HITTING THE ROADS WITH ALTERNATIVE MODES; AN EVALUATION OF YORK REGION'S TDM POLICIES

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EXECUTIVE SUMMARY

Traffic congestion is a growing and urgent concern for municipal governments, who are struggling to keep up with the demand on their roadways. In the post-war period, congestion mitigation policies have traditionally sought to increase the capacity for cars. This approach has not worked, since this approach has little if any long-term positive effects and has a tendency to actually increase congestion long term. A more appropriate approach to mitigating congestion is with transportation demand management (TDM). Instead of reducing congestion by making driving more convenient, TDM strategies attempt to influence the convenience, price and safety of alternative travel modes. The TDM approach seeks to reduce that demand through incentives, disincentives, promotion, education, and policy reform. TDM manages the *demand* for travel by drive alone private car, rather than catering for that demand, or managing the road system.

The Regional Municipality of York is a southern Ontario regional municipality that has incorporated TDM policies into several of its plans. This report investigates the TDM components of York Region's plans in order to assess its policy environment for TDM, by answering two research questions:

Question 1: Does York Region accurately interpret TDM?

Question 2: Has York Region created a policy environment that supports TDM?

First, the interpretation of TDM in three case studies considered best practices is analyzed and compared to York Region's to ascertain whether York Region's interpretation is appropriate. This is done by identifying themes used by the best practice case studies and by York Region to interpret TDM, and comparing the themes found in the best practices' plans to the ones found in York Region's. York Region's themes were found to be generally consistent with those of the best practices. Where there were inconsistencies, this report issues a recommendation to include that theme in York's plans and improve York Region's interpretation of TDM.

Second, York Region's plans were evaluated against a set of nine criteria for creating good TDM policy. This is done by reviewing each of York Region's plans and identifying whether a criterion was addressed, somewhat addressed or not addressed, using a qualitative process. Where a criterion is found to be somewhat addressed or not addressed, this report issues a recommendation to improve upon it. This report also provides an example where this recommendation was carried out in a best practice case study or in another of York Region's plans.

York Region was found provide a better interpretation of TDM than the best practice case studies and to perform fairly well against the list of criteria, though not all plans performed well against all of the criteria. The recommendations from both parts of the analysis are:

Recommendation 1: Directly relate TDM to achieving the long-term vision described by Vision 2051, the ROP and the RTMP.

Recommendation 2: Present TDM as a decision-making tool in evaluating potential road investments.

Recommendation 3: The Vision should explicitly call for integration of TDM at a variety of scales, to be implemented by policies in lower-level plans.

Recommendation 4: The Vision should express the relationship between land use and TDM, to be implemented by policies in lower-level plans.

Recommendation 5: The ROP should explicitly stipulate that alternative modes of transportation must be reliable and predictable.

Recommendation 6: The Vision and RTMP should include equity as part of its vision and/or goals, and develop actions and policies to implement equitable TDM policy.

Recommendation 7: The Vision should include TDM as an integral part of its vision for 2051.

Recommendation 8: The ROP and RTMP should include a more comprehensive set of strategies to disincentivize SOV trips.

Recommendation 9: The Vision should aim to be a leader in TDM in order to be an example to other corporations and individuals in the Region and beyond.

The themes identified in the interpretation analysis have applications for municipalities attempting to interpret and define TDM in their own plans. By keeping the common themes in mind in the planning process, a solid foundation can be set that leads to more justifiable TDM policies. The list of criteria that was developed to evaluate York Region's plans is also applicable to other municipalities and can be used as a checklist for developing comprehensive TDM policies. Further research should be done to scrutinize this set of criteria by testing it against other municipalities and case studies. Further research is also needed in order to assemble criteria with regards to themes for interpreting and defining TDM. The combination of these two could lead to a TDM policy-planning toolkit, to help municipalities integrate TDM into their plans in a comprehensive, well thought-out manner.

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1 | INTRODUCTION

1.1 | BACKGROUND

Traffic congestion has become a growing and urgent concern, with Canadian cities consistently ranked as having the worst congestion in North America. Municipal governments all over Canada are struggling to keep up with the demand on their roadways. Though it is easy to blame our worsening road conditions on a shortage of funds and the recent economic crisis, a more accurate culprit is the continuing practice of outdated and flawed approaches to managing congestion since the post-war period (Palma, Lindsey & Proost, 2012). As a response to the proliferation of car use in North America, policies have focused on mitigating increased traffic congestion through a narrow set of strategies that enhance road capacity by building and widening road infrastructure. Though some literature supports the use of these transportation 'supply' management strategies (for example, Hargen & Fields, 2006), these approaches have little if any long-term positive effects and are short sighted. Supply-side strategies are expensive and provide little return on investment (Sweet, 2011; Winston & Langer, 2006), as well as having a tendency to actually increase congestion long term (Goodwin, 2003; Mogridge, 1997).

Over the past thirty to forty years various local and provincial governments have attempted to mitigate congestion through a suite of policies and strategies known as transportation demand management (TDM). Instead of reducing congestion by making driving more convenient, TDM strategies attempt to influence the convenience, price and safety of alternative travel modes (VTPI, 2010). The TDM approach seeks to reduce that demand through incentives, disincentives, promotion, education, and policy reform. By taking an integrated approach, TDM "manage[s] the *demand* for travel by drive alone private car, rather than catering for that demand, or managing the road system" (Ison & Rye, 2008, 2).

1.2 | PURPOSE

TDM strategies have been incorporated to varying degrees in many parts of the world through policies, programs, vision documents, strategies, official plans, infrastructure master plans, local plans and other policy documents. Yet there is no guide prescribing the definitive collection of TDM strategies that will unequivocally solve the growing problem of urban traffic congestion. A guide like this would be difficult to put together, as every municipality has a unique context that faces different issues to be addressed by TDM. Furthermore, there is no clear guide available which provides policy advice to

municipalities on how to incorporate TDM into their plans. There are, however, alternative ways to evaluate municipal TDM policy.

1.3 | QUESTIONS

The Regional Municipality of York is a southern Ontario regional municipality that has incorporated TDM into several of its plans. York Region serves as the upper-tier municipality for nine cities, towns and townships and stretches from Toronto north to Lake Simcoe (Figure 1).

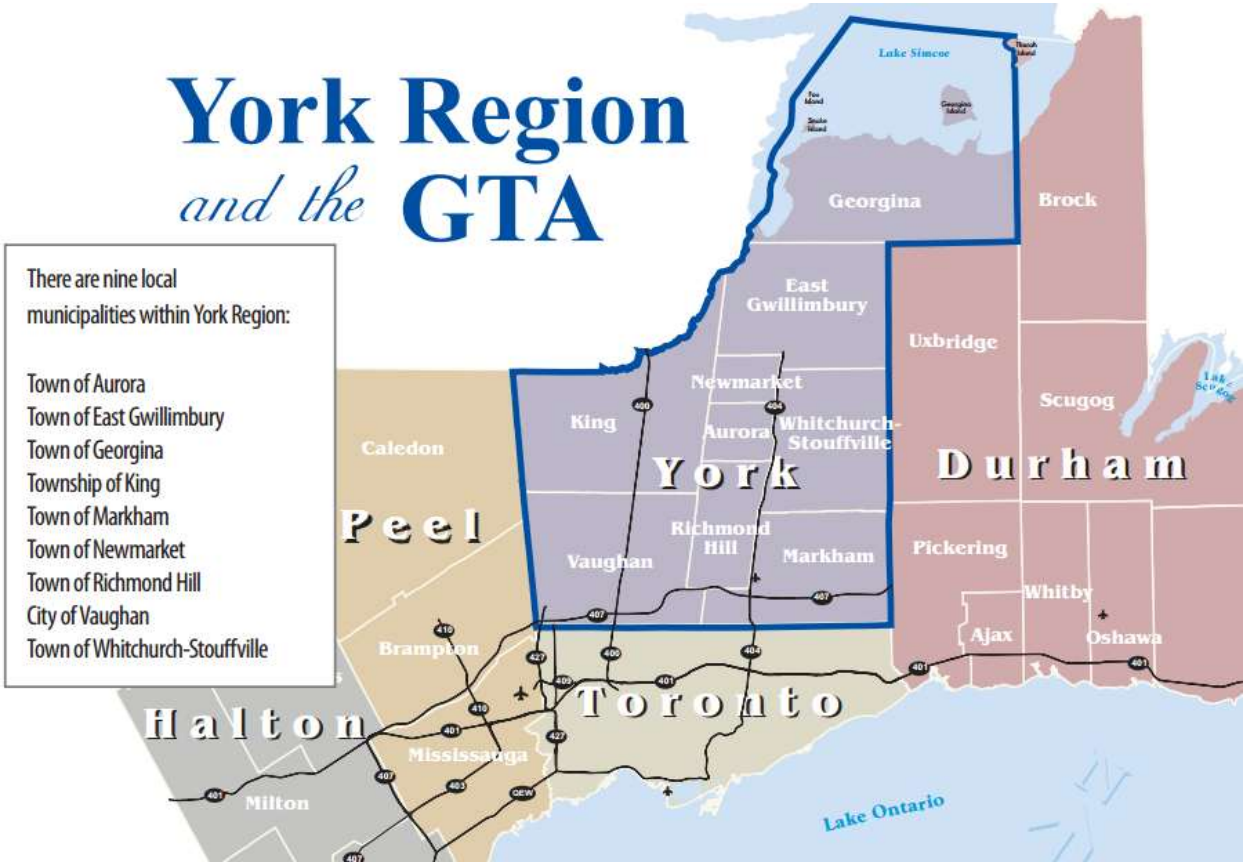

Figure 1 | York Region in the Greater Toronto Area context (York Region, 2009a).

This report investigates the TDM component of York Region's planning scheme in order to assess the potential success of York Region's TDM programs by answering two research questions:

1. *Does York Region accurately interpret TDM?*
2. *Has York Region created a policy environment that supports TDM?*

The first question deals with York Region's interpretation and definition of TDM. Before assessing its policies, it is important to determine whether the Region's interpretation of what TDM is

and how it should be implemented is aligned with proven successful examples. By comparing York Region's definition with several cases considered 'best practices' by academics and professionals, I assess whether York Region has framed TDM in an appropriate way. The second question looks at how the interpretation of TDM manifests itself in the Region's policy documents. Since there is no policy guide for municipalities incorporating TDM strategies into their plans, I use a set of criteria assembled through a literature review to evaluate the Region. By investigating what the Region's policies do to create an environment where demand management techniques are encouraged, it is possible to evaluate its TDM program without requiring a definitive list of required TDM strategies and policies.

1.4 | REPORT OUTLINE

The report is structured as follows. Chapter 2 provides the context for the report, defining TDM and further making the case for it, and discussing potential TDM strategies. It describes York Region and justifies its inclusion as the focus of this research. Chapter 3 outlines the methods used to answer the two research questions, including the criteria used to choose comparative interpretations of TDM and the criteria used to evaluate York Region's plans. Chapter 4 presents the findings of the analysis, which are then interpreted and discussed in Chapter 5. Chapter 6 includes conclusions that can be drawn from this case study report, offers recommendations for York Region to create a supportive environment for TDM, including policies changes, and highlights areas for future research.

2 | CONTEXT & SIGNIFICANCE

This chapter asks why transportation must be managed, outlining the impacts of traffic congestion in order to help establish the significance of this study. It discusses the traditional way of managing transportation, and discusses TDM as an alternative. Finally, this chapter justifies York Region as a case study, and provides a brief summary of the Region and its policies.

2.1 | WHY MANAGE TRANSPORTATION

2.1.1 | HEALTH, ENVIRONMENT & SOCIAL IMPACTS

Congestion and the resulting vehicular emissions have negative effects on human and environmental health. Automobiles produce over fifty percent of all carbon monoxide emissions, and are major contributors to other emissions including nitrous oxide, methane and butane (Behan, Maoh & Kanaroglou, 2008). These pollutants are linked to a variety of health issues including respiratory diseases, cardiovascular diseases, and various cancers, headaches and general fatigue (Behan, Maoh & Kanaroglou, 2008). Not only are vehicles and overcrowded roads major causes of environmentally-damaging greenhouse gas (GHG) emissions, but these emissions are magnified due to traffic congestion. One study found that cars emit twice as much hydrocarbon and carbon monoxide when reducing their speed from 30 miles per hour (48 kilometres per hour) to 15 miles per hour (24 kilometres per hour) (Faiz, Walsh, and Varma, 1990). The emissions caused by vehicles contribute to climate change, affecting global temperatures, sea-level rise, the frequency and severity of natural disasters, and various negative spin-off effects.

A further study found that congestion exacerbates the negative health and environmental effects of automobiles because emissions increase significantly in slower-traveling and idle vehicles, sometimes double or triple the emissions produced at optimal speed levels (Gordon, 1991). When cars are forced to travel slower due to congestion, whether simply traveling at a less-than-optimal speed or slowing to a halt, the costs to our environment and health are dramatically increased, as cars are more prone to acceleration (Stopher, 2004). Reducing both total vehicle travel and the level of congestion can have positive impacts on air quality, and in turn, public health and the environment (Shefer, 1994).

Traffic congestion is also closely linked to other health and social issues stemming from stress. Hennessy and Weisenthal (1997) studied drivers under normal conditions and others driving through congestion, and found significantly higher stress levels for those in congestion. Commuting by car is in fact the most stressful way of getting to work (Gatersleben & Uzzell, 2007). This additional stress can

impact people's social behaviour, at work, home, and in relationships, leading to unhappiness, lower productivity and higher health care costs.

