Appendix G

Transportation Assessment

February 2022

Regional Official Plan Review

EllSo Consulting

Halton REGION

Preface

This technical memorandum was originally submitted in October 2021 summarizing the transportation technical analysis and recommendations based on the Draft Preferred Growth Concept (September 2021) population and employment numbers from September 2021. Since the submission of the October 2021 technical memorandum, there has been a further update to the Draft Preferred Growth Concept (September 2021) population and employment numbers based on consultation with the area local municipalities and updated technical planning analysis. The Draft Preferred Growth Concept (December 2021) population and employment numbers were presented at the November 17, 2021, Council Workshop.

An opinion on the potential impacts to Transportation Servicing recommendations presented in October 2021 from the Draft Preferred Growth Concept (December 2021) numbers is presented in Appendix 5 of this technical memorandum. This opinion is non-quantitative and without the modelling exercise that led to the October 2021 submission. A detailed analysis (including modelling) of the Preferred Growth Concept will be undertaken in March 2022, once these latest numbers undergo further consultation within the Region and its local municipalities, and any modifications are finalized.

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Document Control

Version	Date	Author	Issue
0.1	15 October 2021	A. Almuina	Issued for Regional Team review
0.2	20 October 2021	A. Almuina	Draft issued for main report consolidation
0.3	10 January 2022	A. Almuina	Added Opinion Letter on December draft PGC numbers
0.4	18 January 2022	A. Almuina	Final draft
0	22 January 2022	A. Almuina	Final

1. Introduction

This report summarizes the assessment of the Draft Preferred Growth Concept (September 2021), which was reviewed to identify the impact on the existing and planned regional transportation system. This analysis is a further refinement of the high level, preliminary transportation system analysis of the four Growth Concepts, as presented in Staff Report LPS18-21 - Regional Official Plan Review - Integrated Growth Management Strategy - Growth Concepts Discussion Paper, on February 17, 2021.

This report reviews the following:

- Transportation servicing opportunities and constraints for the existing and planned infrastructure and services to 2031.
- Identify high-level servicing needs to meet 2041 and 2051 demand from the Draft Preferred Growth Concept (September 2021).

It is important to note that this analysis is representative of a high-level transportation strategy to support the Draft Preferred Growth Concept (September 2021). The strategy discussed herein is based on opportunities and constraints and is conceptual only. Further, the strategy and associated costs developed for the analysis of the Draft Preferred Growth Concept (September 2021) are subject to refinement and more detailed planning through the Region's next Multi-Modal Transportation Master Plan to 2051.

Master plans are living documents that are refined and updated over time, which will consider inputs such as the latest Transportation Tomorrow Surveys. These updates reflect the latest trends in transportation, updates to the regional transportation system, and other societal updates pertinent to travel demand. These updates are typically undertaken on a 5 to 10 year interval.

1.1 Transportation Infrastructure

Halton Region is responsible for planning, constructing, operating, maintaining, and improving a network of major arterial roads which accommodate all modes of travel and allows for the transport of goods and people in a safe and efficient manner. As of the end of 2020, the regional road system consisted of approximately 1,154 lane-kilometres of roadway (i.e., total length of all lanes of regional roads) which connects the Region's rural and urban centres and provides connectivity to the provincial highway system.

The Local municipalities are responsible for all other roads which include minor arterials, multi- purpose arterials, collectors, and local roads within the road network. These roads are the primary access to local communities and provide connection to Major Arterial roads and Provincial facilities.

1.2 Background Studies

The Region's Transportation Master Plan (TMP) (2031) – The Road to Change was completed in 2011 to support the balanced approach to growth laid out in Regional Official Plan Amendment 38 (ROPA 38). The TMP identified the need to transition to a more balanced transportation network to accommodate increased travel demands on the network to support all modes of transportation. The vision for the TMP was to accommodate various travel choice and support a sustainable and multi-modal transportation network in the future.

The preferred transportation strategy for Halton Region to 2031 included recommendations and initiatives to support the shift toward a multi-modal approach to transportation that included providing additional capacity in the regional roadway network (i.e., road widenings), active transportation, transportation demand management, and transit. Through the TMP, the Region developed an extensive transportation capital program to accommodate growth to 2031, which included widening most regional roadways in the urban boundary to a 6-lane mid-block cross section by 2031.

In 2015, the Region completed its first **Active Transportation Master Plan** to develop the required strategy, infrastructure, and initiatives to promote non-motorized travel throughout the Region.

Building on the vision and recommendations of the TMP, and in preparation for Metrolinx's Regional Express Rail (RER) as it was known at the time, Halton Region and its Local municipal partners developed the **Mobility Management Strategy (MMS)** for Halton to guide the evolution of a region-wide inter/intra-regional transportation network over the next 25 years to 2041. This study, completed in 2017, built on the strengths of the existing transportation networks in Halton (Provincial, Regional, and Local) to support the strategic integration of Major Transit Station Areas (MTSAs) and focus on enhancing connectivity amongst the Local municipal and intra/inter-regional transit networks. To support these connections, the MMS established a Region-wide grid network of 156 km of Transit Priority Corridors (TPCs) and approximately 36 km of Mobility Links. This network is referred to as the Transit Priority Mobility Network to 2041. These corridors build upon the Higher Order Transit Corridors identified in the Regional Official Plan and TMP documents, with some additions and extensions.

The **Defining Major Transit Requirements in Halton Region (DMTR) Study**, completed in 2019, is a continuation and fulfilment of the next steps established through the MMS in support of the vision for a multi-modal transportation network. This study evaluated the existing and proposed MTSAs, higher order transit stations and surrounding areas that are planned for intensification to identify infrastructure gaps, potential barriers to development and potential opportunities; and defined the type, form, and function of the TPCs as identified in the MMS. It identified transit infrastructure investment opportunities for the 2031 and 2041 planning horizons to address potential transit demand and enhance transportation mobility and connectivity between existing and proposed MTSAs.

The work undertaken as part of the assessment of the Draft Preferred Growth Concept (September 2021) builds on the above noted studies and strategies.

1.3 Basis for Transportation Assessment & Methodology

Transportation infrastructure including regional roadways and major local collectors, transit and provincial facilities were analysed as part of this current analysis. For this analysis, the planned 2031 capacity of roadway infrastructure was compared to the projected 2041 and 2051 growth requirements/demand to identify the impact the Draft Preferred Growth Concept (September 2021) could have on the planned transportation system. Similarly, the 2041 recommended transit priority network from the DMTR Study was tested against the same 2041 and 2051 growth requirements/demand to identify how future transit improvements could accommodate the Draft Preferred Growth Concept (September 2021).

1.3.1 Methodology

The Regional transportation system (regional arterial, local roadways, and high-order transit) was analysed for the Draft Preferred Growth Concept (September 2021). For this analysis, the planned 2031 capacities were compared to the projected 2041 and 2051 growth requirements to identify the impact the planning estimates could have on the existing and planned transportation system. This information was used for the assessment of the Draft Preferred Growth Concept (September 2021) and provided a high-level understanding of opportunities and constraints. A future transportation servicing concept was developed based on the opportunities and constraints identified. The transportation servicing concept accommodates the Draft Preferred Growth Concept (September 2021) population and employment estimates and provides a reasonable basis for infrastructure cost estimates. It is important to note, however, that the servicing concept and associated costs developed for this exercise are subject to refinement and detailed planning through the Region's Multi-Modal Transportation Master Plan Update to 2051.

Halton Travel Demand Forecasting Model

The Halton Travel Demand Forecasting Model (the model) was utilized in the analysis of the Draft Preferred Growth Concept (September 2021). The model is a standard 4-stage travel demand model that has been calibrated and validated at the screenline level using the 2011 Transportation Tomorrow Survey (TTS) data. The model was updated to reflect the inputs described below and used in the assessment of the Eight Growth Scenarios, the Four Growth Concepts, and the Draft Preferred Growth Concept (September 2021).

Base Road Network – Halton Region

The analysis of the Draft Preferred Growth Concept (September 2021) was undertaken using the Region's transportation Capital Program to 2031 as the base in which to determine post 2031 requirements.

2041 and 2051 Population Employment Forecasts – Halton Region

From the Four Growth Concepts presented to Regional Council in February 2021, a Draft Preferred Growth Concept (September 2021) was prepared and refined based on background analyses, direction from the IGMS Steering Committee and consultation with Regional and local municipal staff, regarding planned development and land supply potential.

The Draft Preferred Growth Concept (September 2021) includes the new Schedule 3 forecast numbers based on a 2051 planning horizon, a minimum of 45% intensification within the Built-Up Area, a minimum of 65 persons and jobs per hectare.

2041 and 2051 Population Employment Forecasts – Outside Halton Region

Transportation planning encompasses travel within Halton Region and to/from other municipalities. This requires having population/employment numbers of traffic zones outside Halton to properly model travel demand.

For the purpose of this assessment, the DMTR Study 2041 values have been assumed for the population and employment forecasts of the surrounding municipalities for the 2041 and 2051 planning horizon assessments, consistent with the previous IGMS stages of analyses.

2041 and 2051 Transportation Network Outside Halton

For the purpose of this assessment, the DMTR Study network improvements to 2041 were assumed outside Halton for both the 2041 and 2051 planning horizons.

Transit

The Defining Major Transit Requirements in Halton Region (DMTR) Study provided the basis for the transit service assumptions for the 2041 planning horizon. This DMTR Study included the completion of an analysis of the corridors identified in the Mobility Management Strategy (MMS) and made recommendations on Regional investments to unlock transit-oriented growth and identify how mobility and connectivity in the transportation network can be enhanced between growth areas within the Region, with adjacent municipalities, and across the GTHA.

The Preliminary 2041 Recommended Transit Priority Corridor Network – Infrastructure, as defined by the DMTR Study, formed the basis for the transit services assumed in 2041 in the assessment of the Draft Preferred Growth Concept (September 2021). The 2041 transit service assumed in this analysis is presented in Appendix 1 of this technical memo. The same network was assumed for 2051.

