HERITAGE HEIGHTS SECONDARY PLAN EXISTING AND FUTURE 2051 TRANSPORTATION MODEL DEVELOPMENT AND CALIBRATION

Transportation Master Plan
Appendix C

BRAMPTON

Heritage Heights Landowners Group

BA Group

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1.0 INTRODUCTION

The following report provides an overview of the multi-resolution modelling methodology and documents the development and calibration of a PTV mesoscopic transportation model (herein referred to as “the mesoscopic model”). This model served as the primary transportation analysis tool used in the development of the Heritage Heights Secondary Plan Area Transportation Master Plan (herein referred to as “the HHTMP”).

The mesoscopic model was the main transportation analysis tool that was used to inform the Heritage Heights Transportation Master Plan. The mesoscopic model is a private vehicle model which focuses on auto-related forecasts; however, transit and active transportation considerations are accounted for through a review of mode share outputs from City of Brampton’s macroscopic model (see Future Conditions Model Development in **Section 5.0**). Corridor link volumes and link volume-to-capacity (V/C) ratios (link volume divided by theoretical link capacity) were the primary outputs used to assess transportation operations.

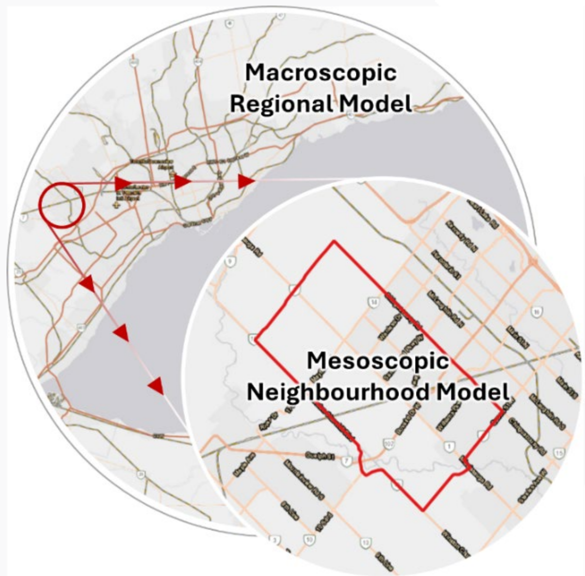
The future conditions mesoscopic model was used to assess network operations of the base OLT-mediated transportation network under 2051 conditions. Results of this analysis were used to identify a long and short list of alternatives, which were assessed using a set of transportation, cultural environment, natural environment, and socio-economic criteria.

Prior to assessing future 2051 conditions, an existing conditions mesoscopic model was developed and calibrated. Calibration of the existing conditions mesoscopic model was evaluated with standard calibration thresholds to demonstrate the model’s ability to adequately replicate current travel demand patterns in the study area. Once the calibration of the existing conditions model was completed, it was deemed appropriate for use as a base model in the development of the future 2051 conditions mesoscopic models that forecast future travel demand patterns and assess future network conditions.

2.0 TRAFFIC MODELLING & FORECASTING METHODOLOGY

This section presents a general description of the applied transportation modelling methodology and many of its key characteristics. Much of the material discussed below is examined at greater length in dedicated sections found later in the report.

The Heritage Heights TMP modelling exercise used a multi-resolution (macroscopic/mesoscopic) approach, allowing the analysis to retain the benefits of each scale of modelling, while mitigating their respective limitations. The macroscopic-mesoscopic multi-resolution modelling exercises allows one to extract detailed corridor-level traffic operations metrics derived from travel demand forecasts that incorporate the effects of region-wide population growth projections and planned infrastructure improvements (i.e. new roads and transit stations), a local-and-regional combination that is unattainable through the use of a standalone macroscopic or mesoscopic model.



From a technical perspective, the multi-resolution transportation modelling methodology consists of the use of a 1) regional macroscopic travel demand forecasting model (City of Brampton macroscopic model) and the development and use of a 2) neighbourhood mesoscopic (Visum) model which interacts with each other through the transfer of sub-area origin-destination traversal demand matrices. These transfers of OD matrices, from larger-scale to localized, smaller models, are the mechanism which ultimately allows the impact of regional-level population growth and infrastructure improvements to be captured in detailed network traffic operations metrics.

Specific aspects and characteristics associated with all stages of the adopted multi-resolution (macro/meso/micro) modelling and forecasting methodology are presented in the following sub-sections.

3.0 EXISTING CONDITIONS MODEL DEVELOPMENT

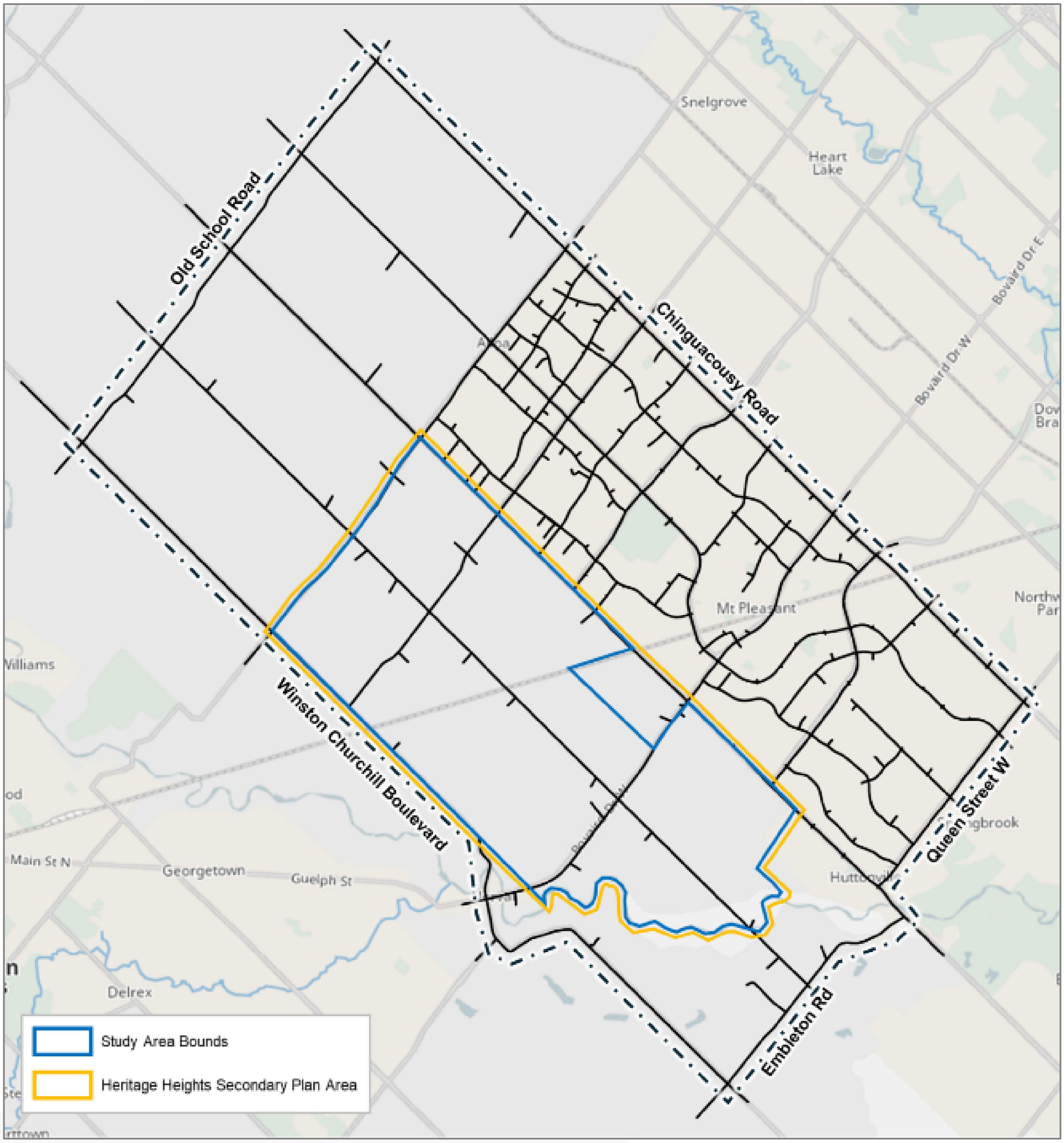
This section discusses the development of the mesoscopic (PTV Visum) model and provides details regarding the coding of several key model elements, including network capacity elements, model zone and connector system, and origin-destination traversal matrices are discussed in the following sections. All model elements are incorporated according to industry standards and accepted professional practice.

3.1 Mesoscopic Model Study Area

The model bounds encompass the Heritage Heights TMP study area and its surrounding lands, with the boundaries being Winston Churchill Boulevard to the west, Old School Road to the north, Chinguacousy Road to the east, Queen Street West and Embleton Road to the south, as shown in **Figure 1.**

These bounds were adopted at the mesoscopic level in order to allow for a comprehensive assessment that considers the effects of all planned population and employment growth, as well as those of future transportation infrastructure improvements, on area travel patterns and traffic operations, including potential mode shift, peak hour spread and diversion of vehicles to alternate paths.

Figure 1: Mesoscopic Technical Analysis & Modelling Area



3.2 Zone System

Preserving the integrity of the origin-destination travel demand data obtained from the City of Brampton's macroscopic model is a critical aspect of this exercise, as is typical with all multi-resolution modelling exercises. The mesoscopic model therefore adopts a zone system that is based upon that of the macroscopic model to allow for the seamless transfer of origin-destination travel demand matrices from the macroscopic model to the mesoscopic model, a process that will be discussed in greater detail in **Section 3.4**.

