Island
St Johns
Green Cove Springs
Interlachen
Fort McCoy
Belleview
Hernando
Crystal River
Inverness
Wildwood
Eustis
Mt Dora
Umatilla
Lake May
New Smyrna Beach
Ormond-by-The-Sea
Timucuan Ecological and Historic Preserve
Wildlife Refuge
Statenville
Macclenny
O'Brien


NW 68th Ave
NW 67th Pl
NW 62nd Ave
NW 54 Ave
NW 53 Ave
Possum Creek Park
Hogtown Creek Headwaters Park
NW 45 Ave
NW 45th Ave
NW 39th Ave
NW 34th Pl
NW 31 Ave
NW 31st Ave
NW 25th Ave
NW 16th Blvd
NW 23rd Blvd
NW 24th Blvd
N Main St
NE 42 Pl
NE 31st Ave
NE 9th St
NE 8th St
441
121
222
20
120


NW 39th Ave
Street View - May 2011
Google


ARTPLAN 2012
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SR 222 between SR 121& US 441/SR 441
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Posted speed = 45 mph
Bounded by major intersections on each end
Non-restrictive median
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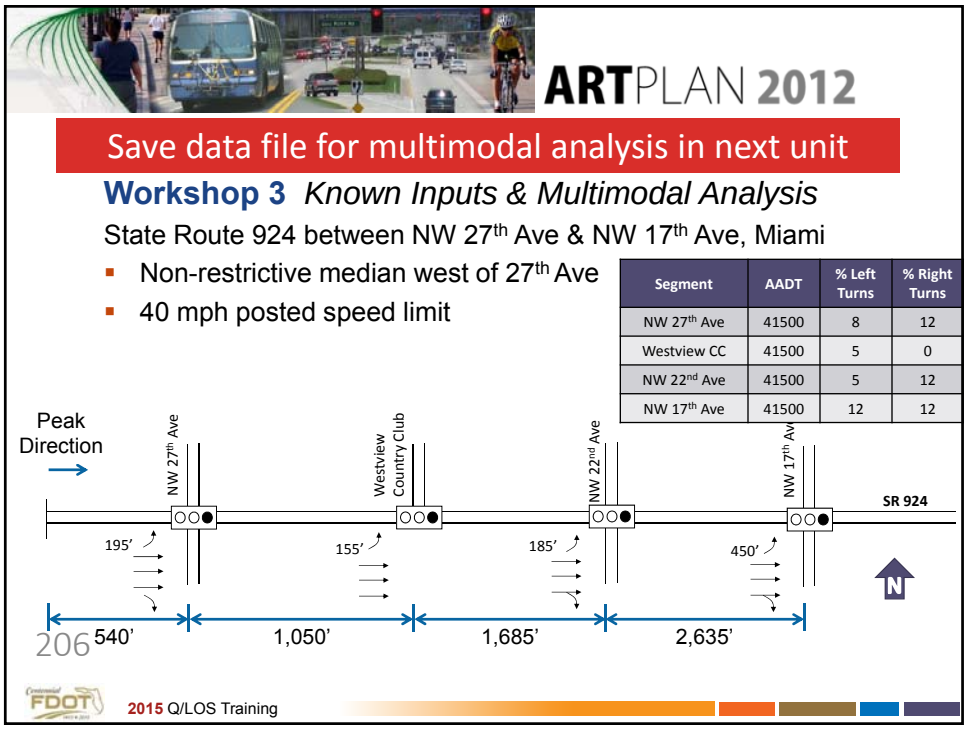
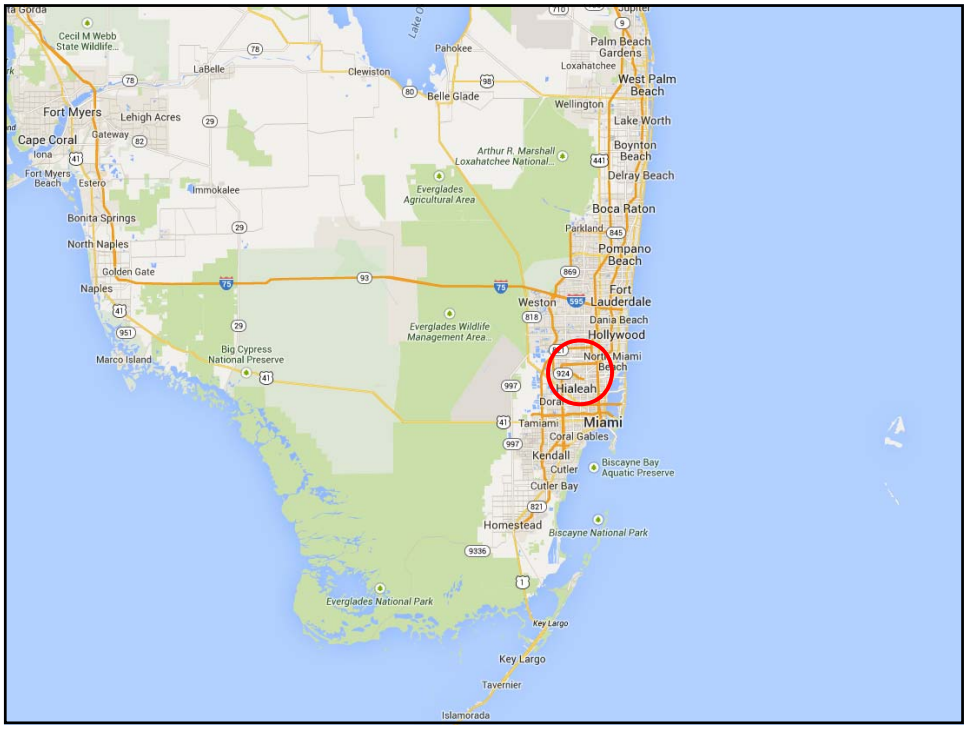
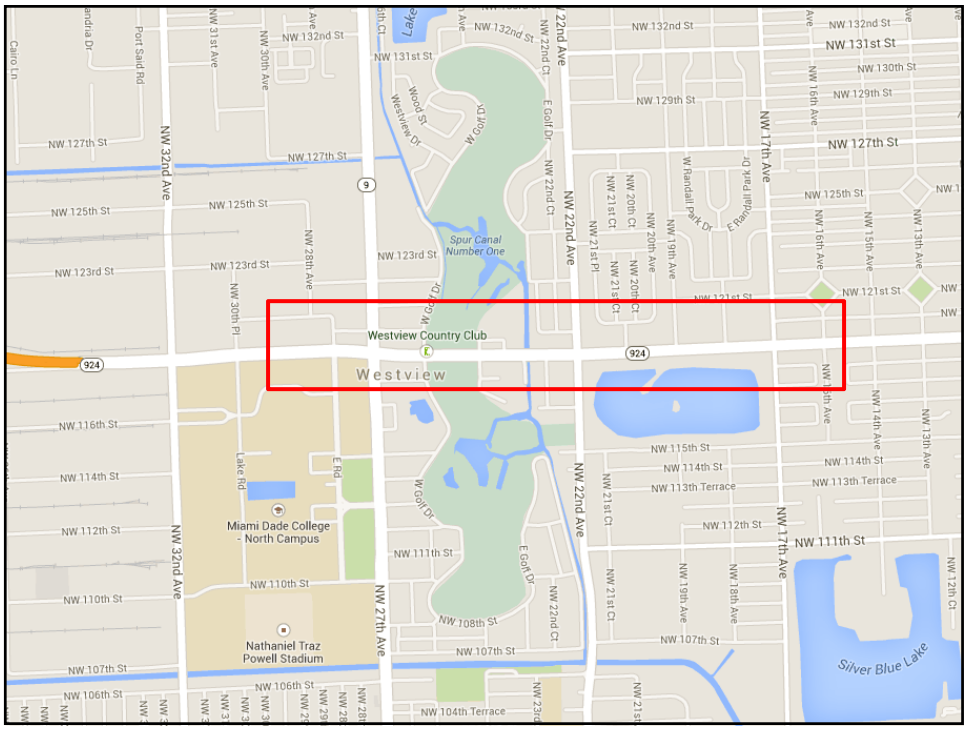
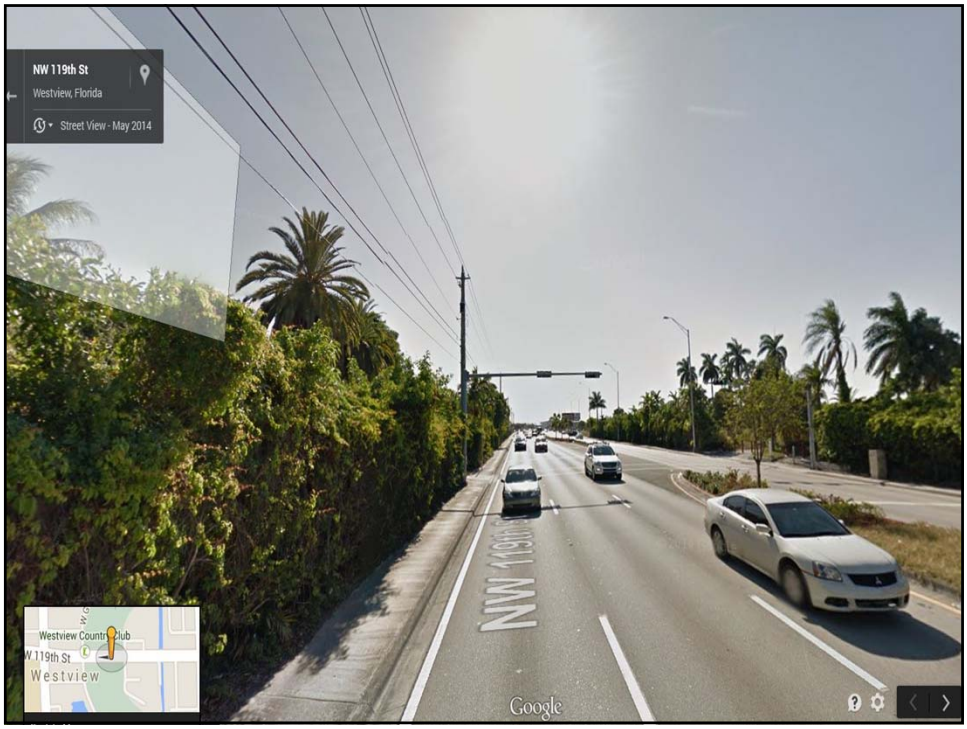
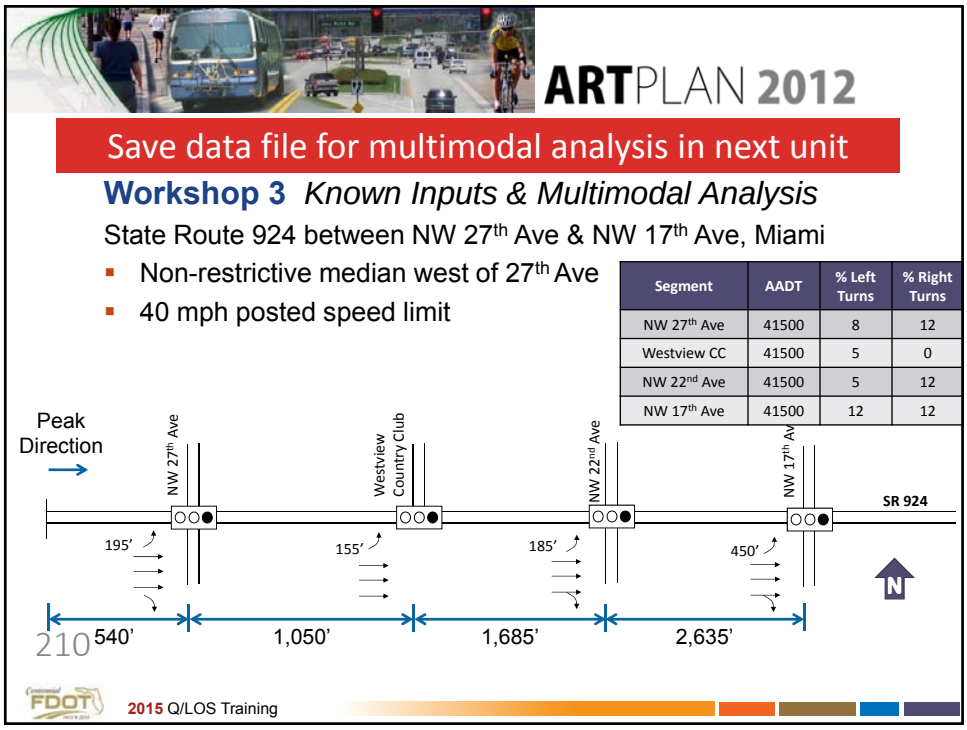
SR 121 | 12 | 12
29th Terr | 5 | 5
24th Blvd | 5 | 5
19th St | 5 | 5
US 441 | 10 | 12
5,270'
2,020'
2,415'
3,500'
2,625'
AADT= 27,000
AADT= 27,000
AADT= 25,000
AADT= 25,000
AADT= 25,500
SR 222
510'
150'
175'
150'
135'
SR 121
29th Ter.
24th Blvd
19th St
US 441/SR 25
Peak Direction
N
205


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
NW 27th Ave | 41500 | 8 | 12
Westview CC | 41500 | 5 | 0
NW 22nd Ave | 41500 | 5 | 12
NW 17th Ave | 41500 | 12 | 12
Peak Direction
NW 27th Ave
Westview Country Club
NW 22nd Ave
NW 17th Ave
SR 924
195'
155'
185'
450'
N
540'
1,050'
1,685'
2,635'
206
2015 Q/LOS Training


Cecil M Webb State Wildlife...
LaBelle
Clewiston
Pahokee
Palm Beach Gardens
Loxahatchee
West Palm Beach
Belle Glade
Wellington
Lake Worth
Fort Myers
Lehigh Acres
Gateway
Cape Coral
Iona
Fort Myers Beach
Estero
Immokalee
Arthur R. Marshall Loxahatchee National...
Boynton Beach
Delray Beach
Everglades Agricultural Area
Boca Raton
Parkland
Bonita Springs
North Naples
Golden Gate
Naples
Pompano Beach
Fort Lauderdale
Weston
Dania Beach
Hollywood
Everglades Wildlife Management Area...
Big Cypress National Preserve
Marco Island
North Miami Beach
Hialeah
Miami
Tamiami
Coral Gables
Kendall
Cutler
Biscayne Bay Aquatic Preserve
Cutler Bay
Homestead
Biscayne National Park
Everglades National Park
Key Largo
Tavernier
Islamorada


NW 132nd St
NW 131st St
NW 130th St
NW 129th St
NW 127th St
NW 125th St
NW 123rd St
NW 121st St
NW 116th St
NW 115th St
NW 114th St
NW 113th Terrace
NW 112th St
NW 111th St
NW 110th St
NW 108th St
NW 107th St
NW 106th St
NW 104th Terrace
NW 32nd Ave
NW 30th Ave
NW 28th Ave
NW 27th Ave
NW 22nd Ave
NW 22nd Ct
NW 21st Ct
NW 21st Pl
NW 20th Ave
NW 20th Ct
NW 19th Ave
NW 18th Ave
NW 17th Ave
NW 16th Ave
NW 15th Ave
NW 14th Ave
NW 13th Ave
NW 12th Ct
Port Said Rd
Wood St
Westview Dr
W Golf Dr
E Golf Dr
W Randall Park Dr
E Randall Park Dr
Spur Canal Number One
Westview Country Club
Westview
Lake Rd
E Rd
Miami Dade College - North Campus
Nathaniel Traz Powell Stadium
Silver Blue Lake
924
9


NW 119th St
Westview, Florida
Street View - May 2014
Westview Country Club
W 119th St
Westview
Google


