Automobility among the Elderly.

The Convergence of Environmental, Safety, Mobility and Community Design Issues

Sandra Rosenbloom* and Agneta Ståhl**
*The University of Arizona
Tucson
USA
E-mail: rosenblo@u.arizona.edu

**Lund Technical University
Lund
Sweden

EJTIR, **2**, no. 3/4 (2002), pp. 197-213

Received: First presented at STELLA FG4 workshop 3&4 May 2002
Accepted: March 2003

The paper describes the aging of the population in developed countries on several continents, the growing automobility of the elderly, the significant environmental, safety, mobility, and community design and land use implications of that automobility, and the implications for research and policy analyses.

1. Introduction

In the coming decades there will be a substantial increase in both the number and percentage of older people in the population of all the developed countries. At least one out of every four citizens in North America and most European countries will be over 65 by 2020--and the percentage will be even higher in countries like Italy, Germany, Spain, and Sweden. An increasingly large component of the elderly will be over 80; in fact, by the middle of the Century those over 80 will constitute more than 13% of the *total* population in Austria, Germany, Greece, Italy, The Netherlands, Portugal and Spain (U.S. Census, 2001, calculated from data in Table 094). At the same time, those who will be elderly in the coming decades will be, on average, better educated, healthier, more active, and wealthier than any previous generation of older people–and substantially more likely to drive to meet their mobility needs.

What will be the impact of these major demographic shifts? A 1999 report by the European Conference of Ministers of Transport noted,

> What is certain is that, by 2020, the elderly will constitute a very substantial category of the population. Over and above that, however, is that those concerned...will be much more demanding than the present generation of older people...they will be car users. Women too will hold driving licenses, which is not always the case today. Because of all these changes, it is not very easy to foresee what the future holds (ECMT, 1999, p. 248).

The growing dependence of the elderly on the private car in Europe as well as North America is routed in the complex interplay between how older people want to live their lives, and, how well their communities are designed to facilitate their needs and desires. But policymakers still substantially underestimate:

- the impact that older drivers will have on congestion and environmental pollution
- the full array of safety consequences of an aging driver pool
- the health and welfare consequences facing active older people when they can no longer drive
- the enormous costs of providing cost-effective and appropriate alternatives at *very large* scales for the huge component of the population who will need them.
- the many aspects of community design and development which must be addressed to target the mobility needs of older people now and in the future

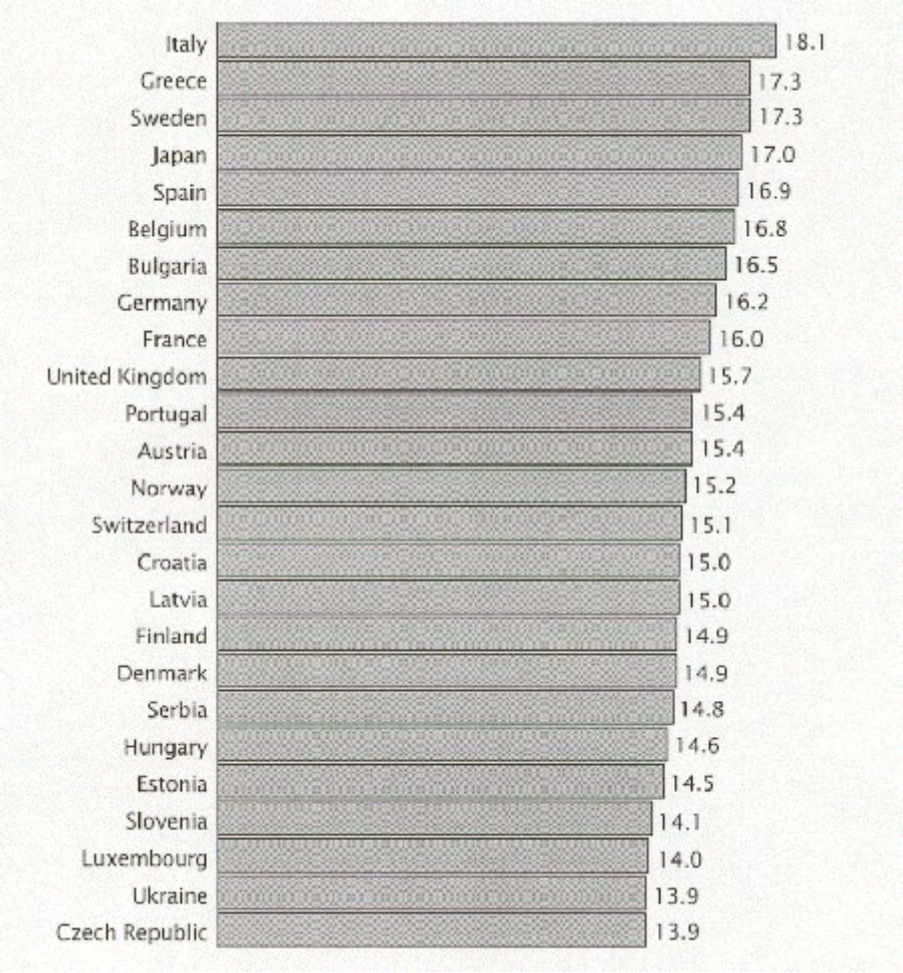
Today discussions about the mobility of older people tend to focus on meeting the needs of people who never drove; generally by offering special or paratransit services. In reality the mobility problem which will face the overwhelming percentage of older people in just a few years is *losing the ability to drive.* And this is a huge problem, not only because there will be millions and millions of people in this position in most countries, but because those who are used to the car may have made residential and other decisions which defy easy mobility solutions.

