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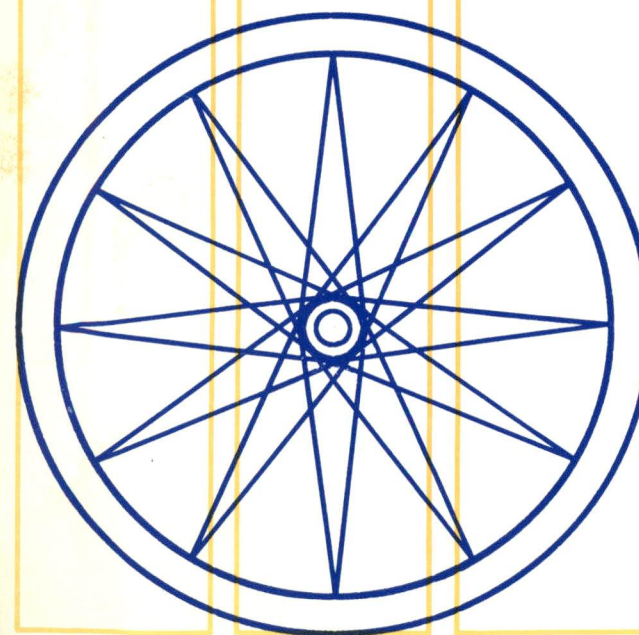
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A WHEELCHAIR USER'S MANUAL FOR PEOPLE WITH SPINAL CORD INJURY



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Hale, G. *Sourcebook for the Disabled*. New York: Paddington Press, 1979.

Kamenetz, H. L. *The Wheelchair Book*. Springfield, Illinois: Charles C. Thomas, 1969.

OTHER RESOURCES

—WHEELCHAIR MANUFACTURERS:

Everest & Jennings, Inc., 1803 Pontius Avenue, Los Angeles, CA 90025

Invacare, Inc. P.O. Box 4028, Elyria, OH 44036

Gendron, Inc. Lugbill Rd., Archbold, OH 43502

Ortho-Kinetics, Inc. P.O. Box 2000, Waukesha, WI 53187

Stainless Medical Products, Inc. Dowdy Drive, San Diego, CA 92126

Theradyne Corporation 21730 Hanover Ave., Lakeville, MN 55044

—INFORMATION SOURCES FOR DISABLED PERSONS:

Accent on Information, Inc. P.O. Box 700, Bloomington, IL 61701

This organization publishes a quarterly magazine *Accent on Living* and an annual volume *Accent on Living Buyer's Guide*.

A WHEELCHAIR USER'S MANUAL FOR PEOPLE WITH SPINAL CORD INJURY

	ALL WHEELCHAIRS	MOTORIZED WHEELCHAIRS
DAILY		Charge battery.
WEEKLY	Check and adjust tire pressure.	Check plug connectors.
MONTHLY	Check wheel lock adjustment. Clean upholstery with soap and water. Clean chrome and painted surfaces.	Check belt drive tensions. Check battery fluid levels.
FOUR TIMES PER YEAR	Check and adjust axle, wheels, casters and front fork bearings. Tighten spokes.	Clean battery terminals with baking soda and water. Inspect all wires for worn insulation. Inspect drive belt for wear and fraying.
TWICE PER YEAR	Check center cross brace for binding of bolt. Be sure all four wheels are in contact with ground when travelling over uneven surfaces. Lubricate center pin. Tighten loose screws and bolts. Inspect entire chair for worn or missing parts. <i>Inspection sites include upholstery, handgrips, side panels, footplates, front rigging, elevating leg rests, handrims.</i>	Check motor brushes.

NOTE: It is recommended that both tires be replaced at the same time as needed, to avoid one side of wheelchair being higher than the other.

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VII. Keeping Your Wheelchair in Good Repair

Wheelchairs, like other mechanical devices, are subject to wear and tear with normal use and require regular maintenance if they are to function properly. Your wheelchair should be kept clean, dry and rust-free, and be given special attention after it has been used outdoors. It should be inspected regularly for loose and worn parts. The manufacturer's instructions, obtained at the time a wheelchair is purchased, should be studied for maintenance and repair information. If your wheelchair needs repair, arrangements should be made with the dealer from whom it was purchased, or with the agency or clinic providing the wheelchair. Bicycle shops often do minor repairs but typically do not accept medical assistance payments. Be sure you are familiar with the conditions of the manufacturer's warranty before you proceed with wheelchair repairs.

