

Rapid Transit as a Catalyst for Reurbanization in Waterloo Region

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Abstract – Rapid Transit as a Catalyst for Reurbanization in Waterloo Region

Waterloo Region is one of the fastest growing communities in Canada with a population today of over a half million people and with forecast growth of almost 50 percent within the next 25 years. The Region is facing many of the same challenges experienced by other rapidly growing communities throughout North America including increasing traffic congestion, outward pressure on urban boundaries, public health concerns and downtowns desperately in need of revitalization. Many of these impacts are directly related to society's dependence on the automobile.

Rapid transit is an integral component of Waterloo Region's *Regional Growth Management Strategy* (RGMS), approved by Regional Council in 2003. Rapid Transit will act as a catalyst for reurbanization bringing together land use planning and transportation infrastructure in an innovative approach to community building. It is being considered within the Central Transit Corridor (CTC), which links the major urban centres of the City of Cambridge, City of Kitchener and City of Waterloo. Higher order transit is also identified in the Province's *Places to Grow* Growth Plan for the Greater Golden Horseshoe.

In 2004, the Federal government contributed funding for Technical Studies for the Region's Rapid Transit Initiative. The studies have revealed positive results. Analysis of development potential within the CTC demonstrates it has the market strength and physical capacity to attract and accommodate significant economic growth. Ridership forecasts indicated substantial ridership growth in the CTC attributed to rapid transit and a benefit-cost economic analysis showed that both LRT and BRT are economically viable rapid transit alternatives in our community.

The Region is currently undertaking an Individual Environmental Assessment in accordance with Provincial and Federal guidelines that will examine the need for a rapid transit system, technology choices, routes and stations and system design. It is scheduled for completion in the spring, 2008.

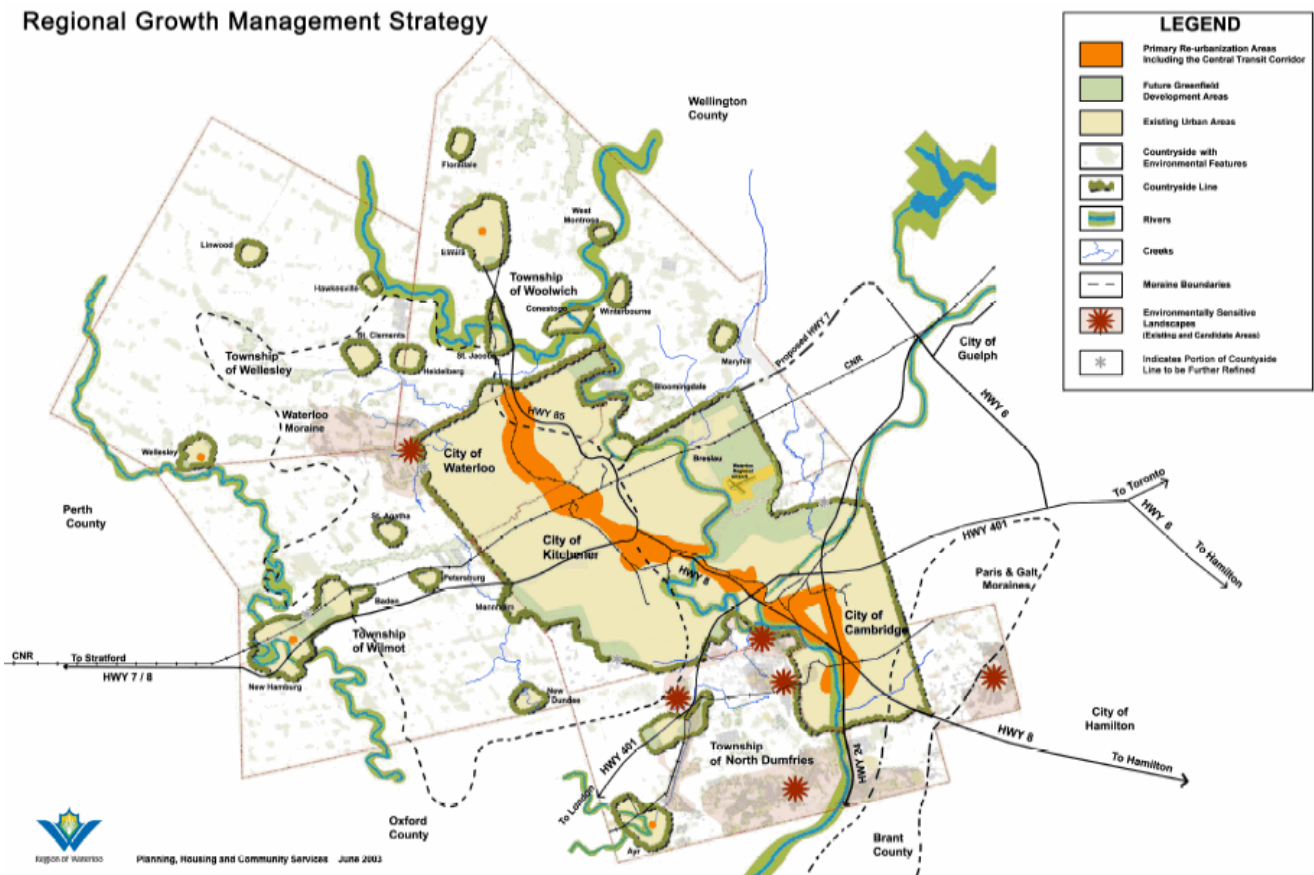
Some of the benefits of rapid transit discussed in this paper include increased modal share brought on by ridership growth with added development around rapid transit stations, reduced urban sprawl and pressure on the urban boundaries, mitigating congestion with policies and resources to control increased traffic in the downtown cores, connections with inter-city transit, minimizing the impact of growth (development and traffic) on climate change and heightening public safety through station area design principles and enhanced security for pedestrians and residents living around stations.

INTRODUCTION

As one of the fastest growing communities in Canada, Waterloo Region has a population of over half a million people with a forecast growth of almost 50 percent within the next 25 to 35 years. Due to this rapid growth, the Region is facing many of the same challenges experienced by other rapidly growing communities throughout North America. These challenges, which include increasing traffic congestion, outward pressure on urban boundaries, public health concerns and downtowns desperately in need of revitalization, are to a great extent directly related to our society's dependence on the automobile.

Fortunately, the Region of Waterloo has a long history of managing growth rather than simply responding to it. Since approval of the first Regional Official Policies Plan in 1976, the Region has been recognized for having one of the strongest and most innovative growth management policies in Ontario. Waterloo's *Regional Growth Management Strategy* (RGMS) approved in 2003 includes rapid transit as a key catalyst to influence urban form and to encourage higher densities along the Central Transit Corridor (CTC) – see the dark-shaded area of Figure 1. The Strategy also provides a high level of protection for environmental areas and agricultural lands. Such policies, and consistently strong political support for transit expansion, set the stage for the Region to introduce this new form of public transit.

FIGURE 1 – CENTRAL TRANSIT CORRIDOR (CTC)



BACKGROUND

Transit Today

Grand River Transit (GRT) employs a fleet of 191 buses that travels more than nine million kilometres per year throughout the cities of Cambridge, Kitchener and Waterloo on a fixed route schedule. GRT carries 12.2 million riders annually on urban and inter-city transit services, including specialized transit services such as Mobility Plus, utilizing two multi-modal transit facilities in Kitchener and Cambridge.