This paper has five major sections. The next section describes the aging of the population in developed countries on several continents, focusing on how demographic changes have been accompanied by major age, cohort, and period effects which will likely continue to influence the mobility choices and options of older people in the future The following major section describes the growing automobility of the elderly–the greater likelihood that they will be licensed to drive and will make more or longer trips, increasingly in a car and increasingly as the driver of that car. The subsequent major section analyzes the significant environmental, safety, mobility, and community design and land use implications of the these societal trends. The fifth and final section summarizes these analyses and considers their research implications.

2. The aging of the population

2.1 Demographic trends

Between July of 1999 and July of 2000 the world's elderly population grew by more than 9.5 *million* people and the largest absolute growth was concentrated in the most developed countries. The world's 25 oldest countries are all in Europe with the exception of Japan; between 14 - 18% of the population of these countries was over 65 in 2000, as Figure I shows. In fact several EC countries, including Germany, Italy, and Spain, have more old people than children. The USA is relatively younger; only 13% of the current population is elderly. However as the large group of baby-boomers reach the age of 65 after 2010, the number of elderly Americans will increase rapidly to constitute 20% of the total population (Kinsella and Velkoff, 2001).



Source: U.S. Census Bureau, 2000a

Figure 1. The world's oldest countries: 2000 (percent of population 65 years and over)

In almost all these countries the fastest growing segment of the elderly is the oldest-old, those over 80. Currently 22% of those over 65 in the world's developed countries are over 80; over

half of the world's population of people older than 80 live in just six countries including the USA and Germany. In 1999 4.0% of the *entire* Danish population was over 80; over 3.5% of the population was over 80 in Austria, Belgium, France, Germany, Italy, and Norway (U.S. Census, 2001). There is substantial evidence that disability and illness are declining among older people in developed countries even as they live longer. And the decline is most pronounced in the most severe forms of disability (Manton, Corder and Stallard, 1997; Freedman and Martin, 1998).

Not only are the elderly increasingly very old, they are increasingly women. In 1997 over 61% of all people over 70 and almost 70% of those over 80 in the developed countries were women. A 1997 US Bureau of the Census report commented,

> Women are the majority of the older population in virtually all nations and face different circumstances and challenges than men as they age. Older women are more likely to be widowed, to live alone, and to live in poverty. Older women tend to have lower educational attainment, less formal labor force experience, and more family caregiving responsibilities than do older men (Gist and Velkoff, 1997).

2.2 Changing lifestyles

The current elderly population, although diverse, is clearly different than the generations who preceded it.

Those elderly today are more active on almost any measure than their counterparts a few years ago because they have had a range of different experiences. Even the oldest-old, for example, make more trips and more varied trips today than those who were 80+ a few decades ago. And this is the result of a complicated set of effects–better nutrition, greater health education, higher incomes, improved medical options, *etc*. Of course, all these effects, can overlap or have a synergetic impact.

Understanding the transportation and related needs of the elderly in the future depends on understanding and tracking the various effects and factors that will impact their lifestyle decisions. Though many of the cohort and period effects are positive, they still pose problems as society attempts to accommodate the growing transportation needs–and demands-of a rapidly expanding population segment.

First, many older women in the future will be alone even early in their retirement years with fewer family members to help them as they age. For example, 12% of older women in Finland and 17% of baby boom women in the USA were childless in 1997. Conversely, being divorced or never having been married are very high among baby boomer women; over 11% of American women born between 1946-55 were never married and almost 17% were divorced or separated. This contrasts sharply with rates of roughly 7% for both indicators among women born between 1926-35 (who may have just retired) (Frey, 1999).

A second cause for concern is the aging-in-place phenomenon, which is linked to both suburbanization and the growing concentration of older people in rural areas. A report for the Milken Institute noted,

> [F]or the mass of aging boomers, the "aging-in-place" phenomenon will prevail...because the plurality of elderly have lived most of their lives in the suburbs, distinctions between "have"and "have-not" communities will not cut across the city-suburb dichotomy. Concentrations of "demographically disadvantaged" boomer elderly

> will arise within suburban communities that will not be prepared to deal with the social services, health care, and transportation needs of a fast growing less well-off senior population (Frey, 1999, Table 6).

Although it was once believed that many older people moved on retirement, elderly housing mobility is actually low and *declining* in the USA. One- and five-year moving rates are lowest among those over 65 and have been dropping steadily over the last three decades. Americans over 65 today are only one-fourth as likely to move home after they retire as comparable people three decades ago. Between 1990 - 95, only 15.7% of those over 65 moved home, compared to almost 70% of those 20 -29 and 56% of those 30 –39 (Schachter, 2000). Within that relatively low aggregate, moving rates were highest for the youngest and oldest cohorts of the elderly, possibly representing movement just after retirement for those 65-69 and to nursing homes and care facilities for those over 85.

Both aging in place and suburbanization are seen in Europe, although the magnitude of suburbanization is probably less. A Dutch study found, for example, that those between 50 - 80 move only once while those younger move as often as three times; moreover most moves by the Dutch elderly are precipitated by serious difficulties, such as losing a spouse or the financial or physical inability to keep a house. A recent OECD report commented,

> "Suburbanisation" and widespread access to cars have facilitated the "urban sprawl" that characterises many modern cities in OECD Member countries, especially in North America. *However, this is becoming increasingly common in certain European and Asian countries as well*. This form of land development has led to higher demands for mobility, often making the car indispensable for organising and carrying out daily activities. As a result, walking and cycling are decreasing in many OECD member countries...Frequently, shopping centres and other services are located in areas not served by public transport and beyond a reasonable walking or bicycling range from residential areas. (OECD, 2001, p.27; emphasis added)

The aging-in-place phenomenon also creates growing concentrations of older people in rural areas; a 2000 US Census study reported,

> [R]ural areas remain disproportionately elderly in a majority of countries. In most nations, this is primarily the result of the migration of young adults to urban areas, and to some extent of return migration of older adults from urban areas back to rural homes (U.S. Census, 2001, p.50).