2.1.2 | ECONOMIC IMPACTS

Traffic congestion also inhibits growth and productivity, and burdens the public sector with significant costs when trying to mitigate or slow delays on the road (Sweet, 2011). In the United States, the Urban Mobility Report (UMR) estimates that the cost of congestion-induced travel delay was $24 billion in 1982, and that it had risen to $115 billion in 2009 (Schrank, Lomax & Turner, 2010). In Canada, the cost of congestion in the Greater Toronto and Hamilton Area (GTHA) has been estimated at $6 billion annually (HDR, 2008), and a more recent report found it could rise to $15 billion annually by 2031 if current trends persist (Metrolinx, 2010).

The literature is divided on the exact economic costs of traffic congestion because so many aspects related to transportation have costs, including health, environment, and social services. Sweet (2011) differentiates between three types of economic costs: (a) costs to systems and users, (b) costs related to business location and (c) costs to the public sector in its attempts to mitigate congestion. Sweet argues that second order impacts, costs related to business location, are the most substantial, while first order impacts are actually insignificant. First order impacts, essentially costs on users, are generally negligible since little or no lost productivity results from congestion. Transportation system users generally substitute trips by traveling using alternative routes, modes and times (Choo & Mokhtarian, 2008; Downs, 1992). Therefore, even if congestion arises, users can be expected to find a reasonable alternative and be only marginally affected. Research on second order impacts has shown that some level of congestion is in fact a good indicator for a strong economy (Schrank, Lomax & Turner, 2010) and that congestion has been around since before the car (Morris, 2007). Sweet argues that though congestion is a part of the economy, facilitating agglomeration economies, for example, creates a threshold that inhibits growth and productivity. When the level of congestion becomes too great, firms experience increased commute times, jobs-housing imbalance and no new agglomeration benefits. Sweet argues that this is a much greater impact than on individual users, though the impact on individual firms is difficult to measure.

The economic impact on the public sector is also complex because these impacts are measured by the effectiveness of money spent by governments to mitigate congestion. The literature can generally be divided in two approaches: supply-side and demand-side. Scholars arguing for supply-side solutions to congestion, namely highway and road network expansion, (for example, Hargen & Fields, 2006) believe in 'building our way out of congestion' (Sweet, 2011; Taylor, 2004). Supply-side approaches are

routinely criticized, however, for being expensive and providing little return on investment (Sweet, 2011; Winston & Langer, 2006), being difficult to measure due to external factors (Downs, 1992) and in fact increasing long-term congestion (Goodwin, 2003; Mogridge, 1997). Conversely, demand-side approaches include more sustainable strategies, including a variety of measures ranging from telecommuting and promoting flexible work schedules to congestion pricing or land use regulation. While most strategies are potentially effective, politicians' and residents' unwillingness to embrace them have reduced the effectiveness of strategies already in place and has increased the political difficulty of introducing new strategies (Taylor, 2004; Winston & Langer, 2006). Public sector initiatives have significant costs that add to the economic costs of congestion borne by the private sector.

2.2 | TRADITIONAL METHODS FOR MANAGING TRANSPORTATION

Traditionally, municipalities have managed transportation based on the idea that congestion can be effectively alleviated by increasing supply. Since the 1930s, but especially in the post-war period, highways were expanded like never before in North America. This trend, combined with the underpricing of personal vehicle use, led to resulting dependence on privately owned vehicles, which provided greater mobility, accessibility, control and a sense of freedom, and has been called a "historical error" (Salomon, 1997). The historical overreliance on cars has caused, and continues to cause, massive congestion on our roads. Traditionally, the response was to build our way out of the problem. Scholars such as Hargen and Fields (2006) and Wachs (2002) argue for further incremental highway expansion, and Samuel (1999, 49-50) calls traffic congestion a "solvable problem" through additional supply of road infrastructure. Yet, the failure of supply-side strategies is their unintended consequences. Goodwin (2003) conducted a thorough study of road expansion projects and found that building roads that allow for an increased traffic speed in an anticipated reduction of congestion actually increases traffic, damages the environment and provides little or no benefit in terms of speed. In another study, Zhou & Zhu (2007) found that massive road improvements in 1980s China improved traffic conditions for a short time, but that soon after these areas returned to their original levels of congestion since the improved traffic conditions attracted additional drivers. Supply-side strategies carry a tremendous cost, require a high level of commitment, can lead to public dissatisfaction and, research has shown, do not improve the congestion they are put in place to alleviate. This has lead Mingardo (2008) to argue that most of the traditional transportation policies of increasing supply to alleviate congestion are no longer relevant since physical space and economic capacity are dwindling, limiting expansion possibilities. Even if cities could afford to expand their infrastructure, there is little evidence that it would have a significant effect on the shift to alternative modes of transportation (Mingardo, 2008).

2.3 | WHAT IS TDM AND WHY IS IT IMPORTANT

TDM is the management of travel demand rather than catering for that demand by increasing supply. TDM is an approach to transportation planning and will be defined as:

> *Strategies, policies and programs aim to comprehensively manage demand for single occupancy vehicle (SOV) trips, either by reducing the total number of trips taken, or by shifting SOV trips to other modes of transport*.

Reducing trips or shifting SOV trips to other modes of transport are complementary as they both have the potential to reduce congestion, yet a comprehensive approach combining the two is required. Holden (1989, p. 259) argues that transportation planners must take a "systems view of all modes of transport in cities," since an improvement in one mode may not lead to an improvement of the whole. In fact, this can have the unintended consequence of induced demand through triple convergence (Downs, 1992). When capacity is increased on roadways, three things happen. Those driving during off-peak periods shift to driving during peak periods, those using alternative routes shift to where there is newly-created capacity, and those using alternative modes of transport (generally rapid transit) choose to drive instead. Mogridge (1997) argues that investment in road infrastructure to reduce congestion actually leads to increased congestion. So though it seems intuitive that building wider and more roads, lanes and interchanges will reduce congestion by creating room for cars to flow, this temporary congestion relief leads to increased congestion. Therefore, a comprehensive transportation *demand* management approach is the most appropriate response to managing congestion.

2.4 | THE CASE OF YORK REGION

York Region is a regional municipality in southern Ontario bounded by Toronto to the south, Lake Simcoe and Simcoe County to the north, Durham Region to the east and Peel Region to the west (see Figure 1). It is made up of nine municipalities: two cities – Vaughan and Markham; six towns – Aurora, Newmarket, Whitchurch-Stouffville, Richmond Hill, Georgina and East Gwillimbury; and one Township – King. York is part of the economic region known as the Greater Toronto Area (GTA), as well as the larger Greater Golden Horseshoe (GGH) (Figure 2). It has a population of over a million people, most of which are concentrated in the Region's urban centres that are largely located in its southern and central areas (York Region, 2010). York's population is growing fast and expected to rise to 1.5 million by 2031. Once considered Toronto's bedroom community, York Region now has almost half a million jobs and is projected to grow by fifteen thousand jobs annually to 2031 (York Region, 2009a). At the same

time, almost seventy percent of York's land area is within the boundaries of the Province's Greenbelt and Oak Ridge's Moraine plans, which place rigorous restrictions on development. These protected lands include active, productive farmland and significant natural heritage features.

Figure 2 | York Region in the the Greater Golden Horseshoe context (Ontario, 2006).

York Region, though traditionally a car-oriented suburban and rural municipality, has taken steps to foster significant use of alternative modes of transportation. The Region's 2002 Transportation Master Plan won a Transportation Association of Canada award for Sustainable Urban Transportation. The plan included a long term transportation vision (to 2031), a decision-making framework, policies and programs to support the vision, and an implementation strategy. It also set the groundwork for various TDM strategies and programs that have since been implemented (York Region, 2009a). The current

Regional Transportation Master Plan (RTMP) from 2009 builds on the previous plan with eleven sustainability principles, additional policies and programs with phasing plans, an implementation and investment strategy and a monitoring process. The Regional Official Plan (ROP) (which has been approved with some sections appealed, which are unrelated to TDM and therefore do not affect this report) and recently-completed Vision 2051 help frame the RTMP and provide broader guidance for transportation planning.

Since 2002 York Region has implemented a variety of strategies considered TDM strategies. York opened Viva, a network of express bus routes traveling along major corridors (Figure 3). The Spadina subway extension from Toronto is currently under construction with three stations planned within or along York's boundaries, and is scheduled for completion in 2015. An extension of the Yonge subway line is proposed and included in *The Big Move*, Metrolinx's (2008) Regional Transportation Plan. Bus Rapid transit (BRT) is also currently under construction on Highway 7 connecting Markham and Vaughan, and in Newmarket on Davis Drive, with more lines planned. The Region adopted a Pedestrian & Cycling Master Plan and began extending its walking and cycling networks, a set of Transit-Oriented Development (TOD) guidelines to encourage development around transit hubs, and helped create transportation management associations to deliver TDM programs locally. Many of these long-term projects may not reduce SOV trips right away, but are part of long term plans that may help the Region avoid the trouble of triple convergence with sustainable TDM strategies.

Figure 3 | York Region's VIVA rapid transit network (York Region Transit, 2013).

3 | METHODS

This report uses two methods, one to answer each of the research questions. First, I describe the method for analyzing interpretations of TDM, and present the three comparative case studies used in the analysis. Second, I outline the method for evaluating the supportiveness of York Region's policy environment, as well as nine criteria to be used in the evaluation.

3.1 | METHOD FOR ANALYZING INTERPRETATIONS OF TDM

3.1.1 | CASE STUDY SELECTION & METHOD OF ANALYSIS

The first research question deals with the accuracy of York Region's interpretation of TDM. I chose three municipalities considered best practices in the delivery of TDM measures and compared their interpretation of TDM to York Region's to ensure that York Region's interpretation is aligned with those of best practices. These case studies were selected based on four criteria. First, they must be regional case studies and, like York Region, should include more than one urban area within their boundaries. This is to ensure that the cases are comparable with regards to the types of policy enacted. Second, the case studies must have been cited for success by either professional reports or peer-reviewed journal articles, to ensure that they were considered best practice case studies by reputable sources. Third, they must have been included as a "successful" case study of TDM in the Victoria Transport Policy Institute's (VTPI) TDM Encyclopedia (VTPI, 2012a). The VTPI is an independently-run research organization that publishes a variety of resources on transportation planning, TDM and related policy, and its TDM Encyclopedia is considered an authority on transportation demand management. Finally, to ensure that there was some variation in the examples, each of the case studies have slightly different contexts: Waterloo Region from Ontario, Metro Vancouver from Canada as well, but from British Columbia, and Arlington County from the United States.

In assessing the case studies' interpretation of TDM, an inductive content analysis method is used to identify the themes that define, describe and prescribe TDM policies and strategies. I read through the planning documents of each case study most related to transportation, and identified the sections where keywords related to TDM were mentioned. The following three sections describe each of these planning documents, while also justifying the case studies' relevance to a comparison with York Region. Using inductive content analysis and open coding, key themes were identified when they were linked to the definition of TDM. After this part of the process, the themes I found were grouped into broad categories by combining similar themes. The process was repeated several times to ensure that the themes induced by each planning document were searched for and identified, if present, in the

other case studies' planning documents as well. After the analysis, the themes in York Region's documents were compared to those in the three best practice case studies. The results of this analysis are reviewed in Chapter 4. First, the next three sections describe the comparative case studies.

3.1.2 | WATERLOO REGION, ON

The Regional Municipality of Waterloo is located in southwestern Ontario, and is a Regional municipality like York Region. It includes seven municipalities including three cities and four townships within its boundaries (Figure 4). It is one of the fastest growing municipalities in Ontario, yet its residents are still largely reliant on cars (Cicuttin, 2010). As part of its TDM initiative, the Region began implementation of a bus rapid transit (BRT) system in 2005, operated by Grand River Transit, which connects the cities of Cambridge, Kitchener and Waterloo, as well as the University of Waterloo. Expansion of an existing line and implementation of a third line are expected.

This approach to connecting the poly-centred region with a high-speed alternative mode of transport was highly successful. A 2007 study found that, accounting for overall network growth, ridership grew by 11% and 46% on the two sections (Farahani, 2007). The study also found that the BRT's implementation reduced annual GHG emissions by 530 tonnes. The Region has had success managing congestion through other strategies under its TravelWise umbrella, such as an employee-based education and incentive program, adoption of a pedestrian charter, and participating in programs such as Commuter Challenge and Bike to Work Week (Waterloo Region, 2009). Waterloo's vision is to become "an inclusive, thriving and sustainable community committed to maintaining harmony between rural and urban areas and fostering opportunities for current and future generations" (Waterloo Region, 2011, 93). With regards to its transportation vision, Waterloo specifically mentions TDM as a strategy to manage the existing transportation system assets.

