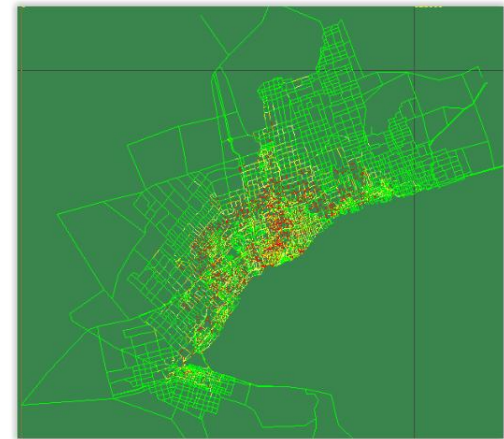


# A Dynamic Traffic Assignment Model for the GTA

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Aya Aboudina, PhD Candidate  
Baher Abdulhai, Ph.D., P.Eng.



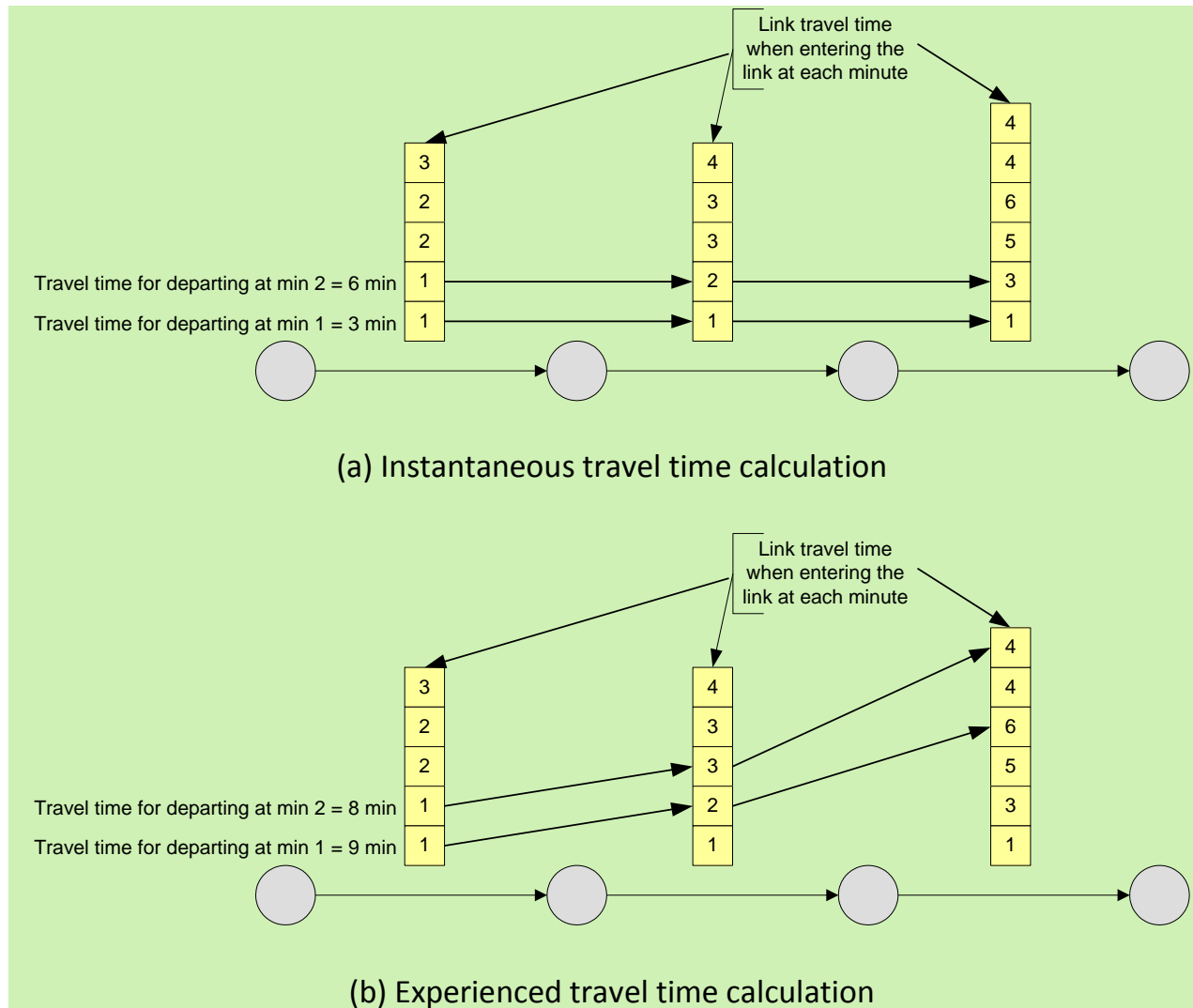
UNIVERSITY OF TORONTO  
FACULTY OF APPLIED SCIENCE & ENGINEERING  
Transportation Research Institute

# STA and DTA

- In a network with many OD zones and a **time period of interest**, for **each OD pair and departure time**, all used routes have equal and lowest **experienced travel time (generalized cost)**. No user may lower his experienced travel time through unilateral action (**deterministic DTA**).
- In a network with many OD zones, for **each OD pair**, all used routes have equal and lowest **travel time (generalized cost)**. No user may lower his travel time through unilateral action (**deterministic STA**).

