Queensland Spinal Cord Injuries Service

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SPOT Spinal Outreach Team

Comparison of Front, Mid and Rear Wheel Drive Power Chairs

N.B. Not comparing power with manual wheel chairs

Rear wheel drive	Mid wheel drive	Front wheel drive
		

Turning circle

Rear wheel drive	Mid wheel drive	Front wheel drive
• Largest turning circumference. • More difficult to manoeuvre in tight spaces.	• Smallest turning circumference. • Tightest turning radius.	• Medium turning circumference. • Turning in small space is difficult due to long back end. • Manages tight corners well due to short front end.

Footplate position

Rear wheel drive	Mid wheel drive	Front wheel drive
• Footplates typically add length to the chair as they need to be angled forward 60-80º to clear the larger front casters. • Central mounted single footplate may reduce overall length.	• Front casters are typically wider apart than the drive wheels, so 90 º footplates add less than 30mm to turning radius.	• No front casters to interfere with 90º footplates, so add less than 30mm to turning radius.
• **N.B.** If client uses a hoist for transfers, consider interface between the hoist and chair. Check to ensure hoist legs can fit around the front castors and drive wheels to enable positioning the client well back in the powerdrive chair.		

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Handling obstacles and inclines

Rear wheel drive	Mid wheel drive	Front wheel drive
• Drive wheels push front casters over obstacles, so less efficient than front wheel drives. • Least stable for tipping compared to mid and front drives, as most of chair's mass is at the rear of the chair. • Must have anti-tippers. • More likely to tip backwards when going up hill, as batteries and motor are at the rear of the chair. • When going up steep hills the chair will lean back on its anti-tippers to assist in preventing chair from tipping backwards. • Need access to expertise for correct set up.	• Most stable chair on slopes, as front and back casters prevent tipping forward or backward. • The chair's centre of gravity is about even with centre of chair. The drive wheels under the user make it stable over even ground. • On uneven terrain or curbs, may get "stuck" on the front and rear casters, suspending the drive wheels off the ground. • On sand or soft ground, the drive wheels may sink into the soft terrain, causing loss of traction.	• Better than rear and mid wheel drives for obstacle climbing and on rough ground, because the large drive wheels pull the chair over obstacles. • Stability dependent on battery location. • Provides better weight distribution than rear and mid wheel chairs, as the weight of chair can be spread by having drive wheels at the front and batteries at the back. This makes it very stable for uneven terrain and hills. • If chair is set up with one battery behind and one in front of the seat, the chair must rely on front anti-tippers to improve stability. This would add length to the front of chair.

Handling at speed

Rear wheel drive	Mid wheel drive	Front wheel drive
• Most stable at higher speeds because most of the weight of the chair is around the drive wheels.	• More sensitive to change of direction than rear wheel drive, due to drive wheel position • To turn quickly, all four casters have to spin back into the direction of travel. • Six points of contact.	• Less stable than rear wheel drive, and tendency to fishtail when turning at high speed because the chair is pulling more weight behind it • On hard braking, may tip forward.
• At low speed (6-8kph) all three drive systems are equally stable		

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- **N.B.** Power chairs in Australia are legally required to be speed limited to 10kph

Smoothness of ride

Rear wheel drive	Mid wheel drive	Front wheel drive
• Larger casters than mid wheel drive chairs, so smoother ride outdoors. • Can be fitted with shock absorbers on all four wheels.	• Generally have smaller casters so a harder ride than rear or front wheel. However, can be offset by the softness of all wheels and quality of suspension. • Six wheels going over the bumps and sending more shocks into the frame and seat. • Suspension system tends to deflect and conform to the surface. Therefore, seat will be straight even if wheels at different heights.	• Larger casters than mid wheel drive chairs, so smoother ride outdoors. • Can be fitted with shock absorbers on all four wheels.

- Pneumatic tyres and casters provide the smoothest ride. Many chairs provide the option of solid casters and drive wheels to prevent flat tyres.
- All MASS funded chairs have solid tyres as standard

Reversing

Rear wheel drive	Mid wheel drive	Front wheel drive
Less sensitive than mid wheel drive. The larger casters have more contact with the ground, so weight is distributed over a larger area; thus, the chair moves in the desired direction before the casters swivel.	• More sensitive to change of direction of travel than rear and front wheel drives, because their smaller casters result in an instant change of direction	Less sensitive than mid wheel drive. The larger casters have more contact with the ground, so weight is distributed over a larger area; thus, the chair moves in the desired direction before the casters swivel.

- The casters have to spin back into the direction of travel for all power chairs, regardless of the location of the drive wheels.

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Ease of attendant operation

Rear wheel drive	Mid wheel drive	Front wheel drive
• Easy for attendant to use.	• Operation by attendant may be difficult.	• Difficult for an attendant to operate.

Other advantages

Rear wheel drive	Mid wheel drive	Front wheel drive
• May be a good balance between indoor manoeuvrability and outdoor or uneven ground ride quality.	• Manoeuvring is more intuitive, because the drive wheel is in line with the user's head and centre of gravity. Therefore, may be better for people with perceptual and/or cognitive impairment.	• Able to get close front on to work surfaces.

References:

Morgan, A., *Power wheelchair drive – Wheel configuration: What's the difference anyway?* Paper presented at the 2011 Canadian Seating & Mobility Conference

EnableNSW and Lifetime Care & Support Authority, *Guidelines for the prescription of a seated wheelchair or mobility scooter for people with a traumatic brain injury or spinal cord injury*. EnableNSW and LTCSA Editor, 2011, Sydney.

Disclaimer:

This chart is intended as a general guide only. It should not be regarded as a prescriptive document for selection of one particular type of powerdrive chair over another. Therapists should always trial an item with the client in his/her home environment. Speak with suppliers for further information about their particular products, as specific characteristics vary between makes and models.

SPOT has made every effort to ensure this information is accurate. However, SPOT accepts no responsibility for any errors, omissions or inaccuracies in respect of the information contained in this document, nor any responsibility for the use of this information.

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