2. Design Criteria & Level of Service

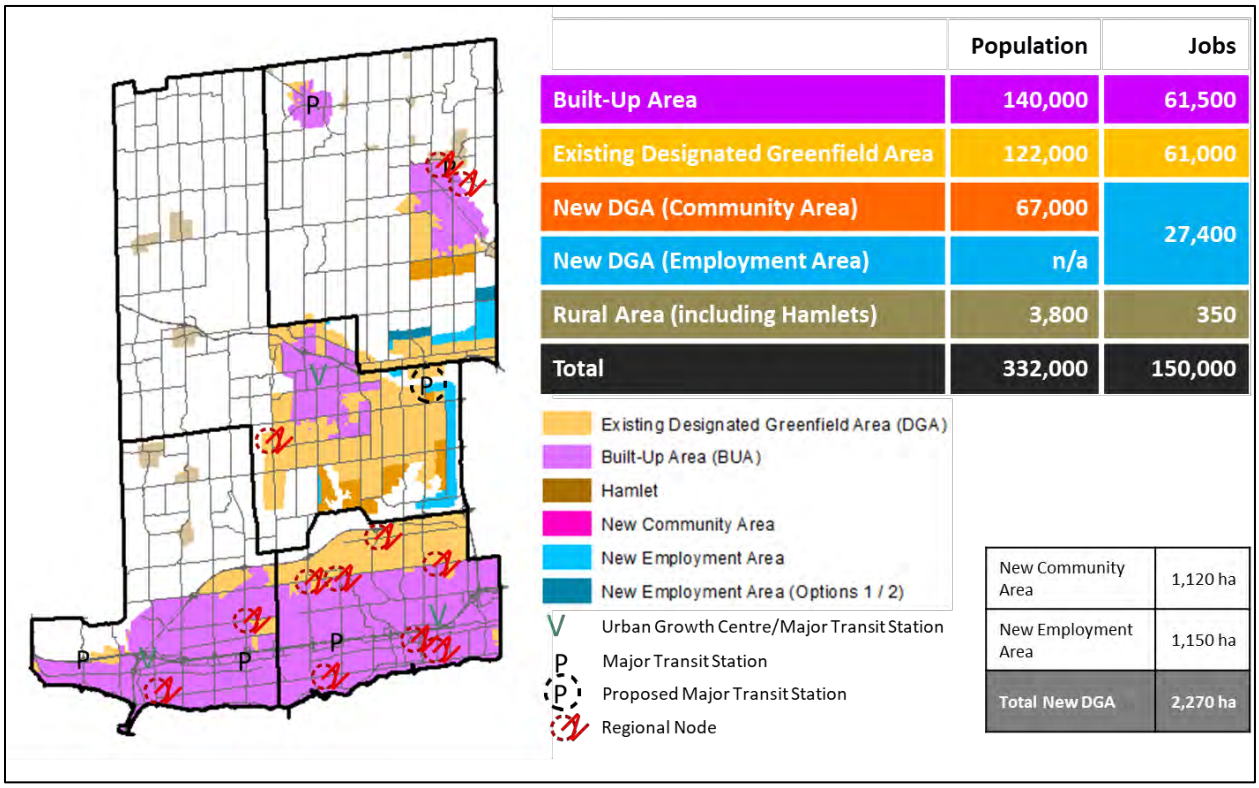
The level of service threshold identified in the Halton Region Transportation Master Plan – The Road to Change (2011), the Halton Region 2017 Development Charges Transportation Technical Report (September 2016) and the Halton Region 2022 Development Charges Transportation Technical Report (September 2021) were used in this analysis. In the context of travel demand forecasting, these studies defined level of service thresholds through a volume to capacity ratio (v/c), with a threshold of 0.9 being the maximum acceptable value. A v/c equal to or greater than 0.9 triggered the need for additional analysis and assessment to determine if here is a need for capacity improvements.

A maximum roadway cross-section of six lanes is the design criteria being used by the Region for roadway improvement considerations.

3. Draft Preferred Growth Concept (September 2021)

The Draft Preferred Growth Concept (September 2021) was defined by Hemson and submitted to the technical teams for review and determination of potential impacts to the existing and future transportation infrastructure. Exhibit 1 provides a brief description of the Draft Preferred Growth Concept (September 2021) and assumptions applied in the development of the planning projections. As noted in the Preface, subsequent to the completion of the analysis, a revised draft preferred growth concept was developed (December 2021). This latter concept is not the basis of the analysis reported in this technical memorandum.

Exhibit 1 - Overview of Draft Preferred Growth Concept (September 2021)



	Population	Jobs
Built-Up Area	140,000	61,500
Existing Designated Greenfield Area	122,000	61,000
New DGA (Community Area)	67,000	27,400
New DGA (Employment Area)	n/a	
Rural Area (including Hamlets)	3,800	350
Total	332,000	150,000

New Community Area	1,120 ha
New Employment Area	1,150 ha
Total New DGA	2,270 ha

Source: Hemson

A summary of the population and employment for each of the Draft Preferred Growth Concept (September 2021) is summarized in the following exhibits.

Exhibit 2 - Population Growth 2031-2051 by Local Municipality & Growth Plan Policy Area

Policy Area	Burlington	Oakville	Milton	Halton Hills	Halton Region
Existing DGA	1,800	30,000	79,500	10,700	122,000
New DGA	0	0	39,500	27,400	67,000
BUA Centres	21,500	33,500	18,000	5,600	78,500
BUA Corridors	10,700	10,500	7,200	2,100	30,500
BUA General	11,700	7,000	9,000	3,100	30,800
Rural	2,500	0	700	500	3,800
TOTAL	48,500	81,000	154,000	49,500	332,000

BUA = Built-up Area
DGA = Designated Greenfield Area
BUA Strategic Growth Areas = Urban Growth Centres, Major Transit Station Areas, Regional Nodes

Exhibit 3 - Employment Growth 2031-2051 by Local Municipality & Growth Plan Policy Area

Policy Area	Burlington	Oakville	Milton	Halton Hills	Halton Region
Existing DGA	3,400	15,700	28,500	13,100	60,200
New DGA	0	0	14,000	13,400	27,400
BUA Centres	3,900	9,100	9,400	1,850	24,400
BUA Corridors	1,900	3,400	4,400	700	10,500
BUA General	7,300	10,900	6,600	2,100	27,000
Rural	200	0	50	100	350
TOTAL 2031-51	17,000	39,000	63,000	31,000	150,000

BUA = Built-up Area
DGA = Designated Greenfield Area
BUA Strategic Growth Areas = Urban Growth Centres, Major Transit Station Areas, Regional Nodes
Source: Hemson

4. Technical Analysis

The analysis of the 2041 and 2051 transportation infrastructure needs for the Draft Preferred Growth Concept (September 2021) was based on two assessments – Transportation Infrastructure and Transit.

4.1 Travel Demand

Travel demand needs were assessed through the regional transportation network performance, at the screenline level, and the ability of the regional transportation network to accommodate travel demand through that screenline consistent with assessments in the Halton Region Transportation Master Plan – The Road to Change (2011), the Halton Region 2017 Development Charges Transportation Technical Report (September 2016), and the 2022 Development Charges Transportation Technical Report (September 2021).

In the context of travel demand forecasting, these studies defined level of service thresholds through a volume to capacity ratio (v/c), with a threshold of 0.9 being the maximum acceptable value. A v/c equal to or greater than 0.9 triggered the need for additional capacity improvements to be analysed and assessed.

A screenline is an imaginary boundary that defines a broad corridor consisting of one or more roadway links. Appendix 2 depicts the Region's screenlines per the current travel demand forecasting tool.

Screenlines where the anticipated volume of vehicles traversing that screenline divided by the capacity of the roadways on that screenline is equal to or greater than 0.9, are flagged for additional roadway capacity assessment (i.e., lane requirements), on either MTO and/or Regional/local facilities. The Draft Preferred Growth Concept (September 2021) was analysed as follows:

- Screenline deficiencies were identified for screenlines with a v/c equal to or greater than 0.9;
- Screenline deficiencies were divided into MTO and Regional/Local deficiencies;
- MTO deficiencies were not carried further in the analysis; and
- Regional/local solutions for each deficient screenline were assessed and recommended solutions provided, where required, possible and feasible.

4.2 Road

As part of the analysis of the Draft Preferred Growth Concept (September 2021) the deficient screenlines were reviewed in further detail, at the link level, to assess road capacity improvements. Road capacity improvements were limited to Regional/local roads. It should be noted that a v/c greater than 0.9 does not necessarily require an improvement in all circumstances to address the additional demand.

4.3 Transit

The Transit Priority Corridors were analysed by comparing the passenger demand in the peak hour along the corridor to the potential capacity of future service. The base service used for 2051 was as identified by the DMTR Study for the 2041 planning horizon.

4.4 Overall Observations

Appendix 3 presents a summary of screenline deficiencies by planning horizon, in graphical form, for all roadway jurisdictions (Region, Local and MTO). These deficiencies have not been assessed or rationalized. The screenlines identified exhibit a v/c ratio equal to or greater than 0.9.

Appendix 4 presents the deficient screenlines and identifies only the screenlines where a Regional/Local solution can be implemented after having rationalized the absolute volume of travel demand deficiency for the screenline. The rationalization of the screenline refers to an assessment of the screenline performance. For example, in some instances, when the v/c ratio is equal to or greater than 0.9 (indicating a potential deficiency), further assessment may find that the volumes (absolute value) are sufficiently low such that they are considered insignificant, or it falls within the forecasting tolerances of a 20-to-30-year forecast.

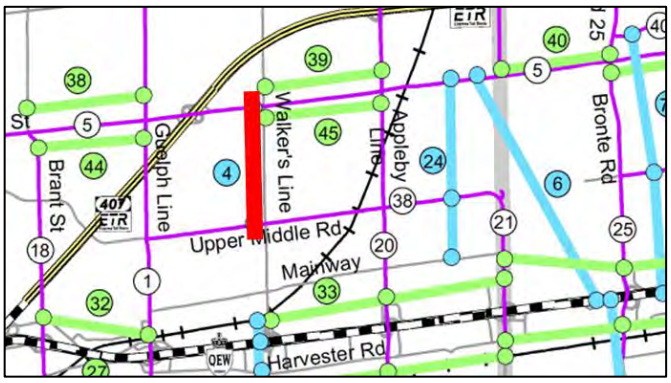
There are screenline deficiencies identified in 2041 and 2051 where the deficient link is a provincial facility (QEW / Highway 403 / Highway 401). In south Halton Region, the QEW, Highway 403 and the Skyway bridge exhibit deficiencies in capacity in both planning horizons. In mid-Halton, Highway 401 exhibits a deficiency in capacity for both planning horizons. As indicated above, these potential provincial facility deficiencies were not analysed further as part of this exercise.

Prior to presenting the findings of the transportation system assessment for the Draft Preferred Growth Concept (September 2021), it is important to note a direct comparison of the results of Stage 1 (Eight Growth Scenarios) transportation assessment and the Stage 2 (Four Growth Concepts) transportation assessment to the Draft Preferred Growth Concept (September 2021) (Stage 3) may not necessarily yield the same solutions and costing. Each stage of assessment has been undertaken with refined forecasts by traffic zone and refined levels of analysis.

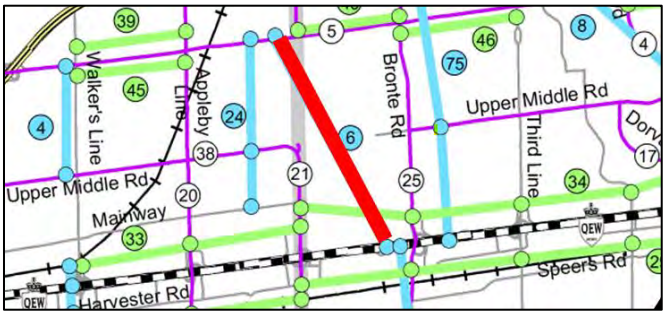
The Stage 1 and Stage 2 transportation assessments were conducted based on a comparative analysis of each growth scenario and concept. Thus, a more standard and rigid approach was used to ensure each scenario and concept was assessed on an equal basis. Whereas, the previous assessments were comparative, the current assessment of the Draft Preferred Growth Concept (September 2021) is absolute, giving the opportunity to be detailed in the assessment of the transportation system and the definition of possible solutions to support growth to 2051. Further, the transportation strategy for the Draft Preferred Growth Concept (September 2021), as presented in this report, will be subject to further refinement and enhancement and detailed planning through upcoming Multi-Modal Transportation Master Plan to 2051.