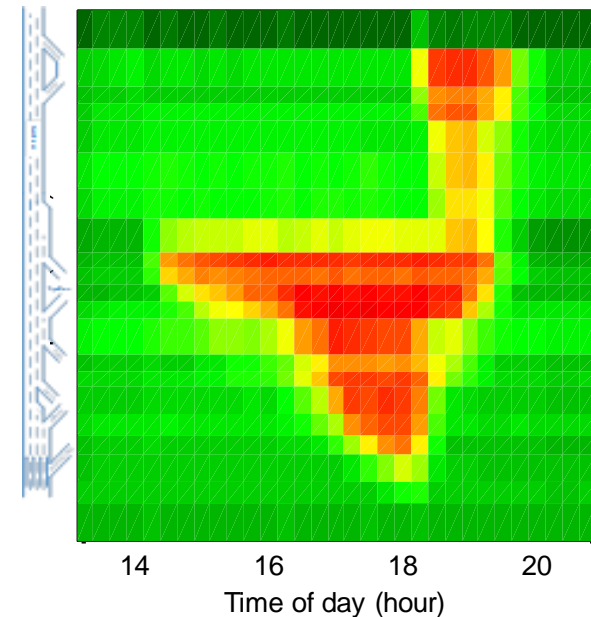


# Experienced vs Instantaneous Travel Time



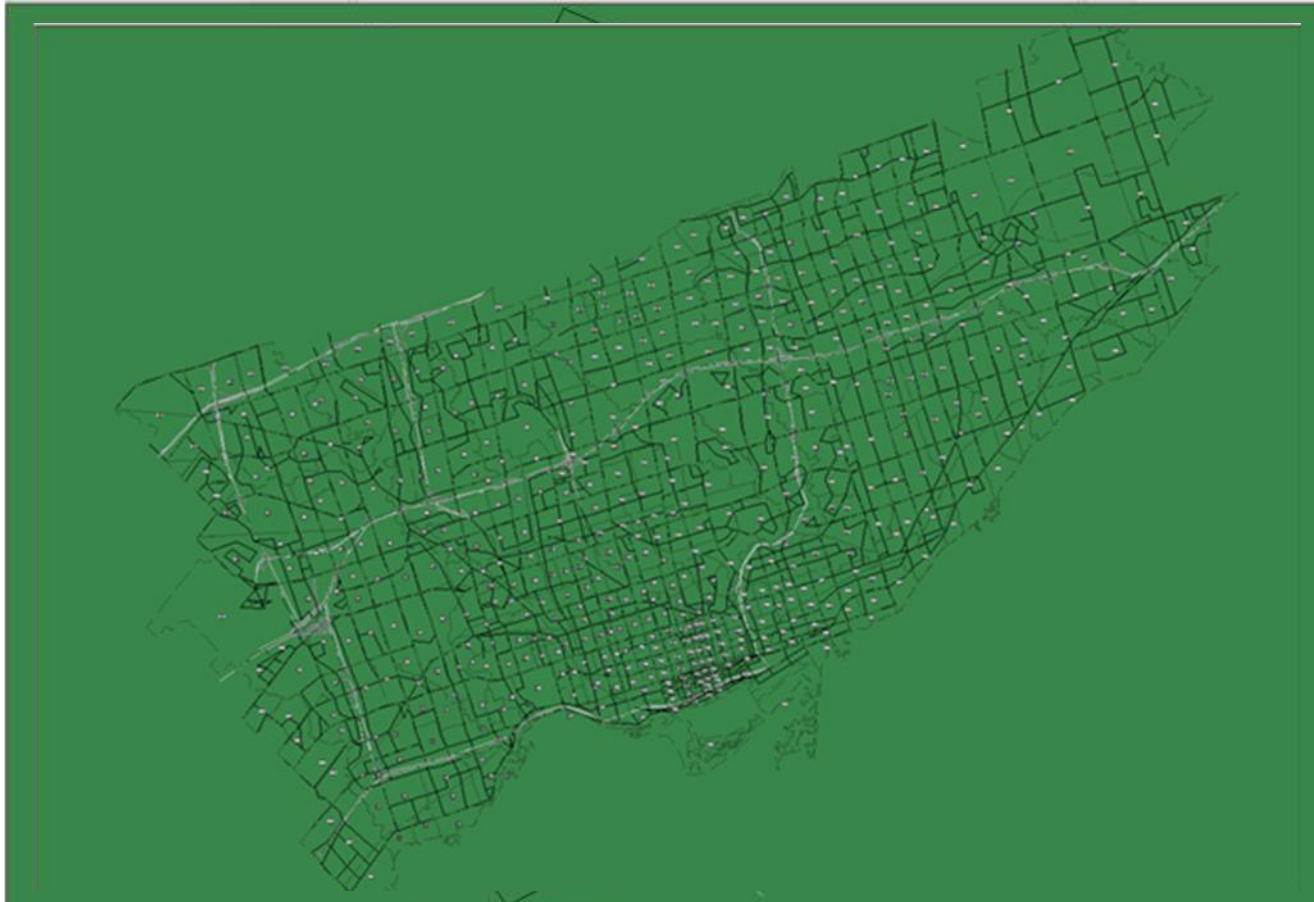
# Why / When do you need Dynamic ?

- Captures the onset and spread of congestion over space and time
- Essential to design control strategies:
  - Ramp Metering
  - Dynamic Congestion Pricing
  - Traffic Signal Control
  - Evacuation Optimization
  - ....etc.



