APPENDIX G
Halton Region Transportation Model

The Road to Change

Halton Region Transportation Master Plan

Halton Region Transportation Model

Halton REGION

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1. Introduction

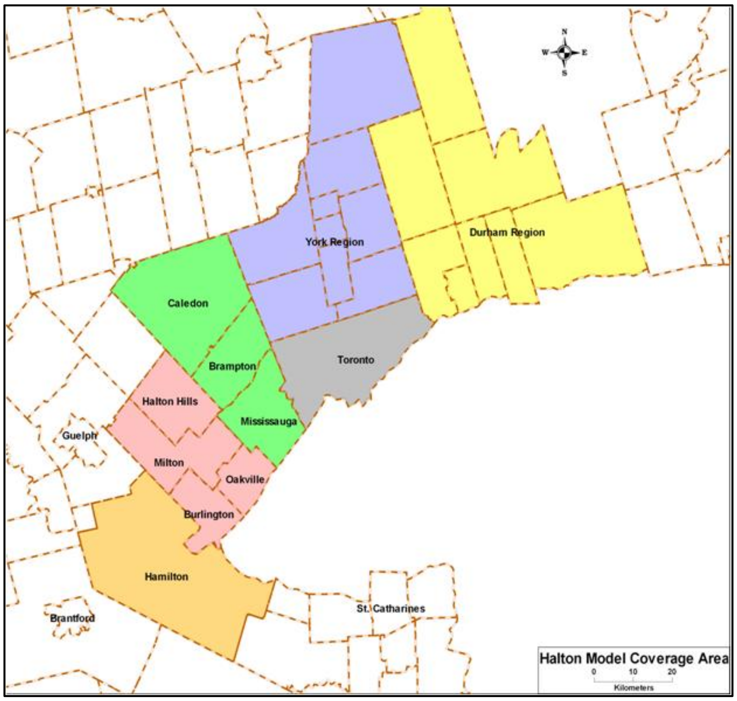
One of the tools used in the development of the Region's transportation strategy to 2031 is the Region's demand forecasting model. This appendix provides the background, assumptions and updates applied to the Halton Region Travel Demand Forecasting model as part of the Halton Transportation Master Plan (2031) – The Road to Change. Prior to using the model to forecast future travel demands and identify future infrastructure requirements, it is necessary to ensure that the model is calibrated to reflect the most recent base year information on travel patterns in the study area.

The Halton Region transportation demand forecasting model has been updated a number of times since it was originally developed. The last major update occurred in 2004, when the model calibration was updated to reflect the observed travel patterns in the 2001 Transportation Tomorrow Survey (TTS). Subsequent refinements and updates occurred during 2006/2007 as part of the Halton Region Development Charges Study Update. With the release of the 2006 TTS Data, a review of the fundamental model assumptions was undertaken to assess the need for model updates to support the Sustainable Halton exercise that led to ROPA 38 and the current Halton Region Transportation Master Plan.

2. Model Overview

The Halton Regional model is a four-stage model incorporating trip generation, mode choice, trip distribution and trip assignment. The model coverage area includes the entire GTA and Hamilton, as illustrated in **Figure G.1**, with more detail in the municipalities adjacent to Halton Region and less detail in municipalities more removed from the Region.

Figure G.1 – Model Coverage Area



The general flow of information through the model is shown in **Figure G.2**. The model uses a pre-distribution (trip end) mode split component that favours the incorporation of assumptions that reflect long term socio-economic trends, household decisions (such as car ownership) and general, area wide, levels of service rather than the details of individual route planning. This results in a mode split that reflects current and anticipated future trends, independent of the potential increase in transit ridership that may be generated from improved service levels or new transit infrastructure.

The model forecasts future travel conditions by extrapolating from existing (observed) travel characteristics and travel patterns as opposed to formulating mathematical equations to synthesize existing relationships. Assumptions regarding future changes in trip rates, mode choice factors, average trip length and auto occupancy are explicitly stated as inputs to the modelling process.

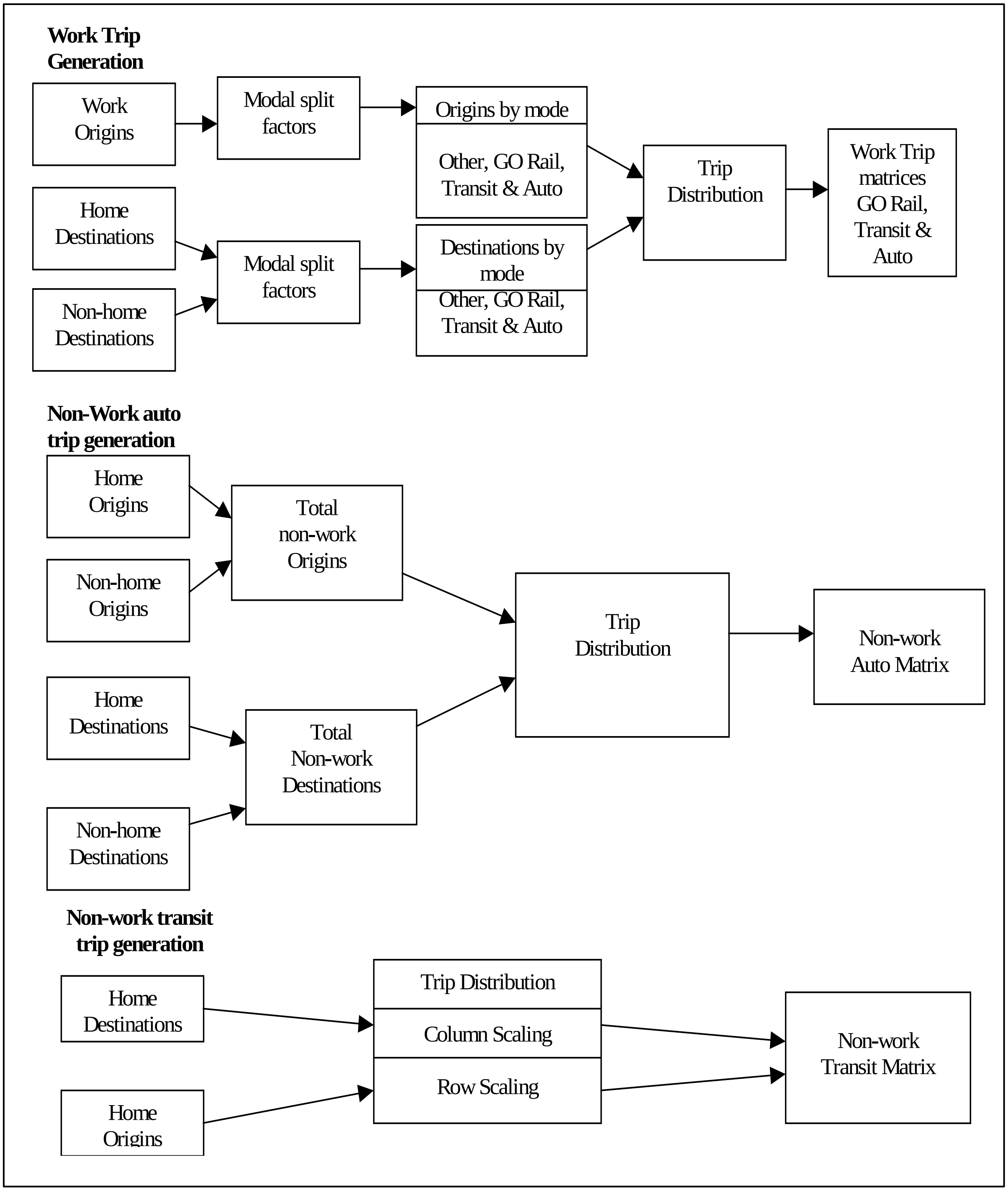
In the trip generation and mode choice components, existing trip rates by trip purpose and mode split factors are applied to future forecasts of population and employment to determine the number of trip origins and destinations for each traffic zone and mode of travel. The rates are adjusted, either globally or by geographic area, to reflect anticipated future trends.

