Innovations in Travel Modeling
Tempe, May 2010

Adjusting Temporal Demand for DTA:
A Practical Method

Michael Florian, Shuguang He, Ido Juran, Michael Mahut, Shane Velan
INRO, Montreal

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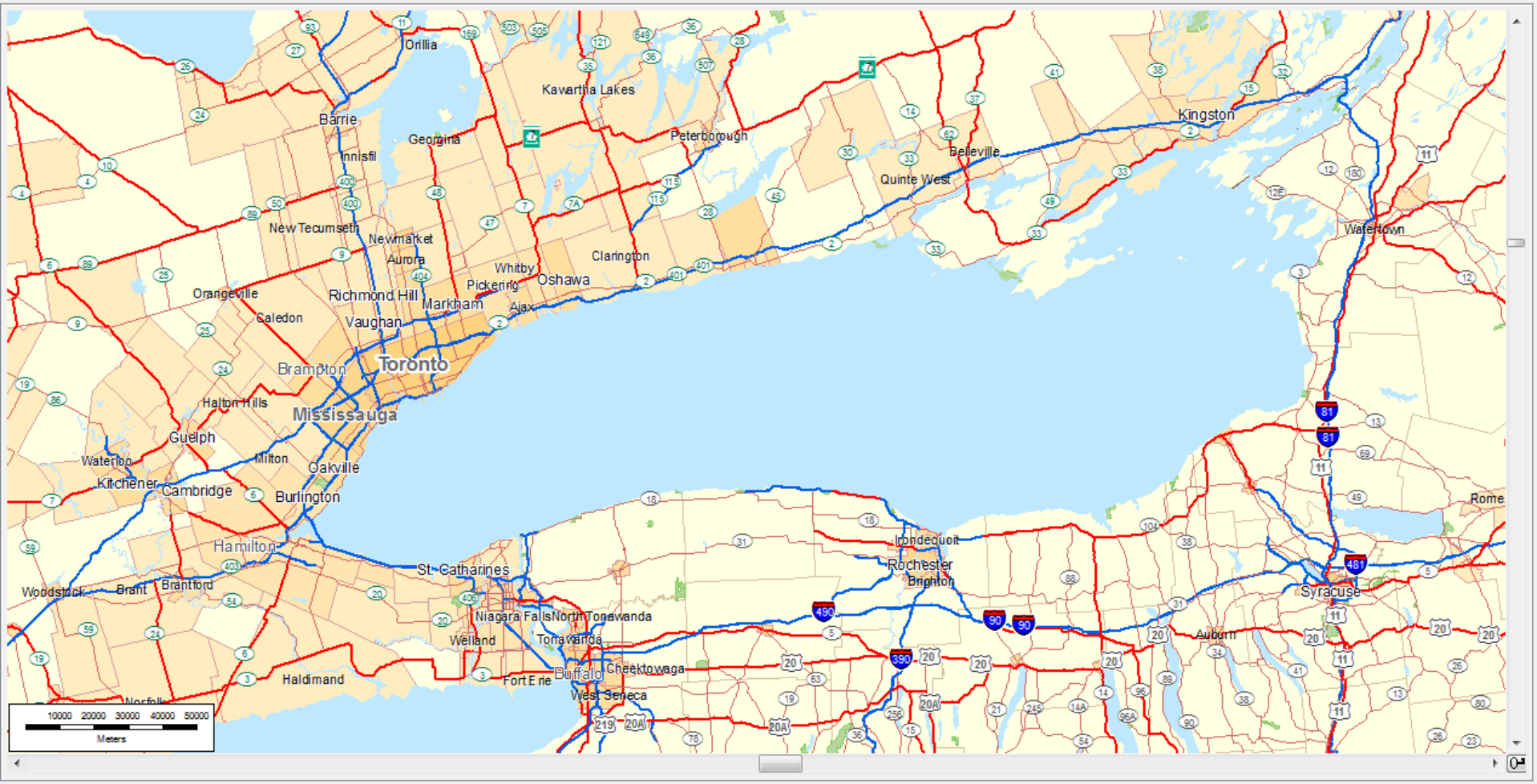
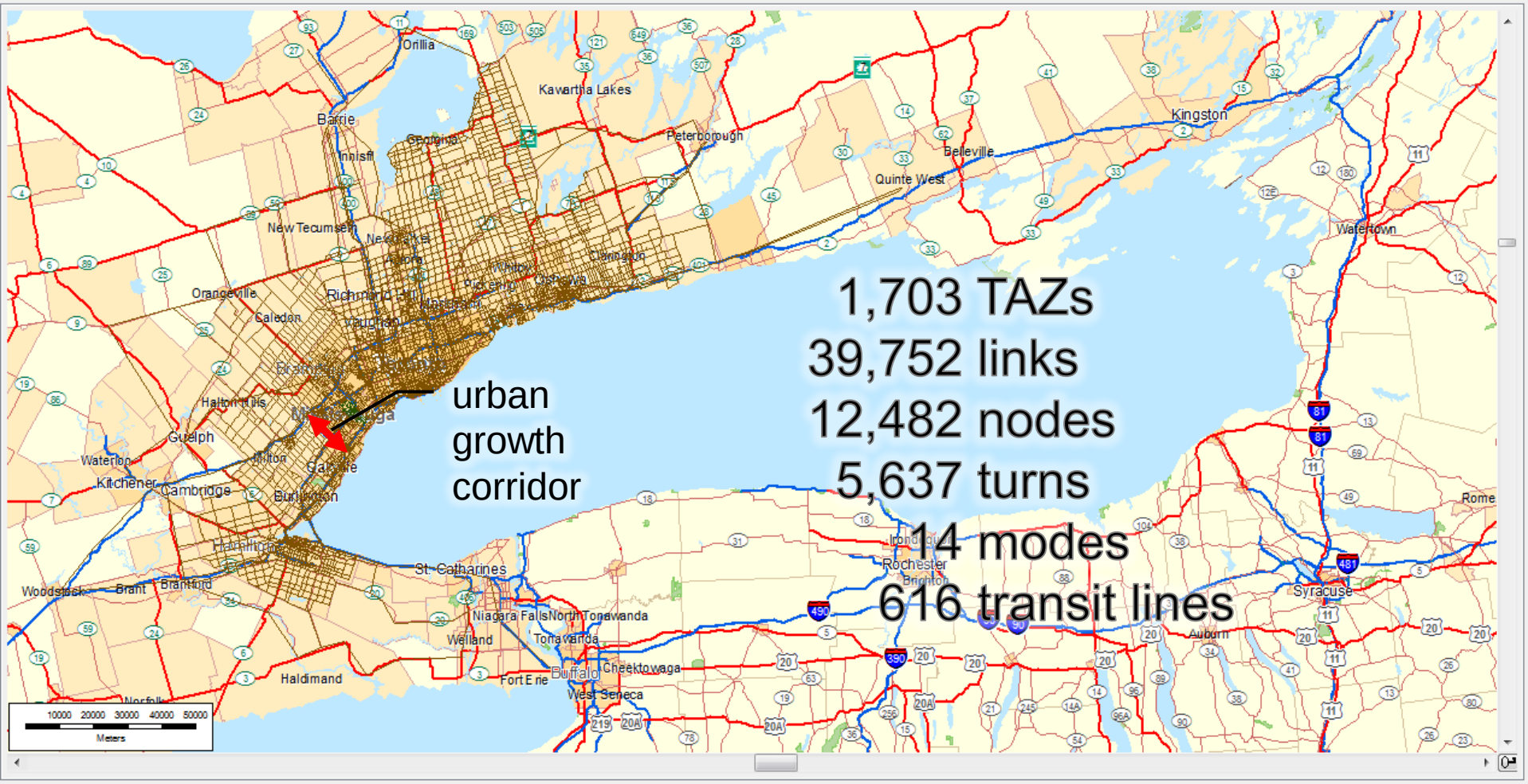
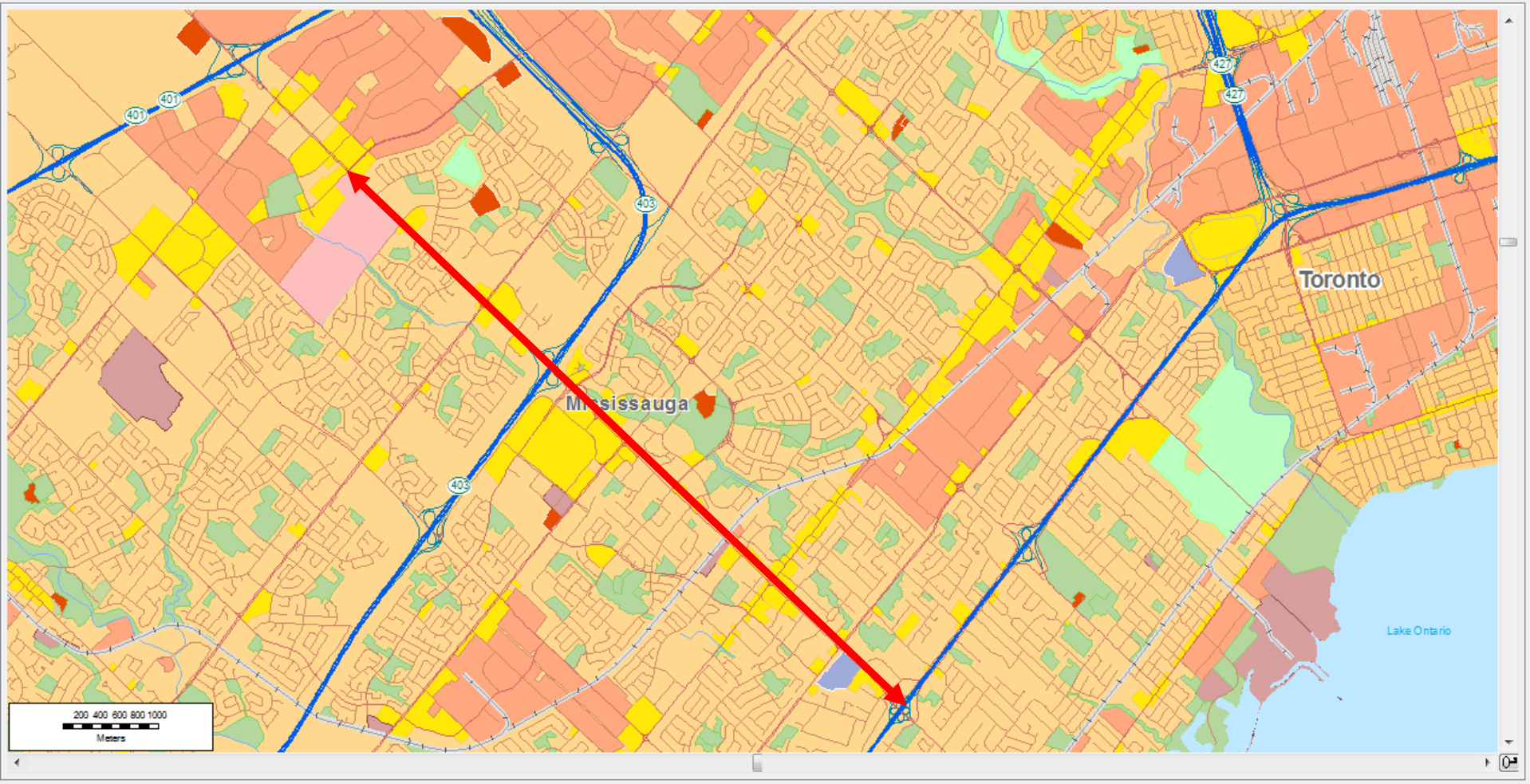
Greater Toronto Area