ARTPLAN 2012
Save data file for multimodal analysis in next unit
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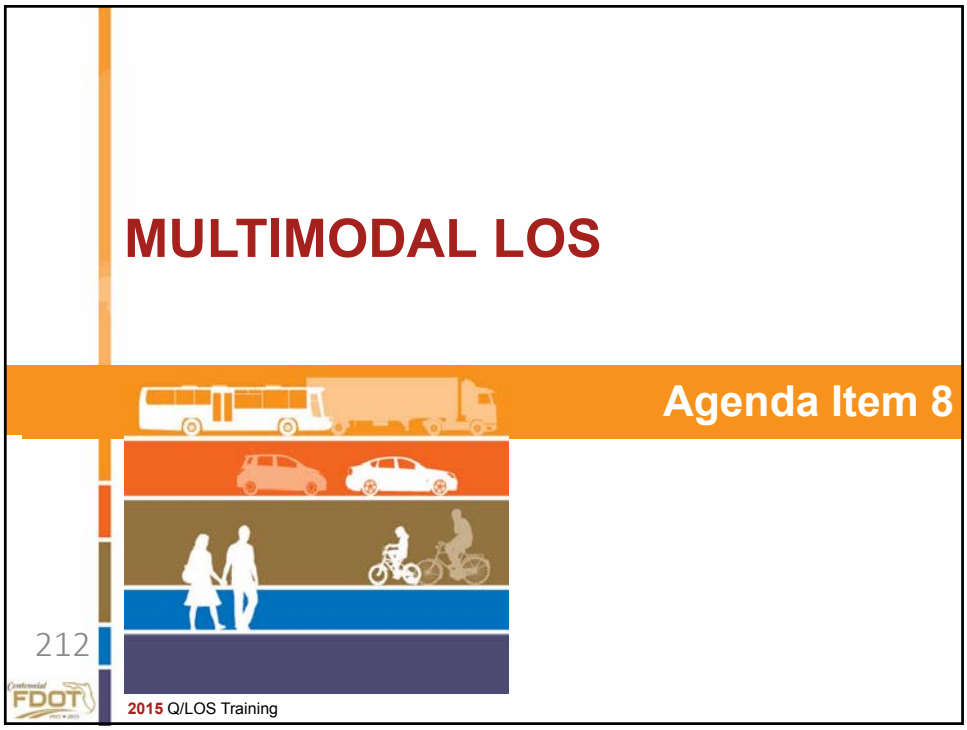
State Route 924 between NW 27th Ave & NW 17th Ave, Miami
Non-restrictive median west of 27th Ave
40 mph posted speed limit
Segment | AADT | % Left Turns | % Right Turns
NW 27th Ave | 41500 | 8 | 12
Westview CC | 41500 | 5 | 0
NW 22nd Ave | 41500 | 5 | 12
NW 17th Ave | 41500 | 12 | 12
Peak Direction
NW 27th Ave
Westview Country Club
NW 22nd Ave
NW 17th Ave
SR 924
195'
155'
185'
450'
N
210
540'
1,050'
1,685'
2,635'
2015 Q/LOS Training


QUESTIONS?
211
2015 Q/LOS Training


MULTIMODAL LOS
Agenda Item 8
212
2015 Q/LOS Training

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

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2015 Q/LOS Training

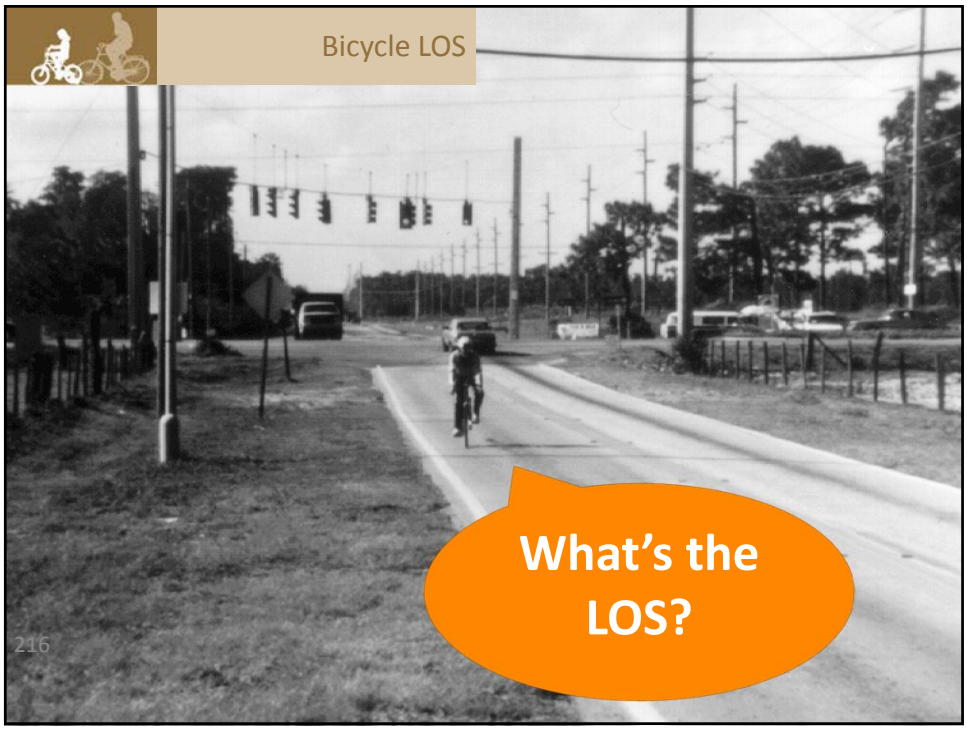
Mode	Automobile	Bicycle	Pedestrian	Bus
Major Inputs	Volume and Lanes	Bicycle Lane	Sidewalk	Bus Frequency
	Volume and Lanes			
	Other Traffic and Roadway Characteristics			
	Arterial Running Speed			
	Arterial Running Time		Sidewalk	
	Control Characteristics			
	Control Delay			
Service Measure	Average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

139

Bicycle/Pedestrian/Bus Level of Service Analyses

215

Bicycle LOS

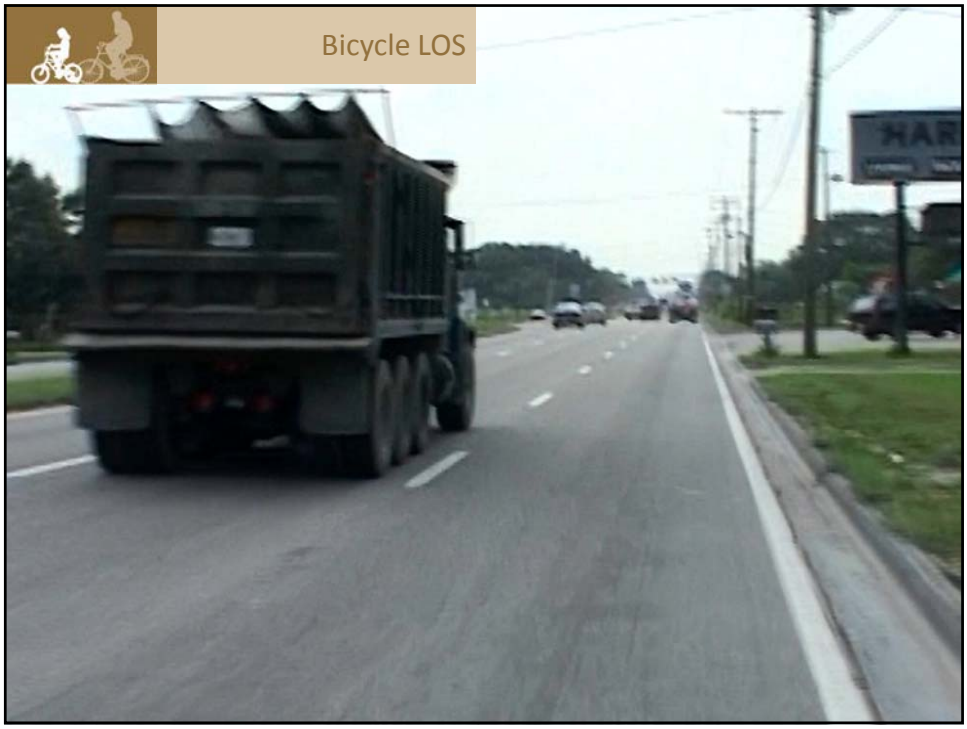


216


Bicycle LOS
217

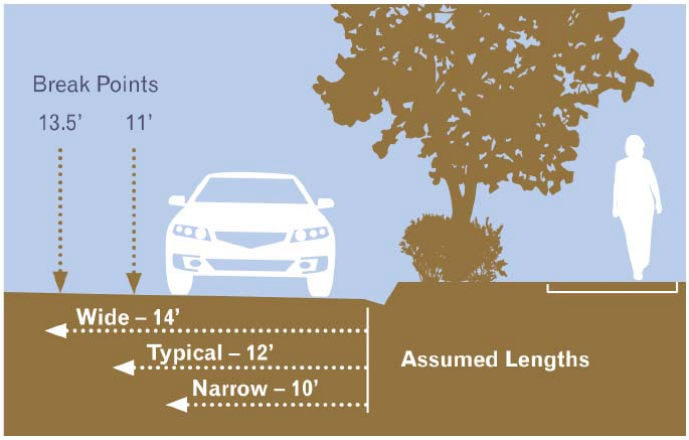

Bicycle LOS
218

Bicycle LOS



Bicycle Mode Variables

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



220

2015 Q/LOS Training

Bicycle Mode Variables

- **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

221

Dan Burden PBIC

Bicycle Mode Variables

- **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

222

Bicycle Mode Variables

- **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

224

2015 Q/LOS Training

Bicycle LOS Model

- 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

225

2015 Q/LOS Training

Bicycle LOS Model

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 Model

$$BLOS = 0.507\ ln(Vol_{15}/L) + 0.199SP_t\ (1 + 10.38HV)^2 + 7.066(1/PR_5)^2 - 0.005(W_e)^2 + 0.760$$

Where:

BLOS	=	Bicycle level of service score
ln	=	Natural log
Vol_{15}	=	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(SPp - 20) + 0.8103
SP_p	=	Posted speed limit (a surrogate for average running speed)
HV	=	Percentage of heavy vehicles
PR_5	=	FHWA's five point pavement surface condition rating
W_e	=	Average effective width of outside thru lane

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2015 Q/LOS Training

Bicycle LOS Model

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 27

Bicycle LOS Model

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

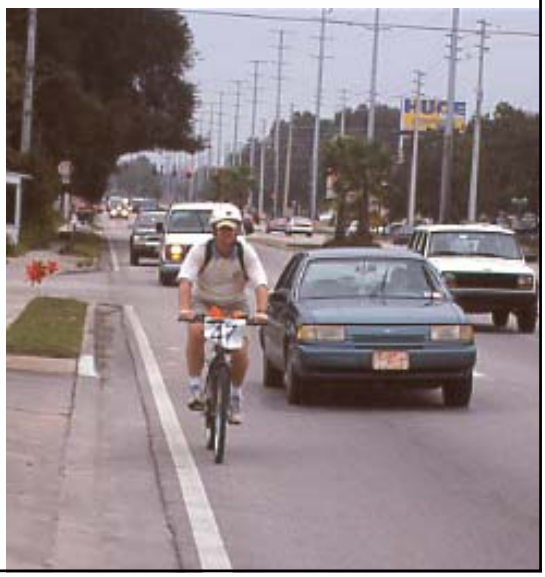
Bicycle LOS Model

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

Bicycle LOS Model

Outside Lane Width

12 Feet – (Typical)



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2015 Q/LOS Training

Bicycle LOS Model

Pavement Condition

Desirable

Typical

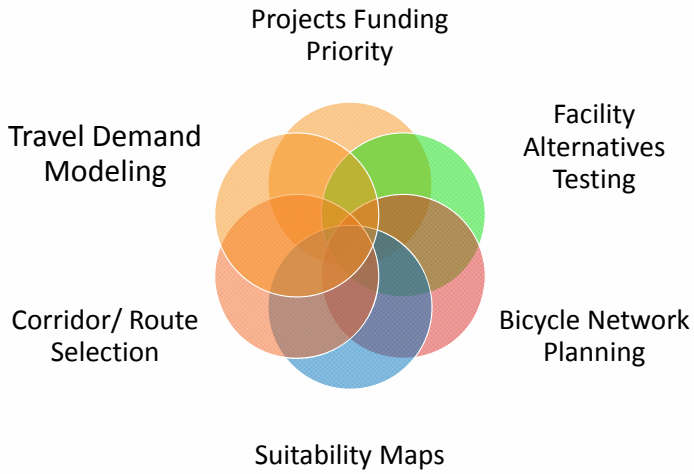
Undesirable

232

2015 Q/LOS Training

Bicycle LOS Model

Potential Applications of Bicycle LOS



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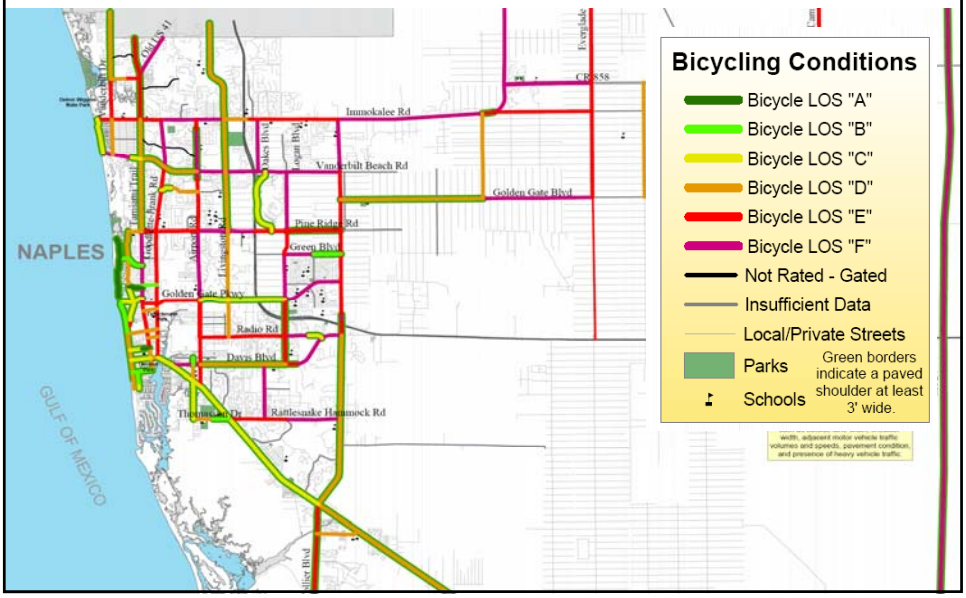
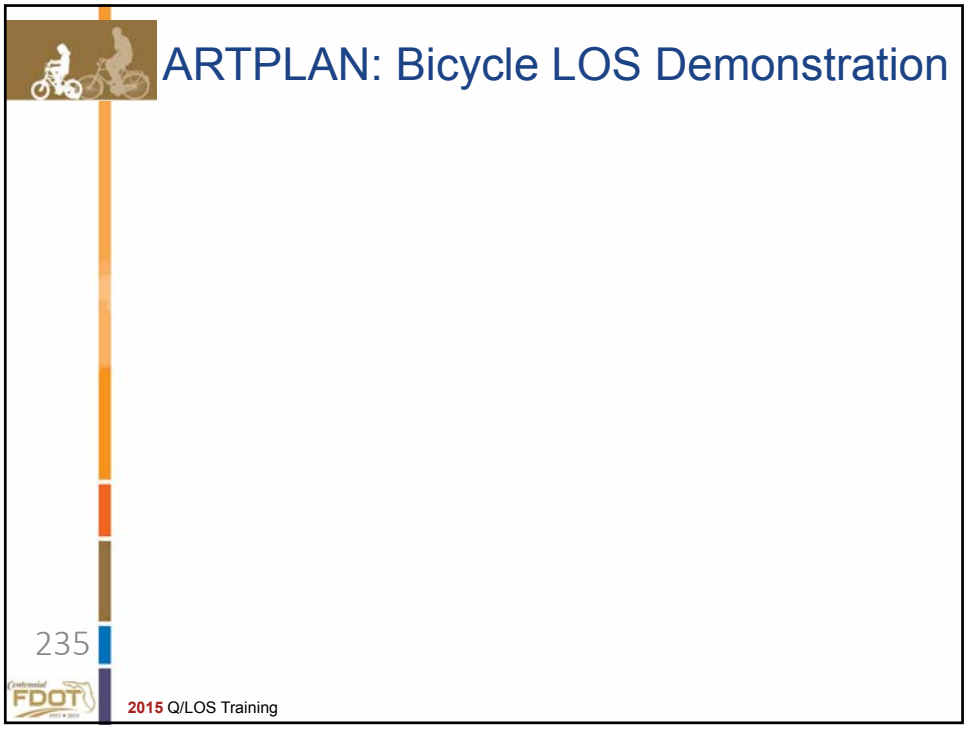
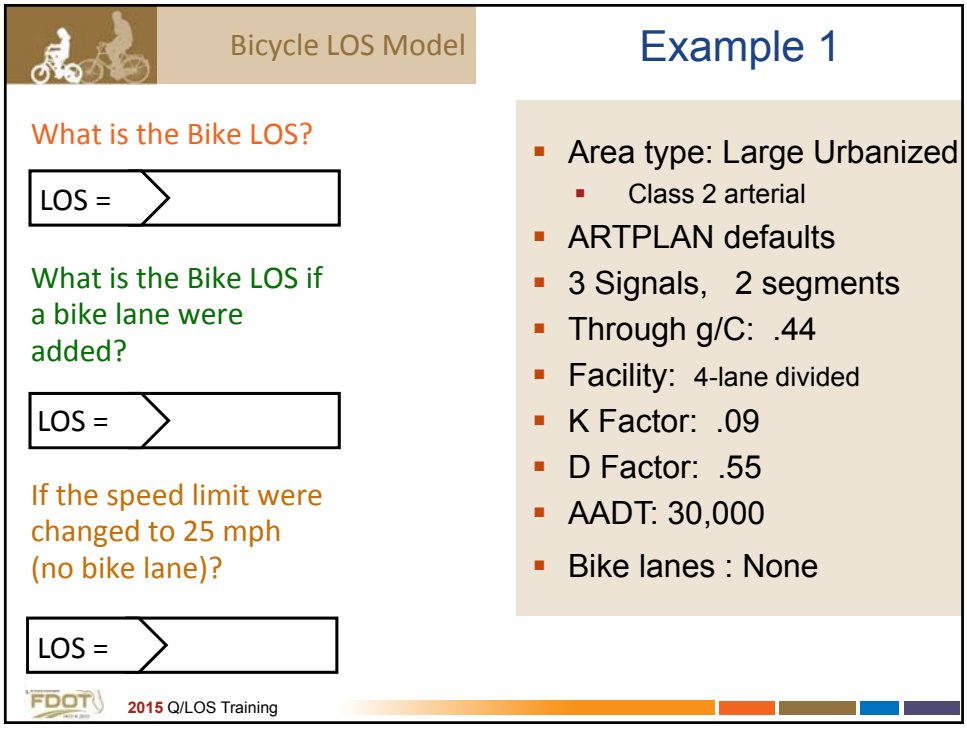
2015 Q/LOS Training