External Zones

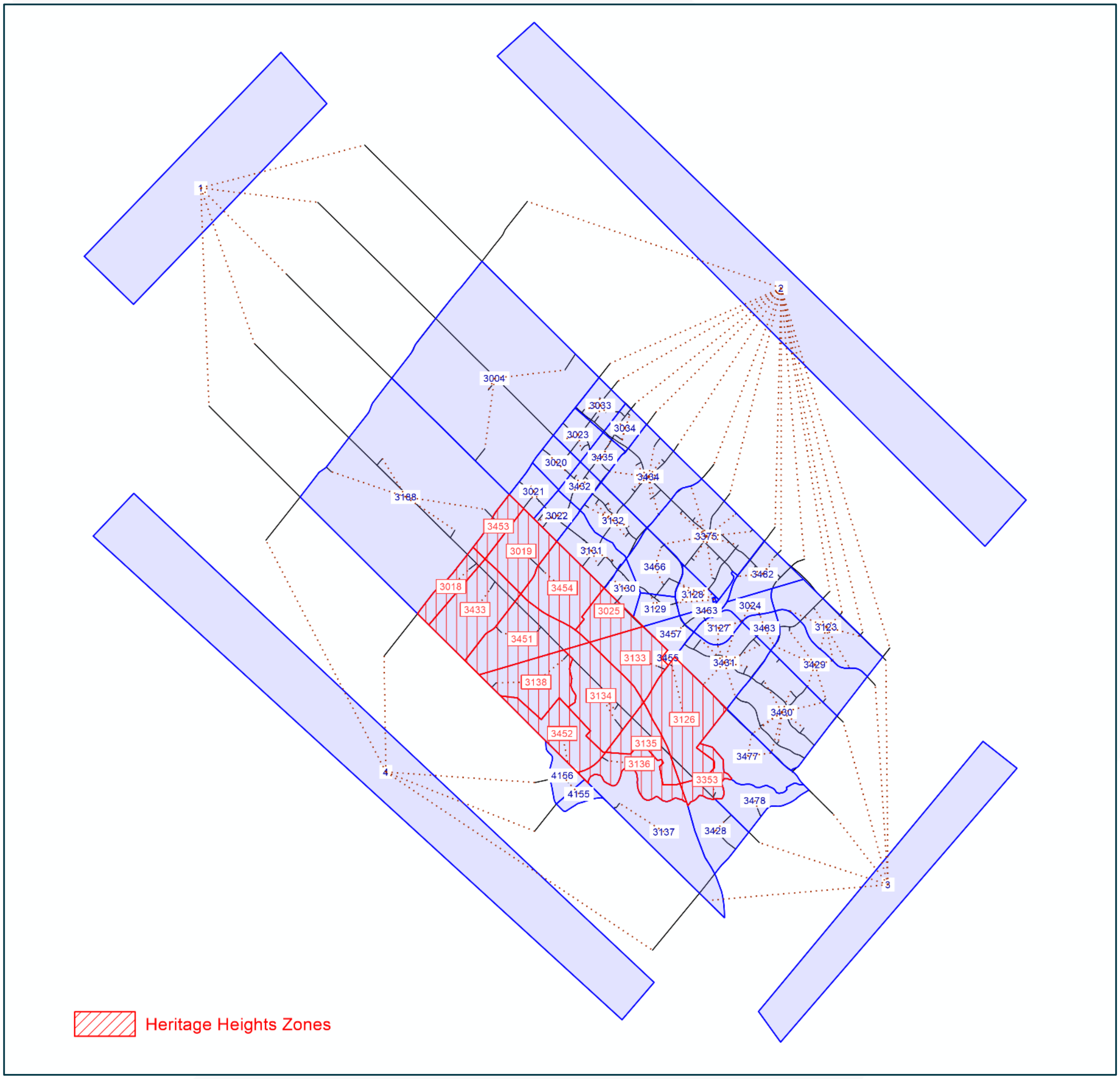
Production of the macroscopic model subarea matrices generated 42 external gateway zones representing corridors that cross the mesoscopic model boundaries. In the mesoscopic model, these zones were aggregated into 4 general external gateway zones, each representing gateways associated with each of the cardinal directions (north, east, south, and west). The original 42 external zones were preserved with the use of individual connectors that tie the aggregated zones to each of the gateway corridor segments.

Aggregating the external gateway zones is expected to enhance flexibility in external traffic assignment at the mesoscopic level, while ensuring that key, heavily used corridors (e.g. Mississauga Rd) retain their roles as traffic carrying anchors to/from their respective aggregated zones.

Internal Zones

The existing conditions mesoscopic model zone system contains a total of 49 internal zones, of which 15 zones are Heritage Heights zones and 34 are other internal zones. Internal zone boundaries reflect those of the macroscopic model's zone system. The mesoscopic model zone system, as well as the external gateway connector system, is illustrated in **Figure 2**.

Figure 2: Mesoscopic Model Zone System



3.3 Existing Conditions Links and Capacities

The existing conditions mesoscopic model's road network and its associated characteristics were coded using information obtained from the City of Brampton macroscopic model, City of Brampton's Official Plan Streets Network map, regional/municipal open data resources, Google Earth satellite imagery, and University of Toronto's EMME coding standards.

Road alignments and the lane count of all link segments in the mesoscopic model were obtained from 2024 Google Earth satellite imagery. Road classifications and operating speeds were informed by resources from the municipalities and regional municipalities within the study area bounds. The resources include road classification/network maps and open data portals from the City of Brampton, Town of Caledon, Peel Region, Halton Hills, and Halton Region.

Mesoscopic model link attributes (e.g., link capacity, link speed, etc.) were informed by the City of Brampton macroscopic model and were refined using University of Toronto's EMME coding standards. **Figure 3 and Figure 4** illustrate the mesoscopic model's road network and details the assumed number of lanes and link capacities, respectively.

Figure 3: Existing Conditions Mesoscopic Model – Link Number of Lanes

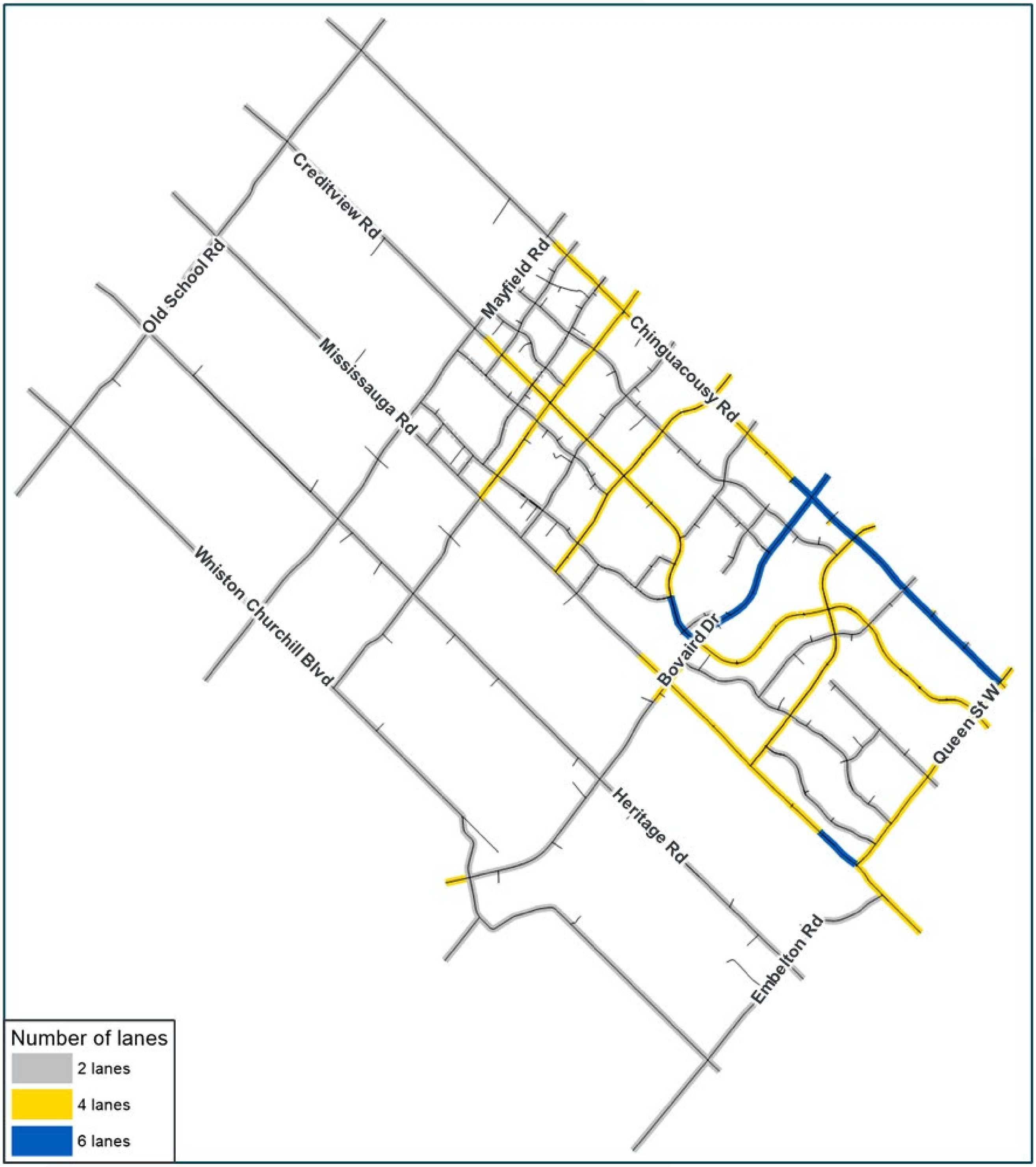
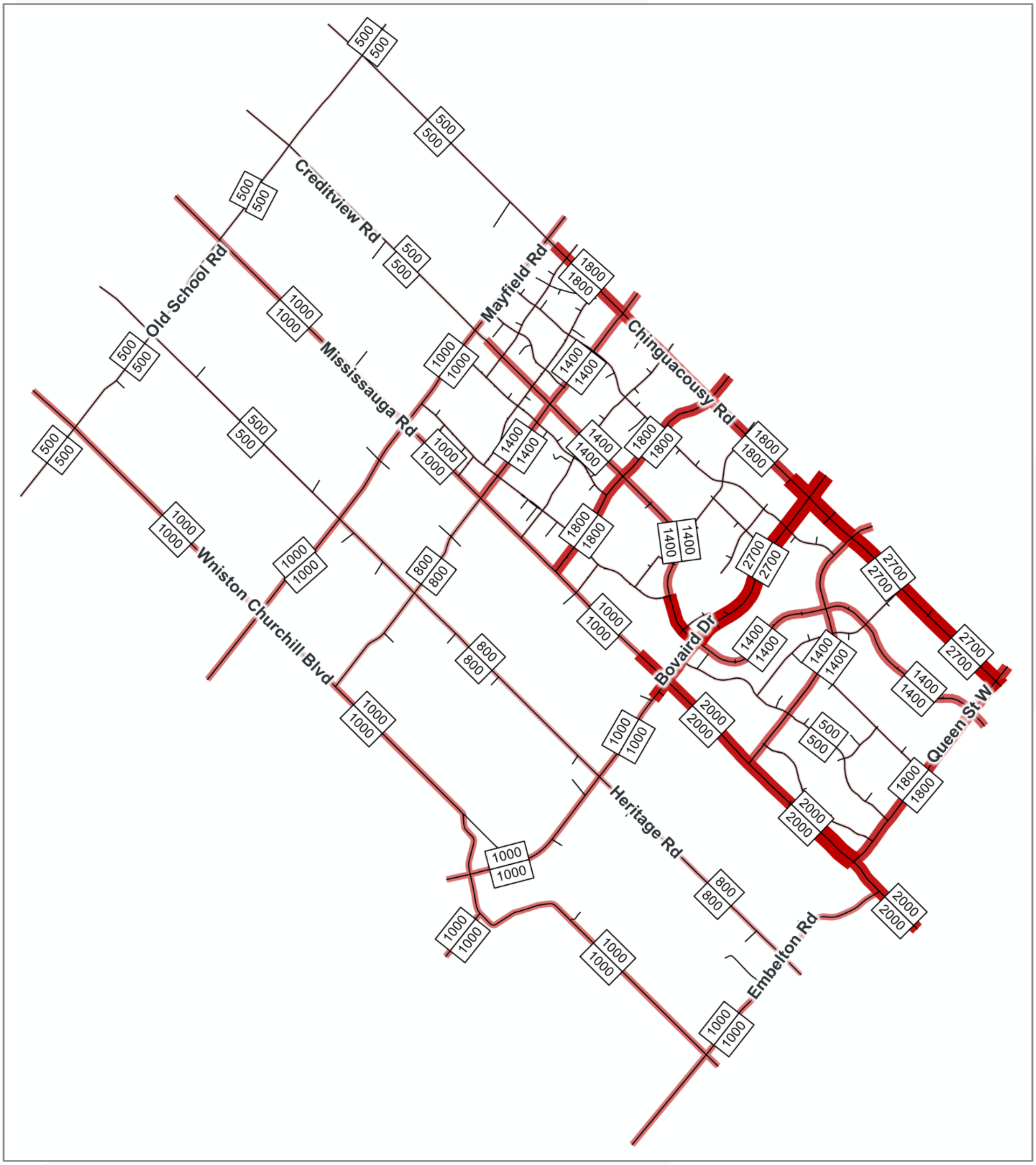


Figure 4: Existing Conditions Mesoscopic Model – Link Capacities



3.4 Travel Demand & Origin-Destination Matrices

A defining feature of multi-resolution modelling exercises is the extraction of origin-destination travel demand matrices from large-scale models for use as demand inputs in smaller, more granular models. This modelling exercise employs the transfer of demand matrices from City of Brampton's macroscopic model to the HHTMP mesoscopic model. This interconnectivity allows the mesoscopic model to account for factors whose effects are difficult to capture in a model of its scale, including those of planned regional growth and transportation infrastructure improvements across the Greater Toronto-Hamilton Area.

