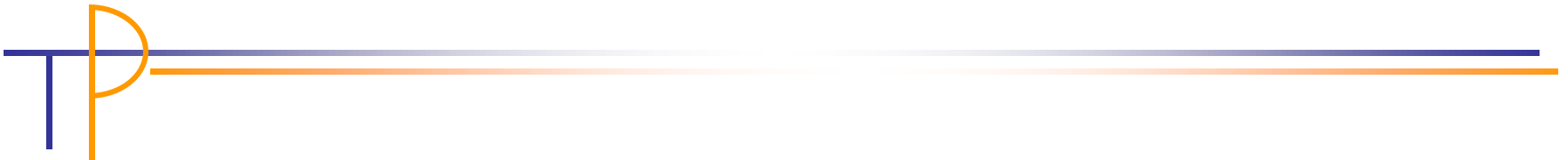


# **NITTEC – Emerging Technologies**

**June 21, 2011**

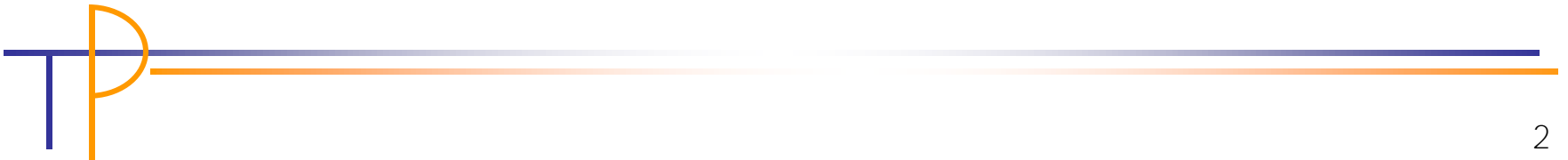
**Ministry of Transportation Ontario**

**Rob Tardif**



# Overview

- **Role of GPS Tracking in Transportation Planning**
- **Commercial and Passenger Vehicle Samples**
- **Review of Performance Measures**
- **Visualization Tool Development**
- **Examples of Corridor Analysis**
- **Next Steps**



# Role of GPS Tracking in Transportation Planning

## Why do trucking companies have GPS tracking devices?

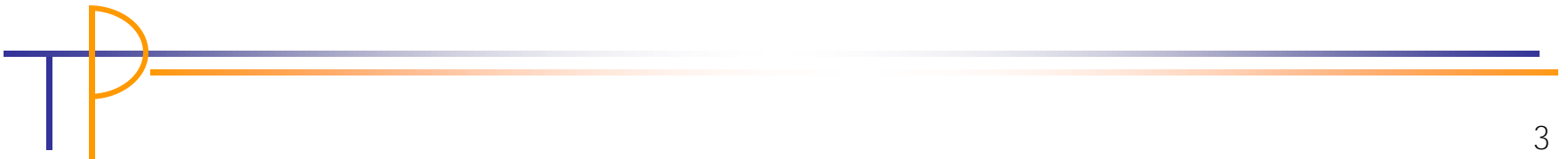
- Fuel tax reporting by jurisdiction
- Customers demanding shipment location and delivery window
- Standardise driver behaviour

## Partnerships

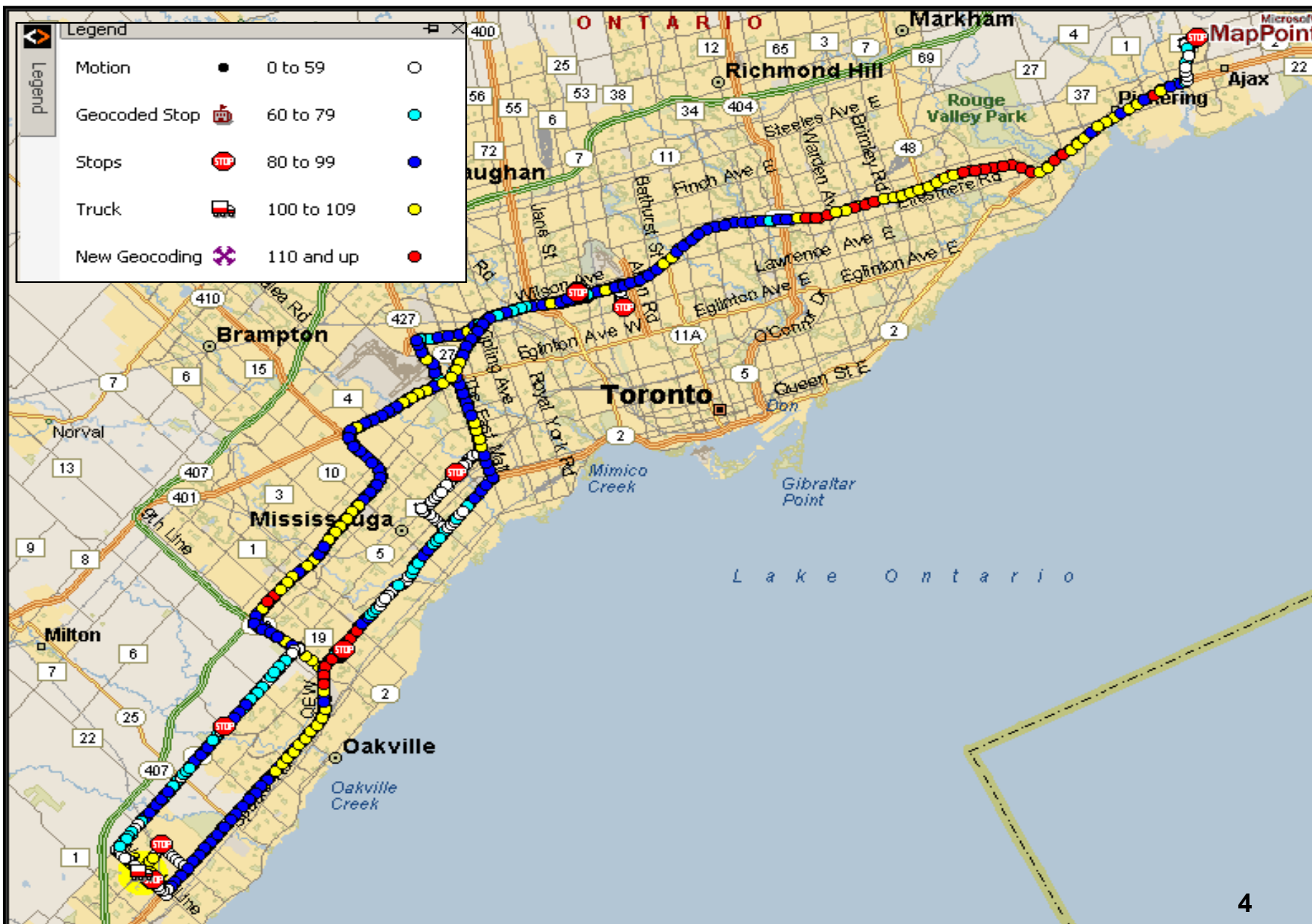
- GPS tour data no longer a waste by-product
- New source of revenue for vendors
- Modal coverage, passenger and commercial

## What information does it provide?

- 24 Hour link travel speeds, (Free Flow Speed)
- Travel Speed Performance Measures related to:
  - Intensity, duration and reliability for each class of road
- Operational and capacity issues
- Complete trip tours, multi-day
- Hard brake events and fuel consumption
- Dwell time data, engine shut-off/start and stop duration, idling
- Supports informed investment decisions



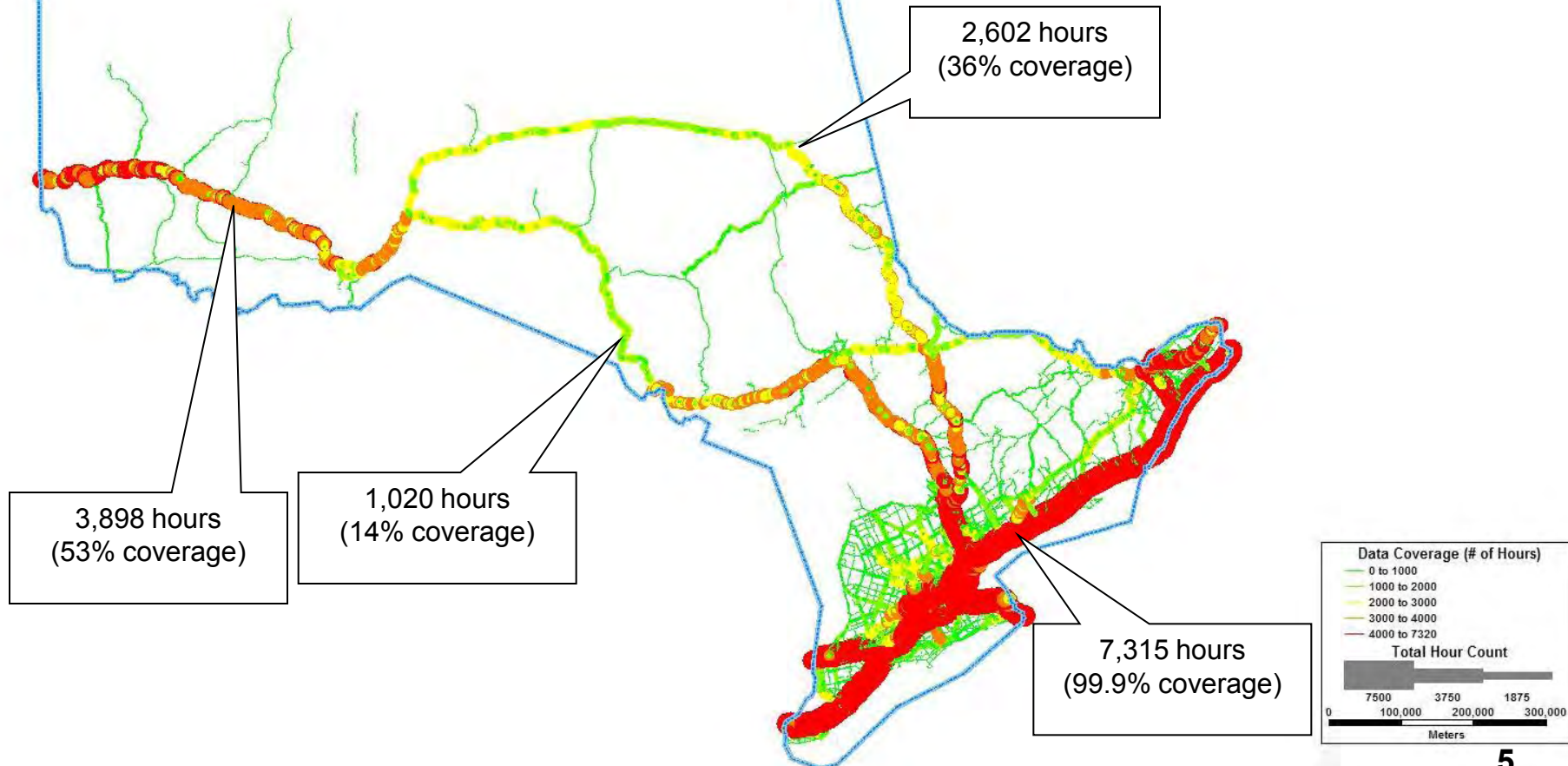
## Path of a Vehicle in a Single Day



# XATA/Turnpike GPS Data Coverage

Total Number of Hours: 7,320

(305 days from Mar 1 to Dec 31, 2009)

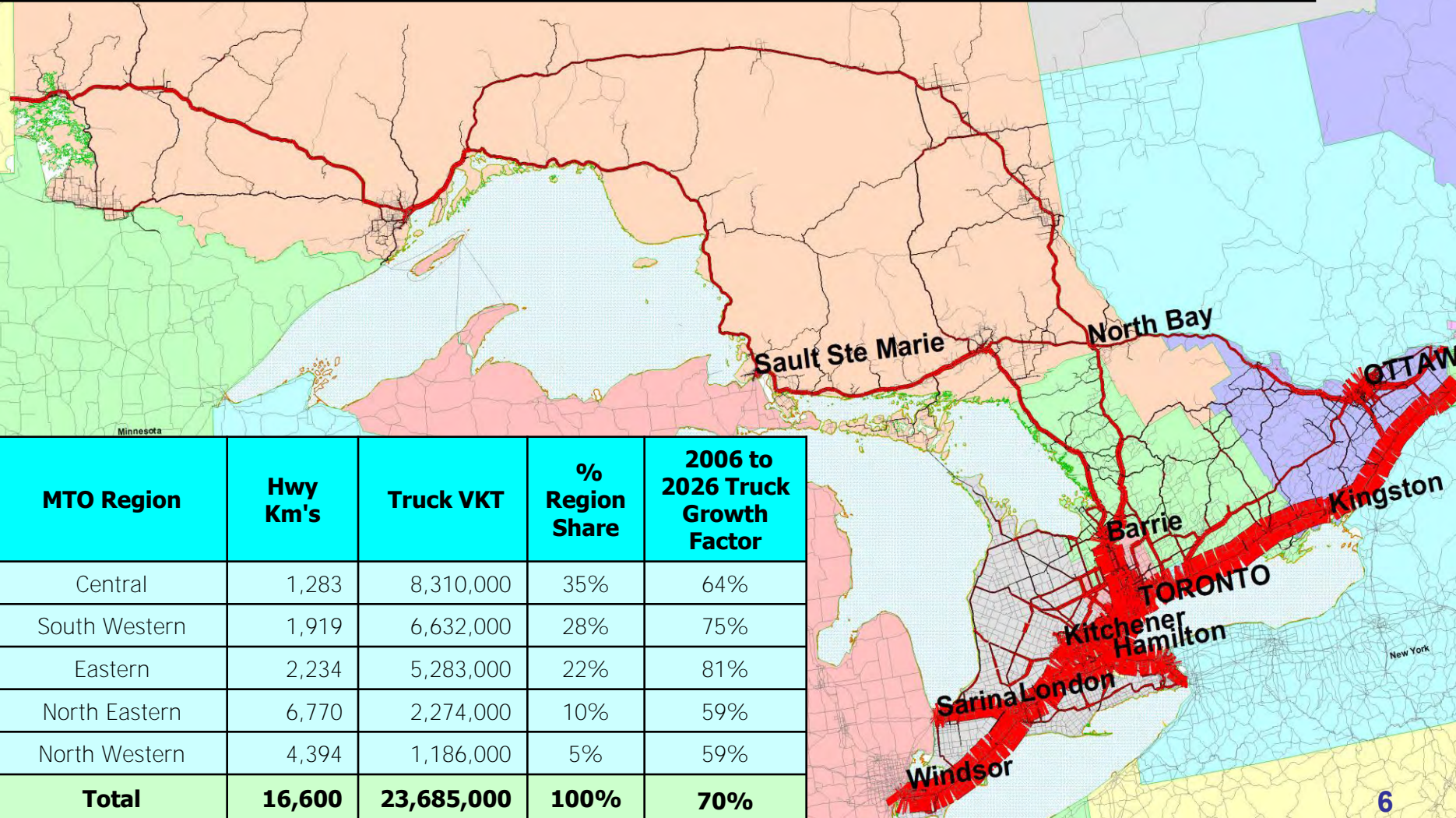




# MTO Region Truck Activity and Growth to Year 2026

## Ontario Commercial Vehicle Statistics

- Each day, 150,000 trucks travel 24 M km's on Ontario's Provincial Roads
- 11 million km's on Highway 401 alone (47%)
- By 2026, truck travel forecasted to grow of 70%
  - Eastern & SWPR at 81% and 75% respectively







