An Integrated Regional Planning / Microsimulation Model for the Buffalo / Niagara Falls Area

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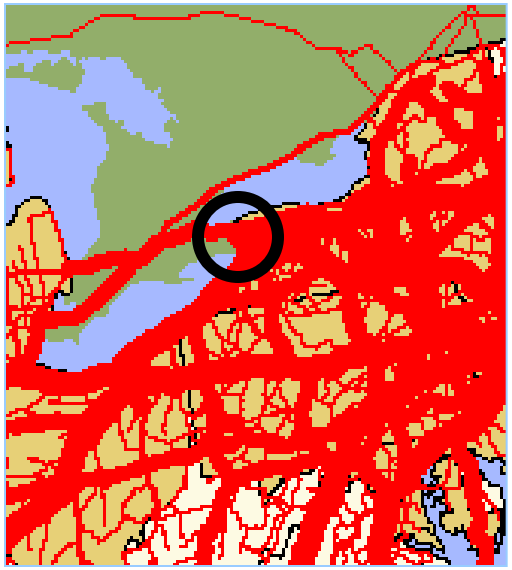
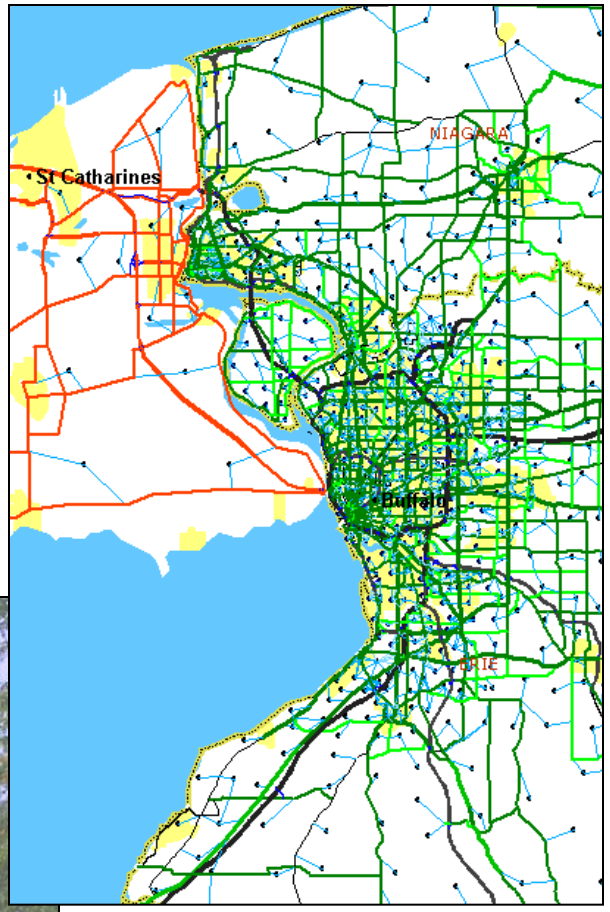
Transportation Border Working Group Meeting
Boston, MA

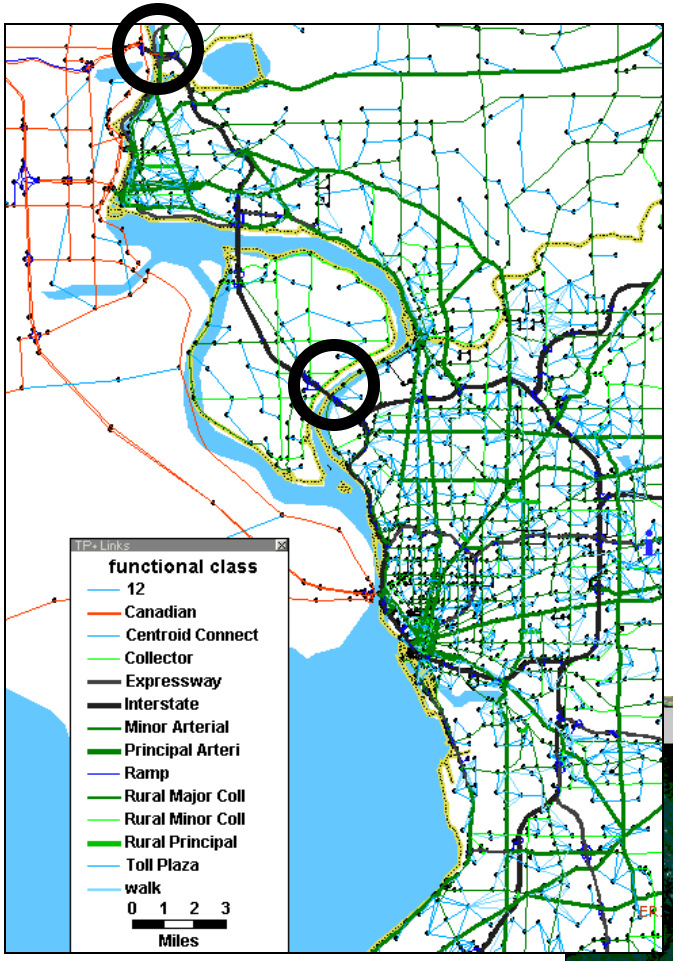
Major Issues



- Freight
- Cross border congestion
- Domestic issues



Gap between Planning and Operational Models



Planning:

- Entire region
- Average flows over several hours
- Trip generation, mode choice, route choice

Operations:

- Small area
- Second by second
- Demand is typically fixed

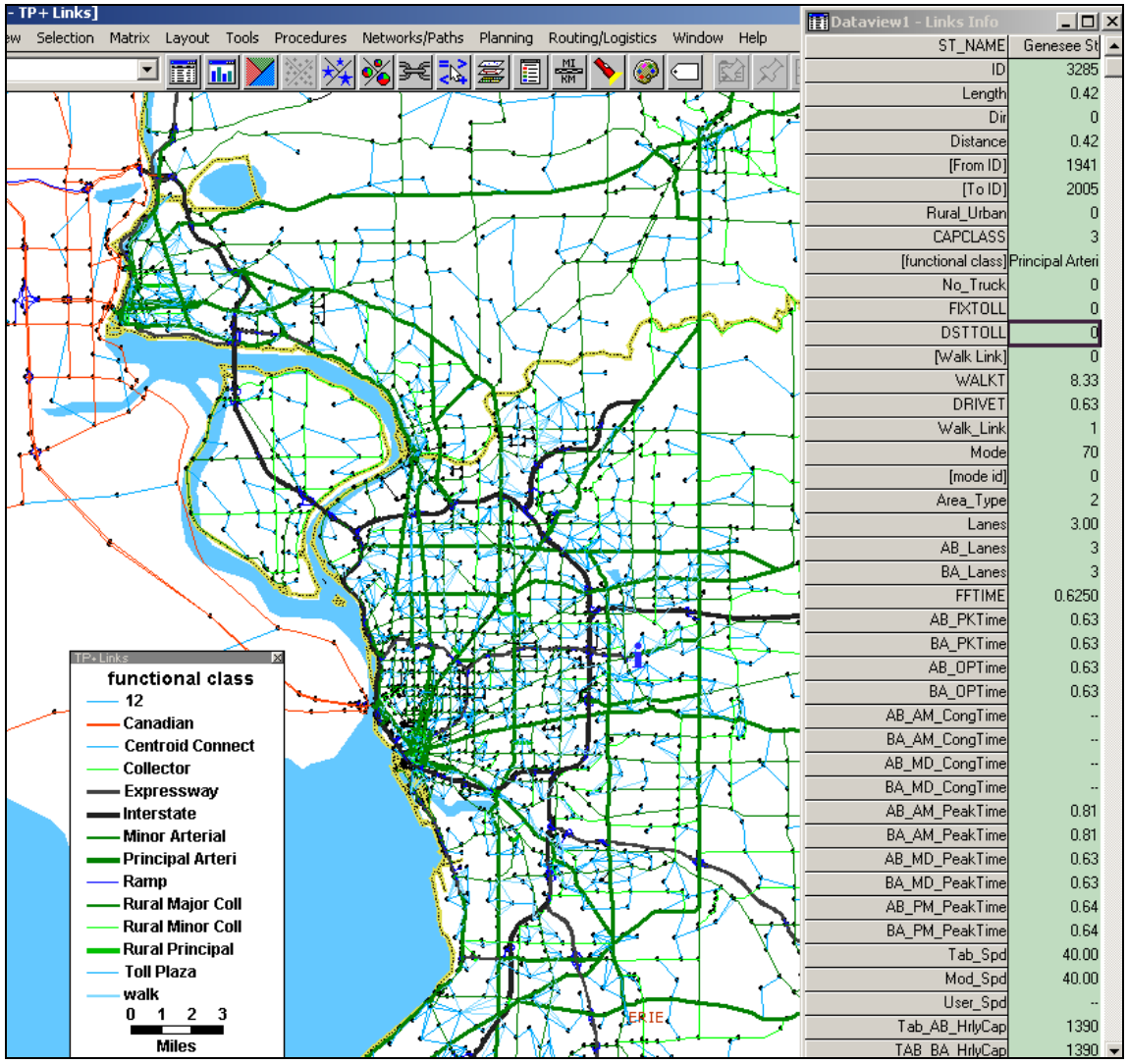
What is TRANSIMS?

- Transportation Analysis and Simulation System
  - Network
  - Travel demand
  - Integration with activity-based models
  - Regional traffic assignment
  - Microsimulation
- Person-based, multimodal, dynamic
- FHWA sponsorship under SAFETEA-LU
  - Deployment emphasis
  - Address current practice limitations

Objectives of this TRANSIMS Implementation

- To show that a regional TRANSIMS model could be developed based on existing data
- To demonstrate the capabilities of this model, some of which go beyond those of a typical four-step model
  - Grand Island Bridge toll plaza changes
  - Lane configurations
- To transfer the TRANSIMS model and the development of further capabilities to GBNRTC

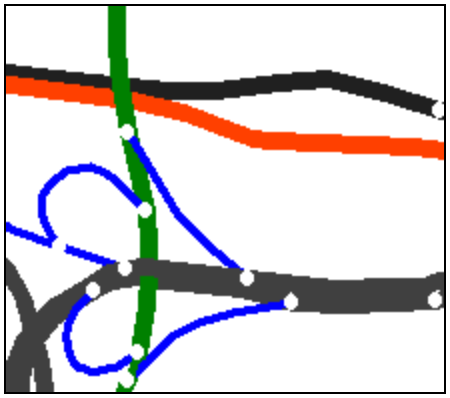
Existing Model Data



- Existing model
  - Links
  - Number of Lanes
  - Speed
  - Some tolls
  - Freeway interchanges
- List of signals
- Highway database
  - Lanes
  - Parking
  - Traffic count data

