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Publication date:
2012

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
Levin, L., Ulleberg, P., Siren, A. K., & Hjorthol, R. (2012). *Measures to enhance mobility among older people in Scandinavia. A literature review of best practice.* VTI. VTI rapport No. 749A

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VTI rapport 749A
Published 2012

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Measures to enhance mobility among older people in Scandinavia

A literature review of best practice

Lena Levin
Pål Ulleberg
Anu Siren
Randi Hjorthol

vti
FINDING A BETTER WAY

Preface

Measures enhancing the mobility of older people, helping them live independently and for longer, are advantageous for society as a whole. They are good business for society and they are good for the well-being and welfare of older people who often want to stay in their own home for as long as possible rather than in a care home. There have been attempts to implement measures aimed at increasing older people's mobility in accordance with various modes of transport, e.g. travelling by private car, by public transport, walking, cycling (the unprotected road users). However, very little research has been conducted into the effects of these measures. Much of the previous research on mobility and the elderly have been concentrated on mapping travel behaviour. However, new generations of older people have different expectations and demands from those of their predecessors.

The present report reviews and discusses measures carried out in Denmark, Norway and Sweden during recent decades and links these to questions about what measures would work in the future.

Entitled *Mobile age: The impact of everyday mobility for elderly people's elfare and well-being* (project no. 187780/S20), this project was funded by the Research Council of Norway's Research Program on Welfare managed by Randi Hjorthol at TØI. The research group responsible for the present report comprises Lena Levin (the Swedish National Road and Transport Research Institute, VTI, Sweden), Pål Ulleberg (University of Oslo, Norway), Anu Siren (Danmarks tekniske universitet, DTU, Denmark) and Randi Hjorthol (Transportøkonomisk institutt, TØI, Norway). We thank the reference group of Svein Olav Daatland (Norsk institutt for forskning om oppvekst, velferd og aldring, NOVA, Norway), Guro Berge (Vegdirektoratet, Norway), Anita Hallernstvedt (Norges statsbaner, NSB, Norway) and Claus Ottersen (Statens Vegvesen, Norway) for useful comments during the entire work process. Finally, thanks to Per Henriksson at VTI who commented on the final report draft and gave good advice, George J. Drennan for language revisiting and to the VTI-KOM-team, Anita Carlsson and Tarja Magnusson who prepared the report draft for publishing.

Linköping, Oslo and Kgs. Lyngby

March 2012

Lena Levin

VTI rapport 749A

Omslag: VTI/Hejdlösa bilder

Quality review

The content of the report has been presented in seminars, for colleagues and the reference group. A first draft of the report was distributed to the reference group in October 2011. A final seminar took place on November 22, 2011 at TØI in Oslo.

Internal peer review was done on March 23, 2012 by Per Henriksson at VTI. Lena Levin made amendments to the final draft manuscript. The research director at VTI Tomas Svensson examined and approved the report for publication on April16, 2012.

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Measures to enhance mobility among older people in Scandinavia – A literature review of best practice

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Summary

Mobility is essential if we are to take an active part in society today. For older people, transport and the ability to get around are important from both an individual and a societal perspective. Being mobile means being able to participate in activities outside the home; it means better health, functional capacity and autonomy, and measures promoting the mobility of older people will be increasingly important in the future.

The present report is part of a larger project about mobility and its impact on older people's well-being and welfare: *Mobile age: The impact of everyday mobility for elderly people's welfare and well-being*. The heterogeneity of older people is emphasised, not only with respect to physical age but also with respect to the specific resource situation and social context of everyday life. The geographical context of the project is Denmark, Norway and Sweden. The report is a literature review examining and evaluating measures designed to improve the independency of mobility among older people.

While a few good examples of "best practice" in the Scandinavian area (Denmark, Norway and Sweden) have been highlighted, gaps and weaknesses remain. The areas which are examined in the present report are private car, public transport, cycling, walking and to some extent other transport modes defined by motorized wheelchairs, scooters, four-wheeled mopeds/motorcycles, etc.

Measures to increase travel with public transport are on the agenda in all three countries, i.e. accessible vehicles and increased accessibility to the interchanges. Also, often small amendments through the travel route could make difference, such as pavements without stairs and benches on the way to the bus stop. Furthermore, strategies and measures for improving public transport concern not only issues such as accessible vehicles, wind shelters and plain pavements at bus stops, but also frequency and routes in relation to the mobility needs of a new generation of older people.

However, lack of information and knowledge about public transport services is often rife among older people, which results in them travelling less than they might have done or shying away completely from using public transport. Information campaigns could be synchronised consciously to meet older people's travel trajectories. New ways of providing information using the latest technology could be found to meet the needs of older people. Actually, sometimes the problem is not lack of information but too much of it or the wrong kind. More research, trials and evaluations are needed here, too.

Measures introduced to improve public transport bring to the fore questions about the entire transport environment and conceptualise the journey from start to finish (i.e. the

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whole journey concept). The outcome from previous research is that public transport measures promoting older people's mobility are not possible without the entire journey being considered. There remains a lot to be improved, e.g. more than 200–300 metres constitute a too long walking-distance for many elderly people, and the environment at many interchanges is uncomfortable and stressful. Moreover the information before and during the trip should be visual and audible, timetables easy to read, it should be easy to buy a ticket and handle the ticket machine, low floor vehicles would be desirable as well as vacant seats on board, and the driver should not start before passengers get seated.

Public transport always also includes some walking or bicycling. Safety and mobility are closely related. Safety measures are most promising when they lead to increased physical activity, e.g. provision of practical aid and by making pedestrian infrastructure less complex, less demanding and more attractive. Older people appreciate prepared pedestrian crossings and signal-regulated intersections. Pavements are important. The future building of urban environment can benefit from the experiences and expectations of an older population influencing the project right from the beginning of the planning process.

Wide bicycle paths or cycle streets separated from main streets are greatly appreciated by older bicyclists, according to the studies reviewed. High kerbstones and steep gradients are to be avoided. There is potential for more technical support systems addressing older bikers' comfort and safety; for example, detectors well in advance of signal-regulated intersections to give cyclists the green light without their having to slow down or dismount, signals or lights warning cyclists of approaching motor vehicles or vice versa at intersections, and better guidance at night time, e.g. leading lights in pavements or stronger street lightening at times when cycle traffic is present.

Also questions of design were highlighted and especially the concept of universal design in public transport and urban areas. The most challenging question is about coming up with improvements for coping with winter conditions. In the present review, a lack of financial resources was pointed out as a barrier to the process of improving accessibility for older and disabled people. Previous evaluations have indicated that when an area is renewed it is not always properly integrated with the surrounding environment, thus a new accessible area can become 'an inaccessible accessible island'.

A memo in Sweden targeted at older drivers highlights vehicle design as important for all car owners/drivers, and especially older drivers. It was for example stated that to facilitate driving in darkness the headlights must be of good luminous quality. An anti-skid system and other technical safety support systems are mentioned, as well as good, well-designed, boot space for the ease of lifting heavy luggage. Automatic gearbox and hill-hold control (HHC), which is a technical support mechanism that holds the brake until the clutch is at friction point (making uphill starts easier), as well as a sun protection systems are also preferred equipment for older drivers.

Questions about the drivers renewing their license in old age and about campaigns promoting car-driving among older, healthy people have also been highlighted in the present literature review. No study has been able to demonstrate that cognitive screening is worthwhile. Recent test studies could not predict accident involvement among older drivers. Rather, tests of all drivers over a certain age seem to be inefficient for society, in relation to security. Instead the focus should be on specific diseases (not on specific age) and also on how information promoting older drivers' skills and willingness to continue driving could be produced and evaluated.

To some extent, drivers can compensate for functional limitations by using in-car technical support systems. One conclusion from this literature review is that there is a need for thorough study of technical support systems based on the experiences of older drivers – not least the oldest drivers (75+). The driver support systems discussed in the present report shown considerable potential to promote safe mobility among older drivers, e.g. in-vehicle information and communication systems (IVIS), and advanced driver assistance systems (ADAS). Another conclusion, one that can be drawn from a Swedish study reviewed in the present report, is that cars with automatic gearbox are advantageous in prolonging safe driving among older people. Further research is needed in this regard.

Norway has a tradition in arranging courses for older drivers. “Driver 65+” is open to all Norwegians from 60 years and organised by the Norwegian Public Roads Administration (Statens vegvesen) in collaboration with authorized driving schools. The aim of these courses is to improve traffic safety and to keep up/improve the mobility of older people. The results from a Norwegian evaluation of education for older car drivers indicate that the refresher course has a beneficial effect on safe mobility given that the driver completes the course before turning 75 years of age. Similar courses are organised in Sweden and Denmark. In Denmark, the Danish Road Directorate (Vejdirektoratet, VD) decided in 2010 to draw attention to the situation of older drivers and therefore to provide subsidies for courses for this target group. In Sweden there are no subsidies from the government and the courses are now organised and developed by NGOs (pensioners’ associations and traffic safety organisations) on non-profit basis. There is a great need for coordination of the courses, and more evaluation is needed concerning both the practical and theoretical moments in the courses across all the Scandinavian countries.

More research and evaluations are needed in almost all the reviewed areas, and also more cooperation between different actors. Transport authorities in Scandinavia have not fully adopted the characteristics of the heterogeneity within the group of so-called “older people”, i.e. pensioners from younger old (about 60–65 years) to older old (80+). Measures often lack an overall view and few of them are evaluated. They are often carried out as pilot projects or small tests, and are always limited in time and resources. New projects often start as well before the “old” projects are properly evaluated. More continuity and permanent measures would be preferable.

Åtgärder för att förbättra mobiliteten bland äldre personer i Skandinavien
En litteraturöversikt

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Sammanfattning

Pensionärer idag reser mycket mer än tidigare generationer och deras välbefinnande är förknippat med att kunna komma ut dagligen. Denna rapport bestående av en litteraturstudie visar att mobilitet (rörlighet) för äldre människor fortfarande är ett område under utveckling. Rapporten ingår i ett större projekt om äldres välfärd och mobilitet: *Mobile age: The impact of everyday mobility for elderly people's welfare and well-being* som genomförts av forskare i Danmark, Norge och Sverige.

Medan några goda exempel på "best practice" i Skandinavien (Danmark, Norge och Sverige) har lyfts fram, finns också luckor och svagheter kvar. De områden som granskas i föreliggande rapport är personbil, kollektivtrafik, cykel, gång och i viss mån övriga transportmedel som definieras av motoriserade rullstolar, skotrar, mopedbilar, etc.

Åtgärder för att öka resandet med kollektivtrafik är på dagordningen i alla tre länderna. Det återstår dock mycket som kan förbättras enligt de forskningsrapporter och utvärderingar som ingår i litteraturstudien. Exempelvis är mer än 200–300 meter en för lång promenadsträcka för många äldre människor och miljön på stationer och hållplatser upplevs av många äldre som obehaglig och stressig. Dessutom bör information före och under resan vara både visuell och hörbar, informationstavlor bör placeras i ögonhöjd, tidtabeller ska vara lätta att läsa och förstå, det ska vara lätt att köpa en biljett och hantera biljettautomater, låggolvsfordon är att föredra, lediga platser ska finnas ombord och föraren ska inte börja köra innan passagerarna har satt sig.

Det kan ofta vara små förbättringar som utgör skillnader för dem som reser, till exempel att trottoarer är utan trappor och att det finns bänkar på gångvägen till busshållplatsen. Dessutom handlar strategier och åtgärder för att förbättra kollektivtrafiken inte bara om frågor som tillgängliga fordon, vindskydd och enkla trottoarer vid busshållplatser, utan också om frekvens och rutter i förhållande till resmönstren hos den nya rörliga generationen äldre.

Dock är bristen på information och kunskap om kollektivtrafiken ofta utbredd bland äldre människor, vilket resulterar i att de reser mindre än de skulle ha gjort eller avstår helt från att använda kollektivtrafiken. Informationskampanjer skulle kunna samordnas bättre för att möta äldre människors resmönster. Nya sätt att sprida information med den senaste tekniken skulle också kunna organiseras i större utsträckning för att möta behoven hos äldre människor. Egentligen är problemet ibland inte brist på information, utan för mycket information eller fel slags information. Mer forskning, studier och utvärderingar behövs här också.

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Åtgärder som införts för att förbättra kollektivtrafiken aktualiserar frågor om hela transportkedjans miljö och konceptualiserar resan från början till slut. Resultat från tidigare forskning visar att kollektivtrafikens åtgärder för att främja äldres mobilitet inte är möjliga utan att ”hela resan” övervägs.

Kollektivtrafiken förutsätter alltid också promenader eller cykling. Säkerhet och rörlighet är nära besläktade och detta gäller inte minst för gång- och cykelstråken. Säkerhetsåtgärder är mest lovande när de leder till ökad fysisk aktivitet och består av praktiska lösningar exempelvis genom att göra gångstråkens infrastruktur mindre komplicerade, mindre krävande och mer attraktiv. Äldre människor uppskattar breda, tydliga övergångsställen och signalreglerade korsningar. Trottoarer är viktiga och de ska vara separerade från cykeltrafiken. Framtidens byggda stadsmiljöer kan i större utsträckning dra nytta av erfarenheter och förväntningar från den äldre befolkningen genom att låta de äldre trafikanterna påverka projektet redan från början av planeringsprocessen.

Breda cykelbanor eller cykelgator skilda från huvudgatorna uppskattas i hög grad av äldre cyklister, enligt de granskade studierna. Höga kantstenar och branta lutningar skulle kunna undvikas. Det finns potential för mer tekniska stödsystem som gynnar äldre cyklisters komfort och säkerhet, till exempel, detektorer i god tid vid signal-reglerade korsningar för att ge cyklister grönt ljus utan att behöva sakta ner eller kliva av cykeln, signaler eller varningslampor för cyklister när motorfordon närmar sig (eller vice versa) vid korsningar och bättre vägledning nattetid, till exempel ledljus i trottoarer eller starkare gatubelysning vid tidpunkter då cykeltrafiken är intensiv.

Också frågor om design lyftes fram och i synnerhet begreppet universell design i kollektivtrafiken och urbana miljöer. Den mest utmanande frågan om förbättringar handlar om att klara vinterförhållanden. I denna litteraturöversikt har en brist på ekonomiska resurser framhållits som hinder för arbetet med att förbättra tillgängligheten för äldre och funktionshindrade. Tidigare utvärderingar har också visat att när områden förnyas är de inte alltid väl integrerade med den omgivande miljön och därigenom kan nya tillgängliga områden bli "otillgängliga tillgänglighetsöar”.

En promemoria i Sverige som riktar sig till äldre förare belyser utformningen av bilarna, vilket är viktigt för alla bilägare/förare och särskilt äldre förare. Det som till exempel uppgavs var att för att underlätta körning i mörker måste strålkastarna vara av god luminös kvalitet. Ett anti-sladd system och andra tekniska säkerhetssystem nämns, samt rymliga, välutformade bagageutrymmen för att underlätta lyft och placering av tungt bagage. Automatisk växellåda och ”hill-hold” kontroll (HHC), som är ett tekniskt supportsystem som håller bromsen tills kopplingen är i funktion (vilket medför lättare start i uppförsbacke), samt solskyddssystem är också utrustning att föredra för äldre förare.

Frågor om förnyelse av körkort och om kampanjer för att främja bilkörning bland äldre, friska människor har också lyfts fram i denna litteraturöversikt. Ingen studie har hittills kunnat visa att kognitiv screening är en användbar metod för att förutse olyckor och skilja ut förare som kan förorsaka olyckor. Studier som genomförts de senaste åren i Danmark och Sverige kunde inte förutse olyckor. Snarare menar forskarna i dessa studier att tester av alla förare över en viss ålder verkar vara ineffektivt för samhället i förhållande till säkerheten. Istället bör fokus i framtida åtgärder ligga på att identifiera personer med specifika sjukdomar som påverkar körförmågan (inte vara fokuserade på specifika åldrar) och på hur information kan främja de äldre förarnas kunskaper och vilja att fortsätta köra.

Till viss del kan förare kompensera för funktionsnedsättningar genom att använda tekniska stödsystem i bilen. En slutsats av denna litteraturstudie är att det finns ett behov av mer grundliga undersökningar av tekniska stödsystem baserade på erfarenheter från äldre förare och inte minst de äldsta förarna (75+). Förarstödsystem som diskuteras i denna rapport visar stor potential för att främja säker rörlighet bland äldre förare, till exempel i fordonens informations- och kommunikationssystem (IVIS), och avancerade system för förarstöd (ADAS). En annan slutsats som kan dras från en svensk studie som ingår i denna översikt är att bilar med automatisk växellåda har visat sig kunna förlänga säker körning bland äldre människor. Ytterligare forskning behövs i detta avseende.

Norge har en tradition av att arrangera kurser för äldre förare. Kursen "Bilfører 65+" är öppen för alla norrmän från 60 år och arrangeras av Statens Vegvesen i samarbete med auktoriserade trafikskolor. Syftet med dessa kurser är att förbättra trafiksäkerheten och att upprätthålla/förbättra rörligheten för äldre människor. Resultaten från en norsk utvärdering av utbildning för äldre bilförare tyder på att en sådan repetitionskurs har en gynnsam effekt på säker rörlighet förutsatt att förarna avslutar kursen innan de når 75 års ålder, om de går kursen därefter verkar effekterna avta. Liknande kurser anordnas i Sverige och Danmark. I Danmark beslutade det danska Vejdirektoratet under 2010 att uppmärksamma situationen för äldre förare och följaktligen ge stöd till kurser för denna målgrupp. I Sverige finns inget liknande stöd på nationell nivå. Kurserna i Sverige anordnas på ideell basis av pensionärs- och trafiksäkerhetsorganisationer.

Mer forskning och utvärderingar behövs inom nästan alla de granskade områdena, och även mer samarbete mellan olika aktörer. Trafikverken tillsammans med andra myndigheter och utförare i Skandinavien har inte fullt ut antagit utmaningen att möta heterogeniteten inom gruppen av så kallade ”äldre”, det vill säga pensionärer från unga äldre (cirka 60–65 år) till äldre äldre (80+). Åtgärder för att öka tillgängligheten och mobiliteten hos äldre resenärer saknar ofta en helhetssyn och enligt vad som framkommit i denna litteraturöversikt blir några av dem inte utvärderade ordentligt. De är ofta utförda som pilotprojekt eller enstaka tester som är begränsade i tid och resurser. En slutsats är även att nya projekt påbörjas innan de gamla projekten har utvärderats ordentligt. Mer kontinuitet och permanenta åtgärder skulle vara att föredra.

1 Introduction

One of the most significant demographic changes in developed countries is ageing of the population, and in the Scandinavian countries it is forecast that about 25 per cent of the population will have reached retirement age (which today is about 65–67 years) within the next few decades. The increase will include the oldest old, those over 80 years who report the greatest need for mobility support (cf. Hjorthol, Longva, Skollerud, & Vågene, 2009). Against that background, measures to promote mobility in older people will be increasingly important in the future. Furthermore, given the heterogeneity of the ageing population a variety of accessible mobility options will be desirable (cf. Levin et al., 2007).

Mobility is essential for participation in society today and, along with transport, is important from an individual and also from a societal perspective. Being mobile enables participation in activities outside the home and promotes health, functional capacity and autonomy.

Reduced mobility in later life can be due to having stopped driving, having experienced difficulty cycling, having to cope with unforeseen situations when using public transport, restricted access to mobility services, and so on. Previous research has shown that mobility and the ability to get out of the home are essential aspects of the quality of life of older people (Farquhar, 1995), and being able to use the transport system unhindered has been defined as one of the seven important areas in the Instrumental Activities of Daily Living of the elderly (Fillenbaum, 1985).

This report is part of an empirical research project about mobility and its impact on the well-being and welfare of older people: *Mobile Age: The Impact of Everyday Mobility for Elderly People's Welfare and Well-being*. The entire project's objectives are: (i) to examine the development of mobility in different groups of older people, (ii) to study the relation between mobility and well-being/welfare of older people in different contexts, and (iii), to examine and evaluate measures to improve the independency of mobility among older people. The project has a comparative perspective and the geographical context is Scandinavia, i.e. Norway, Sweden and Denmark. The project emphasises the heterogeneity of older people, not only with respect to physical age, but also according to the specific resource situation and social context of their everyday lives. In this report we deal with the third objective of the project in identifying and discussing "best practice" measures in the Scandinavian countries. The report covers the various modes of transport that are important in terms of everyday mobility: the car, public transport (including special mobility services for older and disabled people), walking, cycling as well as a few other modes that are useful for older people; for example, mobility scooters and motorized wheelchairs.

Disposition

Section 1 gives a short Introduction and section 2 the aim of the report. The study design, methods and materials are presented in section 3 followed by five sections dedicated to various modes of transport: the car, public transport, walking, bicycling and others (e.g. mobility scooters and motorized wheelchairs) in sections 4–8, respectively; and finally a concluding Discussion in section 9.

2 Objectives

Our aim is to provide an up-to-date overview of “best practice”, i.e. practical measures promoting older people’s mobility in Denmark, Norway and Sweden. The idea is that the report will provide inspiration and guidance in the development of measures promoting older people’s mobility, and at the same time identifying gaps and needs for further research and planning of development.

The review includes: research projects (with implementation objectives), development, testing and evaluation. Our main focus is on research and evaluation projects aimed at promoting mobility for older people. Of several such projects on-going at any one time in the three countries, we describe and discuss the main trajectories of some of them.

3 Study design, methods and materials

3.1 Points of departure

Briefly, our objectives are:

- to examine the everyday mobility of “older people” (from retirement age at about 65 years and above)
- to find examples of “best practice”, i.e. measures that can facilitate and promote older people’s mobility and security in respect of various transport modes
- to review and discuss measures implemented and experienced with the transport modes used in everyday mobility (i.e. out of home activities); see further section 3.2
- to focus on projects in a Scandinavian/Nordic context (mainly Denmark, Norway, Sweden since the entire research project covers these countries)
- to some extent consider other pioneering projects (EU/international) relevant for the current research project.

3.2 Transport modes

Everyday mobility for older people getting to and from out-of-home activities usually means one or several of the following transport modes:

- Private car
- Public transport, including special mobility services
- Walking
- Bicycling
- Others, e.g. moped, four-wheeled mopeds/motorcycles, mobility scooters, and motorized wheelchairs.

We review the documentation of projects that focus on measures promoting the mobility and security of older people using the different transport modes, i.e. research, development, testing and evaluation, including projects on the training and cognitive screening of older drivers. *Actors* (e.g. users and planners), *vehicle design* (e.g. cars, buses, bicycles) and *environmental factors* (e.g. barriers within the built environment) in relation to each transport mode (in sections 4–8) are all given due consideration.

