

Wheelchair Transportation Safety Lessons from the Crash Lab

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Good Occupant Protection

- Elements of good outcome: occupant stays in seat, WC secure early, no structural failure
- Movies show events that happen in 100 ms – the blink of an eye
- Crash severity similar to the CRS federal standard and that used to test compartmentalization



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Four Point Tiedowns Should Comply With WC18

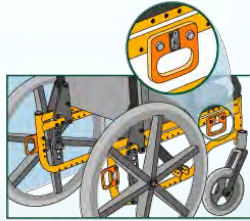
- Secure WC forward facing
- Easiest to use with WC19 WC
- Use all four straps
- Four-point accommodates a wide range of WC types



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Wheelchairs Should Comply With WC19

- Easy to find securement points
- Works well with seatbelts
- Crash tested
- Has necessary qualities of a vehicle seat



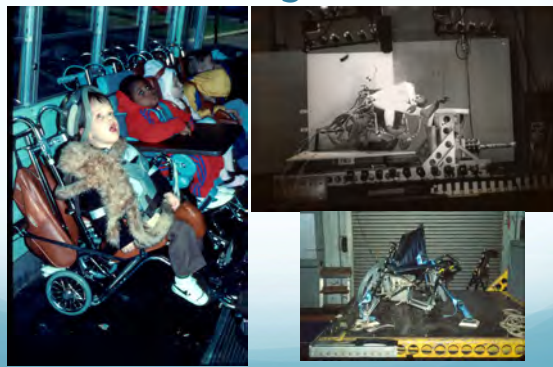
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Why Forward-Facing?

- Frontal Crashes Most Frequent Most Deadly
 - Regulations make protection in frontal crashes a priority
- Structural Strength of the Wheelchair
 - Some Wheelchairs Fold In Sideways Fashion
 - In Side Facing Often Unable to Access Frame
- Best Orientation In Which to Protect Occupant
 - Side Facing Forces Armrests Into Abdomen
 - Shoulder Belt Less effective In Side Facing

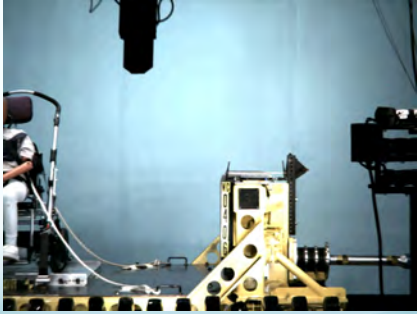
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Side Facing Wheelchairs



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Side Facing Wheelchair



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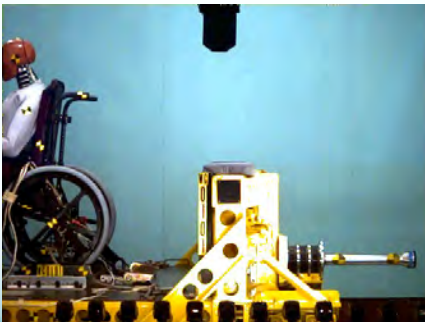
Rear Facing Wheelchair



WC, unlike RF CRS, are not designed for this loading direction.

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Rear Facing Wheelchair



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All Four Tiedown Straps Must Be Used

- Wheelchairs With Difficult Securement Sites Must Be Analyzed By Team
- Tiedown Areas Must Be Maximized or Modified If Preventing Transporters From Safely and Effectively Applying All Belts

Poor Ergonomics Equals Staff Injuries

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WC19 Accessible Securement Points



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Floor Space Recommendations

ADA precedent
Minimum clear floor space of 30" x 48" as near to entrance as possible



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Enlighten Team Influencing WC Space Limitations

- Mechanics Who Install Wheelchair Tiedowns/Occupant Restraints
- Administrative Staff Who Order Buses and Write Specs



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Secure the WC for travel

Use all tiedowns



ERROR – Just two aisle-side tiedowns used!

