VTI rapport 447A · 1999

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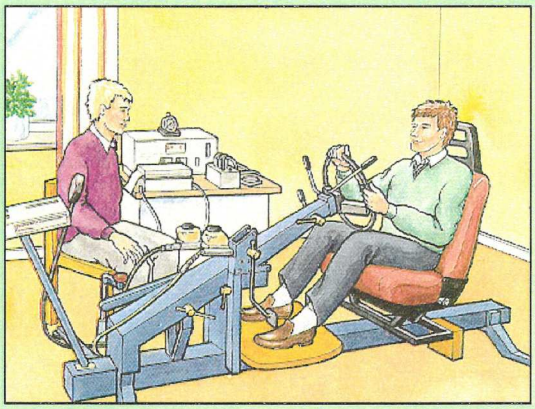
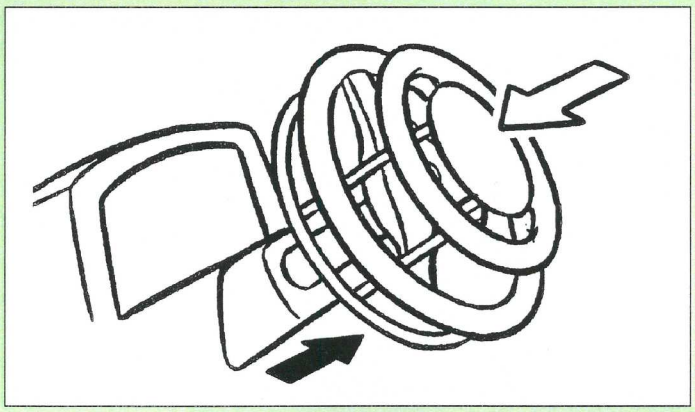
John Fulland and Björn Peters





Swedish National Road and Transport Research Institute

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Test methods for adapted cars for drivers with disabilities

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Title
Regulations and routines for approval of passenger cars adapted to drivers with disabilities – including an international survey

Abstract (background, aims, methods, result)

The report describes the current regulationas and routines for driving licensing and rules applied for matters concerning driving licensing and vehicle adaptation for people with physical impairments in Sweden. Deficiencies in the so-called mediating process i.e. from initial assessment of fitness to drive to adaptation of the car and driving licensing are identified and described. The Swedish conditions are compared to other countries and preliminary recommendations are presented concerning test/assessment of fitness to drive, driving test and vehicle inspection, adaptation evaluation, standards and directives, and competence centres.

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Preface

This report is part of the project "Test methods for adaptations to vehicles for drivers with disabilities", which was financed by the Vehicle Department of the Swedish National Road Administration. The National Road Administration currently has the principal responsibility for ensuring that people with disabilities and the elderly are guaranteed the same conditions as other citizens regarding mobility throughout the transport system (regardless of means of transportation) (Delén, 1999). This means that the traffic environment must be both safe and accessible. In today's Swedish society, people have become increasingly dependent on access to cars to be able to function in society. For people with disabilities, access to a car usually entails an outstanding opportunity to fulfil the need for independent mobility. Often, the car must be adapted, as it is not designed for people with disabilities. Even though the car has been adapted, the measure is neither necessarily adequate nor designed to suit the individual driver optimally. Currently, the adapted car is not tested together with the person who will drive the car. It is known that many drivers with disabilities limit travel because driving is still too strenuous, even when measures have been taken to adapt the car. The aim of this project is to continue the work begun in "Evaluation of the significance of the vehicle in the rehabilitation of spinal cord injury users" (see Peters, 1998). The aim is to develop guidelines for a procedure to evaluate the adaptation. This procedure will be carried out upon delivery of cars adapted for drivers with disabilities. This will ensure the safety, function, comfort and trust of the individual driver. This report describes guidelines, procedures and requirements that are currently observed on both a national and international basis to adapt passenger cars for drivers with disabilities.

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Gunilla Sjöberg, VTI has edited this report.

Contents

Abbreviations used in the text

Abbreviation	Definition/explanation
ABSB	The Swedish Motor Vehicle Inspection Company
ACC	Adaptive Cruise Control
AC	Air Conditioning
ADED	Association of Driver Educators for the Disabled
ADEPD	Association for Driver Educators for People with Disabilities
AS	Australian standard
BEF	Belgian Franc
BEV	Borås Elektromekaniska Verkstad (now BEV Euroaid AB)
BIVV	Belgian Institute for Road Safety
CAN	Canadian standard
CARA	Centre d'adaption à la route pour automobilistes handicapés (Belgium)
CBR	Centraal Bureau Rijvaardigheidsbewijzen (Dutch Driver Licensing Centre)
CEN	Comité Européen de Normalisation
CP	Cerebral Palsy
DEKRA	German equivalent of motor vehicle inspection, similar to TÜV
DIN	Deutsche Industrie Normung
DoT	Department of Transport (Great Britain and USA)
ECE	Economic Commission of Europe
EEC	European Economic Commission (EU)
EMG	European Mobility Group
EU	The European Union
FIM	Finnish Mark
FMVSS	Federal Motor Vehicle Safety Standard
HI	The Swedish Handicap Institute, HjälpmedelsInstitutet (previously HandikappInstitutet)
HMC	Technical Aid Centre, Hjälpemiddelcentral (Denmark)
HMS	Technical Aid Centre, Hjelpemiddelsentral (Norway)
INCA	INventory of European legislation and regulation for Car-Adaptations (EU project)
INRETS	Institut National de Recherche sur les Transports et leur Sécurité, (France)
ISO	International Standardisation Organisation
IT	Information Technology
LBS	Landsdekkende Bilsenter (Central Advisory Centre for Adapted Cars in Norway (Norway)
MAVIS	Mobility and Vehicle Information Service
MCTC	Motorizzazione Civile e Trasporti in Concessione (Italy)
MD	Machine Directive (in the EU)
MDD	Medical Device Directive (in the EU)
MOT	Ministry of Transport
NAH	Nordiska Arbetsgruppen för Handikappbilar
NHF	Norges Handikapforbund
NHTSA	National Highway Traffic Safety Administration
NLFH	Norsk Landsforening for Handikapbil-tilpassere (Norway)
NOK	Norwegian Kronor
NZDRC	New Zealand Disabilities Resource Centre
NZS	New Zealand standard
OMV	Oravais Mekaniska Verkstad AB (Finland)
PTU	Landsforeningen af Polio-, Trafik- og Ulykkesskadede (Denmark)
RADAR	Royal Association for Disability And Rehabilitation
RFV	National Social Insurance Board
RICA	Research Institute for Consumers Affairs

RRV	Swedish National Audit Office
RTF	Rådet for tekniske tiltak for funksjonshemmede (Norway)
RTV	Rikstrygdeverket (Norway)
SAE	Society of Automotive Engineers (USA)
SEK	Swedish Kronor
SINTEF	Stiftelsen for industriell og teknologisk forskning ved NTH (Norway)
SIS	Swedish Institute for Standards
SMS	Swedish Materials & Mechanics Standards
StVZO	Bundesdeutsche Strassenverkehrs-Zulassungsordnung (Germany)
TC	Technical Committee (in ISO)
TELAID	TELematics Applications for the Integration of Drivers with Special Needs (EU project)
TELSCAN	TELematic Standard and Coordination of ATT systems in relation to elderly and disabled travellers (EU project)
TNO	Dutch Research Institute
TRRL/TRL	Transport and Road Research Laboratory (Great Britain)
TSVFS	Trafiksäkerhetsverkets Författningssamling
TÜV	Technisher Überwachungs Verein (Germany)
VA	Veterans Administation
WG	Working Group (in ISO)
VTT	Statens tekniska forskningscentral (Finland)
VV	Swedish National Road Administration (SNRA)
VVFS	Swedish National Road Administration's Statute book

Regulations and routines for approval of passenger cars adapted to drivers with disabilities – including an international survey

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Summary

This report presents an overview of present routines and regulations concerning driving licensing and vehicle adaptation for people with physical impairments. The aim of the report is twofold: firstly, to present deficiencies in the current routines and secondly, compare Swedish conditions with those in other countries in order to provide a basis for improving the situation in Sweden. Thus, both national and international conditions are described in the report. In an earlier report, VTI Report 426, it was concluded that the present routines used to ensure that drivers with physical impairments are provided with the right adaptation are not satisfactory e.g. some form of adaptation evaluation is lacking. The report begins with a short description of the background and a description of how some central concepts such as impairment, disability, and handicap are used in the report. This is followed by a somewhat simplified and idealised description of what is called the mediating process i.e. from the initial assessment of fitness to drive to adaptation of the car and driving licensing. After this follows a presentation of how this process is implemented and works in Sweden of today. The following sections are devoted to the conditions in the other Nordic countries. This is followed by sections dealing with some European countries and what the EU member states have in common. The next sections are devoted to some countries outside Europe. Standards and competence centres have been considered so important in this context that these subjects are dealt with in separate sections. The report ends with some conclusions and recommendations concerning test/assessment of fitness to drive, driving test and vehicle inspection, adaptation evaluation, standards and directives, and competence centres. The authors' intention is that the report will be used as a bank of ideas for future work involving improvements of the mediating process in Sweden, in particular with respect to adaptation evaluation.

1 Introduction

This report is part of the project "Test methods for adaptations to vehicles for drivers with disabilities". The aim of the report is to evaluate Swedish conditions in a larger context, with particular consideration taken to possible changes for the future. By studying the surrounding world it is possible to benefit from lessons learned by other countries as they went through the process of establishing regulations and procedures in this field. Keeping up with international trends that might affect the situation in Sweden is also of interest. This is important not least considering Sweden's membership in the European Union. International standardisation efforts relevant to the area are also in progress at agencies such as the ISO (International Standardisation Organisation) and CEN (Comité Européen de Normalisation). These could lead to new requirements and procedures regarding vehicle adaptations.

Before moving on to the actual subject matter, one concept should be discussed. Usually no distinction is made in daily speech among the terms impairment, disability and handicap; they are used relatively synonymously. However, by distinguishing among these terms, not only will greater clarity be attained; this could also influence ingrained attitudes that present the situation incorrectly. WHO (1980) has defined the concepts of impairment (illness or injury – Swedish funktionshinder: obstacle to function), disability (Swedish funktionsnedsättning: reduction of function) and handicap in detail. This work is based on the need to describe the relationship between an individual with a disability and his or her surroundings. In other words, a handicap is not an absolute condition for an individual but is due to the relationship between an individual's resources and limitations and the design of the specific surroundings in which the individual must operate. Consequently, people should not be referred to as "handicapped drivers", but rather as "drivers with disabilities", since with the right adaptation of the driver's environment they do not need to be handicapped – though they may well retain their disability. In previous publications (e.g., Peters, 1998) no strict distinction is made between disability and impairment; both were used to designate a limitation in the individual's performance. However, by continuing on the same line of thought as above, a distinction should be made between an impairment and an obstacle in that an obstacle is relative to the environment while an impairment in function is linked to the individual. Consequently we have chosen to use the expression "driver with disabilities" throughout this report. There are certain exceptions in the text when the person providing the information has specifically used other words.

A starting point for the account presented in this report is described in figure 1. It shows a simplified and to some extent ideal picture of how someone with disabilities may or could be helped to obtain a driving licence and an adapted vehicle. We call the process described in the diagram the "mediation process". The diagram illustrates the deficiencies of current procedures and offers ideas on how to improve them. Many assessments and decisions are made when a driver with a disability is to obtain a driving licence and get access to a specially adapted vehicle. Unfortunately, current procedures have many deficiencies overall; this appears to be the case in most countries. Differences among the countries are also great.

The mediation process begins at the top of the diagram, with a more or less comprehensive initial assessment of the potential of an applicant with disabilities to be able to drive a car independently, assuming that the vehicle has been adapted. In certain cases this assessment includes various tests to determine the applicant's limitations and resources. However, there are no standardised or uniform procedures (different tests, different authorities, etc.) for this assessment. This initial assessment should result in a preliminary specification of requirements for adaptation and driving education upon which the continued process could be based. These requirements should be a description of the driver's function and needs for adaptation in functional and medical terms. No specific manufacturer should be stipulated in the specifications, which should be specific enough to serve as the basis for submitting an offer on education or adaptation. Usually, this is not the case. Once this first decision on the available opportunities is reached, driver education and vehicle adaptation begins. In certain cases the car must be adapted before education may begin and the car must undergo a technical inspection for approval. The arrow in the diagram between education and adaptation indicates the need for the exchange of information between the driving instructor and the vehicle adaptation company. Sometimes this exchange of experiences occurs, but in many cases it does not take place. Upon completed education and adaptation the applicant takes an ordinary driving licence test and the car is inspected, if this has not taken place previously. Only rarely is there an evaluation to determine whether the solution has been suitable for just this driver. Thus the form of adaptation evaluation shown at the bottom of figure 1 usually does not happen and definitely not in any structured and formal manner. The aim of this project is to try to provide a basis for changing today's process and to initiate a project developing a method for adaptation approval that would take into consideration factors such as impact safety, functional matters, comfort and trust. These details will be considered later in the project.

Even if the primary interest of this project should be

aimed at the adaptation evaluation, this report has been made substantially broader intentionally to give greater context. The description of procedures in other countries includes sections on the local distribution of responsibility, financial support, co-ordinating organisations, standardisation, international projects, etc. We have included whatever we have found that we have considered to be relevant to our subject.

Many contexts refer to a Nordic "model" concerning rights of, and the society's responsibility to, people with disabilities. Consequently, it is only natural to begin this survey by describing conditions in the Nordic countries and then continue to the European Union, followed by a brief review of some countries outside of the EU. The scope of descriptions for the different countries varies based on the information available, as well as in some cases on the scope of existing special procedures for drivers with physical disabilities. The report has been written mainly by John Fulland, who has a lengthy and extensive experience of both Norwegian and international conditions. As a result, Norway has been given somewhat greater attention than most other countries. To facilitate reading and to enable the reader to compare conditions in other countries to those in Sweden, the report begins with a description of the existing conditions in Sweden.

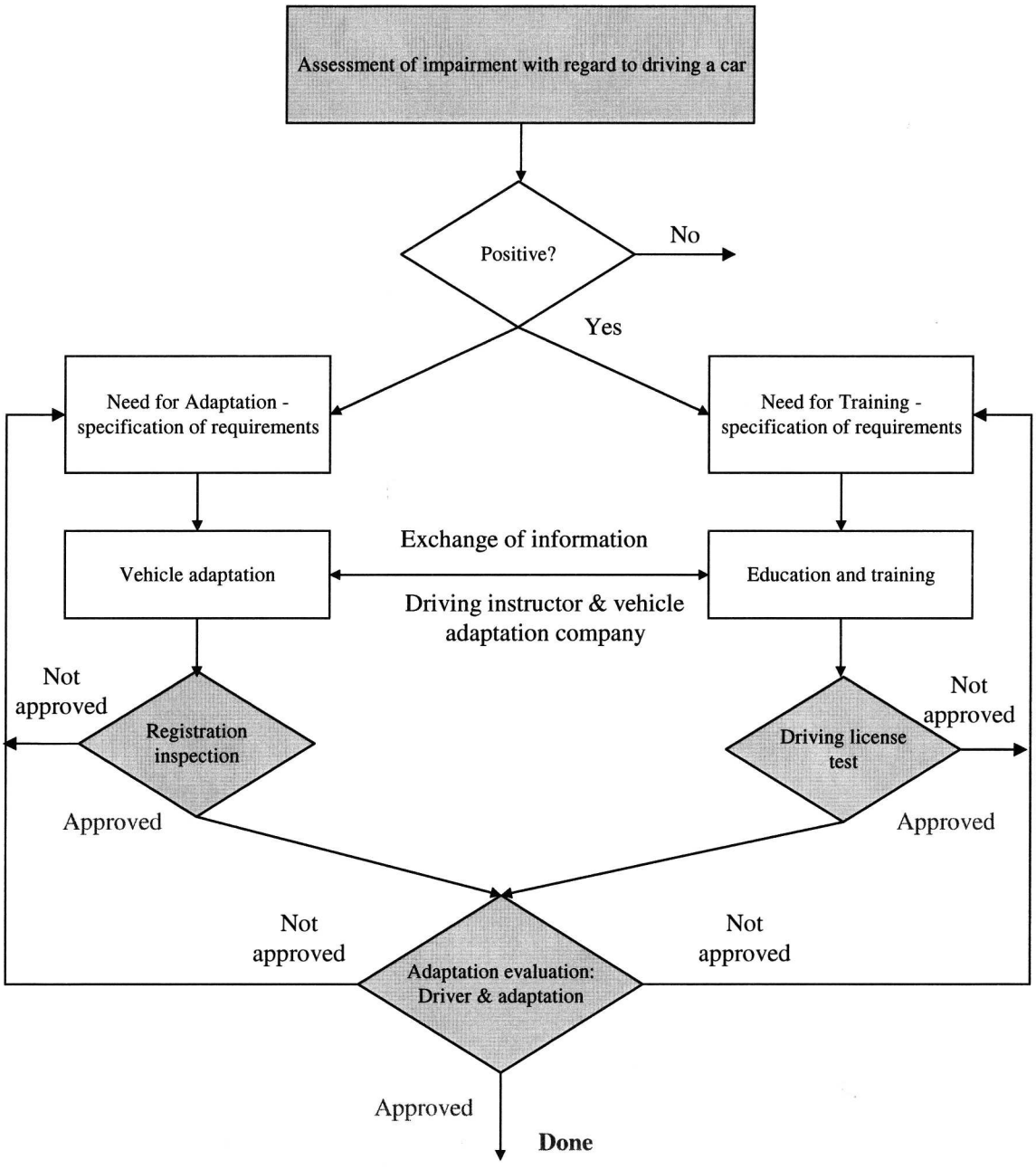

Figure 1 *Diagram describing the evaluations, examinations, tests and inspections that should be carried out to ensure that drivers with disabilities obtain a vehicle with the right adaptation.*

2 Sweden

Conditions in Sweden will be discussed in greater depth later in the project in conjunction with the survey conducted with representatives of vehicle adaptation companies, administrators of the financial support system who authorise vehicle grants at the local social insurance office and traffic inspectors from the Swedish National Road Administration (SNRA). A similar study was planned to be carried out with inspectors and engineers at the Swedish Motor Vehicle Inspection Company (ABSB); however, this was not carried out, since ABSB representatives felt that a description of their motor vehicle inspection agency routines in this field could be created without local interviews. This description will be attached to a later report in this project. In Sweden, many authorities are involved in the issues concerning driving licence and vehicle adaptation for drivers with disabilities. A summary of the responsibilities held by different authorities is presented in table 1.

In Sweden, it is estimated that two to three thousand passenger cars are adapted annually for drivers with disabilities. Still, the information varies; just over two thousand vehicle grants are paid annually, but the vehicle adaptation companies claim a volume of just over three thousand annually. The Swedish National Road Administration regulations on medical requirements for possession of a driving licence (VVFS 1996:200) stipulate that physical disabilities do not necessarily comprise an obstacle for obtaining a driving licence if the disability may be compensated by either an orthopaedic prosthesis or adaptation of the vehicle controls (The Swedish National Road Administration 1996a). The Swedish National Road Administration has not issued any detailed directives on how to determine and test, if necessary, whether this compensation has been obtained or not for a disability. Today's procedures concerning driving licence tests for drivers with physical disabilities and technical approval of the adaptations to passenger cars entails a relatively complicated mediation process, involving several authorities (see figure 2). When applying for learner's permit, applicants (even people without disabilities) must submit a health statement and take a vision test. People with disabilities must enclose a medical report from his or her doctor. Sometimes a battery of tests is carried out by medical experts at hospitals, both to make a diagnosis as well as to determine the extent of a disability, depending on the type of disability involved. The physician's assessment (i.e., the physician's statement) of the user's potential is based on both the test results and on personal knowledge about the individual.

Table 1 *Overview that describes the distribution of responsibility among different authorities regarding driving licence and vehicle adaptation for drivers with disabilities in Sweden.*

Activity	Driving licence	Vehicle approval – adaptation	Vehicle grant, financial
Creates regulations	Ministry of Industry, Employment and Communications	Ministry of Industry, Employment and Communications	Ministry of Health and Social Affairs
Responsibility	Swedish National Road Administration (SNRA), County administrative board (region)	Swedish National Road Administration (SNRA)	National Social Insurance Board (RFV)
Permit/ Statement	County administrative board (region), Physician, Swedish National Road Administration (SNRA)	Swedish National Road Administration (SNRA), (Physician)	Swedish National Road Administration (SNRA), Medical Consultant
Execute	County administrative board (region), Driving licence office	The Swedish Motor Vehicle Inspection Company, (Swedish National Road Administration), Registration inspection	Social insurance office, usually local office, sometimes regional
Follow-up Renewal	County administrative board, Physician	The Swedish Motor Vehicle Inspection Company, Vehicle testing	User, Social insurance office
Suspension of licence Driving ban Suspension	Physician, Police, County administrative board	The Swedish Motor Vehicle Inspection Company, Police	Social insurance office

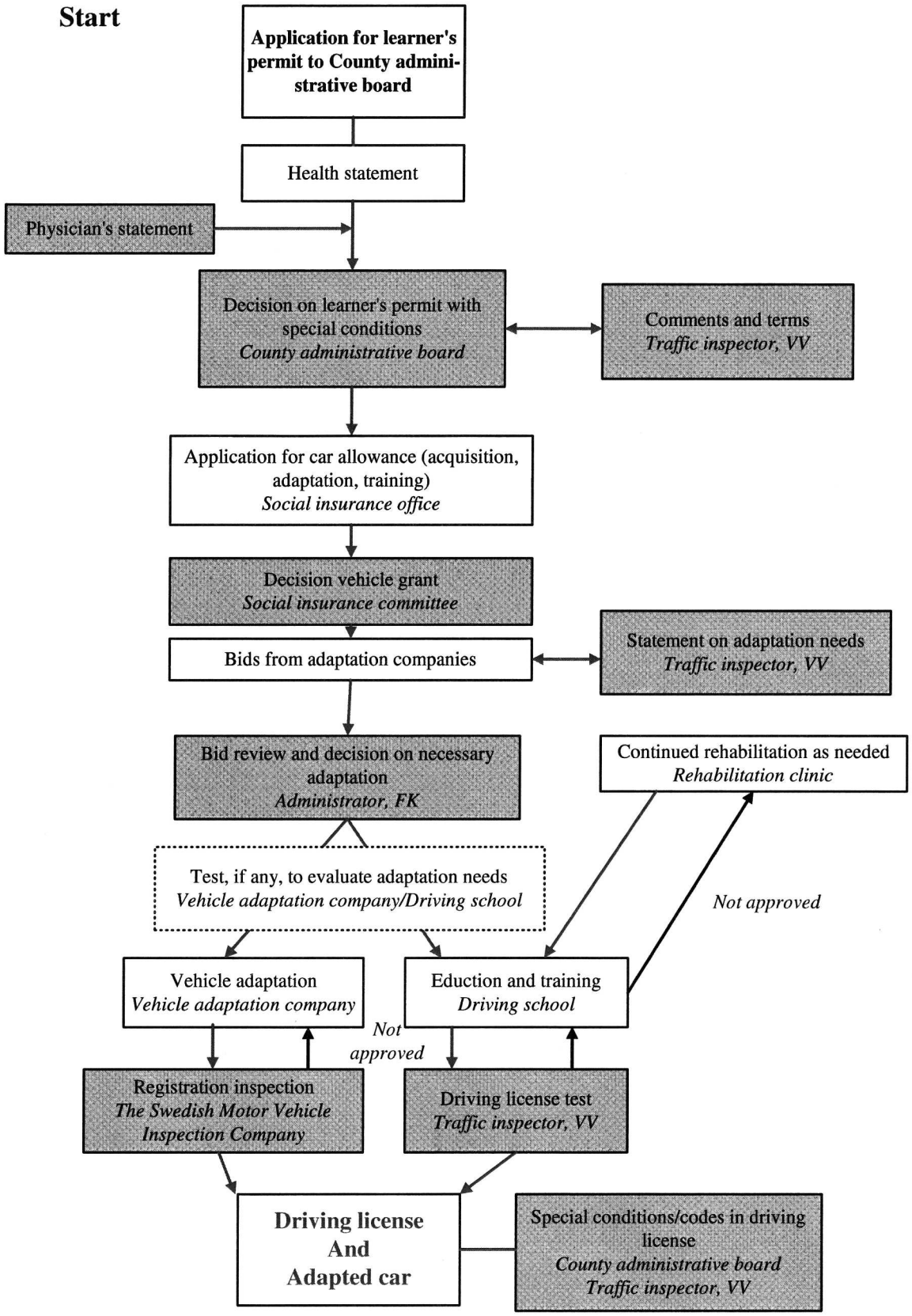

Figure 2 *The mediation process for driving licence and adapted vehicle in Sweden. Yellow boxes indicate measures for which the applicant is responsible. Green boxes indicate decisions.*

No hospital has created suitable test methods for assessing the individual's abilities for driving a car, i.e. quick decisions, under stressed conditions, divided attention doing several operations at the same time. When applying to the county administrative board for learner's permit the case will be referred to a traffic inspector from the Swedish National Road Administration. Usually the inspector will visit the applicant and make a simple, preliminary assessment of the applicant's potential for being able to drive an adapted car. Some traffic inspectors also make a preliminary assessment of the appropriate coding categories for the applicant's driving licence. Driver education, purchasing a vehicle and the adaptation can be very expensive if the individual were to personally finance it. Many people with disabilities would not be able to get an adapted car. A government grant has been available for many years, providing financial support to facilitate the purchase of a vehicle, its adaptation and in some cases even driver licence education for people with disabilities. The vehicle grant has been revised on a few occasions. It has been administered by the local social insurance office since 1988 and the driver licence education allowance since 1995. Applications for the vehicle grant are usually submitted to the local social insurance office. Three conditions must be met for an applicant to be eligible for a vehicle grant:

1. The disability must be permanent.
2. The disability must complicate the mobility of the person.
3. The applicant must belong to the eligible group (certain age requirements), etc.