# TrafficAlert

instant traffic updates

a GreenOwl Mobile product. See also: [SimplyGPS](#)

SHARE



[Home](#) [How it Works](#) [Coverage Area](#) [Get TrafficAlert](#) [FAQ](#) [Product News](#) [Blog](#) [Talk to Us](#)

## Product News

Rock95 and GreenOwl Mobile teamed up to deliver next generation personal traffic reports

Posted on December 28, 2010 by GreenOwl

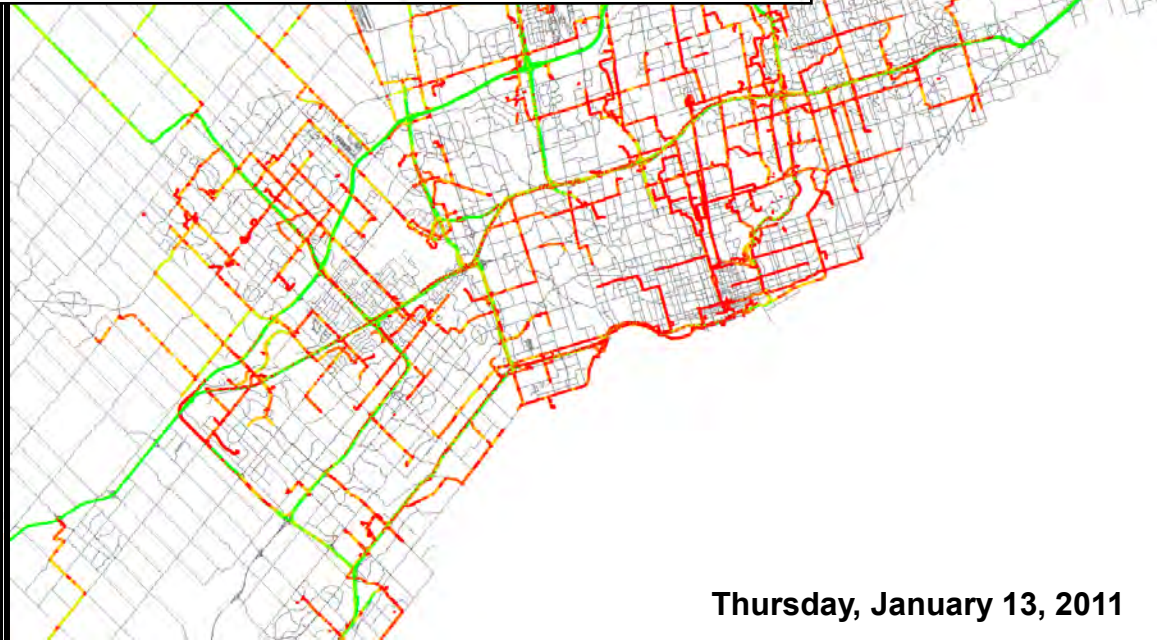
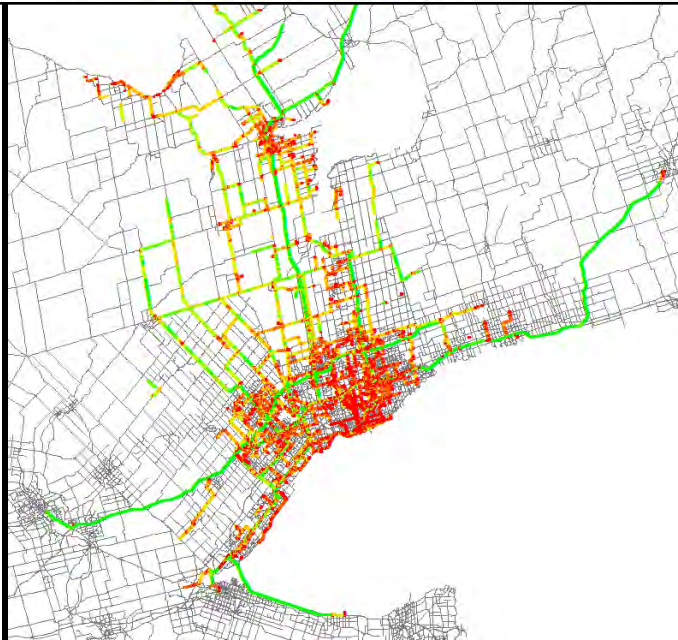


[Learn More »](#)

Get TrafficAlert *Free!*

Available on the  
**App Store**

Get it at BlackBerry  
App World.



Thursday, January 13, 2011

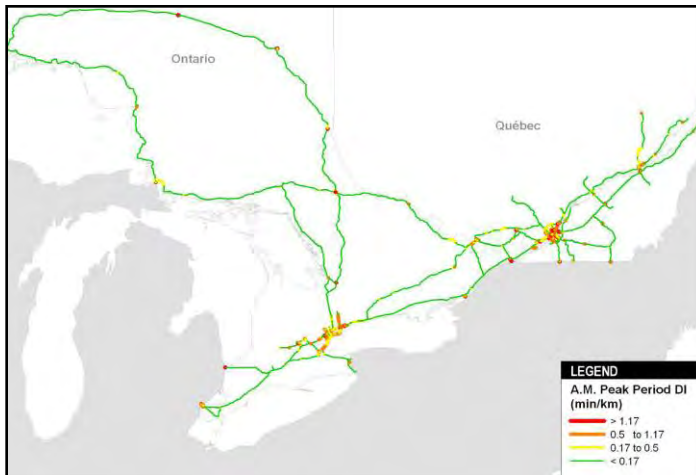
# Congestion Measure Evaluation Matrix – Functional Considerations

		Assessment Investment	Identification of Critical Locations	Identification of Causal Factors	Jurisdiction Composition	Useful to Decision Makers	Importance to Users/ Public	Overall Usefulness
Intensity	Travel Time							Strong
	Average Travel Speed							Strong
	Travel Time & Delay (TTI & DI)							Strong
	Volume Base Delay Index							Strong
	Congestion Index (CGI)							Strong
	Density (Contour Map)							Strong
	Level of Service (LOS)							Moderate
	Volume to Capacity (V/C)							Moderate
Extent	% Distance Congested							Strong
Duration	% Time Congested							Strong
Reliability	Buffer Time Index (BTI)							Strong
	Planning Time index (PTI)							Strong
	Variability Travel Time (VTT)							Strong



## Congestion Intensity:

- **Delay Index (DI)** - the average delay per kilometre (minutes/km)



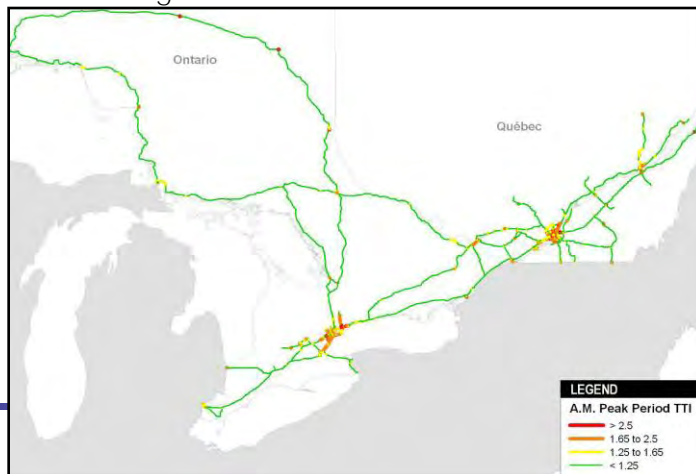
## Congestion Extent:

- **Volume-Based Delay Index (VBDI)** – DI multiplied by AADT or Hourly across the roadway by direction

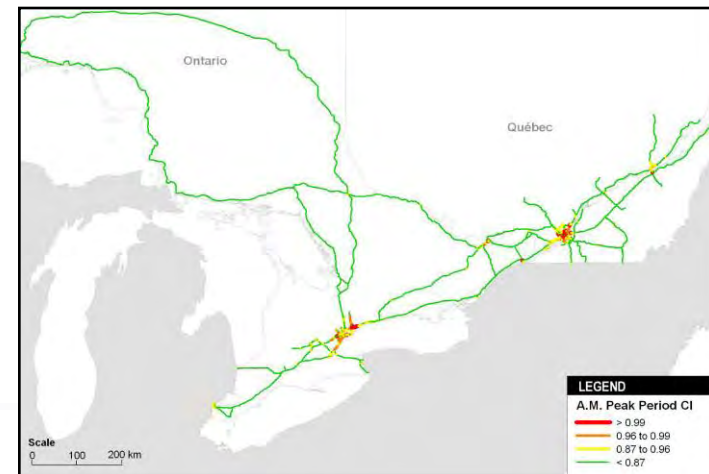


## Congestion Intensity:

- **Travel Time Index (TTI)** – ratio of average travel time to Free Flow Time

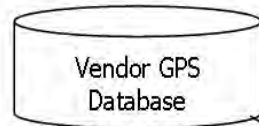


- **Combined Index (CI)** - incorporates the percentile rankings of TTI, DI and VBDI to form a single metric upon which selection of microanalysis sections is based



# Visualization Reporting Tool Development

## GPS Suppliers



Load

## MTO Processing

MTO Data and Application Server

Data Analysis

GIS Data Processing Tools  
(ArcGIS, TransCAD...)

Data Processing

Summarize and Create

Road Performance Measures Database (Speed, TTI, DI, and Other Indices)

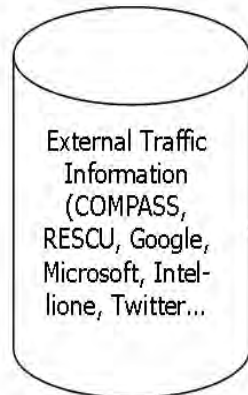
Generate

Road Performance Data for Web Mapping

iCorridor User Interface

External Traffic Information and Web Map Service Providers

External Web Map Service  
(Google Maps / Google Earth)



Maps, Graphs, Tables in Digital or Paper Formats



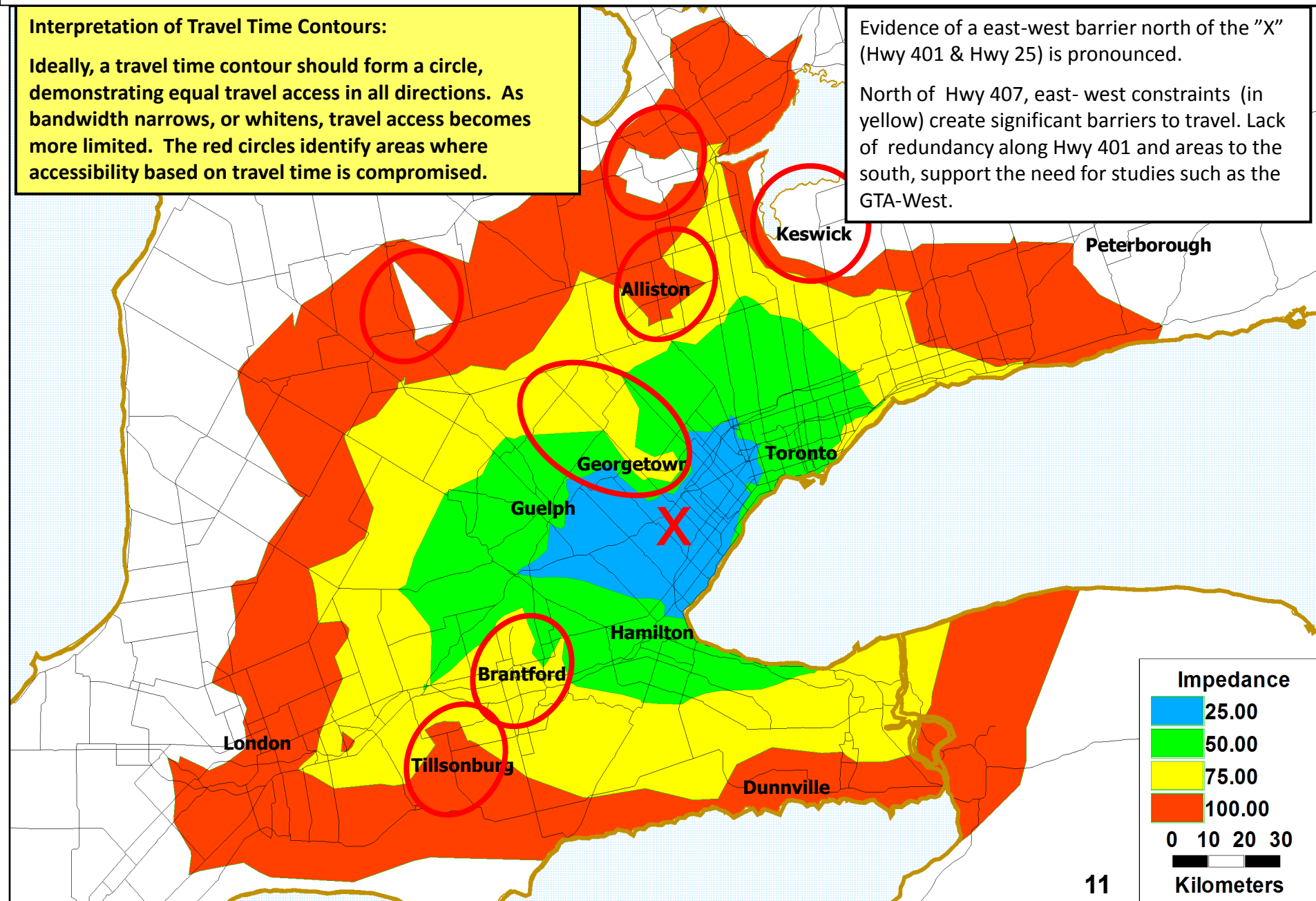
# Truck Travel Time Contour – Hwy 401 @ Milton (Hwy 25)

## Interpretation of Travel Time Contours:

Ideally, a travel time contour should form a circle, demonstrating equal travel access in all directions. As bandwidth narrows, or whitens, travel access becomes more limited. The red circles identify areas where accessibility based on travel time is compromised.

Evidence of a east-west barrier north of the "X" (Hwy 401 & Hwy 25) is pronounced.

North of Hwy 407, east- west constraints (in yellow) create significant barriers to travel. Lack of redundancy along Hwy 401 and areas to the south, support the need for studies such as the GTA-West.





# GPS TRACKING - GTA AM Travel Time Performance

## 2009 Provincial Highway Performance Measures (A.M. Peak Period)

Greater Toronto Area (6:00 a.m. to 9:00 a.m.)

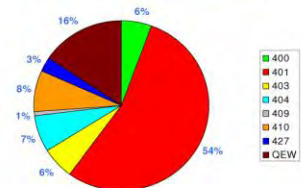
### GTA Travel Time Index (TTI):

**1.23** (travel time 23% longer than under free-flow condition)

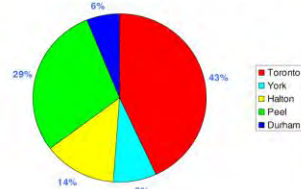
### GTA Delay Index (DI):

**8.6** (seconds per kilometre)

#### Share of Delays by Highway



#### Share of Delays by Region



Systems Analysis and Forecasting Office  
Transportation Planning Branch  
Ministry of Transportation

Date: October 6th, 2010

Greater Toronto Area

LAKE ONTARIO

#### Legend

Average Travel Speed during A.M. Peak Period (km/h)



GTA Boundary

0 5 10 20 30 40 Kilometres

### GTA Travel Time Performance Highlights:

- In the AM Peak Period travel speeds on north-south highways range between 83 to 90 km/h
- In the AM Peak Period travel speeds on east-west highways range between 64 to 74 km/h
- The average travel speed across 45 km's of QEW is 66 km/h
- The average travel speed across 144 km's of Hwy 401 is 74 km/h
- The average travel speed across 29 km's of Hwy 403 is 72 km/h



# GPS TRACKING - GTA PM Travel Time Performance

## 2009 Provincial Highway Performance Measures (P.M. Peak Period)

Greater Toronto Area (3:00 p.m. to 6:00 p.m.)

