Where do rural seniors fit in traditional travel demand modelling practice?

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1 Introduction

Travel demand modelling is an integral component of the urban transportation planning process and the primary aim is forecasting the ability of infrastructure to accommodate future traffic growth. Only a few jurisdictions are recognizing the value of activity-based models which incorporate demographic and other information to understand how activity can impact transportation, and vice-versa. Seniors (65 years and older) are a prime demographic group for inclusion in activity-based models because of a combination of population growth, need for transportation, and conditions that can often affect personal mobility.

Often overlooked is the use of travel demand modelling to assist in rural transportation planning processes. In some Canadian provinces, approximately 50% of the population lives in rural areas, and because traffic congestion is rarely a concern for rural areas, modelling for infrastructure capacity purposes is likely considered unnecessary. However, by 2031 the senior population in Canada will double to over 9 million and represent 23% of the total population (Statistics Canada, 2007). This will undoubtedly have impacts on the urban and rural transportation systems, yet by virtue of not employing activity-based models, very few jurisdictions appear able to understand and to quantify these impacts.

This paper discusses the origins of travel demand modelling and explores whether traditional forecasting efforts for rural jurisdictions in Canada are sufficient to address expected demographic changes, such as the growth in the over 65 population. It presents the state of the practice of travel demand modelling by transportation departments in provinces and cities across Canada to understand the potential for using this tool to understand the impacts of the demographic changes. It then compares Canadian practice to that of the United States. Conclusions and recommendations are made regarding the necessary next steps to ensure seniors retain access to transportation even if they cannot drive.

2 Background

Travel demand modelling (or forecasting) is "an exercise used to determine future travel patterns under given or hypothetical conditions…to plan the provision of public transport services or the need to build or expand road or rail networks" (Lowe, 2002). The simplest method of forecasting is regression analysis, which takes historic traffic counts and projects them forward to determine a growth rate and potential volumes in the future. The challenge in the United States following the Federal Aid Highway Act in 1944 was that metropolitan areas lacked these historic data to assist with facility planning (Weiner, 1999). By conducting origin-destination surveys, it was possible to estimate the demand on transportation routes, consequently, the infrastructure needed to support this demand.

While the projection of future volumes for existing routes based on regression was appropriate, the rapid growth in population and need for infrastructure during the baby

boom of the late 1940's-1960's required more sophisticated methods for understanding the capacity needs of new routes. Over time, two approaches were developed: one which focused on estimating travel demand through the generation of "trips" between zones (traditional four step modelling); the other through estimation of individual activities and the corresponding travel to connect these activities. Pas (1996) pointed to Oi and Shuldiner (1962) as the first to articulate that travel is a derived demand, laying the foundation for activity-based approaches. The traditional four-step method remains the primary modelling approach in transportation practice today.

2.1 Traditional vs. Activity-based modelling

The primary criticism of the traditional four-step method has been the lack of consideration and understanding of why people travel, and this criticism took shape soon after the widespread adoption of this method. At the core of the argument for an alternative to traditional four-step modelling has been the need to understand what is behind the reasons for travel to truly understand the impact that policy decisions will have on transportation demand. The traditional four-step is an aggregate approach to determining demand, however "aggregate behavior is the result of individual decisions" (Ben-Akiva and Lerman, 1985). It is the context of "individual decisions" that advances to the traditional four-step method have been sought.

Researchers such as Vovsha and Bradley (2006) Miller, *et al.,* (2005) and Bhat and Koppleman (2002) discuss at length the need to refine traditional models to advanced activity-based models. The major challenge with activity approaches is the necessity for copious amounts of travel data, but this effort is considered warranted by proponents. It is likely that the activity-based method is gaining momentum among researchers today because of the recognition that in the future, it may be just as, if not more, important to understand how "people" use transportation, instead of how their "vehicles" use transportation.

