

REPORT NUMBER: R&D-CAL-12-005

**MOVING BARRIER TO VEHICLE CRASH TEST IN SUPPORT OF NHTSA'S
FRONTAL OBLIQUE OFFSET PROGRAM
RESEARCH MOVING DEFORMABLE BARRIER INTO LEFT FRONT OF A**

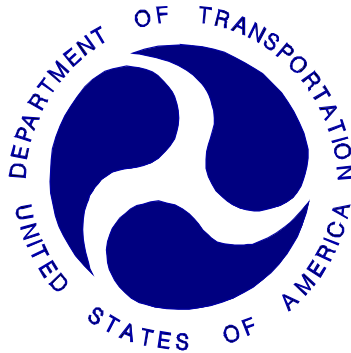
2012 VOLVO S60

56MPH, 7 DEGREE ANGLE, 20% OVERLAP

TEST DATE: 4/30/2012

NHTSA No: RC5909

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PREPARED FOR:

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FINAL REPORT ACCEPTANCE BY OCWS:

Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

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NHTSA, Office of Crashworthiness Standards

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16. Abstract A test was conducted in accordance with Task Order 0001 of Contract DTNH22-10-D-00155. The test consisted of a research moving deformable barrier (RMDB) traveling at a target speed of 90.12 kph into a stationary 2012 Volvo S60. The struck vehicle was positioned 7 degrees relative to the moving barrier, and impacted 20% of the left side of the vehicle. The test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at the Calspan Corporation's crash test facility in Buffalo, New York on Monday April 30, 2012. The impact velocity of the vehicle was 90.64 km/h, and the ambient temperature at the barrier face at the time of impact was 11.6°C. The target vehicle post-test maximum crush was 215 mm. The test vehicle's performance is as follows: <table border="1"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th colspan="2">Driver ATD</th> <th colspan="2">Pass. ATD</th> </tr> <tr> <th>Threshold</th> <th>Result</th> <th>Threshold</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₁₅)</td> <td>N/A</td> <td>700</td> <td>196.63</td> <td>700</td> <td>464.64</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>-44.62</td> <td>52</td> <td>-31.12</td> </tr> <tr> <td>Nij</td> <td>N/A</td> <td>1</td> <td>0.25</td> <td>1</td> <td>0.83</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4,170</td> <td>902.39</td> <td>2,620</td> <td>2,262.67</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4,000</td> <td>-728.12</td> <td>2,520</td> <td>-502.54</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10,008</td> <td>-6,496.15</td> <td>6,805</td> <td>2803.23</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10,008</td> <td>-6,557.63</td> <td>6,805</td> <td>2233.97</td> </tr> </tbody> </table>					Measurement Description	Units	Driver ATD		Pass. ATD		Threshold	Result	Threshold	Result	Head Injury Criteria (HIC ₁₅)	N/A	700	196.63	700	464.64	Maximum Chest Compression	mm	63	-44.62	52	-31.12	Nij	N/A	1	0.25	1	0.83	Neck Tension	N	4,170	902.39	2,620	2,262.67	Neck Compression	N	4,000	-728.12	2,520	-502.54	Left Femur Force	N	10,008	-6,496.15	6,805	2803.23	Right Femur Force	N	10,008	-6,557.63	6,805	2233.97
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SECTION 1
PURPOSE OF TEST

Test Vehicle: 2012 Volvo S60 - Four Door Sedan NHTSA No.: RC5909
Test Program: Research and Development Narrow Offset Test Date: 4/30/2012

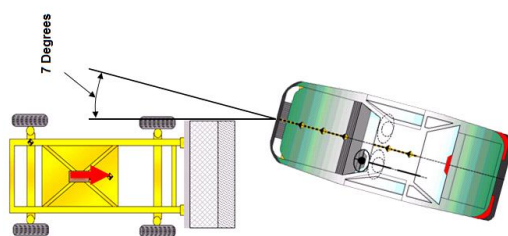
This 90.12 km/h (56 mph) Moving Barrier into a vehicle test is part of the Frontal Offset Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-10-D-00155. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

This test was conducted in accordance with the instructions set forth by NHTSA for a 7° angle, 20% offset moving barrier to vehicle impact, outlined in Task Order One (TO-1) DTNH22-10-D00155. Data was obtained indicant of Federal Motor Vehicle Safety Standard (FMVSS) 208-Occupant Crash Protection, FMVSS 212 – Windshield Mounting, FMVSS 219 (Partial) – Windshield Zone Intrusion, and FMVSS 301 – Fuel System Integrity, in addition to the requirements of TO-1 of DTNH22-10-D-00155.

SECTION 2 SUMMARY OF TEST

Test Vehicle: 2012 Volvo S60 - Four Door Sedan NHTSA No.: RC5909
Test Program: Research and Development Narrow Offset Test Date: 4/30/2012

A 2012 Volvo S60 Four Door Sedan was impacted on the left front corner by a Research Moving Deformable Barrier (RMDB). This test vehicle was stationary and positioned at a target angle of 7° and at a target offset of 20% to the forward line of motion of the RMDB. The RMDB was towed down the test track in a full forward direction, without any crabbing, and at the targeted impact velocity of 90.12 km/h (56 mph) into the test vehicle. The test vehicle's mass was 1,869.0 kg (4,120.4 lbs), and the RMDB's mass was 2486.2 kg (5481 lbs). The test was conducted by Calspan Corporation on April 30, 2012.



The test was documented by one (1) real time and fourteen (14) high-speed video cameras. Camera locations and other pertinent data are located in Data Sheet No. 6 of this report. Pre and post – test photographs of the test vehicle, RMDB, and test setup were taken using a digital still camera. Photographic documentation of the test is presented in Appendix A of this report.

One 50% adult male THOR-NT with MOD KIT (TK) anthropomorphic test device (ATD) (Serial No. 007) was seated in the left front (P1 -Driver's) seating position and one Part 5720 5% adult female (HIII 5th) ATD (Serial No. 070) was seated in the left rear seating position (P4). The THOR TK driver was positioned according to instructions specified in laboratory test procedure for FMVSS No.208, "Occupant Crash Protection", TP208-14, July 27, 2006. The HIII 5% left rear seat occupant was positioned using a modified procedure of the laboratory test procedure for FMVSS No. 214, "Side Impact Protection – Dynamic", TP214D-08, December 15, 2006. The exact procedure used is presented in Appendix E of this report.

The driver was restrained with a 3 – point seat belt, a frontal airbag, curtain airbag, and a torso airbag. The left rear passenger was restrained with a 3 – point seat belt, and a curtain airbag.

SECTION 2 (CONTINUED)

SUMMARY OF TEST

Test Vehicle: 2012 Volvo S60 - Four Door Sedan NHTSA No.: RC5909
Test Program: Research and Development Narrow Offset Test Date: 4/30/2012

Two hundred and fourteen (214) channels of data from the two ATD's, test vehicle and RMDB were collected using Kayser – Threde and DTS data acquisition systems. Appendix B contains dummy data plots, as well as vehicle and RMDB response data plots.

There was 92.9% total windshield retention, with 85.7% and 100% retention on the left and right sides respectively. There appeared to be no intrusion into the protected zone of the windshield during any portion of the impact event. The maximum static crush of the vehicle was 215 mm at C1 to the left of the vehicle's centerline. The maximum crush of the lower bumper beam was 174 mm at C1, to the left of the vehicle's centerline. Full vehicle measurements are presented in Section 3 of this report.

All four vehicle doors remained closed and latched during the test. The left front door was jammed shut, but was able to be opened. The left rear, right front, and right rear doors all remained operational after the test.

Structure observations include the following:

- A-pillar buckled causing separation between the top of the door and vehicle
- Windshield shows cracks throughout
- Hood opened during the impact event

The driver ATD's visible contact points are as follows:

- Head contacted the front airbag, and curtain airbag
- Torso contacted the front airbag and driver's side door
- Knees contacted the knee bolster

The left rear passenger ATD's visible contact points are as follows:

- Head contacted the curtain airbag and head rest
- Torso contacted the passenger side door
- Ankles contacted the driver seatback

SECTION 2 (CONTINUED)

CRASH VEHICLE SUMMARY

Test Vehicle: 2012 Volvo S60 - Four Door Sedan NHTSA No.: RC5909
 Test Program: Research and Development Narrow Offset Test Date: 4/30/2012

PRIMARY IMPACT DATA

Measured Parameter	Units	Value
RMDB Velocity at Impact	km/h	90.64
RMDB Test Weight	kg	2486.2
RMDB Maximum Static Crush	mm	420.9
Vehicle Test Weight	kg	1869
Actual Vehicle Angle	Degrees	7
Vehicle Maximum Static Crush	mm	215
Vertical Offset from Target Point	mm	16 Top
Lateral Offset from Target Point	mm	8 Left
Number of Data Channels		214
Number of Real-Time Cameras		1
Number of High-Speed Cameras		14

DUMMY CONTACTS

	Driver	Picture Ref.	Passenger	Picture Ref.
Dummy Type	50% Male, THOR 007		5% HIII Female, 070	
Head Contact	Front airbag, and curtain airbag	A-37/48	Curtain airbag and head rest	A-49/58
Upper Torso Contact	Front airbag and Driver's side door	A-46	Passenger side door	
Lower Torso Contact	Front airbag	A-46	No contact	
Left Knee Contact	Knee bolster	A-45	Ankle contacted driver's seat back	A-59
Right Knee Contact	Knee bolster	A-44	Ankle contacted driver's seat back	A-59

Data Anamolies:

P1 Driver

- Right abdominal displacement- questionable negative spike at 44 and 63 ms.
- Pelvic Az - questionable after 78 ms.
- Left Femur My - questionable after 30ms.
- Tibia Left Upper Fz - questionable after 33ms..
- Left Ankle Rx – questionable angle drop at 97 ms.
- Left Ankle Rz - questionable 38-41& after 85ms
- Tibia Right Lower My – Channel failed

Vehicle Instrumentation

- Instrument panel Ax questionable after 80 ms.

SECTION 2 (CONTINUED)
PRELIMINARY INJURY SUMMARY: Driver

Test Vehicle: RC5909 2012 VOLVO S60 NHTSA No.: RC5909

Test Program: Research and Development Left Oblique Offset Test Date: 4/30/2012

Driver: Thor Serial No. 007 Injury Summary

	Nomenclature	Units	Source	Max	Min
Head	Head Rotational Acceleration X	rad/s ²	SIMon	9652.85	-9549.35
	Head Rotational Acceleration Y	rad/s ²	SIMon	8511.23	-10019.77
	Head Rotational Acceleration Z	rad/s ²	SIMon	8517.44	-7871.76
	Head Rotational Acceleration Resultant	rad/s ²	Compute	12485.59	
	Head Rotational Velocity X	rad/s	SIMon	16.48	-32.85
	Head Rotational Velocity Y	rad/s	SIMon	10.55	-39.27
	Head Rotational Velocity Z	rad/s	SIMon	22.76	-7.29
	Head Rotational Velocity Resultant	rad/s	Compute	40.85	
	36 ms HIC		Compute	252.87	
	15 ms HIC		Compute	196.63	
	Head Resultant CG Acceleration, 3 ms Clip	g	Compute	55.78	
	Skull fracture correlate	-	SIMon	44.36	
	Cumulative strain (Tolerance = 0.05)	-	SIMon	1.00	0.00
	Cumulative strain (Tolerance = 0.10)	-	SIMon	0.74	0.00
	Cumulative strain (Tolerance = 0.15)	-	SIMon	0.22	0.00
Neck	UNLC Transferred to OC, Neck System, FX	N	1000	265.34	-735.62
	UNLC Neck System Tension, FZ	N	1000	902.39	
	UNLC Neck System Compression, FZ	N	1000		-728.12
	UNLC Transferred to OC, Neck System Flexion, MY	N-m	Thortest	11.37	
	UNLC Transferred to OC, Neck System Extension, MY	N-m	Thortest		-16.34
	NIJ		Compute	0.25	
	On head acting through total neck section, FX	N	Thortest	485.49	-395.60
	On head acting through total neck section, FY	N	Thortest	323.11	-93.39
	On head acting through total neck section, FZ	N	Thortest	1080.31	-647.81
	On head acting through total neck section, MX	N-m	Thortest	42.81	-24.59
	On head acting through total neck section, MY	N-m	Thortest	37.54	-23.74
	On head acting through total neck section, MZ	N-m	Thortest	7.51	-18.88
	On head acting through O.C. joint only, FX	N	Thortest	330.77	-724.07
	On head acting through O.C. joint only, FZ	N	Thortest	892.17	-703.28
	On head acting through O.C. joint only, MY	N-m	Thortest	11.37	-16.34
Chest	Upper Left Crux X – deflection	mm	Thortest	4.07	-18.63
	Upper Left Crux Y – deflection	mm	Thortest	0.88	-8.27
	Upper Left Crux Z – deflection	mm	Thortest	16.82	-12.65
	Upper Left Crux D – deflection	mm	Thortest	3.91	-16.41
	Upper Right Crux X – deflection	mm	Thortest	0.37	-39.31
	Upper Right Crux Y – deflection	mm	Thortest	3.87	-8.76
	Upper Right Crux Z – deflection	mm	Thortest	24.19	-10.27
	Upper Right Crux D – deflection	mm	Thortest	0.28	-33.90

SECTION 2 (CONTINUED)
PRELIMINARY INJURY SUMMARY: Driver

Test Vehicle: RC5909 2012 VOLVO S60 NHTSA No.: RC5909
Test Program: Research and Development Left Oblique Offset Test Date: 4/30/2012

Driver: Thor Serial No. 007 Injury Summary

	Nomenclature	Units	Source	Max	Min
Chest (Con't)	Lower Left Crux X – deflection	mm	Thortest	5.02	-14.69
	Lower Left Crux Y – deflection	mm	Thortest	0.10	-28.72
	Lower Left Crux Z – deflection	mm	Thortest	17.78	-3.20
	Lower Left Crux D – deflection	mm	Thortest	2.94	-16.72
	Lower Right Crux X – deflection	mm	Thortest	0.14	-48.60
	Lower Right Crux Y – deflection	mm	Thortest	5.82	-26.04
	Lower Right Crux Z – deflection	mm	Thortest	0.07	-15.46
	Lower Right Crux D – deflection	mm	Thortest	0.14	-44.62
	Chest CG Acceleration, 3 ms clip	g	Compute	40.63	
Abdomen	Lower Left X – deflection	mm	Thortest	0.60	-44.76
	Lower Left Y – deflection	mm	Thortest	0.53	-13.23
	Lower Left Z – deflection	mm	Thortest	11.61	-1.66
	Lower Left d-deflection	mm	Thortest	0.60	-44.28
	Left Viscous Criterion Based on X - deflection		Compute	1.13	
	Lower Right X – deflection	mm	Thortest	99.07 ⁽¹⁾	-53.92 ⁽¹⁾
	Lower Right Y – deflection	mm	Thortest	2.38 ⁽¹⁾	-9.05 ⁽¹⁾
	Lower Right Z – deflection	mm	Thortest	10.78 ⁽¹⁾	-1.96 ⁽¹⁾
	Lower Right d-deflection	mm	Thortest	99.06 ⁽¹⁾	-53.89 ⁽¹⁾
	Right Viscous Criterion Based on X - deflection		Compute	53.33 ⁽¹⁾	
Spine	Upper Spine (T1) AX	g	180	11.46	-47.09
	Upper Spine (T1) AY	g	180	21.20	-6.20
	Upper Spine (T1) AZ	g	180	24.71	-12.06
	Upper Spine (T1) Resultant	g	Compute	50.12	
	Middle Spine (T6) AX	g	180	11.07	-40.86
	Middle Spine (T6) AY	g	180	26.53	-6.65
	Middle Spine (T6) AZ	g	180	10.34	-7.93
	Middle Spine (T6) Resultant	g	Compute	42.18	
Pelvis	Pelvis CG Resultant Acceleration	g	Compute	515.33 ⁽²⁾	
Acetabulum	Left FX force	N	600	949.08	-1778.18
	Left FY force	N	600	388.57	-687.33
	Left FZ force	N	600	3056.57	-1327.78
	Left Acetabulum Resultant	N	Compute	3551.36	
	Right FX force	N	600	591.49	-2415.28
	Right FY force	N	600	444.93	-1747.60
	Right FZ force	N	600	1022.94	-304.39
	Right Acetabulum Resultant	N	Compute	3091.99	

SECTION 2 (CONTINUED)
PRELIMINARY INJURY SUMMARY: Driver Legs

Test Vehicle: RC5909 2012 VOLVO S60 NHTSA No.: RC5909
 Test Program: Research and Development Left Oblique Offset Test Date: 4/30/2012

Driver: Thor Serial No. 007 Injury Summary

	Nomenclature	Units	Source	Max	Min
Knee	Left Knee Displacement, DX	mm	180	1.47	-13.12
	Right Knee Displacement, DX	mm	180	0.08	-0.80
Femur	Left Femur Force, FZ	N	600	643.67	-6496.15
	Left Femur Moment, MX	N-m	600	22.89	-192.84
	Left Femur Moment, MY	N-m	600	180.09 ⁽³⁾	-137.33 ⁽³⁾
	Left Femur Res (MX / MY only, not MZ)	N-m	Compute	208.24 ⁽³⁾	
	Right Femur Force, FZ	N	600	309.84	-6557.63
	Right Femur Moment, MX	N-m	600	24.24	-103.12
	Right Femur Moment, MY	N-m	600	53.67	-16.61
	Right Femur Res (MX / MY only, not MZ)	N-m	Compute	106.14	
	Left Upper Tibia, FZ	N	600	12960.10 ⁽⁴⁾	-10794.89 ⁽⁴⁾
	Left Upper Tibia, MY	N-m	600	145.13	-41.83
Tibia	Left Upper Tibia, Index		Compute	1.37 ⁽⁴⁾	
	Right Upper Tibia, FZ	N	600	663.63	-818.91
	Right Upper Tibia, MY	N-m	600	39.58	-15.62
	Right Upper Tibia, Index		Compute	0.42	
	Left Lower Tibia, FZ	N	600	348.23	-1534.58
	Left Lower Tibia, MY	N-m	600	41.88	-55.45
	Left Lower Tibia, Index		Compute	0.34	
	Right Lower Tibia, FZ	N	600	290.84	-1237.28
	Right Lower Tibia, MY	N-m	600	1.01 ⁽⁵⁾	-0.74 ⁽⁵⁾
	Right Lower Tibia, Index		Compute	0.45 ⁽⁵⁾	
Ankle	Left Ankle Rotation, RX	Deg	180	29.96 ⁽⁶⁾	-2.46 ⁽⁶⁾
	Left Ankle Rotation, RY	Deg	180	23.74	-4.86
	Right Ankle Rotation, RX	Deg	180	10.96	-32.11
	Right Ankle Rotation, RY	Deg	180	9.16	-21.49

Anomalies

- (1) Questionable spikes at 44&63ms
- (2) Questionable after 78 ms
- (3) Questionable after 30ms
- (4) Questionable after 33ms
- (5) Channel Failed
- (6) Questionable at 97 ms

SECTION 2 (CONTINUED)
PRELIMINARY INJURY SUMMARY

Test Vehicle: RC5909 2012 VOLVO S60 NHTSA No.: RC5909
Test Program: Research and Development Left Oblique Offset Test Date: 4/30/2012

Left Rear Passenger: H3 Serial No. 070 Injury Summary

	Nomenclature	Source	Max	Min
Head	Angular acceleration (rad/sec^2) - X	SIMon	6998.71	-9145.09
	Angular acceleration (rad/sec^2) - Y	SIMon	30340.03	-19804.97
	Angular acceleration (rad/sec^2) - Z	SIMon	7964.86	-7264.84
	Angular acceleration - resultant (rad/sec^2)	SIMon	31218.18	
	Angular velocity (rad/sec) - X	SIMon	25.55	-14.88
	Angular velocity (rad/sec) - Y	SIMon	29.43	-55.84
	Angular velocity (rad/sec) - Z	SIMon	22.48	-35.21
	Angular velocity - resultant (rad/sec)	SIMon	56.37	
	36 ms HIC	Compute	890.54	
	15 ms HIC	Compute	464.64	
	Skull fracture correlate	SIMon	62.58	
	Cumulative strain (Tolerance = 0.05)	SIMon	1.00	
	Cumulative strain (Tolerance = 0.10)	SIMon	0.94	
	Cumulative strain (Tolerance = 0.15)	SIMon	0.64	
	Head resultant CG acceleration, 3 ms clip (g's)	Compute	64.58	
Neck	Upper Neck Tension (N) Fz	1000	2262.67	
	Upper Neck Compression (N) Fz	1000		-502.54
	Upper Neck NTF	Compute	0.83	
	Upper Neck NTE	Compute	0.59	
	Upper Neck NCF	Compute	0.26	
	Upper Neck NCE	Compute	0.05	
Chest	Chest Deflection (mm)	600	0.01	-31.12
	Upper Left Chest X (mm)	Compute	0.01	-24.20
	Upper Left Chest Y (mm)	Compute	6.13	-3.98
	Upper Right Chest X (mm)	Compute	0.04	-39.45
	Upper Right Chest Y (mm)	Compute	11.38	-0.92
	Lower Left Chest X (mm)	Compute	0.07	-14.84
	Lower Left Chest Y (mm)	Compute	7.90	-2.71
	Lower Right Chest X (mm)	Compute	0.06	-31.98
	Lower Right Chest Y (mm)	Compute	14.17	-0.61
	Chest CG acceleration, 3 ms clip, (G's)	Compute	44.81	
Spine	Lower Spine Fx Force (N)	1000	1388.15	-2209.36
	Lower Spine Fy Force (N)	1000	1575.69	-377.50
	Lower Spine Fz Force (N)	1000	1648.14	-922.29
	Lower Spine Res Force (N)	Compute	2255.67	

SECTION 2 (CONTINUED)
PRELIMINARY INJURY SUMMARY

Test Vehicle: RC5909 2012 VOLVO S60 NHTSA No.: RC5909
 Test Program: Research and Development Left Oblique Offset Test Date: 4/30/2012

Left Rear Passenger: H3 Serial No. 070 Injury Summary

	Nomenclature	Source	Max	Min
Spine (Con't)	Lower Spine Mx Moment (N-m)	1000	17.60	-54.91
	Lower Spine My Moment (N-m)	1000	128.50	-26.79
Asis	Right Fx Force (N)	600	3182.51	-37.54
	Right My Moment (N-m)	600	4.11	-6.24
	Left Fx Force (N)	600	2140.79	-25.54
	Left My Moment (N-m)	600	20.24	-4.90
Femur	Right Fz Force (N)	600	2233.97	-115.06
	Left Fz Force (N)	600	2803.23	-159.05
Anomalies				
None				

SECTION 3

DATA SHEETS

Test Vehicle: 2012 Volvo S60 - Four Door Sedan NHTSA No.: RC5909
Test Program: Research and Development Narrow Offset Test Date: 4/30/2012

Data Sheet No.		Page No.
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3	Dummy Longitudinal Clearance Dimensions	3-9
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DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

TEST VEHICLE INFORMATION

NHTSA No.	RC5909
Model Year	2012
Make	Volvo
Model	S60
Body Style	Four Door Sedan
VIN	YV1622FS2C2099609
Body Color	Light gray/silver
Odometer Reading (km/mi)	25.75/16
Engine Displacement. (L)	2.5
Type/No. Cylinders	I5
Engine Placement	Transverse
Transmission Type	Manual
Transmission Speeds	6-Speed
Overdrive	Yes
Final Drive	Front Wheel Drive
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
Anti-Lock Brakes (ABS)	Yes
All-Wheel Drive (AWD)	No
Traction Control System (TCS)	Yes

VEHICLE OPTIONS

Auto-Leveling System	No
Automatic Door Locks (ADL)	Yes
Power Window Auto-Reverse	No
Other Optional Feature	--
Driver Front Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	Yes
Driver Torso/Pelvis Airbag	No
Driver Pelvis Airbag	No
Driver Knee Airbag	No
Pass. Front Airbag	Yes
Pass. Curtain Airbag	Yes
Pass. Head/Torso Airbag	No
Pass. Torso Airbag	Yes
Pass. Torso/Pelvis Airbag	No
Pass. Pelvis Airbag	No
Pass. Knee Airbag	No
Driver Seat Belt Pretensioner	Yes
Pass. Seat Belt Pretensioner	Yes
Driver Load Limiter	Yes
Pass. Load Limiter	No
Other Safety Restraint	--

Does owner's manual provide instructions to turn off automatic door locks?

Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Volvo Car Corporation
Date of Manufacture	9/11

GVWR (kg)	2091
GAWR Front (kg)	1170
GAWR Rear (kg)	980

VEHICLE SEATING AND WEIGHT CAPACITY

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench-Contoured	--	
Number of Occupants	2	3	--	5
Capacity Wt. (VCW) (kg)				465
Cargo Wt. (RCLW) (kg)				125

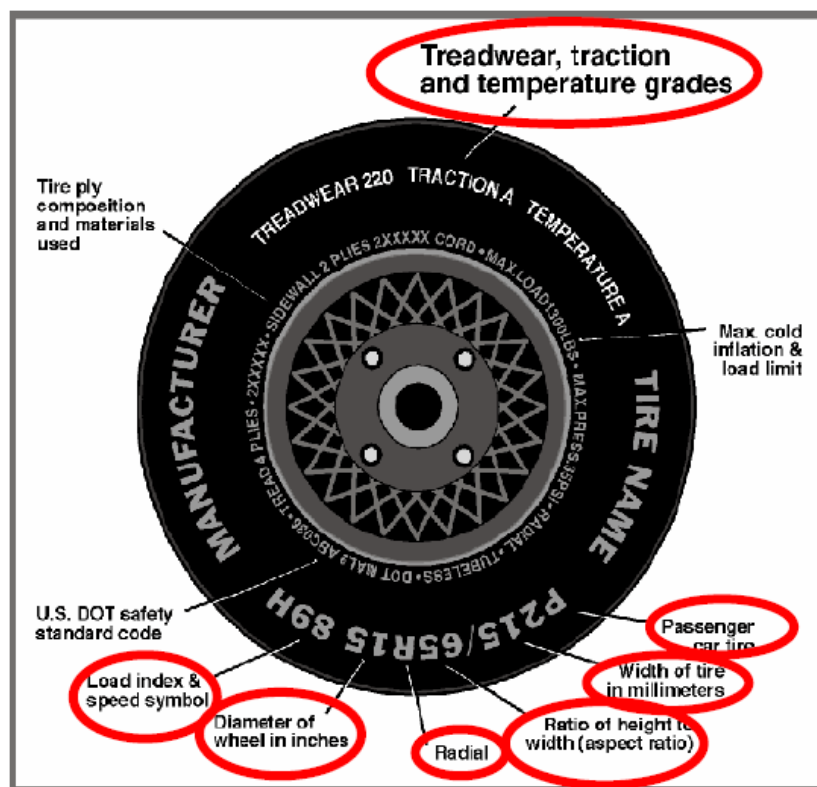
DATA SHEET NO. 1 (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle:	2012 Volvo S60 Four Door Sedan
Test Program:	R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012

Collect items circled in red, tire manufacturer, and tire name.



Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	340	340
Cold Pressure (kPa)	260	260
Recommended Tire Size	P215/50R17	P215/50R17
Tire Size on Vehicle	P215/50R17	P215/50R17
Tire Manufacturer	Michelin	Michelin
Tire Model	Primacy MXM 4	Primacy MXM 4
Treadwear	500	500
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Polyamide	2 Polyester, 2 Steel, 1 Polyamide
Load Index/Speed Symbol	95V	95V
Tire Material	Rubber	Rubber
DOT Safety Code Right	F338005X2511	F338005X2511
DOT Safety Code Left	F338005X2611	F338005X2511

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	507	307.5		546	428.5	
Right	kg	494.5	290		514.5	380	
Ratio	%	62.6%	37.4%		56.7%	43.3%	
Totals	kg	1001.5	597.5	1599	1060.5	808.5	1869

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1,599
Weight of 1 P572E ATD & 1 P572O ATD	kg	153.54
Rated Cargo/Luggage Weight (RCLW)	kg	125
Calculated Vehicle Target Weight (TVTW)	kg	1868.54

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	717	725	725	730	1037.7
As Tested	mm	695	703	660	674	1201.3
Post Test	mm	677	708	652	683	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2777
Total Vehicle Length at Left Side	mm	4516
Total Vehicle Length at Centerline	mm	4630
Total Vehicle Length at Right Side	mm	4516
Weight of Ballast in Cargo Area	kg	12
Weight of Vehicle Components Removed	kg	0
Amount of Stoddard Solvent in Fuel Tank	L	62.83

LIST OF COMPONENTS REMOVED TO MEET TEST WEIGHT:

No components were removed in order to meet the required test weight.

DATA SHEET NO.1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	4630
2	Total Width	1822
3	Bumper Top Height	-3
4	Bumper Bottom Height	107
5	Longitudinal Member Top Height	-105
6	Distance Between Longitudinal Members	1105
7	Longitudinal Member Width	81
8	Engine Top Height	-329
9	Engine Bottom Height	291
10	Engine and Gearbox Width	578
11	Front Bumper-Engine Distance	547
12	Front Shock Absorber Fixing Height	-403
13	Bonnet Leading Edge Height	-292
14	Front Shock Absorber Fixing Width	1178
15	Front Bumper – Front Axle Distance	938
16	Front Axle – A Pillar Distance	520
17	A-Pillar – B-Pillar Distance	1107
18	B-Pillar – Rear Axle Distance	1148
19	B-Pillar – C-Pillar Distance	1041
20	Roof Sill Bottom Height	-822
21	Roof Sill Top Height	-925
22	Floor Sill Bottom Height	240
23	Floor Sill Top Height	102

DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

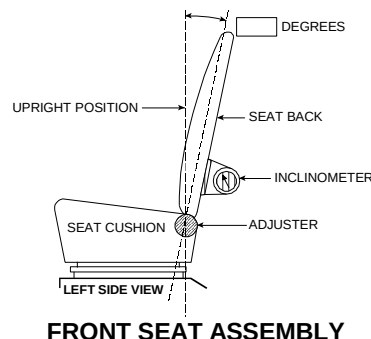
NHTSA No.: RC5909
 Test Date: 4/30/2012

NORMAL DESIGN RIDING POSITION

For adjustable driver and passenger seat backs. Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent, if applicable.