The transfer of travel demand matrices was achieved through the creation of a subarea “cut-out” of the 2022 City of Brampton macroscopic model. This subarea spans the area covered by the mesoscopic model and captures travel demand information, in the form of origin-destination auto travel demand matrices, throughout said area. The macroscopic model's subarea auto demand matrices were used as travel demand inputs in the mesoscopic model. This matrix transfer process is visualized in **Figure 5**. The resulting travel demand associated with the 2022 City of Brampton macroscopic model subarea is summarized in **Table 1**.

Figure 5: OD Matrix Transfer from Macroscopic to Mesoscopic Model

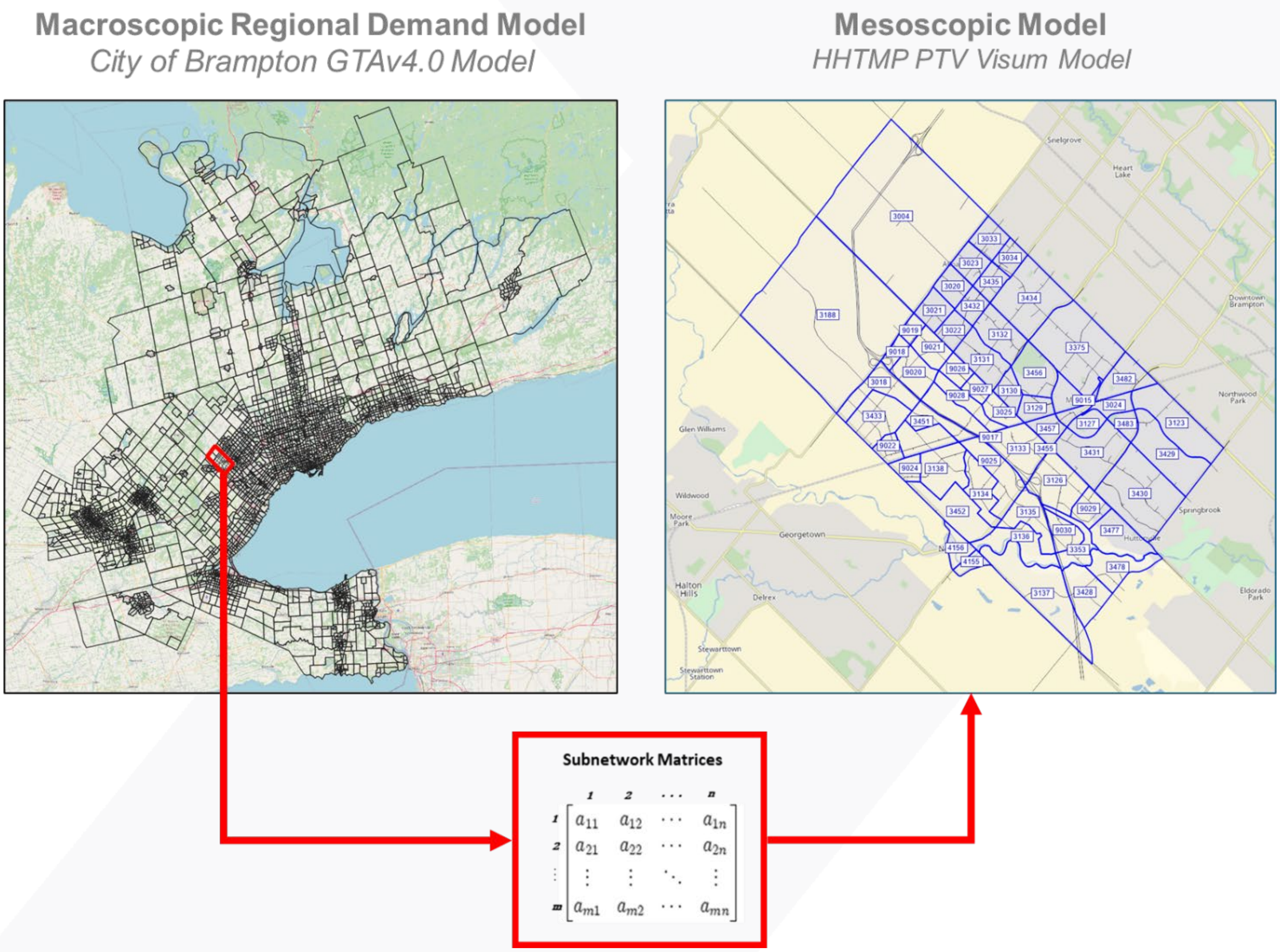


Table 1 Existing Conditions Subarea OD Auto Demand

Origins \ Destinations	Heritage Heights Zones	Other Internal Zones	External Zones
Heritage Heights Zones	0 (0)	10 (20)	260 (140)
Other Internal Zones	5 (20)	5,275 (3,425)	3,940 (10,420)
External Zones	60 (165)	8,165 (7,115)	7,000 (5,885)

Note: AM Peak Hour (PM Peak Hour). Table cells represent number of trips travelling from origin (row header) to destination (column header). For example, number of auto trips travelling from External Zones to Other Internal Zones in the AM peak hour is 8,165.

As is shown in **Table 1**, the trips to and from the Heritage Heights lands are limited due to the greenfield nature of these lands. The travel demand throughout the model bounds is primarily made up of pass-through traffic and traffic travelling to and from internal model zones that are not part of the Heritage Heights Secondary Plan Area.

4.0 EXISTING CONDITIONS MODEL CALIBRATION

Following the development of an existing conditions mesoscopic model, it is calibrated to ensure it can adequately replicate current travel demand patterns within the study area and can be used as a base model to develop the future 2051 future conditions mesoscopic model. This section presents the results of the calibration exercise and demonstrates that the existing conditions mesoscopic model accurately replicates existing traffic conditions throughout the study area. It also discusses the methodology, metrics, evaluation criteria, as well as additional relevant information associated with the model calibration exercise.

4.1 Calibration Objective & Methodology

As with all transportation modelling tools, calibration is a prerequisite to ensure that the model's base-year traffic operations and patterns are accurately replicated. Only upon achieving an acceptable level of calibration can the model be considered valid for forecasting and evaluating future-year network operations and scenarios.

In this case, the mesoscopic model employed an iterative dynamic user equilibrium (DUE) assignment method using demand inputs from the City of Brampton's 2022 macroscopic model, of which is calibrated at the "screenline level". This initially resulted in assigned volumes in the mesoscopic model that did not align with observed 2022-2024 corridor-level traffic volumes, highlighting the need for calibration. The objective of this calibration exercise was to ensure that the existing conditions mesoscopic model adequately replicated corridor-level travel patterns and traffic operations observed under 2022-2024 conditions throughout the study area.

The level of calibration was evaluated through the GEH metric, a goodness-of-fit statistical measure discussed in detail in the following section. The calibration process consisted of the iterative adjustment of model parameters followed by the computation of GEH values to evaluate the effectiveness of said adjustments.

The primary adjustment made during the mesoscopic model calibration involved the use of *PTV Visum's* built-in *TFlowFuzzy* matrix estimation procedure, which was used to modify travel demand between select origin-destination pairs. This process accounted for natural variability in the calibration target data (i.e., 2022-2024 traffic counts), as well as discrepancies between assigned volumes and 2022-2024 target data resulting from the macroscopic model's 2016 base year. The effectiveness of applying the typical *T-Flow Fuzzy* matrix adjustment was confirmed through decreases in total link GEH values, as is discussed later in this section. As demonstrated by outputs presented in **Section 4.4**, the calibration ensured that the mesoscopic model accurately replicates observed existing conditions and provides a reliable foundation for the development of models that can confidently project and assess 2051 network operations.

4.2 Calibration Targets and Evaluation Criteria

As part of the calibration process, the model's assigned link volumes were compared to 2022-2024 counted data throughout the study area to assess the level of calibration as model adjustments were applied. The following sections detail the target data and the calibration evaluation criteria in detail.

4.2.1 Calibration Targets

Intersection turning movement counts (TMCs) across the model study area for the years 2022 to 2024 were provided by City of Brampton and Peel Region. Where gaps in data were identified, additional TMCs were collected via cameras and image processing software by Spectrum Traffic Data Inc. In total,110 TMCs were collected and represent travel demand during morning and afternoon peak hours on weekdays (between Tuesday and Thursday) between May 2022 and June 2024. TMC locations and dates are shown in **Figure 6**.

Figure 6: Collected Turning Movement Counts (2022 – 2024)

The TMC data was used to derive corridor-level traffic volumes which were used as the primary set of calibration targets. **Figure 7** and **Figure 8** detail the resulting AM and PM peak hour corridor traffic volume targets used in the calibration of the mesoscopic models.

