Appendix D: Aimsun Model Development and Calibration

TECHNICAL MEMORANDUM

TO: Margaret Mikolajczak, C.E.T., MTO

CC: Aaron Janke, Ramon Hylton; MTO

Marta Roias; RPP; Musa Deo, P. Eng.; Christopher Tam, P.Eng.,

City of Vaughan

FROM: Qingjie Zeng, P. Eng.; Keyur Shah, P.Eng., WSP

SUBJECT: Weston 7 Secondary Plan - Transportation Master Plan (TMP) and Vaughan Metropolitan Centre (VMC) TMP Update Studies: Calibration of an Aimsun-based Micro-Simulation Model for Traffic Operational Analysis

DATE: February 12, 2021

INTRODUCTION

The City of Vaughan initiated a Weston Road and Highway 7 Secondary Plan - Transportation Master Plan Study, and Vaughan Metropolitan Centre Transportation Master Plan Update Study. The primary objectives of these two TMP studies to examine future transportation needs in these two Secondary Plan areas. WSP Canada Inc. has been retained by the City to carry out these two TMP studies.

A technical memorandum summarising WSP's proposed approach and methodology for the travel demand modelling and traffic operational analysis, submitted to MTO on November 5, 2020 for the Weston 7 Secondary Plan Transportation Master Plan (Weston 7 SP TMP) Study, and Vaughan Metropolitan Centre Secondary Plan Transportation Master Plan update (VMC SP TMP) and advancement and completion of two EA Studies to Phases 3 and 4 for Interchange Way and Millway Avenue.

Following the submission of the proposed approach and methodology, MTO Traffic noted that Aimsun based micro-simulation analysis will be required for these two studies, and a technical memorandum shall be submitted for approval of the model calibration by MTO Traffic Planning. This technical memorandum describes the study methodology considered for travel demand forecasting, developing the micro-simulation model, calibration and validation results, and next-steps for traffic operational analysis.

610 Chartwell Road
Suite 300
Oakville, ON, Canada L6J 4A5

T: +1 905-823-8500
F: +1 905-823-8503
wsp.com

CONTEXT

The Weston Road and Highway 7 (Weston 7) Secondary Plan Area is one of the City of Vaughan's Primary Growth Centres, as defined in the Vaughan Official Plan (VOP 2010). The Secondary Plan will establish the policy framework to support a transit-supportive and pedestrian-friendly centre with a mix of land uses. The Weston 7 plan area is centered around the Weston Road and Highway 7 intersection; bounded by Fieldstone Drive and Portage Parkway to the north, Highway 400 to the east, Highway 407 to the south and Ansley Grove Road/Whitmore Road to the west.

The Vaughan Metropolitan Centre (VMC) Secondary Plan Area is located immediately east of the West 7 Secondary Plan Area, separated by Highway 400. The VMC is Vaughan's 'downtown' area, which is planned to provide a mixed-use centre with a concentration of high-density of employment and housing. The VMC area is generally bounded by Portage Parkway to the north, Creditstone Road and Maplecrete Road to the east, Highway 407 to the south and Highway 400 to the west.

BACKGROUND

Weston 7 Secondary Plan and Transportation Master Plan

The Weston 7 Secondary Plan Area is one of the City's Primary Growth Centres, as defined in the Vaughan Official Plan (VOP 2010). The Weston 7 Secondary Plan will identify an enhanced vision of what the Weston Road and Highway 7 area can become within the next 20 years and beyond. Phase 1 of the Weston 7 Secondary Plan was completed as a high-level visioning exercise and provided the existing transportation planning study area context and conditions. Phase 1 also evaluated the existing conditions and identified transportation opportunities and challenges for the Weston 7 Secondary Plan area to be explored and analyzed in the next phases of study in support of growth and transformation of the Secondary Plan area (Phase 1 Status Update Report).

Following Council direction in June 2019, Vaughan is now continuing with the next phases to complete the Weston 7 Secondary Plan. WSP has been retained by the City to carry out the Weston 7 Secondary Plan - Transportation Master Plan (TMP) Study, which satisfies the requirements in accordance with Phases 1 and 2 of the Municipal Class Environmental Assessment (MCEA) process. The Weston 7 TMP will proceed concurrently with a Secondary Plan study. This Secondary Plan study will, among other outcomes, finalize the land uses and densities for the area.

VMC Secondary Plan and Transportation Master Plan Update

The VMC continues to be planned and developed as the City's 'downtown' area, with a long-term vision to create a dynamic and complete community that is the heart of Vaughan, economically, culturally and physically. It is supported by strong transportation infrastructure including connections to the provincial highway system (Highway 400 and 407ETR), York Region Transit (YRT) Viva bus rapid transit network, the Toronto Transit Commission (TTC) subway system, separated cycling facilities and high-quality pedestrian spaces. The in-effect VMC Secondary Plan, as identified by Schedule 14-A of the Vaughan Official Plan 2010 (VOP 2010), was adopted by Vaughan Council on

September 7, 2010, and forms part of Volume 2 of VOP 2010. It was approved, with modification, by York Region on June 28, 2012. The most recent appeals to the Secondary Plan were approved by the Local Planning Appeal Tribunal (LPAT) on November 30, 2018 (LPAT order issued on December 16, 2019), while certain sections of the Plan remain under appeal.

Following the opening of the VMC TTC subway station and other major transportation improvements within the area, the downtown has rapidly evolved with unprecedented growth. These transportation improvements, along with significant residential development, have contributed to the increase in the local population. Due to VMC's rapid growth and updates to provincial legislation and policies, an update to the VMC Secondary Plan is required.

The VMC TMP will support the VMC Secondary Plan update, provide directions on updating and improving the multi-modal transportation network. The VMC TMP will be conducted in accordance with the Municipal Engineers Association's Municipal Class Environmental Assessment process.

Scope of Works for both Studies

The Weston 7 TMP and VMC TMP Update will include the evaluation and assessment of conceptual land use and built form scenarios, analysis and identification of a preferred transportation multi-modal network alternative and will provide input to inform associated implementation policies in the development of the Secondary Plans. Broadly, the scope of work for both the TMP Studies will include the following:

- Satisfy Phases 1 and 2 of the Municipal Class Environmental Assessment;
- Assess and evaluate grid street network options to support future land use / growth to maximize connectivity and efficiency;
- Evaluate an active transportation network which is comfortable and safe, and provides connectivity to key destinations;
- Use a Multimodal Level of Service approach to evaluate network connections and infrastructure;
- Evaluate the impacts of new mobility options, and
- Develop a travel demand management and parking strategy.

In order to plan for a transportation network and infrastructure needs that support the Weston 7 Secondary Plan and the VMC Secondary Plan areas respectively, the scope of works for both TMP studies includes detailed traffic operational analysis (using an *Aimsun* based micro-simulation modelling software) to evaluate the existing transportation conditions, and to identify multi-modal transportation improvements, as mentioned above. While the focus of the traffic operational analysis is on vehicular traffic, the overall TMP studies evaluations and assessments will take a multi-modal approach with priority active transportation and capitalizing on significant transit investments in the Secondary Plan areas.

STUDY AREA FOR TRAVEL DEMAND MODELLING AND TRAFFIC OPERATIONAL ANALYSIS

The boundaries for both the Weston 7 and VMC Secondary Plans are highlighted in blue and yellow in **Figure 1**, respectively.

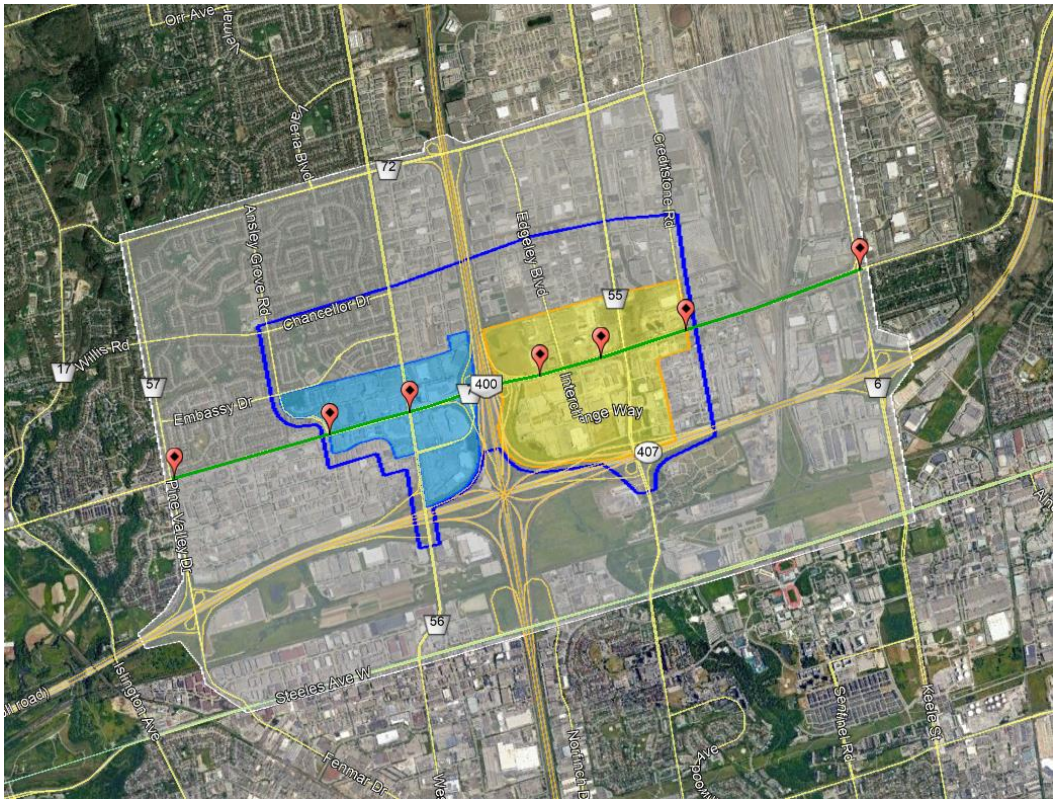


Figure 1: Weston 7 and VMC Secondary Plan Areas and TMP Traffic Analysis Model Boundaries

Figure 1 presents boundaries for the micro-simulation analysis (Aimsun model), marked in dark blue colour extend from Chancellor Drive and Pennsylvania Avenue to the north, Creditstone Road to the east, the 407ETR to the south and Ansley Grove Road to the west. The York Region's Travel Demand Forecasting (YRTDF) model encompassing the entire GTA, will be used for this study.

The sub-area model boundary extends up to Langstaff Road in the north, Keele Street in the east, Steeles Avenue in the south and Pine Valley Drive in the west. The boundaries of the travel demand and traffic operational analysis extend beyond both the Weston 7 and VMC Secondary Plan areas in order to better capture traffic movements in and out of the Secondary Plan area.

MODELLING APPROACH

TRAVEL DEMAND FORECASTING (EMME MODELS)

The micro-simulation model for the Weston 7 TMP and VMC TMP studies is built on origin-destination auto demand data extracted from the York Region Travel Demand Forecasting (YRTDF) model - an *Emme*-based model that estimates travel demand and patterns in the Greater Toronto and Hamilton Area for the morning peak hour with refinements to enhance travel demand forecasts within York Region. YRTDF modelling files for the 2016, 2031 and 2041 planning horizons were provided by York Region for this analysis. The current version of the YRTDF was used in the York Region TMP Study, which considers 45% intensification target for the 2031 and 2041 planning horizon years.

In addition to the most recent available proposed Region-wide land use (i.e. population and employment) forecast, the City and Region's planned and proposed transportation network improvements are also incorporated in the model. To conduct additional travel demand analysis for both studies, a sub-area model was extracted from the YRTDF model.

Figure 2 sets out the proposed methodology on how the YRTDF model is applied in generating the travel demand forecast, with additional detail in outlining each step thereafter.

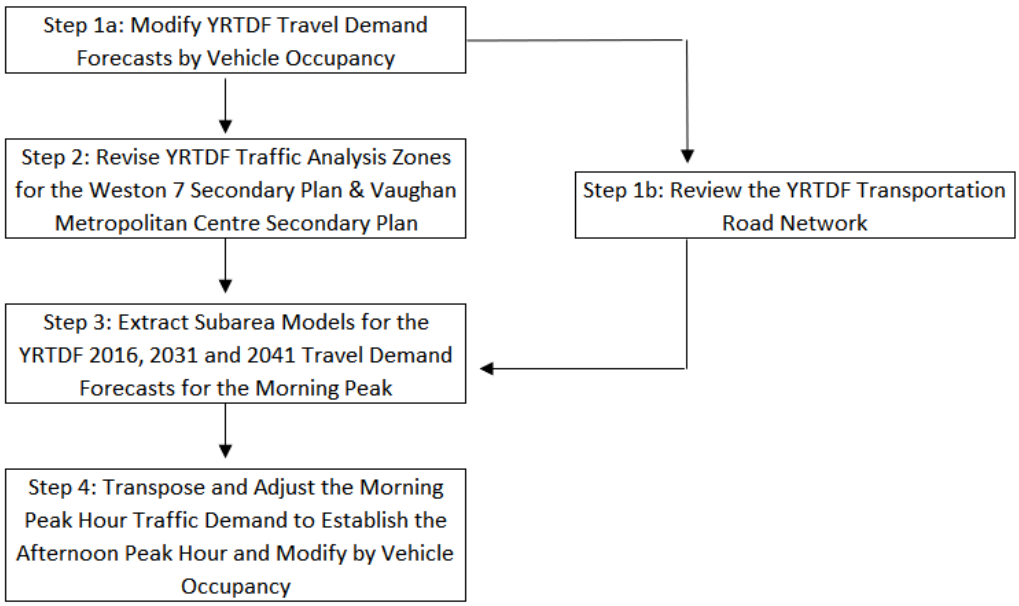


Figure 2: Flowchart showing approach and methodology for Travel Demand Modelling

Step 1a: As the future planning horizons from the YRTDF model are currently estimated for automobile trips only, the YRTDF model modified to estimate automobile trips by vehicle occupancy. This would establish meaningful high occupancy vehicle (HOV) lane estimates associated with future road improvements. The 'auto driver' O-D matrix (which incorporates all vehicle types) were redistributed into single-occupant vehicles (SOV),

vehicles with two occupants (HOV2) and vehicles with three or more occupants (HOV3+). The vehicle occupancy splits were based on the 2016 TTS data. The mode share split for each vehicle occupancy class calculated and incorporated into the YRTDF demand matrices on a planning district (PD to PD flows) basis, to preserve the original travel demand totals. The 2016 vehicle occupancy proportions were maintained in the future planning horizon year to provide conservative forecasts.

