

**DOCUMENT NUMBER**

DET-1268

DOCUMENT REVISION

A

Page 1 of 1

TITLE

FRONTAL IMPACT SLED TEST (Elite Mini w/ Mini Elan Headrest; Elite TR HD with Elan Headrest; IVC Flex3 with Elan Headrest; and MX2 Back)

1. Purpose and scope:

- 1.1. The purpose of this report is to document the results of a frontal impact sled test conducted on a selection of backrests. The test was conducted with the backrests mounted to an unoccupied test rig secured by a surrogate four-point, strap type tie down, using the sled deceleration pulse specified in Annex A of RESNA WC-4 (2012) Section 20.
- 1.2. The scope of this report applies to the following unoccupied wheelchair back systems (incl. headrests where indicated):
 - Matrx Elite Mini Back with a Mini Elan Head Support and Mini-Set Attachment Hardware;
 - Matrx Elite-TR HD Back with Elan Headrest and PBHD (Heavy-Duty) Attachment Hardware;
 - IVC Flex3 Back (EU) with Elan Headrest (incl. Flex 3 Adapter) and Flex3 Attachment Hardware;
 - Matrx MX2 Back and MX2 Attachment Hardware

2. Reference Documents:

ANSI/RESNA WC-4:2012 Section 20 (*Wheelchair Seating Systems for Use in Motor Vehicles*)

3. Acceptance Criteria and Test Methods:

Test Results must meet the minimum acceptance requirements of the referenced test standards.
Testing is to be conducted at an accredited test facility.

4. Results:

- PASS The requirements of Annex A (Sled Impact Conditions) from ANSI/RESNA WC20 (2012) have been met for the
 – FAIL wheelchair back systems identified in Section 1.2

5. Appendix:

Test Report #: **MC1601**

(Testing Conducted By: University of Michigan, University of Michigan Transportation Research Institute (UMTRI), September 27, 2016)

6. Summary of Revisions:

Rev	Author	Description	Change Order
A	P. Patten	Initial release	DCN-1907

Sled Impact Test

**MC 1601
Motion Concepts**

**Frontal Impact of Motion Concepts
1212 Mini with Mini Elan, Elite TR HD with Elan 10",
Flex 3 with Elan 10", and Mx2 Back, Attached to a Motion Concepts Test Rig
Secured by a Surrogate Four-Point, Strap-Type Tiedown**

Tested using the sled deceleration pulse specified in Annex A of ANSI/RESNA WC20
Wheelchair Seating Systems for Use in Motor Vehicles

Test Date: September 27, 2016

Submitted to:
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ACKNOWLEDGMENT AND DATA USE RESTRICTION

This test was sponsored by Motion Concepts of Concord, Ontario and was conducted using the sled impact test conditions set forth in Annex A of Section 20, ANSI/RESNA WC/Vol.4 *Wheelchair Seating Systems for Use in Motor Vehicles*, hereafter referred to as ANSI/RESNA WC20 or WC20. Advertisements and marketing literature should refer to the requirements and provisions of ANSI/ RESNA WC20, but should not refer to the University of Michigan, the University of Michigan Transportation Research Institute (UMTRI). Requests for copies of this report, test film, and video should be directed to the test sponsor.

TEST METHODS

This frontal impact test of three wheelchair seatbacks and their attachment hardware was conducted on the UMTRI impact sled using the Motion Concepts test rig and a sled deceleration pulse that complies with the corridor specified in Annex A of ANSI/RESNA WC20. The sled operates on the rebound principle, achieving a desired change in velocity by reversing its direction of motion during the impact event. The sled crash pulse is trapezoidal in shape and is reported as an average deceleration level in *g*. The sled velocity is monitored immediately before and after impact.

Data generated during the test were digitized live using a TDAS onboard data acquisition system. All signals were filtered to the requirements of SAE J-211. The photo documentation consisted of high-speed (1000-frames/sec) digital video from right and right-rear side views of the impact event. A strobe flash and simultaneous voltage pulse record and synchronize the onset of impact deceleration on video and transducer signals.

TEST SETUP

The Motion Concepts 1212 Mini with Mini Elan, Elite TR HD with Elan 10", Flex 3 with Elan 10", and Mx2 Back, were attached to the test rig. The front and rear tiedown straps were wrapped around the securement points provided on the test rig.

The test was conducted using 48-kph (30-mph) and 20-g average impact conditions to determine the frontal-impact response of the wheelchair seatbacks and their attachment hardware. The following table provides further details about the test equipment and setup.

