

VI. Guidelines for WTORS Transportation Authorities and Installers

The information contained within this section of the Companion Document is intended to guide transportation authorities and WTORS installers. A well designed WTORS is ineffective unless it is properly installed. Accordingly, installers of WTORS must be accomplished using experienced technicians only. Installers are urged to consult complete installation instructions accompanying purchased WTORS, and supplemental information contained in the SAE J2249 document. Several of the key provisions are highlighted below.

- _A complete WTORS consisting of a minimum of four tiedowns, a pelvic restraint and a shoulder restraint must be provided at each wheelchair securement station.
- _Inspect WTORS to verify that WTORS are labeled indicating compliance with SAE J2249.
- _WTORS should be installed for use only with forward-facing wheelchairs.
- _Do not in any way alter the WTORS components, as their crash integrity may be compromised.
- _Do not substitute WTORS parts or components unless, approved by the WTORS manufacturers.
- _Verify that complete manufacturer's installation instructions are contained within the packaging.

Instructions should include:

- _diagrams and methods for fastening WTORS anchorages to the vehicle, along with a description of the types of anchorage fittings that are suitable for use with the vehicle-installed anchorages,
- _a description of how the WTORS is to be used as well as the purpose and function of all components,
- _a drawing, parts list, or receiving inspection checklist for all components required in the installation,
- _ if fasteners are not supplied as part of the WTORS assembly, the minimum specifications for all wheelchair tiedown and occupant restraint anchorage fasteners and related components. The specifications shall be based on the material, size, and quantity of anchorage fasteners used in the simulated frontal impact test,
- _recommended distances between anchor points of four-point wheelchair tiedowns. The figures below provide recommended tiedown angles.
- _recommended locations, relative to wheelchair tiedown anchor points, for anchor points of pelvic restraints that are intended to anchor directly to the floor of the vehicle, and an explanation that pelvic-restraint anchor points should be selected to achieve side-view projected restraint angles of 30 degrees or greater, and preferably between 45 and 75 degrees, to the horizontal, as shown in figure

below, to reduce the possibility of the pelvic restraint loading the occupant's abdomen,

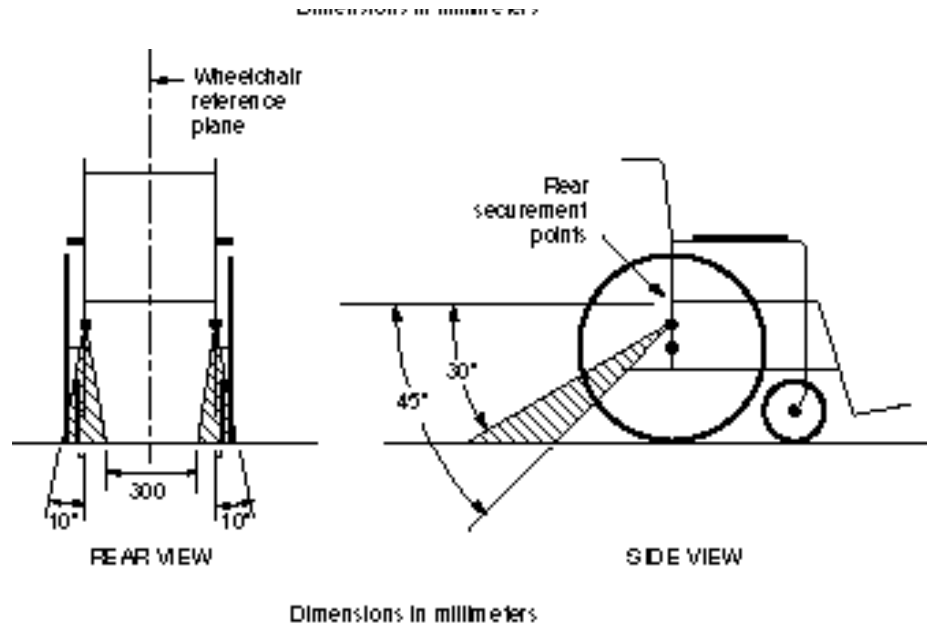


Figure 9-Preferred angles and locations of rear wheelchair tiedown straps and vehicle anchor points. Note that angles indicated are obtained by projecting the angle of each tiedown strap onto a vertical plane parallel to the wheelchair reference plane (side view) or onto a vertical plane that is perpendicular to the wheelchair reference plane (rear view).

