

Appendix A
TDM Papers

Ridesharing

Overview

The objective of ridesharing is to increase the average number of people carried in each vehicle during peak periods, thus using fewer vehicles to move the same number of people and reducing the total vehicle-kilometres of travel. Ridesharing includes carpools, which use private automobiles, and vanpools, which use larger vans often provided by employers or government agencies. Members of each rideshare group have commute trip origins and destinations in the same general vicinity and similar work schedules. They may either agree to meet at a common location (e.g. park and ride lot) or arrange for pick up and drop off at each end of the trip. Participants either share the cost of using one vehicle or take turns driving and providing the vehicle. Car and vanpools are commonly arranged informally through groups of friends and neighbours, or more formally by employers for their employees, or through third parties, often run or supported by government.

Successful ridesharing programs typically include a number of measures to facilitate and promote car and van pooling, including:

- Ride matching tools to help commuters form carpools or vanpools on the basis of common origins, destinations and schedules;
- High occupancy vehicle (HOV) lanes and other HOV priority measures to reduce travel times for car and vanpools, relative to general traffic;
- Incentives such as preferential parking and subsidization of administration costs;
- Emergency transportation to transport carpool members who miss arranged rides due to unexpected schedule changes, mechanical problems, etc; and
- Locally focussed advertising/promotion.

Data from the 2001 Transportation Tomorrow Survey (TTS) showed that the average auto occupancy in Durham Region during the p.m. peak period was 1.21 persons per vehicle, down from 1.27 in 1986. This reflects an overall North American trend to reduced average auto occupancy, generally attributed to increased auto ownership and auto-oriented development patterns that reduce the probability of groups of commuters having origins and destinations in close proximity to each other. Ridesharing programs, as a major component of many travel demand management efforts, are intended to reverse the trend by making ridesharing easy and faster/cheaper than each commuter driving his/her own vehicle.

Policy Environment

The Ontario Ministry of Transportation (MTO) has long had a policy of supporting ridesharing, but practical support for implementation was generally limited to providing free carpool parking lots near freeway interchanges. Recently, the MTO has begun implementing HOV lanes on provincial freeways, including Highway 403 in

Mississauga, Highway 404 southbound in Markham/Toronto and Highway 417 in Ottawa.

The Region of Durham's Transportation Master Plan recommends implementation of ridesharing. The Region is a member of the Smart Commute Association (www.smartcommute.ca), which is jointly sponsored by the GTA regions (Durham, York, Peel and Halton), the Cities of Toronto, Mississauga and Hamilton and Transport Canada. The Smart Commute Association promotes a range of TDM measures, but its current focus is on ridesharing. Initiatives offered in support of ridesharing include a ride matching program (Carpool Zone), a guaranteed ride home program and various promotion/incentive initiatives. All services, except for area-wide ride matching are limited to members of local Transportation Management Associations (TMAs), non-profit groups of local businesses and other stakeholders. Durham Region is in the early stages of TDM implementation and currently has no active TMAs. There are no current plans to implement HOV lanes on Regional roads, and MTO has no current plans to extend freeway HOV lanes east of Toronto.

Quantification

Existing levels of ridesharing in Durham Region are indicated by the results of two recent surveys. A 2005 survey of GTA commuters done by Decima Research for the Smart Commute Association found that 14% of all commuters living in Durham Region reported using a car or vanpool as their primary commute mode during the past year (including passengers and drivers). This is consistent with the 2001 TTS, in which 15% of p.m. peak period trips were reported to be made as auto passengers.

When implemented in conjunction with incentives such as HOV lanes, preferential parking and financial incentives, rideshare programs have been reported to reduce commute trips by 10% to 30%. Effectiveness is diminished as incentives are reduced and/or the background level of congestion drops. Work site trip reductions in the 5% to 15% range can be expected for typical rideshare programs in urban areas. Data from the United States indicates that rideshare programs can be expected to reduce total regional vehicle-kilometres of travel by up to almost 4%.

Practice of Others

Some of the most successful ridesharing programs in North America are operated in Washington State. Large employers are required by law to help employees use alternative transportation modes. A wide variety of support and incentive measures are provided, including ride matching services, HOV lanes, park and ride lots, priority loading on ferries, priority parking at destinations and various financial incentive programs. Vanpooling is highly successful, with over 1200 active vanpools in the Puget Sound area. Vanpools are typically operated through local transit agencies, with support from the state government via leasing/rental programs, sales tax incentives and liability limitation legislation.

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In Canada, the Jack Bell Foundation operates a carpool, vanpool and rideshare program in the B.C. lower mainland and Vancouver Island, which is modelled on the Seattle Metro vanpool/rideshare program in Washington State. JB Rideshare (www.ride-share.com/rideshare.html) currently owns and operates a fleet of 120 carpool/vanpool vehicles, as well as providing ride matching and promotional services. Vehicle financing is provided through various private sector sponsors, while the provincial government and local transit agencies pay administrative and promotional costs. Vehicle operating costs are covered by fees paid by the carpool/vanpool participants. Ridesharing in the Vancouver area is further supported by provisions of HOV lanes on several key commuter links (e.g. Lions Gate Bridge).

Trans Canada Carpool.ca (formerly Commuter Connections) is a British Columbia based company that provides ride matching services and promotes ridesharing in Canada. Starting with programs for the B.C. government and the Jack Bell Foundation, the company later received financing from the federal Ministry of the Environment to extend the ride matching service across Canada. Their ride matching service (www.carpool.ca) currently offers ride matching to over 120 employers and post-secondary institutions located in 45 municipalities in 6 provinces and territories and has over 10,000 registered users.

Key Implementation Issues

The Smart Commute Association has removed a significant barrier to ridesharing implementation by providing ride matching and emergency ride home services. However, services such as the emergency ride home and employer-specific ride matching are offered only to members of active TMAs. As noted above, there are currently no TMAs in Durham Region. Although ridesharing can be implemented without TMAs, its effectiveness will be limited due to a lack of the enhanced Smart Commute services and locally focussed marketing and promotion efforts.

The most effective ridesharing programs provide various incentives to participants, including the use of HOV lanes, dedicated parking spaces and financial incentives such as parking cash-out and operating subsidies. There are currently only a few HOV lanes available in the GTA, and none east of Toronto, so ridesharing participants in the eastern GTA do not have opportunities to significantly reduce travel times relative to single-occupant vehicles. Some financial support is being provided through the Smart Commute Association, but direct financial incentives to participants are not part of that program. Support from employers is required to facilitate effective workplace marketing/promotion efforts and provide incentives such as dedicated HOV parking and flexible work hours.

Markets for ridesharing and public transit tend to overlap. This can result in ridesharing capturing transit users, in addition to vehicle drivers, and reducing the overall transit mode split. Because of this effect, some transit operators have opposed the implementation of ridesharing programs, arguing that scarce resources should be applied to transit improvement and promotion instead.

