

RERC on Wheelchair Transportation Safety



Project P6

In-depth Investigations of Crashes and Moving-Vehicle Incidents Involving Wheelchair-Seated Drivers and Passengers

Project Leaders: Kathy Klinich
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Investigators: Jamie Moore

Duration: 5 years



Background

- In-depth investigations of crashes are used to provide feedback to vehicle safety engineers on how occupant-protection systems perform in the field
- Application to WTS:
 - provide feedback on effectiveness of transit safety technologies (products that comply with standards)
 - identify problems not addressed by current standards and education programs to help prioritize future research and standards



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Statement of Need/Problem

- Objective and quantitative data on real-world transportation safety of wheelchair-seated travelers are scarce
- Need to clearly understand occupant-restraint issues and injury scenarios that are unique to wheelchair-seated travelers in different types of vehicles and transportation modes
- Need to prioritize future research and standards development efforts on real-world data



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Overall Objectives

- Identify safety and occupant-protection issues that are unique to wheelchair-seated occupants
- Evaluate real-world performance of WTORS and wheelchairs that comply with standards
- Estimate risk of injury for occupants in wheelchairs and compare to risk of injury in the general motor-vehicle population



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Specific Tasks

- Conduct in-depth investigations:
 - 5 to 6 per year using RERC funding
 - 5 to 6 per year using NHTSA funding
- Perform biomechanical analysis of each case.
- For each case, document crash/incident scenario and conditions, and most likely factors leading to occupant injuries.
- Enter coded data into WC crash/injury database.
- Analyze database to determine injury risk to WC-seated occupants (e.g., risk versus crash severity).



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Project Organization

- Obtain IRB approval
- Identify potential cases and recruit participants
- Conduct in-depth investigations
- Perform biomechanical analysis and summary of each case
- Compile/analyze WC crash/injury database



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Methods: Identifying Cases

- NASS
- Google News Alerts
- WTORS manufacturers (Q-strait)
- MATAI (Midwest Association of Technical Accident Investigators)
- Responses to wanted poster on website

WANTED

Notification of crashes involving wheelchair-seated occupants



Call Jamie at 734-647-2940 or jlmoore@umich.edu

We need your help. Please call us at the above number if you know about a crash involving a driver or passenger who was seated in a wheelchair. We also want to hear about other problems, like a wheelchair tipping over in a van or bus. We want to investigate these events to learn how wheelchair tiedowns and seatbelts are being used and how well they work in real accidents. The information from our study will help make travel safer for people seated in wheelchairs. You must volunteer for our study and sign a form stating that you have agreed to participate. All information that we collect is recorded in a way so that people, accident locations, or products can't be identified.

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(UMTRI)



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Methods: Recruitment

Publicize study each month through mailings, articles, or ads:

- UMTRI website, press releases
- Other crash investigator organizations
- NMEDA dealerships (van modifiers)
- NASS Investigators
- Publications/groups dealing with users of wheelchairs



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Methods: Crash Investigation

- Measurements and photos of vehicle exterior
 - vehicle crush, location of damage
- Estimate crash severity using reconstruction software



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Methods: Crash Investigation

- Measurement and photos of vehicle interior
 - damage, contact marks, evidence of seatbelt/tiedown use
- Photos of wheelchair and WTORS
 - damage, postural belts



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Methods: Crash Investigation

- Interviews with occupants and drivers
- Inspection and photos of scene
- Information on occupant injuries from treating medical facility



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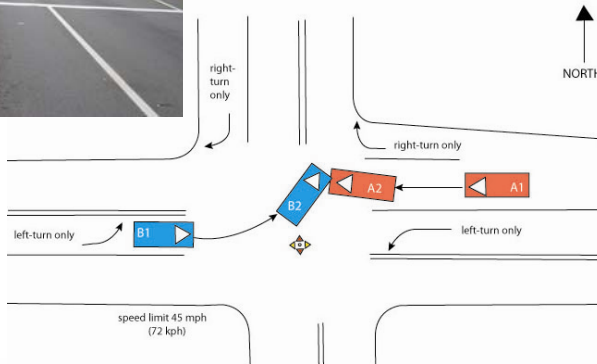
Progress/Results

