Test Report

Customer	**Sunrise Medical Limited**
Test Item	**Xenon 2 FF**
Test	**ISO 7176/19:2008 (EN12183:2014) Wheelchair Test**
Millbrook Report No.	**15/0308**
Millbrook Project No.	**CR0011-047-01**
Millbrook Test No.	**S13543**

Author: K. Dobson
Engineer

Approved: S. Jones
Principal Engineer

Report Date: 14th April 2015

Distribution

Organisation	Recipient	Format	Qty
Sunrise Medical Limited Thorns Road Brierley Hill West Midlands DY5 2LD	D. Davies	PDF	1
Millbrook Proving Ground Ltd Millbrook Bedford MK45 2JQ	Contract file	PDF	1

Report Revision History

Rev.	Revision Description	Date	Author	Approver	Pages
0	Initial release	14th April 2015	K. Dobson	S. Jones	All

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Appendices

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Pre and Post Test Photographs	Appendix B
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High Speed Digital Films	See “Films” directory on data media

Test Facility and Date

The test, number S13543, was performed on 27th March 2015 at the HyGE Sled facility at Millbrook Proving Ground Ltd.

Address: Millbrook Proving Ground Ltd
Millbrook
Bedford
MK45 2JQ
England

Contact: Katie Dobson
Telephone: 01525 408227
Fax: 01525 408 203
Email: katie.dobson@millbrook.co.uk

Test Items

Test parts were delivered to Millbrook on 26th March 2015.

Item	Part No.	Batch No.	Mass (kg)
Xenon 2 FF	Sample	-	14.6
Unwin Red Adjustable Front Straps	OF03	43382	-
Unwin Red Rear Webbing Restraints Karabiner	OR02	49222	-
Unwin Static 3PT Occupant Restraint	OCR02	49784 49786 49759	-