Bicycle LOS Categories

City of Naples




ARTPLAN: Bicycle LOS Demonstration
235
2015 Q/LOS Training


Bicycle LOS Model
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
2015 Q/LOS Training

Pedestrian QOS

237

Pedestrian QOS

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 QOS

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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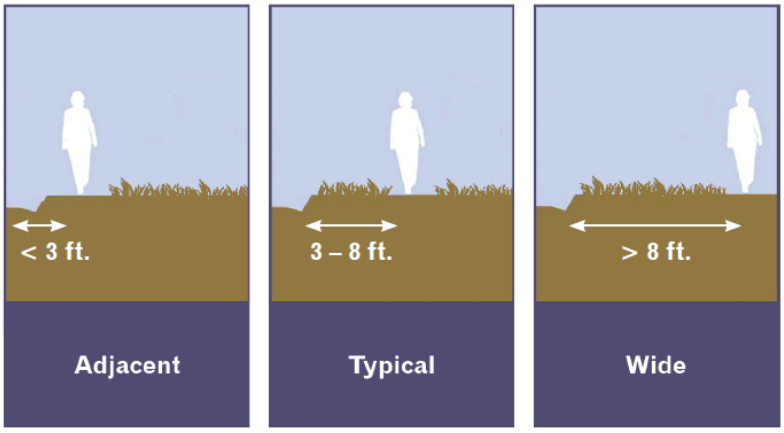
2015 Q/LOS Training

Pedestrian QOS

Input Variables

- **Sidewalk/Roadway Separation** - lateral distance in feet from the outside edge of pavement to the inside edge of the sidewalk



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2015 Q/LOS Training

Pedestrian LOS Model

- Model developed in 2000 from FDOT sponsored research in Pensacola

A/B

C/D

E/F

241

2015 Q/LOS Training 28

Pedestrian LOS Model

$$PLOS = -1.2276\, ln\left(W_{ol} + W_l + f_p \times \%OSP + f_b \times W_b + f_{sw} \times W_s\right) + 0.0091(Vol_{15}/L) + 0.0004SPD^2 + 6.0468$$

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)
fs_w	=	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)

242

2015 Q/LOS Training

Pedestrian LOS Model

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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2015 Q/LOS Training 27

Pedestrian LOS Model

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

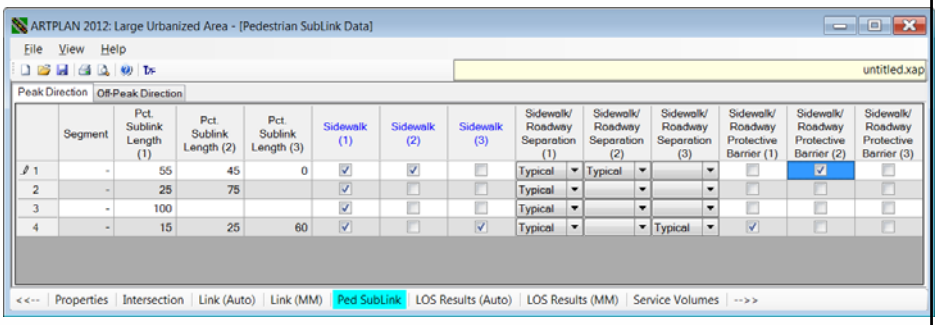
Pedestrian LOS is an integrated module in ARTPLAN

244

2015 Q/LOS Training

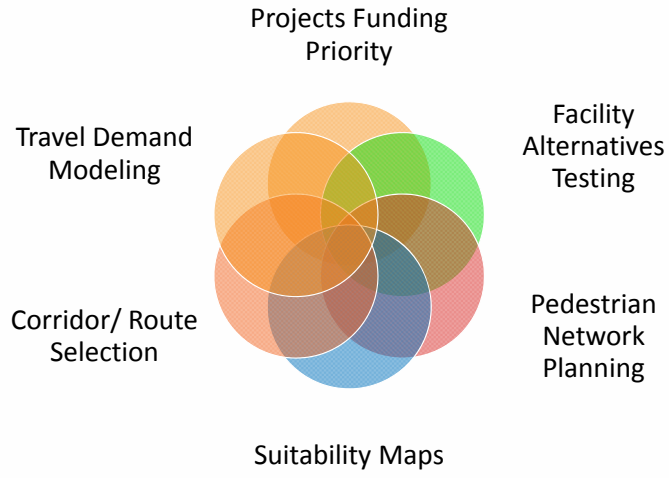
Pedestrian LOS Model

- Allows for coding changes in sidewalks along a segment

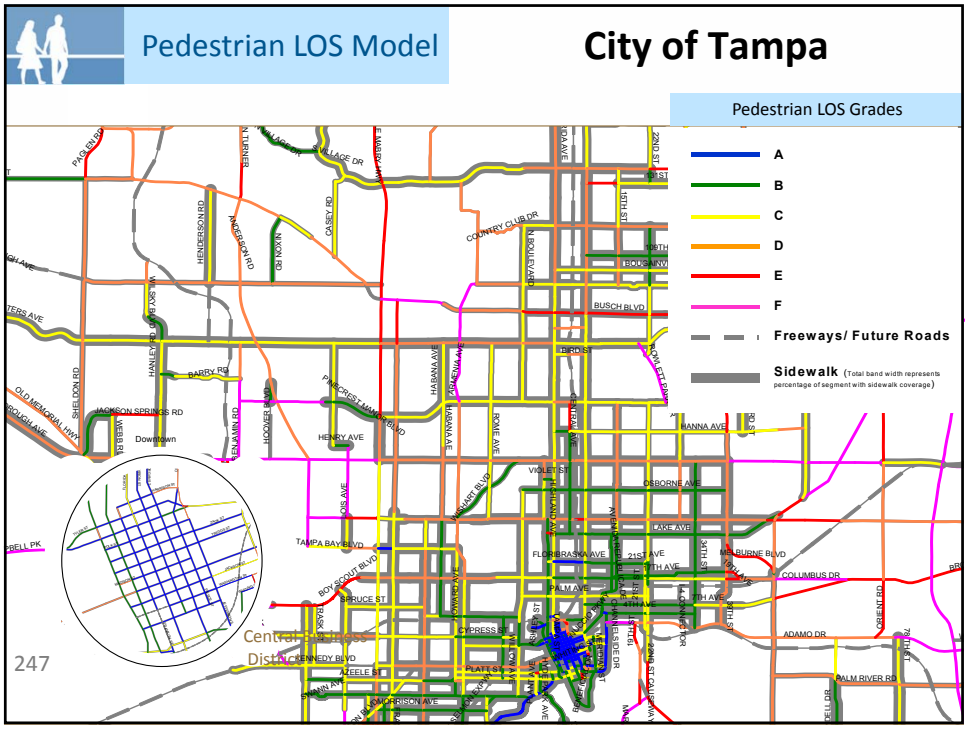


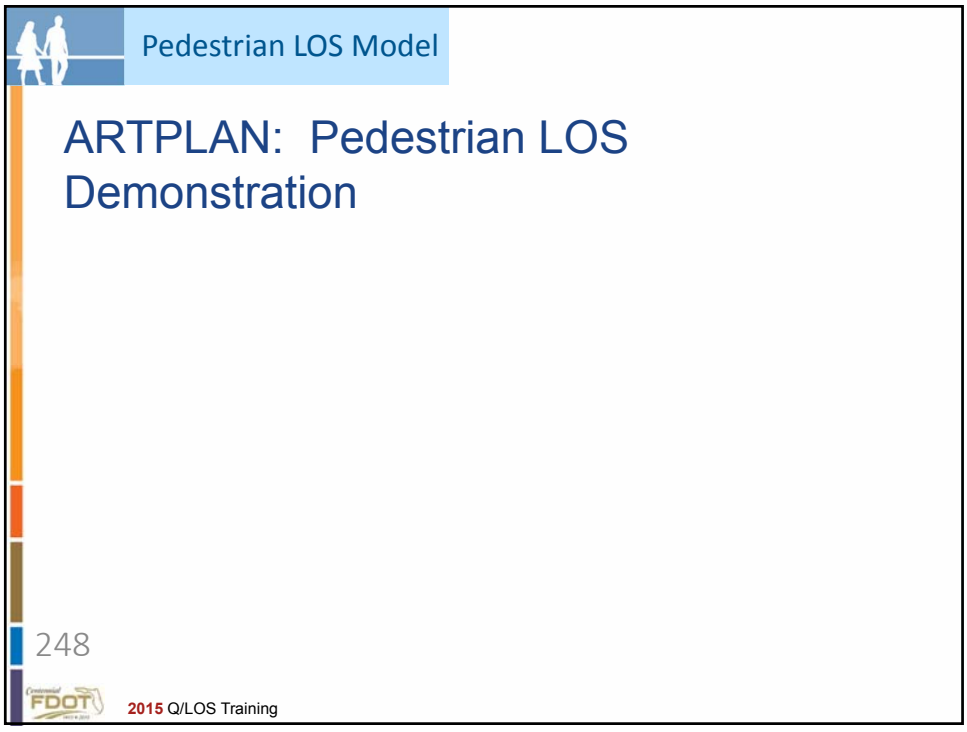
245

Pedestrian LOS Model — Potential Applications



246


Pedestrian LOS Model
City of Tampa
Pedestrian LOS Grades
A
B
C
D
E
F
Freeways/ Future Roads
Sidewalk (Total band width represents percentage of segment with sidewalk coverage)
Downtown
Central Business District
247


Pedestrian LOS Model
ARTPLAN: Pedestrian LOS Demonstration
248
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Pedestrian LOS Model

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.

- 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

249

Agenda – Day Two

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

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ARTPLAN – Bus Analysis

Agenda Item 10

251

Bus LOS

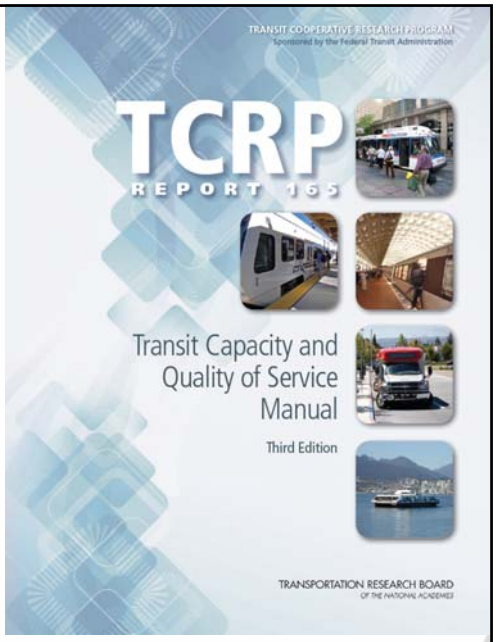
A/B

C/D

E/F

252

Bus LOS



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Bus LOS

Key Factors Affecting Transit QOS

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

110

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)

Bus LOS is an integrated module in ARTPLAN

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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

256

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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

257

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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

258

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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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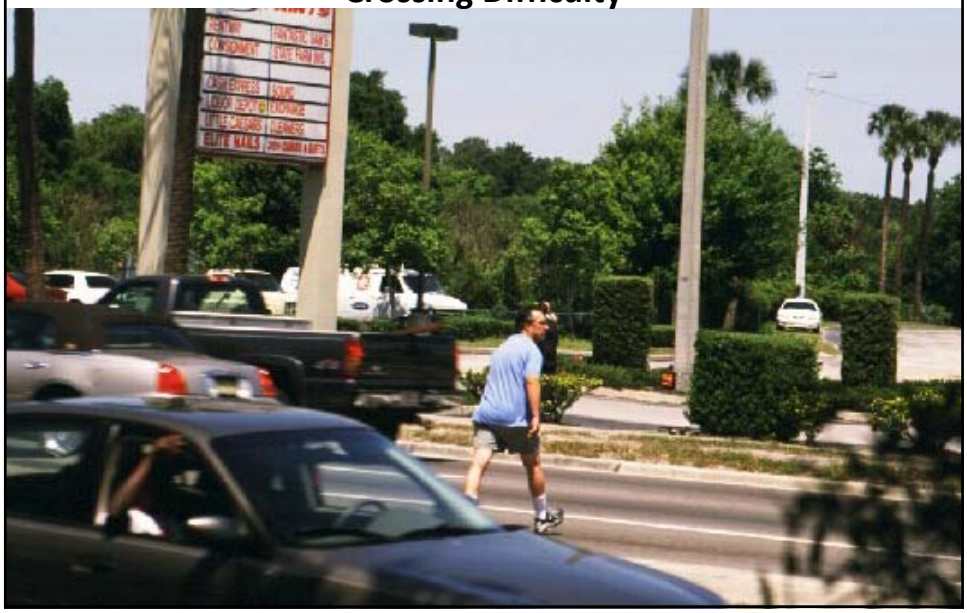
Bus LOS

Bus Frequency Adjustments

Crossing Difficulty



Bus LOS

Bus Frequency Adjustments

Bus Frequency Adjustments (Crossing Difficulty)

Conditions that must be met:				Crossing Adjustment Factor
Arterial Class	Median	Number of Mid-Block Thru lanes	Automobile LOS	
I	All situations	2	A or B	1.05
II	All situations	2	A, B or C	
III	All situations	<=4	A or B	
IV	All situations	<=4	All levels of service	
I	None or Nonrestrictive	>=4	B, C, D, E or F	0.80
	Restrictive	>=8	All levels of service	
II	None or Nonrestrictive	>=4	C, D, E or F	
	Restrictive	>=8	All levels of service	
III	None or Nonrestrictive	>=4	D, E, or F	
	Restrictive	>=8	All levels of service	
All cases not included in conditions for factor 1.05 and 0.80 =				1.00

261

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

LOS =

What is Bus LOS?

