

The Future of Mobility

Approaches for Canada's Capital Region

A Discussion Paper for
Choosing our Future





Choosing our Future Discussion Paper

June 2011

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City of Ottawa

City of Gatineau

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Choosing our Future is an initiative led by the City of Ottawa, in partnership with the City of Gatineau and the National Capital Commission, to prepare Canada's Capital Region to meet the challenges of the 21st century. It will result in long-term strategic directions that integrate the concepts of sustainability, resiliency and liveability into all aspects of our communities.

Purpose

This series of Discussion Papers presents a range of ideas for how we can succeed in facing challenges such as demographic change; resource scarcity; globalization and economic uncertainty; rising energy and food prices; a changing climate; and sudden shocks such as extreme weather conditions and emergencies. The papers are intended to stimulate dialogue about the best ideas for the future of the region and provide the basis for our future plans.

Discussion Papers in this series include:

- The Future of Culture
- Greening the Economy
- The Future of Social Development
- The Future of Food and Farming
- The Future of Natural Systems
- The Future of Buildings and Energy Supply
- The Future of Water, Stormwater, and Wastewater Infrastructure
- The Future of Materials and Solid Waste Management
- The Future of Land Use, Growth Management and Urban Form
- The Future of Mobility

The ideas discussed in this series include many that were suggested by participants at public and stakeholder events during the process to date.

The papers, as well as other information about the initiative, can be found online at:

www.choosingourfuture.ca

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1 Introduction

1.1. The Future of Mobility

How we get from one destination to another is arguably one of the most important topics for any long-term approach to sustainability. Investment in mobility (transportation) infrastructure and the design of transportation systems influence how we choose to travel: by car, bike, transit, or on foot. These transportation types or modes influence a variety of sustainability indicators such as greenhouse gas and other emissions, energy consumption, community health, and economic prosperity.

Investment in transportation is not only one of government's most important spending decisions; how we travel directly affects our quality of life and our experience of living in our neighbourhood and interacting with other people. In both Ontario and Quebec, the fastest growing energy sector is transportation, occupying roughly one-third of energy use. In addition to air quality improvement and reduced reliance on fossil fuels, walking and cycling and other "active transportation" modes can reduce obesity (and associated health costs) and improve levels of cardiovascular fitness. Active transportation can also improve mental health and provide opportunities for interacting with our neighbours and the environment. In the current context of a rapidly aging population, mobility will become an increasingly important issue. Addressing this issue will require making changes not only to transportation facilities and technologies, but also to the way neighbourhoods are planned and designed.

1.2. Summary

A range of high-level approaches to creating vibrant, resilient mobility systems is explored in this paper. Each strategic approach is a response to the question: “How can we better support walking, cycling and transit as residents’ first choices for transportation?” Based on public and stakeholder feedback, this paper is designed to help forge a preferred path for the long-term plans developed through Choosing our Future. The approaches described here are not meant to be exclusive. Rather, they are framed as questions to stimulate discussion, responses and additional ideas. These discussion areas include:

- **Integrated land use and transportation systems** — Land use and transportation work together. When looking at future mainstreets, how can we better provide transit, car, and active transportation modes within the same corridor? How can land uses along these corridors be intensified with a mix of higher-density residential and employment uses to provide the population base needed to support transit more effectively and create the environment for walking and cycling? How can we build regional systems that link communities to hubs, link hubs to one another, and then link to the greater urban region?
- **Complete streets** — “Complete streets” are designed to share the road more equitably between cars, transit, bikes, and pedestrians. They incorporate spaces to sit, public art, and pocket parks. Road diets – where lanes are removed and dedicated for cycling lanes, sidewalks or landscaping – can be used to create complete streets. How can we build complete communities where people can easily access shopping, services and workplaces? What else could be done?
- **Alternative goods movement** — There are many possibilities for the future of freight movement. As fossil fuel prices increase, rising costs may reduce the volume of air freight especially on short-haul flights that could be replaced by high-speed inter-city rail. Although some freight movement could be shifted to rail, much freight movement might continue to be moved by road, possibly in larger but more efficient trucks powered by electricity while on main highways. How would such changes impact the movement of goods throughout the region? How would high-speed inter-city rail impact our economy?
- **Transition to vehicles using alternative power** — What municipal infrastructure would be required if cars become more compact and use different sources of energy (e.g., electric car)?