Sample crash investigation
Frontal crash with WC-seated Passenger



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Scene



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Vehicle Damage



Maximum rearward crush 45 cm
Crash severity 14 mph delta V

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Vehicle Interior



Minimal interior damage
No intrusions

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Case Occupant

- 61-year-old female
- 170 cm, 59 kg (5'7", 130 lb)
- Left second row, forward-facing
- MS, quadriplegia

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Wheelchair/WTORS



Quickie LX1 Jay Manual
No damage



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Tiedowns



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Occupant Restraints



Lap belt misused - routed loosely over WC armrests, chest, and arms
Shoulder belt not used

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Occupant Injuries/Sources

- pneumothorax to left side of chest from seatbelt loading
- multiple comminuted left femur fractures plus tibia and fibula fractures due to ejection from WC and contact with vehicle interior

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Key Observations

- Occupant ejected from wheelchair due to:
 - high placement of lap belt above armrests and over arms
 - no shoulder belt
- Cause of death
 - Chest injury and leg trauma
 - complications from compromised health and refusal of some treatment



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Progress/Results

- Number of cases to date
 - 24 from RERC-WTS-1
 - 6 from RERC-WTS-2
- 30 cases, 31 case occupants



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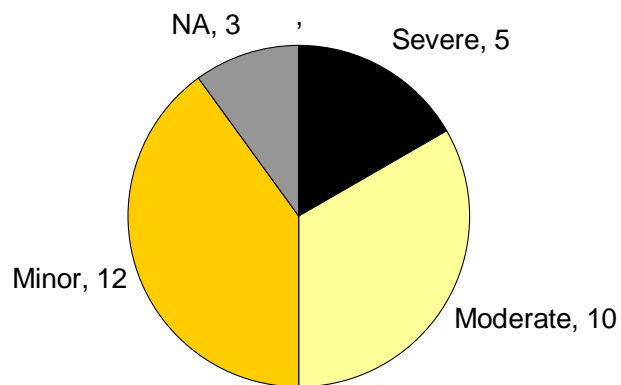
Progress/Results

Distributions of key crash variables



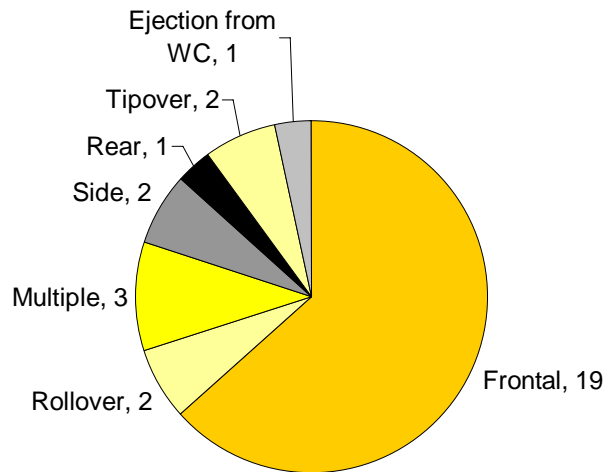
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Crash Severity



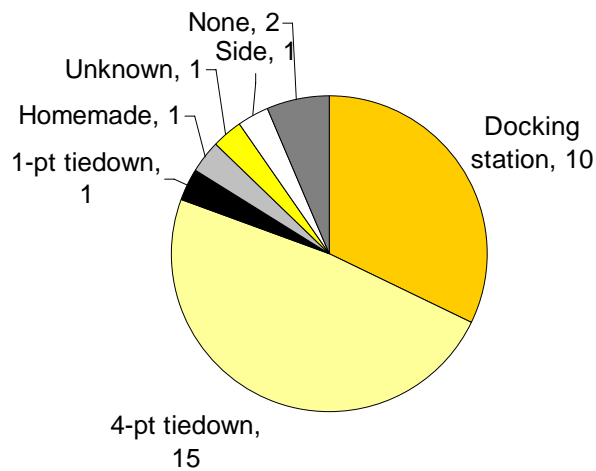
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Crash Type