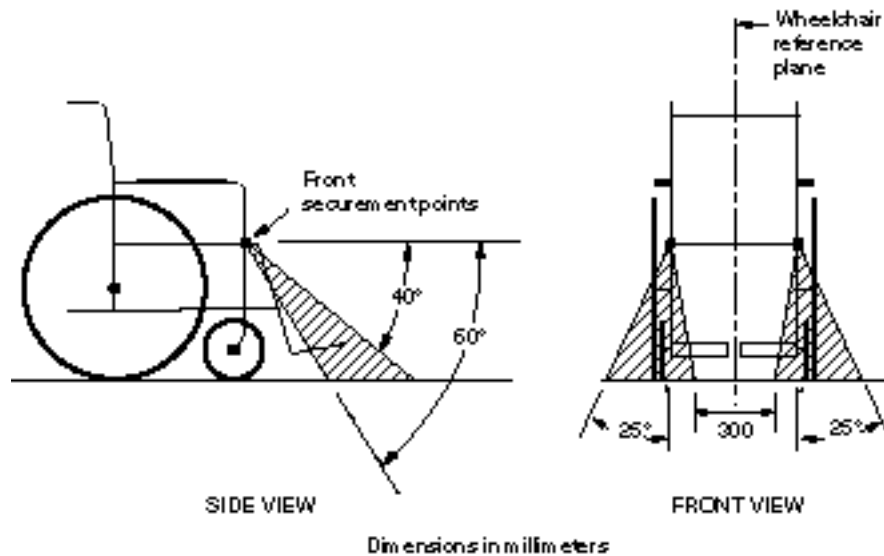


Figure 10 Preferred angles and locations of front tiedown straps from wheelchair securement points to vehicle anchor points. Front tiedowns should be angled out for lateral stability when possible.

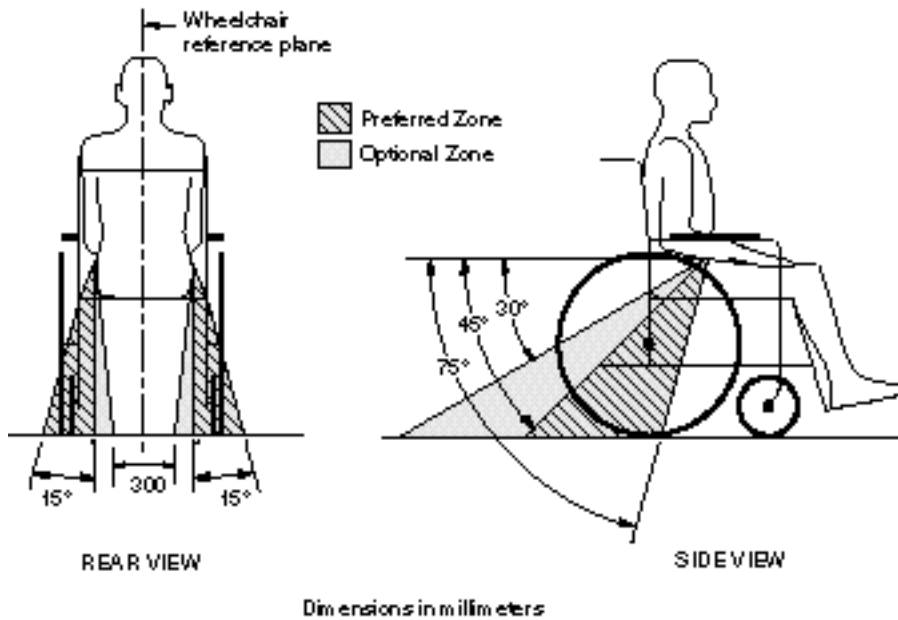


Figure 11 Preferred and optional angles for pelvic restraints.

- Recommended locations for upper anchor or upper guide support points of shoulder and harness restraints, and an explanation that these points should be positioned so that the belt webbing passes over the midpoint of the occupant’s shoulder and at a height that is at or above the level of occupant’s shoulders so as not to impose downward loads on the spine.
- Figure 12 and table 6 below provides guidance for the installation of shoulder belt anchorage points. Note the variation in dimensions depending upon occupant population.