2.2 The case for travel demand modelling of seniors

Goulias, *et al., (*2007) recognized that the aging baby boomer demographic are now becoming seniors and may result in changing transportation behaviour as a function of personal and household changes associated with aging, such as retirement. This reflects the concern in the literature that the transportation systems originally planned to support the growth of this cohort may be inadequate for the aging population. Population projection estimates indicate that by 2031, the number of Canadians aged 65 years and older will double to over 9 million and represent 23% of the total population (Statistics Canada, 2007). This is a substantial segment of the population, and as indicated by Goulias, *et al.,* there will be need to update regional transportation models to understand the impact of this growth on the system.

The need to understand this impact of senior drivers on the transportation system (and the impact of the system on senior drivers) is due to realities of the aging process. This affects everyone at different rates and degrees, and can compromise driving ability and personal mobility. For many, this means reduced reaction times, vision and hearing difficulties, and mobility restrictions. This can make driving an automobile difficult, or in

some instances, dangerous to others, yet the automobile remains the only alternative for most Canadians, and nearly all rural residents. Hildebrand and Myrick (2001) report that the collision rate for rural older drivers are particularly high because the lack of driving alternatives leads these drivers to retain their licences longer than their urban counterparts.

Rosenbloom and Morris (1998) point out there are two main research issues in transportation for senior drivers:

- What are the long-term safety implications of the growing number of senior drivers?
- To what extent can older people meet their own transportation needs over the two decades most will live beyond retirement?

This leads to additional questions: if transportation planning practice has contributed to this situation, can it resolve this situation? Should not greater efforts be made to better understand this issue and plan for the future through the use of these tools? If travel demand modelling is not the right tool to understand this, then what is?

The tools available to transportation planners, such as travel demand modelling, are used "to match transportation supply with travel demand, which represents the need for transportation infrastructure" (Chatterjee and Venigalla, 2003). Goulias, *et al.,* discuss the limitations of the traditional four-step model in the context of modelling the travel needs of seniors and recommend that activity-based models (using destination choice) should replace them for modelling seniors. Hildebrand (1999) demonstrated the applicability of an activity-based approach to model the travel needs of seniors.

Assuming that a jurisdiction decided today to proceed with activity-based modelling for policy analysis, results from this effort would be years away. For example, the Atlanta Regional Commission (ARC) has been working to incorporate activity and tour based modelling into their traditional modelling efforts since 2001 and seven years later is in the experimental stage (Rousseau, 2008). It is clear from the literature that it is primarily researchers that extol the virtues of transportation planning and forecasting efforts that reflect changing demographics. While the researchers are making strong cases, the practitioners in many smaller jurisdictions are not applying this research on any meaningful scale. The Transportation Research Board (TRB) reports that only 20 percent of small and medium are looking at replacing their existing model with an activity- or tour-based model TRB (2007). Given that state of activity-based modelling at the urban practitioner level is very limited, it is unlikely that the adoption in rural areas will happen in the foreseeable future.

2.3 Rural areas: "Last Frontier" of transportation planning

In many ways, rural areas are the "last frontier" of transportation planning, and also where the greatest need for motorized transportation access exists. Ripplinger (2006) reports that in the predominately rural state of North Dakota in the United States, "the number of households without vehicles…is small compared with other parts of the

nation, because of the need for mobility in rural areas". This is likely true of most rural North American jurisdictions. The difficulty in applying travel demand modelling to rural areas (or in jurisdictions that are primarily rural but have urban centres) is two fold. First, the data to supply activity-based models can be non-existent, and likely there is little data to modify traditional models to suit local conditions (defaulting to the defaults). Second, it is not likely that that the effort is considered necessary by practitioners since rural and low-density congestion is rare or exclusive to the brief peak periods (in comparison with metropolitan areas). Painter, *et al.*, (2007) bring up the additional issue of applying existing transportation methods where established empirical relationships, such as using the proportion of road use to county area as an indicator of demand, do not work in the rural areas.