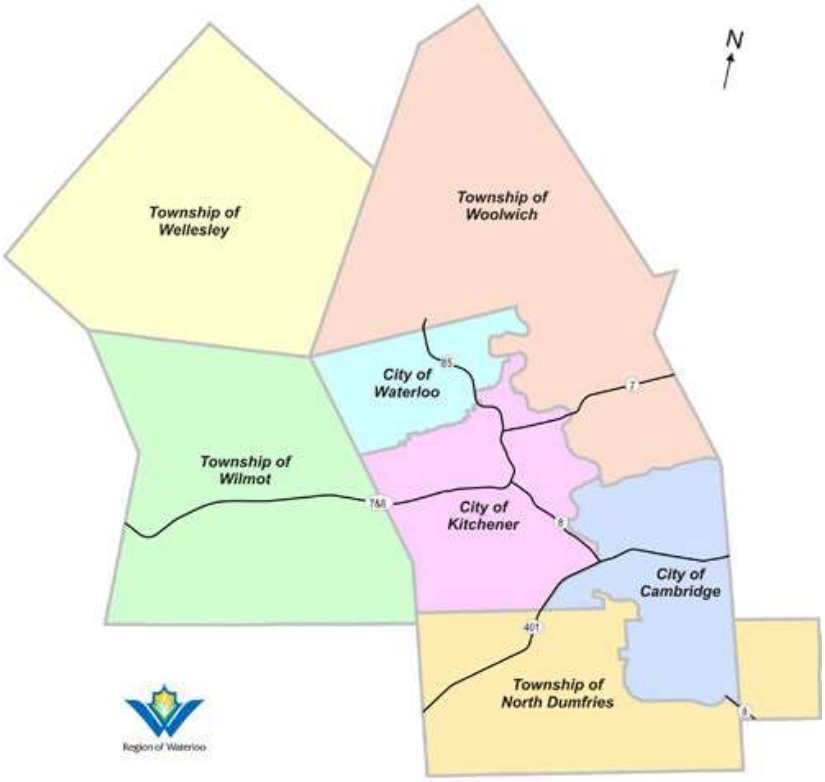

Figure 4 | Waterloo Region and its lower-tier municipalities (gracc.ca)

Figure 5 | Metro Vancouver and its municipalities (cbc.ca)

3.1.3 | METRO VANCOUVER, BC

Metro Vancouver, formerly known as the Greater Vancouver Regional District, is a corporation directed by twenty-four local bodies that are culturally and economically, though not geographically, centred around the City of Vancouver (Figure 5). The twenty-two municipalities, one electoral area and one First Nation treaty that make up the regional district each appoint a member of their own council to the Regional Board, which has a role in providing drinking water, utilities, affordable housing, regional parks and planning for regional growth (Metro Vancouver, 2011a). Several recent TDM initiatives include upgraded buses, transit investments into suburban areas, the opening of the Canada Line rapid transit line which integrates with the Vancouver SkyTrain system, an award-winning website and an expanded role for the TravelSmart program, which manages a variety of smaller-scale TDM initiatives (VTPI, 2012a).

The suite of strategies used by Metro Vancouver at the regional level has been very successful. Between 2004 and 2008, the driving mode share in the entire region decreased from 76.2% to 73.7%, while transit increased from 10.8% to 12.5% (VTPI, 2012a). The share of people not driving a car went up from 40.3% to 44%. Though these figures give a clear indication of success, they do not identify which factors contributed to reducing the SOV mode share and in what proportion. Metro Vancouver's goals are outlined in the Regional Growth Strategy, and include creating a compact urban area through transit-oriented development, developing complete communities and supporting sustainable transportation choices (Metro Vancouver, 2011b).

3.1.4 | ARLINGTON COUNTY, VA

Arlington County is an urban county located across the Potomac River from Washington, D.C. and within the United States capital's greater metropolitan area. Though it has no incorporated municipalities within its boundaries, it does have several distinct neighbourhoods under its jurisdiction. Since the mid-1970s some of these communities have been developing around Metrorail stations, directed by deliberate land use and transportation policies set by Arlington County (VTPI, 2012a) (Figure 6). The regional Metrorail brings commuters into Washington, D.C. on two underground lines, and the County has funneled most of its development to these corridors. Areas surrounding Metrorail stations are most highly developed, with the highest densities nearest the stations and gradually lower development with declining proximity to public transit (VTPI, 2012a).

Arlington's transit-oriented pattern of development is guided by the County's *General Land Use Plan* (GLUP), and has resulted in fifty percent of the County's tax base locating within seven percent of the land area, around its corridors – a highly-sustainable pattern of development that is more conducive

to walking, cycling and transit than conventional suburbs (VTPI, 2012a). Arlington County's success is also attributable to its TDM programs implemented by the County government through the Arlington County Commuter Services (ACCS) program, by workplaces, and a transportation management association (TMA) (Arlington County, 2008). A recent study found that workplaces with TDM programs in the County had about ten percent less vehicle trips than those without programs (VTPI, 2012a). This is likely due to policies calling for the transit corridors to include between half and three quarters the amount of parking found in other areas, leading to decreases in car travel (VTPI, 2012a). Supportive policies are outlined the *Comprehensive Plan*, a broad policy document consisting of nine plans. One of these is the *Master Transportation Plan*, and its *Demand and Systems Management* element. Together these policies have helped make TDM policies a success in Arlington.

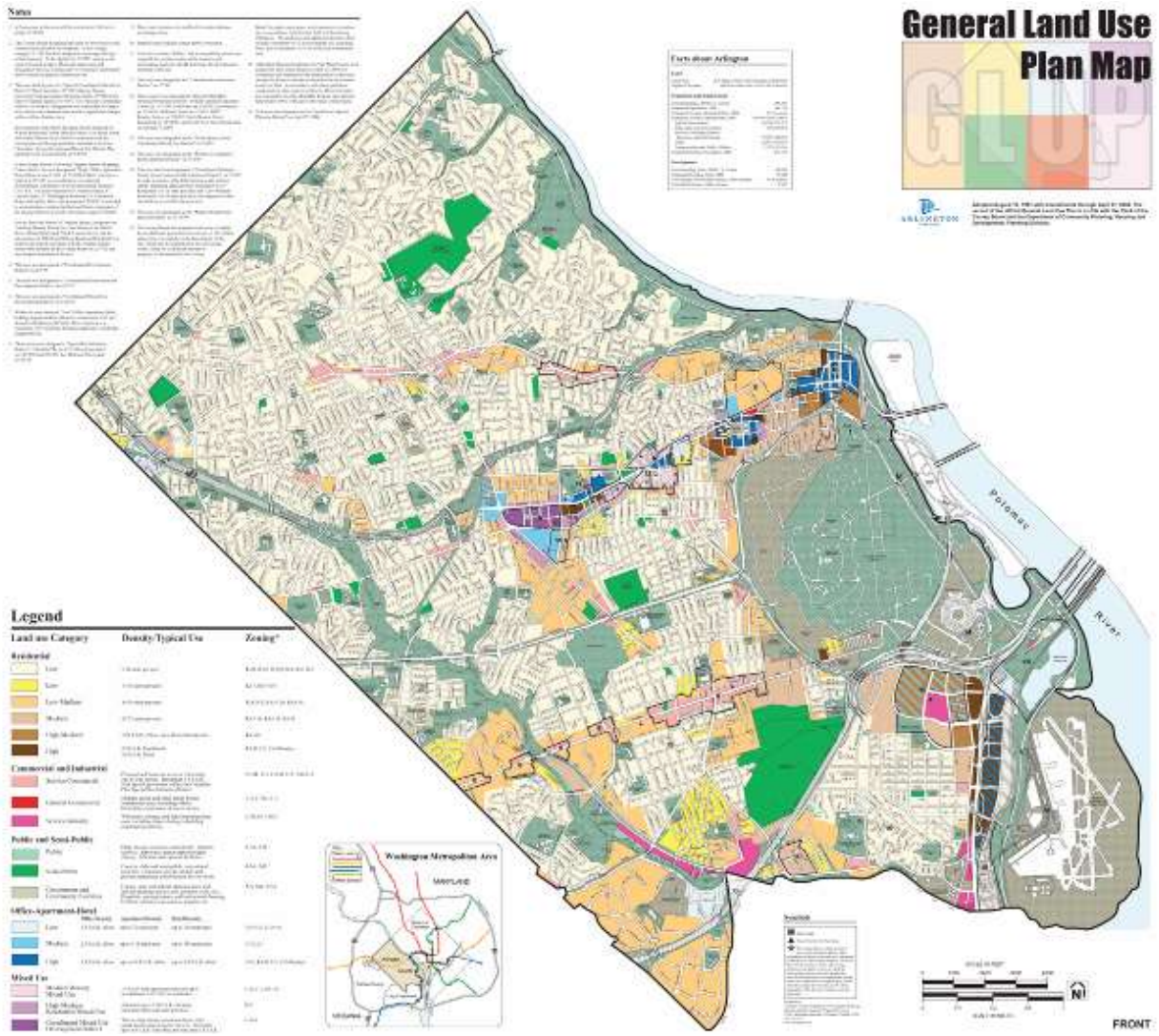

Figure 6 | Arlington County General Land Use Plan (arlingtonva.us)

3.2 | METHOD FOR EVALUATING SUPPORTIVE POLICY ENVIRONMENTS

The second research question asked whether York Region's policy environment is supportive of TDM. In order to answer this question, it is important to note what exactly it is that constitutes a TDM-supportive policy environment. Waterloo, Vancouver and Arlington are cited as best practices because of their policies' observed, or at least expected, success. In most cases, once a municipality has implemented TDM strategies, it evaluates them and successful strategies are promoted as examples for other municipalities to emulate. These case studies can be great teaching tools for demonstrating the success of certain strategies. For example, Waterloo's implementation of a BRT system in major locations in the region is an excellent example of what other poly-centred regional municipalities could do to manage their congestion issues. Yet, this approach does not allow for evaluation of strategies at the outset of the planning process, only after implementation.

Without qualitative or quantitative data available to demonstrate the success of TDM strategies, it is difficult to evaluate a TDM program. Even if data is available, it is often unclear if it is the studied strategy that makes an impact on congestion or whether other factors contribute. For example, if a municipality experiences an increase in its cycling mode share, it may attribute that increase to a completed bike lane. However, that increase could also be caused by rising gas prices (making alternative modes more attractive), a transit strike (forcing people off buses), good weather (encouraging commuters to cycle), or perhaps demographic shifts. Holding external factors constant can be difficult, and this difficulty is inherent in evaluating the success of individual strategies underscores the difficulty in assessing the suitability of an entire TDM program. When a new transportation approach or policy such as a TDM strategy is implemented, it must be tested and evaluated against some criteria both general and context-specific in order to measure its potential to succeed. Before even attempting to measure success, planners must evaluate whether a municipality has the elements expected to lead to a comprehensive and effective TDM program.

Since there is no definitive set of strategies that every municipality should include in its TDM program, I evaluate the policy environment created by its planning documents. This study, therefore, takes an evaluative approach to assessing York Region's TDM policies. Through a review of academic literature and professional reports published by organizations involved in transportation and municipal affairs, I assembled a list of nine criteria by which to evaluate municipalities. Using these criteria, a qualitative evaluation of York Region's strategy and planning documents is made possible. The evaluation focuses on three primary documents. The first is the draft *Vision 2051* (*Vision*) which is the broad blueprint for York Region's future and a high-level document providing decision-making guidance

to Council and staff. York Region's *Regional Official Plan* (ROP), the second document, manages growth in the Region and guides "economic, environmental and community building decisions" (York Region, 2010). Finally, York Region's *Regional Transportation Master Plan* (RTMP) guides decision-making on transportation issues, and the creation of an integrated network.

A document review approach was used to assemble the criteria for a supportive TDM policy environment. Unlike the previous section which analyzes York Region's interpretation of TDM, this section of the analysis takes a holistic approach and focuses on evaluating York Region's plans in their entirety. This method allows for a clear analysis that can be easily verified by the reader by revisiting the analyzed documents (Marshall & Grossman, 2006, 108), while still allowing for a breadth of information to be evaluated (Yin, 2009). Therefore, to answer the second research question, I examine the general intent of York Region's three plans with regards to each criterion that has been assembled. Instead of evaluating the success of the plans' implementation, which can be imprecise, I assess the *potential* for success provided by the policy environment, based on satisfactory fulfilment of the nine criteria. The following sub-sections present and discuss the evaluation criteria.

3.2.1 | INTEGRATING TDM AT ALL SCALES

Traffic congestion is a product of high traffic volumes that affect the quality of service within a transportation system (Sweet, 2011). According to a report commissioned by the Organization for Economic Co-Operation & Development (OECD), congestion is caused by many different factors, both micro and macro in scale. Macro factors include travel behaviour and demand pattern – when, where and how people generally travel – as well as people's experience with and knowledge of congestion (ECMT, 2007). Further macro factors such as land use, demographics, the economy, and fuel price also play a role. These factors affect the "incidence of congestion and its severity" (ECMT, 2007, 61). Essentially, macro factors create general demand for road use on a recurrent basis while micro factors, such as individual driver behaviour or traffic composition, cause incidental congestion, creating traffic on the road in a non-recurrent basis.

In order to properly manage the demand for SOV trips, it is important to include TDM policies on a variety of levels – strategies that target the transport system as a whole as well as those targeting individual projects (ECMT, 2007). Policies should also target different levels of government as suggested by Metrolinx's (2008) report which recommends that TDM should be incorporated into local, provincial and federal government policies. This study investigates how the municipality addresses TDM at a variety of levels.

Does the municipality address TDM at all levels? Does the municipality incorporate elements of TDM at the project level and up to the highest level of jurisdiction afforded it?