In both the UK and France, for example, roughly 30% of those over 65 live in rural areas; the comparable USA figure is 25%. Although not all rural residents are disadvantaged, many have limited mobility options other than the private car.

3. The automobility of the elderly

All of the factors addressed above are directly related to the growing automobility of the elderly. In Europe and the USA most indicators related to auto-use have gone up, sometimes at double-digit rates: the number of trips made, the number of miles/km traveled, the percentage of all trips taken by car, and the percentage of all car trips as the driver. And

whether the growing dependence on the car is the cause or the effect of the forces discussed above, it is an issue we must confront now.

Today a growing percentage of the older population in all developed countries depends substantially on the mobility offered by the personal car–as a driver or passenger and increasingly as the former. A 2001 OECD report noted that,

> In most OECD Member countries, car use by older people is replacing walking, and to a lesser extent, public transit...The private car is likely to remain the dominant form of transport in most OECD countries because of the expected increase in the number of licensed older drivers, particularly women (OECD, 2001, p.34).

3.1 Licensing rates

Licensing rates among the elderly in Europe have been climbing steadily so that within a few years the rates of men in most developed countries will be similar to the supposedly atypical rates of the USA. In 1997 almost 92% of all American men and almost 67% of all American women over 65 had a driver's license; in fact almost three out of four American men over 85 were licenced drivers. Given licensing rates among younger cohorts, by 2012 almost every USA male and more than nine out of ten women will enter their retirement years as drivers.

In contrast, in the mid-1990's, roughly 75% of all older men were licensed to drive in countries as disparate as Japan, Finland, Great Britain, The Netherlands, and Norway. In Great Britain, which began with among the lowest rates in Western Europe, licensing went up for every cohort of elderly driver from 1985 to 1996. For example, in 1985 roughly 70% of men 65-69 had a full license but that figure had grown to almost 82% by 1994 (Oxley, 2000). Given even higher licensing rates among younger cohorts, by 2015 over 90% of older men in the UK will be licensed drivers. Strikingly, while only 34% of older British women had a license in 1994, between 1985 and 1994 the number of women 65-69 with a full license increased 81%. By 2015 almost two-thirds of women over 65 in the UK will be licensed to drive (OECD, 2001, p.29).

Hjorthol developed a more conservative measure of the growth of automobility among the elderly in Norway, combining *holding a license* with *having access to car*. In the period between 1985 - 1992 there were substantial increases in this joint measure of licensing and vehicle access in all cohorts, but particularly among women. For example, between 1985 and 1992, automobility grew 27% among men 64-70 but 83% among comparable women. In 1992 almost 70% of the men and 20% of the women over 78 had both a license and access to a car. Given current licensing rates, by 2010 almost all Norwegian men and 90% of Norwegian women 65-69 will be licensed drivers (Hjorthol and Sagberg, 2000).

In a similar fashion, in 1997 just under 40% of Germans over 65 had a license but roughly 60% of those 60-64 did: almost 80% of the men and 40% of the women. The overwhelming percentage of those with a license also had access to a personal or household car; for example among Germans 70-79, only 6% had a license but no household car--and most were women (Brög, Erl and Glorius, 2000). In fact, the discrepancy between licensing and access to a car is largely a women's issue; in 1999 roughly half as many Swedish women 65-74 had access to a car as comparable Swedish men.

Obviously older women are less likely to be licenced than comparable men but all indications are that women who will retire in the next few decades will do so as drivers.

> A potential future scenario is an increased licensing rate among older people owing predominantly to increased rates for women. Increased licensing is likely to result in greater access to and use of a car (OECD, 2001, p.29).

Although women's licensing rates will be lower than men's in the next 30 years–they will be substantially higher than older women's today. Moreover there is substantial evidence that almost all of the gap between the sexes in licensing will disappear within a few more decades. Licensed women may have more limited access to the car and a greater tendency to use alternatives, but, historically, increasing licensing for both sexes has been associated with rapid increases in all the indices of automobility:

3.2 Travel patterns

Many older people in both North America and Europe make a substantial number of daily trips after retirement, replacing some former work trips with social and recreational and personal travel. Not only do older people take a significant number of trips well into their 80's, they often take either more or longer trips than did their counterparts of just a few decades ago. And around the developed world, older people take an increasingly larger share of those trips in a private car, even if the magnitude of automobility is greater in North America.

In the USA all people over 65 made, on average, 3.4 trips per day (of any length), and traveled, on average, 24.4 miles per day (in any mode) in 1995. Women made fewer trips and traveled fewer miles than comparable men (Rosenbloom, 2003). These trip rates appear to be significantly higher than European ones, although there may be important differences in the definition of "a trip". In 1993-95 British men 65-69 made 2.0 trips per day while comparable women made 1.4 trips per day–but this excluded all trips under one mile (1.6 km) (Oxley, 2000). Italians 65-69 made 1.65 domestic daily trips per person (Marcellini, Gagliardi and Leonardi, 2000)–roughly a third less than the comparable German elder and roughly two-thirds less than the comparable American.