4.5 Draft Preferred Growth Concept (September 2021) Assessment

The output from the Region's Travel Demand Forecasting model was assessed for the 2041 and 2051 planning horizons and discussed in more detail below. As noted above, these deficiencies in transportation capacity are net of any required improvements along provincial facilities.



Screenline (SL) 4 (Burlington) includes Dundas Street and Upper Middle Road. This screenline exhibits a deficiency in capacity equivalent to one (1) arterial lane per direction for both planning horizons. From a more detailed evaluation of the links that make up this screenline, it is concluded that more capacity is required along Dundas Street as most of the unserved volume of the screenline is in this link. However, by 2031, Dundas Street is already at the maximum 6-lane cross section and has been identified as a Transit Priority Bus Corridor based on the DMTR Study. As such, given the magnitude of the unserved volume of trips, a high-order transit solution, through enhanced service, is the most appropriate for consideration.



SL 6 (Oakville) is made up of Dundas Street, North Service Road, and the Queen Elizabeth Way (QEW). This screenline exhibits a deficiency in capacity equivalent to one (1) arterial lane per direction for both planning horizons. From a more detailed evaluation of the links that make up this screenline it is concluded that most of the deficiency would be addressed by adding one lane on the QEW however, there is still a significant volume of trips that are not served along Dundas Street, indicating that although the screenline may be functioning below the threshold with improvements to the QEW, a localized issue still exists along Dundas Street. However, by 2031, Dundas Street is already at the maximum 6-lane cross section and has been identified as a Priority Bus Corridor based on the DMTR Study. As such, a high-order transit solution, through enhanced service, is the most appropriate for consideration.

SL 72 (Oakville) is made up of Dundas Street, Burnhamthorpe Road, Upper Middle Road, William Halton Parkway, and the Queen Elizabeth Way (QEW). This screenline exhibits a deficiency in capacity equivalent to one (1) arterial lane per direction for both planning horizons. From a more detailed evaluation of the links that make up this screenline it is concluded that the deficiency needs to be address though a combination of improvements to the QEW and along Dundas Street. However, by 2031, Dundas is already at the maximum 6-lane cross section and has been identified as a Bus Rapid Transit corridor in 2041 based on the DMTR Study. As such, a high-order transit solution, through enhanced service, is the most appropriate for consideration.

In considering Screenlines 4, 6 and 72 there is a trend within the Dundas Street corridor from the boundary with Peel Region to as far west as Brant Street where there is unserved demand along this corridor. Therefore, a Dundas Street-wide solution is required to address unserved travel demand by 2051. As Dundas Street has been identified as a Bus Rapid Transit Corridor, as illustrated in Exhibit 4, the most appropriate option to serve the magnitude and distance of this demand is through enhanced high-order transit service.

Exhibit 4 – DMTR Study Preliminary 2041 Recommended Transit Priority Corridor Network

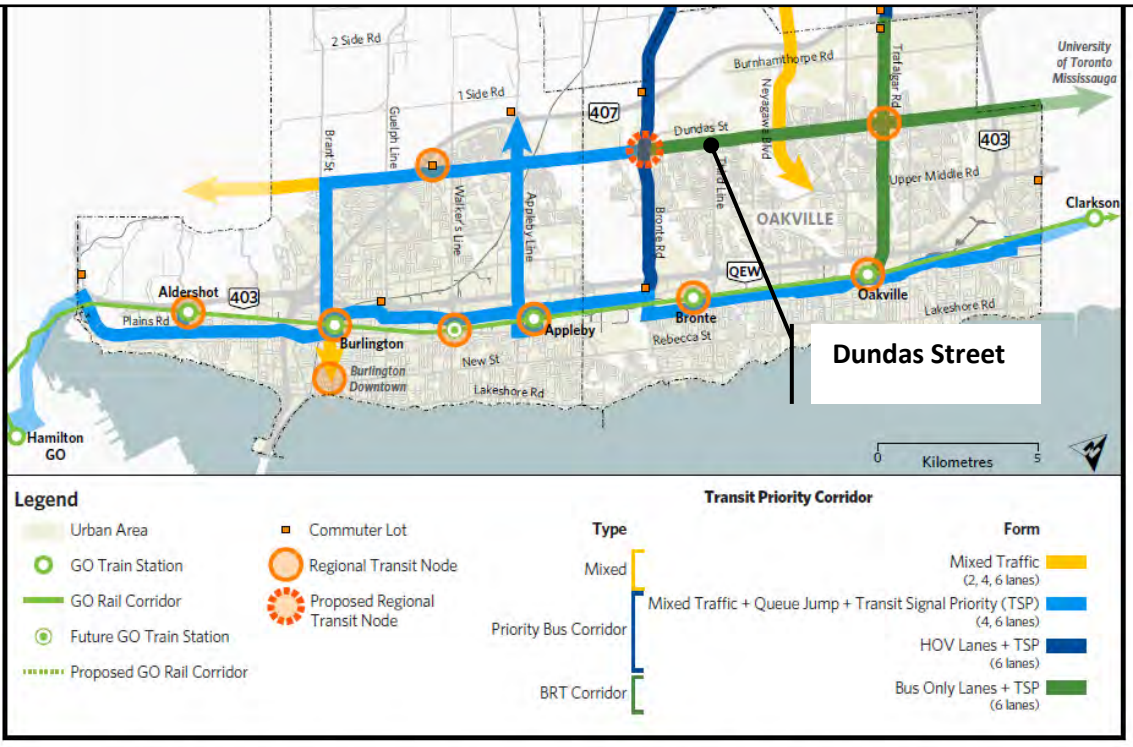
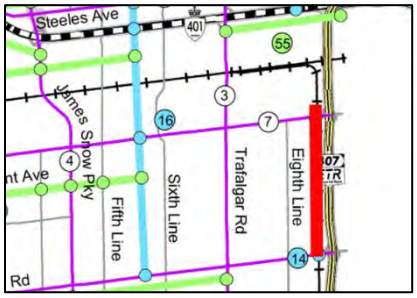


Figure i-5: Preliminary 2041 Recommended Transit Priority Corridor Network

SL 35 (Oakville) is made up of Trafalgar Road, Ford Drive, Highway 403, Winston Churchill Boulevard and Eighth Line. This screenline exhibits a deficiency in capacity equivalent to one (1) arterial lane per direction for both planning horizons. From a more detailed evaluation of the links that make up this screenline it is concluded that the deficiency needs to be addressed through a widening of Ford Drive / Ninth Line, generally between Royal Windsor Dr and Dundas St.



SL 14 (Milton) is made up of Derry Road and Britannia Road. This screenline exhibits a deficiency in capacity equivalent to one (1) arterial lane per direction for both planning horizons. From a more detailed evaluation of the links that make up this screenline it is concluded that more capacity is primarily required along Derry Road, as most of the unserved volume of the screenline is in this link.

However, by 2031, Derry Road is already at the maximum 6-lane cross section and has been identified as a Priority Bus Corridor based on the DMTR Study. Britannia Road has a similar designation and has the proposed Milton Education Village at its west terminus.

Given the magnitude of the unserved volume of trips and the localized nature of the deficiency, a high-order transit solution alone cannot address the demand and other operational improvements would need to be considered for the 2041 planning horizon.

Screenlines 7, 17, and 57 did not exhibit deficiencies in 2041 but did exceed the analysis threshold by 2051.

SL 7 (Oakville) is made up of Speers Road/Cornwall Road, Rebecca Street, Lakeshore Road and the QEW. This screenline exhibits a deficiency in capacity equivalent to one (1) arterial lane per direction for both planning horizons. From a more detailed evaluation of the links that make up this screenline it is concluded that most of the deficiency would be addressed by adding one lane on the QEW, however, there is still a significant volume of trips that are not served along Speers Road/Cornwall Rd, indicating that although the screenline may be functioning below the threshold, a localized issue still exists along Speers Road/Cornwall Road. This link is already at the maximum 6-lane cross section by 2031 and there is no obvious solution to this localized deficiency at the level of analysis undertaken for the Draft Preferred Growth Concept (September 2021). This screenline issue should be considered in future area-specific transportation studies.

SL 17 (Milton) is made up of Steeles Avenue, Main Street, Derry Road, Louis St-Laurent, and Britannia Road. This screenline exhibits a deficiency in capacity equivalent to one (1) arterial lane per direction. From a more detailed evaluation of the links that make up this screenline it is concluded that most of the unserved volume of the screenline is observed at Derry Road and Britannia Road. However, by 2031, Derry Road is already at the maximum 6-lane cross section and has been identified as a Priority

Bus Corridor based on the DMTR Study. Britannia Road has a similar designation and has the proposed Milton Education Village at its west terminus.

Derry Road is identified as requiring additional transportation capacity at SL 14 and SL 17 demonstrating a trend for this corridor. A Derry Road-wide solution is required to address unserved travel demand by 2051. Given this is a transit priority corridor by 2031 there are multiple solutions available for this screenline including enhanced transit service along Britannia Rd, enhanced transit service along Derry Road and/or operational improvements, such as a Reversible Lane, given the peaking characteristics of travel along Derry Road.

SL 57 (Milton) is made up of Tremaine Road, Bronte Street, Ontario Street, Thompson Road, James Snow Parkway, 5th Line, 5 1/2 Line, Ontario Street. This screenline exhibits a deficiency in capacity equivalent to two (2) arterial lanes per direction. The Regional roadways are at their respective maximum cross section by 2031 and there is no obvious solution to this localized deficiency at the level of analysis undertaken for the Draft Preferred Growth Concept (September 2021). This screenline issue should be considered in future area-specific transportation studies as this Urban Growth Centre / Major Transit Station Area (MTSA) develops.

A summary of screenlines (SL) requiring capacity improvements for each of the 2041 and 2051 planning horizons, is presented in Exhibit 5.

