Appendices

VAUGHAN

Appendix A

Focus Area Studies

A1. Vaughan Metropolitan Centre

Transportation AECOM

City of Vaughan

Vaughan Metropolitan Centre (VMC) Transportation Plan

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AECOM: 2012-01-06

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1. Introduction

The City of Vaughan's downtown core will undergo a major transformation over the next several years. The Vaughan Metropolitan Centre (VMC) as planned will become a new community with planned residential, business, recreation and commercial uses. The VMC, with over 300 ha of mixed use development opportunities is a planned downtown development, which will offer all amenities of urban lifestyle including business offices, residences, entertainment, cultural facilities, pedestrian shopping areas and urban squares.

What was the Vaughan Corporate Centre (VCC) has been renamed the Metropolitan Centre to capture the City's new vision for intensified urban living and commerce around the planned terminus of the approved Spadina subway extension. The vision is strongly connected with Provincial, Regional and emerging City planning policies. In the provincial Places to Grow Act (enacted on June 15, 2006), the Vaughan Metropolitan Centre is identified as an "Urban Growth Centre" and a "Major Transit Station and Intensification Corridor".

York Region's Official Plan recognizes the VMC as an important Regional Node. The Region will establish a sustainable infrastructure land use plan that provides direction to the public and private sectors with respect to street and block patterns, building height and density, land use and urban design. York Region's Official Plan calls for the creation of a system of Regional Centres linked by rapid transit in Regional Corridors. The Regional Centres are linked by the Regional Corridors of Yonge Street and Highway 7. The VMC, now focussed east of the Highway 400/Highway 7 interchange, is one of four Regional Centres that have been designated.

A Vaughan secondary plan from the late 1990s envisioned a business centre with only a fraction of the population now projected for the Metropolitan Centre. The City now projects 12,000 housing units, 25,000 people and 11,500 jobs by 2031, a four-fold increase in housing units from that envisaged a decade ago.

The goal of the VMC secondary plan is to create a vibrant and sustainable downtown that serves all Vaughan citizens. It is intended to become a higher order transit hub and eventually to represent the "downtown" of the City of Vaughan. The Vaughan Metropolitan Centre will provide the opportunities for higher density, mixed use development supported by sustainable infrastructure for residential, office, retail and commercial space, urban parks, cultural and recreational amenities.

The extension of the Spadina subway to Vaughan and the need to accommodate a more balanced mix of residents and jobs in the VMC sets the stage for building a more transit-oriented downtown - a distinctive place and centre for business, culture, commerce and living. The subway extension also provides the basis for a new multi-modal transportation plan to support a vibrant and sustainable downtown.

1.1 Planning Policy Context and Background

As noted, the VMC vision is strongly connected with the Provincial, Regional and emerging City planning policies. In the provincial Places to Grow Act, the VMC is identified as a priority urban centre. York Region's Official Plan recognizes the Vaughan Metropolitan Centre as an important Regional Node. The City in partnership with the Region is to establish a sustainable infrastructure / land use plan that provides direction to the public and private sectors with respect to street and block patterns, building height and density, land use and urban design.

The first complete Secondary Plan for the VCC was approved in 1998 through Official Plan Amendment No. 500. The Plan envisioned a new central focus for higher intensity land uses with an identifiable core and a mix of uses. In particular, the VCC was to be a focal point of business activity and major commercial development.

The Vaughan Corporate Centre (VCC) Transportation/Transit Planning and Functional Design Study recommended the road system shown in **Figure 1** (east side of Highway 400 only). This provided the basis for amendments to the Secondary Plan, for the road network in the form of OPA 528. The companion OPA 529 identified the transit network and protected for not only a higher order transit service along Highway 7, but also a rapid transit alignment between the Centre and the City of Toronto. **Figure 2** shows the entire road network (and the rapid transit corridor) included in OPA 528.

OPA No. 663 was approved in 2008. It introduced a new land use designation to the VCC - the Corridor. The Corridor designation recognizes the importance of transit-supportive development along key regional corridors. The Plan envisioned a major transformation of Highway 7 from a high-speed private vehicle route to Avenue 7, a multi-purpose urban street that accommodates pedestrians, higher order transit and private vehicles.

The new VMC Secondary Plan constitutes a part of the City of Vaughan Official Plan and as such is intended to guide and regulate development of the VMC. It replaces all previous Official Plan Amendments applicable to the VMC, including OPAs 500, 528, 529 and the relevant parts of 663.

The approved and fully funded Spadina subway extension to the VMC with its terminal at Highway 7 west of Jane Street will link Vaughan to downtown Toronto and York University, one of Canada's largest higher learning institutions. Just north of the Steeles station in the hydro corridor, some 2,000 park-and-ride spaces are to be provided. There will also be a subway station immediately south of Highway 407, which is to accommodate a further 600 park-and-ride spaces. The subway extension is currently planned to open in 2016 and detailed design has been underway for some time. Within the VMC area, design efforts by the TTC/VIVA team were co-ordinated with the work of the Urban Strategies/AECOM team.

On the road side, the major improvement to be implemented since the approval of OPA 528 is the Portage Parkway crossing of Highway 400 (shown on Figures 1 and 2). The crossing is to open later this year.

1.2 New Secondary Plan and City-Wide Official Plan

A new VMC Secondary Plan has been produced through a Focus Area Study conducted as part of the City's first City-Wide Official Plan Review, which in turn is part of the City's Growth Management Strategy, called Vaughan Tomorrow. The Secondary Plan effort has been led by Urban Strategies Inc. (USI) in partnership with AECOM Canada. AECOM was specifically charged with the complementary transportation analysis, as part of their broader assignment to undertake a City-wide Transportation Master Plan.

The purpose of this report is to document all of the transportation analyses which have led to a significantly different and more multi-modal transportation plan to support the new VMC.

It should be noted that the VMC Focus Area Study was undertaken with extensive stakeholder and public consultation. Early in the study two workshops were held (on May 7 and June 3, 2009) to introduce the Study and gather input regarding a new vision for Vaughan's future downtown. Following extensive analyses by the Study Team, two open houses were held (on March 8 and April 19, 2010) to present findings and the recommended plan. Transportation related presentation materials from these four events are presented in **Appendix I** of this report.

The VMC Focus Area Study was also done in parallel with components of the detailed design for the terminal station for the Spadina subway extension project. Thus, there was significant liaison with the design team through York Region Rapid Transit (YRRT). This led to a complementary, more detailed functional assessment for the Millway Road realignment north of Highway 7.

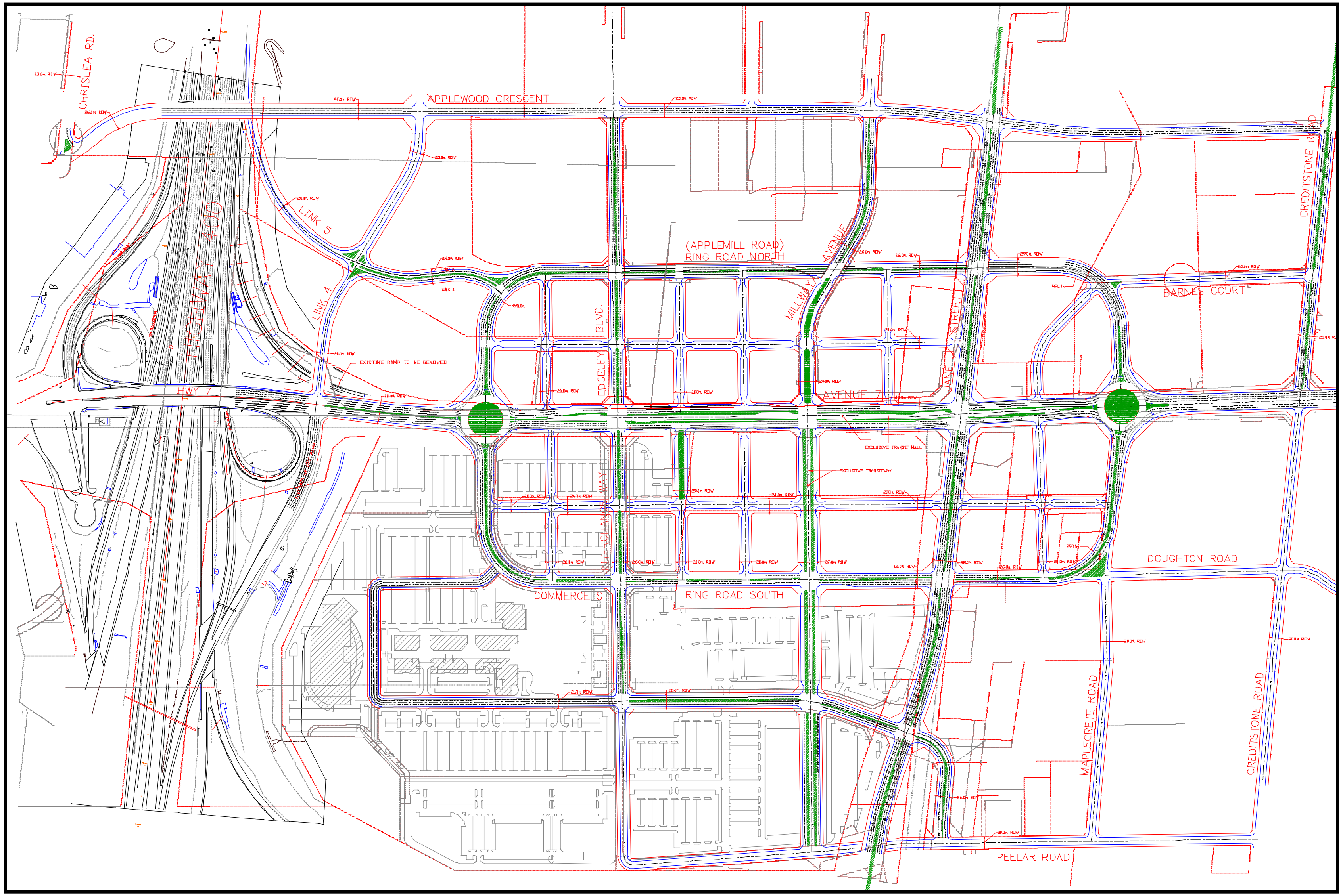

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FIGURE 1

Vaughan Metropolitan Centre (VMC) Transportation Plan

2002 Recommended Corporate Centre Road Network

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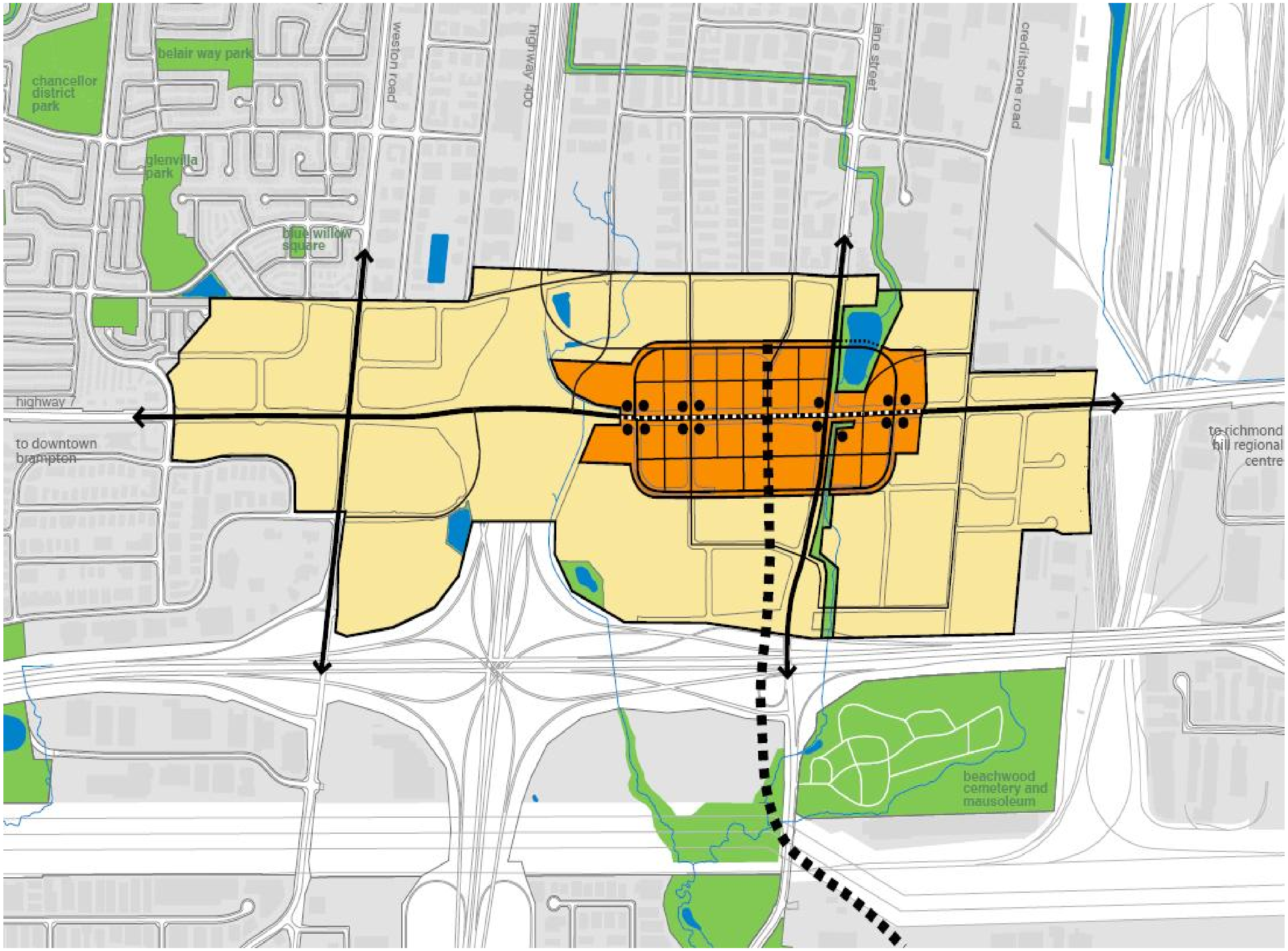

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FIGURE 2

Vaughan Metropolitan Centre (VMC) Transportation Plan

VCC Road Network OPA 528

AECOM

The area under study for the VMC Transportation Plan focussed on the former VCC area (see Figure 2) generally bounded by Highway 407 in the south, the CN rail lines in the east, Portage Parkway (formerly Applewood Crescent and Chrislea Road) in the north and a bit beyond Weston Road in the west. However, a broader area surrounding the VCC, as illustrated in **Figure 3**, was defined to provide a greater understanding of transportation network constraints and opportunities for improvements. This broader area is bounded by Steeles Avenue in the south, Keele Street in the east, Langstaff Road in the north and Pine Valley Drive in the west.

Through completion of the VMC secondary plan, a decision was made to split-off the area west of Highway 400 and consider it as a separate Primary Centre. This area will be the subject of its own new secondary plan, including supporting transportation analysis, in the near future.

1.3 Transportation Study Scope and Approach

The scope of the VMC transportation analyses included the following tasks:

a) Review background reports and data;
b) Provide advice to USI and City staff on overall levels of residential and commercial development for 2031;
c) Provide advice to USI and City staff on practical levels of transit modal shares;
d) Provide advice on road network concepts and feasible road network improvements;
e) Test VMC road network alternatives and select a preferred 2031 network;
f) Identify other desirable road improvements in the broader study area;
g) Test/confirm 2031 road network plan;
h) Classify each road segment and identify needed rights–of-way;
i) Identify supporting TDM programs, and transit and cycling initiatives; and
j) Address 2021 needs and develop an implementation strategy with priority improvements.

Tasks a) through d) constituted the initial phase of work and these tasks were done in close consultation with USI and City staff. Once an initial set of population and employment projections were confirmed, and feasible road improvements were known, tasks e) and f) were undertaken in a second phase with the application of the EMME/2 City-Wide model developed as part of the broader TMP project. The remaining tasks - g) through j) - constituted the final phase of work with task g) undertaken through application of the EMME/2 model.

Prior to the completion of the TMP, the City and Region of York agreed that a more detailed joint transportation study, with a broader study area, would be conducted to address implementation phasing and development triggers, and this study was commenced in July 2011.

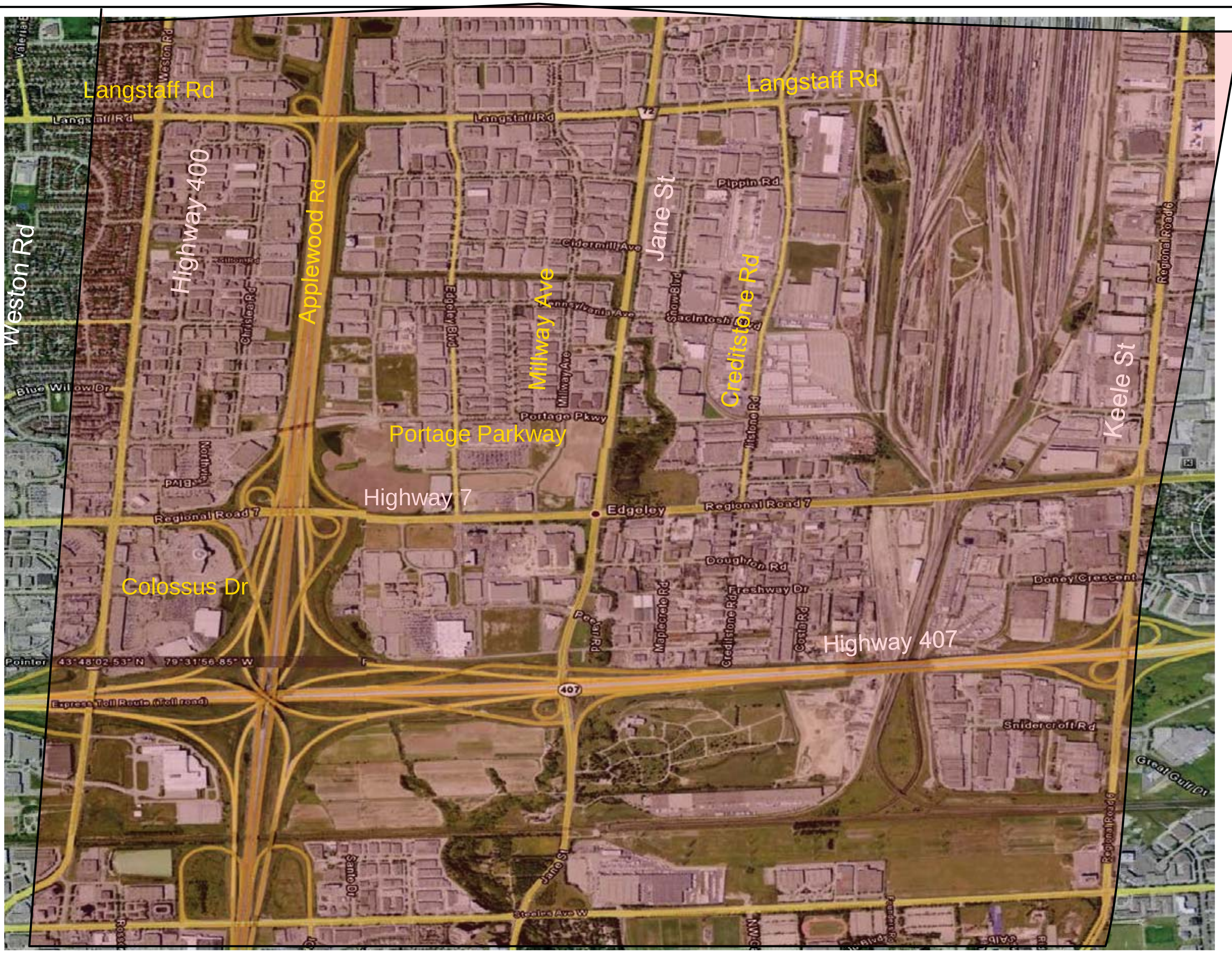

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FIGURE 3

Vaughan Metropolitan Centre (VMC) Transportation Plan

Broader Study Area

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2. Existing Conditions, OPA 528 and Challenges

The secondary plan for the Vaughan Corporate Centre (VCC) from the late 1990s envisaged a business centre with about 30,000 jobs and 5000 residents. Since then, new development has been primarily retail and entertainment with no new office buildings or residential buildings constructed. Major new retailers include IKEA, Wal-Mart and Home Outfitters. Hotels and restaurants have also come on stream over the past decade.

The Vaughan Corporate Centre is located in the heart of a major regional industrial area served by a multi-modal transportation network anchored by two 400 series highways – Highway 400 and ETR 407. These, connected to Regional arterials (Highway 7, Weston Road and Jane Street), provide excellent road accessibility and visibility to the Centre. The existing road network serving the Centre (as shown in Figure 1) is a mix of arterials, collectors and local roads. The east-west roads include Highway 7, Portage Parkway, Interchange Way, and Apple Mill Road. Existing north-south roads include Weston Road, Jane Street, Edgeley Boulevard, Millway Avenue, and Creditstone Road. Weston Road, Jane Street and Highway 7 are generally operating at capacity during weekday peak hours, particularly at major signalized intersections and freeway ramp terminals. Due to the proximity of large industrial areas, the percentage of trucks in the traffic flow is high, adding to congestion during peak times.

The road network envisaged for the VCC is shown in Figure 2 from OPA 528. This future road network included the following major improvements:

1. a Ring Road" east of Highway 400 to relieve Highway 7 traffic and specifically to assist with the diversion of truck traffic from Highway 7;
2. new links 4 and 5 as part of revisions to the Highway 7 / Highway 400 interchange (also to facilitate the diversion of truck traffic from Highway 7); and
3. a new east-west crossing of Highway 400 north of Highway 7 joining Applewood Crescent with Chrislea Road on the west side of Highway 400.

Edgeley Boulevard (currently known as Interchange Way south of Highway 7) was classified as a collector road as was Millway Avenue.

In a companion OP amendment (529), provision was made for a north-south rapid transit line, roughly located in the alignment of the Spadina subway extension now being designed.

In reviewing background plans and other documents related to the VCC with the Urban Strategies planning team, the following challenges were identified:

1. the presence of numerous major physical barriers, including the 2 freeways, the east-west hydro corridor to the south and the CN rail line and yards to the east;
2. with the firm commitment to the extension of the Spadina subway to the VCC, the need to reorient the axis of the secondary plan from east-west to north-south;
3. the function of the Ring Road as a major collector with expected high percentages of truck traffic did not seem compatible with a new VMC vision involving significantly higher levels of residential development, on both sides of the new roadway (in other words, the Ring Road would be splitting new neighbourhoods);

4. the Toronto and Region Conservation Authority (TRCA) was objecting to the completion of a portion of the northern Ring Road through a wooded lot east of Jane Street and crossing Black Creek; and

5. slow progress on the Regional Environmental Assessment for Links 4 and 5 due to concerns expressed by affected landowners and MTO officials; and

6. continuing concerns with high volumes and percentages of through truck traffic.

All of the above led the transportation / land use planning team to re-think the VCC road network concept.

3. Initial Strategic Analysis

The City of Vaughan is the fastest growing municipality in York Region and currently has 27% of the Region's population. Having grown by 181,000 people over the 20 year period from 1986 to 2006, and over 15-fold since 1971, and with an annual growth rate of over 8%, Vaughan actually has the highest annual growth rate among all municipalities across Canada.

Population and employment projections for the City were prepared by the Region of York as part of the Region's review of the Provincial Growth Plan for the Greater Golden Horseshoe Area and its 2009 Transportation Master Plan Update. In keeping with Regional policy to accommodate a large proportion of the Region's growth within existing urbanized areas, Vaughan will have to significantly intensify existing developed areas, particularly along Highway 7 and other corridors planned to accommodate higher order transit services. In this regard, the role of the largely undeveloped Vaughan Centre will be critical in meeting growth targets.

In preparation for early discussions on the vision and levels of development for the new Vaughan Centre plan, a set of combination population and employment scenarios was developed by the Urban Strategies planning team. These included low, medium and high estimates for the two sub areas of the VCC study area – west and east of Highway 400. To get a sense of how these related to the OPA 500 approved VCC plan from a transportation perspective, AECOM conducted a trip generation sensitivity analysis for the VCC study area as a whole. The objective was to compare the total vehicle trips generated by the various possible new scenarios with the estimates prepared by Cansult Limited in the 2002 Transportation/Transit Planning and Functional Design Study, which supported OPA's 528 and 529. The results of this sensitivity analysis are included in two large spreadsheets contained in **Appendix II**. To simplify the comparison, only four of the highest growth scenarios were compared with the original Cansult estimates from 2002:

1. Medium (west of Highway 400) – Medium (east of Highway 400);
2. Medium (west of Highway 400) – High (east of Highway 400);
3. High (west of Highway 400) – Medium (east of Highway 400); and
4. High (west of Highway 400) – High (east of Highway 400).

The comparisons were made for inbound and outbound directions for both the a.m. and p.m. peak hours. Standard I.T.E. trip generation rates provided the basis for the new estimates, but they were adjusted to convert to person trips and to reflect significant transit use. No adjustments were made for "internal to the Centre" trips, which could represent a further reduction of 10% based on I.T.E. adopted methodology.

The first spreadsheet considers "Full Growth" for these four scenarios, while the second considers "50% Growth", thus providing in essence eight possible scenarios. The first spreadsheet assumes lower non-auto modal splits more in line with the conservative 15 to 20% transit modal splits used in the Cansult study, while the second spreadsheet assumes higher non-auto modal splits consistent with the commitments to extend the Spadina subway to the VMC by 2015 and implement full BRT service on Highway 7 by 2020.

Based on the results of the sensitivity analysis, the following conclusions were drawn:

1. Compared with the approved VCC plan, there generally is a much better balance between inbound and outbound trips for both peak hours (due largely to the higher amounts of residential use);
2. In the a.m. peak hour, outbound trips are generally somewhat higher than inbound trips (again due to the greater amounts of residential development). For the approved (business centre oriented) plan, Cansult estimated that inbound trips would be almost four times the number of outbound a.m. peak hour trips;

3. In the p.m. peak hour, outbound trips are also higher than inbound (due largely to the office component);
4. Total p.m. peak hour Centre generated trips are more than 50% higher than the total a.m. peak hour trips (due in part to the significant retail component, which does not generate trips in the a.m. peak hour);
5. The outbound trips in the p.m. peak hour are the highest and therefore will put the greatest demands on the area road network; however, even for the "Full Growth High-High" scenario, the total vehicle trips generated outbound in the p.m. peak hour (11,200) would be significantly less than the 13,317 figure estimated for the currently approved VCC plan; and
6. For the "50% Growth" scenarios with higher non-auto modal splits (second spreadsheet), the total vehicle trips generated are approximately 40% of the corresponding estimates in the first spreadsheet.

Overall, it was concluded that even the "High-High Full Growth" scenario would generate less trips than estimated by Cansult for the approved VCC plan. While all of the growth scenarios were thus considered worthy of further analysis by Urban Strategies, any refinements should nevertheless consider the desirability of further reducing outbound vehicle trips in the p.m. peak hour, which represent the peak demands on the area road network.

4. Committed Road and Transit Improvements

A number of improvements are either underway or committed (i.e., environmental and funding approvals have been or are in the process of being secured). These are briefly described below and will form the basis for the new multi-modal VMC transportation plan.

4.1 The Portage Parkway Crossing of Highway 400

This new 4-lane crossing (formerly known as Applewood Crescent and originating from OPA 528) has been under construction for the past few years and is now virtually complete. The new connection is scheduled to open in the Fall of 2010. It will provide a new connection between Weston Road and Jane Street north of Highway 7 and facilitate a diversion of some traffic from Highway 7, thus alleviating congestion in the vicinity of the Highway 400 / Highway 7 interchange.

4.2 The Spadina Subway Extension

The extension of Spadina subway line to the VMC is the single-most important transportation initiative needed to support Vaughan's future downtown. Environmental and funding approvals are now in place and detailed design for the line extension, including six new stations, is underway co-ordinated by the Toronto Transit Commission (TTC). The line extension is scheduled to be open in the late Fall of 2015. The alignment and station locations are shown in **Figure 4**. The three most northerly stations will directly serve the City of Vaughan, with the terminal station located west of Jane Street on the north side of Highway 7 (in the heart of the Vaughan centre). The Highway 407 and Steeles West stations to the south will both provide significant amounts of commuter parking.

At the VMC terminal station, a major off-street bus terminal is planned, which will accommodate re-structured feeder bus service, provided primarily by York Region Transit. Preliminary feeder bus routings are shown in **Figure 5** as is the location of the planned off-street terminal. The station will also interface with VIVA BRT service along Highway 7. Significant passenger pick-up and drop-off activity is expected to take place, using to a great extent the local street system. No formal commuter parking facilities are contemplated within the VMC.

The terminal underground station facility will be accommodated largely within the current right-of-way of Millway Avenue immediately north of Highway 7. This will necessitate a realignment of Millway Avenue slightly to the east of its existing alignment. This realignment will be done as part of the subway project. As a part of this study, AECOM determined the functional requirements for Millway Avenue and subsequently prepared a functional plan so that the City requirements could be conveyed to the TTC and integrated into the subway project. A letter to the City of Vaughan summarizing this work and including the functional plan and a typical cross-section for Millway Avenue is contained in **Appendix III** to this report.

4.3 VIVA Highway 7 Bus Rapid Transit

York Region is pursuing the next phase of rapid transit (VIVA Next) within the Highway 7 corridor, which will provide for a dedicated median transit right-of-way operation. The transit right-of-way is being referred to as a "rapidway". Conforming with Metrolinx's "Big Move" transportation plan, a small section through the VMC (from Highway 400 to Creditstone Road) will be implemented in concert with the Spadina subway extension. This project is fully funded and will be in place by 2015. Initially 2 stations will be built: one at Millway to interface with the subway; the other west of Edgeley Boulevard. A third station to serve the VMC is seen west of Creditstone Road, but may be implemented later as the area redevelops. Consistent with the VIVA Next phasing plan (see **Figure 6**), the

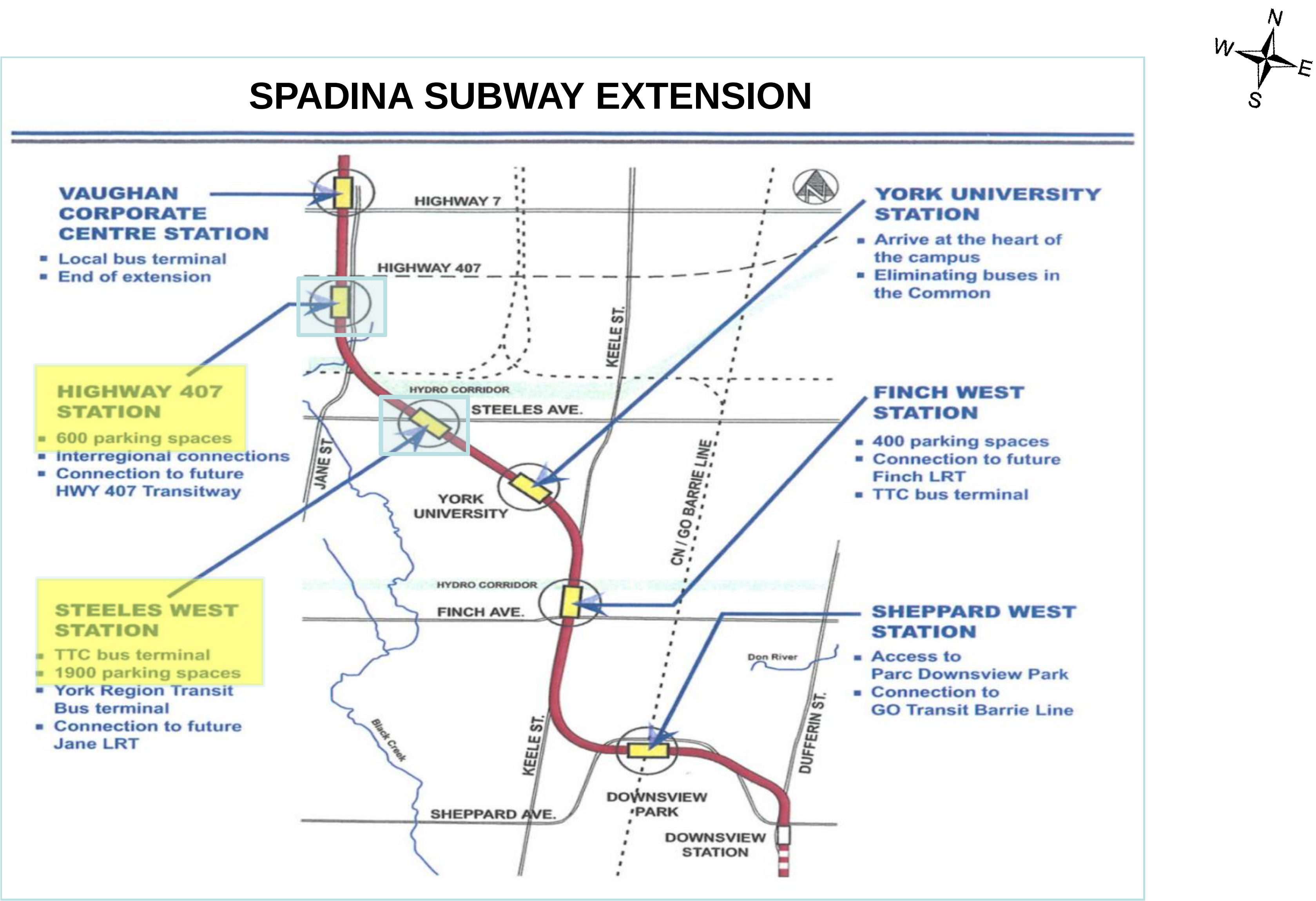

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FIGURE 4

Vaughan Metropolitan Centre (VMC) Transportation Plan

Spadina Subway Extension

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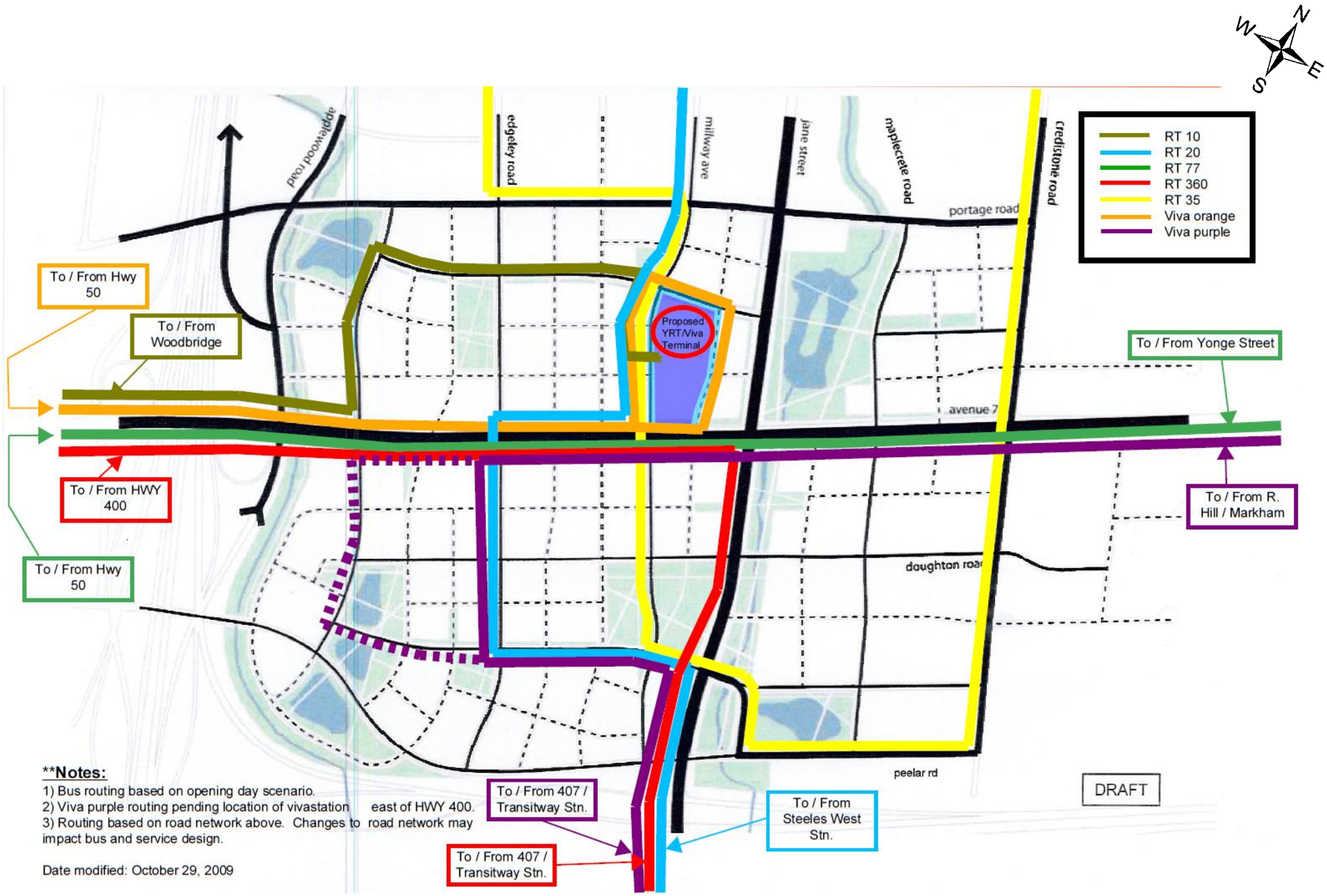

Notes:
1) Bus routing based on opening day scenario.
2) Viva purple routing pending location of vivastation east of HWY 400.
3) Routing based on road network above. Changes to road network may impact bus and service design.

Date modified: October 29, 2009

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FIGURE 5

Vaughan Metropolitan Centre (VMC) Transportation Plan

Preliminary Feeder Bus Routing Plan

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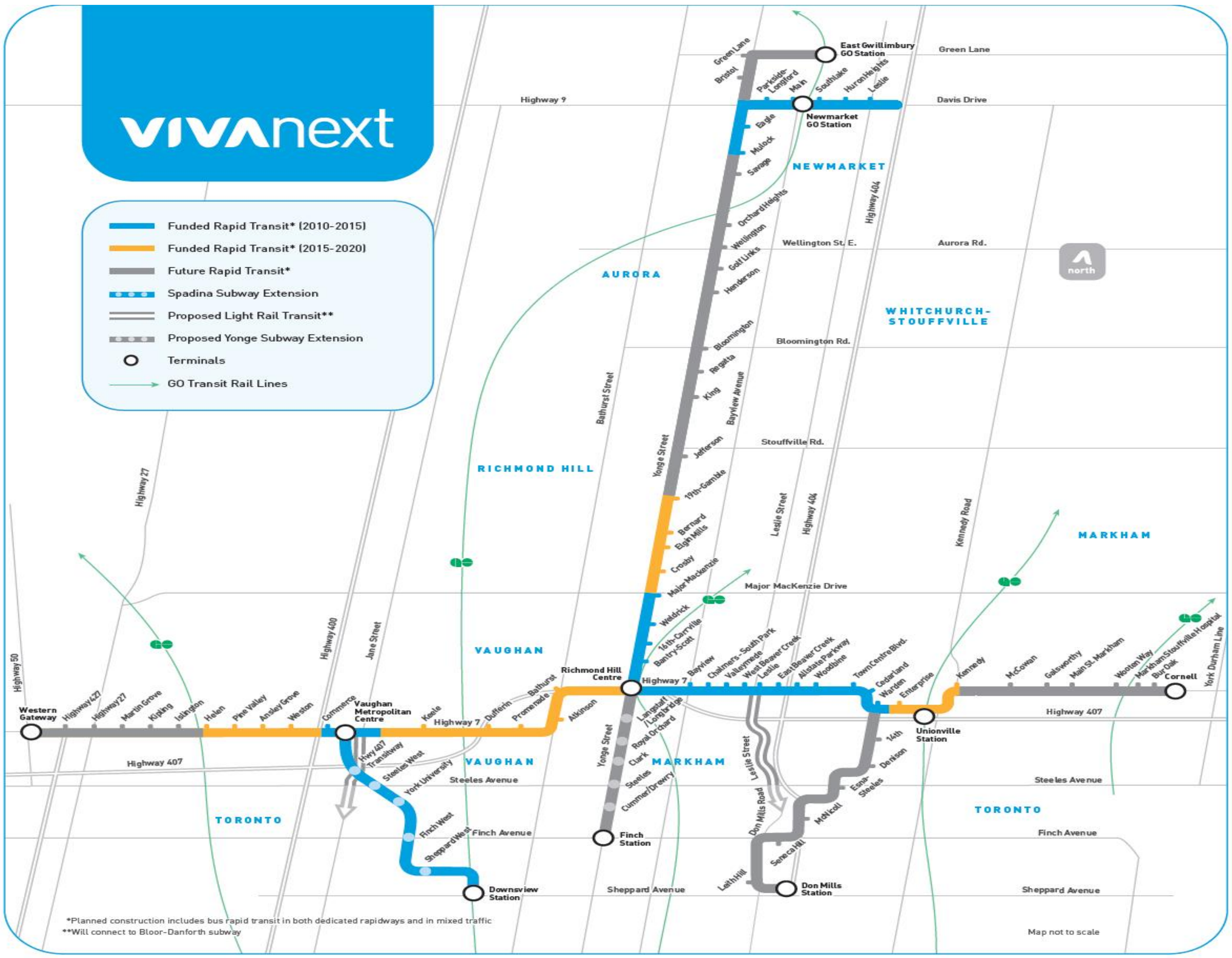

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FIGURE 6

Vaughan Metropolitan Centre (VMC) Transportation Plan

Viva Routes Staging

AECOM

remainder of the Highway 7 west rapidway (from Yonge Street to Pine Valley Drive) would be completed by 2020, and funding has been provided by Metrolinx for this work. The VIVA Millway station will provide direct grade-separated access to the subway station, thus allowing for the safe and efficient transfer of passengers while minimizing adverse impacts on the planned Highway 7 streetscape.

The station locations preferred by YRRT/VIVA, together with 400 m radii (representing a 5 minute walk catchment area) are shown in **Figure 7**.

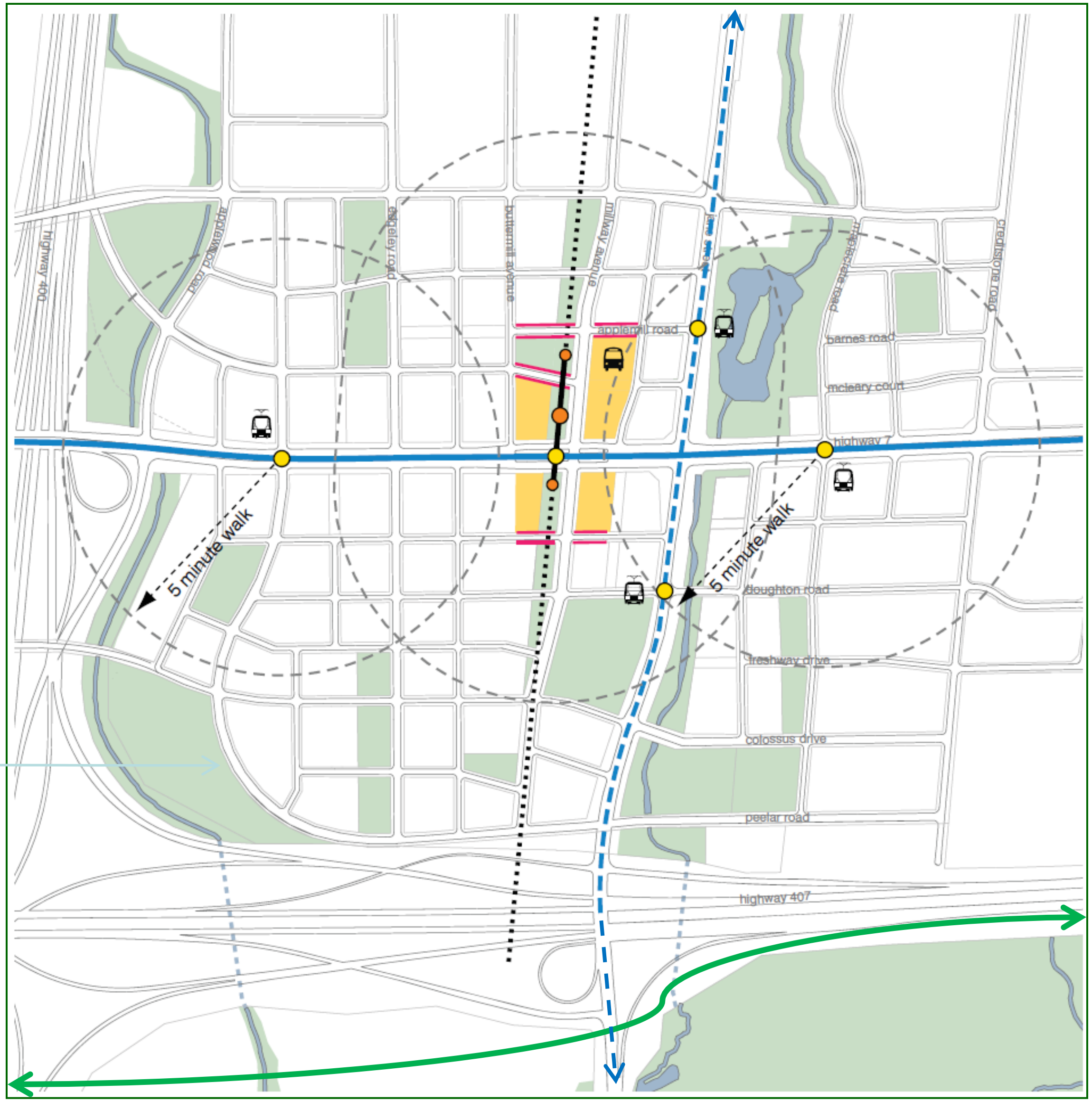
4.4 Longer Term Transit

The final stage of VIVA Next program provides for the westerly extension of BRT rapidway service to Highway 50 (the Peel Region boundary). Through integration with Brampton's planned "Zum" BRT service, this will facilitate connections between the VMC and Brampton City Centre along the Highway 7 (Queen Street) corridor.

The Region of York, in their 2009 Transportation Master Plan Update, designates a number of new rapid transit corridors, including Jane Street from Steeles Avenue to Major Mackenzie Drive. In the first stage, this could take the form of BRT operating either in HOV or exclusive curb lanes. Subsequent stages could entail a median BRT "rapidway" or eventually Light Rail Transit (LRT).

The Province of Ontario and Metrolinx are pursuing the Highway 407 Transitway, an exclusive bus roadway paralleling the freeway with stations to connect with major north-south transit lines. This will provide a broader inter-regional rapid transit service extending to Halton Region in the west and Durham Region in the east. Through a Jane Street station integrated with the Spadina subway 407 station, high quality service will be available for longer distance trips to and from the VMC.

The Jane Street rapidway and 407 transitway alignments are also shown on Figure 7.



LEGEND:

- subway entrances
- potential viva stations
- 5 minute walking radii
- blocks adjacent to subway
- on-street ppudo (long term)
- spadina subway allignment
- spadina subway station box
- highway 7 rapidway
- jane street rapidway
- station block
- 407 transitway

Not to Scale

FIGURE 7

Vaughan Metropolitan Centre (VMC) Transportation Plan

VMC Rapid Transit Stations and Catchment Areas

AECOM

5. Alternative Road Improvements

With Metrolinx's "Big Move" plan and the Region's update of their TMP in place and both very much focussed on transit improvements, the review of the VMC transportation plan concentrated on the area road network. The physical barriers within and surrounding the VMC, including Highways 400, 407 and 7, two CN rail corridors, a cemetery, a major hydro transmission corridor and the Black Creek open space system pose very significant challenges for movement to and within the VMC.

The assessment of the road network began with a review of previous work, including the alternatives addressed in the 2002 Transportation/Transit Planning and Functional Design report prepared by Cansult (which supported OPA 528) and the more recent alternatives examined in the incomplete DelCan Class EA for Links 4 and 5. A matrix of alternatives was developed and served as a screening mechanism. The various candidate improvements examined are shown in **Figure 8**. From this screening, it was concluded that the southerly extensions of Edgeley Boulevard and Creditstone Road across Highway 407 would both be very expensive and, unless they could somehow be extended all the way to Steeles Avenue, not that helpful in the broader network context. Unfortunately with the numerous additional barriers south of Highway 407, these projects were deemed not feasible and screened out.

The projects that passed the screening process are highlighted in a table contained in **Appendix IV** and discussed in the sub-sections below

5.1 Creditstone Road

Creditstone Road (see **Figure 9**) is currently a 2-lane north-south collector roadway crossing Highway 7 at a signalized intersection and terminating at Exchange Drive.

As potentially a major component of the VMC road network, a widening from a basic 2 to 5 lanes was considered for the section of Creditstone Road south of Highway 7, and a widening from a wider 2 to 5 lanes for the section north of Highway 7 to Rutherford Road. The minimum ROW widening required for these road improvements is considered 30 m.

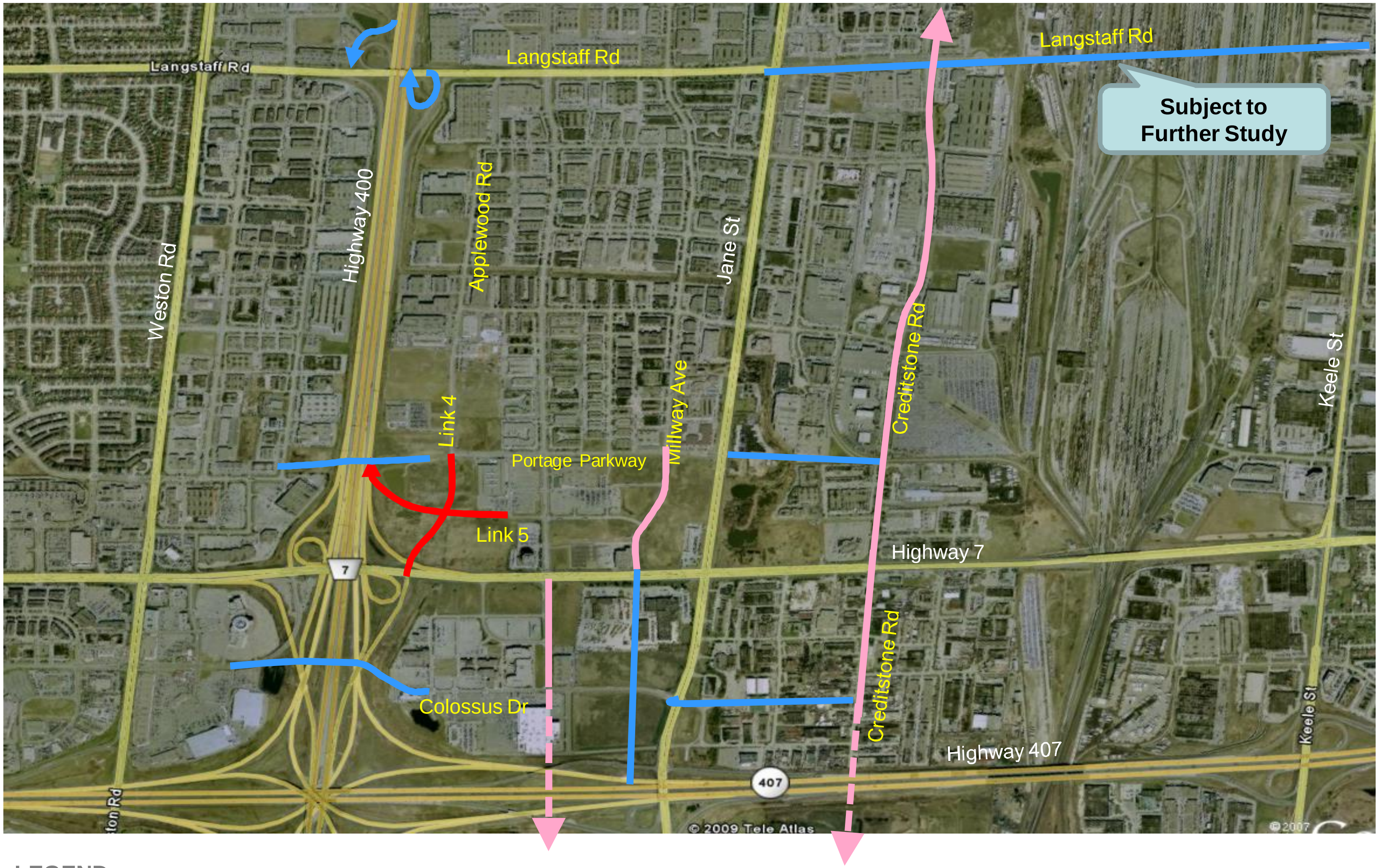
An upgraded Creditstone Road could serve as a critical component of an eastern bypass, which would divert traffic from Highway 7 to an extended Portage Parkway, to an extended Colossus Drive across Highway 400, and to an improved Langstaff corridor to the north.

5.2 Portage Parkway Extension

Portage Parkway (see **Figure 10**) is currently a 2-lane east-west roadway from Applewood Crescent to Jane Street, and is being extended across Highway 400 to connect with Chrislea Road. An easterly extension of Portage Parkway from Jane Street to Creditstone Road was included in the 2002 Transportation/Transit Planning and Functional Design Study, but ultimately not included in OPA 528. With the elimination of the "Ring Road:" now provided for in OPA 528, an easterly extension would take on additional importance in the VMC road network, providing relief for Highway 7 and functioning as a northern bypass (particularly for trucks) It is proposed to be a 4 lane collector and would require a creek crossing and some property for the new right-of-way.

5.3 Millway Avenue Realignment and Southerly Extension

As previously noted, the section of Millway Avenue north of Highway 7 needs to be realigned slightly to the east to accommodate the underground subway terminal, and a separate more detailed functional plan was developed to



LEGEND:

- Improvements to Existing/Planned Roads
- OPA 528 Proposed Links
- New Proposed Links
- Assessed but not proposed

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FIGURE 8

Vaughan Metropolitan Centre (VMC) Transportation Plan
Alternative Road Network Improvements

AECOM

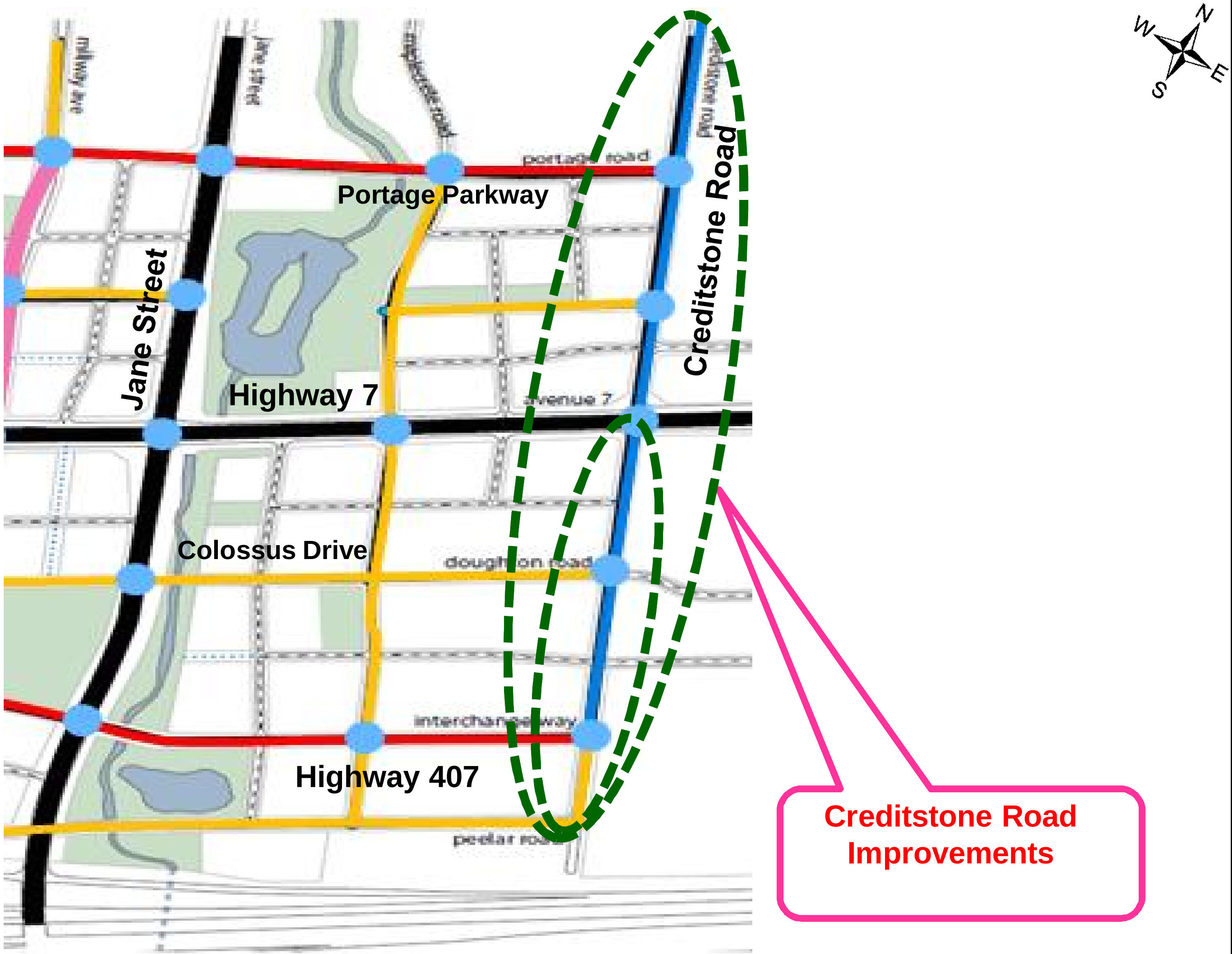

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FIGURE 9

Vaughan Metropolitan Centre (VMC) Transportation Plan
Creditstone Road Upgrading

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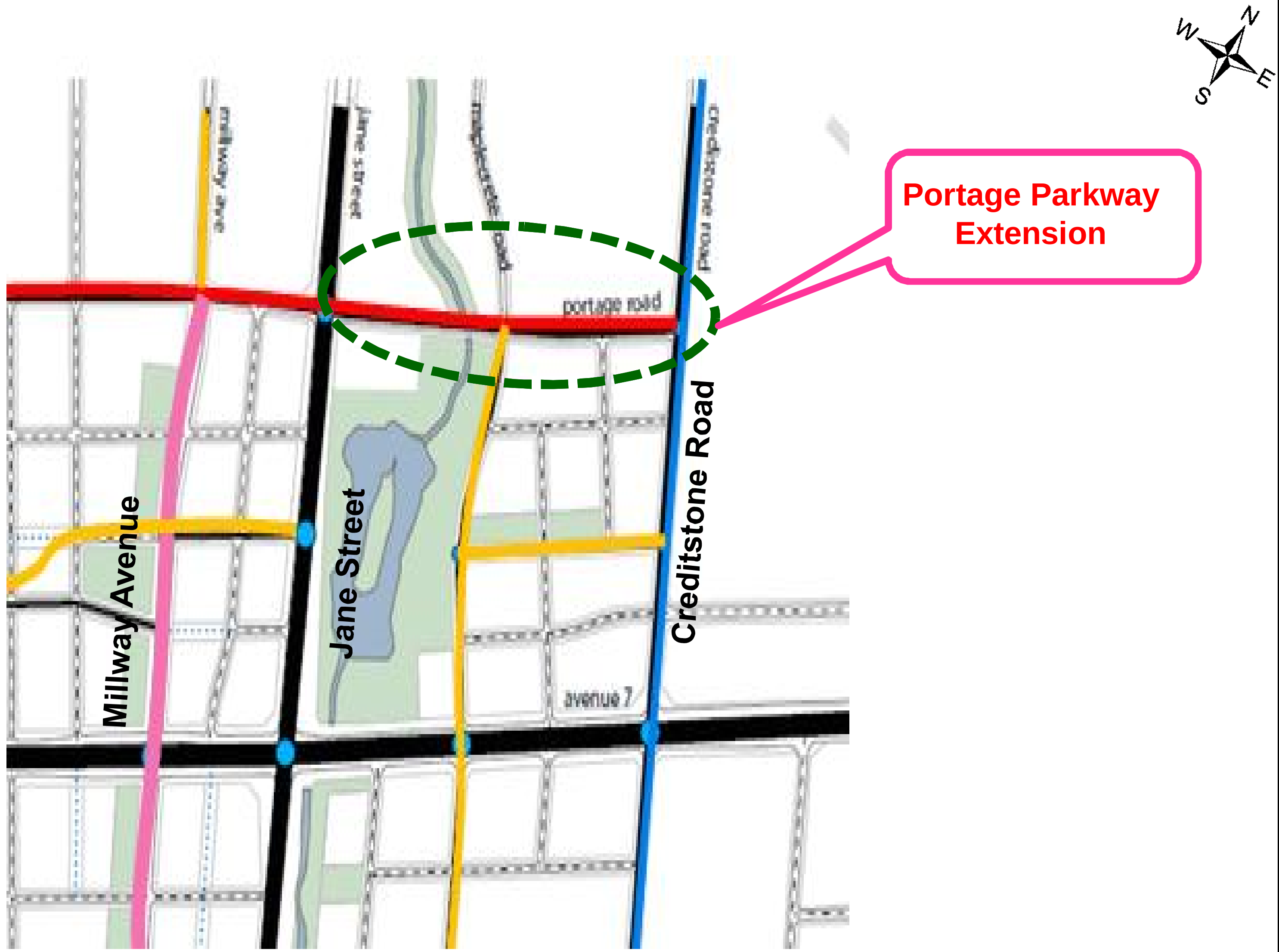

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FIGURE 10

Vaughan Metropolitan Centre (VMC) Transportation Plan
Portage Parkway Extension

AECOM

provide the necessary property requirements to the subway design team. Given its proximity to the subway terminal, it was determined that Millway will ultimately need to be a 5 lane collector roadway (2 through lanes in each direction plus left turn lanes at signalized intersections) with a 33 m right-of-way in order to accommodate the many functional demands on the section of this roadway within the VMC. The conclusions of this work were summarized in a memo to City staff (with attached plan and typical cross-section), which is contained in **Appendix III.**

The extension of Millway Avenue south of Highway 7 to Interchange Way (see **Figure 11**) is provided for in OPA 528 and needed to be confirmed.

5.4 Links 4 and 5

At the onset of the subject VMC transportation study, the Region of York decided to put their current Class Environmental Assessment on hold, pending the outcome of the Focus Area study. Links 4 and 5 were key components of OPA 528, but were somewhat contentious due to concerns expressed by the Provincial Ministry of Transportation and adjacent landowners. The partly completed Class EA study had examined alternatives, but had found none that were as good as the basic concept proposed in OPA 528. Variations of the specific configuration were addressed, including the one shown in **Figure 12**.

Link 4 would be a new roadway connecting the Highway 400 northbound off-ramp terminal at Highway 7 to Applewood Crescent at Portage Parkway. Link 5 is proposed to be a replacement for the westbound on-ramp to Highway 400 northbound, the main benefit of which would be a diversion of traffic (including trucks) from westbound Highway 7. Links 4 and 5 are therefore considered to be a major component of a truck strategy aimed at reducing heavy truck traffic that would otherwise use Highway 7.

5.5 Colossus Drive Extension

Colossus Drive is a 1-lane northbound and a 2-lane southbound roadway extending south from the Highway 400 southbound off ramp to Highway 7. It then turns westerly as a 4 lane collector terminating at Weston Road opposite Rowntree Dairy Road.

The proposed extension of Colossus Drive across Highway 400 (see **Figure 13**) would connect the east-west portion to Interchange Way on the east side. It could then serve as the southern segment of a bypass, which would divert traffic including trucks from Highway 7. The new four lane collector across Highway 400 would increase east-west roadway system capacity at the Highway 400 barrier, improving travel times, and facilitating truck movements and enhanced transit service. Preliminary profiles have been prepared with 5% and 6% grades, and these are included in **Appendix V**.

5.6 Langstaff Road/Highway 400 Interchange Improvements

Currently this interchange provides movements to and from the south only. The provision of a full interchange would divert traffic, including trucks, from the adjacent Highway 400 interchanges at Highway 7 and at Rutherford Road.

Initial reviews confirmed that the building in the northeast quadrant would preclude the provision of a northbound on-ramp in that quadrant. However, it appears that a loop on-ramp located in the southeast quadrant of the interchange could fit, albeit with a relocation of the existing northbound off-ramp slightly to the east (some property may be required). This would require westbound traffic to enter the loop ramp via a left turn at the relocated signalized ramp terminal.