Of course, these rates average the travel patterns of the young-old and old-old. American elders do take fewer daily trips as they age but the biggest drop comes after 80. At the same time Americans continue to make more trips than most European elders. Germans 65-69 made 2.5 trips per day compared to 4.0 daily trips by comparable Americans. The biggest differences between the Germans and the Americans are among the oldest travelers; Americans 80-84 reported 2.7 trips daily while comparable German elders reported only 1.4 daily trips.

Just as interesting are trends in trip making over time American seniors make more trips and longer trips than comparable Americans did just a few years ago. The daily trip rate of all older people increased 86% between 1983 and 1995, and it climbed more rapidly among women. Between 1983 and 1995, women over 65 made 100% more trips while older men made "only" 77% more daily trips. Conversely, American men actually increased the gap in distance traveled between the sexes even as both men and women lengthened trip making. In 1995 older men traveled 114% more miles each day than comparable men had in 1983 although women's distance increased "only" 88%.

There is evidence that growth in travel is also seen among European elders–even if they do not travel as much as Americans. Werner Borg and colleagues report a slight increase in trip making for German elders between 1982 and 1997. However Randi Hjorthol and her

colleagues find that their sample of older travelers made the same *number* of trips in 1991/92 as they had in 1984/85–2.4. On the other hand, she found that older people of both sexes traveled *further* in 1991/92 than they had in the earlier survey. The same patterns have been seen in the UK and Sweden–trip rates among the elderly have stayed constant but the distance traveled has increased. The OECD concluded that "Much of the increase in travel distance among older groups [in Europe] can be attributed to better access to a car." (OECD, 2001, p.33)

3.3 Mode choice

Older Americans are very dependent on the car for their travel, a pattern also seen in Europe although not to the same degree. In 1995, older Americans took 92% of all trips in a car, driving that car three-quarters of the time. But unlike Europe, the difference between older and younger Americans is very small–roughly three percentage points. The major difference between Americans younger and older than 65 is that older people are more likely to be the passenger in that car than the driver–but not by large margins. Conversely older Americans are much more likely to use public transit or walk than younger people–but these two modes together do not account for more than one in eight of their trips.

When USA data are disaggregated by cohort the importance of the private car to the elderly is even clearer. No cohort of the elderly takes fewer than 8 out of 10 trips in a car. At the same time, as people age they are more likely to be the passenger in the car and not the driver. Those 65-69 drove for 79% of their car trips (or 73% of all trips); those over 85 drove themselves for 60% of all car trips (and roughly half of all their trips)! For all cohorts the second most important travel mode was walking. There were only small differences in the use of public transit by cohorts of the elderly; no elderly group made more than 2.3% of all trips by bus or train or tram. Moreover, other USA survey data clearly show a steadily increasing dependence on the private car (Rosenbloom, 1995).

Philip Oxley finds similar patterns in the United Kingdom although the magnitude of car dependance is less. Almost 70% of all trips over one mile made by UK elders 65-69 are made in a car (75% of the men's and 62% of the women's trips); over 91% of the men and 31% of the women in that cohort are *driving* the car. Although he reports that the likelihood of being a passenger in the car increases with age, even among those over 80, where 55.2% of all trips over 1 mile are made in a car, 70% of the men are driving that car.

It is, of course, true that in most developed countries older people are still less dependant on the private car than younger people. But what is happening is that those now elderly are different than preceding cohorts–and probably still more different than those who will be elderly in the future. Each successive generation is less likely to have a lifestyle which makes it possible to use public transit as frequently as did previous cohorts.

> [C]ohort effects may change public transport usage as the baby boomers age. The least use of public transport is found among those in their 40's, who may well prefer driving to public transport as they age (OECD, 2001, p.32).

In fact older people today are not only less likely to use public transit and other non-auto options than older people in the past–they are less likely to take the same percentage of their trips using public transit as they themselves did when younger. Because non-work travel is not as conducive to transit use, some people on retirement trade work trips on buses, trains, and trams for non-work trips in cars.

For example, transit usage between 1985 and 1992 declined for both older men and women in Norway, although substantially more among men. Norwegian men 64-70 took 71% fewer daily transit trips in 1992 than comparable men had in 1985–although the transit use of comparable women only dropped 4%. At the same time, as Norwegians aged they *sustained* their increased use of the car (Hjorthol and Sagberg, 2000). Other studies have found comparable declines in transit use among the elderly in Australia, Germany, New Zealand, Sweden, and the UK as well as the USA. (The drop in transit use among the elderly is taking place in an environment of falling transit shares for all trips in almost all European countries (Pucher and Lefevre, 1996, pp. 46-48; Hook, 1999))
And as suggested earlier, the use of walking as a travel mode is also falling among the elderly not only proportionately but absolutely in Australia, the Netherlands, Norway, Sweden, and the UK, as well as the US (Rosenbloom and Morris, 1998). For example, distance traveled on foot in the Netherlands decreased over 20% from 1975-1995.

4. The implications of automobility

In both Europe and North America older people are increasingly more likely to have a license, to take more or longer trips, and to do so more often in a car–increasingly as the driver--than older people 15-20 years ago. These trends have substantial individual and societal implications. At a personal level, older people who lose the ability to drive will have fewer and fewer relatives to assist them as they age; many will be older women living alone who have had fewer children than previous cohorts and those children will have limited ability to help their parents (U.S. Census, 1995, Castles, 1993). On a societal level, older people may continue to drive when they should not creating increasing safety impacts while their perhaps unexpected auto travel will create environmental and other sustainability issues. If they do not continue to drive, many older people will face sometime staggering mobility losses and the inability to interact in their communities.