The above wheelchair was tested using a 50th percentile male HII ATD with a test mass of 76.3kg on the Millbrook wheelchair test rig.

Photographic

A single high speed camera was positioned to provide overall coverage of the dynamic response of test item and occupant during the test. The high speed camera (nominal 1000 frames per second) used for this test was as detailed below:

Camera Position	Camera	Lens
LH Total On-board View	IDT NXAS2 - 0656	IDT 6mm

Disclaimers

1. The results contained within this report only relate to the items tested (as described in this report).

At Millbrook, we provide a comprehensive range of engineering, test and validation services to customers in the automotive, transport, petrochemical, defence and security industries. We are independent and impartial in everything we do.

At our Proving Ground in the UK, we have 70km of varied test tracks, including hills routes, high speed areas and challenging off road courses. Our professional drivers and engineers perform repeatable tests, on all types of vehicles, in a secure and safe environment. We have a range of test facilities for components and full vehicles. These include engine dynamometers, environmental chambers, crash laboratory and advanced emissions testing.

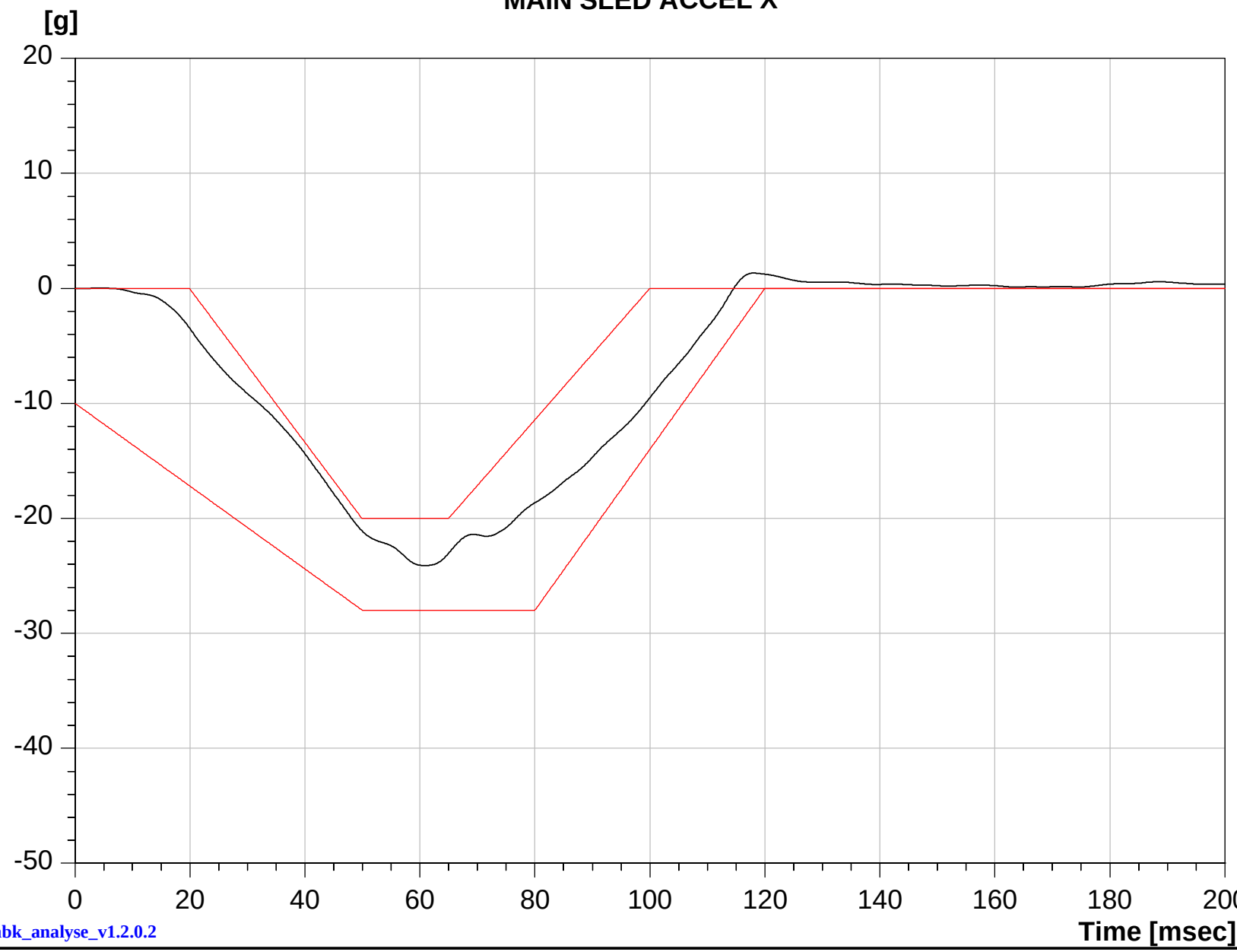
We engineer and manufacture specialist vehicle conversions. These range from new versions of existing platforms, such as estate cars, to armoured solutions and complex electronics installations. We conduct impartial vehicle assessments and develop class-leading vehicle dynamics improvements. We help Vehicle Manufacturers manage complex bills of materials and launch new models.

