ELTOD Applications in Planning Studies:

A Case-Study of a PD&E Project Application in South Florida

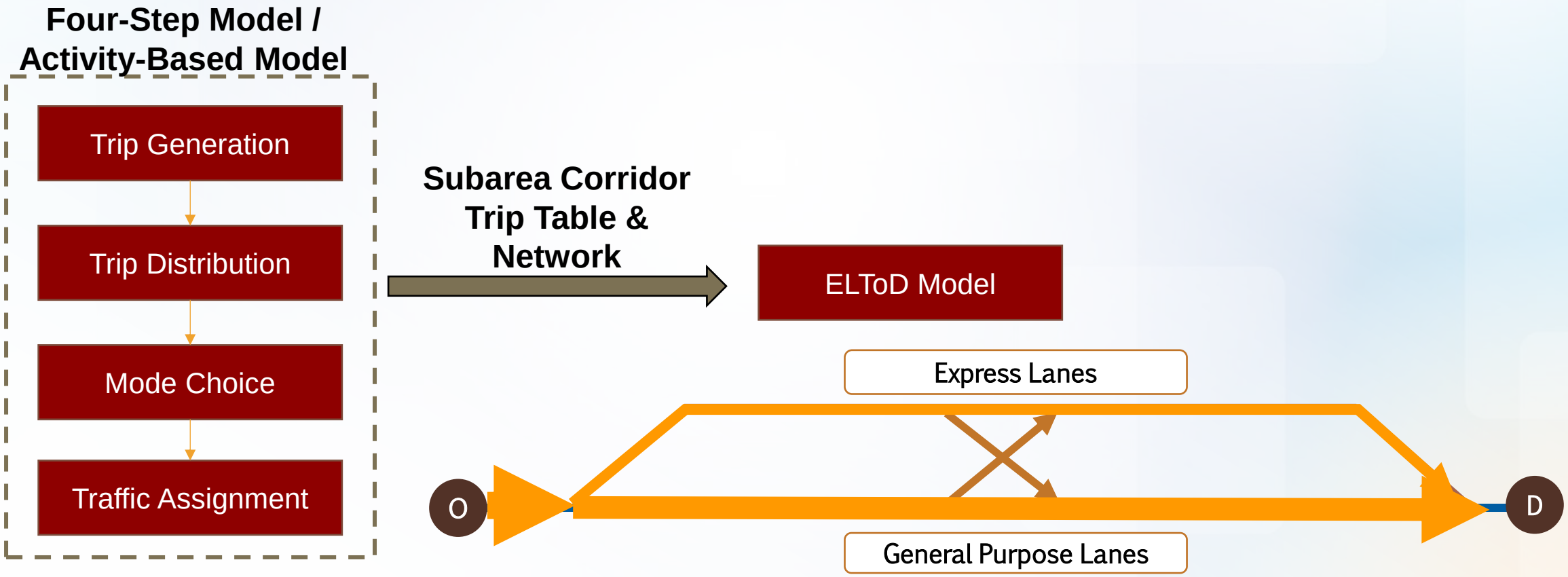
June 16, 2017

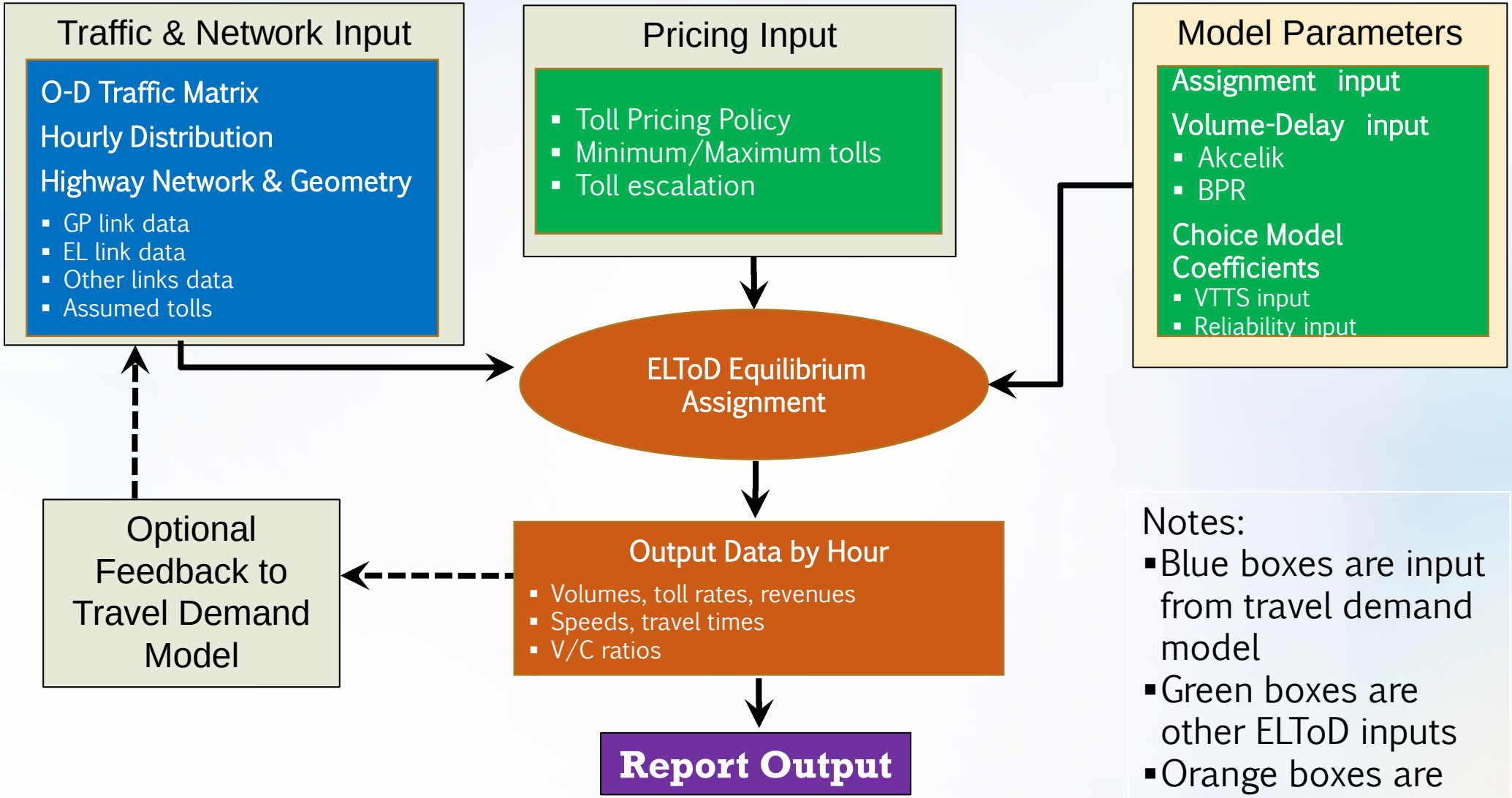
Meeting Overview

- What is ELToD and Why Use it?
- Toll Choice Key Concepts
- ELToD Applications
- SW 10th Street
- ELToD Future Enhancements

What is ELToD?

- ELToD (Express Lanes Time of Day) Model is a traffic assignment model built to forecast traffic volume and toll rates for Express Lanes.



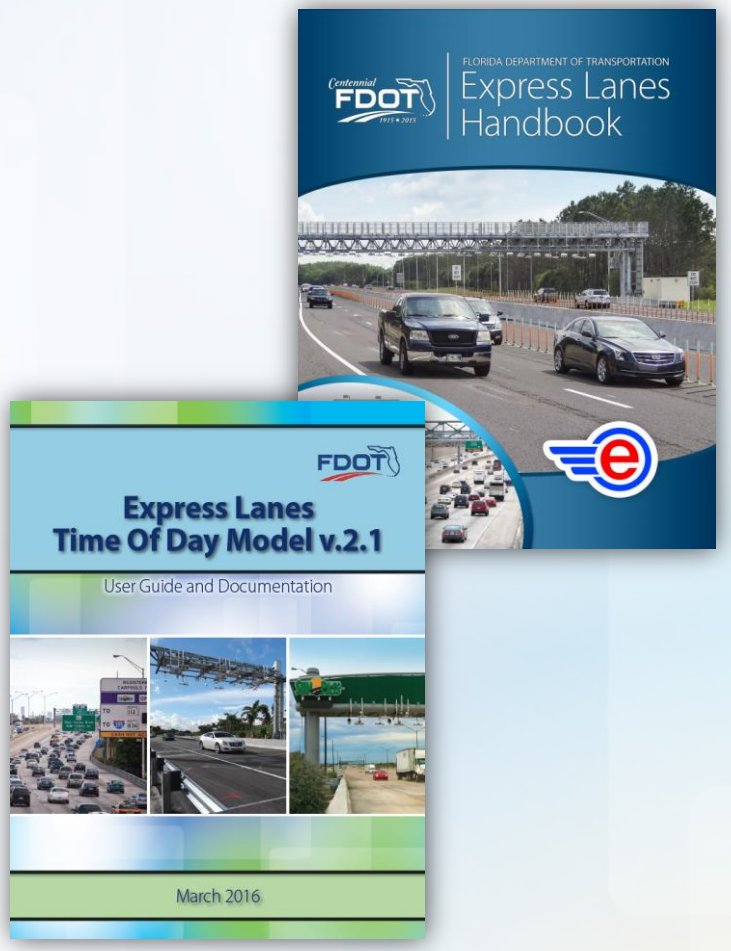


Notes:

- Blue boxes are input from travel demand model
- Green boxes are other ELToD inputs
- Orange boxes are ELToD applications