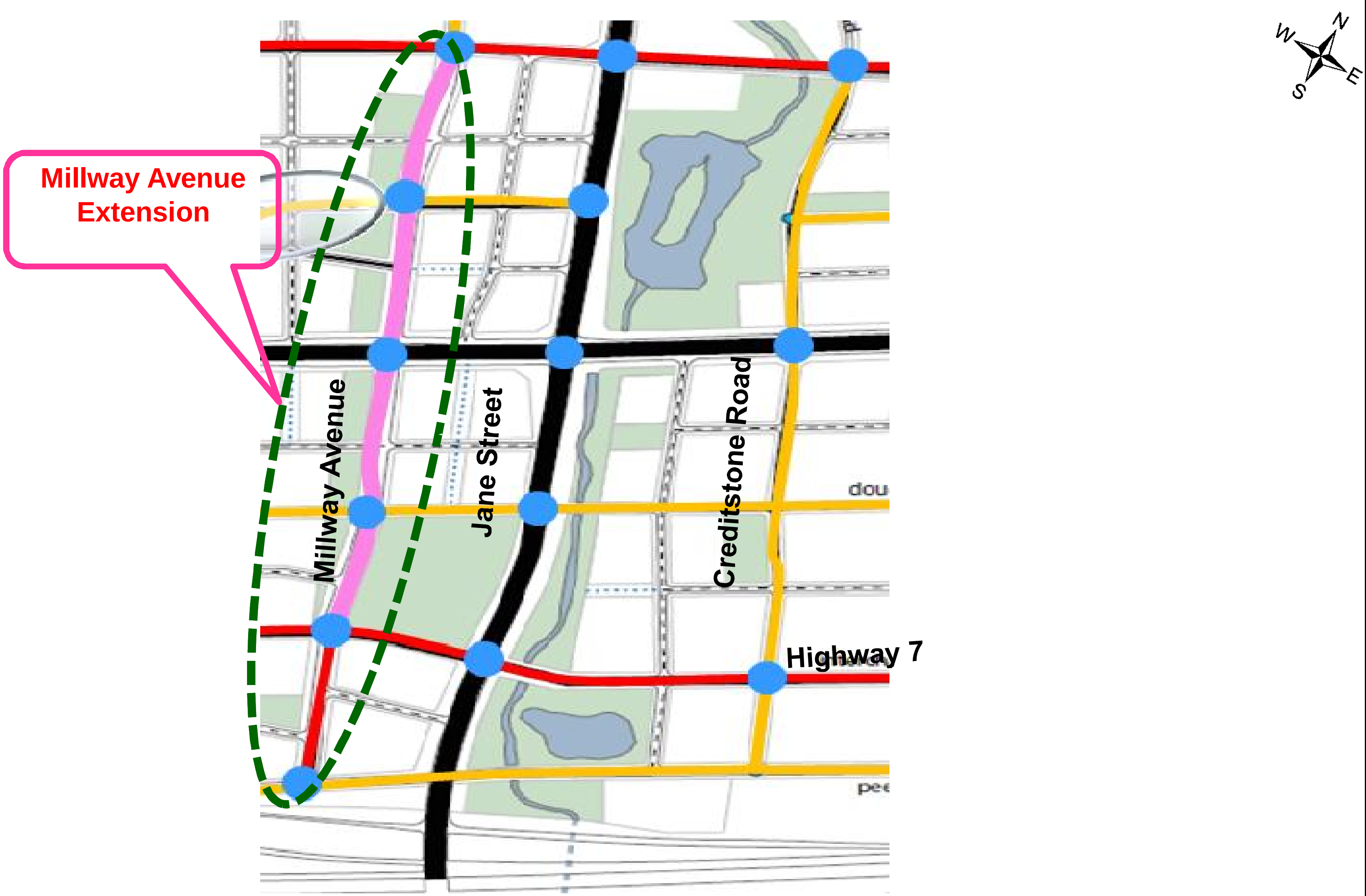

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FIGURE 11

Vaughan Metropolitan Centre (VMC) Transportation Plan
Millway Extension

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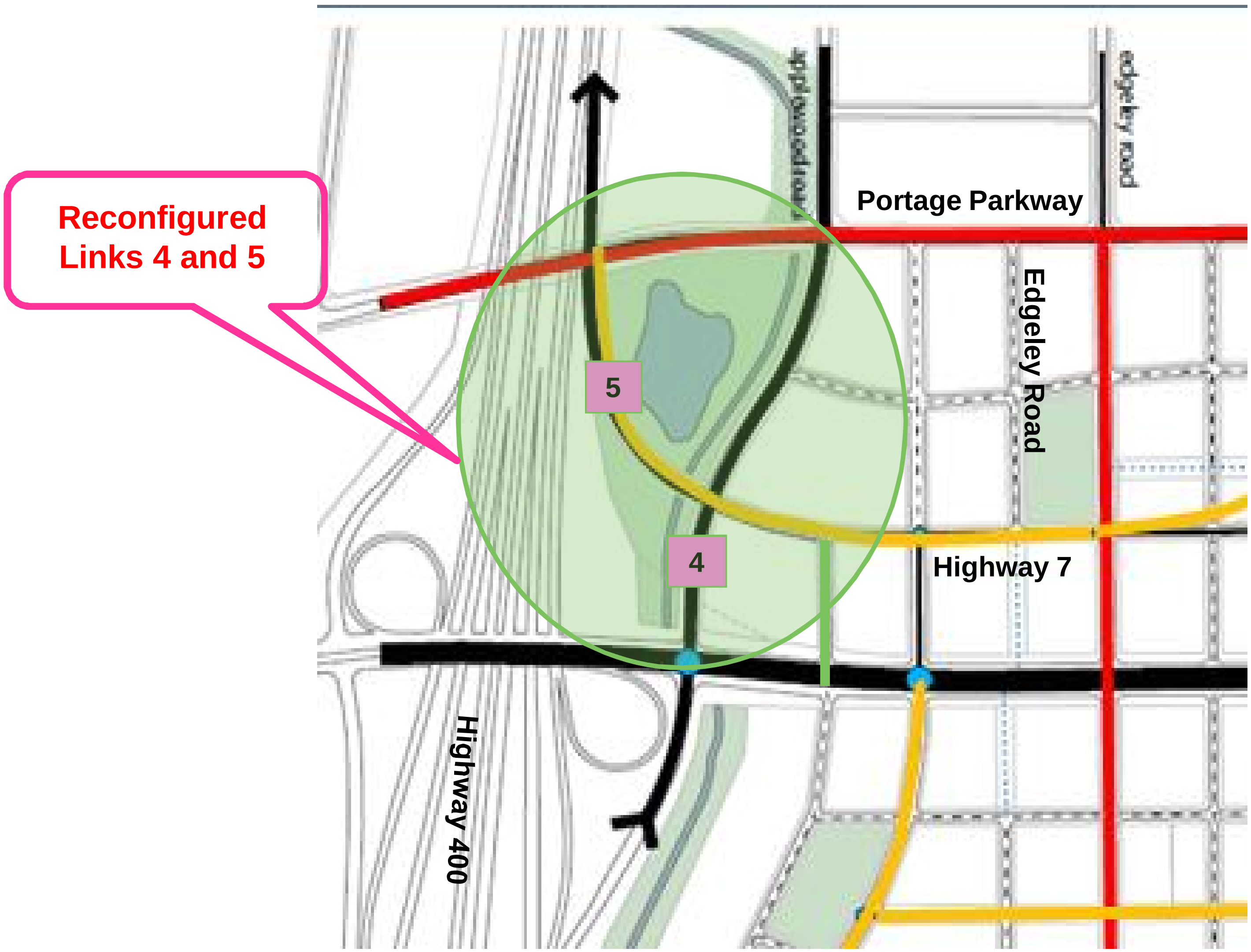

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FIGURE 12

Vaughan Metropolitan Centre (VMC) Transportation Plan
Reconfigured Links 4 and 5

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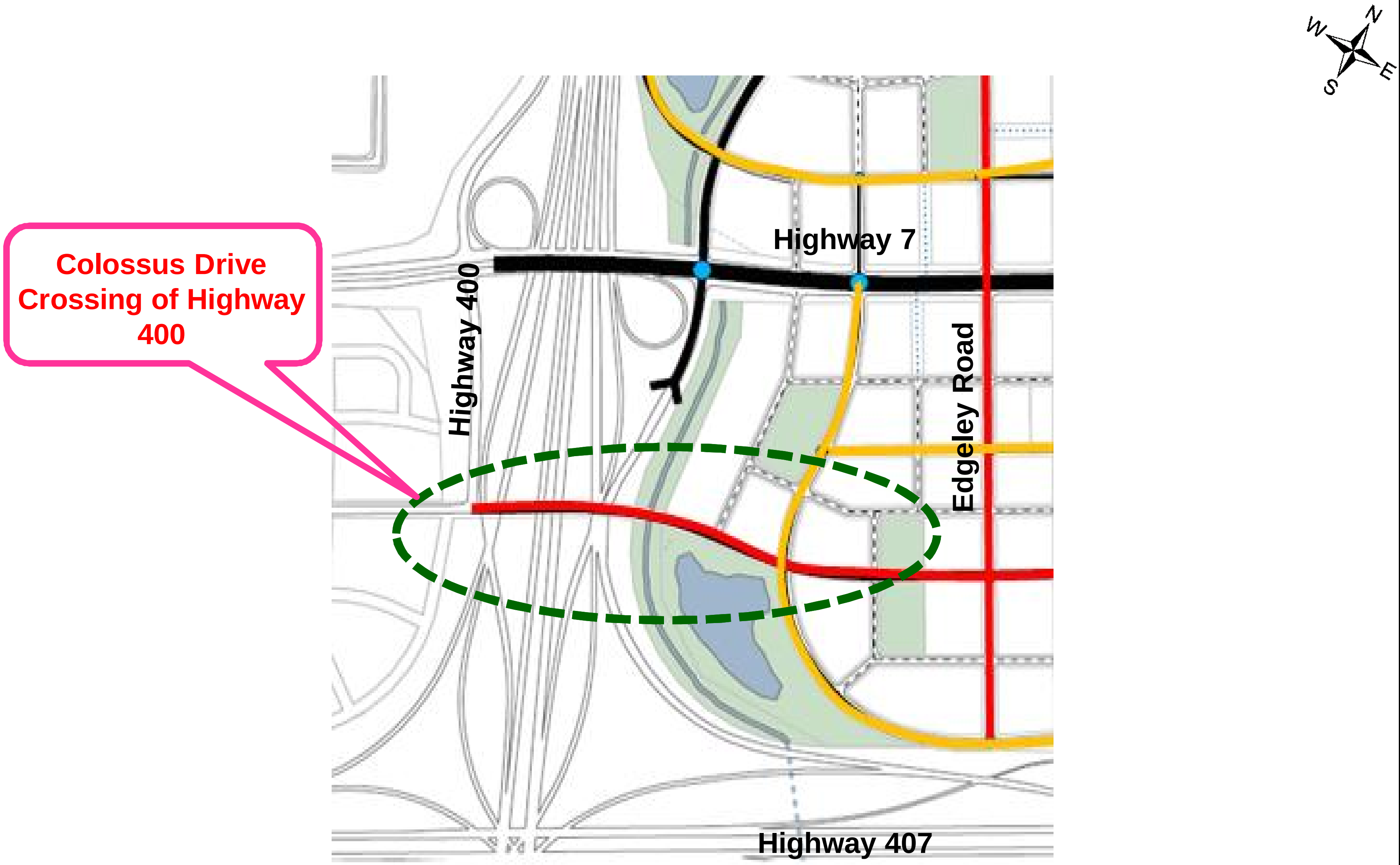

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FIGURE 13

Vaughan Metropolitan Centre (VMC) Transportation Plan

Colossus Drive Crossing of Highway 400

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A southbound off-ramp could be located in the northwest quadrant. A new traffic signal would be required on Langstaff Road, west of Highway 400 to accommodate left turning traffic. This location appears operationally feasible. An existing stormwater management pond would need to be reconfigured.

The proposed improvements are shown conceptually in **Figure 14**.

5.7 Langstaff Road across CN Rail Yard

Langstaff Road is a 4-lane roadway west of CN rail yard and a 2-lane roadway east of rail yard. The connection of Langstaff Road between Creditstone Road and Keele Street would increase the traffic movements at the Highway 400/Langstaff Road interchange, thus relieving the Highway 7/400 and Rutherford/400 interchanges.

This new connection (see **Figure 15**) would provide a substantial increase in east-west capacity and would provide significant relief to both Highway 7 and Rutherford Road, including reductions in truck traffic. Such a connection would also contribute to the better accommodation of truck traffic and delivery service to the many firms in the surrounding industrial areas.

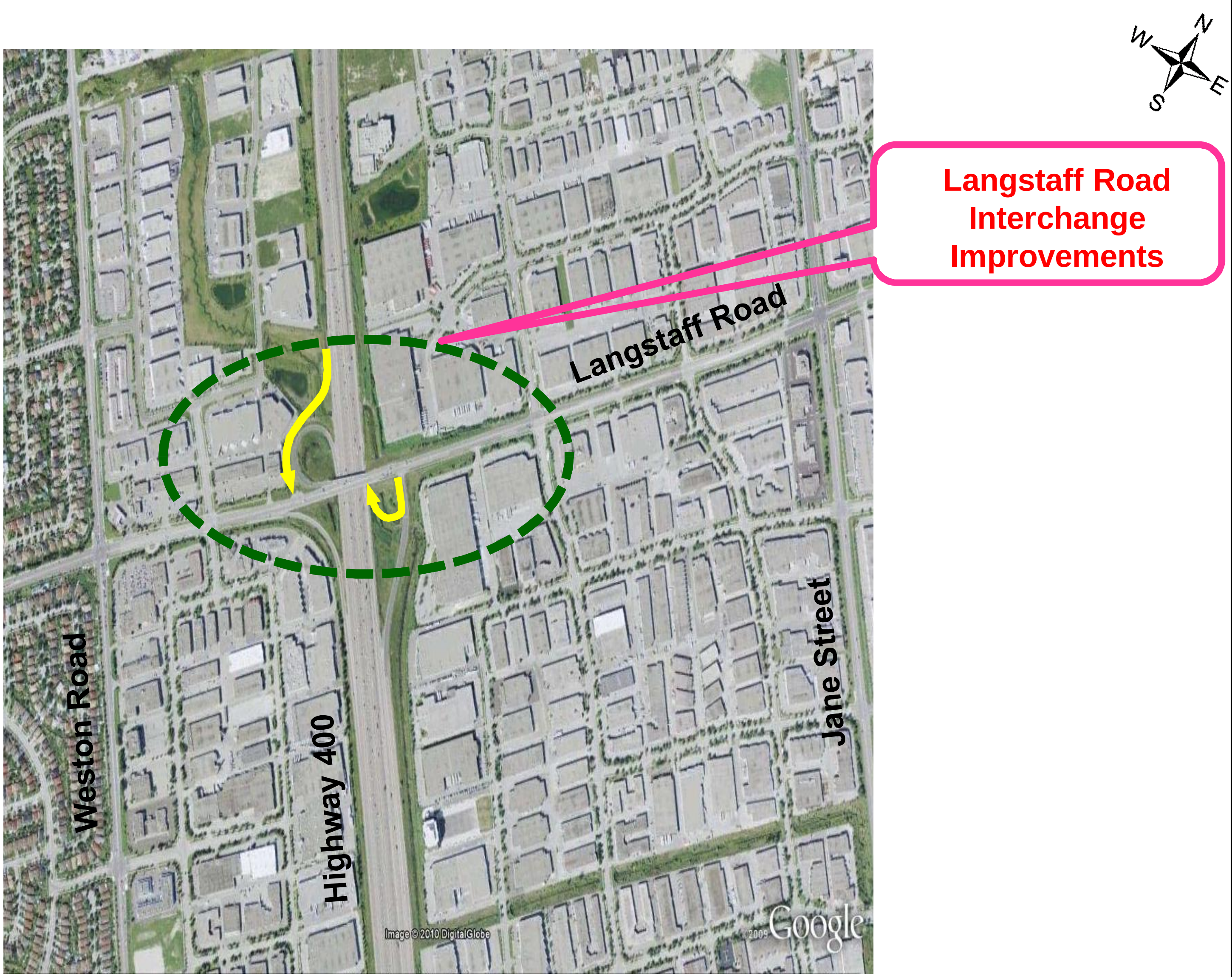

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FIGURE 14

Vaughan Metropolitan Centre (VMC) Transportation Plan
Langstaff Interchange Improvements

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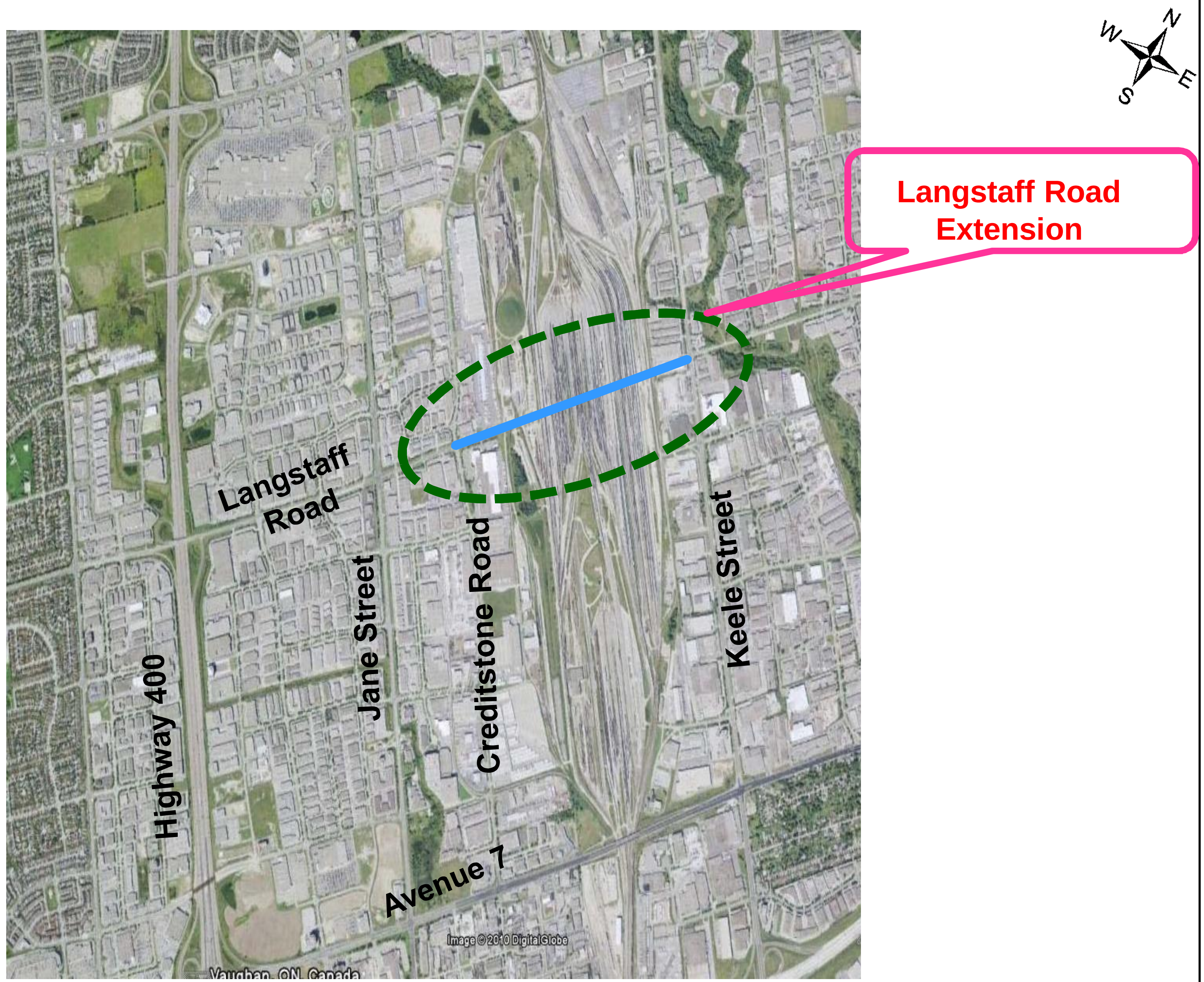

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FIGURE 15

Vaughan Metropolitan Centre (VMC) Transportation Plan
Langstaff Road Extension

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6. Future Travel Demand Forecasts and Network Analysis

The City of Vaughan EMME model was developed to forecast the trips and transportation performance indicators in order to evaluate the transportation system and different road and transit network alternatives. The existing transportation conditions of Vaughan Metropolitan Centre were used for calibration of the study sub area model. The model development and calibration procedure is presented in **Appendix VI-1** by Halcrow. Using the developed EMME model, several major road network alternatives were developed and tested.

6.1 Summary of Future Travel Demand

Trip generation for VMC, east of Highway 400, was forecast using existing population and employment for 2006 and projections for 2021 and 2031 (original and revised). The original population and employment projections were provided by York Region on a traffic zone basis. Including the area on the west side of Highway 400 (consistent with the definition of the approved Vaughan Corporate Centre), these estimates provided for totals of about 32,450 population and 34,350 employment. Initial testing with the Vaughan model demonstrated that this level of employment could not be accommodated by the future transportation network. Accordingly, a revised employment estimate of about 25,700 was tested, resulting in a significantly reduced estimate of about 18,050 jobs east of Highway 400 (in the new VMC study area). Advice from other members of the Official Plan consulting team suggested that this revised estimate could be achieved by 2021, so no further employment growth was assumed post 2021. These figures are summarized by traffic zone in **Table 6.1** below and shown graphically for 2031 and 2021 in **Figures 16 and 17**, respectively.

Table 6.1 Population and Employment Forecast for VMC, West and East of Highway 400

Zone No.	Population				Employment			
	2006	2021	2031 Original	2031 Revised	2006	2021	2031 Original	2031 Revised
6050	919	2670	2819	2819	1922	2022	2022	2022
6052	39	497	539	539	2653	2686	2703	2686
6059	0	1921	2900	2900	1418	1468	1568	1468
1048	0	841	1100	1100	1388	1488	1488	1488
West of Hwy 400	**958**	**5929**	**7358**	**7358**	**7381**	**7664**	**7780**	**7664**
6083	0	1296	2100	2100	1973	2823	4323	2823
6085	0	1313	2100	2100	1025	1825	3375	1825
6084	0	5184	8400	8400	1973	4423	6323	4423
6086	0	2597	4200	4200	342	1942	3442	1942
6087	0	410	600	600	342	692	1992	692
6095	0	2947	4600	4600	949	1249	1749	1249
6090	0	2024	3100	3100	4954	5104	5354	5104
East of Hwy 400	**0**	**15771**	**25100**	**25100**	**11558**	**18058**	**26558**	**18058**
Total	**958**	**21700**	**32458**	**32458**	**18939**	**25722**	**34338**	**25722**

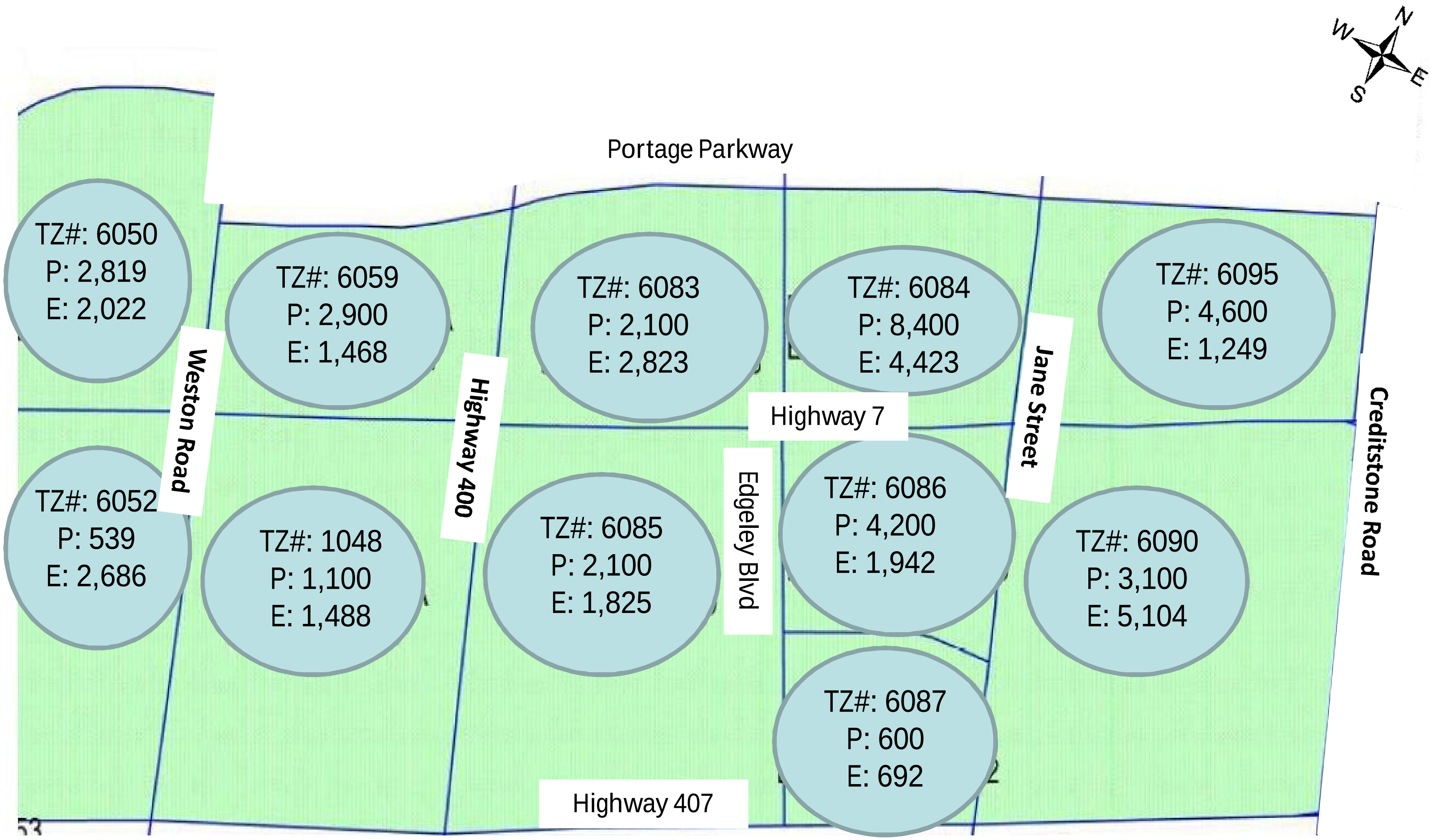

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FIGURE 16

Vaughan Metropolitan Centre (VMC) Transportation Plan

Revised VMC 2031 Population and Employment Projections

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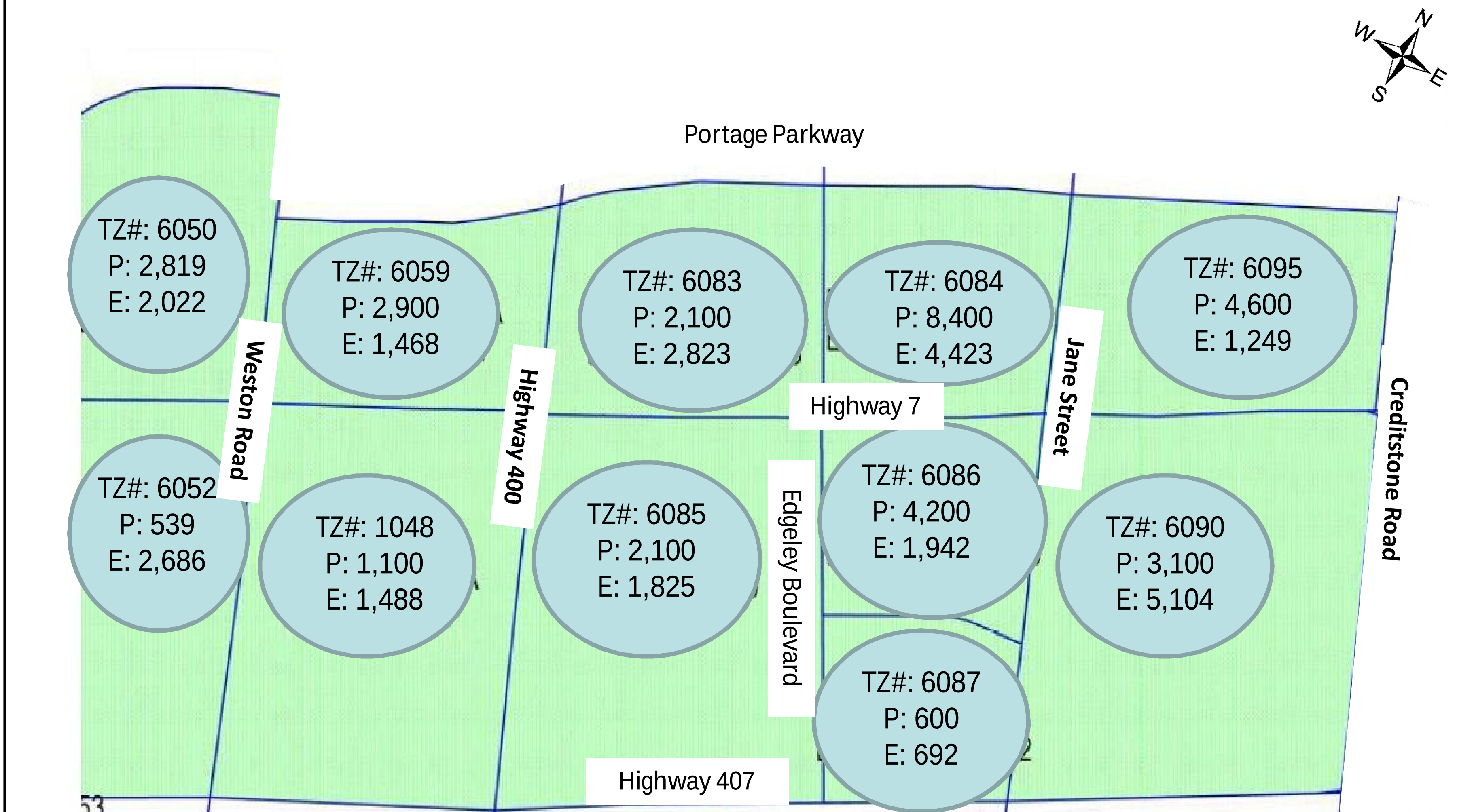

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FIGURE 17

Vaughan Metropolitan Centre (VMC) Transportation Master Plan

2021 Population and Revised Employment Projections

AECOM

Forecasts of originating and destined trips by mode are presented in the following **Table 6.2.**

Table 6.2 Forecast Trips by Mode for AM Peak Period

VMC	Year	Originating Trips				Destined Trips				Total Trips by Mode				Total Trips		
		Auto Driver	Auto Passenger	Transit Passenger	Transit Mode Share %	Auto Driver	Auto Passenger	Transit Passenger	Transit Mode Share	Auto Driver	Auto Passenger	Transit Passenger	Transit Mode Share	Originating Trips	Destined Trips	Sum
East of Hwy 400	2006	307	28	11	3	4753	571	431	7	5060	599	442	7	346	5755	6101
	2021	3908	403	3701	46	8499	1587	2139	17	12407	1990	5840	29	8012	12225	20237
	2031 Using Original Land Use	5154	1315	4148	39	11598	1353	2165	14	16752	2668	6313	25	10617	15116	25733
	2031 Using Revised Land Use	4738	487	3701	41	8747	1764	2139	17	13485	2251	5840	27	8926	12650	21576
	Compounded Annual Growth Rate % 2006-2031 (Revised Land Use)	12	12	26	11	2	5	7	3	4	5	11	5	14	3	5

2031 Travel Demand

The table shows that the forecasted trips by 2031 original land use, especially the destined trips, is much higher than the 2031 trips generated by the revised population and employment. The need to revise the VMC land use to reduce employment was based on the fact that the VMC road network (with all possible improvements) will not be able to accommodate this many trips by 2031.

Using the 2031 revised land use, the annual growth rate of auto drivers, trip-vehicles, would be 12% for originating trips and 2% for destined trips, an average 4% annual growth rate to 2031. Since the transit improvements are the same in both the original and revised 2031 land use scenarios, the transit results are almost the same for both horizons.

The results of the Halcrow modelling show that the transit usage and mode share will increase significantly by 2031, which will help to transform the VMC into a transit-oriented community in the future. The largest increases in transit use are expected for the new residents of the VMC Core area, east of Highway 400, with AM peak period and peak direction transit use increasing from 3% to 41% between 2006 and 2031 (using revised land use), an annual growth rate of 11%. Substantial increases are also forecast for transit trips destined for jobs in the VMC (from 7% to 17%, about 3% a year).

2021 Travel Demand

The trip estimates for 2021 were based on the 2021 population and employment projections (the latter being the same as for 2031 within the VMC area), which assumes that all of the VMC employment planned for 2031 would occur by 2021. Since the transit network assumptions for 2021 and 2031 are exactly the same, the transit forecasts do not show a significant difference from 2021 to 2031, although the transit modal share in 2021 for the peak period and peak direction, is a bit higher than 2031, at 46% (due to the lower number of total trips in 2021).

6.2 Road Network Improvements

The City-wide EMME model was the basis for the VMC model forecasting. The existing VMC road and transit network was adopted from the latest York Region EMME model and developed to be able to respond to the requirements of the focus area study for the VMC.

The 2021 and 2031 VMC road networks were developed and analyzed in two steps, with the original land use and the revised one both summarized in **Table 6.1**. The assumed road improvements are outlined in **Table 6.3** below. The full documentation of alternative road network development is presented in **Appendices VI-1 and VI-2**.

Table 6.3 Elements Included in Various Road Network Alternatives

2006	2021	The Road Network Alternatives Tested with Original 2031 Land Use						The Road Network Alternatives Tested with Revised 2031 Land Use	
		Base Road Network, (Ring Road)	Alternative 1	Alternative 2	Alternative 2A	Alternative 2B	Alternative 2C	Base Road Network, Ring Road	Alternative, Full Network
	Portage Road Extension		Portage Road Extension	Portage Road Extension	Portage Road Extension	Portage Road Extension	Portage Road Extension		Portage Road Extension
	Millway Avenue Extension		Millway Avenue	Millway Avenue	Millway Avenu	Millway Avenue	Millway Avenue		Millway Avenue Connection
	Langstaff Interchange Improvements		northbound on-ramp to Hwy 400 from Hwy 7	Langstaff Interchange Improvements	Langstaff Interchange Improvements	Langstaff Interchange Improvements	Langstaff Interchange Improvements		Langstaff Interchange Improvements
The Existing Road Network	northbound on-ramp to Hwy 400 from Hwy 7	The old road network proposed by Consult in 2001	Off-Ramp from Hwy 400 to the East	northbound on-ramp to Hwy 400 from Hwy 7	northbound on-ramp to Hwy 400 from Hwy 7	northbound on-ramp to Hwy 400 from Hwy 7	northbound on-ramp to Hwy 400 from Hwy 7	The old road network proposed by Consult in 2001	northbound on-ramp to Hwy 400 from Hwy 7
	Off-Ramp from Hwy 400 to the East			Off-Ramp from Hwy 400 to the East	Off-Ramp from Hwy 400 to the East	Off-Ramp from Hwy 400 to the East	Off-Ramp from Hwy 400 to the East		Off-Ramp from Hwy 400 to the East
	Interchange Way Extension to Creditstone Road				Langstaff Extension	Colossus Crossing	Langstaff Extension		Langstaff Extension
							Colossus Crossing		Colossus Crossing
									Interchange Way Extension to Creditstone Road

6.3 Transit Improvements

Transit network assumptions are similar for all road network alternatives. Transit components of the alternatives were also coded based on the 2009 update of the York Region Transportation Master Plan, which includes significant improvements in service frequency for most of the bus routes that pass through Vaughan. Key transit investments in Vaughan are presented in **Table 6.4**.

Table 6.4 Transit Improvements Assumed in 2021 and All 2031 Road Network Alternatives

No.	Description
1	New Bolton GO Rail with 3 stations in Vaughan
2	TTC Spadina Subway Extension to Highway 7
3	TTC Yonge Subway Extension to Highway 7
4	407 Transitway from Halton to Durham Region
5	YRT BRT line along Highway 7
6	"Zum" BRT from Brampton to VMC along Highway 7

Among all the future transit investments, the Spadina Subway Extension is expected to have the biggest impact on transit usage within the VMC, as the terminal station will be located in the core of the VMC on Highway 7 west of Jane Street as shown in **Appendix VI-1**.

6.4 Road Network Alternatives

6.4.1 Existing Road Network in 2006

The 2006 road network, **Figure 18**, was the first one tested with the VMC model. It was also used for the City model calibration and therefore reflects existing transportation conditions. It is noted that the 2006 land use (population and employment), was used to reflect existing conditions.

Figure 19 shows the V/C ratios on the 2006 road network in the PM peak hour. The full documentation of the 2006 road network assessment is also presented in **Appendix VI-1** and the EMME output package is presented in **Appendix VI-2**. The congestion level on Highway 7 and on Jane Street (the east and south entrances to the Vaughan Metropolitan Centre) is high, with V/Cs more than 0.9. Jane Street and Edgeley Boulevard north of Highway 7 have no significant congestion with V/Cs less than 0.8. However, Edgeley Boulevard south of Highway 7 suffers from congested conditions with the V/C more than 0.9. Interchange Way also faces congested conditions in the PM peak hour with a V/C over 0.9.

6.4.2 Network Alternatives Tested with Original Land Use for 2031

2031 Base Road Network

The base road network (2001) for the VMC serves as the reference case for the transportation implications of original land use proposals for the VMC. This network (see **Figure 20**) includes a Ring Road around Highway 7 from east of Highway 400 to west of Creditstone Road. This is the network that was proposed by Cansult in 2002. This network was tested initially with the original 2031 land use.

Road Network Alternative(s)

In addition to the base road network, several other road network alternatives were developed for the long term horizon year, 2031. None of the 2031 road network alternatives include the “ring-road” defined in the base case. Instead, included are a series of smaller collector roads diverting traffic from Highway 7 to the areas surrounding the VMC core. The road networks named Alternatives 1 to 2C, as indicated in **Table 6.3**, are identical in the VMC area, (see **Figure 21**). The only difference between Alternative 1 and 2 is the improved interchange at Langstaff Road. Alternative 1 includes the interchange at Langstaff Road and Highway 400 as it exists today, while Alternative 2 involves improving the interchange to include a southbound off-ramp and a northbound on-ramp. Neither Alternatives 1 nor 2 include the Colossus crossing of Highway 400. Three variations of Alternative 2, namely 2A to 2C, were also developed to include the Langstaff Extension, the Colossus crossing, and both respectively. All the mentioned alternatives were tested with the original 2031 land use.

The V/C ratios for the VMC base road network and Alternative 2C (as the most complete road network among Alternatives 1 to 2C) with 2031 original land use in the PM peak hour are shown in **Figures 22 and 23**, respectively. The full EMME output packages for all the road network alternatives in AM and PM peak hour of 2031 are presented in the **Appendices VI-2** and **VI-3**. Figure 21 shows that the VMC base road network (Ring Road) generally operates at uncongested levels in the 2031 PM peak hour, with most V/C ratios about 0.8 or less. The only congested roads are Highway 7 west and east of the Ring Road in the VMC area with V/Cs higher than 0.9. A section of Jane Street between Highway 407 and Interchange Way is also congested.

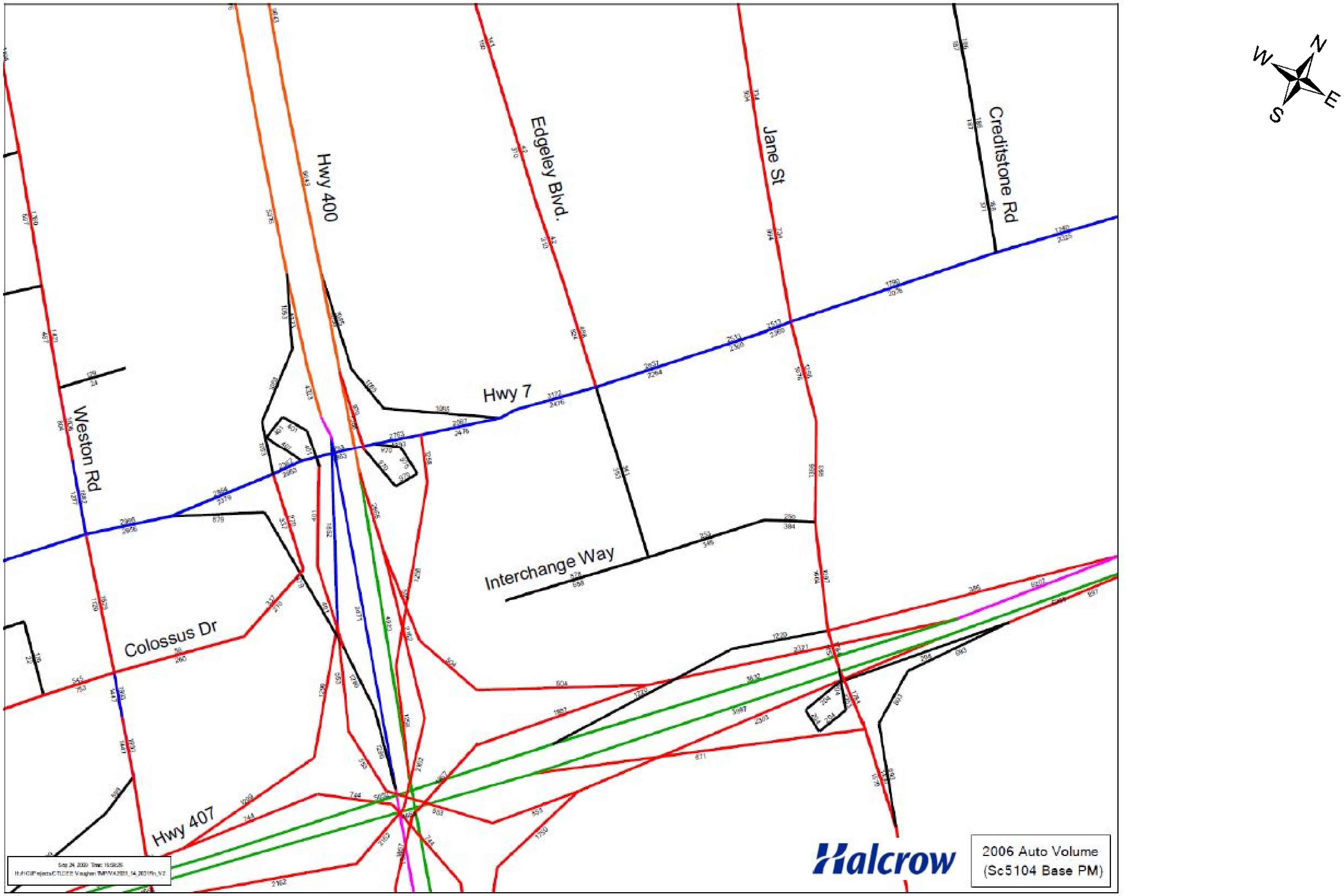

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FIGURE 18

Vaughan Metropolitan Centre (VMC) Transportation Plan

2006 (EMME/2 Model) Road Network

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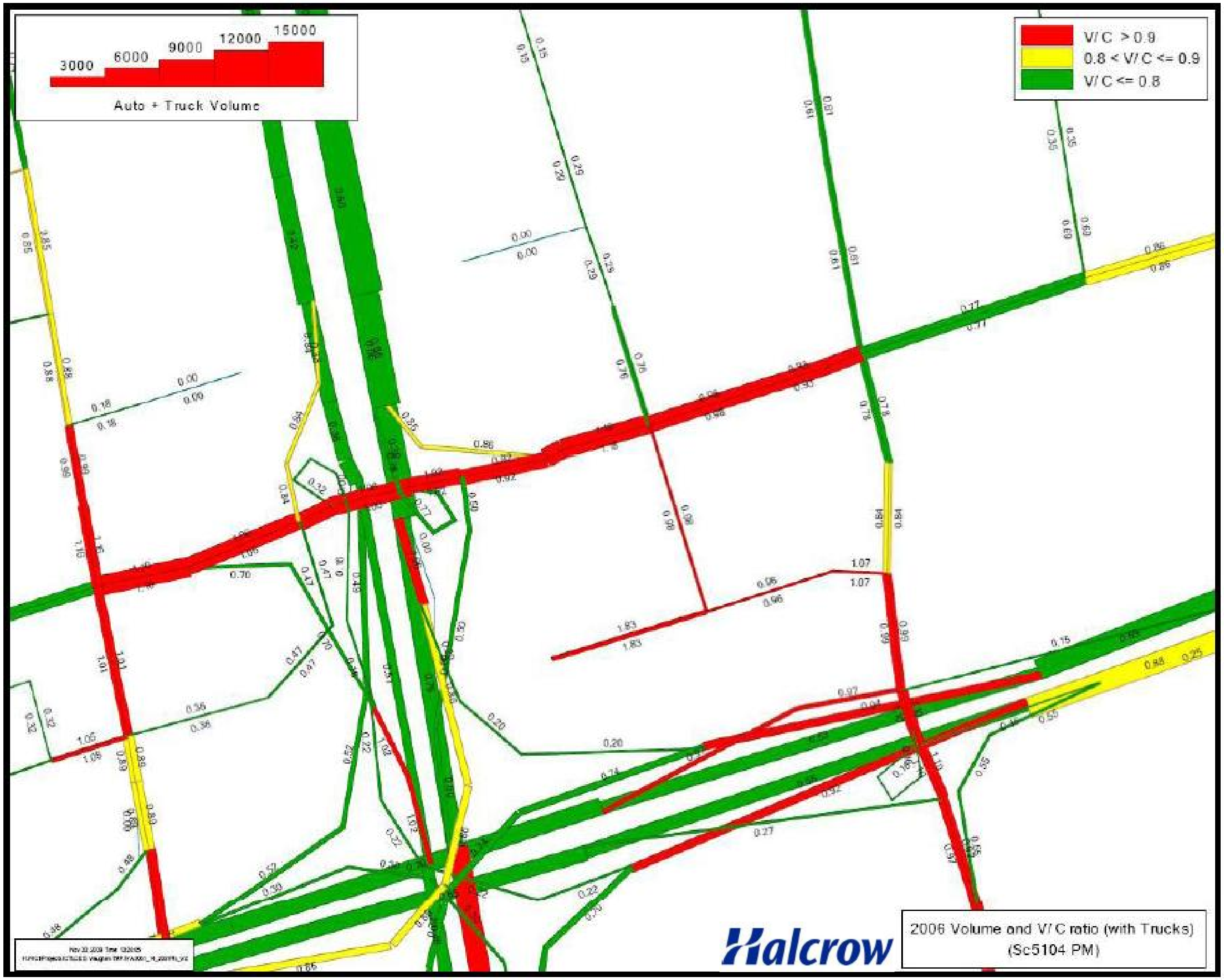

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FIGURE 19

Vaughan Metropolitan Centre (VMC) Transportation Plan
V/C Ratios on 2006 Road Network – PM Peak Hour

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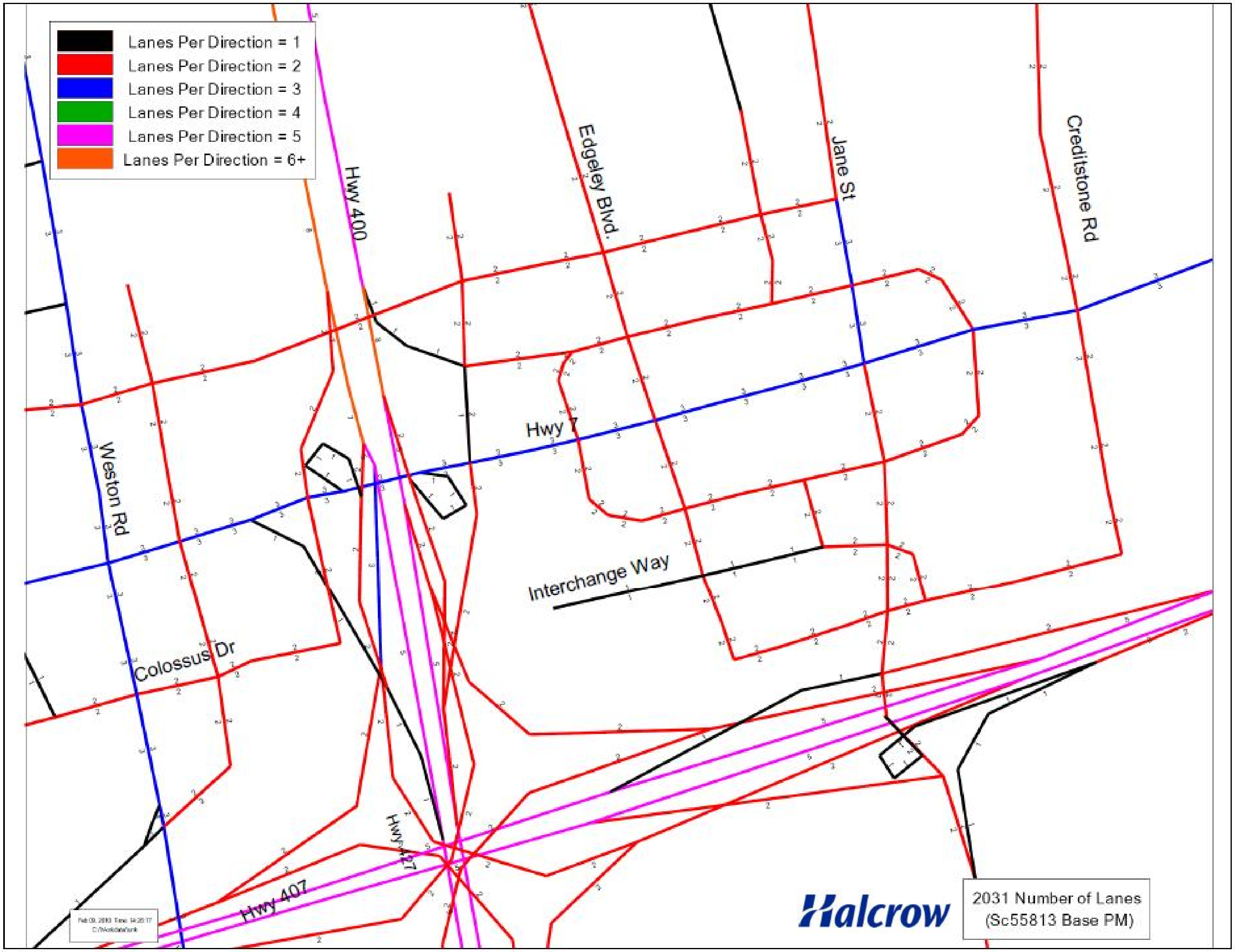

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FIGURE 20

Vaughan Metropolitan Centre (VMC) Transportation Plan

2031 Base (VCC) Road Network

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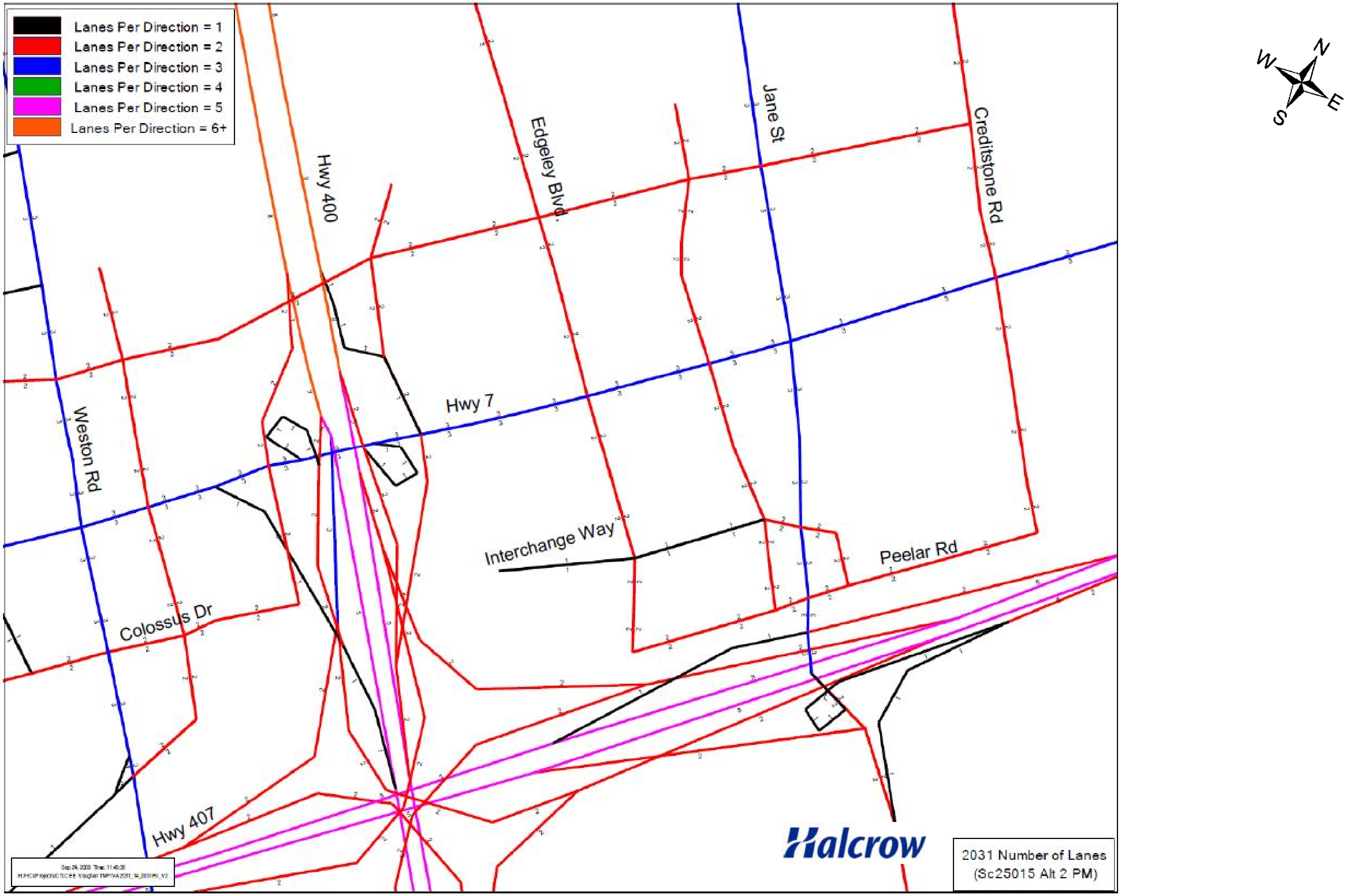

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FIGURE 21

Vaughan Metropolitan Centre (VMC) Transportation Plan

2031 Road Network Alternative Tested With Original VMC Land Use

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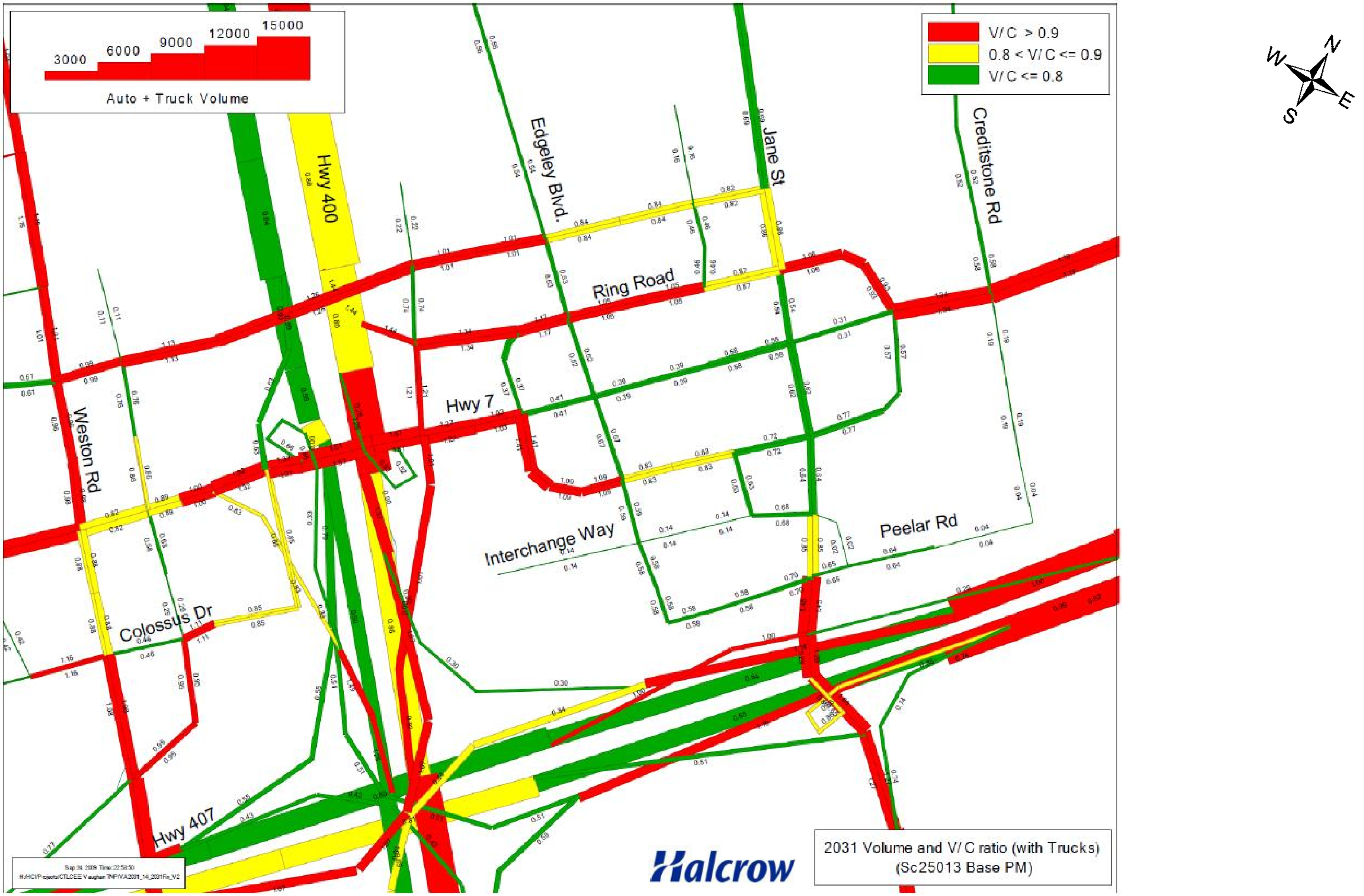

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FIGURE 22

Vaughan Metropolitan Centre (VMC) Transportation Plan

V/C Ratios of Base Road Network with the Original Land Use – PM Peak Hour, 2031

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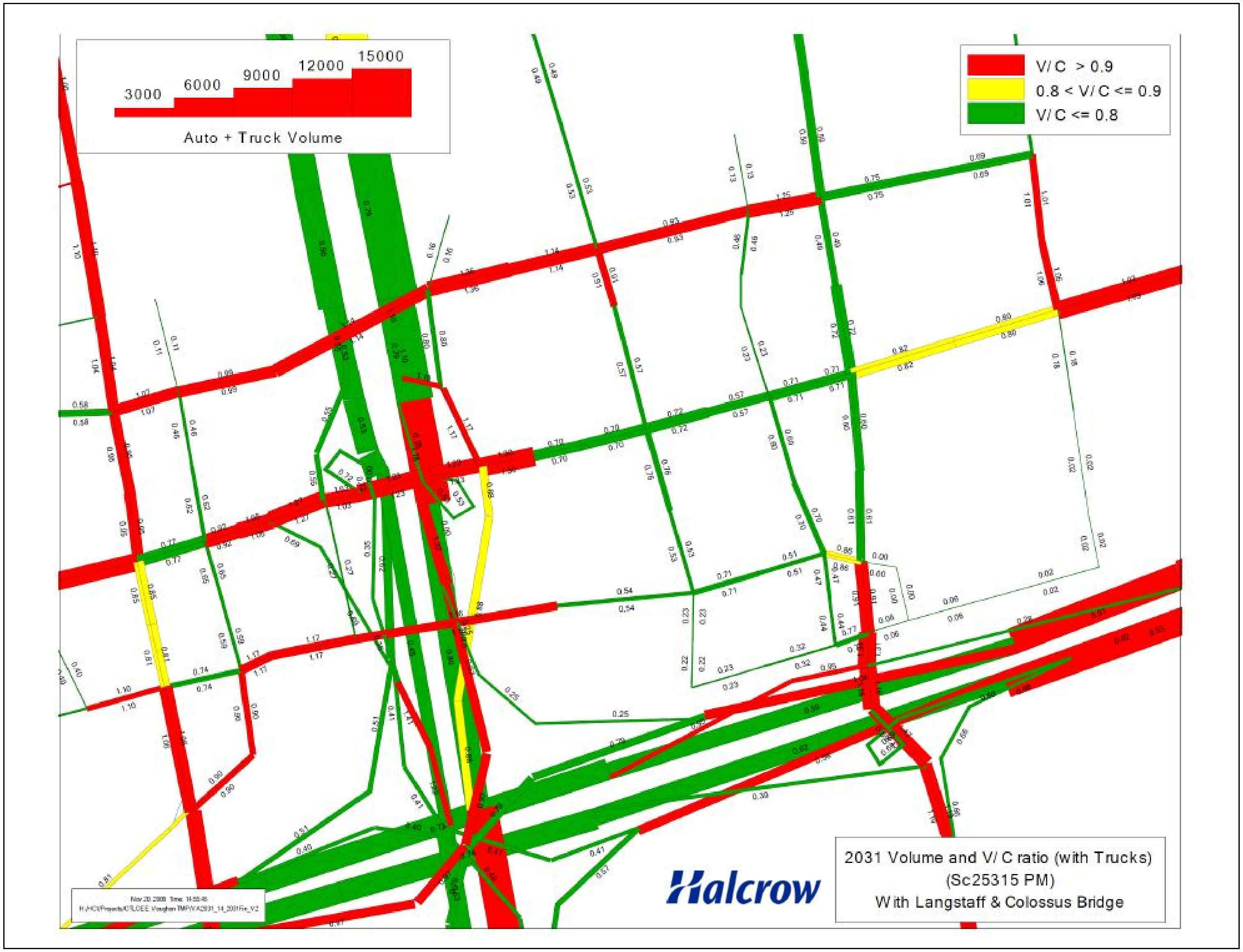

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FIGURE 23

Vaughan Metropolitan Centre (VMC) Transportation Plan

V/C Ratios of Alternative Road Network with the Original Land Use - PM Peak Hour, 2031

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Figure 23 illustrates the congested level of VMC of road network alternative 2C which includes all the proposed road improvements within the VMC proper. The traffic congestion on Highway 7 is partially alleviated due to the Portage Parkway extension in the northeast corner and the Langstaff extension to the north of the VMC. Comparing these two road network alternatives (Base and Alternative 2C), the different traffic pattern observed can be attributed to the conversion of the ring road (in the Base Network) to a full grid network (Alternative 2C) with the addition of missing connections such as the Colossus crossing, Portage extension, Langstaff extension and Millway Avenue extension within the VMC.

Given the proposed Spadina Subway Extension to the VMC “core area,” significant population and employment growth can be expected to occur in the vicinity of the “core area.” The employment growth assumed for 2031 appears to be high, in that the PM outbound traffic on critical links that service the wider VMC is substantially over capacity. In this context, the growth estimates outside of the core area (within VMC) appear to be too high, and land use alternatives with reduced employment need to be considered to bring the PM peak demand levels into line with the total capacity. This fact led the study team to revise the land use, which had been prepared by Urban Strategies. Table 6.1 showed the revised population and employment provided by Urban Strategies for 2021 and 2031.

6.4.3 Road Network Alternatives Tested with Revised 2031 Employment

With a reduced employment obtained from Urban Strategies, the base road network and a network alternative with all proposed improvements, including Langstaff Extension, Langstaff Interchange improvements, Colossus Crossing, Portage Extension, and Millway Avenue Extension were tested using the City of Vaughan EMME model. This road network alternative is virtually the same as Alternative 2C, which had been already tested with the original land use. The only minor difference between these two alternatives is the extension of Interchange Way to Creditstone Road. This alternative is named the “Optimum” road network in this report. **Figure 24** shows the optimum road network alternative for 2031 in the VMC area. The base road network is also the same as the base network tested with the original land use.

Figures 25 and **26** show the V/C ratios on roads for the VMC Base and Alternative road networks in the PM peak hour in 2031 with reduced VMC employment. Comparing Figure 22 and Figure 25**,** shows less congestion on the Ring Road and surrounding roads with the revised land use, compared with the original land use scenario. The full documentation of EMME model outputs, for AM and PM peak hour of 2031 Base and Alternative road networks, are presented in **Appendices VI-4 and VI-5**. Figure 23 and 26 explain the results of the reduced employment for 2031 on the Alternative road network without the Ring Road.

Figure 25 shows the congested condition on Highway 7 and Portage Parkway east of Highway 400, almost the same conditions as the original land use scenario in Figure 23. There are also high levels of congestion on Highway 7 east of Creditstone Road and on Jane Street north of Highway 407, although the V/C ratios are lower than with the original land use scenario (Figure 23). However, there are some improvements on Highway 7, especially the section between Jane Street and Creditstone Road (from approaching congestion condition with V/C greater than 0.8 but less than 0.9 to an uncongested condition with the V/C less than 0.8). Colossus Drive east of Highway 400 is another section in which some improvement can be observed. The V/C in this section has been reduced from greater than 0.9, a congested condition, to lower than 0.8, an uncongested condition.

Moving from the Base road network (Figure 25), to the Alternative (Figure 26) shows some improved and some worsened conditions on different roads, which need to be correctly interpreted. For instance, Portage Parkway east of Highway 400 is under more congested conditions in the Alternative compared to the Base road network, because of a more direct connection due to the Portage Parkway extension.