3.2.2 | RELATING LAND USE OBJECTIVES & POLICIES TO TDM

The OECD report also recommends three principles for managing congestion. Although only the third principle specifically mentions TDM, all three can be included in the criteria for TDM policy creation. The first principle is to connect land use and development policies and objectives to transportation planning and congestion management. ECMT argues that the most effective way to manage congestion is to "explicitly" link land use policies to congestion management policies (ECMT, 2007, 172). Strategies that do not employ this principle can have short term success but this is not sustainable. Of the strategies in the TDM Encyclopedia, many could be construed as strictly related to land use planning, but are in fact also related to TDM (Litman, 2011). These include density and land use clustering, transit oriented development, mixed use, accessibility and many others. Therefore it is important to investigate whether or not land use strategy is being integrated with TDM policy.

Do the municipality's objectives and policies explicitly link land use planning and TDM?

3.2.3 | RELIABILITY AND PREDICTABILITY

The second principle is using policies that encourage predictable travel times. The justification for this is simple. For commuters the reliability of travel is cited as being more important than travel speed. In order to reduce the 'misery' of travel, reliability and predictability of service must be a priority (ECMT, 2007). The concept of misery is meant to relate to travel in private vehicles, though it can be logically extended to any form of travel. In order to entice transit ridership, walking and cycling, municipalities need to take the 'misery' factor into account for all modes. Therefore it is integral that reliability and predictability are factors in the TDM planning process.

Does the municipality address reliability and predictability of travel as an integral part of its planning framework?

3.2.4 | EQUITY

The third principle concerns the long term monitoring of TDM programs. If driving volumes are decreased while capacity remains the same as a result of some people's driving behaviour being disincentivized, the newly available capacity may entice new drivers to use the roads. This induced demand negates the reduction in congestion so it is important that driving volume is not increased due to new users. Congestion-mitigation strategies must therefore be applied to both existing and potential new users of the road. They must be equitable and applied to all in the same manner.

Gärling and Schuitema (2007) observe that to implement TDM strategies, which are sometimes considered politically unfeasible, they must also be *perceived* as fair. They argue that strategies should include some sort of perceived compensation, based on the inconvenience caused to users. For instance if a transit line is given exclusive use of a car lane, the improvement in mobility to many should be significant enough to justify this perceived injustice to some. Creating policies that are perceived as fair will effectively lead to their acceptance by the public, and are therefore political feasibility. This report evaluates the studied municipalities based on their inclusion of a fair and equitable balance of strategies.

Is the municipality's strategy equitable and will it likely be perceived that way?

3.2.5 | CLEAR, COMMUNICATED VISION

The language used by planners in their oral and written communications has a significant influence on the way they plan and on the reception of their plans by the public (Stein & Harper, 2012). The importance of specific and clear language is crucial to the success of plans, such as official plans or infrastructure plans. Klein, Benson, Anderson and Herr (1993) write that participation from the community is represented in the activities of government. This participation is reflected in a community's plans in order to increase the likelihood of successful implementation. Since a plan's *vision* is the ultimate expression of its community's intent and necessary for attaining better results (Moore, 2004), the municipalities' vision statements are evaluated in this report based on their support for TDM.

Does the municipality's vision statement mention or allude to transportation demand management? Is the vision clear in its intent, and does it use strong language?

3.2.6 | CARROTS AND STICKS APPROACH

Switching to an alternative mode of transportation is made more complex, and even impossible, for those whose travel times might increase dramatically if they travelled using an alternative mode of transportation (Gärling & Schuitema, 2007). This makes implicit sense and is supported by travel behaviour theory, where travel decisions are based on the concept of utility maximization and cost minimization. The Diamond of Action theory, a travel behaviour theory described by Levinson and Krizek (2008), posits that there are four factors – constraints, complementors, competitors and chances – that affect travel choices. Some people are *constrained* by money, time or familial obligations and cannot switch to an alternative mode of transportation. There may be *complementors* such as carpool matching services that reduce these constraints but also *competitors* such as having to pick up or drop off children at daycare that increase them. The *chances* that a person will switch modes of transportation depend on

the complexity of the *constraints*, *complementors*, and *competitors*. In order to be successful, it is important for TDM to create both *complementors* for alternative modes and *competitors* to the automobile.

Poudenx's (2008) study of twelve cities concludes that congestion-reduction strategies that focus only on reducing car use do not work since they do not focus on alternative modes of transportation. He argues that planners also need to concern themselves with improving transit, cycling and walking infrastructure to coerce drivers to switch to alternative modes. Essentially, improving alternative modes acts like a complementor and reduces constraints. In another study, Mingardo (2008) analyzes the cases of Gothenburg and London for their innovative urban transport policies, and argues that "decoupling" transportation from economic growth, or creating growth without increases in transportation, should be a priority for today's cities – and to do this TDM must be employed. Mingardo also highlights the importance of using a package of policies that incorporate complementors, or 'carrots', such as public transit improvements, and competitors, or 'sticks', such as like London's congestion charge. Therefore, in order to properly assess TDM policy the inclusion of both carrots and sticks must be analyzed.

Does the municipality include both complementors and competitors in its TDM strategy?

3.2.7 | EDUCATION AND PUBLIC AWARENESS

Along with carrots and sticks, much of the literature on TDM highlights the importance of education and public awareness of demand management and its benefits. The Victoria Transport Policy Institute's (2013) *TDM Encyclopedia* writes that simply promoting TDM can significantly increase the likelihood that alternative modes of transport will be embraced by citizens. Alternatives to the automobile must be made to look "attractive and desirable" (VTPI, 2013) and this can be done through promotion and education.

The importance of TDM promotion is echoed in professional reports including Metrolinx's (2008), which argues that along with carrots and sticks, TDM is most effective when implemented alongside education, promotion and outreach. Transport Canada's 2011 report further reflects this sentiment, arguing that municipalities must detach the assumption of mobility from the assumption of car use (Noxon Associates Ltd., 2011). By promoting alternatives to single-occupancy car use, a municipality is expected to have more success in implementing its TMD policies.

Does the municipality include education, promotion and public awareness as part of their TDM strategy?

3.2.8 | PRIVATE IMPLEMENTATION OF TDM

TDM is best implemented comprehensively, by a variety of parties (Noxon Associates Ltd., 2011). Since municipal resources in terms of money and time are often limited, having the private sector plan, organize and implement TDM strategies can extend the number of people reached by TDM. A study by Higgins (1990) investigated employers using TDM plans in the United States and found that government policies were critical to employers' success at implementation of TDM strategies. Mingardo (2008) also found that partnerships between government and the private sector worked well in European case studies, and argues that both sides are key stakeholders in managing congestion. It is essential for governments to implement TDM, but there are benefits to including other actors in implementation, such as reduced costs and a wider reach. Therefore, analyzing the inclusion of policies targeting the private sector is an important part of the evaluation.

Does the municipality promote private implementation of TDM through policy?

3.2.9 | LEADING BY EXAMPLE

In order to encourage privately-implemented TDM through policy, several reviews of best practices recommend that municipalities lead by example (e.g. BA Consulting Group, 2008; FCM, 2008; Noxon Associates Ltd., 2011). Leadership can be shown by incorporating TDM in civic facilities and creating a TDM program for municipal staff, and by supporting the work of Transportation Management Associations (TMAs) to promote employer-based programs (York Region, 2009b). A report commissioned by the Association for Commuter Transportation of Canada (ACT Canada) puts forth a list of policy planning recommendations for municipalities creating TDM programs and strategies. Several of these amount to leading by example. The report suggests educating municipal staff about TDM, the benefits of this approach and how it fits into their work, especially in development approvals (BA Consulting Group, 2008), since if municipal staff members are not aware of TDM's benefits, developers, employers or citizens can hardly be expected to implement its strategies. It also recommends that municipalities implement TDM programs in order to demonstrate the benefits of TDM to, developers and major employers, but civic employees as well (BA Consulting Group, 2008). This provides the private sector with evidence that localized TDM programs can be achieved.

Does the municipality demonstrate TDM implementation by leading by example?

4 | FINDINGS

4.1 | ANALYZING INTERPRETATIONS OF TDM

The following four sections present the findings from analyzing each case's interpretation of TDM, including York Region's. The final section compares the results of all four analyses.

4.1.1 | WATERLOO REGION'S INTERPRETATION

TDM is framed differently in each of Waterloo Region's two major planning documents. Whereas the Regional Official Plan (ROP) takes a 'big picture' approach to TDM as a broad strategy for reducing automobile dependence, the Regional Transportation Master Plan (RTMP) frames TDM more specifically as a way to manage the existing assets of the regional transportation system. In the ROP, and particularly within the Livability chapter, TDM is considered one of various strategies needed to achieve the goal of creating "vibrant urban and rural places" (Waterloo Region, 2010, 36). Its objective is to "reduce the total number of automobile trips by influencing people to adopt more *sustainable* travel choices when it comes to types of travel" (40). The ROP frames TDM as a link to Waterloo's ultimate vision for a place of vibrancy, liveability and sustainability. The ROP then is expectedly less concrete and more general in its approach to TDM.

In contrast, Waterloo's RTMP frames TDM as a tool that can be used to manage the existing transportation system assets. Mentioned in one of four "themes" that capture the Region's transportation vision, TDM is referred to as one of "other strategies" that optimize the capacity of existing roads and transit systems, allowing them to accommodate more people (Waterloo Region, 2011, 4-2). It is mentioned in the fourth theme of "4.1.4 Managing the Existing Transportation System Assets", and alongside capacity-enhancing measures such as filling in missing road links, improving key intersections, investing in roundabouts, and maintaining a good state of road repair. These are concrete, implementable strategies and TDM is mentioned alongside them. The RTMP again frames TDM as a way to optimize the transportation system, listing an objective to "[u]se transportation demand management (TDM) measures to improve the efficiency of the transportation system" (Waterloo Region, 2011, 4-4). Though they do not specifically mention TDM, the other three themes actually take a more TDM-like approach. For example, the first theme, "Creating a Sustainable Transportation System and Policy Framework", includes integrating land use and transportation planning and adopting policies to support alternatives to SOV travel (Waterloo Region, 2011, 4-1). These themes are used to screen two initial options, a road-oriented and transit-oriented plan, selecting the transit-oriented plan since it

fulfils all the criteria. They are therefore integral to the RTMP, and, although TDM is not mentioned specifically in all four of the RTMP's goals, it is an implicit part of the plan.

Waterloo's RTMP plan then identifies and evaluates three alternative transit-oriented plans based on criteria relating to the three pillars of sustainability (economic, environmental and social/cultural) and a financial analysis, the most transit-oriented alternative is selected. To support this alternative, the plan puts forward "a suite of TDM initiatives and parking and land use policies designed to make transit a competitive and desirable choice for users that have access to an automobile" (Waterloo Region, 2011, 5-15). Here, TDM is interpreted as more than just a tool to achieve optimization, but as a suite of tools to make transit and other alternative modes more viable. This is continued throughout the plan, with TDM and the Travelwise program as support for alternative transit, although in this report's definition, transit is considered a TDM strategy in its own right. Table 1 below summarizes the themes found in each of Waterloo's plans.

Table 1 | Themes found in Waterloo's interpretation of TDM

Themes	Waterloo Region	
	ROP	RTMP
Health & environment		X
Effective & competitive system		X
Liveability	X	
Achieve vision	X	X
Reducing automobile dependence	X	
Encourage sustainable travel modes	X	X
Part of a comprehensive transportation system	X	X
Optimize road capacity		X
Increase system efficiency		X
Optimize existing and future investments		X
Integrate land use and transportation		X
Supporting public transit with TDM		X

4.1.2 | METRO VANCOUVER'S INTERPRETATION

Metro Vancouver's regional government's three major functions are planning for growth, waste disposal and transportation, the latter being the responsibility of the South Coast British Columbia Transportation Authority, or Translink, Metro Vancouver's sister agency. Metro Vancouver's plans are organized around its *Sustainability Framework* (Metro Vancouver, 2010b), which frames decision-making and implementation. Metro Vancouver's various plans integrate into this framework, with the two plans most relevant to TDM being the *Regional Growth Strategy* (2010a) (RGS) and Translink's *Regional Transportation Strategy* (2013) (RTS). The *Regional Growth Strategy* has five goals: 1) creating a

compact urban area; 2) supporting a sustainable economy; 3) protecting the environment and responding to climate change impacts; 4) developing complete communities, and; 5) supporting sustainable transportation choices. All of these can all be thought of as TDM oriented goals or strategies that support the goals of TDM.

The descriptions or policies of Goals 1, 3, and 5 all specifically mention transportation demand management. Goal 1, that of 'Creating a Compact Urban Area', designates Urban Centres and Frequent Transit Development Areas as areas where growth should be focused, with the hope that this will "shape transportation demand and optimize investments in the region's transportation system" (Metro Vancouver, 2010a, 13). The third goal, 'Protecting the Environment and Responding to Climate Change Impacts', briefly provides the only quasi-definition of TDM in the document. It includes a policy to request that the federal and provincial governments take action to enable the implementation of TDM measures such as user-based pricing for transportation. The fifth goal, 'Supporting Sustainable Transportation Choices', includes a variety of policies that define responsibility for delivering TDM strategies, though do not directly define TDM. In this goal, the responsibility for TDM is transferred to Translink and Metro Vancouver's role of providing input through "land use, growth management and air quality information and forecasts, and, as appropriate, evaluation of land use and vehicle emissions impacts" (5.1.1; see also 5.1.7d) (Metro Vancouver, 2010a, 52). The plan also mandates that local municipalities must identify policies and action items that support TDM strategies (5.1.6b). TDM is included as a strategy that encourages transit, carpooling, and active transportation, and lays out the parties responsible for its delivery. TDM is also evoked as a strategy for moving vehicles efficiently, whether for people, goods or services (5.2.4c) and as an evaluative tool for "contemplating future expansion of private vehicle capacity" on major road infrastructure by Translink (5.2.7a) and the federal and provincial governments (5.2.8c).

