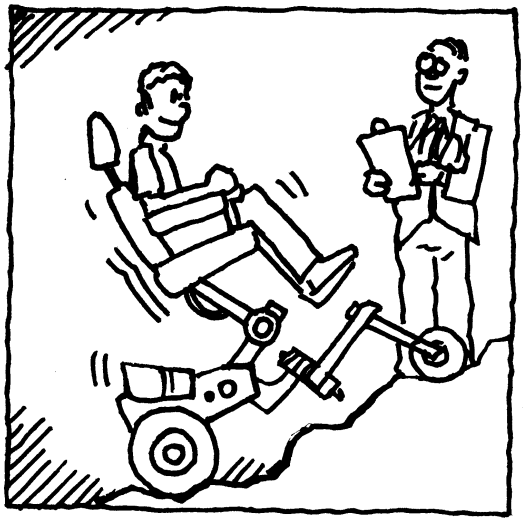
Section 1.2

Determining the Powered Wheelchair Type Best for You

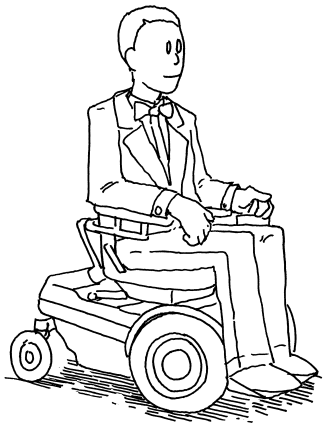


Wheelchair Types

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



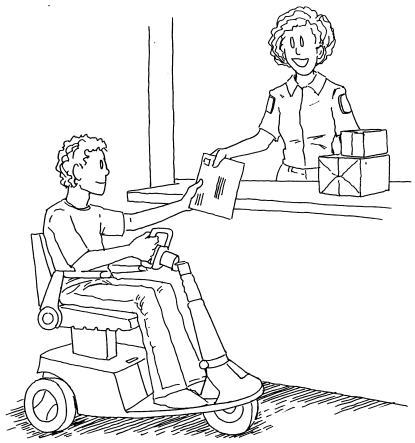
This is a front-wheel drive powered wheelchair with a power base.

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 wheelbase 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

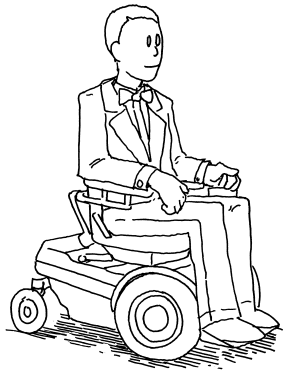
Front-, rear- and mid-wheel drive powered chairs

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.

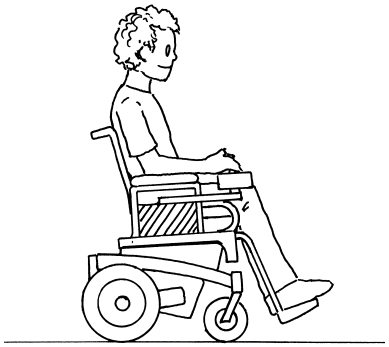
Rear-wheel drive chairs have the larger wheels in the rear with the casters in front.

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

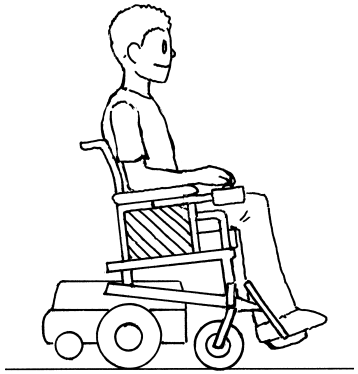
has enabled the creation of control mechanisms for the users to control front-wheel, rear-wheel or mid-wheel drive chairs.



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.