3.3 Restrictions

We have limited ourselves in this work on best practice to “recent years”, which means from about 1995 until today (2011). The search strategies are: previous research references, library databases, www pages (e.g. organisations studying the transport and mobility of older people), and personal contacts with people working in the area of older people’s mobility.
For more details about search strategies, see Annex 1.

3.4 Questions for investigation and discussion

First, we take an explorative approach by describing the research projects and evaluations of measures in a context of “best practice”; secondly, we summarize and discuss the findings.

Questions guiding the review and discussion:

- What is the main focus and aims of the measures and evaluations? How are the measures evaluated? What are the results of the evaluations?
- How do best practice examples work and how well do they fit the purpose?
- How is best practice received among older people?
- What possibilities do these measures provide?
- Is there a need for other measures?
- Is there a need for more research?

Not all these questions will be discussed in detail, but they will be used as guidance for the investigations and for the discussions at the end of the report.

4 Private car

In this section we review measures which aim at older people's safety and mobility in private cars. The measures found are mainly addressing older people as drivers. However some measures also connect to older passenger's security and use of the car.

During the past few decades a great deal of research has shown that older people in general are safe as car drivers. However, when involved in a crash they are often more seriously injured (See eg. Fridstrøm, 1996; Hakamies-Blomqvist, 1996; Hakamies-Blomqvist, Raitanen, & O'Neill, 2002; Hakamies-Blomqvist, Siren, & Davidse, 2004).

Studies show that older drivers are safer because of their ability to adapt their driving behaviour to suit the environmental conditions and also perhaps because of the times of day they tend to go out in the car; for example, avoiding rush-hours, reducing driving at dusk and in darkness, in bad weather and on unfamiliar roads (See eg. Helmers, Henriksson, & Hakamies-Blomqvist, 2004).

Whether or not people retain their travel habits when they grow older is important in relation to development in use of the car compared to using other travel modes. Hjorthol and Sagberg (1997) analysed this on the basis of national travel surveys from 1984/85 and 1991/1992. The development in older people's travel behaviour reflects an increase in driving-licence holders and in access to a car. Few report health problems connected with car driving, while a greater proportion say that they have problems using public transport, walking and cycling. During the period studied (from 1984/1985 to 1991/1992) there was an increase in shopping trips and trips connected with leisure activities, and mostly by car (Hjorthol & Sagberg, 1997). A cohort study from Norway, Sweden and Denmark based on the national travel studies from1985 to 2005 indicates that older people retain their car-use habits well into high age (Hjorthol, Levin, & Sirén, 2010).

Previous research reviews list the following points as important in improving older drivers' safety and desire to continue to drive (See eg. Levin, et al., 2007; Svensson, 2004):

- Safe cars, easy to get in and out of and to drive (e.g. automatic gearbox)
- In-car, user-friendly technical support systems possible to individualize
- Distinct road signs, clear colouring and contrasting letters
- Lighting appropriate for older drivers
- Information about road signs and traffic rules in the mass media
- Refresher courses for adult (older) drivers to improve their knowledge of the current traffic rules and practice in traffic
- Mapping and evaluation of courses and course material
- Comparisons internationally regarding training and refresher courses for older drivers, to increase knowledge about pedagogy and practice
- Information about how various health problems affect driving
- Improved knowledge about the impact of medication on driving skills
- Accessible alternative transport (i.e. public transport) when driving is not possible
- Information about alternative transportation.

4.1 Automatic or manual gearbox

Bolin (2008) has compared between driving a car with an automatic gearbox and a car with a manual gearbox. The aim of the study was to investigate how driving a car with an automatic gearbox affected the driving skills and behaviour of older, healthy, car drivers.

Thirty-one people over 70 years (18 men and 13 women) took the driving test following the same route with the different cars (automatic gearbox and manual gearbox). All of them normally drove cars with a manual gearbox. An occupational therapist from Mobilitetscenter and a driving teacher assessed their practical driving skills on each occasion and, afterwards, those who took the test answered a questionnaire about the differences between manual and automatic gearboxes.

In this study, driving a car with automatic gears had a considerable positive effect on the test person's driving behaviour. Speed control and awareness were better, there was less likelihood of being distracted and thus safety at intersections was also better. The majority of both men and women felt they had more control and would choose to buy a car with an automatic gearbox next time. A vehicle with an automatic gearbox appears to be a way to improve the mobility and traffic safety of older car drivers, since it gives:

- better speed control in an urban environment
- improved awareness in trafficated environments
- increased tolerance when distracted during driving
- more control when crossing at intersections (Bolin, 2008).

4.2 Technical support systems

Old age is typically associated with a decline in visual and perceptual, cognitive and physical abilities, thus impacting on safe mobility in traffic (Holland, 2001; Maycock, 1997; Sivak et al., 1995). To some extent older drivers can compensate by lowering their speed and by avoiding driving in heavy traffic and in the dark.

Another way for drivers with functional limitations to compensate is use of in-car technical support systems, usually referred to as in-vehicle information and communication systems (IVIS) and advanced driver assistance systems (ADAS). Based on functional limitations associated with ageing and traffic situations where elderly drivers tend to be at a high risk of accidents, Davidse (2006) concluded that these systems can be especially helpful for older drivers:

- They help the driver be more aware of approaching traffic
- They warn the driver about road users/objects located in the driver's blind spot
- They draw the driver's attention to relevant information
- They give the driver information about upcoming traffic hazards.

Several relevant ADAS and IVIS are already on the market (in Scandinavia) or in the process of development. Although the systems are not specifically developed or designed to address the needs of older drivers, several potentially address functional limitations associated with old age. However, to serve the needs of older drivers the systems should be better tested by older drivers, and evaluated and developed to

matching their needs. Some of the most relevant systems are mentioned below (for a more comprehensive review of existing ADAS and IVIS, see e.g.A. Linder, Kircher, Vadeby, & Nygårdhs, 2007).

Examples of systems available on the market:

- Parking assistance systems. – These aid the driver when parking and backing the car by alerting the driver auditorily or visually to obstacles in the way. This can aid older drivers with reduced flexibility of head and neck movements and/or a narrower useful field of vision. For instance, a computer display may show the view from a rear-facing camera when the car is moving backwards.
- Night-vision enhancement systems. – A decrease in night-time visual acuity is typically associated with old age, and this can impair the driver's ability to detect what (or who) is on the road in front of him. One type of night vision system illuminates the night with projected infrared light, whereas another type registers images based on body heat. Both systems display the image on a monitor in the car.
- Adaptive headlights actively following the road curvature. – These headlights illuminate not only in a straight forward direction but also in the direction of the road round a bend. They thus improve visibility and help the driver detect hazards and follow the road curvature more easily. This can be particularly helpful for older drivers in giving more time to respond adequately to, for example, a pedestrian walking along the road or changes in the road environment coming out of the bend.
- Navigation systems. – These help the driver find a route toward a destination by giving turn-by-turn directions or by showing the route on a map display. They can be beneficial for older drivers. In Norway, older drivers are known to be at high risk of being involved in an accident when driving in unfamiliar districts (Ulleberg, 2006). Route instructions given through navigation systems potentially decrease the mental workload when driving in unfamiliar areas and can thus promote safe mobility among older drivers.
- Adaptive Cruise Control and Lane Departure Warning Assistant. – Systems such as these can be helpful to older drivers, but they do not expressly address functional limitations to the same extent as the systems described above.

Examples of driver assistance systems relevant for older drivers and that are under development (see. e.g. SWOV, 2008):

- Collision warning systems aimed to be of value at intersections. – Turning left (right in the UK) at intersections is known to be a typical high-risk situation for older drivers. Collision warning systems aimed to be of use at intersections are intended to draw the driver's attention to traffic approaching the intersection, or to indicate when it is safe to cross between two approaching vehicles.
- Automated lane changing and merging systems. – Reduced flexibility of head and neck movements, and/or a narrower useful field of vision resulting from ageing, can hinder drivers from seeing vehicles approaching from behind in a parallel lane. This system assists the driver to find sufficient space between cars and can also take temporary control of the vehicle to ensure safe merging. This means less to think about. The driver's attention is focused on approaching traffic and on identifying objects located in blind spots.

- Systems giving information about complex traffic systems (e.g. intersections) coming up. – These systems can decrease mental workload and free up the driver to cope with heavy traffic safely.
- In-vehicle sign systems. – These are road signs projected on a screen monitor in the vehicle. They help the driver read and perceive traffic signs (e.g. through increasing the size of text), which are available for longer (vital seconds), thus giving the driver more time to perceive, interpret and respond.
- Systems warning of upcoming situations occurring in traffic (e.g. unexpected congestion, animals crossing the road). – Information provided by these systems can give the driver more time to plan and respond adequately to unexpected traffic situations.

The driver support systems mentioned above signify the considerable potential there is to promote safe mobility among older drivers. At present, no official recommendations or restrictions have been made by the public road authorities in the Scandinavian countries pertaining to the use of these types of ADAS/IVIS. One possible reason is that the effects of such systems on traffic safety are difficult to estimate since few evaluation studies have been carried out testing this – or on actual driver behaviour (A. Linder, et al., 2007; SWOV, 2008; Vaa, 2006). However, the several studies already conducted in driving simulators and test courses have produced promising results (see e.g. Davidse, 2007; Hjort, Kölbl, & Fuchs, 2009; Lervåg, Moen, & Elvsaas Nordtømme, 2011) (for a review, see A. Linder, et al., 2007), but they have mainly been based on drivers aged 55 or younger.

Another factor making it difficult to determine whether such systems actually will increase safe mobility among older drivers is that none of them are designed especially for older drivers. For instance, it is quite common for people over the age of 60 to have trouble focusing sharply on nearby objects without putting on reading glasses (Weale, 2003). In-vehicle displays of text could therefore be difficult to read for older drivers if not designed properly. Also, hearing loss, or just reduced hearing, is quite common and should be taken into account when auditory displays are being designed. Poor design puts off older drivers, who are then prone to experience ADAS/IVIS negatively.

Several researchers (see e.g. Davidse, 2006; Saad, 2006) have emphasized that it is important to keep the risk of negative side effects of ADAS and IVIS in mind, one being information overload. Poorly designed ADAS may therefore result in increased cognitive workload and therefore the possibility of ADAS distracting the driver's attention and situation awareness. Consequently, this can have a negative effect on ability to drive safely, especially if the driver receives information from several ADAS and/or IVIS systems at the same time. The expected decline in cognitive ability associated with age renders older drivers particularly sensitive to experience information overload.

Behavioural adaptation, another possible negative side effect of ADAS, means in this case that drivers often adapt their behaviour to improvements in safety by taking more risk and/or paying less attention to the road in front of them (see e.g. Amundsen & Bjørnskau, 2003; Grayson, 1996; OECD, 1990). For instance, night vision systems and adaptive front lights can result in older drivers being more likely than not to drive when it is dark and/or to drive faster in the dark, thereby increasing their exposure to dangerous traffic situations. Likewise, collision warning systems may result in more driving in complex traffic environments. ADAS could also result in drivers being less

consciously aware of what is going on around them if they have undue confidence in such systems.

To sum up, knowledge of the effects of ADAS/IVIS in terms of crash reduction and increased mobility is still rather limited. It is important to keep in mind the risk of unwanted side effects of such systems, although ADAS/IVIS have the potential to compensate for functional limitations associated with ageing. More research on the effects of ADAS/IVIS on the mobility and safety of older drivers is therefore needed – knowledge regarded as especially important since several ADAS/IVIS systems are standard safety equipment in many cars.

4.3 Vehicle advice

The Swedish Transport Administration (formerly the Swedish Road Administration) has produced two short advisory memos on vehicle choice, with overviews of car requirements and support systems to the advantage of older and disabled people (Vägverket, 2007, 2008).[1] Important considerations for an older person when choosing a new car are, for example, strengthened braking force, flexible seats (upright and high seating), uninterrupted view all around, ease getting in and out and in reaching and fastening the seat belts, getting into a comfortable driving position and ready access to the controls and dashboard (key press, knobs, etc.). It is also important that the car dealer demonstrates all the controls and other functions in the car. The memo targeted at older drivers (Vägverket, 2007) highlights this as important for all car owners/drivers, and especially older drivers. It also states that to facilitate driving in darkness the headlights must be of good luminous quality. An anti-skid system and other technical safety support systems are mentioned, as well as good, well-designed, boot space for ease of lifting heavy luggage. Automatic gearbox and hill-hold control (HHC), which is a technical support mechanism that holds the brake until the clutch is at friction point (making uphill starts easier), as well as a sun protection system are also preferred equipment for older drivers, according to this memo. The memo targeted at disabled people is also to some extent relevant for older people (Vägverket, 2008); for example, it reminds us of the procedure involved when renewing our driving licence and about the various forms of adaptions and readjustments of cars. The memo is informative and easy to read, with illustrations, check lists and references to expert knowledge. It is important that this sort of information material is updated regularly, not at least taking into consideration advice about new technical support systems which are useful for older people.

4.4 Environmental aspects

Previous research has shown that road-lighting reduces accidents during darkness. Appropriate road-lighting, reduced dazzle and reflected light are considered more important for older driver groups than for younger (cf. Levin, et al., 2007).

A Norwegian study has shown that older people are more likely to drive where there is better road-lighting. The speed and alertness of car drivers were measured before and

[1] The brochure *Bilar för äldre* has recently been available in pdf-form at the homepage of the Swedish Transport Administration (Trafikverket) www.trafikverket.se and the brochure *Modellen för dig* was downloaded from the www-address: www.dhr.se/index.php?page=Bilstod&download_file=384 (both brochures were available in Mars 2012).

after the introduction of road-lighting on a stretch of the E-18 in Norway; a section of the same road without road lighting was used as control. One conclusion is that that older people drove more in darkness after road-lighting has been introduced. Also women (not specifically older women) showed increased interest in driving in the area where road-lighting was introduced. However, even though earlier research has shown that road-lighting reduces road accidents in darkness, this study also showed that drivers increase their speed a little and have become slightly less attentive after the introduction of lighting (Bjørnskau & Fosser, 1996). More research about older people's experiences of various road conditions is needed.

4.5 Refresher courses for older drivers

Norway has a tradition in arranging courses for older drivers. The program for older drivers was introduced in the Norwegian Road and Road Traffic Plan 1998–2007, and has been implemented in the National Plan of Action for Traffic Safety on the Road from 2006. These ("Bilfører 65+" ["Driver 65+"]) are open for all Norwegians from 60 years and are run by the Norwegian Public Roads Administration (Statens vegvesen) in collaboration with authorised driving schools. A course invitation will be sent to all drivers 65+ holding a licence. This will be repeated for those who reach 70. The courses are based on voluntary participation and contain both theory and practice. The drivers have to pay a fee of about 60 euro (500 Norwegian kroner) to participate in the course. The aim of these courses is to raise traffic safety awareness and to improve, or at least help maintain, the mobility of older people.

The instruction material has been especially tailored to the needs of the target group and it is emphasized that no one would be afraid of being subjected to an exam or losing their driving licence. Also, the contents are adapted to the local area and the participants' own experiences. The Public Roads Administration in Norway has listed things that the participants usually want to know more about:

- right of way
- roundabouts
- road marking
- traffic signs
- traffic light crossings
- highways
- light usage
- overtaking
- parking regulations.

The participants are encouraged to bring up special traffic situations from their local area and the instructor involves the participants in open discussion. There are also information movies for older drivers at the www-page: http://www.vegvesen.no/s/e-lering/65plussTipsBilforere/index.html.

A few of these courses have been evaluated. In Vestfold in the 1990s, data were collected through questionnaires sent to elderly drivers who had taken/not taken "Driver 65+" courses. The questions related to accidents, exposure, uncertainty in relation to signs and regulations, insecurity when driving under certain conditions, necessity of

driving, etc., the results indicating a beneficial effect on safety and mobility. The study also indicated a need for more extensive studies to confirm the evaluations, and among drivers who did not take the course a majority reported an interest in doing so (Glad & Borger Mysen, 1997).

In 2006, the effect the course had on mobility and on the risk of accident was evaluated using a comparison group. A pretest-posttest design was applied. Compared to a randomly selected group of drivers aged 65 years or older, the course participants had a reduced risk of being involved in a traffic accident by 22 per cent one year after completing the course. This was not statistically significant, however. Based on the reduced risk, the estimated benefit of the course was three times greater than the cost (Ulleberg, 2006). The course was not found to have any effect on mobility among older drivers.

The “Driver 65+” refresher course was again evaluated in 2011, this time the effect estimated on the basis of a sample of 2100 drivers aged 70 years or more who had reported an accident to their insurance company during a two-year period. About 24 per cent of the sample had completed the course prior to the accident. Applying the method of quasi-induced exposure (Stamatiadis & Deacon, 1997), the relative crash involvement risk was estimated among drivers who had completed the “Driver 65+” course versus those who had not. Drivers who had taken the refresher course before turning 75 years of age were found to be at 35 per cent lower risk of being involved in multiple vehicle crashes compared to older drivers who had not taken the course (Ulleberg, Bjørnskau, & Fostervold, 2011). This was statistically significant both before and after adjusting for various confounding variables (age, number of miles driven annually, etc.). On the other hand, drivers who had taken the refresher course when they were 75 years of age or older were at the same risk as drivers who had not. The same tendency, although weaker and non-significant, was found for single-vehicle accidents. One possible explanation for the age-dependent effect of the refresher course is that the known ability to learn new skills declines rapidly with ageing; in this case the ability to learn about safe driving. The results from the 2011 evaluation thus indicate that the refresher course does seem to have a beneficial effect on safe mobility, given that the driver completes the course before turning 75 years.

Similar courses are also organised in Sweden and Denmark, but not by the Transport Administration, and so they do not have the same official status as in Norway. These courses are not evaluated equally. In Sweden, courses are organised by NGOs (Nyberg, Peters, & Levin, 2009) and, in Denmark, Vejdirektoratet, VD (Danish Road Directorate), began in 2010 to draw attention to the situation of older drivers by subsidising courses for this target group. Before, a few municipalities organized and financed courses by themselves.

Since 2010 the state subsidy is set at 300 Danish kronor per course participant and a maximum of 9,000 kronor per course. It is run by the Regional Road Safety Committee (Regionale Færdselssikkerhedsudvalg). Application is made through the municipality and the course is open to all citizens. The target group is 65+, in practice 65–80 years of active drivers who wish to improve their skills. Drivers younger than 65 years can participate, but not necessarily with grants from the Road Safety Committee. To qualify for a grant, the content of the course has to be in line with the recommendations of the VD. The municipalities and Ældre Sagen (Dane-Age organisation) hold the courses. For many years now Ældre Sagen has actually been arranging refresher courses for experienced drivers (*Opfriskningskursus for erfarne bilister*) in cooperation with the

Danish driving instructor association. The secretariat of Ældre Sagen provides the materials and the frames, and local councils hold the courses, which comprise both theory and practice, with many older drivers wanting to be brought up to scratch with traffic rules introduced since they first got their driving licence as 18-year-olds. But they also want a sense of whether they are still safe as drivers in traffic, and the best way to find this out is to run a couple of hours with an instructor in one's own car. Following the recommendations, the courses can be scheduled at different levels in accordance with what is feasible in terms of economy and in how much support the courses receive locally. The three levels are entitled: Rolls Royce, Toyota and Trabant (Regionale Færdselssikkerhedsudvalg, 2010):

Rolls Royce model

Theory: 3 × 2 hours
Practice: 1 or 2 hours of driving one's own car with a driving instructor
Practice: Driving on a safe-driving road in one's own car.

Toyota model

Theory: 3 × 2 hours
Practice: 1 or 2 hours of driving one's own car with a driving instructor.

Trabant model

Theory: 3 × 2 hours.

In Sweden they are run by traffic safety organisations and pensioner associations recruiting participants mainly from among their own members. The actual context and execution of courses can differ between organisations in accordance with the members' interests and the course leaders' competence and experience, which makes it difficult to overview the courses on an equal footing. Quite recently, however, researchers at VTI have produced an overview of these courses and have evaluated the predominant refresher course 65+ in a Swedish context (Nyberg, et al., 2009; Peters, Nyberg, & Strand, 2010).

The Swedish evaluation is in two parts: telephone interviews with stakeholders and organisers of refresher courses for older drivers, and two surveys based on postal questionnaires among past and present course attendees. The aim of the first part was to comprehend the organisers' point of view and to collect basic data about the courses. Thus, semi-structured interviews were conducted with eleven experts from traffic safety organisations, mobility centres, motor clubs and retired people's associations. The aim of the second part was to find out what the participants thought of the courses, among other things the benefits they gained. The questionnaires consisted of 35 and 38 questions, respectively. Answers were received from a total of 162 course attendees: 50 pre-course and 112 post-course. Mean age was 70 years, gender distribution was fairly even and almost all were active drivers.

The catalyst for the development of courses for older drivers was a traffic safety project known as Senior-OLA (OLA= Objective facts, Solutions and Intentions) coordinated by the Swedish Road Administration within the context of Vision Zero[2]. The 65+ course is

[2] **Vision Zero.** In 1997 the Swedish Parliament introduced a "Vision Zero" policy for road traffic requiring that fatalities and serious injuries be halved within ten years and reduced to zero by 2020. Zero

mainly theory and the study material is based on research results, analysis of accident statistics and expert knowledge. It was produced in collaboration with non-governmental organisations, e.g. the Swedish National Association of Driving Schools (STR), the National Society for Road Safety (NTF), motor clubs and retired people's associations. Briefly, the content is:

- The road, the car, the driver
- Driving on rural roads
- Entering a main road, right of way, crossings and roundabouts
- The dangerous left turn (driving is on the right in Sweden)
- New traffic rules and regulations, restricted licences and commentary driving
- Impact of ageing on performance and abilities, compensatory behaviour, traffic medicine
- Optional practical training (e.g. skid training).

The interviewees say that refresher courses are popular in Sweden and express a firm belief in the benefits in terms of improved safety and mobility. However, the courses were not evaluated systematically by the organisations and the course leadership varied between organisations. Three main categories of leaders were identified by VTI: 1) organisation members, i.e. amateurs with no expert knowledge usually serving as course moderators; 2) organisation members with some deeper interest and/or domain knowledge acting as traditional teachers; 3) leaders with expert knowledge gained in former traffic-related professions, e.g. police officers, driving teachers, traffic inspectors. The course leader can influence the content and therefore the outcome of courses. Although practical training is rare, when the opportunity is there it is very much appreciated by those who take part. One conclusion is that the course material should be updated and generally improved, and there is a need for more experienced course leaders. Even though no organisation had any experience of simulator-based training, they were positive to try this form of training method.