# Applications – Mesoscopic Level

- **Evacuation of City of Toronto**

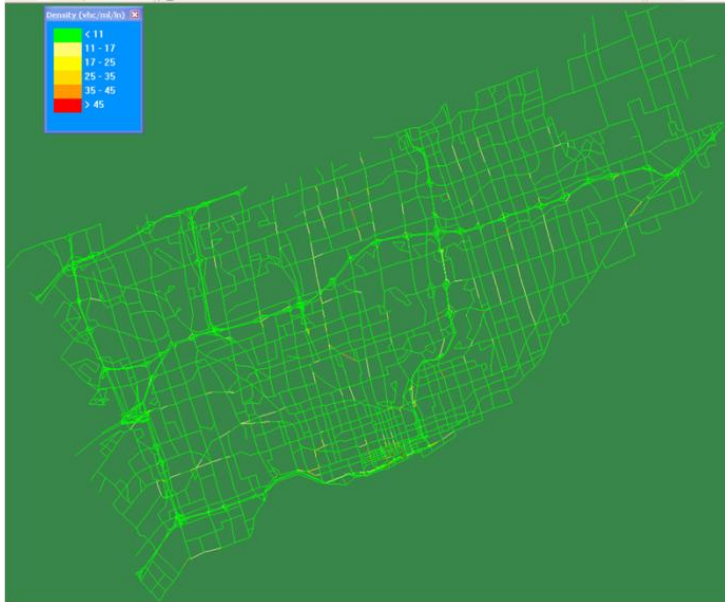


# Optimized Evacuation of Toronto *2.25 M People*

- Avg Evacuation Time = 2 Hrs
- Network Clearance Time = 8 Hrs
- Avg Stop Time = 0.5 Hrs

- Avg Evacuation Time = 7 Hrs
- Network Clearance Time = 30 Hrs
- Avg Stop Time = 6 Hrs

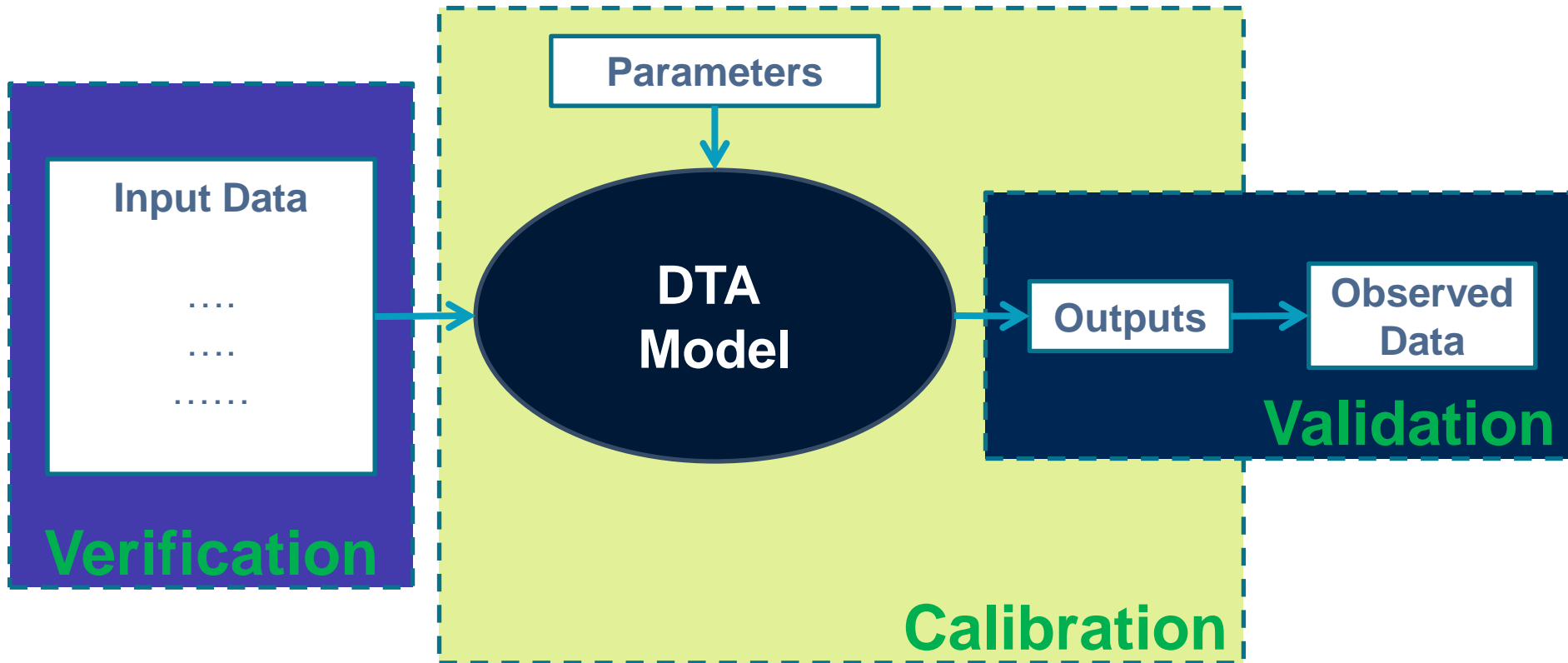
Optimal Plan (OSTE)



