Ontario

Ministry of Transportation

Tolling Analysis Report
Highways 407, 412 & 418

April 2021

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Background

On the direction of the Minister of Transportation, the ministry prepared the following analysis outlining the reasoning behind road tolls on Highways 407, 412 and 418.

Highways 407, 412 and 418 (often referred jointly as Highway 407 East, distinct from Highway 407 ETR) are the first publicly-owned and publicly-controlled set of toll highways in Ontario. The project cost (including construction; 30-years of operations, maintenance and rehabilitation (OM&R); and tolling infrastructure) was approximately $4.439 billion ($3.86 billion in 2011$) and consists of three connected sections: Highway 407 mainline, which runs east-west connecting 407 ETR and Highway 35/115; and Highways 412 and 418, two north-south oriented highways connecting Highway 401 to Highway 407. Project cost for Highway 407 mainline is estimated to be $3.096 billion (around 70% of the total cost), Highway 412 is $662 million (about 15% of the total cost) and Highway 418 is $681 million (about 15.3% of the total cost).

Durham Region is the location and primary market served by the Province's tolled highways, and has benefitted substantially in employment from the construction of the highway, as well as the ongoing benefits of economic growth resulting from the addition of a major connecting highway network. Furthermore, over $100 million in provincial funding was allocated between 2015 and 2019 for the construction of local roads, links, bridges and bike lanes throughout the highway corridor to support local traffic flow and active transportation priorities.

The rapid construction of Highways 407, 412 and 418 was achieved as the provincial government budgeted, funded, and accounted for the project based on the financial understanding that they would be tolled. Had the projects been delivered through the traditional provincial highway construction program, the construction projects would have been phased over several decades. The province retains control of management and tolling operations on the highways; it sets and regulates tolls, certain user fees, interest for late payments, customer service standards and retains tolling revenue.

In November 2011, MTO entered into an agreement with the Canadian Tolling Company International Inc. (Cantoll), for provision of tolling and back office services for Highways 407, 412, and 418. Services include installation of tolling infrastructure, the toll collection system, back office services and customer service for an initial ten-year term, with the option to extend for two additional ten-year terms.

In addition, the province has signed two separate 30-year contracts for the maintenance and rehabilitation of the highways with East Development Group and Blackbird Infrastructure Group.

These highways are expected to generate $2.9 billion (2011$) (see Table 8 on page 30

for how revenue is broken down year by year until 2045) in tolling revenues over the 30-year planning horizon that aligns with the P3 concession agreements period. The share of revenue generation from Highways 412 and 418 is approximately 20% ($580 million 2011$). These highways will not recover their full project costs over the 30-year planning horizon used in various analyses; however, they are forecasted to recover a significant portion through tolling revenues during this time.

A scenario not explicitly identified in the report is to remove tolls on all three highways. This would amount to a loss of $4.335 billion in anticipated revenue between 2020 and 2045. See Table 8 for how revenue is forecasted year by year between 2020 until 2045.

Purpose of the Report

The purpose of this report is to document the work carried out to develop toll traffic and revenue forecasts for Highways 407, 412 and 418. The report was prepared at the request of the Honourable Caroline Mulroney, Minister of Transportation, following public concerns and is intended to provide transparency and clarity for how the Province sets its tolls.

Tolling Revenue Generated

On February 1, 2017 tolling began on Highway 407 and Highway 412 (Phase 1[1]) and on December 9, 2019 tolling began on the remaining portion of Highway 407 and Highway 418 (Phase 2[2]). Since 2017, tolling operations have generated approximately $160 million in revenue for the provincial government. During this time Highways 412 and 418 combined generated $38.2 million, or 24% of the total revenue. The table below shows the distribution of the tolling revenue generated from Fiscal Year[3] (FY) 2016–17 to 2019–20.

Fiscal Year	Revenue			
	Highway 407	Highway 412	Highway 418	Total
2016–17	$4,200,000	$1,400,000	Not Operational	$5,560,000
2017–18	$34,000,000	$12,000,000	Not Operational	$46,100,000
2018–19	$39,600,000	$12,000,000	Not Operational	$51,500,000
2019–20	$43,900,000	$11,700,000	$1,100,000	$56,700,000

[1] Phase 1: Highway 407, running eastward from Brock Road in Pickering to Harmony Road in Oshawa, and opening Highway 412, which connects Highway 407 and Highway 401.
[2] Phase 2: Extending Highway 407 from Harmony Road to Highway 35/115, and opening Highway 418 connecting Highway 407 to Highway 401.
[3] Fiscal Year is from April 1st to March 31st

Modelling Approach Used to Establish the Application of Tolling

This model works from the existing Greater Golden Horseshoe (GGH) modelling framework. The model has been refined to reflect road and transit network updates as provided on the Southern Highways Program, Durham Region, Ajax and Whitby Transportation Master Plans, and calibrated to accurately capture travel in Durham Region. For tolling analysis, an additional post-processing toll diversion algorithm predicts the proportion of motorists that will use the toll facility. The decision to choose a tolled over a non-tolled route is assessed using the amount of time saved, toll charge and user's value of time. Key features of the model are explained in detail under the model overview sections (beginning on page 15).

Yearly traffic and revenue estimates are based off three sub-travel models, which reflect key variations in highway usage during peak hours: 1. a weekday peak hour model (morning and evening), 2. a summer weekend (p.m.) peak hour model, and 3. a 12.5-hour peak commercial vehicle model. These modelled peak hours for passenger and commercial vehicle travel were scaled by expansion factors to daily and annual values.

Forecasted growth in Durham Region was factored into the forecast model. Three future-year land use scenarios were included: Reference, Market and Low Growth scenarios.

The Reference Land Use Scenario is based on the forecasts prepared for the Ministry of Infrastructure for the purposes of Amendment 2 to the Growth Plan for the Greater Golden Horseshoe. The Market Land Use Scenario is a lower growth scenario, in line with real estate market conditions. The Low Growth Land Use Scenario was developed as a test for risk management purposes; this scenario provides overall lower levels of total population and employment growth for the GTHA than predicted in the Market Scenario.

Tolling Scenarios and Revenue Forecasts – 2015 Modelling

2015 Modelling was undertaken to inform the revenue estimates and initial toll rate for the scheduled opening of the Phase 1 in December of 2015. The modelling work analyzed several tolling scenarios for optimizing toll rates, toll rate escalation and land use options.

In total, 23 tolling scenarios were analyzed (Scenario 2.1 below is the tolling plan currently operational and implemented on February 1, 2017). The following scenarios were analyzed.

- **1.0: Market Toll Rate Scenario:** This scenario assumed an optimized toll rate where revenue was maximized while ensuring that the facility was not underutilized for each of the future years.

- **2.0: Toll Sensitivity Scenarios:** Within this Market Toll Rate Scenario, four alternative sensitivity scenarios were tested to examine the revenue impact of various toll levels and escalation approaches:

    - **2.1: Consumer Price Index (CPI) Growth with Initial Toll same as 407 ETR (*current toll plan)*:** this first sensitivity scenario assumed the initial toll rate values be set the same as 407 ETR, which is equal to $0.27/km in 2011 dollars (0.30/km in 2016 dollars), with subsequent years' increases tied to CPI (2%). This is the approach that is currently in place.

    - **2.2: CPI Growth with Reduced Initial Toll:** this second scenario assumed the initial toll values to be set 3 cents lower than 407 ETR and is equal to $0.24/km in 2011 dollars (0.27/km in 2016 dollars), with subsequent year increases tied to CPI (2%).

    - **2.3: 407 ETR Toll Growth:** this third scenario assumed the initial toll and toll rate growth were both linked to 407 ETR values. During the initial ramp-up period toll growth between 2016 and 2017 is equivalent to CPI (2%), followed by 407 ETR growth rate for subsequent years.

    - **2.4: Reduced CPI Growth with 407 ETR Initial Toll:** this fourth scenario assumed the initial toll rate be set the same as 407 ETR, with lower-than CPI annual increases (1.5%).

- **3.0: Alternative Tolling Strategies**: Additional scenarios were evaluated to examine various approaches to maximize throughput on toll highways with the goal of alleviating congestion on Highway 401. The following scenarios were analyzed:

    - **3.1: Maximize Throughput:** this first scenario looked at maximizing traffic throughput on the tolled highways without a significant deterioration in highway operational performance.

    - **3.2: Remove Tolls on Highways 412 and 418:** this second scenario analyzed the impact of removing tolls on Highways 412 and 418. Total revenue declined by about $0.1 billion to $2.7 billion (2011$ compared with Current Tolling Plan, CPI Growth Scenario 2.1) as the increase of traffic on the mainline did not offset the loss of revenue from not tolling Highways 412 and 418. There was no significant impact on parallel highways. Reduction in traffic on Highway 401 was minimal.

- **3.3: Lower Tolls for Commercial Vehicles:** this third scenario analyzed the impact of reducing the commercial vehicle toll by setting the medium commercial vehicle toll to a passenger vehicle rate, and the heavy commercial vehicle toll to 1.5 times the passenger vehicle rate. The analysis for this scenario was limited to 2041 horizon only. Revenue from commercial vehicles declined by about 20%. The reduction in commercial vehicle tolls resulted in a substantial drop in revenue and marginal changes in the congested Highway 401 corridor.

- **4.0: Supplementary Tolling Strategy Alternatives:** Additional tolling scenarios were also analyzed by considering minor changes to the toll rate, or Trip Toll Charge[4]:

The table below summarizes the 30-year (from 2016 to 2045) revenue projections of the various tolling scenarios.

Scenario Description	Revenue Estimate (Billion 2011$)	Change in Revenue from Scenario 2.1 - Current Toll Plan (Billion 2011$)
High Revenue Scenarios		
2.3: 407 ETR Toll Growth	3.4	+0.6
1.0: Market Toll Rate	3.1	+0.3
2.1: CPI Growth with Initial Toll same as 407 ETR (current tolling plan)	2.8*	-
Low Revenue Scenarios		
2.2: CPI Growth with Reduced Initial Toll	2.6	-0.2
2.4: Reduced CPI Growth with 407 ETR Initial Toll	2.6	-0.2
Alternative Tolling Strategies		
3.2: Remove Tolls on Highways 412 and 418	2.7	-0.1
3.1: Maximize Throughput	2.1	-0.7
3.3: Lower Tolls for Commercial Vehicles $^{\alpha}$	20% Revenue decline	Limited analysis scenario $^{\alpha}$
Supplementary Tolling Strategy Alternatives		
4.1: Reduce Market Toll Rate by $0.05/km (2011$)	2.7	-0.1
4.2: Reduce Market Toll Rate by $0.10/km (2011$)	2.4	-0.4
4.3: Market Toll Rates on 407; $0.10/km on 412 & 418	2.8	0

[4] Trip Toll Charge (TTC) is one-time fee per trip for the use of toll facility.

