

**SOCIALLY SUSTAINABLE INFRASTRUCTURE:  
INCORPORATING THE NEEDS OF THE AGING USER  
IN ROADWAY DESIGN AND UPGRADES**

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## **ABSTRACT**

Canadian data shows that, even while overall fatal and injury traffic collisions are decreasing, the involvement of aging road users in these serious collisions has grown in terms of both proportion and frequency. The increasing involvement of older road users reflects the increasing number of older persons in the population. The involvement of older persons in collisions can be expected to continue rising as the aging “baby boom” generation forms an increasing proportion of the driving and general populations, and insists on retaining their driving privileges.

To address this trend, road agencies may undertake a range of measures to meet the greater needs of aging road users, whose visual, physical, and cognitive abilities generally become increasingly limited with age. Meeting the needs of this growing segment of the population ensures that the transportation infrastructure is socially sustainable and satisfies the needs of all users.

This paper and presentation examine ways that an agency can respond to the challenge of maintaining safe mobility for its aging population. A number of agencies within and outside Canada have developed strategies and initiatives to meet the needs of their aging populations. While these strategies and initiatives consider a range of measures (engineering, education, licensing, and transit options), the focus of this paper is on engineering measures that can be implemented during the design of new or upgraded infrastructure, or during routine maintenance activities. The paper focuses in part on the initiative undertaken by the Alberta Motor Association to develop the *Traffic Safety Engineering Toolbox for Aging Road Users*. This Guide adapts and expands the group of measures identified in the US *Guidelines and Recommendations to Accommodate Older Drivers and Pedestrians* (Federal Highway Administration, 2001) to the Canadian/Albertan driving environment, and incorporates more recent research and best practices. The Alberta initiative can serve as a useful model for other Canadian jurisdictions needing to develop their own programs.

The paper/presentation is authored by the engineers from Opus International Consultants who developed the Alberta Guide and led workshops to introduce its content to representatives from a range of road agencies. This paper and presentation will be of interest to a wide range of conference attendees, who may increasingly need to accommodate aging populations through engineering improvements. Emphasis is placed on the potential to adopt engineering enhancements on a maintenance basis, so that upgrades to accommodate aging road users are continually and progressively implemented within ongoing maintenance budgets as the population ages.

## **Background**

The population of Canada, like that of the United States and Western Europe, includes an increasing proportion of the elderly. By the year 2026, one Canadian in five will have reached age 65, a two-thirds increase in proportion from 2001, when one out of every eight Canadians was aged 65 or older.<sup>i</sup> This trend of an aging population is expected to continue through at least the next three decades.

More than ever, these older citizens are maintaining an active lifestyle. From 2004 through 2006, a 6.1% increase in the number of licensed drivers aged 65 and older was reported, a higher growth rate than the rest of the driving population. Indeed, many older drivers are maintaining their licenses well into their eighties. According to a Statistics Canada report, approximately 50% of Canadian households headed by an “old-elderly” (age 85 or older) person still have a driver with a valid driver’s license. Most of these drivers are male, but this is expected to change with the baby-boomer population, which is thought to include more independent women (due to societal factors such as upbringing and marital status) who will attempt to retain their driver’s licenses.

This growth in older drivers was also reflected in their involvement in collisions. While total fatal and injury collisions are decreasing in Canada, the involvement of aging drivers in these serious collisions has grown in terms of both proportion and frequency.<sup>ii</sup> In 2006, the 65+ age group had the highest frequency of fatalities per year, accounting for 16% of fatalities while only fielding 13% of the licensed driver population.<sup>iii</sup>

The disproportionate involvement in collisions is due at least partially to age-related changes that can limit aging drivers. Reduced visual, cognitive and motor abilities that often come with aging can adversely affect the safety of this group. For instance, a reduction in peripheral vision (visual) combined with reduced range of motion (motor) and an increase in reaction time (cognitive) can turn a relatively benign driving manoeuvre – changing lanes, or yielding when exiting a right-turn channel – into something much more difficult.