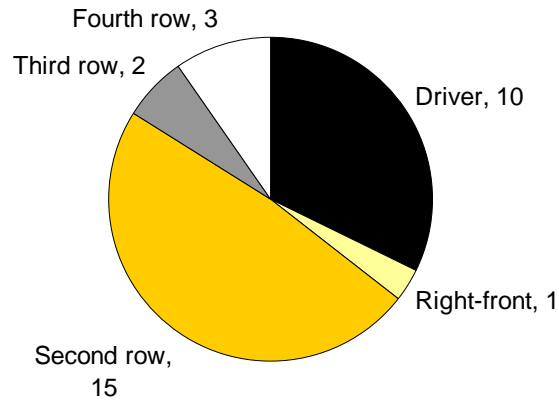
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Tiedown Type



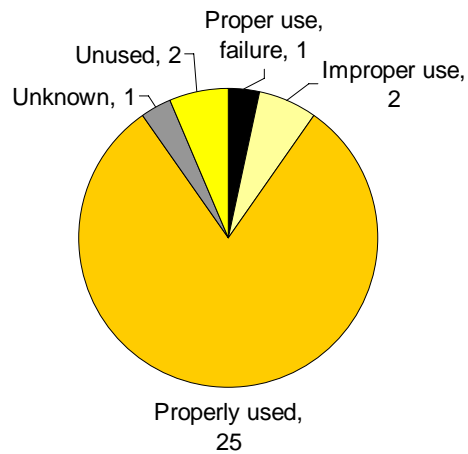
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Occupant Position