SUMMARY OF TEST SETUP AND PRE-TEST MEASUREMENTS

<p>GENERAL TEST INFORMATION</p> <p>Test number Test date Rig type Test Samples</p> <p>Tiedown Occupant restraint Anthropomorphic Test Dummy (ATD) Orientation Sled platform Desired impact velocity (ΔV) Desired average sled deceleration</p>	<p>MC 1601 September 27, 2016 Motion Concepts 1212 Mini with Mini Elan, Elite TR HD with Elan 10", Flex 3 with Elan 10", and Mx2 Back, Attached to a Motion Concepts Test Rig Surrogate four-point, strap-type tiedown Not Applicable None Forward facing Rigid steel plate 48 kph (30 mph) 20 g</p>
<p>TEST RIG TIEDOWN</p> <p>Front-to-rear anchor-point distance Rear tiedowns Lateral distance between anchor points Angle wrt horizontal Angle wrt to wheelchair center plane Length (anchor point to securement point) Front tiedowns Lateral distance between anchor points Angle wrt horizontal Angle wrt to wheelchair center plane Length (anchor point to securement point)</p>	<p>1511 mm (59.5 in) 356 mm (14.0 in) 8 degrees 0 degrees 254 mm (10.0 in) 406 mm (16.0 in) 15 degrees 7 degrees 305 mm (12.0 in)</p>

TEST RESULTS

The Motion Concepts 1212 Mini with Mini Elan, Elite TR HD with Elan 10", Flex 3 with Elan 10", and Mx2 Back, Attached to a Motion Concepts Test Rig were remained attached to the Motion Concepts test rig at all attachment points throughout frontal impact loading. The following table summarizes the test results.

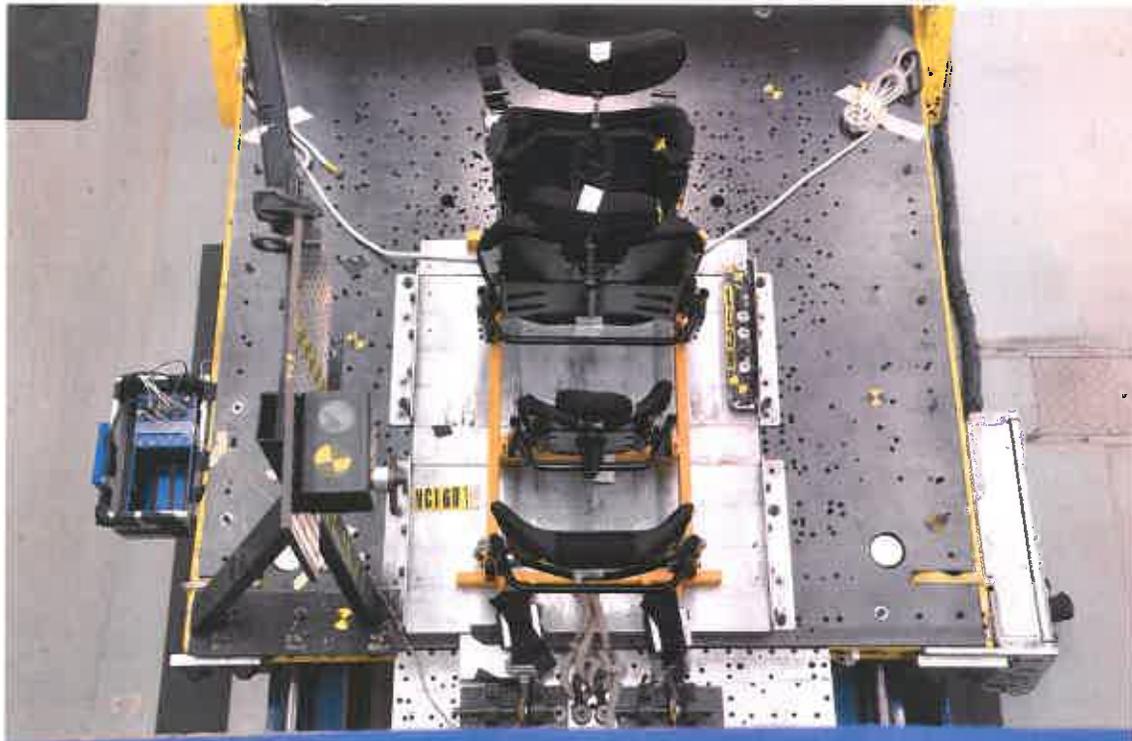
SUMMARY OF TEST RESULTS

GENERAL TEST INFORMATION	
Test number	MC 1601
Actual impact velocity (ΔV)	50.2 kph (31.2 mph)
Actual average sled deceleration level	20.4 g
Actual peak sled deceleration level	24.3 g
Total time of deceleration over 20 g	31.3 ms
Total time of deceleration over 15 g	68.0 ms
Deceleration pulse duration	76.4 ms

