Task: T-1 Design Criteria for Transport Wheeled Mobility Devices

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Rationale

Motor vehicle seats are designed to protect their occupant in a crash. Wheelchairs designed for normal mobility are not commonly designed to be crashworthy. This task was intended to ultimately provide manufacturers with design guidance for producing wheelchair products intended to serve as seats in motor vehicles.

Goals

1. Develop design strategies and criteria for safer transport of Wheeled Mobility Devices (WMDs).
2. Facilitate the commercial availability of transport WMDs manufactured in accordance with nationally recognized industry standards.

Methods Summary

This task has relied upon a combination of computer simulation and experimental testing. Computer crash simulation models were developed and validated for use in the study of factors influencing injury risk of wheelchair occupants in a crash. A wheelchair transportation-specific Injury Risk Assessment method was developed and used in the comparison of injury risk associated with various wheelchair transportation scenarios.

Outcomes Summary

- Developed and validated a production powerbase, dynamic model using crash simulation software.
- Developed and validated a dynamic model of a conventional production power wheelchair.
- Investigated the influence of rear securement point location on frontal crash safety using developed conventional power wheelchair and powerbase models.
- Defined "transport wheelchair" design criteria using computer simulation.
- Developed an Injury Risk Assessment Method appropriate to the WMD transportation crash environment.
- Evaluated injury risk associated with various securement configurations through the use of the developed Injury Risk Assessment Method.
- Evaluated the affects of shoulder belt anchor location on wheelchair crash safety.
- Surveyed 80 various types of WMDs and developed characteristics database appropriate for use in WMD transportation design and research.
- Through the use of the WMD database, redefined the ISO/SAE surrogate test wheelchair to better represent production powered wheelchairs.
- Awarded a "Wheelchair Integrated Restraint System" STTR grant to investigate the integration of a total occupant restraint system.
- Demonstrated the occupant protection advantages associated with a wheelchair integrated restraint as compared to vehicle-mounted restraint systems through the use computer simulation and the developed Injury Risk Assessment method.
- Developed a psuedo-dynamic test to evaluate the crashworthiness of commonly used caster assemblies.
- Evaluated the crashworthiness of common wheelchair caster assemblies using developed test methods.
- Evaluated the crashworthiness of commercially available wheelchair seating systems through the use of FMVSS 207 'Seating Systems' test methods.

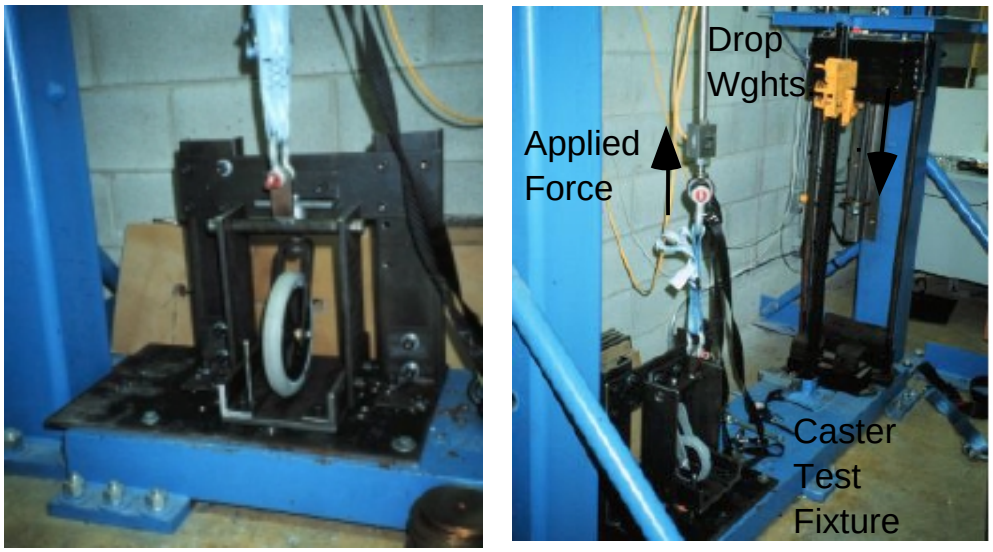

Figure 42 – Dynamic Drop Testing of Caster Assemblies

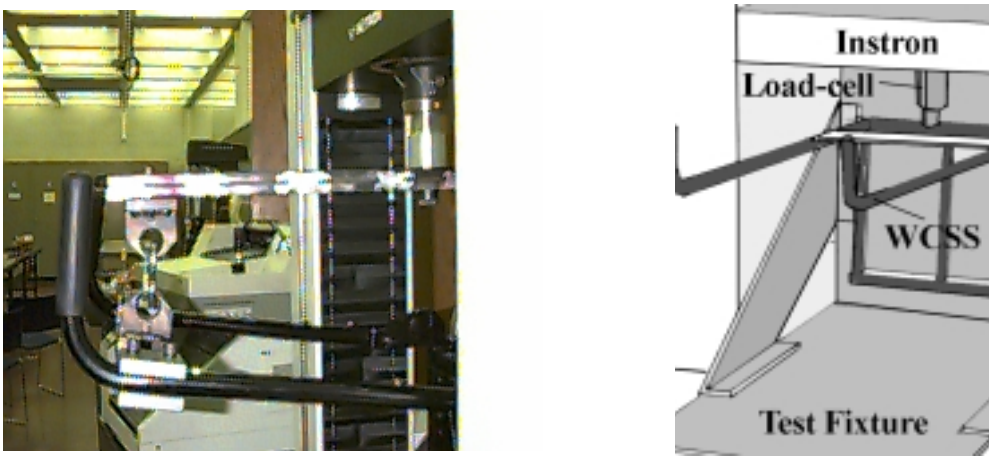

Figure 43 – FMVSS 207 Seating System Testing of Wheelchair Seats

Recommended Future Research

Future research efforts will focus on the crashworthiness of wheelchairs and their components in rear and side impact scenarios. Additional efforts related to the study of frontal impact will concentrate on the development and validation of a computer model to predict occupant submarining when seated in a wheelchair. Various seating characteristics will be evaluated to determine their influence on injury risk and in particular submarining.

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