2.4 Rural seniors: Few alternatives to driving

Turcotte (Statistics Canada, 2006) highlights the transportation challenges facing the many rural seniors in Canada:

> *"Compared with seniors living in urban areas (especially those in the most densely populated neighbourhoods of census metropolitan areas), seniors in rural areas are much less likely to have access to public transport. While proportionally more rural seniors owned a vehicle and were able to drive it, they more often found themselves in a vulnerable position regarding mobility."*

Turcotte presents information for all of Canada (urban and rural combined) and the data show high reliance on private automobiles and little use of transit. Turcotte found that 71% of seniors in Canada owned a vehicle and a valid driver's licence, 9% did not have a valid driver's licence but did have access to a household vehicle as a passenger; 14% did not have access to a vehicle but did have access to public transit; and 6 % had access to neither a household vehicle nor public transit. There are also marked differences between men and women, with 66% of men over the age of 85 with access to a vehicle and having a driver's license, compared to only 33% of women.

Rural seniors are often very dependent on their automobiles and many are dependent of the automobiles of others. Stamatiadis, *et al.* (1996) studied the non-urban elderly in Kentucky, USA and found participants completed 85% of their trips using an automobile. They also state that 40% of the non-urban elderly surveyed do not drive and are dependent on others. Often rural transit or "senior buses" are promoted as solutions, yet, as discussed by Kihl (1992), these systems are frequently underutilized. Hanson's (2009) review of accessible systems in rural New Brunswick also found many systems were underutilized, and many were not "systems" at all, rather one vehicle available for community use.

2.5 Summary

The following summary points have been gleaned from the literature review:

- Canada's population is aging
- Driving performance declines as one ages (though this rate of decline depends on the individual);

- Many of Canada's provinces have a significant rural population;
- Many older rural residents are in a vulnerable position regarding mobility since driving is often the only alternative;
- Researchers indicate the travel needs of seniors can be better understood through activity-based modelling which can contribute to identifying alternatives;
- Rural jurisdictions are generally not in a position to conduct activity-based modelling;
- Consequently, the transportation needs of rural seniors are not fully understood which hinders the development of driving alternatives.

3 Current state of the practice in selected jurisdictions

The exploration of the current state of the practice in selected jurisdictions provides insight into the ability of these jurisdictions to work towards activity-based models, and more fundamentally, their ability to plan for the growth in senior drivers. Jurisdictions employing traffic extrapolation and/or traditional four-step models are likely more infrastructure-focused, and it is unlikely that the impacts of senior drivers on the transportation system (and vice versa) could be considered. Jurisdiction employing activity-based models, and/or collecting demographic information in their origin/destination surveys, are far more likely to be a position to use these tools for policy analysis.

The vast majority of practitioners of passenger travel demand modelling is either in the public sector, or performs work for public agencies. Public agencies include provincial/state transportation agencies, public transit, and municipalities/regional governments.

3.1 State of the practice in selected Canadian jurisdictions

Canada's federal transportation agency, Transport Canada, maintains cost-shared agreements with Canadian provinces to assist with highway construction of national significance. One such agreement in 2004, called the "Transportation Planning and Modal Integration Initiative" allocated $5 million to worthy projects in the passenger and freight domain (Transport Canada, 2008). Two activity model development projects were identified for Toronto and Calgary, and only one provincial agency, Ontario (MTO), applied for cost-shared funding for model development within the Greater Toronto Area. The lack of uptake by smaller urban centres and other provincial agencies suggests that that provincial and municipal entities across Canada are satisfied with their modelling efforts, or do not see a need to model for purposes other than infrastructure management. Informal interviews with selected Canadian provinces and municipalities suggests the latter is true and that many are at similar modelling levels as many U.S. states, that is, regression or extrapolation-based for road traffic forecasting. At the same time, the gap between the modelling efforts of urban and rural transportation authorities appears to be growing in both countries.