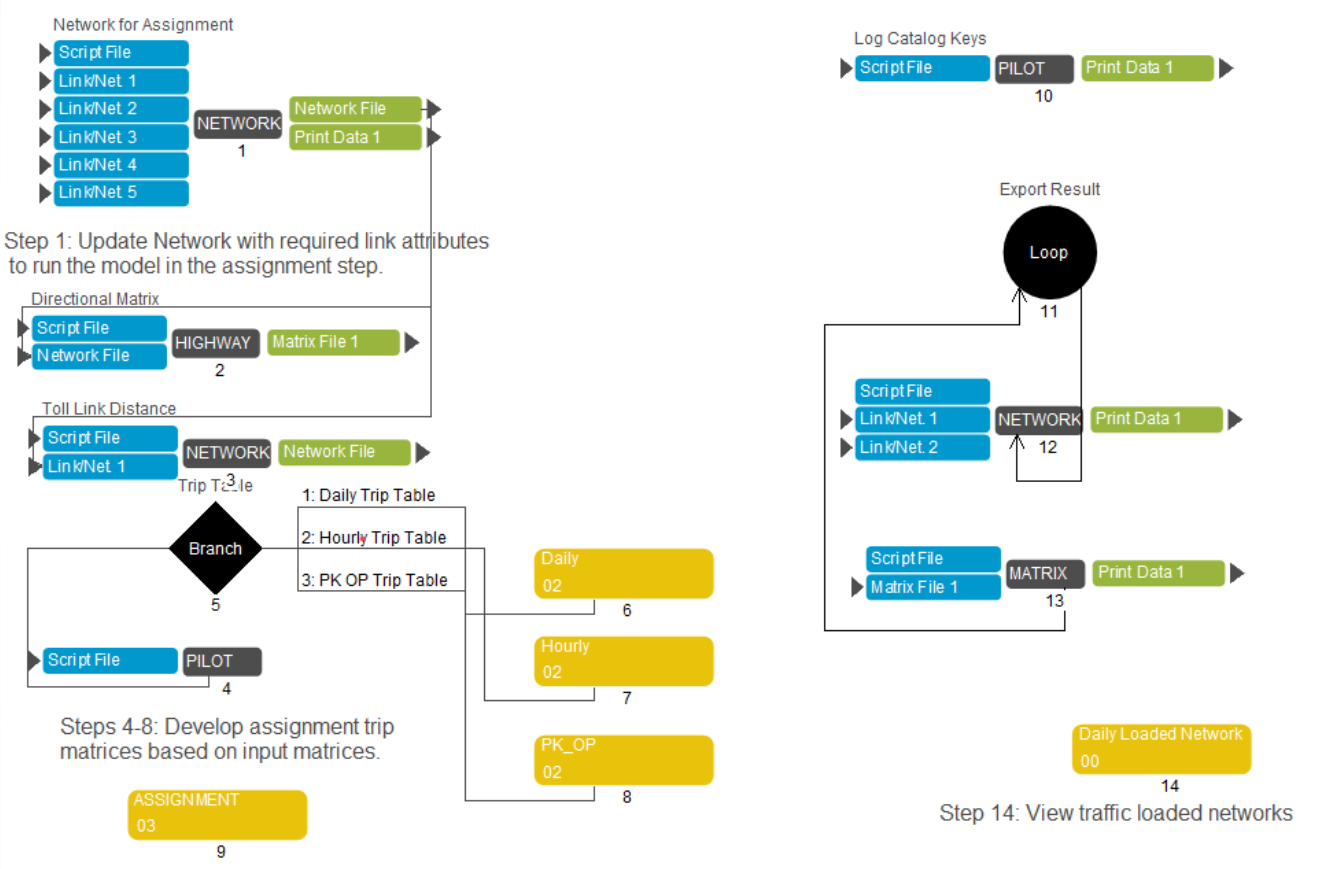
Why ELToD? - Manager's View

- Proven to Be Effective and Low-Cost
- Comprehensive Guidance on Applying to New Projects
- Open Source Allowing Total Transparency
- Ensures Consistency on Projects Evaluation
- Convenient for Peer Review and Quality Assurance
- Widely Used State of Practice Methodology



Why ELToD? - Modeler's View

- Advanced Embedded Binary Toll Choice Model
- Dynamic Toll Rates
- One-Hour Trip Tables
- Cube Software Platform
- Easy to Customize
- Detailed Log Files
- Short Run Time



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SW 10th Street

ELToD Future Enhancements

Express Lane Choices in ELToD

- **Express Lane Share Calculated for Each O-D**
  - **X%** of drivers use express lanes from **A** to **B**
- **Binary Logit Model**
  - Binary choice between Express and GU lanes
  - Share changes gradually as benefits/costs change
  - Simple formula for share:

$$\boldsymbol{Share} = \frac{\mathbf{1}}{\mathbf{1} + \boldsymbol{e}^{-(\Delta \boldsymbol{U})}}$$

where: ΔU describes the benefits vs. costs

Binary Logit Toll Choice Model

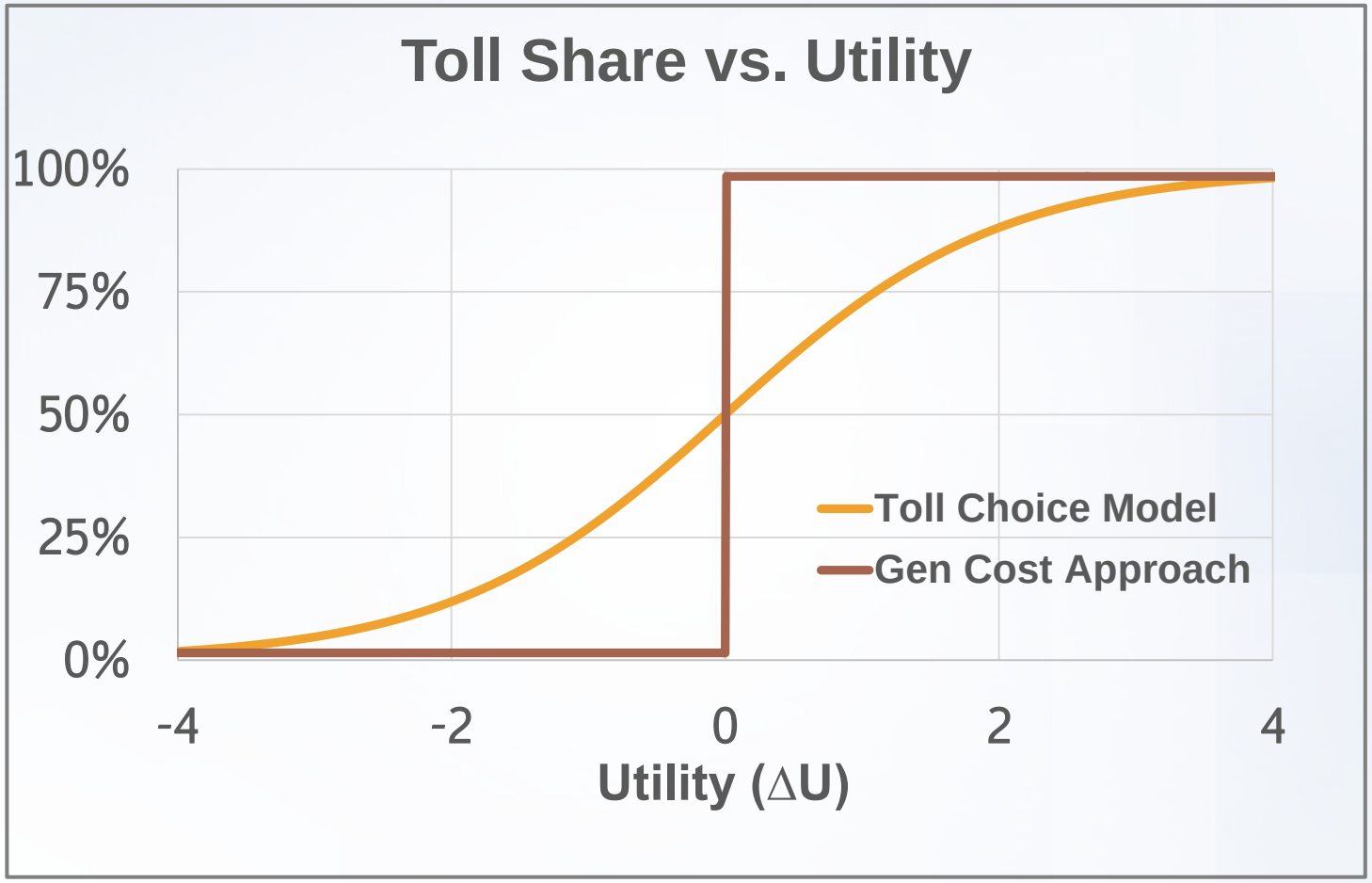
$$\boldsymbol{Express\ Lane\ Share} = \frac{1}{1 + e^{(-1*(\beta_{Constant} + \beta_{Time}*\boldsymbol{Time} + \beta_{Toll}*\boldsymbol{Toll} + \beta_{Reliability}*\boldsymbol{Reliability}))}}$$

Estimated Coefficients	Model Generated Inputs
$\boldsymbol{\beta_{Time}}$ *(beta time)*	Time
$\boldsymbol{\beta_{Toll}}$ *(beta toll)*	Toll
$\boldsymbol{\beta_{Reliability}}$ *(beta reliability)*	Reliability
$\boldsymbol{\beta_{Constant}}$ *(beta constant)*	*(None)*

Choice Model Advantages

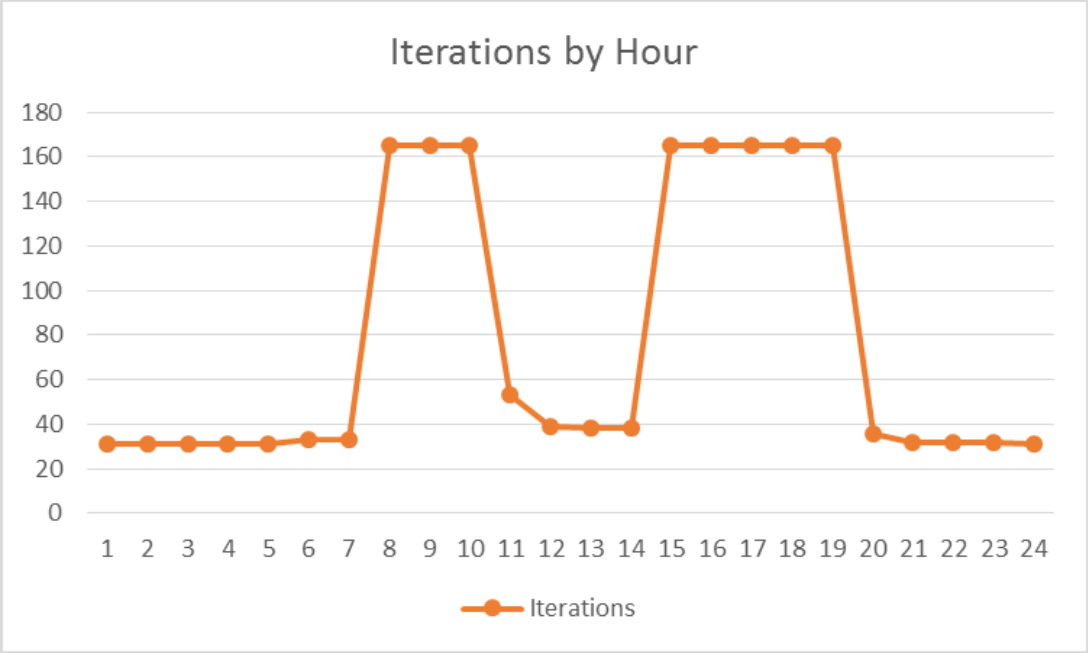
- **Generalized Cost Method**
  - 0% or 100% of trips from A to B use tolled links
  - Generally considers only toll and time
- **Toll Choice Model**
  - Anywhere from 0% to 100% of trips from A to B use tolled links
  - Considers driver heterogeneity
  - Can capture unobserved factors
  - More realistic toll sensitivity

