

# The Powered Wheelchair Training Guide

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PAX Press  
Minden, NV

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This training guide was completed with a grant from the Paralyzed Veterans of America's Spinal Cord Injury Education and Training Foundation.

The illustrations were completed with funding from Beneficial Designs, Inc.

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PAX Press is a division of Beneficial Designs, Inc.  
P.O. Box 69  
Minden, Nevada 89423-0069

ISBN 1-882632-11-7

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Printed in the United States of America

# Table of Contents

Acknowledgments	ix	Foot Support Adjustment	16
Introduction	x	Seat Height Adjustment	16
How to Use this Book	x		
Warnings	xi		
<b>Chapter 1: Getting to Know Your Wheels</b>	<b>1</b>	<b>1.5 Joystick Setup, Adjustments and Operation</b>	<b>17</b>
1.1 The Owner's Manual	2	Joystick Positioning	17
1.2 Determining the Powered Wheelchair Type Best for You	3	Joystick Handles	17
Wheelchair Types	3	Dealer Programmable Drive Performance Adjustments	18
Drive Configurations	5	Reversal of Controls	20
1.3 Specifying the Seating Components and Control Input Device	7	User Adjustable Settings and Joystick Operations	20
Selecting and Ordering Your Powered Wheelchair	7	Checking Your Stability with a Spotter	22
Seating Dimensions and Components	7		
Joystick Type	11	<b>Chapter 2: General Skills</b>	<b>25</b>
Alternate Controls	12	2.1 Asking for Help	26
1.4 Seating Setup and Wheel Adjustments	13	Defining "Assistance"	26
Seat Surface Angle Adjustment	13	Who Can Help?	26
Back Angle Adjustment	14	How to Ask for Help	28
Drive Wheel Position Adjustment	14	Manually Rolling Your Wheelchair	29
Arm Support Height Adjustment	15	Describing Safe Body Mechanics to the Spotter or Assistant	29
Caster Adjustments	15	When You Do Not Want or Need Assistance	29
		Experiencing New Environments	29
		2.2 Learning Your Limits	30
		Techniques for Keeping Your Weight Back	30
		Techniques for Keeping Your Weight Forward	32
		When You are Learning Your Limits	33

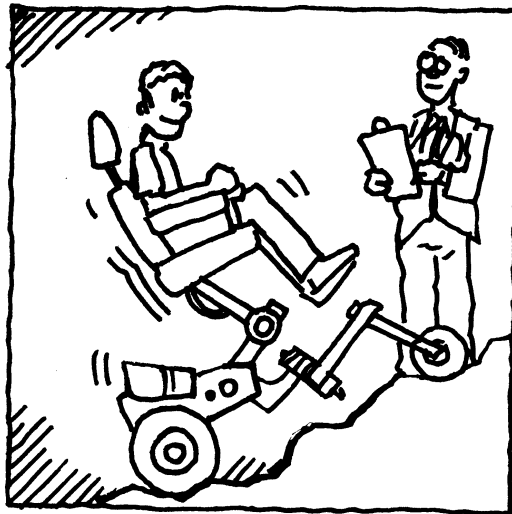
<b>2.3 Relieving Pressure</b>	<b>34</b>		
Forward Weight Shift	34		
Side-to-Side Weight Shift	35		
Push Up Weight Shift	36		
Weight Shift Through Powered Seating	36		
<b>2.4 Reaching, Bending and Lifting</b>	<b>38</b>		
Reaching Sideways	38		
Reaching Forward	39		
<b>2.5 Main Wheel and Caster Management</b>	<b>41</b>		
Wheel Position	41		
Wheel Size	42		
Composition	42		
Condition	42		
Caster Management and Caster Trail	43		
Type of Caster	44		
Caster Flutter	44		
<b>Chapter 3: Navigation Skills</b>	<b>45</b>		
<b>3.1 Smooth Surfaces</b>	<b>47</b>		
Crossing Smooth Surfaces	47		
<b>3.2 Thresholds and Obstacles</b>	<b>48</b>		
Foot Support Clearance	48		
Crossing a Door Threshold or Obstacle	49		
<b>3.3 Doorways and Tight Environments</b>	<b>53</b>		
Manual Swinging Doors	54		
Manual Sliding Doors	56		
Doors in a Sequence	57		
		Double-leaf Doors	57
		Narrow Doors	58
		Automatic Doors	58
		Revolving Doors and Turnstiles	59
		Doors with Objects Around Them	59
		Tight Environments	59
		Vans	62
		<b>3.4 Rough Terrain</b>	<b>63</b>
		Hard, Uneven Surfaces	63
		Soft Surfaces	64
		<b>3.5 Ramps</b>	<b>66</b>
		Going Up a Ramp	66
		Going Down a Ramp	67
		Very Steep Ramps	69
		Telescoping or Portable Ramps	69
		Turning Around on a Ramp	69
		Grade Transitions	70
		<b>3.6 Cross Slopes</b>	<b>71</b>
		Walkways and Hills with Cross Slopes	71
		Curb Ramps	72
		Driveway Crossings	73
		<b>3.7 Curbs and Steps</b>	<b>74</b>
		Going Up Curbs or Steps	74
		Going Down Curbs	77
		<b>3.8 Elevators and Platform Lifts</b>	<b>80</b>
		Catching an Elevator	80
		Entering and Exiting an Elevator	82
		Platform Lifts	84

<b>3.9 Tracks and Grates</b>	<b>85</b>	<b>5.2 Crossing Streets</b>	<b>106</b>
Crossing Railroad and Trolley Tracks	85	Understand the Local Driver Mentality	106
Crossing Grates	86	Examining Street Terrain	106
<b>Chapter 4: Emergency Skills</b>	<b>89</b>	Crossing at a Crosswalk	107
<b>4.1 Stairs</b>	<b>90</b>	Crossing at Mid-block	108
Going Up Stairs	91	<b>5.3 Nighttime Safety</b>	<b>110</b>
Going Down Stairs	91	General Pointers	110
<b>4.2 Falling and Getting Up</b>	<b>93</b>	Emergency Equipment	111
Falling	93	Protect Yourself	112
Battery Acid	94	Moving Around	112
Getting Up	94	<b>5.4 Hiking</b>	<b>113</b>
<b>4.3 Electromagnetic Compatibility</b>	<b>97</b>	Hiking Hazards	113
Sources of Electromagnetic Energy	98	Prepare for Your Trip	113
Dealing with EMI	98	Take Precautions	114
<b>4.4 Evacuation Procedures</b>	<b>100</b>	Asking for Assistance	114
Creating an Emergency Plan	101	<b>5.5 Traveling</b>	<b>116</b>
Personal Emergency	101	Travel Planning Tips	116
<b>Chapter 5: Special Circumstances</b>	<b>103</b>	Hotel Rooms	117
<b>5.1 Planning Your Route</b>	<b>104</b>	Restrooms	117
Transit Stops	104	New Environments	118
Trains and Automobiles	105	Other Hazards	118
Airplanes	105	<b>5.6 Weather</b>	<b>119</b>
Rental Vehicles	105	Precipitation	119
		Sun	121
		Wind	121

<b>5.7 Transportation</b>	<b>122</b>
General Considerations and Safety Issues	122
Transferring In and Out of Your Wheelchair	123
Riding in Vehicles While in Your Wheelchair	124
Air Travel	126
<b>Chapter 6: Body Mechanics</b>	<b>129</b>
<b>6.1 Protecting Yourself</b>	<b>130</b>
Body Position	130
Using Safe Body Mechanics	131
<b>6.2 Setting Limits and Offering Help</b>	<b>134</b>
How to Say “No”	134
Offering Assistance	134
<b>Appendix A: The Americans with Disabilities Act of 1990</b>	<b>137</b>
<b>Appendix B: Specialty Powered Wheelchairs and Accessories</b>	<b>139</b>
<b>Appendix C: References and Resources</b>	<b>148</b>

Section 1.2

# Determining the Powered Wheelchair Type Best for You

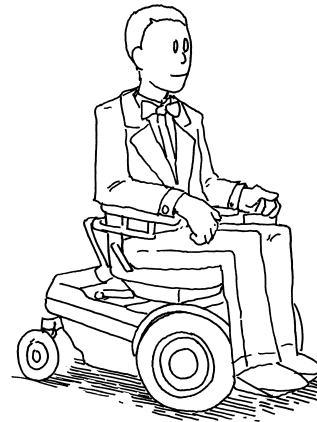


## Wheelchair Types

As with the automobile, inventors have developed many different styles and models of wheelchairs. Each is designed for a different purpose, and permits different types of adjustments to be made.

Changes easily made on standard powered wheelchairs include:

- foot support positioning (typically only length adjustment)
- arm support adjustment
- joystick positioning
- upholstery replacement



*This is a front-wheel drive powered wheelchair with a power base.*

There are many types of powered wheelchairs currently on the market. They generally fall into two main categories: scooters and powered wheelchairs.