In the last five years, the community has expressed continued support for the Region's transit services by the most important factor - use of the service. Transit ridership in Waterloo Region increased 31%, from 9.3 million to 12.2 million annual trips between 2000 and 2005.

The rate of ridership growth averaging 4.9% annually is on target to achieve the Regional Transportation Master Plan's (RTMP) goal of reducing the share of auto travel from 84% to 77% by 2016 (1). This requires more than doubling the transit ridership which will be accomplished by improving the transit network and service levels on average by 6% annually.

Transit and Other Modes in the CTC

The Central Transit Corridor (CTC) is characterized by the highest bus frequency and transit use within the Region, extending 35 kilometers between North Waterloo and South Cambridge (see Figure 1) and connecting the three urban cores of Kitchener, Waterloo and Cambridge. Existing major activity centres along the linear corridor include two universities (University of Waterloo and Wilfrid Laurier University), a health sciences campus and research and technology park, two hospitals, major office developments (Sun Life and Manulife), three downtown cores, three regional-scale shopping centres, high-rise residential buildings and numerous commercial-retailing areas. The current employment in the CTC is around 90,000 along with 54,000 residents. This is expected to increase to 135,000 employees and 94,000 residents by 2031 when the Regional population reaches 729,000 people according to the Province's *Places to Grow* Growth Plan.

The existing bus system accommodates approximately 60,000 boarding passengers on a daily basis. Within the CTC, there are four main bus routes (Routes 7, 8, 52 and *iXpress*); these trunk routes carry approximately 22,900 passengers daily, representing 38% of the total system ridership. The *iXpress* express bus service was introduced in 2005 serving the entire CTC and the three city cores. Ridership has continued to grow since its inception with approximately 4600 riders daily now using the express bus service. *iXpress* will continue to build ridership in the CTC to support the Region's rapid transit initiative.

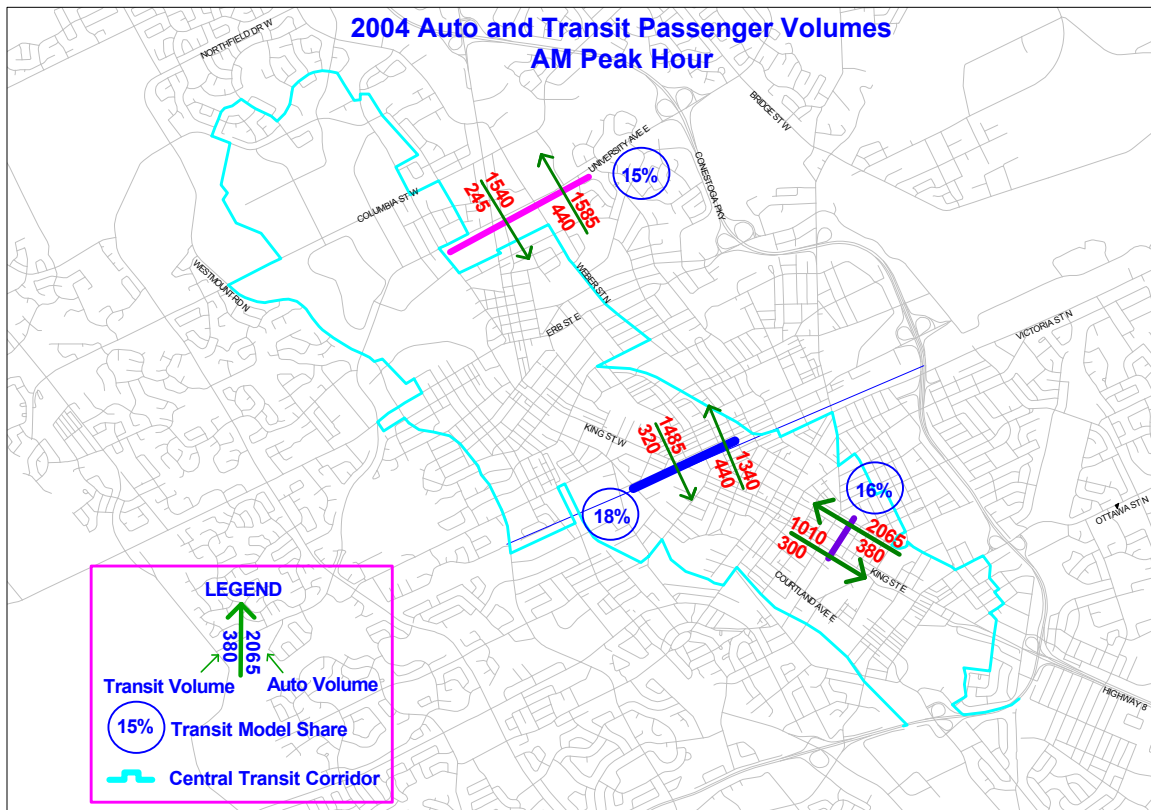
Traffic and transit simulations (2006) prepared using the Regional travel forecasting model indicate that local residents make about 117,500 person trips on a typical weekday morning commute (7:30-8:30AM). Of the total, 79.1% of trips are made by auto, 10.2% by walking, 4.6% by transit, 2.5% by cycling and 3.6% are by other means (e.g. taxi). The transit modal share is higher within the Central Transit Corridor with about 7.5% of motorized trips destined to this area made by public transit.

Road Volumes, Congestion and Traffic Growth

The Central Transit Corridor (CTC) has few alternative road corridors along its 35 kilometer length. Traffic and transit volumes in the corridor were tabulated at the key east-west screenlines where the road corridors cross imaginary lines or physical boundaries (e.g. railway lines).

The 2004 count data included auto, truck and transit passenger information which are illustrated in Figure 2 at key locations within the CTC. The volumes are for the AM peak hour corresponding to the time period that the transit surveys were conducted.