A V/C analysis at the screenline level was also undertaken to find out how the network performance would change from the Base road network to the Alternative. **Figure 27** shows the screenline locations and numbers. The screenlines have been identified and located so that they are able to show all impacts/effects of road network changes properly. **Table 6.5** summarizes the V/C results at the screenline level for both the Base and the

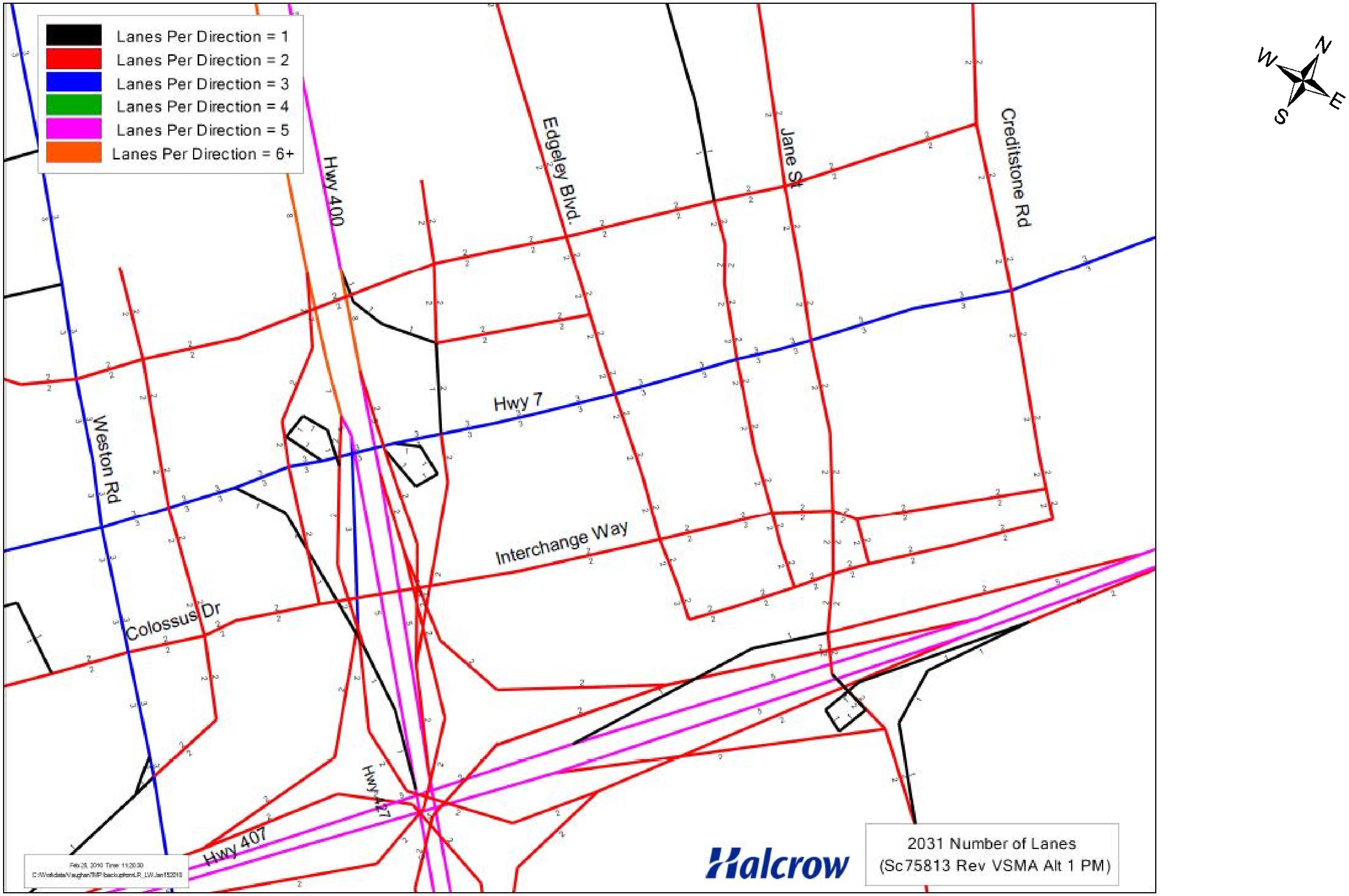

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FIGURE 24

Vaughan Metropolitan Centre (VMC) Transportation Plan

The Optimum (full) Road Network Alternative with 2031 Revised Employment

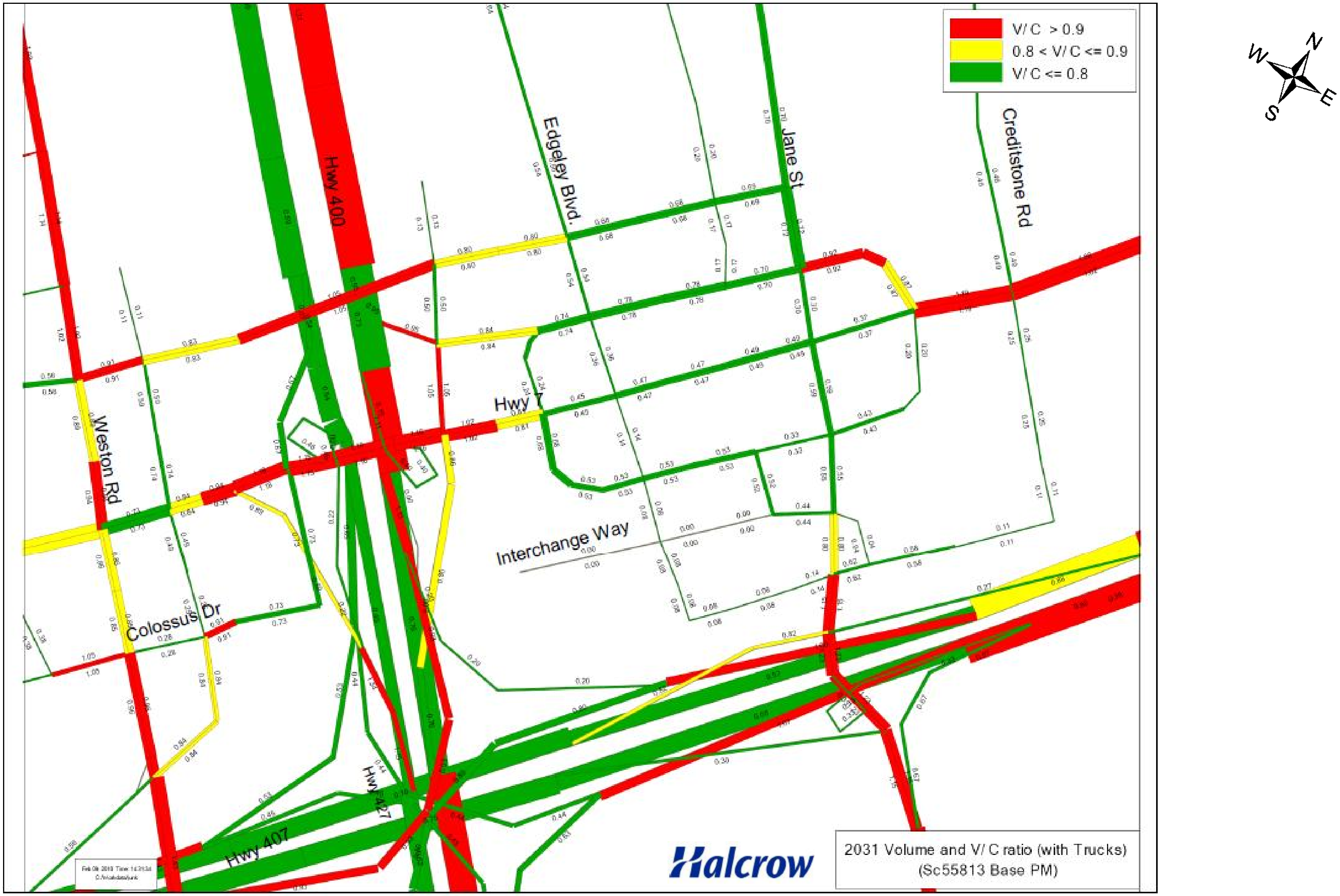

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FIGURE 25

Vaughan Metropolitan Centre (VMC)

V/C Ratio of Base Road Network with the Revised Land Use - PM Peak Hour, 2031

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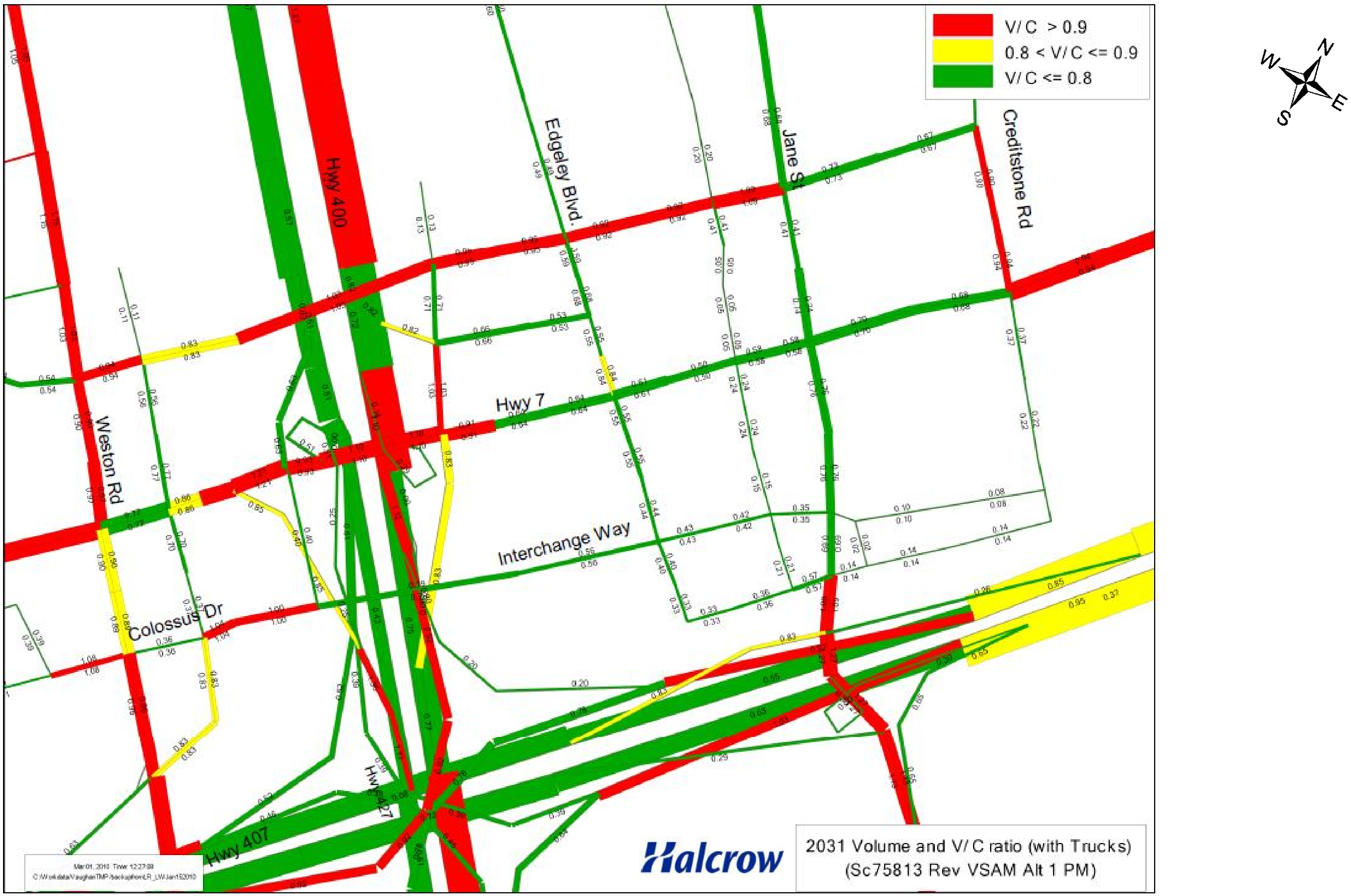

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FIGURE 26

Vaughan Metropolitan Centre (VMC)

V/C Ratios on Optimum Road Network Alternative with Revised Employment–PM Peak Hour, 2031

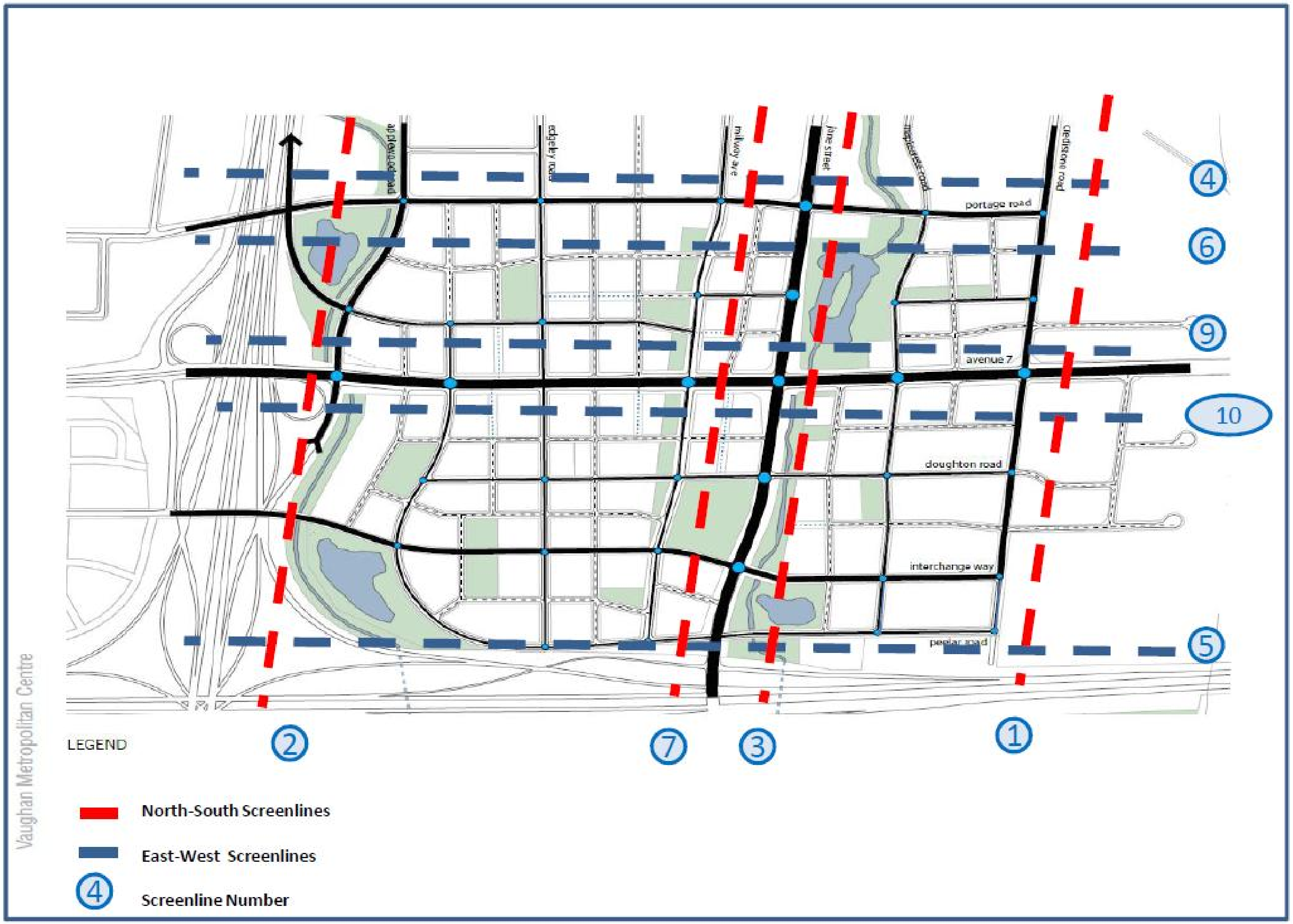

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FIGURE 27

Vaughan Metropolitan Centre (VMC) Transportation Plan

Proposed North-South and East-West Screenlines

AECOM

Alternative road networks for the PM peak hour. Traffic congestion is expected in the eastern end of the VMC in the Highway 7 corridor, east of Creditstone Road, with a V/C over 0.9. This congestion can be observed in both the Base and Alternative road networks. Although, comparing the Base and Alternative road networks, the V/C ratios show an improvement of about 0.06 in the eastbound direction of Highway 7 east of Creditstone Road, the Highway 7 corridor in this section (with the Langstaff Extension) still suffers from congested conditions in the 2031 PM peak hour. However, the same improvements can be seen in the westbound direction, which both are due to capacity increases by inclusion of the Langstaff Extension to the north of the VMC. On the western side of the VMC, at the East of Highway 400 screenline, there is some improvement (about 0.06) in V/C ratios due to the Colossus Drive Extension, although more east-west connections, such as the Portage Parkway extension, Langstaff extension, and the Colossus Crossing, attract more traffic to the area. This could be the main reason why there are not considerable improvements shown in the congestion levels and V/C ratios.

Table 6.5 2031 V/C Ratio for VMC Road Network in PM Peak Hour with the Reduced VMC Employment (Auto plus Truck Volume/Capacity)

Screenline Definition		No.	DIR	Base Network Sc 55813	Alternative 1 Sc 75813	Impact/Effect
Travel Across North-South Screenlines	East of Creditstone Road	1	EB	1.02	0.94	Improved by Langstaff Extension
			WB	0.88	0.81	Improved by Langstaff Extension
	East of Hwy 400	2	EB	0.77	0.71	Improved by Clossuss Dr. Extension although Portage connection cause more congestion on this road
			WB	0.83	0.77	Improved by Clossuss Dr. Extension although Portage connection cause more congestion on this road
	East of Jane Street	3	EB	0.43	0.58	Worsened: elimination of two arms of ring road with the capacity of 900 and add just one, Portage Pkway with the capacity of 600, instead
			WB	0.42	0.48	Worsened: elimination of two arms of ring road with the capacity of 900 and add just one, Portage Pkway with the capacity of 600, instead
	West of Jane Street	7	EB	0.44	0.63	Worsened: elimination of two arms of ring road with the capacity of 900
			WB	0.42	0.58	Worsened: elimination of two arms of ring road with the capacity of 900
Travel Across East-West Screenlines	North of Portage Pkwy	4	NB	0.47	0.43	Slightly Improved by more network continuity
			SB	0.36	0.31	Slightly Improved by more network continuity
	South of Portage Pkwy	6	NB	0.62	0.61	No Change
			SB	0.49	0.46	No Change
	North of HWY 7	9	NB	0.56	0.74	Worsened: elimination of two arms of ring road with the capacity of 900 and add just one, Millway Avenue with the capacity of 600, instead
			SB	0.45	0.56	Worsened: elimination of two arms of ring road with the capacity of 900 and add just one, Millway Avenue with the capacity of 600, instead
	South of HWY 7	10	NB	0.62	0.79	Worsened: elimination of two arms of ring road with the capacity of 900 and add just one, Millway Avenue with the capacity of 600, instead
			SB	0.33	0.39	Worsened: elimination of two arms of ring road with the capacity of 900 and add just one, Millway Avenue with the capacity of 600, instead
	North of HWY 407	5	NB	1.14	1.12	Almost the same as it is expected
			SB	1.30	1.23	Almost the same as it is expected

V/C Color Code:

V/C<=0.8	Green (Uncongested)
0.8 < V/C =< 0.9	Amber (Close to Congested)
V/C>0.9	Red (Congested)

Impacts/Effects Color Code:

Improved Congestion Condition	Green
No Change in Traffic Condition	Blue
Worsened Congestion Condition	Yellow

At screenlines 3 and 7 in the east-west direction and at screenlines 9 and 10 in the north-south direction, there are not any improvements in congestion levels. On the contrary, congestion appears to be worsened and V/C ratios increased. This can be simply the impact of eliminating two east-west or north-south legs of the Ring Road with an assumed capacity of 900 per lane in the base network and converting them to one east-west or one north-south road. This results in relatively worsened levels of congestion (or no improvements) at these locations.

More detailed analysis of the Alternative road network alternative is provided in **Table 6.6**. As it shows the V/C east of Creditstone Road, screenline 1, could be much worse in the absence of Langstaff Road (V/C increases from 0.94 and 0.81 to 1.50 and 1.30 in the eastbound and westbound direction respectively). It is also observed that east of Highway 400, screenline 2, would be much more congested without the Colossus Crossing (about 0.11 and 0.13 increase in V/C ratio in eastbound and westbound directions). These two facts show that in order to avoid severe congestion in the VMC and the surrounding area, the Langstaff Extension and Colossus Crossing need to be built by 2031.

Table 6.6 V/C Ratio of in Road Network Alternative with Various Road Network Assumption for 2031 PM Peak Hour (with the Reduced VMC Employment)

Screenline Location	No.	Condition for V/C Ratio Calculation	Road Network Alternative	
			EB	WB
East of Creditstone Road	1	With Langstaff Extension	0.94	0.81
		Without Langstaff Extension	1.50	1.30
East of Jane Street	3	With Portage Extension	0.58	0.48
		Without Portage Extension	0.75	0.62
East of Highway 400	2	With Colossus Crossing	0.71	0.77
		Without Colossus Crossing	0.82	0.90

Screenline Location	No.	Condition for V/C Ratio Calculation	Road Network Alternative	
			NB	SB
North of Portage Pkwy	4	Creditstone Road 2 lanes	0.48	0.34
		Creditstone Road 4 lanes	0.43	0.31
South of Portage Pkwy	6	Creditstone Road 2 lanes	0.67	0.50
		Creditstone Road 4 lanes	0.61	0.46
North of Highway 7	9	Creditstone Road 2 lanes	0.82	0.62
		Creditstone Road 4 lanes	0.74	0.56
South of Highway 7	10	Creditstone Road (or Millway Avenue) 2 lanes	0.87	0.44
		Creditstone Road and Millway Avenue 4 lanes	0.79	0.39

The results of the detailed screenline analysis east of Jane Street, at screenline 3, show some improvements in the traffic level of service east of Jane Street. By adding the Portage Parkway extension, the V/C ratio would drop from 0.75 to 0.58 in the eastbound direction and from 0.62 to 0.48 in the westbound direction. However, the network operates under "approaching congested levels", with a maximum V/C Ratio of 0.75, even without the Portage Parkway Extension. The Portage Parkway extension would definitely be required to reduce the congestion in the absence of the Langstaff Extension, while might need a substantially longer timeframe to be achieved.

Table 6.6 also compares the V/C ratio for north-south travel on Creditstone Road with two different assumptions for the number of lanes (2 vs. 4). It can be seen that if Creditstone Road is a 2-lane road, and Millway Avenue is a 4-lane road, there will be some congestion in the VMC, both north and south of Highway 7 (screenlines 9 and 10, V/C ratios of 0.82 and 0.87 in northbound direction). Besides, much higher congestion is expected on Creditstone Road itself with the assumption of 2 lanes. Therefore, Creditstone Road is recommended to be a 4-lane road by 2031 north of Highway 7. The V/C ratios of 0.87 (with the assumption of 2 lanes for each of Creditstone Roads or Millway

Avenue) and 0.79 (with the assumption of 4 lanes for both) on the northbound travel of screenline 10, south of Highway 7, indicate that both Creditstone Road and Millway Avenue, should be 4 lanes by 2031, otherwise there will be more congestion at this location.

Figures 28 and **29** illustrate the V/C ratios for North-South and East-West travel (at the corridor level) and can be used to compare the Base and Alternative road networks in the PM peak hour.

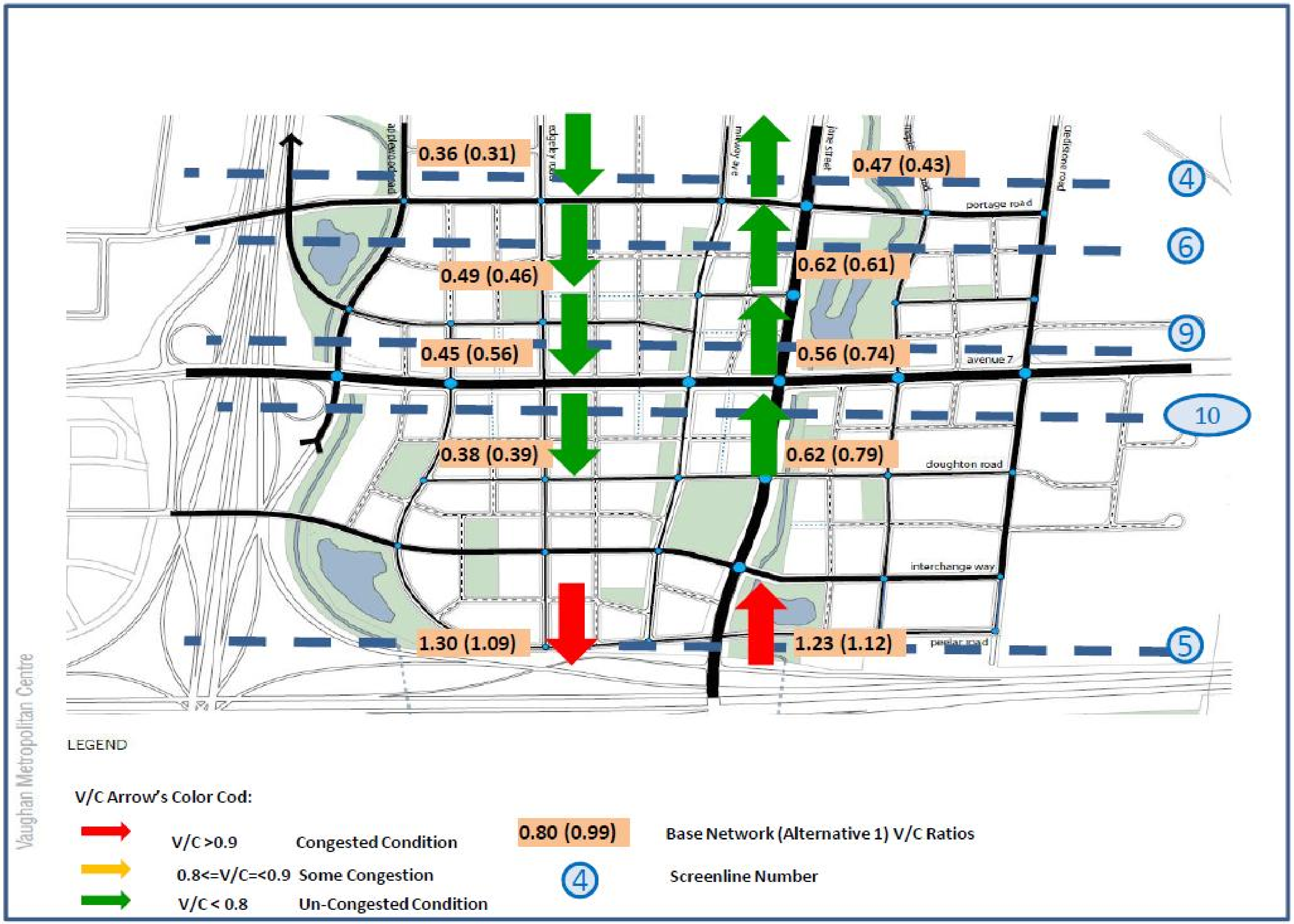
6.4.4 Road Network Analysis for 2021

Another road network was developed for the horizon year of 2021 to support the preparation of a staging and implementation strategy. The 2021 Road Network is the same as the 2031 Alternative road network, except without the Colossus Crossing and the Langstaff Extension which were excluded due to their very high costs. **Figure 30** shows the road network developed for 2021. This road network alternative was tested using the City EMME model. This section of the report presents the network analysis results for the VMC area, east of Highway 400, in both the AM and PM peak hours.

Figure 31 illustrates the V/C ratios on the 2021 road network in the PM peak hour. As shown in the Exhibit there is generally uncongested conditions on the VMC area road network, except for the major bottlenecks, east of Creditstone Road on Highway 7, north of Highway 407 on Jane Street, and east of Highway 400 on Highway 7. There is also a congested condition, V/C more than 0.9, on the Creditstone Road north of Highway 7 and on Portage Parkway east of Highway 400. The full documentation package of EMME model outputs, for both the AM and PM peak hours are presented in **Appendix VI-6**.

Table 6.7 shows the screenline analysis results on the 2021 Base road network for the AM and PM peak hours. The results of PM peak hour screenline analysis show more congested conditions than for the AM, especially east of Creditstone Road (eastbound), east of Highway 400 (westbound), and north of Highway 407 (southbound). These three locations are congested with V/C ratios more than 0.9 in the PM peak hour, while uncongested (V/C less than 0.8), in the AM peak hour. As has already been mentioned, the 2021 VMC road network excludes the Colossus Drive extension across Highway 400, and as a result, the V/C east of Highway 400 shows congested conditions in the area. **Table 6.8** presents detailed screenline analysis to address the needs for the Portage Parkway Extension, Colossus Crossing, and Langstaff Extension, and also to identify the number of lanes required for Creditstone Road and Millway Avenue.

Table 6.8 shows that adding the Colossus Drive extension to the network and increasing east-west capacity helps to reduce the congestion. Indeed, the PM Peak hour V/C ratio for the Highway 7 corridor, when the Colossus Crossing is included, will drop from 0.70 to 0.60 in eastbound direction and from 0.81 to 0.70 in the westbound direction, which is a considerable improvement in congestion levels. The other difference between the 2031 and 2021 road network is the Langstaff extension, which is not included in the 2021 road network. The V/C ratio east of Creditstone Road (eastbound) shows a congested level in the PM peak hour with a V/C ratio of 0.95. The westbound is also close to congested conditions with a V/C ratio of 0.79. It can be easily seen that adding Langstaff to the network can reduce considerably the level of congestion in the PM peak hour (the V/C ratio would drop from 0.95 to 0.59 in the eastbound direction and from 0.79 to 0.49 in the westbound direction). The table also shows that the V/C ratios for the AM peak hour will be similarly reduced by adding the Langstaff Extension to the road network. This proves the need for Langstaff Extension, although it might not be a feasible project by 2021, given the need to negotiate with CN Rail and secure necessary environmental and funding approvals. Therefore, it is recommended that the Portage Parkway be included in the network, in the absence of the Langstaff extension. **Tables 6.7** and **6.8** both show that Portage Parkway extension to Creditstone Road does not considerably change congestion levels in the area. The area with and without Portage Parkway should operate at acceptable conditions (V/C less than 0.8). Therefore, the Portage Parkway Extension, strictly from a capacity perspective, is not needed within the short term period (to 2021).



Not to Scale

FIGURE 28

Vaughan Metropolitan Centre (VMC) Transportation Plan

2031 PM Peak Hour Base (Optimum) Networks V/C Assessment-East West Screenlines

AECOM

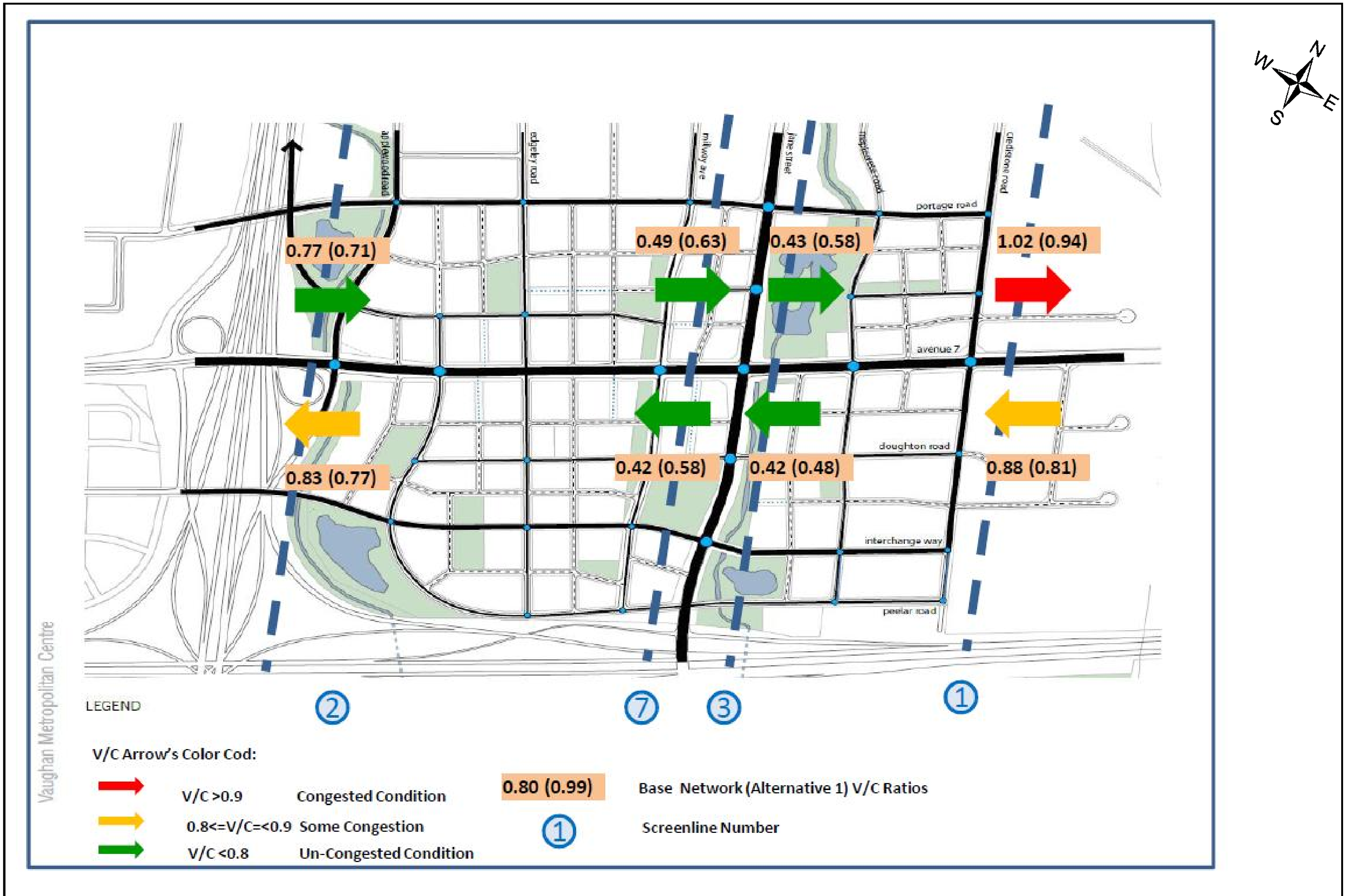


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FIGURE 29

Vaughan Metropolitan Centre (VMC) Transportation Plan

2031 PM Peak Hour Base (Optimum) V/C Assessment-North South Screenlines

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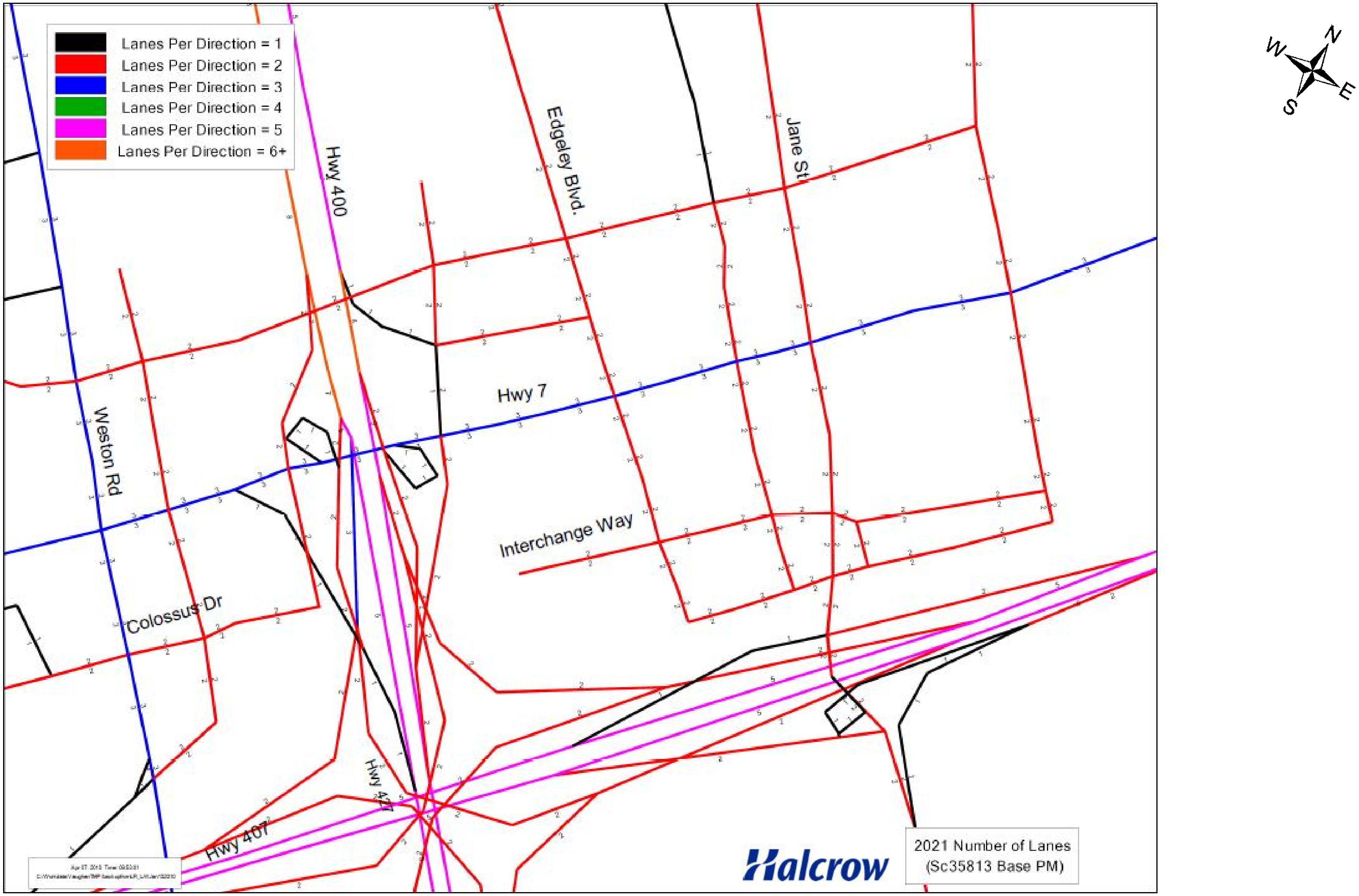

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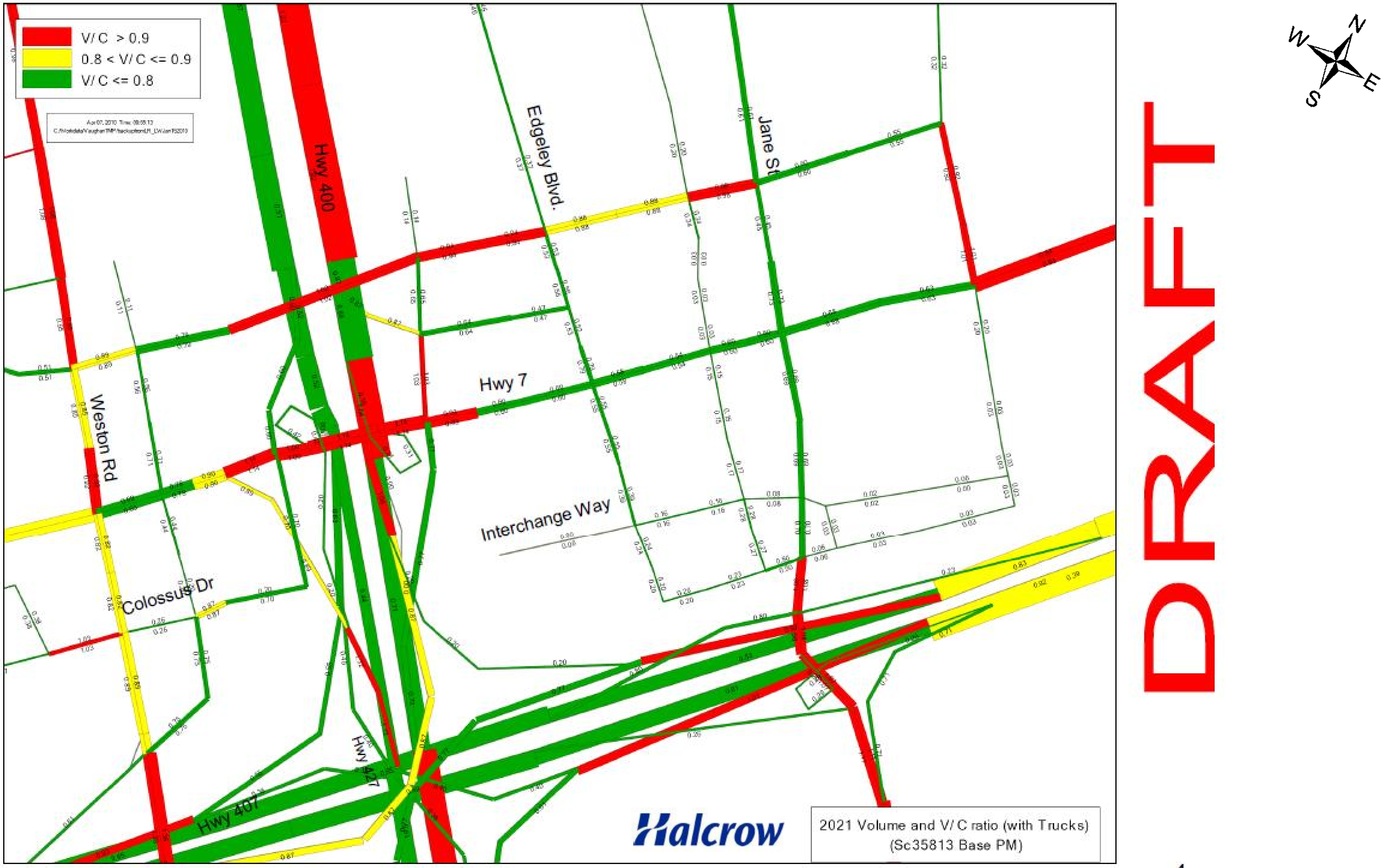
FIGURE 30

Vaughan Metropolitan Centre (VMC) Transportation Plan
2021 (EMME/2 Model) Road Network

AECOM



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Not to Scale

FIGURE 31

Vaughan Metropolitan Centre (VMC) Transportation Plan
V/C Ratios on 2021 Road Network-PM Peak Hour

AECOM

Table 6.7 2021 V/C Ratios for VMC Road Network in AM and PM Peak Hour (Auto with Truck Volume/Capacity)

	Screenline Definition	Screenline No.	DIR	AM Peak Hour	PM Peak Hour
North-South Screenlines	East of Creditstone Road	1	EB	0.75	0.95
			WB	0.85	0.79
	East of Hwy 400	2	EB	0.69	0.70
			WB	0.41	0.81
	East of Jane Street	3	EB	0.31	0.39
			WB	0.35	0.35
	West of Jane Street	7	EB	0.42	0.49
			WB	0.39	0.46
East-West Screenlines	North of Portage Road	4	NB	0.21	0.35
			SB	0.24	0.28
	South of Portage Road	6	NB	0.34	0.57
			SB	0.41	0.48
	North of HWY 7	9	NB	0.54	0.74
			SB	0.45	0.59
	South of HWY 7	10	NB	0.42	0.70
			SB	0.42	0.37
	North of HWY 407	5	NB	0.59	0.90
			SB	0.89	1.21

V/C Color Code:

0 < V/C =< 0.8	Green (Uncongested)
0.8 < V/C =< 0.9	Amber (Some Congested)
V/C>0.9	Red (Congested)

The results of the analysis presented in **Table 6.8** also indicate that Creditstone Road with 2 lanes can accommodate the number of trips in the area by 2021, if Millway Avenue is a 4-lane road. Beyond 2021 (by 2031), the Millway Avenue extension will be required to provide greater network continuity in the area, particularly with the presence of the bus terminal in the VMC core and numerous local bus routes serving the subway terminal.

Table 6.8 Sensitivity Analysis of 2021 Road Network for Various Road Network Assumptions

Screenline Location	No.	Network Configuration for V/C Ratio Calculation	AM Peak Hour		PM Peak Hour	
			EB	WB	EB	WB
East of Creditstone Road	1	With Langstaff Extension	0.47	0.53	0.59	0.49
		Without Langstaff Extension	0.75	0.85	0.95	0.79
East of Highway 400	2	With Colossus Crossing	0.60	0.35	0.60	0.70
		Without Colossus Crossing	0.69	0.41	0.70	0.81
East of Jane Street	3	With Portage Parkway	0.31	0.35	0.39	0.35
		Without Portage Parkway	0.40	0.45	0.51	0.44

Table 6.8 Sensitivity Analysis of 2021 Road Network for Various Road Network Assumptions (continued)

Screenline Location	No.	Network Configuration for V/C Ratio Calculation	AM Peak Hour		PM Peak Hour	
			NB	SB	NB	SB
North of Portage Parkway	4	Creditstone Road 2 lanes	0.24	0.27	0.39	0.32
		Creditstone Road 4 lanes	0.21	0.24	0.35	0.28
South of Portage Parkway	6	Creditstone Road 2 lanes	0.38	0.45	0.63	0.53
		Creditstone Road 4 lanes	0.34	0.41	0.57	0.48
North of Highway 7	9	Creditstone Road 2 lanes	0.60	0.50	0.81	0.65
		Creditstone Road 4 lanes	0.54	0.45	0.74	0.59
South of Highway 7	10	Creditstone Road (or Millway Avenue) 2 lanes	0.46	0.48	0.77	0.41
		Creditstone Road and Millway Avenue 4 lanes	0.42	0.42	0.70	0.37

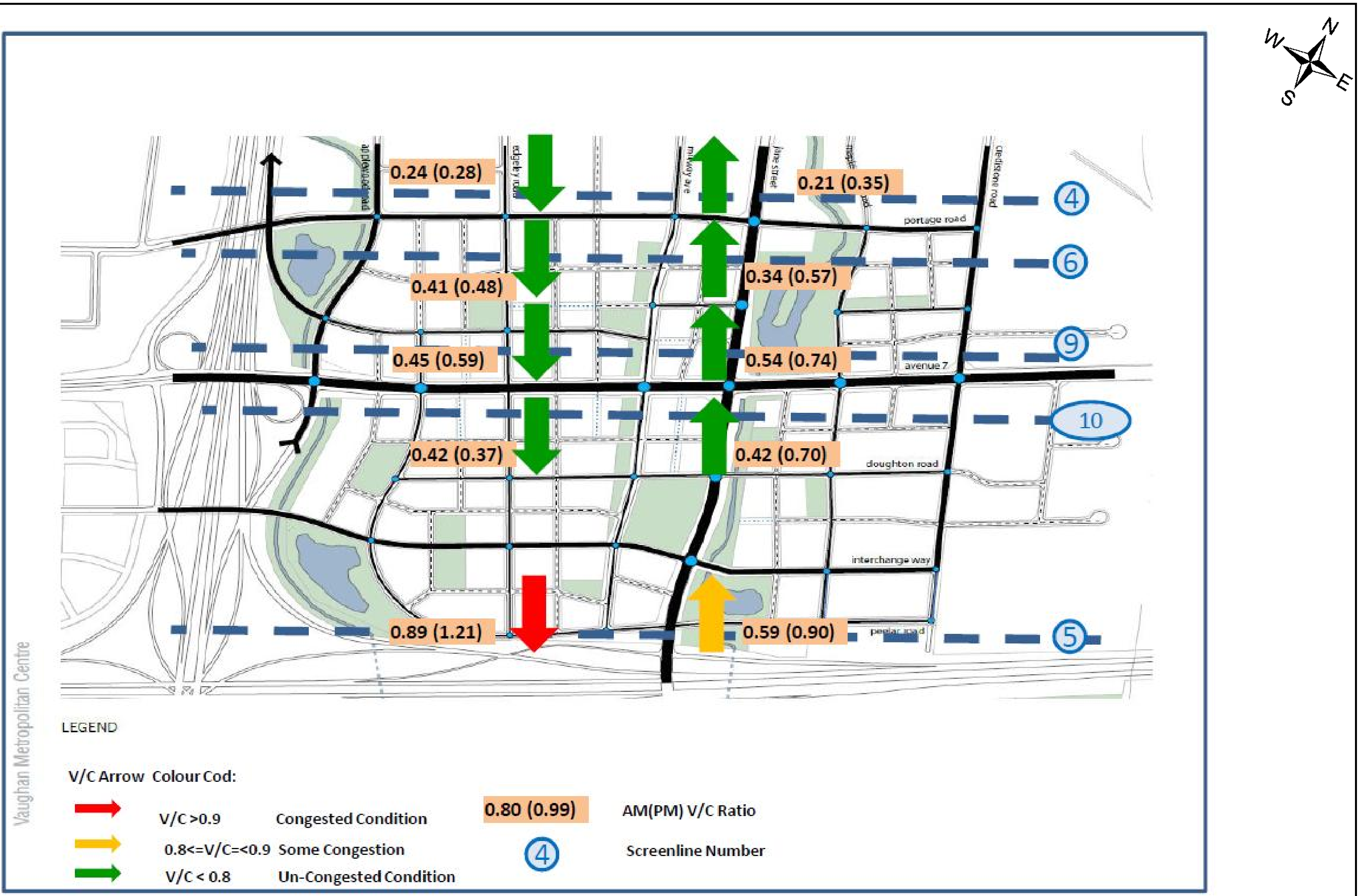
Figures 32 and 33 present the V/C ratios for north-south and east-west travel in both AM and PM peak hours. The outbound traffic from VMC area to the south creates severe congestion on Jane Street (southbound) north of Highway 407 in the PM peak hour. Apart from a few congested locations on major VMC entrance or exit roadways in the PM peak hour, it can be seen that the VMC with a full network, (i.e., including the Colossus Drive extension across Highway 400), would operate at acceptable traffic service levels in both the AM and PM peak hours (most V/C ratios are under 0.8). The outbound trips along the Highway 7 corridor (east-west travel), in the PM peak hour show congested conditions in the absence of the Colossus Crossing and Langstaff extension.

6.4.5 Conclusions

To sum up, the results of the analysis conducted and discussed above are summarized in **Table 6.9.** The table presents the road improvements which have been proposed, coded and tested with the model, analyzed for the effects or impacts, and our final conclusion indicating what improvements need to be included in the network, for which horizon year, and the main rationale for each. The overall VMC road network recommended is shown in **Figure 34**.

Table 6.9 The Road Network Improvements Proposed for the Short Term and Long Term

Road Improvement	2021	2031	The Reasons for including the Road in the Network
Portage Pkwy extension (east of Jane Street)	Yes	+	1. Network Continuity 2. Congestion Reduction 3. Truck Route
Langstaff Extension (east of Creditstone Road)	-	Yes	1. Network Continuity 2. Congestion Reduction 3. Transit service improvement 4. Truck Route
Langstaff/Highway 400 Interchange Improvements	-	Yes	1. Efficient Network Connection 2. Truck Route
Colossus Crossing of Highway 400	Yes	+	1. Network Continuity 2. Congestion Reduction 3. Transit service improvement
Millway Avenue Extension (South of Highway 7)	Yes	+	1. Network Continuity 2. Transit Service Improvement
Creditstone Road Widening to 4 Lanes	-	Yes	1. Congestion Reduction 2. Truck Route



Not to Scale

FIGURE 32

Vaughan Metropolitan Centre (VMC)

2021 AM(PM) Peak Hour V/C Assessment :East-West Screenlines

AECOM

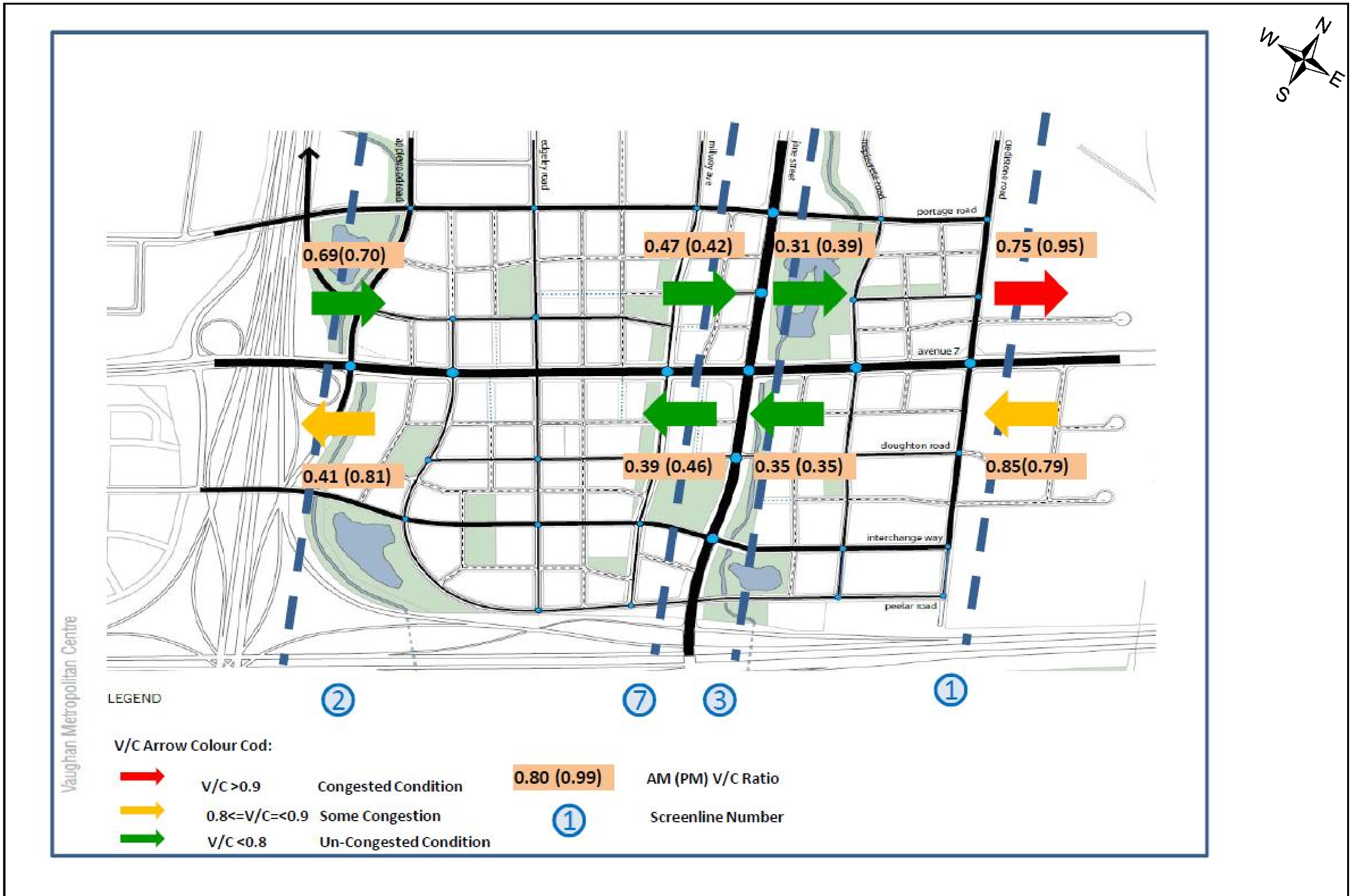


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FIGURE 33

Vaughan Metropolitan Centre (VMC) Transportation Plan

2021 AM(PM) Peak Hour V/C Assessment :North-South Screenlines

AECOM

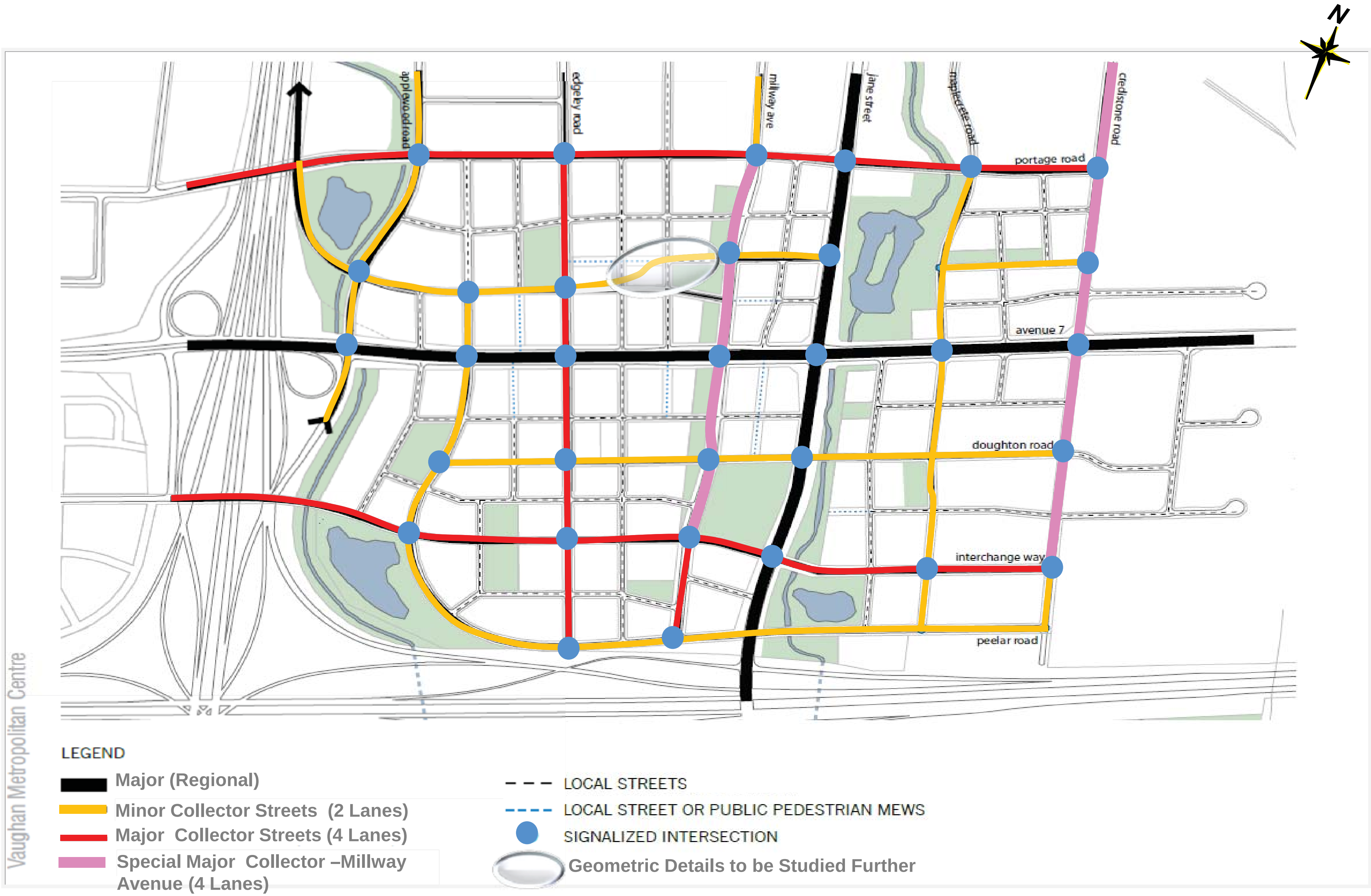

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FIGURE 34

Vaughan Metropolitan Centre (VMC) Transportation Plan

Recommended 2031 Road Network

AECOM

According to the analysis results, the Colossus Crossing is definitely needed to be included in the network by 2021. The Langstaff extension is also required to be built by 2021, but it might not feasible to achieve within that timeframe. In the absence of the Langstaff extension, it is recommended that at least the Portage Parkway extension to Creditstone be in place by 2021 to meet the capacity requirements in this horizon year. Either of these roads will improve the traffic congestion east of Jane Street. Millway Avenue extension (south of Highway 7) is not needed from a traffic capacity point of view, although it will help to reduce the concentrated congestion around the future subway terminal. Creditstone Road within the VMC needs to operate with 4 lanes by 2021, with the segment to the north widened soon thereafter, likely dependent upon the timing of Langstaff Road improvements, either the full interchange with Highway 400 or the extension across the CN rail yard. The improved Langstaff interchange is considered a key part of the strategy to divert truck traffic from the VMC area and, as such, should be pursued as a high priority.

7. Supportive Strategies and Programs

Travel Demand Management is one of the key City-wide TMP elements that will be required to minimize the growth in travel.

7.1 Travel Demand Management (TDM)

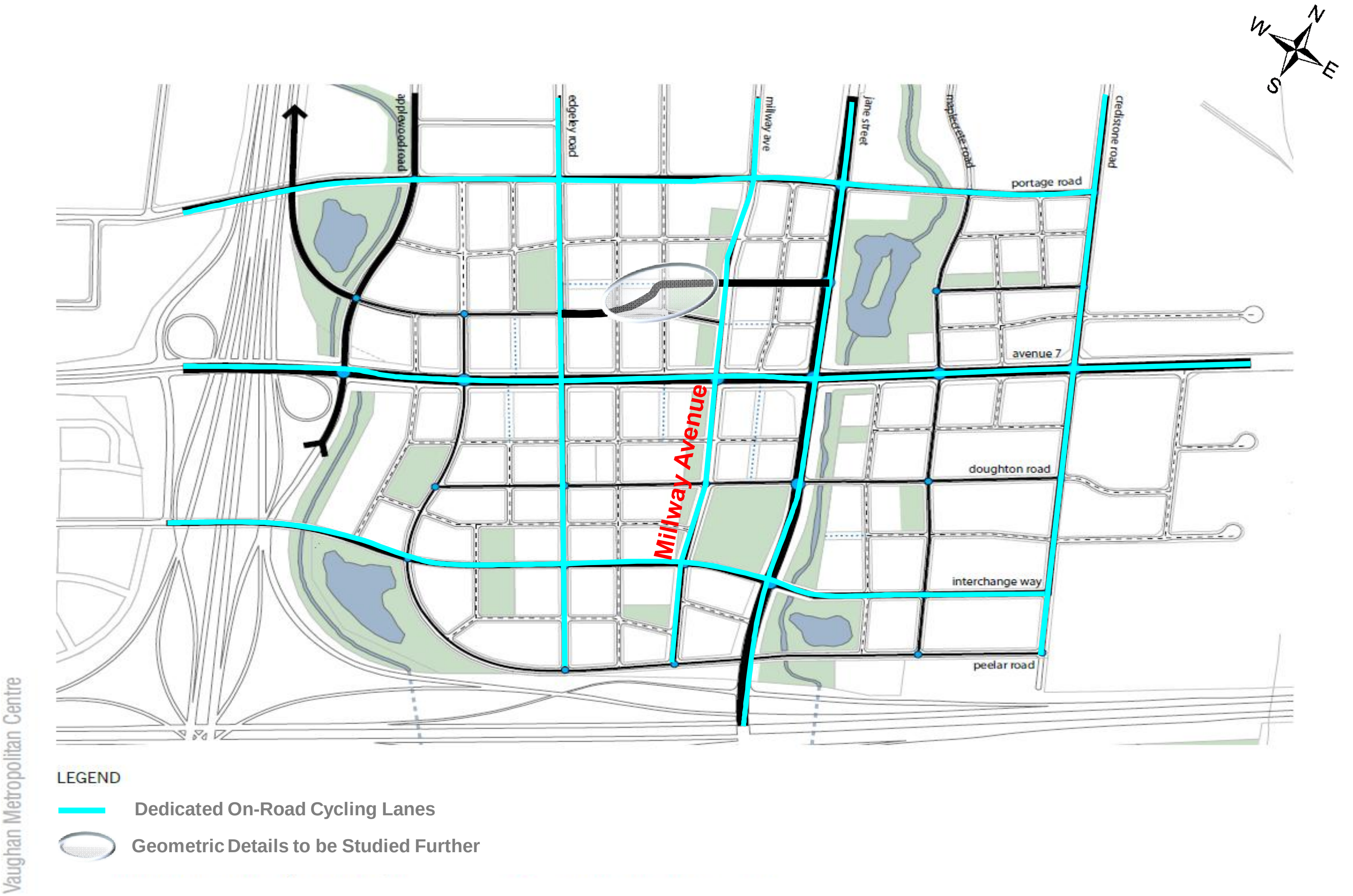
Transportation Demand Management (TDM) will be a critical component of a successful future transportation system for the VMC. The goal of TDM within the VMC area will be to reduce the need to travel by auto during weekday AM and PM peak periods. Objectives should, therefore, be focused in the following four areas:

1. Overall trip reduction (through initiatives to support telecommuting and 4 day work weeks);
2. Mode of travel shifts (from auto to transit, walking and cycling);
3. Time of travel shifts for necessary auto trips (from within to beyond peak periods); and
4. Increases in vehicle occupancy for necessary auto trips (through car and van-pooling initiatives).

As part of an aggressive TDM strategy, specific programs should be developed that provide a combination of incentives and disincentives to achieve these objectives. Smart Commute, an initiative of the Province and GTA municipalities, is now being funded through Metrolinx and would be the appropriate co-ordinating vehicle. Smart Commute is already active in Vaughan through the North Toronto/Vaughan Transportation Management Association (TMA), and this effort could be more focussed on VMC employers. Strong support will be needed from the City of Vaughan, as well as the Region of York through the development review and approvals process to ensure that the VMC plan includes TDM initiatives.

Given the projected strong growth in future travel demand for the VMC area, the road network is expected to be congested under any reasonable growth scenario. An aggressive TDM strategy is, therefore, essential to minimize this growth in “demand”, since “supply” measures alone are not expected to completely satisfy demand. Furthermore, the Colossus and Langstaff extensions are very costly improvements and for that reason their implementation may be later than desired. Auto disincentives should include support for significant reduction in parking supply requirements and for paid parking in the VMC (consistent with the recent study completed for the City). A four pronged strategy is proposed, as follows:

1. Under the Smart Commute umbrella, establish an area-wide VMC Transportation Demand Management thrust to promote expansion of existing successful TDM programs and to work with VMC employers and the broader NTV TMA to help implement TDM programs, including pursuit of telework initiatives, such as Calgary’s Work Shift program.
2. The City adopt the recommendations of the recent city-wide parking study, implement reduced auto parking standards and new bicycle parking standards for new development and support charges for parking along transit corridors and in centres and nodes, including the VMC.
3. The City require TDM plans for all development applications, and that such plans be integrated with broader transportation impact studies and prepared by qualified consultants.
4. The City require new commercial developments to provide cycle end-of-trip facilities, including lockers, change rooms and showers.
5. A bold Active Transportation plan, including an extensive VMC bike network and pedestrian priority zones as key components, as proposed in **Figure 35** be supported by the City and Region.



Not to Scale

FIGURE 35

Vaughan Metropolitan Centre (VMC) Transportation Plan

Recommended 2031 Bike Network

AECOM

The recommended TDM strategy needs to be approved prior to, or concurrently with, the VMC secondary plan to establish a strong TDM presence from the outset and facilitate the early approvals of significant VMC developments, which in the short term may not have all of the necessary infrastructure supports in place. Allowing the status quo (dominant use of automobile) to prevail before implementing the strategy may inhibit the implementation of the very transit oriented developments needed to accelerate changes in travel behaviour, that ultimately will be essential for the overall success of the VMC.

7.2 Transit Modal Split Target

Complementary to the TDM strategy proposed above, a transit modal split target for the VMC should be established. The Region of York in its recent Update to its Transportation Master Plan has identified a transit modal split target of 50% for peak period trips in the peak direction for all four Regional Centres, including the VMC.

The EMME model developed for the City as part of the Vaughan Transportation Master Plan projects a transit modal split of 41% for peak hour, peak direction VMC generated trips. While the model reflects the presence of new and improved transit infrastructure and services, and deals with relative modal costs and travel times, it does not address very well other transit supportive initiatives, such as transit service and fare integration, park-and-ride facilities, reduced parking supply for developments, and other “softer” (more policy oriented) transit incentives.

Looking at experience elsewhere, the case of the North York Centre in Toronto is considered to be most relevant and is instructive. There, the comparable figure observed in 2006 (as measured by results from the Transportation Tomorrow Survey) is 45%. In this light and in view of the Emme/2 model limitations, the Region’s 50% target appears reasonable and is supported. This target should be applied in VMC related studies of medium to long term requirements. Regular surveys should be conducted as part of a broader transportation monitoring program (to be developed as part of the City’s TMP) to track transit modal split over time.

7.3 Truck Strategy

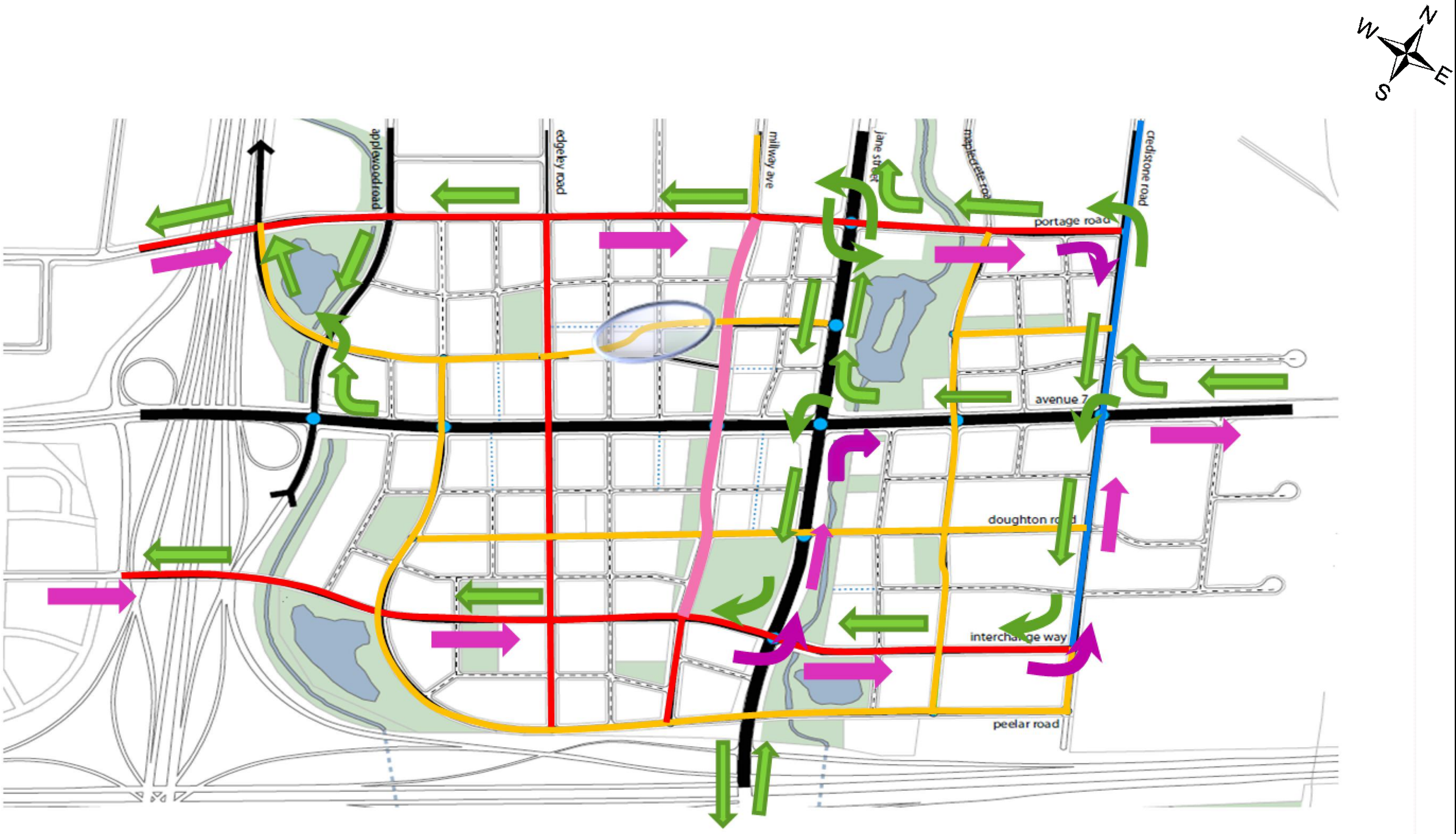
There are a large percentage of heavy vehicles in the traffic composition, as recorded at key intersections within the VMC study area. The concentration of industrial development within the study area, the major inter-regional commercial route catering of Highway 7 to heavy vehicle traffic and the influence of Highway 400 and 407 (both Provincial truck routes) are some of the reasons for this large percentage of heavy vehicles.

Regardless of the time period, the majority of the heavy vehicle traffic passes directly through the study site along Highway 7, Weston Road or Jane Street as opposed to originating in or destined to areas in the VMC. This suggests that if alternative links to these heavily travelled corridors could be developed, heavy vehicle traffic may by-pass the VMC area all together, or at least Highway 7 within the VMC node.

The restriction of heavy vehicles from Highway 7 between Creditstone Road and Highway 400 can be largely supported by diverting traffic to Portage Parkway and Interchange Way / Colossus as presented in **Figure 36**. A more detailed and comprehensive truck strategy should be developed as a priority.

7.4 Commuter Parking (Park-and-Ride)

Normally, park-and-ride facilities are provided at subway terminals to facilitate access to, and enhance the utilization of, capital intensive transit infrastructure. This has certainly been the experience in Toronto. However, in the case of the Spadina subway extension, the VMC as the City’s major growth centre and future downtown, is not considered an appropriate location for large formalized park-and-ride facilities. The VMC developments will



LEGEND:

Eastbound movement

Westbound movement

Not to Scale

FIGURE 36

Vaughan Metropolitan Centre (VMC) Transportation Plan

Truck Route Proposal

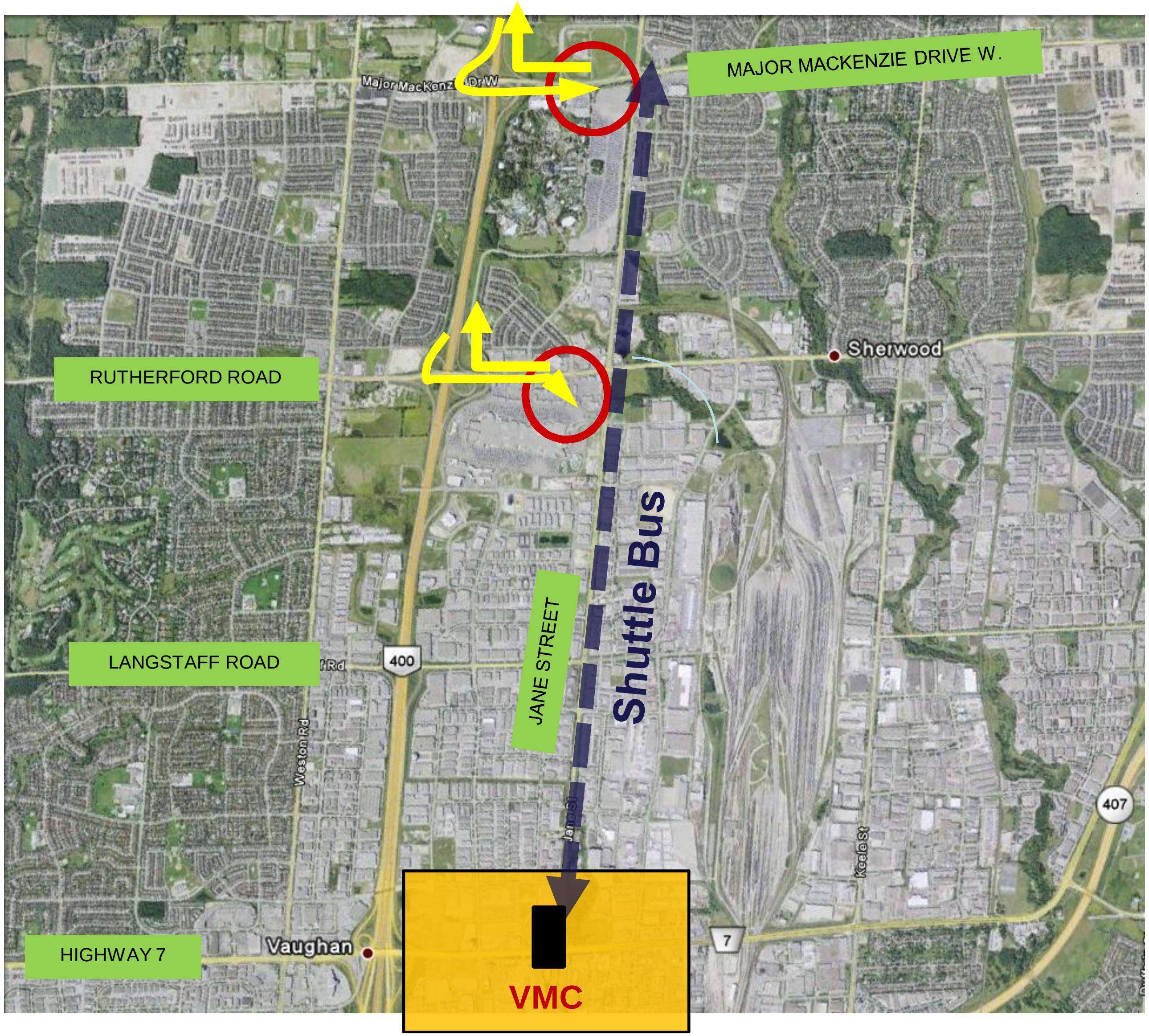
AECOM

generate very significant amounts of weekday peak period traffic on their own, and the added surcharge due to large park-and-ride facilities would only tax the road system further. In recognition of this fact, park-and-ride facilities are being provided at the other two new stations serving Vaughan. At the Steeles West station some 1900 spaces are to be provided in the adjacent hydro corridor, and a further 600 spaces are to be provided at the Highway 407 station accessed from Jane Street.