Supply: Filling in the Gaps

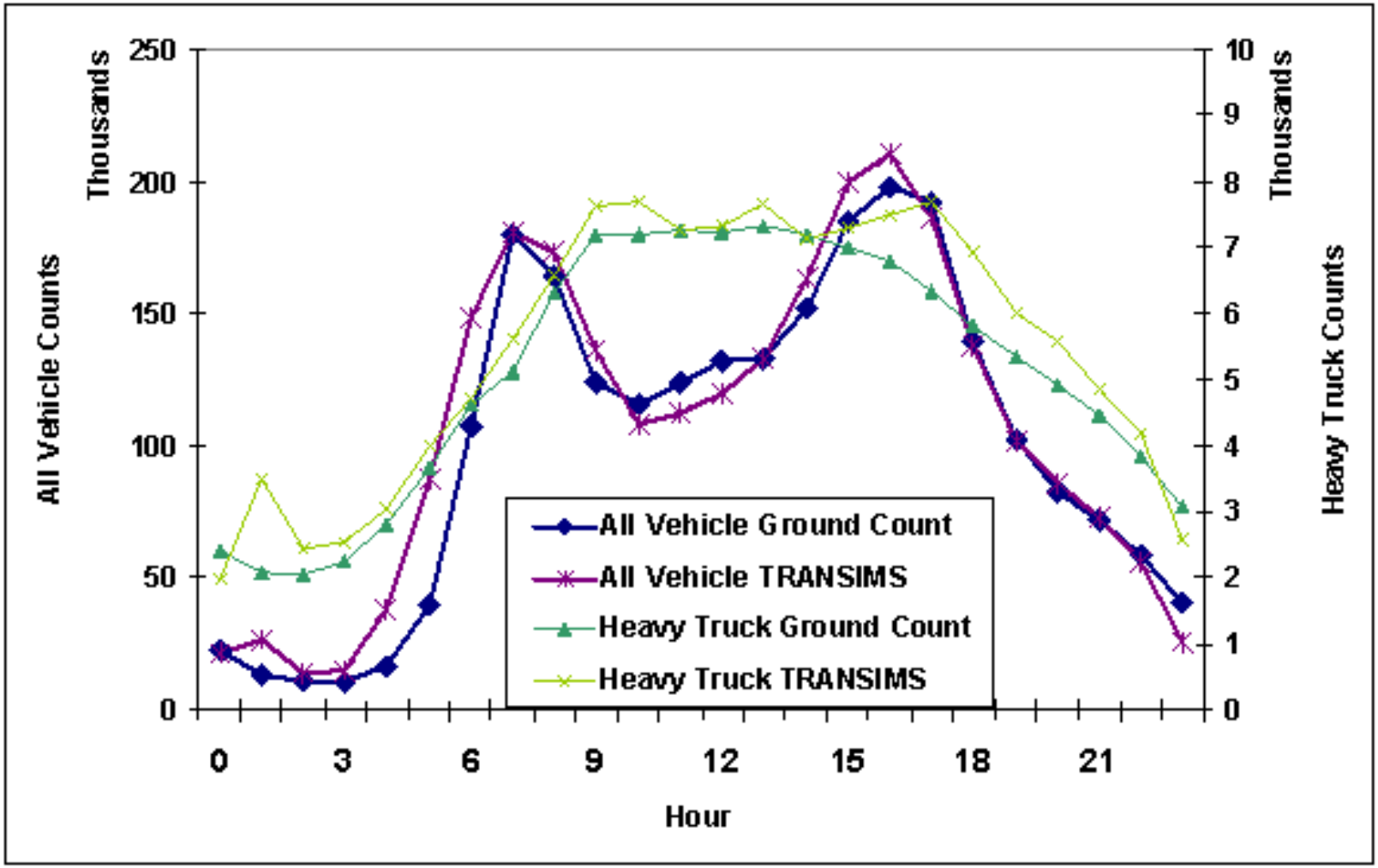
- Defaults
- Local knowledge
- Aerial photography
- Modifications to
  - Capacities
  - Speeds
  - Lane Connectivity



Modeling Demand

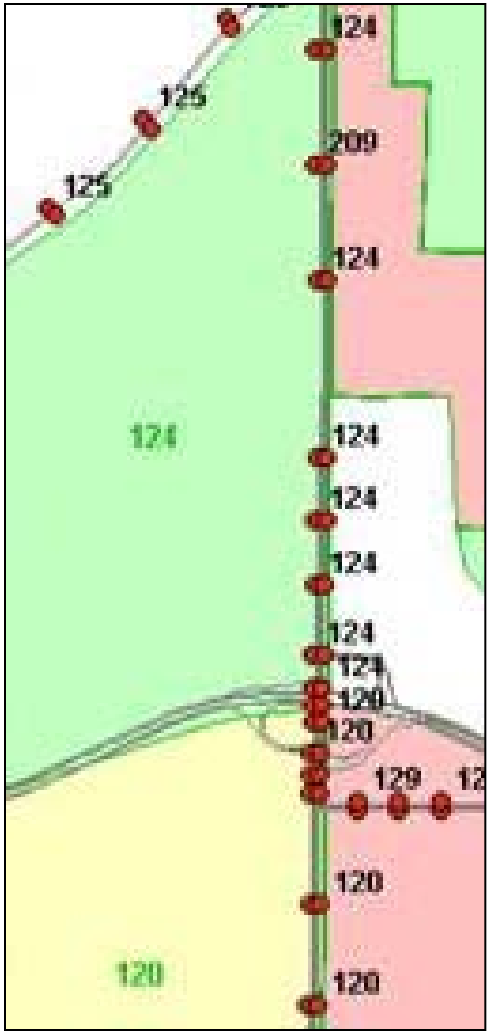
- Four-step model trip tables
  - Four time periods: AM, MD, PM, NT
  - Zones
- TRANSIMS can handle a greater level of detail
  - Minute – by - minute
  - Activity locations