The trip distribution component process uses inputs such as the existing origin-destination (O-D) travel patterns at an aggregate level to forecast future patterns. The model applies these patterns to areas of new development for which there is no existing travel information. There is a separate trip distribution for each combination of mode and trip purpose. The extent to which the existing trip patterns can be maintained by the model may be restricted by the total predicted number of trips that would be generated or attracted to each zone based on the land use. Different growth rates in population and employment may result in either an increase or a decrease in average trip length depending on the circumstances.

The mode split component of the model uses existing observed mode split patterns for different trip purposes from the TTS survey based on the area within the Region (urban areas with transit service currently have transit use while rural areas do not) to forecast the future mode split that would be experienced under the same type of service plan. This is commonly referred to as a "trend" forecast (i.e., continuing the current expectations of activity and service). The model does not estimate the transit ridership that would be generated from a specific transit improvement project, but uses a policy mode split approach, where targets are established for future transit use based on the areas within the region that may benefit from improved transit services. This post model adjustment process reduces that auto demands and increases the transit demands that would be forecast in the trend scenario.

The traffic assignment process in the model essentially estimates the volume of traffic that would use various roadways using an iterative process that seeks to find the shortest travel time between the origin and destination of each trip. The iterative approach allows for congestion effects to be incorporated into the forecasts, which may cause some vehicles to choose other routes to reach their destination to avoid heavily congested corridors. This process is known as an "equilibrium" traffic assignment technique where the travel time on each link is determined by a volume delay function which estimates the increase in travel time as the capacity of the roadway is reached or exceeded. Traffic is re-assigned between competing routes until an equilibrium state is reached where no vehicle can improve its travel time by switching to a different route.

Figure G.2 – Model Flow Diagram



The trip generation, mode split and trip distribution components of the model are based on a three-hour PM peak period. The total auto person trip matrix is converted to a peak hour auto driver matrix prior to trip assignment using auto occupancy factors derived from the TTS survey data.

In the trip generation and mode split components the auto mode includes both auto passengers and auto drivers. A subsequent auto occupancy calculation is used to generate the auto driver matrix used in the trip assignment. The mode-split component includes an "other" mode category (primarily walk and cycle). These trips are not distributed or assigned to the network but are included in the calculation of the total number of work trips.

3. Consideration of Transit in the Model

For transit trips, the model only assigns the GO Rail trips to the transit network. Subsequent to the trip distribution stage, a sub-mode split is performed on the GO Rail trip matrix to determine the mode of egress at the destination trip end. Trips that use auto as the egress mode are divided into two components, local transit and auto egress modes. The rail component is assumed to terminate at the egress station. An auto component, from the egress station to the destination zone, is added to the auto trip matrix. Local transit trips leaving the GO station are added to local transit trip matrix but are not assigned, as discussed above.

The model does feature a useful strategic transit assignment feature that can be used to assess transit demands on various corridors at a high level. The policy mode split feature in the model does create a transit person trip matrix, representing the projected demand for transit between each origin zone and destination zone.

4. Model Calibration and Validation

During the model review, the calibration and validation process utilized a two-step process. The first step of the model review process included a review of trip generation parameters; a review of the trip distribution patterns, and a review of the base mode split patterns compared to 2006 TTS data. In the second step, model validation included a comparison of PM peak hour simulated volumes compared to observed traffic counts at a series of screenlines throughout Halton Region.

The initial trip generation, trip distribution, and mode split calibration process, utilized base year population and employment figures directly from the 2006 TTS database. During the calibration of the trip generation, trip distribution and mode split steps of the modelling process, population and employment figures for each traffic zone, combined with the observed trip information in the TTS database, were used to calculate trip generation rates for comparison with the base rates used in the current model. At the trip distribution stage, the simulated trip distribution estimated by the model was compared to the observed trip distribution patterns from the TTS database. During the mode split process, mode share factors were developed from the raw TTS trip database for each zone group in the model. These factors were input into the model to produce a simulated mode share matrix which was then compared against the observed mode share patterns from TTS.

5. Trip Generation

Trip generation rates are applied to estimates of population and employment in order to obtain the trip end totals used as input to the subsequent stages of the model. The model forecasts future trip making for work related trips and non-work trips separately. For each category of trip, the 2006 data has shown a modest growth in trip making compared to 2001. On a per-capita basis, however, overall trip rates (in terms of trips per capita) for the PM peak period have declined in all GTHA municipalities including Halton Region, as illustrated in **Table G.1**, below.

Table G.1– PM Peak Period Trip Rates – GTA and Halton Region

	2001(TTS) Population	2001 Person Trips	2006 (TTS) Population	2006 Person Trips	2001 trips /capita	2006 trips /capita
Toronto	2,368,706	1,274,011	2,445,936	1,281,223	0.538	0.524
Durham	492,194	304,684	539,501	324,126	0.619	0.601
York	720,953	437,943	857,520	504,150	0.607	0.588
Peel	954,227	562,185	1,119,128	631,123	0.589	0.564
Halton	364,109	237,175	422,725	270,464	0.651	0.640
Hamilton	485,948	286,298	487,070	281,757	0.589	0.578

To reflect the new trip patterns observed in 2006, base trip generation rates were obtained from the TTS data to update the factors used in the previous model. A number of traffic zones within the Region are considered to be "retail intensive" and specialized non-home based trip rates have been previously used for these specific zones to reflect their unique trip generation patterns. Based on review of the 2001 TTS data these zones were grouped into categories for the application of category specific trip rates, based on:

1 Zones with at least 1,000 employment, the majority in Sales and Service,

2 Other Malls & Box stores with a high level of Sales &Service employment,

3 Other zones with a high level of Sales & Service employment,

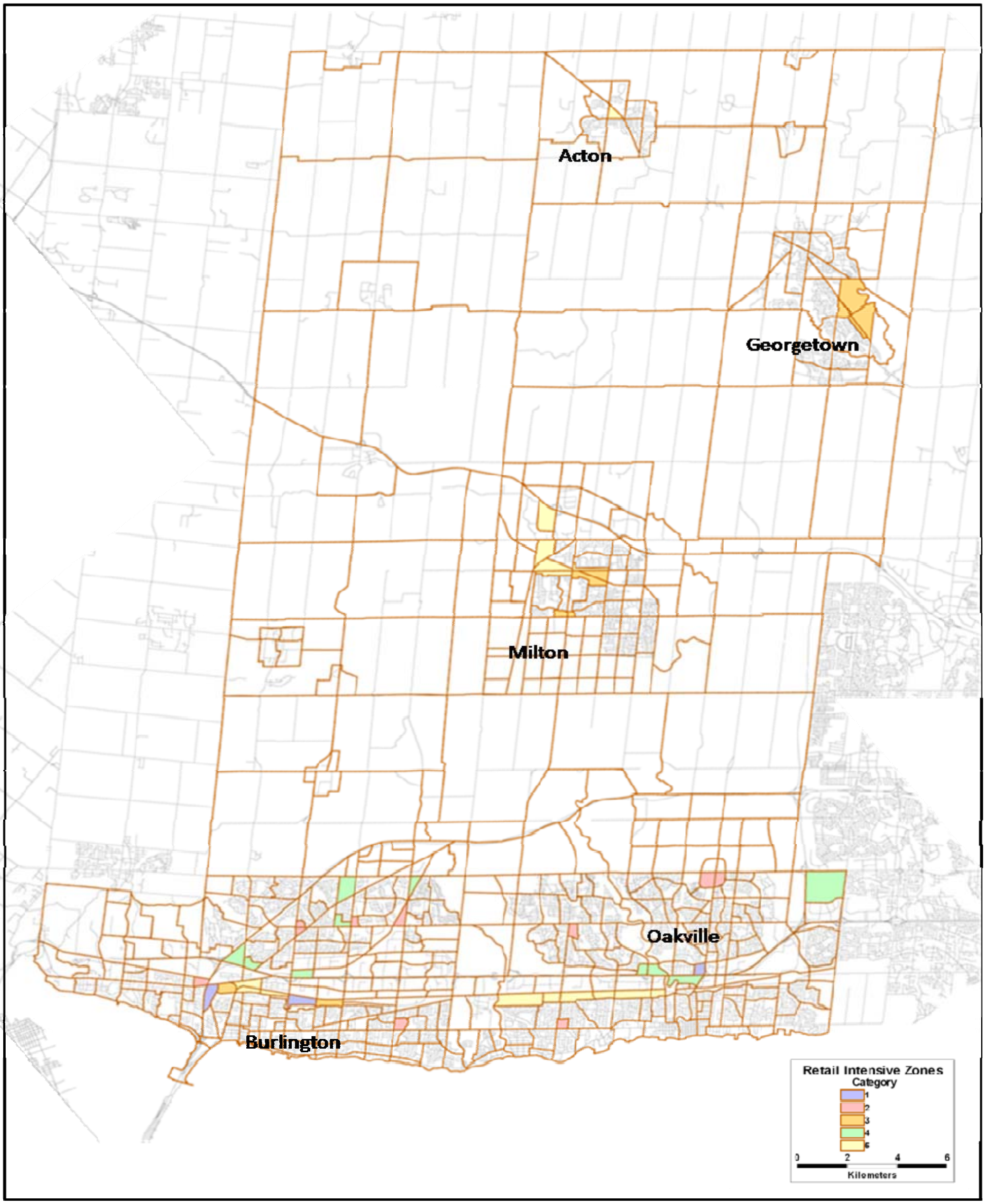
4 Other Malls & Big Box stores,

5 Other zones with retail and industrial or residential mix, and

6 Non-retail zones.

For the purpose of this update, the Retail Intensive Trip Rates that were calculated from the 2001 TTS are representative of 2006 TTS Data and therefore have not been changed from those used in the previous model calibration. **Figure G.3** illustrates the location of the retail intensive zones.

Figure G.3 – Retail Intensive Zones



Calibration of these trip rates was undertaken using the model trip generation procedures and the 2006 TTS population and employment figures. The resulting auto and transit person trip totals were compared to the 2006 TTS trip totals, the results of which are summarized in **Table G.2**, below. For a strategic, regional model, industry standards for calibration are typically set at +/- 15% for trip generation.

Table G.2 – Calibration of Trip Generation to Observed TTS Person Trips

Municipality	Observed Trips	Predicted Trips	Comparison
Halton Hills	26,334	28,640	+9%
Milton	25,367	27,363	+8%
Oakville	88,463	89,798	+2%
Burlington	90,308	95,621	+6%
Total	230,472	241,422	+5%

On an overall basis, the model is slightly over simulating trip making (totals represent auto and transit person trips only) in Halton Region by about 5% (based on the average between the trip origins and destination). This level of calibration is well within industry standards. Trip generation results for the rest of the GTA regions are calibrated to within 10% with the exception of Hamilton where the simulated trip destinations are within 16% of observed destinations. This is an acceptable range of error for an external area in the model when the vast majority of these trips will be trips that take place within Hamilton and have minimal impact on the volume of traffic through Halton Region.

6. Global Trip Rate Adjustment Factors

Global adjustments are also used for future trip generation rates to reflect anticipated socio-demographic changes in the population, primarily the natural aging of the population. Between 2011 and 2031 the proportion of the population of current working age is expected to decline as the baby boom generation reaches retirement age. Other factors that could contribute to a decrease in peak period work trip generation rates include flexible and compressed work weeks, the ability to work at home and continued spreading of the peak period. Non-work trip rates are assumed to increase to reflect increased discretionary travel for the growing number of retirees in the population.

Table G.3 shows the global adjustment factors that are currently being used in the model. The adjustments shown for 2006 are to correct for the over simulation factors noted above and to adjust for differences between the Census and TTS population numbers. The Census population figures include those living in nursing homes, prisons, hospitals and other collective homes, where most residents make fewer trips.

The same factors are used for 2021 and 2031 since the 3% reduction in work trips between 2006 and 2021 represents an aggressive shift in commuting behaviour that favours increased work at home and the influence of an aging population. Metrolinx, in the development of the Regional Transportation Plan, assumed a similar increase in work at home from 5.3% today to 8% in the future[1].