Co-Benefits

In addition to reducing overall vehicle travel, ridesharing helps to reduce the costs of commuting for individual employees. Many ridesharing participants also note social benefits, due to the ability to interact with fellow commuters/colleagues during the commute.

Employers can realize significant benefits from ridesharing, including:

- Reduced parking requirements/costs;
- Reduced tardiness and absenteeism;
- Improved employee morale; and
- Improved employee retention.

Conclusions

Ridesharing can make a small but significant contribution to peak period vehicle travel reductions. Although implementation is at a very early stage in the eastern GTA, there is government/policy support for ridesharing. Successful examples are available in the United States and Canada to guide implementation in this area, but ridesharing will remain at a disadvantage in Durham if incentives such as HOV lanes are not widely available. In the long-term, with full implementation of a program of promotion and incentives, ridesharing can be expected to reduce overall peak period vehicle travel by as much as 4%. This may include some travel attracted from transit, resulting in a lower transit mode split than would be achieved without ridesharing.

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Walking and Cycling

Overview

Walking and cycling have long been neglected as serious modes of transportation in North America. In auto-dominated suburban areas, they have generally been considered as a means of recreation, not transportation. However, walking, cycling and other non-motorized modes of transportation (e.g. roller blades, scooters, etc.) can play a critical role in the transportation mix. They provide a healthy, low-cost, emissions-free alternative to the motorized modes of transportation for short trips, including short commutes to work or school, local shopping trips and connections to transit services for longer commutes.

Recent North American experience has shown that walking and cycling can be significantly increased by providing improved facilities (sidewalks, paths, bike lanes, etc.), increasing mixed-use and higher density development and implementing promotion programs. Use of these modes for utilitarian travel (work, shopping, school) is highest in areas with a moderate climate, mixed-use/higher density development and extensive pathway/bike lane networks.

Policy Environment

The Ministry of Public Infrastructure Renewal document *Places to Grow – Proposed Growth Plan for the Greater Golden Horseshoe* includes a requirement for municipalities to integrate pedestrian and bicycle networks within their transportation planning processes and ensure that appropriate facilities are provided in existing communities and new developments.

The Region of Durham Transportation Master Plan is consistent with this provincial direction. It promotes the use of cycling and walking and recommends development of a Regional cycling plan and integration of pedestrian and cyclist needs in the road improvement planning process. Municipal planning documents also provide general support for walking and cycling.

The Region of Durham is in the process of producing Regional Trail Network and Cycling Network plans. These plans are intended to encourage the development of a Region-wide circulation network for cyclists, integrating the networks previously developed by the individual municipalities within the Region.

Implementation of pedestrian and cyclist facilities is generally the responsibility of the local municipalities. Existing facilities vary from one to another, but are generally sparse. Pedestrian and cyclist needs have been largely an afterthought in the approval process for new developments. This is beginning to change, as municipalities place increasing importance on these alternative travel modes.

Quantification

A Decima Research survey, completed for the Smart Commute Association in May 2005, found that approximately 7% of the surveyed GTA commuters usually walk or cycle to work. The proportion of commuters walking or cycling varied widely, depending on place of residence, from a high of 11% in Toronto to a low of 1% in Durham Region. The survey results also highlighted the seasonal nature of cycling; the proportion of bicycle commuters who reported using their bicycles to get to work ranged from a high of 94% in June to a low of 11% in January and February.

Quantifying the increase in walking and cycling that can be expected is difficult due to the number of factors involved, not all of which can be addressed through government or employer initiatives. The low usage of walking and cycling in Durham Region reflects the current pattern of low density, auto-dominated development and the lack of a comprehensive network of paths and bike lanes. As these change over time, walking and cycling can be expected to increase. Given the existing low rate of usage, it is not unreasonable to assume that walking and cycling could grow to represent 5% to 10% of commute trips in the long term (except during winter).

The reduction in vehicle-kilometres of travel will be less than the increase in walking/cycling trips because these trips are generally short distance. For example, a 1993 study by Comsis for ITE estimated that 5% increases in walking and cycling (from a combined 4.9% to 14.9%) could be expected to reduce overall commute vehicle-kilometres of travel by only 1.5%, based on typical trip lengths for these modes.

Practice of Others

A wide variety of programs to promote walking and cycling have been adopted by governments and interest groups throughout North America. Typical examples include:

- Providing secure bicycle parking at key destinations, such as schools, transit stations and employment centres;
- Employers providing shower and change facilities in work places;
- Improving bike lane and multi-use path networks;
- Municipalities requiring assessment of pedestrian and cyclist circulation as part of the development review/approval process;
- Implementing Smart Growth principals, including more mixed-use development, higher density development and improved road network connectivity;
- Transit agencies allowing bicycles on their vehicles and/or installing bike racks on buses;
- Employers providing incentives such as free/subsidized bicycles and safety equipment, parking cash-out, etc.; and

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- Promotional programs offered by governments, employers and non-profit organizations (e.g. bike to work week).

In Ontario, the City of Toronto adopted a comprehensive cycling plan in 2001 (*Toronto Bike Plan - Shifting Gears*), with the objective of doubling cycling trips in the City within 10 years. The plan is based on six principles: creating bicycle-friendly streets; implementing a bikeway network; improving safety and education; promoting cycling (special events, incentives, etc.); improving integration of cycling with transit; and providing secure bicycle parking. Implementation has been slower than originally planned due to budgetary constraints, but major progress has been made in expanding the bicycle lane network and the availability of bicycle parking.

The City of Ottawa also has a comprehensive cycling plan, as part of their Transportation Master Plan (TMP). They have implemented a network of on and off road bicycle routes and implemented additional measures such as bike racks on buses and promotional programs. Cycling activity levels are monitored annually, using city-wide intersection traffic counts, as part of the transportation performance monitoring component of the TMP.

Key Implementation Issues

There are several issues that determine the extent to which walking and cycling will be adopted for utilitarian trips. Key issues include:

- Length of trip – commute trip lengths of 30 to 40 minutes, or a maximum of 10 km, are generally considered acceptable;
- Availability of safe, secure and attractive walking/cycling routes;
- Weather – temperature extremes and precipitation reduce walking and cycling;
- Terrain – less cycling occurs in hilly terrain; and
- Availability of change facilities and bicycle parking.

The Decima Research survey found that approximately 20% of non-motorized commuters considered the availability of showers and change facilities to be important to their selection of commute mode. Availability of bicycle parking was considered important by 54% of bicycle commuters. These factors are generally to be addressed by employers, although governments may provide incentives and implement bike parking at transit connections.

Trip lengths can be addressed through changes in development patterns, including increased mixed-use and higher density developments, but large areas of low-density, auto-dominated development will remain for years to come. Improvements to sidewalk, path and bike lane networks and changes to typical suburban roadway designs can address the need for safe, secure and attractive routes and can also help to reduce trip lengths by providing key connections (e.g. watercourse and freeway crossings) and reducing the need for circuitous routing to avoid high traffic areas.