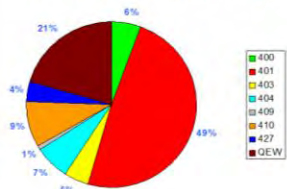
### GTA Travel Time Index (TTI):

**1.31** (travel time 31% longer than under free-flow condition)

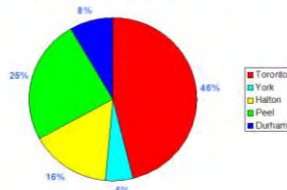
### GTA Delay Index (DI):

**11.7** (seconds per kilometre)

#### Share of Delays by Highway



#### Share of Delays by Region

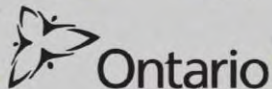


Greater Toronto Area

LAKE ONTARIO

#### Legend

Average Travel Speed during P.M. Peak Period (km/h)



Systems Analysis and Forecasting Office  
Transportation Planning Branch  
Ministry of Transportation

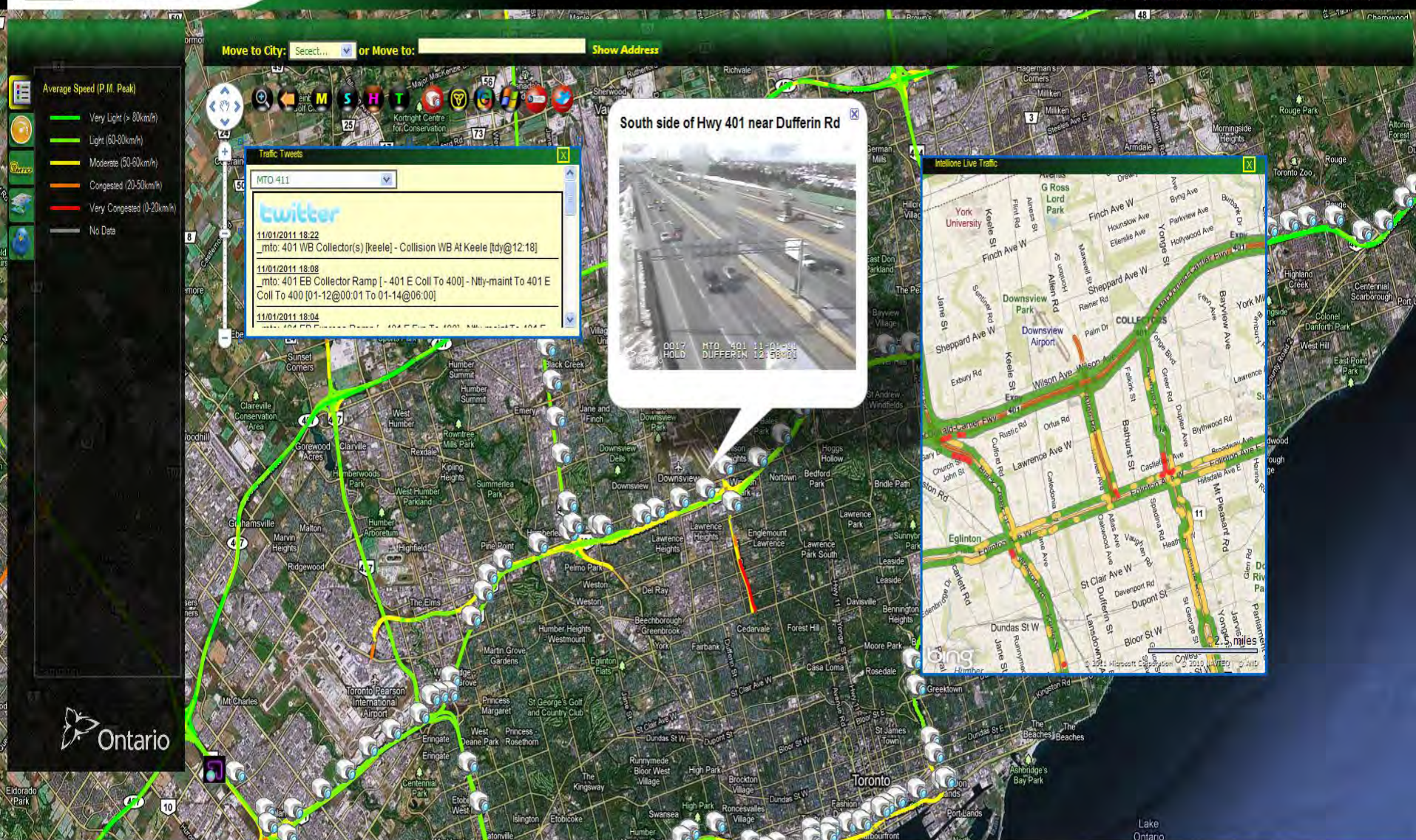
Date: October 18th, 2010



# Web Tool Development - iCorridor



About us | Ministry of Transportation | Government of Ontario | iBoard



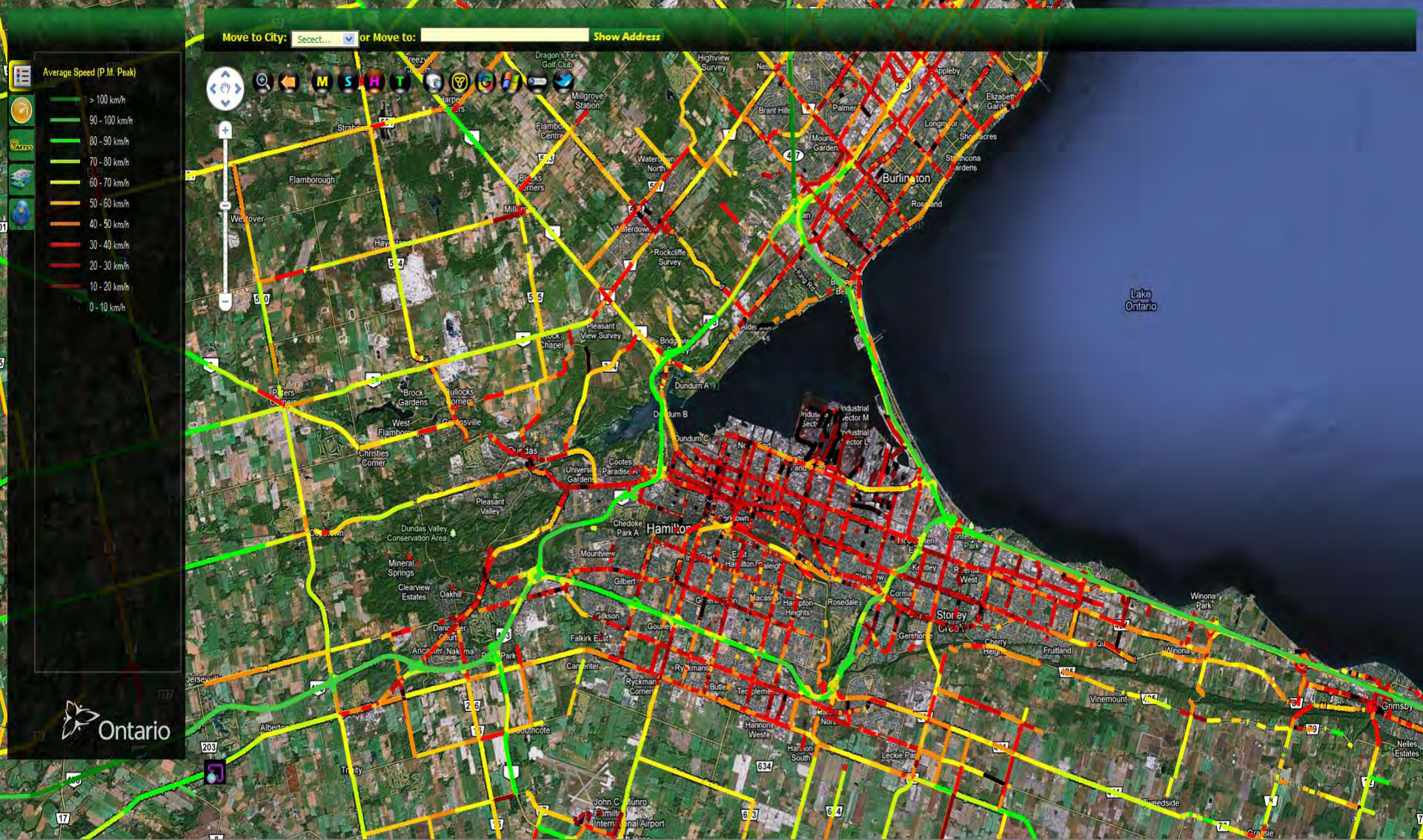
The iCorridor System is Developed by: Systems Analysis and Forecasting Office, Ministry of Transportation of Ontario



# Web Tool Development - iCorridor



About us | Ministry of Transportation | Government of Ontario | iBorder



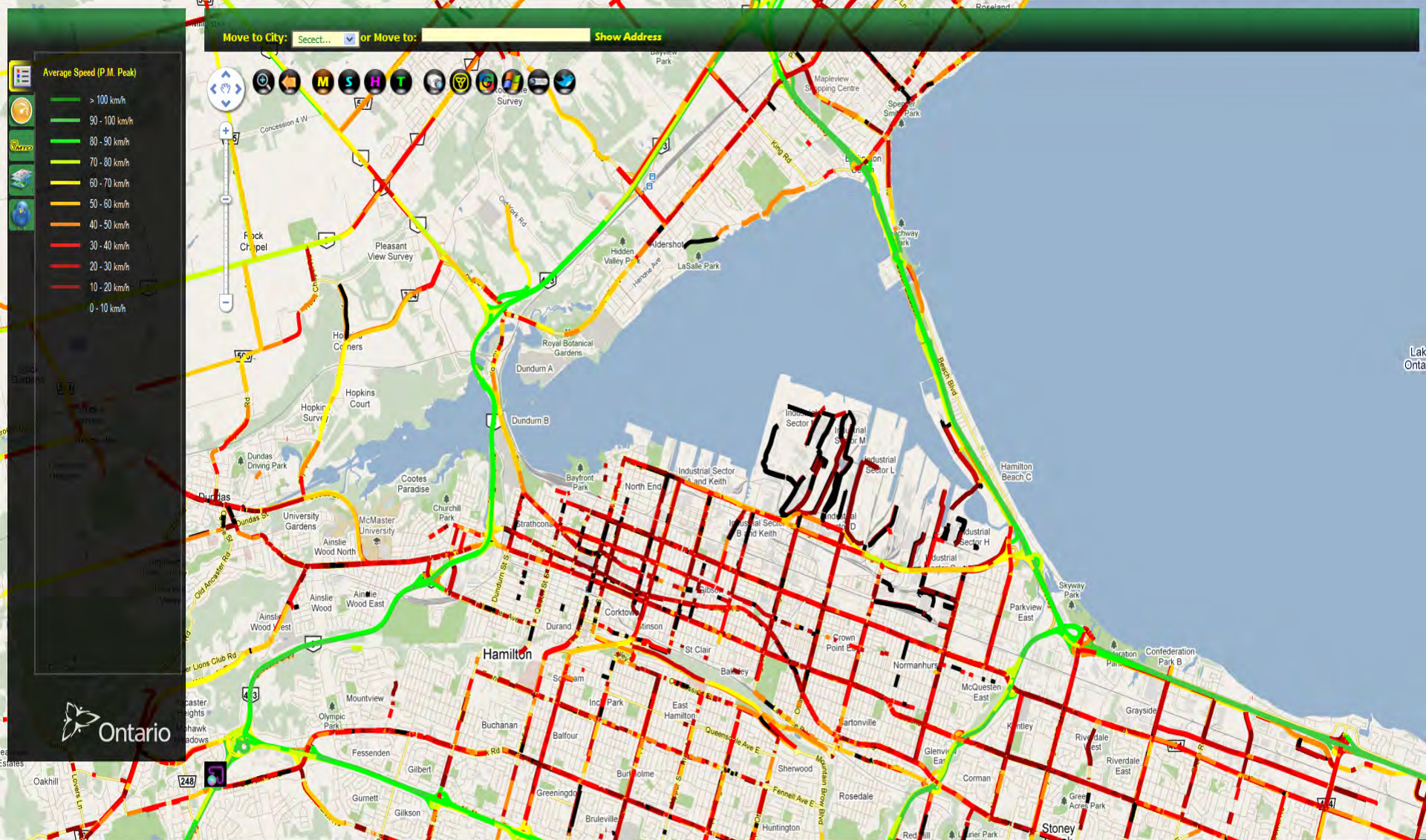
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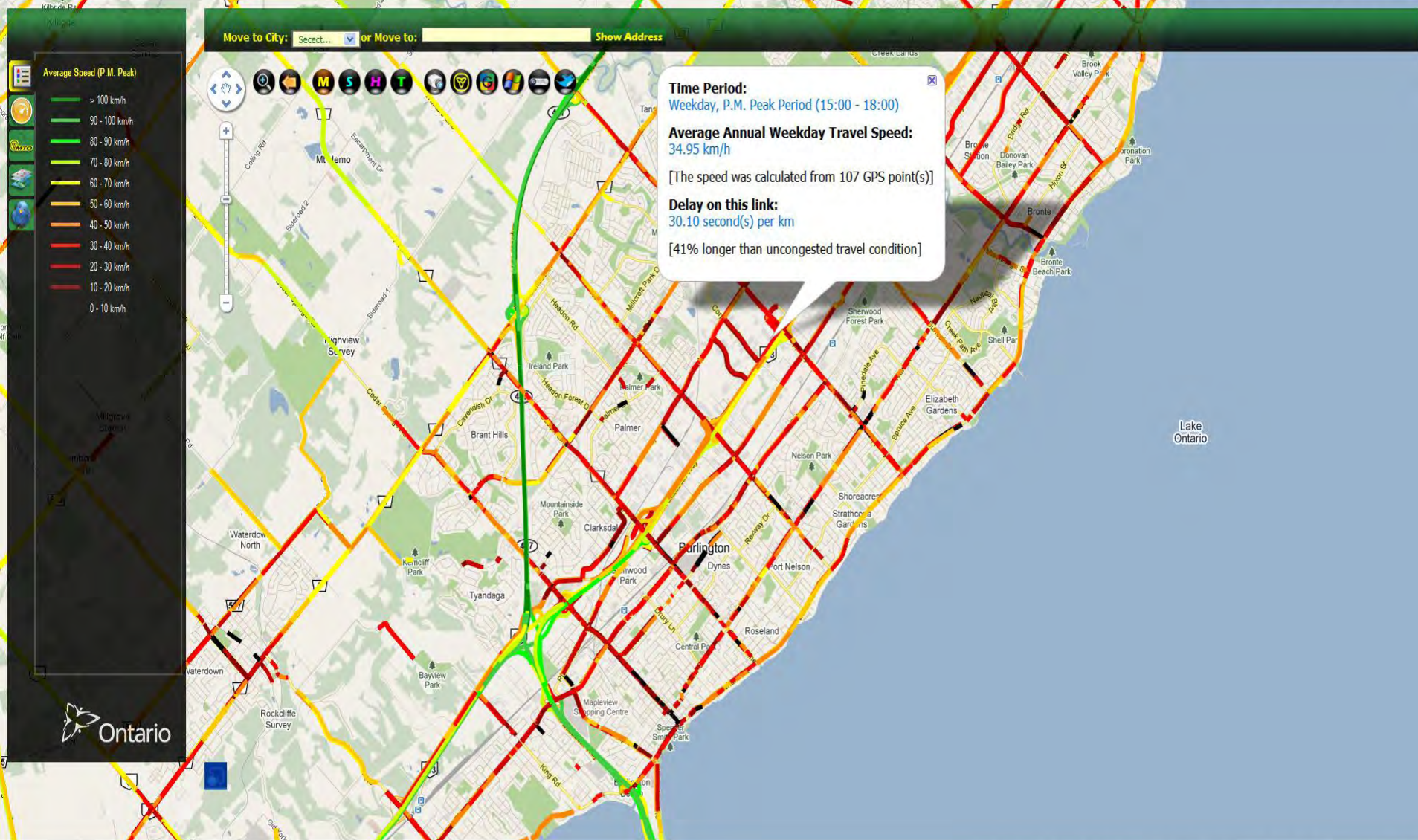
The iCorridor System is Developed by: Systems Analysis and Forecasting Office, Ministry of Transportation of Ontario