Driver seat: The driver seat back was positioned according to the Nominal Design Riding position listed in FORM 1

Passenger Seat: The passenger seat back as positioned to allow for a zero head angle of the passenger SID-IIs dummy



	Deg.
Driver Seat Back Angle	12
Passenger Seat Back Angle	FIXED

SEAT FORE/AFT POSITIONS

Describe the method used of determining seat fore/aft positions.

The driver's seat was positioned at the mid-point of fore/aft travel.

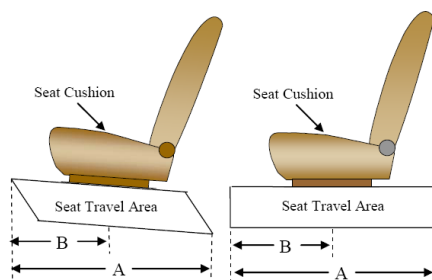
The passenger's seat was positioned at the most forward position of fore/aft travel.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	294	149
Passenger Seat	FIXED	FIXED

SEAT BELT UPPER ANCHORAGES

Describe the method of positioning seat belt upper anchorages. Belt anchorages were moved along the Full range of motion, and marked on the B-Pillar to their respective possible positions. Photographic evidence can be found in Appendix A of this report. Zero is defined as the upper-most position.

	Total # of Positions	Placed in Position #
Driver Seat	4	0
Passenger Seat	FIXED	FIXED

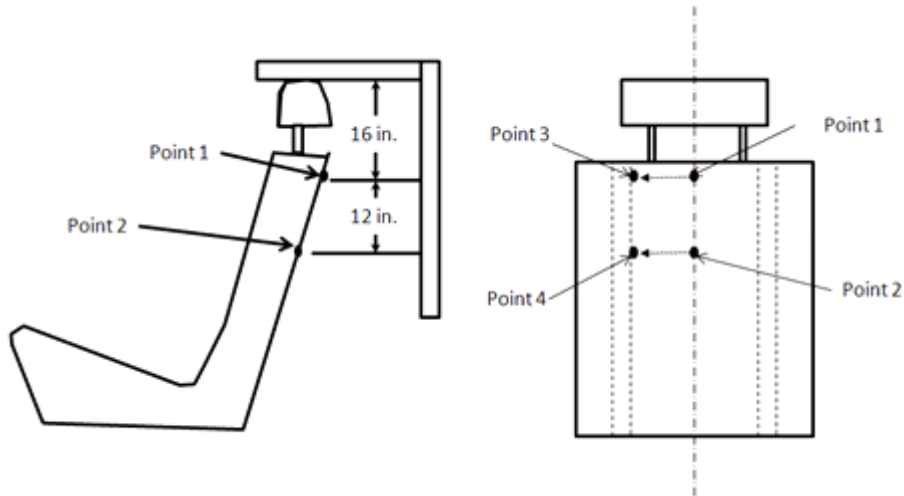


DATA SHEET NO.2 (CONTINUED)
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

SEAT BACK MEASUREMENT POINTS



Reference point: Rear most center of the top of rear bumper beam
 +X – From the rear of the vehicle to the front of the vehicle
 +Y – From the left side of the vehicle to the right side of the vehicle
 +Z – From the top of the vehicle to the bottom of the vehicle

	X	Y	Z
Point 3	1989.21	-504.77	-376.43
Point 4	2080.99	-545.61	-67.59

See Appendix E.1 for detailed description of the CMM measurement procedure.

DATA SHEET NO. 2 (CONTINUED)
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

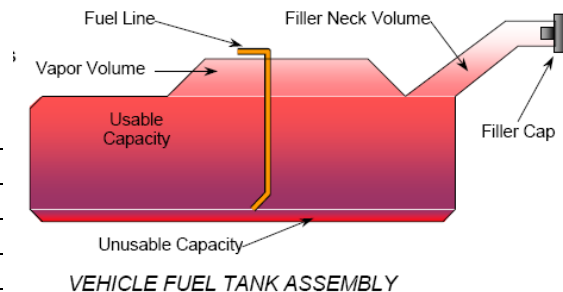
FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	67.8
Usable Capacity of "Optional Tank"	
92%-94% of Usable Capacity	63
Actual Amount of Solvent Used	63
1/3 of Usable Capacity	22

FUEL PUMP

Describe the fuel system - what type of fuel pump, details about how it operates, etc.

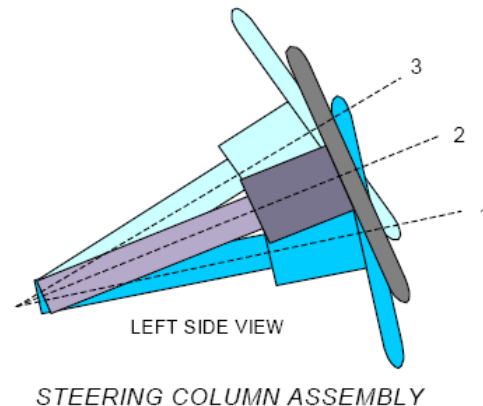
Fuel evacuated according to the specifications provided by the manufacturer in Form 1. Electric fuel pump operates with the ignition is in the 'on' position and the engine is running. The fuel filler neck is located above the right rear wheel.



STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. Describe how this measurement was taken.

The steering wheel was adjusted to the midpoint of Tilt angle range and the midpoint of the telescoping Travel (if applicable)



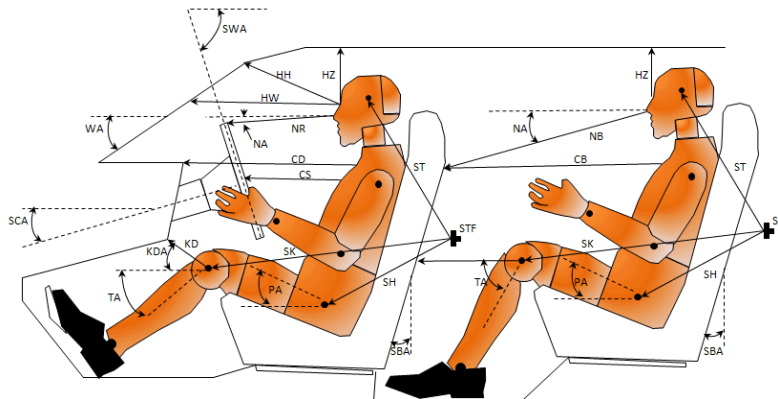
STEERING COLUMN POSITIONS

	Degrees	Fore/Aft Position (mm)
Lowermost position No. 1	20.7	
Geometric center position No. 2	23.5	
Uppermost position No. 3	26.3	
Telescoping Steering Wheel Travel		46
Test Position	23.5	23

DATA SHEET NO. 3 DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012



Code	Measurement Description	Driver (P1)		Passenger (P4)	
		Length (mm)	Angle(°)	Length (mm)	Angle (°)
WA°	Windshield Angle		-26.2		
SWA°	Steering Wheel Angle		23.2		
SCA°	Steering Column Angle		66.8		
SA°	Seat Back Angle (on headrest post)		12		30.4
HZ	Head to Roof (Z)	146	90	282	90
HH	Head to Header	348	20.2		
HW	Head to Windshield	635	0		
NR/NB	Nose to Rim / Seat Back	422	-14.6	530	-11.2
CD/CB	Chest to Dash/ Seat Back	587		533	
CS	Chest to Steering Hub	323	-3.4		
RA	Rim to Abdomen	180	0		
KDL/KBL	Left Knee to Dash/ Seat Back	175	20.1	276	23.1
KDR/KBR	Right Knee to Dash/ Seat Back	152	31.2	267	22.1
PA°	Pelvic Angle		-24.9		
TA°	Tibia Angle		-42		51.8
SK	Striker to Knee	549	2.6	554	-16.6
ST	Striker to Head	13	89	74	76
SH	Striker to H-Point	151	-37	145	-58
HAX°	Head Angle (X)		-0.2		
HAY°	Head Angle (Y)		4.0		
NAX°	Neck Angle (X)		-0.7		
NAY°	Neck Angle (Y)		0		
TAX°	T6 Angle (X)		16.7		
TAY°	T6 Angle (Y)		-1.5		
LAX°	Lumbar Angle (X)		1.6		
LAY°	Lumbar Angle (Y)		24.3		

DATA SHEET NO.3 (CONTINUED)
DUMMY CMM MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012

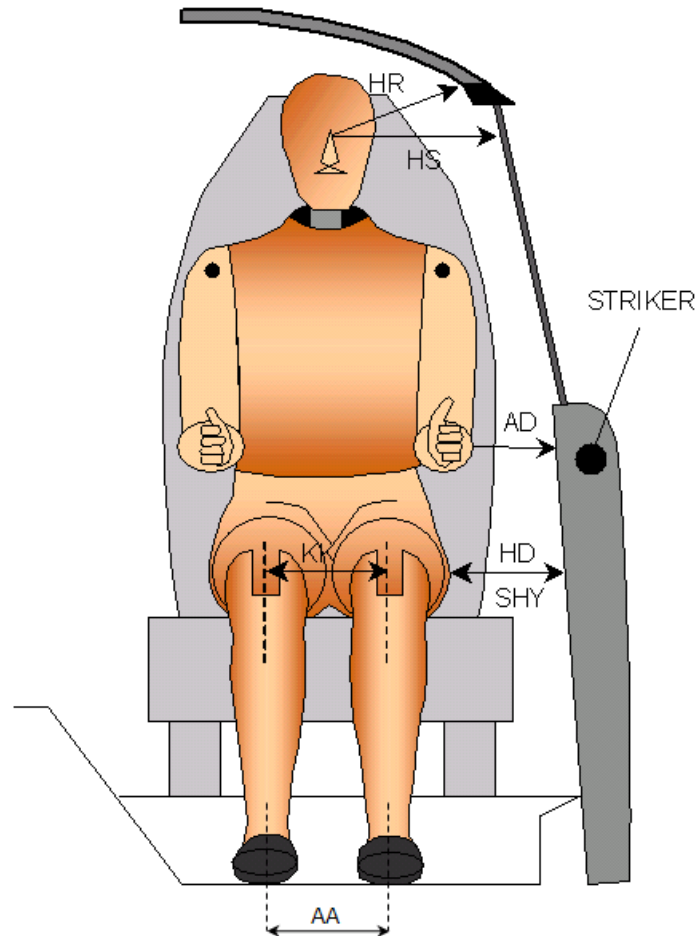
Description	Units	Driver			Passenger		
		X	Y	Z	X	Y	Z
Striker (Driver/Passenger)	mm	2182.40	-791.09	-160.79	1219.28	-798.19	-305.76
Head CG	mm	2225.46	-450.90	-737.00	1324.26	-436.92	-613.18
Bridge of Nose	mm	2323.31	-368.59	-739.06	1422.07	-366.63	-615.00
Tip of Nose	mm	2318.77	-370.00	-685.67	1444.18	-366.55	-583.68
Shoulder Bolt	mm	2251.74	-560.72	-491.75	1315.64	-517.55	-377.66
Tip of Chin	mm	2310.72	-370.29	-608.84	1429.39	-364.02	-513.24
H-point	mm	2363.09	-578.22	-45.42	1394.60	-481.68	-76.49
Left Knee	mm	2760.97	-563.96	-186.05	1803.93	-472.68	-140.88
Right Knee	mm	2767.33	-278.60	-188.26	1810.05	-303.93	-136.66
Left Ankle	mm	3078.85	-572.31	88.33	1964.46	-472.86	172.26
Right Ankle	mm	3084.54	-255.98	94.81	1965.21	-298.25	167.02
Left Heel	mm	3104.86	-543.27	224.42	1896.99	-284.05	241.60
Right Heel	mm	3099.36	-211.61	225.72	1896.85	-456.93	238.95
Driver's Outboard Seat Anchor Bolt	mm	2686.90	-574.86	151.80			
Outboard Head Restraint Post	mm	1999.78	-450.30	-505.08	1044.40	-429.38	-587.95
Top of Head Restraint*	mm	2052.66	-373.65	-784.66	1065.00	-359.94	-776.32
Center of Steering Wheel	mm	2652.34	-375.80	-431.60			

Reference point: Rear most center of the top of rear bumper beam
 +X – From the rear of the vehicle to the front of the vehicle
 +Y – From the left side of the vehicle to the right side of the vehicle
 +Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

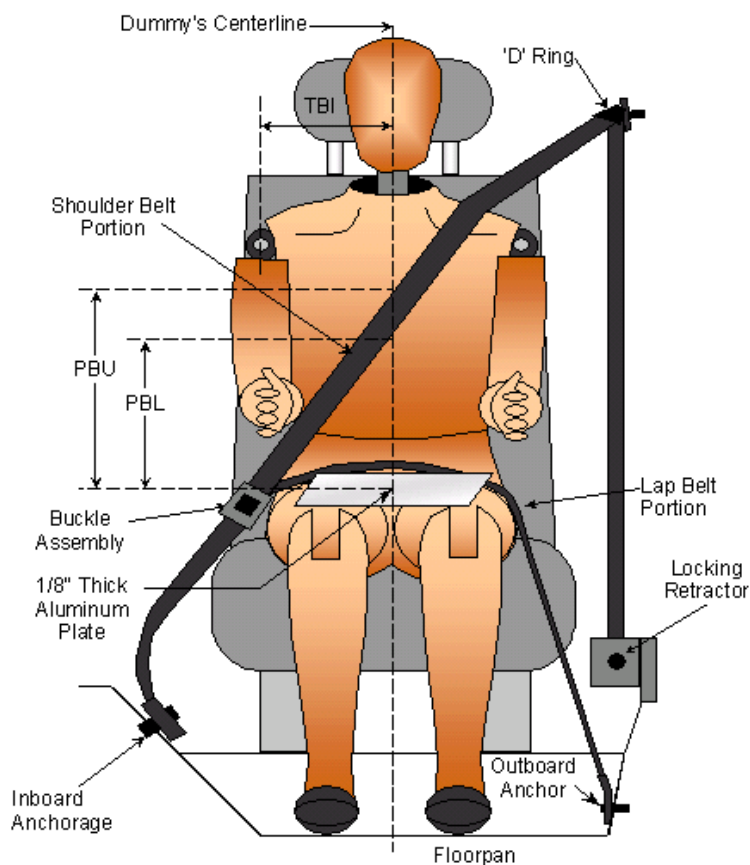


Code	Description	Units	Driver (P1)	Passenger (P4)
AD	Arm to Door	mm	128	105
HD	H-Point to Door	mm	136	196
HR	Head to Side Header	mm	197	250
HS	Head to Side Window	mm	362	360
KK	Knee to Knee	mm	282	168
SHY	Striker to H-Point (Y Direction)	mm	215	295
AA	Ankle to Ankle	mm	305	168

DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU — Top surface of reference to belt upper edge	mm	380	315
PBL — Top surface of reference to belt lower edge	mm	295	225

BELT LENGTH DATA

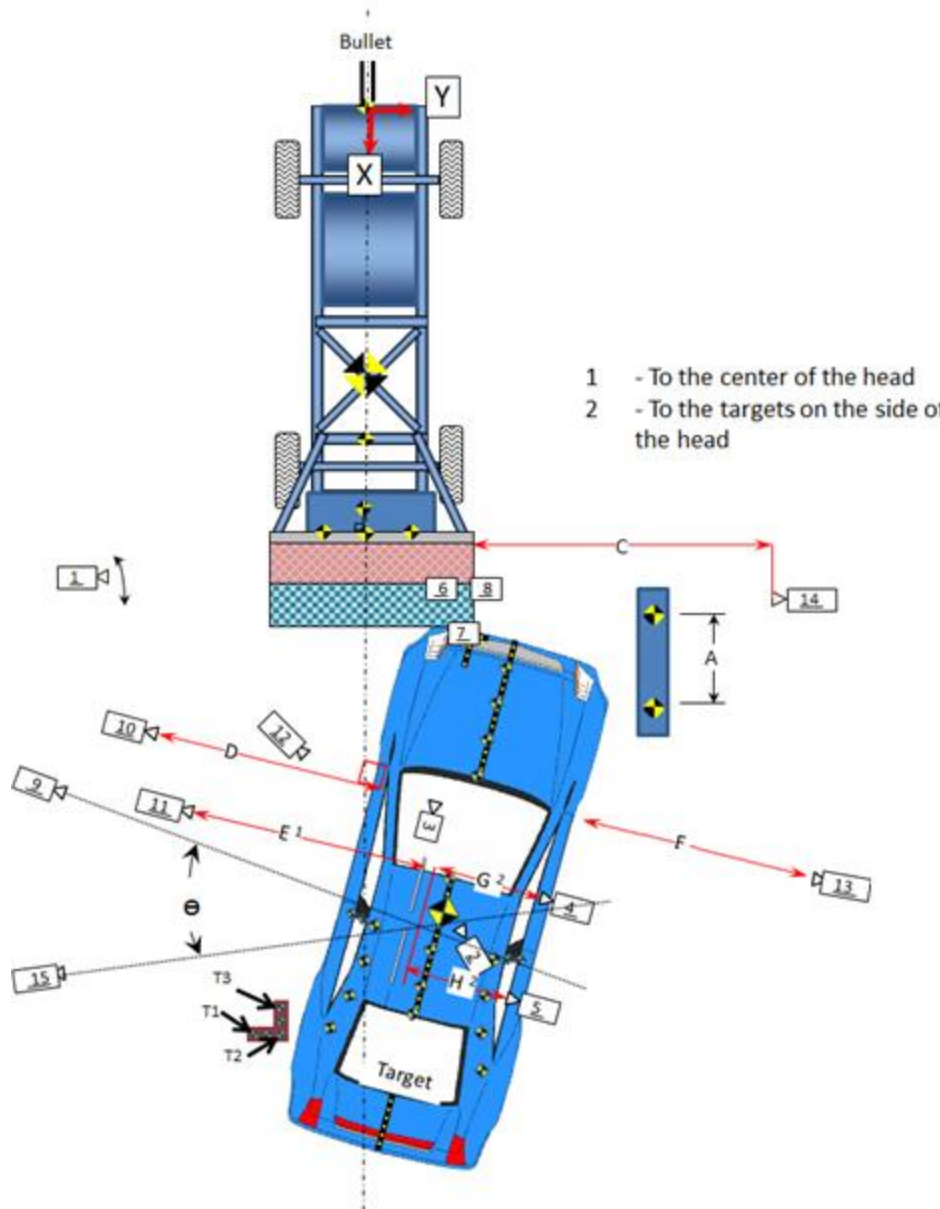
Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	860	950
Lap Belt Length as measured on ATD	mm	470	520
Remainder of belt on reel	mm	1120	1380
Total belt length for continuous webbing systems	mm	2450	2850

DATA SHEET NO. 6 **HIGH-SPEED CAMERA LOCATIONS AND DATA**

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

HORIZONTAL LOCATION



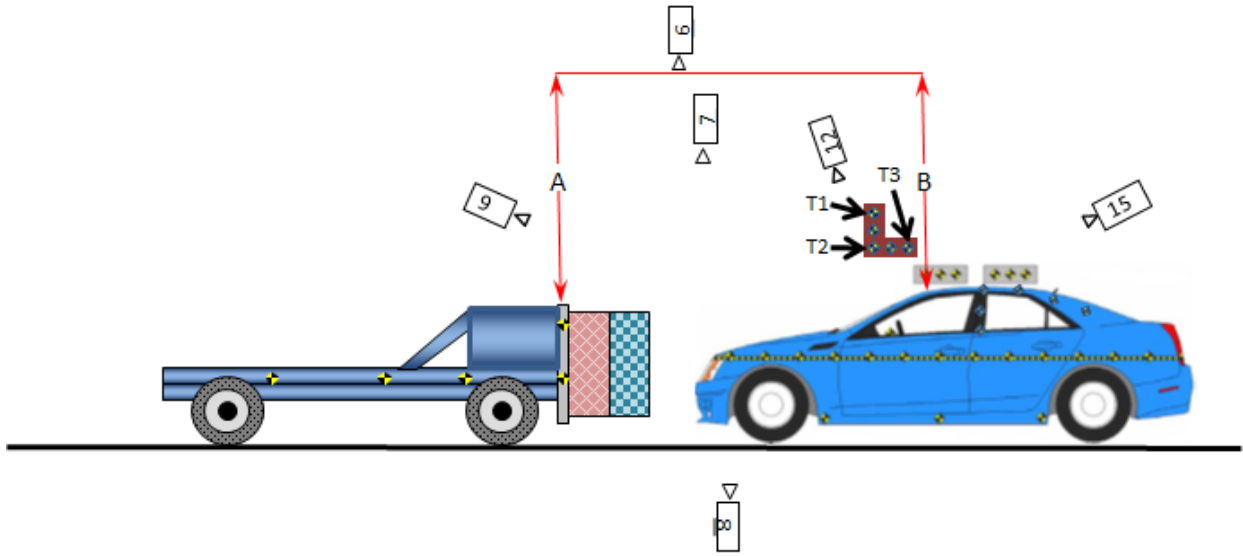
A	mm	915
B	mm	
C	mm	8671
D	mm	9724
E	mm	9500
F	mm	6914
G	mm	778
H	mm	765

DATA SHEET NO. 6 (CONTINUED)
HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle:	2012 Volvo S60 Four Door Sedan
Test Program:	R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012

HORIZONTAL LOCATION



	Units	Value
A	mm	2763
B	mm	2538

DATA SHEET NO. 6 (CONTINUED)
HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

CAMERA LOCATIONS

No.	Camera View	Location (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Side	-	-	-	Zoom	30
2	Onboard Driver Over Shoulder	3222	1451	1217	12.5	500
3	Onboard Driver Lower Leg	1761	1135	249	6.5	500
4	Onboard Driver Perpendicular	2164	2015	814	12.5	500
5	Onboard Rear Passenger Perpendicular	3067	1834	830	12.5	500
6	Overall Top View	2243	985	3950	14	1000
7	Close-Up Impact Point Top View	0	1091	4625	28	1000
8						
9	Overall Left Side View	499	10119	2711	24-70	1000
10	Target Vehicle Left Side	556	8988	1334	28	1000
11	Driver's Motion	292	8762	1323	50	1000
12	Look Down Driver's Motion	2917	563	3558	24	1000
13	Target Vehicle Right Side	3424	9104	1783	24	1000
14	Bullet Vehicle Left Side	110	9779	965	24	1000
15	Bullet Vehicle Right Side	6791	10150	2801	28-70	1000
16	Above RMDB	-75	853	1967	13	1000

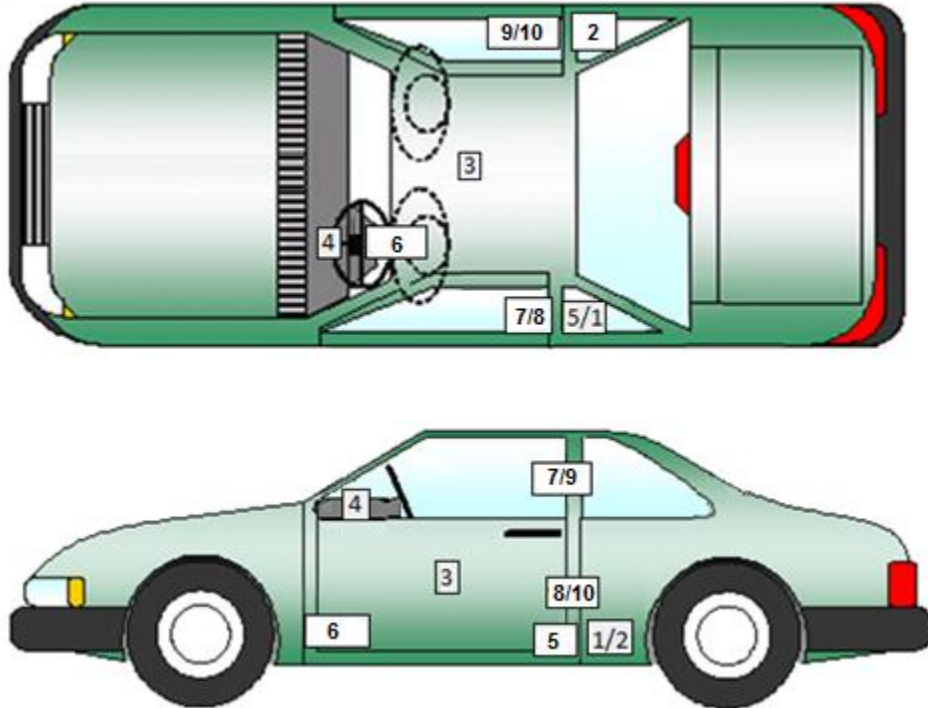
Reference Point: Center most rearward point of the RMDB when in contact with the target vehicle:

- +X – From back of RMDB to front of RMDB
- +Y – Right of monorail center
- +Z – Up from ground

DATA SHEET NO. 7
VEHICLE INSTRUMENTATION DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Axes	Units	Measurements (mm)		
				X	Y	Z
1	Left Rear Sill	X,Y	mm	2087	-677	175
2	Right Rear Sill	X,Y	mm	2044	678	186
3	Vehicle CG	X, Y, Z	mm	2969	95	115
4	Instrument Panel	X	mm	2949	27	-380
5	Driver Seat Track	X, Y, Z	mm	2242	-480	232
6	Behind Brake Pedal	X, Y, Z	mm	3398	-430	-83

Reference Points: Rearmost center of the top of rear bumper beam

+X – From rear of vehicle to the front of vehicle

+Y – From the left side of the vehicle to the right side of the vehicle

+Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO. 7 (CONTINUED)
VEHICLE INSTRUMENTATION DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

VEHICLE INSTRUMENTATION DATA

Loc.	Description	Axes	Units	Positive Direction		Negative Direction	
				Max	Time (ms)	Max	Time (ms)
1	Left Rear Cross Member	X	G	1.58	129.10	-36.68	31.45
		Y	G	21.72	44.90	-3.84	75.70
2	Right Rear Cross Member	X	G	1.01	140.90	-26.55	63.90
		Y	G	19.75	57.75	-10.33	34.40
3	Vehicle CG	X	G	4.79	94.55	-35.85	34.95
		Y	G	35.36	62.80	-34.99	37.10
		Z	G	52.28	43.95	-80.06	48.55
4	Instrument Panel	X	G	0.38	3.05	-512.25	84.85
5	Driver Seat Track	X	G	1.00	129.95	-36.56	42.40
		Y	G	16.13	56.70	-4.84	74.25
		Z	G	20.58	32.85	-17.69	85.60
6	Behind Brake Pedal	X	G	6.64	71.55	-65.89	49.20
		Y	G	32.16	41.35	-10.78	32.75
		Z	G	22.90	33.00	-21.51	41.55
7	Driver Shoulder Belt		N	4692.04	75.75	-31.40	205.60
8	Driver Lap Belt		N	4788.63	59.80	-0.34	3.60
9	Passenger Shoulder Belt		N	6249.28	67.85	-20.72	165.85
10	Passenger Lap Belt		N	5,089.17	57.90	-19.33	238.15

TIME TO FIRE RESTRAINT TIMING

Loc.	Description	Axes	Units	Time to Fire (ms)
1	Driver Air Bag Squib 1	*	V	32.5
2	Driver Air Bag Squib 2	*	V	45.5
3	Steering column deformation igniter	*	V	32.5
4	Driver Head Curtain Airbag	*	V	45.5
5	Driver Torso Airbag	*	V	Did Not Fire
6	Driver Pretensioner	*	V	33.5
7	Driver Lap Belt	*	V	33.5

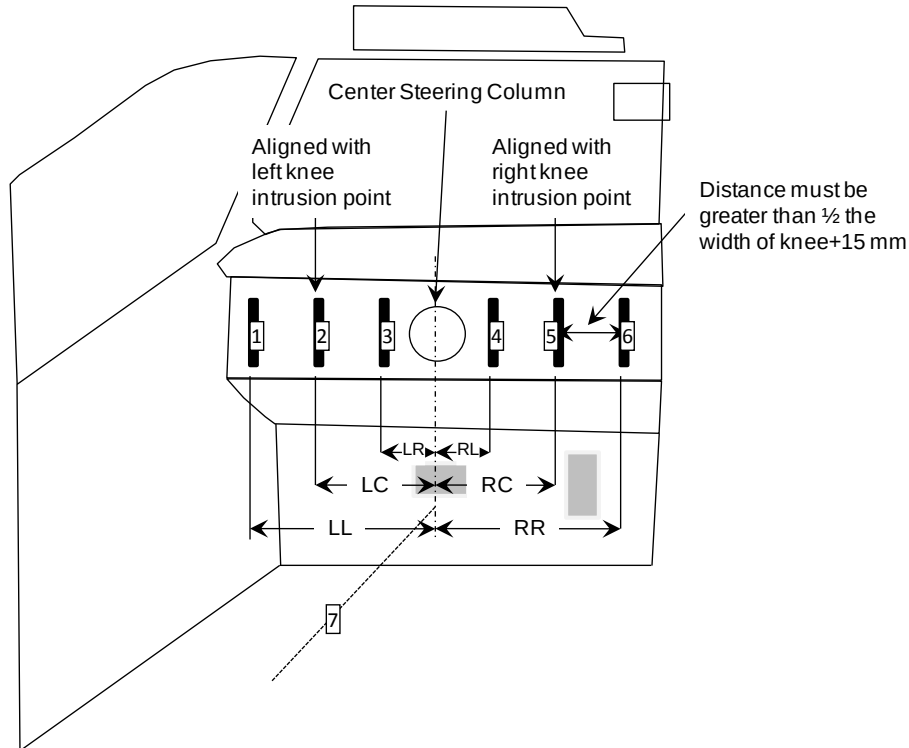
* The measurement indicates the time the voltage changed