The administrator at the social insurance office determines whether the conditions are met. The physician's statement comprises an important component in the paperwork upon which the decision is based. In difficult cases an internal physician from the insurance office is contacted by the administrator to provide a second opinion. The case is presented by the administrator to the Social Insurance Board, which makes the final decision regarding the vehicle grant. If the vehicle grant is approved, an administrator at the social insurance office determines the extent of adaptation required and decides who is to carry out the work, as well as who will provide education if a driver licence education allowance is also provided. Administrators are aided in their work by a description of the vehicle grant published by RFV (RRV, 1996). The social insurance office does not carry out any tests directly to evaluate suitability or to determine the actual needs for adaptation. However, occasionally the administrator will consult an experienced traffic inspector to obtain a technical statement describing the type of adaptation that the applicant might need (see also Peters & Östlund, 1999). Appropriately, the same inspector that handled the learner's permit case on referral from the County Administrative Board would be consulted for the technical statement. The Swedish National Road Administration is paid by the social insurance office for this report, which may be one reason why a technical statement is not always requested. According to a memo from Swedish National Audit Office (RRV) (Häggkvist & Önnhage, 1999), 75% of all decisions on individual needs for adaptation are made without a statement from a National Road Administration traffic inspector. The administrator may also consult more experienced colleagues and the supervisor physician on the case to obtain support and advice. Social insurance office administrators also try to build up good relationships with serious, knowledgeable vehicle adaptation companies.

Once the vehicle grant is approved, the applicant must obtain offers for the adaptation work, but there is no specific requirement for more than one offer. The social insurance office then reviews the offer(s) and selects the offer suitable for the job. In Sweden there are just over 20 companies specialising in adapting vehicles for people with disabilities (see annex 1). The size of the firms varies from sole proprietorship to medium-sized companies. A successful adaptation requires good communication between driving instructor, applicant, adaptation company, traffic inspector and medical personnel, but it is the social insurance office that establishes the financial limits. There is no quality control by the social insurance office upon delivery (see Norway). Administrators trust the companies carrying out the adaptation and the inspection conducted during the registration inspection at the Swedish Motor Vehicle Inspection Company (ABSB). Often an ordinary basic adaptation is modified to individual needs. Since 1997, all new cars sold in the EU must be covered by a whole vehicle type approval when they leave the factory. One effect of this regulation is that they may be imported to other EU countries without requiring a local registration inspection. If adaptation involves changes to any equipment in the car that is covered by a safety regulation, the changes must comply with the applicable safety regulations. This means that equipment that has been modified or replaced at a later date must be proved to be in compliance with current Swedish regulations or the applicable EU directive (see also table 6 with exceptions for standards such as ISO and DIN). If satisfactory test documentation cannot be obtained from the car manufacturer or an independent laboratory for equipment that has been replaced and is covered by the requirements, the Swedish National Road Administration may grant a technical exemption after submission of a special application. With current procedures there is risk that adapted cars may not meet the same requirements for safety during impact as ordinary cars. Adaptation components that have been collision-tested and approved should be given preference if they are available for the adaptation process. In principle,

all adapted cars should automatically be brought for registration inspection by the Swedish Motor Vehicle Inspection Company. Exceptions are permitted if the car is equipped with a left foot accelerator pedal and/or a steering spinner knob (TSVFS 1984:28). It would be reasonable to require that the car to undergo registration inspection before payment of the vehicle grant; however, this is not always the case. The Swedish Motor Vehicle Inspection Company does not employ any specific procedures to inspect vehicles adapted for drivers with disabilities. These cars go through the same inspection as all other vehicles; consequently, the adaptation itself is not tested. The final examination ensuring that the actual adaptation meets the needs and resources of the driver is made by traffic inspectors from the Swedish National Road Administration (see also Peters, 1998). Unfortunately, there are no procedures for a uniform and documented adaptation approval with the aim of fulfilling the demands for traffic safety requirements ensuring that the disability has been compensated. The inexperienced customer – the driver with the disability – will certainly have some difficulty evaluating whether the adaptation is adequate. Sometimes occupational and physical therapists may serve as advisors during vehicle adaptation to achieve an ergonomically correct car for their user. They may also help to select the technical aids necessary for getting in and out of the specialised car. Unfortunately this does not happen as often as it should.

At some driving schools they use a simple test rig to study the user's force resources, reaction capacity and ability to reach the controls. Perhaps the most important test takes place when the user first tries to drive. Driving instructors with experience testing and teaching people with disabilities usually emphasise the importance of letting the user try practical driving as early as possible to enable a study of the user's potential for successful driving and to plan the education program. After October 1998 it was no longer possible to carry out this type of test without learner's permit, which may make it more difficult to correctly assess a user at an early stage (upon application for the learner's permit). Driver education may be obtained at private, often local driving schools; through the public school system (some upper secondary schools); driving schools with a residential option, or it is possible to practice driving privately with someone such as a family member as the instructor. The same regulations are in effect here as for all other driving licence candidates. One problem with practical driving is that it often requires access to an adapted car and only a few driving schools have cars that can be adapted. Most users with disabilities come to these schools. After the education program the user is obliged to pass a driving licence test (theory and road test) executed by a traffic inspector from the Swedish National Road Administration. It is not required that either the education or the test be carried out in the same car, as the user will drive subsequently. It may be observed that in connection with driver education there are no uniform or standardised tests with the purpose of assessing whether the car is adapted properly. This is a deficiency. In certain cases traffic inspectors may have contact with the user during the education program in order to follow the user's progress.

After passing the test the user gets a driving licence with a special conditional document. The conditional document describes the disability and the required adaptations for the car. The conditional document is designed as an individual exemption from driving licence regulations and is in effect when the person has a car that has been adapted. Thus no general exemptions are issued. The new, small, EU-driving licence has been under implementation since 1996. A code is entered on these describing the driver's disability and the type of adaptation required in the car (The Swedish National Road Administration, 1996b). In Sweden we have no regular re-testing of holder of a driving licence, which means that the driving licence is valid for life, assuming that conditions remain unchanged. It is the responsibility of the holder and the treating physician to inform the Swedish National Road Administration of any changes in the user that might significantly affect the user's ability to drive safely. Since 1996 driving licence requirements in Sweden have been regulated by an EU directive (EEC 91/439).

As can be seen, many authorities are involved regarding driving licences and adaptation of cars for drivers with disabilities. There is a need for increased co-operation and better channels for exchanging experiences and knowledge. One step in the right direction was taken in 1998, when the department for driving licences at the Swedish National Road Administration formed a special committee concerning the assessment and licensing of drivers with disabilities.

3 The rest of the Nordic countries

3.1 Nordiska Arbetsgruppen för Handikappbilar (NAH)

Nordiska Arbetsgruppen för Handikappbilar (NAH), which is still formally led by John Fulland, was formed in 1986 to gather the existing expertise in the car adaptation field from the Nordic countries. The initiative came from Arne Jönsson, who worked with Handikappinstitutet and who truly wanted to see a Nordic Co-operation similar to that found involving wheelchairs and other technical aids for persons with disabilities.

Through the years, NAH has arranged many courses and conferences on vehicle adaptation for companies in the industry as well as driving instructors (or combinations thereof). The basic idea in the Nordic countries is that if there are no medical reasons to prevent someone from obtaining a driving licence, no means shall go untried regarding the adaptation of the car itself. This also includes the concept that everyone concerned - physicians, therapists, technicians who make the modifications, driving instructors, traffic inspectors and technical inspectors - should contribute positively toward finding a good solution for the disabled person. This often entails expensive, high-tech solutions, but also that regulations are sometimes interpreted a bit freely to include high-tech equipment. Joystick-control for cars that have been adapted is one such example. The electronic joystick is not even close to what is required by the vehicle regulation for a steering system, but it functions for severely disabled drivers who would otherwise be unable to manoeuvre a car.

As a consequence of the Nordic conferences some people also took the initiative to establish national meetings for the same subject. In this manner expertise was distributed from a limited number of experts to people on the practical level from all of the participating countries. NAH is run as an association without any membership fee. All arrangements must be self-financed and the administration is based on voluntary work. There has been little activity during the past five years.

3.2 Norway

A person with a disability in Norway who wishes to start driving a car must turn to the local "trygdekontoret" (social insurance office) in his or her municipality. An administrator will help fill in the application and then find out whether all criteria for getting the vehicle grant are met. At this stage the administrator may contact the municipality's occupational therapist to obtain information on living conditions (topography), distance to bus stop, etc. It is important for the applicant to document the need for transportation that cannot be fulfilled by using public transportation or special transport (transportation service for the disabled). The municipal therapist is often able to give good advice on transporting children and how to get in and out of the car, but skills and expertise vary widely.

"Fylkestrygdekontoret", which is the regional insurance office of the Rikstrygdeverket (RTV) approves or rejects the vehicle grant application. The allowance must cover an "appropriate and necessary solution;" that is, the least expensive vehicle option that meets the needs of the applicant. However, financial need is also evaluated based on income, so many do not receive 100% coverage of the cost of the car. Support is also available for driver licence education, but this is again based on financial need. Costs for necessary vehicle adaptations are covered in full. The vehicle grant is also available to people with physical disabilities who do not want to get a driving licence, or who for medical reasons cannot obtain a driving licence, as well as to children under the age of 18. In other words, the vehicle grant is also available for a car even if the recipient will only be carried as a passenger.

If the applicant intends to do the driving, financial support for driver education may also be relevant. If he or she already has a driving licence, and the medical prerequisites have not changed, the case is sent to a local technical aid centre called "Hjelpemiddelsentral" (HM) to assess the type of car and adaptation needed for the applicant to be able to use the car; that is, to get in and out, operate the wheelchair tie-down system, etc. The same procedures are followed for people who are not going to drive the car themselves. HMS may consult adaptation companies directly or leave the case to the national resource centre to carry out the adaptation, or "Landsdekkende Bilsenter" (LBS) in Oslo, if they do not have the necessary expertise (see also the section "National Resource Centres" later in the text). Preferably the assessment is carried out independently of the vehicle adaptation companies. The assessment involves drawing up specifications to fill in a form indicating which adaptations are needed (see annex 3). The form is then sent to at least three companies to get an offer on equipment and labour for the adaptation job. Based on these offers, HMS determines which companies will receive the task of adapting the car. HMS orders both the car and the adaptations and they are also responsible for monitoring the offer, the billing and the car itself before any money is paid. They have to ensure that they receive what was ordered and that no changes have been made in relation to the original offer.

HMS often has access to cars that are ready to change owner for different reasons, which the applicant first must try out. HMS keeps them until a new user is found. With a

little luck, the old adaptation can give a good indication of what is needed. Before granting any money to the applicant to buy a completely new car they check to see if HMS has a suitable adapted car that is not currently in use. HMS must look for a usable car throughout the country, but this can be done electronically. Unlike the Swedish vehicle grant where money is distributed, the car and equipment are actually possessions of the Norwegian government, even if the user has used it for up to nine years.

If the applicant does not have a driving licence, the testing must also include test driving with an adequately adapted training vehicle, so that a statement can be issued on driving ability. A local driving school may be used for this purpose if it has a suitable car. However, LBS usually has to be consulted in such cases. The therapist from HMS always goes with the client to Oslo in such cases, both to learn, but also to discuss the adaptation that must be made. It is still HMS that orders the car and adaptation. The distribution of actors with responsibility in Norway can be seen in table 2.

Since the government is the legal owner of adapted cars and buys approximately 3000 cars per year, cars in Norway have to be purchased through an offer system, following EU regulations, starting 1995. Agreements have been met with suppliers for two-year terms. The purchasing office has tried to limit the number of suppliers to five, which has excluded several major car importers from this market.

Driving training takes place either in a well-equipped training car belonging to a driver school, or in the adapted car that the user will use later. For this purpose, this car is equipped with double pedals and other features necessary for approval as a driving training car. In both cases, a driving instructor from the home town is hired. The driving licence test is carried out as usual by the government-run Biltilsynet, which administers driving licence cases in Norway. The new European driving licence categories are used to describe the driver's impairment and which adaptation is needed, but so far this has not been implemented consistently.

The vehicle adaptation company is responsible for ensuring that the modified car will pass the registration inspection. Expertise at the vehicle inspection authorities varies greatly and an inspection of the same adaptation could give different results. The judgement is usually too kind. Companies often build up confidence at a small number of inspection stations. If something wrong is found, it is corrected by the adaptation company and the car is presented again for inspection until it can be approved on purely technical terms.

In the systematic evaluation of the vehicle grant, carried out during 1994, a practical and functional test was executed by the vehicle inspection authority, preferably in the user's home town or at least in the same county and was requested as a part of the new organisation. This has not yet been feasible to implement. There is still no description of the functional tests edited. One reason for the requested local connection is that the routine inspection (EU-control of used cars) will probably be carried out at the home community's inspection station.

In 1985 RTV attempted to increase the quality of adaptations to cars for drivers with disabilities. This assignment was given to SINTEF at Rådet för tekniske tiltak för funksjonshemmede (RTF). From the start, annual meetings

Table 2 *Overview describing the distribution of responsibility among different authorities with regard to driving licences and car adaptations for drivers with disabilities in Norway.*

Activity	Driving licence	Car approval – adaptation	Vehicle grant, new car
Issue regulations	Samferdsels-departementet Ministry of Transport and Communications	Samferdsels-departementet Ministry of Transport and Communications	Sosialdepartementet Department of Social Affairs
Responsibility	Vegdirektoratet The Norwegian Public Roads Administration	Vegdirektoratet The Norwegian Public Roads Administration	Rikstrygdeverket National Social Insurance Board
Permission/ Statement	Fylkeslegen Norwegian Board of Health	Hjelpemiddelsentral Technical Aid Centre Landsdekkende Bilsenter	
Execute	Biltilsynet pr fylke og distrikt Vehicle Inspection	Biltilsynet pr fylke og distrikt Workshops	Trygdekontorene per fylke og kommune Regional and local Social Insurance offices
Follow-up/ Renewal	Physician	Biltilsynet Workshops	Hjelpemiddelsentralene per fylke
Suspension of licence/ Technical refusal of car	Police Biltilsynet Vehicle Inspection	Police Biltilsynet Vehicle Inspection	Trygdekontorene per fylke og kommune Regional and local Social Insurance offices

were held for employees, insurance office staff and the vehicle adaptation companies. In other years, courses were also arranged for car inspectors (aimed both at conversion equipment and driving licences), for driving schools or for combinations of those referred to above. During 1995 this project was discontinued and RTV has only sporadically permitted LBS to arrange courses for the social insurance office, HMS, the conversion industry and Biltilsynet (see also the section Resource Centres).
Vehicle inspectors have no special education on vehicles with adaptations, but some inspectors usually acquire expertise during the years. After SINTEF published "Guidelines for the Adaptation of Cars" in 1993 (see the section on information activities) and the accompanying "Proposal for Inspection Guidelines for adapted vehicles" courses were arranged for vehicle inspectors and the quality of inspections climbed sharply. At the same time a common terminology was implemented in the field of adaptations at the local social insurance office, the vehicle adaptation industry and motor vehicle inspection. In recent years procedures have deteriorated; new inspectors do not receive the same training and others forget what they once learned, as there are not many inspections of modified vehicles. Consequently, there is great variation in the standard of technical judgement.

The vehicle adaptation company usually makes an appointment for inspection with a specific inspector. When complicated adaptations are made, the firm invites the inspector to come and look "behind the scenes" before the equipment is hidden by upholstery and fabric. A complicated adaptation is defined as an adaptation where the cost exceeds NOK 50,000. When the work is done, the same inspector can approve the car on purely technical grounds. After the Norwegian vehicle adaptation industry organised to form the "Norsk Landsforening for Handikapbiltilpassere" (NLFH) this association developed a document called "Annex for Vehicle Registration", which essentially certifies what has been done to adapt this specific car. This gives a good starting point for the inspector's work with the car and the document follows with the car's registration certificate so that it is always available during future technical inspections (see annex 2).

Vegdirektoratet, the Governmental Road Authority; the supervisory organisation for the vehicle inspectorate, has not shown any interest in trying to increase the skill level of the inspectors and thereby eliminate the differences in judgements from one inspection station to another. This situation, however, may result in a distorted competitive situation within the vehicle adaptation industry as firms submit offers for legislative approved adaptations (see also Denmark).

If completely new adaptation products are to be presented to the market, the vehicle adaptation companies attempt to contact their local vehicle inspectors for a preliminary evaluation, but there is no regulated type inspection of these products. The central authorities do not wish to make such assessments. Consequently only the completed vehicle can be approved after an individual inspection of each vehicle.

Fundamental to the Norwegian vehicle regulations is the fact that a technical inspector may approve anything he or she can inspect and then feel competent to judge. If the inspector does not feel competent to evaluate modifications of the car's technical specifications he or she must order the vehicle owner to obtain a certificate from the car manufacturer indicating that it (or its Norwegian representative, usually the car importer) accepts the car adaptation. Since the car manufacturers have shown little interest in vehicle adaptation, they have rarely formed an opinion in such issues and it is very difficult to obtain a satisfactory certificate. Consequently, inspectors are often forced to be "kind" even if they feel uncertain of the assessment. Naturally they know that a modified car is extremely important to the individual it is meant for. Public accident statistics cannot indicate whether adapted cars are more dangerous than non-adapted cars in traffic or not. This suggests a general lack of knowledge. It might be worth mentioning that right now, in 1999, three interesting projects are in progress on this subject. At VTI a project commissioned by the Swedish National Road Administration is in progress with the purpose of studying accidents (occurrence and type) with cars adapted for drivers with disabilities. Similar projects are in progress in Norway (SINTEF) and in Germany (vehicle adaptation company Zawatzky).

3.3 Denmark

A person with disabilities in Denmark who wishes to acquire and drive a car approaches the municipality for financial assistance. An administrator fills in an application and asks for the applicant's driving licence. If this is relatively recent and contains the correct notes on which adaptive equipment is necessary to drive, the administrator, preferably together with the municipality's occupational therapist, will prepare the case and send it on to the county administration where the financial decision is made regarding the vehicle grant.

If the applicant does not have a driving licence, or if no necessary adaptation is stated, the administrator or occupational therapist must arrange an assessment. A therapist may be engaged from the county technical aid centre "Hjälpemiddelcentralen" (HMC) (Technical Aid Centre) for this purpose if there is any expertise there. If not, the case may be submitted to "Landsforeningen af Polio-, Traffic- og Ulykkesskadede" (PTU), which is an independent assessment centre with two departments in Denmark. One alternative may be that municipalities contact a vehicle adaptation firm directly to get assistance with an assess-

ment. Often it is the adaptation firms that have the greatest expertise in the field. A traffic inspector from Statens Bilinspektion (Vehicle Inspection) is also present at the assessment and the results are summarised in a report indicating which equipment is needed. The driving licence might need to be modified, with new notes or conditions entered. The practical driving licence test is held by the traffic inspector referred to above, on behalf of the police, who normally handle driving licence issues in Denmark.

Table 3 shows the distribution of responsibility among different authorities in Denmark regarding vehicles that have been adapted to meet the needs of drivers with disabilities. If HMC or PTU has made the assessment, the results are sent as a basis for offers from several vehicle adaptation companies and the order is determined subsequently based on the offers that arrive. If a specific firm has participated during the assessment, the order must go to this company as well.

The vehicle adaptation company is responsible for ensuring that the modified car will pass the "syn", or registration inspection. The expertise of Statens Bilinspektion varies substantially and judgement of the same adaptation may give different results. The vehicle adaptation companies often build confidence at a small number of inspection stations. The driver/owner of the car must always participate during the inspection and a functional test is carried out, though it is fully informal. If any problems are discovered, the adaptation company makes corrections and the car is inspected again. It is found preferable that the customer (car owner) is picked up at his or her home town and brought to the vehicle adaptation company's town for inspection, rather than the firm making two long trips if anything should be wrong. A repeated inspection (if required) must always be done at the same inspection station as the first.

Vehicle inspectors have no specialist training for adapted vehicles, but some acquire expertise and experience with time. In general, inspectors have little contact with this type of vehicle and therefore may find it difficult to make a correct judgement. There are no written guidelines for inspections or special regulations for adapted cars, a situation that appears to be general in most countries. When a vehicle adaptation company makes the appointment for the inspection and then arrives at the station, they never know which inspector will conduct the inspection. Preliminary inspections on adaptation in progress (in complicated adaptations) are not regulated, but still occur. Vejdirektoratet has not shown any interest in increasing the skills of the inspectors, in an effort to eliminate the variations found among the stations, which makes it rather difficult for the vehicle adaptation industry. This situation, however, could result in a distorted competitive situation among the vehicle adaptation companies when they submit offers for adaptations. It appears that this situation may arise in most countries, indicating that this is a "grey zone" that should be better regulated in general. Specialist training of technical inspectors is probably also something that should be implemented to a greater extent. This can be compared with the situation in Norway years ago, where a trial period offering special training to staff at the vehicle testing and inspection agencies gave good results for a period of time.

If completely new adaptive products are to be brought out on the market, the adaptation companies contact the local vehicle inspectors, if they have adequate expertise, or a central inspector at Statens Bilinspektion, to discuss whether the product may be approved. This is not, in any way, a regulated type approval of the product, but a small reassurance that once the vehicle has been adapted it has a chance of approval. Consequently only the complete vehicle can be approved after an individual inspection of each vehicle.

Table 3 Overview describing the distribution of responsibility among different authorities with regard to driving licences and car adaptations for drivers with disabilities in Denmark.

Activity	Driving licence	Car approval – adaptation	Vehicle grant, new car
Issue regulations	Trafikministeriet Ministry of Transport	Trafikministeriet Ministry of Transport Færdselsstyrelsen	Socialministeriet Ministry of Social affairs
Responsibility	Police	Statens Bilinspektion National Vehicle Inspection	Socialministeriet Ministry of Social affairs
Permission/ Statement	Physician, Sundhedsstyrelsen, Danish National Board of Health, Specialist physician, Statens Bilinspektion National Vehicle Inspection	Car importers, manufacturers, testing from accredited institutes	
Execute	Police, Statens Bilinspektion National Vehicle Inspection	Local Vecicle Inspections	Counties/Communities
Follow-up/ Renewal	Police	Local Vehicle Inspections	Communities/Counties
Suspension/ Driving ban	Police	Police	

3.4 Finland

In Finland people with disabilities are often referred to as "invalids", probably because of the relatively large number of people who became invalids as a result of war injuries. Consequently this designation has been retained to some extent in the description of the situation in Finland. Information on conditions in Finland has been provided by Ove Knekt from Fordonsförvaltningscentralen. Table 4 shows the distribution of responsibility among different authorities in Finland regarding adapted vehicles and driving licensing that have been adapted to meet the needs of drivers with disabilities.

According to §70 of the road traffic act, the police issue learner's permit if the applicant meets requirements stipulated in the statutes concerning health and if the individual is not considered dangerous as a driver in traffic due to continued abuse of alcohol or any other intoxicant. Police praxis has been to require a statement from a physician and/or driving school/driving test examiner on the suitability of a driving licence for a person with disabilities and on the additional equipment with which the car should be equipped. The additional equipment is noted in the driving licence register. A driving licence is issued according to §71 of the same act, to anyone who has been granted a learner's permit, is the appropriate age stipulated in the statute and has passed the driving test. The driving licence is obtained from the police. The police may decide whether certain conditions and limitations must be attached to the licence.

In the early 1990s the attitude toward vehicle adaptations became more positive, thanks to the efforts of Kalle Könkkölä, a member of parliament who had a disability that required an adaptation to his car. He ordered a custom-built car for private use from Statens teknisk forskningscentral (VTT) in Tammerfors, which also carried out the assignment; the car's features included a lift device so that Könkkölä could get behind the steering wheel independently. The car's special equipment was never officially approved in an inspection; in other words, he drove at his own risk. VTT only built this sole custom-ordered car for Könkkölä and the project was discontinued after that.

The following example gives a description of how the Finnish vehicle adaptation industry has developed. In the early 1990s Oravais Mekaniska Verkstad AB specialized in adaptive equipment for cars. Among other things, a joystick steering device was manufactured and installed in several cars, as well as a lift device (OMV lift) for the driver with reduced mobility, etc. The technical equipment in these cars for drivers with disabilities was approved during inspection by Trafikministeriet and the local inspection authorities and was patented. In all, adaptive equipment was installed in about a hundred cars in Finland by Oravais Mekaniska Verkstad. It could be said that production of the adaptive equipment for cars at this phase was relatively well developed in Finland, but on the basis of the uncertain economic conditions for people with disabilities, it was difficult to further develop the market in Finland for the vehicle adaptation industry. Consequently, today it is most common to find simpler conversions such as manual devices for accelerators and brakes.

According to the vehicle tax act, an invalid with impaired mobility or vision is exempt from the vehicle tax when purchasing a car, to a maximum sum of FIM 22,400. Vehicle tax is an excise duty to be paid in conjunction with the first registration of all new passenger cars. If the invalid must use a car with automatic transmission, the upper limit of the vehicle tax exemption is FIM 29,600. According to the vehicle tax act the invalid must apply to the Helsinki district customs office for the vehicle tax exemption,

which is administered by the Customs Board. The vehicle tax represents about 30% of the price of a new car for the consumer.

Exemption from vehicle tax is granted to anyone who is entitled to a refund on the car tax on the basis of invalidity. Vehicle tax amounts to FIM 500 per year for vehicles that were taken into use prior to 1994 and FIM 700 for vehicles taken into use on 1 January 1994 or later. The vehicle tax is an annual tax.

The municipalities' social welfare authorities may, within the framework of their budget, approve support to invalids for the acquisition of cars. The amount may represent half of the car's actual acquisition cost for the invalid. Consequently, this form of financing is not mandatory for municipalities and in current financial conditions municipalities often lack the funds for this purpose in the budget. It is the car tax exemption that comprises the essential form of financial support to the handicapped for acquiring cars in Finland.

Before a car fitted with extra equipment may be taken into use it must be inspected and approved. Inspection is carried out by an inspection company and the inspector declares that the extra equipment found on the car is adequate for the driver, from the viewpoint of traffic safety, considering their invalidity. Nevertheless there are no detailed special regulations for how a vehicle with extra equipment should be inspected. The situation is as follows until further notice:

1. According to the driving licence regulation, the police may attach to the driving licence "conditions for any vehicle driven by the holder of the licence requiring the vehicle to have automatic transmission or such special driving devices as have been approved by the driving test examiner(traffic inspector in Sweden) according to instructions issued by the Vehicle Administration Centre". Traffic inspectors have been issued a recommendation by the Vehicle Administration Centre for the type of special equipment required by different handicaps.