Choice Model vs. Generalized Cost Method

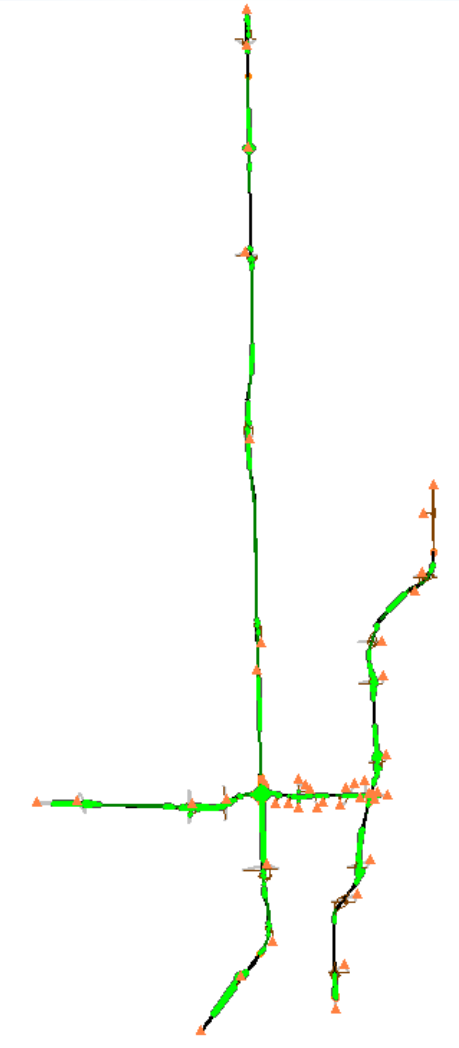


ELToD vs. Other Choice Models

- **Other Choice Models May Consider Only Time and Toll**
- **ELToD Considers Reliability and Discomfort**
- **Scenario testing is fast (runtime is about 10 minutes)**



RGAP=0.0001
Not less than 30 iterations



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What is ELToD and Why Use it?

Toll Choice Key Concepts

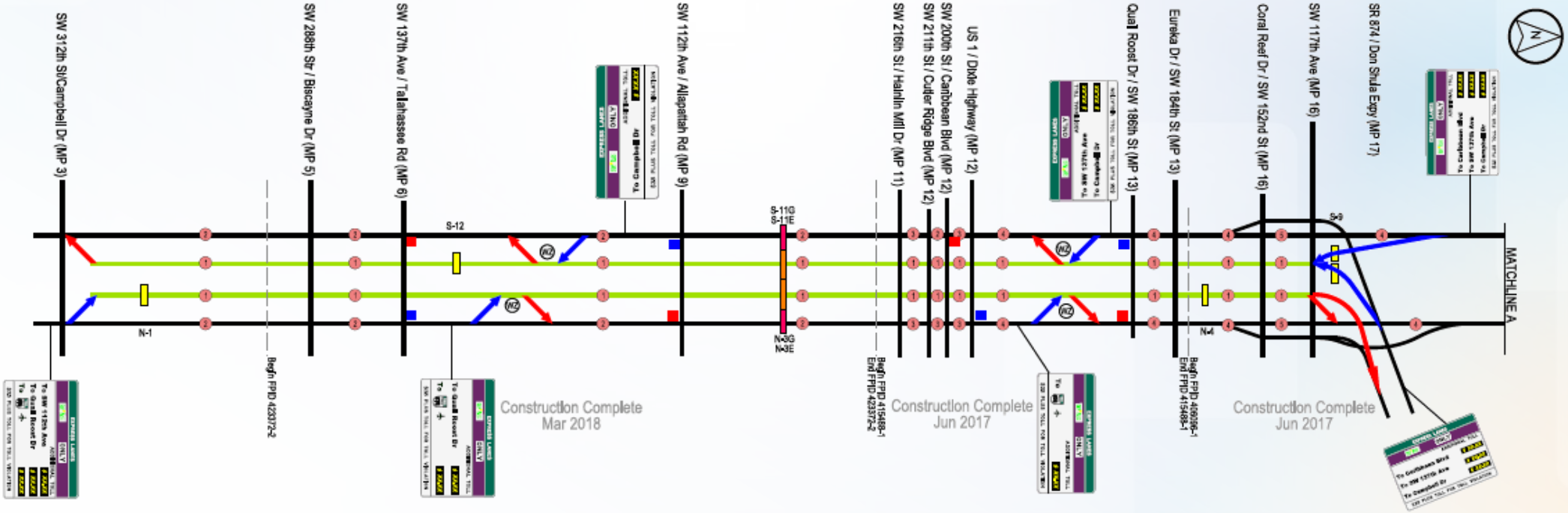
ELToD Applications

SW 10th Street

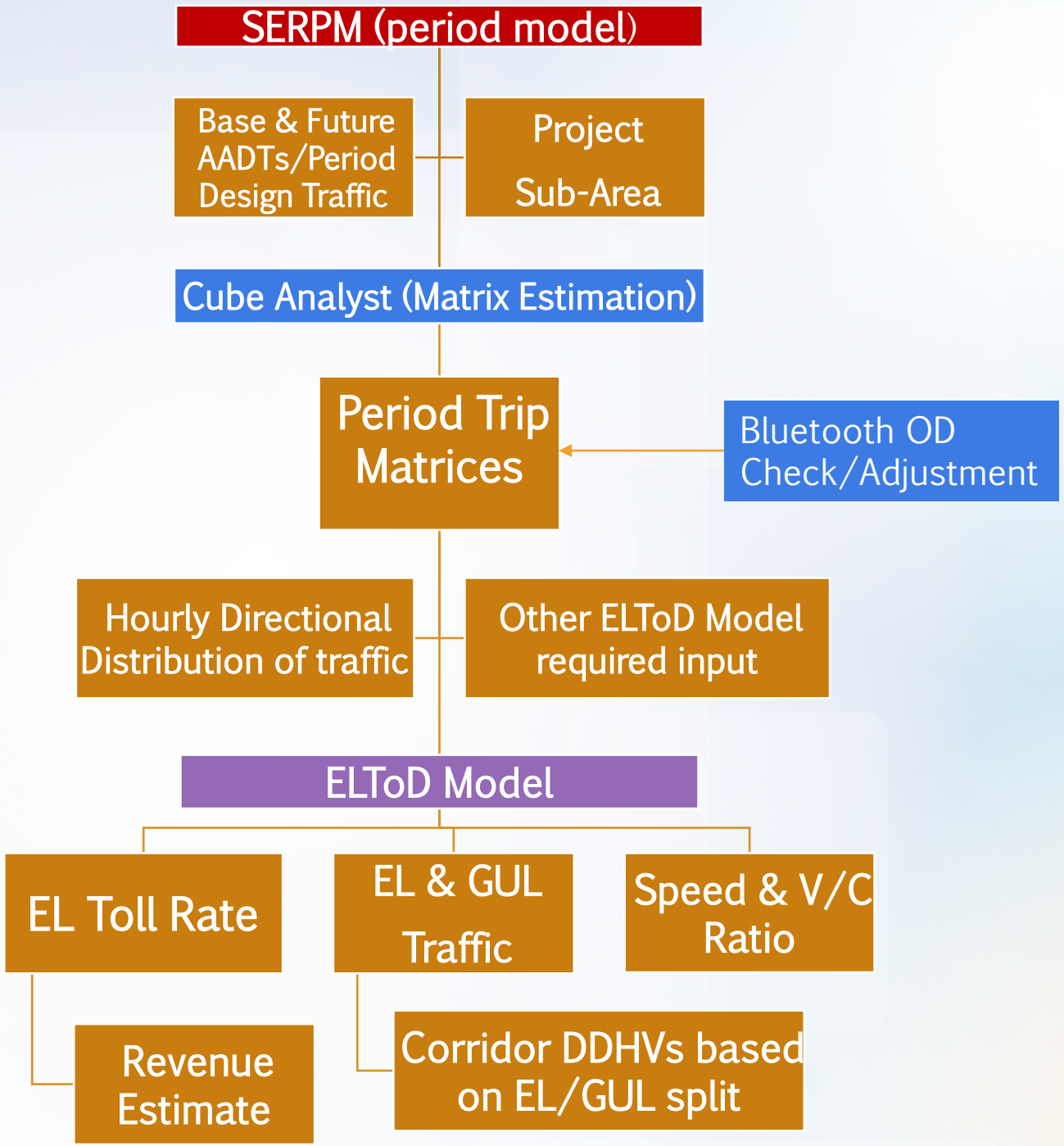
ELToD Future Enhancements

ELToD Applications

- Traffic and Revenue Studies
  - Express Lane Traffic
  - Projected Toll Rates
  - Sensitivity Testing – Toll Policy, Value-of-Time
- Planning and PD&E Studies
  - Ingress/Egress Location Analysis
  - Express lane project traffic for operational analysis