2 Background

2.1. Mobility Defined

The Centre for Sustainable Transportation, a non-profit organization based at the University of Winnipeg, describes a *sustainable transportation system* as one that:

- Allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations
- Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy
- Limits emissions and waste within the planet's ability to absorb them, minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noiseⁱ

Several other definitions are useful to assist in understanding transportation and mobility.

- *Active Transportation* refers to cycling, walking and other human-powered modes of travel
- *Light Rail Transit* (LRT) is rail-based transit capable of operating in a range of environments, including separate rights-of-way and mixed traffic on public roads
- *Bus Rapid Transit* (BRT) is fast, limited-stop bus service that operates in a separate right-of-way or with priority measures over mixed traffic in shared corridors

- *Transportation Demand Management* or *TDM* refers to various strategies that aim to change or shift travel behaviours (how, when and where people travel) in order to reduce demand on the transportation system.

2.2. Context

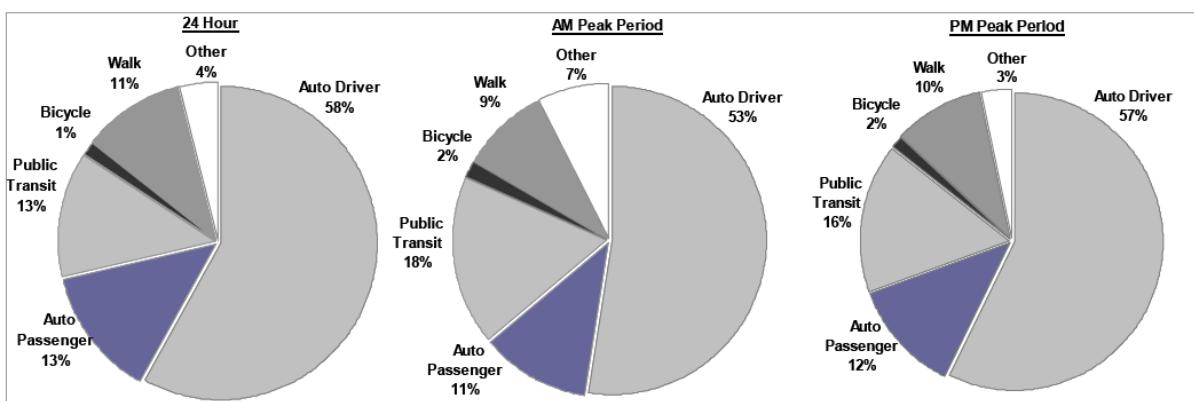
Transportation in Canada's Capital Region is a shared responsibility of local, provincial, and federal governments. The roadway network in the Capital Region is largely planned, owned, and managed by the local governments. Provincially managed highways include the Queensway Highway (417) and Highway (416) on the Ontario side, and Autoroute 50, Autoroute 5, and Route 307 on the Quebec side of the region. The federal government plays a role in transportation decisions, providing funding for transportation infrastructure along with the provincial government, and input on decisions about federal highways and the five interprovincial bridges that cross the Ottawa River. The National Capital Commission owns lands and infrastructure such as bridges, parkways, and transportation corridors; this means that the NCC also plays an important role in transportation planning. The City of Ottawa and the NCC's perspective on transportation emphasizes a balanced transport system, recognizing that integrated land use and transportation planning can contribute to long-term emission reductions, and support for public transit, walking and cycling over other modes.ⁱⁱ

A short history of transportation in Canada's Capital Region

The private automobile arrived in Ottawa in 1901, and by the 1920s it had established itself as the travel mode of choice.ⁱⁱⁱ Currently, the car is the predominant mode for personal transportation in the Capital Region with car trips making up about 71% of all trips in a 24-hour period.^{iv}

