

SAE - WHEELCHAIR SECUREMENT AND RESTRAINTS TASK GROUP

**Meeting Minutes, January 28, 1997
Orlando, Florida**

1. Roll Call, Acceptance of Minutes, Document Identification

Meeting attendance was recorded and is attached. Minutes (WR150) from the previous Dallas meeting (8/96) were accepted as distributed. The following documents were identified for this meeting.

WR150 - Minutes from Aug 1996 Dallas, Texas meeting

WR151 - Agenda-Jan 28, 1997 meeting

WR152 - Fax from Q'straint to D. Hobson - Jan 22, 1997

WR153 - ISO Voting comments from Beneficial Designs - Jan 17, 1997

2. Finalize Agenda

Item 7.5 "Harmonization of ISO, Sowhat and SAE Documents" was added to the meeting agenda which was accepted as proposed.

3. Update on CSA activities

No CSA representatives were present, therefore a CSA progress report was not provided at this meeting.

4. Update on Orlando ISO meeting

- The last ISO meeting was held November, 1996 in Orlando. ISO 10542 WTORS was in the voting process during the time of this meeting, therefore meeting discussions focused primarily on 7176/Part 19. Voting comments on 10542 will be addressed at the May 1997 ISO meeting.
- Testing of unique combination securement systems-wheelchairs will be addressed under Part 5 of 10542. ISO 10542 will be organized as follows: Part 1 General, Part 2 Strap-Type Tiedowns, Part 3 Docking Systems, Part 4 Clamping, and Part 5 Specific Combinations of Wheelchairs and Securement Systems.
- ISO 10542-Part 1 will require testing using only the surrogate wheelchair.
- WG6 will submit three new work items (i.e. Parts 3,4,and 5) to the Secretariat to seek approval for their inclusions in the ISO10542 scope. International voting will be necessary before these items can be officially added to the scope.
- 7176/Part 19 will be targeted for voting this month (1/97). To meet this goal the scope of Part 19 was decreased and some compromises were made. This process will allow for international feedback on this document. Part 19 voting comments may be available in May, 1997.

- Currently, 7176/19 provides General Requirements and addresses securing wheelchairs by various means of securement. Notes have been added to the document indicating that addendums will follow. Testing will be accomplished using commercial securement systems. The document does not require a specific type or number of securement points.

5. Update on SOWHAT activities

- New terminology has been defined by the SoWhat committee to describe wheelchairs complying with the ANSI/RESNA Standard: “Transit Wheelchair”. Jean-Marc Girardin raised a concern that this terminology may suggest that transport is limited to the transit industry alone, which is not the intent.
- The full SoWhat committee met in Nov, 1996. A draft document which is close to completion, was presented at this meeting. The document version presented at this meeting required that securement point geometry be compatible with hook-only type end fittings. The document also required a lap belt to be provided with the wheelchair and allowed for the use of commercially available WTORS in testing. The committee requested that the research group re-evaluate these requirements.
- In a subsequent research team meeting (Jan 27, 1997) the following outcomes resulted:
 - Securement point geometry will not be limited to compatibility with hook-only end fittings. Securement point geometry will be similar to the currently specified ISO Part 19 geometry which specifies a slot which will allow for the use of strap-type end fittings. A letter detailing this preliminary decision will be submitted to the full committee for their review, comment and voting.
 - The research group will re-evaluate the wheelchair weight at which 4 rear securement points are required based upon recent accident frequency statistics. The probability of a 20g/30mph frontal crash in large vehicles is very low; a 20g/30mph level of crash severity is a concern primarily for personal/private vehicles. Therefore, heavy wheelchairs transported on private vehicles are the greatest concern and should be equipped with 4 rear securement points. The private vehicle is an environment where 4 rear securement points/straps can be most readily accomplished and controlled. The user manuals provided with purchase of will recommend that wheelchairs used in a private vehicles and weighing greater than a pre-defined weight should use four rear securement straps.
Eugene Blumkin expressed concern that users will not likely use 4 rear straps. He stated that mini-vans may pose space problems related to the installation of 4 rear tiedowns.
 - Wheelchair-mounted lap belts remain a requirement. Transit wheelchairs must be tested with a lap belt mounted to the wheelchair. Lap belt anchorage may be accomplished through retrofit or integral to the wheelchair’s design.
 - The research committee has agreed that testing of transit wheelchairs shall be accomplished through use of surrogate WTORS alone; not commercial WTORS.
 - A mailing to wheelchair manufacturers will be used to obtain feedback on securement point geometry and securement point location, along with the content of the entire document.