4.1 Environmental implications

The increasing automobility of the elderly will have important impacts on the environment. First, there simply will be many more auto-based trips than planners may be prepared for, both because there will be so many more older drivers in the future and because older drivers in the future will actually make more or longer trips than their counterparts today. Second, the actual trips made by older people may pollute more than trips they made when younger. Third, as older people long dependant on the car curtail or cease their driving, younger friends and relatives may alter and lengthen their own travel to provide needed assistance.
Traditional planning efforts in both the transportation and the environmental arenas have tended to underestimate or even ignore the "contribution" of older retired people to environmental problems. Many transport, land use, and environmental models assume that the relatively low licensing and travel rates seen among older people in the past will continue into the future (Rosenbloom, 2001). However, if all older drivers in the USA only drove as much as did those in 1995, by 2030 the total number of miles by older people would more than double, as Table I shows, simply because the population of older drivers would have

increased substantially. But if older people actually increased the miles they drove to resemble the travel patterns of the cohort just ten years younger in 1995, as current trends suggest, the total number of miles they drove annually would more than triple in the next three decades.

Second, not only will older people take more trips than comparable people in the past, they will also use the car for a greater percentage of their trips for two reasons; *first,* the elderly like most travelers, have come to depend on the car for more of their trips in general, and, *second*, they will trading work trips–where transit options are the most useful–for non-work trips where transit is the least useful. And not only will they be driving for a greater percentage of all trips after leaving the labor force, most older people will take shorter trips. If so, their car engines may never get warm enough for pollution control devices to be effective–this is the so-called "cold start" problem[1].

Finally, *non-elderly* people responding to the needs of those who have stopped driving may increase or change their travel behavior in ways with important environmental implications. In all developed countries co-residence of older people and their family has dropped precipitously in just a few decades; today not many older people live with their children or relocate to do so when they cannot drive (OECD, 1994, p.7). So family members may make additional trips to assist their aging parents. While not all assistance provided by others to older people will increase trip making (or be made in a car or encounter the cold-start problem) some undoubtedly will.

4.2 Safety implications

Older drivers are far safer than commonly assumed; until they reach 80 or 85 older drivers have fewer crashes per capita than any other age group (IHS, 2001; Hu, Young and Lu, 1993). Moreover per capita crash rates have been declining among those over 65 for decades, leading one expert to postulate a cohort effect: younger drivers are safer and have more driving experience than their counterparts of a few decades ago and will continue to bring their safer habits with them into their retirement years (Evans, 1991). Yet unless per capita crash rates among the elderly drop drastically, the large increase in the sheer number of older drivers will cause an absolute increase in crash rates.

There are other forces at work as well. A large body of research shows that older drivers may have difficulty in key driving tasks because of declining physical, mental, or emotional skills (Ranney and Pulling, 1990; Evans, 1988; Ball *et al.*, 1998). Many otherwise healthy older people will develop conditions that can impinge on their mobility: reduction in working memory capacity, decreased physical flexibility in the neck and upper body, increased sensitivity to glare, poor night vision, reduced contrast sensitivity, a loss of information processing skills and speed, and slowed response time (Benekohal *et al.*, 1994; Brouwer *et al.*, 1991; Goggin, Stelmach and Amrhein, 1989; Owsley, 1983). In addition older people are more likely to use medications which can negatively effect driving performance. Moreover the elderly are more susceptible to over-medication and multiple drug interactions (Leveille *et al.*, 1994; Nakra, Geller and Hassan, 1992; Nicholson, 1986).

[1] The catalytic converters on modern cars work best at reducing the hydrocarbons, carbon monoxide, and oxides of nitrogen produced by car engines when both the catalyst and the engine are hot. (In fact very little catalytic activity occurs below roughly 600° F.) Emission rates during cold starts can be 20 to 100 times higher than rates from a "hot" vehicle. As a result, in laboratory tests on modern, properly operating cars, the majority of emissions occurred during the first 10% of the test before the engine and catalyst were hot.

However, older people are often aware that they have problems and alter aspects of their driving to respond. Many studies show that older people change their driving patterns to accommodate loss of driving skills or to react to driving situations they find problematic (Eberhard, 1996; Persson, 1993; Yee, 1983). Older drivers often avoid congested areas and peak-period travel, they don't drive at night or on unfamiliar roads or in bad weather or when they don't feel well. This *self-regulation* explains why older drivers are safer on a per capita basis than younger drivers in spite of declining (average) performance–and the fact that, on a per-exposure basis (that is, miles/km driven), older drivers have as many crashes as teenage boys (IHS, 2002).

But will future generations of older drivers continued to self-regulate? There is little doubt that current self-regulatory behavior constrains the lifestyle of older people (Rosenbloom, 2002). If older drivers in the future are not as willing to self-regulate in ways that compromise their freedom and independence--and we do not develop ways to increase driving skills or abilities and/or change the road or vehicle to accommodate declining skills–per capita crash rates among the elderly may well increase in spite of greater driving skills and experience.

Whether or not total or per capita crash rates increase, older people are more susceptible to injury and death in the crashes which do occur. As a 2001 OECD report noted,

> Arguably, the most important safety issue for older road users concerns their increased frailty, which makes them more susceptible to serious injury. Although older people have fewer accidents than other age groups, they are over-represented in accident fatalities and serious injuries (OECD, 2001, p.39).

Thus older people, who represent 13% of the U.S. population, constitute 18% of U.S. motor vehicle deaths. Moreover people over 75 have more motor vehicle deaths per 1000,000 miles driven than any cohort of the population except those under 25.

