

Public Transportation, Mobility Aids and Passenger Safety

(Wheelchairs, Scooters, Walkers, Crutches & Canes with Passengers on Public Transit)

The National Institute for Rehabilitation Engineering (NIRE) is a non-profit organization which designed, and dispensed customized assistive equipment with user training, job placement and transportation services. This was from 1967 through 1997. Working with disabled people and their doctors, therapists and employers, the NIRE staff assisted *hundreds* of people having severe and permanent motor impairments. *The NIRE pioneered the development and use of POWER WHEELCHAIRS and MOTORIZED SCOOTERS.* During these years, a great deal was learned concerning USER SAFETY, generally, **and when traveling by van, bus or train.** This paper discusses important transportation safety issues and is written for Disabled People and Transportation Service Providers and Operators, public or private. *PERMISSION is granted for the free copying and distribution of this © paper, provided that all copies are complete and unaltered ... and that The NIRE is fully credited as the source.*

THIS PAPER is intended for **Disabled People** and/or **Public Transportation Operators** using or planning to use public transport vehicles - such as vans, buses and trains - for transporting people and mobility equipment. It assumes the public transportation vehicles are handicapped accessible by means of ramps, lifts, or kneeling systems, etc. The vehicle's driver and aides, if any, should be trained for and experienced in dealing with disabled riders, their mobility aids, and in using their own vehicle's special access equipment. This paper was written in response to requests from operators and drivers, and from passengers. It discusses the special precautions that must be taken for people's safety when both people and personal mobility equipment are carried in the same van, bus or train coach. **THIS PAPER is an INTRODUCTION to the topics covered and is not enough, in and of itself, to substitute for local, on-site services by a qualified transportation safety engineer.** The services of an engineer will cost a transportation system operator considerable money. However, the use of safety engineering services can result in significant cost reductions in the premiums paid by carriers for their own liability insurance.

Mobility Equipment Transported on Vans, Buses, and Trains by disabled riders commonly include one or more of the following: (1) Wheelchairs – manual or battery powered; (2) battery powered scooters; (3) walkers, with or without wheels; (4) crutches, canes or walking sticks. **CAUTION: Gasoline or Propane powered scooters or wheelchairs should NEVER be carried in a van, bus or train.**

Passenger Travel Modalities – Every disabled person should travel carrying papers with emergency contact information and application medical and Rx information.

- 1) **Severely Disabled Passengers Unable to Transfer** between wheelchair and bus seat must **ride seated in their own wheelchairs.** These riders, and their equipment, may present hazards to themselves and others if not fully and adequately secured: “passenger-to-wheelchair” and “wheelchair-to-floor.” (A person cannot safely travel in van or bus or train while seated on a motorized scooter. He can, however, do so while seated in a motorized wheelchair if certain precautions are taken, as discussed below.)
- 2) **Disabled Riders Able to Transfer,** can most safely **ride in a regular seat** in a van, bus or train seat – with their walkers, wheelchairs, scooters and luggage being safely transported in the same van, bus or train. Unless properly secured, these

items can bring high risks of injuries from unexpected and extreme movement of the equipment. Therefore, all mobility equipment and luggage onboard must be safely secured in the vehicle so it cannot strike and injure passengers or employees. *Powered mobility equipment must be secured differently than non-powered equipment.*

- 3) **Passengers with No Mobility Equipment** who can walk, should use regular seats in the van, bus or train. Some of these people may be blind, deaf, mentally retarded or otherwise handicapped. Some may be senior citizens. These riders may also be at risk of injury from inadequately secured equipment or luggage which can roll or slide into, and injure anyone aboard the vehicle.

Transit Service Facilities & Modalities - Every vehicle transporting disabled people should have aboard, for emergency use, **two-way radios and/or cellphones**. Just as airport buses have **enclosed, protective equipment & luggage compartments**, so should vans, buses and trains which transport passengers with mobility aids and/or luggage.