The physical environment of a community, including weather and terrain, cannot be changed. These factors will remain a significant barrier to the widespread adoption of cycling and walking for utilitarian travel.

Co-Benefits

In addition to reducing vehicle travel for short trips, the promotion of walking and cycling, with the provision of supporting facilities, can be expected to:

- Improve safety for pedestrians and cyclists, reducing the risks of collisions with motor vehicles;
- Reduce health care costs, because of the health benefits of regular physical activity;
- Improve low cost transportation options for low income families; and
- Make communities more attractive to potential residents and employers, improving economic development.

Shifting travel from motorized vehicles to walking and cycling also has significant air quality benefits. Vehicle emissions are greatest in the period immediately after start-up, so the replacement of short vehicle trips by walking and cycling results in emissions reductions greater than would be expected on the basis of the reduction in vehicle-kilometres of travel.

Conclusions

Walking and cycling have major advantages over other modes of travel, as they do not produce any emissions, do not contribute to road congestion, and directly improve the health of commuters who use them. These travel modes can play a vital role in the transportation network, and will become increasingly important as current policies on Smart Growth, transit oriented development and promotion of alternative travel modes are implemented. Demand for travel by walking and cycling can be expected to increase over time with improvements to pedestrian and cyclist facilities and increasing mixed use/higher density developments that shorten average trip lengths.

The major disadvantage of walking and cycling for commute trips is that they are limited to relatively short trips, generally less than 10 km. They are also constrained by the weather, with use of these travel modes greatly diminishing during the winter months and other times of inclement weather. They will therefore remain impractical for many commute trips in the existing low density developed areas of Durham Region. As a result of these limitations, the contribution of walking and cycling to the overall mix of commuter travel will remain small, likely reaching a maximum of 5% of short trips (less than 10 km) within 30 years.

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Telecommuting

Overview

Advancements in information and communications technologies allow some employees to work from home, using the internet and telephone connections to exchange information and communicate with colleagues and customers. The ability to work from home, instead of having to travel to a centralized work site, is referred to as telecommuting. Workers who telecommute typically do so between one and three days per week, travelling to their employer's location on the other days to complete tasks that cannot be done remotely.

Telecommuting programs are typically implemented by individual employers, although they may be encouraged/supported by government. Employer contributions to telecommuting typically include:

- Policies to define the positions and activities that can be done through telecommuting, as well as the responsibilities of the employee and employer;
- Providing some or all required equipment; and
- Subsidizing communication costs.

Although telecommuters typically work from home, some employers may establish telework centres. These are office facilities located near employees' homes that may be shared by multiple companies. A short trip to the telework centre, often on foot or bicycle, replaces the long commute to the employer's main facility.

Policy Environment

There are no apparent provincial or federal government policy barriers to the implementation of telecommuting in Ontario. Working at home is technically illegal under the zoning bylaws in many residential communities. However, these bylaws are rarely enforced with respect to the types of work for which telecommuting is suitable.

Governments play a limited role in the implementation of telecommuting, except in the case of their own employees. Promotion of telecommuting by government can increase its adoption. Typical promotional activities can include:

- Providing telecommuting programs for government employees, as an example for others to follow;
- Providing information and resources for employers and employees; and
- Providing tax credits or other financial incentives to offset the costs of implementing telecommuting.

The federal government and most provincial governments currently offer telecommuting programs for their employees. Revenue Canada allows telecommuters tax deductions for some home office expenses.

Quantification

Telecommuting greatly reduces the work-related travel of those employees who participate. For example, an employee who telecommutes only two days per week reduces their commute trips by 40%. The contribution of telecommuting to reductions in region-wide vehicle-kilometres of travel is small because of the relatively low number of employees who currently telecommute. Work-related travel reductions are also slightly offset by increases in non-work trips for purposes that would previously have been accomplished as part of the commute to or from work. The ability to telecommute may also encourage employees to live farther from their place of employment, as the length of commute becomes less important than the cost and characteristics of housing.

An assessment of long-term travel trends in the United States concluded that telecommuting does reduce overall vehicle-kilometres of travel (VKT), but the reduction is very small, estimated at 0.8% or less. Other American research estimated that the long-term travel reductions due to telecommuting would be 1-2% or less, but could range as high as 4%, if 10% of the workforce telecommutes on any given day. An assessment of current telecommuting in California estimated an overall travel reduction of approximately 0.6%, with an estimated 6.1% of the workforce participating and 1.5% of the workforce telecommuting on any given day.

In Canada, the proportion of workers who telecommute at least one day a week has been estimated to grow from 6.4% in 2004 to 8.4% in 2008. This would translate into approximately 1.7% of employees telecommuting on any given day, which can be expected to produce an approximate 0.7% decrease in overall travel, assuming characteristics similar to the California data cited above.

In a survey of commuters completed by Decima Research for the GTA Smart Commute Association in 2005, 3% reported working from home at least three days a week, including those who telecommute and those who have a home-based business. Approximately one-third of these home workers stated that they telework or telecommute (rather than having a home-based business), and work from home an average of 14 days per month. This represents an approximate 70% reduction in commute trips by these workers, but less than a 1% reduction in overall commute trips in the GTA.

Practice of Others

Telecommuting has been implemented widely throughout North America. Notable examples in Canada include the Government of Canada, most provincial governments and many of Canada's leading corporations, including Bell Canada, Nortel, IBM Canada, the Bank of Canada, Creative Labs, HP Canada, Bank of Montreal, CIBC and Royal

Bank. Overall adoption of telecommuting in Canada has been slower than in the United States.

Key Implementation Issues

Although governments can provide policy support and financial incentives for telecommuting, it must be implemented by employers. Barriers to implementation commonly cited by businesses include:

- Up front capital costs for equipment and communications infrastructure;
- The need to change basic organizational practices and create new policies;
- Reduced managerial supervision of workers;
- Information security/confidentiality concerns; and
- Administrative issues, such as health and safety policies, collective agreements, time tracking/payroll issues, etc.

Some employees may also resist the implementation of telecommuting due to concerns about isolation from colleagues, increased pressure for additional hours of work and reduced potential for career advancement compared to co-workers who do not telecommute.

Most of these concerns can be addressed through implementation of appropriate policies and practices. However, an inherent limitation on telecommuting is that it is not applicable to all jobs. While the output of a large, and increasing, proportion of workers is information that could be transmitted electronically, many require access to specialized equipment/materials, frequent face-to-face meetings, or physical interaction with co-workers on a daily basis. Employees that do telecommute typically do so only one to three days per week for these reasons, as well as the need to maintain a social connection with co-workers.

Co-Benefits

The ability to work from home is seen as a valuable benefit by most employees who telecommute. They enjoy the added flexibility it provides, as well as the reduction of commute time and work-related expenses (wardrobe, meals, etc.). The ability to work from home also increases accessibility to employment opportunities for people with disabilities and residents of rural/remote communities.