Step 1b: Alongside the travel demand forecasts modifications, the YRTDF analysis also includes a review of the transportation road network for the future planning horizon years for the Weston 7 Secondary Plan study area and the VMC Secondary Plan study area to confirm assumed road network attributes, as well as network improvements and land-use identified in the 2012 City of Vaughan Transportation Master Plan (TMP). Other proposed/planned network improvements for roadways under the jurisdictions of the MTO and York Region will also be included as part of this review for the future planning horizons.

Step 2: Refinements to the study area (e.g. additions and modifications to roadways and traffic analysis zone desegregation) were implemented in both the Emme sub-area model and Aimsun models. The primary objective of this refinements to assign trips to various parts of the zone/local road network according to observed travel patterns and identify impacts of trips travelling using local and minor collector road network which may be not included in the Region's travel demand model.

The original traffic analysis zone system in the YRTDF model assigns a total of eight traffic analytical zones for Weston 7 and VMC Secondary Area (four for each secondary area), as presented in **Figure 3.** The updated traffic analytical zone (TAZ) system considered in the Emme sub-area model is presented in **Figure 4,** considers 21 TAZs for the Weston 7 Secondary Area and 24 TAZs for VMC Secondary area. The remaining six adjacent TAZs in the YRTDF model has been desegregated into 18 TAZs. Therefore, the Emme sub-area model includes a total of 63 TAZs.

Step 3: Following the amendments to the travel demand forecasts and a review of the road network, the sub-area models were extracted from the 2016 and 2021 YRTDF model, corresponding to the 'Travel Demand Model Boundary' as depicted in **Figure 1**. The 2016 subarea model was further reviewed, and additional developments completed in the recent years were added in the 2016 land use based on the review of 2021 sub-area model. The missing road network (e.g. collector and local roads) were also added in the sub-area model. This sub-area model was calibrated with the most recent traffic counts (i.e. ATR and turning movement counts). These adjustment factors will be carried forward for the future condition analysis for 2031, 2041 and full build-out conditions. This refined subarea model provides inputs to develop a microsimulation model (*Aimsun*) for conducting the detailed traffic operational analysis.

Step 4: As mentioned above, the YRTDF model simulates travel demand exclusively for the morning peak hour. Therefore, to evaluate the afternoon conditions, the morning peak hour traffic demand will be transposed to establish initial afternoon peak hour demands. This initial afternoon peak hour travel demand also modified to estimate automobile trips by vehicle occupancy, and then adjusted based on observed traffic volumes (i.e. ATR and turning movement counts) in an effort to better reflect observed travel patterns.

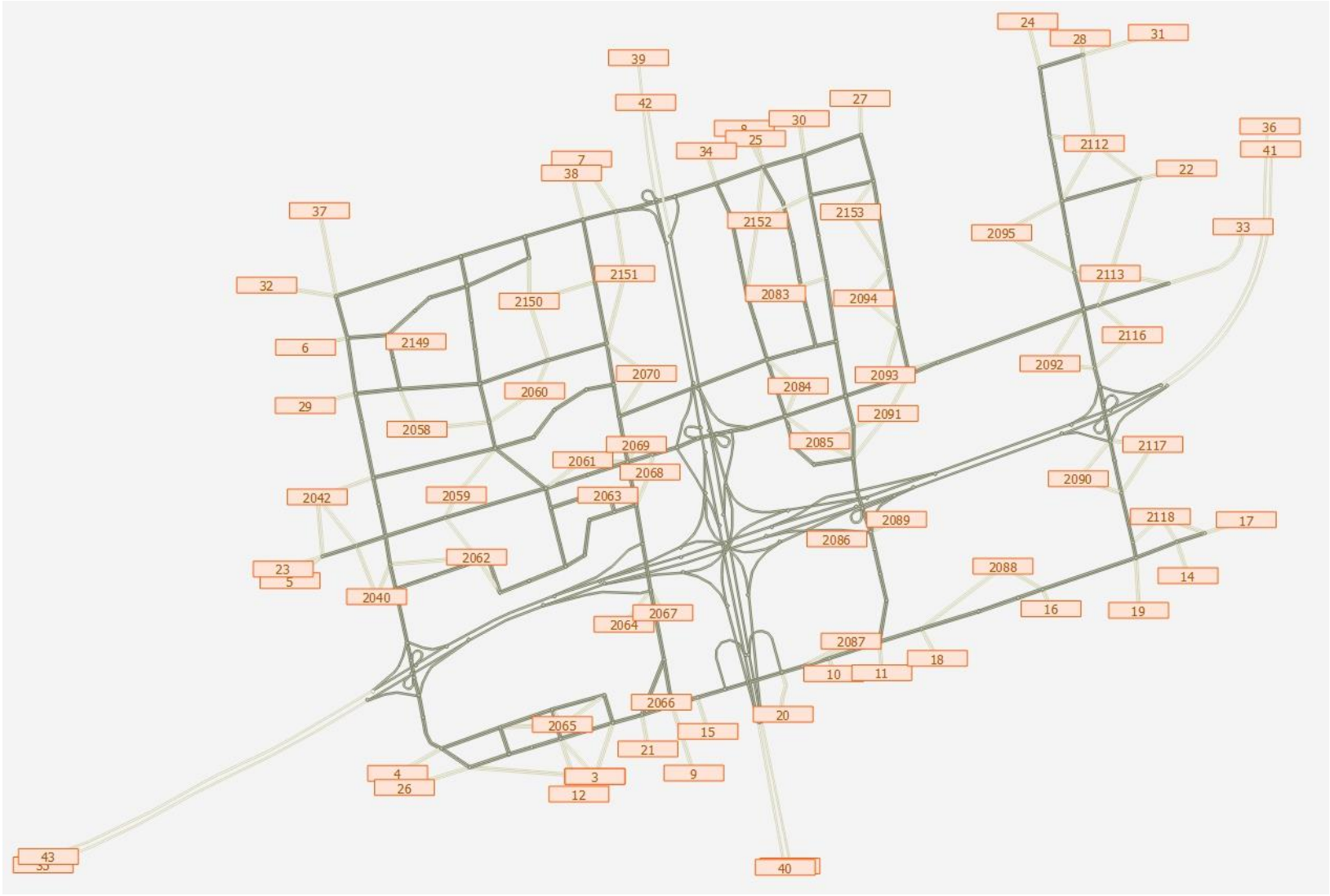


Figure 3: Original Traffic Analytical Zone (TAZ) System in YRTDF Model

Figure 4: Revised TAZ System in Emme Sub-Area Model

AIMSUN MODEL DEVELOPMENT

Aimsun is an integrated traffic modelling program that incorporates macro-scopic functionalities with meso-scopic and micro-scopic traffic simulation. It facilitates detailed assessment of traffic operations for different road network configuration and intersections, combined with dynamic traffic route choice assignment options related to the local road network inclusive of the study area. The Aimsun model for this study builds on information and data extracted from the YRTDF subarea model.

As mentioned above, the refinements to the study area (e.g. additions and modifications to roadways and traffic analysis zone disaggregation) were also implemented in Aimsun models - to assign trips to various parts of the zone/local road network according to observed travel patterns and identify impacts of trips travelling using local and minor collector road network. The TAZ system for Aimsun model is presented in **Figure 5.**

The development of the micro/meso-simulation base model requires a wide range of input data, including:

- Transportation Network - posted speed limits, number of lanes, intersection lane configurations, priority rules/conflict area, transit lanes (for Viva, BRT), etc.;
- Driving Behavior-- desire speed distribution, car following and lane changing parameters;
- Traffic Controls – 'Stop' / 'Yield' signs, traffic signals, placement of 'Stop' bar, detector placement, signal timing plans, turning permissions/restrictions, etc.;
- Travel Demand Inputs (i.e. based on YRTDF model forecast as detailed in the previous section) – traffic volumes, origin-destination pattern, mode share, transit routes and schedules, proportion of commercial vehicles – small/medium and heavy vehicles, variation in demand during peak periods, and
- Calibration Data – traffic counts, field observations of queue lengths at major intersections (including highway ramp terminals) during peak periods, travel time data.

The Aimsun model for this study was developed reflecting existing intersection lane configurations - including, number of through/turning lanes, storage lengths for turning lanes, traffic controls, VIVA transit corridor, etc. which was initially identified based on aerial images and Google Street views, which were confirmed and refined based on the site visit.

vivaNext BRT Rapidway: The vivaNext BRT rapidway opened along Highway 7 at the end of November 2019 as a full dedicated rapidway is also included in the Aimsun model.

The road network included in Aimsun model is presented in **Figure 6**.

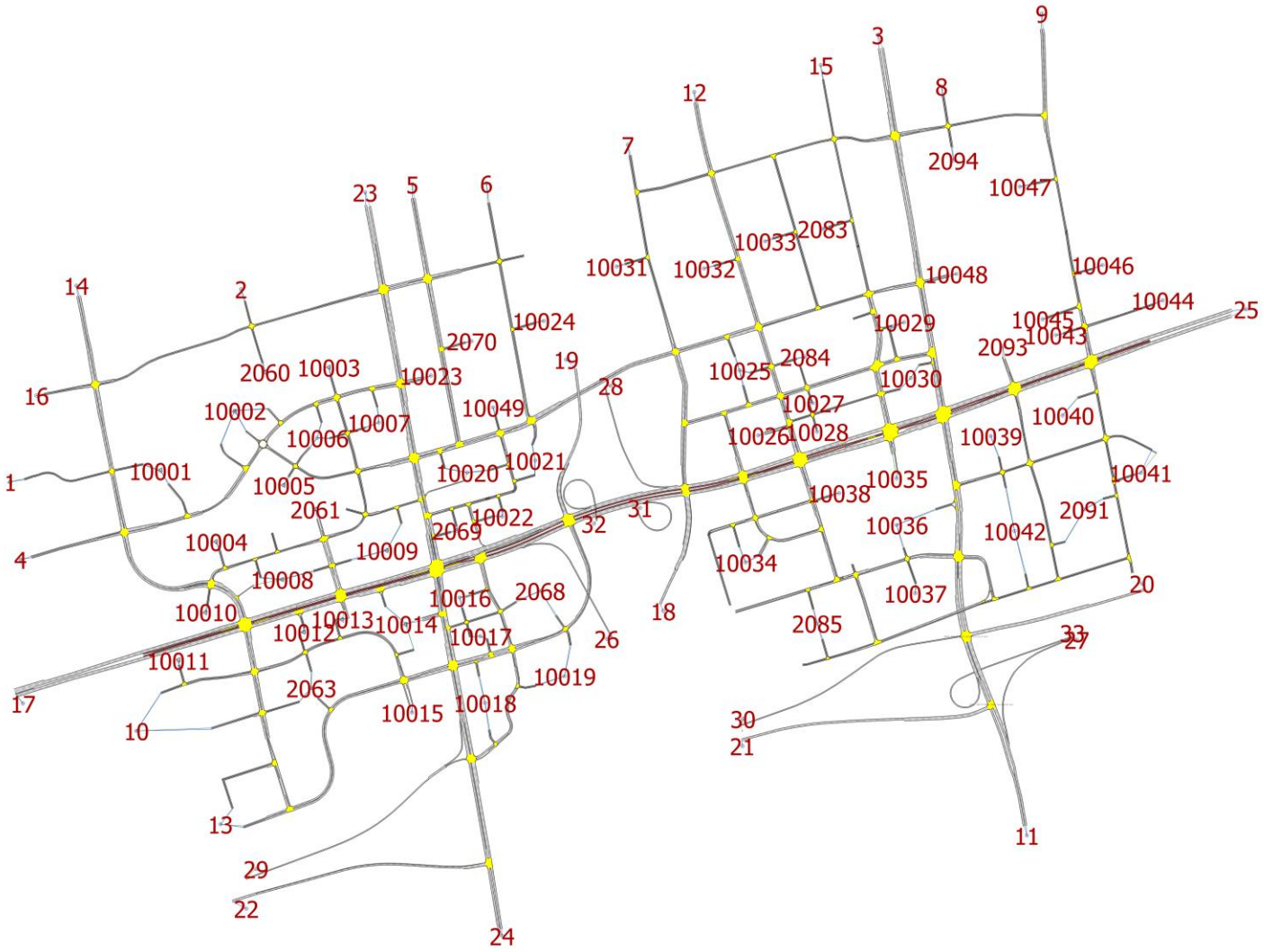


Figure 5: Traffic Analytical Zone System in Aimsun Model

Figure 6: Existing Transportation Network in Aimsun Model

Review of Existing Traffic Data

The traffic data (including TMCs and ATR counts) for the study area were collected from the York Region for the regional road intersections, and from the City of Vaughan for major collector and minor collector roads, and additional counts were received from MTO and *407 ETR* for the ramp terminal intersections.

Additional turning movement counts were collected by WSP in June 2020 and October 2020 for 28 missing study area intersections. To assess the potential impact of COVID-19 on the travel demand during weekday peak hours, and to estimate traffic demand for these 28 intersections prior to COVID-19 conditions, additional sets of turning movement counts were collected for the eight key intersections. The traffic counts for these 28 intersections were reviewed and adjusted based on following procedures:

1. Review 2019 and 2020 traffic counts by corridors, and by directions using available traffic counts and identify demand adjustment factors;
2. Apply demand adjustment factors to the traffic counts collected in 2020 to reflect the pre-COVID-19 condition;
3. Adjust traffic volumes in the study area based on reviewing control counts ensure consistent and reasonable traffic flow along corridors and between adjacent intersections.

The adjusted existing (2019/2020) peak hour traffic volumes were used as the 'real-data-set' in Aimsun model for existing traffic demand calibration, as presented in the Appendix. Based on the review of the traffic counts collected in 2019, the 8:00 a.m. to 9:00 a.m., and 4:00 p.m. to 5:00 p.m. were identified as the weekday morning and afternoon peak hour, respectively. The traffic demands for the shoulder hours were also considered in the micro-simulation analysis to represent the traffic conditions before and after each peak hour. Therefore, the existing year model represents the weekday morning peak period conditions between 7:00 a.m. and 10:00 a.m., and afternoon peak period conditions between 3:00 p.m. and 6:00 p.m. for year 2019/ early 2020 – i.e. represents the pre COVID-19 conditions.

Commercial vehicles (i.e. trucks) are an important consideration in the traffic analysis as the industrial areas surrounding the study area, along with the CN Rail yard, generate and attract high volumes of truck traffic. However, traffic demand obtained from the YRTDF model reflects automobile trips only. Initial truck percentages (derived from study area counts) of approximately of 9% and 7% for the morning and afternoon peak hour, respectively, of the total peak hour auto traffic demand were used to generate seed traversal matrices for developing and calibrating commercial vehicle demand.