Notwithstanding these provisions, there will be some demand for subway-related parking in the VMC to serve catchment areas to the northwest, north and northeast. While some of this demand may be accommodated by regular commercial parking in the VMC, opportunities should be investigated to provide formal park-and-ride facilities to the north of the VMC and connect them to the VMC station by frequent regular or special shuttle bus services. Furthermore, there are some access restrictions associated with the park-and-ride facilities at the Steeles West and Highway 407 stations that would support provision of additional facilities to the north of the VMC. Specifically, trips using Highway 400 cannot access Highway 407 to exit at Jane Street, and the Steeles/Highway 400 interchange currently only serves trips to and from the south. So, for example, trips using Highway 400 from points north of Vaughan will not be able to easily access these planned park-and ride lots.

As a result, it is proposed that the City, together with the Region and York Region Transit explore opportunities for remote park-and ride facilities that can be easily accessed from Highway 400. A preliminary review suggests that there might be opportunities in the Jane corridor at Rutherford Road (in conjunction with Vaughan Mills Mall) and at Major Mackenzie Drive (in conjunction with Canada's Wonderland theme park). In both cases, shared use parking schemes should be investigated, given the large amounts of surface parking already in place, much of which is not used during weekdays (when park-and-ride is needed). Both Vaughan Mills Mall and Wonderland are conveniently accessed from Highway 400 as shown in **Figure 37** and could be served conveniently by Jane Street bus service, which would feed the subway at the VMC station. It is noted that there is an existing carpool lot at the Highway 7/ Highway 400 interchange (southwest quadrant) and it may have a limited ability through a VIVA connection or shuttle bus to accommodate some park-and-ride demand.

In the short to medium term, there may be opportunities to develop interim park-and-ride facilities within the VMC. These opportunities should only be pursued in the context of a broader VMC parking strategy, which would comprehensively address all parking issues and ensure that stand-alone park-and-ride facilities are phased out over time as the more important vehicular access needs of VMC developments are fulfilled.



Not to Scale

FIGURE 37

Vaughan Metropolitan Centre (VMC) Transportation Plan

Remote Park-and-Ride Opportunities

8. Implementation Strategy

While more detailed analysis is to be completed as part of the follow-up joint study with the Region, an overall implementation strategy has been formulated. This centres around the two critical long-term objectives of achieving a significantly higher transit modal split (target of 50% for peak hour, peak direction VMC trips) and diverting as much heavy truck traffic as possible from Avenue 7.

The transit modal split objective will be advanced significantly with the arrival of the Spadina Subway, a committed and fully funded project, scheduled for completion by late 2015. This is expected to trigger substantial development activity resulting in a significant increase in auto traffic in the short term as well as new transit ridership. With the arrival of the subway to the VMC, there will also be a restructuring of YRT bus routes to feed the new terminal station, which will increase the overall transit accessibility of the VMC for Vaughan and other York Region residents. In the medium term (2016 – 2021), the VIVA Highway 7 BRT service is planned to be extended westerly to Pine Valley Drive, providing an east-west rapid transit service complementing and feeding the Spadina Subway. This will represent a second major milestone in upgrading transit service to the VMC.

On the road network side, the top priorities should involve network accessibility and capacity improvements that will provide alternate routes to Avenue 7, thereby helping to transform this major east-west facility from an auto and truck oriented highway to an urban arterial accommodating all modes of travel. While a detailed implementation plan is yet to be developed (as part of the study with the Region), short-term improvements should include the extension of Portage Parkway east of Jane Street to Creditstone Road, widening of Creditstone Road from Avenue 7 to Portage Parkway, construction of Highway 400 interchange improvements at Highway 7 (similar to previously referenced Links 4 and 5) and at Langstaff Road. Medium-term projects would include the Colossus Road crossing of Highway 400. In the longer-term the extension of Langstaff Road across the CN rail yard would benefit not just the VMC, but also the broader Highway 7/Rutherford corridor.

Depending on how quickly some of the proposed short-term road network improvements can be advanced, and the timing and scale of new developments, the existing road network may be stressed over the next few years. This “short-term pain” should be tolerated in recognition that major changes in travel behaviour are essential and that significant transit improvements are committed for short to medium term implementation (i.e., Spadina Subway extension and VIVA Next Avenue 7 BRT service). TDM initiatives and a comprehensive parking strategy will also be necessary to help change travel behaviour, and these can alleviate the pain. A TDM plan should be developed and implemented with the guidance and support of Metrolinx, the Region of York, and the Smart Commute North Toronto/Vaughan TMA.

Appendix I

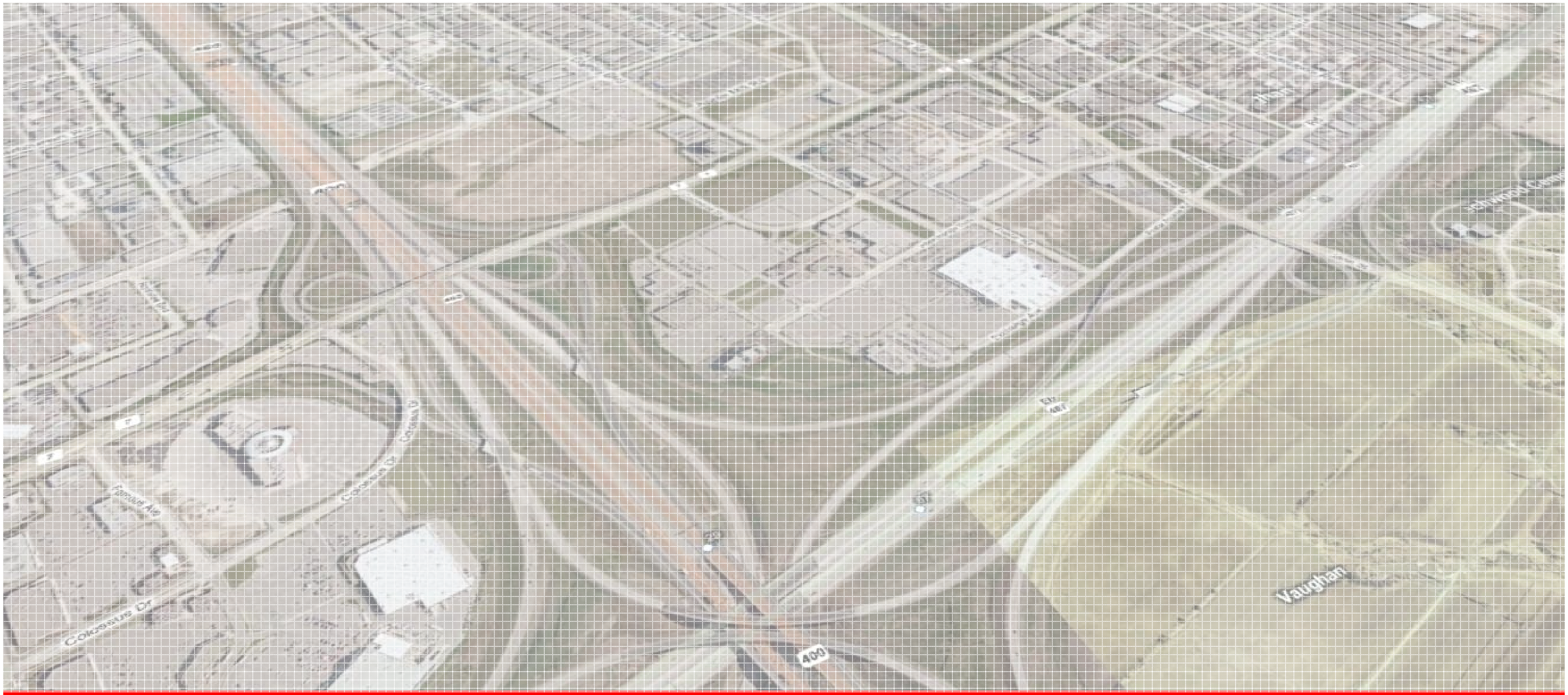
Consultation

1. Extracts from Presentation:
   Vision Workshop (May 7, 2009)
2. Extracts from Presentation:
   Workshop #2 (September 30, 2009)
3. Extracts from Presentation:
   Open House #1 (March 8, 2010)
4. Transportation Presentation:
   Open House # 2 (April 19, 2010)

1. Extracts from Presentation: Vision Workshop (May 7, 2009)

VCC Plan Review

Toward a New Vision for Downtown Vaughan

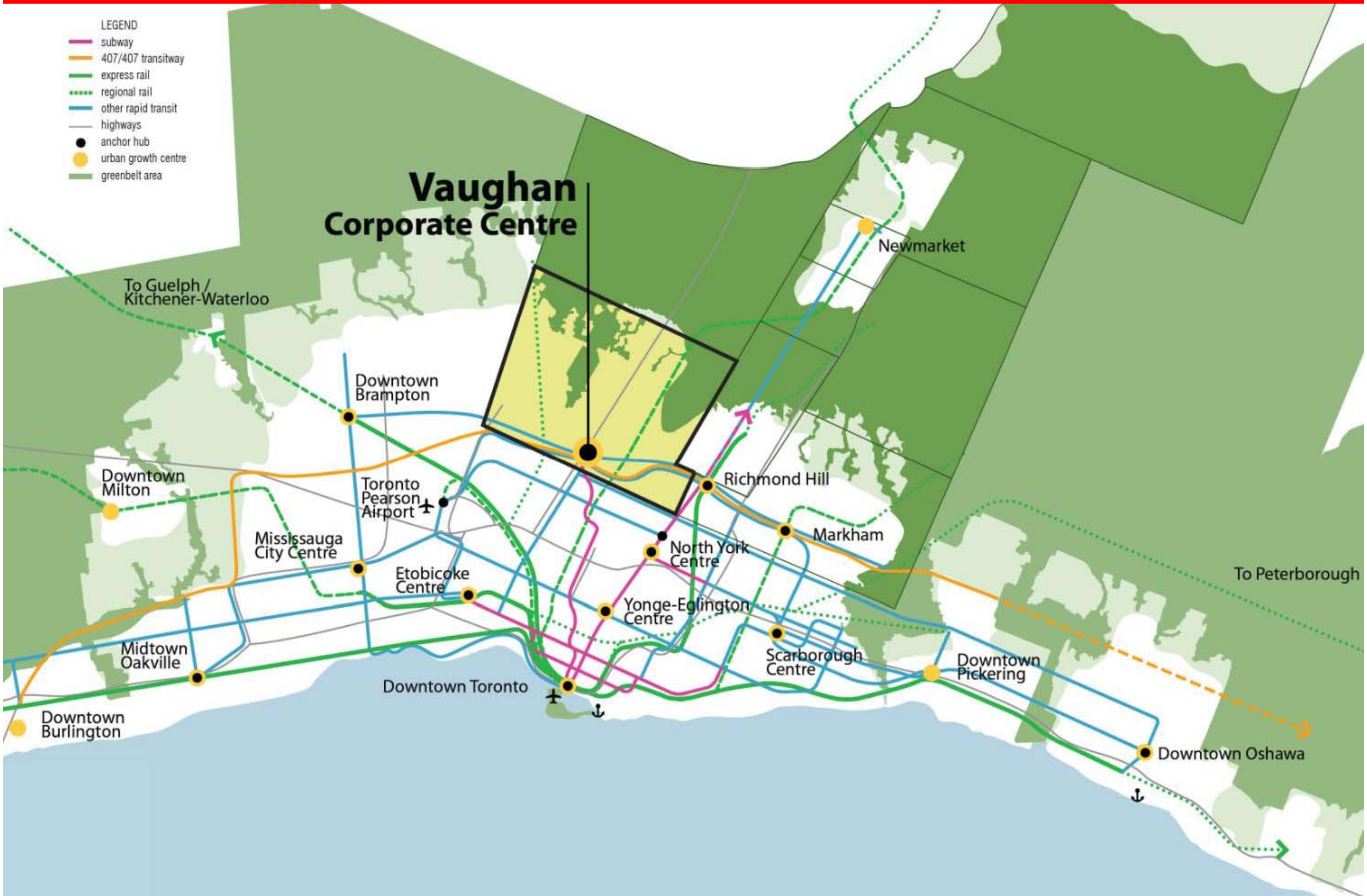


Visioning Workshop

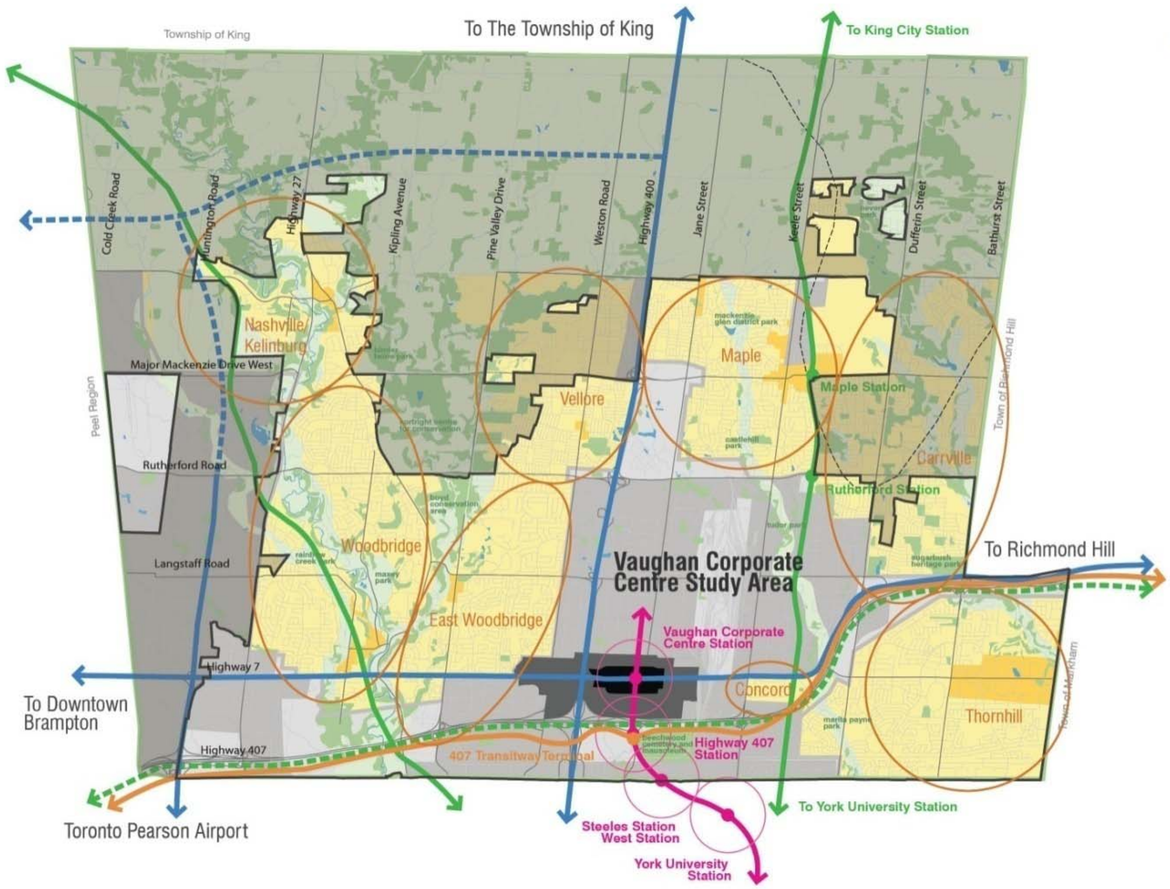
May 7, 2009

URBAN STRATEGIES INC.

...and one of four UGCs in York Region



The VCC is a key location for residential and employment growth within Vaughan's built boundary. Growth in the VCC must be focused strategically to establish the critical mass of a downtown.



Growth Projections to 2031:

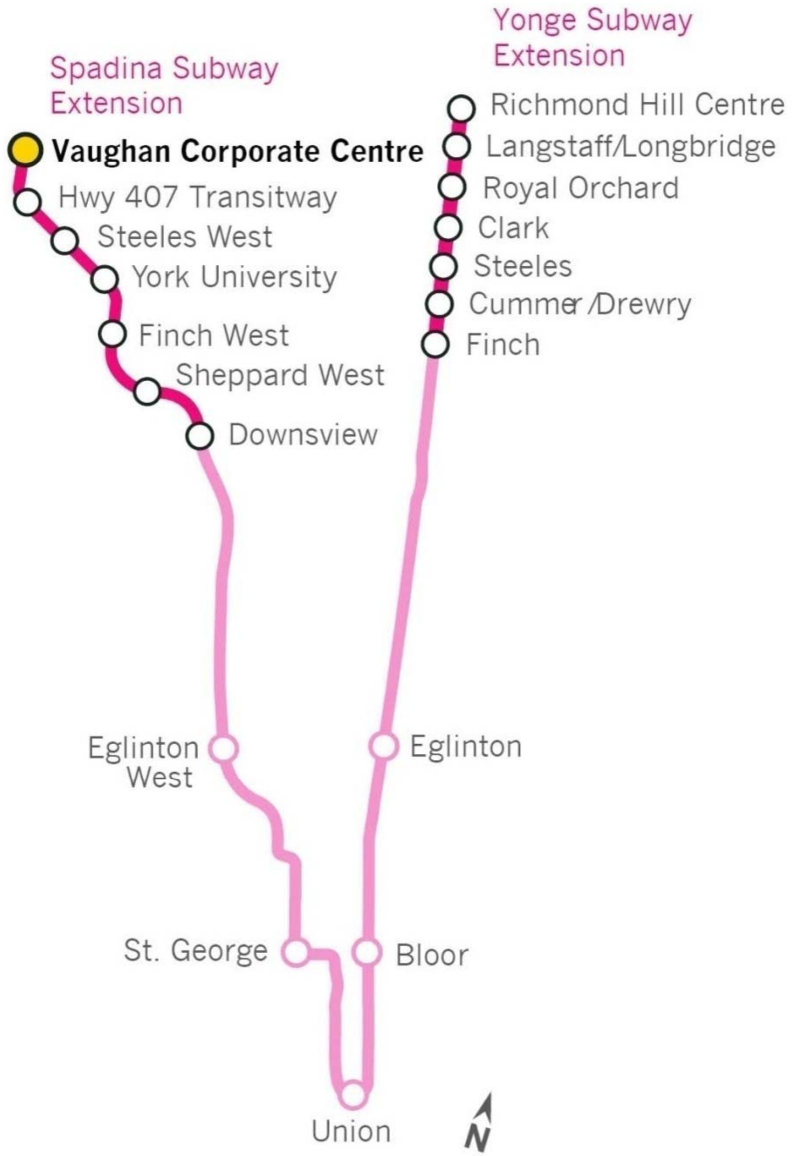
65,000 units city-wide

30,000 units within the built boundary (45%)

13,000+ units within the VCC

27,500 residents and 13,000 jobs in the VCC

The subway, the fundamental piece of infrastructure to make the downtown accessible and walkable, will be here in 2015



OPA 500 (1998) introduces the structure

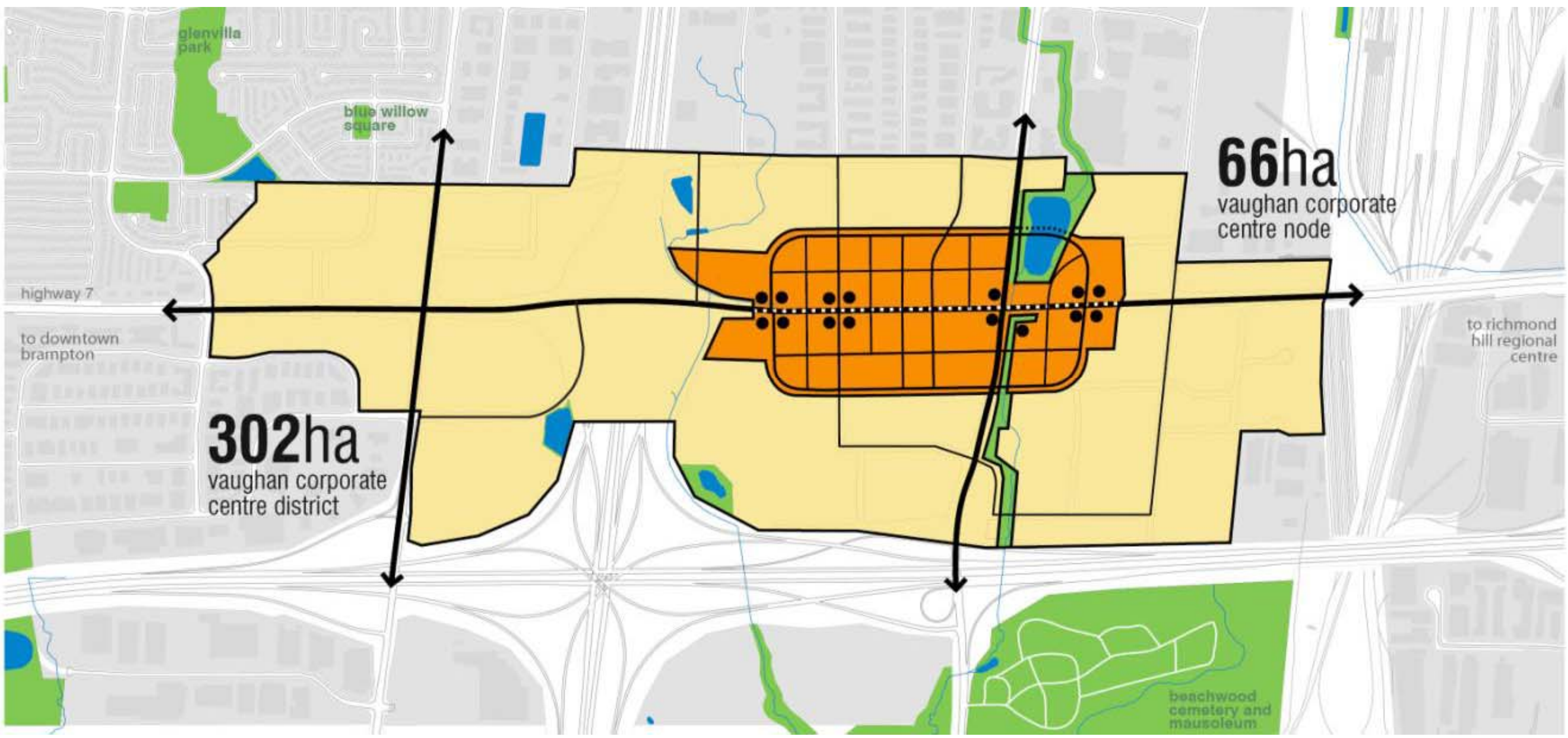
STRUCTURE

- Node
- District
- Hwy 7 Urban Street
- Ring Road
- Street Grid

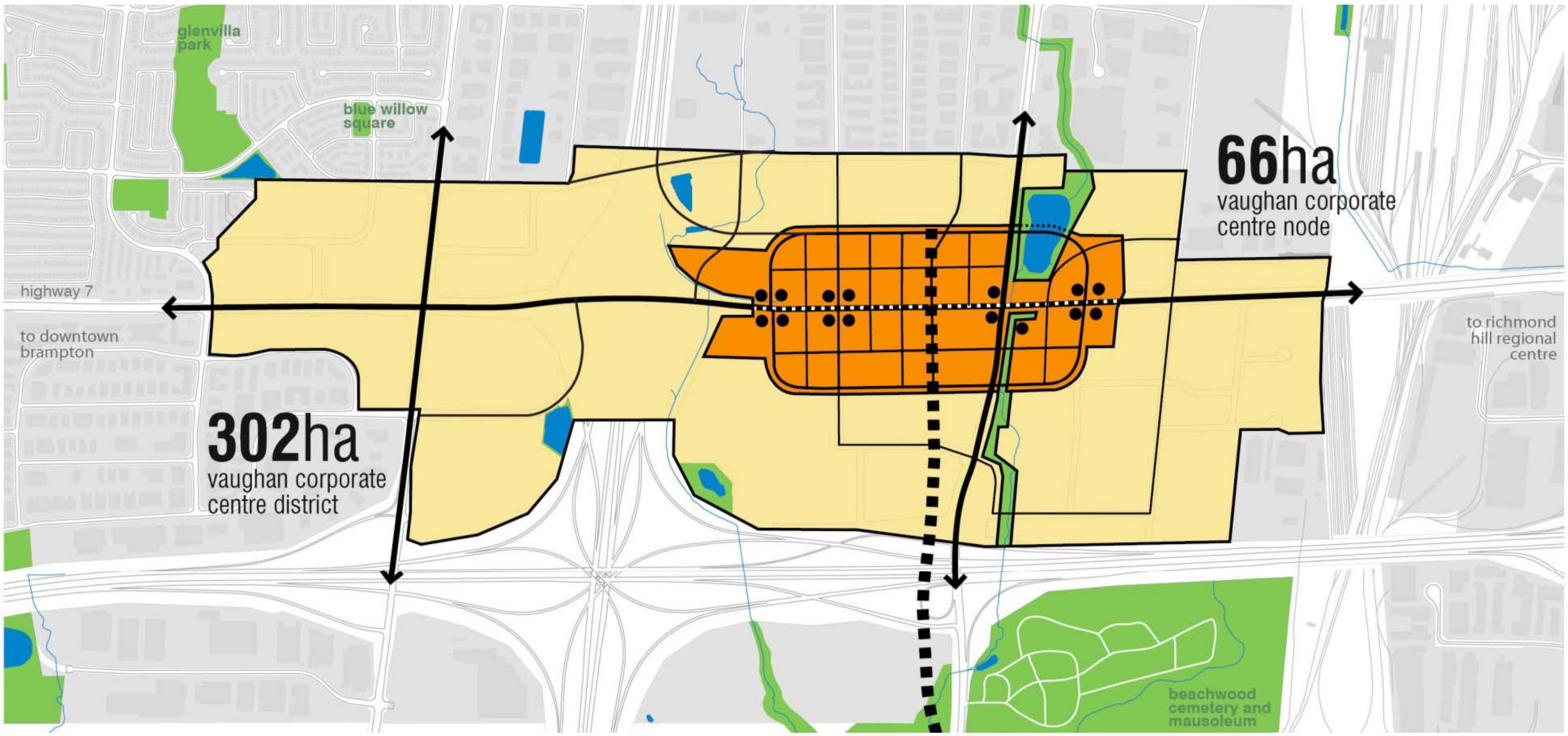
LAND USE

- Residential and commercial in Node
- Commercial and industrial in District

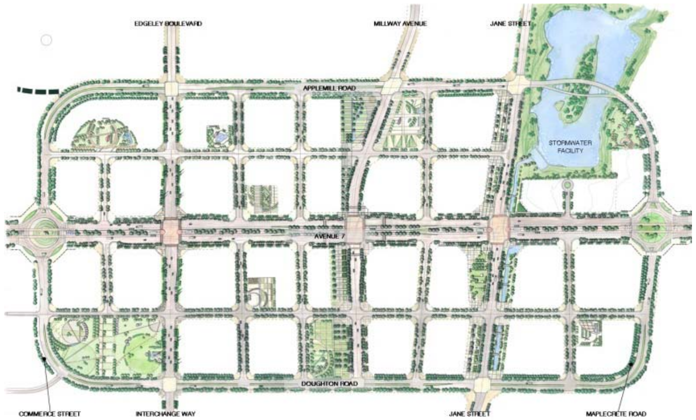
5,000 residents and 30,000 jobs forecasted

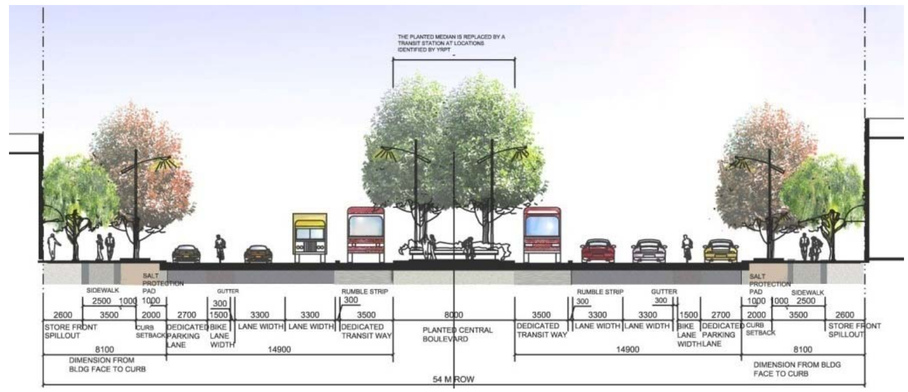


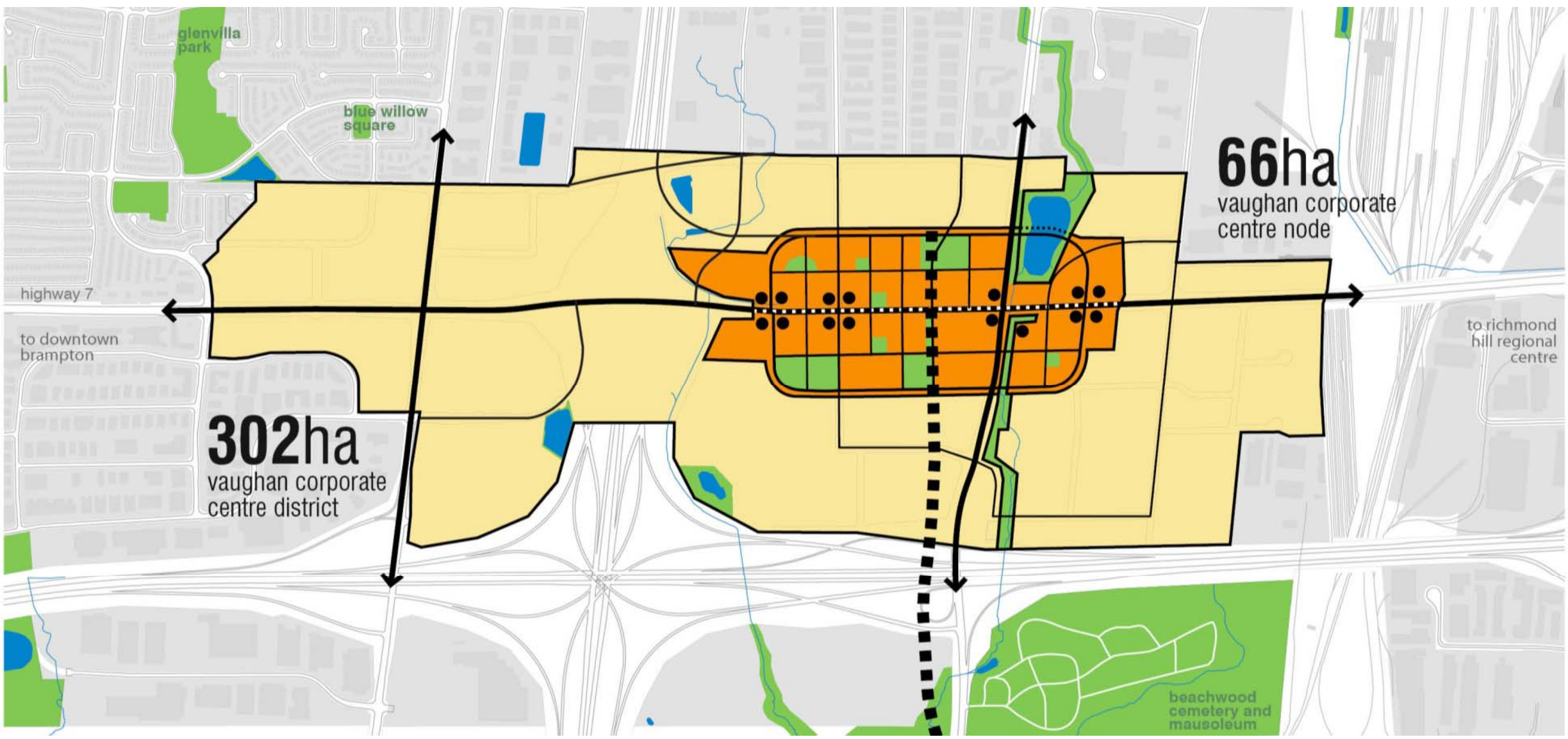
OPA 528 and 529 extend the road network and plan for the subway



Streetscape and Open Space Plan







OPA 663 (2008) introduces the “Corridors”

LAND USE

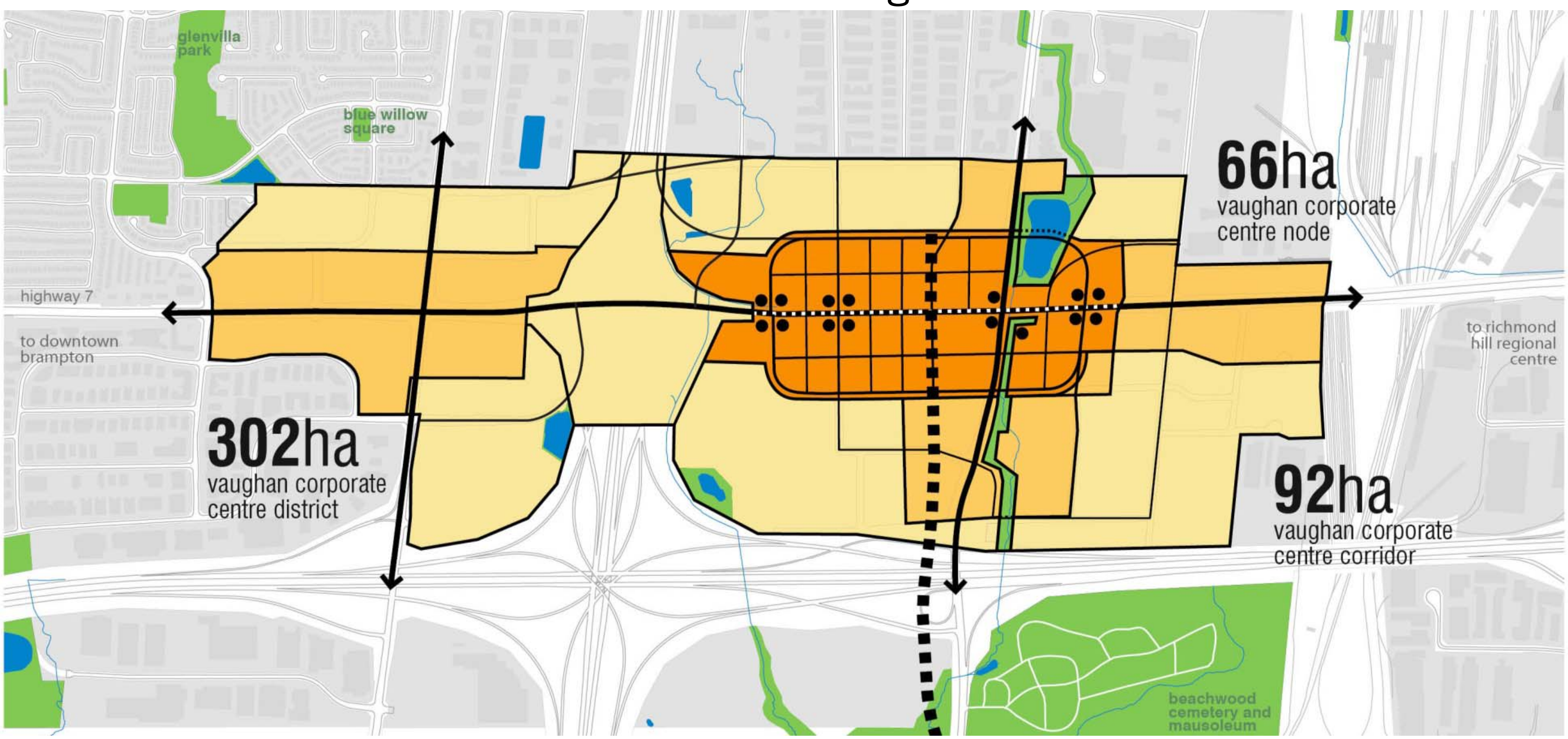
- Residential and commercial in Node **and Corridor**
- Commercial and industrial in District

DENSITY AND HEIGHT

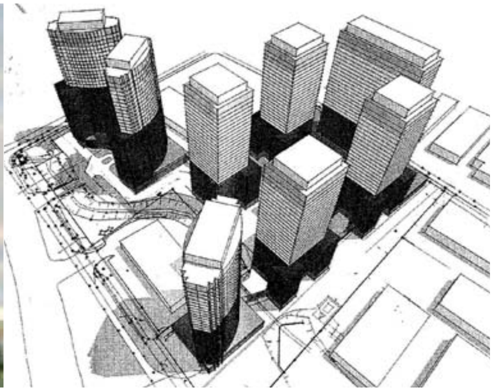
Node Density: No max, 5.0 Avg, 3.5 min (interim)
Height: 25m max, no max on gateway sites

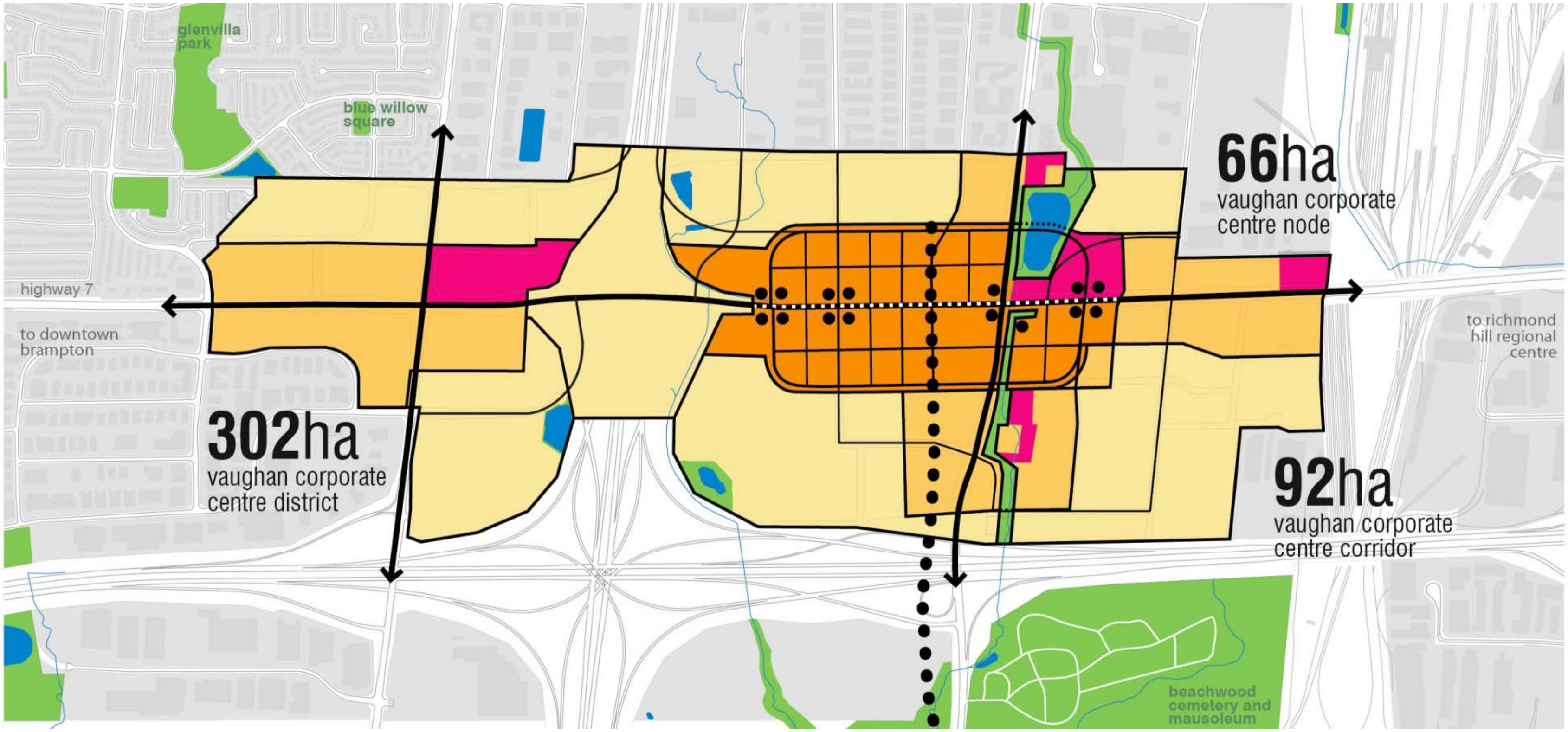
Corridor Density: 1.5 Avg, 0.75 Min, 2.5 Max
No mention of height

District Density: FSI 1.5 Max
Height: 16.5m Max



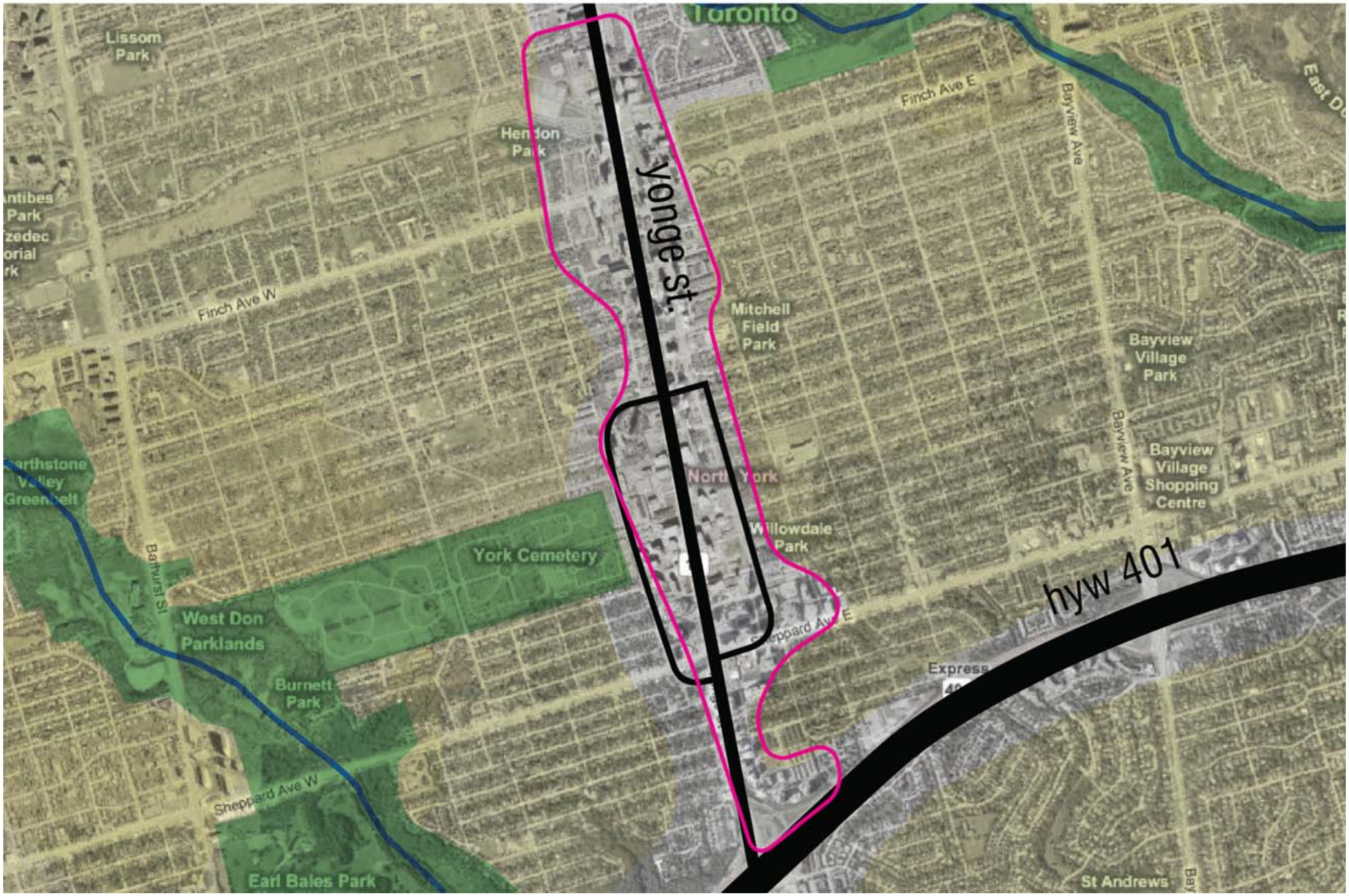
Proposed developments – 10,000+ units



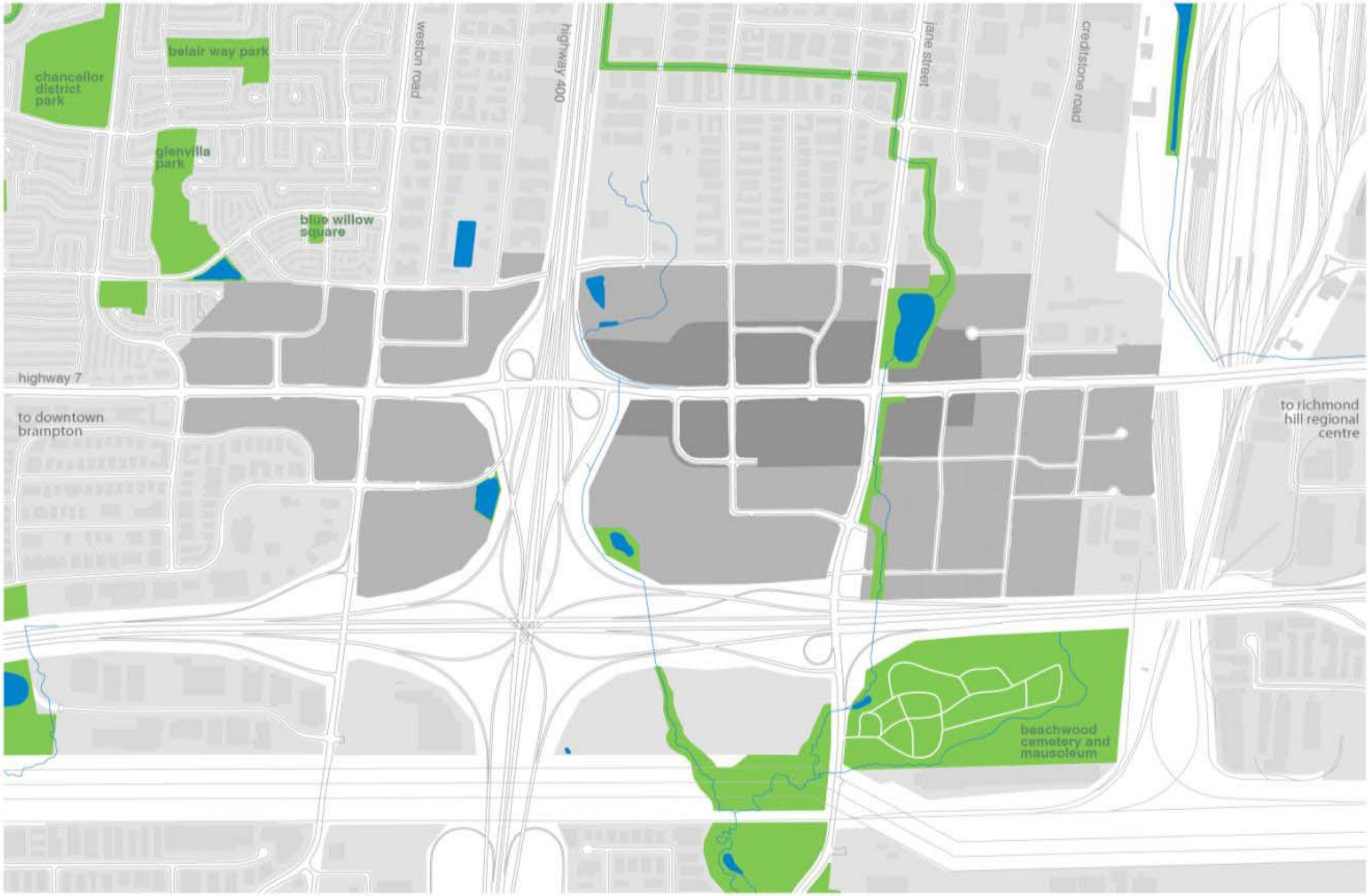


North York Centre has a subway, high density employment, adjacent neighbourhoods, strong civic elements

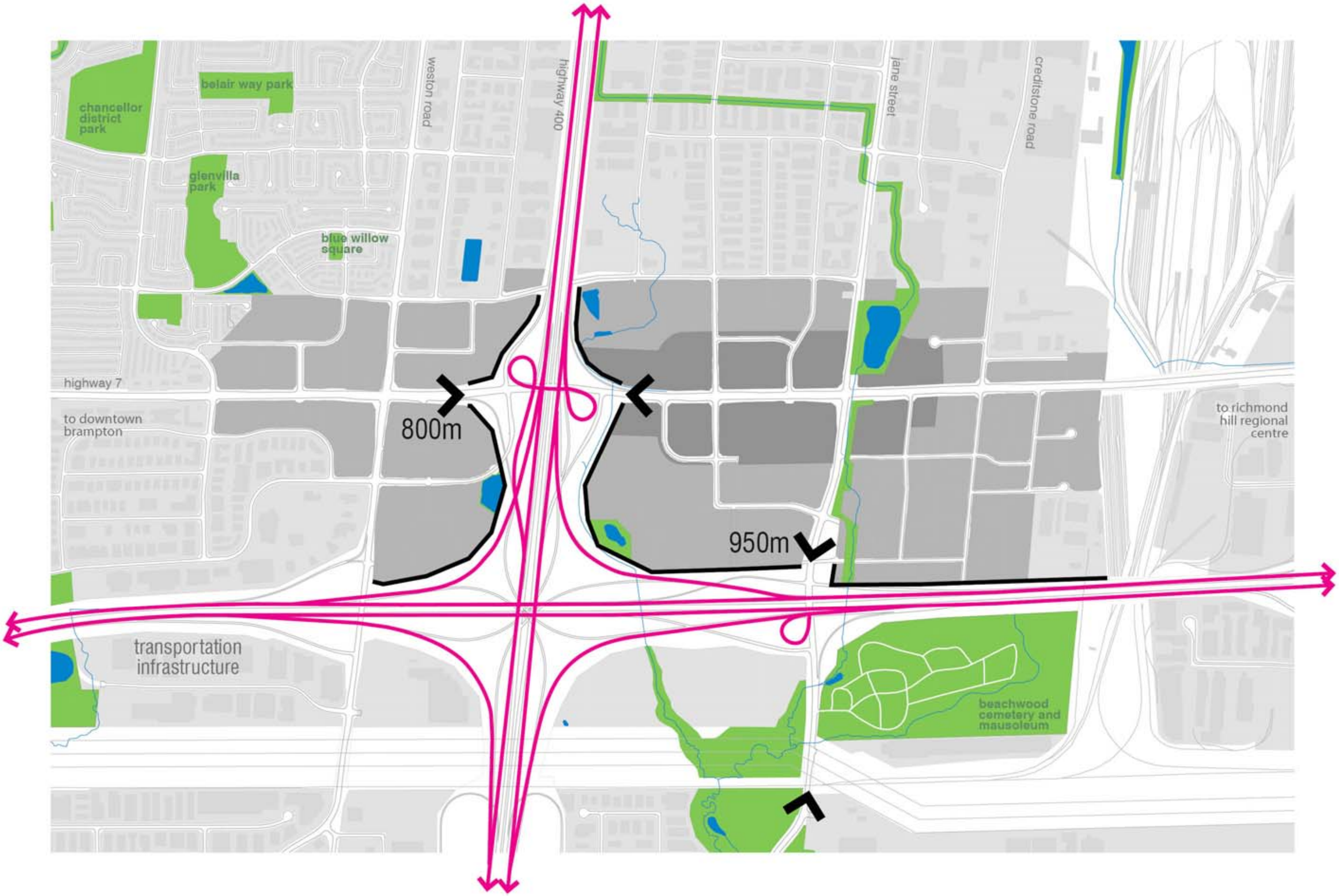
(210 residents and jobs per ha)



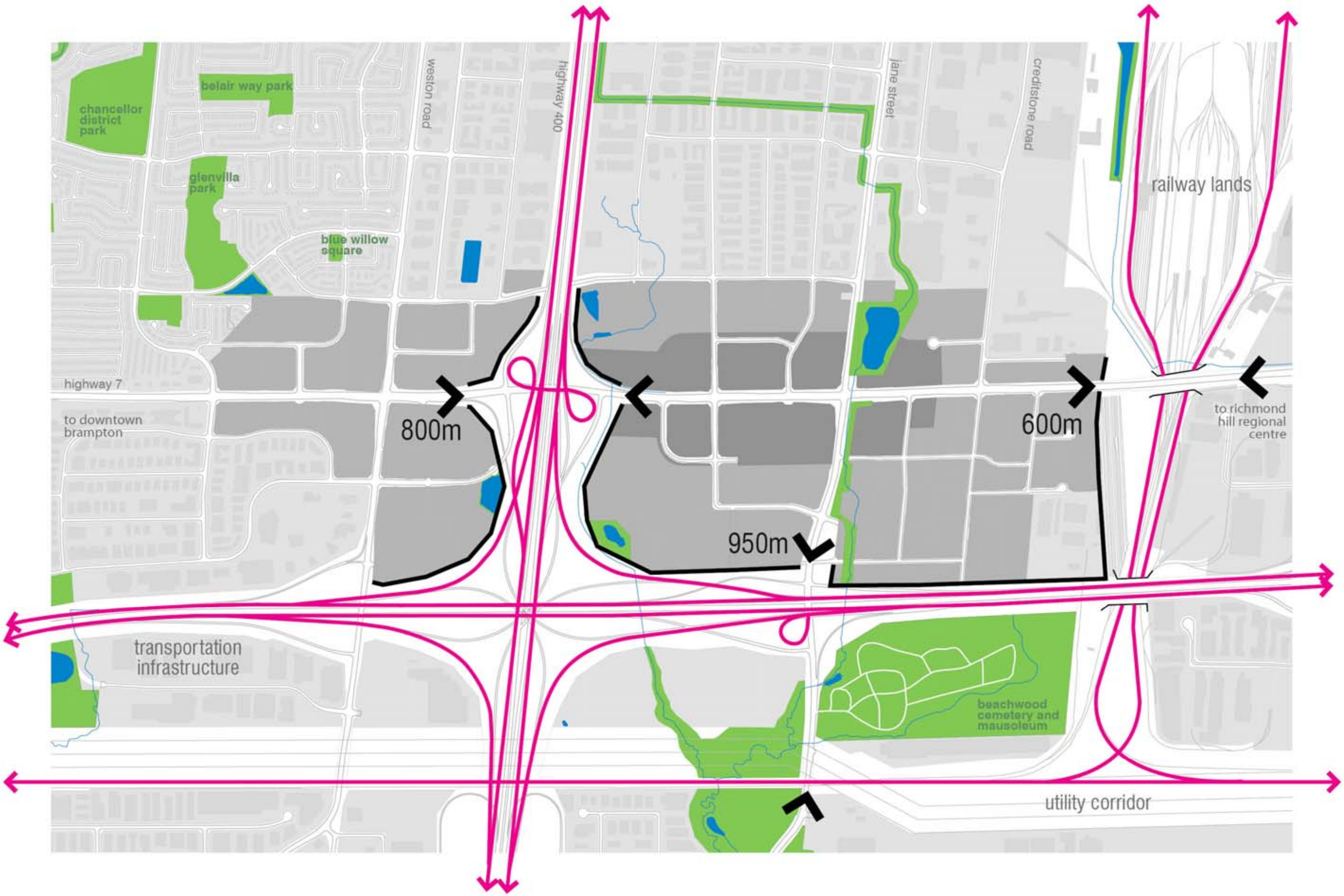
Great highway access, but this is both an advantage and a constraint.



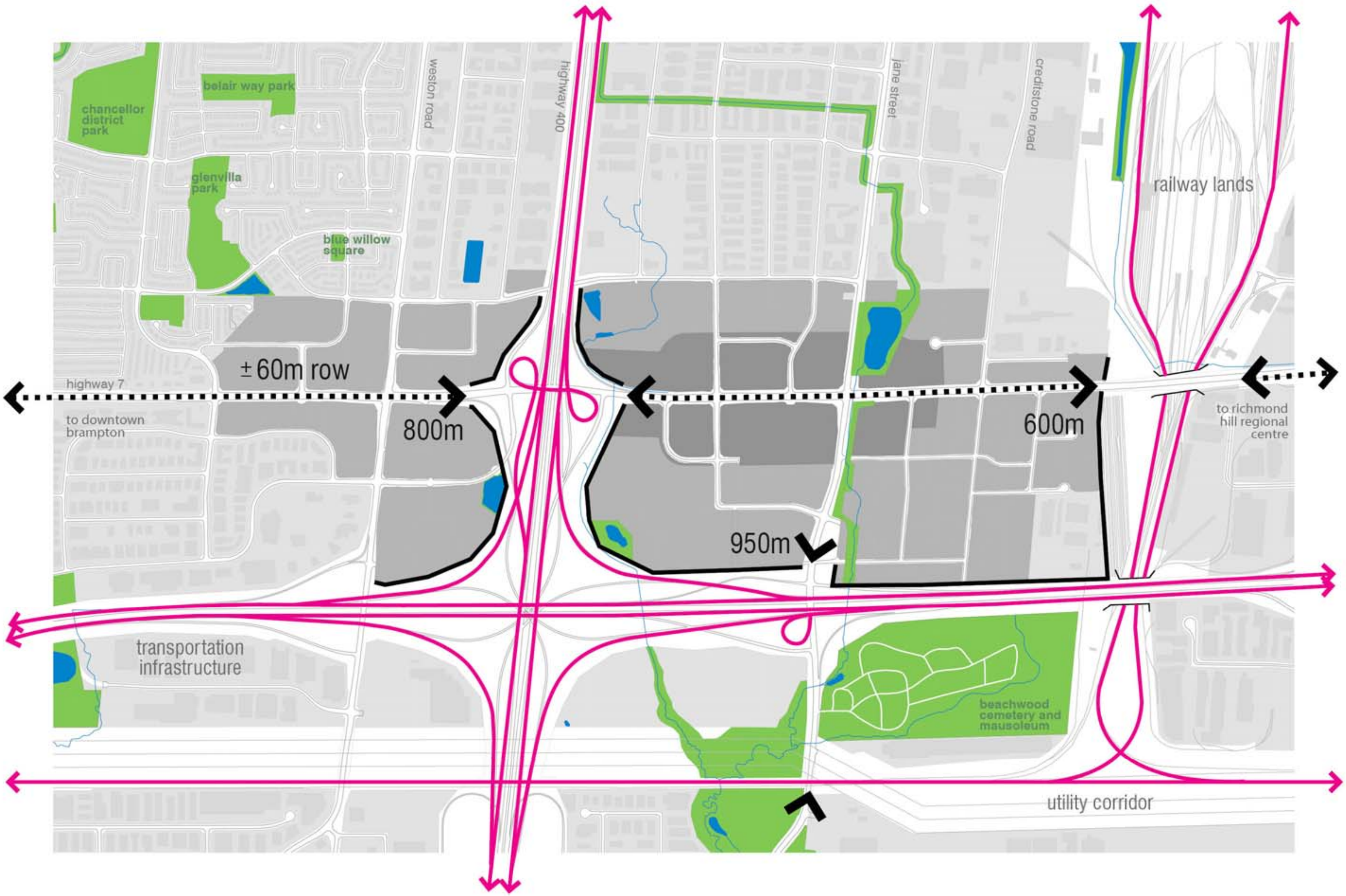
The expressways create barriers that divide.



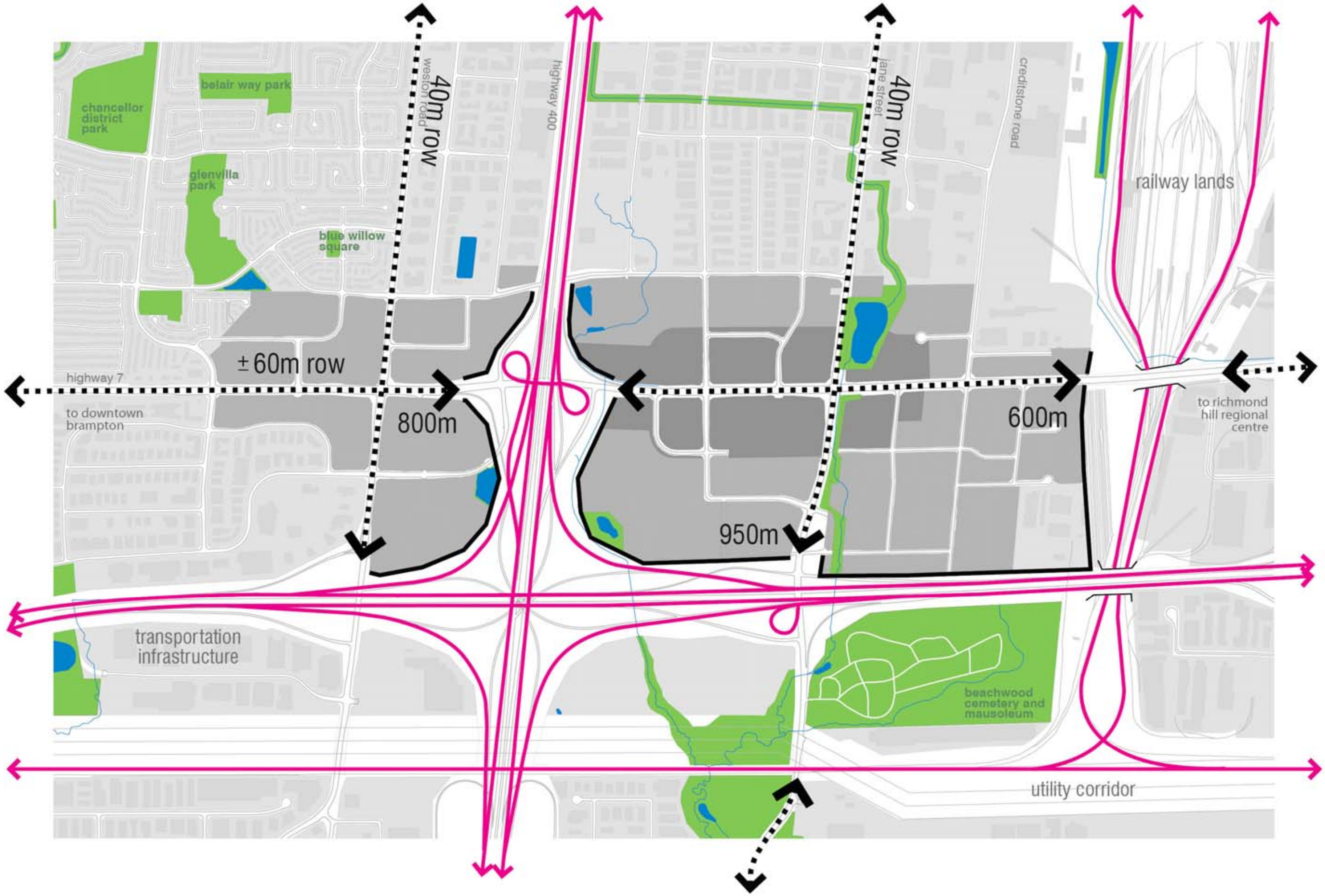
Hydro and rail corridors compound the area's separation and isolation.



Highway 7 adds a further barrier, which will require considerable effort and coordination to mitigate.



And Jane and Weston are very wide arterial roads.

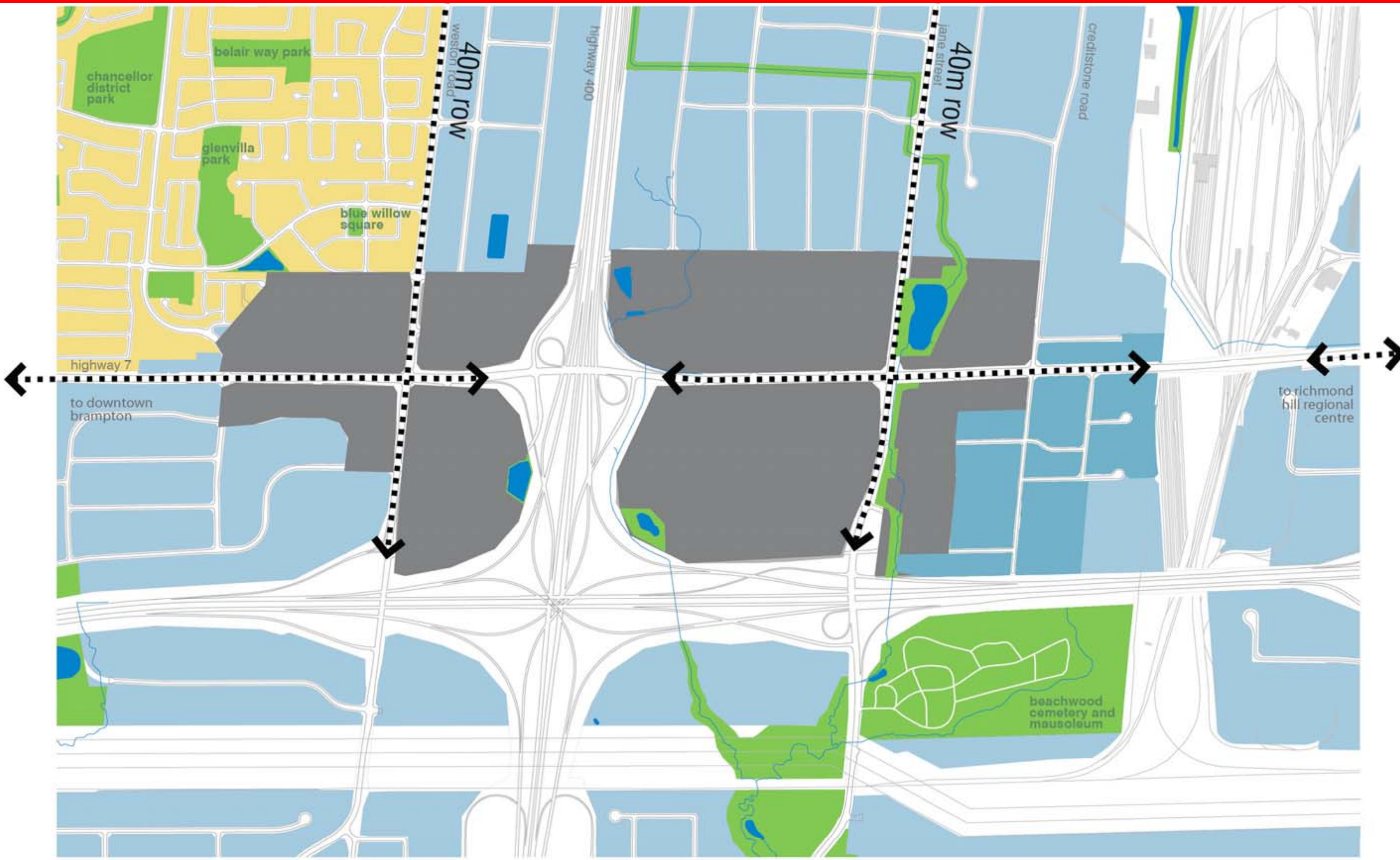


Challenges

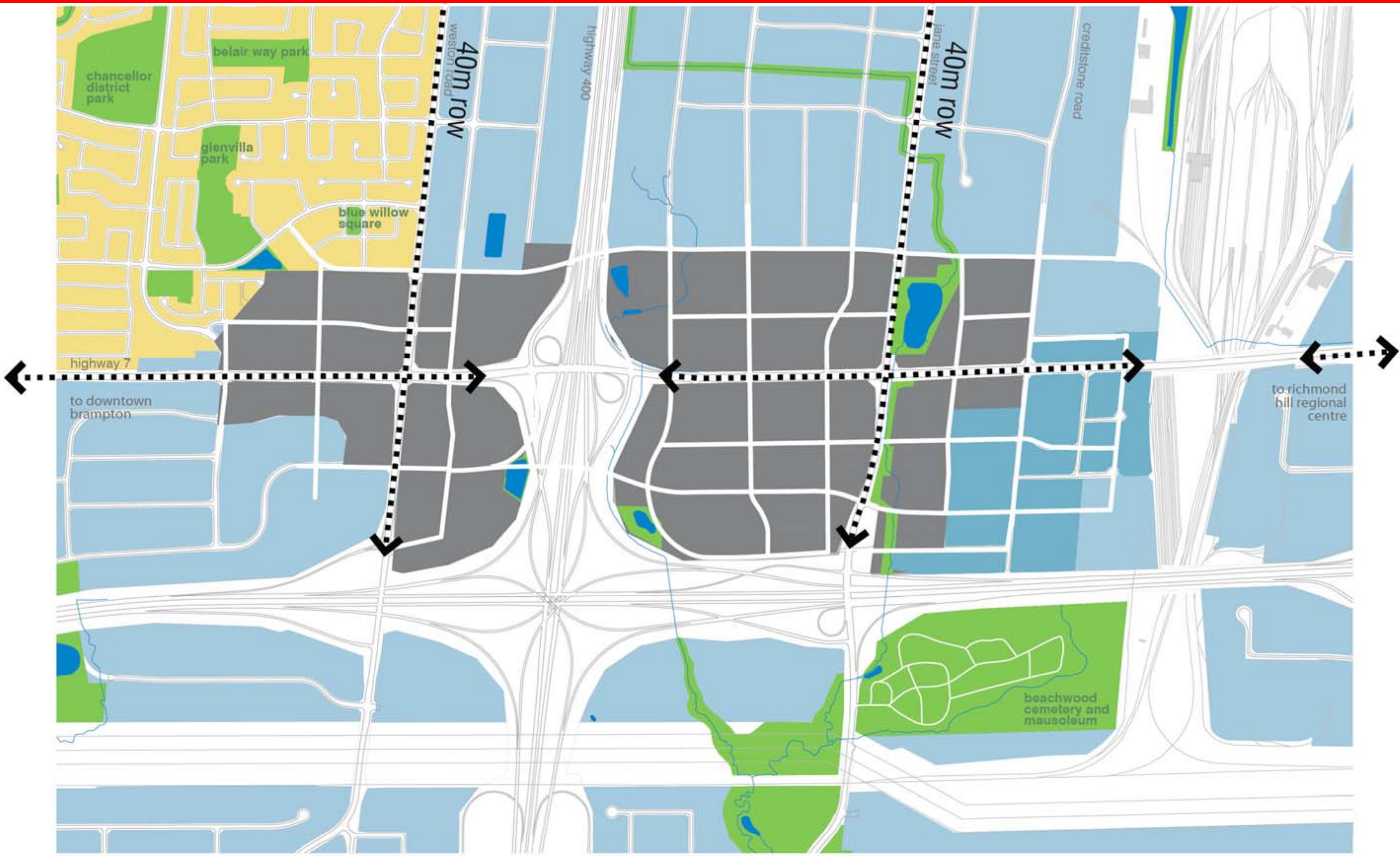
- No major natural feature
- No visible cultural heritage
- Lack of residential context
- Major physical barriers
- Walkability
- No “places”

“Where is the Downtown?”