PRE-TEST PHOTOS



mc160101.JPG



mc160102.JPG

TEST AND POST-TEST PHOTOS

MC1601

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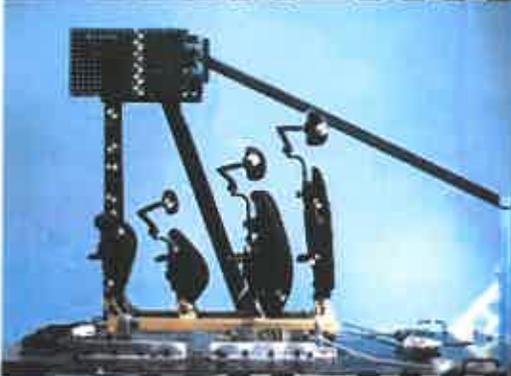
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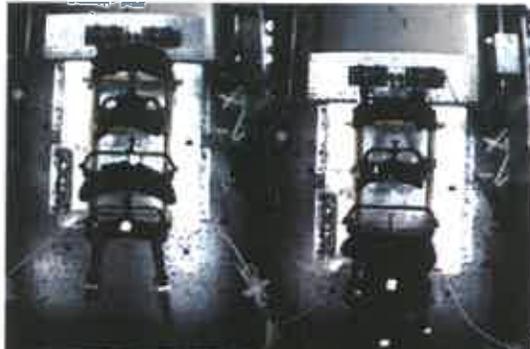


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MC1601

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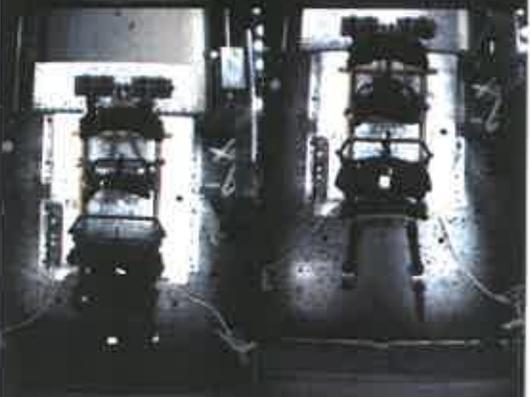
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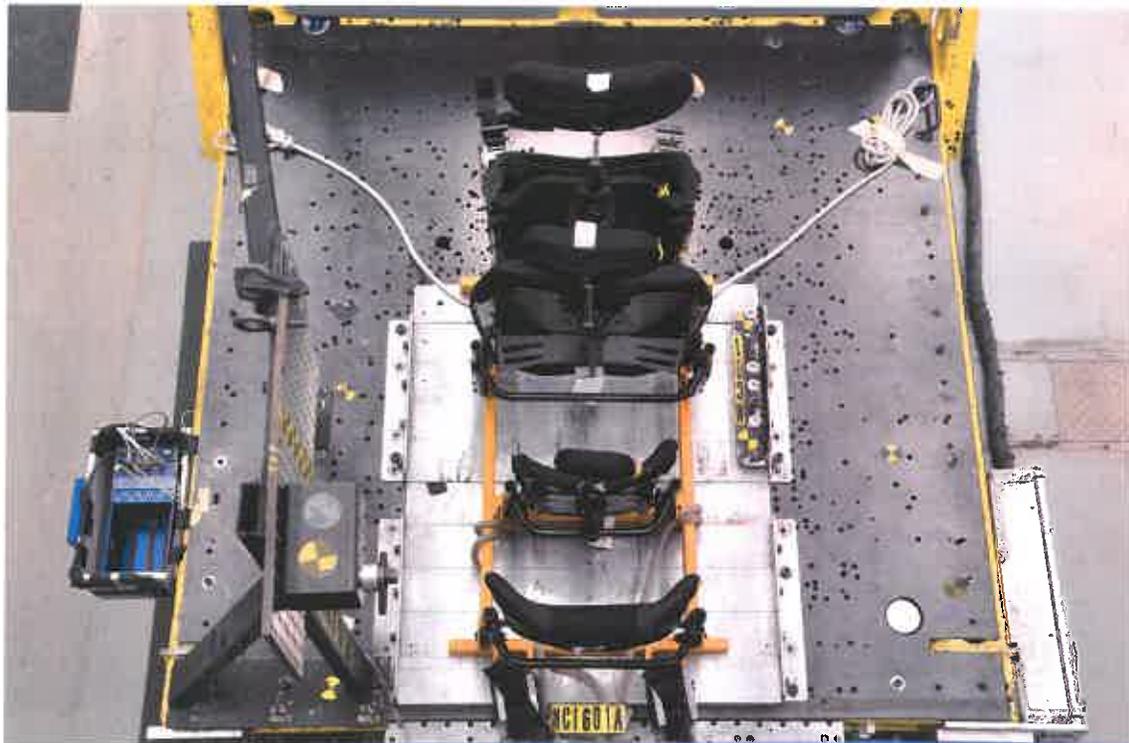
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mc1601A01.JPG