Assessment of afternoon conditions was also required for both TMP studies. In absence of travel demand for the afternoon peak hour, the Initial afternoon peak hour travel demand was estimated by transposing the morning peak hour travel demand matrices. The initial afternoon peak hour demand was subsequently adjusted using the same process employed for the morning peak hour.

MODEL CALIBRATION AND VALIDATION

The morning peak hour travel demand (i.e. traversal matrices extracted from the sub-area model) was calibrated to the observed 2019/2020 conditions within Aimsun model. The extracted travel demand from the Emme based sub-area model was adjusted based on the balanced turning movement volumes. This demand adjustment was conducted using the demand adjustment module available in Aimsun software. The adjustment was performed for two vehicle classes; passenger vehicles and commercial vehicles.

The model validation sought to ensure consistency between simulated travel time/speeds and observed travel time on Regional Roads (Highway 7, Weston Road and Jane Street).

FACTORS AFFECTING MODEL CALIBRATION & VALIDATION

Calibration of the Aimsun model for these two TMP studies may be affected by the following factors:

COVID-19 and Traffic Data

The traffic data used in model development and calibration includes TMCs, ATR counts, and travel time/speed data that were collected from 2016 to 2020, during which period the study area has experienced significant developments and travel patterns may have changed. There are also TMCs collected in June and October 2020 which may have lower traffic volumes and different travel patterns due to COVID-19. Various mitigation measures have been carried out to mitigate the limitation of traffic data collected after COVID-19 conditions by applying adjustment factors and volume balancing. However, the estimated traffic volumes may not fully represent a typical/actual traffic conditions at study area intersections.

Based on our prior experience working in the study area, we understand that highways and arterial road network in the study area are frequently congested, particularly in the afternoon peak period. As a result, vehicles typically divert from Regional Roads to collector road network. Therefore, the traffic demand on the City's road network varies significantly on daily basis, depending upon the congestion on Highway 400 and Regional Road network. Therefore, the model calibration focused on major arterial road network to avoid congestion-related impacts on collector and local corridors.

Opening of VIVA Transitway

The segment of Highway 7 VIVA West Woodbridge (west of Highway 400) was open in November 2019, which may have changed the travel patterns and travel modes along Highway 7 and other corridors. Due to the implemented center-running transitway, signal timing plans for Highway 7 intersections were also updated recently. The updated signal timing plans with longer cycle lengths and protected-only left turning phases along Highway 7 may reduce the traffic processing capacity at intersections and change traffic arriving patterns. Therefore, turning movement counts and travel time data collected prior to the opening of Highway 7 VIVA West Woodbridge/ traffic signal update may be impacted due to construction related activities along Highway 7, and would not reflect the potential change in travel demand and travel patterns with the implementation of VIVA corridor.

Model Complexity

The Aimsun modelling area covers two most-busiest metropolitan areas in Vaughan with mixed residential, commercial, and industrial land use types. To capture detailed land use at blockage level, the initial 14 Traffic Analysis Zones (TAZs) included in the YRTDF model within or in the vicinity of the study areas were further desegregated into 63 TAZs in Aimsun model (please refer to **Figure 5**).

In addition, the Aimsun model contains a comprehensive road network with roadways of different functional classifications, including regional arterials, collector roadways, and on- and off-ramps. A total of 55 intersections and 525 movements were considered in traffic demand calibration. It is of note that the demand calibration process has been carried out at the turning movement level (and not based on mid-block or total approach volumes). Calibrating a micro-simulation model for a grid-road network, becomes very complex when traffic data on parallel corridors is collected during different days/season/year, and distributing traffic volumes on multiple corridors in a complex road network can affect the ability to achieve an ideal calibration.

Estimation of Afternoon Peak Hour Travel Demand

The YRTDF model includes detailed land uses and road network for York Region, and provides travel demand forecasts exclusively for the morning peak hour. To evaluate the afternoon conditions, the morning peak hour traffic demand was transposed to establish initial afternoon peak hour demands. This initial afternoon peak hour travel demand was subsequently adjusted based on observed traffic volumes (i.e. ATR and turning movement counts) as an effort to reflect observed travel patterns. Given the available data resources and the study's purpose, this estimation process was considered appropriate for this study. However, the transposed initial afternoon peak hour demands do not include other trip purposes which may be prominent in the afternoon peak period. Better representation of afternoon peak period travel demand can only be obtained through significant Region-wide changes to the YRTDF model and was beyond the scope of this study.

YRTDF Network Detail

The travel demand from the YRTDF model defines travel patterns in the Aimsun model. However, the YRTDF model like any other travel demand model, lacks detail in the road network, such as the collector and local roads that feed traffic onto the collector and arterial road network. This poses issues when assigning traffic demand at entrance and exit points (i.e. gateways) as well as on local road network.

TRAFFIC VOLUMES

The adjusted/balanced existing (2019/2020) traffic volumes used for traffic demand adjustment consist of 525 turning movements for the 55 intersections included in the study area. Figure 7 and Figure 8 illustrate the relationship between the simulated and observed volumes, for all the movements and intersections considered, and for regional road intersections only, respectively; for all vehicle class, autos and commercial vehicles. In data comparison cases, the R-square value greater than 0.9 indicates a close fit between observed and simulated traffic volumes where 1.0 is a perfect match. The R-square values derived from modelling results are greater than 0.9 for all the intersections and movements during both peak hours, indicating a good match between the observed and simulated volumes.

Figure 7: Simulated vs. Observed Volumes (All Movements)

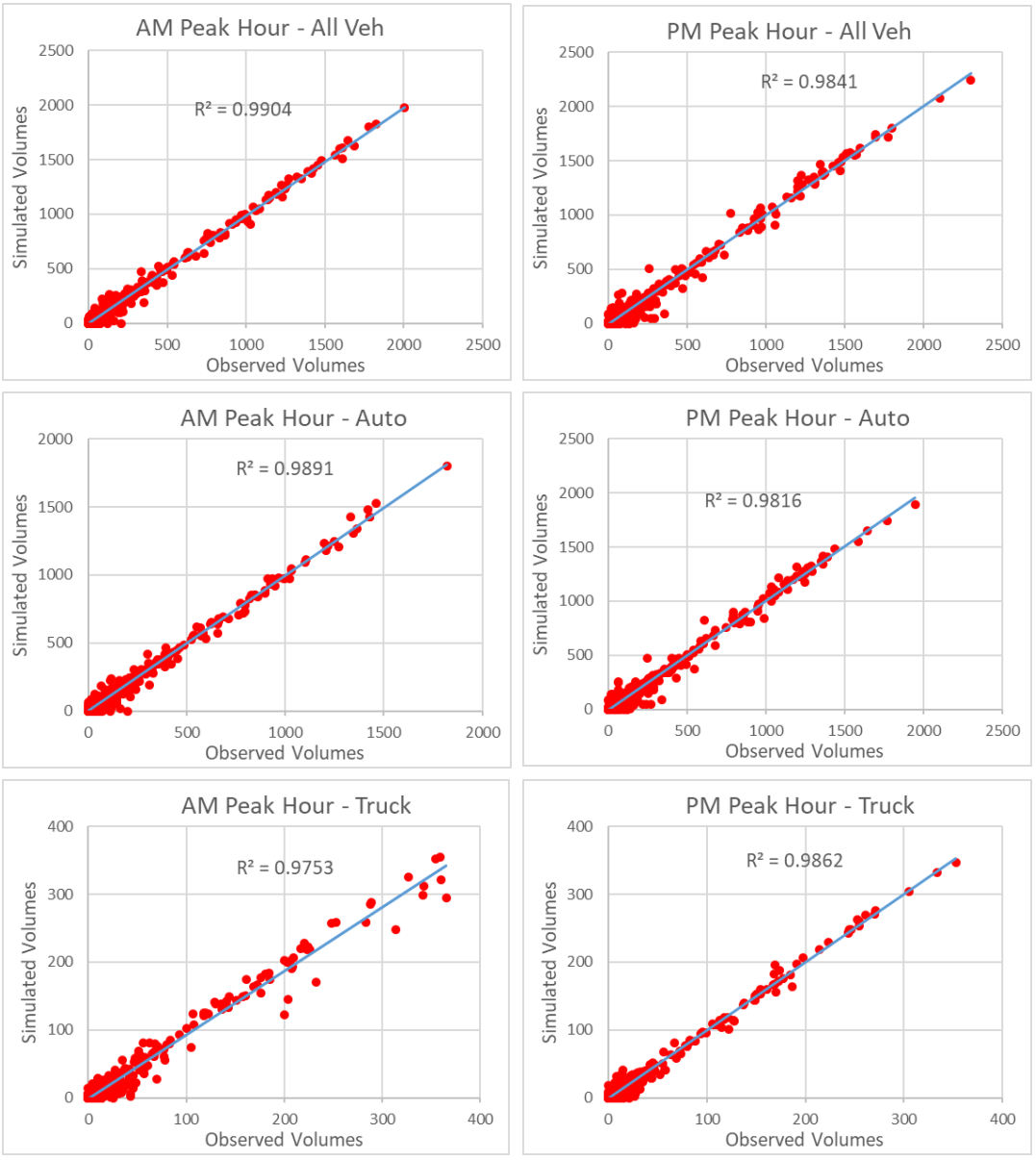
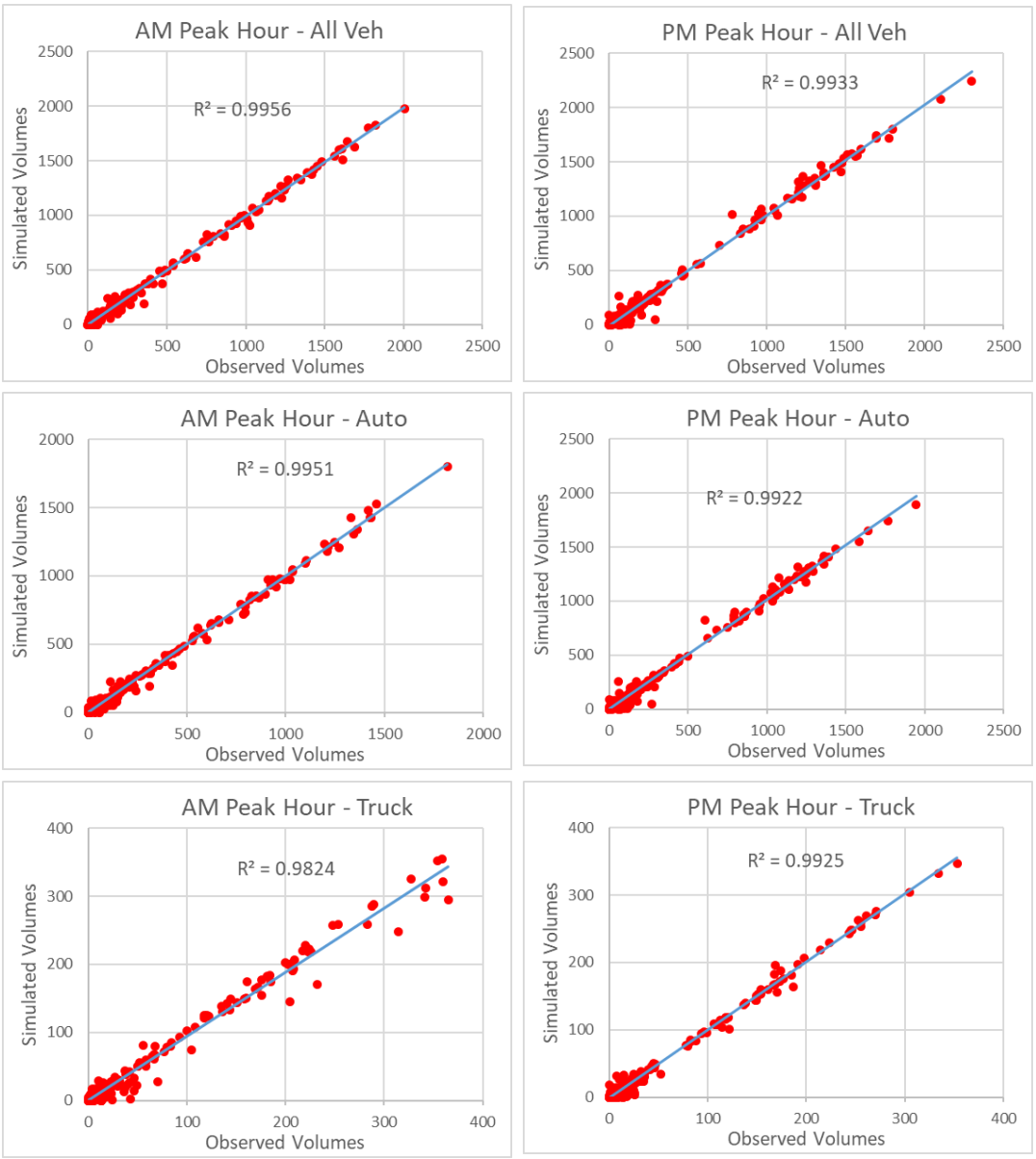


Figure 8: Simulated vs. Observed Volumes (Regional Road Intersections and Movements)



The GEH statistic was evaluated for each control volume flow in both the peak hours to assess differences between simulated and observed volumes. It is an industry-standard validation measure for simulation models which measures the agreement between simulated and observed traffic volumes

The formula is expressed as:

$$GEH = \sqrt{\frac{2(M-C)^2}{M+C}}$$

where *M* is the simulated volume and *C* is the observed count.

Lower GEH values represent more reliable simulated traffic volumes.

Table 1 summarizes the target thresholds of GEH values under different criteria for both auto and truck volumes, which are based on MTO's microscopic simulation guidelines for intersection turning movements (local and regional road intersections. Based on the results, all calibration targets were met for both autos and commercial vehicles, for study area intersections included in the microsimulation analysis.

The GEH for the regional road turning movements were reviewed specifically and presented in

Table 2. The GEH values meet over 90% of GEH for the regional road intersections during both peak hours.