TRANSIMS Link Flows versus Counts by Hour



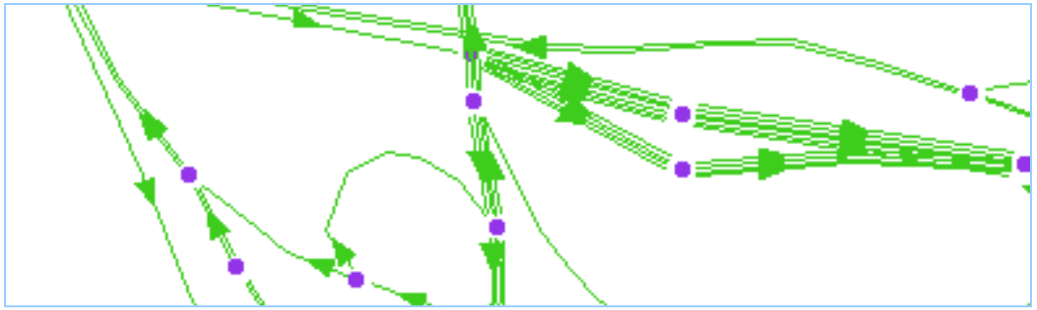
Activity Locations and Zones

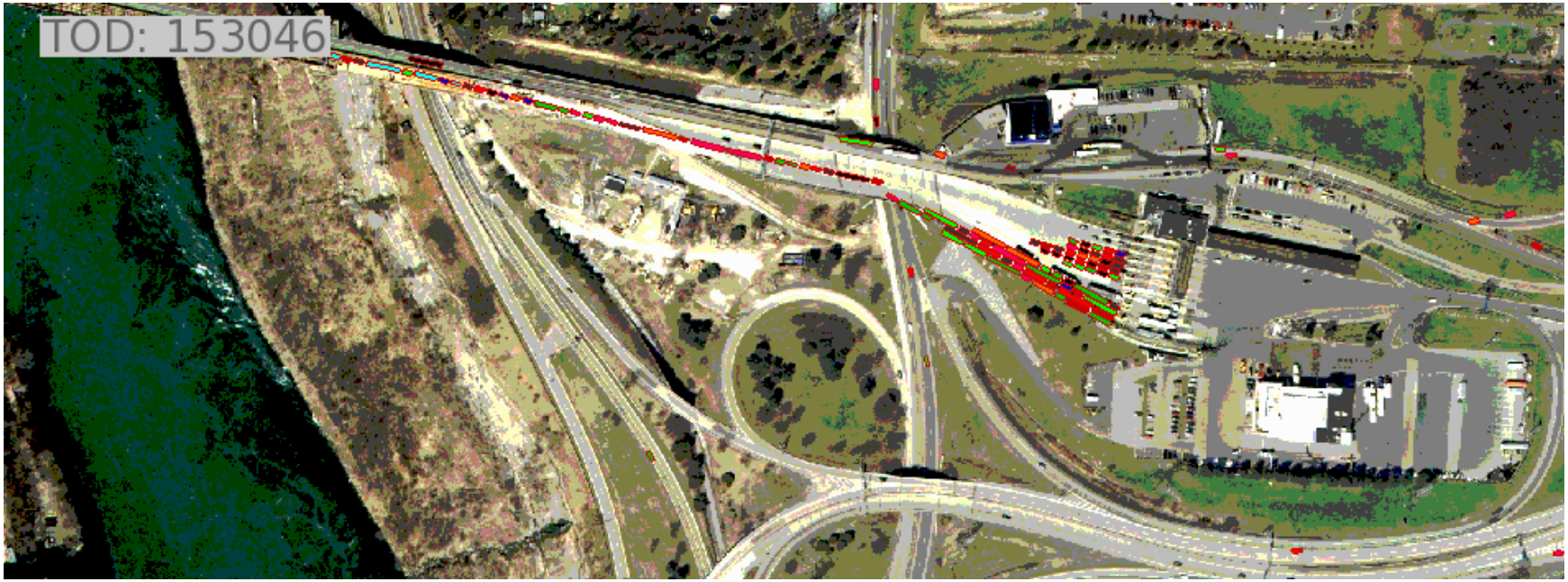
- Activity locations are generated with the TRANSIMS network
  - Pairs along non-freeway, non-ramp links
  - Near each external zone
- Each zone typically includes many activity locations
- Zone – activity location assignment process
  - Default: nearest zone centroid
  - Use LocationData to associate activity locations with the proper zone based on the zone shapefile (supplied by GBNRTC)



Modeling a Border Crossing

Lewiston-Queenston Bridge:
U.S. Inspection





Modeling a Border Crossing

- Limited by primary inspection capacity
- TRANSIMS Router
  - Lowered capacity on the crossing
  - Penalties (via the Toll table) to discourage crossing the border to save a few minutes of travel time.
- TRANSIMS Microsimulator
  - Lane use restrictions to separate cars and trucks
  - Traffic signal with 2-minute red and 1-second green.

Bridge	**"Toll"**	**EB Lanes**	**EB Cap. (veh/hr)**
Lewiston-Queenston	900 sec.	6 car, 4 trk	180 car, 120 truck
Whirlpool (NEXUS only)	1200 sec.	2	60
Rainbow (no trucks)	900 sec.	15	450
Peace	900 sec.	18	540

Subarea Microsimulation

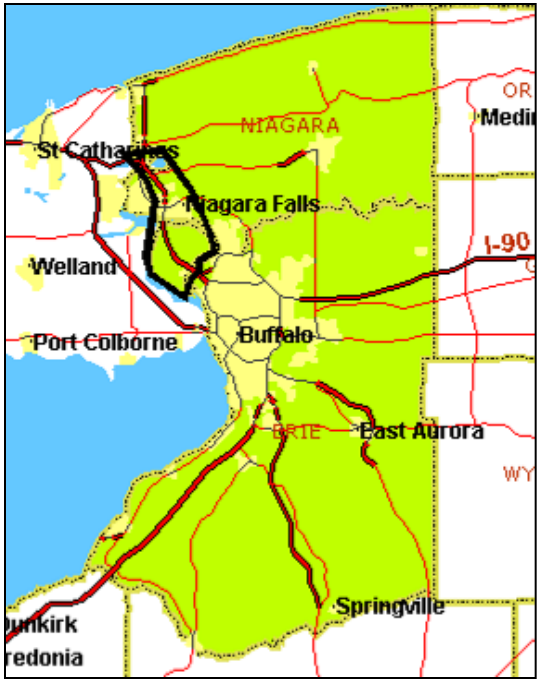
Subarea:

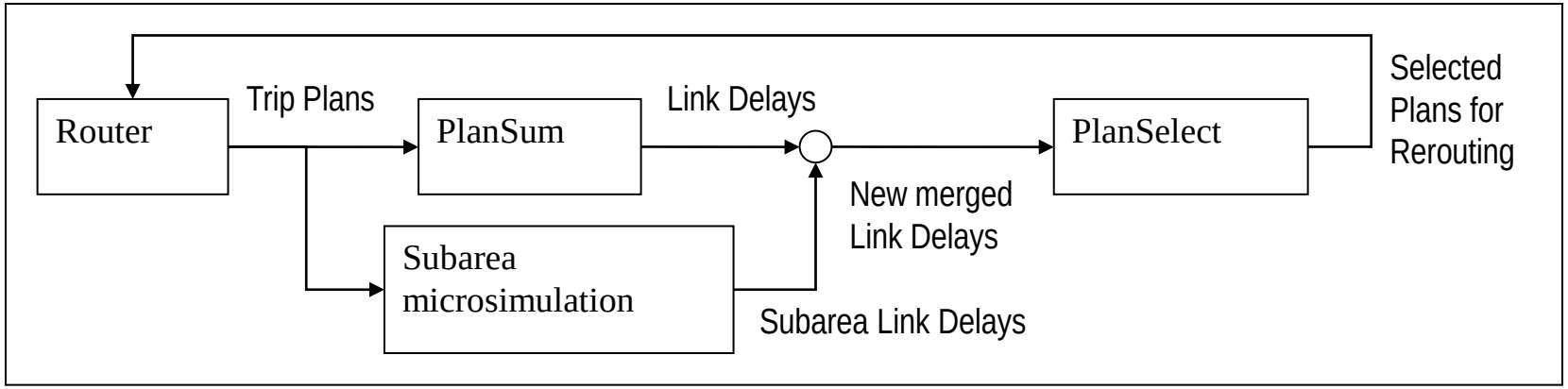
•I-190 corridor - North side of Buffalo to Lewiston-Queenston bridge

Process:

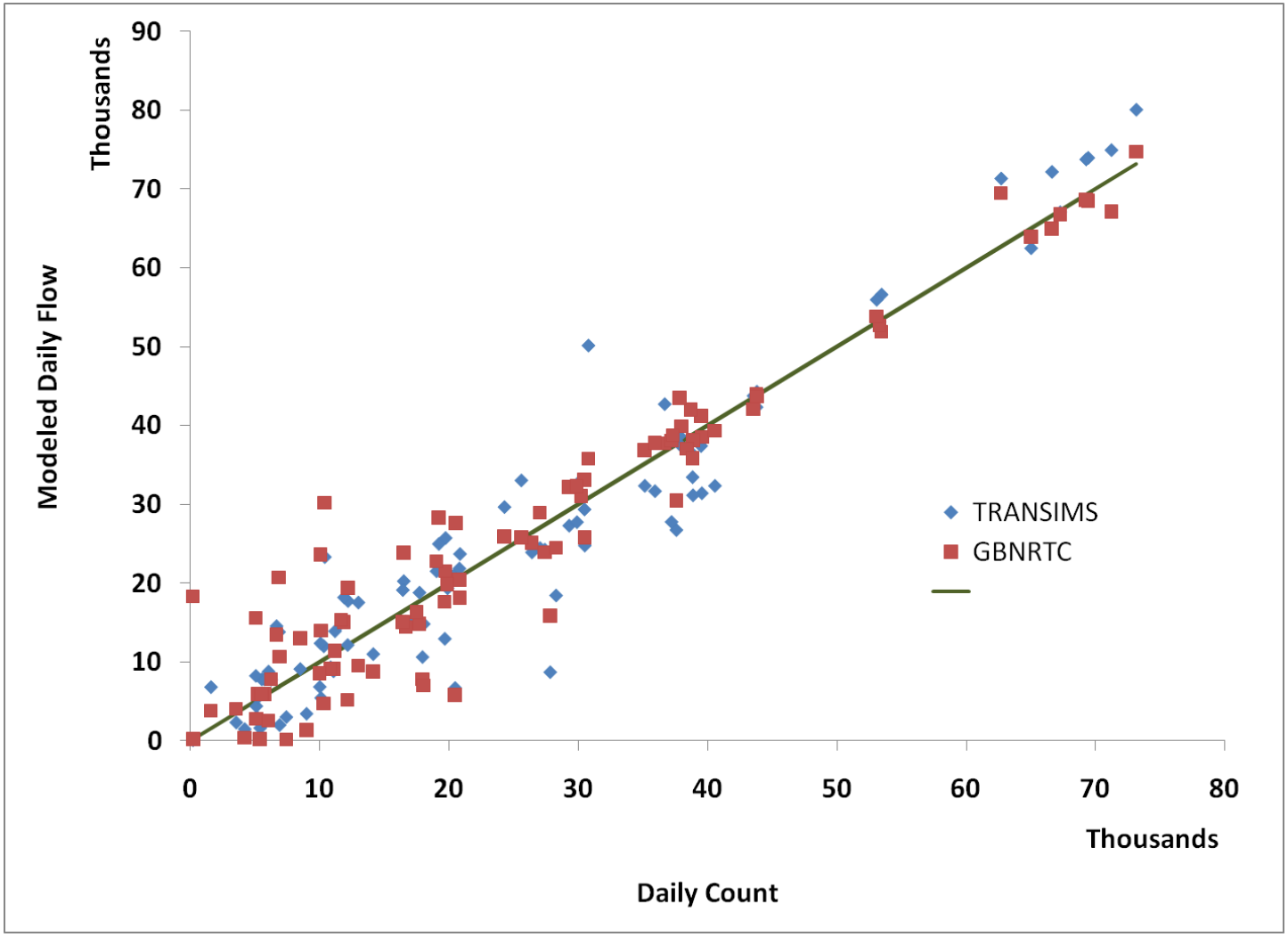
•Iterate between the microsimulator (sub area) and router (full area)