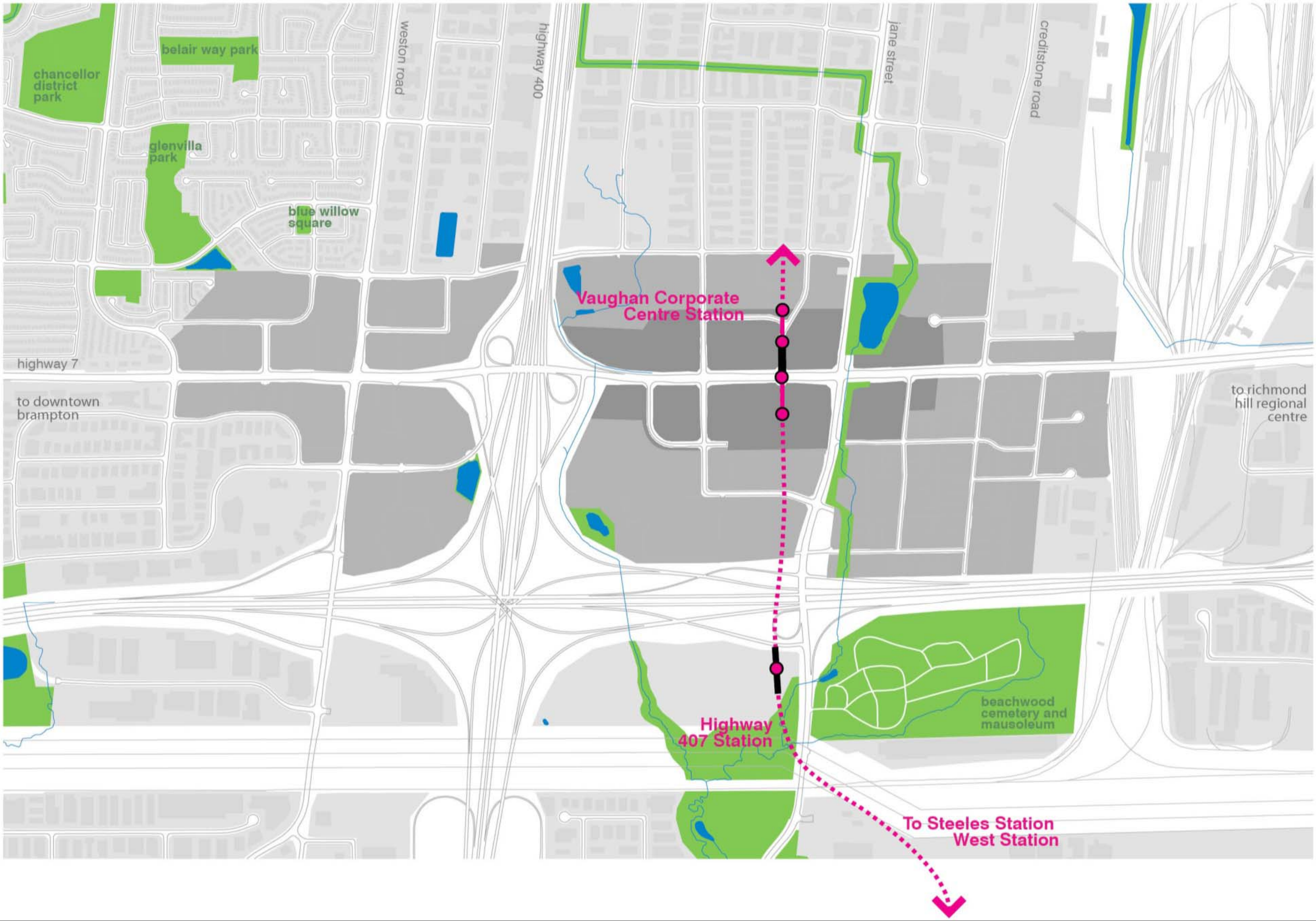
Other streets within an extended grid will play an important connecting and "place-making" role—an essential part of the public realm



An interconnected network will offer multiple route choices and encourage walking, cycling and transit use. It will become the framework to for a range of downtown uses.

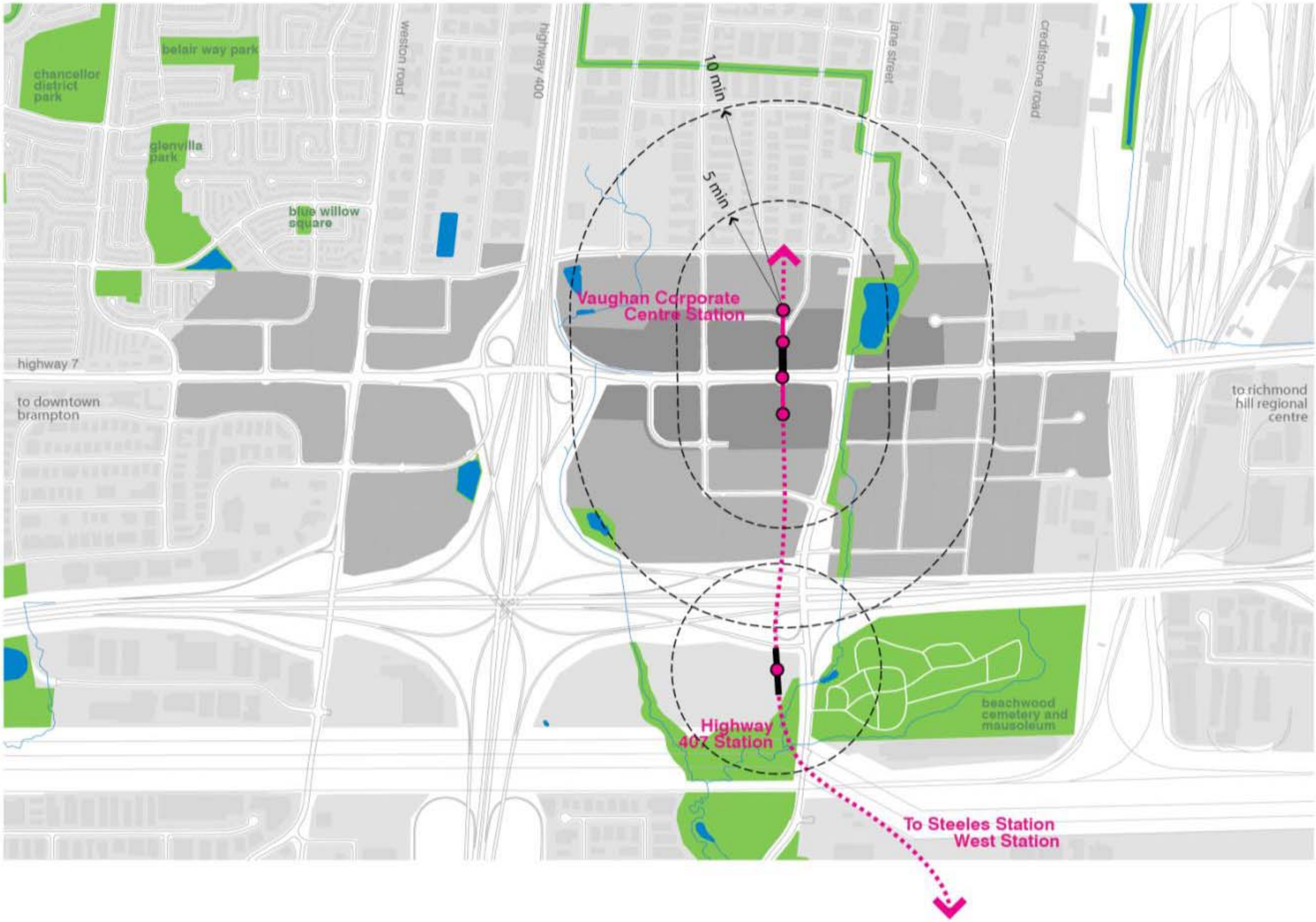


Transit creates a range of new and exciting opportunities.



The subway station location suggests a new orientation for the downtown core.

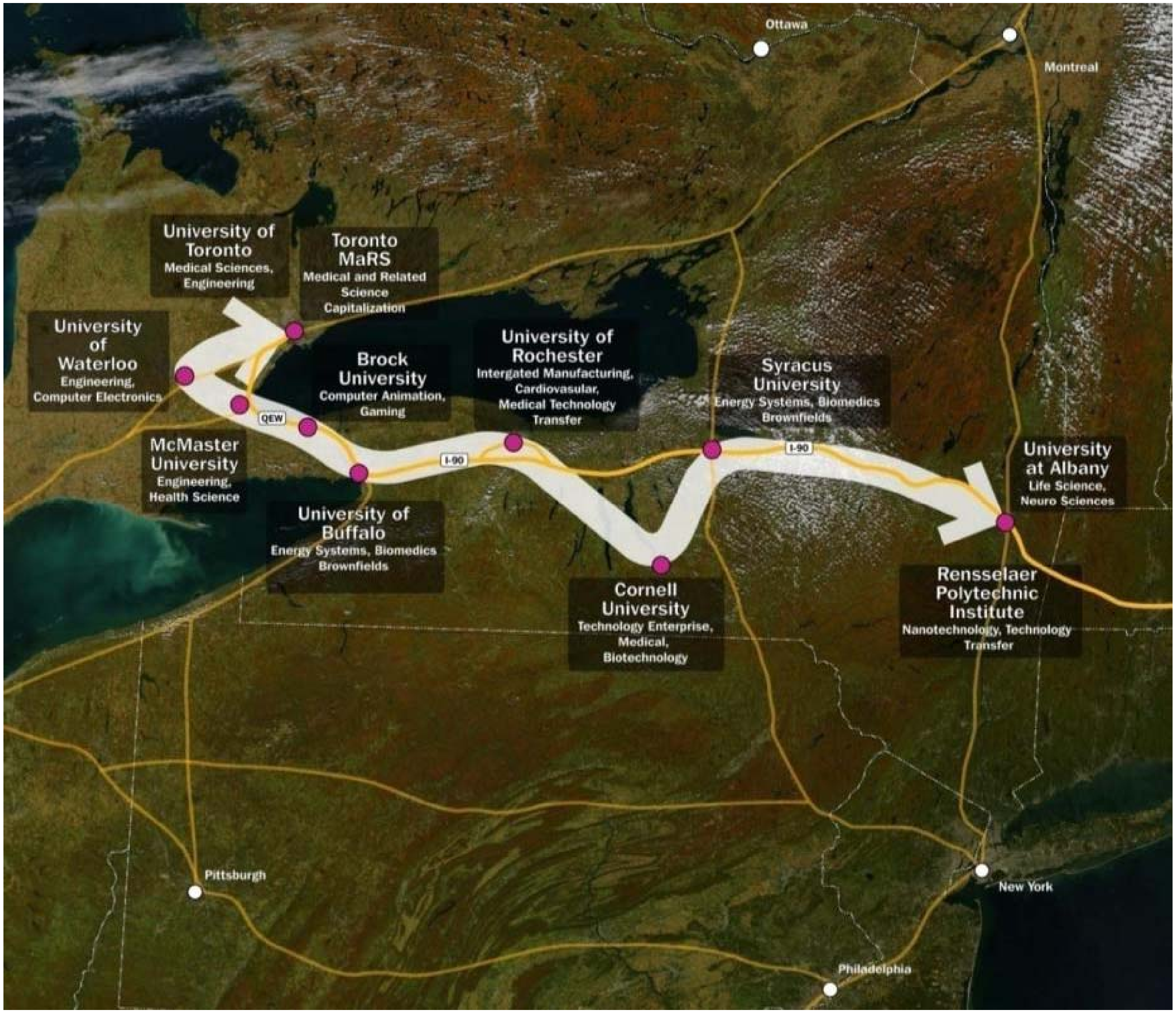
The walking distance to the subway captures a larger area that should be pedestrian-oriented and transit-supportive.



VIVA and the 407 Transitway will provide important linkages and connections to the subway and new downtown core.

How could the VCC participate in the I-90/QEW research and innovation Corridor? Are partnerships with York a possibility?

- I90/QEW research and innovation corridor
- Total US Research - $1.33B in 2004 – With Canadian component $2.4B in 2004 Compared Raleigh-Durham, $1.36B in 2004



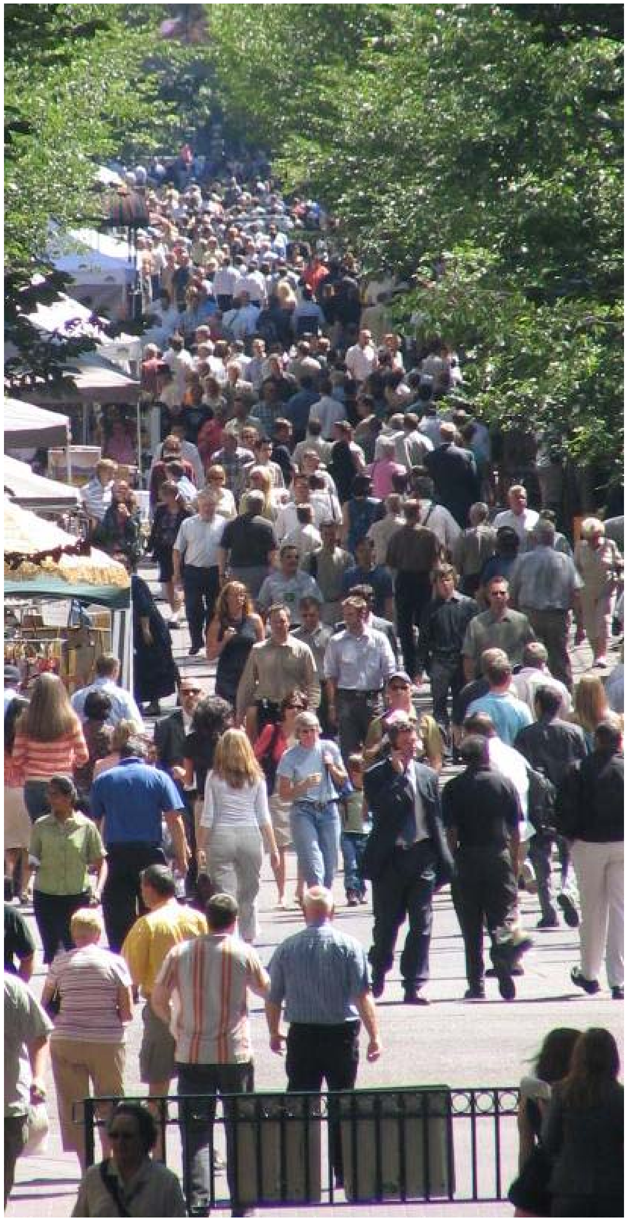
What should the character and role of Avenue 7 be?

EXPRESSIVE, MEMORABLE + UNIQUE

How should transit areas be designed?

How should the transit station be integrated on transit routes? Should these be integrated into new developments where possible, or located on the street without compromising the public realm.

How can we place a priority on walking and walkability?



2. Extracts from Presentation: Workshop #2 (September 30, 2009)

Vaughan Metro Centre Plan Review

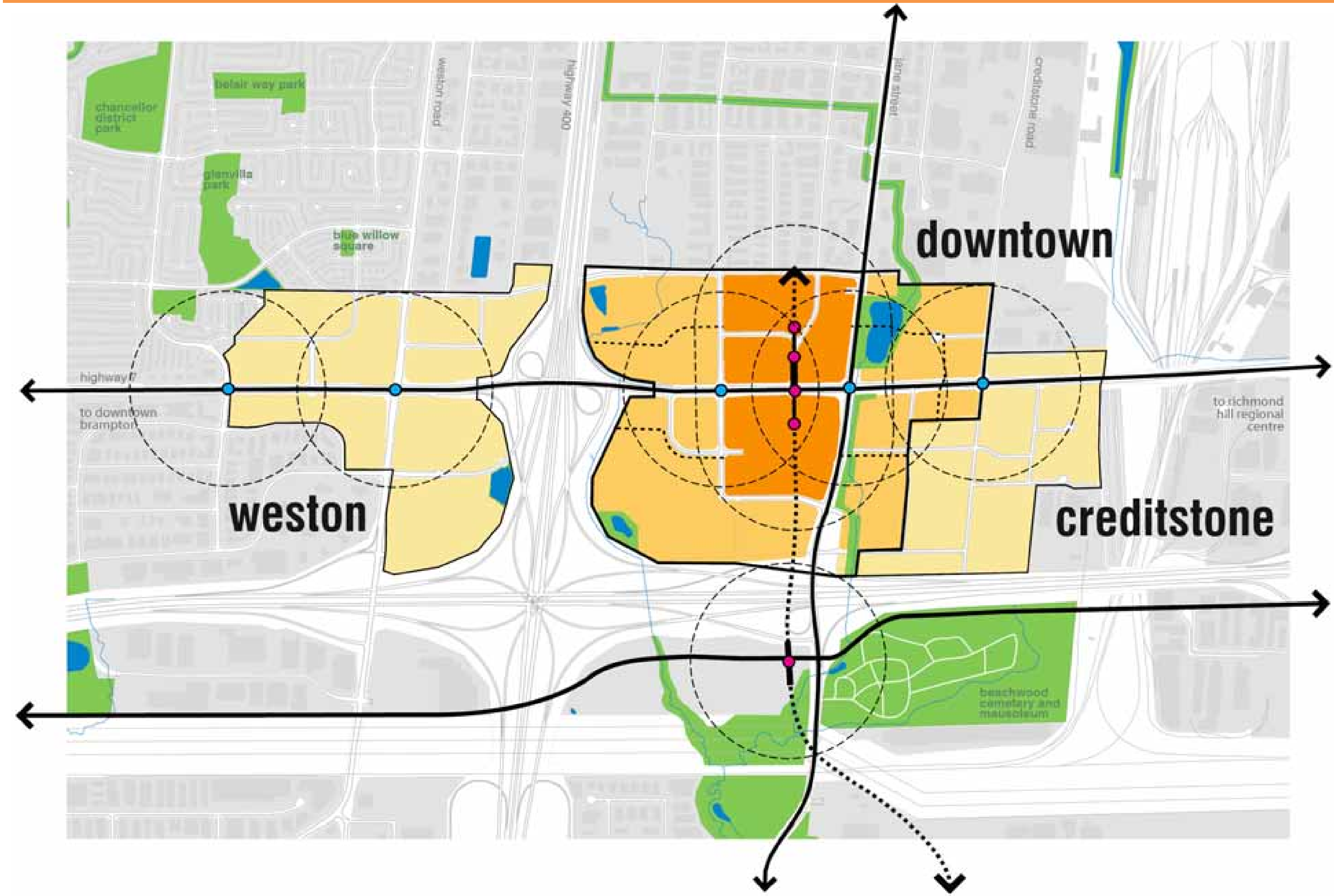
Visioning Workshop

September 30, 2009

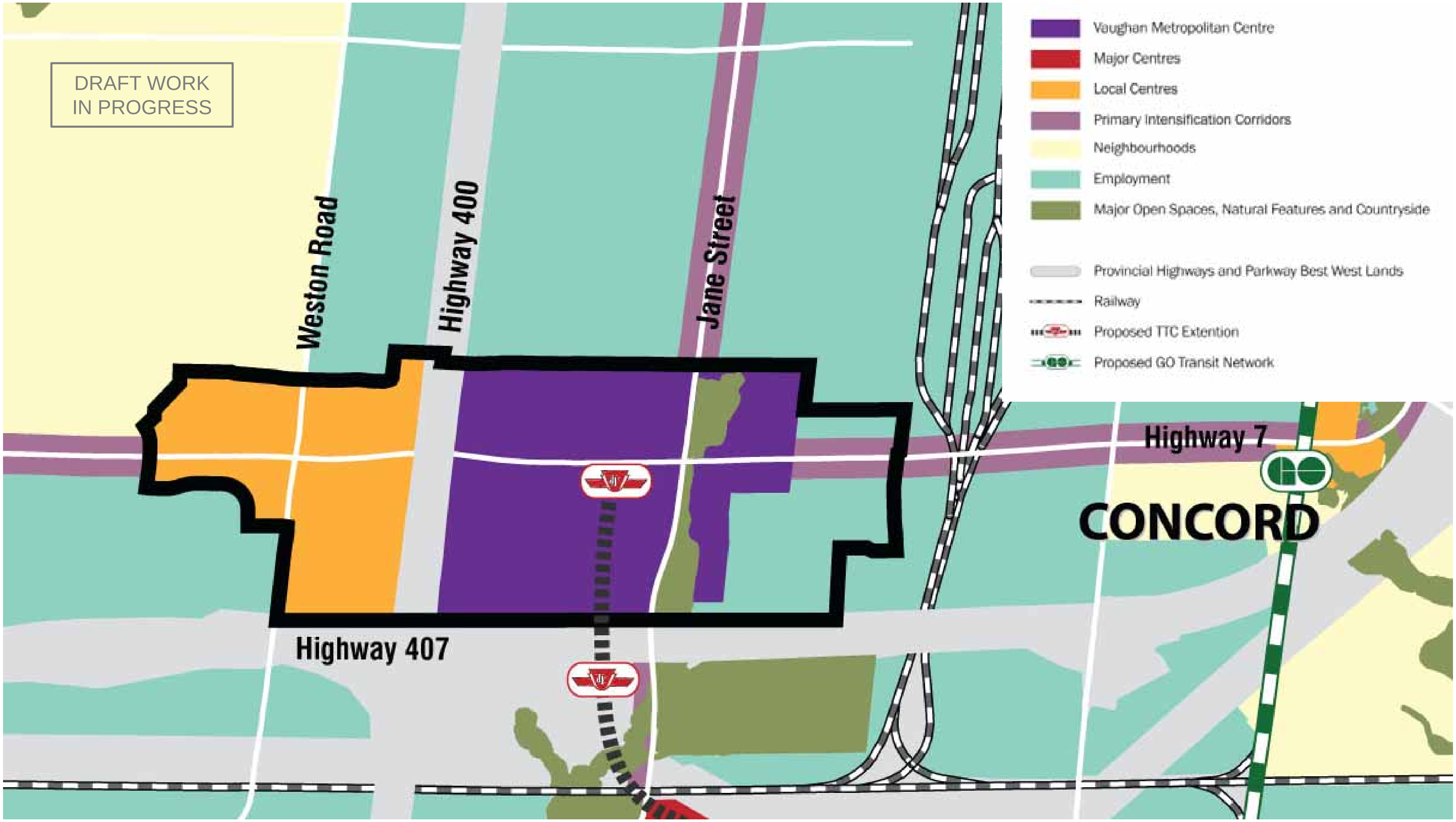
WELCOME!

Challenges	Opportunities
▪ No major natural feature	✓ Build an extraordinary public realm
▪ No visible cultural heritage	✓ Build beautiful architectural and cultural legacies
▪ Lack of residential context	✓ Create a range of distinct neighbourhoods
▪ Major physical barriers	✓ Focus the downtown, establish a critical mass & make connections
▪ Walkability	✓ Establish a fine-grained street network with inviting streetscapes
▪ No “places”	✓ Focus on cohesive place making, not individual projects

A more focused VMC



A more focused VMC



The Framework

Green **infrastructure** – for the efficient movement of people, energy and water

Green **spaces** – to establish a remarkable setting for development and a diverse, inter-connected public realm

Diverse **land use** pattern – that supports a vibrant centre for living, working, shopping, learning and playing

The larger road network

areas of investigation:

01 langstaff interchange
(potential improvements)

02 400/Hwy7 interchange
and suggested service roads
(new configuration)

03 applewood extension
(new service road)

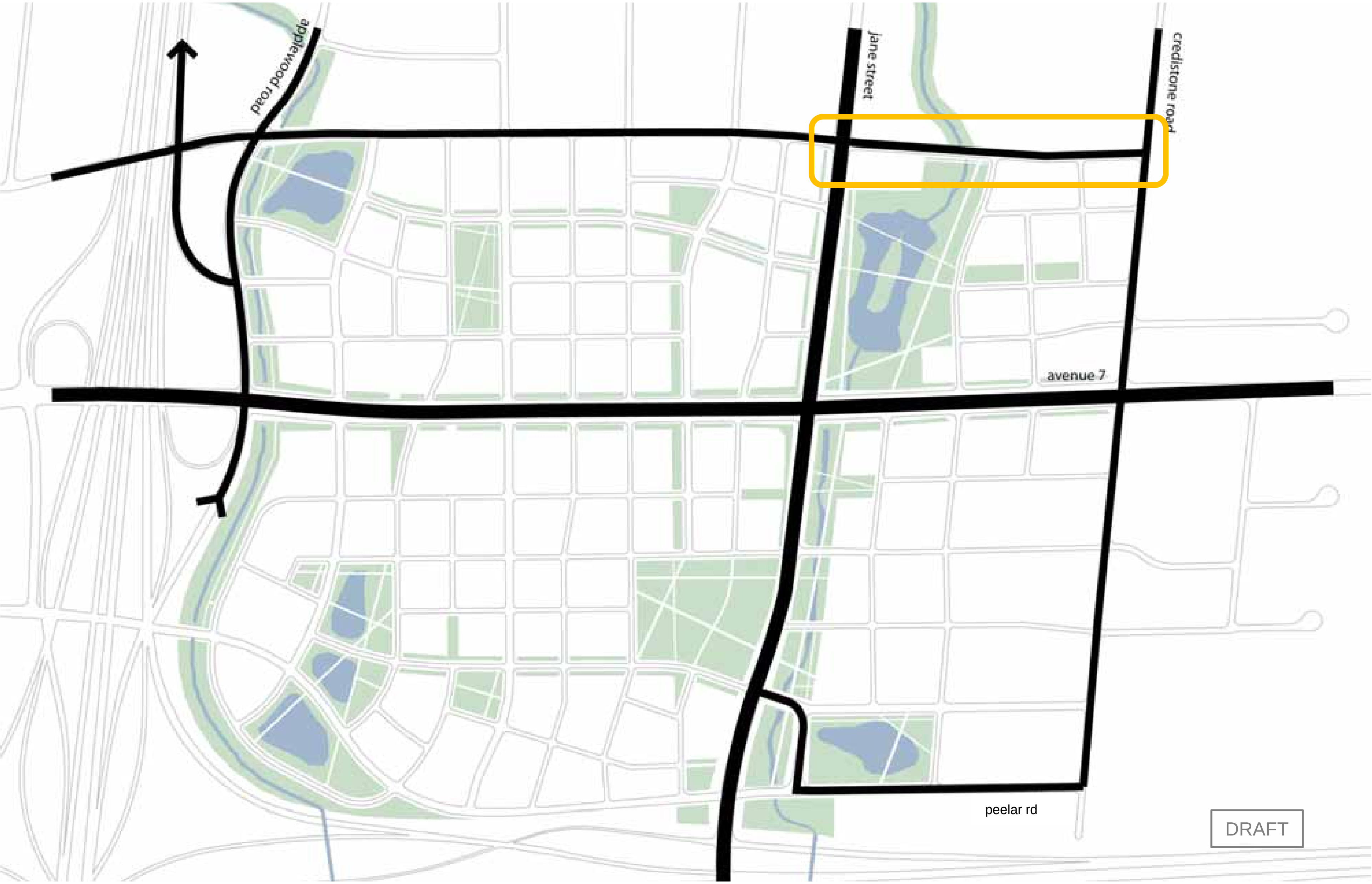
04 portage extension
(new creek crossing)

05 creditstone bypass
(improvements to
existing row)

06 colossus crossing
(new bridge crossing)

DRAFT

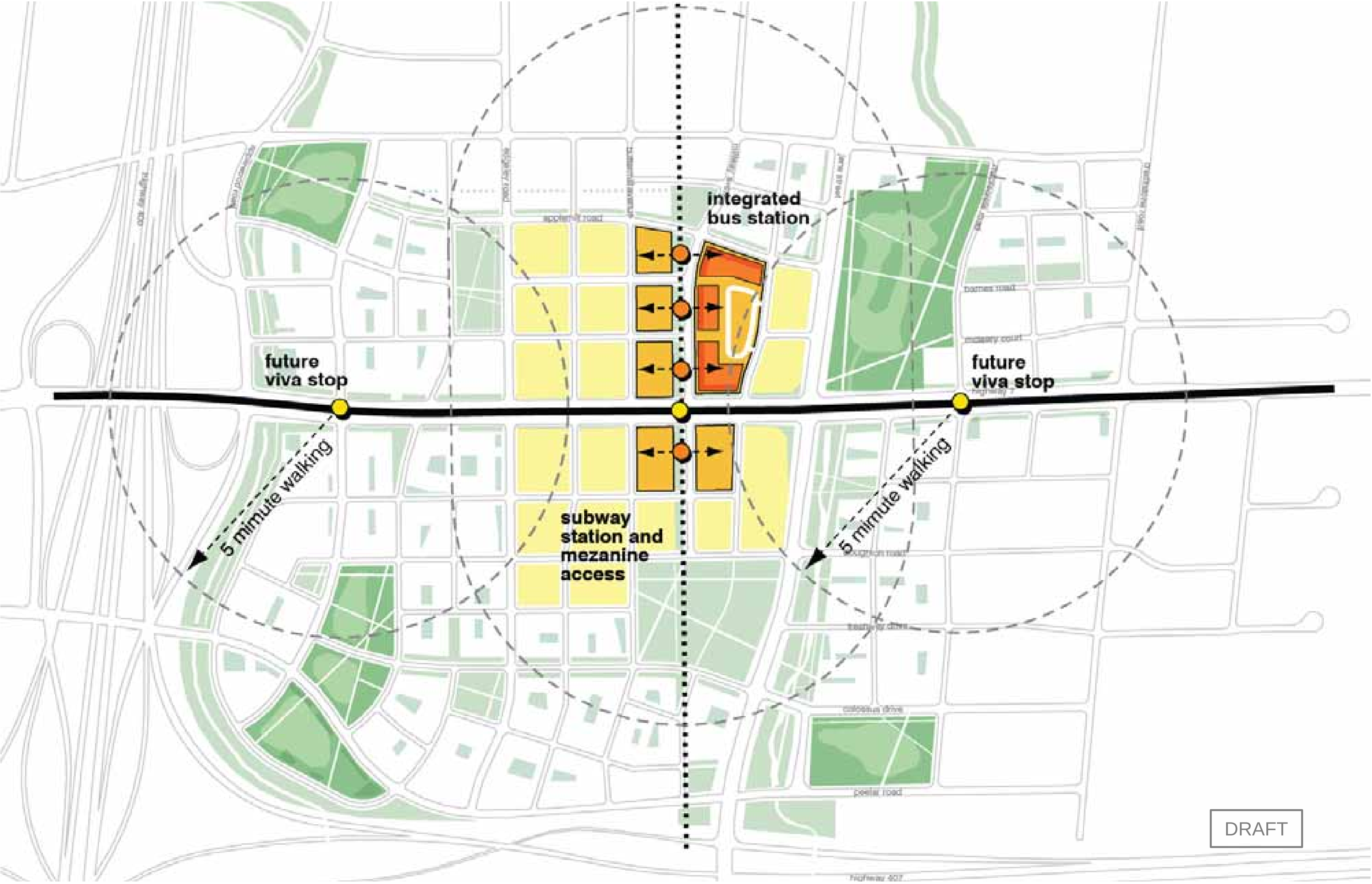
Street network



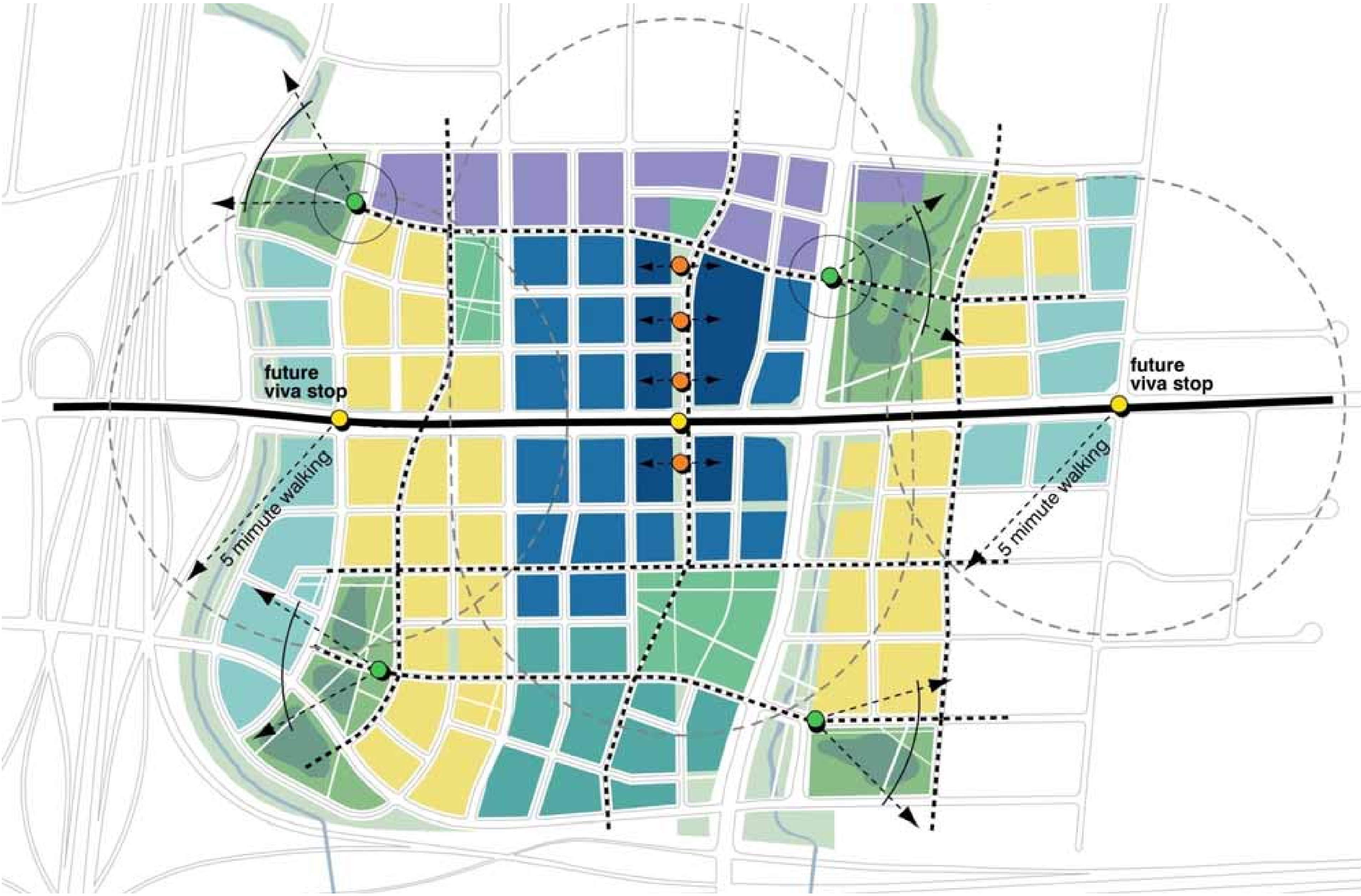
Street network

Street network

Public transit



the consolidated framework



3. Extracts from Presentation: Open House #1 (March 8, 2010)

Vaughan Metropolitan Centre

Secondary Plan Directions

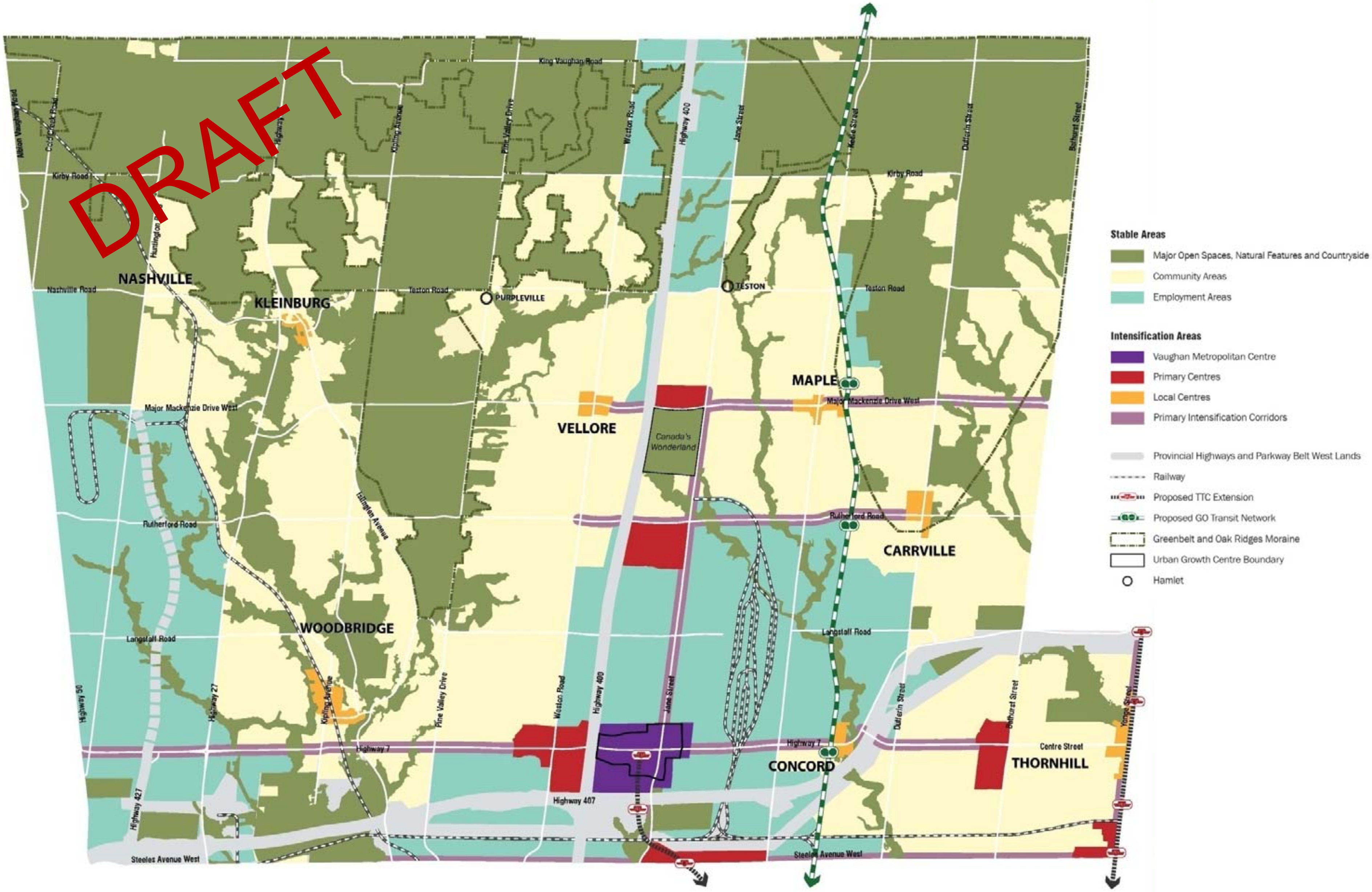
Open House | March 8, 2010

Welcome!

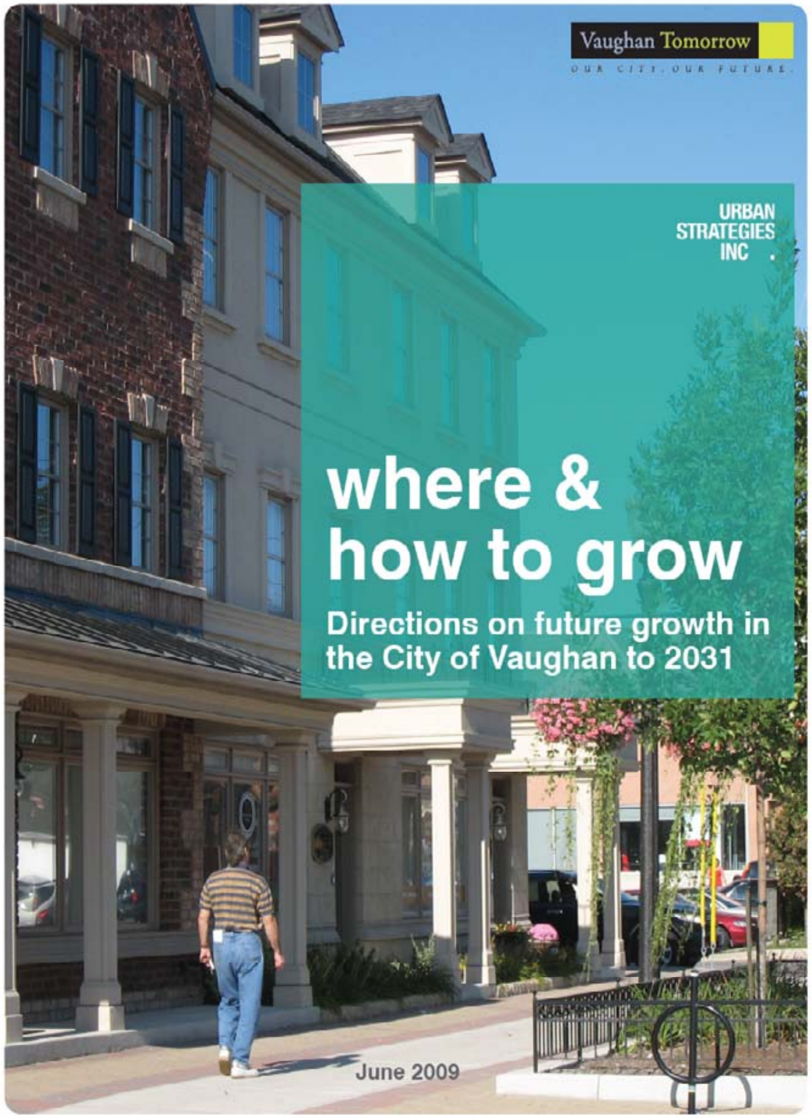
Agenda

7:00	Review the panels on display
7:30	Presentation on the Secondary Plan Directions
8:00	Questions and comments
8:30	Review the panels and fill in a comment sheet

The city's future centre



…with enormous potential for growth



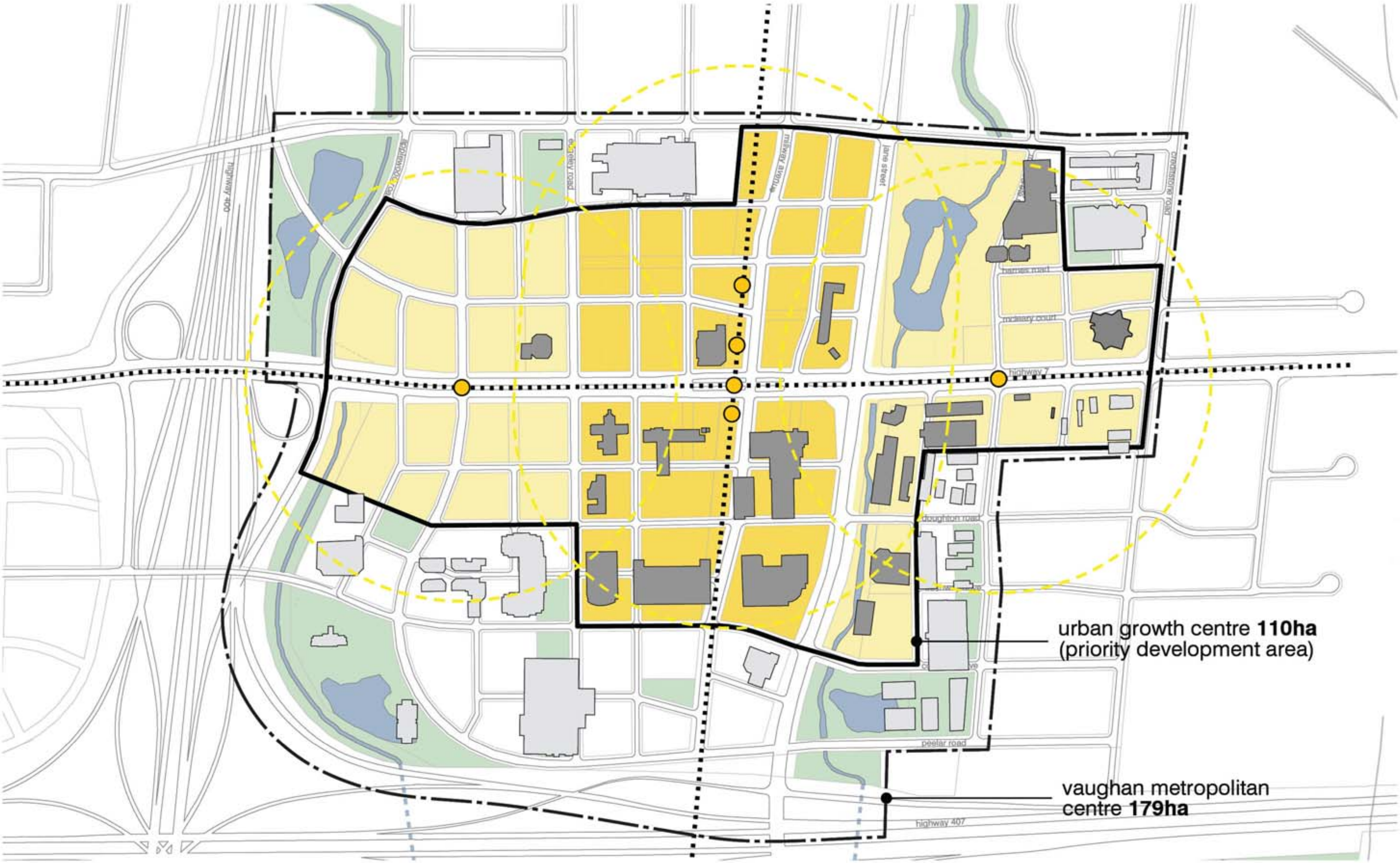
Population and Employment Targets for the VMC to 2031:

12,000 units

25,000 residents

6,500 new jobs
(Total 11,500)

To create a downtown, growth needs to be focused.



The proposed framework

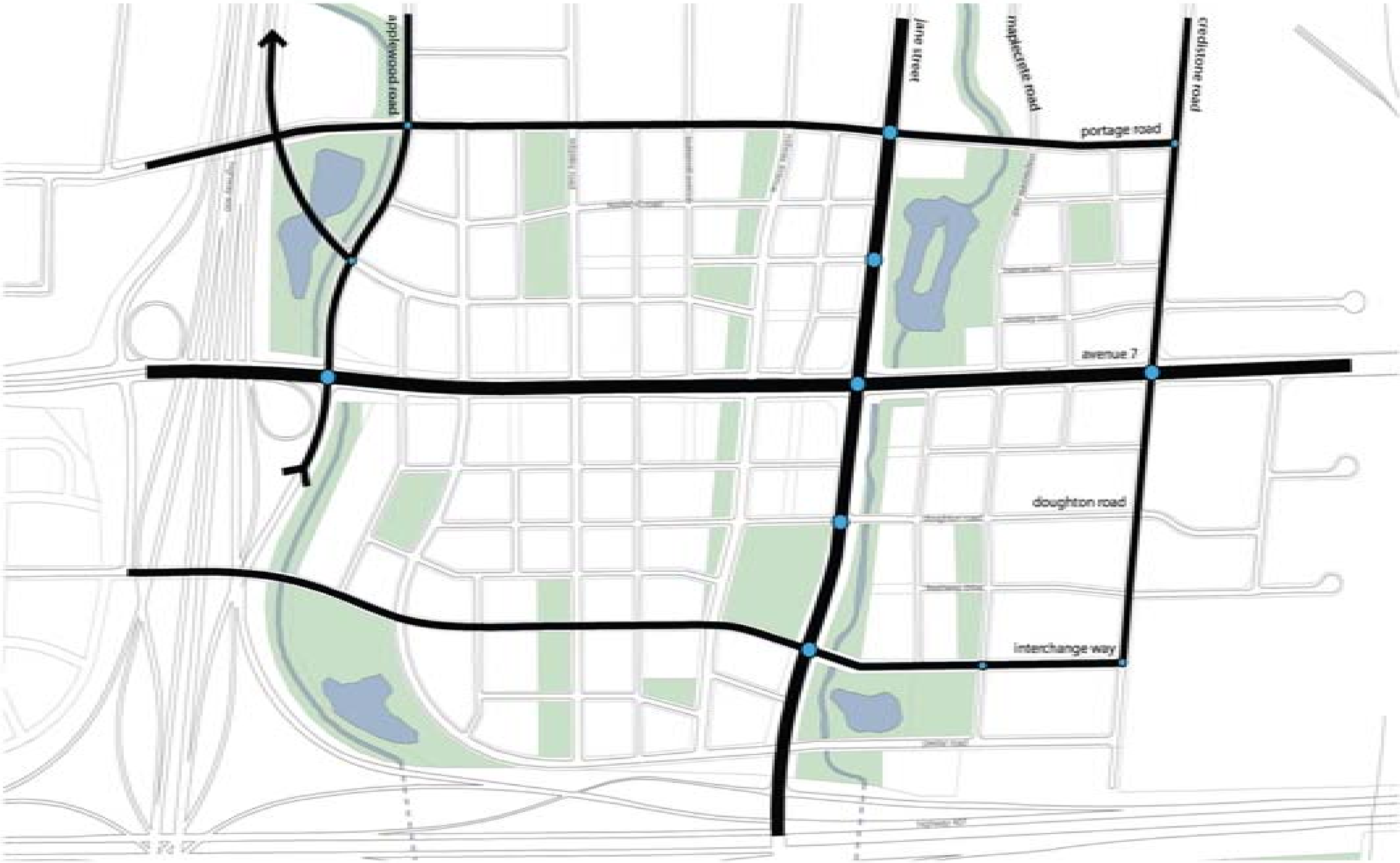
Streets and Transit

Major Open Spaces and Amenities

Land Use

Density and Height

Street network



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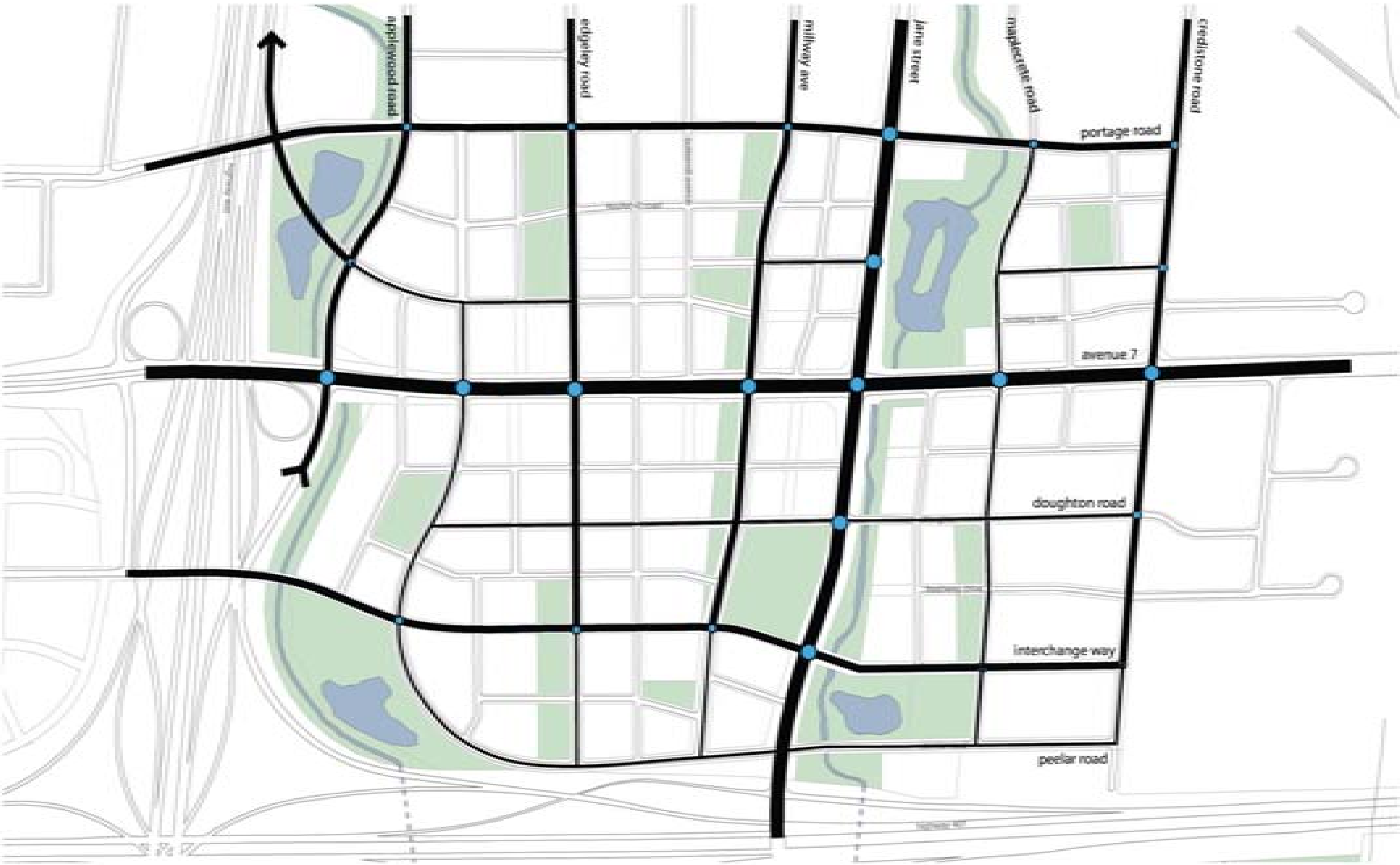
Street network



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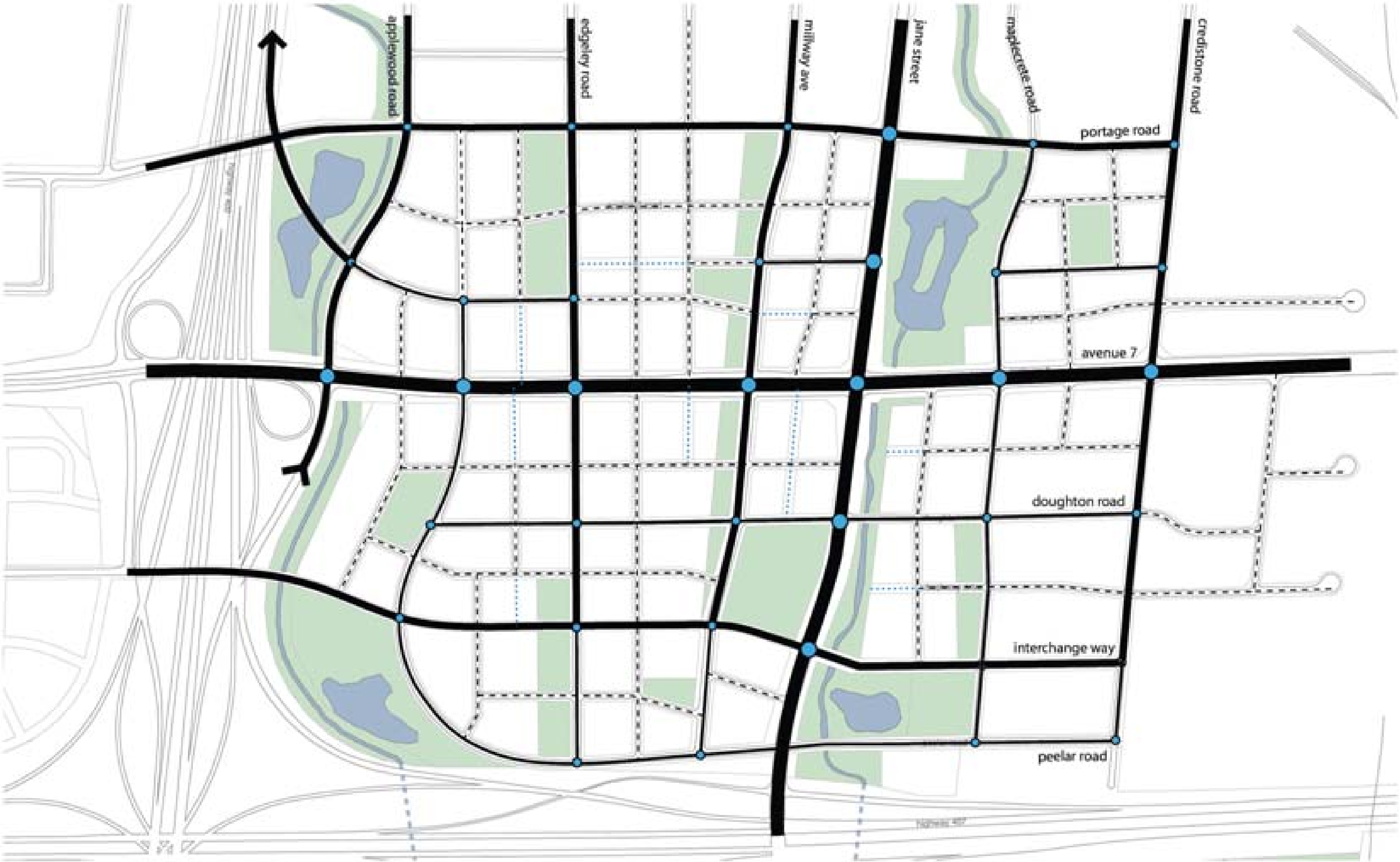
Street network



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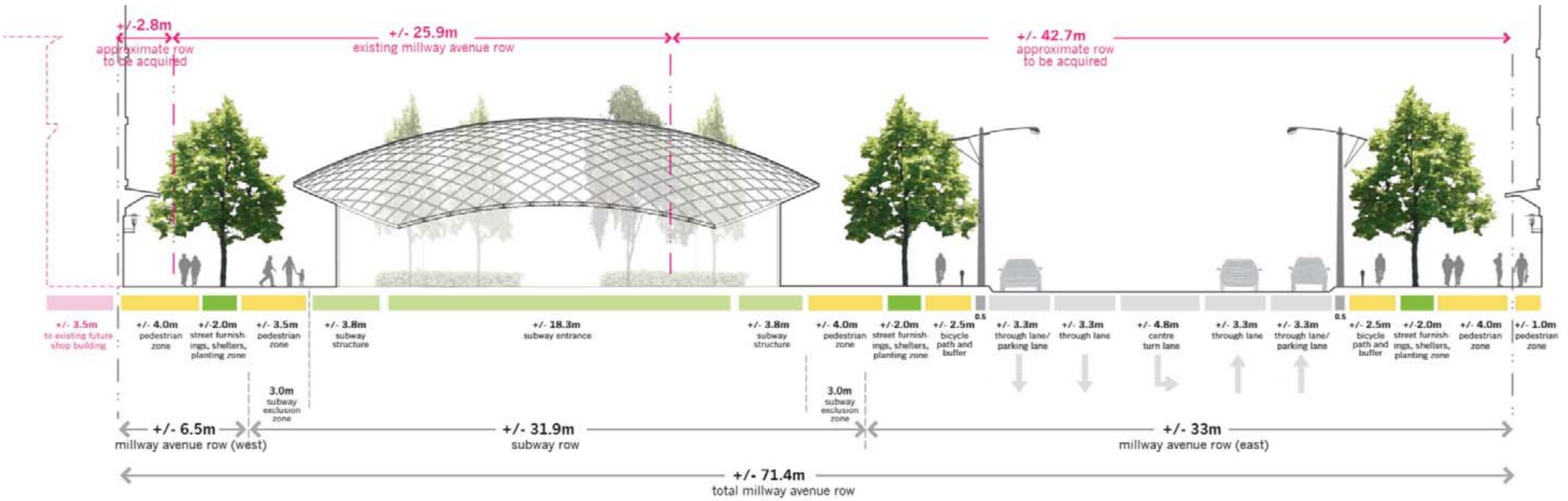
Public transit

DRAFT

Key streetscapes



Millway Avenue at subway station

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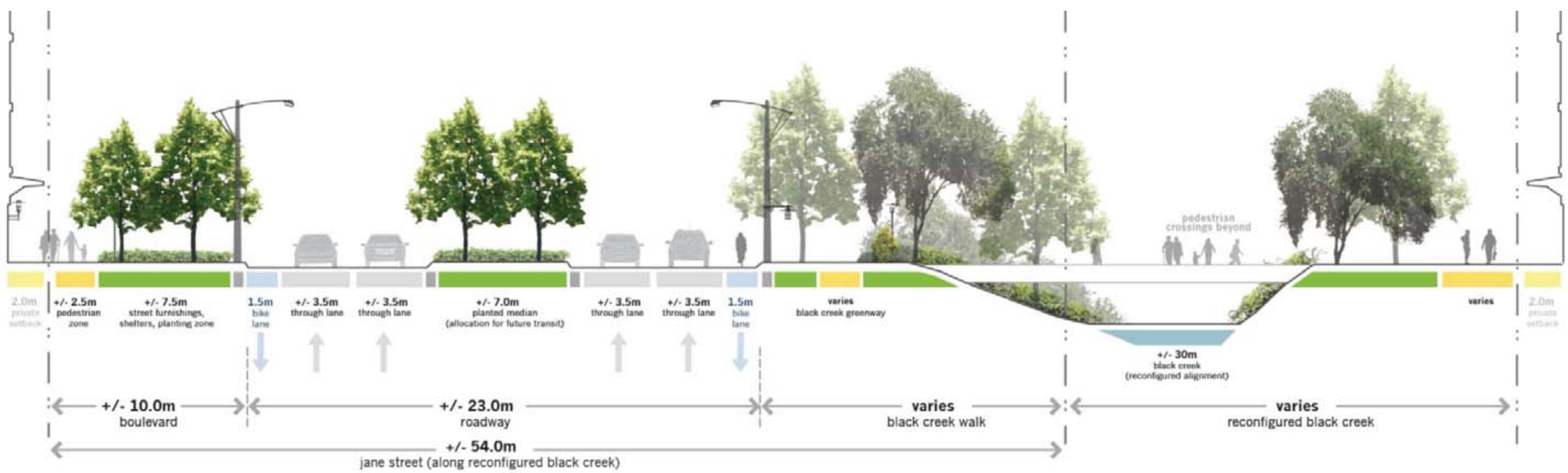
Key streetscapes

Millway Park and Avenue

at subway station, looking south

Key streetscapes



Jane Street along Black Creek

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Key streetscapes

Jane Street along Black Creek, looking north

Key streetscapes

Avenue 7 typical condition

DRAFT

Key streetscapes

Avenue 7 at a VIVA station

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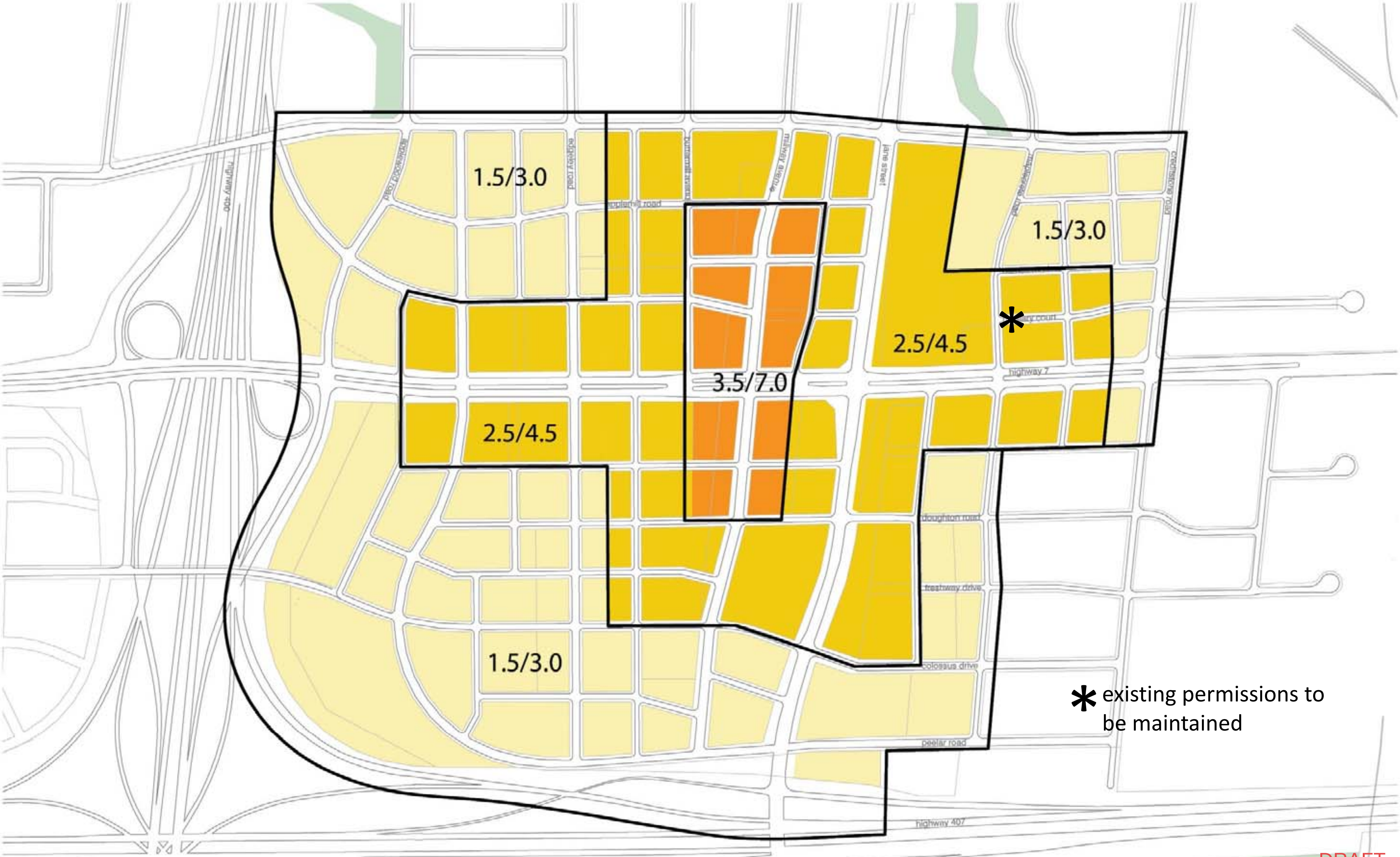
Densities



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4. Transportation Presentation: Open House # 2 (April 19, 2010)

VAUGHAN METROPOLITAN CENTRE

April 19 2010

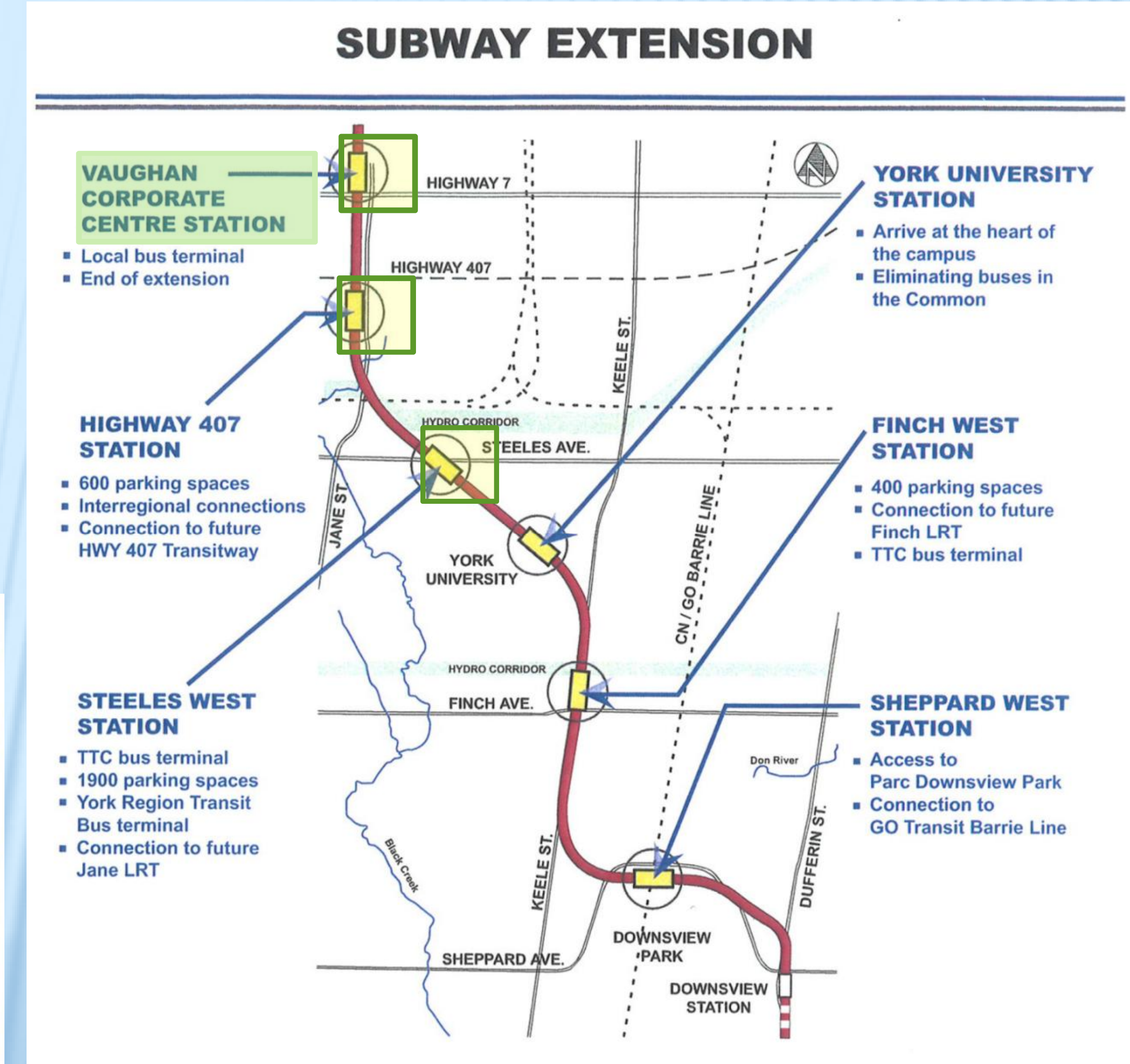
Vaughan Tomorrow

OUR CITY. OUR FUTURE.