Table 1: GEH Statistic Assessment (TMCs for All Intersections)

		MODEL RESULTS	
CRITERIA	TARGET	AM PEAK HOUR	PM PEAK HOUR
Auto Volumes			
GEH < 5	65-75%	85%	80%
GEH < 10	90%	98%	93%
Truck Volumes			
GEH < 5	65-75%	97%	97%
GEH < 10	90%	100%	100%

Table 2: GEH Statistic Assessment (TMCs for Regional Road Intersections)

		MODEL RESULTS	
CRITERIA	TARGET	AM PEAK HOUR	PM PEAK HOUR
Auto Volumes			
GEH < 5	65-75%	91%	90%
GEH < 10	90%	100%	96%
Truck Volumes			
GEH < 5	65-75%	97%	96%
GEH < 10	90%	100%	100%

TRAVEL TIME VALIDATION

The observed travel time and traffic operating speed data during morning and afternoon peak periods was received from the York Region. This travel time data for the study area corridors were collected using Bluetooth sensors. The travel time data was collected for the month of February 2020, which represents pre COVID-19 conditions and also represents travel time data after opening of Highway 7 VIVA corridor in the study area.

The comparison of observed vs. simulated travel time for Highway 7, Weston Road, and Jane Street are presented in Table 3 to Table 5, respectively.

Table 3: Comparison of Highway 7 Travel Time

ROAD SEGMENT	TRAVEL TIME (MIN)			
	Observed	Simulated	Difference	Difference in %
Morning Peak Hour				
Ansley Grove Rd - Weston Rd	1.5	1.4	-0.1	-4%
Weston Rd – Hwy 400 SB Off-ramp	1.5	1.3	-0.2	-13%
Hwy 400 SB Off-ramp – Hwy 400 NB Off-ramp	0.8	0.6	-0.3	-31%
Hwy 400 NB Off-ramp - Edgeley Blvd	1.3	1.9	0.6	44%
Edgeley Blvd - Jane St	2.5	3.2	0.7	26%
Jane St - Creditstone Rd	2.2	1.9	-0.3	-15%
Eastbound Overall	**9.8**	**10.2**	**0.4**	**4%**
Creditstone Rd Jane St	2.4	2.8	0.4	15%
Jane St - Edgeley Blvd	1.4	1.7	0.3	24%
Edgeley Blvd -400 NB Off-ramp	1.4	1.3	-0.1	-11%
Hwy 400 NB Off-ramp – Hwy 400 NB Off-ramp	0.5	0.8	0.3	57%
Hwy 400 NB Off-ramp - Weston Rd	1.4	1.0	-0.3	-23%
Weston Rd - Ansley Grove Rd	2.0	1.6	-0.3	-18%
Westbound Overall	**9.1**	**9.3**	**0.2**	**2%**
Afternoon Peak Hour				
Ansley Grove Rd -Weston Rd	1.7	1.7	0.0	-1%
Weston Rd - Hwy 400 SB Off-ramp	1.6	1.1	-0.5	-33%
Hwy 400 SB Off-ramp – Hwy 400 NB Off-ramp	0.7	0.8	0.1	9%
Hwy 400 NB Off-ramp - Edgeley Blvd	1.4	1.4	0.0	0%
Edgeley Blvd -Jane S	2.5	3.4	0.9	37%
Jane St - Creditstone Rd	2.0	1.5	-0.5	-26%
Eastbound Overall	**10.0**	**9.9**	**-0.1**	**-1%**
Creditstone Rd - Jane St	3.2	2.7	-0.5	-15%
Jane St - Edgeley Blvd	1.7	2.6	1.0	59%

ROAD SEGMENT	TRAVEL TIME (MIN)			
	Observed	Simulated	Difference	Difference in %
Edgeley Blvd - Hwy 400 NB Off-ramp	1.7	1.9	0.2	10%
Hwy 400 NB Off-ramp – Hwy 400 NB Off-ramp	0.6	0.8	0.3	44%
Hwy 400 NB Off-ramp - Weston Rd	1.3	1.0	-0.2	-18%
Weston Rd - Ansley Grove Rd	1.6	1.1	-0.6	-35%
Westbound Overall	**10.0**	**10.1**	**0.1**	**1%**

For some of the individual roadway segments, the simulated travel times do not match with the observed travel times. These discrepancies may be due to the exact locations of Bluetooth sensors are not known (i.e. far sight or near sight of the intersection). Additionally, the short distance between intersections along Highway 7 could potentially change the traffic arriving patters at different intersections; the traffic platoon might be metered either at the upstream or downstream intersections and affect the travel time between roadway segments. However, the total travel time for Highway 7 between Ansley Grove Road and Creditstone Road (for approximately 3 km of length) confirms that the simulated travel times for both the directions are within ±4% compared to the observed travel time, during both peak hours which is within a typical criterion of ±15% used by various agencies.

This comparison of observed and simulated travel time confirms that the simulated travel time for Highway 7 represents a good validation result.

Table 4: Comparison of Weston Road Travel Time

ROAD SEGMENT	TRAVEL TIME (MIN)			
	Observed	Simulated	Difference	Difference in %
Morning Peak Hour				
Hwy 407 WB On-ramp - Hwy 7	1.5	1.9	0.4	26%
Hwy 7 - Carlauren Rd	1.9	1.8	-0.1	-5%
Northbound Overall	**3.4**	**3.7**	**0.3**	**8%**
Carlauren Rd - Hwy 7	1.9	2.4	0.4	23%
Hwy 7- Hwy 407 WB On-ramp	1.6	1.5	-0.1	-5%
Southbound Overall	**3.5**	**3.9**	**0.4**	**10%**
Afternoon Peak Hour				
Hwy 407 WB On-ramp - Hwy 7	1.9	2.9	1.1	59%
Hwy 7 - Carlauren Rd	1.9	1.1	-0.8	-41%
Northbound Overall	**3.8**	**4.1**	**0.3**	**8%**
Carlauren Rd - Hwy 7	2.4	2.7	0.3	14%
Hwy 7 – Hwy 407 WB On-ramp	1.3	1.1	-0.2	-17%
Southbound Overall	**3.7**	**3.8**	**0.1**	**3%**

Similar to Highway 7, the simulated travel times for individual roadway segments do not match with the observed travel times. However, the overall travel time comparison for Weston Road (between Highway 407 and Carlauren Road) during both peak hours indicate a close match (i.e., within ±15%) with the observed travel times.

Table 5: Comparison of Jane Street Travel Time

ROAD SEGMENT	TRAVEL TIME (MIN)			
	Observed	Simulated	Difference	Difference in %
Morning Peak Hour				
Hwy 407 WB Off-ramp - Hwy 7	1.8	2.8	1.0	59%
Hwy 7 - Pennsylvania Ave	2.1	1.4	-0.6	-30%
Northbound Overall	**3.8**	**4.2**	**0.4**	**11%**
Pennsylvania Ave - Hwy 7	2.0	1.9	-0.1	-6%
Hwy 7 - Hwy 407 WB Off-ramp	2.5	1.2	-1.3	-51%
Southbound Overall	**4.6**	**3.1**	**-1.4**	**-31%**
Afternoon Peak Hour				
Hwy 407 WB Off-ramp - Hwy 7	1.8	2.6	0.8	44%
Hwy 7 - Pennsylvania Ave	2.0	1.6	-0.4	-19%
Northbound Overall	**3.8**	**4.2**	**0.4**	**11%**
Pennsylvania Ave - Hwy 7	2.3	2.3	0.0	2%
Hwy 7 - Hwy 407 WB Off-ramp	1.8	1.5	-0.2	-14%
Southbound Overall	**4.1**	**3.9**	**-0.2**	**-5%**

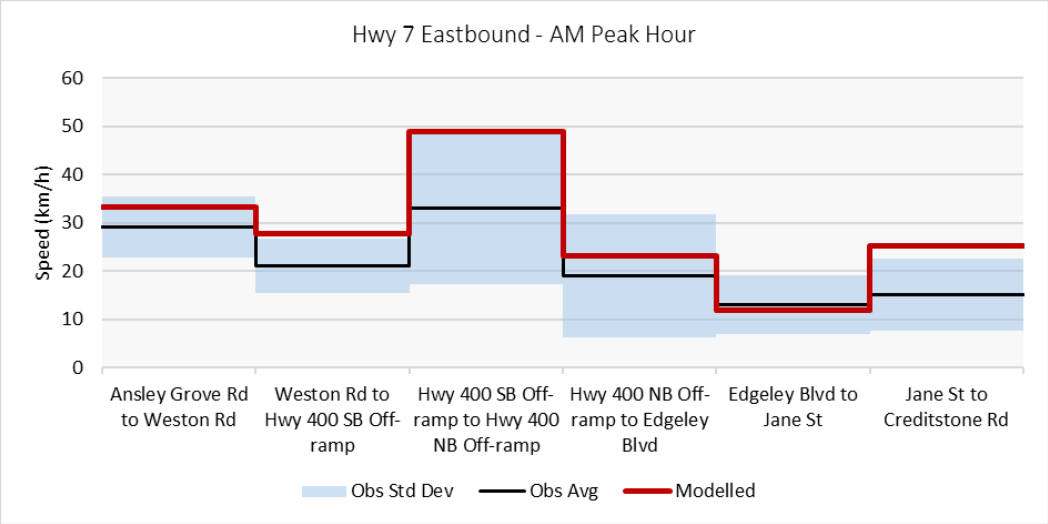
The comparison of observed vs. simulated travel time along Jane Street shows that model generally simulating the observed conditions for both directions during both peak hours except for the southbound direction during morning peak hour. The southbound travel time on Jane Street between Highway 7 and Highway 407 off-ramp is particularly higher than simulated travel time, which may be due to downstream congestion on Jane Street (outside of the study area).

TRAFFIC OPERATING SPEED

The review of traffic operating speed represents a similar condition as the travel time, where the longer and shorter travel time observed/simulated was replicated by lower and higher operating speed.

Traffic operating speed review for Highway 7, Weston Road, and Jane Street segments within the study area are presented in Figure 9 to Figure 14. The simulated operating speeds generally aligned within the standard deviation of observed speeds. The discrepancies between the observed and simulated speed for some roadway segments/directions can be explained as discussed previously in the travel time review.

Figure 9: Modelled vs Observed Highway 7 Speed - AM Peak Hour



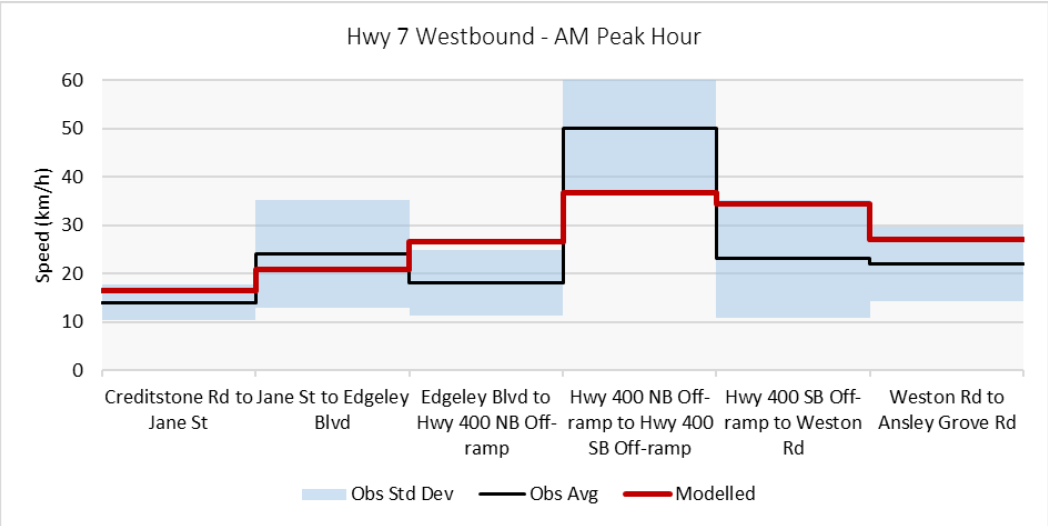
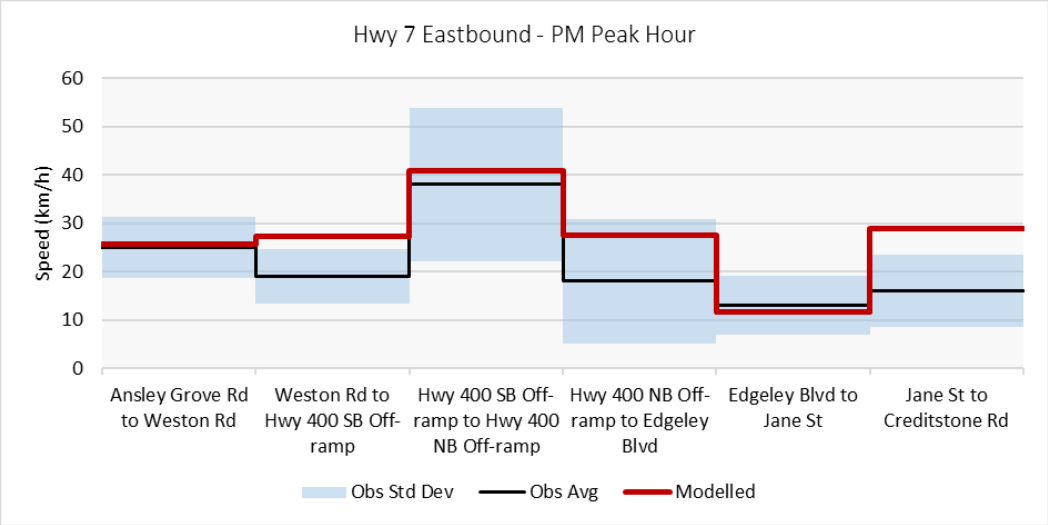