262

Bus LOS

Workshop 1.A

With inputs from Bus 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
LOS =	Easy	First	3	Yes	50%	Excellent
LOS =	First	Second	2	Yes	60%	Excellent
LOS =	Second	Third	2	No	60%	Excellent
LOS =	Third	Mulberry	1	No	75%	Excellent

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Bus LOS

Workshop 1.B

With inputs from Bus Problem #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
LOS =	Easy	First	2	Yes	110%	Excellent
LOS =	First	Second	2	Yes	80%	Excellent
LOS =	Second	Third	2	No	80%	Excellent
LOS =	Third	Mulberry	2	No	110%	Excellent

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Bus LOS

Workshop 1.C

With inputs from Bus Problem #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
LOS =	Easy	First	3	Yes	50%	Excellent
LOS =	First	Second	2	Yes	60%	Good
LOS =	Second	Third	2	No	60%	Fair
LOS =	Third	Mulberry	1	No	75%	Poor

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Bus LOS

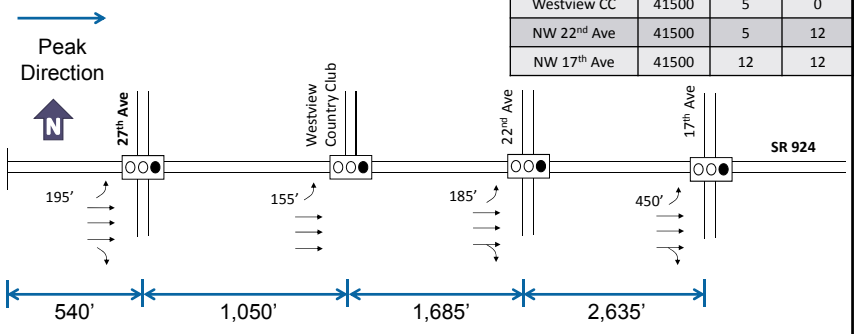
Use data file saved from Workshop 3 in ARTPLAN unit for the following Bus Workshop 4

Bus Workshop 4 *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	AADT	% Left Turns	% Right Turns
NW 27th Ave	41500	8	12
Westview CC	41500	5	0
NW 22nd Ave	41500	5	12
NW 17th Ave	41500	12	12



266

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Bus LOS

Use data file saved from Workshop 3 in ARTPLAN unit for the following Bus Workshop 4

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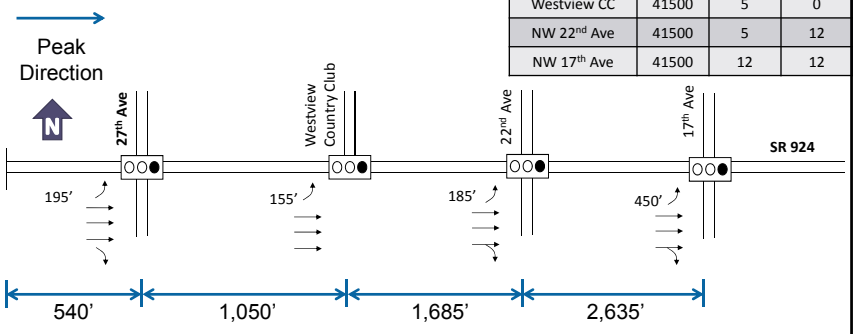

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Monroe Street data collection

Agenda 11

270

2015 Q/LOS Training

Table Workshop

North Monroe

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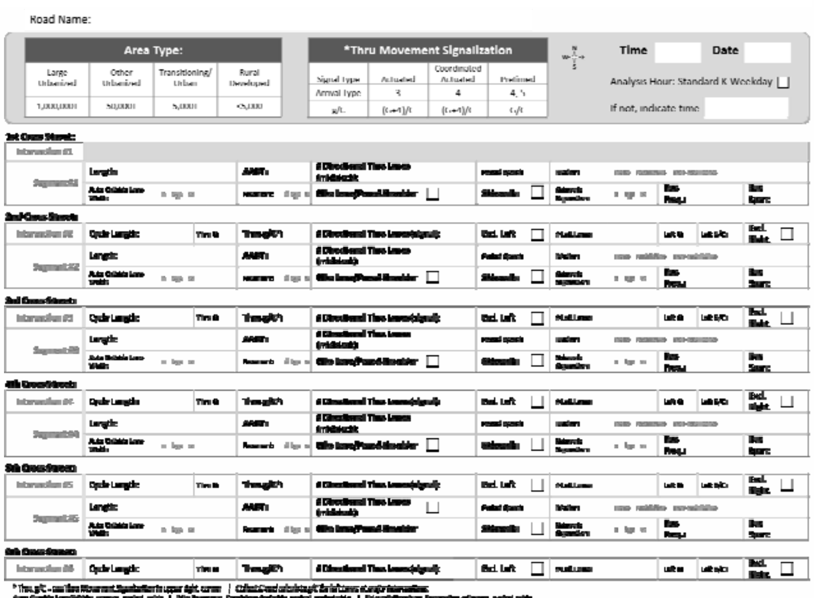
2015 Q/LOS Training

Data Collection Sheet


Road Name:

Area Type:

Large Urbanized	Other Urbanized	Transitioning/ Urban	Rural Developed
1,000,000	50,000	5,000	<5,000

*Thru Movement Signalization

Time

Date

Analysis Hour: Standard K Weekday

If not, indicate time

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Monroe Street ARTPLAN ANALYSIS

AGENDA ITEM 12

Freeway Capacity and LOS Analysis

AGENDA ITEM 13

- 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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When to use other tools

- When conducting operational or design level analysis

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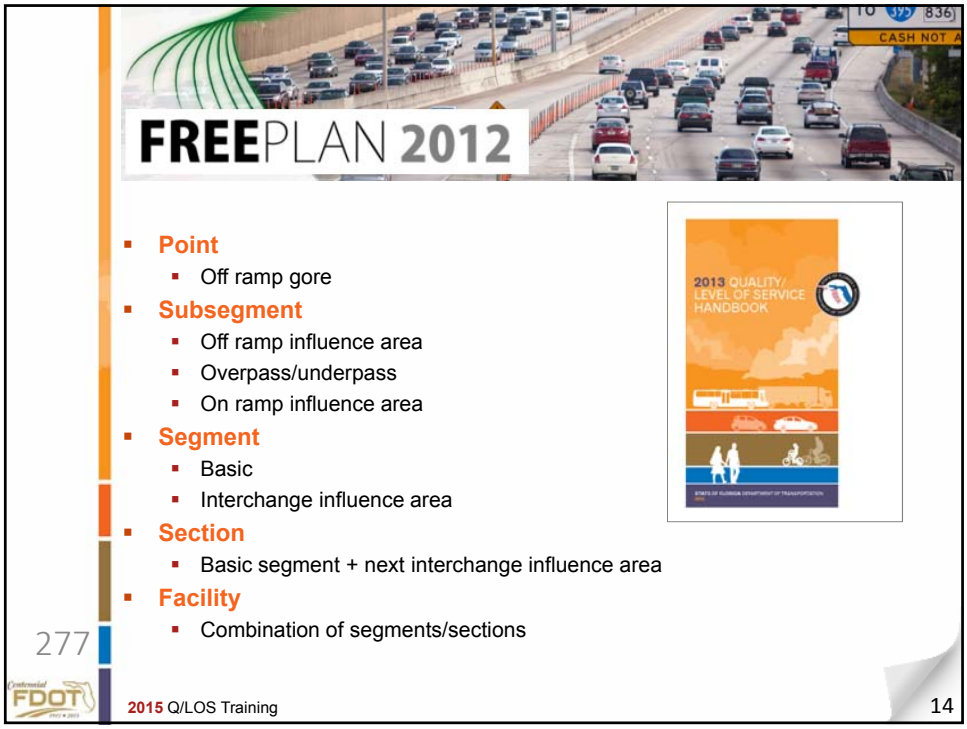
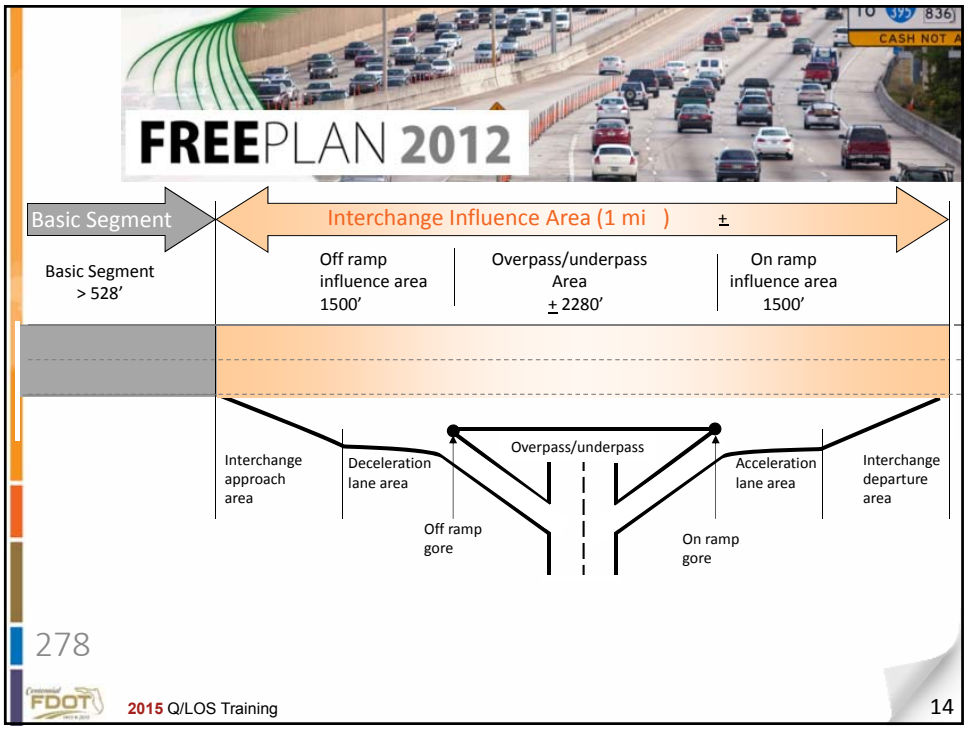

FREEPLAN 2012
2013 QUALITY/ LEVEL OF SERVICE HANDBOOK
Point
Off ramp gore
Subsegment
Off ramp influence area
Overpass/underpass
On ramp influence area
Segment
Basic
Interchange influence area
Section
Basic segment + next interchange influence area
Facility
Combination of segments/sections
277
2015 Q/LOS Training
14


FREEPLAN 2012
Basic Segment
Interchange Influence Area (1 mi) ±
Basic Segment > 528'
Off ramp influence area 1500'
Overpass/underpass Area ± 2280'
On ramp influence area 1500'
Interchange approach area
Deceleration lane area
Off ramp gore
Overpass/underpass
On ramp gore
Acceleration lane area
Interchange departure area
278
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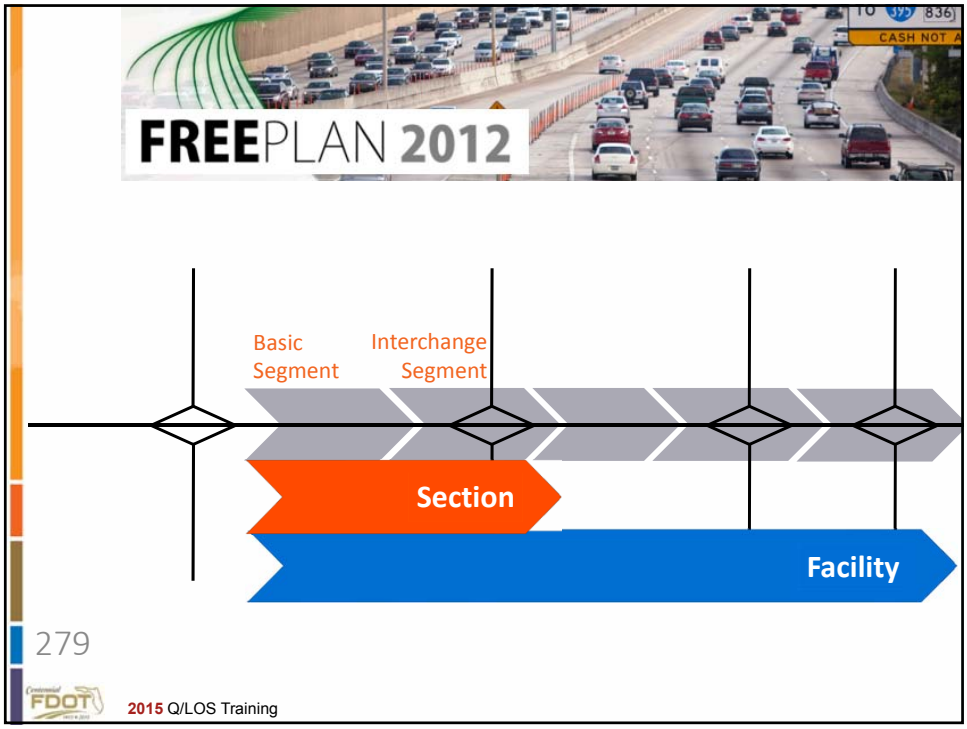
14


FREEPLAN 2012
Basic Segment
Interchange Segment
Section
Facility
279
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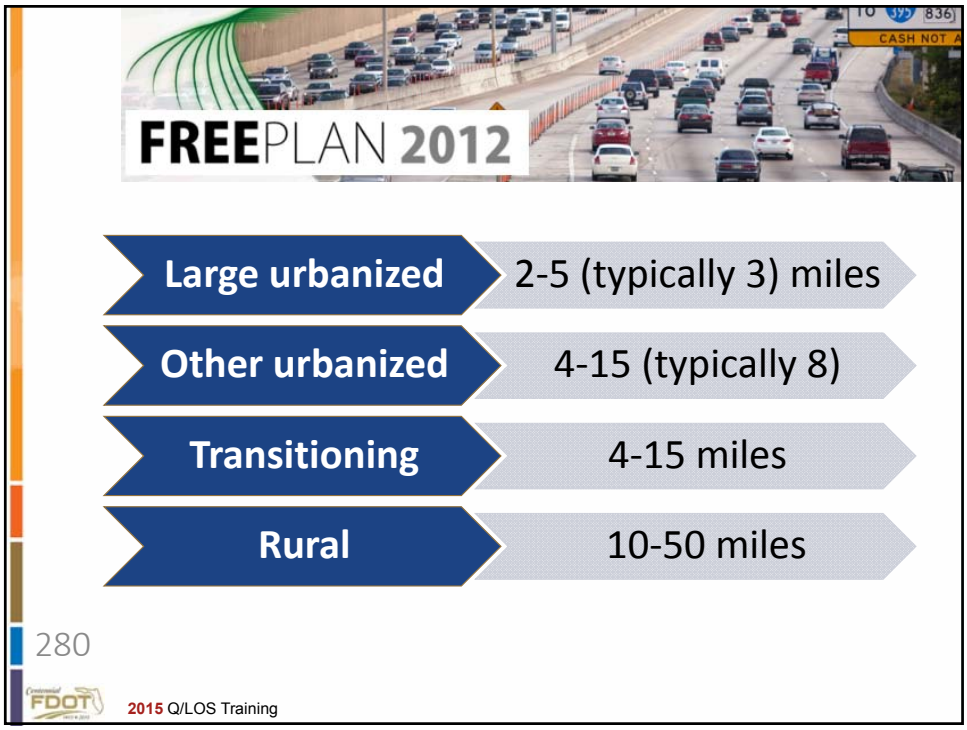
FREEPLAN 2012
Large urbanized
2-5 (typically 3) miles
Other urbanized
4-15 (typically 8)
Transitioning
4-15 miles
Rural
10-50 miles
280
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Freeway Level of Service Analysis

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Developed for planning applications	Directly applicable to Florida
• Calculates LOS for design concept and scope • Determines maximum service volumes • Identifies "hot spots"	• Matches well with Florida freeway capacities • Warnings if values are out of line

HCM Based

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

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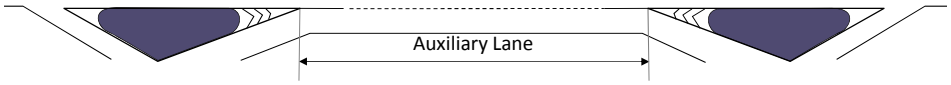


Auxiliary Lane

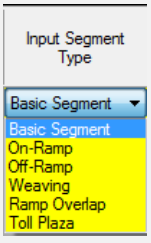
284

1. **Provide facility characteristics** → Roadway → Traffic → Especially key input variables
2. **Provide segment characteristics** → Segment types → Ramp traffic / information (if desired) → Ramp capacity check (if desired)
3. **Compute LOS** → Analyze "hot spots" (if desired)
4. **Compute service volume table**

285

Segment Types

1. Basic
2. On-Ramp
3. Off-Ramp
4. Ramp Overlap
5. Weaving
6. Toll Plaza



Segment Length

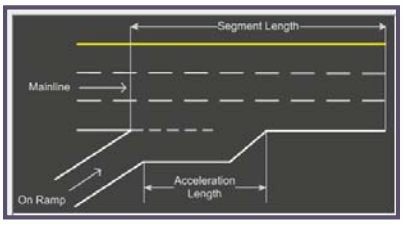
Default Segments	Length (in feet)
Basic Segment	5280
On-Ramp Segment	1500
Off-Ramp Segment	1500
Ramp Overlap Segment	500
Weaving Segment	3000
Toll Plaza Segment	3000