Translink is designated as the major deliverer of TDM strategies, yet its RTS does not provide a clearer interpretation than the broader RGS. The RTS interprets TDM as a tool for evaluating investment decisions in the transportation system (Strategy 1), and as a consideration in a sustainable funding strategy by the Provincial and Federal governments, such that any funding strategy must support TDM goals (3.3). Furthermore TDM is considered by the RTS as an alternative approach to building more transportation capacity, to encourage efficient use of what currently exists (Translink, 2013, 8). By 'efficient', the RTS interprets TDM as both shifting transport trips to alternative modes of transportation and to shifting driving trips to alternative times to reduce congestion during peak hours. This shifting of

trips may lead to induced trips and more congestion long term, which does not adhere with this report's definition of TDM and is therefore not a recommended interpretation.

Translink's (2011) *Transit oriented communities: Primer on key concepts*, a document integrated into the RTS, provides suggested guidelines for municipalities in the region promoting communities oriented around transit. The document outlines 6 principles, or 'D's, of transit oriented communities (TOCs), the sixth of which is demand management. While this document is not a plan but a set of guidelines to assist municipalities in planning TOCs, it does offer a clearer definition of TDM from the regional agency. TDM is interpreted as a strategy that improves the environment by promoting alternative modes of transportation including cycling, walking and taking transit, and discourages driving (Translink, 2011, 11). It mentions that TDM policies are most effective when combining strategies that discourage driving with those that encourage alternatives (11). The *Primer* interprets TDM as more than just a preferred alternative to SOV transportation, as the RTS suggests, but instead incorporates TDM as a crucial aspect of planning TOCs. Table 2 below summarizes the themes found in each of Metro Vancouver's plans.

Table 2 | Themes found in Metro Vancouver's interpretation of TDM

Themes	Metro Vancouver	
	RGS	RTS
Health & environment		X
Reducing automobile dependence		X
Encourage sustainable travel modes		X
Reduce peak hour congestion		X
Part of a comprehensive transportation system	X	
Increase system efficiency	X	X
Optimize existing and future investments	X	X
Evaluative tool for future road investments	X	X
Advocate for user-based pricing	X	
Advocate for sustainable federal/prov funding		X
Mandate lower-tier municipal TDM policies	X	
Integrate land use and transportation	X	X
Use a carrots and sticks approach		X
Supporting public transit with TDM	X	

4.1.3 | ARLINGTON COUNTY'S INTERPRETATION

Arlington County's primary planning document is its *Comprehensive Plan* (CP). The original CP was published in 1960 and had five supplementary sections, or elements, while the most recent update

includes nine elements, one of which is the *Master Transportation Plan* (MTP). The CP makes links to, and discusses progress made on projects within the MTP, but does not discuss any specifics of transportation planning. The County's interpretation of TDM is found in its MTP and its supplementary element on *Demand and Systems Management* (DSM). The most recent version of the MTP defines TDM as "a set of specific strategies that influence travel behavior" to reduce vehicular trips (Arlington County, 2007, 13). It is juxtaposed with TSM, or transportation *system* management, which is defined as strategies that "focus on increasing the efficiency, safety and capacity of existing streets, transit and other transportation facilities" (Arlington County, 2007, 13). The two concepts are treated separately, although they are combined in the DSM section with to goal of achieving sustainable and efficient transportation in the County while improving equitable mobility and environmental goals. TDM and TSM are expected to reduce demand and ensure the efficiency of the existing transportation system (Strategy 5.1). Seven TDM and TSM policies are included in the MTP, six of which are primarily concerned with TDM.

Demand systems management is one of six 'elements' included in the MTP and highlighted as the only one focusing on the demand-side of transportation, with the first five focused on improving supply (including the supply of alternative modes of transportation). This sixth element defines TDM as strategies that "influence travel behavior by mode, frequency, time, route, or trip length to maximize the efficiency and sustainable use of transportation facilities" which is slightly different than the MTP's interpretation (Arlington County, 2008, 2). Whereas the MTP's definition of TDM is about the goal of reducing vehicle trips, the element defines it as strategies that influence the aspects of that trip, with the goal being efficiency and sustainability. There is a subtle difference between the two, as the element's definition does mention equitable access to all transportation system users, improved mobility and minimized environmental and health impacts as other goals of TDM. Table 3 below summarizes the themes found in each of Metro Vancouver's plans.

Table 3 | Themes found in Arlington County's interpretation of TDM

Themes	Arlington County	
	MTP	DSM
Equity		X
Health & environment		X
Reducing automobile dependence	X	X
Encourage sustainable travel modes	X	X
Reduce peak hour congestion		X

Part of a comprehensive transportation system	X	X
Optimize road capacity		X
Increase system efficiency		X
Optimize existing and future investments	X	X
Opposite of system management	X	
Supporting public transit with TDM	X	X

4.1.4 | YORK REGION'S INTERPRETATION

Starting from its highest level, planning in York Region is governed by *Vision 2051* (2012), the *Regional Official Plan* (2010), and infrastructure plans including the *Transportation Master Plan* (2009a). *Vision 2051* begins with a broad vision statement that is supported by a series of more concrete goals, which in turn lead to a series of actions, each with several illustrative points. The vision statement itself does not mention demand management, though it does include various TDM goals. York envisions a region where everyone will be able to "walk or cycle for all their daily needs" (York Region, 2012, 10). It cites a variety of mobility choices, an interconnected transit system, and streets that prioritize pedestrians. The transportation goal also neglects to mention TDM specifically though the actions supporting this goal do mention TDM explicitly. One action, for example, is to "reduce automobile dependence by enhancing opportunities" for the use of alternative modes which is a TDM strategy, though the *Vision* doesn't expressly articulate demand management (York Region, 2012).

This focus on reducing automobile dependence through TDM is echoed in the *Regional Official Plan* (ROP), although it first mentions TDM within the goal of providing healthy communities enlisting TDM strategies to improve air quality by reducing emissions (policy 3.2.3). The ROP refers to TDM, primarily and understandably, as part of the goal to reduce the demand for services, for reducing trips and making better use of existing infrastructure. Along with other approaches, the ROP expects TDM to be used in promoting alternative modes of transportation in order to achieve a "per capita reduction in trips taken" (York Region, 2010, 97). TDM policies and programs are framed as tools for making alternative modes of transportation comfortable and convenient ways to travel. TDM is also framed as a complementary strategy to a comprehensive transportation system. It is listed along with rapid and local transit, pedestrian and cycling networks, and transit-oriented communities, as a cornerstone of the transit network (York Region, 2010).

However, the ROP does not offer a definition of TDM, which is only provided in the Region's Transportation Master Plan (TMP). The RTMP includes TDM as one aspect of the Regional transportation system along with roadways, transit service, cycling and walking. It defines TDM as, "a set of strategies that foster increased efficiency of the transportation system by influencing travel behaviour by mode,

time, frequency, trip length, cost or route" (York Region, 2009a, 21). The RTMP also includes an appendix, *Appendix P*, which is a background paper on TDM. It frames TDM as a combination of incentives and disincentives that encourage sustainable mode trips and discourage SOV trips, and highlights the need for TDM even with a fully built out transit network. The plan uses TDM as a guiding principle under the pillar of creating sustainable natural environment, with the goal of reducing SOV trips. It aims to do this by enticing residents to consider switching to more sustainable modes of transportation. Since Region's goals are rooted in triple bottom line sustainability from the infrastructure master plans to *Vision 2051*, the RTMP mandates an aggressive TDM program to maintain the transportation system's effectiveness and "economic competitiveness" (York Region, 2009b, 3). Table 4 below summarizes the themes found in each of Metro Vancouver's plans.

Table 4 | Themes found in York Region's interpretation of TDM

Themes	York Region		
	Vision	ROP	TMP
Equity	X		
Health & environment		X	X
Effective & competitive system			X
Liveability		X	
Reducing automobile dependence	X	X	X
Encourage sustainable travel modes	X	X	X
Part of a comprehensive transportation system	X	X	X
Increase system efficiency			X
Optimize existing and future investments	X	X	
Mandate lower-tier municipal TDM policies		X	
Integrate land use and transportation		X	
Use a carrots and sticks approach		X	X
Supporting public transit with TDM		X	

4.1.5 | SUMMARIZING THE COMPARISON

The intent of this analysis was to examine the interpretation of TDM in three case studies considered best practices, and compare their interpretations to York Region's to ascertain whether York Region's interpretation is appropriate. This was done by identifying themes used by the best practice case studies and York Region to interpret TDM, and comparing the themes found in the best practices to the ones found in York Region's. If York Region's themes were found to be similar to those of the best practices, it would be logical that their interpretation of TDM is appropriate.

Table 5 | A summary of the 20 themes by category and by municipality's plan

Themes	Waterloo Region		Metro Vancouver		Arlington County		York Region		
	ROP	RTMP	RGS	RTS	MTP	DSM	V	ROP	TMP
Broad Goals									
Equity						X	X		
Health & environment		X		X		X		X	X
Effective & competitive system		X							X
Liveability	X							X	
Achieve vision	X	X							
Trip Management									
Reducing automobile dependence	X			X	X	X	X	X	X
Encourage sustainable travel modes	X	X		X	X	X	X	X	X
Reduce peak hour congestion				X		X			
Comprehensive Policy									
Part of a comprehensive transportation system	X	X	X		X	X	X	X	X
Efficiency									
Optimize road capacity		X				X			
Increase system efficiency		X	X	X		X			X
Optimize existing and future investments		X	X	X	X	X	X	X	
Evaluative tool for future road investments			X	X					
Opposite of system management					X				
Strategies									
Advocate for user-based pricing			X						
Advocate for sustainable federal/provincial funding				X					
Mandate lower-tier municipal TDM policies			X					X	
Integrate land use and transportation		X	X	X				X	
Use a carrots and sticks approach				X				X	X
Supporting public transit with TDM		X	X		X	X		X	

The analysis of York Region and the three case studies showed that York Region's interpretation is, on the whole, an appropriate interpretation of TDM, since York Region's plans echoed many of the themes found in Waterloo's, Metro Vancouver's and Arlington's. During the open coding process, five categories of themes emerged that help interpret TDM. Twenty-seven themes were found in total, and were grouped into these categories, which I have called Broad Goals, Trip Management, Comprehensive

Policy, Efficiency and Strategies. Some of the themes were then consolidated due to their similarities or overlap, resulting in a list of 20 themes, in five categories. The full results are displayed in Table 5 above.

Starting with the Broad Goals, York Region's plans echo the themes of 'Equity', in *Vision*, and of 'Health & Environment', having an 'Efficient & Competitive System' and 'Liveability', in the ROP and/or RTMP. The only theme missing from York Region's plans is the one of TDM as a tool for achieving the Regional vision. However, this theme was found only in Waterloo Region's plans. In terms of Trip Management, the themes of 'Reducing Automobile Dependence' and 'Encouraging Sustainable Travel Modes' were both found in all of York Region's plans. The goal to reduce peak hour congestion was not, and was only found in one of Metro Vancouver's and Arlington County's plans.

In the Comprehensive policy category, York Region's plans considered TDM as an integral 'Part of a Comprehensive Transportation System', as did all the other municipalities. However, the similarities are less pronounced in the last two categories. For Efficiency, York Region's plans incorporated the themes of 'Increasing System Efficiency' and 'Optimizing Existing and Future Investments', while avoiding mention of 'Optimizing Road Capacity', using 'TDM as an Evaluative Tool for Future Road Investments', and calling TDM the 'Opposite of System Management'. The first is mentioned in Waterloo and Arlington's plans, while the second two are minor themes only appearing in either Metro Vancouver's and Arlington County's documents, respectively. In the Strategies category, York Region's plans mention all themes except for 'Advocating for User-based Pricing' and 'Sustainable Provincial and Federal Funding', which are both only mentioned in one of Metro Vancouver's plans. The Strategies themes present in York Region include 'Mandating Lower-tier Municipal TDM Policies', 'Integrating Land Use & Transportation', 'Using a Carrots and Sticks Approach', and 'Supporting Public Transit with TDM'. Overall, York Region included 13 of the 20 themes found in the analysis (Table 6).

Table 6 | Identifying the common themes present and absent in York Region's interpretation of TDM

Themes	Theme Present?
Broad Goals	
Equity	X
Health & environment	X
Effective & competitive system	X
Liveability	X
Achieve vision	
Trip Management	
Reducing automobile dependence	X
Encourage sustainable travel modes	X
Reduce peak hour congestion	

Comprehensive Policy	
Part of a comprehensive transportation system	X
Efficiency	
Optimize road capacity	
Increase system efficiency	X
Optimize existing and future investments	X
Evaluative tool for future road investments	
Opposite of system management	
Strategies	
Advocate for user-based pricing	
Advocate for sustainable federal/provincial funding	
Mandate lower-tier municipal TDM policies	X
Integrate land use and transportation	X
Use a carrots and sticks approach	X
Supporting public transit with TDM	X

4.2 | EVALUATING YORK REGION'S SUPPORTIVE POLICY ENVIRONMENT

The following nine sections present York Region's fulfilment of the evaluative criteria identified from the literature review, as discussed in the previous chapter. Each of the nine sections below shows how York Region's plans meet or do not meet the particular criterion, and these findings are discussed in the next chapter.