4.4: Market Toll Rates on 407; $0.20/km on 412 & 418	2.9	+0.1
4.5: TTC and Toll Rates to Maximize Revenue	3.5	+0.7
4.6: TTC and Toll Rates to Maximize Throughput	2.4	-0.4
4.7: TTC and Toll Rates to achieve optimal conditions	3.0	+0.2
4.8: Toll Rates to achieve maximum revenue at TTC of $0.11 ($2011)	3.4	+0.6
4.9: Toll Rates to achieve maximum throughput at TTC of $0.11 ($2011)	2.4	-0.4
4.10:Toll Rates to achieve optimal conditions at TTC of $0.11 ($2011)	3.0	-0.2
4.11: TTC and Toll Rates to Maximize Revenue with future tolls linked to CPI	3.2	-0.4
4.12: TTC and Toll Rates to Maximize Throughput with future tolls linked to CPI	1.9	-0.9
4.13: TTC and Toll Rates to achieve optimal conditions with future tolls linked to CPI	2.6	-0.2

Notes:

* 2018 modelling update re-estimated tolling revenue to $2.9 billion (2011$). See the section below.

α Limited analysis scenario (2041 horizon year analyzed only). Commercial vehicle revenue decline is in comparison with Market Toll Rate scenario.

Trip Toll Charge (TTC) was introduced by 407 ETR in 2009, and is part of the total cost of tolls and it is billed per trip to all customers (transponder and non-transponder customers) each time they enter 407 ETR.

Tolling Scenarios and Revenue Forecasts – 2018 Modelling

After the first year of tolling operations, sufficient tolling data was available to review and verify the initial modelling assumptions. Commuter weekday traffic volume along Highways 407 and 412 was adjusted, as the original model overestimated the mainline volumes. Weekend traffic and commercial vehicle traffic were reviewed to address underestimation.

Other adjustments included trip length distribution, expansion factors, traffic volume on parallel highway, travel trend and a transportation network update for Durham Region.

The 2015 tolling scenarios and revenue forecasts were updated and analyzed during the 2018 modelling work as follows:

- **2.1 (updated): CPI Growth with Initial Toll same as 407 ETR (current tolling plan):** this scenario with updated model inputs estimates $2.9 billion (2011$) in revenues over a 30-year period. The scenario generates more revenue than the 2015 forecasts by about $190 million (2011$) or 7%. This is due in large part to far higher than anticipated volumes of commercial vehicles. This is the tolling plan that is currently operational.

- **3.2 (updated): Remove Tolls on Highways 412 and 418:** this scenario estimates overall revenue decrease by $430 million (2011$) or about 15%, in comparison to the current tolling plan, however, Highway 407 mainline revenue increases by $180 million or about 7.5%, as the highway system as a whole is more affordable and attracts more use. The increase in Highway 407 mainline revenue is not enough to recover the lost revenue from removing tolls on Highways 412 and 418.

  A diversion analysis examined the number of drivers diverted to Highway 412 from parallel municipal roads as a result of removal of tolls on Highway 412. Despite a substantial diversion under a "no toll" scenario, it was found that Lake Ridge Road would remain congested south of Rossland Road with a marginal decrease in intensity and duration of congestion.

- **5.0 (new): Revenue Offset:** the revenue offset scenario looked at optimal toll rates on Highway 407 required to balance the revenue lost from removing tolls on Highways 412 and 418. Two approaches were examined: Immediate and Incremental. The immediate increase approach requires tolls to be raised by 39% to $0.406/km in 2020, followed by annual CPI increases to 2045. The incremental increase approach would need Highway 407 tolls to be raised gradually to 124% by 2041 with higher than CPI annual increases. Overall, both approaches suggested that a substantial toll rate increase would be required for Highway 407 users.

- **6.0 (new): Maintain Tolls:** this scenario assumed to hold toll rates constant for Highways 407, 412 and 418 throughout the 30-year analysis period and, therefore, the tolls are decreasing in real terms at the assumed rate of inflation (2%).

The table below summarizes the 30-year (2016 to 2045) revenue projection.

Scenario Description	Revenue Estimate (Billion 2011$)	Change in Revenue from Current Toll Plan (Billion 2011$)
2.1(updated): CPI Growth with Initial Toll same as 407 ETR (Reference Scenario, current toll plan)	2.9	-
3.2(updated): Remove Tolls on Highways 412 and 418	2.5	-0.4
5.0: Revenue Offset*	2.9	-
6.0: Maintain Tolls (for Highways 407, 412 and 418)	2.4	-0.5

Notes:

*Sets toll on Highway 407 to balance lost revenue from removing tolls on Highways 412 and 418. Under the Immediate Approach tolls are required to increase by 39% (0.406 cents/km in 2020) to recover the lost revenue. Under the Incremental Approach higher than CPI (4%) increase is required each year.

Summary

Highways 407, 412 and 418 are anticipated to be heavily utilized by commuters, recreational travelers and commercial vehicles. The western portion of the highway is located in a rapidly growing urban area that is anticipated to continue to attract new residents and businesses. Existing levels of congestion on competing roads are significant and growing, and the demand for the new toll route will increase significantly over the next 30 years.

Maximizing Revenue alternatives such as “Trip Toll Charge (TTC) and Toll Rates to Maximize Revenue and 407 ETR Toll Growth” scenarios generate the most amount of revenue ($3.5 billion 2011$); however, highway usage is not optimal and the highway would appear under-utilized. On the other side of the revenue range, “Maximize Throughput” alternatives (such as “Trip Toll Charge (TTC) and Toll Rates to Maximize Throughput” Scenarios) generate the most amount of traffic volume; however, the revenue potential of the facility is not fully realized ($1.9 billion 2011$).

Scenario 2.1 “CPI Growth with Initial Toll same as 407 ETR” was implemented upon start of tolling in February 2017 as the preferred tolling plan. The scenario provides a balanced combination of tolling revenue and highway usage with future toll growth linked to CPI.

During the initial modelling work in 2015, Scenario 3.2 investigated removal of tolls on Highways 412 and 418. Subsequently, with model updates during 2018, the analysis shows a reduction/loss of $430 million (2011$) or about 15% in comparison to the current tolling plan.

As part of the highway construction, over $100 million was invested in Durham Region by the Provincial government for upgrades to other infrastructure projects, to mitigate the potential impacts for residents. This included $83 million for various P3 scope improvements to roads, intersections and bridge expansions, and direct municipal contributions; $15 million in revised P3 scope costs during construction, and $20 million (shared with other stakeholders) for carpool lots.

In terms of achieving maximum revenue generation, future toll growth linked to CPI provides many advantages for escalation of toll rates. CPI provides more certainty that tolls will be set at reasonable levels. CPI escalation of tolls is generally accepted as a ‘fair’ adjustment and ensures consistency between the fluctuating costs of inputs versus the revenue generated from tolling.

The toll structure and plan are similar across the three sections (Highways 407, 412 and 418). The toll structure is similar to 407 ETR’s current structure with modifications such

as; a single morning and evening peak toll rate, same toll rate for both directions of travel and no one-time flat fee.

The recommended opening day peak period toll rate of 29 cents/km in 2016 was based on review, investigation and analysis undertaken by an independent consulting firm. The review, investigation and analysis are based on various factors such as toll levels, revenue generated, traffic volumes, customers' acceptance of tolls charged to travel with Greater Toronto Area (GTA), value of time, land use projections and customers' expectation of reliable highway operations.

In 2015, the government announced that Highways 407, 412 and 418 toll rates would be set at or below the 407 ETR in all categories. The opening day peak period toll rate was set at $0.29/km (29 cents/km) for light vehicles through regulation in 2015. The regulation for toll rates on Highways 407, 412 and 418 was enacted mid-2015 and established that toll rates would increase by CPI annually on June 1.

This modelling analysis remains valid, and consistent with Durham Region's *2017-2021 Economic Development Strategy and Action Plan*. In addition, *Growth Plan for the Greater Golden Horseshoe August 2020* does not impact the outcome of this study significantly. The model assumes a slower population and employment growth rate beyond 2041, which aligns with the change in growth rate between the previous and new version of the Growth Plan.

This modelling analysis outlines factors considered in the past policy decisions regarding the tolls on Highways 407, 412 and 418 that remain relevant in any future decisions on tolling policy.

Background

Planning for Highway 407 started in the 1950s, and construction for the section now known as 407 Express Toll Route (407 ETR) commenced in the 1980s, with the understanding it would be a tolled facility. While that initial section, from the QEW in the west to Brock Road in the east, was leased to and completed by the private company 407 ETR in 1999, the province continued to plan for the extension of the highway corridor.

Recognizing the area's growth potential, and the desire of local stakeholders for the highway to be fully constructed, the Province reviewed options for it to be extended, including that it could be rapidly constructed with funds recovered from tolling. The continuation of Highway 407 east of Brock Road, along with two north-south connecting links to Highway 401, were studied as part of an Environmental Assessment in 2009.

An independent review by Deloitte determined that it would be beneficial to establish a tolling system leveraging existing tolling infrastructure. In 2008, Infrastructure Ontario (IO) and the Ministry of Transportation of Ontario (MTO) undertook the preparation of a business case for acquiring tolling technology consistent with technology used by 407 ETR. A year later, the Highway 407 East Project was announced as the province's first fully owned and controlled toll highway.

The Highway 407 East Project is comprised of three connected sections. Highway 407 mainline runs east-west from 407 ETR near Brock Road in Pickering to the Highway 35/115 interchange. Highways 412 and 418 are both north-south oriented highways that provide seamless, high-speed connections from Highway 401 to Highway 407.

Construction of Highway 407 East was completed in two phases at an overall project cost of approximately $4.439 billion ($3.86 billion in 2011$). Project cost for 407 mainline is estimated at $3.096 billion (about 70% of the total cost), Highway 412 at $662 million (about 15% of the total cost) and Highway 418 at $681 million (about 15.3% of the total cost). The construction project itself employed thousands of people to add 272 lane-kilometres to the provincial highway network. Furthermore, the highways provide significant benefits to regions further afield, as improved commute times, reliability and less congestion helps link Toronto to Peterborough, Haliburton, the Kawarthas, and other areas.