Exhibit 5 - Summary - Screenline Deficiency by Planning Horizon (Regional and Local Solutions Only)

Screenline	2041 Deficiency	2051 Deficiency
4 - Burlington - West of Walkers Line (North)	Lane-equivalent needed on Dundas Street west of Walkers Line - Enhanced Transit Service Solution Recommended	Lane-equivalent needed on Dundas Street west of Walkers Line - Enhanced Transit Service Solution Recommended
6 - Oakville - Bronte Creek (North)	Lane-equivalent needed on Dundas Street at Bronte Creek - Enhanced Transit Service Solution Recommended	Lane-equivalent needed on Dundas Street west of Walkers Line - Enhanced Transit Service Solution Recommended
7 - Oakville Creek (South)	None	Lane equivalent needed on Speers Road/Cornwall Rd at Oakville Creek - Area specific issue. No Solution recommended. Further analysis required as Node develops
14 - Milton - West of Highway 407	Lane equivalent needed on Derry Road west of Highway 407 ETR - Operational improvements assumed - Reversible Lane	Lane equivalent needed on Derry Road west of Highway 407 ETR - Operational improvements assumed - Reversible Lane
17 - Milton - East of Thompson Rd.	None	Lane equivalent needed on Derry Road east of Thompson Road - Operational improvements assumed - Reversible Lane
35 - Oakville - East Oakville north of QEW	Lane equivalent needed on Ford Drive and Ninth Line north of QEW - Recommended Widening of Ford Dr from Royal Windsor to QEW	Lane equivalent needed on Ford Drive & Ninth Line north of QEW - Recommended Widening of Ninth Line from QEW to Dundas Street
57 - Milton - Central Milton south of Main St.	None	2 lane equivalents required - south of Main Street - Area specific issue. High reliance on GO Transit. No regional/local solution recommended. Further analysis required as Node develops
72 - Oakville - East of Trafalgar Rd	Lane-equivalent needed on Dundas Street - Enhanced Transit Service Solution Recommended	Lane-equivalent needed on Dundas Street - Enhanced Transit Service Solution Recommended

5. System Opportunities and Constraints

This section focusses on the screenlines where a regional/local solution is feasible and practical as discussed in the previous section.

Capacity improvements can be made from an operational perspective (traffic signal timing adjustments), a shift in travel behaviour (more HOV, transit travel) or through a physical improvement to the transportation infrastructure (e.g., road widening). In reference to roadway widening, it has been the Region's practice not to widen roadways more than six lane cross-section at the mid-block location. At intersections there are additional lanes to accommodate left and right turns.

Some operational options to improve capacity include signal timing improvements, localize intersection improvements, such as adding left or right turn lanes, turn restrictions and reversible lanes. These operational improvements are proposed in this assessment on a qualitative basis and were generally assumed to be practical and feasible solutions where the absolute volume of traffic not being served was less than 30% of the capacity of the screenline or link being assessed.

5.1 Screenline Assessment

Potential solutions to the identified screenlines above are identified below. It is important to note these are solutions identified within the context of a strategic and conceptual analysis of the requirements to support the travel demand for the Draft Preferred Growth Concept (September 2021). These potential solutions are subject to the evolution of project development from conceptual, to master plan to Municipal Class Environmental Assessment to detailed design, which consider these potential solutions (and/or alternatives) in the context of factors such as socio-economic, natural environmental, archaeological, cultural, transportation and cost impacts. For the purpose of the IGMS, the potential solutions presented below are conceptual only.

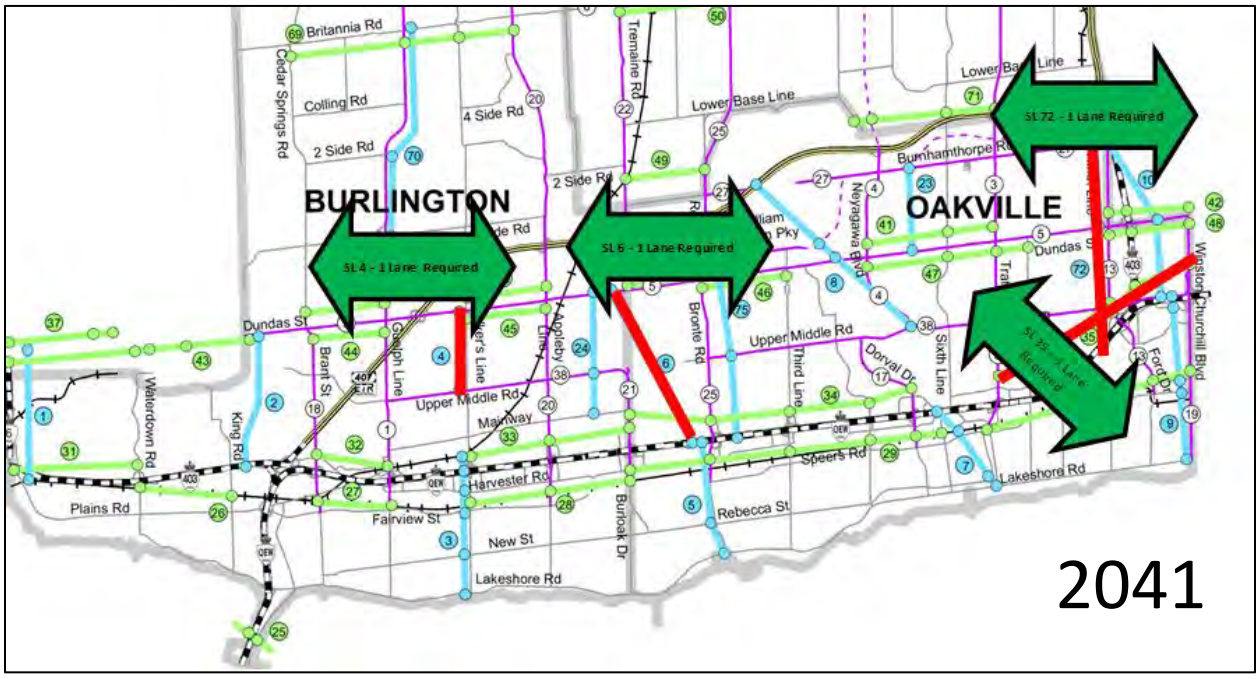
As shown in Exhibit 6, in south Halton Region, Screenlines 4, 6, and 72 demonstrated deficiencies greater than the equivalent of one lane of traffic per direction for both 2041 and 2051 planning horizons.

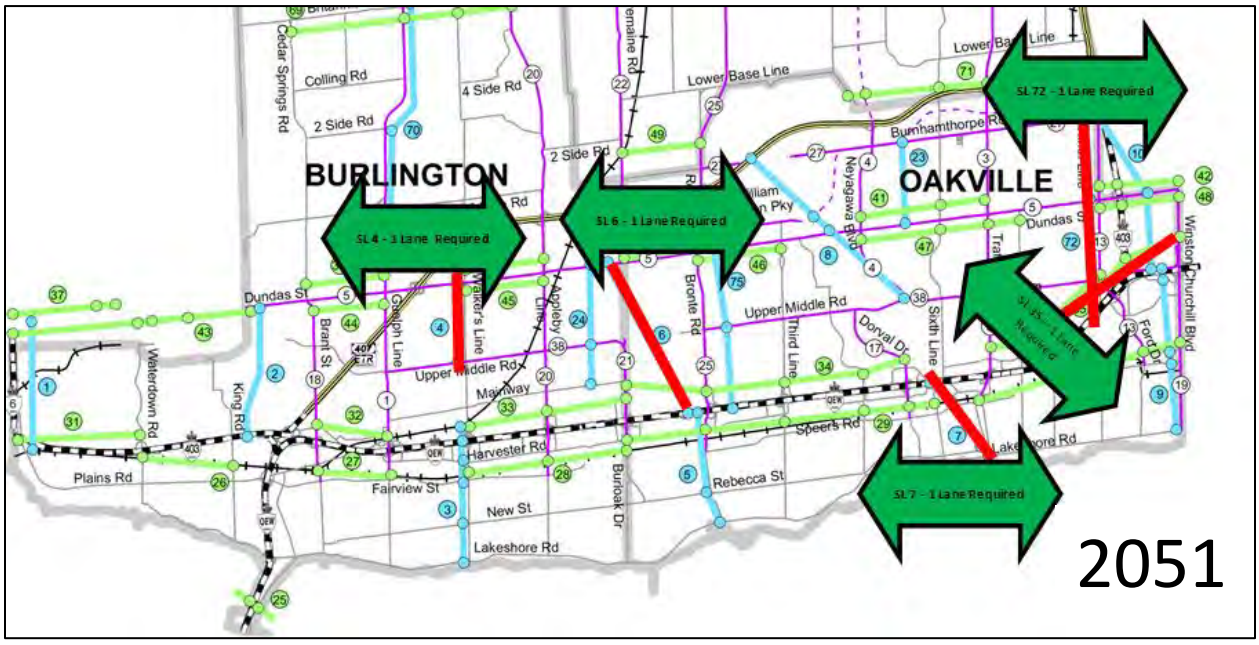
These screenlines include the QEW, Upper Middle Road and Dundas Street as common links. As already indicated, the QEW is under MTO jurisdiction and as such, no solutions are identified as part of this exercise.

To address observed deficiencies in east/west travel demand in south Halton Region that are within the ability of the Region or its local municipalities to resolve, an increase in transit service along Dundas Street is a possible solution, from a pure travel demand perspective, and is consistent with the recommendations of the DMTR Study and the urban context of the IGMS with three Regional Nodes located along this corridor.

The road and transit service capacity, as identified in the DMTR Study, along Dundas Street is reached in 2041. To address travel demand forecasted to 2051, consideration of an enhanced service will be required along Dundas Street from Brant Street to the Halton-Peel boundary.

Exhibit 6 – South Halton Screenline Deficiencies





The service required to meet the forecasted demand could include bi-articulated buses running on 5-minute headway or an articulated LRT vehicle on 15-minute headway, as examples. The solution for this corridor would be addressed as part of future transportation master plans. For the purpose of this assessment, it is assumed that bi-articulated buses would be the solution implemented as it would make use of already planned infrastructure.

Bi Articulated Bus, Source: Volvo Buses

The improvements in transit service along Dundas Street could be phased in a manner consistent with the Region's DMTR Study, where the curb lane on select corridors will transition from general purpose lanes, to HOV, to priority transit to exclusive transit, as the demand builds.

To address the deficiencies in the southeast section of the Region (Screenline 35), Ford Drive would need to be widened to six lanes between Royal Windsor Road and the QEW and Ninth Line would need to be widened to six lanes between the QEW and Dundas Street.