Employers have found that offering the option to telecommute can enhance employee recruitment and retention, while generally improving productivity and reducing absenteeism. Employers can also realize reductions in office space requirements, parking requirements and employee relocation expenses.

Conclusions

Telecommuting is likely to play an increasing role in the commuter transportation mix as more jobs become information-focussed and telecommunications technology continues to improve. It has the advantage of completely removing some commute trips from the transportation network, and is particularly attractive for long trips. However, telecommuting faces significant barriers to implementation and can only be applied to certain types of jobs. As a result of these disadvantages, its contribution to overall commuter travel reduction will remain small for the foreseeable future. The maximum contribution of telecommuting to future reduction in overall vehicle travel is probably in the order of 1%.

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Road Pricing

Overview

With road pricing, motorists must pay a fee in order to travel on a particular facility or within a designated area. As a TDM strategy, the objective of road pricing (also called congestion pricing) is to decrease the demand for vehicle travel during peak periods by increasing its cost. The payment of a fee linked to time of day, traffic volumes or congestion levels can induce motorists to change the time of their commute trips, change travel modes, change travel routes or reduce their travel, depending on the nature of the road pricing program.

Road pricing programs implemented to date have typically included:

- Variable tolls, changed by time of day, traffic volume or congestion level to reflect the increasing marginal cost of trips made during high demand periods. The tolled facility may be a new road, an existing road or dedicated lane(s) in an existing road corridor. On an existing road, variable tolls can be applied as a means of deferring the need for additional peak period capacity. Variable tolls may also be applied to specific lanes in an existing road corridor, providing motorists with a choice between driving in congested conditions or paying to drive in uncongested conditions.
- Area (or cordon) tolls, which all motorists entering a designated area must pay. The toll generally varies by time of day to discourage peak period travel. Applications of this measure have been in mature core areas of major cities, where the ability to increase road capacity is severely constrained.
- High Occupancy Toll (HOT) lanes, which allow drivers of single-occupant vehicles to pay a toll to drive in a High Occupancy Vehicle (HOV) lane. The toll varies by time of day or traffic volume in the lane to control demand and ensure that free-flow operations are generally maintained in order to preserve the incentive for HOV travel. This measure can increase the congestion reduction benefit of an otherwise under-utilized HOV lane, while generating revenue that can be applied to transit or other alternative travel mode improvements.
- Parking charges, which can be changed by time of day and/or location to discourage driving during peak demand periods.

Conventional road tolls are a form of road pricing, since users must pay to use the tolled facility. However, they are not considered a TDM strategy because their objective is to generate revenue to pay for the facility, not to modify travel behaviour.

Policy Environment

In general, road pricing plans are perceived by the public as an additional tax burden on drivers, adding to fuel, registration fees and insurance costs that are perceived as being too high. Negative reaction to proposals to impose fees on roads currently driven “for free” is particularly strong. As a result, the Ontario government’s policy has been to

consider tolls only on new facilities and only where parallel “free” routes are available. As congestion increases, this policy may change to reflect a lack of alternatives to effectively add capacity or reduce demand. However, policy changes to implement broadly-applied road pricing in Ontario are unlikely to occur for many years.

Quantification

The effects of road pricing on peak period travel demand are dependent on the type and amount of fees charged, as well as factors such as the availability of alternative travel modes or alternative “free” routes. Research completed by the California Air Resources Board in 1998 indicates that road pricing can be expected to reduce area-wide vehicle kilometres of travel by approximately 1-3%, which the Center for Clean Air Policy recommends for quantifying the benefits of congestion pricing. Other studies, based on modelling or monitoring of actual implementations, have shown travel reductions ranging from less than 1% to over 25%, with the highest rates occurring with area tolling in heavily congested areas.

Practice of Others

One of the best-known road pricing programs in the world is the London Congestion Charging Zone. Under this program, all private vehicles must pay an £8.00 per day fee to travel within a designated area of central London between 7:00 a.m. and 6:30 p.m. on weekdays. Implemented in 2003, the program has produced significant reductions in traffic volumes and congestion within the designated area, as well as improvements in transit service, taxi service, travel speeds and air quality. A plan to extend the congestion charging area and increase the fee was approved in September 2005.

There are several examples of road pricing in the United States. These include:

- State Route 91 Express Toll Lanes, Orange County California – 10 mile private toll road built in the median of the heavily congested Riverside Freeway. Tolls vary from \$1.10 during low-demand periods to \$8.50 during the highest demand period (p.m. peak) to control demand and maintain free flow conditions.
- I-15 FasTrak, San Diego – 8 mile median HOT lane facility; single-occupant vehicles allowed in HOV lane by paying a toll. Toll rates generally vary from \$0.50 to \$4.00, depending on the actual traffic volumes using the HOT lane; toll may be as high as \$8.00 if necessary to reduce demand and maintain free-flow operations during severe congestion. Revenues fund an express bus service in the corridor.
- Port Authority of New York and New Jersey – tolls on the Hudson River bridges are increased during peak hours and reduced for HOVs, resulting in time shifting of traffic to off-peak periods and increased transit and carpool usage.
- New York State Thruway Authority – tolls for trucks with E-ZPass transponders passing the Spring Valley and Tappan Zee Bridge Toll Barriers near New York City vary by time of day to discourage commercial vehicle travel during peak periods.

Peak period tolls for E-ZPass equipped trucks are approximately double the off-peak period tolls. Trucks without E-ZPass are charged the peak period rate at all times.

In Ontario, the 407 ETR uses a form of congestion pricing, charging passenger vehicles 0.75¢ more per kilometre during weekday peak periods (6:00-10:00 a.m. and 3:00-7:00 p.m.) than at other times of the day. In addition to increasing the revenue per user during the highest demand portion of the day, this price differential is intended to encourage travellers to shift the times of their trips or to use alternative routes in order to maintain a high level of service for the 407 ETR's customers. The peak period price premium is higher for heavy vehicles (up to 2.25¢/km) to discourage truck travel during the commuter peaks.

No other significant Canadian examples of road pricing have been identified.

Key Implementation Issues

As noted above, the negative public reaction to road pricing proposals is the single biggest barrier to implementation. If this reaction can be overcome through education efforts, other implementation issues include:

- Choosing an effective pricing method that is also easy to implement and perceived as fair;
- Allocating the revenue to a suitable use (e.g. transit improvements versus road improvements);
- The need to provide good travel alternatives, particularly alternative modes such as transit and ride sharing;
- The ability of area employers to respond by allowing employees to vary their work hours/commute times;
- Managing the potential for diversion of traffic from the tolled route/area to undesirable alternative routes or through surrounding neighbourhoods; and
- The need to address impacts on economically disadvantaged road users.

Co-Benefits

In addition to its potential travel and congestion reduction benefits, road pricing strategies provide a stable, long-term source of funding that can be applied to the maintenance and expansion of the area transportation network. The funding may be applied to the road system and/or the improvement of alternative transportation modes. In addition, road pricing improves the economic equity of the transportation system by reducing the cross-subsidization of road network peak period capacity improvements by off-peak travellers and alternative mode users.

