Researchers in UMTRI's Biosciences Group have been working for more than thirty-five years to improve transportation safety for people who remain seated in wheelchairs when traveling in motor vehicles, and have been leaders in the development of industry wheelchair transportation safety (WTS) standards.

UMTRI's Biosciences Group conducts sled-impact and related tests of wheelchairs, wheelchair seating systems, and wheelchair tiedown and occupant restraint systems (WTORS) to determine their frontal-impact performance to national and international (ISO) industry standards.

IMPACT SLED

- UMTRI's impact sled operates on a rebound principle, achieving the desired velocity change (i.e., delta V) by reversing direction during the impact event.
- For typical WTS frontal-impact testing, the sled platform is decelerated to achieve a change in speed of 48 kph (30 mph) using a barrier deceleration pulse similar to a frontal impact of a full-size van or minivan typically used by occupants seated in wheelchairs.

WHEELCHAIRS

Wheelchairs are tested in accordance with:

- RESNA WC-4:2012 Section 19 (WC19) *Wheelchairs used as seats in motor vehicles, or*
- ISO 7176-19 *Wheeled mobility devices for use as seats in motor vehicles*

These standards include test methods for evaluating wheelchair frontal-impact performance and the design of wheelchairs with regard to tiedown clear paths, lateral stability during travel, securement-point accessibility, and accommodation for proper positioning of vehicle-anchored belt restraints on passengers in wheelchairs.

WHEELCHAIR SEATING SYSTEMS

Complete seating systems are tested in accordance with:

- RESNA WC-4:2012 Section 20 (WC20) *Wheelchair seating systems for use in motor vehicles*, and/or
- ISO 16840-4: *Wheelchair seating – Part 4: Seating systems for use in motor vehicles*

Testing is performed by installing the seating system on an adjustable surrogate wheelchair frame (SWCF).

WHEELCHAIR TIEDOWN & OCCUPANT RESTRAINT SYSTEMS

WTORS are tested in accordance with:

- RESNA WC-4:2012 Section 18 (WC18) *Wheelchair tiedown and occupant restraint systems for use in motor vehicles (*an updated version of SAE J2249), and/or
- ISO 10542-1: *Wheelchair tiedown and occupant restraint systems for use in all motor vehicles – Part 1: Systems for forward-facing wheelchair-seated occupants*

To evaluate the frontal-impact performance of WTORS intended for general use, both standards specify the same 85-kg (187-lb) surrogate wheelchair (SWC) to dynamically load the tiedown/securement system and a 76-kg (170-lb) anthropomorphic test device (ATD), or crash-test dummy, to load the belt-restraint system.

INSTRUMENTATION

- Signals from test instrumentation, such as load cells and accelerometers, are digitized live using a data-acquisition system (DAS) mounted to the impact sled.
- All test signals are filtered to the requirements of SAE J-211.
- Graphs of test data, such as time histories of sled deceleration, tiedown loads, and ATD instrumentation, and calculated results, such as sled change in velocity and average sled deceleration, are available within minutes after a test.
- Precise measures of peak ATD, wheelchair, and/or surrogate wheelchair excursions from analysis of high-speed videos.

CRASH-TEST DUMMIES

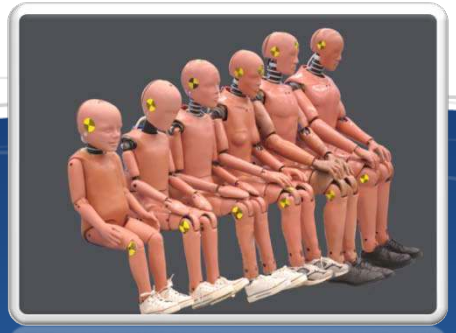
Several different sizes of ATD, as listed below, are available for use in wheelchair, seating-system, and WTORS tests. The ATD used in a wheelchair or seating-system test is selected based on the user weight capacity for the wheelchair or seating system.

3-Year-Old Child (15.5 kg)
6-Year-Old Child (23.4 kg)
10-Year-Old Child (35.3 kg)
Small Adult Female (48.9 or 59.0 kg)
Midsize Adult Male (78.0 kg)
Large Adult Male (102.0 kg)

Most ATDs are instrumented to measure head and chest accelerations, although WTS standards do not require these measures for pass/fail criteria. Additional mass can be added to the ATD upon request.

TEST REPORTS

Each sled-test report includes descriptions of the sled operation and test setup, a summary of test results and compliance with performance criteria of WTS standards, pre-test and post-test color photos, and output of test instrumentation. Copies of high-speed videos taken at 1000 frames per second, digital copies of all test photos, and the test report are also available to each test sponsor through a password-protected and secure online database.



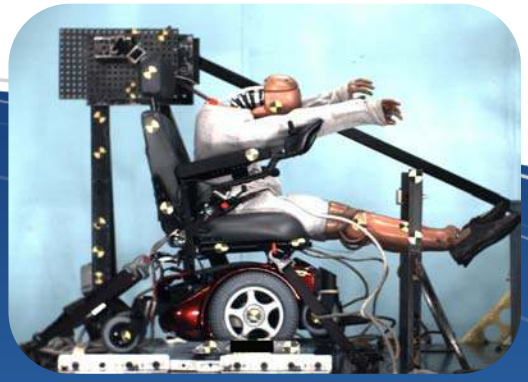
For further information contact:

Nichole Orton
nritchie@umich.edu
Ph: (734) 936-1107
Lab: (734) 647-0551
Fax: (734) 647-3330

Lawrence Schneider
lws@umich.edu
Ph: (734) 936-1103
Fax: (734) 647-3330

UMTRI is committed to research that advances safe and sustainable transportation for a global society. For nearly 50 years UMTRI has responded to the research needs of industry and government by drawing on our strengths: our geographical location, our partnerships with government and industry, and our scholarly collaborations across the University of Michigan.

UMTRI
UNIVERSITY OF MICHIGAN
TRANSPORTATION RESEARCH INSTITUTE



Testing Products to Wheelchair Transportation Safety (WTS) Standards

Wheelchair Transportation Safety Research Program
UMTRI Biosciences Group