2. The requirements for the vehicle during inspection are determined by "the regulation on vehicle design and equipment", which in principle follows the relevant EU directive. According to the regulation, the Vehicle Administration Centre may grant minor deviations from the regulations while major deviations require permission from the Ministry of Traffic. In other words, the regulation only contains general regulations on design and equipment.

The Vehicle Administration Centre has decided internally that next autumn it will try to issue a recommendation to the inspection companies with guidelines for approval of handicap equipment for private cars, which would then mainly comply with those recommendations issued to the licensing traffic inspectors. This project is in the process of being carried out in Finland, where they intend to review procedures next spring.

3.5 Iceland

Iceland is rather similar to the other Nordic countries, even if certain differences are found. We have not considered it to be that important to include Iceland in this report. For anyone who wishes to know more, there is some information in a VTI memo, which may be a few years old but does present a comparison among the Nordic countries (Peters, 1992).

Table 4 *Overview describing the distribution of responsibility among different authorities with regard to driving licences and car adaptations for drivers with disabilities in Finland.*

Activity	Driving licence	Car approval – adaptation	Vehicle grant, new car
Issue regulations	Trafikministeriet Ministry of Transport and Communications	Trafikministeriet Ministry of Transport and Communications	Finansministeriet Ministry of Finance
Responsibility	Fordonsförvaltningscentralen Vehicle Administration Centre Police	Inspection Company	Customs
Permission/ Statement	Fordonsförvaltningscentralen Vehicle Administration Centre Police	Inspection Company	Customs
Follow-up		Police, Inspection Company	Fordonsförvaltningscentralen Vehicle Administration Centre
Suspension/ Driving ban	Police	Police	Fordonsförvaltningscentralen Vehicle Administration Centre

4 The European Union (EU) apart from the Nordic countries

We will include some European countries under this heading to present the situation there. We have not been able to cover every country, nor has it been possible to gain access to reliable and extensive information from every country. We have selected certain countries that we feel give a good picture of the similarities and differences that are found. However, first a brief overview of circumstances that are relevant throughout the EU.

4.1 The EU as a whole

The EU commission issues regulations and directives for vehicles and traffic, particularly Directorate (DG) VII. Through a number of different directives they have succeeded in transforming Europe into an homogenous market in which car manufacturers can deliver almost the same product to all countries. Brakes, steering and all safety details must meet the same requirements in all countries and are made identical in large numbers, reducing the price of each component. Nevertheless, cars are still built based on different specifications on the basis of the special needs of different countries; e.g., battery size, alternator capacity, differences in heating and ventilation, etc. In some countries with high national tax (e.g., Norway and Denmark) they cut back on luxury equipment (fabrics, electronic components, etc.) to achieve competitive prices. As a result, the standard model may show small differences in the individual EU–countries.

There is no doubt that a well developed and accepted EU directive on adapted vehicles would make daily life easier for those who manufacture and install adaptive equipment in cars, but the hard part is making directives flexible enough to cover all of the different expert opinions found all over Europe. The new EU–driving licences are one example of EU directives. An EU directive does not mean an immediate change in the individual country; it must be ratified by each country before it comes into force.

Regarding driving licences, there is an EU directive (91/439/EEC) that describes the requirements for the EU driving licence. The directive describes different types of driving licence classes (A, B, C, D, E) and the requirements that must be met by the driving licence test. Medical requirements are also included (annex III, page 20 – 24). In principle, the same requirements are made as in VVFS 1996:200 regarding reduced mobility. In other words, a driving licence may not be issued to anyone with reduced mobility if there is any risk that the disability entails danger related to the individual's ability to drive the vehicle. Driving licences (all classes) may, according to the directive, be issued on condition that a qualified physician issues a statement based on a test/assessment of the individual's ability to drive with a prosthesis or an adapted vehicle. It must also be clear in the certificate which form of adaptation is required to avoid jeopardising safety. In Sweden, such certificates are often (but not always) issued on the basis of a collaborative effort comprising the treating physician, the traffic inspector and the vehicle adaptation company, while the county administrative board reaches the final decision on issuing driving licences. If the disability is progressive there must be regular reviews to ensure that the driver can still drive the modified car safely. In an additional directive (94/72/EEC) it can be read that Sweden, together with Finland, beginning in 1998 must issue driving licences as defined in directives from 1991. In annex 1a to an additional directive from 1996 (96/47/EEC) it is established that the physical design of the EU–driving licence must comply with ISO 7810 and ISO 7816–1 and that codes 1 – 99 shall be used for additional information on necessary adaptations, disabilities and limitations. Codes over 100 may be used for national requirements. Additional directive 97/26/EEC specifies the main codes 1 – 99. Corresponding Swedish regulations are found in VVFS 1996:193, 1998:78, 1999:3 (see reference list). It can also be added that Sweden has the special regulation that drivers of vehicle group 3 (bus and taxi) must be able to help passengers in and out of the vehicle as well as assist passengers with fastening and removing their seat belts.

The EU commission has subsidised a number of different projects that have been and are focused on drivers with disabilities, or as it is often referred to in these contexts, "drivers with special needs". They wish to point out that there are many who are also outside the "traditional handicap groups" with special needs and who have much to win if they were permitted to make demands on the lay-out of the traffic environment. The share of drivers and passengers with special needs is increasing, not least considering the fact that the proportion of elderly people in Europe is growing. Some of these projects are briefly described below. The number of people with disabilities is steadily rising. In Europe it is estimated that there will be between 12 and 36 million people with disabilities in 2000. As a result, the EU commission has increased its efforts for these target groups.

4.2 European Mobility Group (EMG)

This group was formed in December 1987 as collaboration between a few European vehicle adaptation companies and would be a "non profit" organisation for the distribution of good products. This initiative has no connection with the EU commission. In the beginning the EMG tried to include at least one member from each EU country so that they would be represented across most of Europe. After a while, new companies evolved and even though admission criteria were rigorous, interest in membership rose constantly. Slowly the focus of the operation changed from a trade alliance into information, harmonisation of technical regulations and activities in those countries where it is difficult for people with disabilities to convince the authorities that they could drive a car with the right equipment and/or adaptation. Today, the group has 39 (19 full and 20 associate) members in 10 countries and the annual meetings and conferences are held at a high level. EMG has no employees; all work is run as an association, on a volunteer basis. In some contexts, EMG has functioned as a referral authority in cases that have concerned vehicle adaptations. They have also participated in EU projects. This is an activity that could definitely benefit from expansion.

One EMG member, Jan Brekelmans (DeLangstraat) from the Netherlands, conducted a large project together with TNO, studying European regulations on brakes and steering to see what might prevent approval of adapted vehicles. His work was presented in several EMG Newspapers. The work resulted in a report from the Dutch research institute TNO (Veenbaas & Brekelmans, 1996). See also under standardisation.

4.3 TELAID (TELematics Applications for the Integration of Drivers with Special Needs)

The project was carried out between 1992 and 1995. VTI and AmuGruppen in Kävlinge participated from Sweden. Project participants came from six European countries. Within the framework of the project many reports were produced, including one classifying different vehicle adaptations. The goal of TELAID was to study how transport telematics (information technology in the traffic environment) could contribute toward making driving for the driver with disabilities more comfortable, safe and better adapted to their needs and resources. Within the framework of TELAID, three experiments were carried out in which drivers with different types of disabilities participated. VTI's driving simulator was used in two of these studies; one in which a comparison was made between quadriplegic drivers and drivers without disabilities and another where an adaptive cruise control, ACC (that is, a cruise control that can adjust the speed of the car so that a safe distance is maintained in relation to the vehicle ahead of it) was evaluated. The aim of the latter study was to investigate how ACC driving affects comfort and driving behaviour for the wheelchair–dependent paraplegic driver. All drivers in both studies had paralysed legs and drove with hand–operated accelerator and brakes. VTI and AmuGruppen/Kävlinge also carried out a smaller field study with two different reverse driving aids. One system comprised a TV camera and a monitor placed on the instrument panel and the other was based on ultrasound technology. Nine drivers, who all had difficulties turning to see behind them, participated in the experiment. The drivers experienced that the ultrasound technology gave somewhat better support. TNO from the Netherlands carried out a study to see how design and placement of different controls (buttons, switches, rotary controls) could affect driving behaviour in paraplegic drivers, compared with drivers without any disabilities. One finding was that people with disabilities are more sensitive to how the controls are designed and located than those without disabilities. The results from the experiments were included in the TELAID Design Guidelines Handbook. Most recommendations in the handbook, however, come from other sources (scientific studies, standards, expert knowledge, etc.). A database called TELDAT was developed, containing several hundred descriptions of technical aids for vehicle adaptations, including telematic systems. TELDAT is available on the Internet. The simulator studies that were carried out in TELAID comprise a valuable contribution toward the development of test methods for adapted vehicles, particularly with regard to testing of function.

4.4 TELSCAN (TELematic Standard and Coordination of Att systems in relatioN to elderly and disabled travellers)

TELSCAN is a "horizontal" project in the EU's fourth framework programme. The project will be completed by summer 1999. Participants from Sweden include VTI, Lunds Institute of Technology (Traffic technology) and AmuGruppen in Kävlinge. The aim of the project is to protect the interests and needs of the elderly and handicapped when developing and evaluating information technology (IT) applications in the traffic field. It clearly states in the section in which goals are set for the fourth framework programme that the interests of the elderly and handicapped must be given special consideration in all projects that develop systems. The project will ensure that this is actually the case and will also support other projects, as it cannot be expected that all projects will have knowledge of the needs of elderly and handicapped drivers and passengers. Support may be provided in the form of advice, as well as by making resources from TELSCAN available so that different IT–systems may be evaluated with consideration taken to the needs of the elderly and handicapped. The project has co–operated and is co–operating with a large number of projects. Meanwhile, the focus of

the project has been more on public transport and not as much on private motoring. The work of developing guidelines that was begun at TELAID has continued at TELSCAN. VTI has carried out a few simulator studies in Cooperation with a project called AC–ASSIST focused on anti–collision systems in which elderly (over age 65) drivers have participated. Meanwhile, no work has been aimed at test methods for evaluating vehicles adapted to the needs of drivers with disabilities.

4.5 Inca

INCA is the name of an EU project within DG VII (Transport) that is led by TNO, Delft, in the Netherlands. The aim of the project is to survey current national procedures for driving licences and inspection of adapted vehicles, that are applied in the EU countries, as well as to subsequently propose joint regulations and procedures that may be applied throughout Europe. Several different aspects have been taken into consideration, such as the technical characteristics of the adapted vehicles, evaluation of "usability" aspects (that is, man–machine properties) and the relationships between the codes that are to be entered on the driving licence and the car inspection document.

It became apparent rather soon that it was very difficult to gather the information from the different countries, partly because often there was no collected information available and also because in several cases this was a field that is poorly regulated with many vague regulations. Participating countries include the Netherlands, Belgium, Great Britain, Germany and Italy. Unfortunately, Sweden has not been represented; consequently it has been somewhat difficult to gain insight into the project. However, there has been contact between TNO and the department of vehicles at the National Road Administration, as well as some sporadic contact with VTI and SINTEF in Norway. EMG was invited to participate in the INCA project and a representative was appointed. After the first meeting, however, the project team became doubtful about EMG's participation since the appointed representative came from a vehicle adaptation company. Consequently it was decided that EMG would not have any representative. The project began in 1997 and was supposed to be concluded by January 1999, but it was extended. The work has become considerably delayed. The project reported its progress to DG VII during February 1999 and the consortium is now waiting to hear what DG VII intends to do in the area for the future. Negotiations will be held during March. It has not been possible to find out the outcome of these negotiations. The work appears to be cloaked in secrecy and the reason is uncertain.

During the course of this project, we have received three newsletters from the INCA project. The first describes the project rather generally, but also requests information from readers who might have such information. An attempt is made to cover all European countries, including those that do not have representatives in the project. TNO is responsible for the Nordic countries.

Newsletter number two describes preliminarily how vehicle inspection works around Europe, but there is no information on the Nordic countries. Labelling the vehicle's registration document is an important theme for the INCA project.

Newsletter number three describes driving licence procedures in Europe, but the Nordic countries are not included here either. The details from other countries, however, are described well. The European code system (the new EU driving licence), initially from the Netherlands, has been developed as a tool to create a common system for Europe in the future.

We have gained access to two rough drafts for reports from the INCA project that are significant in this report:

1. "Technical guidelines: Adaptations and modifications on motor vehicles" and
2. "The assessments of the driving skills".

Both are based on the European code system in the new EU driving licence and were probably written in German and then, unfortunately, poorly translated into English. The weak translation actually makes it difficult for the reader to understand what is meant without a minimum understanding of German. Further, they have not used terminology consistently. For example, for brake pedal the expressions "operations device", "actuation device" and "control device" are used, without the reader getting any feeling of whether this choice of terms involves technological differences. Another problem is the understanding of the expressions "modification", "alteration" and "adaptation", "installation" where the Americans also use the expression "conversion". In all technical descriptions of this type, certain base terms must be clearly defined and be used consistently.

Swedish uses the terms for "modification", "alteration", "adaptation", and "conversion". These expressions make it possible to indicate the degree of technical changes. According to the authors, a *modification* is a change that is reversible almost without any trace and measurable costs (e.g., a spinner knob). An *alteration* must then refer to replacement of original equipment with alternative accessories; for example, a driver's seat where the manufacturer (e.g., Recaro) describes the reversible installation, or how to return the car to its original condition, so carefully that nothing can go wrong. An *adaptation* is normally also technically reversible, but this may not be a good idea for financial reasons (e.g., hand controls/electric switches). A *conversion* normally refers to a modification of the body of the car (e.g., lowering the floor), doors, or

roof height, which normally cannot be restored to the original condition without significant expense.

A modification and alteration should be able to be carried out without asking the car manufacturer, an adaptation would require substantial technical knowledge and sometimes a statement from the car manufacturer, while a conversion absolutely must be approved by the car manufacturer.

INCA Report 1 is 17 pages long and forms a basis for technological regulations. It is written as a supplement to existing EU directives. Indeed, these must be available for the reader if he/she is to get all of the details. General technological requirements are discussed, followed by a detailed description of the brakes, accelerator, steering, doors (wheelchair accessibility), interior design, the seats (including the wheelchair as a seat in the car), safety belts, etc.

INCA Report 2 contains 101 pages and goes into great detail regarding each technical adaptation component that can be installed in a car. The descriptions are related to the 99 codes used on the EU driving licence (mandatory) and to those requirements found in the EU directive concerning driver capacity and driving ability. The English is consistently poor and sometimes technological speculations are encountered that should have been included in Report 1. The organisation of the contents is good and certain components are repeated in each section: Definition – General – Driving task – Application – Usability requirements.

One consistent requirement is that all vehicle adaptations that prevent normal use of the car must have a yellow warning sign that is easily visible. In cars with very advanced solutions – which are found to some extent in the Nordic countries – these signs will take up a lot of room and will probably cover an entire wall. If anyone without disabilities tries to drive a car like this, it will not be long before they understand that this is not possible without extensive instructions from the owner or some other knowledgeable person. They would probably not even be able to start the engine – so why all these warnings?

4.6 Germany

German motor vehicle inspection, a branch of a large consortium called Technisher Überwachungs Verein (TÜV), has based its monitoring of adapted passenger cars on an old DIN–standard for many years. A few years ago TÜV acquired a competitor known as DEKRA. Both companies serve about the same function as the motor vehicle inspection system in Sweden. Both TÜV and DEKRA are private companies that comply with "Bundesdeutsche Strassenverkehrs–Zulassungsordnung" (StVZO). Consequently, the regulations are identical throughout the country. StVZo has many paragraphs that only contain references to DIN standards. In other words, the details can only be found in the standard itself. Indeed, each inspector may make a personal interpretation of what may be approved or not. Obviously, different decisions are made and vehicle adaptation companies learn what is required in the different inspection stations. Sophisticated solutions may be tested in advance in Germany at great economic expense and trouble for the manufacturer. Here the old DIN standards are of no help to the inspectors and they must improvise. Hydraulic controls are approved for a few car models, but the joystick (4–way electronic control) does not fulfil the requirement for a mechanical connection between the steering wheel and the turning wheels. Consequently, no such car would be approved in Germany, but exemptions are still given in certain districts. Vehicle adaptation companies such as Zawatzky in Heidelberg are sometimes requested to help with training and continuing education of inspectors from TÜV and DEKRA, but this only helps during brief periods.

The vehicle adaptation industry is not satisfied with the situation and some of them are trying to work in partnership with the car manufacturers. For the latter this appears attractive; it would give them a "handicap–friendly" reputation, but the problem would be that car manufacturers would not become aware of all the other vehicle adaptation companies and consequently a number of products that are made for their cars would be excluded. One example of this is VW/Audi, which in its catalogues show cars with adaptations where different components have original part numbers, but they all come from the same company. For example, if you ask for a manual control from another supplier, a car dealer would say there are no other options, which is actually wrong. This is an example of an effort to move toward a homologation solution that may have drawbacks.

4.7 Great Britain

Great Britain has no vehicle inspection of individual new vehicles, except for the Department of Transport (DoT) with its "Type Approval". A car that has been adapted to meet the needs of drivers with disabilities will therefore come out in traffic without any form of registration inspection. Whether the driver gets a good or bad adaptation becomes a pure consumer issue and only with reference to consumer legislation can he or she contest price or quality. To correct this situation, the DoT appointed a task force through its subdivision at that time, the Transport and Road Research Laboratory (TRRL – later TRL), which presented the handbook "Guidelines on the Adaptation of Car Controls for Disabled People" in 1990, published by the "Institution of Mechanical Engineers". The book gives great advice to vehicle adaptation companies as well as to the individual driver/car owner who wishes to invest money in a car and associated adaptations. In 1993 SINTEF received permission to make abstracts from the book and use

Norwegian translations in their own guidelines (see Norway, above).

Great Britain has a system with mandatory inspection of used cars, known as the "MOT" inspection (Ministry of Transport), which checks safety in cars that are 4 years old or older (and every other year after that). Private garages carry out vehicle inspection and interest in the safety of the adaptations has been non–existent, probably due to a shortage of expertise and guidance in the assessment of the equipment.

Great Britain has no national vehicle grant system similar to our vehicle grant and the financial issues have always been a large problem for drivers with disabilities. Much is based on charity and the needy can apply for financial support through foundations, etc. Consequently there is a great need for counselling and support. Through this need, twelve assessment centres have grown up around Great Britain, such as Banstead Mobility Centre in the outskirts of London and MAVIS (Mobility and Vehicle Information Service), which is the only government–run centre. Many people with disabilities come here annually for testing and to receive advice on the type of adaptation they might need, as well.

In Great Britain an organisation was formed during the late 1980s known as ADEPD (Association for Driver Educators for People with Disabilities), inspired by the American organisations ADED (see USA). ADEPD was started by a group of driving instructors, as well as people who were active at different resource centres such as Banstead and MAVIS. The aim of the operation was to try to gather people such as driving instructors, physical therapists, psychologists, physicians and others interested in exchanging experiences at meetings that were – and are still – held twice a year. It was soon realised that people active in the field needed training. Since there is no formal training, they began to invite knowledgeable, experienced guest speakers. Rather soon there was a need to implement accreditation for driving instructors and people who made assessments regarding the right to have a driving licence and/or vehicle adaptations. Consequently ADEPD aimed its operation at planning and offering courses that resulted in two separate accreditation programs:

- "Accreditation in Driving Evaluation" for driving instructors and other professionals, e.g., occupational therapists who make assessments of people with disabilities
- "Driving Education" for driving instructors who train people with different disabilities

During the time that procedures were developed for accreditation a variety of different problems were encountered, such as what the courses would cover and how to test the knowledge of those who were to become accredited. It became evident that the knowledge was neither easy to teach nor to test. The discussions resulted in a defined standard that would be achieved for accreditation and the first five or six people were accredited in both categories during 1994. Accreditation must be renewed every three years to ensure that skills are maintained. The work in ADEPD has now led to a co–ordinated academic curriculum at two levels at Reading University. It will begin in spring 2000 and those with the greatest amount of experience in the country will study to become driving instructors. There is no similar program in Sweden but it should be possible, not least considering the planned investment in handicap research.

During the past few years the foundation "Motability", which offers drivers with disabilities reasonable leasing contracts for cars and electric wheelchairs, has become extremely important to the development in Great Britain. The organisation currently administers 375,000 contracts and actually buys about 500 new cars every working day. Motability has become a power factor that the automotive industry must take into consideration and collaborate with in the best possible manner. Car owners with disabilities are no longer considered to be a small and problematic customer group, something which despite everything still appears to be the case in the Nordic countries. Car dealers must learn Motability's regulations and procedures and then they may function as Motability's local representative. They must also actually pay a fee for this. There is strong competition among dealers to offer the best possible service. Dealers who do not wish to participate are under great pressure from car manufacturers, since it has clearly become so profitable and important to deliver many cars to Motability.

Recently, Motability has also received government funding that is used to help drivers with disabilities finance adaptation of the car. Based on this work, "Motability" has launched a quality assurance control of vehicle adaptations and accreditation of suppliers (we have a copy of the workshop inspection protocol), to avoid investing public funds in poor products. Consequently, Motability has developed extensive and detailed procedures for approval of suppliers (vehicle and vehicle adaptations). This monitoring has not been popular, but it has removed quite a few truly bad products from the market. Products are monitored through an evaluation based on both type and principle that is made in advance (drawings or prototypes) and an inspection of each completed car, especially if the adaptation costs over GBP £3,000. The inspection of the finished car includes an evaluation that contains a driving test with the user behind the wheel. A report is filed in conjunction with this test, ("Vehicle Evaluation Inspection Report") that can be found in annex 4.

4.8 The Netherlands

As in most other countries, all applicants must submit a physician's statement to the national driving licence authority (CBR) when applying for a driving licence. If the applicant has some form of disability, a medical certificate/ statement from a physician must be submitted with the application. If the applicant has some form of vision or cognitive disability CBR will request a statement from an expert in the field. A specialist in vehicle adaptations will then advise the applicant and CBR's department of Traffic Medicine on the necessary type of adaptation. An examiner with special training will carry out the driving test in a suitable adapted car. The adaptation, as specified by the expert referred to above, will be coded with the new EU code on the driving licence. People without disabilities who already have a driving licence and then acquire a disability, are not required to report this to CBR, but the financial support (vehicle grant) that is available for adapting the vehicle to meet the needs of drivers with disabilities is linked to codes on the driving licence. This means that anyone who wishes to benefit from the vehicle grant must notify CBR of the disability. This information is retrieved from INCA Newsletter 3.

According to INCA Newsletter no. 2, all adapted cars in the Netherlands must be inspected by a suppliers association, and when it is approved, a comment is added to the car's documents stating that it has been adapted with certain technical equipment. Details about the solution are not stated and this causes problems at subsequent inspections because it is impossible to check if any other changes have been made. The technological adaptation and the code must then agree with the code the driver has on the driving licence (compare with the new EU driving licence). The Netherlands has been a driving force in the implementation of the new EU driving licence. During routine inspection, carried out annually from the time that the car is three years old, a functional test of the adaptation must be included in the assessment.

4.9 Belgium

CARA (Centre d'adaption à la route pour automobilistes handicapés), which is a subdivision of the Belgian traffic safety department (BIVV) plays a central role regarding driving licence cases for drivers with disabilities or the elderly driver. CARA functions both as a driving licence authority and an assessment centre. The staff comprises three physicians (part–time), two psychologists and four occupational therapists with technological training specialising in vehicle adaptations, as well as an administration. They are in the process of employing additional staff focusing on psycho–physiological expertise. Information on Belgium has been submitted by Guido Baten, who is the head of CARA.

As in most other countries, in Belgium a physician's statement must be submitted in conjunction with applying for learner's permit. All applicants with any form of disability must apply for the learner's permit through CARA. About 2,200 applicants usually come to CARA annually. The current year (1999) an increase (about 250 applicants/ month) has been noted, which would mean about 3,000 applicants during 1999. Elderly drivers who need to be tested to evaluate whether they will be permitted to retain their driving licence are also among the customers. At CARA an assessment ("fitness to drive") is made that usually contains a number of tests with the purpose of evaluating an applicant's potential for being able to drive a car. The assessment also contains a description of the adaptation that is considered necessary for the applicant's car. The tests that are carried out are aimed at evaluating the practical, physical and mental function in the applicant. Should the applicant only have disabilities, e.g., a paraplegic, no special neurologic or psychological testing is carried out. Vision, reaction capability, strength and reach are tested and a memory test is carried out if appropriate. In addition, a road test is always carried out with a braking test. If it is suspected or even known that the applicant has a neurologic injury or impairment, a rather extensive battery of tests is carried out with the aim of establishing the orientation and scope of the impairment. Drivers over the age of 75 must always complete the more extensive battery of tests.

After assessment and issuing of the learner's permit, the applicant takes driver training in his or her home town. CARA does not have its own driver education program. CARA has 17 cars that are equipped so that they may be adapted to meet different needs. These cars may be lent to applicants to be used during education and training. Education is usually carried out at a local driving school. After completed education a driving licence test is carried out by CARA, which then issues the driving licence with harmonised country codes according to the same model as is currently used in Sweden. The codes originally come from Belgium and the Netherlands. Sometimes redundant information is entered, such as "manual gearbox" just to point out specifically that the individual may drive with a manual gearbox to avoid any questions during an inspection.

After having passed the driving test, the customer usually orders the car and its adaptation, according to the specifications recommended by CARA. However, the car may be purchased and adapted at an earlier phase if desired. The vehicle adaptation firm ensures that the car is inspected for registration. The company assumes all responsibility for the adaptation that is carried out on the car and issues a certificate. No control is made during the motor vehicle inspection to check the adaptation in relation to the driver's needs. This is a shortcoming, according to CARA. Annual inspection is carried out from the time the car is three

years old. The adaptation is also checked during these inspections.

According to INCA Newsletter no. 2, an adapted car in Belgium must be inspected before being released in traffic. The company that has carried out the adaptation must fill in certain forms and also declare that it is responsible for what has been done. After approval the registration document is marked with the text "adapted vehicle – see annex" and the annex describes the adaptation in greater detail. At later inspections this annex ensures that the adaptation is not changed after the first inspection.

In Belgium they are rather restrictive about approving more technically advanced adaptations. For example, 4–way joystick–controlled vehicles are not approved, regardless of whether it is an electric or electro–hydraulic system. They feel that such systems place great demands on the driver's stability, so that there is risk that unintended or hard–to–control movements by the driver may result in dangerous manoeuvres. Meanwhile, an electro–hydraulic steering system from the Netherlands has been approved in two cases. The driver steers the car with something that resembles bicycle handlebars.