Through the Ministry of Public Infrastructure Renewal, the Ontario government has been pursuing Alternative Financing and Procurement (AFP), partnering with the private

sector as a means of accelerating needed public infrastructure improvements. Road pricing provides a potential means of partially or fully funding an AFP arrangement for transportation network improvements.

Conclusions

Road pricing has the advantage of applying a financial cost to motorists that is directly related to the level of congestion at the time and location of travel. As a result, it can strongly influence choice of travel time, route and mode. Should Highway 407 be extended through Durham Region as a tolled facility, road pricing could be applied to it. Given current public and political attitudes to tolls, it is unlikely that road pricing could be implemented on other roads or specific areas of the Region for the foreseeable future. As a result of this disadvantage, road pricing is not expected to produce any significant, region-wide reduction in vehicle travel.

There has been some discussion of applying an area toll, similar to London's, in downtown Toronto. If such a plan is ever implemented, the effects on vehicle travel in Durham Region would be minimal, because a very high proportion of commute trips from this area to Toronto's downtown are already made on transit.

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Commuter Incentives

Overview

Commuter incentives include a range of financial incentives paid by employers to their employees to encourage commuting by travel modes other than single occupant vehicles. They may also include tax incentives and other government policies to support the incentives provided by employers. The incentives are intended to create a more neutral financial environment for work trip mode choice by reducing the financial advantage usually given to private vehicles. For example, most employers provide their employees with free parking, but do not offer a benefit of comparable value for employees who do not drive to work (e.g. transit fare subsidy).

A wide range of commuter incentives is available. Some of the most common incentives include:

- Parking cash out – employees who do not use a free/subsidized parking spot are provided with the cash equivalent;
- Travel allowances – payments provided to employees instead of parking subsidies, which can be used to pay for parking or alternative travel modes;
- Transit benefits – free or discounted transit fares provided to employees;
- Reduced parking subsidies – employees are required to pay some or all of the costs of the parking they use at work; and
- Company travel reimbursement – provides mileage reimbursement for work-related travel by transit or bicycle in addition to the usual policy of reimbursement for automobile mileage only.

Policy Environment

Current practices in the implementation of federal tax policy are generally not supportive of commuter incentives. Free parking provided to employees is supposed to be taxed at its “fair market value”, but in practice, most employers do not include parking as a taxable benefit because they do not attach a specific financial value to it. In contrast, free transit passes or other forms of payment for alternative travel modes have a clear financial value and are generally taxed. The 2006 federal budget introduced a non-refundable tax credit for the cost of monthly (or longer duration) transit passes. Governments at all levels are supportive of the objectives of commuter incentives, but no specific programs, other than this federal tax credit, have been identified.

Quantification

The amount of travel reduction that can be achieved through commuter incentives is difficult to define because:

- There is a wide range of potential incentives that could be implemented;

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- Incentives are typically implemented as a supplement to other TDM measures, making it difficult to isolate their effects; and
- The effectiveness of incentives varies depending on the environment in which they are implemented. For example, larger mode shifts generally occur in a dense, urban environment with good transit service rather than in a low density suburban environment with poor transit service.

The published data reflects a wide variation in vehicle travel reduction, depending on the locations where data was collected, as well as the nature and amounts of incentives provided. For sites at which incentives are implemented, vehicle-km of travel reductions ranging from 8% to 18% are quoted in one source (Comsis), and a range of 5% to 25% quoted is quoted in another (Dierker). Other sources based on observed data are generally within these ranges, but economic modelling indicates that even higher travel reductions should be achievable under ideal conditions. Region-wide travel reductions based on commuter incentives would depend on the proportion of employers that adopt them.

Practice of Others

Commuter incentives are widely used in the United States. The Environmental Protection Agency (EPA) and Department of Transportation list over 1,500 employers throughout the United States that provide TDM benefits, including incentives, on their “Best Workplaces for Commuters” web site (www.bwc.gov). The Association for Commuter Transportation web site (www.commuterchoice.com), co-sponsored by the Federal Highway Administration (FHWA) and EPA, lists active TDM and commuter incentive programs in 19 major urban areas spread over 15 states.

The U.S. federal government supports commuter incentive programs through, for example, tax policies that exempt transit passes and rideshare program benefits, as well as through various programs offered/supported by the EPA, FHWA and Federal Transit Administration. They also require a commuter incentive program to be provided for all federal employees. In the United Kingdom, tax policy exempts free or subsidised work buses, subsidies to public bus services, bicycles and safety equipment made available for employees and workplace parking for bicycles and motorcycles. Tax policy was also recently changed to provide incentives to reduce mileage driven in company cars and encourage replacement of company cars with more efficient models.

In Canada, commuter incentives are not widely applied, and are primarily focussed on various forms of transit fare subsidies. Examples include:

- Employer-subsidized transit passes in Winnipeg (EcoPass);
- Transit pass purchase through payroll deductions, with a 15% discount off regular price, offered by OC Transpo in Ottawa and Translink in Vancouver;
- Transit fare discounts offered to employees by the Toronto Transit Commission, GO Transit, York Region, Town of Richmond Hill and Town of Newmarket;

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- One month free transit provided to car commuters by the Agence Métropolitaine de Transport in Montreal; and
- A York Region/Smart Commute Association pilot project to provide discounted transit passes through private sector employers.

Key Implementation Issues

Commuter incentives are best implemented as part of a comprehensive TDM strategy, because they will not be effective in getting employees to change travel modes if alternative modes are not readily accessible.

Most incentive programs must be implemented through employers, but some employers resist implementation due to:

- A lack of familiarity with TDM measures and the role that incentives can play in their effective implementation;
- Costs of providing/administering the incentives;
- A lack of readily apparent short term financial benefits for the employer;
- Administrative barriers, for example, inclusion of free parking as a defined benefit in a collective agreement; and
- A perceived potential for abuse by employees (e.g. taking a parking cash out while still driving to work, but parking off site).

A key financial benefit to employers of the travel reductions that incentives can produce is the ability to reduce the size/cost of parking facilities. Some employers cannot realize this benefit if they already have an ample supply of free parking and there are no opportunities to lease surplus spaces to others. In the construction of new facilities, developers may be unwilling to build a reduced parking supply because this is perceived as a restriction on the future marketability of the property. Minimum parking requirements enforced by municipal governments can also be a barrier to realizing this benefit.

As noted above, current tax policies are also a barrier to implementing commuter incentives.

Co-Benefits

In addition to their ability to reduce business-related vehicle-kilometres of travel, commuter incentives can:

- Reduce parking demand and employers' parking costs;
- Improve employee recruitment, retention and morale;
- Lower employees' costs of commuting;

- Improve fairness and equity by providing non-drivers with a benefit comparable in value to the parking benefit received by motorists.