# Web Tool Development - iCorridor

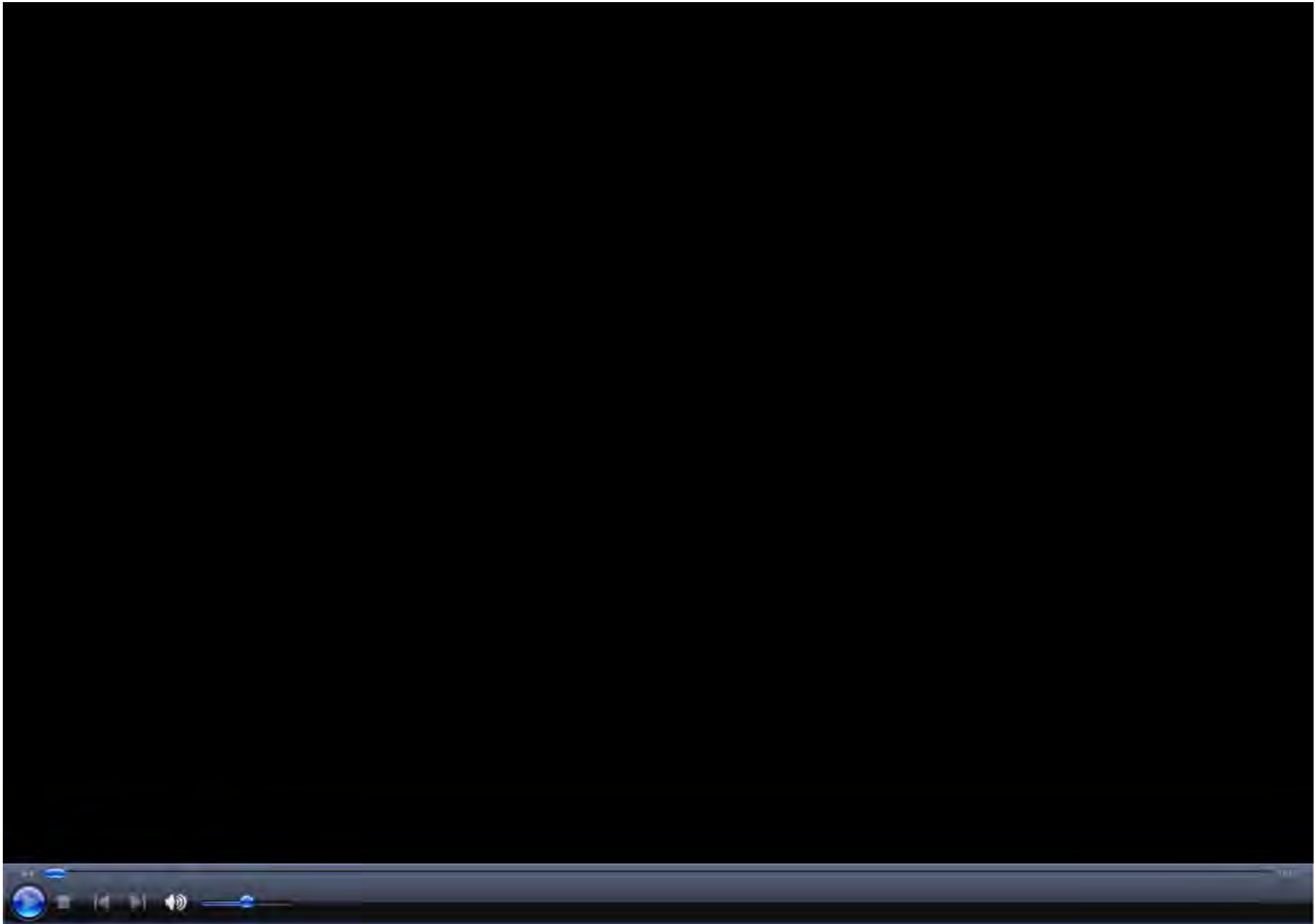


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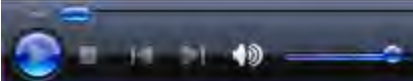


The iCorridor System is Developed by: Systems Analysis and Forecasting Office, Ministry of Transportation of Ontario

# Ontario-U.S. International Border Performance Animation

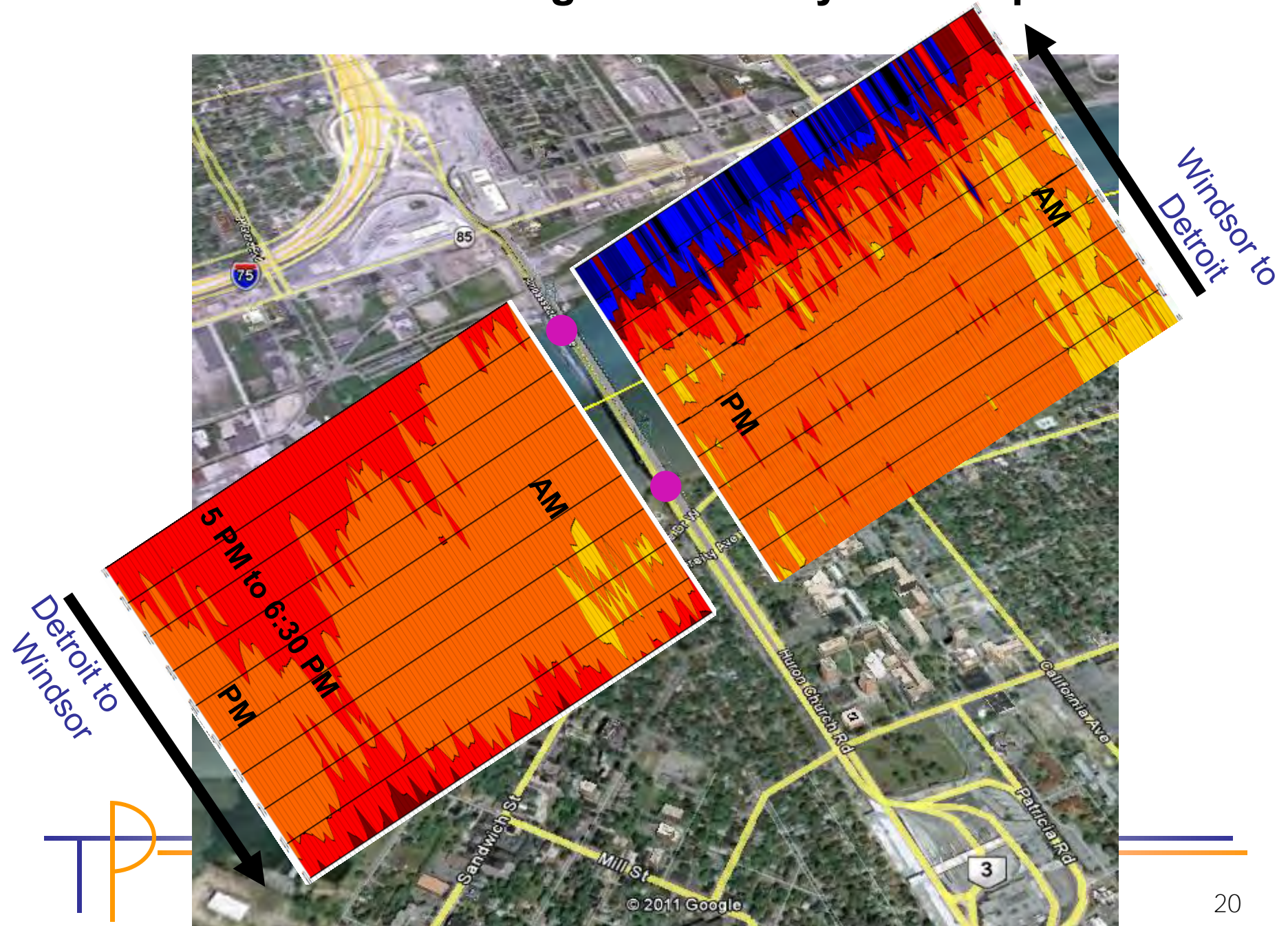


# Windsor-Detroit Animation



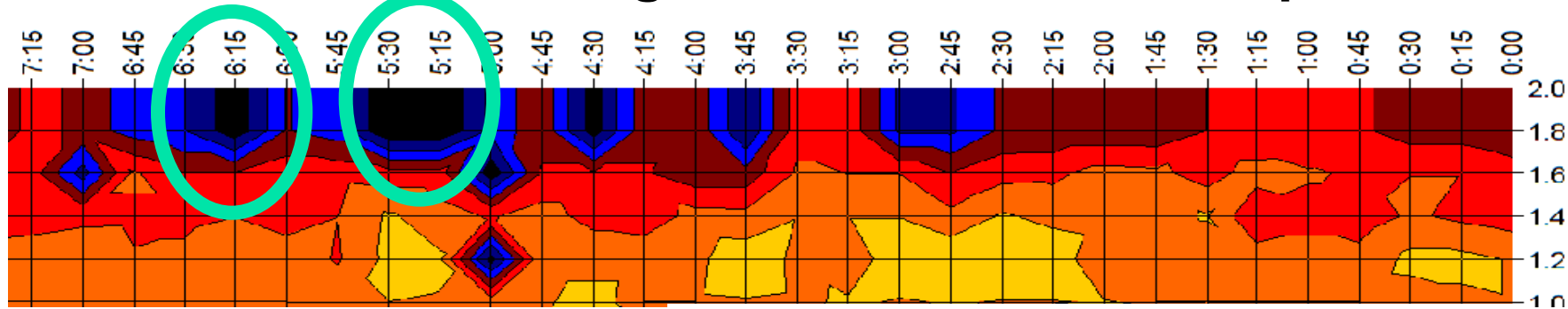


# Ambassador Bridge – Weekday Truck Speeds



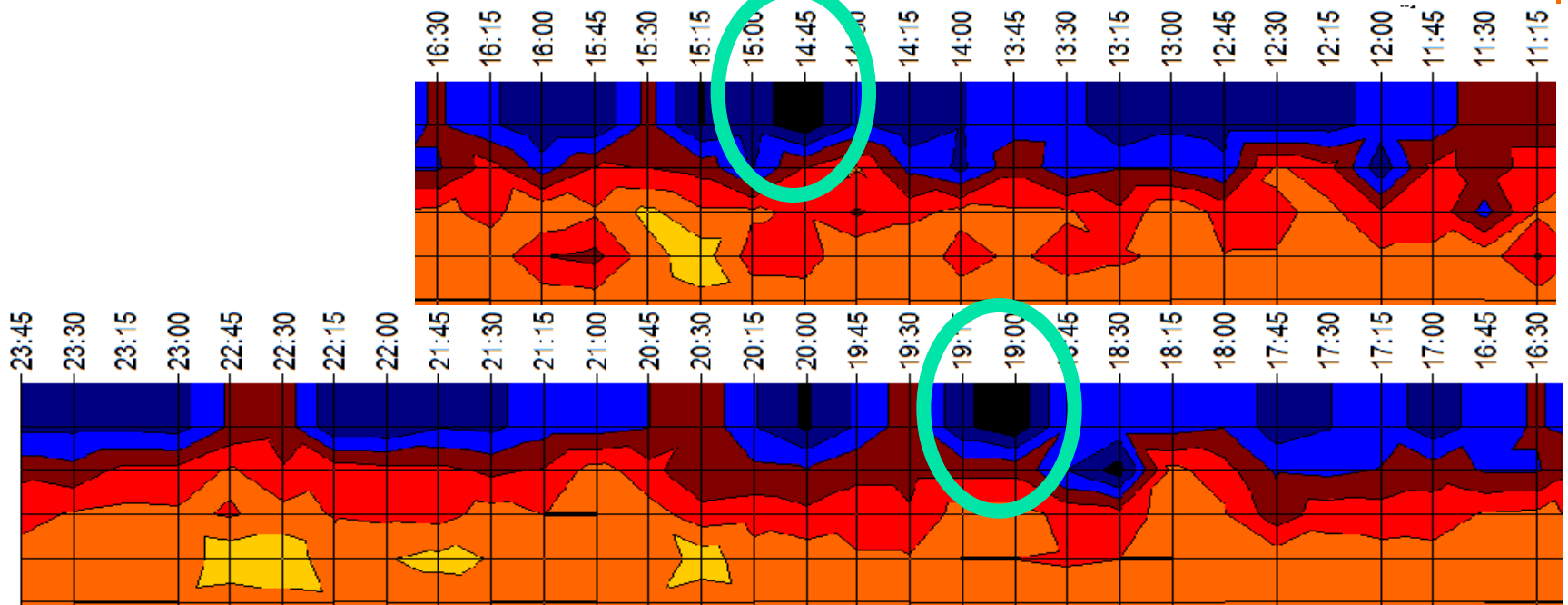
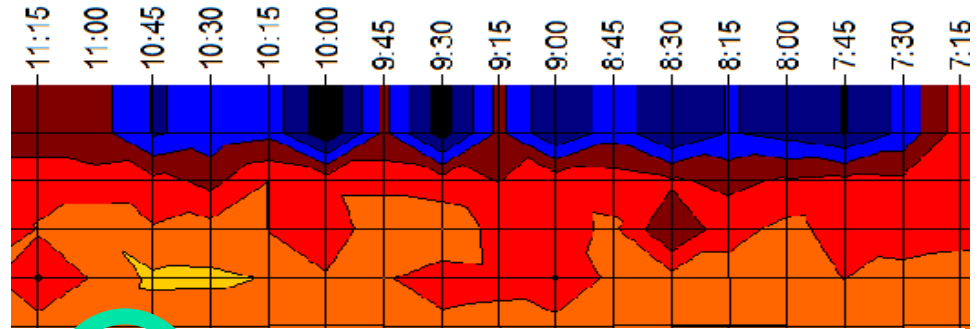