Figure 10: Modelled vs Observed Highway 7 Speed - PM Peak Hour



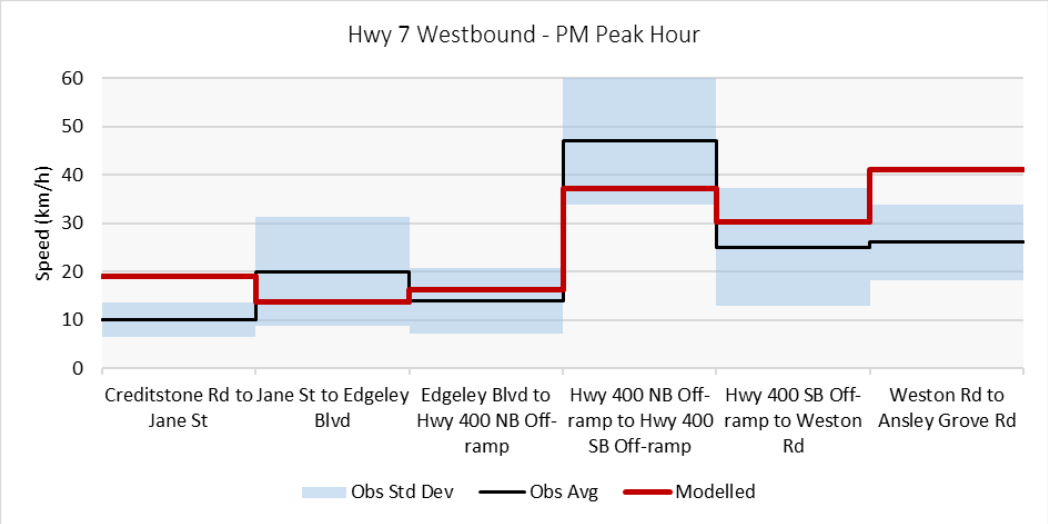
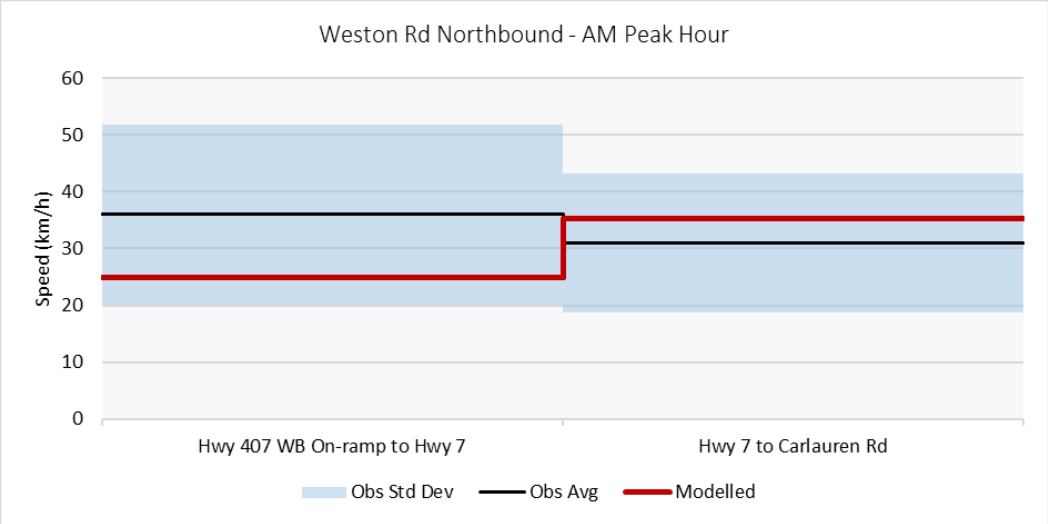


Figure 11: Modelled vs Observed Weston Road Speed - AM Peak Hour



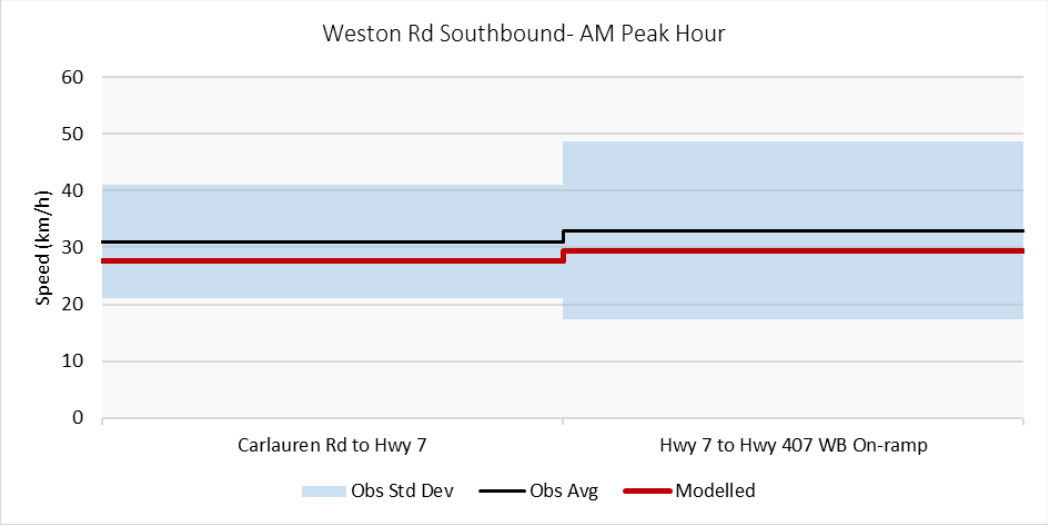
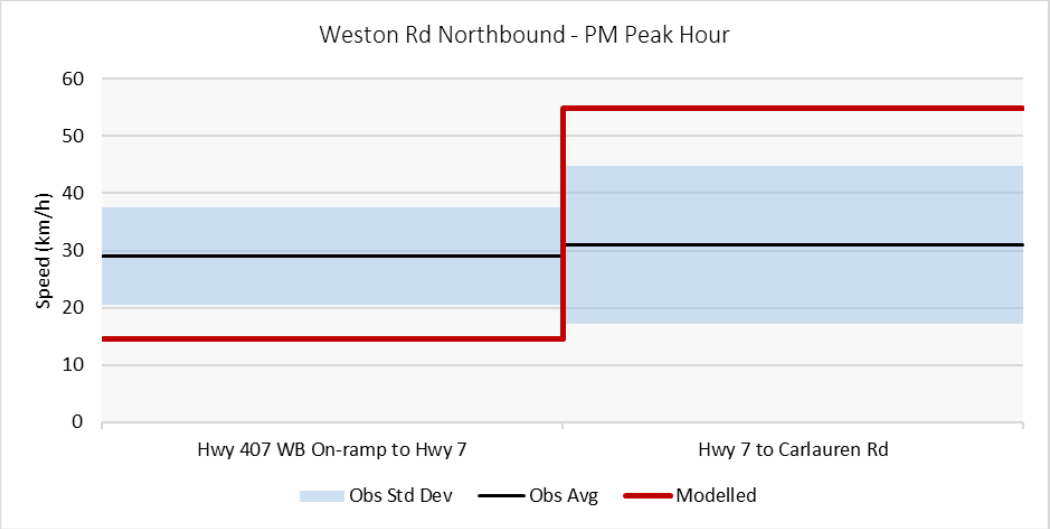


Figure 12: Modelled vs Observed Weston Road Speed - PM Peak Hour



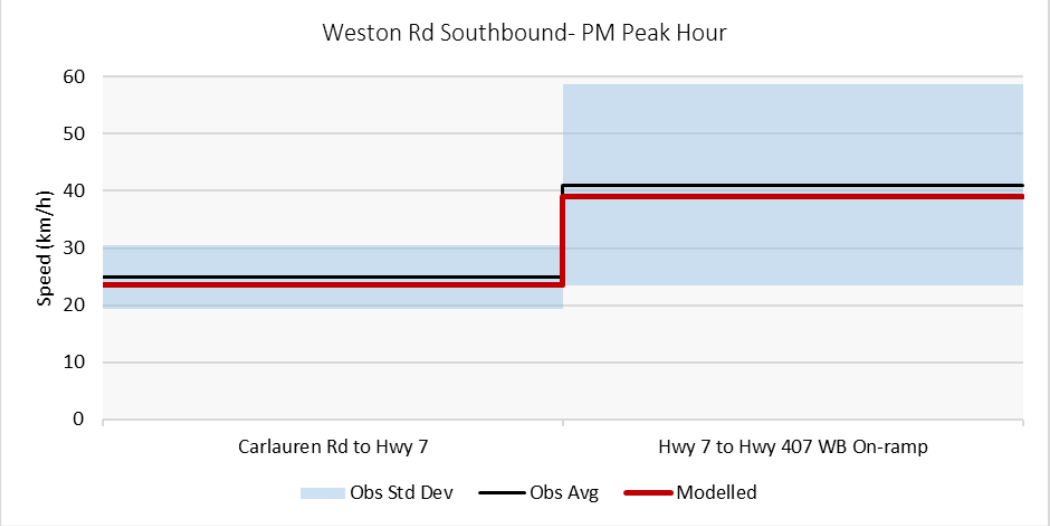
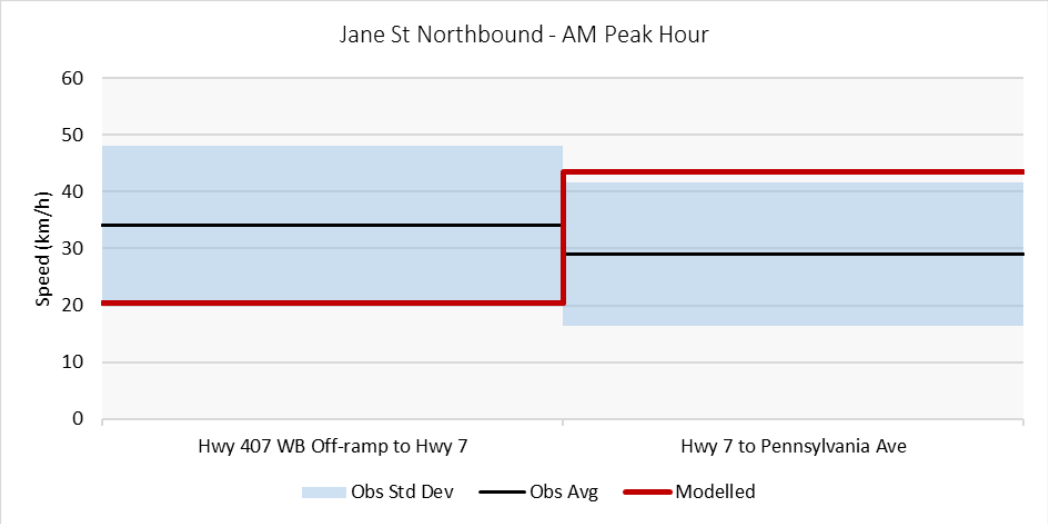


Figure 13: Modelled vs Observed Jane Street Speed - AM Peak Hour



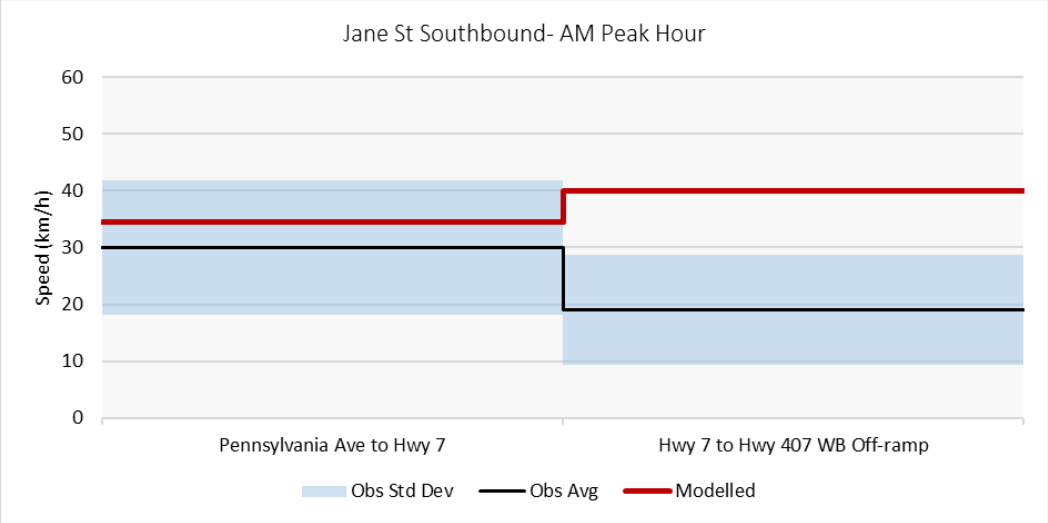
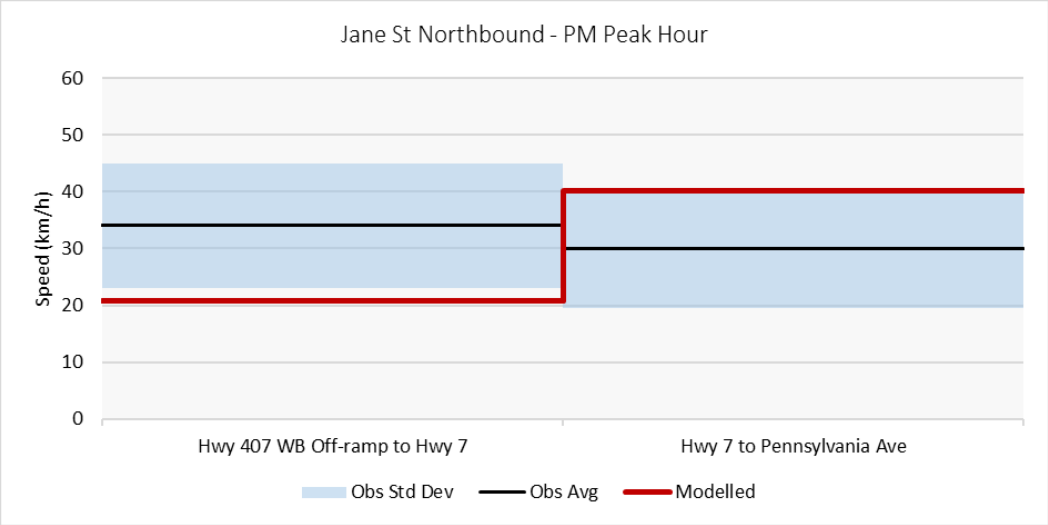
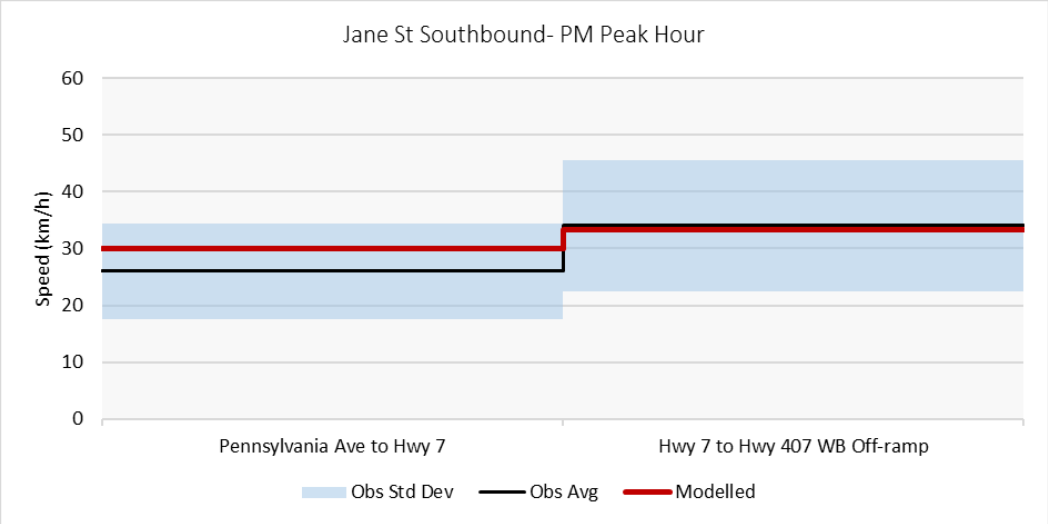


Figure 14: Modelled vs Observed Jane Street Speed - PM Peak Hour





As presented in Figure 9 and Figure 10 show that simulated operating speeds on Highway 7 generally match observed average speeds and are within the observed standard deviation of observed speed data. The simulated speeds for Weston Road and Jane Street also generally match with observed average speeds and are within the observed standard deviation, except for the northbound direction on Weston Road during afternoon peak hour, and the southbound direction on Jane Street during morning peak hour.