Regarding financial support to drivers with disabilities, opportunities to apply for funding from the social welfare authorities are available. In this context it should be noted that Belgium is a divided country, with Dutch and French speaking regions. The two regions have separate economies. Consequently, financial support will depend on place of residence in the country. It is very common that support is available to actually buy the car and there is a general maximum age limit of 65. People with a disability of 50% or more in any extremity pay no value–added tax (VAT) on the car and in addition, only 6% on maintenance and repairs. This applies throughout Belgium. Financial support for adaptations varies among the regions. In the Dutch section, the application is made first, followed by the purchase, while in the French section people "shop" first and apply for support afterwards. In the Dutch section there is an upper limit to acceptable adaptation expenses (BEF 300,000 corresponds with approximately SEK 75,000). This covers about 80 – 90% of all cases, according to CARA. However, there are exceptions where a higher limit is accepted (unlimited) but it is based on recommendations from CARA. In the French section there is no specific upper expense limit for vehicle adaptations, but the decision is made on a case by case basis. In both regions, the application for adaptation support must be renewed every five years. But this may even take place earlier depending on whether the impairment is progressive or if the car is used in professional traffic. In principle, no subsidy is given currently for automatic transmission or power steering, but it will be given beginning in 2000. Quadriplegics may receive support for installation of climate controls (AC – Air Conditioning). In certain cases support is available to purchase electric wheelchairs that are approved for use as a driver's seat. CARA wishes there were better harmonisation between the regions regarding financial support. In certain cases, industrial injury insurance may pay for vehicle adaptations, which are placed on a level with prostheses. This also depends on CARA's opinion in the individual cases. Regarding financial support for driver licence training, there are certain opportunities depending on the type of impairment involved. Normally (applies to all users, even those without any impairment) candidates must drive at least 20 hours before being permitted to take the road test. A person with a CP injury may take 6 – 10 teaching hours extra, paid, while people with hearing injuries may also get several hours paid. In these cases CARA's recommendations are also determining factors. The idea is that the extra training that is given will help the user reach the same starting point in terms of education as a person without any impairment. This support is also given through the social welfare authorities.

As can be seen, the situation in Belgium differs significantly from other countries in that procedures for driving licences and vehicle adaptations are much more centrally controlled. Naturally this has both advantages and disadvantages. Some of the advantages include opportunities for a more equitable assessment of applicants, collective expertise, good opportunities for quality follow–up procedures, etc. On the negative side, it is possible that the system may become rigid and conservative, depending on CARA's views in the individual cases. The Belgian system should be of great interest considering the reflections stated about a Swedish resource centre. However, it would be desirable to obtain a user–oriented evaluation of the system. The authors are not aware of whether such an evaluation exists, however.

4.10 France

The situation in France is rather unclear to us. The little bit of information that we have comes from Claude Marin–Lamellet from INRETS in Bron (Lyon). There are ordinances that regulate the conditions, but it appears as though these are applied differently in different locations. The new regulations for driving licences prescribe that all applicant must have undergone a medical examination. But since most physicians have no experience of disabilities, they often ask for advice from colleagues who work in rehabilitation. There is a table to help the doctors, in which different types of disabilities are described and what consideration should be taken when issuing driving licences and decisions on which adaptation needs to be made. However, it is not noted which specific adaptation details are needed. Depending on which impairment the applicant has, it may be necessary to visit a rehabilitation centre that has access to a test vehicle with suitable adaptation. The rehabilitation centre and a driving school may then propose a

suitable adaptation. However, no specific tests are prescribed for drivers with disabilities. After education and training, the learner driver with disabilities undergoes a driving licence test just like every other user. The driving licence is issued by regional authorities (prefecture) where there is also a medical committee. Driving licences may be issued for a limited period (6 months to 5 years) or for an unlimited period of time. After five years a new medical certificate must be submitted. Adaptations to the drivers seat must have national approval and fulfil safety requirements (collision requirements). Approval is given by the corresponding traffic inspector. If there are several vehicle adaptation options, it is the driver who gets to determine which equipment will be installed. A driver with disabilities may receive an allowance of between 70 – 80% of the costs for the adaptation. Otherwise, tax reductions are in effect as in Italy (see below). At the annual vehicle inspection the adaptation is not checked in any particular way. There does not appear to be any form of control regarding whether the driver has received the correct adaptation, either.

4.11 Italy

Information on Italy has been obtained both from an official document that describes regulations and procedures for driving licences issued to people with disabilities, as well as from information provided by FIAT that describes the "AUTONOMY" program (see below) and also through personal contact with a person who works in the "AUTONOMY" program at Fiat.

To obtain a special driving licence the suitability of the person with the disability must be tested by the local medical committee, (la Commissione Medica Locale) which is authorised to carry out such an examination. Some other committee than the one in the town where the person is registered may also carry out the medical examination. In order to apply for a medical examination, the applicant submits a certificate from a physician on the appropriate form together with an identification document. If the person with the disability already has an ordinary driving licence (which is to be converted into a special driving licence) this must be presented instead of the identification document. In conjunction with the medical examination the applicant may present additional documents and at his or her own expense receive assistance from a personally selected physician.

Any appeal of the decision reached by the local medical committee may be made within 30 days. The rejection issued by the local medical committee must be attached to the application for renewed testing. The general board of directors for MCTC – Motorizzazione Civile e Trasporti in Concessione – (the unit responsible for civil vehicle traffic and professional transports), notifies the applicant of the date and the board to which the applicant should apply for the new medical examination. The person with a disability may obtain help from a personally selected physician at his or her own expense.

Assuming that vehicles with prescribed special equipment are used, the person with the disability may practice driving and take the road test to obtain a driving licence. The prescribed special equipment must be stated in the driving licence after that (which may be checked by MCTC's engineers). Only vehicles fitted with this equipment may be presented. The person with the disability who already has an ordinary driving licence does not need to take a new road test. He or she is entitled to drive all vehicles that have been fitted with the special equipment listed in the new driving licence.

Special driving licences are valid for five years, even if shorter periods of validity occur based on the state of health of the individual with the disability. To renew the special driving licence a medical certificate on a special form and a copy of the existing driving licence must be submitted to the local medical committee no later than 90 days before the expiration of the old driving licence, together with a request to undergo a medical examination.

As far as we know, the vehicle modification system in Italy is still, to some extent, "antique", even if they do not seem to think so themselves. In the early 1980s they designed a point system, similar to the one used by the insurance companies when establishing the degree of permanent invalidity as the basis for payment of compensation. In other words, one finger received one point, an amputated (or non–functioning) hand, leg or foot gave different points, etc. When all the points were counted the result gave both an amount for the vehicle grant as well as an amount that describes which adaptation must be done to the car. Indeed, the physician plays a key role in this system. According to INCA Newsletter no. 2, all adapted cars in Italy must be inspected before they may be used. In addition to vehicle inspection a local medical authority must also approve the car for the individual user. It is unclear whether any functional driving licence test is included. After approval an entry is made directly in the registration documentation and this must be kept in the car. All changes entail a new inspection and this responsibility rests with the user.

Since 1998 tax cuts have been implemented (sales, vehicle, registration tax) for people with permanent disabilities. When purchasing a car they only pay 4% sales tax on the car. They do not need to pay registration tax with change of ownership and they do not have to pay vehicle tax. Further, the local health authorities may pay up to 20% of the expenses for vehicle adaptation.

During 1995 Fiat launched the "AUTONOMY" program aimed at improving mobility for people with disabilities. The program includes both public transport and private motoring. Only private motorists will be handled

here. The program involves the local health authorities, rehabilitation centres and the ministry of transport and health. What is unique is the fact that a car manufacturer has taken the initiative in this case. Together with a financial institution and an insurance company, Fiat has established about ten "Mobility Centres" spread throughout Italy. There are medical personnel, occupational therapists and driving instructors at these centres. Together, these people can make an assessment of a person with disabilities to determine which possibilities are available for people to drive themselves in an adapted car. The centre has access to different testing resources, including a test rig where reaction time can be measured (visual stimuli), reaching distances, strength resources, etc. Further, there is access to a test track and test car equipped with different vehicle adaptations. Some centres have specialised in different types of disabilities, e.g., quadriplegics. The unique aspect of the "AUTONOMY" program is, however, the fact that Fiat collaborates with some companies that manufacture adaptation components and Fiat guarantees the function, safety and comfort of the adapted car with equipment from these companies. They even promise that the car will be able to be adapted by a Fiat dealer within 48 hours. Fiat also offers an assistance service based on a GSM telephone, which includes services such as help with flat tires, engine breakdowns, theft, towing, etc.

4.12 Spain

The following information has been provided by Dr. Juan F Dols Ruiz at the Technical university in Valencia. Dr. Ruiz is also secretary of the ad hoc group in the ISO that is working on developing a standard for adaptations to meet the needs for passenger car drivers with disabilities (see the section Standards and Resource centre below). In Spain, a person with disabilities that are of importance with regard to the ability to drive a car must go through the following steps. First, a physician evaluates the medical suitability of the prospective driver at a Medical Centre. This is prescribed by Spanish law, which is indeed ambiguous and out of date. This medical test covers both a physiological and psychological assessment of the person's potential for driving a car. The suitability test also prescribes the type of adaptation that will or should be made on the car. Unfortunately they are often unaware of the modern technological possibilities that are available for adapting a vehicle.

If the outcome of the suitability testing is positive the applicant can turn to the Traffic Office Administration. Even here a subjective medical assessment of the applicant's potential is made and suitable adaptation is prescribed. Unfortunately, even here they are often unaware of the technological possibilities that exist. If the applicant was rejected in the first phase, he or she may turn to another centre or a local medical centre to obtain a new suitability test. It is unacceptable that the applicant does not come directly to an authority that can make a correct assessment. There is great risk that people who might very well be able to drive a car with the right adaptation never get the chance.

Once the traffic safety administration is positive and has accepted the planned adaptation, the applicant must pass a road test in a car with the prescribed adaptation. After that the driver may obtain his or her driving licence with any restrictions (e.g., maximum allowable speed). Before the driving licence test the applicant will have completed education and training at a driving school with his or her private adapted car. Normally driving schools do not have access to adapted cars; consequently, the person with the disability must buy the car and have it adapted, which can be expensive and financially risky. There are some opportunities for applying for government funding for adaptation, but according to the information received they are relatively limited. Sometimes vehicle adaptation companies sell and install adaptive components that are not covered by Spanish legislation and then it may happen that a person with disabilities is stuck with an adapted car, but cannot obtain a driving licence.

To correct these conditions a project led by Dr. Ruiz was initiated, many years ago, with the purpose of improving procedures. The goal is to develop objective experimental methods to assess the possibilities for a person with disabilities to drive a car and to test different adaptive components (controls).

The following laws and ordinances are found in Spain regarding drivers with disabilities:

- **Adapted vehicles**; Royal ordinance 736/1988 describes procedures (technological inspection) for approving vehicles adapted for drivers with disabilities.
- **Driving licence test**;
- Royal ordinance 2272/1985 describes physiological and psychological tests for testing the suitability of drivers with disabilities.
- EC 91/439 directives (1991) regulate procedures for the new EU driving licences regarding coding of disabilities and corresponding vehicle adaptations.
- **Adaptive components**; UNE 26450–95 ("Highway vehicles, Technical specifications of vehicles intended to be used by drivers with disabilities") This standard regulates the vehicle adaptations that can be made on passenger cars for drivers with disabilities, but it does not bring up what is most suitable for different disabilities.

5 Outside of the EU

5.1 USA

Conditions in Sweden and the United States differ in many regards, but even so there are many reasons for including a description of how it works over there. The differences are partly due to different social systems, with consequences that are not least financial. Procedures, regulations, distribution of responsibility and financial conditions may be very different within the United States and it is impossible to discuss any uniform American model for drivers with disabilities who drive adapted cars. The differences are largely due to the fact that the United States is a federal national comprising a large number of states. It is mainly at the state level that it is interesting to study how society's support to drivers with disabilities is designed and which procedures are involved.

One reason for taking a closer look at the United States is that cars were first converted for people with impairments during the early childhood of the car, more specifically after World War I (Koppa, 1990). These cars, often model T Fords, were intended for those returning wounded from the war. Indeed there is a long tradition of adapting cars for people with disabilities in the United States. There is also a large market for adapted cars. According to the NHTSA (National Highway Traffic Safety Administration) the number of cars with some form of adaptation is estimated to be about 400,000 vehicles; that is, 0.2% of all cars (NHTSA, 1997). In the United States there are many companies that have specialised in converting cars for people with disabilities or producing adaptation components, e.g., Braun Corporation (body conversions), Electronic Mobility Controls (advanced control systems such as the joystick), Ricon (wheelchair lifts) and Ez Lock (wheelchair tie-down) are just a few. The car manufacturers themselves have contributed to the development. For example, Chrysler conducted many expensive crash tests with the Voyager with its floor lowered before the concept was released. Instructions and authorisation of those companies that may carry out conversions on these cars, such as Braun Co., are controlled by Chrysler. In the same way as in many other areas in the United States, it is product liability that largely regulates what is released out on the market. This means that the producer is responsible for any injuries to person or property that might occur when the product is used in what may be considered to be normal use. Interpretation of "normal use" often leads to legal action with large damage claims. This has surely had a restraining effect on what manufacturers wish to release on the market. Usually there are no regulations issued by authorities specifying what is permissible.

In 1990 a law on access called the "Americans with Disabilities Act" (ADA) came into force. It has become extremely important for many people with disabilities. The Swedish Handicap Institute (now known as Hjälpmedelsinstitutet) (Technical Aid Institute) has published a report describing the experiences of this legislation (Augustsson, 1990). Augustsson believes that the United States is without doubt the country in the world with the greatest access for people with disabilities. This is noted, mainly, in changes in hotels, driving schools, public buildings, restaurants, etc. Further, the ADA has ensured that anyone with disabilities now has the right to accessible transportation. As a result, public means of transportation have become more accessible to people with disabilities, but there is still much that remains to be done. The changed legislation has probably also entailed changes in a positive direction regarding cars for drivers with disabilities.

When considering the United States it is important to keep in mind the fact that the United States consists of several states, which in many regards are very independent. For example, it is the state authorities that issue driving licences and decide which requirements will be in effect for driving licences, yet the driving licence is valid throughout the country. In certain cases this relationship has led to people moving to a different state to be able to get a driving licence that was not possible to obtain in the state where he or she lived previously. Driving licences do not have a uniform appearance or size in different states, either. Compare this with the fact that an EU driving licence has begun to be implemented. On the federal level the department of transportation determines which requirements will be in effect for motor vehicles, including for adapted cars. These requirements are issued by the NHTSA and the FMVSS (Federal Motor Vehicle Safety Standard). However, there are also requirements that must be fulfilled on a state level. Additional requirements for adapted cars may arise from standardisation work; e.g., the SAE (Society of Automotive Engineers) and ISO.

The United States does not have the type of social legislation that is found in Sweden, which among other things serves as the basis for the government vehicle grant for people with disabilities. Consequently there is no general financial support to drivers with disabilities in the United States. However, strong organisations, such as the war Veterans Administration (VA), have supported the rights of people with disabilities to be able to drive their own car. Currently there are essentially four different possibilities for a private person to finance an adaptation of his or her car: vocational rehabilitation, Veterans Administration, insurance companies, or private funding. Something which is unique to the US is the fact that it is the source of financial support that also largely regulates which safety criteria will be in effect for the adaptation. Naturally the

financial source also decides what will be reimbursed and how to establish the applicant's need for adaptation. The VA prescribes a special procedure for how applicants will be tested to determine the need for the adaptation. They have also developed a test vehicle which can be used to help carry out very advanced studies of the extent of an impairment in relation to the task of driving a car. The VA also has its own large testing department where they evaluate technical aids such as wheelchairs, as well as products for vehicle adaptations.

There are several rehabilitation centres all over the United States aimed at driver training. Organisation and staff composition differ among the different centres. Usually there is medical and paramedical expertise combined with skills in rehabilitation technology and training. Paramedical personnel usually include occupational therapists with special training in the field. Some centres are linked to universities, such as the "Centre for Rehabilitation Science and Biomedical Engineering" at Louisiana Tech University in Ruston. Some centres specialise in certain types of disabilities, such as those caused by spinal injuries, or cognitive disabilities/injuries. Common to these centres is the fact that they receive people with disabilities to investigate what possibilities exist for the applicant to drive a car. The payer can prescribe that a certain centre must be used, but this varies. In the investigation they usually have access to a physician's statement that describes the disease or injury (diagnosis and prognosis) that caused the disabilities that are to be assessed. There is no standardised form for the physician's statement, which sometimes may entail the lack of essential information, e.g., medications, occurrence of stroke, temperature regulation, etc. It becomes important in these cases to find out this information; consequently it is important to have access to medical experts at the centre. It is always the physician's statement that serves as the basis for the decision about driving licences. The investigation is then carried out so that, based on the physician's statement, an impression is formed of the problems, limitations and resources one can expect to find. Special tests are also carried out, such as measurement of reaction time, strength and endurance measurements to evaluate the need for adaptation. Usually a road test in a car that is somewhat adapted is included. This road test is considered to be very important. The study will result in a description of the possibilities for having a driving licence, which adaptation is needed and how driving education should be designed. Unfortunately it appears that when the adaptation requirement is described a specific manufacturer is also specified. Apart from this the organisation of the American rehabilitation centre appears to function well. Some centres also offer driver licence education on a residential basis.

In the United States, for many years there has been an organisation called ADED (Association of Driver Educators for the Disabled), which arranges a well-attended annual conference with participants from all categories: physicians, occupational therapists, physical therapists, driving instructors, manufacturers of adaptation components, conversion companies, representative from the authorities, etc. Concurrently there is an exhibition mainly to show people adaptation technology and converted cars. ADED also arranges courses simultaneously with written tests that must be passed in order to work as an accreditation expert in the field. Consequently ADED fills an important expertise enhancing function that we lack in Sweden. Despite this fact it appears as if there are the same type of communication problems between professional groups/areas of responsibility as those we see here in Sweden.

As was mentioned previously, the local state plays an important roll in the context, not least regarding vocational rehabilitation. The social welfare authorities in Connecticut have published a brochure that describes the financial support that is available if access to a car is part of a plan to help a person get to work (Sidlovsky, 1999). Consequently there must be a link between work and access to a car for this form of support to be relevant. This link was stronger in Sweden earlier, but nevertheless still remains to some extent in the vehicle grant structure. In Connecticut it functions as follows. First it must be established that: 1) the applicant has a disability that limits the opportunities for employment and 2) access to a car would facilitate opportunities for work. After that the applicant is referred to one of two rehabilitation centres to investigate the chances for a driving licence as described above. The investigation then serves as a basis for requests for offers and the decision on who will get to carry out the adaptation. The applicant may influence the decision about who is to carry out the adaptation, but it is the authorities that decide which vehicle adaptation companies may be considered. The applicant must pay for the car. The brochure contains certain recommendations on how the car should be chosen considering that it will be modified. After having decided who will carry out the adaptation it is up to the applicant to follow and participate in the adaptation job. In other words, the applicant must be involved in the process in order to achieve the necessary individual adaptation that may be needed. After the adaptation the car must be inspected to ensure that it meets federal and/or state safety standards before payment is made. The brochures state who is authorised to carry out this inspection. Those vehicle adaptations that may be paid by authorities are essentially only those required to enable the applicant to drive the car. Any others must be paid by the applicant. The car with the adaptation will be owned by the applicant and the brochures emphasise the importance of insuring the adaptation as well. With the first adaptation the authorities will pay up to 100% of the cost of the adaptation. Within

three years after the adaptation, they will not pay for any further measures. After three year they may contribute up to 50% of the cost and after five years the allowance may cover 100%. This describes the process in a state when vocational rehabilitation is involved. However, as was mentioned previously, the differences can be great. One general problem appears to be that, as in other places, no actual formal adaptation inspection that truly takes the needs of the individual driver into consideration is made in the US.

If in conclusion we return to the federal level, it is worth mentioning that the NHTSA appears to have acquired a greater interest in adapted cars. One expression of this has been the proposal of exempting adapted cars with regard to regulations governing disconnection of built-in safety systems, such as airbags (NHTSA, 1999). In certain cases it may be necessary to disconnect the airbag in the steering wheel, such as when the driver uses a spinner knob. In a collision the airbag could result in greater injury than protection. In the US, an airbag is required on the driver's side of the car. This has led to an intense debate currently in progress in which the NHTSA is participating. This is a problem area that should be brought up for discussion in Sweden as well. Further, the NHTSA has presented a questionnaire on the Internet, where people with adapted cars may report problems with their cars or the adaptations. Finally, it may be worth mentioning that the SAE has issued some standards that apply to adapted cars (see table 5). SAE is an American standardisation organisation that also has a committee dedicated to working on standards for adapted cars. In summary it can be established that the most interesting aspect about the United States is the work carried out at the rehabilitation clinics and the organisation ADED.

5.2 Canada

There is a standard here called "CAN3-Z323.1.2-M85 Adaptive automotive control systems for physically disabled persons" that has been in effect since 1985. The standard represents the state of knowledge that existed at that time and has not been updated. Nevertheless, some other countries have based their standardisation on just this publication.

5.3 New Zealand

Since 1988 this country "down under" has had a standard called "NZS 5832:Part 1:1988 Driving controls for people with disabilities. Part 1 – Hand controls". The standard covers hand controls that permit the car's original pedals to remain, but does not include electromechanical products. This does not mean that such products are not accepted, but that the standardisation committee did not consider itself to be capable of describing them. It is stated in the requirements that the movements for the accelerator and brakes must be "distinctly different" to eliminate the risk of a mix-up. In addition, the movement for the accelerator may not be affected by the driver's dynamic forward movement during braking. Normally this is solved if the accelerator movement goes backward or sideways.

Testing requirements specify a vibration test for 30 minutes in two different directions, strength test with 250,000 repeated movements, crack formation inspection and corrosion test. The products must be marked with the name and logo of the manufacturer and have a serial number. After approval the standard's number, NZS 5832-1, must also be found on the product. The standard has many details and recommendations for installation, etc. It would be a good point of departure for creating a new international standard. However, ISO requires objective test methods for all stated requirements. Expressions such as "good" or

Table 5 *SAE Standards for adapted cars.*

Document id	Title
J1725 June 1995	Structural Modifications for Personally Licensed Vehicles to Meet the Transportation Needs of Persons with Disabilities
J2093 May 1995	Test of Wheelchair Lifts for entry to or Exit from a Personally Licensed Vehicle
J2903 May 1995	Design Considerations for Wheelchair Lifts for Entry to or Exit from a Personally Licensed Vehicle
J1903 Aug 1990	Automotive Adaptive Driver Controls – Manual
J2249 Oct 1996	Wheelchair Tiedown and Occupant Restraint Systems for use in Motor Vehicles
J2094 June 1992	Vehicle and Control Modifications for Drivers with Physical Disabilities - Terminology

"satisfactory" are not accepted without an associated method of measurement. The control form "by inspection" may not be used. NZS 5832-1 would therefore need substantial work before it could become an international standard.

5.4 Australia

Australia and New Zealand collaborate on standards that regulate vehicles adapted for people with disabilities. The work in Australia has mainly covered the following areas:

- Car seats
- Wheelchairs
- Wheelchair tie-down systems
- Wheelchair lifts
- Installation of equipment

The standard mentioned above under New Zealand appears to have been the platform even for an Australian standard. The standard there is called "Motor vehicle controls - Adaptive systems for people with disabilities part 1 and 2 (AS 3954, AS 3954.2). Part 1 describes general requirements. It includes specific definitions, requirements for design, building and installation, as well as certain functional requirements and requirements for information. The functional requirements contain specific tests for hand controls for the brakes, accelerator and extended foot controls for the brakes and clutch. It will guarantee some form of functional quality for the controls. This may be considered to be a good first step, but it is not enough. That is to say, this standard may be a good base for continued work. The ISO TC 22 ad hoc group (see below under standardisation) also refers to this standard. However, it is very interesting to see that this standard includes "softer" aspects, such as carrying out an assessment of the driver's needs for adaptation and that the physiological and psychological aspects regarding the driver's situation must be considered when approving an adaptation. However, no test methods are stated for how this shall be measured and evaluated, but it is important that it is marked as essential. The question, however, is whether this should be included in a standard. It could be included in guidelines but it appears to be difficult to standardise.

6 Standardisation, regulations and directives

In addition to the national level, such as Standardiseringen i Sverige (SIS) and Deutsche Industrie Normung (DIN) in Germany, standardisation occurs on two different international levels. The "International Standardisation Organisation" (ISO) develops standards that are accepted all over the world, while the "Comité Européen de Normalisation" (CEN) makes standards for the common market in Europe. ISO is an old organisation that traditionally lies a bit ahead of CEN. Consequently, CEN can "borrow" definitions and test methods from ISO but set up its own requirements that will be in effect in Europe.

In Europe, the ECE regulations are used in the vehicle field, but these regulations are kept mostly for older vehicles where no EEC directives are applicable. New vehicles are inspected according to the EEC-directives. Table 6 shows a compilation of relevant EEC and ECE standards.

ECE stands for the "Economic Commission of Europe" and is a UN organisation with headquarters in Geneva, Switzerland.

EEC refers to the "European Economic Commission", which is an older name for the European Union (EU) and is located in Brussels, Belgium.

ISO standards are voluntary for compliance by manufacturers, but usually there are great advantages if a product is related to a standard; for example, for electrical connections, etc. An ISO standard may gain increased significance if a country's national regulations refer to test methods in a standard. For example, this is the case for combustible materials in vehicles. Instead of developing new test methods, the material must fulfil ISO 3795 requirements for flammability.

CEN standards are mandatory for products that are sold in Europe. The standards are based legally on one or another EU directive and the most well known here are the "Medical Device Directive" (MDD) and the "Machine Directive" (MD). Further, there are many directives in the automotive field, for example on type approval of vehicles. For this report the former is the most interesting.

The MDD is in effect for all technological equipment in a hospital, but also included in the definition of "medical devices" are components and devices that will "replace or compensate for the person's reduced function" or disability. Consequently, all technical aids for people with disabilities are included here. But this has resulted in major problems in the automotive field, where strict directives are already in place. Hand controls for accelerator and brakes can be mentioned as an example. This equipment greatly affects the traffic safety of the vehicle, but it is designed to compensate for the driver's impairment. Consequently, the product would not have been developed if the driver with the impairment had not needed it.