# Ambassador Bridge – CBP Access Backup

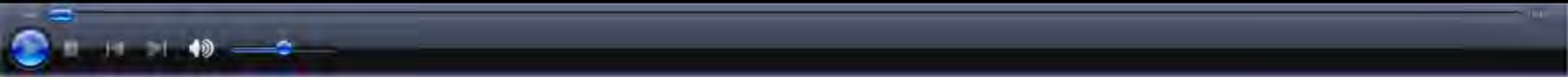


## Pressure Points Extending 10 Minutes

1. 5:10 AM – 5:35 AM
2. 6:45 PM -7:15 PM
3. 2:40 PM – 2:50 PM
4. 6:10 AM – 6:20 AM

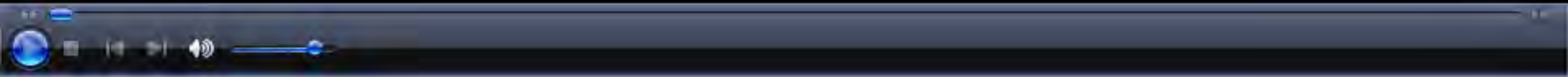


# Road Performance Animation - Truck and Passenger Car Speeds in Toronto



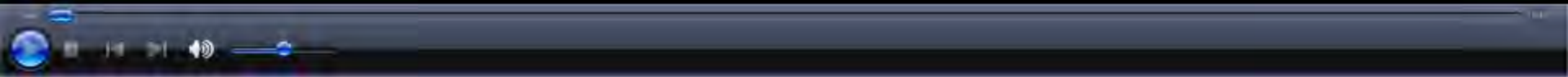
# Hwy 401 Core/Collector System 24-hour Road Performance Animation

(200-meter segments with 15-minute time interval)



# Downtown Toronto 12-hour Road Performance Animation

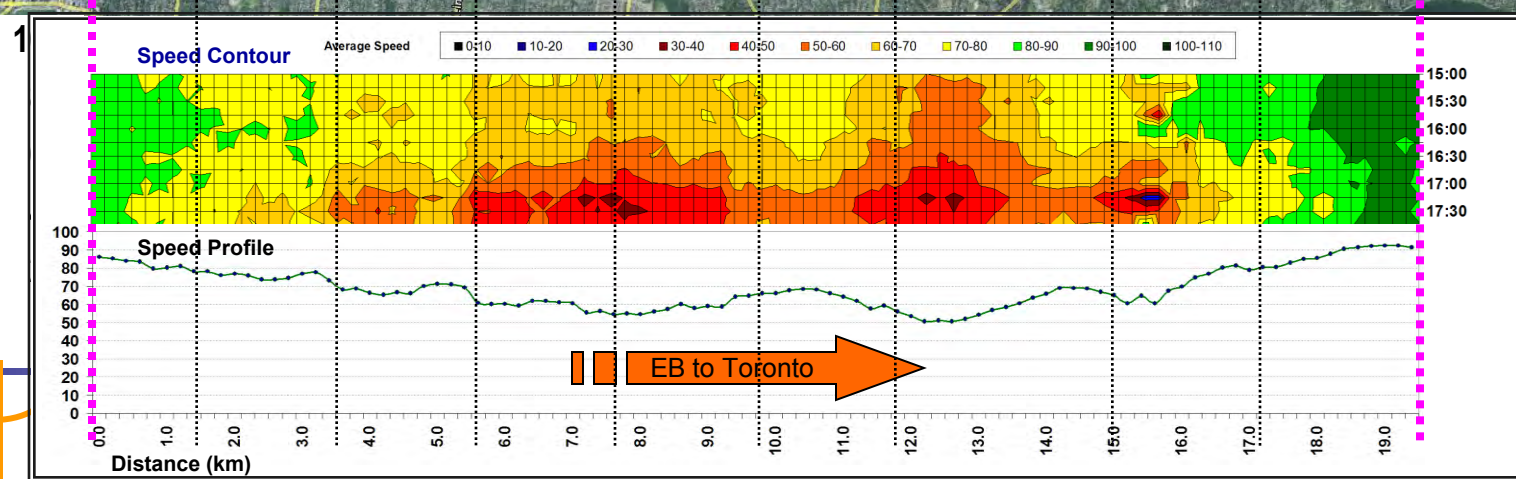
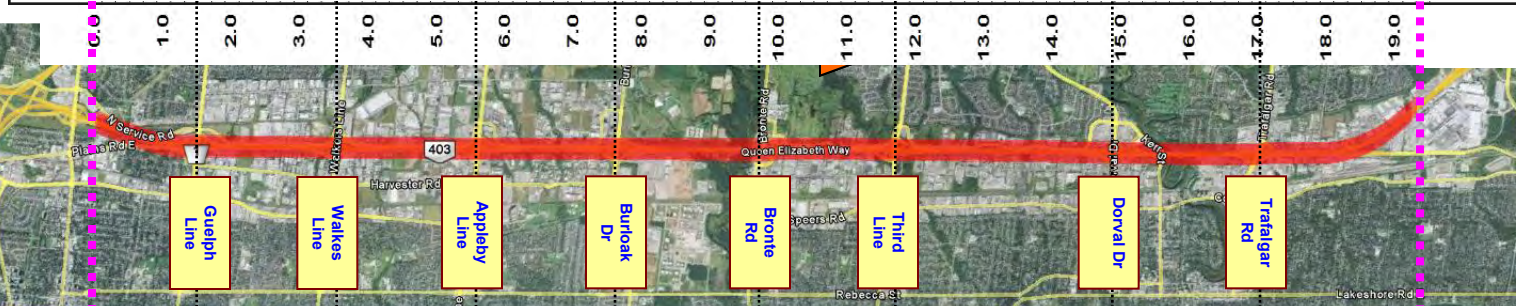
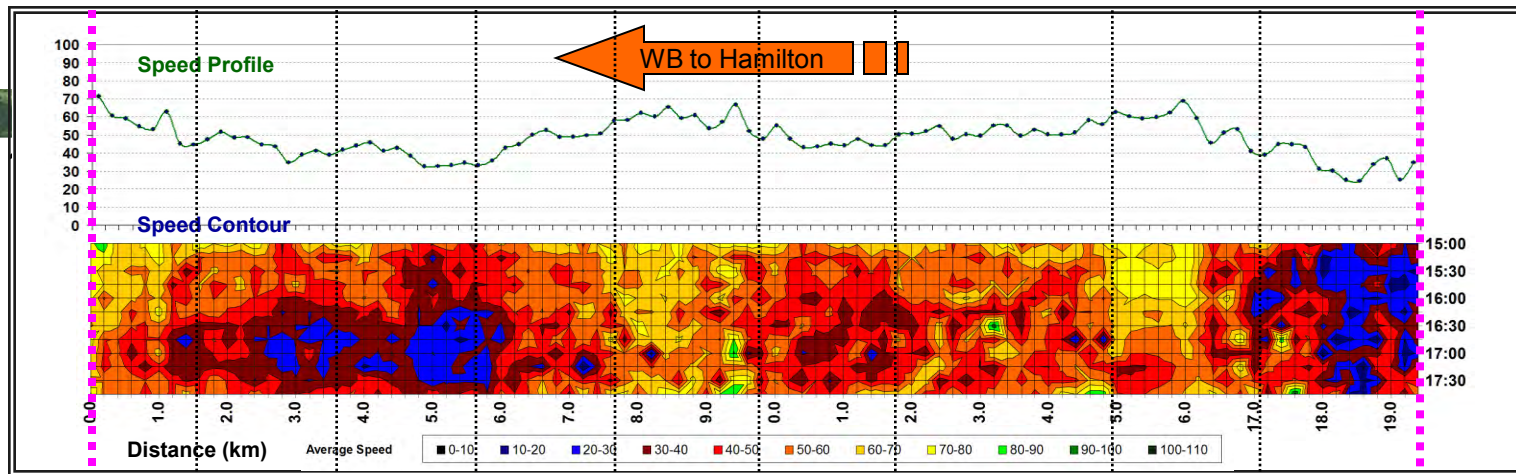
(1-hour time interval)





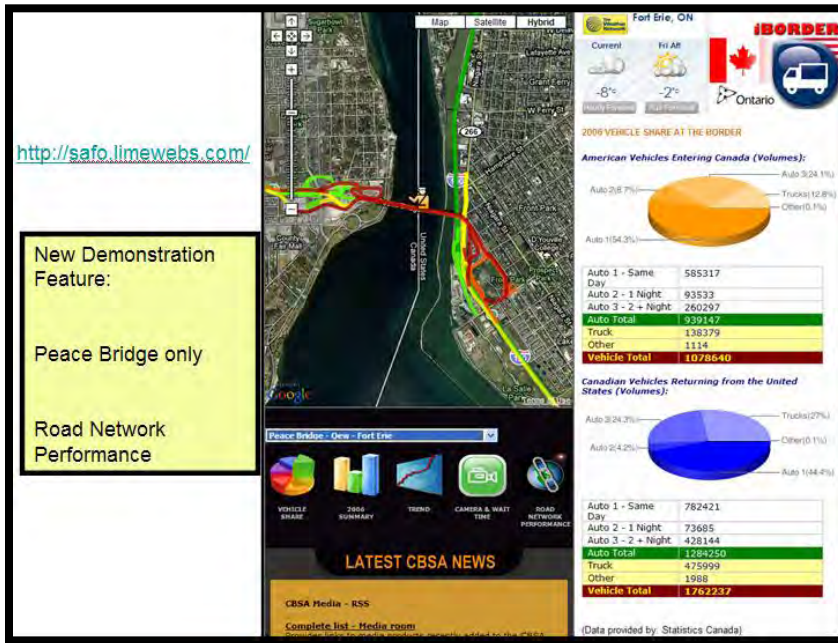
# QEW Analysis: Hwy403 to Hwy 407 - Speed Contours & Profiles

2009 P.M. Peak Period (3:00p.m. to 6:00p.m.)

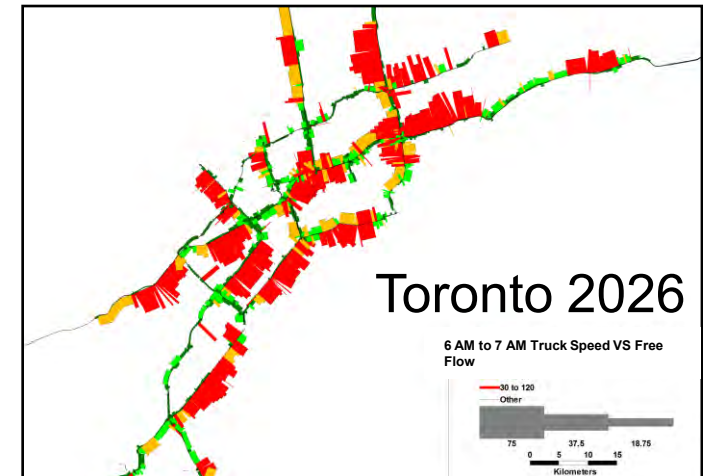
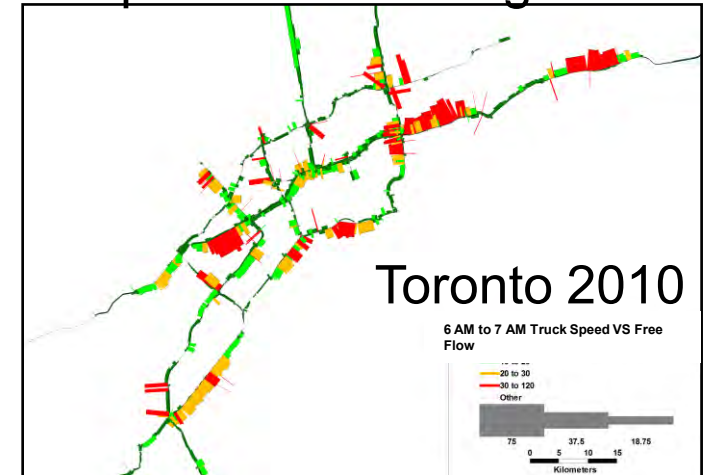


# Next Steps – Forecasts - iBorders and iCorridor

The suite of web analysis tools under development are expected to provide state-of-the-art knowledge management capabilities establish a criteria based process to prioritize investment options.



## Year 2010 to 2026 Travel Speed Forecasting Tool

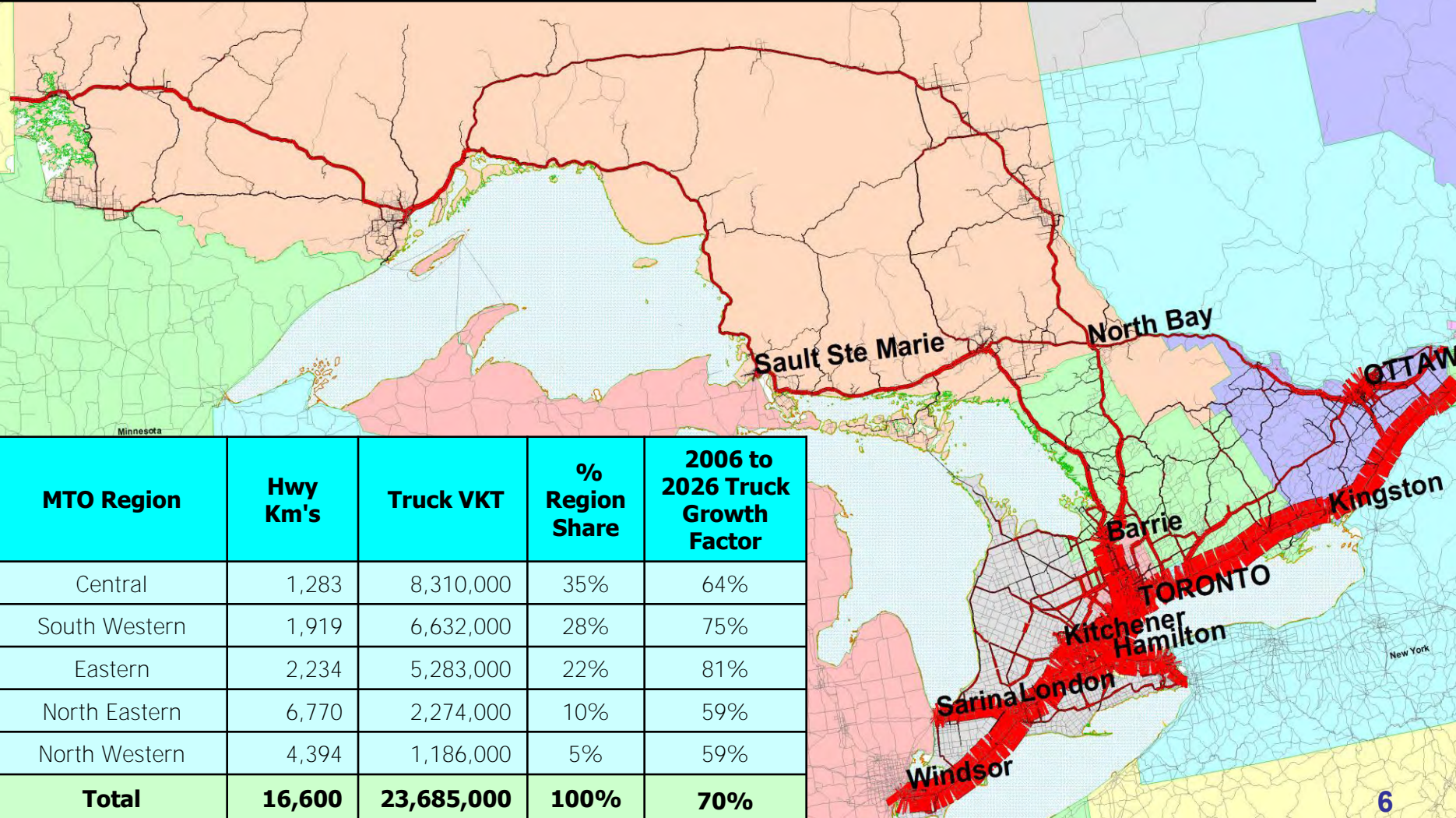




# MTO Region Truck Activity and Growth to Year 2026

## Ontario Commercial Vehicle Statistics

- Each day, 150,000 trucks travel 24 M km's on Ontario's Provincial Roads
- 11 million km's on Highway 401 alone (47%)
- By 2026, truck travel forecasted to grow of 70%
  - Eastern & SWPR at 81% and 75% respectively