An origin-to-destination survey was completed in the Capital Region in 2005. It found that vehicle ownership has increased since 1995, as has single-occupant vehicle trips (which saw an increase of 18% since 1995). While the proportion of interprovincial trips crossing the Ottawa River has remained about the same from 1995 to 2005, the volume of trips has increased by 18% in both directions in the morning and by 25% in both directions in the afternoon.^v

Figure 1: Modal shares by time of day in Canada's Capital Region, 2005. Source: TRANS., 2005 Origin-Destination Survey



Public transit appeared first on both sides of the Ottawa River in the form of street cars, but by 1946 these had been replaced in Hull by buses.^{vi} In Ottawa, trolley buses were introduced in 1951, but were shut down eight years later “in a bid to rid the downtown core of their accompanying mishmash of unsightly wires.” Trolley buses were replaced by diesel buses.^{vii}

In 1960, Sparks Street in Ottawa was closed to vehicular traffic during the summer months for the purpose of hosting Canada’s first pedestrian mall—an experiment, initially, but one which soon became a permanent project. It was a difficult task given that Sparks Street was the premier street in the city and by this time the private car was firmly entrenched as the region’s primary transportation mode.^{viii}

Throughout this history of transportation changes, the geographical division made by the Ottawa River between Ottawa and Gatineau has been an ever-present challenge. River crossings have been needed to connect not just two cities, but two provinces. When the Rideau Canal was constructed between 1826 and 1832, the first bridge crossing the Ottawa River was built to link Hull with the construction site. It was first called Union Bridge, later renamed the Chaudière Bridge. Four more bridges were added at different locations across the Ottawa River over the next 150 years: Alexandra Bridge, Champlain Bridge, Macdonald-Cartier Bridge, the Prince of Wales railway bridge and most recently the Portage Bridge—completed by the NCC in 1973.^{ix} Since that time population and travel demand have grown significantly. The Interprovincial Crossings Environmental Assessment Study is currently underway, and is recommending an additional bridge crossing of the Ottawa River in the east end of the region, at a location yet to be determined.^x

The historical focus on mobility infrastructure supporting the private automobile is typical for most North American cities and reflects accepted practices in transportation policy that have been developed and adjusted over many decades. The increasing reliance on the car for trips both short and long is only recently being brought into question as the interconnected topics of mobility, energy insecurity, and public health concerns rise to our attention.

Ottawa’s current transportation system includes walking and biking facilities, conventional and specialized bus services, Transitway and O-Train rapid transit lines, a road network, and parking facilities. These city-owned facilities are combined with province-owned freeways as well as roads, interprovincial bridges and multi-use pathways owned by the federal government (NCC). There are also international and general aviation airports, intercity rail and bus stations, two ferries, and a freight yard.^{xi} Most freight movement to and from the Capital Region is by truck, although rail and air are important modes



The Transitway and rapid bus system have been a mainstay of the region’s transit system.

for goods movement as well. Cycling facilities are increasing, with the City of Ottawa adding an additional 110 kilometres of on-road and off-road cycling facilities in 2010 and Gatineau doubling its budget for cycling lanes in 2011. The region benefits from some high-quality active transportation infrastructure including beautiful walking and cycling pathways along the Ottawa River and Rideau Canal and the Rideau Canal winter skateway.

