Technology Testing as Part of the QEW High Occupancy Toll (HOT) Lane Pilot Project

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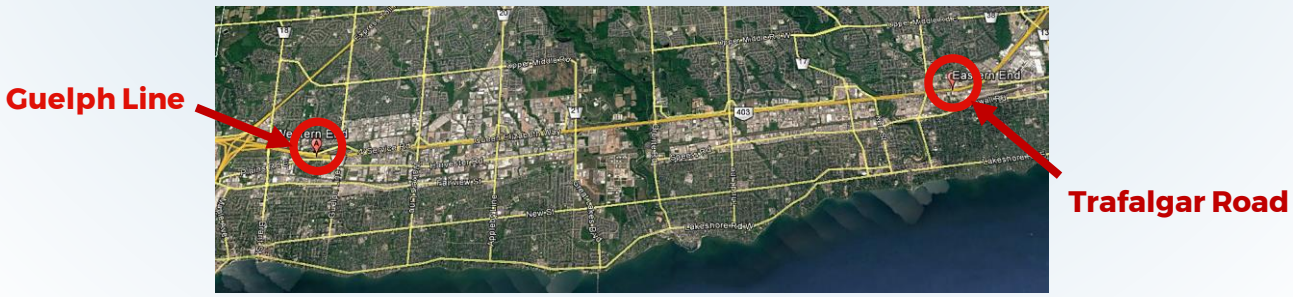
Urban Mobility - ITS Planning

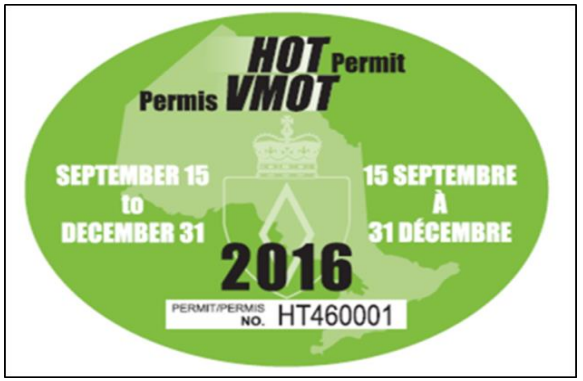
Overview of the QEW HOT Pilot

- On September 15, 2016, the Ontario Ministry of Transportation launched Canada's first High Occupancy Toll (HOT) Lanes on a 16.5 km section of the Queen Elizabeth Way (QEW) in the Greater Toronto Area.
- Regulation under the *Highway Traffic Act* authorizes the establishment of a pilot and the setting of a permit fee. The pilot is expected to operate between two to four years.
- Goals of the Pilot include:
  - *Optimizing highway network capacity and providing motorists with additional travel choices;*
  - *Gathering information and learning about market demand, customer behaviour and highway performance; and*
  - *Testing new technologies.*



Purchase and Renewal Processes

- Permit sales have been limited to allow the ministry to observe network impacts as distribution increases. To ensure fair and equitable distribution of the limited permits available, allocation is done through a random draw.



- HOT permits cost $180 for a three month term and are renewable for a maximum of two more terms.
- Number of permits issued is based on road capacity available during highest traffic volume hours.
- Each term of the pilot a high percentage of users report being satisfied or very satisfied with their experience and a large majority of permit holders renew their permits.

Technology Testing

- To support goal of testing technologies the Ministry issued a Request for Information (RFI) to help identify technological solutions on four aspects of HOT lanes delivery:
  1. **Customer billing based** on using HOT lanes and distance travelled;
  2. **Dynamic toll pricing**, managing HOT lane use and understanding travel patterns;
  3. **In-vehicle communication of toll rates** and other relevant operational details (e.g. occupancy requirements); and
  4. **Compliance** based on vehicle classification and vehicle occupancy.