- A) **Door-To-Door ... Recurring Transportation** is when a particular traveler regularly uses the same transportation service. This arrangement promotes safety because both the passenger and the driver are fully familiar with the important factors: (1) the disabled person's condition, seating needs, and tie-down needs, (2) the person's mobility equipment and its tie-down capabilities, and (3) the anticipated travel routes, time requirements, and road conditions. **This is often the safest mode of transportation for people who have disabilities** and is highly recommended.
- B) **Door-To-Door ... One-Time Transportation** is when a particular traveler spontaneously uses a particular transportation service. This arrangement requires more care and preparation because both the passenger and the driver are **not** fully familiar with all of the factors: (1) the disabled person's condition, seating needs, and tie-down needs, (2) the person's mobility equipment and its tie-down or security needs, and (3) the anticipated travel routes, time requirements and driving conditions. The driver of this van must be trained and experienced in assessing the best ways of securing a new rider and his mobility equipment, whether together or separately in the same vehicle. He knows more about his vehicle and route than does the transient passenger. Therefore, the driver and any aides he may have, must use their own judgment as to placements, tie-downs and the security of the passenger and/or his mobility equipment. **Not having previously known or evaluated the prospective rider, considerable time must be taken by the driver to evaluate, accept, and properly seat and secure the new disabled passenger and his equipment, before driving.**
- C) **Public Bus or Train Ride** is when a particular traveler spontaneously uses a public transportation service that runs on a standard public route. Typically, the bus or train has special wheelchair access facilities and is designed mostly for non-handicapped riders but with space for a small number of passengers using mobility aids. This type transportation is bound to a route schedule and drivers must board and discharge passengers (disabled or not) and their equipment very rapidly. **These public carriers must have pre-published specifications, rules,**

regulations and policies. Their drivers must be trained to know whom – and what equipment to board, how to board them for safe travel – and whom and what to refuse to board, for good cause.

Securing Disabled People and Their Appliances ... for safe transportation

- (1) **Passenger Sits in Regular Seat of a Van, Bus or Train.** If rapid transfer is feasible, the disabled passenger should transfer from his wheelchair to a regular seat because travel in the wheelchair is less safe for this person – and for other passengers – than travel in a regular seat. **WHEN IN A REGULAR SEAT**, the disabled passenger should be secured as if riding in a modern automobile's front passenger seat. He should have **BOTH** a lap belt **AND** an across-the-chest belt. Also, there should be a head rest, just as in an automobile. (If children are to be transported, then these may need to be scaled down in size as is done in the safest of school buses.) How to secure this person's equipment will be discussed separately, below.
- (2) **Passenger Sits in Wheelchair – Manual or Battery-Powered.** First of all, the passenger must be secured to the wheelchair with two belts: a lap-belt **AND** an across-the-chest belt. These will prevent his pitching forward and striking his head, or his sliding out of the wheelchair in case of sudden stops, a rollover, etc. Secondly, the wheelchair must be adequately secured to the floor. Two requirements for this must be satisfied. (A) The wheelchair must be tightly strapped **DOWN** to the floor with two separate but very strong belts. And (B) The wheels must be engaged with or against slots or bars on the floor to prevent the wheels from rolling forward or backward, or from sliding sideways. This means there must be (detachable but firm) fittings in or on the floor to prevent sliding or rolling of the occupied wheelchair.
- (3) **Passenger Sits on a Motorized Scooter while being transported.** **NO - DO NOT ALLOW THIS** because scooters usually have low seats giving inadequate upper body and head support; and they usually have wheel designs that enable them to tip over too easily. Travelers with scooters should transfer to and ride on a regular seat ... and have the equipment carried as secured freight.
- (4) **Carrying Powered Mobility Appliances** means carrying a battery powered electric wheelchair or motorized scooter. (Do **NOT** carry any gasoline or propane powered appliances.) **BATTERY ACID:** Most electric wheelchairs and scooters carry one or two rechargeable storage batteries, often similar to car batteries. Some will spill concentrated sulfuric acid onto the floor if turned over. Others are sealed and will not leak unless broken or crushed. The extra danger these vehicles present is that of leaking acid, which can burn people's skin or, from inhaled vapors, damage their lungs. **THESE VEHICLES MUST BE SAFELY SECURED** for two purposes: (a) to prevent their skidding across the

floor and striking passengers or other objects, and (b) to prevent them from overturning and spilling acid. **RECOMMENDED:** each such appliance, wheelchair or scooter, be firmly strapped to the floor as described for an occupied wheelchair, or that each be strapped in its own box-like compartment (the walls of which can be padded).

(5) Carrying Non-Powered Mobility Appliances and Aids including manual wheelchairs, walkers, crutches, and canes:

- a) **Manual Wheelchairs** are mostly foldable and should be folded and secured with straps, to a wall or in a compartment so that, they cannot slide into and injure passengers.
- b) **Walkers** may or may not be foldable. They come both ways. Some walkers have wheels and others do not. The most difficult walker to transport is a non-foldable model with wheels. This needs to be secured on its side or upside down so that it cannot roll around in the van, bus or train and injure passengers.
- c) **Crutches and Canes:** Crutches may be full-size or may be half-size (canadian crutches). **Full-size crutches** can be dangerous if the owner cannot hold them tightly. It is often better for drivers to collect full-size crutches and to secure them, for the ride, in a secure storage slot or compartment. **Short-Crutches or Canes** can still be hazardous in the event of an accident or rollover. Three options exist for their transport: (1) allow the passenger to hold same in his hands for the ride – but only if strong enough to do so effectively; (2) collect and secure all crutches and canes for transport, returning them as passengers disembark.