Figure 7: Existing Conditions Corridor Volume Targets – AM Peak Hour

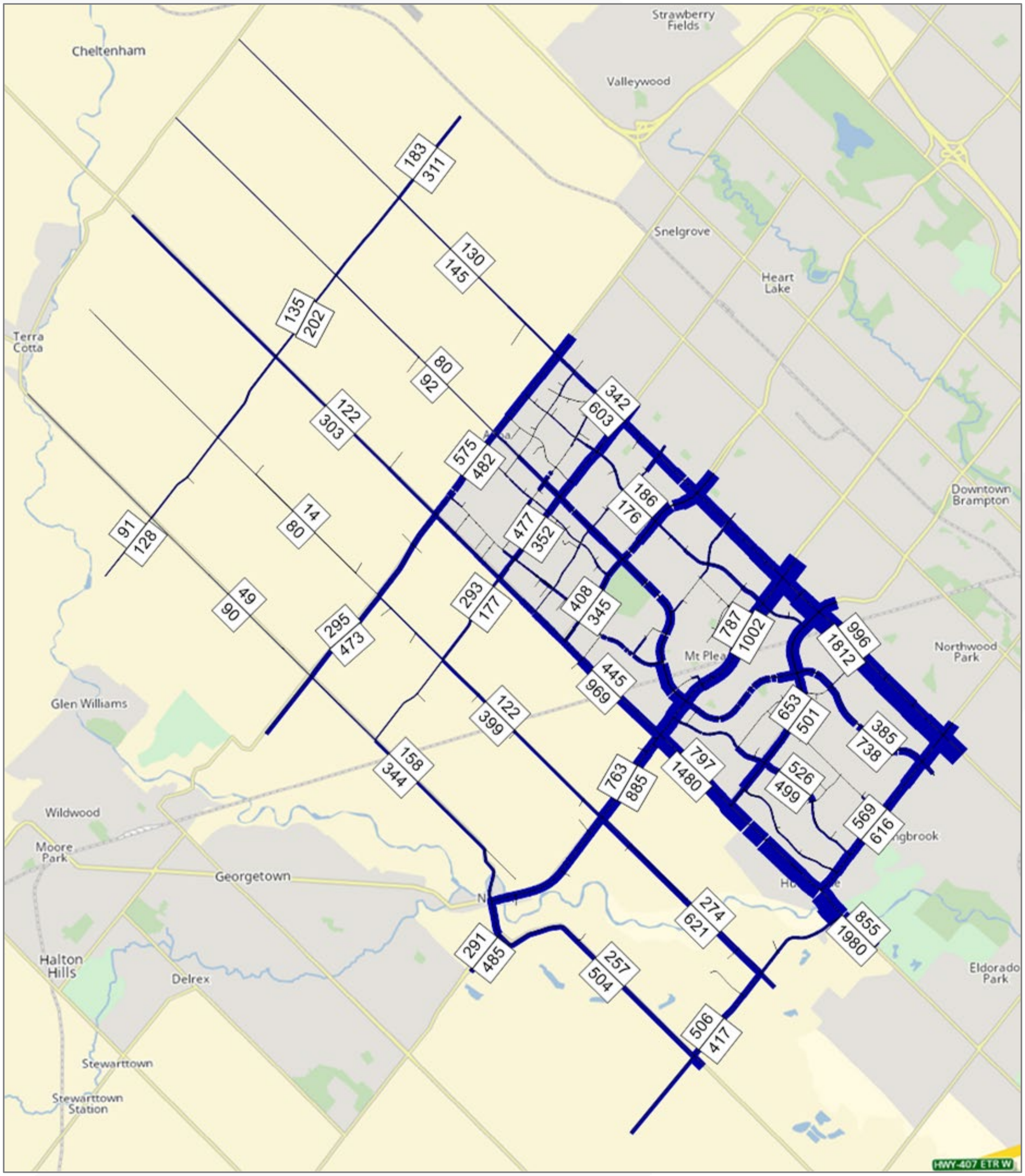
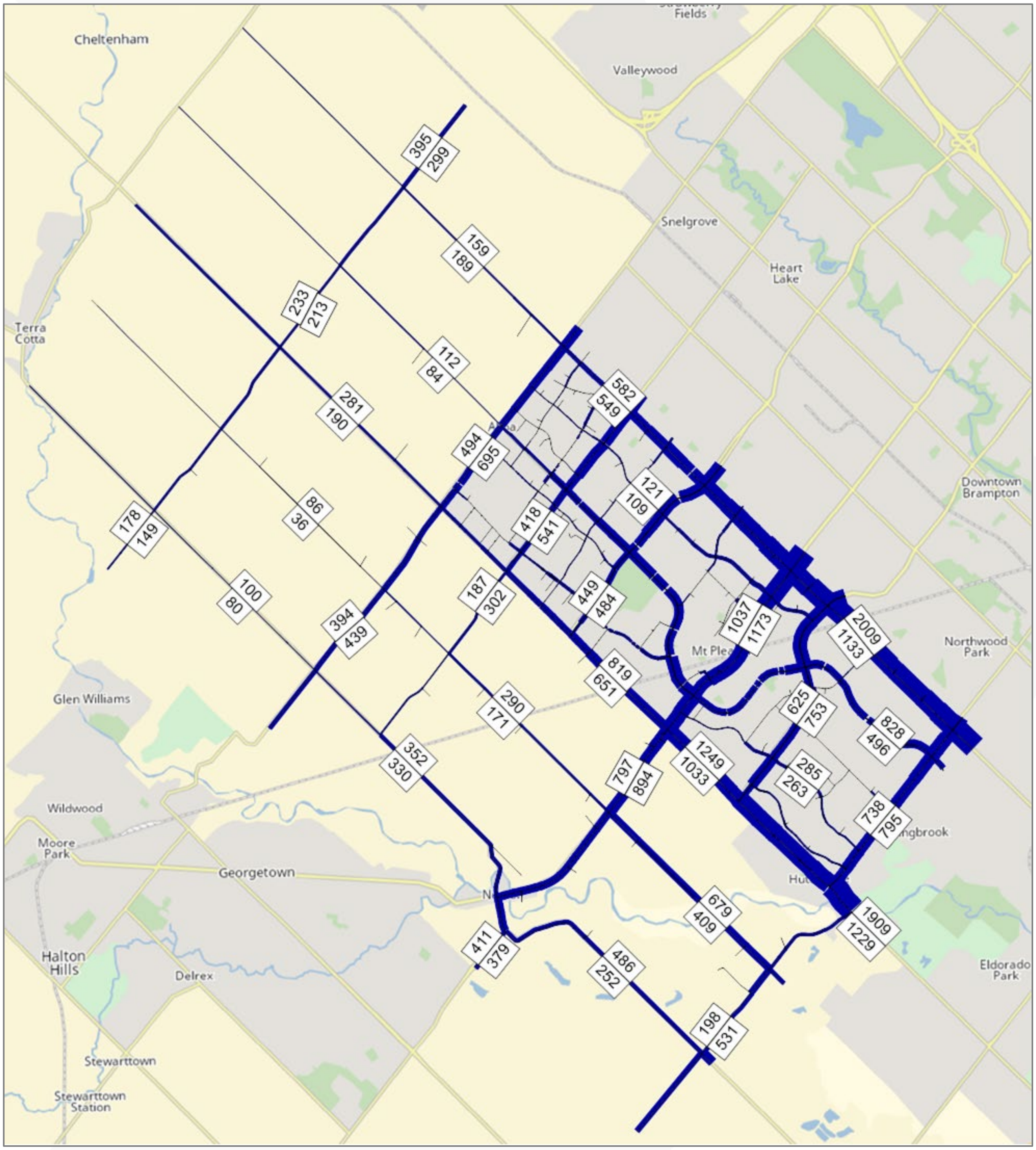


Figure 8: Existing Conditions Corridor Volume Targets – PM Peak Hour



4.2.2 Goodness-of-Fit Statistic

As is customary in most transportation model calibration exercises, the goodness-of-fit measure used to evaluate the statistical distance between the model outputs and observed traffic volume targets is the GEH statistic, which is expressed by the following equation, where M represents model outputs and C represents observed traffic data:

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

The values resulting from the GEH equation, for both the mesoscopic and microscopic models, are usually interpreted as GEH < 5.0 representing good calibration, 10.0 < GEH < 5.0 representing average calibration and GEH > 10.0 representing poor calibration.

4.2.3 Evaluation Criteria

It should be stated that no standard set of formal guidelines exists to direct multi-resolution modelling exercises conducted to assess the impacts of proposed large-scale development projects in Ontario, let alone to regulate the calibration of said models. Hence, technical decisions pertaining to the calibration of multiresolution models are typically made based on previously approved and ongoing projects, applicable past experience and engineering judgement, as well as collaboration with stakeholders and modelling staff at municipal and regional agencies. The following calibration thresholds were developed in coordination with Transportation Planning and Integrated Planning staff at the City of Brampton.

- GEH < 5.0 for no less than approximately 80% of all link segments in the network
- GEH < 10.0 for no less than approximately 95% of all link segments in the network
- GEH > 10 for no more than approximately 5% of all link segments in the network

The thresholds presented above were used to provide sets of metrics from which to evaluate the ability of different pre-calibration model runs to replicate observed traffic conditions and hence guide the adjustment of parameters required to improve the calibration of said models.

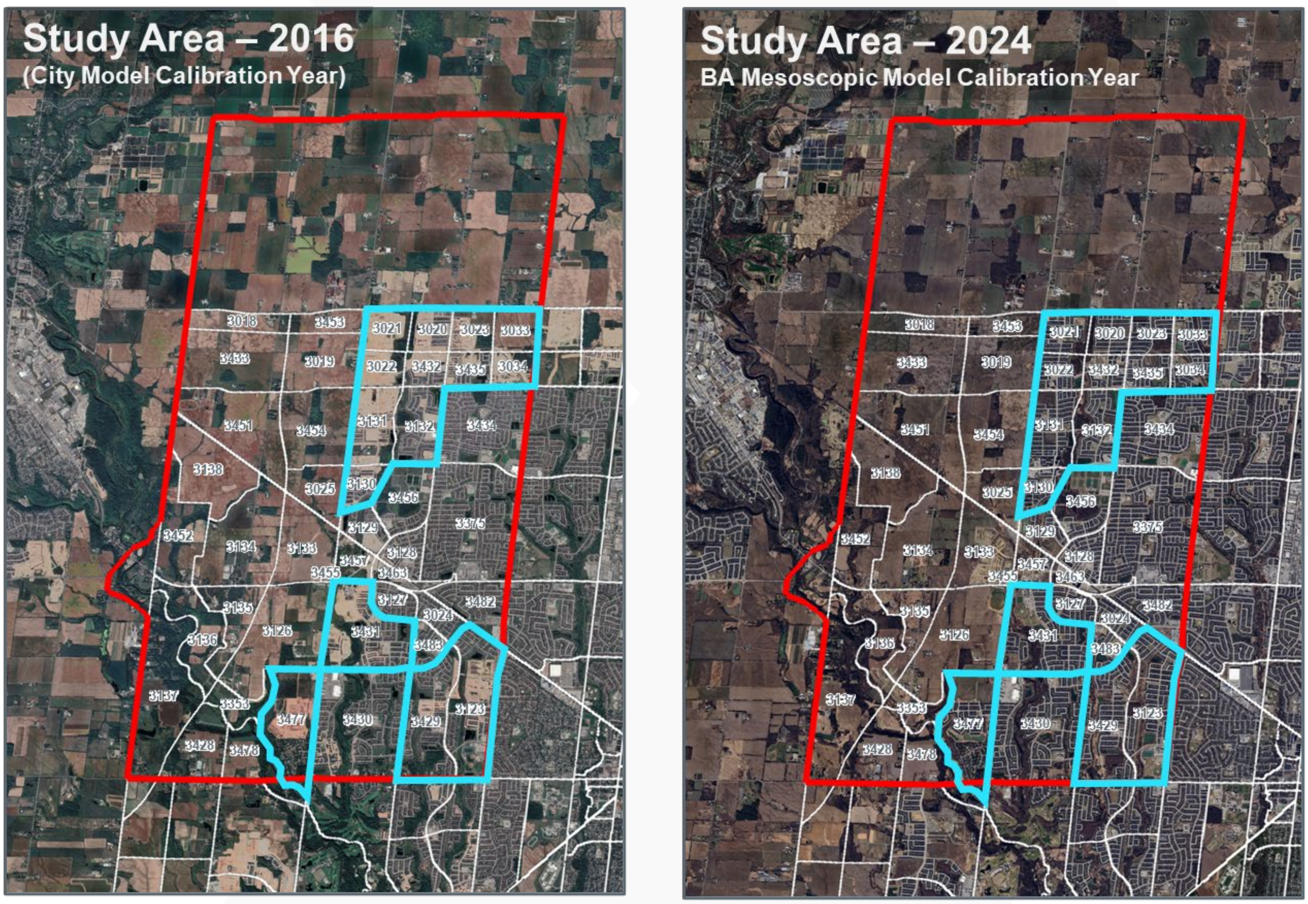
4.3 OD Matrix Adjustments

As previously mentioned, the calibration of the mesoscopic model primarily consisted of demand matrix adjustments to account for natural variability in the calibration target data, as well as discrepancies between the initial assigned volumes and the corridor volume targets. These discrepancies are likely due to the macroscopic model being calibrated at the "screenline" level and also due to the macroscopic model being calibrated to 2016 travel demand data, therefore resulting in subarea travel demand matrices that do not align with corridor-level volume targets derived from 2022-2024 TMCs.

