TRL Impact Sled Facility
Test Report

Thomashilfen für Behinderte

ANSI/RESNA WC/Vol 1. – Section 19
Wheelchair Frontal Impact Test

Test No. – 44TT01
Test Date – 18 October 2007

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Test Details

Test Centre	TRL Impact Sled Facility
Regulations	ANSI/RESNA WC/Vol 1. – Section 19
Test Type	Wheelchair Frontal Impact Test
Test No.	44TT01
Test Date	18 October 2007
Report Date	19 October 2007
Job No.	TS2282

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APPROVALS

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Test Specifications

The test was based on ANSI/RESNA WC/Vol 1. – Section 19. The test was carried out at ISF test facility of TRL, sled ref. ISF01. A P10 manikin, weighing 32kg, was used for the test.

Test Requirements

Test Object	Manufacturer	Reference Number	Description	Mass
Wheelchair	Thomashilfen	6788+6401	Twist^{EASyS} Size 2, A Chassis	21 kg
Wheelchair Tie-downs	Q'Straint	Q-5004-T2	L Track fitting kit	N/A
Occupant Restraints	Q'Straint	Q5-6410-T	Shoudler Belt	N/A
Anchorage	Unwin	RLL/D	LP Rail Fixed M8	N/A
Set up Concessions	P10 ATD			N/A

Wheelchair Measurements

Adjustment	Pre-test Measurement	Post-test Measurement
Hip ↑ Left (mm) HL	520 mm	510 mm
Hip ↑ Right (mm) HR	535 mm	516 mm
Mean Hip Height [HL + HR]/2	527.5 mm	513 mm
B-post rail, height above plate	1063 mm	1063 mm
B-post rail, height above shoulder	179 mm	248 mm
Wheelchair tie down angle [Front]	33°	32°
Wheelchair tie down angle [Back]	34°	36°
Pelvic Belt Angle	45.9°	N/A
Shoulder Belt Angle	30.5°	N/A

Photography

Video One high speed digital camera (Photron camera at 500 frames per second) was used. This was positioned to the right of the sled providing a side view for analysis.
Stills Pre and post test photographs were taken using a digital stills camera.

Instrumentation

Data Acquisition

The data was sampled at 20kHz, pre-filtered using a 3500Hz 6 pole Butterworth filter.

Sled Transducers

Location	Transducer ID	Calibration Date	Range (g)
Sled Left X	CV48	05/04/07	250
Sled Right X	CV78	05/02/07	250

Note: transducers are calibrated at least annually.

Data Processing

The data is filtered at CFC_60 and CFC_180 during post processing. The sled channels filtered at CFC_180 are integrated to produce sled velocity channels. The right and left hand sled channels are averaged to produce a sled mean acceleration at CFC_60 and sled mean velocity at CFC_180.

Velocity Measurement

The impact velocity is measured by a timer triggered by an optical interrupt.
Uncertainty of measurement at 14m/s is 0.04m/s.
The sled velocity change is the difference between the impact velocity and the rebound velocity (from the calculated meant trolley velocity).

Film Analysis

Film analysis is carried out using Photron Motion Tools version 1.1.6.0 supplied by Photron USA Inc. The uncertainty of measurement is ± 2 pixels, which on this test equates to ±4mm.