2.3. Challenges and Trends

Key issues related to transportation in the region include:

Oil futures

The transportation system in the Capital Region is overwhelmingly dependent on petroleum oil, and as a result, its long-term price and availability are a primary concern. Most oil used in eastern Canada is imported from overseas, where political instability may further disrupt the availability of gasoline.^{xii}

GHG emissions

Greenhouse gas emissions resulting from road transportation—which represent approximately 30% of all energy consumed in Canada—make mobility and transport systems major GHG producers. Overall, transportation was the second largest emission-producing category in 2006 accounting for 36% of Canada's emission growth from 1990 to 2006.^{xiii}

Air quality

Air pollution associated with vehicle use includes particulate matter (from industrial and motor vehicle emissions), carbon monoxide (from motor vehicle exhaust), and ground level ozone, which is a respiratory irritant and one of the major components of smog (created by burning fossil fuels for transportation). Air pollution discourages physical activity, is a significant risk factor for heart disease and stroke, and can worsen existing heart and lung problems.^{xiv}

Land use implications

Land use patterns (the arrangement and form of residential, commercial, industrial, and institutional activities) and the accompanying patterns of street networks have implications for travel choices. Historical trends toward single-use residential suburbs have resulted in an urban form that favours vehicle travel and makes biking and walking more challenging. Neighbourhoods with medium or higher residential density, a good mix of uses within close proximity, and a closer-knit grid pattern of streets are more conducive to travel by foot, bicycle or transit. This smart growth pattern of development has been linked with reductions in vehicle trips of 20–40% as compared to conventional low-density single-use development. This translates into GHG reductions of 18–36% as compared to conventional scenarios.^{xv}

Employment land

The distribution of employment land within the cities encourages the use of private automobiles. While the central areas of Gatineau and Ottawa still command a large share of total employment and are well-served by transit, much growth has occurred in dispersed employment parks away from rapid transit and most-readily accessible by car.

Public health and obesity

Auto-dependent development increases the amount of time people spend in their vehicles. This has been correlated to higher rates of obesity, increased incidence of heart disease and Type 2 diabetes, and other lifestyle diseases. Conversely, living in a higher-density mixed-used neighbourhood encourages active transportation and reduces the probability of obesity by approximately 30%.^{xvi} Increased physical activity has also been linked to enhanced psychological well-being and self-esteem, and reduced stress levels.^{xvii}

Demographic change

Within 30 years, one of every four Canadians will be a senior citizen, and the population is expected to be more diverse.^{xviii} The overall population is projected to increase, with the population of Ottawa and Gatineau growing from 1.2 million to 1.8 million by 2060—a 50% increase over 50 years^{xix}. The increased demand for living space will further densify urban areas, which creates both challenges and opportunities for transportation infrastructure development. While higher density can support more walking, cycling and transit for an older and larger population, the liveable community also requires attention to design, creation of quality public spaces, and places for all people to live, work, and spend their leisure time.

Geographic challenges

The Ottawa River is a major challenge to connections between Ottawa and Gatineau, and any improvements to the connectivity between these two cities must be carefully considered. This geographic feature has contributed to a land use pattern that spreads development out in a linear pattern matched by its streets. In a report written for Ottawa in 2009, concern was expressed about a lack of integration between the Ottawa and Gatineau transit systems in recognition of the significant cross-border flow of residents.^{xx}

In Ottawa, the Greenbelt poses an additional geographic challenge. Total travel during rush hours across the Greenbelt, estimated as the number of kilometres travelled by all travelers in a year, is about the same distance as 20,000 trips across Canada. These trips add to the cost of fuel and vehicle maintenance for private car owners, as well as add travel time. For Ottawa, the costs include costs of road repair and snow clearing and an estimated \$10 million annually to the City's operating costs for buses that must travel through the Greenbelt to serve communities outside it. For everyone, the trip across the Greenbelt contributes to their personal production of greenhouse gases.^{xxi} More travel across the Greenbelt will also lead to increased pressure for wider corridors and new roads that could possibly impact sensitive environmental features and the rural

character of the landscape. Increased use of public transit, car pooling, and improved cycling facilities through the Greenbelt may help reduce this pressure.

Technological change

Advances in technology will continue to change the structure of production, where we work, and the use of leisure time. Such changes will affect our transportation needs and behaviours. Already, communications technology has enabled a growing proportion of the workforce to work from home and in the future, this may shape demand for transportation facilities. Technology will also revolutionize our transportation options and their performance, conceivably promoting greater environmental sustainability. Cleaner transport and new technologies will not, however, be sufficient to reduce transport emissions. Concerted efforts will be required to influence social behaviour and attitudes toward more sustainable modes.