Do-Nothing

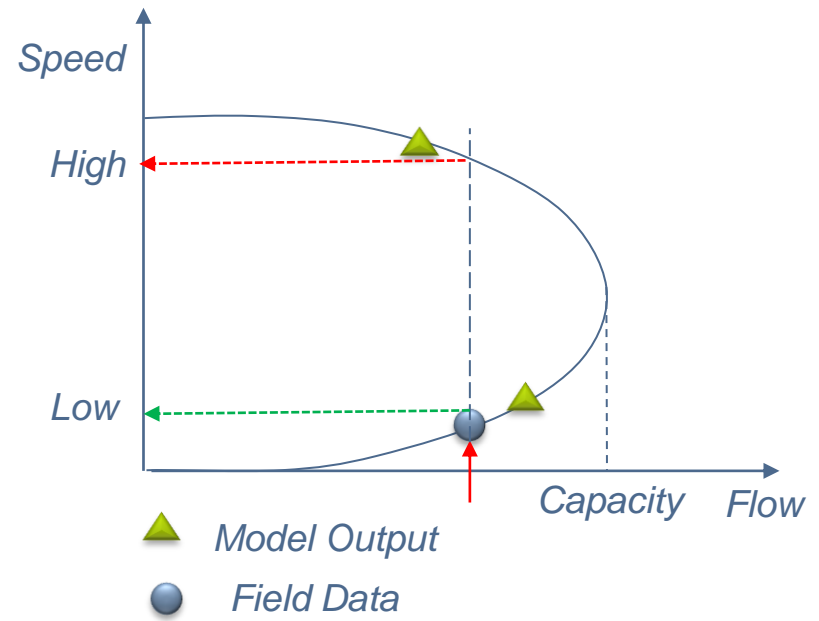
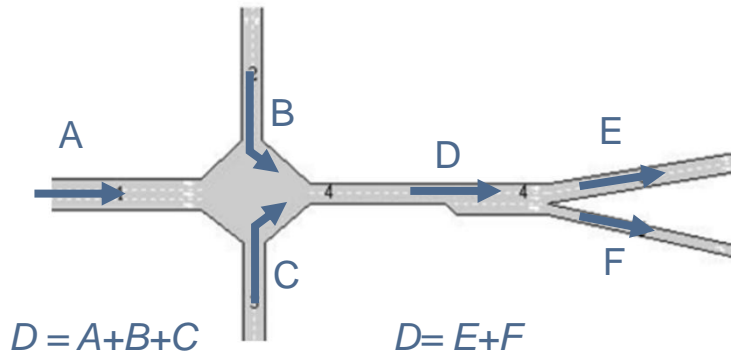


# Overall Modelling Approach



# Verification of Input Data

- Consistency, volume balance (multiple sources of data)
- Volumes and Speeds (congested or uncongested)