FIGURE 2: 2004 AUTO AND TRANSIT PASSENGER VOLUMES



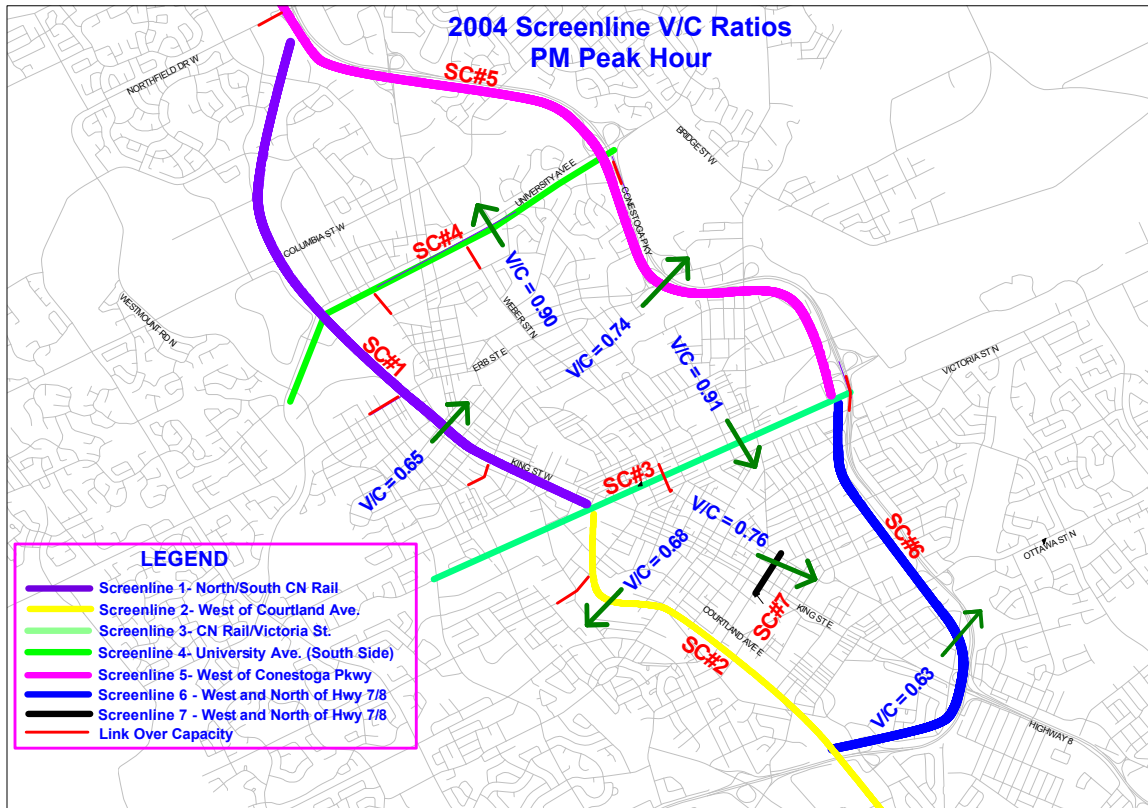
The main north-south roads in the CTC carry the highest percentage of transit passengers – about 15-18% of total trips at the three locations where counts were taken. This reflects the higher transit modal share for travel within the CTC.

Existing roadway operation within the CTC is summarized along seven screenlines for the weekday afternoon commuting period – the busiest time period for traffic in the Region. Figure 3 illustrates volume/capacity ratios (2004) for those roads crossing the screenlines.

The volume to capacity analysis reveals areas of congestion – mainly on the north-south roads that run the length of the CTC. These routes (i.e. King Street and Weber Street in Kitchener and Waterloo) are presently operating near their practical capacity limits (V/C of 0.9) which suggests that further traffic increases would likely encumber roadway operations particularly in the

downtown cores. Just outside of the CTC, Highway 85 (Conestoga Parkway) which is a main thoroughfare on the east side of Kitchener and Waterloo is also operating at its capacity limits in the afternoon peak. The operating efficiency of conventional bus transit in serving the heaviest demand corridor is compromised by the lack of available road capacity in this area.

FIGURE 3: 2004 SCREENLINE VOLUME TO CAPACITY – PM PEAK HOUR



Traffic growth in the CTC can be mainly attributed to intensification (more employment and residential units) but growth is expected to be moderate due in part to the existing roadway capacity constraints within the downtown areas. Traffic passing through the downtowns will be forced to bypass the heaviest traffic routes and use perimeter roads. The highest growth (2% per annum to 2041) was found in South Kitchener and the central part of the corridor between downtown Kitchener and Uptown Waterloo. This area is the heart of the CTC where most institutions and commercial/office land uses are located.

REGIONAL/MUNICIPAL/PROVINCIAL PLANS

Rapid transit is a key component of Waterloo Region’s *Regional Growth Management Strategy* (2) and the Province’s *Places to Grow Growth Plan* (3) as summarized below:

Regional Growth Management Strategy (RGMS)

The RGMS is a holistic approach that intrinsically links the development of transportation infrastructure with land use objectives and is structured around six main goals:

- Enhancing the Natural Environment
- Building Vibrant Urban Places
- Providing Greater Transportation Choice
- Protecting the Countryside
- Fostering a Strong Economy
- Ensuring Overall Coordination and Communication

The main thrust of the RGMS is to:

- Establish permanent growth boundaries to reverse the trend toward urban sprawl by redirecting growth inward and away from prime agricultural land and significant environmental resources;
- Encourage significant residential and employment intensification in the Central Transit Corridor to accommodate much of the future growth (40%) within the community;
- Focus on progressive urban design and development of public spaces;
- Promote transit and other non single-occupant vehicle modes of transportation throughout the urban area; and
- Use rapid transit to leverage private sector development within the Central Transit Corridor to anchor the transportation system required to support continued development.

Ontario's Growth Plan - Places to Grow - for the Greater Golden Horseshoe

The Province of Ontario's Bill 136, the *Places to Grow Act*, which received Royal Assent on June 16, 2005, identifies strategies to ensure prosperous, healthy and diverse communities and will provide the legal framework for future plans, like rapid transit. The newly released *Places to Grow Growth Plan for the Greater Golden Horseshoe* (November 2005) has designated Urban Growth Centres. In Waterloo Region, three Urban Growth Centres are located within the Central Transit Corridor: Uptown Waterloo, Downtown Kitchener and Downtown Cambridge. According to the Plan:

“Urban Growth Centres are particularly important, not only because they can accommodate growth, but also because they will be regional focus points. They are meeting places, and locations for cultural facilities, public institutions, major services and transit hubs. They also play a key role in supporting the economy of the surrounding area.”

The Provincial Growth Plan anticipates 729,000 residents and 366,000 jobs in Waterloo Region by 2031. The Plan also sets targets for urban intensification. By 2015, a minimum of 40 percent of all annual residential development must take place within the built-up urban areas and a minimum target of 200 people and jobs per hectare within the Urban Growth Centres. The Province's Growth Plan also acknowledges higher order transit serving Waterloo Region.

Regional Official Policies Plan (ROPP)

The Region first identified the need for a Central Transit Corridor more than 25 years ago and it appeared in its Official Plans (ROPP) since 1976. The current ROPP shows the potential location of the corridor as well as a policy statement on the use of abandoned rail corridors for rapid transit.

The new Regional Official Plan, currently in development (projected completion 2008), will expand on the policy direction of the *Regional Growth Management Strategy* and the Ontario *Places to Grow* Growth Plan. The provision of rapid transit and the accompanying reurbanization will become the basis for many new policies in the plan reflecting the Region's position in providing transit services.

Local Municipalities

Recognizing the limited supply of land and the benefits of intensification in the urban area, the Official Plans of the three Area Municipalities express commitment to a sustainable community through the promotion of a compact urban form. They support rapid transit in moving policy into practice, including, among others:

- City of Waterloo's Height and Density Study;
- City of Kitchener's EDGE Program; and
- City of Cambridge's Areas in Transition Policies

Waterloo's Height and Density study focuses on accommodating increased residential densities within the built environment. Kitchener's EDGE program provides incentives in selected areas to promote node and corridor development, brownfield redevelopment, and heritage protection. Cambridge's Areas in Transition policies address introducing sensitive uses into areas that may not otherwise be permitted as a means to facilitate reurbanization of older industrial areas. Combined, they provide the basis of a comprehensive reurbanization strategy that will focus much of the new growth to the Central Transit Corridor through adaptive reuse of vacant or under-utilized lands.