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Only Two Tiedowns



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WC Secured but No OR Used



Other children on the bus are restrained by compartmentalization

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No Occupant Restraint



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Postural Supports Are Not Occupant Protection in Crash



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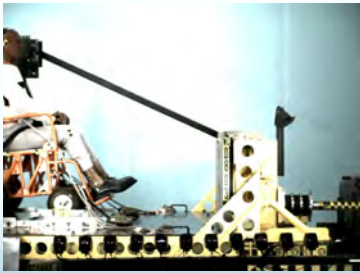
Postural belts are not designed for crash loads



Apply seatbelt over the top, being careful to achieve good fit

19

Postural belts are not designed for crash loads



20

Postural belts are not designed for crash loads



21

Postural belts are not designed for crash loads



Apply seatbelt over the top, being careful to achieve good fit

22

Postural belts are not designed for crash loads



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Postural belts are not designed for crash loads



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Check Tiedown Installation – Without Brakes

- Release Wheel Locks/Brakes
- Check For Movement:
 - No More Than Two Inches of Movement
 - Front to Back
 - Side to Side
- Reapply Wheel Locks

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Elements of Great Seat Belt Fit



- Provide both upper and lower torso belt restraints (i.e., both pelvic and shoulder belts).
- Apply restraint forces to the skeletal regions of the pelvic bone and shoulders, not to the abdomen.
- Achieve lap-belt angles of 30 to 75 degrees to the vertical and ideally 45 to 75 degrees

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Three Types of Crashworthy Seat Belts

#1 Lap and Shoulder belt that only anchors to vehicle



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Three Types of Crashworthy Seat Belts

#1 Lap and Shoulder belt that only anchors to vehicle



- Hardest to get good fit
- Most common in field
- New WC19 rates WC for compatibility with vehicle

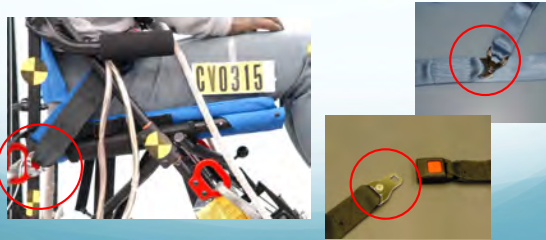
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Three Types of Crashworthy Seat Belts

#2 Lap and shoulder belt with ends of lap belt anchored to WC

WC19 wheelchairs must provide the user with the option of a wheelchair-anchored lap-belt restraint with connector for attaching vehicle-anchored shoulder belt.

Will be marked with WC19 symbol and or WC19 text



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Three Types of Crashworthy Seat Belts



- #3 A crash worthy 5 point harness that anchors to the wheelchair
- New WC19 requirement for wheelchairs to provide a five-point restraint harness and head support for children under 50 lb

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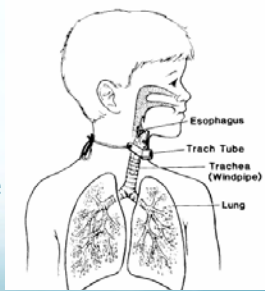
Shoulder Belt Must Always Be Used

- Attaches to Bus Wall At/Or Above and Slightly Behind Level Of Shoulder Joint
- Lies on Collar Bone While Avoiding Neck Area
- Never Put Under The Arm
- Nothing Between Belt and Child's Chest

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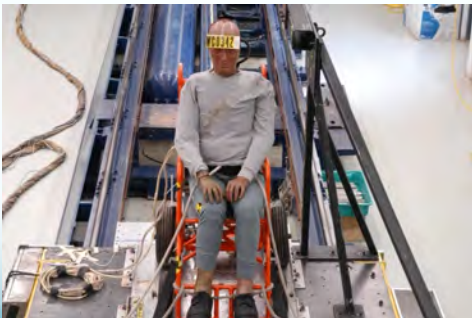
Shoulder Belt Must Be Used By All