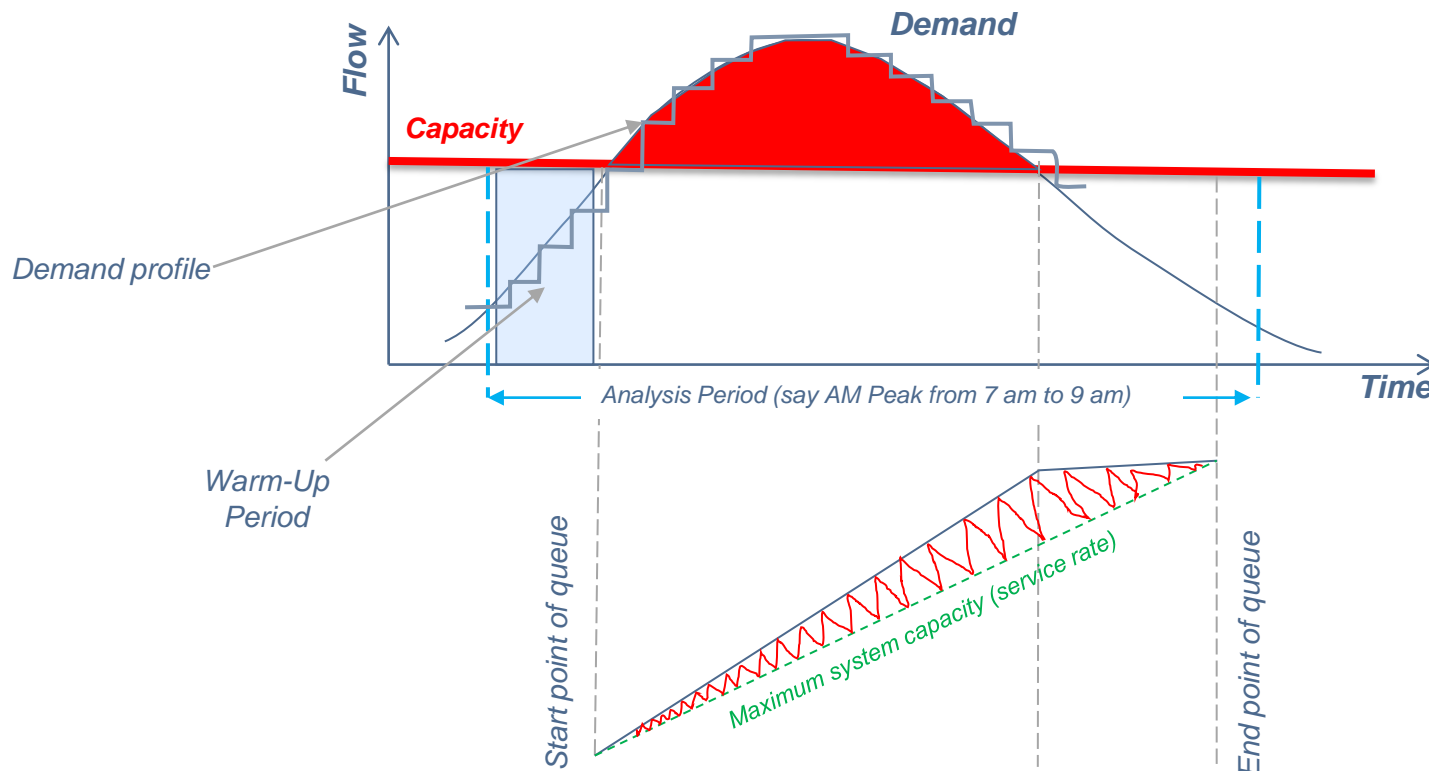




# Notes on Demand Data



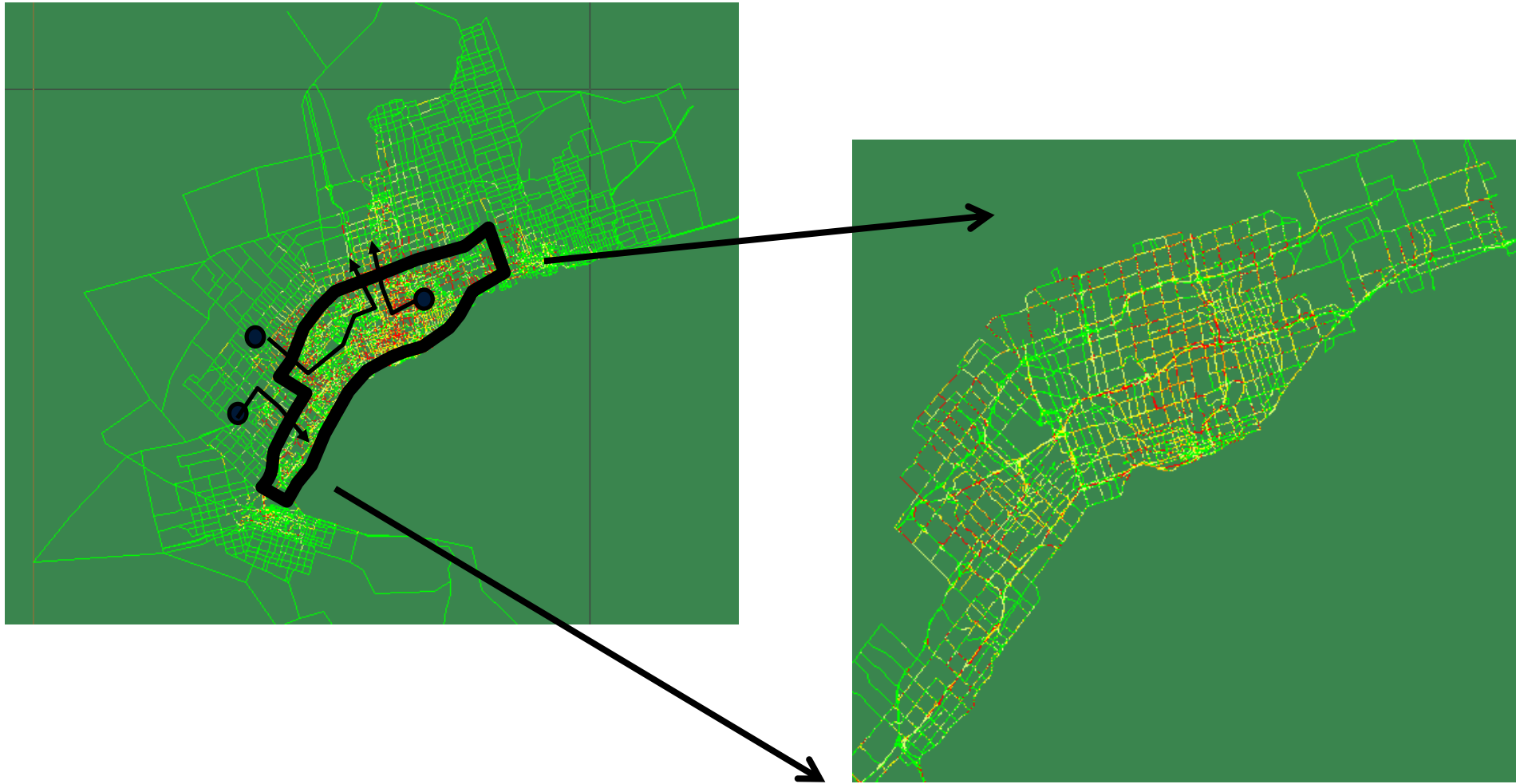
- Capacity vs Demand
- Time-dependent demand (demand profile)