### Scooters

Scooters usually have three or four wheels and have a seat that is mounted on a pedestal attached to the floor of the scooter. One main difference between a scooter and a conventional powered wheelchair is the way it is steered. On a conventional powered wheelchair, an electronic control input device, such as a joystick, causes different amounts of power to go to each of the rear wheels to control both speed and direction. On a scooter, users

generally hold handlebars at the end of a tiller that is attached to the front wheel (or wheels) to mechanically turn the wheelchair. Four-wheeled scooters typically have the front wheels connected together such that turning the tiller left and right causes the front wheels to turn left and right together. While turning the tiller often controls the direction of movement, the speed of the scooter is usually controlled with a lever attached to the handlebars, which is pressed with the thumbs or another part of the hand. Scooters often require more arm movement and hand function to operate than traditional powered wheelchairs. Scooters do not typically provide foot positioning to accommodate users that have no leg function. The seating on a scooter is typically not designed to accommodate someone with poor trunk stability. For these reasons, scooters are generally used by persons who have the ability to walk, but who may be limited on how far they can stand or walk.



*This is a three-wheeled scooter.*

The seats of most scooters rotate and lock into position. The seat is often rotated and locked when the person is transferring onto and off the scooter. If the person cannot get close enough to a table or other object when approaching it from the front, the user can rotate the pivoting seat, to the side or all the way around to the rear. Some scooters also have elevating seats that may be

adjusted, depending on the height of the user or the activity performed. Many manufacturers of cushions and back supports make products that can easily be placed on the seat of the scooter.

One of the positive features of scooters is that their overall wheel-base tends to be longer, providing greater stability in the fore-aft direction. That length however, can make it difficult to maneuver in some situations. A scooter may be more stable side-to-side than a powered wheelchair, depending on the width of the scooter. The manual linkage for the tiller steering allows the scooter user to turn rapidly and this can cause the scooter to begin to tip to the side. If not corrected immediately by turning the tiller back in the other direction, the scooter could tip over.

### **Powered wheelchairs with power bases**

When talking about powered wheelchairs, people usually picture a powered wheelchair with a power base. They differ from scooters in their design and operation. Power base wheelchairs have a base that houses the motors, batteries and wheels, along with a seating system that is mounted on top of the base. Most powered wheelchair bases have at least four wheels. While scooters are steered using a tiller that is mechanically linked to the front wheel(s), power base wheelchairs can be controlled using a variety of input switches. The most common control input device is a joystick that is operated by the hand. Powered wheelchairs can also be controlled using joysticks operated by other parts of the body, or by a variety of single or multiple switches, including sip and puff breath-activated ones. Many people who are unable to operate scooters due to limited arm function, are able to use traditional powered wheelchairs.

Powered wheelchairs come in a variety of drive wheel types: front-wheel drive, mid-wheel drive and rear-wheel drive. There are also a variety of specialty powered wheelchairs. These fall into several categories, including stair climbing powered chair bases that are intended for independent or attendant operation, those that are able to move laterally, and those designed for off-road use.

## Powered chairs for traveling

Due to the weight of most power base chairs, transportation is a major consideration. Users of power base chairs often prefer using a modified van or mini van for their personal vehicle. There are a limited number of powered chairs available that are ideal for travel. These chairs differ from the typical power base chairs that do not fold. They are easier to remove the batteries, have smaller drive wheels and can be quickly folded to put in the back of a vehicle.

Traveling powered chairs more closely resemble a folding manual wheelchair equipped with motors and batteries. The folding frame allows for easier transport. The batteries are often housed in separate boxes with easy to separate electrical connectors, which facilitate dismantling the chair. After removing the batteries and the battery tray, the chair can fold. The motors and controller are usually still mounted to the frame, which results in at least one heavy component to be lifted into and out of a vehicle. While dismantling and folding the chair would not likely be a daily activity, knowing a chair *can* be folded and transported in a car, may be very useful for some users.

In terms of durability, generally traveling powered chairs are not designed to be as durable as power base chairs. You will need to consider the trade-off of car transportation and your power mobility driving needs – light-duty versus heavy-duty use.

## Add-on power systems and power-assist wheels

Two other options are available if you are considering power mobility. Both of these product types – add-on power systems and power-assist wheels – use a manual wheelchair frame as the base structure.

Add-on power systems are a means of converting a manual wheelchair frame into a power mobility device. Several methods are available, including a conversion unit that operates like a scooter with tiller steering, and another unit that uses specialized

wheels, a battery pack and a joystick to create a more traditional powered chair conversion.

Wheelchairs with power-assist wheels can be considered as a transitional product between manual mobility and power mobility. Most wheelchairs with power-assist wheels are sold as complete wheelchairs. Power-assist wheels have motors inside of the wheels that amplify the push of the user on the handrim – the switch that tells the wheel to go forward. Depending on how hard the user pushes on the handrim, the wheel puts out more or less power to amplify the user's push. The power-assist wheels extend the length of the roll from a single push. The effect is to travel longer distances with less effort.

While either option may be suitable to meet a person's needs, these devices are not designed to be as durable or as powerful as a power base chair.

## Drive Configurations

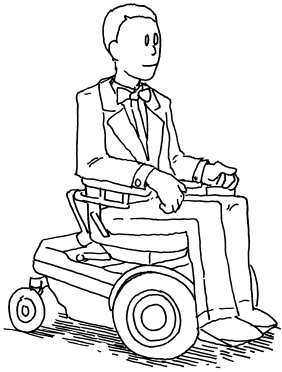
### Front-, rear- and mid-wheel drive powered chairs

**Front-wheel drive** chairs have large drive wheels in the front of the chair with casters (usually smaller wheels) in the rear. Front-wheel drive chairs were first introduced in Europe and are now becoming more popular in the U.S., where rear-wheel drive chairs have traditionally been most predominant.

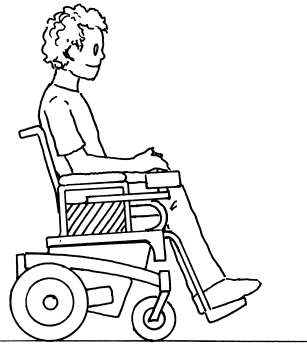
**Rear-wheel drive** chairs have the larger wheels in the rear with the casters in front.

In the mid 1990's, several manufacturers introduced **mid-wheel drive** powered chairs. These wheelchairs have the main drive wheel centered under the user's center of mass. Mid-wheel drive powered chairs have six wheels: two drive wheels, a pair of casters and a pair of anti-tipping wheels. The casters and anti-tippers may be mounted either in the front or the rear of the chair. The advent of computer microprocessors for power base wheelchairs

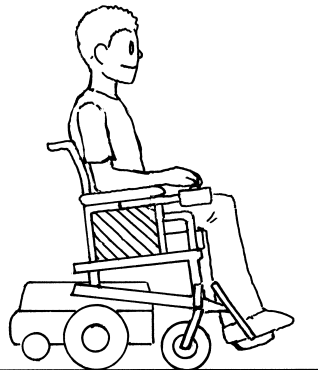
has enabled the creation of control mechanisms for the users to control front-wheel, rear-wheel or mid-wheel drive chairs.



*A typical front-wheel drive chair.*



*A typical rear-wheel drive chair.*



*A typical mid-wheel drive chair.*

The location of the drive wheel impacts the way the wheelchair handles and how it is steered. In a front-wheel drive chair, the mass of the wheelchair is behind the drive wheels. When the wheelchair slows down, there is a tendency for it to turn around backward. This is prevented by the controller, which keeps the wheelchair tracking straight by carefully monitoring the position of the front wheels. Front-wheel drive chairs have good traction going

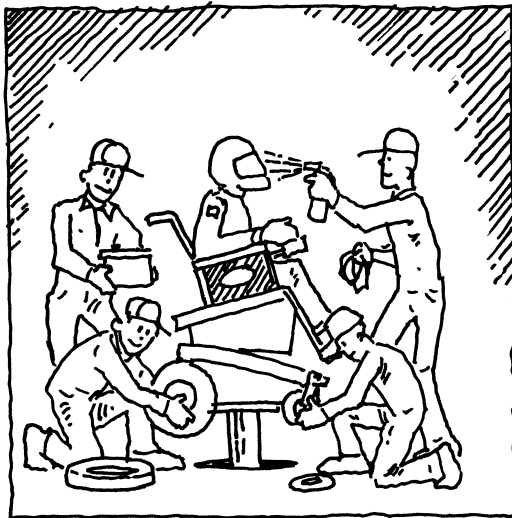
downhill, but can lose traction over sandy or slippery surfaces when going uphill, with the drive wheels pulling the chair forward.