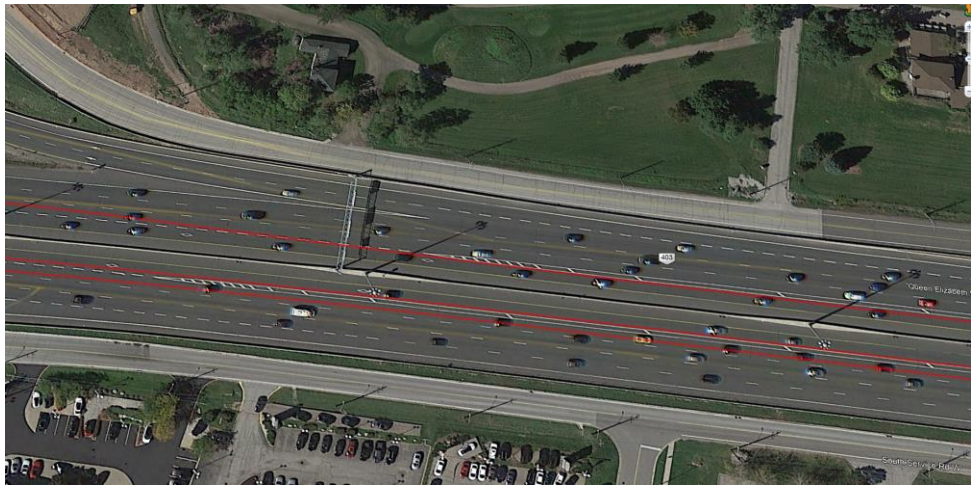
- RFI responses were received that covered varying technologies, such as:
  - *Multi-protocol radio frequency identification (RFID) readers*
  - *Bluetooth readers*
  - *Telematics devices*
  - *Mobile phone applications*
  - *Vehicle occupancy detection equipment*

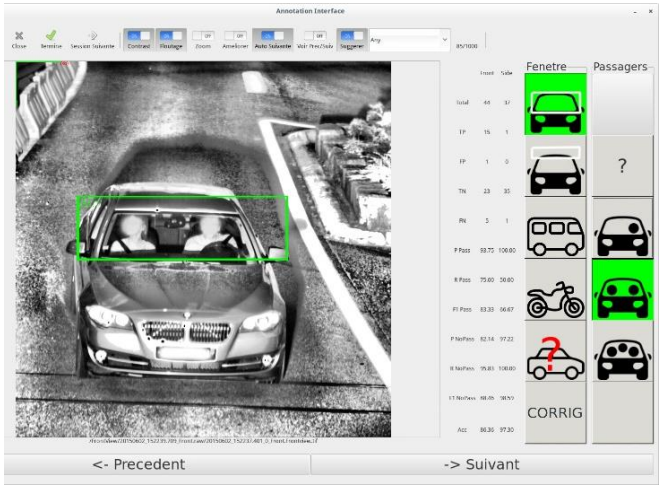
Technology Testing (cont'd)

- MTO is working with the Ministry of Economic Development and Growth and the Ontario Centres of Excellence to support development of automated technologies to improve user experience and simplify occupancy detection enforcement through the Small Business Innovation Challenge.
  - *10 feasibility studies and 2 prototype projects were initiated in fall 2017.*
  - *All prototype projects are up to two years in duration.*

Technology Testing Efforts to Date

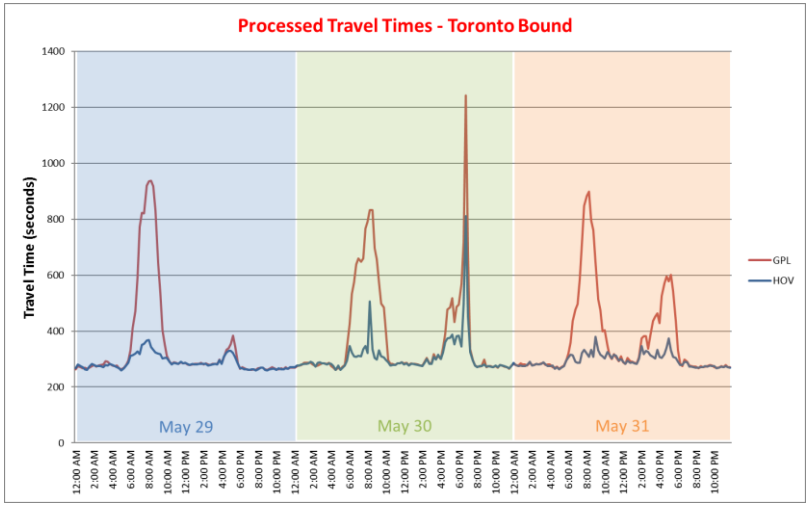
- Accuracy of Bluetooth technologies for estimating separate travel times for HOV/HOT and General Purpose Lanes.
- Use of Bluetooth Low Energy (BLE) beacons to collect and analyze traffic pattern data from HOT Lane Pilot Permit Holders.
- Accuracy of Mobile Applications and telematics devices to track vehicle, by lane, for the purpose of HOT Lane tolling
- Accuracy of Vehicle Occupancy Detection solutions