Students With Trachs Often Resist Use of the Shoulder Restraint-Modification and Adjustment Should Be Addressed By The Entire Team



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Lap Belt, No Shoulder Belt



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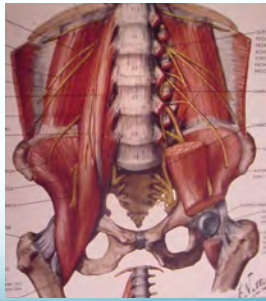
Lap Belt, No Shoulder Belt



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Lap Belt Portion

- Lower Edge of Lap Belt Should Touch Thigh: Low and Snug: Over Knobs
- Should Not Be Padded
- Should Never Be Placed Over Armrests Of WC



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Belt Routing Can Be Difficult On Some Wheelchairs



Seat Insert May Need To Be Modified



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Seating May Need to be Modified



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Poorly Routed Lap Belt



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Poorly Routed Lap Belt



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Rating Compatibility With Vehicle-mounted Seat Belts is Part of WC19



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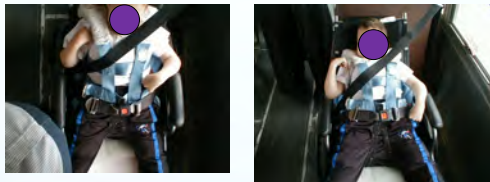
Torso Recline

- In General, Students Should Ride Upright (less than 30 deg recline) if Their Medical Condition Allows
- Shoulder Belt Anchor Can Be Moved Rearward To Improve Belt Fit and Contact



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Adjust Shoulder Belt On Tilted Chair: Making Contact With Chest Wall



Shallow Out Angle

Anchor Rearward

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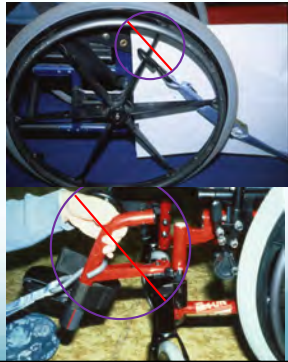
Tiedown Attachment To WC Frame

- Not an issue with a WC19 WC
- Use Strong WC Joints
- As High On The Frame As Possible But Below The Seating Surface
- No Removable Components or Wheels



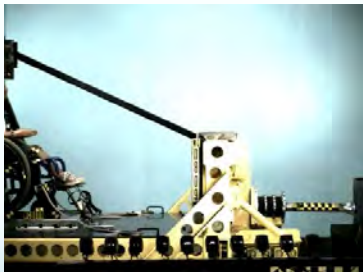
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Do Not Attach Tiedowns to Removable Parts



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Removable Parts Can Come Off in a Crash



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3-Wheeled Wheelchairs or Scooters



- Difficult to secure in vehicle
- May need to cut away shroud
- Few comply with WC19

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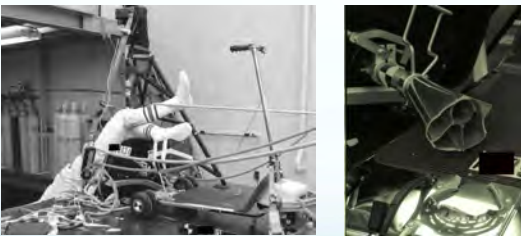
Scooter Crashworthiness



- Scooter tested to the 30 mph/20 *g* crash pulse
- same as the WC19 standard
- secured by tiedowns
- occupant restraint fitted to dummy

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Scooter Crashworthiness



Pedestal seat fractured at base of stalk

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Ventilators, Oxygen Tanks and Other Equipment



- Equipment that meets a medical need for the ride must be accommodated
- Should be secured/strapped down
- Positive attachment to needed
- Avoid occupant contact/proximity with mass when possible

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New Products to Secure Oxygen Tanks