In the *pre-questionnaire* (answered by 50 course participants) the questions concerned driving experience, accident involvement and driving practice. Only one person had been involved in a crash, a minor accident where the driver himself was not at fault. The results from the pre-questionnaire showed that males were more frequent drivers than females and they dominated on long trips (69% compared to 31% for females). Female drivers reported that they had changed their driving habits more during the 10–15 years than the men did. For example, female drivers reported that they avoided driving in darkness, in snow, at low friction, at roundabouts and at difficult crossings more frequently than men. They also said they avoided parking situations more often now than for 10-15 years ago.

The *post-questionnaires* (answered by 112 course participants from several courses and locations) reported the motives for taking the course: a wish to learn more, curiosity and recommendations from other course participants. The only significant gender difference was that women more frequently mentioned traffic changes and a feeling of vulnerability as causes for taking the course. In general, the courses were rated highly, but that the balance between theory and practice could be better. The participants also

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vision was also launched in a National Transport Plan in Norway 2002–2011 (Rugland, 2011), and in other European countries similar aims and methods are under discussion (Whitelegg & Haq, 2006).

reported that they had learned much about six topics in particular: traffic rules, road-vehicle-human interaction, traffic medicine, left turns (right in the UK), eco driving and crash scene behaviour. The most likely reasons for giving up driving were: a feeling of being unfit to drive, bad health, critical relatives, crash involvement (no gender differences were found) (Table 1).

Table 1 The eight most frequently mentioned, presumable motives behind giving up driving (Peters, et al., 2010).

Causes	Per cent	Causes	Per cent
Self-assessed unfit	77	Financial	19
Decline in health	74	Access to public transport	14
Relatives	52	New residence	13
Accident involvement	24	Certain age	9

The most frequent feelings associated with giving up driving were sadness, restrictions and loneliness, men more so than women (Table 2).

Table 2 The eight most frequently felt feelings related to stopping driving (Peters, et al., 2010).

Feelings	Per cent	Feelings	Per cent
Sadness	66	Indifference	5
Limiting	52	Other	5
Loneliness	20	Relief	3
Humiliation	9	Unfair	1

A majority of the participants felt that the courses had a positive impact in general and in safety issues specifically. Participation in a course raised their level of knowledge and seemingly also their general well-being. One conclusion is that improved self-assessment and risk awareness should be prime goals of refresher courses. The courses could also be improved if there were more opportunity to practise hands on, and the recruiting basis was extended. The Swedish research group suggests methods identifying critical drivers in combination with offering the courses to all senior drivers, and that Sweden should consider the Norwegian concept. This study was the first attempt to evaluate the Swedish courses for older drivers and one conclusion was that the methodology could be further improved with questionnaires and scales more appropriate for catching critical changes (Peters, et al., 2010). The organisers were positive to including simulator training in refresher courses, although they had not used this themselves (Nyberg, et al., 2009).

Computer and simulator training

Computer and simulator training can be helpful in identifying shortcomings and idiosyncrasies in a driver’s behaviour, and in providing an opportunity for participants

to challenge their own limitations. The simulator does not contribute to air pollution, the same critical situations can be simulated and tested over and over again and driving performance can be analysed and communicated to drivers in a systematic way afterwards. Also, various support systems can be tested and evaluated in the simulator. Simulators have been greatly improved in the past few years to be more like driving in real life; however, simulator driving is not the same as driving a car in real traffic situations. Despite the constructed, constrained situation in simulators, the method can be a valuable complement to theory and road practice. A research overview with simulator studies involving older participants (65+) found that common results of driving performance were that average speed of older people was, as a rule, lower than that of other age groups, and it varied more. Additionally, the studies describe older people with longer reaction times to stimuli and that they perform less well on cognitive information, require longer time gaps to carry out left-hand turns, maintain lower speed and overtake less often than younger drivers. In other words behaviour which to a great extent is recognized from not experimental situations. But there are also simulator studies in which older people perform on a level comparable to other participants, or do better than them. Few studies describe how simulators have been used for training or education of older people. Also, only a limited number of validation studies involving older people have been found. The problem of simulator sickness was discussed, too, and the overview found tendencies that older people more often than younger drivers felt simulator sickness in the driving tests (Henriksson, 2007). Researchers have stated a need for further evaluation of simulator training as a method for developing courses for older people (HUMANIST, 2006; Levin, et al., 2007: 87-91).

4.6 Identifying risk behaviour

In the coming years, the older part of the entire mass of drivers is expected to increase in all industrialised countries. It is important to note that older drivers are not characteristically unsafe drivers. According to previous research on healthy older people's behaviour as car drivers, the image of the older ones is complex and thus their categorisation as a risky group is unfair. For example, in a Swedish-Norwegian study assigned by the Norwegian Public Roads Administration, both older (75+) and younger (35–55 years) drivers were tested on road and also in laboratory situations using a hazard perception test and eye movement measures such as Useful Field of View (UFOV). One conclusion was that chronological age was not an appropriate way of identifying unsafe car drivers, and that driver behaviour varied among individuals of all ages. Compared to the group of drivers
35–55 years, the older ones were the more heterogeneous group, i.e. more individual differences were found among the older drivers than among the younger ones. In other words, it would not be a good idea to classify an entire group of "older drivers" as the more risky in road traffic. There are potentially risky individuals in both the older and younger groups and also safe drivers among the older. The research team recommended that there should be more refined methods for identifying risky traffic behaviour and more flexible solutions for increasing the safety of all road users. These would include intersection design, vehicle design as well as adaptive safety systems to promote various individual needs (Levin, Dukic, Henriksson, Mårdh, & Sagberg, 2009). In a follow-up study, researchers provided an overview of tests and activities designed to improve the safe mobility of older drivers. The aim was to describe traffic safety measures in regard to older car drivers and to evaluate the effect these might have on traffic safety and mobility. The study was based on a literature review as well as on existing and possible

self-evaluation tests for older drivers, and these formed the basis of evaluation of the effects of measures on traffic safety, safe mobility and viability. Seven measures of action were presented (Heikkinen, Dukic, Henriksson, Høyne, & Peters, 2010):

- The current Norwegian driving licence policy of mandatory medical certificates for car drivers 70 years old and older should be re-evaluated
- The current Norwegian policy of restricted driving licences should be re-evaluated
- Education and training for older drivers should continue to develop with the aim of increasing the effects on safe mobility
- Self-evaluation tests should be implemented step-by-step and their use evaluated
- Checklists and advice to facilitate older drivers when choosing a car beneficial to safe mobility should be disseminated
- A separate signal phase for left-turning (right-turning in the UK) vehicles at intersections regulated by traffic lights, possibly complemented by a separate lane, should be introduced where possible
- Complex intersections without traffic lights should where possible be reconstructed as roundabouts.

Self-evaluation tests are primarily directed at drivers who feel unsafe in traffic and those more accident prone due to illness or immobility. These tests can also be taken by family members or friends of older drivers – in this way helping in the assessment of driving ability. Most current tests are checklists and questionnaires inquiring about situations assumed to be connected with risks in traffic. An advantage, according to Heikkinen et al., is that they are accessible and easy to complete. Some tests evaluate abilities (e.g. cognitive or conceptual). Others focus on different functions (e.g. sight, awareness), behaviour, illness or intake of medication. Examples of self-tests are AAA Roadwise Review, Driving Health Inventory, Useful Field of View, Hazard Perception Test, Driving Decisions Workbook and Enhanced Driving Decision Handbook. However, most tests are not empirically evaluated and in many cases records of how they have been developed are inadequate (Heikkinen et al. 2010).

Advice and expert knowledge, and also testing and training, are available at the Swedish competence centre of mobility “Mobilitetscenter”,which has a web-portal giving information and advice (http://www.mobilitetscenter.se/). At the training centre, located in the City of Gothenburg, assessment and training are provided by experts. Mobilitetscenter started in 2002 with the aim of promoting mobility for people with various disabilities (Mobilitetscenter, 2011). It is run by a consortium formed by disability associations and in collaboration with health care, habilitation and national health insurance. Individual assessments are provided by occupational therapists with specialist competence in this area and the centre helps with for example rebuilding of cars, wheelchairs, etc. and the integration of rehabilitation technology in vehicles. The assessment methods and training activities are scientifically tested (cf. Peters & Anund, 2005).

Illness and health conditions can affect driving ability to such an extent that it endangers the safety of older persons themselves and other road users. Dementia has been identified as a significant factor in this regard. In Denmark, traffic safety researchers at DTU, Siren and Meng (2010, 2011), have recently carried out analyses of Danish accident data and have presented an international literature review of dementia tests

striving to evaluate the effects on traffic safety. According to these analyses and to previous studies, there are no significant effects on traffic safety from the screening of older drivers. Meanwhile, the Danish researchers point out the complexity of traffic safety and the difficulty in differentiating the “unsafe drivers”. There are often several reasons why accidents occur and measures such as screening may instead decrease the mobility of healthy older drivers. Previous research has shown that older women, in particular, are often too hesitant about renewing their driver licence, which has negative effects on their mobility and traffic safety. Screening at a specific age (e.g. at 70 or 74 years) would perhaps have an unwanted effect of restraining healthy older people from driving (Hakamies-Blomqvist, Henriksson, & Heikkinen, 1999; Hakamies-Blomqvist, Johansson, & Lundberg, 1996; Hakamies-Blomqvist & Wahlström, 1998; Hakamies-Blomqvist, Wiklund, & Henriksson, 2005; Siren & Meng, 2010).

4.7 Driving licence renewal in the Scandinavian countries

The legislation regarding driving licence and fitness to drive in old age varies in the Scandinavian countries (here “Scandinavian” refers to Denmark, Sweden and Norway). While in Denmark driving licence renewal is age-based and requires a medical examination, in Sweden renewal is purely administrational and the same for all drivers regardless of age. In Norway, there is no renewal, but drivers aged 70 and over need to have a certificate from a physician stating that they are able to drive.

The procedures for renewal of driving licence for private cars (B-personbil), in the different Scandinavian countries are described below.

Denmark

In Denmark, a driving licence is valid until age 70. It has to be renewed at ages 70, 74, 76, 78 and 80. After age 80, the licence has to be renewed every year.

A requirement of renewal is that the driver presents a medical certificate ratifying ability to drive and signed by a doctor. As of 1 May 2006, short versions of a mini-mental test and a clock-drawing test were added to the examination in order to identify drivers with cognitive deficits. Costs incurred in getting the certification vary and are at the driver’s expense.

If the physician has no remarks, the licence can be renewed automatically at a minor cost if the applicant is 70 years or older. If the doctor is undecided or makes any qualification, the process will be dealt with by the police and usually the applicant needs to take a practical driving examination, which, at the time of writing (autumn 2011), costs DKK 870. This, plus the hire of the test car, is also paid for by the driver. The driving test covers driving in different traffic environments and otherwise contains the same elements as the driving test for novice drivers. The police can also gather further information about the applicant, for example, neuropsychological test results, in coming to a decision. When the decision has been made, the applicant will be informed and will have the right to appeal to the police.

The renewal procedure and age limits were reviewed by a working group about ten years ago (Sundhedsstyrelsen, 2003), when the 70-year age limit for licence expiration was kept unchanged. The working group recommended adding cognitive tests to the medical screening and this was implemented in 2006. MMSE-test is used to screen for

cognitive impairment, which is based on tests commonly used in medicine to screen for dementia.

Aspects of the Danish screening system have been evaluated in two studies. First, Hansen & Hansen (2002) carried out a pilot study of the new screening system with the mini-mental test (MMSE) and clock drawing test before it was implemented in the country as a whole. In the study, which was carried out in Southern Jutland, two periods were compared: one before (6 months) and one after (10 months) implementation of the cognitive test. During the two periods, a total of 6,091 applied for licence renewal (2,631 before and 3,460 after implementation of the cognitive test). Before the test was introduced, 0.6 per cent of drivers (15 persons) did not get their licence renewed, while after it was introduced, the share was significantly higher at 1.5 per cent (50 persons). There were also fewer older drivers than normal who applied for licence renewal after the test was introduced. One conclusion from the study was that use of MMSE test resulted in a higher number of drivers sent for a driving test and also a higher number of drivers who did not renew their licence. This was seen as positive and that use of cognitive screening would enhance road safety.

Safety effects were not evaluated in the Hansen & Hansen (2002) study, however, and thus their main conclusion is weak. Many other international studies have pointed to the negative aspects of driving cessation and have problematized the expected safety gains (Fonda, Wallace, Herzog, & Regula, 2001; Hakamies-Blomqvist & Wahlström, 1998; Langford & Koppel, 2006; Marottoli et al., 2000; Marottoli et al., 1997; Siren, Hakamies-Blomqvist, & Lindeman, 2004; Stutts & Wilkins, 2003; Wilkins, Stutts, & Schatz, 1999).

A more recent study by Siren & Meng (2010, 2011) evaluated the safety effects of the renewal procedure with cognitive screening. In comparing accident rates for older road users before and after nationwide implementation of the MMSE and clock-drawing tests, they showed that while there was no change in accident rates before and after for older drivers, there was a significant increase in fatalities among older vulnerable road users (bicyclists and pedestrians). This increase could not be found among the control group (18–69 year olds). Their conclusion was that while cognitive screening had not succeeded in preventing accidents among older drivers it had caused a modal shift towards less protected modes of transport, thus indirectly more pedestrian and bicyclist fatalities among older persons.

Recently, the Regionale Færdselssikkerhedsudvalg (the Regional Road Safety Committee) in Denmark produced a brochure describing why and how to renew a driving licence. The campaign was designed because it was found that older people faltered to renew their licence. The leaflet was tested among all 69-year-old drivers in East Jutland, and 41 per cent of respondents answered the enclosed questionnaire. The evaluation project also shows that nine out of ten are now planning to renew their licence in good time. The leaflet resulted in more older people than normal, especially older women, thinking about their driving licence (and their spouse). They were being persuaded to continue to drive, some saying they would now drive more often or take a refresher course (Regionale Færdselssikkerhedsudvalg, 2011).

Norway

In Norway, drivers aged 70 years and above need to have a medical certificate from a doctor stating that they are able to drive. This certificate has to be carried with them at

all times when driving and is usually valid for 3–5 years for persons aged 70 to 75 years and for one year for those over 75 years.

The certificate is usually issued by the driver's own doctor, but also by other doctors, including specialists. Issues that need to be checked include: vision, brain dysfunction, psychological or mental disorder (including dementia), abuse of alcohol or drugs, motor abilities and other possible illnesses of relevance to driving. In order to evaluate psychological and mental capabilities, neuropsychological tests, often MMSE and clock-drawing tests, are used.

If a doctor is undecided, a driving test is recommended. The test is supplementary to the medical examination and cannot supersede it. The driving test does not take place if the driver clearly has problems that show up in the medical examination.

The driving test is administrated by the Norwegian Public Roads Administration. It is not a standard test but ad hoc in terms of use of the applicant's own car vs. test car and also in terms of the route driven during the test.

If the doctor concludes, based on medical examination and possibly the driving test, that the driver is not fit to drive, the County Governor has to be informed (in total there are 19 County Governors in Norway). The Governor's medical department will then determine whether the driver should be allowed to continue driving. In coming to a decision, social factors can also be taken into account and the applicant might get a permit to drive in a geographically limited area. If the decision by the County Governor is negative, the police will be informed and the driving licence of the applicant will be annulled. In this case, the applicant is entitled to get a second opinion or to appeal. The Norwegian system, including its safety effects, has not been evaluated.

Sweden

In Sweden, a driving licence needs to be renewed every 10 years, regardless of the driver's age. Renewal is administrational and does not require medical examination or other proof of fitness to drive. Drivers are automatically sent renewal forms by mail when the expiry date is nearing. The cost of renewal is presently (2011) SEK 150.

Doctors are required to report to the authorities if they have patients whose driving ability they are in doubt about. Any doubt needs to be based on a medical examination, but as of 2010 doctors have been able to report drivers (but are not required to) who refuse to be examined. A patient reported by the doctor has to be further examined, and this is the responsibility of the Swedish Transport Agency (Transportstyrelsen), which has a separate traffic medicine department. The actual examinations to determine fitness to drive are carried out in at the centre for traffic medicine. In Sweden the applicant might get a permit to drive under limited conditions, e.g. driving exclusively in daylight if the applicant has problems with his night vision (Widman, 2008).

In Sweden, traffic medicine is a well-established and well-regulated field. Medical issues and procedures in relation to driving licences have been evaluated, reviewed and redefined often by different actors and stakeholders (doctors, other traffic medicine professionals, the Association for Traffic Medicine, researchers, road authorities and politicians). The role and responsibility of doctors in this regard has been reviewed several times (e.g. Englund, 2010; Svensk trafikmedicinsk förening, 2009; Vägverket, 2005). The safety effects of the lack of age-based population screening in Sweden have been examined in one study (Hakamies-Blomqvist, et al., 1996), while in another the

competence and attitude of doctors have been compared in relation to older driver evaluations in Sweden and Finland (where the system is similar to the Danish one) (Hakamies-Blomqvist, Henriksson, Falkmer, Lundberg, & Braekhus, 1998).

Hakamies-Blomqvist et al. (1996) compared accident rates in Sweden (no age-related screening) and Finland, where all drivers from the age of 70 have to be checked medically if they wish to renew their licence. The results did not show any safety benefits resulting from the Finnish system; on the contrary, it showed that this country had a higher pedestrian fatality rate after the age of 70. The authors argued that in the modal shift from being a car driver to an unprotected road user (pedestrian, cyclist, moped rider), the screening indirectly brought about an increase in the number of unprotected road users who were killed. They concluded that the age-based mandatory screening produced an overall negative safety effect.

In the Hakamies-Blomqvist et al. (1998) study comparing the competence and attitudes of general practitioners in relation to older driver evaluations in Sweden and Finland, it was found that the strict screening policy did not mean that Finnish general practitioners were better informed about ageing and fitness to drive than were their Swedish counterparts, but just that they had more restrictive attitudes to ageing and driving. A recent study from Trafikmedicinskt Centrum at Karolinska Institutet in Stockholm showed similar results (Lundberg & Johansson, 2011). The study was based on voluntary participation of 493 active drivers and car insurance holders over 65 years. The study compared data from comprehensive health controls, reported accident involvement, questionnaires, cognitive tests and professional talk with the participating car drivers. Despite an extensive investigation and test battery, a large sample and an observation period of five years, the research team could not predict future crash involvement with any degree of certainty among the insurance holders who were participating. However, they found a tendency of higher involvement in minor crashes among the insurance holders with certain medical conditions and disabilities (e.g. poorer dynamic visual acuity) but the crashes, consisting of parking-related collisions were rarely reported to the police and thus not very serious. The research team suggested that future studies should focus on specific disease groups and be prospective tests (Lundberg & Johansson, 2011).

5 Public transport

In this section we discuss contemporary measures to increase the opportunities of older people to travel using public transport. Different measures are currently operating with the aim of improving accessibility to vehicles and environments in the domain of public transport. This section also deals with salient experiences and attitudes of users.

Talk of public transport always includes some out-of-home movement in reaching the stops or share-points (e.g. walking, bicycling). Thus it could be described in terms of a need to understand the *Whole Journey* and that public transport measures cannot be dealt with without considering the entire journey.

5.1 The whole journey

Previous research reviews have raised some important points for older people in public transport. For example (see Levin, et al., 2007; Svensson, 2004):

- Low-floor buses and other vehicles accessible with a wheelchair, walker, etc.
- Short walking distances
- Maintenance of walkways, bus stops, etc.
- Wind shelters, lighting, benches and toilets at bus stops/train stations
- High service level on board
- Optional transport (timetables)
- Seat on board
- If possible no changes of buses/trains
- Possibility to avoid rush hours (crowded buses)
- No stress
- No advance reservation on public transport.

Warsén et al. have studied the whole journey concept in implementation projects and in collaboration with transport authorities, departments and companies, and have tried to improve the environment around public transport (Warsén, 1997; Warsén & Haywood, 2005; Warsén, Lundin, Melzer, & Haywood, 2004). In cooperation with authorities in Sheffield and Tel Aviv, the Jönköping Public Transport Authority in Sweden conducted a research project about how people experience safety and security.

The “whole journey” concept was introduced and involved county transport companies, entrepreneurs, civil servants and politicians, travel organisations, police, schools, among others. The project involved:

- Passengers on board, interviews and surveys
- Cooperation with the news media, to get the message over to the public and ensure that the partners that are responsible take care
- Involve the operators and drivers more in the development process. Drivers are those best placed to understand the needs of passengers and the situation on board
- Training for partners and, particularly, drivers

- Better understanding of the whole journey and the public environment through escorted journeys made by public transport staff and the community to obtain better empathy for the passenger
- Physical measures such as CCTV (Closed-circuit television) on board and at terminals, lighting and cleanliness on board, at terminals and in the public environment.

The method used in the project is described in terms of “Walking for Safety”, which implies being in the environment in question in surveying and identifying locations and products. Residents, passengers and staff together can “scan” and document a particular environment. Visual tools were used, such as cameras, videos, maps and descriptive material. In small work groups, planners and other representatives (e.g. from public transport) participated in organised walking tours together with user groups. Discussions taking place during the walk were summarised and documented and focus group discussions after the walk led to further understanding. Checklists of aspects concerning security, safety and comfort were carried out in accordance with Design, Information and Operation (Warsén & Haywood, 2005) (see Annex II).

Along with other forms of structured models, checklists can sometimes be perceived as being too formal and governing; however, they may also be a guide and help when the discussion is developing, particularly when different actors are working in partnership (e.g. public authorities, municipalities, private transport companies). The whole journey environment and travel chain could also be described and analysed more thoroughly by drawing together urban design, digital data analysis (e.g. GIS), participant observation and qualitative methods. The use of GIS, participation techniques and map walks with residents, and integrated studies with digital data analysis and visualization of the whole journey environment, has been accomplished by for example planners and researchers in the UK. Local authorities, the police and transport agencies have the key role and practitioner networks have been established (Evans, 2009). The next section deals with a concept which has been introduced in many areas, and could be useful in providing public transport for various user groups: the concept of *Universal Design*. The concept has recently been adopted in Norway.

5.2 Universal Design

Universal Design is a strategy for achieving equal possibilities for different participants in society. Equal possibility is justice in relation to physical planning (Øvstedal, 2009). Øvstedal points at two approaches for evaluating usability of the transport system. One is to survey the physical design, generally by the use of checklists and GIS tools providing the opportunity to analyse the accessibility of a journey or district. The other approach is by analysing behaviour, travel diaries and the travellers’ assessment of accessibility and satisfaction which is dependent on the travellers’ expectations.