CONCLUSION

Based on the results presented in this memorandum, the micro-simulation (Aimsun) model developed for the study area concluded to closely represent observed traffic conditions and can be used as a calibrated/validated model for the future traffic analysis. The trip correction matrices derived from the existing traffic modelling (i.e., the differences between the initial trip matrices derived from Region's travel demand model and the trip matrices after adjustment) will then be used for future traffic demand correction.

NEXT STEPS

This microsimulation model calibration and validation report is being submitted for MTO's review and approval. Following the approval of MTO, WSP will submit the existing traffic condition report, describing the road network details and existing level of service for the study area intersections; along with the supporting modelling files (i.e. Aimsun and Synchro software) to MTO. The traffic operational analysis for the future (2041 and full build-out) conditions with alternative network improvement scenarios will be conducted based on the calibrated Aimsun-model discussed herein above. Modelling of future conditions will incorporate all proposed and planned changes (with respect to land use and road network) to the study area, including the surrounding extended study area in the model.

Appendix

Existing (2019/2020) Traffic Volumes

Name	AM Car	AM Truck	AM Total	PM Car	PM Truck	PM Total
Ansley Grove Road and Blue Willow Drive EBL	38	3	41	55	9	64
Ansley Grove Road and Blue Willow Drive EBT	44	5	49	69	8	77
Ansley Grove Road and Blue Willow Drive EBR	140	7	147	76	2	78
Ansley Grove Road and Blue Willow Drive WBL	9	3	12	26	0	26
Ansley Grove Road and Blue Willow Drive WBT	42	7	49	89	12	101
Ansley Grove Road and Blue Willow Drive WBR	23	9	32	72	16	88
Ansley Grove Road and Blue Willow Drive NBL	39	5	44	137	10	147
Ansley Grove Road and Blue Willow Drive NBT	91	53	144	588	34	622
Ansley Grove Road and Blue Willow Drive NBR	8	2	10	49	2	51
Ansley Grove Road and Blue Willow Drive SBL	17	6	23	28	0	28
Ansley Grove Road and Blue Willow Drive SBT	398	20	418	253	17	270
Ansley Grove Road and Blue Willow Drive SBR	40	0	40	35	5	40
Ansley Grove Road and Windflower Gate EBL	6	1	7	6	0	6
Ansley Grove Road and Windflower Gate EBT	5	1	6	3	0	3
Ansley Grove Road and Windflower Gate EBR	11	0	11	3	0	3
Ansley Grove Road and Windflower Gate WBL	95	12	107	203	7	210
Ansley Grove Road and Windflower Gate WBT	1	0	1	10	0	10
Ansley Grove Road and Windflower Gate WBR	74	7	81	375	22	397
Ansley Grove Road and Windflower Gate NBL	4	0	4	22	2	24
Ansley Grove Road and Windflower Gate NBT	28	52	80	402	24	426
Ansley Grove Road and Windflower Gate NBR	61	6	67	196	10	206
Ansley Grove Road and Windflower Gate SBL	146	6	152	167	10	177
Ansley Grove Road and Windflower Gate SBT	400	24	424	189	9	198
Ansley Grove Road and Windflower Gate SBR	2	0	2	3	0	3
Ansley Grove Road and Highway 7 EBL	111	32	143	125	9	134
Ansley Grove Road and Highway 7 EBT	1216	176	1392	1052	152	1204
Ansley Grove Road and Highway 7 EBR	260	50	310	26	22	48
Ansley Grove Road and Highway 7 WBL	44	4	48	54	7	61
Ansley Grove Road and Highway 7 WBT	950	136	1086	1141	161	1302
Ansley Grove Road and Highway 7 WBR	78	4	82	61	2	63
Ansley Grove Road and Highway 7 NBL	97	11	108	113	10	123
Ansley Grove Road and Highway 7 NBT	355	22	377	439	27	466
Ansley Grove Road and Highway 7 NBR	49	19	68	161	29	190
Ansley Grove Road and Highway 7 SBL	131	5	136	94	4	98
Ansley Grove Road and Highway 7 SBT	196	10	206	200	5	205
Ansley Grove Road and Highway 7 SBR	105	22	127	106	7	113
Ansley Grove Road and Trowers Road EBL	160	18	178	109	16	125
Ansley Grove Road and Trowers Road EBT	67	12	79	95	17	112
Ansley Grove Road and Trowers Road EBR	7	3	10	6	1	7
Ansley Grove Road and Trowers Road WBL	16	8	24	4	0	4
Ansley Grove Road and Trowers Road WBT	52	11	63	77	12	89
Ansley Grove Road and Trowers Road WBR	156	14	170	291	21	312
Ansley Grove Road and Trowers Road NBL	4	4	8	1	0	1
Ansley Grove Road and Trowers Road NBT	184	20	204	332	29	361
Ansley Grove Road and Trowers Road NBR	19	3	22	59	3	62
Ansley Grove Road and Trowers Road SBL	208	17	225	107	10	117
Ansley Grove Road and Trowers Road SBT	161	26	187	95	11	106
Ansley Grove Road and Trowers Road SBR	144	21	165	79	13	92
Blue Willow Drive and Matthew Drive EBL	4	0	4	10	0	10
Blue Willow Drive and Matthew Drive EBT	72	13	85	121	12	133
Blue Willow Drive and Matthew Drive WBT	72	17	89	180	28	208
Blue Willow Drive and Matthew Drive WBR	2	2	4	20	2	22
Blue Willow Drive and Matthew Drive SBL	14	2	16	16	0	16
Blue Willow Drive and Matthew Drive SBR	5	2	7	7	2	9
Blue Willow Drive and Fieldstone Drive EB In	91	14	105	129	9	138

Name	AM Car	AM Truck	AM Total	PM Car	PM Truck	PM Total
Blue Willow Drive and Fieldstone Drive EB Out	76	16	92	203	32	235
Blue Willow Drive and Fieldstone Drive WB In	26	14	40	66	16	82
Blue Willow Drive and Fieldstone Drive WB Out	47	9	56	68	6	74
Blue Willow Drive and Fieldstone Drive NB In	49	5	54	169	20	189
Blue Willow Drive and Fieldstone Drive NB Out	52	9	61	87	9	96
Blue Willow Drive and Fieldstone Drive SB In	17	4	21	21	7	28
Blue Willow Drive and Fieldstone Drive SB Out	8	3	11	27	5	32
Blue Willow Drive and Pottery Place EBL	8	2	10	8	2	10
Blue Willow Drive and Pottery Place EBT	47	9	56	50	3	53
Blue Willow Drive and Pottery Place EBR	3	0	3	10	0	10
Blue Willow Drive and Pottery Place WBL	7	0	7	10	2	12
Blue Willow Drive and Pottery Place WBT	30	3	33	72	8	80
Blue Willow Drive and Pottery Place WBR	4	0	4	7	2	9
Blue Willow Drive and Pottery Place NBL	1	3	4	26	2	28
Blue Willow Drive and Pottery Place NBT	18	3	21	57	5	62
Blue Willow Drive and Pottery Place NBR	7	0	7	36	2	38
Blue Willow Drive and Pottery Place SBL	5	2	7	5	3	8
Blue Willow Drive and Pottery Place SBT	42	9	51	35	4	39
Blue Willow Drive and Pottery Place SBR	2	3	5	11	6	17
Fieldstone Drive and Windflower Gate EBL	0	0	0	1	0	1
Fieldstone Drive and Windflower Gate EBT	190	9	199	77	5	82
Fieldstone Drive and Windflower Gate EBR	26	1	27	22	3	25
Fieldstone Drive and Windflower Gate WBL	115	23	138	341	16	357
Fieldstone Drive and Windflower Gate WBT	73	8	81	249	13	262
Fieldstone Drive and Windflower Gate WBR	12	0	12	48	1	49
Fieldstone Drive and Windflower Gate NBL	113	10	123	244	27	271
Fieldstone Drive and Windflower Gate NBT	23	1	24	141	6	147
Fieldstone Drive and Windflower Gate NBR	5	0	5	31	5	36
Fieldstone Drive and Windflower Gate SBL	52	1	53	16	0	16
Fieldstone Drive and Windflower Gate SBT	57	2	59	52	7	59
Fieldstone Drive and Windflower Gate SBR	5	1	6	1	1	2
Chrislea Road and Jevlan Drive EBL	64	8	72	77	0	77
Chrislea Road and Jevlan Drive EBT	575	57	632	418	33	451
Chrislea Road and Jevlan Drive WBT	218	51	269	888	69	957
Chrislea Road and Jevlan Drive WBR	59	2	61	96	15	111
Chrislea Road and Jevlan Drive SBL	118	10	128	95	8	103
Chrislea Road and Jevlan Drive SBR	25	10	35	66	4	70
Chrislea Road and Northview Blvd EBL	0	0	0	6	1	7
Chrislea Road and Northview Blvd EBT	684	62	746	434	37	471
Chrislea Road and Northview Blvd EBR	9	5	14	49	3	52
Chrislea Road and Northview Blvd WBL	38	9	47	160	13	173
Chrislea Road and Northview Blvd WBT	292	51	343	902	67	969
Chrislea Road and Northview Blvd WBR	0	0	0	0	0	0
Chrislea Road and Northview Blvd NBL	19	2	21	80	16	96
Chrislea Road and Northview Blvd NBT	0	1	1	0	0	0
Chrislea Road and Northview Blvd NBR	234	23	257	152	16	168
Chrislea Road and Northview Blvd SBL	0	0	0	1	0	1
Chrislea Road and Northview Blvd SBT	0	0	0	1	0	1
Chrislea Road and Northview Blvd SBR	0	0	0	1	1	2
Chrislea Road and Portage Parkway EBL	42	10	52	69	9	78
Chrislea Road and Portage Parkway EBT	899	70	969	539	42	581
Chrislea Road and Portage Parkway EBR	0	0	0	7	2	9
Chrislea Road and Portage Parkway WBL	4	1	5	39	1	40
Chrislea Road and Portage Parkway WBT	306	47	353	986	73	1059
Chrislea Road and Portage Parkway WBR	193	20	213	179	45	224

Name	AM Car	AM Truck	AM Total	PM Car	PM Truck	PM Total
Chrislea Road and Portage Parkway NBL	0	1	1	4	1	5
Chrislea Road and Portage Parkway NBT	0	0	0	7	2	9
Chrislea Road and Portage Parkway NBR	13	2	15	21	1	22
Chrislea Road and Portage Parkway SBL	332	23	355	229	20	249
Chrislea Road and Portage Parkway SBT	1	0	1	11	1	12
Chrislea Road and Portage Parkway SBR	23	12	35	77	6	83
Portage Parkway and Applewood Crescent EBL	233	14	247	61	11	72
Portage Parkway and Applewood Crescent EBT	763	71	834	665	47	712
Portage Parkway and Applewood Crescent EBR	147	10	157	64	5	69
Portage Parkway and Applewood Crescent WBL	16	13	29	26	6	32
Portage Parkway and Applewood Crescent WBT	395	48	443	831	56	887
Portage Parkway and Applewood Crescent WBR	60	9	69	13	8	21
Portage Parkway and Applewood Crescent NBL	73	9	82	144	16	160
Portage Parkway and Applewood Crescent NBT	188	13	201	29	14	43
Portage Parkway and Applewood Crescent NBR	118	22	140	28	5	33
Portage Parkway and Applewood Crescent SBL	55	10	65	117	3	120
Portage Parkway and Applewood Crescent SBT	22	11	33	118	11	129
Portage Parkway and Applewood Crescent SBR	36	11	47	231	47	278
Portage Parkway and Edgeley Blvd EBL	118	15	133	122	4	126
Portage Parkway and Edgeley Blvd EBT	351	53	404	385	23	408
Portage Parkway and Edgeley Blvd EBR	576	35	611	303	28	331
Portage Parkway and Edgeley Blvd WBL	58	10	68	81	7	88
Portage Parkway and Edgeley Blvd WBT	235	38	273	461	63	524
Portage Parkway and Edgeley Blvd WBR	46	2	48	38	0	38
Portage Parkway and Edgeley Blvd NBL	238	13	251	220	7	227
Portage Parkway and Edgeley Blvd NBT	195	12	207	356	11	367
Portage Parkway and Edgeley Blvd NBR	38	4	42	38	20	58
Portage Parkway and Edgeley Blvd SBL	19	4	23	28	2	30
Portage Parkway and Edgeley Blvd SBT	302	35	337	356	29	385
Portage Parkway and Edgeley Blvd SBR	58	19	77	193	0	193
Windflower Gate and Teahouse Road EBL	9	0	9	85	4	89
Windflower Gate and Teahouse Road EBT	167	16	183	241	24	265
Windflower Gate and Teahouse Road WBT	138	13	151	404	22	426
Windflower Gate and Teahouse Road WBR	11	1	12	40	1	41
Windflower Gate and Teahouse Road SBL	17	0	17	26	2	28
Windflower Gate and Teahouse Road SBR	13	2	15	166	1	167
Windflower Gate and Nova Star Drive EBL	11	0	11	11	1	12
Windflower Gate and Nova Star Drive EBT	143	16	159	252	11	263
Windflower Gate and Nova Star Drive EBR	36	3	39	57	3	60
Windflower Gate and Nova Star Drive WBL	83	14	97	80	9	89
Windflower Gate and Nova Star Drive WBT	115	9	124	221	12	233
Windflower Gate and Nova Star Drive WBR	3	0	3	7	0	7
Windflower Gate and Nova Star Drive NBL	11	1	12	63	1	64
Windflower Gate and Nova Star Drive NBT	39	4	43	87	8	95
Windflower Gate and Nova Star Drive NBR	69	12	81	142	10	152
Windflower Gate and Nova Star Drive SBL	2	0	2	2	1	3
Windflower Gate and Nova Star Drive SBT	14	1	15	55	3	58
Windflower Gate and Nova Star Drive SBR	3	2	5	34	4	38
Highway 7 and Nova Star Drive EBL	27	0	27	124	18	142
Highway 7 and Nova Star Drive EBT	1365	200	1565	1193	167	1360
Highway 7 and Nova Star Drive EBR	3	0	3	6	0	6
Highway 7 and Nova Star Drive WBL	17	4	21	30	4	34
Highway 7 and Nova Star Drive WBT	835	135	970	1194	151	1345
Highway 7 and Nova Star Drive WBR	85	7	92	202	19	221
Highway 7 and Nova Star Drive NBL	1	0	1	13	0	13