The rear-wheel drive chair has the same difficulty with driving backward. When decelerating after driving backward, the wheelchair tends to try and turn. Rear-wheel drive chairs have better traction going uphill than they do going downhill.

Mid-wheel drive chairs have the potential for better traction than either front-wheel or rear-wheel drive chairs, because the drive wheels are located directly under the user's center of mass, putting maximum traction on the drive wheels. In a mid-wheel drive chair, the user has to get used to tipping back onto their small anti-tip wheels when going up a hill or during rapid acceleration. Mid-wheel drive powered wheelchairs may also be easier to maneuver in tight environments than either front-wheel or rear-wheel drive wheelchairs.

## Section 1.4

# Seating Setup and Wheel Adjustments



One change to your wheelchair usually affects the fit of all the other components, so be prepared to spend a fair amount of time setting up the seating and positioning within your wheelchair. Ideally, when adjusting your wheelchair, you should enlist the help of an assistive technology practitioner or supplier certified by RESNA (Rehabilitation Engineering and Assistive Technology Society of North America).

After each adjustment, test drive the wheelchair with assistance on ramps, different surfaces, and side slopes to make sure your mobility needs have been met. This can be done by driving the wheelchair onto a sloped surface or by physically tipping the wheelchair to its balance point in various directions. Extreme caution should be exercised using the help of multiple assistants. If your seating system is adjustable, the stability of your chair should also be checked with the seating system in all of its extreme positions.

Whenever you alter the setup of your wheelchair, check your forward, side-to-side, and rear stability with a spotter to make sure your wheelchair performs the way you would like.

The set up and adjustment of your wheelchair is a topic worthy of an entire book. There are many adjustments which you will probably refine over many years; others you will want to make throughout each day.

## Seat Surface Angle Adjustment

The seat surface angle can be adjusted on some wheelchairs. A forward sloping seat might cause you to slide forward. Raising the front edge of the seat creates a “bucket” between the back support and seat and closes the seat-to-back angle. If the seat back is reclined at the same time the front of the seat is tipped upward, and the seat-to-back angle stays the same, this is called “tilt-in-space.”

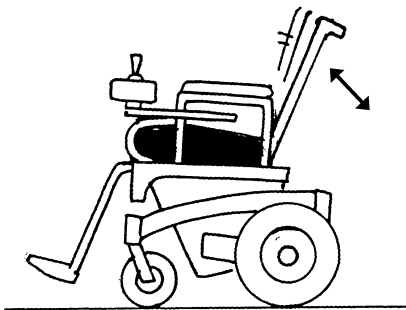
Several powered wheelchair frames allow seat angle adjustments. If the chair frame itself does not adjust, you can still adjust the seat surface angle by:

- Adding a wedge to the seat base beneath the seat cushion
- Purchasing a cushion that will angle the seat surface
- Adding a solid seat with angle adjustable hardware

## Back Angle Adjustment

Your back support angle should provide a comfortable sitting posture while you are upright in the chair. The back angle should not cause you to curl your shoulders, hold your head forward for balance, or cause you to slide out of your seat.

The angle formed by the seat and the back support is called the seat-to-back angle. A seat-to-back angle greater than 90 degrees is often referred to as an “open angle,” while an angle smaller than 90 degrees is referred to as a “closed angle.” An open angle lets you use gravity to help balance your trunk. People with high spinal cord injuries who cannot flex well at the hips often use an open seat-to-back angle. However, an open angle can cause people to slide down in their chairs. If you have the flexibility, a closed angle cradles the body in the curve of the seat, holding you in place. A more open or closed angle can often reduce spasticity.



*This powered wheelchair has an electrically powered reclining back support.*

## Drive Wheel Position Adjustment

Though less critical than on manual wheelchairs, the distribution of weight carried between the drive wheels and the casters on a powered chair will influence the driving performance of the chair. Due to the weight of a powered chair, when attempting to traverse soft terrain like gravel or sand, the chair will tend to sink and the casters will get stuck.

When negotiating low obstacles, for example small curbs, the location of the drive wheels (front, mid, or rear) can make a difference. On a few powered wheelchairs, the actual mounting position of the drive wheels on the frame can be adjusted.

Alternatively, some manufacturers allow for adjustment of the seat frame on the power base. Moving the entire seat forward or backward on the power base has the same effect as moving the drive wheel mounting position – to redistribute the weight between the drive wheels and the casters.

**Front-Wheel Drive** – For the most part, the drive wheels on front-wheel drive chairs have a fixed mounting position on the frame. Frequently, the batteries will be positioned on the chair in such a way as to evenly distribute the weight on the frame, getting as much weight forward as possible. Because the casters are in the rear, one advantage to front-wheel drive chairs is the ability for you to just drive forward over obstacles. The larger drive wheels mounted in the front will not get “hung up,” but rather will drive right up and over an obstacle.

**Mid-Wheel Drive** – This style of chair is available in a wide number of configurations. If you are interested in a mid-wheel drive style chair, it is important to test drive the particular wheelchair model to understand what effect the setup of drive wheels and casters will have on the drive performance of the chair. The first thing to look at is the actual position of the drive wheel on the frame. There is some variation among manufacturers as to where the drive wheels are mounted to the power base, relative to the seat:

- Directly under the seat
- Slightly behind the mid-point of the seat (though forward of the back posts)

Check with your supplier or the manufacturer to determine if the position of the seat or the drive wheel can be adjusted slightly forward or backward.

A “true” mid-wheel driving wheel location may increase the “rocking” of the chair when you rapidly speed-up or come to a quick

stop. If you look carefully, some mid-wheel drive chairs are actually six-wheeled chairs, with two drive wheels and four stabilizing wheels (usually two casters in front and two large anti-tip wheels in the rear).

**Rear-Wheel Drive** – Rear-wheel drive chairs most often have a fixed drive wheel mount. The position of the batteries and your weight when sitting in the chair naturally tend to increase the load on the rear wheels. In many rear-wheel drive chairs, the actual mounting of the drive wheels is behind the backpost of the seat (placing your center of gravity in front of the wheels). This rear placement of the drive wheel makes for a very stable configuration that is more difficult to “pop a wheelie” (lifting the front casters off the ground). A very stable configuration may give you security when negotiating ramps and inclines, but will make negotiating small obstacles very difficult.

Changing the drive wheel position or the position of the seat on the frame is a “heavy duty” adjustment and most often should be done by a qualified wheelchair service technician.

## Arm Support Height Adjustment

The arm support should be adjusted so the arms are not pulling down on the shoulders. Your elbows should be slightly forward of your shoulders when your arms are resting on the arm supports. The front-to-back position of the arm supports should allow the upper arm to slope forward slightly. Some people like to be able to pull their elbows back for stability on non-level surfaces. If your joystick is mounted on the arm support of the wheelchair, make sure you can reach it easily. When adjusting the arm support height on a wheelchair with power recline, make sure the arm support does not interfere with moving the back support from the completely reclined to fully upright position.

## Caster Adjustments

### Mounting adjustments

Your casters should be mounted on the frame so they are perpendicular to the ground. If they are not, your front casters may become afflicted with “shopping cart syndrome” and flutter when you drive your chair. This may also make it difficult to turn your wheelchair or change direction. Use a carpenter’s square to verify that the caster housing is perpendicular to the ground.

### Height and suspension adjustments

Due to the tendency of a mid-wheel drive chair to “rock,” there are smaller wheels mounted on the front and the back of the chair. Look carefully at these wheels. In most cases, one set will be allowed to swivel and will function as casters. The second set are fixed and will function as anti-tip devices. The position of the “caster wheels” and the “anti-tipper wheels” may be at the front or rear, depending on the specific wheelchair design.

Frequently, the “anti-tipper wheels” will have these adjustments:

- Height off the ground
- Tension of suspension

**Height** – The position of the anti-tip wheels off the ground will affect the amount of rocking you feel when you either accelerate rapidly or come to a quick stop. The closer the wheels are to the ground, the less rocking you will experience. However, the closer the wheels are to the ground, the greater the likelihood will be of getting “hung-up.” If the anti-tipper wheels are too close to the ground, when you drive off of a small threshold or through a curb ramp, you run the risk of having all the “little” wheels being on the ground, with the drive wheels being “suspended” in the air. With no drive wheels contacting the ground, you are stuck!

**Suspension** – In an attempt to reduce the likelihood of getting hung-up and to smooth out the “rocking” sensation, some models

have suspension in the anti-tipper wheels. The spring in the suspension may be adjustable to match your weight and driving style. Other power base wheelchairs have suspension on the casters and the main drive wheels.

Much like any adjustment to the drive wheel position, changing the height or tension of the anti-tipper wheels is a “heavy-duty” adjustment. Working with a trained wheelchair technician can facilitate getting the adjustments made to meet your driving style.