Helpful Documentation

The carrier's owners or operators should write and print their own books of rules, make their rules known to the riders, and vigorously enforce them.

POLICY & INSTRUCTION BOOKLETS: To simplify the driver's job on his route, to save time, and to promote safety, documentation should be prepared by each carrier's owners or operators, with the help of a qualified engineer. Documentation should be specific to each vehicle – not general for all vehicles. We recommend that, first, all needed mechanical work be completed on each van, bus or train car – before the documentation is written. Then, booklets should be created – appropriate to each van, bus or train car, and these booklets should be inserted into a pouch at each passenger seat. (They can be in pouches on the backs of the preceding seats as in airliners.) Disabled passengers should be encouraged to take home with them, copies of the booklets. This will enable them to better prepare for future rides. *These booklets can be multilingual.*

LARGE-PRINT SIGNS should be created and posted in each van, bus or train car to remind riders to read, and to take home, the informational booklets. They should also

remind passengers of the few most important rules, such as: “All Assistive Devices MUST be checked with and secured by the driver.” “All disabled passengers must be secured with multiple safety belts before we can move.”

Some Additional Information

MOTORIZED SCOOTERS vs POWER WHEELCHAIRS

Comparisons are between “light, foldable power wheelchairs” and “motorized scooters.” Both have small wheels in front – the typical wheelchair has two small casters in front, on opposite sides – the typical scooter has one small steerable wheel, centered in front. *Heavy duty outdoor, stand-up, and stair-climbing wheelchairs cannot be compared with any type of motorized scooter. These are more difficult to transport in a van, bus or train.*

Transportability & Storability: Both types of vehicles can usually be partially disassembled and folded for compact storage, or transportation in the trunk of a car. Scooter and wheelchair weights may be comparable or the wheelchair may be slightly heavier depending on its construction. Both vehicles carry a storage battery. Only the wheelchair can be transported in a van, bus or train with the user seated in it. This is not safe with a scooter.

Appearances: Motorized Scooters appear quite different than Power Wheelchairs. The scooters are usually smaller and lighter-weight. Scooters may be favored by some people because they look, to others, more like recreational vehicles than medical equipment. *Some people - mostly those with mild disabilities - have the option of choosing either a motorized wheelchair or a motorized scooter. (Those with more severe disabilities must pass on the scooter and take the wheelchair.)*

Comparative Features: Most *power wheelchairs* have at least four wheels; some have more. Some have small-diameter wheels in front and large wheels in back ... and are better suited for indoor use. Others have large wheels in front and smaller ones in back ... and are better suited for outdoor use. The wheels are widely spaced, opposites usually being on opposite sides of the wheelchair. This gives the wheelchair increased stability and safety, lessening the likelihood of rollover accidents. *Motorized scooters often lack this stability.*

Most power wheelchairs are propelled by two motors, one on each side. One motor drives one wheel and the other motor drives the other wheel. Power wheelchairs are steered by the user, using his fingers to move a small control stick forward, backward, left, or right to control speed and direction of travel. People so severely disabled that they cannot reliably operate the small joystick control can be fitted with high-technology (quadriplegic) controls that sense changes in breath ... or eye movements ... to steer and control the power wheelchair. *Special quadriplegic controls require intensive mobility and safety training for each user. They are available for power wheelchairs, only – not for motorized scooters.* In addition to the special controls available for severely disabled people, power wheelchairs can be dispensed with electric user-controlled elevating legrests, back and head supports, etc. – *not available to scooter users.* Wheelchairs often

feature removable sides to facilitate sideways transfer in and out, via a sliding transfer board – *this is not available to scooter users*. The use of four wheels stabilizes the wheelchair to make such transfers safe for the severely disabled wheelchair user. *Scooters often have only 3 wheels and lack such stability.*

Most **motorized scooters** have three wheels and use mechanical steering. The typical design has two widely spaced wheels in the rear, across from each other. A single or double-width wheel is in front, attached to a tiller, handlebar or steering wheel. The entire scooter looks a little like a child's tricycle – a major difference being that the scooter has smaller wheels. A child's tricycle has a saddle seat which is unsuitable for most disabled people. The scooter has a larger seat which gives much more support than a saddle seat on a tricycle. The scooter seat may or may not have armrests and/or a back support. *Often, the seat has to be customized for a particular user.*