The schedule on the adjacent page outlines most service needs:

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VI. The Legal Status of Motorized Wheelchairs

Currently there are no statutes, in most states, specifically regulating the operation of standard or motorized wheelchairs or specifying safety equipment standards. In many areas, pedestrian laws are extended to apply to persons in wheelchairs, but the consistency with which policies of this nature are carried out is unclear.

Recent technological developments in mobility aids such as adapted golf carts and other small vehicles, and wheelchairs designed to travel at speeds from 25 to 30 miles per hour have increased the opportunities for independent travel for many disabled persons. There is also an increasing concern for the regulation of such vehicles and their operation by disabled persons, many of whom are unable to obtain regular operator's licenses.

In Wisconsin, recent legislation was passed amending state laws regarding the registration and operation of motor vehicles. The Department of Motor Vehicles is now authorized to issue special restricted operator's licenses and registration of specially designed vehicles having a maximum speed of 35 miles per hour to be operated on the highway. While this law does not specifically address motorized wheelchairs, they are not automatically excluded from the category of specially designed vehicles for which standards may be set. In most cases however a standard motorized wheelchair would not be authorized for operation on the highways.

Motorized wheelchairs are in a unique position as pedestrians and as motor vehicles and should be operated in a responsible manner on the sidewalk or in the street.

It is advisable to familiarize yourself with the legal status, if any, of motorized wheelchairs in your state by contacting the State Dept. of Motor Vehicles and local law enforcement officials. You may also wish to find out about insurance coverage appropriate to the area in which you live.

We would like to thank Richard F. Harvey, M.D. and Daniel Halpern, M.D., Department of Rehabilitation Medicine, University of Wisconsin Clinical Sciences Center for their technical review of the manuscript and acknowledge the assistance we have received from the project advisory committee in the preparation of this booklet.

After you have completed the training sequence outlined in Section IV and feel that you are a proficient traveller, you may wish to gain experience using accessibility guides and transportation services. Arrange with a friend or family member to meet you at a place which you choose on the basis of its accessibility. Travel there alone and notice any unexpected obstacles you encounter. You may wish to make notes or addenda to your accessibility guide regarding the conditions you encounter for future reference on route planning.

Depending on the area where you live and the extent of travelling you intend to do, accessibility guides may be incomplete or unavailable. In this instance you can take an active role in obtaining information you need.

It is important for you to identify the conditions that are necessary for an area or building to be accessible for you. You may want to use an accessibility guide from another city as a guideline for asking questions. Once you have identified the information you want, you can call the facility or place of business to which you would like to go and ask specific questions regarding accessibility. If communication is a problem you can give a friend, family member or counselor specific standards and obtain the information from them.

I. Introduction

For many persons with spinal cord injuries or other severe physical disability, a wheelchair can mean the freedom to move independently in the home and community environments. The mobility afforded by the wheelchair opens to the spinal cord injured person many social, educational, and vocational opportunities. To ensure its safe, efficient and pleasurable use in these pursuits, the wheelchair should be carefully chosen to meet individual needs, maintained in good working order and operated in a skillful manner.

This booklet offers some basic guidelines for choosing and maintaining a wheelchair. Suggestions for safety equipment, techniques for safe handling and a useful training sequence are outlined. Most of the information contained in this booklet applies to both STANDARD (manually operated) and MOTORIZED wheelchairs (1/4 horsepower with a maximum speed of 5 miles per hour). Where appropriate, the type of wheelchair referred to is specified. The last section of this booklet contains a brief overview of the legal status of motorized wheelchairs.

II.Choosing a Wheelchair

Although the wheel and the chair are among the earliest of human inventions, only in the last few centuries have these two items been combined specifically to serve disabled persons. Today there is a wide variety of wheelchairs available from which to choose. With the assistance of your health care team, determine the range of wheelchairs appropriate to your needs. If you can, obtain selected wheelchairs on a trial basis. This way you can find the one best suited to your lifestyle. There are several factors to consider when choosing the wheelchair that is right for you:

A . Your Individual Characteristics:

1. Height, weight and age
2. Degree of upper limb (hand and arm) function
3. Sitting balance, trunk control
4. Ability to transfer
5. Presence of additional handicaps such as visual field defect, hearing loss, seizure activity, communication disorders, or spasticity.