BENEFITS OF RAPID TRANSIT

In 2005, the Region of Waterloo through Federal Government funding initiated the Rapid Transit Technical Studies (4). These studies identified a wide range of benefits that could accrue by introducing rapid transit as an alternative form of public transit in the Region's Central Transit Corridor. Some of the benefits identified in the Technical Studies are highlighted as follows:

Increased Modal Share

By introducing rapid transit with its superior travel speed compared with conventional bus or transit lanes, higher ridership will result. Other benefits of rapid transit including travel time savings, greater reliability, high frequency service, passenger comfort and convenience all point to increased transit modal share within the region as a whole and the CTC.

Ridership: Ridership forecasts were prepared for a potential first stage (15km) rapid transit line comparing both Light Rail and Bus Rapid Transit. The ridership was forecast as 11,800 daily riders in 2011 and increasing to 24,000-31,000 by 2041. Note: the lower numbers are for BRT and the higher figures are for LRT. These are somewhat conservative estimates and did not account for increased ridership levels associated with a successful TDM program throughout the CTC and the U-Pass for both Universities and Conestoga College. By comparison, an express bus service in the CTC coupled with expanded bus routes in the suburbs would generate 11,000 daily passengers (by 2041) or more than double the current *iXpress* ridership of 4,600 trips daily.

As a point of comparison, the Edmonton LRT system, which is similar in size to the proposed Waterloo system but is currently undergoing a Phase 2 expansion, reports 36,000 daily boardings

with a transit service population of 0.66M. LRT has been operating in Edmonton for more than 25 years.

Average boardings per station for Waterloo Region’s rapid transit line are estimated between 1,300 and 2,800, for the period 2011 to 2041, and 800 and 2,100 boardings per track kilometer in this same period. The Portland LRT system reports 80,000 daily boardings or 1,300 boardings per track kilometer and 1,500 boardings per station. For the potential first stage line in Waterloo Region, the daily boardings per station and per track kilometer are in line with the Portland experience.

Average Trip Length: Average trip lengths in Waterloo Region are based on data collected for the 2005 Rapid Transit Technical Studies, as follows:

- Auto - 6.8 km
- Transit - 7.7 km
- Walk (mostly Post Secondary School students) - 3.0 km

Table 1 summarizes the average passenger trip length derived from surveys (2004) of bus routes operating in the CTC:

TABLE 1: 2004 GRT ROUTE TRIP LENGTHS

Route	Average Trip Distance (km)	
	All Trips	Work Trips
7	7.5	7.1
8	6.4	6.1
101	11.6	9.8
52 Express	11.7	13.7
Avg of all CTC routes	7.7	7.2

Passengers using the express bus routes have the longest trip lengths at about 11.6 km while other routes within the CTC are lower (6.4-7.5 km)

Once rapid transit replaces the *iXpress* service, it will enlarge the transit user catchment area beyond that of conventional bus service, i.e. patrons traveling further in less time, thereby attracting a broader customer base as more residential areas become accessible by transit. The average passenger trip length in the CTC will drop to 6.5km (by 2041) as more people live and work in the CTC and use rapid transit for their commute.

Travel Time Savings: Rapid transit will foster substantial travel time savings thereby encouraging ridership growth in the Central Transit Corridor. Travel time savings were determined by comparing the existing express bus service and rapid transit on common sections of their routes. *iXpress* operation is largely affected by road congestion along the 35 km route while rapid transit will operate in a mix of on-road and off-road dedicated transit lanes. Travel times were compared using the Regional travel forecasting model at major stops along common route sections between Kitchener and Waterloo; the stops include both downtown cores, a shopping centre at the south end (Fairview Park Mall) in South Kitchener and the most northerly station at Northfield Drive in North Waterloo. Table 2 shows the travel time differences of one rapid transit technology (LRT) and the express bus service.

TABLE 2: TRAVEL TIME SAVINGS (MINUTES) OF EXPRESS BUS AND LRT (2041)

Express Bus Total Travel Time	Northfield	U of Waterloo	Uptown Waterloo	Downtown Kitchener	Fairview Mall
Northfield		31	32	46	73
U of Waterloo	31		20	32	54
Uptown Waterloo	32	20		22	43
Downtown Kitchener	46	32	22		33
Fairview Mall	73	54	43	33	

LRT Total Travel Time	Northfield	U of Waterloo	Uptown Waterloo	Downtown Kitchener	Fairview Mall
Northfield		17	20	27	45
U of Waterloo	17		13	20	38
Uptown Waterloo	20	13		15	33
Downtown Kitchener	27	20	15		26
Fairview Mall	45	38	33	26	

Difference Express-LRT Travel Time	Northfield	U of Waterloo	Uptown Waterloo	Downtown Kitchener	Fairview Mall
Northfield		14	12	19	29
U of Waterloo	14		7	12	16
Uptown Waterloo	12	7		6	10
Downtown Kitchener	19	12	6		7
Fairview Mall	29	16	10	7	

Express bus service has longer travel times and larger time differential (against LRT) ranging between 6 minutes for short distance trips (Downtown Kitchener to Uptown Waterloo) to 29 minutes along the entire 15 km route (Northfield to Fairview Park Mall). It can be expected that as the CTC grows (in population and employment) over time, future express bus service will be significantly affected by the added traffic and roadway delay.

Modal Shift: The combination of shorter trip lengths and the travel time advantage with rapid transit will result in higher ridership and increased transit modal share in the CTC. In 2006, the transit modal share across the Region of Waterloo was approximately 4.6 percent. With rapid transit, this is expected to rise to about 8.4 percent by 2041. Annual GRT ridership will grow from 12.2 million trips in 2005 to 36.7 million by 2041 with rapid transit versus 28.1 million with express bus service. For trips made in the morning peak to the *downtown cores*, the transit modal share is forecast to rise from 6-15% today up to 35% with rapid transit.

Reducing Urban Sprawl

Rapid transit is a proactive strategy providing significant benefits to Waterloo Region within all four pillars of sustainability: environmental, social, economic and cultural. It allows the basic access needs of individuals and society as a whole to be met safely, by offering transportation choices, and contributing to a vibrant economy. It limits emissions and waste, minimizes consumption of non-renewable resources, and maximizes the use of land and production of noise. As rapid transit is implemented, it will act as a catalyst for development at and around stations with mixed-use higher-density nodes located throughout the CTC.

Potential Development Benefits: The Region of Waterloo is committed to exploring public/private implementation and funding opportunities, and has been very successful in developing multi-party agreements such as the agreement for the University of Waterloo Research and Technology Park, a joint partnership initiative with the Government of Canada, Province of Ontario, Region of Waterloo, City of Waterloo and University of Waterloo.