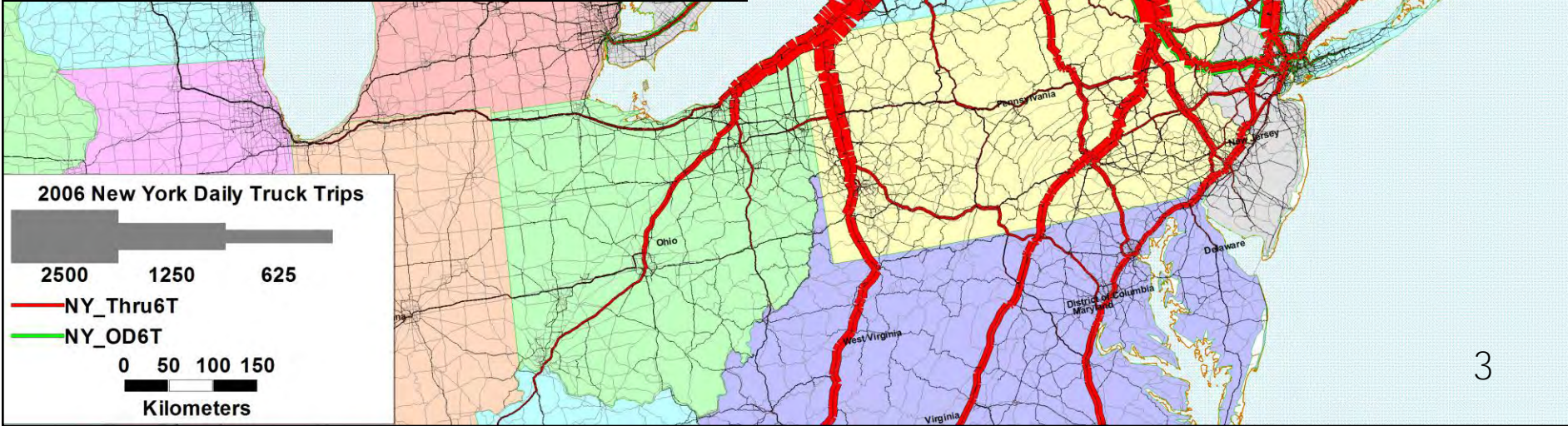




# Canada – New York Truck Trade Plus Trade Using NY Roads Accessing Canadian Markets

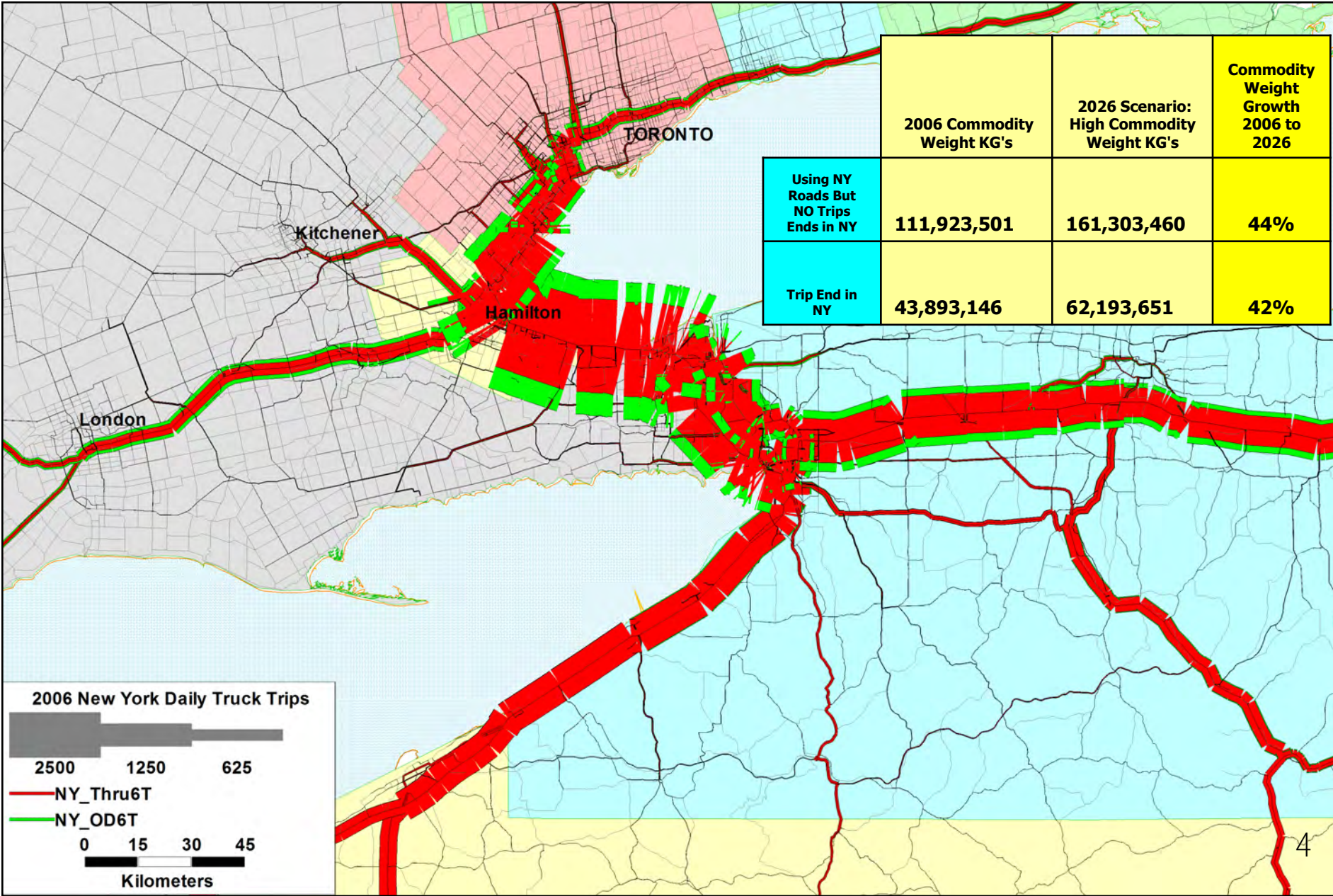
	2006 Daily Trips	2026 Scenario: High Daily Trips	Trip Growth 2006 to 2026
Using NY Roads But NO Trips Ends in NY	10,415	15,502	49%
Trip End in NY	4,768	7,084	49%

	2006 Commodity Value Trips	2026 Scenario: High Commodity Value	Commodity Value Growth 2006 to 2026
Using NY Roads But NO Trips Ends in NY	\$ 356,253,158	\$ 545,467,761	53%
Trip End in NY	\$ 144,479,746	\$ 212,680,466	47%





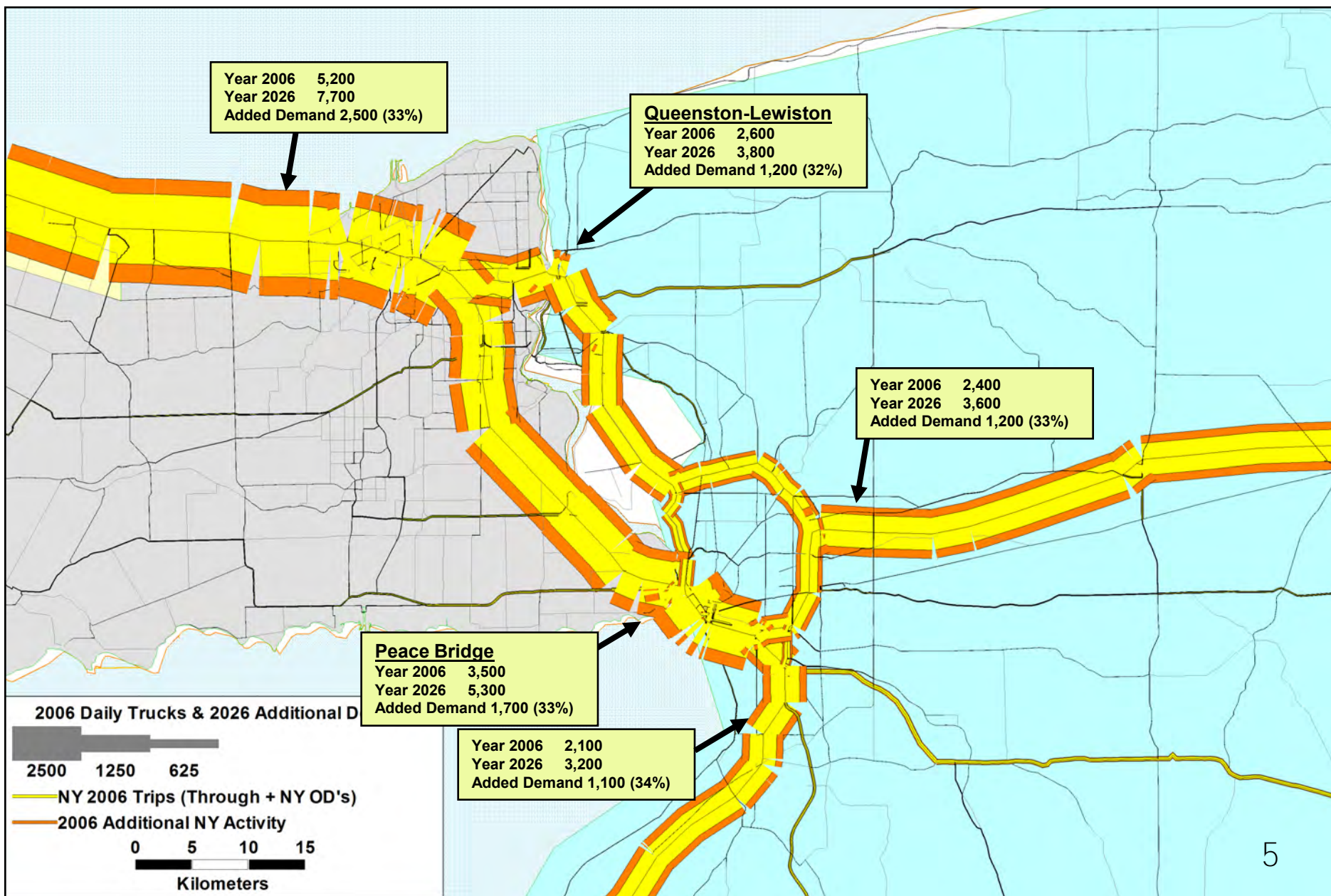
# Canada – New York Truck Trade Plus Trade Using NY Roads Accessing Canadian Markets