The concept of universal design (universell utforming) has become standard in Norwegian planning vocabulary, and in legislation and management. Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design (Miljøverndepartementet, 2007). The Ministry of the Environment gives guidelines on the definition and interpretation of universal design and recommends its use as the basis for efforts relating to various sectors:

The concept of universal design represents a new line of thinking; it incorporates a stronger focus on equality than is implied in the concept of accessibility for persons with reduced functionality. While it is possible to obtain accessibility for persons with disabilities by means of specially-targeted solutions, the universal design principle stipulates that the primary solution must be designed to anticipate the needs of all users (Miljøverndepartementet, 2007: 9).

It is predicted that the phrase "usable by all people" will be incorporated as a first starting-point without exception. Environments and products are to be designed in such a way that they can be utilised by persons of *all ages* and with different levels of skills, ability and functionality. Factors relating to mobility, vision, hearing, comprehension and sensitivity to the environment (asthma/allergies) are important in this context. For example, special solutions intended to compensate for general solutions that are not usable by all, such as stair lifts, should be avoided. The concept 'universal design' is promising according to ageing society and the increased population of older people. However, the strategy may come into conflict with other areas of statutory regulation, e.g. safety considerations, and in such cases an effort should be made to seek solutions that satisfy universal design requirements to the greatest possible degree.

In addition, the universal design strategy imposes interdisciplinarity in planning, follow-up, implementation and assessment activities. An appropriate process for participation is needed that encourages the involvement of a wide array of users and organises the participation of various user groups (Miljøverndepartementet, 2007). The standardisation of universal design has resulted in rather detailed local action plans where specific streets and pavements are pointed out and specified in municipalities' timetables for renovation (for example: Oslo kommune, 2008/2009).

A number of measures primarily designed for passengers with special needs (e.g. low-floor buses with wheelchair access) provide benefits and ease of use similarly for all passengers. Fearnley et al. (2009) included universal design measures in a Cost Benefit (CBA) framework, arguing that it is possible to prioritise, rank and compare them with other investments in the transport sector. The project is based on focus groups and on-board interviews with passengers in three different Norwegian cities where public transport services have been considerably upgraded towards accessibility for all (universal design). For example, travellers said they are willing to pay for:

- Screen with real-time information at bus stops
- All three information devices: map, speaker and visual real time information
- Next stop via both speaker and screen in the bus
- Shelter with seating
- Adequate snow and ice removal
- Light at stops
- End to end trip universally designed
- Stops and vehicle universally designed

One statement from the CBA is that measures for universal design are broadly regarded as quality enhancements and contribute to an increase in safety and security (Fearnley, et al., 2009). However the CBA-analysis of universal design is not specific focused on older or disabled people's experiences and opinions.

5.3 Accessibility

The public transportation system comprises buses, trams, metro and local trains, and is usually augmented with various mobility service options for older and disabled people, e.g. special transport service (STS) run by taxi-cars, mini-buses, so-called multi-purpose vehicles and service buses.

The use of conventional public transport (PT) is quite low among older people in general. For example, research in Sweden shows that about 40 per cent of the older population do not use PT at all (Svensson, 2003; Transek, 2005) and that about 5 per cent of everyday journeys among older people in the year 2000 were by conventional public transport (60 per cent of the journeys were by car) (Svensson, 2001). In Norway, 5 per cent of daily trips were by public transport in the age group 67–74 years in 2009 (Vågane, Brechan, & Hjorthol, 2011). Comparisons show that the trajectories are the same in other Western countries, i.e. older people generally avoid travelling by public transport (Mitchell, 2001; Rosenbloom, 2001; Whelan, Langford, Oxley, Koppel, & Charlton, 2006). However, there are differences between countries and within countries, often due to the transport service provided for older and disabled people.

Accessibility of public transport has been the subject of several studies in Sweden in recent decades (cf. Arnör, Pettersson, & Folkesson, 2006; Björnehult, Ingelsson, & Rosén, 1996; Lindahl, 2007; Lindahl & Odebo, 2007; P. Linder, 2007; Ståhl, 1996; Ståhl, Brundell-Freij, & Makrí, 1993; Ståhl & Ivarsson, 2007; Ståhl & Petzäll, 1997; Westerlund, 1991; Wretstrand, Svensson, Fristedt, & Falkmer, 2009). They show that the use of PT among older people can increase in areas where specific measures (e.g. service buses) have been implemented to meet the needs of the older population (see for example Göteborgs stad & Västtrafik, 2010), but also that despite such objective accessibility measures journeys with PT among older people do not increase to the extent expected (Wretstrand, et al., 2009). During the past two decades the theory of design of PT in urban areas has improved quite well and now meets the experiences and needs of disabled and ageing people. The user's perspectives can be represented as in Table 3 (cf. Ståhl, 2000).

Table 3 User perspective (Ståhl, 2000).

Needs		**Transport chain**
Reliable information before and during the trip	Accessible, barrier-free pedestrian environment Proximity	Normalization Integration Freedom of choice
Good operational standards	Good design for terminals and bus stops	
Security Safety Trained personnel	High vehicle standards	**Accessible Public Transport**

5.4 From theory to practice

During the past ten years accessibility measures have gone from theory to practice. The Swedish PT policy assumes that no community can be fully served with only one transport mode. Sweden has now a relatively well developed service with public transport solutions in urban areas which have been followed up by research and evaluation projects. However many of them are isolated projects managed by districts or municipalities. Urban PT solutions are usually based on three levels (cf. Ståhl, 2000):

1. Traditional Fixed Route Service. Standard 12 metre low-floor buses, trams or metro-trains (Stockholm) supporting the mass transport of people with little or no mobility limitations.

2. Service routes, fixed routes or on demand. These are usually served by smaller low-floor buses along routes close to residential areas and to the entrance of service centres and health facilities. Service routes can be planned as a regular route, they may deviate or they may operate on demand. This type of service mainly serves older and disabled people who have difficulties using the ordinary Fixed Route Service.

3. Special Transport Service (STS). Special mobility services are available for people who are seriously disabled and require door-to-door transport and/or more personal assistance. The STS is mainly operated with taxi-cars or multi-purpose vehicles.

Since 1975, all Swedish municipalities have had to provide STS by law. During recent years some municipalities have tried to replace STS with ordinary public transportation by introducing better equipped service routes and so-called flex routes serviced by mini buses with a start and end point but no fixed route. Travellers call in advance and can be picked up at their door. These routes that have currently been tested in some urban areas are PT services providing a high level of service. Most of the passengers are people entitled to STS. In Göteborg, where these flex routes have been tested since 1996, financial viability was reached after two years, when about 60 per cent of all local STS-taxi travel was by STS-users who had shifted to flex route minibuses. Other advantages noticed were flexible everyday travel among older people, independent living and reduced costs for nursing homes (Ståhl, 2000). See also below, under “Special Transport Services STS”.

It has also been noticed that the costs of flex routes have been higher than expected; compared to ordinary PT, flex routes are costly but cheaper than STS-taxi.

Previous research has shown that there are many challenges to be surmounted if older people’s usage of public transport, including service routes and flex routes, is to increase. Wretstrand, Svensson, Fristedt and Falkmer (2009) have described provision, supply and use of PT and STS through studies of travellers’ self-reports, municipalities’ and transit authorities’ transport statistics and accomplished objective analysis (GIS) of public transport accessibility. The scope of the study included older people aged 75 and above living in three Swedish municipalities (Helsingborg, Borås and Karlskrona) with well-recognized PT standards. The scope of the study was housing areas in communities with more than 2,000 inhabitants in order to secure the existence of basic PT provision. The municipalities of Helsingborg, Borås and Karlskrona have all taken extensive measures towards more efficient PT and STS. For example, in Borås the essential concept of Service Route Traffic was invented and measures regarding barrier-free pedestrian zones and tactile surfaces have been in place for more than 20 years. Hence the transport service available in the chosen districts could be seen as “best practice” (the majority of municipalities in Sweden provide PT systems that are less accessible).

In each municipality, 700 residents in the towns and villages outside were contacted and asked to answer a postal questionnaire. The response rate was 46 per cent. In the cities, 27 per cent and in villages more than 50 per cent did not travel by bus at all. Only 16 per cent travelled by bus two or more times a week – women more so than men. Most respondents answered that they travelled by private car or STS rather than by bus or flex bus. Underlying reasons mentioned were "boarding/alighting" and "insecure feelings" while travelling alone. One conclusion is that the answer "boarding/alighting" probably included more than the actual entrance or exit step heights, since only low-floor vehicles were in use in these municipalities. Far more men answered that they travelled by car rather than by bus while women referred to STS. "In total, the respondents that had ceased using the local transit buses experienced them as too difficult to use, regardless of the documented accessibility improvements being made" (Wretstrand, et al., 2009: 58).

One challenge to be met is that older people have little or no experience of travelling by bus or of handling ticket machines and they worry about how they will be treated by other passengers or the bus driver (cf. AENEAS, 2011). Would-be passengers are often confused by different regulations and different ways of paying, "the passengers' main concern is being able to carry out a trip without too much inconvenience and at a reasonable price" (Ståhl, 2000: 6). Information about public transport options is also a crucial factor in older peoples' use of public transport. Information on the Internet is not enough to reach their awareness of new routes, new accessible buses or timetables. TØI has evaluated the effects of information provided in eleven packages of measures for public transport. Better information leads to passengers travelling more, while poorer information leads to a drop in the number of passengers. The traditional channels of information – posters at bus stops, timetables and information sent by post – are still the most important. However, friends are also important sources of information. One in five people become aware of changes in public transport services through their friends. Young people use posters at bus stops more than older people, while advertisements and reports in local newspapers primarily reach those above the age of 25. Men are more aware of reports in the newspapers, while women more frequently read information sent by post. In Kristiansund and Tromsø, where real time information has been introduced, passengers feel that real time information is useful and makes it easier to travel by public transport and that it should be available at all bus stops (Ruud, 2005).

A study in Sweden, known as the KOLLA-project, is about accessible public transport for older and disabled people in the City of Gothenburg. It is part of a larger EU-financed project called AENEAS and its local basis is a collaboration between the Special Mobility Service Office, the Office for Transport Planning and the public transport company Västtrafik during the years 2005 to 2010 (Göteborgs stad & Västtrafik, 2010). The project strives to improve the urban environment by encouraging more use of public transport and bicycle, and fewer cars. It seeks to increase the use of regular public transport and flex-lines and decrease reliance on STS-buses and taxis. The number of flex-lines in Göteborg has expanded and stops have been adapted to travellers' needs; other measures carried out have been travel training and trip accompaniment. According to evaluations, the project has succeeded in that many STS-passengers have switched to buses and trams. From 2008 to 2009, the number of STS-trips decreased by 32,000, i.e. a reduction of 5.2 per cent. The goal is to reduce STS by 35,000 per year. At the same time, journeys with flex-lines increased from 132,000 to 137,000. The project also resulted in the introduction of free public transport for passengers older than 65 years between the hours of 8.30 and 15.00 and 18.00 and 06.00

and all day on Saturdays and Sundays, which has changed the travel habits of older people (Fiedler, Schuster, & Link, 2010). The three partners in KOLLA intend to continue the project with a regional section of the Swedish Transport Administration. Key issues are reconfiguration of stops and access to stops, driver coaching, vehicle design, payment systems, the development of flex-lines and information and travel training. One part of the improvement of information within the project is a homepage (see figure 1).

http://www.kolla.goteborg.se/

Figure 1 Homepage with information and guidance for older travellers in Göteborg.

Since 1996 the Norwegian Ministry of Transport and Communications has supported packages of coordinated measures to develop public transport. Frøysadal (2000a, 2000b) summarises the effects of three packages of measures in rural areas: in Hedmark county (in the south-east of Norway), Vest-Agder county (south of Norway) and in Troms county (north of Norway). Conclusions from the project were that the services should be flexible in order to meet people's needs both in the short and longer run and that the operators should be given incentives to develop a market-oriented way of operation. Main problems in the study area were inappropriate departure times and connections. The most appreciated public transport measures were improved services to local centres, improved service during school holidays (most services in sparsely populated areas had hitherto been run in connection with school transport), and improved connections between bus services, all of which also serve older people's needs. One objective was to improve social equality by improving public transport services to satisfy both young people and the elderly, e.g. proper information and uncomplicated service-booking (Frøysadal & Norheim, 2000).

The report from the project *Målretted kollektivtransport* (Ruud, Tuveng, & Norheim, 2001) shows how various groups' evaluation of journeys with public transport differs in relation to walking times to and from bus stops, frequency, journey time, changing between various forms of transport and shelters at bus stops. For example, hidden waiting time is regarded as a greater disadvantage than journey time. Passengers regard

having to change buses as a greater disadvantage than journey time. Also, older passengers regard it important to have a seat on the bus. The results also indicate that older people, perhaps to a greater extent than other groups, may feel that public transport cannot be adapted to their requirements, but that they themselves have to adapt to the existing provision. This tendency applies particularly on optional journeys, but also on shopping trips. The *Målretted kollektivtransport* project produced a handbook giving planners in roads offices, transport and communications departments and public transport companies advice on how best to implement differentiated product development of public transport services. The purpose of the handbook, which was updated in 2007 and 2008, was to summarise current knowledge in the field, demonstrate good examples and give advice on the planning process and on evaluating public transport measures. The handbook distinguishes between the needs of existing and potential users of public transport. Older people's mobility needs are addressed in the concept *Tailormade services for specific, small customer groups*. Examples of these are service routes adapted for elderly users or buses to and from places of employment (Norheim & Ruud, 2007/2008; Ruud & Frøysadal, 2002; Statens Vegvesen and Urbanet Analyse, 2011).

Several Swedish cities have introduced a public transport network as a matter of high priority, with Jönköping the example in the handbook. Several cities in Norway have since introduced a considerable simplification of the route network with high frequency routes in densely populated areas in line with the high priority network principle. Göteborg in Sweden is an example and also the county of Akershus in Norway now has good examples of public transport terminals. The design of changing points is highly important for public transport with older passengers in mind. To come some way to meeting the special needs of older and disabled people, service routes and tailor-made public transport services are suggested designed for people who have difficulty using the standard public transport provision but also for the general public. Measures taken to adapt ordinary route-based bus transport to cope with some of the service line functions were:

- Function-friendly small buses with a low step, level floor, wheelchair lift / ramp, etc., such that the service can partially replace special transport arrangements for the physically handicapped
- Drivers helping passengers when necessary
- Routes and bus stations part of a flexible system between residential areas and important destinations, with emphasis on short walking distances
- Buses making minor detours from fixed routes. In some residential areas, the service could run without permanent bus stops
- System flexibility in that service routes have reliable timetables and that accessibility is guaranteed throughout the entire journey (Norheim & Ruud, 2007/2008; Ruud & Frøysadal, 2002; Statens Vegvesen and Urbanet Analyse, 2011; cf. Göteborgs stad & Västtrafik, 2010). Similar systems that are developed in Copenhagen in Denmark.

The research project *Transportløsninger for eldre i distriktene* (Hjorthol, et al., 2009) focuses on older people in urban areas. In interviews and focus groups, people over 80 years living in Vågå, Marker and Nes in Akershus have been asked questions about

transport and services in their living area. Suggested policy measures in relation to public transport are:

- Introduction of time schedules for public transport services in accordance with older people's travel patterns and needs
- Information and marketing campaigns aimed at older people
- Increased coordination of the various types of public transport
- Increased number of seats reserved for older people in buses/trains
- Promotion of safe and trustworthy relationships between users and operators (e.g. by introducing regular drivers on certain routes)
- More benches and places to rest on the way to bus stops.

Some further, more specific, measures targeted at older people with disability problems are:

- Increasing the economic support for STS due to longer travel distances brought about by the closing down of local grocery shops
- Support activities that could help older people get their groceries from the shop to their home
- Increased coordination or economic support for transport to health services organised by the state, local/institutional transport organised by the municipalities and STS organised by the counties.

The research report from the project points out the need for increased information about alternative transport services, and about possibilities for economic support and accessibility to further information (Hjorthol, et al., 2009).

Moreover, surveys have shown that older people often believe that they have insufficient or incorrect knowledge about local public transport services (Norheim & Ruud, 2007/2008, Wretstrand, et al. 2009). Lack of knowledge about public transport services can be a barrier contributing to a number of people travelling less than they would normally, or not using public transport at all. Information given by new technology can be a problem if there is too much of it – the problem then one of sifting out the requisite information.

5.5 Special transport services STS

Special transport services (STS), traditionally demand-responsive, eligibility restricted door-to-door service, are provided for people with severe functional limitations who cannot use ordinary public transport.

Denmark

In Denmark, transport for the disabled (”funktionshæmmede” or ”bevægelseshæmmede” in the Danish context) is to a large extent covered by the terms of ”specialkørsel” and ”handicap-kørsel”. Handicap & specialkørsel is a broad concept which includes many different transport schemes. General examples are:

- Individual disability transport (provided by transport companies and municipalities)
- Patient transport to and from treatment in hospital (provided primarily by municipalities)
- Special services for disabled and mobility-impaired people from residence to special education classes, adult education, workshops, institutions, etc. (provided by municipalities)
- Transport of the elderly between residence and nursing home, institutions and day care centres (provided by municipalities)
- Coordinated public transport where two or more of the above-mentioned transport schemes are included (executed by transport companies).
- Other similar transport services.

Since January 2007, operation of the individual disability transport scheme has been in new regions and new transport companies (over the whole country). Financing is in the hands of the municipalities. There are variations between the municipalities in terms of how many trips per person are allowed, how the services are connected, how they are used by the inhabitants and in costs. In Denmark, transport companies should involve disability organizations in organizing this kind of transport. In several municipalities there are private companies and public institutions working together in partnership. Handicap & specialkørsel is ordered by the municipalities for people who have permanently reduced mobility preventing them from using ordinary public transport.

The criterion is that people so disabled that they cannot use ordinary public transport will have access to transport in the form of small specially equipped buses. They will be wheelchair users and others who use a walker or crutches. They will have received mobility aid from the public and be above 18 years of age.

Blind and visually impaired people are not included in the existing scheme for individual disability transport. In 2009 the Ministry of Transport (Transportministeriet) carried out a pilot project in which blind and visually impaired people were given the option to use individual disability transport. Evaluation of the project reflected great satisfaction among the participants; 90 per cent answered that the individual disability transport arrangement contributed to their better quality of life and to less dependence on others. For more details about Handicap & specialkørsel in Denmark, see, for example, Center for Ligebehandling af Handikappede (2007), Dansk Handicap Forbund (2011), De Samvirkende Invalideorganisationer og Danske Busvognmænd (2005), Movia & Flextrafik (2011) and Transportministeriet (2010).

Norway

In Norway, all county councils (fylkeskommunene) are obliged to organise a special transport service adapted for older and disabled people. Known as “TT-ordningen” (Norwegian: tilrettelagt transport), it is to be used primarily for leisure activities. Trips financed by other services do not come under the TT-ordning (Solvoll, 2010).

Permits for the special transport service are offered by municipalities to those who have permanently reduced mobility (forflytningshemming) that prevents them from using ordinary public transport. In most county councils the service is organised in the form of

a taxi from door to door. There are variations in how TT is organized between county councils; for example, in the number qualified to receive TT, the extent to which they may use it, and the number of trips each traveller can go on. Also very young persons can avail themselves of the TT service. Seven county councils have no age-bound limits for children, while a few have introduced a limit for persons below a specific age (for example 9, 10, 12, 14 years). There are also priorities for some user groups, such as wheel-chair bound persons. According to one evaluation (Solvoll, 2010) not all Norwegian county councils have a good overview of users.

However, there are no national regulations regarding the TT-ordning other than the responsibility of county councils to organise some sort of special transport service. The economic resources also vary from one county council to the next. Despite a reduction in the number of trips during the past few years, in some counties the overall cost of providing transport services has increased. In some county councils the users themselves have to pay for a part of the trip. Usually TT is given in the form of electronic value cards or coupons with a limited amount of trips.

In 2010 there were about 100,000 permits for the special transport service in the country as a whole, i.e. an increase of about 7,300 compared to 2009 but a decrease of 900 compared to 2008. Often some of those qualified to use the special transport service (TT) do not use their permits. About two of every ten permitted users are not active travellers for some reason. The mean number of trips of active travellers is about 30 per year. Active travellers in Oslo each go on about 65 trips per year, while in the county councils of Vestfold and Sogn and Fjordane each traveller does about 10 trips. For more details about TT-ordningen in Norway, see, for example, Solvoll (2010).

Sweden

In Sweden there are two forms of mobility service for older and disabled people: special transport services (färdtjänst) and inter-municipal transport services (riksfärdtjänst). Both forms are solely for the disabled and are organised primarily by the municipalities. There is also a scheme for patient transport to and from treatment in hospitals that is run primarily by the county councils (landstingen) (Trafikanalys, 2011a).

The special transport service (färdtjänst) is intended as a complement to ordinary public transport and is accessible to anyone who has difficulty travelling by themselves. A permit for the special transport service is granted by the municipality according to need. The special transport service means commuting, leisure trips and daily activity and welfare. Going for medical or physiotherapy treatment, to the dentist or even to school (young people, too, qualify for special transport services) is not included in the special transport service since these are already financed by the public (Lag om färdtjänst 1997:736).

The inter-municipal transport service (riksfärdtjänst) functions mainly between municipalities. The municipalities arrange for distribution of the permits and pay the costs of the service (Lag om riksfärdtjänst, 1997:735).

There are variations among municipalities in the number of trips they offer each person, how the services are organised and connected, and how they are used by the inhabitants. The user’s fee varies from county to county in Sweden, and the number of trips by the special transport services and the inter-municipal transport services shows large differences between counties. The counties with the highest usage of special transport

services and inter-municipal transport services per 1,000 inhabitants are in northern Sweden, while the lowest are in southern Sweden.

More elderly (65+) than younger people and more women than men use the special transport services. About 80 per cent of those qualified for these services are over 65 years; the majority are over 80 years. The distribution by age is unchanged compared to previous years. More women than men are permitted to use the service.

In 2010, approximately 11 million trips were made using the special transport service and 66,000 using the inter-municipal service. Compared to 2009 this is an increase of 1 per cent in trips using the special transport service and a 10 per cent decrease in trips made using the inter-municipal transport services. In total, the number of transport service permit holders declined.