AECOM

VMC New Plan

- ❑ Arrival of the Spadina Subway extension
- ❑ With improved transit, opportunities for further intensification
- ❑ With strong residential market, opportunities for better jobs/labour force balance



Vaughan Tomorrow
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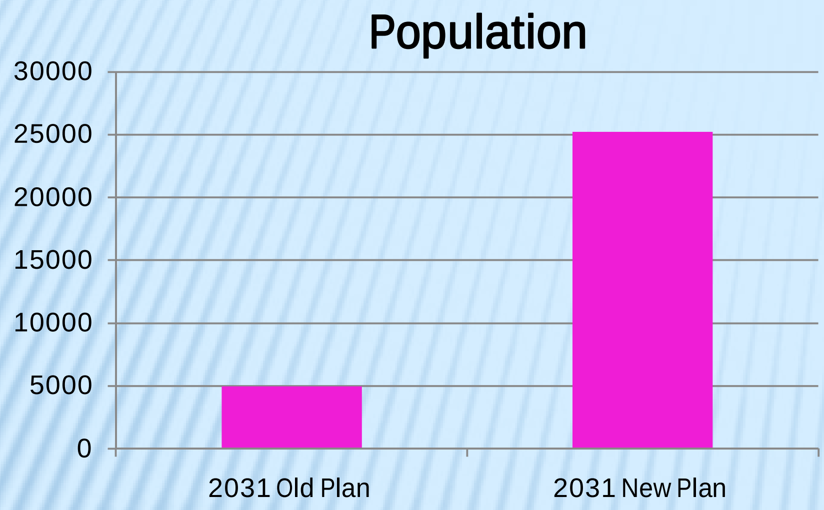
Land Use Changes

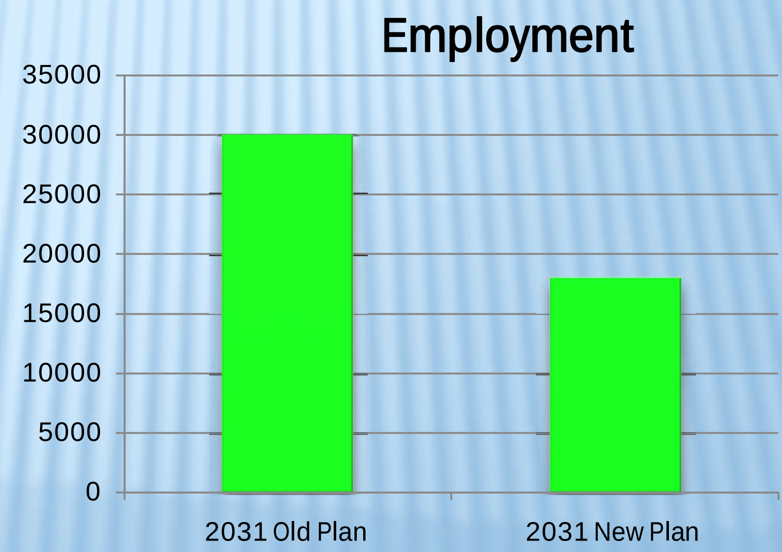
Current

Future built condition

2031 Population & Employment



- Major increase in Population
- Significant reduction in employment



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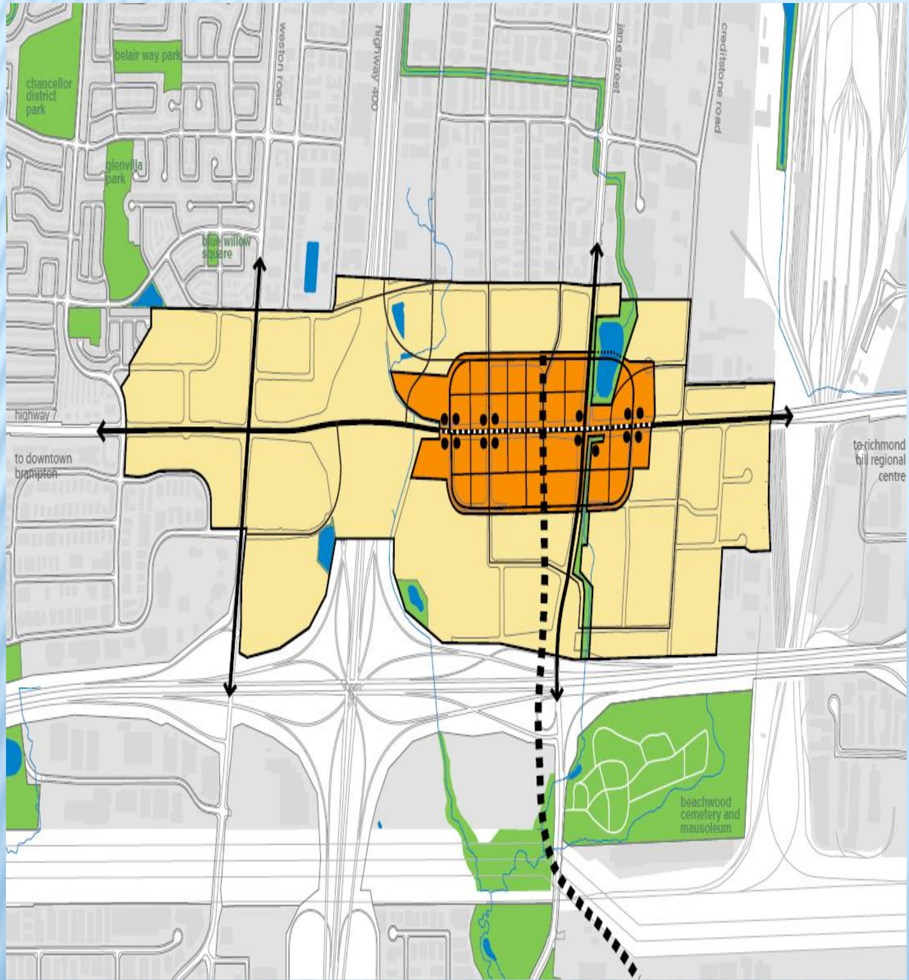
New and Old Plan Comparison

Official Plan Amendment 528



VMC Proposed Road Network

Vaughan Tomorrow

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Comparison of VMC Generated Trips

	Cansult Study 2002	AECOM 2010
AM Peak Hour		
Inbound	8,475	5,085
Outbound	2,250	11,700
PM Peak Hour		
Inbound	8,190	8,105
Outbound	13,315	10,460

* Assumes 20% Transit Modal Split

Transit Modal Split and Future Targets

Outbound Transit Mode Share (AM Peak Hour)

VMC 2006 Actual	VMC 2031 Projected Modal Split	North York C.C. 2006 Actual	VMC Modal Split Target
6%	35%	45%	50%

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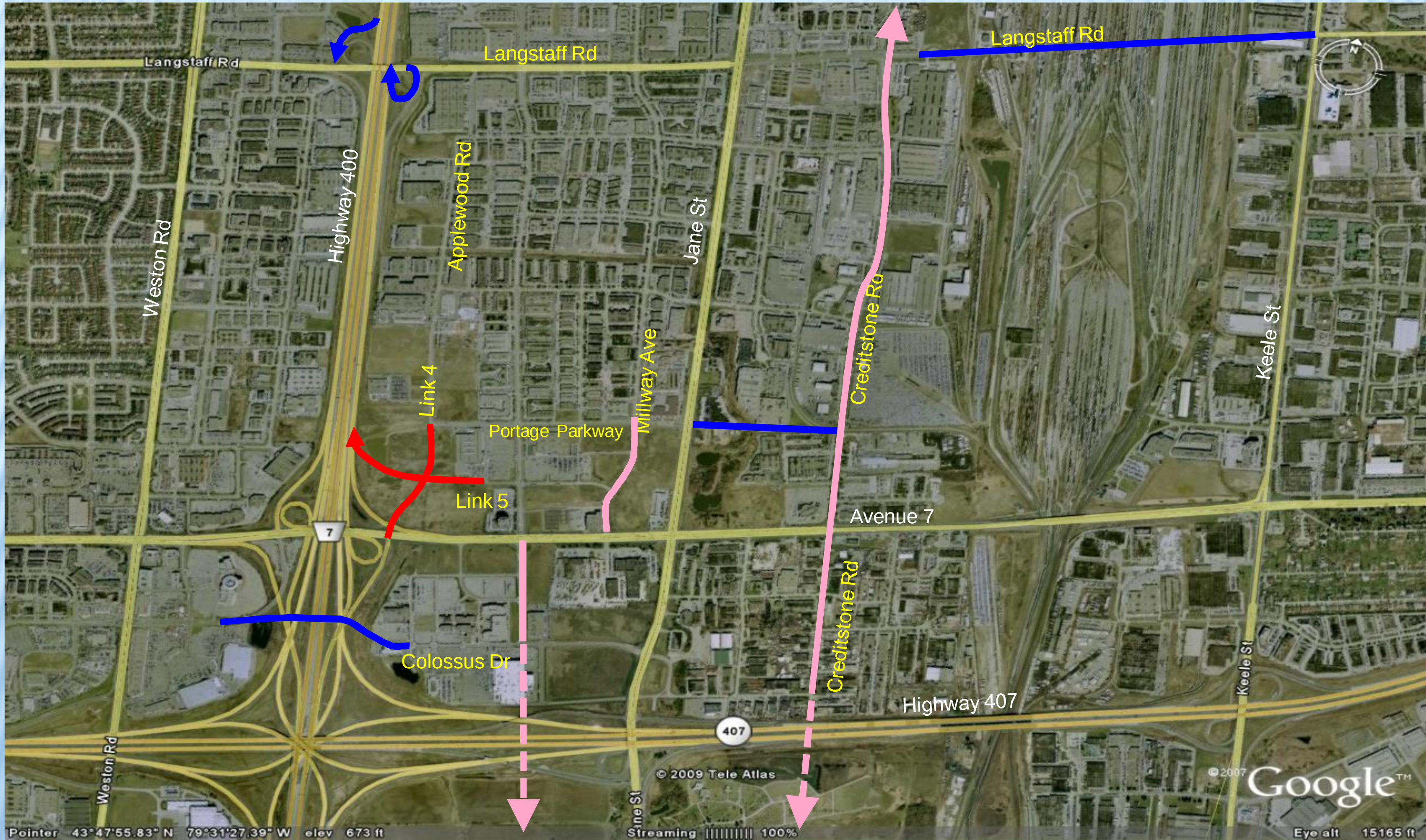
AECOM

Alternative Road Improvements Considered



LEGEND:

- Improvements to Existing/Planned Roads
- OPA 528 Proposed Links
- New Proposed Links
- Assessed but not proposed

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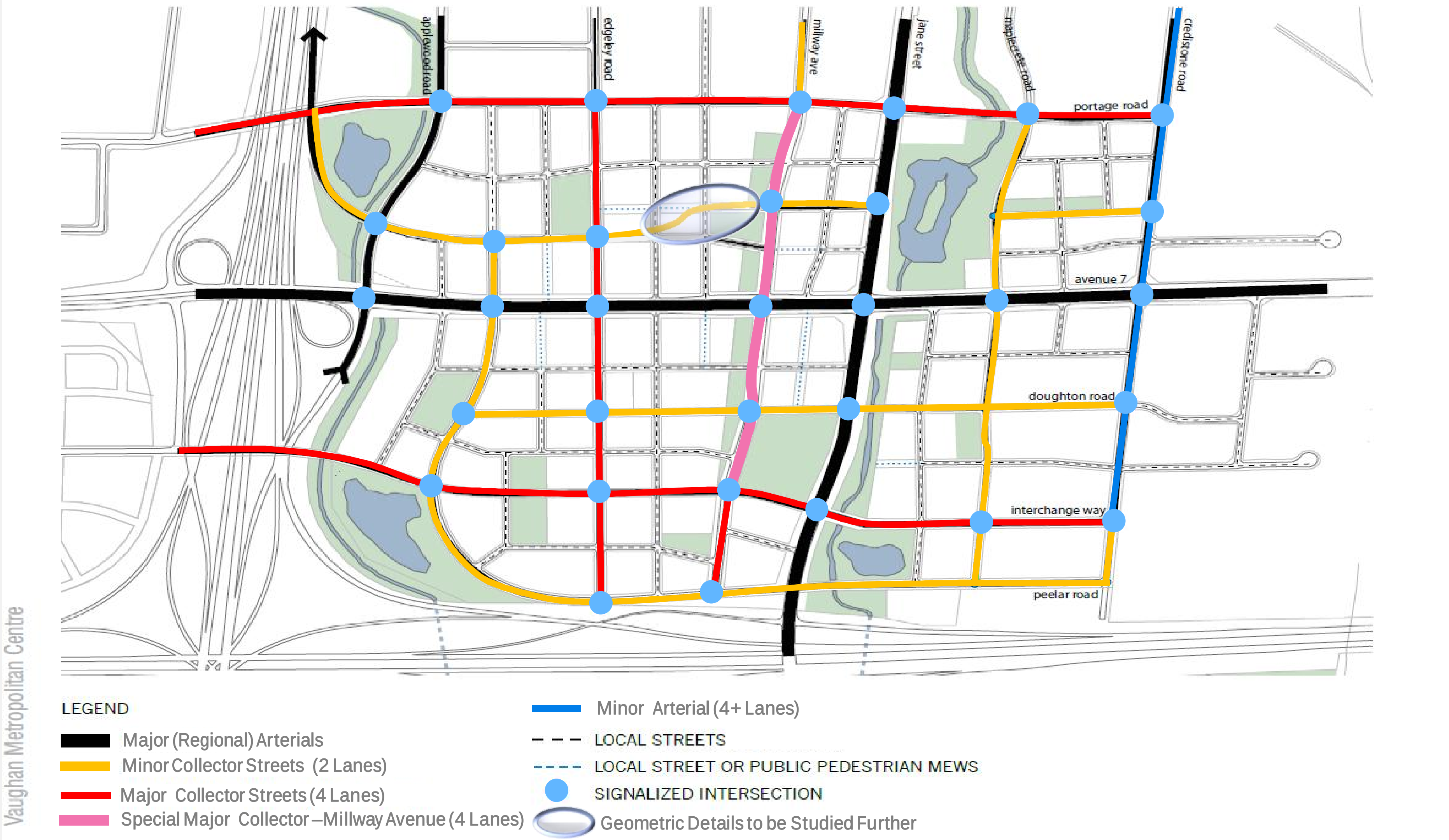
Recommended Network Links and Draft Classification



Vaughan Tomorrow

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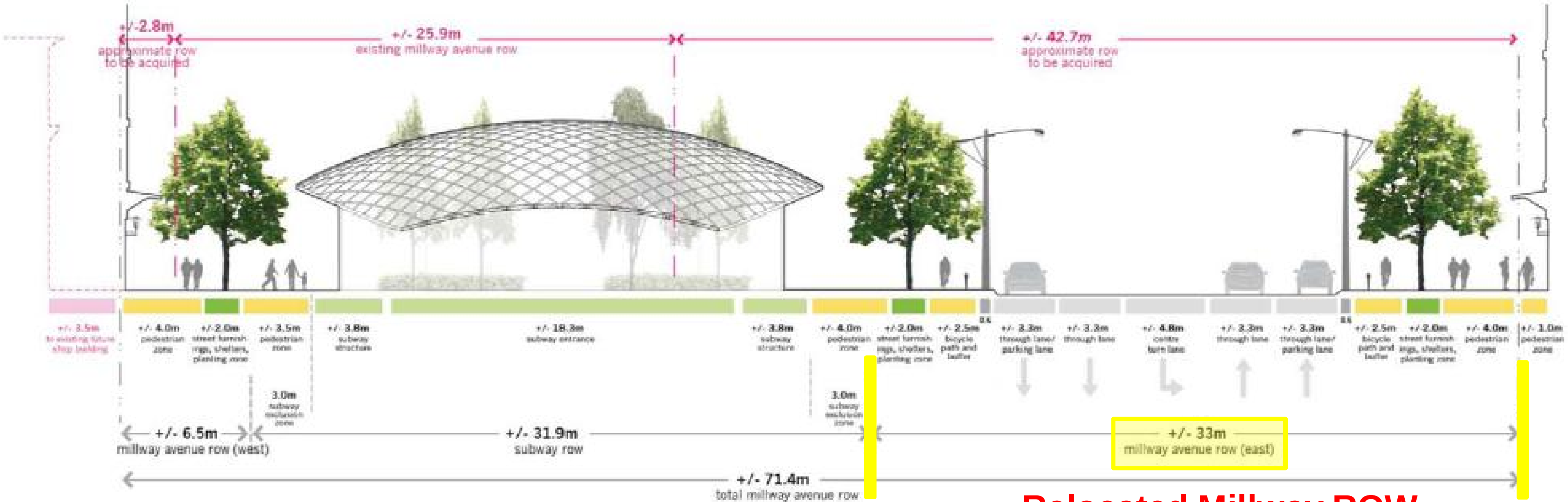
Millway Corridor Streetscape



Relocated Millway ROW
(4 Lane Special Collector)

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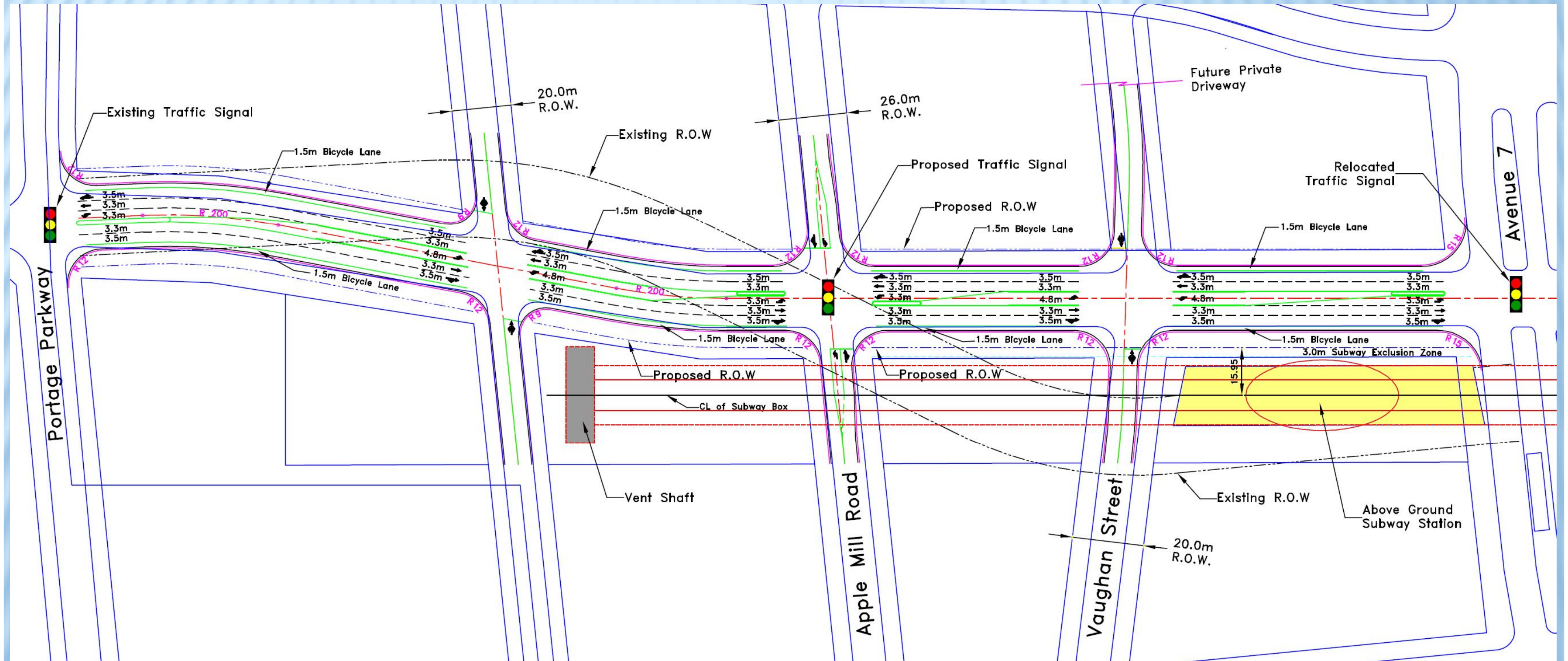
Millway Avenue Realignment

- Easterly realignment required to accommodate Subway terminal.
- Widen R.O.W (33 m.) to support cyclists and pedestrians.



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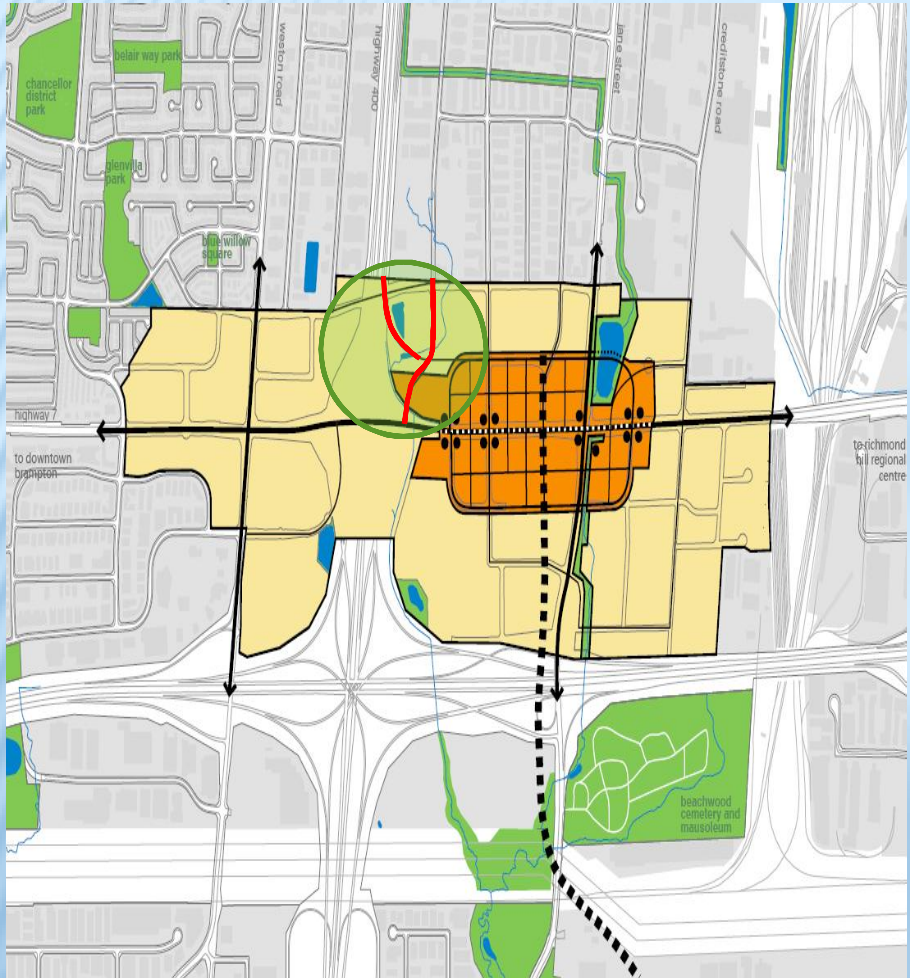
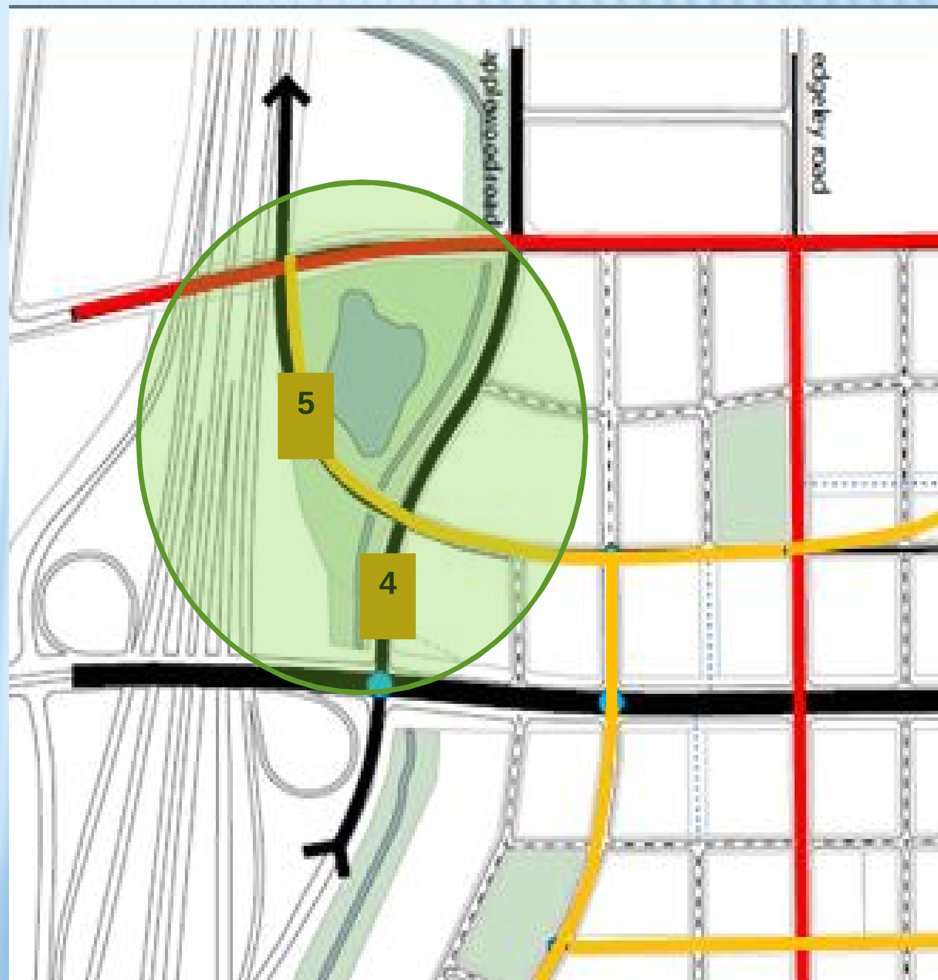
Links 4 and 5
Still Key Elements

Official Plan Amendment 528



Reconfigured Links 4 and 5



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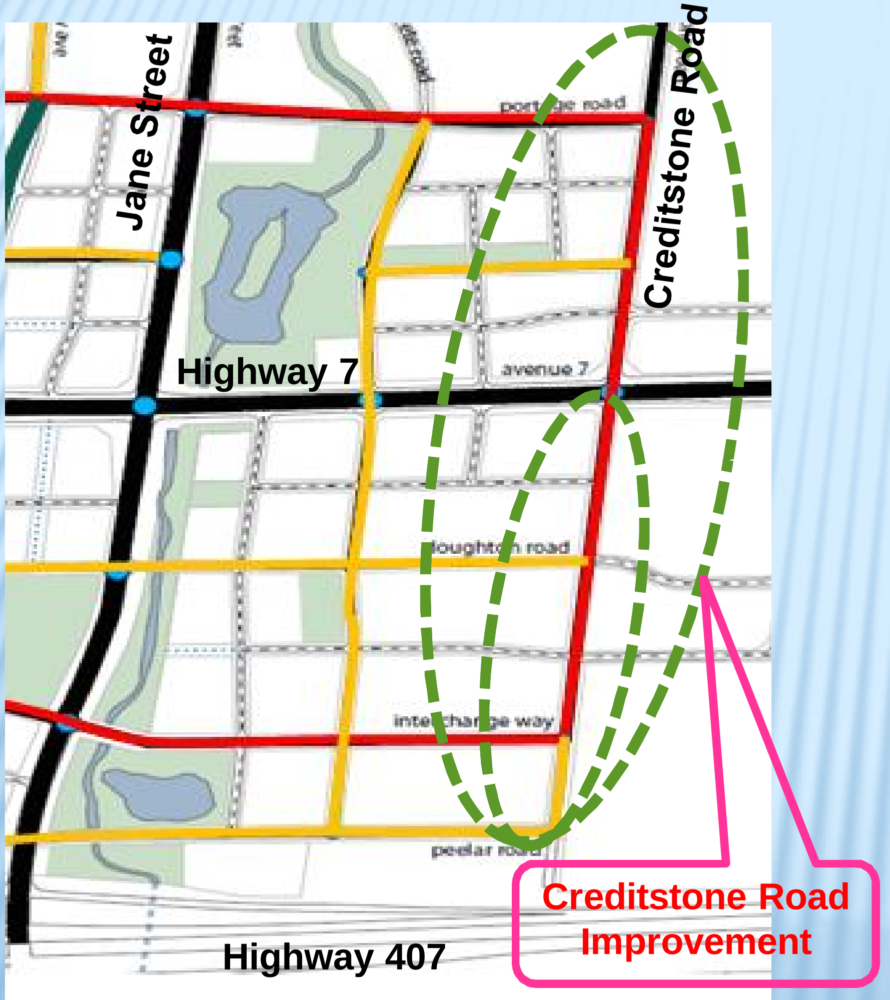
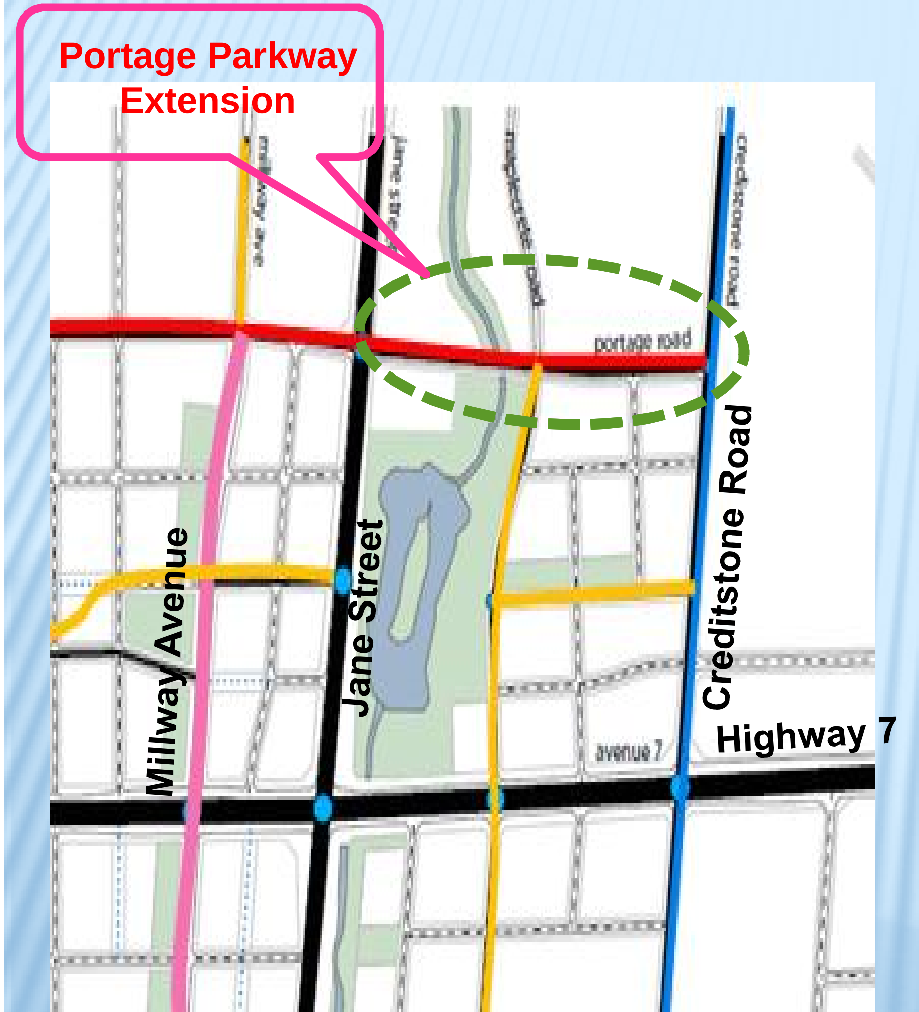
Creditstone Road Upgrading



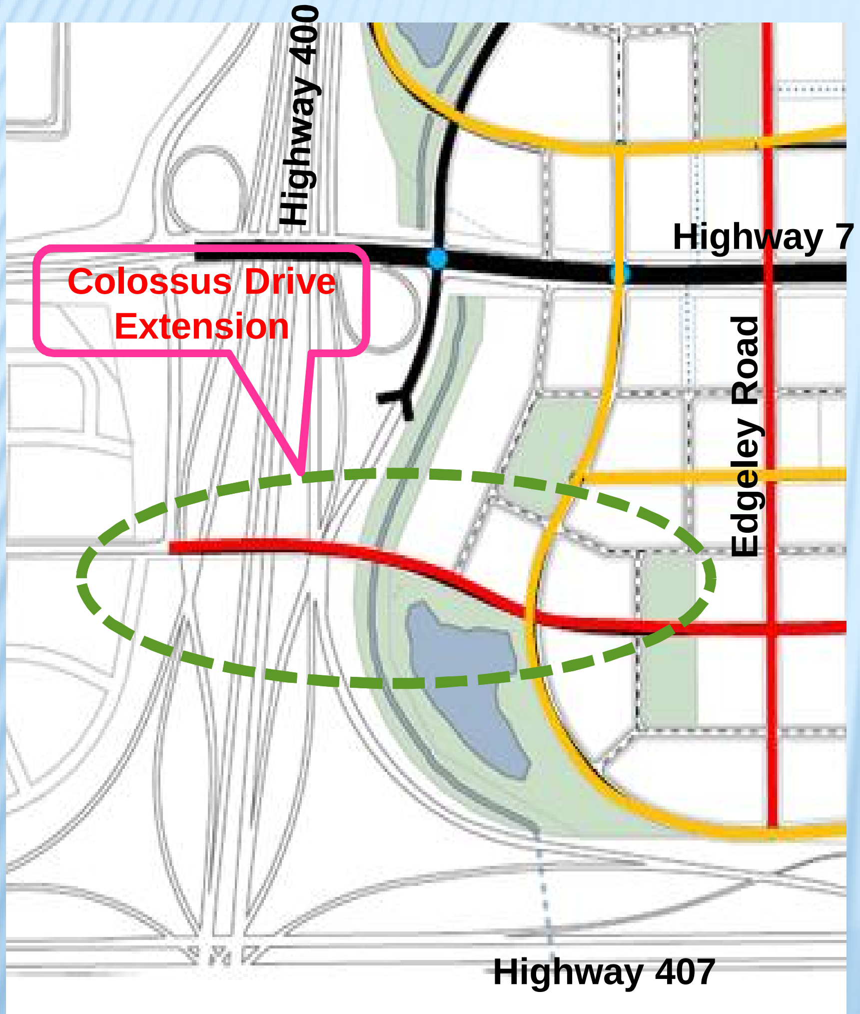
- Support intensification with in VMC and Jane Street corridor
- widening from 2 to 5 lane cross section south of Highway 7
- widening from 4 to 5 lane cross section north of Highway 7 to Rutherford Road
- serves as an eastern bypass to divert truck traffic from Highway 7 to Portage, Langstaff and eventually Colossus
- ROW widening required to 35 m.

Portage Parkway Extension



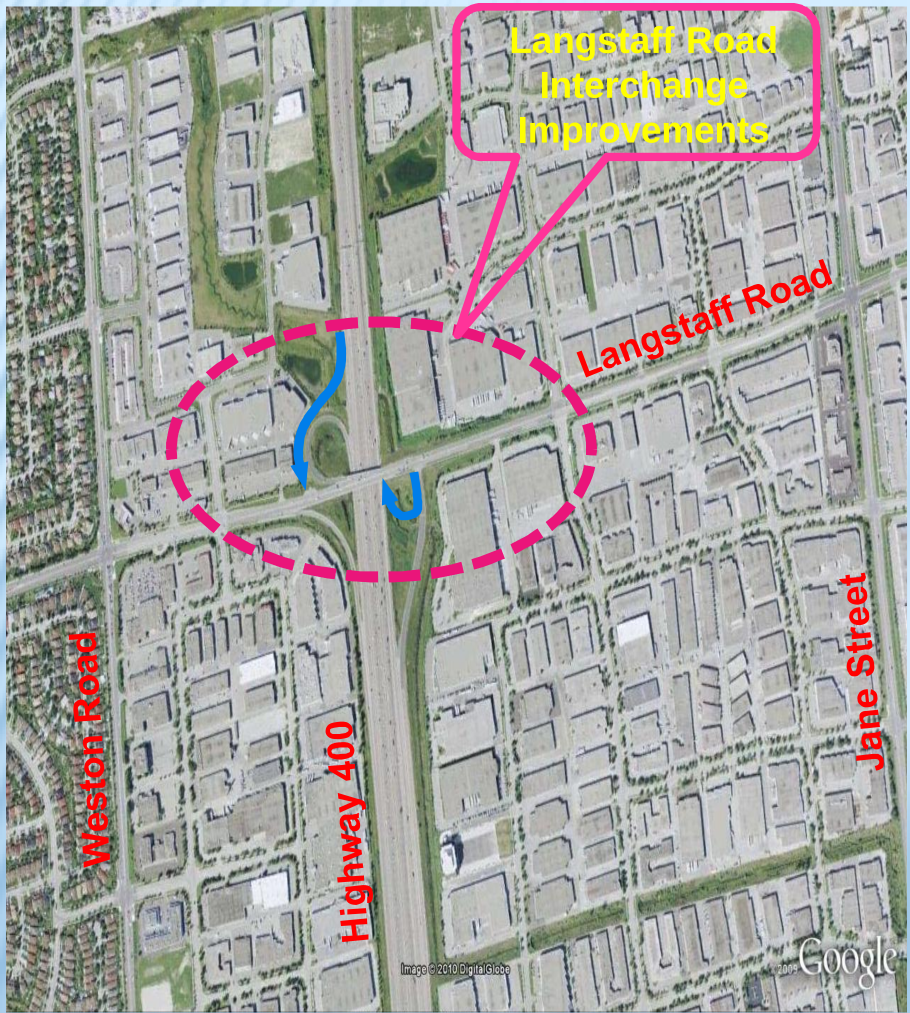
- new 4 lane collector from Jane Street to Creditstone Road
- requires creek crossing and some property for new ROW
- compatible with OPA 528
- provides relief for Highway 7 by functioning as a northern bypass particularly for trucks

Colossus Drive Extension-Long Term (new crossing of Highway 400)



- 4 lane collector from West of Highway 400 to Interchange Way
- Serves as a southern bypass to divert traffic from Highway 7 including trucks.
- Increases roadway system capacity
- Improves travel times
- Facilitates enhanced transit
- Costly, but significant system benefits

Langstaff Road / Hwy. 400 Interchange Improvements



- NB on-ramp is proposed to be located in the SE quadrant of the interchange (existing NB off-ramp may need to be relocated)
- SB off-ramp is located in the NW quadrant (existing SWM pond may need to be reconfigured)
- new traffic signal required on Langstaff Road west of Hwy. 400
- integral component of VMC truck strategy
- divert traffic away from Hwy. 7 interchange, particularly trucks

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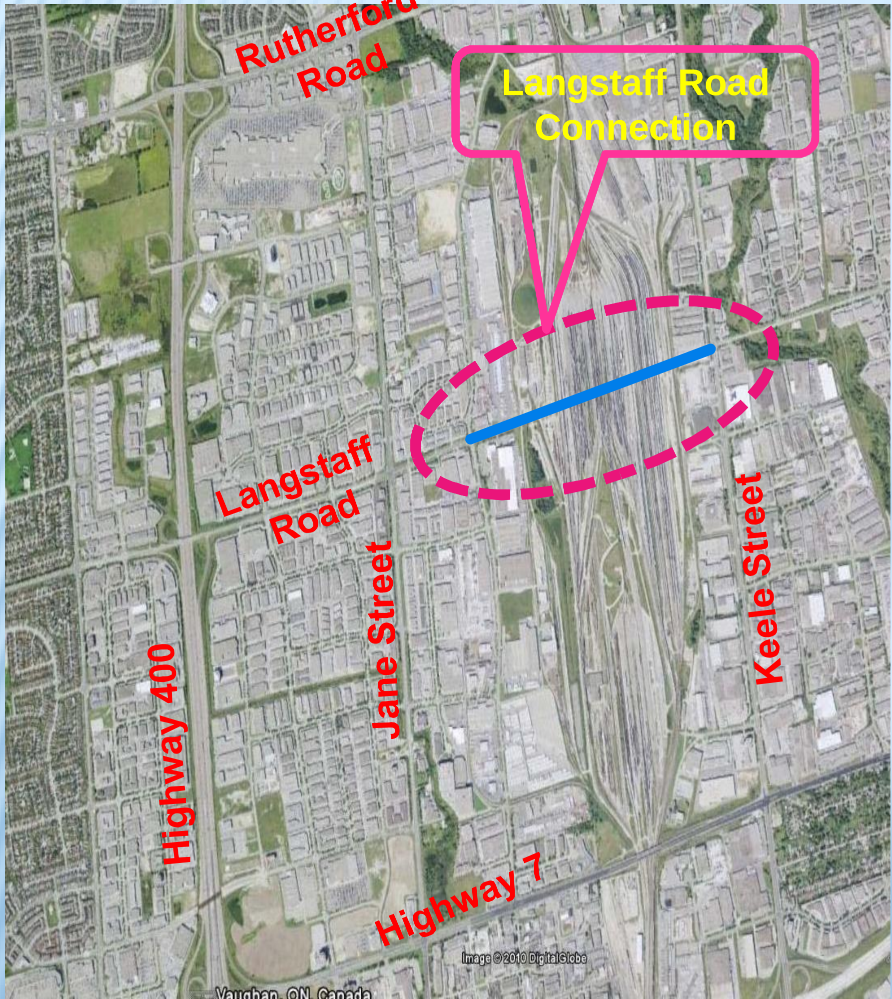
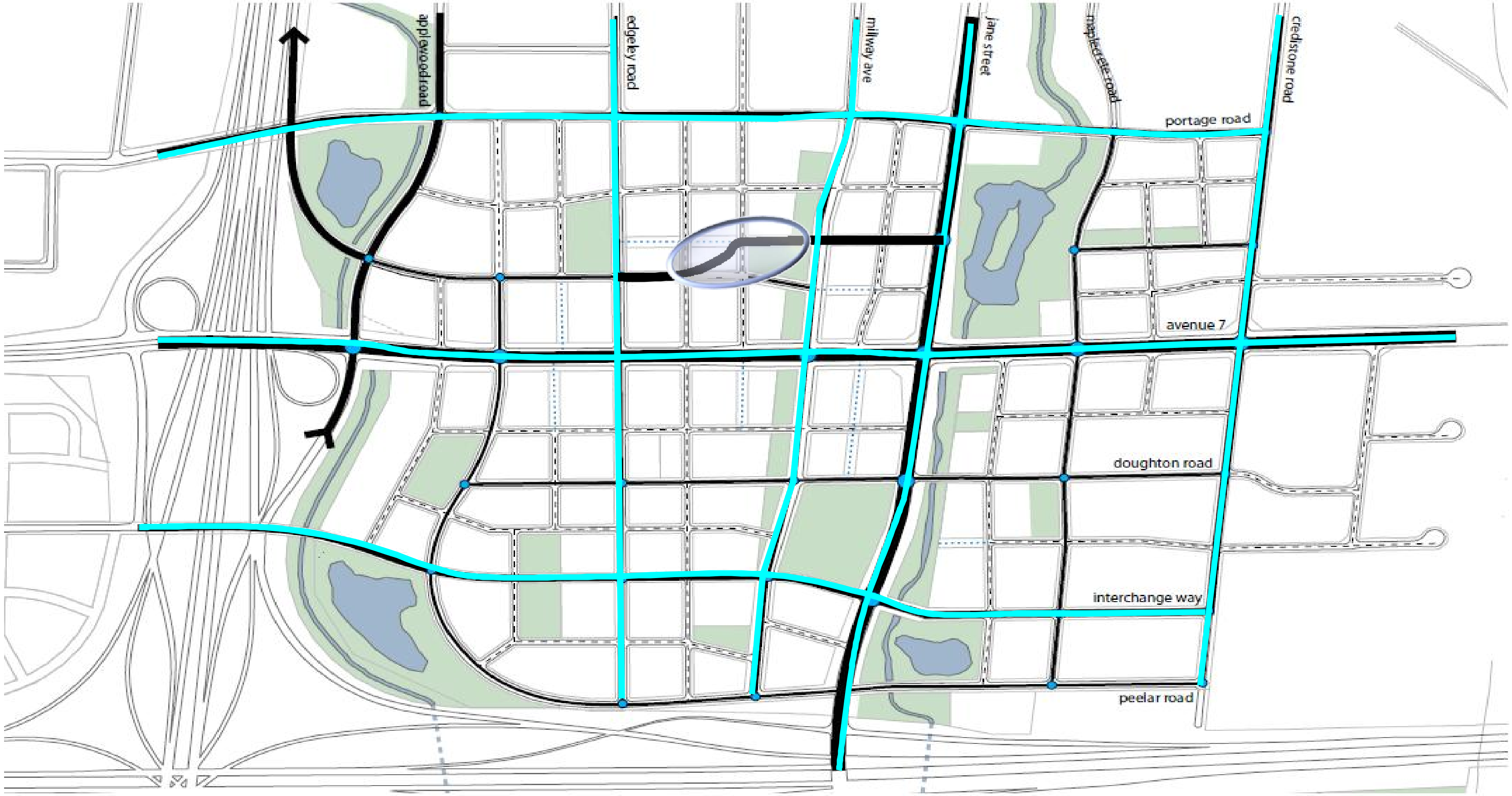
Langstaff Road Across CN Rail Yard



- would increase the traffic movements at the Highway 400 / Langstaff Road interchange, thus relieving the Highway 7/400 and Rutherford/400 interchanges.
- new connection would provide a substantial increase in east-west capacity.
- this link will provide relief to both Highway 7 and Rutherford Road.
- will link residential developments west of Weston Road to industrial areas east of CN rail yard.

VMC Proposed Cycling Network

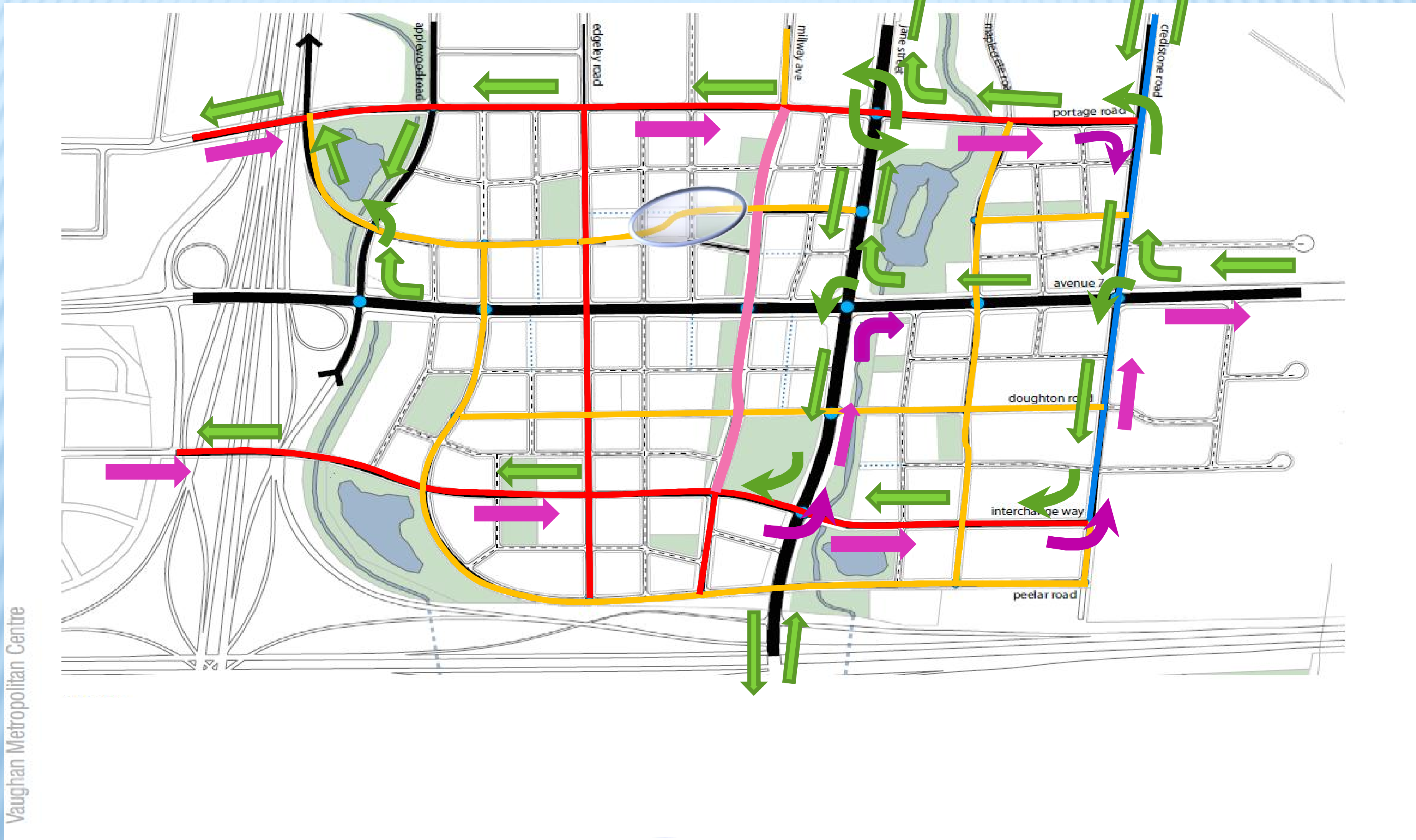


LEGEND

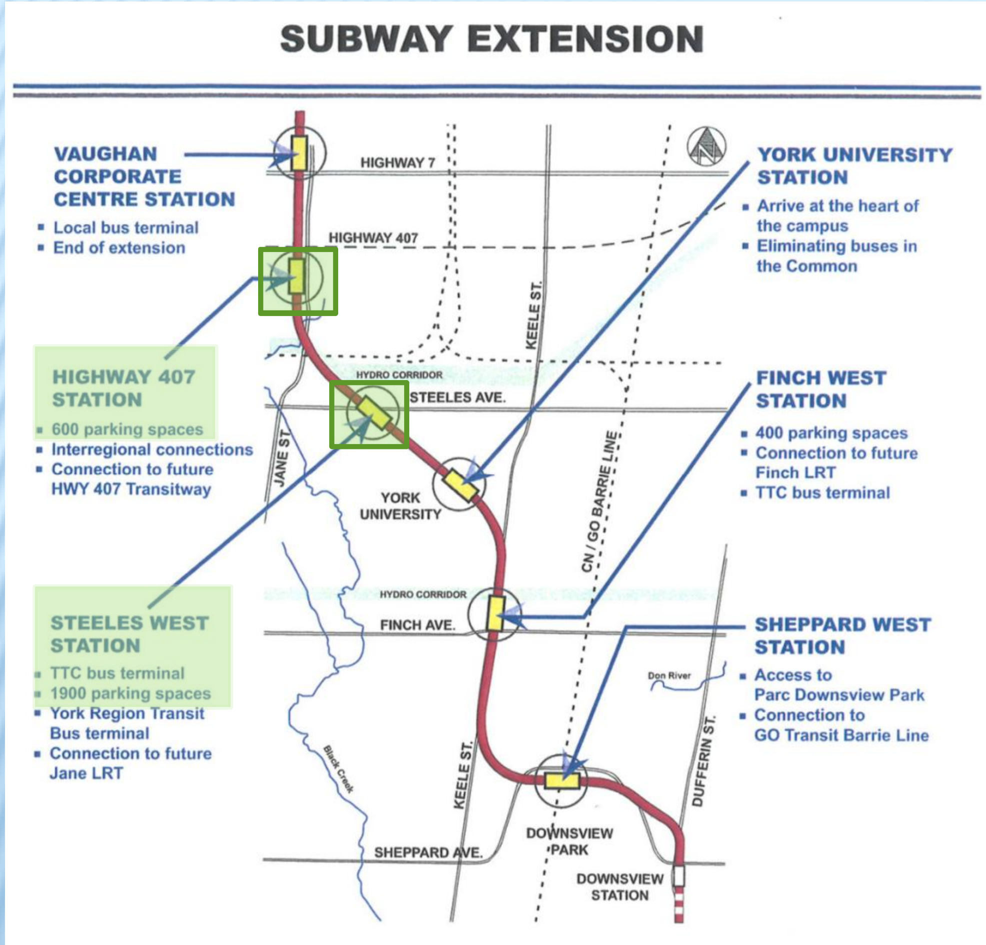
Dedicated On-Road Cycling Lanes

Geometric Details to be Studied Further

Truck Route Proposals

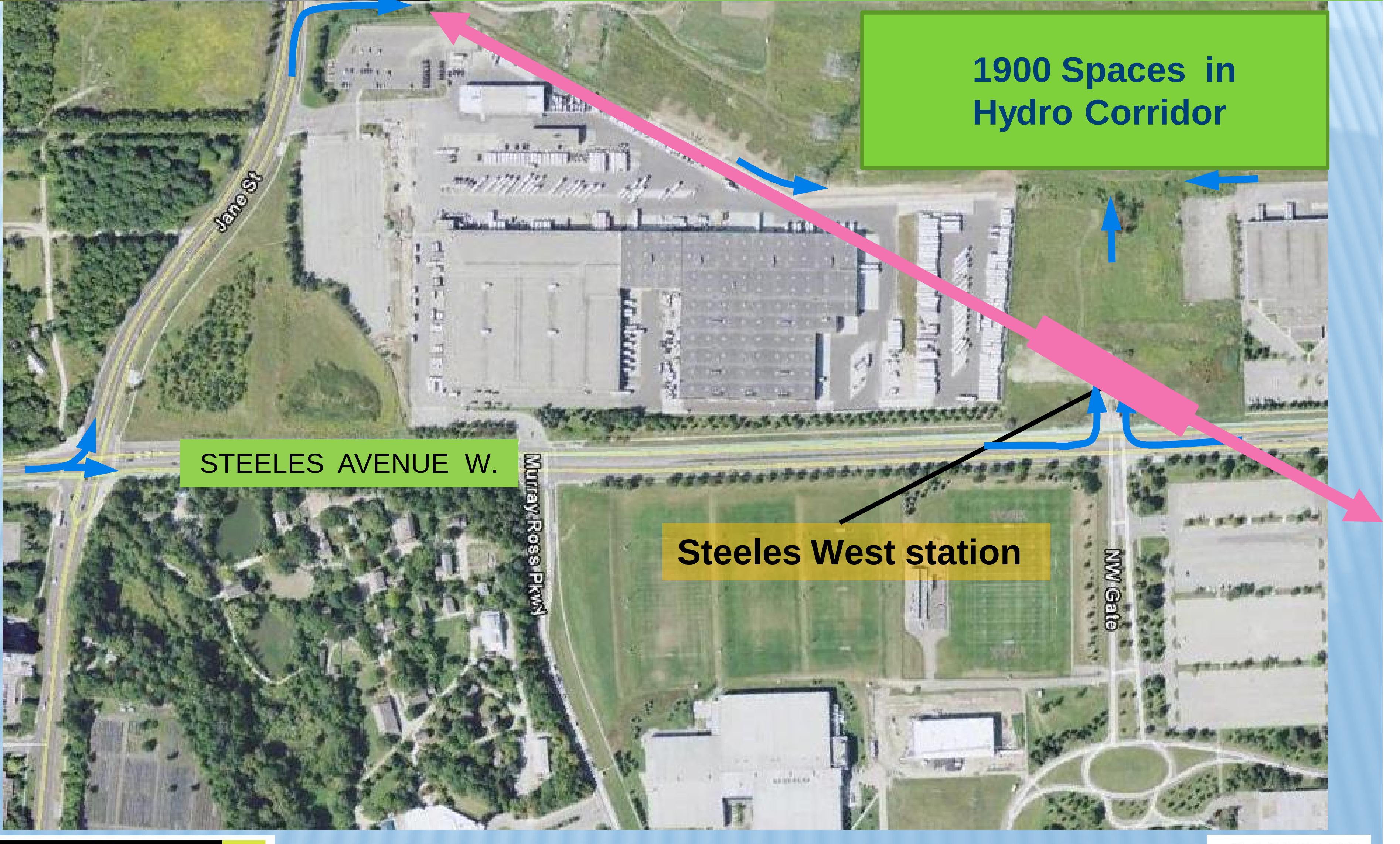


Park-and-Ride



- ❖ Not consistent with long term VMC vision
- ❖ 600 spaces at 407
- ❖ 1900 spaces at Steeles
- ❖ Access constraints from S.B. Highway 400
- ❖ Will be demand for Park-and-Ride at VMC

Park-and-Ride at Steeles West



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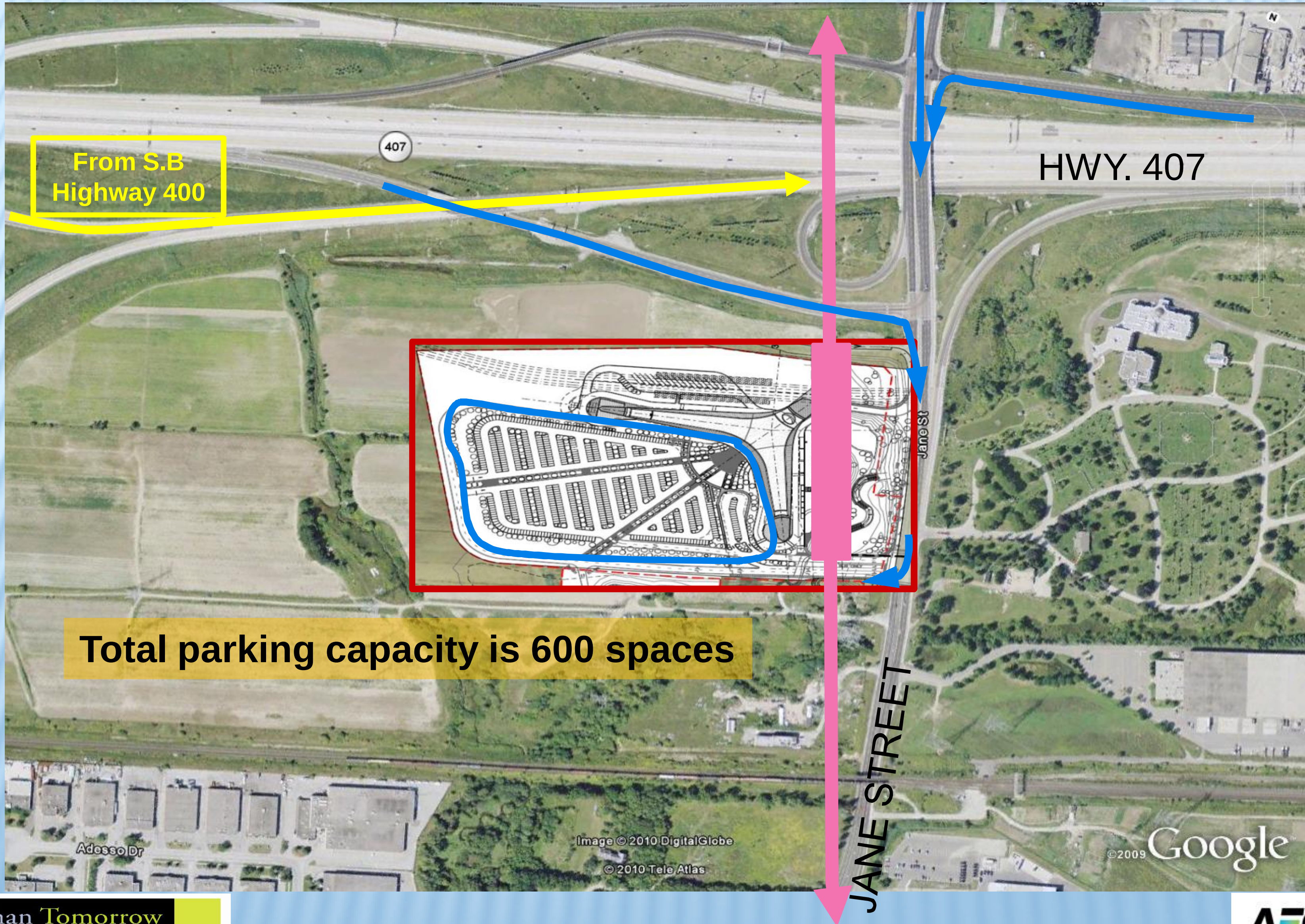
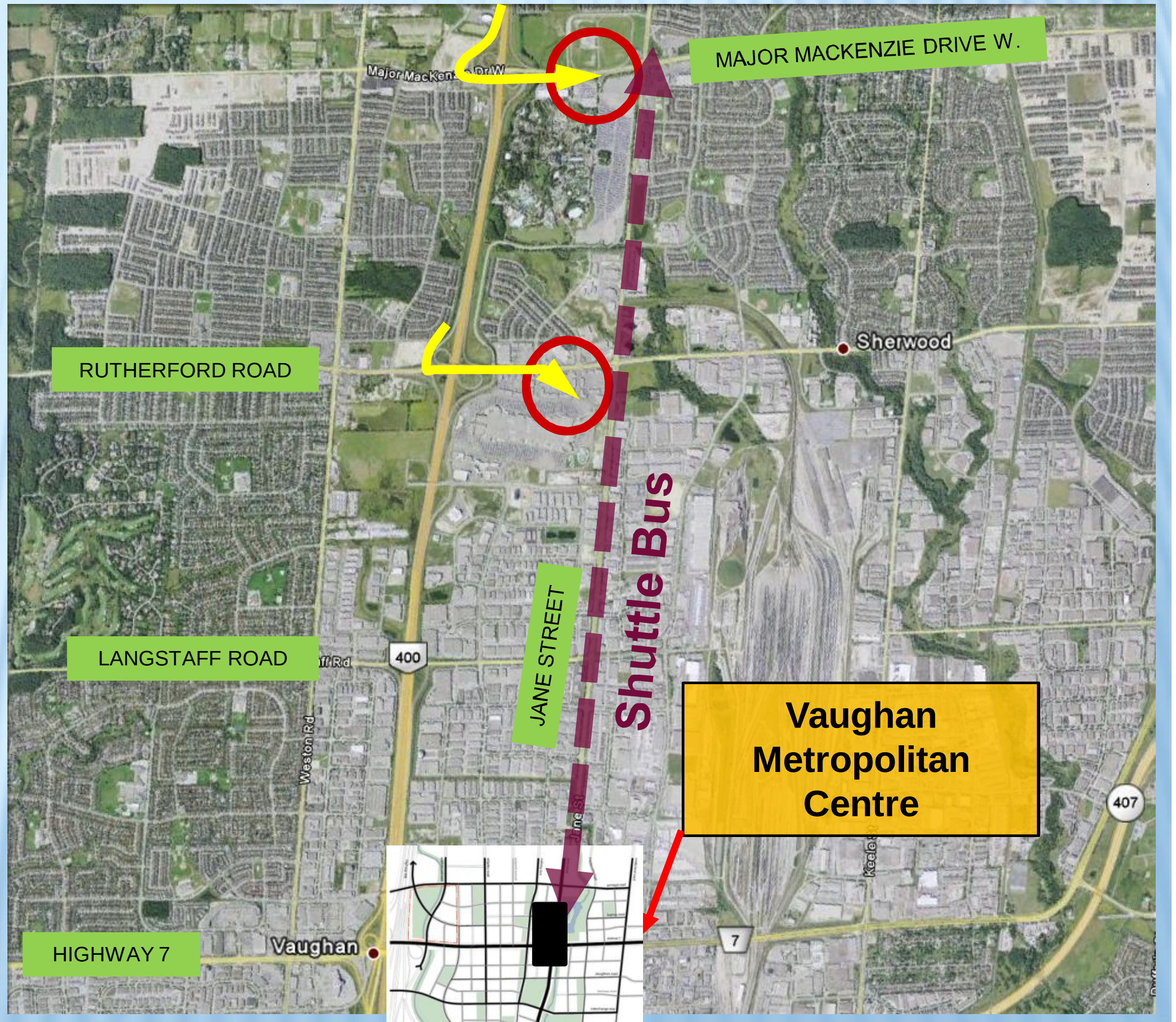
Park-and-Ride at Jane St. and HWY. 407



Park-and-Ride Alternatives North of VMC

- Need to explore options north of VMC
- Sites should be in close proximity to HWY. 400 interchanges
- Sites would be linked to VMC terminal via YRT or shuttle bus
- Opportunities exist for shared use facilities with private sector (eg. Canada's Wonderland, Vaughan Mills Mall)



Questions?