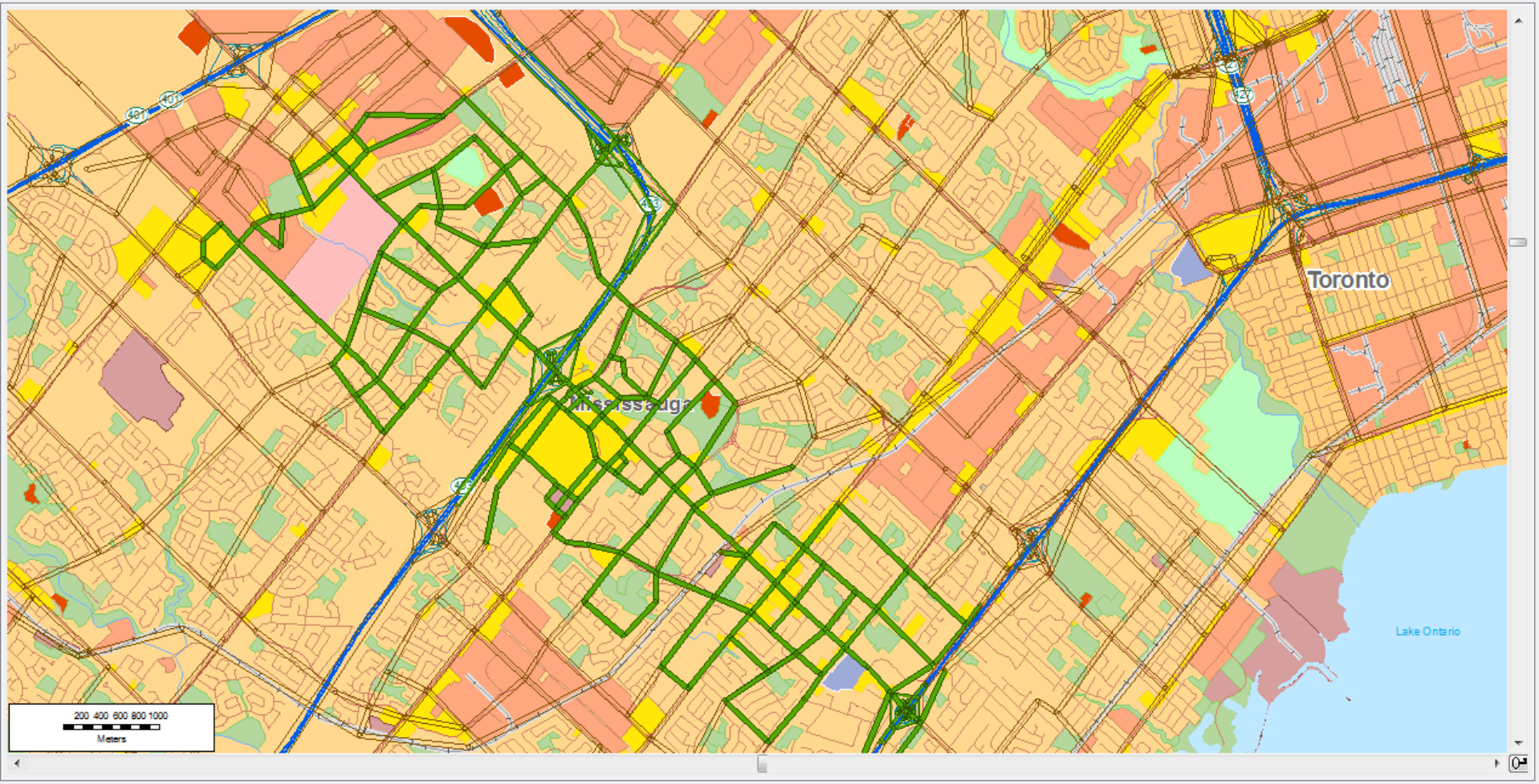
Regional Network



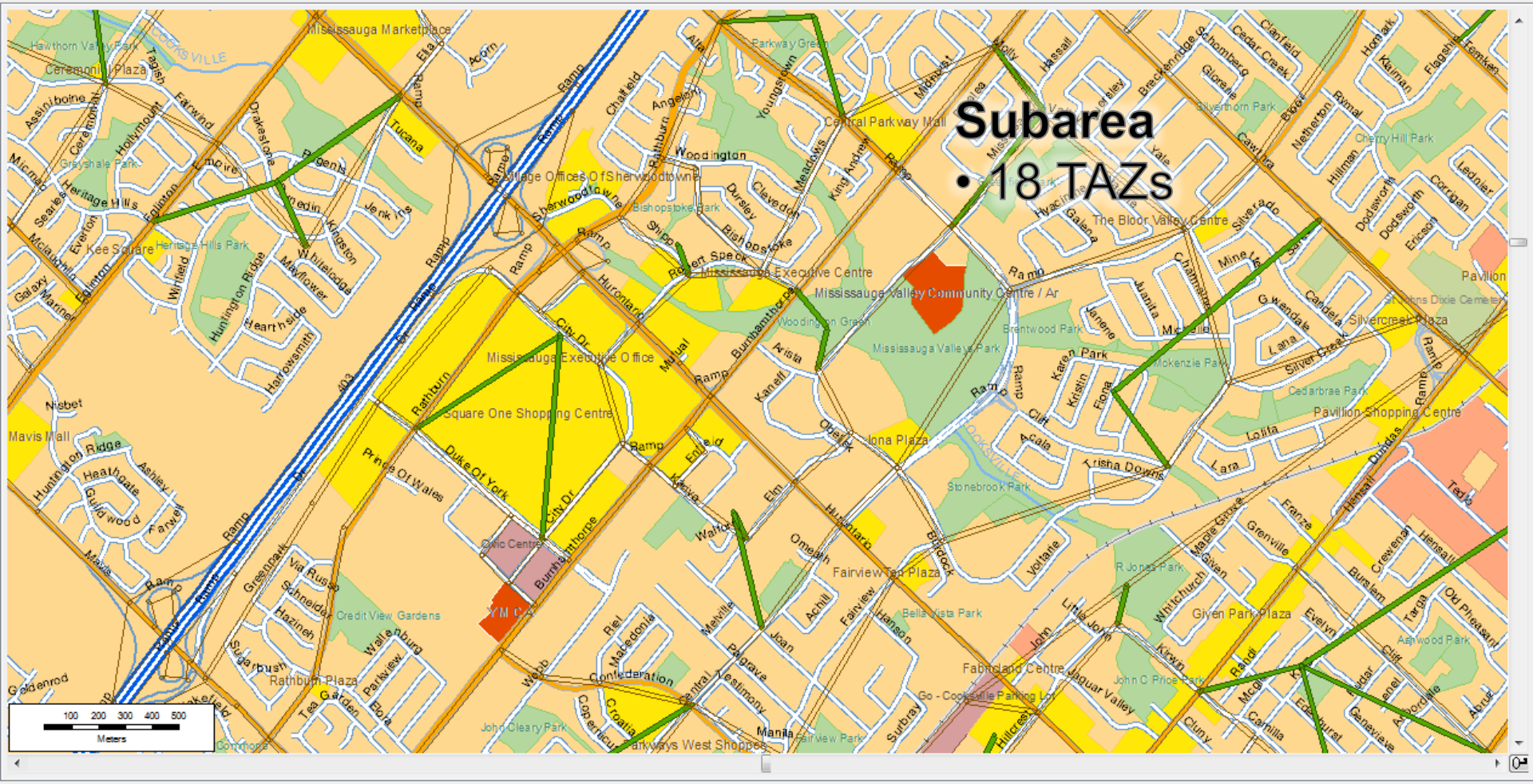
Urban Growth Corridor



Subarea

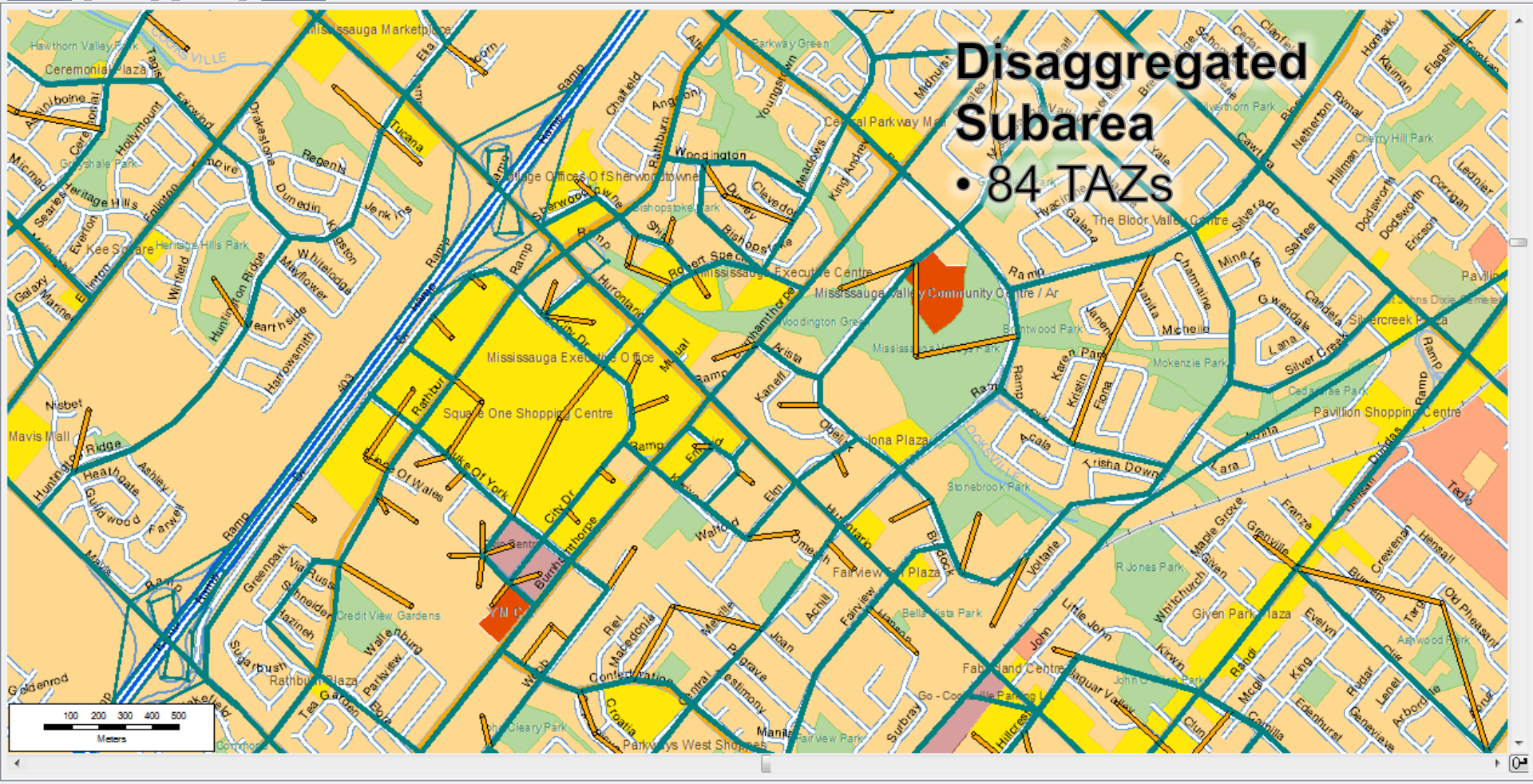


Regional Network Abstraction



Subarea Network Abstraction

EMME



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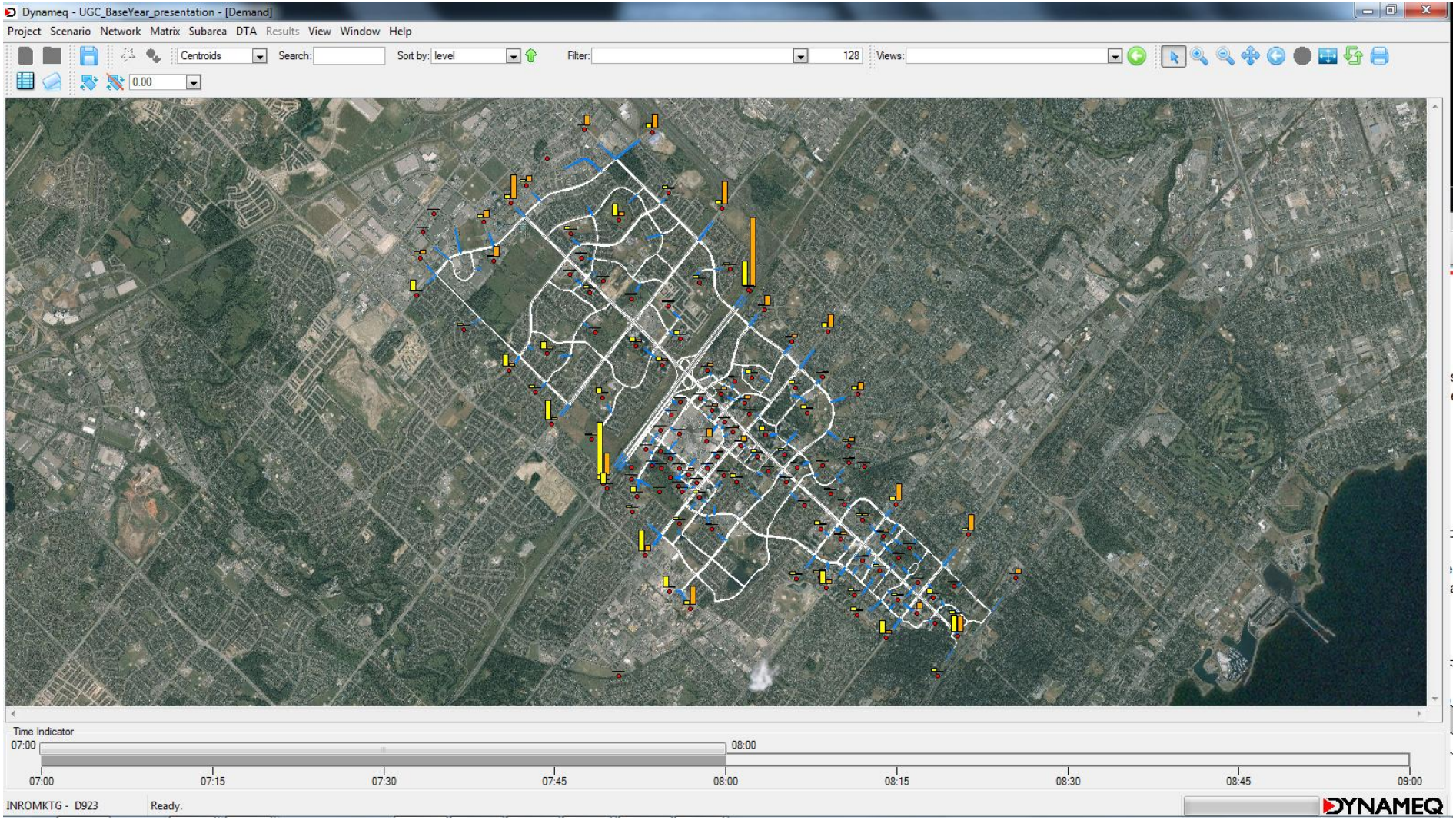
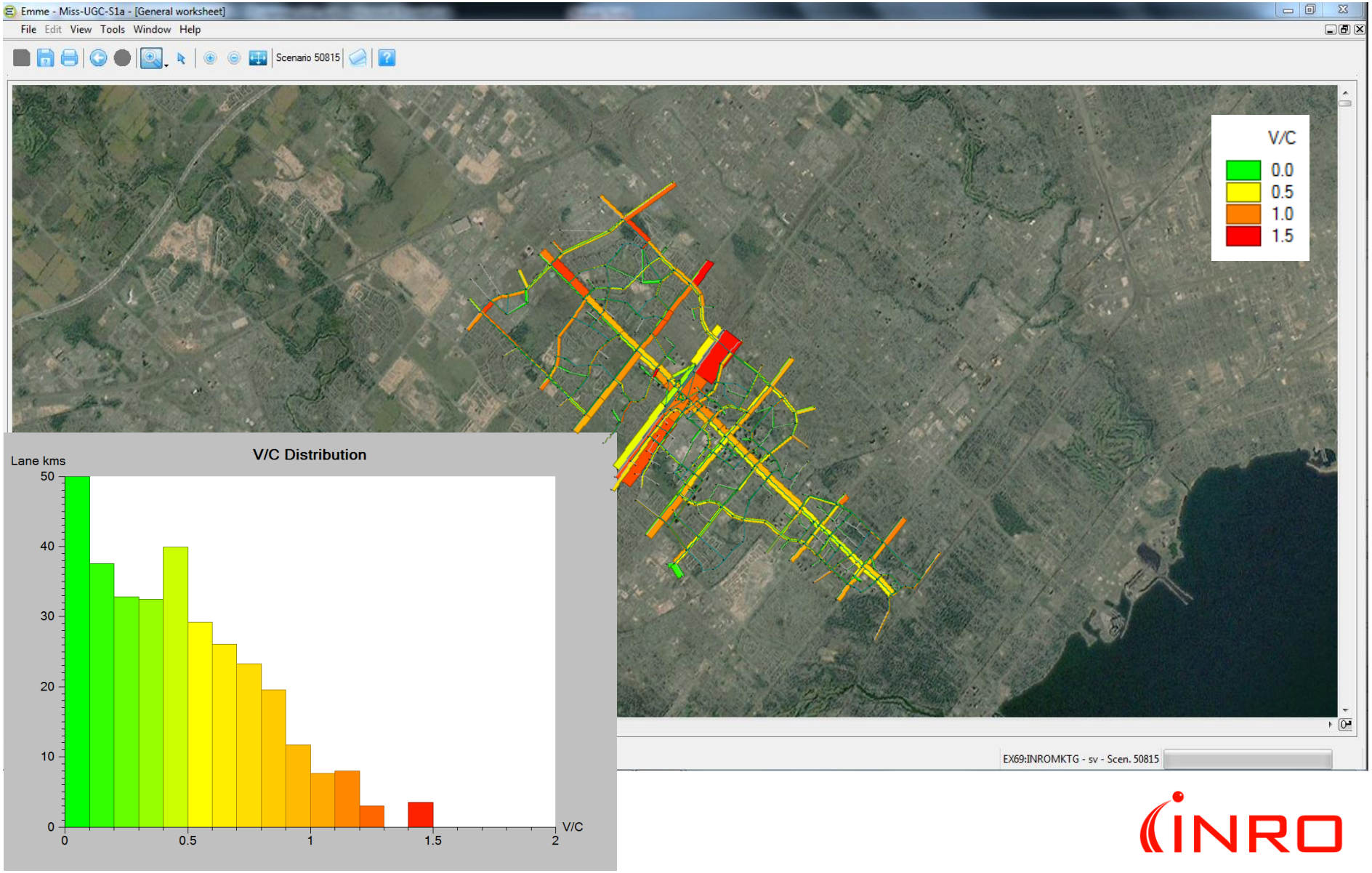
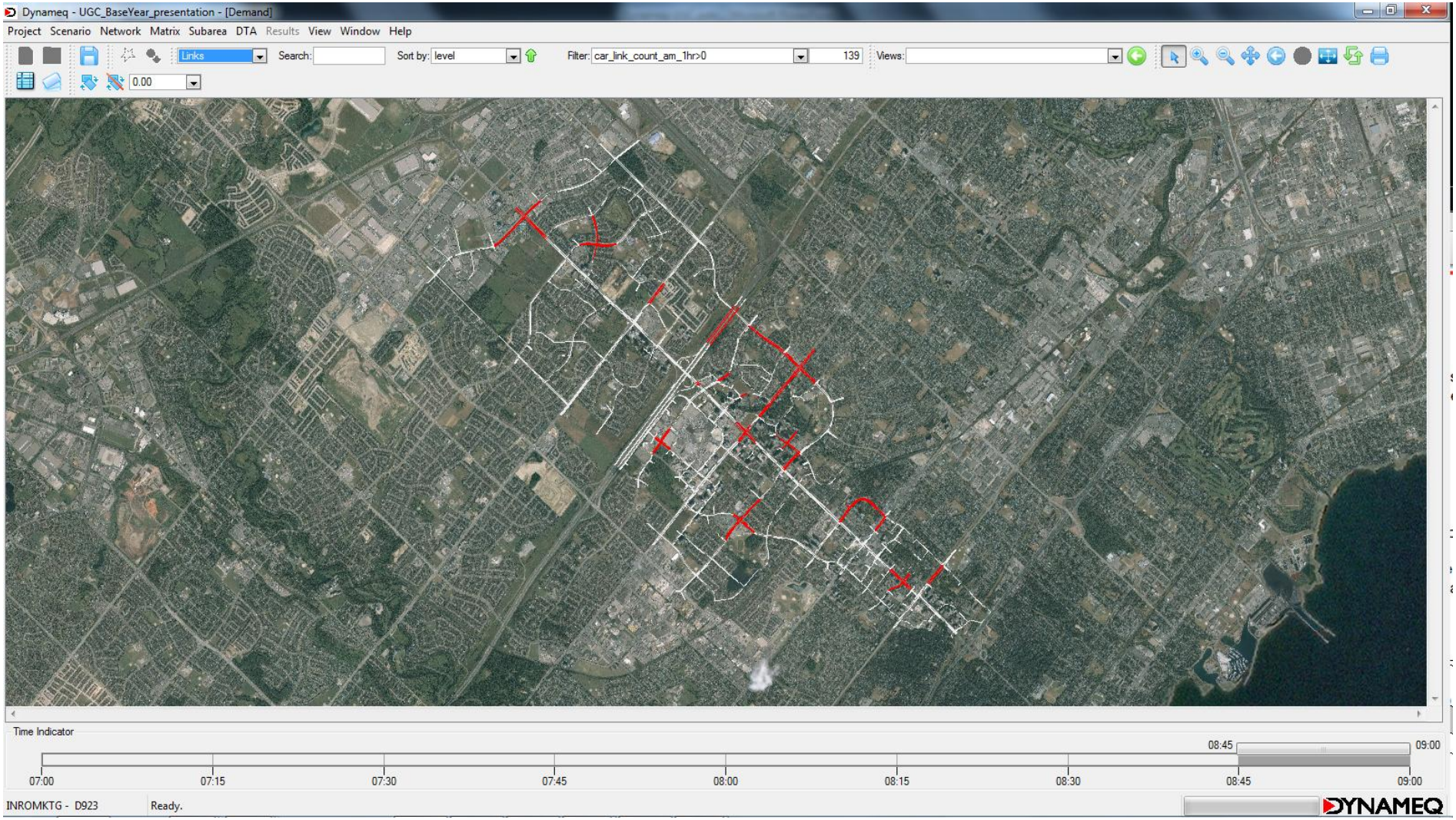
Traversal Matrix 7:00-9:00



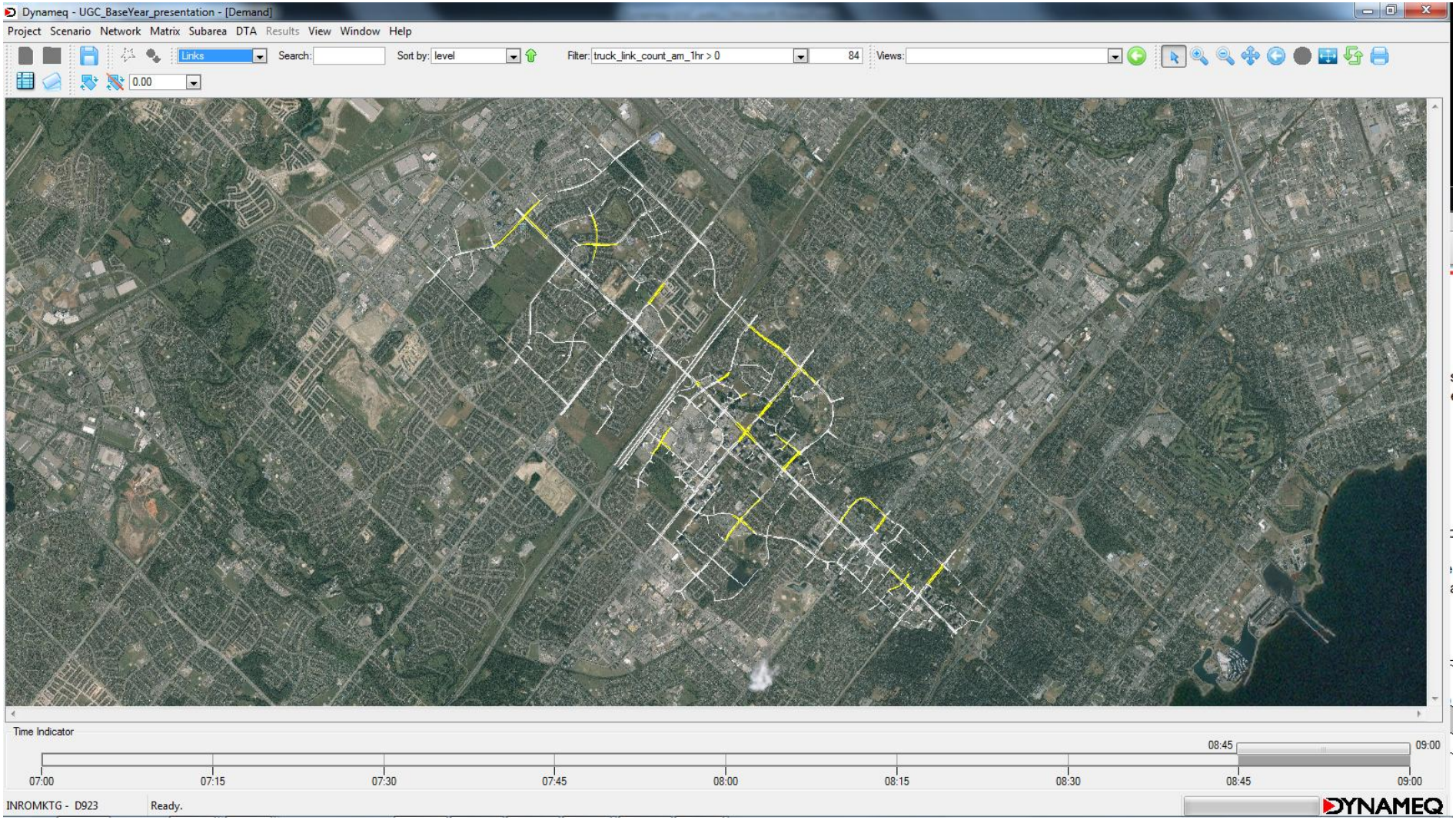
Traversal Demand Static Assignment



Car Counts


Dynameq - UGC_BaseYear_presentation - [Demand]
Project Scenario Network Matrix Subarea DTA Results View Window Help
Links
Search:
Sort by: level
Filter: car_link_count_am_1hr>0
139
Views:
0.00
Time Indicator
07:00
07:15
07:30
07:45
08:00
08:15
08:30
08:45
09:00
INROMKTG - D923
Ready.
DYNAMEQ

Truck Counts



Demand Adjustment

Find new O-D matrix such that

$$\min \sum_{\text{counts}} (\text{assigned flows} - \text{counts})^2$$

Demand Adjustment

Find new O-D matrix such that

$$\min \sum_{\text{counts}} (\text{assigned flows} - \text{counts})^2$$

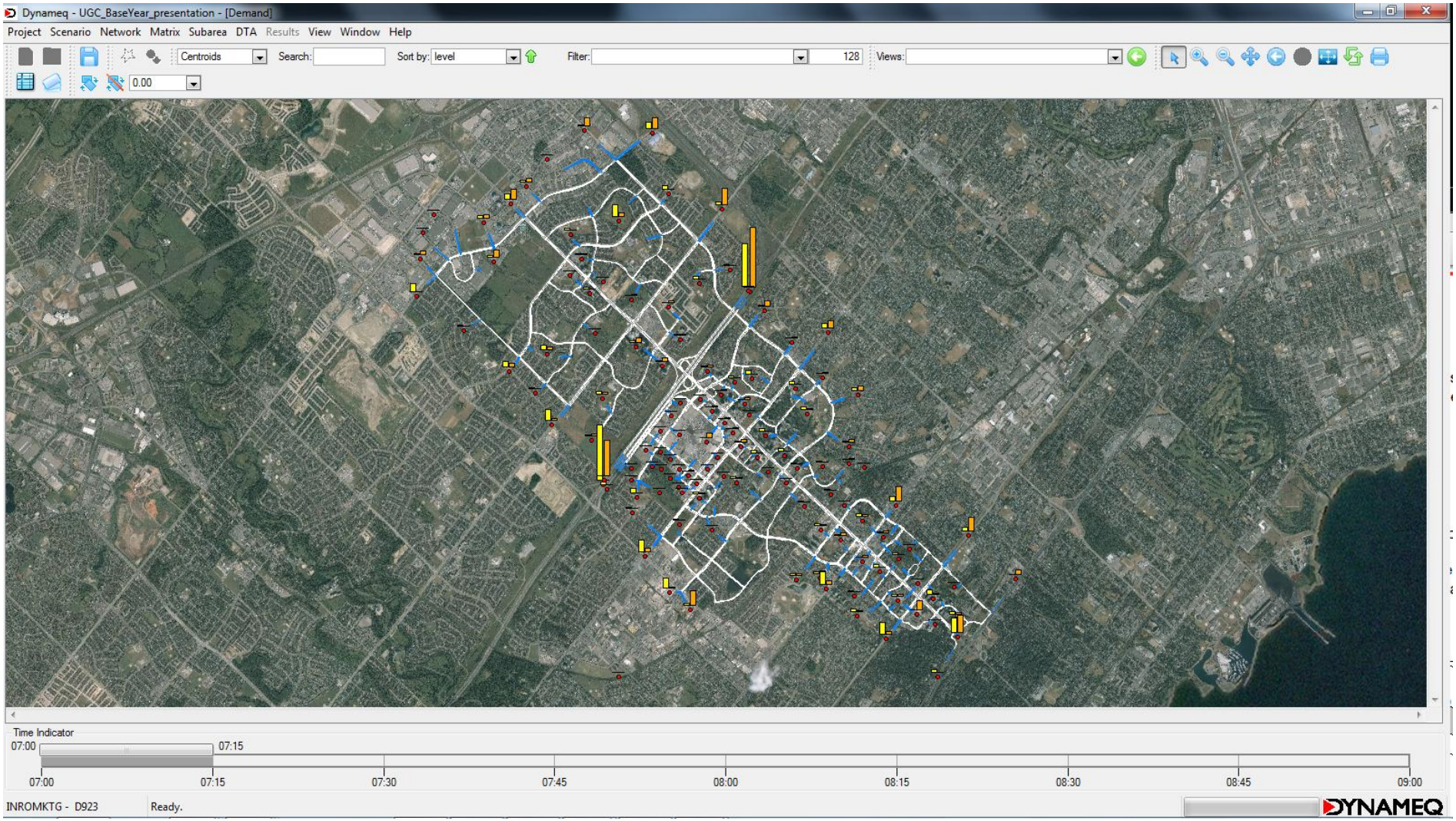
$$+ (1-\alpha) \sum_{\text{O-Ds}} (\text{adjusted demand} - \text{seed matrix})^2$$

weight
$0 \leq \alpha \leq 1$

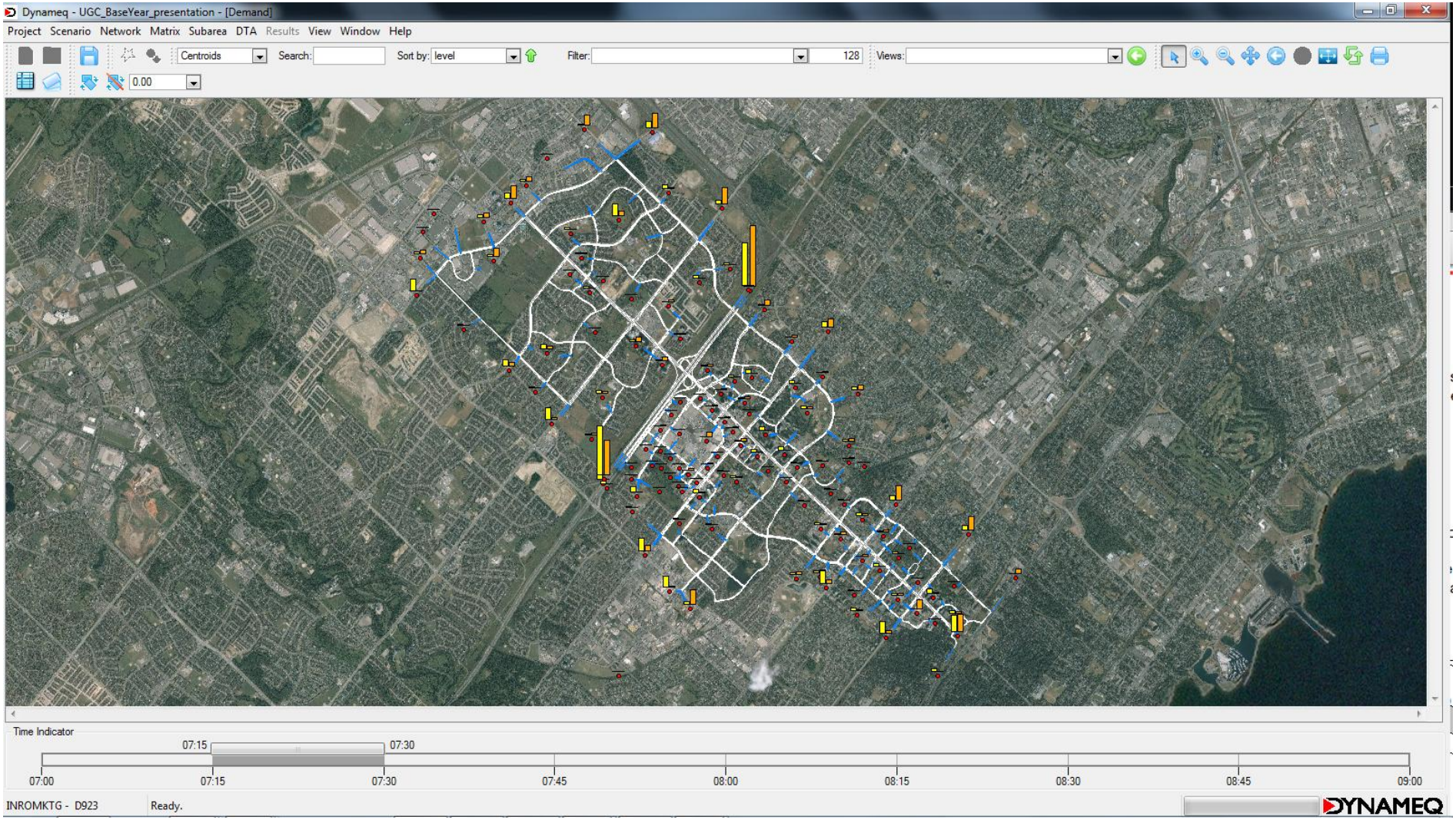
- links and turns
- multiclass
- time-varying
- (weighted)