## Foot Support Adjustment

Adjust your foot supports after you have your seat cushion, back support, and other positioning aids in place. Don’t forget to put your shoes on; sole height affects your leg positioning. Make sure you are seated upright against the back of the chair. When adjusting the foot supports, make sure you have:

- A minimum clearance of 2 inches underneath the foot plates
- Clearance for your knees under desks and tables

If you do not have enough foot or knee clearance, you might need to readjust your seat height. If your feet are supported at the correct height by your foot supports, your thighs should rest in a balanced manner on your cushion. Foot supports that are too high can lead to little or no weight under the thighs and excessive weight under your sitting bones, the ischial tuberosities. You might need to compromise on your knee height to get the desired weight distribution on the seat cushion.

If your knees will not fit under a table, you can slip coasters or wooden blocks under the table legs to raise the table up higher. At a restaurant, it is possible to turn small plates upside down and slide them underneath each of the table legs. Make sure the table is secure and will not slip off the leg props.

## Seat Height Adjustment

To increase the foot support to ground clearance (raise yourself higher off the ground), you can adjust the seat up. Alternatively, you can increase the seat cushion thickness by adding a layer of stiff foam or a solid insert under the seat cushion. If all of the wheels are vertically adjustable it may be possible to move all of the wheels lower to raise the seat height, or to raise all of the wheels to lower the seat height.

To lower your knee height and decrease ground clearance (lower yourself closer to the ground), you could decrease the thickness of the seat cushion only if appropriate.

Sometimes you can push your knees down as you pull forward underneath the table and your knees can spring back up under the table. If you try this, be sure that there is not too much pressure on the top of your legs from the edge of the table.

Swing-away foot supports permit you to get under some obstacles because one or both foot supports can be removed, allowing the feet to dangle and the knees to drop lower for maneuvering in tight quarters. If you do this, you will need to be very careful backing up from underneath the table. The casters can swing around and catch on your feet, potentially causing injury.

## Section 2.1

# Asking for Help



Access improvements for people with disabilities are being made every day. However, you will still encounter situations where you need help.

Everyone with or without a disability needs help now and then. The need for assistance will vary from situation to situation, and person to person. The hardest part for many people is knowing and understanding when they have reached their limits.

## Defining “Assistance”

“Assistance” has many meanings. You may need to be lifted up stairs, helped over a loose gravel pathway, up a steep ramp, across a street, up or down a curb, over a railroad track, etc.

- **Independent Skills:** Independent skills are those things you can do without help.
- **Supervised/Assisted Skills:** Supervised/assisted skills are those things you are uncomfortable doing totally by yourself, but you can do partially. You might need occasional help or someone nearby “just in case.” Being able to ask for help and being able to instruct others is very important.
- **Dependent Skills:** Dependent skills are those things you can only do with a lot of help.

## Who Can Help?

The amount of help you need will depend on your present skills and abilities, as well as the task you need to accomplish. In some cases, you might want someone nearby because you are learning a new skill or you are just a bit unsure about the situation. At other times, you may be trying to get past an obstruction that you are unable to negotiate. This section gives you some pointers on working with different kinds of helpers, including spotters, assistants, personal care attendants or PCA’s, family or friends, coworkers, acquaintances and strangers.

## Spotter

A spotter is a person who stands nearby to help if you need it. Always use a spotter when learning a new skill, such as driving down a steep ramp, and when you are not confident in your ability to handle a situation alone. The spotter could help to prevent you from tipping or falling forward out of your wheelchair. It is up to you to decide when you are uncomfortable with a maneuver and would like to use a spotter. You might need more than one spotter when learning a new skill. It is also important to instruct your spotter(s) as to exactly how you need to be spotted. For example, going down a ramp you might ask a spotter to walk alongside of the wheelchair, ready to catch your upper body should you lose your balance in the forward direction.

## Assistant

A spotter becomes an assistant when you know you will need help or will require more assistance than someone standing by offering an occasional hand. Assisting often involves pushing or lifting the wheelchair in some capacity (e.g., up a curb or threshold that is too high to cross independently). An assistant might also be required to perform other tasks, such as picking up things you drop or getting things you cannot reach. In many cases, an assistant is hired and trained by the wheelchair rider. These assistants are often referred to as personal care assistants (PCA's) and attendants.

## Personal Care Assistant (PCA)

If you need help frequently or at regular times during the day, you may want to hire a personal care assistant. Some wheelchair users find it difficult to ask a family member or a friend to help because they feel they are burdening them. Relationships with family members or friends may become strained if they always feel responsible for helping you.

A potential advantage of a hired assistant is that the assistant can help you with personal tasks, such as bowel and bladder care, and is generally not as emotionally involved with you.

It is the job of a hired assistant to provide the help you need in a given situation. You can train your professional assistant to do things the way you want. If the arrangement does not work out, you also have the freedom to replace the PCA.

## Family and friends

Family and friends with whom you spend most of your time will need to spot or assist you on some occasions. It can be valuable to rely on people you feel comfortable with when facing a difficult or challenging situation.

Do not assume that a family member or friend will always be comfortable helping you. Be sure to ask if they are willing to help. Make sure they know not to help you unless you request assistance. You probably have a good idea of which friends and family members you can trust as assistants based on your familiarity with their personalities.

## Coworkers or acquaintances

Coworkers or friendly acquaintances can also make good assistants when you need help at work. If you are on good terms with a coworker, you may be comfortable casually asking for assistance (e.g., "Hi. Can you give me a push over this threshold?").

People you meet after your injury may be more comfortable with you as a wheelchair user than friends or family still making the adjustment to your new circumstances.

## Strangers

When you are alone, situations may arise where you need the assistance of a stranger. For example, you may have dropped

your car keys where you cannot reach them. In these cases, you may need to ask someone you do not know for help.

Alternatively, you may be out with a friend and find yourself in a situation where the assistance of a second person is necessary. For example, you may need an additional person to help lift the front end of your wheelchair up a curb.

## How to Ask for Help

How you ask for help will vary from situation to situation. Ask for assistance in a way that allows the person to comfortably decline. You can practice asking for assistance with a companion acting as a stranger. This will help you learn how to ask strangers for assistance, as well as teach your companion to help only when asked. This type of practice also helps you learn how to instruct others to safely assist you.

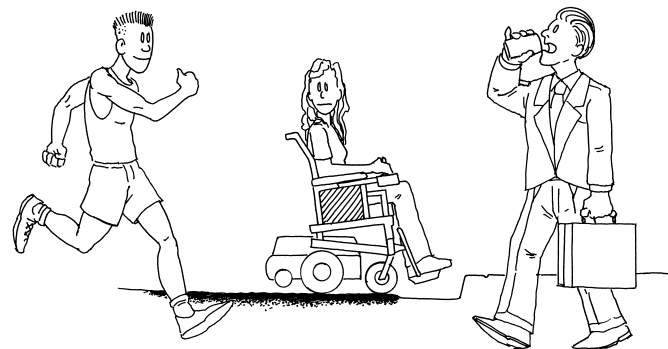
Remember that there can be many valid reasons for people to decline to help you. Some people have disabilities that may not be visible, such as arthritis or heart disease, and they may be reluctant to disclose their condition to you. Other people's beliefs or customs may present a barrier to assisting you.

Gracefully accept refusals to help. After all, you don't want help from a person who feels uncomfortable with the task because their apprehension can increase the risk of injury for both of you.

Consider the following before asking a stranger for help:

- Do not ask for assistance from anyone you feel might be a threat.
- Consider the people around you and approach only those who look prepared to provide some physical assistance.
- Body size is not that critical when performing most assisting skills. Do not assume a smaller person is not strong enough to help you.

- Ask for assistance from people involved in activities similar to your own. For example, if you are shooting baskets in the park and lose the basketball in a bush, ask another ball player for assistance.
- If you enjoy challenging environments, such as hiking trails, remember that this type of environment attracts a lot of people who, like yourself, might be looking for an adventure. They may see helping you as yet another challenge and be very eager to assist.
- If there are few people around and you know you will need assistance soon (e.g., there is a curb around the corner), ask someone if they would be willing to follow you to the place where you will need help.
- Try "Do you mind giving me a hand up this curb?" or "Could you help me down this steep curb ramp? I can talk you through what I need you to do."



*Observe the people around you and ask those who look ready and willing to assist.*

Be clear and concise when giving instructions. Most of the skills in this book include instructions you can give an assistant.

- You are in charge. Instruct your assistant not to do anything unless you specifically ask.

- Read Section 6.1 for more information about protecting the back. Make sure friends and family who assist frequently read that chapter also.
- Tell your assistant where to stand.
- Indicate how to hold onto your wheelchair (e.g., “Please do not lift from the foot supports because it might break off. Hold the frame next to my knees instead”).
- Give body mechanics suggestions (e.g., “Bend at your knees and keep your back straight”).
- Always instruct your assistant to move on your count of three to coordinate the efforts of all parties.
- Remember to thank your assistant for the help.