We are passionate about customer service and technical excellence; we take pride in delivering exactly what our customers want, whether that is a vehicle test, engineered solution or smooth-running conference. We develop our people so that they remain at the leading edge of their specialist fields and contribute to the development of future regulations. The quality of our work is reflected in our ISO 9001 and ISO 17025 certification.

All of this combines to make Millbrook an integral part of the industries we serve and an ideal partner at any stage in the development and launch of the vehicles of tomorrow.

Millbrook, Bedford, MK45 2JQ, UK
www.millbrook.co.uk

Test Report



Test No. : S13543

Test Date : 27 March 2015

Test Type : ISO 7176/19:2008
: (EN12183:2014)
: Double Wheelchair
: Test

Customer : Sunrise Medical

Test Item : Xenon 2 FF

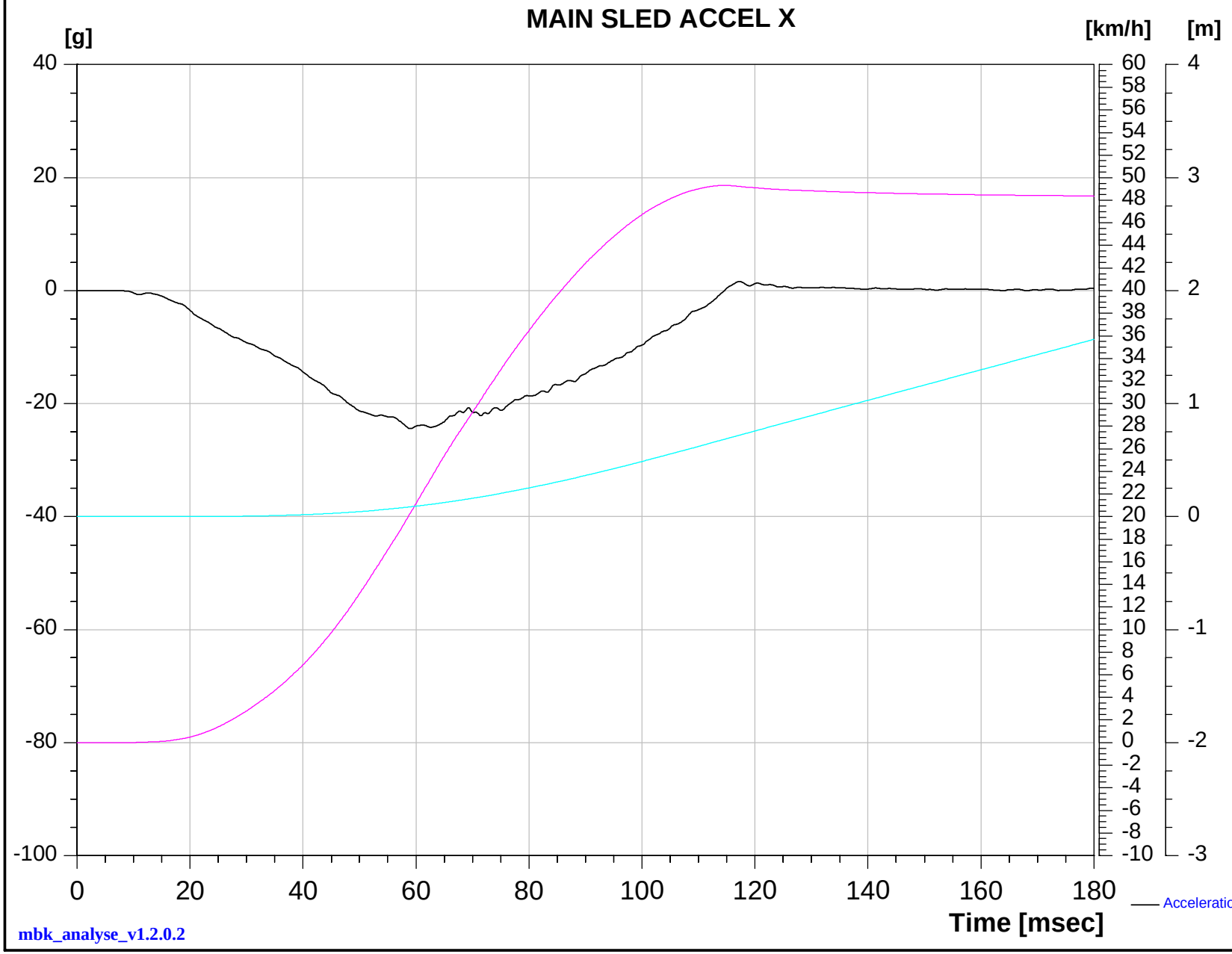
Millbrook Test Engineer: J. Lennon

Customer Test Engineer : D. Davies

Max Test Velocity = 49.32 [km/h]

Filter : CFC 60 (SAE J211)
CAC : 200.00 [g]
Sensor ID : ZR23
Max Value : 1.33 g [118.0 msec]
Min Value : -24.11 g [60.9 msec]
Plot Date : 27/03/2015 at 11:53:54

Test Report



MILLBROOK

Test No. : S13543

Test Date : 27 March 2015

Test Type : ISO 7176/19:2008
: (EN12183:2014)
: Double Wheelchair
: Test

Customer : Sunrise Medical

Test Item : Xenon 2 FF

Millbrook Test Engineer: J. Lennon

Customer Test Engineer : D. Davies

Filter : CFC 180 (SAE J211)
CAC : 200.00 [g]
Sensor ID : ZR23

Acceleration
Max Value : 1.62 g [117.2 msec]
Min Value : -24.40 g [59.0 msec]
Velocity
Max Value : 49.32 km/h [114.6 msec]
Min Value : -0.00 km/h [4.7 msec]
Displacement
Max Value : 5.69 m [500.0 msec]
Min Value : 0.00 m [0.0 msec]
Plot Date : 27/03/2015 at 11:55:21