Phase 1 was comprised of Highway 407 and Highway 412, and opened to the public on June 20, 2016, with tolls taking effect on February 1, 2017. Phase 2 was comprised of Phases 2a and 2b. Phase 2a was an eastward extension of Highway 407 from Harmony Road to Taunton Road, and tolling started on January 2, 2018. Phase 2b was the remaining eastward extension of Highway 407 to Highway 35/115 and included the Highway 418 north-south link that connected Highway 407 to Highway 401. Phase 2b opened to the public on December 9, 2019 and tolling started the same day.

Construction of the Highway 407 East Project consisted of two Private-Public-Partnership (P3) contracts to design, build, finance and maintain the two phases. Both contracts are 35-year agreements which include five years of construction and 30 years of operation, maintenance and rehabilitation.

In November 2011, MTO entered into an agreement with the Canadian Tolling Company International Inc. (Cantoll), for provision of tolling and back office services. In 2015, the agreement was amended and renamed – Amended and Restated Tolling Services Agreement (ARTSA). ARTSA is a 30-year concession and includes installation of tolling infrastructure, toll collection systems, back office services for an initial ten-year term with an option to extend for two additional ten-year terms. The agreement provides customers of 407 ETR and Highways 407, 412 and 418 a seamless and integrated customer service experience, including one invoice, one transponder, a single point of contact for customer service and joint collection and settlement of debt.

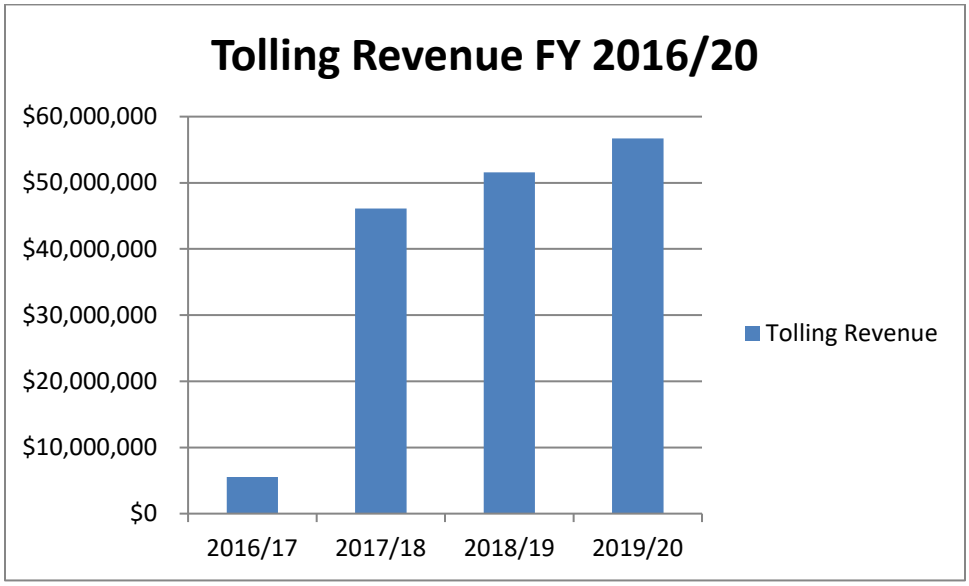
The province retains control of management and tolling operations of Highways 407, 412 and 418. The province sets and regulates tolls, certain user fees, interest for late payments, customer service standards and retains tolling revenue. Through the tolling requirements in the *Highway 407 East Act, 2012*, toll rates are adjusted on June 1st of each year, based on a percent change in Ontario Consumer Price Index (CPI).

Existing Conditions

Tolling Revenue

Since the start of tolling operations on the provincial highways (February 2017 to March 2020), approximately $160 million has been generated in tolling revenue for the provincial government. There has been significant and steady growth over the last two fiscal years which were 11% and 9% for FY 2018–19 and 2019–20 respectively. The Figure 1 below shows the tolling revenue growth trend.

Figure 1: Tolling Revenue for Highways 407, 412 & 418 FY 2016–17 to 2019–20



Highways 412 and 418 combined have a significant share in tolling revenue, 24% for the first four years of operation, and is expected to generate approximately $580 million (2011$), about 20%, of the 2016 to 2045 revenue stream.

Traffic Level

Highways 412 and 418 carry a significant amount of traffic in addition to Highway 407. A total of 38.2 million trips have been recorded on Highways 407, 412 and 418 since start of tolling (February 2017 to March 2020). Roughly 44% of these trips have used Highways 412 and 418, either exclusively or to access Highway 407.

The majority of trips are from light vehicles. Table 1 below shows the distribution of trips by vehicle classifications which has remained relatively static over time.

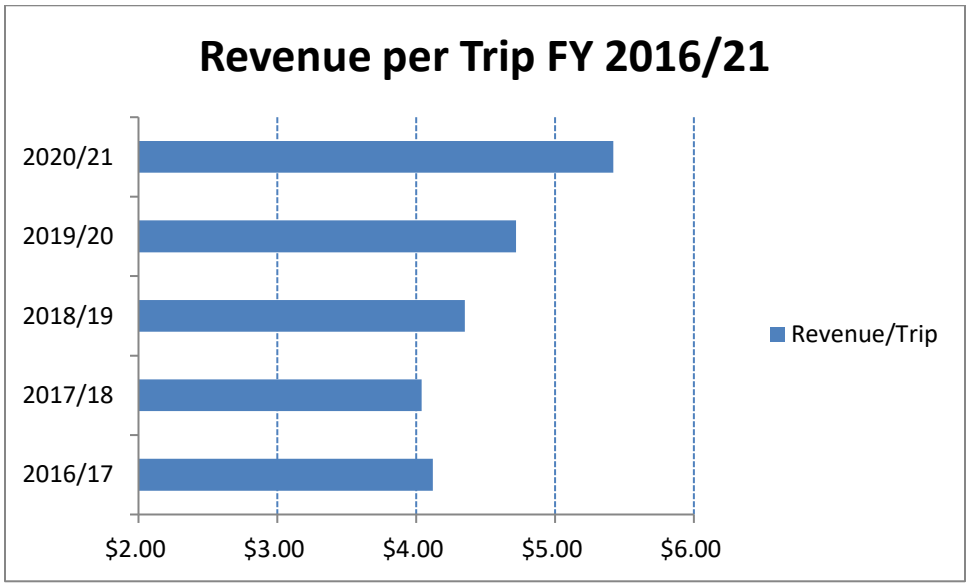
Table 1: Distribution of Traffic on Highways 407, 412 & 418 by Vehicle Classification

Vehicle Classification	Percent of Total Trips
Light Vehicles	93.2 %
Heavy Single Unit Vehicles	4.4 %
Heavy Multiple Unit Vehicles	2.4 %

Most of the provincial highways' customers are using a transponder for travel. Use of a transponder is beneficial to both the customer and operator. Customers using a transponder avoid the extra video charges of $4.20 per trip (2020 rates) for light vehicles. Transponder use is also beneficial for the highway operator as they are more efficient in capturing, processing and invoicing trip data compared to video capture methods. Transponder penetration rate is approximately 72%.

Although, the number of trips between FY 2017–18 and 2019–20 has remained relatively flat, revenue per trip has increased significantly. Revenue/trip rates have increased by approximately 15% from the start of tolling operations to the end of FY 2019–20. This essentially means that customers are travelling longer distances compared with previous years. Figure 2 below shows average revenue per trip trend.

Figure 2: Average Revenue per Trip FY 2016–17 to 2019–21



Notes:
Fiscal Year 2020/21 estimates are not for complete year. Limited to April and May, 2020.

Average revenue for trips starting/ending at Highway 418 ($7.50) is roughly double

compared with Highway 412 ($3.74). This is partly due to travel time saving and travel reliability Highway 418 offers for long distance travellers that are using Highway 407 as a route to circumvent the congested Highway 401. Highway 418 is also on the outskirts of Durham Region, so trips are generally longer in distance, whether they are local or not, as compared to Highway 412.

Current Toll Rates

The first automatic CPI-based toll increase was scheduled to occur on June 1, 2017. As tolling began on February 1, 2017, the first scheduled automatic toll increase would have resulted in tolls being increased only four months after tolling began. To avoid this situation, O. Reg 175/15 was amended to freeze existing toll rates until May 31, 2019.

On June 1, 2019, in accordance with the *Highway 407 East Act, 2012*, toll rates were adjusted for the first time on Highway 407 and Highway 412 by CPI, 2.27%. To provide relief for highway customers who needed to continue to use any of the provincially owned and operated toll highways during the COVID-19 pandemic of 2020, the province temporarily froze toll rates for Highways 407, 412, and 418. Table 2 below shows the toll rates for different vehicle classes.

Table 2: Current Toll Rates on Highways 407, 412 & 418 by Vehicle Classification

Toll Rates for Light Vehicles

Travel Day	Time Period	Toll Rate (cents/km) June 1, 2019 to May 31, 2021	Toll Rate (cents/km) February 1, 2107 to May 31, 2019	Change (cents/km)	Time
Weekdays	Peak Period	29.66	29.00	0.66	6:00:00 a.m. - 9:59:59 a.m. 3:00:00 p.m. - 6:59:59 p.m.
Weekdays	Midday Period	23.52	23.00	0.52	10:00:00 a.m. - 2:59:59 p.m.
Weekdays	Off-Peak Period	19.43	19.00	0.43	7:00:00 p.m. - 5:59:59 a.m.
Weekends & Holidays	Midday Period	22.50	22.00	0.50	11:00:00 a.m. - 6:59:59 p.m.
Weekends & Holidays	Off-Peak Period	19.43	19.00	0.43	7:00:00 p.m. - 10:59:59 a.m.

Toll Rates for Heavy Single Unit Vehicles

Travel Day	Time Period	Toll Rate (cents/km) June 1, 2019 to May 31, 2021	Toll Rate (cents/km) February 1, 2107 to May 31, 2019	Change (cents/km)	Time
Weekdays	Peak Period	59.32	58.00	1.32	6:00:00 a.m. - 9:59:59 a.m. 3:00:00 p.m. - 6:59:59 p.m.
Weekdays	Midday Period	47.04	46.00	1.04	10:00:00 a.m. - 2:59:59 p.m.
Weekdays	Off-Peak Period	38.86	38.00	0.86	7:00:00 p.m. - 5:59:59 a.m.
Weekends & Holidays	Midday Period	45.00	44.00	1.00	11:00:00 a.m. - 6:59:59 p.m.
Weekends & Holidays	Off-Peak Period	38.86	38.00	0.86	7:00:00 p.m. - 10:59:59 a.m.