3.1.1 New Brunswick

New Brunswick Department of Transportation (NBDOT, 2008)

The New Brunswick Department of Transportation (NBDOT) maintains over 18,000 km of roadways, from rural roads to multilane highways. Over 70% of the provincial network consists of rural roads (NBDOT, 2007). Future traffic volumes are extrapolated from historic volumes to assist with determining level of service and maintenance considerations. NBDOT collects, classifies and adjusts traffic data (seasonal, daily) from various temporary and permanent counters throughout the province. While not undertaking travel demand modelling as an agency, NBDOT provides data to those who need it to assist with their modelling efforts (NBDOT, 2008a). Typically this would be for the impacts of provincial highway traffic in a municipality.

Municipalities in New Brunswick

The City of Fredericton uses QRS II as its travel demand model software, which was last updated in 2000 with a new update planned for 2008. It is a four-step traditional travel demand model (City of Fredericton, 2008). The cities of Saint John and Moncton have also used QRS II. In terms of data collection, models are built on employment and household data for Statistics Canada enumeration areas, and have included origin-destination studies based on one day of previous travel, collected through telephone surveys (Holyoke, 2008).

3.1.2 Nova Scotia

Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR, 2008)

The Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) does not often employ travel demand modelling for the provincial highway network, rather employing extrapolation of past volumes to determine future volumes on the rural highways. It has not completed a network study as modelling efforts are generally focused on site specific projects, such as impact studies, and employs QRS II. NSTIR has been working with the Halifax Regional Municipality on a corridor study relating to one of the major highways travelling into the city.

Halifax Regional Municipality (HRM, 2008)

The Halifax Regional Municipality (HRM) actively employs QRS II for travel demand modelling. The decision to use QRS II was predicated on two things: the original development of QRS II models by the Nova Scotia provincial government in the Halifax area; the low cost ($500) of QRS II when compared to other modelling software such as TransCAD ($9,995 USD) (Caliper, 2008). HRM does not undertake origin-destination studies, rather relying on census data to determine trip generation by zone. Generally, the QRS II defaults are used as demographic information is not collected due to various resource constraints. Traditional trip generation values, as outlined by the Institute of Transportation Engineers (ITE) are employed since other local values are not readily available.

3.1.3 Prince Edward Island

Prince Edward Island Department of Transportation and Public Works (PEIDOT&PW, 2008)

The Prince Edward Island Department of Transportation and Public Works (PEIDOT&PW) occasionally participates in travel demand modelling as part of site specific transportation studies. In 2001 the province and the City of Charlottetown jointly employed a consultant to complete a Charlottetown Area Transportation Study, which utilized a QRS II model to evaluate future transportation conditions and issues. Following this, QRS II and Synchro were used to evaluate specific projects, but never found widespread adoption due to staffing constraints and other priorities. Currently, the consultant hired to perform a transportation study of the Trans Canada Highway in the greater Charlottetown area is employing VISUM/VISSIM to forecast future patterns.

3.1.4 Quebec

Ministère des transports du Quebec (MTQ, 2008)

The Ministère des transports du Quebec (MTQ) performs all its travel demand modelling in-house using EMME software. It conducts origin-destination (O-D) surveys for each urban area to develop models for road and transit. These O-D surveys are based on telephone interviews that ask a household to detail all of the trips taken on the previous day (MTQ website, 2008). The data collected include: the origin and destination of each trip during the day covered by the survey, the reasons for travelling, transport modes used, and the time of day that was made the trip. Sociodemographic information is also collected.

Municipalities generally do not have their own models, therefore MTQ provides the modelling support. While transit agencies usually have their own models, MTQ works jointly with them in terms of identifying modal split. Montréal has just started to employ a new platform for dynamic roadway models called “Inro” and “Dynameq” microsimulation. Currently, 50% of the city is covered by this model.

MTQ does not do much for modelling in rural areas, instead modelling on a case-by-case basis. It assists with local O-D surveys for corridors and developed growth assumptions. MTQ has started developing a province-wide model of the major road system and is using Statscan data to build the trip data.

