15th International Conference on
Managed Lanes
May 5, 2016

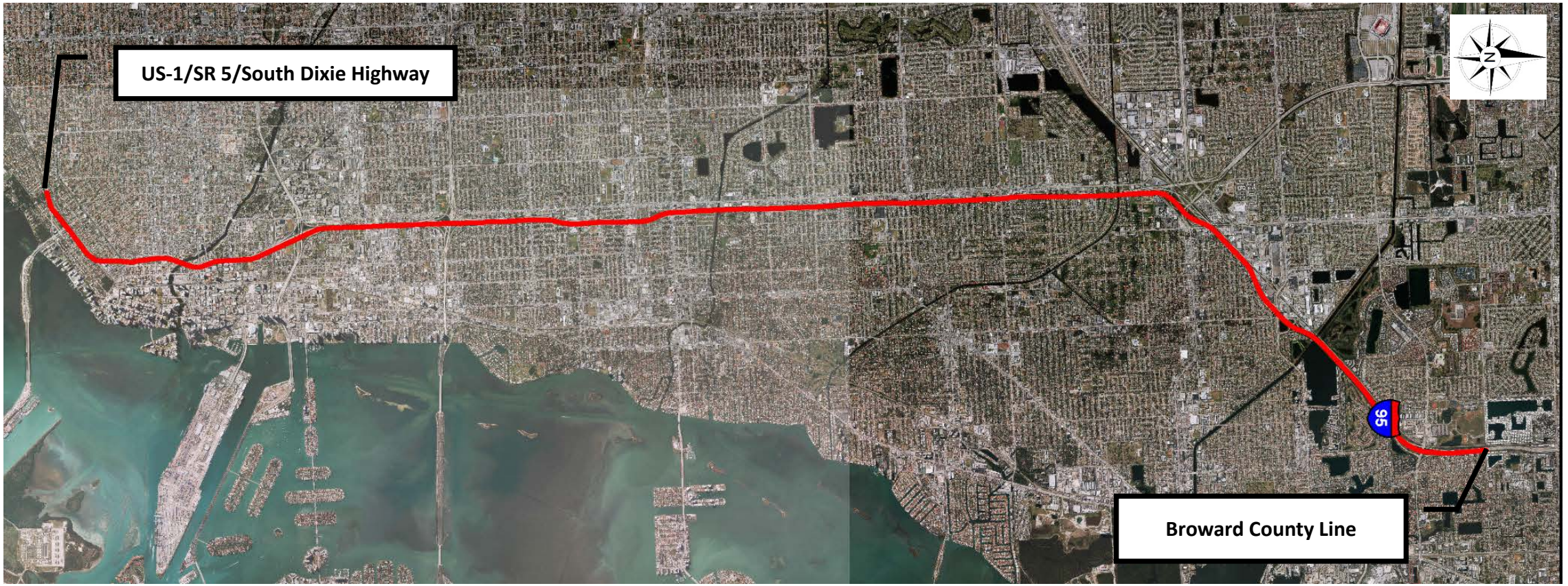
FDOT DISTRICT SIX

Corridor Planning Study

Project Overview

- Interstate 95 Corridor Planning Study from US-1/SR 5/South Dixie Highway to the Broward County Line
- Planning study will lead into multiple future Project Development and Environment (PD&E) Studies along the corridor to further evaluate improvements/alternatives
- Study will develop future traffic forecasts and a detailed operational model for use in future PD&E Studies
- Determine the mainline (GPL/EL) cross section of corridor

Project Limits

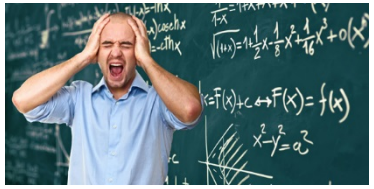


Managed Lane Simulation Analysis Project

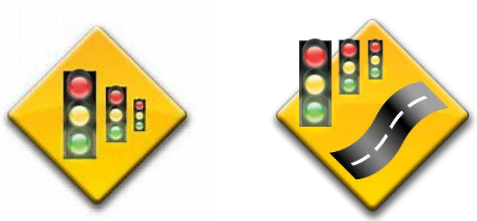
- High Volume, Congested freeway-facility (I-95) with a "**Dynamic-Tolling"** managed lane facility with sensor collection ("Express Lanes")
- **SunGuide** sensor data (speed, volume, density, etc.) available in 5-minute slices for real-time analysis
- Desire to produce a dynamic simulation model that can **accurately** replicate the existing logic in the dynamic-tolling managed lanes and the resulting change in vehicle behavior due to facility
- Model will need to be **advanced** and **flexible** to handle future changes in tolling logic and data collection techniques

Managed Lanes Analysis Toolkit – What Options?