Toll Rates for Heavy Multiple Unit Vehicles

Travel Day	Time Period	Toll Rate (cents/km) June 1, 2019 to May 31, 2021	Toll Rate (cents/km) February 1, 2107 to May 31, 2019	Change (cents/km)	Time
Weekdays	Peak Period	88.98	87.00	1.98	6:00:00 a.m. - 9:59:59 a.m. 3:00:00 p.m. - 6:59:59 p.m.
Weekdays	Midday Period	70.56	69.00	1.56	10:00:00 a.m. - 2:59:59 p.m.
Weekdays	Off-Peak Period	58.29	57.00	1.29	7:00:00 p.m. - 5:59:59 a.m.
Weekends & Holidays	Midday Period	67.50	66.00	1.50	11:00:00 a.m. - 6:59:59 p.m.
Weekends & Holidays	Off-Peak Period	58.29	57.00	1.29	7:00:00 p.m. - 10:59:59 a.m.

Initial Modelling – 2015 Analysis

Between the years of 2013 and 2015, MTO engaged IBI Group to assist with establishing initial toll rates and developing a 30-year revenue forecast for the provincially owned toll highways. The initial modeling work was completed in November 2015.

Yearly traffic and revenue estimates are based off three sub-travel demand models: a weekday peak hour model (morning and evening) predominantly for work purpose, a summer weekend p.m. peak hour model mostly travelling for leisure and recreational purposes, and a 12.5-hour peak commercial vehicle model. Each of the models was independently validated to ensure best possible revenue estimates using existing data available. Expansion factors were used to scale the modelled peak hours for passenger and commercial vehicles travel to daily and annual values.

Travel Demand Model Overview

The Highways 407, 412 and 418 travel model uses the existing Greater Golden Horseshoe (GGH) modelling framework, a standard Ministry tool for transportation policy and infrastructure analysis. For tolling analysis there is an additional post-processing toll diversion algorithm to accurately capture the toll road usage. The GGH Model is specifically designed to be sensitive to changes in costs, demographics and socio-economic variables. Key features of the model are as follows:

- The GGH Model directly links with the Province's Growth Plan (Places to Grow) and provides a transportation demand and forecasting tool to assess the ability of transportation alternatives, options and policies to support the Growth Plan.

- The model is able to forecast passenger travel by several modes including auto driver, auto passenger, transit sub-modes (GO transit and local transit) and non-motorized modes (walk and cycle). The model is designed to predict combined modes, i.e. park-and-ride at GO rail or rapid transit stations.

- The model is sensitive to key variables that influence the use of sustainable modes and the benefits of more compact, mixed-use land use and the promotion of nodes and corridors.

- The model follows the industry standard Four-stage Modelling Approach, used consistently across ministry transportation projects.

- A post processing toll diversion algorithm is used to accurately predict volumes on Highways 407, 412 and 418. The algorithm allocates people who would potentially use toll routes and those who will not. The split is based on user's value-of-time, travel time savings, toll cost and willingness-to-pay.

Land Use Scenarios

Population and employment projections are critical input to the travel demand model. The future year land use forecasts were provided by Hemson Consulting for three land use scenarios (Reference, Market and Low). The Reference scenario is used as standard land use information for all the travel demand forecasting work in the ministry. These scenarios provide the following demographic data for the GTHA and Durham:

The Reference Land Use Scenario is based on the forecasts prepared for the Ministry of Infrastructure for the purposes of Amendment 2 to the Growth Plan for the Greater Golden Horseshoe. The key policy component in the Reference Scenario affecting the Region of Durham's forecast is the assumption that the Region will receive a significantly higher share of the Greater Toronto and Hamilton Area (GTHA) residential and non-residential real estate market than current market conditions suggest.

The Market Land Use Scenario is a lower growth scenario for Durham in line with real estate market conditions. All the same assumptions and premises as the Reference Scenario apply, except a more moderate shift in GTHA residential and non-residential market shares to Durham were assumed.

The Low Growth Land Use Scenario was developed as a test for risk management purposes. This scenario provides a lower level of total population and employment growth for the GTHA than the Market Scenario. This scenario is based on a lower forecast outlook for the GTHA and assumes lower migration to Ontario and the GTHA, lower fertility rates, higher mortality rates and reflecting the assumptions used by the Ministry of Finance's Low Scenario for the province as a whole.

Tolling Scenarios and Revenue Forecasts – 2015 Modelling

The initial modeling work analyzed several tolling options for optimizing toll rates, toll rate growth and land use scenarios. Revenue was estimated over a 30-year horizon using the Reference Land Use assumptions (compliant to the Provincial Growth Plan). The following scenarios were analyzed:

- **1.0: Market Toll Rate Scenario:** this scenario assumed an optimized toll rate, where revenue was maximized while ensuring that the facility was not underutilized for each of the future years. The scenario calculated an initial toll rate of 27 cents/km (2011$) or 30 cents/km (2016$) to 36 cents/km (2011$) or 65 cents/km (2041$) by 2041. Highway 401 a.m. peak hour traffic volume for 2031 and 2041 horizon years remains at or over capacity for most sections of the highway.

- **2.0: Toll Sensitivity Scenarios**

Four alternative tolling scenarios were tested to examine the revenue impact of different increases for the Market Toll Rate Scenario, as follows:

- **2.1: Consumer Price Index (CPI) Growth with Initial Toll same as 407 ETR (*current tolling plan)*:** this sensitivity scenario assumed the initial toll rate values to be set the same as 407 ETR which is equal to $0.27/km in 2011 dollars (0.30/km 2016$), with subsequent years increases tied to CPI (2%).

- **2.2: CPI Growth with Reduced Initial Toll:** this scenario assumed the initial toll values be set 3 cents lower than 407 ETR and is equal to $0.24/km in 2011 dollars (0.27/km in 2016 dollars), with subsequent year increases tied to CPI (2%).

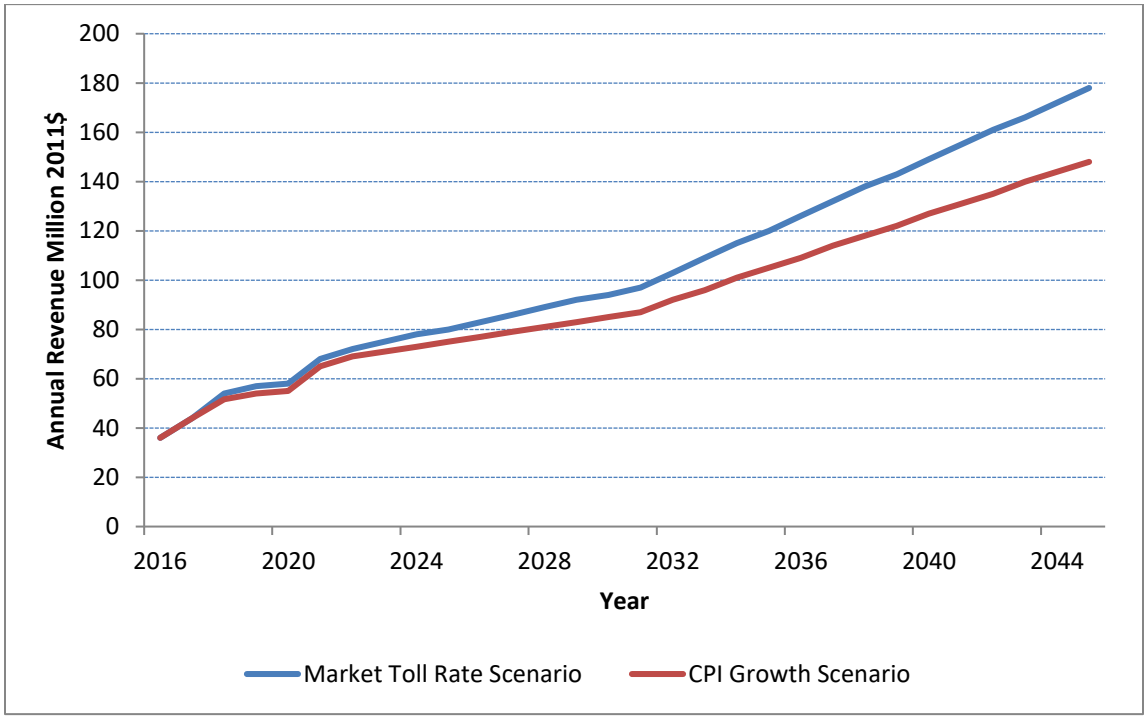
- **2.3: 407 ETR Toll Growth:** this scenario assumed the initial toll and toll rate growth were both linked to 407 ETR values. During the initial ramp-up period toll growth between 2016 and 2017 is equivalent to CPI (2%), followed by 407 ETR growth rate for subsequent years.

- **2.4: Reduced CPI Growth with 407 ETR Initial Toll:** this scenario assumed the initial toll rate be set the same as 407 ETR, with lower-than CPI annual increases (1.5%).

For all scenarios Highway 401 a.m. peak hour traffic volume for 2031 and 2041 horizon years remains at or over capacity for most sections of the highway.

For the Market Toll Rate scenario, the total revenue was estimated to be $3.1 billion (2011$). Four other toll sensitivity scenarios were analyzed to estimate a lower and an upper bound on the expected revenue. The results of these analyses yielded a range from $2.6 billion (2011$) with CPI growth and reduced initial toll rate to $3.4 billion (2011$), assuming tolls will increase at the same rate as 407 ETR. While the 407 ETR Toll Growth scenario provides the highest overall revenue, it also represents a riskier overall scenario as the toll rates are above the optimal values and have the potential of resulting in significantly lower highway usage. The Market Toll Rate Scenario is approximately 14% higher than the CPI Toll Rate Scenario, which has a total value of $2.8 billion (2011$) as shown in Figure 3 below.