In 2009, the special transport services and inter-municipal services cost 2,808 million Swedish kronor, while revenues were 270 million kronor. In spite of the reduction in the number of trips, the cost of providing both services has increased by 67 per cent since 1998, while revenues have dropped by 5 per cent. For more details about färdtjänst and riksfärdtjänst in Sweden, see, for example, Trafikanalys (2011a).

Municipalities are required to provide STS services, although in many municipalities there is extensive development of alternatives and also restrictions in STS eligibility in order to control the costs.

5.6 Complements to the special transport service

In spring 2005, the Swedish Government report ”Mobil med bil – Ett nytt synsätt på bilstöd och färdtjänst” (SOU 2005:26) gave strong socioeconomic reasons for why people with disabilities should be given greater opportunities to travel using their own car. The investigation suggested that as an alternative to the special transport services (färdtjänst) it should be possible for municipalities to support people with disabilities to adjust and purchase their own vehicle (mobilitetsstöd). Since a temporary law was introduced on 1 November 2006, a total of 18 municipalities have participated in the experiment.[3] In June 2010 the experiment on car support complementing the special transport services was ended. In their evaluation of the experiment, Trafikverket (the Swedish Transport Administration) stated that there was good reason to continue car support and to do this more generally, whereas there was also a need for distinct guidelines for the financing of this. Also more specialised support and more professional guidelines are needed (Trafikverket, 2010). Permits for car support (“bilstöd”) are given out to persons who are permanently disabled, live in Sweden and do not work abroad (Försäkringskassan, 2011). For more information about “bilstöd”, see, for example, Vägverket (2008).

In Denmark, in the region of Copenhagen a new transport service, “Flextrafik”, has been introduced to meet the needs of disabled people and with the aim of providing a service level pretty much on a par with the ordinary public transport system. Flextrafik cover the whole of Sjælland, Lolland, Falster, Møn and to islands connected by bridges. Flextrafik is “handikapkørsel” from door to door. There are usually several persons in the vehicle (small buses) and it will often take alternative routes depending on the

[3] Knivsta, Linköping, Norrköping, Göteborg, Askersund, Degerfors, Hallsberg, Kumla, Laxå, Lekeberg, Lindesberg, Nora, Jokkmokk, Örebro, Ljusnarsberg, Karlskoga, Hällefors and Krokom.

passengers. Flextrafik can only be used for leisure trips (for example visiting family or friends, shopping activities). Trips to the physiotherapist, the doctor, hospital, etc., are not organised by Flextrafik but by “handicap and specialkørsel”. In Norway and Sweden the concepts “flexiturer” and “flextrafik” are used nearly similarly as the Flextrafik in Copenhagen i.e. they take several passengers in the vehicles, small buses running from door to door and the routes are depending on the passengers travel needs. In Norway, a test project was started in 2009 in Østfold, Telemark, Vest-Agder, Rogaland, Sogn and Fjordane. “Flexitur” in Telemark is one of the examples and it will run for three years (Solvoll 2010). The test had not yet been evaluated when the present report was written.

Measures have recently been taken by public transport authorities in Sweden to reduce the costs of STS (“färdtjänst”); for example, in Borås persons eligible for STS have been able to travel free of charge on local buses and in Karlskrona at 50 per cent reduction. However, despite these initiatives, no modal shift is observable. Wretstrand, Svensson, Fristedt and Falkmer (2009) showed that, despite development of a public transport system with a mean distance to the nearest low-floor bus stop of less than 300 metres, there are still groups of older people with very limited mobility options. The areas studied (Helsingborg, Karlskrona, Borås) were regarded as districts of “best practice”, with low-floor vehicles, fairly short walking distances and improved bus stops and pedestrian environments. One conclusion is that public transport systems are even less accessible in other areas. Researchers also concluded that the mainstream solutions would never be able to fully replace individual STS solutions, and that further restrictions of STS eligibility aimed at forcing a modal shift would only reduce mobility for locomotor-impaired people. Instead, intermediate solutions would be required. The public transport service must be informed not just by an objective measure of the accessibility perspective but also by an analysis of the usability perspective. Service routes may attract older but experienced bus travellers; flex route traffic may attract STS travellers who are already used to pre-booking solutions; and, in order to facilitate a modal shift, enhanced information and travel training services will be needed to attract car users (Carlsson & Ståhl, 2006; Wretstrand, et al., 2009). The accessibility project in Göteborg (KOLLA) showed similar variations in travel trajectories according to the usability perspective (Göteborgs stad & Västtrafik, 2010; Lindahl & Odebo, 2007).

The image of older peoples’ travel choice is complex, since ability and health conditions may vary not only between groups but also between individuals. Thus, for the same individuals, modal choice may vary from one day to the next (cf. Berg & Levin, 2011).

We conclude that service route traffic and flex routes provide better travel opportunities for older people with minor disabilities than ordinary public transport. Nevertheless, one particular group of people entitled to Special Transport Services finds it difficult to use any form of public transport and that is the vulnerable group whose opportunities to travel are already extremely limited. Another conclusion is that for those who are not experienced at booking their trips, the requirement of doing so seems to be a barrier to their travelling.

6 Walking

Previous research shows that the majority of older people leave the house at some time every day. However, approximately 10–15 per cent go walking only a couple of times or less per month. Younger old people (65–75 years) walk more frequently than older (85+), and the older, when asked in a questionnaire, also mentioned that they would go out more often if it was possible (Wretstrand, et al., 2009).

Even though much travel in old age is by car, walking is one of the most important travel modes. In European countries, 30–50 per cent of older people's travel is on foot. In the same time, older people often feel that accessibility of the pedestrian areas is poor or that it is difficult to move around freely in their neighbourhood. Falls in the walking environment are often caused directly or indirectly by obstacles in the surroundings, thus safety is an important aspect of older people's movements outside the home (OECD, 2001).

Studies in Sweden have shown that accidents among older people as pedestrians and bicyclists account for more than three-fourths of traffic accidents involving older people. Over 60 per cent of all injuries outside the home are considered caused by accidents involving unaccompanied pedestrians. According to previous research, falls among older people walking alone are often caused by factors that have been identified as environmental, but in some cases also health (Gustafsson & Thulin, 2003; Ståhl & Ivarsson, 2007).

In a literature review and analysis of accident statistics in Norway, it has been found that in many ways older pedestrians are a disadvantaged group of road users. They are at increased risk of accidents and are more vulnerable to injury. They also suffer more serious and long-lasting impairments when injured, including reduced life expectancy and quality of life. Thus, safety and mobility are closely related. Physical activity is related to reduced risk of accidents and severity of injuries. High accident risk in road traffic is often associated with reduced walking. Safety measures are most promising when they increase physical activity, e.g. by physical and motivational training, by providing practical aids, and by making pedestrian infrastructure less complex, less demanding and more attractive (Erke, 2008). An extensive report from Denmark shows similar results, i.e. older people preferring pedestrian crossings, signal-regulated intersections and cycle paths separated from pavements and streets significantly more than younger road users do, and to a large extent feel unsafe when crossing the road where these facilities are missing. Furthermore, older pedestrians consider the presence of pavements very important, and, more often than younger road users, will choose to walk to a pedestrian crossing rather than just cross at the nearest point. They will seldom cross against a red light (Bernhoft, Carstensen, & Lund, 2003).

Previous reports have identified the needs of older people themselves (Bernhoft, et al., 2003; Levin, et al., 2007; Svensson, 2004):

- Smooth, solid pavements separate from cars and other vehicles (also separate from bicycles)
- Safe passages for unprotected road users, and located not too far away from the footway
- Clean pavements/footways in both winter (e.g. snow and ice) and summer (e.g. leaves and litter)
- Benches adjacent to pavements/footways

- No steep footways (it can be a problem walking uphill on steep footways)
- Street lighting along footways and passages
- Longer green light intervals at pedestrian crossings
- Accessible transport to service facilities when walking distance is long.

During 2001 NTF, the National Society for Road Safety in Sweden started a project called “Older unprotected road users” which was run by six central pensioners’ associations and local traffic ombudsmen in 23 NTF county federations. NTF is a non-governmental organisation that aims to improve road safety. It is an umbrella organisation comprising 24 county road safety federations, 70 national, interest and professional organisations and hundreds of local voluntary associations. The project was evaluated in 2003 when those who worked with measures for older unprotected road users within the project were interviewed (Anund, Forsberg, & Sörensen, 2003).

One aim of the project “Older unprotected road users” was to inform older people and to increase their knowledge and engagement in road safety issues. Another was local opinion groups capturing the experiences of older people and implementing changes in the physical environment that could promote road safety and accessibility as unprotected road users. Of over 3,400 participants attending the project a large majority of the older ones were satisfied (79 %) and believed that what they had learned would be useful (83 %) when they had to map and report traffic hazards in the environment. Mapping activities resulted in 4,683 reported traffic problems and shortcomings in local environments. In the evaluation, 52.5 per cent of the older people interviewed considered that their reported traffic hazards had been fixed. Examples were: intersections; wrongly parked cars; restricted views because of hedges; insufficient lighting at zebra crossings; cycle paths; and snow removal and sanding. However, there were problems getting in touch with the actual road manager, i.e. the person responsible for the road environment. Road managers thought that information was not as provident as it might have been and just 50 per cent knew the aim of the project from the beginning. While appreciated, the project would have been more useful if the same information had been given to everybody, and registers of the road managers had been more reliable (Anund, et al., 2003).

In the city of Kristianstad in the south of Sweden, a research project called “Let’s go for a walk” was started (Ståhl & Ivarsson, 2007). It ran for five years and addressed accessibility and the safety and security of older people in the local outdoor environment. The process started in 2002 when older people were invited to take part in mapping existing problems and deficiencies in their out-of-home environment in the residential area. A programme was developed dealing with the problems and four years later followed up the results. It was carried out in three parts in the area under investigation (a limited area in central parts of Kristianstad with a high proportion of older people) using different methods.

The study was based on postal questionnaires and focus group discussions with retired people, participatory observations of the environment mapping the obstacles for out-of-home movements and objective assessment of the observed environment, and a research circle consisting of eight representatives of older people and eight from municipalities. The results were partly based on comparisons of the postal questionnaires, the participatory observations as well as the objective assessments of the environment, and partly on the results collected by means of focus group discussions.

In part one of the three sub-studies, the measures were classified within two categories: general measures and selective measures (see Table 4).

Table 4 Measures for facilitating walking

General measures	**Selective measures**
Separating pedestrians and bicyclists/mopedists	More and better designed pedestrian crossings
Better signposting	Signal regulations
Improved conditions for walking	Wider pavements
Speed reduced to 30 km/h	More bus stops
More benches	Bevelled edges at pedestrian crossings and other strategic locations
Better snow clearance/handling of slippery conditions	Less slope where pavements intersect
Improved maintenance/cutting of hedges, etc.	Smoother surfaces on pavements
Better information to bicyclists about traffic rules, behaviour in traffic, etc.	Removal of steps into buildings
Improved maintenance/removal of leaves, sweeping, etc.	One-way streets

In part two the measures were implemented, e.g. pedestrianised areas at intersections improved; guiding and warning surfaces in place before kerbs; steps removed; one-way traffic introduced in local streets; pavements widened; and bicyclists and pedestrians separated. In addition, holes in pavements were filled in and more benches were located in pedestrianised areas.

In the evaluation in part three, the issue was to conclude whether the measures taken within the framework of the project had made the out-of-home environment any more accessible and safer for residents in the investigation area. The number of people who experienced problems in traffic and in the pedestrian environment had decreased between the two occasions studied: It was particularly interesting to note that the deficiencies assigned highest priority for remedial measures by the older residents in Part 1 of the study were the deficiencies that had been attended to most, e.g. holes in pavements, insufficient bevelling, poor snow clearing and maintenance during slippery conditions, bicyclists and mopedists on pavements and too few benches (Ståhl & Ivarsson, 2007: xiii). However, the objective assessment revealed that there were still obstacles that needed to be dealt with if they were to be properly accessible, e.g. slopes adjusted, pedestrian crossings better located, pavements widened, irregularities in the walking surface eliminated, and other details.

It was also concluded that not all things could be eliminated since they were due to careless flouting of the rules, e.g. cars parked at bevelled kerbs, bicycles parked on pavements. A majority of the old people who were dissatisfied with their possibilities for out-of-home activity gave their own health conditions as a reason for this. The results implied that the measures taken in the project had positive effects and had increased accessibility and usability in the area, but those specific measures were

considered not enough to compensate for other impacts on the mobility of the older people, at least not personal health. The results also implied that quite small measures were at the top of the lists of older people (e.g. removing of kerbstones, more benches, separating pedestrians and bicyclists) which would be quite easy to implement.

Also research at European level puts improved conditions of pedestrian areas, e.g. speed reductions (to prevent accidents involving pedestrians) and improvement of pavements, as highest ranked methods of improving mobility among older people (SIZE, 2006). Furthermore, a sense of safety and security is emphasized in this and other projects as an important aspect of the mobility of older people, since fear can become a psychological barrier (cf. Warsén & Haywood, 2005; Warsén, et al., 2004).

Wennberg moves the perspective from the societal level to the individual level, i.e. ‘from the objective concept of accessibility to the subjective concept of usability’(Wennberg, 2009: 21), and problematizes objective accessibility measures in connection with perceived safety and security. In her doctoral thesis, a year round perspective was taken on walking in old age, and reported in four studies examining: 1) the implementation process of measures in municipalities; 2) older people’s perceptions of the out-of-home environment before and after implementation; 3) the effects of measures to improve accessibility by removal of physical barriers in both bare ground and snow/ice conditions; 4) the implementation process from the point of view of municipal employees. A mixed method approach is taken in these studies with questionnaires and interviews with municipal employees as well as with older people.

A questionnaire was sent out to 290 municipalities in Sweden, i.e. to municipal employees working on accessibility in the field of traffic planning; 188 municipalities participated in the survey (response rate 65%). The survey was complemented by telephone interviews with non-responding municipalities in order to analyse drop-outs. The results revealed that accessibility issues were treated differently among Swedish municipalities. Several had made extensive efforts, others accomplished less. For example, 75 per cent of the Swedish municipalities were aware of the directives about removal of easily eliminated obstacles in daily planning, while 15 per cent were not (BFS 2003:19 HIN-1, 2003). Sixteen per cent of the municipalities had an accessibility plan and 18 per cent employed an accessibility advisor.

Focus group discussions with older participants (63–93 years old) followed up on accessibility measures before and after implementation. Usability factors on bare ground and snow/ice conditions were identified and rated by the focus groups. On bare ground conditions the most rated factors were: no cyclists in pedestrian areas, lighting and handrails on stairs. In ice/snow conditions the most rated factors were: even surfaces, no rough ice and sanded surfaces. Also, no blocking heaps of snow and no snow on zebra crossings were rated almost as highly.

Lighting and more benches were examples of issues that could be further improved according to the municipal employees. They also mentioned safety/security-related issues causing older people to hesitate about going out of their home more than necessary. There are also weak links, single crossings within the central districts of the study where someone who is visually impaired or in a wheelchair or using a walking frame cannot pass. All the interviewees agreed that a “new winter” was taking place, characterised by constant fluctuations between freezing and thawing conditions increasing the problems with snow and ice. Further improvements during these weather conditions were down to resources. Lack of financial resources was pointed out as a barrier to improving accessibility for older and disabled people. Interviewees also

pointed out that when an area is rebuilt it is not always phased in with the surrounding environment, thus a new area can become an island of accessibility; '*an inaccessible accessible island'* (Wennberg, 2009: 67).

One conclusion to be emphasized from these research projects (Anund, et al., 2003; SIZE, 2006; Ståhl & Ivarsson, 2007; Wennberg, 2009) is that the experiences of older people can be valuable if taken into account as well as influence the measures taken. In future design of urban environments the experiences and expectations of an older population will influence the project right from the beginning of the planning process.

In Odense in Denmark, an activity known as "Walk and talk" has been introduced to motivate older people into walking, thereby strengthening social relations and maintaining walking habits in old age. This activity is part of the EU project AENEAS (Attaining Energy-Efficient Mobility in an Ageing Society). Walking networks were formed at neighbourhood level in Odense in cooperation with older people's associations, sports clubs, medical centres, volunteers and municipal employees. They are open to active as well as less active people and at suitable distances and speeds depending on what the participants can cope with. New people are recruited by the organisers paying a home visit to persons over 75 years. A walking network group of friends in the local area is then established, the idea being that the more active among them can support and motivate the less active. In a third step, participants have created local walking associations that organise walks on a regular basis once a week with an average of 35 participants – even during cold and long winters (AENEAS, 2011).

The Norwegian Public Roads Administration (Statens Vegvesen) has prepared a national walking strategy (Berge & Haug, 2011) with the aim of promoting walking, since physical activity leads to good health and walking is considered an environmentally friendly form of "transport". The aim of the National Transport Plan during the period 2014 to 2023 is to make it more attractive to walk and therefore more choosing to walk. The walking strategy can mean: a) skiing or roller-blading, b) wheel-chair and sled (kjelke and sparkstøtting), c) bicycle or moped, baby stroller or toy vehicles. It will also include people who are dependent on a walker, a mobility scooter or motorised wheel chair, a guide dog, walking stick, or similar.

Increasing traffic problems in urban areas, such as queues of traffic and air pollution, are actualizing the strategy. Many people feel that they are excluded from participating in public activities and from moving around in public spaces because they cannot drive and because the transport system does not fit their needs or their competence. The increasing population means the need for a strategy to meet mobility needs in the future, and walking is seen as one important mode. It is proposed that by the year 2023 about 68 per cent of the transport in local areas will be in the form of walking. Although older people walk a lot today, the aim is to further increase this (also adult people of working age and schoolchildren should be encouraged to walk more as an everyday activity). Both walking campaigns and design of densely built-up areas will be implemented. Services and bus stops in densely built-up areas will be located within walking distances, and the neighbourhoods of residential areas will be more attractive for pedestrians (Berge & Haug, 2011). The walking strategy also works in combination with the strategy of universal design in Norway (see also section 5.2 in the present report).

7 Bicycling

Accident analysis in the Nordic countries shows that older cyclists (65 years and above) are overrepresented in crashes in relation to their exposure to traffic. They have more crashes than younger adults and are more involved in incidents when turning left (right in the UK) (Gustafsson & Thulin, 2003; Leden & Johansson, 2010). At the same time, they are more cautious. They seldom cross against red lights, they more often stop before turning left and they seldom ride on the pavement against the direction of the cycle path (Bernhoft, et al., 2003).

A few per cent of the daily travel of older people (65+) is by bicycle. In Norway, for example, the figure is 3 per cent (Vågane, et al., 2011) and according to travel surveys it is virtually the same in Sweden. In Denmark, older people travel more by bicycle than in the other Scandinavian countries (cf. Hjorthol, et al., 2010).

The overall mobility patterns of retired people were explored in two studies (Waara & Henriksson, 2010) in Sweden in the counties of Skåne and Östergötland: a cross-sectional study (2008) and a longitudinal follow-up study (2010). Among the younger age groups (< 74 years), approximately 40 per cent of both men and women cycled at least once or twice a week. In the oldest age group (> 75 years), men cycled at least twice as often as women (28.4 % compared to 12.7 %). Cycling was least common among the oldest respondents.

Asked about the most important transport mode, 9 per cent of respondents answered cycling (Waara & Henriksson, 2010); (see figure 2).

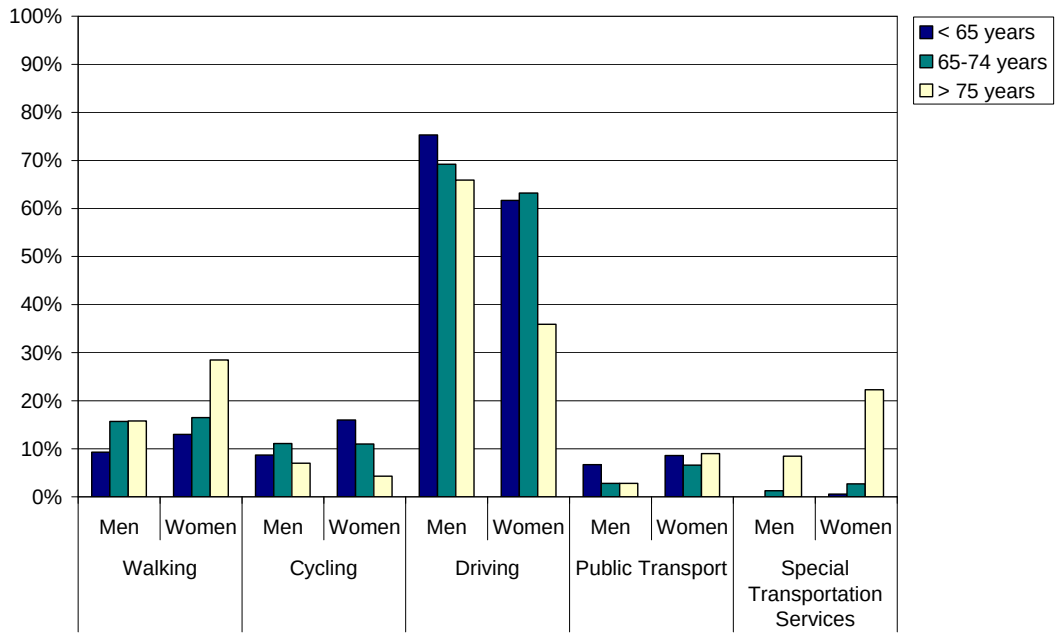

Figure 2 Mode of transport based on gender and age group (Swedish survey) (Waara & Henriksson, 2010).

Swedish transport policy takes account of the Danish bicycle habits to promote bicycling in Sweden (Trafikanalys, 2011b). The National Institute of Public Health suggests exercise in the form of walking and cycling which it sees as health-promoting, especially for older people (Folkhälsoinstitutet, 2004). The majority of international

studies show that the weather, hills, the infrastructure for cyclists and physical limitations all have a bearing on bicycle use. The relation between cycling and socio-demographic factors is ambiguous. For example, gender has been shown to be an important factor in bicycle use in the USA but not in several European countries (Eriksson, 2009). Older people also explain their avoidance of bicycling as being because of busy traffic in urban areas and insufficient maintenance of roads in winter (Waara & Henriksson, 2010).

Leden and Johansson's studies (Leden, 2008; Leden & Johansson, 2010) in Finland and Sweden describe the traffic safety of older bicyclists and explore the differences in regard to younger age groups.