Default Values

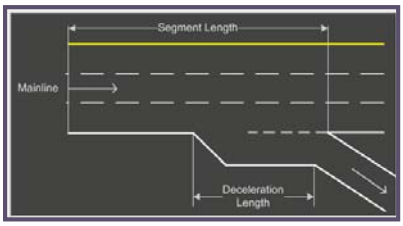
28

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’



287

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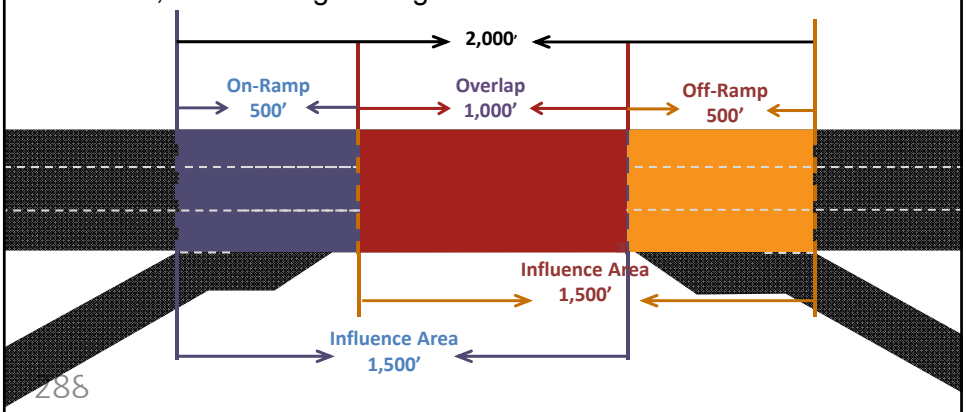
FREEPLAN Definitions

- **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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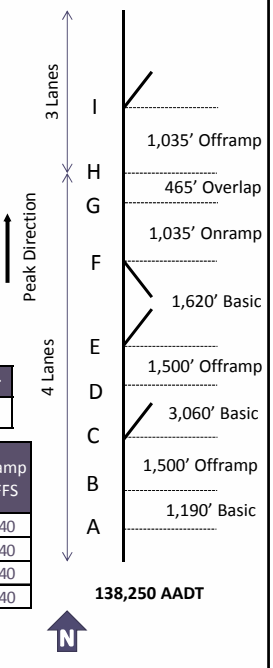
FREEPLAN

Example 1

Basic/Ramps/Ramp Overlap

I-4 between Princeton St & Lee Rd, Orlando

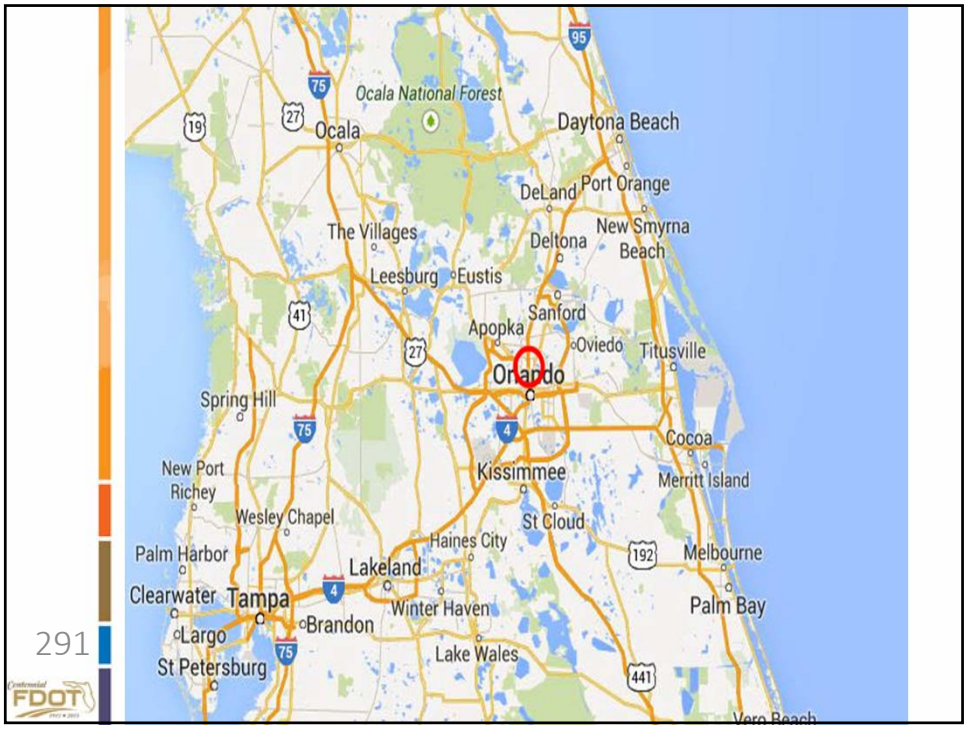
- Large urbanized area type
- Core freeway – K-factor of 8.0 (K_{other})
- 50 mph posted speed limit



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

290


Ocala National Forest
Ocala
Daytona Beach
DeLand
Port Orange
The Villages
Deltona
New Smyrna Beach
Leesburg
Eustis
Sanford
Apopka
Oviedo
Titusville
Orlando
Spring Hill
Cocoa
Kissimmee
New Port Richey
Merritt Island
Wesley Chapel
St Cloud
Haines City
Palm Harbor
Lakeland
Melbourne
Clearwater
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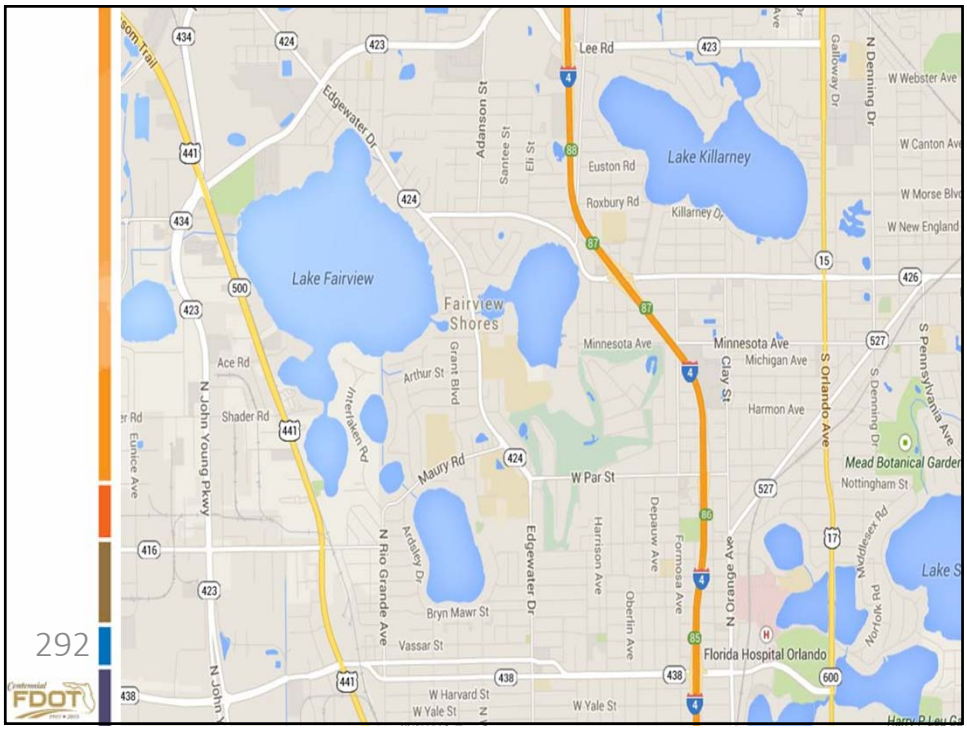
Lake Wales
Vero Beach
95
75
27
19
41
4
192
441

291


Lee Rd
Edgewater Dr
Adanson St
Lake Killarney
Euston Rd
Roxbury Rd
Killarney Dr
W Webster Ave
W Canton Ave
W Morse Blvd
W New England
Lake Fairview
Fairview Shores
Minnesota Ave
Michigan Ave
Ace Rd
Arthur St
Grant Blvd
Clay St
Harmon Ave
S Orlando Ave
S Pennsylvania Ave
Mead Botanical Garden
Shader Rd
N John Young Pkwy
Interlaken Rd
Maury Rd
W Par St
Nottingham St
Middlesex Rd
Ardsley Dr
N Rio Grande Ave
Bryn Mawr St
Vassar St
Edgewater Dr
Harrison Ave
Oberlin Ave
Depauw Ave
Formosa Ave
N Orange Ave
Florida Hospital Orlando
Norfolk Rd
W Harvard St
W Yale St
W Yale St
Lake S
Harry P Leu G
Galloway Dr
N Denning Dr
S Denning Dr
Eunice Ave
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416
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87
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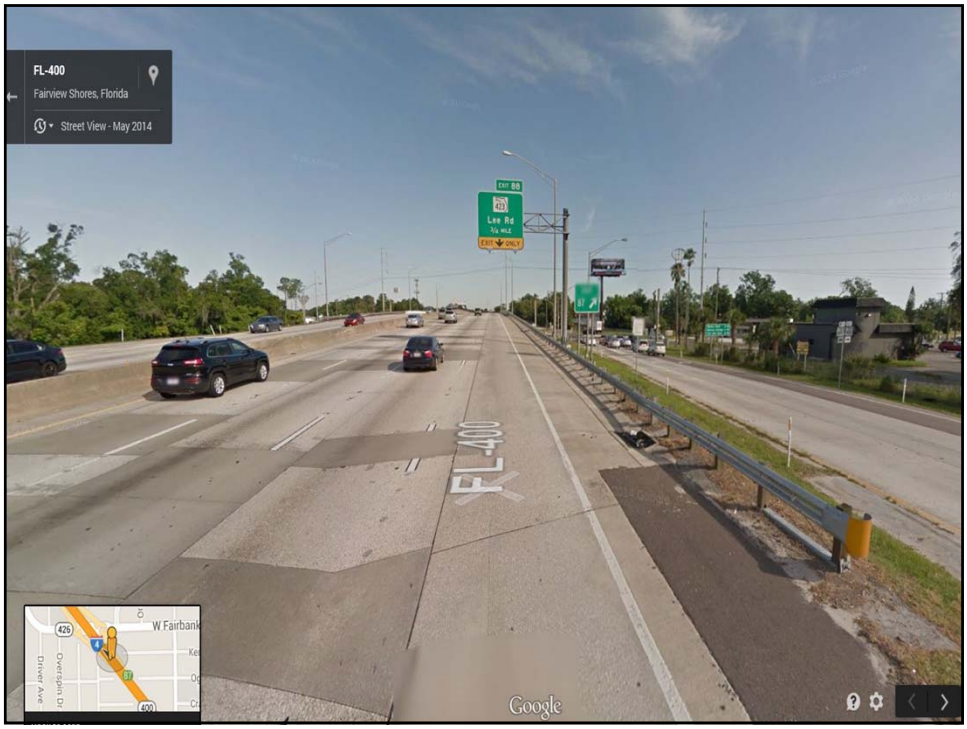
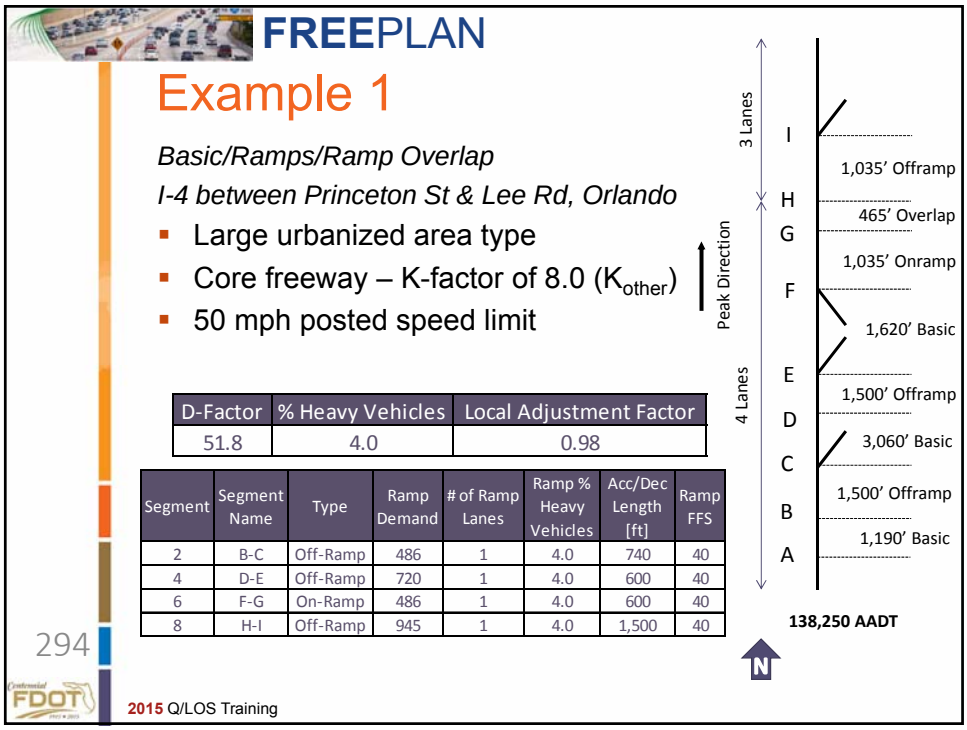
85
4

292





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
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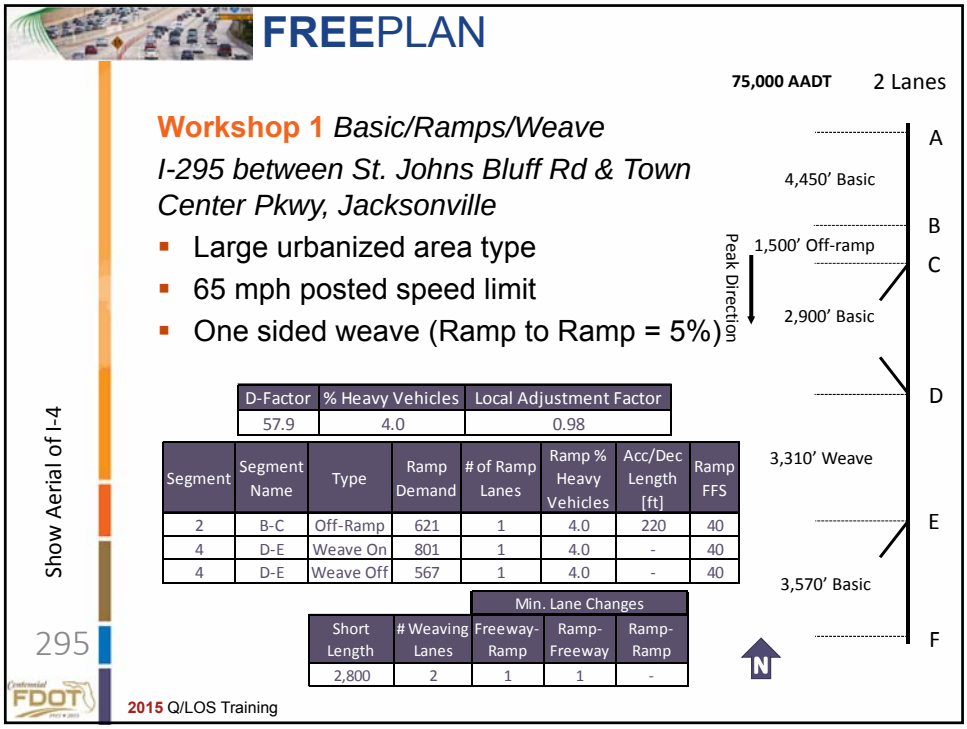
4	D-E	Off-Ramp	720	1	4.0	600	40
6	F-G	On-Ramp	486	1	4.0	600	40
8	H-I	Off-Ramp	945	1	4.0	1,500	40