The discussion is still taking place, but if you look at wheelchair transports, people are pretty much in agreement: the wheelchair comes under the MDD, the wheelchair tie-down comes under the MDD, the special occupant restraint for the wheelchair-bound passenger comes under the MDD, while the lift for getting into the vehicle comes under the MD. Other equipment in an adapted car is not defined in the system, but representatives for TÜV in Germany firmly believe that they should comply with the vehicle directives - neither the MDD nor the MD. This is yet another argument indicating that special regulations or standards for special adaptation of vehicles are needed in Europe.

The MDD emphasises product liability and makes the manufacturer responsible for carrying out a "risk analysis" where all conceivable uses, as well as normal abuse, must be reviewed and analysed regarding dangers and injuries that might occur. It is important to remember that product liability lasts the entire lifetime of the product, not just while the guarantee is in effect!

Table 6 *Directives and standards that are in effect with car adaptation in Europe (from Veenbaas & Brekelmans, 1996).*

Description	Existing standards	Comments
General	EEC 74/60 ECE 21	Inner components in passenger compartment
	EEC 89/336	Electromagnetic compatibility missing
Modified gearbox		Missing
Modified clutch		Missing
Modified brake	EEC 71/320, ECE 13	Brake components
	EEC 35	Placement of pedals
	EEC 72/297,ECE12	Collision/impact requirement for steering device
Modified accelerator control	EEC 35	Placement of pedals
	EEC 74/297, ECE12	Collision/impact requirement for steering device
Modified steering	EEC 70/311, ECE 79	Steering device for motor vehicle and trucks
	EEC 74/297, ECE12	Collision/impact requirement for steering device
Modified secondary controls	EEC 76 /756, ECE 48	Lighting
	EEC 78 /317	Defroster
	EEC 78 /318	Windscreen wiper and washer
	EEC 78/548	Heating system for passenger and driver space
	EEC 77 /649	Visibility
	ISO4040	Placement of controls, indicators and information
	ISO 4513	Visibility (eyelipses)driver's eye position
	ISO 3958	Reach for the driver
	EEC 71 /127	Rear visibility
Modified driver's seat	EEC 77/649, ISO 6549	Visibility
	ISO 4513, ISO 6549	Position of eye and H-point[1]
Wheelchair tie-down	ISO CD 10542	Collision requirement
Wheelchair	ISO WD 7176-19	Collision requirement
Wheelchair storage	None	
Wheelchair hoist	None	
Assistive device to get in and out of car	None	
Modification of doors and door openings	DIN 13249	
Protection for wheelchair user	DIN 75 078	

[1] The H point is a reference point on the driver located at the hip joint. The H point is used when setting sitting, space and reach requirements for the driver.

6.1 ISO TC 22

ISO has a Technical Committee (TC 22) that is responsible for "Road Vehicles". Working Group 4 ("Accessibility of vehicles to the physically handicapped" WG4) comes under this heading. It has invested a great deal of work on making busses and other vehicles accessible for people with impairments. Participants are mainly representatives from the European automotive industry (heavy vehicles), body shops and transport authorities. The group also decided in 1991 to develop a standard for passenger cars adapted for people with disabilities. The first draft was unacceptable and was stopped by the ISO administration. During 1995 it was decided to try again and an ad hoc group was formed. This work is led by Dr. Juan F Dols Ruiz, from Polytechnic University of Valencia, Spain. Karosseriverken AB participated from Sweden. They are specialists in vehicle adaptations for transport service vehicles and Borås Electromechanical Verkstad (BEV) also attended some meetings. Participants from Norway included RICON Scandinavia in Oslo. RICON and Zawatzky from Germany participated as adaptation specialists.

At a meeting in October 1998, John Fulland participated once again on the commission from VTI within the framework of this project. With substantial disagreement in the group, very little progress was made. One reason for this may be the fact that the ISO do not give priority to standardisation projects in areas where there already are regulations and directives. They feel that these are in effect even if the directives don't contain any details regarding adaptive equipment - so now they are going round in circles! The participating experts in the ad hoc group are fighting largely for the point of view of their own countries and place too little value on what is good for the users - people with disabilities. In the Nordic countries they would like to let people with disabilities try out a special device to see if it will work for him/her (e.g., drive from a wheelchair, use joystick control), while countries farther south prefer to have clear regulations that set limits for what may be permitted to be changed on a car, even if this would limit mobility for people with impairments. Some countries design "thresholds" for drivers with disabilities even though statistics in all countries, to the extent that they exist, show that drivers with disabilities are not involved in more accidents than other drivers. In the Nordic countries people with disabilities have been permitted to use the most advanced solutions - and accident statistics do not appear to indicate any increased risk despite this fact. But actually, we know too little about this.

Work in the ad hoc group has resulted in a proposal to establish a new work group directly under TC22 to develop a proposal for a standard called "Driving controls for people with disabilities". This proposal for a work group has been out for a vote (February 1999) and for Sweden's part the matter has been handled by Svensk Material- & Mekanstandard (SMS). Following a statement by the co-operative organisation of the Swedish Association for the Handicapped, Sweden voted in favour of the proposal and a representative was nominated from the co-operative organisation of the Association for the Handicapped, who will participate from Sweden in any future work group. At a meeting held in March 1999 with participants from the National Road Administration, the Swedish Handicap Institute, BEV Eurosupport AB, VTI as well as SMS, a proposal was discussed to establish a Swedish reference group for this field. Those who participated at the meeting agreed that it would be good to form a Swedish reference group with representatives for manufacturers, authorities, users and research if a standardisation project is launched. This could be a good method of promoting an appropriate standard for Swedish conditions. It is important to have a broad foundation in such a project. If an ISO project is ever launched, Sweden's participation must take place through SMS, which is associated with costs that SMS must be able to cover. The solution to this was left open. However, at the meeting the results of the ISO voting were still unclear. After this, Sweden, Spain, Italy and Japan evidently voted in favour of establishing a work group within the ISO. England and Germany voted against the proposal and several countries did not vote at all. Five positive votes were needed, which means that currently the matter is inactive. A new meeting with the ad hoc group will be held in November 1999 in Valencia. The originator of the proposal, Juan Dols Ruiz, will evidently continue working to convince one or more countries to vote yes. In the long run, a new work group will probably be formed within the ISO.

Efforts should even be aimed at developing directives or regulations from an appropriate authority. With this goal there is some uncertainty whether Swedish initiatives should concentrate on an ISO standard or on CEN, or possibly on a directive from the EU from DG VII, which is in charge of the transport field. Currently, as far as we know, there is neither an EU nor a CEN initiative in this area. However, it is unclear what the results of the INCA project described earlier in this report may be. Consequently it appears as if the most advanced alternative is the ISO TC 22 project described above.

7 Resource centres and dissemination of information

7.1 Introduction

A national resource centre may be built up in different ways and have different functions, but usually it is a national institution where people are collected who are highly competent in a certain field. Sometimes people also talk about "cutting edge expertise", but that usually brings to mind a world-leading institution, or in any case an applied or theoretical operation with an excellent reputation in the field, usually with a focus on research. Regarding adapted cars and drivers with disabilities, there is usually a tendency for expertise to be gathered in combination with rehabilitation clinics or hospitals. Other times expertise in vehicle adaptation is linked with institutions that work with traffic safety or driver licence education or with vehicle adaptation companies.

Naturally the duties of a resource centre may vary, but considering the relevant problem area, they deal with making available the collective and comprehensive expertise, applying and developing knowledge within the automotive field and distributing this knowledge actively. Target groups must be clearly defined and measurable operational goals must be established. We will now see how people in a few different countries have gone about collecting, applying and distributing knowledge about disabilities and vehicle adaptations. Further along in the text (the section "Conclusions and recommendations") a few proposals are given for how to design a resource centre in Sweden.

An important component in what we call the mediation process of obtaining driving licences and adapted cars for drivers with disabilities is the dissemination of information. This is brought up in a special section after the following.

This chapter concludes with a summary that describes some different models for resource centres and the dissemination of information.

7.2 Example of resource centres in different countries

One method of collecting expertise is to form an information centre. Early on, both in **New Zealand** and in **the Netherlands**, a good library was built up in rehabilitation, technical aids and vehicle adaptations. Upon request copies were sent to therapists or other professionals, or to other interested people so that they would be aware of the latest knowledge in the field. From this point the two centres under discussion developed differently, perhaps due to the human factor and the personal interests of the staff.

The "IRV-Bibliotheek" in Hoensbroek, Netherlands, remained a paper-based institution, while the "New Zealand Disabilities Resource Centre" (NZDRC) with the help of active therapists and technicians, became a prescribing institution, where wheelchairs were improved and cars converted for drivers with disabilities. Through the years NZDRC has developed new products and initiated standards in the automotive and technical aids fields. Vehicle adaptations are no longer being made, but the NZDRC has its function in technical testing of products and control of vehicles that have been adapted - as part of the quality assurance system for the national vehicle grant. The NZDRC is not involved in any research of which we are aware.

In **Belgium** a resource centre was established in a different manner. The driving licence authorities had major problems in the 1970s determining which of those people with disabilities should - or should not - get their driving licences. To eliminate local differences, a resource centre was established in Brussels where everyone with medical problems came for assessment of their ability to drive. This is called, as was mentioned previously, "Centre d'adaption à la route pour automobilistes handicapés" (CARA) and is administered under the Belgian "traffic safety administration". The staff comprises occupational therapists and physical therapists with technical training, as well as psychologists and administrative support. Clients are referred from the local driving licence authorities for evaluation of the possibility of obtaining, or being permitted to retain a driving licence. Most customers are people with disabilities, but elderly drivers also come to be evaluated. CARA has a number of cars available that may be adapted and fitted with dual steering. If the results from tests are positive, people may borrow a training car and take it home, where they will complete their education with a local driving instructor. When the driving licence is obtained, the car is returned and the person may order a car that can be adapted the same way. CARA has a high level of expertise regarding traffic safety, physical and cognitive impairments. CARA runs its own research on the data that is collected through the different tests. They also follow up on how things go for the people who have passed the institute. For example, they find out the extent to which people have been involved in traffic accidents. Unfortunately too little is published for the knowledge to achieve adequate distribution. See also under Belgium above.

In **Denmark** the "Landsforeningen af Polio-, Trafficog Ulykkesskadede" (PTU) in the 1970s had a very knowledgeable occupational therapist who was interested in transport and motor vehicles for people with disabilities. Systematic studies were carried out at PTU and then published and during the early 1980s they had the country's best expertise in driving with adapted cars. PTU built up two departments that had adapted flexible Demonstration cars. When the therapist, often in Co-operation with a

vehicle adaptation company, found the best solution for a client, the car was adjusted/adapted and the driving instructor involved could form a practical road test. The report that was issued from PTU then comprised the basis for granting vehicle grants. PTU is run by an association that must cover its costs by clients paying for the services. When the customer is referred from a municipality or an assistive device centre in a vehicle grant case, they must pay for the costs and this has led to municipalities trying to find less expensive options; for example, by hiring vehicle adaptation companies. As a result, both the workload and revenues have been uncertain and varying for PTU, but now it is going well. It is necessary to have a certain volume of business to be able to maintain an acceptable level of expertise. Research is not carried out at PTU.

In **Great Britain**, traditionally there was no vehicle grant or car allowance, but people with disabilities were provided with three-wheel vehicles, known as "trikes", that did not require a driving licence. In the 1980s these special vehicles were no longer built and those that were disposed of were used for spare parts for the very last ones. To cover the need for mobility a large number of people with disabilities must acquire driving licences and their own cars. Counselling on medical and functional possibilities arose at several rehabilitation clinics and hospitals. Several centres of excellence, known as "Assessment Centres" were established. We will take up two of these: "Banstead Mobility Centre" (Banstead) and the "Mobility and Vehicle Information Service" (MAVIS), both close to London.

Banstead was the home of the "Queen Elisabeth Hospital", specialised in rehabilitation. Through good contacts and great goodwill from suppliers of wheelchairs and cars/vehicle adaptations, they have been able to "rent" (at no charge) wheelchairs and cars to be tried out by drivers with disabilities. The customers come on their own initiative to get advice on how they should use their own private funds, but they can also be referred by the driving licence authority. When ordering a consultation it is decided whether it will be a "full assessment" or "passenger assessment". The former involves assessment for a driving licence and the latter for attachment of wheelchairs, how to get in and out of the car, etc. A complete test takes a full day and works about the same as at PTU. Banstead is run as a foundation and the customers must pay for the services. The staff comprises therapists, psychologists, physicians, orthoptists and contracted driving instructors. Banstead goes a little deeper regarding assessment of cognitive and perceptual functions/disabilities and has specialised in brain damage and strokes. Banstead has carried out a research project on these specific diagnoses (e.g. Simms & O'Toole, 1993).

The other centre, MAVIS, was established as a result of the Department of Transport (DoT) responsibility for the mobility requirements of people with disabilities. The DoT established, early, a special group that would ensure that all means of transport would eventually be accessible to everyone. This "Disability Unit" receives all transport plans for review. So far, it has arranged for many bus lines to be used by people in wheelchairs and has also set requirements that by 2000 all taxis in London must be accessible for people with disabilities. MAVIS was established for private drivers, as a national assessment centre for the adaptation of passenger cars. MAVIS is located in Crowthorn where the DoT had its major traffic research facility. They have access to nearly 20 Demonstration cars with different vehicle adaptations. The cars are owned by the car manufacturers and importers. The staff comprises driving instructors and therapists. MAVIS services are free for the customers. Many are referred by the driving licence authority for evaluation after changes of medical conditions for driving licences. MAVIS does not carry out any research of its own and has its expertise in assessment technique - the easiest way to find the right car and right adaptation.

The "Forum of Assessment Centres" is an organisation that unites all twelve assessment centres that currently exist in England, Wales, Scotland and Ireland in 1999. Both Forum and the different centres arrange courses for driving instructors, therapists and other professionals to distribute expertise, but also because the courses bring in a welcome extra income. The organisation ADEPD also plays an important roll through the courses that are held and the accreditation that it issues, mainly to driving instructors and occupational therapists (see also Great Britain above).

For Great Britain's part we will also mention "Motability", which is not actually an assessment centre according to the definition stated above, but they are building up technical expertise for their own interests, for testing adaptive products (see also under the section Great Britain previously in the text). In their capacity as a major purchaser they can place demands on quality for whatever they purchase and while lacking an authority-regulated registration inspection they have tried to develop something similar that they administer themselves (see also annex 4).

In **Norway** a resource centre was part of the organisational plan that was introduced for the technical aid system in 1995. The user organisation "Norges Handikappforbund" (NHF) had opened a car centre in 1989 similar to the English "Assessment Centres" described above. The idea was that NHF's members would receive the best possible information and be able to visit the centre freely. This social function was greatly appreciated by many people with disabilities. Revenues would come when the RTV (the national social insurance office) ordered evaluations of (potential) drivers with disabilities and paid for these, in the same manner as at PTU in Denmark. There was also some income as the centre took care of reusable adapted

cars for RTV and serviced them for the next user.

Financially it still could not support itself and RTV was not willing to invest more funds directly in the centre. Consequently NHF decided to discontinue the operation, at the same time that new procedures for prescribing arrangements for adapted cars were studied by RTV. As a result, RTV bought out NHF, moved the centre to the newly established HMS (technical aids centre) in Oslo, named it "Landsdekkende Bilsenter" (LBS) and continued the operation with reduced access. Now the customers had to be referred by HMS before they could make an agreement. Staffing at the centre comprises technicians, driving instructors, as well as therapists and evaluation of driving ability is one of the major duties. Driver education is carried out at the centre; however, not to the point of the driving licence test. This is carried out by local driving schools in the users home town, though it often takes place in Co-operation with LBS. The expertise that has been accumulated is completely within mediation technology. No research is carried out at the centre.

LBS has arranged courses for car providers in the rest of Norway. RTV's expertise focuses on cars and mopeds as aids for people with disabilities. This was handled previously by RTF (Rådet for tekniske tiltak for funksjonshemmede) at SINTEF, which also compiled a special compendium comprising several catalogues (see under SINTEF in the Reference list and in the section on Dissemination of Information). The aim was to try to implement a common terminology, increase understanding for co-operation and thereby achieve better quality in adapted cars. The printed information that was issued by SINTEF/RTF, however, has not been taken care of after SINTEF discontinued this operation in 1995.

In addition to LBS, Norway also has a small resource centre in Trondheim where SINTEF has built up a laboratory that evaluates the driving ability of people with disabilities. The driving licence test is carried out using a simple static car simulator in which the "driver" sits in a car and follows a video on a screen. Based on knowledge of different diagnoses, a vision test and the results from the simulator, the behavioural scientists advise the driving licence authority about the tested person's traffic safety as a driver. The collected material is still too small to be used for research, but they are hopeful about future projects.

In **Italy** the medical evaluation of drivers with disabilities has been given high priority for a long time. No road testing is carried out with the equipment before a medical centre issues permission for driving. As a result, with an incorrect or uninformed medical assessment, a person with disabilities would never get the chance to drive a car. One of the problems has been to educate physicians about the technical possibilities that are available for adapting a car. As the first car manufacturer in the world, FIAT has shown interest in helping car buyers with disabilities. Through its "AUTONOMY" program, FIAT has established about ten "Mobility Centres" throughout the country. The staff comprises medical personnel, occupational therapists and driving instructors, who together evaluate the individual to find a suitable car type, adaptation and route to a driving licence. Measurement of the person's resources (strength, reach, ability to react, etc.) is carried out in a car simulator. The intention is not to carry out research at these centres, at least not in the beginning. More details can be found in the text about Italy.

In **Spain** the medical certificate that is needed to be able to begin practising driving is as difficult to obtain as in Italy. Physicians' knowledge about vehicle adaptations needs to be increased. To give people with disabilities better chances of receiving an objective assessment of driving ability the "Universidad Politecnica de Valencia" has in recent years built a laboratory with a static car simulator for evaluation (Dols Ruiz, 1998). There is great potential for the drivers' seat in the simulator to be adapted so that it is can compensate for many different disabilities. The technical installations are now complete and the trial project is in the process of being launched. The method is reminiscent of the one referred to above for SINTEF; let people take a test in the simulator and then evaluate the results without any practical driving on a road. The simulator makes it possible to measure the person's physical performance and also tests the ability to concentrate and react, but it cannot fully replace true driving. There is a risk the evaluation would be too rigid - that a person who wishes to receive a driving licence in the Nordic countries would not have the opportunity to try driving in a car. If the rejection level is set a bit too low, which would be more humane, there is a natural risk that someone might start driving on the road without really being tested for a driving licence, but at least society has done what it can. From experience it is known that a country's difficult economy, or possibly its high ambitions for traffic safety, may be the reason why people with disabilities are treated by stricter regulations when it comes to driving a car. The centre is staffed by technicians and psychologists and the results from the experiments will probably be used in future research.

In conclusion, we will discuss the situation in **Sweden**. There is not now, nor has there ever been, a true centre of competence for drivers with disabilities and adapted cars. There is a traffic medicine centre at Huddinge hospital that has been active for years. Activities at the centre have mainly focused on cognitive problems, with an emphasis on elderly drivers. Medical and psychological expertise is found at the centre. A traffic inspector is also associated with the operation. Recently, a physical therapist with extensive experience studying and helping people with disabilities has been added to the staff. However, there is no

expertise in either teaching or technological skills. The centre carries out both research and clinical work. It serves as a referral authority in driving licence cases. In an investigation the following is carried out: Medical examination, neurological/psychological testing and a road test. The investigation is completed with a driving licence conference where the experts involved make a comprehensive assessment.

At Karolinska hospital's department of neurology there is a car simulator that is used as a testing tool when studying people with brain damage. The work carried out at the department is mainly clinical, but research is also conducted. Some activities aimed at driving are also carried out at other medical centres, such as rehabilitation clinics, but there is nothing with the nature of a resource centre. As was mentioned earlier in the text, previously there were two operations under the auspices of AmuGruppens, in Kävlinge and Hedemora, which trained drivers with disabilities and adapted cars for drivers with disabilities. The educational operation remains at Kävlinge, but in Hedemora both the driving school and the adapting workshop have been transferred to private ownership.

Centralised medical expertise related to driving licences can be found at the National Road Administration. In 1998 a central committee for vehicle grant cases was formed to co-ordinate driving licence cases for people with disabilities in which traffic inspectors are involved. The local social insurance office has no operation that could be considered to be a resource centre.

Research is carried out at VTI focused on drivers with different impairments, such as physical, perceptual and cognitive impairments. Expertise is available in fields such as technology, education, paramedicine, psychology, sociology, statistics and traffic safety. In principle, no investigative or clinical operations are carried out at the institute. Research is aimed at experimental studies both in driving simulators and with cars fitted with instruments on the road, longitudinal studies and accident statistics. The institute was and is involved in international co-operative projects in the field, as well.

In conclusion it can be noted that there are many different forms of centres of competence and the variations are great among different countries. In Sweden there is currently no resource centre with a focus on disabilities and driving that offers complete services, covering all necessary skills: medical, paramedical, technical, ergonomic, traffic safety, educational, financial and legal expertise. It would be of great value if a trial operation could be launched in Sweden within the near future. This will be discussed in greater detail in the section Conclusions and recommendations.

7.3 Dissemination of information

In **Norway** the problem of informing and increasing the skills of the approximately 100 people who were to become "experts" on vehicles adapted for people with disabilities was recognised in 1985. RTV commissioned SINTEF at an early date to draw up a plan to provide these people with information and education.

The first publication that was issued in 1986 was a booklet about the Norwegian vehicle grant act, aimed at individuals with disabilities, relatives, therapists and other people with professional interests. This booklet was intended only for the Norwegian market, but thousands of copies were sold and it was printed in four editions. Some copies were sold to the other Nordic countries, but only to people with special interests.

Evidently there was also a crying need for comparable information on different car models that were available on the market. In 1986 SINTEF began to take internal measurements in all types of cars, hatchbacks, and station wagons. They also catalogued the available original equipment that could be delivered (automatic transmission, power steering, power windows, electric rear-view mirrors, central locks, etc.). In early 1987 the first issue of "Bildata 01" (CarData 01) was published, a loose-leaf system with sheets giving measurements of about 120 cars. The publication was offered to the other Nordic countries, but only Denmark bought a larger number of copies.

Two years later an equivalent market overview for larger cars was ready and published as "Bildata 02". This gave measurements for about 50 MPVs, minibuses, and vans. The measurements differed from those in "Bildata 01" in that here they had selected measurements that were important to people who travel and possibly drive, sitting in their wheelchairs. This publication also sold well in Norway and Denmark, but not in Sweden.

Later, a number of product catalogues were published and several of these were designed as "idea catalogues", with neutral drawings that could represent several products with the same function, but from different manufacturers. All catalogues have a general, methodical introduction presenting information to therapists and other interested people, offering good advice on how to choose the right product. Normally, there is also a checklist for practical use. Market studies were made in all of the Nordic countries and supplier information covered five countries (Norway, Sweden, Denmark, Finland and Iceland). Interest in Sweden for these catalogues was essentially non-existent. The content of the catalogues is evident from the translations of the Norwegian titles (see also the reference list).

The following catalogues were published:

- ☆ "Hjelpemidler for adkomst bil" (SINTEF; 1992a): Aids for getting in and out.
- ☆ Rullestolheis i bil (SINTEF, 1995): Wheelchair hoists and permanently installed ramps.
- ☆ Seter, belter og rullestolfester (SINTEF, 1992b): Sitting right and safely.
- ☆ Betjeningshjelpemidler i bil (SINTEF, 1991): Adaptations to the car controls.
- ☆ Mopeder og spesialkjoretoy (1995): Vehicles that are neither wheelchairs nor cars.

Why did these publications sell so well in Denmark and not at all in Sweden? The differences between written Norwegian and Danish are very small, while there are greater differences between Swedish and Norwegian. This could also have been the reason why sales were low, but the publications are well illustrated and it would still be possible to use the available product information. The Handikappinstitutet (HI) in Stockholm was responsible for sales in Sweden, however and their efforts to distribute the information were unsatisfactory. This could be because HI tried to protect its own adapting workshop. The greatest individual sale took place when "Körkort Handikapp" (Driving Licence Handicap) at AmuGruppen in Kävlinge held a course for the insurance offices in Malmöhus county: 350 copies each of the two catalogues "Adkomsthjelpemidler" and "Betjeningshjelpemidler" were purchased as course literature. The catalogues were very popular among those who learned about them.

Parallel to publication in Norway, courses were held for the employees at the Norwegian insurance offices and technical aid centres to encourage the staff to feel secure in terminology, know which company delivered what and even understand what was described in adaptation offers. Vehicle adaptation companies also participated in these courses (fully or partly), depending on the actual course content. This offered good communications between the parties and the social insurance office's control function became much easier. At one of the courses, two schemes were introduced for detailed descriptions of the actual assessment of a person with disabilities in relation to the demands of driving a car. These were used as a basis for submitting offers from the vehicle adaptation company to the local social insurance office (annex 3).

In an effort to rectify the very different evaluations during registration inspection of adapted cars, in 1993 the Vegdirektoratet wanted to develop regulations for adaptation of cars for the disabled. After much work, the committee that was appointed reached the conclusion that regulations and written instructions would always have a conservative effect and prevent the development of new sophisticated products. It was the opinion of the group that it would be better to design inspection guidelines with the purpose of achieving more homogeneous judgements of vehicle adaptations. Then, after a few years, the guidelines could be reviewed to study whether anything could be redefined into regulations.

The committee referred to above presented in 1993 a booklet entitled "Retningslinjer for tilpassing av bil" (Guidelines for adaptation of cars, SINTEF, 1993a), largely based on an English publication (DOT, 1992). Illustrative examples from these publications include guidelines regarding acceptable strength levels that are required for using primary controls (accelerator, brakes and power steering) in the car. Control of the accelerator normally means (without cruise control) a continuous load and the necessary force should not exceed 10% of the person's maximum ability in the extremity used. However, the driver only brakes periodically; consequently the requirements should not exceed 30% of the person's maximum strength. Requirements regarding steering control are somewhere in between the accelerator and the brakes and normal highway driving should not require more than 10% of the person's maximum strength, while a turn at a road junction, which normally requires more strength, may amount to 30% of maximum strength. Publications on guidelines for adaptation were almost fully distributed at inspection stations in Norway and this gave a noticeable improvement in quality on the adapted cars that came out in traffic.