The scooter's handlebar, tiller or steering wheel is used for manually steering the scooter. Because the scooter has only 3 functional wheels, it can turn over if the user leans heavily forward and/or to one side. This can happen while riding, especially if a tilted or uneven incline is encountered. Or, the scooter can fall over when stopped, when the user transfers in or out. *These characteristics of the motorized scooter limit its safe use to people with full use of at least one arm and hand, who have strong trunk muscles and can sit upright with little body support, and who can efficiently and safely transfer in and out of the scooter's seat.* Scooter users can include people with conditions such as arthritis, cerebral palsy, Parkinson disease, multiple sclerosis, etc. in early stages with mild impairment.

Necessary HAND & ARM MOBILITY for Safe Scooter Use - Many motorized scooters are mechanically steered using a handlebar (two hands required) similar to a bicycle. Braking while driving is mechanical, usually requiring the user to squeeze one or two braking handles, using one hand or both hands. The parking brake, a necessity for safety, is also mechanical and requires at least one normal arm and hand. Safe operation of some models may require normal mobility of BOTH arms and hands. Other models use a steering "tiller" or "wheel" which can be operated with one good arm and hand. *Note: If the free arm and hand are disabled, then braking and other controls must be on the tiller or steering wheel so all are operable by the same hand and arm used to steer.*

Necessary BODY STRENGTH and MOBILITY for Safe Scooter Use – The first need is for a user to be able to safely transfer in or out of the scooter seat – *alone and unaided*. To do this, the person must be able to walk unaided, or to walk with a walker, cane or crutches. Wheelchair users have a problem in that transferring between a wheelchair and a scooter, alone and unaided, is very risky and often leads to serious falls. A second need is stability while sitting on the scooter seat for long periods of time and while bouncing and tilting as one drives. A third need is for sufficient body mobility and flexibility to maintain balance as the scooter tilts and bounces along, especially on outdoor sidewalks and pavements. *Scooters are not safe to use on soil or grass.*

Where Can Motorized Scooters be used safely? INDOOR TRAVEL is safest, with flat and level floors. *Notes: Deep-pile carpets can present immediate mobility and safety problems and can, sometimes, cause equipment problems due to carpet fibers entering the wheel bearings, gears or pulleys. Low-cut carpets and rugs usually cause no problem*

except that they can be stained by oil or dirt falling from the scooter. Scooters usually travel well in malls, public buildings, food stores, etc. – and in any and all indoor areas having flat, level and hard floors. OUTDOOR TRAVEL requires more caution. Generally, travel is safe on outdoor sidewalks and pavements ... PROVIDED the small front wheel of the scooter does not encounter raised slabs, potholes or debris. Also ... PROVIDED the sidewalk or pavement does not tilt to the left or right (which could cause the scooter to roll over). NOTES: Know how steep a grade your particular scooter can safely traverse, up and down, with the particular user's height and weight. Then, safely ride up or down inclines within these limits ... but always directly UP or DOWN an incline – NEVER across an incline! GRASS and SOIL are not good places to be on a motorized scooter because (a) you are more likely to fall and be hurt ... and (b) grass and soil can damage the equipment and can damage rugs and floors when brought home. WET grass and soil are especially dangerous – and it is a good idea to NOT use a motorized scooter outdoors when it is raining or when the ground is wet or icy.

Related Papers Available from the N.I.R.E. –

1. Residential and Workplace Accommodations for Quadriplegics
HTML: http://www.abledata.com/abledata_docs/Quad_Accommodations.htm
PDF : http://www.abledata.com/abledata_docs/Accommodations-for-Quads.PDF
2. Assistive Technology for Quadriplegics
HTML: http://www.abledata.com/abledata_docs/Quad_AT.htm
PDF : http://www.abledata.com/abledata_docs/Asstv-Tech-for-Quads.PDF
3. Power Wheelchairs and User Safety
HTML: http://www.abledata.com/abledata_docs/PowerChair-Safety.htm
PDF: http://www.abledata.com/abledata_docs/PowerChair-Safety.pdf
4. Motorized Scooters and User Safety
HTML: http://www.abledata.com/abledata_docs/MotorScooter-Safety.htm
PDF: http://www.abledata.com/abledata_docs/MotorScooter-Safety.pdf

For additional information or free technical support, please email: nire@warwick.net or dons@warwick.net ... or contact us by regular mail or telephone.

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