- Will use voting on 7176/Part 19 as an opportunity to bring the ISO and Sowhat documents closer in harmonization regarding sec point geometry.
- A companion document describing the intent, application and background of the Sowhat Standard will also be prepared by the research group.
- Jean-Marc Girardin raised a concern that vehicle operators will not be able to distinguish between postural belts and safety belts in the future.
- Jean Marc Girardin expressed that it would be desirable to have ISO 7176/19 also require testing with wheelchair-mounted lap belts.

5.1 Q'straint Faxed Letter (WR152), Jan 22, 1997

- This letter expressed a concern of driver confusion with the requirement of 4 rear tiedowns.
- Ken Digges stated that we should address in subsequent phases of J2249 those wheelchairs which exceed the weight of the surrogate, and are transported in private vehicles.
- Accident statistics indicate that the need for 4 rear securement straps is primarily in private vehicles, which alleviates some of the concerns expressed in the Q'straint letter.

6 Review of voting results and comments on SAE WTORS-J2249

- SAE J2249 was approved unanimously by voting members with only several minor comments. Most comments were editorial. One non-editorial comment requested eliminating application to public transportation. This issue has been previously discussed by the group with agreement that the scope will include public modes of transportation. Larry Schneider has incorporated applicable comments into the final version of the document which was sent to SAE. SAE has formatted and returned this document for final review. Upon completion of this review and return to SAE, the standard will be available for purchase within 6 weeks.
- SAE will provide the committee with two official copies of the standard. The Chairman will make copies of the final standard and distribute it to members of the committee. Members agreed to not reproduce standard.
- This committee is now responsible for educating the industry in the use of the standard. To this end the University of Pittsburgh RERC will facilitate compiling a companion document for this standard.

7. Clarification Phase II Work Priorities:

7.1 SAE-J2252-Revised Surrogate Drawing Package

- A Gesac representative was not present at the meeting. Ken Digges reported that Gesac has recently changed locations and has not been able to work on the drawings. He indicated that Gesac will complete the drawings within the next 2 months.

7.2 Fabrication and testing of new surrogate W/C

- How will a new surrogate wheelchair be financed? At the last meeting the group discussed approaching Gary Pollack about SAE funding for the development of the new surrogate. It

was estimated that the cost of the new surrogate wheelchair is \$5-6K. This cost could be shared between testing laboratories and WTORS companies who would use the test device.

- Gesac may also be interested in building the new surrogate wheelchair.
- Q'straint indicated that they could obtain a price quote for fabricating the surrogate.
- The key to moving forward on producing the surrogate is obtaining the modified drawings so that quotes could be obtained. Drawings will be distributed upon completion.
- SAE J2252 Introduction, Preface, and Foreward should be updated along with the drawings. The revised document will be passed through voting process.

7.3 Guidelines for application, education and monitoring of J2249

- It was pointed out that the NASS database is now recording the presence of adaptive devices in accidents. These statistics should be monitored on an on-going basis by this group.
- It is important to capture and disseminate the rationale behind this standard. This could be accomplished in the form of a SAE paper or document. For example, the rationale related to CSA has been completed by Larry Schneider previously, and was published as a Biokinetics report. Doug Hobson suggested that Larry Schneider be funded through the Pitt RERC to prepare such a document with focuses on WTORS. (This approach would parallel the effort of the Sowhat "transit wheelchair" companion document.) Upon completion it would be offered as an RERC technical report. The target audience would consist of consumers, WTORS manufacturers and transporters. The content would include the rationale behind the use of the surrogate wheelchair in testing, the basis for selecting the test crash pulse, the purpose of sled testing, discussion of warnings, installation best practices, etc.