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Appendix II

Trip Generation Sensitivity Analysis

PRELIMINARY - FOR DISCUSSION

Thursday, February 26, 2009

Vaughan Corporate Centre

Vehicle Trips Generated by Alternative Growth Scenarios

	Inbound A.M. Peak					Outbound A.M. Peak					Inbound P.M. Peak					Outbound P.M. Peak				
Growth Scenario / Trips Generated	2002 TTPFD	M-M	M-H	H-M	H-H	2002 TTPFD	M-M	M-H	H-M	H-H	2002 TTPFD	M-M	M-H	H-M	H-H	2002 TTPFD	M-M	M-H	H-M	H-H
1 ITE Vehicle Trip Generation																				
a) Office		2414	2977	2456	3016		329	406	335	411		558	721	570	733		2725	3520	2782	3578
b) Retail		0	0	0	0		0	0	0	0		464	662	699	898		590	842	890	1143
c) Residential		543	774	758	989		2314	3300	3230	4216		2065	2950	2887	3772		1266	1808	1769	2312
Total		**2957**	**3751**	**3214**	**4005**		**2643**	**3706**	**3565**	**4628**		**3086**	**4333**	**4156**	**5403**		**4580**	**6171**	**5442**	**7032**
2 Equivalent ITE Person Trips																				
a) Office		2776	3423	2824	3469		379	467	385	473		642	829	655	843		3133	4048	3199	4114
b) Retail		0	0	0	0		0	0	0	0		533	761	804	1032		678	969	1024	1314
c) Residential		624	890	871	1137		2661	3795	3714	4849		2375	3393	3320	4338		1455	2079	2035	2659
Total		**3401**	**4313**	**3696**	**4606**		**3039**	**4262**	**4099**	**5322**		**3549**	**4983**	**4780**	**6213**		**5267**	**7096**	**6258**	**8087**
3 Non Auto Person Trips																				
a) Office		1111	1369	1130	1387		151	187	154	189		257	332	262	337		1253	1619	1280	1646
b) Retail		0	0	0	0		0	0	0	0		133	190	201	258		170	242	256	328
c) Residential		250	356	348	455		1064	1518	1486	1940		950	1357	1328	1735		582	832	814	1064
Total		**1360**	**1725**	**1478**	**1842**		**1216**	**1705**	**1640**	**2129**		**1340**	**1879**	**1791**	**2330**		**2005**	**2693**	**2350**	**3038**
4 Person Trip by Auto																				
a) Office		1666	2054	1695	2081		227	280	231	284		385	497	393	506		1880	2429	1920	2469
b) Retail		0	0	0	0		0	0	0	0		400	571	603	774		509	727	768	985
c) Residential		374	534	523	682		1596	2277	2229	2909		1425	2036	1992	2603		873	1248	1221	1595
Total		**2040**	**2588**	**2217**	**2764**		**1824**	**2557**	**2460**	**3193**		**2210**	**3104**	**2988**	**3883**		**3262**	**4403**	**3908**	**5049**
5 Adjusted Vehicle Trips																				
a) Office	6564	1514	1867	1541	1892	1065	207	255	210	258	1597	350	452	357	460	6211	1709	2208	1745	2244
b) Retail	0	0	0	0	0	0	0	0	0	0	5123	363	519	548	704	5123	463	661	698	896
c) Residential	160	340	486	475	620	620	1451	2070	2026	2645	620	1295	1851	1811	2366	400	794	1134	1110	1450
d) Light Industry	1753					566					849					1583				
Total	**8477**	**1855**	**2353**	**2016**	**2512**	**2251**	**1658**	**2325**	**2236**	**2903**	**8189**	**2009**	**2822**	**2717**	**3530**	**13317**	**2965**	**4003**	**3553**	**4590**

Legend: TTPFD: Transportation Transit Planning and Functional Design Study (Cansult 2002)
M: Moderate Growth Scenario
H: High Growth Scenario

Assumed Non Auto Modal Splits (Average East & West), based on similar experience observed in North York City Centre

Office	40%
Residential	40%
Retail	25%

Equivalent I.T.E. Person Trips = Vehicle Trips x 1.15 to allow for 5% transit and 1.10 vehicle occupancy

	50% Reduced USI Growth Scenarios			
	M-M	**M-H**	**HM**	**H-H**
Residential Units	9,750	13950	13650	17850
Residential Populatior	20500	28850	28500	36850
Office GFA (sq.m)	265750	345250	271500	351000
Retail GFA (sq.m)	39950	57400	60700	78150

Notes:
1. Equivalent ITE person trips = ITE vehicle trips times 1.15 to account for 5% assumed transit and 1.1 vehicle occupancy factor
2. Non Auto Person Trips = Equivalent ITE Person Trips times Assumed Non Auto Modal Split
3. Person trips by Auto = Equivalent ITE Person Trips - Non Auto Person trips
4. Adjusted Vehicle Trips = Person Trips by Auto divided by 1.10

PRELIMINARY - FOR DISCUSSION

Thursday, March 05, 2009

Vaughan Corporate Centre

Vehicle Trips Generated by Alternative Growth Scenarios

Growth Scenario / Trips Generated	Inbound A.M. Peak					Outbound A.M. Peak					Inbound P.M. Peak					Outbound P.M. Peak				
	2002 TTPFD	M-M	M-H	H-M	H-H	2002 TTPFD	M-M	M-H	H-M	H-H	2002 TTPFD	M-M	M-H	H-M	H-H	2002 TTPFD	M-M	M-H	H-M	H-H
1 ITE Vehicle Trip Generation																				
a) Office		4204	5183	4276	5252		573	707	583	716		1103	1429	1126	1452		5384	6975	5499	7090
b) Retail		0	0	0	0		0	0	0	0		918	1314	1389	1786		1168	1673	1768	2273
c) Residential		1080	1543	1510	1973		4604	6577	6436	8409		4120	5891	5764	7535		2525	3611	3533	4618
Total		**5283**	**6725**	**5786**	**7224**		**5177**	**7284**	**7019**	**9125**		**6141**	**8634**	**8280**	**10773**		**9077**	**12258**	**10800**	**13981**
2 Equivalent ITE Person Trips																				
a) Office		4834	5960	4918	6039		659	813	671	824		1268	1643	1295	1670		6191	8021	6324	8153
b) Retail		0	0	0	0		0	0	0	0		1055	1511	1598	2054		1343	1924	2034	2614
c) Residential		1242	1774	1736	2268		5295	7564	7402	9671		4738	6775	6629	8665		2904	4152	4063	5311
Total		**6076**	**7734**	**6654**	**8308**		**5954**	**8376**	**8072**	**10494**		**7062**	**9929**	**9522**	**12389**		**10438**	**14097**	**12420**	**16078**
3 Non Auto Person Trips																				
a) Office		1209	1490	1229	1510		165	203	168	206		317	411	324	417		1548	2005	1581	2038
b) Retail		0	0	0	0		0	0	0	0		158	227	240	308		201	289	305	392
c) Residential		310	444	434	567		1324	1891	1850	2418		1185	1694	1657	2166		726	1038	1016	1328
Total		**1519**	**1934**	**1663**	**2077**		**1488**	**2094**	**2018**	**2624**		**1660**	**2331**	**2221**	**2892**		**2475**	**3332**	**2902**	**3758**
4 Person Trip by Auto																				
a) Office		3626	4470	3688	4529		494	610	503	618		951	1232	971	1252		4643	6016	4743	6115
b) Retail		0	0	0	0		0	0	0	0		897	1285	1358	1746		1142	1635	1728	2222
c) Residential		931	1331	1302	1701		3971	5673	5551	7253		3554	5081	4972	6499		2178	3114	3047	3983
Total		**4557**	**5801**	**4990**	**6231**		**4465**	**6282**	**6054**	**7871**		**5402**	**7598**	**7301**	**9497**		**7963**	**10765**	**9518**	**12320**
5 Adjusted Vehicle Trips																				
a) Office	6564	3296	4064	3353	4118	1065	449	554	457	562	1597	865	1120	883	1139	6211	4221	5469	4312	5559
b) Retail		0	0	0	0	0	0	0	0	0	5123	815	1168	1235	1587	5123	1038	1487	1571	2020
c) Residential	160	847	1210	1184	1547	620	3610	5157	5047	6594	620	3231	4619	4520	5908	400	1980	2831	2770	3621
d) Light Industry	1753					566					849					1583				
Total	**8477**	**4143**	**5273**	**4537**	**5664**	**2251**	**4059**	**5711**	**5504**	**7155**	**8189**	**4911**	**6907**	**6638**	**8634**	**13317**	**7239**	**9786**	**8653**	**11200**

Legend: TTPFD: Transportation Transit Planning and Functional Design Study (Cansult 2002)
M: Moderate Growth Scenario
H: High Growth Scenario

Assumed Non Auto Modal Splits (Average East & West), based on similar experience observed in North York City Centre

Office	25%
Residential	25%
Retail	15%

	Original USI Growth Scenarios			
	M-M	**M-H**	**HM**	**H-H**
Residential Units	19,500	27,900	27,300	35,700
Residential Populatior	41,000	57,700	57,000	73,700
Office GFA (sq.m)	531,500	690,500	543,000	702,000
Retail GFA (sq.m)	79,900	114,800	121,400	156,300

Notes: 1. Equivalent ITE person trips = ITE vehicle trips times 1.15 to account for 5% assumed transit and 1.1 vehicle occupancy factor
2. Non Auto Person Trips = Equivalent ITE Person Trips times Assumed Non Auto Modal Split
3. Person trips by Auto = Equivalent ITE Person Trips - Non Auto Person trips
4. Adjusted Vehicle Trips = Person Trips by Auto divided by 1.10

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Appendix III

Millway Road Realignment

AECOM
300 – 300 Town Centre Boulevard
Markham, ON, Canada L3R 5Z6
www.aecom.com

905 477 8400 tel
905 477 1456 fax

April 16, 2010

Michael Frieri
Manager, Development Engineering
City of Vaughan
2141 Major Mackenzie Drive
Vaughan, Ontario, L6A 1T1

Dear Michael:

Project No: **60145887**

Regarding: **Millway Avenue Functional Assessment and Plan, Avenue 7 to Portage Parkway**

Introduction and Background:

Further to your request, AECOM Canada Ltd. is pleased to submit the results of a functional assessment of the Millway Avenue realignment between Avenue 7 and Portage Parkway to better accommodate transit needs and future redevelopment in the Vaughan Metropolitan Centre (VMC).

The proposed subway terminal at Avenue 7 and Millway Avenue is a part of the Spadina subway extension, extending from Downsview Station in Toronto to VMC. The alignment of the subway is to follow the approximate alignment of Millway Avenue, with the terminal station extending for about 2 blocks north of Avenue 7 and tail tracks beyond that. Based on our analysis of the future transportation needs of the VMC, efficient traffic operations and the high level functionality of Millway Avenue north of Avenue 7 are critical to providing for a successful Metropolitan Centre.

Approach and Methodology:

It should be noted that in order to evaluate the feasibility and address land requirements we developed a preliminary plan, which conforms to City of Vaughan standards. Our plan is based on available survey information from the City in the form of CAD file and scanned drawings, hard copy drawing of the future subway station, and Urban Strategies Inc (USI) CAD file with the VMC road network information. No new surveys were conducted and the study results should be reviewed within the limitations of this approximate information.

Design Criteria and Assumptions:

The Design Criteria were based on the City of Vaughan design guidelines and standards and the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (1999).
In order to meet minimum design and safety requirements the following standards/assumptions were made:

- design speed: 70 Km/h (50 Km/h posted)
- traffic control for new Millway Avenue / Applemill Road intersection: Traffic Signals
- cross section: 4 lane with left turn lanes at intersections
- generous boulevards as proposed by Urban Strategies Inc.

Millway Avenue is proposed to be redesigned to continue to connect Avenue 7 and Applemill Road, which is to be extended easterly to a signalized intersection at Jane Street. It would provide secondary vehicular access from Jane Street, Portage Road and Avenue 7 to support future developments along both sides of Millway Avenue, although no direct development access from Millway Avenue should occur between intersections with municipal roads. It should be noted that the Millway Avenue/Applemill Road intersection is a prime candidate for signalization, and this is assumed in the functional plan. The functional plan matches the Highway 7 north limit of ROW, as well as with the south ROW limit at Portage Parkway.

Assessing the functional requirements we developed a functional plan for the future Millway Avenue, which identified the roadway alignment and the right of way requirements to permit the design and construction to acceptable City standards. Consideration was given to safety standards with regards to a new access points/intersections onto Millway Avenue, including the proposed VMC road network based on Urban Strategies latest plan (three intersections with Millway Avenue between Avenue 7 and Portage Parkway including the realignment of Applemill Road which is to be extended easterly to Jane Street).

Millway Avenue Features and Configuration

Millway Avenue is designated as a Collector Road in Vaughan's new Official Plan and in the VMC secondary plan. It would provide secondary vehicular access from Jane Street, Portage Parkway and Avenue 7 to support future developments along both sides of Millway Avenue. The proposed Millway Avenue cross section contains four (4) through lanes on Millway Avenue north of Avenue 7, together with left turn lanes at signalized or future signalized intersections. A 33 metre Right-of-Way (ROW) is necessary to accommodate the proposed cross section, excluding the 3 metres of subway exclusion zone on the east side of the subway box.

As the Millway intersection with Avenue 7 is one of only a few locations along Avenue 7 that can be signalized, Millway Avenue is expected to carry relatively high levels of Centre generated peak period traffic, and must therefore be designated and designed as a collector road in Vaughan's new Official Plan and in the VMC secondary plan. At the same time, it must be recognized that a balance between traffic movement on Millway Avenue and transit terminal traffic (including pedestrians and cyclists accessing the subway terminal) is necessary to support the overall smooth functioning of the VMC transportation network.

As illustrated in Plate No.1, Millway Avenue will remain approximate 510 m in length with an acceptable geometry for the road classification and function. The proposed cross-sections for the Millway Avenue immediately north of Avenue 7 is illustrated in Plate No. 2.

The proposed Millway Avenue is proposed to consist of the following:

- 33.0 m Right-Off-Way
- 4.8 m centre turn lane (including concrete islands)
- 1. 5 m dedicated on road cycling lane on both sides of Millway Avenue
- Millway Avenue exclusive southbound and northbound left turn lane at all intersections
- two traveling through lanes (3.3 m and curb lane 3.5 m) in each direction

It is proposed that the Millway Avenue/Applemill Road intersection is signalized with exclusive 3.3 m left turn lanes on Applemill Road to facilitate higher traffic volumes on Applemill Road. The intersection of Vaughan Street and Millway Avenue and the local Street/Millway Avenue (south of Portage Parkway) are proposed to have shared left/through/right turn lanes on both local street approaches.

The intersection of Applemill Avenue and Jane Street is also proposed to be signalised and will facilitate bus access/egress to and from the proposed bus terminal. While most routes will access Applemill Avenue via Jane Street, some will use Millway Avenue. All bus access to the terminal will be to/from Applemill Road, via a driveway in public control.

Pedestrian and Cyclist Facilities

In order to create a superior urban environment, opportunities to maximize the number and continuity of pedestrian and cycling pathways must be sought. The utilization of the VMC walkway and cycling network will not only depend on development within the VMC study area, but also the level of connectivity between the VMC and the surrounding development areas (through the use of broader regional based cycling lanes, routes and off-road pathways). Without these external connections, pedestrian and cyclist activity would be limited primarily to those trips originating in and destined to areas within the VMC. It is recognized however, that confident urban cyclists will also use major high-speed arterial roadways such as Avenue Seven and Jane Street even when they are widened to 3 lanes per direction with on-street bike lanes.

In general, as illustrated on the attached Plate No. 2 pedestrians will be facilitated on sidewalks along both sides of all Millway Avenue. Sidewalks would generally be located between the curb and property line with a provision within this pedestrian precinct for appropriate landscaping, street furniture and other street elements.

On-road cycling lanes are a portion of a roadway which is designated by painted lane markings, roadside signage, painted pavement symbols and possibly indicated on maps for the exclusive use of cyclists. Cycling lanes are typically one-way facilities located on both sides of a bi-directional roadway. They are used to guide cyclists through difficult traffic situations or to establish a constant graphic reminder to motorists that cyclists are authorized users of that specific lane. Cyclists are integrated with motorists at intersections where cycling lanes are discontinued.

Based on our assessment and discussion with the City dedicated on-road cycling lanes are recommended on Millway Avenue extending from Portage Parkway to Peelar Road. The proposed on road cycling lanes on Millway Avenue are consistent with the latest Regional and City's bicycle master plan/network and will provide bicycle lane continuity within a comprehensive area network which includes the following other dedicated lanes:

- dedicated on-road cycling lanes along Avenue Seven
- dedicated on-road cycling lanes on Jane Street
- dedicated on-road cycling lanes on Edgeley Boulevard
- dedicated on-road cycling lanes on Portage Parkway

The cycling route in particular is intended to be used by people with varying degrees of confidence and cycling ability, some of whom would be intimidated cycling on major collectors or multi-lane arterial roadways; pedestrians would be accommodated along all roadways on adjacent sidewalks and thus would be separate from cyclists.

Property Impacts:

As illustrated on the Plate No. 3, the implementation of the proposed Millway Avenue realignment between Avenue 7 and Portage Parkway will have impacts on adjacent land owners; however no significant environmental impacts are anticipated. As shown on the drawing the existing Milway Avenue ROW south of Portage Parkway on the east side will no longer be required. In order to accommodate the Millway Avenue realignment, significant property needs to be protected and acquired. In addition, as illustrated on the drawing, additional ROW also needs to be acquired for the subway project.

Conclusion

The importance of the Vaughan Metropolitan Centre to the City of Vaughan is very significant. The VMC will become the focus of the City – a thriving mixed-use urban area with the full range of commercial, office and residential developments – and will effectively become the "downtown" of Vaughan and the nucleus through which connections to Woodbridge, Kleinburg, Maple and Thornhill will be sought. The identity that the VMC assumes over time will depend on the human travel experiences and quality of connectivity that can be generated by its planners.

The proposed subway terminal at Avenue 7 and Millway Avenue is a key to transforming the VMC into a transit and pedestrian supportive environment. The new standards should recognise that pedestrians (and cyclists) are legitimate users of the street and that their needs must be balanced against those of motorists.

To provide an east-west and north-south cycling spine through the VMC node, dedicated on-road cycling lanes have been introduced along Millway Avenue (one cycling lane per direction) to allow for cyclists immediately adjacent to the main stream of traffic. From a safety perspective, this is preferred to separate boulevard lanes as it fosters the relationship between cyclists and motorists, with each becoming more aware of the other. It also allows cyclists to merge into and through other traffic lanes to make the necessary turns.

The proposed cross section of Millway Avenue will accommodate a 5 lane cross section with two traveling lanes in each direction and left turn lanes at intersections.

Since the Millway Avenue intersection with Avenue 7 is one of only a few locations along Avenue 7 that can be signalized, Millway Avenue is expected to carry relatively high levels of Centre generated peak period traffic, and must therefore be designated and designed as a collector road in Vaughan's new Official Plan and in the VMC secondary plan. Due to its proximity to the subway terminal, the right-of-way however needs to be somewhat wider.

In order to facilitate higher traffic volumes on Applemill Road, the Millway Avenue/Applemill Road intersection is proposed to be signalised. At the same time, it must be recognized that a balance between traffic movement on Millway Avenue and transit terminal traffic (including pedestrians and cyclists accessing the subway terminal) is necessary to support the overall smooth functioning of the VMC transportation network.

We look forward to continuing to assist you with VMC related work and would be pleased to discuss any of the foregoing at your convenience.

Sincerely,
AECOM Canada Ltd.

Dick Gordon

Dick Gordon, P.Eng., MCIP, RPP
Manager, Transportation Planning
Dick.Gordon@aecom.com

MD:
Encl.
cc:

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- must be read as a whole and sections thereof should not be read out of such context
- were prepared for the specific purposes described in the Report and the Agreement
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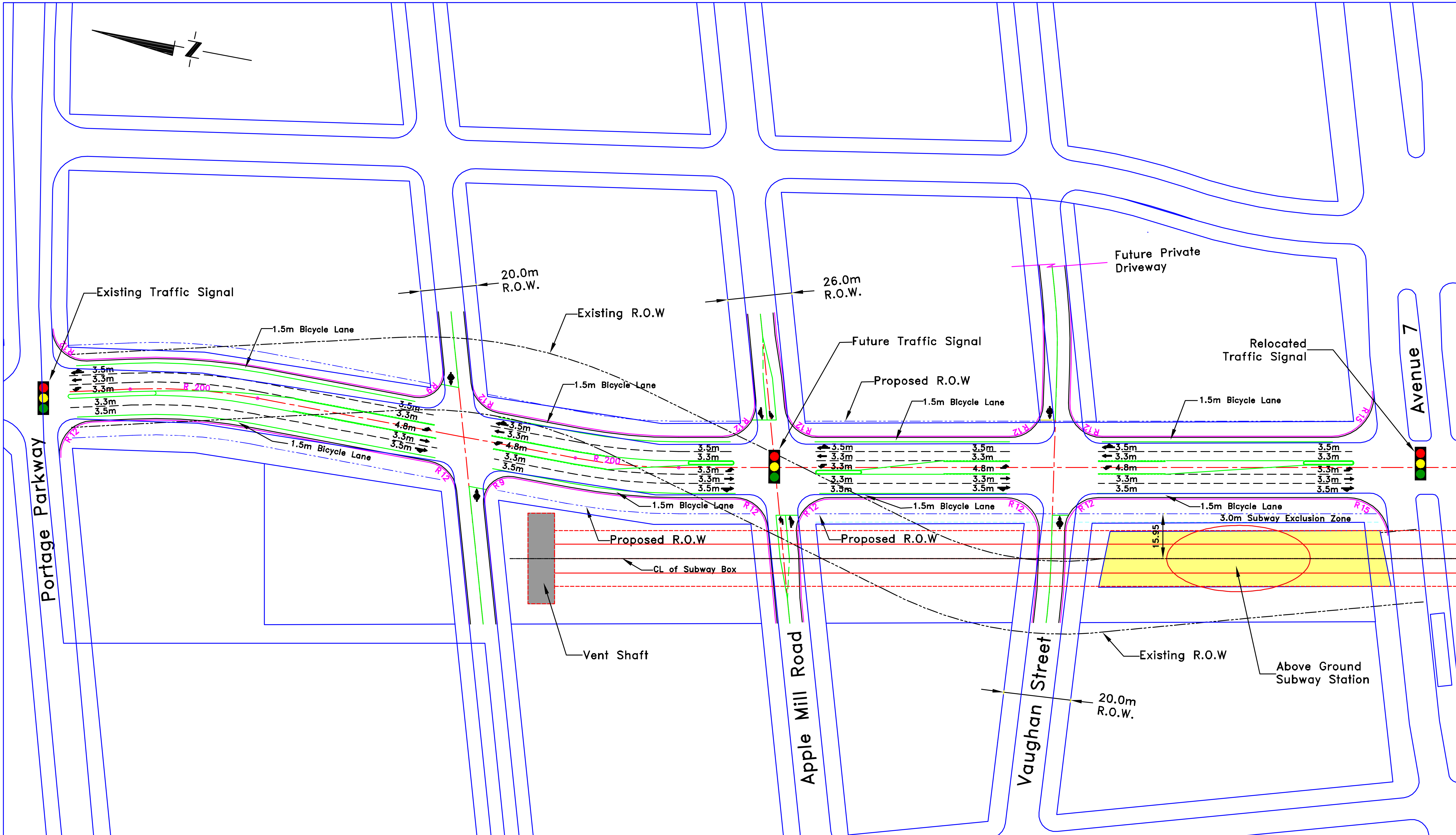


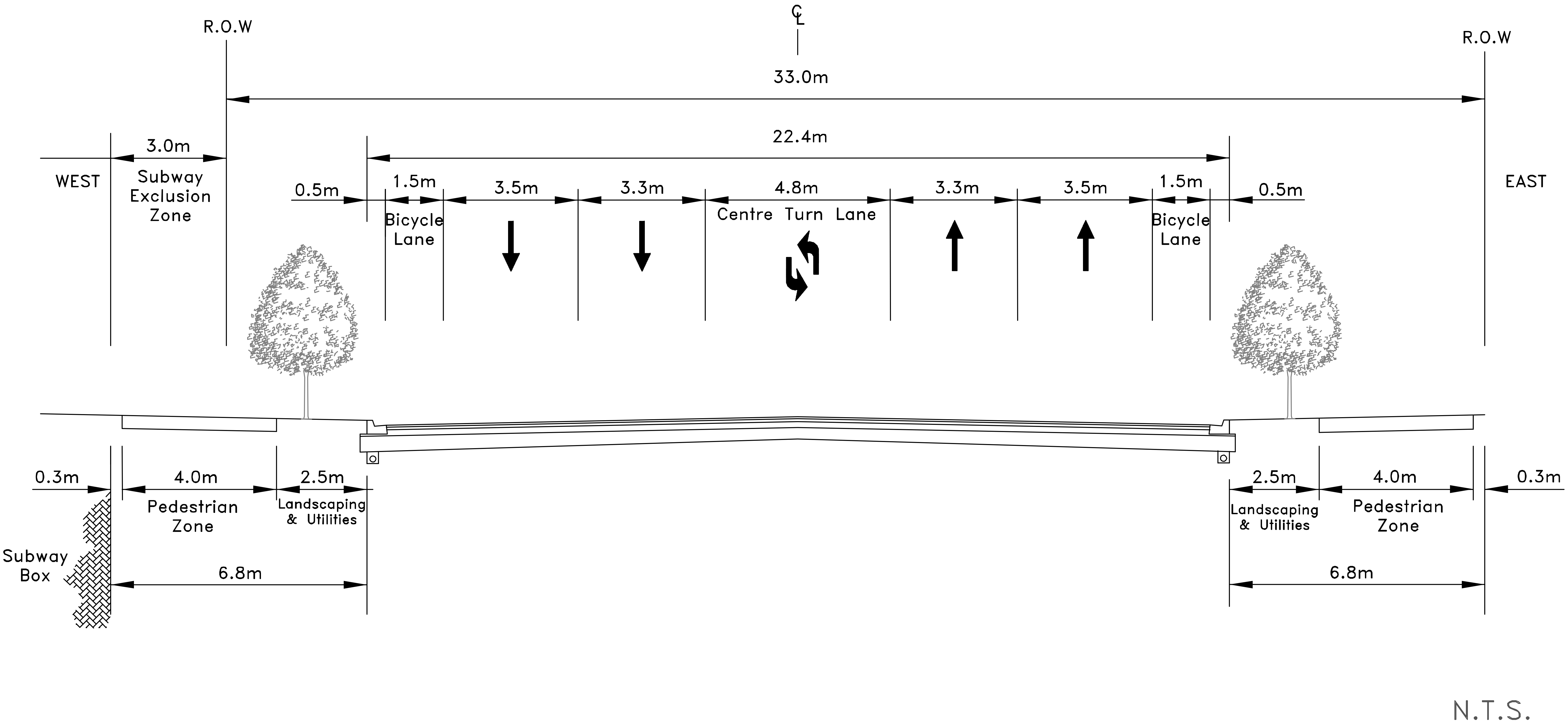
AECOM

City of Vaughan
The City Above Toronto

VAUGHAN METROPOLITAN CENTRE
PROPOSED MILLWAY AVENUE REALIGNMENT (AVENUE 7 TO PORTAGE PARKWAY)
FUNCTIONAL PLAN

PLATE: 1

APRIL 2010



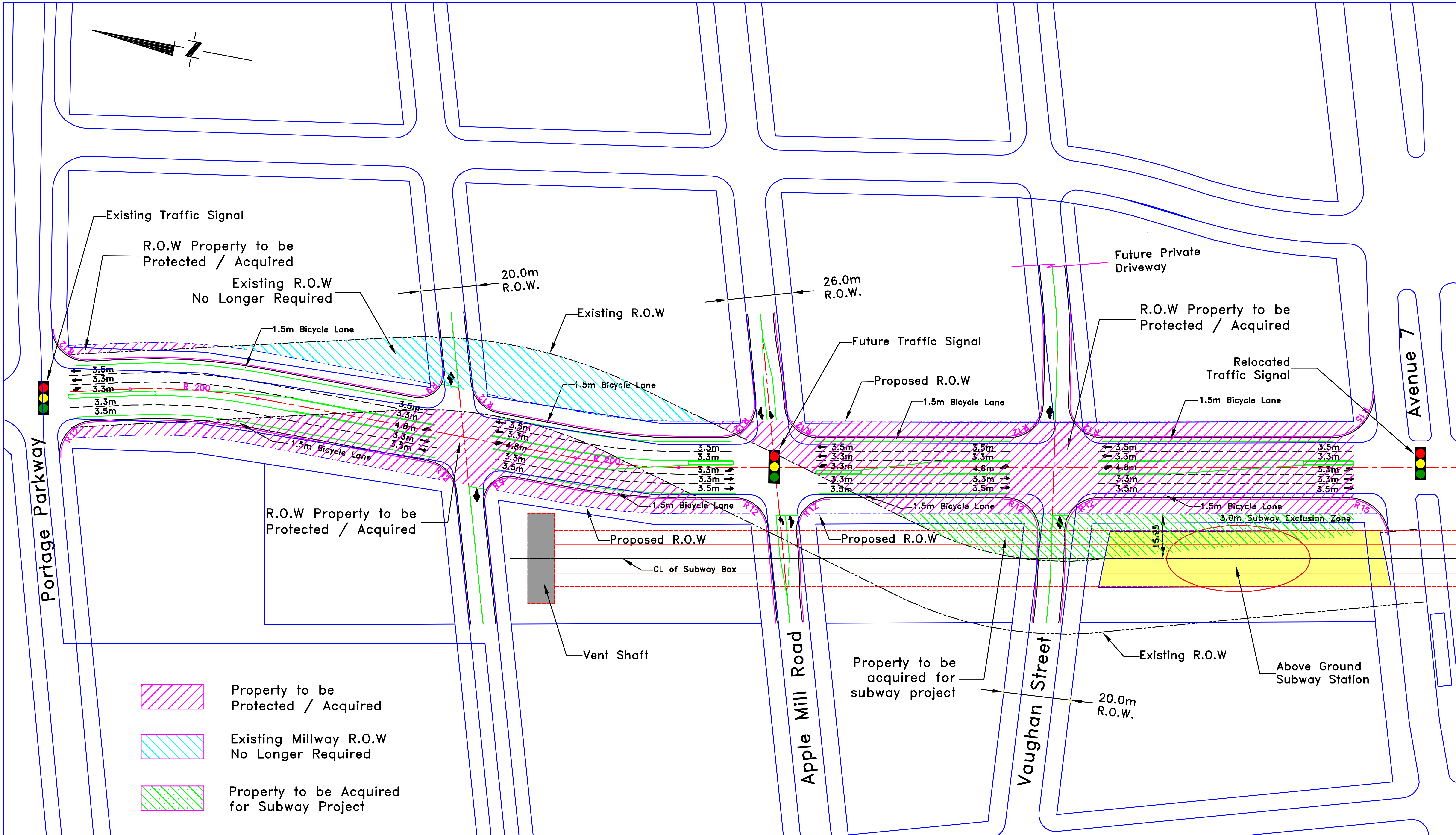
AECOM

City of Vaughan
The City Above Toronto

VAUGHAN METROPOLITAN CENTRE
PROPOSED MILLWAY AVENUE REALIGNMENT (AVENUE 7 TO PORTAGE PARKWAY)
CROSS SECTION AT SUBWAY STATION

PLATE: 2

APRIL 2010



AECOM

City of Vaughan
The City Above Toronto

VAUGHAN METROPOLITAN CENTRE
PROPOSED MILLWAY AVENUE REALIGNMENT (AVENUE 7 TO PORTAGE PARKWAY)
PROPERTY IMPACT

PLATE: 3

APRIL 2010

Appendix IV

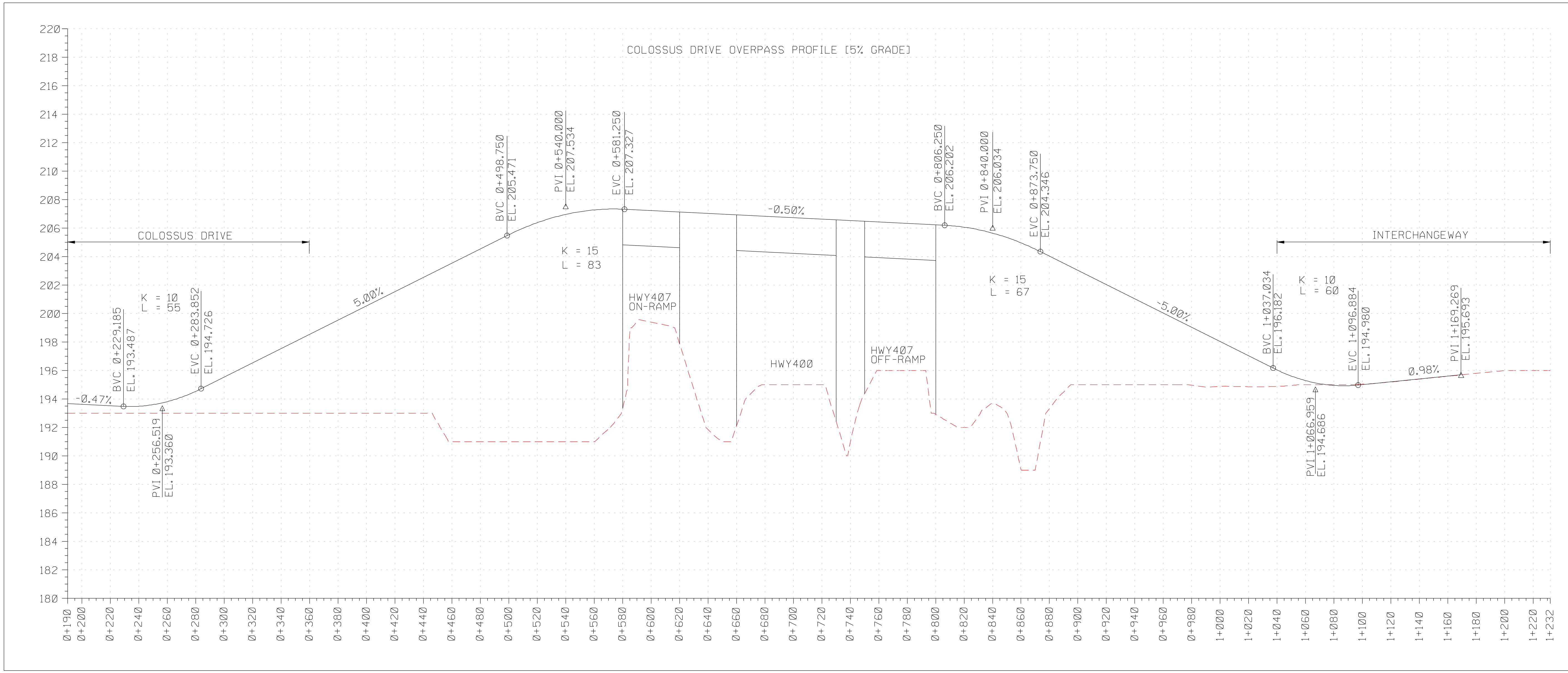
Preliminary Assessment of Road Network Improvements

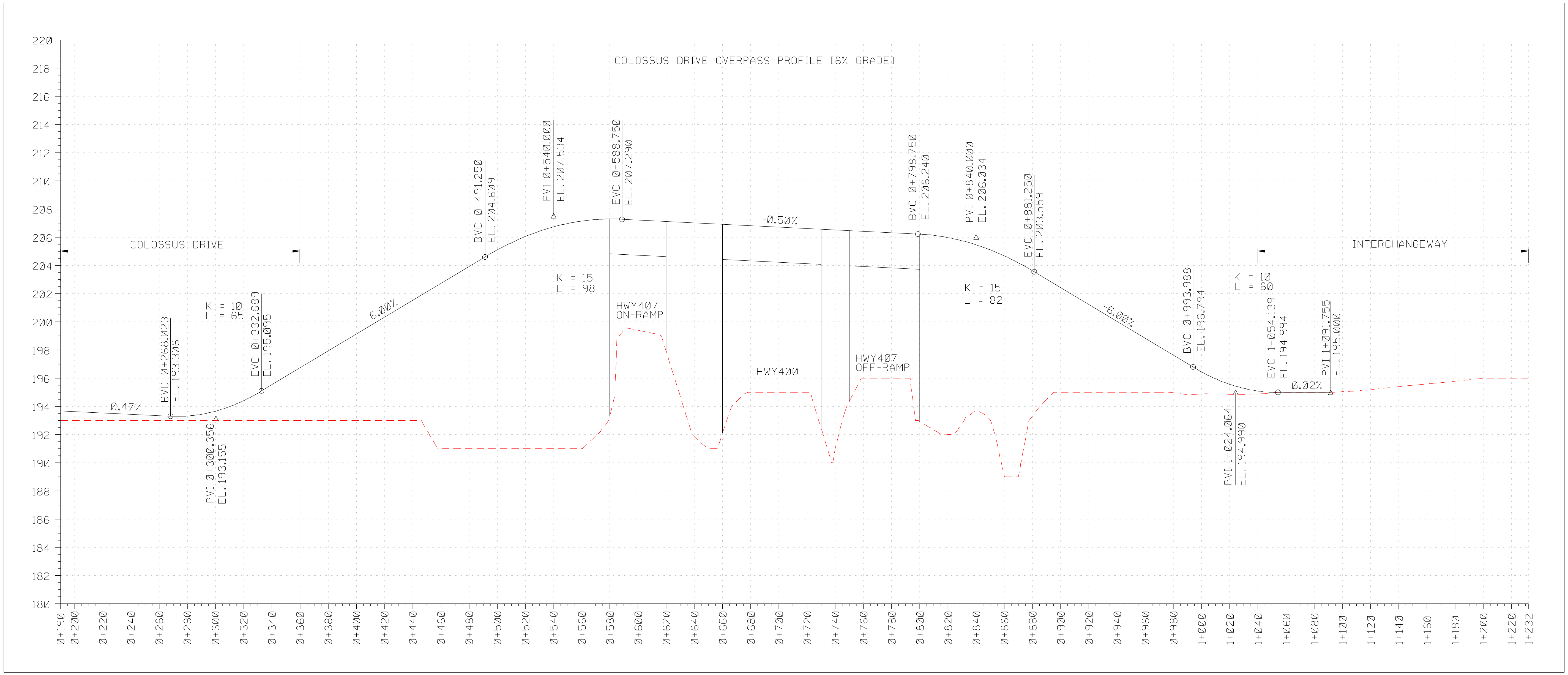
Appendix IV.   Preliminary Assessment of Road Network

Options	Original Description	Proposal Modification or Refinement AECOM	Compatibility with OPA 528	Benefits	Physical Feasibility	Operational Feasibility	Conclusion
1A	Langstaff interchange(potential improvements)	Full Interchange (NB on-ramp and SB off-ramp) - NB on-ramp is proposed to be located in the NE quadrant of the interchange while SB off-ramp is located in the SW quadrant.	No	Integral component of VCC truck reduction strategy; divert traffic away from Hwy 7 interchange, particularly trucks	Feasible, but may require removal of the building within the NE quadrant; New signal required on Langstaff west of Hwy 400; Impact on the pond	No significant constraints; appears feasible	Not carrying forward due to significant impact on building within the NE quadrant
1B	Langstaff interchange(potential improvements)	Full Interchange (NB on-ramp and SB off-ramp) - NB on-ramp is proposed to be located in the SE quadrant of the interchange while SB off-ramp is located in the NW quadrant.	No		Feasible with some minor impact on parcel of land for building in the SE quadrant of the interchange; New signal required on Langstaff west of Hwy 400; Impact on the pond		Option 1B - SB off-ramp in NW quadrant and NB on-ramp in SE quadrant merit further functional study - **Carrying forward for further testing**
2A	400/Hwy7 interchange and suggested service roads (new configuration)	Links 4 and 5 in current plan	Yes	Improves access to VCC; Alleviates traffic congestion on Hwy 7	Feasible, but concerns raised by property owners	MTO concerns previously regarding weaving on Hwy 400 and elimination of Hwy 7 on-ramp previously addressed by Cansult and Delcan studies (Feasible)	**Carry forward for further testing**
2B	400/Hwy7 interchange and suggested service roads (modifications to existing configuration)	Modification to 400/Hwy7 interchange and suggested service roads (new configuration) (Link 5)	No			Adds new left turn movements to ramp terminal intersections and complicates signal system; Proximity of traffic signals; Merging difficulties on existing loop ramps; inconvenient for traffic but will reduce traffic on Hwy 7 and add to the viability of the bypass network; No direct access for E/W traffic from Hwy 7 to S and N bound Hwy 400	Do not carry forward
3	Applewood extension southerly to Hwy 7 (new service road)	Applewood southerly extension to Ramp Terminal at Hwy 7 (Link 4)	Yes	Increase system connectivity; Provide direct link b/n areas east and west of Hwy 400; Provide access to new Hwy 400 Ramp terminal; Alleviates traffic congestion on Hwy 7	Feasible	MTO concerns with connection to ramp terminal, but appears feasible	**Carry forward**
4	Portage extension (new creek crossing)	Portage extension - New roadway from Jane to Creditstone	Yes	Increase system capacity; Provide relieve for Hwy 7 by functioning as a northern bypass	Feasible but requires Creek crossing and potential property impacts for new ROW (industrial buildings)	Feasible	**Carry forward**
5	Creditstone upgrading (improvements to existing row)	Creditstone upgrade from Portage Road to Peelar Road - 4 lanes	No	Serves as an eastern bypass to divert traffic from VCC (Hwy7); 4 lane roadway will improve travel time; Increase traffic capacity	Feasible but ROW south of Hwy 7 may need to be increased	Feasible	**Carry forward**
6A	Colossus crossing (new bridge crossing)	Colossus Bypass - From East of Hwy 400 to Creditstone along Interchange Way	No	Serves as a southern bypass to divert traffic from Hwy 7 including trucks; Increase system capacity; Improve travel times; facilitate approved transit	Feasible	Feasible	**Costly but significant system benefits (Need to resolve preferred alignment) - Carry forward**
6B	Colossus crossing (new bridge crossing)	Colossus Bypass - From East of Hwy 400 to Creditstone - roughly along Exchange/Peelar (immediately north of Hwy407)	No	Serves an southern bypass to remove traffic from VCC; Increase system capacity; Improve travel times	Feasible	Feasible	
7A	New North-South Road (West of Hwy.400)	Western Component of New Bypass System (East of Weston Road)	No	Serves as a western bypass to divert traffic from VCC; Increase system capacity; Improve travel times	Further study needed	Further study needed	Further assessment of these 2 options needed
7B	New North-South Road (West of Hwy.400)	Western Component of New Bypass System (West of Weston Road)	No				
8	Langstaff extension across CN rail yard	Connecting link (bridge or tunnel) between Creditstone and Keele	No	Provides additional east-west arterial capacity for autos, trucks and transit, relieving congestion on Hwy.7	Further study needed	Feasible	**Costly, but significant system benefits (Needs further assessment of physical feasibility and impacts on CN operations) - Carry forward**

Appendix V

Colossus Extension Profiles


COLOSSUS DRIVE OVERPASS PROFILE [5% GRADE]
COLOSSUS DRIVE
INTERCHANGEWAY
-0.47%
BVC 0+229.185
EL. 193.487
K = 10
L = 55
EVC 0+283.852
EL. 194.726
PVI 0+256.519
EL. 193.360
5.00%
BVC 0+498.750
EL. 205.471
PVI 0+540.000
EL. 207.534
EVC 0+581.250
EL. 207.327
K = 15
L = 83
-0.50%
HWY407
ON-RAMP
HWY400
HWY407
OFF-RAMP
BVC 0+806.250
EL. 206.202
PVI 0+840.000
EL. 206.034
EVC 0+873.750
EL. 204.346
K = 15
L = 67
-5.00%
BVC 1+037.034
EL. 196.182
K = 10
L = 60
EVC 1+096.884
EL. 194.980
PVI 1+066.959
EL. 194.686
0.98%
PVI 1+169.269
EL. 195.693



COLOSSUS DRIVE OVERPASS PROFILE [6% GRADE]
COLOSSUS DRIVE
INTERCHANGEWAY
-0.47%
BVC 0+268.023
EL. 193.306
PVI 0+300.356
EL. 193.155
K = 10
L = 65
EVC 0+332.689
EL. 195.095
6.00%
BVC 0+491.250
EL. 204.609
PVI 0+540.000
EL. 207.534
K = 15
L = 98
EVC 0+588.750
EL. 207.290
HWY407
ON-RAMP
-0.50%
HWY400
HWY407
OFF-RAMP
BVC 0+798.750
EL. 206.240
PVI 0+840.000
EL. 206.034
K = 15
L = 82
EVC 0+881.250
EL. 203.559
-6.00%
BVC 0+993.988
EL. 196.794
K = 10
L = 60
PVI 1+024.064
EL. 194.990
EVC 1+054.139
EL. 194.994
0.02%
PVI 1+091.755
EL. 195.000
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1+060
1+080
1+100
1+120
1+140
1+160
1+180
1+200
1+220
1+232

Appendix VI

Halcrow Documentation on Model Runs

1. Vaughan Sub-Area Model Technical Report
2. VMC Tech Note
3. Sensitivity Analysis of VMC Road Network for Colossus Crossing, Langstaff Extension, and Langstaff Interchange Improvements
4. 2031 Base Road Network EMME Results Package, AM and PM Peak Hour
5. 2031 Road Network Alternative EMME Results Package, AM and PM Peak Hour
6. 2021 Base Road Network EMME Results Package, AM and PM Peak Hour

1. Vaughan Sub-Area Model Technical Report

City of Vaughan

Transportation Master Plan Study

Vaughan Sub-Area Model (VSAM)

Draft Technical Report

November 2009

Halcrow Consulting Inc

City of Vaughan

Transportation Master Plan Study
Vaughan Sub-Area Model (VSAM)
Draft Technical Report
November 2009

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City of Vaughan

Transportation Master Plan Study

Vaughan Sub-Area Model (VSAM)

Draft Technical Report

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Approved by
1		Draft Final Report	6/11/09	DFC

Contents

1 Introduction

1.1 Background

As part of the on-going Vaughan Transportation Master Plan (TMP) Study, Halcrow was commissioned by the City of Vaughan and the prime consultant, AECOM, to develop a sub-area travel demand model for the City of Vaughan based on a local refinement of the York Rapid Transit Plan (YRTP) regional model. For the purposes of this TMP Study, Halcrow refined, updated and validated the YRTP model to a 2006 base to reflect the more current travel habits and traffic count information specific to the study area. This new Vaughan Sub-Area Model (VSAM) will be used to evaluate future transportation infrastructure requirements for the City of Vaughan in the long and short terms (2011, 2021 and 2031), in support of the study objectives to encourage public transit use, alleviate congestion and promote liveable street networks and neighbourhoods within the City. The model will also be used by the City Staff for their in-house traffic forecasting after completion of the TMP Study. This technical report documents the VSAM development and validation process as well as the resulting forecasts generated for this study.

1.2 Key Tasks

Some of the key tasks involved in the VSAM model development and validation are described below:

- Refined traffic zone system within the City of Vaughan to provide more realistic representation of the network and of walking distances to transit stations/stops;
- Updated the existing YRTP model base year from 2001 to 2006 on the latest EMME 3 platform;
- Added local collector roads which are under the jurisdiction of the City of Vaughan for local traffic diversion and infiltration analysis;
- Improved the YRTP modelling process to provide more reliable auto traffic and transit ridership forecast;
- Validated the model results at the screenline level for the base year 2006;
- Developed a PM model based on the calibrated AM model to estimate future PM peak hour auto traffic demand; and
- Developed future 2031 base model using updated land use and demographic data, road networks and external matrices.

1.3 Deliverables

The following deliverables were prepared for this VSAM study:

- A refined sub-area model for the base year 2006 and 2031;
- 2006 and 2031 auto and transit base networks;
- An enhanced model input preparation spreadsheet to incorporate land use and other necessary zonal data; and
- A set of EMME macros for implementing base and future year model runs.

1.4 Report Organization

This report is organized into six sections. **Section 2** describes the model structure, model updates and model inputs for the 2006 base year. **Section 3** presents the validation results for the AM model. **Section 4** describes the PM modelling approach, shopping trip analysis and the PM model validation. **Section 5** summarizes the 2031 model assumptions and the resulting forecasts. Finally, **Section 6** provides a summary and conclusions.

2 AM Model Development

2.1 Introduction

This chapter documents the model development and validation of the AM Vaughan Sub-Areal Model (VSAM). This chapter is organized into five sections:

- Section 2.2 describes the YRTP and Western Vaughan IEA model
- Section 2.3 provides an overview of the VSAM model
- Section 2.4 documents the model update process
- Section 2.5 describes the traffic zone system and demographic inputs
- Section 2.6 describes the road and transit networks

2.2 YRTP and Western Vaughan IEA Models

VSAM is an updated version of the YRTP regional model, which is a traditional 4-Stage EMME/2-based model developed by IBI Group for the York Region Rapid Transit Plan (YRTP) Study in 2003. The YRTP model was designed primarily for forecasting transit ridership on the proposed rapid transit lines along the Yonge Street and Highway 7 rapid transit corridors at the time of the study. It has the capabilities to model three trip purposes including work, school and other trips during the AM peak period (6AM-9AM) by the motorized travel modes.

The YRTP model uses the standard 2001 GTA traffic zone system developed by the Data Management Group, with enhanced zonal detail in the transit-oriented intensification areas to better reflect variations in walk access to transit stops. This multi-modal model was originally calibrated using 2001 travel data collected as part of the 2001 Transportation Tomorrow Survey (TTS) and 2001 traffic and transit count information. It estimates peak period traffic demands for the base and future horizon years at the arterial and collector road level within the Greater Toronto and Hamilton Area (GTHA) as well as transit demands for planned rapid transit facilities and feeder bus routes.

In the fall of 2007, Halcrow was commissioned by York Region and UMA (now AECOM) to update the YRTP model and provide travel demand forecasts for different auto and transit network alternatives in support of the Western Vaughan Individual Environmental Assessment (IEA) Study. While the traffic zone system of the YRTP model was retained, demographics and networks were updated to 2006 base for the Western Vaughan IEA. The resulting 2006 trip matrices were validated against the 2006 TTS and traffic assignment were checked against 2006 traffic counts. Given the full 4-stage multi-modal modelling capability and the geographic similarity of the revised Western Vaughan IEA model, it was the logical choice as the basis for the VSAM.

2.3 VSAM Overview

2.3.1 Modelling Approach

VSAM is a standard travel demand model that estimates the overall trip-making decisions of individuals within the GTHA. Such models are often referred to as “macroscopic” models. The techniques used and degree of detail of model results are in sharp contrast to traffic simulation or “microscopic” models that simulate the expected behaviour of individual trip makers as they negotiate their respective paths through a section of the transportation network.

The principal inputs to VSAM are:

- Land use (e.g. population and employment information by traffic zone)
- Road network (e.g. number of lanes, lane capacity, etc.)
- Transit network and services (e.g. route alignment, stops, headways, etc.)
- Economic and travel cost data (e.g., value of time, vehicle operating costs, parking costs, transit fares, etc.)

The model outputs are forecasts of travel volumes and times and out-of-pocket costs by travel mode for:

- All origin-destination pairs
- Each roadway link in the coded road network
- Each transit line segment in the coded transit network

VSAM is a multi-modal transportation model that estimates travel demand in the following steps:

- Trip generation
- Trip distribution
- Mode split
- Trip assignment

These steps are covered in the following sections in more detail.

2.3.2 Trip Generation

Trip generation equations estimate the number of trips produced and attracted by each traffic zone during the AM peak period based on demographic data, trip rates and calibrated regression equations for the following major trip purposes and the corresponding sub-categories:

- Work trips for 3 occupational groups (Office / Manufacturing / Professional)
- School trips (Secondary / Post-secondary)
- Other trips

External trips with an origin or destination outside the GTHA are not modelled specifically in VSAM as they were extracted directly from the 2006 TTS data with a standard growth rate assumed for future years. These external trips are added to the internal trips after the mode split stage and prior to the trip assignment procedure.

2.3.3 Trip Distribution

The trip distribution sub-model estimates the number of person trips travelling between O-D pairs for each trip purpose. For work trips, distinct trip distributions are estimated for 3 occupational groups. Gravity models are calibrated to estimate work trip distributions through a multi-step process involving calculation of travel costs between O-D pairs and the corresponding impedance or “friction” factors that describe the propensity to travel between different locations. The friction factors are then incorporated in a balancing algorithm to convert the resulting trip production and attraction vectors from the trip generation stage into full O-D matrices for each occupation group. This process ensures that work trips are sensitive to changes in transit level-of-service and traffic congestion as the gravity model utilizes the auto and transit travel time between O-D pairs. It should also be noted that the work trip distribution models also use K-Factors to adjust for a significant undersimulation of travel to the Toronto CBD.

For school and other trips that are relatively less sensitive to traffic conditions on roads, a Fratar balancing process was used instead of the gravity model approach in estimating home to school and other, non-work, O-D matrices.

2.3.4 Mode Split

A multinomial logit sub-model is calibrated to estimate the percentage of work trips by the following motorized modes:

- Auto driver
- Public transit with walk access
- Public transit with auto access (Park/Kiss-and-ride at subway stations)
- GO Rail with walk or public transit access
- GO Rail with auto access (Park/Kiss-and-ride at GO Rail stations)

The following input variables are used in the multinomial logit formulation:

- Level-of-service and cost (e.g. In-vehicle travel time, auto operating cost, parking cost etc.)
- Transit supportive land use variables (e.g. Urban density, land use mix etc.)
- Percentage of households without auto access estimated by an auto-ownership sub-model

A standard logit function is used for estimating modal share for post-secondary school trips while observed modal split rates for each planning district are used for secondary school and other trips.

2.3.5 Trip Assignment

Trip assignment is the final step of the 4-stage modelling process. A standard generalized cost equilibrium auto assignment is implemented in this stage to model route choices for the auto drivers as well as transit patronage based on the weighted generalized cost (i.e. travel time and cost) between each O-D pair. These travel times for auto and transit were estimated using volume-delay functions and transit time functions that are described in **Section 2.6** of this chapter. Park-and-ride trips are also assigned onto the auto sub-network in this stage to allow potential users to access all the commuter parking lots for transit stations within the GTHA (e.g. TTC Finch Station). Peak hour auto traffic are estimated for assigned traffic by applying appropriate peak hour factors (PHFs) that reflect observed peaking characteristics for the auto mode.

The YRTP model does not model high-occupancy vehicles (HOV). VSAM represents HOV lanes by assuming two thirds of the capacities of the general purpose lanes in order to reflect lower traffic usage in the trips assignment stage. Trucks are not modelled in VSAM. Observed truck percentages on specific roadways or classes of roadway can be applied to the assigned auto volumes manually (post-model run) to estimate the approximate impact of truck volumes on traffic conditions.

2.3.6 Modelling Process

The modelling process is iterative, involving the recycling of outputs to achieve “convergence”. For example, travel times or travel costs are the key inputs for the trip distribution process. Whenever significant changes occur that affect travel times or travel costs in the trip distribution stage, the subsequent modelling procedures (i.e. mode split and trip assignment) are also affected. Therefore, the model must be cycled multiple times until input travel times in the trip distribution stage and the resulting output times generated from the trip assignment stage are consistent in order to achieve model convergence. It has been tested that four cycles are sufficient for the VSAM to meet the convergence criteria.

The model structure and calibration parameters of the YRTP model were largely preserved in VSAM. For more details regarding modelling methodology and calibration parameters, please refer to the following documents prepared for the YRTP program:

- Ridership Forecasting Model Development Draft Report, July 2003
- Ridership Forecasting – Model Development Report: v1.1, Dec 2003
- YRTP Model User's Manual v1.11, Feb 2005

2.4 Model Update

2.4.1 Background

As a forecasting tool designed for transit service planning, the YRTP model was calibrated specifically to provide ridership forecasts during the AM peak period with traffic zone refinement focused primarily in the rapid transit corridors along Yonge Street and Highway 7. Given its coarse traffic zone system outside the designated rapid transit corridors and its inability to forecast PM traffic (when travel demand is highest due to additional discretionary trips on the local roads), the YRTP model is not suitable for generating detailed traffic and ridership data for the network assessment required by this TMP study. To address these specific issues, Halcrow developed a sub-area model, VSAM, based on the existing YRTP model to produce more reliable traffic forecasts in local development areas within Vaughan for both AM and PM periods. The following sections document the VSAM update process.

2.4.2 Traffic Zone Refinement

In consultation with City Staff and the study team, traffic zones within the City of Vaughan were refined to produce a more detailed network and a more precise depiction of walk distances to transit stations/stops. Centroid connectors for trips coming in and out of traffic zones were also adjusted to ensure appropriate vehicle loading to road network for these refined traffic zones. Total number of traffic zone within the City increased from 124 in the YRTP model to 185 in VSAM, with 61 new zones added as a part of the refinement process.

2.4.3 Demographics Update

2006 to 2031 population and employment estimates for the entire York Region at the 2001 TTS traffic zone level were provided by the Region's Planning Department for the use of this study. However, these numbers did not reflect the anticipated growth or intensification within the City, particularly for the focused study areas (e.g. Vaughan Metropolitan Centre, Vaughan Mills and Woodbridge Core areas). As such, additional land use re-allocation was undertaken by Halcrow in close collaboration with Urban Strategies Inc. and the City Staff, to incorporate the City's latest growth scenarios, to update demographics for each 2001 TTS traffic zone, and to disaggregate the demographic and other land use data for the VSAM refined traffic zones.

2.4.4 Auto and Transit Network Refinement

Network coding for the 2006 auto network within the City was validated using 2007 aerial photos available on the York Region Geomatics Branch website to ensure proper representation of road alignment and lane configuration[1]. Travel speeds and road capacities within the City were also vetted for reasonableness. Transit route alignment, stop location and frequency were verified using published schedules provided by York Region Transit (YRT) and GO Transit for all transit routes that traverse Vaughan. Selected local collector roads that are under the jurisdiction of the City were coded in the VSAM in consultation with City Staff to allow for analysis of local traffic diversion and infiltration. Volume delay functions for estimating travel times on 407ETR were updated to reflect 2006 toll costs and estimated value of time.

2.4.5 PM Model Development

In order to address the need for PM peak period forecasts (when traffic loads are the highest for the day), a PM model was developed to estimate base year and future PM peak hour auto traffic demand based on the calibrated AM model. This PM model was developed by a procedure that transposes and factors AM auto driver matrices to PM based on relationships between the AM and PM trips by purpose, as identified from the 2006 TTS data. More importantly, this new PM model has the capability to estimate local shopping or pass-by trips for shopping centres or retail stores based on the number retail jobs for each individual traffic zone. This feature greatly improves the robustness of the PM peak forecasting results as large numbers of discretionary trips are made during the afternoon peak period, which cannot be adequately accounted for with the transpose and factor method.

2.4.6 Model Validation and Fine-Tuning

AM and PM trip matrices estimated by the VSAM were compared to the observed 2006 TTS data, and assigned traffic volumes in the VSAM were validated against observed traffic counts for each individual screenline station. Based on these validation results, an adjustment matrix was developed, after successive testing, to account for differences between the forecasted and observed 2006 AM and PM auto driver trips. Effectively, this matrix reflects the variations in trip generation rates (from the average rates used by the model) that are observed for specific land uses within the study area. This refinement significantly improves the accuracy of the model in the base year and is applied to all horizon year scenarios.

The following sections describe the model inputs required for the forecasting process.

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[1] York Aerial Photographs. York Region. Available at <http://maps.york.ca/imf/imf.jsp?site=geoRegOrtho>

2.5 Traffic Zone System and Demographics

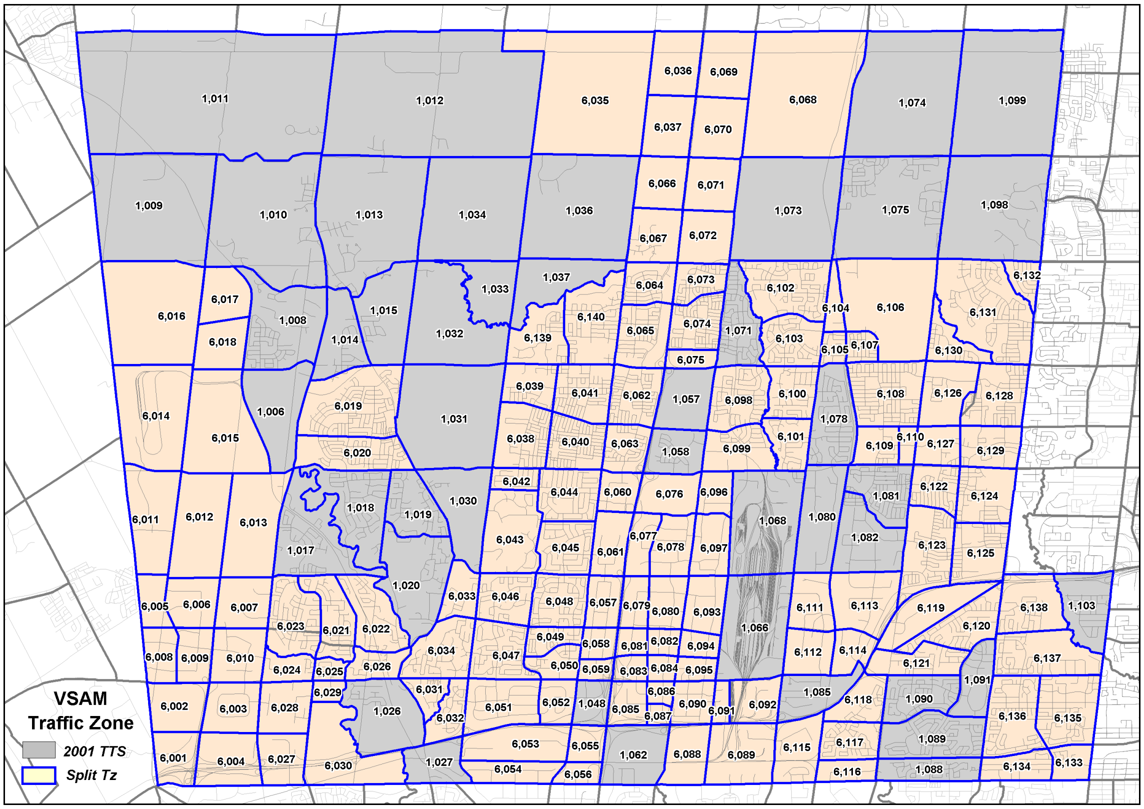
2.5.1 Traffic Zone System

The standard 2001 TTS traffic zone system developed by DMG divides the entire GTHA into 1,717 traffic zones with 103 zones located within Vaughan. Some of these 103 traffic zones along Yonge St. and Highway 7 have been split in the previous YRTP Study, which increased the total number of traffic zones in Vaughan to 124 for the YRTP Model. However, the level of traffic zone detail in the YRTP model was not sufficient for the sub-area modelling in Vaughan. A more refined sub-area zone system was therefore redefined in conjunction with the City, to better model the zonal access points throughout the city. As a result of this traffic zone refinement process, a total of 60 traffic zones were added in the VSAM, with the YRTP traffic zone system was maintained outside of Vaughan. The VSAM has a total of 1,885 traffic zones, with 184 zones in Vaughan, and 26 external traffic zones that represent trips coming from and to areas outside of the GTHA,. **Table 1** shows the traffic zone number assigned for each zone group and **Figure 1** illustrates the Vaughan sub-area zone system.

Table 1– VSAM Traffic Zone Numbering System

VSAM Study Area	Tz # Range
Vaughan	1006-1103
Vaughan (VSAM Split)	6001-6140
GTA Region	**Tz # Range**
City of Toronto	1-481
Durham Region	501-765
York Region	1006-1353
York Region(VSAM Split)	6001-6319
Peel Region	1501-1753
Halton Region	2001-2197
City of Hamilton	2501-2670
External Zones	4000-4410

Figure 1- VSAM Traffic Zone System Map



2.5.2 Land Use (Population and Employment)

Current and future year population and employment by traffic zone are key inputs to the VSAM model. For the base year (2006) VSAM, the latest population and employment data for the City of Vaughan provided by the City's Planning Department at the 2001 traffic zone level were utilized for the City, and the comparable data assumed by York Region for the YRTP model were adopted for areas outside Vaughan.

Since traffic zones within Vaughan have been refined in detail for better network representation, manual allocation were undertaken in collaboration with Urban Strategies Inc. and City Staff to distribute 2006 population and employment estimates at the 2001 traffic zone system to each smaller and refined zone. Split percentages used to distribute zonal employment into sub-categories (office / manufacturing / professional) in the YRTP model were retained for the VSAM. **Table 2** summarizes the 2006 population and employment estimates for Vaughan and GTHA municipals.

Table 2 – 2006 Population and Employment

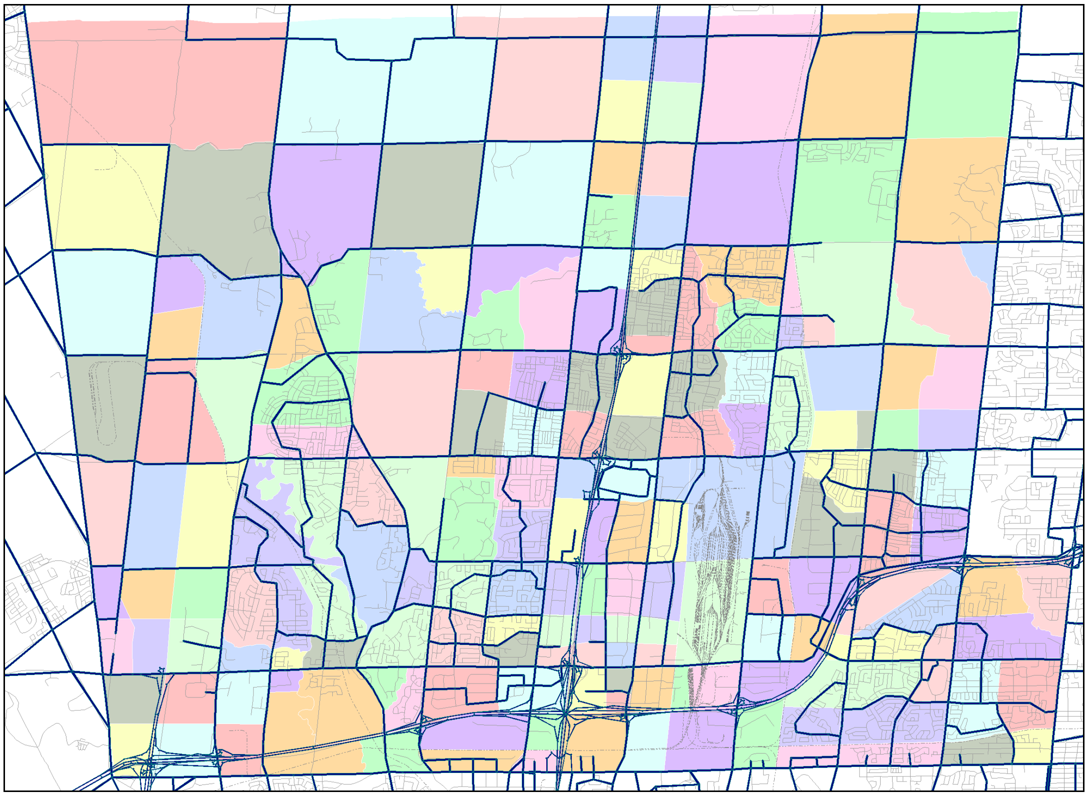
Area	Pop	Emp
Toronto PD1	190,937	451,065
Rest of Toronto	2,405,601	1,082,880
Durham	588,935	194,375
York	929,865	459,152
Peel	1,205,877	636,884
Halton	429,900	194,000
Hamilton	515,000	199,600
GTHA	**6,266,115**	**3,217,956**
Vaughan	***248,807***	***158,999***

2.6 Road and Transit Networks

2.6.1 Road Network

The road network in the YRTP model was first developed based on the 2001 GTA EMME/2 network provided by DMG. It was updated in 2006 by York Region staff for their modelling purposes and subsequently by Halcrow for the Western Vaughan IEA Study. While most of the network attributes (number of lanes, speed, capacity, length, turn restriction, etc.) from these previous models were preserved for VSAM, Halcrow conducted an extensive check and refinement of network coding within the Vaughan sub-area to ensure accurate network representation. Road geometry for the roadways within Vaughan was also refined to improve visual appearance by adding details to the highway interchanges and arterial roads. Selected local collector roads under the jurisdiction of the City were also added to the VSAM for local traffic diversion and infiltration analysis. The revised network is illustrated in **Figure 2**.