mbk_analyse_v1.2.0.2

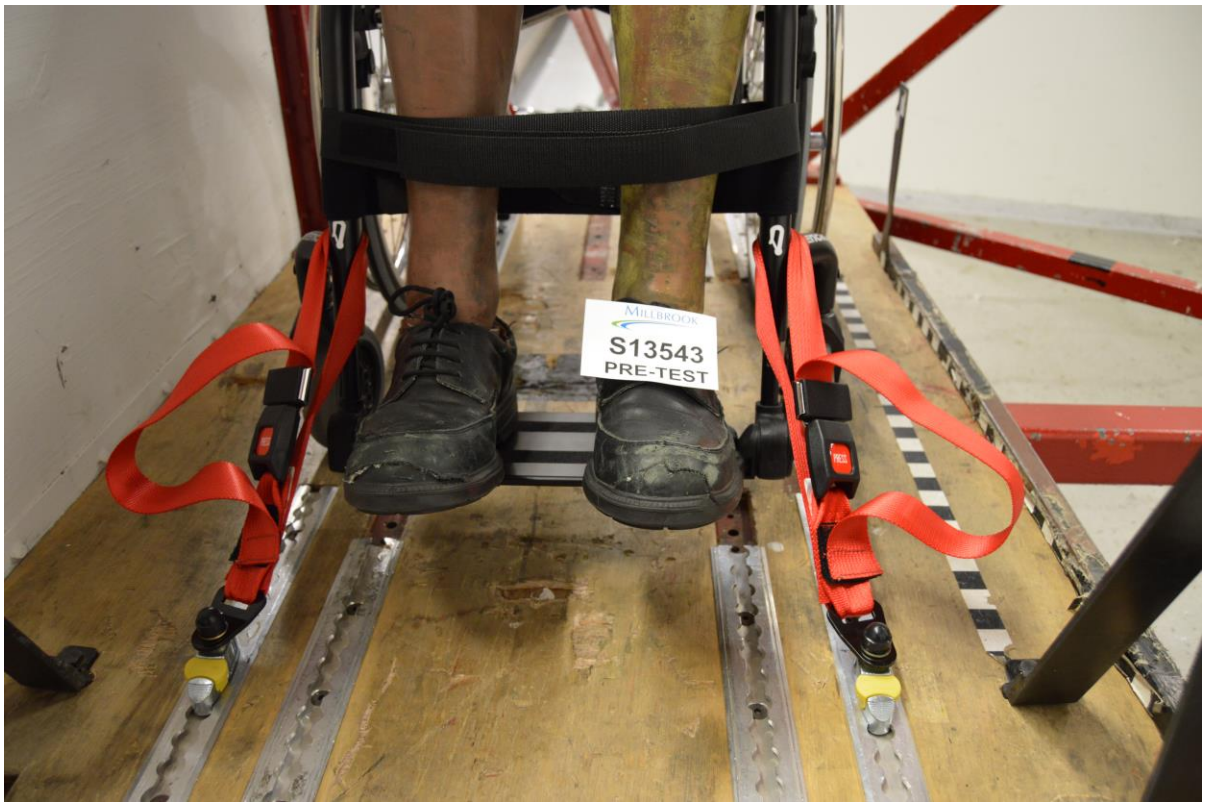
Front view of occupant, pre-test

Front 3/4 view, pre-test

LH view, pre-test

Rear 3/4 view, pre-test

Rear view, pre-test



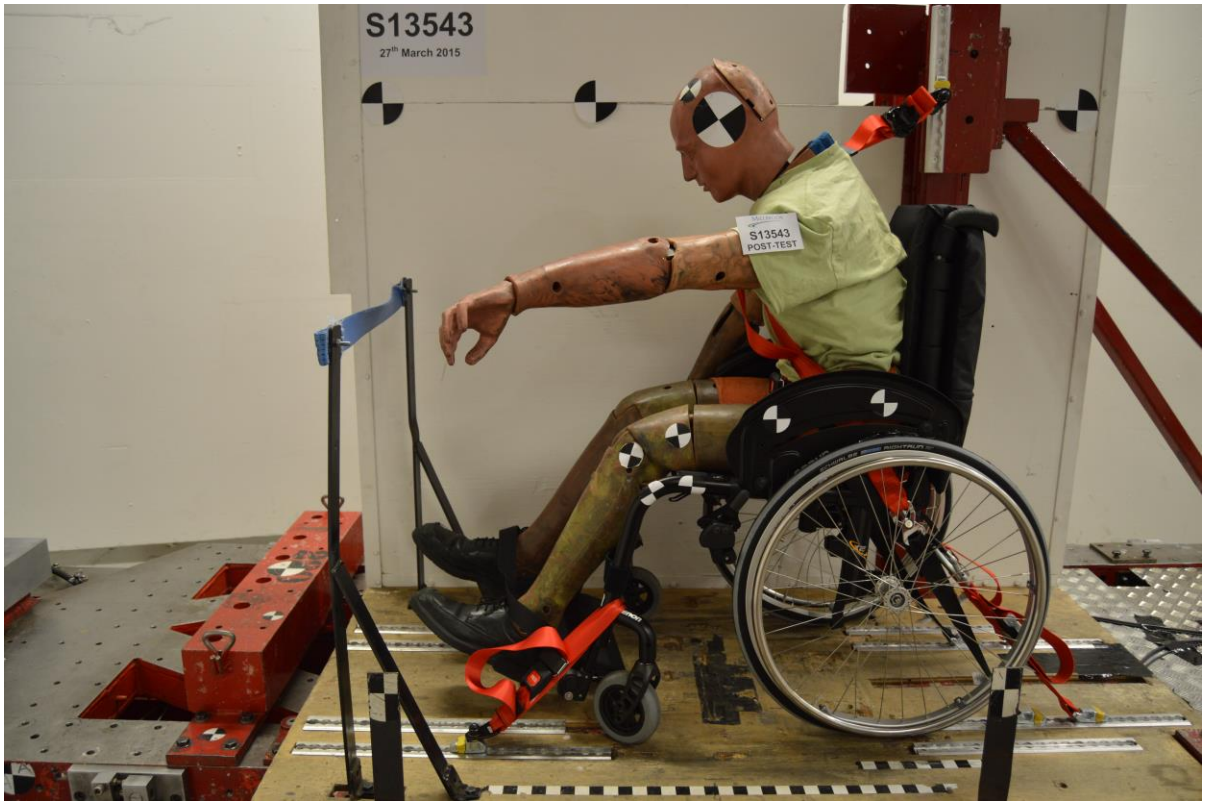
Front wheelchair restraints, pre-test

Rear wheelchair restraints, pre-test

Occupant restraint anchorage point, pre-test

Front view of occupant, post-test

Front 3/4 view, post-test



LH view, post-test

Rear 3/4 view, post-test

Rear view, post-test

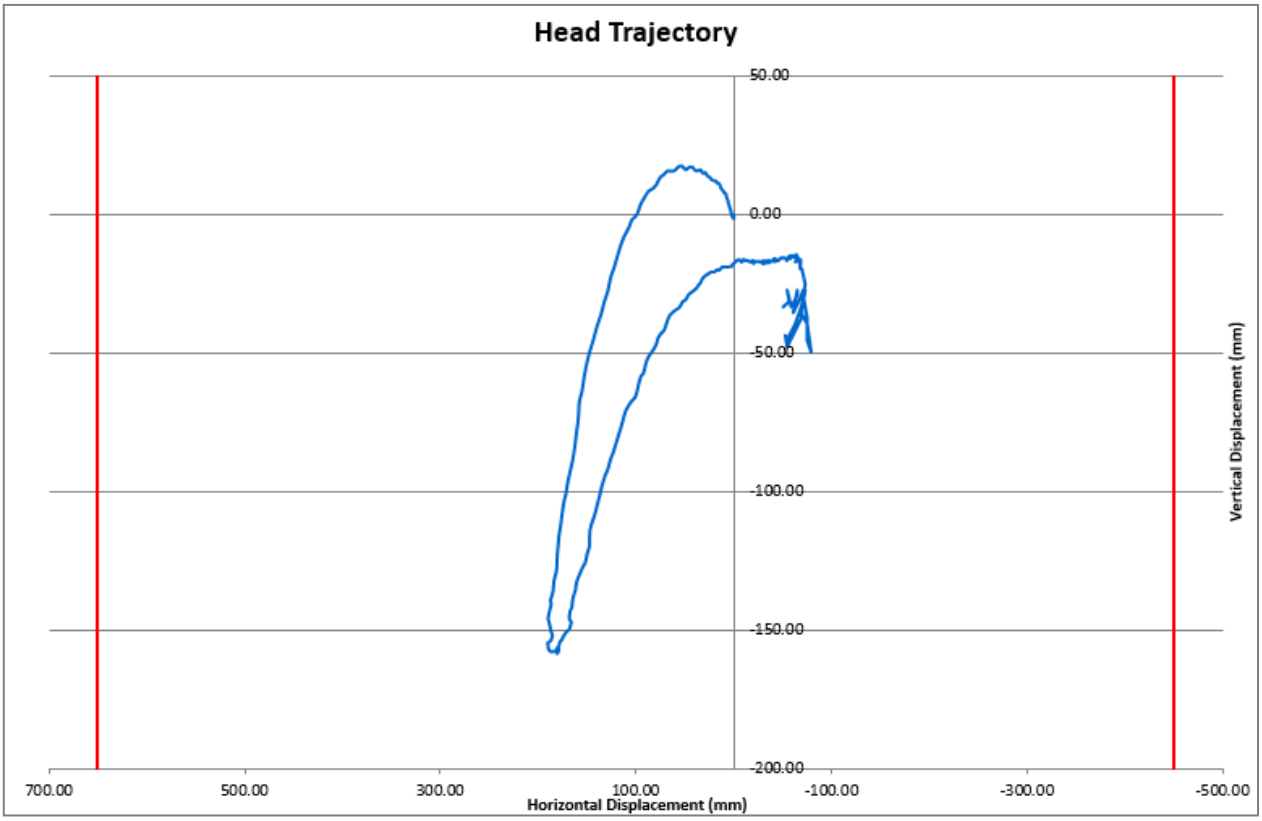
Front wheelchair restraints, post-test

Rear wheelchair restraints, post-test

Occupant restraint anchorage point, post-test

Post-test

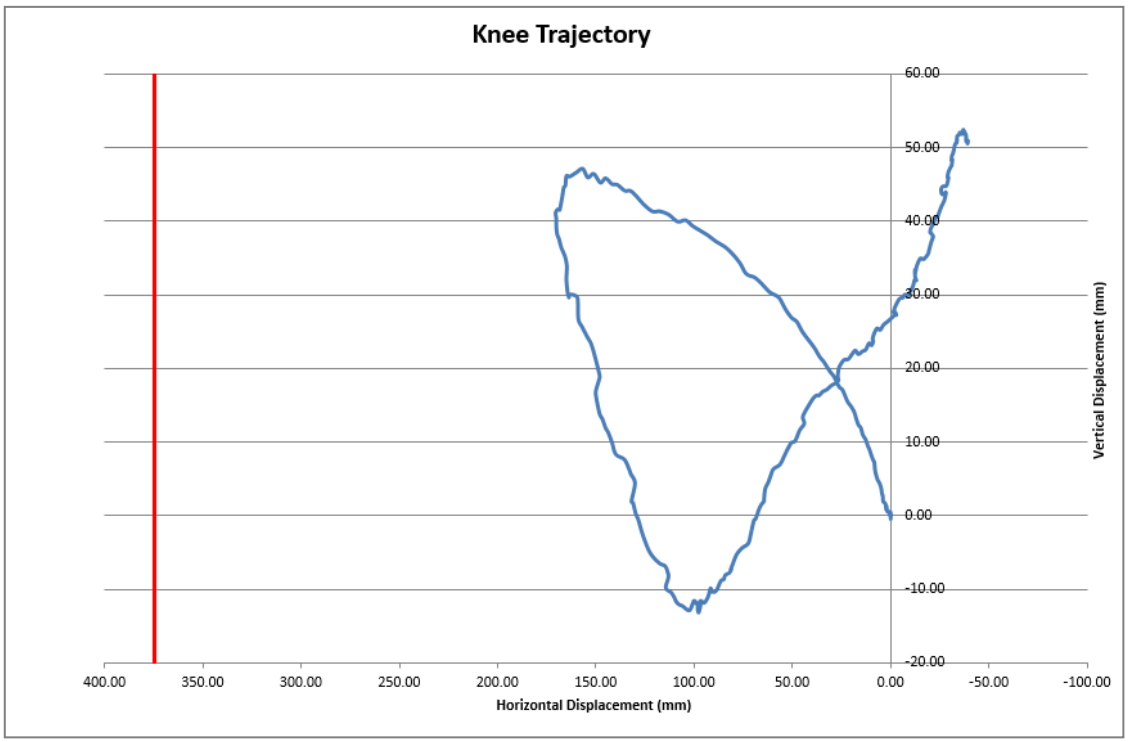
Film Analysis Data



Maximum horizontal displacement	=	190.1 mm
Minimum horizontal displacement	=	-79.3 mm
Maximum vertical displacement	=	17.7 mm
Minimum vertical displacement	=	-158.4 mm