# Calibration: Iterative Process



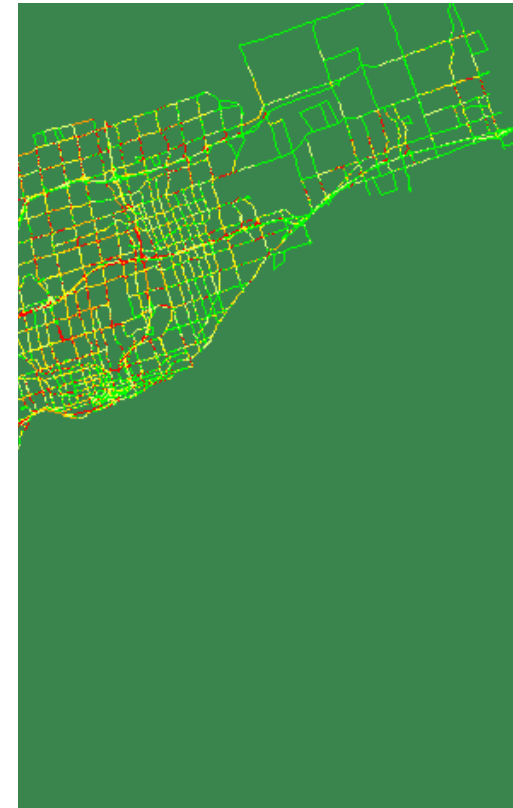
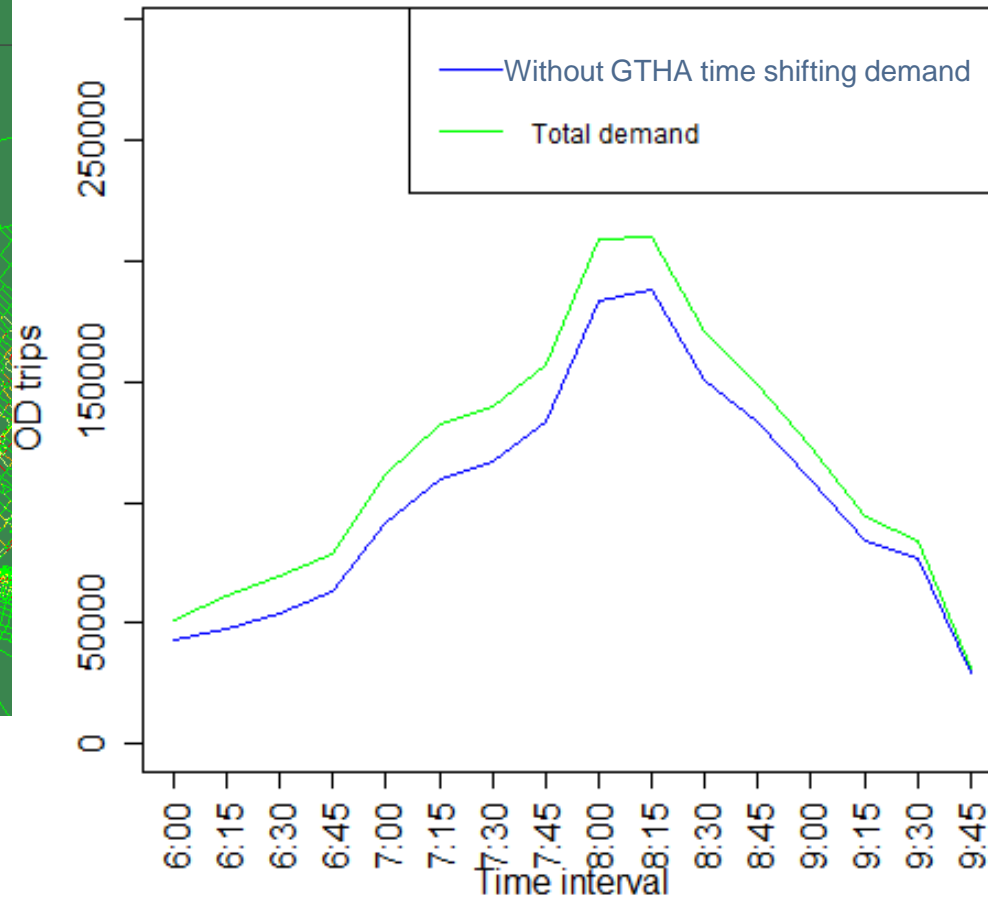
# Model Scope: GTA



# Demand Shifting from GTHA to GTA



**GTA Total Demand Profile**



# Calibration Criteria

The GEH statistic is computed as follows:

$$GEH = \sqrt{\frac{(V - C)^2}{(V + C)/2}} \quad \text{Equation 6}$$

where:

GEH = The statistic

V = model estimated directional hourly volume at a location.

C = directional hourly count at a location.

*Example:*

- a)  $v = 10000, c = 9000 \rightarrow \% \text{ Diff} = 10\%$
- b)  $v = 1000, c = 900 \rightarrow \% \text{ Diff} = 10\%$

*Example:*

- a)  $v = 10000, c = 9000 \rightarrow GEH = 10.3$
- b)  $v = 1000, c = 900 \rightarrow GEH = 3.2$