Accuracy of Bluetooth to Separate HOTL/GPL Travel Times

- PURPOSE: The ability to accurately differentiate travel times in HOTL and GPL can support:
  - *Traveller information*
  - *Motorist choice decisions*
  - *Analysis and evaluation of KPIs (travel time savings)*



- Testing Set Up
  - *Travel Times between Trafalgar Road and West of Bronte Road (~8.3 km)*
  - *Total of twenty-one (21) floating car 'ground truth' surveys were completed for each direction*
    - Twelve (12) HOV and Nine (9) GPL
    - Between 7:00AM - 10:30AM & 4:00PM-6:00PM
  - *Also tested effectiveness of Reading Bluetooth Low Energy devices*

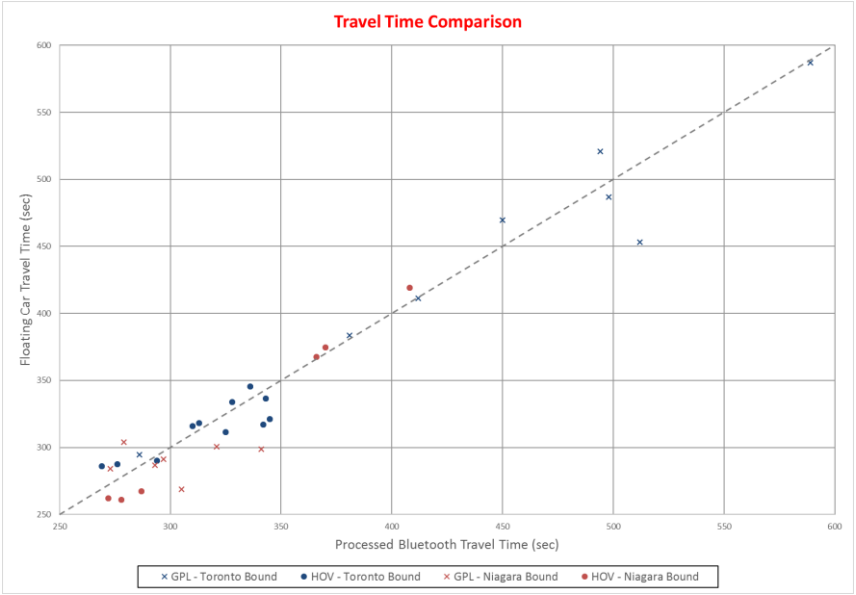
Bluetooth Testing Results

89%

of the raw travel times were within 20 seconds of 'ground truth' (vehicle passing reader)

70%

of corresponding processed travel times were within 20 seconds of 'ground truth'



- Vendor was able to correctly identify if vehicle was in GPL or HOV for ALL runs.
- BLE unit are a viable alternative for Bluetooth-base collection of travel time data

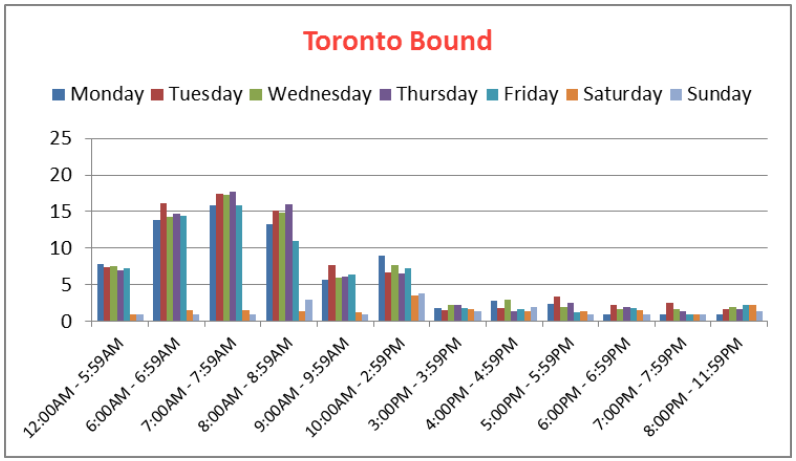
BLE Beacons for Focused Traffic Data Collection