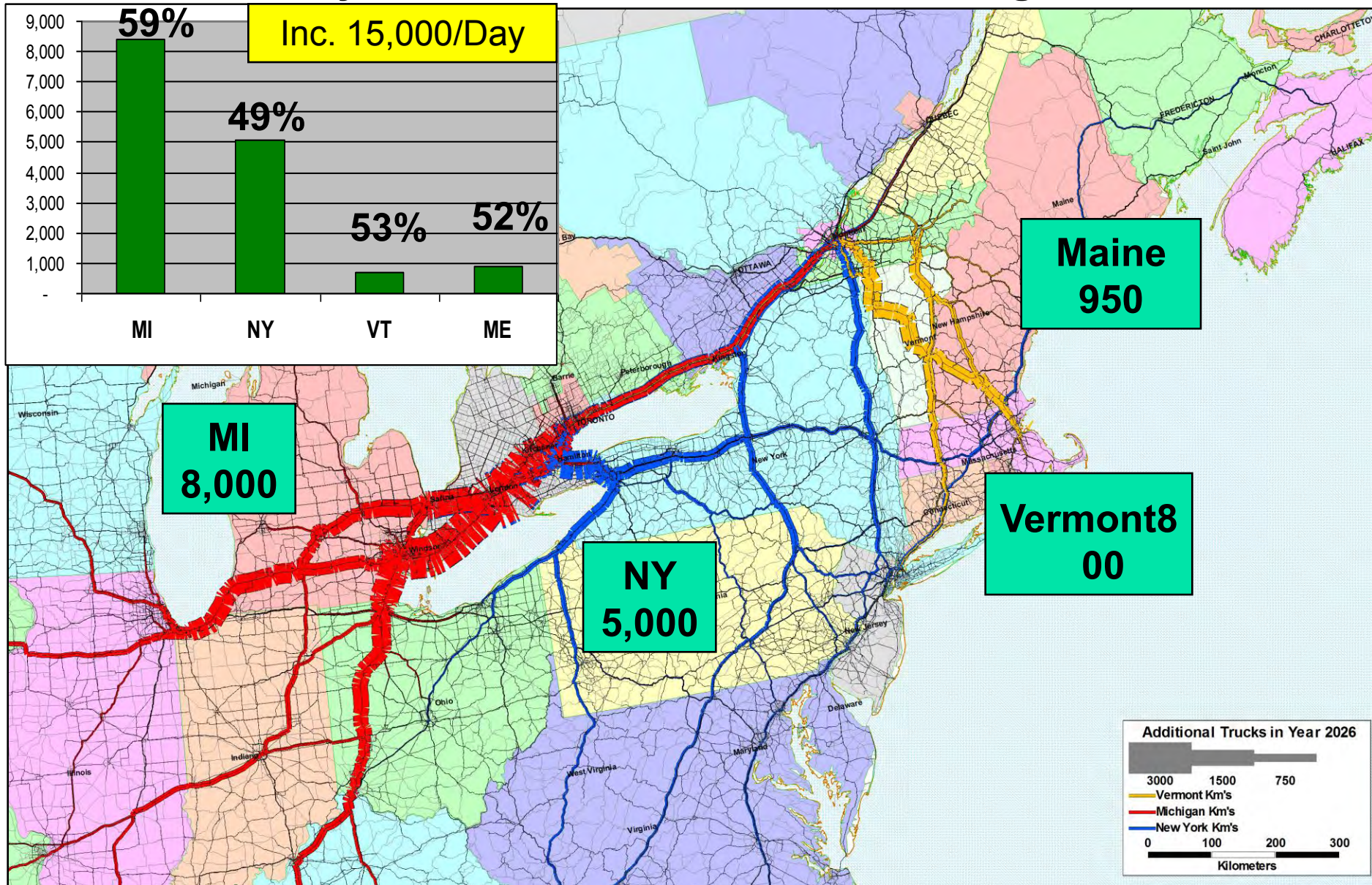
# Canada – New York Truck Trade

## Year 2006 (Yellow) Plus 2026 Additional Demand (Orange)



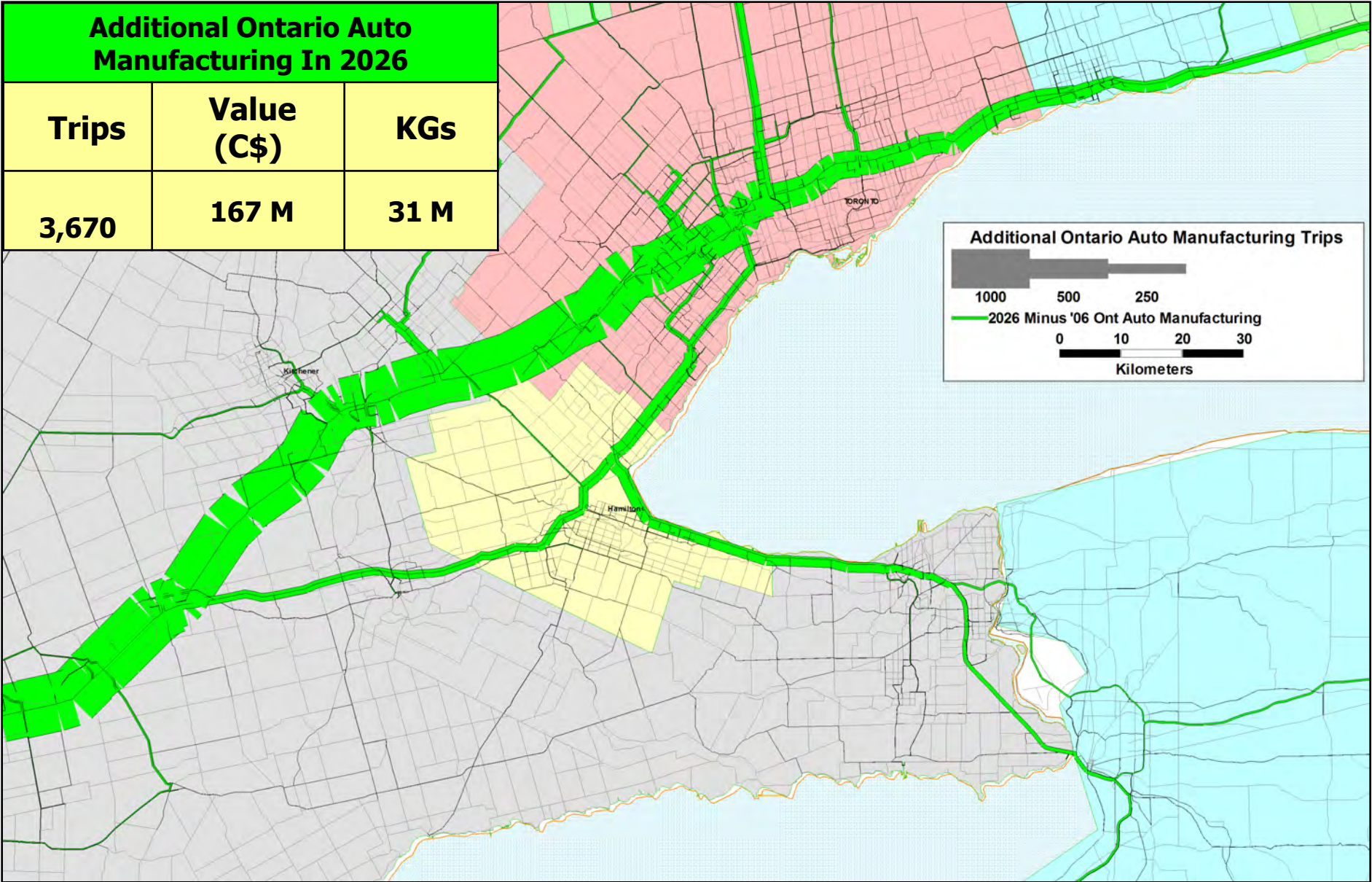


# Additional Daily Trucks At State Border Crossings 2006 To 2026



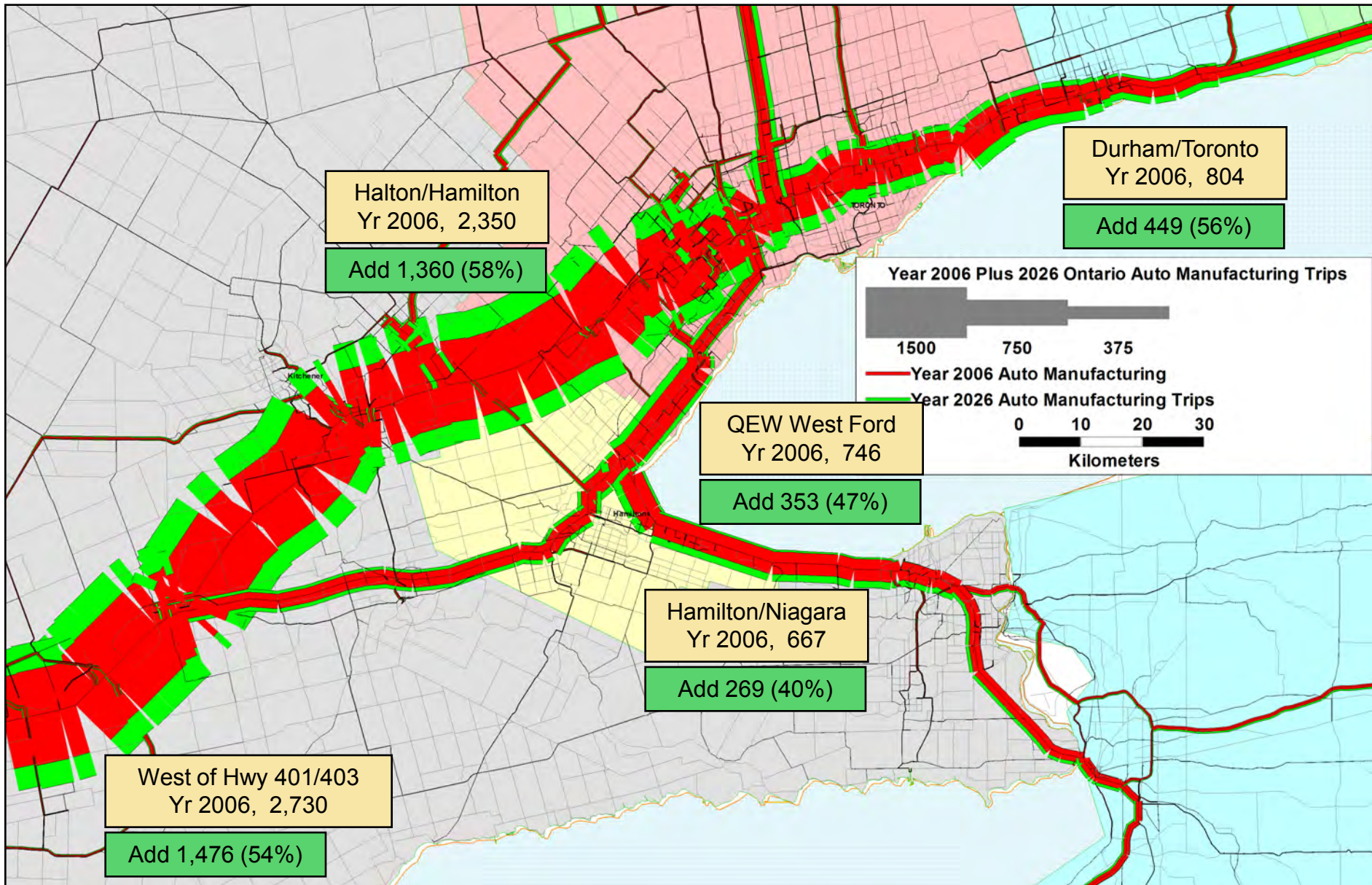


# Ontario Automotive Manufacturing Sector Truck Trip Growth – Year 2006 to 2026

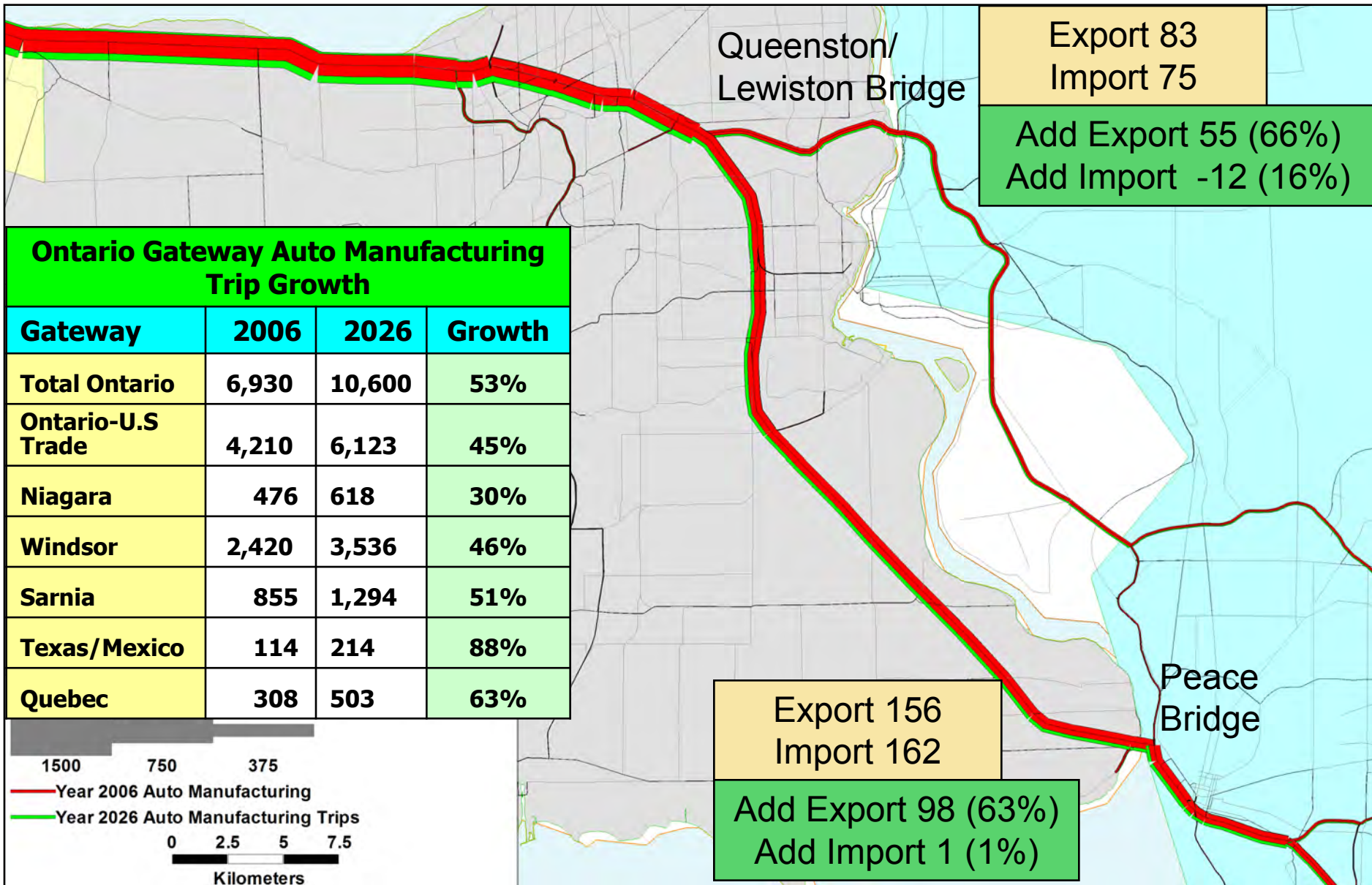




# Ontario Automotive Manufacturing Sector Truck Trip Growth – Year 2006 to 2026



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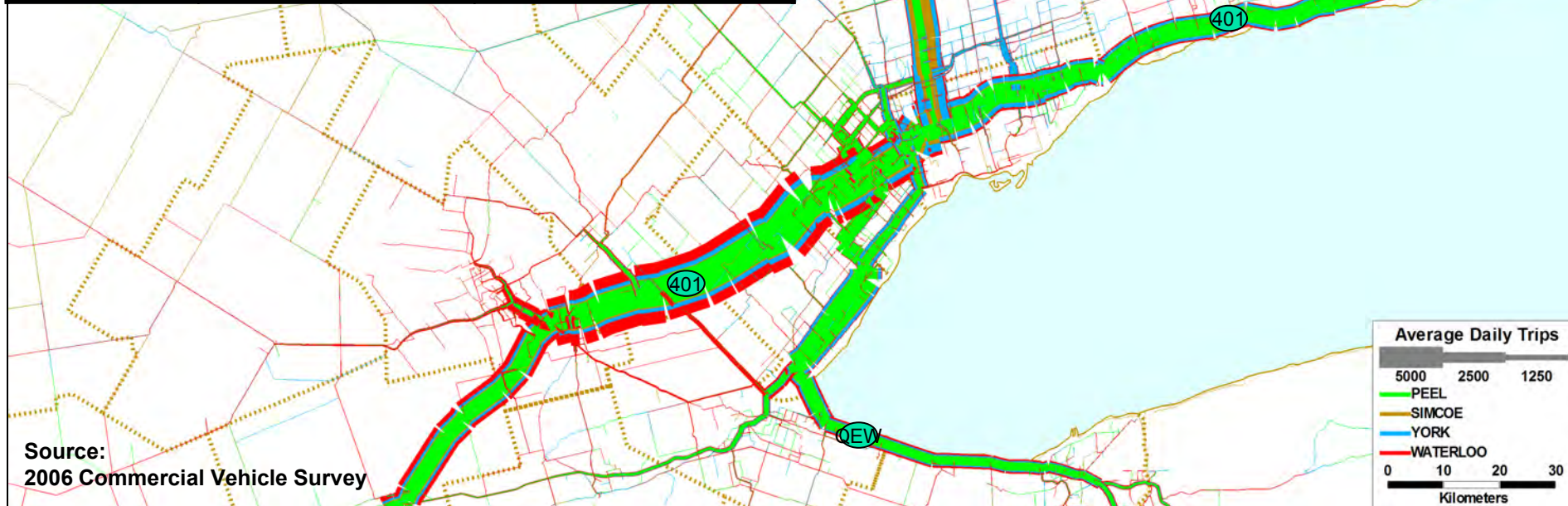