Head Trajectory Data

Time (ms)	Horizontal Disp.(mm)	Vertical Disp.(mm)
0	0.00	0.00
5	0.20	-0.80
10	0.20	-0.80
15	0.10	-0.50
20	0.00	-1.30
25	0.00	-1.30
30	0.30	0.00
35	2.10	0.10
40	4.00	2.50
45	6.10	5.50
50	9.70	8.00
55	14.70	11.30
60	24.60	13.70
65	36.60	16.00
70	53.00	17.70
75	71.40	14.60
80	91.40	6.20
85	112.10	-7.80
90	128.60	-27.30
95	146.60	-48.60
100	159.00	-74.10
105	170.10	-97.30
110	178.70	-115.90
115	183.70	-132.00
120	186.70	-140.70
125	187.30	-149.60
130	190.00	-155.00
135	187.30	-157.60
140	178.70	-157.10
145	178.00	-154.50
150	168.10	-149.60
155	165.70	-142.00
160	158.40	-130.50
165	147.30	-117.20
170	137.00	-101.30
175	122.90	-85.50
180	110.50	-70.80
185	92.30	-57.10
190	77.40	-44.50
195	60.10	-34.50
200	42.70	-27.80
205	30.30	-22.30
210	14.80	-19.90
215	2.10	-18.40
220	-6.00	-16.10
225	-16.30	-16.80
230	-20.30	-16.70
235	-26.90	-16.80
240	-28.60	-16.80
245	-32.90	-16.70
250	-37.40	-16.60