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%)
Peak Direction
A
4,450' Basic
B
1,500' Off-ramp
C
2,900' Basic
D
3,310' Weave
E
3,570' Basic
F
N
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 -
Show Aerial of I-4
295
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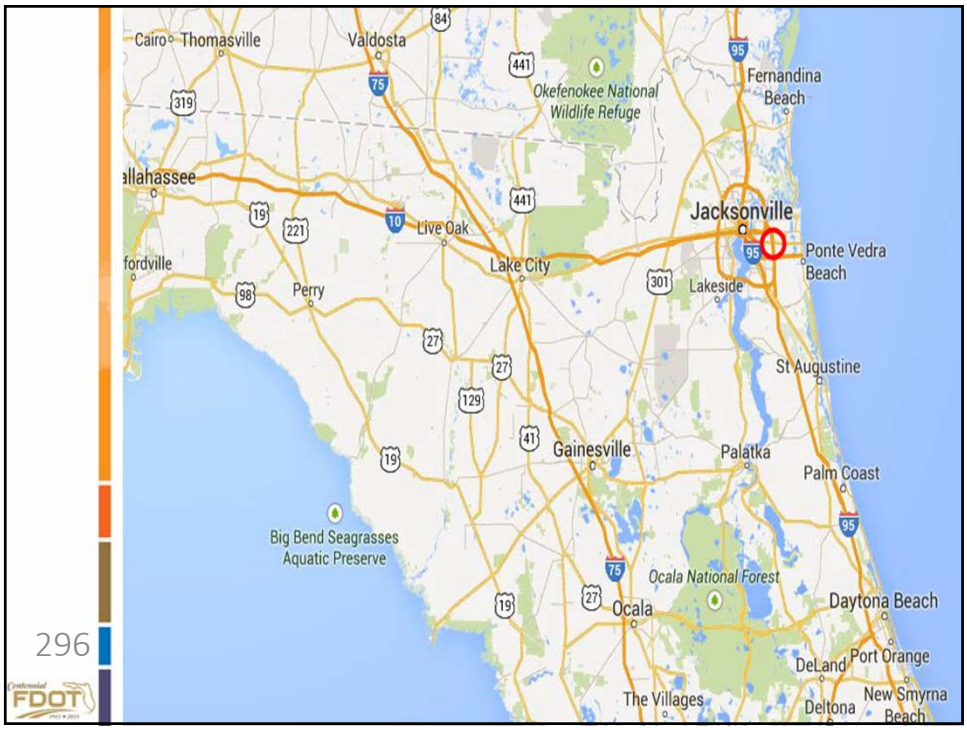
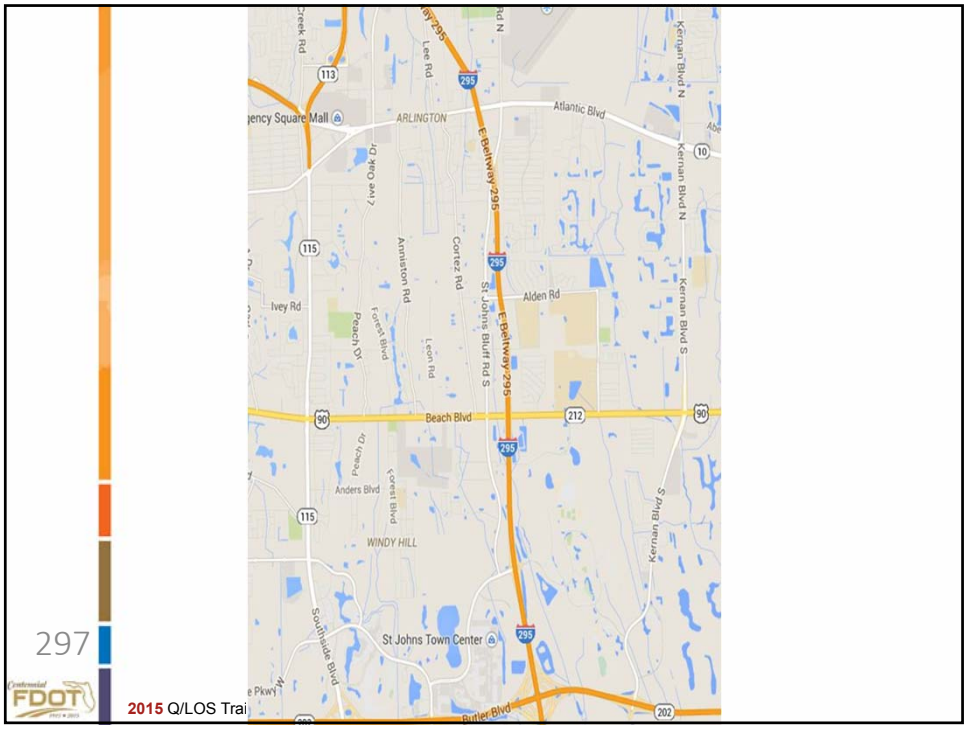
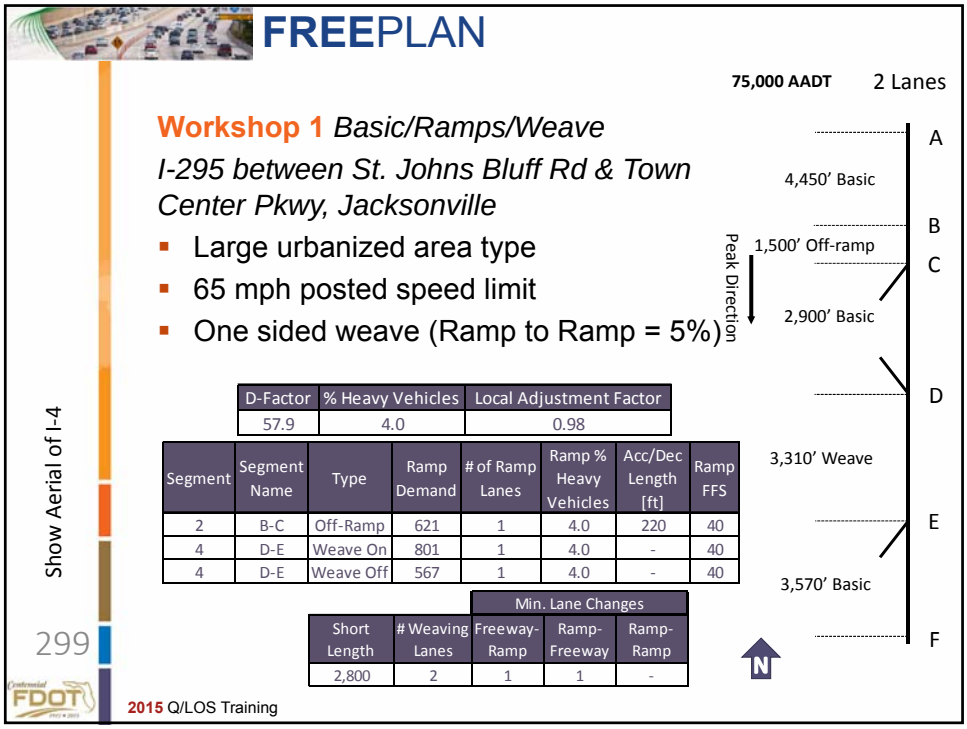
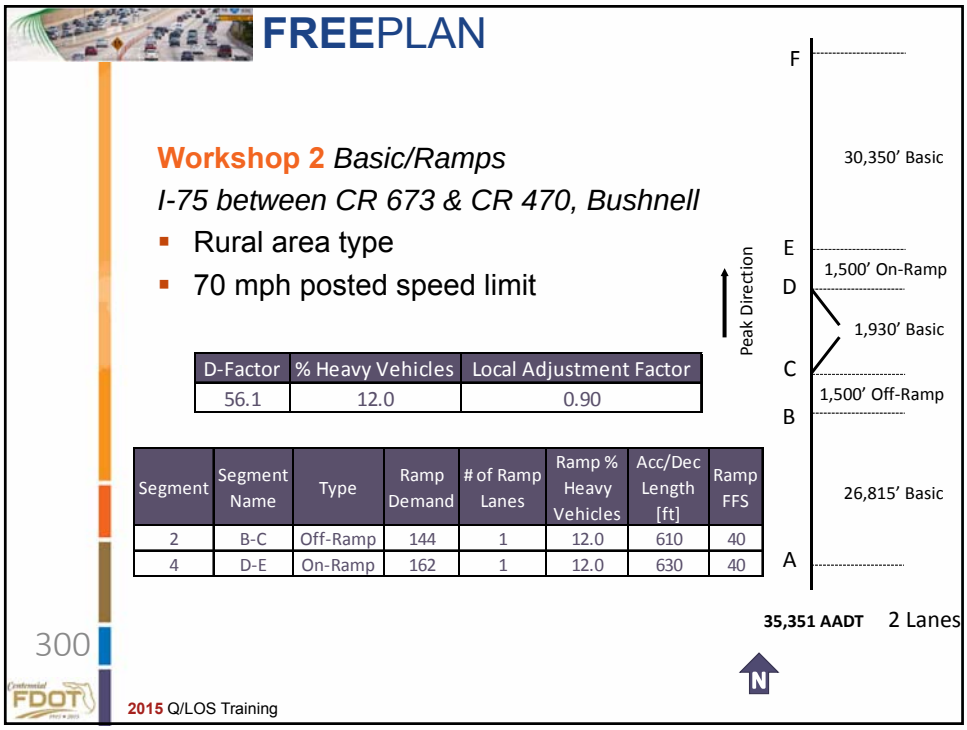
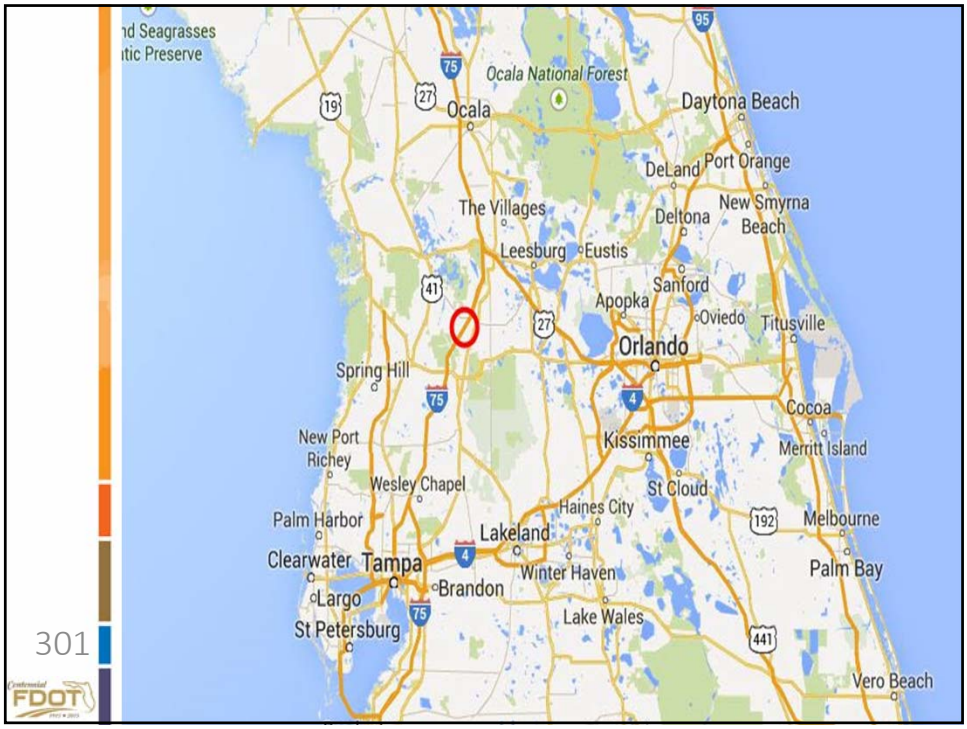

Cairo
Thomasville
Valdosta
Okefenokee National Wildlife Refuge
Fernandina Beach
allahassee
fordville
Live Oak
Lake City
Jacksonville
Ponte Vedra Beach
Perry
Lakeside
St Augustine
Gainesville
Palatka
Palm Coast
Big Bend Seagrasses Aquatic Preserve
Ocala National Forest
Ocala
Daytona Beach
DeLand
Port Orange
The Villages
Deltona
New Smyrna Beach
296

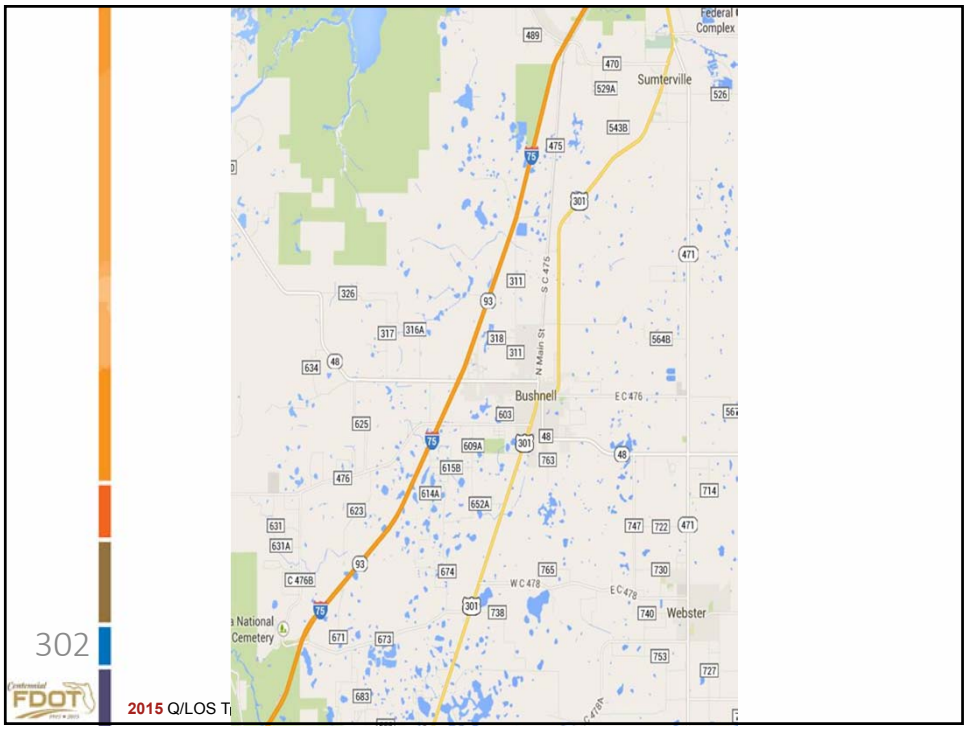

297
2015 Q/LOS Trai
ARLINGTON
Atlantic Blvd
E Beltway 295
Alden Rd
Beach Blvd
WINDY HILL
St Johns Town Center
Butler Blvd
Kernan Blvd N
Kernan Blvd S
Cortez Rd
Anniston Rd
Lee Rd
Ivey Rd
Peach Dr
Forest Blvd
Leon Rd
Anders Blvd
Southside Blvd
St Johns Bluff Rd S

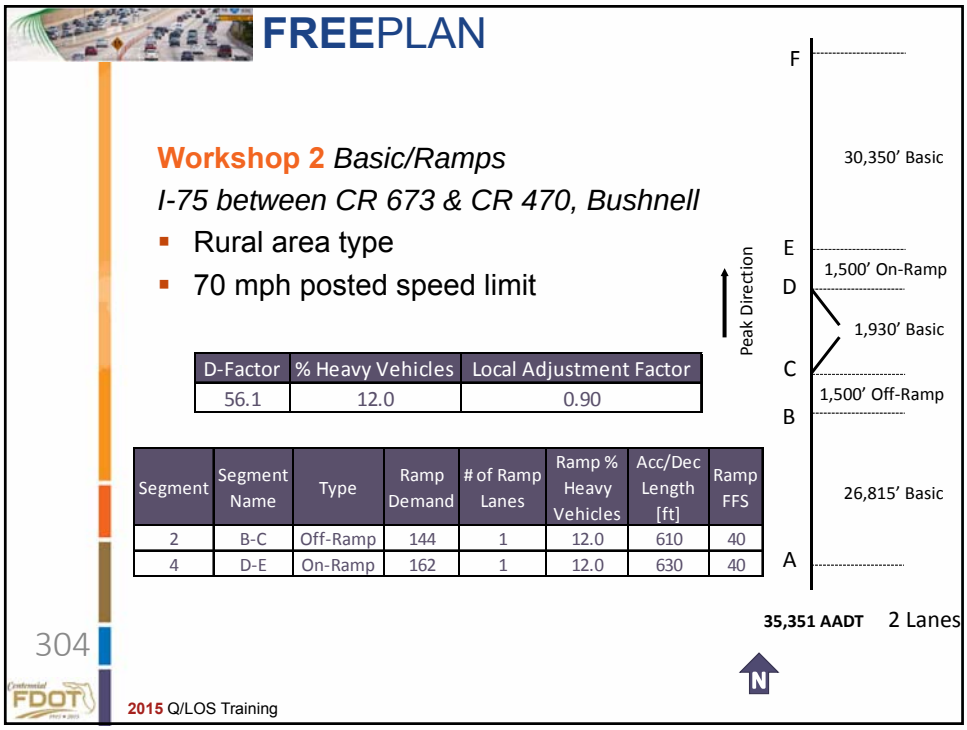

Street View - Jul 2014
Google


FREEPLAN
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%)
75,000 AADT
2 Lanes
A
4,450' Basic
B
1,500' Off-ramp
C
Peak Direction
2,900' Basic
D
3,310' Weave
E
3,570' Basic
F
N
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 | -
Show Aerial of I-4
299
2015 Q/LOS Training