Name	AM Car	AM Truck	AM Total	PM Car	PM Truck	PM Total
Highway 7 and Nova Star Drive NBT	4	0	4	55	4	59
Highway 7 and Nova Star Drive NBR	1	3	4	29	0	29
Highway 7 and Nova Star Drive SBL	64	9	73	168	9	177
Highway 7 and Nova Star Drive SBT	0	0	0	0	0	0
Highway 7 and Nova Star Drive SBR	51	9	60	146	13	159
Highway 7 and Weston Road EBL	198	24	222	135	32	167
Highway 7 and Weston Road EBT	896	169	1065	1113	118	1231
Highway 7 and Weston Road EBR	192	19	211	99	26	125
Highway 7 and Weston Road WBL	270	50	320	248	22	270
Highway 7 and Weston Road WBT	772	120	892	1079	148	1227
Highway 7 and Weston Road WBR	48	11	59	180	14	194
Highway 7 and Weston Road NBL	62	2	64	183	10	193
Highway 7 and Weston Road NBT	407	80	487	799	88	887
Highway 7 and Weston Road NBR	190	27	217	251	24	275
Highway 7 and Weston Road SBL	151	22	173	182	12	194
Highway 7 and Weston Road SBT	794	118	912	825	94	919
Highway 7 and Weston Road SBR	51	19	70	112	17	129
Highway 7 and Famous Avenue EBT	1209	208	1417	1362	149	1511
Highway 7 and Famous Avenue EBR	28	10	38	148	5	153
Highway 7 and Famous Avenue WBL	271	16	287	320	28	348
Highway 7 and Famous Avenue NBR	176	46	222	163	22	185
Highway 7 and Highway 400 SB Off-Ramp EBT	863	143	1006	1238	121	1359
Highway 7 and Highway 400 SB Off-Ramp WBT	1033	160	1193	1587	187	1774
Highway 7 and Highway 400 SB Off-Ramp NBR	144	10	154	302	10	312
Highway 7 and Highway 400 SB Off-Ramp SBL	389	67	456	278	40	318
Highway 7 and Highway 400 SB Off-Ramp SBT	578	42	620	308	27	335
Highway 7 and Highway 400 SB Off-Ramp SBR	526	83	609	412	47	459
Highway 7 and Highway 400 NB Off-Ramp EBT	1022	207	1229	982	149	1131
Highway 7 and Highway 400 NB Off-Ramp WBT	911	359	1270	1946	353	2299
Highway 7 and Highway 400 NB Off-Ramp WBR	9	3	12	3	3	6
Highway 7 and Highway 400 NB Off-Ramp NBL	432	67	499	497	80	577
Highway 7 and Highway 400 NB Off-Ramp NBT	354	23	377	141	31	172
Highway 7 and Highway 400 NB Off-Ramp NBR	663	176	839	421	138	559
Highway 7 and Highway 400 NB Off-Ramp SBR	62	22	84	166	22	188
Highway 7 and Commerce Street EBL	29	5	34	37	19	56
Highway 7 and Commerce Street EBT	1419	360	1779	1216	261	1477
Highway 7 and Commerce Street EBR	170	18	188	150	7	157
Highway 7 and Commerce Street WBL	1	0	1	0	0	0
Highway 7 and Commerce Street WBT	997	354	1351	1770	334	2104
Highway 7 and Commerce Street WBR	2	2	4	2	0	2
Highway 7 and Commerce Street NBL	5	2	7	65	8	73
Highway 7 and Commerce Street NBT	0	0	0	1	3	4
Highway 7 and Commerce Street NBR	1	1	2	2	5	7
Highway 7 and Commerce Street SBL	2	0	2	16	2	18
Highway 7 and Commerce Street SBT	1	1	2	2	1	3
Highway 7 and Commerce Street SBR	10	6	16	115	14	129
Highway 7 and Edgeley Blvd EBL	111	13	124	117	24	141
Highway 7 and Edgeley Blvd EBT	1272	341	1613	1026	245	1271
Highway 7 and Edgeley Blvd EBR	45	7	52	78	1	79
Highway 7 and Edgeley Blvd WBL	7	3	10	29	13	42
Highway 7 and Edgeley Blvd WBT	851	288	1139	1293	271	1564
Highway 7 and Edgeley Blvd WBR	223	11	234	139	6	145
Highway 7 and Edgeley Blvd NBL	21	8	29	185	18	203
Highway 7 and Edgeley Blvd NBT	62	7	69	157	6	163
Highway 7 and Edgeley Blvd NBR	3	2	5	68	4	72

Name	AM Car	AM Truck	AM Total	PM Car	PM Truck	PM Total
Highway 7 and Edgeley Blvd SBL	142	10	152	167	8	175
Highway 7 and Edgeley Blvd SBT	161	13	174	173	8	181
Highway 7 and Edgeley Blvd SBR	122	58	180	280	45	325
Rowntree Dairy Road and Winges Road EBL	11	0	11	32	1	33
Rowntree Dairy Road and Winges Road EBT	228	57	285	501	40	541
Rowntree Dairy Road and Winges Road EBR	61	11	72	77	7	84
Rowntree Dairy Road and Winges Road WBL	119	13	132	60	13	73
Rowntree Dairy Road and Winges Road WBT	372	61	433	363	30	393
Rowntree Dairy Road and Winges Road WBR	121	19	140	253	11	264
Rowntree Dairy Road and Winges Road NBL	42	7	49	72	16	88
Rowntree Dairy Road and Winges Road NBT	19	6	25	39	3	42
Rowntree Dairy Road and Winges Road NBR	51	16	67	102	21	123
Rowntree Dairy Road and Winges Road SBL	170	21	191	170	12	182
Rowntree Dairy Road and Winges Road SBT	40	8	48	24	6	30
Rowntree Dairy Road and Winges Road SBR	20	1	21	13	2	15
Colossus Drive and Famous Avenue EBL	30	4	34	118	16	134
Colossus Drive and Famous Avenue EBT	111	13	124	225	15	240
Colossus Drive and Famous Avenue EBR	21	4	25	98	13	111
Colossus Drive and Famous Avenue WBL	201	9	210	68	4	72
Colossus Drive and Famous Avenue WBT	388	44	432	257	29	286
Colossus Drive and Famous Avenue WBR	33	1	34	73	4	77
Colossus Drive and Famous Avenue NBL	35	6	41	161	12	173
Colossus Drive and Famous Avenue NBT	31	5	36	181	17	198
Colossus Drive and Famous Avenue NBR	49	12	61	122	8	130
Colossus Drive and Famous Avenue SBL	71	5	76	153	10	163
Colossus Drive and Famous Avenue SBT	107	13	120	148	11	159
Colossus Drive and Famous Avenue SBR	161	13	174	80	12	92
Weston Road and Blue Willow Drive EBL	39	2	41	60	3	63
Weston Road and Blue Willow Drive EBT	5	0	5	0	0	0
Weston Road and Blue Willow Drive EBR	36	5	41	35	3	38
Weston Road and Blue Willow Drive WBL	1	4	5	15	3	18
Weston Road and Blue Willow Drive WBT	0	0	0	7	3	10
Weston Road and Blue Willow Drive WBR	2	0	2	19	2	21
Weston Road and Blue Willow Drive NBL	21	2	23	56	2	58
Weston Road and Blue Willow Drive NBT	599	84	683	1083	122	1205
Weston Road and Blue Willow Drive NBR	18	7	25	22	7	29
Weston Road and Blue Willow Drive SBL	16	0	16	15	2	17
Weston Road and Blue Willow Drive SBT	849	122	971	748	83	831
Weston Road and Blue Willow Drive SBR	21	2	23	38	6	44
Weston Road and Fieldstone Drive EBL	34	5	39	91	9	100
Weston Road and Fieldstone Drive EBT	240	18	258	225	12	237
Weston Road and Fieldstone Drive EBR	53	0	53	52	1	53
Weston Road and Fieldstone Drive WBL	125	42	167	230	32	262
Weston Road and Fieldstone Drive WBT	89	8	97	450	15	465
Weston Road and Fieldstone Drive WBR	65	11	76	242	26	268
Weston Road and Fieldstone Drive NBL	36	4	40	121	11	132
Weston Road and Fieldstone Drive NBT	463	77	540	854	96	950
Weston Road and Fieldstone Drive NBR	164	30	194	98	17	115
Weston Road and Fieldstone Drive SBL	209	17	226	104	4	108
Weston Road and Fieldstone Drive SBT	625	108	733	623	78	701
Weston Road and Fieldstone Drive SBR	52	6	58	69	7	76
Weston Road and Northview Blvd WBL	135	15	150	244	13	257
Weston Road and Northview Blvd WBR	73	11	84	115	9	124
Weston Road and Northview Blvd NBT	533	100	633	951	115	1066
Weston Road and Northview Blvd NBR	144	15	159	162	19	181

Name	AM Car	AM Truck	AM Total	PM Car	PM Truck	PM Total
Weston Road and Northview Blvd SBL	33	6	39	51	1	52
Weston Road and Northview Blvd SBT	849	144	993	868	110	978
Weston Road and Rowntree Dairy Road EBL	68	14	82	153	14	167
Weston Road and Rowntree Dairy Road EBT	98	12	110	314	18	332
Weston Road and Rowntree Dairy Road EBR	291	68	359	347	25	372
Weston Road and Rowntree Dairy Road WBL	222	13	235	134	14	148
Weston Road and Rowntree Dairy Road WBT	311	43	354	250	19	269
Weston Road and Rowntree Dairy Road WBR	49	2	51	128	11	139
Weston Road and Rowntree Dairy Road NBL	210	23	233	248	16	264
Weston Road and Rowntree Dairy Road NBT	538	93	631	951	99	1050
Weston Road and Rowntree Dairy Road NBR	56	8	64	134	8	142
Weston Road and Rowntree Dairy Road SBL	33	2	35	134	17	151
Weston Road and Rowntree Dairy Road SBT	969	158	1127	857	106	963
Weston Road and Rowntree Dairy Road SBR	147	27	174	122	19	141
Weston Road and Highway 407 WB On-Ramp WBL	388	24	412	228	11	239
Weston Road and Highway 407 WB On-Ramp WBT	32	5	37	30	7	37
Weston Road and Highway 407 WB On-Ramp WBR	52	6	58	103	10	113
Weston Road and Highway 407 WB On-Ramp NBL	39	24	63	162	27	189
Weston Road and Highway 407 WB On-Ramp NBT	819	118	937	1247	113	1360
Weston Road and Highway 407 WB On-Ramp NBR	163	18	181	427	35	462
Weston Road and Highway 407 WB On-Ramp SBL	56	5	61	57	6	63
Weston Road and Highway 407 WB On-Ramp SBT	1430	161	1591	1055	107	1162
Weston Road and Highway 407 EB Off-Ramp EBL	303	19	322	192	21	213
Weston Road and Highway 407 EB Off-Ramp EBR	205	13	218	65	7	72
Weston Road and Highway 407 EB Off-Ramp NBT	797	141	938	1644	154	1798
Weston Road and Highway 407 EB Off-Ramp SBT	1820	185	2005	1254	118	1372
Applewood Crescent and Apple Mill Road WBL	21	0	21	24	1	25
Applewood Crescent and Apple Mill Road WBR	36	9	45	47	6	53
Applewood Crescent and Apple Mill Road NBT	324	29	353	127	31	158
Applewood Crescent and Apple Mill Road NBR	38	7	45	20	2	22
Applewood Crescent and Apple Mill Road SBL	135	6	141	42	3	45
Applewood Crescent and Apple Mill Road SBT	37	27	64	140	20	160
Edgeley Blvd and Apple Mill Road EBL	31	0	31	19	2	21
Edgeley Blvd and Apple Mill Road EBT	44	4	48	22	4	26
Edgeley Blvd and Apple Mill Road EBR	15	1	16	14	2	16
Edgeley Blvd and Apple Mill Road WBL	39	3	42	50	2	52
Edgeley Blvd and Apple Mill Road WBT	18	5	23	64	8	72
Edgeley Blvd and Apple Mill Road WBR	65	2	67	78	2	80
Edgeley Blvd and Apple Mill Road NBL	27	0	27	24	1	25
Edgeley Blvd and Apple Mill Road NBT	305	26	331	457	34	491
Edgeley Blvd and Apple Mill Road NBR	44	4	48	46	3	49
Edgeley Blvd and Apple Mill Road SBL	74	2	76	54	3	57
Edgeley Blvd and Apple Mill Road SBT	659	77	736	677	58	735
Edgeley Blvd and Apple Mill Road SBR	17	1	18	3	3	6
Interchange Way and Interchange Way EBL	75	6	81	457	12	469
Interchange Way and Interchange Way EBT	10	4	14	49	3	52
Interchange Way and Interchange Way WBT	45	2	47	51	3	54
Interchange Way and Interchange Way WBR	80	10	90	131	4	135
Interchange Way and Interchange Way SBL	273	13	286	128	8	136
Interchange Way and Interchange Way SBR	253	11	264	363	14	377
Northview Blvd and Private Driveway EBT	179	21	200	160	17	177
Northview Blvd and Private Driveway EBR	5	0	5	27	3	30
Northview Blvd and Private Driveway WBL	3	0	3	16	1	17
Northview Blvd and Private Driveway WBT	109	14	123	212	17	229
Northview Blvd and Private Driveway NBL	50	12	62	71	7	78