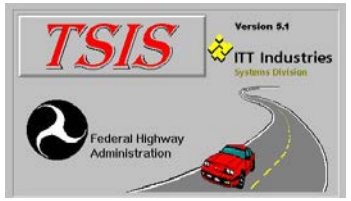
- Hand Calculations



- Operational Analysis Packages



- Static Simulation Packages



- Dynamic Simulation Packages

PTV VISSIM
the mind of movement

QuadstoneParamics
cutting edge microsimulation software

TransModeler
Traffic Simulation Software

Aimsun

VISSIM Managed Lanes Model Overview

- VISSIM utilizes a built in managed lane **Logit Model** to calculate the **"pay-no-pay"** decision in real-time
- Vehicles are given toll cost information as they approach facility and decide whether it is **"worth the money"**
- **The Logit Model utilizes:**
  - LogitA Coefficient: global value applied to all vehicle classes
  - Cost Coefficient: **value of money** applicable to each class/user
  - Time Coefficient: **value of time** applicable to each class/user
  - Base Utility: optional smoothing factor for decreasing/increasing probability of toll choice based on vehicle type or other precipitating factors

VISSIM Managed Lanes Model Overview

- When approaching facility, each vehicle is assigned a **"toll utility"** as U(toll) based on the vehicle type and/or other characteristics:

U(Toll) = Cost coefficient ● Current Toll Amount + Time coefficient ● Time gain + Base utility

- Then the utility U(toll) is used to calculate the probability of each vehicle:

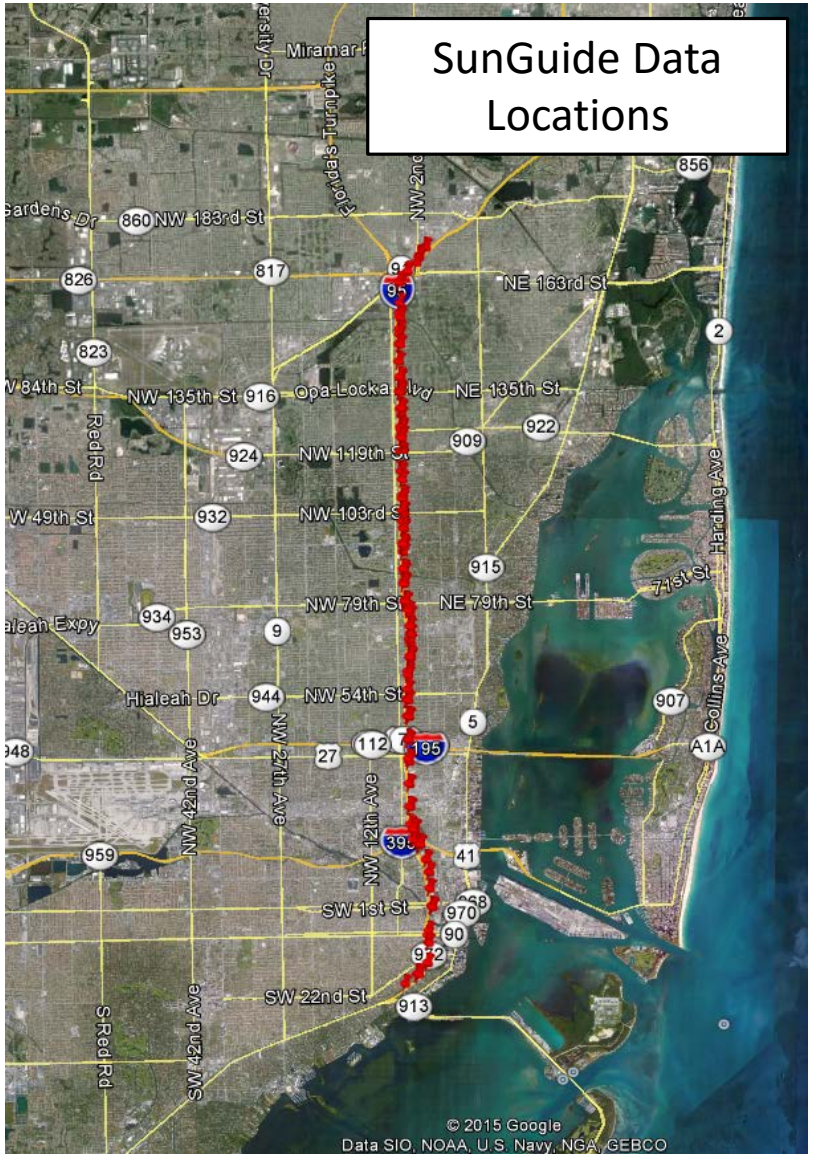
$$P_{(Toll)} = 1 - \frac{e^{a*U_{Toll-free}}}{e^{a*U_{Toll-free}} + e^{a*U_{Toll}}} = 1 - \frac{1}{1 + e^{a*U_{Toll}}}$$

