Optimized Time-Dependent Congestion Pricing System for Large Networks:
Integrating Distributed Optimization, Departure-Time Choice, and Dynamic Traffic Assignment in the GTA

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Outline

- Motivation
- Theory
- U of T’s Framework and System
- Application to the GTA
- Conclusions and Future Research
What is Congestion Pricing?

- **Road pricing** is any system that directly charges motorists for the use of a road or network of roads.

- **Congestion pricing** refers to road tolls intended to *reduce* traffic congestion or to *distribute* it more evenly over *time* and *space*. 
Congestion Pricing Inevitable

- Much like traffic lights are!
- Viable congestion control tool
- Revenue is a (welcomed?) by product
- Why inevitable?
  - Demand/Supply > 1.0 \(\rightarrow\) Congestion
  - Spills over longer periods and larger space
  - Constrained supply (space, $, environment)
  - Ever increasing demand
  - Ever increasing congestion until it chokes the metropolis
- Not a matter of if, but when, where and how
Evidence Why Congestion Pricing?

- Tragedy of the commons (Hardin, 1968).

- VKT is quite responsive to price, as opposed to transit/capacity expansions (Duranton and Turner, 2011).

- Therefore, policy makers should emphasize not only on improving the supply of alternative modes but also on financial disincentives for auto use.
Traffic 101: what is congestion?

- Hyper-congestion, or
- Supercritical congestion
Pricing with **Static Congestion**

\[ \tau = \text{mecc} \]

**Demand**

**Social Subsidy**

**MC**

**AC**

**V**

Un-priced

*Equilibrium in Impasse Congestion*

*Profit Maximized*

*Social-Welfare Maximized*

Un-priced

*Equilibrium in Hyper-Congestion*

Un-priced

*Equilibrium in Normal Congestion*
Dynamic Hyper-Congestion Pricing
The Basic Bottleneck Model

Optimal pricing in the Bottleneck Model

Departure-time rescheduling.
Departure Time Rescheduling: Pacing Beats Rushing
Generalized Dynamic Congestion Pricing

Objective
• Eliminating hyper-congestion through spatio-temporal traffic redistribution

Method
• Time-dependent distance-based tolling.

Impact
• Departure time shift.
• Route shift.
• Mode shift (if transit capacity exists).
Optimal Congestion Pricing System
Design Features

- Travel Survey Data (TTS 2011)
- DTA Simulation
- Bottleneck Model
- Departure Time Choices
- Large-Scale System
- Distributed Computing
- Genetic Algorithm Optimization
- Distance-Based Tolling
Optimal Congestion Pricing System
Framework

Congested Facilities (to be tolled)

Optimal Toll Determination – Level I
(Bottleneck Model)

Initial Toll Structures for Congested Facilities

Optimal Toll Determination

Optimal Toll Determination – Level II
(Distributed Optimization Algorithm)

Network Performance

Adjustment Factors for Initial Toll Structures

Levels of (Iterative) Convergence

1st
2nd
3rd

DTA Traffic Network Simulator (Route Choice)

(Historical) OD Demand Matrices

LOS Attributes

Updated Demand

Econometric Model for Departure-Time Choice

Commuters Personal and Socio-Economic Attributes

Testbed

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Greater Toronto Area Case Study
1- DTA Simulation Model for the GTA

Main Features

- DTA, mesoscopic (DynusT).
- Large size.
- GIS database from LIO.
- OD matrices: 6-10:30 am.
- Background demand.
- Calibrated and validated.
1- DTA Simulation Model for the GTA (cont’d)

Adding background demand

GTA simulation model Convergence

Traffic simulation in DynusT

Speed at capacity

Critical density

Flow (veh/hr./lane)

Capacity

Critical density

Relative Gap (RG)

Iterations

0 0.1 0.2 0.3 0.4 0.5 0.6

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
2- Departure-Time Choice Model (*Sasic and Habib, 2013*)

**Model Variables**

- Driver and LOS attributes.

**Model Retrofitting for 2011**

- Updating ASC’s (2011 TTS data).
- Integrating schedule-delay and toll cost components.
- Recalibrating travel time coefficients.
- Model validation.