DATA SHEET NO. 7 (CONTINUED)

VEHICLE INSTRUMENTATION DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012



Location	Distance (mm)	Location	Distance (mm)
LL	200	RL	100
LC	150	RC	150
LR	100	RR	200

VEHICLE INSTRUMENTATION DATA

Loc.	Description		Positive Direction		Negative Direction	
			Max	Time (ms)	Max	Time (ms)
1	Left knee contact switch (LL)	*	1.00	48.40	0.00	-50.00
2	Left knee contact switch (LC)	*	1.00	52.45	0.00	-50.00
3	Left knee contact switch (LR)	*	1.00	53.85	0.00	-50.00
4	Right knee contact switch (RL)	*	1.00	43.40	0.00	-50.00
5	Right knee contact switch (RC)	*	1.00	50.75	0.00	-50.00
6	Right knee contact switch (RR)	*	0.00	-50.00	0.00	-50.00
7	Toe Pan String Pot (mm)		0.07	1.10	-31.84	98.20

* The measurement indicates the initial time the voltage changed

DATA SHEET NO. 8

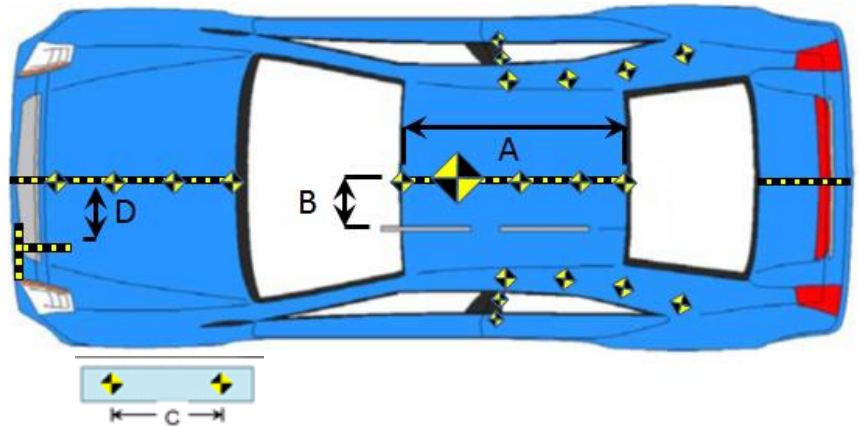
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

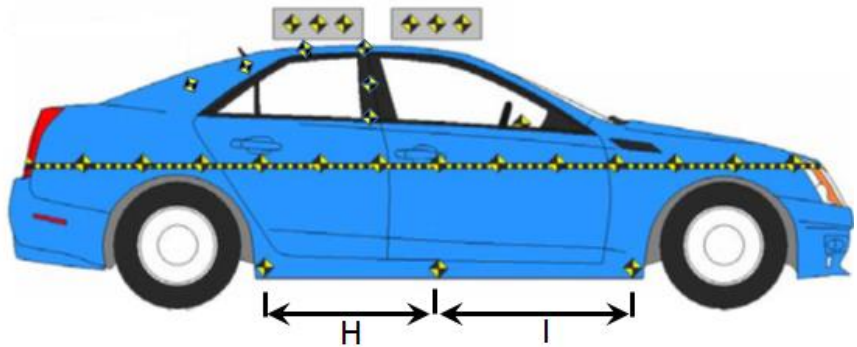
NHTSA No.: RC5909
 Test Date: 4/30/2012

Item	Units	Value
A	mm	1375
B	mm	350
C	mm	915
D	mm	366
E	mm	849
F	mm	938
G	mm	936
H	mm	938
I	mm	931

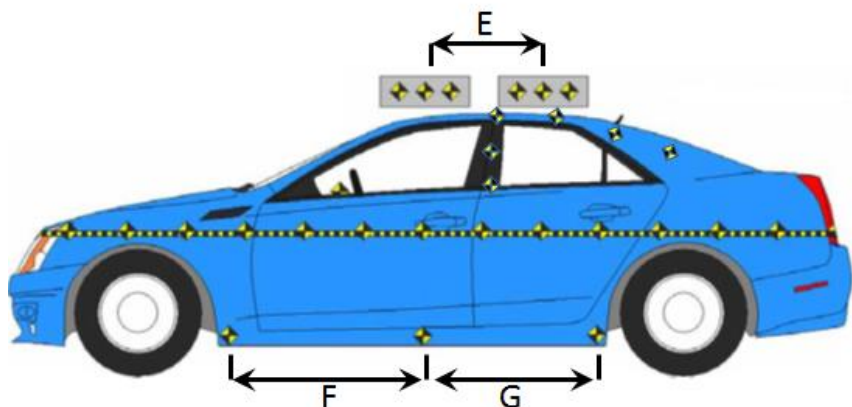
TOP VIEW



RIGHT SIDE VIEW



LEFT SIDE VIEW



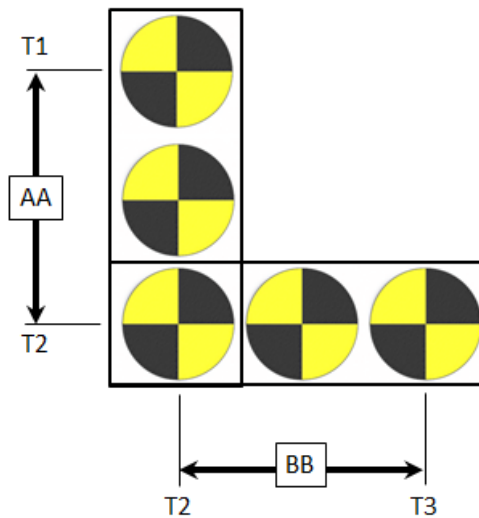
DATA SHEET NO. 8 (CONTINUED)
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012

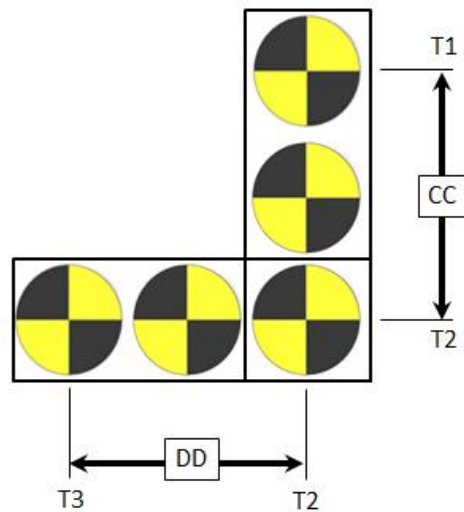
Overhead Reference Targets:

AA (T1 to T2) 236 mm
BB (T2 to T3) 236 mm



Ground Reference Targets:

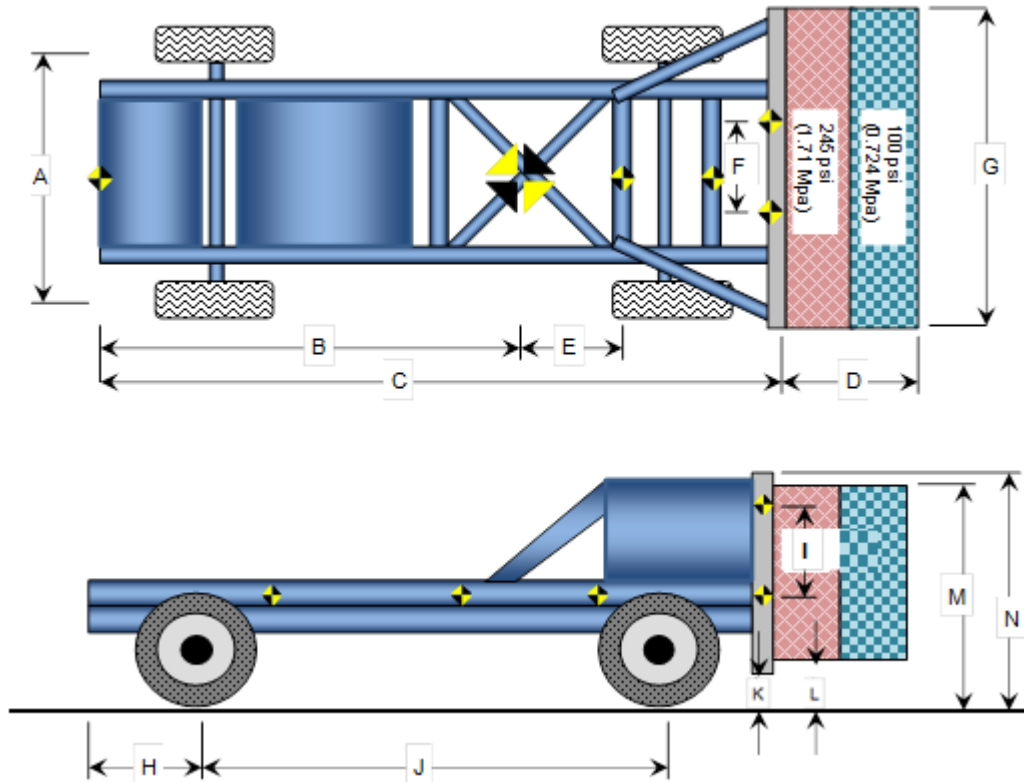
CC (T1 to T2) 236 mm
DD (T2 to T3) 236 mm



DATA SHEET NO. 8 (CONTINUED)
RMDB PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012



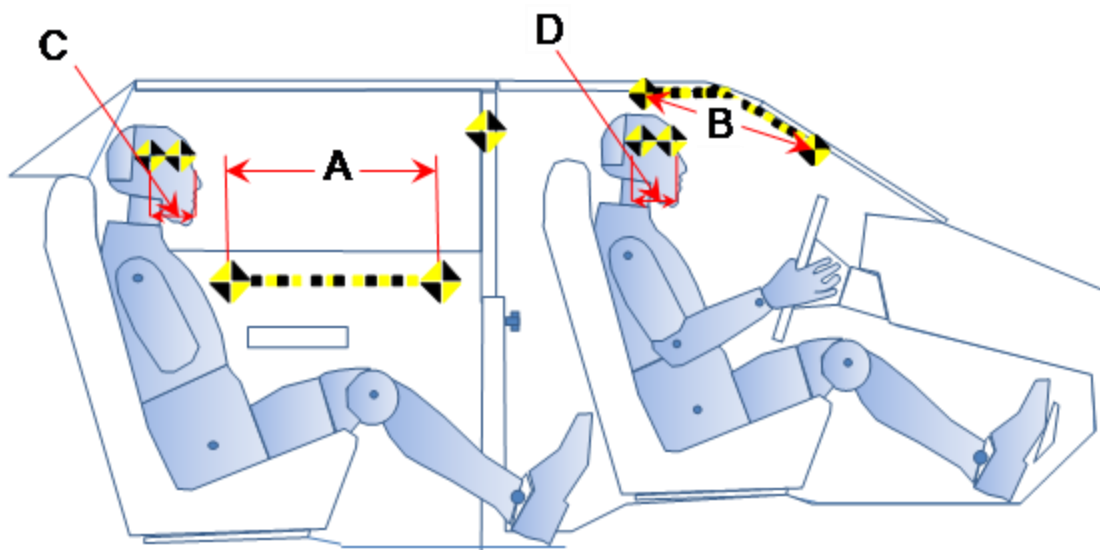
Item	Units	Value	Item	Units	Value
A	mm	1313	H	mm	795
B	mm	2215	I	mm	500
C	mm	3940	J	mm	2585
D	mm	606	K	mm	90
E	mm	1185	L	mm	83
F	mm	1127	M	mm	1034
G	mm	2210	N	mm	1187

	Units	Front Axle	Rear Axle	Total
Left	kg	779.3	470.4	1249.7
Right	kg	749.3	487.2	1236.5
Ratio	%	61.5%	38.5%	100%
Total	kg	1528.6	957.6	2486.2
CG After of Front Axle	mm			1285.6

DATA SHEET NO. 8 (CONTINUED)
DUMMY PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012



Item	Units	Value (mm)
A	mm	305
B	mm	305
C	mm	50
D	mm	51

Note: Target measurements are center to center.

DATA SHEET NO. 9
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012

INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy Accelerometers	124
Passenger Dummy Accelerometers	52
Vehicle Structure Accelerometers	32
RMDB Cart Accelerometers	6
Total	214

CAMERA COVERAGE

Type of Camera	Number Used in this Test
High-Speed Vehicle Onboard	4
High-Speed Off-board	10
Real-Time Panning	1
Total	15

DATA SHEET NO. 10
POST TEST OBSERVATIONS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type/Serial No.	THOR 007	HIII 5 th Female 070
Lower Leg Type	THOR LOWER LEG LX	
Lower Leg Serial No.	LX036 / LX037	
Head Contact	Front airbag, curtain airbag	Curtain airbag and head rest
Upper Torso Contact	Front airbag and driver door	Passenger door
Lower Torso Contact	Front airbag	No contact
Left Knee Contact	Knee bolster	Driver seat back
Right Knee Contact	Knee bolster	Driver seat back

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Unlocked	Unlocked
Front Door Opening	Jammed shut	Remained closed and operational
Rear Door Opening	Remained closed and operational	Remained closed and operational
Seat Track Shift (mm)	No Shift	No Shift
Seat Back Failure	No Failure	No Failure
Glazing Damage	None	None

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	A-pillar buckled causing some separation between top of door and vehicle
Windshield Damage	Cracks throughout
Window Damage	None
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

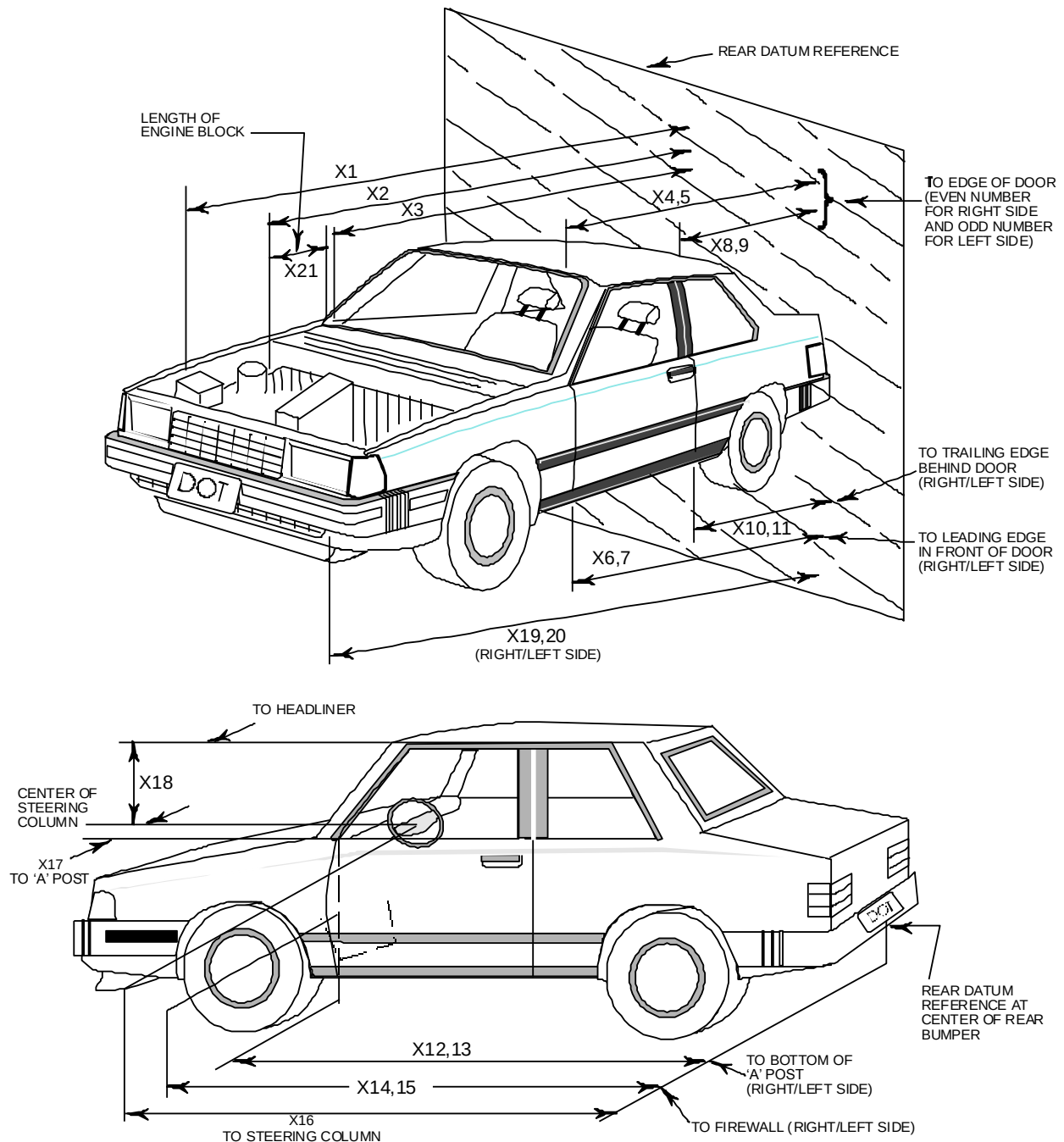
Restraint Type	Driver (Occupant 1)		Left Rear Passenger (Occupant 2)	
	Installed	Deployed	Installed	Deployed
Front Airbag	Yes	Yes	No	N/A
Curtain Airbag	Yes	Yes	Yes	Yes
Torso Airbag	Yes	No	No	N/A
Knee Airbag	No	No	No	N/A
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes	Yes	Yes	Yes
Other				

DATA SHEET NO. 11

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012



DATA SHEET NO. 11 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

No.	Measurement Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	4630	4633	-3
2	Rear Surface of Vehicle (RSOV) to Front of Engine	4083	4036	47
3	RSOV to Firewall	3474	3441	33
4	RSOV to Upper Leading Edge of Right Door	3165	3151	15
5	RSOV to Upper Leading Edge of Left Door	3168	3150	18
6	RSOV to Lower Leading Edge of Right Door	3165	3149	16
7	RSOV to Lower Leading Edge of Left Door	3163	3124	39
8	RSOV to Upper Trailing Edge of Right Door	2070	2057	13
9	RSOV to Upper Trailing Edge of Left Door	2072	2076	-4
10	RSOV to Lower Trailing Edge of Right Door	2129	2114	15
11	RSOV to Lower Trailing Edge of Left Door	2130	2093	37
12	RSOV to Bottom of "A" Post of Right Side	3138	3124	14
13	RSOV to Bottom of "A" Post of Left Side	3142	3134	8
14	RSOV to Firewall, Right Side	3765	3754	11
15	RSOV to Firewall, Left Side	3763	3625	138
16	RSOV to Steering Column	2652	2720	-68
17	Center of Steering Column to "A" Post	279	263	17
18	Center of Steering Column to Headliner	407	379	28
19	RSOV to Right Side of Front Bumper	4549	4559	-10
20	RSOV to Left Side of Front Bumper	4550	4537	13
21	Length of Engine Block	371	371	0
RD	RSOV to Right Side of Dash Panel	2909	2919	-10
CD	RSOV to Center of Dash Panel	2873	2855	18
LD	RSOV to Left Side of Dash Panel	2909	2864	46

All Dimensions in mm

DATA SHEET NO. 12
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

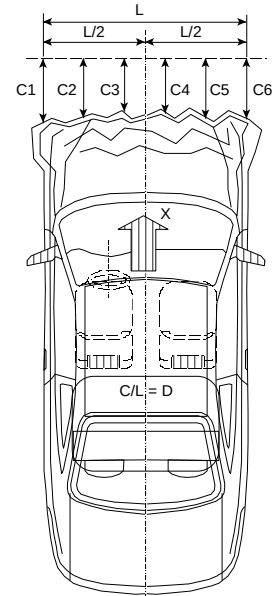
NHTSA No.: RC5909
 Test Date: 4/30/2012

VEHICLE INFORMATION

VIN: YV1622FS2C2099609 Wheelbase (mm): 2777
 Vehicle Size Category: Four Door Sedan Test Weight (kg): 1869

ACCELEROMETER DATA

Accelerometer Locations: As Described in Data Sheet No. 7
 Cal. Procedure/Interval: Calspan Procedure / 6 month
 Integration Algorithm: Trapezoidal
 Linearity: > 99%
 Impact Velocity (km/h): 90.64
 Velocity Change (km/h): 90.64
 Time of Separation (ms):



CRUSH PROFILE

Collision Deformation Classification: 12FLEE5
 Midpoint of Damage: C2
 Damage Region Length (mm): 1289
 Impact Mode: Frontal 7° Angle, 20% Offset

Crush Measurements: With Bumper Cover

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4446	4231	215
C2	Crush zone 2 at left side	mm	4589	4578	11
C3	Crush zone 3 at left side	mm	4627	4624	3
C4	Crush zone 4 at right side	mm	4626	4633	-7
C5	Crush zone 5 at right side	mm	4587	4600	-13
C6	Crush zone 6 at right side	mm	4444	4452	-8
L	C1 to C6	mm	1289	1227	62

Crush Measurements: With Bumper Cover Removed

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4455	4281	-174
C2	Crush zone 2 at left side	mm	4490	4398	-92
C3	Crush zone 3 at left side	mm	4504	4441	-64
C4	Crush zone 4 at right side	mm	4504	4465	-39
C5	Crush zone 5 at right side	mm	4490	4474	-16
C6	Crush zone 6 at right side	mm	4454	4460	7
L	C1 to C6	mm	1191	1132	59

DATA SHEET NO. 13
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

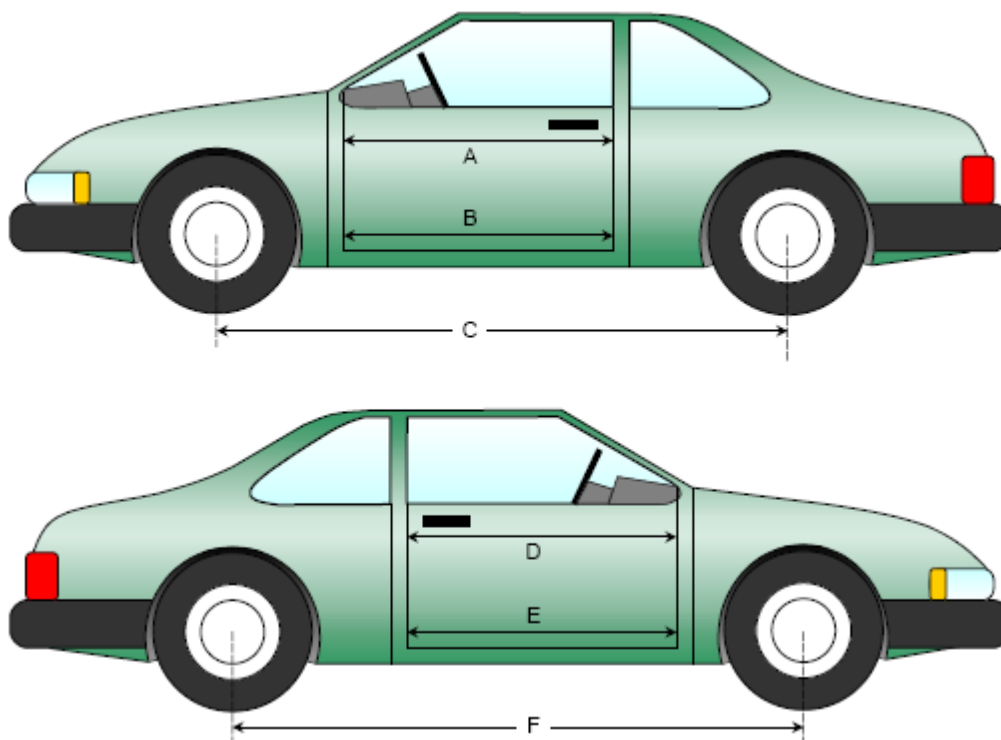
NHTSA No.: RC5909
 Test Date: 4/30/2012

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	930	864	-66
B	Left Side Lower	mm	815	763	-52
D	Right Side Upper	mm	931	930	-1
E	Right Side Lower	mm	818	818	-1

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2775	2706	-69
F	Right Side Wheelbase	mm	2778	2807	29



DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

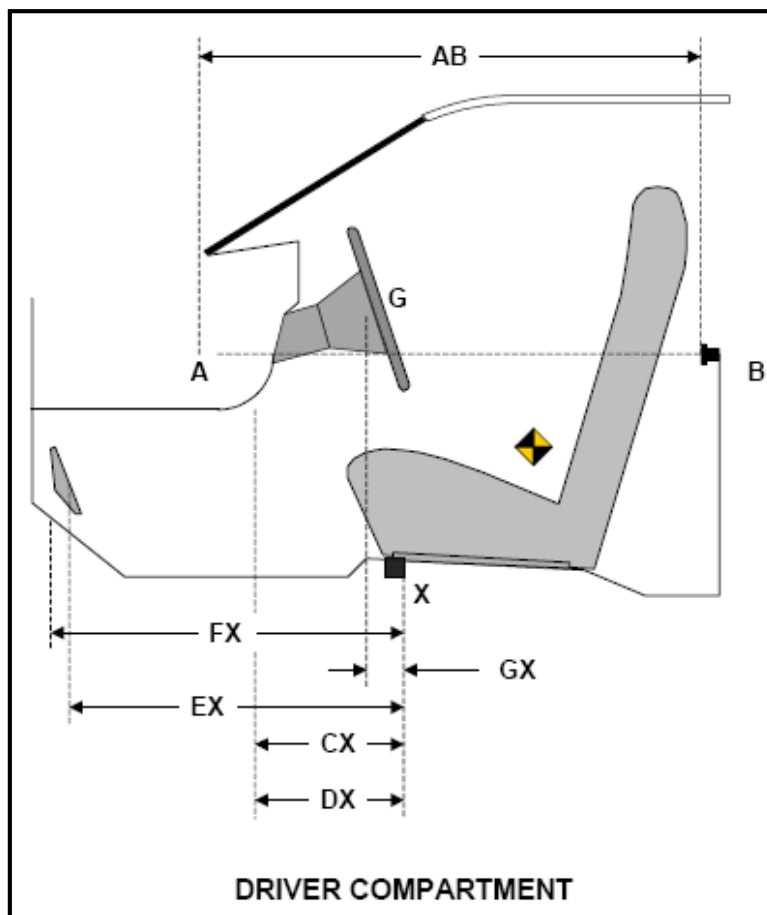
Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	764	731	-33
CX	Left Knee Bolster to X	mm	270	235	-34
DX	Right Knee Bolster to X	mm	241	224	-16
EX	Brake Pedal to X	mm	477	452	-25
FX	Foot Rest to X	mm	627	590	-36
GX	Center of Steering Column Wheel Hub to X	mm	-35	35	70

X = Front of Seat Track (Stationary)

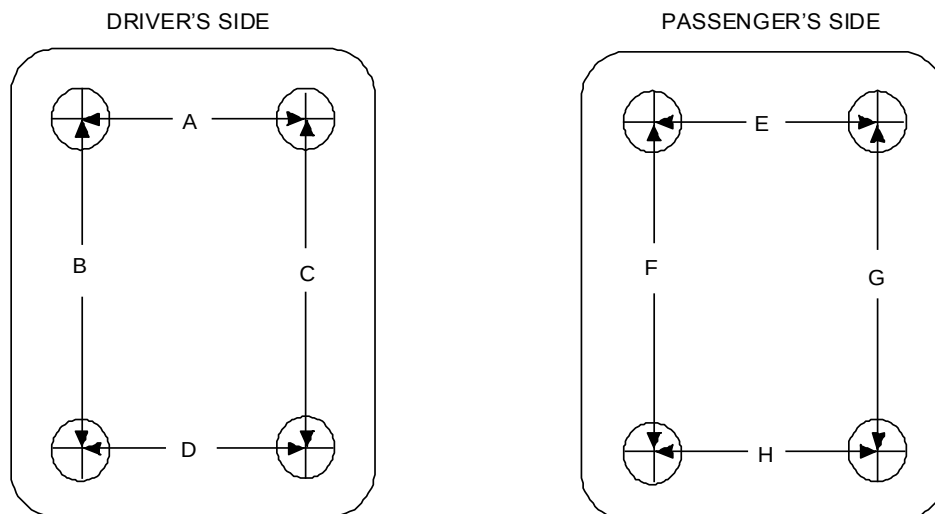


DATA SHEET NO.13 (CONTINUED) **VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

TOP VIEW THROUGH FLOOR PAN



UNDERBODY FLOOR DEFORMATION

Measurement	Pre-Test	Post-Test	Difference
A	415	417	-2
B	347	344	3
C	323	313	10
D	469	448	21
E	439	434	4
F	264	263	1
G	284	286	-3
H	354	352	2

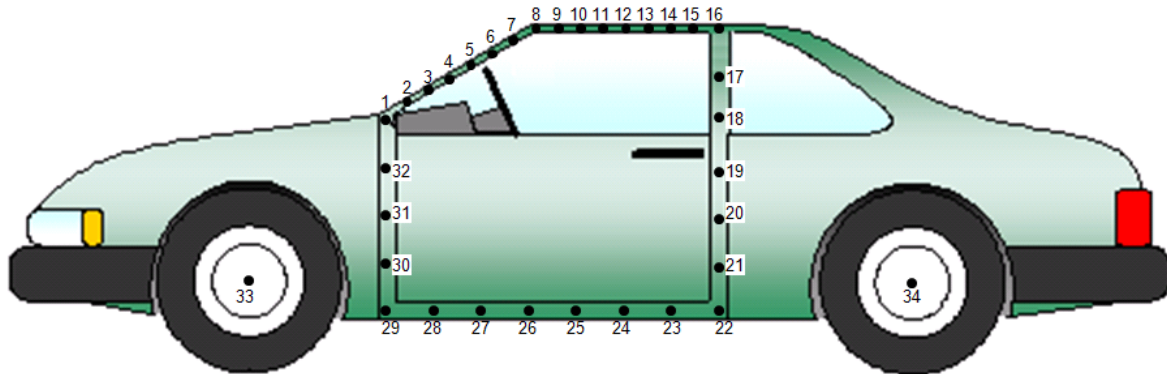
All units are in millimeters

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012

DRIVER SIDE DOOR SILL INTRUSIONS



Left Side View

Reference point: Rear most center of the top of rear bumper beam

+X – From the rear of the vehicle to the front of the vehicle

+Y – From left side of the vehicle to the right side of the vehicle

+Z – From the top of the vehicle to the bottom of the vehicle

Note: See appendix E.2 for detailed procedure to measure required Door sill intrusion.