**The utility of the toll-free lane ($U_{toll-free}$) is always zero, since there is neither a toll, nor time gain comparing to itself*

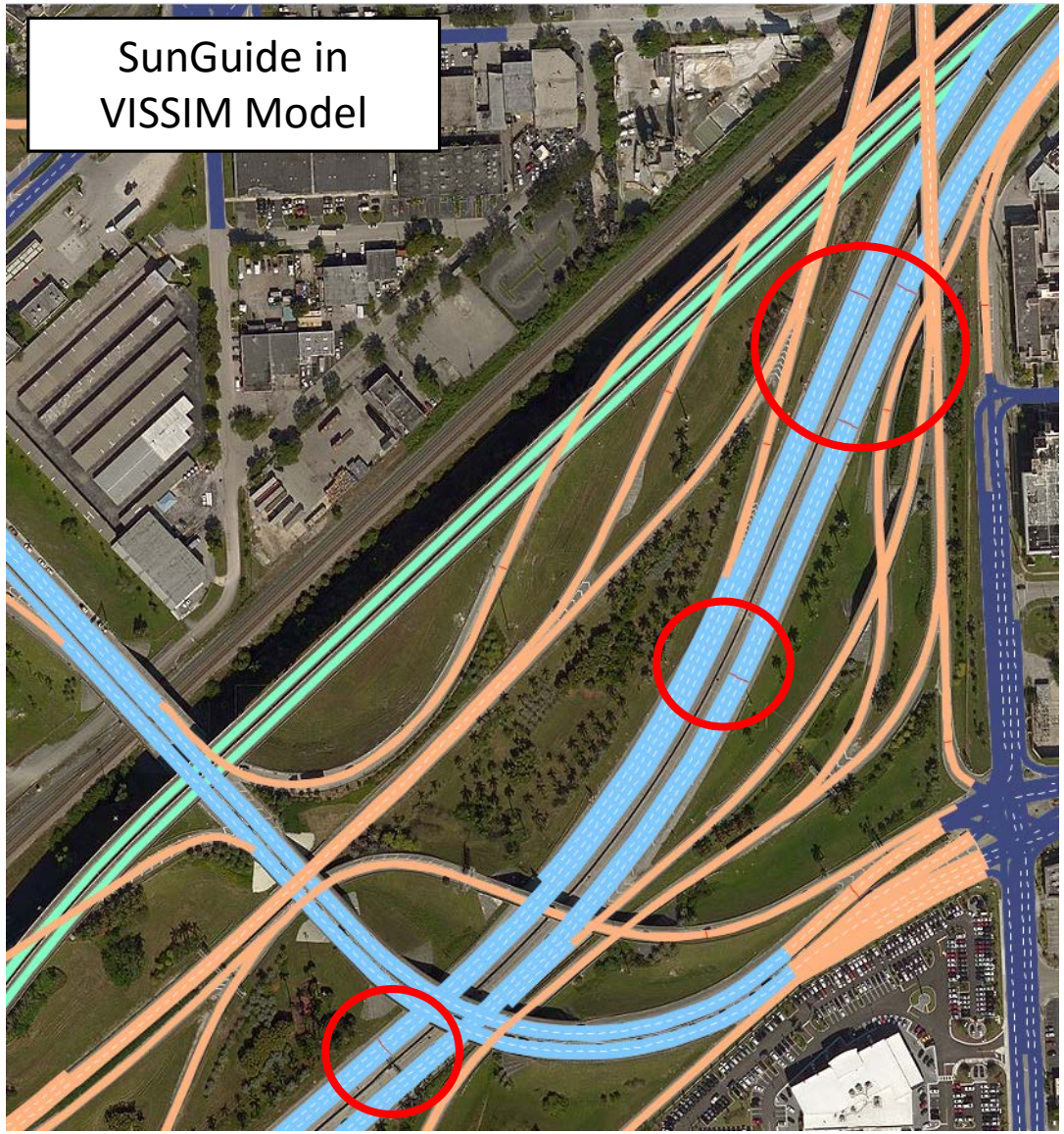
Useful Features of VISSIM for Managed Lanes