# Understanding County Level Truck Trip Highway System Infrastructure Needs

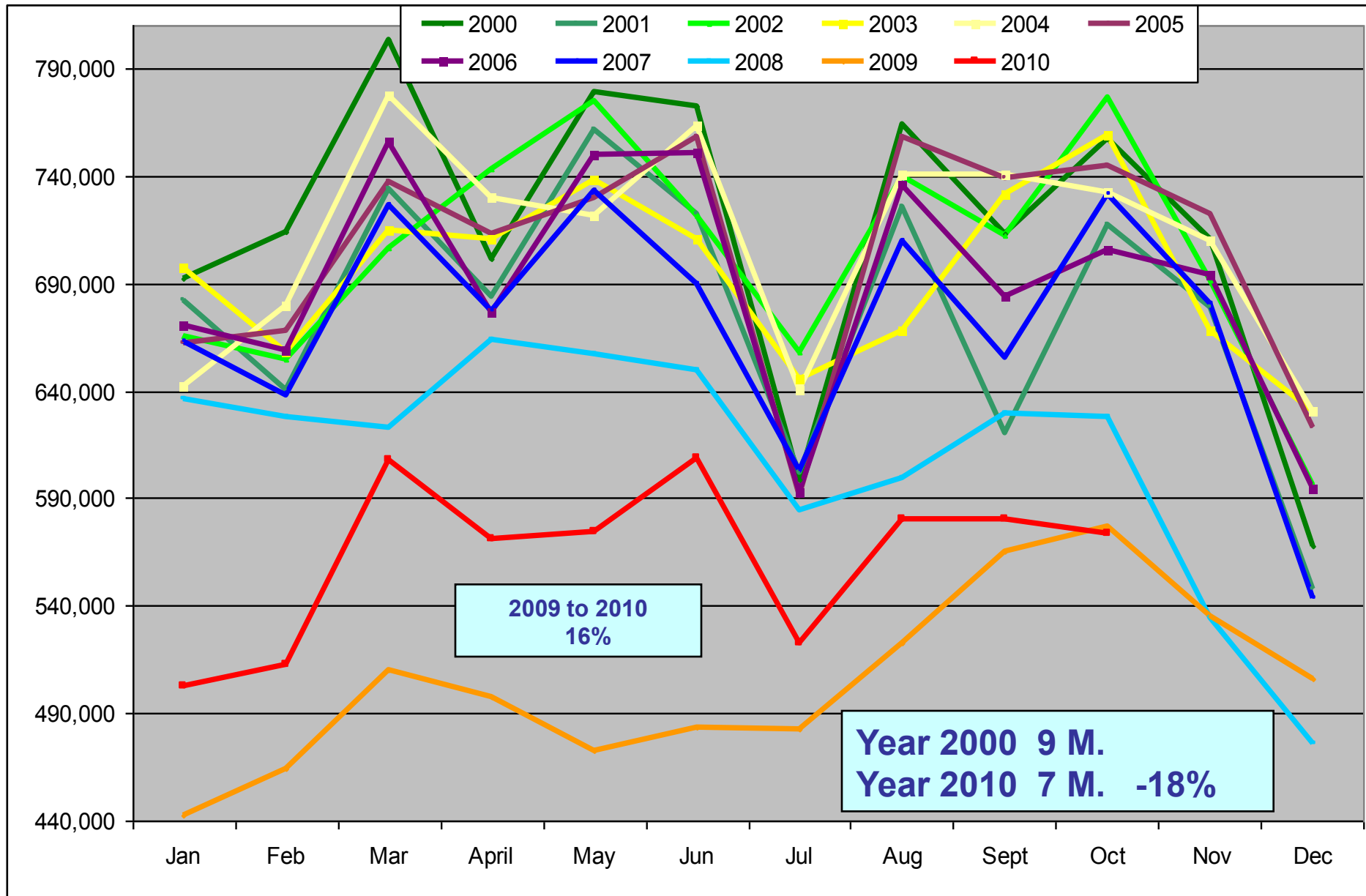
Waterloo, Peel, York, and Simcoe Region Origins or Destinations

Region	2006 Daily Trips	2026 Daily Trips	2006 Cargo Value	2026 Cargo Value
Peel	22,500	38,500	\$580 M	\$1.1 B
Peel % Share	74%	75%	77%	77%
York	7,900	13,200	\$170 M	\$320 M
Total	30,400	51,600	\$750 M	\$1.4 B

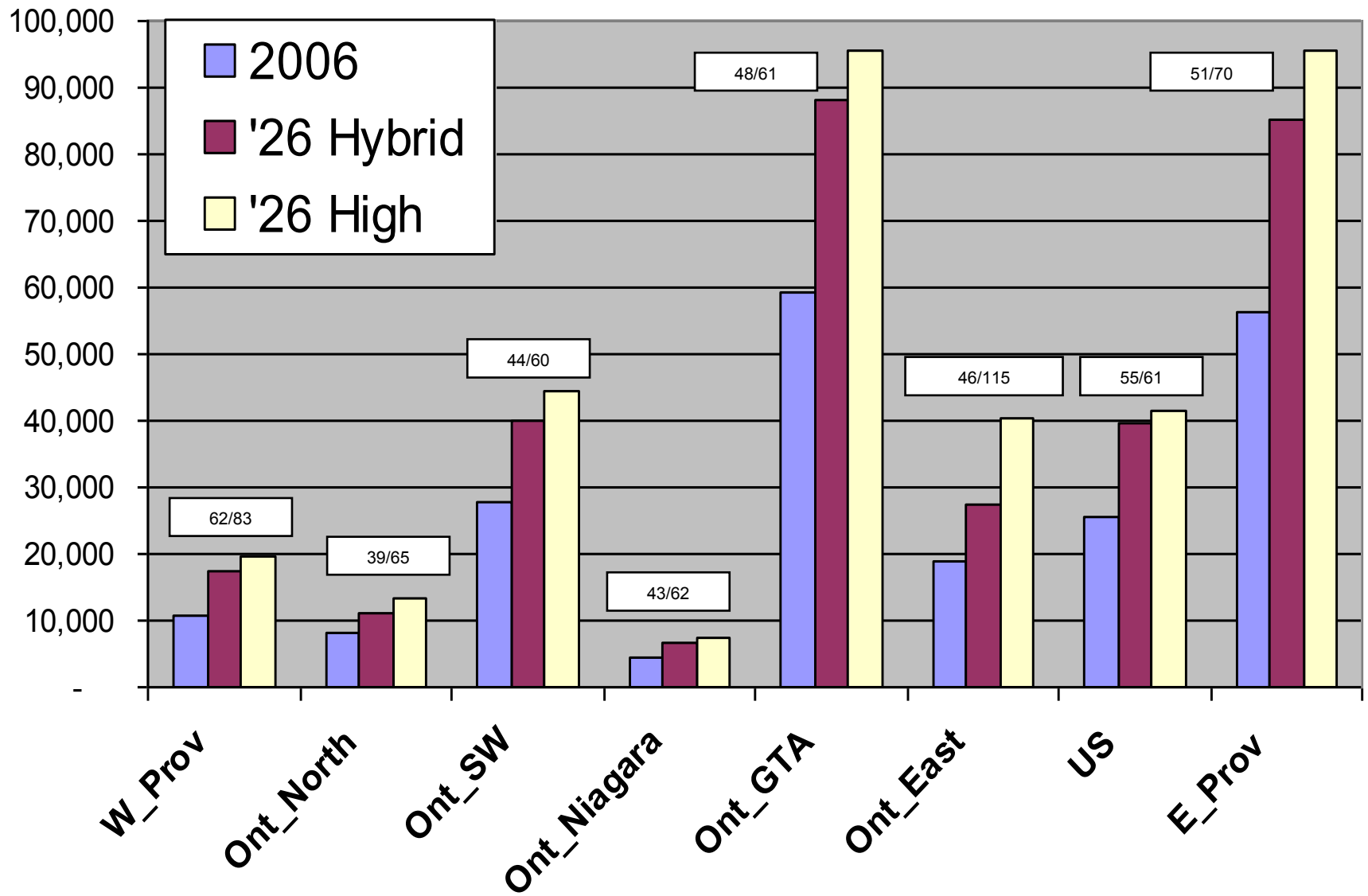




# Monthly 2000 to 2010 Ontario International Border Crossing Truck Volumes



# 2006 to 2026 Hybrid and High Scenario Truck "Trip" Forecasts



# 2006 to 2026 Ontario – U.S. Trade By Truck – Percent Growth

## Highlights

- Ontario Export growth 56%
- Ontario Import growth 61%
- Waste exp. declines -27%
- Empty trips increase by 57%

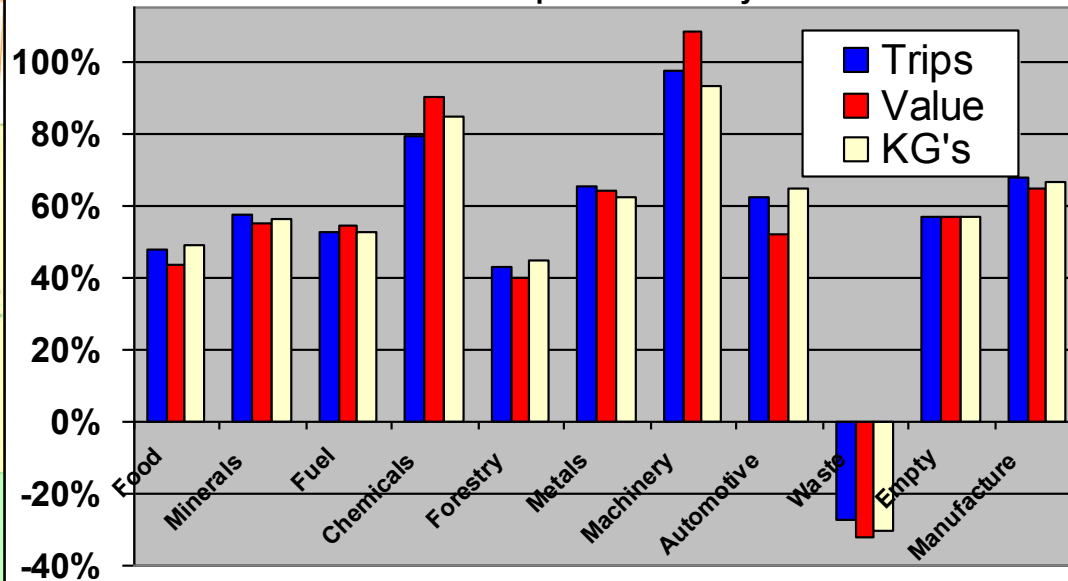
## Exports

- Machinery 97%
- Chemicals 79%
- Auto 62%

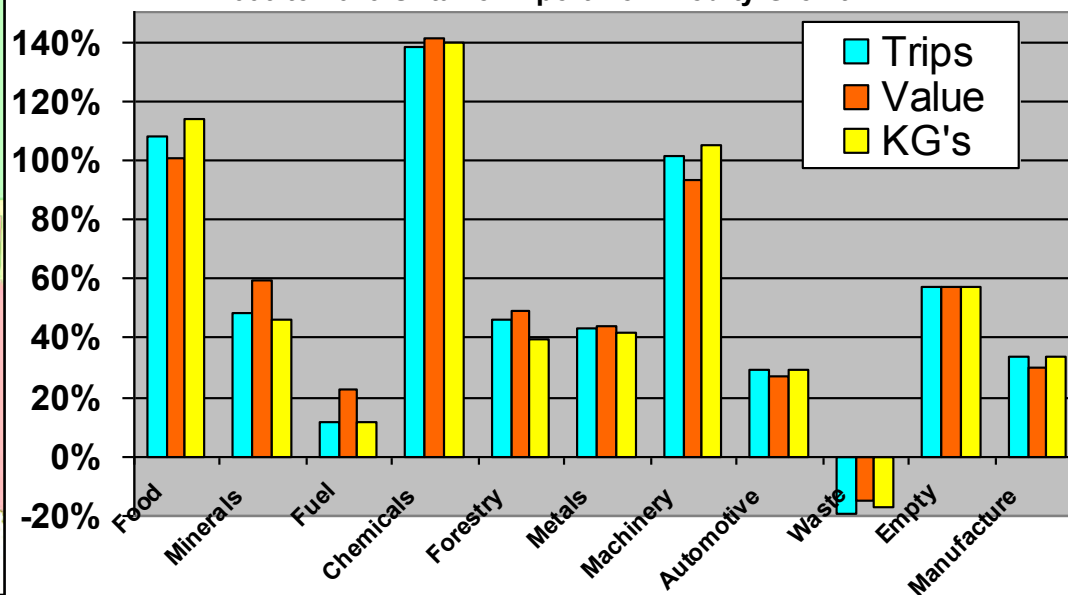
## Imports

- Chemical 138%
- Machinery 102%, US drives CDN manufacturing automation
- Auto 30%

2006 to 2026 Ontario Export Commodity Growth

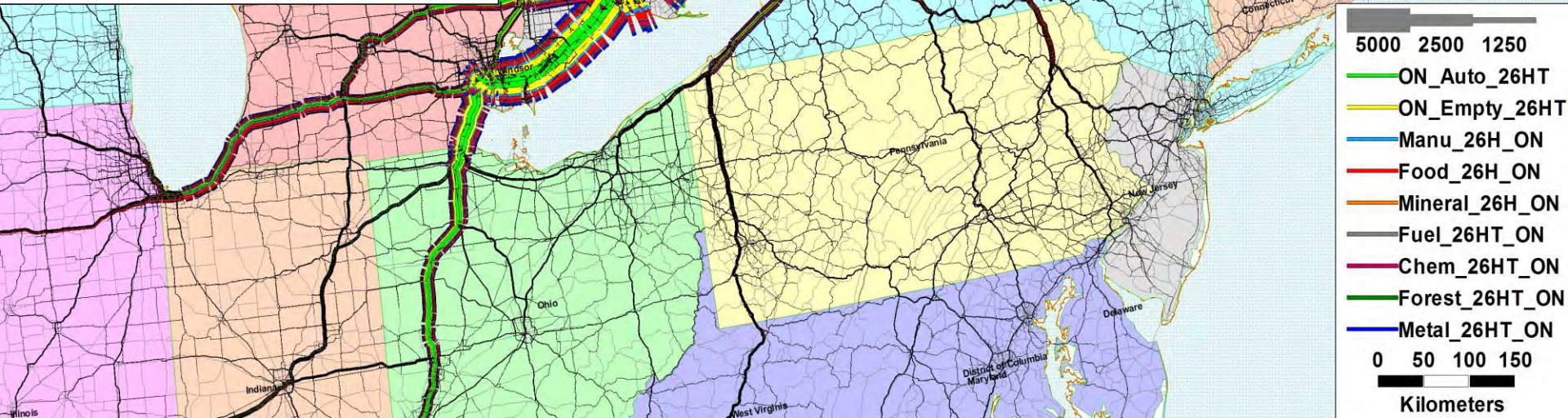
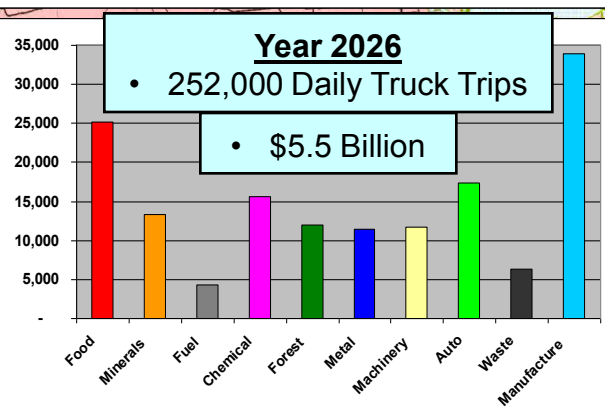
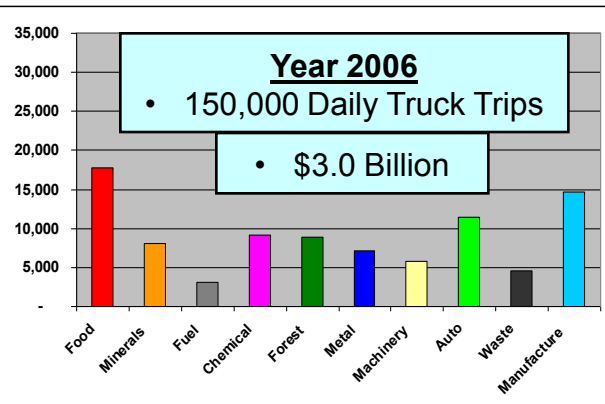


2006 to 2026 Ontario Import Commodity Growth





# Year 2026 High Scenario - Ontario Truck Activity By Commodity



# Conclusions

- New sources of GPS and mobile device data provide:
  - Innovative solutions to support infrastructure planning
  - Performance Measures
  - Micro analysis of hourly operations
  - Source to produce OD matrices
  - Aid Model calibration

<http://icorridor.limewebs.com/>