traversal matrix

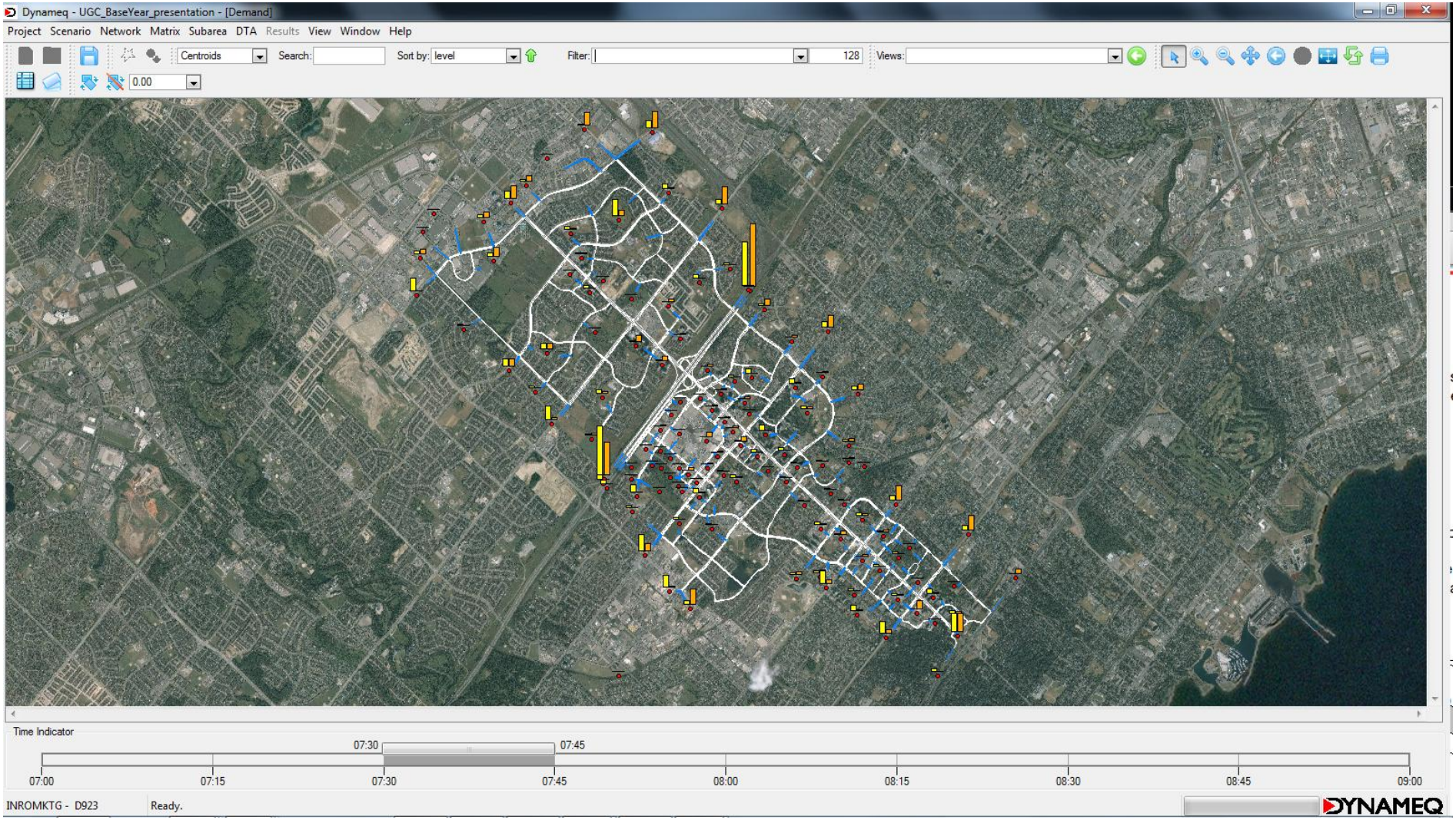
Adjusted Car Matrix 7:00-7:15



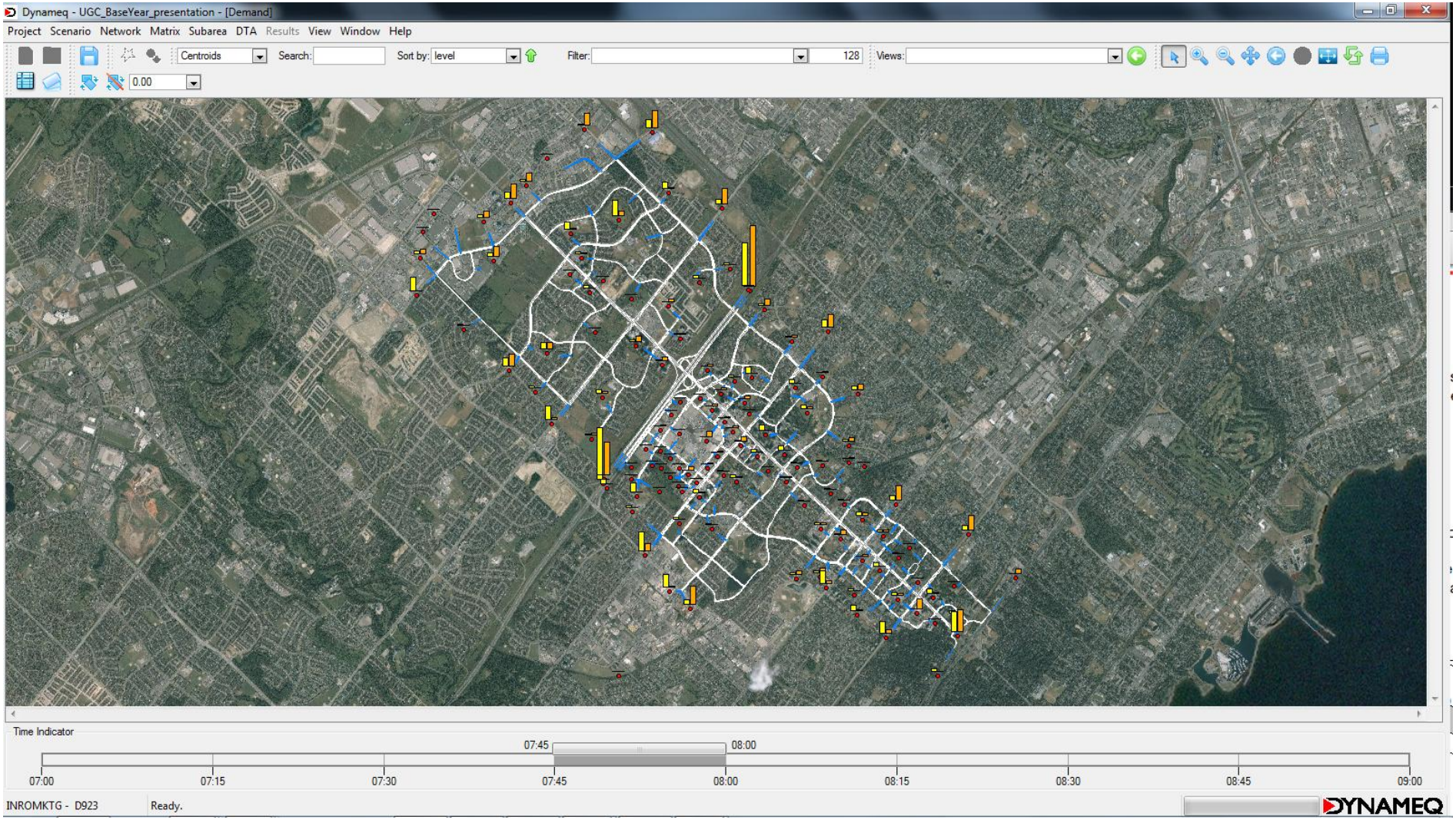
Adjusted Car Matrix 7:15-7:30



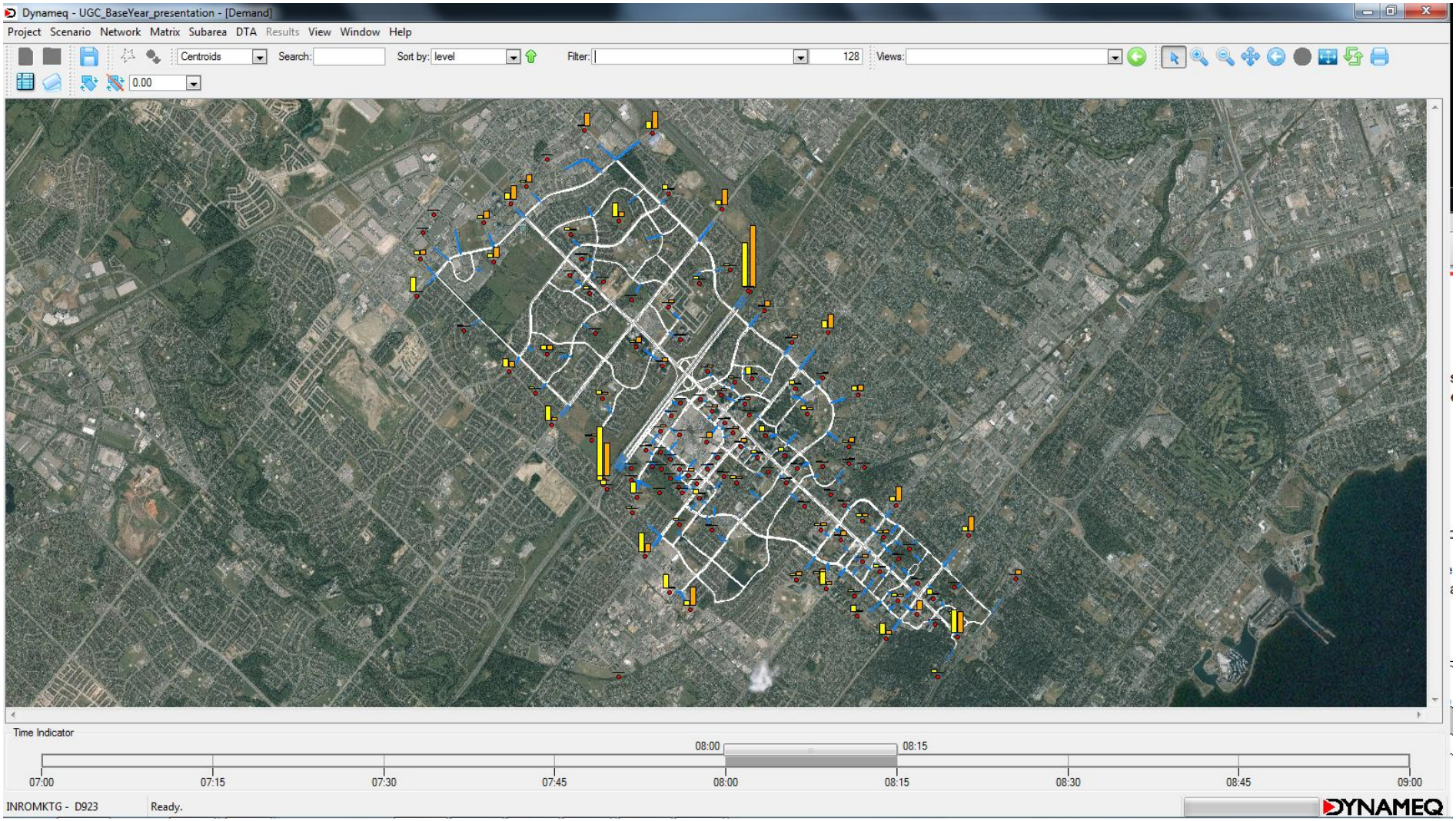
Adjusted Car Matrix 7:30-7:45



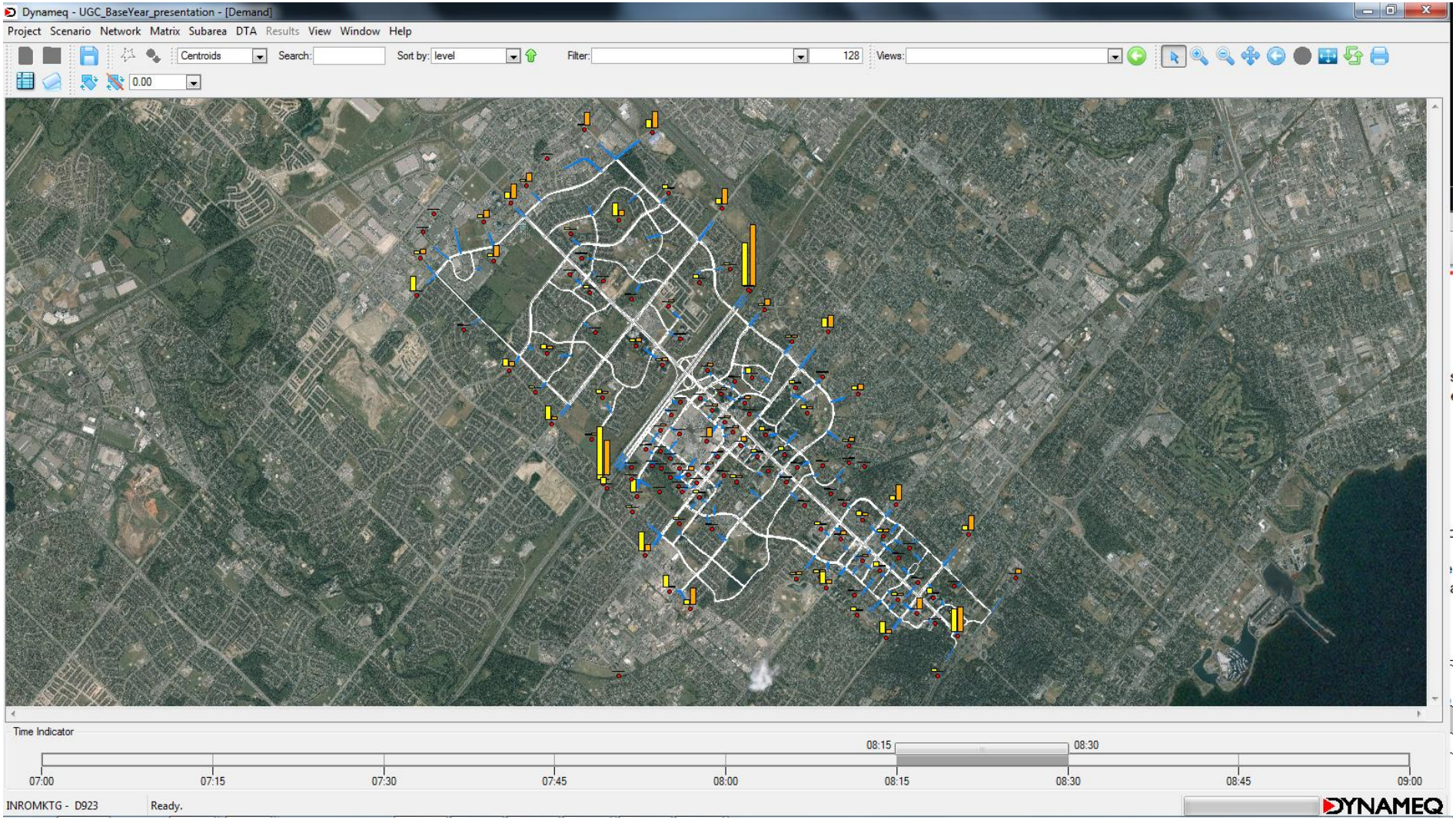
Adjusted Car Matrix 7:45-8:00



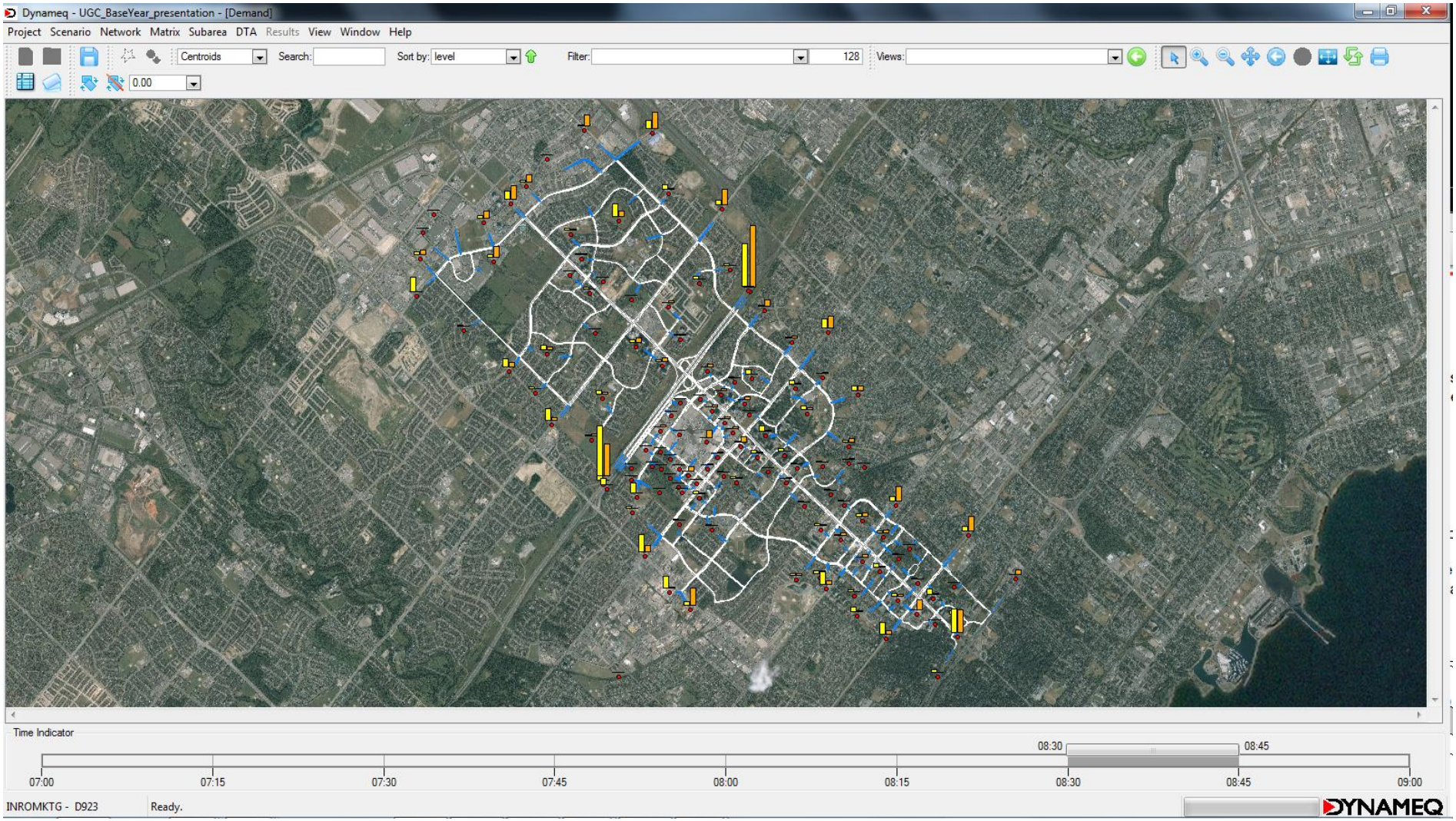
Adjusted Car Matrix 8:00-8:15



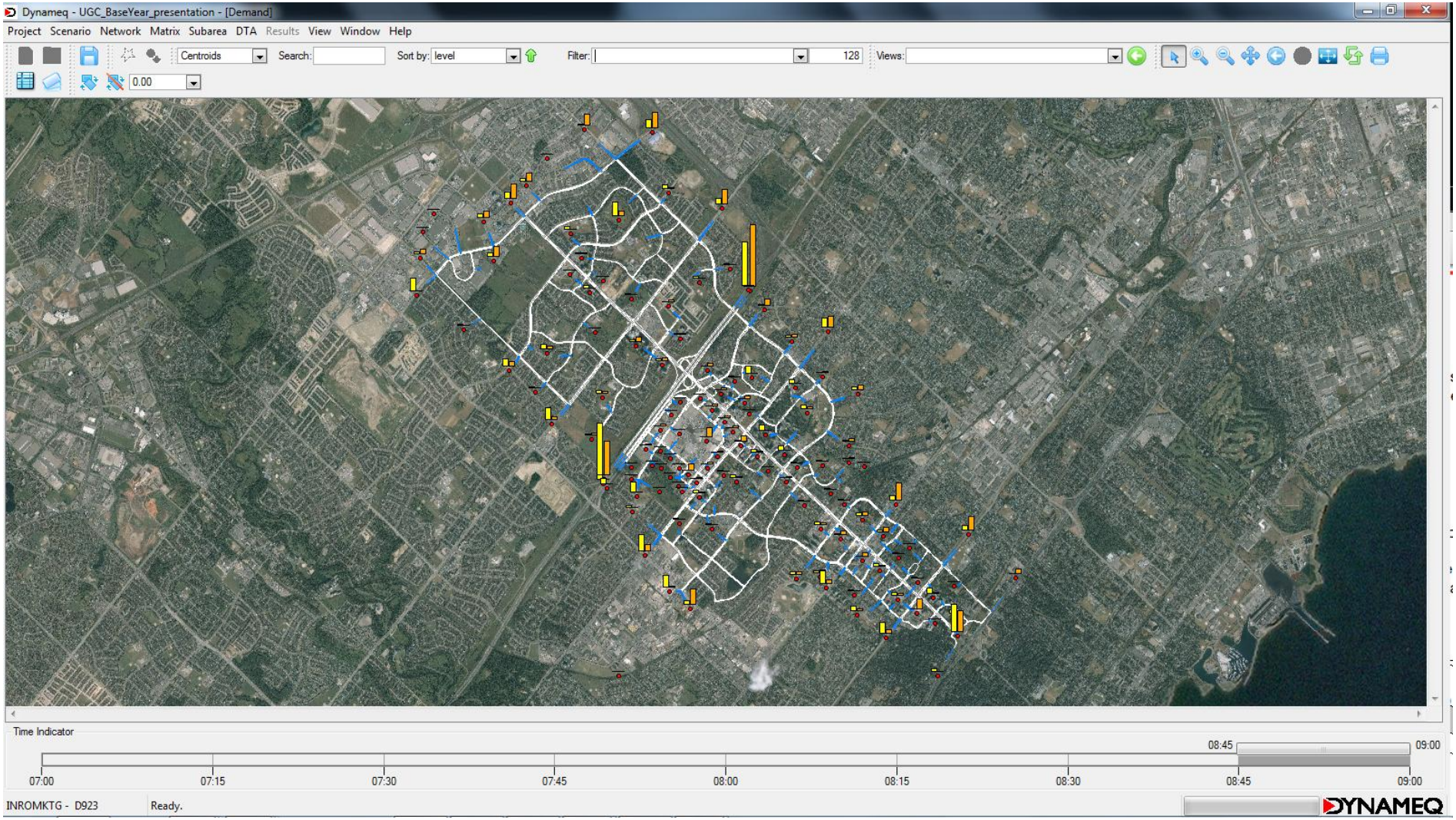
Adjusted Car Matrix 8:15-8:30



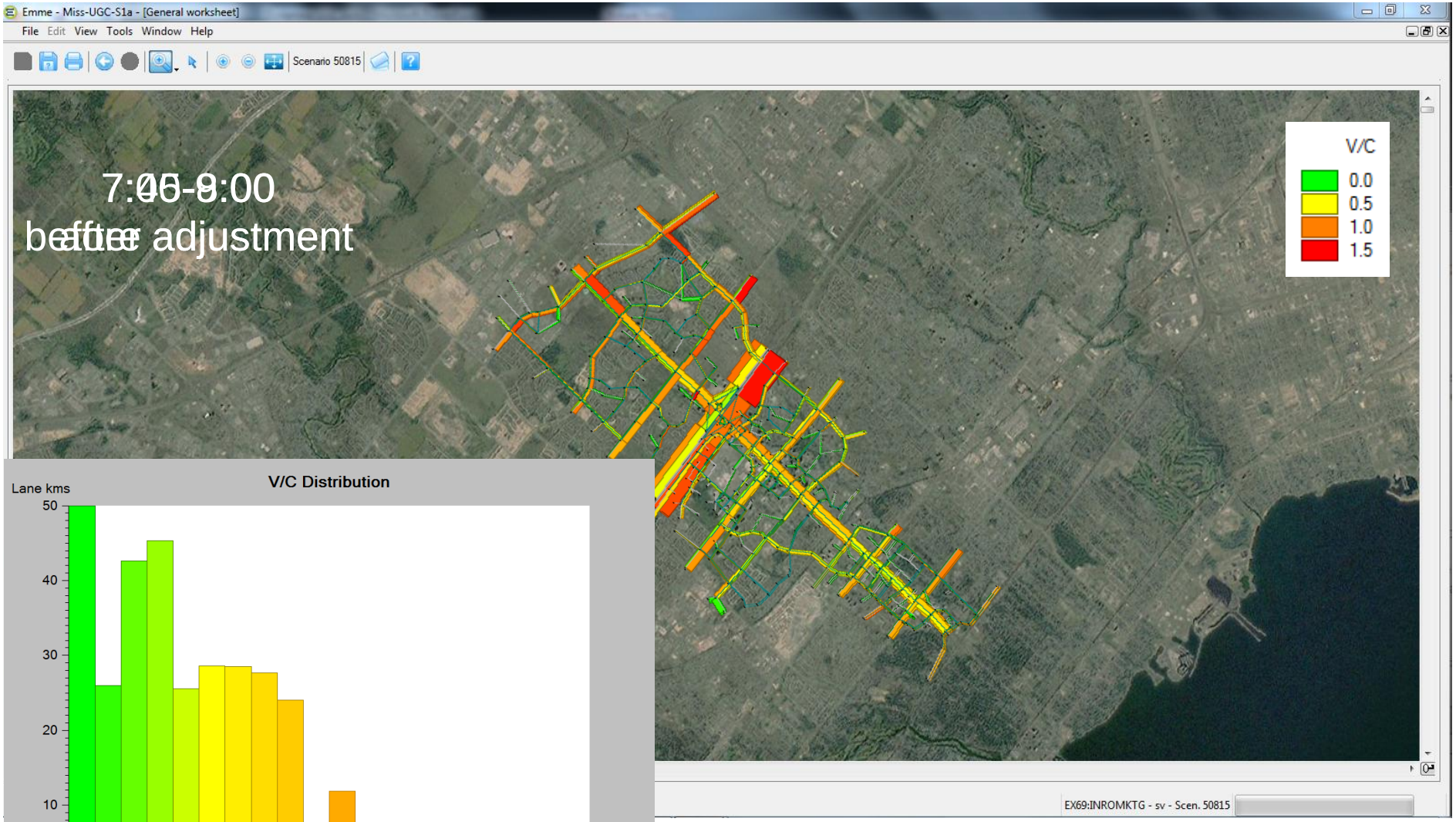
Adjusted Car Matrix 8:30-8:45

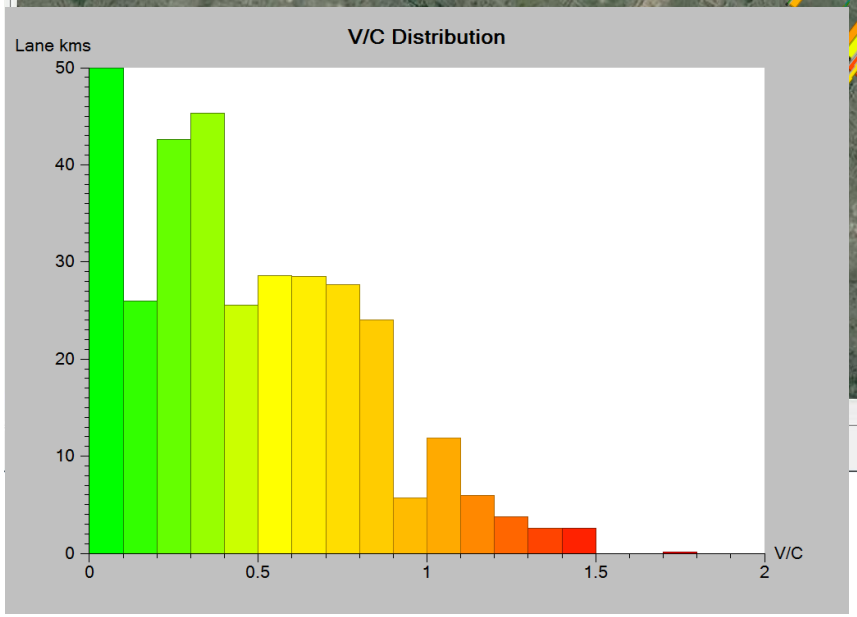


Adjusted Car Matrix 8:45-9:00



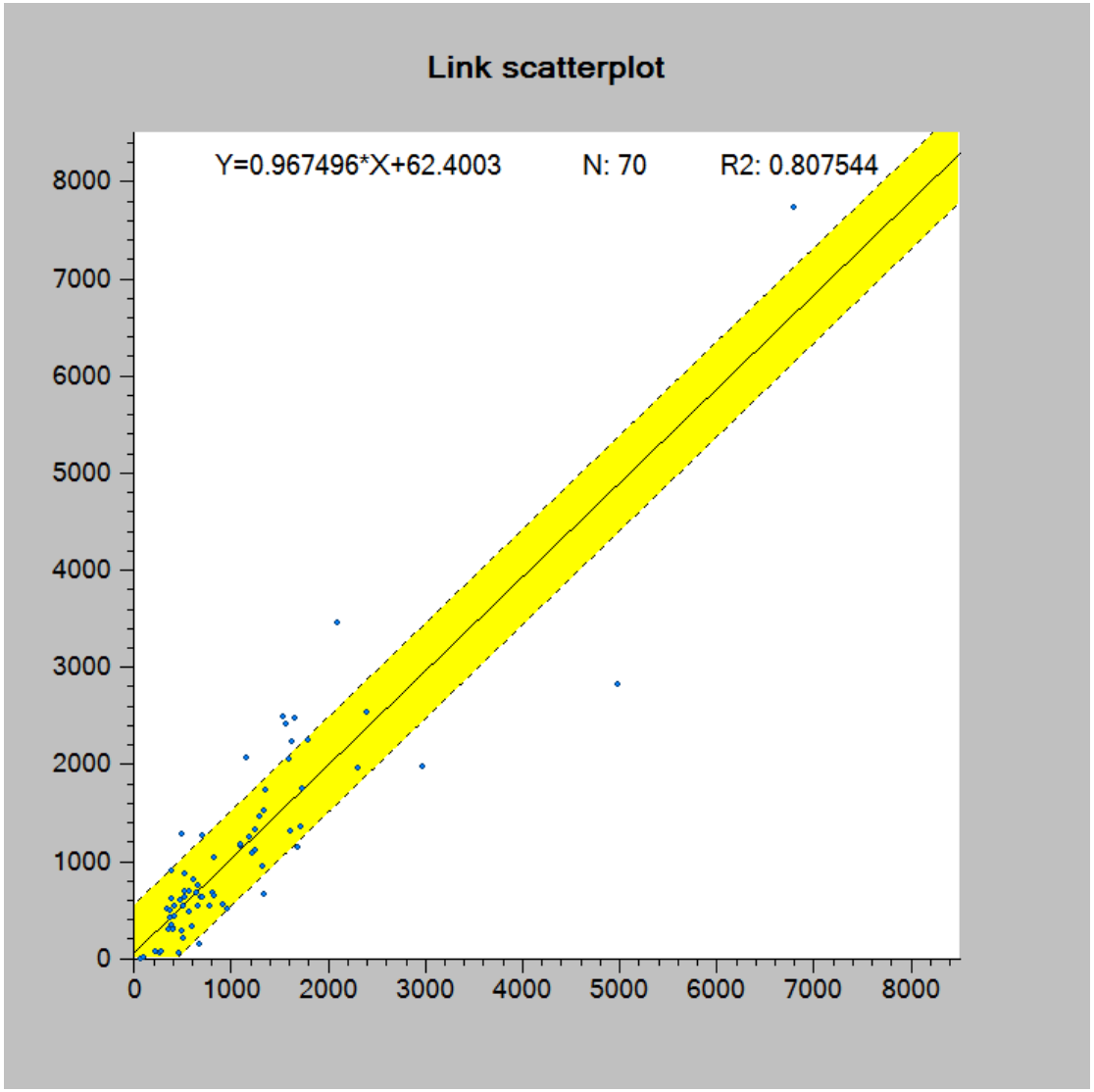
Adjusted Demand Static Assignment





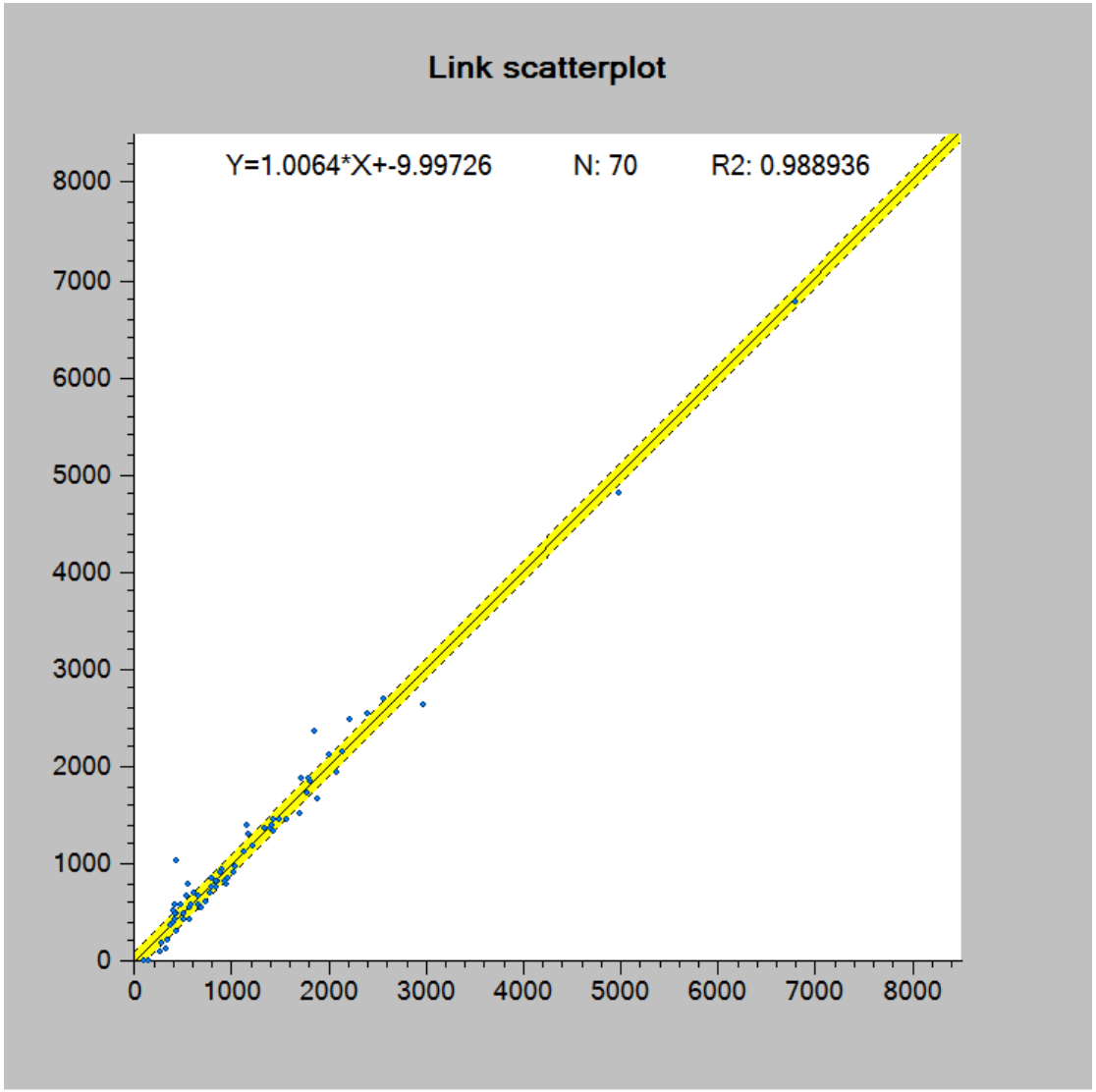
Multiclass Demand Adjustment

cars before adjustment



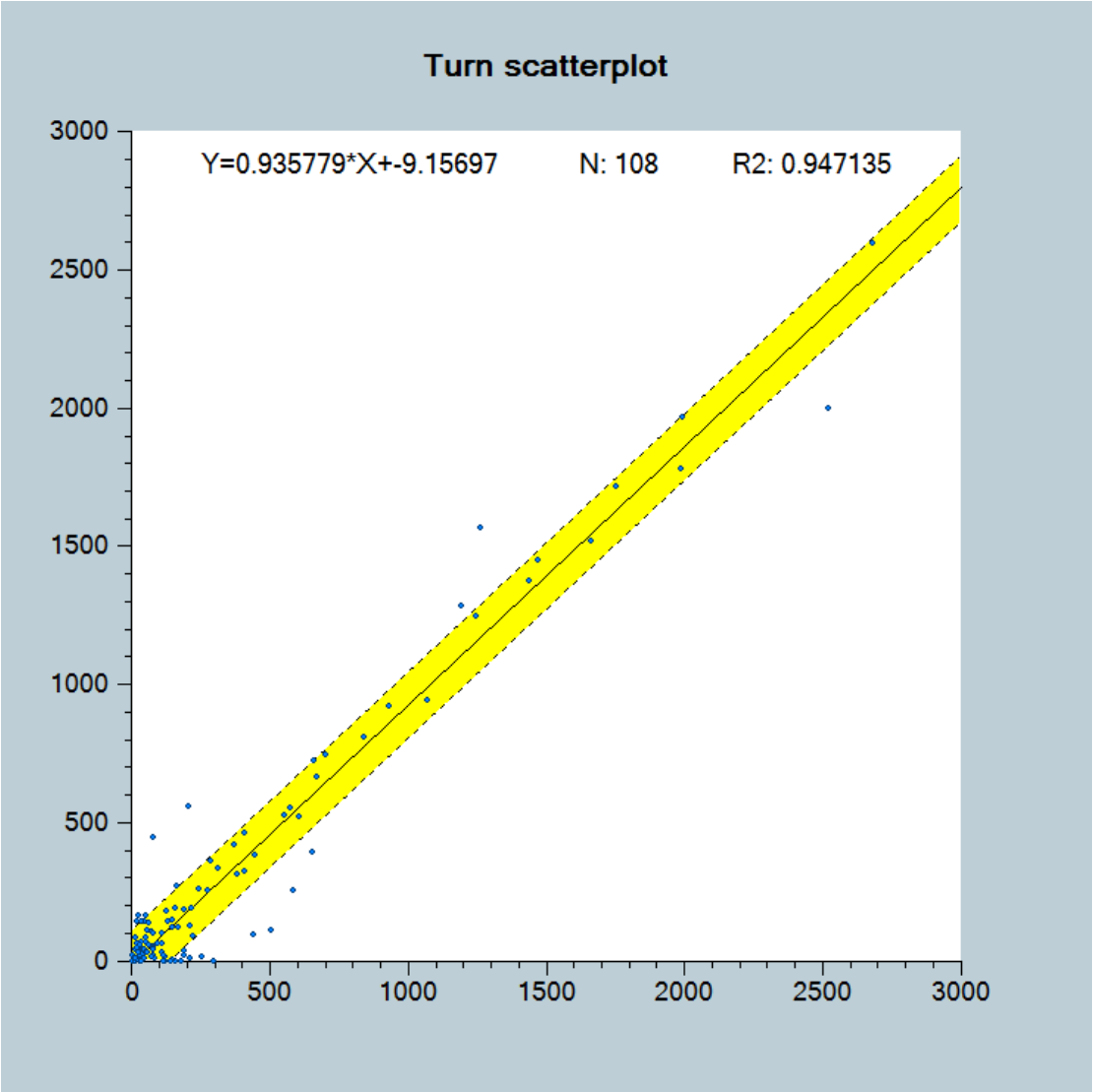
Multiclass Demand Adjustment

cars
7:45-8:00
α =0.75



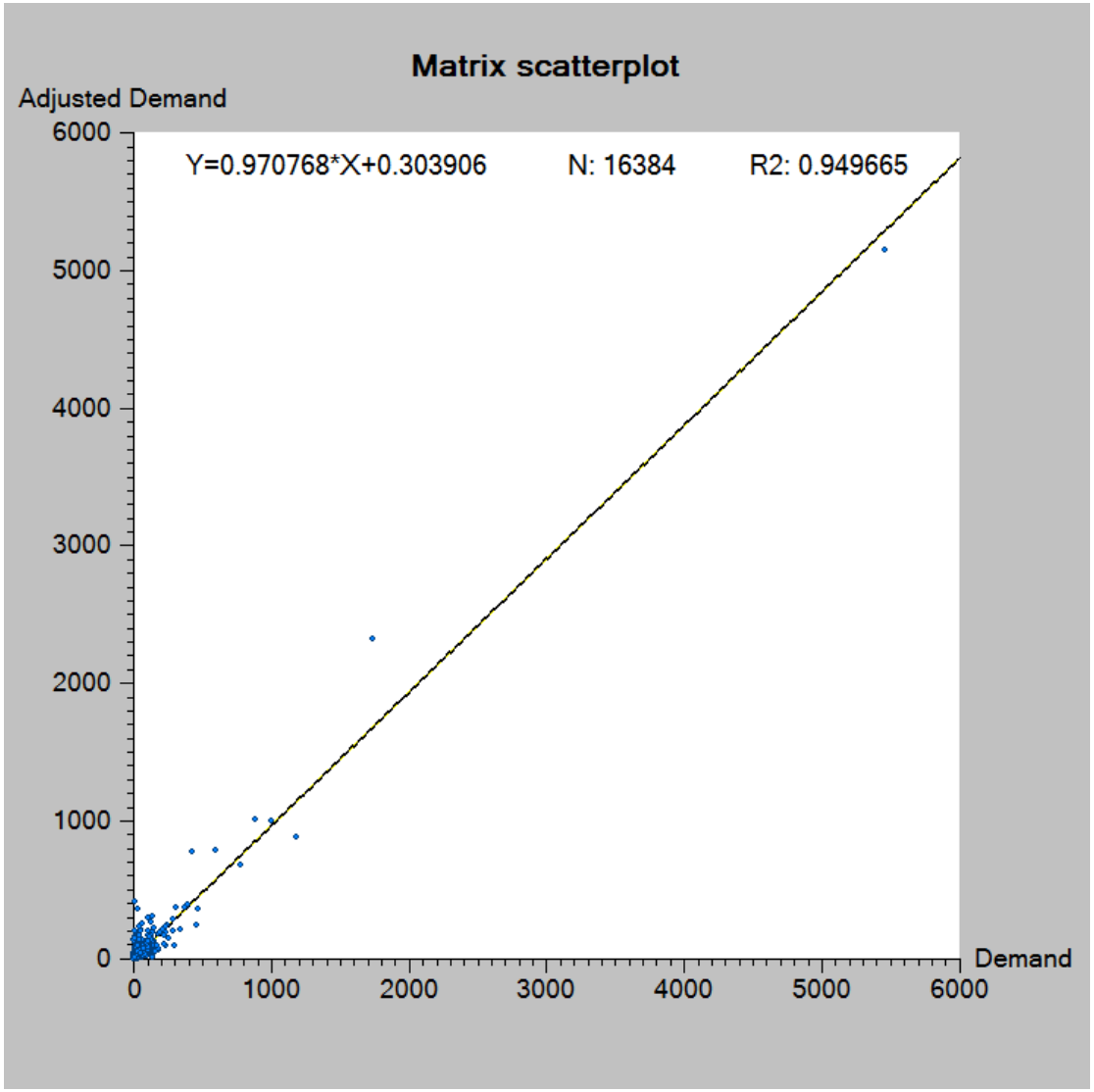
Multiclass Demand Adjustment