At the same time the work group developed a smaller booklet called "Forslag til Kontrollveiledning for biler som er spesialtilpasset for funksjonshemmede" (SINTEF, 1993b and annex 5). This booklet is intended as a tool for the inspector during the practical vehicle inspection and will help him not to forget important points on an adapted car. However, he does not receive much help with the actual judgement beyond the references to paragraphs in the Norwegian vehicle regulation, making it easier to find the actual text of the act.

In **Great Britain** the Royal Association for Disability and Rehabilitation (RADAR) has published a book since the 1980s with excellent and comprehensive information on disabilities and driving. The book is entitled "Motoring and Mobility" (Darnbrough & Kinrade, most recent edition: 1997) and contains the following headings:

1. Assessment and learning to drive
2. Driving licence tests
3. Driving licences
4. Choosing your car
5. Converting your car
6. Motoring with a wheelchair
7. Motoring accessories
8. Financial matters
9. On the road
10. Organisations which can help

Clearly there are many questions concerning driver licence training, purchasing the car and vehicle adaptations. You can also get information on different centres that can provide assistance. This book provided inspiration when the Norwegian information project began in 1985. Unfortunately, there is no similar information available in Sweden.

To improve the quality of vehicle adaptations in cars, the Department of Transport (DoT), through its subdivision at that time, the Transport and Road Research Laboratory (TRRL - later TRL) appointed a working group that presented a handbook in 1990: Guidelines on the Adaptation of Car Controls for Disabled People, published by the Institution of Mechanical Engineers. The book offers excellent advice to vehicle adaptation companies as well as to the individual driver who wishes to invest his own money on a car and the necessary adaptation. SINTEF received permission in 1993 to make an extract from the book and use Norwegian translations in its own guidelines (see above).

During 1991 the English Research institute for Consumers Affairs (RICA) became interested in opportunities for people with disabilities to choose the right car. For some time, RICA had carried out consumer testing of cars and published the results in its journal, "Motoring Which". RICA felt that they could make a better information publication than the Norwegian "Bildata 01" (see above Norway), which had just been translated to English and was called "Cardata 01 GB". Since about 1995, product information sheets have been published for several car models under the title "Ability Car Guide". The product information sheet gives a very detailed description of each model and provides measurements, almost like a copy of "Bildata 01". The sheets follow RICA's regular test procedures; consequently, a product information sheet is not developed until a car model has passed the entire testing procedure. Consequently it can take a rather long time from a new model's entry on the market until the printing of the product information sheet in "Ability Car Guide" is issued. The product information sheet is not a good tool for therapists looking for the right car for someone with disabilities, but a good supplement to the car manufacturers' glossy brochures.

In **Germany**, Dr. Hans-Jochen Küppers, who had a disability himself, began to collect product information on technical aids for people with impairments in the early 1980s. Through his organisation "Stiftung Rehabilitation" (Informations- und Dokumentationsstelle für Technische Hilfen) in Heidelberg he published catalogues divided into ten different product groups. Catalogue number 6 is about Auto und Verkehr. The second edition was published in 1990 following revision and contains many products. Küppers has also worked with a database, but in the same manner as for Teldat (see under TELAID) it is difficult to get this to function as an accepted tool for professional therapists. This German catalogue also served as an inspiration to the Norwegian compendium described above.

There is a **Swiss** publication, called "Behinderten fahren Autos" that was published by the Touring Club der Switzerland. The book is available in both German and French. This publication was first published in 1983, but was then revised and a second edition was published in 1986. The book corresponds with RADAR's book in Great Britain in many ways. Most products that are shown, however, are German.

What kind of informative literature for (future) drivers with disabilities has been available in **Sweden**? Not much, just one small brochure, "Hjälpmedelsguiden", in A5-format, published by Handikappinstitutet (HI), (now known as Hjälpmedelsinstitutet). Some information can be found in this guide to technical aids. The vehicle adaptation industry usually advertises in journals that are published by the different organisations for people with disabilities. Another method of spreading the information has been through trade fairs aimed at technical aids for people with disabilities. Probably the technical aid centres have also functioned as distributors of information. The local social insurance office provides information about the vehicle grant on request. The organisations for the disabled also provide some information, but as far as we know, there is no collective printed information. The National Road Administration has published some informative literature within the framework of its responsibility to motorists with disabilities, including information on the National Road Administration policy and responsibility, as well as the brochure "The importance of the vehicle in the rehabilitation of users with spinal cord injuries". The dissemination of information in Sweden is and has been, very poor and whatever is available is not particularly well co-ordinated.

There is some information available for professionals,

but mostly in the form of research reports, travelogues, including a study trip to the United States to study the use of Vans for wheelchair users (Arnberg, Lundblad & Ottosson, 1979). We are not aware of the distribution of these reports, but they have probably not been distributed among therapists, vehicle adaptation companies, or local social insurance office administrators to any great extent.

7.4 Summary - resource centres and dissemination of information

A few different forms or models that have been applied regarding resource centres and dissemination of information can be distinguished in different contexts. Below are various proposals for models.

7.4.1 Some models for centres of excellence

7.4.1.1 Assistive device model

Here the car is considered to be an advanced support for mobility (such as an electric wheelchair) and therapists test to evaluate function, reaction, strength, etc. in the applicant. The human component is taken well care of. After this assessment the case is transferred to the vehicle adaptation company with the highest technical knowledge about possible adaptations. If technically knowledgeable personnel are employed, offers are evaluated before an order is placed. Communication must be good between client and supplier/adaptation company. If there is a driving instructor, which there should be, the applicant's driving ability is also tested. Complete driving education is not offered. Demonstration and training cars are available, which are usually owned by the centre. Adaptation evaluation is carried out by the therapist, in the same manner as for other expensive technical aids. A functional test is also included here. Technical approval is issued by another authority. No research is carried out at the centre. In certain cases this type of centre is able to more or less directly influence the economic decisions made regarding financing the adaptation. This applies to Norway, but in Denmark there is no direct link to the source of financing; instead, investigation/assessment is commissioned. Legal expertise is not available.

Staff: Paramedical personnel, driving instructors, technicians, administration

Example: Landsdekkende Bilsenter (N), HMC/PTU (DK).

7.4.1.2 The simple Information model

This model actually exists already in Sweden, where organisations for people with disabilities, the social insurance office, assistive device centres and rehabilitation clinics provide information about available opportunities. Personnel answer questions by phone and tell which company sells what. Information is provided on how to apply for permits, etc. - in other words, how to get through the bureaucratic system. The applicant can often obtain free information, but as a rule, testing is not conducted. There is no adaptation evaluation. No research is carried out, but sometimes statistics are maintained to document customer needs. There is legal, technical and medical expertise.

Staff: Information workers, paramedical personnel.

Example: Mobility Information Service (GB), New Zealand Disability Resource Centre (at the beginning of its operation)

7.4.1.3 The advanced Information model

Therapists answer questions on the phone and carry out testing to find the right car model and the right adaptation. Medical and psychological expertise is available. Driving instructors are employees or contracted (on an hourly basis) and training cars are available. Demonstration cars with different equipment may be borrowed when needed, or are available at the centre. Demonstration cars and equipment may be owned by suppliers. The applicant may call and get free help, but there is a charge for testing/assessment. In certain cases this fee is assigned to one of the "authorities" placing the order; for example, when financing the car and adaptation. Research is carried out with special project funds, but this is very dependent on personal initiative. Statistics are maintained to document the need for the operation. There is no adaptation evaluation. There is no direct legal expertise but sometimes they can help the applicant regarding the authorities and financing.

Staff: Paramedical and medical personnel, driving instructor, psychologists, administration.

Example: Banstead, etc. (GB), New Zealand Disability Resource Centre (now).

7.4.1.4 Driving licence model

The centre has a strong link with the driving licence authority or is quite simply a part of the authority. The centre tests applicants with disabilities and issues learner's permits or similar. A number of tests are carried out at the centre to assess both physical and mental conditions for having a driving licence. The test results are collected for research purposes but research is not the main task. Recommendations are given on which vehicle adaptations should be done to the car. However, no conversions or testing of the adapted vehicle are carried out. The centre owns the training cars with a variety of adaptive equipment. These cars may be borrowed for continued driver training in the user's home town. There is no adaptation evaluation.

Staff: Medical and paramedical personnel, psychologists, technicians.

Example: CARA (B).

7.1.4.5 Technical model

In some countries, such as Spain, it has been difficult to gain acceptance for more extensive technical adaptation solutions. The knowledge of decision-makers, often physicians, about technical possibilities for adaptations has been deficient. This has led to initiatives from technical research expertise to try to "market" the technical possibilities. They are working with this model at the university in Valencia and have developed a driving simulator for the purpose of testing and assessing the ability of people with impairments to drive a car and the necessary adaptations. The centre focuses on technical and ergonomic research. There is no medical, paramedical, psychological or legal expertise. This type of centre can also be compared with the operation currently carried out by some vehicle adaptation companies, even with the difference of the research orientation. They are more focused on product development.

Staff: Vehicle and computer technology research expertise.

Example: Polytechnic University of Valencia (ES), vehicle adaptation company.

7.4.1.6 Medical model

Medically oriented centres can either be focused on helping with mobility (e.g., rehabilitation clinics) or on assessing the medical prerequisites for obtaining a driving licence (traffic medical centres). Consequently the emphasis will be placed on the medical aspects of driving a car. This may be supplemented with traffic safety expertise, e.g., driving instructors or examiners. There usually is no technical, training, or legal expertise. Driver education, however, may be available if there is adequate expertise; sometimes all the way to the driving licence. Certain centres are also specialised in testing and evaluating cognitive and perceptual resources or disabilities, not least regarding evaluating the abilities of elderly drivers. Research is often carried out at these centres. There may be some form of adaptation evaluation, but not always.

Staff: Medical and paramedical personnel, psychologists, driving instructors/traffic inspectors (possibly on contract).

Example: Sunnaas Sykehus (N), certain English assessment centres (GB), Traffic medicine centre at Huddinge hospital.

8 Conclusions and recommendations

From the description above it is clear that the differences among various countries are great, even in Europe. It can also be stated that no country appears to have an optimal solution, considering the introductory description of what would be desirable from a Swedish perspective. It can particularly be noted that no country has a well-functioning delivery or final evaluation of cars adapted for drivers with disabilities as described in the introduction.

In some regards, the situation in Sweden is, or at least has been, better than in many other countries, e.g., regarding economics (the vehicle grant). Meanwhile recent cutbacks of resources for the vehicle grant give cause for worry for long-term changes for the worse. Much suggests that the vehicle grant is socio-economically profitable. It also contributes toward reducing dependence and increasing mobility in a way that no other means of transportation can offer. However, it can truly be developed in its form to become more of a mobility support with greater freedom for the individual. Still, we have not gone into this in any depth in this report. There is every reason to await the effects of RRV's study of the vehicle grant system (RRV, 1999).

In certain regards it functions worse in Sweden than in other countries; for example, the distribution of responsibility among different authorities does not appear to be particular effective and there is a risk of arbitrariness. There is actually no support for the consumer in the system as it is applied today. The individual driver with a disability must turn to different authorities and it can be difficult to make demands based on the goal of safe mobility. In this situation it should be possible to learn from experiences abroad with resource centres (e.g. in Belgium, England, the United States) even if these have developed in a different context. Transferred to Swedish conditions, a resource centre would be able to play an important role in solving some of the deficiencies that we believe exist today. Co-ordinating vehicle grant cases could be a step in the right direction. The type of informative literature and courses that were previously found in Norway would also be a good method of achieving improvements. Collective experience and knowledge would become critical to successful results. To a large extent, much of the work that has been carried out in the field has focused on mobility and not as much on safety. But safety is a prerequisite for mobility (Delen, 1999). In conclusion in this context we would like to highlight the following deficiencies in the Swedish system:

- *Poor co-ordination between responsible authorities and the risk of arbitrariness. One authority should bear the main responsibility.*
- *There is a lack of some form of collective expertise that could among other things, function as a help for the users - drivers with disabilities.*
- *Assessment procedures and test methods for learner's permits need to be improved and validated.*
- *Local social insurance office procedures include no quality control. Vehicle grant can be paid out before the car is inspected and approved.*
- *There is no adaptation evaluation that can verify that the driver received the right adaptation in his or her car.*
- *The system with harmonised licence codes is not fully satisfactory. Which system should Sweden actually have?*
- *There is no equivalent for harmonised licence codes in the car's registration document.*
- *Motor vehicle inspection procedures for inspection of adapted cars need to be reviewed.*
- *Motor vehicle inspection and testing should include the adaptation even for used cars.*

8.1 Test/assessment before education and adaptation

Variations among countries are very large regarding the tests and considerations that are made to evaluate assessments of the driving licence candidate with disabilities. It appears as though all countries require the applicant to make a personal health statement and provide a medical certificate in order to obtain a learner's permit or the equivalent (see also under the EU as a whole). Naturally it is a basic requirement that a medical evaluation is carried out, but medical experts do not always possess adequate knowledge on traffic safety or the possibilities available for adapting the driving environment. There are no validated, standardised, or uniform test methods today, on either a national or international level. This means that the basis that is used in decisions on learner's permits may differ significantly. In addition to the most common tests, such as vision, road testing and testing of physical ability/disability, an assessment should, in certain cases, even be based on perceptual and cognitive ability/ disability testing (particularly, elderly drivers). Indeed, there is a need here for initiatives such as directives from the authorities that

are written more clearly. Which tests should be carried out and who will conduct them?

Even the National Road Administration traffic inspectors who receive driving licence cases on referral from the county administrative board are in need of more explicit guidelines, as well as some training. In addition, there should be forms for better communication between medical expertise and experts in traffic safety. If, hypothetically, greater responsibility were placed on the traffic inspectors for completeness regarding adaptations to drivers' environment, there is a need to provide traffic inspectors with continuing education. This is supported in the responses to the questionnaire that was carried out within the project. What speaks against this is that the distribution of vehicle grant cases is very uneven among the approximately 25 inspectors who currently process driving licence cases for drivers with disabilities. Some of them have very few cases. This makes it difficult to motivate specialist training. A better solution would be to establish a national resource centre for driving licence cases for drivers with disabilities.

The mediation process, for the vehicle grant, for which the social insurance office is currently responsible, lacks procedures that ensure the quality of the adapted car. It is not certain that the adapted car will even be inspected upon registration, which should be a minimum requirement. Today there are no adequate controls to ensure that the driver who is entitled to the vehicle grant has received the right adaptation. The inspection carried out by motor vehicle inspection is definitely not adequate to ensure that the driver received an optimal adaptation for his or her impairment. Much can be learned here from the procedures that have been applied in Norway (see the section on Norway and annex 5). An adaptation evaluation would be able to satisfy the need for better control of the adapted car. This will be discussed in greater detail later in the text.

8.2 Driving licence test and vehicle inspection with adapted driver's environment

According to current directives, the driving licence test must be carried out so that drivers with disabilities meet the same requirements as all other drivers. There is a clear risk that it could be difficult for traffic inspectors to make an equivalent assessment of drivers with disabilities. There is risk that the assessment could either be too hard (poor insight into the potential for adaptation) or too gentle (the "feeling sorry" phenomenon). One question that may arise in this context could be the degree to which a more careful approach to driving might compensate for a deficiency in capability. This is a very difficult question. The tendency in today's driver education (generally - all categories of drivers) is to focus more on creating insight than on practical skills. This approach could be accompanied by a risk that during the driving test deficiencies in skills might be overlooked as long as the understanding is present. For drivers with disabilities it is probably important that measures that create insight are not given priority at the cost of mastering skills. Both are needed to a high degree. Further, it is possible that drivers with disabilities could be more aware of the limitations in their driving ability from the start. However, deficient skills could be due to deficiencies in the adaptation. If this were the case it would be important to discover this. Naturally, what has been stated above is based on speculation, but holding a manoeuvrability test could be a reasonable idea, in addition to the usual driving licence tests. This would ensure that the adaptation enables the driver to handle a critical situation. This refers to a manoeuvrability test intended to evaluate the adaptation, not the driver.

The prescribing authority for vehicle inspections carried out in Sweden is the National Road Administration. Motor vehicle inspection's task is to ensure that the vehicle meets the requirements stated by the National Road Administration. The inspection carried out by motor vehicle inspection may either be a registration inspection or the annual vehicle testing. In principle, a registration inspection should be carried out with all conversions. All cars that are adapted for drivers with disabilities must undergo a registration inspection. There are certain exceptions, such as the installation of a left accelerator pedal or a simple steering spinner knob. Currently there are no special procedures for inspection of adapted cars during motor vehicle inspection as a complement to what is required for the equivalent non-adapted cars. During vehicle testing this may mean that adaptation components such as a hand control may not necessarily be checked separately. If the hand control affects the ordinary pedals, the brakes could be checked in the same way that the inspector checks the ordinary brake pedal and not the specially developed adaptation. In this manner it is possible that something could be wrong with the adaptation equipment that would not be discovered. The real function of the adaptation has to be tested as it is intended for use the by individual driver. However, perhaps this responsibility should not rest on the motor vehicle inspection at all since its responsibility is to check the technology and not the relationship between the technology and the driver. It is rather common that the company that adapted the car checks the adaptation regularly, often just before a vehicle inspection. However, this is not regulated and it is nothing that is required by an authority such as the social insurance office, which paid for the adaptation. AB Svensk Bilprovning is currently in the process of reviewing procedures for inspecting adapted cars. However, it is not clear whether this will lead to changed procedures or new instructions. In conclusion, there appears to be good cause to review procedures and directives for the operations at the motor vehicle inspection facilities regarding adapted vehicles. A good platform

for this project could be to evaluate the proposal for an inspection protocol that was developed in Norway (see annex 5).

8.3 Adaptation evaluation - quality control

The aim of this project is to develop a proposal for a testing method that could function as an adaptation evaluation for cars that have been adapted to meet the needs of drivers with disabilities. From what is said above it is clear that currently there is no comprehensive, uniform method for this, either nationally or internationally. However, the overview also shows that there are components and fragments that could be used when designing a proposal. The goal of an adaptions evaluation is to help the individual driver with disabilities so that he or she may have a "receipt" ensuring that the adaptation is the "right " one considering traffic safety, impairment, health and mobility. The economic evaluation, which naturally also must be carried out, has been omitted from this project. The aim has never been to include an economic calculation in the project. Below are some of the indications for what could be considered to be included in a proposal for a testing method. Four areas appear to be essential at an adaptation evaluation. These are safety, function, comfort/discomfort and experienced trust. These will be described in greater detail below. The question of who will have the total responsibility for ensuring that an adaptation evaluation is conducted and who must carry it out, depends on how it will be designed. According to the proposal described below, the expertise required for different components in the evaluation will vary. It is only natural that the pictured evaluation would be a task for a resource centre. Yet another aspect of this adaptation evaluation is that, particularly considering quality, it must be repeated and followed up a certain period of time after delivery. The aim is to control that the adaptation matches the driver's needs. Consequently it could be envisioned that the evaluation in its entirety or parts thereof could be used: to initially determine how to adapt the vehicle that will be used during driver licence education, and also to check the adaptation in the driver's own car upon delivery and follow it up later after being used during a specified period of time.

A suitable platform for formulating a goal, or rather a vision, of the requirements that should be met in an adaptation evaluation may be those requirements presented by Koppa (1990) regarding vehicle adaptations for drivers with disabilities:

1. The driver must be able to get in and out of the car unassisted.
2. The driver must be able to drive the car unassisted in all conditions and be able to achieve the same driving ability as a driver without any disabilities. Consequently the driver must be able to handle the steering wheel, hand controls, buttons, levers, etc. (primary and secondary control functions, see below) that are needed to be able to drive the car.
3. The driver must have the same safety protection on impact as a driver without any impairment in a standard car. In other words, the driver must be able to put on a safety belt, anchor the wheelchair if the driver sits in one and drive, etc. and the adaptation must be designed so that if there should be a collision, the driver is at no greater risk of injury than any other driver without impairment in a car that is not converted or adapted.

Superficially, these requirements may appear to be reasonable and perhaps even trivial, but if considered it will be noted that these are comprehensive requirements; probably there are few vehicle adaptations - or perhaps none at all - that completely meet them. For example, it may be difficult or even impossible to fulfil the requirement for safety during impact. A person with impairments often has significantly worse potential for handling physical strain. A collision could have devastating effects even if "normal" safety requirements are met. When requirements are set for vehicle adaptations, several different goals can be identified; mainly, the person with the disability must be able to use the adaptation; also a certain comfort level must be achieved for the user (it should not require any unnecessary strain to be able to drive the car) and not least, safety requirements must be fulfilled. Regarding comfort, perhaps it should be added that this is mainly about setting a limit for discomfort, rather than that it should be specifically comfortable. One more requirement that should be added is that the driver should feel trust toward the car; the driver must be able to depend on the car and the adaptation, otherwise he or she will not use the car. Safety requirements may be divided into active safety and passive safety. Active safety deals with requirements on function with the aim of avoiding a collision, while passive safety deals with requirements aimed at reducing the consequences of a collision if it should occur. In addition to these aspects, the quality of the adaptation should be evaluated, including its calculated lifetime - thus involving quality follow-up procedures over time. Independent mobility presumes a certain level of safety in its broadest meaning, but mobility will always be linked to a certain amount of risk-taking.

In addition to those requirements listed by Koppa, several other requirements could be added that are not directly related to driving, but which could be absolutely essential to enable a person with disabilities to use a car. People with disabilities may have problems coping with hot and cold climates, partly due to the impaired ability to move, but also the impairment itself could directly affect thermoregulation in the body. As a result it could be necessary to install a petrol-driven defroster unit if there is not access to a heated garage. Not only the climate itself in winter, but also iced-up windows could cause problems for a person with limited mobility. Service and maintenance of the car could also be a problem. Full-service petrol stations are becoming increasingly rare and even if the station is staffed it could be a good idea to ensure that the driver is able to call for attention, preferably without having to get out of the car. This item, called servolink, is available at some petrol stations, but far from all. As can be seen from these requirements, it is important that the situation is evaluated in its entirety and testing should take place under different conditions that correspond with the user's everyday situation.

The proposal for a test structure that is presented here is based on designing a checklist with the number of points that must be reviewed together with the driver for whom the car has been adapted. The checklist must also function as a record for those tests that are conducted. The idea at this phase is that the checklist should mainly be used without having the use of expensive and custom-designed test equipment. The model could be based on the type of test protocol used by Motability (see annex 4). It is also assumed that existing tests such as registration and vehicle inspections will be carried out, but with the requirement that the driver must be present at the vehicle inspection and that the results are documented on the protocol. Regarding motor vehicle inspection's control, a test protocol similar to the one developed in Norway (annex 5) could be used. Where there are already possibilities to place demands on the adaptation, the protocol must function to ensure that requirements are fulfilled; for example, ordinary requirements on the fastening of seats even with the installation of pivoting seats. Collision/impact tested and approved components must be used whenever possible. The pictured test procedure should be an appropriate task for a resource centre (see below); this assumes that adaptation evaluation is carried out as a team project combining all of the expertise found at the centre.

8.3.1 Safety during impact (passive safety)

Passive safety can be checked through different types of collision tests (simulated or real). There is extensive experience from comprehensive collision testing and accident analyses with non-adapted cars that should be able to be used at least partially to formulate requirements for adapted vehicles. To some extent, dynamic testing has been done on the adaptation components such as Wheelchair tie-downs and occupant restraints. Surely more specific knowledge is needed about people with disabilities and vehicle adaptations in order to design detailed requirements regarding passive safety. It is important that requirements are established that can be tested and measured; the requirement should not be expressed in general terms such as "the adaptation must be safe", or "the adaptation must be of good quality". The task of establishing requirements for safety during impact in adapted cars probably requires great investments. Within the framework of this project it could be possible to check which components in the adaptation are collision tested and approved and further, to control that components are correctly installed and that no additional changes have been made to components that have been bear an approval. Control that there is documentation for testing. As an example, there should be a requirement that the car cannot be started or driven before the wheelchair is safely anchored if the driver drives sitting in the wheelchair. Specific requirements for anchoring the drivers' seat exist and should be applied. Many adaptation components, even those that are critical to safety, require access to electricity and in certain cases may also draw a substantial amount of current. In such cases it is important to control and evaluate the power supply in the car. In addition, it should be checked that safety belts do not rub against sharp edges or similar. If the body of the vehicle has been modified (e.g., lowering the floor) there should be documentation to certify that the conversion has not had a negative effect on safety during impact. In addition, the control should include an assessment of impact zones (upholstery), distance between the driver and components in the driver environment, an assessment of the risk of the driver being injured by the adaptation components in a collision. It should be possible to use the inspection protocol developed in Norway (annex 5) to a great extent when testing passive safety in the adapted car.

8.3.2 Function (active safety)

Formulating requirements for active safety is much harder than for passive safety. First of all, it must be clear that each adaptation is essentially unique: a unique driver with a personal set of abilities and limitations, a unique car and a unique adaptation that must fit together. Further, there are no comprehensive or unambiguous requirements designed for function to fulfil the requirements for active safety. The norm that must be fulfilled is the driving ability of people without impairments who drive a car that has not been adapted. In its basic design, the car fulfils a number of well-defined functional requirements such as braking capacity, steering capacity, road-holding performance, etc. However, these are not related to the driver's ability, but assume that the driver "functions" perfectly. Consequently

it is important that the adapted car is tested with the intended driver to study whether the adaptation fulfils the requirements that are placed; in other words, that the disability is compensated. Certain requirements for active safety that include the driver, however, can be relatively easily set up and evaluated, such as braking reaction ability. One possibility is to design a manoeuvrability test that is conducted on a monitored test track. A manoeuvrability test of this type was used in a recently conducted project on joystick controlled vehicles at VTI (Östlund & Peters, 1999). This manoeuvrability test included braking in a straight line situation, braking in a curve and lane changing. *The aim of this type of test is not to test the driver but to see if the driver has received an adaptation that is good enough.* The scope and contents of a manoeuvrability test is something that further work would be able to illuminate.