Model Forecast Process



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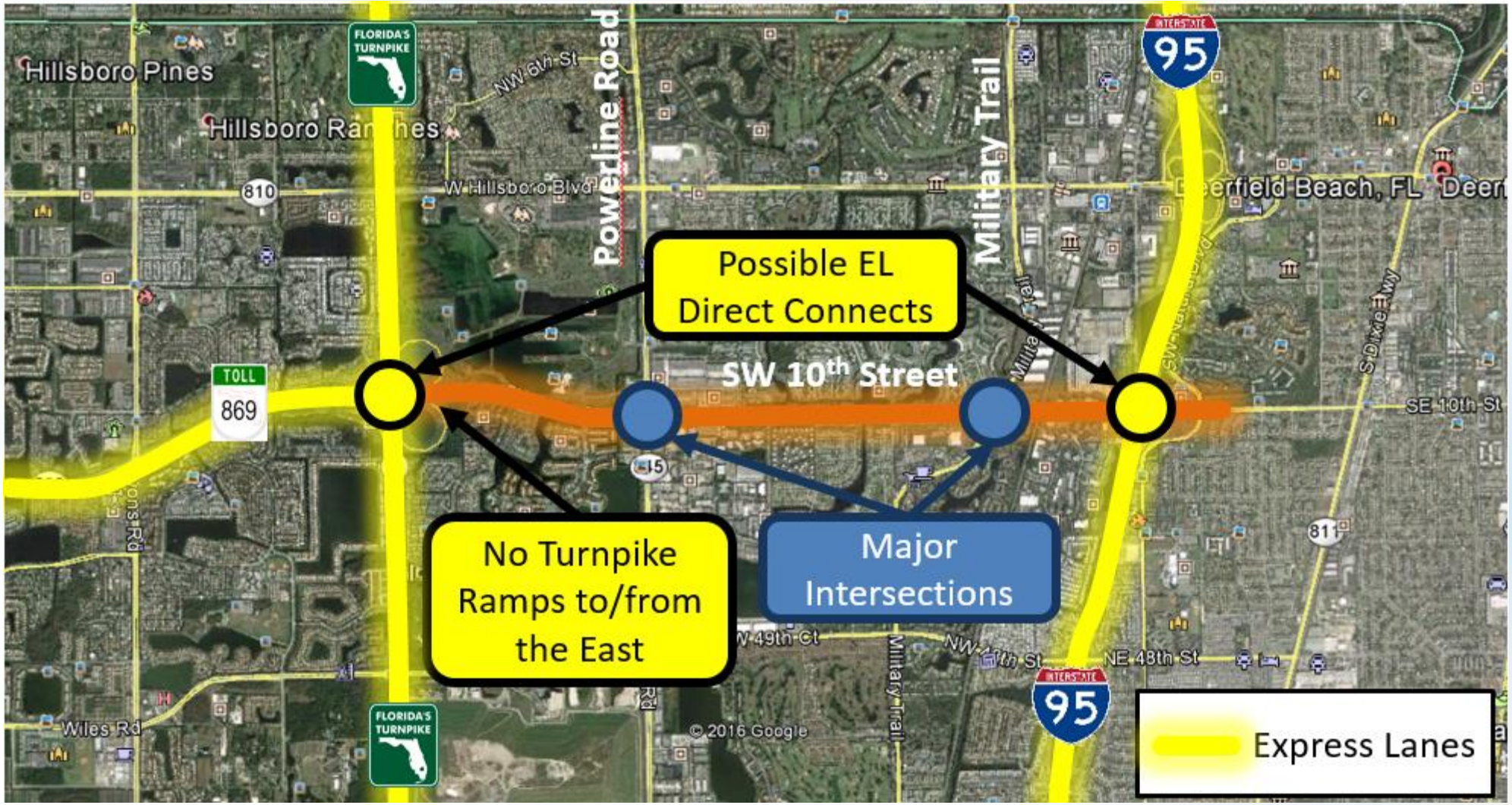
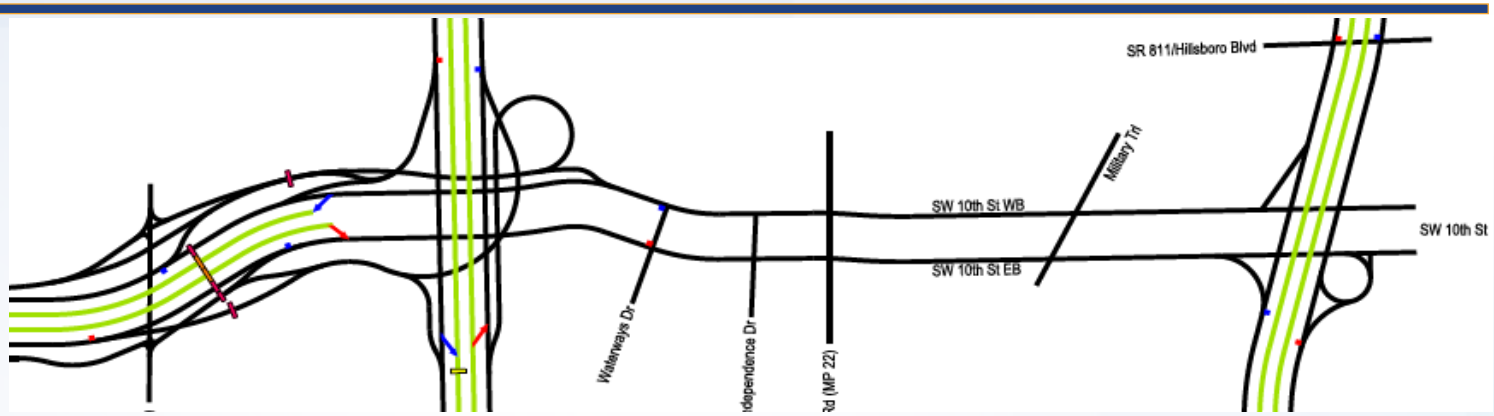
Project Overview

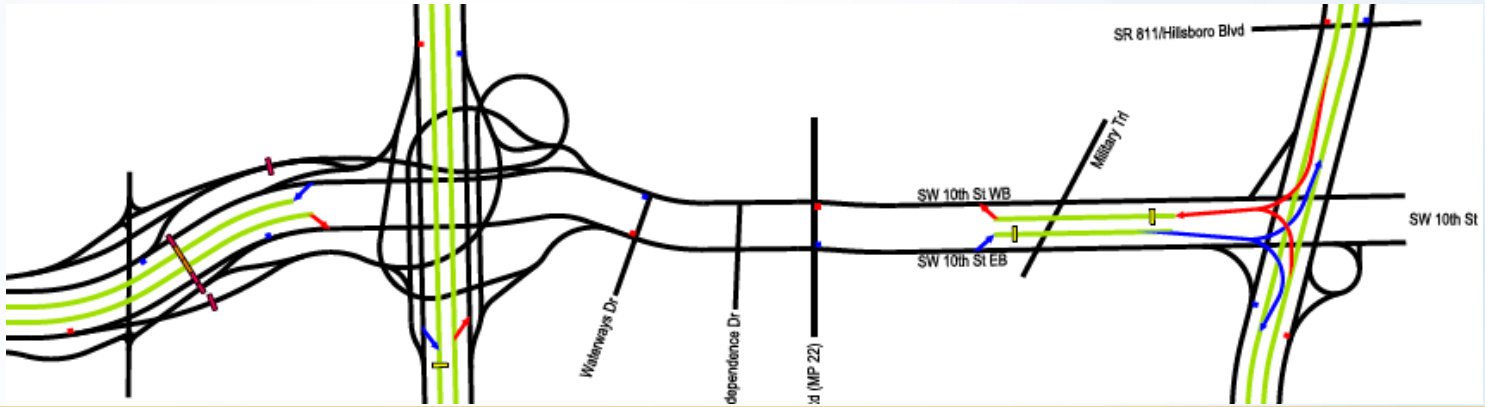


SW 10th Street Forecast Alternatives

No-Build
No
Interchange
(NBNI)



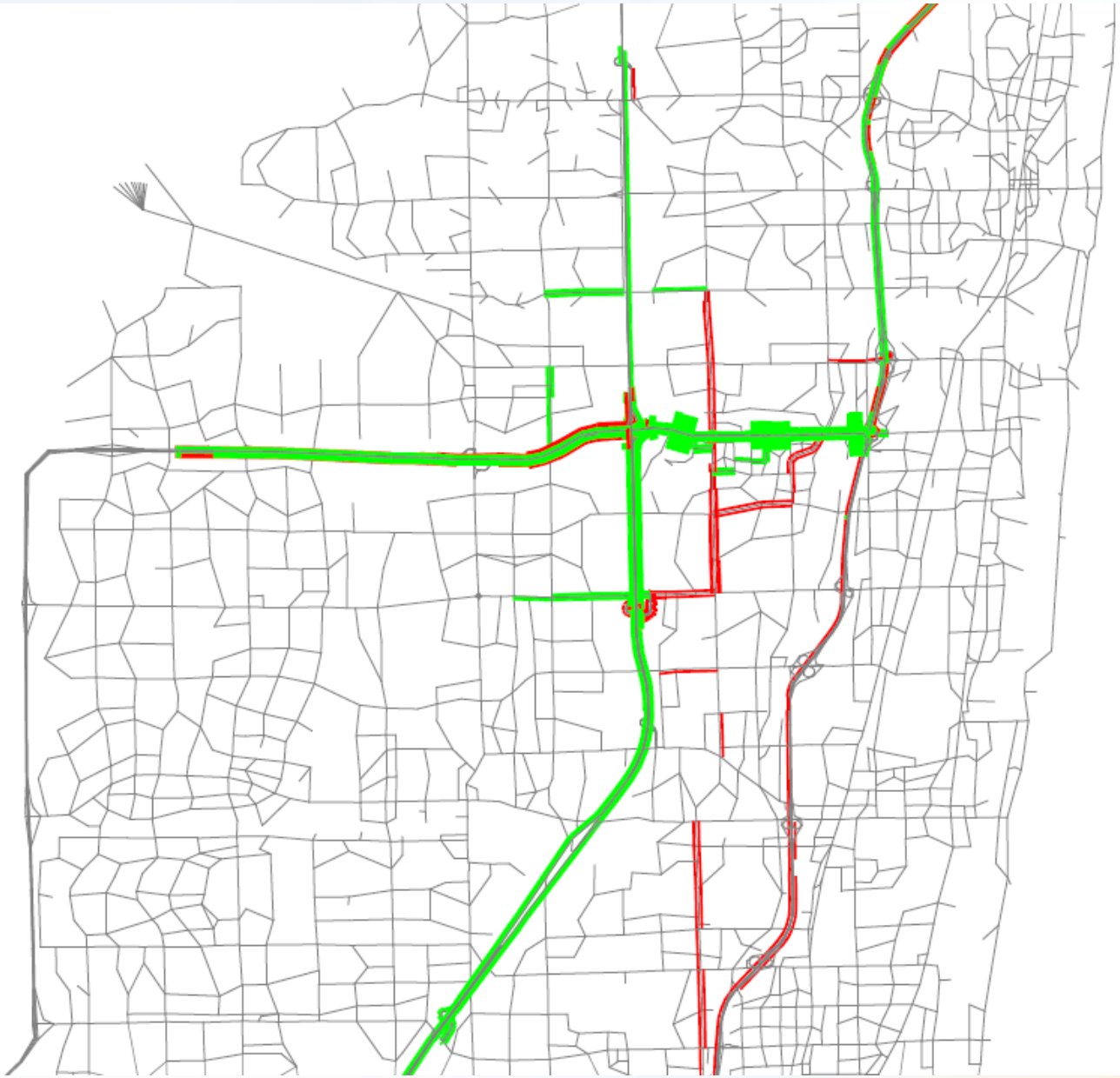
No-Build (NB)