- Dynamic "agent-based" microsimulation models accurately portray congestion/bottlenecks/speeds in order to appropriately replicate managed lane logic and vehicle response
- **"Managed Lanes Module"** takes care of the logic and behavioral response to dynamic ITS facilities
- **"Managed Lanes Routing"** set within the model allows an analysis of savings for any number of alternative routes (travel time vs. cost) as well as look ahead distance for ITS signage replication
- **"Data Collection Points"** allow very customizable and reliable dynamic data collection and aggregation by lane and direction

SunGuide Data Locations



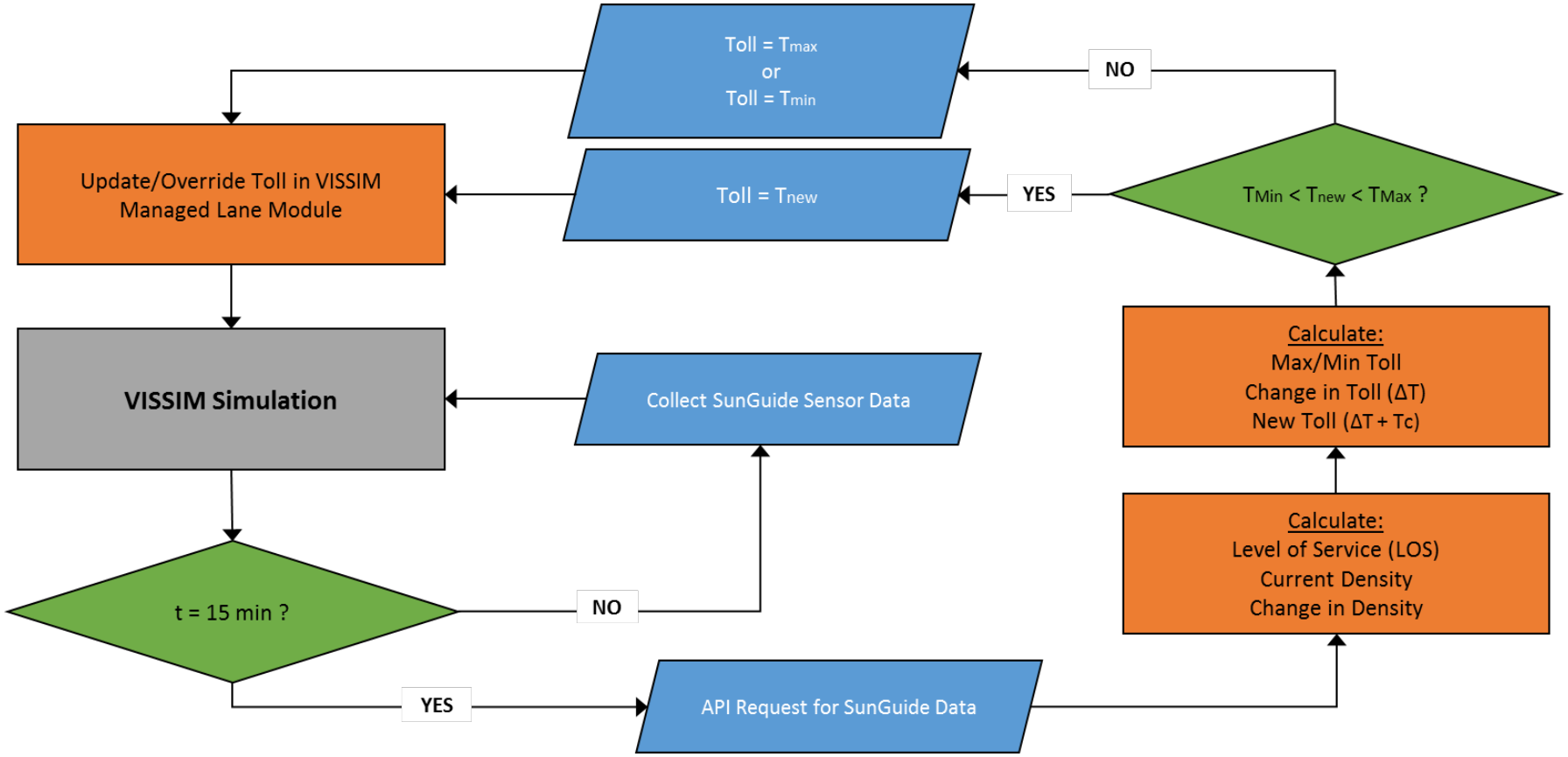
SunGuide in VISSIM Model



Expanding VISSIM for Better ITS

- One **shortcoming** of "managed lane modules" in **all** dynamic sim packages is lack of toll customization and real-time pricing response
- In addition, tolling algorithms are different based on **location and facility**, including for the I-95 "Express Lanes"
- Luckily, VISSIM allows for coding modification/extension through the **API/Scripting suite**
- Through this, the VISSIM model can be modified to collect and aggregate data like the SunGuide system, and then run the algorithms to determine/implement the tolls based on **real-time conditions**