Table G.3 – Global Adjustments Applied to Trip Rates

Description	2006	2011	2016	2021	2031
Work to home destination factor	0.95	0.94	0.92	0.92	0.92
Work to non-home destination factor	1.00	0.99	0.99	0.99	0.99
Auto non-work origin factor	0.99	1.00	1.02	1.05	1.05
Transit from home factor	0.98	0.99	1.02	1.04	1.04
Transit non-home to home destination factor	0.97	0.97	0.97	0.97	0.97

[1] Metrolinx RTP, Backgrounder: Modelling Methodology and Results, pg 10, October 2008

7. Mode Split

Mode split factors are applied in a sequential fashion to adjust the future person-trip demands into future travel demands by mode of travel. The sequence of application is:

- Other (Walk and Cycle);
- GO Rail; and
- Local Transit.

The remaining trips are assumed to be made by automobile (driver or passenger). For GO Rail trips, the model applies mode split factors to trips made by GO Rail to reflect those who leave the GO train and continue their trip by auto versus local transit.

Calibration of the mode split component of the model was undertaken using the model trip generation and mode split procedures and the 2006 TTS population and employment figures. The resulting auto and transit person-trip totals were compared to the 2006 TTS trip totals, the results of which are summarized in **Table G.4**.

On an overall basis, the model does a good job in simulating observed transit trip making to and from Halton Region. For internal transit trips, the model is over simulating local transit usage in Halton Region by approximately 1,840 person-trips during the three hour peak period (3,440 simulated transit trips versus 1,600 observed).

There are two key factors contributing to this difference. Firstly, as previously discussed, the over simulation in the trip generation component of the model plays a role in the over simulation of the transit use. For the 3 hour PM peak period this over simulation translates into about 10,750 person-trips across the region (based on trip destinations). The over simulation on the trip generation component is primarily due to the correction for under reporting of discretionary trips in the TTS. Secondly, the under reporting of discretionary travel in the TTS also results in under reporting for the transit use in TTS, particularly during the PM peak period which is highly influenced by student transit use.

Table G.4 – Simulated Versus Transit Trips – 2006 PM Peak Period

2006 Simulated Transit Trips - PM Peak Period

Origin	Dest.>>	Halton Hills	Milton	Oakville	Burlington	Total	Hamilton	Peel	York	Toronto	Durham	Total
Halton Hills		0	0	0	0	0	0	0	0	0	0	0
Milton		0	40	0	0	40	0	0	0	0	0	0
Oakville		0	0	1649	133	1782	24	455	3	177	14	673
Burlington		0	0	67	1552	1619	366	26	0	109	0	501
		0	40	1716	1685	3441	390	481	3	286	14	1174
Hamilton		0	39	0	325	364						
Peel		28	2	265	87	382						
York		0	0	0	0	0						
Toronto		614	552	4629	3492	9287						
Durham		0	0	0	0	0						
Total		642	593	4894	3904	10033						

2006 TTS Transit Trips - PM Peak Period

Origin	Dest.>>	Halton Hills	Milton	Oakville	Burlington	Total	Hamilton	Peel	York	Toronto	Durham	Total
Halton Hills		0	0	0	0	0	0	0	0	0	0	0
Milton		0	18	0	0	18	41	20	0	49	0	110
Oakville		0	0	756	152	908	42	713	0	438	0	1193
Burlington		0	0	56	616	672	478	77	0	86	0	641
		0	18	812	768	1598	561	810	0	573	0	1944
Hamilton		0	15	65	297	377						
Peel		51	50	173	69	343						
York		0	0	19	0	19						
Toronto		534	920	6304	3155	10913						
Durham		0	0	0	0	0						
Total		585	985	6561	3521	11652						

Given these two considerations, and the fact that the difference between simulated and observed transit trips is equivalent to just over 600 trips per hour across the entire region, this difference is negligible in terms of the predictive capabilities of the model. Simulated transit usage from Hamilton, Peel and Toronto to Halton Region is in the same order of magnitude as the observed transit usage in TTS, with simulated trips within 86% of observed.

8. Calibration of Trip Distribution

Changes in trip distribution patterns are complex based on the differences in population and employment growth rates throughout the modelled area and relative attractiveness of travel between different communities. For the calibration of the trip distribution component of a model, the industry standard approach is to compare the trip length distribution between simulated and observed trip making patterns. **Figure G.4** illustrates this comparison of simulated versus observed TTS trip lengths for auto and transit person trips to and from Halton Region for the PM Peak Period. **Table G.5** summarizes the share of person trips within each length category.

Figure G.4 – Simulated Versus Observed Trip Length Distribution

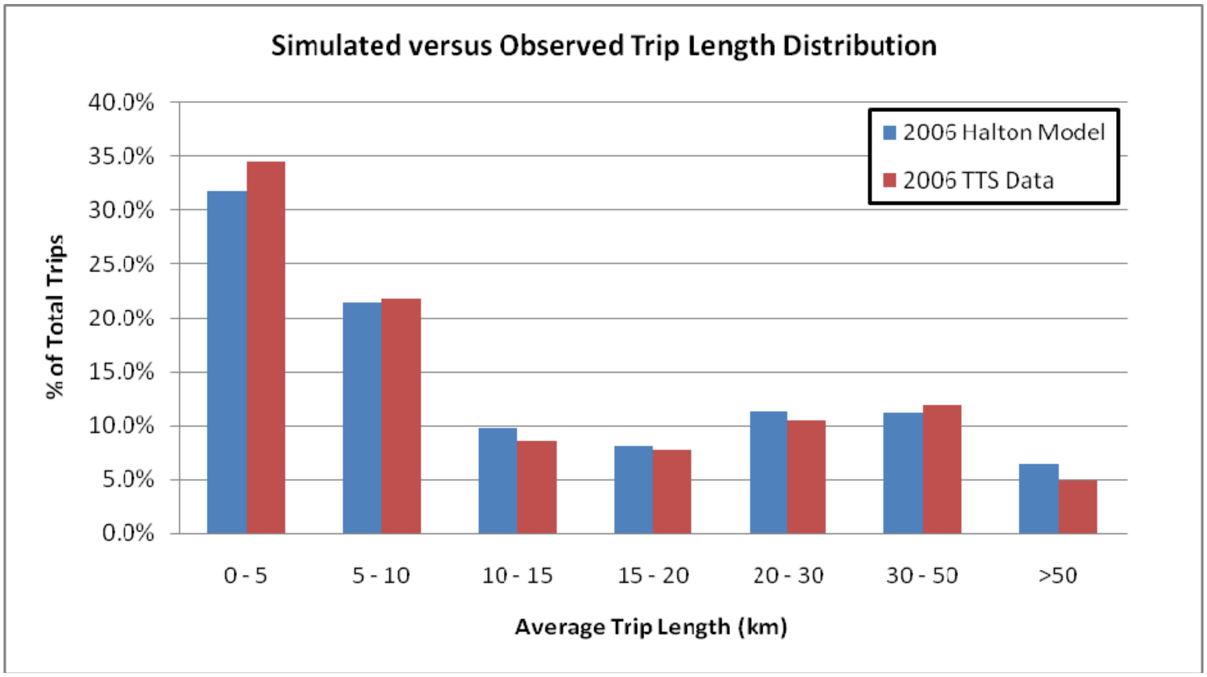


Table G.5 – Simulated Versus Observed Trip Length Distribution

Trip Length Range (km)	Simulated Person Trips	2006 TTS Person Trips
0 - 5	31.8%	34.5%
5 - 10	21.4%	21.8%
10 - 15	9.8%	8.6%
15 - 20	8.1%	7.7%
20 - 30	11.3%	10.6%
30 - 50	11.2%	11.9%
>50	6.4%	5.0%
Sum	**100.0%**	**100.0%**
Note: Excludes walk/cycle trips		