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3- Toll Determination – Level I: The Bottleneck Model

<table>
<thead>
<tr>
<th>Model Assumptions</th>
<th>Our Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Homogeneous drivers.</td>
<td>- Heterogeneous drivers.</td>
</tr>
<tr>
<td>- Single desired arrival time.</td>
<td>- Distribution of desired arrival times.</td>
</tr>
<tr>
<td>- Only departure-time choice.</td>
<td>- Route and departure-time choices.</td>
</tr>
<tr>
<td>- No driver attributes.</td>
<td>- Considers driver attributes.</td>
</tr>
</tbody>
</table>

Initial (sub-optimal) **step-toll** structure determination procedure:

1- Travel time (hence **queueing-delay**) estimation.
2- Identify the **tolling period** and set the **max toll** value.
3- Determine the full **toll structure**.
4- Toll structure **smoothing**.
Queueing-Delay Estimation Example (GE- Eastbound)

Queueing-delay is calculated as the excess travel time over the value of “travel time at capacity” on the congested facility.

**Base-case travel time**

**Initial toll structure**
4- Toll Determination – Level II: Distributed Genetic Algorithm *(Mohamed, 2007)*

- **Decision Variables**
  - Scale factors for initial toll structures.
  - Variables’ ranges.

- **Objective Function**
  - Total travel times then utilization levels (flow*speed).
  - Optimization problem segmentation for “quasi-flat” fitness phenomenon.

- **Distributed Computing**
  - Apache Ignite: Map-reduce paradigm.
  - Calibration of Parallel cluster.
  - Linear speedup.
(I) Simple Tolling Scenario: GE

Tolled Route (GE)
- 18 km (427 to DVP).
- 6 to 10 lanes wide.
- 90,000 morning commuting trips on the GE corridor.

Purpose of the Scenario
- Test the effectiveness of first-level of optimal toll determination.
- Compare flat and variable tolling through the integrated testbed.

Assumptions
- Queueing-delay estimated based on all corridor users (on both directions).
- Same toll for EB and WB directions of the GE.
(I) Simple Tolling Scenario: GE (Evaluation)

<table>
<thead>
<tr>
<th>% Travel Time Savings</th>
<th>Variable Toll</th>
<th>Flat Toll</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE-EB (tollled route)</td>
<td>25% (8-8:30 am)</td>
<td>-ve ?</td>
</tr>
<tr>
<td>GE Corridor</td>
<td>9.5%</td>
<td>2%</td>
</tr>
<tr>
<td>Network-Wide</td>
<td>1.7%</td>
<td>0.6%</td>
</tr>
</tbody>
</table>

Average Travel Time on GE-EB:
- GE Corridor: 9.5% (2%)
- Network-Wide: 1.7% (0.6%)

Graph showing travel time intervals and savings for different tolling scenarios.
(II) Extended Tolling Scenario: GE, DVP, and 401 Express

1. GE-EB  
   DVP-NB

2. 401-EB-1  
   401-EB-2

3. 401-WB-3  
   401-WB-2  
   DVP-SB  
   GE-WB

Route to be tolled
## (II) Extended Tolling Scenario: GE, DVP, and 401 Express - Correlation Matrix

<table>
<thead>
<tr>
<th></th>
<th>GE-EB</th>
<th>GE-WB</th>
<th>DVP-NB</th>
<th>DVP-SB</th>
<th>401-EB-1</th>
<th>401-EB-2</th>
<th>401-WB-2</th>
<th>401-WB-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE-EB</td>
<td>35976</td>
<td>11 (0.0%)</td>
<td>42904</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GE-WB</td>
<td></td>
<td>6576 (23.4%)</td>
<td>238 (0.7%)</td>
<td>26883</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVP-NB</td>
<td></td>
<td>0 (0.0%)</td>
<td>11481 (35.7%)</td>
<td>394 (1.3%)</td>
<td>32969</td>
<td>29864</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVP-SB</td>
<td></td>
<td>2523 (8.0%)</td>
<td>3 (0.0%)</td>
<td>67 (0.2%)</td>
<td>284 (0.9%)</td>
<td>10809 (38.6%)</td>
<td>36910</td>
<td></td>
</tr>
<tr>
<td>401-EB-1</td>
<td></td>
<td>0 (0.0%)</td>
<td>450 (1.1%)</td>
<td>26 (0.1%)</td>
<td>1596 (4.7%)</td>
<td>0 (0.0%)</td>
<td></td>
<td>42781</td>
</tr>
<tr>
<td>401-EB-2</td>
<td></td>
<td>661 (1.7%)</td>
<td>0 (0.0%)</td>
<td>3284 (9.9%)</td>
<td>346 (0.9%)</td>
<td>0 (0.0%)</td>
<td>1 (0.0%)</td>
<td></td>
</tr>
<tr>
<td>401-WB-2</td>
<td></td>
<td>157 (0.4%)</td>
<td>2094 (5.2%)</td>
<td>209 (0.6%)</td>
<td>6332 (19.0%)</td>
<td>0 (0.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>401-WB-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40086</td>
</tr>
</tbody>
</table>
(II) Extended Tolling Scenario: GE, DVP, and 401 Express – Execution Time