Safety analysts have long been concerned with the joint goal of identifying poor older drivers, and figuring out how to convince them to either stop driving or do something to become better drivers. However, we are often stymied by the lack of accurate and effective measures or tests which predict poor driving performance. There is little evidence that testing or re-testing older drivers is effective in lowering crash rates, largely because current tests do such a poor job of identifying bad drivers, especially those who drive enough to make their removal from the road noticeable (Hakamies-Blomqvist, Hohansson and Lundberg, 1996). But even if we could effectively identify unsafe drivers, we know very little about whether they can be taught to drive more safely or if we must force them to stop driving.

While there may be a number of ways to address the safety problems created by the automobility of the elderly, the most effective policy may be one which squarely addresses the mobility and access needs of those who wish or have to stop driving, occasionally or all the time. Active and mobility people with few options other than driving are unlikely to stop doing so–unless provided with alternatives that meet their real lifestyle needs.

4.3 Mobility implications

In support of a wide range of sustainability goals, most countries have policies designed to discourage people from driving and to induce them to use alternative modes of transport. While these efforts have not traditionally focused on older people, their growing automobility may make older drivers a larger and larger focus of such policies in the future. At the same

time, a different set of policymakers, concerned with the traffic safety implications of an aging driving pool, have worked to develop policies and programs to target unsafe older drivers and remove them from the road. So far, neither set of policymakers have been very successful in removing unsafe, or many, older drivers from the road for a mixture of reasons– but common to both policy agenda is:

- the failure to recognize the significant personal benefits which the private car offers to everyone, but particularly to older people.
- the failure to provide meaningful alternatives to driving

There is no reason to assume that older people today or in the future will be any less dependant on the car than younger people. Although many European countries have strong policies to discourage car ownership and use, most have not been widely successful and there is no reason to assume that they will be more successful among older people (Pucher and Lefevre, 1996). As a 1999 ECMT report noted, "The car will remain a vital means of transport for pensioners, which...is in obvious contradiction with the goal of environmentally sustainable transport." (ECMT, 1999, p. 249)

A fact which few policymakers take into account is that, in many situations, driving a car is the *easiest* travel mode for older people facing declining physical skills. For example, data from the US show that almost 40% of people too disabled to use public transport actually drive a car. A 2001 OECD study commented,

> Older people who suffer from limitations related to health must often cease walking or using public transport before they are forced to cease driving. Approximately one-third of women over 80 years of age cannot use walking as a means of transport, but many with a license still drive (OECD, 2001, p.128).

The greater mobility associated with increased automobility produces significant, and very real, resistance to reducing driving–for safety or any other reasons. Today several studies show that older drivers resist driving cessation even when they are confronted with physical, emotional, and/or mental problems which seriously interfere with their ability to drive safely (Ball *et al.*, 1998; Hakamies-Blomqvist and Wahlstrom, 1998; Marottoli *et al.*,1995). How likely is a *new* generation of seniors, far more used to, and dependent on the private car, to stop driving when faced with similar situations or in support of environmental goals? Even in Europe, those who have long relied on the car to meet their mobility needs resist driving cessation (Schlag, Schwenkhagen and Tränkle, 1996) (Oxley, 2000, p.239).

Substantial evidence suggests that, because they lack realistic alternatives to the car, 1) many older people will continue to drive for as long as they can even when driving becomes difficult and even dangerous (Marottoli *et al.*,1995; Oxley, 1992), and 2) many who give up driving will still have substantial needs for out-of-home travel. It is conceivable that those who will be elderly in the future will be even less likely to easily give up driving, having made so many life style choices based on the flexibility and access offered by the private car.

Just as important, the *alternatives* available for those who have driven but must stop are not very satisfactory from either a personal or societal stand-point. As described above, seniors in both Europe and North America increasingly live in low density rural or suburban places with limited (or no) public transit services. As such they are very dependant on the car for their mobility. When they can no longer drive, it is unlikely that the kind of paratransit or special transit services currently available can replace even a fraction of the sheer number of

auto-based trips that will be lost by millions and millions of older people giving up (or even reducing) driving. And even if they could, the costs would be prohibitive.
In the US today many cities are paying between $14 - 30 a one-way paratransit trip; that is, it costs between $28 - 60 to take one older person to and from the doctor or grocery store *just once*. It is hard to imagine the number of zeros that would follow any calculation based on multiplying that dollar figure by the total number of trips lost by those forced to give up their licenses today–let alone in the future. While such paratransit services may be *part* of the solution to the mobility problems of former drivers (and those who have never driven), they can only be a small part or they will bankrupt most societies.

5. Community design and land use implications

Surrounding, or perhaps undergirding, all the issues discussed above are questions of how well communities are laid-out and designed–both physically and institutionally--to assist older people to meet their needs and maintain their independence without being totally dependent on the private car. In fact, the "appropriate" design of communities is a complex question–many dense European communities pose a range of problems for some older people seeking non-auto alternatives for mobility. In fact, whether a community can meet the mobility needs of older people is a result of the interaction of a number of factors, including

- the *accessibility* as well as the availability of public transport
- the accessibility and maintenance of walkways, public buildings, and community infrastructure
- the safety and security of the public environment
- the range of public transport options available
- the dimensions of the homes in which people are aging
- the enforcement of traffic and other safety regulations
- the character and atmosphere of public places
- the home and housing options available for older people–their design, cost, and location
- how a range of public and private services are offered or delivered to older people

Unfortunately policymakers in both Europe and the US have tended to ignore the serious problems faced by ageing cyclists, pedestrians, and transit users in their communities. As older people age they often develop problems in walking, keeping their balance in crowds or while riding on public transit vehicles, climbing up or down steps (including those in transit stations and on buses, trams, and trains), and maintaining their sense of orientation or personal security in busy public places. As a result, some experts believe that older people are at least 15 times more likely to be injured or killed as pedestrians than as car drivers.
In both Europe and the USA, elderly pedestrians who compromise 20% or less of road users constitute half or more of all pedestrian deaths. While a majority of those deaths (and pedestrian injuries among the elderly) are related to car-pedestrian crashes, a substantial percent of all older pedestrian injuries result from street-falls in which cars are not involved at all (although crowds, inappropriate street furniture, vendors, poorly maintained walkways, and illegally parked cars may be). Street falls are extremely serious for the elderly, since what might be minor problems for younger people can be life-threatening for older people.