MTQ’s modelling efforts in urban areas do include demographic and gender attributes and takes a disaggregate approach to forecasting. It recognizes the importance of adjusting forecast factors by these attributes given the change in demographic to an older population, and the increasing participation of women in the workforce. The inclusion of demographic and gender factors is further supported by the expected change in the driving patterns of retired people, which will include both men and women that have been driving for their adult lives.

3.1.5 Ontario

Ontario Ministry of Transportation (MTO, 2008)

Information is collected every five years through the multiagency "Transportation Tomorrow Survey", which is a telephone survey of daily trip-making based on a 5% sample of population, resulting in nearly 140,000 interviews for the 2001 survey (Transportation Tomorrow, 2008). There are 21 participating agencies in the 2005/2006 survey, including municipalities, transit agencies, regional governments, and the provincial government. Information is collected on household attributes, personal attributes, and trip-making on the previous day.

The Ontario Ministry of Transportation (MTO) employs EMME software for its travel demand modelling. Models are focused on urban areas and corridors and are trip-based. MTO currently does not employ an activity-based approach. Anecdotally, MTO perceives some difference between the trip-making of seniors 65-74 years and seniors 75 years and up and is considering changing the current modelling of only 65 years and up.

While the approach is zone based, information is collected on the street address or building where people took their trips on the previous day. Conceivably, it would be possible to determine intrazonal movements if sufficient valid data of this type existed.

3.1.6 Manitoba

Manitoba Infrastructure and Transportation (MIT, 2008)

Manitoba does not have a travel demand model for the province. They do have permanent and program counts province-wide that are used for traffic growth projections. For site specific modelling projects, TransCAD is employed by the planning department. They often work with the City of Winnipeg, which already has a travel demand model, in areas where provincial and municipal routes overlap.

City of Winnipeg (City of Winnipeg, 2008)

Winnipeg employs traditional travel demand modelling, currently focusing on estimating motor vehicle demand. They used to model transit and may do so again in future modelling exercises. They recently completed a travel survey and are using it to update their four-step model. There is some consideration for inclusion of pedestrians and cyclists in future models. They did investigate activity-based approaches at one time, but did not have the resources to undertake the venture. Winnipeg is converting to TransCAD from EMME.

3.1.7 Alberta

Alberta Ministry of Transportation (Kilburn, 2008)

Alberta has a highway infrastructure modelling focus based on a projection of past traffic. They undertake trip generation and macroscopic modelling, with some microscopic modelling. They discontinued their UTPS model in 1995. Origin-destination data were

collected in roadside surveys, of which 130 were conducted in the 1980's. Alberta cities and regions also do transportation modelling. Edmonton and region, Calgary and region, and District of Rocky View all use EMME/2, while Lethbridge uses EMME/3. Red Deer is using VISSIM/VISUM, and Edmonton might move to this system as well.

Edmonton's model is based on Fall weekday travel, and is modeled for five times of day over 557 zones. There were 6600 households surveyed in 2005.

3.1.8 British Columbia

B.C. Ministry of Transportation (BCMOT, 2008)

The Ministry of Transportation (MOT) in B.C. does not undertake any provincial level modelling. It does not maintain any travel demand models or in-house expertise. If needed, consultants are retained. The MOT does have a permanent count and short count program. Future demand on the rural highway corridors is typically estimated based on future population forecasts, delineated by health areas.

Several municipalities make use of travel demand modelling. EMME/2 is used in Kelowna, Kamloops and Prince George, and regionally by the Greater Vancouver Regional District (Metro Vancouver). The Capital Regional District (Greater Victoria) employs TransCAD. The Vancouver model includes a separate truck model, with a goods movement survey currently under way.

3.1.9 Newfoundland & Labrador and Saskatchewan

Provincial transportation agencies in Newfoundland & Labrador and Saskatchewan do not generally undertake travel demand modelling as part of the normal planning process (NLTW, 2008, SK Highways, 2008). The main reason is likely that travel demand modelling is viewed as a congestion planning tool, therefore not considered applicable for the vast majority of the network under provincial jurisdiction.