FREEPLAN
Workshop 2 Basic/Ramps
I-75 between CR 673 & CR 470, Bushnell
Rural area type
70 mph posted speed limit
F
30,350' Basic
E
1,500' On-Ramp
D
1,930' Basic
C
1,500' Off-Ramp
B
26,815' Basic
A
Peak Direction
35,351 AADT
2 Lanes
N
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
300
2015 Q/LOS Training

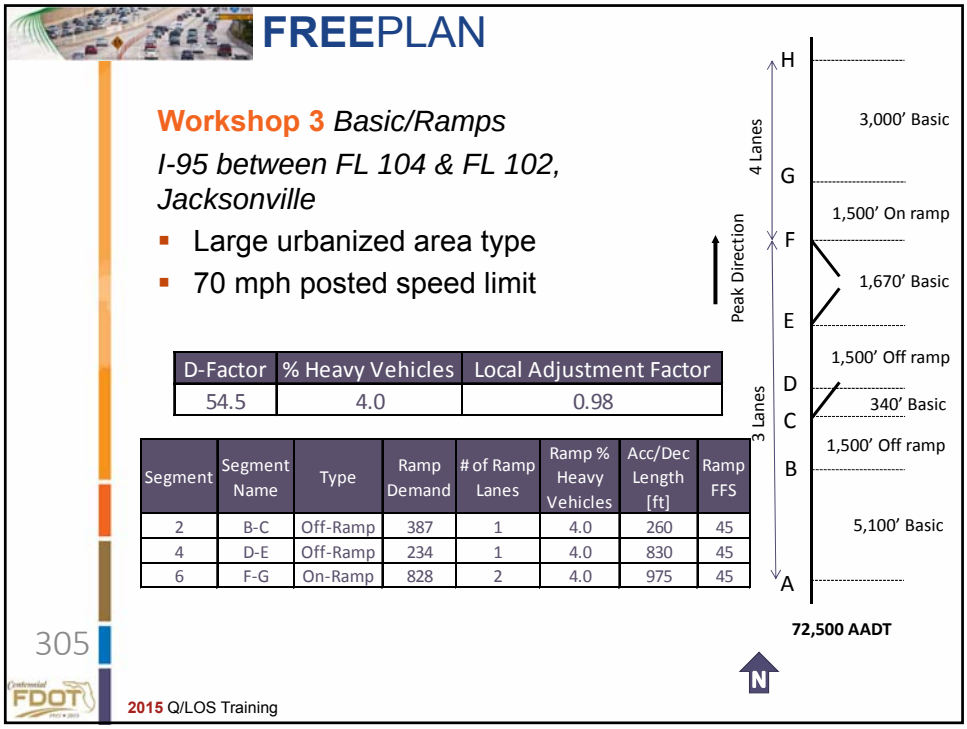

Ocala National Forest
Ocala
Daytona Beach
DeLand
Port Orange
The Villages
Deltona
New Smyrna Beach
Leesburg
Eustis
Sanford
Apopka
Oviedo
Titusville
Orlando
Spring Hill
Cocoa
Kissimmee
New Port Richey
Merritt Island
Wesley Chapel
St Cloud
Haines City
Palm Harbor
Melbourne
Lakeland
Clearwater
Tampa
Winter Haven
Palm Bay
Brandon
Largo
Lake Wales
St Petersburg
Vero Beach
301

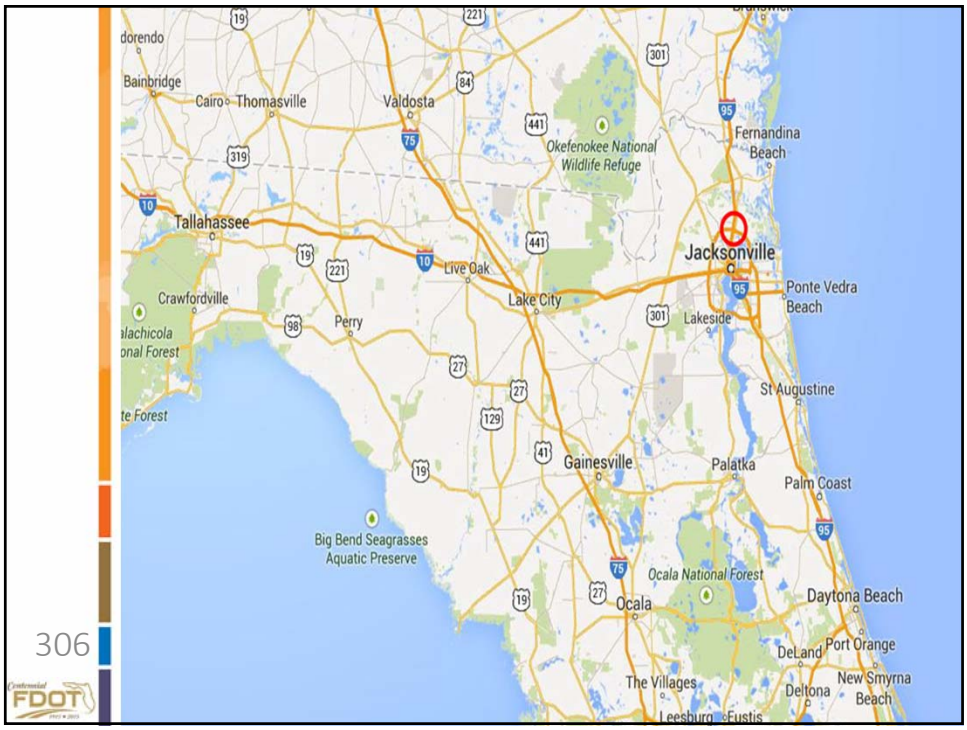

Sumterville
Bushnell
Webster
302
2015 Q/LOS T

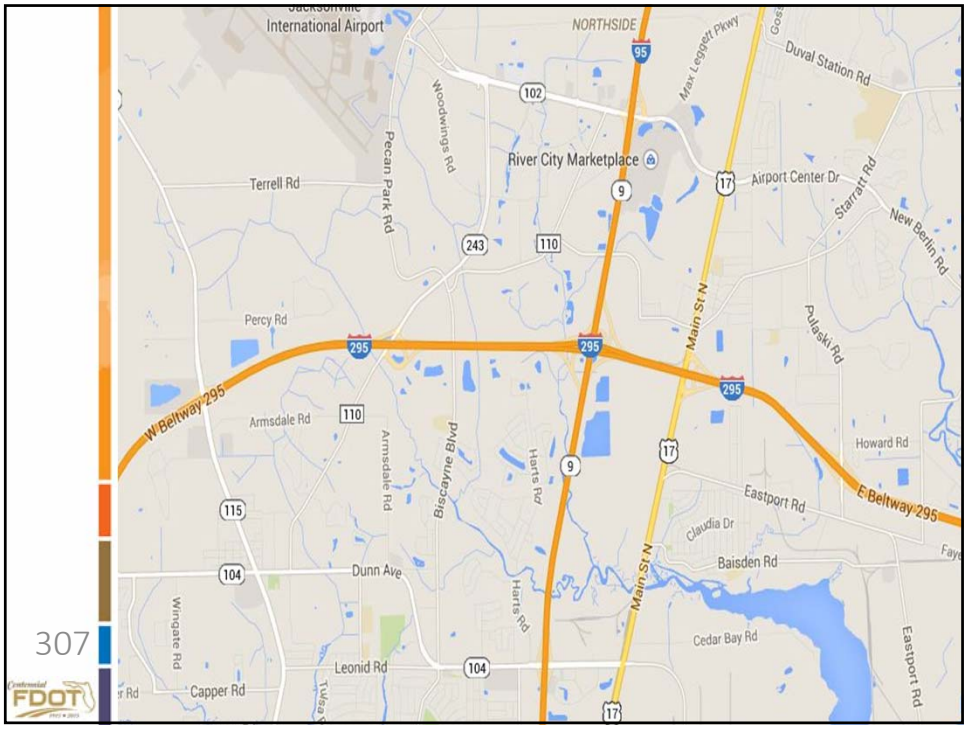


D-Factor	% Heavy Vehicles	Local Adjustment Factor
56.1	12.0	0.90

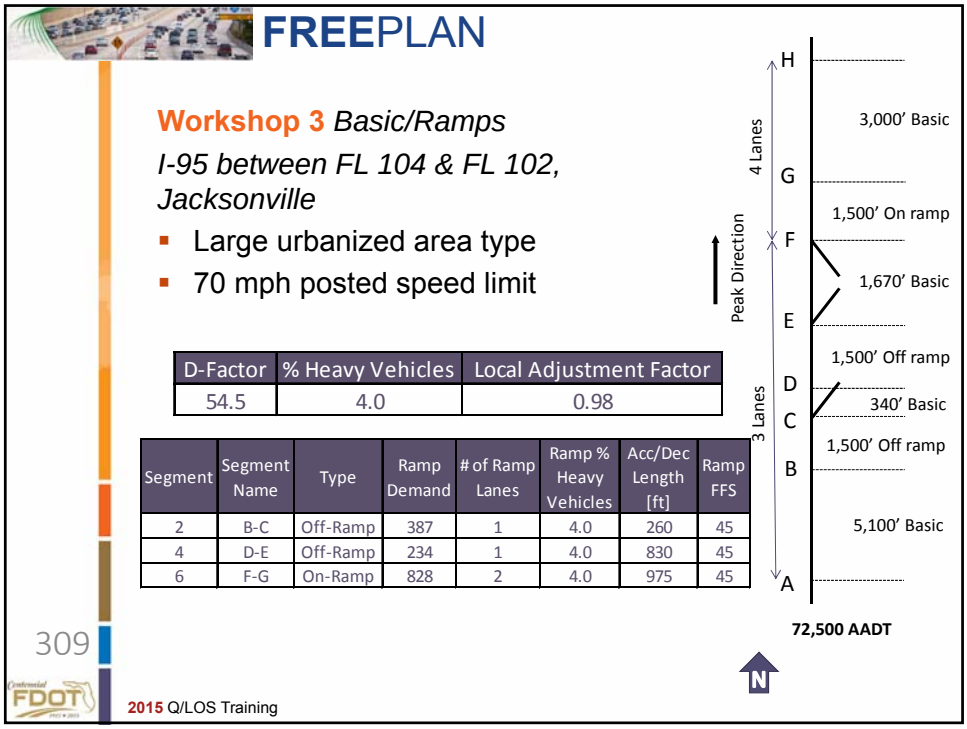
Segment	Segment Name	Type	Ramp Demand	# of Ramp Lanes	Ramp % Heavy Vehicles	Acc/Dec Length [ft]	Ramp FFS
2	B-C	Off-Ramp	144	1	12.0	610	40
4	D-E	On-Ramp	162	1	12.0	630	40

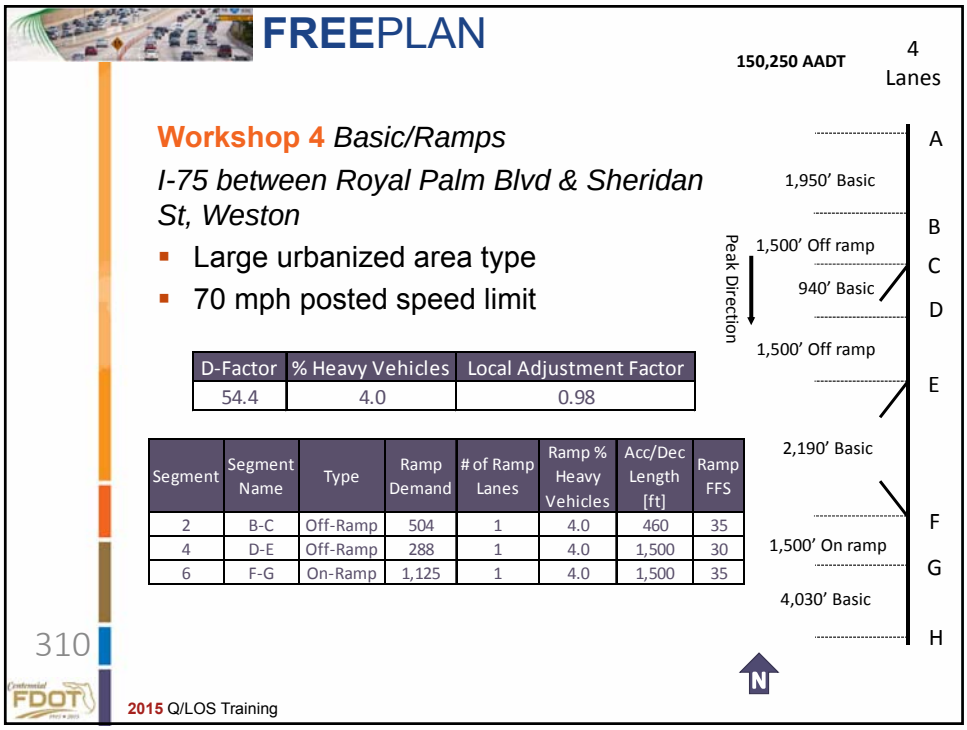

FREEPLAN
Workshop 3 Basic/Ramps
I-95 between FL 104 & FL 102, Jacksonville
Large urbanized area type
70 mph posted speed limit
D-Factor | % Heavy Vehicles | Local Adjustment Factor
54.5 | 4.0 | 0.98
Segment | Segment Name | Type | Ramp Demand | # of Ramp Lanes | Ramp % Heavy Vehicles | Acc/Dec Length [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
4 Lanes
3 Lanes
Peak Direction
H
G
F
E
D
C
B
A
3,000' Basic
1,500' On ramp
1,670' Basic
1,500' Off ramp
340' Basic
1,500' Off ramp
5,100' Basic
72,500 AADT
N
305
2015 Q/LOS Training

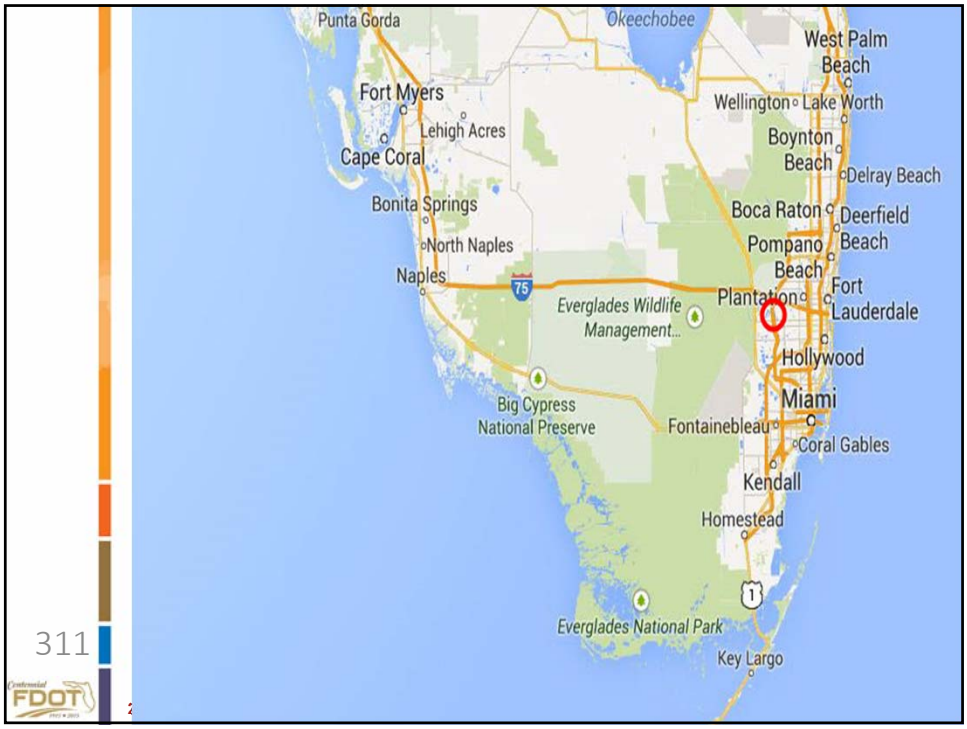

Bainbridge
Cairo
Thomasville
Valdosta
Okefenokee National Wildlife Refuge
Fernandina Beach
Tallahassee
Live Oak
Jacksonville
Crawfordville
Lake City
Ponte Vedra Beach
Perry
Lakeside
St Augustine
Gainesville
Palatka
Palm Coast
Big Bend Seagrasses Aquatic Preserve
Ocala National Forest
Ocala
Daytona Beach
DeLand
Port Orange
The Villages
Deltona
New Smyrna Beach
Leesburg
Eustis
306