Build

2040 SERPM Impacts

Build SW 10th minus No-Build No-Interchange



Traffic Increase

Traffic Decrease

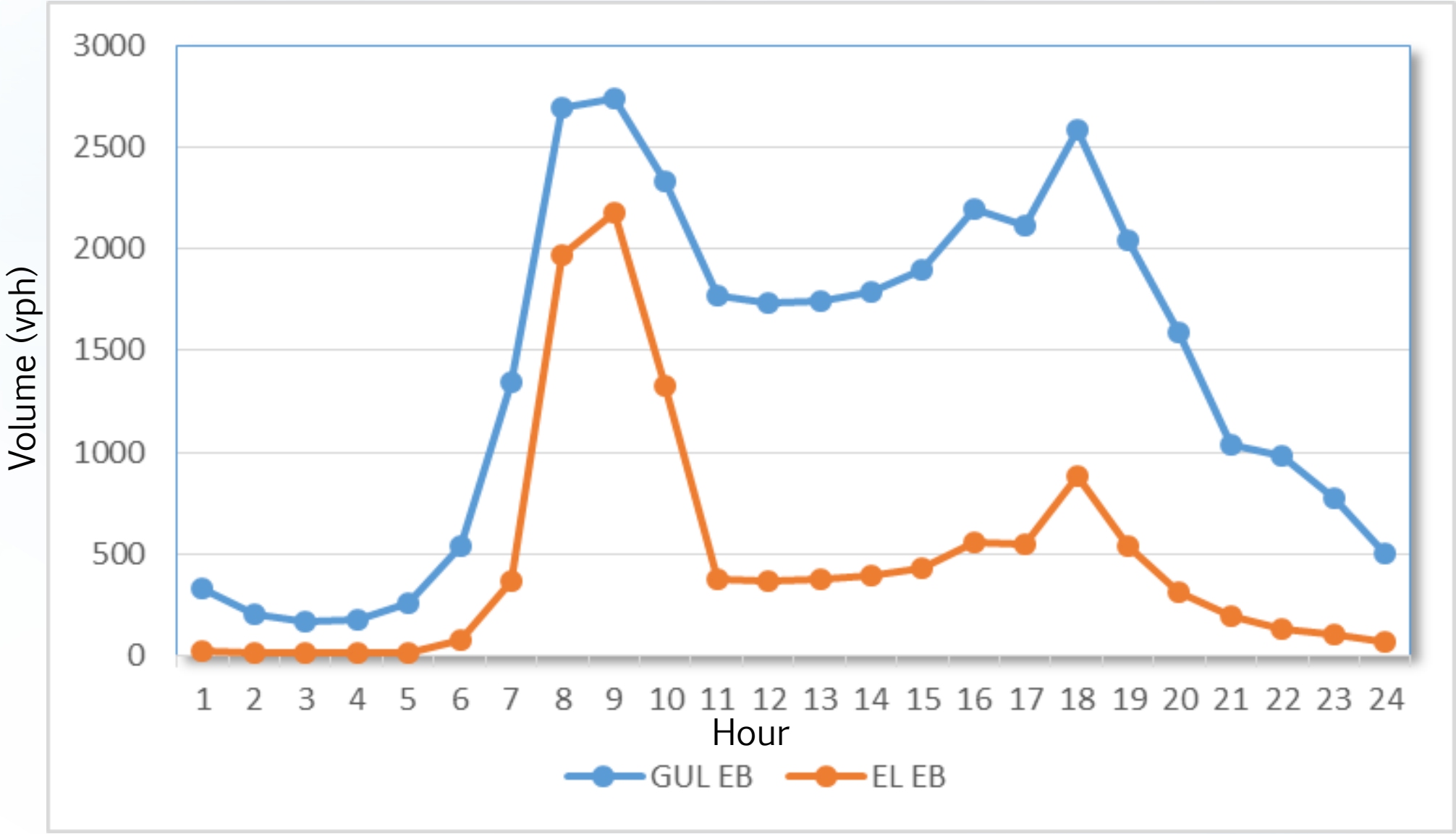
2040 AADTs

No-Build No-Interchange

No-Build

Build

ELToD Traffic Profile Output

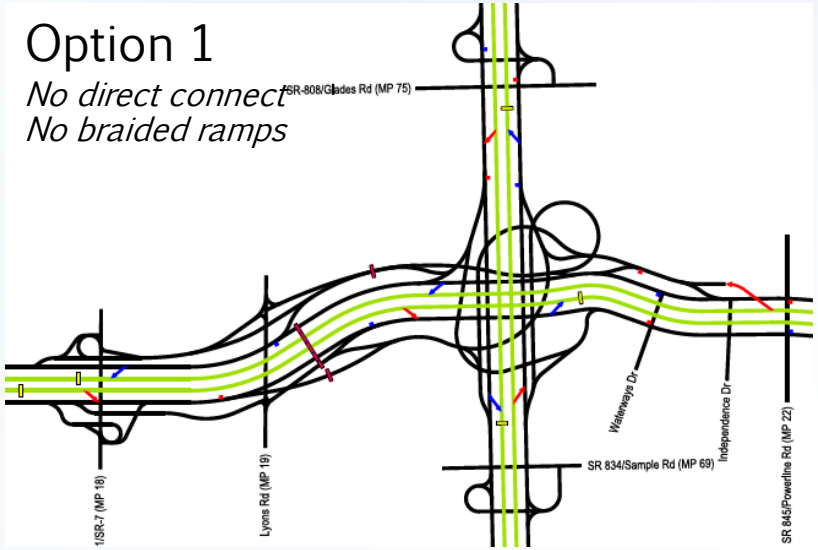


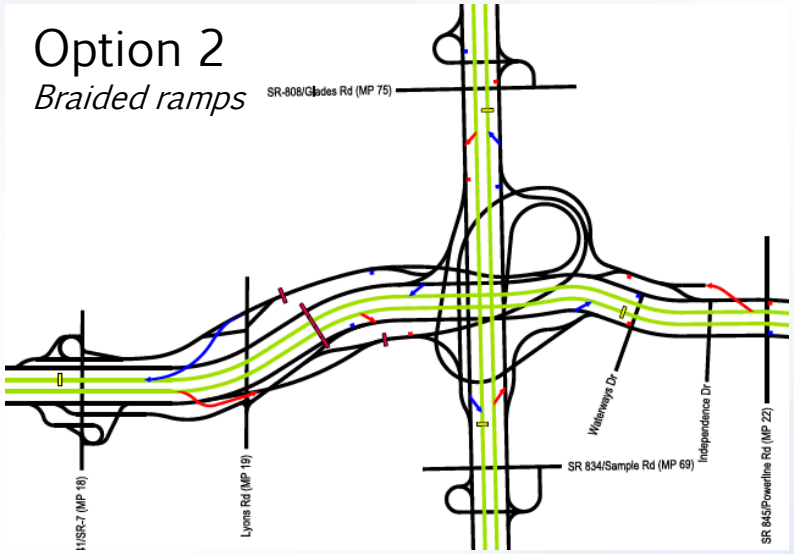
K Factor (EL AM) = 13.7%

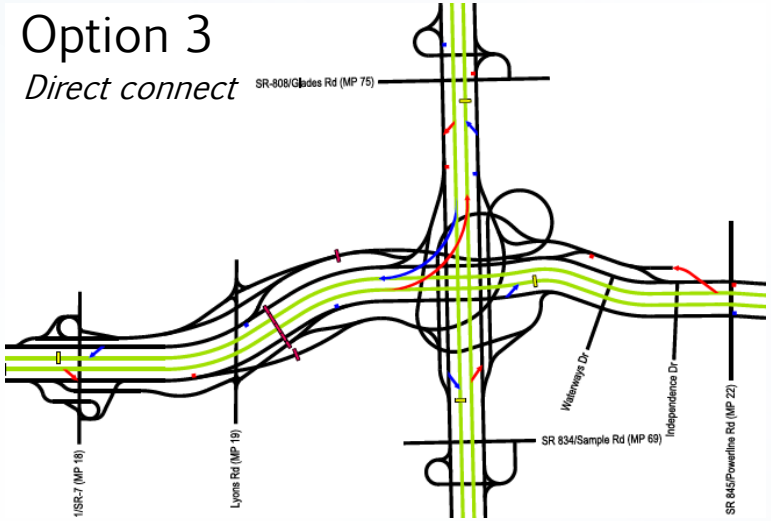
K Factor (GUL AM) = 7.8%

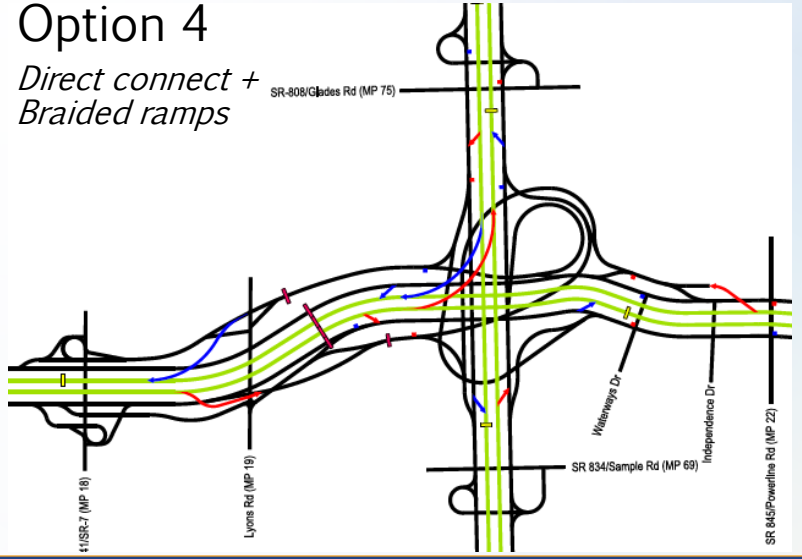
SW10th St. between Powerline Road and Military Trail

