TP 13019E

Persons with Disabilities and Converted Vehicles

Phase I – Preliminary Investigation

Phase II – Detailed Study Design

Prepared for

Transportation Development Centre
Safety and Security
Transport Canada

by

Goss Gilroy Inc., in association with TES Limited

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16. Abstract

This report describes the work carried out in phases 1 and 2 of a proposed three-phase project to assess the use, safety, and cost of personal vehicles that have been converted for the use of drivers with physical disabilities.

The project was designed to clarify a number of difficulties related to the perceived expense and difficulty of ensuring that vehicle conversions comply with Canadian motor vehicle safety standards.

Phase 1 involved the collection of the following information related to converted vehicles:

statistics on current use by disabled persons;
number of collisions, other accidents, and incidents, and whether they were related to the structural integrity of the vehicle;
compliance issues (e.g., cost of dynamic testing, effects of compliance);
types of conversions;
status of conversion industry; and
approaches to regulation of the conversion industry.

Phase 2 covered the development of a plan for further data collection and detailed data analysis. A seven-task approach, to address key information requirements related to the conversion industry and disabled consumers, is proposed for Phase 3.

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16. Résumé

Ce rapport rend compte des travaux des phases 1 et 2 d'une étude en trois phases visant à évaluer l'utilisation, la sûreté et le coût des véhicules personnels adaptés à l'usage des conducteurs ayant une incapacité physique.

Le projet avait pour but de clarifier diverses questions touchant les obstacles perçus à surmonter, notamment sur le plan financier, pour faire en sorte que les travaux de conversion de véhicules soient conformes aux Normes de sécurité des véhicules automobiles du Canada.

La phase 1 comportait la collecte de données préliminaires reliées aux véhicules adaptés :

les statistiques concernant l'utilisation actuelle de véhicules adaptés par des personnes à mobilité réduite;
le nombre de collisions, et d'autres types d'accidents et d'incidents mettant en cause des véhicules adaptés, et le rôle de l'intégrité structurale du véhicule dans ces accidents;
les enjeux reliés à la conformité (p. ex., coût des essais dynamiques, effets de la conformité);
les types de conversion;
la situation de l'industrie de la conversion;
les diverses approches concernant la réglementation de l'industrie de la conversion.

La phase 2 comportait l'élaboration d'un plan de collecte de données supplémentaires et d'analyse détaillée des données. Une approche en sept tâches, visant à répondre aux besoins en informations-clés sur l'industrie de la conversion de véhicules et sur les utilisateurs de ces véhicules est proposée en vue de la phase 3.

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Conducteur handicapé, véhicule adapté, conformité, sûreté, NSVAC	Le Centre de développement des transports dispose d'un nombre limité d'exemplaires.

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Executive Summary

Transport Canada contracted Goss Gilroy Inc., in association with T E S Limited, to undertake a study to assess issues related to vehicles converted for the personal use of persons with disabilities in Canada.

At present there is a lack of data regarding the demand for vehicles converted for use by persons with disabilities, the supply of these converted vehicles, and issues such as crash involvement. Transport Canada, following consultations with its ministerial Advisory Committee on Accessible Transportation (ACAT), decided to undertake a study, to collect information on a variety of topics related to vehicle modifications, and to identify and document possible alternatives to the current policy of complying with the Canadian Motor Vehicle Safety Standards (CMVSS).

The study requirements were divided into three phases. The objectives of the first two phases were to provide an overview of information based on currently available literature and databases, and provide a strategy for addressing information gaps. These phases were not intended to provide policy alternatives or policy recommendations. These first two phases are described below:

- Phase I included preliminary data collection to establish the feasibility of collecting and assessing information on issues such as the use, safety, and cost of personal vehicles converted for use by persons with disabilities. Information requirements and preliminary methodologies were also identified. This first phase involved a literature and database review, and consultations with selected stakeholders. A variety of stakeholder groups were contacted, including federal and provincial governments, persons with disabilities, the conversion industry (including conversion companies and driver assessment centres), automobile manufacturers, the insurance industry, driver trainers, and foreign government representatives involved in the regulation of personal vehicles (including converted vehicles). While 30 consultations were originally planned for Phase I, a total of 52 individuals were actually contacted.

- Phase II involved a more detailed identification and prioritization of information requirements, and described appropriate methodologies for addressing these information needs.

The results of the first two phases were documented in a study report and presented to the Project Advisory Committee. Depending on the Committee's decisions, a third phase could be implemented to collect data required to address outstanding information needs.

A summary of the Phase I and II findings is presented below. In reviewing the findings, the reader should appreciate that they are summaries of readily available information and that this information contains a number of gaps. For example, the information on converters and the needs of users of converted vehicles is considered to be preliminary at this point; a third phase would entail considerable additional effort to collect the information requested in the Terms of Reference.

Summary of Phase I Findings

The Motor Vehicle Conversion Industry

After a vehicle is produced by a (first stage) vehicle manufacturing company (e.g., Ford, General Motors, Chrysler), it can be modified by a second stage manufacturing company (also known as a conversion company) to meet certain requirements. For example, converted vehicles can include limousines, ambulances, fire trucks, motor homes, transport trucks, accessible taxis, some forms of delivery vans, and vehicles converted for personal use by persons with disabilities. Unofficial estimates from Transport Canada suggest that one in every seven vehicles in Canada has been converted in some manner.

The conversion industry includes a variety of organizations such as:

- small and medium-sized second-stage manufacturers who actually perform conversions to vehicles, mostly for commercial use, but also for personal use (including mini-vans, full-sized vans, light trucks, and automobiles);
- dealers, distributors, and importers of converted vehicles;
- durable medical supply companies (i.e., companies that supply mobility aids such as wheelchairs, driving aids such as hand controls, and devices such as mobility aid securement systems); and
- companies which install and repair equipment (e.g., lifts).

Two organizations (the Enforcement Branch of Transport Canada's Road Safety Directorate, and the Canadian Paraplegic Association - CPA) provided lists of companies that perform conversions.

Transport Canada's list (continually updated) identifies 125 companies, including companies with multiple locations. Of these 125 companies, 11 are identified as providing major modifications to vans (including mini-vans and full-sized vans). The remaining 114 companies include dealers and distributors for other converters, companies that perform equipment installations and repairs, and modifiers of (primarily) non-personal vehicles (such as full and mid-sized buses) and recreational vehicles (RVs), who may undertake conversions on personal-use vehicles.

The companies identified on Transport Canada's list include those that are registered with Transport Canada as having a National Safety Mark (NSM), and importers capable of certifying motor vehicles under the United States' Federal Motor Vehicle Safety Act (MVSA). The list also contains companies that have not demonstrated any capacity to modify new motor vehicles, but may act as dealers for certifying companies. The list is neither exclusive nor exhaustive.

The Enforcement Branch of Transport Canada's Road Safety Directorate is currently upgrading a computerized system that will assist them in profiling companies involved in converting vehicles, including vehicles for use by persons with disabilities. This would include key indicators such as the company's NSM status.

The CPA list consists of 78 companies identified as vehicle conversion companies, 76 of which are included in the Transport Canada list (the remaining two companies are conversion companies not identified on Transport Canada's listing). The CPA believes that of the companies on its list, approximately 30 are involved in performing some type of conversion to vehicles for persons with disabilities, with the remaining companies installing/repairing equipment (e.g., lifts, hand controls), or acting as dealer representatives.

The 50 companies not covered by the CPA list, but covered by the Transport Canada list, include 25 companies that perform modifications, act as dealers and distributors for other converters, and companies that perform equipment installations and repairs; and 17 companies that import, modify, and/or manufacture buses; and, 8 companies that modify RVs (and undertake roof modifications for accessible vehicle converters).

Driver rehabilitation specialists are also involved in the process of obtaining a converted vehicle, through the provision of driver assessments and/or advice regarding the appropriate automotive adaptive equipment needed by an individual with a disability to drive a vehicle and/or travel as a passenger. During Phase I, 39 organizations from across Canada were identified as providing driver assessment services.

Clients of driver rehabilitation specialists require a converted vehicle for travelling as a passenger or as a driver (including individuals with, and without, prior driving experience). With the exception of Quebec, individuals can go directly to a converter for a vehicle as there is no requirement that a person with a disability first consult a driver rehabilitation specialist. However, certain converters require a prescription from a driver rehabilitation specialist before modifying a vehicle for a potential client. In Quebec, a legislative requirement stipulates that individuals must see a driver rehabilitation specialist for a driver assessment before having a vehicle modified.

Driver assessments typically include an assessment of an individual's vision, range of movement (e.g., hand, neck, and back movements), and cognitive abilities necessary for driving. In addition, a road test is usually included. Based on the assessment, the examiner recommends whether or not the individual should be allowed to drive; if the driver is allowed to drive, the examiner indicates what modifications or adaptive equipment are required.

Annual and Total Vehicle Conversions

Estimates on annual vehicle conversions were gathered from a variety of sources, including the Canadian Paraplegic Association (CPA), the National Mobility Equipment Dealers Association of Canada (NMEDA), a conversion company, and driver rehabilitation specialists. The estimates indicate that up to 600 conversions are conducted per year that would involve modifications to the vehicle. In the U.S., a report by the Transportation Rehabilitation Engineering Centre of the University of Virginia, suggests that there are approximately 7 000 personal vehicles modified annually, of which between 1 000 and 2 000 are modified for drivers using their mobility aids as the vehicle seat.

Types of Conversions

A wide variety of modifications may be performed when modifying a personal vehicle for use by persons with disabilities, and can range from minor to major in scope. In summary, the vehicle components or systems that may be affected by modifications (and specific examples) include:

- Group A and B driving controls (e.g., throttle/accelerator, steering system, brake system, ignition start switch, gear selector, parking brake, windshield wipers/washer, windshield defroster, rearview mirrors, turn signals);
- accessory controls (e.g., air vents, air conditioner, seat positioner, door locks, sun visor);
- vehicle electrical system (e.g., electrical wiring, ignition system, battery);
- vehicle chassis, suspension and body (e.g., vehicle frame, vehicle body and/or doors, vehicle floor, vehicle roof, seats, windows);
- engine (e.g., engine cooling, engine operation);
- drivetrain (e.g., clutch, transmission, axles);
- fuel system (e.g., fuel lines, fuel tank);
- vehicle safety systems (e.g., occupant protection system, air bag, seat belt assembly); and,
- mobility aid securement and occupant restraint systems, stowage systems for mobility aids, mobility aid/occupant lifting and elevating devices.

The type of modification that is performed can also range from standard to customized, depending on the nature and severity of the disability experienced by

the driver/passenger, the individual's personal characteristics (e.g., height), the desires of the individual in terms of type of vehicle (e.g., mini-van versus full-sized van) and equipment to be used, and the individual's financial circumstances.

Depending on the nature of the modification(s) performed, compliance with CMVSS may be required. A converter may also choose to meet recommended practices of the Society of Automotive Engineers (SAE) and/or standards of the Canadian Standards Association (CSA).

With respect to persons using a mobility aid, the following are examples of potential scenarios illustrating the relationship between the nature and severity of an individual's disability, and the nature and extent of the modification(s) to be performed. It is emphasized that these are examples only. Given each individual's unique requirements, variations from these examples can be expected.

- Manual wheelchair users with requisite upper body strength to transfer themselves and/or their mobility aid into a vehicle, may only require minor adaptive equipment to operate their vehicle (typically an automobile). This adaptive equipment would include hand controls in conjunction with steering devices. In this situation, they would transfer themselves from their mobility aid into the driver's position, storing their mobility aid (typically) in the back seat of the vehicle. Devices also exist that allow individuals to store their mobility aid on the roof of the vehicle.

- Mobility aid users without requisite upper body strength to transfer themselves into a vehicle and/or to load their mobility aid into the vehicle, would require a lift or ramp to enter their vehicle (given the requirement for a ramp or lift, a van would be required). In most cases, modifications to either the roof or the floor would be required in order to provide sufficient headroom for the individual while in the mobility aid.

  If the individual uses the driver's seat or passenger's seat, a power seat-base may be used. These bases facilitate the process of transferring oneself from the mobility aid to the driver/passenger seat. For drivers, hand controls (in conjunction with steering devices) would also be required. If the individual is travelling only as a passenger, and remains in the mobility aid, a mobility aid securement system would be required.

- Those who are not capable of transferring themselves from their mobility aid to the driver's seat, and therefore driving from their mobility aid, would require the removal of the driver's seat and structural changes to the vehicle itself (e.g., dropping the floor and/or raising the roof), in order to allow adequate headroom to operate the vehicle while in their mobility aid. A mobility aid securement system would also be required (for drivers, these are typically

powered systems, while manual systems are used for individuals travelling as a passenger). For driving, hand controls (in conjunction with steering devices) would also be required.

Users of Converted Vehicles

None of the organizations contacted during Phase I was able to indicate the number of individuals currently using converted vehicles. However, data from the 1991 Health and Activity Limitation Survey (HALS) provide an indicator of the extent to which automotive adaptive devices are in use, although not the number of converted vehicles. By combining responses to the use of a scooter or wheelchair (mobility aid) and adaptive devices, a proxy for converted vehicles was developed. Based on a HALS data, there were approximately 31 000 persons with disabilities who used a mobility aid, and also used automotive adaptive equipment, either as a driver or a passenger (1991). Automotive adaptive equipment was defined as hand controls/brake controls, hand rails, straps, specialized handles, ramps/lifts, or space for wheelchair or other specialized equipment (including storage space).

Based on Statistics Canada's population forecasts (medium growth projections), persons who use a mobility aid and use adaptive devices for travelling in a personal vehicle are estimated to increase from 31 000 in 1991 to 49 000 in 2015.

Cost and Subsidization of Motor Vehicle Conversions

As noted above, the nature and scope of conversions can range from relatively minor modifications such as the installation of mechanical hand controls, moderate modifications designed to provide greater accessibility to passenger positions, and complex/customized modifications allowing the operation of the vehicle from a mobility aid using adapted driving controls. In general, the costs of conversions are directly related to various factors, including:

- the nature and severity of an individual's disability;
- the principal use of the vehicle (e.g., for transporting an individual as a passenger versus driving the vehicle);
- the complexity and number of modifications required to adapt a vehicle, based on the nature/severity of an individual's disability and the purpose of the vehicle; and
- the type of vehicle (e.g., uni-body, body-on-frame).

Depending on the nature of the conversion, costs can range from $1 000 or less for hand controls to $15 000 and up for conversions involving major modifications to mini-vans (e.g., lowering the vehicle's floor, installation of electronic driver controls).

Persons with disabilities typically finance the cost of conversions through personal funds (including bank loans), and/or through financial assistance offered through a variety of means, including provincial workers' compensation boards, provincial vocational rehabilitation programs, local service clubs, disability organizations, and motor vehicle accident insurance. The three large North American automobile manufacturers (Ford, GM, and Chrysler) also offer rebate programs for modifications to new vehicles. With the exception of motor vehicle accident insurance, assistance programs typically only cover the adaptations; the base cost of the vehicle is not covered.

Although there are various sources of assistance, it is generally considered by the converters and driver rehabilitation specialists contacted during Phase I that many individuals who purchase converted vehicles do so with their own financing.

In the 1997 February Budget, the federal Department of Finance announced a broadening of the medical expense tax credit to include 20% (to a maximum of $5 000) of the cost of a van that is adapted (or will be adapted within six months), for the transportation of an individual using a mobility aid.

Converted Vehicles and Collisions

There is currently a lack of reliable national information on collisions involving vehicles converted for persons with disabilities in Canada (such as the number of collisions involving converted vehicles, whether the conversion was a contributing factor in the collision, and whether the conversion increased the severity of the collision).

The Defects Investigation Group of Transport Canada's Road Safety Directorate has investigated collisions involving vehicles converted for use by persons with disabilities. These have included situations involving occupant restraints, modified steering wheels, and the use of a wheelchair as the driver's seat. A recent case involved the failure of a modified occupant restraint system, resulting in a recall notice. Transport Canada's Vehicle Recalls database indicates that 14 units were recalled and inspected, with four of the units found to have defective stitching. All of the defective units were subsequently replaced.

The Société d'ssurance automobile du Québec (SAAQ) was contacted regarding collision information and vehicles converted for use by person with disabilities. Based on a special analysis of data, SAAQ reports that between 1994 and 1996, there were an average 132 collisions per year involving drivers with a licence restriction (based on licence restrictions requiring one of the following: a left-foot gas pedal, hand controls, driving controls for persons with a disability, or safety/security restraint system). Overall, 2 409 drivers have these restrictions on their licences. The collision rate for drivers who have a licence restriction is approximately 5.5%, as

compared to approximately 7% for all drivers. However, these figures have not been adjusted for the exposure to risk, based on amount driven (i.e., the more a vehicle is driven, on average, increases its likelihood of being in a collision).

In addition, the SAAQ cross tabulations do not provide any indication of whether the vehicle has been structurally modified. Additional information on the collision, and potentially the nature of the vehicle, could be ascertained by manually reviewing the comments section of the relevant accident records; but again, there is no assurance that additional information was provided in this section by the reporting officer. A similar situation would exist if other provinces generated data on collision involvement based on driver licence restrictions.

Discussions with several provincial ministries of transportation, the Ontario Provincial Police, the Insurance Corporation of British Columbia (ICBC), the Manitoba Public Insurance Corp., Saskatchewan Government Insurance, private insurance companies, and the Vehicle Information Centre of Canada (VICC) indicate that these organizations do not have data available on collisions involving vehicles converted for personal use by persons with disabilities.

The Insurance Bureau of Canada also does not track incidents involving these vehicles. The bureau states that it is a very small market segment and that collisions involving vehicles converted for use by persons with disabilities have not been an issue in the past.

In the U.S., the National Highway Traffic Safety Administration (NHTSA), through its National Accident Sampling System (NASS) investigated 5 070 crashes in 1995, of which 13 (0.26%) involved vehicles that were outfitted with adaptive devices (in particular, hand controls, steering controls, and/or low effort power steering mechanisms). Based on variables used to describe the interior of the vehicle, these figures do not indicate whether structural modifications have been made to the vehicle. NASS data for the complete 1996 calendar year have not yet been released by NHTSA; however, no collisions involving adaptive devices were reported in the first six months or 1996.

Discussions with a representative of the U.K. Department of Transport revealed that no official statistics on collisions involving converted personal vehicles are tracked in the U.K. or other European countries. However, the U.K.-based Banstead Mobility Centre did conduct a survey of driver-assessment clients during the 1988-1990 period. The Centre concluded from its survey that the number of accidents reported indicates that for those with a physical disability alone, the pattern of accidents is similar to national (U.K.) statistics. In particular, men, drivers under thirty years old, and elderly drivers using converted vehicles, appear more at risk.

Conversion Issues

The design of vehicle bodies and frames is complex, requiring extensive computer calculations and simulations. OEMs perform numerous complex calculations and tests during the development of a vehicle to ensure compliance with governing standards and regulations as well as other design goals.

In addition, structural components are optimized by OEMs to reduce unnecessary weight and production costs without sacrificing vehicle integrity. Some vehicle bodies, especially those of the uni-body type, are designed as protective cages around the occupant compartment and contain energy-absorbing impact zones. Frequently, several vehicle systems must function collectively to achieve the level of protection required by governing standards such as the CMVSS.

Vehicle converters often modify vehicle components or structural features in the course of adapting a vehicle for use by persons with disabilities. Without knowing the original intent of the OEM, modifications may compromise the safety of a vehicle. In this regard, advice and assistance from OEMs can be valuable in preventing converters from compromising the original certification of the vehicle, thus minimizing certification costs.

The areas where potential problems may occur in modifying OEM systems and components include the frame and body, fuel system, roof, door widening, and occupant protection systems.

Airbags

Vehicle manufacturers have included air bags as standard equipment in a large number of passenger vehicles in Canada. The effectiveness of airbags in reducing injury levels depends greatly on the relationship between the airbag, occupant, and surrounding features. In vehicle modifications, installing special seats, adding adaptive controls in the vicinity of the steering wheel, or modifying the steering column may alter this critical relationship. It is difficult to predict the effect of such modifications on the performance of an airbag system; some conversion companies are not able to perform the necessary tests.

Other Safety Concerns

During the consultations undertaken during this phase, a variety of specific safety concerns regarding converted vehicles and automotive adaptive equipment were raised. These included:

- modifications to seat belts;
- installation of power seats;

- the integrity of brakes;
- construction, installation, reliability, and use of hand controls;
- risk of fire from reduced integrity of the fuel system;
- strength and reliability of mobility aid securement systems, especially in collisions;
- lack of standardization regarding the use of mobility aid securement systems, and lack of requisite skills/experience on behalf of individuals responsible for securing mobility aids;
- ability to safely exit a converted vehicle, especially if the side-door is blocked by a lift device (it was noted that the introduction of mini-vans with two side doors may help alleviate these concerns); and
- the overall reliability of conversions and related maintenance/servicing requirements.

Compliance with CMVSS

Given the wide variety of modifications that can be performed on a vehicle, a number of standards from CMVSS can be applicable. Depending on the standard in question and the nature of the modification performed, the impact of complying with CMVSS can range from minor to major. A detailed analysis evaluating the issue of compliance with each of the safety standards is provided in the report.

However, the issue of compliance with CMVSS must be assessed with consideration of the following points.

The need to conduct testing is dependent on the nature and extent of the modification that is made to the vehicle. In situations where the modification does not negate the original certification achieved by the original equipment manufacturer, Transport Canada is prepared to accept the certification testing performed by the first-stage manufacturer or equipment supplier.

Exemptions to specific standards do exist with respect to CMVSS. In particular, an exemption will be provided to a company if compliance with CMVSS: 1) will lead to financial hardship; 2) will impede the development of new safety or emission control features that are equivalent to or superior to those that conform to prescribed standards; and 3) will impede the development of new kinds of vehicles, vehicle systems or components.

An exemption may not be granted if the exemption would substantially diminish the safe performance of the vehicle in question or the control of emissions from it, or if the company applying for the exemption has not attempted in good faith to bring the vehicle into conformity with all prescribed standards applicable to it.

- Transport Canada is prepared to accept representative certification testing (also known as generic testing) on behalf of a group of companies, either as a consortium or under the auspices of an industry association. A representative product can be tested and the test records used by all parties, provided that evidence is available that the critical features of a company's product are identical to the test representative. NMEDA Canada currently offers this form of generic testing to its members. In addition, Transport Canada has noted that this approach to testing has proven cost-effective for some limousine and truck manufacturers.

- Transport Canada's Enforcement Branch states that they will not take action on "one-of" conversions that are not certified, if the conversion company is willing to accept that risk. In these situations, the consumer must be informed and be willing to purchase the vehicle uncertified.

Incremental Cost of Compliance with CMVSS

During the Phase I consultations, the Enforcement Branch of Transport Canada's Road Safety Directorate (unofficially) estimated that in relation to the entire second stage manufacturing industry, the cost of complying with CMVSS adds an additional $200 to $400 per vehicle. This estimate, which includes engineering and testing costs, is based on the assumptions that:

- not all conversions require dynamic testing;
- testing for compliance which takes place involving a specific vehicle can cover future conversions involving the same vehicle and set of modifications (although it must be demonstrated that modifications that are made to subsequent vehicles are safe vis-à-vis the original tests); and,
- internal expertise and body builder guides can be used to help ensure that modifications do not negate the original safety certifications (thus reducing the need for dynamic testing).

It was noted, however, by Transport Canada that many conversion companies do not know the cost of compliance. In addition, this cost does not include the costs borne by the original manufacturer of the vehicle in certifying the vehicle (e.g., design and testing costs). These costs would be included in the base price of the vehicle.

Overall, it can be concluded that the incremental cost of complying with CMVSS depends on a number of factors:

- nature of the conversion and the related compliance requirement - depending on the nature of the modification, the cost associated with compliance can range from a simple visual verification to a fully instrumented dynamic (i.e., crash) test.

- number of vehicles modified by a conversion company - a converter's ability to absorb certification costs and distribute the cost of compliance across conversions is facilitated by a higher volume production run. In general, compliance costs are higher for low production volume or highly specialized vehicle conversions.

- changes to the design of the base vehicle - after modifications to a vehicle have been designed and tested, and compliance with CMVSS demonstrated, the design and test costs can be distributed over the period where there are no significant design changes to the vehicle (i.e., the vehicle's "quiet design years"). However, when the base design of the vehicle is changed by the original manufacturer (e.g., Ford, Chrysler, GM), the modifications may require re-designing and re-testing to ensure compliance.

- availability of generic test results - NMEDA (Canada) provides test results for certain types of modifications to specific types of vehicles; these results can be used by a converter as a substitute to conducting their own testing, significantly reducing certification costs.

- availability of base vehicles which facilitate conversions - General Motors is introducing vans and mini-vans that accommodate modifications such as the installation of lifts and ramps. It is anticipated that these vehicles will be easier and less costly to modify.

- availability of build guides and conversion kits that allow converters to pass through the original safety certification obtained by the OEM.

- the additional design and fabrication effort required to ensure the modification complies with CMVSS.

- the technical expertise of the converter.

- the extent to which testing and examination are required to verify that the modification complies with the CMVSS (only to the extent that the converter chooses to invalidate the original OEM certification).

In addition, there are a number of methods of mitigating the cost of conversion, including the cost of complying with CMVSS. These methods include generic testing as noted above; base vehicles designed to accommodate conversion (therefore not requiring re-certification); build guides supplied by the automotive suppliers; and adoption of standard types of conversions.

However, it is impossible to know the incremental cost of conversion because of the many factors involved and the business decisions that must be made by the converter. To estimate the extent of the direct and indirect costs of conversion, it will

be necessary to understand the approach used by individual converters to attribute their costs under several conversion scenarios.

Alternative Approaches Regarding Regulation and Compliance

Regulatory methods that relate to the conversion of personal vehicles include performance standards, technical standards, and self-regulation.

Performance standards (combined with self-certification) reflect the current approach to regulating vehicle safety. Performance standards set out the results or objectives that must be achieved by a certain product. As an example, a standard may set a test of strength or some other objective performance feature for a product. Performance standards do not specify exactly what a supplier must do to comply with the standards (e.g., what technology must be used). In this sense, the supplier must still meet a target, but can choose the method.

Among the advantages of performance standards are: they can lower the risk of product failure; they may substantially reduce the amount of information and evaluation required in making a purchase decision (compensating for inequality in the information available to buyers as compared to sellers); they can produce more results-oriented policy than design (or technical) standards; and they can provide incentives for innovation (manufacturers benefit from finding less expensive methods of achieving compliance).

One disadvantage of performance standards is that they can impede innovation and the entry of new suppliers into the marketplace if methods required to demonstrate required performance levels are too demanding (e.g., in terms of cost) for some companies in an industry. However, this disadvantage must be seen in light of the reduced risk of product failure that can be achieved by these standards.

The U.S. Approach

In the U.S., the National Highway Traffic Safety Administration (NHTSA) is authorized to issue Federal Motor Vehicle Safety Standards (FMVSS) that set performance requirements for new motor vehicles and items of motor vehicle equipment. Manufacturers of new vehicles are required by the National Traffic and Motor Vehicle Safety Act (Safety Act) to certify that their products conform to the safety standards before they can be offered for sale.

Companies that undertake conversions must also certify that their product complies with the regulations of the Safety Act (if the conversion(s) are done prior to the first consumer purchase). Companies undertaking conversions after a vehicle has been purchased by an individual are not required to certify that the vehicle complies with the Safety Act (i.e., the FMVSS regulations do not apply to "used" vehicles).

However, manufacturers, distributors, dealers, and repair businesses modifying certified vehicles are prohibited from knowingly rendering inoperative any elements of design installed on a vehicle in compliance with a FMVSS (known as the "make inoperative" prohibition). To make inoperative is defined as making the safety situation for the vehicle occupant worse than it was in the certified vehicle.

NHTSA has exercised discretion in enforcing this prohibition to provide some allowances to businesses which cannot conform to the FMVSS requirements when making modification to accommodate persons with disabilities. In certain situations where a vehicle must be modified to accommodate the needs of a particular disability, NHTSA has been willing to consider any violation of FMVSS related to the "making inoperative" clause a purely technical one justified by public need, and has indicated in certain cases that it would not institute enforcement proceedings against the converter for violating the Safety Act.

While NHTSA notes that it will not commence enforcement proceedings, it does advise modifiers that:

- only necessary modifications should be made to the vehicle component;
- the person making the modifications should consider the possible safety consequences of the modifications;
- the converter should consult with the manufacturer to determine the effect of the modification and how the modification can be safely performed; and
- if the vehicle is sold, NHTSA encourages the owner to advise the purchaser of the modifications.

NMEDA-U.S. and Industry Self-Regulation

The U.S.-based NMEDA has recently developed a Quality Assurance Program (QAP) for conversion companies, representing a regulatory approach involving industry self-certification/self-regulation. To be certified under NMEDA's QAP, individual conversion companies must:

- follow specific guidelines when performing modifications. These guidelines include certain FMVSS standards and SAE recommended practices;
- have a certified automotive welder on staff;
- have an individual on staff who is trained and certified in dealing with assistive components for vehicles (e.g., lift systems, securement systems);
- have a knowledgeable person on staff responsible for quality control;
- agree to a review of payroll information to verify that the individuals identified as being certified are in fact involved in vehicle modifications;
- have a minimum of one million dollars product liability insurance;

- agree to two mandatory site inspections each year (either announced or unannounced) where the company's facilities and products are inspected by an independent engineering firm (the first site visit was undertaken in March of 1997).

The annual cost of being certified under the QAP is $1 300 (U.S.), including $300 for an annual registration/self-certification fee, and $500 for the two annual site inspections. Costs must also be incurred for the certification of staff.

One benefit of being certified under the QAP is demonstrated by the fact that (currently) seven states will only purchase and/or fund modified vehicles from companies certified under the QAP. In a related effort to strengthen the QAP status, NMEDA-U.S., in conjunction with NHTSA, are attempting to have the U.S. Veterans Affairs only purchase and/or fund modified vehicles from QAP-member companies.

Each vehicle modified by a QAP certified company will include a registration card indicating the type of vehicle and nature of the modifications performed. To be completed and mailed to NMEDA by the consumer, NMEDA-U.S. anticipates that this will allow more accurate tracking of the number and types of conversions being performed in the U.S.

Approaches taken in Europe, the U.K, and France

For original vehicles, design and build standards, including safety standards, have been set by the European Commission and the Regulations of the United Nations Economic Council for Europe (ECE). These standards have been enacted by member countries, including the U.K. In Europe, under the auspices of the Directorate-General for Transport of the European Commission, efforts are also being made to develop a code of practice to evaluate the performance of converted vehicles.

A converter can make modifications to a vehicle, but cannot deliberately breach the safety and crashworthiness of the vehicle. Certification of the vehicle's safety does not involve crash testing; rather, in all European countries (except the U.K.) certification is based on engineering inspections. In the U.K. inspections are not performed; certification of safety is based on the internal judgement of the conversion company. Converters are advised that if a legal dispute arises, they must be able to demonstrate that they made a reasonable and conscientious effort to work within conformity of the design and build regulations.

A publication for converters entitled "Guidelines on the Adaptation of Car Controls for Disabled People" has been produced in the U.K., as a joint initiative of the Institution of Mechanical Engineers and the Transport and Road Research laboratory. As the publication notes, "the guidelines are intended to collect

information on good practice in a form that can be used easily by those directly concerned with the conversion of vehicles for disabled people".

Ongoing attempts are being made to organize converters (in both the U.K. and Europe) and bring about agreement on quality guidelines (reflecting ISO 9000 standards regarding quality) for conversions. This effort is aimed at both improving the overall quality of the conversions which are conducted, and protecting converters against liability.

In France, the Ministry of Transport has approved the driving of a vehicle from a wheelchair, but no safety measures such as occupant restraint and wheelchair securement have been mandated.

As the result of an R&D initiative, there now exists an optional modification of a Renault Espace which allows a tetraplegic person (or a person with equivalent limitations) to enter the vehicle with a lift, proceed to the driver's position, and drive with a joystick (other driver controls are voice activated). The present regulation stipulates that a passenger must be seated next to the driver and have direct access to the hand brake in case of an emergency.

Risk Assessment

During the preliminary interviews with the users of converted vehicles, several perspectives were given regarding the safety of these vehicles. On the one hand, it was noted that persons with disabilities would be prepared to accept a greater amount of personal risk if they could obtain increased independence through access to converted vehicles at lower cost. However, other users stated that they expected the same degree of safety in their vehicles as they would in a vehicle that had not been converted. At this time, due to the small number of interviews conducted, it is not possible to know how broadly these two perspectives are held.

Outstanding Information Requirements

There is a very strong need for more detailed information on the conversion industry (i.e., the supply of converted vehicles), users of converted vehicles (i.e., the demand for converted vehicles), and collision involvement.

The Supply of Converted Vehicles

The following detailed information requirements exist, which could be addressed through more in-depth consultations with companies in the conversion industry:

- conversion industry details, such as:
  - size of companies (e.g., in terms of number of vehicles converted)

  - source of customers (e.g., referrals through prescribers/driver rehabilitation specialists)
  - knowledge concerning customer financing
  - conversions of new versus used vehicles
  - conversions based on completed versus incomplete vehicles
  - imports of converted vehicles from the U.S.;

- estimates of annual motor vehicle conversions and total number of converted vehicles in use (to calibrate estimates obtained during Phase I);

- number of the various types of conversions performed, including number of conversions for:
  - individuals driving from a mobility aid
  - individuals who use a mobility aid, but drive from the original driver's seat
  - individuals who use a mobility aid and travel as passengers;

- number of individuals who have not purchased a converted vehicle within the last three years but have inquired about converted vehicles (i.e., latent demand);

- trends regarding the use of, and demand for, converted vehicles;

- estimates and/or insights into collisions involving converted vehicles;

- views of conversion companies regarding the role of OEMs, including vehicle manufacturers and equipment manufacturers, and existing support provided by OEMs;

- extent of in-house technical capability/capacity available to address CMVSS requirements, and the degree to which compliance with CMVSS (including cost) is preventing conversion companies from performing certain categories/types of conversions (limiting innovation) and the impact compliance has in terms of availability of converted vehicles for persons with disabilities. This would also include the extent to which conversion companies make use of generic test results (e.g., from NMEDA) for compliance purposes;

- use of body builder guides, and other related information (e.g., recommended practices of the SAE);

- views regarding alternative regulatory approaches to CMVSS, such as the status quo, industry self-regulation, technical standards, and the potential impact of these alternatives in terms of risk versus safety for both users of converted vehicles and other road users.

The Demand for Converted Vehicles

In order to determine the demand, consultations with those using converted vehicles and those wishing to, the following questions/issues would be addressed:

- how individuals obtained their vehicle (e.g., financing, use of a driver rehabilitation specialist for prescription purposes and driver assessment);
- usage and travel patterns;
- collision experience;
- maintenance/service requirements;
- perceptions regarding the trade-off between the safety and cost of the vehicle;
- extent to which individuals purchasing converted vehicles are eligible for financial assistance and the degree to which a lack of financing is a barrier to purchasing a converted vehicle; and
- perceptions regarding the safety of conversions and other issues (e.g., vehicle and equipment maintenance/service).

For those who need a converted vehicle but have not purchased one, the questions/issues would include:

- reasons for not purchasing a vehicle (cost barrier, severity/nature of disability);
- extent to which the cost barrier is related to compliance with CMVSS; and
- perceptions regarding the trade-off between the safety of vehicle and cost of the vehicle.

Collision

Although collision data is a key information requirement, based on the findings of Phase I, it is not anticipated that reliable statistics would be collected during Phase III of the study. However, anecdotal insights into converted vehicles and collisions could be probed in consultations with industry representatives and users. In addition, possible actions for collecting collision data (e.g., suggesting that converted vehicles be identified in future collisions as part of a special study) could be discussed with the larger provinces (British Columbia, Alberta, Ontario, and Quebec) in order to determine their feasibility, and suggesting actions for future consideration by Transport Canada and provincial governments.

Proposed Approach for Phase III

The following approach is proposed to address the key information requirements related to the conversion industry and users; it consists of seven integrated tasks.

Task 1 would consist of consultations with rehabilitation centres (in particular driver assessment centres). The objective of consulting with driver assessment

centres would be to collect information on the demand (including latent demand) for converted vehicles, particularly demand from persons who remain in their mobility aid when driving. In addition, insights into collisions involving converted vehicles and the issue of access to conversion services, would be addressed. Driver assessment centres would also be asked to assist in identifying commonly used converters (who would be contacted during Task 2) and potential interviewees for the consultations with users.

Task 2 would involve consultations with vehicle conversion companies, and **Task 3** would include an assessment of body builder guides, generic converted-vehicle test information, assistance provided by suppliers of adaptive equipment (e.g., six-way power seats), and standards information. The objective of these tasks would be the development of a profile of the vehicle conversion industry, including an assessment of the capacity of conversion companies to address CMVSS requirements. This would be important in determining the degree to which compliance with CMVSS (including cost) is preventing conversion companies from performing certain categories/types of conversions, and the subsequent impact this has in terms of cost of converted vehicles (or types of conversions) for persons with disabilities.

These industry-related tasks would be followed by **Task 4**, which entails consultations with individuals who could potentially use a converted vehicle. For those people using converted vehicles, the consultations would address demand and user characteristics such as travel patterns; collision experience; barriers to, and assistance for, purchasing converted vehicles; and perceptions regarding safety, including the trade-off between safety and cost. For those people not currently using a converted vehicle, the consultations would address reasons for not purchasing a converted vehicle (e.g., barriers, severity/nature of disability) and perceptions regarding the trade-off between vehicle safety and cost.

The proposed approach to consulting with persons with disabilities would involve a combination of a mail-out, mail-back (MOMB) survey (with a target completion rate of 400 responses), and 100 telephone-based interviews. The MOMB survey will allow for comments from a broad group of respondents, while the telephone interviews will allow for more in-depth and targeted responses.

An optional task would be consultations with groups representing persons with disabilities. Consultations could be undertaken with ten groups such as the Muscular Dystrophy Association of Canada, Multiple Sclerosis Society of Canada, and the March of Dimes. The focus of these consultations would be to ascertain views on the use, safety, and cost of vehicles converted for use by persons with disabilities represented by these organizations.

Another option could be conducting focus groups to discuss the key findings of the surveys. This would allow in-depth discussion of the findings in order to improve

and refine the conclusions and recommendations resulting from the broader surveys.

The first four tasks represent the data collection component of the proposed approach. These tasks would be followed by analysis **(Task 5)**, and briefing sessions to regulatory authorities of Transport Canada and to the Project Advisory Committee **(Task 6)**. The objective of the briefing sessions would be to disseminate the key research findings and possible approaches to regulating the conversion industry, to Transport Canada staff and members of the advisory committee.

Task 7 would involve the preparation of draft and final reports. The final report would include a summary of the key observations captured during the briefing session.

Other Suggested Actions

During the research conducted in Phase I, the following action items were identified for possible implementation by Transport Canada,

- capture collision data through police reports or special studies;
- develop a communications strategy targeted at consumers and the conversion industry;
- continue to encourage OEM assistance and advice to conversion companies;
- systematically capture feedback from consumers in the future; and
- re-evaluate policy with respect to converted vehicles (when more comprehensive information is available from Phase III and/or the action items suggested above).