Table 6
Typical values of SH, SB, W and seat height for Different Size Occupants

Occupant Size	Shoulder Height - SH (mm)	Half Shoulder Breadth - SB (mm)	Half Neck Breadth - W (mm)	Seat Height (mm)
6 year old	775	130	50	380
small female & 14-year-old	1000	175	75	450
midsize male	1100	200	75	500
large male	1200	210	75	550

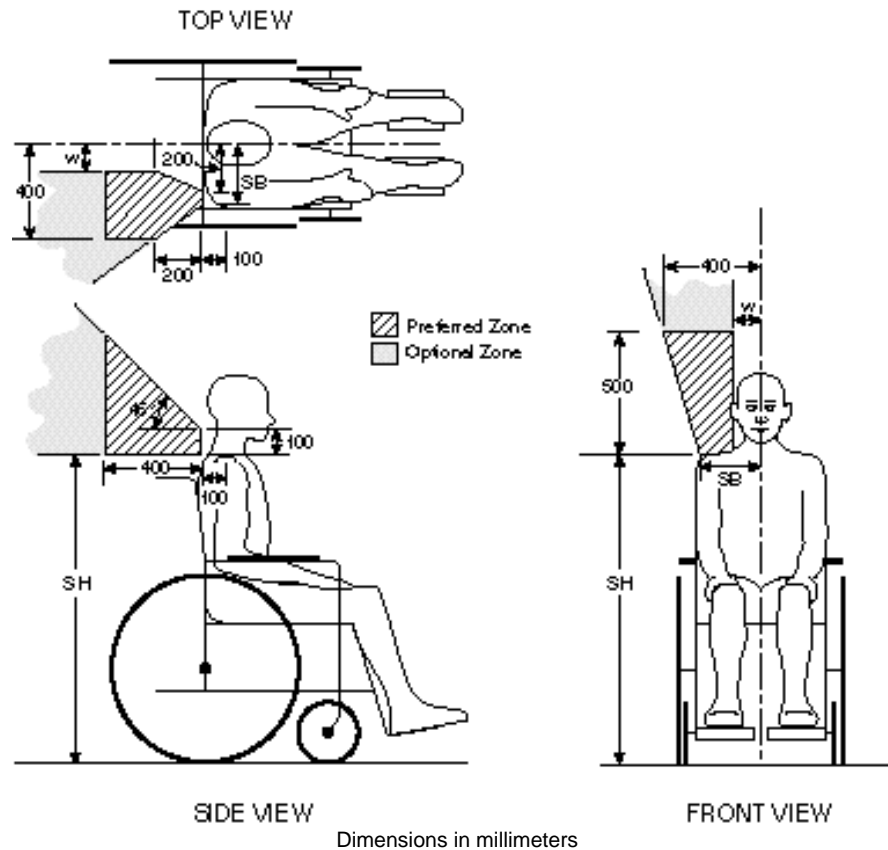


Figure 12-Preferred and optional zones for upper vehicle anchor point of shoulder restraint.

- _A forward and rearward clear zone should be provided so as to reduce potential for head impact with the vehicle interior in a crash. The clear zone should be approximately 16" behind the wheelchair seated occupant's head and roughly 37" in front of the occupant's head. This zone would be provided through the full height to the occupant's head, and should be the width of the securement station.
- _If a head restraint is anchored to the vehicle, a vehicle- anchored back restraint must be provided to minimize rearward deflection of the wheelchair seatback to prevent neck injury.
- _Provide energy absorbing and flame retardant padding (complying with FMVSS 302) to cover vehicle structures near the wheelchair securement station.
- _WTORS anchorages must be installed only into structurally suitable vehicle materials and adequately reinforced to assure WTORS crash integrity. The WTORS manufacturer should indicate anchorage strength requirements in their installation instruction.
- _Tiedown straps and occupant restraint belts should be stowed to avoid theft, vandalism or soiling. Webbing should be protected against contact with sharp edges.
- _Wheelchair seated drivers of vehicles equipped with airbags, should consult the National Highway Traffic Safety Administration for advice

regarding airbag disabling, since the airbag may cause injury to those sitting too close.

- _In the case of any questions regarding the WTORS, consult WTORS manufacturer for guidance.