255	-35.90	-16.80
260	-41.70	-15.70
265	-41.60	-16.60
270	-45.70	-16.50
275	-47.80	-15.80
280	-53.30	-15.70
285	-57.30	-14.70
290	-61.30	-15.30
295	-62.20	-14.80
300	-65.30	-15.00
305	-64.20	-16.90
310	-67.50	-16.20
315	-69.60	-19.30
320	-69.60	-19.30
325	-73.20	-25.00
330	-71.10	-29.10
335	-73.20	-33.20
340	-73.20	-33.20
345	-75.20	-37.30
350	-75.20	-45.50
355	-79.30	-49.60
360	-75.20	-39.40
365	-69.10	-35.30
370	-73.20	-27.10
375	-69.10	-33.20
380	-62.90	-39.40
385	-56.80	-43.50
390	-56.80	-45.50
395	-52.70	-43.50
400	-54.70	-47.60
405	-69.10	-37.30
410	-71.10	-27.10
415	-69.10	-29.10
420	-60.90	-35.30
425	-65.00	-27.10
430	-65.00	-29.10
435	-58.80	-33.20
440	-54.70	-27.10
445	-56.80	-31.20
450	-50.60	-33.20



Maximum forward horizontal displacement	=	170.4 mm
Minimum horizontal displacement	=	-39.3 mm
Maximum vertical displacement	=	52.5 mm
Minimum vertical displacement	=	-13.1 mm