3.2 State of modelling practice in the United States

In the United States (U.S.), transportation modelling is typically done by Metropolitan Planning Organizations (MPO's), the state government, or a combination of both. MPO's are required by the federal government for any urban area with a population over 50,000 (TRB, 2007). For small MPO's (50,000 – 200,000), 42% have the state develop the model and the forecasts, 28% develop the model while the state provides technical assistance, 8% develop model with no assistance, 7% have the state develop the model and the MPO develop the forecasts, and 15% of small MPO's do no modelling. Smaller MPO's tend to use fewer "trip purposes" and tend to employ Travel Analysis Zones (TAZ), and Gravity models. Only 25% of small MPO's use a mode-choice model, as compared to 90% for large MPO's (TRB, 2007).

At the MPO level, TRB (2007) indicates that only three of the 228 (out of 381) reporting MPO's are using activity-based travel models in practice: Columbus, Ohio; New York City; and San Francisco County. These agencies appear satisfied with the results. Eight other larger MPO's are in the process of designing and implementing these models:

Atlanta; Denver; San Francisco Bay Area; Dallas-Ft. Worth; Portland, Oregon; Sacramento; St. Louis; Tahoe (Lake Tahoe, California and Nevada). The remaining MPO's that do modelling employ traditional techniques.

At the state level, states considered the most "mature" are modelling at a macro level using the traditional urban approach, that is, with Traffic Analysis Zones (TAZ) and four-step models. Horowitz and Farmer (1999) conducted an informal survey of 45 of the 50 states to determine state of the practice with travel demand modelling. They found Michigan and Kentucky had the most mature statewide models. Michigan's model was similar to traditional four-step urban models, with TAZ corresponding to townships, but information for Canada and Mexico was also included. The survey indicated that many state transportation departments extrapolate historical data to forecast for future trends for highways (Minnesota and Wisconsin were two examples). In addition, local data were not available for some jurisdictions (Michigan and Kentucky), therefore national data were employed. Horowitz and Farmer conclude that there is a good understanding of what is needed for urban modelling, but due to "size, expense, and numerous required compromises, it is apparently not possible to build an all-round statewide model". They also highlight the different approach needed between urban modelling and statewide modelling, especially in the contest of trip purpose and recreation travel, and the need for better intercity modelling.

3.3 Canada – United States modelling comparisons

Many U.S. states and Canadian provinces are similar in terms of travel demand forecasting practice on the rural network, that is, extrapolated traffic volumes to focus on infrastructure maintenance and growth. Only a select few U.S. jurisdictions are employing activity-based models in practice and these are in large urban areas, not on a statewide basis. Quebec and Ontario appear to be the only Canadian provinces to be in a position to move beyond traditional modelling if so desired, as they seemed to be the only agencies soliciting demographic information in origin-destination studies.

Given the bulk of literature relating to transportation models, whether it is discussion of data needs, new algorithm development, or new model approaches, there is consensus that transportation modelling in the United States can still be improved. The MPO framework ensures that at minimum, metropolitan areas are actively planning and modelling, and efforts are not strictly municipality by municipality. State governments by default become the planners for the rural areas. In Canada, no such national mandate exists since highways fall under provincial jurisdiction.

Based on the literature from the U.S. and the interviews conducted with selected Canadian jurisdictions, it is unlikely that jurisdictions are employing the modelling tools necessary to understand and quantify what the growth in rural senior drivers will mean to their transportation system. In addition, no jurisdiction appears to be using the modelling tools (namely activity-based modelling) to understand the impacts of the transportation system on rural senior drivers.