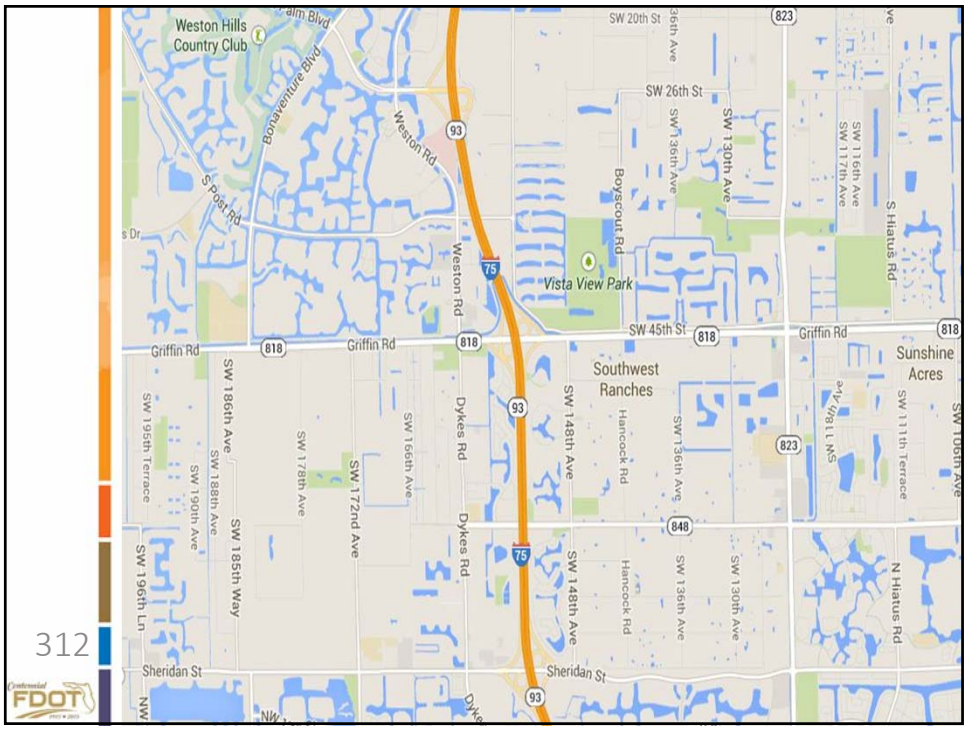

International Airport
NORTHSIDE
Duval Station Rd
Max Leggett Pkwy
Woodwings Rd
Pecan Park Rd
River City Marketplace
Terrell Rd
Airport Center Dr
Starratt Rd
New Berlin Rd
Percy Rd
Main St N
Pulaski Rd
W Beltway 295
Armsdale Rd
Howard Rd
Biscayne Blvd
Harts Rd
E Beltway 295
Eastport Rd
Claudia Dr
Baisden Rd
Dunn Ave
Wingate Rd
Cedar Bay Rd
Leonid Rd
Capper Rd
307


I-95
Jacksonville, Florida
Street View - Aug 2014
Google

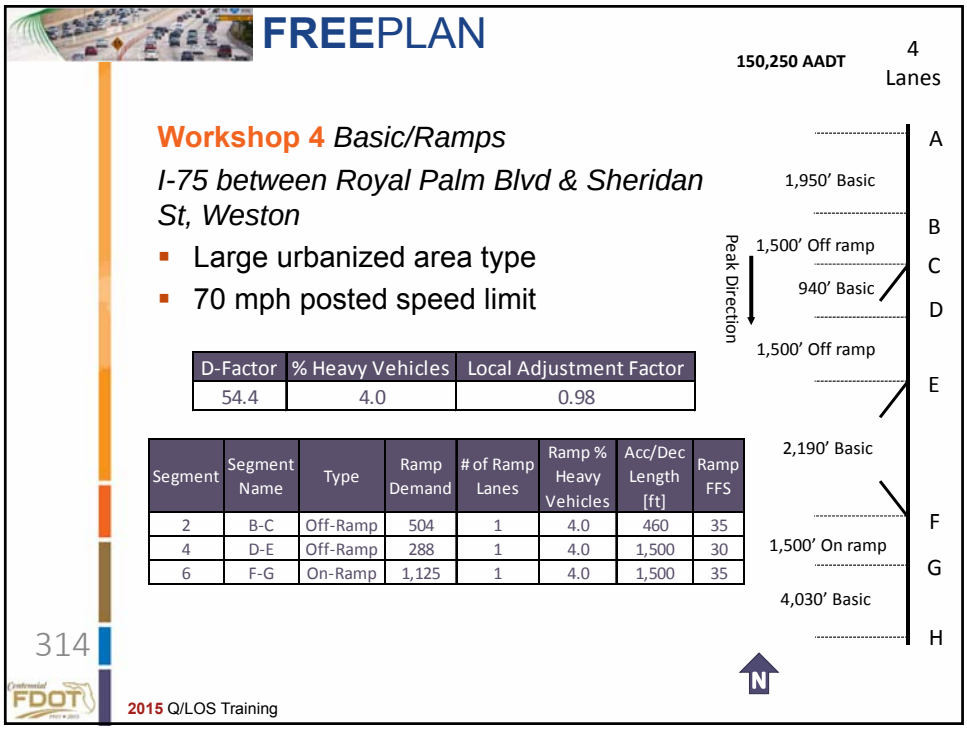

FREEPLAN
Workshop 3 Basic/Ramps
I-95 between FL 104 & FL 102, Jacksonville
Large urbanized area type
70 mph posted speed limit
D-Factor | % Heavy Vehicles | Local Adjustment Factor
54.5 | 4.0 | 0.98
Segment | Segment Name | Type | Ramp Demand | # of Ramp Lanes | Ramp % Heavy Vehicles | Acc/Dec Length [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
4 Lanes
3 Lanes
Peak Direction
H
G
F
E
D
C
B
A
3,000' Basic
1,500' On ramp
1,670' Basic
1,500' Off ramp
340' Basic
1,500' Off ramp
5,100' Basic
72,500 AADT
N
309
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
N
310
2015 Q/LOS Training


Punta Gorda
Okeechobee
West Palm Beach
Fort Myers
Wellington
Lake Worth
Lehigh Acres
Cape Coral
Boynton Beach
Delray Beach
Bonita Springs
Boca Raton
Deerfield Beach
North Naples
Pompano Beach
Naples
75
Everglades Wildlife Management...
Plantation
Fort Lauderdale
Hollywood
Miami
Big Cypress National Preserve
Fontainebleau
Coral Gables
Kendall
Homestead
1
Everglades National Park
Key Largo
311


Weston Hills Country Club
SW 20th St
823
SW 26th St
Bonaventure Blvd
Weston Rd
93
S Post Rd
SW 136th Ave
SW 130th Ave
SW 116th Ave
SW 117th Ave
S Hiatus Rd
Boyscout Rd
75
Vista View Park
Weston Rd
SW 45th St
818
Griffin Rd
Griffin Rd
Griffin Rd
Sunshine Acres
Southwest Ranches
SW 186th Ave
SW 195th Terrace
SW 188th Ave
SW 190th Ave
SW 178th Ave
SW 172nd Ave
SW 166th Ave
Dykes Rd
SW 148th Ave
Hancock Rd
SW 136th Ave
SW 111th Terrace
SW 185th Way
SW 196th Ln
848
SW 130th Ave
N Hiatus Rd
Sheridan St
Sheridan St
312

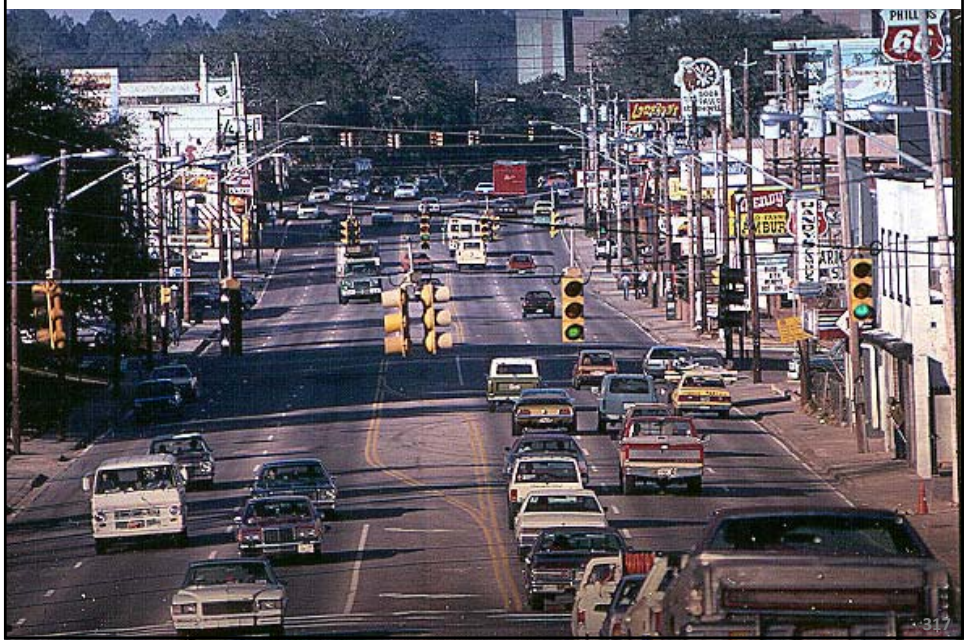

Florida
Street View - Mar 2014
FL-93
Google


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
N
314
2015 Q/LOS Training

Applications

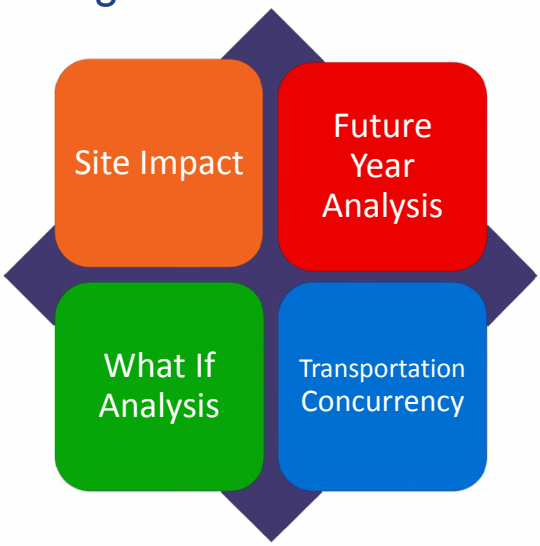
AGENDA ITEM 14

LOS APPLICATIONS



317

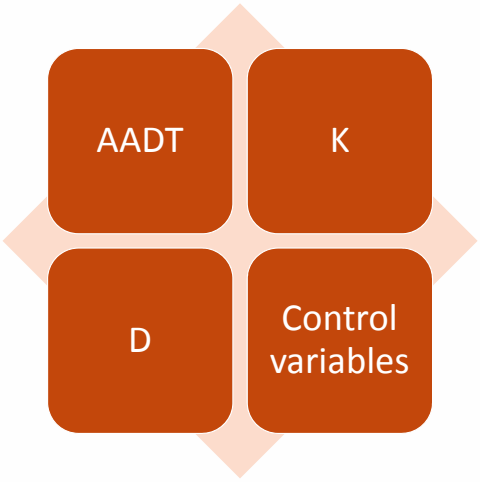
Planning Uses of LOS Techniques



318

2015 Q/LOS Training

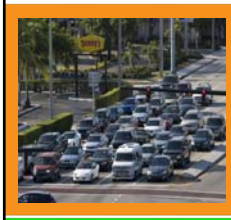
Future Year Analysis



319

Future Year Analysis

Roadway variables



Traffic variables

Control variables

Conditions change – what should we do?

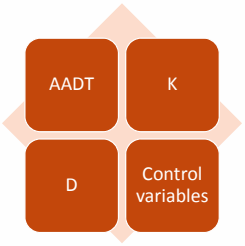
Good Assumptions = Good Results

324

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

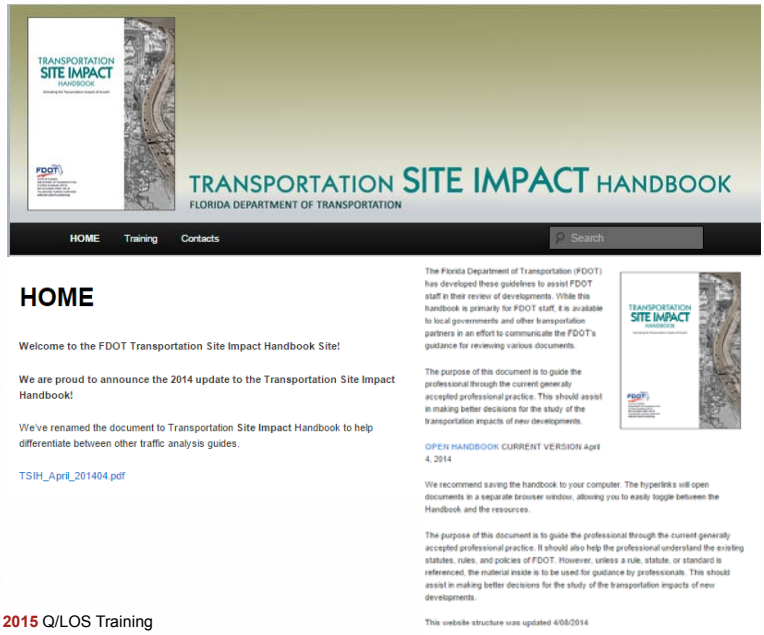


321

Transportation Impact Handbook

322

Transportation Impact Handbook Website



323

2015 Q/LOS Training

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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2015 Q/LOS Training 119

Maximum Acceptable Capacity Volumes for Arterials

Large urbanized	1,000 vehicles per hour per lane (vphpl)
Other urbanized	950 vphpl
Transitioning	920 vphpl
Urban	920 vphpl
Rural	850 vphpl

325

Maximum Acceptable Capacity Volumes for Freeways

Large urbanized	2,100 vphpl (1900 vphpl if oversaturated)
Other urbanized	2,000 vphpl (1900 vphpl if oversaturated)
Transitioning	1,900 vphpl
Urban	1,800 vphpl
Rural	1,800 vphpl

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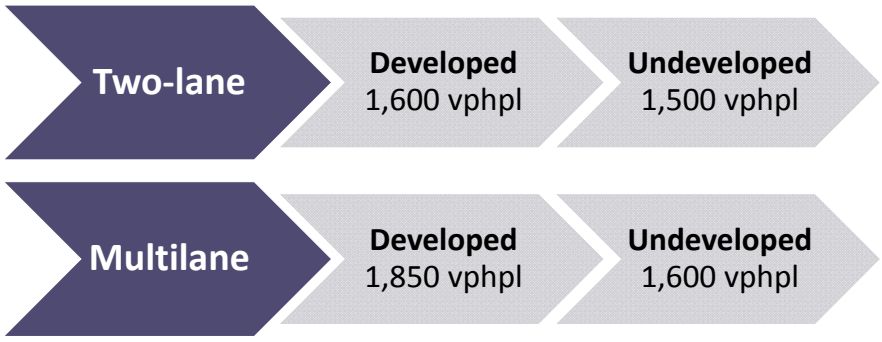
Maximum Acceptable Capacity Volumes for Highways



327

Precursor to HCM Analysis

- LOSPLAN or Generalized Tables screening.
  - If facilities show problems then a more detailed analysis can follow

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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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2015 Q/LOS Training

WRAP-UP

AGENDA ITEM 15

331

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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2015 Q/LOS Training

Wrap-Up

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

Complete Evaluation Form

Wrap-Up

Contact Information

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Gina Bonyani
Gina.bonyani@dot.state.fl.us
(850) 414-4707