The average trip length simulated by the model is 17.2 kilometres compared to 16.0 kilometres as reported in the 2006 TTS, which represents a slight over simulation of approximately 7%. The trip length data extracted from the TTS is based on the straight line trip distance between origin and destination location while the simulated trip lengths from the model take into account the road network paths between origin and destination. This slight difference in methodology accounts for the main difference in the observed patterns.

9. Road Network Assumptions

The transportation network, described by a series of links and nodes, represents all provincial freeways and highways in the GTA, arterial roads in Halton, Peel and Hamilton, as well as major urban and rural collector roads in Halton. The degree of network detail decreases for areas outside of Halton Region.

Each link representing an existing or planned segment of a roadway was assigned a set of attributes including, a volume delay function, number of lanes, lane capacity, free flow speed and truck percentage. The 2006 base network was updated to reflect the attributes of the major roads in the Region as they existed in 2006 and some additional local road network links were added to the model at the request of Local Municipalities.

A volume delay function is a mathematical relationship that relates travel time on each link of the auto network relative to the defined capacity, an initial free flow link speed and the assigned volume. As the volume approaches or exceeds the capacity of the link the travel time increases exponentially to reflect the delay drivers would experience in congestion.

To model travel behaviour on the toll road (Highway 407), the travel time relationship is expanded to include the toll cost translated into an equivalent time penalty. The assumed value of travel time is $22.67 per hour. This time penalty represents the resistance drivers would face to paying to use the toll road to save time. If there is no time savings between two routes, one tolled and one free, the drivers would use the free route. This approach to forecasting volumes on Highway 407 has been used throughout the GTA for planning level estimates of usage.

Roadway capacity, defined as passenger car units per hour per lane (pcu/hr), was established from GTA-wide transportation modelling experience, field observation, traffic volumes and design standards, and is set as follows:

- Provincial roadways (freeways) – 1,700-1,850 pcu/hr;
- Former and current provincial highways (e.g. RR 5, RR 25, rural section of Highway 7) – 950-1,200 pcu/hr;
- Major rural arterial (e.g. Derry Road, Trafalgar Road) – 850-1,200 pcu/hr;
- Major urban arterial (e.g. Upper Middle Road, Appleby Line in Burlington) – 850 pcu/hr;
- Minor urban arterial (e.g. Rebecca Street, 6th Line in Oakville) – 750-950 pcu/hr;
- Minor rural arterial (e.g. Eighth Line) – 400-750 pcu/hr;
- Rural collectors – 500-700 pcu/hr depending on location; and
- Urban collectors – 400-500 pcu/hr.

9.1 Trucks

There is separate function in the model that estimates the total volume including trucks, using existing observed truck percentages to adjust the simulated auto volumes to reflect the total volume including trucks. This function was used during the assessment of future volume-capacity ratios and the identification of future deficiencies on the road network.

9.2 Regional Screenlines

The screenlines used in the model for analysis purposes are illustrated in **Figure G.5**. These same screenlines were also used for the purpose of the model calibration grouped for this purpose as presented in **Table G.6**.

9.3 Model Validation

Validation of the model consists primarily of comparisons between a 2006 "Base Case" simulation, and available traffic count information. **Table G.7** provides a comparison between the simulated auto volumes from the base case assignment and cordon count/ATR count data across a number of screenlines in the Region. The cordon count data were collected in the spring and summer of 2006 whereas the TTS data used to calibrate the model were collected in the fall. For other locations that are not included in the cordon count program, ATR data from 2004-2006 was used in model validation. Considering the fact that seasonal and daily variation can exist in observed traffic count volumes, along with the use of ATR data from various years, a calibration target of +/- 15% has been used. Since the model does not directly simulate truck trips, for the purpose of model validation, the counts and simulated volumes do not include commercial vehicles.