Figure 3: Annual Revenue Market and CPI Growth Toll Rate Scenarios



- **3.0: Alternative Tolling Strategies**

Additionally, three scenarios were analyzed to examine various approaches to best balance revenue and vehicle throughput with the goal of alleviating congestion on Highway 401, such as:

- **3.1: Maximize Throughput:** The first scenario looked at maximizing traffic throughput on the tolled highways without a significant deterioration in highway operational performance. The traffic volume to capacity ratio (v/c) that corresponds to maximized throughput without resulting in congestion is 0.9. In cases where projected traffic was insufficient to reach the target v/c ratio for any toll value, a minimum toll value of $0.10/km (2011$) was used. It was found that maximizing vehicle throughput leads to a 33% reduction in revenue compared to the Market Toll Rate Scenario, from $3.1 to $2.1 billion (2011$). Reduction in traffic on Highway 401 is not significant and most sections of the highway remain congested.

- **3.2: Remove Tolls on Highways 412 and 418:** The second scenario analyzed the impact of removing tolls on Highways 412 and 418. It was found that eliminating tolls would result in a relatively minor (6–9%) increase in traffic on the mainline Highway 407 and up to 42% increase in traffic volume on Highways 412

and 418. The resulting total revenue declined by about $0.4 billion to $2.7 billion (2011$ compared with Market Toll Rate Scenario) as the increase of traffic on the mainline did not offset the loss of revenue from not tolling Highways 412 and 418. There was no significant impact on parallel highways. Reduction in traffic on Highway 401 was minimal.

- **3.3: Lower Tolls for Commercial Vehicles:** The third scenario analyzed the impact of reducing the commercial vehicle toll by setting the medium commercial vehicle toll to a passenger vehicle rate, and the heavy commercial vehicle toll to 1.5 times the passenger vehicle rate. The reduction in tolls resulted in a 60% to 100% increase in commercial vehicle traffic on toll highways and 5% reduction in truck traffic on Highway 401 with no or little impact on the municipal arterial network in the vicinity. Revenue from commercial vehicles declined by about 20% over the limited analysis period (2041 horizon only). The reduction in commercial vehicle tolls resulted in a substantial drop in revenue and marginal changes in the congested Highway 401 corridor.

Table 3 below shows comparison of the various tolling scenarios.

Table 3: Comparison of Tolling Scenarios (Billion 2011$)

Tolling Scenarios	Total Revenue	Revenue Maximizing	Initial Toll Rate Optimized	Traffic Maximizing	Balanced Revenue and Traffic Usage	Toll Rate Escalation
High Revenue Options						
2.3: 407 ETR Growth	3.4	√	√	×	×	Aggressive (>>CPI)
1.0: Market Toll	3.1	×	√	×	√	Optimal (>CPI)
2.1: CPI Growth ('current tolling plan')	2.8	×	√	√	×	CPI
Low Revenue Options						
2.2: CPI Growth with Reduced Initial Toll	2.6	×	×	√	×	CPI
2.3: Reduced CPI Growth	2.6	×	√	√	×	< CPI

3.2: Remove Tolls on Highway 412 & 418	2.7	×	√	√	×	CPI
3.1: Maximize Throughput	2.1	×	×	√	×	CPI
3.3: Lower Tolls*	**	×	×	√	×	CPI

Notes:

*Limited analysis scenario (2041 horizon year analyzed only).

**20% decrease in commercial vehicle revenue as compared with Market Toll Scenario for 2041 analysis year.

- **Land Use Sensitivity Scenarios**

In addition to testing the sensitivity of the revenue projections to different toll rates, sensitivity to two different land use assumptions was evaluated. These alternative land uses assumed reduced growth in population and employment in Durham Region, and are as follows:

- **Market Growth:** is a lower growth scenario for Durham as compared to the Reference Land Use and is in line with the current real estate market conditions. The scenario assumed 8% reduction in population and 5% reduction in employment growth, relative to the Reference Land Use.

- **Low Growth:** is a lower level of population and employment growth than the Market Growth Land Use scenario. The scenario assumed an even lower growth with 22% less population and 19% less employment growth relative to the Reference Land Use.

  Table 4 below shows the estimated revenue for Market and Low Growth Land Use scenarios is lower, in comparison with the Market Toll Rate scenario (using reference land use). The Market Land Use scenario estimated 10% reduction in revenue, or 2.8 billion (2011$), and the Low Land Use Scenario estimated 25% reduction in revenue, or 2.3 billion (2011$). CPI Toll scenario has even lower revenue projections compared with Market Toll Rate scenario as the CPI rate does not fully realize the revenue potential of the facility.

Table 4: Revenue Estimate for Land Use Scenarios (Billion 2011$)

Toll Rate Scenario	Land Use Scenario		
	Reference	***Market***	***Low***
1.0 Market Toll	3.1	2.8	2.3
2.1 CPI Growth	2.8	2.6	2.2

- **4.0: Supplementary Tolling Strategy Alternatives**

Additional tolling scenarios were evaluated with the objective of increasing throughput and alleviating congestion along the Highway 401 corridor. These additional scenarios can be grouped into two categories as follows:

- Testing minor changes in toll rates,
- Implementing Trip Toll Charge (TTC), which is a one-time fee per trip for use of facility in addition to per kilometer rates.

30-year revenue projections from the additional tolling scenarios ranged $1.9 – $3.5 billion (2011$), as shown in Table 5 below. For all tolling scenarios Highway 401 a.m. peak hour traffic volume for 2031 and 2041 horizon years remains at or over capacity for most sections of the highway.

Table 5: Additional Tolling Strategies Revenue Projections (Billion 2011$)

#	Scenario Description	Revenue Estimate
4.1	Reduce Market Toll Rate by $ 0.05/km (2011$)	2.7
4.2	Reduce Market Toll Rate by $ 0.10/km (2011$)	2.4
4.3	Market Toll Rates on 407; $ 0.10/km on 412 & 418	2.8
4.4	Market Toll Rates on 407; $ 0.20/km on 412 & 418	2.9
4.5	TTC and Toll Rates to Maximize Revenue	3.5
4.6	TTC and Toll Rates to Maximize Throughput	2.4
4.7	TTC and Toll Rates to achieve optimal conditions	3.0
4.8	Toll Rates to achieve maximum revenue at TTC of $ 0.11 (2011$)	3.4
4.9	Toll Rates to achieve maximum throughput at TTC of $ 0.11 (2011$)	2.4
4.10	Toll Rates to achieve optimal conditions at TTC of $ 0.11 (2011$)	3.0
4.11	Scenario 4.5 with future tolls linked to CPI	3.2
4.12	Scenario 4.6 with future tolls linked to CPI	1.9
4.13	Scenario 4.7 with future tolls linked to CPI	2.6

Note: Trip Toll Charge (TTC) was introduced by 407 ETR in 2009, and is part of the total cost of tolls and it is billed per trip to all customers (transponder and non-transponder customers) each time they enter 407 ETR.

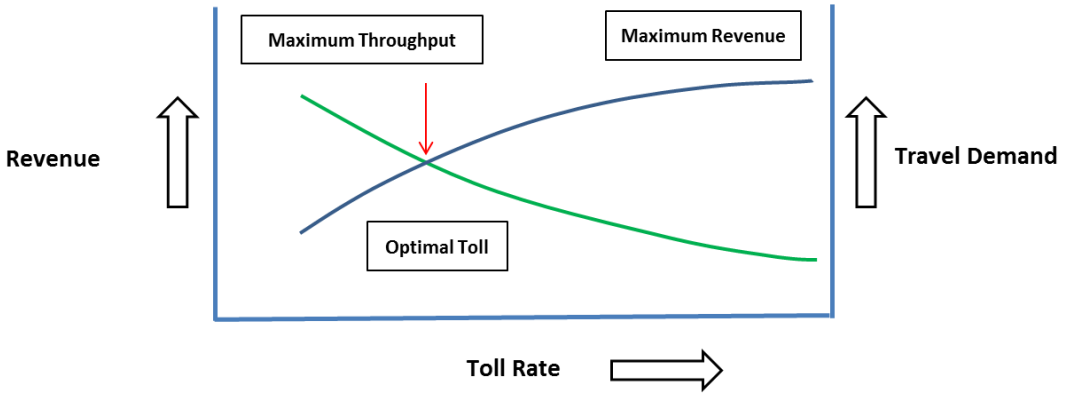
How Toll Rates Were Set for Highway Opening (2015–2017)

The Market Toll Rate scenario seeks to maximize revenue while ensuring that the facility was not underutilized for each future year.

This 'toll optimization' process consists of plotting toll sensitivity curves, which show the revenue at different levels of tolls. At low values of the toll, the demand is high, however, the revenue is relatively low. As the toll increases, the demand begins to decline but at a slower rate than the toll, thus resulting in growing revenue projections. Eventually, a point is reached where the decline in demand offsets the benefits from charging a higher toll and the revenue declines. The toll corresponding to the highest revenue is considered the 'optimal toll'.

To determine the optimal toll rate, the methodology selected was to determine the point where maximum vehicle throughput and maximum revenue intersect. This point was selected as it maximizes the use of the highway and revenue generated.

Figure 4: Toll Rate Optimization



Other factors considered in investigation and analysis of the initial toll rate included: value of time, land use projections, observed traffic volumes, customer expectation of reliable highway operations, customer acceptance of tolls charged to travel within the Greater Toronto Area (GTA), and highway fiscal and operational performance. A similar analysis was completed for the off-peak and mid-day toll rates. The optimization process found the opening day peak period toll rate of 30 cents/km - in 2016 for light vehicles.

Following the analysis and direction of the government, the ministry set Highways 407, 412 and 418 toll rates at or below the 407 ETR in all categories, with the opening day peak period toll rate set at $0.29/km (29 cents/km) for light vehicles.

The regulation for toll rates on Highways 407, 412 and 418 was enacted during July 2015 with anticipated opening of the toll highways during December, 2015. Due to this six-month project delay to open the highway and subsequent six-month delay in

commencing tolling, rates were not increased by CPI in June 2016 as anticipated, resulting in tolls already lower by approximately 1.6% on the opening day in February 2017.

Toll Structure

2015 analysis of the toll structure was limited to three alternatives, as follows:

- Single (Flat) toll structure
- Dynamic Pricing Structure
- 407 ETR style toll structure

A Single (Flat) toll structure is not responsive to travel demand fluctuations especially during the morning and evening peak hours of travel. With constant toll value throughout the day there is no incentive for customers to drive outside of peak travel time and therefore does not help manage peak congestion.

A Dynamic pricing structure is more suitable for heavily congested corridors. This toll structure gives the ability to adjust toll rates based on real time traffic conditions and ensures free flow travel conditions on the facility. For these types of toll structures, infrastructure requirements are extensive along with higher operational and enforcement costs.