4.2.1 | INTEGRATING TDM AT ALL SCALES

York Region's plans were found to address TDM at all levels. Policies in the ROP and RTMP encourage programs at the Regional level and the more localized transportation management association (TMA) level, while also encouraging a coordinated approach between development approvals and TDM implementation and monitoring. According to the RTMP, existing Regional-level programs include "carpooling, vanpooling, discount transit pass programs, telecommuting, flexible work hours, compressed work weeks and shuttle buses" (21). TDM includes policies promoting preferential parking spots for carpoolers, supporting high occupancy vehicle (HOV) lanes on highways, and planning development of a commute time calculator for all modes. The RTMP calls on the Regional government to work with a variety of partners to implement TDM programming and promotions. Policies under 'Principle 7' call for work with the local TMAs, the nine lower-tier municipalities and "key stakeholders" such as major employers to develop a "promotional plan" for TDM (97). 'Principle 8' includes mandatory consultations with "municipal agencies, school boards, hospitals, colleges and major employers" on the

"actions timelines and targets" of TDM strategies (98). The ROP and the RTMP specifically subscribe TDM measures on a variety of levels.

While addressing TDM at the Regional and institutional level, both the ROP and RTMP include policies for TDM measures at the development level. The ROP requires all new development applications to show how a proposed development is transit oriented (Policy 7.1.7) and requires the Region to work with developers to ensure all new-home buyers are informed about alternative options to SOV travel (Policy 7.1.8). This includes information on pedestrian and cycling facilities, viable transit routes, and the available carpooling options. As well, the RTMP requires TDM plans or strategies to be developed for all major development applications, and sets out an action for the ROP to be amended to include this policy. Other local policies include encouraging all employers to develop TDM plans, partnering with retailers to develop incentive programs for transit users, and promoting school programming that encourages children to walk to school. Since the Region's plans include policies at all scales, the Region meets the first criterion.

4.2.2 | RELATING LAND USE OBJECTIVES & POLICIES TO TDM

The Region's land use objectives and policies are both directly and indirectly linked to important TDM measures. *Vision* includes the goal of reaching an "Interconnected Systems for Mobility", where there is a "seamless network for mobility that provides accessibility to all destinations using diverse transportation options to people in all communities, promotes active healthy living and safely and efficiently moves people and goods" (13). This goal highlights the importance of mobility not just in terms of moving people or goods, but in terms of accessibility to destinations, and therefore to land uses. While TDM is not explicitly mentioned in York Region's planning documents, the demand management objective of shifting SOV trips to other modes of transport is well-integrated into them. Within this goal, *Vision* concentrates on creating "A Network of Complete Streets" and mandates that the Region should be "[d]esigning streets to be context-sensitive and complement adjacent land uses and environmental needs" (25). A link between transportation and land use is made, and therefore a link to TDM can also be made since designing complete streets is considered a TDM strategy (VTPI, 2010).

York Region's ROP is more explicit in linking land use objectives and policies to TDM. Policy 7.1.11 requires local municipalities to "adopt land use and site design policies that promote sustainable modes of transportation, including walking, cycling, transit, and carpooling" (99), requiring that land use is linked to alternatives to SOV. Policy 7.1.7, as mentioned in the previous section, requires that all major developments show how the development is transit-oriented, while other policies such as 7.2.4 call for

development of an integrated cycling network to link recreation, services and employment destinations, as well as transit. These links are echoed in the RTMP, where Principle 1, "Integrate Land Use and Transportation Planning", includes several relevant policies including directing the ROP to adopt a policy requiring local municipalities to establish minimum densities to sustain existing and proposed transit initiatives (88). As well, Principle 2, "Putting Pedestrians and Transit First", requires local municipalities to change the parking requirements of various land uses "to reflect the level of transit services and other sustainable modes" (91). While TDM is not explicitly linked to land use, a variety of TDM strategies are included even without mentioning TDM. The Region meets the second criterion.

4.2.3 | RELIABILITY AND PREDICTABILITY

York Region includes the reliability and predictability of alternative modes of transportation in its plans. *Vision*'s goal of an "Interconnected Systems of Mobility" has several policies addressing this issue. It calls for a focus on alternative modes of travel, such as walking, cycling, taking transit and carpooling, and for ensuring they are "convenient and reliable alternative modes of travel" (24). It also specifically calls for prioritizing people, by implementing TDM initiatives that provide opportunities to use these alternative modes. Regarding transit, the ROP includes a policy for improving the reliability of the Region's transit system using intelligent transportation systems, which prioritize transit vehicles through strategies such as priority at traffic signals, off-board fare collection and real time schedules at waiting areas. This improves people's travel by making transit more reliable.

Reliability and predictability of transportation is echoed in the RTMP, especially in two of its goals. The plan's second goal is to provide more convenient and reliable alternative modes of transportation, and its fourth is to optimize roads so that they accommodate all travel modes instead of being exclusively accessible by car. These goals promote the reliability of walking, cycling and transit infrastructure and the predictability of the system as a whole. There are also several policies that address reliability and predictability. For example, transit is to be made more reliable through intelligent transit systems, echoing the ROP, as well as queue jump lanes, and HOV lanes, which also promote carpooling as a travel mode. Reliability and predictability are thoroughly addressed by York Region's plans, meeting the third criterion.

4.2.4 | EQUITY

York Region's plans demonstrate some attention to equity in their TDM policies. Every new major residential development must demonstrate how the proposal is transit-oriented (ROP Policy 7.1.7), and developers must provide new home-buyers with information on alternative transportation

options in their community (7.1.8). Every new institutional, commercial and industrial development must include a TDM strategy (7.1.9). This focus on targeting new development addresses the equity criteria because it appears fair to the general public, putting less of a burden on existing residents and employers, a politically popular strategy. Equity is also encouraged in the ROP as a policy affecting Regional transit fares. Policy 7.2.29 stipulates that the transit fare strategy must be equitable and also integrated into transit services around the Region. It calls for the strategy to be integrated into transit services in adjacent regions as well, facilitating transit use for those who cannot afford to commute by car.

Another example of an equitable ROP policy is located within the objective of creating vibrant and sustainable urban areas. Policy 5.3.4 stipulates that the distance to a transit stop in the 'Urban Area' must be within five hundred metres of ninety percent of residents and within two hundred metres of fifty percent of residents. Not only does this policy call for equitable treatment of the Region's population (the remaining ten percent, we can assume, are those residents living in the still rural sections of the 'Urban Area'), it also serves as a sort of compensation for perceived inconveniences by ensuring that almost all residents can walk to transit. Whereas the ROP includes a variety of policies that can be perceived as injustices by some residents, such as removing traffic lanes for HOV lanes, reducing parking availability, or increasing parking costs, policies such as 5.3.4 ensure that almost all users are provided access to an alternative mode of transportation.

4.2.5 | CLEAR, COMMUNICATED VISION

York Region's *Vision* is organized around a vision statement supported by a series of goals, which are in turn supported by several actions – each illustrated by several points. The vision statement itself does not mention transportation demand, though it does include various aspects of TDM and its goals. York envisions a region where everyone will be able to get around actively for all their needs due to the urban structure. It also mentions a variety of mobility choices, an interconnected transit system and streets that prioritize people. The statement uses strong language in the present tense, such as "York Region's residents *are able to*... [emphasis added]", as opposed to stating, for example, that York Region's residents 'should' or 'may be able to'. As a vision document in and of itself, *Vision*'s goals are also relevant to this evaluation. The goal related to transportation, "Interconnected Systems for Mobility", makes only one weak statement about transportation options. It states that in 2051 all residents will have access to a seamless network for mobility with diverse transportation options that promote health and economic activity. Though the goal does not mention TDM, an action that supports

it does, calling for the implementation of TDM initiatives to reduce automobile dependence by promoting alternatives.

The ROP does not provide a vision statement, but instead uses the *York Region Sustainability Strategy: Towards a Sustainable Region* (York Region, 2007) as the framework for evaluating its policies. The *Sustainability Strategy*'s long term vision includes seven characteristics for every resident and employee. Two of these relate to TDM: that every resident and employee must have access to "different, efficient and affordable modes of transportation," and that they must also be able to "lead an active and healthy lifestyle" (8). Again, TDM is not explicitly mentioned in a vision, but is mentioned in the document's action items, this time under 'Theme Area' where it is enlisted as a method with which a sustainable natural environment can be created. One of the actions of this theme area, regarding protecting the natural environment so that it contributes to quality of life and the economy, is to apply TDM strategies to increase alternative mode use, which will improve access and mobility (18).

Unlike *Vision* and the *Sustainability Strategy* documents, the RTMP has a clear vision that explicitly makes use of TDM. To support the Regional vision, the RTMP has four goals:

1. Develop initiatives and strategies that reduce the need to travel;
2. Provide more convenient and reliable alternative modes;
3. Enhance public transit by improving existing infrastructure and services; and
4. Optimize roads to accommodate all modes of travel, and expand roadways only when necessary.

These four goals support the vision of developing in a more sustainable manner, and each is directly related to TDM. The first goal, reducing the need is travel, is one aspect of TDM, with the other being shifting travel to alternative modes – the second goal. Enhancing public transit is an important component of an integrated TDM strategy, and expanding roadways only when necessary is a supportive component as well. The RTMP's vision and goals are clearly communicated, and address TDM directly.

4.2.6 | CARROTS AND STICKS APPROACH

York Region's plans include many 'carrots' and some 'sticks' in an effort to incentivize switching to an alternative mode of transportation and disincentivize SOV trips. For its own employees, the Region provides various flexible work options including teleworking and compressed work weeks to reduce the need to travel to work at least on some days. The Region's employees also benefit from discounted transit passes and preferential carpool parking spots. The ROP calls for various incentives targeted

towards workers in the public and private sectors, retail customers, students and transit users. For example, Policy 7.1.14 stipulates that the Region will work with Smart Commute to promote employer-based incentives similar to those provided by the Region. Policy 7.1.15 encourages retailers to offer discounts to employees and customers using alternative modes, 7.1.16 calls for the development of a discounted student transit pass, and 7.1.17 suggests real-time information on commuting options, including wait times and bus location information for public transit users. There are few sticks directly affecting these users, however.

The ROP also provides carrots to developers, as well as some sticks. One example includes creating incentives to attract major office uses to Regional Centres and Corridors (Policy 4.2.2), which directs major employers to areas where alternative modes of transportation are more viable ways to commute. In the same vein, Policy 7.5.19 calls for an incentive program that may include "wastewater servicing allocation credits, density bonusing, expedited processing of development approvals or the use of local municipal community improvement plans and associated financial tools" for sustainable building practices (121). At the same time, sticks include Policy 5.3.4, which, as mentioned earlier, stipulates that most residents must be near transit in the Urban Area. This policy gives Regional staff a tool to reject auto-centric development if there are no plans for transit routes in that area, thereby directing development to transit-oriented areas, and disincentivizing these types of developments. Disincentives are also provided for drivers through parking management, as the plan stipulates that throughout York Region (Policy 5.2.10), and along all Regional Centres and Corridors specifically (Policy 5.4.8), secondary plans and zoning by-laws shall include reduced minimum and maximum parking requirements near transit, and shared parking requirements where possible between complementary uses. This reduction in parking disincentivizes driving as it makes parking, especially free parking, more difficult to find, leading to additional time and monetary consumption. Incentives for drivers to switch modes include HOV carpool lanes and bike lanes on all six-lane or more Regional streets (Policy 7.2.41) and transit priority lanes (7.2.40-41).

Similar policies are found in the RTMP. First, the plan's four goals directly call for incentivizing approaches to managing transportation. The goals call for developing initiatives that reduce the need to travel, providing convenient alternative modes, enhancing public transit, and optimizing roads for all modes of travel, not just the car – carrot approaches are used to persuade drivers to use alternatives to SOV. To support these goals, policies include subway, light rail and bus expansion projects, carpooling, cycling and pedestrian infrastructure expansion. However, the sticks are again largely absent aside from parking management, including a policy under Principle 2 to work with local municipalities to "adjust",

not reduce, the amount of parking in areas where alternative modes of transportation exist. Another policy under Principle 8 regarding TDM, calls for considering disincentivizing all-day parking, with no further details. In general, York Region's plans include a variety of incentives but few disincentives to driving alone.

4.2.7 | EDUCATION AND PUBLIC AWARENESS

York Region's *Vision* includes the goal of creating Living Sustainability by fostering healthy and sustainable behaviours. This is illustrated by two points relating directly to education and public awareness. The first calls for providing "education and training on the use of alternative transportation modes including commuting safely on cycling routes and transit use" and the second for "providing public education and outreach to increase awareness of the health impacts associated with air quality, climate change and the built environment", three impacts of unmitigated traffic congestions (26). The *Vision* stipulates that sustainable and healthy behaviours are fostered through the use of education and public awareness, just as required by the criterion.