**GEH < 5**

**5 < GEH < 10**

**10 < GEH < 15**

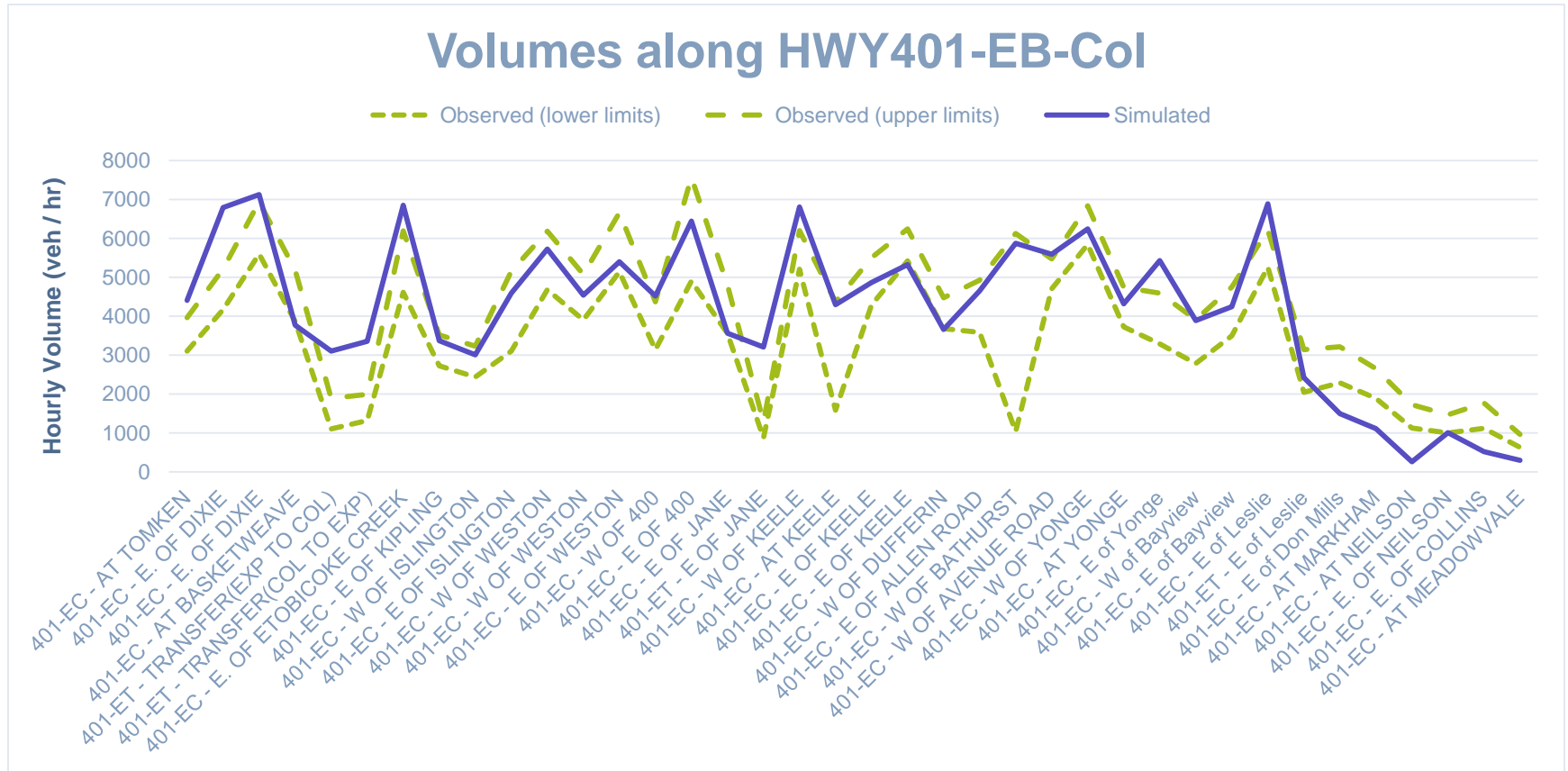
**(Perfect)**

**(acceptable)**

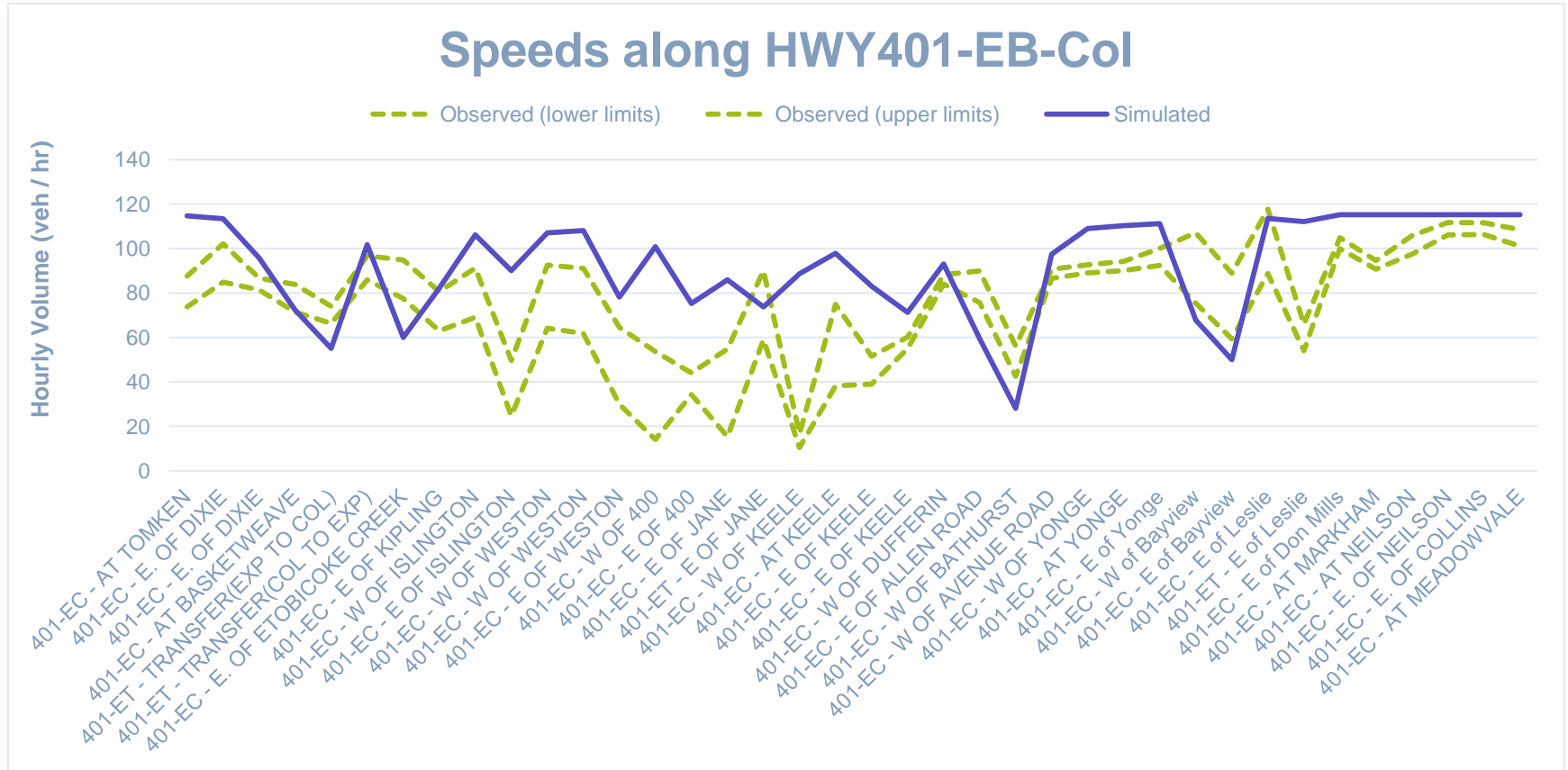
**(question data quality or model performance)**