The primary adjustment made during the mesoscopic model calibration involved the use of *PTV Visum's* built-in *TFlowFuzzy* matrix estimation procedure, which was used to modify travel demand between select origin-destination pairs. Matrix adjustments were reviewed, and origin-destination pairs with significant adjustments were flagged. The flagged adjustments were investigated to ensure the magnitude of said adjustments were warranted. The majority of the flagged adjustments were related to internal model zones that have seen significant growth between 2016 and the present day.

Figure 9 shows the model zone system and change in level of development across the model study area using Google Earth satellite imagery.

Figure 9: Model Area Population Changes Between 2016 and 2021



As shown in the satellite imagery shown above, significant amounts of undeveloped/lands under construction in 2016 have seen growth since then, especially in the Mount Pleasant Secondary Plan Area. With the macroscopic model's base year being 2016, the base set of subarea matrices underestimates demand to and from these internal zones and therefore significant adjustments to demand generated by these zones was required in order to calibrate to existing conditions corridor volume targets. **Table 2** below summarizes the magnitude of adjustments made to calibrate the subarea demand matrices.

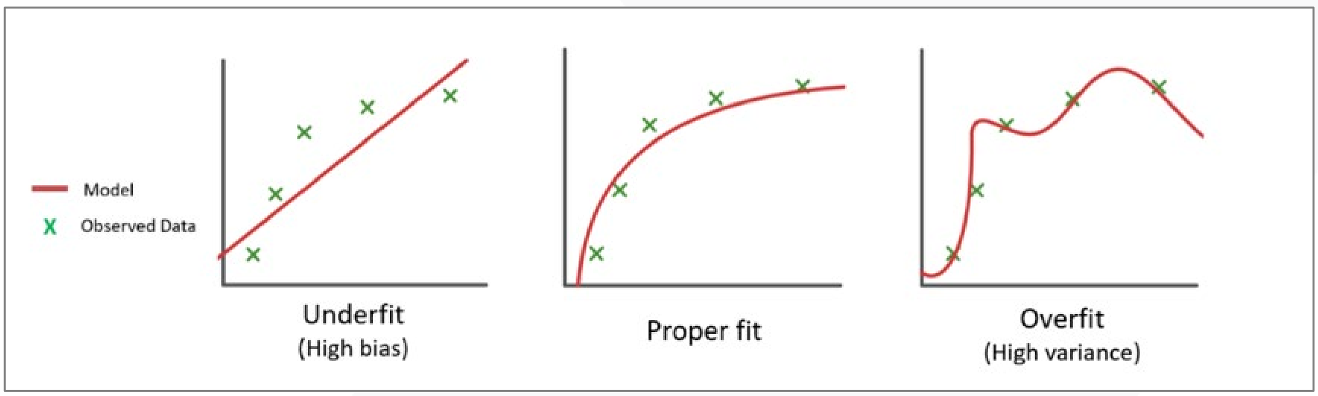
Table 2 Mesoscopic Model Adjusted Matrix Trips

Peak Hour	Total Trips Pre-Adjustments	Total Trips Post-Adjustments	Absolute Difference	Adjustments Related to Internal Zone Growth	Remaining Adjustments
AM	19,973	24,711	+4,738	+5,730	-992
PM	17,624	27,192	+9,567	+8,456	+1,111

4.3.1 Importance of Avoiding Model "Overfit" to Existing Conditions

Model overfit occurs in an over-reliance on parameter adjustments in order to meet prescribed targets and thresholds during the model calibration process. This over-reliance leads to a model that appears to be very well calibrated but has in fact lost the generality necessary to accurately represent (i.e. model) inherently varying situations and scenarios. This concept is shown in **Figure 10**, where the example on the right illustrates an unfortunately successful attempt to replicate all naturally occurring variation present in the observed existing conditions dataset. Despite achieving higher model calibration results, this example is clearly overfitted to specific existing conditions and, as a consequence, has lost all of its forecasting and predictive capabilities (it in fact predicts future severe decreases in the dependent variable when the actual relationship clearly indicates an asymptotically upward trend).

Figure 10: Proper Model Calibration vs. Model Overfit



4.4 Calibration Results

The link-based GEH values resulting from the mesoscopic Visum model calibration exercise are summarized in **Table 3** and compared to the calibration criteria provided in **Section 4.2.3**. Said criteria can be described as corresponding to “good” calibration in the case of GEH values less than or equal to 5, “average” calibration in the case of GEH values greater than 5 and less than or equal to 10, and “poor” calibration in the case of GEH values greater than 10

Table 3 Mesoscopic Model – Link Volumes Calibration Results

	Calibration Thresholds	Weekday Morning (AM) Peak Hour Conditions Model	Weekday Afternoon (PM) Peak Hour Conditions Model
% of links with GEH ≤ 5	≥ 80 %	81%	81%
% of links with GEH ≤ 10	≥ 95 %	96%	96%
% of links with GEH > 10	≤ 5 %	4%	4%

In addition to **Table 3**, a graphical representation of the assigned link volumes and resulting GEH values of both the weekday morning (AM) and afternoon (PM) peak hour existing conditions mesoscopic Visum models is provided in **Figure 11, Figure 12, Figure 13, and Figure 14**. As shown in the table above, as well as the following figures, the weekday morning (AM) and afternoon (PM) peak hour existing conditions mesoscopic Visum models meet the calibration targets laid out for this analysis exercise, while ensuring that the models were not overfit to the existing conditions 2022-2024 turning movement count data.