The ROP also includes several policies calling for education and public awareness to support TDM. Policy 7.1.8 stipulates that the Region will require developers to provide residents purchasing new homes with information on alternative modes available to them, including pedestrian, cycling and transit facilities, and carpooling options. Communicating with home buyers or those new to the Region as soon as they move-in theoretically allows these newcomers to create sustainable habits before unsustainable ones have formed. ROP policy, Policy 7.1.14, calls for the Region to work with the local TMA, Smart Commute, to promote TDM initiatives in workplaces, such as alternative or flexible work schedules, transit incentives, such as employer discounts or 'guaranteed ride home' programs, and carpooling options.

The Region's RTMP similarly calls for educating new and existing residents, echoing ROP policies, but takes it a step further by calling for the development of a best practices planning handbook for those involved in land development –municipal staff and the development community. Principle 7 ensures that those staff making approval decisions or providing comments know what criteria to use in evaluating developments, and those proposing developments know what is expected for a supported development application. In light of these policies, York Region's plans address the criterion.

4.2.8 | PRIVATE IMPLEMENTATION OF TDM

The ROP requires private involvement in TDM implementation in several ways. It does this both in its chapter on city-building and complete communities, and in the chapter on servicing the

population. In the city-building chapter, Policy 5.4.16 stipulates that the Region require, as a condition of development approval, that new major developments include cycling facilities such as bicycle storage, and lockers and showers to encourage cycling. Similarly, the servicing section includes six policies (7.1.1, 7-8, 12, 14) that require the private sector to contribute to TDM implementation. Policy 7.1.1 requires all development applications and transportation studies to identify appropriate TDM measures to reduce SOV trips, while Policy 7.1.7 requires all development applications to prove that a development is transit-oriented. Policy 7.1.8, as mentioned in the last section, calls for the Region to work with residential developers to provide education on the availability and viability of alternative modes of transportation. For institutional, commercial and industrial development applications, Policy 7.1.9 requires a TDM strategy that considers a comprehensive suite of TDM measures to reduce SOV trips to and from the proposed development. Though it is not required, as with the previous policies mentioned in this section, the Region's ROP (Policy 7.2.12) encourages property owners to provide facilities that improve the walking and cycling experience in at major destinations, and to promote employer-based TDM initiatives (Policy 7.1.14). These policies are repeated almost exactly in the RTMP.

4.2.9 | LEADING BY EXAMPLE

In 2004 York Region helped establish Smart Commute, the local network of GTHA TMAs. Much of its leadership through policy is related to this initiative, now run by Metrolinx, from whom the Region received the 2008 and 2012 Employer of the Year Award for its TDM programs. Its employer-based initiatives include carpool parking spaces at Regional buildings, an emergency ride home program, bicycle parking and storage facilities, showers, an employee transit discount program, the option to work a compressed work week, and flexible schedules. The Region's *Vision 2051* mentions leading by example, but not as it relates to transportation. The ROP and RTMP, however, do have specific language stipulating that the Region should become a leader in transportation and service provision. Under Principle 7 of its RTMP, the Region calls for a handbook for staff and the development community. As mentioned in an earlier section a procedure for working with transit agencies and local municipalities and organizing TOD materials in a portal on the Regional website was developed (97).

York Region takes it upon itself to organize materials and educate others on best practices, while also striving to demonstrate and excel in these practices. Also under Principle 7, the RTMP calls for producing a newsletter highlighting sustainable development in the Region, and includes discussions about various policies regarding engaging the media about TDM. The RTMP's 2-year Action Plan calls for preferential carpool parking at all Regional facilities, as well as for electric-powered vehicles and facilities for these vehicles (107). In its 5-10 year goals, the RTMP aims to pilot individualized commuter

plans for employees to promote lower SOV use (111). The Region addresses the criterion well, in the ROP and RTMP, but not in *Vision*.

4.2.10 | SUMMARIZING THE CRITERIA

Table 7 below summarizes York Region's fulfillment of the nine criteria and grades each of the Region's plans based on how well it addresses the criteria. Although each grade is represented with a full, half full or empty circle, the grade is somewhat subjective and should not be understood as absolute. An empty circle means that the plan did not address a criterion very well, a half-filled circle represents that it was somewhat addressed, and a full circle means it was addressed well.

Table 7 | Summarizing York Region's meeting of the evaluative criteria

Evaluative Criteria	Vision	ROP	RTMP
Integrating TDM at all scales	○	●	●
Relating land use objectives & policies to TDM	◗	●	●
Reliability and predictability	●	◗	●
Equity	○	●	○
Clear communicated vision	◗	○	●
Carrots and sticks approach	○	◗	◗
Education and public awareness	●	●	●
Private implementation of TDM	○	●	●
Leading by example	○	●	●

● Addressed
◗ Somewhat Addressed
○ Not Addressed

5 | DISCUSSION & RECOMMENDATIONS

This chapter provides a discussion of the findings as presented in Chapter 4 with recommendations for York Region. First, I make recommendations based on the interpretation of TDM by all four case studies, and then compound those recommendations with the themes that arose in this research and that should be taken into consideration when writing York Region's TDM policies. Second, I make specific recommendations based on the second research question, with regards to each of the 9 criteria used in the analysis.

5.1 | INTERPRETATION OF TDM

The planning documents of the three chosen best practice case studies, Waterloo Region, Metro Vancouver and Arlington County, produced a list of 20 themes to define and interpret TDM. Thirteen of them were found in York Region's plans as well. Of those that were missing in York Region's planning documents, two ('Reducing Peak Hour Congestion' and 'Optimizing Road Capacity') were found in two of the comparative case studies, and five were found only in one ('Achieving a Vision', 'Evaluative Tools for Future Road Investments', 'Opposite of System Management', 'Advocate for User-based Pricing' and 'Advocate for Sustainable Federal/Provincial Funding'). Since none of the missing themes were found in all three of the comparative case studies, it is likely that York Region's interpretation of TDM is aligned with the comparative case studies considered best practices.

Although the themes of 'Reducing Peak Hour Congestion' and 'Optimizing Road Capacity' were found in two of the other cases, it is not recommended that York Region include them as part of its interpretation of TDM. Defining TDM as a solution for reducing peak hour congestion, thereby simply pushing SOV trips to other times of the day, may be a short term solution but, over the long term will induce demand which will worsen the situation by attracting new drivers to the road. The Region should continue to focus on reducing demand, and not simply shifting it to other times of the day. Similarly, optimizing the road capacity does not reduce the demand for driving and is likely to attract new drivers to the increased capacity, thereby increasing the total number of cars on the road and the overall level of congestion.

Of the five other missing themes, 'Achieving a Vision' through TDM is perhaps the most glaring omission from York Region's plans. As discussed in Sections 3.2.6 and 4.2.5, including TDM in a plan's vision is important to its success. While all three plans make some indirect link to TDM when describing their vision, the connection is not clearly communicated. An example where this is done well is in Vernon, British Columbia, where the Transportation Plan (2008) outlines the guiding principles of the

Official Community Plan, and the specific ways in which TDM strategies are used to achieve these principles. For example, the first principle, "Protect and preserve green spaces and sensitive areas," is followed by "The plan emphasizes Transportation Demand Management (TDM) initiatives, which can either displace or defer the construction of new roads" (Vernon, 2008, 6). Another principle, "Create a culture of sustainability," is followed by "The provision of TDM options is intended to not only make walking, cycling and transit efficient options, but attractive ones. Ultimately, however, their success is dependent upon the use of TDM by the community…" (Vernon, 2008, 6).

Recommendation 1: Directly relate TDM to achieving the long-term vision described by Vision 2051, the ROP and the RTMP.

Another missing theme, using TDM as a Tool to Evaluate Future Road Investments, is an interesting theme included in Metro Vancouver's plans. Connecting TDM to road investments ensures that municipal money is not spent on unnecessary road expansion, when viable alternatives are available. Though one of the RTMP's goals does mention only expanding roadways when necessary, it does not include TDM as an evaluative tool for making these decisions. Metro Vancouver's RGS is a good example of this, as it calls for evaluating capacity expansion for motor vehicles (e.g. new roads, bridges, and other improvements) against TDM strategies as alternatives. (Metro Vancouver, 2013, 56).

Recommendation 2: Present TDM as a decision-making tool in evaluating potential road investments.

Advocating for the ability to implement user-based pricing and for sustainable Federal or Provincial funding of transit are two other themes only found in Metro Vancouver's plans when describing and defining TDM. User-based pricing is widely considered to be one of the most effective strategies for reducing SOV trips, particularly into a cordoned area such as a downtown. Sustainable funding from upper levels of government is necessary for both Metro Vancouver and York Region, as Provincial and Federal funding is often provided primarily on a project-by-project basis. Though advocating for these two is an important piece in implementing TDM, including them as policies is more appropriate. While it is clear that advocating for these tools and funding should be included in the plan, they are not themes that are needed to define TDM.

The final missing theme, framing 'TDM as the Opposite of System Management', should not be incorporated into York Region's interpretation as it is not a suitable interpretation. As noted earlier, the goal of TDM is to reduce demand for SOV travel, whereas TSM is based on managing the system in order to optimize the network, particularly for motor vehicles. TDM should not be framed as the opposite of

optimization, since it requires a comprehensive approach. There is room for road optimization, but TDM should not be its opposite, but its complement. Recommendations 1 and 2 address the interpretation of TDM in York Region's planning documents, and the following section provides recommendations based on the supportiveness of the Region's policy environment.

5.2 | CRITERIA FOR A SUPPORTIVE POLICY ENVIRONMENT

Overall, York Region's plans perform well against the evaluation criteria, as seen in Table 7. There is, however, room for improvement. For the first criterion regarding integrating TDM at all scales, the ROP and RTMP succeed quite well by including policies that target the Regional, local, TMA, and specific site and use scales. However, the *Vision* neither mentions this criterion nor discusses integrating TDM at any scale. Since the *Vision* document is a broad document with an overarching focus and this criterion deals with specific policies at a variety of levels, the absence of this discussion is not as critical an issue as it would be in the ROP or RTMP. Nevertheless, the *Vision* could include this criterion as a goal, instead of as a specific policy or action.

Recommendation 3: The Vision should explicitly call for integration of TDM at a variety of scales as one of its goals, to be implemented by policies in lower-level plans.

Just as with the first criterion, the ROP and RTMP perform well when it comes to relating land use objectives and policies to TDM with various goals and policies specifically stipulating that land use and TDM are linked in their planning. Yet, the *Vision* makes little mention of the relationship between the two. Though both transportation and land use are discussed separately, there is no express language connecting the two concepts. It is important that this critical link is established at the visioning level of planning. This could be done by taking the same approach as was taken in the ROP and RTMP. For example, the ROP states that one of its key elements is "Enhanced mobility systems using a 'people and transit first approach' to connect land use and transportation planning" (10). The *Vision* could employ a similar approach.

Recommendation 4: The Vision should express the relationship between land use and TDM, to be implemented by policies in lower-level plans.

For the third criterion, reliability and predictability of alternative modes of transportation, York Region's plans perform quite well. The *Vision* includes strong calls for both measures, while the RTMP addresses them directly in two of its four goals, as well as indirectly through various policies. The ROP, however, only addresses reliability and predictability indirectly, and even then, only with one policy

regarding transit. More needs to be done to ensure that the ROP properly plans for the reliability and predictability of alternative modes. This could be done similarly to the RTMP, where one of the goals is to "Provide more convenient and reliable alternative modes" (52). This makes a clearly stated link to reliability of alternative modes and emphasizes its importance by including it as one of the plan's goals.

Recommendation 5: The ROP should explicitly stipulate that alternative modes of transportation must be reliable and predictable.

Equity, the fourth criterion, is aptly defined and addressed by the ROP, but neglected by both the *Vision* and RTMP. The *Vision* does not allude to equitable policies when it comes to transportation, and the RTMP, though it does help implement some of the policies of the ROP, does not expressly aim for equity as a goal or as part of its vision. To improve, York could learn from the Region of Waterloo. In its vision statement, Waterloo's ROP calls for social sustainability, which "involves building cities and towns as complete communities, which provide for the needs of all residents, foster social *equity*, inclusion and collaboration, and encourage healthy lifestyles [emphasis added]" (3).

Recommendation 6: The Vision and RTMP should include equity as part of its vision and/or goals, and develop actions and policies to implement equitable TDM policy.

In terms of including TDM as part of a clear, communicated vision, the fifth criterion, the RTMP performs best of the three plans. The ROP uses a separate document as its vision (which includes TDM in its vision) so it received a grade of 'not applicable' for this criterion. The *Vision* document does include TDM as an action, though not as part of its goals or vision, and could do more to incorporate TDM. For example, Metro Vancouver's RGS links three of its five goals directly to TDM. The goal of creating a compact urban area is expected to shape transportation demand, while an integral part of the goal of supporting sustainable transportation choices is managing the road system and the demands on it.

Recommendation 7: The Vision should include TDM as an integral part of its vision and goals for 2051.

York Region performs the worst at addressing the sixth criteria, incorporating a carrots and sticks approach to TDM. A lack of sticks was found in all three plans, though this is perhaps not an issue in V*ision* since it is a broad policy document, which may not need to include such specific strategies that directly incentivize and disincentivize users. Both the ROP and RTMP included some policies regarding parking management to disincentivize SOV trips, but overall provide plenty of incentives but few disincentives. Metro Vancouver's RTS uses such a carrots and sticks approach. While promoting the

safety, security, ease and attractiveness of alternative modes of transport, it also calls for mobility pricing to ensure fairness to all users, as well as managing parking. This approach incentivizes alternative modes while disincentivizing SOV travel.