Sommaire

Transports Canada a passé un contrat avec Goss Gilroy Inc., en association avec T E S Limited, pour l'étude de la conversion des véhicules adaptés à l'usage particulier des personnes à mobilité réduite au Canada.

À l'heure actuelle, on manque de données sur la demande de véhicules privés adaptés à l'usage des personnes à mobilité réduite, sur l'offre de ce type de véhicule et sur des questions comme leur implication dans des collisions. Transports Canada, par suite de consultations avec son Comité consultatif sur le transport accessible (CCTA), a décidé d'entreprendre une telle étude, de réunir de l'information sur divers sujets reliés à la conversion des véhicules, et de cerner et documenter d'éventuelles solutions de rechange à l'obligation actuelle de se conformer aux Normes de sécurité des véhicules automobiles du Canada (NSVAC).

L'étude a été répartie en trois phases. Les deux premières phases avaient pour objectif de fournir un aperçu de l'information existante en se fondant sur la documentation et sur les bases de données couramment disponibles, et de définir une stratégie pour combler les trous dans cette information. Ces deux phases n'avaient pas pour but de trouver des solutions de rechange aux lignes directrices en vigueur, ni de fournir des recommandations concernant la politique. Les deux premières phases sont définies comme suit :

- La phase 1 comportait la collecte de données préliminaires afin de vérifier s'il est possible de colliger de l'information sur des questions comme l'utilisation, la sécurité et le coût des véhicules privés adaptés à l'usage par des personnes à mobilité réduite, et d'évaluer cette information. Était également comprise la définition des besoins en information et de la méthodologie préliminaire. Cette première phase a comporté une recherche documentaire ainsi que des consultations avec des acteurs sélectionnés dans le domaine. Des contacts ont été établis avec divers groupes d'acteurs (entre autres les gouvernements fédéral et provinciaux, des personnes à mobilité réduite, l'industrie de la conversion (y compris des entreprises spécialisées dans la conversion et des centres d'évaluation des conducteurs), des constructeurs automobiles, des assureurs, des moniteurs de conduite automobile et des représentants de gouvernements étrangers qui ont adopté des règlements sur les véhicules personnels (véhicules convertis y compris). Trente (30) consultations avaient été initialement prévues pour la phase I et l'étude a permis de rejoindre un total de 52 personnes.

- La phase II supposait une définition plus détaillée des besoins d'information ainsi que leur ordonnancement par ordre de priorité. On y décrivait en outre les méthodes à employer pour satisfaire à ces besoins.

Les résultats des deux premières phases ont été documentés dans un rapport d'étude et présentés au Comité consultatif du projet. Sous réserve des décisions du Comité, une troisième phase pourrait être mise en oeuvre afin de colliger les données requises pour suppléer aux besoins non comblés d'information.

On trouvera ci-après un résumé des conclusions de la phase I et de la phase II; leur lecture permettra de se rendre compte qu'il s'agit de résumés d'informations facilement accessibles, mais contenant des trous. Par exemple, l'information sur les entreprises de conversion et sur les besoins des utilisateurs de ce type de véhicule est préliminaire seulement; une troisième phase supposerait davantage d'efforts pour colliger l'information prescrite dans l'Énoncé des travaux.

Résumé des conclusions de la phase I

L'industrie de la conversion des véhicules automobiles

Une fois la construction du véhicule de base terminée par l'entreprise de premier niveau, notamment le constructeur (p. ex. Ford, Chrysler, General Motors), le véhicule est confié à une entreprise de deuxième niveau (entreprise de conversion) qui lui intégrera les modifications requises pour qu'il réponde à certains besoins. Les limousines, les ambulances, les engins d'incendie, les autocaravanes, les camions, les taxis pour personnes à mobilité réduite, certaines fourgonnettes de livraison et les véhicules privés convertis à l'usage par des personnes à mobilité réduite sont aussi des véhicules adaptés ou transformés. Selon des évaluations officieuses de Transports Canada, un véhicule en service sur sept au Canada a été adapté d'une certaine manière.

L'industrie de la conversion est composée de diverses organisations, entre autres :

- des fabricants de tailles petite et moyenne qui réalisent des conversions de véhicules destinés principalement à un usage commercial, mais aussi à un usage privé (mini-fourgonnettes, fourgonnettes ordinaires, camions légers et automobiles);
- des concessionnaires, des distributeurs et des importateurs de véhicules adaptés;
- des entreprises de fournitures médicales durables (p. ex. des compagnies spécialisées dans les aides à la mobilité comme les fauteuils roulants, les aides à la conduite automobile comme les commandes manuelles, et les dispositifs comme les systèmes d'arrimage d'aides à la mobilité;
- des entreprises spécialisées dans l'installation et la réparation d'équipement (p. ex. élévateurs).

Deux organisations (l'Association canadienne des paraplégiques et la Direction de l'application des règlements de la Direction générale de la sécurité routière, de Transports Canada) ont fourni des listes d'entreprises de conversion.

La liste de Transports Canada (continuellement mise à jour) recense 125 entreprises, dont certaines exercent leurs activités à plusieurs endroits. De ce nombre, 11 effectuent des modifications majeures sur les fourgonnettes (mini-fourgonnettes et fourgonnettes ordinaires). Les autres, soit 114 entreprises, sont des vendeurs et des distributeurs de produits des autres entreprises de conversion, des entreprises actives dans l'installation et la réparation d'équipement, ainsi que des entreprises qui font surtout la conversion de véhicules autres que les véhicules privés (p. ex. les autobus de format normal et intermédiaire) et de véhicules de loisirs, mais qui peuvent entreprendre la conversion de véhicules à usage personnel.

Les entreprises qui figurent sur la liste de Transports Canada comprennent celles autorisées par Transports Canada à utiliser la Marque nationale de sécurité et les importateurs qui ont la capacité de certifier des véhicules automobiles aux termes de la Federal Motor Vehicle Safety Act (FMVSA) des États-Unis. La liste renferme également des entreprises qui n'ont pas de capacité de modifier des véhicules automobiles neufs, mais qui peuvent agir en qualité de revendeurs pour le compte d'entreprises de certification. Cette liste n'est ni exclusive, ni exhaustive.

La Direction de l'application des règlements de la Direction générale de la sécurité routière, de Transports Canada, est à mettre à niveau un système informatisé qui l'aidera à établir le profil des entreprises actives dans la modification de véhicules, y compris les véhicules destinés à l'utilisation par des personnes à mobilité réduite. Ce système comprendra des indicateurs principaux comme le statut de l'entreprise quant à l'utilisation de la Marque nationale de sécurité.

La liste fournie par l'Association nationale des paraplégiques est composée de 78 entreprises de conversion de véhicules, dont 76 figurent aussi sur la liste de Transports Canada (les deux autres sont des entreprises de conversion non inscrites sur la liste de Transports Canada). L'Association estime que du nombre d'entreprises qui composent sa liste, environ 30 sont actives dans un type quelconque de conversion de véhicules pour les personnes à mobilité réduite, les autres se consacrant à l'installation et à la réparation d'équipement (p. ex. des élévateurs et des commandes manuelles) ou agissant en qualité de représentant des vendeurs.

Les 50 entreprises absentes de la liste de l'Association canadienne des paraplégiques mais qui sont sur la liste de Transports Canada comptent : 25 entreprises qui effectuent des modifications, qui agissent à titre de vendeurs et de distributeurs pour les autres entreprises de conversion et qui installent et réparent de l'équipement; 17 entreprises qui importent, modifient et/ou fabriquent des autobus; 8 entreprises qui modifient des véhicules de loisirs (et font la modification de toits pour les entreprises de conversion de véhicules adaptés).

Des spécialistes en réadaptation des conducteurs interviennent également dans le processus d'obtention d'un véhicule adapté, en fournissant des évaluations des conducteurs et/ou des conseils concernant le matériel spécialisé requis pour une personne ayant une incapacité l'empêchant de conduire un véhicule ou d'y prendre place comme simple passager. Durant la phase I, on a recensé au Canada 39 organisations qui fournissaient des services d'évaluation des conducteurs.

Les clients des spécialistes en réadaptation des conducteurs ont besoin d'un véhicule adapté pour se déplacer comme passager ou comme conducteur (qu'ils aient ou non une expérience de la conduite). Sauf dans la province de Québec, toute personne peut se procurer un véhicule adapté en s'adressant directement à une entreprise de conversion puisque rien ne l'oblige à consulter d'abord un spécialiste en réadaptation. Mais, certaines entreprises de conversion exigent une prescription d'un spécialiste en réadaptation avant de modifier un véhicule pour un client potentiel. Au Québec, il faut, en vertu de la loi, obtenir une évaluation d'un spécialiste en réadaptation des conducteurs avant de faire modifier un véhicule.

L'évaluation du conducteur porte habituellement sur la vision, la liberté de mouvement (p. ex. des mains, du cou et du dos) de même que sur les capacités cognitives nécessaires à la conduite d'un véhicule. De plus, l'évaluation comporte généralement un essai sur route. Suivant les résultats de l'évaluation, l'examinateur recommande ou non que la personne soit autorisée à conduire un véhicule. Si l'autorisation est accordée, l'examinateur indique les modifications ou les équipements requis.

Conversions annuelles et globales

Différentes sources dont l'Association canadienne des paraplégiques, la National Mobility Equipment Dealers Association of Canada (NMEDA), une entreprise de conversion et des spécialistes en réadaptation des conducteurs ont communiqué des données estimatives sur le nombre de véhicules transformés par année. D'après ces données, on recense par année jusqu'à 600 conversions comportant des modifications au véhicule proprement dit. Aux États-Unis, selon un rapport publié par le Transportation Rehabilitation Engineering Centre de la University of Virginia, environ 7 000 véhicules privés sont modifiés par année, dont 1 000 à 2 000 pour des conducteurs qui utilisent leur aide à la mobilité comme siège.

Types de conversions

La conversion de véhicules privés à l'usage des personnes à mobilité réduite peut comporter un grand nombre de modifications, pouvant aller de l'intervention mineure aux transformations d'envergure. Les composants et les systèmes ci-après sont autant d'éléments qui peuvent être touchés par les transformations :

- commandes de conduite des groupes A et B (p. ex. commande des gaz/accélérateur, système de direction, freins, contact de démarrage, sélecteur de vitesse, frein de stationnement, essuie-glaces et lave-glace, désembueur de pare-brise, rétroviseurs, clignotants);
- commandes d'accessoires (p. ex. buses de ventilation, climatiseur, réglage des sièges, verrouillage des portes, pare-soleil);
- circuit électrique du véhicule (p. ex. câblage, démarrage, batterie);
- châssis, suspension et carrosserie (p. ex. bâti, caisse, portes, plancher, toit, sièges, fenêtres);
- moteur (p. ex. refroidissement, gestion du moteur);
- transmission (p. ex. embrayage, boîte de vitesses, essieux);
- système carburant (p. ex. canalisations carburant, réservoir);
- systèmes de sécurité (p. ex. systèmes de protection des occupants, coussins gonflables, ceinture de sécurité);
- systèmes d'arrimage des aides à la mobilité et de retenue de l'occupant, systèmes de rangement des aides à la mobilité, dispositifs de levage/élévateurs de l'aide à la mobilité et de l'occupant.

Le type de modification effectuée peut s'entendre de modifications standard ou de modifications spéciales, selon la nature et la gravité de l'incapacité du conducteur/passager, les caractéristiques physiques de la personne (p. ex. la taille), le type de véhicule (mini-fourgonnette ou fourgonnette de taille normale), l'équipement que l'on veut installer et les moyens financiers dont la personne dispose.

Il se peut que le véhicule doive respecter les exigences des NSVAC, selon la nature des modifications apportées. L'entreprise de conversion pourra également volontairement choisir de satisfaire aux pratiques recommandées de la Society of Automotive Engineers (SAE) et/ou aux normes de l'Association canadienne de normalisation (CSA).

Pour ce qui est des personnes utilisant une aide à la mobilité, on trouvera ci-après des exemples de scénarios illustrant le lien entre, d'une part, la nature et la gravité de l'incapacité de la personne et, d'autre part, la nature et l'importance des modifications à effectuer. Il importe de souligner que les énoncés ci-après sont des exemples seulement et que les modifications peuvent varier en fonction des besoins particuliers de chacun.

- Les utilisateurs de fauteuils roulants non motorisés ayant la force requise dans le haut du corps pour entrer eux-mêmes, seuls ou avec leur aide à la mobilité, dans un véhicule peuvent ne nécessiter qu'un minimum d'équipement spécialisé pour conduire leur véhicule (habituellement une automobile). Cet équipement spécialisé pourrait comprendre des commandes manuelles utilisées de pair avec des dispositifs de direction. Dans une telle situation, ils seraient en mesure de

passer eux-mêmes de leur aide à la mobilité à la place du conducteur et de placer leur aide à la mobilité sur le siège arrière du véhicule. Il existe également des dispositifs qui permettent de ranger l'aide à la mobilité sur le toit du véhicule.

- Les utilisateurs d'aide à la mobilité qui ne possèdent pas la force nécessaire dans le haut du corps pour passer eux-mêmes dans le véhicule et/ou ranger leur aide à la mobilité dans le véhicule auront besoin d'un élévateur ou d'une rampe pour monter dans le véhicule (l'installation d'une rampe ou d'un élévateur suppose l'utilisation d'un véhicule de type fourgonnette). Dans la plupart des cas, des modifications devront être apportées au toit ou au plancher pour assurer la hauteur libre requise lorsque la personne est assise dans son fauteuil roulant.

  Si la personne s'assoit dans le siège du conducteur ou dans un siège passager, on pourra installer une base de siège électrique, ce type de base facilitant le passage de l'aide à la mobilité au siège conducteur/passager. Pour les personnes à mobilité réduite qui conduisent leur véhicule, il faudra prévoir des commandes manuelles (utilisées conjointement avec des dispositifs de direction). Si la personne occupe une place de passager seulement et si elle reste assise dans son aide à la mobilité, on devra installer un système d'arrimage spécial.

- Dans le cas des personnes à mobilité réduite qui ne peuvent passer elles-mêmes de l'aide à la mobilité au siège du conducteur et qui doivent par conséquent conduire depuis leur fauteuil roulant, l'intervention consistera à retirer le siège du conducteur et à modifier la structure même du véhicule (p. ex. abaisser le plancher et/ou relever le toit), afin que la hauteur libre soit suffisamment élevée pour que la personne puisse conduire assise dans son aide à la mobilité. Les modifications supposent également l'installation d'un système d'arrimage de l'aide à la mobilité (si la personne conduit, on utilise habituellement un système motorisé; si elle est passager, le système est manuel). Pour la conduite proprement dite, des commandes manuelles doivent être installées (à utiliser avec des dispositifs de direction).

Utilisateurs de véhicules adaptés

Aucune des organisations contactées durant la phase I n'a été en mesure d'indiquer le nombre de personnes qui utilisent couramment un véhicule adapté. Or, des données provenant de l'Enquête sur la santé et les limitations d'activités fournissent un indice de l'utilisation d'équipements spécialisés sans toutefois donner le nombre de véhicules adaptés. En combinant les données relatives à l'utilisation d'un scooter ou d'un fauteuil roulant (aide à la mobilité) et d'équipements spécialisés, on a calculé le nombre approximatif de véhicules adaptés. Selon les données de l'enquête, environ 31 000 personnes à mobilité réduite utilisaient une aide à la mobilité ainsi que de l'équipement spécialisé, autant à titre de conducteur que de passager (1991). L'équipement spécialisé pour l'automobile comprend les commandes manuelles, les

commandes de frein, des mains courantes, des sangles, des poignées spéciales, des rampes, des élévateurs, des espaces pour le fauteuil roulant ainsi que tout autre matériel spécialisé (y compris des espaces de rangement).

D'après les prévisions démographiques de Statistique Canada (projections de croissance moyenne), le nombre de personnes qui utilisent une aide à la mobilité et de l'équipement spécialisé pour se déplacer en véhicule privé passera de 31 000 qu'il était en 1991 à 49 000 en 2015.

Conversions de véhicules automobiles - Coût et subventions

Comme on a pu l'observer plus haut, les conversions varient en nature et en importance, s'agissant de transformations mineures comme l'installation de commandes manuelles mécaniques, de transformations moyennes conçues pour donner davantage d'accessibilité aux places passager et de transformations complexes, sur mesure, qui permettent de conduire le véhicule depuis une aide à la mobilité, au moyen de commandes spécialisées. En général, le coût de la conversion est directement fonction de facteurs comme :

- la nature et la gravité de l'incapacité;
- l'usage principal du véhicule (p. ex. la personne est conducteur ou passager);
- la complexité et le nombre des modifications requises pour adapter le véhicule en fonction de la nature et de la gravité de l'incapacité et l'usage prévu du véhicule;
- le type de construction du véhicule (p. ex., construction monocoque ou châssis carrossé).

Suivant la nature des transformations, la conversion peut coûter 1 000 $ ou moins pour les commandes manuelles et elle peut atteindre 15 000 $ et plus s'il s'agit de transformations majeures sur mini-fourgonnette (p. ex. abaissement du plancher, installation de commandes électroniques).

Pour financer le coût de la conversion, les personnes à mobilité réduite utilisent généralement leurs propres ressources (y compris le recours à un emprunt de la banque) et/ou une aide financière de diverses sources comme les commissions provinciales de santé et sécurité au travail, les programmes provinciaux de réadaptation professionnelle, les organismes locaux de services, les associations de personnes à mobilité réduite et l'assurance automobile. Les trois grands constructeurs nord-américains (Ford, Chrysler, General Motors) ont aussi des programmes de remise du coût des modifications apportées aux véhicules neufs. À l'exception de l'assurance automobile, les programmes d'aide couvrent habituellement seulement les conversions, le coût du véhicule de base étant à la charge de la personne.

Bien qu'il existe plusieurs sources d'aide, les entreprises de conversion et les spécialistes en réadaptation des conducteurs contactés durant la phase I estiment généralement qu'un bon nombre des personnes qui achètent des véhicules adaptés en assurent elles-mêmes le financement.

Dans son budget de février 1997, le ministère fédéral des Finances a annoncé un élargissement du crédit d'impôt pour frais médicaux, ce crédit couvrant désormais 20 % (jusqu'à concurrence de 5 000 $) du coût d'acquisition d'une fourgonnette adaptée (ou qui le sera dans les six mois) pour le transport d'une personne faisant usage d'une aide à la mobilité.

Véhicules adaptés et collisions

On déplore le manque d'informations nationales fiables sur les collisions impliquant des véhicules adaptés à l'usage de personnes à mobilité réduite au Canada (p. ex. le nombre de collisions impliquant un véhicule adapté, le rôle de la conversion dans la collision et dans la gravité de la collision).

Le Groupe d'enquête sur les défauts de la Direction générale de la sécurité routière de Transports Canada s'est penché sur les collisions impliquant un véhicule adapté à l'usage de personnes à mobilité réduite. Ces collisions mettaient en cause les systèmes de retenue de l'occupant, les volants de direction modifiés et l'utilisation du fauteuil roulant comme siège de conducteur. Dans un cas récent, on a observé la défectuosité d'un système de retenue qui avait été modifié, situation qui a donné lieu à l'émission d'un avis de rappel. La base de données de Transports Canada sur les rappels de véhicules indique que 14 systèmes de retenue ont été rappelés puis inspectés; quatre de ces systèmes présentaient des coutures défectueuses. Tous les systèmes défectueux ont été remplacés par la suite.

Dans le cadre du projet, on a communiqué avec la Société d'assurance automobile du Québec (SAAQ) pour obtenir des détails sur les collisions et sur les véhicules adaptés à l'usage des personnes à mobilité réduite. Une analyse spécifique des données révèle, selon la SAAQ, qu'entre 1994 et 1996 il s'est produit en moyenne, par année, 132 collisions mettant en cause des conducteurs dont le permis de conduire était assorti d'une restriction (restrictions comportant l'obligation de l'un des équipements ci-après : pédale d'accélération pour le pied gauche, commandes manuelles, commandes de conduite pour personnes ayant une incapacité ou système de retenue de sécurité). En tout, 2 409 personnes sont titulaires d'un permis de conduire avec restriction. Le taux de collision chez les conducteurs qui ont un permis restreint est d'environ 5,5 % contre environ 7 % chez l'ensemble des conducteurs. Néanmoins, ces chiffres n'ont pas été corrigés pour tenir compte de l'exposition au risque en fonction de la distance parcoure (p. ex., plus un véhicule roule, plus il risque d'être impliqué dans une collision).

De plus, les croisements des données de la SAAQ ne permettent pas de déterminer si les modifications touchent à la structure du véhicule. Un examen des observations consignées dans la section Commentaires des dossiers pertinents d'accidents permettrait de tirer d'autres conclusions sur la collision et, probablement, sur les caractéristiques du véhicule, mais rien ne permet de croire que ce type d'information a été fourni par l'auteur du rapport. On observerait une situation similaire si d'autres provinces fournissaient des données de collisions impliquant des conducteurs avec permis restreint.

Des discussions avec plusieurs ministères provinciaux des transports, la Police provinciale de l'Ontario, l'Insurance Corporation of British-Columbia (ICBC), la Société d'assurance publique du Manitoba, la Saskatchewan Government Insurance, des compagnies d'assurance privées et le Centre d'information sur les véhicules du Canada révèlent que ces organisations n'ont pas de données sur les collisions impliquant des véhicules adaptés à l'usage de personnes à mobilité réduite.

Le Bureau d'assurance du Canada (BAC) ne tient pas non plus de relevé des incidents mettant en cause ces types de véhicules. Selon le BAC, les véhicules adaptés représentent un segment très faible du parc de véhicules et les collisions impliquant des véhicules de ce type n'ont pas été source de préoccupation dans le passé.

Aux États-Unis, la National Highway Traffic Safety Administration (NHTSA), grâce à son National Accident Sampling System (NASS), a étudié 5 070 collisions en 1995, dont 13 (0,26 %) mettaient en situation un véhicule muni d'équipement spécialisé (particulièrement des commandes manuelles, des commandes de direction, et/ou des mécanismes de servo-direction nécessitant peu d'effort). Sur la base seule des paramètres servant à décrire l'intérieur du véhicule, ces chiffres n'indiquent pas si la structure du véhicule a subi des modifications. Les données de la NASS pour toute l'année 1996 n'ont pas encore été publiées; cependant, aucune collision avec véhicule adapté n'a été signalée durant les six premiers mois de 1996.

Des discussions avec un représentant du ministère des Transports du Royaume-Uni ont permis de constater qu'il n'existe là-bas aucune statistique officielle sur les collisions de véhicules privés adaptés, ni dans d'autres pays d'Europe. Néanmoins, le Banstead Mobility Centre, au Royaume-Uni, a effectivement mené une enquête sur les clients des services d'évaluation des conducteurs durant la période comprise entre 1988 et 1990. Le Centre en conclut que, d'après le nombre d'accidents signalés, les statistiques touchant les personnes ayant une incapacité physique coïncident avec les statistiques nationales du Royaume-Uni. Plus particulièrement les hommes, les conducteurs de moins de 30 ans et les conducteurs âgés qui utilisent des véhicules adaptés semblent plus susceptibles d'être impliqués dans une collision.

La conversion

La conception de carrosseries et de châssis automobiles est une activité complexe nécessitant un grand nombre de calculs et de simulations par ordinateur. Les équipementiers effectuent de nombreux essais et calculs durant le développement du véhicule pour s'assurer que leur matériel est conforme aux normes et aux règlements en vigueur et aux objectifs de conception.

De plus, les éléments de structure sont optimisés par les équipementiers dans leur volonté de réduire le poids et les coûts de production des véhicules sans sacrifier pour autant leur résistance. Certaines carrosseries automobiles, particulièrement les carrosseries monocoques, sont construites autour de l'habitacle, où elles assurent un rôle de cage de protection, et elles comprennent des zones d'impact à absorption d'énergie. Dans bien des cas, plusieurs systèmes sont conjugués pour assurer le niveau de protection requis par les normes en vigueur, par exemple les Normes de sécurité des véhicules automobiles du Canada (NSVAC).

Les entreprises qui font la conversion de véhicules pour l'usage des personnes à mobilité réduite doivent fréquemment intervenir sur des composants de véhicule ou sur des éléments de structure; si elles ne sont pas au courant de l'intention initiale de l'équipementier, leurs changements risquent de compromettre la sécurité du véhicule. Sous cet aspect, les conseils et l'aide des équipementiers peuvent être très utiles pour éviter que les entreprises de conversion compromettent la certification initiale du véhicule, et ils peuvent contribuer à réduire au minimum les coûts de certification après conversion.

Le châssis, la carrosserie, le système de carburant, le toit, l'élargissement des portes et les systèmes de protection des occupants sont autant de sources potentielles de problèmes lors de la modification de systèmes et de composants fournis par les équipementiers.

Coussins gonflables

Au Canada, les coussins gonflables font partie de l'équipement standard d'un très grand nombre de véhicules de promenade. L'efficacité avec laquelle les coussins peuvent limiter les blessures dépend beaucoup de la position relative de cet équipement de sécurité, de l'occupant et des éléments composant l'environnement de l'occupant à bord du véhicule. Dans un véhicule adapté, l'installation de sièges spéciaux, la pose de commandes spéciales près du volant ou la modification de la colonne de direction sont susceptibles d'altérer cette position. Il est difficile de prédire les conséquences de ces modifications sur le fonctionnement des coussins gonflables, et certaines entreprises de conversion ne sont pas en mesure de faire les essais nécessaires.

Autres facteurs influant sur la sécurité

Au cours des consultations tenues durant cette phase, beaucoup de préoccupations précises sur la sécurité ont été soulevées quant aux véhicules adaptés et à leur équipement spécialisé; entre autres :

- les modifications aux ceintures de sécurité;
- l'installation de sièges électriques;
- l'efficacité des freins;
- la construction, l'installation, la fiabilité et l'utilisation des commandes manuelles;
- le risque d'incendie causé par les modifications apportées au système de carburant;
- la résistance et la fiabilité des systèmes d'arrimage des aides à la mobilité, particulièrement en collision;
- l'absence de normes sur l'utilisation et l'arrimage des aides à la mobilité et le manque de compétence et d'expérience des personnes qui arriment les aides à la mobilité;
- la possibilité de sortir en toute sécurité d'un véhicule adapté, particulièrement si la porte latérale est bloquée par un dispositif de levage (on a fait observer que l'arrivée de mini-fourgonnettes munies de deux portes latérales coulissantes pourrait remédier à ce problème);
- la fiabilité globale des conversions et des exigences d'entretien et de réparation.

Conformité aux NSVAC

Vu le grand nombre de modifications susceptibles d'être effectuées sur un véhicule, certaines normes des NSVAC s'appliqueront; aussi, se conformer aux NSVAC peut avoir, pour une entreprise de conversion, des conséquences majeures suivant la norme à observer et suivant la nature des modifications effectuées. On trouvera dans le rapport une analyse détaillée des incidences de la conformité à chacune des normes de sécurité.

Au regard de la conformité aux NSVAC, il importe de prendre en compte les points ci-après :

- On décidera de la nécessité de soumettre le véhicule ou ses composants à des essais d'après la nature et l'ampleur des modifications. Lorsque les modifications n'annulent pas la certification initiale obtenue par l'équipementier, Transports Canada est disposé à reconnaître les essais de certification effectués par le fabricant ou le fournisseur de premier niveau.
- Des exemptions peuvent être obtenues quant à la conformité à des normes spécifiques des NSVAC. Plus particulièrement, une exemption sera accordée à l'entreprise si le fait de se conformer aux NSVAC 1) entraînera des difficultés

financières pour l'entreprise, 2) nuira au développement de nouvelles caractéristiques de sécurité ou de lutte contre la pollution qui sont équivalentes ou supérieures à celles qui sont conformes aux normes prescrites et 3) nuira au développement de nouveaux types de véhicules, de systèmes ou de composants de véhicules.

Une exemption peut être refusée si cette exemption avait pour effet de réduire de manière appréciable la sécurité du véhicule ou l'efficacité des mesures antipollution; ou si l'entreprise qui veut bénéficier d'une exemption n'a pas fait les efforts de bonne foi pour rendre le véhicule conforme aux normes applicables.

- Transports Canada est disposé à accepter des essais représentatifs (aussi appelés essais génériques) effectués au nom d'un groupe d'entreprises soit par un consortium, soit par une association de l'industrie. Un produit représentatif pourra être soumis à des essais et les dossiers de ces essais pourront être utilisés par toutes les parties, pourvu qu'il existe des preuves que les caractéristiques critiques du produit d'une entreprise sont identiques à celles mises à l'épreuve dans les essais représentatifs. La NMEDA (Canada) offre la possibilité d'essais génériques à tous ses membres. De plus, Transports Canada a fait remarquer que cette approche s'est révélée rentable pour certains fabricants de limousines et de camions.

- À la Direction de l'application des règlements, de Transports Canada, on n'interviendra pas dans le cas de conversions «uniques» non certifiées si l'entreprise est disposée à prendre le risque. Le consommateur doit être informé de telles situations et il doit consentir à acheter le véhicule non certifié.

Coût additionnel de la conformité aux NSVAC

Durant la phase I des consultations, la Direction de l'application des règlements de la Direction générale de la sécurité routière de Transports Canada a estimé (de manière officieuse) que la conformité aux NSVAC grevait le coût de chaque véhicule d'un supplément de 200 à 400 $. Pour obtenir cette estimation, qui comprend les coûts reliés aux études et aux essais, on s'est fondé sur les hypothèses ci-après :

- les conversions ne nécessitent pas toutes des essais dynamiques;
- les essais de conformité effectués pour un véhicule en particulier peuvent s'appliquer aux conversions futures du même véhicule et à des séries de modifications (bien qu'il doive être démontré que les modifications des autres véhicules par la suite sont sécuritaires selon les essais initiaux);
- on pourra se fier à la compétence de l'entreprise et aux guides préparés par les constructeurs-carrossiers pour s'assurer que les modifications n'annulent pas la certification initiale de sécurité (et par conséquent éliminent la nécessité des essais dynamiques).

Transports Canada a remarqué que beaucoup d'entreprises de conversion ignorent ce qu'il en coûte pour se conformer aux NSVAC. De plus, ce coût ne reflète pas les coûts supportés par le constructeur du véhicule pour le faire certifier (p. ex. coûts liés aux études et aux essais). Ces coûts seraient inclus dans le prix de base du véhicule.

De manière générale, il est permis de conclure que le coût de la conformité aux NSVAC dépend d'un certain nombre de facteurs :

- la nature de la conversion et l'exigence de conformité qui en découle - selon la nature de la modification, le coût supplémentaire de la conformité peut être le coût associé à une simple vérification visuelle ou celui d'un essai dynamique instrumenté (p. ex. un essai de collision);

- le nombre de véhicules modifiés par l'entreprise de conversion - la capacité de l'entreprise d'absorber les coûts de certification et de répercuter le coût de la conformité sur l'ensemble des conversions est d'autant plus grande que le volume de véhicules est important. En général, les coûts de conformité sont plus élevés si le volume de production est faible ou s'il s'agit de conversions hautement spécialisées;

- les changements par rapport au véhicule standard - une fois les modifications adoptées et soumises aux essais requis et une fois la conformité à la NSVAC démontrée, les coûts reliés aux études et aux essais peuvent être répartis sur toute la période durant laquelle aucun changement important n'est apporté au véhicule. Néanmoins, lorsque le constructeur (Ford, Chrysler ou General Motors) change le modèle du véhicule, il est possible que les modifications doivent faire l'objet de nouvelles études et de nouveaux essais pour que leur conformité soit reconduite;

- la disponibilité de résultats d'essais génériques - la NMEDA (Canada) fournit les résultats des essais de certains types de modifications effectuées sur des types particuliers de véhicules; ces résultats peuvent être utilisés par une entreprise de conversion comme substitut à ses propres essais, ce qui contribue à réduire sensiblement les coûts de conversion;

- la disponibilité de véhicules de base sur lesquels les conversions sont plus faciles - General Motors introduit sur le marché des fourgonnettes et des mini-fourgonnettes qui se prêtent bien à des modifications comme l'installation d'élévateurs et de rampes; ces véhicules devraient être plus faciles à modifier, à un moindre coût;

- la disponibilité de guides de construction et d'ensembles de conversion grâce auxquels les entreprises pourront profiter de la certification initiale de sécurité dont l'équipementier est titulaire;

- l'effort additionnel d'étude et de fabrication qui est nécessaire pour garantir que la modification est conforme aux NSVAC;

- le savoir-faire technique de l'entreprise de conversion;

- les essais et les examens requis pour vérifier que la modification est conforme à la NSVAC (seulement si l'entreprise de conversion choisit d'invalider la certification initiale de l'équipementier).

Il existe de plus un certain nombre de moyens d'atténuer le coût de la conversion, y compris le coût de conformité aux NSVAC. Ces moyens comprennent les essais génériques comme il est mentionné plus haut; l'utilisation de véhicules de base qui conviennent aux conversions (et ne nécessitent pas une nouvelle certification); des guides de construction venant des fournisseurs d'équipement automobile et l'adoption de conversions standard.

En raison des nombreux facteurs en jeu et des décisions de gestion que doit prendre l'entreprise de conversion, il demeure toutefois impossible de connaître le coût supplémentaire ajouté par la conversion. Pour évaluer l'importance des coûts directs et indirects de la conversion, il faudra étudier les méthodes que les différentes entreprises utilisent pour l'imputation de leurs coûts suivant le type de conversion.

Réglementation et conformité à la réglementation – Approches diverses

Les normes de performance, les normes techniques et l'autoréglementation/ autocertification sont autant de moyens de réglementation qui régissent la conversion des véhicules personnels.

Les normes de performance (combinées à l'autocertification) constituent aujourd'hui le moyen de réglementation de la sécurité des véhicules le plus répandu. Ces normes établissent les résultats optimaux, p. ex. une résistance d'essai ou une caractéristique de performance objective similaire, que doit atteindre un produit particulier. Elles ne précisent pas exactement ce qu'un fournisseur doit faire pour que ses produits soient conformes aux normes établies (p. ex. à quelles technologies il doit faire appel); elles définissent les objectifs à atteindre, mais laissent au fournisseur le choix de la méthode à utiliser.

Voici quelques-uns des avantages que présentent les normes de performance : possibilité de diminution des risques de défaillance du produit, possibilité de réduction substantielle du nombre de données d'information et d'évaluation

nécessaires à la prise de décision en matière d'achat (ce qui met fin aux inégalités entre acheteurs et vendeurs en ce qui a trait à l'information disponible); possibilité d'établissement de politiques beaucoup plus axées sur les résultats que ce que permettent les normes de conception ou normes techniques; incitation à l'innovation (les fabricants gagnent à trouver des méthodes moins coûteuses de fabrication et de mise en oeuvre de leurs produits, qui permettent de rendre ces derniers conformes aux exigences).

Un des désavantages de ce moyen de réglementation est qu'il est susceptible de freiner l'innovation et d'empêcher l'entrée de nouveaux fournisseurs sur le marché si les méthodes de démonstration des niveaux de performance demandés sont trop exigeantes (au chapitre des coûts, par exemple) pour certaines entreprises d'une industrie donnée. Toutefois, à ce désavantage, on peut opposer la possibilité de risques réduits de défaillance d'un produit réalisé selon des normes de performance.

L'approche américaine

Aux États-Unis, la National Highway Traffic Safety Administration (NHTSA) est autorisée à publier des normes visant la sécurité des véhicules automobiles (Federal Motor Vehicle Safety Standards - FMVSS), qui établissent les exigences de performance relatives à ce type de véhicules et aux équipements connexes. Les fabricants de nouveaux véhicules doivent, en vertu de la National Traffic and Motor Vehicle Safety Act, certifier que leurs produits sont conformes aux normes de sécurité avant de les mettre en marché.

Les entreprises spécialisées dans la conversion de véhicules doivent également certifier la conformité de leurs produits aux règlements découlant de ladite loi, si les transformations sont effectuées avant que le véhicule soit vendu une première fois. Si les transformations sont effectuées à la demande de la personne qui a acheté le véhicule, cette obligation ne tient plus (les FMVSS ne s'appliquent pas aux véhicules déjà en circulation).

Toutefois, il est interdit aux fabricants, distributeurs, concessionnaires et entreprises de réparation appelés à modifier des véhicules certifiés, de consciemment rendre inopérants des éléments ou pièces d'équipement installés sur un véhicule conforme à une FMVSS (ce qu'on appelle l'interdiction de «rendre inopérant»). «Rendre inopérant» signifie rendre le véhicule moins sécuritaire pour l'occupant qu'il ne l'était dans sa version certifiée.

La NHTSA a exercé un pouvoir discrétionnaire dans la mise en application de l'interdiction susmentionnée pour laisser un certain jeu aux entreprises qui ne peuvent se conformer aux exigences des FMVSS lorsqu'elles apportent des modifications à un véhicule pour l'adapter aux besoins d'une personne ayant une incapacité particulière. Dans certains cas, la NHTSA a consenti à considérer tout

non-respect d'une FMVSS relativement à la disposition visant l'interdiction de «rendre inopérant» comme étant une infraction de forme, justifiée par les besoins de l'utilisateur, et a indiqué qu'elle n'entreprendrait pas, le cas échéant, de procédures contre l'entreprise contrevenante.

À cet égard, la NHTSA avise cependant les entreprises spécialisées dans la conversion des véhicules :

- que seules des modifications jugées nécessaires doivent être apportées au véhicule ou à ses éléments composants;
- que la personne qui apporte les modifications doit évaluer les conséquences possibles de ces dernières sur la sûreté du véhicule;
- qu'elles doivent consulter le fabricant pour déterminer les conséquences des modifications apportées et pour savoir comment celles-ci peuvent être réalisées pour ne pas compromettre la sûreté du véhicule;
- que si le véhicule est vendu, il importe que le propriétaire fasse part des modifications à l'acheteur.

NMEDA (É-U.) et autoréglemenation de l'industrie

La NMEDA (É.-U.) a récemment élaboré un Programme d'assurance de la qualité (PAQ) à l'intention des entreprises spécialisées dans la conversion des véhicules, misant sur l'autoréglementation de l'industrie. Pour être certifiées aux termes du PAQ de la NMEDA, les entreprises doivent :

- apporter les modifications en respectant certaines lignes directrices spécifiques, en l'occurrence certaines normes FMVSS et certaines pratiques recommandées par la SAE;
- avoir à leur service un soudeur spécialisé en automobile;
- avoir à leur service une personne formée et qualifiée dans le domaine des aides techniques pour véhicules automobiles (p. ex. plates-formes élévatrices, systèmes de retenue);
- avoir à leur service une personne compétente responsable du contrôle de la qualité;
- accepter que des vérifications soient effectuées sur la liste de paye pour garantir que les employés désignés comme étant certifiés travaillent effectivement à la conversion des véhicules;
- posséder une assurance responsabilité de produits d'au moins un million de dollars;
- accepter de se soumettre à deux inspections obligatoires par année (annoncées ou non) aux cours desquelles leurs installations et leurs produits feront l'objet d'une évaluation par une firme spécialisée (la première inspection de ce genre a été effectuée en mars 1997).

Il en coûte aux entreprises 1 300 $ US annuellement pour être certifiées aux termes du PAQ, y compris des frais de 300 $ pour l'inscription annuelle/l'autocertification, et de 500 $ pour les deux inspections annuelles. Des coûts doivent également être engagés pour la certification des employés.