Figure 11: Mesoscopic Model Link Volume – AM Peak Hour

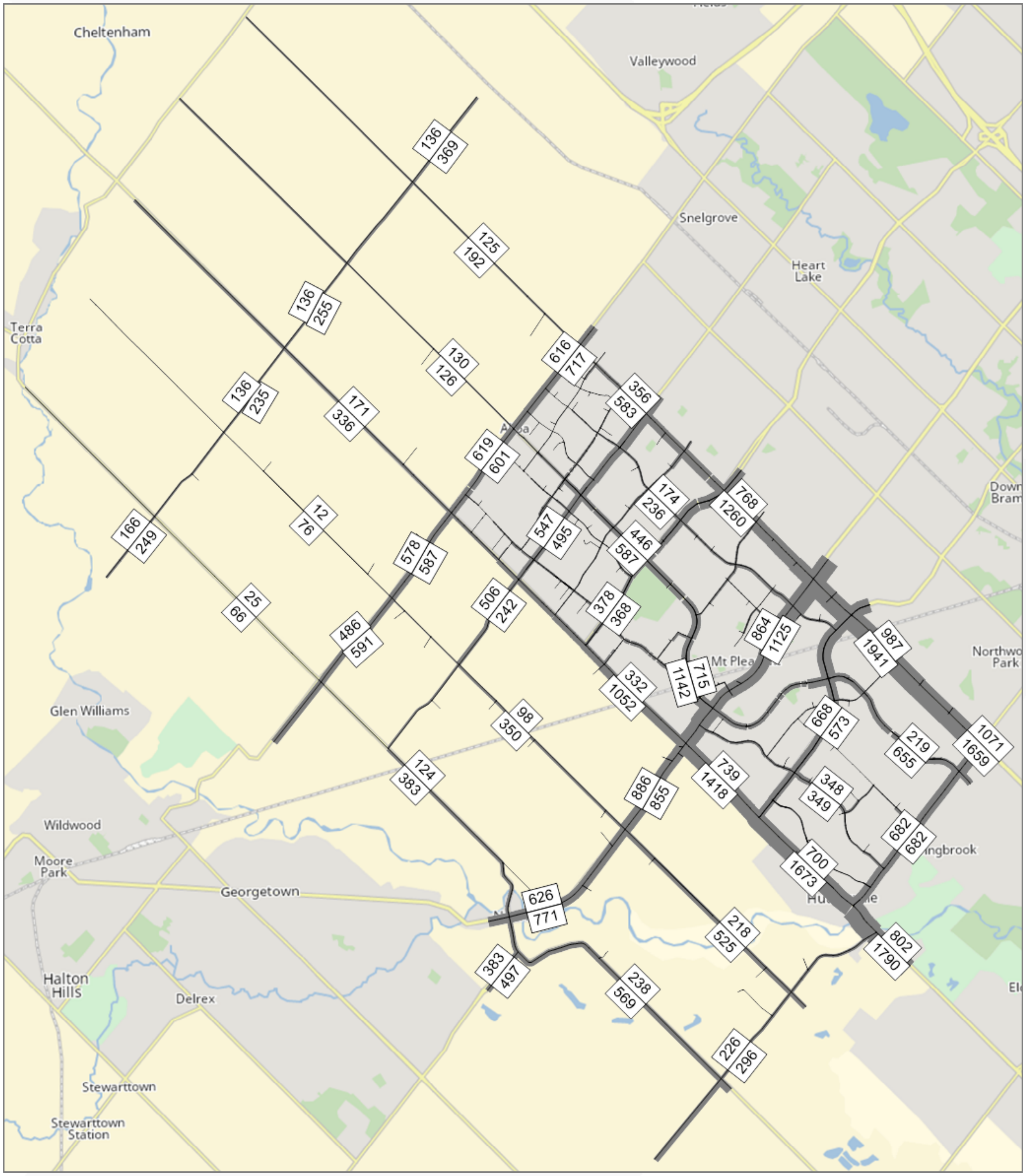


Figure 12: Mesoscopic Model Link Volume – PM Peak Hour

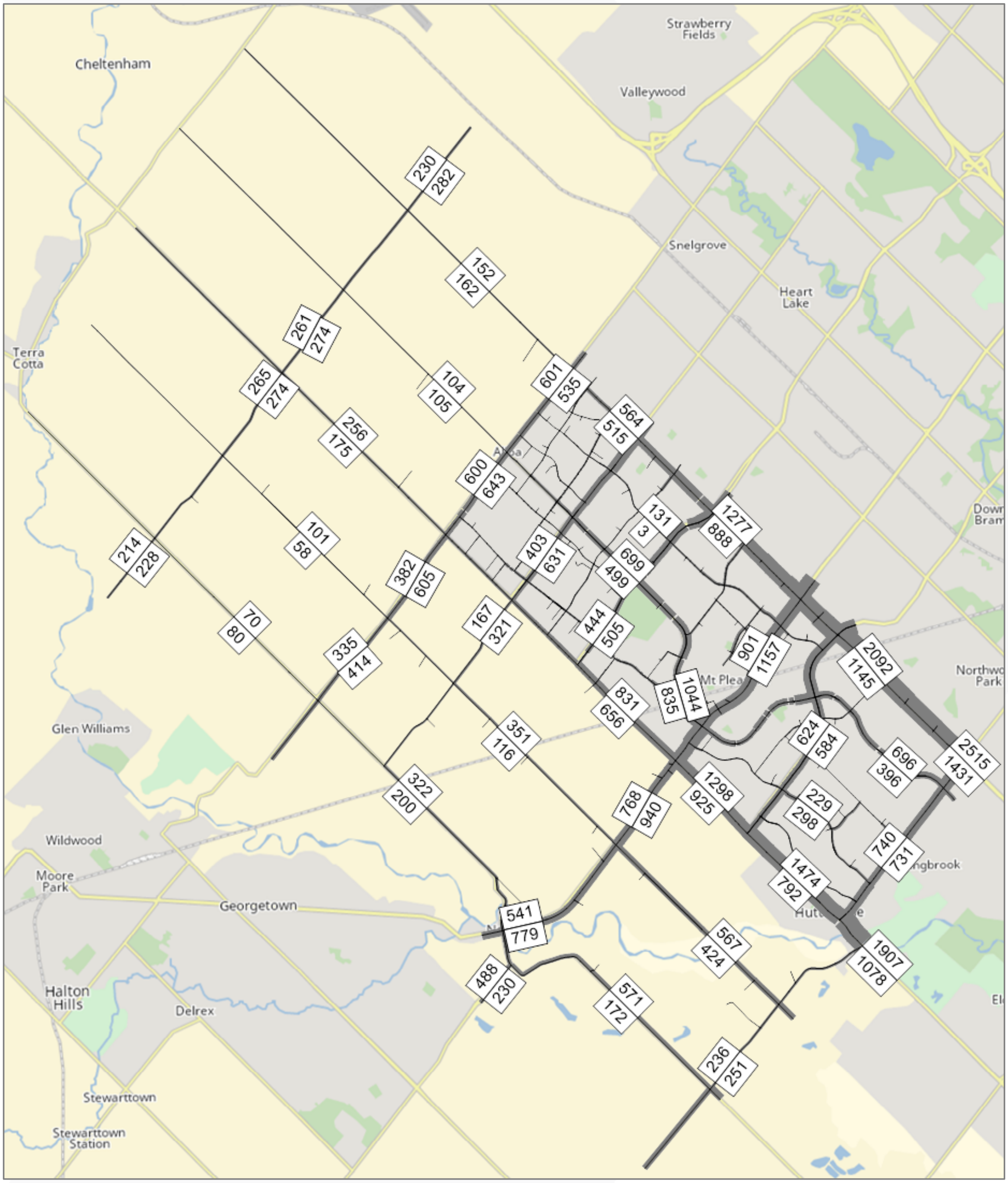


Figure 13: Mesoscopic Model Link GEH Calibration Results – AM Peak Hour

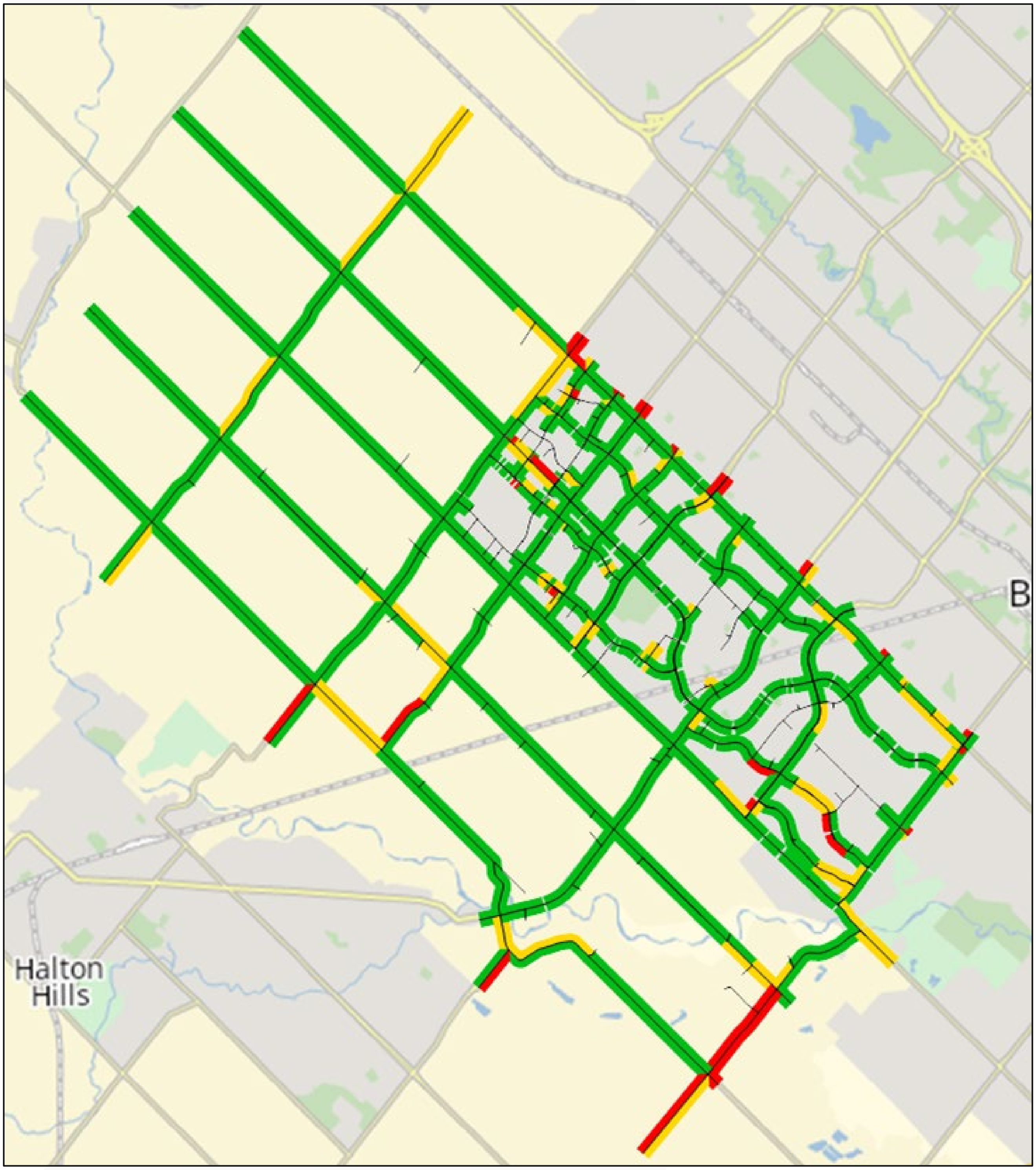
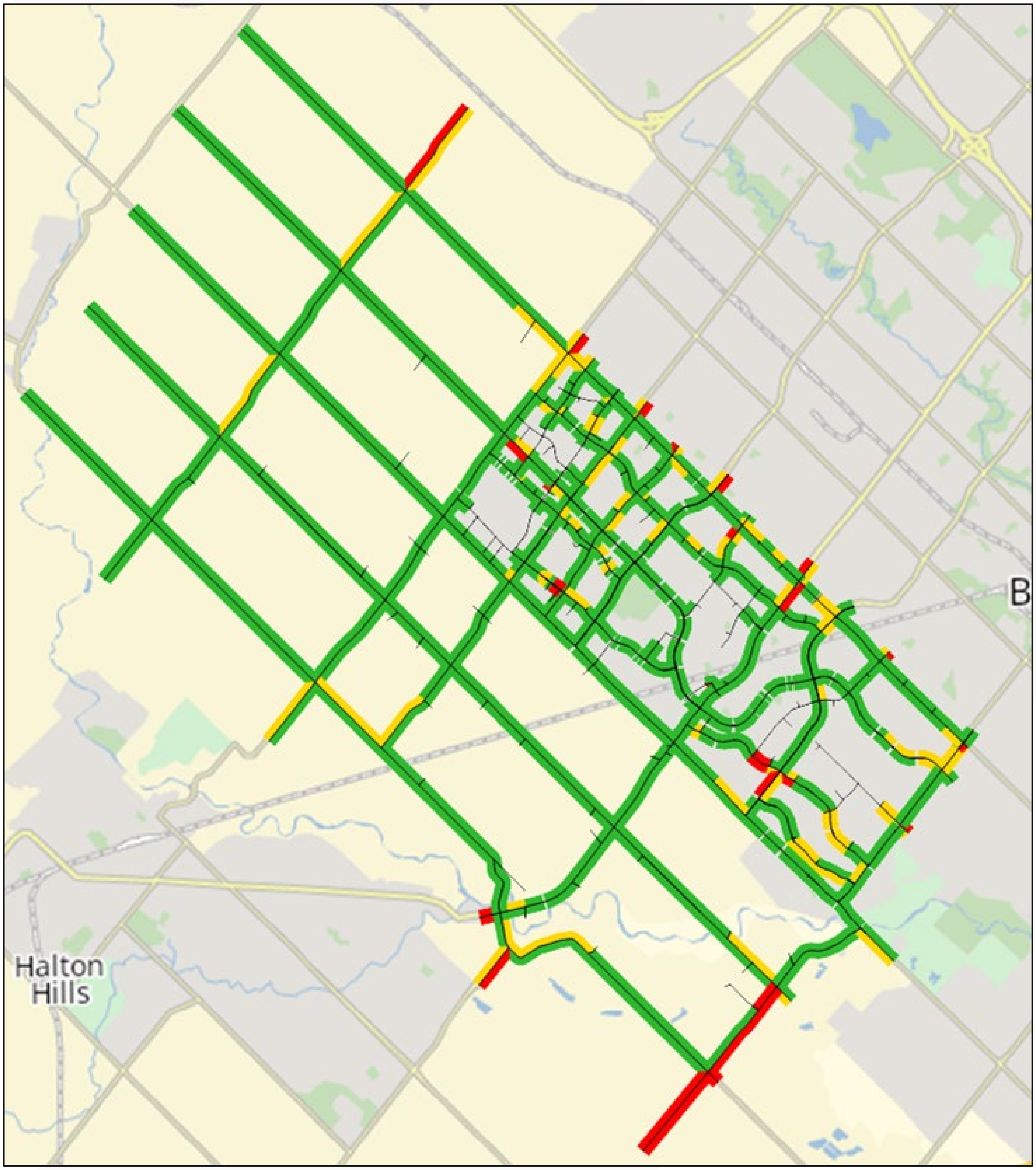


Figure 14: Mesoscopic Model Link GEH Calibration Results – PM Peak Hour



5.0 FUTURE 2051 BASE MODEL DEVELOPMENT

5.1 Overview

With the existing conditions mesoscopic model meeting calibration thresholds, it was deemed suitable for use as a base to which supply and demand related model adjustments were applied to reflect the future (2051) base conditions assumed for this study.

The base 2051 conditions represent the OLT-mediated population and employment yields for the Heritage Heights SPA and the associated transportation network, as shown in **Figure 15** and **Figure 16**. This model was used to assess the transportation operations associated with the OLT-mediated network and informed the development and assessment of the transportation network alternatives.

The following sections will provide an overview of the 2051 Brampton Mobility Plan macroscopic regional demand model and its associated subarea demand matrices, post-processing adjustments of said subarea demand matrices prior to their use as mesoscopic model inputs, mesoscopic model zone system refinements, and adjustments made to the mesoscopic model road network.