## Manually Rolling Your Wheelchair

It will be difficult or impossible to manually push your wheelchair with the motor engaged. Know how to explain the disengagement of the motors so an assistant can push you if necessary. Be sure you know where the motors are located and how to operate the motor disconnect system.

## Describing Safe Body Mechanics to the Spotter or Assistant

Be sure to protect your spotter or assistant from injury by reminding her to watch her body position. Remind your spotter or assistant to:

- Bend at the knees, not at the waist.
- Use her legs for strength rather than the weaker muscles of the back or arms. This will help prevent back strain.
- Keep her knees bent, not locked straight.

- Never twist at the waist. Instead, she should keep her torso facing the same direction as her hips. This will help prevent back strain.
- Keep her back straight. Hunching over or rounding at the shoulders can cause back strain.
- Keep breathing. Sometimes people forget to breathe when they are involved in physical activity. When someone holds their breath, they are more likely to tense their muscles and when their muscles are tense, they are more prone to strain and injury.

## When You Do Not Want or Need Assistance

Sometimes people will try to help even when you do not ask. This can be very frustrating.

- A simple “Thanks, but I would like to do this by myself” or “Thank you, but it is actually easier for me to do this without assistance” can be effective.
- “Please don’t grab my wheelchair” or a similar instruction is sometimes necessary for the more aggressive helper.

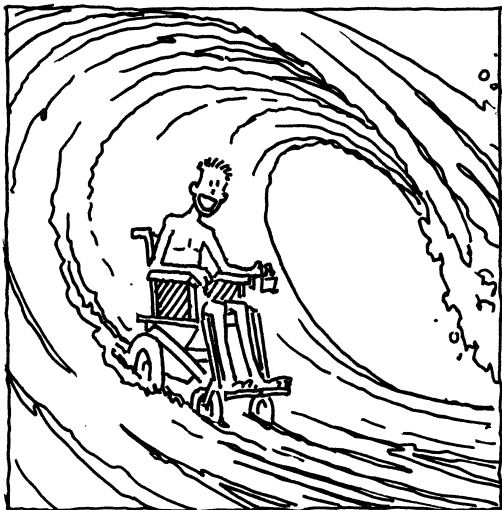
## Experiencing New Environments

It is important to have assistance available when you try things for the first time (e.g., your first time using a crosswalk with curb ramps). Having a companion along to both spot and assist makes it safer to experiment with new or different skills.

The goal is to develop full independence. This does not necessarily mean that you will be able to perform all skills independently. Rather, it means that you are able to understand when and where you may need assistance, how to ask for it, and how to instruct others to assist safely.

Section 2.2

# Learning Your Limits



Riding at different speeds, going up and down hills, over different surfaces and past obstacles affects your stability. Depending on the terrain and your speed, you might have difficulty keeping your balance or your hand on the joystick. It is important to know your limits. To learn what you can do, you have to experience a variety of situations. Each time you try something new, it is best to have another person stand by to help you regain your balance and prevent you from falling. That person is referred to as a spotter throughout this book.

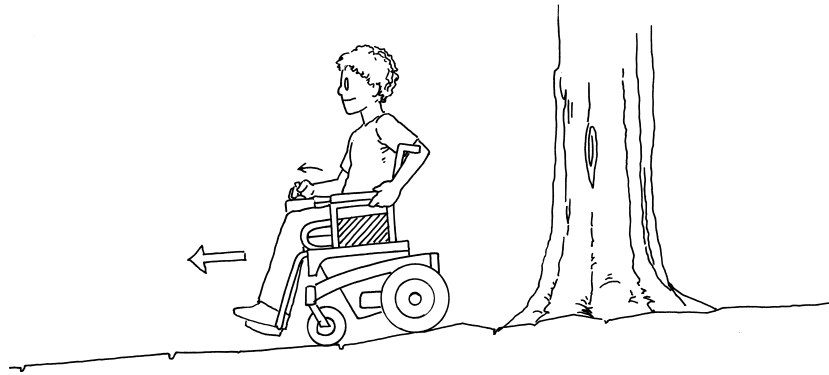
## Techniques for Keeping Your Weight Back

Hitting an obstacle, coming to an abrupt stop or driving down a ramp, curb ramp or hill can all cause you to fall forward. Shifting your weight back in your wheelchair might help you keep your balance.

In order to counteract falling forward, it is important to stay as far back in your wheelchair as possible. Although the wheelchair's back support will prevent you from leaning back very far, leaning even your head and shoulders back will help keep you in your wheelchair. If you tend to lose your balance or fall forward, the following suggestions might be useful to you.

### Hook your arm behind you

Hooking will help keep your body "locked against the back of your wheelchair." You will need sufficient arm movement and strength to position your arm and hold the push handle in the crook of your elbow. You may find that hooking your non-driving arm around the push handle will provide added stability while driving over obstacles or down ramps.



*Hooking your arm can help you keep your balance when you ride downhill or over rough ground in your powered wheelchair.*

Since hooking requires you to twist and lean, using this technique over many years can lead to back pain, pressure ulcers on your buttocks, and skeletal deformation. Hooking also occupies an arm that might be better used for other activities. If you find you need to hook often to feel safe while driving, you may want to obtain additional postural supports to minimize usage of this technique. Extended lateral supports or a chest support might be of great benefit.

### Use of additional straps

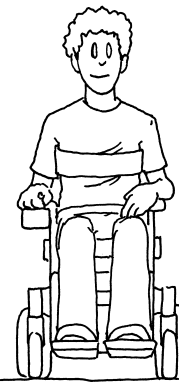
A lap belt will help hold your buttocks back and keep you from sliding forward in your seat. Sliding forward in your seat could allow you to get dumped out on the ground. A lap belt can be positioned at different angles; however, a strap that crosses your thighs at an angle between 60 and 90 degrees will work the best.

A chest strap can help hold your upper body in place, preventing you from falling forward. Different styles are available depending on your needs and preferences. An alternative to the traditional chest strap is an across-the-shoulder automotive style belt or backpack style straps that come down across each shoulder.

Chest straps should be used with great care, because if you slide down (or forward) in your wheelchair, a chest strap can get caught around your throat and choke you. Chest straps of any type should only be used with a properly functioning lap belt.

## WARNING!

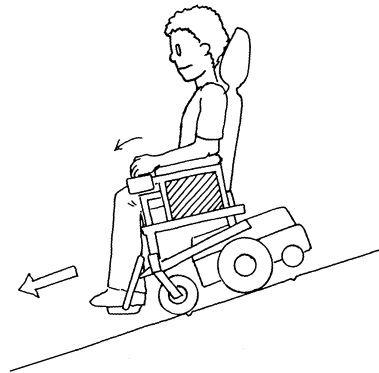
Lap belts mounted at angles less than 60 degrees have the potential of pivoting up, and can allow the hips to slide underneath and forward on the wheelchair seat. For people using a chest support of some type, sliding down in the wheelchair can create a strangulation hazard. People have also slid down in their wheelchairs such that the lap belt created a strangulation hazard.



*A chest strap in combination with a lap belt can help you maintain your sitting balance. Try several chest support styles to see what works best for you.*

### Power recline back support

If your wheelchair is equipped with power recline, you can adjust the back support rearward to prevent you from losing forward stability. The next section discusses this type of seating system in more detail.



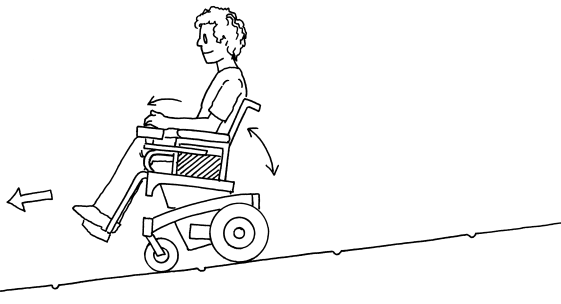
*Reclining the back support a little bit might help you keep your balance when going downhill.*

## CAUTION

Never recline your back support when traveling uphill. This could lead to rearward instability when driving uphill, through a curb ramp or other uphill sloped situation.

### Power tilt-in-space seating system

In a power tilt-in-space seating system the entire seating system tilts back, not just the back support. This type of seating system is discussed in more detail in the next section.