Figure G.5 – Halton Region Screenlines

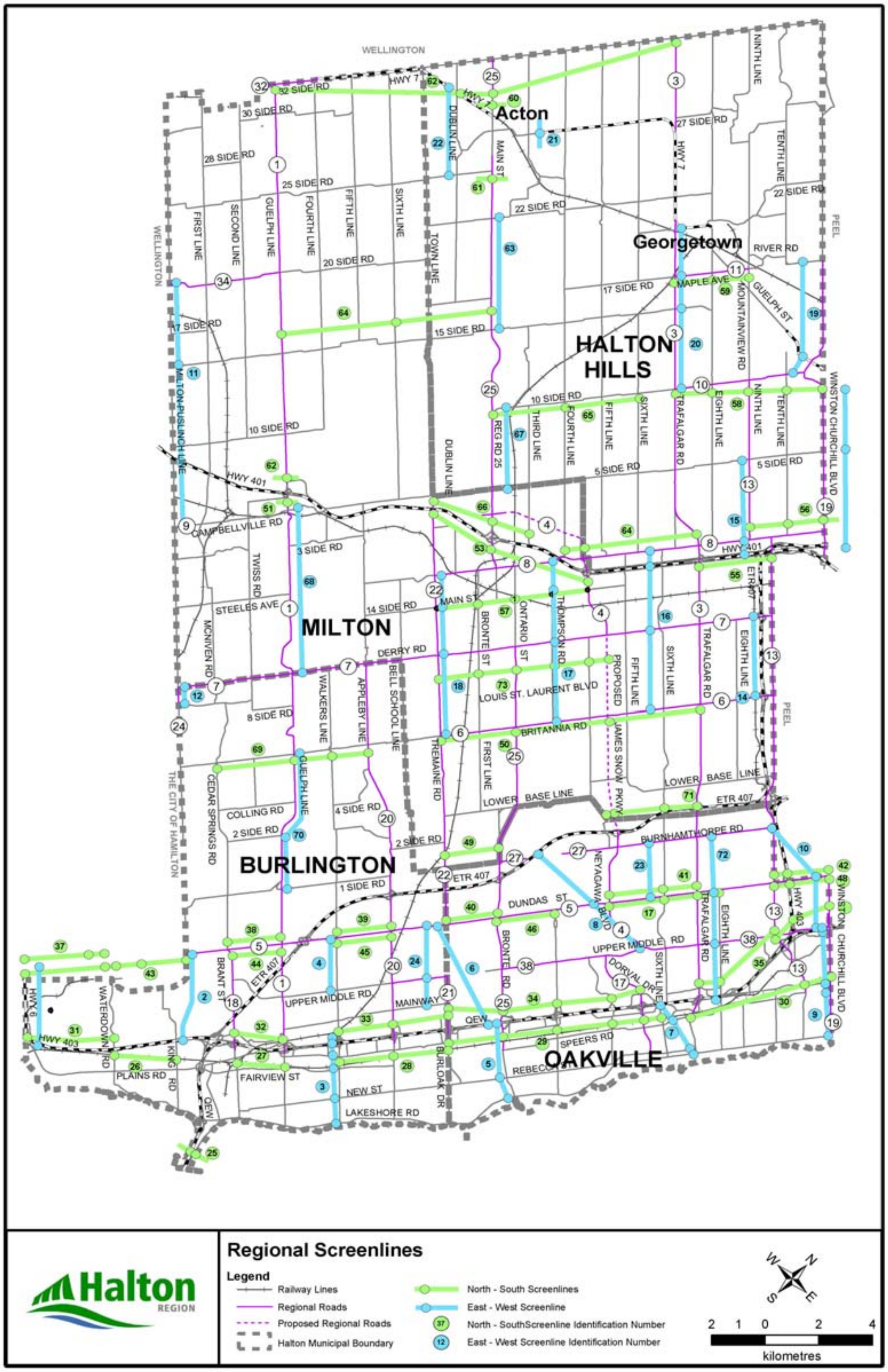


Table G.6 - Correlation of Model Screenlines to Calibration Screenlines

Calibration Screenline	Roads in Calibration Screenline
Northbound / Southbound	
CNR West Oakville	• Bronte Rd at the CNR • 3rd Line at the CNR • 4th Line at the CNR • Kerr St at the CNR • Dorval Dr at the CNR
CNR East Oakville	• Trafalgar Rd at the CNR • Chartwell Rd at the CNR • Ford Dr at the CNR • Winston Churchill Blvd at the CNR
403 Corridor	• Highway 403 North of the QEW • Winston Churchill Blvd South of Dundas St
Milton North	• Regional Rd 25 North of Highway 401 • 4th Line North of Steeles Ave
Halton Central North	• Trafalgar Rd North of Highway 401 • James Snow Pkwy North of Highway 401 • Regional Rd 25 North of Highway 401 • Guelph Line North of Highway 401 • Regional Rd 25 North of Highway 401 • 4th Line North of Steeles Ave
Georgetown South	• Trafalgar Rd South of #10 Side Rd • 8th Line South of #10 Side Rd • 9th Line South of #10 Side Rd • 10th Line South of #10 Side Rd • Winston Churchill Blvd South of #10 Side Rd
Georgetown North	• 9th Line South of Wildwood Rd • Wildwood Rd North of Silver Creek • Highway 7 North of #20 Side Rd
CNR West Burlington	• Waterdown Rd at CNR (North of Plains Rd) • King Rd at the CNR • Brant St at the CNR
CNR East Burlington	• Guelph Line at the CNR • Walkers Line at the CNR • Appleby Line at CNR • Burloak Dr at the CNR
South of Dundas in Burlington	• Kerns Rd South of Dundas St • Brant St South of Dundas St • Guelph Line South of Dundas St • Highway 407/ETR South of Dundas St • Northampton Blvd South of Dundas St • Walkers Line South of Dundas St • Appleby Line South of Dundas St • Orchard Drive South of Dundas Street
South of Dundas in Oakville	• Highway 25 South of Dundas St • 3rd Line South of Dundas St • Neyagawa Blvd South of Dundas St • 6th Line South of Highway 5 • Trafalgar Rd South of Dundas St • 8th Line South of Dundas St • 9th Line South of Dundas St
Milton South	• 1st Line South of Derry Rd • Regional Rd 25 South of Derry Rd • 3rd Line South of Derry Rd
Halton Central South	• 9th Line South of Highway 401 • Trafalgar Rd South of Highway 401 • 5th Line South of Highway 401 • James Snow Pkwy South of Highway 401 • Highway 25 South of Highway 401 • Tremaine Rd South of Highway 401 • Guelph Line South of Highway 401

Calibration Screenline	Roads in Calibration Screenline
Skyway	• Beach Blvd North of Liftbridge • QEW North of the Skyway Bridge
Acton North	• Regional Rd 25 North of Highway 7
Halton North	• Guelph Line South of Halton/Wellington Boundary • Highway 7 East of Dublin Line • Regional Rd 25 North of Highway 7 • Trafalgar Rd South of Halton/Wellington Boundary
Eastbound / Westbound	
Acton West	• Highway 7 East of Dublin Line • 25 Side Rd East of 1st Line
Bronte Creek	• Dundas St at Bronte Creek • QEW at Bronte Creek • Lakeshore Rd at Bronte Creek
16 Mile Creek	• Highway 407/ETR East of Regional Rd #25 • Dundas St at Oakville Creek • Upper Middle Rd at Oakville Creek • QEW at Oakville Creek • Lakeshore Rd at Oakville Creek • Rebecca St at Oakville Creek
Oakville South - Halton to Peel	• Lakeshore Rd West of Winston Churchill Blvd • Royal Windsor Dr West of Winston Churchill Blvd • South Sheridan Rd West of Winston Churchill Blvd • QEW West of Winston Churchill Blvd • Upper Middle Rd West of Winston Churchill Blvd • Dundas St West of Winston Churchill Blvd
Halton/Peel between Highway 403 and 401	• Britannia Rd West of 9th Line • Derry Road West of 9th Line • Lower Base Line West of 9th Line • Highway 403 West of Winston Churchill Blvd
Halton/Peel North	• Steeles Ave West of Winston Churchill Blvd • #5 Side Rd West of Peel Boundary • Highway 7 East of Winston Churchill Blvd • Highway 401 West of Winston Churchill Blvd • Highway 407 ETR West of Winston Churchill Blvd
Milton East	• Derry Rd East of 3rd Line (Thompson Rd) • Main St East of Thompson Rd • Steeles Ave East of Thompson Rd
Milton West	• Highway 401 West of Dublin Line • Steeles Ave West of 1st Line • Main St West of 1st Line (CNR) • Derry Rd West of Bronte St
Halton/Peel at Hwy 401/407	• Highway 401 West of Winston Churchill Blvd • Highway 407 ETR West of Winston Churchill Blvd
Halton West - South Section	• Kilbride St East of the Halton/Hamilton Boundary • Campbellville Rd East of Townline Boundary
Halton West - North Section	• Highway 401 East of 1st Line • #15 Side Rd East of Halton/Wellington Boundary • #20 Side Rd East of Halton/Wellington Boundary
Georgetown West	• #17 Side Rd West of Trafalgar Rd • #15 Side Rd West of Trafalgar Rd • #10 Side Rd West of Trafalgar Rd
Georgetown East	• Highway 7 East of Winston Churchill Blvd • River Drive East of the Credit River
Burlington West End	• Plains Rd East of the Halton/Hamilton Boundary • Highway 403 East of Highway 6
Indian Creek	• Dundas St West of Kerns Rd • Highway 403 East of King Rd • North Service Rd East of King Rd • Lakeshore Rd East of King Rd • Plains Road West of the QEW • Orchard Drive South of Dundas Street