Recommendation 8: The ROP and RTMP should include a more comprehensive set of strategies to disincentivize SOV trips.

The next criterion, using education and public awareness, is done relatively well by all three plans. The *Vision* proposes education of the positive aspects of alternative modes, and the health, environmental and social negatives of driving. Both the ROP and RTMP include a variety of policies to ensure new and existing residents are educated about alternative modes, and the RTMP includes various other targets including municipal staff and the development community. No further action is recommended.

York Region again performs well in the eighth criterion, private implementation of TDM. Both the ROP and RTMP include a variety of policies to engage various actors in the private sector in education and strategy implementation. Though the *Vision* does not address this criterion, its scope should not be expected to include this fairly narrow tool for implementation. Again, no further action is recommended.

Finally, the RTMP does an excellent job addressing the ninth criterion, leading by example, with many policies directly stipulating that the Regional corporation take the initiative on TDM. The ROP also addresses this well, though more could be done to improve the *Vision*, especially considering it envisions being a leader in other aspects, such as water demand management. This could be improved by simply doing the same for TDM. A similar vision statement could be extended where York Region is a leader in transportation demand management.

Recommendation 9: The Vision should aim to be a leader in TDM in order to be an example to other corporations and individuals in the Region and beyond.

6 | CONCLUSIONS

The management of the demand for driving vehicles alone has never been more important. The costs of congestion, whether economic, social, environmental or health-related, are alarming and unsustainable. This report has discussed the transportation demand management policies of York Region in order to answer two questions: first, whether York Region's interpretation of TDM is aligned with that of cases considered to exemplify best practices, and second, whether its TDM policies met nine criteria crucial to successful TDM policy.

After completing the analysis, it was evident that York Region's interpretation is well aligned with that of Waterloo Region's, Metro Vancouver's and the County of Arlington's interpretations. In fact, though I make two recommendations to improve the interpretation, York Region provided a better definition, framing TDM accurately and comprehensively. York Region also performed fairly well against the list of criteria, though not all plans performed well for all of the criteria. Two of the criteria were very well addressed and do not require any further action, while the other seven require one or two of the three plans to make improvements. The nine recommendations are summarized below:

Recommendation 1: Directly relate TDM to achieving the long-term vision described by Vision 2051, the ROP and the RTMP.

Recommendation 2: Present TDM as a decision-making tool in evaluating potential road investments.

Recommendation 3: The Vision should explicitly call for integration of TDM at a variety of scales, to be implemented by policies in lower-level plans.

Recommendation 4: The Vision should express the relationship between land use and TDM, to be implemented by policies in lower-level plans.

Recommendation 5: The ROP should explicitly stipulate that alternative modes of transportation must be reliable and predictable.

Recommendation 6: The Vision and RTMP should include equity as part of its vision and/or goals, and develop actions and policies to implement equitable TDM policy.

Recommendation 7: The Vision should include TDM as an integral part of its vision for 2051.

Recommendation 8: The ROP and RTMP should include a more comprehensive set of strategies to disincentivize SOV trips.

Recommendation 9: The Vision should aim to be a leader in TDM in order to be an example to other corporations and individuals in the Region and beyond.

The themes gleaned from York Region and the best practice cases provide lessons for other municipalities on how to define TDM in their own plans. By keeping the common themes in mind during the planning process, a solid foundation can be set that leads to more justifiable TDM policies. Also, by developing a list of criteria with which to evaluate York Region's policy environment for TDM, this report provides a starting point for municipalities looking to develop their own TDM policies. The use of a set of general criteria can be useful to municipalities looking to adopt policies comprehensively, as opposed to incorporating strategies on an ad hoc basis.

While this report presents nine criteria for evaluating policy environments for TDM, further research could go into scrutinizing this list by testing it against other municipalities and case studies. As well, further study is needed in order to assemble criteria with regards to themes for interpreting and defining TDM. Combining the two could lead to a TDM policy-planning toolkit, helping municipalities integrate TDM into their plans in a comprehensive, thought-out manner.

REFERENCES

Arlington County. (2007). *Master transportation plan*. Arlington County, VA.

Arlington County. (2008). *Master transportation plan: Demand and system management element*. Arlington County, VA.

Arlington County. (2010). *Five-year review of Arlington County's Comprehensive Plan 2005-2010*. Arlington County, VA.

BA Consulting Group. (2008). *TDM supportive guidelines for development approvals*. Toronto, ON: Association for Commuter Transportation of Canada.

Behan, K., Maoh, H., & Kanaroglou, P. (2008). Smart growth strategies, transportation and urban sprawl. *The Canadian Geographer*, 52, 3, 291-308.

Cicuttin, J. (2010). iXpress: Central transit corridor express bus project – Transport Canada. *Transport Canada*. Retrieved August 2, 2013 from http://www.tc.gc.ca/eng/programs/environment-utsp-waterloo-1093.htm.

Downs, A. (1992). *Stuck in traffic*. Washington, DC: Brookings Institution.

European Conference of Ministers of Transport (ECMT). (2007). *Managing urban traffic congestion*. 1-295. Paris: OECD Publishing.

Farahani, S. (2007). *Impacts of the introduction of an express transit service in Waterloo Region*. Waterloo, ON: University of Waterloo.

Gärling, T., & Schuitema, G. (2007). Travel demand management targeting reduced private car use: Effectiveness, public acceptability and political feasibility. *Journal of Social Issues*, 63, 1, 139-153.

Gatersleben, B., & Uzzell, D. (2007). Affective appraisals of the daily commute: Comparing perceptions of drivers, cyclists, walkers and users of public transport. *Environment and Behavior*, 39, 416.

Gordon, D. (1991). *Steering a new course: Transportation, energy and the environment*. Union of Concerned Scientists: Island Press.

HDR Corporation. (2008). *Costs of road congestion in the Greater Toronto and Hamilton Area*. Toronto: Metrolinx.

Higgins, T. (1990). Demand management in suburban settings - effectiveness and policy considerations. *Transportation*, 17, 2, 93-116.

Holden, D.J. (1989). Wardrop's third principle: Urban traffic congestion and traffic policy. *Journal of Transport Economics and Policy*, 23, 3, 239-262.

Ison, S., & Rye, T. (2008). The implementation and effectiveness of transport demand measures: An international perspective. Aldershot, England: Ashgate Publishing Limited.

Klein, W., Benson, V., Anderson, J., & Herr, P. (1993). Vision of things to come. *Planning*, 59,5, 10-15.

Levinson, D. M., & Krizek, K. J. (2008). *Planning for place and plexus: Metropolitan land use and transport*. New York: Routledge.

Litman, T. (2011). *Victoria Transport Institute - Online TDM Encyclopedia*. Retrieved September 29, 2011, from http://www.vtpi.org/tdm/.

Marshall, C., & Grossman, G.B. (2006). *Designing qualitative research* (4th Ed.). Thousand Oaks: Sage.

Metro Vancouver. (2010a). *Metro Vancouver 2040: Shaping our future* (*Regional Growth Strategy, Bylaw No.1136)*. Metro Vancouver: Burnaby, BC.

Metro Vancouver. (2010b). *Metro Vancouver: Sustainability framework*. Metro Vancouver: Burnaby, BC.

Metro Vancouver. (2011a). Who is Metro Vancouver. *Metro Vancouver*. Retrieved August 13, 2013, from http://www.metrovancouver.org/about/Pages/default.aspx.

Metro Vancouver. (2011b). RGS Goals and Strategies. *Metro Vancouver*. Retrieved August 13, 2013, from http://www.metrovancouver.org/planning/development/strategy/Pages/designations.aspx.

Metrolinx. (2008). *The big move: Transforming transportation in the Greater Toronto and Hamilton Area.* Metrolinx.

Metrolinx. (2010). *Platform for Change: 09-10 Annual Report*. Toronto: Metrolinx.

Mingardo, G. (2008). Cities and innovative transportation policies. *Innovation: management, policy & practice*, 10, 2-3, 269-281.

Mogridge, M.J.H. (1997). The self-defeating nature of urban road capacity policy: A review of theories, disputes and available evidence. *Transport Policy*, 4, 5-23.

Moore, S.W. (2004). *Smart communities: How citizens and local leaders can use strategic thinking to build a brighter future.* San Francisco: John Wiley & Sons.

Morris, E. (2007). From horse power to horsepower. *Access*, 30, 2-9.

Noxon Associates Limited. (2011). *Transportation demand management for Canadian communities: A guide to understanding, planning and delivering TDM programs*. Transport Canada: Ottawa, ON.

Palma, A., Lindsey, R., & Proost, S. (2012). Introduction to the special issue on funding transportation infrastructure. *Networks and Spatial Economics*, 12, 2, 183-185.

Poudenx, P. (2008). The effect of transportation policies on energy consumption and greenhouse gas emission from urban passenger transportation. *Transportation Research Part A*, 42, 901-909.

Samuel, P. (1999). Traffic congestion: A solvable problem. *Issues in Science & Technology*, 15, 3, 49-56.

Schrank, D., Lomax, T., & Turner, S. (2010). *TTI's 2010 Urban Mobility Report*. College Station, TX: Texas Transportation Institute, A&M University.

Shefer, D. (1994). Congestion, air pollution, and road fatalities in urban areas. *Accident Analysis and Prevention*, 26, 4, 501-9.

Stein, S.M., & Harper, T.L. (2012). Creativity and innovation: Divergence and convergence in pragmatic dialogical planning. *Journal of Planning Education & Research*, 32, 1, 5-17.

Stern, P.C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, 56, 407-424.

Stopher, P.R. (2004). Reducing road congestion: A reality check. *Transport Policy*, 11, 117-131.

Sweet, M. (2011). Does traffic congestion slow the economy? *Journal of Planning Literature*, 26, 4, 391-404.

Taylor, B.D. (2004). Rethinking traffic congestion. *Access*, 21, 8-16.

Translink. (2011). *Transit oriented communities: Primer on key concepts*. Translink.

Translink. (2013). *Regional transportation strategy: Strategic framework*. Translink.

Victoria Transport Policy Institute (VTPI). (2010). *Online TDM Encyclopedia – About this Encyclopedia*. Retrieved May 29, 2013, from http://www.vtpi.org/tdm/tdm12.htm.

Victoria Transport Policy Institute (VTPI). (2011a). *Online TDM Encyclopedia – Land Use Density and Clustering*. Retrieved May 29, 2013, from http://www.vtpi.org/tdm/tdm81.htm/.

Victoria Transport Policy Institute (VTPI). (2011b). *Victoria Transport Institute - Online TDM Encyclopedia*. Retrieved September 29, 2011, from http://www.vtpi.org/tdm/.

Victoria Transport Policy Institute (VTPI). (2012a). *Online TDM Encyclopedia – Success Stories*. Retrieved May 30, 2013, from http://www.vtpi.org/tdm/tdm3.htm.

Victoria Transport Policy Institute (VTPI). (2012b). *Victoria Transport Institute – Walking and Cycling Encouragement*. Retrieved May 30, 2013, from http://www.vtpi.org/tdm/tdm3.htm.

Victoria Transport Policy Institute (VTPI). (2013). *Victoria Transport Institute - TDM Marketing*. Retrieved May 30, 2013, from http://www.vtpi.org/tdm/tdm23.htm.

Wachs, M. (2002). Fighting traffic congestion with information technology. *Issues in Science & Technology*, 19, 1, 43-50.

Waterloo Region. (2009). "Travel Wise" strategies overview: Regional Transportation Master Plan.

Waterloo Region. (2010). *Regional Official Plan*. Regional Municipality of Waterloo.

Waterloo Region. (2011). *Regional Transportation Master Plan.* Regional Municipality of Waterloo.

Winston, C. & Langer, A. (2006). The effect of government highway spending on road users' congestion costs. *Journal of Urban Economics*, 4, 63-83.

Winston, C. & Langer, A. (2006). The effect of government highway spending on road users' congestion costs. *Journal of Urban Economics*, 4, 63-83.

Yin, R.K. (2009). *Case study research: Design and methods* (4th Ed.). Sage Publications Inc.: Thousand Oaks, CA.

York Region. (2007). *York Region Sustainability Strategy: Towards a Sustainable Region*. Retrieved October 12, 2012, from http://www.york.ca/wps/wcm/connect/yorkpublic/e6e04658-d63b-4dcf-a2da-0e4972c8029c/Final%2BSustainability%2Bdocument.pdf?MOD=AJPERES.

York Region. (2009a). *York Region Transportation Master Plan*. York Region: York Region.

York Region. (2009b). *York Region Transportation Master Plan – Appendix P*. York Region: York Region.

York Region. (2010). *York Region Official Plan*. Retrieved October 12, 2012 from http://www.york.ca/Departments/Planning+and+Development/Long+Range+Planning/ROP.htm.

York Region. (2012). *Vision 2051*. York Region. Retrieved October 12, 2012 from http://www.york.ca/Departments/Planning+and+Development/Long+Range+Planning/Vision2051_Home.htm.Zhou, J. & Zhu, Z. (2007). Hierarchy analysis and strategies on the imbalance between supply and demand of urban traffic. *Journal of Transportation Systems Engineering and Information Technology*, 7, 4, 24-29.