B . Intended Usage:

1. Will the wheelchair be used indoors, outdoors or both?
2. How will the wheelchair be transported? Will it be folded and carried in a car or placed in a van by a mechanical lift?
3. How much will the wheelchair be used? Does it need to be compact for easy storage or must it be durable for extensive use?
4. What are the expected operating areas? Will it have to fit under a desk, afford good reach, fit through narrow doors or travel over rough outdoor terrain?

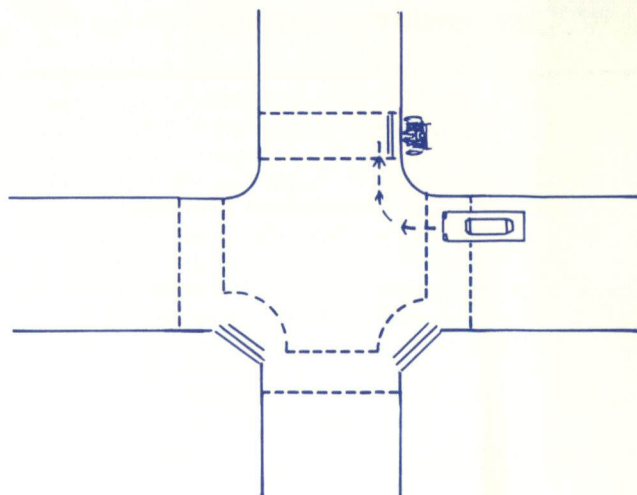
- Watch for cars, bicycles and other pedestrians.
- If you will need assistance getting up a curb, check for pedestrians who can help you before you enter the intersection.
- h . The wheelchair has a low profile and is not always visible to drivers in the street. Your wheelchair can be made more visible by using the safety equipment listed on page 4. You may see a car but never assume the driver has seen you. If you can, get the attention of the driver and make eye contact with him or her. This assures that the driver is aware of your location.

B . Transportation and Accessibility:

Many cities provide some type of transportation service for people who use wheelchairs and other persons who have limitations to mobility. Services may include a public transit system with accessible vehicles and passenger loading areas, or a special para-transit system of a lift-equipped van fleet.

To find out about transportation services in your area, call the local transit authority or a social service agency such as an independent living center which specifically serves people who are handicapped. When you contact the transportation service, remember to ask for route information (if applicable), and about fares, the priority system for service delivery, and ride scheduling if necessary.

Also available in many communities are accessibility guides to local public and private facilities. These are often available from organizations such as the State Division of Vocational Rehabilitation, United Cerebral Palsy, the area chapter of the National Spinal Cord Injury Foundation, centers for independent living, and from other state, county or local agencies concerned with services for disabled persons. Numbers for these agencies can often be found in the front of the telephone directory in **Community Service Numbers** under Disabled Services, or under Human Services or Social Services.



- c. Cross in crosswalks or at corners where feasible. At corners with only one curb cut, the crosswalk generally includes the area around the apex of the corner. When there are no curb cuts and you must use a nearby driveway:
 - Stop and look before you enter the street
 - Stay close to the curb until you are ready to cross
 - Move as quickly as possible to the safety of the opposite sidewalk.
- d. Travel on the left, or facing the traffic if you must travel in a road with no sidewalk.
- e. Avoid entering a street from between two parked cars. If you must, stop and look as you leave the sidewalk and again as you emerge from between the cars.
- f. When crossing streets at lighted intersections, position your wheelchair for a rapid start and wait for the beginning of the next "WALK" cycle. Proceed quickly when the light is in your favor.
- g. Always look where you are going and continue route planning as you travel.
 - Be aware of the location of curb cuts, driveways, broken sidewalks, sewers and grates.

C. Wheelchair Specifications and Accessories

1. **Standard versus Motorized:** A STANDARD chair is usually smaller, more stable, and more easily transported. A MOTORIZED wheelchair is appropriate for a person with limited stamina or upper extremity function.
2. **Chair Size:** Smaller wheelchairs are lighter and allow greater access to more areas.
3. **Arm Styles:** Several are available including fixed or detachable, and "desk" arms. Fixed arms provide support and allow for easy handling. Detachable arms are convenient for transfers but add width to the wheelchair.
4. **Tires:** Are available in several widths, pneumatic and solid. Pneumatic tires provide greater traction and shock absorption but add width, maintenance requirements, and more rolling resistance.
5. **Handrims:** Are available in standard styles or with projections or contoured knobs for easier grasp.
6. **Leg Rests:** Swing-away type allow for getting closer to furniture.
7. **Seat Cushions:** Are very important for stability and protection of the skin.
8. **Accessories:** Include heel and toe loops, crutch and cane holders and other items. Other wheelchair modifications and accessories such as lapboards, cupholders, clip-on ashtrays, etc. are commercially available or can be custom made.