Sawgrass Expwy/Turnpike Options

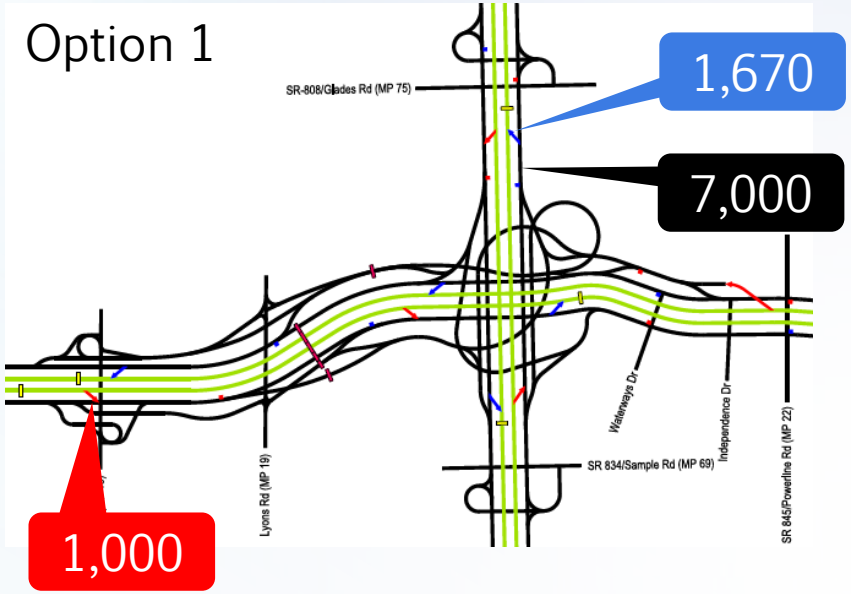


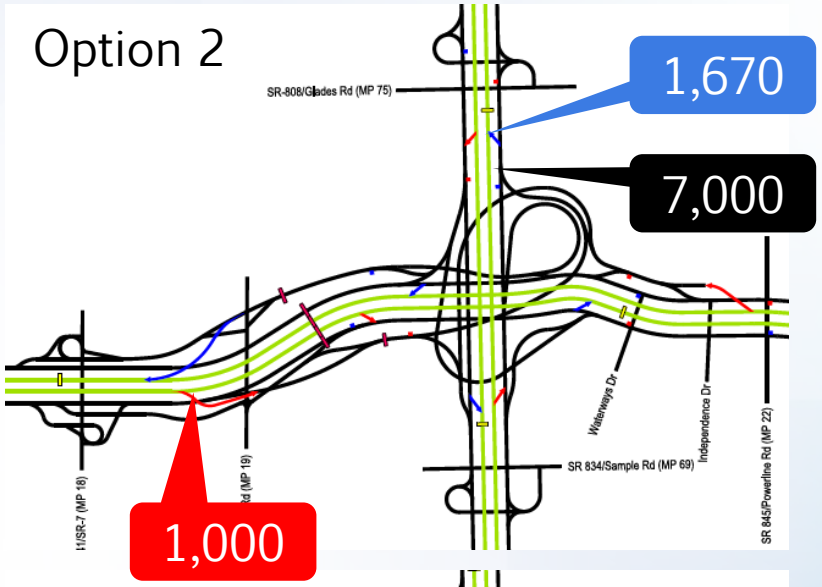


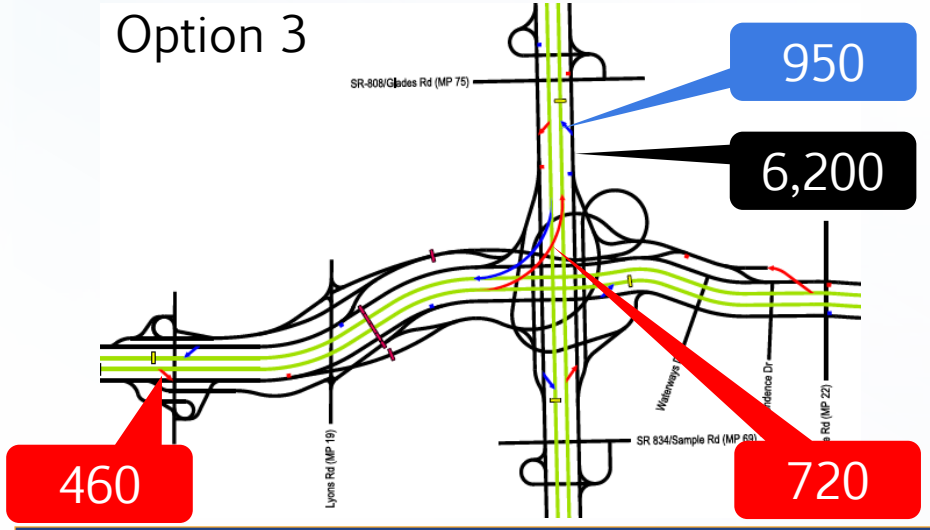


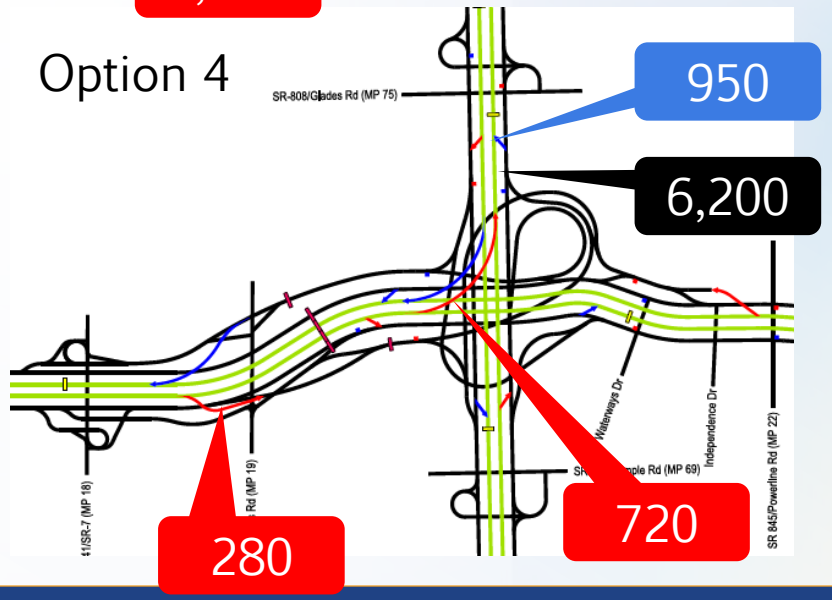


Sawgrass Expwy/Turnpike DDHVs

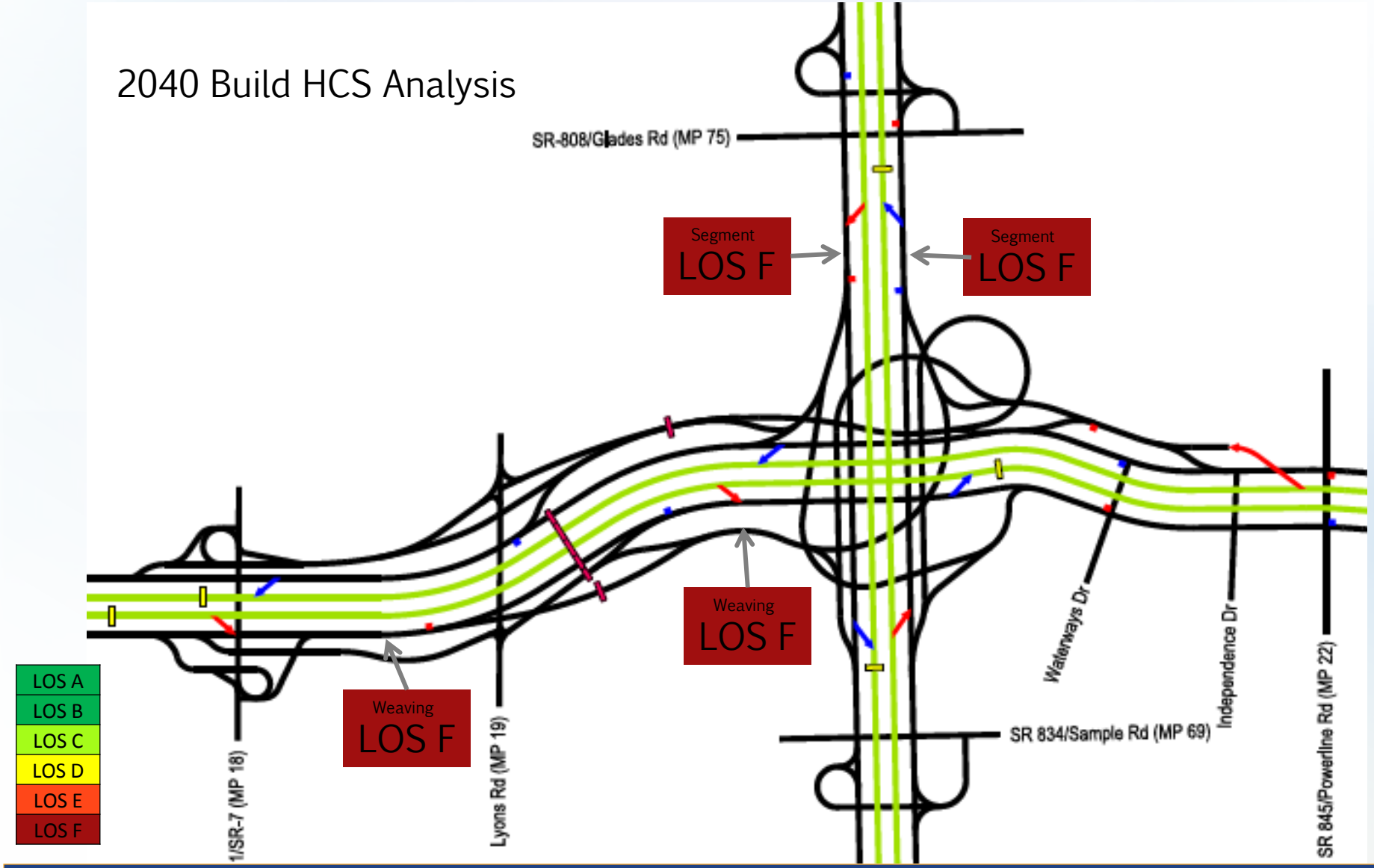




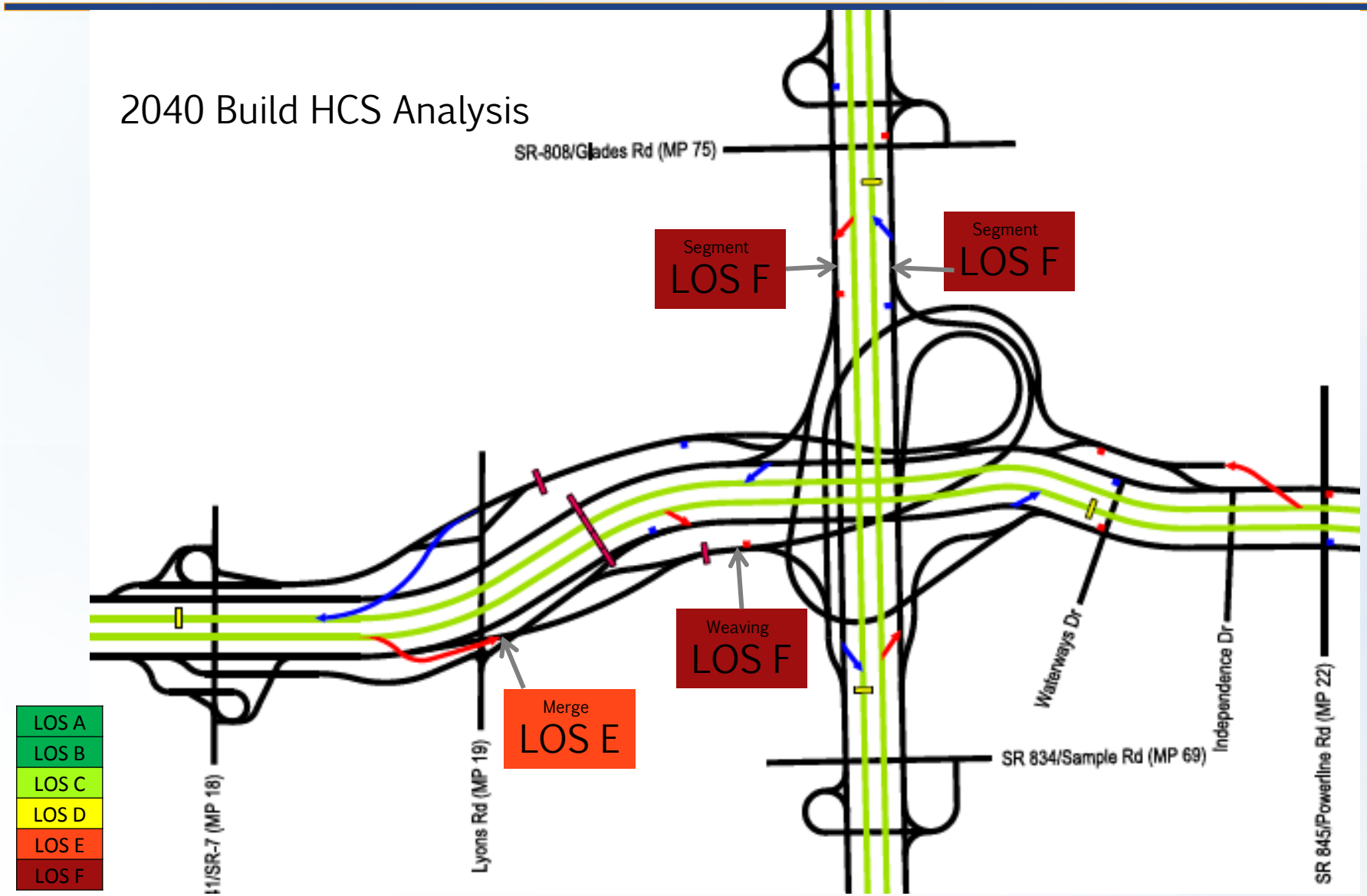




Sawgrass Expy/Turnpike – Option 1

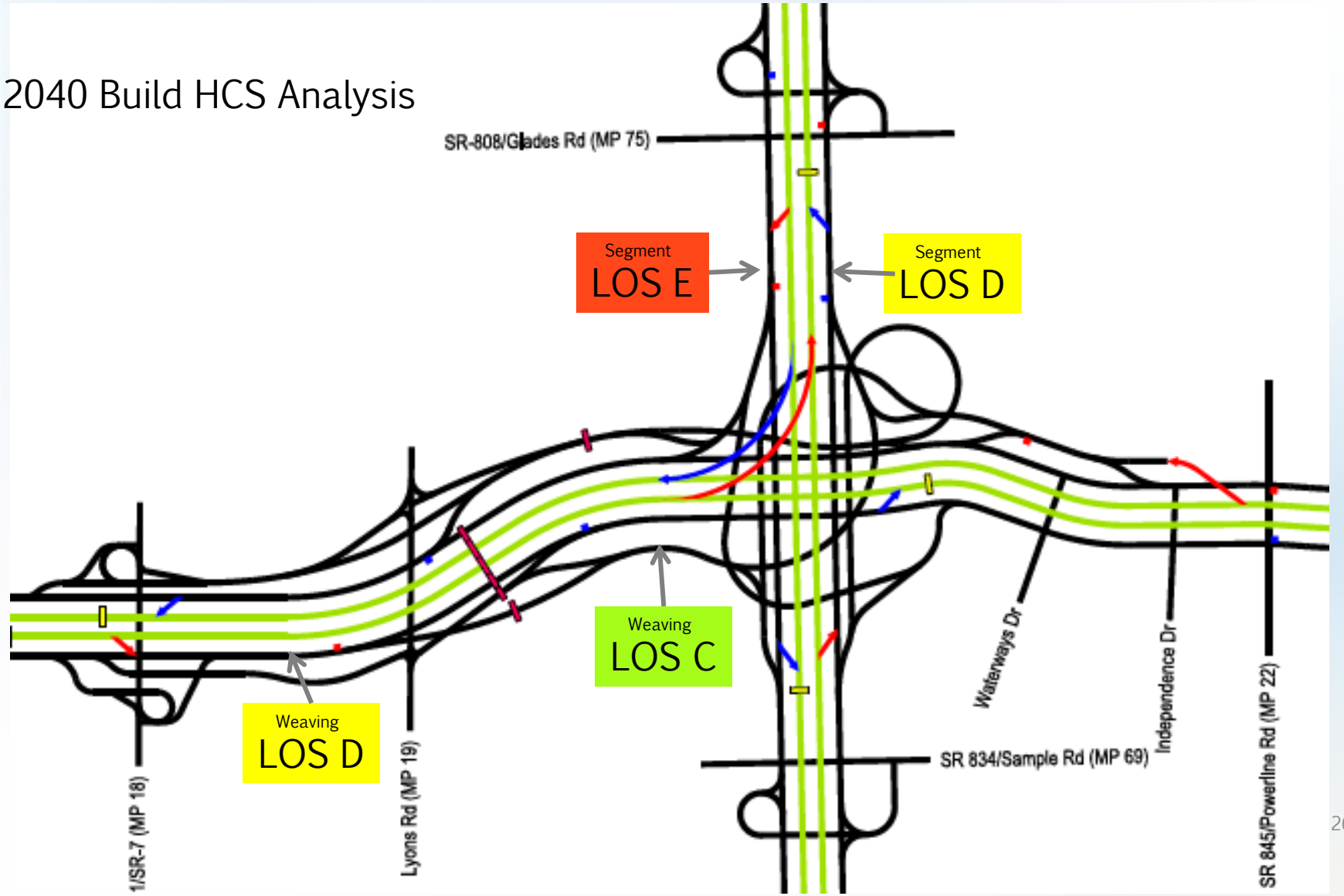


Sawgrass Expwy/Turnpike – Option 2



Sawgrass Expwy/Turnpike – Option 3

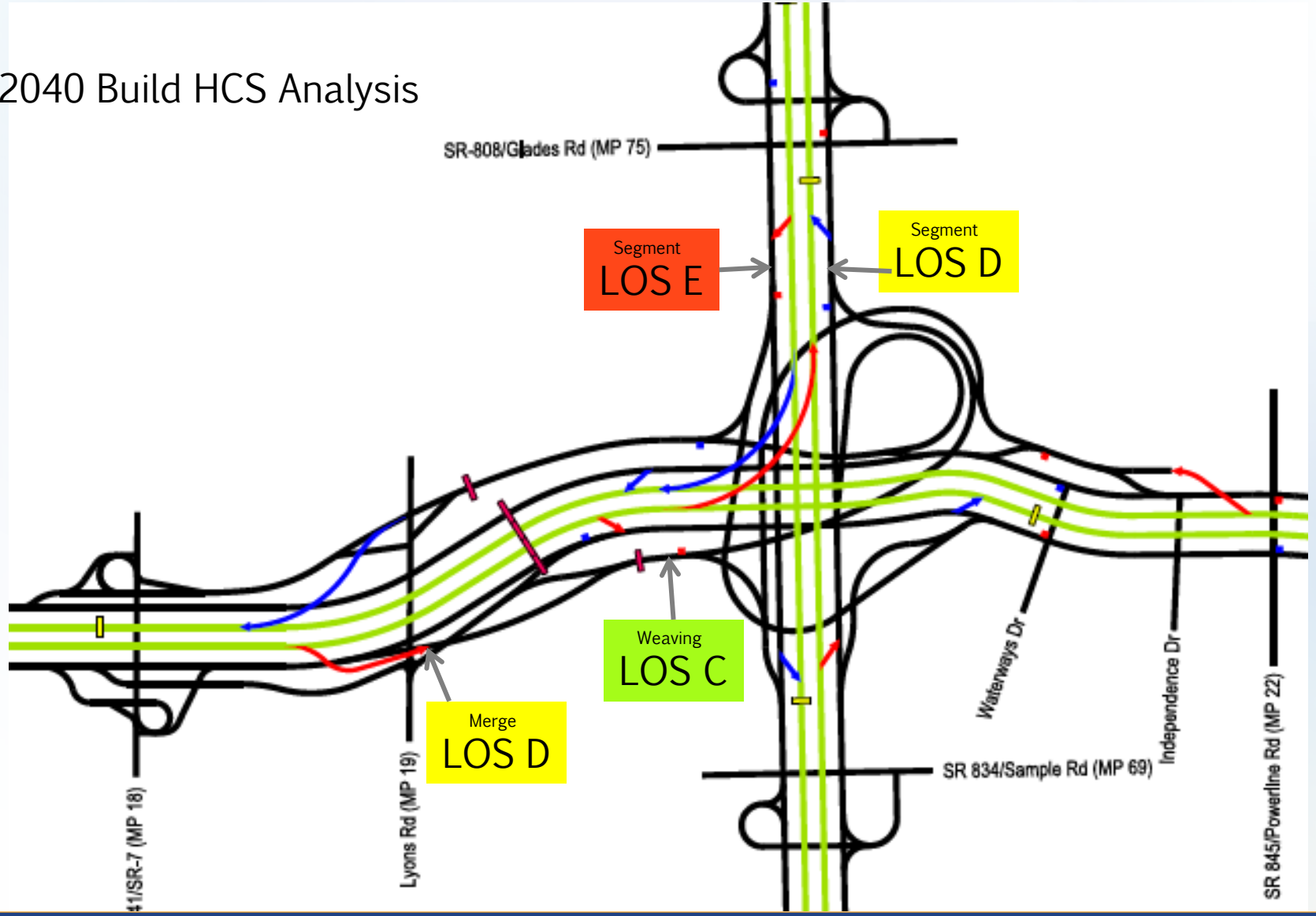
2040 Build HCS Analysis



LOS A
LOS B
LOS C
LOS D
LOS E
LOS F

Sawgrass Expwy/Turnpike – Option 4

2040 Build HCS Analysis



LOS A
LOS B
LOS C
LOS D
LOS E
LOS F

Option Evaluation Summary

Option 1	Option 2	Option 3	Option 4
• SB Turnpike Mainline North of Sawgrass Expressway – LOS F. • NB Turnpike Mainline North of Sawgrass Expressway – LOS F. • EB Sawgrass Expressway C-D Road to Turnpike – LOS F. • EB Sawgrass Expressway Mainline – LOS F.	• SB Turnpike Mainline North of Sawgrass Expressway – LOS F. • NB Turnpike Mainline North of Sawgrass Expressway – LOS F. • EB Sawgrass Expressway C-D Road to Turnpike – LOS F. • EB Express