cars
7:45-8:00
α =0.75



Multiclass Demand Adjustment

cars
7:45-8:00
α =0.75



Demand Adjustment

Find new O-D matrix such that

$$\min \alpha \sum_{\text{counts}} (\text{assigned flows} - \text{counts})^2$$

$$+ (1-\alpha) \sum_{\text{O-Ds}} (\text{adjusted demand} - \text{seed matrix})^2$$

weight
$\alpha = 0.75$

Demand Adjustment

Find new O-D matrix such that

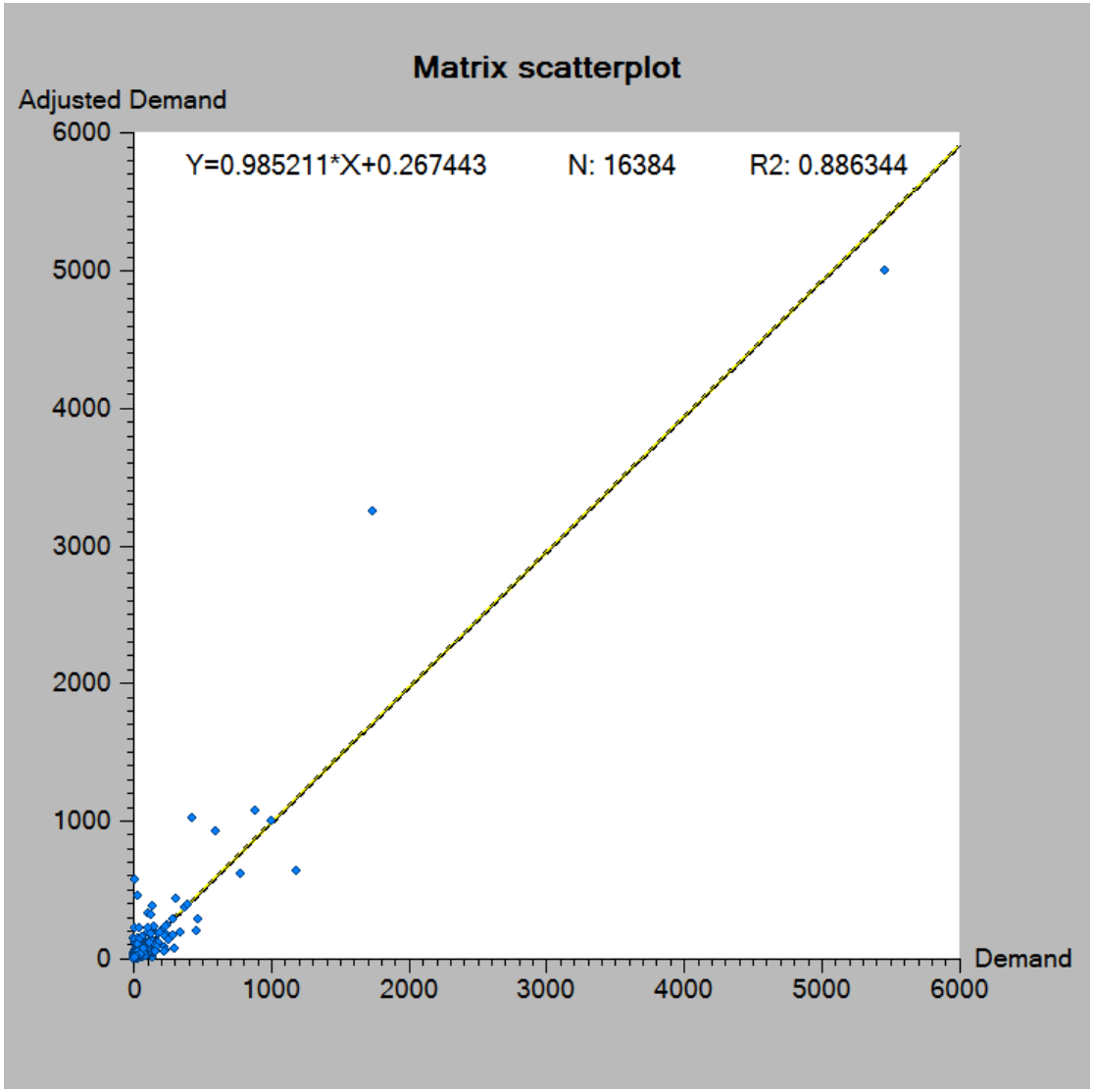
$$\min \alpha \sum_{\text{counts}} (\text{assigned flows} - \text{counts})^2$$

$$\cancel{+ (1-\alpha) \sum_{\text{O-Ds}} (\text{adjusted demand} - \text{seed matrix})^2}$$

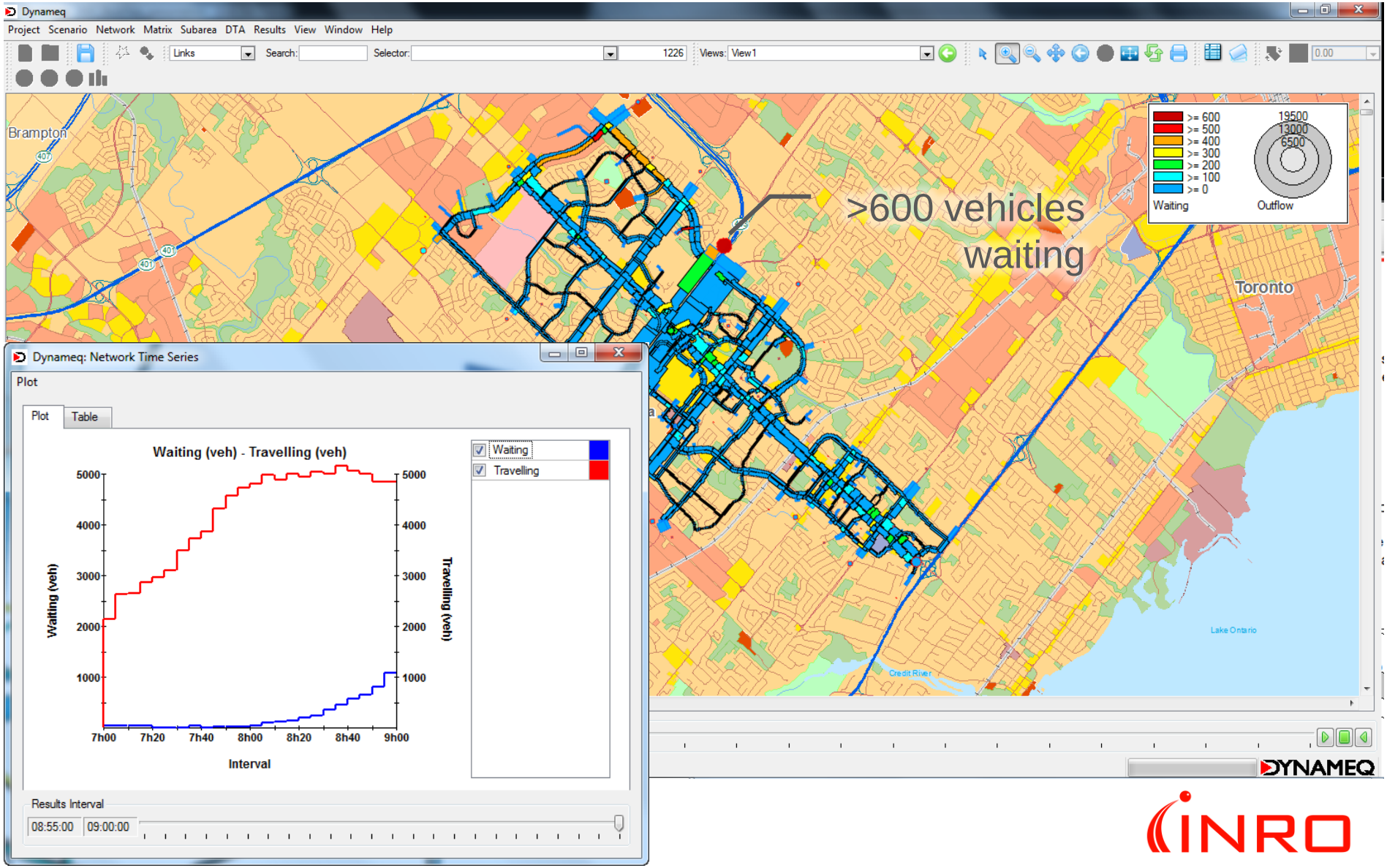
weight
$\alpha = 1.00$

Multiclass Demand Adjustment

cars
7:45-8:00
α =1.00



Initial DTA Results



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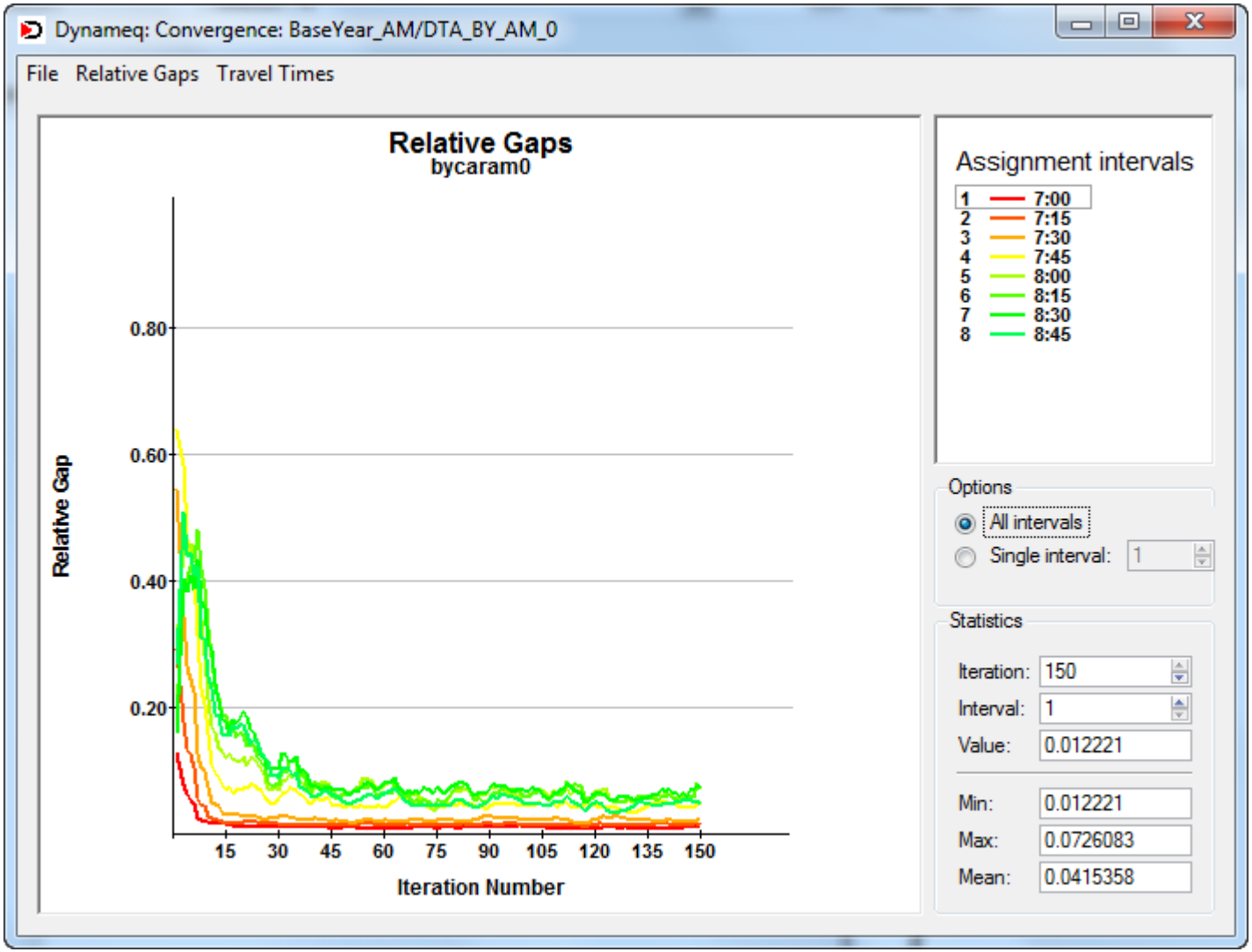
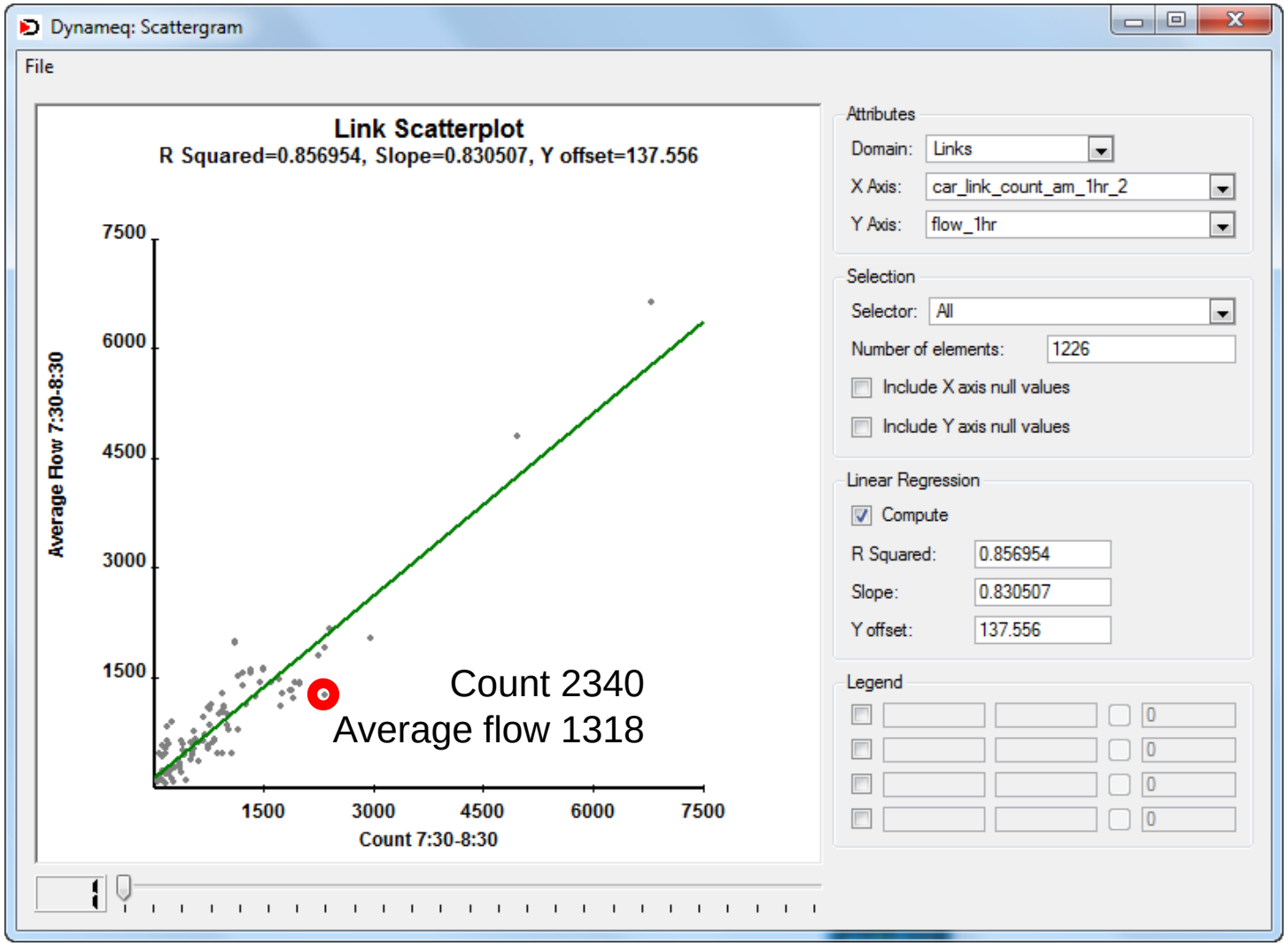
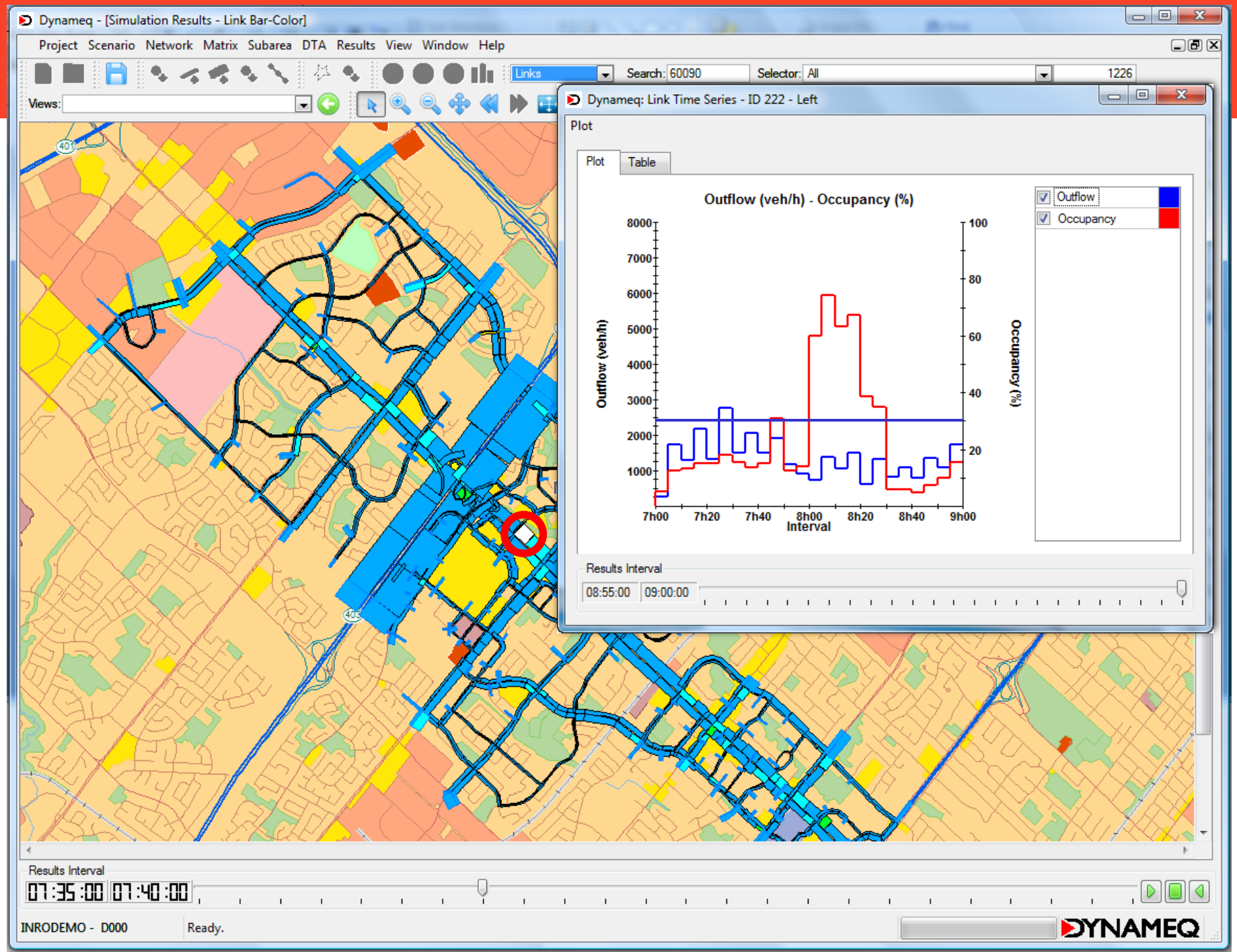
Initial Convergence