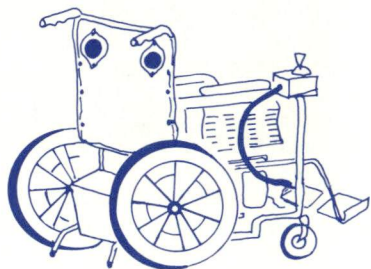
III. Wheelchair Safety

A . Safety Equipment

If you plan to use your wheelchair outdoors, you may wish to add some special equipment to make your wheelchair more visible to motorists and to other pedestrians. Safety equipment may include:

- 1 . A bicycle safety flag on a flexible fiberglass or telescoping pole (available at most discount and dime stores).
- 2 . Reflective tape, added to the front, sides and back of the wheelchair. The dimensions of the wheelchair can be demarcated with reflectors placed at the upper outer corners of the wheelchair back. Some MOTORIZED wheelchair users display SLOW MOVING VEHICLE emblems on the back of their wheelchairs.

*Reflectors
Demarcating the
Upper Outer Corners of the
Wheelchair*



*Slow Moving
Vehicle Emblem*



- 3 . A horn, bell or other warning device, placed where you can reach it easily.
- 4 . A rear view mirror, if limited vision is a problem.
- 5 . Head lights (white) and tail lights (red) are recommended if the wheelchair will be used in the street after dark.

Bicycle dealers may be willing to assist with custom brackets to attach flags, horns, and lights to your wheelchair. When attaching accessories, care should be taken to assure that no hazardous sharp edges are exposed and that the additions do not increase wheelchair width.

V. Community Travel

A . Rules of the Road

Common sense and caution will probably prove to be the best rules to follow when travelling outdoors in a wheelchair. The following guidelines represent some of the important considerations for safe travel.

1 . **Before using your wheelchair on heavily travelled sidewalks or in the street:**

- a . Be thoroughly familiar with its operation and skilled in maneuvering your wheelchair (Refer to **Section IV**).
- b . Be sure that your wheelchair is in good working order. If you have a MOTORIZED WHEELCHAIR, the battery should be fully charged and you should have some idea how far it will take you.
- c . Plan your route as completely as possible. This may include checking transportation services and facilities for accessibility, and considering the amount of pedestrian traffic and any environmental obstacles you may encounter.
- d . Be aware of weather conditions which will affect how easily you can travel outdoors. Extremes of hot and cold will reduce the amount of time a battery will stay charged. Rain or snow may make ramps, slopes and metal grates slippery. High winds will slow your progress and make heavy outer doors difficult to open.

2 . **When travelling outdoors:**

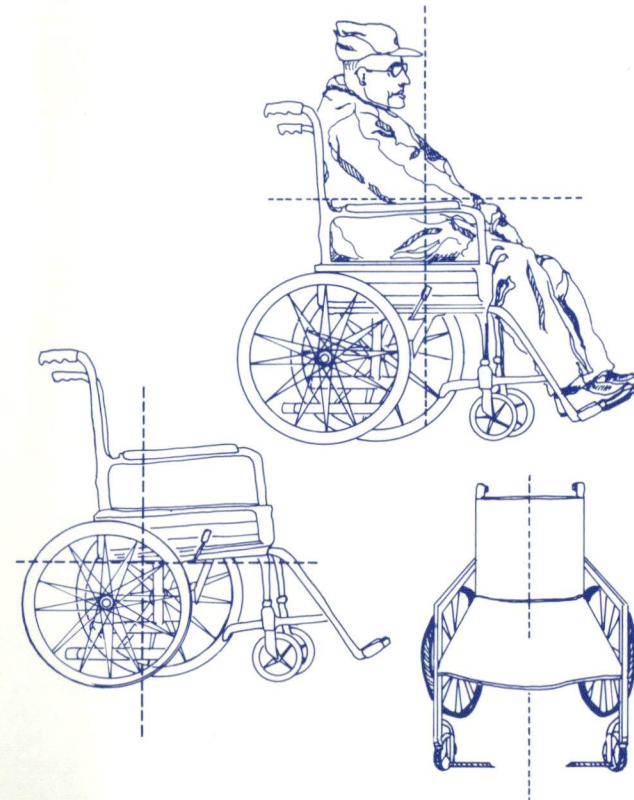
- a . Observe all pedestrian rules when possible.
- b . Obey traffic signals, but always stop and look before entering a street or intersection, even if the traffic signals and signs indicate that you have the right-of-way. Look out for cars turning into your path (especially where right turns on red are permitted).