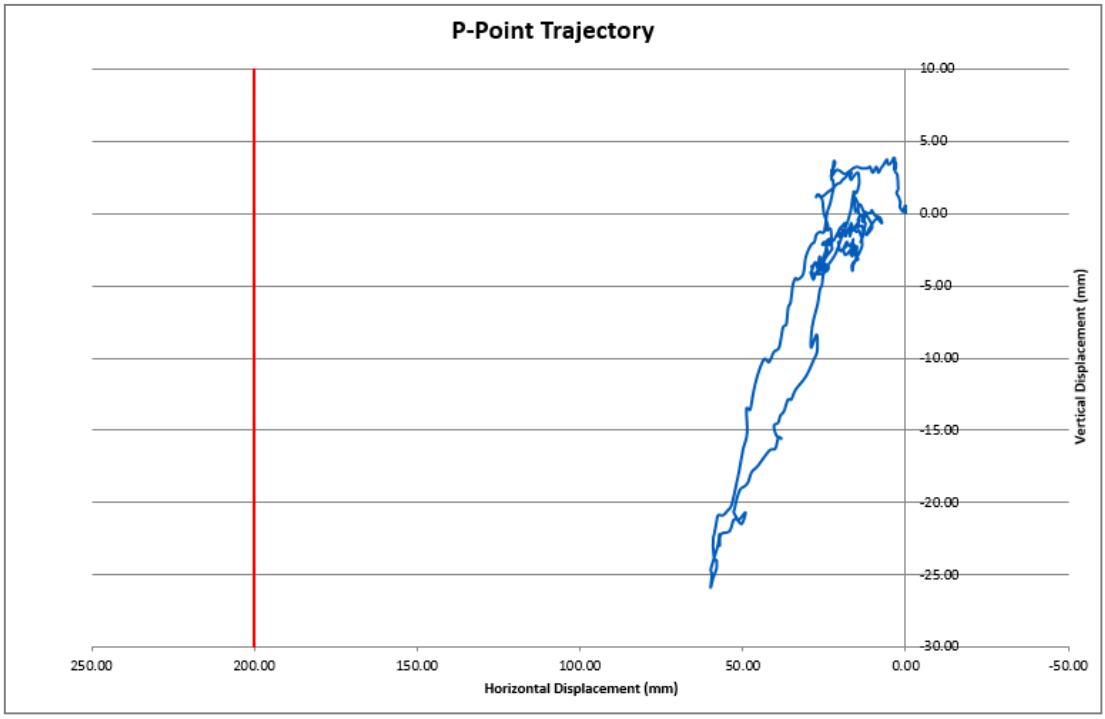
Note: Unfortunately due to the knee being obscured after 317msec, the knee was unable to be tracked fully.

Knee Trajectory Data

Time (ms)	Horizontal Disp.(mm)	Vertical Disp.(mm)
0	0.00	0.00
5	0.00	0.50
10	0.40	0.20
15	0.40	0.20
20	0.00	-0.10
25	0.00	0.50
30	1.00	0.60
35	3.80	2.00
40	6.60	4.90
45	10.00	8.40
50	15.20	12.00
55	22.00	15.60
60	34.10	21.00
65	47.70	26.40
70	65.00	31.40
75	84.40	36.60
80	104.30	40.20
85	125.80	42.40
90	141.70	45.10
95	156.60	47.20
100	165.40	44.90
105	169.20	41.70
110	169.60	38.30
115	164.90	32.40
120	159.20	29.60
125	152.30	23.40
130	149.70	16.10
135	141.70	10.00
140	130.00	4.50
145	126.60	-2.10
150	114.60	-6.80
155	111.90	-10.30
160	105.90	-12.20
165	97.70	-13.10
170	91.60	-9.80
175	84.10	-8.00

Time (ms)	Horizontal Disp.(mm)	Vertical Disp.(mm)
180	78.30	-5.20
185	69.40	-0.50
190	64.40	2.30
195	56.30	7.00
200	48.60	10.20
205	43.90	14.00
210	34.60	16.90
215	26.70	18.70
220	21.60	21.30
225	12.70	22.60
230	9.20	24.00
235	1.70	26.40
240	-1.30	27.70
245	-7.20	30.10
250	-13.10	32.00
255	-13.40	34.10
260	-19.70	36.30
265	-20.10	38.50
270	-23.70	40.60
275	-25.90	43.80
280	-29.30	46.00
285	-31.40	48.50
290	-32.60	50.40
295	-33.80	51.60
300	-36.70	52.00
305	-35.40	51.90
310	-37.90	52.00
315	-39.30	51.00
320	-	-
325	-	-
330	-	-
335	-	-
340	-	-
345	-	-
350	-	-
355	-	-

Time (ms)	Horizontal Disp.(mm)	Vertical Disp.(mm)
360	-	-
365	-	-
370	-	-
375	-	-
380	-	-
385	-	-
390	-	-
395	-	-
400	-	-
405	-	-
410	-	-
415	-	-
420	-	-
425	-	-
430	-	-
435	-	-
440	-	-
445	-	-
450	-	-



Maximum forward horizontal displacement	=	59.7 mm
Minimum horizontal displacement	=	-0.1 mm
Maximum vertical displacement	=	3.8 mm
Minimum vertical displacement	=	-25.9 mm

Note: Unfortunately due to the p-point being obscured after 356msec, the p-point was unable to be tracked fully.