Initial Calibration




Dynameq - [Simulation Results - Link Bar-Color]
Project Scenario Network Matrix Subarea DTA Results View Window Help
Links
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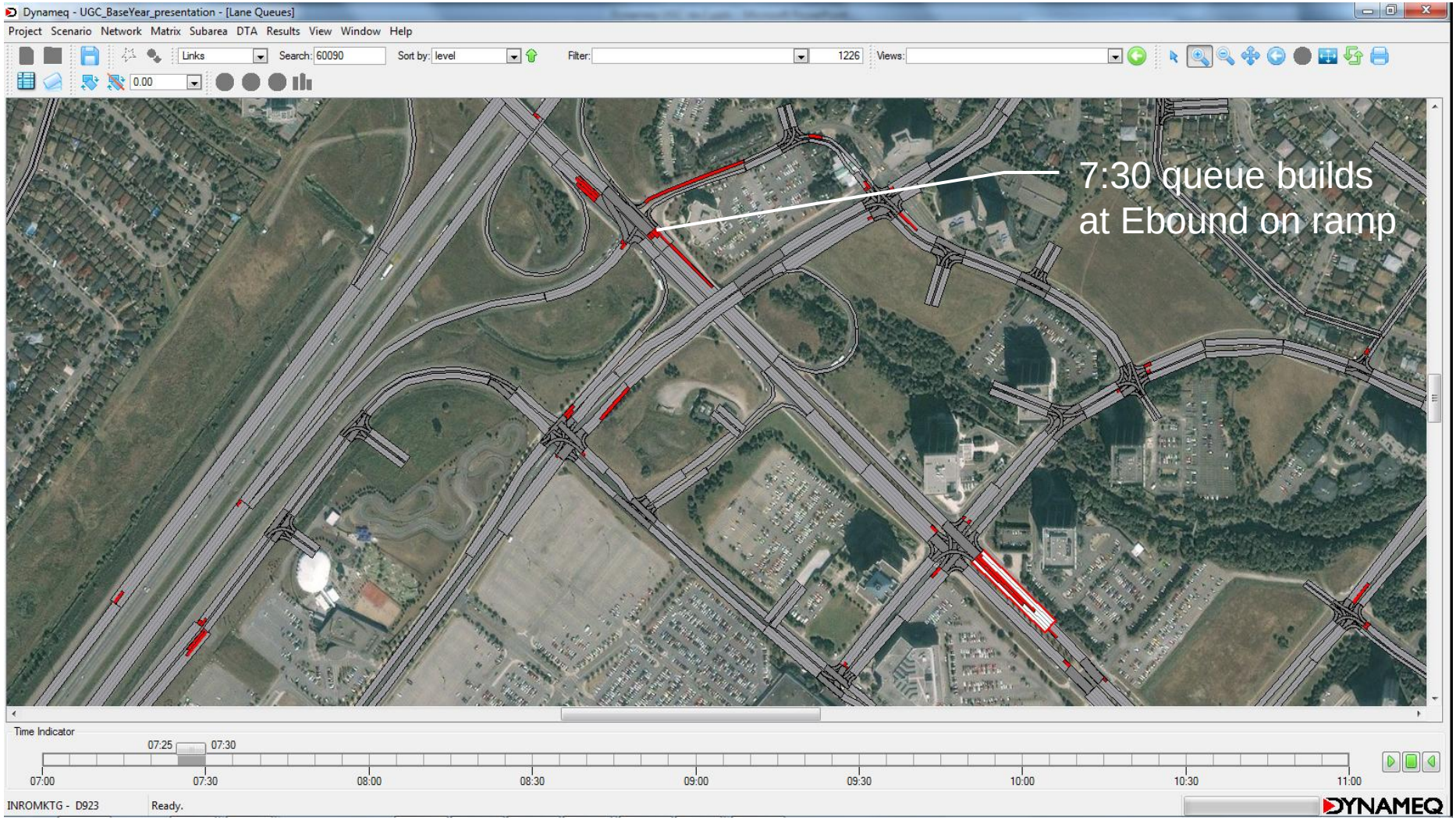
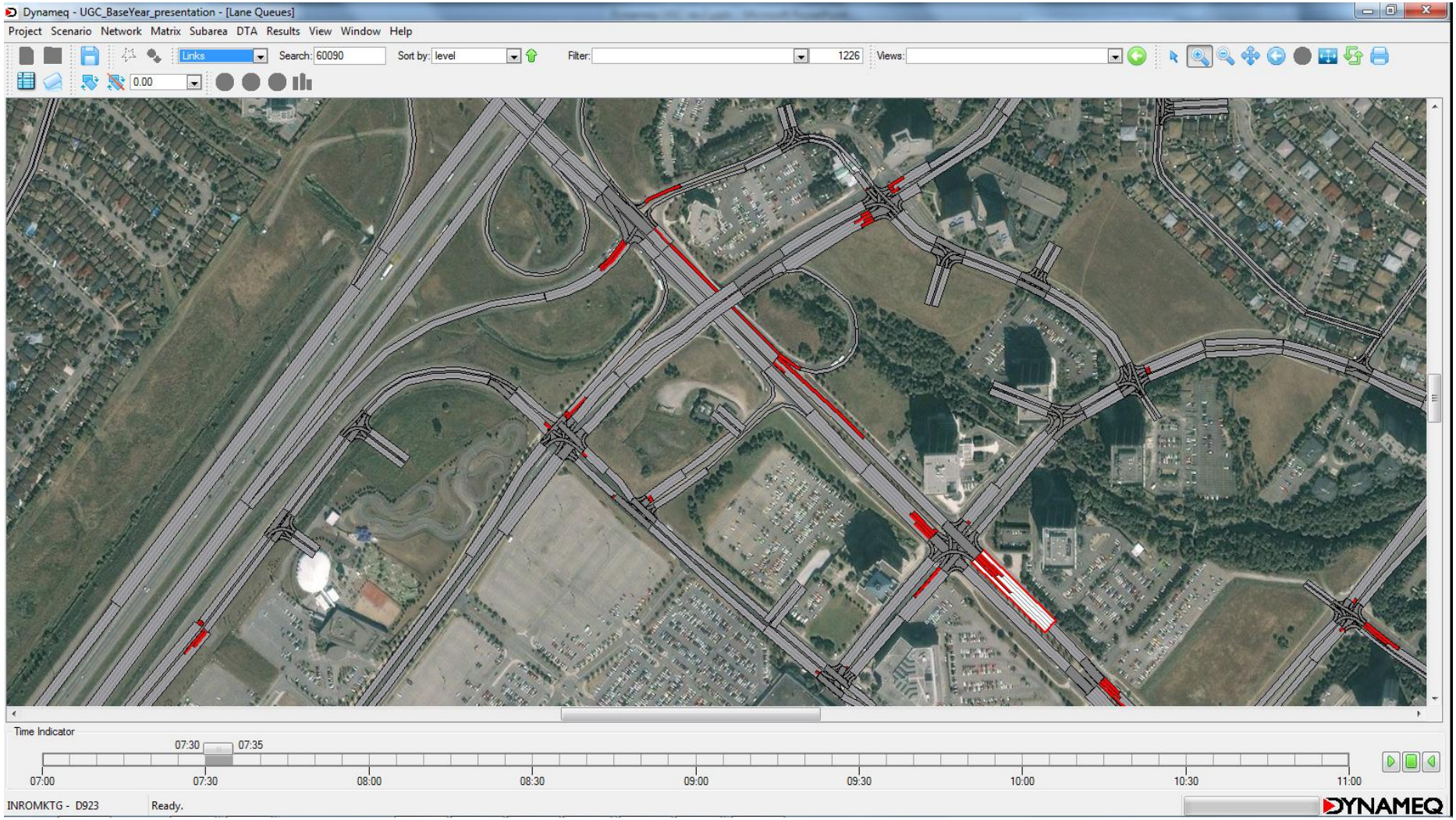
Selector: All
1226
Views:
Dynameq: Link Time Series - ID 222 - Left
Plot
Plot
Table
Outflow (veh/h) - Occupancy (%)
Outflow (veh/h)
Occupancy (%)
8000
7000
6000
5000
4000
3000
2000
1000
100
80
60
40
20
7h00
7h20
7h40
8h00
8h20
8h40
9h00
Interval
Outflow
Occupancy
Results Interval
08:55:00
09:00:00
Results Interval
07:35:00
07:40:00
INRODEMO - D000
Ready.
DYNAMEQ