Table G.7 Model Validation Results

Screenline	Capacity per dir.	Eastbound 2004/2006 Counts	Eastbound 2006 Sim	Eastbound Ratio - Sim/Count	Eastbound V/C - Sim	Westbound 2004/2006 Counts	Westbound 2006 Sim	Westbound Ratio - Sim/Count	Westbound V/C - Sim
Bronte Creek	8,450	6730	6709	1.00	0.79	8307	8595	1.03	1.02
16 Mile Creek	15,500	9153	10824	1.18	0.70	13974	15751	1.13	1.02
Oakville South - Halton to Peel	12,500	5931	7533	1.27	0.60	8102	9498	1.17	0.76
Halton/Peel between Highway 403 and 401	8,900	3817	4041	1.06	0.45	6593	6247	0.95	0.70
Halton/Peel North	11,750	6799	5064	0.74	0.43	9730	8470	0.87	0.72
Milton East	5,300	2063	1763	0.85	0.33	2786	2045	0.73	0.39
Milton West	7,950	3388	3826	1.13	0.48	5421	5252	0.97	0.66
Halton West - South Section	1,700	119	114	0.95	0.07	341	356	1.04	0.21
Halton West - North Section	1,350	3265	3038	0.93	2.25	3894	4738	1.22	3.51
Georgetown West	1,100	178	588	3.30	0.53	166	468	2.82	0.43
Georgetown East	1,800	587	903	1.54	0.50	1068	1367	1.28	0.76
Burlington West End	6,800	4587	4818	1.05	0.71	5245	5716	1.09	0.84
Indian Creek	11,950	6244	7560	1.21	0.63	9429	10442	1.11	0.87
Total - All Screenlines	**95050**	**52,861**	**56,780**	**1.07**	**0.60**	**75056**	**78947**	**1.05**	**0.83**
		Northbound				**Southbound**			
CNR West Oakville	8,500	4083	4005	0.98	0.47	4316	3781	0.88	0.44
CNR East Oakville	6,550	4370	3649	0.83	0.56	3872	2625	0.68	0.40
403 Corridor	5,500	3622	4350	1.20	0.79	3475	3292	0.95	0.60
Milton North	2,200	994	802	0.81	0.36	962	740	0.77	0.34
Halton Central North	7,500	4150	2942	0.69	0.39	3226	2828	0.90	0.38
Georgetown South	3,800	2850	2663	0.93	0.70	1108	1392	1.26	0.37
Georgetown North	2,400	1236	1646	1.33	0.69	637	1279	2.01	0.53
CNR West Burlington	4,150	2104	1661	0.79	0.40	2024	1733	0.86	0.42
CNR East Burlington	8,700	4089	4197	1.03	0.48	6594	5542	0.84	0.64
South of Dundas in Burlington	13,600	4281	5754	1.34	0.42	6870	6731	0.98	0.49
South of Dundas in Oakville	11,450	3926	4135	1.05	0.36	3950	3655	0.93	0.32
Milton South	1,700	1180	1007	0.85	0.59	1062	1370	1.29	0.81
Halton Central South	7,050	3900	3786	0.97	0.54	4001	3528	0.88	0.50
Skyway	8,050	4771	3325	0.70	0.41	7722	5941	0.77	0.74
Total - All Screenlines	**281,250**	**45,556**	**43,921**	**0.96**	**0.16**	**49,819**	**44,436**	**0.89**	**0.16**

10. Screenline Validation Results

For the few screenlines where the simulated versus observed volumes do not fall within the +/- 15% validation targets a review of the results was undertaken to determine if changes were needed to the model. A brief discussion of some of the observed differences in screenline validation results is provided below in **Table G.8.**

Table G.8 - Validation Observations

Screenline: 16 Mile Creek	Variance: 18%
The over simulation at the 16 Mile Creek, Oakville South Screenlines are related to differences between the modelled and observed volumes on the QEW. Due to the extensive congestion and unstable flow that occurs on the QEW during the PM peak period, traffic counts are only able to reflect the number of cars that passed through the area under stop and go conditions, while the model represents a true picture of the auto demand. The difference between the demand and the capacity is what causes the queues that regularly form on this section of QEW.	
Screenline: Indian Creek	Variance: 21%
A similar pattern was observed at the Indian Creek Screenline, where simulated volumes on Highway 403 were higher than the counts due to congested conditions on this section of Highway 403 during peak periods. If the Highway 403 is excluded the simulated volume using the Regional and local roads on this screenline is within 12% of observed volumes. No changes to the model are required to correct for this condition.	
Screenline: Georgetown East and West	Variance: 230%
The differences between simulated and observed volumes at the Georgetown East and West screenlines are higher than the 15% target primarily due to the low volumes crossing these two screenlines. The actual difference in simulated versus observed traffic volumes for each of these locations is less than 400 vehicles per hour. Correction factors will be used to adjust modelled volumes on this screenline to better match observed patterns.	
Screenline: CNR East	Variance: 32%
The differences at the CNR East screenline in Oakville are due to a general under simulation in the model although it is noted that the count data used for this screenline features counts from different years, which may be part of the reason for the differences in both directions. No changes to the model are required to correct for this condition.	