*A power tilt-in-space feature can also help you keep your balance when going downhill.*

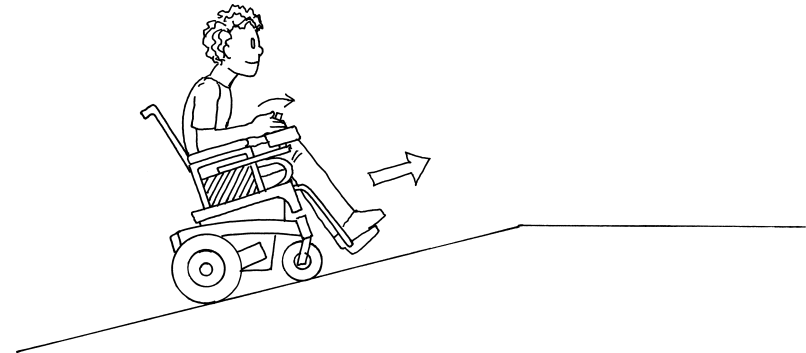
## CAUTION

Never use the power tilt feature when traveling uphill. This could lead to rearward instability when driving uphill, through a curb ramp or other uphill sloped situation.

## Techniques for Keeping Your Weight Forward

When traveling uphill, you may need to keep your weight forward to prevent your wheelchair from tipping backward.

- Lean forward with your head and shoulders when driving over obstacles and when driving up hills and ramps.
- If you use a chest strap, it may be easier to lean forward against the strap with it slightly loosened.



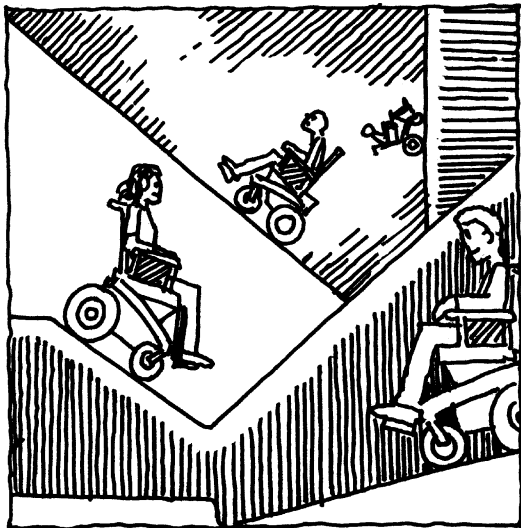
*When traveling up a steep hill, you may need to keep your weight forward to prevent your wheelchair from tipping backward.*

## When You are Learning Your Limits

- First learn your balance point when sitting in your powered wheelchair. With a spotter's assistance, find out how steep a ramp (forward, rearward and sideways) you can handle before you start to lose your balance.
- Try different postural supports to see which will help you maintain your upper body balance.
- Learn to recognize environments that are beyond your ability to maintain your postural stability. Learn how to recognize ramps that are too steep for you to manage.
- Have a spotter stand by to help you regain your balance and prevent you from falling.

## Section 3.5

# Ramps



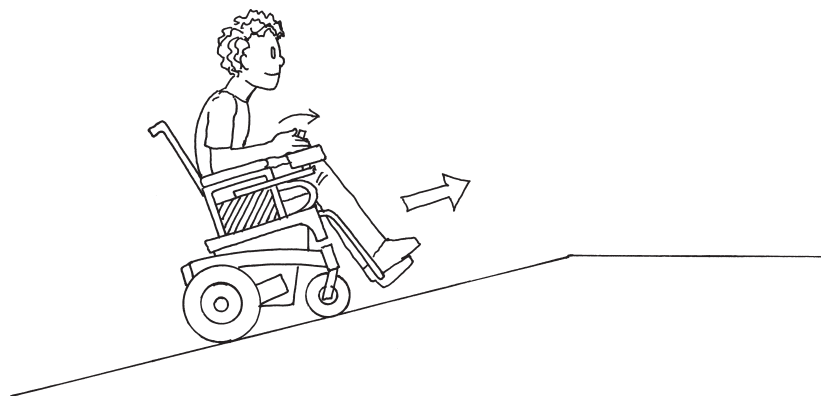
According to the Americans with Disabilities Act (ADA) Accessibility Guidelines, a standard ramp in the built environment should have a grade no steeper than 1:12. This means that for every inch of rise (change in height), there should be 12 inches of run (change in length). This is sometimes referred to as an 8 percent grade or slope. Using this formula, a ramp going to a door with two 8-inch steps should be at least 16 feet long.

A standard ramp is gradual enough for powered wheelchairs to climb safely, but the limit beyond that is different for each powered wheelchair.

With experimentation, you will learn how steep a ramp you can negotiate without assistance. Always use a spotter when practicing on ramps and when driving up a steeper ramp for the first time. Practice descending steep ramps with a spotter until you find one that is at the limit of your trunk stability. Experience the loss of stability, and remember the steepness of the slope that caused this to happen. When climbing steeper ramps you may reach a point where you will begin to tip to the rear or the wheelchair may just run out of power. Obtain assistance before going up or down slopes this steep, or steeper, in the future. Loading docks are good places to find steeper than normal ramps for practice on steep ramps.

## Going Up a Ramp

- There will be a tendency for the wheelchair to tip backward when driving up a steep ramp. A backpack or other gear on the back of your wheelchair will cause you to tip backward more easily. If you use a reclining back wheelchair or a tilt-in-space seating system, you will find that having your back support in the fully upright position gives you the greatest stability when driving up a ramp.
- Drive slowly to maintain control.
- On steep ramps, it is best to keep a straight path. Approaching a steep ramp at an angle will increase the severity of the cross slope. Cross slopes are discussed later in this section.



*Lean forward when you are going up a steep ramp facing forward.*

### How a spotter can help

- Walk behind the wheelchair and place your hands close to the push handles or back posts. Try not to influence the movement of the wheelchair.
- Prevent the front casters from lifting off the ground by lifting up or by pushing forward on the push handles or back support.
- If the wheelchair runs out of power, assist by pushing the wheelchair up the slope.

## Going Down a Ramp

Before descending a ramp, always check for obstacles such as cracks and changes in level. Also examine the base of the ramp for obstacles you may need to cross, such as drainage grates.

Always shift your weight back when going down ramps, and proceed slowly to maintain control. As you get more comfortable and confident with ramps, you will be able to increase your speed and remain safe.

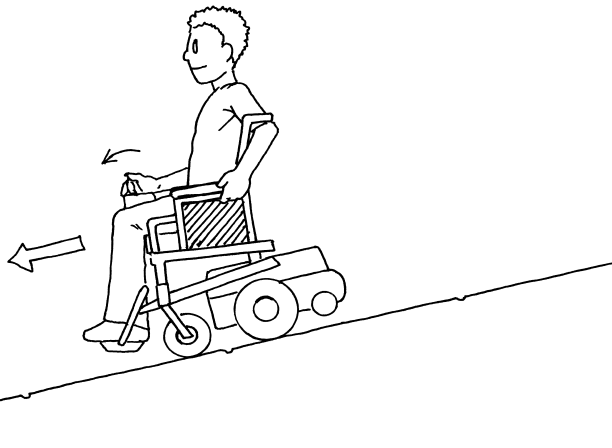
Be careful of foot support clearance when you get to the base of the ramp. Drive slowly in case your foot supports contact the ground. If they do, you will come to an abrupt stop.

Always practice descending ramps with a spotter. Travel down ramps of increasing steepness until you find the angle where you can no longer descend the ramp alone with confidence. Always obtain assistance when you do not feel comfortable descending a ramp independently.

Practice with a spotter on the non-joystick side of your wheelchair, ready to catch your upper body if you should fall forward.

### Going down a ramp forward independently

- Examine the ramp for obstacles.
- Drive slowly to maintain control.
- The ramp may be so steep that you will lose forward balance. If this happens, compensate by shifting your weight back (see Section 2.3 for more information about shifting your weight).
- Putting the joystick in reverse can further slow the speed of some chairs. However, this technique is not recommended for wheelchairs with non-digital controllers on a continuous basis, as the braking action could permanently damage the controller or motors.
- Some ramps might be so steep that you will lose traction under the rear wheels and begin to slide. You will maintain more control by driving forward than you will sliding forward.



*Hooking one arm around a push handle and leaning back into your back support may help you keep your balance when going down ramps.*

### How a spotter can help

- Walk on the non-joystick side of the wheelchair rider as the rider moves down the ramp.
- Be ready to catch the wheelchair rider's upper body if the rider falls forward.
- Stand behind the wheelchair rider and reach over the shoulder to provide additional trunk support.

### Going down a ramp backward independently

Traveling down a steep ramp can cause you to lose trunk stability in the forward direction. When shifting your weight back during the descent or hooking your elbow on the push handle is not enough to maintain your balance, descend the ramp backward. You should also descend a ramp backward if you believe it is so steep that the foot supports will hit the ground at the bottom.

- Check the ramp for any obstacles.
- Move slowly to maintain control.

- It may be difficult to maintain the direction you want to go when you are driving backward down a ramp. Have a spotter or an assistant ready to help guide the wheelchair from the rear.
- If you are using anti-tippers, watch for clearance of the anti-tippers at the bottom of the ramp. If your anti-tippers get caught at the bottom of the ramp, you could tip over backwards.
- Letting go of the joystick should cause the wheelchair to dynamically brake and slow or stop.