Reversible Lane, Washington DC

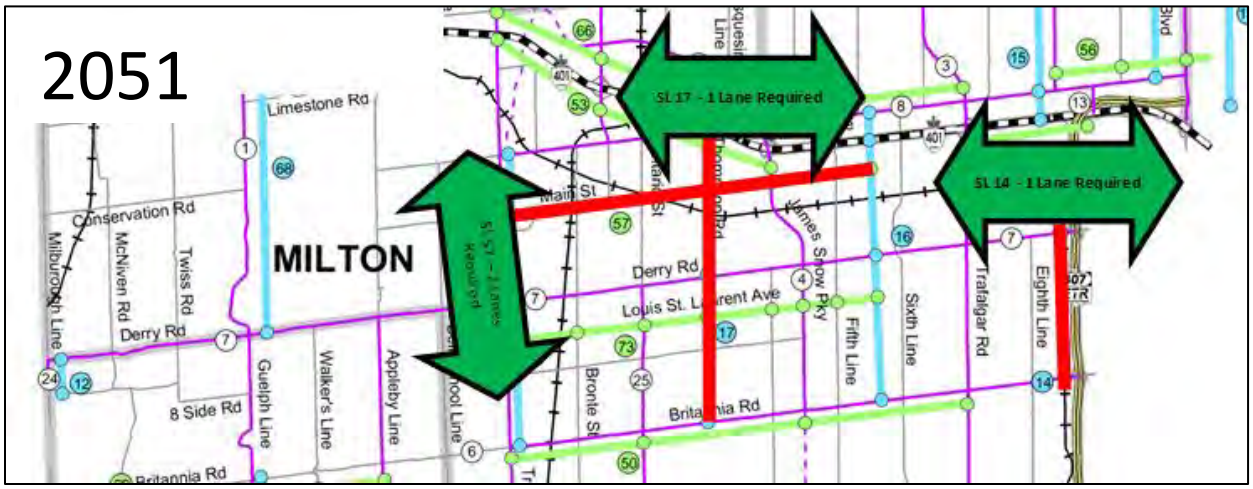
As shown in Exhibit 7, in mid-Halton Region, Screenlines 14 and 17 demonstrated deficiencies greater than the equivalent of one lane of traffic per direction for both 2041 and 2051 planning horizons. However, all the roadways that make up these screenlines are already at six lanes in cross-section and have been identified as a Priority Bus Corridor by 2041 based on the DMTR Study.

There are no opportunities within this area for any new links to add capacity or on the existing regional roadways (Steeles Ave, Derry Road and Britannia Rd) and adding a lane on Main St or Louis St Laurent will not address the full east/west demand observed by 2051.

Reversible Lane, City of Calgary

Screenlines 17 and 14 must rely on a transit solution or operational improvements, such as a reversible lane. Reversible lanes help address traffic congestion by allowing road authorities to switch the travel direction of one or more lanes when additional capacity is needed.

Exhibit 7 – Mid-Halton & South Halton Hills Screenline Deficiencies



Because they move capacity from one direction and give it to the other, they provide the most value for roads with highly directional congestion. This is observed on Derry Road by 2051, with a 28% / 72% split of traffic in the eastbound/westbound directions, respectively. Reversible lanes are typically operated on regular fixed schedules that reflect daily commuting patterns. For the purpose of defining a solution for this assessment, a reversible lane would be a cost-effective potential solution for consideration for this screenline.

Screenline 57 requires capacity improvements by 2051. Within the ability of the Region or Milton, the options to improve the north/south travel performance is through some operational improvements, as discussed above, an increase in transit use, and the addition of a lanes. The addition of lanes is not feasible as the roadways that make up this screenline are already at their maximum cross section. Within the context this strategic analysis reliance on enhanced GO Service to this area would be an appropriate solution, consistent with the Draft Preferred Growth Concept (September 2021) designation of downtown Milton as an Urban Growth Centre/Major Transit Station Area (MTSA).

Notwithstanding the above Regional/Local improvements, it must be noted that there will be significant congestion along the provincial facilities, affecting the regional transportation system.

5.2 Summary of Screenline Capacity Improvements

The required transportation system improvements for each planning horizon are summarized in Exhibit 8.

Exhibit 8 – Transportation System Improvements (2041 – 2051)

Potential Solution*	Planning Horizon		
	2041	2046	2051
Road			
Ford Dr - Royal Windsor Dr to QEW (widen to 6 lanes)	√		
Ninth Line – QEW to Dundas (widen to 6 lanes)		√	
Derry Rd – Highway 407 to Trafalgar Rd (Reversible Lane)	√		
Derry Rd – Trafalgar Rd to RR25 (Reversible Lane)			√
Transit			
Dundas St Transit Improvements – (Per DMTR Study)	√		
Dundas St Transit Improvements – (shorter headway – standard bus)		√	
Dundas St Transit Improvements – (transition to Bi-articulated buses)			√

**Subject to undertaking of transportation master plan and Class Environmental Assessment process*

The above capital and transit improvements will be subject to further enhancement and refinement and detailed planning through the upcoming Multi-Modal Transportation Master Plans to 2051.

Master plans are living documents that are refined and updated on a regular basis, over time, which will consider inputs such as the latest Transportation Tomorrow Surveys. These updates reflect latest trends in transportation, updates to the regional transportation system, and other societal updates pertinent to travel demand. These updates are typically undertaken on a 5 to 10 year interval.

5.3 Transportation System Performance

The Region's transportation system performance for each of the 2041 and 2051 planning horizons was assessed.

The key observation of this assessment is that the regional transportation system, specifically the roadway infrastructure system, will mature by 2041. Therefore, non-auto solutions, primarily high-order transit services, need to be primary consideration for transportation capacity improvements beyond this timeline.

6. Transportation Servicing Cost Assessment

A preliminary high-level cost analysis was completed for each of the potential road infrastructure and transit improvements required to service growth to 2051. The preliminary high-level cost analysis is consistent with previous master planning cost estimating approach. The accuracy range for this analysis presents a typical variation of - 30% and +50% consistent with a Class 4 cost estimate, as per the Association for the Advancement of Cost Engineering (AACE) Cost Estimate Classification System.

6.1 Roads

Exhibit 9 presents a summary of the preliminary high-level cost analysis for road improvements suggested by 2051.

The costs presented below represent the incremental costs to the regional capital and operating programs.

Exhibit 9 – Summary of Increase in Road Capital Costs to Service Draft Preferred Growth Concept (September 2021)

Potential Solution*	**Preliminary High-Level Cost** (2031 to 2051) (2021$)**
Ford Dr – Royal Windsor Dr to QEW (widen to 6 lanes)	$32.3 Million to $69.3 Million
Ninth Line – QEW to Dundas (widen to 6 lanes)	$17.6 Million to $37.8 Million
Derry Rd – Highway 407 to Trafalgar Rd (Reversible Lane)	$9.24 Million to $19.8 Million
Derry Rd – Trafalgar Rd to RR25 (Reversible Lane)	$21.2 Million to $45.5 Million

**Subject to undertaking of transportation master plan and Class Environmental Assessment process*
***Reflects total incremental costs for the 2031 to 2051 period*

6.2 Transit Costs

Based on the above servicing scenario, a preliminary high-level cost was derived for the transit component of the regional transportation system, as presented in Exhibit 10.

It is important to note the preliminary high-level costs presented below are from 2031 to 2051 and are in addition to the 2031 cost estimate recommendations from the DMTR Study. As presented in the DMTR Study, the Transit Priority Networks includes $261M (2016$) in new transit infrastructure by 2031, which includes transit station infrastructure, transit priority infrastructure including TSP, fibre optic communications, and queue jump lanes. In addition to infrastructure costs, transit fleet requirements in the range of $117M (2016$) have also been allocated by 2031 and approximately $39M (2016$), per year, to cover Operations and Maintenance (O&M) costs to 2031. These 2016 costs were adjusted to current values.

Based on the above servicing scenarios, costs were derived for the transit component of the regional transportation system, as presented in Exhibit 10.

The costs presented below represent the incremental costs to the regional capital and operating programs.

Exhibit 10 – Summary of Increase in Transit Costs for Draft Preferred Growth Concept (September 2021)

Draft Preferred Growth Concept (September 2021) *	**2031 to 2051** (2021$)**
Capital	$127 Million to $272.3 Million
O&M	$21.7 Million to $46.5 Million

**Costs include the recommendations per the DMTR Study in addition to the recommendations suggested in this analysis.*
***Reflects total incremental costs for the 2031 to 2051 period*

7. Summary of Key Findings and Conclusions

The estimates of future capacity requirements to 2051 are approximate and intended to provide a high-level assessment of potential future capacity constraints and opportunities. The transportation strategy of the Draft Preferred Growth Concept (September 2021), as presented in this report, will be subject to further enhancement through future multi-modal transportation master plans over the next 30 years.

Master plans are living documents that are refined and updated on a regular basis over time, which will consider inputs such as the latest Transportation Tomorrow Surveys. These updates reflect trends in transportation, updates to the regional transportation system, and other societal updates pertinent to travel demand. These updates are typically undertaken on a 5 to 10 year interval.

Through its transportation planning efforts to-date, Halton Region recognizes that travel and mobility evolve. The Region is ensuring in its planning processes that transportation corridors are protected now and, as its transportation system evolves, transportation solutions can also evolve to accommodate multi modal transportation demand into 2051 and beyond.

It is important to note that this analysis is representative of a high-level transportation strategy to support the draft Preferred Growth Concept (September 2021). The strategy discussed herein is based on opportunities and constraints and is conceptual only. Further as noted the strategy and associated costs developed for the analysis of the draft Preferred Growth Concept (September 2021) is subject to refinement and detailed planning through the Region's next Multi-Modal Transportation Master Plan update.

8. Draft Preferred Growth Concept (December 2021)

This report outlined the technical assessment of the Draft Preferred Growth Concept (September 2021) as defined, at that time, per the September 2021 draft PGC population and employment numbers, issued September 13, 2021.

Since the submission of the draft report in the Fall of 2021, there has been a further update to the IGMS population/employment numbers, based on consultation with the area local municipalities and further planning analyses.

Appendix 5 presents an opinion on the impacts to the infrastructure analysis and recommendations, as presented in sections 1 through 7 of this report, from the Draft Preferred Growth Concept (December 2021) numbers. This opinion is non-quantitative and without the modelling exercise that led to the Fall 2021 submission. A detailed analysis (including modelling) of the final PGC numbers will be undertaken in March 2022, once these latest numbers undergo further consultation within the Region and its local municipalities and any modifications are finalized.