The ability to lever public/private funding is demonstrated by projects in close proximity to potential rapid transit stations identified in the Rapid Transit Technical Studies that were either recently completed, are in various forms of development approval, or are currently planned in the Waterloo Region. Some of these projects are highlighted in Table 3:

TABLE 3: DEVELOPMENT POTENTIAL AROUND RAPID TRANSIT STATIONS

- Conestoga Mall, a designated Regional Shopping Centre: \$25 million expansion projected completed with 275,000 square feet of commercial space.
- University of Waterloo Research and Technology Park, a joint partnership initiative with the Government of Canada, Province of Ontario, Region of Waterloo, City of Waterloo and University of Waterloo: \$214 million in planned development with 1.2 million square feet of floor space.
- Uptown Waterloo: \$100 million in planned and potential development, including brownfield redevelopment at the 12-acre Canbar site currently zoned for office and mixed-used residential (700 new residential units and redevelopment of the Waterloo Town Square site).
- Charles /Cedar: \$40 million in planned and potential development near the Kitchener Market site, and the newly designated mixed use corridor along King Street East.
- Fairview Park Mall station: \$10 million in planned and potential development; 720,000 square foot Regional Shopping Centre with pending application to expand to 830,000 square feet. Additional retail space expected with redevelopment along Fairway Road.
- Grand River Hospital station: \$35 million in potential development on surface parking areas and the conversion/adaptive reuse of underutilized buildings; part of the City of Kitchener's King Street West Mixed Use Corridor with opportunity for the creation of a mixed use village.

- Victoria/King Street station: \$100 million in planned and potential development in the City of Kitchener’s Warehouse District, including relocation of Wilfrid Laurier University’s Faculty of Social Work, University of Waterloo’s Health Sciences Campus and School of Pharmacy and residential redevelopment of several former warehouses and factories into loft units.
- Downtown Kitchener Transportation Centre: \$50 million in planned and potential development, including the City of Kitchener’s plans to create an enhanced pedestrian environment that will link the area with additional redevelopment such as a potential new library, educational and residential uses.

This totals more than \$600 million in planned or potential development in the immediate vicinity of proposed rapid transit stations.

Station Area Plans: Although higher intensity development throughout the CTC is important for fostering rapid transit, it is the intensification around the stations that will provide the greatest ridership support. Providing a mix of uses around a station is important to create a vibrant neighbourhood and provide support for all-day transit use and shorter distance walks.

Once station locations are identified through the Environmental Assessment process, Station Area Plans will be developed through a full public consultation process. The specific uses and densities determined through the Station Area Planning exercise will be incorporated into new mixed-use zoning that addresses regulations such as minimum building setbacks, building heights, and urban design standards.

There is already significant development around the potential rapid transit stations in the CTC to attract ridership. However, full maturation of the areas will occur over a period of time. In the shorter term, opportunities for further development at higher densities should not be precluded with non-transit supportive uses. These include automotive sales, large format retail stores, warehouses and low density housing.

It is important to recognize that public transit usage is not solely for a specific demographic segment of the community and should be an attractive choice for all people. Development around transit stations should appeal to residents of all economic circumstances, providing for a range of housing from affordable to luxury development.

Urban Design Guidelines: Development around rapid transit stations is really about “place making” and requires good urban design since many stations are located near existing communities and developed areas. Well designed projects can create a more desirable location to live, work, shop or just visit. Visual appeal is cited as key to making higher density development nodes interesting and attractive within the local community. Some design guidelines that the Region of Waterloo will consider in the Station Area Planning exercise are:

- Near the rapid transit station, it is important that policies promote buildings oriented to the street;
- Higher density needs human-scale elements, particularly along sidewalks to lessen the perceived impacts of large buildings;
- Creating an attractive and functional streetscape is important for attracting alternative modes (walking and cycling); and

- Block lengths should be short to allow for better pedestrian connectivity with the transit stations.

Infrastructure Investment: The Rapid Transit Technical Studies identified that the potential first phase of rapid transit will occur in established urban areas and over time will attract significant residential and employment growth near its stations. An assessment of both hard services (sewer, water, electricity, utilities, etc.) and soft services (schools, libraries, health and social services, etc.) will identify potential deficiencies and help ensure they are addressed as development proceeds in station areas. The infrastructure study will take place as part of the Station Area Planning.

Parking Management: The Technical Studies found that parking is a major lever in influencing mode choice and attracting transit-oriented development. Interestingly, comments from a workshop held with local stakeholders focused on the cost of constructing underground or decked parking, which was perceived to be the key barrier to new development. The participants felt that rapid transit would reduce parking requirements and thereby improve project feasibility. However, they stressed that any regulated reduction in parking should be undertaken in consultation with developers, landlords and tenants and that reductions in parking should only be phased in over time.

Some of the parking initiatives identified by the Rapid Transit Technical Studies are:

- **Develop a Regional Parking Strategy:** develop an overarching parking strategy and set of complementary policies that support the rapid transit initiative;
- **Introduce Minimum and Maximum Parking Requirements:** to promote transit use, minimum and maximum parking requirements must be established in the form of new parking standards for the Station Areas;
- **Limit New Surface Parking Facilities:** limit and manage temporary surface parking within the Station Areas which are counter-productive to increasing transit use;
- **Reduce or Eliminate Free Parking:** encourage large employers and all new employers to adopt trip reduction targets and TDM plans such as eliminating free employee parking;
- **Continue Short-Term Parking Rates:** discourage free all-day employee parking by having a graduated (increasing) scale of short-term parking rates and high daily maximum; and
- **Pursue Shared Use Park-n-Ride Opportunities:** shared-use parking for commuter transit users can be incorporated into new developments or where surface parking is available (e.g. terminal stations).

Mitigating Congestion

The Regional transportation system including rapid transit will become more efficient by incurring shorter distances trips and more people taking transit or walking/cycling instead of driving automobiles. There will be reduced need for additional road building; and our transit system will cost less per passenger trip to operate due to higher usage.

The Rapid Transit Environmental Assessment Study (Phase 1) brought forward a preferred strategy for future regional growth, rapid transit and road expansion, which was approved by Regional Council in July 2006. The strategy provides the necessary balance of modest road expansion and focus on rapid transit service to encourage a much higher percentage of trips be made by walking, cycling and transit. Road building will be targeted to traffic routes in areas designated for reurbanization that need additional capacity to offset that lost by dedicated transit

lanes. This approach will not only prove to be more cost effective but will also conserve land and aid in maintaining more attractive and comfortable streets thereby encouraging more walking and cycling.

Given that more trips will be made within the area designated for reurbanization, new policies will be needed for managing infrastructure resources to best control road congestion. Rapid transit will be unaffected by any additional auto demand and congestion on the few arterial roads connecting the urban cores as it will run on its own right-of-way (e.g. existing rail lines) or in dedicated transit lanes separate from the general traffic flow. Transit priority will reduce the effects of localized road congestion. With only a few arterial roads linking the core areas, and some of these being dedicated as separate transit lanes, traffic will be encouraged to bypass the CTC and use its perimeter routes. The perimeter roads will be upgraded as necessary to accommodate the additional traffic brought on by intensification of the cores.

Rapid transit will be supported by comprehensive land use and Transportation Demand Management (TDM) programs to manage the growth in traffic demand and to encourage the use of public transit. The Region of Waterloo is already exploring initiatives to reduce single occupant vehicle use and increase transit, carpooling, cycling and walking activities. Some of the key TDM programs now underway are outlined below:

- Update the Regional Cycling Master Plan, which includes a revised facilities network with short and long term priorities, policies and supporting initiatives for cycling system;
- Strengthening interest in ridesharing and alternative modes by developing a Regional “brand” called Travelwise. This is an integrated transportation service providing among others ridesharing services, information on Park-n-Ride lots and Telework;
- Shifted the focus on major roadway projects from motor vehicles to reflect more of a multi-modal orientation including transit signal priority and cycle lanes;
- Provided leadership and financing of annual Commuter Challenge in Waterloo Region; and
- Implemented a universal transit pass at Wilfrid Laurier University (and recently approved at University of Waterloo) as well as implemented the intermodal integration and community-based social marketing components of the *iXpress* Bus Project – the Region’s Urban Transportation Showcase Program.