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

DRIVER SIDE DOOR SILL INTRUSIONS

Point	Pre-Test			Post-Test			Difference		
	X	Y	Z	X	Y	Z	X	Y	Z
1	3102.41	-772.20	-481.93	3092.89	-715.44	-375.18	-10	57	107
2	3040.02	-748.24	-551.39	3049.01	-699.54	-456.96	9	49	94
3	2960.94	-731.64	-612.13	2988.45	-685.40	-535.59	28	46	77
4	2876.53	-711.31	-659.49	2925.98	-661.34	-606.97	49	50	53
5	2791.19	-691.71	-702.24	2847.33	-642.79	-654.57	56	49	48
6	2702.82	-671.37	-741.14	2755.24	-627.66	-691.42	52	44	50
7	2610.46	-652.41	-776.76	2662.72	-611.22	-728.07	52	41	49
8	2515.97	-635.31	-806.90	2569.04	-596.00	-757.09	53	39	50
9	2451.85	-625.48	-823.88	2504.66	-588.10	-774.78	53	37	49
10	2386.96	-616.73	-837.94	2439.43	-580.68	-789.18	52	36	49
11	2320.00	-609.48	-849.86	2373.26	-575.00	-801.41	53	34	48
12	2255.52	-603.80	-858.92	2308.07	-571.10	-811.01	53	33	48
13	2187.66	-599.61	-865.70	2240.36	-569.56	-818.34	53	30	47
14	2122.92	-597.22	-870.53	2175.26	-569.08	-823.40	52	28	47
15	2055.72	-594.64	-871.81	2108.72	-566.89	-828.30	53	28	44
16	1993.25	-593.56	-872.35	2046.44	-565.96	-830.51	53	28	42
17	2029.71	-702.61	-729.89	2076.10	-673.41	-686.36	46	29	44
18	2071.09	-777.15	-565.10	2111.26	-748.11	-519.95	40	29	45
19	2111.02	-809.87	-388.31	2143.17	-782.17	-342.85	32	28	45
20	2138.85	-813.51	-203.92	2160.90	-786.87	-156.05	22	27	48
21	2173.58	-816.27	-23.76	2186.10	-792.71	25.51	13	24	49
22	2210.95	-827.33	152.42	2214.63	-799.16	203.92	4	28	51
23	2342.41	-829.92	162.80	2344.85	-797.82	221.99	2	32	59
24	2471.49	-829.45	171.13	2473.32	-794.64	237.29	2	35	66
25	2600.28	-827.86	170.88	2602.26	-789.19	245.48	2	39	75
26	2728.03	-829.10	173.37	2729.87	-785.09	253.91	2	44	81
27	2858.12	-829.14	174.07	2859.92	-781.29	263.63	2	48	90
28	2990.52	-829.33	173.55	2991.15	-774.32	273.71	1	55	100
29	3120.82	-829.83	173.18	3090.24	-768.18	263.97	-31	62	91
30	3126.59	-821.37	6.11	3072.23	-772.91	106.23	-54	48	100
31	3114.96	-817.47	-154.75	3067.86	-762.20	-55.51	-47	55	99
32	3105.02	-814.15	-319.85	3064.02	-759.01	-220.45	-41	55	99

Points are measured at the inner most surface of the door opening, typically on the pinch weld.

Note:

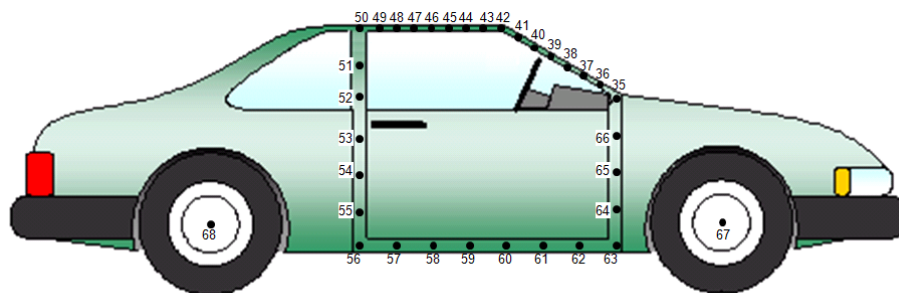
See Appendix E.2 for detailed procedure on how to measure the required door sill intrusions.

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012

PASSENGER SIDE DOOR SILL INTRUSIONS



Right Side View

Reference point: Rear most center of the top of rear bumper beam

+X – From the rear of the vehicle to the front of the vehicle

+Y – From left side of the vehicle to the right side of the vehicle

+Z – From the top of the vehicle to the bottom of the vehicle

Note: See appendix E.2 for detailed procedure to measure required Door sill intrusion.

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

PASSENGER SIDE DOOR SILL INTRUSION

Point	Pre-Test			Post-Test			Difference		
	X	Y	Z	X	Y	Z	X	Y	Z
35	3099.78	764.20	-494.24	3112.40	801.70	-442.56	13	37	52
36	3034.77	742.08	-563.88	3049.11	777.85	-513.16	14	36	51
37	2954.46	721.51	-616.33	2971.76	755.99	-568.27	17	34	48
38	2870.48	702.86	-664.38	2888.76	734.20	-617.73	18	31	47
39	2784.67	683.03	-706.69	2803.89	712.94	-663.23	19	30	43
40	2696.93	663.99	-746.12	2718.24	691.87	-703.97	21	28	42
41	2607.04	645.60	-780.15	2629.08	671.73	-740.74	22	26	39
42	2509.66	627.96	-810.60	2533.05	652.91	-773.28	23	25	37
43	2445.66	618.83	-827.65	2469.84	643.22	-791.81	24	24	36
44	2382.31	610.34	-840.62	2406.87	634.19	-806.53	25	24	34
45	2318.31	603.77	-851.97	2343.32	626.64	-818.82	25	23	33
46	2253.77	598.52	-860.96	2278.94	620.71	-829.67	25	22	31
47	2188.80	594.90	-868.46	2214.02	616.26	-838.59	25	21	30
48	2122.85	592.05	-872.63	2147.89	612.99	-843.82	25	21	29
49	2054.81	590.01	-875.92	2081.04	610.29	-848.91	26	20	27
50	1991.76	588.47	-875.27	2017.27	608.11	-851.76	26	20	24
51	2026.33	697.56	-733.49	2046.83	715.85	-707.08	21	18	26
52	2066.80	771.94	-570.08	2082.01	789.01	-540.91	15	17	29
53	2104.91	806.78	-398.51	2116.32	822.07	-368.60	11	15	30
54	2126.68	809.66	-215.23	2133.67	822.89	-184.38	7	13	31
55	2150.94	813.72	-34.20	2152.80	825.16	-2.86	2	11	31
56	2155.14	824.55	149.29	2151.93	833.12	179.95	-3	9	31
57	2292.97	827.41	158.45	2289.60	839.25	192.07	-3	12	34
58	2432.26	827.06	164.45	2428.91	843.22	202.92	-3	16	38
59	2570.73	826.30	171.06	2566.87	845.70	210.00	-4	19	39
60	2711.65	826.17	171.01	2705.93	850.92	214.23	-6	25	43
61	2848.83	825.88	170.61	2843.94	855.08	216.49	-5	29	46
62	2990.04	825.79	167.68	2983.57	859.96	216.24	-6	34	49
63	3127.39	826.04	161.24	3122.26	862.42	212.21	-5	36	51
64	3122.82	817.58	1.97	3124.83	856.03	55.61	2	38	54
65	3119.58	813.23	-167.76	3123.56	851.16	-115.35	4	38	52
66	3100.22	809.08	-334.68	3107.71	846.50	-281.96	7	37	53

Points are measured at the inner most surface of the door opening, typically on the pinch weld.

Note:

See Appendix E.2 for detailed procedure on how to measure the required door sill intrusions.

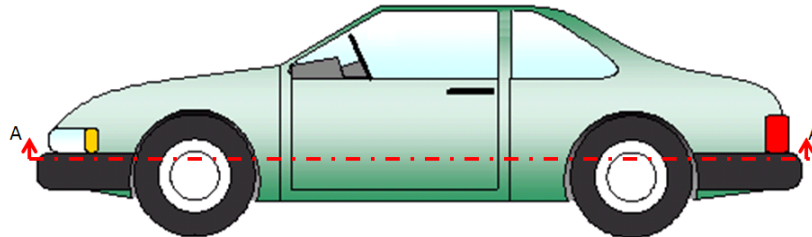
DATA SHEET NO.13 (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

VEHICLE EXTERIOR CRUSH PROFILE



Reference point: Rear most center of the top of rear bumper beam

+X – From the rear of the vehicle to the front of the vehicle

+Y – From left side of the vehicle to the right side of the vehicle

+Z – From the top of the vehicle to the bottom of the vehicle

SECTION A-A

Point	Pre-Test			Point	Post-Test		
	X	Y	Z		X	Y	Z
1	526.50	869.78	51.88	1	543.14	863.09	39.80
2	442.51	845.34	47.01	2	404.47	806.99	37.80
3	343.96	810.63	46.46	3	239.85	711.75	25.67
4	257.63	773.22	45.56	4	112.65	634.56	17.21
5	174.76	727.81	43.03	5	43.52	482.43	8.48
6	113.22	673.45	42.06	6	24.95	293.63	-0.46
7	64.35	583.24	45.39	7	24.05	150.62	-3.91
8	34.70	492.33	44.50	8	27.16	-58.13	-14.77
9	13.33	345.01	48.23	9	36.00	-293.23	-20.90
10	5.52	188.32	47.90	10	62.44	-502.54	-29.94
11	2.17	69.84	44.94	11	146.37	-688.26	-30.43
12	1.78	-31.19	44.45	12	329.47	-804.80	-24.95
13	3.43	-150.35	44.72	13	433.89	-844.33	-21.19
14	8.01	-281.81	43.27	14	517.34	-869.89	-17.85
15	14.85	-385.48	41.65	15	1307.26	-895.44	28.70
16	34.58	-499.21	38.95	16	1373.38	-890.78	30.49
17	63.74	-586.19	41.65	17	1528.77	-879.93	35.36
18	116.01	-678.49	40.85	18	1655.16	-877.96	36.95
19	145.83	-708.11	39.36	19	1764.91	-878.29	36.68
20	195.67	-742.83	39.68	20	1895.48	-879.01	40.80
21	238.21	-765.90	39.90	21	2021.60	-881.38	46.76
22	291.61	-790.26	42.68	22	2109.88	-879.97	47.71
23	352.97	-815.46	42.58	23	2129.59	-884.67	46.81
24	414.74	-837.49	42.28	24	2202.54	-898.62	49.10
25	493.65	-861.27	42.20	25	2393.31	-891.21	54.18

Note: See Appendix E.3 for detailed procedure on how to measure the required exterior crush profile

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

VEHICLE EXTERIOR CRUSH PROFILE
SECTION A-A (Continued)

Point	Pre-Test			Point	Post-Test		
	X	Y	Z		X	Y	Z
26	1301.55	-896.51	38.51	25	2451.74	-890.46	52.69
27	1368.84	-892.83	35.81	26	2553.13	-886.73	59.18
28	1459.31	-886.79	34.47	27	2722.83	-884.43	59.52
29	1555.72	-886.07	32.40	28	2845.87	-890.18	62.43
30	1718.08	-888.69	33.95	29	2948.18	-855.80	63.85
31	1875.34	-893.18	33.61	30	3039.15	-844.00	67.56
32	2056.57	-897.36	33.22	31	3139.86	-844.70	69.06
33	2183.22	-899.79	32.62	32	3214.47	-913.01	72.56
34	2271.15	-901.17	31.15	33	3230.61	-947.36	27.13
35	2529.05	-902.53	29.34	34	3243.73	-928.08	28.07
36	2618.67	-901.96	29.98	35	3213.13	-879.04	26.26
37	2703.15	-901.27	29.13	36	3382.38	-846.54	29.99
38	2788.21	-900.20	29.39	37	3484.31	-838.70	28.98
39	2913.57	-898.11	29.31	38	3648.54	-822.27	30.54
40	3029.87	-896.53	28.49	39	3773.71	-812.60	28.36
41	3138.52	-896.92	27.50	40	3851.26	-811.84	28.31
42	3297.32	-904.95	30.07	41	3894.07	-771.31	27.58
43	4076.18	-890.80	30.16	42	3878.31	-630.13	29.85
44	4136.80	-875.13	29.31	43	3844.38	-536.88	32.92
45	4209.52	-847.27	30.23	44	3880.90	-444.47	35.28
46	4301.30	-791.00	28.99	45	4034.41	-496.56	32.25
47	4385.97	-718.66	27.54	46	4170.74	-496.01	31.98
48	4455.00	-632.82	27.53	47	4279.84	-533.19	30.34
49	4512.29	-547.33	27.57	48	4327.78	-519.54	33.45
50	4551.82	-464.57	30.56	49	4329.26	-400.72	32.65
51	4596.00	-402.23	30.66	50	4417.58	-308.97	39.83
52	4606.62	-360.58	29.67	51	4414.26	-239.29	39.00
53	4619.98	-256.02	25.57	52	4417.48	-111.56	40.51
54	4625.46	-174.92	26.30	54	4419.84	0.27	43.03
55	4628.26	-94.54	26.20	55	4424.01	140.60	46.49
56	4629.10	-9.29	24.41	56	4419.16	247.84	48.63
57	4627.18	103.63	27.53	57	4425.62	359.66	49.30
58	4622.98	196.94	28.52	58	4462.07	400.38	61.21
59	4616.85	274.32	27.36	59	4430.55	468.34	65.89
60	4605.47	362.58	27.00	60	4419.02	573.49	65.92
61	4565.66	440.61	27.95	61	4406.91	640.41	69.91
62	4528.41	516.61	26.60	62	4210.02	613.66	69.36
63	4470.52	607.95	23.76	63	4221.23	703.89	69.57
64	4411.74	687.41	23.53	64	4206.28	766.51	72.87
65	4349.92	754.53	19.20	65	4137.32	781.88	69.75

Note: See Appendix E.3 for detailed procedure on how to measure the required exterior crush profile

DATA SHEET NO.13 (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

VEHICLE EXTERIOR CRUSH PROFILE SECTION A-A (Continued)

Point	Pre-Test			Point	Post-Test		
	X	Y	Z		X	Y	Z
66	4282.54	804.87	21.89	66	4103.03	784.22	72.17
67	4237.75	834.22	24.69	67	4077.68	864.33	72.02
68	4179.59	860.82	26.43	68	4054.61	890.06	75.24
69	4136.82	876.64	27.68	69	3293.31	932.37	67.33
70	4091.08	890.34	29.78	70	3252.88	933.49	66.95
71	4062.19	894.21	30.47	71	3152.57	925.29	69.82
72	3311.26	900.39	29.51	72	3015.64	921.67	65.88
73	3224.34	897.28	28.69	73	2835.31	920.09	69.18
74	3074.27	890.90	29.40	74	2678.05	918.54	66.69
75	2950.38	892.66	30.80	75	2498.81	915.60	68.60
76	2753.66	895.63	33.56	76	2343.53	912.39	61.34
77	2554.56	897.19	34.15	77	2292.15	911.07	62.89
78	2451.26	897.33	35.53	78	2243.98	909.66	63.25
79	2245.72	895.38	36.49	79	2115.52	903.07	63.80
80	2077.11	892.61	37.16	80	1936.67	897.57	59.09
81	1853.21	888.13	38.53	81	1726.34	889.02	57.70
82	1661.64	883.17	40.35	82	1590.16	884.22	59.79
83	1461.09	881.99	40.06	83	1454.05	883.09	59.33
84	1317.13	890.57	42.21	84	1346.84	886.38	53.00
85	526.50	869.78	51.88	85	1310.61	885.10	55.81
				86	543.14	863.09	39.80

Note: See Appendix E.3 for detailed procedure on how to measure the required exterior crush profile

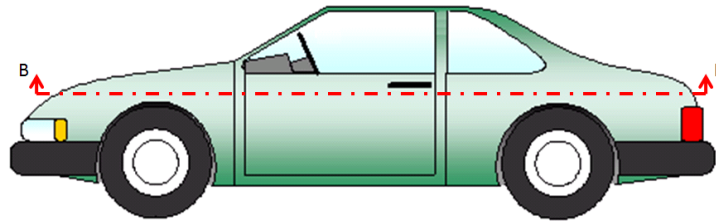
DATA SHEET NO.13 (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

VEHICLE EXTERIOR CRUSH PROFILE



Reference point: Rear most center of the top of rear bumper beam
 +X – From the rear of the vehicle to the front of the vehicle
 +Y – From left side of the vehicle to the right side of the vehicle
 +Z – From the top of the vehicle to the bottom of the vehicle

VEHICLE EXTERIOR CRUSH PROFILE SECTION B-B

Point	Pre-Test			Point	Post-Test		
	X	Y	Z		X	Y	Z
1	893.70	912.07	-227.39	1	913.36	912.69	-224.41
2	809.43	910.96	-227.67	2	873.50	908.22	-225.31
3	739.31	908.50	-225.68	3	794.77	903.74	-228.23
4	606.55	881.18	-224.92	4	685.39	883.46	-234.11
5	475.35	844.78	-223.61	5	559.20	868.19	-240.20
6	369.97	817.66	-225.04	6	428.18	831.98	-248.67
7	254.58	783.12	-225.30	7	300.20	808.67	-256.77
8	181.39	696.28	-226.73	8	221.89	749.68	-260.48
9	145.21	614.51	-226.66	9	221.05	680.34	-264.33
10	135.88	557.29	-227.25	10	172.69	558.69	-270.22
11	137.51	505.14	-226.56	11	155.21	401.49	-276.77
12	110.13	350.30	-227.00	12	153.28	252.53	-282.30
13	93.23	182.32	-226.52	13	133.78	104.91	-289.32
14	87.98	43.82	-227.12	14	133.67	-4.62	-291.97
15	89.76	-103.47	-227.13	15	133.09	-151.69	-293.84
16	94.84	-198.63	-226.49	16	146.85	-327.45	-300.73
17	103.62	-293.76	-226.48	17	174.01	-483.85	-304.33
18	120.25	-404.58	-227.03	18	185.95	-568.03	-308.27
19	141.01	-513.06	-225.82	19	216.33	-658.00	-320.38
20	132.27	-569.95	-230.91	20	310.40	-789.44	-320.62
21	171.51	-677.79	-231.31	21	411.07	-818.01	-315.86
22	226.92	-763.04	-231.60	22	572.72	-856.47	-310.31
23	308.95	-801.43	-226.90	23	775.02	-895.49	-301.00
24	434.47	-834.40	-227.68	24	873.25	-907.21	-296.17
25	557.65	-868.07	-229.85	25	953.18	-908.55	-292.83
26	694.91	-903.05	-233.71	26	942.29	-910.05	-276.79

Note: See Appendix E.3 for detailed procedure on how to measure the required exterior crush profile

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

VEHICLE EXTERIOR CRUSH PROFILE
SECTION B-B (Continued)

Point	Pre-Test			Point	Post-Test		
	X	Y	Z		X	Y	Z
27	787.48	-910.41	-232.75	27	1092.63	-903.30	-272.52
28	909.61	-912.24	-235.78	28	1240.88	-899.00	-268.12
29	925.49	-913.69	-232.63	29	1409.41	-895.00	-263.12
30	989.17	-913.91	-233.39	30	1569.02	-891.07	-258.25
31	1126.92	-909.86	-233.89	31	1751.15	-889.15	-255.20
32	1238.83	-903.89	-233.34	32	1802.14	-889.42	-249.08
33	1447.66	-902.12	-233.91	33	1954.37	-889.34	-243.28
34	1672.10	-903.61	-235.70	34	2019.99	-888.84	-243.43
35	1824.67	-907.69	-237.43	35	2151.33	-918.97	-238.70
36	2009.84	-911.97	-238.14	36	2257.15	-927.59	-238.39
37	2157.40	-914.28	-237.85	37	2448.44	-927.03	-235.69
38	2279.32	-914.90	-238.23	38	2592.71	-924.60	-235.19
39	2414.11	-914.30	-239.64	39	2691.58	-922.09	-230.49
40	2585.62	-912.66	-240.53	40	2814.80	-917.98	-225.86
41	2733.68	-909.98	-242.33	41	2928.17	-894.12	-227.68
42	2897.79	-905.54	-242.58	42	3100.79	-879.73	-216.56
43	3055.34	-900.65	-242.85	43	3143.28	-855.69	-217.39
44	3229.09	-899.99	-241.69	44	3187.00	-944.33	-215.55
45	3408.79	-904.75	-240.96	45	3256.23	-1009.42	-216.49
46	3546.46	-912.27	-240.78	46	3418.05	-872.96	-213.50
47	3678.36	-911.67	-240.16	47	3408.93	-894.31	-262.82
48	3692.81	-912.07	-237.94	48	3491.69	-838.05	-262.39
49	3772.69	-910.50	-239.45	49	3478.18	-729.15	-256.20
50	3847.90	-904.85	-241.60	50	3689.94	-764.65	-259.16
51	3965.02	-868.45	-242.25	51	3750.30	-742.68	-264.95
52	4055.48	-838.90	-241.18	52	3829.00	-731.75	-258.61
53	4153.42	-815.72	-239.72	53	3874.62	-646.89	-256.64
54	4267.77	-753.44	-240.59	54	3873.59	-527.53	-255.55
55	4341.64	-671.78	-243.52	55	3937.24	-386.74	-249.75
56	4387.99	-610.30	-241.65	56	4083.90	-366.90	-252.69
57	4436.85	-560.34	-246.95	57	4357.18	-447.42	-256.95
58	4486.32	-483.20	-243.85	58	4407.65	-387.62	-251.87
59	4521.47	-408.97	-243.91	59	4390.92	-304.72	-235.11
60	4537.59	-368.65	-242.94	60	4358.68	-180.19	-233.31
61	4552.04	-305.15	-244.85	61	4379.23	24.49	-230.26
62	4567.86	-226.51	-243.48	62	4377.16	121.89	-226.97
63	4574.71	-139.22	-245.11	63	4368.33	236.29	-225.05
64	4578.42	-71.76	-244.90	64	4359.67	321.89	-223.73
65	4579.37	3.81	-245.35	65	4411.21	372.78	-223.83
66	4576.42	101.23	-245.06	66	4411.89	491.10	-220.72

Note: See Appendix E.3 for detailed procedure on how to measure the required exterior crush profile

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

VEHICLE EXTERIOR CRUSH PROFILE
SECTION B-B (Continued)

Point	Pre-Test			Point	Post-Test		
	X	Y	Z		X	Y	Z
67	4565.71	211.42	-245.49	67	4296.44	548.26	-219.59
68	4545.34	324.48	-245.71	68	4293.61	559.20	-218.11
69	4495.66	460.72	-245.46	69	4439.50	609.12	-220.95
70	4440.45	556.44	-246.46	70	4414.83	651.59	-216.14
71	4376.99	629.57	-242.52	71	4390.23	688.57	-216.52
72	4294.30	723.11	-246.29	72	4358.68	732.30	-213.60
73	4217.94	789.64	-242.51	73	4318.73	777.58	-213.61
74	4125.99	823.28	-244.52	74	4250.93	831.10	-214.48
75	4045.41	844.24	-242.80	75	4188.41	861.06	-215.66
76	3951.42	874.88	-242.64	76	4126.78	879.40	-216.95
77	3882.33	899.54	-239.68	77	4061.54	894.65	-212.69
78	3817.49	908.52	-236.21	78	3968.09	922.93	-214.44
79	3799.81	907.60	-238.15	79	3904.19	941.41	-211.10
80	3672.38	909.21	-243.69	80	3833.88	945.02	-212.30
81	3526.92	908.58	-245.43	81	3785.00	946.36	-213.39
82	3348.71	898.11	-241.14	82	3784.72	946.21	-215.41
83	3167.41	893.85	-241.06	83	3560.52	946.41	-217.25
84	2973.02	898.91	-240.98	84	3413.46	943.66	-214.91
85	2828.76	904.38	-242.73	85	3239.88	933.95	-214.55
86	2651.05	909.14	-241.45	86	3050.81	927.74	-217.06
87	2563.65	910.74	-238.41	87	2945.19	928.39	-218.27
88	2368.58	911.70	-235.21	88	2801.17	930.47	-220.65
89	2204.70	909.51	-233.41	89	2681.23	930.54	-220.36
90	2025.12	907.90	-231.65	90	2586.36	930.09	-221.94
91	1835.86	905.23	-229.65	91	2362.83	927.41	-221.78
92	1653.56	900.79	-227.36	92	2325.15	926.57	-222.45
93	1441.15	899.12	-230.45	93	2195.58	922.03	-223.87
94	1244.16	899.26	-228.97	94	2083.36	918.10	-224.03
95	1117.39	904.97	-230.78	95	1969.72	915.82	-226.14
96	999.45	908.27	-227.13	96	1874.22	913.46	-225.53
97	914.37	907.78	-227.31	97	1763.61	909.54	-226.36
				98	1650.39	905.48	-226.90
				99	1529.13	902.18	-228.37
				100	1433.93	901.16	-228.63
				101	1277.75	899.41	-231.36
				102	1184.01	900.38	-230.50
				103	1084.15	908.34	-229.54
				104	986.15	909.85	-231.46

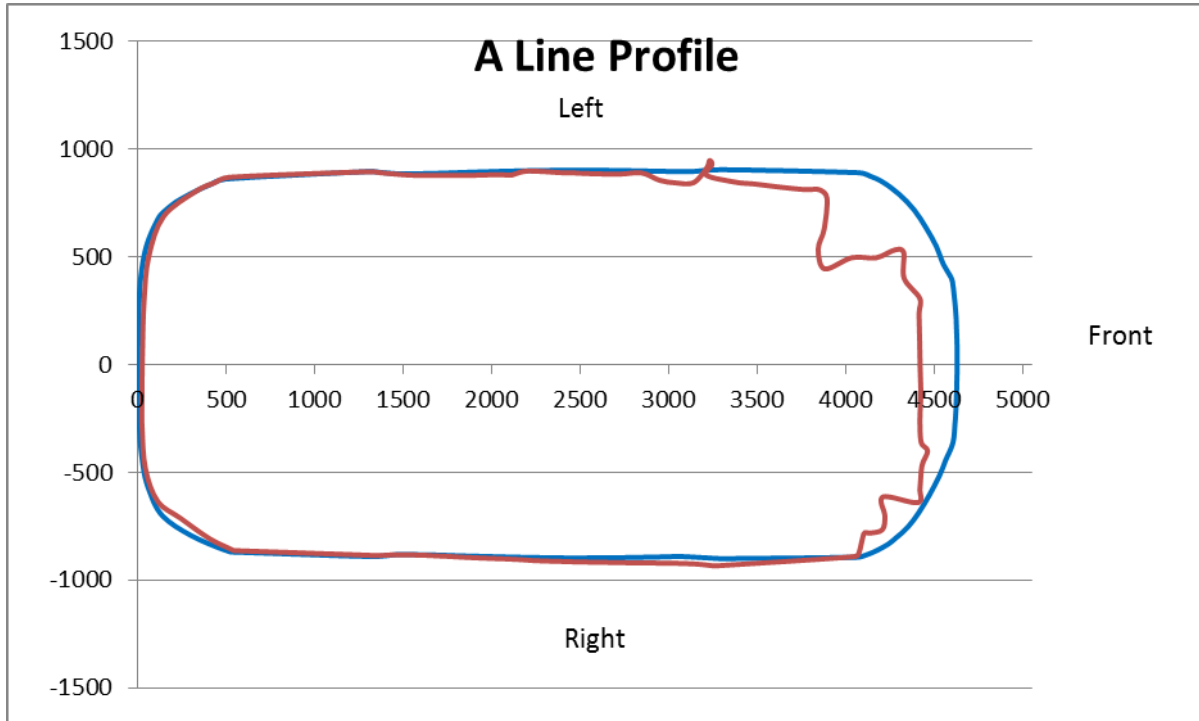
Note: See Appendix E.3 for detailed procedure on how to measure the required exterior crush profile