- you. Remember that the distance will be affected by the type of surfaces you travel over and by weather conditions.
2. Practice going up and down curb cuts of various qualities until you get a feel for what you can and cannot do.
 3. Learn to recognize and avoid difficult or hazardous areas such as rough and broken sidewalks, steep slopes, sewers and gratings, and curbs with no curb cuts. You must learn to look ahead and scan your environment for these obstacles at the same time that you are aware of the surfaces in your path.
 4. Practice backing off curbs (STANDARD WHEELCHAIR) and doing wheelies up curbs of various heights (if you have had instruction in this from a qualified physical therapist).
 5. Learn to judge the distances and speeds of approaching vehicles. Learn how much time is required for you to cross a street. Later, practice street crossings where vehicles are present.
 6. At lighted intersections, notice the length of time the pedestrian cycle lasts. Press the pedestrian "walk light" button if there is one available. This usually will give you an additional seven seconds to cross the street. You can maximize the amount of time you have to cross the street by positioning yourself for a rapid start and leaving the curb just as the light changes to be in your favor. Learn to plan routes to avoid unsafe intersections.
 7. Practice using your horn as a warning signal where appropriate.
 8. Learn what situations require you to ask for assistance. Learn to give clear concise instructions to persons offering aid. Also, learn the best way to refuse assistance you do not need.
 9. Learn to recognize complex pedestrian and traffic patterns, and think about the safest way to avoid curbs, mid-block crossings and other potential obstacles and hazards. You will have to learn to make the best route choice in sub-optimal circumstances.
 10. Become familiar with the **Rules of the Road** listed in the next section and make a habit of obeying them.

B. Safe Wheelchair Handling

Whether you are using your wheelchair indoors or outdoors there is the potential for a mishap to occur if safe handling procedures are not observed. Section IV of this booklet contains a sequence of exercises you may experiment with to gain expertise in safe wheelchair handling. With experience, you should learn how steep an incline or cross slope you should attempt to traverse, and other limits of safe wheelchair use. The present section offers basic guidelines for maintaining a safe distribution of body weight in the wheelchair, and for balance, control, and safe stops on inclines and cross slopes.

1. **Distribution of Body Weight in the Wheelchair.** On level surfaces, the center of gravity should be at a point just in front of the hub of the rear wheels. The line of gravity must always be within the base of the four wheels. If it is not, the wheelchair will tip over.



*Center of Gravity
in a STANDARD
WHEELCHAIR*

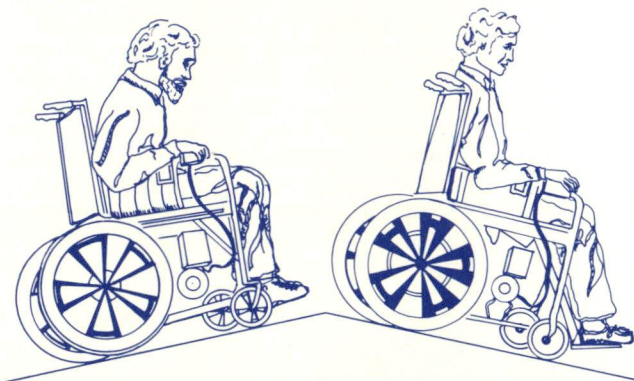
*Plumbline
through the
Center of Gravity*

2. **Inclines and Declines.** When ascending or descending an incline, the distribution of body weight must be adjusted so that the line of gravity falls within the four wheel base of support. This means that when you are going *up* a hill you should lean *forward*, and when you are coming *down* you should *sit erect* with your back against the seat back of the wheelchair.