7.4 Docking devices

- Doug Hobson has prepared a draft of new items for ISO which includes docking systems. Should this group undertake a parallel effort in SAE?
- Larry Schneider indicated that our current J2249 does include docking systems, whereas ISO has chosen to handle docking systems as a separate Part 3. SAE J2249 has provisions for testing of docking systems.
- It was agreed that the committee will work with and monitor the activities of ISO 10542, Part 3 on docking systems. SAE will not have a separate work item related to docking systems.

7.5 Harmonization with ISO, SOWHAT, and CSA documents

- SAE J2249 WTORS and ISO 10542 WTORS are fairly compatible at this time.
- ISO 7176/19 and ANSI/RESNA W/C 19 have a number of differences between them in their current versions. These differences include:
 - the use of commercial WTORS in sled testing is permitted in ISO 7176/19, but not in ANSI/RESNA W/C 19

- a wheelchair-mounted lap belt is required for testing under ANSI/RESNA W/C 19, but is optional in ISO 7176/19
- Larry Schneider will forward a copy of SAE J2249 to CSA for their review and update.

7.6 Rear/Side impacts

- Ken Digges presented accident statistics related to side/rear impacts at a previous SAE meeting.
- The Australian WTORS standard addresses side and rear impact. A review of this document should be done to evaluate the content. Deceleration pulse severities in testing are reduced in this standard to correspond with accident crash pulses found in these impact modes.
- Jean-Marc Girardin reported that testing in accordance with the Australian Standard was performed on the Q'straint WTORS system. The testing consisted of a 32 kph side impact test and 17 kph rear impact test.
- FMVSS 214 regulations for side impact use a crash severity which is vehicle specific (between 15-17mph).
- In side impact the angles of tiedowns in the longitudinal plane are important to effective wheelchair securement.
- Greg Shaw pointed out that accident statistics should dictate the priority for considering side and rear impacts.
- The primary concern in side impact collisions is occupant ejection. In rear impacts the primary concern is neck injury.
- The addition of testing in these directions would broaden the standard to provide protection for impacts in all directions. Also, testing in side and rear would be useful for docking system evaluation. It was suggested that compliance in frontal impact testing conditions of WTORS would probably translate to passing in other directions.
- The surrogate wheelchair must be evaluated for use in side and rear impact testing also.

7.7 Universal Interface standard

- Before docking technology can move forward, the various industries must agree on a universal securement interface standard.
- It was expressed that this may be more of a wheelchair (ANSI/RESNA) issue than a WTORS issue.
- The question was raised as to how wheelchair users feel about adding this hardware to their wheelchairs? Doug Hobson reported that Pitt focus group participants comprised of power wheelchair users are in support of this interface.
- The group agreed that we will monitor the progress of this development as an SAE group but will not cite it as work item at this time.

7.8 Combined Zones - shoulder belt anchors (adult and children)

- At a previous meeting Gina Bertocci presented a review of shoulder belt fit across various occupant sizes, indicating that a fixed upper shoulder belt anchor point could render shoulder belts ineffective when used in mixed occupant populations. Additionally, varying wheelchair seat heights compound the problem of poor shoulder belt fit when using a fixed anchorage for various occupant sizes.
- It was suggested that the use of an integrated shoulder belt (mounted to the wheelchair) is one solution to this problem. It was also suggested that a guide on the wheelchair to better direct the shoulder belt could be another solution. Furthermore, an adjustable vehicle mounted anchor could also aid in better belt fit across various populations.
- Some wheelchairs used for pediatrics currently employ an integrated shoulder belts.
- The group agreed that the standard provides guidance to installers of WTORS for positioning shoulder belt anchorages for various occupant sizes. The market will develop additional products and solutions to meet the needs.
- It may be desirable to incorporate additional diagrams of various occupant sizes and corresponding wheelchair seat heights vs. shoulder belt anchor zones in the companion document.
- It was also pointed out that our standard currently prohibits integrated restraints which transmit load through the wheelchair. (This will be in conflict with SAE requirements for an integrated lap belt.)