- Two separate studies were undertaken over two consecutive terms of the pilot
  - *Term 3 – March to May 2017 (~750 permit holders)*
  - *Term 4 – June to August 2017 (~800 permit holders)*
- Purpose was to analyze traffic patterns and conditions to better understand how many permits may be distributed per term
- HOT Lane Pilot Corridor has eight (8) BT readers ~ at each interchange

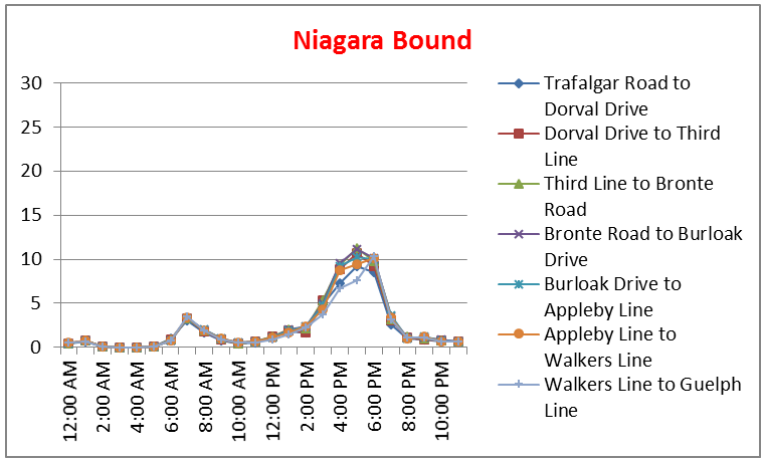
- BLE Beacons were distributed to willing volunteer HOTL Pilot permit holders (167 in Term 3, 149 in Term 4)
  - *MAC IDs of distributed BLEs were known and recorded, but NOT matched to permit holder*
  - *Assumed that not all BLEs were installed and/or set up correctly*