Distribution of Weight on a Slope

Ascending: Lean Forward in the Wheelchair

Descending: Sit Erect with Back Against Seat Back



3. **Cross slopes.** The plumbline through the center of gravity may be kept within the four wheel base of support by leaning toward the hill, *regardless* of which way you are travelling.
- To avoid veering on a cross slope, the wheelchair must be steered toward the incline. In a STANDARD WHEELCHAIR this means propelling the lower wheel faster when you are ascending across a slope, or slowing the higher wheel when you are descending across the slope. Similarly, in a MOTORIZED WHEELCHAIR, you must steer with the joystick pointed slightly toward the hill when you are travelling across a sloped surface.
 - Maximum control on a slope is gained by following its grade, provided that the slope is not so steep that it is impossible to control the speed of the wheelchair.

B. Outdoors

When you are first learning to use your wheelchair outdoors, practice in areas away from traffic. A qualified professional or a family member should be present to help you. Explore the activities listed.

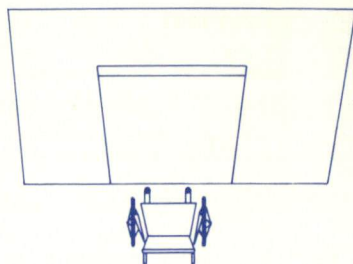
- Practice stopping and starting in an open area with a smooth level surface.
- Try your wheelchair on various surfaces such as asphalt, gravel, grass and sidewalks of various surface qualities. Notice how the type of surface affects speed, handling and stops.
Note: The larger wheels will go over rough surfaces, railroad tracks, etc. more easily than the small front casters. You may find it effective to *back* over obstacles which you are not able to negotiate going forward.
- Try your wheelchair on inclines, declines and cross slopes. Pay attention to the grade of the slope you can safely negotiate.
- Practice making emergency stops and starts.
- Experiment with approaches to doors to find the method of opening outer doors which is easiest for you. Begin with doors with wide flat entrance ways and then try doors with narrow entrances, doors next to projecting walls, doors preceded by slopes, etc. You may find that you are unable to open many of them so practice asking for assistance in these situations.
- Try your wheelchair on entrance ramps and learn how to use wheelchair lifts if they are available in public or private transportation vehicles.

C. Residential and Business Travel

When you are familiar with your wheelchair and have practiced with it in the situations listed above, explore the following activities which you will encounter in community travel.

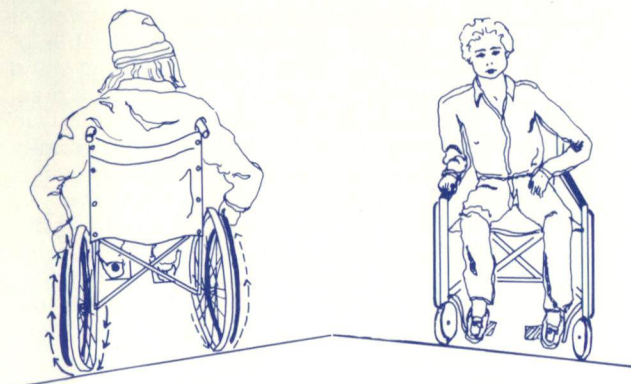
- Learn the limits of your stamina, and how far you will be able to travel without becoming excessively fatigued. This will be especially important if you are using a STANDARD WHEELCHAIR. If you use a MOTORIZED WHEELCHAIR, learn how far a fully charged battery will take

Front Casters
Should be
Perpendicular to
Threshold



them at right angles so that the front casters are perpendicular to them.

- 4 . Experiment with speed. Notice the distance required for stopping at various speeds and how easily you can handle your wheelchair.
- 5 . Try your wheelchair on inclines and ramps. Learn how steep an incline or decline you can safely negotiate. If you have a **MOTORIZED WHEELCHAIR**, it is wise to avoid slopes greater than 10% as these may strain the motor.
- 6 . Practice starting and stopping, and turning on inclines and declines. Learn your safe limits.
- 7 . Try making emergency stops and test your reaction time. An assistant may help you with this by rolling a ball or other object into your path unexpectedly.
- 8 . Move to areas where there are more obstacles such as tables and chairs and other people, and notice how much space you require and safe speeds in these areas. If turning your head is difficult, learn to turn your wheelchair to look about you right and left.
- 9 . Experiment with opening and closing doors, approaching tables for seating, and using elevators, toilets, public telephones and vending machines to learn the techniques easiest for you.
- 10 . Explore other maneuvers needed for your routine activities such as bending and reaching, and determine your safe limits.
- 11 . Practice asking for assistance where you might need it, for example at doors or when transferring to and from your wheelchair. Learn how you can give distinct and clear instructions to others helping you in these situations.