4 Discussion and Conclusions

The reality facing many seniors (especially those in rural areas) is that there are very few realistic alternatives if they do not or are unable to drive. Transportation decision-makers inherently assume that the provision of a public highway network assures transportation access for the public, but this access is by no means secure. Access is available to those who are licensed, own a vehicle, can afford insurance, and feel competent enough in their driving abilities. In some provinces of Canada, at least half of the population lives in a rural area and roads and highways are the only way for this population to access necessary services. With a growing population (and proportion) of seniors in these rural areas, combined with the effects of aging, accessing the public highway system will be difficult for many. It is certain that a substantial segment of the Canadian public will be unable to safely use the transportation system their tax dollars supported. The breadth and scope of this segment, especially in the rural context, is not known.

Many transportation agencies are not equipped to move beyond the scope of infrastructure provision into mobility provision. They would likely argue that this is beyond their mandate of highway network provision. In that case, well-funded regional or provincial transportation "authorities" are needed that focus on service provision and transportation access. Many governments have policies that encourage suburban and rural area growth, and consequently, automobile ownership. It is no longer sufficient for governments to be concerned with only the vehicles using the system, but with how much (or how little) the public uses the system, especially if it is the only acceptable transportation option available. This performance measure is lacking, and will continue to do so as long as the data are lacking. Collecting data on the travel habits of rural senior drivers can lead to quantification and addressing of multiple issues:

- What will be the impact on public safety if unsafe drivers continue to drive?
- Is a formal rural transportation needed, or is an informal system satisfying needs?
- Does land use planning need to be revisited in light of changing demographics?

While research on senior drivers has continued to gain attention from a public safety point of view, research that would result in applied "senior-friendly" solutions by practitioners does not appear readily available. The responsibility lies with the transportation decision-makers. While progressive transportation systems exist world-wide, the North American transportation planning philosophy revolves around providing access to automobiles, not to their drivers. If it were, the transportation issues facing automobile-dependent seniors that have been discussed for over 30 years would have been incorporated into transportation and land use design principles. Instead, healthcare, education, social and even retail services and facilities continue to be subject to anachronistic planning methods that make them only accessible by automobile because that is only mode rural planners have to work with. This will not change unless policy decisions are made at the top to support a network of driving alternatives.

5 Recommendations and next steps

Given that government services, shopping centres, recreational activities, and even social opportunities are being centralizing (often without consideration of automobile alternatives), ensuring automobile access remains the most pressing need. The degree of need is not yet known. While promoting more automobile travel not a popular view given the global warming debate, the perceived and real lack of sustainability for rural alternatives suggests taking advantage of the capacity that already exists in the "system" as an intermediate measure until sustainable rural planning is achieved.

Another area generally overlooked in transportation surveys is the transportation support network for the shut-in elderly. Trips and activity are generated in support of this person's needs (people visiting, someone dropping off groceries) that do not actually result in this person travelling. This represents a very different approach to modelling, which is, determining the impact of the shut-in elderly on the transportation habits of other individuals. Considering Turcotte's survey showing Atlantic Canada had the highest rate of seniors who had neither automobile nor transit access (9%), and the comparatively high rural population of the region, there is merit in further researching this phenomenon.

Three modelling approaches relating to rural senior drivers are evident: The first is the understanding of their travel habits and the impacts of those habits on the safety of the urban and rural transportation systems they use (roads and highways); The second is how those urban and rural transportation systems impact their ability to meet their travel needs with an automobile; The third is an understanding of how government policy directions, aimed at enhancing public safety through senior-driver targeted programs, could impact the safety, well-being and activity making of rural senior drivers. When the anticipated demographic changes are considered, especially in the Canadian context, there are millions of people in rural areas that will face transportation uncertainty.

Activity-based modelling is viewed as the new approach towards enhancing the precision of models, but is hindered by lack of data to apply on large scale and by perceived and real complexities for agency deployment. It is considered to be very useful for modelling subgroups, such as seniors, in terms of potential implications of policy on safety and mobility.

Finally, there is a need for an institutional champion of transportation considerations for the rural seniors in Canadian jurisdictions. There appears to be gap in transportation planning at the regional and rural level that may leave those dependent on automobiles stranded if unable to drive. A comprehensive data collection effort is needed to truly understand this issue in the context of rural senior drivers.

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