### How a spotter can help

- Walk on the non-joystick side of the wheelchair and hold on to the wheelchair frame to physically assist with guiding the wheelchair straight.
- If the ramp is steep, position yourself behind the wheelchair, hold the push handles, and walk backward down the ramp. Move with the wheelchair as it drives backward.

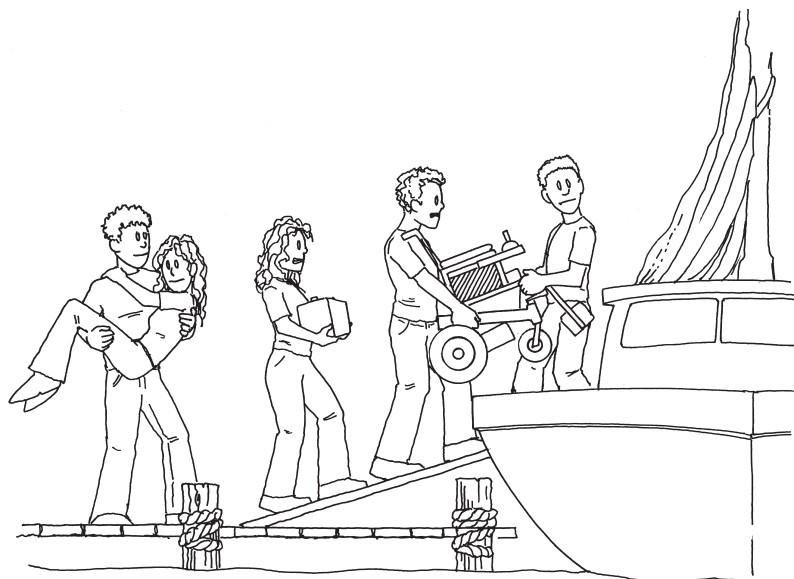


*To slow the wheelchair, a spotter can walk behind the wheelchair with his or her hands on the push handles, leaning forward into the back support.*

## Very Steep Ramps

If the ramp is too steep for your wheelchair to ascend or descend, even with an assistant, find an alternate route or have two or three assistants help you by pushing and/or pulling.

- Attach pull straps to the wheelchair near the front casters to enable helpers to pull on the left and right sides of the wheelchair. Have the strongest assistant behind the wheelchair assist by pushing.
- You can assist by driving the wheelchair slowly to apply as much power as possible.
- When going down, applying a very small amount of reverse power will keep the parking brakes from engaging. You will also be able to assist with steering. If this does not work, disengage the drive motors and have your assistant(s) manually roll the chair down.



*If the ramp is too steep or narrow, have your assistant transport you and your wheelchair separately.*

## How a spotter can help

- Walk behind the wheelchair rider as the rider moves up the ramp with your hands near the push handles. If necessary, push the wheelchair to keep the casters from lifting off the ground, and to provide extra power to ascend the ramp or to slow the descent.
- The second spotter should walk on the joystick side of the wheelchair rider as they move up or down the ramp. Be prepared to shut the wheelchair off if there are any difficulties.

## Telescoping or Portable Ramps

Telescoping or portable ramps are made so that they can be moved and used in different locations. Sometimes the ramp is wide enough for the whole wheelchair to fit on it. Other times, two narrow ramps are used under the wheels on each side. If these narrow ramps are used, make sure they are wide enough for your wheels. Some wheelchairs are made so the casters are not in line with the main wheels. If this is the case with your wheelchair, you may have more difficulty using portable ramps because individually they may not be wide enough for both the front and rear wheels. Before using telescoping or portable ramps:

- Stretch the ramps out on a flat surface and be sure your wheels can safely drive through the full length of the ramps before attempting to use them on an incline.

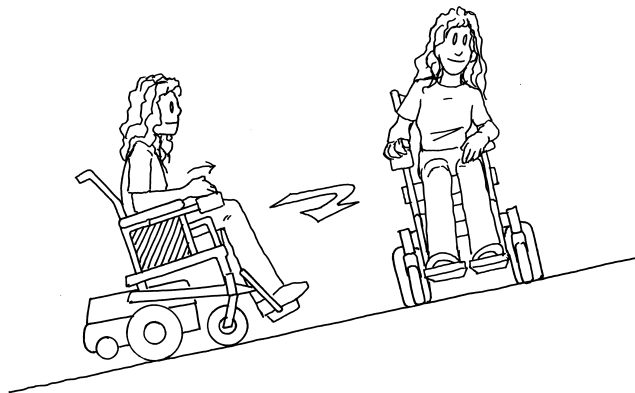
## Turning Around on a Ramp

The safest way to turn around on a ramp is to continue traveling until you reach a level resting area or the end of the ramp. However, this is not always possible. For example, you might be driving on a road or trail that is a steep ramp. With a little practice, you will be able to turn around on a ramp safely. Lean and shift your weight in the uphill direction as you turn. This helps to move the center of mass uphill and will help to prevent your wheelchair from tipping.

## How to turn around on a ramp

- Look behind you to check for oncoming traffic.
- If the path is clear, move to the non-joystick side of the ramp and stop.
- When you have come to a halt, turn your wheelchair in the direction of the joystick until you are sideways on the ramp. This allows you to maintain your upper body position with your joystick arm. You may find it easier to turn in the other direction if you have more ability to balance with the other arm.
- Keep your weight shifted uphill.
- Continue to turn your wheelchair using the joystick until you are facing downhill. Be sure to keep your weight shifted back.
- Drive your wheelchair forward down the ramp.

Note: It will be important for you to determine the steepest ramp on which you can ascend, descend, and turn around. Always have a spotter with you when determining the maximum limits of your wheelchair.



*When you make a turn on a ramp, be careful that your wheelchair does not tip sideways.*

## How a spotter can help

- Stand downhill from the rider throughout the turn to keep the rider from falling forward out of the chair and to keep the chair from tipping.

## Grade Transitions

Curb ramps are, unfortunately, often built up to or beyond the maximum slope allowance (8.3%), and at the bottom of the curb ramp the gutter slopes up in the opposite direction toward the center of the street. This creates a downslope-to-upslope transition where the foot supports can dig into the ramp or the gutter, bringing the wheelchair to an abrupt stop. This can cause you to be thrown forward in the chair or completely out of the chair if you do not use a lap belt.



*Foot supports that are adjusted too low can get caught going through a curb ramp.*



*Anti-tip wheels can get caught where there is a lip at the base of the curb ramp and the ramp and gutter slopes create a rapidly changing grade.*

Section 6.2

# Setting Limits and Offering Help



It can be hard to admit you have reached your limits. However, you should safeguard your own health and well-being. You need to know your limits and how to say “no” when you have reached them.

## How to Say “No”

It is important to understand that you should not assist a wheelchair rider if it presents a physical hazard to your own health or you are not confident in the outcome. This could result in injury to the wheelchair rider and/or yourself. For example, pushing a wheelchair up a curb with an injured back could be painful and may cause further injury to your back. Do not be afraid to say “No.” The following are several ways to decline to help:

- Politely decline by saying, “I don’t feel comfortable or safe assisting you in that way.” Explaining why you declined is often appreciated. However, if your reasons are personal, you have no obligation to explain yourself.
- Offer to find someone who can help. “I’m not able to assist you up this curb because I have a shoulder injury. Can I help you find someone else to assist?”
- Offer an alternative skill. “I’m not comfortable pulling your wheelchair backward up the curb because I don’t think I can lift the weight of the wheelchair. Can we try lifting your casters up onto the curb and then I can push you up the curb?”
- Offer an alternative route. “I’m concerned about trying to assist you down this steep hill. The hill isn’t so steep if we go to the next corner.”

## Offering Assistance

Sometimes watching a wheelchair rider do something is difficult because you can see that whatever the rider is doing is not easy. Remember that the person may not want assistance; it may be important for the person to accomplish the activity independently. It might be easier for the wheelchair rider to do the activity alone than to explain to others how they can help. The wheelchair rider might have had bad experiences or even injuries in the past when people tried to help. It may be difficult to watch, but you do not necessarily need to help the person.

Only assist a wheelchair rider when you are asked and/or have been given permission. If you think a wheelchair rider might need assistance, offer. The wheelchair rider may be in a position that looks precarious, but have the situation under control.

Unexpected assistance might throw him or her off balance.