Given their increasing difficulty in walking far, older people need new and different kinds of public transport services, those which are routed closer to their homes and nearer major destinations. These options should constitute a family of mobility services which include different kinds of traditional transit, senior carpooling schemes, volunteer driver programs, new forms of demand services, and information and training programs (Ståhl, 1991; 1992).

6. Summary

The growing automobility of an aging population poses environmental, safety, mobility, and community design challenges to developed societies. Most older people in the developed countries will be drivers within just a few decades; in fact licensing is almost universal among men today in industrial countries and women are rapidly closing the gap. As drivers, older people lead active, busy lives–but their lifestyles will be severely threatened by the need to stop driving, whether for personal or societal reasons. The emphasis on *sustainability* must include appropriate and cost-effective options to allow older people to reduce and eventually cease driving without seriously reducing their independence and sense of self-worth. A sustainable solution to the problems created by automobility among the elderly must target several key areas including vehicle design, transport alternatives, service delivery models, and community support and infrastructure. It is crucial that we undertake a comprehensive evaluation of the large number of issues that effect the mobility of older people in order to develop sustainable communities. We can no longer rely on old solutions, inadequate information, or policy prescriptions driven by wishful thinking rather than good data.

References

Ball, K. *et al* (1998) "Visual Processing Impairment and Risk of Motor Vehicle Crash Among Older Adults," *Journal of the American Medical Association*, vol. 279, pp. 1083-1088

Benekohal, R. F. *et al* (1994) "*Effects of Aging on Older Drivers*' Travel Characteristics," TRB Preprint 94-0699, paper given at the 1994 73th Annual Meetings of the Transportation Research Board, Washington DC

Brög, Werner, Erhard Erl, and Birgit Glorius (2000) "Elderly People's Travel Choices in Germany," *in* European Conference of Ministers of Transport (1999), *Transport and Ageing of the Population*, Economic Research Centre, Round Table 112, Paris, Organisation for Economic Co-operation and Development, pp. 43-142

Brouwer, W.H. *et al* (1991) "Divided Attention in Experienced Young and Old Drivers; Lane Tracking and Visual Analysis in a Dynamic Driving Simulator," *Human Factors*, vol. 33, no. 5, pp 573-582

Castles, Ian (1993) *Women in Australia*. Report No. 4113.0, Australian Bureau of Statistics. Canberra: ABS, March, p. iii

Eberhard, John W. (1996) "Safe Mobility for Senior Citizens," *IATSS Research*, vo. 20, no. 1, pp. 29-37

European Conference of Ministers of Transport (ECMT) (1999), *Transport and Ageing of the Population*, Economic Research Centre, Round Table 112, Paris, Organisation for Economic Co-operation and Development, p. 248

Evans, Leonard (1991) *Traffic Safety and The Driver*, Chapter Three, "Effects of Sex and Age," pp. 19-43, New York: Van Nostrand Reinhold

Evans, Leonard (1988) "Older Driver Involvement in Fatal and Severe Traffic Crashes," *Journal of Gerontology: Social Sciences*, pp. S186-193

Freedman, Vicki A. and Linda J. Martin, (1998), "Understanding Trends in Functional Limitations Among Older Americans," *American Journal of Public Health*, vol. 8, no. 10, pp. 1457-62

Frey, William H. (1999) "Beyond Social Security: The Local Aspects of An Aging America," Discussion Paper 99-4, Washington, DC, The Brookings Institution, Center on Urban and Metropolitan Policy

Gist, Yvonne J. and Victoria A. Velkoff (1997) *Gender and Aging; Demographic Dimensions*, US Department of Commerce, U.S Census Bureau, International Brief IB/97-3, December

Goggin, N. L., G.E. Stelmach, and P.C. Amrhein (1989)"The Effects of Age on Motor Preparation and Restructuring," *Bulletin of the Psychonomics Society*, vol 27, 1989, pp. 199-202

Hakamies-Blomqvist, Liisa, Kurt Hohansson and Catarina Lundberg (1996), "Medical Screening of Older Drivers as a Traffic Safety Measure: A Comparative Finnish-Swedish Evaluation Study," *Journal of the American Geriatric Society*, vol. 44, no. 6, June.