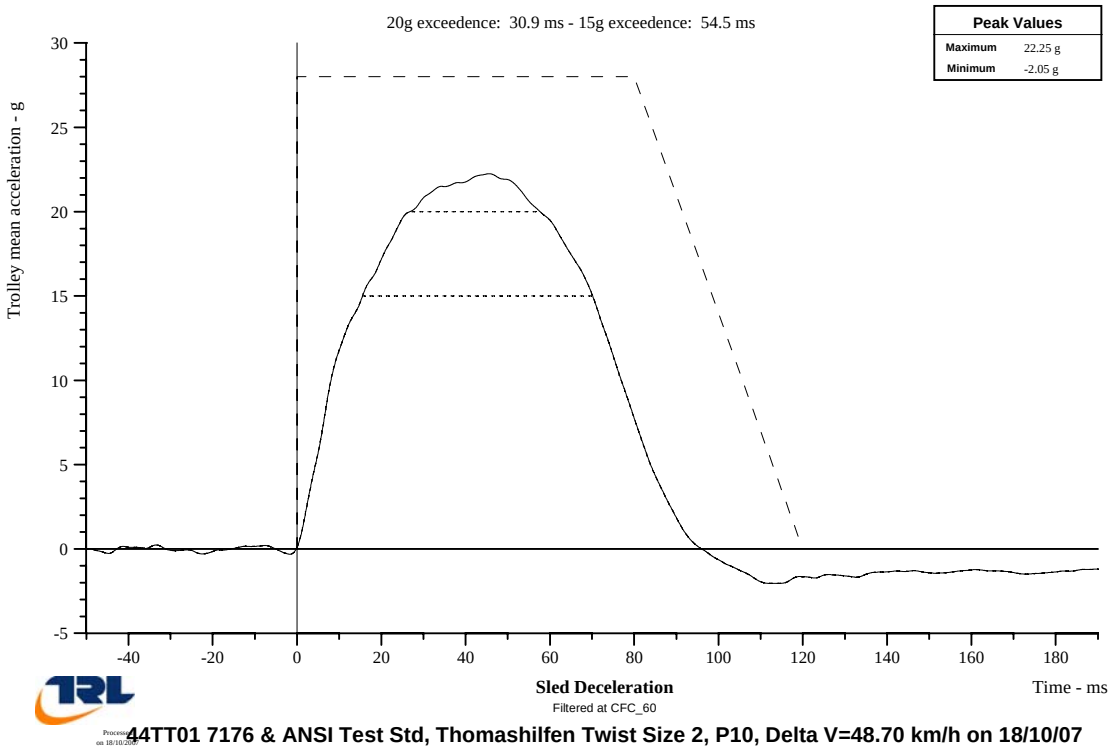
Test Results

The test criteria of this test are as per the section 5.3 of ANSI/RESNA WC/Vol.1 - Section 19 standard.

Section	Test Criteria	Results	Pass/Fail
5.3	**During the test**		
(h)	The horizontal excursions of the ATD and the wheelchair shall not exceed the limits shown below: (Draft limits for a P10)		
	- The wheelchair point P excursion [X_{WC}] shall not exceed 175 mm	117 mm	Pass
	- The ATD knee excursion [X_{Knee}] shall not exceed 325 mm	290 mm	Pass
	- The ATD front of head excursion [X_{headF}] shall not exceed 500 mm	351 mm	Pass
	The ATD rear of head excursion [X_{headR}] shall not exceed 400 mm	250 mm	Pass
i)	The wheelchair shall not impose forward loads on the ATD, which is considered to be achieved if the peak ATD knee excursion exceeds the peak wheelchair Point-P excursion by 10%: The ratio of [X_{Knee}] : [X_{WC}] shall exceed 1.1	2.48	Pass
l)	Batteries of powered wheelchairs, or their surrogate replacement parts, shall not move completely outside the wheelchair footprint, remain attached or tethered to the battery compartment, and not move into the wheelchair user's space (e.g., shall not contact the back of the ATD's legs).	Not Fitted	N/A
Section	**Test Criteria**	**Results**	**Pass/Fail**
5.3	**After the test**		
a)	The wheelchair securement points shall not show signs of material failure, other than deformation or yielding.	No visible signs of failure	Pass
b)	The wheelchair securement points shall not show deformation or distortion that prevents manual disengagement and removal of the hook end fittings of the surrogate tiedown system.	No tools needed	Pass
c)	At the end of the test, the wheelchair shall be in an upright position on the test platform.	Remained upright	Pass
d)	At the end of the test, the ATD shall be retained in the wheelchair seat in a seated posture, as determined by the ATD torso being oriented at not more than 45o to the vertical when viewed from any direction.	ATD remained upright and in a seated position	Pass
	Angle	35.9°	
e)	Rigid components, parts, equipment, or accessories in excess of 100 grams shall not become detached from the wheelchair during the test.	No visible signs of failure	Pass
f)	Wheelchair components that may contact the occupant shall not fragment or separate in a manner that produces sharp edges with a radius of less than 2 mm.	None separated	Pass
g)	Primary occupant load-carrying parts and components, including but not limited to, the seat, backrest, wheels, casters, axles, frame members, occupant restraint belts and occupant restraint anchorages, shall not show visible signs of structural failure.	No visible signs of failure	Pass
j)	The post test height of the average of left and right ATD H-points relative to the wheelchair ground plane shall not decrease by more than 20% from the pretest height.	Decreased by 2.75%	Pass
k)	Detachable seating inserts shall not break free from the wheelchair frame at any attachment point.	Inserts remained intact with W/C	Pass

Impact Graph

The processed sled deceleration pulse is given below:



(Figure A.1)

The test pulse criteria of this test are as per the Annex A of ANSI/RESNA WC/Vol.1 - Section 19 standard.

Annex A	Test Pulse Criteria	Results	Compliance
A.4.1	**Sled velocity change**		
	The sled shall be subject to a horizontal velocity change of 48 (+2/-0) km/h in the direction of impact	48.70km/h	Yes
A.4.3	**The processed sled deceleration time pulse, (Graph above)**		
a)	Falls within the marked area of Figure A.1	Yes	Yes
b)	exceeds 20g for a cumulative time period of at least 15 ms	30.9 ms	Yes
c)	exceeds 15g for a continuous time period of at least 40ms	54.5 ms	Yes
d)	has a duration of at least 75 ms from t_o (start time) to t_f (finish time)	>75 ms	Yes

Test Set-up Photo