2.4. Goals

Recognizing the need to address these issues and challenges and to envision a better future Choosing our Future, through community outreach, has developed a set of high-level aspirational goals to define success over the long term. This discussion paper and the strategic directions identified respond to a primary *Connectivity and Mobility goal* as well as several other related goals.

Other goals can be found on the project website: www.choosingourfuture.ca.

Primary Goal

Walking, cycling, and transit are residents' first choices for transportation

Through careful land use planning, the need to travel long distances has been greatly reduced because jobs and most of our daily needs are provided in complete, livable communities. Transportation networks are well-connected between and within communities, minimizing environmental impacts, moving residents and goods safely, efficiently, and affordably, and encouraging social interaction. Residents choose walking, cycling and transit, and mobility is enhanced by electronic communications, good planning and urban design.

Related Goals

Energy is used efficiently and supplied from green, renewable sources

Energy is used efficiently and responsibly in the region and comes from a diverse portfolio of resources that are renewable, low-impact, and contribute to local economic development. The region also manages demand for energy through community planning, transportation initiatives, and building design.

The Region adapts to a changing climate

The Region's greenhouse emissions are reduced to the point where they can be absorbed (sequestered) by its ecosystems and technologies. The region has also ensured that it can adapt to deal with the impacts of climate change.

All residents enjoy a high quality of life and contribute to community well-being

Our communities are healthy, safe, secure, accessible, and inclusive places, where all residents have the opportunities required to enjoy a high quality of life and be involved in community life.

2.5. Current Plans and Programs

Many of the current Ottawa, Gatineau, and NCC policies and plans consider sustainability priorities relating to transportation, reflecting broader public and stakeholder priorities, energy and infrastructure costs, trends in technology, and other issues.

Ottawa's Transportation Master Plan, approved in November 2008, sets the direction for day-to-day transportation programs and identifies transportation infrastructure, facilities, and services that the city will need by 2031. Investment in rapid transit (Light Rail Transit and Bus Rapid Transit) and active transportation are positioned as plan priorities. Other aspects of a sustainable transportation system are also highlighted, such as transit accessibility for customers with disabilities, improved vehicle efficiency, road design to support all mode types, development of an integrated ride sharing strategy, and recognition of parking as a transportation demand management (TDM) tool. The City of Ottawa also has an anti-idling bylaw, and Ottawa's Growth Management Strategy includes direction to reduce energy consumption through transportation. While the region uses air and rail transportation to move goods, trucks dominate and will likely continue to do so.

Within the City of Gatineau's November 2008 Action Plan for Implementing Environmental Policy, there are commitments to reduce vehicle traffic, improve public transit, and encourage active transportation modes.^{xxii} The NCC's Strategic Transportation Initiative (STI) supports provincial and municipal goals for smart growth and integrated transportation planning for the movement of people and goods. It outlines potential strategies to move away from a transportation system dominated by low-occupancy vehicles to a more balanced transportation system where public transportation and alternative transportation options are given preference and strongly supported.^{xxiii} Strategies include: interprovincial integration of transit and roadways as well as consideration of the Capital Region in any future high-speed interurban rail systems; a TDM approach for popular places such as Gatineau Park and federal employment areas; reducing the impacts of heavy truck transport in the core; and way-finding

Seeds of Success

Below are examples of the many programs and initiatives currently underway in the region:

- The Rapibus project in Gatineau is under construction: a 15 km route connecting Gatineau to downtown Hull with links to Ottawa dedicated for the exclusive use of buses, with an adjacent bicycle path and amenities for cyclists at various stations,
- ¹ The Ottawa Light Rail Transit (OLRT) Project will connect Tunney's Pasture to Blair Station, with a tunnel through the downtown. A study to improve the design of public areas downtown and create seamless access to the new Transitway stations is underway. Following a pilot project, NCC's Capital BIXI bike-share service has become a permanent transportation option, which will allow residents and tourists on both sides of the Ottawa River to rent bikes at stations throughout the Capital Region core.
- The City of Ottawa is piloting a segregated bike lane on Laurier Avenue West, from Bronson Avenue to Elgin Street area. The segregated bike lanes are physically separated from car lanes through curbs and buffers, which increase the safety for cyclists and could get more people riding.

improvements and identification of symbolic gateways.