<table>
<thead>
<tr>
<th>Population Size</th>
<th># of Generations</th>
<th>Execution Time (Parallel Mode**)</th>
<th>Execution Time (Serial Mode*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimization Problem 1</td>
<td>16</td>
<td>3</td>
<td>198 hours (8.25 days)</td>
</tr>
<tr>
<td>Optimization Problem 2</td>
<td>10</td>
<td>3</td>
<td>108 hours (4.5 days)</td>
</tr>
<tr>
<td>Optimization Problem 3</td>
<td>10</td>
<td>6</td>
<td>216 hours (9 days)</td>
</tr>
<tr>
<td>Total</td>
<td>--</td>
<td>--</td>
<td>522 hours (22 days)</td>
</tr>
</tbody>
</table>

*Serial Mode*: Intel Core i7-3770 processor @ 3.40 GHz with 16 GB of RAM memory.

**Parallel Mode**: a parallel cluster of five computers having the above specs.
(II) Extended Tolling Scenario: GE, DVP, and 401 Express (Optimal Toll Structures)
(II) Extended Tolling Scenario: GE, DVP, and 401 Express (Total Travel Time Savings)

Network-Wide (2 million trips)
- 10,313 hr. (1.7%)*

Trips using tolled corridors (455,000 trips)
- 7831 hr. (2.91%)*

Trips using tolled routes (220,000 trips)
- 12,457 hr. (7.5%)*

*percentages are calculated relative to the total base case travel times of each group.
(II) Extended Tolling Scenario: GE, DVP, and 401 Express (Corridor Analysis Ex. 1: GE-EB)

### Utilization Level

<table>
<thead>
<tr>
<th>Route</th>
<th>Base-Case</th>
<th>Initial Toll Structures</th>
<th>Fine-Tuned Toll Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE-EB (Tolled)</td>
<td>7.20E8</td>
<td>7.39E8 (\uparrow)</td>
<td>7.58E8 (\uparrow\uparrow)</td>
</tr>
<tr>
<td>GE-EB (Parallel)</td>
<td>9.48E8</td>
<td>9.69E8 (\uparrow)</td>
<td>9.57E8 (\uparrow\downarrow)</td>
</tr>
<tr>
<td>GE-EB (Corridor)</td>
<td>1.67E9</td>
<td>1.71E9 (\uparrow)</td>
<td>1.71E9 (\uparrow\uparrow)</td>
</tr>
</tbody>
</table>

### Tolled Route

- **GE-EB (Tolled)**
  - % Demand Drop: All: 2%, Tolled: 5%, Non-tolled: -4%
- **GE-EB (Parallel)**
  - Travel Time (min)
- **GE-EB (Corridor)**
  - 11 min (38%)
  - [8:00-8:30]
(II) Extended Tolling Scenario: GE, DVP, and 401 Express (Corridor Analysis Ex. 2: DVP-NB)

<table>
<thead>
<tr>
<th>Route</th>
<th>Base-Case</th>
<th>Initial Toll Structures</th>
<th>Fine-Tuned Toll Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVP-NB (Tolled)</td>
<td>8.37E8</td>
<td>8.45E8 ▲</td>
<td>8.27E8 ▼▼</td>
</tr>
<tr>
<td>DVP-NB (Parallel)</td>
<td>4.18E8</td>
<td>4.16E8 ▼</td>
<td>4.18E8 ▲▲</td>
</tr>
<tr>
<td>DVP-NB (Corridor)</td>
<td>1.25E9</td>
<td>1.26E9 ▲</td>
<td>1.25E9 ▲▼</td>
</tr>
</tbody>
</table>