The studies show that older bicyclists in general have more difficulty when turning left (right in the UK): 22 per cent of older bicyclists involved in fatal crashes intended to turn left compared to 8 per cent of adults and 14 per cent of children. These studies also show that the share of older bicyclists who flaunt the rules is similar to that of other adult bicyclists, i.e. 80 per cent of older as well as adult bicyclists who are involved in an accident do not obey the rules.

To gather information about older bicyclists, a questionnaire (see Leden, 2008) was sent to 569 members of Cycling Promotion in Sweden (Cykelfrämjandet) in June 2007. Answers were received from 351 members aged 65. The frequency of members who answered decreased with increasing age and was 61 per cent on average. Forty per cent of the respondents were female, seven (2 per cent) were 85+ and the oldest was 89 years old.

Since the respondents were members of Cycling Promotion in Sweden and have more experience in cycling and matters related to cycling than people in general, they are not representative of all bicyclists of the same age in Sweden. Having experienced respondents was considered an advantage for the study, the aim of which was gathering background information to be used to develop strategies and measures leading to safe cycling for senior citizens.

A questionnaire was also distributed to experts during the Velo-city 2007 Conference. A total of 14 experts answered, describing in their own words the preconditions for bicycling as a means of transport.

The results revealed that the most common manoeuvres older bicyclists avoid taking are roundabouts, left turns and crossing streets where there is no cycle crossing. The main reason they leave their bike at home and use another means of transport is poor road conditions, especially during winter (this is also the reason that many do not cycle at all during winter): slippy roads (81%), insufficient snow removal (79%) and snowfalls (77%). According to the older respondents, the biggest hazards to safety are potholes, slippy surfaces and insufficient snow removal; 76, 74 and 70 per cent of the respondents, respectively, refer to these factors as hazardous. Distance is another reason for older people not using their bike, especially when the distance in one direction is more than 6 kilometres. There were no big differences between gender and age groups among the respondents, except that the share who cycle only up to five kilometres increases with age. About two-thirds of all respondents cycle in mixed traffic. The number of older people who stated that they usually cycled in mixed traffic is slightly higher in the age group 65–69 than in the other age groups. The main factors given (from the older cyclists' own view) as criteria that would get them cycling more are better cycle tracks and better maintenance of the tracks, the possibility to take their bike on to the bus or train, good health and better weather (Leden & Johansson, 2010).

The experts were asked to describe the preconditions for older people cycling as a means of transport. The most common were:

- Safety and a feeling of security when cycling
- Network of roads for cycling including appropriate bicycle parking facilities
- Positive attitudes among users and non-users (Leden & Johansson, 2010).

7.1 Safety and comfort for older bikers

In conclusion, older cyclists say that important basic safety-increasing measures are: separate cycle paths, construction of more cycle paths, networks of roads for cycling and appropriate bicycle parking facilities. More detailed measures are suggested under infrastructure and technology (Table 5).

Table 5 Suggestions about measures to promote bicycling for older people (Leden & Johansson, 2010).

Infrastructure and technology for older bicyclists
Comfortable, wide bicycle paths or cycle streets away from main streets.
Avoidance of high kerbstones and steep gradients.
Electric motor (could be useful) on gradients.
Detectors well in advance of signal-regulated intersections to give cyclists a green light without their having to slow down or dismount.
Low motor vehicle speeds achieved by Intelligent Speed Adaption (ISA).
Signals or lights warning cyclists of approaching motor vehicles, or vice versa, at intersections.
Warning devices of a motor vehicle approaching from behind.
Better guidance at night, e.g. lead-lights in pavements or increased intensity of street lighting at times when cycle traffic is present.
Equipment facilitating the left turn, e.g. a rear-view mirror.
Digital map giving on-line route guidance while cycling and also when planning the trip.
On-line devices, e.g. Personal Digital Assistants (PDAs), giving local weather information, finding time-tables for public transport and, especially, seeing whether it is permissible to take a bike on the tram or bus.
A key plan of the on-line devices that makes it easy for older people to use them.
Various pieces of automatic equipment for bicycles, e.g. electronic locking and unlocking, automatic gears, sensors controlling front and rear lights, automatic elevating of the saddle after mounting.

Finally, it was concluded that a user friendly design of bicycles and of on-line devices improves comfort and at the same time provides better safety, and that many of the suggested measures could apply to all bicyclists (not just older people). They would at any rate allow older people to travel safely by bicycle to a greater extent (Leden & Johansson, 2010).

In a consultation report produced by Vinnova (the Swedish Governmental Agency for Innovation Systems), Spolander (2007) analyses the need for more comfortable and safer cycles for elderly people. His aim is a discussion of the possibilities for designing bicycles for older people, how to initiate such a development and the role of research in this area. Three activities were conducted to highlight the need for better cycles for older people: 1) group discussions with older cyclists, 2) test-riding with a new type of cycle with displaced frame geometry, and 3) a seminar with experts from the cycle industry, design and ergonomics research and public institutions. The results show that bicycles are burdened by shortcomings from an age perspective and indicate that there is need for improvement. Requirements for better comfort and better safety seem compatible in terms of design (Spolander, 2007).

Problems identified in the group discussions concern seat height, forward-leaning riding position and an overly high step-through, as well as a long list of equipment that could be improved ergonomically and functionally. Participants reported difficulty choosing the right size of cycle and adapting it to suit their individual physique. Cycles are often too big; the range is limited for short people; as is the possibility of adaption for people with minor impairments. One conclusion is that a help system for checking frame size, setting handlebars, saddle and pedals should be produced. Quick release connections for adjusting saddle height are often too tight. Participants also wanted to see design that would allow saddle and handlebars to be adjusted without tools. Another wish was for a greater range of different types of saddle made to fit older people. Details from the discussions are listed below (Table 6).

Table 6 Bicycle design improvements for older bicyclists (Spolander, 2007).

Suggested bicycle improvements for older bicyclists
Saddles suitable for older people
Braking – anti-lock, particularly the front brake
Technological solutions to braking and simultaneously giving a signal
Better power transfer in the controls
Footbrake – a footbrake functioning on both wheels
Gears – easier controls and automatic gears
Automatic gears
Steep-less gearing
Better rear view
Rotary pedalling – pedalling up-and-down?
Additional power – electrically assisted cycles
Integrated lighting with automatic switching
Tyres – simpler to change from summer to winter tyres
Three-wheelers – narrower, lighter
Weight – 10 kilos or less
Cleaner cycles – for example enclosed chains, “self-cleaning”

materials
Folding cycles
Better weather-proofing
Simpler effective locks and anti-theft devices
Alarms that react to vandalism
Management of cycle helmets and other accessories
Saddle bags integrated with the cycle
Cycle helmets – improved strap and clip
Cycles – as maintenance-free as possible
Wheels – maintenance-free
Self-servicing – simpler, e.g. reducing the need for special tools
Multifunction cycle – adaptable design …

It was also concluded that it is crucial the cycle industry, technical research, design and ergonomics and safety authorities all work in partnership, preferably within the framework of a research and development programme. Today, there are specially designed three-wheel models of bikes on the market for older and disabled people, but according to the participants' discussion in the referred study three-wheeled models cannot make inroads on the market. There are flaws in riding performance, weight, handling ability among others. If three-wheelers are to have a chance in the wider market, an entirely different approach has to be taken (Spolander, 2007).

Many people give up the healthy habit of cycling as they get older due to lack of fitness and worries about traffic safety. The EU project AENEAS has encouraged measures promoting cycling among pensioners in Odense, Almere, Munich, Bern and Villeurbanne, e.g. training courses, guided trips, the introduction of new vehicles. In 2009 in Odense in Denmark, a city with a strong cycling culture, eight volunteer bicycle captains planned and carried out 24 bicycle trips to encourage cycling among older people. These had different starting points, lengths and destinations to widen appeal and to show the variety of cycling possibilities in the city's environment. The planning phase comprised a first aid course for the captains, learning about cycling in large groups, relevant safety issues, and a meeting informing about cycle planning in the city of Odense. The trips were designed and announced in local newspapers, magazines and webpages targeted at older people. Posters and brochures were distributed to old people's organisations, sports clubs, etc. The trips took between two and four hours each, including breaks and sometimes a talk by a municipality representative. Each trip was guided by a pair of captains and drew up to 15 participants. Initially, a series of trips was planned and carried out in 2009 but older people in Odense appealed for further activities and the city decided to continue the scheme into 2010 (AENEAS, 2011).

7.2 Specific bicycles

During the past few years (2007-2011), a couple of specific bicycle projects have been accomplished in Sweden with the aim of increasing mobility and well-being among older people living in service houses and nursing homes. Two of these projects were started in the Swedish municipalities of Piteå and Gävle. Special side-by-side bicycles (parcyklar) were purchased by the municipalities and made accessible to older people living in service houses and nursing homes. Municipalities' evaluations show satisfaction from most of the participants (cf. Arbin, 2009).

The background of the projects was that many older and disabled people have few opportunities to get out and get close to nature. They have learned to ride a bike as a child, but in old age as balance, sight and hearing diminish the bike is put away. Trips made by older people with poor balance are to a large degree by car or with the special transport service. The aim was to promote freer, healthier lives for those who have previously been referred to a wheelchair or car for transportation, and to improve the quality of life of older people, while at the same time reducing the costs of the transport service and the amount of greenhouse gases into the atmosphere.

In Piteå, most of the trips were organised by occupational therapists and physiotherapists, who also arranged guide tours to cultural and historic places in the neighbourhood and brought coffee along on the trips. The goal of this project was that the residents (who wanted and had the physical ability) would see and experience the surrounding natural and local environment.

On a “parcykel” one can pedal or just sit. Disabled people, too, can participate if they are biking together with someone who has the physical balance and strength. An overall conclusion from the project was that it has brought great joy to many and satisfies a basic need not least in terms of quality of life. The occupational therapists and physiotherapists in Piteå noted that after a while most of those who participated began to talk more about themselves (Arbin, 2009).

In Gävle, the aim of the local project was to investigate whether an electric side-by-side cycle (elparcykel) could be an alternative mode of travel for older people. These bicycles have pedals and a motor which can be used as help up-hills or otherwise when the bicyclists get tired. It was stated that it could lead to reduced CO_2 emission pollution of the environment. Since spring 2010, electric bicycles for two have been placed in an area where many older people live. Citing of bicycles is done in agreement between the residents, who are jointly responsible for each cycle. Service houses and nursing homes have appropriate "garage" indoors with the facility to charge the battery.

The project has been much appreciated and has given many older people the opportunity to get out into nature. Requests have been made to purchase similar vehicles for more areas. An electric bicycle for two costs about SEK 50,000.

Side-by-side bicycling is greatly liked and has given many older people the opportunity to get out into nature. (Photo from the bicycle project in Gävle).

8 Other

This section glimpses at other transport modes that could attract older people, e.g. mobility scooters and motorised wheelchairs. In many countries these are quite common among older and disabled people, but in the Nordic countries their use is not as common as in for example the UK, perhaps because of the climate with long periods of cold, ice and snow.

A mobility scooter is a motorized vehicle marketed as perfect for one person shopping over a short distance. They are often used by people with minor disabilities such as neck-back problems or motor disability in the legs. They may be used not just by people with "traditional" mobility impairments, but also by others with cardiovascular and fatigue-based conditions. A mobility scooter has a seat, three, four or five wheels and a flat area or footplate for the feet. The seat can swivel to allow access when the front is blocked by the handlebars. Mobility scooters are often battery powered with one or two batteries stored on board and charged via an on-board or separate battery charger. Gasoline-powered scooters are available in some countries, though they are rapidly being replaced by electric models (see e.g. Levin, et al., 2007: 62-63). There are different types of scooters and four-wheeled mopeds/motorcycles classified according to weight and maximum speed. The market seems to be increasing and so do also the need for more coherent information on evaluations of the effects of scooter use, especially among older people from mobility, health and safety perspectives.

A motorized wheelchair is one that is driven by means of an electric motor rather than by manual power. They are used by people unable to propel a manual wheelchair or who may need to use a wheelchair for longer distances or over terrain which would be fatiguing in a manual wheelchair.

The Special Transport Services take wheelchairs on board and in the "new" accessible public transport system with low-floor buses it may be possible to do this. To increase mobility options among older people, in the future this sort of motorized individual vehicle may have potential. For the time being, there is not much general information about mobility scooters and other motorized light individual vehicles owing to the climatic conditions in the Nordic countries. Many of the solutions with assistive technology are based on individual needs and provided by municipalities and/or county councils.

The Swedish Institute of Assistive Technology (SIAT)[4] is a national resource centre for assistive technology and accessibility for people with disabilities. SIAT aims towards full participation and equality by ensuring access to high-quality and secure assistive technology, effective provision of assistive devices and an accessible environment. The Centre gives evaluations and information about disability issues in fact sheets (in Swedish) about currently available solutions for travel with a wheelchair on different transport modes: bus, train, tram, aeroplane, STS (http://www.hi.se/sv-se/Arbetsomraden/Tillganglighet-och-design-for-alla/Rullstolar-i-kollektivtrafiken-och-pa-flyget/). Also a Special Library for disability and assistive technology is provided.

[4] The Swedish Institute of Assistive Technology (Hjälpmedelsinstitutet) is run by the Ministry of Health and Social Affairs and the Swedish Associations of Local Authorities and Regions (SALAR) (in Swedish Sveriges Kommuner och Landsting, SKL).

9 Discussion

In this final section the measures reviewed in the previous sections are summarised and discussed in four subsections corresponding to the four main transport modes: car driving, public transport, walking and bicycling. Conclusions are added in each section.

9.1 Car driving

Older people are a heterogeneous group categorised from retirement (about 65 years and above). For many years, old age has typically been associated with a decline in visual, perceptual, cognitive and physical abilities, all things that may influence one's ability to drive. In recent years the image of older drivers has become much more complicated and contradictory. Older drivers can for example compensate to some extent for functional limitations by lowering the speed they drive at, by avoiding driving in heavy traffic and at night in the dark in order to maintain safe mobility.

To some extent, drivers can compensate for functional limitations by using in-car technical support systems. The driver support systems discussed in the present report (see more details in section 4) signify considerable potential to promote safe mobility among older drivers; in-vehicle information and communication systems (IVIS), for example, and advanced driver assistance systems (ADAS).

Technical systems assisting the driver can be especially helpful for older drivers:

- They draw attention to approaching traffic
- They warn about vehicles/objects located in the driver's blind spot
- They assist in directing attention to relevant information
- They give information about upcoming traffic.

However, at present, the public roads authorities in the Scandinavian countries have not made any official recommendations or restrictions pertaining to the use of these types of ADAS/IVIS.

One problem is that there have been only a few studies evaluating the effects of such systems on traffic safety in relation to crash involvement and actual driver behaviour.

- None of these systems is designed especially for older drivers.
- It is quite common for people over 60 years to have trouble reading without glasses. In-vehicle displays showing text can therefore be difficult to read for older drivers if they are not designed properly.
- Hearing loss or impairment is quite common and has to be taken into account by designers of auditory displays. Poor design quickly results in older drivers experiencing other negative side effects of ADAS/IVIS.

Studies conducted in driving simulators and on test courses are promising, but these have been based mainly on drivers aged 55 or younger.

Mobilitetscenter in Sweden carried out a test to compare between automatic versus manual gearboxes; 31 persons (18 men and 13 women) older than 70 years took the driving test and it was found that driving a car with an automatic gearbox had a considerable positive effect on the test person's driving behaviour. The majority, both men and women, said that they would choose a car with an automatic gearbox the next time they bought a car.

Among older drivers, mobility and traffic safety are improved in a car with an automatic gearbox:

- better control of speed in the urban environment
- better awareness in trafficated environments
- more tolerant of distractions during driving
- safer crossing at intersections.

Conclusions

One conclusion from this review is that there is a need for thorough study of technical support systems (ADAS/IVIS) based on the experiences of older drivers, not least the very oldest (75+).

Another conclusion that can be drawn is that a car with an automatic gearbox appears to prolong safe driving in older people. Further research is needed.

Refreshing older drivers' skills

Norway has a tradition in arranging courses for older drivers. "Driver 65+" is offered to all Norwegians over 65 years and is organised by the Norwegian Public Roads Administration (Statens vegvesen) in collaboration with authorized driving schools. The aim of these courses is to improve traffic safety and to keep up/improve the mobility of older people. A few evaluations have been carried out.

The effect of the "Driver 65+" course was evaluated (in 2006) on mobility and accident risk by applying a pretest–posttest design with a comparison group.

- Being drivers aged 65 years or older, the course participants were at a 22 per cent reduced risk of being involved in a traffic accident one year after completing the course (this reduction was not statistically significant, however).
- The estimated benefit of the course was three times greater than the cost.
- The course was found not to have any effect on the mobility of older drivers.

The "Driver 65+" refresher course was evaluated again in 2011, this time the effect estimated on the basis of a sample of 2,100 drivers aged 70 years or more who had reported an accident to their insurance company during a two-year period.

- Drivers who had taken the refresher course before turning 75 years of age were found

to be at 35 per cent lower risk of being involved in multiple vehicle crashes compared to older drivers who had not taken the course (this was statistically significant both before and after adjusting for various confounding variables: age, annual number of miles driven, etc.).

- On the other hand, drivers who had taken the refresher course when they were 75 or older were at the same risk as drivers who had not taken the refresher course.
- One possible explanation for this age-dependent effect of the refresher course is that the ability to learn new skills declines rapidly with ageing, in this case the ability to learn safety measures in connection with driving.

The results from the 2011 evaluation indicate that the refresher course has a beneficial effect on safe mobility given that the driver completes the course before turning 75 years of age.

Similar courses are organised in Denmark and Sweden. In Denmark, the Danish Road Directorate (Vejdirektoratet, VD) decided in 2010 to draw attention to the situation of older drivers and therefore to provide subsidies for courses for this target group. Participation in the course must be sought through the municipality and it is open to all citizens. The target group is 65+, in practice 65–80 year old active drivers who wish to improve their skills. The municipalities and Ældre Sagen (Dane-age organisation) organise the courses, while the Ældre Sagen secretariat provides the materials and frames, and the local councils hold the courses. The courses provide opportunities for both theory and practice and can be scheduled according to whatever is feasible, the economy or the support for the courses locally. However, in Sweden, refresher courses for older car drivers are not organised by the Swedish Transport Administration and thus do not have the same official status as in Norway or in Denmark. In Sweden, courses are organised by non-governmental organisations to improve safety among older drivers. Also, the courses have not been evaluated to the same extent as in Norway.

Conclusions

There is a need for more coordination of refresher courses for older drivers in Sweden. Denmark is now developing a model similar to the one in Norway, since the Danish Road Directorate decided in 2010 to draw attention to the situation of older drivers, and therefore to provide subsidies for refresher courses.

More evaluation is needed of both the practical and theoretical moments in the courses in all Scandinavian countries.

The latest evaluation of refresher courses in Norway indicates that the course does seem to have a beneficial effect on safe mobility, given that drivers complete the course before turning 75 years of age. More research is needed in this area.

Renewal of a driving licence for older drivers

In a recent study in Denmark (2010), the effects that the driving-licence renewal procedure had on safety were evaluated using cognitive screening. Accident rates for older road users were compared before and after nation-wide implementation of two tests (mini-mental and clock-drawing tests). The results showed that while there was no

change in accident rates before and after the tests for older drivers, there was a significant increase in fatalities among older vulnerable road users (bicyclists and pedestrians). This increase was not seen among the control group (18–69 year olds).

Another study carried out in 1996 compared accident rates in Sweden (no age-related screening) and Finland (where the system is similar to the Danish one), where all drivers from the age of 70 onwards are subjected to a medical check if they want renew their licence. The results did not show any safety benefits resulting from the Finnish system, but rather that Finland had a higher pedestrian fatality rate after the age of 70. The authors argued that with a modal shift from car driver to unprotected road user (pedestrian, cyclist, moped rider), the screening indirectly caused an increase in the number of unprotected road users who were killed, and concluded that the age-based mandatory screening therefore had an overall negative effect on safety.

The Regional Road Safety Committee (Regionale Færdselssikkerhedsudvalg) in Denmark recently completed a campaign and has produced a leaflet describing why and how to renew a driving licence. The campaign was designed because it was found that many older people faltered to renew the licence. An information leaflet was distributed among all 69-year-old drivers in East Jutland and 41 per cent responded to the enclosed questionnaire. The project shows that 9 out of 10 older licence holders are now planning to renew their licence in good time. The leaflet prompted more older people, especially older women, to think about their driving licence and their spouses to persuade them to continue to drive. Some said they would now drive more often or take a refresher course.

Conclusions

It is concluded that while cognitive screening did not succeed in preventing accidents among older drivers, it did cause a modal shift into less protected modes of transport, thus indirectly causing more pedestrian and bicyclist fatalities among older people. While many other policies are evidence-based, no studies have demonstrated that screening is worthwhile. It is bad business for both society and the elderly (in relation to both efficiency and security; instead, the result of screening is lost mobility for older people).

Information campaigns for older drivers on why and how to renew their licence are rare but seem to have an effect. A Danish project shows that 9 out of 10 older drivers are now planning to renew their licence in good time after having received information about how to do it. Older women in particular think about their driving licence and continue to drive. They would now drive more often or take a refresher course. More information and activities promoting older drivers' skills and willingness to continue driving should therefore be completed and evaluated.

In the decision about continuing to drive, social factors can also be taken into account, with the older driver possibly getting a permit to drive in a geographically limited area if reluctant to drive, since it is often safer to drive in a familiar area. Restricted permits issued in Norway should perhaps be considered even more frequently and introduced in other countries, too; and followed up with research and evaluations.

9.2 Public transport

Among older people in general, the use of conventional public transport (PT) is quite low. For example, research in Sweden shows that about 40 per cent of the older

population do not use public transport at all and that only about 5 per cent of everyday journeys among older people in the year 2000 were accomplished using conventional public transport (60 per cent of the journeys were by car).

Comparisons show that the trajectories are the same in other Western countries, i.e. older people generally avoid travelling in public transport. Accessibility measures are considered necessary if older people's travel needs are to be met. Recent projects show that the use of public transport among older people can increase in areas where specific measures (e.g. service buses) have been implemented to meet the needs of the older population, but some studies also show that despite such objective accessibility measures, journeys with public transport among older people do not increase to the extent expected.

Taking public transport always means some other out-of-home movement before the stops or share-points are reached (e.g. walking, bicycling). There could therefore be a need to understand the *whole journey*. The outcome from previous research is that public transport measures promoting older people's mobility are not possible without the entire journey being considered.