•Link delays from the microsimulator are inputs to the router





Daily Flows


Modeled Daily Flow
Thousands
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
Thousands
Daily Count
TRANSIMS
GBNRTC

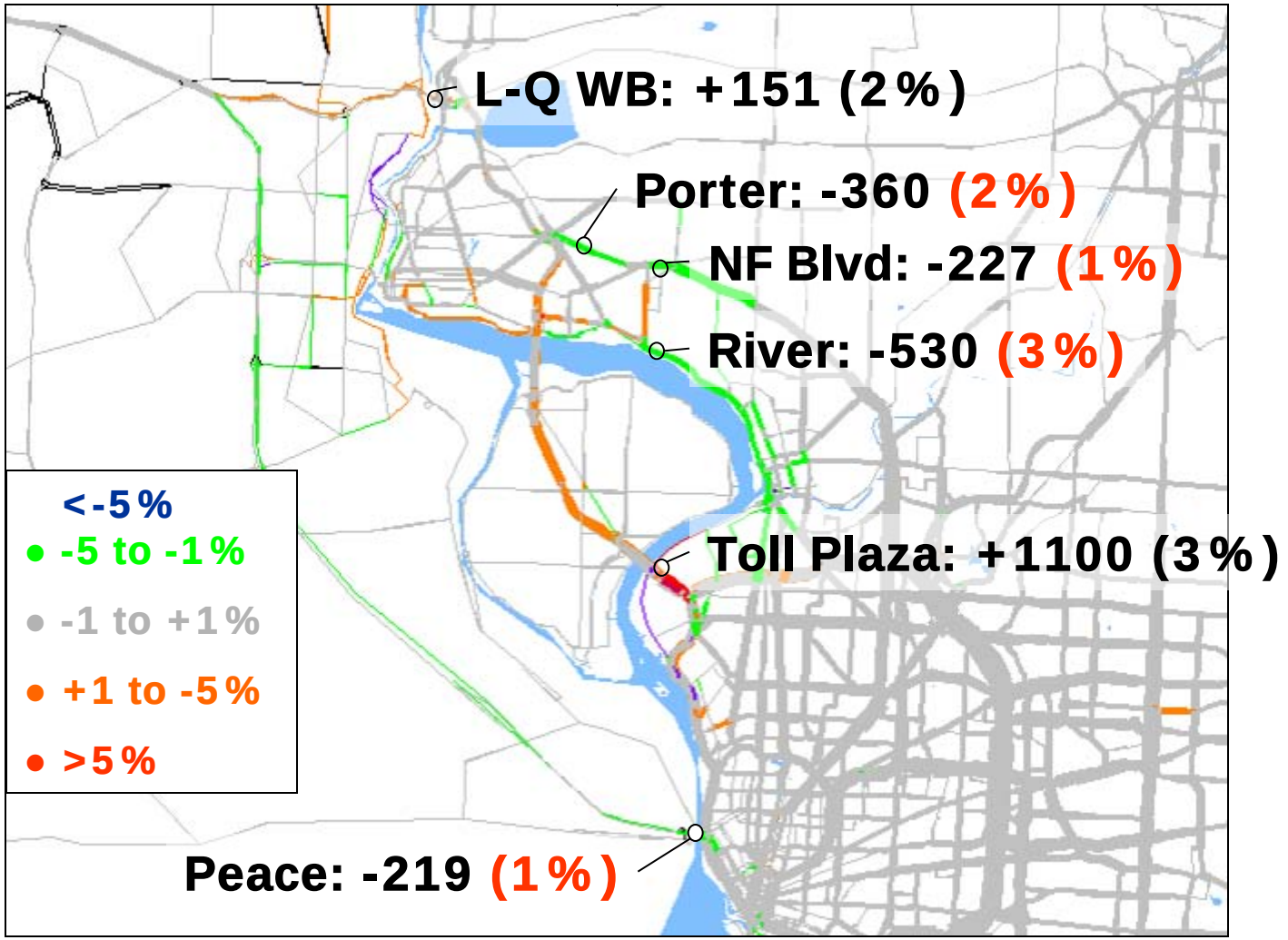
Scenario Test: Grand Island Bridge

Baseline:

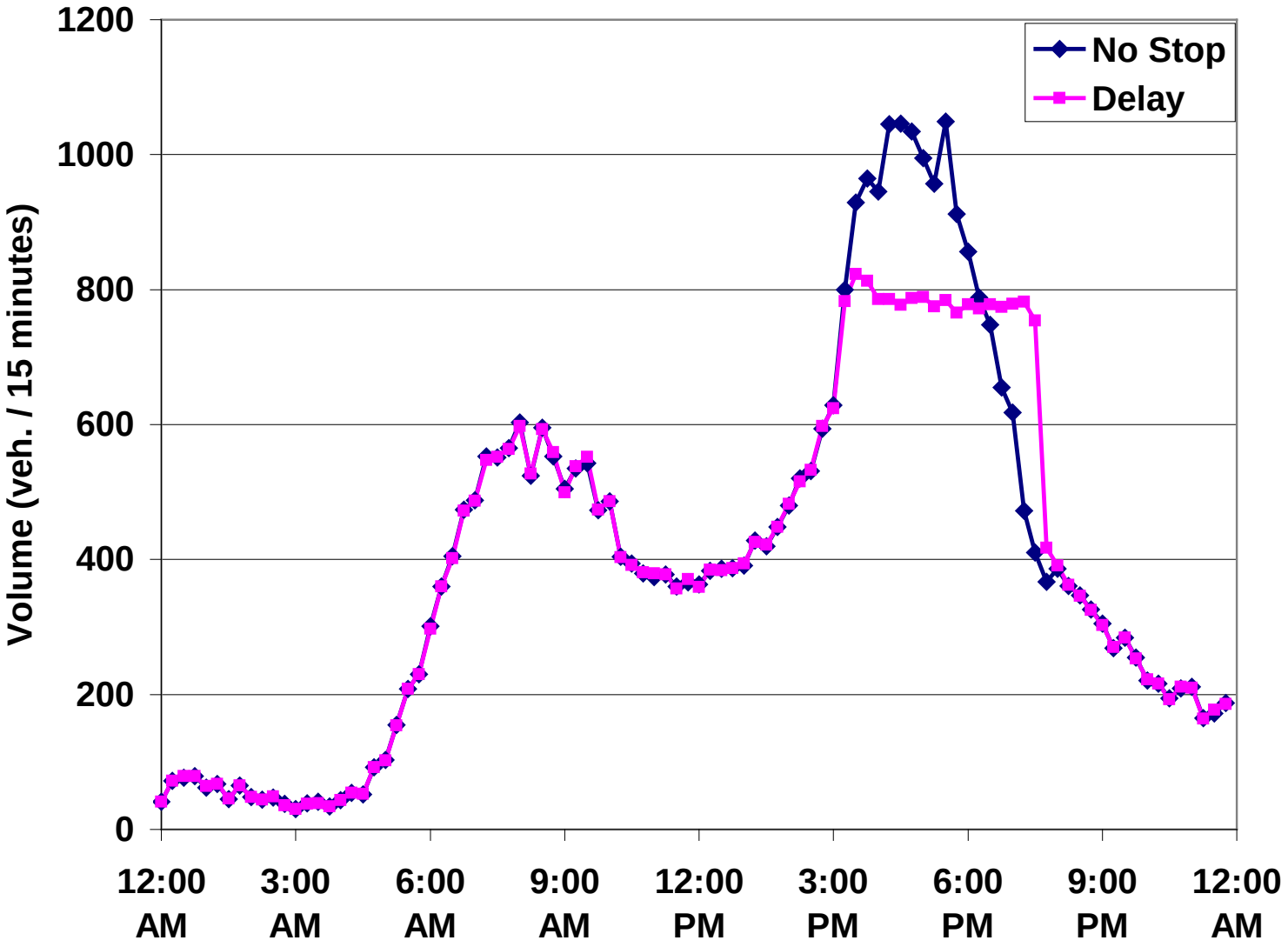
6 second **delay** for all traffic at toll plaza

Scenario: **No stop** at the plaza

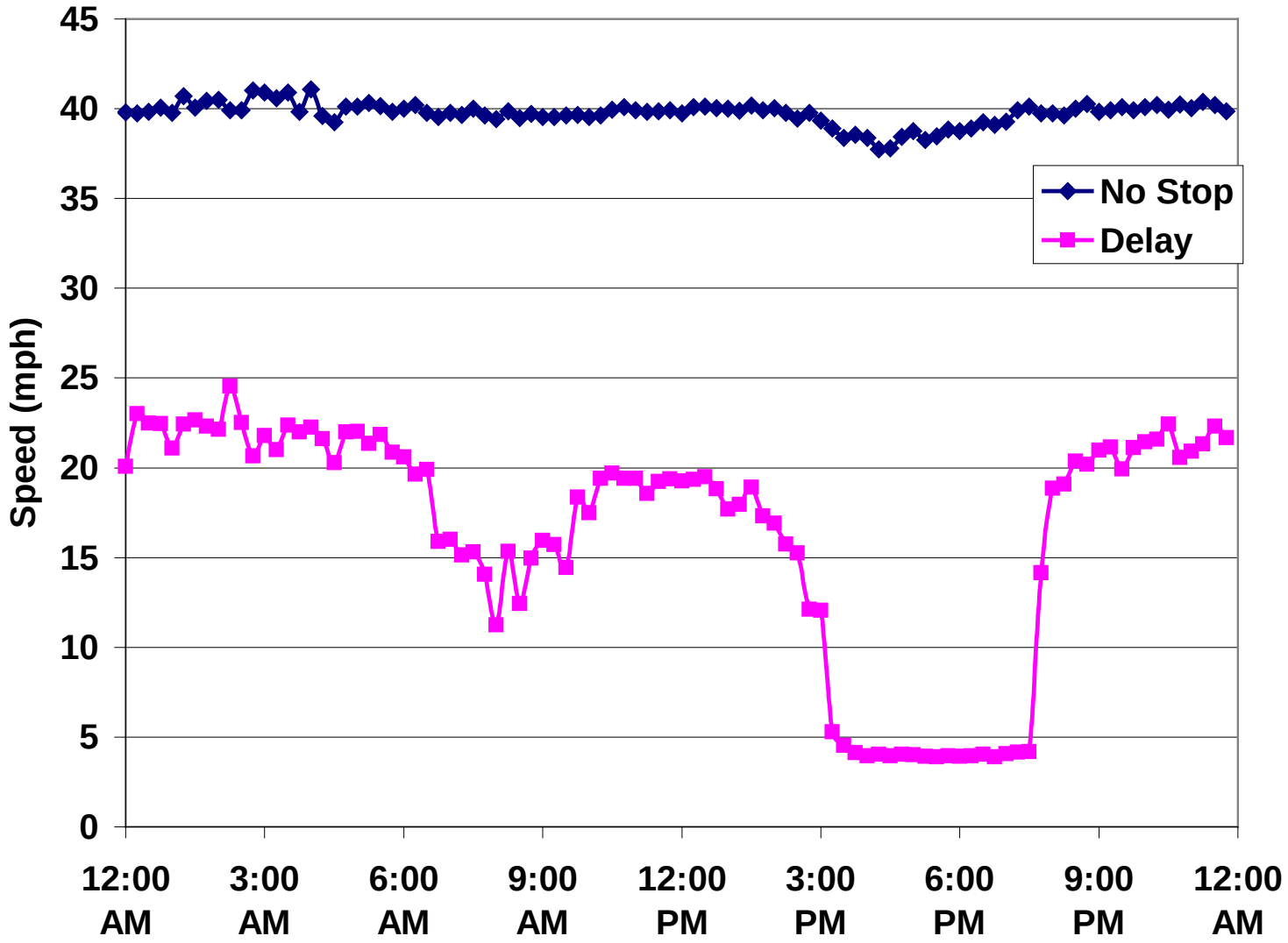
Changes in Daily Flows



Flow at Plaza (link 6228)