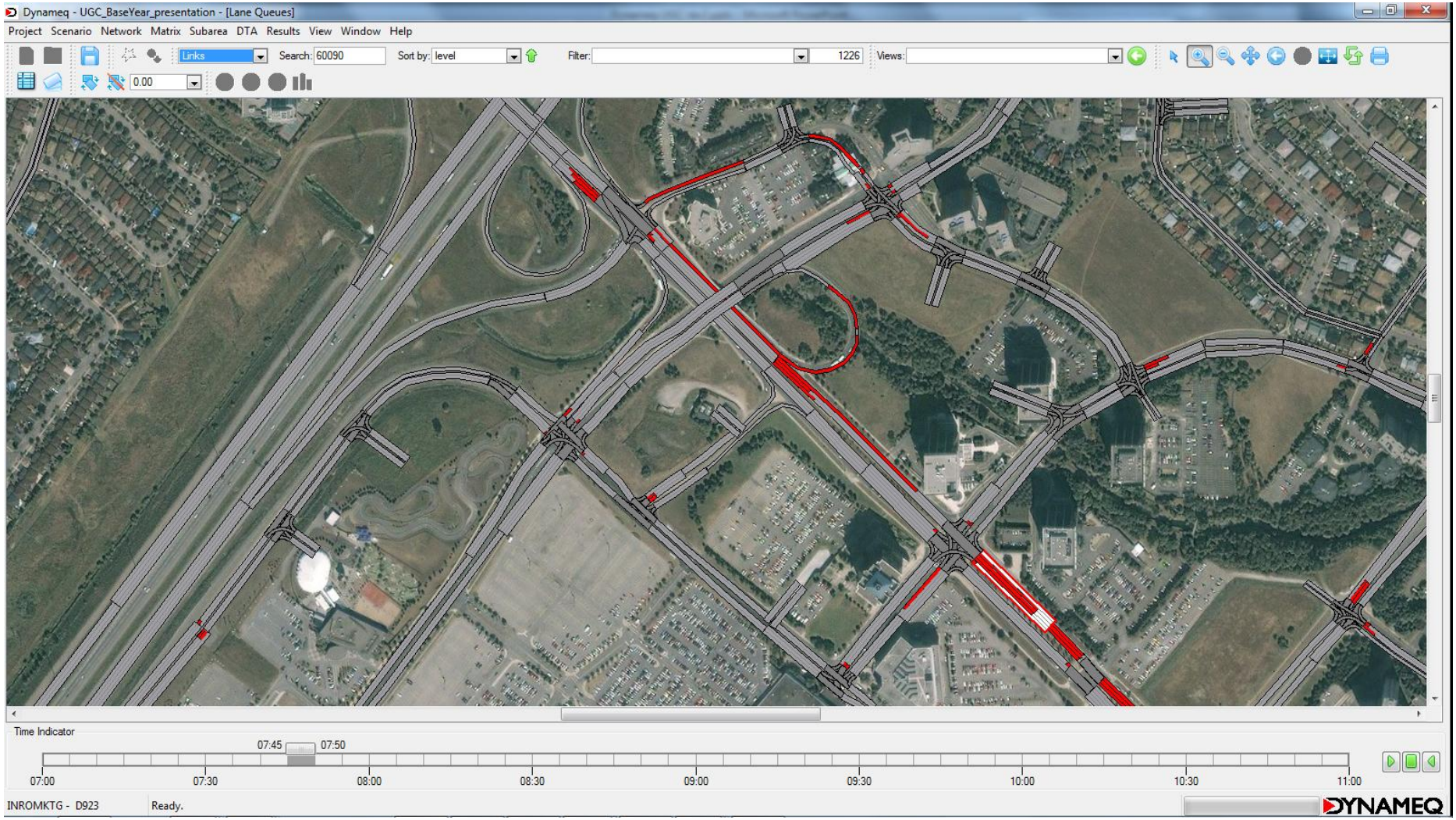
Queue Spillback 8:00-8:30



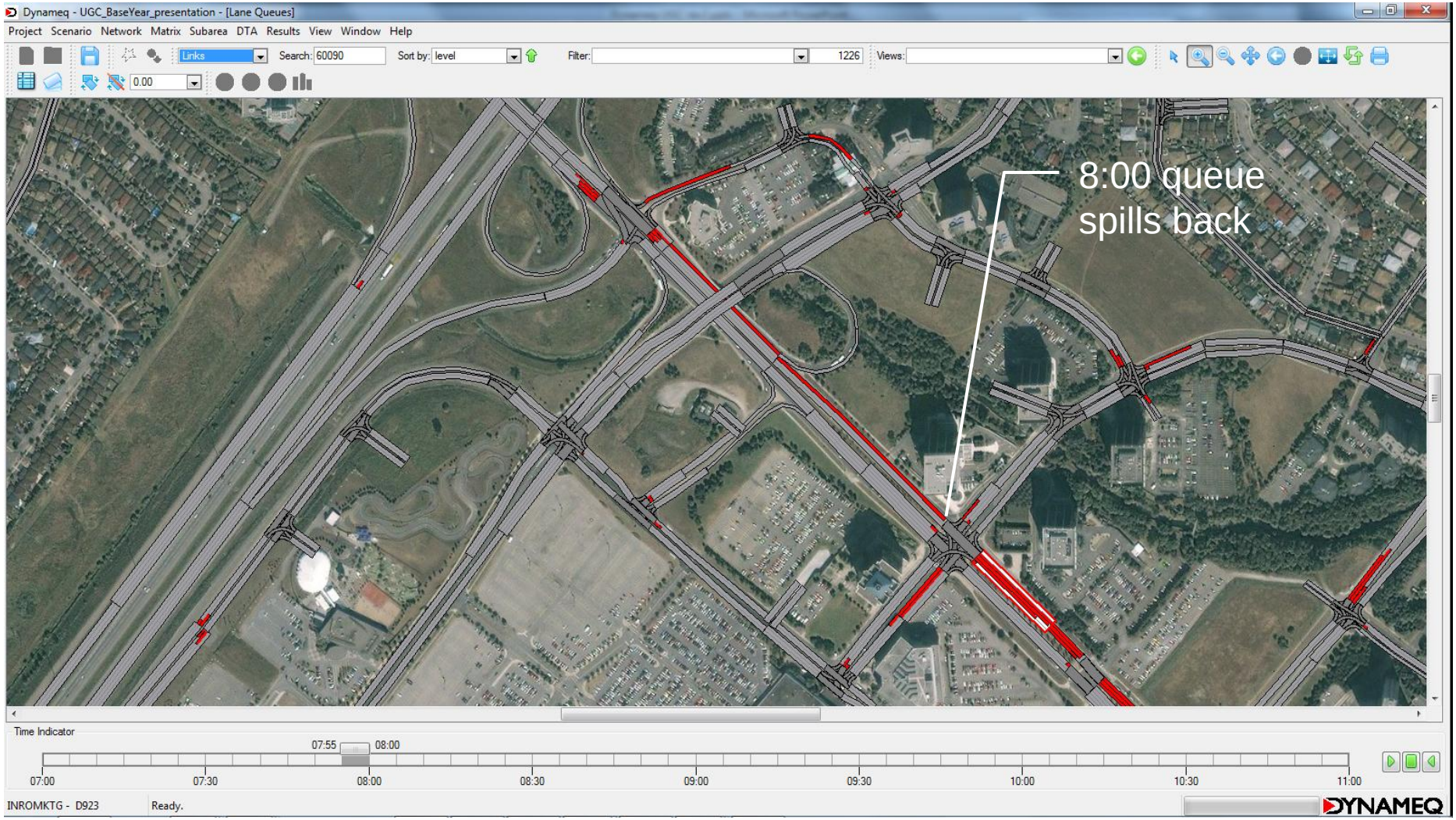
Queue Spillback 8:00-8:30



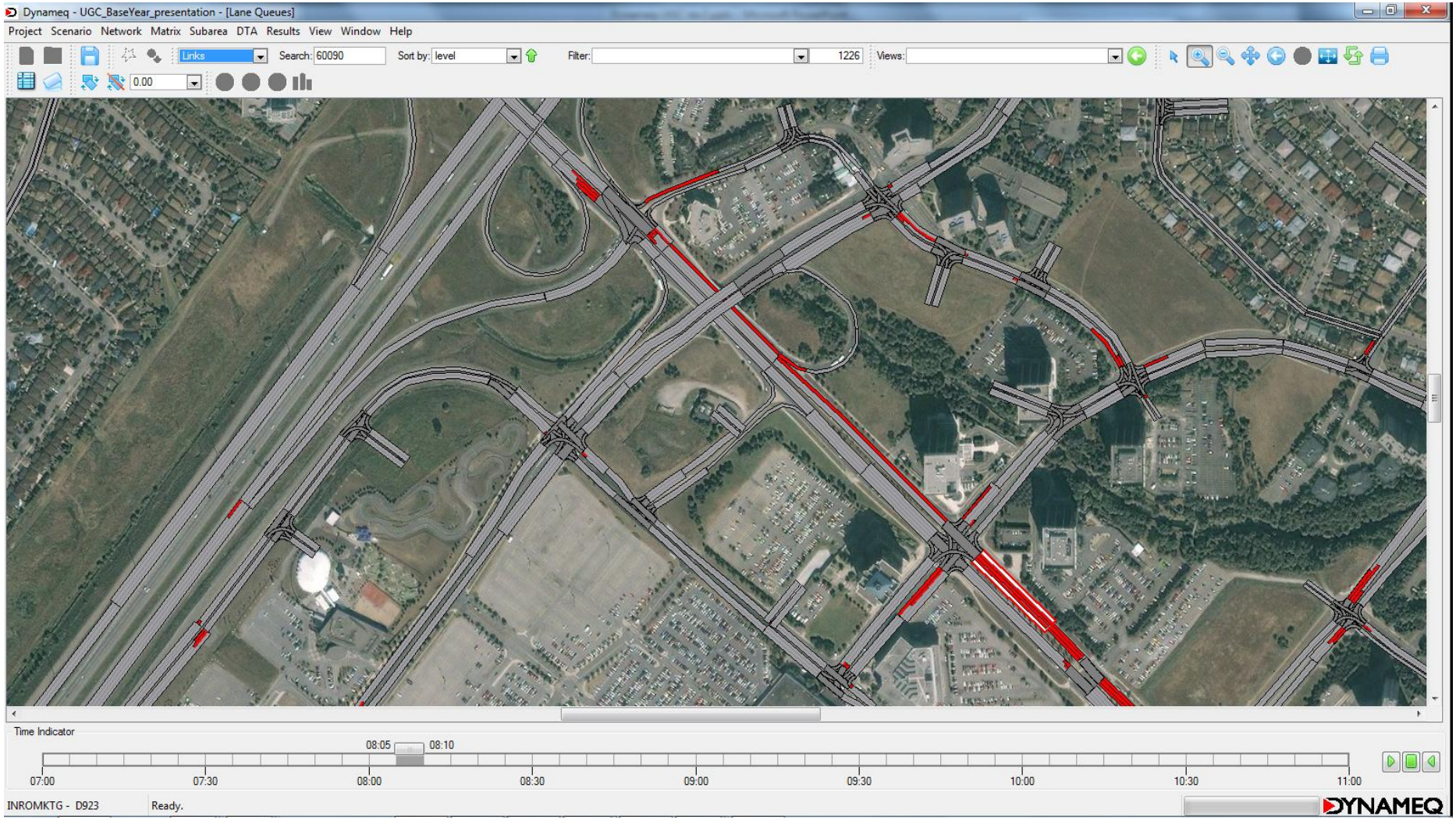
Queue Spillback 8:00-8:30



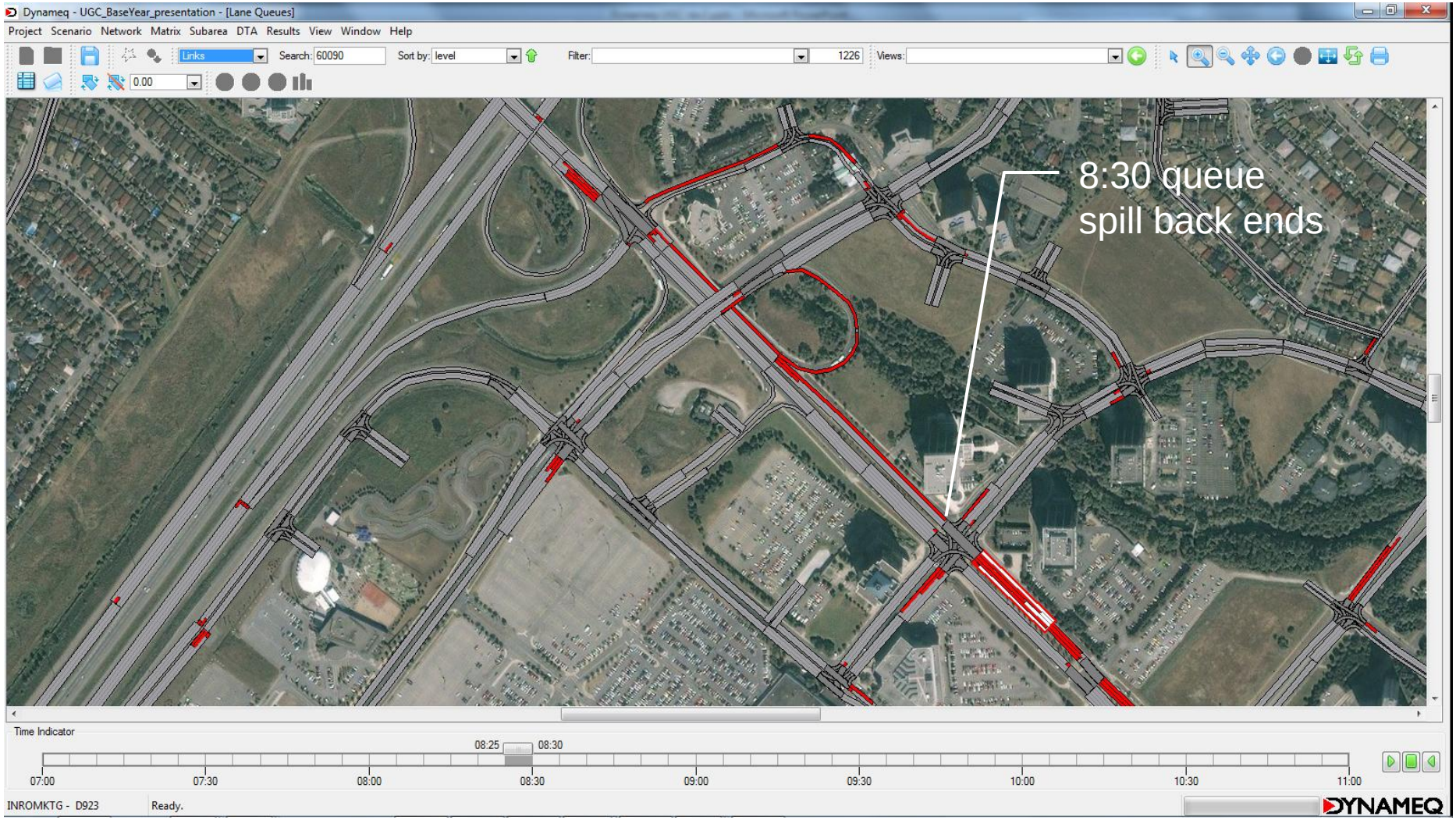
Queue Spillback 8:00-8:30



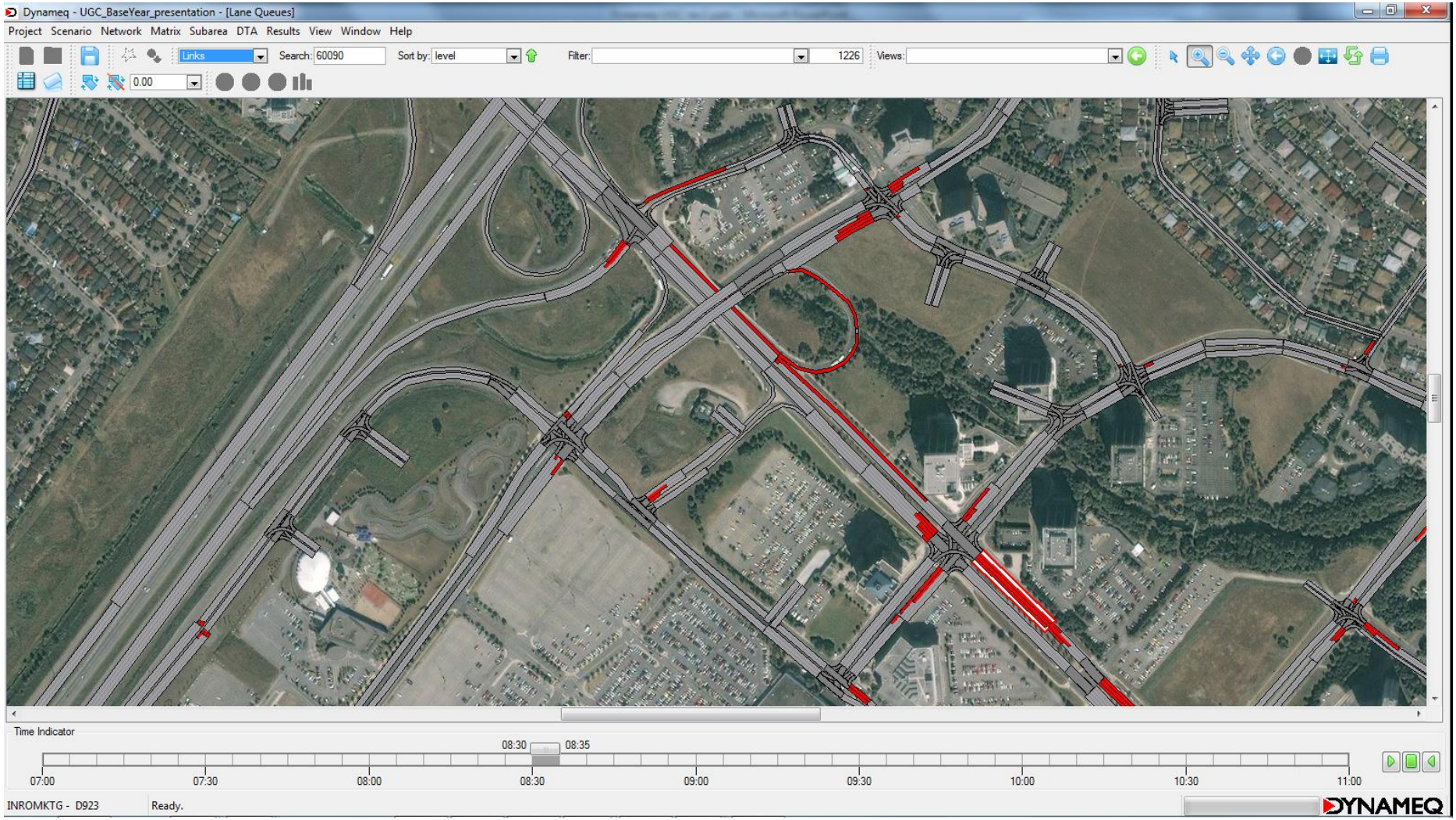
Queue Spillback 8:00-8:30



Queue Spillback 8:00-8:30



Queue Spillback 8:00-8:30



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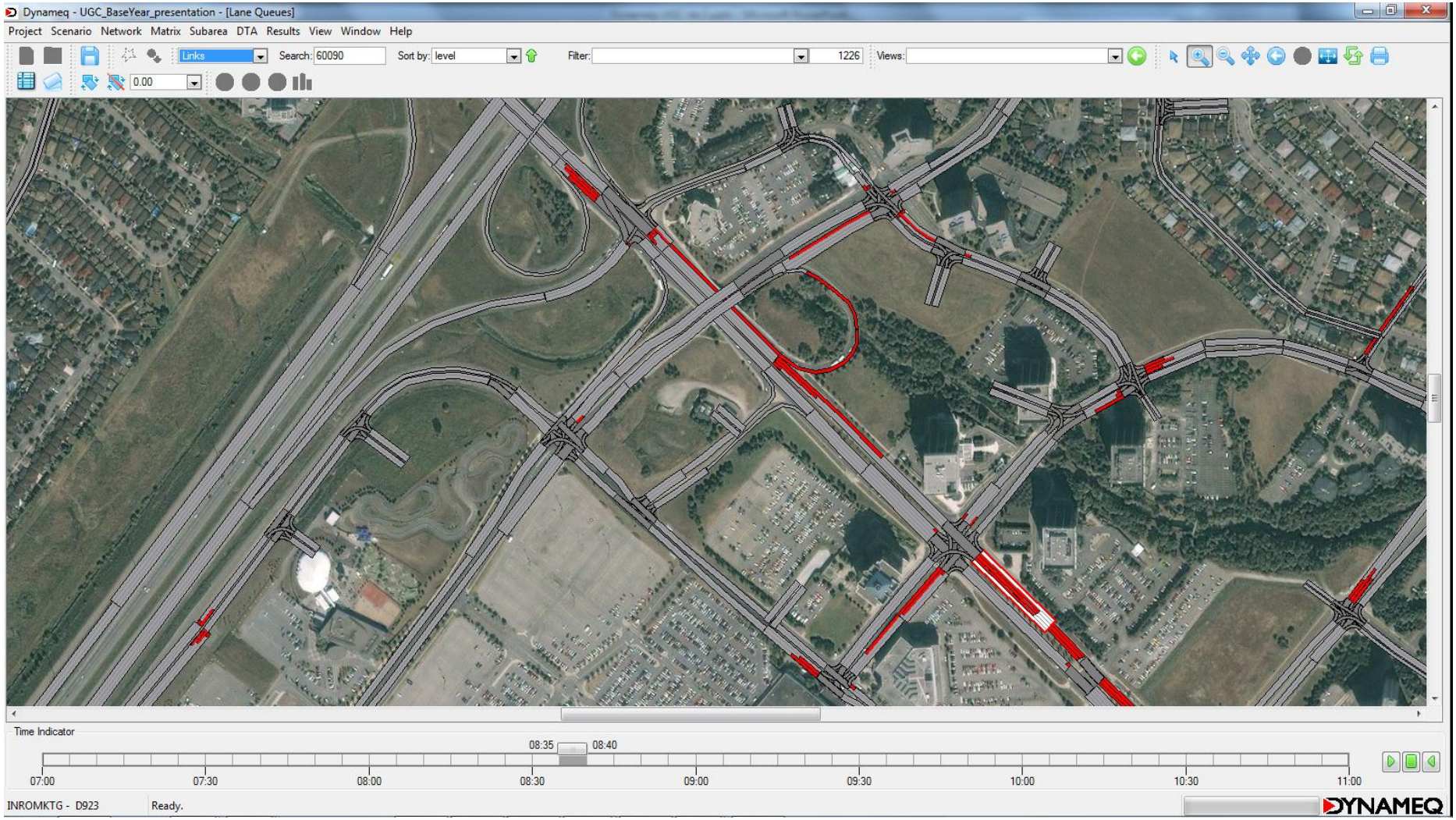
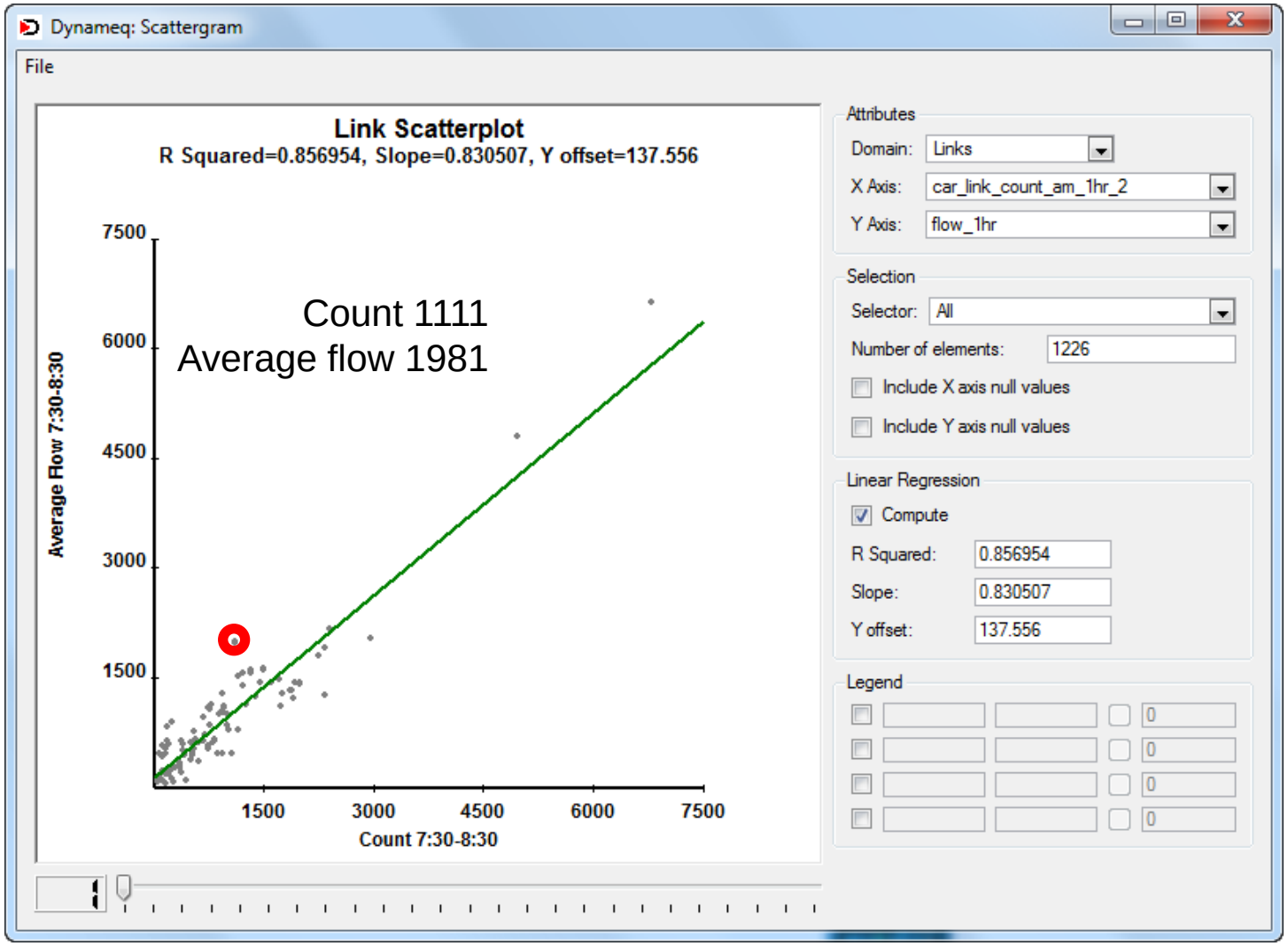


Calibration: another outlier



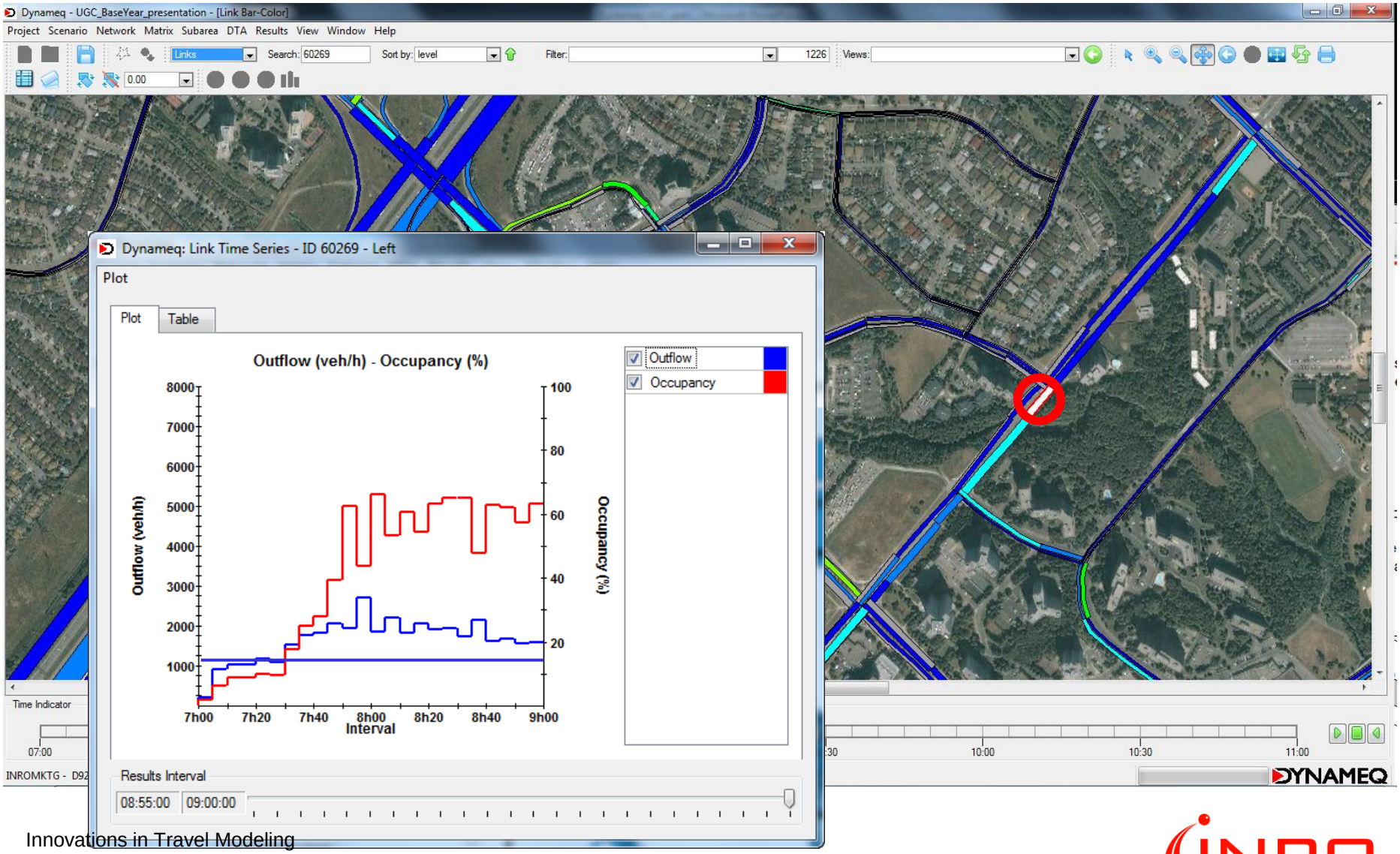

Dynameq - UGC_BaseYear_presentation - [Link Bar-Color]
Project Scenario Network Matrix Subarea DTA Results View Window Help
Links
Search: 60269
Sort by: level
Filter:
1226
Views:
Dynameq: Link Time Series - ID 60269 - Left
Plot
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Table
Outflow (veh/h) - Occupancy (%)
Outflow (veh/h)
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8000
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6000
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100
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7h20
7h40
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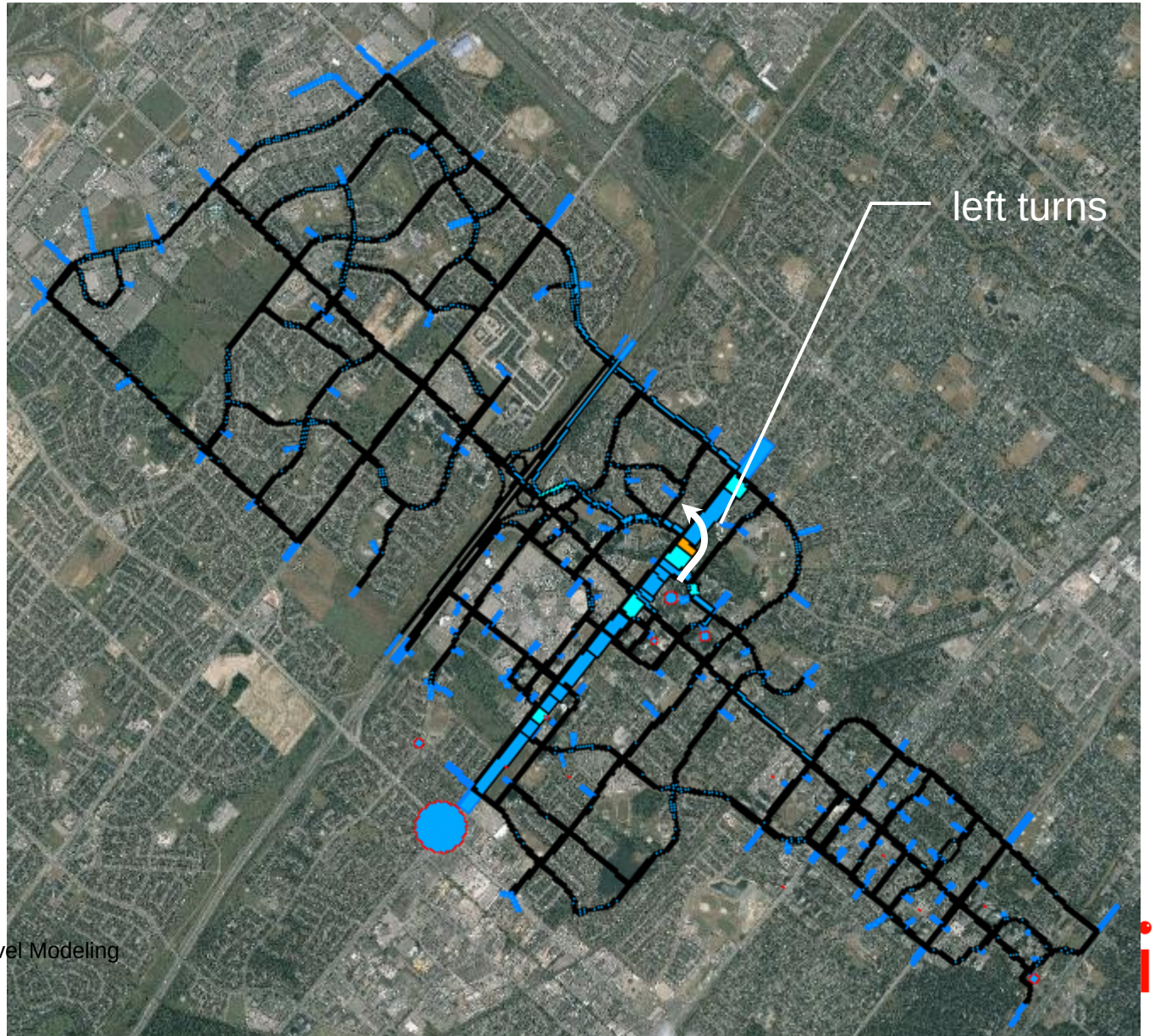
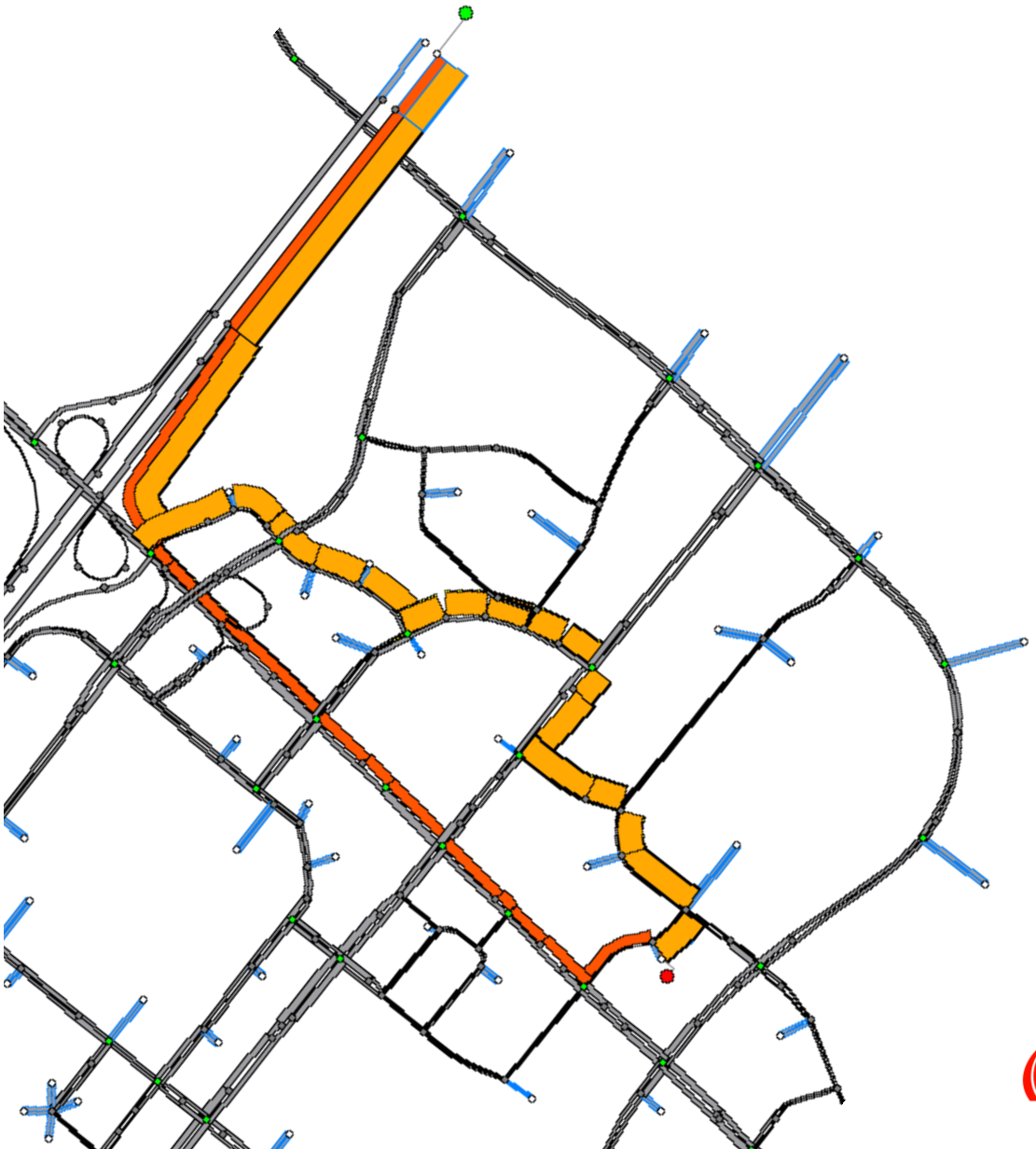
8h40
9h00
Interval
Outflow
Occupancy
Results Interval
08:55:00
09:00:00
Time Indicator
07:00
10:00
10:30
11:00
DYNAMEQ