Better Access to Major Transportation Hubs

The Region of Waterloo has an excellent network of inter-city rail (VIA Rail) and inter-city bus services that connect with local bus services at transit terminals in the three cities. The rapid transit system will provide connections to other local, provincial and federal transportation facilities including connections to VIA rail service, inter-city bus and future GO transit service.

The Province of Ontario’s *Places to Grow* Growth Plan supports connections between the Region’s rapid transit system and intercity transit services. The Region is currently investigating the possibility of relocation of the existing VIA rail station closer to one of the potential rapid transit stations to improve opportunities for connectivity to bus (local and inter-city) and rapid transit services. Relocation of the rail station would also lead to less land required for parking. Future rapid transit connection with GO Transit service will be explored as plans for inter-urban commuter transportation services unfold.

Minimizing the Impact of Urban Transportation on Climate Change

Emissions resulting from road-based transportation are a major contributor to air pollution and climate change. In fact, transportation is one of the single largest sources of air pollution in Canada and is also responsible for about 50% of personal greenhouse gas emissions (GHGs). By opting for alternatives to fuel-powered, single occupant vehicles and more sustainable forms of transportation like public transit, we increase the quality of the air we breathe and help make our communities more sustainable.

GHG emissions are released directly from the tailpipe of a vehicle. GHG emissions are also created during the production, refining and transportation of fuels. According to the Canadian Urban Transit Association (CUTA), urban passenger travel causes 8% of Canada's national GHG emissions, but public transit operations cause less than 0.3%. Furthermore, shifting travel to public transit is good for the environment since one passenger-kilometre of travel by public transit creates 65% fewer GHG emissions than traveling by car (5).

A GHG emission tool (developed for Transport Canada for the Costs and Impacts of Transit Investments Study) was used to calculate both direct and indirect GHG emissions (e.g., CO₂, CH₄, N₂O and CO_{2eq}). The largest contributor to GHG accumulation is CO₂. Table 4 summarizes the CO₂ emissions, for 2004, both Region-wide and the CTC:

TABLE 4: GHG EMISSIONS - 2004

<u>Region-wide GHGs:</u> CO ₂ – 914,600 tonnes per year	<u>Central Transit Corridor GHGs:</u> CO ₂ – 552,100 tonnes per year
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The CTC contributes about 60% of the total GHGs emissions for the entire Region; reason why a rapid transit system serving this central area is crucial to offset the potential rise in automobile pollution.

Rapid transit in Waterloo Region will result in reduced production of GHG and airborne pollutants, through the use of electrified light rail vehicles or diesel-electric buses that produce less pollution than diesel buses and the equivalent volume of cars. Based on Regional forecasts, rapid transit will result in a savings of 25,400 kilolitres of fuel annually and CO₂ emissions will be reduced by about 60,000 tonnes annually or about 10% of the total CO₂ emissions from travel in the CTC.

Public Health Benefits

Ontario's Ministry of the Environment tracks the air quality of specific areas in the province. Waterloo Region is well known as one of those areas with the worst air quality in Canada, year after year. Smog advisories are one method of warning the public of these especially poor air quality days when fine particulate matter, produced by vehicles and other polluters may have health impacts on citizens.

The number of days per year the Region's public health department issues advisories about poor air quality is one indicator of the frequency of this problem. In 2001 and 2002 the number of smog advisory days was 20 and 19, respectively; in 2003 and 2004, 12 advisory days were issued each year; and for 2005 the Region of Waterloo had 44 advisory days.

An accurate measure of air pollution levels considers the Ambient Air Quality Criterion for Ozone and Canada-wide standards for fine particulate matter; when the Air Quality Index reaches “poor”, air quality standards have been exceeded. In 2003, the last year data were collected by the Province, 12.3% of the Air Quality Index readings recorded for Waterloo Region were in the moderate to poor range (6).

Figure 4 illustrates the total number of hours per year that the air quality was worse than public health standards. The trend does not show improvement over time, as we know there is high correlation between the generation of fine particulate matter and increasing traffic volumes.

FIGURE 4: AIR QUALITY STANDARDS 1994 - 2003

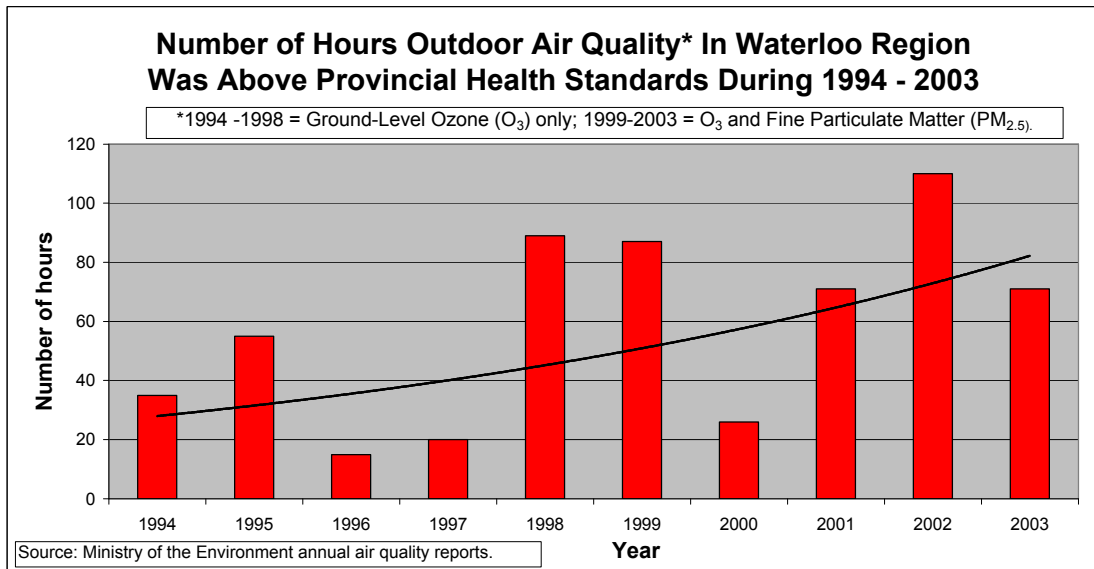


Table 5 shows the most recent estimates of fine particulate matter:

TABLE 5: PARTICULATE MATTER - 2004

Region-wide Particulates:

Central Transit Corridor Particulates:

PM_{totrd} – 12,600 tonnes annually

PM_{totrd} – 7,200 tonnes annually

It is evident from this table that the CTC is beleaguered with poor air quality raising concerns about public health since cycling and walking trips are prevalent in the downtown cores exposing people to the fine particulates. Rapid transit is expected to assist in mitigating air quality impacts through encouraging alternative transportation options such as transit, walking and cycling and attracting a greater proportion of personal trips formerly made by low-occupancy automobile. In addition, air pollution is not created to propel the electric and hybrid-electric rapid transit vehicles and not dispensed of at street level, as with the automobile, creating a safer breathing environment. The cores will be less encumbered by road traffic, which will be moved to the perimeter routes of the downtown areas where roads will be improved.