During the past two decades, several studies have been carried out showing that the theory of the design of public transport in urban areas has improved to meet the experiences and needs of disabled and ageing people. Accessibility measures in the past ten years have been taken from the theory level to practice. The policy assumes that no community can be fully served with just one transport mode. Solutions are based on various combinations of buses, trams or metro-trains, service routes and flex-buses, and the special transport service (STS) for disabled people.

A model developed for urban public transport solutions based on three levels:

1. Traditional Fixed Route Service. Standard 12-metre low-floor buses, trams or metro-trains supporting the mass transportation of people with little or no mobility limitations.

2. Service routes, fixed routes or flexible routes on demand. These are usually operated by smaller low-floor buses routed as closely as possible to where people live and to service centres and health facilities. This sort of service mainly serves older and disabled people who have difficulty using the ordinary Fixed Route Service.

3. The Special Transport Service (STS). Special mobility services available to people who are seriously disabled and require door-to-door transport and/or more personal assistance. The STS is mainly operated with taxi-cars or multi-purpose vehicles.

Special transport services (STS), traditionally demand-responsive, eligibility-restricted door-to-door services, are provided for people with severe functional limitations who cannot use ordinary public transport. There are variations between the Scandinavian countries, but also within these countries. More details about specific STS solutions in each of the three countries are given in section 5.5.

Previous research has shown that there are many obstacles standing in the way of increasing older people's use of public transport, including service routes and flex routes. Respondents often answer questions about using ordinary buses or flex buses saying that they travelled by private car or STS. Underlying reasons mentioned were difficulty "boarding/alighting" and a feeling of insecurity when travelling alone. One

conclusion is that the answer “boarding/alighting” probably meant more than actually getting on and off the high platform, since only low-floor vehicles were in use in these municipalities. Far more men answered that they travelled by car rather than bus, while women preferred STS.

According to previous research, here are some points considered important by older people using public transport:

- Low-floor buses and other vehicles accessible with a wheelchair, walker, etc.
- Short walking distances
- Well maintained walkways, bus stops, etc.
- A wind shelter, lighting and a bench at the bus stop/train station and on the way to the bus stop
- High service level on board
- Sage and trustworthy relationships between users and operators (e.g. by introducing regular drivers on certain routes)
- Optional transport (timetables)
- Coordination of various forms of public transport
- Vacant seats on board
- No changing from bus to train or vice versa
- Avoid rush hours (crowded buses)
- No stress
- No advance reserving of a place on public transport.

One challenge met by older people is that they have little or no experience of using buses or ticket machines and they are often worried about rough treatment from fellow passengers or the bus driver. Passengers on public transport are often confused by different regulations and different ways of paying the fare and this can be a barrier to travelling.

One group of people entitled to Special Transport Services who find it difficult to use any other form of public transport are the particular vulnerable group of people who already have extremely limited opportunities to travel.

A couple of specific measures that would ease travel for older people with disabilities:

- Increase economic support for the STS and provide coordination activities over longer distances, particularly in rural areas between services, shops, etc., and where people live.
- Provide support activities to help older people get their merchandise from shop to home.
- Increase coordination of transport for health services, i.e. local public transport and STS organised by the counties/municipalities.

Retired people often find that the time schedules for public transport are out of kilter with their travel patterns and needs.

The research points out a need for increased information about alternative transport services, possibilities for economic support and about where further information can be found. Surveys have shown that older people often perceive that they have insufficient or incorrect knowledge about local public transport services.

Conclusions

Lack of information and knowledge about public transport services can be a barrier contributing to some people travelling less than they would have done normally, or even not at all. Information campaigns should be synchronised with efforts to meet older people's travel trajectories.

New opportunities to provide information by new technology should be designed to meet older people's needs. Sometimes the problem is not lack of information but too much information or the wrong information. More research, tests and evaluations are needed in this area.

Development of models depicting the journey from beginning to end, as well as the public environment, are recommended through, for example, escorted journeys by public transport staff and the community to obtain better empathy with the passenger.

An appropriate process for participation in and having access to public transport is needed, for example marketing and training campaigns for older people encouraging the involvement of a wide array of users and organised participation of various user groups.

New solutions would be considered; for example, increased coordination of various PT and also between PT and other transport modes (e.g. private cars and local STS), which is especially important for older people living in rural areas. Further research is needed accomplished in cooperation with public transport suppliers.

9.3 Walking

Even though much travel in old age is by car, walking is one of the most important travel modes. In European countries, 30–50 per cent of older people's travel is on foot. At the same time, older people often feel that accessibility of pedestrian areas is poor or that it is difficult to move around freely in their neighbourhood. Falls in the walking environment are often caused, directly or indirectly, by obstacles in the surroundings, thus safety is an important aspect of older people's movements out of the home.

Over 60 per cent of all injuries among older people outside the home are incurred by unaccompanied pedestrians. According to previous research, these falls among older people walking alone are often the result of factors that have been identified as environmental but in some cases also refer to older people's health situations.

In a literature review and analysis of accident statistics in Norway it was found that older pedestrians in many ways are a disadvantaged group of road users. They are at increased risk of accident and are more vulnerable to injury. They also suffer more serious and longer-lasting impairments when injured, including reduced life expectancy and quality of life.

A couple of research projects in Sweden have classified categories of measures to be taken: general and selective. Lighting could be further improved and more benches

placed strategically to sit on. There are also weak links, single crossings within central districts where someone with a wheelchair, a walking frame or has a visual impairment cannot pass.

General measures	Selective measures
Separating pedestrians and bicyclists/mopedists	More and better designed pedestrian crossings
Better signposting	Traffic-signal regulation
Improved conditions for walking	Wider pavements
Speed reduced to 30 km/h	More bus stops
More strategically placed benches to sit on	Bevelled edges at pedestrian crossings and other strategic locations
Better snow clearance/handling of slippery conditions	Less slope where pavements intersect
Improved maintenance/cutting of hedges, etc.	Smoother surface on pavements
Better information to bicyclists about traffic rules, behaviour in traffic, etc.	Removal of steps into buildings
Improved maintenance/removal of leaves, sweeping, etc.	One-way streets

Conclusions

Safety and mobility are closely related. Safety measures are most promising when they lead to increased physical activity, e.g. in the provision of practical aids and by making pedestrian infrastructure less complex, less demanding and more attractive. Older people appreciate prepared pedestrian crossings and signal-regulated intersections. Pavements are important. The future building of urban environments can benefit from the experiences and expectations of an older population influencing the project right from the beginning of the planning process.

9.4 Cycling

Analysis of accidents shows that older adult bicyclists (65 years and above) are overrepresented in crashes in comparison with their exposure to traffic. They have more crashes than younger adults and, paradoxically, at the same time they are more cautious. They seldom cross against red lights, they more often stop cycling before turning left and they seldom ride on the pavement in the wrong direction.

A few per cent of the daily travel of older people (65+) is by bicycle. In Norway, for example, 3 per cent of daily travel among older people is this way, and the figures of bicycling in per cent of daily travel are almost the same in Sweden. In Denmark, more older people travel by bicycle than in any of the other Scandinavian countries. Bicycling is considered healthy exercise, but there are few measures promoting it among older people.

To gather more extensive knowledge about older bicyclists, a questionnaire was sent to 569 members of Cycling Promotion in Sweden in 2007. Answers were received from 351 aged 65 and above – the frequency decreasing with increasing age and was 61 per

cent on average. Forty per cent of the respondents were female and seven (2 per cent) were 85+. The oldest was 89 years.

Results from the study in Sweden revealed that the most common manoeuvres older bicyclists avoid are roundabouts, left turns and crossing streets where there is no cycle crossing. The project came up with one or two main factors that would increase cycling among older people. In addition, the infrastructure for older bicyclists was investigated from the perspective of users.

Factors that would increase cycling among older people:

- More cycle tracks
- Better cycle tracks
- Maintained cycle tracks
- Possibility to take the bicycle onto the bus/train
- Health
- Better weather
- Better cycle-parking facilities
- Motivation
- More time
- More consideration from other road users
- No mopeds on cycle tracks.

Other problems identified in previous studies are: seat height, a forward-leaning riding position, an overly high step-up, as well as a long list of equipment that could be improved ergonomically and functionally.

Conclusions

Wide bicycle paths or cycle streets separate from main streets are greatly appreciated by older bicyclists, according to the studies reviewed. High kerbstones and steep gradients were to be avoided. There is potential for more technical support systems addressing older bikers' comfort and safety; for example, detectors well in advance of signal-regulated intersections to give cyclists the green light without their having to slow down or dismount, signals or lights warning cyclists of approaching motor vehicles or vice versa at intersections, and better guidance at night time, e.g. leading lights in pavements or stronger street lightening at times when cycle traffic is present.

One conclusion is that a system for checking bicycles could be helpful, e.g. for checking frame size, handlebars, saddle and pedals. Quick-release connections for adjusting saddle height are often too tight and, according to previous studies, design of cycles that allowed the saddle and handlebars to be adjusted without tools would be a step forward. It should also be easier to find an optimum setting. Further research on technical systems supporting bicycling in urban areas is needed, especially regarding older people's opportunities to cycle.

9.5 Concluding remarks

This literature review has shown that mobility for older people is still an area under development. While a few good examples of "best practice" in the North European area

(Denmark, Norway and Sweden) have been highlighted, gaps and weaknesses remain. For example, strategies and measures for improving public transport concern not only issues such as accessible vehicles, wind shelters and plain pavements at bus stops, but also frequency and routes in relation to the mobility needs of a new generation of older people. Retired people today travel a lot more than previous generations, their well-being connected with being able to get out and about daily. Another example is how measures introduced to improve public transport bring to the fore questions about the entire transport environment and conceptualise the journey from start to finish (i.e. the whole journey concept). The opportunities, as well as the problems, differ between urban and rural areas, and travel trajectories vary between and within different districts because of the different range of services in the neighbourhood.

Questions about drivers renewing their licence in old age and about campaigns promoting car-driving among older, healthy people have been highlighted in this study. No study has been able to demonstrate that cognitive screening is worthwhile. Rather, it seems to be bad business for society, in relation to both efficiency and security. Instead, screening may result in reduced mobility for older people and in the elderly hesitating about renewing their driving licence. Information campaigns for older drivers about why and how to renew their driving licence should be started. An interesting Danish project shows that nine out of ten older people renew their licence in good time after a campaign. Older women, in particular, considered continuing to drive after the campaign. More information promoting older drivers' skills and willingness to continue driving should therefore be produced and evaluated. Social factors could be taken into account and the older driver perhaps given a permit to drive at least in a geographically limited area. This is the case in Norway; it could be tested more frequently and should be evaluated systematically.

The whole journey concept points to the necessity for good pedestrian areas and cycle paths, since all transport modes include at least some walking or bicycling. Measures to improve older unprotected road users' mobility would be beneficial for all user groups. However, older and disabled people are the most vulnerable. The most challenging question is about coming up with improvements for coping with winter conditions. In the present review, a lack of financial resources was pointed out as a barrier to the process of improving accessibility for older and disabled people. Previous evaluations have indicated that when an area is renewed it is not always properly integrated with the surrounding environment, thus a new accessible area can become 'an inaccessible accessible island'. More research and evaluations are needed, and also more cooperation between different actors. Measures often lack an overall view and few of them are evaluated. They are often carried out as pilot projects or small tests, and are always limited in time and resources. Even new projects start before the "old" projects are properly evaluated. More continuity and permanent measures would be preferable.

The mission to meet the mobility needs of an ageing society still has many questions that need answers. The transport authorities in Scandinavia have not yet fully adopted the characteristics of the heterogeneity within the group of "older people", i.e. pensioners from young old (about 60–65 years) to older old (80+). Our knowledge about older people's mobility and transport needs will have to expand if we are to satisfy the mobility needs of growing generations of older people.

References

AENEAS. (2011). Attaining Energy-Efficient Mobility in an Ageing Society. Retrieved 20 Mars 2011, from http://www.aeneas-project.eu/?page=about

Amundsen, A. H., & Bjørnskau, T. (2003). *Utrygghet og risikokompensasjon i transportsystemet. En kunnskapsoversikt for RISIT-programmet* (TØI-report no 622/2003). Oslo, Norway: Institute of Transport Economics.

Anund, A., Forsberg, I., & Sörensen, G. (2003). *NTF:s projekt "Äldre oskyddade trafikanter" - en utvärdering av lokala trafiksäkerhetsombuds och väghållares åsikter och erfarenheter* (VTI notat 57-2003). Linköping: VTI.

Arbin, I. (2009). Cykelprojektet Mogården – ett gott exempel inom äldreomsorgen. Retrieved 12 September, 2011, from http://www.suntliv.nu/Projekt/Idebanken/Projekt-och-exempel/Cykelprojektet-Mogarden--ett-gott-exempel-inom-aldreomsorgen/

Arnör, W., Pettersson, L., & Folkesson, M. (2006). *FOKAT: systemarkitektur för IT-system inom anropsstyrd trafik*. Stockholm: VINNOVA, Vägverket, Stiftelsen Teknikdalen.

Berg, J. & Levin, L. (2011). Äldres vardagliga resor. Val av färdmedel och erfarenheter av kollektivtrafik. [Older people's everyday travel – Choice of travel mode and experience of public transport]. (VTI Report 737). Linköping (Sweden): Swedish National Road and Transport Research Institute (VTI). Swedish with a summary in English.

Berge, G., & Haug, E. (2011). *Nasjonal gåstrategi. Strategi for å fremme gange som transportform og hverdagsaktivitet* (Utkast 21.11.2011). Oslo: Statens Vegvesen.

Bernhoft, I. M., Carstensen, G., & Lund, H. (2003). *Ældre fodgængere og cyklister i byerne. Risikooplevelse og adfæard* (Rapport 2). Kgs. Lyngby: Dansmarks TransportForskning.

BFS 2003:19 HIN-1. (2003). *Boverkets föreskrifter och allmänna råd om undanröjande av enkelt avhjälpta hinder till och i lokaler dit allmänheten har tillträde och på allmänna platser* Karlskrona: Boverket.

Björnehult, Å., Ingelsson, M., & Rosén, P. (1996). *Kvinnligt & manligt i kollektivtrafiken. En kunskapssammanställning*. Stockholm: KFB, Rapport 1996:17.

Bjørnskau, T., & Fosser, s. (1996). *Bilisters atferdstilpasning til innføring av vegbelysning : resultater fra en før- og etterundersøkelse på E-18 i Aust-Agder [Car drivers' behavioral adaptation to the installation of road lighting: before-and-after study on Route E-18 in Norway]* (TØI rapport 332/1996). Oslo: Transportøkonomisk institutt, TØI

Bolin, I. (2008). *Betydelsen av användning av bil med automatisk växellåda för äldre bilförare*. Göteborg: Mobilitetscenter.

Carlsson, G., & Ståhl, A. (2006). *Hur används servicelinjer och flextrafik? Resvanor och attityder bland boende och resenärer [The use of Service Routes and Flex Traffic. Travel Habits and Attitudes among Residents and Travellers]* (Bulletin 230). Lund: Lunds Tekniska Högskola.

Center for Ligebehandling af Handikappede. (2007). Notat om de individuelle kørselsordninger. Retrieved October 20, 2011, from http://www.clh.dk/index.php?id=1326

Dansk Handicap Forbund. (2011). Det arbejder vi for. Retrieved October 20, 2011, from http://danskhandicapforbund.dk/det_arbejder_vi_for/transport/bus_handicapkoersel/

Davidse, R. J. (2006). Older drivers and ADAS - Which systems improve road safety? *IATSS Research, 30*(1), 6-20.

Davidse, R. J. (2007). *Assisting the older driver. Intersection design and in-car devices to improve the safety of the older driver*. Leidschendam, Nederland: SWOV-dissertatiereeks.

De Samvirkende Invalideorganisationer og Danske Busvognmænd. (2005). Vejledning ved udarbejdelse av udbud af handicap- og specialkørsel. Retrieved October 20, 2011, from http://www.db-dk.dk/files/DSI%20og%20DB%20Vejledning.pdf

Englund, L. (2010). Nya föreskrifter om medicinska krav för körkort från den 1 september 2010 *Trafikmedicinska rådets Nyhetsblad*(20, Nov 2010).

Eriksson, L. (2009). *Tema Cykel - faktorer som påverkar cykelanvändningen utifrån ett individperspektiv. En litteraturstudie* (VTI Rapport 652). Linköping: Statens väg- och transportforskningsinstitut, VTI.

Erke, A. (2008). *Making Vision Zero real: Prevention of accidents and injuries among elderly pedestrians* (TØI report 972/2008). Oslo: Transportøkonomisk institutt, TØI.

Evans, G. (2009). Accessibility, Urban Design and the Whole Journey Environment. *Built Environment, 35*(3), 366-385.

Farquhar, M. (1995). Elderly people's definitions of quality of life. *Social Science & Medicine*(41), 1439-1446.

Fearnley, Flügel, S., Killi, M., Dotterud Leiren, Nossum, Skollerud, K. H., et al. (2009). *Kollektivtrafikanters verdsetting av tiltak for universell utforming* (TØI-rapport 1039/2009). Oslo: Transportøkonomisk institutt.

Fiedler, M., Schuster, A., & Link, J. (2010). *A trip through Europe about mobility management in ageing societies. Study Tour Catalogue*: AENEAS.

Fillenbaum, J. E. (1985). Screening the elderly: A brief instrumental activities of daily living measure. *Journal of the American Geriatrics, 33*, 698-706.

Folkhälsoinstitutet. (2004). *Liv till åren. Om hälsofrämjande och sjukdomsförebyggande insatser för äldre*. Stockholm: Folkhälsoinstitutet och Sveriges Kommuner och Landsting.

Fonda, S. J., Wallace, R. B., Herzog, A., & Regula. (2001). Changes in driving patterns and worsening depressive symptoms among older adults. *Journals of Gerontology: Series B: Psychological Sciences & Social Sciences, 56B*(6), 343-S351.

Fridstrøm, L. (1996). *Prognoser for trafikkulykkene [Road accident forecasts for Norway]* (TØI Notat 1027/96). Oslo: Transportøkonomisk institutt, TØI

Frøysadal, E. (2000a). *Hovederfaringer fra tiltakspakker for kollektivtransport i distriktene [Main experiences from packages of measures to improve public tranport in rural areas]* (TØI report 494/2000). Oslo: Transportøkonomisk institutt, TØI.

Frøysadal, E. (2000b). *Tiltakspakke "Transport for alle i Kongsvinger". Resultater av før- og etterundersøkelsene [Package of measures öTransport for all in Kongsvingerö.*

Results from before and after surveys] (TØI Notat 1167/2000). Oslo: Transportøkonomisk institut, TØI.

Frøysadal, E., & Norheim, B. (2000). *Ny kollektivtransport på landsbygda. Erfaringer fra et forsøksprosjekt i Vest-Agder sammenholdt med erfaringer fra liknende forsøk andre steder [New Rural Public Transport Solutions]* (TØI report 478/2000). Oslo: Transportøkonomisk institutt, TØI.

Försäkringskassan. (2011). Bilstöd. Retrieved October 20, 2011, from http://www.forsakringskassan.se/privatpers/funktionsnedsattning/bilstod

Glad, A., & Borger Mysen, A. (1997). *Kurs for eldre førere i Vestfold : Effekter på sikkerhet og mobilitet [Courses for olderly driver in Vestfold. Effects on traffic safety and mobility]* (TØI Notat 1086). Oslo: Transportøkonomisk institutt, TØI.

Grayson, G. B. (1996). *Behavioural adaptation: a review of the literature* (TRL Report 254). Crowthorne, Berkshire: Transport Research Laboratory.

Gustafsson, S., & Thulin, H. (2003). *Gående och cyklister, exponering och skaderisker i olika trafikant miljöer för olika åldersgrupper* (VTI meddelande 928.2003). Linköping: VTI.

Göteborgs stad & Västtrafik. (2010). *På väg mot en resa utan hinder [Going for a Journey without Barriers]*. Göteborg: Göteborgs stad, KOLLA-projektet.

Hakamies-Blomqvist, L. (1996). Research on older drivers: A review. *IATSS Research, 20*(1), 91-101.

Hakamies-Blomqvist, L., Henriksson, P., Falkmer, T., Lundberg, C., & Braekhus, A. (1998). *Körkortsdiagnostik i allmänläkares dagliga patientarbete med äldre. En jämförelse av svenska och finska allmänläkares aktiviteter, kunskaper och attityder* (VTI-rapport 431). Linköping: Väg och transportforskningsinstitutet.

Hakamies-Blomqvist, L., Henriksson, P., & Heikkinen, S. (1999). *Diagnostisk testning av äldre bilförare. Möjligheter och begränsningar mot bakgrund av mobilitetsbehoven och den allmänna trafiksäkerheten*. Helsingfors: Fordonsförvaltningscentralens utredningar.

Hakamies-Blomqvist, L., Johansson, K., & Lundberg, C. (1996). Medical screening of older drivers as a traffic safety measure - A comparative Finnish-Swedish evaluation study. *Journal of the American Geriatrics Society, 44*(6), 650-653.

Hakamies-Blomqvist, L., Raitanen, T., & O'Neill, D. (2002). Driver ageing does not cause higher accident rates per km. *Transportation Research Part F: Traffic Psychology and Behaviour, 5*(4), 271-274.

Hakamies-Blomqvist, L., Siren, A., & Davidse, R. (2004). *Older drivers - a review* (No. VTI rapport 497A). Linköping: Statens väg- och transportforskningsinstitut.

Hakamies-Blomqvist, L., & Wahlström, B. (1998). Why do older drivers give up driving? *Accident Analysis & Prevention, 30*(3), 305-312.

Hakamies-Blomqvist, L., Wiklund, M., & Henriksson, P. (2005). Predicting older driver´s accident involvement – Smeed´s law revisited. *Accient Analysis & Prevention, 37*, 675-680.

Hansen, E. A., & Hansen, B. L. (2002). Kognitive funktioner og kørefærdighed hos ældre bilister. *Ugeskrift for Læger, 164*, 337.

Heikkinen, S., Dukic, T., Henriksson, P., Høyne, A., & Peters, B. (2010). *Åtgärder för äldre bilförare - effekter på trafiksäkerhet och mobilitet* (VTI Rapport 682). Linköping: VTI.

Helmers, G., Henriksson, P., & Hakamies-Blomqvist, L. (2004). *Trafikmiljö för äldre bilförare - Analys och rekommendationer utifrån en litteraturstudie* (No. 493). Linköping.

Henriksson, P. (2007). *Äldre deltagare i körsimulatorstudier. En kunskapsöversikt [Older participants in driving simulator studies. A literature review]* (VTI Report 581). Linköping: Statens väg- och transportforskningsinstitut, VTI.