Appendices

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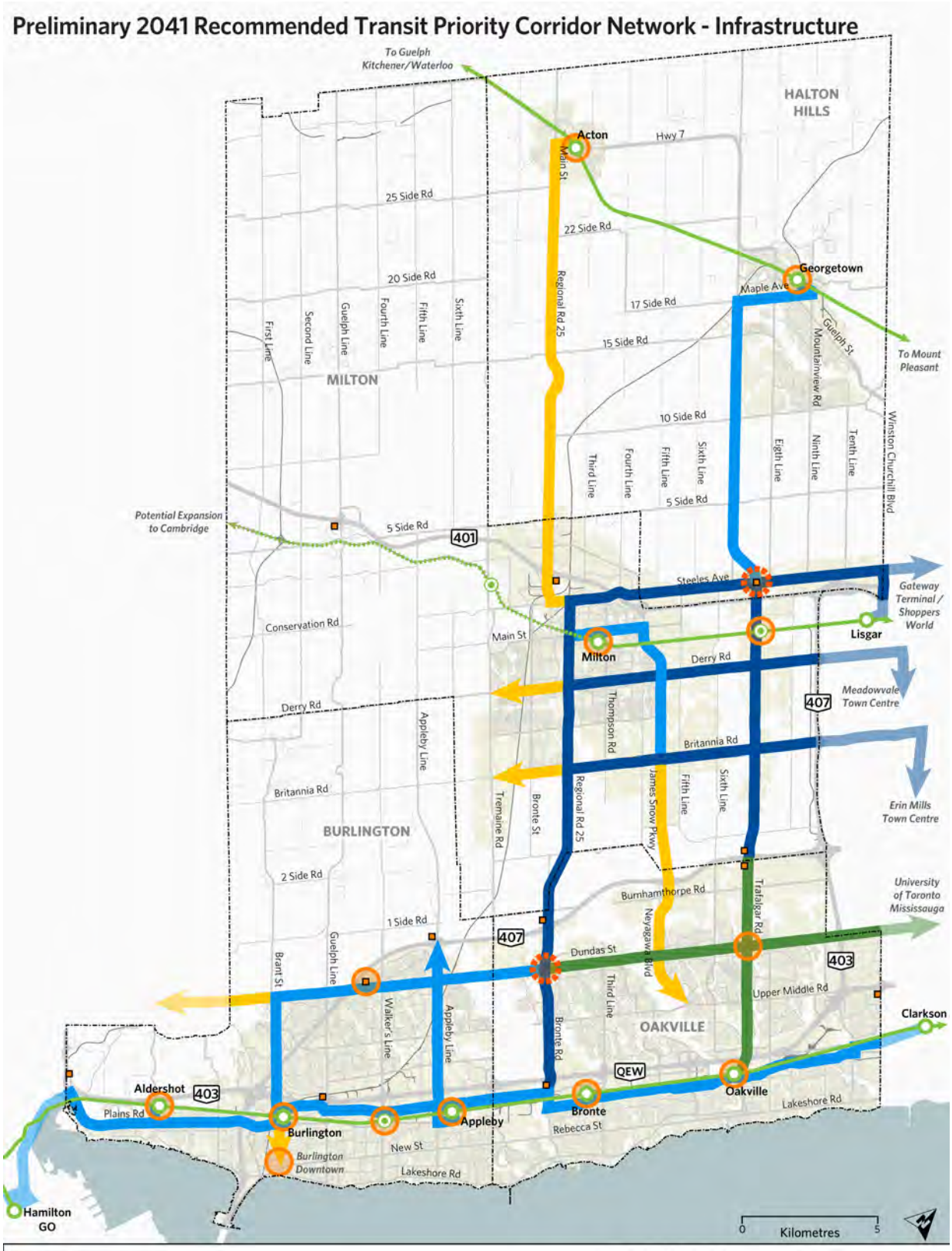
Appendix 1

2041 Recommendation of the Defining Major Transit Requirements in Halton Region (DMTR) Study

Preliminary 2041 Recommended Transit Priority Corridor Network - Infrastructure



Legend

- Urban Area
- GO Train Station
- GO Rail Corridor
- Future GO Train Station
- Proposed GO Rail Corridor
- Commuter Lot
- Regional Transit Node
- Proposed Regional Transit Node

Transit Priority Corridor

Type	Form
Mixed	Mixed Traffic (2, 4, 6 lanes)
Priority Bus Corridor	Mixed Traffic + Queue Jump + Transit Signal Priority (TSP) (4, 6 lanes)
	HOV Lanes + TSP (6 lanes)
	Bus Only Lanes + TSP (6 lanes)
BRT Corridor	

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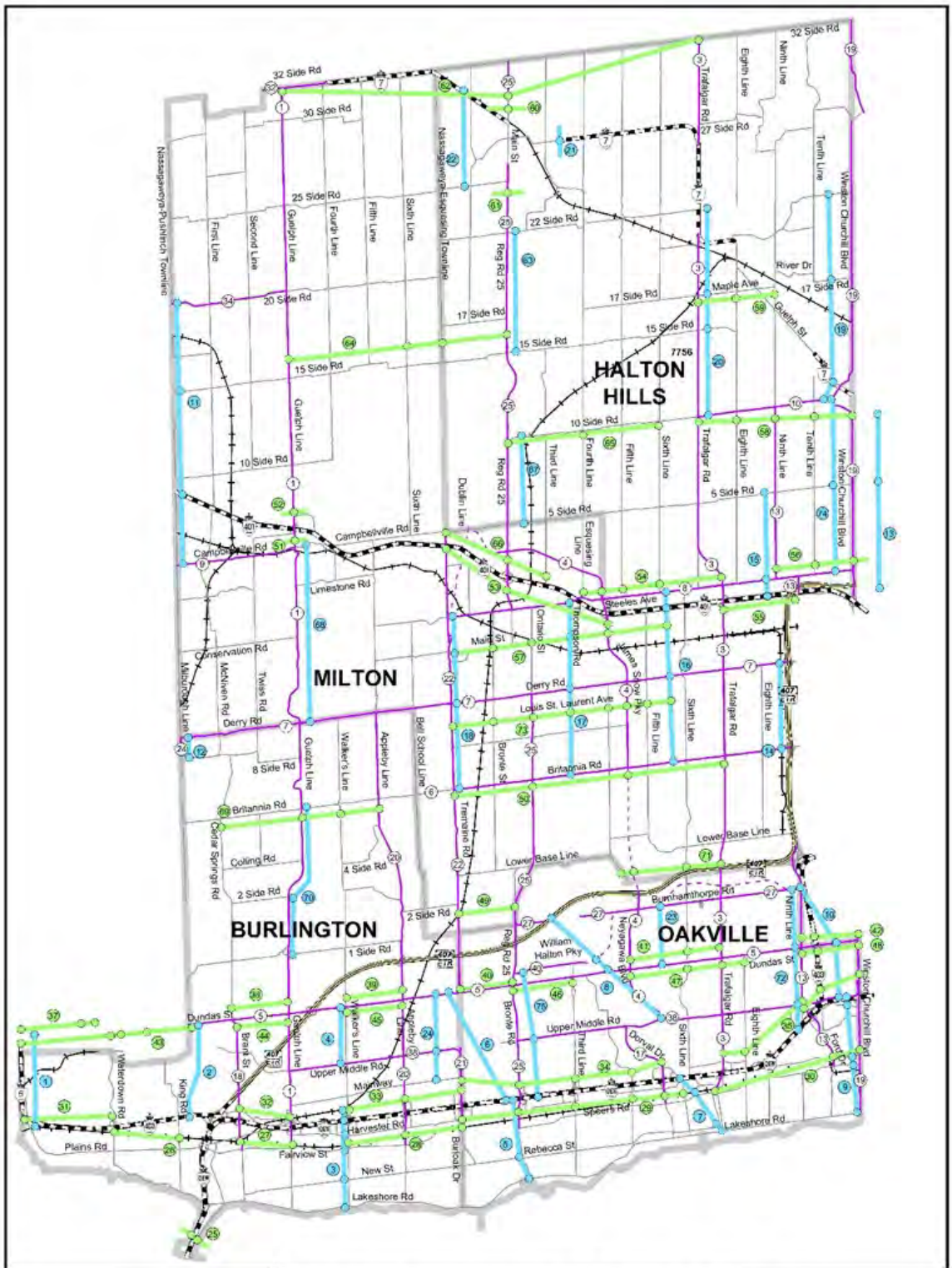
Appendix 2

Regional Screenlines



Regional Screenlines (As of February 2019)

Legend

- Major Roads
- Highway
- Toll Highway
- Regional Roads
- Proposed Regional Roads
- Railway Lines
- Halton Municipal Boundary
- North - South Screenlines
- East - West Screenlines
- North - South Screenline Identification Number
- East - West Screenline Identification Number

March 2019

0 1 2 4 6

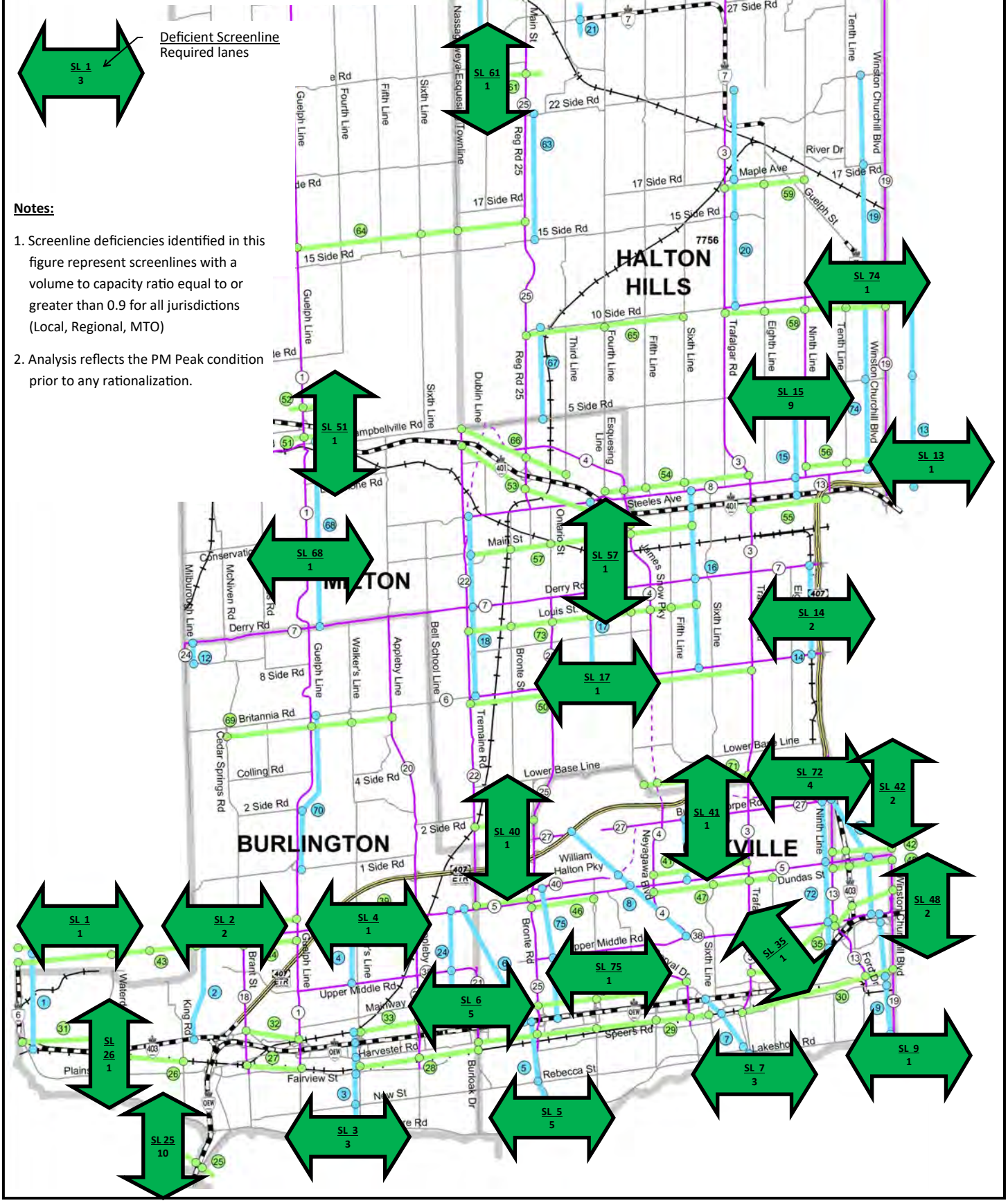
Kilometres

EllSo Consulting

Appendix 3

Regional and MTO screenline deficiency - Draft Preferred Growth Concept (September 2021)