Figure 2 – 2006 VSAM Road Network



2.6.2 Transit Network

Similar to the road network, the transit network in the YRTP was first developed based on the 2001 GTA EMME/2 network with further updates by York Region staff and Halcrow. For this Vaughan TMP Study, Halcrow reviewed and updated the transit headways, route alignments and stops based on the latest schedule available for all the YRT, TTC and GO transit routes that traverse the City of Vaughan. **Table 3** shows all the transit routes that have been verified and updated for VSAM.

Table 3 – VSAM AM Transit Network

Transit Agency	Route #	Route ID	Transit Agency	Route #	Route ID
GO bus	32	Brampton - Sheppard	TTC	165F	Weston Rd South F
GO bus	42	Bolton - York Mills	TTC	191	Hwy 27 Rocket
GO bus	44	Mount Joy - York U	TTC	Subway	Bloor - Danforth Subway
GO bus	45	Streetsville-York U	TTC	Subway	Finch - Downsview Subway
GO bus	45A	York U - Square One	TTC	Subway	Scarborough RT
GO bus	46	Oakville - York U	TTC	Subway	Sheppard Subway
GO bus	47	Hamilton - York U	VIVA	Pink	VIVA Pink
GO bus	48A	Meadowville - York U	VIVA	Purple	VIVA Purple
GO bus	48B	Meadowville - York U	VIVA	Green	VIVA Green
GO bus	49	York U - Pickering	VIVA	Orange	VIVA Orange
GO bus	49	Pickering - York U	VIVA	Blue	VIVA Blue
GO bus	49	Pickering - York U 407	YRT	3	Thornhill - York U
GO bus	52	Oshawa-York U	YRT	3B	Thornhill - YorkU
GO bus	61	Richmond Hill - Union	YRT	4	Major Mackenzie
GO bus	62	Newmarket - York Mills	YRT	4A	Major Mackenzie
GO bus	64	Newmarket - York U	YRT	5	Clark
GO bus	65	Barrie - Maple	YRT	7	Martin Grove
GO bus	65	Newmarket - Union	YRT	10	Woodbridge - York U
GO bus	65	King City - Union	YRT	11	Woodbridge
GO bus	66	Newmarket - Yorkdale	YRT	12	Pine Valley
GO bus	66	Yorkdale - Newmarket	YRT	13A	Islington NapaValley
GO bus	68	Bradford - Yorkdale	YRT	13B	Islington Nashville
GO rail	65	Bradford - Yorkdale	YRT	20	Jane
TTC	35A	Jane A	YRT	22	King City
TTC	35C	Jane C	YRT	23	Thornhill Woods
TTC	35D	Jane D	YRT	27	Highway 27
TTC	35E	Jane E	YRT	77	Hwy 7 / Centre
TTC	37D	Islington North	YRT	83	Trench
TTC	37	Islington	YRT	83A	Trench
TTC	46	Martin Grove	YRT	85	Rutherford - 16 Ave.
TTC	60E	Steeles West E	YRT	85A	Rutherford - 16 Ave
TTC	60F	Steeles West F	YRT	85B	Rutherford - 16 Ave
TTC	84A	Sheppard West A	YRT	86	Weldrick Newkirk
TTC	84D	Sheppard West D	YRT	87	Langstaff Maple
TTC	105B	Dufferin North	YRT	88	Bathurst
TTC	107B	Keele North	YRT	90	Leslie South
TTC	107C	Keele North	YRT	98	Yonge North
TTC	107F	Keele North	YRT	99	Yonge South
TTC	160	Bathurst North	YRT	260	Rutherford GO Shuttle
TTC	165	Weston Road North	YRT	360	Maple Express
TTC	165D	Weston Road North D	YRT	463	Emily Carr Sec Sch
TTC	165F	Weston Rd North F			

2.6.3 Volume Delay Functions

A volume delay function (vdf) estimates the link travel time (in minutes) as a function of the link length, number of lanes, free flow speed and road capacity. As traffic volume increases, travel speeds decline, resulting in higher travel times on the link. VSAM adopts the standard Bureau of Public Road (BPR) type of vdf's for arterial road and freeway from the YRTP model as shown in **Equation 1** and **Equation 2.** The shape of the volume delay function, which is determined by the calibration parameters α and β functions, are plotted in **Figure 3**. **Table 4** shows the typical capacity assumptions for each road class.

Equation 1 – Travel Time for Arterial Road (α=1.0 and β=4.0)

$$Auto\ Travel\ Time = Length \times \frac{60}{FreeFlowSpeed} \times \left\{1 + 1.0 \times \left(\frac{Total\ Volume}{Lanes \times RoadCapacity}\right)^{4.0}\right\}$$

Equation 2 – Travel Time for Freeway (α=1.0 and β=6.0)

$$Auto\ TravelTime = Length \times \frac{60}{FreeFlowSpeed} \times \left\{1 + 1.0 \times \left(\frac{Total\ Volume}{Lanes \times RoadCapacity}\right)^{6.0}\right\}$$

Figure 3 – Volume Delay Functions

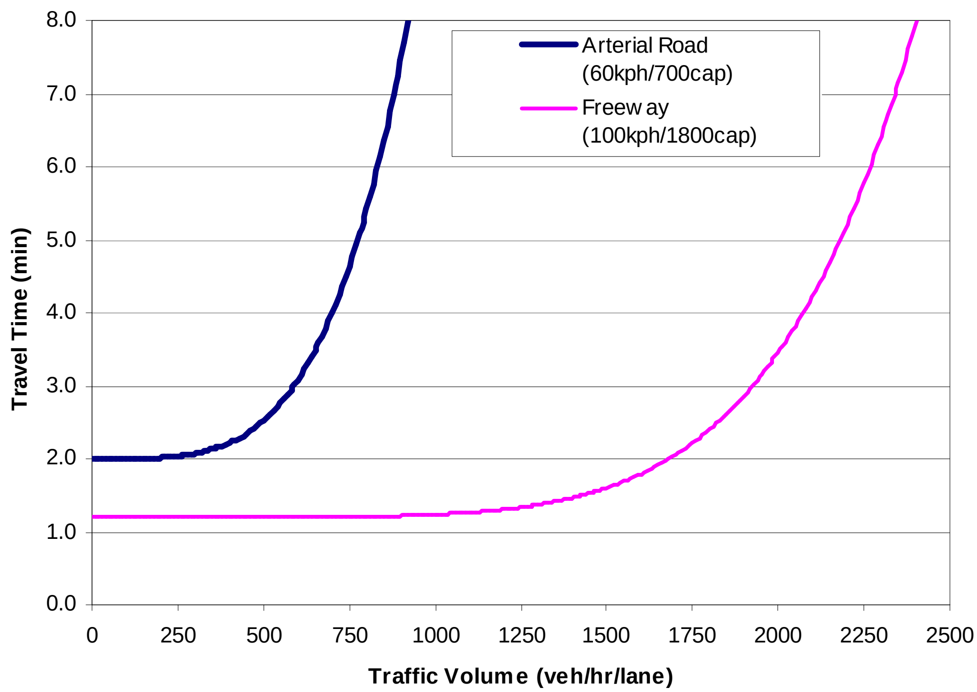


Table 4 – Typical Capacity for Each Road Class

Road Classification	Typical Capacity (veh/hr/lane)
Freeways	1,800
Freeway ramps	1,400
Controlled access or rural highways & arterial roads	1,200-1,500
High capacity urban arterial roads	900
Medium capacity urban arterial roads	700
CBD/minor arterial and collector roads	500
Centroid Connectors	9,999

2.6.4 407ETR Traffic Assignment

The 407ETR is the only toll road in Ontario and its usage is strongly influenced by toll rates and potential users' willingness to pay the associated costs. Typically, associated toll costs for a complete trip are included in the volume-delay function to model the usage of this toll facility. The resulting total travel cost is often called "generalized time", which is a combination of the actual driving time and the perceived toll charge in minutes. The YRTP model uses this generalized time in the trip distribution stage, but treats the 407ETR is the same as other 400-series freeways in the last stage of trip assignment. This treatment would potentially lead to underestimation of travel demand on Vaughan's local road system since traffic would divert from severely congested alternative roads (e.g. Highway 7) to the 407ETR without considering the toll costs associated with the usage of the toll facility. This issue was addressed in the VSAM by applying generalized time assignment in both trip distribution and trip assignment stages. An updated toll charge of 14.72¢/km and value of time of $22/hr were used to reflect 2006 values. A discount of 20 percent calculated on top of the toll cost is estimated based on recent toll road studies in North America to reflect the travel reliability gained by using the 407ETR. All these parameters have been refined and validated through an iterative calibration process and the traffic assignment was validated against the observed 407ETR traffic counts (provided to Vaughan by 407ETR staff) to ensure a reasonable goodness of fit. **Equation 3** shows the volume-delay function used for estimating 407ETR travel time.

Equation 3 – Generalized Travel Time for 407ETR (α=1.0 and β=6.0)

AutoTravelTime for 407ETR=

$$Length \times \frac{60}{Free\ Flow\ Speed} \times \left\{1 + 1.0 \times \left(\frac{Total\ Volume}{Lanes \times Road\ Capacity}\right)^{6.0}\right\} + Length \times \frac{Toll\ Rate}{Value\ of\ Time} \times 0.8$$

2.6.5 Transit Travel Time

The VSAM uses an average operating speed for each individual bus route to estimate the transit travel time. For transit routes that run on exclusive rights-of-ways (e.g. commuter rail, subways and rapid transit), transit travel times are used to estimate transit speeds on specific transit segments instead. However, as is the case with the YRTP model, transit travel time is not sensitive to congestion on auto networks as the travel speeds are hardcoded.

Equation 4 – Transit Segment Travel Time for Transit with Explicit Rights-of-Way

$$\mathit{Transit\ Segment\ Travel\ Time} = \mathit{Length} \times \frac{60}{\mathit{TransitSegmentSpeed}}$$

2.7 Model Inputs

2.7.1 Seeding Matrix and External Trips

Besides land use data and transportation networks, the VSAM also requires a set of input matrices that are prepared prior to a full model run. One of these input matrices is the auto driver "seeding" matrix, which is used at the first cycle of the trip distribution stage to initiate the gravity model for estimating the number of trips between O-D pairs. This seeding matrix contains the AM peak auto driver trip data collected from the 2006 TTS. Seeding is used only once throughout the model feedback loop and is overridden by the output trip matrix generated by the final trip assignment for the rest of the modelling cycles. The external auto driver trip matrix is another input matrix that is added to the internal trip matrix to include all the trips that would potentially travel on the VSAM transportation network. Both of these matrices were updated in this study to reflect the latest 2006 TTS data released by DMG in fall of 2008. The seeding and external matrices, together with other required input matrices inherited from the YRTP Model, have been split and allocated to the refined VSAM traffic zone system using the appropriate population and employment distributions. An annual growth rate of 1.5% is assumed for all external trips in the future horizon years.

2.7.2 Incremental Matrices

Given the complexity of model procedures and algorithms, the model coefficients and parameters were rigorously calibrated to replicate observed travel behaviour as close as possible. However, the model algorithms represent the average condition and are not able to reflect the subtle differences associated with the specific socio-demographic and/or land use characteristics in one area versus another (e.g., a Walmart may have higher trip generation rates than a Zellers, but both are retail stores). Like many regional models, the YRTP model provides reasonable travel demand estimates at the regional level but travel demand estimates are less than satisfactory for sub-areas like the City of Vaughan. To help solve this problem, an "incremental matrix" was introduced in the VSAM to enhance the fit to observed auto traffic at key screenlines within Vaughan. The first step in the development of incremental matrices was to apply an iterative assignment and demand adjustment process. The initial model matrix was then subtracted from the demand-adjusted matrices to create an “incremental matrix” for auto driver trips. This incremental matrix is subsequently added to the auto driver trip matrices prior to assignment for base and future years. This step significantly improves the base model validation and these adjustments are carried forward in future years. The final validation results are presented in the next chapter.

3 AM Model Validation

3.1 AM Trip Summary

Table 5 compares the 2006 VSAM AM peak period person trip totals with the 2006 TTS targets by travel mode. TTS data collected by DMG in 2006 shows that there are 2.6 million total trips travelling on GTHA network during AM peak period. Among these 2.6 million motorized trips, 1.75 million of the trip makers are auto drivers, 0.4 million are auto passengers and the remaining 0.5 million are transit passengers. The model generates very similar trip totals with less than 5 percent differences between the survey data and modelled trips. Regional transit mode share is estimated at 17% in VSAM compared to 18% from the survey.

Table 5 – 2006 AM Peak Period Person Trip Totals - GTHA

Region	Mode	Orig Trips			Dest Trips		
		Survey*	Model	Diff	Survey*	Model	Diff
GTAH	Auto Driver	1,732,290	1,818,390	5%	1,732,290	1,818,390	5%
	Auto Passenger	383,760	388,820	1%	383,760	388,820	1%
	Transit	467,890	463,640	-1%	467,890	463,640	-1%
	Total Trips	***2,583,940***	***2,670,850***	***3%***	***2,583,940***	***2,670,850***	***3%***
	Transit Mode Share	***18%***	***17%***	***-1%***	***18%***	***17%***	***-1%***

** - 2006 Transportation Tomorrow Survey (TTS) Data*

For a smaller study area like Vaughan, however, model's goodness-of-fit is usually less accurate compared to the aggregated regional numbers due to difficulties in estimating local traffic variation and the unique travel characteristics for neighbourhoods. **Table 6** shows that VSAM overestimates the travel demand by 6 percent for trips generated by Vaughan and 14 percent for trips attracted to Vaughan. To solve this problem without undergoing a major re-calibration effort to update the YRTP model parameters, an "incremental matrix" was introduced to enhance the fit to the observed auto traffic at key screenlines within Vaughan. This incremental matrix was estimated based on the latest 2006/2007 traffic counts on major arterials and local collectors within Vaughan. An iterative approach was undertaken to validate the matrix at both trip and screenline level. **Table 7** shows the improved AM peak hour auto driver trips for trip assignment. Screenline validation is described in the next section.

Table 6 – 2006 AM Peak Period Person Trip Totals - Vaughan

Region	Mode	Orig Trips			Dest Trips		
		Survey*	Model	Diff	Survey*	Model	Diff
Vaughan	Auto Driver	82,980	89,060	7%	88,500	101,250	14%
	Auto Passenger	17,750	18,810	6%	17,850	18,970	6%
	Transit	11,570	11,690	1%	5,010	6,440	29%
	Total Trips	***112,300***	***119,560***	***6%***	***111,360***	***126,660***	***14%***
	Transit Mode Share	***10%***	***10%***	***-1%***	***4%***	***5%***	***1%***

** - 2006 Transportation Tomorrow Survey (TTS) Data*

Table 7 – 2006 AM Peak Hour Auto Driver Trip Totals - Vaughan

Region	Mode	Orig Trips			Dest Trips		
		Survey	Model	Diff	Survey	Model	Diff
Vaughan	Auto Driver	35,670	36,220	2%	38,170	38,870	2%

3.2 Screenline Validation

Screenline validation was undertaken by comparing the observed traffic counts with the modelled volumes generated by VSAM. **Figure 4** and **Figure 5** show the 11 screenlines (22 directional screenlines) and 214 count stations identified for this validation to account for most of the major arterials and local collectors within Vaughan. ATR and turning movement counts were provided by York Region and the City of Vaughan while cordon counts from DMG and traffic counts from the 407 ETR were also utilized.

In measuring the goodness of fit for individual screenlines, the GEH statistic was used. A GEH analysis provides a different form of review and adds value because it considers the relative importance of specific roads or transit lines crossing each screenline in relation to the volume of traffic that they carry. For example, a 10% error on a count of 100 cars is less significant than a 10% error on a count of 3,000 cars.

The GEH statistic measures the overall level of error associated with traffic volumes on the individual roads being analyzed, with lower values reflecting a better fit between model-based estimates and the observed traffic. A GEH statistic of less than 10 on individual screenlines is an accepted standard by international agencies (e.g. TransFund New Zealand) and, therefore, an effort has been made to achieve this standard for most, if not all screenlines . This statistic is defined as:

$$GEH = \sqrt{\frac{(V_{obs} - V_{est})^2}{0.5 \times (V_{obs} + V_{est})}}$$

Figure 4 – East-West Screenline

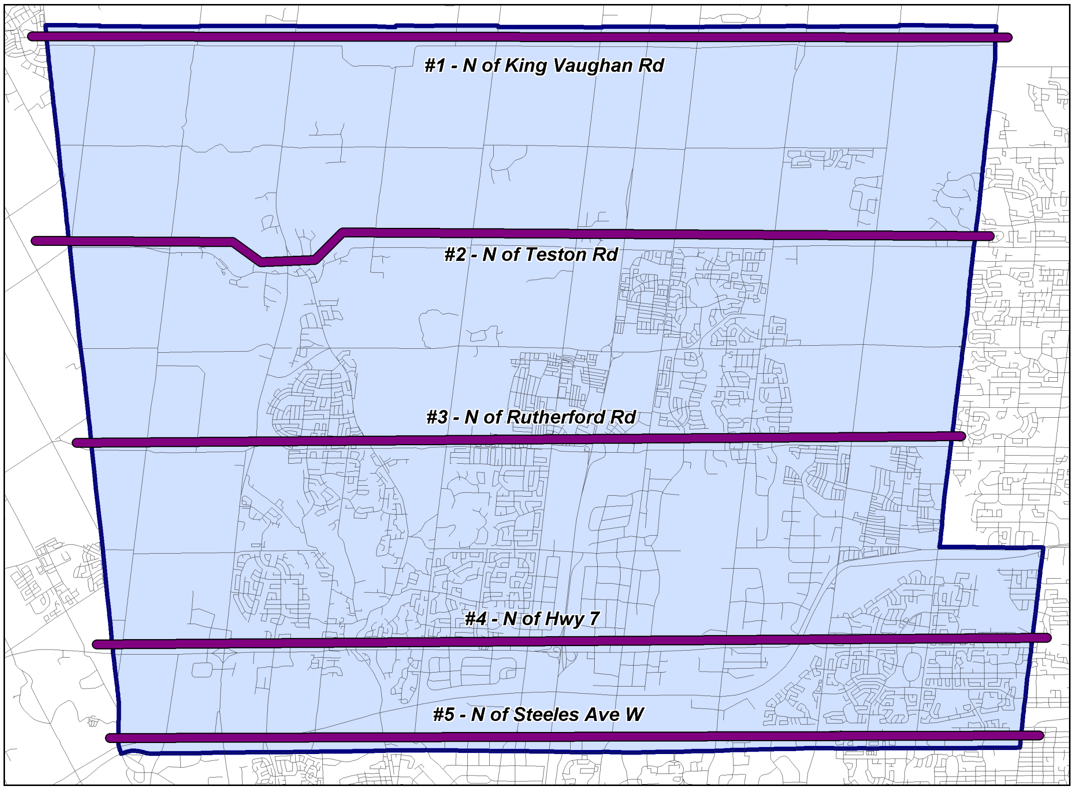


Figure 5 – North-South Screenline

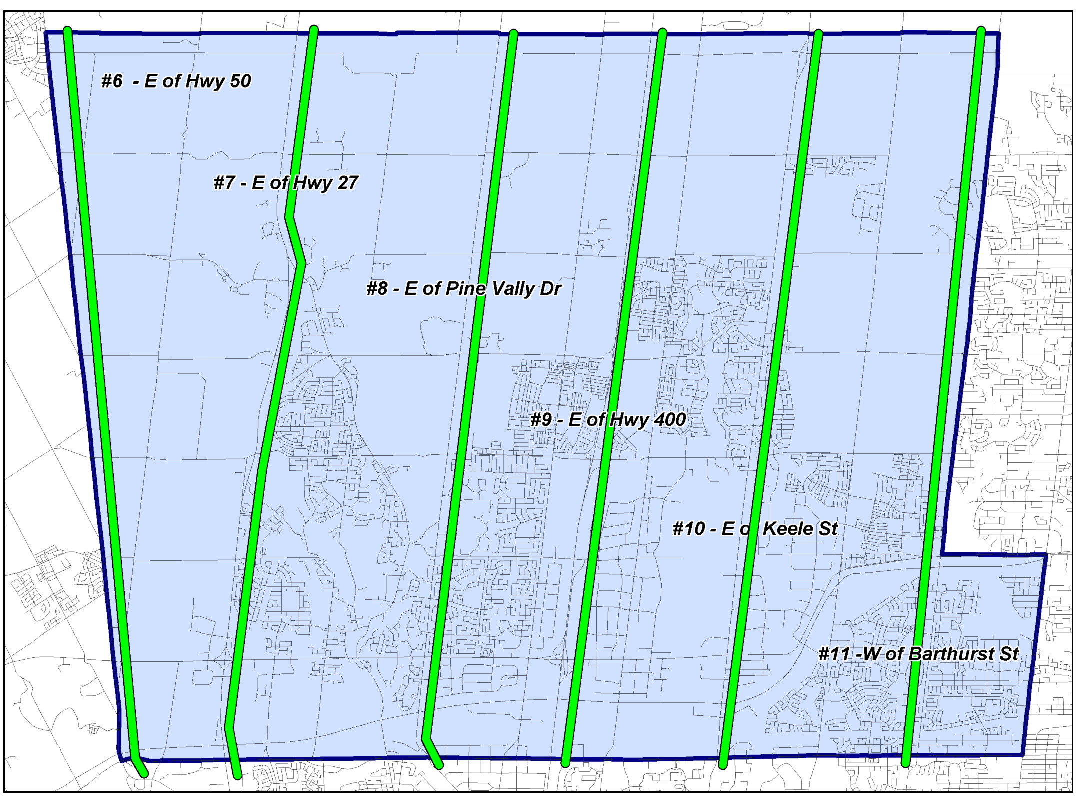


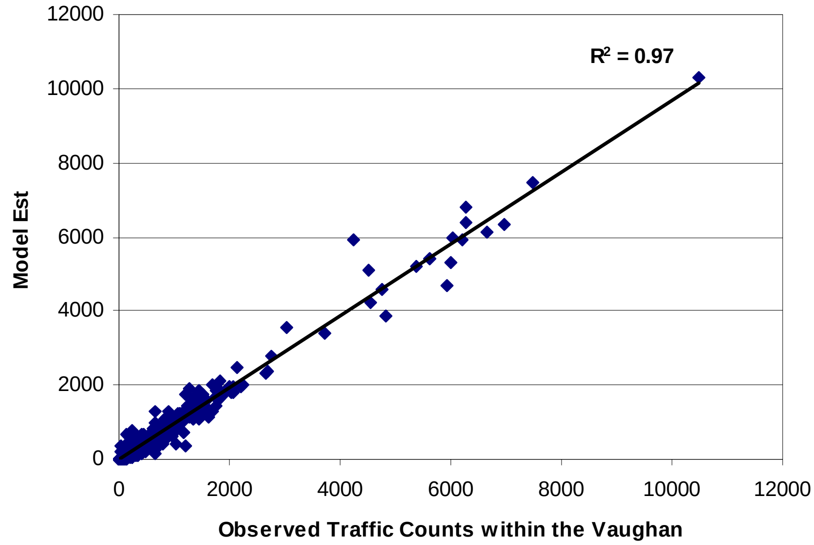
Table 8 compares the modelled AM peak hour auto volumes with the observed traffic counts. 18 out of 22 directional screenlines (82%) produce a GEH lower than 10 and approximately 77% of the auto count stations (165 out of 214) produce a GEH lower than 10.

Table 8 – AM Sub-Area Traffic Count Comparison

Scln	Dir	Screenline	Obs	Est	GEH
1	N	N of King Vaughan Rd	3,630	3,250	6.5
1	S	N of King Vaughan Rd	10,580	9,830	7.4
2	N	N of Teston Rd	4,970	4,430	7.8
2	S	N of Teston Rd	12,570	12,760	1.7
3	N	N of Rutherford Rd	7,170	6,490	8.2
3	S	N of Rutherford Rd	16,360	17,510	8.9
4	N	N of Hwy 7	10,670	10,100	5.6
4	S	N of Hwy 7	23,560	23,820	1.7
5	N	N of Steeles Ave W	13,540	11,950	14.1
5	S	N of Steeles Ave W	24,680	25,910	7.8
6	E	E of Hwy 50	12,090	12,730	5.7
6	W	E of Hwy 50	8,820	7,130	18.9
7	E	E of Hwy 27	10,960	11,250	2.8
7	W	E of Hwy 27	11,200	9,600	15.8
8	E	E of Pine Valley Dr	11,490	12,040	5.1
8	W	E of Pine Valley Dr	10,230	9,430	8.0
9	E	E of Hwy 400	15,860	14,830	8.3
9	W	E of Hwy 400	12,820	12,190	5.7
10	E	E of Keele St	7,920	8,550	7.0
10	W	E of Keele St	9,760	10,180	4.2
11	E	W of Bathurst St	10,470	11,510	9.9
11	W	W of Bathurst St	14,370	11,600	24.3

Figure 6 shows that the R-squared of the model fit to observed counts for all screenline stations is 0.97. Based on these validation statistics, it can be concluded that the model provides reasonable travel demand estimation within the Vaughan sub-area.

Figure 6 – 2006 AM VSAM Screenline Validation



4 PM Model Development and Validation

4.1 *Modelling Approach*

To address the need to forecast auto traffic during the PM peak hour, conversion procedures were developed to transpose and factor the AM auto driver trip matrices to obtain the PM peak hour traffic. This chapter provides a summary of this conversion procedure, which involves the following steps:

- Analyze the 2006 TTS data and estimate conversion factors
- Introduce local shopping trip estimation
- Estimate and apply incremental matrices
- Validate the PM model at the screenline level

4.2 *TTS Survey Data Analysis*

4.2.1 Introduction

The TTS collected travel information from households within the GTHA and the survey data were used to develop the trip generation, trip distribution and mode choice model in the YRTP and VSAM AM models. Since the TTS database contains 24-hour origin and destination information, the survey data were analyzed to understand relationship between the morning and afternoon trip purposes in the study area. Through the analysis of the TTS survey data, appropriate afternoon trip purposes were identified and compared to the morning trip purposes. Conversion factors were then developed to convert the AM auto driver trip matrices to the PM trip controls for each trip purpose. This section outlines the cross-tabulation conducted to obtain the conversion factors, followed by the validation of these conversion factors to ensure the consistency of the data.

4.2.2 PM Peak Period

It was necessary to determine the modelled PM peak period before establishing the AM to PM relationship. **Table 9** shows the total number of GTHA destination trips that start from 3pm till 7pm by 3-hours intervals. It is observed that higher demand normally occurs between 3pm to 6pm, which is a reasonable choice for the PM modelling period.

Table 9 – PM Peak Period Selection

Trip Purpose of Destination	2001			2006		
	3:00-5:59PM	3:30-6:29PM	4:00-6:59PM	3:00-5:59PM	3:30-6:29PM	4:00-6:59PM
Other	**345,100**	392,630	445,000	**366,190**	410,590	458,430
Subsequent work	**72,830**	61,190	52,350	**68,390**	55,070	46,680
School	**12,820**	15,410	16,850	**12,460**	13,970	14,730
Subsequent school	**5,080**	5,210	5,450	**4,740**	5,330	6,060
Daycare	**20,590**	19,520	17,470	**25,000**	23,760	20,940
Facilitate a passenger	**213,860**	186,990	163,120	**239,490**	202,050	179,690
Work	**104,050**	85,430	72,330	**96,670**	78,850	66,090
Home	**2,076,860**	1,999,120	1,790,880	**2,198,460**	2,063,660	1,837,990
Market/Shop	**208,240**	217,030	229,200	**237,980**	240,680	247,510
Unknown	**180**	230	220	**80**	60	60
Total	**3,059,610**	**2,982,760**	**2,792,870**	**3,249,460**	**3,094,020**	**2,878,180**

4.2.3 PM Trip Purposes

The TTS survey data collected information according to 9 origin and 10 destination trip purposes that combined to produce over 90 unique trip purposes. For the purpose of model calibration, it was essential to consolidate these trip purposes into major categories with similar travel characteristics. Initially, the TTS data were aggregated into 14 main trip purposes that describe travel throughout the day. **Table 10** shows the auto driver trip totals for the major trip purposes during the PM peak period (1500-1759). The 4 trip categories aggregated from these 12 main trip purposes for the VSAM AM Model are: to work, to secondary school, to post-secondary school and to other.

2006 trips by purpose were examined to understand PM travel patterns and to establish the relationship between AM and PM trip purposes. The cross tabulation analysis indicates that approximately 42 percent of the afternoon trips are related to work. The rest of the trips are mostly home-based other or non-home-based other trips. The linkage between AM “to work” trips and “work to home” trips in the PM is obvious. Less “work to home” trips are observed in the PM, which is logical as start time for work trips are usually more “peaked” during the AM period. For the rest of the trip purposes, however, relationships between AM and PM peak periods were less obvious.

Table 10 – Auto Driver Trip Purpose Analysis for PM Peak Period

	AM			PM		
Trip Purpose	**Trips**	**%**	**Trip Purp**	**Trips**	**%**	**Trip Purp**
To Work	920,990	55%	To Work	49,480	3%	Other (HBO & NHBO)
From Work to Home	27,460	2%	Other	703,080	36%	From Work
To SS	8,910	1%	To SS	370	0%	Other (HBO & NHBO)
SS to Home	20	0%	Other	5,110	0%	From SS
To PS	23,700	1%	To PS	5,240	0%	Other (HBO & NHBO)
PS to Home	60	0%	Other	18,610	1%	From PS
To Other	139,040	8%	Other	288,170	15%	Other (HBO & NHBO)
From Other to Home	14,810	1%	Other	157,530	8%	Other (HBO & NHBO)
To Serve	297,730	18%	Other	161,680	8%	Other (HBO & NHBO)
From Serve to Home	95,310	6%	Other	169,750	9%	Other (HBO & NHBO)
Serve to Work	109,860	7%	To Work	1,230	0%	Other (HBO & NHBO)
Work to Serve	860	0%	Other	65,050	3%	From Work
To Shop	18,820	1%	Other	168,160	9%	Other (HBO & NHBO)
From Shop to Home	3,090	0%	Other	139,660	7%	Other (HBO & NHBO)
Total	**1,660,660**			**1,933,120**		

As a result of this analysis, the 14 main trip purposes were re-aggregated for the afternoon to produce the following PM peak hour trip purposes as defined below:

- From Work – Based on the transposed and factored AM “to work” trips
- From Secondary School – Based on the transposed and factored AM “to SS” trips
- From Post Secondary School – Based on the transposed and factored AM “to PS” trips
- Other trips (Home-Based Other and Non-Home-Based Other) – Based on the AM “Other” trips

4.2.4 Conversion Factor of Auto Driver Trip Matrices

After selecting the modelled time period and trip purposes, conversion factors are to be estimated to adjust the transposed AM matrices to the PM control totals. **Table 1** shows the aggregated auto driver trip totals for the AM and the PM peak periods. There are approximately 16% more trips in total during the PM period with double the amount of “other” trips observed during the PM. This is due to more discretionary trips being made in the afternoon.

Table 11 – Auto Driver Trip Totals by purpose (AM & PM Periods)

AM		PM	
Trip Purpose	**Trips**	**Trip Purpose**	**Trips**
To Work	1,030,860	From Work	768,130
To SS	8,910	From SS	5,110
To PS	23,700	From PS	18,610
Other	597,170	Other (HBO, NHBO)	1,141,270
Total	**1,660,640**	**Total**	**1,933,120**

PM to AM Ratio: **1.16**

Different super-zone systems have been tested to compute the conversion matrix. **Table 12** shows the conversion factor set out for the conversion of AM work trips to PM. **Table 13** shows the factors used for other trips.

Table 12 – AM to PM Conversion Factor for Auto Driver Work Trips

Region	Toronto	Durham	York	Peel	Halton	Hamilton	total
Toronto	0.7029	0.7930	0.7228	0.7387	0.7906	1.0623	**0.7220**
Durham	0.6944	0.7428	0.8100	0.9468	1.8118	1.2000	**0.7448**
York	0.7148	0.8160	0.7540	0.7752	0.6653	1.3989	**0.7497**
Peel	0.7299	0.9610	0.7185	0.7773	0.7372	0.7317	**0.7613**
Halton	0.7373	1.3569	0.6340	0.7942	0.7605	0.8221	**0.7779**
Hamilton	0.6425	0.7687	0.6518	0.7215	0.7239	0.7807	**0.7722**
total	**0.7082**	**0.7720**	**0.7388**	**0.7694**	**0.7526**	**0.7963**	**0.7451**

Table 13 – AM to PM Conversion Factor for Auto Driver Other Trips

Region	Toronto	Durham	York	Peel	Halton	Hamilton	Total
Toronto	1.8713	2.2588	1.9919	2.1608	2.7671	1.9364	**1.9061**
Durham	2.0273	1.9152	2.5229	1.4689	0.3684	1.1143	**1.9236**
York	2.6550	2.4187	1.7264	2.4859	4.7727	3.2532	**1.8561**
Peel	2.7541	2.3388	2.8792	1.6384	2.8996	3.3668	**1.7652**
Halton	3.2396	1.4103	3.2967	2.6504	1.9980	2.8605	**2.0961**
Hamilton	3.9177	1.9500	3.5179	1.5978	2.4829	2.2029	**2.2208**
Total	**1.9519**	**1.9472**	**1.7981**	**1.7163**	**2.1070**	**2.2427**	**1.9111**

To validate the conversion method, the control PM trip matrices cross-tabulated by the TTS data were compared against estimated PM matrices that were developed by transposing and factoring of the AM trip matrices at the sub-area level. **Table 14** to **Table 16** demonstrate the validation of the auto driver work trip matrix. Initially, TTS data were cross-tabulated to generate an AM trip matrix. The AM trip matrix was then transposed and factored to produce the output PM auto driver work trip matrix. Finally, this output PM auto driver work trip matrix was compared against the control PM trip matrix generated by cross-tabulation of TTS database. R-Squared of 0.99 as shown in **Table 17** indicates a close fit between two matrices.

Table 14 – 2006 TTS AM Auto Driver Work Trips

2006	Toronto PD 1	Rest of TO	Durham	Georgina	E Gwillimbury	NewMarket	Aurora	Richmond Hill	Whitchurch Stouffville	Markham	King	Vaughan	Peel	Halton	Hamilton	Total
PD 1	5,650	7,140	250	-	-	70	100	270	-	870	-	480	2,790	250	160	18,030
Rest of TO	39,290	175,560	5,900	170	110	1,480	1,090	5,600	540	18,990	330	20,070	38,470	3,690	560	311,850
Durham	3,290	26,530	63,670	190	150	810	580	1,410	1,020	7,760	50	1,470	2,510	300	130	109,870
Georgina	180	980	220	1,680	320	2,090	600	490	140	850	20	340	200	60	20	8,190
E Gwillimbury	150	840	90	110	470	1,410	470	360	120	410	120	280	140	-	-	4,970
NewMarket	510	3,400	180	290	230	4,860	1,430	1,080	390	2,020	250	1,260	610	80	20	16,610
Aurora	470	2,820	90	60	110	1,200	1,880	1,080	110	1,520	230	1,020	710	90	20	11,410
Richmond Hill	2,000	10,500	290	80	20	880	620	5,190	150	5,030	230	4,560	2,590	330	20	32,490
Whitchurch Stouffville	160	1,180	220	40	40	270	170	540	1,070	1,090	40	350	250	-	-	5,420
Markham	2,960	20,340	1,090	20	30	570	410	3,090	520	14,510	40	2,940	3,640	290	110	50,560
King	140	1,070	-	-	50	210	150	410	80	260	240	640	560	90	-	3,900
Vaughan	2,590	20,980	380	40	70	470	260	1,930	70	3,030	220	15,270	7,320	450	60	53,140
Peel	9,260	43,860	700	-	20	340	290	1,010	150	2,980	170	10,240	147,020	13,060	1,400	230,500
Halton	2,300	7,800	90	-	20	20	70	320	40	670	-	1,050	30,640	45,050	5,900	93,970
Hamilton	470	1,320	90	-	-	-	20	40	20	90	-	220	4,660	17,170	56,030	80,130
Total	69,420	324,320	73,260	2,680	1,640	14,680	8,140	22,820	4,420	60,080	1,940	60,190	242,110	80,910	64,430	1,031,040

Table 15 – Estimated PM Auto Work Trip Matrix (Transposed and Factored AM Matrix)

2006	Toronto PD 1	Rest of TO	Durham	Georgina	E Gwillimbury	NewMarket	Aurora	Richmond Hill	Whitchurch Stouffville	Markham	King	Vaughan	Peel	Halton	Hamilton	Total
PD 1	3,970	27,610	2,610	130	110	370	340	1,440	120	2,140	100	1,870	6,840	1,700	340	49,690
Rest of TO	5,020	123,410	21,030	700	610	2,460	2,040	7,590	850	14,700	770	15,160	32,400	5,760	970	233,470
Durham	170	4,100	47,290	180	70	140	70	240	180	880	-	310	660	80	90	54,460
Georgina	-	120	150	1,270	80	220	40	60	30	20	-	30	-	-	-	2,020
E Gwillimbury	-	80	120	240	350	170	80	10	30	30	40	60	10	10	-	1,230
NewMarket	50	1,060	660	1,580	1,070	3,660	900	660	200	430	160	350	260	10	-	11,050
Aurora	70	780	470	450	350	1,080	1,420	460	130	310	110	190	230	50	20	6,120
Richmond Hill	190	4,010	1,150	370	270	820	810	3,910	410	2,330	310	1,460	780	210	50	17,080
Whitchurch Stouffville	-	390	830	110	90	290	80	110	810	390	60	50	120	20	20	3,370
Markham	620	13,570	6,340	640	310	1,520	1,150	3,790	820	10,940	190	2,280	2,310	440	120	45,040
King	-	240	40	10	90	190	170	170	30	30	180	160	130	-	-	1,440
Vaughan	340	14,340	1,200	260	210	950	770	3,440	260	2,220	480	11,510	7,930	700	300	44,910
Peel	2,040	28,080	2,410	150	100	440	510	1,860	180	2,620	400	5,260	114,290	22,580	3,410	184,330
Halton	190	2,720	400	40	-	50	60	210	-	190	60	290	10,370	34,260	14,120	62,960
Hamilton	100	360	100	10	-	10	10	10	-	70	-	40	1,010	4,270	43,750	49,740
Total	12,760	220,870	84,800	6,140	3,710	12,370	8,450	23,960	4,050	37,300	2,860	39,020	177,340	70,090	63,190	766,910

Table 16 – 2006 TTS PM Auto Driver Trip Control Totals

2006	Toronto PD 1	Rest of TO	Durham	Georgina	E Gwillimbury	NewMarket	Aurora	Richmond Hill	Whitchurch Stouffville	Markham	King	Vaughan	Peel	Halton	Hamilton	Total
PD 1	3,750	24,350	2,760	150	100	410	280	1,090	120	1,650	130	2,040	6,120	1,760	610	45,320
Rest of TO	4,730	127,180	20,890	1,020	770	2,670	2,130	7,440	750	14,610	890	15,270	33,120	6,220	1,280	238,970
Durham	90	4,180	47,290	240	70	180	50	230	230	870	30	170	660	150	110	54,550
Georgina	-	80	180	1,320	70	230	20	60	40	-	-	20	-	-	-	2,020
E Gwillimbury	-	20	90	300	350	250	70	-	60	-	30	60	-	20	-	1,250
NewMarket	20	1,080	740	1,410	1,010	3,430	920	610	190	470	150	410	260	-	-	10,700
Aurora	70	840	420	430	370	1,160	1,300	450	160	350	100	250	230	30	-	6,160
Richmond Hill	200	3,800	950	380	240	840	720	3,750	370	2,290	240	1,440	810	160	80	16,270
Whitchurch Stouffville	-	470	1,100	130	100	430	70	120	840	440	40	40	110	20	40	3,950
Markham	580	13,240	6,200	740	310	1,510	1,330	3,610	740	10,620	160	2,030	2,000	440	70	43,580
King	-	220	90	-	90	190	230	170	60	60	260	200	150	-	20	1,740
Vaughan	270	14,980	1,210	450	300	980	820	3,380	200	2,170	530	12,110	8,210	790	310	46,710
Peel	1,670	28,450	2,410	240	140	540	510	1,730	180	2,430	410	5,350	114,290	22,580	3,410	184,340
Halton	130	2,780	400	40	20	40	50	230	-	180	20	310	10,370	34,260	14,120	62,950
Hamilton	80	380	100	-	-	-	-	20	-	80	-	60	1,010	4,270	43,750	49,750
Total	11,590	222,050	84,830	6,850	3,940	12,860	8,500	22,890	3,940	36,220	2,990	39,760	177,340	70,700	63,800	768,260

Table 17 – Estimated PM Auto Driver Work Trips vs. TTS PM Trips (with R-Squared=0.99) (Volume>500)

2006	Toronto PD 1	Rest of TO	Durham	Georgina	E Gwillimbury	NewMarket	Aurora	Richmond Hill	Whitchurch Stouffville	Markham	King	Vaughan	Peel	Halton	Hamilton	Total
PD 1	-6%	-12%	6%	-	-	-	-	-25%	-	-23%	-	9%	-11%	4%	77%	-9%
Rest of TO	-6%	3%	-1%	44%	27%	9%	5%	-2%	-12%	-1%	15%	1%	2%	8%	32%	2%
Durham	-	2%	0%	-	-	-	-	-	-	-1%	-	-	0%	-	-	0%
Georgina	-	-	-	4%	-	-	-	-	-	-	-	-	-	-	-	0%
E Gwillimbury	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1%
NewMarket	-	2%	12%	-11%	-5%	-6%	2%	-8%	-	-	-	-	-	-	-	-3%
Aurora	-	8%	-	-	-	8%	-8%	-	-	-	-	-	-	-	-	0%
Richmond Hill	-	-5%	-17%	-	-	3%	-11%	-4%	-	-2%	-	-1%	4%	-	-	-5%
Whitchurch Stouffville	-	-	32%	-	-	-	-	-	4%	-	-	-	-	-	-	17%
Markham	-6%	-2%	-2%	17%	-	-1%	16%	-5%	-10%	-3%	-	-11%	-13%	-	-	-3%
King	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19%
Vaughan	-	4%	1%	-	-	3%	7%	-2%	-	-2%	11%	5%	4%	12%	-	4%
Peel	-18%	1%	0%	-	-	23%	-1%	-7%	-	-7%	-	2%	0%	0%	0%	0%
Halton	-	2%	-	-	-	-	-	-	-	-	-	-	0%	0%	0%	0%
Hamilton	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	0%	0%
Total	-9%	1%	0%	12%	6%	4%	1%	-5%	-3%	-3%	4%	2%	0%	1%	1%	-

4.3 Local Shopping Trips

4.3.1 Introduction

A satisfactory fit to regional travel data for the PM peak period is expected using the transpose and factor method. However, like many other macroscopic models, model fit on some local streets and commercial streets in the afternoon is less than satisfactory with substantial under-estimation of traffic. One of the reasons for this problem is the lack of shopping trips during the AM peak period (dominated by work and school-related travel), which means that very few if any shopping trip samples are collected in travel surveys during this period. Therefore the flip-and-factor approach cannot be used to capture the shopping trips generated in the afternoon. Also, it is a common problem in household travel surveys that short / by-pass trips and particularly "multiple-destination" shopping trips may not be reported at all. Furthermore, many local trips do not cross a regional screenline and may therefore not be part of the data to which the regional model like YRTP model is calibrated. To compensate for this under-representation of short-distance auto trips to/from shopping areas, a new shopping trip purpose was introduced to represent short trips to and from neighbouring shops or shopping centres. Such trips include home-based shopping as well as work-to-shop and shop-to-shop travel (a high proportion of which can be described as pass-by traffic where persons returning from work to home may stop on the way to pick up household items etc.).

4.3.2 Shopping Trip Estimation

A matrix growth factoring process was adopted to estimate PM shopping trips for Vaughan based on retail job ratios and shopping trip matrices extracted from the TTS database. As for the refined traffic zones where TTS retail job ratios cannot be applied directly, a set of split percentages developed with the aid of aerial photos was applied to distribute retail jobs to every refined zone in Vaughan. The resulting retail job estimates would be used as control vectors in the factoring process to adjust the 2006 TTS "to shop" and "from shop" O-D matrices to the retail trips.

It is an iterative process to calibrate shopping trip attraction and production rates. After testing different sets of trip rates and validating against local screenlines and ITE trip totals, trip rates of 0.60 and 0.45 trips per retail job were considered to be appropriate for trip attraction and production associated with the shopping areas in Vaughan, respectively. These trip rates are to be used to forecast shopping trips for base and future horizon years. It should be noted that the resulting shopping matrix also includes by-pass trips that were made by the "non-shoppers" as listed in the travel survey due to undercounting issue associated with "multiple-destination trips". These by-pass trips, which are now included in the new shopping trip matrix, can backed out from the non-shopping trip matrix using a calibrated factor of 0.80.

4.3.3 Shopping Trips at Major Shopping Centres

The following six major shopping centres located in Vaughan were selected for validation purpose:

- RioCan Colossus Centre
- The Promenade
- The Interchange
- Westridge Power Centre
- Seven and 400 Power Centre
- Vaughan Mills

After attempts to collect traffic cordon counts for these major shopping centres, it was determined that traffic data were not sufficient for estimating total incoming and outgoing trips for the model base year. Therefore, Institute of Transportation Engineers (ITE) trip rates were used instead to estimate auto trip productions and attractions based on Gross Leasable Area (GLA) information provided by urbanMetrics inc. A comparison between trips associated with these locations and the nearby traffic counts indicate that ITE trip rates could be overstating the traffic to/from these shopping areas, especially for shopping centres along Highway 7, where frequent transit services and limited parking spaces might reduce auto usage. This issue is addressed by lowering the ITE trip "target" by 20% to reflect more reasonable trip generation rates for the study area. **Table 18** summarizes the adjusted ITE trip totals for these six retail centres used for validation and the corresponding model forecasts.

Table 18 – ITE Trip Estimates for PM Peak Hour

Location	Used GLA(sf) Retail	Category	ITE Trips*		VSAM Model		Diff vs. ITE	
			IN	OUT	IN	OUT	IN	OUT
RioCan Colossus Centre	572,600	Retail	760	820	770	860	-9%	-8%
	113,100	Theatre	90	110				
The Promenade	632,300	Retail	810	880	1,010	1,080	19%	15%
	24,200	Theatre	40	60				
The Interchange	510,200	Retail	700	760	810	980	-5%	4%
	111,000	Theatre	150	180				
Westridge Power Centre	496,350	Retail	690	750	680	780	-1%	4%
Seven and 400 Power Centre	330,600	Retail	670	720	480	680	-28%	-6%
Vaughan Mills**	1,336,350	Retail	1,330	1,440	1,370	1,550	3%	8%
Overall			**5,240**	**5,720**	**5,120**	**5,930**	**-2%**	**4%**

** - Based on adjusted ITE Trip Rates. ITE Trip Generation, 7th edition*

*** - Including Tuscany Pl & The Village*

4.4 PM Model Validation

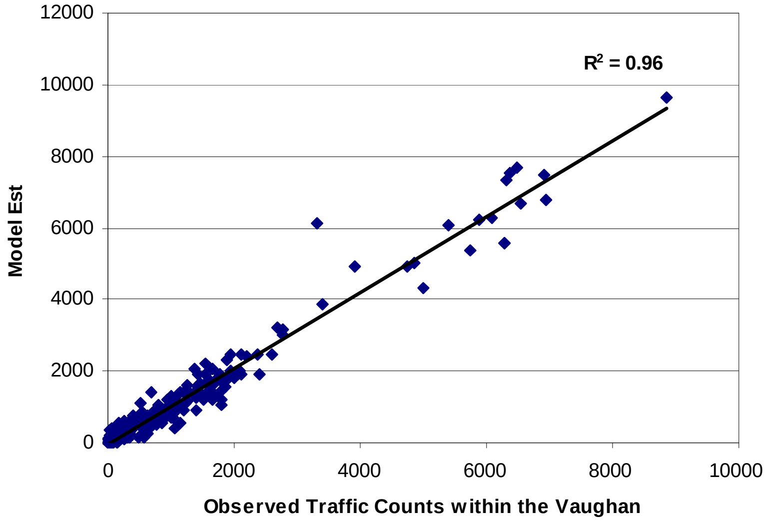
As with the AM VSAM model, an incremental matrix is developed to enhance the fit to the observed auto traffic at key screenlines during the PM peak period.

Table 19 provides a comparison of the model auto flow versus the observed PM peak hour auto counts for the 22 directional screenlines. It shows that 15 (68%) out of 22 screenlines produce a GEH lower than 10 and the overall R-Squared is 0.96 as shown in **Figure 7**. Among all the 214 screenline stations, 160 of them (75%) are within a GEH of 10. Based on these validation statistics, it can be concluded that the model provides reasonable travel demand estimation for the PM peak period within the Vaughan sub-area.

Table 19 - PM Sub-Area Traffic Count Comparison

Scln	Dir	Screenline	Obs	Est	GEH
1	N	N of King Vaughan Rd	11,030	10,570	4.4
1	S	N of King Vaughan Rd	3,900	3,810	1.3
2	N	N of Teston Rd	12,950	13,240	2.5
2	S	N of Teston Rd	5,190	5,280	1.2
3	N	N of Rutherford Rd	16,180	17,580	10.8
3	S	N of Rutherford Rd	7,180	7,870	8.0
4	N	N of Hwy 7	21,810	23,470	11.0
4	S	N of Hwy 7	14,180	12,810	11.8
5	N	N of Steeles Ave W	24,670	26,490	11.4
5	S	N of Steeles Ave W	16,320	15,560	6.0
6	E	E of Hwy 50	8,790	7,650	12.6
6	W	E of Hwy 50	11,370	12,440	9.8
7	E	E of Hwy 27	11,210	10,600	5.8
7	W	E of Hwy 27	11,640	11,900	2.4
8	E	E of Pine Valley Dr	11,510	12,280	7.0
8	W	E of Pine Valley Dr	12,220	13,450	10.9
9	E	E of Hwy 400	14,890	15,560	5.4
9	W	E of Hwy 400	17,000	17,210	1.6
10	E	E of Keele St	10,600	11,280	6.5
10	W	E of Keele St	8,250	9,170	9.8
11	E	W of Bathurst St	13,180	12,190	8.7
11	W	W of Bathurst St	9,860	11,640	17.2

Figure 7 - 2006 PM VSAM Screenline Validation



5 2031 Travel Demand Forecasts

5.1 Introduction

AM and PM travel demand forecasts were developed for the future 2031 base model. This chapter provides a summary of the following key model assumptions as well as the future year forecasts:

- Demographics
- Road and transit network improvements

5.2 Demographics

The Region of York is undertaking studies of future land use patterns in response to the Provincial “Place to Grow” Growth Plan, which calls for less greenfield development and greater intensification in transit-oriented development corridors and nodes. A set of demographics and land use projections that would conform to the Growth Plan was provided by the Region for this study in early 2009. Based on the Region’s estimates, an update of the demographic data was undertaken by Urban Strategies Inc. and the City Staff to incorporate growth strategies that have been developed recently for Vaughan. Additional land use intensification in focused areas (e.g. Vaughan Metropolitan Centre (VMC) and the Vaughan Mills area) was also incorporated in the future base scenario. For areas outside of York Region, population and employment estimates assumed in the YRTP Model were retained in VSAM. **Table 20** summarizes the population and employment projections for 2006 and 2031.

Table 20 – 2006 and 2031 Population and Employment Estimates

Area	Population				Employment			
	2006	2031	Diff	CAGR	2006	2031	Diff	CAGR
Toronto PD1	190,940	266,170	39%	1.3%	451,070	568,610	26%	0.9%
Rest of Toronto	2,405,600	2,615,350	9%	0.3%	1,082,880	1,265,670	17%	0.6%
Durham	588,930	1,000,010	70%	2.1%	194,380	434,100	123%	3.3%
York	929,870	1,513,800	63%	2.0%	459,150	786,300	71%	2.2%
Peel	1,205,880	1,640,010	36%	1.2%	636,880	876,110	38%	1.3%
Halton	429,900	703,390	64%	2.0%	194,000	389,640	101%	2.8%
Hamilton	515,000	597,270	16%	0.6%	199,600	248,150	24%	0.9%
GTHA	**6,266,120**	**8,335,990**	**33%**	**1.1%**	**3,217,960**	**4,568,570**	**42%**	**1.4%**
Vaughan	***248,810***	***425,150***	**71%**	**2.2%**	***159,000***	***262,800***	**65%**	**2.0%**

5.3 Road and Transit Network Improvements

5.3.1 Road Network

Future road network improvements were provided by different agencies. Within Vaughan, proposed improvements for the local collector system were prepared by the City Staff while the latest regional arterial improvements assumed in the Western Vaughan IEA study were provided by the York Region. For areas outside Vaughan in York Region, the latest York Region Transportation Master Plan assumptions were coded into the 2031 base network while future network assumptions assumed in the YRTP Model are used for areas outside York Region. **Table 21** identifies the key road network improvements for the 2031 base auto network assumed in VSAM.

Table 21 – 2031 Future Road Network Assumptions

			Within Vaughan			
A. Provincial						
#	Roadway	From	To	Improvement	2006	2031
1	Hwy 50	Steeles Ave.	Mayfield Rd.	Widen	2 / 2	3 / 3
2	Hwy 50	Mayfield Rd.	Kirby Rd.	Widen	1 / 1	3 / 3
3	Hwy 427	NB off-ramp, SB on-ramp at Albion Rd.	Hwy 407	Widen	2 / 2	4 / 4
4	Hwy 427	Hwy 407	NB on-ramp, SB off-ramp at Hwy 407	Widen	2/3	4 / 4
5	Hwy 427	Hwy 7	Major Mac Dr.	Extension	-	3 / 3
6	Hwy 400	NB off-ramp, SB on-ramp at Steeles Ave.	Hwy 407	Widen	4 / 4	5 / 5
7	Hwy 400	Hwy 407	Hwy 7	Widen	3 / 4	5 / 5
8	Hwy 400	NB off-/SB on-ramp at Bass Pro Mills Dr.	Rutherford Rd.	Widen	5 / 4	5 / 5
9	Hwy 400	SB off-ramp, NB on-ramp at Rutherford Rd.	N of Rutherford Rd.	Widen	4 / 5	5 / 5
10	Hwy 400	NB off-ramp, SB on-ramp at Major Mac Dr.	Major Mac Dr.	Widen	4 / 3	5 / 5
11	Hwy 400	Major Mac Dr.	NB on-ramp, SB off-ramp at Major Mac Dr.	Widen	3 / 3	5 / 5
12	Hwy 400	NB on-ramp, SB off-ramp at Major Mac Dr.	King-Vaughan Rd.	Widen	3 / 3	4 / 4
13	New Interchange	Martingrove Rd. / Hwy 407		East-Oriented Partial IC	-	-
14	New Interchange	Hwy 407 / Centre St.		Partial IC	-	-
15	Improved Interchange	Extended Hwy 427 / Hwy 7		Full	-	-
16	New Interchange	Extended Hwy 427 / Langstaff Rd.		Full	-	-
17	New Interchange	Extended Hwy 427 / Rutherford Rd.		Full	-	-
18	New Interchange	Extended Hwy 427 / Major Mac Dr.		Full	-	-
B. Regional						
#	Roadway	From	To	Improvement	2006	2031
19	Hwy 27	Steeles Ave.	Major Mac Dr.	HOV	2 / 2	2 / 2 GP + 1 / 1
20	Hwy 27	Major Mac Dr.	Wilsen Rd. (King)	Widen	1 / 1	2 / 2
21	Pine Valley Dr.	Steeles Ave.	Hwy 7	HOV	2 / 2	2 / 2 GP + 1 / 1
22	Weston Rd.	Steeles Ave.	Major Mac Dr.	HOV	2 / 2	2 / 2 GP + 1 / 1
23	Weston Rd.	Major Mac Dr.	Kirby Rd.	Widen	1 / 1	2 / 2
24	Jane St.	Hwy 407	Major Mac Dr.	HOV	2 / 2	2 / 2 GP + 1 / 1
25	Jane St.	Teston Rd.	King-Vaughan Rd.	Widen	1 / 1	2 / 2
26	Keele St.	Steeles Ave.	Major Mac Dr.	HOV	2 / 2	2 / 2 GP + 1 / 1
27	Dufferin St.	Steeles Ave.	Glen Shields Ave.	HOV	2 / 2	2 / 2 GP + 1 / 1
28	Dufferin St.	Major Mac Dr.	King Rd.	Widen	1 / 1	2 / 2
29	Bathurst St.	Crestwood Rd.	Worth Blvd.	HOV	2 / 2	2 / 2 GP + 1 / 1
30	Bathurst St.	N of Autumn Hill Blvd.	Elgin Mills Rd.	HOV	2 / 2	2 / 2 GP + 1 / 1
31	King-Vaughan Rd.	Hwy 400	Bathurst St.	Widen	1 / 1	2 / 2
32	Teston Rd.	Weston Rd.	E of Hwy 400	Widen	1 / 1	2 / 2
33	Teston Rd.	Keele St.	E of Rodinea Rd.	Widen	1 / 1	2 / 2
34	Teston Rd.	E of Rodinea Rd.	Dufferin St.	Extension	-	2 / 2
35	Teston Rd.	Dufferin St.	Shaftsbury Ave.	Widen	1 / 1	2 / 2
36	Major Mac Dr.	Hwy 50	W of Weston Rd.	Widen, HOV Jog elimination	1 / 1	2 / 2 GP + 1 / 1
37	Major Mac Dr.	W of Weston Rd.	McNaughton Rd.	HOV	2 / 2	2 / 2 GP + 1 / 1
38	Rutherford Rd.	Hwy 50	Weston Rd.	HOV	2 / 2	2 / 2 GP + 1 / 1
39	Rutherford Rd.	Weston Rd.	Jane St.	HOV	3 / 3	2 / 2 GP + 1 / 1
40	Rutherford Rd.	Jane St.	Bathurst St.	HOV	2 / 2	2 / 2 GP + 1 / 1
41	Langstaff Rd.	Hwy 50	Hwy 27	Widen	1 / 1	2 / 2
42	Langstaff Rd.	Keele St.	Dufferin St.	Widen	1 / 1	2 / 2
43	Steeles Ave.	Weston Rd.	Jane St.	Widen	2 / 2	3 / 3

Table 21 (con't) – 2031 Future Road Network Assumptions

			Within Vaughan			
	C. Cityof Vaughan					
#	**Roadway**	**From**	**To**	**Improvement**	**2006**	**2031**
44	Future E-W Rd., N of Major Mac Dr.	Hwy 50	Huntington Rd.	New Link	-	1 / 1
45	Huntington Rd.	McGillvray Rd.	Teston Rd.	Truncate + Realign	1 / 1	1 / 1
46	McGillvray Rd.	Rutherford Rd.	N of Rutherford Rd.	Realign	1 / 1	1 / 1
47	Future E-W Rd., N of Langstaff Rd.	Huntington Rd.	Hwy 27	New Link	-	1 / 1
48	*Zenway Blvd.	Old Huntington Rd.	Rainbow Creek Dr.	New Link	-	1 / 1
49	Huntington Rd.	Fogal Rd.	N of Hwy 7	Extension	-	1 / 1
50	New Huntington Rd.	S of Langstaff Rd.	Hwy 7	New Link	-	2 / 2
51	Future E-W Rd., S of Langstaff	Old Huntington Rd.	New Huntington Rd.	New Link	-	1 / 1
52	Vaughan Valley Blvd.	Hwy 7	Zenway Blvd.	New Link	-	1 / 1
53	Future E-W Rd., N of Kirby Rd.	Weston Rd.	Jane St.	New Link	-	1 / 1
54	Future E-W Rd., N of Teston Rd.	Weston Rd.	Jane St.	New Link	-	1 / 1
55	Cityview Blvd.	Canada Dr.	Teston Rd.	Extension	-	1 / 1
56	Future E-W Rd., N of Major Mac Dr.	Canada Dr.	America Ave.	New Link	-	1 / 1
57	Future E-W Rd., N of Major Mac Dr.	Weston Rd.	Future N-S Rd.	New Link	-	1 / 1
58	Future N-S Rd., E of Pine Vallye Dr.	Future E-W Rd.	Major Mac Dr.	New Link	-	1 / 1
59	Future N-S Rd., W of Weston Rd.	Future E-W Rd.	Major Mac Dr.	New Link	-	1 / 1
60	Via Campanile	Davos Rd.	Major Mac Dr.	Extension	-	1 / 1
61	Davos Rd.	Via Campanile	Pine Valley Dr.	Extension	-	1 / 1
62	Future N-S Rd., W of Hwy 400	Creditview Rd. Terminus	Rutherford Rd.	New Link	-	1 / 1
63	Bass Pro Mills Dr.	Weston Rd.	Hwy 400 SB on-ramp	Extension	-	1 / 1
64	Bass Pro Mills Dr.	Romina Dr.	Jane St.	Extension	-	1 / 1
65	Peter Rupert Ave.	Rutherford Rd.	McNaughton Rd.	New Link	-	1 / 1
66	Maurier Blvd.	Peter Rupert Ave.	Dufferin St.	New Link	-	1 / 1
67	Via Romano Blvd.	Major Mac Dr.	Teston Rd.	New Link	-	1 / 1
68	Queen Filomena Ave.	Via Romano Blvd.	Bathurst St.	New Link	-	1 / 1
69	Thomas Cook Ave.	Rutherford Rd.	Major Mac Dr.	New Link	-	1 / 1
70	Lebovic Campus Dr.	Thomas Cook Ave.	Bathurst St.	New Link	-	1 / 1
71	Pleasant Ridge Blvd.	Apple Blossom Dr.	Rutherford Rd.	Extension	-	1 / 1
72	Future E-W Rd., N of Hwy 7	Chrislea Rd.	Applewood Crescent	New Link	-	2 / 2
73	Fieldstone Dr.	Blue Willow Dr.	Weston Rd.	Widen	1 / 1	2 / 2
74	Applewood Cres. (N of Hwy 7)	Applewood Cres.	Jane St.	Widen	1 / 1	2 / 2
75	Future Ring Rd.	E of Hwy 400 Off-ramp	Maplecrete Rd.	New Links	-	2 / 2
76	Future N-S Rd.	Interchange Way	Ring Rd.	New Link	-	2 / 2
77	Future N-S Rd.	Hwy 7	Chrislea Rd.	New Link	-	2 / 2
78	Future N-S Rd.	Hwy 400 NB off-ramp	Future Hwy 400 NB on-ramp	New Link	-	1 / 2
79	Future N-S Rd.	Future Hwy 400 NB on-ramp	Applewood Crescent	New Link	-	2 / 2
80	Famous Ave.	Weston Rd.	Hwy 7	Widen	1 / 1	2 / 2
81	Credistone Rd.	MacIntosh Blvd.	N of Hwy 407	Widen	1 / 1	2 / 2
			Outside Vaughan, in GTHA			
	D. Provincial					
#	**Roadway**	**From**	**To**	**Improvement**	**2006**	**2031**
81	Hwy 407	Hwy 401 (Peel)	Hwy 427	Widen	3 / 3	5 / 5
82	Hwy 407	Weston Rd.	Hwy 404	Widen	4 / 4	5 / 5
83	Hwy 407	Hwy 404	Kennedy Rd.	Widen	3 / 4	5 / 5
84	Hwy 407	Kennedy Rd.	Markham Rd.	Widen	3 / 3	5 / 5
85	Hwy 407	Markham Rd.	Brock Rd. (Durham)	Widen	2 / 2	5 / 5
86	Hwy 407	Brock Rd.	Hwy 401 (Oshawa)	Extension via Whitby	-	2 / 2
87	Hwy 407	Britannia Rd. West	Hwy 403	HOV	2 / 2	2 / 2 GP + 1 / 1
88	Hwy 401	Guelph Line	Trafalgar Rd.	HOV	3 / 3	3 / 3 GP + 1 / 1
89	Hwy 401	Trafalgar Rd.	Winston Churchill Blvd.	Widen + HOV	3 / 3	5 / 5 GP + 1 / 1
90	Hwy 401	Winston Churchill Blvd.	Hwy 410	Widen + HOV	3 / 3 - 4 / 4	6 / 6 GP + 1 / 1
91	Hwy 401	Brock Rd.	Regional Rd. 34 / Courtice Rd	Widen + HOV	3 / 3 - 5 / 5	6 / 6 GP + 1 / 1

5.3.2 Transit Network

Transit network assumptions were coded based on the latest preferred option developed for the Western Vaughan IEA study which includes significant improvement in headway for most of the bus routes that pass through Vaughan. Other key transit investments in the study area include:

- Bolton GO Rail
- TTC Spadina Subway Extension
- TTC Yonge Subway Extension
- 407 Transitway
- Improve transit headway for YRT VIVA line to 2-4 min
- Acceleride from Brampton to VMC

5.4 2031 Base Case Forecasts

5.4.1 AM & PM Trip Summary

Table 22 presents the 2006 and 2031 trip totals for Vaughan and GTHA. In 2006, origin and destination trip totals for Vaughan were approximately 119,600 and 126,700 respectively. In 2031, trips originating from Vaughan is forecast to grow to 205,300 (72% growth), while destination trip total is estimated at 203,900 (61% growth). These high growth rates of total trips can be explained by the similar growth rates of population (71%) and employment (65%) in Vaughan as shown in **Table 20**. These growth rates also highlight the fact that future road and transit network within the study area is expected to accommodate almost double amount of travel demand in 2031.

Table 22 – AM Peak Period Trip Forecasts (2006 and 2031)

Region	Mode	Orig Trips				Dest Trips			
		2006	2031	Diff	CAGR	2006	2031	Diff	CAGR
GTHA	Auto Driver	1,818,390	2,470,240	36%	1.2%	1,818,390	2,470,240	36%	1.2%
	Auto Passenger	388,820	517,260	33%	1.1%	388,820	517,260	33%	1.1%
	Transit	463,640	633,040	37%	1.3%	463,640	633,040	37%	1.3%
	Total Trips	***2,670,850***	***3,620,540***	***36%***	***1.2%***	***2,670,850***	***3,620,540***	***36%***	***1.2%***
	Transit Mode Share	***17%***	***17%***	***0%***	***0.0%***	***17%***	***17%***	***0%***	***0.0%***
Vaughan	Auto Driver	89,060	143,480	61%	1.9%	101,250	159,790	58%	1.8%
	Auto Passenger	18,810	31,210	66%	2.0%	18,970	29,970	58%	1.8%
	Transit	11,690	30,640	162%	3.9%	6,440	14,090	119%	3.2%
	Total Trips	***119,560***	***205,330***	***72%***	***2.2%***	***126,660***	***203,850***	***61%***	***1.9%***
	Transit Mode Share	***10%***	***15%***	***5%***	***1.7%***	***5%***	***7%***	***2%***	***1.2%***

The growth of transit users is anticipated to be much faster than the auto drivers, as shown by the 5 percent increase of ridership for origin trips and 2 percent increase for destination trips. This increased transit mode share is mostly due to significant heavy transit service improvements, including the Spadina subway extension to VMC, planned improvement of transit frequency of the VIVA bus rapid bus, introduction of Bolton GO rail and also the improved services for other YRT bus routes as defined in the Western Vaughan IEA study.

The expected traffic growth rates in Vaughan are relatively higher than the rest of the GTA regions.

Table 23 summarizes the AM and PM peak hour traffic forecasts that are used for trip network assignment. Annual traffic growth rate for AM peak hour trips is 2 percent, which is reasonably close to the growth rate of 1.9% for the AM peak period while PM peak hour trips would grow at the similar rate of 1.7% per annum.

Table 23 – AM and PM Peak Hour Traffic Forecasts (2006 to 2031)

Mode	Orig Trips				Dest Trips			
	2006	2031	Diff	CAGR	2006	2031	Diff	CAGR
AM Auto Driver	36,220	60,140	66%	2.0%	38,870	64,410	66%	2.0%
PM Auto Driver	58,070	89,100	53%	1.7%	55,300	84,680	53%	1.7%

Detailed forecasts for each focused area (e.g. VMC) required for this Vaughan TMP study are documented separately by Halcrow.

6 Summary and Conclusions

This report describes the model update and validation process of the AM and PM Vaughan Sub-Area Model (VSAM) developed for the Vaughan Transportation Master Plan (TMP) Study. The validation results presented show that VSAM generates reasonable and acceptable 2006 traffic volume estimates at both regional and local levels for both the AM and PM peak hours as documented in Sections 3 and 4.

The new PM VSAM model, which now has the capability of estimating total PM peak traffic including local shopping trips, produces reasonable traffic forecasts at and near major shopping centres during the afternoon peak period when auto traffic volumes are highest.

Traffic forecasts for the 2031 base land use/transportation system scenario indicate that the model is sensitive to the extensive transit investment planned for Vaughan, particularly for the VMC focused areas where aggressive land use intensification is planned. This model is thus applicable for the Vaughan TMP Study and is a practical tool to evaluate the City's future transportation infrastructure requirements that can be expected to encourage increased public transit use, alleviate congestion and promote livable street networks and neighbourhoods.

Other deliverables, including detailed transportation analysis for the designated focused areas and the final transportation model package, will be provided separately as the study proceeds.