7.9 Rear facing in frontal crash

- This item would require establishing design criteria for rear facing accommodation. Issues such as head restraint, backrests, bulkheads, etc. would need to be considered.
- This item will remain on the work list to be addressed in the next phases of the Standard.

7.10 Lo-G securement

- Europeans have been transporting wheelchair users employing compartmentalization principles. Montreal is preparing to embark on a similar pilot study which evaluates wheelchair compartmentalization. The premise is that accident statistics indicate low probability of an accident occurring on large transit vehicle, therefore designs can be based purely on normal driving conditions.
- A problem with the compartment approach is that this method relies upon wheelchair brakes. A padded bulkhead behind the rear-facing is also typically used in this concept. Europeans are accustomed to traveling rear-facing which is necessary for the success of this concept. In North America travelers are not accustomed to being transported in the rear facing orientation.
- Recent testing at Pitt is studying various vehicle flooring materials and wheelchair sliding which must be understood to successfully implement the compartmentalization concept. There is a concern that steep terrain may lead to sliding of the wheelchair.
- It was suggested that we should evaluate crash severities which are appropriate for securement system design on various types of vehicles. This could be accomplished based upon accident statistics. For large vehicles roll-overs (2-3g) become more of the issue as opposed to high impact crashes. Perhaps one approach is to design for

wheelchair securement in a rollover. Rollovers usually result in only minor injuries so long as the occupant is not ejected and is maintained in their seat, or in this case an effectively secured wheelchair.

- Ken Digges suggested that along with Lo-"g" needs we should also evaluate wheelchairs which exceed the weight of the surrogate wheelchair (187 lb.) as a part of our next phase of the standard. We recognize that power wheelchairs are of weights which exceed 187 lb. This issue also arises with the SOWHAT requirement to integrate pelvic belts, which increase the loading on the securement system. It was suggested that we would have a standard which increased the surrogate wheelchair weight and also included an integrated restraint. Perhaps the surrogate wheelchair could be ballasted with additional weights to represent this scenario.
- For docking systems, unlike four-point tiedowns, off-center impacts are also an issue since less than four points of wheelchair securement are generally used. Testing could be conducted at 15 degrees off center to evaluate docking system performance. Larry Schneider also expressed a concern regarding normal driving maneuvers vs. stability of a wheelchair secured by a docking system.

8. Future Work List and Priorities:

1. Wheelchairs with weights exceeding the surrogate wheelchair weight of 187 lb. and including an integrated pelvic restraint.

- This issue could be accomplished through modification of the existing document.
- This item will be assigned a high priority in future work.
- The Chairman will request to add this item to our work list at the ADSC meeting.
- Ken Digges will review SAE J2249 and provide modifications to account for increased wheelchair weight and occupant restraint loads.

2. Lo-g Securement

- Henry Richardson (NHTSA) will be updating the database on wheelchair motor vehicle accidents which should be monitored by this group.
- This will be added to the group's priority list.
- Doug Hobson and Greg Shaw will take the lead on this item.

3. Docking System Performance in Normal Driving Maneuvers

- The group will monitor ISO developments related to this item.

4. Side and Rear Impact

- Low floor minivans are currently tested under side and rear impact conditions.
- Eugene Blumkin and Charian Thomas will review existing Federal Regulations and the Australian Standard to identify side and rear impact related requirements.

5. Driver Restraints

- Due to time constraints, this item will be discussed at a future meeting.

9. Meetings Planning

9.1 Next ISO meeting

This next ISO meeting will be held during the week of May 12th in Metz, France.

9.2 Next SOWHAT meeting

The meeting previously scheduled for March in Tulsa will be postponed. Arrangements have not been made to reschedule at this time.

9.3 Next SAE meeting

The next SAE meeting will be held in Arlington, VA in August. This meeting will be in conjunction with the ADED conference.

10. Adjournment

The Chairman thanked everyone for a productive effort and adjourned the meeting at 4:30 pm.