The most important aspect in a function control would be to check the primary controls, but the secondary controls should be checked as well. Perhaps the concept of primary and secondary control functions need a bit more of an explanation. **Primary control** functions refer to steering, accelerating and braking the vehicle. That is to say, functions over which the driver must have control all the time and where rapid and safe reaction ability is necessary for the driver to be able to retain control over the vehicle. Primary controls are very critical to safety. **Secondary control** functions include all other functions that in one way or another are needed for driving; for example, turning on the lights, switching between high beam and low, signalling, adjusting the heat, using the radio, etc. The secondary controls are only used temporarily and are not as safety and time critical as the primary controls. Secondary control functions should be checked to observe whether the driver can handle them while driving. Consequently a function test should be designed to test all functions necessary for safe driving in traffic.

8.3.3. Comfort/discomfort

Comfort and discomfort are not direct opposites. Zhang et al. (1996) showed in a study on seating comfort/discomfort in office chairs that we associate comfort with more aesthetic values, not only as the lack of discomfort. According to the same study, the concept of discomfort includes fatigue, restlessness, revitalisation, pain, etc. These are symptoms that may occur after exposure over a longer period of time, in our case while driving a car. It is not certain that they will appear during shorter drives. Consequently it is important that a test of comfort/discomfort is long enough. One critical point regarding discomfort often proves to be getting in and out of the vehicle. This may be both tiring and cumbersome. This could probably have negative effects on driving safety. The need to collapse and lift the (electric) wheelchair into the car may result in the driver lifting incorrectly and perhaps even injuriously, which could result in deteriorated health. This type of assessment can be carried out by occupational or physical therapists, who are knowledgeable about such matters. Thus it becomes important to include the type of experience and knowledge when designing that part of the checklist that covers the comfort/discomfort aspect. It is important that an assessment of comfort/discomfort include a control of the driver's ability to get in and out of the car as well as the actual driving situation. The assessment of driving comfort/discomfort should be designed so that the test version is driven for at least an hour. Testing comfort/discomfort must be based partly on asking the driver questions and partly on expert opinions. There are well developed and verified subjective test methods for evaluating workload that also include physical workload, e.g. NASA-TLX, which could be useful here (Hart & Staveland, 1988). Koppa (1990), referred to above, used a modified version of the "Cooper-Harper scale", when he tested different manual devices for drivers with disabilities. But there are also established test methods for evaluating the risk of injury (WMSD - Work Related Musculoskeletal Disorders, see e.g., Hagberg et al., 1995). Staff from the technical aid centres may have valuable expertise for this area, as well.

8.3.4 Trust

The reason trust as a concept is included in a test of vehicles adapted for drivers with disabilities is that even if the three previously discussed areas; safety, function and comfort/discomfort are tested and evaluated as acceptable, it happens that drivers with disabilities do not use their adapted cars. One probable reason may be that they do not feel trust in themselves as drivers. The concept of trust is ambiguous and not simple to describe. The concept of trust is certainly perceived differently by different individuals and in different situations. The fact is that anyone who does not mistrust a situation would never think of the situation as a matter of trust. However, when starting to consider trust and suspicion, naturally there is some form of experienced threat or risk that affects the security situation. The concept "trust" has been studied in connection with operators in process controls and their faith in automatic functions and in the degree to which these are used ("trust in automation") (Lee & Moray, 1992; Lee & Moray, 1994; Muir, 1987; Muir & Moray, 1994; Muir & Moray, 1996). The theoretical point of departure for many of these studies has often been based on sociopsychological studies about relations between people that have been transferred to relations between people and machines. This may also be a basic productive point for studies concerning drivers' trust in their adapted vehicle.

As far as is known, there have not been any studies on how drivers with disabilities experience their trust. If you continue to think about the concept of trust and drivers with

disabilities, it should be possible to divide trust into what could be called internal and external trust. Internal trust refers to the driver's belief that he or she is capable of handling an unexpected situation that could arise if the car did not work as expected. External trust refers to the driver's faith in the car and the adaptation (the technology), that it will not expose the driver to unexpected situations. This division was used in the study of the joystick controlled vehicle (Östlund & Peters, 1999) referred to previously. It was apparent that this division was possible to make for those drivers who participated in the experiment. The questions were asked both before and after they completed the manoeuvrability test, which was experienced by most as rather difficult. After the manoeuvrability test, they lowered their estimates somewhat of the internal trust, but not of the external trust. Consequently they felt somewhat less secure regarding their own ability to handle the car in difficult situations.

Experiments have also been carried out measuring what the opposite concepts, trust/suspicion, stand for in the same manner as with comfort/discomfort (Jian, Bisantz, & Drury, 1998) but the same clear results were not found as with comfort/discomfort. Continued studies would be of great value to clarify what is added to the concept. What trust stands for, how it is measured and which requirements should be placed on trust, will be the object of further studies in this project.

8.4 Standards and requirements

Some initiatives have been taken and there is some activity regarding developing standards for adapted cars (see above under standards). Sweden has not been particularly active in this work so far. Hopefully there are now better prerequisites for more active participation, partly because the National Road Administration's responsibility for motorists with disabilities has been pointed out and partly because of the activities resulting from the ISO/TC22 project. It is important to learn from the experiences of developing guidelines for the new EU driving licence codes. When these were developed, Sweden did not participate, which was probably very unfortunate. We were not able to participate and influence the design and we were not so well prepared when they were to be implemented. Ultimately, interest and initiatives should be aimed at which directives will be in effect in the future regardless of whether these come from the EU or are decided upon nationally. The experiences and values underlying the current organisation of this topic should not be ignored, putting us at risk to wind up in a situation that is worse than the one we are in now. There should be an effort to identify ambiguities and "grey zones" in order to eliminate them, thus creating clarity, facilitating the process for everyone involved.

8.5 Resource centre

Within the framework for the project, administrators of vehicle grant cases at the social insurance office, traffic inspectors who have special responsibility for drivers with disabilities and vehicle adaptation companies have had to answer questionnaires with the aim of charting the mediation process. The idea of a resource centre received strong support in the response from both administrators at the social insurance office, where 27 of 30 (90%) respondents were positive toward a resource centre and the National Road Administration traffic inspectors, with 17 of 20 (85%) in favour. Among vehicle adaptation companies the response to a resource centre was predominantly negative; only 6 of 24 (25%) were positive, but the question was asked differently compared with the questions asked of the administrators and traffic inspectors. The question to the vehicle adaptation companies was phrased to refer to a resource centre for vehicle adaptations, but probably they considered themselves to be experts in the field and did not need help.

The "mediation process" of driving licence and adapted car for drivers with disabilities (see figure 2) as it functions today is not optimally designed. This is also shown in RRV's report (RRV, 1999). In the government communication on policy for people with disabilities (1996/97:120) it is stated that the principles on full participation, equality in living conditions, self determination and access form the foundation on which the Swedish policy for people with disabilities is based currently and henceforth (RRV, 1999). Applied to the area of transport, the goal of safe mobility for people with disabilities, in our specific case drivers with disabilities. Achieving the goal requires cross-disciplinary specialist expertise (medical, paramedical, traffic safety, technology, training, legal, etc.) for an mediation process to live up to the goal. Further, communication between areas of expertise must be clear and effective. In addition, those active in the mediation process must possess good insight into national directives, regulations and procedures. A national resource centre would be able to increase goal fulfilment as well as simplify the mediation process, making it more efficient. "Customers" at a resource centre should be private individuals with disabilities who will be offered counselling free of charge and also authorities and professionals who work in the mediation process (e.g., county medical care, vehicle adaptation company, administrators at the social insurance office, traffic inspectors, driving instructors, etc.). There are decision-makers in the mediation process that do not have adequate experience or expertise for the decisions that must be made. For example, there are administrators at the social insurance office who have no expertise in evaluating the need for a car and adaptations, physicians who lack

expertise in traffic medicine, traffic inspectors who lack medical expertise and clear procedures for evaluating whether an adaptation fills the requirements for compensation, inspectors who lack clear directives and knowledge of vehicle adaptations. The differences are also great among different individual inspectors. There are those who have a very high level of expertise, but the great majority who are involved do not have adequate expertise or experience. A national resource centre would be able to gather the existing expertise and make it available and distribute it as a component in improving the mediation process.

What is the optimum way of running a resource centre? Who will be the owners? What tasks will the centre have? The goal for a resource centre must be to help people with disabilities to a safe mobility; the needs of both safety and mobility must be satisfied. A resource centre must be a national resource. A resource centre must be able to:

- provide information and advice on driving licence and vehicle adaptations to people with disabilities,
- function as a communication link between experts who work with driving licence and adaptation cases or drivers with disabilities,
- test and evaluate an applicant's potential for driving a car with adaptation, if appropriate,
- offer suggestions for selecting a vehicle, vehicle adaptation and training,
- test and check that the vehicle adaptations correspond to the driver's need for optimum compensation of the impairment (adaptation evaluation),
- be neutral and not linked to any company or authority,
- maintain international contacts and visit exhibitions,
- possibly participate in standardisation work.

Two different forms are conceivable for a resource centre, with a focus on either regulating and decision-making, or on counselling advice and support. The former will be a centre linked to an authority. It is easy for centres that are owned and run by national institutions to appear to have a controlling nature, such as restricting driving licences (driving licence model) or financially restrictive (technical aid model). Currently as far as we know, there are no such centres that are run by the technical safety controlling authority (motor vehicle inspection), but there is a danger that "traffic safety" could be taken into consideration so greatly at such a centre that some existing and new advanced vehicle adaptations would not be accepted. Safety would be given priority at the cost of mobility. The same risk appears to exist for centres run by the driving licence authority. Independent counselling centres are uncommitted. Counselling should be separated from decision-making. People with disabilities to a high degree may need some kind of "advocate" who can fight for the vehicle grant (financial), make demands for technical improvements and work toward exemption from bureaucratic regulations or clearer directives, such as on driving licence conditions. Consequently we see it to be essential that a resource centre has the confidence of its primary target groups, people with disabilities and that the centre is experienced by this group as supportive. This can also be a prerequisite for good human relations.

Through the years all regulations and procedures have been stretched and changed after pressure from "someone" to take greater consideration to people with disabilities. In the Nordic countries this "someone" has often been the strong organisations for people with disabilities. Because of the strong position of these organisations, it is possible that a government-owned resource centre with a well-balanced board of directors would be able to function in Sweden. This would differ from a resource centre owned by an association (or foundation), as found in some other countries. But it is also important that a centre have an independent position in relation to the participating authorities. This allows it to act on behalf of its customers when necessary. Another factor that is good in Sweden is that the National Road Administration is in charge of both driving licences and technical requirements for adaptation of cars.

Even if it has not been a primary goal with this report to present a detailed proposal for a trial period, we would like to give a suggestion at this juncture of how to launch a trial operation for a resource centre, since this issue has become increasingly relevant, not least as a result of RRV's report (RRV, 1999). Before the proposal is presented it is important to point out that the target group for this project is drivers with disabilities who require adaptation of the driver's environment. There are other important target groups that must be considered regarding the goal of the vehicle grant; for example, children and other car passengers with impairments or other disabilities. They are also important customers for a resource centre, but since they have not been treated previously in the report they will not be included now either. However, they must be considered before deciding about a possible preliminary operation. We propose starting a trial operation in the form of a pilot project with the aim of studying how a resource centre for drivers with disabilities could be organised and run. Such a project should have a hand-picked staff of well-known specialists in the fields of medicine, paramedicine, psychology, ergonomics, traffic safety, adaptation engineering, training, economics and law. Funding for the operation should come from the National Road Administration, the National Social Insurance Board, the Federation of County Councils and the Association of Local Authorities. A reference group with representatives of financiers and organisations for people with disabilities will follow and monitor the operation. Two questions that also need to be answered in a trial operation are how great is the need (one

or more centres?) and where should the centre(s) be located? The trial centre should be located physically to facilitate easy access. It should be located close to existing resources, or the operation could be mobile. A customer should not have to travel around to different places to get the help he or she needs. In addition to personnel there should be access to various test equipment. It is also important that there is access to one or more test vehicles that could easily be adapted for different needs to carry out the practical driving licence test. Advice shall be free of charge. Since it will be a preliminary operation that will be evaluated considering potential future operations, it should not be open to everyone who wants to come there. The selection of customers to the trial operation should be controlled. Consequently it may be important to choose people with disabilities who are representative of some average and also cover the extremes; in other words, people with simpler disabilities/adaptation needs (e.g., spinner knob, swivel seat), as well as people with "average" adaptation needs (e.g., hand accelerator/brakes plus adaptation of some simpler secondary controls) and finally people with serious disabilities and in need of advanced vehicle adaptations (e.g., joystick). Suitable candidates could be chosen among those who are applying for vehicle grant. The operation should be followed up and evaluated on an ongoing basis. Clear goals for evaluation of the operation shall be established before the trial operation begins. Evaluation should be carried out by an independent board (besides the reference group) which also participates and organises the trial operation. It is also important that the results of the trial operation are taken care of so they can be used for research purposes. All authorities that participate in the mediation process must be allowed access to the trial operation. In addition to the applied advisory operation, within the framework of the trial operation, information on the mediation process should be compiled and used to distribute knowledge about disabilities and vehicle adaptations. The trial operation must simulate an intended future resource centre.

What has been presented above shall not in any way be understood as a finished proposal but only as a preliminary draft. There is probably every reason to appoint a committee with the task of developing a more detailed proposal for the trial operation. As a suggestion, a committee could be appointed at the joint initiative of the National Road Administration and Local social insurance office.

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Addresses to vehicle adaptation companies in Sweden

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Bil & Marin Textil	Mats Carmesten Rune Carmesten	Låsblecksgatan 2	589 41	Linköping	013 - 16 16 90	013 - 16 11 14
Bilanpassning i Staffanstorp AB	Tommy Andersson	Fabriksvägen 2	245 34	Staffanstorp	046 - 25 28 80	046 - 25 28 87
Caleb Bilglas AB	Ulf Synnes	Sigurdgatan 31	721 30	Västerås	012 - 18 51 41	021 - 41 24 37
CM Fordonsteknik AB	Conny Eriksson	Rörvägen 57	156 50	Haninge	08 - 500 128 38	08 - 500 128 17
HandiCare Fordon AB	Inger Knutsson Rolf Knutsson Knut H Peterson (N)	Kurödsvägen 13 B	451 55	Uddevalla	0522 - 65 39 80	0522 - 65 39 85
Handikappanpassning i Bålsta	Håkan Carlsson	Helgövägen 1	746 30	Bålsta	0171 - 583 50 070 - 576 17 44	0171 - 570 66
Handikappanpassning i Trestad AB	Leif Berndsson Leif Siljewall	Installatörsvägen 4	461 37	Trollhättan	0520 - 375 19	0520 - 830 70
Handikappspecialisten i Kungsbacka	Lars Andrén	Hantverksgatan 14	434 42	Kungsbacka	0300 - 186 96	0300 - 149 44
Hanngrens Bil & Sadelmakeri AB		Torggatan 18	852 32	Sundsvall	060 - 61 12 87	
Haro Lyft	Rolf Berglund	Lagmansvägen 29	954 32	Gammelstad	0920 - 25 33 12	0920 - 25 33 12
Hedemora Anpassning AB	Ove Lund Rickard Undevik	Vintergatan 8	776 33	Hedemora	0225 - 77 40 00	0225 - 77 47 00

Företagsnamn	Kontaktperson	Adress	Postnr	Ort	Telefon	Fax
Hjälpmedel i Piteå AB	Ingemar Mörtsell	Jägarvägen 9	944 73	Piteå	0920 - 888 00	0902 - 22 88 01
IFAB i Nyköping AB	Lorenz Broman Stefan Stengård	Industrigatan 12-14	611 38	Nyköping	0155 - 21 11 45	0155 - 21 11 55
Karosseriverken AB	Christer Nilsson	Box 91	370 11	Backaryd	0457 - 45 01 60	
Ortman Fordon & Maskin	Jan Ortman Kent Stenström Peter Karlsson	Gräddvägen 23	906 20	Umeå	090 - 18 93 93	090 - 18 93 93
Per Stjärnehag Woodstar	Per Stjärnehag	Slättegårdsvägen 10	427 50	Billdal	031 - 91 15 26	031 - 91 33 14
Permobil Autotech AB	Simon Bergström	Box 120	861 23	Timrå	060 - 59 59 00	060 - 57 52 50
Permobil Autotech AB	Peter Nydahl	Mekanikervägen 6	564 35	Bankeryd	036 - 37 17 99	036 - 37 09 01
Rolf Anderssons Bilservice HB	Rolf Andersson	Rosenlundsgatan 20	214 30	Malmö	040 - 96 97 77	040 - 96 98 77
SB Electro-tech AB	Sonnie Hermansson	Kalvhed 2185	460 20	Sjuntorp	0520 - 44 07 87	0502 - 44 48 07
Toyota Center Malmö AB	Owe Gustafsson	Agnefridsvägen 180	231 75	Malmö	040 - 21 00 00	040 - 94 35 16
TOYOTA Kjell Askling Bil AB	Tomas Sandin	Box 663 Roxtorpsgatan 10	581 07	Linköping	013 - 31 17 30	013 - 31 17 47

Vedlegg til vognkort (Norge)

NORSK LANDSFORENING FOR HANDICAP-BIL-TILPASSERE

VEDLEGG TIL VOGNKORT PÅ BILER TILPASSET AV MEDLEMSBEDRIFTER I
"NORSK LANDSFORENING FOR HANDICAP-BIL-TILPASSERE."
DETTE VEDLEGG MÅ ALLTID LIGGE VED VOGNKORTET, OG FREMVISES VED EVENTUELL KONTROLL.
VEDLEGGET FYLLES DELVIS UT AV BIL-TILPASSERFIRMA, DELVIS AV BILTILSYNET.
LEVERANDØR AV BILEN SOM SÅDAN FYLLES ENTEN UT AV BIL-TILPASSER ELLER BILENS EIER.

BILMERKE	TYPE, ÅRSMOD.	REG.NR.
EIER	BILFORHANDLER	BILTILPASSER
ADR.	ADR.	ADR.
POSTNR./STED	POSTNR./STED	POSTNR./STED
TLF.	TLF.	TLF.
FØRERKORTNR.	KONTAKTPERSON	KONTAKTPERSON

TILPASS. DATO	BESKRIVELSE	GODKJENT, DATO, SIGN.

Dato, Biltilsynets stempel og underskrift	Dato, Tilpassers stempel og underskrift

Alfa Grafiske A/S

Diagram for commercial offers for adaptations in Norway

TRYGDEETATEN
RIKSTRYGDEVERKET

Opplysningene i dette skjema er underlagt taushetsplikt, jfr Lov om folketrygd § 18-4

TILBUDSSKJEMA
SPESIALUTSTYR

TILBUDSOPPLYSNINGER

Tilbud fra: ..... Dato: ..... Tilbudet utløper: .....

Brukerens trygdekontor: .....

Tilbyders underskrift: .....

BRUKEROPPLYSNINGER

Brukerens navn og adresse:.....

Brukerens kjønn [M] [F] Brukerens fødselsdato:.....

Tilbudet bygger på vurderingsskjema utfylt av: .....

Dato for utprøvingen: ..... Brukeren har senere besøkt tilbyder [Ja] [Nei]

Ev datoer: .....

TEKNISKE OPPLYSNINGER

Tilbudet bygger på tilpassing av følgende bil: Registreringsnr: ..... Resirkulert [ ]

Bilmerke: ..... Modell/type: .....

Årsmodell: ..... Kilometerstand: .....

Karosseritype:..... Antall dører: ..... Type dører: .....

Originalt utstyr på den valgte bilen:.....

.....

.....

.....

Ved beskrivelse av hjelpemidler/spesialutstyr, brukes betegnelser hentet fra RTF-S sitt kompendium «Bil for funksjonshemmede»

TILBUDSSSKJEMA — UTSTYR

Tilpassingsmuligheter/spesialutstyr	Utstyrets pris	Monteringstid	Ferdigmontert	For trygden
A Dører				
01 Tilpassing av døråpnere				
02 Tilpassing av dørlåser/nøkler				
03 Sentrallås				
04 Nøkkelfri lås				
05 Manuelle hjelpemidler for å lukke dør/bakluke				
06 Skyvedørmekanisme på ordinær bakdør				
07 El.bryter for døråpner utvendig/ved førerplassen				
08 Fjernstyring av dør/heis				
09 Modifisering av døråpning (dørstopper, dørlomme, polstring mm.)				
10 Motorisert døråpner				
11 Annet som ikke er nevnt ovenfor				
B Adkomst				
01 Ekstra håndtak				
02 Skliplate for forflytting til sete				
03 Stigtrinn				
04 Ratt som kan felles bort				
05 Motorisering av setefunksjoner				
06 Oppstigningselevator				
07 Dreiesete (manuelt)				
08 Dreiesete med hev/senk/motorisering				
09 Personheis (rullestolheis, se I)				
10 Transportsete/stol for overflytting til bil				
11 Annet som ikke er nevnt ovenfor				
C Sitteplasser				
01 Modifisering av originalt sete (setestopping mm.)				
02 Modifisering av setebetjeninger				
03 Modifisering av seteskinner (Nye setefester, se K 02)				
04 Høyderegulerbart sete fra bilfabriken				
05 Spesialsete med bedre sitte-egenskaper				
06 Armlener				
07 Rullestolfeste i førerrom (manuelt/ motorisert)				
08 Tilpassing av rullestol til C 06				
09 Spesielle barneseter				
10 Belter, vester, stropper (holde brukeren i sittestilling)				
11 Annet som ikke er nevnt ovenfor				
D Innvendig plass				
01 Flytting av seter/fjerning av baksetet				
02 Modifisering av setefester for fleksibel setemont.				
03 Hvilebenk				
04 Forsterkning av gulvbelegg				
05 Ombygging som fører til ny avgiftsgruppe				
06 Annet som ikke er nevnt ovenfor				
E Betjeninger				
01 Modifisering av tenningslås				
02 Modifisering av girvelger				
03 Modifisering av pedaler (sjåførlærersett. se J)				
04 Modifisering av parkeringsbrems				
05 Håndbetjening av gass og brems (enkle løsninger)				
Motorsvkkelgass				
Radialgass				
Aksialgass				
Vrigass				
Gassring				
T-gass/brems fra gulvet				
06 Spesialbetjening av gass/brems (servoassistert)				
Underarmsgass				
Bremsering over rattet				
Joystick				

Tilpassingsmuligheter/spesialutstyr	Utstyrets pris	Monteringstid	Ferdigmontert	For trygden
07 Modifisering av original servobrems				
08 Håndbetjent/automatisk kobling				
09 Modifisering av girspak/velger				
10 Modifisering av original servostyring				
11 Spesialstyring:				
Fotstyring				
Knestyring				
Horisontalstyring				
VS 200 XLS styresystem				
Spakstyring (fullhydraulisk)				
Joystick-styring (elektronisk)				
12 Spesialratt:				
Rattkule eller annet grep				
Tiltratt				
Forlenget rattstamme				
13 Modifisering av betjeningene for varmeapparatet				
14 Modifisering av originale el.brytere				
15 Bygging av ny bryterkonsoll/brytere i nakkeputen				
16 Rattmonterte brytere/trådløse brytere				
17 Brytere som styres av blås/sug				
18 Menystyrte brytere				
19 Talecomputer				
20 Nødaggregat – styring/brems				
21 Annet som ikke er nevnt ovenfor				
F Utsyn/observasjon				
01 Modifisering av vinduspusser (ikke bryteren)				
02 Vinduspusser på bakvindu				
03 Modifisering av speil				
04 Elektrisk justerbare speil				
05 Oppvarmede speil (automatisk av-ising)				
06 Vidvinkel-linse på bakvindu				
07 Elektriske vindusheiser				
08 Spesielle vindustyper/farging/isolering				
09 Modifisering av solavskjerming				
10 Ryggevarsler				
11 Avstandsvarsler ved rygging				
12 Rygge-TV				
13 Annet som ikke er nevnt ovenfor				
G Bagasjeplass				
01 Endring av bekledning (matter, trekk mm)				
02 Modifisering av bagasjeluke				
03 Motorisering av bagasjeluke				
04 Annet som ikke er nevnt ovenfor				
H Innlasting av rullestol (Rullestolheis, se I)				
01 Manuelle hjelpemidler for innlasting (snorer/kroker/trinser/håndtak)				
02 Rullestolramper, ev med motorisering				
03 Utjevningsplate for å utjevne kardantunnel				
04 Rullestolvinsj				
05 Rullestolkran i bakre sidedør eller bagasjerom				
06 Motorisert opplasting på taket				
07 Motorisert innlasting ved baksetet (skyvedør, se A)				
08 Annet som ikke er nevnt ovenfor				
I Rullestolheis				
01 Rullestolheis for person i rullestol				
Heisfabrikat:				
Sidemontert:				
Bakmontert:				
02 Tilpassing av el.bryterne for brukeren				

TILBUDSSSKJEMA — UTSTYR

Tilpassingsmuligheter/spesialutstyr	Utstyrets pris	Monteringstid	Ferdigmontert	For trygden
03 Fjernstyring (hvis kombinert med døråpner, se A 08)				
04 Varselmerking for fri plass til heis				
05 Annet som ikke er nevnt ovenfor				
J Transportutstyr				
01 Festeutstyr for tom rullestol				
02 Lastsurring for andre hjelpemidler				
03 Transportstativ/boks utenpå bilen				
04 Tilhengerfeste				
05 Tilhenger for rullestol/hjelpemidler				
06 Annet som ikke er nevnt ovenfor				
K Karosseriendringer				
01 Nye beltefester				
02 Nye setefester				
03 Utjevning av gulv				
04 Senking av gulv				
05 Heving av tak				
06 Nødutgang				
07 Modifisering av døråpninger				
08 Bil med senkbar fjæring bak				
L Sikkerhetsutstyr				
01 Tilpassing av sikkerhetsbeltet				
02 Justerbare øvre beltefester				
03 Airbag				
04 Lykterengjøring				
05 Hjelptilkaller (Servolink)				
06 Mobiltelefon				
07 Differensialbrems/sperre				
08 Firehjulstrekk				
M Annet utstyr				
01 Motor/kupévarmer (bensin/diesel/220V)				
02 Varme i sete				
03 Pollenfilter				
04 Cruise control				
05 Air condition				
06 Batterilader				
07 Dobbelt batterisystem				
08 Garasjeåpner				
09 Innvendig åpning av tank				
10 Tyverialarm				
11 Sjåførlærerutstyr (pedaler/speil)				
12 Avstandsmarkør for innstigning/ plass til heis				
N Konsulenttid/utgifter				
01 Henting/bringing av brukeren				
02 Instruksjon av brukeren				
03 Tid medgått for godkjenning av bilen				
04 Frakt av bil til/fra importør				
05 Frakt av bil til/fra brukerens hjemsted				
06 Annen frakt				
Tilbudssummer:				
Sum utstyr:				
Timeprisen på verksteder er kr..... Sum monteringstid:				
Totalsum eksklusive selve bilen og mva:				

Vehicle Evaluation Inspection Report från Motability, Storbritannien

Motability
Registered Charity No. 299745

Vehicle Evaluation Inspection Report

CONTENTS Page

WD 40

Motability
Registered Charity No. 299745

Vehicle Evaluation Inspection Report

Date of review:

Vehicle:
Make:
Model:
Description:

Manufacturer:
Name:

Address:

Telephone No:
Facsimile No:

Contact person:
Name:
Title:

Vehicle Review/Evaluation:

Introduction:

WD 40

METHODOLOGY:
For the purpose of this vehicle evaluation inspection Motability has developed a comprehensive method for gathering information and facts for presentation in the report. This ensures that at the end of the vehicle evaluation inspection a clear summary and recommendation can be made.