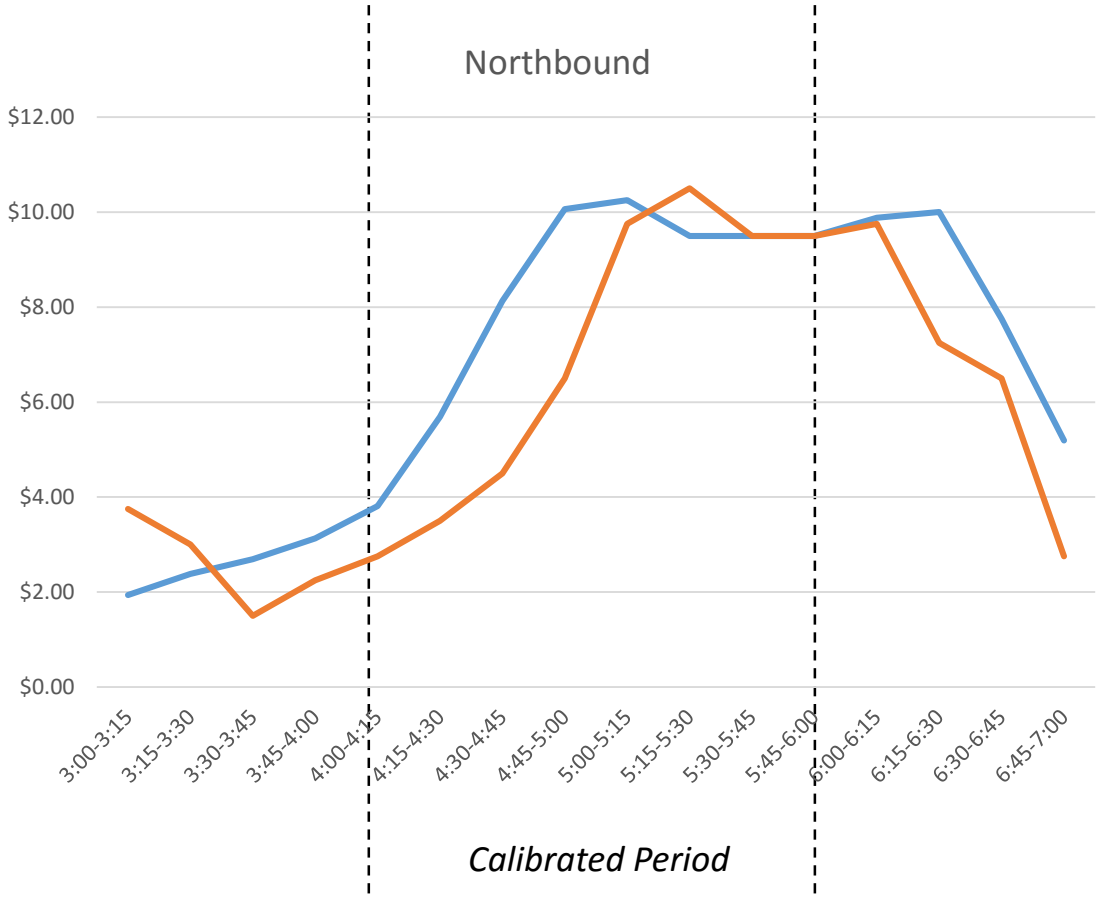
VISSIM Managed Lane API Logic

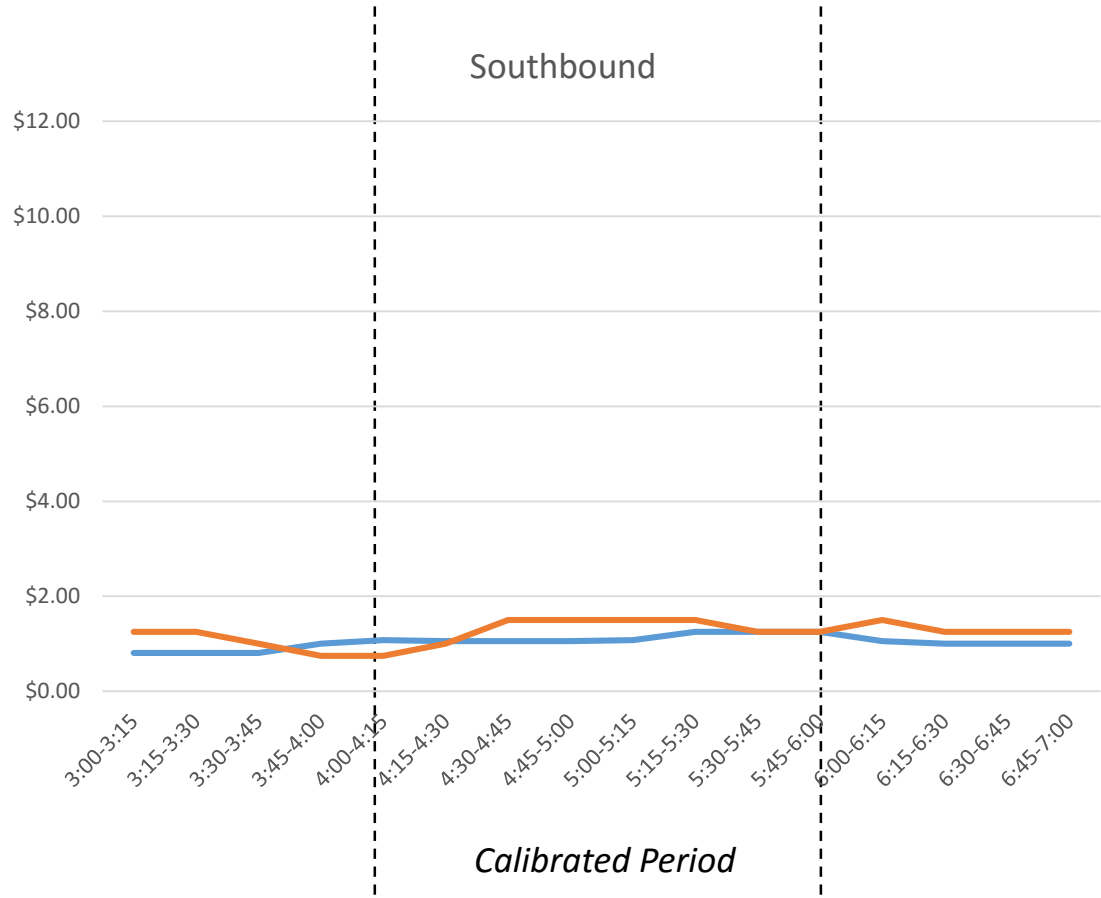


Closing Thoughts on Dynamic Simulation

- Use of simulation suites such as VISSIM (and others) are useful for many reasons (but not limited to):
  - Second-by-second **real-time realistic response** to conditions by both vehicles and infrastructure
  - Many useful features for ITS replication, data collection, and analysis
  - Modification of base code to suit any possible facility-type, law or logic, physical location, or desired future alternative analyses
- The logic of these simulation packages can also be expanded for use in other next-generation ITS technologies and facilities

Modeled vs. Actual Toll Calculation





Actual SunGuide Toll
VISSIM Modeled Toll

Questions?

DRIVING DOWN FATALITIES