With this in mind, road safety stakeholders have recognized the need to develop strategies and initiatives to meet the challenges of maintaining safe mobility for their

aging populations. In Canada, while the Road Safety Vision 2010 initiative calls for reductions in fatalities and serious injuries as one of its targets, older drivers are not singled out in the Vision.<sup>iv</sup> As a result, road safety stakeholders, in the absence of national initiatives or programs focused specifically on older road users, have adopted a more local approach. These strategies and initiatives typically consider a range of measures: engineering, education, licensing, transit options, etc. Engineering measures, both those implemented during the design of new or upgraded infrastructure and those enacted during routine maintenance activities, have gained significant traction in recent decades.

### **Literature and Agency Adoption in Canada**

A variety of literature on accommodating older road users through engineering measures is available, much of it based on research and initiatives in the United States. Perhaps the most widely-used North American document to date is the *Older Driver Highway Design Handbook*, published in 1998 by the Federal Highway Administration (FHWA). This guide aims to provide practitioners with literature that links older road user characteristics to highway design, operational and traffic engineering recommendations by addressing specific roadway features. The handbook's recommendations supplement existing standards and guidelines in the areas of highway geometry, operations, and traffic control devices, targeting both drivers and pedestrians.

An updated and expanded edition of the guide was published in 2001, the *Highway Design Handbook for Older Drivers and Pedestrians*. A companion piece, the *Guidelines and Recommendations to Accommodate Older Drivers and Pedestrians*, was released the same year. Both guides provided a range of enhancements for five roadway features: at-grade intersections, interchanges, curves and passing zones, work zones, and at-grade rail crossings. Each recommendation's relationship to existing standards (recommendation selects the most conservative design value, recommendation selects a preferred design value where a discrepancy exists, etc.) was noted. Updated editions of both FHWA guides are expected in 2010.

Another federal U.S. body, the National Cooperative Highway Research Program (NCHRP), has published the Report 500 series, technical guides associated with the AASHTO Strategic Highway Plan. *Volume 9: A Guide for Reducing Collisions Involving Older Drivers* (Transportation Review Board, 2004) contains enhancements for improving the roadway and driving environment to better accommodate the specific needs of older drivers. Eleven engineering countermeasures are detailed, including the provision of advance warning signs, the increase of size and letter height of roadway signs, off-set left-turn lanes at intersections, improved roadway delineation, and the reduction of intersection skew. Policy recommendations pertaining to medical boards, educational programs and licensing requirements are also included.

Other recent US-based publications include the NCHRP Synthesis 348, *Improving the Safety of Older Road Users: A Synthesis of Highway Practice* (2005) and *Planning Complete Streets for an Aging America* (AARP Public Policy Institute, 2009).

Domestically in Canada, a similar set of comprehensive national guidelines focused on the older road user does not exist. However, as mentioned previously, groups of road safety stakeholders have organised their own initiatives. In Alberta, the Canadian Automobile Association (CAA) affiliate, Alberta Motor Association (AMA), sponsored the preparation of the *Alberta Guide to Accommodate Aging Drivers* (2005), Canada's first guide with enhancements aimed at improving road and traffic control design for the aging driver population, and its update and expansion to include older pedestrians, the *Traffic Safety Engineering Toolbox for Aging Road Users* (2009). CAA has also published *Senior Drivers and Highway Design* (December 2008), a compilation of recent research surrounding the issue of older drivers. That publication cites the AMA *Alberta Guide to Accommodate Aging Drivers* as a strong starting point for Canadian jurisdictions interested in improving infrastructure for older drivers.