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

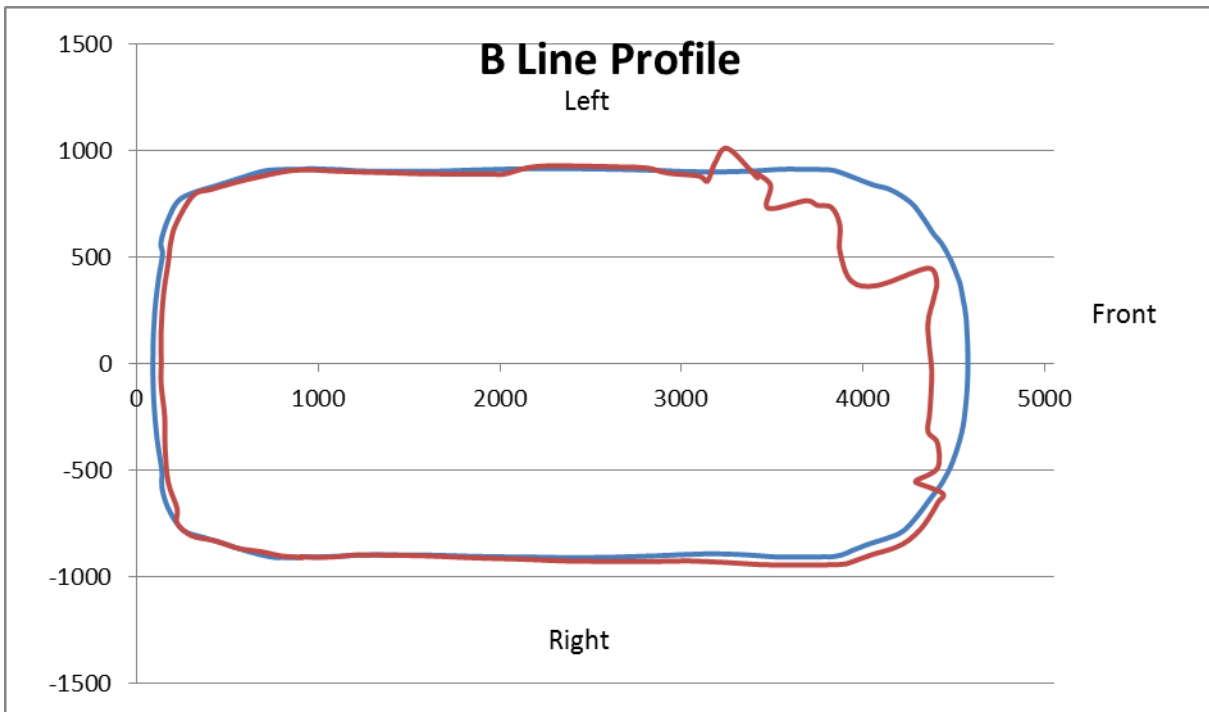
Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012

SECTION A-A



SECTION B-B



DATA SHEET NO.13 (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

LEFT PROFILE OF THE DASH



Point	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
LB3	3030.06	-523.94	-131.22	2992.17	-463.09	-65.93	-37.9	60.9	65.3
LB2	2991.21	-527.68	-164.79	2953.34	-464.91	-101.34	-37.9	62.8	63.5
LB1	2956.58	-527.51	-206.87	2920.56	-464.39	-144.10	-36.0	63.1	62.8
DIPL	2927.48	-526.36	-247.91	2894.23	-464.10	-186.41	-33.2	62.3	61.5
LT1	2913.92	-523.81	-294.31	2879.08	-462.12	-232.36	-34.8	61.7	62.0
LT2	2922.67	-525.17	-345.12	2891.66	-460.75	-282.10	-31.0	64.4	63.0
LT3	2946.45	-524.19	-371.79	2910.63	-468.43	-329.13	-35.8	55.8	42.7
LT4	2996.30	-525.97	-358.50	2943.03	-469.88	-339.32	-53.3	56.1	19.2
LT5	3003.12	-524.32	-405.12	2978.29	-467.71	-349.06	-24.8	56.6	56.1
LT6	2993.61	-521.64	-450.51	2963.61	-466.22	-393.53	-30.0	55.4	57.0
LT7	2953.01	-523.66	-492.83	2921.57	-466.68	-432.16	-31.4	57.0	60.7
LT8	2949.22	-524.33	-531.87	2919.23	-471.04	-471.83	-30.0	53.3	60.0
LT9	3002.22	-523.46	-530.57	2971.76	-471.45	-468.54	-30.5	52.0	62.0

Reference point: Rear most center of the top of rear bumper beam

+X – From the rear of the vehicle to the front of the vehicle

+Y – From left side of the vehicle to the right side of the vehicle

+Z – From the top of the vehicle to the bottom of the vehicle

Note: Please see Appendix E.4 for a detailed procedure for how to measure the required profile dash.

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

RIGHT PROFILE OF THE DASH



Point	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
RB3	3006.81	-227.14	-141.54	2987.73	-167.78	-93.82	-19.1	59.4	47.7
RB2	2962.84	-229.51	-169.09	2945.53	-167.54	-120.16	-17.3	62.0	48.9
RB1	2927.63	-230.69	-206.98	2909.68	-168.64	-158.24	-17.9	62.0	48.7
DIPR	2906.92	-228.06	-247.41	2887.61	-167.31	-201.66	-19.3	60.8	45.7
RT1	2899.40	-227.37	-297.97	2877.53	-167.50	-249.55	-21.9	59.9	48.4
RT2	2912.13	-227.27	-345.61	2898.13	-169.91	-344.03	-14.0	57.4	1.6
RT3	2939.71	-228.50	-368.57	2931.75	-170.46	-348.61	-8.0	58.0	20.0
RT4	2987.04	-225.76	-356.15	2963.87	-165.02	-314.82	-23.2	60.7	41.3
RT5	3004.61	-223.23	-393.04	2979.20	-165.56	-351.02	-25.4	57.7	42.0
RT6	2997.46	-222.30	-437.31	2974.48	-172.38	-390.35	-23.0	49.9	47.0
RT7	2957.49	-229.19	-479.78	2936.33	-171.09	-433.50	-21.2	58.1	46.3
RT8	2952.35	-227.00	-528.44	2930.91	-169.66	-483.05	-21.4	57.3	45.4
RT9	3002.64	-228.77	-532.50	2980.51	-176.18	-487.55	-22.1	52.6	45.0

Reference point: Rear most center of the top of rear bumper beam
 +X – From the rear of the vehicle to the front of the vehicle
 +Y – From left side of the vehicle to the right side of the vehicle
 +Z – From the top of the vehicle to the bottom of the vehicle

Note: Please see Appendix E.4 for a detailed procedure for how to measure the required profile dash.

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

	Point	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
		X	Y	Z	X	Y	Z	X	Y	Z
Lower Bumper Beam	1	4455.38	-595.91	46.22	4280.94	-507.60	-72.82	-174	88	-119
	2	4489.66	-363.76	52.23	4398.07	-329.95	-34.35	-92	34	-87
	3	4504.36	-120.90	59.78	4440.67	-91.61	-9.61	-64	29	-69
	4	4504.26	119.66	59.95	4465.48	147.41	5.62	-39	28	-54
	5	4489.76	359.34	53.51	4474.19	386.28	13.48	-16	27	-40
	6	4453.55	594.54	43.16	4460.13	623.70	17.50	7	29	-26
Upper Bumper Beam	1	4460.68	-597.31	-9.01	4279.03	-509.62	-110.43	-182	88	-101
	2	4489.71	-362.11	-16.01	4399.31	-325.15	-97.33	-90	37	-81
	3	4503.71	-121.58	-26.63	4439.65	-88.56	-96.00	-64	33	-69
	4	4503.52	119.81	-26.96	4464.08	152.36	-81.83	-39	33	-55
	5	4489.28	359.87	-15.35	4472.96	391.50	-55.61	-16	32	-40
	6	4459.42	597.47	-13.09	4465.25	630.36	-39.32	6	33	-26
Upper Radiator Support	1	4358.96	-317.78	-263.10	4342.77	-278.80	-334.09	-16	39	-71
	2	4360.17	-190.66	-260.51	4344.85	-151.55	-329.58	-15	39	-69
	3	4360.13	-63.91	-260.12	4344.22	-24.51	-328.09	-16	39	-68
	4	4360.86	63.18	-260.93	4345.39	101.28	-321.11	-15	38	-60
	5	4360.51	192.78	-262.58	4348.12	232.71	-313.68	-12	40	-51
	6	4358.83	319.61	-265.90	4346.29	358.27	-310.04	-13	39	-44

Reference point: Rear most center of the top of rear bumper beam

+X – From the rear of the vehicle to the front of the vehicle

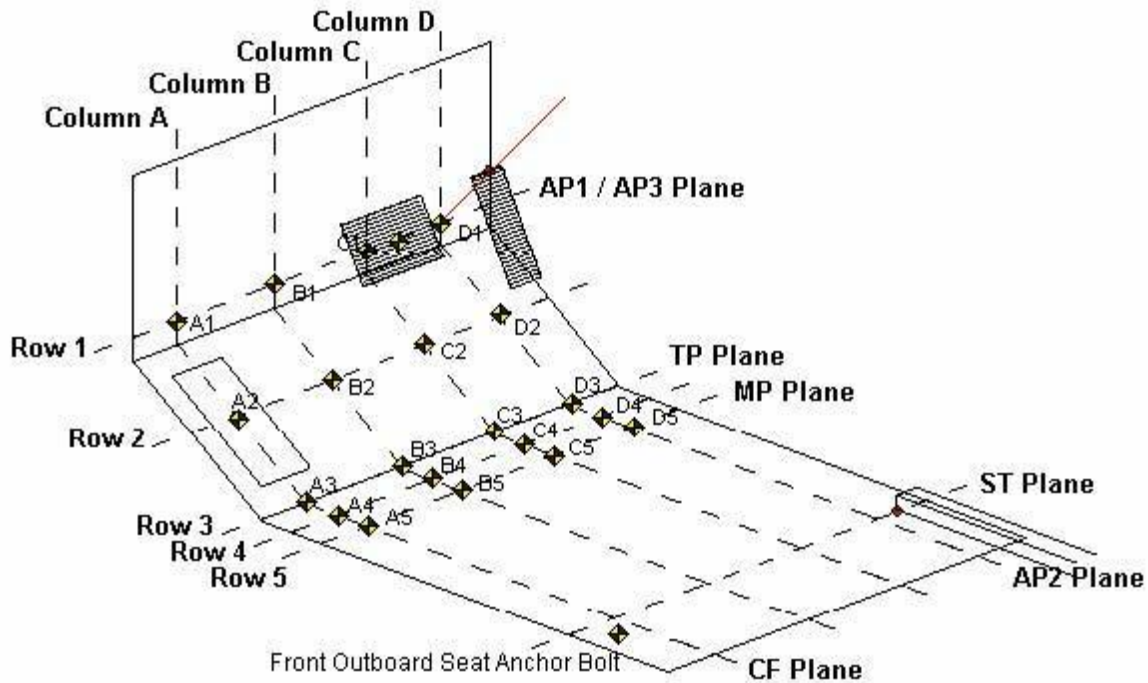
+Y – From left side of the vehicle to the right side of the vehicle

+Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO.13 (CONTINUED) **VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012



AP1: Y-Z plane passing through D1

AP2: X-Z plane passing through D1

AP3: X-Y plane passing through D1

MP: Y-Z plane, halfway between the ST plane and AP1 plane

CF Plane: X-Z plane passes through center of footrest.

BP Plane: X-Z plane passes through center of brake pedal

TP Plane: Y-Z plane, intersection of BP Plane and the intersection of the toe pan and floorboard

Column A: intersection of vehicle and CF plane

Column D: Intersection of vehicle and AP2 plane

Row 1: intersection of the vehicle and the AP3 Plane

Row 3: intersection of the vehicle and TP plane

Row 5: intersection of the vehicle and MP plane

Row 2: evenly spaced between row 1 and 3

Row 4: evenly spaced between row 3 and 5

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

Intrusion Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
A1	3273.135	-582.242	94.7711	3242.797	-518.901	158.2562	-30.3378	63.3409	63.4851
B1	3358.324	-447.291	94.7989	3320.583	-383.173	150.118	-37.7415	64.118	55.3191
C1	3345.975	-312.044	128.5929	3319.171	-251.24	182.6333	-26.8039	60.8041	54.0404
D1	3337.919	-180.787	95.2531	3312.596	-117.281	147.6641	-25.3232	63.5053	52.411
A2	3202.443	-583.93	179.391	3180.825	-525.113	246.4908	-21.6175	58.8168	67.0998
B2	3275.337	-459.12	179.9947	3248.985	-400.537	236.3329	-26.3522	58.5832	56.3382
C2	3280.02	-318.275	175.6208	3258.586	-254.97	236.3485	-21.4343	63.305	60.7277
D2	3260.596	-185.945	171.5129	3233.508	-124.629	222.9199	-27.0883	61.316	51.407
A3	3180.91	-589.052	235.9082	3167.518	-529.629	306.7873	-13.392	59.4226	70.8791
B3	3178.974	-457.899	235.1311	3165.45	-398.228	301.3006	-13.5236	59.6706	66.1695
C3	3177.674	-320.752	233.3865	3158.039	-258.803	297.03	-19.6348	61.949	63.6435
D3	3176.846	-188.797	231.2178	3152	-115	320	-24.8458	73.7973	88.7822
A4	3087.983	-595.442	245.9891	3078.042	-539.769	322.946	-9.9409	55.6732	76.9569
B4	3089.496	-462.122	242.1017	3074.054	-408.239	301.8181	-15.4423	53.8821	59.7164
C4	3090.539	-325.927	247.1133	3074.543	-269.967	296.2588	-15.9964	55.9595	49.1455
D4	3089.983	-192.814	240.2976	3069.221	-141.187	291.7384	-20.7615	51.6262	51.4408
A5	2997.943	-600.407	242.6921	2991.007	-550.106	312.1645	-6.9362	50.3013	69.4724
B5	2998.336	-467.111	241.0236	2985.747	-417.478	298.6475	-12.5883	49.6335	57.6239
C5	2998.553	-328.43	239.8579	2982.962	-279.264	294.7458	-15.5907	49.1659	54.8879
D5	2998.985	-197.36	239.3475	2978.741	-149.698	284.6634	-20.2444	47.6619	45.3159
Brake Pedal	3164.071	-328.879	42.884	3137.537	-277.581	85.4572	-26.5348	51.2987	42.5732
IP Left	2956.58	-527.507	-206.866	2920.56	-464.392	-144.1	-36.0192	63.1155	62.7659
IP Right	2927.628	-230.685	-206.98	2909.68	-168.642	-158.245	-17.9484	62.0433	48.7348
Steering Column	2652.338	-375.801	-431.587	2720.479	-340.018	-419.863	68.1409	35.783	11.7244
Front Outboard Bolt	2686.904	-574.864	151.8264	2685.198	-543.662	207.9323	-1.7064	31.2015	56.1059
IIHS Foot Rest	3313.469	-576.207	43.8616	3275.428	-498.208	121.5362	-38.0414	77.9991	77.6746
IIHS Brake Pedal	3388.539	-327.374	48.2658	3359.917	-255.24	125.4169	-28.6214	72.1346	77.1511
IIHS Left	3378.062	-478.151	41.3858	3337.076	-400.28	113.0287	-40.9863	77.8706	71.6429
IIHS Right	3394.03	-182.046	44.9088	3367.432	-110.141	122.7742	-26.5977	71.9055	77.8654

Reference point: Rear most center of the top of rear bumper beam

+X – From the rear of the vehicle to the front of the vehicle

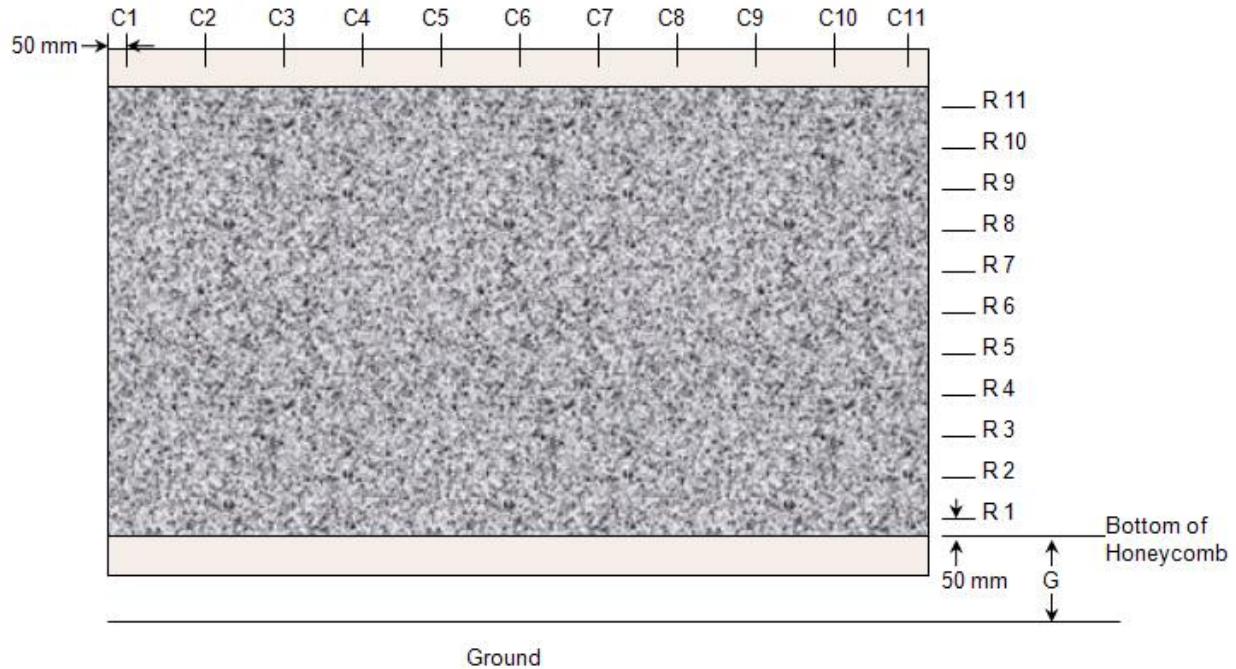
+Y – From left side of the vehicle to the right side of the vehicle

+Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO.14 **RMDB CRUSH MEASUREMENTS**

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012



		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
		50 mm	260 mm	470 mm	680 mm	890 mm	1100 mm	1310 mm	1520 mm	1730 mm	1940 mm	2150 mm
R11	910mm	-4.6	-2.2	-1.4	-1.1	-0.1	0.7	1.1	1.7	2.6	3.9	20.5
R10	824mm	-4.7	-4.5	-3.9	-3.4	-2.6	-1.9	-0.8	-0.1	1.0	4.7	43.6
R9	738mm	-4.6	-4.9	-4.2	-3.4	-2.9	-1.9	-1.2	-0.2	1.5	46.8	96.1
R8	652mm	-4.5	-4.8	-4.3	-3.5	-2.9	-1.9	-1.2	-0.2	120.8	271.1	159.8
R7	566mm	-4.7	-4.9	-4.0	-3.7	-2.7	-1.9	-0.6	0.1	2.2	420.9	240.9
R6	480mm	-5.4	-5.3	-4.4	-3.6	-2.8	-2.0	-0.7	0.3	8.1	65.8	318.5
R5	384mm	-5.4	-5.5	-4.6	-3.5	-2.7	-1.8	-0.7	0.4	38.6	74.8	170.0
R4	308mm	-5.9	-5.6	-4.8	-3.6	-2.6	-1.6	-0.4	0.6	70.5	126.9	133.1
R3	222mm	-6.0	-5.6	-4.7	-3.4	-2.5	-1.5	-0.4	0.6	99.5	173.0	117.0
R2	136mm	-6.5	-5.9	-4.5	-3.3	-2.3	-1.3	-0.2	0.8	122.2	209.1	122.0
R1	50mm	-6.7	-5.6	-4.0	-2.8	*	*	0.2	5.9	138.5	233.9	149.2

*Barrier was cut to clear the rail, therefore these defined points were un-measurable.

DATA SHEET NO. 15
SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012

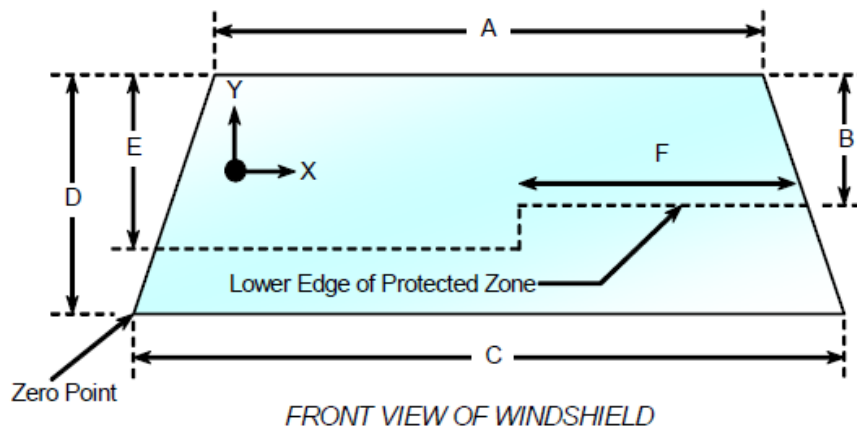
Please provide windshield mounting details. A 0.8 mm trim surrounds the top and side of windshield while a plastic shroud is on the bottom.

The standard requires that the post-test retention measurement be a minimum of 75% of the pre-test total periphery measurement for vehicles not equipped with occupant passive restraints and 50% for each side of the windshield for vehicles which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 11.7°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2205	1890	85.7%
Right Side	2205	2205	100%
Total	4409	4095	92.9%



Item	Units	Value
A	mm	1215
B	mm	471
C	mm	1434
D	mm	880
E	mm	564
F	mm	300

AREAS OF PROTECTED ZONE FAILURES

A. Provide coordinates of the area that the protected zone was penetrated more than .25 inches by a vehicle component other than one that is normally in contact with the windshield.

X	Y

-There was no penetration in the protected zone.

B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component.

X	Y

- There was no penetrations beneath the protected zone

DATA SHEET NO. 15 (CONTINUED)
SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 11.7° C Test Time: 4:45 PM

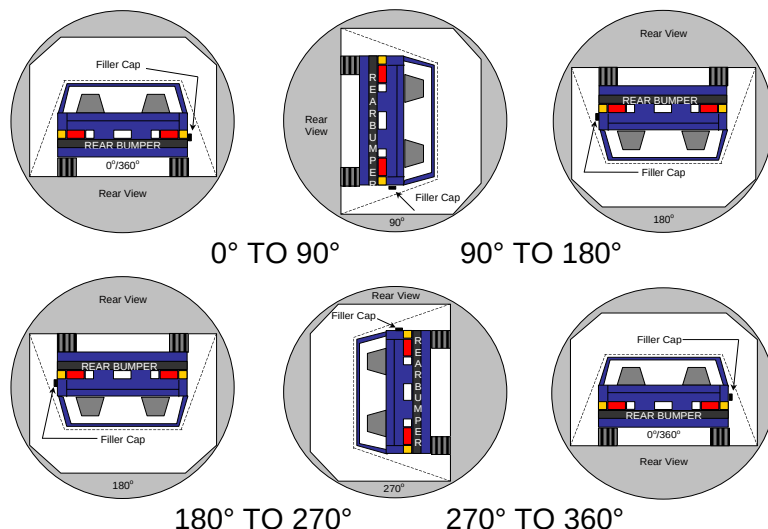
Stoddard Solvent Spillage Measurements

A.	From impact until vehicle motion ceases: (Maximum allowable = 1 oz.)	<u>0</u>	oz
B.	For the 5-minute period after motion ceases: (Maximum allowable = 5 oz.)	<u>0</u>	oz
C.	For the following 25 minutes: (Maximum allowable = 1 oz./minute)	<u>0</u>	oz
D.	Spillage	<u>0</u>	oz

DATA SHEET NO. 16 **FMVSS 301 STATIC ROLLOVER RESULTS**

Test Vehicle: 2012 Volvo S60 Four Door Sedan
 Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
 Test Date: 4/30/2012



1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent spillage: None

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	70	300	370
90° to 180°	64	300	364
180° to 270°	62	300	362
270° to 360°	70	300	370

FMVSS 301 SPILLAGE TABLE

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0		
90° to 180°	0	0		
180° to 270°	0	0		
270° to 360°	0	0		

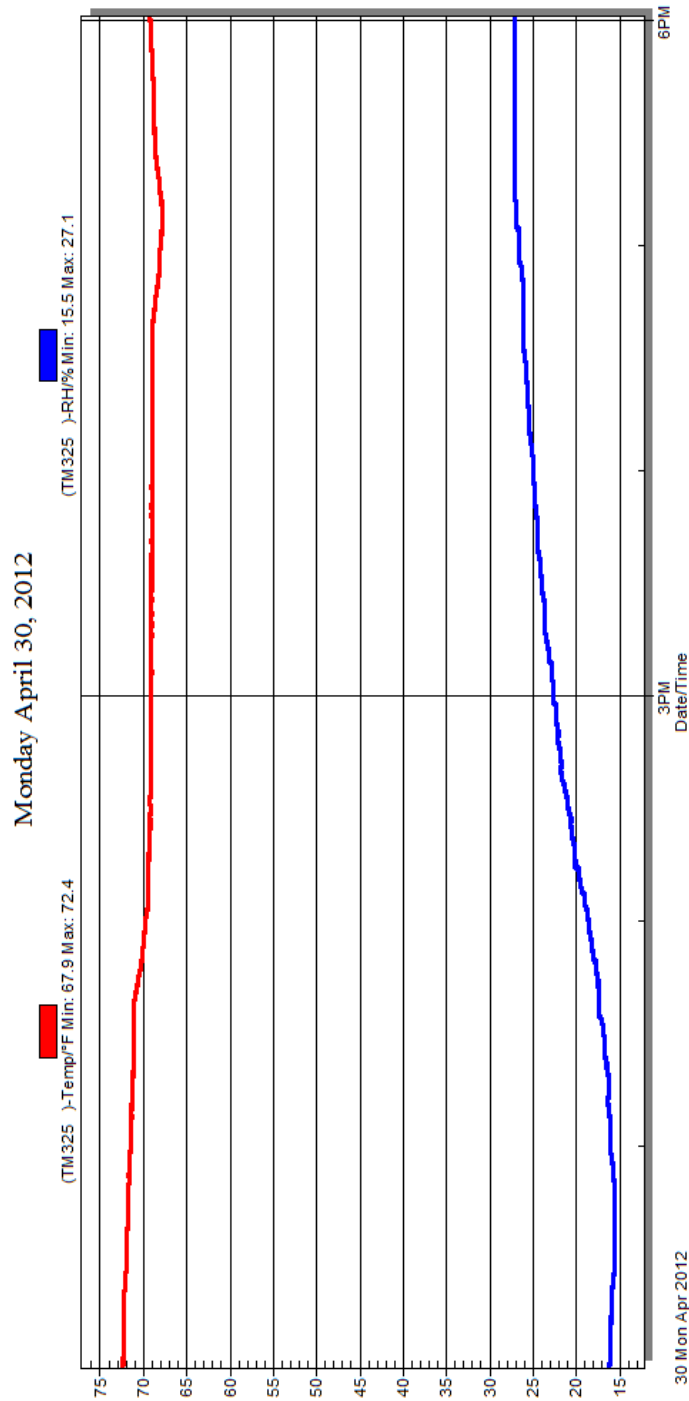
SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	No Spillage Occurred
90° to 180°	No Spillage Occurred
180° to 270°	No Spillage Occurred
270° to 360°	No Spillage Occurred

DATA SHEET NO. 17
DUMMY/VEHICLE TEMPERATURE STABILIZATION

Test Vehicle: 2012 Volvo S60 Four Door Sedan
Test Program: R&D 56mph, 7° angle, 20% offset

NHTSA No.: RC5909
Test Date: 4/30/2012



Temperature Stabilization Chart/Data

APPENDIX A PHOTOGRAPHS

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No. 001 As Delivered Right Front 3-4 View of Test Vehicle