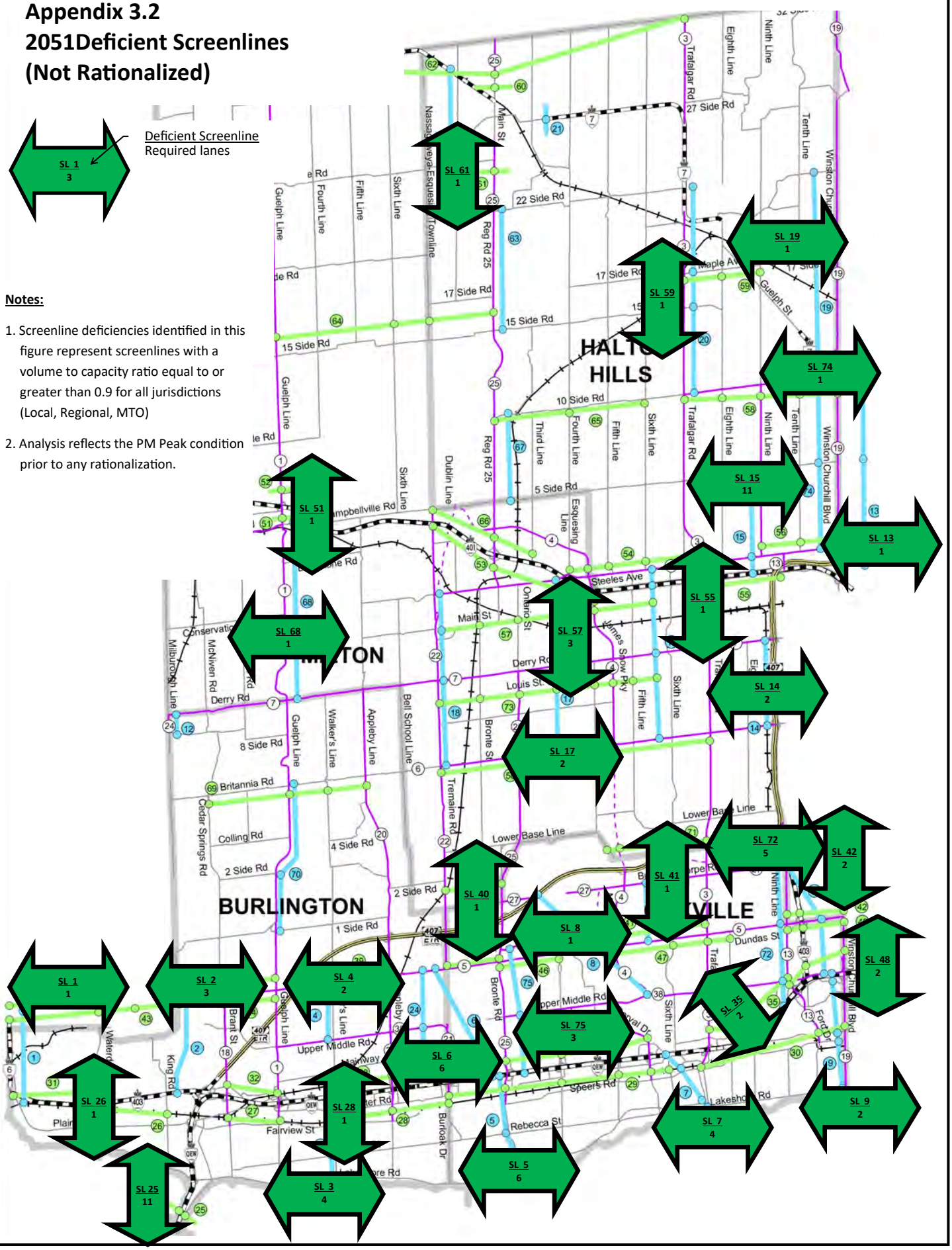
Appendix 3.1
2041Deficient Screenlines
(Not Rationalized)



Notes:

1. Screenline deficiencies identified in this figure represent screenlines with a volume to capacity ratio equal to or greater than 0.9 for all jurisdictions (Local, Regional, MTO)
2. Analysis reflects the PM Peak condition prior to any rationalization.

Appendix 3.2
2051Deficient Screenlines
(Not Rationalized)



Notes:

1. Screenline deficiencies identified in this figure represent screenlines with a volume to capacity ratio equal to or greater than 0.9 for all jurisdictions (Local, Regional, MTO)
2. Analysis reflects the PM Peak condition prior to any rationalization.

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Appendix 4

Regional Screenline deficiency - Draft Preferred Growth Concept (September 2021)

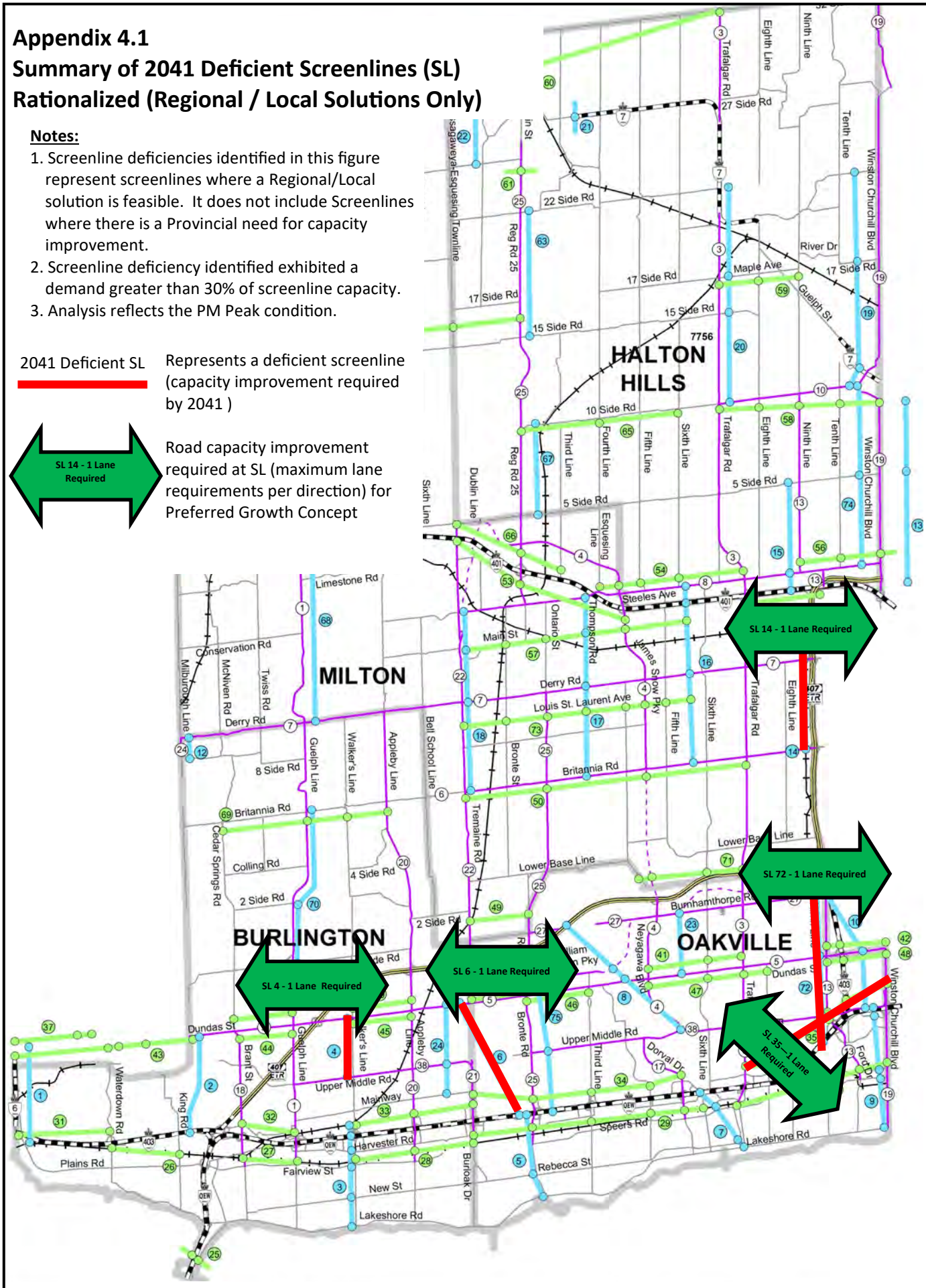
Appendix 4.1
Summary of 2041 Deficient Screenlines (SL)
Rationalized (Regional / Local Solutions Only)

Notes:

1. Screenline deficiencies identified in this figure represent screenlines where a Regional/Local solution is feasible. It does not include Screenlines where there is a Provincial need for capacity improvement.
2. Screenline deficiency identified exhibited a demand greater than 30% of screenline capacity.
3. Analysis reflects the PM Peak condition.

2041 Deficient SL — Represents a deficient screenline (capacity improvement required by 2041)

SL 14 - 1 Lane Required — Road capacity improvement required at SL (maximum lane requirements per direction) for Preferred Growth Concept