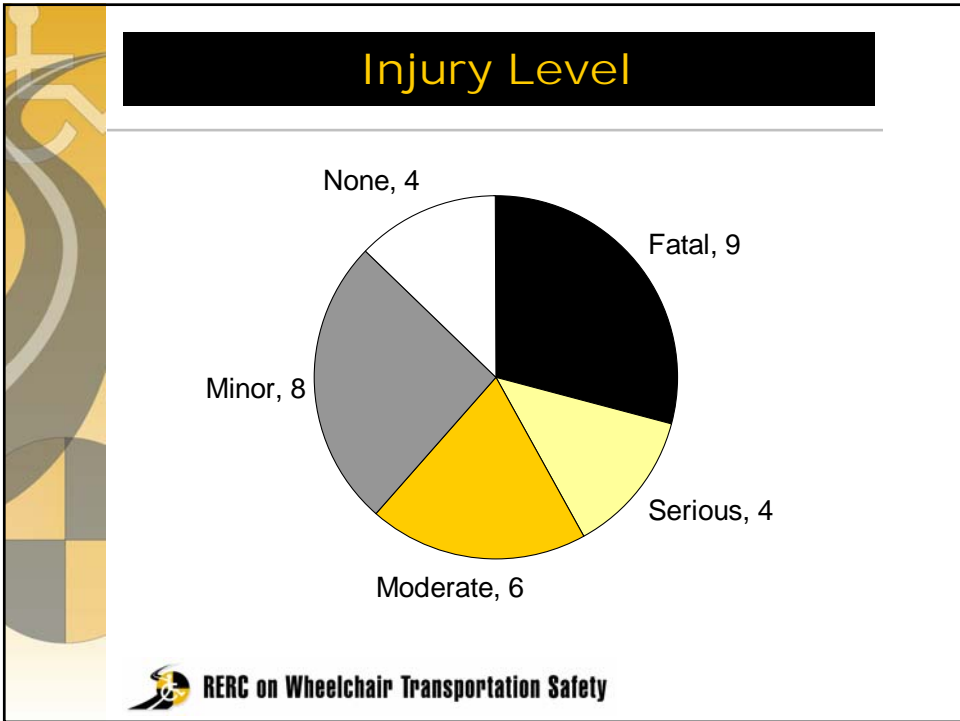
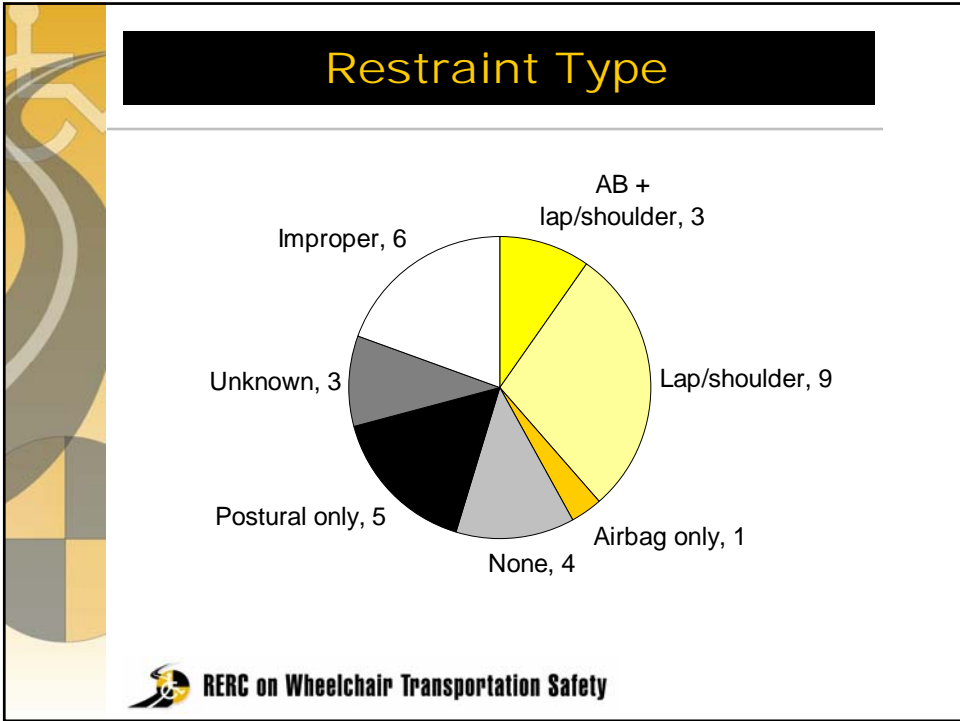


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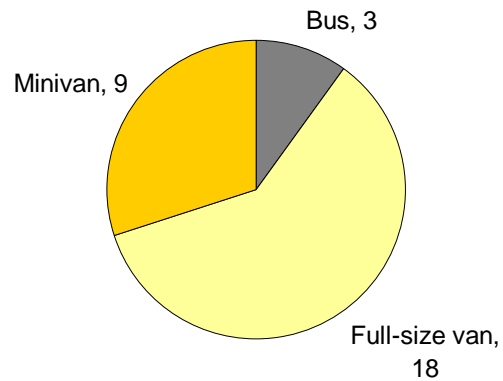
Tiedown Use/Performance



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Vehicle Type



Conclusions/Observations

- Wheelchairs are generally being effectively secured in different types of crashes
- Occupants are not properly using 3-point belt restraints:
 - poor training on how to position seatbelts on people in different types of wheelchairs
 - lack of knowledge
 - user modifications of belt restraints
 - wheelchair interference problems

The Belt Restraint Problem



Planned Outputs

- Peer-reviewed journal publication in 2008
- Articles in consumer magazines

Plans for Year 2

- Continue to identify, investigate, and document cases
- Implement NASS as a source of case identification



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Questions/Discussion

- Other recruitment strategies



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