No. 002 As Delivered Left Rear 3-4 View of Test Vehicle



No. 003 Test Vehicle Certification Label



No. 004 Test Vehicle Tire Placard



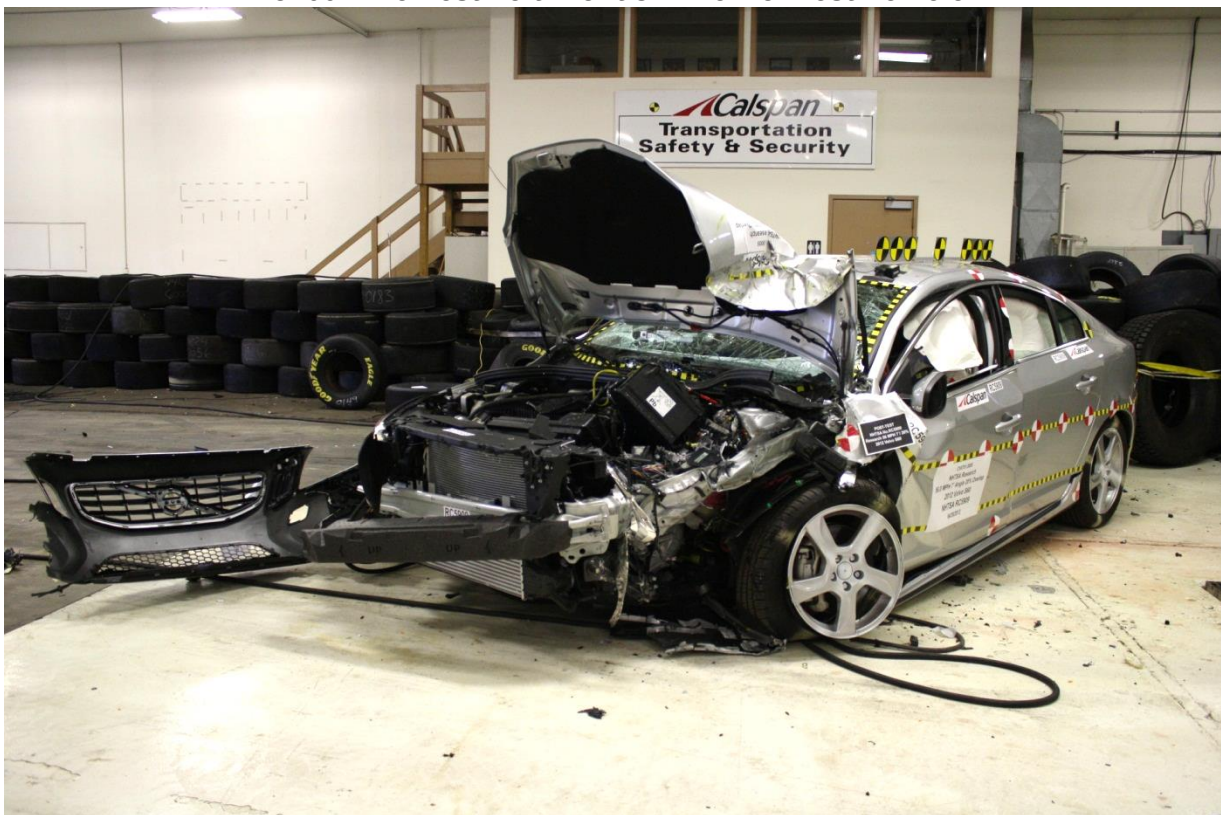
No. 005 Pre-Test Front View of Test Vehicle



No. 006 Post-Test Front View of Test Vehicle



No. 007 Pre-Test Left Front 3-4 View of Test Vehicle



No. 008 Post-Test Left Front 3-4 View of Test Vehicle



No. 009 Pre-Test Left Side View of Test Vehicle



No. 010 Post-Test Left Side View of Test Vehicle



No. 011 Pre-Test Left Rear 3-4 View of Test Vehicle



No. 012 Post-Test Left Rear 3-4 View of Test Vehicle



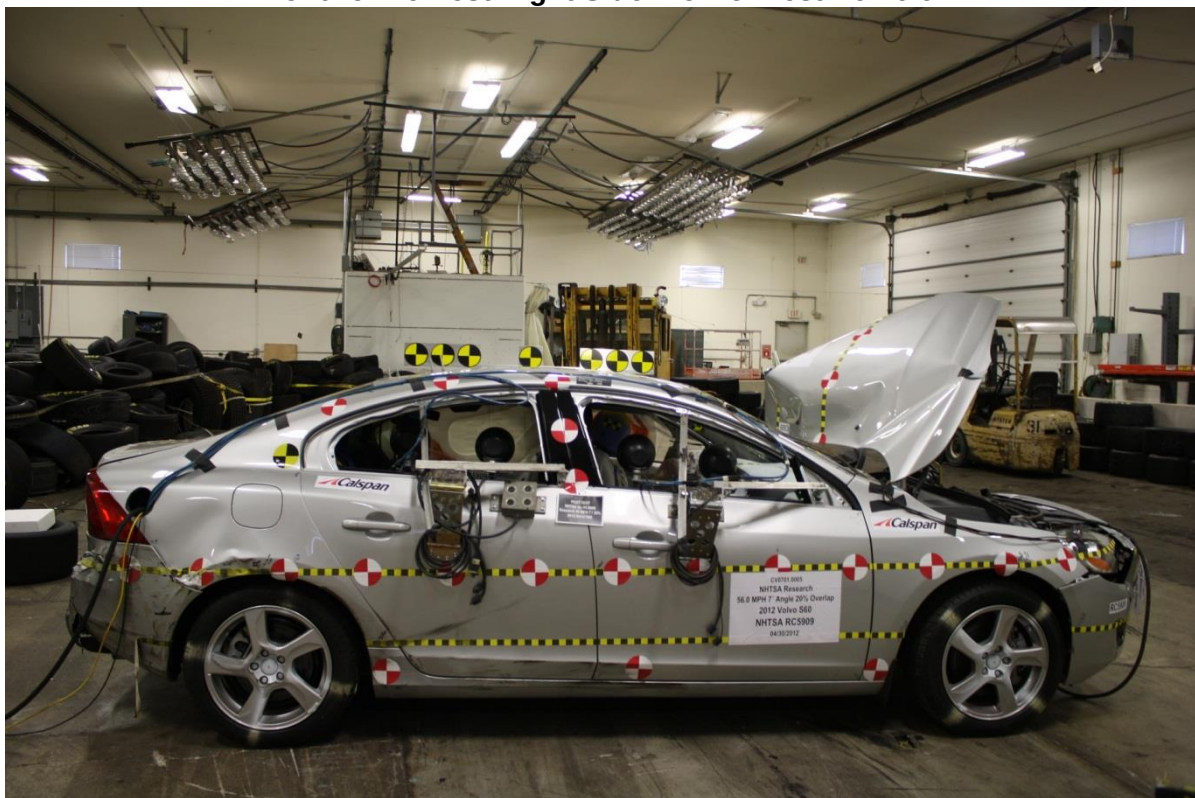
No. 013 Pre-Test Rear View of Test Vehicle



No. 014 Post-Test Rear View of Test Vehicle



No. 015 Pre-Test Right Side View of Test Vehicle



No. 016 Post-Test Right Side View of Test Vehicle



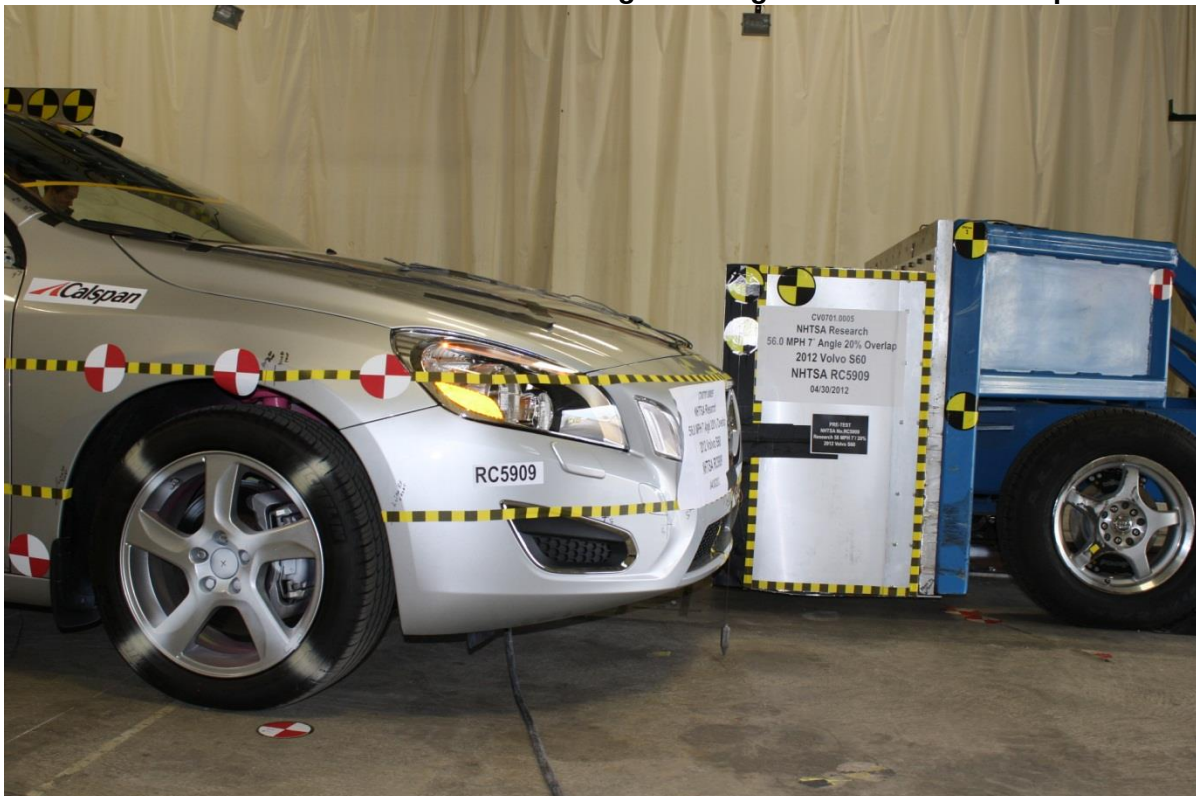
No. 017 Pre-Test Right Front 3-4 View of Test Vehicle



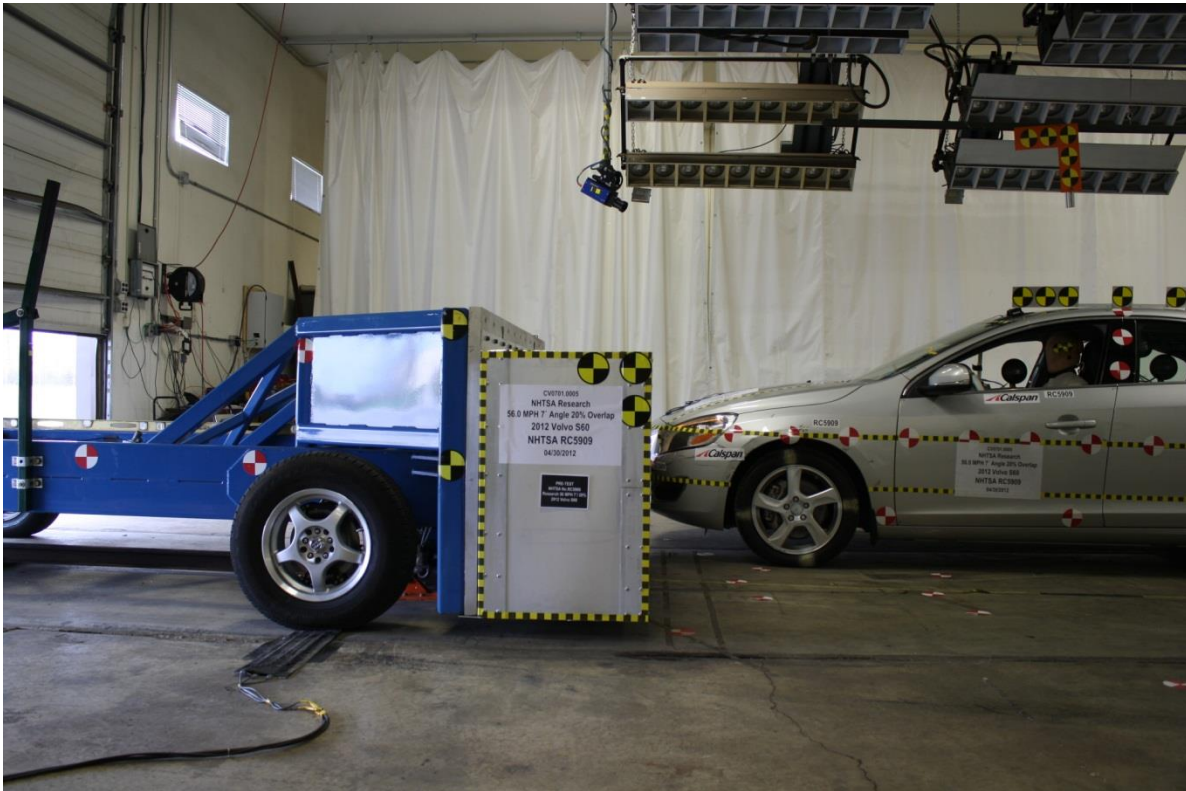
No. 018 Post-Test Right Front 3-4 View of Test Vehicle



No. 019 Pre-Test Overhead View of RMDB against target vehicle at ideal Impact Point



No. 020 Pre-Test Left Side View of RMDB against target vehicle at ideal Impact Point



No. 021 Pre-Test Right Side View of RMDB against target vehicle at ideal Impact Point



No. 022 Pre-Test Close-up View of Impact Point



No. 023 Post-Test Close-up View of Impact Point



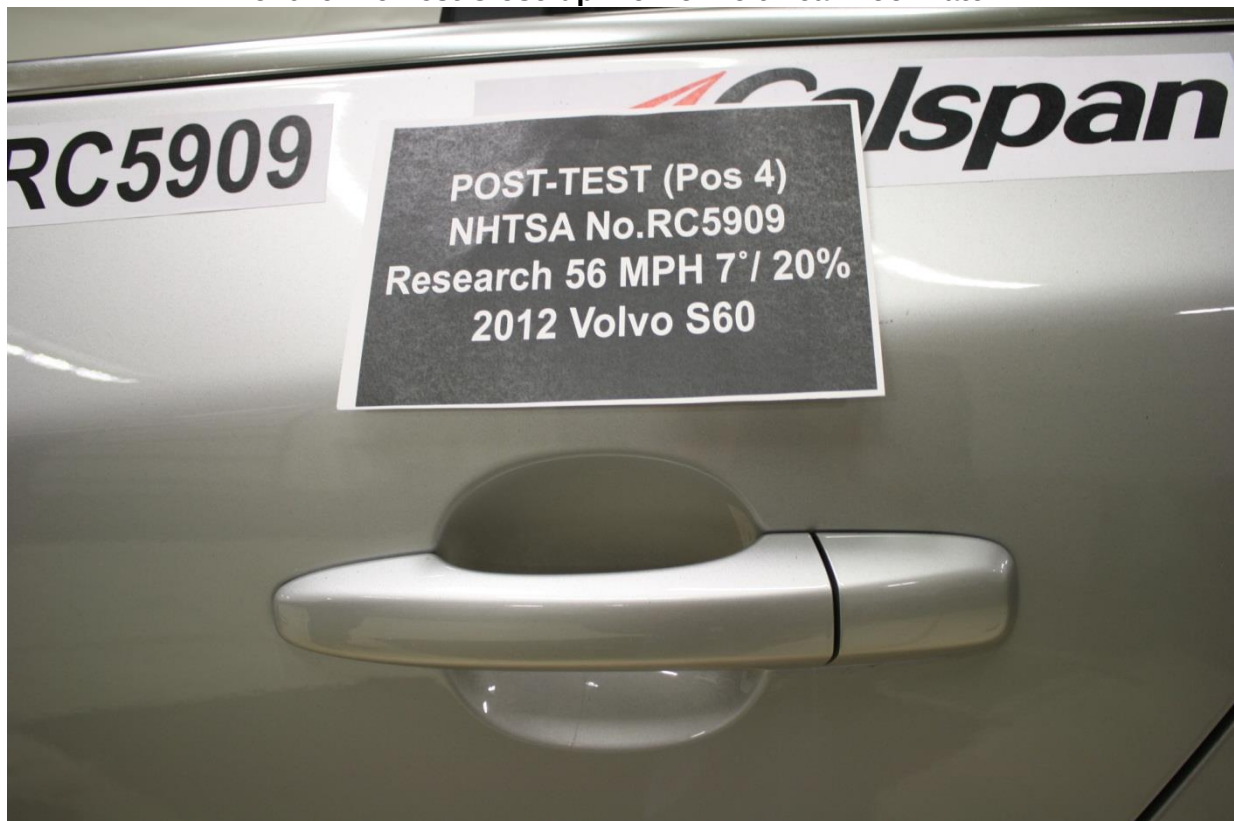
No. 024 Pre-Test Close-up View of Left Front Door Latch



No. 025 Post-Test Close-up View of Left Front Door Latch



No. 026 Pre-Test Close-up View of Left Rear Door Latch



No. 027 Post-Test Close-up View of Left Rear Door Latch



No. 028 Pre-Test Windshield View



No. 029 Post-Test Windshield View



No. 030 Pre-Test View of Driver Inner Door Panel



No. 031 Post-Test View of Driver Inner Door Panel



No. 032 Pre-Test View of Passenger Inner Door Panel



No. 033 Post-Test View of Passenger Inner Door Panel



No. 034 Pre-Test Frontal View of Driver Seat pan



No. 035 Pre-Test Frontal View of Driver Seat back



No. 036 Pre-Test Frontal View of Left Rear Seat pan



No. 037 Pre-Test Frontal View of Left Rear Seat back



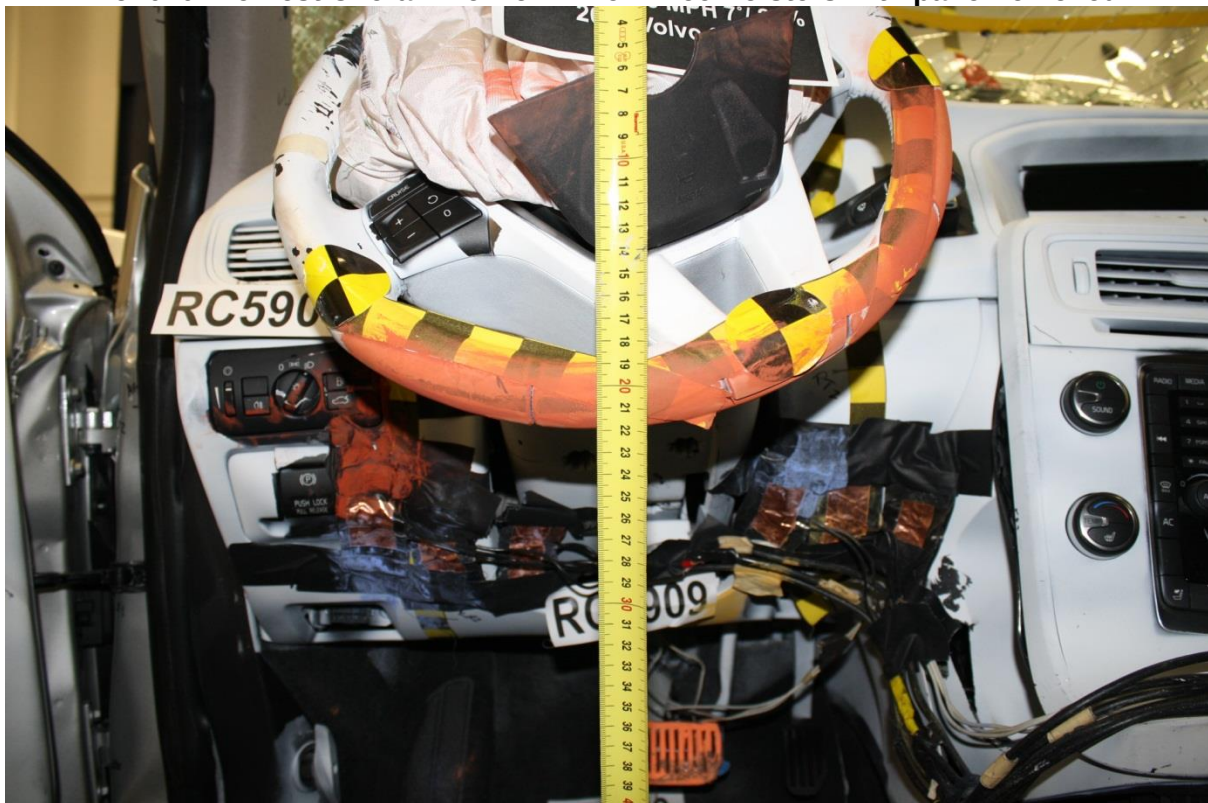
No. 038 Pre-Test Overall View of Driver Knee Bolsters



No. 039 Post-Test Overall View of Driver Knee Bolsters



No. 040 Pre-Test Overall View of Driver Knee Bolsters with panel removed



No. 041 Post-Test Overall View of Driver Knee Bolsters with panel removed



No. 042 Pre-Test Left Side View of Driver Knee Bolsters



No. 043 Post-Test Left Side View of Driver Knee Bolsters



No. 044 Pre-Test Left Side View of Driver Knee Bolsters with panel removed



No. 045 Post-Test Left Side View of Driver Knee Bolsters with panel removed



No. 046 Pre-Test Right Side View of Driver Knee Bolsters



No. 047 Post-Test Right Side View of Driver Knee Bolsters



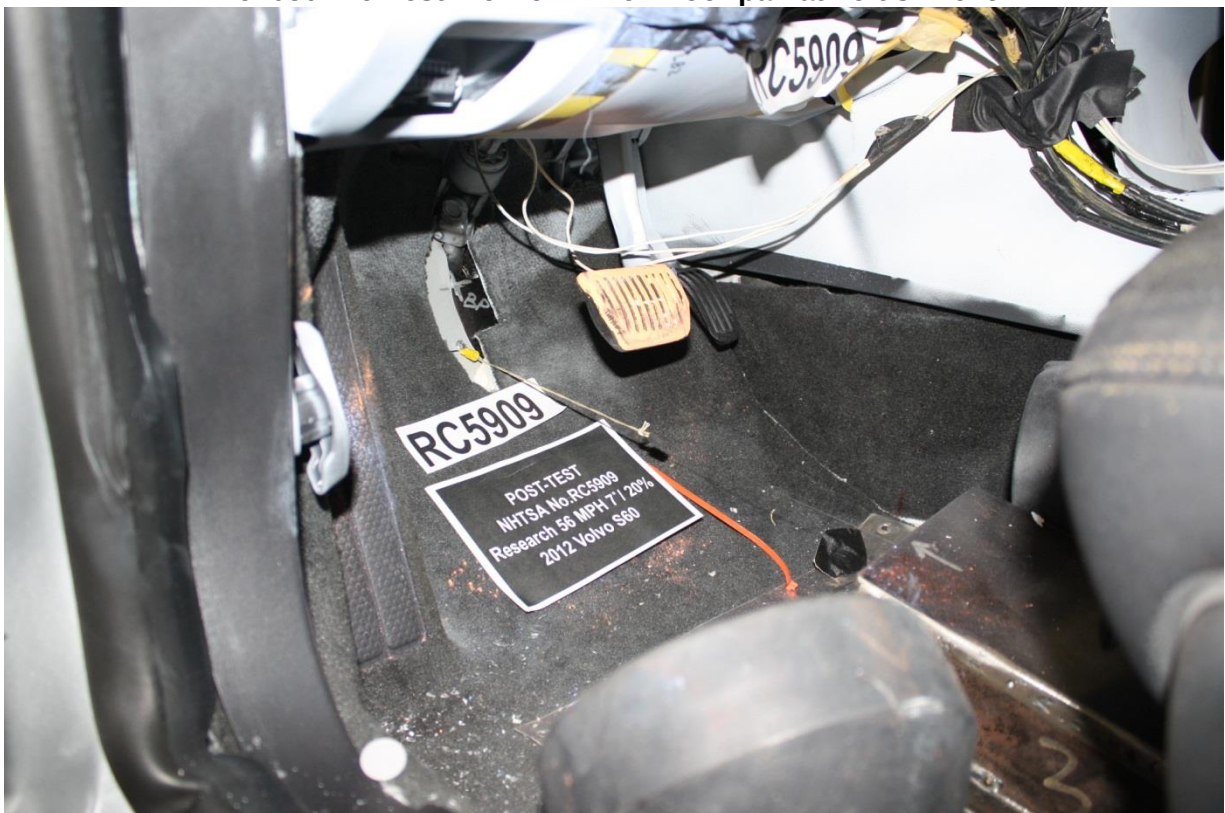
No. 048 Pre-Test Right Side View of Driver Knee Bolster with panel removed



No. 049 Post-test right side view of driver knee bolster with panel removed



No. 050 Pre-Test View of Driver Floor pan at Left sill level



No. 051 Post-Test View of Driver Floor pan at Left sill level



No. 052 Pre-Test View of Driver Floor pan at Mid seat level



No. 053 Post-Test view of Driver Floor pan at Mid seat level



No. 054 Pre-Test Driver Dummy Front Windshield View



No. 055 Post-Test Driver Dummy Front Windshield View



No. 056 Pre-Test Left Side View of Driver Dummy and Interior



No. 057 Post-Test Left Side View of Driver Dummy and Interior



No. 058 Pre-Test Left Side Driver Dummy Window View



No. 059 Post-Test Left Side Driver Dummy Window View



No. 060 Pre-Test Right Side View of Driver Dummy and Interior



No. 061 Post-Test Right Side View of Driver Dummy and Interior



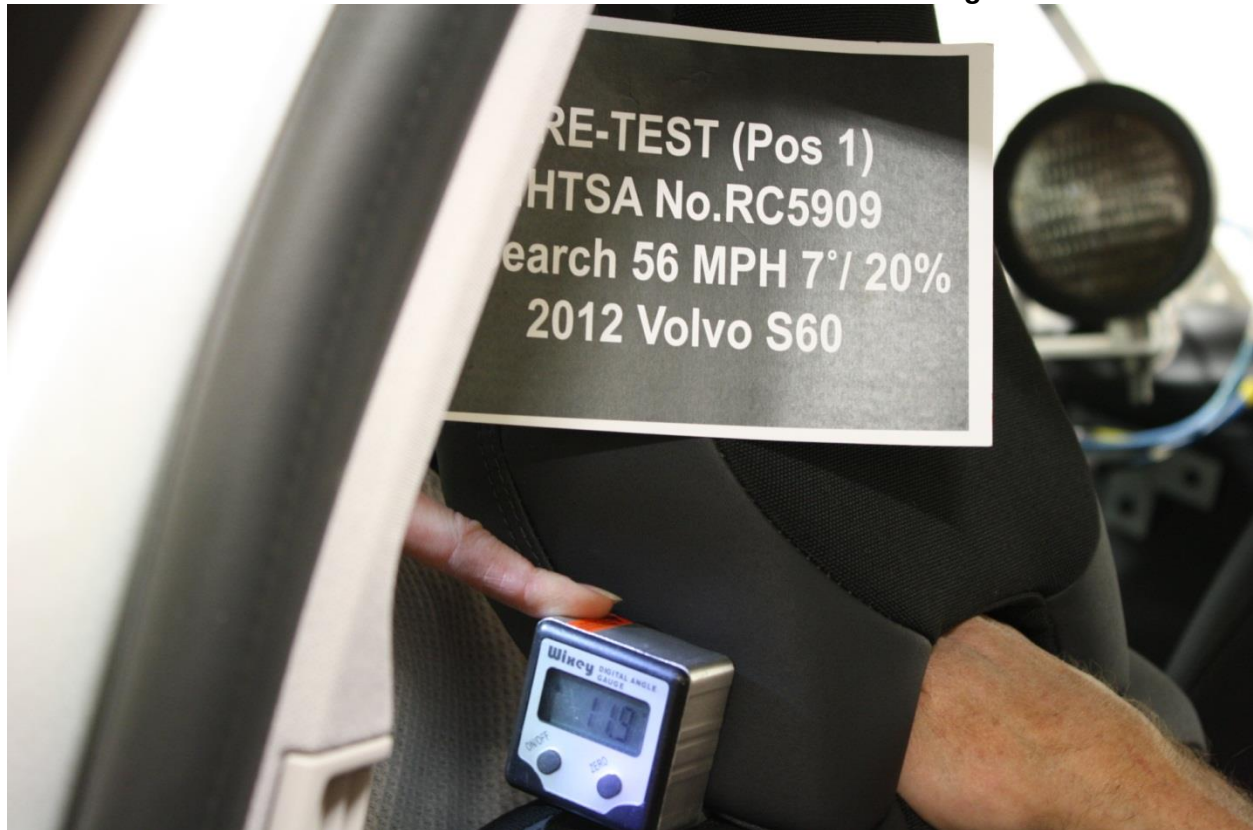
No. 062 Pre-Test View of Driver Dummy Door Clearance