Screenline: Milton North	Variance: 23%
At the Milton North screenline the simulated versus observed volumes do not meet the 15% threshold, although it is noted that this is a very short screenline with relatively low volumes that can tend to magnify the differences. In absolute terms the difference is only 190 - 220 vehicles per hour for the northbound and southbound directions respectively. No changes to the model are required to correct for this condition.	
Screenline: Halton Central North	Variance: 31%
The northbound direction at the Halton Central North screenline is under simulating compared to count data; however this may be due to the large traffic zones in this area making it difficult to simulate the interaction with local developments along the various arterial roads. Since the southbound direction is simulating within 10% of observed volumes a correction factor will be used in analysis of the results for this screenline to correct for the under simulation.	
Screenline: Georgetown North	Variance: 100%
A similar approach will be used for the Georgetown North screenline, where the model is over simulating in both directions of travel. The volumes on this screenline are low, and therefore small differences in volumes are magnified. In the northbound direction the total difference is about 400 veh/hr across the three roads crossing the screenline. In the southbound direction the difference is about 600 veh/hr. Correction factors will be used to adjust modelled volumes on this screenline to better match observed patterns.	
Screenline: South of Dundas	Variance: 34%
The South of Dundas screenline in Burlington is over simulating in the northbound direction, however this is primarily due to an over simulation of northbound volumes on Highway 407. If the Highway 407 link is ignored, the model is simulated within 5% of observed volumes on the remaining local and Regional roads crossing this screenline. In the southbound direction the model matches observed volumes within 2%. No changes to the model are required to correct for this condition as the impact of this over simulation on the Regional road network is limited.	
Screenline: Skyway	Variance: 30%
The under simulation at the Skyway screenline may also be related to the over simulation observed at the Indian Creek screenline, where Highway 403 volumes in the model are higher than observed counts. As this is at the edge of the road network for the Halton model and the Hamilton area is represented by large aggregated traffic zones, the simulation of the route choice between the QEW and Highway 403 for trips to /from Hamilton may be contributing to both of these differences. Since this screenline only includes Beach Boulevard and QEW the impacts on the Halton Region road network are relatively minor in nature. No changes to the model are required to correct for this condition. A similar pattern was observed at the Indian Creek Screenline, where simulated volumes on Highway 403 were higher than the counts due to congested conditions on this section of Highway 403 during peak periods. If the Highway 403 is excluded the simulated volume using the Regional and local roads on this screenline is within 12% of observed volumes. No changes to the model are required to correct for this condition.	

11. Forecasting Future Trip Making for Milton Education Village

The TMP analysis includes the proposed Milton Education Village, a proposed multi-use educational complex, in the vicinity of Tremaine Road and Britannia Road, which combines population, retail and institutional employment, along with about 15,000 new post-secondary students attending classes within the site. The Halton Regional model generates trips based on estimates of population and employment within the Region, but does not explicitly consider trips made by post-secondary students in the trip generation stage.

Population and employment related to the residential units in the mixed use neighbourhood and employment at the new campus and retail land uses have been included in the overall population and employment forecasts. Therefore, to accurately assess the impacts of this proposed new campus on the Regional Road system a separate approach was required to estimate the trips made by the students attending the new campus.

The post-secondary education village will be attended by approximately 15,000 students with on-campus residence available. For the purpose of this assessment it was assumed that 15% of the students would live in residence. Approximately 10% of students attending the University of Toronto Mississauga Campus currently live in residence. Given the location of the Milton Education Village, outside of the built up area, a slightly higher rate of students living in residence was assumed.

The process for determining the future trip making for the new student trips followed a traditional four-step demand forecasting process, implemented within a spread sheet. The resulting auto trip matrix was imported into the Halton Region EMME model and was added to the PM peak hour auto trip matrix and was then re-assigned to the road network.

The trip generation, distribution, and mode split assumptions used to forecast the future student trips are briefly described below.

11.1 Trip Generation

Trip generation rates for post-secondary student trips were determined based on the 2006 TTS data for the Greater Golden Horseshoe, which includes a number of post-secondary institutions in both urban and more rural communities. Based on the number of trips made in the PM peak period (4:30 PM -7:30 PM) by students 19 and over to and from school, trip generation rates were developed.

These rates, summarized in **Table G.9**, correspond to the peak period for auto traffic rather than the peak period for school trips. A peak hour factor of 0.402 was used to convert the peak period trips to peak hour trips, based on the same peak hour factor used in the Halton Region model (based on 2006 TTS data). **Table G.10** summarizes the forecast PM Peak Period auto trips for the Milton Education Village.

Table G.9 – GTA Post-Secondary Student Trip Rates

<table>
<tr><th>PM Peak Period Trips</th><th>2006 Student Person Trips</th><th>2006 Student Population</th><th>Trip Rate</th></tr>
<tr><td>Attractions: To School From All Origins</td><td>19,816</td><td rowspan="2">438,138</td><td>0.045</td></tr>
<tr><td>Productions: From School to All Destinations</td><td>66,431</td><td>0.152</td></tr>
</table>

Table G.10 – PM Peak Period Auto Trip Generation – Milton Education Village

<table>
<tr><th>PM Peak Period Trips</th><th>Students</th><th>Students Living Off Campus</th><th>PM Peak Period Person Trips</th><th>PM Peak Hour Person Trips</th></tr>
<tr><td>Attractions: To School From All Origins</td><td rowspan="2">15,000</td><td rowspan="2">12,750 (85%)</td><td>574</td><td>232</td></tr>
<tr><td>Productions: From School to All Destinations</td><td>1,938</td><td>777</td></tr>
<tr><td colspan="3">Total Person Trips</td><td>2,512</td><td>1,009</td></tr>
</table>

11.2 Auto Trip Distribution

Future trip distribution for student trips living off campus was based on the 2031 distribution of population living within Halton Region. For trip distribution purposes it was assumed that none of the students at the facility would live in external municipalities and commute to school. **Table G.11** summarizes the trip distribution for student trips.

Table G.11 – 2031 PM Peak Period Auto Trip Generation

Municipality	Student Trips	
	To School	**From School**
Oakville	75	255
Burlington	57	192
Milton	71	237
Halton Hills	28	93
Total Halton Region	231	777

11.3 Mode Split

There currently is no regular transit service to the future Milton Education Village area, and this is reflected in the current low transit mode split for this area used in the model.

For the Trend transit scenario (status quo on transit usage) it was assumed that there is no increase in transit use to/from this area and all students will arrive by automobile. For the Enhanced transit scenario a 2% transit mode split was assumed for student trips to and from the Education Village.

An auto occupancy rate of 1.37 was assumed for trips to / from the Education centre based on the average PM peak period auto occupancy for school trips observed in the 2006 TTS. These assumptions were built into the development of the future PM peak hour trips forecast for the Milton Education Village, as summarized in **Table G.12.**

Table G.12 – PM Peak Hour Student Trip Generation

Municipality	Peak Hour Student Auto Trips Trend Transit		Peak Hour Student Auto Trips Enhanced Transit	
	To School	**From School**	**To School**	**From School**
Oakville	55	186	54	182
Burlington	42	140	41	137
Milton	52	173	51	170
Halton Hills	20	68	20	66
Total Halton Region	**169**	**567**	**166**	**555**

Based on the above assumptions and calculations a PM Peak Hour Auto Driver matrix for student trips was generated and added to the auto driver matrix generated from the Halton Region model. Trips to and from Local Municipalities were distributed to the various traffic zones based on the overall distribution of future trips. The same assumptions and trip generation parameters were used for both the 2021 and 2031 horizon years, assuming full build out of the education village by 2021.

12. Conclusions

On an overall basis the model provides a good level of correlation with observed traffic volumes crossing major screenlines within Halton Region. Most screenlines show simulated volumes within 15% of observed volumes and there is an acceptable level correlation between peak directions and reverse flows as well. In the east-west direction the model is simulating within 5-7% of observed volumes, and in the north-south direction the overall difference is within 4-11%. Based on the average of all screenlines the model is generally simulating traffic within 2-3% of observed volumes.