Hakamies-Blomqvist, Liisa and Barbro Wahlstrom, (1998), "Why Do Older Drivers Give up Driving," *Accident Analysis and Prevention*, vol. 30, no. 3, pp. 305-312

Hjorthol, Randi and F. Sagberg (2000) "Changes in Elderly Persons' Modes of Travel," *in* European Conference of Ministers of Transport (1999), *Transport and Ageing of the Population*, Economic Research Centre, Round Table 112, Paris, Organisation for Economic Co-operation and Development, pp. 181-210

Hook, W. (1999) "The Political Economy of Post-Transition Transportation Policy in Hungary," *Transport Policy*, vol. 6, no. 4, October, pp. 2017-2224

Hu, Patricia, Jennifer Young, and An Lu (1993) *Highway Crash Rates and Age-Related Driver Limitations: Literature Review and Evaluation of the Data Bases*, Center for Transportation Analysis, Oak Ridge National Laboratory, Oak Ridge, TN

Institute for Highway Safety (IHS) (2001), *Older Drivers Up Close; They aren't dangerous except Maybe to themselves*, USA, on www.highwaysafety.org/srpdfs/sr3608.pdf

Kinsella, Kevin and Victoria A. Velkoff (2001) *An Aging World: 2001.* Census Bureau, US Department of Commerce, Series P95/01-1, November. Washington, DC: US GPO, pp. iv

Leveille, Suzanne G. *et al* (1994) "Psychoactive medications and injurious motor vehicle collisions involving older drivers," *Epidemiology*, vol. 5, pp. 591-598

Manton, Kenneth, Larry Corder, and Eric Stallard (1997) "Chronic Disability Trends in Elderly United States Populations: 1982 to 1994," *Proceedings of the National Academy of Sciences*, vol. 94, pp. 2593-98

Marcellini, Fiorella, Cristina Gagliardi and Fabio Leonardi (2000), "The Aging Population and Transport; A New Balance between Demand and Supply," in European Conference of Ministers of Transport (1999), *Transport and Ageing of the Population*, Economic Research Centre, Round Table 112, Paris, Organisation for Economic Co-operation and Development, pp. 145-177

Marottoli, Richard A., *et al* (1995) "Consequences of Driving Cessation Among Elderly Individuals" *Journal of the American Geriatrics Society*, vol. 43

Nakra, B.R.S., J.D. Geller, and R. Hassan (1992) "A Double-blind comparisons of the effects of temazepam and triazolam on residual daytime performance in elderly insomniacs," *International Pyschogeriatrics*, vol. 4, 45-53

Nicholson, A.N. (1986) "Hynotics and transient insomnia," in J.F. O'Hanlon and J.J. de Gier, (eds), *Drugs and Driving*, Basingstoke, Hampshire: Taylor and Francis, pp. 239-244

Organisation for Economic Co-operation and Development (OECD) (2001), *Ageing and Transport; Mobility Needs and Safety Issues*, Paris: OECD, p. 27

OECD (1994) *Caring for Frail Older: New Directions in Care*, Social Policy Studies, Paris: OECD, p. 7

Owsley, Cynthia *et al* (1983) "Contrast Sensitivity Throughout Adulthood," *Vision Research*, vol. 23, no. 7, pp. 689-699.

Oxley, Philip (2000) "The United Kingdom", *in* European Conference of Ministers of Transport (1999), *Transport and Ageing of the Population*, Economic Research Centre, Round Table 112, Paris, Organisation for Economic Co-operation and Development, pp. 211-242

Oxley, Philip *et al* (1992) *Medical, Psychological, and Behavioural Characteristics of Elderly Drivers*, Commission of the European Communities, DG XIII, Brussels

Persson, Diana (1993) "The Elderly Driver: Deciding When to Stop," *The Gerontologist*, vol. 33, pp. 88-91

Pucher, John and Christine Lefevre (1996) *The Urban Transportation Crisis in Europe and North America*, New York: McMillan, pp. 46-48

Ranney, Thomas A. and Nathaniel H. Pulling (1990) "Performance Difference on Driving and Laboratory Tasks Between Drives of Different Ages," *Journal of Gerontological Nursing*, vol. 16, pp. 12-15

Rosenbloom, Sandi (2003), "The Mobility of the Elderly; There's Good News and Bad News," *in* Transportation Research Board, *Transportation and an Aging Society*, Washington DC: National Academy Press, (forthcoming)

Rosenbloom, Sandi (2001), "Sustainability and Automobility among the elderly; An International Assessment," *Transportation*, vol. 28, pp. 375-408

Rosenbloom, Sandra (1995) "Travel by the Elderly," in U.S. Department of Transportation, Federal Highway Administration, *Demographic Special Reports: 1990 NPTS Series*, Washington, DC, February

Rosenbloom, Sandi and Jennifer Morris (1998) "The Travel Patterns of Older Australians in an International Context: Policy Implications and Options," *Transportation Research Record*, vol. 1617, pp. 91

Schachter, Jason P. (2000), *Geographical Mobility; Special Studies*, U.S Bureau of the Census, Current Population Reports, P23-200, Tables 1 and 2

Schlag, Bernhard, Ursula Schwenkhagen, and Ulrich Tränkle (1996) "Transportation for the Elderly; Towards a User-Friendly Combination of Private and Public Transport," *IATSS Research*, vol. 20, no. 1, pp. 75-82

Ståhl, Agneta (1991) "Providing Transportation for elderly and disabled in Sweden: Experience gained and future trends," *Public Transport International*, vol. 40, no. 2, pp. 180-201

Ståhl, Agneta (1992) "Mobility and Accessibility for elderly and disabled people in Sweden," *IATSS Research*, vol. 16, no. 2, pp. 96-97

U.S. Bureau of the Census (2001), *International Data Base*, Calculated from data in Table 094

U.S. Bureau of the Census (1995) *Sixty-Five Plus in the United States*, Statistical Brief, SB/95-8, May

Yee, Darlene (1983) "A Survey of the Traffic Safety Needs of Drivers Aged 55 and Over," *in* J.L. Malfetti (ed.) *Needs and Problems of Older Drivers; Survey Results and Recommendations*, AAA Foundation for Traffic Safety, Falls Church, VA