BLE Beacons for Focused Traffic Data Collection

Example Trend Analysis: Observed Trips



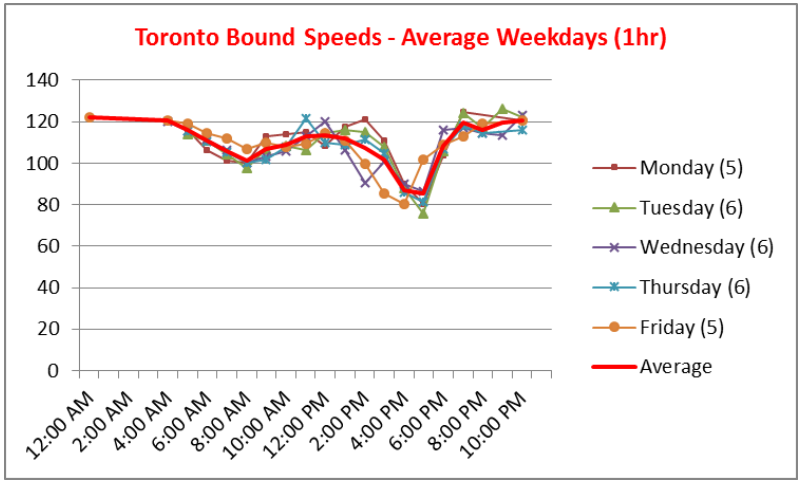
Directional by Week Day



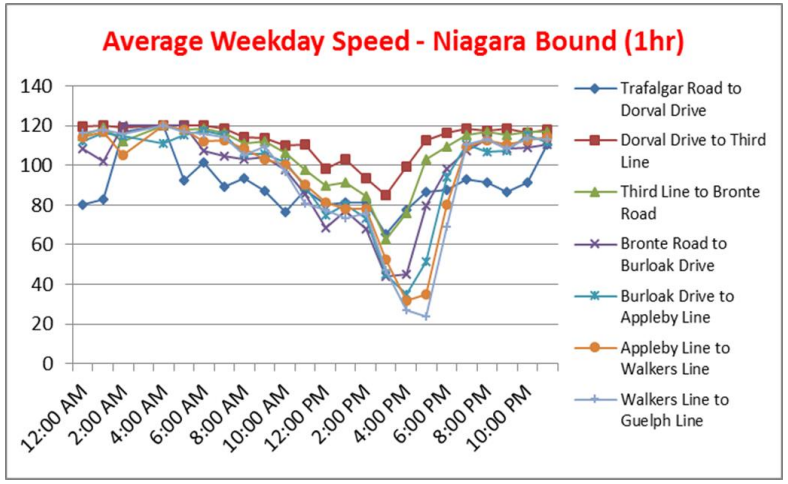
Directional Segment – Average Weekday

BLE Beacons for Focused Traffic Data Collection

Example Trend Analysis: Average Speeds



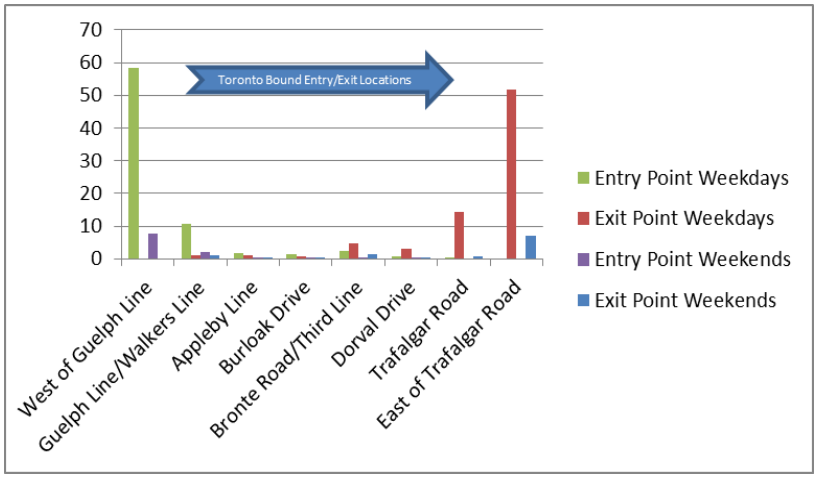
Directional by Weekday
(15 min & 1 Hr)



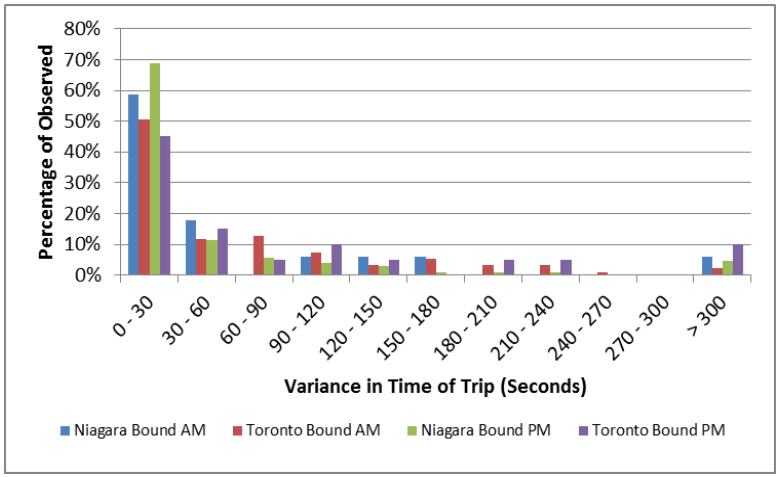
Directional Segment - Average Weekday
(15 min & 1 Hr)

BLE Beacons for Focused Traffic Data Collection

Example Trend Analysis: Other Trip Characteristics



Average Entry and Exit Points - Directional



Variance In Trip Departure Times

Thank you!

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