Conclusions

Commuter incentives have been proven to provide an advantage in the implementation of TDM programs by enhancing the effectiveness of other TDM measures, but there are no examples of large-scale implementation in the Greater Toronto Area. The current tax environment and the other implementation issues noted above, are a distinct disadvantage to the implementation of commuter incentives. As a result, their adoption by Durham Region and area businesses may be slow. Governments are beginning to recognize the policy barriers to encouraging the use of alternative travel modes and can be expected to remove them eventually.

Given current trends and practices in urban areas across Canada, commuter incentives are likely to be implemented in Durham Region over the long term. However, the Canadian experience to date indicates that they can be expected to form a relatively minor part of an overall TDM program in the Region. As such, commuter incentives are expected to have a limited impact of region-wide vehicle travel for the foreseeable future.

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Transit-Oriented Development

Overview

Transit oriented development (TOD) is designed to maximize the potential for travel by public transit and other alternative travel modes. Typical features include:

- Location along a major transit route and/or near a higher order transit station, which provides frequent, high quality transit service;
- Sized to maintain a maximum five minute walk from a transit stop, or up to a ten minute walk from a higher order transit station;
- Higher densities than conventional development, with highest densities adjacent to transit nodes and corridors, to concentrate potential transit users near transit service;
- Mix of residential and commercial uses;
- Streets designed to provide good connectivity, low vehicle operating speeds and an attractive pedestrian environment; and
- Reduced parking supply, compared to similar conventional development, due to reduced automobile use.

Policy Environment

In 1992, the Ministry of Transportation and Ministry Municipal Affairs (now Municipal Affairs and Housing) jointly developed guidelines for transit supportive land use planning that reflected the TOD features noted above. Current Ontario provincial government policies are also supportive of the principles of TOD, including more compact development forms, mixed use development, intensification/redevelopment of existing developed areas and directing development to areas that are, or can be, served by transit. These policies have been enacted in the Ministry of Municipal Affairs and Housing's *Provincial Policy Statement (PPS)*, which provides direction on matters of provincial interest related to land use planning and development. They are also reflected in the Ministry of Public Infrastructure Renewal document *Places to Grow – Proposed Growth Plan for the Greater Golden Horseshoe*.

The provincial policies are generally reflected in the Regional and local planning documents that guide and regulate development. For example, the Durham Region Official Plan includes policies requiring increased densities, intensification in existing developed areas and mixed use development, with a focus of this development along arterial roads and around transit stations. The Region's Transportation Master Plan recommends TOD principles in support of the recommended transit priority network, with a focus on the five recommended major transit corridors and 13 transportation centres in the Region's urban areas.

While municipal planning policies generally reflect the provincial and Regional requirements with respect to TOD principles, actual results have been mixed. Greenfield

development still dominates new construction in the Region of Durham. Densities in these developments have increased over time, but developers have not always been building to the maximum densities permitted. Efforts to intensify development in the existing urban areas have generally met with significant opposition from developers and residents; the resulting applications for Official Plan amendments and zoning changes are often successful.

Some municipal development requirements contradict the overall policy support for TOD. Examples include parking supply requirements based on auto-dominated development patterns and building set-back requirements that are not consistent with a pedestrian and transit-oriented streetscape.

Quantification

The focus of TOD is reducing the number of vehicle trips generated by a development by diverting travel demand to transit. Because of the compact, mixed use nature of a TOD, vehicular travel is also reduced by increases in walking and cycling. In well-planned TOD, with an appropriately high level of transit service, overall vehicle travel can be reduced by approximately 20-25%. The impact of this reduction on overall, regional vehicle travel will depend on the proportion of population and employment growth that occurs in TODs.

Practice of Others

There is a long history of TOD in North America, beginning with the development of suburban communities along radial suburban railway lines in the early 20th century. TOD fell out of favour through the mid-20th century, when suburban development was designed around the private automobile, but it is being widely applied once more to address increasing traffic congestion.

There are numerous examples of planned and recently-built TODs throughout North America. Some Canadian examples include:

- Village de la Gare, Mont-Saint-Hilaire, QC – planned 1000 residential units, with related commercial and institutional land uses, all located within an approximate 10-minute walk to a commuter rail station with service to Montreal; currently under development;
- Regional town centres, Vancouver, BC – series of high density, mixed use community centres that have been developed around SkyTrain transit stations;
- Fort Road Old Town redevelopment, Edmonton, AB – mixed use development, approved and under design by the City of Edmonton, to accommodate up to 1500 residents near the Belvedere LRT station; pilot project for development near other at-grade LRT stations; and
- City of Toronto Official Plan – new city-wide Official Plan directs future growth to corridors and centres focussed on transit routes and stations.

Key Implementation Issues

Although the current policy environment is supportive of TOD, there are significant barriers to its successful implementation in the eastern GTA. These include:

- Large areas of existing low density residential development and dispersed centres of employment, which do not support efficient, effective or attractive transit service;
- A general lack of high quality, high frequency transit service;
- A lack of pedestrian and cyclist facilities;
- Opposition to intensification proposals from existing area residents, often with local political support;
- Existing fragmented land ownership along key transit corridors, which makes intensification difficult or infeasible;
- The requirement for the development industry to change existing building and marketing practices; and
- Existing municipal Official Plan designations and zoning bylaws that discourage or do not permit transit oriented forms of development. An example of this is minimum parking supply and building set-back requirements that are excessive and counter-productive in a TOD.

Co-Benefits

In addition to the travel benefits noted above, successful transit oriented developments are generally perceived to be more attractive and “liveable” than conventional suburban developments. As a result, they are often more marketable, providing an incentive for developers to build them, and generate higher property tax revenues than conventional development. The additional tax revenue can be used to fund infrastructure and transit service improvements required to support the developments. Because of their location near major transit nodes and corridors, often in older, underdeveloped areas, TODs can serve as a catalyst for urban renewal.

Since TOD is a more compact form of development, it results in lower land consumption than would be required for the same population in conventional development, consistent with Smart Growth principles. The combination of compact development with mixed uses and a variety of transportation options increases basic mobility for TOD residents.

Conclusions

TOD provides significant advantages over conventional development, including reduced vehicle travel, reduced land consumption and support for the development of higher order transit services. Current planning policies at all levels of government support development of TODs. As with Smart Growth, the major disadvantage of TOD is that implementation is a slow process. Although TODs are a critical element of travel demand management and the promotion of transit region-wide, they can be expected to

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represent a small proportion of the overall developed area for many years to come. Vehicle travel reductions within TODs can be substantial, in the range of 20-25%, but the overall region-wide vehicle travel reduction attributable to TODs will be much less due to the small proportion of Durham Region's urban area that will be developed in this way.

The transit demand increases that are expected to occur with TOD in Durham Region are already accounted for in the travel demand forecasts based on the Region's growth plan. As a result, no further reductions in vehicle travel should be applied to these projections as a result of TOD.