Le fait qu'actuellement sept États américains n'achètent ou ne financent l'achat de véhicules adaptés qu'à des entreprises certifiées aux termes du PAQ montre bien l'avantage pour les entreprises spécialisées dans ce domaine d'adhérer à un tel programme. Dans le but de renforcer le statut du PAQ, la NDMEDA (É.-U.), en collaboration avec la NHTSA, essaie de convaincre le ministère des Anciens combattants des États-Unis de n'acheter et/ou de ne financer l'achat de véhicules adaptés qu'à des entreprises participant au programme PAQ.

Dans le cas de tous les véhicules modifiés par une entreprise certifiée aux termes du PAQ, on remet une fiche d'enregistrement indiquant le type de véhicule et la nature des modifications apportées, fiche qui doit être remplie et retournée à la NMEDA par le consommateur; cette dernière croit ainsi pouvoir retracer de façon plus précise les véhicules qui ont été adaptés aux États-Unis et répertorier les types de modifications réalisées.

Les différentes approches adoptées en Europe, au Royaume-Uni et en France

Les normes de conception et de construction, y compris les normes de sécurité, visant les véhicules originaux, ont été élaborées par la Commission européenne et par la Commission économique des Nations unies pour l'Europe (CEE-ONU). Ces normes ont été adoptées par les pays membres, y compris le Royaume-Uni. En Europe, sous les auspices de la Direction générale des transports de la Commission européenne, on travaille à la préparation d'un code de pratique destiné à évaluer la performance des véhicules adaptés.

Les entreprises spécialisées dans la conversion de véhicules peuvent apporter des modifications à ces derniers, mais ne peuvent délibérément en compromettre la sécurité ni diminuer la protection des occupants en cas d'accidents. Pour certifier la sécurité d'un véhicule, il n'est pas nécessaire de le soumettre à des essais de choc; dans les pays d'Europe (sauf au Royaume-Uni), la certification repose plutôt sur des inspections techniques. Au Royaume-Uni, aucune inspection n'est effectuée; c'est l'entreprise elle-même qui détermine si elle certifie ou non la sécurité du véhicule. Les entreprises sont avisées qu'en cas de litige, elles doivent prouver qu'elles se sont efforcées, de façon consciencieuse et raisonnable, de modifier le véhicule en respectant les normes de conception et de construction.

Un document intitulé *Guidelines on the Adaptation of Car Controls for Disabled People*, préparé conjointement par l'Institution of Mechanical Engineers et le Laboratoire de recherche sur les transports et les routes a été publié au Royaume-Uni à l'intention

des entreprises spécialisées dans la conversion de véhicules. Comme il est mentionné dans le document, celui-ci visait à rassembler toutes les données nécessaires sur les règles de l'art, dans un format facile à utiliser par les intervenants oeuvrant dans le domaine de la conversion des véhicules destinés aux personnes présentant une incapacité.

Des efforts soutenus sont déployés pour mobiliser les entreprises (au Royaume-Uni et en Europe) et pour élaborer une entente sur les critères de qualité à respecter (correspondant à ceux de la norme ISO 9000) en matière de conversion de véhicules. Ces efforts visent à améliorer la qualité totale des véhicules adaptés et à protéger les entreprises spécialisées dans ce domaine en cas de recours en responsabilité.

En France, le ministère des Transports a approuvé la conduite d'un véhicule à partir d'un fauteuil roulant; toutefois, aucune mesure de sécurité associée à cette réalité, comme la retenue des occupants et l'assujettissement des fauteuils roulants, n'a été proposée.

Résultat d'une initiative de R&D, une modification (facultative) peut maintenant être apportée à une Renault Espace pour permettre à une personne quadriplégique (ou ayant une incapacité équivalente) de monter dans le véhicule à l'aide d'une plate-forme élévatrice, de prendre place sur le siège du chauffeur, et de conduire le véhicule à l'aide d'une manette (d'autres commandes de conducteur sont actionnées par la voix). Selon la réglementation actuelle, un passager doit cependant prendre place à côté du conducteur et avoir un accès direct au frein à main en cas d'urgence.

Évaluation des risques

Au cours des entretiens préliminaires avec d'éventuels utilisateurs de véhicules adaptés, divers points de vue ont été exprimés en ce qui a trait à la sécurité de tels véhicules. D'une part, on a noté que des personnes présentant une incapacité seraient prêtes à accepter un taux de risque plus élevé pour leur sécurité si cela leur permettait d'accéder à une plus grande autonomie via l'acquisition d'un véhicule adapté, à moindre coût. D'autre part, certains autres utilisateurs éventuels ont mentionné qu'ils s'attendaient à retrouver dans leur véhicule le même niveau de sécurité que dans un véhicule non modifié. Pour l'instant, il est impossible, en raison du petit nombre de personnes interrogées, de mesurer jusqu'à quel point ces opinions sont partagées.

Besoin de renseignements supplémentaires

Il importe au plus haut point de recueillir d'autres données détaillées sur l'industrie de la conversion de véhicules (c.-à-d. l'offre de véhicules adaptés), sur les utilisateurs de véhicules adaptés (c.-à-d. la demande de tels véhicules) et la fréquence des accidents (collisions) impliquant de tels véhicules.

L'offre de véhicules adaptés

Les entreprises oeuvrant dans le domaine de la conversion de véhicules automobiles constituent la principale source à consulter pour obtenir les renseignements supplémentaires nécessaires concernant les différents points énoncés ci-après :

- détails sur l'industrie de la conversion :
  - taille de l'entreprise (p. ex. nombre de véhicules convertis);
  - provenance des clients (p. ex. dirigés par des spécialistes en réadaptation/ prescripteurs;
  - données sur le financement accordé aux clients;
  - rapport entre le nombre de véhicules neufs et le nombre de véhicules déjà en circulation, qui sont convertis;
  - rapport entre le nombre de conversions effectuées sur des véhicules complets et le nombre de conversions effectuées sur des véhicules incomplets;
  - le nombre de véhicules adaptés importés des États-Unis.

- estimation du nombre de conversions de véhicules automobiles effectuées par année et du nombre total de véhicules adaptés en circulation (pour comparaison avec les estimations obtenues au cours de la phase I);

- nombre de conversions effectuées selon le type, y compris celles effectuées pour :
  - des personnes qui conduisent à partir d'une aide technique;
  - des personnes qui utilisent une aide technique, mais qui conduisent assises sur le siège du conducteur;
  - des personnes qui utilisent une aide technique et qui voyagent comme passagers.

- nombre de personnes qui, au cours des trois dernières années, n'ont pas acheté de véhicule adapté mais se sont informées à ce sujet (demande latente);

- tendances en ce qui a trait à l'utilisation de véhicules adaptés et à la demande de tels véhicules;

- estimations et/ou aperçus du nombre de collisions impliquant des véhicules adaptés;
- points de vue des entreprises concernant le rôle des OEM, y compris les fabricants de véhicules et les fabricants de pièces et d'équipements, et le support effectivement reçu des OEM;

- étendue des compétences et des ressources disponibles à l'interne pour satisfaire aux exigences des NSVAC, et évaluation des conséquences du respect de ces normes (jusqu'à quel point le respect des NSVAC, y compris les coûts qui y sont associés, empêche-t-il les entreprises d'effectuer certains types de conversions, ce

qui freine l'esprit d'innovation; quels sont les effets de la conformité aux normes sur la disponibilité de véhicules adaptés pour les personnes présentant des incapacités; et jusqu'à quel point les entreprises utilisent-elles les résultats des essais génériques, p. ex. ceux de la NMEDA, pour établir la conformité des produits?);

- consultation des guides préparés par les constructeurs-carrossiers et d'autres documents connexes (p. ex. les pratiques recommandées par la SAE);

- opinions relatives aux solutions autres que les NSVAC en matière de réglementation, comme, par exemple, le statu quo, l'autoréglementation, les normes techniques, et l'effet de ces solutions de rechange sur la sécurité des utilisateurs de véhicules adaptés et des autres usagers de la route.

Demande de véhicules adaptés

Pour évaluer la demande de véhicules adaptés, il faut consulter les personnes qui en possèdent et celles qui en désirent un, et les interroger sur les divers points suivants :

- méthodes d'obtention du véhicule (p. ex. financement, consultation d'un spécialiste en réadaptation aux fins de prescription et d'évaluation comme conducteur);
- utilisation et habitudes de déplacement;
- dossier d'accidents;
- besoins en matière d'entretien/de service;
- opinions concernant les compromis acceptables entre la sécurité et le coût d'un véhicule adapté;
- admissibilité à une aide financière pour l'achat d'un véhicule adapté, et importance du manque de ressources financières en tant qu'obstacle à l'acquisition d'un tel véhicule;
- opinions concernant la sécurité des véhicules adaptés et autres questions (p. ex. entretien/service des véhicules et des équipements).

Dans le cas des personnes qui ont besoin d'un véhicule adapté mais qui n'en possèdent pas encore un, les points suivants devraient être abordés :
- raisons pour lesquelles elles n'ont pas acheté de véhicule (coût trop élevé, gravité/nature de l'incapacité);
- relation entre coût élevé et conformité aux NSVAC;
- opinions concernant les compromis acceptables entre la sécurité et le coût du véhicule.

Collisions

Bien que les données concernant les collisions constituent des informations-clés, si l'on se reporte aux résultats de l'analyse effectuée au cours de la phase I, on ne s'attend pas à pouvoir établir de statistiques fiables au cours de la phase III de l'étude. Toutefois, les données non scientifiques recueillies concernant les collisions impliquant des véhicules adaptés devraient être confirmées auprès des représentants de l'industrie et des utilisateurs. De plus, diverses mesures de collecte de données à cet égard (p. ex. dans le cadre d'une étude spéciale, signaler les véhicules adaptés impliqués dans des collisions) devraient être étudiées en collaboration avec les grandes provinces (Colombie-Britannique, Alberta, Ontario et Québec) pour déterminer s'il serait possible de les mettre en application, puis soumises, le cas échéant, à Transports Canada et aux gouvernements provinciaux aux fins d'examen.

Approche proposée de la phase III

Une approche a été proposée afin de répondre aux besoins en informations-clés sur l'industrie de la conversion de véhicules et sur les utilisateurs de ces véhicules. On trouvera ci-après une description des sept (7) tâches intégrées composant cette approche.

Tâche nº 1 – Consultation de centres de réadaptation et, plus spécifiquement, de centres d'évaluation des conducteurs. La consultation de ces derniers viserait à collecter de l'information sur la demande (y compris la demande latente) de véhicules adaptés, particulièrement par des personnes qui conduisent depuis leur aide à la mobilité. De plus, on souhaite prendre un aperçu des collisions impliquant des véhicules adaptés et examiner la question de l'accès aux services de conversion. La collaboration des centres d'évaluation des conducteurs serait demandée pour déterminer quelles entreprises de conversion sont fréquemment utilisées (des contacts seraient établis avec ces entreprises durant la tâche nº 2) et pour repérer des candidats potentiels à des interviews dans le cadre de consultations auprès des utilisateurs.

Tâche nº 2 – Cette tâche comporterait des consultations auprès des entreprises de conversion des véhicules. La **tâche nº 3** consisterait entre autres à évaluer les guides destinés aux carrossiers, l'information générique sur les essais de véhicules adaptés, l'aide venant des fournisseurs de matériel adapté (p. ex. sièges électriques orientables sur six axes) et l'information relative aux normes. Ces deux dernières tâches auraient pour but d'aider à élaborer un profil de l'industrie de la conversion des véhicules, de même qu'une évaluation de la capacité de ces entreprises de se conformer aux Normes de sécurité des véhicules automobiles du Canada (NSVAC). Ces informations sont primordiales pour déterminer l'effet dissuasif que la conformité aux NSVAC et les coûts associés peuvent avoir sur la réalisation de

certaines catégories ou de certains types de conversions, et pour apprécier l'influence du coût des véhicules adaptés ou du coût de la conversion seule, sur les intentions des personnes à mobilité réduite.

À ces trois tâches, intéressant surtout l'industrie, succéderait la **tâche nº 4**, qui suppose des consultations auprès des utilisateurs potentiels de véhicules adaptés. Dans le cas des personnes qui les utilisent déjà, les consultations porteraient sur les caractéristiques de la demande et des utilisateurs, notamment les déplacements, les accidents, les obstacles et l'aide à l'achat de tels véhicules, et sur les perceptions de l'aspect sécurité et du compromis entre la sécurité et le coût. Dans le cas des personnes qui n'utilisent pas de véhicule adapté, on chercherait à connaître les raisons qui les empêchent de faire l'acquisition de ce genre de véhicule (p. ex. les obstacles, la gravité/la nature de l'incapacité) et leurs vues sur le compromis entre la sécurité du véhicule et son coût d'acquisition.

La consultation de personnes à mobilité réduite combinerait une enquête avec envoi et retour par la poste visant un objectif de 400 réponses, et une interview téléphonique auprès de 100 personnes. L'enquête postale donnera des informations sur un large éventail de répondants; quant à l'interview au téléphone, elle fournira des réponses plus détaillées à des questions davantage ciblées.

Il serait intéressant de consulter des groupes représentant des personnes ayant une incapacité. On pourrait s'adresser à une dizaine d'organisations, notamment l'Association canadienne de la dystrophie musculaire, la Société canadienne de la sclérose en plaques et la Marche des dix sous. Ces consultations s'attacheraient principalement à valider les opinions sur l'utilisation, la sécurité et le coût des véhicules adaptés aux personnes représentées par ces organisations.

Une autre option mérite que l'on s'y intéresse; c'est la mise sur pied de groupes de discussion des résultats de l'enquête. Les éléments fournis par l'enquête y seraient étudiés en profondeur, ce qui permettrait de mieux définir et cerner les conclusions et les recommandations issues de l'enquête globale.

Les quatre premières tâches définies par l'approche proposée concernent la collecte d'informations; elles seraient suivies d'une analyse de ces informations (**tâche nº 5**), puis d'exposés à l'intention des organismes réglementaires de Transports Canada et du Comité consultatif du projet (**tâche nº 6**). Les séances d'information auraient pour but de diffuser, auprès du personnel de Transports Canada et des membres du Comité, les principaux résultats de recherche et les solutions qui s'offrent pour réglementer l'industrie de la conversion des véhicules.

Tâche nº 7 – Élaboration de rapports provisoires et du rapport définitif. Le rapport définitif renfermerait un sommaire des observations-clés collectées durant les séances d'information.

Autres actions proposées

La recherche menée durant la phase I a permis de cerner les éléments d'action ci-après, dont Transports Canada pourrait assurer l'exécution :

- rassemblement de données de collisions à partir de rapports de police ou d'études spécifiques;
- développement d'une stratégie de communication visant les consommateurs et l'industrie des véhicules adaptés;
- encouragement des fabricants d'équipement d'origine à aider les entreprises de conversion;
- collecte systématique de la rétroaction des consommateurs, à l'avenir; et
- réévaluation de la politique concernant les véhicules adaptés (une fois que l'on disposera d'informations plus complètes sur la phase III et/ou sur les actions ci-dessus).

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Phase I
Preliminary Investigation

1 Introduction

1.1 Introduction and Background

Transport Canada, under its mandate to reduce the number of deaths, injuries, and property damage resulting from the use of motor vehicles, has recognized the need to maintain the safety of converted vehicles, and has accomplished this by enforcing compliance of converted vehicles with Canadian Motor Vehicle Safety Standards (CMVSS).

The community of persons with disabilities is concerned, however, that the application of CMVSS to vehicles converted for use by persons with disabilities is a deterrent to the acquisition of converted vehicles. It is contended that having vehicles converted for use by persons with disabilities comply with CMVSS unduly increases the cost of a converted vehicle, and reduces vehicle availability due to the impact additional costs of complying with CMVSS has on the viability of vehicle converters.

There is a lack of data regarding the demand for vehicles converted for use by persons with disabilities, the supply of these converted vehicles, and issues such as crash involvement. Transport Canada, following consultations with its ministerial Advisory Committee on Accessible Transportation (ACAT), decided to undertake a study, to collect information on a variety of topics related to vehicle modifications, and to identify and document possible alternatives to the current policy of complying with CMVSS.

This study is divided into three phases. The first two phases are covered in this report and provide an overview of information based on currently available literature and databases, and outline a strategy for addressing information gaps. These phases were not intended to provide policy alternatives or recommendations.

The first phase included preliminary data collection with the aim of establishing the feasibility of collecting and assessing information on issues such as the use, safety, and cost of personal vehicles converted for use by persons with disabilities. Information requirements and preliminary methodologies were also identified. The second phase involved a more detailed identification and prioritization of information requirements, and appropriate methodologies for addressing these information needs. The third phase would implement the data collection and analysis strategy identified in the second phase. A copy of the Statement of Work is provided in Appendix A.

1.2 Research Questions

A variety of research questions were identified as being relevant to this study. They are presented in Table 1.1 by topic area. A detailed list of research questions is presented in Appendix B.

During Phase I, a wide variety of stakeholders were contacted. Additionally, data analysis was conducted using the 1991 Health and Activity Limitation Survey (HALS), and a literature search was undertaken. The literature search used a variety of sources, including the Transport Canada departmental library, Transport Canada's Road Safety library, NRC's CISTI, the U.S. Bureau of Transportation Statistics, the U.S. National Rehabilitation Information Center's REHAB Database, and the Institute of Transportation Studies, University of California – Berkeley's PATH Database. A keyword-based Internet search was also undertaken. References are provided at the end of the report, and a list of interviewees is provided in Appendix C.

1.3 Overview of Phase I and II Reports

The Phase I report contains a summary of the information collected on each issue, an identification of outstanding information requirements, and an identification of potential methodologies for addressing these requirements. The Phase I report is divided into the following sections:

- Section 1 (this section) provides an introduction and background of the project;
- Section 2 discusses the conversion industry;
- Section 3 profiles users of vehicles converted for use by persons with disabilities;
- Section 4 discusses the cost and subsidization of conversions of vehicles used by persons with disabilities;
- Section 5 includes an overview of vehicles converted for use by persons with disabilities and collisions;
- Section 6 discusses specific issues related to conversions;
- Section 7 discusses the impact of CMVSS and the proposed CMVSS 208;
- Section 8 profiles alternative approaches to regulation and compliance;
- Section 9 discusses risk assessment issues; and
- Section 10 provides a summary of the information collected and outstanding information requirements. Potential approaches for addressing remaining information requirements, by issue, are also provided.

The Phase II report is presented in sections 11 and 12. Section 11 discusses an approach for addressing the outstanding information requirements identified in Phase I, while Section 12 outlines other action items for possible implementation by Transport Canada.

Table 1.1 Summary of Research Questions

1. The Motor Vehicle Conversion Industry • number of companies converting vehicles for use by persons with disabilities • number of converted vehicles in use today • number of vehicles converted per year (e.g., during the period of 1994 to 1996) • types of conversions performed
2. Users of Converted Vehicles • number of persons with disabilities using converted vehicles (as drivers or passengers) • socio-economic and disability characteristics of users • latent demand for converted vehicles
3. Cost and Subsidization of Motor Vehicle Conversions • total cost of conversions • incremental cost of a conversion due to complying with CMVSS, including certification procedures (i.e., vehicle testing) • assistance available for purchasing converted vehicles
4. Converted Vehicles and Collisions • data on converted vehicles and collisions • causal factors contributing to collisions (e.g., driver error, vehicle-related, poor structural integrity of vehicle, weather) • impacts/societal costs of collisions involving converted vehicles (e.g., deaths, injuries, property damage, repair costs)
5. Conversion Issues • areas of concern related to conversions and converted vehicles • role of Original Equipment Manufacturers (OEMs) in providing assistance to converters • other safety issues (e.g., air bags, door locks)
6. Impact of CMVSS and the Proposed CMVSS 208 • impact of CMVSS compliance in terms of the viability of converters and the availability of converted vehicles
7. Alternative Approaches Regarding Compliance • approaches by other regulators (e.g., in terms of compliance), including those in the United States, and in other regulatory areas (e.g., health)
8. Risk Assessment • impact of alternative regulatory approaches to CMVSS regarding converted vehicles in terms of risks vis-à-vis safety for both users of converted vehicles and other road users • risk perceptions of persons with disabilities and other road users

2 The Conversion Industry

2.1 Nature of the Conversion Industry

After a vehicle is produced by a (first stage) vehicle manufacturing company (e.g., Ford, General Motors, Chrysler), it can be modified by a second stage manufacturing company (also known as conversion companies) to meet certain purposes. For example, types of converted vehicles can include limousines, ambulances, fire trucks, motor homes, transport trucks, accessible taxis, some forms of delivery vans, and vehicles converted for personal use by persons with disabilities. Unofficial estimates from Transport Canada suggest that one in every seven vehicles in Canada has been converted in some manner.

For persons with a disability, the process of obtaining a converted vehicle is dependent on whether the vehicle is being adapted to allow an individual with a disability to drive the vehicle, or to travel as a passenger. In both cases, an individual can go directly to a conversion company to have the necessary modifications performed. However, individuals who require a vehicle for driving typically go to a driver rehabilitation specialist for a driver assessment, and advice on the type(s) of automotive adaptive equipment and modifications required by the individual. Conversion companies and driver rehabilitation specialists are discussed below.

2.1.1 Conversion Companies (Second-Stage Manufacturing Companies)

The conversion industry includes a variety of organizations such as:

- small and medium-sized second-stage manufacturers who actually perform conversions to vehicles, mostly for commercial use, but also for personal use (including mini-vans, full-sized vans, light trucks, and automobiles);
- dealers, distributors, and importers of converted vehicles;
- durable medical supply companies (i.e., companies that supply mobility aids such as wheelchairs, driving aids such as hand controls, and devices such as mobility aid securement systems); and
- companies that install and repair equipment (e.g., lifts).

Two organizations (the Enforcement Branch of Transport Canada's Road Safety Directorate, and the Canadian Paraplegic Association – CPA) provided lists of companies that perform conversions.

Transport Canada's list (which is continually updated) identifies 125 companies, including companies with multiple locations. Of these 125 companies, 11 are identified as providing major modifications to vans (including mini-vans and full-

sized vans). The remaining 114 companies include dealers and distributors for other converters, companies that perform equipment installations and repairs, and modifiers of (primarily) non-personal vehicles (such as full and mid-sized buses) and recreational vehicles (RVs), who may undertake conversions on personal-use vehicles.

The companies identified on Transport Canada's list include those that are registered with Transport Canada as having a National Safety Mark (NSM), and importers capable of certifying motor vehicles under the United States' Federal Motor Vehicle Safety Act (MVSA). The list also contains companies that have not demonstrated any capacity to modify new motor vehicles, but may act as dealers for certifying companies. The list is neither exclusive or exhaustive.

Based on discussions with Transport Canada, of the companies on their list that perform major conversions, there are six that have the capacity to perform structural modifications to mini-vans. Due to their uni-body design, mini-vans (a commonly chosen vehicle for conversions) can require more extensive modifications than those performed on full-sized vans. These companies include:

- Care Transportation (Montreal, Quebec)
- Ricon (Montreal, Quebec)
- Creative Carriage (Cambridge, Ontario)
- Freedom Motors (Burlington, Ontario)
- Custom Coach (Winnipeg, Manitoba)
- Gold Care Medical Ltd., previously Golden Boy Medical (Edmonton, Alberta)

The Enforcement Branch of Transport Canada's Road Safety Directorate is currently upgrading a computerized system that will assist them in profiling companies involved in converting vehicles, including vehicles for use by persons with disabilities. This would include key indicators such as their status in terms of having an NSM.

The CPA list consists of 78 companies identified as vehicle conversion companies, 76 of which are included in the Transport Canada list (the remaining two companies are conversion companies not identified on Transport Canada's list). The CPA believes that of companies on its list, approximately 30 are involved in performing some type of conversion to vehicles for persons with disabilities, while the remaining companies install/repair equipment (e.g., lifts, hand controls) or act as dealer representatives.

The 50 companies not covered by the CPA list, but covered by the Transport Canada list, include: 25 companies that perform modifications, act as dealers and distributors for other converters, and companies that perform equipment installations and repairs; 17 companies that import, modify, and/or manufacture

buses; and, 8 companies that modify RVs (and undertake roof modifications for accessible vehicle converters).

The vehicle conversion industry is represented in Canada by the National Mobility Equipment Dealers Association (NMEDA). A non-profit organization, NMEDA has 25 company members, and is open to all organizations involved in the conversion industry (e.g., driver rehabilitation specialists, equipment suppliers, disability associations, and government agencies).

The Canadian branch of NMEDA evolved from its U.S. affiliate, based in Florida, which has a membership of 400 (190 are conversion companies and 210 organizations represent equipment manufacturers, vehicle manufacturers, driver assessment and training centres, and rehabilitation centres).

2.1.2 Driver Rehabilitation Specialists

Driver rehabilitation specialists are also involved in the process of an individual acquiring a converted vehicle through the provision of driver assessments and advice to persons with disabilities. Clients of driver assessment programs are individuals who require a converted vehicle for travelling as a passenger or as a driver (including individuals with, and without, prior driving experience).

Driver Assessment Programs

During Phase I, 39 organizations from across Canada were identified as providing driver assessment services. These include:

- St. John's Health Care Corp., L.A. Miller Centre, St. John's, Newfoundland
- Stan Cassidy Centre for Rehabilitation, Fredericton, New Brunswick
- Nova Scotia Rehabilitation Centre, Adaptive Driving Service, Halifax, Nova Scotia
- Centre François-Charon, Quebec City, Quebec
- Hôpital Champlain de Verdun, Programme Conduite Automobile, Verdun, Quebec
- Jewish Rehabilitation Centre, Laval, Quebec
- Constance Lethbridge Rehabilitation Centre, Psycho-Social Program, Montreal, Quebec
- Centre Hospitalier Pierre Gilbert, Chamy, Quebec
- Maison Rouyn-Noranda, Rouyn Noranda, Quebec
- CLSC Valleé de la Lièvre, Buckingham, Quebec
- Cornwall General Hospital, Rehabilitation Department, Cornwall, Ontario
- The Rehabilitation Centre, Occupational Therapy Department, Ottawa, Ontario
- Ottawa-Carleton Occupational Therapy Services, Manotick, Ontario

- Smith Falls Community Hospital, Evaluation of Skills and Abilities Required for Driving, Smith Falls, Ontario
- Kingston General Hospital, Occupational Therapy Department, Kingston, Ontario
- Peterborough Driver Rehabilitation Program (ABI Rehabilitation Services), Peterborough, Ontario
- Skill Builders Rehabilitation Centre, Barrie, Ontario
- Bloorview MacMillan Centre, Driver Rehabilitation Services, Toronto, Ontario
- Rehabilitation Services of Canada, Mississauga, Ontario
- Hamilton Health Sciences Corporation, Chedoke Driver Rehabilitation Services, Chedoke-McMaster Hospital, Hamilton, Ontario
- St. Joseph's Hospital, J.A.D. Marquis Day Hospital, Brantford, Ontario
- St. Joseph's Hospital and Home, Rehabilitation Services Department, Guelph, Ontario
- Grand River Hospital, Driver Assessment Services, Kitchener, Ontario
- Kitchener-Waterloo Occupational Therapy Association, Driving Assessment Clinic, Kitchener, Ontario
- Rainbow Rehabilitation Centre, Services for People with Brain Injuries, London, Ontario
- London Board of Education, Driver Education Department, London, Ontario
- Aetna Health Management, Occupational Therapists, London, Ontario
- Rehability Occupational Therapy Services Inc., London, Ontario
- Windsor Occupational Therapy, Windsor, Ontario
- Laurentian Hospital, Occupational Therapy Department, Sudbury, Ontario
- St. Joseph's General Hospital, Lakehead Rehabilitation Centre, Thunder Bay, Ontario
- Rehabilitation Hospital, Occupational Therapy Department, Winnipeg, Manitoba
- Saskatoon City Hospital, Occupational Therapy Department, Saskatoon, Saskatchewan
- Saskatchewan Abilities Council, Saskatoon, Saskatchewan
- Glenrose Rehabilitation Hospital, Edmonton, Alberta
- Calgary General Hospital, Rehabilitation Department, Calgary Alberta
- Driver Rehab and Assessment Centre, Vancouver, British Columbia
- Rehab – George Pearson Centre, Driver Rehabilitation Centre, Vancouver, British Columbia
- Gorge Road Hospital, Victoria, British Columbia

In 1991, the Transportation Development Centre sponsored a workshop involving driver assessment programs. The workshop proceedings (entitled *On the Road Again*, October 1992), provided information on 17 of the organizations attending the workshop, including approximate number of clients in 1991. This information is

profiled in Table 2.1. Overall, in 1991, the centres attending the workshop had approximately 2,825 clients, with a variety of characteristics, including:

- general aging
- amputation
- multiple sclerosis
- muscular dystrophy
- paraplegia
- quadriplegia
- learning disability
- deaf/hearing disability

Table 2.1 Overview of Driver Assessment Programs (1991)

Centre	Location	Clients in 1991
General Hospital L.A. Miller Centre	St. John's, Newfoundland	15
Forest Hill Rehabilitation Centre	Fredericton, N.B.	50
Nova Scotia Rehabilitation Centre	Halifax, Nova Scotia	170
Centre François-Charon	Quebec City, Quebec	300
Constance Lethbridge Rehabilitation Centre	Montreal, Quebec	341
Chedoke-McMaster Hospital	Hamilton, Ontario	100
Kingston General Hospital	Kingston, Ontario	100
Kitchener-Waterloo Hospital	Kitchener, Ontario	50
The Rehabilitation Centre	Ottawa, Ontario	30 (over six months)
Laurentian Hospital	Sudbury, Ontario	50
The Hugh MacMillan Rehabilitation Centre	Toronto, Ontario	800
West Park Hospital	Toronto, Ontario	102
St. Joseph's Hospital	Thunder Bay, Ontario	15
Health Science Centre Rehabilitation Hospital	Winnipeg, Manitoba	130
Glennrose Rehabilitation Hospital	Edmonton, Alberta	180
G.F. Strong Centre	Vancouver, B.C.	300
Gorge Road Hospital	Victoria, B.C.	62

Source: Transportation Development Centre, *On the Road Again* Workshop Proceedings, October 1992.

The goals of driver assessments are to determine whether an individual is capable of driving safely, and to determine training and equipment needs. A complete driver assessment can include:

- an assessment of an individual's medical history;
- a physical/functional assessment (e.g., physical examination to determine whether an individual has sufficient physical functioning to control a motor vehicle, such as range of movement, strength, coordination, reaction time);
- inquiry about current or proposed mobility aids (e.g., power scooter, wheelchair);
- vision testing (e.g., visual acuity and peripheral vision);
- cognitive assessment (e.g., attention, tolerance)
- driving history; and
- lifestyle and needs issues (e.g., location of individual's residence, purpose of vehicle).

A driving/road test is usually undertaken, and an individual may also be tested on knowledge of road safety and rules of the road. A driving simulator (when available) may be used to provide an individual with the opportunity to use various automotive adaptive equipment (e.g., hand controls).

After the driver assessment is completed, the specialist typically notifies the provincial ministry of transportation of any automotive adaptive equipment required by the individual for driving purposes (e.g., hand controls, left foot gas pedal), and whether an individual should be re-tested.

Training and Equipment Needs

In addition to assessing an individual from a driving perspective, rehabilitation centres will also prescribe the equipment required by an individual, as part of the specifications supplied to the vehicle converter. A centre may also inspect the vehicle after it has been converted to ensure that it meets the specifications prescribed. For example, as a service to its clients, the Hugh MacMillan Rehabilitation Centre in Toronto, Ontario, has an engineer on staff who will ensure that an individual can get in and out of the vehicle, can dock and secure the mobility aid, and reach the controls.

Rehabilitation centres and driver rehabilitation specialists may also provide in-car driver training/lessons. These lessons may also be provided by specialized driving instructors.

With the exception of Quebec, individuals can, however, go directly to a converter for a vehicle as there is no requirement that a person with a disability first see a driver rehabilitation specialist. However, certain converters require a prescription

from a driver rehabilitation specialist before modifying a vehicle for a potential client.

In Quebec, an individual must consult a driver rehabilitation specialist for a driver assessment, which results in the completion of the form *Rapport d'évaluation fonctionnelle sur l'aptitude physique et mentale à conduire un véhicule routière*. When the recommendation allows the individual to drive, a separate form detailing recommended modifications must be completed (the form is entitled *Recommendations d'adaptation de véhicule automobile*). This approach may also be pursued in other provinces.

2.2 Number of Converted Vehicles

2.2.1 Annual Conversions of Vehicles for Use by Persons with Disabilities

Conversions in Canada

Estimates on annual conversions involving vehicles for use by persons with disabilities were gathered from a variety of sources, including the conversion industry, the Canadian Paraplegic Association (CPA), and driver rehabilitation specialists. The Workers' Compensation Board of Ontario, the Insurance Corporation of British Columbia, the Société de l'Assurance Automobile du Québec (SAAQ), General Motors of Canada, and Chrysler Canada have also provided an estimate of the number of individuals for whom they provide assistance regarding vehicle conversion. A similar enquiry was made to the Ford Motor Company, but no response was provided.

The estimates collected are given below:

- Based on discussions with three members of the conversion industry, including NMEDA Canada, a rough estimate of the number of major conversions to vehicles for personal use by persons with disabilities, was generated from conversion industry "guesstimates" (these estimates do not include conversions made to vehicles for commercial use). It is estimated that there are approximately 600 vehicle conversions for use by persons with disabilities performed annually, involving major modifications (e.g., dropped floor, raised door/roof). *It should be stressed that the above figure is an estimate only.* Of these estimated modifications, approximately 200 involve a lift with a dropped floor, 200 involve a lift with a raised door/roof, and 200 involve a ramp with a dropped floor. It was also estimated that of the total 600 conversions, between 25 and 50 high-technology conversions (i.e., involving electronic steering controls) for persons who are quadriplegic, are performed annually.

Approximately 300 of these conversions would involve a mini-van and 300 would involve a full-sized van. In addition, approximately 75% involve a complete vehicle, and 25% involve an incomplete vehicle. Approximately 25% of annual conversions are conducted on used (i.e., previously owned) vehicles, primarily because of the vehicle's lower base price.

It is also estimated that there are approximately 200 annual lift installations that would not require modifications to the vehicle, and approximately 700 annual hand control installations (with no vehicle modifications).

- The CPA has estimated that approximately 1,200 conversions are conducted to vehicles for use by persons with disabilities, per year, with approximately 300 of these conversions involving modifications to the vehicle's structure (e.g., raised roof, dropped floor). This estimate is based on the number and type of new spinal cord injuries occurring per year.

- Discussions with the Rehabilitation Centre (Ottawa) and the Hugh MacMillan Rehabilitation Centre (Toronto) indicate that between 5% and 12.5% of the clients they see on an annual basis require converted vans. Applied to all clients of rehabilitation centres, this would indicate that between 140 and 350 clients of driver assessment centres would require converted vans annually.

- The Ontario Workers' Compensation Board estimates that they fund approximately 10 vehicle modifications per year.

- The Insurance Corporation of British Columbia provides funds for the purchase of a motor vehicle that can either be a van for their clients with quadriplegia, or a car for clients with paraplegia. Funds may also be provided for the purchase and conversion of a motor vehicle for the use of non-ambulatory clients with traumatic brain injury. According to their reports, in 1996, 13 of 448 clients served by Rehabilitation Services (3%) were classified as being quadriplegic, and 20 (4.5%) were paraplegic.

- SAAQ indicates that in 1996, 172 individuals received funding for vehicle adaptations, including 28 who received funding for adaptations to vans or light trucks[1]. In addition to SAAQ, the Office des personnes handicapées du Québec provided funding to 739 individuals for vehicle adaptations, and the Commission de la santé et de la sécurité du travail provided funding to 198 individuals for vehicle adaptations.

[1] Source: Nombre de Victimes et Versements Visant l'adaptation d'un véhicule 1987-1996 (SAAQ), SAAQ, 1997.

- General Motors of Canada and Chrysler Canada have stated that, combined, they provide financial assistance to an estimated 200 to 350 individuals per year for adaptations that would involve structural modifications to the vehicle (e.g., raised roof, dropped floor).

The conversion industry figures, while only rough approximations, appear to be the most comprehensive estimates of annual major conversions undertaken at this time. The other estimates, all of which provide incomplete estimates of the total number of conversions, appear to be consistent with the conversion industry estimates.

Conversions in the United States

A report by the Transportation Rehabilitation Engineering Center of the University of Virginia, suggests that there are approximately 7,000 personal vehicles modified annually, of which between 1,000 and 2,000 are modified for drivers using their mobility aids as the vehicle seat. The greater number of vans converted annually in the U.S. as compared to Canada is in part due to a larger overall market, the existence of war veterans (e.g., especially veterans of the Vietnam War), and greater access to funding.

NMEDA-U.S. does not have accurate statistics on the number or type of conversions being performed. They do know that there are between 17,000 and 20,000 lifts purchased per year, but these include lifts for public transport vehicles (e.g., buses), personal vehicles, and replacement lifts. NMEDA-U.S. does, however, consider the University of Virginia figures listed above as being reasonable for the personal vehicle market.

As discussed later in Section 8, NMEDA-U.S. anticipates that the vehicle registration program under its Quality Assurance Program will allow for more accurate tracking of the number and types of conversions being performed in the U.S.

2.2.2 Converted Vehicles Currently in Operation

Estimates for Canada

No organization contacted during this phase was able to indicate the number of vehicles converted for persons with disabilities in use today. However, using figures generated from the conversion industry, and assuming a seven-year life span for vehicles (with no change in the number of vehicles converted per year), it can be estimated that there are approximately 4,000 vehicles with a major modification(s), 1,500 with a lift (and no major modifications), and 5,000 with hand controls only. Note that these figures are estimates only.

Data from the 1991 HALS can also be used to provide an indicator of the extent to which automotive adaptive devices are in use, although not the number of converted vehicles. However, by combining responses to the use of a scooter or wheelchair (mobility aid) and adaptive devices, a proxy for converted vehicles was developed.

In particular, HALS asked respondents if, as drivers, they used either hand controls/brake controls, hand rails, straps, specialized handles, ramps/lifts, or space for mobility aid or other specialized equipment (including storage space). HALS also asked respondents if, as passengers, they used hand rails, straps, specialized handles, ramps, or lifts. Due to the HALS coding process, the use of devices such as ramps/lifts cannot be separated from those who use just hand or brake controls.

Based on a data run using the 1991 HALS, there were approximately 31,000 persons with disabilities who used a mobility aid, and used automotive adaptive equipment, either as a driver or a passenger. This should, however, be considered an upper bound for vehicles that are converted, as it does not take into consideration individuals who used a mobility aid, but only required hand controls or other minor modifications, but no ramps or lifts due to the nature/severity of their disability. This figure may also include vehicles that are co-owned by two (or more) persons using a mobility aid.

Estimates for the United States

In the United States, the National Center for Disease Control estimates that there are approximately 211,000 Americans who use some form of automotive adaptive equipment. This estimate does not specify the type of equipment, or whether the vehicle has been converted to accommodate a person using a mobility aid. These figures are based on a survey of automotive adaptive equipment used during a person's daily activities.