Dynamic Select-link Analysis



Dynamic Path Analysis

departures
7:30-7:45

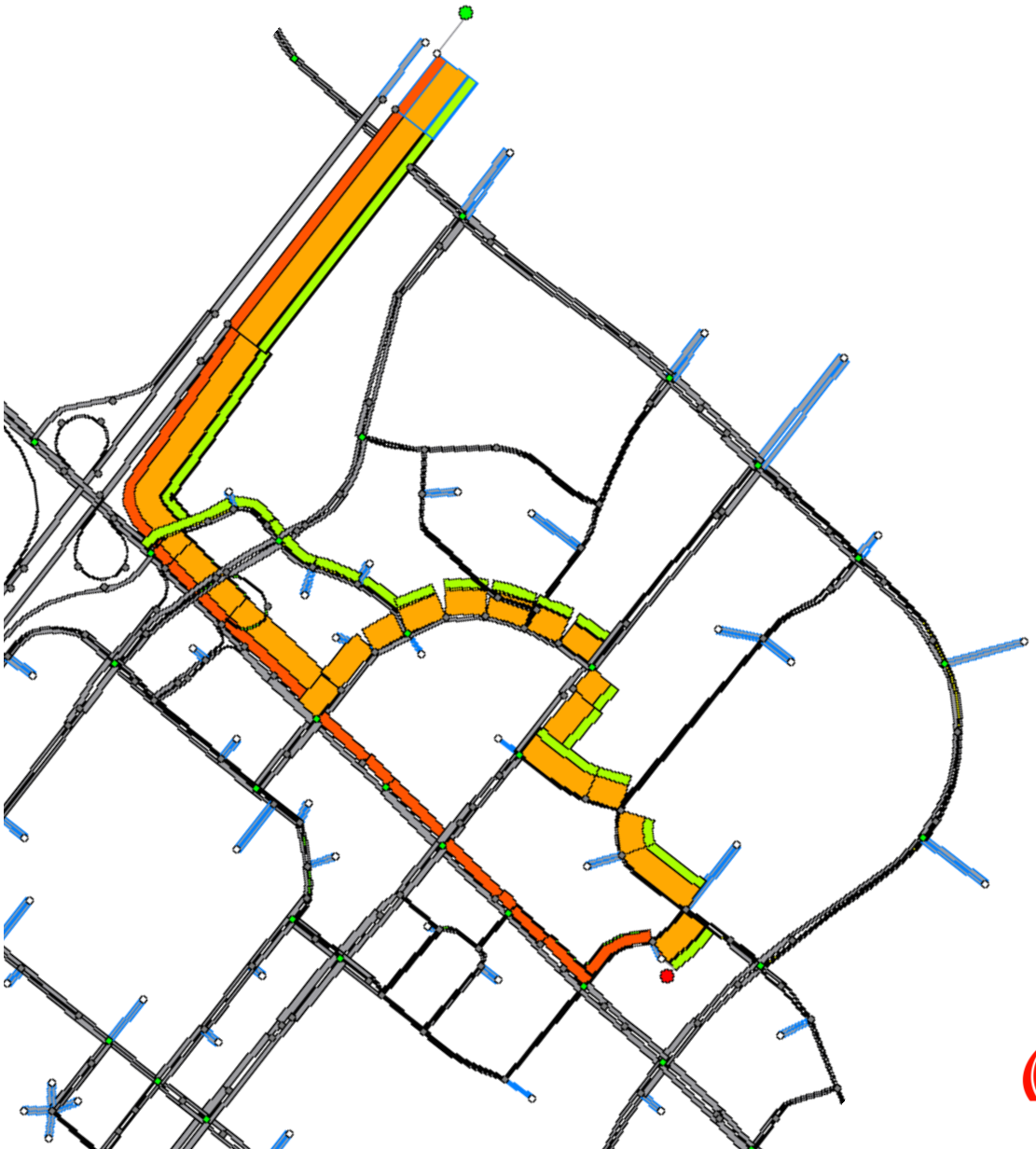


Dynamic Path Analysis

departures
7:45-8:00

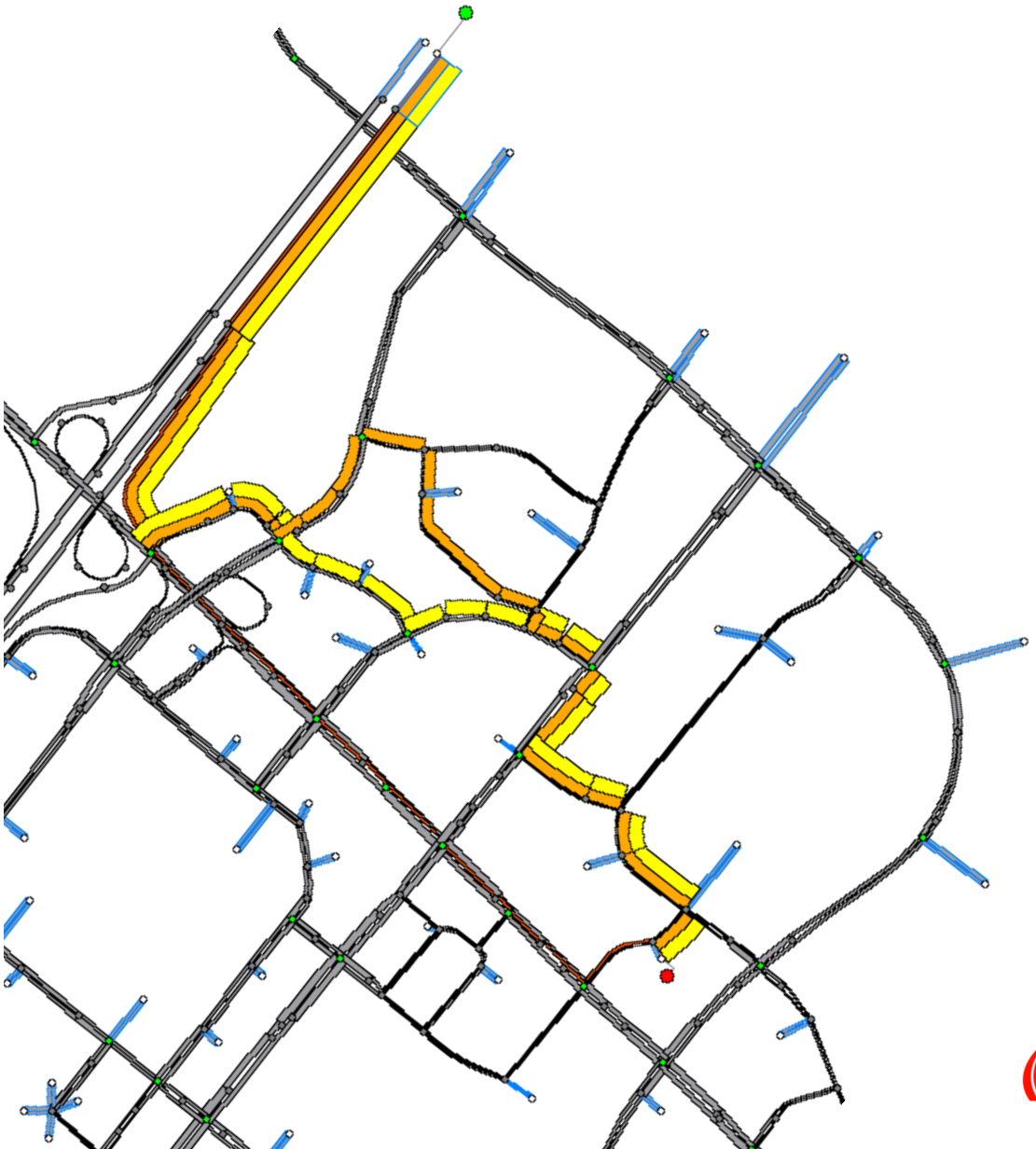
Dynamic Path Analysis

departures
8:00-8:15



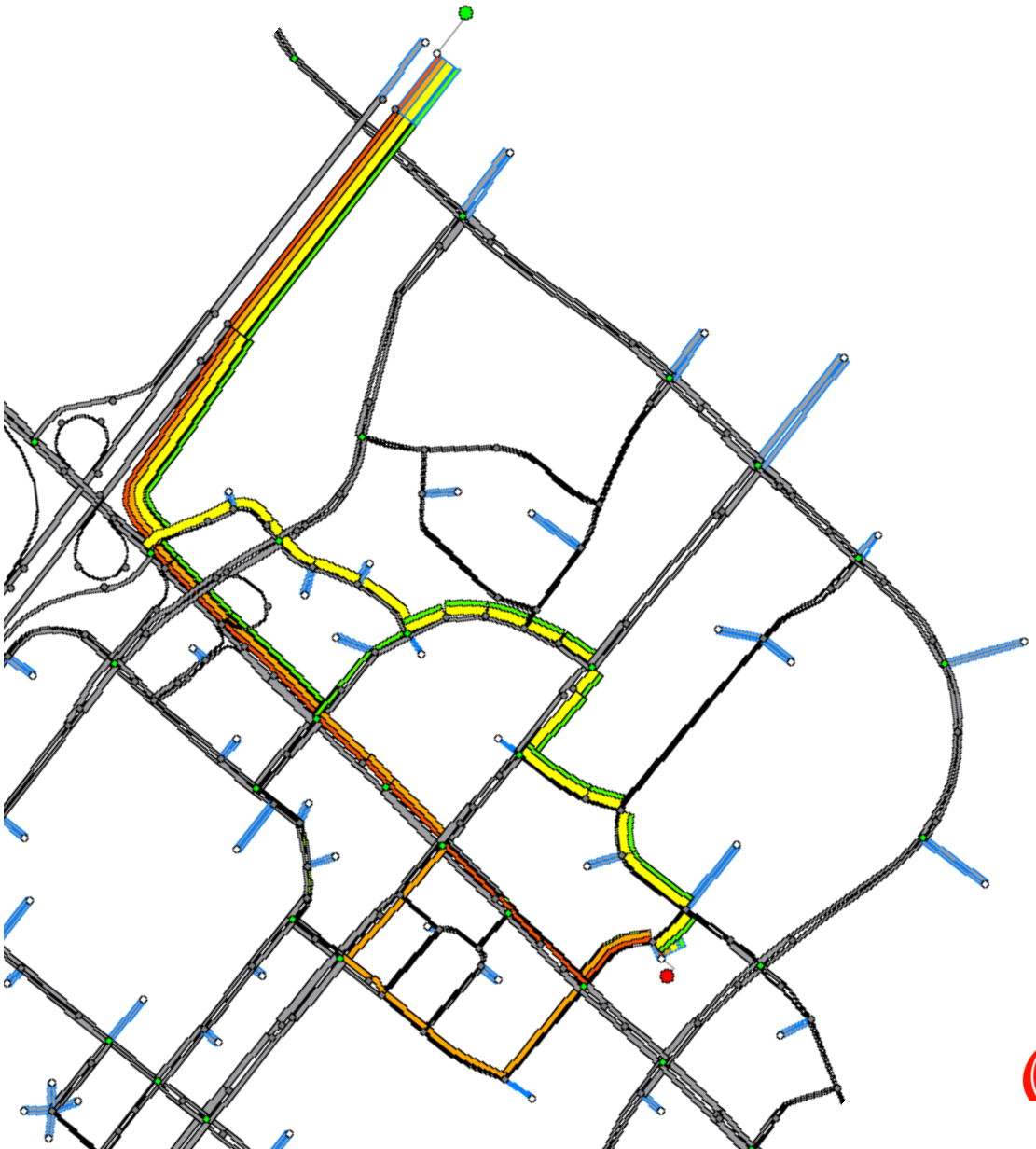
Dynamic Path Analysis

departures
8:15-8:30



Dynamic Path Analysis

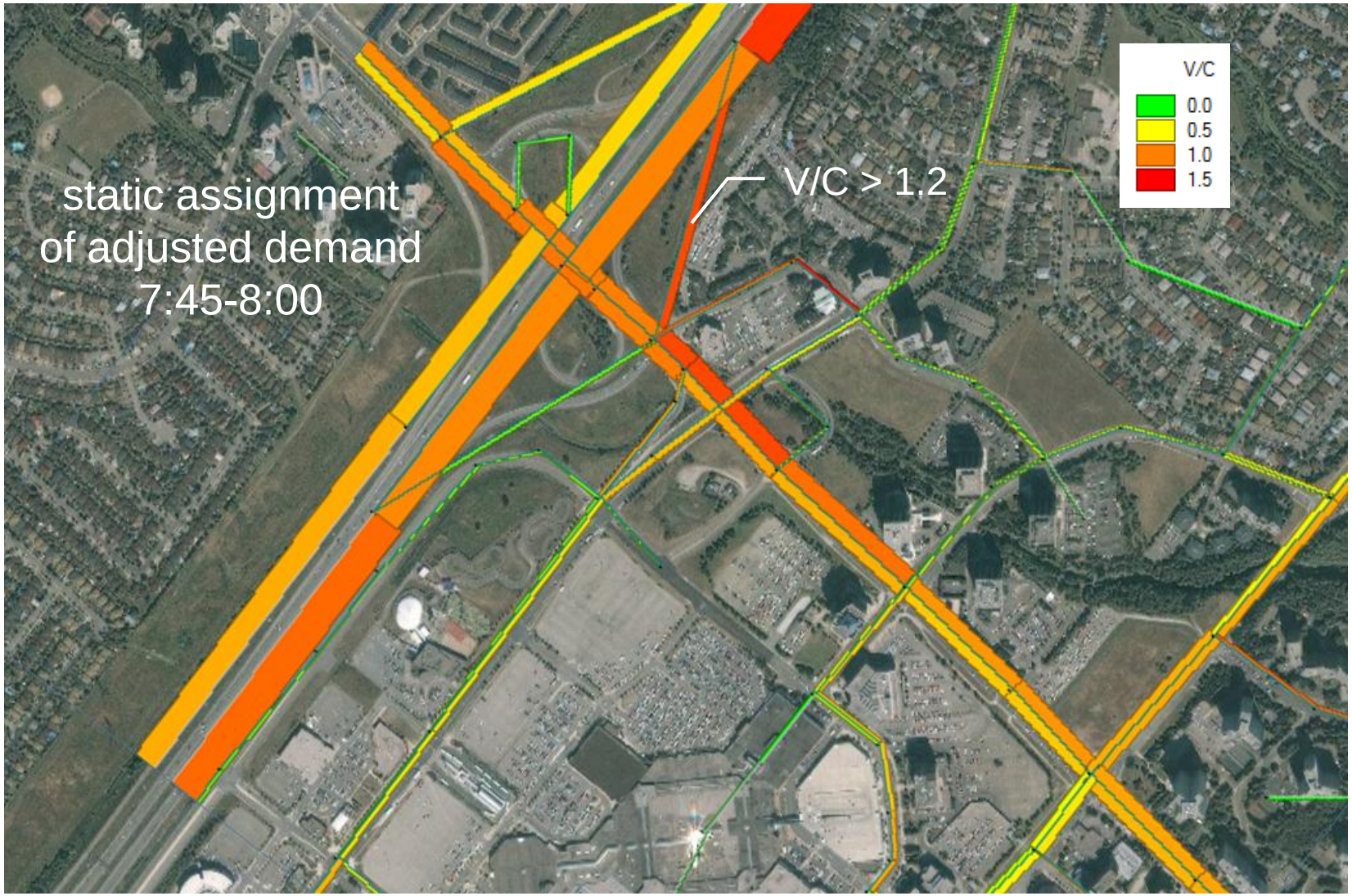
departures
8:30-8:45



Dynamic Path Analysis

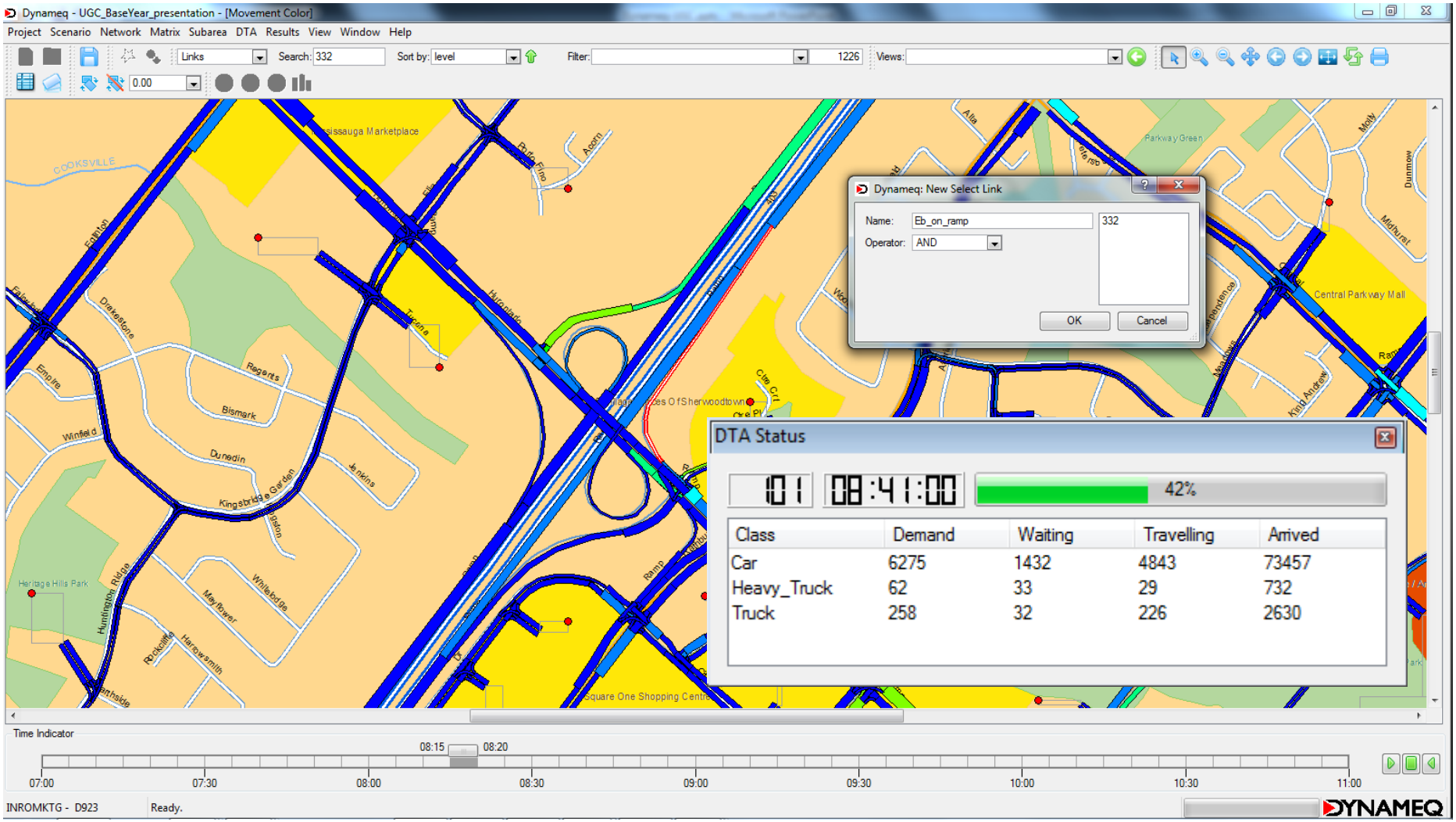
departures
8:45-9:00

Downstream Bottleneck

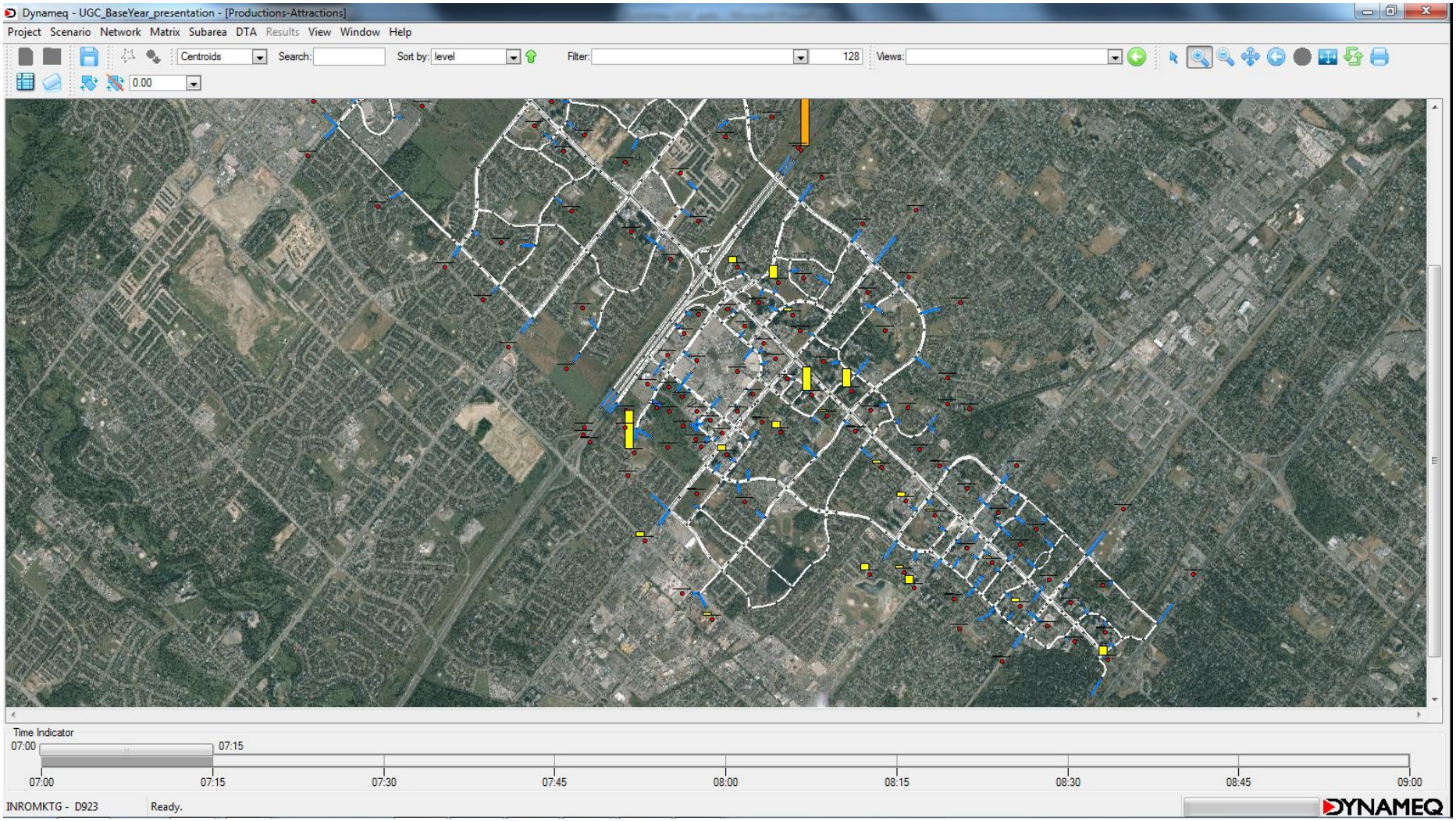


Car Counts

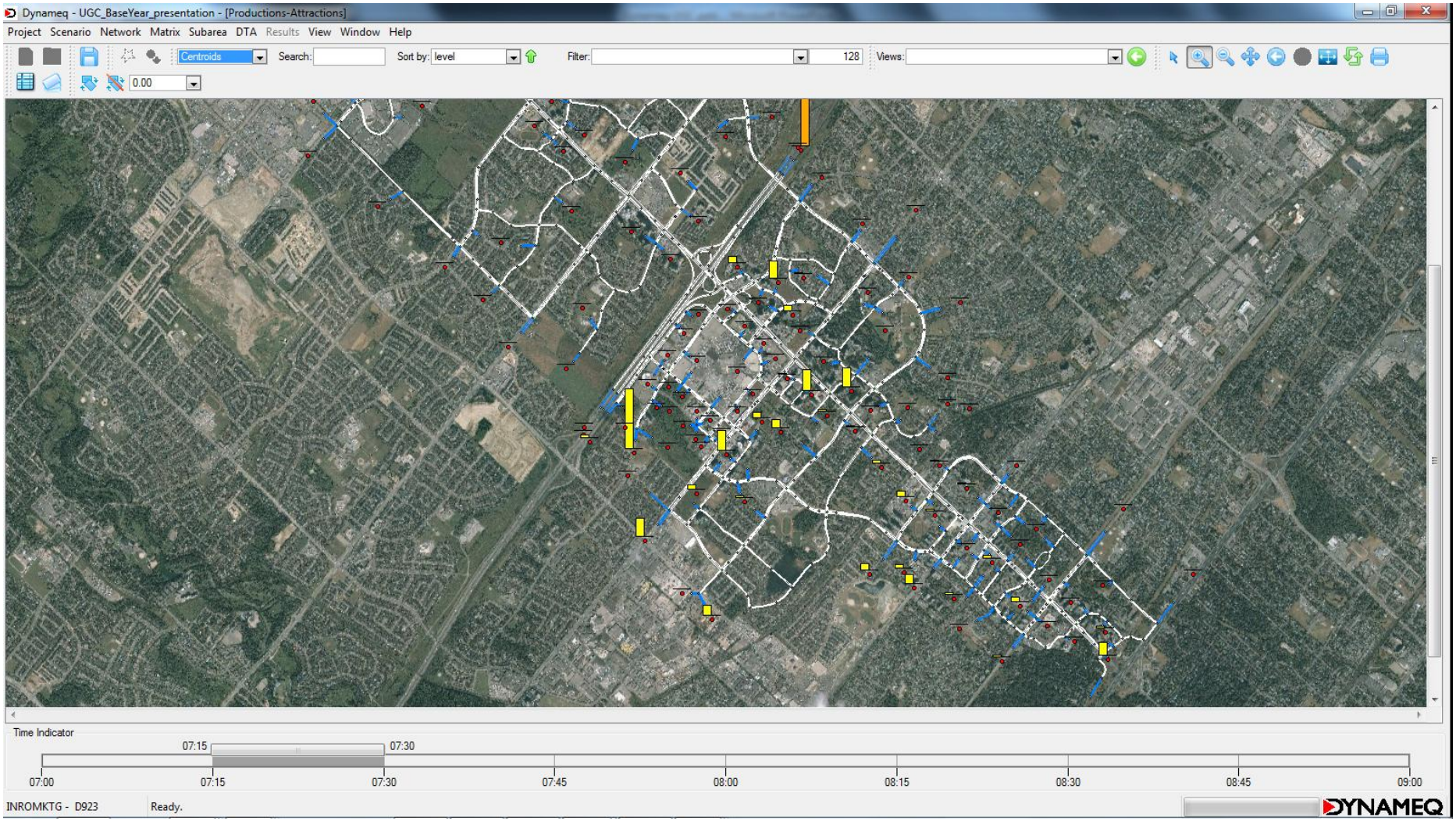
Dynamic Select-link Analysis



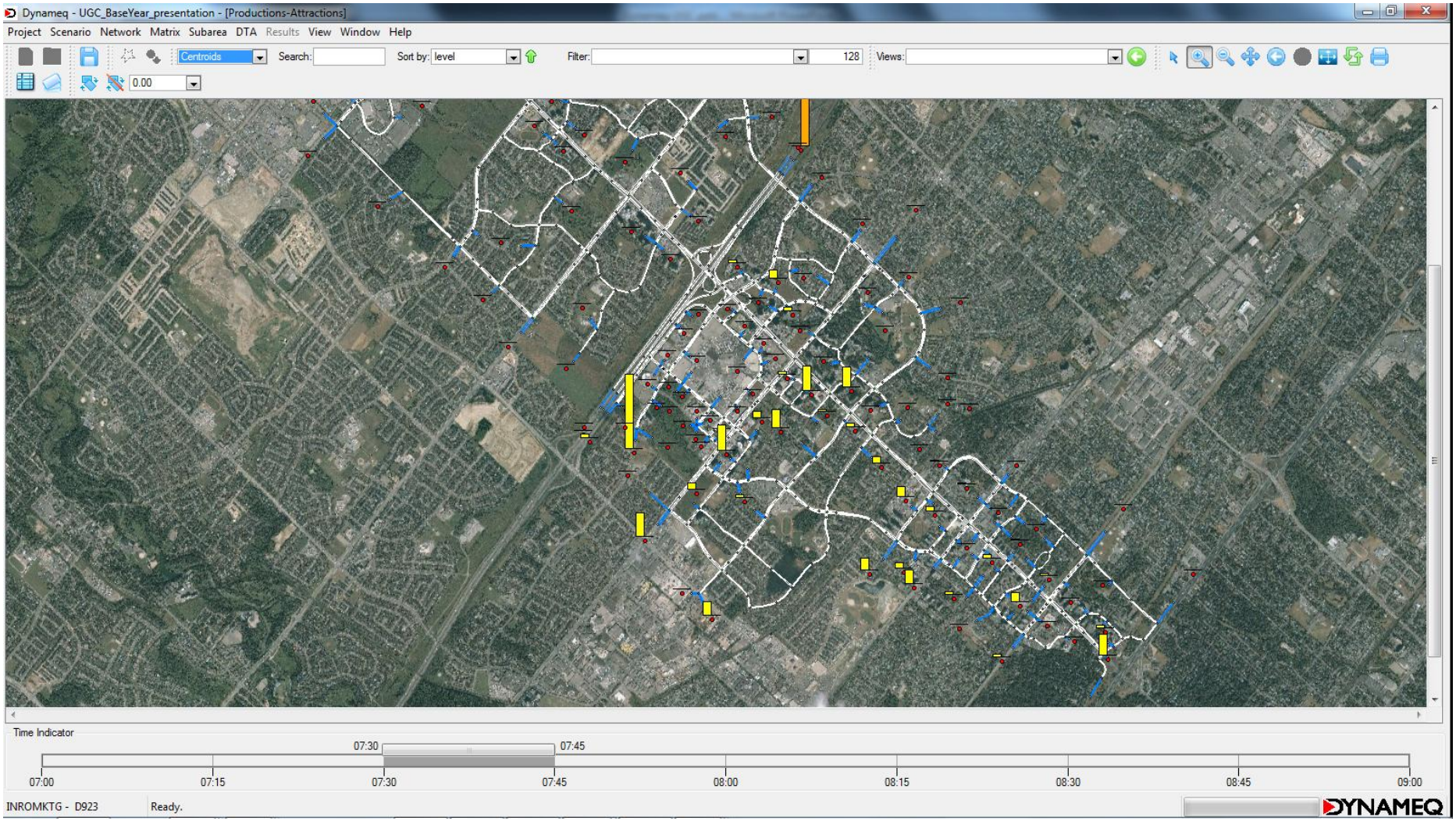
Select-link Demand for Ebound On Ramp



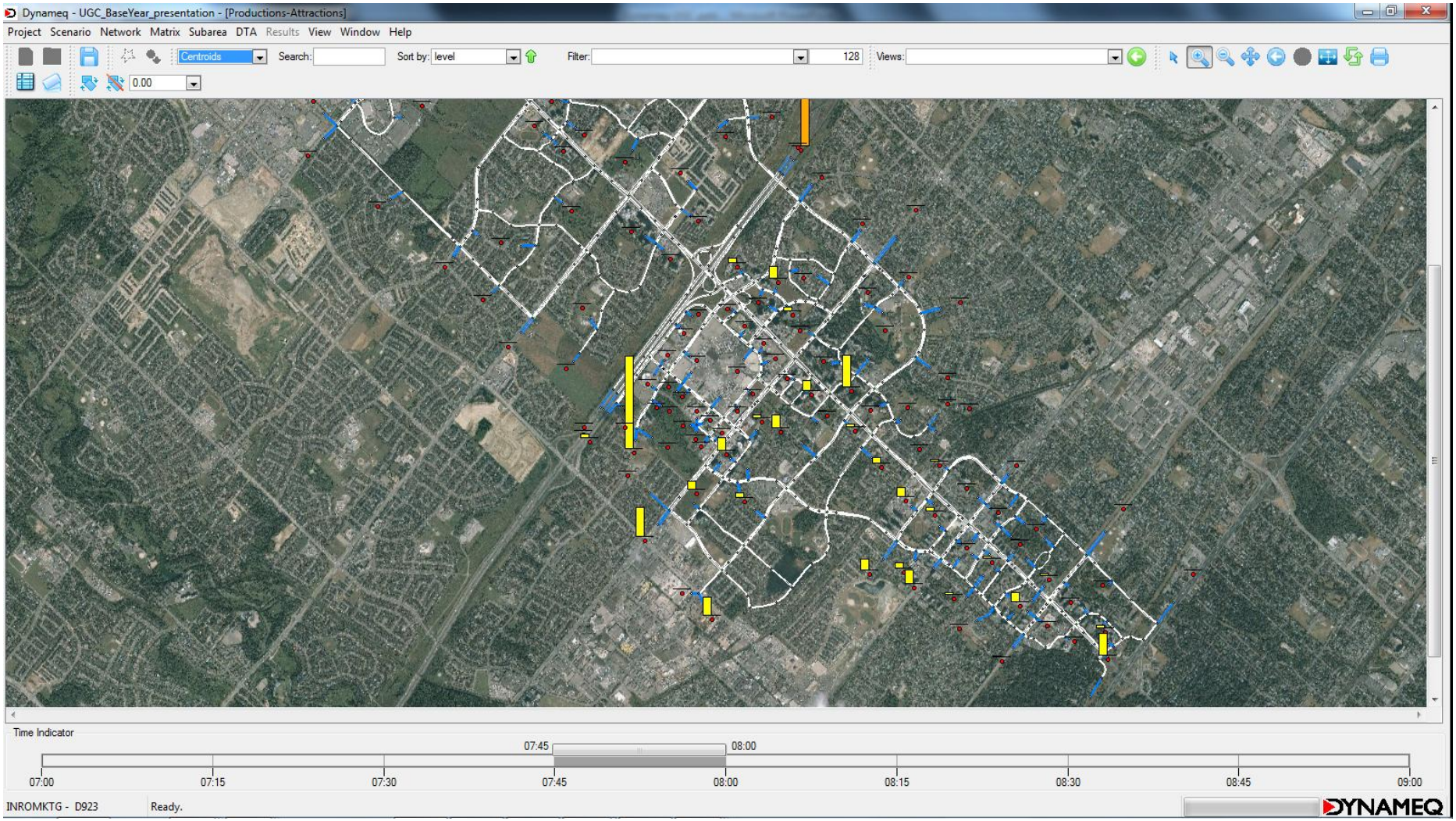
Select-link Demand for Ebound On Ramp



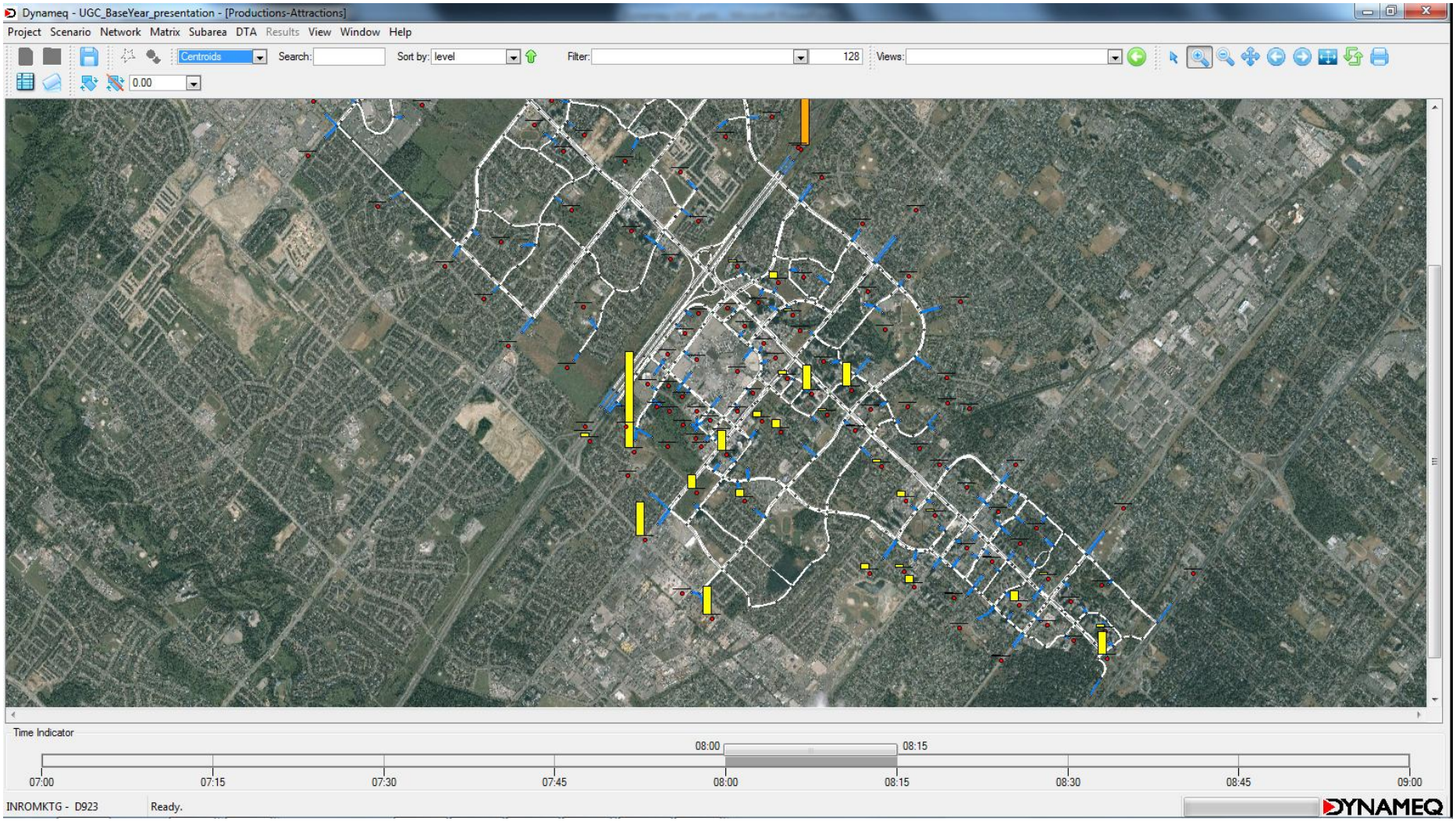
Select-link Demand for Ebound On Ramp



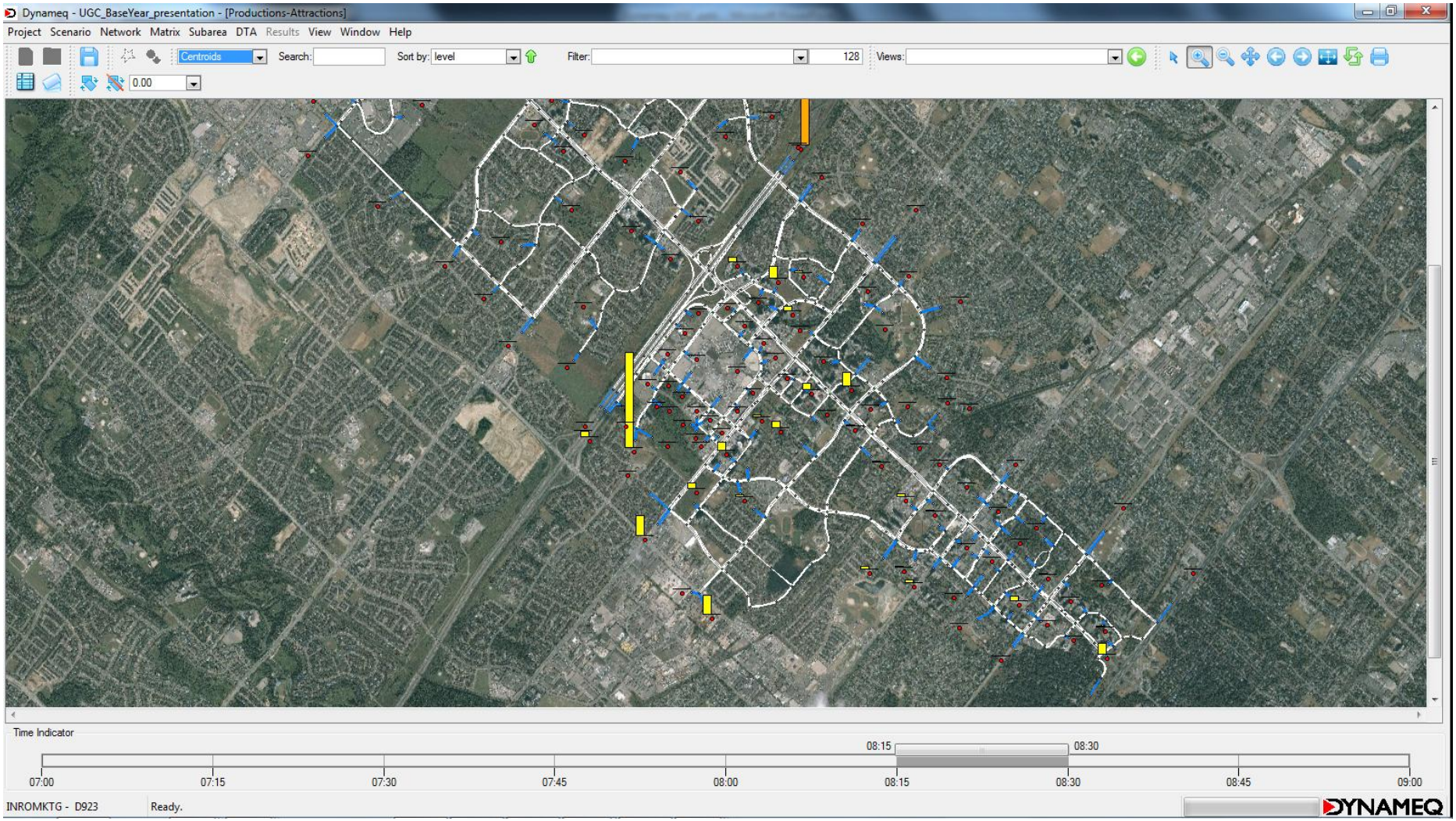
Select-link Demand for Ebound On Ramp



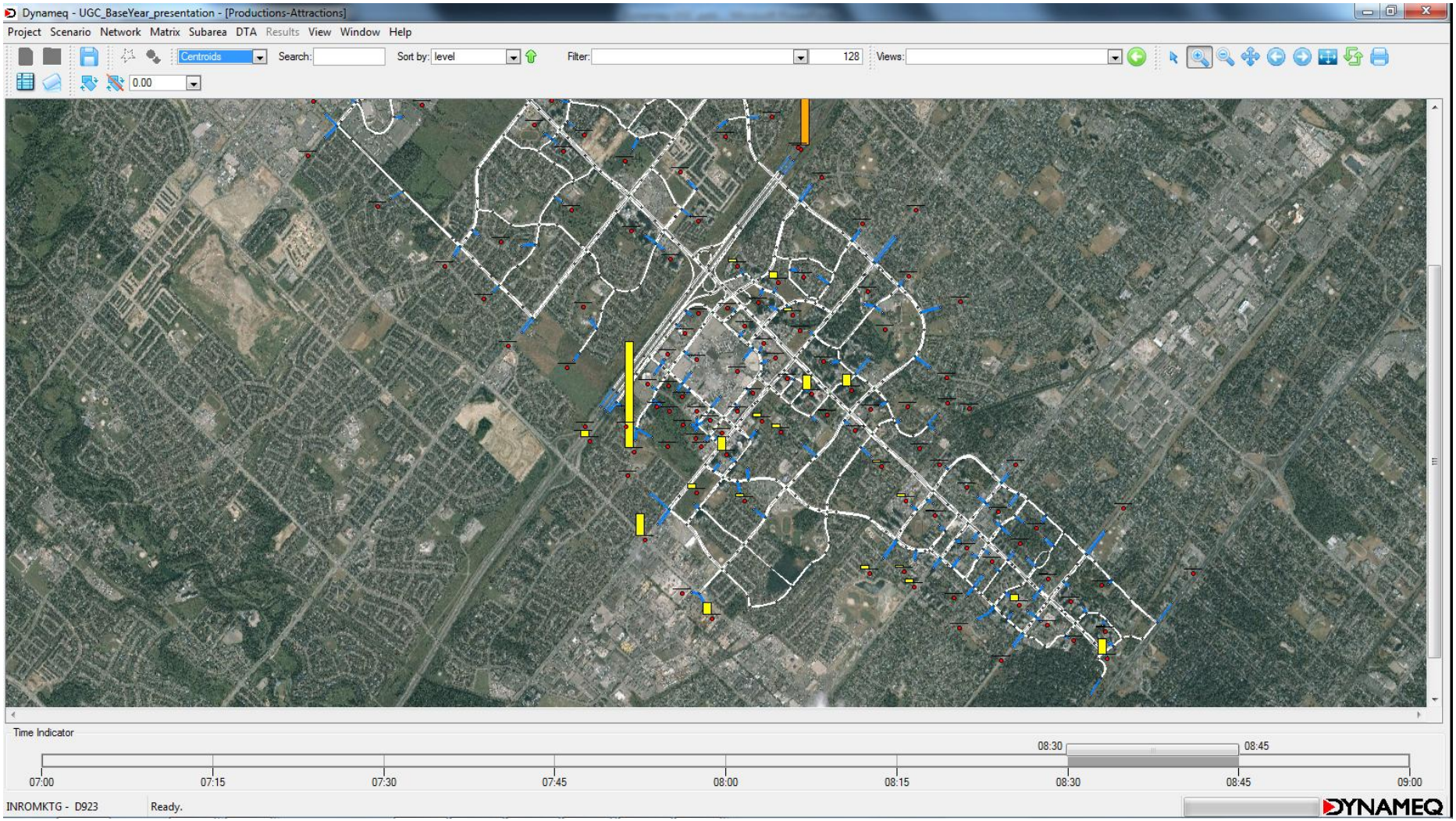