The 407 ETR style toll structure was recommended and finally adopted with modifications. Similar to 407 ETR, Highways 407, 412 and 418 are heavily influenced by commuter traffic and as such there are significant variations to traffic volumes by time of day. In addition, the contract between the Province and Cantoll for tolling back office services (ARTSA) contemplates a toll rate structure for Highways 407, 412 and 418 to be similar to 407 ETR. This structure has clear advantages for customer experience. Most of the customers are familiar with this toll structure, and using it creates a consistent customer travel experience. In addition, a single peak hour rate allows for simpler customer messaging of toll rates.

The Highways 407, 412 and 418 toll structure is *similar* to 407 ETR in the following ways:

- Time-of-day pricing is applied for weekday and weekend travel, including holidays.
- Usage is based on rate per kilometer.
- Commercial vehicles are split into heavy single unit and heavy multiple unit vehicles, and the rates per kilometer are about 2 and 3 times that of light vehicles.
- Toll rates are same across the facility (Highways 407, 412 and 418).

The Highways 407, 412 and 418 toll structure *differs* from 407 ETR in the following ways:

- There is a single peak rate for both morning and evening peak travel.

- Toll rate does not vary by direction of travel.
- Simple time band structure.
- No flat fee per trip (407 ETR levies trip toll charge which is a one-time fee/trip).

In 2020, 407 ETR introduced seasonal tolling. The ministry has not investigated seasonal tolling for the provincially owned highways at this time.

Toll Rate Escalation

Annual adjustment of tolls by CPI (Ontario) was selected as the preferred escalation method.

The advantage of using CPI for escalation of toll rates includes:

- CPI provides more certainty to the public that tolls will be set at reasonable levels, and will not be subject to unreasonable increases in the future.
- CPI escalation of tolls is more readily perceived as a 'fair' adjustment. Linking rate increases to CPI ensures that there is a consistency between the fluctuating costs of inputs versus the revenue generated from tolling.
- If toll rates do not, at minimum, keep up with inflation, the gap between revenues and cost recovery will grow.
- CPI optimizes the cost of doing business. Using CPI as an escalation factor allows MTO to reasonably plan for anticipated revenues and mitigate the associated fluctuations in operating expenses, as well as providing customers and businesses with a degree of certainty in anticipated increases.

Modelling Update – 2018 Analysis

After completion of the first year of tolling operations in 2017, sufficient tolling data was available to be able to verify initial modelling assumptions. IBI Group was retained to review and update the 2015 model inputs and re-run select tolling scenarios.

Adjustments were made to the land use assumptions. While original model land use information was in compliance to the province's *Growth Plan for the Greater Golden Horseshoe*, the population and employment assumed in the model did not reflect the actual conditions as of 2018. Development in the corridor did not progress as rapidly as anticipated at the time of the development of the original model. Land use adjustments were applied to 2021 horizon year but removed for 2031 and beyond. This reflects the assumption that population and employment growth in Durham Region will catch up to the province's Growth Plan forecasts by 2031.

Commuter weekday traffic volume along Highways 407 and 412 was adjusted as the original model overestimated the mainline volumes. Weekend traffic and commercial vehicle traffic was reviewed to address underestimation.

Other adjustments included trip length distribution, expansion factors, traffic volume on

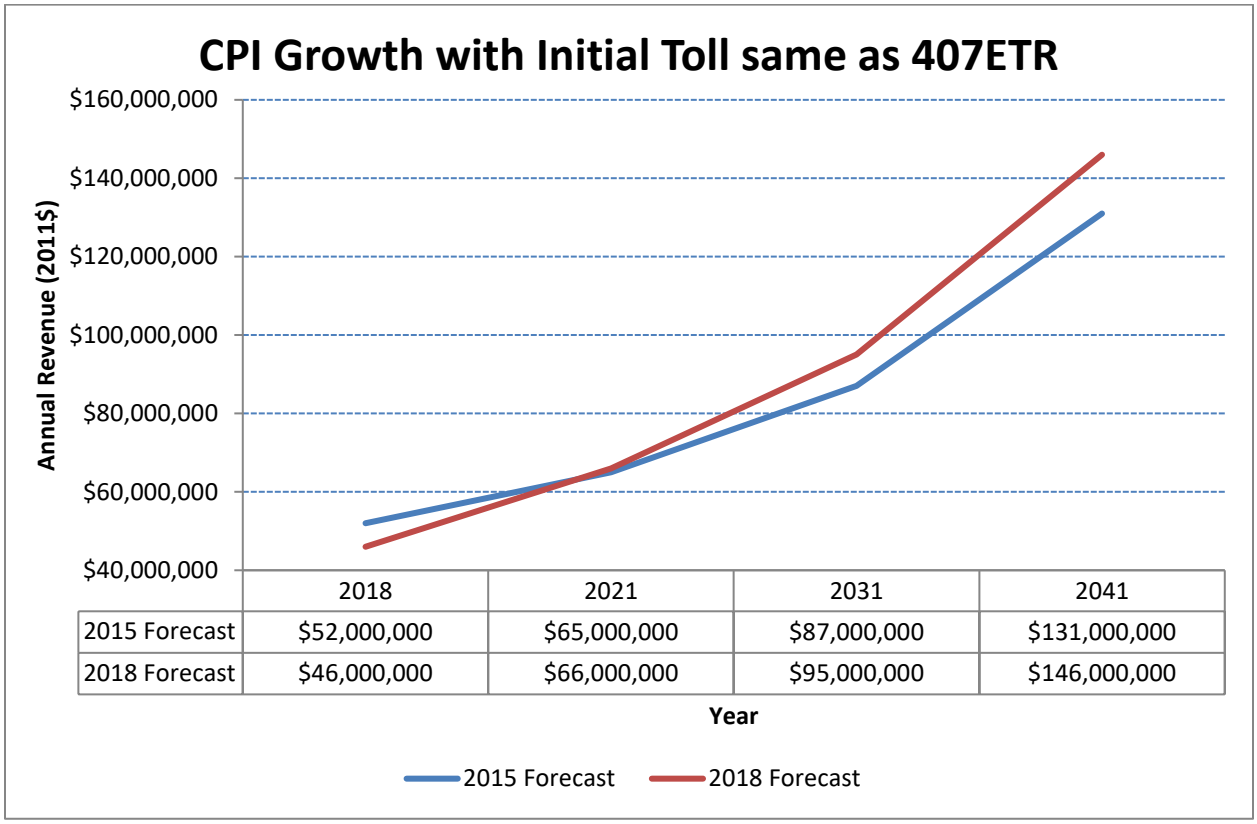
parallel highway, travel trend, and transportation network update for Durham Region.

Tolling Scenarios and Revenue Forecasts – 2018 Modelling

During the 2018 model update, the following tolling scenarios were updated or analyzed as new:

- **2.1 (updated): CPI Growth with Initial Toll same as 407 ETR (*current tolling plan*):** The scenario assumed toll rates to increase at the rate of CPI and estimates $2.9 billion in revenues over a 30-year period (2011$). The scenario generates more revenue than the 2015 forecasts by about $190 million (2011$). This is due in large part to far higher than anticipated volumes of commercial vehicles. Figure 5 below shows the comparison.

Figure 5: Revenue Comparison - CPI Growth with Initial Toll same as 407 ETR Scenarios



In addition, two scenarios were studied to investigate the sensitivity of land use distribution and tolling rates on the revenue forecast using 2041 horizon year only as follows, shown in Table 6 below:

- **Market Growth land use**
  The market growth scenario investigated the sensitivity of alternative land use

assumption to the reference scenario. Whereas the reference scenario assumes that new growth proceeds according to the guidance of the *Growth Plan for Golden Horseshoe*, the market scenario draws on recent real estate market trends, as well as growth patterns recorded between the 2011 and 2016 Census to present an alternative distribution of people and jobs. The distribution of population and jobs in the market scenario is based on work conducted by Metrolinx for the *Regional Transportation Plan*.

There are two primary differences between the population and employment forecasts in the reference scenario versus the market growth scenario:

- The Market Growth scenario assumes that Durham Region receives a lower proportion of population and employment growth than in the reference scenario; and
- The Market Growth scenario assumes a greater proportion of population and employment growth in Durham Region occurs at the northern edge of the urban area (i.e. in close proximity to Highway 407).

The changes in land use contributed to 27% increase in revenue, in comparison to reference scenario, based on 2041 horizon year only. There is limited downside risk to Highway 407 revenue in case market forces prevail over growth plan directions.

- **Alternative toll rates on Highways 412 and 418**
  An alternative toll scenario analyzed the revenue impact if Highways 412 and 418 were tolled at a lower rate of $0.10/km for light vehicles, $0.20/km for medium and $0.30/km for heavy vehicles (2018$). The tolls on Highways 412 and 418 are over 50% lower than the current tolling plan while tolls on Highway 407 remain unchanged.

  The analysis found that lowering tolls on Highways 412 and 418 increased the vehicle-kilometers travel (VKT) on toll highways. The increase in VKT was not enough to offset the lost revenue from lowering tolls on Highways 412 and 418. The estimated revenue was lower by 7%, relative to the reference scenario, based on 2041 horizon year only.

Table 6: Sensitivity Tests Land Use and Alternative Tolls

Sensitivity Tests Land Use & Alternative Tolls	Revenue Estimate*
Market Growth land use	27% Revenue increase
Alternative toll rates on Highways 412 and 418	7% Revenue decrease

Note:
*Revenue estimates in comparison to Reference Scenario

The remaining three scenarios analyzed the revenue impact from tolling options for Highways 412 and 418, such as:

- **3.2 (updated): analyzed the impact of removing tolls on Highways 412 and 418.**

- **5.0 (new): analyzed the increase of toll rates on Highway 407 required to offset the lost revenue from removing tolls on Highways 412 and 418.**

- **6.0 (new): analyzed the impact of maintaining tolls for Highways 407, 412 and 418 at 2019 levels.**

The purpose of Scenario 3.2 is to calculate the difference in tolling revenue if no toll is charged on Highways 412 and 418. In this scenario it was assumed that tolling on Highways 412 and 418 stops by the end of 2018 and the facilities will be free for all users. Removing tolls from Highways 412 and 418 decreases overall revenue by $430 million (2011$) or about 15%, in comparison to the current tolling plan, however, Highway 407 mainline revenue increases by $180 million or about 7.5% as the highway system as a whole is more affordable. The increase in Highway 407 mainline revenue is not enough to recover the lost revenue from removing tolls on Highways 412 and 418.