The purpose of the Alberta toolbox is to present a comprehensive list of current traffic engineering practices that benefit aging road users. The guide states that agencies can follow these suggestions at locations with a high proportion of older road users or at all locations if they wish to accommodate older road users as a general policy. The document builds on the FHWA publications, and included a wide-ranging literature review of existing guidelines and recent papers related to improved roadway designs and countermeasures. Extensive consultation with local agencies, including cities,

seniors' advocacy groups and Alberta Transportation, was carried out to ensure the practicality of the enhancements, especially to Alberta's climate and roadway network characteristics. Over 150 engineering enhancements are organised into nine network components, including at-grade intersections (layout and traffic control), roundabouts, work zones and sidewalks and multi-use paths. The document also attempts to prioritize enhancements based on some having a higher potential for effectiveness while representing relatively inexpensive investments.

The 2005 guide was introduced to road agencies through workshops at the Centre for Transportation Engineering and Planning (C-TEP), a partnership focussed on coordinating research and development and technology transfer formed by the private sector, the University of Alberta and Edmonton, the Cities of Edmonton and Calgary, and the provincial government. The guide was also distributed to road agencies, and is available for free download on the website of AMA's Foundation for Traffic Safety ([http://www.ama.ab.ca/cps/rde/xchg/ama/web/advocacy\\_safety\\_traffic\\_caa\\_foundation.htm?link=nav3](http://www.ama.ab.ca/cps/rde/xchg/ama/web/advocacy_safety_traffic_caa_foundation.htm?link=nav3)).

In developing the 2009 update to the Alberta guide, consultation with agencies that used the initial guide provided insight into their experiences implementing its strategies. Agencies reported using a wide range of the guide's listed enhancements, including the widespread use shoulder rumble strips, the use of Clearview and mixed cased fonts, overhead placement of street name signs, and a variety of recommendations for safer work zones. Enhancements were typically carried out through retrofits and upgrades, for example, in the replacement of older signs, though the guide was also being used to overhaul existing design standards.<sup>v</sup>

## **International Initiatives**

In the United States, Florida, with its high proportion of seniors, has been a leader in proactive planning for aging road users. Florida DOT's Elder Roadway User Program was developed in the early 1990s. The initiative, now known as the Safe Mobility for Life Program, included improvements separated into two categories – short-term and long-term – in order that elements of the program could be implemented in the shortest amount of time. Short-term improvements included the increased use of reflective pavement markers (RPMs), wider pavement markings and improved pedestrian

crossings. Over the longer term, recommendations included increased sign visibility, supplemental pavement markings, and offset turning lanes at intersections.<sup>vi</sup>

Data on the effectiveness of the Elder Roadway User Program is scarce. The successor Safe Mobility for Life Program includes in its mandate that before and after evaluation of improvements are to be carried out.

In California, the state's Strategic Highway Safety Plan identifies improving safety for older roadway users as one of its 16 core challenge areas. The plan encourages the implementation and installation of traffic control devices included in the California Manual on Uniform Traffic Control Devices (CAMUTCD) that accommodate older drivers and pedestrians, particularly in areas with senior populations.<sup>vii</sup> It also mandates training for local and county design engineers on CAMUTCD-approved countermeasures that target older road users. The California DOT hosted a live web-conference in May 2009, and currently offers self-paced modules for training purposes.

Other agencies have narrowed their focus for improvements to specific areas. The Maricopa Association of Governments (MAG), a council that serves as a regional agency for the metropolitan Phoenix (Arizona) area, for example, has recently launched a project which will provide funding for local jurisdictions to implement a street sign project in line with the FHWA guides.<sup>viii</sup> MAG has secured \$400,000 (USD) in funds to be allocated proportionately to jurisdictions based on the percentage of elderly residents living there. To obtain funding, member agencies need to submit a street-signing project, including the specific locations of the proposed signs, information about the signs' contents, the estimated time to install the signs, and publicity plans pertaining to the signs' improved safety function for seniors. The jurisdictions must also assist MAG and FHWA in performing evaluation of the safety improvement project, including feedback from the public. The initiative is currently ongoing.

