HARDWARE (VEHICLES, MODIFICATION, TECHNICAL AIDS, ETC.) AND TRAINING EVALUATION OF PEOPLE WITH SEVERE DISABILITIES, ESPECIALLY PEOPLE WITH QUADRIPLÉGIA.

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The purpose of the Driver Education Programs, is to aid several disabled individual's total rehabilitation. The ultimate goals are competence, mobility, new independence and useful return to the community.

The programs provide instructions both to experienced drivers (now disabled) and those with no previous driving experience. The Driver Education Program usually consists of two parts, evaluation (approximately one to three lessons) and complete training (according to individual's needs). In addition to evaluating and training those who are able to learn, the professionals in these programs provide counseling to those individuals who are not yet ready, or those who are too severely disabled (above the C5 quadriplegia level) or those who would not be able to drive because of their visual, perceptual or cognitive difficulties.

Driver Education Programs of various degrees of sophistication can be found in commercial auto schools, high school driver education programs, universities that offer traffic safety and driver education programs, Veterans Administration hospitals and as integral parts of rehabilitation departments that are usually associated with major medical centers.

Various Motor Vehicles are available for the physically disabled drivers. There are: passenger automobiles, mini vans, standard vans and off the street vehicles such as modified golf carts. Two door sedans, power equipped, are preferred to other cars because of the available space in the back of the passenger seat for the manual disposal of the wheelchair. However, any automobile can be equipped with the wheelchair disposal unit which is mounted on top of the car and disposes

the wheelchair automatically, after the driver transfers into the car.

Mini vans can be equipped with a lift and a six way power transfer seat. The disabled driver enters the van in a wheelchair and then transfers from the wheelchair to the motorized transfer seat. A mini van can also be modified in such a way that it can be driven while the driver remains in the wheelchair. To accomplish this the whole floor is lowered 10" to gain sufficient interior clearance. The van suspension is equipped with air bags that further lowers the van within several inches off the ground at the time of entry. The driver then enters the van via a motorized fold out ramp rather than a lift.

Standard size, fully automatic vans seem to be the most popular means of independent transportation for the severely disabled drivers in recent times. To enter, the door and the lift can be operated by a remote control, or with a keyless system activated by a magnet, or with a regular key which unlocks an exterior switch box usually located on the fender of the van.

The wheelchair lifts could be semi automatic, automatic, fold out or rotary. They could be operated by hydraulic electric or combined principles. If the van is used predominantly in the city where the parking is done by the curb the lift should be mounted on the side of the van. In the country, where there is predominantly parking in parking lots, the lift could be mounted in the back of the van. All lifts should have manual override. The roof and the doors can be raised for easier entry, and for a safe and comfortable ride for those who remain in the wheelchair. In addition to the raised roof, a power pan is available in the drivers area. The floor can be automatically lowered four to six inches so the average size individual can achieve a proper eye level for driving as another option to the power pan. The floor in the area between the door and the driver's compartment can be permanently lowered. For small people in wheelchair the floor can be permanently or automatically raised. The Ford van offers the maximum space in the driver's area and also offers the highest windshield. Dodge Van offers the

least amount of space for the wheelchair bound driver in the driver's compartment. For the wheelchair bound drivers, a disconnect seat on casters is available so when needed, it can be snapped in so an abled body driver can drive the modified van.

Those individuals that can transfer from their wheelchair to a driver's seat a 6 way transfer seat is available, this seat is motorized, it travels back and forth up and down and swivels 90° for easy transfer. For those individuals that drive from their wheelchair, numerous automatic lockdown systems are offered, electric, crash tested wheelchair lockdown is preferred. Maximum harnessing is recommended, such as automatic chest restrain and a seat belt combination.

Steering mechanism and steering wheel - In addition to regular power steering there are low, (reduced effort steering) and zero effort steering. Zero effort steering drastically reduces effort needed to steer. Once the steering wheel is set into motion it will continue to turn by itself by its own momentum. Such systems require an automatic back up system in case of an engine failure. Steering wheel can be standard size or reduced to 5 inches in diameter. It could be horizontal or vertical. When connected to the steering mechanism by cables, the steering wheel can be positioned anywhere within the limited reach of a severely disabled driver.

For those individuals who have completely lost the use of their upper extremities (bilateral shoulder disarticulation) but have functional lower extremities, complete foot controls are available.

Steering Devices - There are many steering devices available, such as the standard steering knob for the one arm driver, a bipin or a tripin for those who have non-functional grip, standard or custom fitted cuffs, modified splints, "T" bars and amputee rings.

Hand Controls - To facilitate acceleration and braking for individuals who have lost the functional use of their lower extremities. These hand controls could be

mounted on the left side or the right side of the steering wheel. The simplest principle is "push and pull". Push to brake and pull to accelerate. Other Principles of operation are: push for brake and rotate at right angle to accelerate, push for brake and twist (like a motorcycle) to accelerate. There are also dual lever controls: push for brake and push to accelerate, or pull for brake and pull to accelerate. For those individuals who require maximum assistance there are Servo assist controls. The remote brake and throttle controls are designed especially for the individual who cannot operate the conventional hand controls. This device can be positioned according to individual's need. They could be operated by a shoulder, elbow, knee or hand, with only a "feather-like" touch. Their motion of operation could be lateral, left to brake, right to accelerate, vertical push and pull or with the dual lever principle, lift to brake and lift to accelerator.

Gear selector could remain as is, it could also be motorized and remote, to be operated with a conveniently located toggle switch. Ignition could be relocated, operated with a quad key or it could be keyless. Parking brake can also be extended or remote.

Directional signal arm could be as is, extension, crossover to the other side or remote, usually to be operated by left or right elbow. Horn is usually mounted on the hand control. Dash board controls could be extended or relocated, on engine cover or on a small or center quad control box, with small or large toggle switches. These switches controls: heater and air conditioning, ignition, wipers, parking brake, power windows, door lift, power pan, wheelchair lockdown, remote gear selector. Instead of the quad controls box with toggle switches a touch sensitive contact console is also available.

Mirrors are very important. Two professional mirrors are recommended (on each side of the van, (one of them on each side should be slightly convexed for greater field of vision).

In addition to all the other controls mentioned, there are unique state of the art systems available for the severely disabled drivers. These controls can be operated with only one arm or one hand. The one arm device consist of a zero effort system. The driver lowers his or her elbow into a cradle. To accelerate the cradle device is moved forward, to brake, it is pulled back, to steer, the forearm is rotated from left to the right. The other system is operated by hand. The operation is identical to the joy stick control of an electric chair.

This control an electronically controlled hydraulic system, requires a push for braking, a backward pull for acceleration and a left/right movement for complete steering control. A power operated head rest reduces possibility of whiplash and it can contain optional switches (to be operated by the movement of the drivers head) that would activate, horn, dimmer, directionals and back up systems.

In conclusion, I would like to stress that every graduate no matter how severely disabled, must be able to perform all aspects of driving, safely and competently. Included are ability to drive under all road and wheather conditions, to be able to pay tolls, to back into a garage at night, to navigate and drive at highway speeds and to perform various emergency and road procedures. The vehicles, devices and systems must meet the highest safety standards and be maintained accordingly.