The 5.0 revenue offset scenario looked at optimal toll rates on Highway 407 required to balance the revenue lost from removing tolls on Highways 412 and 418. Toll increases are applied onto the 2018 toll rates for a.m. peak hour, p.m. peak hour, commercial vehicles and the off-peak rates are increased by the same amount as the peak hour rates. Two approaches to revenue offset were studied: immediate and incremental toll rate increases. The immediate increase approach would need tolls to be raised by 39% to $0.406/km in 2020, followed by annual CPI increases to 2045. The incremental increase approach would need tolls to be raised gradually to 124% by 2041 with higher than CPI annual increases. Overall, both approaches suggested that a substantial toll rate increase would be required.

The maintaining tolls scenario assumed to hold toll rates constant throughout the 30-year analysis period and, therefore, the tolls are decreasing in real terms at the assumed rate of inflation (2%). By 2041, the real value of the toll rates is almost 40% lower than the base toll of 2019. This results in 18% less revenue, or about $535 million (2011$) in comparison to the current toll plan. The lower toll rates in the future years result in a 12% increase in annual trips and 16% increase in annual vehicle travel. Table 7 below shows revenue comparison.

Table 7: Revenue Comparison with the Current Toll plan (Reference Scenario)

Scenario Description	Revenue Estimate (Billion 2011$)	Change in Revenue from Reference Scenario (Billion 2011$)
2.1(updated): CPI Growth with Initial Toll same as 407 ETR (Reference Scenario)	2.9	-
3.2(updated): Remove Tolls on Highways 412 and 418	2.5	-0.4

5.0: Revenue Offset*	2.9	-
6.0: Maintain Tolls	2.4	-0.5

Notes:

* Sets toll on Highway 407 to balance lost revenue from removing tolls on Highways 412 and 418. Under the Immediate Approach tolls are required to increase by 39% (0.406 cents/km in 2020) to recover the lost revenue. Under the Incremental Approach higher than CPI (4%) increase is required each year.

Highway 412 Impact on Lake Ridge Road

A diversion analysis examined the number of drivers diverted to Highway 412 from parallel municipal roads as a result of removal of tolls on Highway 412. Despite a substantial diversion under a “no toll” scenario, it was found that Lake Ridge Road would remain congested south of Rossland Road with marginal decrease in intensity and duration of congestion.

The 2018 analysis found that for a.m. and p.m. peak hour, approximately 4,300–4,500 vehicles would divert to Highway 412 as a result of removal of tolls. However, only 6–7% of these vehicles are diverting from Lake Ridge Road with the remainder diverting from parallel arterial roads. During the commercial vehicle 12.5-hour peak, approximately 2,300 heavy vehicles would divert to Highway 412, of which about 11% would divert from Lake Ridge Road.

Revenue and Traffic Forecast

Highways 407, 412 and 418 combined are expected to generate $2.9 billion (2011$) or $4.4 billion (constant$) from 2016 to 2045. During the FY 2017–18, Highways 407 and 412 combined generated approximately $46.1 million in revenues. Tolling revenue increased by approximately 11%, to a total of $51.5 million for FY 2018–19 and by 10% to a total of $56.7 million for FY 2019–20. Highways 412 and 418 combined are expected to generate approximately 20% of the total tolling revenue. Table 8 below provides revenue breakdown by highway.

Table 8: Actual and Forecasted Revenue by Highways

Fiscal Year	Revenue			
	Highway 407	Highway 412	Highway 418	Total
Actual				
2016-17	4,200,000	1,400,000	Not Operational	5,560,000
2017-18	34,000,000	12,000,000	Not Operational	46,100,000
2018-19	39,600,000	12,000,000	Not Operational	51,500,000
2019-20	43,900,000	11,700,000	1,100,000	56,700,000
Total Revenue Generated (2016-20)				**159,860,000**
Forecasted				
2020-21	*47,400,000*	*14,100,000*	*2,000,000*	*63,500,000*
2021-22	*53,100,000*	*14,900,000*	*2,100,000*	*70,100,000*
2022-23	*59,400,000*	*15,700,000*	*2,200,000*	*77,300,000*
2023-24	*65,200,000*	*16,600,000*	*3,600,000*	*85,300,000*
2024-25	*72,800,000*	*17,600,000*	*3,800,000*	*94,100,000*
2025-26	*77,800,000*	*19,400,000*	*3,900,000*	*101,100,000*
2026-27	*83,200,000*	*19,800,000*	*4,000,000*	*107,000,000*
2027-28	*87,600,000*	*20,200,000*	*4,000,000*	*111,800,000*
2028-29	*93,400,000*	*20,600,000*	*4,100,000*	*118,100,000*
2029-30	*99,100,000*	*21,200,000*	*4,200,000*	*124,600,000*
2030-31	*104,200,000*	*22,800,000*	*4,300,000*	*131,300,000*
2031-32	*109,100,000*	*23,300,000*	*5,800,000*	*138,200,000*
2032-33	*119,800,000*	*24,000,000*	*6,000,000*	*149,700,000*
2033-34	*127,200,000*	*25,400,000*	*6,000,000*	*158,600,000*
2034-35	*138,300,000*	*26,400,000*	*6,200,000*	*170,900,000*
2035-36	*148,800,000*	*26,900,000*	*6,300,000*	*182,100,000*
2036-37	*158,400,000*	*27,200,000*	*8,000,000*	*193,600,000*
2037-38	*168,000,000*	*29,400,000*	*8,200,000*	*205,500,000*
2038-39	*181,000,000*	*30,200,000*	*8,400,000*	*219,500,000*
2039-40	*191,300,000*	*30,700,000*	*8,500,000*	*230,600,000*
2040-41	*203,700,000*	*33,100,000*	*8,700,000*	*245,500,000*
2041-42	*215,000,000*	*33,500,000*	*10,600,000*	*259,100,000*
2042-43	*228,000,000*	*34,400,000*	*10,900,000*	*273,200,000*
2043-44	*240,100,000*	*36,600,000*	*11,000,000*	*287,700,000*

2044-45	*450,500,000*	*66,300,000*	*19,800,000*	*536,700,000*
Total Revenue Forecasted (2020-45)				***4,335,100,000***

Notes:
FY 2016-20 represents actual revenue generated.
FY 2021-45 represents forecasted revenue.
Rate of inflation assumed for future years is 2%.
2044-45 includes April-December 2045 period

Table 9 below shows highway sections with the highest average annual daily traffic (AADT) counts. Along Highway 407, the highest AADT is observed at the Brock Road – Lake Ridge Road section. For Highway 412, the highest AADT is observed at the Taunton Road – Dundas Street section. And for Highway 418 the busiest section is between Highway 2 – Taunton Road.

During 2018 and 2019 a slight decrease in AADT is observed on Highway 412 due to the opening of Phase 2a (2018) and Phase 2b (2019), which provided alternative routes to drivers.

Table 9: Actual and Forecasted Peak Point AADT by Highways

Calendar Year	AADT by Highway		
	407	**412**	**418**
2017	25,900	12,900	Not Operational
2018	26,600	12,300	Not Operational
2019	27,000	12,200	3,100
2020	*27,500*	*12,400*	*3,200*
2021	*28,100*	*12,600*	*3,300*
2022	*28,700*	*12,900*	*3,400*
2023	*29,300*	*13,200*	*3,500*
2024	*29,900*	*13,500*	*3,600*
2025	*30,500*	*13,800*	*3,700*

Notes:
Calendar Years 2017–19 represent actual volume.
Highway 418 2019 average based on one month (December, 2019) data.
Calendar Years 2020–25 represent forecasted volume.

Toll Rate Comparison with 407 ETR

There is a significant toll rate difference between Highways 407, 412, 418 and 407 ETR. During the current calendar year (2020), the provincially owned highways' toll rates are on average 40% lower compared with 407 ETR. Depending on the time of travel, day of the week, section of travel and direction of travel, the range of difference is 23% to 55%.

Table 8 in Appendix A provides details of how the rates compare.

Cost Recovery Estimates

The total project costs for Phase 1 and Phase 2 were $2.6 billion and $1.8 billion respectively. Tolling models are calculated until 2045, which does not assume the recovery of all project related costs (i.e. construction, operations, maintenance, rehabilitation and tolling infrastructure). Highways 407, 412 and 418 are expected to generate a substantial amount of revenue ($2.9 billion 2011$/$4.4 billion Constant$ - see table 8 above for distribution of revenue) under the 2.1 CPI Growth Scenario. While not a scenario explicitly considered in this report, the complete removal of tolls for all three highways from 2021 onwards would amount to a loss of $4.335 billion.

Given the expected toll revenues generated from Highways 412 and 418, it is estimated to take more than 25 years to pay for construction costs of the highways. Additionally, if full project costs are included, it is expected to take much longer than 25 years to recover costs incurred. This would be substantially longer if tolls were removed from Highways 412 and 418.

As the project was not anticipated to achieve cost-recovery within the 30-year period, options to lower revenue, including removing/lowering tolls on Highways 412 and 418, would extend even further the province's ability to recover the initial outlay.

Community and Local Municipal Infrastructure Improvements

Located just 37 km from downtown Toronto, Durham Region was well suited to benefit from the movement of goods and products across the southern Ontario corridor with the addition of Highway 407 and its north-south connecting links to Highway 401. There are many advantages, with local businesses benefitting from holding less inventory, using just-in-time inventory procedures, enjoying greater locational choice, and more efficient distribution or production patterns. Reduced transportation costs can also generate savings in the overall cost of production. For every $100 million invested in this type of public infrastructure, real GDP for the area is boosted by $114 million.

Recognizing the area's growth potential, and the desires of local stakeholders for the highway to be fully constructed, the Province reviewed options for extending the highway. This involved assessing if it could be rapidly constructed with funds recovered from tolling. Construction through the traditional provincial highway expansion construction program would have been phased over several decades. The outcome was that the rapid construction of Highways 407, 412 and 418 could be achieved if the provincial government budgeted, funded, and accounted for the project and recovered the costs from tolling revenues.