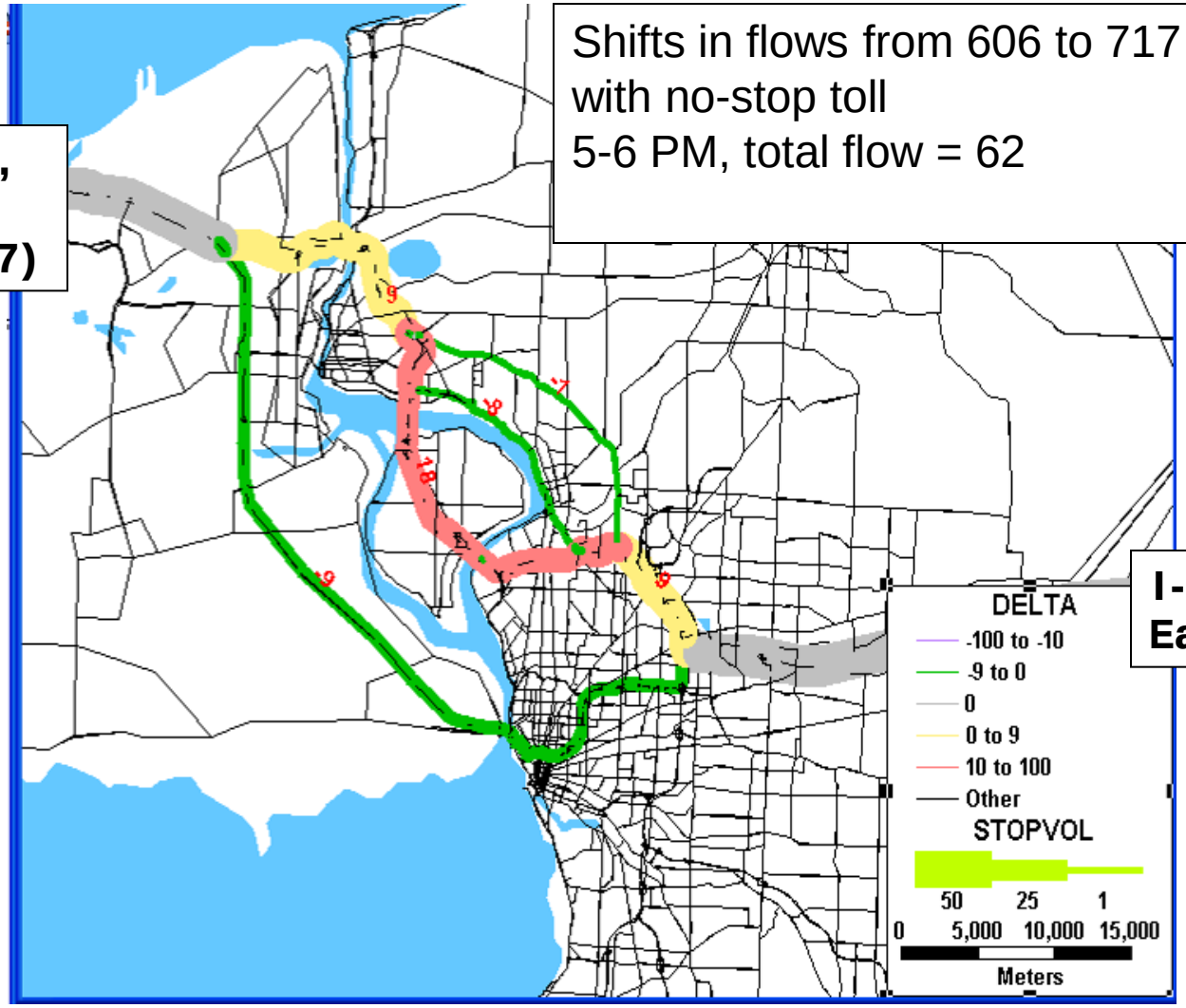
Speed at Plaza (link 6228)



Shift in I-90 to Canada Flow

Hamilton, Toronto (Zone 717)

Shifts in flows from 606 to 717
with no-stop toll
5-6 PM, total flow = 62



I-90 from the East (Zone 606)

Technical Lessons Learned

- It is possible to set up a usable TRANSIMS model with existing data
  - Run time and quality of results comparable to existing four-step models
- Typical issues in going from a four-step model to a TRANSIMS model
  - TRANSIMS is more sensitive to time-of-day information in the trip tables
  - Some advanced features in a four-step model might need to be addressed in the microsimulator, not the router
  - The TRANSIMS microsimulator is much more sensitive to network fidelity (signals, stop/yield signs, lane configurations, etc.) than a four-step model

Future Work

- SUNY-Buffalo project
  - Assess the feasibility of using TRANSIMS for on-line transportation management during emergencies
  - Builds upon the model presented here
- TRANSIMS – version 5
  - Major enhancements to TRANSIMS, due later in 2010
  - Improved toll / border delay modeling
  - Car-following model for microsimulator
    - Higher fidelity than the current cellular automata model