Steering on a
Cross Slope

To Travel Across
a Slope, Lower
Wheel Must be
Propelled Faster

Lean Toward the
Hill

- c . Avoid changing direction abruptly when you are on a hill or sloping surface. This may result in the wheelchair tipping over because of its high center of gravity.

4 . **Slowing and Stopping on a Hill or Cross Slope.**

The wheel locks or "brakes" should never be applied as a measure to slow descent or stop your wheelchair on a decline. Attempting to use them this way will result in them locking, as they are designed to do. This will cause the wheelchair to veer suddenly to one side, to tip sideways or to abruptly stop, possibly pitching you forward and out of the wheelchair.

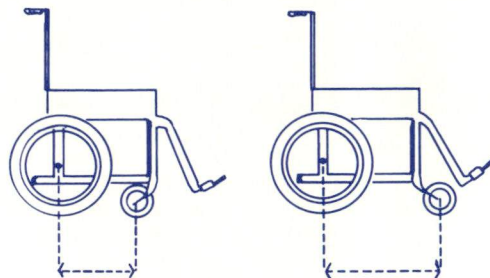
- a . In a **STANDARD WHEELCHAIR**, the speed of descent can be controlled by applying the hands evenly and firmly to the handrims. Some people choose to wear gloves to reduce the discomfort of the heat produced by the friction. Because it is very difficult to apply the wheel locks while on a hill, it is best to avoid stopping on a hill (or, possibly, being on a hill) where you cannot hold yourself comfortably by simply grasping the handrims.
- b . For a **MOTORIZED WHEELCHAIR**, release of the joystick will result in considerable slowing on a decline due to the nature of the belt-drive mechanism. It may be useful to apply the motor in reverse to steady the wheelchair while applying the wheel locks.

The most important safety rule is know what you and your wheelchair are capable of handling before you find yourself travelling unassisted in a potentially hazardous area. Situations which you encounter regularly in the home, at work, or in the community should be explored when another person is available to assist you in the event that you should lose your balance or tip your wheelchair. In this way you can determine the safety limits in your daily activities, for example when reaching for household objects or supermarket purchases. The following guidelines for bending and reaching should be observed:

1 . Bending or reaching forward or to the side

- a . Maneuver wheelchair as close to goal as possible.
- b . Rotate front casters so they extend in the direction you will be reaching. This will extend your base of support in that direction.

Rotate the Front Casters Forward to Extend the Base of Support in that Direction



- c . Engage wheel locks
 - d . Do not shift your weight or sitting position in the direction you are reaching, or attempt to reach objects if you must move forward in your seat.
- 2 . Bending or reaching backward**
- a . Move wheelchair as close to goal as possible.
 - b . Do not engage wheel locks. It is better to roll back than to tip over.
 - c . Do not lean over the top of back upholstery.
 - d . Reposition wheelchair if necessary.

IV. Learning to Use Your Wheelchair: How Your Friends, Family and Others Can Help You.

When you receive your wheelchair from a clinic or a dealer you should have an opportunity to become familiar with its parts and how they work, and with the operation of your wheelchair. It will then be up to you to develop skills and good techniques for its use. You will need to learn your safe limits: What you can and cannot do in your wheelchair. It is ideal to have a therapist or mobility specialist available to assist you as you learn about the use of the wheelchair in your home and in the community. If no professional assistance is available, a friend or family member may help you by being present as you experiment with the activities outlined in the training sequence below. If difficult situations arise or if you tip your wheelchair it is preferable to have assistance readily available. When you encounter similar situations on your own in the future, you will have a good idea of your abilities and limitations.

A . Indoors

Before undertaking outdoor travel, learn how your wheelchair performs and develop skill in maneuvering in a sheltered indoor environment. Try these activities in the following sequence.

- 1 . In an open area with smooth level surfaces, practice stopping and starting. Try your wheelchair in forward and in reverse. In a **MOTORIZED WHEELCHAIR**, try driving in a straight line backwards for some distance.
- 2 . Practice turning first forward to the right and left and then try it in reverse. Try turning in large circles and in small circles. Notice how much room is required to make a U-turn.
- 3 . Try your wheelchair over various surfaces: over smooth floors, carpeting, and over small surface level changes such as thresholds and carpet edges. You will probably find that it is easiest to get over small obstacles if you approach