**Toll Structure**

**Utilization Level**

**Tolled Route**

Initial

Fine-Tuned
## (II) Extended Tolling Scenario: GE, DVP, and 401 Express (Annual Benefit-Cost Analysis)

<table>
<thead>
<tr>
<th>Entity</th>
<th>Overall Costs ($ Millions)</th>
<th>Overall Benefits ($ Millions)</th>
<th>Benefit-Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital Cost:</td>
<td>Annual Cost:</td>
<td>Toll Revenues</td>
</tr>
<tr>
<td>Government (Producer)</td>
<td>88.5</td>
<td>73.2</td>
<td>76.8</td>
</tr>
<tr>
<td></td>
<td><strong>Total Producer Costs:</strong></td>
<td></td>
<td><strong>Total Producer</strong></td>
</tr>
<tr>
<td></td>
<td>1st year: 161.7</td>
<td></td>
<td>Benefits: 157.3</td>
</tr>
<tr>
<td></td>
<td>After 1st year: 73.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toll Payers (Consumers)</td>
<td><strong>Toll Paid: 76.8</strong></td>
<td></td>
<td><strong>Schedule-Delay</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Savings: 26.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total Consumer</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Benefits: 123.6</td>
</tr>
</tbody>
</table>
Conclusions

- The optimal congestion pricing system developed in this research provides a comprehensive tool for optimal time-dependent tolling strategies determination and evaluation in large-scale networks.

- The results demonstrate that:
  - More benefits are attained from variable tolling due to departure-time rescheduling as opposed to re-routing only in case of flat tolling.
  - Widespread spatial re-distributions of traffic are observed across the regional network in response to tolling significant – yet limited – highways.
  - Optimal variable pricing that mirrors temporal and spatial congestion patterns induces departure-time re-scheduling and rerouting, resulting in improved average travel times and schedule-delays at all scales in addition to benefits to toll payers.
Conclusions

– Optimal toll levels intended to manage traffic demand are significantly lower than those intended to maximize toll revenues.
– Toll payers benefit from tolling even before toll revenues are spent.
– Tolling policies determined offer a win-win solution in which travel times and overall network performance are improved while raising funds to invest in sustainable transportation infrastructure.
Research General Contributions

**Designing**

A system for optimal congestion pricing determination and evaluation in large networks.

**Developing**

The different system modules for the GTA region.

**Integrating**

The large-scale computationally-intensive modules developed.
Key Contributions

- Developing the optimal congestion pricing system by integrating distinct modules.
- Incorporating a 3-level nested feedback structure in the large-scale optimal congestion pricing system (unlike one-shot approaches).
- Building, calibrating, and validating a large-scale DTA mesoscopic simulation model for the GTA, based on the most recent available data.
- Simulating commuters’ departure-time choices through an econometric model that considers drivers’ attributes.
- Deriving the initial toll structures based on a conceptual model of dynamic congestion pricing (the Bottleneck Model).
- Applying a GA to adjust/fine-tune the initial toll structures for optimal network performance.
- Distributing the computations of the GA on a parallel computing cluster.
- Implementing the (full) optimal congestion pricing system through an extended scenario of tolling multiple highways in the GTA region.
Future Research

2. Including transit demand and integrating the transit network details along with a transit assignment module.
3. Including truck demand.
4. Re-estimating the departure-time choice model based on joint RP (TTS data) and SP data surveys incorporating toll information.
5. Developing an online toll regulator to update the optimal tolls based on real-time traffic measurements.
Thank you

Questions?
Traffic Simulation in DynusT

- Anisotropic Mesoscopic Simulation (AMS).
- Speed Influencing Region (SIR) = 240 Metres.
- Speed of vehicle $i$ is determined using a macroscopic $v$-$k$ relationship based on the density in SIR$i$. 
Desired Arrival Time Distribution

- $X$ is lognormally distributed $\Rightarrow \ln(X)$ has a normal distribution with $\mu$ and $\sigma$.
- $\ln(X) = (\mu + \sigma \cdot Z) \Rightarrow X = e^{(\mu + \sigma \cdot Z)}$
- $\mu = \ln(150)$ and $\sigma = 0.05$ (in ln(min)).
Original vs. Modified IVTT Coefficients
# Congestion Pricing Policies: Objectives and Impacts