Improved Transportation Public Safety and Security

Strategic investment in public transportation through the implementation of rapid transit will improve public safety and security. Passengers traveling by rapid transit are very safe. A single rapid transit vehicle will remove 125 cars from the road making neighbourhood streets safer for other modes of transportation. Less cars, fewer traffic accidents.

Transit contributes to road safety in our cities by being the safest mode of urban transportation. According to the Canadian Urban Transit Association, motor vehicle crashes kill almost 3,000 Canadians each year—nearly half of all accidental deaths—and are the most common cause of death for people under the age of 35. Another 220,000 are injured each year by car crashes, which cost our health care system at least \$10 billion annually. The risk of fatality for a car passenger is 20 times higher than for a transit passenger making the same trip (7).

Reurbanization will create neighbourhoods with an improved sense of community where people will have an opportunity to interact with one another and more pedestrian activity will create vibrant and safer places to live and work.

In addition to road safety, the design principles that will be incorporated into planning rapid transit stations will rehabilitate the street-side pedestrian environment. Increased pedestrian activity will provide additional “eyes on the street”, which helps create vibrant and safe places to live. From the rapid transit vehicle perspective, low floor vehicles (LRT and buses) are easily accessible by wheelchairs, pedestrians, strollers and bicycles offering comfort and security for all users.

INDIVIDUAL ENVIRONMENTAL ASSESSMENT

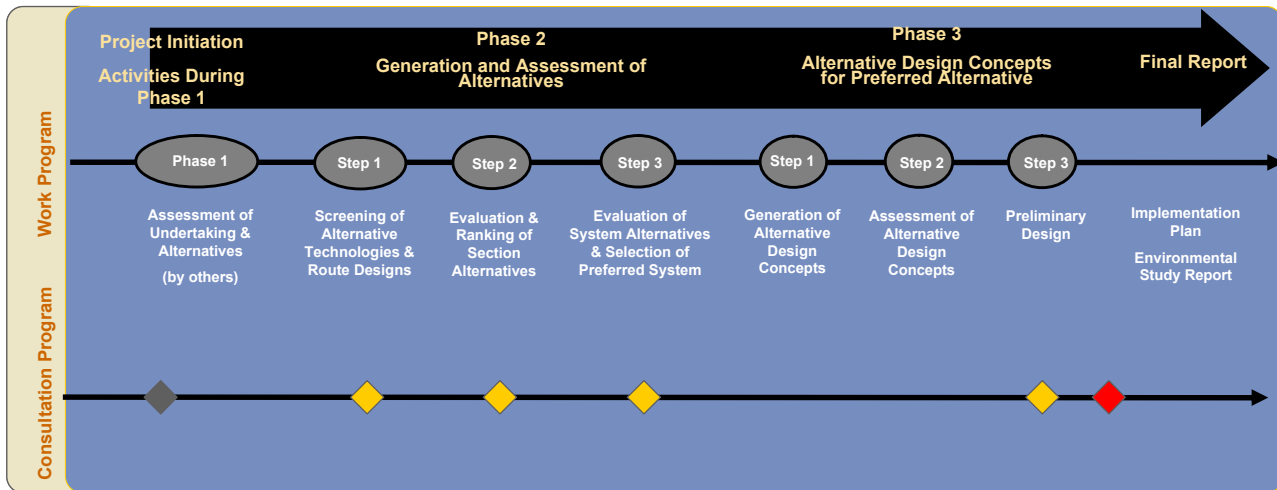
Waterloo Region is seeking approval for this major rapid transit initiative as an Individual Environmental Assessment (IEA), under the coordinated process of the Ontario Environmental Assessment Act (EAA) and Canadian Environmental Assessment Act (CEAA). Both provincial and federal levels of government have formally agreed to coordinate their respective EA processes.

The process to obtain approval for this undertaking is identified in the Individual Environmental Assessment Terms of Reference (ToR), approved by the Ontario Minister of the Environment on July 21, 2005. The ToR provides a binding framework for what is going to be studied in the EA and outlines a process for obtaining approval for the project (8).

As stated in the approved Terms of Reference, “Rapid Transit is defined as a public transportation system operating for its entire length primarily on an exclusive right-of-way. The definition includes systems operating at-grade, and systems operating on elevated or underground facilities.” During Phase 1 of the IEA, this definition was broadened slightly to include “a dedicated transit lane” as an additional means of implementing rapid transit.

An overview of the Waterloo Region Rapid Transit Individual EA process is depicted Figure 5:

FIGURE 5: OVERVIEW OF INDIVIDUAL ENVIRONMENTAL ASSESSMENT PHASES



As at April 2007, the status and work completed for the IEA was as follows.

Phase 1: Assessment of the Rapid Transit Initiatives and Alternative Transportation Strategies.

Phase 1 is complete. The Phase 1 evaluation concluded that Rapid Transit was the preferred transportation strategy for Waterloo Region. The Phase 1 report was approved by Regional Council on July 12, 2006.

Phase 2: Assessment of Alternate Methods of Carrying out the Preferred Transportation Strategy

Phase 2, Step 1 – Screening of Alternative Technologies and Route Designs is complete. It was recommended that Bus Rapid Transit and Light Rail Transit, operating in a mix of on-road and off-road route designs, be carried forward to the Phase 2, Step 2 evaluation.

The Region identified a wide range of existing rapid transit technologies as part of the approved Terms of Reference. For the IEA study, ten rapid transit technologies were considered, including:

- Aerobus
- Automated Guideway Transit (AGT)
- Bus Rapid Transit (BRT)
- Commuter Rail
- Light Rail Transit (LRT)
- Magnetic Levitation (Maglev)
- Monorail
- Personal Rapid Transit System (PRT)
- Diesel Multiple Units (DMU)
- Subway or Metro (heavy rail)

The term “route design” refers to the physical structure(s) of the transit route within the urban environment, i.e. tunnels, at-grade, elevated guideways, etc., associated with each technology.

The route design choice reflects the degree of interaction between the rapid transit system, other traffic and pedestrians, and the surrounding land uses. Route design is an important element of a rapid transit system because where the system operates will have a significant impact on its ability to meet urban design, intensification and reurbanization objectives. Four route design alternatives were considered:

Dedicated On-Road – Rapid transit operating mostly at ground level within a road right-of-way in dedicated lanes along the entire route length;

Dedicated Off-Road – Rapid transit operating mostly at ground level within a dedicated right-of-way that is separate from the road network along the entire route length;

Mix of On/Off Road – Rapid transit operating mostly at ground level using both on-road and off-road route designs; and

Grade-Separated – Rapid transit operating within a dedicated right-of-way either above or below ground level.

For evaluating the rapid transit candidate technologies and route designs, technologies were assessed against thirteen measures that were used to express three screening criteria: Compatibility for Reurbanization, Service Quality and Threshold Capacity. Failure to meet any one of the essential attributes of the individual measures resulted in a “FAIL” grade for the criterion. With one failing grade, this technology/route design alternative was eliminated from further consideration.