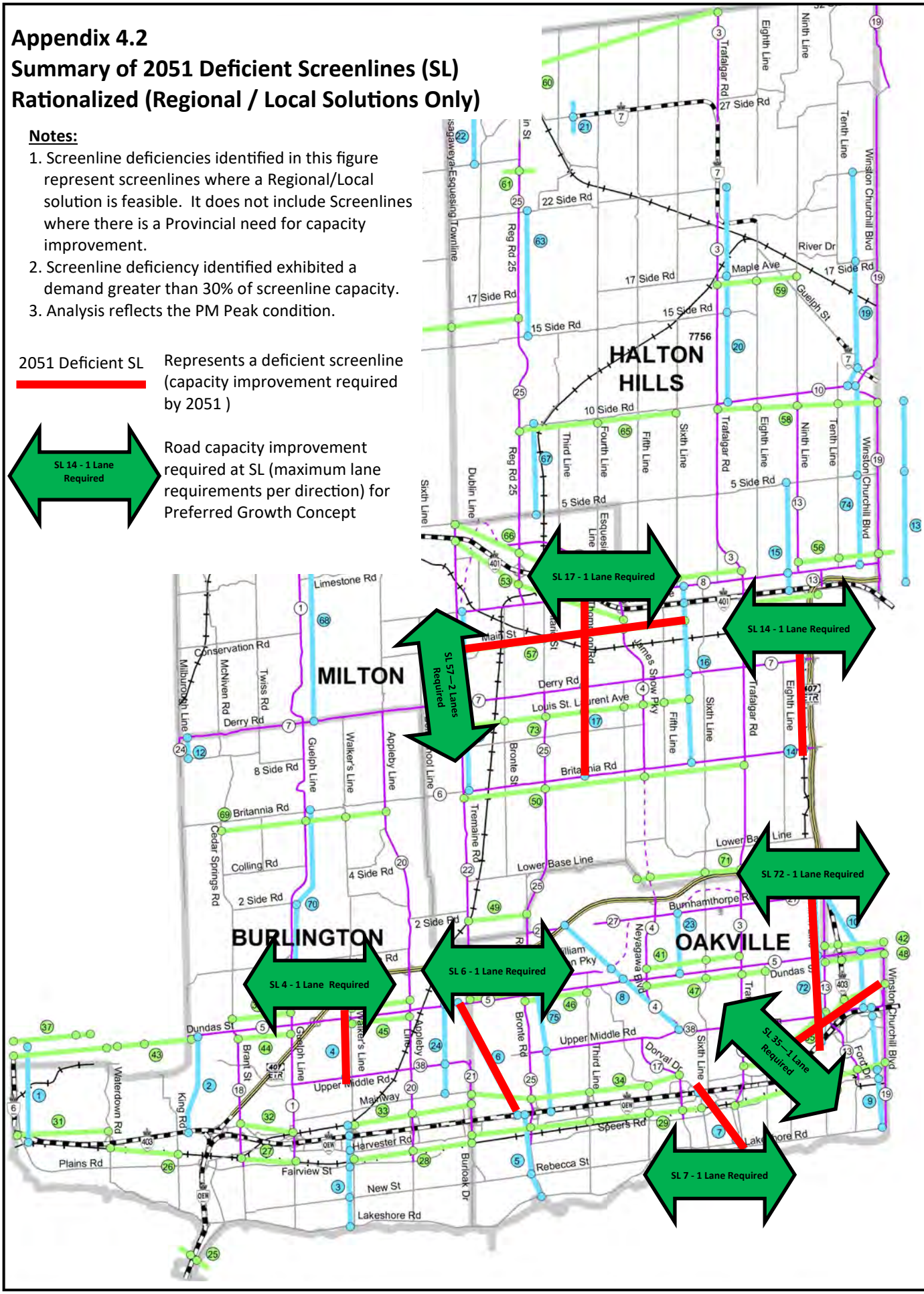
Appendix 4.2
Summary of 2051 Deficient Screenlines (SL)
Rationalized (Regional / Local Solutions Only)

Notes:

1. Screenline deficiencies identified in this figure represent screenlines where a Regional/Local solution is feasible. It does not include Screenlines where there is a Provincial need for capacity improvement.
2. Screenline deficiency identified exhibited a demand greater than 30% of screenline capacity.
3. Analysis reflects the PM Peak condition.

2051 Deficient SL — Represents a deficient screenline (capacity improvement required by 2051)

SL 14 - 1 Lane Required — Road capacity improvement required at SL (maximum lane requirements per direction) for Preferred Growth Concept



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Appendix 5

Opinion Letter on Draft Preferred Growth Concept (December 2021)

January 18, 2022

Mr. Russell Mathew, RPP, MCIP, MRICS, PLE
Partner
Hemson Consulting
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Halton Region Integrated Growth Management Strategy
Opinion on Impacts to Transportation Servicing from the
December 2021 Draft Preferred Growth Concept population and employment numbers

The purpose of this letter is to present an opinion on the potential impacts to the infrastructure analysis and recommendations, as presented in the IGMS Transportation Technical Memorandum (herein referred to as the September 2021 technical analysis), from the December 2021 release of draft Preferred Growth Concept (PGC) population and employment numbers for the Halton Region Integrated Growth Management Strategy (IGMS).

1. Introduction

Since the submission of the September 2021 technical analysis, there has been a further update to the draft Preferred Growth Concept (PGC) based on consultation with the area local municipalities and updated technical planning analysis - the Draft Preferred Growth Concept (December 2021) population and employment numbers. These numbers were presented at the November 17, 2021, Council Workshop.

In order to meet the current IGMS timelines and reporting to Regional Council, it has been decided that the Draft Preferred Growth Concept (December 2021) be assessed on a non-quantitative basis without the modelling exercise that comprised the September 2011 technical analysis. A detailed analysis (including modelling) of the Draft Preferred Growth Concept (December 2021) will be undertaken in March 2022, once these latest numbers undergo further consultation within the Region and its local municipalities, and any modifications to the numbers are finalized.

2. Review of December 2021 Draft Preferred Growth Concept

The basis of this opinion letter is a non-quantitative analysis of the change and potential additional transportation needs from the Draft Preferred Growth Concept (December 2021). In comparing these numbers to the Draft Preferred Growth Concept (September 2021), the most significant changes appear to take place in Milton and North Oakville area.

The numbers show the same population and employment growth to 2041 as well as 2051 Region-wide totals, as the Draft Preferred Growth Concept (September 2021) numbers.

There are some changes in the projected growth at the municipality level to 2051, such as:

- More population growth (~24,000) in Oakville;
- Less population growth in Halton Hills (~6,000) and Milton (~20,000);
- More employment growth (~2,000) in Burlington and (~3,000) in Oakville; and
- Less employment growth (~ 1,000) in Halton Hills and (~4,000) in Milton.

Overall, there are approximately 118,000 people+jobs that were moved across the Region. Some changes are not very significant (less than 500 or 100 people+jobs), but some others have more potential to have an impact on infrastructure servicing. Phasing of infrastructure could also be impacted as there appears to be some areas that are showing growth before 2041 that were shown as post-2041 in the Draft Preferred Growth Concept (September 202).

The Draft Preferred Growth Concept (December 2021) is summarized in Table 1 below, by local municipality.

Table 1 – Draft Preferred Growth Concept (December 2021)

Population and Employment Growth (2016 – 2051)

Municipality	Population Growth		Employment Growth	
	(2016-2041)	(2016-2051)	(2016-2041)	(2016-2051)
Burlington	52,000	77,000	18,000	27,000
Halton Hills	39,000	63,000	24,000	42,000
Milton	144,000	221,000	56,000	91,000
Oakville	130,000	175,000	58,000	77,000
Total	**365,000**	**534,000**	**156,000**	**237,000**

Note: Values rounded to the closest 1,000.
Totals may not add up due to rounding

3. Infrastructure recommendations for December 2021 draft PGC numbers

The potential impact to the transportation infrastructure identified for the conceptual transportation system, presented in the September 2021 technical analysis, is presented below by local municipality.

The discussion and high-level assessment of the impacts of the Draft Preferred Growth Concept (December 2021) numbers is based on a non-quantitative review and professional experience and is focused on areas where the change in population and employment, at the traffic zone level, was greater than 1000 people and jobs by 2051. Modelling or detailed assessments/calculations have not been performed to support this opinion.

3.1 City of Burlington

The Draft Preferred Growth Concept (December 2021) numbers have two areas within the City of Burlington where there is a change in population and employment, compared to the Draft Preferred Growth Concept (September 2021), that could impact the September 2021 technical analysis and recommendations: Waterdown and Alton. As a result, the following changes may result, to the September 2021 technical analysis and recommendations.

More people+jobs in Waterdown could potentially contribute to more demand on Highway 403, Dundas St. and Plains Rd. Screenlines 1, 2 and 26 could be impacted. These screenlines were deficient based on the modelling undertaken for the September 2021 technical analysis; hence this change could potentially increase the demand for capacity in west Halton. The degree of the potential increase on the screenline performance is to be defined once modelling work is undertaken for the latest population/employment numbers.

More people+jobs in Alton could potentially contribute to more demand on Highway 407, Dundas St and Appleby Line. Screenlines 2, 4, and 6 could be impacted. These screenlines were deficient based on the modelling undertaken for the Draft Preferred Growth Concept (September 2021); hence this change could potentially increase the demand for capacity in west Halton. Dundas St. could experience higher travel demands than those already identified in the September 2021 technical analysis, affecting an already congested link in the network. The degree of the increase on the screenline performance is to be defined once modelling work is undertaken for the latest population/employment numbers.

3.2 Town of Oakville

The Draft Preferred Growth Concept (December 2021) numbers have an increase in population and employment in the North Oakville area, compared to the Draft Preferred Growth Concept (September 2021) numbers, that may impact the September 2021 technical analysis and recommendations. There is a net increase of approximately 24,700 population and approximately 3,300 employment, primarily in North Oakville. As a result, the following changes may result, to the September 2021 technical analysis recommendations.

More population and employment in North Oakville could potentially generate more demand on Dundas St, Highway 407, Trafalgar Rd, Regional Road 25, Neyagawa Blvd, Ninth Line and Highway 403, which generally capture screenlines 1, 8, 41, 72 and 42. All of these screenlines had capacity deficiencies in the September 2021 technical analysis and could have a greater deficiency under the Draft Preferred Growth Concept (December 2021). This could potentially require a much greater higher-order transit service on Dundas St than recommended in the September 2021 technical analysis, improvements to William Halton Parkway (e.g., widening), as well as greater higher-order transit service on Trafalgar Road.

3.3 Town of Milton

Compared to Draft Preferred Growth Concept (September 2011) numbers, the Draft Preferred Growth Concept (December 2021) numbers have less population and employment with a difference of approximately 19,500 and 3,700, respectively.

The population and employment numbers in the core of Milton, per the Draft Preferred Growth Concept (December 2021), could contribute to relieving the deficiency identified at screenline 57, however, the magnitude of this change cannot be determined at this time and will be reviewed in further detail as part of subsequent analysis of the final population/employment numbers.

The changes in southeast Milton could potentially result in additional demand on Britannia Rd than was identified in the September 2021 technical analysis and potentially result in less demand along Derry Rd., since there is less population/employment closer to Derry Rd and more along/close to Britannia Rd. The magnitude of the net change between the Draft Preferred Growth Concept (September 2021) and Draft Preferred Growth Concept (December 2021) cannot be defined as part of this analysis. Based on the location of the changes, more demand would appear to be directed towards Britannia Rd.

3.4 Town of Halton Hills

Compared to Draft Preferred Growth Concept (September 2011) numbers, the Draft Preferred Growth Concept (December 2021) has less population and employment in the Town of Halton Hills, with a difference of approximately 5,000 population and 1,800 employment.

Due to the geographical dispersion of the affected areas, further analysis beyond the scope of this opinion, is required to define whether there will be any significant impact on transportation services.

It would appear that improved transit service may be required along Trafalgar Rd. to accommodate the increase in population north of 10 Side Road.

The changes in the southern section of the municipality are not anticipated to affect the defined screenline deficiencies, which are primarily driven by demand on Highway 401.

4. Conclusions

Based on this high-level, non-quantitative review of the Draft Preferred Growth Concept (December 2021) numbers, there may be some impact to the recommendations of the September 2011 technical analysis, primarily along three corridors in the Region: Dundas St, Britannia Rd, and Trafalgar Rd. The extent, or magnitude, of the potential impact along these corridors cannot be defined, at this time, and will be reviewed in detail once modelling of the final PGC numbers is undertaken in March 2022.

It is important to note the transportation system improvements suggested through the IGMS as reported in the September 2011 technical analysis, and this opinion letter, are conceptual and define a snapshot in time. These recommendations will be confirmed in the Region's next Multi-Modal Transportation Master Plan update to 2051.

Yours truly,

ELLSO CONSULTING INC.

Alvaro L Almuina, P.Eng., M.Eng., PMP, DCE
Director