A representative of the U.S. National Highway Traffic Safety Administration (NHTSA) commented that the conversion industry in the United States feels that these figures low. As such, NHTSA is considering future studies in this area.

2.3 Types of Conversions

In the context of this analysis, personal vehicle conversions are modifications to an original equipment manufacturer (OEM) vehicle which include any alteration of existing OEM automotive components or systems. Personal vehicle conversions are performed to provide either greater accessibility to various passenger positions in the vehicle or to allow operation of the vehicle from the driver position. Conversions

performed to adapt the driver position generally require modifications to the vehicle control systems.

A wide variety of modifications may be performed to a personal vehicle for use by persons with disabilities, and can range from minor to major in scope. Appendix D provides a detailed list of the vehicle components or systems which may be affected by modifications, and the types of modifications themselves. In summary, the vehicle components or systems which may be affected by modifications (and specific examples) include:

- primary controls – group A (e.g., throttle/accelerator, steering system, brake system);
- primary controls – group B (e.g., ignition start switch, gear selector, parking brake, windshield wipers/washer, windshield defroster, rearview mirrors, turn signals);
- accessory controls (e.g., air vents, air conditioner, seat positioner, door locks, sun visor);
- vehicle electrical system (e.g., electrical wiring, ignition system, battery);
- vehicle chassis, suspension, and body (e.g., vehicle frame, vehicle body and/or doors, vehicle floor, vehicle roof, seats, windows);
- engine (e.g., engine cooling, engine operation);
- drivetrain (e.g., clutch, transmission, axles);
- fuel system (e.g., fuel lines, fuel tank);
- vehicle safety systems (e.g., occupant protection system, air bag, seat belt assembly); and
- other items (e.g., mobility aid securement and occupant restraint systems, stowage systems for mobility aids, mobility aid/occupant lifting and elevating devices).

The type of modification which is performed can also range from standard to customized, depending on the nature and severity of the disability of the driver/passenger, the individual's personal characteristics (e.g., height), the desires of the individual in terms of type of vehicle (e.g., mini-van versus full-sized van) and equipment to be used, and an individual's financial circumstances.

Depending on the nature of the modification(s) performed, compliance with CMVSS may be required. A converter may also choose to meet recommended practices of the Society of Automotive Engineers (SAE) and/or standards of the Canadian Standards Association (CSA).

With respect to persons using a mobility aid, the following are examples of potential scenarios illustrating the relationship between the nature and severity of an individual's disability, and the nature and extent of the modification(s) to be

performed. It is emphasized that these are examples only. Given each individual's unique requirements, variations from these examples can be expected.

- An individual using a manual wheelchair, with requisite upper body strength to transfer him/herself and/or the mobility aid into a vehicle, may only require minor adaptive equipment to operate the vehicle (typically an automobile). This adaptive equipment would include hand controls, in conjunction with steering devices. In this situation, the individual would transfer from the mobility aid into the driver's position, storing the mobility aid (typically) in the back seat of the vehicle. Devices also exist that allow individuals to store the mobility aid on the roof of the vehicle.

- An individual using a mobility aid, without requisite upper body strength to transfer into a vehicle and/or to load the mobility aid into the vehicle, would require a lift or ramp to enter the vehicle (given the requirement for a ramp or lift, a van would be required). In most cases, modifications to either the roof or the floor would be required to provide sufficient headroom while in the mobility aid.

  If the individual uses the driver's seat or passenger's seat, a power seat base may be used. These bases facilitate the process of transferring from the mobility aid to the driver/passenger seat. For drivers, hand controls (in conjunction with steering devices) would also be required. If the individual is travelling only as a passenger, and remains in the mobility aid, a mobility aid securement system would be required.

- An individual not capable of transferring from the mobility aid to the driver's seat, and therefore one who drives from the mobility aid, would require the removal of the driver's seat and structural changes to the vehicle itself (e.g., dropping the floor and/or raising the roof), to allow adequate head room to operate the vehicle while in the mobility aid. A mobility aid securement system would also be required (for drivers, these are typically powered systems, while manual systems are typically used for individuals travelling as a passenger). Hand controls for driving (in conjunction with steering devices) would also be required.

Table 2.2 presents an overview of the relationship between the nature of a disability and the extent to which the individual's need(s) can be met through standardization versus customization.

Table 2.2 Relationship between Nature of Disability and Vehicular Adaptation/Conversion

Nature of Disability	Vehicular Component/System Related to Adaptation						
	Steering	**Braking**	**Acceleration**	**Gear Selection**	**Parking Brake**	**Electric Functions (horn, lights, wipers, etc.)**	**Loading Mobility aid**
One leg impaired, arms OK	0	2	2	0	0	0	1
Both legs impaired, arms OK	0	2	2	0	0	0	2
One arm impaired, legs OK	2	0	0	2	2	½	0
Both arms impaired, legs OK	3	3	3	3	2	3	0
One arm and one leg Impaired	2	2	2	2	2	½	2
Both legs and one arm impaired	2	3	3	4	¾	¾	¾
Both legs impaired, both arms functioning weakly/impaired	4	4	4	4	4	4	4

Adapted from *The Adaptation of Cars for the Needs of People with Functional Impairments*, Dr. Hans-Jochen Küppers, Germany (1989)

Legend: 0 = no problem encountered
1 = standard option to vehicle
2 = standard adaptation
3 = difficult to solve, but single solutions are known and available (shaded)
4 = very complex, individual development/adaptation necessary (shaded)

3 Users of Converted Vehicles

3.1 Persons with Disabilities

3.1.1 Persons with Disabilities Using Converted Vehicles

As discussed in Section 2.2, the estimated number of vehicles converted for persons with disabilities currently in use today (excluding hand controls) is likely somewhere in the order of 5,500. Including hand controls and other minor modifications, this figure could increase to 31,000 using the HALS data.

Further, the HALS data indicates that there are an estimated 46,000 additional individuals who use a mobility aid but do not travel in a personal vehicle either as a driver or passenger. These individuals reported that, due to their health condition, they are prevented from leaving their residence (and consequently were not asked questions related to local travel), or they were asked the question but did not respond.

3.1.2 Characteristics of Persons with Disabilities Using Converted Vehicles

The characteristics of persons using converted vehicles are based on the HALS data from which the 31,000 figure noted above was estimated. Tables 3.1 and 3.2 provide a profile of persons with disabilities, persons with disabilities who use a mobility aid, persons with disabilities who use a mobility aid who drive a personal vehicle or travel as a passenger, and persons with disabilities who use a mobility aid who use adaptive devices either as a driver or passenger. The profile focuses on age and severity of disability. Highlights of these profiles include:

- persons with disabilities who use a mobility aid are relatively older than the population of persons with disabilities in general (58% of mobility aid users are 65 years of age or older, versus 35% for the population of persons with disabilities in general);

- fewer persons with disabilities who use a mobility aid and drive a personal vehicle or travel as a passenger are 65 or over (approximately 50%) as compared to all mobility aid users in general; and

- a much higher percentage of persons with disabilities who use a mobility aid, and those who use a mobility aid and drive a personal vehicle or travel as a passenger, have severe disabilities, as compared to the population of persons with disabilities in general (approximately 80% of mobility aid users, including those who drive or travel as a passenger, have a severe disability, versus 18% for the population of persons with disabilities in general).

Table 3.1 Age Characteristics (1991)

Age Group	All Persons with Disabilities	Persons Who Use a Mobility Aid	Persons Who Use a Mobility Aid and Drive a Personal Vehicle or Travel as a Passenger	Persons Who Use a Mobility Aid and Use Adaptive Devices for Driving or as a Passenger
15-64	65%	42%	49%	51%
65 and Over	35%	58%	51%	49%
Total	3.5 Million	125,000	79,000	31,000

Source: TransAccess Information Base and the 1991 HALS Microdata File.

Table 3.2 Disability Severity Characteristics (1991)

Severity of Disability	All Persons with Disabilities	Persons Who Use a Mobility Aid	Persons Who Use a Mobility Aid and Drive a Personal Vehicle or Travel as a Passenger	Persons Who Use a Mobility Aid and Use Adaptive Devices for Driving or as a Passenger
Mild	49%	2% **	3% **	1%
Moderate	33%	16%	19%	21%
Severe	18%	82%	78%	79%
Total	3.5 Million	125,000	79,000	31,000

Source: TransAccess Information Base and the 1991 HALS Microdata File.
** Use figure with care; CV is greater than 33%.

An additional HALS data run was generated focussing on total income for persons 15 years of age and over. Total income is defined as total money received by individuals 15 years of age and over (during the 1990 calendar year) from wages and salaries, self-employment income, family allowance, federal child tax credit, pensions, UI payment, other income from government sources, interest, and other money income. Based on this variable, of the 125,000 persons with disabilities using a mobility aid:

- 9% had total income of less than $1,000;
- 38% had total income of between $1,000 to $9,999;

- 45% had total income of between $10,000 and $24,999; and
- 9% had total income of $25,000 or more.

There was no significant difference in total income between persons who use a mobility aid and those who use a personal vehicle (either with or without automotive adaptive equipment).

In terms of benefits or social assistance, approximately 19% of mobility aid users (all ages) indicated that they received a disability pension from the Canadian Pension Plan (CPP) or the Quebec Pension Plan (QPP), while approximately 10% of mobility aid users indicated that they received social assistance or welfare. Approximately 4% or less of mobility aid users indicated that they received another type of benefit (e.g., worker's compensation, motor vehicle accident insurance, private or employer insurance disability plan, veterans disability pension/allowance).

3.1.3 Future Projections

Table 3.3 presents forecasted estimates of persons with disabilities, those who use a mobility aid, those who use a mobility aid and travel in personal vehicles either as a driver or passenger, and those who use a mobility aid and use adaptive devices for travelling in a personal vehicle.

As illustrated in this exhibit, persons who use a mobility aid and travel in personal vehicles either as a driver or passenger are estimated to increase 65% from 79,000 in 1991 to 130,000 in 2015. Meanwhile, persons who use a mobility aid and use adaptive devices for travelling in a personal vehicle or as a passenger are estimated to increase 58% from 31,000 in 1991 to 49,000 in 2015. These forecasts are based on Statistics Canada's 1994 population forecasts (medium-growth projections).

3.2 Persons who Drive from their Mobility Aid

No organization contacted during this phase was able to indicate the number of individuals who drive from their mobility aid. In addition, the HALS figures presented above do not indicate the extent to which individuals actually drive from their mobility aid.

As noted previously, the University of Virginia's Transportation Rehabilitation Engineering Center suggests that there are approximately 7,000 personal vehicles modified annually in the United States, of which between 1,000 and 2,000 are modified for drivers using their mobility aid as the vehicle seat.

Table 3.3 Base Year and Forecasted Estimates

Base and Forecast Years	All Persons with Disabilities	Persons Who Use a Mobility Aid	Persons Who Use a Mobility Aid and Drive a Personal Vehicle or Travel as a Passenger	Persons Who Use a Mobility Aid and Use Adaptive Devices for Driving or as a Passenger
1991 (base year)	3.5 Million	125,000	79,000	31,000
1997	3.8 Million	143,000	90,000	35,000
2000	4.2 Million	151,000	95,000	37,000
2005	4.6 Million	167,000	104,000	41,000
2010	5.1 Million	185,000	116,000	44,000
2015	5.6 Million	210,000	130,000	49,000

Source: TransAccess Information Base and the 1991 HALS Microdata File.

3.3 Trip Patterns

The 1991 HALS provides information on the number of trips taken by persons with disabilities (ages 15 and over), by various modes of transportation including a car, van, or truck. This information pertains to long distance trips (i.e., over 80 km) and does not include local trips (e.g., back and forth to work). Due to coding limitations, this information cannot be profiled by persons who use mobility aids and as such can not be used.

A report prepared on persons with transportation disabilities for Alberta Transportation and Utilities (1991)[2], using data from the Urban Mass Transportation Administration (UMTA) and a variety of other data sources, estimated that persons with transportation disabilities (defined as persons with disabilities who encounter difficulties while travelling) take an estimated 30 trips in urban areas, per month, with 65% of these trips (approximately 20) involving a personal vehicle.

In comparison, the general population take an estimated 55 trips in urban areas per month, with 79% of these trips (approximately 44) involving a personal vehicle.

[2] Transportation Demand Study for People with Disabilities in Alberta, Alberta Transportation and Utilities (prepared by Hickling Corp., 1991).

Thus, the general population take 83% more trips per month than persons with transportation disabilities. Of these trips, the general population takes 120% more trips by personal vehicle.

3.4 Other Users of Converted Vehicles

A variety of organizations make use of converted vehicles, such as:

- long-term health care facilities and homes for the elderly;
- accessible taxis; and
- car rental agencies.

With the exception of car rental agencies (which primarily involve the use of removable hand controls), these vehicles are typically converted for transporting persons with disabilities as passengers, not for operation as drivers.

The Ontario Ministry of Transportation (MOT) estimates that there are approximately 400 accessible taxis operating in Ontario. MOT also estimates that there are an estimated (maximum) 800 operating in Canada (including Ontario).

A detailed survey of special care facilities was undertaken by Statistics Canada in 1984 (on behalf of the Transportation Development Centre[3]). The survey covered 3,966 special care facilities, and determined that approximately 50% (1,913) owned, leased, or rented a total of 3,596 vehicles (approximately two vehicles per facility). Of the 1,913 vehicles, approximately 15% (523) were specialized cars, vans or trucks (in particular, 12% were specialized vans, 2% were specialized automobiles, and 1% were specialized trucks).

3.5 Overall Demand for Converted Vehicles

There are no reliable statistics indicating the overall potential demand for vehicles converted for use by persons with disabilities (including persons who have purchased a vehicle, and those who have not purchased a vehicle but would like to do so). In estimating the overall potential demand for converted vehicles, several issues would need to be considered such as:

- an individual's propensity to purchase a converted vehicle, especially in the absence of secondary or supporting finances;
- additional cost of insuring the vehicle given the added value of the modifications;

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[3] Source: *Transportation and Disabled Persons: A Canadian Profile*.

- the physical ability of the individual to operate a motor vehicle;
- alternative modes of transportation available (e.g., parallel transit); and
- personal desire to own and/or operate a converted vehicle.

4 Cost and Subsidization of Conversions

4.1 Cost of Conversions

As discussed in Section 2.3, the nature and scope of conversions to vehicles for use by persons with disabilities, can range from relatively minor modifications such as the installation of mechanical hand controls, moderate modifications designed to provide greater accessibility to passenger positions, and complex/customized modifications allowing the operation of the vehicle from a mobility aid using adapted controls.

The cost of conversions is directly related to various factors, including the:

- the nature and severity of an individual's disability;
- the principal use of the vehicle (e.g., for transporting an individual as a passenger versus driving the vehicle);
- the complexity and number of modifications required to adapt a vehicle (based on the nature/severity of an individual's disability and the purpose of the vehicle); and
- the type of vehicle (e.g., uni-body, body-on-frame).

The type of vehicle, in particular its interior dimensions and body construction (uni-body, body-on-frame), can affect the amount of work required to install adaptive devices. Typically, a vehicle's floor may need to be lowered or its roof raised to accommodate the use of a mobility aid as an occupant seat or to install a mobility aid lift. These modifications can be costly if structural components need to be altered. Structural modifications and the incorporation of advanced driving controls can both account for a large portion of total conversion costs.

The following scenarios provide examples of the cost of a conversion. The scenarios, based on suggested retail prices provided by a conversion company, are for a mini-van and full-sized van, and provide cost estimates for conversions suited for a passenger and a driver. These costs do not include the base price of the vehicle.

- **Scenario 1:** A mini-van conversion for passenger purposes, with a lowered floor, ramp, and removable seats, would add $14,550 to the original retail price. The same vehicle with driver options (power door, power ramp, power seat base, kneeling feature, remote door control), would add an additional $5,435 (total: $19,985).

- **Scenario 2:** A full-sized van conversion for passenger purposes, with a lowered floor, relocated gas tank, anti-skid floor, and lift, would add $12,700 to the retail

price. The same vehicle with driver options (power door and power seat base) would add an additional $3,085 (total cost: $15,785).

Assuming the base price for a mini-van or full-sized van is $26,000, the total costs for the two scenarios would be:

- **Scenario 1 (mini-van)**
  Passenger modifications: $40,550 (conversion is 56% of total cost)
  Driver modifications: $45,985 (conversion is 77% of total cost)

- **Scenario 2 (full-sized van)**
  Passenger modifications: $38,700 (conversion is 49% of total cost)
  Driver modifications: $41,785 (conversion is 61% of total cost)

Table 4.1 profiles estimated price ranges associated with vehicle modifications. These prices are based on estimates provided by representatives of NMEDA and TES Ltd. The prices do not include the base price of the vehicle, component design and development, and costs associated with testing or certification.

4.2 Incremental Cost of Compliance with CMVSS

As will be discussed below, the cost of complying with CMVSS is dependent on a number of factors. During the Phase I consultations, the Enforcement Branch of Transport Canada's Road Safety Directorate (unofficially) estimated that in relation to the entire second stage manufacturing industry, the cost of complying with CMVSS adds an additional $200 to $400 per vehicle. This estimate, which includes engineering and testing costs, is based on the assumptions that:

- not all conversions require dynamic testing;
- testing for compliance which does take place involving a specific vehicle can cover future conversions involving the same vehicle and set of modifications (although it must be demonstrated that modifications which are made to subsequent vehicles are safe vis-à-vis the original tests); and
- internal expertise and body builder guides can be used to help ensure that modifications do not negate the original safety certifications (thus reducing the need for dynamic testing).

It was noted by Transport Canada, however, that due to the many factors involved in modifying a vehicle, many conversion companies may not have the capacity to accurately determine the full cost of compliance. In addition, this cost of compliance does not include compliance costs borne by the OEM (these costs would be included in the base price of the vehicle).

Table 4.1 Potential Costs of Conversions

Modification Performed	Nature of Modification	Cost Estimate
Adapting Driver Controls • hand-operated brake and throttle controls • reduced effort steering • steering wheel aid • gear shift extension • electrically-operated parking brake • remote turn signal, headlight dimmer, horn, and windshield washer controls	Minor/Major	$700 to $1,000 for mechanical controls $5,000 plus for low effort, high technology steering controls
Adapting Accessory Controls • remote heater/air conditioner controls • remote door opener	Minor	$500-$1,000
Lowering Vehicle Floor (including relocation of body mounts, brake lines, fuel lines, electrical wiring) • full-size van (body-on-frame construction) • mini-van (uni-body construction)	Major Major	$5,000-$8,000 $14,000/$15,000
Enlarging Vehicle Door Opening • moving body pillar • strengthening body mounts • extending door • installing modified windows	Major	$3,500-$5,500
Fabricating and Installing a Lift System • strengthening vehicle body • installing track guides, heavy-duty electrical system, hydraulic pump, and hydraulic lines	Major	$4,000-$14,000
Installing/Modifying Seat Belts • relocating seat belt anchors • installing modified seat belt assemblies	Major	$200-$500
Vehicle Preparation and Finishing • removal/reinstallation of interior components • modifications to interior trim and carpet • body work and painting	Minor	$1,000-$3,000

Source: Based on estimates provided by TES Ltd. and NMEDA Canada.

Industry respondents have noted that if a consumer's requirements are unique, and the modifications undertaken result in the vehicle no longer being compliant in

terms of CMVSS, demonstrating compliance through testing (especially if dynamic testing is required) could potentially double the cost of the modifications. It may also lead to the conversion not being undertaken due to the high cost.

Transport Canada's Enforcement Branch notes, however, that they will not take action on "one-off" conversions that are not certified, if the conversion company is willing to accept the risk of not having the vehicle certified. In these situations, the consumer must be informed of the situation, and be willing to purchase the vehicle uncertified.

Overall, it can be concluded that the incremental cost of complying with CMVSS depends on a number of factors:

- **nature of the conversion and the related compliance requirement** – depending on the nature of the modification, the cost associated with compliance can range from a simple visual verification to a fully-nstrumented dynamic (i.e., crash) test.

- **number of vehicles modified by a conversion company** – a converter's ability to absorb certification costs and distribute the cost of compliance across conversions is facilitated by a higher volume production run. In general, compliance costs are more pronounced on low production volume or highly specialized vehicle conversions.

- **changes to the design of the base vehicle** – after modifications to a vehicle have been designed and tested, and compliance with CMVSS demonstrated, the design and test costs can be distributed over the period where there are no significant design changes to the vehicle (i.e., the vehicle's "quiet design years"). However, when the base design of the vehicle is changed by the original manufacturer (e.g., Ford, Chrysler, GM), the modifications may require re-designing and re-testing to ensure compliance.

- **availability of generic test results** – NMEDA (Canada) provides test results for certain types of modifications to specific types of vehicles, which can be used by a converter as a substitute to conducting their own testing, significantly reducing certification costs.

- **availability of base vehicles which facilitate conversions** – General Motors is introducing vans and mini-vans that accommodate modifications such as the installation of lifts and ramps. It is anticipated that these vehicles will be easier and less costly to modify.

- **availability of build guides and conversions kits** which allow converters to pass through the original safety certification obtained by the OEM.

- the **additional design and fabrication effort** required to ensure that the modification complies with CMVSS;

- the **technical expertise of the converter;** and

- the **extent to which testing and examination** are **required** to verify that the modification complies with the CMVSS (only to the extent that the converter chooses to invalidate the original OEM certification).

From a converte's perspective, the price to a consumer of a particular vehicle will include some component of cost that is attributable to complying with CMVSS. As the actual cost will clearly vary depending on the factors noted above, the converter must make a business decision as to how the costs will be distributed across their product line(s) and how much will be directly passed on to the purchaser. Consider two types of conversions, one minor and one major:

- CV1 – a converter undertakes a number of similar relatively minor vehicle conversions, on a base vehicle that has been in production for some time and for which generic test results are already available.

- CV2 – the same converter undertakes complex conversions on a small number of vehicles that may not be in production for a number of years, for which crash testing is required but there are no generic test results. Similarly, this could involve a converter who undertakes a "one-off" conversion, where the converter is either unwilling to accept the risk of selling the vehicle uncertified, or their client is not willing to purchase an uncertified vehicle.

For CV2, it is apparent that there would be significantly higher costs of compliance with CMVSS than there would be for CV1. It would be unreasonable to expect that the converter would absorb all the cost of compliance for the CV2 type of complex conversion into overhead, and recover the cost through the larger base of CV1 type vehicles, particularly if the CV1 vehicles must compete with vehicles from another converter.

While the range of $200 to $400 per vehicle has been estimated by the Road Safety Directorate's Enforcement Branch as the incremental cost of complying with CMVSS (in relation to the entire second stage manufacturing industry), it is apparent that the cost of compliance can vary by vehicle model, depending on the factors noted above, the converter's business decisions regarding cost recovery, and the willingness of the converter and the consumer to produce an uncertified vehicle.

A number of methods exist for minimizing conversion cost (including the cost of complying with CMVSS). These methods, as noted above, include generic testing of base vehicles designed to accommodate conversion (therefore not requiring re-

certification), conversion kits that provide "flow-through certification", build guides supplied by the automotive suppliers, and adoption of standardized conversions types.

From the above discussion, it is impossible to state how much the incremental cost of compliance will be because of the factors involved and the business decisions that must be made by the converter. To estimate the extent of direct and indirect compliance costs, it will be necessary to understand the number and types of conversions undertaken, as well as the approach to recovery cost by individual converters.

4.2.1 Design and Fabrication

The additional design and fabrication effort required to ensure that the modification complies with CMVSS, and the requisite expertise of the converter, can also be factors related to certification costs. In particular, careful consideration must be given to the integration of conversion designs with automotive systems and safety-related features incorporated into vehicles by the OEMs. Significant modifications to OEM systems may require extensive retesting to verify that a converted vehicle satisfies the requirements of CMVSS. A thorough design effort to develop the necessary modifications and the correct layout of components can significantly lower costs related to vehicle certification.

For example, depending on the nature of the conversion, and the technical expertise/ knowledge of the converter, it may be feasible to design and undertake a conversion such that testing to a standard is not required, by ensuring that original OEM specifications are not compromised or negated. In this scenario, technical expertise and knowledge of the OEM design and related safety factors are critical. The use of OEM bodybuilder guides, and advice from OEMs can also prove valuable.

Alternately, the correct use of OEM conversion and installation packages (e.g., for auxiliary gas tanks) can allow a converter to comply, using "flow through" certifications (i.e., a converter, following the installation guidelines, can comply based on the original compliance attained by the OEM). For example, Ford currently offers a pass-through certification conversion kit for auxiliary gas tanks and for raising roofs on Club Wagons.

The amount of effort required to design a conversion is difficult to estimate since many automotive systems are interrelated. Components and systems that are regulated by a particular CMVSS may be directly affected by systems not explicitly covered by the standard and may also affect the performance of the vehicle under test conditions. For example, the fuel system is particularly susceptible to modifications. Modifying the vehicle's frame and body can alter the vehicle's

deformation characteristics during a collision, which may damage fuel system components to the extent that the vehicle is no longer in compliance with CMVSS.

Generally, design and fabrication costs will be closely related to the particular vehicle and model selected, the body type of vehicle, the automotive systems being modified, the extent of modifications performed, and the expertise/knowledge of the converter.

4.2.2 Testing Requirements

The extent to which testing and examination are required to verify that the modification complies with the CMVSS in question is also a major factor in the cost associated with CMVSS compliance. Testing costs are directly related to the type of modification being performed and the related CMVSS, and may be a significant portion of the incremental costs, especially if custom modifications requiring dynamic testing (i.e., crash testing) are performed. The more extensive standards require dynamic impact testing to verify compliance with stated specifications, with some tests incorporating anthropomorphic test devices to obtain static measures.

The following list indicates the CMVSS standards that may require testing, *depending on the nature of the modification*. This list includes potential testing costs, based on estimates provided by PMG Test and Research Centre (Blainville, Quebec). The tests are dynamic, unless otherwise noted:

- 105 – hydraulic brake systems ($12,500)
- 201 – occupant protection ($6,500)
- 203 – driver impact protection ($6,500)
- 204 – steering column rearward displacement ($18,000)
- 207 – anchorage of seats ($6,500, static test)
- 210 – seat belt anchorages ($6,000, static test)
- 212 – windshield mounting, and 301 – fuel system integrity (frontal crash test – $7,500)
- 219 – windshield zone intrusion, and 301 – fuel system integrity (frontal crash test – $9,000)
- 301 – fuel system integrity (side or rear crash test – $7,000)

With respect to the dynamic tests, the estimated costs do not include the base price of the test vehicle. The test costs are based on the conversion of a mini-van, although the costs would not vary significantly if a full sized van were used. Additionally, overall costs would be reduced if several tests were conducted simultaneously. However, PMG recommends that simultaneous testing be discussed with Transport Canada prior to being undertaken, to ensure that the results would be accepted as valid.

The proposed 208 (seat belt installations), while requiring dynamic testing, currently includes an exemption for companies converting vehicles for persons with disabilities. This issue is discussed in more detail in Section 7.3.

4.2.3 Potential Impact on Conversion Industry

As discussed above, there is an incremental cost associated with complying with CMVSS, which must be recovered by the conversion industry from their customers. The incremental cost of compliance is clearly more of a concern for smaller converters, and it was noted during Phase I consultations that three conversion companies in Alberta are no longer providing a conversion service. These companies chose to stop conducting conversions due to the additional effort(s) and resources required in complying with CMVSS.

Additionally, other companies (e.g., suppliers of durable medical supplies), who have provided conversion services in the past, may also stop providing this service due to the extra costs of complying with CMVSS. For example, it was noted that in the Ottawa area, six to seven converters who previously may have performed major conversions (e.g., raised roof, lowered floor), are no longer conducting these types of conversions, opting to have larger companies (who have certified their conversions with CMVSS) perform these functions.

Local access to vehicle converters can also be reduced, with the market for major conversions becoming increasingly concentrated in a limited number of firms. It has been noted however, that a distribution network between a main converter and local vehicle and/or equipment dealers can minimize the impact of increased concentration within the conversion industry. Such a distribution network would reflect the current approach taken by large automobile manufacturers. However, convenient access to service and maintenance for vehicle modifications can be an issue, depending on the location and capabilities of the local dealers/distributors.

4.3 Financing for Converted Vehicles

Persons with disabilities typically finance the cost of conversions either through personal funds (including bank loans) or through financial assistance offered through a variety of means, including:

- provincial workers' compensation boards;
- provincial vocational rehabilitation programs;
- local service clubs;
- disability organizations;

- automobile manufacturer financial assistance programs;
- federal government tax credits; and
- motor vehicle accident insurance.

With the exception of motor vehicle accident insurance, assistance programs typically only cover the adaptations made to the vehicle; the base cost of the vehicle is not covered.

The extent to which conversion costs are subsidized varies by the source of assistance and the nature of the situation. For example, provincial workers' compensation boards provide funding in situations where the disability resulted from the working environment. Furthermore, certain guidelines exist with respect to the funding available. For example, the Ontario Workers' Compensation Board Operational Policy states that (subject to evidence of medical need)

the Board may authorize vehicle modification when modification to an injured workers' personal vehicle will improve or enhance the quality of life and facilitate:

- *mobility within the community, and*
- *socialization with family, friends, or organizations.*

Vocational rehabilitation programs typically limit funding to cases where the converted vehicle is vital to an individual performing his/her job especially where adequate alternative transportation is not available (e.g., parallel transit). Rehabilitation programs did provide funding if the vehicle was vital to an individual continuing education, but with limited funding, priority is being given to those who require the vehicle for employment purposes.

Local service clubs and disability organizations may provide funding, but again, limitations exist. For example, the Easter Seals and March of Dimes provide funding for hand controls, but funding is typically not provided for vehicle modifications due to their high cost. With respect to local service clubs, the individual requesting the funding would have to submit a formal request to the club's board of directors. Funding reductions over the last several years have affected the ability of these types of organizations to provide financial assistance with respect to vehicle modifications.

The "big three" automobile manufacturers also provide financial assistance to persons with disabilities for the modification of new vehicles.

- At GM Canada, the Mobility Program reimburses buyers of any new GM vehicle up to $1,000 for adaptive equipment and/or modifications.

- The Chrysler Canada Physically Challenged Assistance Program offers up to $1,000 for adaptive equipment or modifications when a full-sized Ram van or wagon is purchased, and up to $750 for adaptations made to all other vehicles.[4]
- The Ford Canada Mobility Motoring Program provides reimbursements up to $750 when adaptations are made to a newly-purchased Ford vehicle.

With respect to the federal government, in the 1997 February Budget, the Department of Finance announced a broadening of the medical expense tax credit to include 20% of the cost of a van (to a maximum of $5,000) that is adapted (or will be adapted within six months), for the transportation of an individual using a mobility aid.

In addition, the Customs Tariff has been amended to provide duty-free entry for all goods designed to be used by people with disabilities. In particular, Code 2531 of the Customs Tariffs Act specifies that the duty-free entry of "goods specifically designed to assist persons with disabilities in alleviating the effects of those disabilities, and articles and materials for use in such goods" will be allowed into Canada duty-free. The Code does not make mention of the availability of the goods or materials in Canada (i.e., regardless of whether the goods or materials are available in Canada, the duty-free condition applies).

In the case of motor vehicle accident insurance, funding is only provided to those who are in a position to claim insurance.

Although there are various sources of assistance, it is generally felt by converters and driver rehabilitation specialists that many individuals who purchase converted vehicles do so with their own financing.

4.4 Latent Demand

The nature and severity of an individual's disability will have a direct impact on the extent to which modifications must be made for them to operate and/or travel as a passenger in a personal vehicle. For example, an individual who requires only hand controls will not encounter as high a financial barrier as those who require modifications that will enable them to drive from their mobility aid.

Additionally, the economic status of the individual, and the availability of secondary funding will also affect the ability of an individual to afford a converted vehicle. As discussed in Section 3, persons with disabilities who use a mobility aid, and those who use mobility aid and drive a personal vehicle or travel as a passenger, have

[4] In the Chrysler program, adaptive equipment is defined as "equipment needed by a physically challenged person to drive, enter, exit, and/or be transported safely in a motor vehicle".

relatively low levels of total income. Also, while secondary funding is available, the individual must often meet specific requirements in order to be eligible. Currently, there are no reliable statistics on the proportion of persons with disabilities and other users who want to obtain a converted vehicle but cannot do so either because of the total conversion cost or the incremental cost of certification.

5 Converted Vehicles and Collisions

5.1 Canadian Collision Data

There is a lack of reliable national information on collisions involving vehicles converted for persons with disabilities in Canada (such as number of collisions involving converted vehicles, whether the conversion was a contributing factor in the collision, and whether the conversion increased the severity of the collision).

Discussions with the Road Safety Directorate's Motor Vehicle Standards and Research Branch of Transport Canada, conversion companies, and driver rehabilitation specialists, revealed that there has been no systematic collection of information as to whether a vehicle involved in a collision was converted to be used by a person with a disability. Nor is there any information on the percentage of disabled drivers who have been involved in a collision.

Other sources of information contacted regarding national data on collisions involving vehicles converted for personal use included Transport Canada's Collision Investigation teams and the Motor Vehicle Defects Investigation groups. The Defects Investigation Group has noted collisions involving vehicles converted for use by persons with disabilities. These have included situations involving occupant restraints, a modified steering wheel, and the use of a wheelchair as the driver's seat. A recent case involved the failure of a modified occupant restraint system, resulting in a recall notice. Transport Canada's Vehicle Recalls database indicates that 14 units were recalled and inspected, with four of the units found to have defective stitching. All of the defective units were subsequently replaced.

The Société de l'Assurance Automobile du Québec (SAAQ) was contacted regarding collision information and vehicles converted for use by person with disabilities. Based on a special data analysis, SAAQ reports that between 1994 and 1996, there were an average 132 collisions per year involving drivers with a licence restriction (based on licence restrictions requiring one of the following: a left-foot gas pedal, hand controls, driving controls for persons with a disability, or safety/security restraint system). Overall, 2,409 drivers have these restrictions on their licences. As a percentage of total drivers with a licence restriction, the collision rate is approximately 5.5%, as compared to collision rate of approximately 7% for all drivers. However, these figures have not been adjusted for the exposure to risk, based on amount driven (i.e., the more a vehicle is driven, on average, increases the likelihood of it being in a collision).

In addition, the SAAQ data does not provide any indication of structural modification. Additional information on the collision, and potentially the nature of the vehicle, could be ascertained by manually reviewing the comments section of the

relevant accident records, but again, there is no assurance that additional information was provided in this section by the reporting officer. A similar situation would exist if other provinces generated data on collision involvement based on driver licence restrictions.

Discussions with several provincial transportation ministries – the Ontario Provincial Police, the Insurance Corporation of British Columbia (ICBC), the Manitoba Public Insurance Corp., Saskatchewan Government Insurance, private insurance companies, and the Vehicle Information Centre of Canada (VICC) – indicate that these organizations do not have data available on collisions involving vehicles converted for personal use by persons with disabilities.

The Insurance Bureau of Canada also does not track incidents involving vehicles converted for personal use by persons with disabilities. They state that it is a very small market segment and that collisions involving these vehicles have not been an issue in the past.

Additional premiums could be applied depending on the individual's previous driving record, and whether the individual is in a high risk group (e.g., the 16 to 24-year-old age group). In addition, drivers may also be faced with higher premiums due to the higher value of the vehicle resulting from the modifications or equipment added to the original vehicle. Insurance companies are prevented from charging additional premiums to drivers simply because they have a disability as this would constitute discrimination and be a human rights violation.

5.1.1 Information from Police Accident Reports

Police accident reporting templates were also reviewed to determine whether the resulting statistics could be used to indicate that a vehicle had been converted for use by a persons with a disability. Two variables (related to driver and vehicle condition) were assessed to determine whether they could be used as a proxy for vehicles converted for use by a persons with a disability, and are discussed below.

Driver Condition

With respect to driver condition, for all provinces except Quebec and British Columbia, the driver condition "*medical or physical disability*" is included as a contributing factor variable on accident report forms. Checking of this variable would indicate that in the reporting officer's opinion, the driver's medical condition or physical disability was a contributing factor to the accident. It should be noted, however, that this variable does not indicate the nature of the disability, whether an adaptive device(s) was being used, or whether the vehicle had been modified. In addition, no distinction exists between medical condition (e.g., heart attack, stroke,

use of prescription medication) and physical disability. *Therefore, because of these limitations, this variable cannot be used as a proxy for converted vehicles.*

For information purposes, figures related to driver condition are presented in Table 5.1. As illustrated in this exhibit, based on the most recent national collision statistics (1993), a driver's medical or physical disability accounted for 1,200 of the 303,051 collisions in Canada (approximately 0.4%) which resulted in a fatality or injury (no accidents involving property damage only are reported). In particular, a driver's medical or physical disability was a contributing factor in 52 fatal collisions and 1,122 collisions resulting in an injury. Table 5.2 illustrates that, as a contributing factor in collisions, a driver's medical or physical disability did not increase significantly between 1990 and 1993.

Additional information on the collision, and potentially the driver's condition, could be ascertained by manually reviewing the comments section of the relevant accident records, but there is no assurance that additional information was provided in this section by the reporting officer.

Table 5.1 Driver Condition and Collisions Involving a Fatality or Injury

Driver Condition	Total for Canada			Percentage of Total		
	Fatal	Injury	Total	Fatal	Injury	Total
Apparently Normal	3,087	231,992	235,079	61.7	77.8	77.6
Had Been Drinking	331	8,195	8,526	6.6	2.8	2.8
Ability Impaired by Alcohol	661	6,840	7,501	13.2	2.3	2.5
Fatigued/ Fell Asleep	101	4,529	4,630	2.0	1.5	1.5
Medical Condition/ Physical Disability	52	1,122	1,174	1.0	0.4	0.4
Ability Impaired by Drugs	10	182	192	0.2	0.06	0.06
Other/ Unspecified	759	45,190	45,949	15.2	15.2	15.2
Total	5,001	298,050	303,051	100.0	100.0	100.0

Source: "Traffic Collision Statistics in Canada", Transport Canada, 1993.

Table 5.2 Incidence of a Driver's Medical or Physical Disability being a Contributing Factor to a Collision – 1990 to 1993

Collisions	Medical Condition/Physical Disability As a Contributing Factor			
	1990	**1991**	**1992**	**1993**
Total	1042	1013	1016	1174
% of Total	0.32%	0.33%	0.33%	0.39%

Source: "*Traffic Collision Statistics in Canada*", Transport Canada, 1990-1993.

Vehicle Condition

"Vehicle modification" for Newfoundland, P.E.I., Nova Scotia, New Brunswick, Manitoba, and British Columbia, is provided as a contributing factor field on accident report forms. Checking this variable would indicate that in the reporting officer's opinion, a vehicle modification was a contributing factor to the accident.

It should be noted that the nature of the modification is not defined, except in B.C. and Newfoundland. British Columbia requires the reporting officer to "explain" the nature of the modification. In Newfoundland, modifications are captured as part of a special study category, and include variables such as jacked-up suspensions, wheel spacers, full window darkened glass, moose whistles, and headlight covers and shields (special studies allow for the collection of specific collision or vehicle-related information over a pre-determined period of time). As per driver condition, due to these limitations, this variable cannot be used as a proxy for vehicles converted for use by persons with disabilities.