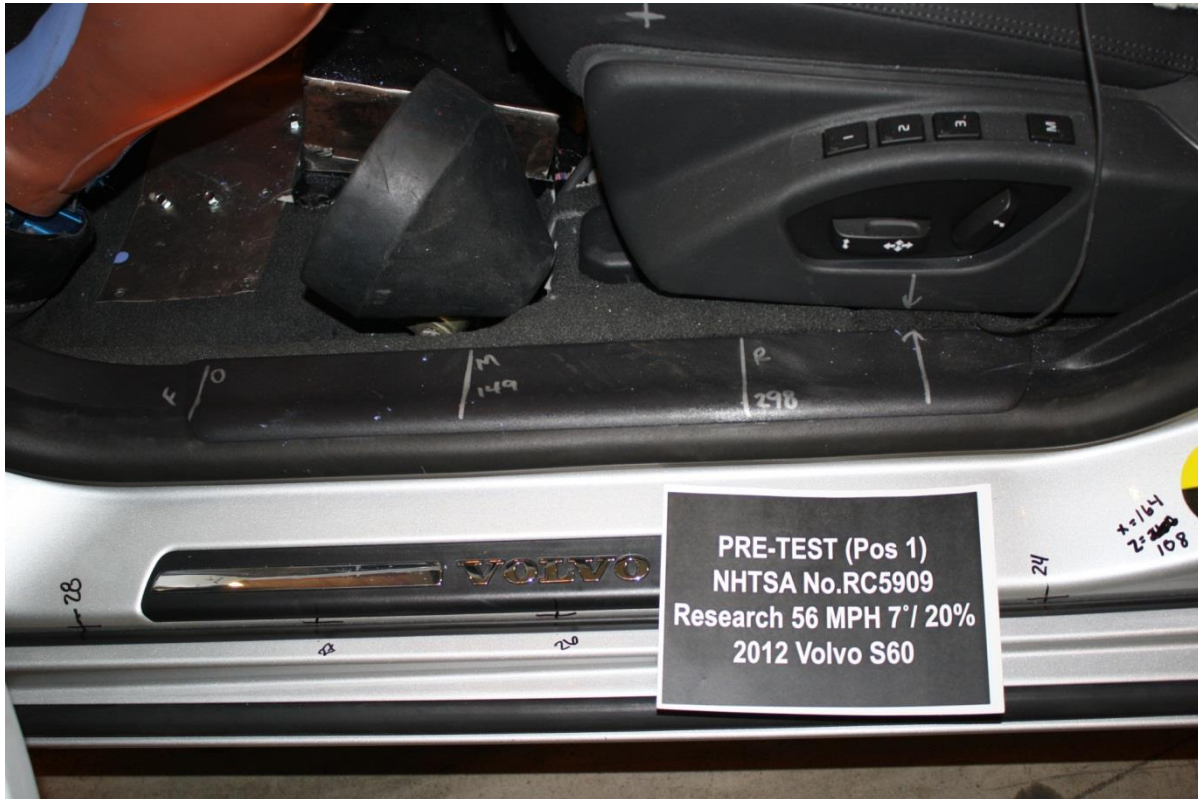
No. 063 Post-Test View of Driver Dummy Door Clearance



No. 064 Pre-Test Driver Seat Back Position markings



No. 065 Pre-Test Driver Seat Back Position with Level or Inclinometer



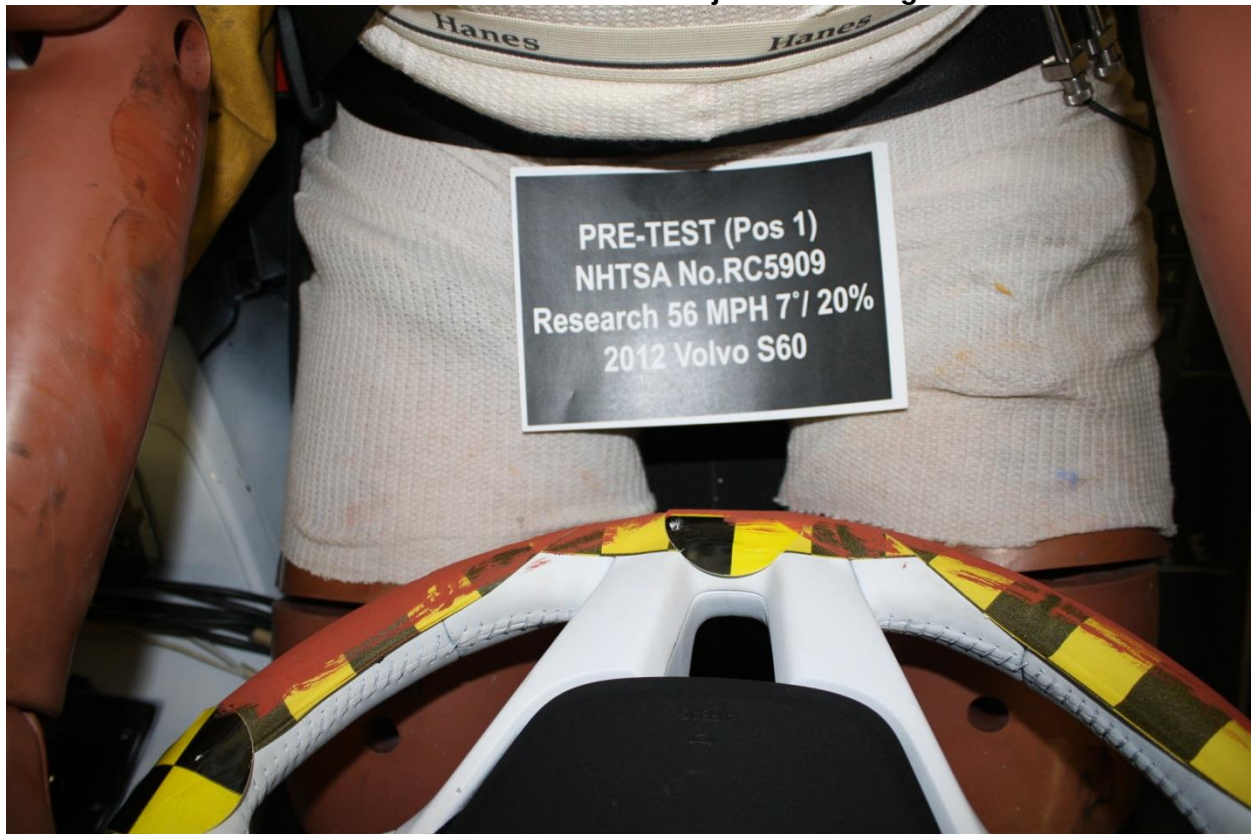
No. 066 Pre-Test Driver Seat Fore Aft Markings



No. 067 Post-Test Driver Seat Fore Aft Markings



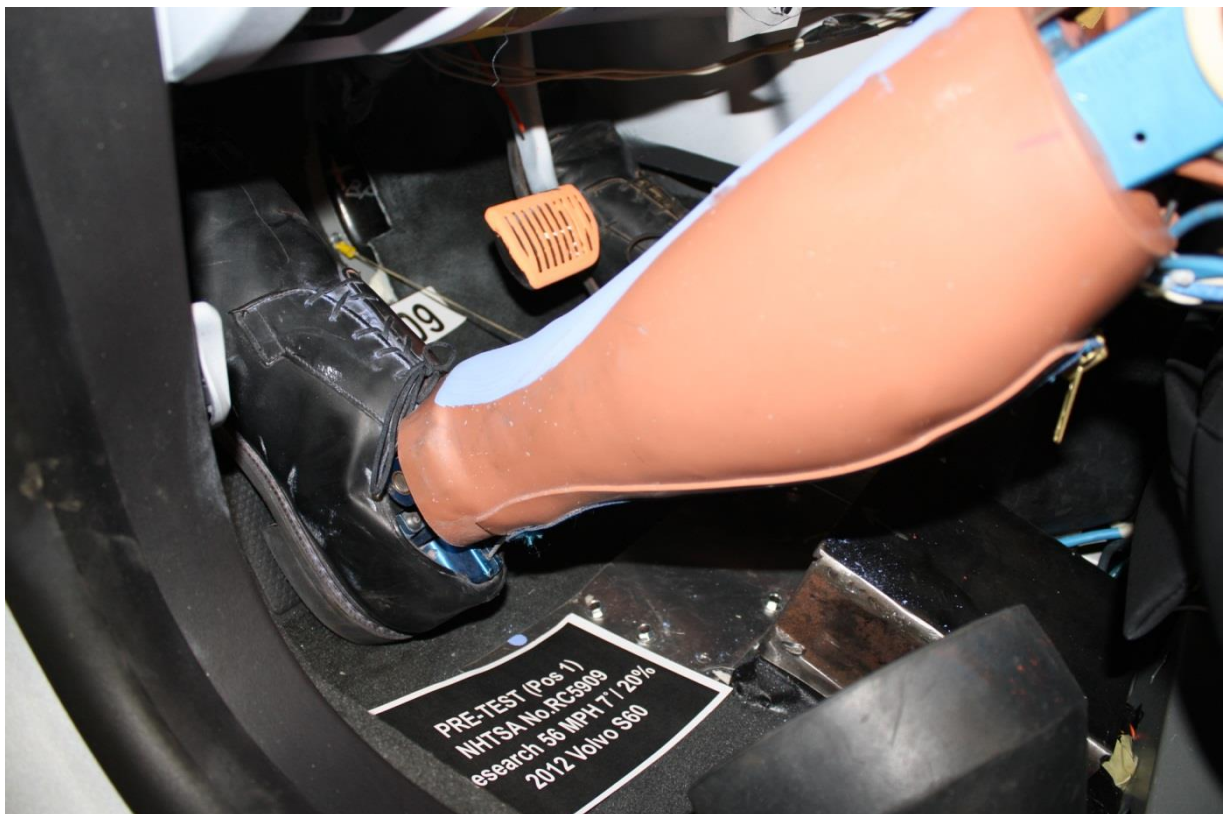
No. 068 Pre-Test Driver Adjustable D-ring



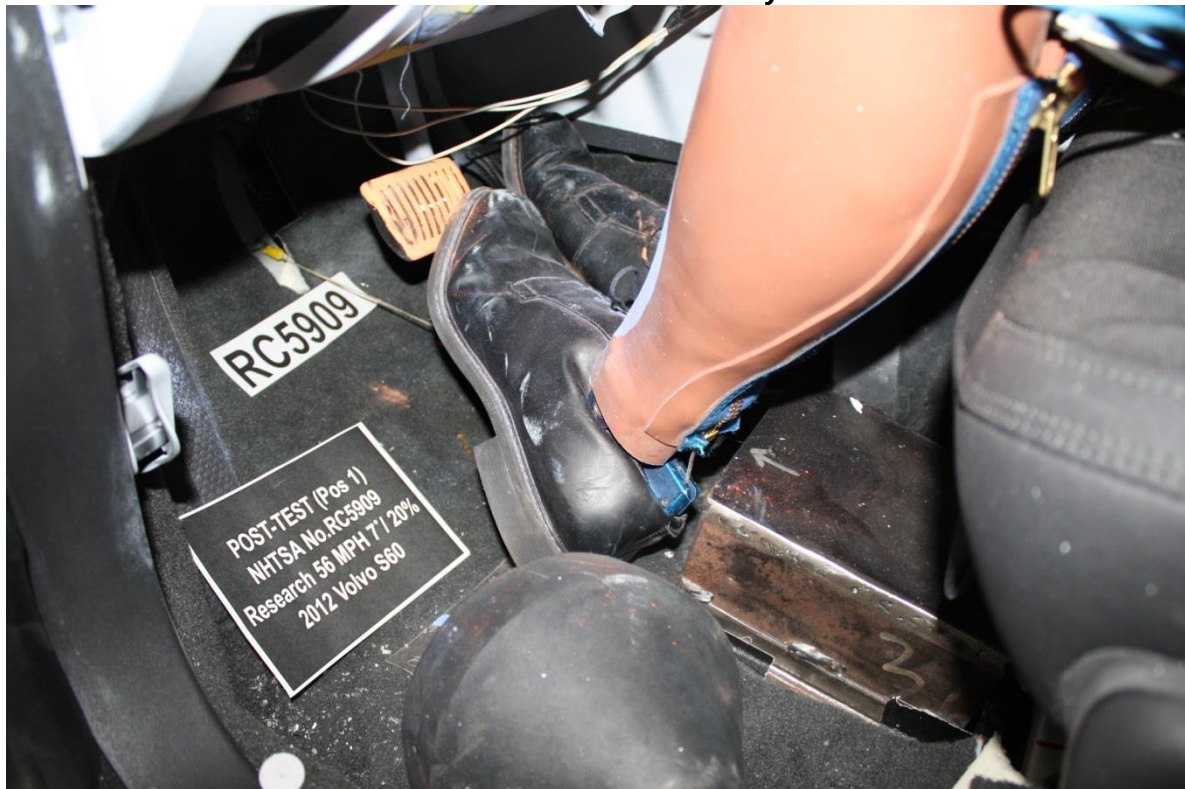
No. 069 Pre-Test Overhead View of Driver Dummy Thighs in seat



No. 070 Pre-Test View of Parking Brake



No. 071 Pre-Test Driver Dummy Feet



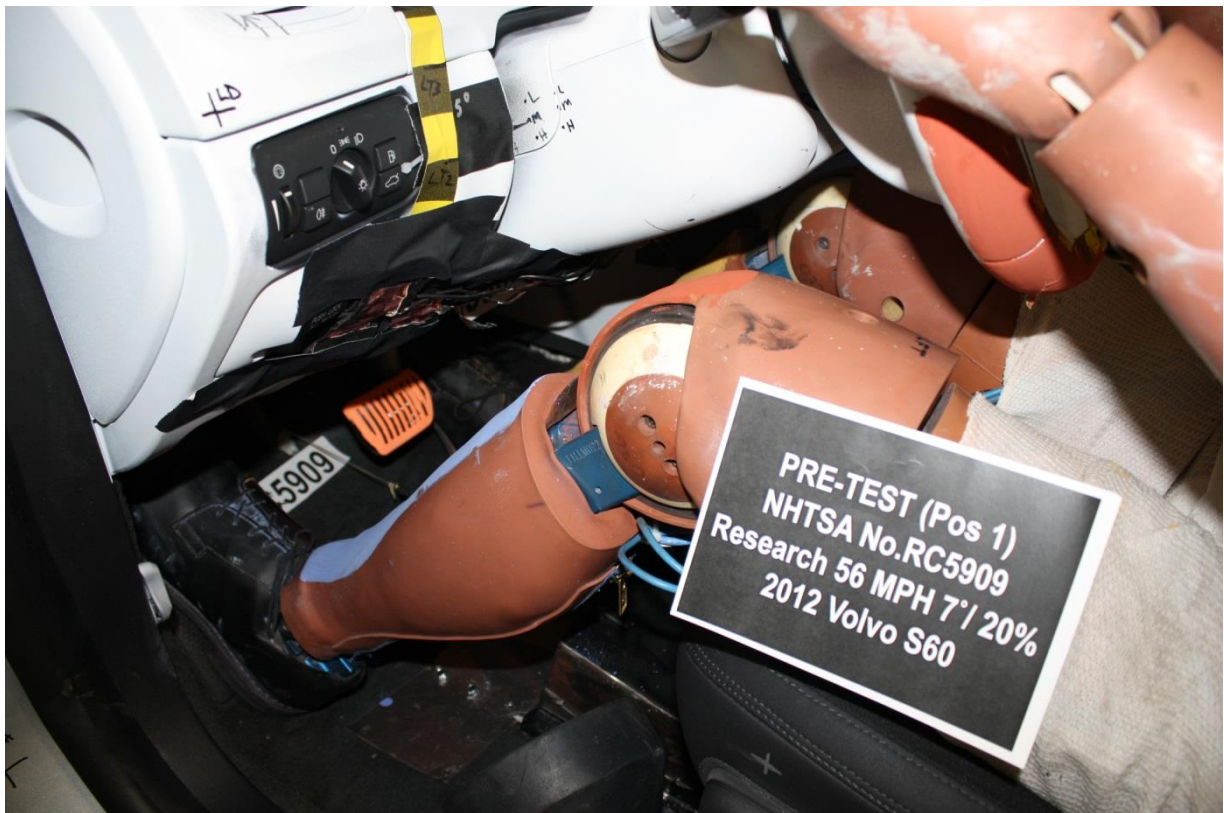
No. 072 Post-Test Driver Dummy Feet



No. 073 Pre-Test View of Driver Dummy Right Knee and Bolster



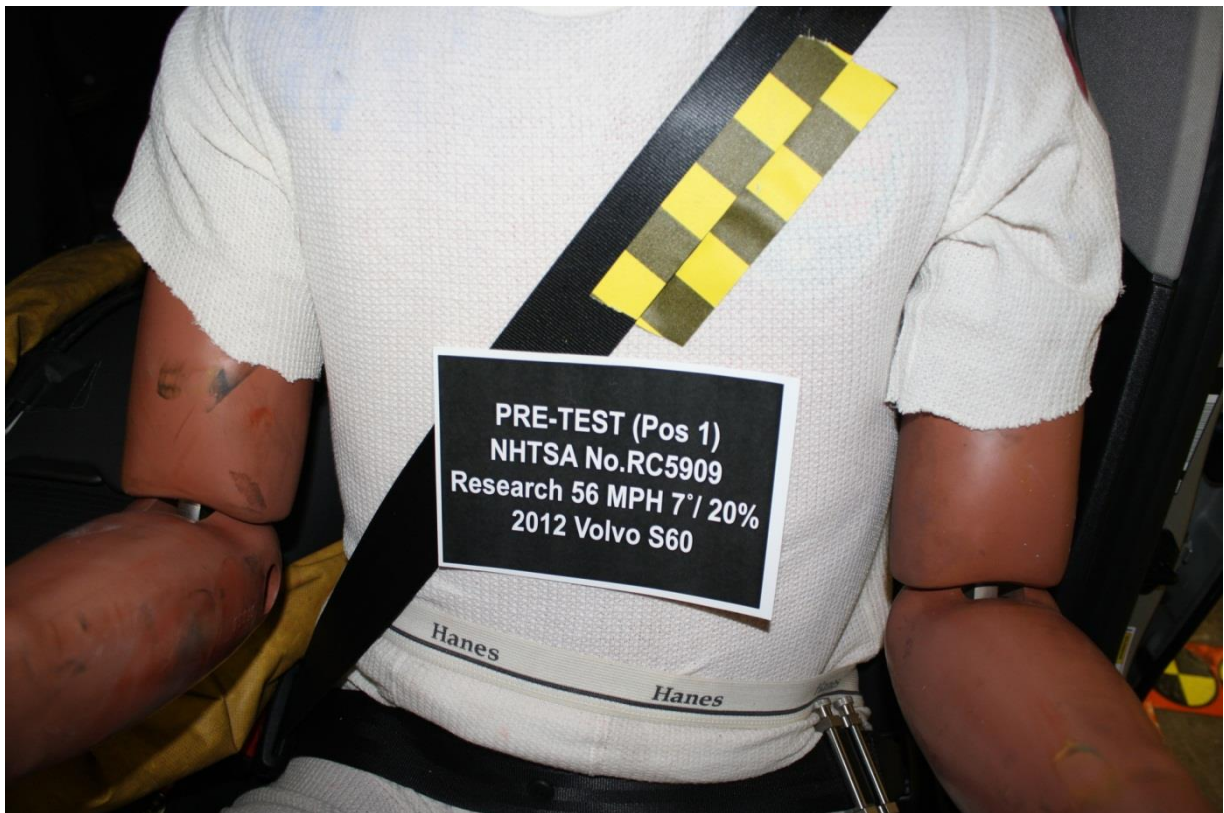
No. 074 Post-Test View of Driver Dummy Right Knee and Bolster



No. 075 Pre-Test View of Driver Dummy Left Knee and Bolster



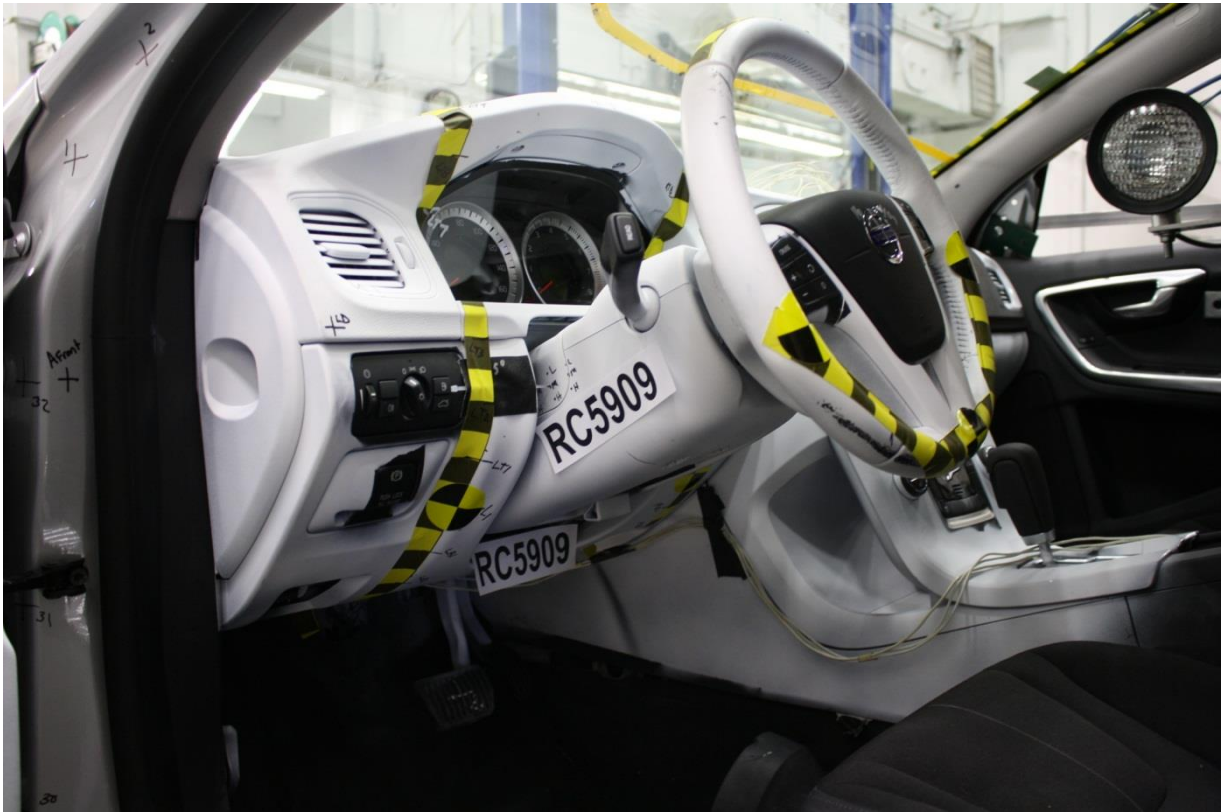
No. 076 Post-Test View of Driver Dummy Left Knee and Bolster



No. 077 Pre-Test View of Driver Dummy Abdomen



No. 078 Post-Test View of Driver Dummy Abdomen



No. 079 Pre-Test Left Side View of Steering Wheel set position



No. 080 Post-Test Left Side View of Steering Wheel set position



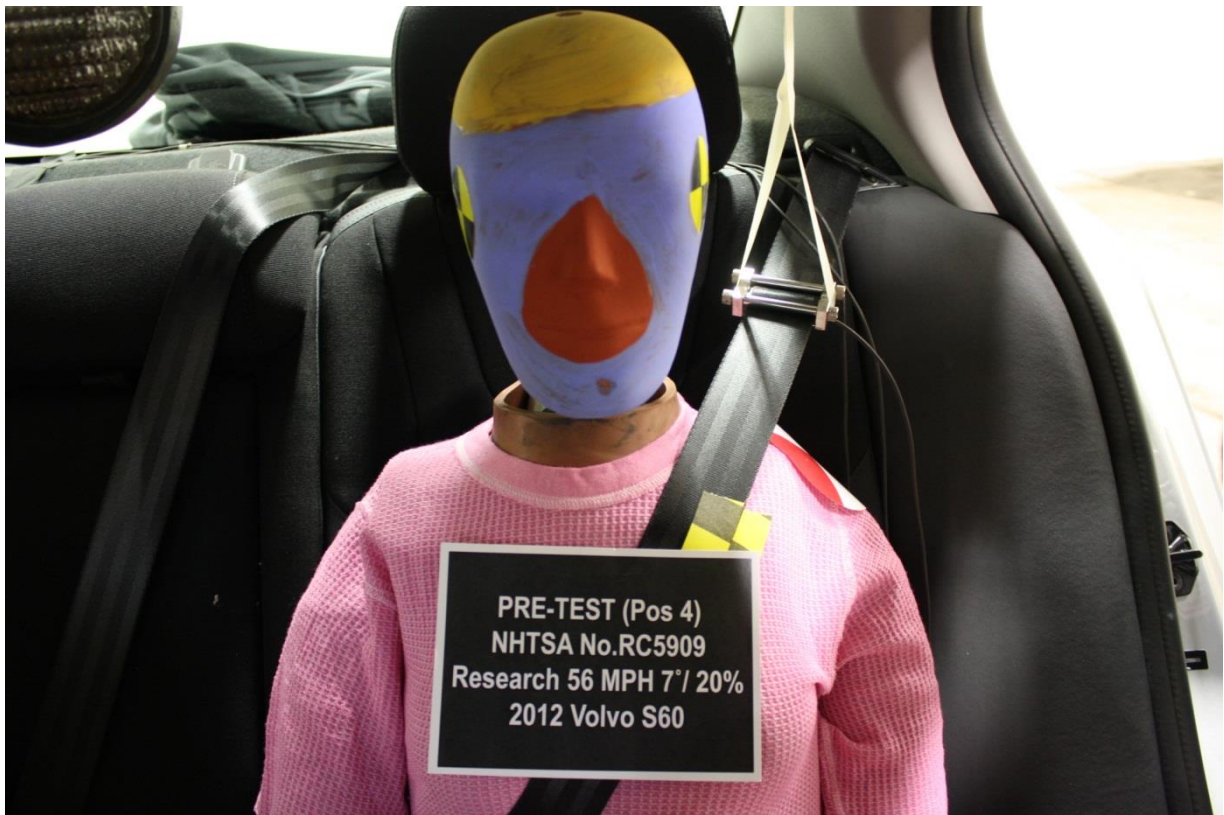
No. 081 Post-Test View of Driver Dummy Head Contact with Airbag



No. 081a Post-Test View of Driver Dummy Head Contact with Airbag



No. 082 Post-Test View of Driver Dummy Head Contact with Vehicle Interior



No. 083 Pre-Test Passenger Dummy Front Close-up View



No. 084 Post-Test Passenger Dummy Front Close-up View



No. 085 Pre-Test Left Side Passenger Dummy and Interior View



No. 086 Post-Test Left Side Passenger Dummy and Interior View



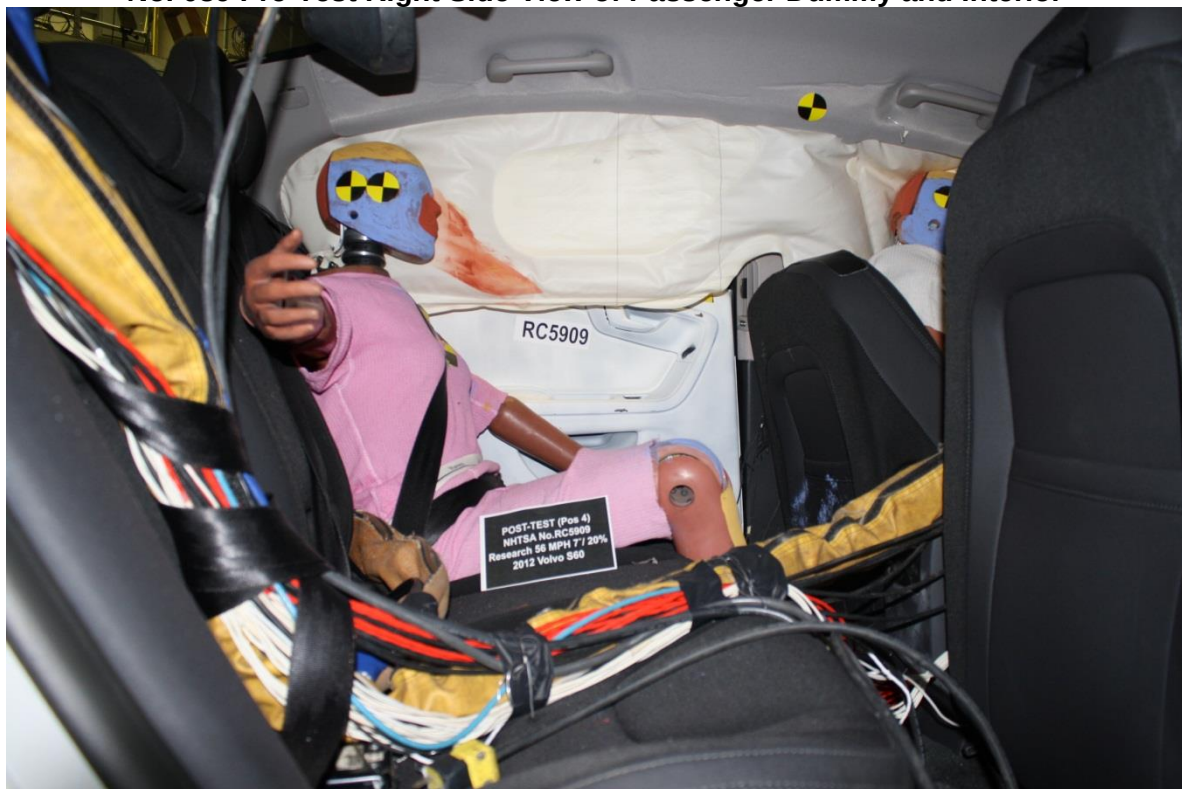
No. 087 Pre-Test Left Side Passenger Dummy Window View