Consult Oxygen+WTORS Distributers/Dealers
Excellent Resources

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Add/use straps to control object movement



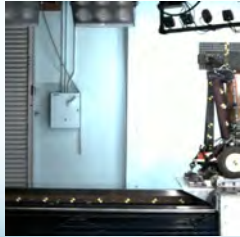
Strap Used



Strap Not Used

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Add/use straps to control object movement



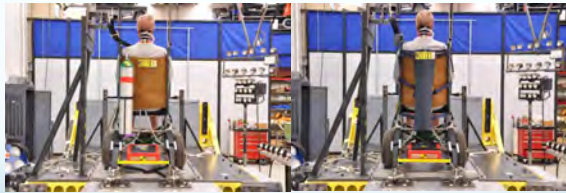
Strap Used



Strap Not Used

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Rigid Frames Control Mass Better



Rigid Frame

Soft Bag

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Rigid Frames Control Mass Better



Rigid Frame



Soft Bag

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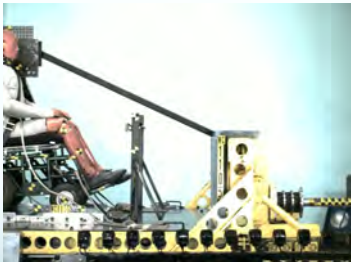
Padded Bags Hung on Canes Can Detach



Eliminate unnecessary items and secure elsewhere
Keep mass low and use different containing method

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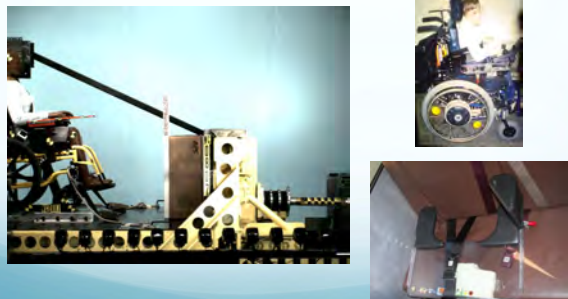
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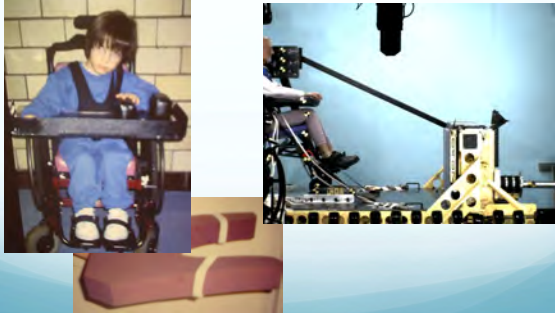
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Hard/Sharp Laptrays Must Be Removed From WC And Secured



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If Laptray Must Stay, Use a Vinyl-Covered Foam Tray



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ANSI/RESNA Standards on Wheelchair and Transportation

Your "TICKET TO RIDE" more safely!



Products that comply with the latest versions (since 2012) will be marked with this symbol

WC18 = WTORS

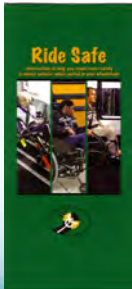
WC19 = Complete Wheelchairs (Frames + Seating)

WC20 = Custom Seating that can be used with many different wheelchair frames



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Resources RideSafe Brochure

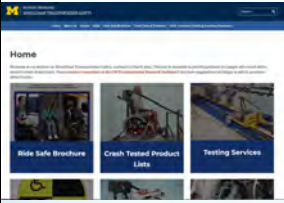


- Revised in 2018
- Available as glossy hardcopy
- Available in Spanish and French
- Also on web at www.travelsafer.org

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Resources – WTS Website

Travelsafer.org



- Information on recent WTS standards
- Crash-test videos
- Technical publications
- Consumer publications
- Answers to FAQs
- Updated lists of products that comply with WTS standards

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Postural Support Guideline Document



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Contact Information

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