Name	AM Car	AM Truck	AM Total	PM Car	PM Truck	PM Total
Northview Blvd and Private Driveway NBR	115	34	149	92	15	107
Portage Parkway and Buttermill Ave EBL	150	8	158	17	5	22
Portage Parkway and Buttermill Ave EBT	250	55	305	429	44	473
Portage Parkway and Buttermill Ave WBT	268	41	309	544	55	599
Portage Parkway and Buttermill Ave WBR	87	4	91	14	0	14
Portage Parkway and Buttermill Ave SBL	113	0	113	23	5	28
Portage Parkway and Buttermill Ave SBR	66	8	74	41	8	49
Portage Parkway and Millway Ave EBL	65	21	86	61	23	84
Portage Parkway and Millway Ave EBT	213	30	243	256	9	265
Portage Parkway and Millway Ave EBR	93	7	100	143	14	157
Portage Parkway and Millway Ave WBL	111	8	119	100	7	107
Portage Parkway and Millway Ave WBT	308	35	343	323	23	346
Portage Parkway and Millway Ave WBR	34	2	36	10	1	11
Portage Parkway and Millway Ave NBL	34	3	37	125	8	133
Portage Parkway and Millway Ave NBT	27	12	39	48	7	55
Portage Parkway and Millway Ave NBR	29	0	29	34	0	34
Portage Parkway and Millway Ave SBL	7	3	10	22	0	22
Portage Parkway and Millway Ave SBT	51	0	51	251	4	255
Portage Parkway and Millway Ave SBR	11	7	18	111	23	134
Apple Mill Road and Millway Ave EBL	5	0	5	17	1	18
Apple Mill Road and Millway Ave EBT	56	5	61	136	1	137
Apple Mill Road and Millway Ave EBR	81	4	85	142	8	150
Apple Mill Road and Millway Ave WBL	63	7	70	46	8	54
Apple Mill Road and Millway Ave WBT	82	3	85	123	10	133
Apple Mill Road and Millway Ave WBR	12	14	26	40	8	48
Apple Mill Road and Millway Ave NBL	47	4	51	74	0	74
Apple Mill Road and Millway Ave NBT	162	1	163	150	6	156
Apple Mill Road and Millway Ave NBR	18	8	26	25	7	32
Apple Mill Road and Millway Ave SBL	14	6	20	27	8	35
Apple Mill Road and Millway Ave SBT	179	6	185	290	15	305
Apple Mill Road and Millway Ave SBR	35	3	38	56	2	58
Edgeley Blvd and New Park Pl WBL	34	4	38	43	8	51
Edgeley Blvd and New Park Pl WBR	71	3	74	72	5	77
Edgeley Blvd and New Park Pl NBT	305	27	332	375	34	409
Edgeley Blvd and New Park Pl NBR	88	4	92	28	4	32
Edgeley Blvd and New Park Pl SBL	259	3	262	116	3	119
Edgeley Blvd and New Park Pl SBT	455	78	533	497	57	554
Millway Ave and New Park Pl EBL	134	3	137	118	0	118
Millway Ave and New Park Pl EBT	0	0	0	4	0	4
Millway Ave and New Park Pl EBR	208	4	212	137	7	144
Millway Ave and New Park Pl WBL	3	0	3	34	0	34
Millway Ave and New Park Pl WBT	7	0	7	3	0	3
Millway Ave and New Park Pl WBR	3	0	3	81	0	81
Millway Ave and New Park Pl NBL	82	6	88	38	0	38
Millway Ave and New Park Pl NBT	91	10	101	64	13	77
Millway Ave and New Park Pl NBR	3	0	3	22	0	22
Millway Ave and New Park Pl SBL	4	0	4	13	0	13
Millway Ave and New Park Pl SBT	103	16	119	279	18	297
Millway Ave and New Park Pl SBR	216	1	217	184	13	197
Highway 7 and Millway Ave EBL	31	5	36	40	1	41
Highway 7 and Millway Ave EBT	1346	342	1688	1220	253	1473
Highway 7 and Millway Ave EBR	31	6	37	1	3	4
Highway 7 and Millway Ave WBL	23	4	27	4	5	9
Highway 7 and Millway Ave WBT	934	289	1223	1267	270	1537
Highway 7 and Millway Ave WBR	146	6	152	66	9	75

Name	AM Car	AM Truck	AM Total	PM Car	PM Truck	PM Total
Highway 7 and Millway Ave NBL	1	5	6	49	10	59
Highway 7 and Millway Ave NBT	2	2	4	18	3	21
Highway 7 and Millway Ave NBR	4	13	17	42	7	49
Highway 7 and Millway Ave SBL	145	9	154	290	12	302
Highway 7 and Millway Ave SBT	26	3	29	15	3	18
Highway 7 and Millway Ave SBR	143	8	151	145	10	155
Highway 7 and Jane Street EBL	124	16	140	44	25	69
Highway 7 and Jane Street EBT	1197	283	1480	1248	223	1471
Highway 7 and Jane Street EBR	176	65	241	260	24	284
Highway 7 and Jane Street WBL	93	29	122	106	27	133
Highway 7 and Jane Street WBT	940	248	1188	1171	255	1426
Highway 7 and Jane Street WBR	170	58	228	185	32	217
Highway 7 and Jane Street NBL	157	28	185	133	15	148
Highway 7 and Jane Street NBT	621	172	793	793	154	947
Highway 7 and Jane Street NBR	181	31	212	159	18	177
Highway 7 and Jane Street SBL	149	70	219	134	30	164
Highway 7 and Jane Street SBT	713	151	864	788	137	925
Highway 7 and Jane Street SBR	5	23	28	33	14	47
Highway 7 and Maplecrete Road EBL	39	14	53	87	9	96
Highway 7 and Maplecrete Road EBT	1460	365	1825	1439	255	1694
Highway 7 and Maplecrete Road EBR	26	5	31	15	7	22
Highway 7 and Maplecrete Road WBL	15	3	18	9	2	11
Highway 7 and Maplecrete Road WBT	1101	327	1428	1391	305	1696
Highway 7 and Maplecrete Road WBR	6	2	8	8	0	8
Highway 7 and Maplecrete Road NBL	2	6	8	13	5	18
Highway 7 and Maplecrete Road NBT	7	3	10	13	4	17
Highway 7 and Maplecrete Road NBR	8	3	11	41	6	47
Highway 7 and Maplecrete Road SBL	20	1	21	12	2	14
Highway 7 and Maplecrete Road SBT	17	1	18	16	0	16
Highway 7 and Maplecrete Road SBR	100	2	102	58	4	62
Highway 7 and Creditstone Road EBL	125	38	163	89	30	119
Highway 7 and Creditstone Road EBT	1331	314	1645	1360	214	1574
Highway 7 and Creditstone Road EBR	34	17	51	42	19	61
Highway 7 and Creditstone Road WBL	93	15	108	134	15	149
Highway 7 and Creditstone Road WBT	1034	224	1258	1215	244	1459
Highway 7 and Creditstone Road WBR	487	56	543	395	83	478
Highway 7 and Creditstone Road NBL	7	40	47	57	20	77
Highway 7 and Creditstone Road NBT	56	37	93	87	34	121
Highway 7 and Creditstone Road NBR	20	4	24	63	10	73
Highway 7 and Creditstone Road SBL	230	58	288	351	18	369
Highway 7 and Creditstone Road SBT	150	21	171	170	22	192
Highway 7 and Creditstone Road SBR	81	68	149	136	43	179
Jane Street and Portage Parkway EBL	83	2	85	134	3	137
Jane Street and Portage Parkway EBT	5	1	6	35	1	36
Jane Street and Portage Parkway EBR	163	30	193	143	5	148
Jane Street and Portage Parkway WBL	5	2	7	10	0	10
Jane Street and Portage Parkway WBT	5	0	5	7	0	7
Jane Street and Portage Parkway WBR	4	2	6	10	1	11
Jane Street and Portage Parkway NBL	241	30	271	269	26	295
Jane Street and Portage Parkway NBT	553	203	756	610	169	779
Jane Street and Portage Parkway NBR	5	0	5	1	0	1
Jane Street and Portage Parkway SBL	2	0	2	2	1	3
Jane Street and Portage Parkway SBT	663	204	867	680	170	850
Jane Street and Portage Parkway SBR	207	15	222	157	5	162
Jane Street and Apple Mill Road EBL	15	7	22	29	4	33

Name	AM Car	AM Truck	AM Total	PM Car	PM Truck	PM Total
Jane Street and Apple Mill Road EBR	72	12	84	160	12	172
Jane Street and Apple Mill Road NBL	125	20	145	171	20	191
Jane Street and Apple Mill Road NBT	787	226	1013	851	191	1042
Jane Street and Apple Mill Road SBT	795	232	1027	795	169	964
Jane Street and Apple Mill Road SBR	35	4	39	38	6	44
Jane Street and Doughton Road WBL	105	37	142	219	27	246
Jane Street and Doughton Road WBR	23	22	45	51	19	70
Jane Street and Doughton Road NBT	936	209	1145	1034	168	1202
Jane Street and Doughton Road NBR	179	32	211	181	27	208
Jane Street and Doughton Road SBL	58	22	80	35	11	46
Jane Street and Doughton Road SBT	924	223	1147	1119	177	1296
Jane Street and Interchange Way EBL	9	8	17	65	15	80
Jane Street and Interchange Way EBT	28	13	41	32	14	46
Jane Street and Interchange Way EBR	314	22	336	305	36	341
Jane Street and Interchange Way WBL	47	36	83	84	46	130
Jane Street and Interchange Way WBT	23	4	27	47	8	55
Jane Street and Interchange Way WBR	2	13	15	16	5	21
Jane Street and Interchange Way NBT	1104	220	1324	1135	174	1309
Jane Street and Interchange Way NBR	144	46	190	158	52	210
Jane Street and Interchange Way SBL	7	5	12	6	0	6
Jane Street and Interchange Way SBT	994	253	1247	1290	198	1488
Jane Street and Interchange Way SBR	28	2	30	42	6	48
Jane Street and 407ETR WB Ramp WBL	326	3	329	101	19	120
Jane Street and 407ETR WB Ramp WBR	423	49	472	268	41	309
Jane Street and 407ETR WB Ramp NBL	74	19	93	255	24	279
Jane Street and 407ETR WB Ramp NBT	828	217	1045	1036	185	1221
Jane Street and 407ETR WB Ramp SBT	1248	206	1454	1351	246	1597
Jane Street and 407ETR WB Ramp SBR	106	105	211	328	34	362
Jane Street and 407ETR EB Ramp EBL	344	52	396	154	36	190
Jane Street and 407ETR EB Ramp EBR	448	22	470	117	27	144
Jane Street and 407ETR EB Ramp NBT	584	184	768	1137	173	1310
Jane Street and 407ETR EB Ramp SBT	1431	181	1612	955	244	1199
Creditstone Road and McCleary Court EBL	0	0	0	14	0	14
Creditstone Road and McCleary Court EBT	0	0	0	24	5	29
Creditstone Road and McCleary Court EBR	5	0	5	12	1	13
Creditstone Road and McCleary Court WBL	85	17	102	62	9	71
Creditstone Road and McCleary Court WBT	20	0	20	28	1	29
Creditstone Road and McCleary Court WBR	52	4	56	26	1	27
Creditstone Road and McCleary Court NBL	10	0	10	21	6	27
Creditstone Road and McCleary Court NBT	658	107	765	512	127	639
Creditstone Road and McCleary Court NBR	0	24	24	35	14	49
Creditstone Road and McCleary Court SBL	15	4	19	25	2	27
Creditstone Road and McCleary Court SBT	372	129	501	583	73	656
Creditstone Road and McCleary Court SBR	28	3	31	28	3	31
Creditstone Road and Doughton Road EBL	43	28	71	85	22	107
Creditstone Road and Doughton Road EBT	63	25	88	58	12	70
Creditstone Road and Doughton Road EBR	40	13	53	10	10	20
Creditstone Road and Doughton Road WBL	0	2	2	1	0	1
Creditstone Road and Doughton Road WBT	30	27	57	56	10	66
Creditstone Road and Doughton Road WBR	23	10	33	58	6	64
Creditstone Road and Doughton Road NBL	8	25	33	19	13	32
Creditstone Road and Doughton Road NBT	40	43	83	64	36	100
Creditstone Road and Doughton Road NBR	12	4	16	12	0	12
Creditstone Road and Doughton Road SBL	35	5	40	31	5	36
Creditstone Road and Doughton Road SBT	113	34	147	106	27	133

Name	AM Car	AM Truck	AM Total	PM Car	PM Truck	PM Total
Creditstone Road and Doughton Road SBR	68	14	82	160	24	184
Maplecrete Road and Doughton Road EBL	26	3	29	44	4	48
Maplecrete Road and Doughton Road EBT	145	57	202	148	32	180
Maplecrete Road and Doughton Road EBR	12	5	17	3	3	6
Maplecrete Road and Doughton Road WBL	8	4	12	7	3	10
Maplecrete Road and Doughton Road WBT	70	57	127	224	43	267
Maplecrete Road and Doughton Road WBR	7	5	12	10	0	10
Maplecrete Road and Doughton Road NBL	2	5	7	9	3	12
Maplecrete Road and Doughton Road NBT	11	4	15	20	4	24
Maplecrete Road and Doughton Road NBR	8	3	11	6	2	8
Maplecrete Road and Doughton Road SBL	18	3	21	1	6	7
Maplecrete Road and Doughton Road SBT	5	7	12	1	3	4
Maplecrete Road and Doughton Road SBR	30	0	30	43	0	43
Interchange Way and Commerce Street EBL	10	1	11	50	1	51
Interchange Way and Commerce Street EBR	238	3	241	163	3	166
Interchange Way and Commerce Street NBL	7	0	7	12	0	12
Interchange Way and Commerce Street NBT	148	16	164	577	15	592
Interchange Way and Commerce Street SBT	287	22	309	328	19	347
Interchange Way and Commerce Street SBR	6	0	6	6	0	6
Creditstone Road and Barnes Court EBL	20	12	32	12	5	17
Creditstone Road and Barnes Court EBR	7	6	13	31	4	35
Creditstone Road and Barnes Court NBL	40	10	50	11	0	11
Creditstone Road and Barnes Court NBT	571	200	771	541	128	669
Creditstone Road and Barnes Court SBT	408	130	538	605	74	679
Creditstone Road and Barnes Court SBR	58	15	73	43	2	45
Creditstone Road and Freshway Drive WBL	8	7	15	7	8	15
Creditstone Road and Freshway Drive WBR	5	12	17	29	14	43
Creditstone Road and Freshway Drive NBT	21	31	52	66	35	101
Creditstone Road and Freshway Drive NBR	43	12	55	3	21	24
Creditstone Road and Freshway Drive SBL	53	6	59	8	13	21
Creditstone Road and Freshway Drive SBT	70	32	102	107	26	133