mc1601A02.JPG

TEST SIGNALS

Nominal = 30 mph/20 g

Pressures: 116.6/962

Actual[P] = 50.2 km/h (31.2 mph) (87.7%) Plateau Avg.= -20.4 G; Peak = -24.3 G

Dummy: (kg)

Buck Weight: 1989

Buck: Steel plate, risers, shoulder brace

Motion Concepts Rig with 4 WC seatback assemblies

Sled Summary

Sled Pulse Duration = 76.4 ms

Efficiency = $V_{out} / V_{in} = 23.4 / 26.7 = 87.7\%$

Sled Plateau Average Level = -20.4 G

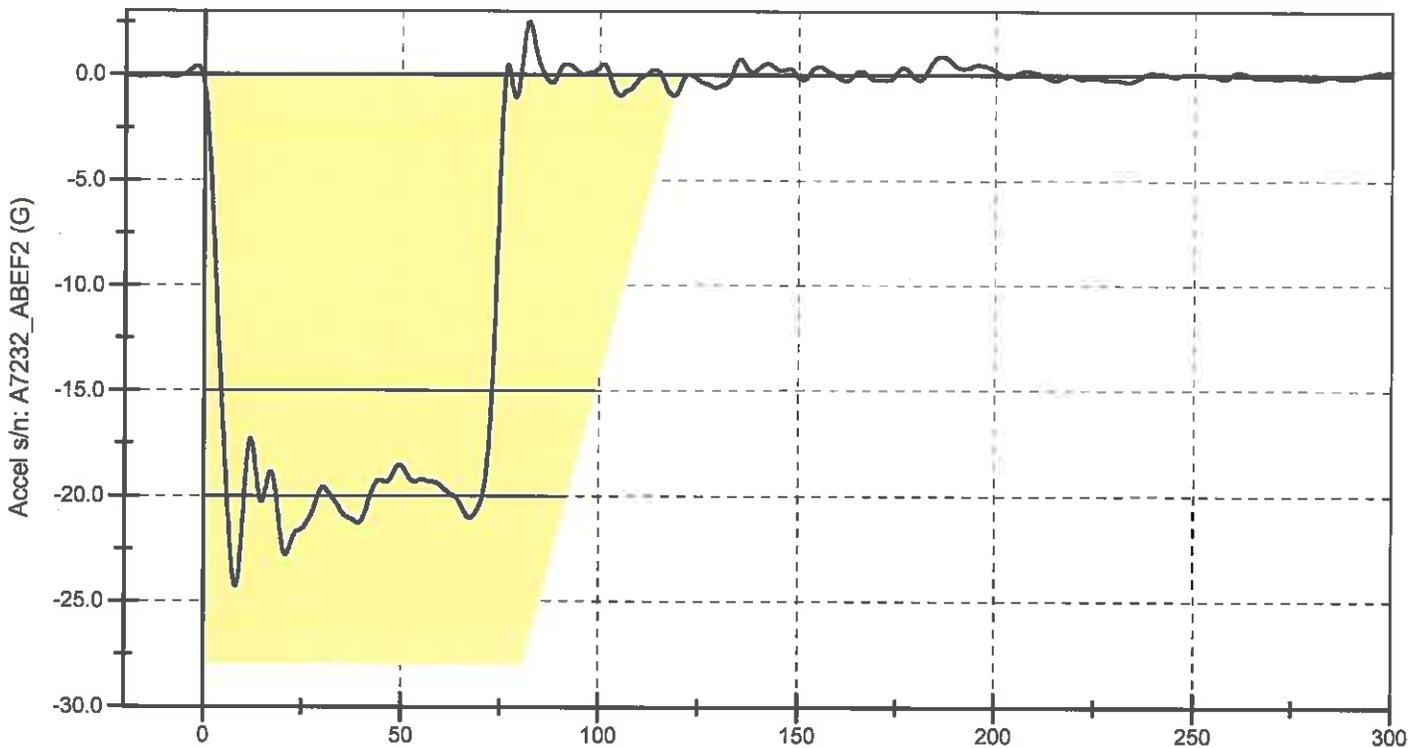
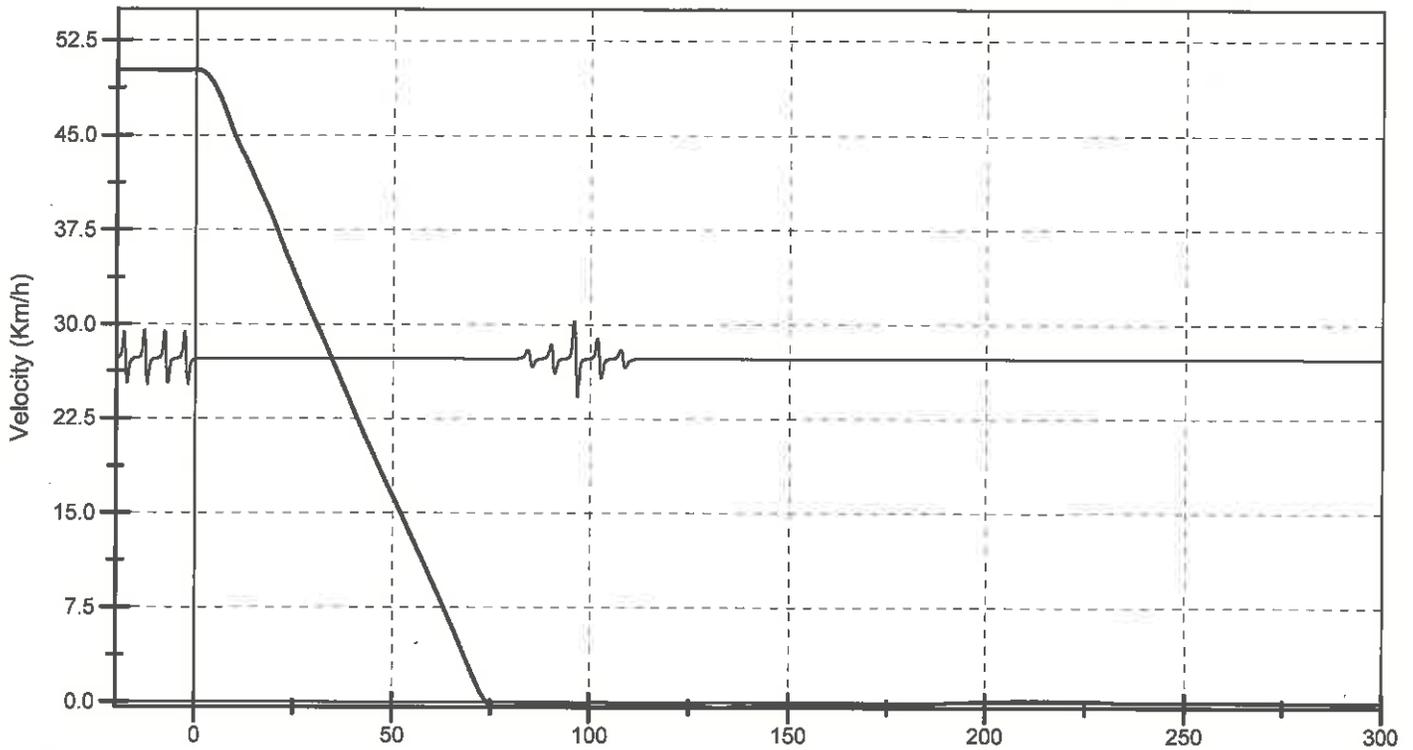
Sled Delta V = 50.2 kph (31.2 mph)

Sled Decel Peak = -24.3 G

Stopping Dist. (est) = .535 m

Total time under -20.0 G was 31.3 ms

Continuous time under -15.0 G was 68.0 ms



Continuous time under -15.0 G was 68.0 ms

Total time under -20.0 G was 31.3 ms

Sled Decel Peak = -24.3 G

Sled Plateau Average Level = -20.4 G

Sled Pulse Duration = 76.4 ms

Stopping Dist. (est) = .535 m

Sled Delta V = 50.2 kph (31.2 mph)

Efficiency = $V_{out} / V_{in} = 23.4 / 26.7 = 87.7\%$