<table>
<thead>
<tr>
<th>Pricing Policy</th>
<th>Objectives/Impacts</th>
<th>Example(s)</th>
</tr>
</thead>
</table>
| **Cordon tolls**            | Reduce downtown traffic                                       | – London Congestion Pricing  
                               |                                                               | – Stockholm Congestion Pricing |
| **HOT lanes**               | Encourage carpooling                                         | – I-15 HOT Lanes, San-Diego, CA                             |
|                             |                                                               | – I-394 in Minnesota                                          |
|                             |                                                               | – SR-167 in Seattle                                           |
| **For Profit (Monopoly)**   | Maximize profits                                             | – ETR 407 (Express Toll Route)                               |
| **Variable tolls**          | Control congestion (temporal and/or spatial distribution)    | – Singapore Electronic Road Pricing                          |
| – Distance-based fees       | Reduce automobile use                                         | – "MileMeter", Texas, US                                      |
| – Pay as you drive (PAYD)   | Reduce emissions                                             | – "Real Insurance PAYD", Australia                           |
|                             | (PAYD) insurance                                             |                                                               |
| **Bottleneck pricing**      | Reschedule departure-time (without altering route-choice, mode-choice, or miles driven) | ---- |

---
Congestion Pricing Decision Making Process

**Operations Side**
- Tolls: Infrastructure Spatial
  - Facility-based
    - Freeway with HOT lanes
    - Freeway corridor
    - Tolling on entire road
    - Condo tolls
    - Area tolls
    - Dynamic pricing in a network
- Tolls: Temporal
  - Flat
  - Variable (time of day)
  - Dynamic
  - Pass-based
  - Per-use based
- Tolls: Access Method
  - Distance-based (per km)
- Revenue maximization
- Minimize total travel cost
- Maintain certain level of service
- Maintain certain road utilization level
- Keep emissions under certain level
- Infrastructure expansion
- Transit improvements
- Reducing motor fuel taxes
- Reducing general taxes (e.g., income and property taxes)
- Subsidizing improvements to the non-priced part of the highway system

**Analysis Side**
- Traffic Assignment
  - Deterministic network equilibrium
  - Stochastic choices of travelers
- Auto Demand Assumption
  - Inelastic/Rigid
  - Elastic
- Route choice
  - Departure choice
  - Destination choice
  - Cancelling a trip
- Responses to Tollsing
  - Route choice
  - Departure time choice
  - Mode choice
  - Destination choice
  - Cancelling a trip
- Simulation Level
  - Microscopic
  - Mesoscopic
  - Macroscopic
- Degree of Public Participation
  - Nonparticipation
  - Degrees of takuism
  - Degrees of citizen power

**Degree of Public Participation**
- Initiating
- Consultation
- Placation
- Partnership
- Delegated power
- Citizen control

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Congestion-Pricing Decision Making Process – Analysis Side

Traffic Assignment
- Deterministic network equilibrium
- Stochastic choices of travelers

Auto Demand Assumption
- Inelastic/fixed
- Elastic
- Route choice
- Departure time choice

Responses to Tollsing
- Mode choice
- Destination choice
- Cancelling a trip

Route choice only
Route choice and departure-time choice
Route choice, departure-time choice and mode-choice
Congestion-Pricing Decision Making Process – *Analysis Side*
Congestion-Pricing Decision Making Process – *Operations Side*

- **Facility-based**
  - Freeway with HOT lanes
  - Freeway corridor
  - Tolling an entire road
  - Cordon tolls
  - Area tolls
  - Dynamic pricing in a network

- **Area-based**

**Tolled Infrastructure: Spatial**
Congestion-Pricing Decision Making Process – *Operations Side*

- **Toll: Temporal**
  - Flat
  - Variable (time-of-day)
  - Dynamic
- **Toll: Access Method**
  - Pass-based
  - Per-use based
  - Distance-based (per km)
Congestion-Pricing Decision Making Process – *Operations Side*

**Fee Collection Options**

- Toll Booths
- Pass
- Electronic Tolling
- Optical Vehicle Recognition
- GPS
Congestion-Pricing Decision Making Process – *Operations Side*

**Purpose of Tolling**

- Revenue maximization
- Minimize total travel cost
- Maintain certain level of service
- Maintain certain road utilization level
- Keep emissions under certain level
Congestion-Pricing Decision Making Process – *Operations Side*