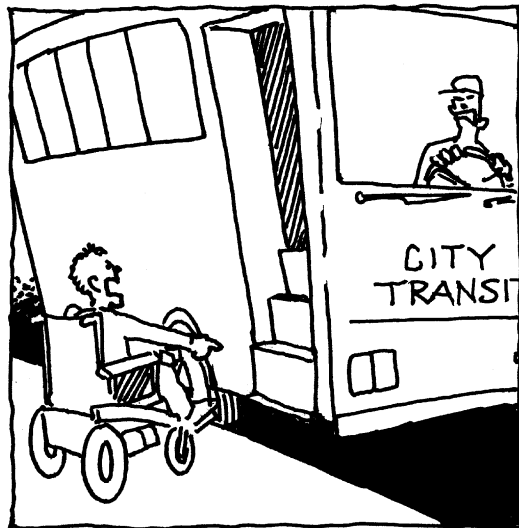
- Ask if the wheelchair user wants help. Avoid assertive statements such as, “Let me do this for you,” which make it difficult for the wheelchair rider to decline your help.
- Try wording your offer more casually. “Could you use a hand?” or “Can I help you out?”

If your offer to assist has been accepted, let the wheelchair rider be in charge. Ask the wheelchair rider how you can help and follow the rider’s instructions. Ask the wheelchair rider to talk you through the sequence before trying it, then work together to do it correctly.

- Do not push, lift or pull unless the wheelchair rider asks. Often you will be working together (e.g. to climb a curb, you may be pushing on the push handles as the wheelchair user drives forward).
- Speak up if you feel in danger of injuring yourself by following the rider’s instructions.

## Appendix A

# The Americans with Disabilities Act of 1990



The Americans with Disabilities Act (ADA) was adopted as law in 1990 to ensure that equal access is provided to all individuals without regard to needs related to disability. This comprehensive law focuses on a number of areas, including accessibility to and within public buildings and services.

If you encounter problems with the accessibility of a building, you should first speak with the building owner or manager and explain your problem. They may have been unaware of any accessibility difficulties, and could make immediate changes for you. If the building manager or owner is unwilling to help, the next step is to get other people in the building to talk to the management. Local advocacy groups, such as Centers for Independent Living, may offer intermediary services or provide alternative resources for addressing problems. If you cannot achieve a resolution of the problem using these methods, you can file a complaint with the Department of Justice. For information about filing a complaint, call the ADA information line at 800-514-0301.

A problem might be as simple as a plant that was placed in front of the elevator buttons or within the clear passage of a hallway. It may be as complex as a multi-level building not serviced by an elevator or doorways that are too narrow for you to pass through.

## U.S. Department of Justice

The U.S. Department of Justice provides general information about the Americans with Disabilities Act (ADA), answers to specific technical questions, ADA materials, and information about filing a complaint.

websites

[www.usdoj.gov/disabilities.htm](http://www.usdoj.gov/disabilities.htm)

[www.usdoj.gov/crt/ada/adahom1.htm](http://www.usdoj.gov/crt/ada/adahom1.htm)

ADA Information Line

Voice 800-514-0301

TTY 800-514-0383

## The Access Board

The U.S. Architectural and Transportation Barriers Compliance Board (The Access Board) provides technical assistance on the ADA Accessibility Guidelines.

website	<a href="http://www.access-board.gov">www.access-board.gov</a>
Voice	800-872-2253
TTY	800-993-2822

## U.S. Department of Transportation

The ADA also addresses accessibility to transportation services. The U.S. Department of Transportation oversees this aspect of the ADA.

website	<a href="http://www.dot.gov/accessibility">www.dot.gov/accessibility</a>
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Office of the Secretary

Office of Civil Rights

Voice	202-366-4648
TTY	202-366-5273

Federal Transit Administration

Office of Civil Rights

Voice	888-446-4511
E-mail	<a href="mailto:ada.assistance@fta.dot.gov">ada.assistance@fta.dot.gov</a>

## Appendix C

# References and Resources



If you are interested in obtaining additional information about wheelchairs and mobility skills, there are a number of resources you can tap with a visit, a phone call, a letter or a modem.

## Centers for Independent Living (CIL)

Most communities have a Center for Independent Living (also called Independent Living Centers or ILCs). These centers are run by and for people with disabilities. Their mission is to help people with disabilities live more independently and become productive, fully participating members of society.

## Rehabilitation Centers

The rehabilitation center in your area may have facilities you can use to try out equipment and see which devices might benefit you. They may recommend an evaluation by an occupational or physical therapist, or a RESNA certified assistive technology practitioner. These professionals can often provide you with insight into your abilities and potential needs, and may be able to direct you toward other helpful accessories. Your rehabilitation center may also refer you to other centers that can better meet your specific needs.

## Medical Equipment Suppliers

Medical Equipment Suppliers represent equipment manufacturers and should be able to help you make equipment choices compatible with your lifestyle. Remember that these companies are in the business of selling equipment, so you need to be an educated consumer and look further than the salesperson. The National Registry of Rehabilitation Technology Suppliers has a registry of equipment suppliers.

When buying equipment, consider the resources and reliability of the supplier. Ask them about their repair policies. For instance, will they loan you equipment when yours is being repaired? Are they helpful on the telephone? Do they seem willing to spend time telling you about the pros and cons of the variety of equipment? Will they help you adjust and re-adjust your equipment? The supplier should be willing to give you the names of a few of their

customers. Contact these people to determine how they feel about the supplier's services.

## Equipment Manufacturers

Most wheelchair and related equipment manufacturers have toll-free numbers and are available for assistance. They will often refer you to a local supplier or others in your area who are familiar with their products. Some manufacturers have technical assistance departments that may be able to help you with specific questions about modifications, adjustments or repairs. Some manufacturers publish documents in addition to their wheelchair owner's manuals. You can talk with your local supplier about getting documents from any of the manufacturers.

## Other Users

Find people in your community who have similar interests and needs. Other people often have recommendations for equipment and you can combine their information with the recommendations you get from rehab professionals and equipment suppliers. By learning as much as you can, you will be able to make informed decisions about your equipment.

## Professional Organizations

Some professional organizations may be able to provide you with information directly or refer you to members in your area who may be familiar with similar circumstances to yours.

### APTA

#### American Physical Therapy Association

1111 N. Fairfax St. (800) 999-2782  
Alexandria, VA 22314 www.apta.org

### AOTA

#### American Occupational Therapy Association

4720 Montgomery Lane (800) 729-2682  
PO Box 31220 www.aota.org  
Bethesda, MD 20824-1220 info@aota.org

### NRRTS

#### National Registry of Rehabilitation Technology Suppliers

P.O. Box 4033 (512) 267-6832  
Lago Vista, TX 78645-4033 www.nrrts.org  
nrrts@ctsinet.com

### Paralyzed Veterans of America

#### Spinal Cord Injury Education and Training Foundation

801 18<sup>th</sup> Street NW (800) 424-8200  
Washington, DC 20006 www.pva.org  
info@pva.org

### RESNA

#### Rehabilitation Engineering and Assistive Technology Society of North America

1700 N. Moore St., Suite 1540 (703) 524-6686  
Arlington, VA 22209-1903 www.resna.org  
info@resna.org

## Publications

### ***A Guide to Wheelchair Selection: How to Use the ANSI/RESNA Wheelchair Standards to Buy a Wheelchair***

Written by Peter Axelson, Jean Minkel and Denise Chesney  
Paralyzed Veterans of America, Washington, DC  
PVA Publications Distribution Center (888) 860-7244  
info@pva.org

### **Active Living Magazine**

P.O. Box 2659  
Niagara Falls, NY 14302-9945  
www.cripworld.com/themall/activeliving/shtml

### **Enable Magazine**

Magazine of the American Association of People  
with Disabilities (AAPD) (800) 840-8844  
1819 H Street NW,  
Suite 300 www.dnaco.net/~elainc/enable.html  
Washington, DC 20006 readenable@aol.com

### **New Mobility**

**No Limits, Inc.**  
P.O. Box 220 (888) 850-0344  
Horsham, PA 19044 www.newmobility.com

### **Paraplegia News**

PVA Publications (606) 224-0500  
2111 East Highland Avenue, Suite 180 www.pn-magazine.com  
Phoenix, AZ 85016-4702 pvapub@aol.com

### **Sports 'n Spokes**

PVA Publications (602) 224-0500  
2111 East Highland Avenue, Suite 180 www.sns-magazine.com  
Phoenix, AZ 85016-4702 pvapub@aol.com  
Sports 'n Spokes publishes articles comparing available wheel-  
chair models.

## Websites

There are numerous websites with information about wheelchairs and for wheelchair users. Here are a few of them.

### **ABLEDATA**

**www.abledata.com**

A searchable database of rehabilitation products.

### **Beneficial Designs, Inc.**

**www.beneficialdesigns.com**

A rehabilitation engineering design firm specializing in recreational technologies, innovative wheeled mobility and seating, and access to outdoor recreation environments.

### **SpinLife**

**www.SpinLife.com**

A site featuring wheelchairs, scooters and accessories.

### **WheelchairJunkie**

**www.WheelchairJunkie.com**

A site for wheelchair users by wheelchair users.

### **WheelchairNet**

**www.WheelchairNet.org**

A virtual community that provides information, support and a forum for wheelchair users.