For information purposes, with respect to B.C. figures, in 1994, the Road Safety Research Branch of the Insurance Corporation of British Columbia (ICBC) reported that there were 97,157 collisions (including collisions that resulted in either property damage, personal injury, or a fatality), with 23 involving vehicle modifications as a contributing factor (0.02%). Vehicle modifications contributed to 11 collisions involving property damage, 11 collisions resulting in an injury, and one collision resulting in a fatality.

Overall, 2,014 vehicle conditions were reported by B.C. as contributing to collisions; defective brakes (contributing to 550 collisions) and defective tires (contributing to 485 collisions) were the most commonly identified. Vehicle modifications accounted for 1.14% of all vehicle condition factors reported.

Additional information on the collision, and potentially the nature of the vehicle modification, could be ascertained by manually reviewing the comments section of the relevant B.C. accident records where there is a requirement to "explain" the

modification (resources do not currently exist at the provincial level to undertake this task). For other provinces, there is no assurance that additional information was provided by the reporting officer.

5.2 Experiences of the U.S. and the U.K.

The U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) operates the National Accident Sampling System (NASS). The NASS contains the General Estimate System (GES), which collects data on an annual sample of approximately 52,000 police traffic crash reports, and the Crashworthiness Data System (CDS), which collects additional detailed information on an annual sample of approximately 5,000 police reported traffic crashes involving a towed passenger car, van, or truck that is less than or equal to 10,000 pounds GVWR.

Since 1995, the NASS-CDS has had a data variable indicating whether any of the vehicles involved have automotive adaptive equipment (in particular, hand controls, steering controls, and/or low effort power steering mechanisms). Figures for 1995 indicate that of the 5,070 crashes investigated (involving a towed passenger car, van, or truck that is less than or equal to 10,000 pounds GVWR), only 13 involved vehicles that were outfitted with adaptive devices (0.26%). Based on variables used to describe the interior of the vehicle, these figures do not indicate whether structural modifications were made to the vehicle.

Discussions with a representative of the U.K. Department of Transport revealed that no official statistics on collisions involving converted personal vehicles are tracked in the U.K. or other European countries. However, the U.K.-based Banstead Mobility Centre did conduct a survey of driver-assessment clients during the 1988 to 1990 period. Among the issues covered during the survey was collision experiences of drivers with disabilities. The report, *Driving Assessment of Disabled People – 1988-1990*, states that:

> *The number of accidents reported indicates that for those with a physical disability alone, the pattern of accidents is similar to national (U.K.) statistics – men, drivers under thirty years old and elderly drivers appear more at risk. For those with a disability including brain damage, women appear to be at higher risk, whilst those over seventy years old reported no accident involvement. There was also the tendency for those with a higher mileage to be more at risk of being involved in an accident.*

6 Issues related to Conversions

6.1 Safety Issues related to Conversions

The design of vehicle bodies and frames is complex and requires extensive computer calculations and simulations. OEMs perform numerous complex calculations and tests during the development of a vehicle to ensure compliance with governing standards and regulations as well as other design goals.

In addition, structural components are optimized by OEMs to reduce unnecessary weight and production costs without sacrificing vehicle integrity. Some vehicle bodies, especially those of the uni-body type, are designed as protective cages around the occupant compartment and contain energy-absorbing impact zones. Frequently, several vehicle systems must function collectively to achieve the level of protection required by governing standards such as the CMVSS.

Vehicle converters often modify vehicle components or structural features in the course of adapting a vehicle for use by persons with disabilities. Without knowing the original intent of the OEM, modifications may compromise vehicle's safety. In this regard, advice and assistance from OEMs can be valuable in preventing converters from compromising the original certification of the vehicle, thus minimizing certification costs.

The following areas are where potential safety issues may arise when modifying OEM systems and components.

6.1.1 Frame and Body

Vehicle bodies and frames are often altered by vehicle converters to improve accessibility for mobility impaired persons and to accommodate conversion components. Without knowing the original intent of the OEM, these modifications may compromise the integrity of the vehicle.

A common modification to accommodate mobility aids consists of lowering the vehicle's floor. A ramp or lift system may also be added. Modifications of this nature may interfere with a number of systems including the fuel tank, fuel lines, brake lines, electrical wiring, exhaust system, drive shaft (rear-wheel drive or four-wheel drive vehicles), suspension components, and vehicle frame (body-on-frame vehicle construction).

In the case of body-on-frame vehicle construction, the frame is often the principal structural element of the vehicle to which the body, suspension, and drivetrain are attached. A proper frame modification involves numerous considerations including

frame strength, fatigue resistance, stress concentration, existing high stressed areas, failure modes, and the application and type of loads. Overlooking any of these factors during design may lead to premature frame failure resulting in loss of control during vehicle operation or degradation of the desired frame deformation characteristics in a collision. Proper frame geometry is also required to provide adequate protection for the fuel system.

6.1.2 Fuel System

Floor and frame modifications frequently affect the fuel system, requiring the fuel tank and fuel lines to be relocated. Fuel system integrity and protection are of utmost importance and steps must be taken to ensure that it is maintained even after a collision. The CMVSS are very stringent on this area.

6.1.3 Roof

Another approach to accommodate mobility aids consists of raising the vehicle's roof. Modified glazing (windows) must then be installed to provide adequate visibility for the occupants.

From a structural point of view, this modification has a greater impact on uni-body type vehicles. Uni-body type vehicles derive their strength by distributing loads over the entire body structure, relying heavily on the roof, floor, door sills, and floor hump to provide adequate stiffness in the middle section of the vehicle. Improper modification of the roof structure will affect the vehicle's integrity and reduce its collision and roll-over performance.

6.1.4 Door Widening

Door openings are widened or made taller to improve accessibility to the occupant compartment. Typical approaches include moving body pillars, lowering the floor, and raising the roof. As with all other body alterations, care must be taken to restore the integrity of the vehicle after the modifications have been made.

Moving body pillars also affects the side impact protection of the vehicle. In addition, seat belt anchor points are usually located on body pillars. The relocation of body pillars will alter the relative position of the occupant to the seat belt anchor points unless proper action has been taken to relocate the anchor points.

6.1.5 Occupant Protection System

The seats, seat belts, air bags, padded dashboard, knee bolsters, and collapsible steering column are all part of the occupant protection system and function collectively to protect the vehicle occupants in a collision. Modifications performed

on these systems or in the vicinity of these systems must be carefully considered to avoid any performance degradation, especially when a mobility aid is used in place of an occupant seat.

Operator controls are often adapted in some form or another to accommodate a variety of different disabilities. Since most of these controls are located in occupant impact zones, converters must pay particular attention to their design to avoid introducing potential hazards during a collision. Controls should be clearly identified to avoid confusion.

6.2 Air Bags

Vehicle manufacturers have included air bags as standard equipment in a large number of passenger vehicles in Canada. The effectiveness of air bags in reducing injury levels depends greatly on the relationship between the air bag, occupant, and surrounding features. With respect to vehicle modifications, installing special seats, adding adaptive controls in the vicinity of the steering wheel, or modifying the steering column may alter this critical relationship. It is difficult to predict the effect of such modifications on the performance of an air bag system, a capability some conversion companies may not possess.

In the United States, NHTSA is currently studying the issue of air bags and persons with disabilities. This research is summarized in the Federal Register, August 6, 1996 (volume 61, no. 152), article on Federal Motor Vehicle Safety Standards – Occupant Crash Protection:

> *The agency is continuing to evaluate the special problems faced by persons with disabilities. People with disabilities may have problems with air bags in addition to those that result primarily from their proximity to the air bag at the time of deployment. Persons with disabilities may also face unique problems due to the special automotive adaptive equipment they need to drive, or vehicle modifications needed to accommodate the disability. The installation of certain automotive adaptive equipment may require removal of the air bag, reduce the effectiveness of air bags by interfering with their deployment, or cause injury to a driver because of movement of the device during deployment. In September 1994, the agency issued a consumer advisory cautioning drivers with disabilities not to use steering control devices mounted on a bar installed across the steering wheel hub (a "spanner bar") of vehicles with driver-side air bags.*
>
> *NHTSA currently lacks sufficient data to decide if air bags will pose unique problems for people with disabilities because of the interaction with the special automotive adaptive equipment. Thus, the agency does not believe it is appropriate, at this time, to propose special requirements for air bags in vehicles adapted for people with disabilities. Nor does the agency have enough information to make recommendations.*

The agency has started a sled testing program to investigate the potential for injury from steering control devices used by people with disabilities and the possible interaction of these devices with deploying air bags. This testing is scheduled to be completed by September 1996. The agency will then analyse the test results and take appropriate actions.

Note that (as of mid-April 1997) the report associated with the NHTSA study was in the process of being printed for release through NHTSA and the U.S. National Technical Information Service (NTIS).

6.3 Concerns Raised during Consultations

During the consultations undertaken during this phase, a variety of specific safety concerns regarding converted vehicles and automotive adaptive equipment were raised, including:

- modifications to seat belts, especially if seat belt anchors are affected by the modification;
- secure installation of power seats, including securement of seat base to the vehicle and the seat to the seat base (currently, only Ricon power seats can be legally installed, and only in Chrysler Caravans);
- integrity of brakes;
- construction and installation of hand controls, including reliability of self-installed hand controls (these are not covered by CMVSS);
- reaction of hand controls in collisions (e.g., collapse-ability);
- reaction of hand controls in emergency situations, including situations requiring evasive action (e.g., how will hand controls react?, will hand controls react as expected?);
- reliability of electronic/low effort steering controls (e.g., joy sticks) and steering back-up systems;
- adequate training into the use of hand controls;
- risk of fire from reduced integrity of the fuel system;
- strength and reliability of mobility aid securement systems, especially in collisions;
- lack of standardization with respect to the use of mobility aid securement systems, and lack of requisite skills/experience on behalf of individuals responsible for securing mobility aids;
- ability to safely exit a converted vehicle, especially if side door is blocked by a lift device (it was noted that the introduction of mini-vans with two side doors may help alleviate these concerns); and
- overall reliability of conversions, and related maintenance/servicing requirements.

6.4 Role of Original Equipment Manufacturers (OEMs)

OEMs can be defined as including vehicle manufacturers (e.g., Ford, Chrysler, GM) and manufacturers of automotive adaptive equipment (e.g., mobility aid lift devices, access ramps, hand controls).

The reasoning behind OEMs' adoption of a particular design feature may not be apparent to a second stage manufacturer. To address this issue, OEMs have published vehicle modification manuals that identify structures or components that can be modified and the types of modifications that can be performed without compromising a vehicle's integrity. OEMs may also provide direct assistance to vehicle converters through technical or engineering support departments.

The following manufacturers were contacted to obtain information on the extent of support available to vehicle converters:

- Chrysler Canada – Vehicle Safety and Regulations;
- Ford – Modified Vehicle Engineering, Truck Operations;
- General Motors – North American Operations, NAO Technical Center (awaiting response); and
- General Motors of Canada – Engineering Department.

Ford, through its Modified Vehicle Engineering Department, publishes *Incomplete Vehicle Manuals* for its truck-based vehicles. These manuals cover areas that can be safely modified by vehicle converters and outline where equipment can be installed without compromising the performance of safety systems. Ford also provides assistance to U.S. and Canadian vehicle converters through its Modified Vehicle Engineering department. A separate manual, the *Ford Truck Bodybuilder's Layout Book*, covers common body repairs and modifications.

The bulk of the information contained in these manuals covers truck or van type vehicles of body-on-frame construction. The Modified Vehicle Engineering Department will, however, attempt to answer questions related to uni-body type vehicles. Samples of these manuals have been requested for further study. Contact with Chrysler and General Motors indicates that they offer similar support to U.S. and Canadian vehicle converters, in the form of manuals and advice.

During the consultations, it was generally agreed that, until recently, original vehicle manufacturers have not provided significant advice to the Canadian conversion industry regarding modifications. This has primarily been due to the small Canadian market. From Transport Canada's perspective, it would be ideal if original vehicle manufacturers provided more technical assistance to converters, especially for more commonly used vehicles and conversions. Additional guidance would help converters understand what can and cannot be done to a vehicle in terms of

ensuring compliance with CMVSS, and as a result, facilitating "flow-through" certifications (e.g., incomplete vehicles can be accompanied by a manual outlining how modifications can be made to the vehicle while ensuring the original certification is not compromised). It is estimated by NMEDA Canada that up to 90% of automotive adaptive equipment used in vehicle conversions is imported from the United States. However, due primarily to the small Canadian market, automotive adaptive equipment is typically not designed or tested to Canadian safety standards. As a result, Canadian converters must test the equipment to ensure compliance with CMVSS.

7 Compliance with CMVSS

7.1 Standards from CMVSS that Pertain to Converted Vehicles

Given the wide variety of modifications that can be performed on a vehicle, a wide variety of standards from CMVSS can be applicable. These standards are presented in association with specific modifications in Appendix D.

7.2 Impact of Compliance with CMVSS

Vehicles converted for use by persons with disabilities are currently required to comply with the safety standards contained in the Canadian MVSA. TES Limited conducted the following analysis to evaluate the impact of complying with each of the MVSA safety standards.

7.2.1 Impact of Individual Safety Standards

To evaluate the impact of applying the MVSA safety standards to converted vehicles, Transport Canada's Motor Vehicle Inspection Guide was consulted in association with the actual CMVSS. The primary focus of the analysis was to determine the extent of the safety standard and the types of details that would be examined by Transport Canada.

Highlights from the analysis contained in the following pages focus on those standards that may have a major, or potentially major, impact on converters. A detailed analysis of the impact of all applicable standards, including those with minor impacts, is presented in Appendix E.

The impact of compliance with CMVSS must be assessed with consideration of the following points:

- The need to conduct testing is dependent on the nature and extent of the modification that is made to the vehicle. In situations where the modification does not negate the original certification achieved by the original equipment manufacturer, Transport Canada is prepared to accept the certification testing performed by the first-stage manufacturer or equipment supplier. For example, with respect to CMVSS 204 – Steering Column Rearward Replacement, the addition of a spinner-knob to the steering wheel would not require the vehicle to be subject to a barrier crash test, as the modification does not negate the original certification achieved by the OEM.

However, if the steering column was significantly altered (e.g., the length is adjusted to allow greater access for the driver), proof of compliance must be established by testing to the standards; engineering analysis and judgements are insufficient to confirm compliance according to the Motor Vehicle Safety Act, unless they are backed up by test records.

- Exemptions to specific standards do exist with respect to CMVSS. As noted in the Motor Vehicle Safety Act:

  On application by a company in the prescribed form, supported by prescribed technical and financial information, the Governor in Council may, by order, grant an exemption for a specified period, subject to any conditions specified in the order, for any model of vehicle manufactured or imported by the company from conformity with any prescribed standard applicable to that model where conformity with that standard would, in the opinion of the Governor in Council:

  a) create substantial financial hardship for the company;
  b) impede the development of new safety or emission control features that are equivalent to or superior to those that conform to prescribed standards; or
  c) impede the development of new kinds of vehicles, vehicle systems or components.

  An exemption may not be granted for a model if the exemption would substantially diminish the safe performance of the model or the control of emissions from it, or if the company applying for the exemption has not attempted in good faith to bring the model into conformity with all prescribed standards applicable to it. [5]

- In terms of certification testing, Transport Canada is prepared to accept representative certification testing (also known as generic testing) on behalf of a group of companies, either as a consortium or under auspices of an industry association. A representative product can be tested and the test records used by all parties, provided that evidence is available that a company's product is identical in critical features to the test representative. NMEDA Canada currently offers this form of generic testing to its members. In addition, Transport Canada has noted that this type of program has proven cost-effective for some limousine and truck manufacturers.

- As noted in Section 4.2, Transport Canada's Enforcement Branch states that they will not take action on "one-off" conversions that are not certified, if the conversion company is willing to accept the risk of not having the vehicle certified. In these situations, the consumer must be informed of the situation, and be willing to purchase the vehicle uncertified.

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5 Motor Vehicle Safety Act, Vehicle Exemptions.

Major Impact

- **201 – Occupant Protection –** significant modifications to head impact areas in the vehicle may require testing according to the requirements of this standard and/or SAE J921b – Motor Vehicle Instrument Panel Laboratory Impact Test Procedure – Head Area and SAE J211 – Instrumentation For Impact Tests.

- **202 – Head Restraints –** modifying the OEM seats or head restraints or removing an OEM seat to accept an occupied mobility aid may require a forward acceleration test to verify compliance with this standard.

- **203 – Driver Impact Protection –** significant modifications to the OEM steering control system may require testing according to SAE J944, Steering Control System-Passenger Car-Laboratory Test Procedure.

- **204 – Steering Column Rearward Displacement –** modifications to the OEM steering column may require barrier impact testing to verify compliance with this standard.

- **206 – Door Latches, Hinges, and Locks –** modifications to OEM side door hinges and latches may require pull force tests to verify compliance with this standard.

- **209 – Seat Belt Assemblies –** seat belt installations may need to be tested to verify compliance with the performance requirements of this standard. These tests may involve applying forces to seat belt components and measurement of actuation and engagement forces.

- **219 – Windshield Zone Intrusion –** if the OEM windshield is replaced or modified, barrier impact testing may be required to verify compliance with this standard.

- **301 – Fuel System Integrity –** if the OEM fuel system is altered by relocating fuel lines or the fuel tank or any other significant structural modification, barrier impact testing may be required to verify compliance with this standard. Compliance with this standard requires components other than the fuel system to meet minimum design requirements.

- **301.1 – L.P.G. Fuel System Integrity –** if the OEM fuel system is altered by relocating fuel lines or the fuel tank or any other significant modification, barrier impact testing or verification of compliance with other standards may be required to verify compliance with this standard. Compliance with this standard requires components other than the fuel system to meet minimum design requirements.

- **301.2 – CNG Fuel System Integrity –** if the OEM fuel system is altered by relocating fuel lines or the fuel tank or any other significant modification, barrier impact testing or verification of compliance with other standards may be required to verify compliance with this standard. Compliance with this standard requires components other than the fuel system to meet minimum design requirements.

Potentially Major Impact

Depending on the nature of the modification, the following standards may have a potentially major impact:

- **101 – Location and Identification of Controls and Displays –** there should be no major difficulty in meeting the majority of these requirements as the accessibility of controls is one of the aims of modifying a vehicle. Generally, the extra effort in following the above specifications should not be extensive. A potentially major difficulty in meeting these requirements is the altering of the OEM driver position, which may directly affect viewing of the displays.

- **207 – Anchorage of Seats –** seat anchorages conforming to MVSA safety standards will comply with the majority of the seat specific requirements. Installation of the seats may require testing to verify compliance with this standard.

- **210 – Seat Belt Assembly Anchorages –** seat belt anchorage installations may require testing to verify compliance with this standard. Tests apply to the loading of the seat belt anchorages, measurements of the anchorage locations and the location of seat belts relative to an anthropomorphic test device. (A discussion pertaining to the proposed amendments to 208 and 210 is provided in Section 7.3.)

- **212 – Windshield Mounting –** if the OEM windshield is replaced or modified, barrier impact testing may be required to verify compliance with this standard.

- **213.3 – Restraint Systems for Disabled Persons –** an OEM seat and seat belt system that has been removed or modified to accept an occupied mobility aid will need to meet the requirements of this standard. Using an approved production restraint system may alleviate the testing requirements; however, a custom restraint system may require barrier impact testing to verify compliance with this standard. (It should be noted that this standard applies to child restraint systems, and restraints for small adult occupants up to and including 105 pounds in weight.)

7.3 Impact of Proposed CMVSS 208 and 210

7.3.1 Overview of Proposed Amendments

On December 2, 1995, Transport Canada published a Regulatory Impact Analysis Statement (RIAS) in the Canada Gazette Part I, concerning proposed amendments to occupant protection systems, in particular, motor vehicle safety regulations (MVSR) 208 (seat belt installations) and 210 (seat belt anchorages). As the RIAS notes, the existing MVSR 208 states requirements for seat belt installation, crash protection, and air bags, while MVSR 210 sets the strength requirements for the seat belt anchor system, and defines an envelope in space, relative to the occupant, in which the anchorages may be located.

Existing MVSR requires that light-duty vehicles be equipped at the driver and right-front passenger positions with either:

- manual three-point belts; or
- automotive protection systems consisting of either air bags or automatic seat belts.

It further stipulates that vehicles equipped with air bags or automatic seat belts must pass a 48 km/h-frontal-barrier crash test. While all seat belts must pass certain static tests, manual three-point seat belts do not have to be dynamically tested. When air bags are installed without seat belts, the vehicle must also pass a roll-over and side-impact test, requirements that, as noted in the RIAS, have effectively discouraged manufacturers from installing air bags alone.

An important proposed amendment to MVSRs 208 and 210, in relation to this study, is the requirement that manual seat belts in front outboard positions, would be subject to dynamic testing, and the criteria for testing head and chest protection, would be strengthened. The RIAS summarizes proposed amendments to MVSRs 208 and 210 by stating that:

> *As of September 1, 1997, the installation of manual three-point seat-belt systems in all motor vehicles would be required, and the installation of air bags would remain optional. Seat belts, like air bags, would be subject to dynamic testing, and the performance of all occupant protection systems would be evaluated in accordance with advanced injury criteria* (Canada Gazette Part I, December 2, 1995, page 4136).

7.3.2 Dynamic Testing of Vehicles Altered for Drivers using a Mobility Aid

As noted in the RIAS for the proposed amendments to 208 and 210, a vehicle modified to accommodate a driver using a mobility aid would be subject to dynamic

testing. Transport Canada had tentatively concluded at the time that allowing an exemption from the testing requirements for these vehicle would entail an unacceptable risk of injury to the disabled driver, passengers, and third parties, and no exemption was proposed.

Transport Canada officials have noted that regardless of the crash test requirements for the proposed MVSR 208, vehicles that have been modified to accommodate a person with a disability as a driver (in particular, drivers using a mobility aid), are currently subject to a crash test requirement under the MVSR 301, Fuel System Integrity. Transport Canada noted that the crash test is required because of the unknown effect of structural changes to the vehicle on the integrity of the fuel system in the event of a collision, and because Transport Canada has observed failures, no consideration has been given to removing this requirement. However, the crash test requirement of the proposed MVSR 208 would have a minimal incremental impact in the majority of cases where the modification was based on a driver using a mobility aid as this test could be combined with MVSR 301.

The impact would be much greater in the (few) cases where no structural modifications were made that would affect the fuel system integrity. Furthermore, this exemption does not apply to vehicles that are modified, but not for use by a persons with a disability as a driver, and as such, the requirement would have a greater impact in certain cases. For example, if modifications are made that affect the safety of the originally installed seat belts and anchorages (e.g., raising the roof of a van to accommodate access, which requires removal and/or relocation of the seat belt anchorages), the vehicle must be dynamically tested by the converter.

To avoid the testing requirement, the converter could choose another option for how modifications accommodating access are made (e.g., a lift or ramp could be located at the rear of the vehicle). In this situation, the cost of dynamic testing is replaced by increased design costs, and/or reduced modification options.

8 Alternative Approaches Regarding Regulations and Compliance

8.1 Defining Regulation

According to the federal government's guide to assessing regulatory alternatives, the most commonly used definition of "*regulation*" was developed for the Economic Council of Canada's Regulation Reference, which defines regulation as:

> *The imposition of rules backed by the threat of government sanctions, with the intention of modifying or controlling private behaviour. These rules can be established statutes, subordinate legislation (regulation), administrative procedures, orders, directives, manuals, and implicitly, in administrative and quasi-judicial decisions. (*Assessing Regulatory Alternatives, Treasury Board of Canada).

In simpler terms, the House of Commons Sub-Committee on Regulations and Competitiveness has proposed the following definition:

> *Regulation can be defined as a set of rules, made and enforced by the state, restricting or specifying the nature of social or economic activity*. (Ibid)

Regulatory methods that are relevant in regards to the conversion of personal vehicles, include:

- performance standards;
- technical standards; and
- voluntary actions and self-regulation.

These regulatory approaches are discussed briefly below.[6]

8.1.1 Performance Standards

Performance standards set out the results or objectives that must be achieved by a certain product. As an example, a standard may set a test of strength or some other objective performance feature for a product. Performance standards do not specify what a supplier must do to comply with the standards (e.g., what technology must be used). In this sense, the supplier must still meet a target, but can choose what method to use.

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[6] For a more detailed discussion on regulatory approaches, please see *Assessing Regulatory Alternatives*, Treasury Board of Canada, 1996.

The government may also set a design standard that requires a specific technology to be used but, at the same time, allows equivalent means to be used. This permits industry to propose alternative technologies (given they meet or exceed the performance levels required in the standard).

Among the advantages of performance standards are that they can lower the risk of product failure, they may substantially reduce the amount of information and evaluation required in making a purchase decision (compensating for inequality in the information available to buyers as compared to sellers), they can produce more results-oriented policy than design (or technical) standards, and they can provide incentives for innovation (manufacturers benefit from finding less expensive methods of achieving compliance).

One disadvantage of performance standards is that they can impede innovation and the entry of new suppliers into the marketplace if methods required to demonstrate required performance levels are too demanding (e.g., in terms of cost) for some companies in an industry.

However, this disadvantage must be seen in light of the reduced risk of product failure that can be achieved by performance standards.

Performance standards (combined with self-certification) reflect the current approach to regulating vehicle safety.

8.1.2 Technical Standards

Technical standards specify exactly how compliance with regulations is to be achieved. Technical standards have been criticized for impeding innovation, but such standards do provide highly specific information about what a manufacturer must do to comply, potentially lowering the risk of product failure, and reducing the cost of enforcing compliance.

Appendix F presents standards and draft standards that form part of the report entitled *Working Draft for a General Standard Governing Adaptations of OEM Vehicles for Use by Disabled Drivers and Passengers*, developed by TES Limited for the Transportation Development Centre, Transport Canada. The aforementioned report references standards that pertain to the vast majority of modifications performed to adapt vehicles for use by persons with disabilities. This report has not been further developed since its original release in April 1994.

A number of related ISO standards have also been listed as possible alternatives to CMVSS. These standards have not been fully assimilated and their exact content is yet unknown, but they have been included to illustrate the range of alternatives available.

In addition, there are research documents that have formed a part of past research programs at TES. These documents may not pertain specifically to vehicles converted for personal use, but do address some of the related issues and may be further developed for incorporation in future standards.

8.1.3 Voluntary Standards and Self-Regulation

Persuasion, or promoting voluntary action, can be an alternative to regulatory intervention. Under this approach, government does not make legally binding rules that specify a desired behaviour. Instead, it attempts to achieve public policy objectives by persuading appropriate stakeholders to modify their behaviour voluntarily. Voluntary action can be achieved through codes, guidelines, and voluntary standards. In certain industries and occupations, companies or individuals can become certified by following industry codes or guidelines.

Given the voluntary nature of this arrangement, compliance with guidelines, or an industry code of practice, can be more difficult to ensure. The lack of effective sanctions or enforcement mechanisms may lead companies to contravene codes or guidelines. However, compliance can be encouraged by government, who can threaten to impose binding regulations if industry compliance with a code of practice is not satisfactory.

Self-regulation involves members of an industry mutually agreeing to follow an industry code of practice (or conduct). Typically, the responsibility of defining rules and obligations to be followed is vested in an organization representing the industry in question (e.g., an industry association), with compliance encouraged through industry-based certification.

Self-regulation can be used for certain industries and occupations (e.g., lawyers, doctors, engineers). In these situations, regulatory authority is delegated by government to an organization representing members practicing in that industry or occupation. This organization makes the rules, levies charges, and applies discipline, having the same force and legal authority as if they were carried out by the government itself. In this sense, there is nothing voluntary about self-regulation.

The (voluntary) Quality Assurance Program (QAP), initiated by NMEDA-U.S., represents an example of the motor vehicle conversion industry attempting to regulate itself through the use of guidelines and certification (see Section 8.2 for details).

8.2 Regulatory Approaches of Other Jurisdictions

This section discusses regulatory approaches in other jurisdictions involving converted vehicles. For comparative purposes, regulatory approaches in subject areas other than converted vehicles are also provided.

8.2.1 The U.S. Approach

NHTSA[7]

In the United States, the National Highway Traffic Safety Administration (NHTSA) is authorized to issue Federal Motor Vehicle Safety Standards (FMVSS) that set performance requirements for new motor vehicles and items of motor vehicle equipment. Manufacturers of new vehicles are required by the National Traffic and Motor Vehicle Safety Act (Safety Act) to certify that their products conform to the safety standards before they can be offered for sale.

Companies that undertake conversions must also certify that their product complies with the regulations of the Safety Act, if the conversion(s) are done prior to the first consumer purchase. NHTSA has stated that converters must have some independent basis for their certification that an altered vehicle continues to comply with all applicable safety standards. This does not necessarily mean that an alterer must conduct crash testing, even with respect to a standard like Standard No. 301 (fuel system integrity) that specifies dynamic test requirements. Certifications of continuing compliance for altered vehicles may also be based on, among other things, engineering analyses, computer simulations, and/or following instructions for alteration voluntarily provided by the original vehicle manufacturer in a "body builder's guide".

Companies undertaking conversions after a vehicle has been purchased by an individual are not required to certify that the vehicle complies with the Safety Act (i.e., the FMVSS regulations do not apply to "used" vehicles)[8]. However, manufacturers, distributors, dealers, and repair businesses modifying certified vehicles are affected by Section 108(a)(2)(A) of the Safety Act. This section prohibits those businesses from knowingly rendering inoperative any elements of design installed on a vehicle in compliance with a FMVSS (known as the "*make inoperative*" prohibition). To make inoperative is defined as making the safety situation for the vehicle occupant worse than it was in the certified vehicle.

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7 Sources for the U.S. approach include: "Q&A's from NMEDA and NHTSA", NMEDA (U.S.) Newsletter, Volume VII, No. 2, 1996; U.S. Federal Register, 1992, 1993, 1994; NHTSA Project Overviews, 1996; selected NHTSA Letters of Interpretation related to FMVSS.

8 A "new" vehicle becomes a "used" one after its first purchase for purposes other than resale.

In general, the "make inoperative" prohibition would require repair businesses which modify motor vehicles to ensure that they do not remove, disconnect, or degrade the performance of safety equipment installed in compliance with an applicable safety standard. Violations of Section 108(a)(2)(A) are punishable by civil fines up to $1,000 per violation.

The "make inoperative" prohibition was designed to ensure that vehicles remained in compliance with the FMVSS throughout its life, in part because NHTSA was not given authority by the U.S. Congress to establish manufacturing standards for a motor vehicle after its first purchase for purposes other than resale. NHTSA has exercised discretion in enforcing the prohibition to provide some allowances to businesses which cannot conform to the FMVSS requirements when making modifications to accommodate persons with disabilities. Companies must, however, apply to NHTSA to have this discretion exercised.

In certain situations where a vehicle must be modified to accommodate the needs of a particular disability, NHTSA has been willing to consider any violation of FMVSS related to the "making inoperative" clause a purely technical one justified by public need, and has indicated in certain cases that it would not institute enforcement proceedings against the converter for violating the Safety Act.

While NHTSA notes that it will not commence enforcement proceedings, it does advise modifiers that:

- only necessary modifications should be made to the vehicle component;
- the person making the modifications should consider the possible safety consequences of the modifications;
- the converter should consult with the manufacturer to determine the effect of the modification and how the modification can be safely performed; and
- if the vehicle is sold, NHTSA encourages the owner to advise the purchaser of the modifications.

As noted in the discussion paper prepared by the Road Safety Directorate of Transport Canada (*Compliance of Converted Vehicles for Disabled Drivers to Canadian Motor Vehicle Standards*, April 1996), NHTSA has rarely prosecuted for the offence of non-compliance with the Safety Act, and/or knowingly making inoperative a vehicle component or system, as they have limited resources for inspection and enforcement.

There are no blanket exemptions or case-by-case exemptions for vehicles modified to accommodate persons with disabilities. However, there are two exclusions, for FMVSS 208 (occupant crash protection) and 206 (door locks and door retention components). While these are discussed briefly below, they are both under review in the United States.

With respect to FMVSS 208 (occupant crash protection), vehicles modified to be **driven** by persons with disabilities are excluded from the requirement that occupant restraint systems in front outboard seating positions be dynamically tested. NHTSA notes that (barring any future action by NHTSA), this exclusion will expire on September 1, 1997, when the Congressionally-mandated requirement for dual air bags in all light vehicles becomes effective[9].

Vehicles manufactured for operation by persons with disabilities are defined in the U.S. Code of Federal Regulations as:

> *Vehicles that incorporate a level change device (e.g., a mobility aid lift or ramp) for onloading or offloading an occupant in a mobility aid, an interior element of design intended to provide the vertical clearance necessary to permit a person in a mobility aid to move between the lift or ramp and the driver's position or to occupy that position, and either an adaptive control or special driver seating accommodation to enable persons who have limited use of their arms or legs operate a vehicle. For purposes of this definition, special driver seating accommodations include a driver's seat easily removable with means installed for that purpose or with simple tools, or a driver's seat with extended adjustment capability to allow a person to easily transfer from a wheelchair to the driver's seat.*

NHTSA's reasoning for this exclusion is that, because of the modifications which must be made to the vehicles, converters are unable to certify compliance with the regulatory requirements by passing through certification of the chassis manufacturer (i.e., the original manufacturer). In addition, the final stage manufacturers and alterers are small businesses who cannot individually afford to independently certify compliance with the dynamic test requirements of these vehicle.

Vehicles equipped with a lift for mobility aids are excluded from provisions related to FMVSS 206 (door locks and door retention systems), if the side doors are linked to an alarm system consisting of either a flashing visible signal located in the driver's compartment or an alarm, which is activated when the door is open and audible to the driver. For example, if the converter changes the door latch in the process of installing the lift, the vehicle is excluded from provisions pertaining to door locks and door retention components.

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[9] As noted in Section 6.2 of this report, NHTSA is examining issues concerning the undesired side effects of air bags, including interactions with special automotive adaptive equipment for persons with disabilities, which may affect the expiry of the exclusion after September 1, 1997.

NMEDA-U.S. and Industry Self-Regulation

The U.S.-based NMEDA has recently developed a Quality Assurance Program (QAP) for conversion companies, representing a regulatory approach involving industry self-certification/self-regulation. To be certified under NMEDA's QAP, individual conversion companies must:

- follow specific guidelines when performing modifications. These guidelines include certain FMVSS standards and SAE recommended practices;
- have a certified automotive welder on staff;
- have an individual (on staff) who is trained and certified in dealing with assistive components for vehicles (e.g., lift systems, securement systems);
- have an individual responsible for quality control;
- agree to a review of payroll information to verify that the individuals identified as being certified are in fact involved in vehicle modifications;
- have a minimum of one million dollars product liability insurance; and
- agree to two mandatory site inspections each year (either announced or unannounced) where the company's facilities and products are inspected by an independent engineering firm (the first site visit was undertaken in March 1997).

The annual cost of being certified under the QAP is $1,300 (U.S.), including $300 registration/self-certification fee, and $500 for the two annual site inspections. Cost must also be incurred for the certification of staff.

An indication of the benefit of being certified under the QAP is demonstrated by the fact that (currently) seven states will only purchase and/or fund modified vehicles from companies certified under the QAP. In a related effort to strengthen the QAP status, NMEDA-U.S., in conjunction with NHTSA, are attempting to have the U.S. Veterans Affairs only purchase and/or fund modified vehicles from QAP-certified companies.

Each vehicle modified by a QAP certified company will include a registration card, indicating the type of vehicle and nature of the modifications performed. NMEDA-U.S. anticipates that the card, to be completed and mailed to NMEDA by the consumer, will allow more accurate tracking of the number and types of conversions being performed in the U.S.

As a service to its members, and clients of conversion companies, NMEDA-U.S. also offers information on:

funding for automotive adaptive equipment;
technology/equipment updates;
driver evaluation facility referrals;
industry-related conferences;

- safety information;
- adaptive vehicle modifier referrals; and
- legislative information pertaining to automotive adaptive equipment.

NMEDA-U.S. also offers an arbitration service (between customers and conversion companies and between customers and manufacturers) for resolving customer complaints. The resolution of these complaints typically involves the conversion company or manufacturer, repairing the vehicle, or adjusting the modification. If a QAP company does not adequately satisfy three customer complaints, they risk having their certification status suspended. To date, NMEDA has assisted in resolving 10 of the 12 total complaints lodged against QAP companies. NMEDA-U.S. will not, however, become involved if a consumer is suing a conversion company.

Because of the voluntary nature of the program, and the fact that there is no requirement within the QAP that the converter conduct modifications that comply with FMVSS, the program has been viewed as an industry quality control program as opposed to a substitute for regulations ensuring compliance with FMVSS.

8.2.2 The European Union (EU), the United Kingdom (U.K.), and France

With respect to the European Union[10], new motor vehicles intended for the carriage of goods or passengers must comply with certain mandatory technical requirements. Prior to 1992, individual EU member states had nationally-based requirements. However, to reduce trade barriers amongst EU member states, in June 1992, member state officials approved the adoption of EU legislation creating a single system for certifying that passenger cars meet safety and other technical requirements. The legislation establishes an EU type-approval system to replace the twelve-member state national schemes. The EU type-approval approach was optional through 1995; however, the approval system became mandatory in 1996.

A parallel type-approval scheme exists, known as ECE Regulations. The Economic Commission for Europe (ECE) is one of four regional economic commissions set up by the United Nations and not limited to the EU. In 1958, various ECE countries signed an agreement in Geneva which set out the framework for the adoption of uniform conditions of approval and for reciprocal recognition of approval in respect of motor vehicle equipment and parts. Signatories to this agreement are known as ECE Contracting Parties. Unlike the European Union framework described above, ECE Contracting Parties include all European states.

Under the auspices of the Directorate-General for Transport of the European Commission, efforts are also being made to develop a code of practice to evaluate

10 Source: National Standards Authority of Ireland.

the performance of converted vehicles. Currently, a converter can make modifications to a vehicle, but cannot deliberately breach the safety and crashworthiness of the vehicle. Certification of the vehicle's safety does not involve crash testing; rather, in all European countries (except the U.K.) certification is based on engineering inspections.

In the U.K., certification of the safety of converted vehicles is based on the internal judgement of the conversion company. Converters are advised that if a legal dispute arises, they must be able to demonstrate that they made a reasonable and conscientious effort to work within conformity of the type-approval regulations.

There are mandatory three-year inspections of light vehicles (e.g., automobiles, light trucks, and vans) in the U.K., which focus on vehicle systems such as brakes, lights, steering, safety belts, and corrosion. Conversions are typically not tested, as it is felt that the staff at these test stations do not have the requisite expertise or knowledge to test modifications made to a vehicle.

A publication for converters, *Guidelines on the Adaptation of Car Controls for Disabled People*, has been produced in the U.K., as a joint initiative of the Institution of Mechanical Engineers and the Transport and Road Research laboratory. As the publication notes, "the guidelines are intended to collect information on good practice in a form that can be used easily by those directly concerned with the conversion of vehicles for disabled people".

Ongoing attempts are being made to organize converters (in both the U.K. and Europe as a whole) and have them agree on quality guidelines (reflecting ISO 9000 standards) with respect to conversions. This is aimed at both improving the overall quality of the conversions which are conducted, and protecting converters against liability. Steering Developments, a U.K.-based manufacturer of higher-technology driver adaptations (e.g., electronic hand controls) has formed the European Mobility Group, which establishes quality standards for these types of adaptations.