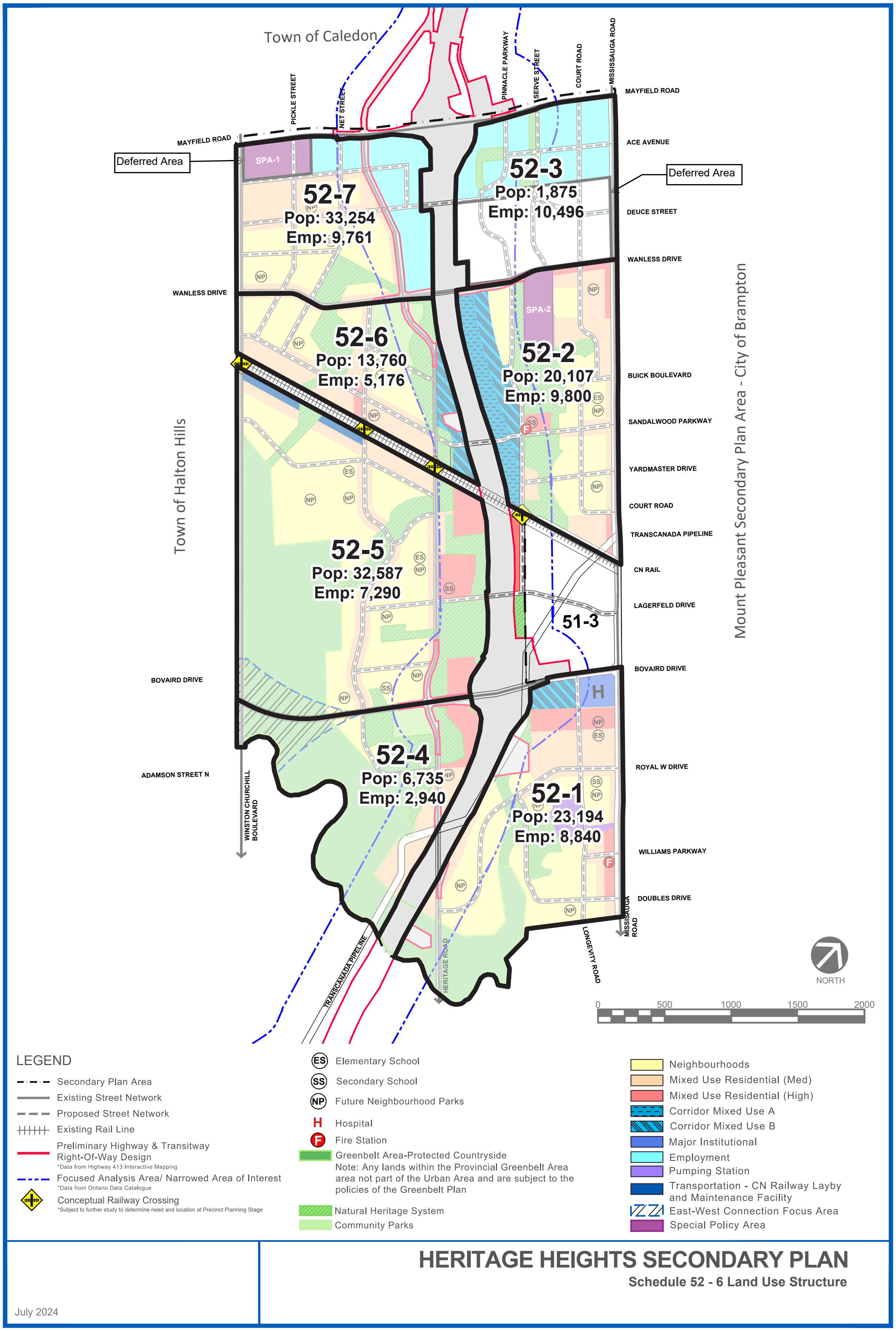


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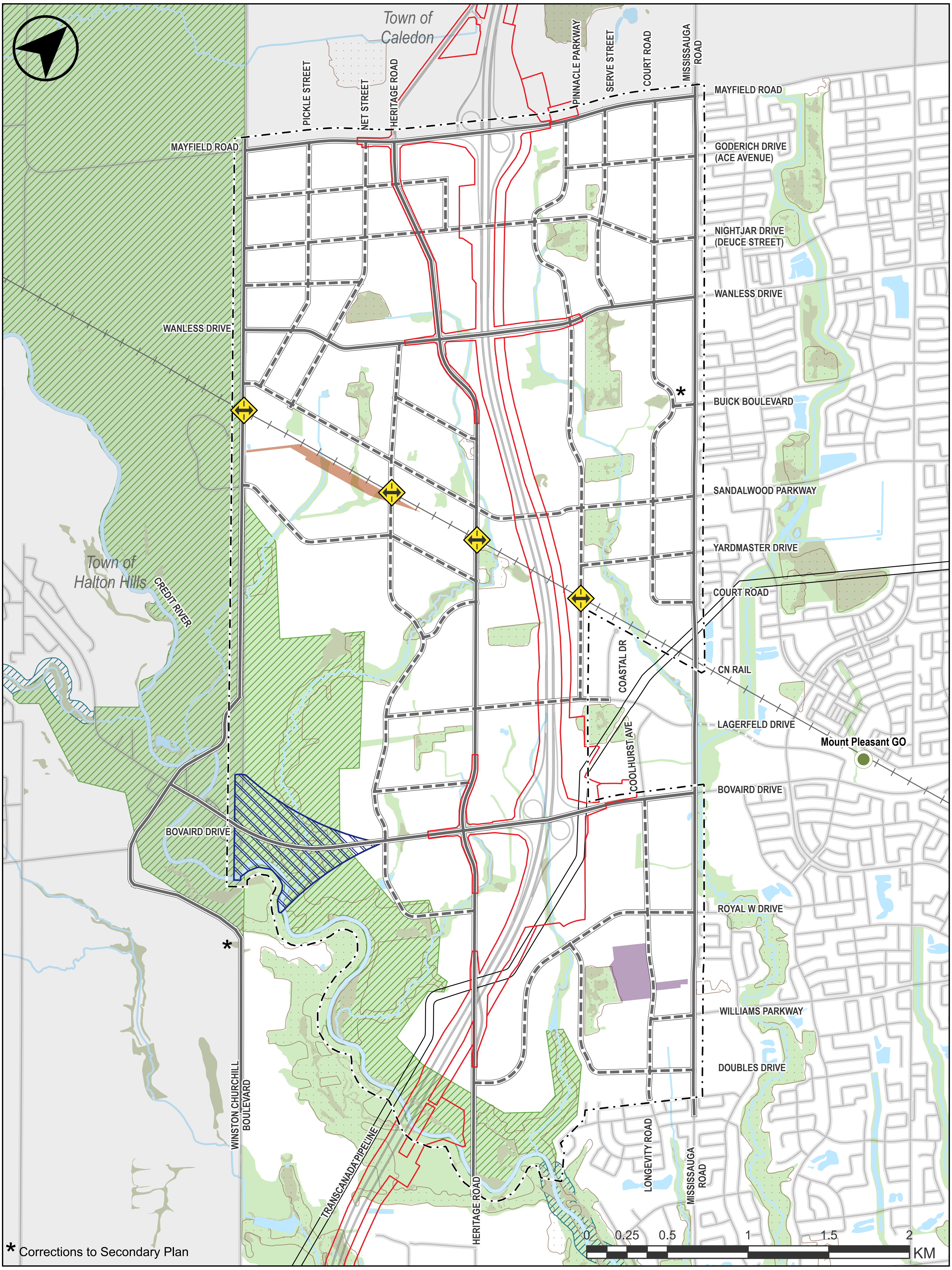
FIGURE 15 OLT APPROVED SECONDARY PLAN YIELDS BY PRECINCT



OLT Approved Secondary Plan Road Network

LEGEND

- Heritage Heights Secondary Plan Area
- Natural Heritage System†
- Greenbelt Area (Protected Countryside)*
- Urban River Valley *
- Wetland§
- Woodland‡

Street Network

- Existing Street Network
- Proposed Street Network
- Highway 413 & Transitway Preliminary Right-of-Way #
- Conceptual Railway Crossing

- East-West Connection Focus Area
- Peel Region Pumping Station
- Metrolinx Heritage Road Layover Facility

Sources: † City of Brampton GeoHub, ‡ Region of Peel Open Data
* Municipal Affairs and Housing, Ontario GeoHub
§ Ministry of Natural Resources and Forestry, Ontario GeoHub

Highway 413 Corridor reflects the Preliminary Design as outlined the Environmental Impact Assessment Report (Dec. 1, 2025).

FIGURE 16 OLT APPROVED SECONDARY PLAN ROAD NETWORK (BASELINE)

5.2 2051 City of Brampton Macroscopic Regional Demand Model

The 2051 mesoscopic Model for Heritage Heights adopts regional inputs from the 2051 City of Brampton macroscopic models developed in support of the Brampton Mobility Plan (BMP). BMP macroscopic model considerations / assumptions include population and employment growth and transportation network assumptions primarily informed by:

- the 2025 BMP, specifically the resulting transportation infrastructure recommendations,
- the 2024 Brampton Plan,
- University of Toronto's 2016 GTAv4.0 regional demand model,
- Peel Region's 2019 Long Range Transportation Plan,
- Peel Region's 2024 Regional Growth Forecast Update,
- Halton Region Official Plan Population and Employment,
- Town of Caledon's 2024 Multi-Modal Transportation Master Plan, and
- the transportation corridor design of the planned Highway 413.

The BMP macroscopic model was refined by the City for use in the mesoscopic Heritage Heights transportation model through the incorporation of the Heritage Heights Secondary Plan OLT population and employment yields (described below) and the Base Transportation Network. For the purposes of this analysis, the BMP macroscopic model transportation network was modified to include the OLT-mediated transportation network.

Resulting Mode Splits and Subarea Origin-Destination Matrices

Subarea origin-destination (OD) auto travel demand matrices were extracted from the 2051 macroscopic regional travel demand (BMP) model for use as inputs for the mesoscopic model, consistent with the approach taken in modelling existing conditions.

BMP mode share targets were reviewed in the context of modelling future conditions for the Heritage Heights Secondary Plan. The BMP establishes 25% transit and 11% active transportation City-wide mode share targets for the 2051 horizon year. The BMP targets were compared with the resulting macroscopic model mode share to inform reduction of auto demand and an increase in transit demand to and from the Heritage Heights SPA. The macroscopic model forecasts a Heritage Heights transit and active transportation mode split of 10% and 3%, respectively.

An adjustment of 5% from auto to transit mode share was established to reflect a shift in travel behaviour aligned with encouraging the City's broader sustainable transportation goals while also maintaining the integrity of the macroscopic regional demand model. The resulting mode splits assumed in the Heritage Heights TMP model are detailed in **Table 4**.

Table 4 Macroscopic Model Initial and Adjusted Heritage Heights Mode Splits

Mode	Mode Shares		
	Macroscopic Model Initial	Macroscopic Model Adjusted	BMP City-Wide Target
Auto (Driver + Passenger)	75%	70%	50%
Transit	10%	15%	25%
Active Transportation	3%	3%	11%
Other	12%	12%	14%

5.3 Mesoscopic Model Zone System

As was done for the existing conditions mesoscopic model, the future conditions model adopts a zone system that is based on the City of Brampton's 2051 BMP macroscopic model's zone system.