Agencies outside of North America are also actively planning for older drivers. Austroads, the association of Australian and New Zealand road and traffic authorities, developed its own guide for aging drivers, *Road Safety Environment and Design for Older Drivers*, borrowing heavily from the FHWA guides. Agencies have been slow to adopt these recommendations, however, and have done so largely on a site specific basis.<sup>ix</sup> Among the improvements carried out are protected right-turns phases

(equivalent to left-turns in North America), increased merge lane length, and the avoidance of skewed intersections. Measures to improve safety for older pedestrians included the increased use of pedestrian median islands and traffic calming measures such as raised crosswalks and curb extensions.<sup>x</sup>

## **Conclusions**

The aging of Canada's population has significantly increased the number of older citizens using our roads. A disproportionate amount of these older road users are reflected in the number of serious injuries and fatalities resulting from collisions. There does exist, however, a wide range of initiatives for increasing the safety of our roads to compensate for the older road user's often diminished visual, cognitive, and motor abilities. As an added incentive, and indeed of benefit, it is commonly accepted that roadway safety improvements for older drivers and pedestrians increases the safety of the roadway for all road users.

Much of North American practice aimed at accommodating aging road users builds on the initiatives of the US FHWA that culminated in the 2001 *Highway Design Handbook for Older Drivers and Pedestrians* and *Guidelines and Recommendations to Accommodate Older Drivers and Pedestrians*. Both of these publications are being updated for re-release in 2010.

Road safety stakeholders have been pursuing improvements in a variety of ways. In Canada, CAA recently sponsored an extensive literature-review initiative on aging driver research. CAA's Alberta affiliate, AMA, sponsored the development of a practical guide aimed at providing agencies a comprehensive list of current traffic engineering practices that benefit aging road users. The guide prioritizes enhancements by cost effectiveness, allowing agencies to select countermeasures proven to be effective for initial implementation. The publicity resulting from successful implementation of these more affordable improvements may pave the way for securing funding for larger scale initiatives. Training courses hosted by Alberta's C-TEP have been used to familiarize agencies with the Alberta toolbox.

In the United States, local jurisdictions have targeted specific areas of the FHWA guides for interim improvements. The Maricopa Association of Governments in Arizona, for



example, has funded local jurisdictions proportionate to the amount of seniors living within the jurisdiction to undertake comprehensive signage replacement programs.

Elsewhere, the Florida DOT, a pioneer in acknowledging and designing for the special needs of aging road users, has categorized its recommendations into short- and long-term improvements in order to expedite the implementation of its Safe Mobility for Life program.

Florida's west coast counterpart, the California DOT, has mandated training to local and county design engineers on California MUTCD-approved countermeasures that target older road users. The state's Strategic Highway Safety Plan encourages the use of these countermeasures, especially in areas with senior populations.

Beyond North America similar steps are being taken. Austroads has developed its own guide for accommodate aging drivers, based in large part on the FHWA Older Driver guides. Studies suggest that agencies have been slow to adopt these recommendations, and in the absence of overarching strategic initiatives, have done so on a site specific basis.

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- i Canada's Aging Population (Minister of Public Works and Government Services Canada 2002).
  - ii Mature Drivers in Casualty Motor Vehicle Collisions, 1988-1998 (Transport Canada, 2001)
  - iii Canadian Motor Vehicle Traffic Collision Statistics 2006 (Transport Canada, 2007)
  - iv Canada's Road Safety Targets to 2010 (Transport Canada, 2001)
  - v Traffic Safety Engineering Toolbox for Aging Road Users (Alberta Motor Association, 2009)
  - vi Traffic Engineering Manual (Florida Department of Transportation, March 1999)
  - vii Implementation of the California Strategic Highway Safety Plan (California Department of Transportation, 2008)
  - viii Safety and Elderly Mobility Sign Project, [<http://www.mag.maricopa.gov/project.cms?item=7792>].
  - ix New Moves for Older Road Users, Robin Anderson, September 2006.
  - x Improving Safety and Mobility for Older Road Users in Australia and Japan, FHWA, October 2008.