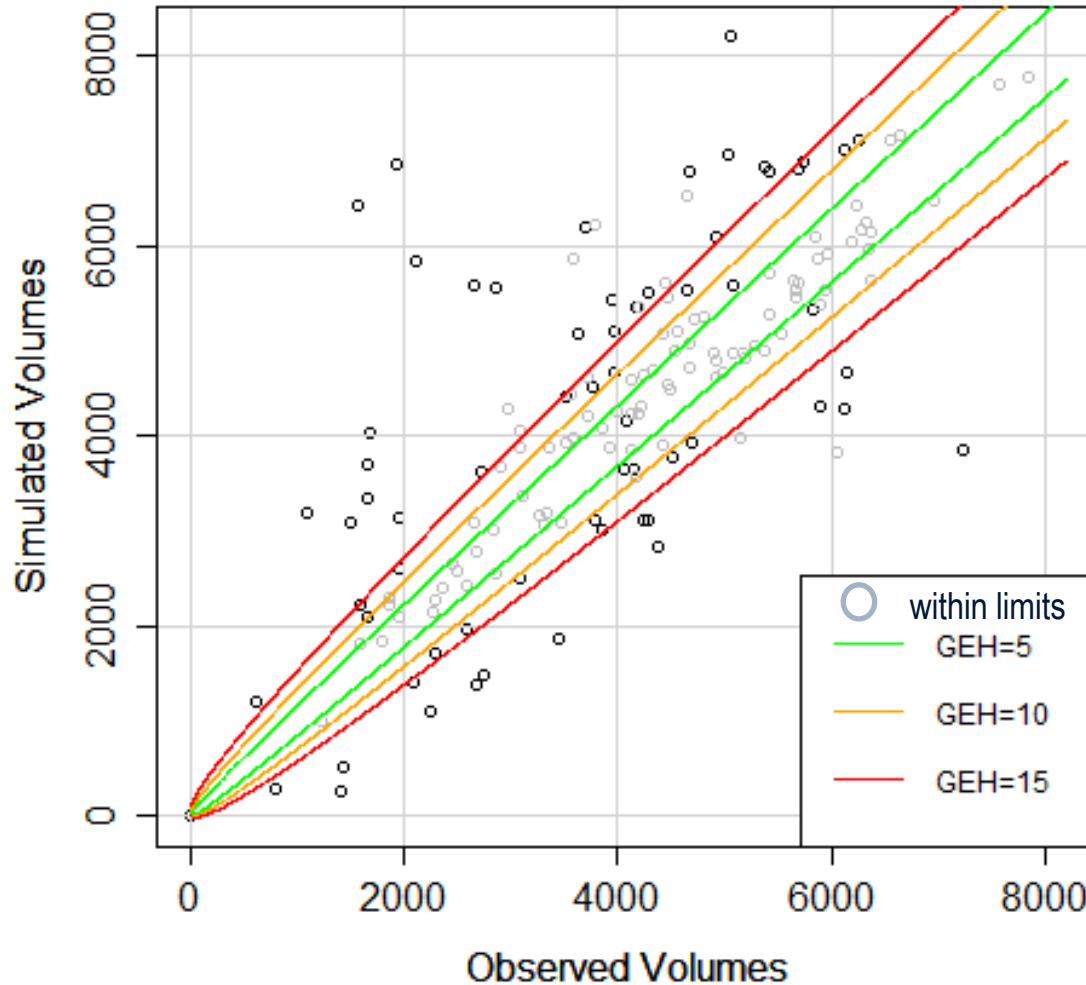
# Calibration Results (Morning Peak)



# Calibration Results (Morning Peak)



# Calibration Results (Morning Peak)



**Avg GEH = 12.8**

*HWY 401*

*QEW*

*DVP*

*HWY 404*

*HWY 400*

*HWY 410*

*HWY 403*

*Gardiner Exp*

*LakeShore Blvd*



Thank You!

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