Current plans and programs are working towards a more sustainable transportation system, but they are unlikely to go far enough to shift mobility patterns to mostly non-automobile travel. The focus is still primarily on traditional fuel sources, though there is some encouragement for fuel efficiency. Plans demonstrate some major improvements to the transit system and encouragement of active transportation through policy. Connections between land use and transportation are being made in Ottawa through the Official Plan and Community Design Plans (CDPs). Moreover, some current rapid transit stations have successful transit-oriented development and are moving the bar on density targets, while others represent significant future opportunities.



3 New Directions

3.1. Strengthening Sustainable Mobility

There are a number of new opportunities that could emerge when looking toward the future. The following presents a range of strategies and practices, including some that build on existing initiatives already underway for creating a more sustainable mobility system.

Integrated land use and transportation systems

Communities across North America reflect the strong relationship between transportation behaviour and community design, density, and land use mix. What could this relationship look like in a more sustainable future for Canada's Capital Region? Possibly, major streets such as Bank Street and Richmond road, rue Montcalm and, boulevard Greber would combine transit, car, and active transportation modes to serve residences and shops located along these corridors. Land uses bordering these complete streets would be intensified with a mix of higher-density residential development and job-related land uses, which would provide the population base needed to support effective local and regional transit. Rapid transit would connect all major neighbourhood hubs to make the choice to take transit easy and convenient. Neighbourhoods that place home, work, shops and leisure activity in convenient proximity to each other would not only see a shift to more active forms of transportation, but would also become more sought-after places to live, with a range of affordable housing and housing suited to many different types of households.

Isolated areas of single land uses, such as employment-only areas, would be remnants of the past. In the future, these would be replaced by compact developments containing multiple land uses where people, jobs, goods and services, and open spaces will co-

exist. The mix and balance of land uses would allow many residents to live within comfortable walking distance of daily needs, supporting active modes of travel. Cycling lanes would thread through the surrounding areas, putting most homes within 5 kilometres (less than a half hour of cycling) of transit and community facilities.

Creating this future over the next 50 years could involve:

- Continued investment in rapid transit infrastructure (BRT and LRT)
- More transit-oriented development around rapid transit stations (high density, mixed use, walkable)
- LRT Service to dense town centres outside of the Greenbelt
- Exploring ways to reduce the impact of travel cross the Greenbelt
- New rapid transit connections between Ottawa and Gatineau
- An extensive network of dedicated cycling facilities connecting homes, offices, community facilities and rapid transit stations, plus the provision of other facilities such as secure bicycle parking and office-place locker rooms and showers to accommodate cycling.

Complete streets

The design of our streets is a major factor in our choice of transportation mode. If streets are directly connected to our destinations, safe, comfortable and interesting, then walking, cycling and transit (transit users are of course also pedestrians) become realistic and preferred choices.

A sustainable approach to mobility would incorporate the creation of “complete streets” that are designed to accommodate cars, transit, cyclists and pedestrians as equal participants within the mobility network.



Complete Street Source: flickr/SDOT Photos



Road Diet Conversion Source: flickr/R. Drudl

This approach would recognize that streets are our primary public places and therefore should incorporate public art, spaces to sit, and pocket parks. Complete streets have less pavement (more landscaping), fewer lanes for cars (more space for people and bikes), and improved connectivity (more connection points between streets and paths).

Transforming our streets would require sufficient funding to support all transportation systems, with spending allocated so as to achieve our targets for walking, cycling, transit, and vehicle use.