P-Point Trajectory Data

Time (ms)	Horizontal Disp.(mm)	Vertical Disp.(mm)
0	0.00	0.00
5	0.00	0.00
10	0.00	0.30
15	0.00	0.30
20	0.00	0.30
25	0.00	0.10
30	0.70	0.10
35	1.60	0.80
40	3.00	2.80
45	3.40	3.00
50	3.70	3.80
55	3.80	3.70
60	6.80	3.30
65	10.80	3.20
70	16.60	3.00
75	22.00	1.70
80	27.30	-1.50
85	33.00	-4.60
90	36.50	-7.70
95	43.30	-10.10
100	48.50	-15.20
105	54.60	-20.60
110	58.90	-22.50
115	58.90	-25.20
120	57.00	-22.20
125	52.60	-21.20
130	52.40	-20.50
135	47.10	-17.90
140	38.00	-15.60
145	37.20	-13.70
150	28.20	-10.20
155	27.60	-6.90
160	24.60	-3.90
165	19.70	-1.70
170	15.90	1.30
175	11.70	-0.20

Time (ms)	Horizontal Disp.(mm)	Vertical Disp.(mm)
180	11.40	0.00
185	9.20	-0.20
190	12.80	-0.20
195	15.00	1.40
200	17.00	2.50
205	22.70	2.50
210	22.60	3.00
215	23.50	1.50
220	25.60	1.00
225	22.90	-1.10
230	25.60	-3.60
235	24.50	-3.50
240	28.00	-4.20
245	27.00	-4.00
250	26.00	-4.00
255	28.70	-4.00
260	24.20	-2.50
265	23.30	-2.20
270	23.20	-1.80
275	18.30	-0.90
280	18.70	-1.30
285	17.20	-1.00
290	16.60	-0.70
295	14.60	-1.00
300	13.20	-0.50
305	13.20	-1.70
310	15.20	-1.00
315	13.20	-1.70
320	16.20	-2.40
325	15.70	-2.80
330	15.50	-3.30
335	15.30	-3.30
340	16.30	-2.70
345	16.30	-2.30
350	18.40	-2.90
355	19.10	-2.50

Time (ms)	Horizontal Disp.(mm)	Vertical Disp.(mm)
360	-	-
365	-	-
370	-	-
375	-	-
380	-	-
385	-	-
390	-	-
395	-	-
400	-	-
405	-	-
410	-	-
415	-	-
420	-	-
425	-	-
430	-	-
435	-	-
440	-	-
445	-	-
450	-	-

Test Results Summary
ISO 7176 Part 19: 2008 as amended by EN12183
Section 5.2 - Dynamic Performance Requirements

		RESULTS
Test No:	**S13543**	
Client:	**Sunrise Medical Limited**	
WC Model:	**Xenon 2 FF**	
Mass (kg):	**14.5kg**	
Head Restraint:	**No**	
Occupant:	**Hybrid II 50th Percentile (76.3 kg)**	
Front Tie Downs:	**Unwin Red Adjustable Front Straps - Part No OF03**	
Rear Tie Downs:	**Unwin Red Rear Webbing Restraints Karabiner - Part No OR02**	
Occupant Restraint:	**Static 3PT Occupant Restraint – Part No OCR02**	
5.1	**During the Test**	
a)	Horizontal ATD and wheelchair excursion limits as per limits shown in Table 3:-	
	Was the horizontal movement of the test wheelchair P- Point (X_{ss}) less than 200 mm. (±5 mm)	PASS 60mm
	Was the horizontal movement of the dummy Knee (X_{knee}) less than 375 mm. (±5 mm)	PASS 170mm
	Was the forwards horizontal movement of the Dummy Head (X_{headF}) less than 650 mm. (±5 mm)	PASS 190mm
	Was the rearwards horizontal movement of the Dummy Head (X_{headR}) greater than -450 mm. (±5 mm)	PASS 79mm
b)	Was the ratio X_{knee}/X_{ss} >1.1:1	PASS 2.8:1
c)	Did the batteries of powered wheelchairs, or their surrogate parts:-	
	I. move outside of the wheelchair footprint	N/A
	II. move into the wheelchair user's space	N/A
5.2	**Post Test**	
a)	Did the wheelchair remain upright on the test platform and did the ATD remain in a seated posture in the test wheelchair with a torso angle > 45°	PASS
b)	Did the wheelchair securement points show visible signs of material failure	PASS
c)	Did any components of a mass greater that 100g become detached from the wheelchair	PASS
d)	Did any occupant contactable components fragment or separate with an edge of less than 2mm	PASS
e)	Did any primary load carrying components of the wheelchair show any visible signs of failure	PASS
f)	Did any 'tilt in space' locking mechanisms show signs of failure	PASS
g)	Was the ATD released from the wheelchair without the use of tools	PASS
h)	Was the wheelchair released from the restraint system without the use of tools	PASS
i)	Was the average decrease of H-Point height relative to the wheelchair platform less than 20% of the pre-test height	PASS
j)	Did the wheelchair and its components cause partial or complete failure of the webbing or any of the WTORS assemblies	PASS
	The wheelchair satisfied the Dynamic Test requirements of ISO 7176 pt19: 2008 as amended by EN12183	**PASS**