In France, the Ministry of Transport has approved the driving of a vehicle from a wheelchair, but no safety measures such as occupant restraint and wheelchair securement have been mandated.

As the result of an R&D initiative, there now exists an optional modification of a Renault Espace which allows a tetraplegic person (or a person with equivalent limitations) to enter the vehicle with a lift, proceed to the driver's position, and drive with a joystick (other driver controls are voice-activated). The present regulation mandates that a passenger must be seated next to the driver and have direct access to the hand brake in case of an emergency.

8.2.3 Transportation of Dangerous Goods – Transport Canada

The Transportation of Dangerous Goods Directorate (TDG) of Transport Canada is responsible for enforcing the Transportation of Dangerous Goods Regulations, as per the federal Transportation of Dangerous Goods Act, 1992. The Act and Regulations cover the transporting, handling, and the offering for transport of dangerous goods.

Traditionally, TDG regulations have been prescriptive in nature, specifying the technical standards which had to be followed when transporting dangerous goods. TDG is in the process of rewriting, in clear language, all Transportation of Dangerous Goods Regulations. Included in the rewrite is a shift towards more performance-based regulations from prescriptive, technical standards-based regulation.

TDG does provide permits which allow individuals and companies to "conduct an activity in a way that is different from complying with the other sections of the Act." Permits will only be issued if the applicant can demonstrate that they will provide the same level of safety as would be the case with compliance with the Act and Regulations. As such, permits are officially called "permits for equivalent level of safety". This means that any permit that is issued should provide that an activity be done in a way that is as safe as complying with the Act and Regulations. In other words, a level of safety must exist that is at least equivalent to the level of safety achieved by complying with the Act and Regulations.

TDG conducts an assessment of a permit application to determine whether the applicant's explanation of why the permit will provide an equivalent level of safety is justified. The applicant's explanation involves the presentation of a detailed description of the proposal for a permit, and must include:

- the length of time or schedule of events for which a permit is requested;
- the text or substance of the Act or the Regulations that the applicant proposes not to comply with;
- the procedure the applicant will follow and how that procedure will ensure a level of safety as good as to that achieved by complying with the Act and Regulations, and
- drawings, plans, calculations, procedures, test results and any other relevant information.

Once all the information necessary to evaluate the application is received, it usually takes 90 days or longer depending on the complexity of the permit to complete the legal steps necessary to issue permits. Transport Canada may require additional information than that provided with the permit and the onus is on the applicant to

provide the information. Depending on the materials being transported, this may require container testing.

8.2.4 Medical Devices – Health Canada

At Health Canada, the Medical Devices Program regulates thousands of medical devices sold in Canada, ranging from pacemakers to surgical lasers, to promote safety and efficacy in their design, manufacture, and use.

Manufacturers who wish to market a medical device in Canada must issue a notice of compliance demonstrating the safety and efficacy of the device, based on test methods defined by Health Canada. These test methods vary by type of device (devices could include implantable (e.g., pacemakers), orthopaedic, diagnostic, and neurological). Statistical evidence is typically required to demonstrate that the benefit of introducing the device outweighs the risk it presents to the general public.

In examining information and materials submitted by a manufacturer, demonstrating the safety and efficacy of new medical devices, Health Canada charges the manufacturer fees ranging from $500 to $11,000, depending on the device.

Exemptions

Exemptions to a Notice of Compliance[11] can be issued by the Medical Devices Bureau, based on compassionate grounds. For example, if a manufacturer does not have the Notice of Compliance completed, but the benefit of the device for a patient outweighs its risk, the device would be released. Similarly, if the device is not sold in Canada (due to a small market), and a Canadian Notice of Compliance is not worthwhile for the manufacturer, the device will be released.

When an exemption based on compassionate grounds is allowed, the patient must be informed of the device, along with its risks and benefits. Also, within 30 days of the device's use, a notice as to the results of its use (and any adverse reactions) must be provided to Health Canada. Health Canada may suspend and/or cancel an exemption if it is believed that the use of the device would seriously endanger the life or health of the patient.

It was noted by the Device Evaluation Division (which handles implantable devices) that exemptions are typically given to devices that have had previous approval in the United States.

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[11] For reference, please see the Medical Devices Regulations of the Food and Drug Act Health Canada, May, 1996).

8.2.5 Drugs Program – Health Canada

The mandate of Health Canada's Drugs Program is to ensure that the drugs available in Canada are safe, effective, and of high quality, by assessing their benefits and risks effectively, continually, in a timely manner (benefit/risk assessment), and by managing their risks appropriately (risk management).

Like the Medical Devices Bureau, manufacturers who wish to market a drug in Canada must issue a notice of compliance demonstrating the safety and efficacy of the drug, based on clinical trials and test methods defined by Health Canada. These methods vary by drug type. Statistical evidence is typically required to demonstrate that the benefit of introducing the drug outweighs the risk it presents to the general public.

8.3 Other Alternative Regulatory Approach Considerations

As will be discussed in Section 9, when addressing questions concerning the issue of alternative regulatory approaches to ensuring the safety of vehicles converted for use by persons with disabilities, in terms of risks versus safety for both users of converted vehicles and other road users, it is important to understand factors surrounding the existing risk profile, such as number of converted vehicles in operation, frequency of collisions involving converted vehicles, consequences of the collisions (e.g., fatalities, injuries, property damage), and perceptions regarding the risk of collisions involving converted vehicles occurring.

These variables, for which there are no currently reliable statistics, are important in determining the current level of risk involving converted vehicles, the appropriateness of the existing regulatory approach given the risk exposure associated with converted vehicles, and the potential value of alternative regulatory approaches.

The Enforcement Branch of Transport Canada's Road Safety Directorate considers the current approach the only viable option for ensuring that vehicles converted for use by persons with disabilities are safe, as per the Motor Vehicle Safety Act (MVSA) and Canadian Motor Vehicle Safety Standards (CMVSS).

Their experience has indicated that in the absence of clearly established performance standards, auditing and testing for compliance with these standards, and regulatory enforcement in situations where the standards are not being met, optional methods such as voluntary industry self-regulation, adherence to technical standards, and industry consultations are not sufficient to maintain safety levels required by the MVSA and CMVSS.

9 Risk Assessment

During preliminary interviews with the users of vehicles converted for use by persons with disabilities, several perspectives were obtained regarding the safety of these vehicles. On the one hand, it was noted that persons with disabilities would be prepared to accept a greater amount of personal risk if they could obtain increased independence through access to converted vehicles at lower cost. On the other hand, some users stated that they expected the same amount of safety in their vehicles, as if they purchased a vehicle that had not been converted. At this time, due to the small number of interviews undertaken, we cannot comment on how broadly these two perspectives are held.

The efforts of TC to enforce the provisions of CMVSS are directed at ensuring that all road vehicles are safe, whether or not the vehicle is converted. These efforts result in an increased price to the purchasers of converted and non-converted vehicles, but at the same time provide increased safety for all road users.

The trade-off between safety and cost is largely one of acceptance of risk, which is the issue underlying the extent to which safety regulations, such as CMVSS, are required and enforced. This section discusses risk and its components in some detail.

9.1 The Nature of Risk

Risk can be defined as exposure to the possibility of personal injury or fatality, and/or to financial loss. The nature of risk can be understood through its three components: frequency, consequence, and acceptability of injury/fatality or financial loss. Each component is discussed below in terms of how it relates to the conversion of motor vehicles.

9.1.1 Frequency of Injury/Fatality or Financial Loss

The frequency of occurrence can be addressed by answering the following questions:

- how often does an injury/fatality or financial loss take place?
- what is the chance (probability) of a injury/fatality or financial loss occurring?

In this study, frequency of occurrence is measured by the probability of a collision involving a vehicle converted for personal use, where the modification has either contributed to the collision or to the severity of the collision. Exposure data, in terms of how much vehicles converted for personal use are driven in comparison to other vehicles, is also required to determine whether the probability of a collision is higher

or lower given the amount of time the vehicles are on the road. As noted later in this section, information that meets these requirements is not currently available.

9.1.2 Consequence of the Injury/Fatality or Financial Loss

The consequence of the collisions can be addressed by answering the following question:

- What is the impact or implications (extent/magnitude) of the injury/fatality or financial loss?

While there is no reason to anticipate that the consequence of a collision involving a converted vehicle should be greater or less than collisions not involving a converted vehicle, there is no information to support this perspective. However, the insurance companies contacted in this study stated that they do not charge a higher premium for converted vehicles, except in relation to the fact that converted vehicles have higher values. This suggests that they do not perceive a greater risk in insuring drivers of converted vehicles.

9.1.3 Acceptability of the Injury/Fatality or Financial Loss

The acceptability of the injury/fatality or financial loss can be addressed by the following question:

- How acceptable are the injuries/fatalities or financial losses to the affected parties?

The perspectives may vary depending on the stakeholder being considered. A driver or passenger in a converted vehicle may be prepared to accept a reduced level of personal safety than would otherwise be provided in order to acquire a converted vehicle at a reduced cost. However, from a societal perspective, other road users would probably not be prepared to accept a reduced safety level to enable persons with disabilities to purchase a converted vehicle at reduced cost.

9.2 Risk and Alternative Regulatory Approaches

Risk management is the approach taken to understand and appropriately minimize or eliminate risks, and consequently, the risk of financial loss or injury or death. For vehicles converted for personal use by persons with disabilities, risk management is achieved through regulation and the enforcement of CMVSS, aimed at minimizing collisions through the assurance that modifications meet safety standards as set in the MVSA and applicable CMVSS (i.e., the modifications do not negate or compromise the original compliance of the vehicle).

In addressing alternative regulatory approaches to CMVSS regarding vehicles converted for use by persons with disabilities in terms of risks versus safety for both users of personal-use converted vehicles and other road users, it is important to understand the factors surrounding the existing risk profile, namely:

- how frequently collisions involving vehicles converted for personal use occur and the extent to which modifications were a contributing factor in the collision (or the severity of the collision);
- the relative frequency of collisions involving vehicles converted for personal use (e.g., as a percentage of total converted vehicles, kilometres traveled, and overall collisions involving all vehicles);
- the consequences of the collisions (i.e., fatalities, injuries, property damage); and
- perceptions regarding the risk of collisions involving vehicles converted for personal use occurring.

The preliminary research conducted during this phase has revealed that there are no reliable statistics on collisions involving vehicles converted for use by persons with disabilities. Nor are there reliable statistics relating to the number of vehicles converted for use by persons with disabilities currently in use or kilometres travelled. These variables are important in determining the current level of risk, the appropriateness of the existing regulatory approach given the risk exposure associated with vehicles converted for personal use, and the potential for alternative regulatory approaches. Preliminary perceptions regarding the risk of collisions were captured, however, and are discussed below.

9.3 Perceptions of Risk Collected during Consultations

In addition to statements concerning risk, as discussed in the background paper prepared by the Road Safety Directorate of Transport Canada, initial perceptions regarding risk were captured during the first phase. They included comments from current owners/users of converted vehicles, converters, driver rehabilitation specialists, representatives of persons with disabilities, and government officials.

For reference, the discussion paper noted that the Canadian Paraplegic Association (CPA) believes that persons with disabilities "are prepared to accept somewhat greater risk if it means greater accessibility to more reasonably priced converted vehicles", adding that "safety and cost have to be balanced; it should not be safety at any cost".

The Enforcement Branch of Road Safety (Transport Canada), which has a mandate to reduce the number of deaths, injuries, and damage to property resulting from the use of motor vehicles, claim that persons with disabilities with whom they have talked, want their vehicles to be just as safe as those operated by persons without

disabilities (i.e., to comply with all standards). These owners do not feel that they should have to accept vehicles that are not as safe as those operated by persons without disabilities.

The Enforcement Branch notes that they receive telephone calls from consumers regarding defects and complaints regarding vehicles converted for persons with disabilities, and use this feedback in determining which companies are audited in terms of compliance. In addition, the Enforcement Branch undertook a small survey of consumers with disabilities regarding their use of converted vehicles. The feedback obtained during this survey indicated that the consumers were concerned about safety and expect their vehicles to be as safe as other vehicles on the road. In addition, they expect the federal government to play a role in ensuring that these safety concerns are met by the conversion industry.

Comments made during the consultations regarding risk, and issues such as the trade-off between risk and lower costs of vehicles, and the current approach to compliance, included:

- Although independence and mobility are very important factors, given the potential impact that an unsafe vehicle may have in terms of other road users, safety must be seen as the primary concern.

- Although conversions may be contributing factors, other factors, such as inexperience or lack of training on the part of the driver, may also play a role in terms of the risk of collisions occurring.

- The added cost of compliance becomes an issue if it becomes restrictive in terms of being able to purchase a converted vehicle, which is important given that persons with disabilities may have more tolerance to "prudent risk"; however there is a limit. For example, as this respondent noted, "in a crash, I want to be confident that the vehicle and the mobility aid securement systems are safe and reliable. There is no greater fear than the vehicle catching on fire because of the gas tank, especially if your exit route from your van (the side door) is blocked by a lift". The respondent also noted that new models of mini-vans with two side doors may facilitate exiting a van in the case of an emergency, especially if one door is blocked by a lift.

- "I have not felt at risk using a converted vehicle because I assumed that converted vehicles were always tested and were in compliance with safety regulations".

- Given the history of the conversion industry, and the relatively unsafe vehicles that were being produced in the past, the current approach to compliance is appropriate.

- "I would resist lowering safety standards in order to provide greater access to vehicles for our community" (i.e., persons with disabilities).

- In the long run, compliance with CMVSS is in the best interests of the consumer. However, there may be trade-offs, as there may be less choice in terms of types of vehicles and modifications, and as a result, fewer persons with disabilities will use personal vehicles for transportation.

- With the current approach regarding compliance, consumers may use alternative approaches to modifying their vehicles. For example, if a van's side door is modified to include a remote door opener, the door lock mechanism must meet CMVSS 206 (which would require a pull force test) in order to be in compliance. However, the door lock may interfere with the efficient operation of the remote door opener. As a result, the consumer may have the lock adjusted and/or removed (without the help of a converter) to facilitate the use of the remote door opener. As a result, by having consumers use alternative sources for completing modifications, the conversion industry risks losing control over how certain modifications are performed.[12]

- There seems to be a tendency to make persons with disabilities safer than everyone else. Given that they may have more tolerance to "prudent risk", they would probably prefer mobility over safety.

- "I see there being no difference in the risks between a person with a disability driving a vehicle that has had a poor conversion performed on it, and a person without a disability driving a vehicle that has had a poor brake-job performed on it".

It should be noted that NHTSA in the United States has recently launched an Internet-based questionnaire on automotive adaptive equipment and modified vehicles. The aim of this questionnaire is to obtain information on types of adaptations and modifications, the perceived safety of these adaptations and modifications, and safety-related problems experienced by users.

The agency would like the experiences of consumers with adaptive equipment and modified vehicles to guide their research projects and help identify areas where people may be having problems.

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12 It has been noted by Transport Canada that similar priced technology exists that would allow a converter to install automatic door openers which meet the requirements of CMVSS 206 while maintaining the efficient operation of the door, thus eliminating the need for the consumer to have the lock adjusted and/or removed.

10 Summary of Findings and Remaining Information Requirements

This section provides a summary of the information collected and outstanding information requirements. Potential approaches for addressing remaining information requirements, by issue, are also provided. In preparing this summary, we have combined those issues related to the cost of complying with CMVSS, the impact of CMVSS and the proposed amendment to the 208 regulation.

Table 10.1 provides a summary of information requirements and approaches for addressing these needs, by issue.

10.1 Issue: Motor Vehicle Conversion Industry

Information Collected

- preliminary information on the number and size of conversion companies
- 1991 profile of driver rehabilitation specialists/rehabilitation centres providing driver assessments
- preliminary estimates on the number and types of conversions performed

Outstanding Information Requirements

- Detailed profile of the conversion industry, including:
  - size of companies (e.g., in terms of number of vehicles converted)
  - types of conversions performed based on representative industry input
  - number of conversions (based on representative industry input) for:
    - individuals driving from a mobility aid
    - individuals who use a mobility aid, but drive from the original driver's seat
    - individuals who use a mobility aid and travel as passengers
  - source of customers (e.g., referrals through prescribers/driver rehabilitation specialists)
  - knowledge concerning customer financing
  - support from OEMs (including vehicle manufacturers and equipment manufacturers)
  - extent of in-house technical capability/capacity available to address CMVSS requirements
  - problems/concerns related to complying with CMVSS
  - conversions of new versus used vehicles
  - conversions based on completed versus incomplete vehicles

- imports of converted vehicles from the U.S.
- knowledge of collisions involving converted vehicles

Potential Approaches for Addressing Information Requirements

- case studies of selected conversion companies
- consultations with a mix of conversion companies (i.e., small, medium, large)
- consultations with driver rehabilitation specialists
- analysis of Transport Canada reporting system

10.2 Issue: Annual and Total Vehicle Conversions

Information Collected

- estimates of annual motor vehicle conversions
- estimates (based on estimates of annual conversions) on total number of converted vehicles in use

Outstanding Information Requirements

- estimates of annual motor vehicle conversions and total number of converted vehicles in use, to improve the estimates obtained during Phase I

Potential Approaches for Addressing Information Requirements

- information on the *number* of conversions over the last three years could be obtained through consultations with the conversion industry
- consultations with driver rehabilitation specialists
- analysis of Transport Canada reporting system

10.3 Issue: Types of Conversions

Information Collected

- inventory of minor and major conversions

Outstanding Information Requirements

- number of various types of conversions performed

Potential Approaches for Addressing Information Requirements

- information on the types of conversions over the last three years could be obtained through consultations with the conversion industry
- analysis of Transport Canada reporting system

10.4 Issue: Users of Converted Vehicles

Information Collected

- industry estimates on annual conversions
- 1991 HALS estimates provided baseline data and future projections on the number of persons with disabilities who use automotive adaptive equipment as a driver or passenger, and the number of these individuals who use a mobility aid (as noted above, automotive adaptive equipment includes hand controls/brake controls, hand rails, straps, specialized handles, ramps/lifts, space for mobility aid or other specialized equipment, including storage space)
- selected socio-economic characteristics also estimated through the 1991 HALS

Outstanding Information Requirements

- reliable estimates on the number of individuals who have purchased a converted vehicle within the last three years for purposes of driving or travelling as a passenger
- issues related to those persons who have purchased a converted vehicle, including:
  - how individuals obtained their vehicle (e.g., financing, use of a driver rehabilitation specialist for prescription purposes and driver assessment)
  - usage and travel patterns
  - collision experience
  - maintenance/service requirements
  - perceptions regarding the trade-off between the safety of vehicle and cost of the vehicle
- reliable estimates on the number of individuals who have *not* purchased a converted vehicle within the last three years *but have a desire to*
- issues related to those persons who have *not* purchased a converted vehicle, including:
  - reasons for not purchasing a vehicle (cost barrier, severity/nature of disability)
  - perceptions regarding the trade-off between the safety of vehicle and cost of the vehicle

Potential Approaches for Addressing Information Requirements

- consultations with persons with disabilities
- consultations with driver rehabilitation specialists

10.5 Issue: Cost and Subsidization of Motor Vehicle Conversions

Information Collected

- cost estimates of conversions
- factors contributing to cost of conversions
- testing requirements and estimated testing costs
- sources of financial assistance

Outstanding Information Requirements

- extent to which individuals purchasing converted vehicles are eligible for financing assistance
- extent to which lack of financing is a barrier to purchasing a converted vehicle

Potential Approaches for Addressing Information Requirements

- consultations with persons with disabilities
- consultations with driver rehabilitation specialists

10.6 Issue: Converted Vehicle and Collisions

Information Collected

- overall Canadian collision statistics and selected causal factors such as driver and vehicle condition
- U.S. statistics related to collisions involving vehicles with automotive adaptive equipment
- anecdotal information on collisions from Phase I consultations

Outstanding Information Requirements

- reliable statistics on collisions involving converted vehicles

Potential Approaches for Addressing Information Requirements

- manual review of provincial-based accident reports indicating medical condition of driver, the use of automotive adaptive equipment (where available) and/or modified vehicles (where available)
- consultations with persons with disabilities
- consultations with conversion companies
- adjustments to police reporting forms or special study for collecting information on converted vehicles

It should be noted that the anticipated value of reviewing accident reports based on variables such as the medical condition of the driver, use of automotive adaptive equipment, and vehicle modification is limited, and would vary by province. Given the resources required to perform such as review (both at the provincial level and from the project team), this method would not be cost-effective, and is therefore not a recommended approach for consideration in either Phase II or III.

10.7 Issue: Conversion Issues

Information Collected

- inventory of safety issues related to conversions
- concerns identified through Phase I consultations
- preliminary assessment of the role of OEMs in the vehicle conversion process

Outstanding Information Requirements

- perceptions of users regarding safety of conversions and other issues (e.g., vehicle and equipment maintenance/service)
- views of conversion companies regarding role of OEMs
- detailed assessment of OEM body builder guides

Potential Approaches for Addressing Information Requirements

- detailed assessment of OEM body builder guides
- consultations with persons with disabilities
- consultations with conversion companies

10.8 Issue: Compliance with CMVSS and Proposed 208, Including Cost of Compliance

Information Collected

- inventory of standards from CMVSS that pertain to vehicle conversions
- impact of individual safety standards with respect to vehicle conversions
- factors contributing to cost of complying with CMVSS requirements, including testing requirements and associated costs
- impact of proposed amendments to CMVSS 208

Outstanding Information Requirements

- extent to which compliance with CMVSS (including cost) is preventing conversion companies from performing certain categories/types of conversions, and the impact compliance has in terms of availability of converted vehicles for persons with disabilities

Potential Approaches for Addressing Information Requirements

- consultations with conversion industry

10.9 Issue: Alternative Approaches Regarding Regulation and Compliance

Information Collected

- regulatory approaches involving converted vehicles in other jurisdictions, including the United States, Europe, and the United Kingdom
- regulatory approaches in other jurisdictions, including transportation of dangerous goods, medical devices, and drugs

Outstanding Information Requirements

- the impact of alternative regulatory approaches to CMVSS regarding converted vehicles in terms of risks versus safety for both users of converted vehicles and other road users

Potential Approaches for Addressing Information Requirements

- consultations with regulatory authorities
- consultations with persons with disabilities

- consultations with conversion companies
- consultations with driver rehabilitation specialists

10.10 Issue: Risk Assessment

Information Collected

- factors related to risk assessment
- perceptions of risks associated with converted vehicles based on Phase I consultations

Outstanding Information Requirements

- perceptions regarding the trade-off between vehicle safety and cost of the vehicle from the perspective of current owners of converted vehicles and would-be/prospective owners

Potential Approaches for Addressing Information Requirements

- consultations with persons with disabilities

Table 10.1 Summary of Information Requirements and Approaches for Addressing Information Needs, by Issue

Issue	Information Requirements	Potential Approaches for Addressing Information needs
Motor Vehicle Conversion Industry	• detailed information on the conversion industry	• consultations with: – conversion industry – driver rehabilitation specialists • TC reporting system
Annual and Total Vehicle Conversions	• number of annual conversions and total converted vehicles in use	• consultations with: – conversion industry – driver rehabilitation specialists • TC reporting system
Types of Conversions	• number of conversions by type of conversion	• consultations with conversion industry • TC reporting system
Users of Converted Vehicles	• number of individuals who have purchased a converted vehicle • characteristics of individuals who have purchased a vehicle, including travel patterns • number of individuals who have not purchased a converted vehicle, but have a desire to • factors preventing the purchase of a converted vehicle	• consultations with: – persons with disabilities – driver rehabilitation specialists • conversion industry
Cost and Subsidization of Motor Vehicle Conversions	• eligibility and use of financial assistance • ineligibility as a barrier to owning converted vehicles	• consultations with: – persons with disabilities – driver rehabilitation specialists
Incremental Cost of Compliance with CMVSS	• compliance with CMVSS as a cost of performing conversions	• consultations with conversion industry

Table 10.1 Summary of Information Requirements and Approaches for Addressing Information Needs, by Issue (cont'd)

Converted Vehicles and Collisions	• reliable statistics on collisions involving converted vehicles	• consultations with: – persons with disabilities – conversion industry • police reporting forms or special study
Conversion Issues	• perceptions of users regarding safety of conversions and other issues • perception of conversion companies regarding role of OEMs	• consultations with: – persons with disabilities – conversion industry
Compliance with CMVSS and Proposed 208	• compliance with CMVSS and proposed 208 as barriers to performing conversions	• consultations with conversion industry
Alternative Regulatory Approaches	• impact of alternative regulatory approaches	• consultations with: – regulatory authorities – persons with disabilities – driver rehabilitation specialists – conversion industry
Risk Assessment	• perceptions regarding the trade-off between safety and the cost of converted vehicles	• consultations with persons with disabilities

Phase II

11 Approach for Addressing Outstanding Information Requirements in Phase III

Phase I of this study involved an investigation into the feasibility of collecting and assessing information on the use, safety, and cost of personal vehicles converted for use by persons with disabilities. Information requirements and preliminary methodologies were also identified.

This section (which represents Phase II of the study), provides a discussion of options Transport Canada could pursue regarding vehicles converted for use by persons with disabilities, including a detailed approach for addressing the outstanding information requirements (as identified in Phase I). If undertaken, the data collection, analysis, and reporting tasks outlined in this section, would constitute the third and final phase of the study (i.e, Phase III).

In addition to the Phase III data collection strategy, additional options for implementation by Transport Canada are presented in Section 12.

11.1 Proposed Phase III Data Collection and Analysis Strategy

11.1.1 Objectives

The objective of Phase III would be to collect information on converted vehicles and their users, that would help Transport Canada review its approach to regulating converted vehicles. The primary outputs of Phase III, based on a prioritization of the outstanding information requirements discussed in Section 10, would be:

- a detailed profile of the conversion industry;
- an assessment of the number of vehicles converted since 1993, the type of conversions performed, and the annual demand for converted vehicles;
- characteristics of the users of these converted vehicles, in particular, whether the individuals:
  - drive from a mobility aid
  - use a mobility aid, but drive from the original driver's seat
  - use a mobility aid and travel as passengers only
- an assessment into the impact of compliance with CMVSS in terms of cost, accessibility to converted vehicles, and access to certain types of conversions;
- the feasibility of adopting alternative regulatory approaches, such as self-regulation, and the adoption of technical standards for converted vehicles; and
- perceptions regarding the safety of converted vehicles and the risk trade-offs between safety and cost.

Although collision data is a key information requirement, based on the findings of Phase I, it is not anticipated that reliable statistics would be collected during Phase III. However, anecdotal insights into converted vehicles and collisions would be probed in consultations with industry representatives and users. In addition, possible actions for collecting collision data (e.g., suggesting that converted vehicles be identified in future collisions as part of a special study) would be discussed with the larger provinces (British Columbia, Alberta, Ontario, Quebec) with the aim of determining their feasibility.

11.1.2 Overview of Approach

The approach consists of seven integrated tasks. Task 1 would consist of consulting with rehabilitation specialists. The objective of consulting with these specialists would be to collect information on the demand (including latent demand) for converted vehicles, particularly demand from persons who remain in their mobility aid when driving. In addition, insights into collisions involving converted vehicles and the issue of access to conversion services, would be addressed. Driver rehabilitation specialists would also be asked to identify commonly used converters (who would be contacted during Task 2) and potential interviewees for the consultations with users.

This initial task would be followed by:

- Task 2: consultations with vehicle conversion companies; and
- Task 3: an assessment of body builder guides, generic converted-vehicle test information, and standards information. An assessment of current activities surrounding international regulatory harmonization in the area of motor vehicle regulations and certification procedures would also be undertaken.

The objective of these tasks would be the development of a profile of the vehicle conversion industry, including an assessment of the difficulties conversion companies have in addressing CMVSS requirements. This would be important in determining the degree to which compliance with CMVSS (including cost) is affecting conversion companies in performing certain categories/types of conversions. This information would be used in assessing the impact of CMVSS on the access to converted vehicles (or types of conversions) for persons with disabilities and issues such as access to maintenance and servicing.

The decision to undertake this profiling task should be made in light of the fact that the Enforcement Branch of Transport Canada's Road Safety Directorate is currently developing a computerized system that would be used to profile and track conversion companies (e.g., in terms of possessing a National Safety Mark).

An assessment of international regulatory harmonization would be valuable in terms of evaluating alternative approaches to regulating the production of converted vehicles.

Task 4 would consist of consultations with individuals who use, or could potentially use, a converted vehicle. For those people using converted vehicles, the consultations would address demand and user characteristics such as awareness of safety requirements, expectations regarding vehicle and equipment safety, risk perceptions including the trade-off between safety and cost; travel patterns; collision experience; and barriers to, and assistance for, purchasing converted vehicles. For those people not currently using a converted vehicle, the consultations would address reasons for not purchasing a converted vehicle (e.g., barriers, severity/nature of disability) and perceptions regarding the trade-off between safety of the vehicle and cost.

The above four tasks represent the data collection component of our approach. These tasks would be followed by analysis (Task 5), and a briefing session to regulatory authorities of Transport Canada (Task 6). The objective of the briefing session would be to disseminate the key research findings to Transport Canada staff, and to discuss possible approaches that could be used to regulate the industry.

Task 7 would involve the preparation of a draft and final report. The final report would include a summary of the key observations captured during the briefing session.

Each of these tasks is described in more detail below.

Task 1 Consultations with Driver Rehabilitation Specialists

Proposed Approach

The objective of consulting with a sample of driver rehabilitation specialists is to collect information on their relationship with conversion companies, and on the demand for converted vehicles. To achieve this, we propose to conduct 20 to 25 interviews with driver rehabilitation specialists who are affiliated with driver assessment centres. The organizations listed in Section 2 would form the basis of the sampling frame for this task.

Issues to be Addressed

The following demand-related issues would be addressed through consultations with driver rehabilitation specialists:

- number of individuals who have undertaken driver assessments since 1993
- characteristics of these clients (e.g., age, nature/severity of disability)
- number of individuals who have gone on to purchase, or modify, a vehicle to travel either as a driver or a passenger, and customer financing
- whether these individuals:
  - drive from a mobility aid
  - use a mobility aid but travel as a passenger only
  - use a mobility aid but only require hand controls
- number of individuals who use a mobility aid but do not have access to, or travel in, a converted vehicle (and reasons why, such as nature or severity of disability, financial restraints)
- trends regarding the use of, and demand for, converted vehicles

In addition, issues related to converted vehicles would also be discussed, including:

- opinions regarding access to, and availability of vehicle conversion services
- views regarding the trade-off between safety and cost of converted vehicles
- estimates and/or insights into collisions involving converted vehicles

Design Considerations

In undertaking the consultations with driver assessment centres, assistance in identifying potential interviewees for the conversion industry, and user consultations, would be sought.

Task 2 Consultations with the Conversion Industry

Proposed Approach

Based on Transport Canada's listing of conversion companies, there are 125 companies providing conversions in Canada. Of these companies, 100 are involved in conversions of personal vehicles (the remainder being involved in buses and RVs), with 11 undertaking major modifications.

Overall, we propose to contact 36 of the 126 conversion companies, including the 11 companies that undertake major modifications, and a sample of 25 of the remaining companies. This sample of 25 companies would include two companies that convert buses and two that convert RVs to determine the extent to which they are involved in performing modifications to personal vehicles. Contacting these 36 companies would allow us to develop a composite profile of the conversion industry in Canada.

It is proposed that the consultations with the conversion industry involve the following:

- visits to four conversion companies; and
- in-depth telephone consultations with an additional 32 conversion companies.

The visits, allowing on-site consultations, would be used to collect in-depth information on the issues. It is proposed that two larger conversion companies and two smaller companies be selected for the on-site interviews. These companies would be distributed between two larger urban centres (e.g., Ottawa, Toronto, Montreal) and one to two smaller communities (e.g., Kingston).

Results of the on-site interviews would be used to finalize the issues to be addressed during the subsequent telephone interviews, and refine the questionnaire to be used.

In addition to consultations with the conversion industry, a review the Enforcement Branch's upgraded reporting system could also be undertaken (to address issues such as number and type of conversions). Information from this source would be useful for profiling the industry; however, because of the confidential nature of the information, assurances would have to be made to ensure that the information is presented in aggregate format only. Also, it is estimated that the revised reporting system is not expected to be fully operational until later 1997.

Issues to be Addressed

The following issues would be addressed through consultations with conversion companies:

- conversion industry details, including:
  - size of companies (e.g., in terms of number of vehicles converted)
  - source of customers (e.g., referrals through prescribers/driver rehabilitation specialists)
  - knowledge concerning customer financing
  - conversions of new versus used vehicles
  - conversions based on completed versus incomplete vehicles
  - imports of converted vehicles from the U.S.
- estimates of annual motor vehicle conversions and total number of converted vehicles in use
- number of the various types of conversions performed, including number of conversions for:
  - individuals driving from a mobility aid
  - individuals who use a mobility aid, but drive from the original driver's seat
  - individuals who use a mobility aid and travel as passengers

- number of individuals who have not purchased a converted vehicle within the last three years but have enquired into converted vehicles (i.e., latent demand). It should be noted that the ability to address this issue is dependent on client tracking systems employed by conversion companies.
- trends regarding the use of, and demand for, converted vehicles
- estimates and/or insights into collisions involving converted vehicles (although converters would not have a complete picture of collisions, they may have a sense as to the frequency of collisions based on repairs they may have to make to converted vehicles)
- views of conversion companies regarding the role of OEMs, including vehicle manufacturers and equipment manufacturers, and existing support provided by OEMs. Conversion companies would be asked to comment on their use of body builder guides, and other related information (e.g., SAE recommended practices). The companies would also be asked to comment on the cost(s) of base vehicles that they use for conversions.
- extent of in-house technical capability/capacity available to address CMVSS requirements, and the degree to which compliance with CMVSS (including cost) is preventing conversion companies from performing certain categories/types of conversions (limiting innovation) and the impact compliance has in terms of availability of converted vehicles for persons with disabilities. This would also include the extent to which conversion companies make use of generic test results (e.g., from NMEDA) for compliance purposes.
- need for technical assistance in terms of achieving compliance and how best to receive this assistance.
- views regarding alternative regulatory approaches to CMVSS, such as the status quo, industry self-regulation, technical standards, and the potential impact of these alternatives in terms of risks versus safety for both users of converted vehicles and other road users.

Design Considerations

In undertaking the industry consultations, the following design issues would be considered:

- Participants for the study would be selected based on the existing lists of Transport Canada and the Canadian Paraplegic Association (CPA).
- The sample would be selected so as to be geographically representative of the industry (companies in all regions would be contacted, including the Maritimes, Quebec, Ontario, Prairies, Western Canada (Alberta, B.C., Territories)).
- Prior to the case studies taking place, a detailed survey instrument would be prepared with input and approval by Transport Canada and the Transportation Development Centre. As noted above, based on the results of the case studies, adjustment(s) to the instrument may be undertaken (again, based on approval by the client).

- Similar in scope to the Phase I consultations, a covering letter and list of questions to be addressed would be sent out prior to undertaking the case studies and interviews.
- To increase participation and buy-in, NMEDA Canada would be asked to provide assistance in terms of contacting conversion companies who are part of their membership. In addition, NMEDA would be asked to comment on the covering letter, which would indicate NMEDA's support for the study.
- Given the potential sensitivity companies may have in terms of discussing competitive aspects of their company (e.g., number and types of conversions performed), confidentiality would be assured so as to reduce the rate of non-response.
- Extent to which the Enforcement Branch's computerized system can be used to help in the profiling process.

Task 3 Review of OEM Support and Related Information

This task would involve a detailed assessment of OEM support provided by both vehicle manufacturers (e.g., body builder guides) and adaptive equipment manufacturers, generic test results (where available), and standards information to assess the value of this information in assisting conversion companies comply with CMVSS.

One example of support from vehicle manufacturers is OEM Body Builder guides, which present a vast array of information for specific vehicles and vehicle types. The information may include primary vehicle dimensions, adjustment distances, location of reference points, centre of gravity locations, and cargo volumes and weights.

Body builder guides also provide information on modifications that may affect safety and emission components and regulatory requirements. This information is typically presented in four sections: vehicle noise requirements, emission control requirements, alternative fuels guidelines, and U.S. and Canada safety standards for complete and incomplete vehicles. Design recommendations are also provided for specific commonly applied conversions.

The foremost objective of reviewing the OEM body builder guides would be to determine the extent this information addresses the types of modifications performed for converting vehicles for use by persons with disabilities. To provide a thorough cross-section of the industry and to assess the information provided for the most commonly used vehicles, the following body builders manuals are proposed to be reviewed:

- 1997 Ford Trucks, Body Builders Layout Book
- 1997 Chevrolet or GMC Light Truck/Van Body Builders Manual
- 1997 Chrysler Light Truck/Van Body Builders Manual

In addition, OEMs produce an Incomplete Vehicle Manual which provides statements of conformity for the completion of incomplete vehicles. These manuals provide compliance statements that indicate how conformance to U.S. and Canada safety standards can be accomplished when converting an incomplete vehicle. This information is typically presented in the following three formats:

- A statement that the vehicle when completed would conform to the standard if no alterations are made in identified components of the incomplete vehicle.
- A statement of specific conditions of final manufacture under which the manufacturer specifies that the completed vehicle would conform to the standard.
- A statement of conformity when the standard is not substantially affected by the design of the incomplete vehicle, and that the incomplete vehicle manufacturer makes no representation as to conformity with the standard.

It is suggested that the incomplete manuals associated with the three major vehicle manufacturers be reviewed to determine the extent to which this information addresses the types of modifications performed for converting vehicles for use by persons with disabilities.

After a review of both types of OEM information, it may be possible to provide further insight into the differences between incomplete and complete vehicles. For instance, it appears from the outset the incomplete vehicle manual more thoroughly addresses the specific issue of complying with Canadian Motor Vehicle Safety Standards. As well, during Task 2, the conversion industry would be consulted on their use of OEM information.

Task 4 Consultations with Persons with Disabilities

Proposed Approach

Our proposed approach to consulting with persons with disabilities would involve a combination of a mail-out, mail-back (MOMB) survey (with a target completion rate of 400 responses), and 100 telephone-based interviews. The MOMB survey would allow for comments from a broad group of respondents, while the telephone interviews would allow for more in-depth and targeted responses.

Detailed questionnaires would be prepared for each survey method, and input and approval would be obtained from Transport Canada and the Transportation

Development Centre. Based on the results of initial five pilot test interviews, adjustment(s) to the questionnaires may be undertaken (again, based on approval by the client).

Issues to be Addressed

As presented in Section 10 of the Phase I report, the following issues would be addressed through consultations with persons with disabilities.

For people currently using a converted vehicle, the following issues would be addressed:

- awareness of vehicle safety requirements;
- expectations regarding vehicle safety;
- how individuals obtained their vehicle (e.g., financing, use of a driver rehabilitation specialist for prescription purposes and driver assessment);
- whether modifications were made to a new or used vehicle;
- usage and travel patterns;
- collision experience;
- maintenance/service requirements;
- perceptions regarding the trade-off between vehicle safety and cost;
- extent to which individuals purchasing converted vehicles are eligible for financial assistance and the degree to which a lack of financing is a barrier; and
- perceptions regarding the safety of conversions and other issues (e.g., vehicle and equipment maintenance/service).