A useful tool to assist with this shift is the “road diet,” which typically involves the conversion of a four-lane road to three lanes with a shared centre turning lane, using the leftover lane for cycling or landscaping. This approach has been found to decrease crash frequency by 29% per mile,^{xxiv} increasing driver, cyclist, and pedestrian safety. The efficiency of vehicular travel on these slimmed down roads can actually increase since cross-traffic turning happens separate from the main thoroughfare.^{xxv} The conversion of road lanes to cycling lanes is best done initially in locations where there is underused road capacity.



Off-road pathways would also be developed as extensive greenways forming an integral part of the overall mobility network, connecting open spaces and other destinations in the community.

Alternative goods movement

Trucking has been severely affected by high oil prices and the global recession. In a context of high fuel prices, some freight movement could be shifted to rail. Much freight would likely continue to be moved by road but in trucks that may be quite different from what we are used to. New trucks could be much larger to reduce fuel costs, but powered by electricity while on main highways.

The establishment of distribution centres where freight is off-loaded to smaller vehicles for local delivery—much as freight can be off-loaded from a train for local delivery—and where smaller vehicles bring outgoing freight could be opportunities to explore further. Among the best known is the Retail Consolidation Centre at Heathrow Airport (London, UK), which receives and distributes all items for the shops in the five Heathrow



Alternative goods vehicles like this electric delivery vehicle can reduce impacts on urban streets.

terminals. Establishment of the Centre has reduced related traffic within the airport by 70%, with corresponding reductions in fuel use and emissions, improvement in security and in the punctuality of deliveries, and reductions in overall costs.^{xxvi}

In addition, unless an alternative to jet kerosene (aviation gasoline) becomes available, air travel could be severely reduced if fossil fuel prices escalate. This is particularly relevant for flights to destinations less than 1,000 km away. Most shorter flights could be replaced by high-speed rail for movement of both people and freight. Powered with low-carbon electricity, this could significantly reduce GHG emissions.^{xxvii} Electricity-based ground-level light rail that links with rapid transit systems could ensure efficient travel at neighbourhood, city, and regional scales.

Transition to vehicles using alternative power

If they are to remain a part of our future transportation system, automobiles will need to become compact and pollution free. Imagine a future where automobiles are only being used in special situations where walking, biking, and transit options are not feasible...

Electric vehicles provide numerous advantages including reducing our dependence on oil. They are also highly energy efficient, have remarkable stop-start performance, and produce no direct emissions. There can be pollution generated by the production of at the electricity generating station, depending on the fuel used; however, pollution from stationary sources like electricity generation facilities is easier to control and typically impacts fewer people than widely dispersed pollution from traffic. How would the region transition to electric power? Means of facilitating this could include:

- Conversion of the region's bus and rail systems to electricity
- Investment in infrastructure that collects fees from drivers to accelerate the transition to electric vehicles.
- Requirements that all new multi-family residential, industrial, commercial and institutional buildings in the region provide charging facilities for battery-electric and plug-in hybrid vehicles.

This transition would also rely on federal and provincial improvements to vehicle efficiency standards. For vehicles, the preferred standard would be equivalent to the California *Equivalent Tailpipe Emission Standards*. This could be accompanied by a rapid shift to electric power and renewable fuels such as local wood-based ethanol and methane from biodigesters and food waste. For transit vehicles, the future could see a



Public electric vehicle charging station in Berlin. Source: www.daimler.com

transition to electricity for wheeled vehicles and the use of low-carbon fuels (including electricity) for other types of vehicles.

3.2. Conclusion

Compact development and mixed-use neighbourhoods can encourage walking, cycling, and transit, thereby reducing the need to rely on private vehicles. This shift in transportation modes can result in increased fitness levels, improved air quality, reduced collisions, and a reduction in traffic noise. Changes to mobility infrastructure networks can result in reduced emissions, less reliance on fossil fuels, and reduced environmental impacts—such as polluted stormwater runoff, lack of groundwater recharge, and habitat loss associated with large areas of pavement for roads and parking.

Endnotes

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