Lane Egress braided ramp to C-D – LOS F	• SB Turnpike Mainline North of Sawgrass Expressway – LOS E. • NB Turnpike Mainline North of Sawgrass Expressway – LOS D. • EB Sawgrass Expressway C-D Road to Turnpike – LOS C. • Fewer destinations	• SB Turnpike Mainline North of Sawgrass Expressway – LOS E. • NB Turnpike Mainline North of Sawgrass Expressway – LOS D. • EB Sawgrass Expressway C-D Road to Turnpike – LOS C. • Additional destination • Low Demand w/Braided ramp
Eliminate From Further Consideration	Eliminate From Further Consideration	Proceed Further in PD&E Process	Eliminate From Further Consideration

Benefits of ELToD model application for PD&E/Planning

- Complete multiple alternative scenarios in a short time
- More direct calculations of EL and GP design hour volumes than traditional approaches
- Minimizes post processing efforts
- Consistent assignment in controlled environment
- Design team can eliminate undesirable alternatives through comparison

Meeting Overview

What is ELToD and Why Use it?

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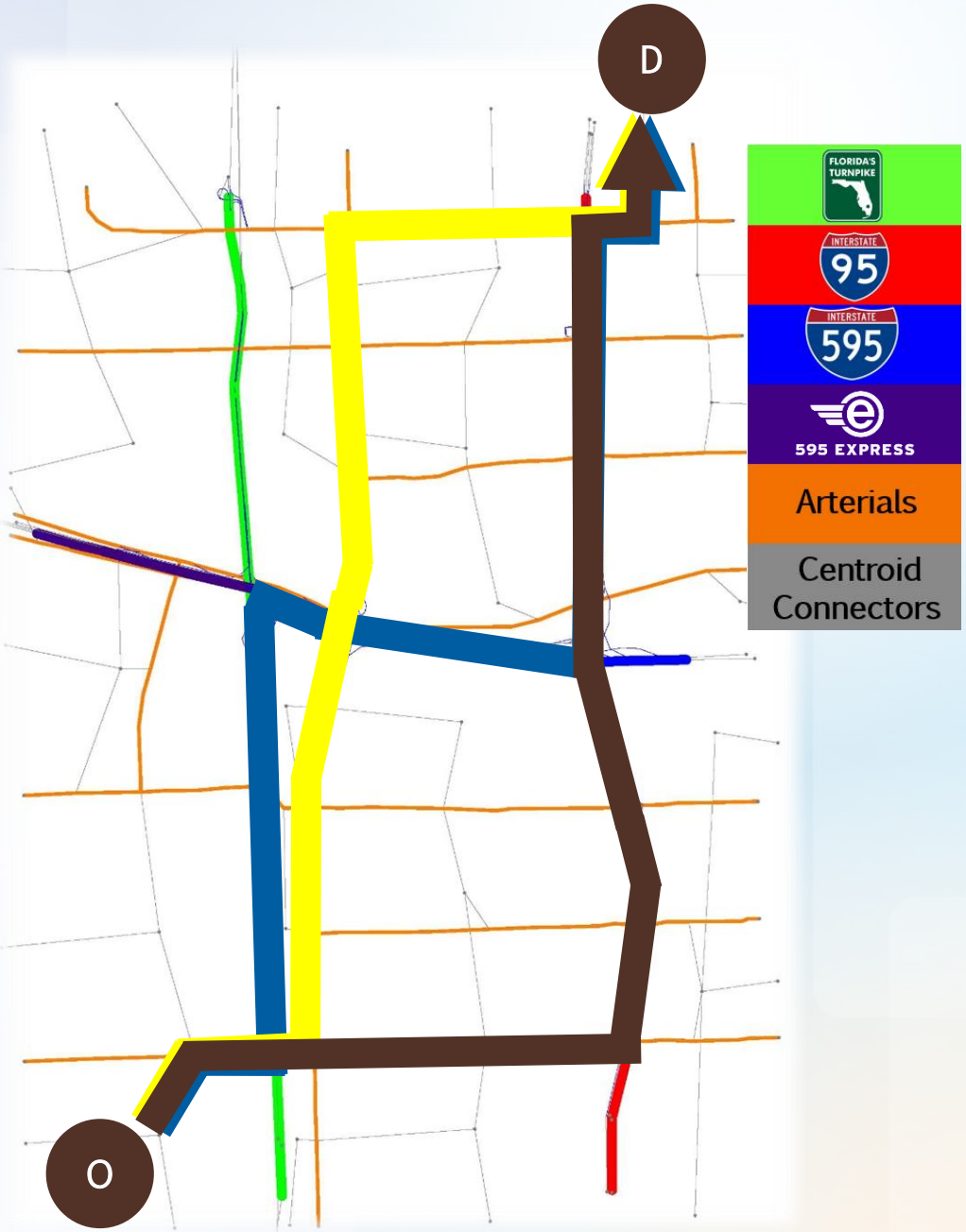
ELToD Future Enhancements

ELToD v3.0 Goals