For those who need a converted vehicle but have *not* purchased one, the issues would include:

- reasons for not purchasing a vehicle (cost barrier, severity/nature of disability); and
- perceptions regarding the trade-off between the safety of the vehicle and cost of the vehicle.

It should be noted that the design of the questionnaire would require careful consideration to ensure that respondents are not biassed in their views regarding the trade-off between safety and the cost associated with certification. For example, in addition to the cost of compliance, the cost of other factors incorporated in the final cost of the conversion must also be taken into consideration.

Design Considerations

With respect to the MOMB survey, the CPA has expressed willingness to assist in distributing the questionnaire. As such, the survey frame would be based on members of the CPA, with distribution of the survey (potentially) coinciding with the distribution of its *Caliper* newsletter/magazine. Client confidentiality policies prevent making direct contact (e.g., via telephone) with members of the CPA.

While other organizations representing persons with disabilities (i.e., Muscular Dystrophy Association of Canada, Multiple Sclerosis Society of Canada) were investigated as possible approaches for conducting the survey, the CPA is the most representative of persons with disabilities who would use converted vehicles.

Telephone interviews would be based on individuals identified through driver assessment centres. Task 1 (consultations with rehabilitation centres) would be used to facilitate the process of identifying potential interviewees. The 100 interviewees would be identified from individuals who have received a driver assessment within the previous three years, and would include a cross section of the following users and non-users of converted vehicles:

- individuals who drive from a mobility aid;
- individuals who travel as passengers in their mobility aid;
- individuals who use a mobility aid and require only hand controls to drive (although outside the scope of CMVSS, the survey would provide a valuable opportunity to capture information related to this subject);
- individuals who use a six-way power seat base and transfer to it from their mobility aid; and
- individuals who use a mobility aid but do not have access to, or travel in, a converted vehicle.

In addition, the respondents would be selected to be representative of both primary driving-age groups (i.e., 15 to 64, and 65 and over).

Given the potential sensitivity that individuals may have in terms of discussing certain issues (e.g., financial barriers, collision experience), confidentiality would be assured to reduce the non-response rate.

Both the Hugh MacMillan Rehabilitation Centre (Toronto) and the Rehabilitation Centre (Ottawa) have expressed willingness to assist in identifying potential contacts. However, the issue of confidentiality of individual names may be a problem in obtaining information from some of the other driver assessment centres. This may impact the extent to which the telephone interviews are representative of all regions in Canada (i.e., Maritimes, Quebec, Ontario, Prairies, Western Canada (Alberta, B.C., Territories).

Optional Consultations and Focus Groups

In addition, formal consultations could be undertaken with a selected number of specific groups (maximum ten) such as the Muscular Dystrophy Association of Canada, Multiple Sclerosis Society of Canada, and the March of Dimes. The focus of these consultations would be to ascertain views on the use, safety, and cost of vehicles converted for use by persons with disabilities represented by these organizations.

An additional, optional task could involve conducting focus groups involving persons with disabilities to discuss the key findings of the surveys. This would allow in-depth discussion of the findings, with the objective being to improve and refine the conclusions and recommendations resulting from the data collection.

Task 5 Analysis

Analysis of the information collected during the first four tasks would address the following key outputs, as identified in Section 11.1, including:

- a profile of the conversion industry;
- an assessment of the number of vehicles converted since 1993, the type of conversions performed, and the annual demand for converted vehicles;
- characteristics of the users of these converted vehicles, in particular, whether the individuals:
  - drive from a mobility aid
  - use a mobility aid, but drive from the original driver's seat, or from a six-way power seat
  - use a mobility aid and travel as passengers only
- an assessment into the impact of compliance with CMVSS in terms of cost, and accessibility to converted vehicles and certain types of conversions;
- the feasibility of adopting alternative regulatory approaches, such as self-regulation, and the adoption of technical standards for converted vehicles; and
- perceptions regarding the safety of converted vehicles, and the risk trade-offs between safety and cost.

Information collected pertaining to collision experiences would also be analysed. As part of this analysis, discussions would be undertaken with provincial authorities in British Columbia, Alberta, Ontario, and Quebec, concerning potential alternatives for collecting collision data (e.g., suggesting that converted vehicles be identified in future special studies involving collisions).

The key findings of the data collection activities would be summarized and a brief findings document would be prepared. Apart from findings, the document would

include several alternatives on how Transport Canada could approach future regulation of the motor vehicle conversion industry.

This document would be disseminated to the briefing session participants, to facilitate discussion during the session. The key findings and possible approaches would also be prepared in the form of a presentation for use during the briefing session.

Task 6 Briefing Session for Transport Canada Officials and Project Advisory Committee

The objective of this briefing session would be to disseminate the key research findings, and possible approaches to both Transport Canada staff and the Project Advisory Committee, and to solicit feedback.

Task 7 Reporting

The reporting task would include the preparation of a final draft report. This draft report would be presented to both the Project Management Committee and the Project Advisory Committee.

Based on feedback and comments on the draft report and the presentation, a final report would be prepared and submitted to the Project Advisory Committee, in accordance with TDC's report requirements.

12 Other Suggested Actions

The following action items were identified for possible implementation by Transport Canada during the research conducted in Phase I.

12.1 Obtain Collision Data through Police Reports or Special Studies

As discussed in Phase I, one of the key information gaps is accurate national information related to collisions involving vehicles converted for use by persons with disabilities. Two approaches that could be used to address this gap are:

- Modify the existing collision reporting templates used by police, to include a variable related to whether the vehicle was converted for the use of a person with a disability, what type of conversion was performed (e.g., lift or ramp installed, raised roof), and whether the conversion contributed to the collision or increased the severity of the collision.
- Undertake a special study through the police reports (special studies allow the collection of specific types of information on the reporting template, related to the collision).

Consideration could also be given to expanding the existing reporting templates to include all vehicles involved in the second stage manufacturing industry which is regulated by the MVSA and CMVSS.

This approach could be led by the Evaluation and Data Systems Group, of Transport Canada's Road Safety Directorate, although coordination and cooperation from provincial ministries of transportation would be required. The Enforcement Branch of the Road Safety Directorate and the Defects Investigation Group, could also be used for advice regarding the definition and types of conversions that are performed by the second stage manufacturing industry.

12.2 Communications Strategy

A communications strategy could be implemented, focusing on consumers and the conversion industry.

Develop a Guide Providing Advice and Guidance to Consumers

There can often be a gap between what consumers know (or don't know) about certain products and what suppliers know about these products. In terms of vehicles converted for use by persons with disabilities, Transport Canada could develop a

guide targeted specifically at persons with disabilities informing them of the safety aspects of converted vehicles. This could include information on CMVSS and the MVSA, Transport Canada's role in regulating the conversion industry, benefits of certification, and guidance when purchasing a converted vehicle. Information on the conversion industry and services offered through driver assessment centres could also be included in the guide.

Develop Conversion Assistance Guide for Conversion Companies

It has been suggested that a guide on conversions to vehicles for use by persons with disabilities could be developed for conversion companies. This would help companies understand what is required in terms of certification, and how certain conversions can be undertaken to ensure that the original OEM certification is not invalidated. Transport Canada's Enforcement Branch notes that a guide has been prepared for the trailer manufacturing industry.

Improved knowledge of OEM design considerations and certification requirements can assist the converter in ensuring that the original OEM certification is not invalidated, reducing the need for additional testing (and consequently, additional costs to the consumer).

This guide could be developed to complement the information bulletins and articles for industry association newsletters – currently being produced by Transport Canada – that advise conversion companies of current regulatory issues.

12.3 Continue to Encourage OEM Assistance and Advice

As discussed in Phase I, it would be ideal from Transport Canada's perspective if original OEMs provided more technical assistance to converters, especially for more commonly used vehicles and conversions. Additional guidance would help converters understand what can and cannot be done to a vehicle in terms of ensuring compliance with CMVSS, and as a result, facilitating "flow-through" certifications.

In this regard, Transport Canada should continue to encourage OEMs to provide assistance and advice to Canadian conversion companies, possibly through the establishment of Canadian-based technical advisors working in the field (similar in nature to field-based warranty advisors and service specialists).

12.4 Systematically Capture Feedback from Consumers

Transport Canada currently receives feedback from consumers regarding vehicles converted for persons with disabilities, in part through its 1-800 number. This feedback is not, however, consistently recorded or analysed. A data capture form (either paper-based or electronic) could be developed to capture information from consumers, such as types of adaptations and modifications performed to their vehicle, the perceived safety of these adaptations and modifications, and safety-related problems that they may have experienced. Such a tool could also be integrated with the existing Transport Canada Web site or distributed with the consumers' guide as discussed above.

12.5 Re-evaluate Policy regarding Converted Vehicles

When comprehensive information is available from Phase III and/or the action items suggested above, Transport Canada should review the implications of CMVSS (in terms of the public good versus the private benefit of reduced cost), associated with the regulation of vehicles converted for use by persons with disabilities and possible alternative approaches. At this time, there is insufficient information to support such a study.

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See Appendix F for a detailed listing of related technical standards and research documents.

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Appendix A
Statement of Work

(not available in electronic format/
pas disponible en format électronique)

Appendix B
Issues and Research Questions

The main issues and related research questions include:

- Issue 1: The Conversion Industry

  1.1 What companies are involved in converting vehicles for use by persons with disabilities?
  1.2 What is the number of converted vehicles in use today?
  1.3 How many vehicles are converted per year (e.g., during the period of 1993 to 1996)?
  1.4 What types of conversions are performed?

- Issue 2: Users of Converted Vehicles

  2.1 How many persons with disabilities use converted vehicles, both as drivers and as passengers? What are the characteristics of these users?
  2.2 What is the future estimated number of persons with disabilities as drivers and passengers?
  2.3 How many persons with disabilities a) drive from a wheelchair; b) need to have the driver seat modified?; c) use the original seat, but need other modifications or adaptive equipment to the vehicle (e.g., hand controls)?
  2.4 How many trips are taken by persons with disabilities using converted vehicles per year? How do these trip patterns compare with society as a whole?
  2.5 What other organizations use converted vehicles (e.g., taxis, car rental agencies)?
  2.6 To what extent would more affordable converted vehicles affect demand for these vehicles?

- Issue 3: Cost and Subsidization of Conversions

  3.1 What is the total cost of conversions (by type of conversion)?
  3.2 What is the incremental cost of a conversion due to complying with CMVSS?
  3.3 How do persons with disabilities typically finance the cost of converted vehicles?
  3.4 What proportion of persons with disabilities and other users of converted vehicles who want to obtain a converted vehicle, cannot do so because of the conversion cost?

- Issue 4: Converted Vehicles and Collisions

  4.1 What is the extent of vehicle collisions (involving all types of vehicles) in Canada (e.g., between 1993 and 1996)?

  4.2 How many converted vehicles are involved in accidents (annually)? What percentage of converted vehicles are involved annually in collisions (both as a percentage of total accidents and as a percentage of total converted vehicles in use)? What is the nature of these collisions (e.g., collisions with other vehicles or objects, rollovers)? To what extent were other vehicles involved in collisions involving converted vehicles?

  4.3 How does the crash involvement of converted vehicles compare to the general population of passenger vehicles? What is the probability/risk of a converted vehicle being involved in a collision versus a non-converted vehicle?

  4.4 Can causal factors be identified as contributing to collisions (e.g., driver error, vehicle-related, environmentally-related, such as weather)?

  4.5 What are the impacts/societal costs of collisions involving converted vehicles (e.g., deaths, injuries, property damage, repair cost(s))?

  4.6 Where information on the involvement of converted vehicles in collisions can not be obtained, can substitute (or proxy) data be used to estimate the number of collisions involving converted vehicles? What is the reliability of using substitute data?

- Issue 5: Issues related to Conversions

  5.1 What are the primary problems related to converted vehicles (e.g., structural changes, use of hand controls)?

  5.2 Why are these problem areas (e.g., due to conversion design/process, capability of converter, functionality of conversion - e.g., hand controls)?

  5.3 To what extent does compliance with CMVSS reduce the risk of these problems occurring?

  5.4 Are there approaches being developed (or that exist but are not widely applied) which can mitigate these problems? What are the costs of these mitigating factors?

  5.5 To what extent are Original Equipment Manufacturers providing assistance on certification to converters who are altering vehicles, including suppliers of special features (e.g., of ramps/lifts, seats, hand controls)? Are OEM's liable for vehicle conversions, if an accident occurs? Would they be liable if they took a greater role in terms of conversions?

  5.6 Will other safety issues (e.g., air bags) also have an impact on converted vehicles?

  5.7 From the perspective of users, are there other technical problems related to conversions which may impact the safety and integrity of the vehicle?

- Issue 6: Impact of CMVSS and the Proposed CMVSS 208

  6.1 What are the primary standards from CMVSS that pertain to vehicles converted for use by persons with disabilities?
  6.2 What is the impact of compliance with these standards in terms of:
  - viability of converters? availability of converted vehicles?
  6.3 What will be the potential impact of 208 be in terms of:
  - viability of converters? availability of converted vehicles?

- Issue 7: Alternative Approaches Regarding Compliance

  7.1 What approaches are taken by other organizations involved in road safety (e.g., NHTSA, SAE) and other regulatory environments (e.g., within Transport Canada, Health Canada, Environment Canada, Agriculture Canada) regarding compliance with standards/regulations?
  7.2 Can approaches by other regulators (e.g., in terms of compliance) be applied to CMVSS and converted vehicles?
  7.3 What would be the impact of alternative regulatory approaches be in terms of:
  - risks vis-a-vis safety for both users of converted vehicles and other road users
  - cost of conversions (i.e., affordability)
  - demand for converted vehicles
  7.4 What alternatives exist for ensuring converted vehicles comply with CMVSS? What are the advantages and disadvantages of these various policy options (e.g., in terms of impact on safety, affordability/accessibility, demand, usage, industry viability)?
  7.5 To what extent is standardization of vehicle conversions an option for addressing the needs of disabled drivers, and potentially reducing compliance costs associated with conversions?

- Issue 8: Risk Assessment

  8.1 What would be the impact of alternative regulatory approaches to CMVSS regarding converted vehicles in terms of risks vis-a-vis safety for both users of converted vehicles and other road users?
  8.2 Are persons with disabilities willing to accept greater risk (e.g., due to less enforcement of CMVSS, or exceptions to CMVSS for converted vehicles) for improved access to converted vehicles?
  8.3 To what extent would alternative regulatory approaches affect the safety of other road users? If safety were at risk, would other road users be willing to accept greater risk (e.g., due to less enforcement of CMVSS, or exceptions to CMVSS for converted vehicles) for the improved accessibility to converted vehicles gained for persons with disabilities?

Appendix C
Interviewees

Interviewees - Phase I

1. Harry Baergen, Senior Enforcement Officer
   Component Testing, Importation and Audit Inspection, Road Safety Directorate, Transport Canada

2. Linda Yuen, Research Support Officer
   Evaluation and Data Systems, Road Safety Directorate, Transport Canada

3. France Legault, Automotive Safety Engineer
   Motor Vehicle Standards and Regulations Branch, Transport Canada

4. André St-Laurent, Automotive Safety Engineer
   Crashworthiness and Engineering, Road Safety Directorate, Transport Canada

5. Alan German/Lars Eif
   Collision Investigation, Transport Canada

6. Kit Mitchell, UK Department of Transportation

7. Eric Boyd, Managing Director
   Canadian Paraplegic Association

8. Eric Norman, Past President, Current Board Member
   Consumer Organization of Disabled Persons, Chair, Wheelchair Access Group, and Member of Council of Canadians with Disabilities

9. Dr. Shirley Van Hoof, Executive Secretary
   Action League of Physically Handicapped Adults

10. Bob Loveless
    Converted vehicle co-owner, London, Ontario

11. Brian MacLean, Events Coordinator, Spinal Cord Research Institute,
    Converted vehicle owner, and Peer Group Organizer, Lyndhurst Hospital

12. Margaret Young, Driver Rehabilitation/Assessment Services
    The Hugh MacMillan Rehabilitation Centre

13. Lynn Hunt, Driver Rehabilitation/Assessment Services
    The Rehabilitation Centre, Ottawa

14. Gayle Dalrymple, Project Manager
Study on Safety of Automotive Adaptive Equipment, NHTSA

15. Grace Hazzard, Data Analyst, National Accident Sampling System (NASS)
National Centre for Statistics and Analysis, NHTSA

16. Andrew Merrit, Supervisor
Driver Review and Control, Licensing and Control Branch, Ontario Ministry of Transportation

17. Paul Boase, Senior Research Officer, Landsay Thom, Research Officer
Safety, Planning and Policy Branch, Ontario Ministry of Transportation

18. Sonia Kamel, Senior Policy Advisor
Passenger and Mobility Services, Ontario Ministry of Transportation

19. David Hanes, Project Policy Advisor
Public Transportation Office, Ontario Ministry of Transportation

20. Kwei Quaye, David Koch
Traffic Safety Program Evaluation Group, Auto Fund Division, Saskatchewan Government Insurance

21. Daryl Hammond, George Egukun, Chris Szwarc
Road Safety Department, Manitoba Public Insurance

22. Claude Dussault/Jacques Richard
Societé de l'Assurance Automobile du Québec (SAAQ)

23. Jean Wilson, Manager
Road Safety Research, Research Services Department, Insurance Corporation of British Columbia

24. Anita Gill, Rehabilitation and Technical Services
Insurance Corporation of British Columbia

25. Mike Jarmasz, Manager
Serious Injury Program, Ontario Workers' Compensation Board

26. Nancy Delorme, Assistive Devices Administrator
Assistive Devices Program, Ontario March of Dimes (Eastern Ontario Region)

27. Emily Atkins, Government Relations Coordinator, Michelle Cronin, Access Services Coordinator, Ontario March of Dimes (Head Office)

28. Ontario Ministry of Health, Assistive Devices Program

29. Eric Burpee, Research Officer
Vehicle Information Centre of Canada (VICC)

30. Cora Hughes, Statistical Analyst
Traffic and Marine Branch, Ontario Provincial Police

31. Consumer Division
Insurance Bureau of Canada

32. Peter Beland, Driving Instructor for Persons with Disabilities
Rite Way Driving School

33. Richard Cerna, Director
Association of Driver Educators for the Disabled (International)

34. Bob Nunn, NMEDA Canada
c/o Creative Carriage Ltd.

35. John Labron, NMEDA Canada
c/o Labron Mobility

36. Paul Murphy, Regulatory Affairs
Motor Coach Industries, Winnipeg, Manitoba

37. Jean-Françoise Viau, Vice-President National Dealer Sales
Ricon Canada Ltd.

38. Jean Beaulieu, Manager Technical Marketing
PMG Technology (previously Motor Vehicle Test Centre)

39. Becky Plank, Executive Director
NMEDA U.S.

40. Phil Doolittle
General Motors, and the SAE Adaptive Devices Committee

41. Paul Ulrich, Development Engineer
General Motors

42. Rick Chesnut, Supervisor
Modified Vehicle Engineering, Ford Motor Co.

43. Howard Wilson
Chrysler Corp.

44. Andy Miklosik
Engineering Dept., General Motors of Canada

45. Trevor Williams
Ford Motor Co. Of Canada Ltd.

46. John Jackson
Vehicle Safety and Regulations, Chrysler Canada

47. Dr. Tomaz Yscinowicz, Chief, Clinical Trials and Special Access Program
Bureau of Pharmaceutical Assessment, Health Canada, Drugs Directorate

48. Linda Hume/Marie Claude Mailloux, Legislation, Regulations and Permits
Regulatory Affairs Branch, Dangerous Goods, Transport Canada,

49. Kathy Bird, Support Services Coordinator
Device Evaluation Division, Medical Devices Bureau, Health Canada

50. Paul Cavanagh
Long Term Health Office, London, Ontario

51. Edward Stait, Mobility Unit
Mobility Advice and Vehicle Information Service (MAVIS), U.K. Department of Transportation

52. Rod George, Senior Research Scientist
ARRB Transport Research Ltd., Vermont South Victoria, Australia

Appendix D
Types of Conversions

T E S Ltd. conducted a detailed analysis of the automotive components and systems which could be modified to achieve a desired conversion and indicates the Canadian MVSA safety standard applicable to the modified component or system. The analysis results indicate those modifications which would apply specifically to conversions adapting the vehicle for operation from the driver position.

The conversions have been further segregated into those requiring minor and major modifications to OEM components or systems. Minor modifications typically consist of the installation of add-on components which do not require significant alteration of OEM components or their function. Major modifications include substantial alterations to OEM components or systems including vehicle structure modifications and/or replacement of major OEM components or systems by custom fabricated components. Major electrical modifications are considered to be additions to the vehicle electrical system which either draw operating current in excess of 10 amperes during engine operation or in excess of 10 amperes over a period of more than one minute.

The analysis has been limited to the following types of personally owned motor vehicles as defined by the Canadian MVSA:

- Passenger Car – a vehicle having a designated seating capacity of 10 or less, but does not include an all-terrain vehicle, competition car, multipurpose passenger vehicle, antique reproduction vehicle, motorcycle, truck or trailer.

- Multipurpose Passenger Vehicle – a vehicle having a designated seating capacity of 10 or less that is constructed either on a truck-chassis or with special features for occasional off-road operation, but does not include an air cushion vehicle, all-terrain vehicle, golf-cart, passenger car or truck.

- Truck – a vehicle designed primarily for the transportation of property or equipment, but does not include a chassis-cab, crawler-mounted vehicle, trailer, work vehicle or a vehicle designed for operation exclusively off the public highway.

The results of the analysis are presented in the following tables, utilizing a matrix type arrangement to provide a cross-reference from the modified automotive component or system to the applicable Canadian MVSA safety standard.

The first column of Table 1, "Vehicle Component or System Modified" lists the common OEM automotive components or systems that may be modified for the purpose of adapting a vehicle for use by persons with disabilities. These are categorized by major automotive systems. To remain consistent with industry terms the designations Primary Controls – Group A, Primary Controls – Group B have been utilized as assigned by the SAE.

The second column, "Modifications Required" describes a range of modifications that may be performed on the components and systems to complete the desired conversion since a large amount of customizing is involved in the modifications which may be performed. Descriptions of the modifications also indicate the components or systems, if any, that may be affected by the listed modification which may indirectly involve the application of a CMVSS. As well, the description indicates if the modification applies only to the driver position.

The third column, "Type of Modification" indicates whether the extent of the modification is considered to be major or minor.

The fourth column, "Applicable CMVSS" indicates the CMVSS, if any, that applies to the modified automotive component or system. Where the CMVSS applies to a specific component of a larger automotive system, the component or sub-system is indicated in brackets () beside the applicable standard.

The fifth column, "Other Applicable Standards" references other standards which may apply to the modified automotive component or system, but may not be required to have the vehicle comply with the MVSA.

Typical Vehicle Modifications and CMVSS Applicability

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Primary Controls – Group A:				
Throttle/ Accelerator	- driver modification only - installation of add-on or replacement controls for OEM throttle/accelerator components to provide throttle/accelerator control independent of muscular input from driver (powered throttle/accelerator control) - addition of mechanical hand control components fastened to existing OEM components with minor modifications required for adapting brackets and the like - attachment of foot pedal extensions - installation of left foot pedal accelerator	Major Minor Minor Major	CMVSS 124 – Accelerator Control Systems CMVSS 101 – Location and Identification of Controls and Displays	SAE J1903 – Automotive Adaptive Driver Controls, Manual SAE J2094 – Vehicle and Control Modifications for Drivers with Physical Disabilities SAE[5] – Recommended Practice for Powered Throttle/Brake Control Systems
Steering System	- driver modification only - installation of add-on or replacement controls for OEM steering components to provide steering control independent of muscular input from driver (powered steering control) - modification of OEM hydraulic steering control mechanism to reduce "break away force" (reduced effort steering) - installation of emergency backup steering system - installation of modified steering wheel - extension of the steering column - modification or replacement of the steering column to allow for horizontal orientation of the steering wheel	Major Major Major Minor Major Major	CMVSS 101 – Location and Identification of Controls and Displays CMVSS 107 – Reflecting Surfaces (horn ring, steering hub) CMVSS 203 – Driver Impact Protection CMVSS 204 – Steering Column Rearward Displacement	ISO 2575[6] – Road Vehicles – Symbols for Controls, Indicators and Tell-Tales SAE J190 – Power Steering Pressure Hose – Wire Braid SAE J1903 – Automotive Adaptive Driver Controls, Manual SAE J2094 – Vehicle and Control Modifications for Drivers with Physical Disabilities

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Service Brake System	- driver modification only - installation of add-on or replacement controls for OEM brake components to provide braking control independent of muscular input from driver (powered braking control) - modification of OEM hydraulic braking control system to reduce braking effort (reduced effort braking) - installation of emergency backup braking system - relocation of hydraulic brake lines	Major Major Major Minor	CMVSS 101 – Location and Identification of Controls and Displays CMVSS 105 – Hydraulic Brake Systems CMVSS 106 – Brake Hoses CMVSS 116 – Hydraulic Brake Fluids	ISO 2575[6] – Road Vehicles – Symbols for Controls, Indicators and Tell-Tales SAE J135 – Service Brake System Performance Requirements SAE J201 – In-Service Brake Performance Test Procedure SAE J229 – Brake System Structural Integrity Test Procedure SAE J299 – Stopping Distance Test Procedure SAE/ANSI J843 – Brake System Road Test Code SAE/ANSI J1047 – Tubing – Motor Vehicle Brake System Hydraulic SAE J1290 – Automotive Hydraulic Brake System – Metric Tube Connections SAE J1403 – Vacuum Brake Hose SAE J1703 – Motor Vehicle Brake Fluid SAE J1903 – Automotive Adaptive Driver Controls, Manual SAE J2094 – Vehicle and Control Modifications for Drivers with Physical Disabilities SAE[5] – Recommended Practice for Powered Throttle/Brake Control Systems
Primary Controls – Group B:				
Ignition Start Switch	- driver only modification - adaptations to ignition key - relocation of ignition/start switch to increase accessibility	Minor Major	CMVSS 101 – Location and Identification of Controls and Displays CMVSS 114 – Locking System	CSA – Z323.1.2[7] Adaptive Driving Controls for Persons with Disabilities SAE J259 – Ignition Switch

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Gear Selector	- driver modification only - replacement of OEM gear selector with electronically controlled gear selector - adaptation of OEM gear selector to reduce muscle force input by driver - installation of a powered gear selector	Major Minor Major	CMVSS 102 – Transmission Shift Control Sequence CMVSS 101 – Location and Identification of Controls and Displays	ISO 2575[6] – Road Vehicles – Symbols for Controls, Indicators and Tell-Tales SAE J1211 – Recommended Environmental Practices for Electronic Equipment
Parking Brake	- driver modification only - replacement of OEM parking brake with electronically controlled parking brake applicator - adaptation of OEM parking brake lever to reduce muscle force input by driver - adaptation of OEM foot-operated parking brake for hand use - installation of a powered parking brake applicator	Major Minor Minor Major	CMVSS 101 – Location and Identification of Controls and Displays	ISO 2575[6] – Road Vehicles – Symbols for Controls, Indicators and Tell-Tales SAE J293 – Vehicle Grade Parking Performance Requirements SAE J1211 – Recommended Environmental Practices for Electronic Equipment
Windshield Wiper/ Washer	- driver modification only - relocation of wiper/washer controls in small control boxes, in door panel, centre console or in seat head rest or cushion to increase accessibility	Minor	CMVSS 101 – Location and Identification of Controls and Displays CMVSS 104 – Windshield Wiping and Washing System CMVSS 107 – Reflecting Surfaces (wiper arms and blades)	SAE J903c – Passenger Car Wiper Systems SAE J942b – Passenger Car Windshield Washer Systems SAE J1211 – Recommended Environmental Practices for Electronic Equipment
Windshield Defroster	- driver modification only - relocation of specific controls in small control boxes, in door panel, centre console or in seat head rest or cushion to increase accessibility of controls	Minor	CMVSS 101 – Location and Identification of Controls and Displays CMVSS 103 – Windshield Defrosting and Defogging	SAE J902 – Passenger Car Windshield Defrosting Systems SAE J1211 – Recommended Environmental Practices for Electronic Equipment

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Rearview Mirrors	- driver modification only - relocation of controls for electronically controlled OEM mirrors - installation of electronically controlled OEM mirrors	Minor Minor	CMVSS 111, 111.1 – Rearview Mirrors CMVSS 107 – Reflecting Surfaces (inside mirror)	SAE J834a – Passenger Car Rear Vision
Other Group B Controls: - Turn Signal - Hazard Flasher - Horn - Headlight Dimmer	- driver modification only - relocation of specific controls in small control boxes, in door panel, centre console or in seat head rest or cushion to increase accessibility of controls (OEM controls may remain in place as backup systems or for use by other drivers when necessary) - installation of turn signal extension or adaptation for right hand use	Minor Minor	CMVSS 101 – Location and Identification of Controls and Displays	ISO 2575[6] – Road Vehicles – Symbols for Controls, Indicators and Tell-Tales SAE J1211 – Recommended Environmental Practices for Electronic Equipment
Accessory Controls:				
Accessory Controls - Air Vents - Heater/Air Conditioner - Window Regulator - Seat Positioner - Radio - Door Locks - Cigarette Lighter - Courtesy Light	- driver modification only - design and installation of special consoles to house relocated OEM controls, alternative or modified OEM controls and additional controls for accessory equipment - relocation of specific controls in small control boxes, in door panel, centre console or in seat head rest or cushion to increase accessibility of controls	Major Minor	CMVSS 101 – Location and Identification of Controls and Displays CMVSS 118 – Power Operated Windows, Power Operated Partitions and Power Operated Roof Panels	SAE J1211 – Recommended Environmental Practices for Electronic Equipment
Other Accessory Items - Sun Visor	- installation of levers and other adaptations for ease of use	Minor	CMVSS 201 – Occupant Protection CMVSS 302 – Flammability	SAE J369 – Flammability of Automotive Interior Materials
Vehicle Electrical System:				
Vehicle Electrical Wiring	- modification of OEM electrical wiring to accommodate additional electrical loads or relocate existing electrical loads, switches and/or actuators	Minor	N/A	SAE J1292 – Automobile, Truck. Truck-Tractor, Trailer, and Motor Coach Wiring

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Ignition System	- driver modification only - installation of a keyless ignition with remote or electrically actuated starting	Minor	CMVSS 101 – Location and Identification of Controls and Displays CMVSS 114 – Locking System	SAE J2032 – Ignition Cable Assemblies
Battery and Charging System	- installation of a second battery, battery isolator and associated wiring and possibly an upgrade of the OEM alternator and power generation system - installation of an auxiliary power generating system, gasoline or diesel powered generator exterior to vehicle	Minor Minor/Major	N/A (if none of the existing OEM electrical systems are modified such as lighting)	SAE J537 – Storage Batteries SAE J1127 – Battery Cable
Vehicle Chassis, Suspension and Body:				
Vehicle Frame or Unibody Frame/Body Style Structure	- lateral channelling of frame structure to allow for drop floor installation - introduction of vertical transition in frame to allow for drop floor installation - modification of frame to allow for installation of mobility aid lift and/or ramp (including attachment of lift or ramp to vehicle frame and/or floor pan with reinforcement where necessary) - reinforcement of modified unibody style frame/body structure - modification to install steps or running boards	Major Major Major Minor	CMVSS 201 – Occupant Protection CMVSS 301 – Fuel System Integrity CMVSS 301.1 – LPG Fuel System Integrity CMVSS 301.2 – CNG Fuel System Integrity	AWS D1.3-81 – Sheet Metal AWS D1.1-88[8] – Structural Welding AWS D8.4-61 – Automotive Welding Design AWS D8.5-66 – Automotive Portable Gun Resistance Spot Welding AWS D8.7-78 – Auto Weld Quality Resistance Spot Welding AWS D8.8-79 – Auto Frame Weld Quality Arc Welding Specification SAE J850 – Fixed Rigid Barrier Collision Tests SAE V.S. 20[9] – Vehicle Structural Modification Recommended Practice MIL-STD-1472D – Human Engineering Design Criteria for Military Systems, Equipment and Facilities

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Vehicle Body and/or Doors	- installation of oversized doors requiring lateral relocation of door pillars - modification of doors for automated control (opening/closing/door latching) - installation of a raised door opening to gain additional height at the door entrance - installation of structural reinforcement where required to strengthen vehicle body - modification of OEM body attachment points to increase body height relative to frame allowing lowered floor modification - reinforcement of modified unibody style frame/body structure - modification to install grab handles	Major Minor Major Major Minor Major Minor	CMVSS 201 – Occupant Protection CMVSS 205 – Glazing Materials CMVSS 206 – Door Latches, Hinges and Locks CMVSS 214 – Side Door Strength CMVSS 302 – Flammability (trim panels)	AWS D1.3-81 – Sheet Metal AWS D1.1-88[8] – Structural Welding AWS D8.4-61 – Automotive Welding Design AWS D8.5-66 – Automotive Portable Gun Resistance Spot Welding AWS D8.7-78 – Auto Weld Quality Resistance Spot Welding AWS D8.8-79 – Auto Frame Weld Quality Arc Welding Specification SAE J367 Passenger Car Door System Crush Test Procedure SAE J369 – Flammability of Automotive Interior Materials SAE/ANSI J689 – Curb Clearance Approach, Departure, and Ramp Breakover Angles SAE J839 – Passenger Car Side Door Latch Systems SAE V.S. 20[9] – Vehicle Structural Modification Recommended Practice MIL-STD-1472D – Human Engineering Design Criteria for Military Systems, Equipment and Facilities

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Vehicle Floor	- modification to vehicle floor to provide a smooth surface for mobility aid movement (flat floor) - modification to lower a portion of the vehicle floor (lowered floor) to accommodate a lift device or a person seated in a mobility aid - modification to lower and raise portions of the vehicle floor to accommodate a lift device - modification to vehicle floor to provide wheelchair wells which align with the wheels of a wheelchair - reinforcement of modified unibody style frame/body structure	Major Major Major Major	CMVSS 201 – Occupant Protection CMVSS 301 – Fuel System Integrity CMVSS 301.1 – LPG Fuel System Integrity CMVSS 301.2 – CNG Fuel System Integrity	AWS D1.3-81 – Sheet Metal AWS D1.1-88[8] – Structural Welding AWS D8.4-61 – Automotive Welding Design AWS D8.5-66 – Automotive Portable Gun Resistance Spot Welding AWS D8.7-78 – Auto Weld Quality Resistance Spot Welding AWS D8.8-79 – Auto Frame Weld Quality Arc Welding Specification SAE/ANSI J689 – Curb Clearance Approach, Departure, and Ramp Breakover Angles SAE J850 – Fixed Rigid Barrier Collision Tests SAE V.S. 20[9] – Vehicle Structural Modification Recommended Practice

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Vehicle Roof	- raising of vehicle roof to provide greater interior headroom thereby accommodating a person seated in a mobility aid	Major	CMVSS 201 – Occupant Protection CMVSS 216 – Roof Intrusion Protection CMVSS 302 – Flammability (headlining) CMVSS 210 – Seat Belt Assembly Anchorages	AWS D1.3-81 – Sheet Metal AWS D1.1-88[8] – Structural Welding AWS D8.4-61 – Automotive Welding Design AWS D8.5-66 – Automotive Portable Gun Resistance Spot Welding AWS D8.7-78 – Auto Weld Quality Resistance Spot Welding AWS D8.8-79 – Auto Frame Weld Quality Arc Welding Specification SAE J369 – Flammability of Automotive Interior Materials SAE J374 – Vehicle Roof Strength Test Procedure SAE J850 – Fixed Rigid Barrier Collision Tests SAE J857 – Rollover Tests Without Collision SAE V.S. 20[9] – Vehicle Structural Modification Recommended Practice SAE J383, J384, J385 – Seat Belt Anchorages

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Seats	- replacement of OEM seats with custom seats or aftermarket seats typically with additional postural supports or powered adjusting controls - installation of a removable seat base to allow removal and re-installation of vehicle seat	Major Major	CMVSS 207 – Anchorage of Seats CMVSS 208 – Seat Belt Installations CMVSS 209 – Seat Belt Assemblies CMVSS 210 – Seat Belt Assembly Anchorages CMVSS 302 – Flammability (seat cushions, seat backs, seat belts, arm rests, head restraints)	SAE J114 – Seat Belt Assembly Webbing Abrasion Performance SAE J140a – Seat Belt Hardware Test Procedure SAE J141 – Seat Belt Hardware Performance Requirements SAE J369 – Flammability of Automotive Interior Materials SAE J383, J384, J385 – Seat Belt Anchorages SAE J941 – Motor Vehicle Driver's Eye Range SAE J1052 – Motor Vehicle Driver and Passenger Head Position SAE J1517 – Driver Selected Seat Position MIL-STD-1472D – Human Engineering Design Criteria for Military Systems, Equipment and Facilities
Tires and Wheel Rims	- replacement of OEM tires to accommodate greater load carrying capacity	Minor	CMVSS 110 – Tires and Rim[10] CMVSS 120 – Tire Selection and Rims[10]	SAE J918c – Passenger Car Tire Performance Requirements and Test Procedures
Windows	- installation of new or modified side door windows - installation of new or modified front windshield due to raised roof	Major Major	CMVSS 118 – Power Operated Windows, Power Operated Partitions and Power Operated Roof Panels CMVSS 205 – Glazing Materials CMVSS 212 – Windshield Mounting CMVSS 107 – Reflecting Surfaces (inside windshield moulding)	SAE J673 – Automotive Safety Glazing SAE J674 – Safety Glazing Materials – Motor Vehicles

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Interior Upholstery	- alteration of vehicle upholstery as a result of other modifications	Minor	CMVSS 302 – Flammability	SAE J369 – Flammability of Automotive Interior Materials SAE J986 – Sound Level for Passenger Cars and Light Trucks SAE J1030 – Maximum Sound Level for Passenger Cars and Light Trucks
Suspension Components	- increase spring load carrying capacity to accommodate increased sprung weight - may affect vehicle lighting system requiring adjustment of headlamp aim	Minor	CMVSS 108 – Lighting System and Retroreflective Devices (headlamp aim) CMVSS 108.1 – Alternative Requirements for Headlamps (headlamp aim)	SAE J274 – Rated Suspension Spring Capacity SAE J689 – Curb Clearance Approach, Departure, and Ramp Breakover Angles
Engine:				
Engine Cooling	- upgrade of OEM engine cooling system to increase cooling capacity to accommodate additional vehicle load (typically OEM replacement parts are utilized)	Minor	N/A	SAE/ANSI J20 – Coolant System Hoses
Engine Operation	- relocation of engine and related components to provide greater interior floor space - typically engine operation is not directly modified or affected by other modifications or alterations	Major N/A	CMVSS 1101 – General (Emission Devices) CMVSS 1102 – Crankcase Emissions CMVSS 1104 – Opacity CMVSS 1105 – Evaporative Emissions CMVSS 1106 – Noise	SAE/ANSI J615 – Engine Mountings
Drivetrain:				
Clutch	- driver modification only - installation of attachments to clutch pedal to bring pedal surface closer to driver - installation of attachments to reduce muscle force input by driver	Minor Major	CMVSS 101 – Location and Identification of Controls and Displays	N/A

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Transmission	- relocation of transmission and related components to provide greater interior floor space - upgrade of OEM transmission cooling system to increase cooling capacity to accommodate additional vehicle load (typically OEM replacement parts are utilized) - re-routing of transmission hydraulic lines	Major Minor Minor	CMVSS 102 – Transmission Shift Control Sequence	SAE J915 – Automatic Transmission – Manual Control Sequence SAE J311 – Fluid for Passenger Car Type Automatic Transmissions SAE J1377 – Transmission Mounted Vehicle Speed Signal Rotor Specification
Axles	- possible change to axle gear ratio as a result of increased vehicle load or changes to tire size - not normally modified as OEM axles can accommodate a moderate increase in overall vehicle weight	Minor N/A	N/A	SAE J2200 – Passenger Cars and Light Truck Axles
Fuel System:				
Fuel Lines	- re-routing of fuel lines	Major	CMVSS 301 – Fuel System Integrity CMVSS 301.1 – LPG Fuel System Integrity CMVSS 301.2 – CNG Fuel System Integrity	N/A
Fuel Tank	- relocation of fuel tank	Major	CMVSS 301 – Fuel System Integrity CMVSS 301.1 – LPG Fuel System Integrity CMVSS 301.2 – CNG Fuel System Integrity	SAE/ANSI J1114 – Fuel Tank Filler Cap and Cap Retainer – Threaded SAE J398 – Fuel Tank Filler Conditions

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Vehicle Safety Systems:				
Occupant Protection System	- modifications to non-glazed impact surfaces such as knee bolsters and instrument panel - extension of steering column to bring steering closer to driver - modification of OEM headrest or introduction of custom fabricated headrest - altered position of occupant relative to OEM driver position requiring further modifications	Major Major Major Major	CMVSS 201 – Occupant Protection CMVSS 202 – Head Restraints CMVSS 203 – Driver Impact Protection CMVSS 204 – Steering Column Rearward Displacement CMVSS 216 – Roof Intrusion Protection CMVSS 219 – Windshield Zone Intrusion	CAN/CSA-Z605 – MASOR Systems for Motor Vehicles SAE[11] – WTORS for Use in Motor Vehicles
Air Bag Supplemental Restraint System	- deactivation of air bag supplemental restraint as a result of installation of hand controls or modification of OEM steering wheel - deactivation of air bag supplemental restraint as a result of altered position of occupant relative to OEM driver position	Minor Minor	CMVSS 208 – Seat Belt Installations	SAE J1856 – Identification of Automotive Air Bags
Seat Belt Assembly or Automatic Occupant Restraint System	- relocation of OEM seat belt anchorage points - altered position of occupant relative to OEM driver position requiring further modifications	Major Major	CMVSS 208 – Seat Belt Installations CMVSS 209 – Seat Belt Assemblies CMVSS 210 – Seat Belt Assembly Anchorages	CAN/CSA-Z605 – MASOR Systems for Motor Vehicles SAE J114 – Seat Belt Assembly Webbing Abrasion Performance SAE J140a – Seat Belt Hardware Test Procedure SAE J141 – Seat Belt Hardware Performance Requirements SAE J383, J384, J385 – Seat Belt Anchorages SAE[11] – WTORS for Use in Motor Vehicles

Vehicle Component or System Modified	Modifications Required	Type of Modification	Applicable CMVSS[1,2]	Other Applicable Standards[3,4]
Other Items:				
Mobility Aid Securement and Occupant Restraint Systems	- installation of an aftermarket restraint system to safely restrain an occupied mobility aid during vehicle travel	Minor	CMVSS 213.3 – Restraint Systems for Disabled Persons	CAN/CSA-Z605 – MASOR Systems for Motor Vehicles SAE J114 – Seat Belt Assembly Webbing Abrasion Performance SAE J140a – Seat Belt Hardware Test Procedure SAE J141 – Seat Belt Hardware Performance Requirements SAE J383, J384, J385 – Seat Belt Anchorages SAE[11] – WTORS for Use in Motor Vehicles
Compliance Label	- where a vehicle identification number is stated on a label bearing a statement of compliance affixed to a vehicle and the vehicle is altered, the vehicle identification number shall apply to the altered vehicle.	Minor	CMVSS 115 – Vehicle Identification Number MVSR Section 9 – Altered Vehicle	SAE J273 – Passenger Car Vehicle Identification Number System SAE J853 – Vehicle Identification Numbers
Stowage Systems for Mobility Aids	- installation of stowage brackets and restraint systems for unoccupied mobility aids	Minor	CMVSS 215 – Bumpers	N/A
Mobility Aid/Occupant Lifting and Elevating Devices	- installation of hoists and other lifting devices to lift and move an unoccupied mobility aid - installation of elevating devices for lifting an occupied mobility aid into or out of a vehicle	Minor Major	CMVSS 215 – Bumpers	SAE J514 – Hydraulic Tube Fittings SAE J516 – Hydraulic Hose Fittings SAE J517 – Hydraulic Hose SAE[12] – Wheelchair Lifting Device for Entry or Exit from a Personally Licensed Vehicle, Draft Recommended Practice

Note 1: All modifications listed in Table 1 apply only to vehicles purchased in Canada and converted or modified in Canada. A vehicle purchased and converted in the United States and imported into Canada is required to comply with CMVSS 902 - American Specifications Vehicle Standards in addition to complying with the regulations set out in Section 12 - Importation of a Vehicle Purchased in the United States.