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Smart Growth

Overview

Smart Growth is a term applied to land use planning policies and processes that encourage accommodation of population and employment growth through compact, mixed-use and higher density development within existing urban areas, rather than through low density, auto-dominated development on greenfield sites surrounding urban areas. Typical characteristics of Smart Growth development include:

- Compact development forms, typically based on neighbourhoods with residential land uses around a commercial/institutional mixed use core area, all within reasonable walking distance;
- Mixed use development, including, for example, residential units above small commercial uses;
- Intensification of existing urban areas through infill developments, brownfield development and redevelopment of existing low density land uses;
- Smaller buildings, blocks and roads than in conventional auto-oriented development – “human scale” design;
- Highly connected street/sidewalk/path systems, allowing relatively direct travel by motorized and non-motorized modes;
- Transportation and land use patterns that support and encourage the use of a variety of transportation modes, including walking, cycling and transit;
- Attractive streetscapes, to encourage pedestrian activity;
- Streets designed to control vehicle speeds, including features such as roundabouts, reduced lane widths, on-street parking and physical traffic calming measures; and
- Integration of land use and transportation planning, with coordination among all affected jurisdictions and stakeholders.

As can be seen from this list, Smart Growth encompasses a wide range of changes to conventional development patterns and processes. The combined effects of the application of multiple Smart Growth principles can produce significant reductions in vehicle travel demand compared to conventional development, as well as substantial environmental benefits. The more of the principles that are applied, the greater the benefits.

Policy Environment

Ontario provincial government policies are supportive of the principles of Smart Growth, including more compact development forms, mixed use development, intensification/redevelopment of existing developed areas and directing development to areas that are, or can be, served by transit. These policies have been enacted in the Ministry of Municipal Affairs and Housing’s *Provincial Policy Statement* (PPS), which

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provides direction on matters of provincial interest related to land use planning and development. They are also reflected in the Ministry of Public Infrastructure Renewal document *Places to Grow – Proposed Growth Plan for the Greater Golden Horseshoe*.

The provincial policies are generally reflected in the Regional and local planning documents that guide and regulate development. For example, the Durham Region Official Plan includes policies requiring increased densities, intensification in existing developed areas and mixed use development, with a focus on this development being located along arterial roads and around transit stations.

Municipal planning policies generally reflect the provincial and Regional requirements with respect to Smart Growth principles, but actual implementation of Smart Growth to date has been very limited. An assessment of Smart growth implementation in six urban areas of Canada, completed for CMHC in 2005, found that generally little change in development patterns has occurred. For the suburban Toronto area, the study found that:

- Single-family, detached housing on greenfield sites still dominates residential development;
- Development densities have increased, but primarily due to lot sizes becoming smaller as land costs increase;
- Transit is not integrated with development planning, and transit services are not extended as developments are built;
- Employment nodes remain low density and auto-dominated; and
- Intensification of existing developed areas is not occurring (with a few exceptions).

The reasons identified for this lack of success include:

- The lack of enforceable overall growth management and transportation master plans for the GTA, and a lack of enforcement of Regional Official Plan policies at the time of the municipal development approval process;
- Continued high market demand for single-family housing;
- Continued availability of land for greenfield development;
- Administrative barriers to innovative development forms, including minimum requirements for building set-backs, road rights-of-way and parking supply;
- Opposition of existing residents to infill and intensification in existing developed areas; and
- Development charges structured so as to favour conventional low density development and not recognize the servicing cost savings that can be realized through Smart Growth.

The study also found that where individual Smart Growth developments have been built, auto use remains at high levels due to a lack of high quality transit service and isolation of these neighbourhoods from major employment and shopping destinations.

Quantification

Smart Growth reduces the demand for vehicle travel through reductions in average trip lengths and shifting travel modes, particularly transit and non-motorized modes. Its effectiveness varies depending on a variety of factors, such as the extent to which Smart Growth principles are applied, the area over which they are applied, the nature of the surrounding area and the availability of high quality transit service.

Research in the United States indicates that the individual elements of Smart Growth design can produce vehicle travel reductions of between 5% and 20%. Infill developments in various American urban centres have been found to generate between 14% and 52 % fewer vehicle trips per capita than comparable greenfield developments. With full implementation of a comprehensive Smart Growth strategy, projected per capita vehicle travel demands are 20-40% lower than comparable conventional greenfield development. Given the existing large areas of auto-oriented development in the eastern GTA suburbs and current development trends, trip reductions at the lower end of this range appear to be a reasonable average expectation for Smart Growth developments for the foreseeable future.

Practice of Others

Smart Growth has been adopted and applied throughout the United States, with varying degrees of coverage and success. Strategies include firm urban growth boundaries, alternative development standards, location-specific development charges (to reflect the lower cost of servicing Smart Growth developments), population/employment balance requirements and various financial incentives to developers and potential residents. Some states have enacted laws requiring new development to be done in accordance with Smart Growth principles. Municipal governments in the United States have significantly more authority than Canadian municipalities to implement, enforce and finance Smart Growth policies.

In Canada, the 2005 CMHC study found a lack of progress on Smart Growth in most of the six urban areas that were reviewed. Some progress was noted in Vancouver, where there has been considerable infill and intensification activity, in addition to greenfield development, even in suburban areas. This progress is attributed primarily to a lack of developable land and having a coordinated land use and transportation plan, the Liveable Region Strategic Plan, for all 21 municipalities (and one Electoral Area) in the Greater Vancouver Area, overseen by a single body, the Greater Vancouver Regional District (GVRD).

In the Toronto area, the CMHC study found little progress on Smart Growth in the suburban Regional Municipalities, but significant progress in the City of Toronto, with substantial infill, intensification and brownfield redevelopment activity. The primary driving force for this is the almost complete lack of land available for greenfield development. The availability of a high level of transit service in many areas of the city and the responsibility of a single tier government for all land use and transportation

planning decisions are also contributing factors. Market forces also play a role, as there is greater demand for smaller/higher density forms of housing in the City than in the suburbs.

Key Implementation Issues

Although existing land use planning policies at the provincial and municipal levels are supportive of Smart Growth, adoption of Smart Growth by the development industry has been slow in the suburban GTA. Recent changes to the Provincial Policy Statement and Planning Act should further encourage Smart Growth, but significant barriers remain to successful implementation. These include:

- Existing zoning regulations and development standards that prohibit elements of Smart Growth (e.g. mixed use development) or make it difficult to fully implement;
- Development charges that are biased in favour of low density development and restricted in their use for new transit services or travel demand management initiatives;
- Lack of high quality transit services and large areas of existing development that cannot be efficiently served by transit; and
- Lack of sufficient enforcement mechanisms to ensure implementation of appropriate urban design standards in new development;
- Lack of sufficient enforcement mechanisms to prevent undesirable changes in planned land use through the municipal development approvals process, including deletion of designated areas of mixed-use and higher density in residential areas and rezoning of employment lands to residential; and
- Strong opposition to intensification and infill development by existing area residents.