1. Model a network of express lanes
   - Multiple express lane projects
   - Include regular toll roads and arterials
2. Improve multiple segment modeling
3. Maintain reasonable run times
4. Include Dynamic Traffic Assignment
5. Improve Toll Rate Calculations

Route Choices

1. Origin-destination pairs are not strictly required to use the express or general purpose lanes.
2. Arterial-only paths are possible.



Static vs. Dynamic Assignment

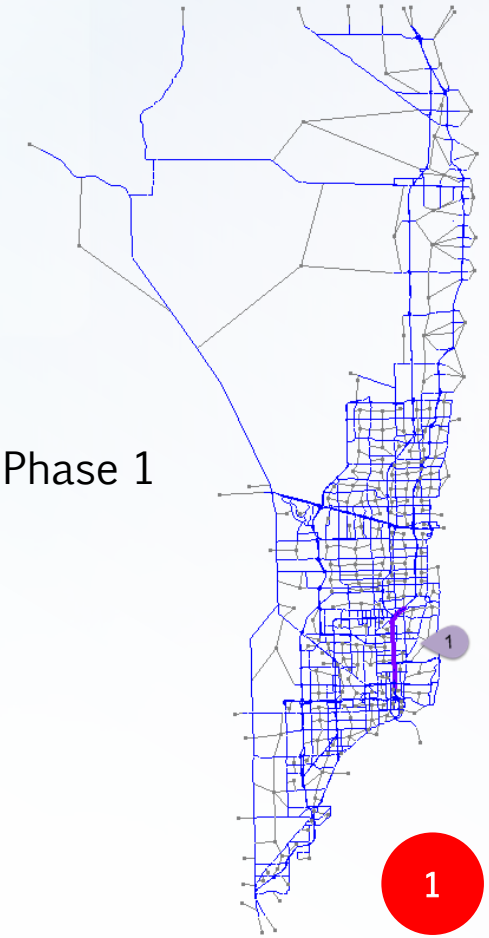
- What is Dynamic Traffic Assignment (DTA)?
- What are the advantages of DTA?

Static (ELToD 2.0)	Dynamic (ELToD 3.0)
• Driver decision before trip.	• Driver decision during trip.
• Smallest Time Interval = 1 hour.	• Smaller Time Interval = 15 minutes.
• Not designed for modeling static toll roads and express lanes together.	• Designed for modeling both static toll roads and express lanes.

South Florida Network

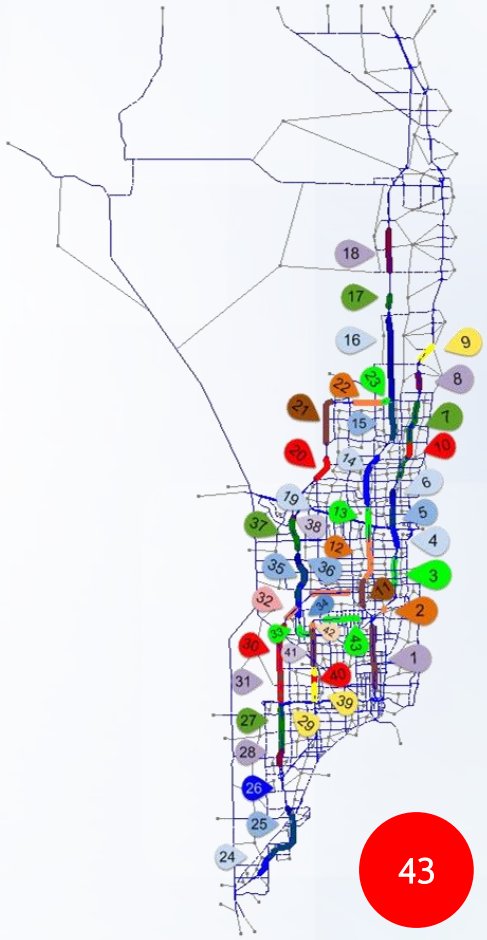
Base Year: 2010 Network

I-95 Phase 1



- I-95 Phase 1,2,3
- Turnpike Mainline
- I-595 Express
- HEFT
- Sawgrass
- I-75 Express
- 826 Palmetto Express

Future Year: 2040 Network



Thanks!

Questions?