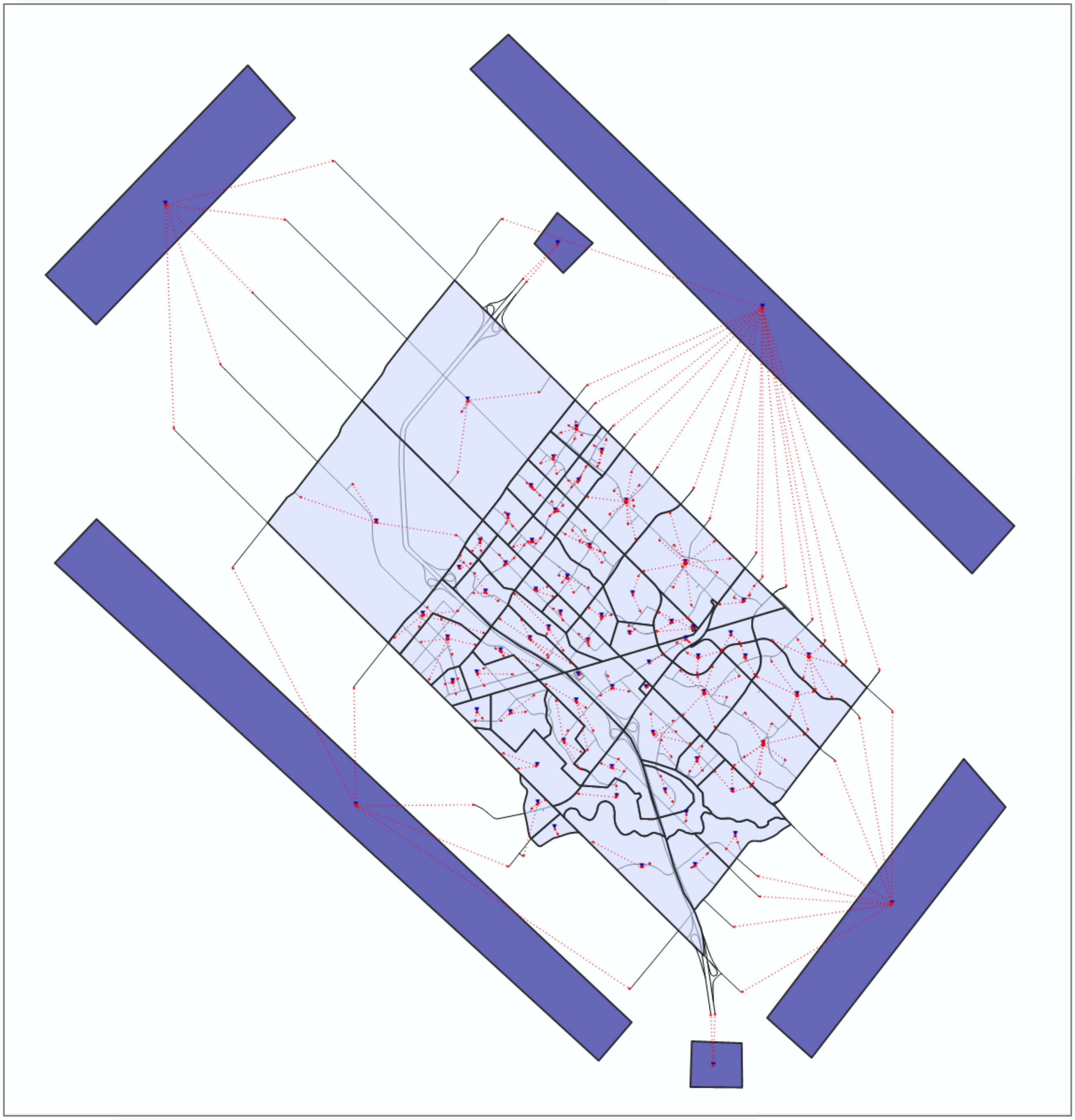
External Zones

Production of the macroscopic model subarea matrices generated 49 external gateway zones representing corridors that cross the mesoscopic model boundaries. As was done for existing conditions, these external gateway zones were aggregated into 4 large zones that represent the north, east, south, and west gateways at the mesoscopic model bounds. The external zones that represent the planned Highway 413 gateways were not included in the aggregation of external zones in order to maintain the macroscopic model's distribution of trips to and from the Highway 413.

Internal Zones

The future conditions macroscopic model subarea zone system contains 50 internal zones. The internal zones that represent the Heritage Heights Secondary Plan Area were disaggregated to reflect a more granular zone system that is better suited to capture travel demand internal to the Secondary Plan Area. The final future conditions mesoscopic model zone system is made up of 6 external zones and 63 internal zones. The zone system, as well as the connector system, is illustrated in **Figure 17**.

Figure 17: Future 2051 Base Conditions – Mesoscopic Model Zone System



5.4 Base Transportation Network

The 2051 mesoscopic model road network was established and assumes the following:

- Heritage Heights collector road network informed by the OLT-mediated Secondary Plan Road Network as shown in **Figure 16**,
- Arterial road network and collector road network outside of Heritage Heights informed by road network infrastructure improvements detailed in Official Planning and Transportation Master Plan documents outlined in **Section 5.2**.

The resulting road network for the future base 2051 mesoscopic model is shown in **Figure 18** and the associated model link capacities are shown in **Figure 19**.

Figure 18: Future Base 2051 Mesoscopic Model Network

Figure 19: Future Base 2051 Mesoscopic Model Network Link Capacities

5.5 Future Conditions Travel Demand

As mentioned in **Section 5.2**, subarea origin-destination (OD) auto travel demand matrices were extracted from the 2051 macroscopic regional travel demand (BMP) model for use as inputs for the mesoscopic model. Prior to use as demand inputs, post-processing adjustments to the subarea matrices were made to account for mesoscopic model calibration, the auto mode shift to transit detailed in the previous section, and the intended usage of Highway 413.

2051 Subarea Demand Adjustments – Calibration Adjustments

The existing conditions matrix demand correction addressed discrepancies between initial mesoscopic model volumes and the 2022-2024 target volume data that were due to: 1) the unadjusted subarea matrices representing 2016 travel demand patterns and 2) the unadjusted subarea matrices being calibrated at the screenline level.

With the 2051 macroscopic model's being built on its existing conditions counterpart, the 2051 unadjusted subarea demand matrices are also calibrated at the screenline level and therefore require further calibration. The matrix adjustments meant to further calibrate the existing conditions subarea matrices to the corridor level were carried forward the 2051 subarea matrices.

It is important to note that the overall existing conditions matrix adjustment included significant increases of trips to and from internal model zones that have seen significant amount of growth between 2016 and 2024. These adjustments were not carried forward to the 2051 subarea matrices as their main purpose was to capture the change in travel demand patterns associated with these zones that had occurred between 2016 (the macroscopic model's calibration year) and 2024. The magnitude of the matrix adjustments that were carried forward to the 2051 subarea matrices are summarized in **Table 5**.

Table 5 2051 Subarea Demand Adjustments – Calibration Adjustments

Peak Hour	Base 2051 Subarea Demand	Adjusted 2051 Subarea Demand	Adjustment Magnitude
AM Peak Hour	60, 480 auto trips	59, 488 auto trips	-992 (-1.6%)
PM Peak Hour	60, 341 auto trips	61, 452 auto trips	+1,111 (+1.8%)

2051 Subarea Demand Adjustments – Mode Shift Adjustments

To capture the 5% reduction in auto mode share for trips generated by Heritage Heights detailed in **Section 5.2**, targeted adjustments to specific origin-destination pairs were applied to the calibrated 2051 subarea matrices. The targeted adjustments aimed to reflect the shift in travel behaviour along key transit corridors, such as Mississauga Road, Heritage Road, Mayfield Road, Bovaird Drive, and Queen St West. In coordination with Transportation Planning and Integrated Planning staff at the City of Brampton, the following subarea matrix adjustments were applied to the Heritage Heights zones to achieve a 5% reduction in auto mode share.

- Total reduction of 830 outbound trips from Heritage Heights in the AM peak hour, applied to the "Heritage Heights Zones to East Gateway Zone" and "Heritage Heights Zones to South Gateway Zone" origin-destination pairs.

- Total reduction of 670 inbound trips to Heritage Heights in the AM peak hour, applied to the "East Gateway Zone to Heritage Heights Zones" and "South Gateway Zone to Heritage Heights Zones" origin-destination pairs.
- Total reduction of 650 outbound trips from Heritage Heights in the PM peak hour, applied to the "Heritage Heights Zones to East Gateway Zone" and "Heritage Heights Zones to South Gateway Zone" origin-destination pairs.
- Total reduction of 680 inbound trips to Heritage Heights in the PM peak hour, applied to the "East Gateway Zone to Heritage Heights Zones" and "South Gateway Zone to Heritage Heights Zones" origin-destination pairs.

2051 Subarea Demand Adjustments – Highway 413 Usage

Through a review of the 2051 subarea matrices and initial mesoscopic modelling results, traffic congestion along north-south corridors within Heritage Heights (i.e., Heritage Road, Mississauga Road, and Winston Churchill Boulevard) were flagged. These north-south corridor segments that were over-capacity stood in contrast with the planned Highway 413 corridor, where there was significant residual capacity.

Given the contrast between north-south corridor segments and the planned Highway 413 corridor capacity, 15% of trips travelling between Heritage Heights and the south screenline were shifted to use Highway 413. This shift resulted in a balancing of usage between the north-south corridors and Highway 413 and represents travel between Heritage Heights and major employment nodes in the GTHA (City of Toronto to the south-east, City of Mississauga to the south, etcetera) that is expected to use the 400-series highways to travel from home to work and vice versa. With the above-mentioned adjustments applied, the resulting weekday morning and afternoon peak hour auto demand associated with Heritage Heights is summarized in **Table 6**.

Table 6 Adjusted Future 2051 Subarea OD Auto Travel Demand Matrices

To Destinations / From Origins	Heritage Heights Zones	Other Internal Zones	External Zones
Heritage Heights Zones	1,775 (2,920)	705 (2,360)	10,305 (7,825)
Other Internal Zones	1,770 (1,475)	1,975 (1,900)	12,205 (7,910)
External Zones	6,825 (9,250)	4,850 (11,130)	16,890 (14,680)

Note: AM Peak Hour (PM Peak Hour). Table cells represent number of trips travelling from origin (row header) to destination (column header). For example, number of auto trips travelling from External Zones to Heritage Heights in the AM peak hour is 6,825.

As shown in **Table 6**, the majority of auto demand to and from the Heritage Heights SPA are forecasted to have origins/destinations that fall outside of the model bounds. The total two-way auto trips to/from Heritage Heights is forecasted to be 21,380 trips and 23,830 trips in the AM and PM peak hours, respectively, with the proportion of those trips starting and ending within the model bounds being 20% to 30%. The AM peak hour forecasts show an outbound peak directionality from Heritage Heights, where the PM forecasts show a fairly balanced distribution of inbound and outbound trips.

6.0 CONCLUSION

The mesoscopic model was the main transportation analysis tool that was used to inform the Heritage Heights Transportation Master Plan. The mesoscopic model was used to assess network operations of the base OLT-mediated transportation network under 2051 conditions. Results of this analysis were used to identify a long and short list of alternatives, which were assessed using a set of transportation, cultural environment, natural environment, and socio-economic criteria.

Prior to assessing future 2051 conditions, an existing conditions mesoscopic model was developed and calibrated. Calibration of the existing conditions mesoscopic model was evaluated with standard calibration thresholds to demonstrate the model's ability to adequately replicate current travel demand patterns in the study area.

As detailed in this report, the existing conditions mesoscopic model was developed and follows industry modelling standards. This report demonstrates that the existing conditions model was suitably calibrated using 2022-2024 turning movement count data and meets standard modelling calibration thresholds.

Once the calibration of the existing conditions model was completed, it was deemed appropriate for use as a base model in the development of the future 2051 conditions mesoscopic models that forecast future travel demand patterns and assess future network conditions. The development of the base future conditions 2051 model consisted of refinement to model demand and network to represent the OLT-mediated growth yields and the associated road network.

Model outputs for the existing and future conditions models are included in the main TMP document