Note 2: References to the Canadian Motor Vehicle Safety Standards (CMVSS), are contained in Schedule III of the Motor Vehicle Safety Regulations (MVSR), and form part of the safety regulations which are contained in the Motor Vehicle Safety Act (MVSA).

The following CMVSS standards normally do not apply to vehicles converted for personal use by persons with disabilities due to the type of vehicle considered or the OEM component or systems affected by typical conversions:

- CMVSS 112 - Headlamp Concealment Devices;
- CMVSS 113 - Hood Latch System;
- CMVSS 121 - Air Brake Systems;
- CMVSS 122 - Motorcycle Brake Systems;
- CMVSS 123 - Controls and Displays - Motorcycles;
- CMVSS 131 - School Bus Pedestrian Safety Devices;
- CMVSS 210.1 - Tether Anchorages for Child Restraints;
- CMVSS 211 - Wheel Nuts, Hub Caps and wheel Discs;
- CMVSS 213 - Child Restraint Systems;
- CMVSS 213.1 - Infant Seating and Restraint Systems;
- CMVSS 213.2 - Booster Cushions;
- CMVSS 213.4 -Built-in Child Restraint Systems/Built-in Booster Cushions;
- CMVSS 217 - Bus Window Retention, Release and Emergency Exits;
- CMVSS 220 - Rollover Protection;
- CMVSS 221 - School Bus Body Joint Strength;
- CMVSS 222 - School Bus Passenger Seating and Crash Protection;
- CMVSS 901 - Axles;
- CMVSS 903 - C-dolly Specifications;
- CMVSS 904 - C-dolly Hitch Requirements;
- All of Schedule VI, Schedule VII and Schedule VIII.

The following CMVSS standards should be referenced for explanations of specific definitions which apply to the standards referenced in Table 1:

CMVSS 100 - Definitions;
CMVSS 1100 - Definitions.

Note 3: Where modifications invalidate the certification achieved by the OEM, testing may be required to determine adequate functioning of the modified system. In these instances, relevant test procedures/standards have been included in addition to component design, assembly and

performance requirements and general workmanship and installation requirements.

Note 4: The following standards apply generally to personal vehicle conversions:

- Occupational Health and Safety Act, Revised Statutes of Ontario, 1990, Chapter 0.1 as Amended (and other provincial acts as required);
- SAE J429 - Requirements for Externally Threaded Fasteners;
- SAE/ANSI J1100 - Motor Vehicle Dimensions;
- SAE J1555 - Design Guidelines for Optimizing Automobile Collision Damage; Resistance, Repairability and Serviceability;
- SAE J1828 - Uniform Reference and Dimensional Guidelines for Unibody Vehicles;
- SAE J1959 - Corrosion Preventative Compound Under Vehicle Corrosion Protection;
- SAE J1976 - Outdoor Weathering of Exterior Materials.

Note 5: The referenced SAE standard "Recommended Practice for Powered Throttle/Brake Hand Control Systems" is a draft working document issued for critical review and comment. An accompanying SAE draft document is "Recommended Test Procedure for Powered Throttle/Brake Hand Control System".

Note 6: Other ISO standards for road vehicles do exist and those applicable will be listed as alternative standards (Issues and Discussion Points Reference: 6. Alternative Approaches Regarding Compliance). ISO 2575 Road Vehicles - Symbols for Controls, Indicators and Tell-tales is currently referenced by CMVSS 101 - Indentification and Location of Controls and Displays.

Note 7: The referenced CSA standard "CSA - Z323.1.2 Adaptive Driving Controls for Persons with Disabilities".

Note 8: Although pertaining primarily to building construction the following standards may also apply: CSA W59-M1989 Welded Steel Construction (Metal Arc Welding) and CSA W47.1-92 Certification of Companies for Fusion Welding of Steel Structures. The following standards may also apply:

- SAE J1147 - Welding, Brazing, and Soldering;
- SAE/ANSI J1827 - Unibody Weld Quality Testing.

Note 9: The referenced SAE standard "V.S. 20 - Vehicle Structural Modification Recommended Practice" is a draft working document issued for critical review and comment.

Note 10: The Motor Vehicle Tire Safety Act - CRC 1039 Motor Vehicle Tire Safety Regulations also applies.

Note 11: The referenced SAE standard "Wheelchair Tiedowns and Occupant Restraint Systems for Use in Motor Vehicles" is a draft working document issued for critical review and comment.

Note 12: The referenced SAE standard "SAE - Wheelchair Lifting Device for Entry or Exit from a Personally Licensed Vehicle, Draft Recommended Practice" is a draft working document issued for critical review and comment.

Appendix E
Detailed Assessment of Impact of CMVSS

Detailed Assessment of Impact of CMVSS

The following assessment details both minor and major impacts, by CMVSS.

CMVSS 101 – Location and Identification of Controls and Displays

The following controls and components, where fitted on a vehicle, shall be fitted in such a manner that they are operable by the driver while the driver is seated in the driver's designated seating position with the driver's seat belt fastened around the driver. As well, the displays for the following functions and malfunctions shall be mounted in such a manner that they are identifiable by the driver while the driver is seated in the driver's designated seating position with the driver's seat belt fastened around the driver.

- accelerator
- automatic vehicle speed system
- choke (if manually operated)
- clutch pedal
- driver's sun visor
- engine start control
- engine stop control
- hand throttle
- hazard warning switch and indicator
- headlamp upper or lower beam switch and indicator
- horn
- ignition switch
- illumination intensity control
- master lighting switch
- parking brake pedal or lever
- rear window defog and defrost control
- service brake pedal or control
- steering wheel
- transmission shift control (except the transfer case if one is exists)
- turn signal control and indicator
- windshield defog and defrost system control
- windshield washing system control
- windshield wiping system control
- clearance lamps switch
- identification lamps and switch
- side marker lamps

- antilock system failure
- battery charging
- brake failure
- engine coolant temperature
- engine oil pressure
- fuel
- gear position
- odometer
- seat belt
- speedometer
- extreme position for heating and air conditioning
- fan for heating and ventilation system

CMVSS Impact: Minor, Potentially Major

There should be no major difficulty in meeting the majority of these requirements as the accessibility of controls is one of the aims of modifying a vehicle. Generally, the extra effort in following the above specifications should not be extensive. A potentially major difficulty in meeting these requirements is the altering of the OEM driver position which may directly affect viewing of the displays.

CMVSS 102 – Transmission Shift Control Sequence

The vehicle automatic transmission must provide engine braking between gear ratios, below 40 km/h (25 mph) and not allow the engine starter to operate when a forward or reverse drive position is selected. Identification of automatic transmission control positions shall be P R N D L and the shift lever pattern of manual transmissions, except manual transmissions having three forward speeds and the standard "H" pattern, shall be permanently displayed in view of the driver of the vehicle.

CMVSS Impact: Minor

If the OEM transmission components are modified, there should be no major difficulty in meeting these requirements. The shift sequences are not normally altered and the display should be easily viewable.

CMVSS 103 – Windshield Defrosting and Defogging

A defrosting and defogging system shall be installed in the vehicle and shall meet the operating requirements of the standard. The system shall be tested according to

SAE Recommended Practice J902 Passenger Car Windshield Defrosting Systems and additional testing requirements stated in the standard.

CMVSS Impact: Minor

Although these OEM components are not normally modified, there should be no major difficulty in meeting the requirements of this standard. The testing requirements are relative to performance and are not extensive.

CMVSS 104 – Windshield Wiping and Washing System

A vehicle is required to have a power driven windshield wiping system which is independent of engine speed and load. The system must meet the performance requirements of the standard which references SAE Recommended Practice J903a Passenger Car Windshield Wiper Systems. In addition, the system is required to comply with the wiping pattern of the OEM or that stated in the standard.

CMVSS Impact: Minor

If the OEM windshield is modified, there should be no major difficulty in meeting the requirements of this standard. Functional testing required to verify compliance, some of which is performed according to SAE Recommended Practice J903a Passenger Car Windshield Wiper Systems is not extensive.

CMVSS 105 – Hydraulic Brake System

The vehicle is to be equipped with a service brake system acting on all wheels with indicators and displays as set out in the standard. In addition, the vehicle is to be equipped with a friction type parking brake.

CMVSS Impact: Minor, Major

If the functional hydraulic components of the OEM brake system are not modified, there should be no major difficulty in meeting the requirements of this standard. Inspection does not normally involve testing, however, a large portion of this standard pertains to testing according to the requirements of the standard. A substantial modification of the hydraulic system may require performing this testing.

CMVSS 106 – Brake Hoses

Brake hoses must utilize appropriate fittings and must be labelled according to the requirements of the standard.

CMVSS Impact: Minor

There should be no major difficulty in meeting the requirements of this standard if approved brake and vacuum hoses are installed during modification.

CMVSS 107 – Reflective Surfaces

The specular gloss of wiper arms and blades, inside windshield moulding, horn ring and inside mirror must meet the requirements of the standard.

CMVSS Impact: Minor

If OEM components are modified or replaced, there should be no major difficulty in meeting the requirements of this standard.

CMVSS 108 – Lighting Equipment

The vehicle headlamps, daytime running lamps, parking lamps, turn signal lamps, side marker lamps, side reflex reflectors, identification lamps, clearance lamps, tail stop lamps, licence plate lamps, and back-up lamp must meet the requirements of the standard.

CMVSS Impact: Minor

If OEM components are modified or replaced, there should be no major difficulty in meeting the requirements of this standard.

CMVSS 108.1 – Headlamps

The vehicle may be equipped with alternative headlamps as stated in the standard.

CMVSS Impact: Minor

If OEM components are modified or replaced, there should be no major difficulty in meeting the requirements of this standard.

CMVSS 110 – Tire Selection and Rims

Every vehicle tire shall meet the quality requirements of the standard and have the appropriate tire markings.

CMVSS Impact: Minor

If approved tires and rims are utilized, there should be no major difficulty in meeting the requirements of this standard.

CMVSS 111 – Rearview Mirrors

The vehicle mirrors shall provide the rear view as prescribed in the standard and the components are to meet the requirements of the standard.

CMVSS Impact: Minor

If OEM components are modified or replaced, or the OEM driver position is modified, there should be no major difficulty in meeting the requirements of this standard.

CMVSS 112 – Headlamp Concealment Devices

Headlamp concealment devices shall conform to the requirements of the standard.

CMVSS Impact: None

These OEM components are not normally modified.

CMVSS 113 – Hood Latch System

Any compartment which would partially obstruct the driver's view requires a second latching position.

CMVSS Impact: None

These OEM components are not normally modified.

CMVSS 114 – Locking System

A vehicle shall have a locking system operated by a key that prevents normal activation of the vehicle engine or other main source of motive power, and either steering or forward self-mobility or both, when the key is removed. A warning to the driver of the vehicle shall be activated whenever the key has been left in the locking system and the driver's door is opened.

CMVSS Impact: Minor

If OEM components are modified or replaced, there should be no major difficulty in meeting the requirements of this standard.

CMVSS 115 – Vehicle Identification Number

The vehicle identification number shall apply to the altered vehicle and the label shall conform to the requirements of the standard.

CMVSS Impact: Minor

There should be no major difficulty in meeting the requirements of this standard.

CMVSS 116 – Hydraulic Brake Fluid

The vehicle hydraulic brake fluid shall conform to the requirements of the standard.

CMVSS Impact: Minor

If quality brake fluid is used, there should be no major difficulty in meeting the requirements of this standard.

CMVSS 118 – Power Operated Windows

A power-operated window shall only be capable of moving with the ignition key in the On, Start or Accessory position, by a muscular force, by activation of a key-locking system on the exterior of the vehicle or by a power source within the vehicle with the key in the Off position.

CMVSS Impact: Minor

If OEM components are modified or replaced, there should be no major difficulty in meeting the requirements of this standard.

CMVSS 120 – Tire Selection and Rims for Vehicles Other Than Passenger Cars

Vehicle tires must comply with the Motor Vehicle Tire Safety Regulations. In addition, tires must comply with maximum load ratings and rim markings as specified in the standard.

CMVSS Impact: Minor

If approved tires and rims are utilized, there should be no difficulty in meeting the requirements of this standard.

CMVSS 124 – Accelerator Control Systems

The vehicle throttle control system shall return to idle position from any accelerator position, if disconnected or severed and have two sources of energy for returning throttle to idle position. In addition, the throttle shall return to idle within the times specified in the standard.

CMVSS Impact: Minor, Major

For the application of add-on hand controls, there should be no major difficulty in meeting the requirements of this standard. Major modifications to the accelerator control system will be required to meet the requirements of this standard.

CMVSS 201 – Occupant Protection

A vehicle must have adequate energy absorbing material in the head impact area. The instrument panel of a vehicle shall be constructed so that the deceleration of a spherical head form will be limited to the specifications of the standard. The area of a seat back that is within a head impact area shall comply with the specifications of the standard. The sun visor and arm rest shall also meet the requirements of the standard.

CMVSS Impact: Major

Significant modifications to head impact areas in the vehicle may require testing according to the requirements of this standard and/or SAE J921b – Motor Vehicle Instrument Panel Laboratory Impact Test Procedure C Head Area and SAE J211 – Instrumentation For Impact Tests.

CMVSS 202 – Head Restraints

A head restraint shall be provided at each outboard front designated seating position on a vehicle which when tested during a forward acceleration of not less than 8g on the seat supporting structure, limits rearward angular displacement of the head. The head restraint must also meet the static load and dimensional requirements of the standard.

CMVSS Impact: Major

Modifying the OEM seats or head restraints or removing an OEM seat to accept an occupied mobility aid may require a forward acceleration test to verify compliance with this standard.

CMVSS 203 – Driver Impact Protection

The steering control system of a vehicle shall be constructed in such a manner that, during normal driving manoeuvres, no component or attachment, including any horn actuating mechanism and trim hardware, is capable of catching the clothing, watch, rings, bracelets, other than bracelets with loosely attached or dangling members, or other jewellery of the driver. The steering system must also limit the impact force developed on the chest of a body block and transmitted to the steering control system to the specifications of the standard when tested in accordance with SAE Recommended Practice J944, Steering Control System-Passenger Car-Laboratory Test Procedure.

CMVSS Impact: Major

Significant modifications to the OEM steering control system may require testing according to SAE J944, Steering Control System-Passenger Car-Laboratory Test Procedure.

CMVSS 204 – Steering Column Rearward Displacement

Vehicle steering column must meet the rearward displacement requirements of the standard.

CMVSS Impact: Major

Modifications to the OEM steering column may require barrier impact testing to verify compliance with this standard.

CMVSS 205 – Glazing Material

Vehicle glazing materials shall meet requirements of American National Standard Z26.1-1983 Safety Code for Safety Glazing Materials for Glazing Motor Vehicles Operating on Land Highways and the requirements of the standard.

CMVSS Impact: Minor

Utilizing approved automotive glazing will satisfy the majority if not all of the requirements of this standard.

CMVSS 206 – Door Latches, Hinges and Locks

The latches and hinges of the vehicle side doors, cargo type doors and sliding doors are required to be designed and tested to meet the force requirements of the standard. In addition, the doors must include an interior locking control.

CMVSS Impact: Major

Modifications to OEM side door hinges and latches may require pull force tests to verify compliance with this standard.

CMVSS 207 – Anchorage of Seats

The vehicle seat installations must meet the applied force requirements stated in the standard. In addition, a hinged or folding occupant seat shall be equipped with a self-locking device meeting the requirements of the standard.

CMVSS Impact: Major

Seats conforming to MVSA safety standards will comply with the majority of the seat specific requirements. Installation of the seats may require testing to verify compliance with this standard.

CMVSS 208 – Seat Belt Installations (based on existing regulations)

A vehicle shall be equipped at each front outboard designated seating position with a Type 2 seat belt assembly that has a non-detachable upper torso restraint or an automatic occupant protection system meeting the requirements of the standard. A vehicle shall also be equipped at each forward facing rear outboard designated seating position with a Type 2 seat belt assembly that has a non-detachable upper torso restraint. A vehicle equipped with a front outboard designated seating position with a gas-inflated occupant protection system shall also be equipped at that position with a Type 2 seat belt assembly. The system must also incorporate the appropriate warning indicators and the seat belt assemblies must fit the required occupant sizes and meet the adjustment requirements.

CMVSS Impact: Major

Static testing with anthropomorphic test devices may be required to verify compliance with this standard. As well, front impact, lateral impact and lateral roll over crash impact tests may be required if substantial modifications have been performed to the OEM occupant restraint system. An OEM seat and seat belt system that has been removed or modified to accept an occupied mobility aid will need to meet the requirements of this standard and those of CMVSS 213.3 – Restraint Systems for Disabled Persons.

CMVSS 209 – Seat Belt Assemblies

Every seat belt assembly shall comply with the design and performance requirements set out in the standard including webbing, buckle latch, and buckle of a seat belt. All seat belt installation hardware shall be designed to prevent attachment parts from becoming disengaged during vehicle service and meet the design and performance requirements of the standard. All release mechanisms shall meet the design and performance requirements of the standard. Non-locking, automatic and emergency release retractors shall meet the design and performance requirements of the standard. Appropriate labelling and marking is also required.

CMVSS Impact: Major

Seat belt installations may need to be tested to verify compliance with the performance requirements of this standard. These tests may involve applying forces to seat belt components and measurement of actuation and engagement forces.

CMVSS 210 – Seat Belt Assembly Anchorages (based on existing regulations)

Anchorages for seat belts must incorporate components to withstand the load requirements set out in the standard. In addition, anchorages must be located such that they meet the requirements of the standard, SAE Recommended Practice J383 Upper Torso Restraint and SAE Recommended Practice J384 Typical Body and Shoulder Blocks. The standard also requires documentation with the incorporation of statements indicating the proper use and installation of the seat belt system.

CMVSS Impact: Minor, Major

Seat belt anchorage installations may require testing to verify compliance with this standard. Tests apply to the loading of the seat belt anchorages, measurements of the anchorage locations and the location of seat belts relative to an anthropomorphic test device.

CMVSS 211 – Wheel Nuts, Hub Caps, and Wheel Discs

Wheel nuts, hub caps and wheel discs used on a vehicle shall not incorporate non-functional projections that constitute a hazard to pedestrians or cyclists.

CMVSS Impact: None

These OEM components are not normally modified.

CMVSS 212 – Windshield Mounting

When a vehicle, prepared and loaded, travelling longitudinally forward at any speed up to and including 48 km/h (30 mph), impacts a fixed collision barrier perpendicular to the line of travel of the vehicle, the windshield mounting of the vehicle shall retain not less than the minimum portion of the windshield periphery specified.

CMVSS Impact: Minor, Major

If the OEM windshield is replaced or modified, barrier impact testing may be required to verify compliance with this standard.

CMVSS 213.3 – Restraint Systems for Disabled Persons

Every production restraint system for disabled persons shall exhibit no complete separation of any load-bearing structural element and no partial separation exposing hazardous surfaces, remain in the same adjustment position (where the

system may be adjusted to different adjustment positions), limit the test accelerations, and not allow any portion of the head of the anthropomorphic test device to pass through the vertical transverse plane as stated in the standard. No portion of the system shall burn or transmit a flame front across its surface at a rate of more than 101.6 mm per minute. Every production or custom restraint system for disabled persons shall be capable of being restrained against forward movement solely by means of a Type 1 or Type 2 seat belt assembly or by means of a Type 1 or Type 2 seat belt assembly together with a tether strap that is supplied with the system utilizing webbing, buckles, latches and attaching hardware that meet the requirements of the standard. Appropriate labelling and documentation is also required.

CMVSS Impact: Minor, Major

An OEM seat and seat belt system that has been removed or modified to accept an occupied mobility aid will need to meet the requirements of this standard. Utilizing an approved production restraint system may alleviate the testing requirements, however, a custom restraint system may require barrier impact testing to verify compliance with this standard.

CMVSS 214 – Side Door Strength

The side doors of the vehicle shall have an initial crush resistance, an intermediate crush resistance and a peak crush resistance of not less than that specified in the standard.

CMVSS Impact: Major

Replacement or modification of a vehicle side door may require crush testing to verify compliance with this standard.

CMVSS 215 – Bumpers

A vehicle impacted by a pendulum-type test device shall meet the requirements of the standard followed by a longitudinally rearward and/or longitudinally forward fixed-collision barrier test as set out in the standard.

CMVSS Impact: None

These OEM components are not normally modified.

CMVSS 216 – Roof Intrusion Protection

Vehicle roof structure shall withstand loads stated the standard and shall not sustain an intrusion into the roof of the vehicle that exceeds 127 mm in depth.

CMVSS Impact: Major

If the OEM roof structure is modified, the roof intrusion protection test may need to be performed to verify compliance with this standard.

CMVSS 219 – Windshield Zone Intrusion

A vehicle travelling longitudinally forward at any speed up to and including 48 km/h (30 mph) which impacts a fixed collision barrier that is perpendicular to the line of travel of the vehicle, shall not reveal any penetration through the zones stated in the standard.

CMVSS Impact: Major

If the OEM windshield is replaced or modified, barrier impact testing may be required to verify compliance with this standard.

CMVSS 301 – Fuel System Integrity

A vehicle shall not exceed the fuel spillage requirements stated in the standard as a result of forward or rearward, fixed or moving impact barrier collision tests or lateral impact tests, followed by a static roll-over test. A particular vehicle need not meet further requirements after having been subjected to a single barrier crash test and a static roll-over test.

CMVSS Impact: Major

If the OEM fuel system is altered by relocating fuel lines or the fuel tank or any other significant structural modification, barrier impact testing may be required to verify compliance with this standard. Compliance with this standard requires components other than the fuel system to meet minimum design requirements.

CMVSS 301.1 – L.P.G. Fuel System Integrity

A vehicle may comply with the requirements of the barrier crash test set out in the standard or the requirements of the Canadian Gas Association Preliminary Standard 12.2 Propane Fuel System Components for Highway Vehicles in association with

National Standard of Canada CAN 1-B149-2-M80 Installation Code for Propane Burning Appliances and Equipment.

CMVSS Impact: Major

If the OEM fuel system is altered by relocating fuel lines or the fuel tank or any other significant modification, barrier impact testing or verification of compliance with other standards may be required to verify compliance with this standard. Compliance with this standard requires components other than the fuel system to meet minimum design requirements.

CMVSS 301.2 – CNG Fuel System Integrity

A vehicle shall comply with the requirements of the barrier crash test set out in the standard and the requirements of the Canadian Gas Association Preliminary Standard 12-3 1981 Compressed Natural Gas Fuel System Components for Use on Highway Vehicles.

CMVSS Impact: Major

If the OEM fuel system is altered by relocating fuel lines or the fuel tank or any other significant modification, barrier impact testing or verification of compliance with other standards may be required to verify compliance with this standard. Compliance with this standard requires components other than the fuel system to meet minimum design requirements.

CMVSS 302 – Flammability

The following material covered components shall not burn in excess of or transmit a flame front across its surface, at a rate of more than 101.6 mm (4 inches) per minute or have stopped burning in 60 seconds and has not burnt more than 2 inches:

- seat cushions
- seat backs
- seat belts
- headlining
- arm rest
- trim panels
- head restraints
- floor covering
- sun visors
- wheel housing cover

- engine compendiment covers
- any other materials that are designed to absorb energy or contact by occupants in the event of a crash, including padding and crash-deployed elements.

CMVSS Impact: Minor, Major

If OEM components are replaced by materials and/or components which meet the CMVSS requirements, testing will not be required and there will be no major difficulty in meeting the requirements of this standard.

CMVSS 1101 – Emission Devices

A vehicle shall not cause emission into the atmosphere of any air pollutant that would not be emitted into the atmosphere during the operation of the vehicle or vehicle engine if it were not equipped with the system or device and shall not result in any unsafe condition endangering persons or property. In addition, appropriate labelling is required which complies with the standard.

CMVSS Impact: Minor

OEM components related to atmospheric emissions are not normally modified and after-market components typically comply with the requirements of this standard.

CMVSS 1104 – Opacity

A diesel fuelled vehicle shall meet the smoke emission opacity requirements of the standard.

CMVSS Impact: Minor

OEM components related to exhaust emissions and engine operation are not normally modified.

CMVSS 1105 – Evaporative Emissions

The evaporative hydrocarbon emission from a gas fuelled motor vehicle shall not exceed those stated in the standard.

CMVSS Impact: Minor

OEM components related to evaporative emissions are not normally modified.

CMVSS 1106 – Noise

A vehicle shall comply with the noise measurement requirements set out in the standard.

CMVSS Impact: Minor

OEM components producing noise (exhaust, engine operation) are not normally modified.

CMVSS Motor Vehicle Tire Safety Act CRC – 1039 Motor Vehicle Tire Safety Regulations

A National Tire Safety Mark and Tire Identification Number is required on all vehicle tires in the appropriate locations.

CMVSS Impact: Minor

These OEM components are not normally modified and replacement components will typically meet the requirements of this standard.

Appendix F
Relevant Standards and Research Documents

Related Standards

1 Vehicle and Control Modifications for Drivers with Physical Disabilities Terminology
Society of Automotive Engineers, Document No. J2094, June 1991

2 Wheelchair Lifting Device for Entry and Exit from a Personally Licensed Vehicle Draft, Recommended Practice
Society of Automotive Engineers, Revision 8, 1993

3 Testing of Wheelchair Lifts
Draft Recommended Test Procedure, Document No. J2092
Society of Automotive Engineers, Revision 9, 1993

4 Wheelchair Tiedowns and Occupant Restraint Systems for Use in Motor Vehicles, Working Document
Society of Automotive Engineers, 1994

5 Automotive Adaptive Driving Controls for Persons with Physical Disabilities
Canadian Standards Association
Rexdale, Ontario, Canada
Document No. Z323.1.2-94

6 Recommended Practice for Powered Throttle/Brake Control Systems Draft Document
Society of Automotive Engineers, 1994

7 Recommended Test Procedures for Powered Throttle/Brake Control Systems, Draft Document
Society of Automotive Engineers, 1993

8 Vehicle Structural Modification
Recommended Practice, Document No. V.S. 20
Society of Automotive Engineers, 1993

Related ISO Standards

1 Installation of Lighting and Light Signalling Devices for Motor Vehicles and Their Trailers, ISO Document No. 303, Feb. 86

2 Braking of Automotive Vehicles and Their Trailers – Vocabulary
ISO Document No. 611, Feb. 94

3 Anchorages for Seat Belts
ISO Document No. 1417, Feb. 74

4 Reciprocating Internal Combustion Engines – Hand-Operated Control Devices – Standard Direction of Motion
ISO Document No. 2261, Dec. 94

5 Road Vehicles – Symbols for Controls, Indicators and Tell-Tales
ISO Document No. 2575, Dec. 95

6 Exterior Protection for Passenger Cars
ISO Document No. 2958, Sep. 73

7 Evaluation of Protrusions Inside Passenger Cars
ISO Document No. 3208, Oct. 74

8 Determination of Fuel Leakage in the Event of a Collision
ISO Document No. 3437, Nov. 75

9 Windscreen Defrosting Systems – Test Method
ISO Document No. 3468, Dec. 89

10 Windscreen Washing Systems – Test Methods
ISO Document No. 3469, Dec. 89

11 Windscreen Demisting Systems – Test Methods
ISO Document No. 3470, Dec. 89

12 Safety Glazing Materials – Mechanical Tests
ISO Document No. 3537, Jul. 93

13 Frontal Fixed Barrier Collision Test Method
ISO Document No. 3460, Nov. 75

14 Passenger Cars – Driver Hand Control Reach
ISO Document No. 3958, Feb. 96

15 Passenger Cars – Moving Barrier Rear Collision Test Method
ISO Document No. 3984, Feb. 82

16 Brake Hose Assemblies for Hydraulic Braking Systems Used with Non-Petroleum-Base Brake Fluid
ISO Document No. 3996, Feb. 95

17 Location of Hand Controls, Indicators and Tell-Tales
ISO Document No. 4040, May 83

18 Special Warning Lamps – Dimensions
ISO Document No. 4148, Dec. 88

19 Measurement of Variations in Dipped-Beam Headlamp Angle as a Function of Load
ISO Document No. 4182, Feb. 86

20 Sled Test Procedure for Evaluating Adult Restraint Systems in Simulated Frontal Collisions
ISO Document No. 7862, Feb. 92

21 Controls – Types, Positions and Functions
ISO Document No. 9021, Sep. 88

22 Driver Hand-Control Reach – In-Vehicle Checking Procedure
ISO Document No. 9511, Apr. 91

It should be noted that the ISO wheelchair securement standard now includes personal vehicles; this increased scope has resulted in publishing delays.

Research Documents

1 Computer Experiments for Optimal FMVSS 208 and NCAP Performance
Yih-Charng Deng and J. T. Wang
General Motors NAO R & D Center, 1994
Society of Automotive Engineers, Document No. 942230

2 Wheelchair and Occupant Restraint System for Use in Buses
Jan Petzäll
Chalmers University of Technology,
Gothenberg, Sweden, 1991
Society of Automotive Engineers, Document No. 916049

3 Safety of Wheelchair Occupants in Road Transport
J. Kooi, E. G. Janssen, TNO Road-Vehicles Research Institute
Delft, The Netherlands, 1987
Society of Automotive Engineers Document No. 1987-13-0013

4 The Safe Transportation of Wheelchair Occupants in the United Kingdom
S. P. F. Petty
Transport and Road Research Laboratory
Crowthorne, Berkshire, United Kingdom, 1985
Society of Automotive Engineers Document No. 856068

5 Wheelchair Restraint Systems, Dynamic Test Results and the Development of Standards
E. Red, K. Hale, M. McDermott, B. Mooring
Mechanical Engineering Dept.
Texas A&M University, 1982
Society of Automotive Engineers, Document No. 821161

6 Interlaboratory Study of Proposed Compliance Test Protocol for Wheelchair Tiedown and Occupant Restraint Systems, 1994
G. Shaw, A. Lapidot, M. Scavnicky
University of Virginia Transportation Rehabilitation Engineering Centre
L. Schneider
University of Michigan Transportation Research Institute
Peter Roy
Middlesex University Road Safety Engineering Lab
Society of Automotive Engineers Document No. 942229

7 The Application and Safety of Securement and Restraints for Wheelchair Seated Travellers on Public Transit Vehicles
T. C. Adams, S. I. Regers, D. K. Ault, V. Sahgal
Cleveland Clinic Foundation, Dept. of Physical Medicine and Rehabilitation, Cleveland, Ohio, U.S.A., 1994
Society of Automotive Engineers Document No. 1994-13-0013

8 Motor Vehicles for the Transportation of Persons with Physical Disabilities
Canadian Standards Association
Rexdale, Ontario, Canada
Document No. CAN/CSA-D409-92

9 Transportable Mobility Aids
Health Care Technology
Canadian Standards Association
Rexdale, Ontario, Canada
Document No. CAN/CSA-Z604-95

10 Mobility Aid Securement and Occupant Restraint (MASOR) Systems for Motor Vehicles
Health Care Technology
Canadian Standards Association
Rexdale, Ontario, Canada
Document No. CAN/CSA-Z605-95

11 Development of a Standard Interface Concept for Securing Wheelchairs in Accessible Vehicles
L. A. Garland, T E S Limited
Kanata, Ontario, Canada
Transportation Development Centre, Transport Canada, 1989
Document No. TP9734E

12 Positioning and Securing Riders with Disabilities and Their Mobility Aids in Transit Vehicles: Designing an Evaluation Program
Project Action, US Department of Transportation/Easter Seals
ECRI, Plymouth Meeting, Pennsylvania, U.S.A.

13 Comparative Field Testing of the Cleveland Securement System
Project Action, US Department of Transportation/Easter Seals
S. Reger, T. Adams, Cleveland Clinic Foundation
Dept. of Rehabilitation Medicine, Cleveland, Ohio, U.S.A.

14 A Universal Securement/Restraint System for Wheeled Mobility Aids on Public Transportation Vehicles, The Oregon State University Securement System
Project Action, US Department of Transportation/Easter Seals
K. M. Hunter-Zaworski, Transportation Research Institute
Oregon State University, Oregon, U.S.A., 1992

15 Wheelchair Securement and Passenger Restraint for Public Transit
Transit Cooperative Research Program
Transportation Research Board, National Research Council
Dept. of Rehabilitation Medicine, Cleveland Clinic Foundation/Invacare Corp.
Cleveland, Ohio, U.S.A., 1995

16 American Disabilities Act, Transportation Accessibility Reference Guide
Information kit on American Disabilities Act

17 Wheelchair Tiedown and Occupant Restraint System for Motor Vehicles, Part 1 – General Requirements
International Standards Organization
Working Group: TC173/SC-1/WG-6
Document No. ISO CD-10542-1

18 The Mechanics of Mobility Aid Securement/Restraint on Public Transportation Vehicles
K. M. Hunter-Zaworski, D. G. Ullman
Oregon State University, 1991
Corvallis, Oregon, U.S.A.

19 Wheelchair Accommodation and Related Safety Standards for Full Size Urban Buses
E. Rutenberg, D. Mietzker
Canadian Urban Transit Association
Rutenberg Design Inc., 1993
Ottawa, Ontario, Canada

20 IDEA Program Final Report, Wheelchair Restraint System
T. Krouskop
Dept. of Physical Medicine and Rehabilitation
Baylor College of Medicine, 1995
Texas Medical Centre, Houston, Texas, U.S.A.

21 User-Friendly Scheduled Service Buses for Able-Bodied Passengers and the Disabled
P. Kasten
STUVA (Studiengesellschaft für unterirdische Verkehrsanlagen e.V.)
Ministry of Transport
Cologne, Germany, 1991

22 Safety of Wheelchair Users in Standard Line Buses
M. Dejeammes, Y. Bonicel
Institute National De Recherche Sur Les Transports et Leur Securite
Dept. of Land Transportation in the Ministry of Transport
94114 Arcueil Cédex, France, 1992

23 Code of Practice
The Safety of Passengers in Wheelchairs on Buses
Department of Transport, Vehicle Standards Engineering Division
London, England, 1987