Hjort, M., Kölbl, R., & Fuchs, S. (2009). *Results of the coopers simulator study: A comparison of driver behaviour in different usage groups /simulation results.* . ITS World 2009 Stockholm.

Hjorthol, R., Levin, L., & Sirén, A. (2010). Mobility in different generations of older persons: The development of daily travel in different cohorts in Denmark, Norway and Sweden. *Journal of Transport Geography, 18*(5), 624-633.

Hjorthol, R., Longva, F., Skollerud, K. H., & Vågene, L. (2009). *Transportløsninger for eldre i distriktene* (TØI-rapport 1043/2009). Oslo: Transportøkonomisk institutt.

Hjorthol, R., & Sagberg, F. (1997). *Endring i eldre aldersgruppers reisevaner: en analyse av resultater fra de nasjonale reisevaneundersøkelsene i 1984/85 og 1991/92 [Change in travel behaviour among old age groups: an analysis of results from the national travel surveys in 1984/85 and 1991/92]* (TØI Notat 1068/97). Oslo: Transportøkonomisk institutt, TØI.

Holland, C. A. (2001). *Older drivers: a review* (Road safety research report No. 25). London: Department for Transport, Local Government and the Regions (DTLR)

HUMANIST. (2006). Human centred design for Information Society Technologies applied to road transport. Retrieved May 3, 2011, from http://www.noehumanist.org/index.htm

Lag om färdtjänst 1997:736. Stockholm: Sveriges Regerings rättsdatabas. Retrieved October 20, 2011, from http://www.notisum.se/rnp/sls/lag/19970736.htm. .

Lag om riksfärdtjänst. (1997:735). Sveriges Regerings rättsdatabas. Retrieved October 20, 2011, from http://www.notisum.se/rnp/sls/lag/19970735.htm.

Langford, J., & Koppel, S. (2006). The case for and against mandatory age-based assessment of older drivers. *Transportation Research Part F, 9*, 353 – 362.

Leden, L. (2008). *Safe and joyful cycling for senior citizens* (VTT Working Papers 92). Finland: VVT.

Leden, L., & Johansson, C. (2010). *The safety of elderly bicyclists*. Paper presented at the 12th WCTR, July 11-15, 2010. Lisbon, Portugal.

Lervåg, L.-E., Moen, T., & Elvsaas Nordtømme, M. (2011). *Dynamisk varsling av farlige situasjoner – førerstøtte eller distraksjon? En effektstudie av hendelsesvarsler i bil med bruk av kjøresimulator* (SINTEF Rapport A19565).

Levin, L., Dukic, T., Heikkinen, S., Henriksson, P., Linder, A., Mårdh, S., et al. (2007). *Äldre i transportsystemet: Mobilitet, design och träningsproblematik* (VTI- rapport 593). Linköping: Väg- och transportforskningsinstitutet.

Levin, L., Dukic, T., Henriksson, P., Mårdh, S., & Sagberg, F. (2009). *Older car drivers in Norway and Sweden: Studies of accident involvement, visual search behaviour, attention and hazard perception* (VTI Report 656A). Linköping: VTI.

Lindahl, L. (2007). *Kollektivtrafikresan är fortfarande förenad med svårigheter - en andra rapport om KOLLA-resenärernas resor*. Göteborg: FoU i Väst.

Lindahl, L., & Odebo, L. (2007). *Kollektivtrafikresan som frihet och normalitet. En intervjustudie om färdtjänstresenärers upplevelser av sina resor med kollektivtrafik*. Göteborg: FoU i Väst.

Linder, A., Kircher, A., Vadeby, A., & Nygårdhs, S. (2007). *Intelligent Transport Systems (ITS) in passenger cars and methods for assessment of traffic safety impact. A literature review* (VTI report 604A 2007). Linköping, Sweden: Statens väg- och transportforskningsinstitut.

Linder, P. (2007). *Äldre människors res- och aktivitetsmönster -- en litteraturstudie*. Umeå: Transportforskningsenheten Umeå Universitet, TRUM.

Lundberg, C., & Johansson, K. (2011). *Äldre bilförare, deras bilförsäkringsskador och trafikolyckor* (TrMC Rapport Nr. 7). Stockholm: Karolinska Institutet.

Marottoli, R., Mendes de Leon, C., Glass, T., Williams, C., Cooney, L., & Berkman, L. (2000). Consequences of driving cessation: Decreased out-of-home activity levels. *Journal of Gerontology: Social Science, 55B*, 334-340.

Marottoli, R., Mendes de Leon, C., Glass, T., Williams, C., Cooney, L. J., Berkman, L., et al. (1997). Driving cessation and increased depressive symptoms: prospective evidence from the New

Haven EPESE. Established Populations for Epidemiologic Studies of the Elderly. *Journal of American Geriatric Society, 45*, 202-206.

Maycock, G. (1997). *The safety of older car drivers in the European Union*. Brussels/Basingstoke: European Road Safety Federation ERSF/ AA Foundation for Road Safety Research.

Miljøverndepartementet. (2007). *Universal Design* (Thematic Report). Oslo Miljøverndepartementet. Retrieved October 20, 2011, from http://www.regjeringen.no/

Mitchell, C. G. (2001). *Driving and other means of mobility for older people*. Paper presented at the Proceedings of the 9th International Conference on Mobility and Transport for Elderly and Disabled People.

Mobilitetscenter. (2011). Mobililtetscenter - ett unikt kompetencenter! Retrieved May 3, 2011, from http://www.mobilitetscenter.se/

Movia & Flextrafik. (2011). *Værd at vide om Flextrafik*. Valby: Trafikselskabet Movia. Retrieved October 20, 2011, from http://www.moviatrafik.dk/dinrejse/Flextrafik/Documents/quicklinks/Vaerd_at_vide_handicap_folder_030211_web_FINAL.pdf.

Norheim, B., & Ruud, A. (2007/2008). *Kollektivtransport. Utfordringer, muligheter*

og løsninger for byområder. Oslo, Norway: Statens Vegvesen and Urbanet Analyse, UA.

Nyberg, J., Peters, B., & Levin, L. (2009). *Vidareutbildning för äldre bilförare. En översikt* (VTI notat 12-2009). Linköping: VTI.

OECD. (1990). *Scientific Expert Group (1990). Behavioural adaptations to changes in the road transport system*. Paris: OECD.

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

Oslo kommune. (2008/2009). *Handlingsplan for universell utforming 2009-2012*. Oslo: Oslo kommune, Samferdselsetaten.

Peters, B., & Anund, A. (2005). *Utvärdering av Mobilitetscenter.se* (VTI-notat 32-2005). Linköping: Väg och tansportforskningsinstitutet.

Peters, B., Nyberg, J., & Strand, N. (2010). *Refresher courses for senior drivers in Sweden*. Paper presented at the TRANSED, Hong Kong. Retrieved from http://www.daneprairie.com

Regionale Færdselssikkerhedsudvalg. (2010). Retningsliner for bilistkurser. Retrieved November 3, 2011, from http://www.vejsektoren.dk/wimpdoc.asp?page=document&objno=610929

Regionale Færdselssikkerhedsudvalg. (2011). Når kørekortet skal fornys. Retrieved November 3, 2011, from http://www.vejsektoren.dk/wimpdoc.asp?page=document&objno=371974

Rosenbloom, S. (2001). *Mobility, safety and life after driving*. Paper presented at the Proceedings of the 9th International Conference on Mobility and Transport for Elderly and Disabled People.

Rugland, E. (2011). Zero vision, zero results? Retrieved May 3, 2011, from http://www.uis.no/news/article21890-50.html

Ruud, A. (2005). *Tiltakspakker for kollektivtransport 1996 - 2000. Effekter av informasjonstiltakene [Packages of public transport measures 1996-2000. The effect of information measures]* (TØI report 774/2005). Oslo: Transportøkonomisk institutt, TØI.

Ruud, A., & Frøysadal, E. (2002). *Målrettet kollektivtransport : Veileder med oppsummering av kunnskap og eksempler på tiltak [Targeted public transport. Summary of current knowledge and examples of measures]* (TØI report 587/2002). Oslo: Transportøkonomisk institutt, TØI.

Ruud, A., Tuveng, I., & Norheim, B. (2001). *Målrettet kollektivtransport. Delrapport 3 : Trafikantgruppers verdsetting av tilbudet [Targeted public transport]* (TØI report 545/2001). Oslo: Transportøkonomisk institutt, TØI.

Saad, F. (2006). Some critical issues when studying behavioural adaptations to new driver support systems. *Cognition, Technology and Work, 8*, 175-181.

Siren, A., Hakamies-Blomqvist, L., & Lindeman, M. (2004). Driving Cessation and Health in Older Women. *Journal of Applied Gerontology, 23*(1), 58 -69.

Siren, A., & Meng, A. (2010). *Helredsmæssig control ved ældre bilisters kørekortfornyelse – Evaluering af de sikkerhetsmæssige effekter af demenstesten*. Kgs. Lyngby: DTU Transport.

Siren, A., & Meng, A. (2012). Cognitive screening of older drivers does not produce safety benefits. *Accident Analysis & Prevention, 45, 634-638.*

Sivak, M., Campbell, K. L., Schneider, L. W., Sprague, J. K., Streff, F. M., & Waller, P. F. (1995). The safety and mobility of older drivers: what we know and promising research issues. *UMTRI Research Review, 26*(1), 1-21.

SIZE. (2006). Life quality of senior citizens in relation to mobility conditions. Retrieved October 23, 2006, from http://www.size-project.at/

Solvoll, G. (2010). *Transportordningen for funksjonshemmede (TT-ordningen)* (SIB notat 1003/2010). Bodø: SIB AS - SENTER FOR INNOVASJON OG BEDRIFTSØKONOMI [Centre for Innovation and Economics).

SOU 2005:26. *Mobil med bil. Ett nytt synsätt på bilstöd och färdtjänst*. Stockholm: Statens offentliga utredningar.

Spolander, K. (2007). *Better Cycles. An analysis of the needs and requirements of older cyclists* (Report VR 2007-17). Stockholm: VINNOVA.

Stamatiadis, N., & Deacon, J. A. (1997). Quasi-induced exposure: Methodology and insights. *Accident Analysis and Prevention, 29*(1), 37-52.

Statens Vegvesen and Urbanet Analyse. (2011). Kollektivtransportboka. Retrieved October 18, 2011, from http://fase2.kollektivtransport.net/

Stutts, J. C., & Wilkins, J. W. (2003). On-road evaluations: A potential tool for helping older adults drive safely longer. *Journal of Safety Research, 34*, 431-439.

Ståhl, A. (1996). *Tillgänglig kollektivtrafik för äldre och funktionshindrade - betydelsen av reskedjans olika delar. Demonstrationsprojekt i Borås*. Stockholm Kommunikationsforskningsberedningen, KFB-rapport 1996:7.

Ståhl, A. (2000). *Public Transport or Special Service or a Mix?* Lund: Lund University, Dep. of Technology and Society, Div. of Traffic Planning.

Ståhl, A., Brundell-Freij, K., & Makrí, M. (1993). *The Adaption of the Swedish Public Transport System - Yesterday, today and Tomorrow. An evaluation* (TFB-report 1993:14). Stockholm: TFB.

Ståhl, A., & Ivarsson, S. (2007). *Tillgänglighet, säkerhet och trygghet för äldre i den lokala miljön. Demonstrationsprojekt "Kom så går vi"* (Publikation 2007:109). Lund och Kristianstad: Lunds universitet och Vägverket Region Skåne.

Ståhl, A., & Petzäll, J. (1997). *Servicelinje eller låggolvsbuss - studie av äldres och färdtjänstberättigades resande i Uppsala*. Lund: Institutionen för trafikteknik, Lunds tekniska högskola.

Sundhedsstyrelsen. (2003). *Rapport fra arbejdsgruppen vedr. forslag til vurdering af kognitiv funktion ved lægeundersøgelse i forbindelse med kørekortfornyelse fra det 70 år* (Januar 2003). København: Sundhedsstyrelsen.

Svensk trafikmedicinsk förening. (2009). *Trafikmedicinska centrum och enheter. Ett förslag till förverkligandet av Vägverkets förslag*. Stockholm-Solna Universitetsservice AB.

Svensson, H. (2001). *Effects for elderly People when Introducing Trunk Bus Routes in Public Transport*. Lund: Lund University, Department of Technology and Society, Traffic Planning.

Svensson, H. (2003). *The Public Transport Preferences of Elderly People: A Study Related to Individual Capacity and Environmental Stress in Service Route Traffic and Other Systems* (Diss.). Lund: Tekniska högskolan, Teknik och samhälle.

Svensson, H. (2004). *Behov i trafikmiljön för äldre personer* (Arbetsmaterial). Borlänge: Vägverket.

SWOV. (2008). *The elderly and Intelligent Transport Systems (ITS)* (SWOV Fact Sheet, November 2008).

Trafikanalys. (2011a). *Färdtjänst och riksfärdtjänst 2010 [Special transport service and inter-municipal transport service 2010]* (Statistik 2011:16). Stockholm: Trafikanalys

Trafikanalys. (2011b). *Uppföljning av de transportpolitiska målen* (Rapport 2011:1). Stockholm Trafikanalys.

Trafikverket. (2010). *Mobilitetscentrum i Stockholm - ett verktyg till ökad frihet för handikappade och äldre bilförare* (TR 80-A 98:2158). Borlänge: Trafikverket http://www.trafikverket.se/.

Transek. (2005). *Samhällsekonomiska konsekvenser av Trafikmedicinska centrum och enheter* (Rapport 2005:38). Solna: Transek.

Transportministeriet. (2010). *Blinde og svagtseende i den individuelle handicapkørsel - evaluering af et forsøg*. Copenhagen: Transportministeriet. Retrieved October 20, 2011, from http://www.trm.dk/da/publikationer/2010/blinde+og+svagtseende+i+den+individuelle+handicapk%C3%B8rsel/.

Ulleberg, P. (2006). *Blir man bedre billist etter oppfriskningskurs? Evaluering av kurset "Bilfører 65+" [Evaluation of the "Driver 65+" refresher course for elderly drivers]* (TØI report 841/2006). Oslo: Transportøkonomisk institutt, TØI.

Ulleberg, P., Bjørnskau, T., & Fostervold, K. I. (2011). *Evaluation of a refresher course for older drivers* (Manuscript in preperation). Oslo: Transportøkonomisk institutt.

Vaa, T. (2006). *Intelligent Transport Systems (ITS): An overview of effects on behaviour and accidents* (TØI-report no 845/2006). Oslo, Norway: Institute of Transport Economics.

Waara, N., & Henriksson, P. (2010). *Mobility in old age. Implications of senior life transition points* (WSP Report 2010:100). Stockholm: WSP.

Warsén, L. (Ed.). (1997). *Kvinnors och mäns liv och resande. Kunskapssammanställning och förslag till forskningsprogram om kvinnligt och manligt i kollektivtrafiken*. Stockholm: KFB, Rapport 1997:34.

Warsén, L., & Haywood, P. (2005). *Designing safe travel*. Jönköping: Public Transport Authority, PTA.

Warsén, L., Lundin, I., Melzer, R., & Haywood, P. (2004). *Trygg och säker resa*. Jönköping: Jönköpings länstrafik och Jönköpings kommun.

Weale, R. A. (2003). Epidemiology of refractive errors and presbyopia. *Survey of Ophthalmology, 48*(5), 515–543.

Wennberg, H. (2009). *Walking in old age. A year-round perspective on accessibility in the outdoor environment and effects of measures taken*. (Diss.) Lund: Lund University, Dep of Technology and Society.

Westerlund, Y. (Ed.). (1991). *Flexibel kollektivtrafik i Göteborg - Erfarenheter av försök med Flexlinjen samt studie av framtida möjligheter*. Stockholm: Kommunikationsforskningsberedningen, KFB-rapport 1999:26.

Whelan, M., Langford, J., Oxley, J., Koppel, S., & Charlton, J. (2006). *The Elderly and Mobility: A Review of the Literature*. Clayton: Monash University. Accident Research Center.

Whitelegg, J., & Haq, G. (2006). *Vision Zero: Adopting a Target of Zero for Road Traffic Fatalities and Serious Injuries*. Stockholm: Stockholm Environment Institute.

Widman, L. (2008). *Medicinska körkortskrav vid Neurologiska och Psykiska sjukdomar. Patient-Läkare-Myndighet* (VVFS 2008:158). Umeå: H. Lundbeck AB.

Wilkins, J. W., Stutts, J. C., & Schatz, S. J. (1999). Premature reduction and cessation of driving: Preliminary study of women who choose not to drive or to drive infrequently.

Transportation Research Record, 1693, 86-90.

Wretstrand, A., Svensson, H., Fristedt, S., & Falkmer, T. (2009). Older people and local public transit: Mobilitiy effects of accessibility improvements in Sweden. *Journal of Transport and Land Use, 2*(2), 49-65.

Vågane, L., Brechan, I., & Hjorthol, R. (2011). *Den nasjonale reisevaneundersøkelsen 2009 – nøkkelrapport* (TØI-rapport 1130/2011). Oslo: Transportøkonomisk institutt.

Vägverket. (2005). *Regeringsuppdrag om läkares skyldighet att anmäla olämpliga förare*. Borlänge: Vägverket.

Vägverket. (2007). *Bilar för äldre* (Publikation 2007:29). Borlänge: Vägverket.

Vägverket. (2008). *Modellen för dig. En hjälp för funktionshindrade att välja bil och anpassning*. Borlänge: Vägverket och VTI.

Øvstedal, L. (2009). *Litteraturstudie om universell utformning i transport* (Rapport A10438). Trondheim: SINTEF, Teknologi og samfund.

Search sources and strategies

Search the years 1995–2011 in:

Libraries

DTU
Oslo University and TØI
VTI TRAX/TransGuide

Databases

Scopus, Google Scholar

Search examples, in libraries and databases

Search was done in English and Scandinavian languages (Swedish, Danish, Norwegian)

1 older **OR** elderly **OR** old people **OR** senior →

AND

2 car driver **OR** driver →

car driver **AND** refresher course →

cyclist **OR** bicycle **OR** bicyclist →

pedestrian **OR** walking →

public transport **OR** public transit →

special transport service →

(mobility) scooter **OR** wheelchair →

AND

3 measures **OR** best practice **OR** improvement **OR** guidelines **OR** needs **OR** requirements

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Homepages

For example: Transport authorities, the Transport Administrations in Denmark, Norway and Sweden, counties and municipalities, pensioners associations, disability organisations.

E-mail contacts

For example: Transport authorities, the Transport Administration, project leaders in counties and municipalities, pensioners associations.

Example of checklist

Examination of safety, accessibility and comfort in public transport environments (from Warsén et al. 2005).

Information	Yes	No	Design	Yes	No	Operation	Yes	No
Public address systems are in full working order, and are regularly used by trained staff to inform passengers about services.			An access consultant has been involved at the design stage to ensure any potential problems can be addressed before bricks and mortar are in place.			Control and management of the bus station will ensure that the environment is clean and well maintained, affording reassurance to passengers that the area is well managed.		
Audible and visual information systems are provided.			There are adequate shelters and seating at the interchange.			Bus station inspections should be made (weekly?) to ensure that any potential threat to personal safety is identified and resolved.		
Information about delays is given as soon as possible.			Through informal surveillance passengers can expect to both see and be seen by passers, road users etc. and all parts of the bus station will be well lit to encourage a feeling of security and to assist people with visual impairments.			Toilets are checked and cleaned frequently to deter misuse and maintain cleanliness and should not be isolated.		
Information on fares is easily available.						Checking and cleaning of toilets includes disabled persons' toilets which are often isolated from other areas and can easily be forgotten.		
Information on fares is available in alternative formats to meet the needs of those with disabilities.								
Information on routes is easily available.			Artificial illumination may be necessary in some parts of some bus stations in daylight hours.			Waiting areas are checked regularly to deter misuse and check for litter and damage.		
Information on routes is available in alternative formats to meet the needs of those with disabilities.								
Information is displayed in vandalproof form.			Lifts are provided where vertical circulation routes are not accessible.			Crime Prevention Surveys are conducted periodically at all existing bus stations by an appropriate Police Architectural Liaison Officer in order to monitor and review design features affecting personal security and inform any plans		

						for improvement.		
Information displayed conforms to DPTAC guidance (legibility of timetables).			Unstaffed interchanges or remote areas of large interchanges have accessible, clearly signed help points or other emergency communication facilities for passengers.			The landscape management programme will ensure that landscape features do not become targets for vandalism or provide cover for potential criminal activity.		
Signage includes information on toilets and telephones and uses international symbols.								
Signage includes information on toilets and telephones and uses international symbols.			Doors are not too heavy to open.					
Signage includes specific information about disabled persons' toilets in the vicinity.			There is a working and accessible public telephone nearby.					
Where there are safe and accessible pedestrian routes from the interchange these are clearly signed.			Public telephones and help points are at a suitable level to allow access for wheelchair users.					
Entrances and exits accessible by those with disabilities are clearly signed.			Tunnels are well lit and have mirrors at blind corners.					
There is a local map and directional signs at all interchanges.			The station/ interchange has visible and publicised CCTV in working order covering all public areas.					

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VTI är ett oberoende och internationellt framstående forskningsinstitut som arbetar med forskning och utveckling inom transportsektorn. Vi arbetar med samtliga trafikslag och kärnkompetensen finns inom områdena säkerhet, ekonomi, miljö, trafik- och transportanalys, beteende och samspel mellan människa-fordon-transportsystem samt inom vägkonstruktion, drift och underhåll. VTI är världsledande inom ett flertal områden, till exempel simulatorteknik. VTI har tjänster som sträcker sig från förstudier, oberoende kvalificerade utredningar och expertutlåtanden till projektledning samt forskning och utveckling. Vår tekniska utrustning består bland annat av körsimulatorer för väg- och järnvägstrafik, väglaboratorium, däckprovnings-anläggning, krockbanor och mycket mer. Vi kan även erbjuda ett brett utbud av kurser och seminarier inom transportområdet.

VTI is an independent, internationally outstanding research institute which is engaged on research and development in the transport sector. Our work covers all modes, and our core competence is in the fields of safety, economy, environment, traffic and transport analysis, behaviour and the man-vehicle-transport system interaction, and in road design, operation and maintenance. VTI is a world leader in several areas, for instance in simulator technology. VTI provides services ranging from preliminary studies, highlevel independent investigations and expert statements to project management, research and development. Our technical equipment includes driving simulators for road and rail traffic, a road laboratory, a tyre testing facility, crash tracks and a lot more. We can also offer a broad selection of courses and seminars in the field of transport.

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