- Infrastructure expansions
- Transit improvements
- Rebating motor fuel taxes
- Reducing general taxes (e.g. income and property taxes)
- Subsidizing improvements to the non-priced part of the highway system
International Experience

USA, UK, France, Norway, Sweden, Germany, Switzerland, Singapore, and Australia have implemented major road pricing projects.
London Congestion Pricing

- In service since 2003.
- The first congestion pricing program in a major European city.
- £11.5 daily cordon fee (flat price) for driving in “Central London Congestion Pricing Zone” during weekdays (from 7am to 6pm) (one time per chargeable day).
- Bus and taxi service improved.
- Accidents and air pollution declined in city center.
- After 1 year of cordon tolls and during charging:
  - Traffic circulating within the zone decreased by 15%.
  - Traffic entering the zone decreased by 18%.
  - Congestion (measured as the actual minus the free-flow travel time per km) decreased by 30% within the zone.
London Congestion Pricing

The Central London Congestion Pricing Zone
Stockholm Congestion Charge

- Public support increased after a 7-months trial in 2006.
- Charge based on time of day, and up to a max charge per day.
- Vehicles entering “Stockholm City Center” on weekdays (from 6:30am to 6:30pm) charged $1.29 to $4.11 per trip, with a max daily charge of $8.
- Traffic volumes reduced by ~25%.
- Public transit ridership increased by 40,000 users per day.
Stockholm Congestion Charge

- Uses **electronic transponders** to bill cars.
- Non-equipped cars are **photographed**, matched to a motor vehicle database and then billed.
I-15 HOT Lanes, San Diego, CA

- First significant congestion pricing project (i.e., price mirrors congestion).
- Implemented in 1996 along the 13 km HOV section of I-15 in San Diego. The HOT lanes on I-15 are now about 32 km long.
- Convert HOV to HOT; solo drivers pay tolls to use HOV during peak periods.
- In 1998, automated and dynamic pricing scheme.
I-15 HOT Lanes, San Diego, CA

- Toll levels determined from congestion level to maintain “free-flow” conditions in the HOV lane.
- Tolls updated every 6 minutes ($0.5 to $4) (closed-loop regulator).
- Toll level displayed on real-time sign.
- Success in congestion minimization.
407 ETR (Express Toll Route)

- Multi-lane, electronic Hwy running 107 km across the top of the GTA from HYWY 403 (in Oakville) to HYWY 48 (in Markham).
- Constructed in a partnership between “Canadian Highways International Corporation” and the Province of Ontario.
- Currently owned by 407-ETR International Inc.
407 ETR (Express Toll Route)

- Current Rate Chart:

<table>
<thead>
<tr>
<th>Zone Type</th>
<th>Peak Period</th>
<th>Peak Hours</th>
<th>Regular Rate</th>
<th>Light Rate</th>
<th>Midday Rate (entire highway)</th>
<th>Off Peak Rate (entire highway)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular Zone Rate</td>
<td>Mon-Fri: 6am-7am, 9am-10am, 3pm-4pm, 6pm-7pm</td>
<td>7am-9am, 4pm-6pm</td>
<td>28.30¢ /km</td>
<td>26.90¢ /km</td>
<td>24.06¢ /km</td>
<td>19.35¢ /km</td>
</tr>
<tr>
<td>Light Zone Rate</td>
<td>Mon-Fri: 6am-7am, 9am-10am, 3pm-4pm, 6pm-7pm</td>
<td>7am-9am, 4pm-6pm</td>
<td>30.20¢ /km</td>
<td>28.70¢ /km</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midday Rate (entire highway)</td>
<td>Weekdays 10am-3pm</td>
<td></td>
<td>26.90¢ /km</td>
<td>24.06¢ /km</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midday Rate (entire highway)</td>
<td>Weekends &amp; Holidays 11am-7pm</td>
<td></td>
<td>22.25¢ /km</td>
<td>22.25¢ /km</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Off Peak Rate (entire highway)</td>
<td>Weekdays 7pm-6am, Weekends &amp; Holidays 7pm-11am</td>
<td></td>
<td>19.35¢ /km</td>
<td>19.35¢ /km</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Speeds on Hwy 407 ~ double free Hwys.
- High level of user satisfaction.
- Monopoly price!