Significant economic benefits to the region also result in a certain amount of congestion, as the movement of goods, transport and workers increases. To ensure the smooth, reliable flow of traffic, and to support residents paying for use of the highways, the

provincial government invested over $100 million in municipal improvements between 2015 and 2019 as part of the design and construction of the Highway 407 corridor, including:

A. Approximately $83 million toward items in the P3 scope of work, and direct compensation to municipalities.

   Items included in the P3 scope of work:
   - Overbuilding bridges to accommodate future municipal road expansion:
     - Dundas Street/Highway 412 – built to accommodate future 6 lanes;
     - Lake Ridge Road/Highway 401 – built to accommodate future four lanes, and a future full moves interchange;
     - Rossland Road/Highway 412 – built to accommodate future four lanes;
     - Highway 407/Winchester Road – built to accommodate a potential future six lanes, sidewalks and cycling;
     - Highway 407/Thornton Road – built to accommodate a future four lanes;
     - Thickson Road/Highway 407 – bridge and bridge approaches built to four lanes to facilitate future adjacent Durham Region widening; and
     - Simcoe Street/Highway 407 – bridge and bridge approaches to four lanes to facilitate future adjacent Durham Region widening; also included a southbound left turn lane.
   - Partial interchange at Highway 401 and Lakeridge Road;
   - Lyndebrook Road construction;
   - Grandview Street realignment;
   - Enfield Road connector realignment;
   - Additions to support municipal Active Transportation plans:
     - Extra width on multiple bridges (in addition to those mentioned above) to accommodate future cycling infrastructure, including Durham Highway 2, Baseline Road, Bloor Street, Old Scugog Road; and
     - Accommodation of the Trans Canada Trail on Paddock Road.

   Direct compensation to municipalities for various roads, intersections, and other improvements throughout the region, including:
   - Municipal intersection improvements at Simcoe Street/Winchester Road, Harmony Road/Winchester Road, and Harmony Road/Columbus Road;
   - Property acquisition, design and construction of a new 4 km, two-lane equivalent (Des Newman Boulevard);
   - Partial funding for intersection improvements on Rossland Road, between Lake Ride Road and Highway 412; and
   - Don Beer Memorial Park.

B. Over $15 million for scope changes resulting from municipal consultation during design/construction of the P3 projects for additional municipal improvements, including active transportation/cycling infrastructure improvements, localized municipal resurfacing, provision for future water/sewer and traffic signals. These include:
   - Paved shoulder enhancements at Anderson Road, Ashburn Road, Baseline Road, Highway 2, Nash Road, Langmaid Road, Concession 6, Solina Road, Middle Road, Bethesda Road, Darlington-Clarke Townline, Best Road.
   - Bloor Street structure widening;
   - Improvements to adjacent local roads (Sideline 14, Salem Road, Leask Road, Langmaid Road, Solina Road, Middle Road, Liberty Street, Bethesda Road, Concession 6, Leskard Road, Nash Road);
   - Intersection improvements at Solina Road/Taunton Road, Langmaid Road/Concession 6, Solina Road/Concession 6, Taunton Road /Courtice Road.
   - Community, Indigenous and Highway of Heroes commemoration incorporated into Simcoe Street, Baldwin Street, Winchester Road, Solina Road, Best Road, and Baseline Road bridges; and
   - Upgrades to municipal lighting at new Dundas Street/Highway 412 interchange.

C. Approximately $20 million (shared with other stakeholders) for three GO Transit carpool lot facilities, with adjacent municipal intersection and road improvements, at Brock Road, Dundas Street and Baldwin Street.

These many benefits support the sector advances and population growth outlined in Durham Region's *2017–2021 Economic Development Strategy and Action Plan*. The province will continue to work with the region to support their plan, and their place within the Ontario's *Growth Plan for the Greater Golden Horseshoe*.

Contractual Impacts of Eliminating Tolls on Highways 412 and 418

The province has 30-year contracts with three different service providers related to these highways. One contract provides tolling and back-office services for the entire toll facility, and two others provide for operations, maintenance, and rehabilitation for Phase 1 (Highways 407 and 412) and Phase 2 (Highways 407 and 418) of the project.

Changes to the tolling structure for these highways, such as the elimination of tolls on Highways 412 and 418, would require modifications to these contracts, and could result in significant financial impacts to the ministry.

Conclusion

Highways 407, 412 and 418 are anticipated to be heavily utilized by commuters, recreational travelers and commercial vehicles. The highways are located in a rapidly growing urban area that is anticipated to continue to attract new residents and businesses. Existing levels of congestion on competing roads are significant and growing, and the demand for the new toll route will increase significantly over the next 30 years.

How and why toll rates are set is the subject of much scrutiny from the public and stakeholders. As such, the ministry carefully reviews various scenarios, representing the many ways in which those toll rates can be influenced. The ministry's principal mission in this is to balance maximizing revenue for the province while encouraging maximum highway usage. The analysis for this report looked at the previous modelling work undertaken in 2015 and 2018.

The modelling work analyzed several tolling scenarios for optimizing toll rates and toll rate escalation. Maximizing Revenue alternatives such as 4.5 (TTC and Toll Rates to Maximize Revenue) and 2.3 (407 ETR Toll Growth scenarios generate the most amount of revenue i.e. $3.5 billion 2011$); however, highway usage is not optimal, and the highway would appear under-utilized. On the other side of the revenue range, Maximize Throughput alternatives such as 4.12 (TTC and Toll Rates to Maximize Throughput) and 3.1 (Maximize Throughput Scenarios) generate the most amount of traffic volume; however, the revenue potential of the facility is not fully realized ($1.9 billion 2011$).

Scenario 2.1 (CPI Growth with Initial Toll same as 407 ETR) provides a balanced combination of tolling revenue and highway usage with future toll growth linked to CPI.

There has been interest in the community for the removal of tolls on Highways 412 and 418. In addition to a forecasted $407 million (2011$) loss of revenue, there are a number of additional contractual costs associated with this scenario.

The recommended opening day peak period toll rate of 30 cents/km in 2016 was based on review, investigation and analysis undertaken by an independent consulting firm. The review was based on various factors such as toll levels, revenue generated, traffic volumes, customers' acceptance of tolls charged to travel within the Greater Toronto Area (GTA), value of time, land use projections and customers' expectation of reliable highway operations.

The government set the provincial highways' toll rates at or below those of 407 ETR in all categories; the opening day peak period toll rate was set at $0.29/km (29 cents/km) for light vehicles.

The regulation for toll rates on Highways 407, 412 and 418 was enacted mid-2015 with anticipated opening of the toll highways during December 2015. However, the project

was delayed, and the highway opened toll-free on June 20, 2016, and tolling commenced on February 1, 2017. Due to this six-month project delay to open the highway and subsequent six-month delay in commencing tolling, rates were not increased by CPI in June 2016 as anticipated, resulting in tolls already lower by approximately 1.6% on the opening day in February 2017.

The initial toll rates were in effect for four months until May 31, 2017, when the first toll escalation was required, and it was determined to be too soon for an adjustment of toll rates. A regulation amendment freezing the toll rates was enacted to be in effect until May 31, 2019. During the last four years of tolling operations, the toll rates have increased only once by 2.27%.

The current approach includes the following points, which continue to remain significant:

A. CPI adjustment is recognized as a simple, understood change (represents an indicator of percentage change in the average cost of goods & services over time).

B. CPI may provide more certainty to the public and businesses that tolls will be set at reasonable levels and will not be subject to unreasonable increases in the future.

C. CPI is understood as a 'fair' adjustment. Linking rate increases to CPI ensures that there is a consistency between the fluctuating cost of inputs versus the revenue generated from tolling. If rates do not, at minimum, keep up with cost inflation (CPI), the gap between revenues and cost recovery will continue to grow. The province would have to provide other means to offset this shortfall.

D. CPI optimizes the cost of doing business. Using CPI as an escalation factor allows the ministry to reasonably plan for anticipated revenues and mitigate the associated fluctuations in operating expenses.

E. MTO currently uses CPI to index driver examination fees. MTO, as authorized by the Highway Traffic Act, can increase driver examination fees using CPI.

F. Ontario's annual Rent Increase Guideline is based on the Ontario CPI, which is a measure of inflation calculated monthly by Statistics Canada.

G. Using CPI is also consistent with previous ministerial direction.

While this approach has many advantages, the current extraordinary pandemic situation is an example of where a CPI increase may be perceived as less than fair. With consideration to this situation, the government has chosen to freeze CPI rates at their current levels for 2020. The repercussions of this extraordinary event will continue to be relevant for forecasting purposes..

This modelling analysis remains valid, and consistent with Durham Region's *2017-2021*

Economic Development Strategy and Action Plan. In addition, the *Growth Plan for the Greater Golden Horseshoe August 2020* does not impact outcome of this study significantly. The model assumes a slower population and employment growth rate beyond 2041, which aligns with the change in growth rate between the previous and new version of the Growth Plan.

This modelling analysis outlines factors considered in the past policy decisions regarding the tolls on Highways 407, 412 and 418 that remain relevant in any future decisions on tolling policy.

Appendix A (Light Vehicle Toll Rate Comparison with 407 ETR)

Table 10: Light Vehicle Toll Rate Comparison with 407 ETR

Day Type	Highway 407/412/418		407 ETR Toll Rate Range and Provincial Highways Tolls Percent Lower than 407 ETR			
	Time Period	Tolls	Zone 1	Zone 2	Zone 3	Zone 4
Weekdays	Morning Peak (6am–10am)	29.66	42.53-55.13 ¢/km	42.83-56.44 ¢/km	46.31-56.43 ¢/km	42.04-54.93 ¢/km
			30% to 46% lower	31% to 47% lower	36% to 47% lower	29% to 46% lower
	Midday (10am–3pm)	23.52	39.07-51.93 ¢/km	39.07-50.55 ¢/km	40.17-51.92 ¢/km	38.47-48.61 ¢/km
			40% to 55% lower	40% to 53% lower	41% to 55% lower	39% to 52% lower
	Evening Peak (3pm–7pm)	29.66	44.04-61.14 ¢/km	48.98-59 ¢/km	51.01-62.24 ¢/km	43.62-58.48 ¢/km
			33% to 51% lower	39% to 50% lower	42% to 52% lower	32% to 49% lower
	Off Peak (7pm–6am)	19.43	25.29-25.29 ¢/km	23% to 23% lower		
Weekends and Holidays	Midday (11am–7pm)	22.5	34.63-35.96 ¢/km	35% to 37% lower		
	Off Peak (7pm–11am)	19.43	25.29-25.29 ¢/km	23% to 23% lower		