The evaluation concluded that Bus Rapid Transit and Light Rail Transit were the only technologies to receive the necessary “Pass” grades for all thirteen criteria. All other technologies received fewer “Pass” grades, ranging from three or four (out of thirteen) in the cases of Aerobus, Commuter Rail and Diesel Multiple Unit, to eight passing grades for Automated Guideway Transit and Monorail. The latter technologies failed to meet the attributes of system flexibility, environmental impacts, operating constraints, urban design, and cost-effectiveness largely because they are elevated systems that cannot (or not fully) achieve the key reurbanization objectives (with street level activity) or have a high infrastructure cost.

BRT and LRT were selected to be carried forward into the next step of the Rapid Transit IEA for the following reasons:

Bus Rapid Transit was considered to be feasible due to the flexibility of the technology in a variety of operating environments. BRT infrastructure can be expanded as ridership grows and is easily integrated with existing and planned local bus service. Modern bus technologies can be powered by alternative fuels (natural gas, propane gas and dual mode diesel-electric) which can lessen concerns regarding environmental impacts on air quality and noise. New industry developments such as mechanically or optically guided buses with 100% low floor accessibility address accessibility concerns. This technology is proven in Canadian environments (e.g. the Ottawa BRT system has been operating for 25 years) and a variety of systems are available from many vendors. BRT capital and operating costs are low to moderate making it economically viable to accommodate demands at an affordable cost. High quality vehicle and station design can provide an attractive, reliable system adaptable to a variety of operating environments and passenger needs. Operating speeds of up to 80 km/h may suit suburban services, while lower average speed of 25 km/h are typically found in downtown areas, in transit malls or on commercial streets. Station spacing can be close (400m) enough to provide convenient pedestrian access and is compatible with existing land uses. BRT is recognized as fostering compact multi-use development around stations but not as widely so as LRT. It is a street-level system that can be integrated with street level development and pedestrian activity.

Light Rail Transit offers flexibility in operating environments such as “streetcar” operating on the street or LRT operating on-street or in a rail corridor. LRT is predominantly a street-level rapid transit system that makes it easily accessible for patrons and integration with alternative modes (e.g. feeder bus systems, park and ride, pedestrian walkways). Permanent track alignment and stations can provide the incentive for intensification and redevelopment with opportunities to integrate stations with higher density development. LRT vehicles can be operated as single vehicles or in train sets to accommodate fluctuating passenger demands. The technology is proven in Canadian environments and a variety of systems are available from many vendors. Capital and operating costs are moderate making LRT economically viable for urban transit application. LRT with modern electrically powered vehicles is clean and has low noise levels. High quality vehicle and station design can provide an attractive, reliable system adaptable to a variety of operating environments and passenger needs. Operating speeds of up to 80 km/h may suit suburban services, while lower speeds of 25 km/h are typically found in downtown areas, in transit malls or on arterial roads with commercial activity. Station spacing can be close (500m) enough to provide convenient pedestrian access and is compatible with existing land uses. LRT is recognized in Europe and North America as positively influencing land use change and street level activity through intensification around stations.

Phase 2, Step 2 – Evaluation and Ranking of Alternate Routes in Each Section is now underway. In this step of the IEA, potential rapid transit stations will be identified at locations within the CTC to promote the reurbanization goals of the Region’s Growth Management Strategy. Potential station locations and reasonable routes between stations, both on-road and off-road, have been identified for evaluation. Public input on the proposed reasonable routes and station locations was obtained at workshops held on March 20-22, 2007 in the three municipalities.

Alternative routes throughout the CTC were identified based on the following principles:

- Routes should connect potential stations in a relatively direct manner to minimize transit travel time and delays;
- Routes should minimize potential disruption through environmentally sensitive areas and mature, stable neighbourhoods; and
- Routes should have a reasonable right-of-way width to accommodate either BRT or LRT technologies.

The reasonable routes will go forward in June-September 2007, for more detailed assessment. Twenty-one evaluation criteria /measures identified in the ToR will be applied to each route and technology option. The outcome of this Step will be a ranking of technologies and routes within seven segments of the CTC study area. The evaluation assessment will address the social/cultural, economic, natural environment and transportation aspects of the possible routes and stations including the following factors:

- Social/Cultural Environment: Ability to serve residential uses, ability to serve institutional uses, vibration, noise, contribution to cultural environment, contribution to recreational environment, contribution to public health, contribution to built heritage;
- Natural Environment: Ecological impact, water quality, air quality, mineral aggregate resources;
- Economic Impact: Ability to serve concentrations of employment, ability to serve retailers, cost; and

- Transportation: Ridership potential, system reliability/speed, system performance, property requirement, travel time competitiveness with auto, road network demand.

Phase 2, Step 3 – Evaluation of System Alternatives and Selection of a Preferred System is scheduled to commence in the Fall, 2007 and to be completed by year end. This final Step will identify a preferred rapid transit system comprised of technology, route and stations as well as the first stage rapid transit line. Further work on the preliminary design and costing of the preferred first stage rapid transit line will be undertaken in Phase 3 of the IEA. The IEA is scheduled to be completed in Spring, 2008.

CONCLUSIONS

Waterloo Region is one of the fastest growing communities in Canada with a population today of over a half million people and with forecast growth of almost 50 percent within the next 25 years. The Region is facing many of the same challenges experienced by other rapidly growing communities throughout North America including increasing traffic congestion, outward pressure on urban boundaries, public health concerns and downtowns desperately in need of revitalization.

Rapid transit is an integral component of Waterloo Region’s *Regional Growth Management Strategy* (RGMS), approved by Regional Council in 2003. Rapid Transit will act as a catalyst for reurbanization within the Central Transit Corridor (CTC), which links the major urban centres of the City of Cambridge, City of Kitchener and City of Waterloo.

In 2004, the Federal government contributed funding for the Rapid Transit Technical Studies. The studies have revealed positive findings for implementing rapid transit in Waterloo Region. Some of the benefits of rapid transit explored in the studies included increasing the transit modal share, reducing urban sprawl, congestion relief, enhanced connections with inter-urban transit, minimizing the effects of climate change, and enhancing public safety.

The Region is currently undertaking an Individual Environmental Assessment in accordance with Provincial and Federal guidelines that will examine the need for a rapid transit system, technology choices, routes and stations and system design.

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- (1) Regional Municipality of Waterloo, “Regional Transportation Master Plan”, 1999.
 - (2) Regional Municipality of Waterloo, “Planning Our Future - Regional Growth Management Strategy”, 2003.
 - (3) Ontario Ministry of Public Infrastructure Renewal, “Places to Grow: Better Choices, Brighter Future, Proposed Growth Plan for the Greater Golden Horseshoe Schedule 3”, Government of Ontario, Toronto, November, 2005.
 - (4) Regional Municipality of Waterloo, “Growth Management Strategy Transit Initiative – Technical Studies”, Cansult, November, 2005.
 - (5) Canadian Urban Transit Association, Issue Paper #2, “Promoting Better Health Through Public Transit Use”, CUTA, 2005.
 - (6) Ontario Ministry of Environment, “Air Quality in Ontario, 2003”, Government of Ontario, Toronto, 2004.
 - (7) Canadian Urban Transit Association, Issue Paper #3, “Public Transit and Our Quality of Life: Building Better Communities”, CUTA, 2005.
 - (8) Regional Municipality of Waterloo, “Individual Environmental Assessment Terms of Reference – Rapid Transit Initiative”, July, 2006.