Procedure:

- Brochures and technical specifications are studied to determine vital criteria as part of the planning and preparation stage.

- An appointment is then made to visit the premises where the vehicles are built/modified/converted.

- The vehicle is fully demonstrated by the vehicle supplier in the same way that it would normally be demonstrated to a Motability wheelchair dependent customer and carer/driver.

- All components and equipment used in the vehicle conversion are inspected to ensure that they comply with Motability's Vehicle Adaptation Modification standard Technical Specification requirements. e.g. nuts, bolts, backing plates, locking washers, electric motors, ramps and wheelchair securing systems etc.

- All materials used in the vehicle conversion are inspected to ensure that they comply with Motability's Vehicle Adaptation Modification standard Technical Specification requirements. e.g. steel and tube used in construction, plywood carpeting and fabrics etc. used for trim work.

- Vehicles at various stages of construction are inspected in the workshops to ensure that sound engineering principles and good workshop practice are being applied.

- A completed vehicle is then fully inspected to ensure that it is "Fit for the purpose use," looking specifically at safety, functionality, reliability and quality of finish.

- A completed vehicle is then test driven by the reviewer/inspector. Duration of road test is approximately 45 minutes, covering a distance of approximately 20 miles, in village, town and open road conditions at speeds up to a maximum of 70 m.p.h.

- During the road test access, primary and secondary driving controls, together with handling of the vehicle on the road are evaluated. Other aspects such as visibility, ride quality and access to the wheelchair dependent passenger are also reviewed.

- The reviewer/inspector then accesses the vehicle in a wheelchair and is taken on a test drive whilst seated in the wheelchair for a duration of

approximately 45 minutes, covering a distance of approximately 20 miles, in village, town and open road conditions at speeds up to a maximum of 70 m.p.h.

Specifics reviewed during this part of the road test are access, wheelchair securing, all round visibility, ride quality, ventilation, sound levels and overall comfort and safety.

At approximately the half way point of this journey, the reviewer/inspector transfers into a rear passenger seat to review all aspects, as described, considering use of the vehicle by other passengers.

- All other factors regarding the vehicle are then addressed e.g. warranty, after sales service, vehicle cost and optional extras, etc. Thus enabling an opinion to be given regarding value for money and customer service.

Vehicle Description:

Review - Brochure and Technical Specifications:

Vehicle Demonstration:

- **Human Factors**

- **Mechanical Factors**

Vehicle Components Inspection:

WD 40

Vehicle Materials Inspection:

Vehicle Construction Inspection:

Vehicle Inspection - (Completed Vehicle):

Vehicle Road Test - Driver/Carer:

- **Access to Drivers Seat**
- **Seating**
- **Primary Driving Controls**
- **Secondary Driving Controls**
- **Visibility**

WD 40

- Vehicle Handling
- Vehicle Suspension (Ride Quality)
- Access to Rear of Vehicle

Vehicle Road Test - Passenger:

- Access
- Seating
- Wheelchair Securing
- Vehicle Suspension (Ride Quality)
- Visibility
- Sound Levels
- Ventilation
- General Comfort

Special features:

WD 40

Warranty:

After Sales Service:

Vehicle Cost:

Summary:

Recommendation:

WD 40

Name:..... **Signature:**.....

Date:.....

WD 40

Motability customer first

Leslie Reeson Assessors

Motability Vehicle Inspection Report (Page 1 of 3)

CUSTOMER NAME	
Diagnosis	
Address	
Reference	

VEHICLE CONVERSION SPECIALIST	
Address	
Telephone Number	
Contact/Reference	

VEHICLE NAME	
Model	
Registration Number	
Colour	

MOTABILITY VEHICLE INSPECTION REPORT

VEHICLE ADAPTATIONS	COMPLETED		SATISFACTORY		COMMENTS ON QUALITY
	YES	NO	YES	NO	& TYPE OF ADAPTATIONS
1 ACCESS DOORS					
■ automatic					
■ other					
TRANSFER:-					
■ wheelchair lift/hoist					
■ wheelchair ramp					
■ person hoist					
■ other					
2 SEATING					
■ six-way					
■ swing out					
■ seat belt					
■ other					
3 PRIMARY CONTROLS					
■ steering					
■ accelerator					
■ brake					
4 SECONDARY CONTROLS					
■ gear selector					
■ parking brake					
■ ignition					
■ horn					
■ indicators					
■ dipswitch					
■ lights					
■ front washer wiper					
■ rear washer wiper					
■ other					
5 WHEELCHAIR STORAGE					
■ car roof					
■ towbar carrier					
■ boot					
■ inside vehicle					
■ automatic tie-down					
■ other					

MOTABILITY VEHICLE INSPECTION REPORT

VEHICLE ADAPTATIONS	COMPLETED		SATISFACTORY		COMMENTS ON QUALITY
	YES	NO	YES	NO	& TYPE OF ADAPTATIONS
6 MISCELLANEOUS					
■ floor					
■ body					
■ windows					
■ carpeting					
■ upholstery					
■ trim					
■ vents/heater/fan					
■ electrical					
■ interior lighting					
■ battery/Adverc					
■ mirrors					
■ fire extinguisher					
■ other					

SUMMARY COMMENTS
(quality of finish, standard of work, etc.)

VEHICLE INSPECTOR	*The vehicle and adaptations inspected today have been completed to a *satisfactory /unsatisfactory standard. I certify that the vehicle is *fit/unfit for the purpose of use.*
Name:	
Signature:	
Date:	

COMMENTS ON ROAD TEST, i.e. handling/noise/stability

CUSTOMER SATISFACTION DOCUMENT COMPLETED PREVIOUSLY *YES/NO
CUSTOMER SATISFACTION DOCUMENT COMPLETED IN PRESENCE OF INSPECTING ENGINEER *YES/NO

If the inspection is carried out in the presence of the customer, please ensure that the customer signs the Customer Satisfaction Document

**delete where applicable*

Inspection protocol from Norway developed by SINTEF/RTF and NLFH

Forslag til
Kontrollveiledning
for biler som er spesialtilpasset
for funksjonshemmede

NORSK LANDSFORENING FOR HANDIKAPBIL-TILPASSERE
NLFH

Rådet for tekniske tiltak for funksjonshemmede

Forslag til
Kontrollveiledning
for biler som er spesialtilpasset
for funksjonshemmede

Desember 1993

Forord

Dette forslaget til kontrollveiledning er laget av en arbeidsgruppe med representanter fra
- Bilsenter for funksjonshemmede
- Biltilsynet
- Foreningen for muskelsyke
- Norges Handikapforbund
- Norsk Landsforening for Handikapbiltilpassere (NLFH)
- Rådet for tekniske tiltak for funksjonshemmede v/sekretariatet (RTF-S)

Arbeidsgruppen fikk i 1993 i oppdrag fra Vegdirektoratet å forsøke å lage regler for tilpassede biler. Dette ble funnet svært vanskelig, og en bestemte seg istedet for å lage en kontrollveiledning for Biltilsynets kontrollører slik at de lettere kan gjøre en vurdering av tekniske løsninger i forhold til de regler som allerede finnes i «Krav til kjøretøy».

Kontrollveiledningen er satt opp på samme måte som Vegdirektoratets tidligere kontrollveiledninger og gir inspektøren et verktøy i sitt arbeid, men samtidig muligheten til å bruke skjønn i sine bedømmelser. Denne kontrollveiledningen er et forslag og er ikke bindende for noen!

Arbeidsgruppen har tro på at erfaringene med kontrollveiledningen etterhvert kan avkrystallisere detaljer som kan brukes i et eventuelt regelverk om biler som er tilpasset for funksjonshemmede.

Rådet for tekniske tiltak for funksjonshemmede
v/ Sekretariatet (RTF-S)
Oslo, desember 1993

Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
Ktk § 3-3	**Identifikasjon**	Kjennemerke mot vognkort Understellsnummer innpreget i rammen	Understellsnummer kan ikke påvises Understellsnummer er feil Kjennemerker er skadet	2 2 (3) 1 (2)
Ktk § 3-6	**Dokumenter mm**	Elektrisk koblingsskjema fra tilpasseren Bruksanvisning for heis, sete, servosystem mm Vedlegg til vognkort fra biltilpasseren	Dokumenter mangler Dokumenter mangler Vedlegg til vognkort mangler	2 2 2
Ktk § 6-1	**Generelt**	Bilen skal være kjørbar med ordinære betjeninger, eller merket for spesiell betjeningsmåte Den aktuelle brukeren skal være med under kontrollen og demonstrere at han mestrer utstyret (forutsatt trening) Totalvekt og akseltrykk må ikke overskrides Intet utstyr må monteres i varme soner Utstyr må ikke hindre motorens dynamiske bevegelser eller hjulenes sving eller fjæringsvei	Merking mangler Brukeren ikke tilstede/ mestrer ikke utstyret For høye vekter (OBS: inkl. rullestol) For nær eksosanlegg/uten varmeskjold For nær motor/girkasse (Klaring under 30 mm)	2 2 2 2 2

Bedømming: **1:** Påpekte feil – **2:** Ny fremvisning – **3:** Kjøreforbud
Ktk: «Krav til kjøretøy» **ECE:** Economic Commision of Europe

Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
Ktk §11 ECE R26	**Karosseri**	Betydelig endring av bærende konstruksjoner	Dokumentasjon fra bilprodusent mangler	2
		Sjekk for skarpe kanter, svekkelser, e.a	Jfr besiktning under arbeidets gang	2
		Bearbeidede flater skal rustbeskyttes	Manglende rustbeskyttelse	1 (2)
Ktk § 24-1	**Elektrisk anlegg**	Kontrollér tilkoblinger og sikringer	Tilførsler fra batteriet/manglende sikringer	2
		Ledningskvadrater i forhold til strømstyrke	For tynne ledninger	2
		Ledningsføringer	Ledninger kan komme i klem/dårlig festet	2
		Reléer, moduler og deres jordings-punkter	Plassering og maks 1,5 Ω fra jording til batteriet	1 (2)
Ktk § 14 ECE R11	**Dører**	Sjekk lukkefunksjon	Dårlig konstruksjon	2
		Lukket dør skal låses med sluttstykke	Døren henger bare i kjede eller aktivator	2
		Fare for klemming, tøy i kjeder mm.	Dårlig skjerming av mekanismen	2
		Kan dørene åpnes innenfra?	Det må være mulig å ta seg ut av bilen	2
		Nødåpning av dørene hvis bilen er uten strøm	Dører kan ikke åpnes uten strøm (rømningsvei)	2
		Nødutganger, spesielt ved motoriserte dører	Manglende nødutganger	2
		Økt åpningsvinkel	Dørstopper for dårlig/kontakt med karosseriet	1

Bedømming: **1:** Påpekte feil – **2:** Ny fremvisning – **3:** Kjøreforbud
Ktk: «Krav til kjøretøy» **ECE:** Economic Commision of Europe

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Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
Ktk § 33-1 § 34-1	**Transportutstyr**	Mekanisk inn-/utlastingsutstyr må fungere godt og kunne betjenes lett	Bruken av utstyret fungerer dårlig	2
		Skinner/rampe må under bruk kunne festes mot bilen	Skinner/rampe dårlig sikret mot bilen	2
		Skinner må kunne sperres i korrekt bredde	Skinner kan forflytte seg under bruk	2
		Hvis heisen ikke hindrer dørene fra å lukkes/varsling	Varsling av at heisen ikke er i transport-stilling mangler	3
		Varsling av heis som vipper ut fra bilsiden	Heisen er farlig for fotgjengere/syklister	2 (3)
		Fjernkontroll av heis må ikke influere på andre funksjoner	Fjernkontroll influerer ufrivillig på annet utstyr	2
		Nødbruk av heis/løfter opp og ned	Nødbruk fungerer ikke	2 (3)

Bedømming: **1:** Påpekte feil – **2:** Ny fremvisning – **3:** Kjøreforbud
Ktk: «Krav til kjøretøy» **ECE:** Economic Commision of Europe

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Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
Ktk §15 Spesial-transport ECE R17 ECE R44	**Sete/rullestol**	Innfesting mot sitteinnretningen	Uoriginal innfesting for dårlig	2 (3)
		Forlengede seteskinner	Skinner for dårlig festet eller svak sperremekanisme	2 (3)
		Innfesting mot gulvet/uoriginale fester	Holdbarhet må beregnes/dokumenteres	2
		Dreiesete	Funksjon og holdbarhet	2
		Elektrisk seteunderstell (6-vegs)	Vurderes for holdbarhet og stabilitet	1
		[Rullestolfestet oppfyller standardiserte krav (når ferdig!)]	[Merking eller godkjenningspapirer mangler]	[2]
		Manuelt rullestolfeste – betjening/ utførelse	Løsner under bruk	2
		Elektrisk rullestolfeste – betjening og nødutløsning	Svak innfesting mot rullestol eller gulvet	2 (3)
			Varsellampe som slukker når alt er ok mangler	2 (3)
			Manuell utløsning fungerer ikke	2
		Stabilitet i sittestillingen (støttebelter, polstring e.a)	Støttebelter/polstring mangler eller er dårlig utformet	
		Puter som benyttes av komfort – eller medisinske grunner	Puter ikke festet	1 (2)
		Godkjent barnesete tilpasset brukeren	Modifisering ikke godkjent av sete-produsenten	2
		Spesialløsning av barnesikringen	Barnesete uten E-merking (lege-erklæring kreves)	2

Bedømming: **1:** Påpekte feil – **2:** Ny fremvisning – **3:** Kjøreforbud
Ktk: «Krav til kjøretøy» **ECE:** Economic Commision of Europe

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Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
Ktk § 13 ECE R14 ECE R16	**Sikkerhetsbelte**	Betjening av bilbeltet	Brukeren mestrer ikke beltet	2
		Beltets anlegg mot personen	Ugunstig anlegg mot kroppen	2
		Belter eller stropper er sydd om	Dokumentasjon mangler/dårlig kvalitet	2
		Beltelås modifisert	Låsen kan åpne seg i en kollisjon	2
		Beltelås montert på uoriginalt sete-understell	Dokumentasjon for holdbarhet mangler	2 (3)
		Beslag og tilpassingsstykker som ikke er merket	Dimensjoner og kvalitet utilstrekkelig	2
		Innfesting i karosseriet	For dårlig innfesting/manglende underlagsbrikker	2 (3)
		Ettermontert justering av øvre belte-feste	Dokumentert styrke	2
		Korrekt montering av flerpunktsbelter	Feil vinkel på festestropp bakover til gulvet	2 (3
		Barnesikringsutstyr – er det gjort modifikasjoner?	Endringer utover godkjenningen	2

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Bedømming: **1:** Påpekte feil – **2:** Ny fremvisning – **3:** Kjøreforbud
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Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
Ktk § 16-1 ECE R35	**Generelt om betjenings-innretninger**	Innenfor brukerens rekkevidde (hele vandringen)	Ugunstig plassering/vandring	2 (3)
		Ikke fare for å henge seg opp i klær e.a	Utstikkende deler	2
		Brukeren skal kunne nå nødvendige betjeninger samtidig	Kan ikke utføre normale kjøremanøvrer	2
		Utforming	Skarpe kanter	2
		Konstruksjon	Sikkerhetsfaktor på 2,5	2
		Det skal ikke bores hull i originale pedaler	Pedalen svekket	2
		Det skal ikke sveises i bremsepedalen	Pedalen svekket	2 (3)
		Originale betjeninger skal belastes så rett som mulig	Skrå belastning (over 15°) på pedaler	2
		Montering av utstyr bør ikke spolere ECE R12 (kollisjonssikkerhet)	Ugunstig plassering/innfesting	2 (3)
		Myk, jevn bevegelse	Dårlig funksjon	2
		Kraftbehov mindre enn brukerens ytelse	For tung å operere	2 (3)
		Full vandring på originalbetjening	For kort vandring	2 (3)
		Nullstilling ved avlastning (retur)	Går ikke tilbake til 0-stilling	2
		Minimal dødgang kan tillates	Unødvendig stor dødgang	2 (3)
		Nødservo	Nødaggregat skal starte på manglende trykk	2 (3)

Bedømming: **1:** Påpekte feil – **2:** Ny fremvisning – **3:** Kjøreforbud
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Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
Ktk § 16-1	**Betj. gass**	Venstregass må kunne fjernes/slås opp	Fast gasspedal på venstre side	2
		Høyregass må skjermes når venstre-gass benyttes	Manglende skjerming av høyre pedal	2
		Delt gasspedal	Hvis samme pedal benyttes H/V skal den sitte sikkert	2
		Gassen skal gå av når betjeningen frigjøres	Går ikke av etter betjening	1
		Gassen skal kunne reguleres jevnt over hele turtallet	Vanskelig regulering	1 (2)

Bedømming: **1:** Påpekte feil – **2:** Ny fremvisning – **3:** Kjøreforbud
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Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
Ktk § 23	**Betj. brems**	Håndbetjeningen skal gi brems ved press i kjøreretningen	Feil betjeningsretning	2 (3)
		Hvis det må skiftes grep, bør brems ligge lavere enn gass	Bremsehåndtak for høyt	2
		Bremsevirkningen må kunne reguleres jevnt	Bremsen «lugger seg på»	2 (3)
		Arm for håndbetjening skal hengsles bolt i gaffel, eller med gj.gående hylse	For dårlig lagring	2 (3)
		Driftsbremsen skal kunne holdes tilsatt mens under girskift	Vanskelig betjening	2
		Ev låsefunksjon skal løse seg selv når bremsen igjen betjenes	Låsefunksjonen løser seg ikke automatisk	2 (3)
		Brukeren skal kunne fylle kravene til retardasjon	Manglende retardasjon	2 (3)
		Håndbetjeningen skal fungere selv om én krets faller ut.	Betjeningen gir ikke full pedalvandring	2 (3)
		Betjeningen skal ikke kunne presses mot andre deler av bilen	Ugunstig utforming	2
		Ingen stag må falle av dersom pedalen betjenes	Feil utforming	2 (3)
		Bremsepedalen skal ikke fjernes permanent	Bremsepedal demontert eller dårlig hutigkobling	3
		Pneumatisk eller hydraulisk servo skal ha nødservo hvis brukeren ikke kan oppnå 490 N på pedalen	Servovirkning opphører ved én teknisk feil	2 (3)

Bedømming: **1:** Påpekte feil – **2:** Ny fremvisning – **3:** Kjøreforbud
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Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
Ktk § 23-3	**Betj. P-brems**	Betjening mulig samtidig som det gis gass (bakkestart)	Uheldig løsning	2
		Dette gjelder ikke dersom driftsbremsen har låseanordning	Uheldig løsning	2
		Varsellampe skal vise at p-brems ikke er i fristilling	Manglende varsellampe/feil funksjon	2
		El.drevet P-brems skal være moment-styrt, og bare kunne hvile når av eller på, men en operasjon skal kunne snus vilkårlig	Feil funksjon	2
		Tiltrekkingen skal gå så langsomt at en nedbremsing blir myk	For brå virkning	2
			Kan ikke tilsettes i fart	2
			Er ikke «regulerbar»	2
		Bremsevirkning som nødbrems	Virkning for dårlig	2
Ktk § 16-1 § 20-1	**Betj. kobling/ girvelger**	Håndbetjent manuell kobling skal kunne hvile både inn- og utkoblet (Gjelder ikke automatisk kobling)	Hviler bare i innkoblet	2
		Ved kombinerte betjeninger må det være mulig å bremse eller gasse samtidig som koblingen betjenes	Bilen kan ikke bremses under selve utkoblingen	2 (3)
		Girvelger skal ha posisjonsbevegelser (one touch)	Betjeningen må holdes til rett posisjon	2

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Bedømming: **1:** Påpekte feil – **2:** Ny fremvisning – **3:** Kjøreforbud
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Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
Ktk § 18 ECE R12	**Betj. styring**	Ratt skal vanligvis ha en diameter på over 30 cm	For lite ratt (krever dispensasjon)	1
		Uoriginalt ratt bør fylle ECE R12, spesielt hvis kollisjonsfare	Manglende dokumentasjon/dårlig plassering	2
		Rattkule/spesialgrep skal festes på innsiden av rattkransen	Monteringen gir ujevn rattkrans	2
		Festet må ikke skade rattkransen	Uhensiktsmessig løsning	2
		Diagonal grepsinnfesting i rattet	Må ikke skjerme instrumenter	2
			Kan ikke kombineres med airbag	3
		Kule/grep skal kunne demonteres eller slås inn	Fast montering uten demonteringsmulighet	2
		Mekanisk fotstyring skal være sikkert koblet mot rattakselen	For dårlig overføring	2
		Styreplaten må ikke hindre pedalbevegelsene	Uhensiktsmessig løsning	2 (3)
		Plass til fulle styreutslag	Forstillingsdeler eller dekk tar i karosseriet	2
		Styringen bør være selvopprettende på asfalt	Svak selvoppretting	2
		Dersom rattet er demontert, bør det være en optisk indikasjon på hjulenes stilling/styreutslag	Indikator mangler	2
	Betj. styring fortsettes	Spesielle servosystemer skal ha nødservo som starter automatisk og tillater at føreren stanser bilen kontrollert	Nødfunksjon mangler	2 (3)

Bedømming: **1:** Påpekte feil – **2:** Ny fremvisning – **3:** Kjøreforbud
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Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
	Betj. styring fortsatt	Manglende servotrykk skal varsles både optisk og akustisk	Manglende varsling	2
		Ved spak-/joystickstyring skal kroppen ha god støtte	For dårlig støtte for betjeningsarm/-ben/kropp	2 (3)
		Uoriginale styresystemer skal ikke øke skaderisiko (brukeren)	Fare for skader etter en kollisjon	3
Ktk § 16-1	**Betj. brytere**	Alle nødvendige bryterfunksjoner skal kunne betjenes mens bilen står i ro	Uheldige løsninger	2
		Under kjøring må følgende kunne betjenes uten å slippe styring/gass/brems:		
		• Retningslys	Kan ikke betjenes/går ikke av igjen	2
		• Blendingsbryter	Kan ikke betjenes	2
		• Viskerspusser (minst 1 steg)	Kan ikke betjenes	2
		• Vindusspyler	Kan ikke betjenes	2
		• Lydsignal	Kan ikke betjenes	2
		Grepsforbedringer på brytere må ikke kunne feste seg i klær eller være i veien for andre betjeninger	Utstikkende deler	2
		Uoriginale brytere må ikke kunne forveksles med originale	Manglende merking	2
		Dersom originale brytere mister sin funksjon skal de fjernes	Gamle brytere ikke fjernet eller blendet av	2
		Nye brytere skal merkes tydelig med samme symbol	Manglende merking	2

Bedømming: **1:** Påpekte feil – **2:** Ny fremvisning – **3:** Kjøreforbud
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Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
Ktk §31 ECE R18	**Betj. lås**	Føreren skal kunne betjene alle låser (ikke motorpanser)	Mestrer ikke alle låser	2
		Bilen skal sikres med dørlås + én fastmontert lås	Merking av ny tenningslås	2
		Tenningslåsen flyttet fra rattet	Rattlås ikke utkoblet på forsvarlig måte	2 (3)
		Alle dører skal kunne åpnes *innenfra* selv om sentrallås er i funksjon (men brukeren behøver ikke å mestre dette selv)	Dørlåser kan ikke åpnes	2
		Fjernkontrollen av sentrallås og tenningslås må ikke influere på andre funksjoner i bilen	Fjernkontrollen influerer ufrivillig på andre funksjoner	2
Ktk §17-1	**Betj. varme**	Føreren skal kunne betjene alle funksjoner når bilen står stille	Klarer ikke betjeningen	2
		Dersom betjeningene flyttes, må originale betjeninger fungere, eller de nye må merkes tydelig	Manglende merking	2

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Henvisning	Kontrollpunkt	Metode/virkning	Hovedgrunn for mangel	Bedømming
Ktk § 27	**Observasjon/ speil**	Hvis nødvendig skal føreren kunne benytte solskjermen foran førerplassen	Solskjerm lar seg ikke benytte under kjøring	2
		Tilnærmet samme synsfelt som ordinære bilførere	Uhensiktsmessige speil	2
		Vinduspussernes dekningsfelt	Dekker for dårlig i forhold til brukeren	2
		Ekstra speil kan monteres innvendig og utvendig	Farlig plassering av speil	2
		Hvis krumningen på utvendig ekstraspeil er mindre enn R = 1.200 mm, må originale speil være på plass	For sterk krumning	2
		Vidvinkelspeil montert direkte på original utvendig speil	For liten speilflate igjen på original speil	2
		Motoriserte speil kan monteres for å kompensere for førerens manglende evne til hodebevegelser	Ekstraspeil kompenserer ikke godt nok	2
		Speilene må kunne manøvreres uten å ta mer enn én hånd bort fra rattet	Vanskelig betjening	2

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Väg- och transport-
forskningsinstitutet

VI FORSKAR FÖR ETT LIV I RÖRELSE

Statens väg- och transportforskningsinstitut (VTI) har kompetens och laboratorier för kvalificerade forskningsuppdrag inom transporter och samhällsekonomi, trafiksäkerhet, fordon, miljö samt för byggande, drift och underhåll av vägar och järnvägar.

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