Select-link Demand for Ebound On Ramp



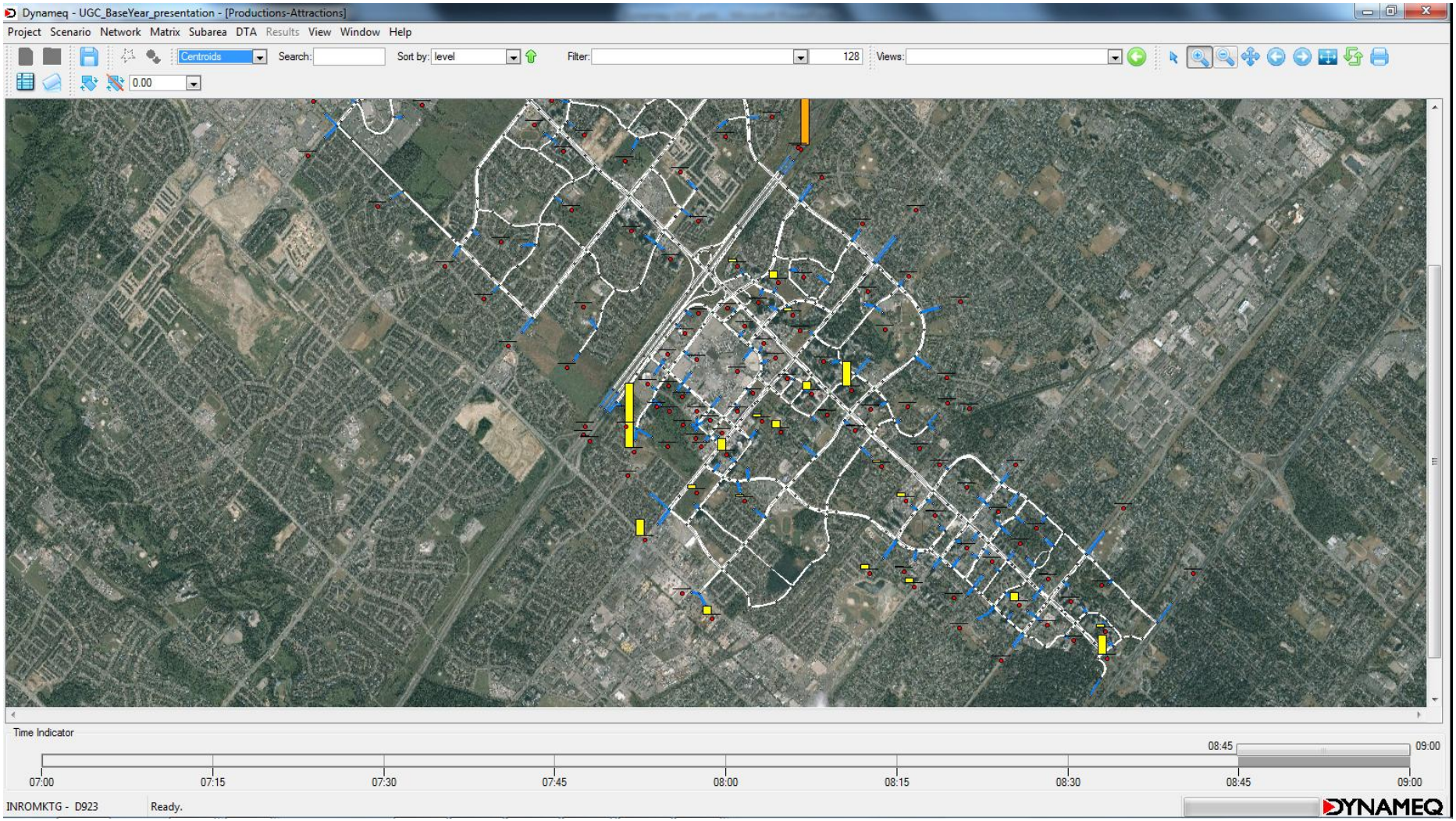
Select-link Demand for Ebound On Ramp



Select-link Demand for Ebound On Ramp



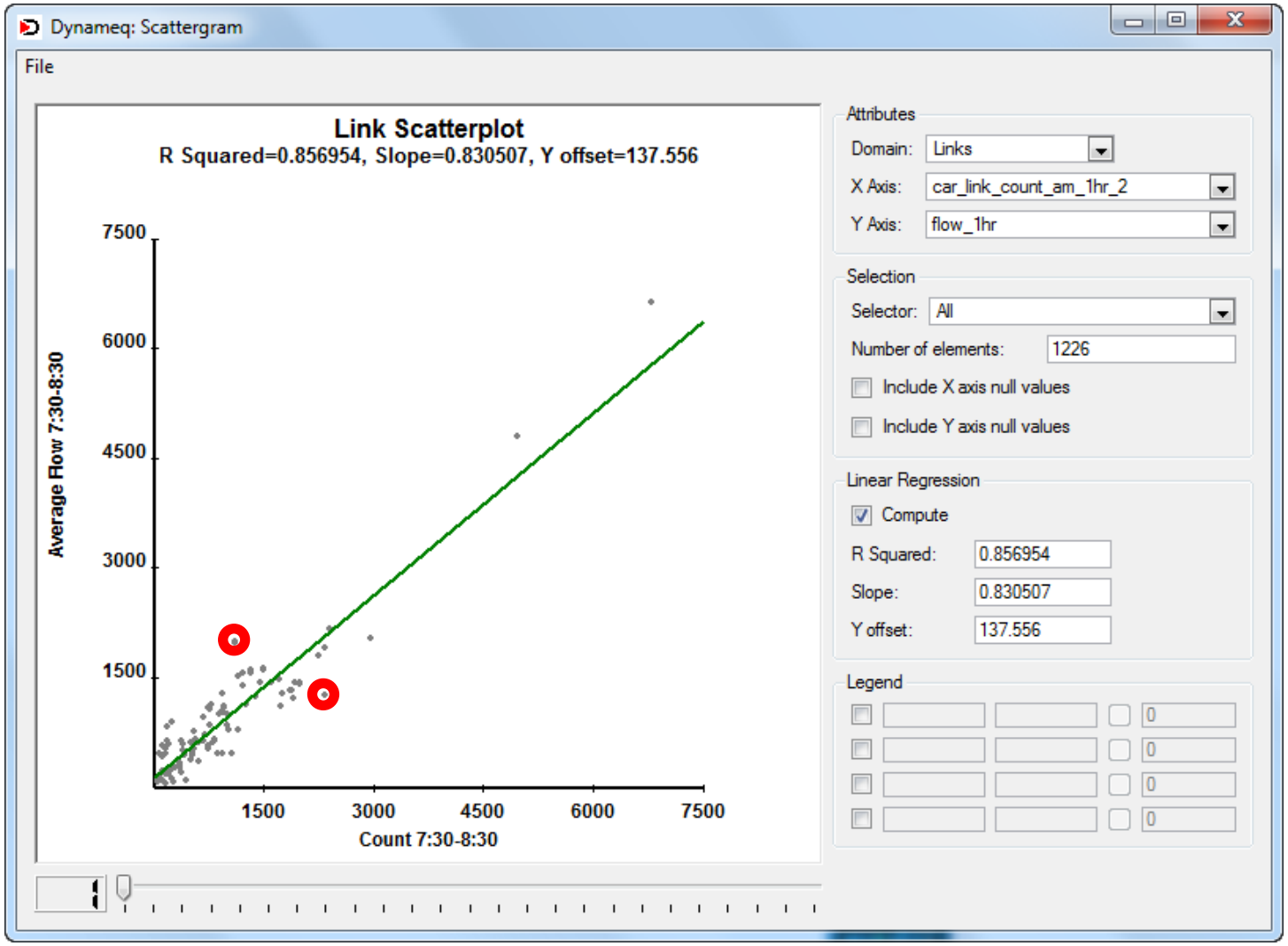
Select-link Demand for Ebound On Ramp



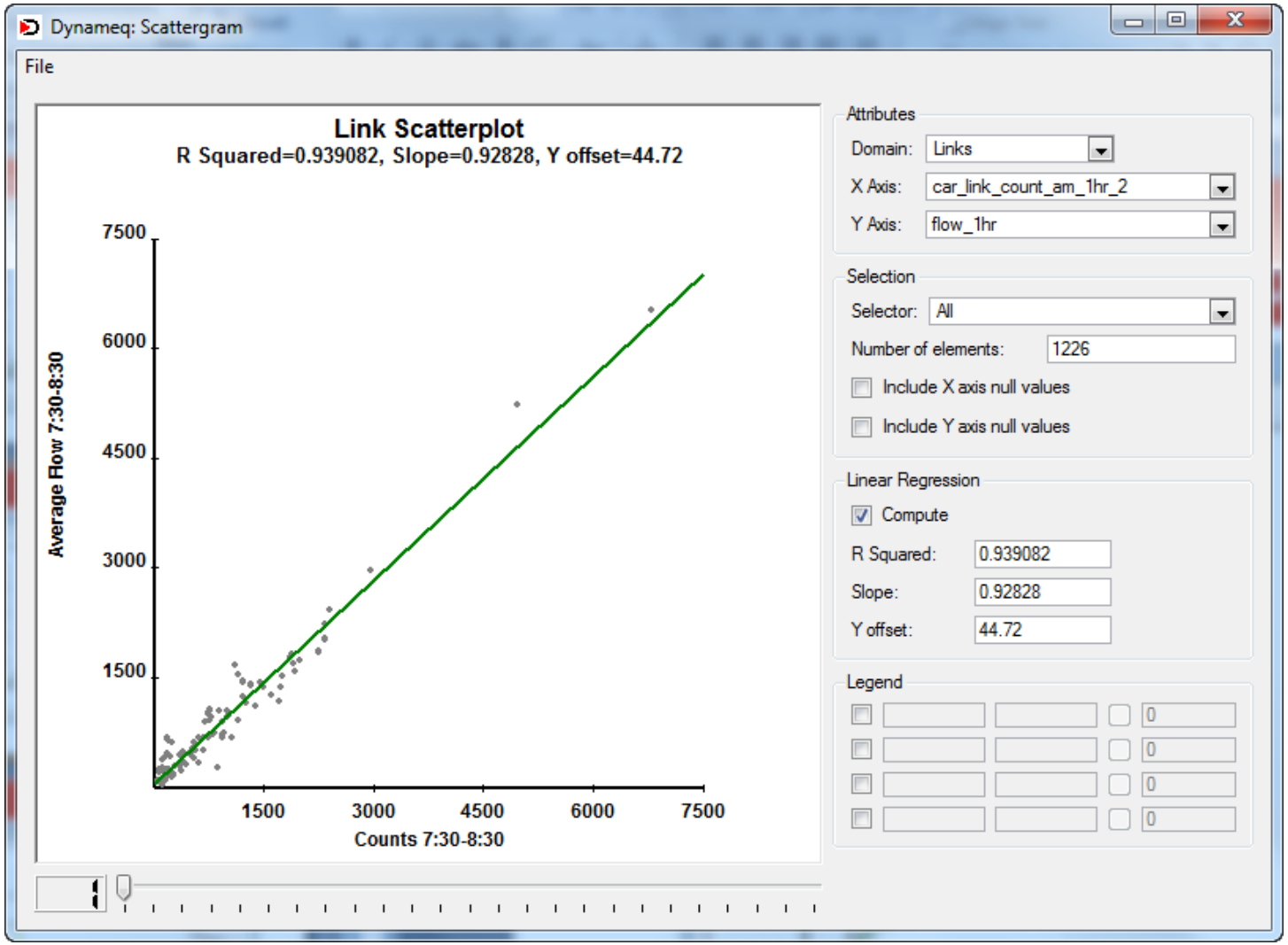
Dynamic Demand Adjustment

Scale down the demand matrix
for each demand interval
in proportion to the dynamic select-link demand
until the spillback is sufficiently reduced

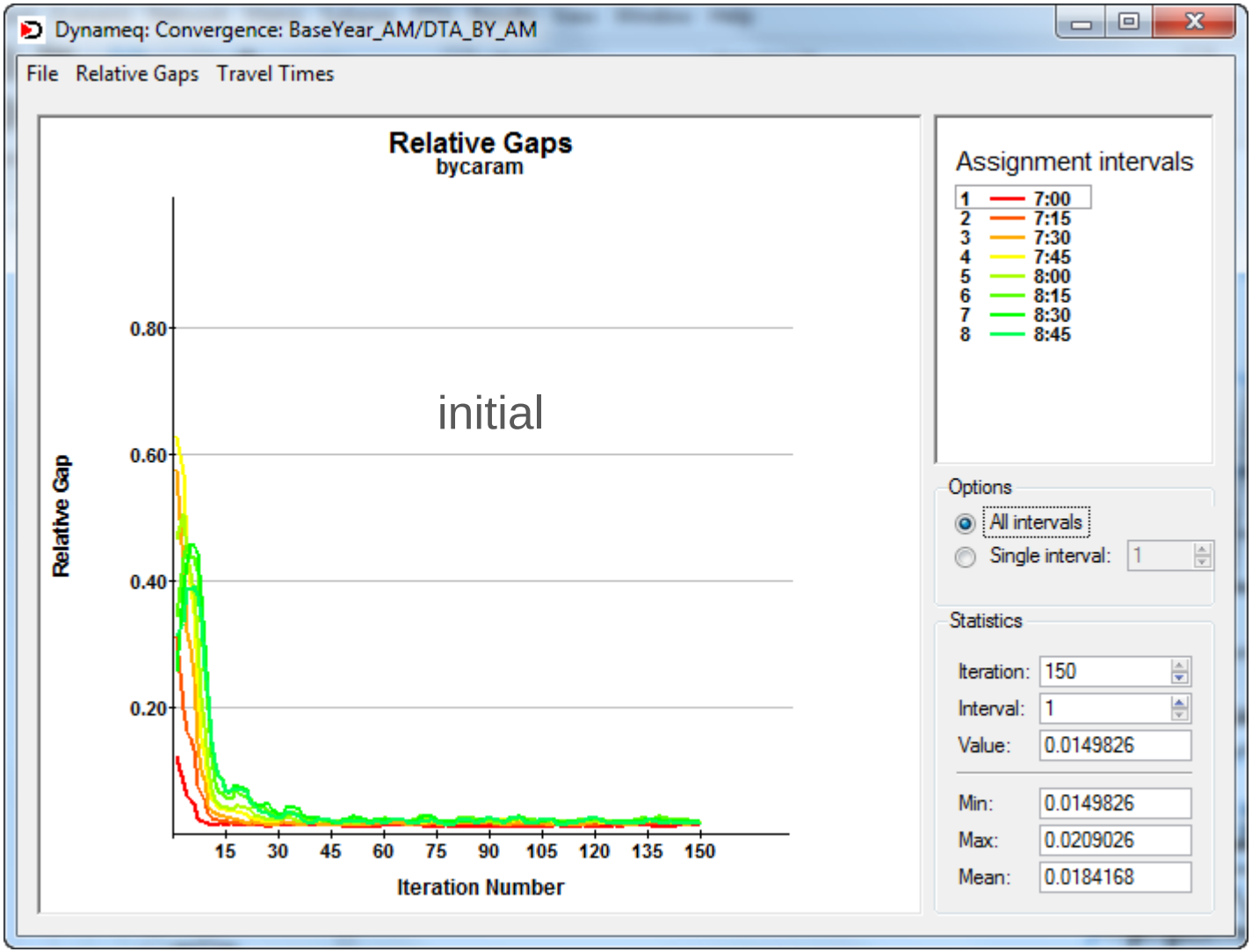
Calibration: more outliers?



Final Calibration



Mature Convergence



Conclusions

Static demand adjustment

- Check the network coding
- Collect consistent counts for gates, main intersections, ramps
- Do not abuse the seed demand
- Assign the adjusted demand and check V/C

Dynamic demand adjustment

- Follow poorly fitting flows downstream to identify bottlenecks
- Scale down O-D flows causing the bottleneck with dynamic select-link analysis

Innovations in Travel Modeling
Tempe, May 2010