Most of these barriers can largely be addressed through government action. To overcome barriers such as market demand and public opposition will require significant public education and marketing efforts. Successful implementation of Smart Growth will also require the development industry to change current practices, including marketing that focuses on the traditional suburban, single-family home. Implementing the required changes will be a gradual process, taking many years to complete, but the pace of change should accelerate over time as greenfield development sites within the designated urban areas are exhausted.

Co-Benefits

A wide range of non-transportation benefits can be expected through application of Smart Growth principles. These include:

- More efficient use of developable land, with reduced land costs and environmental impacts;
- Reduced costs for the construction and operation of municipal services;

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- Increased physical activity levels among residents;
- Improved productivity for local businesses, which can improve economic development;
- Enhanced sense of community and liveability, which can increase the area's attractiveness and property values while decreasing crime.
- Reduced travel costs for residents; and
- Improved mobility for residents with low incomes or physical disabilities.

Conclusions

Smart Growth has multiple advantages, including reducing travel demand, increasing use of alternative travel modes and reducing the land consumption and environmental impacts of development. Current provincial and municipal land use policies support the implementation of Smart Growth principles to accommodate planned population and employment growth. However, to date, actual implementation of Smart Growth to new development in suburban areas of the GTA has lagged well behind the planning policies due to market forces, as well as administrative barriers such as zoning bylaws, parking requirements and the structure of development charges. Increasing application of Smart Growth in the suburban GTA can be expected in the future as a result of the existing planning policy context, combined with a shrinking supply of developable land, reduction of existing administrative barriers and increasing awareness of the environmental and transportation impacts of conventional suburban development.

As a result, the vehicle trip generation attributable to planned population and employment growth should gradually decrease over time in comparison to the trip generation rates of existing developed areas in the suburban GTA. The main disadvantage of Smart Growth is that it is a very long-term strategy. The impacts on overall vehicle travel will be small until significant new Smart Growth development and redevelopment of existing developed areas occur. Given the extent of existing development in Durham Region, including developments currently approved or under construction, significant impacts on regional travel demand are unlikely to be realized for at least 20 years.

With broad implementation of Smart Growth across the GTA, well beyond the 20 year horizon, travel reductions in the order of 20% could be realized, compared to conventional greenfield development with the same population and employment. These travel reductions would apply only the areas developed according to Smart Growth principles, and represent a combination of reduced number of trips, shorter average trip length and increased use of alternative travel modes.

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Travel Demand Management

Overview

Travel Demand Management measures are intended to maximize the people-carrying capacity of the transportation system by influencing factors that drive demand, independent of road network improvements or other transportation supply measures. The overall objective of TDM is to reduce the demand for peak period automobile travel by: reducing the demand for travel by single-occupant auto; reducing the average length of commute trips; encouraging people to make fewer trips; and shifting travel demand into off-peak periods.

TDM encompasses a wide range of potential measures, ranging from financial incentives/disincentives to changes in development patterns. Seven TDM measures have been identified as potentially applicable in Durham Region and have been assessed to determine their potential effects on peak period travel demand in the Region. These measures are:

- **Smart Growth** – changes in land-use planning to encourage increased density and mixed-use development, to reduce overall travel demand and average trip lengths while facilitating the use of alternative travel modes;
- **Transit-oriented development** – a subset of Smart Growth policies that focus higher density and mixed use development around transit stations and along major transit corridors to increase transit demand and the efficiency/effectiveness of transit service;
- **Ridesharing** – a range of measures to encourage carpooling and vanpooling in order to increase the average occupancy of vehicles on the road network during peak periods;
- **Walking/Cycling** – provision of bike lanes, paths, support facilities and other incentives to encourage increased use of non-vehicular travel modes, particularly for short trips;
- **Telecommuting** – application of communications technology to allow employees to work from home some days of the week;
- **Road pricing** – charging motorists for use of transportation facilities according to congestion levels, to discourage travel during peak periods, by using variable toll rates, central area tolls, high-occupancy/toll (HOT) lanes and variable parking charges; and
- **Commuter incentives** – a range of financial incentives to encourage use of alternative travel modes, including employer transit subsidies, cash in lieu of parking for non-drivers, etc.

The potential for auto trip reductions through transit improvements has been assessed separately.

Quantification of Travel Demand Management Results

The transit mode shares used in the travel demand forecasting process represent significantly increased transit use, relative to existing travel characteristics in Durham Region. Inherent in the assumption of these mode splits is an assumption that transit service improvements and transportation demand management (TDM) measures, such as financial incentives and transit-oriented development, are implemented.

TDM-related auto trip reductions, beyond those attributable to increased transit use, can be anticipated due to increases in the use of alternative travel modes, particularly ridesharing, telecommuting, walking and cycling. Additional auto trip reductions may be realized through reductions in the average home-work trip length that are expected to occur with implementation of Smart Growth, particularly an increase in the proportion of internal trips within each neighbourhood (or traffic zone, for modelling purposes).

Estimates of these effects of TDM have been made on the basis of research into each of the TDM measures, which reflects prior experience in North America. Using professional judgement, the research results have been applied to Durham Region in consideration of the existing and planned land use and transportation characteristics of the Region. The potential for variations in auto trip reduction by trip length and for phasing in of trip reductions over time have also been estimated. The results are summarized in **Table 1**.

Table 1 - Summary of TDM Auto Trip Reduction Potential (Exclusive of Transit)

TDM Measure	Short Trips			Long Trips		
	2011	2021	2031	2011	2021	2031
Smart Growth (internalization effect only)	-	1%	2.5%	-	1%	2.5%
Transit-Oriented Development	Included in assumed transit mode share increases.					
Ridesharing (numbers reflect potential for overlap with transit)	1%	2%	2%	2%	3%	3%
Walking/Cycling (except winter)	2%	4%	5%	-	-	-
Telecommuting	-	0.5%	0.5%	1%	1%	1.5%
Road Pricing	No significant effect expected under current policy regime.					
Commuter Incentives	Included in effects of other TDM measures & assumed transit mode share increases.					

The auto trip reduction for each TDM measure was applied independently in the travel demand forecasting process. This allowed each measure's applicability to specific trip lengths to be taken into account. For example, walking/cycling is generally applicable only to "short trips" of less than 10 km, while the "short trip" cut-off for ridesharing was assumed to be 10 km due to an increased potential for cost and time savings for trips of

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greater length. This process is a simplification of the complex commuter trip-making and mode selection decisions that would occur in reality, but it is considered to provide a reasonable approximation of the effects that TDM can be expected to have in the future.

When the auto trip reductions in **Table 1** are applied in the travel demand forecasting process, they produce an overall reduction of 3% in peak period auto demand in 2011, increasing to 6% by 2021 and 8% by 2031. These reductions reflect the combined effects of the various TDM measures on the range of trip lengths and do not include increased transit use. When assumed increases in transit mode share are included, the overall reductions in peak period auto travel demand are 10.5% in 2011, 13.8% in 2021 and 15.7% in 2031.