No. 088 Post-Test Left Side Passenger Dummy Window View



No. 089 Pre-Test Right Side View of Passenger Dummy and Interior



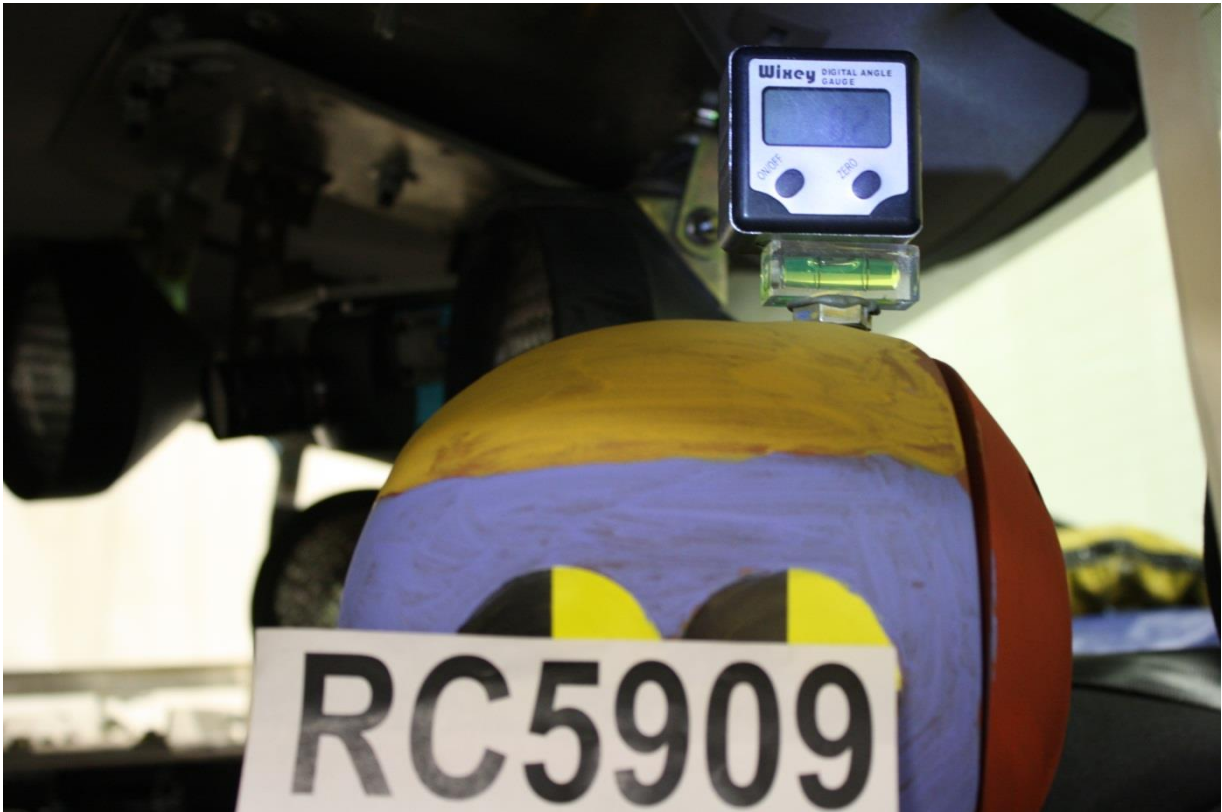
No. 090 Post-Test Right Side View of Passenger Dummy and Interior



No. 091 Pre-Test View of Passenger Dummy Door Clearance



No. 092 Post-Test View of Passenger Dummy Door Clearance



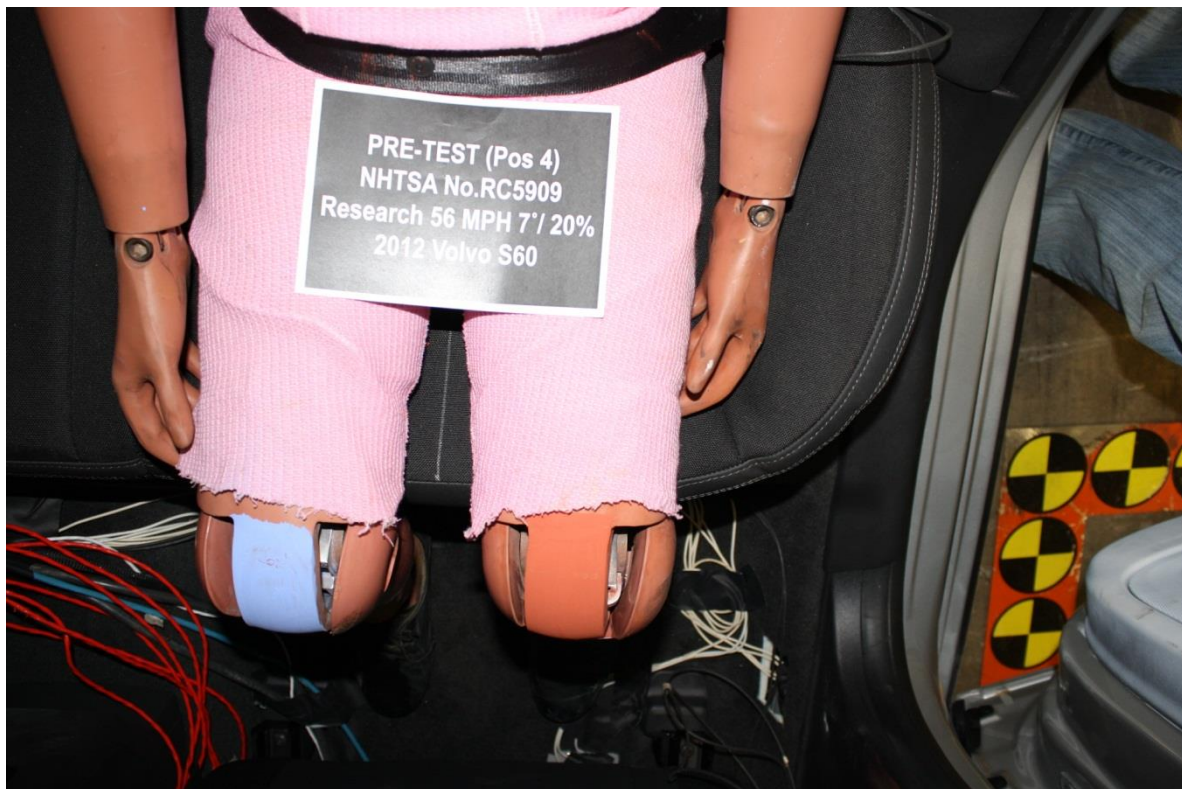
No. 093 Pre-Test Passenger View Showing Head Level



No. 094 Pre-Test Passenger Seat Fore-Aft Markings



No. 095 Pre-Test Passenger Seat Back Angle



No. 096 Pre-Test Overhead View of Passenger Dummy Thighs on seat



No. 097 Pre-Test Passenger Adjustable D-ring



No. 098 Pre-Test View of Passenger Dummy Feet



No. 099 Post-Test View of Passenger Dummy Feet



No. 100 Post-Test View of Passenger Dummy Head contact with Airbag

Photo Not Applicable

No. 101 Post-Test View of Passenger Dummy Head contact with Interior (a,b,c)



No. 102 Post-Test View of Passenger Dummy Knee Contact with Seatback



No. 103 Pre-Test Ballast Locations



No. 104 Post-Test Speed Trap Readout



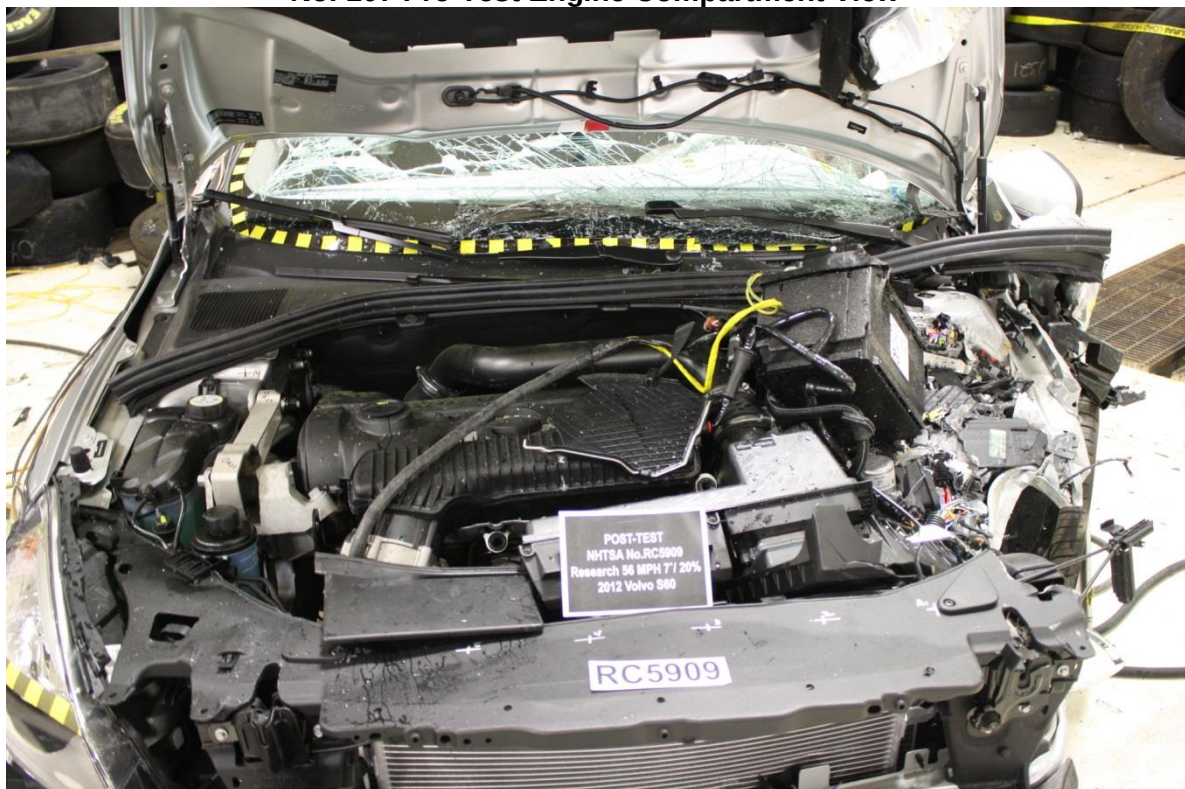
No. 105 Pre-Test View of Fuel Filler Cap



No. 106 Post-Test View of Fuel Filler Cap



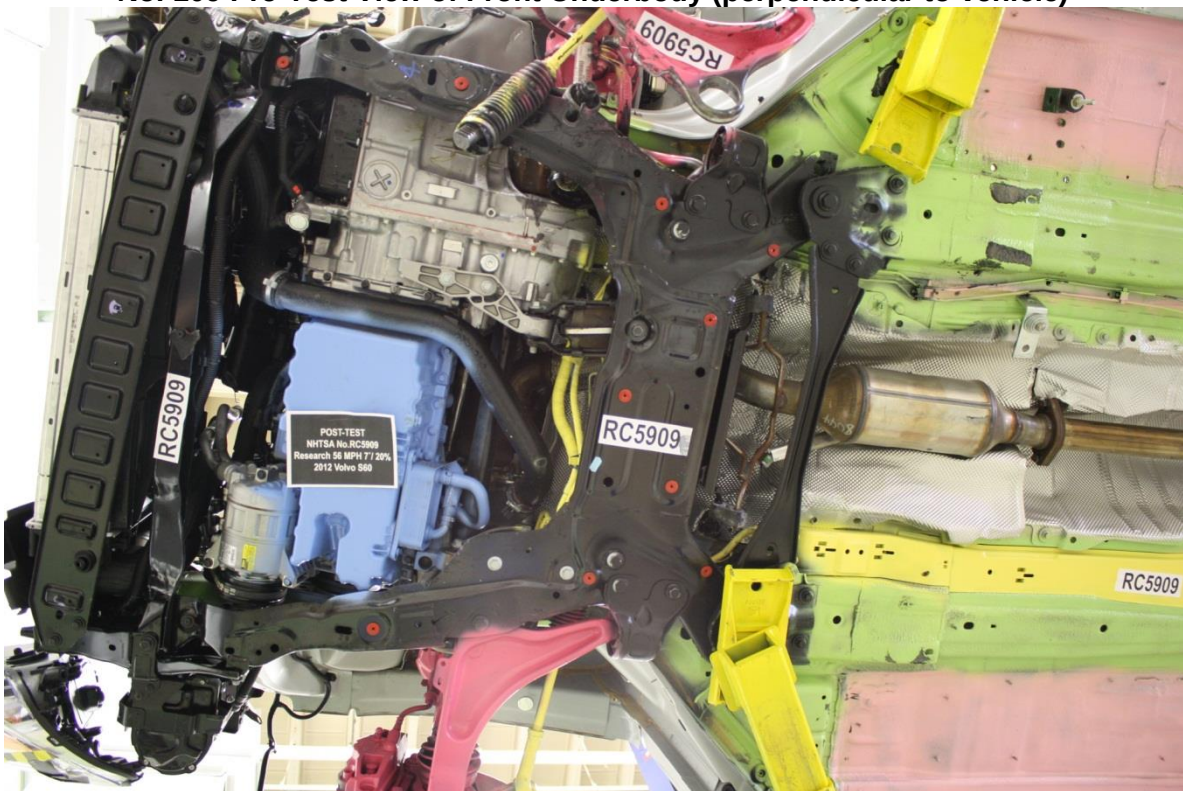
No. 107 Pre-Test Engine Compartment View



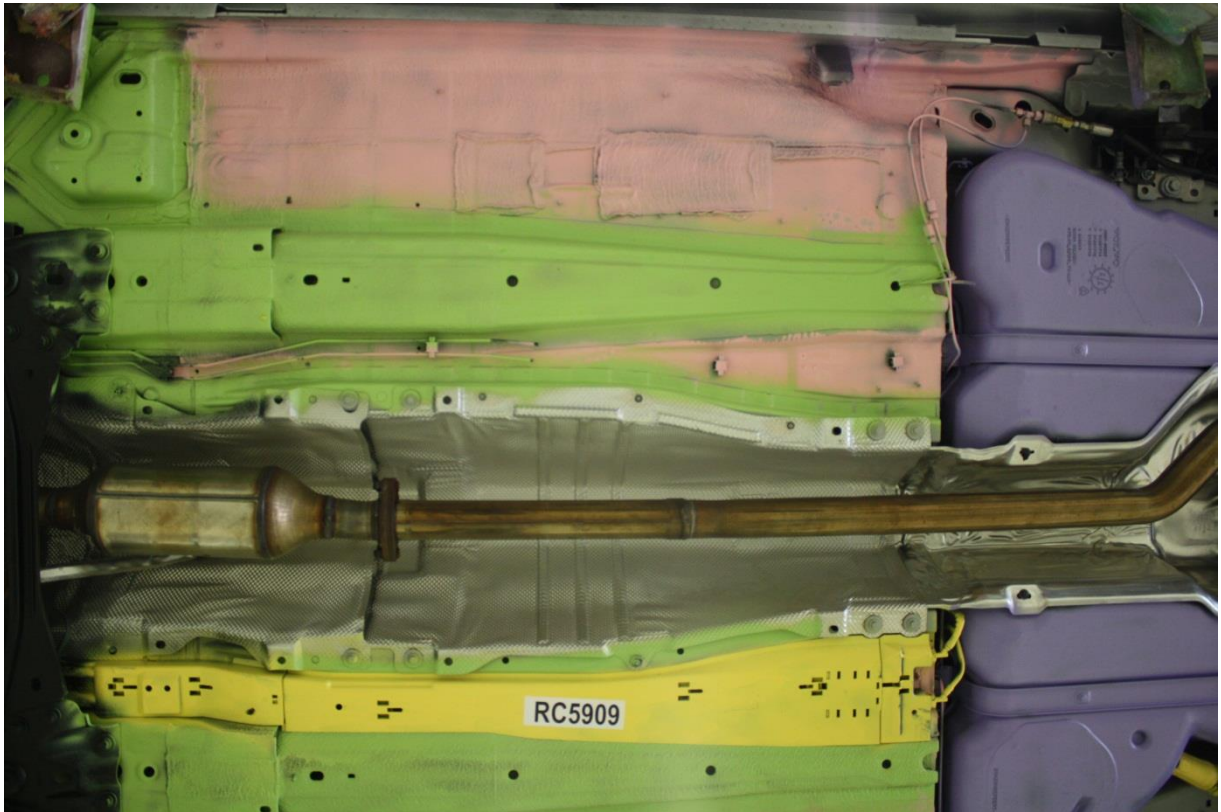
No. 108 Post-Test Engine Compartment View



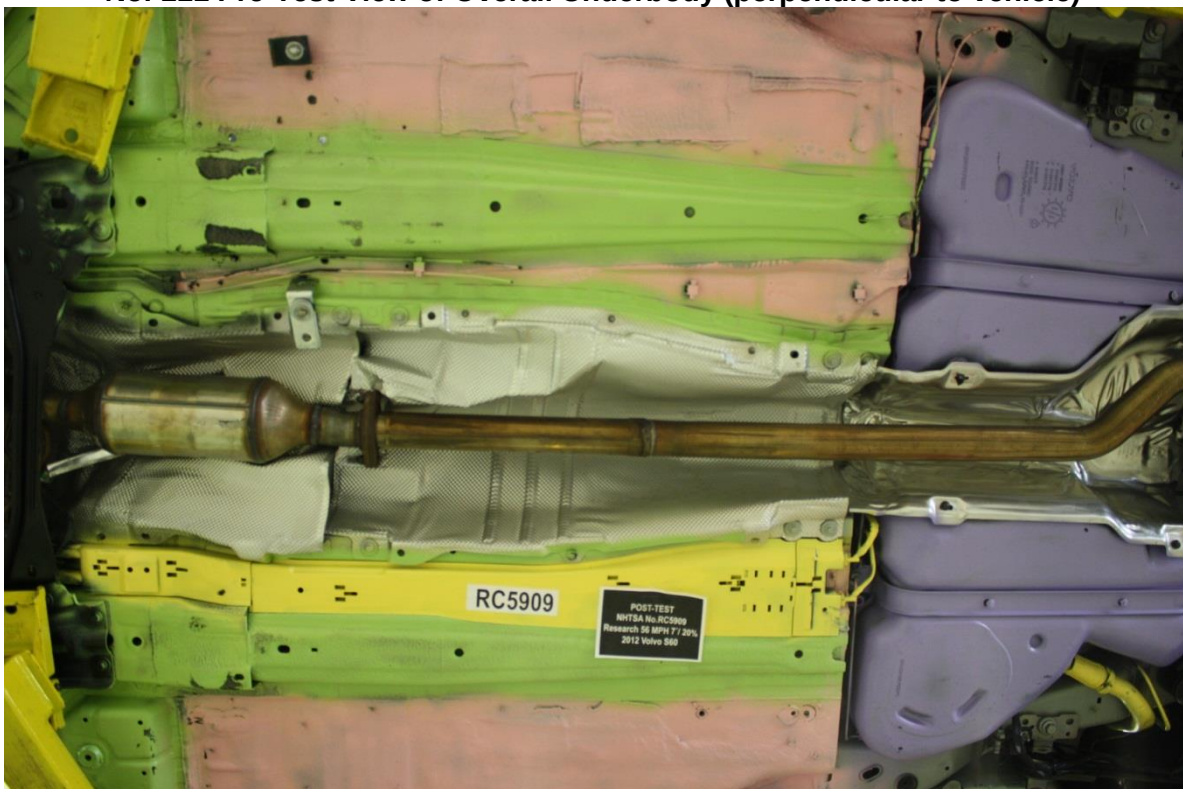
No. 109 Pre-Test View of Front Underbody (perpendicular to vehicle)



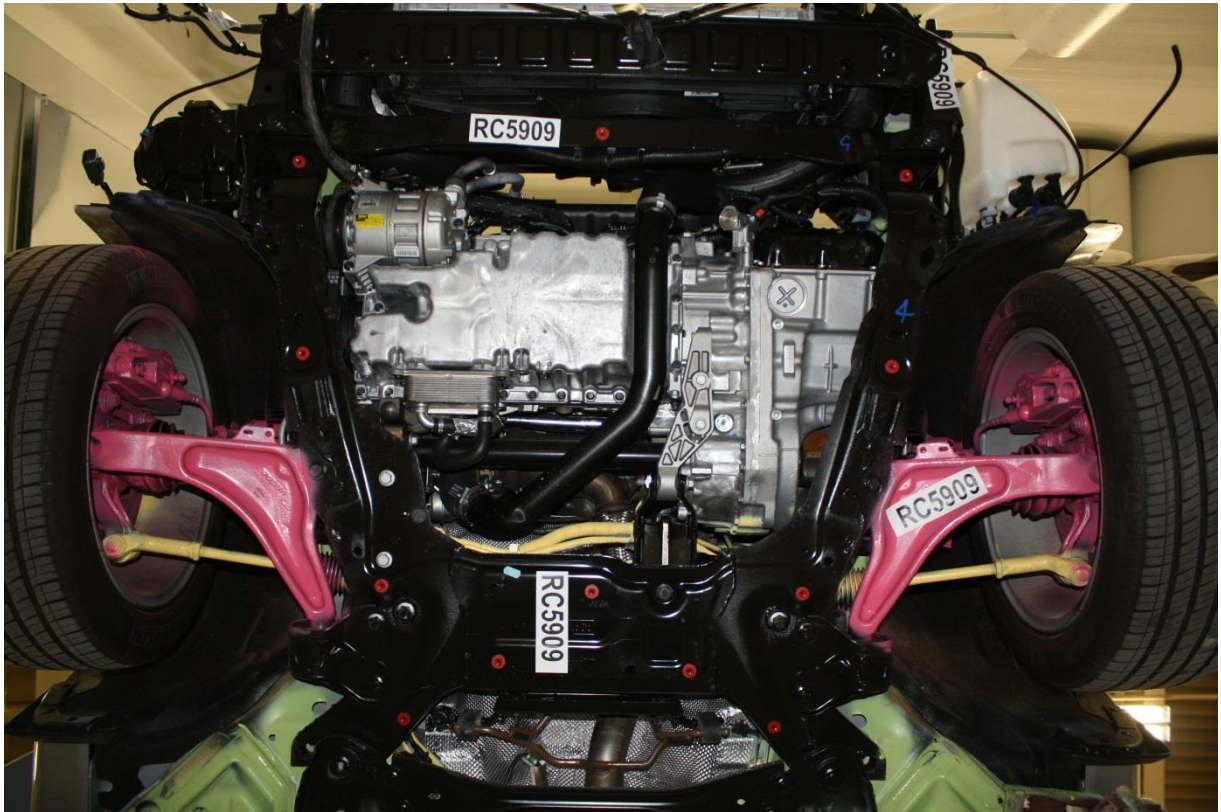
No. 110 Post-Test View of Front Underbody (perpendicular to vehicle)



No. 111 Pre-Test View of Overall Underbody (perpendicular to vehicle)



No. 112 Post-Test View of Overall Underbody (perpendicular to vehicle)



No. 113 Pre-Test View of Steering rack and or sway bar



No. 114 Post-Test View of Steering rack and or sway bar



No. 115 Pre-Test Close up of Bumper and Crush Initiators



No. 116 Post-Test View of Front Sub-Frame Deformation



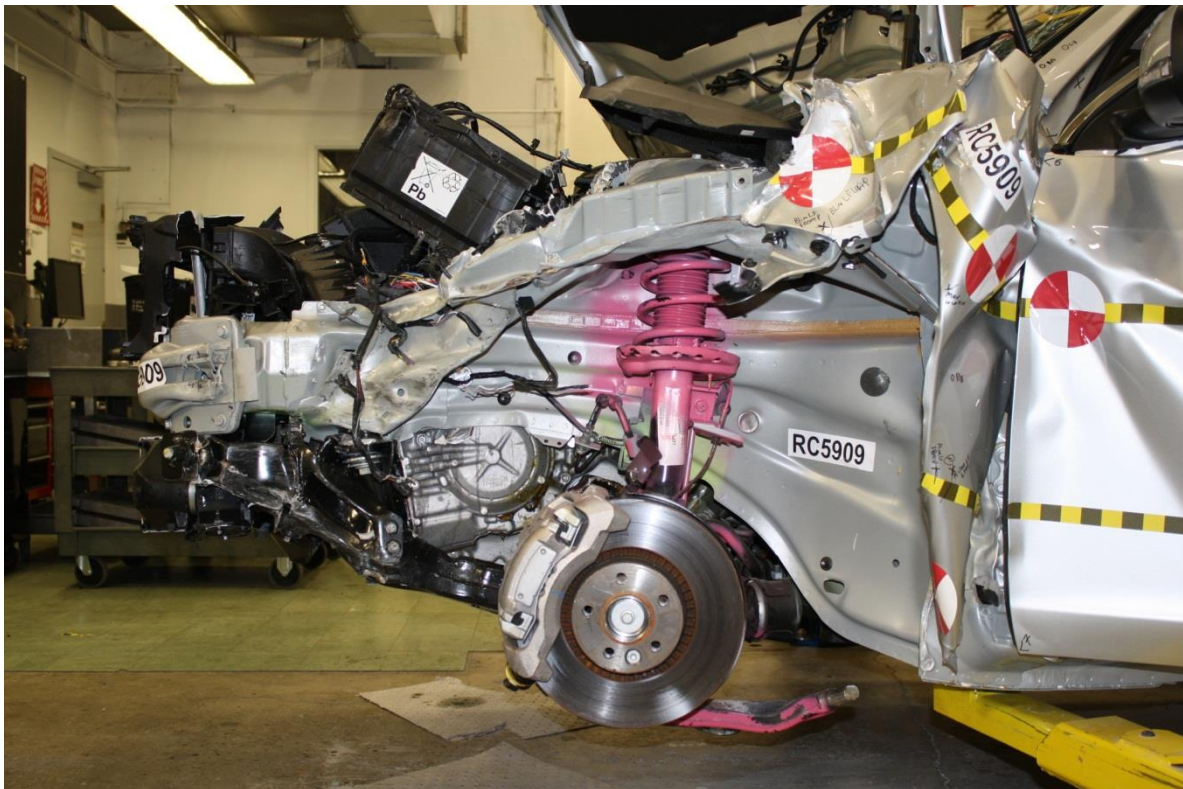
No. 117 Pre-Test Frame Rail with tire removed



No. 118 Post-Test Frame Rail with tire removed



No. 119 Pre-Test View of Wheel Well with tire removed



No. 120 Post-Test View of Wheel Well with tire removed



No. 121 Post-Test View of Door Sill with door open



No. 122 Post-Test View of Deformation of A pillar



No. 123 Post-Test View of Deformation of B pillar



No. 124 Post-Test View of Deformation of C pillar



No. 125 Post-Test View of Wheel and or Tire Deformation



No. 126 Post-Test View of Deformation of Rocker or Post



No. 127 Post-Test View of Windshield Separation



No. 128 Pre-Test Left Side View of RMDB



No. 129 Post-Test Left Side View of RMDB



No. 130 Pre-Test Right Side View of RMDB



No. 131 Post-Test Right Side View of RMDB



No. 132 Pre-Test Top View of RMDB



No. 133 Post-Test Top View of RMDB



No. 134 Pre-Test Front View of RMDB



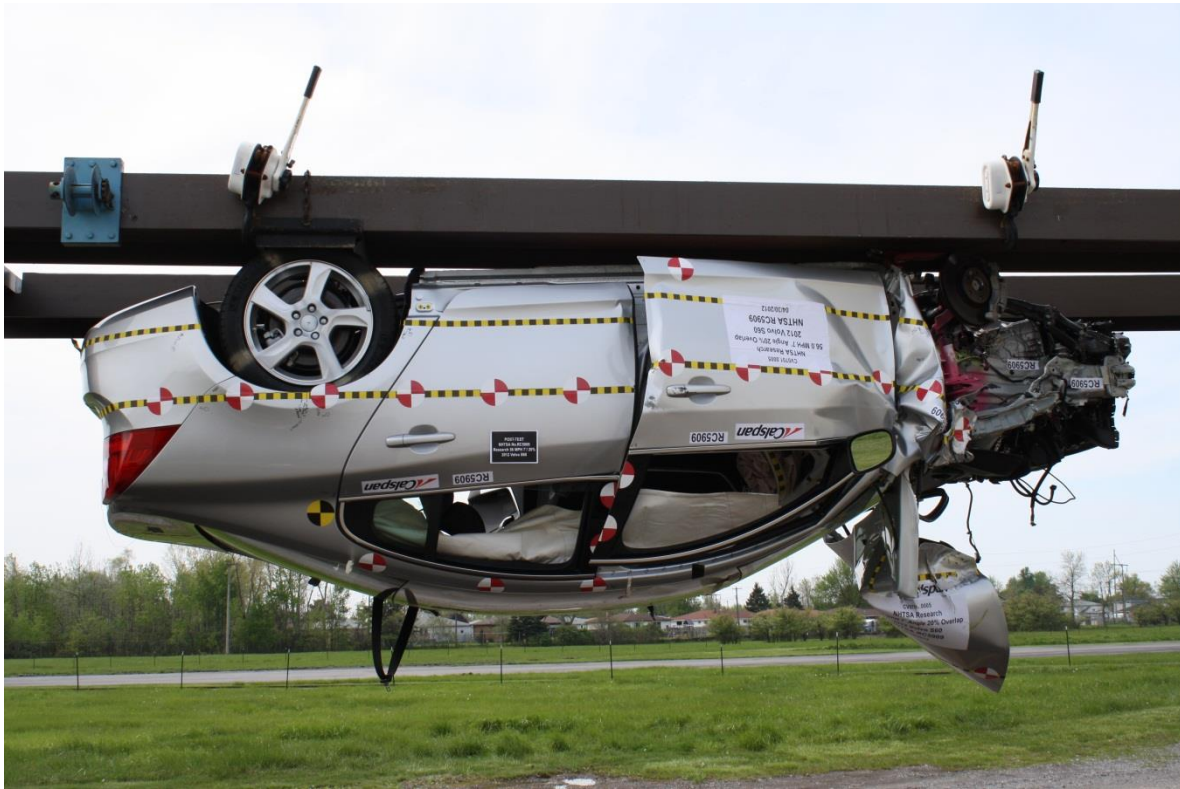
No. 135 Post-Test Front View of RMDB



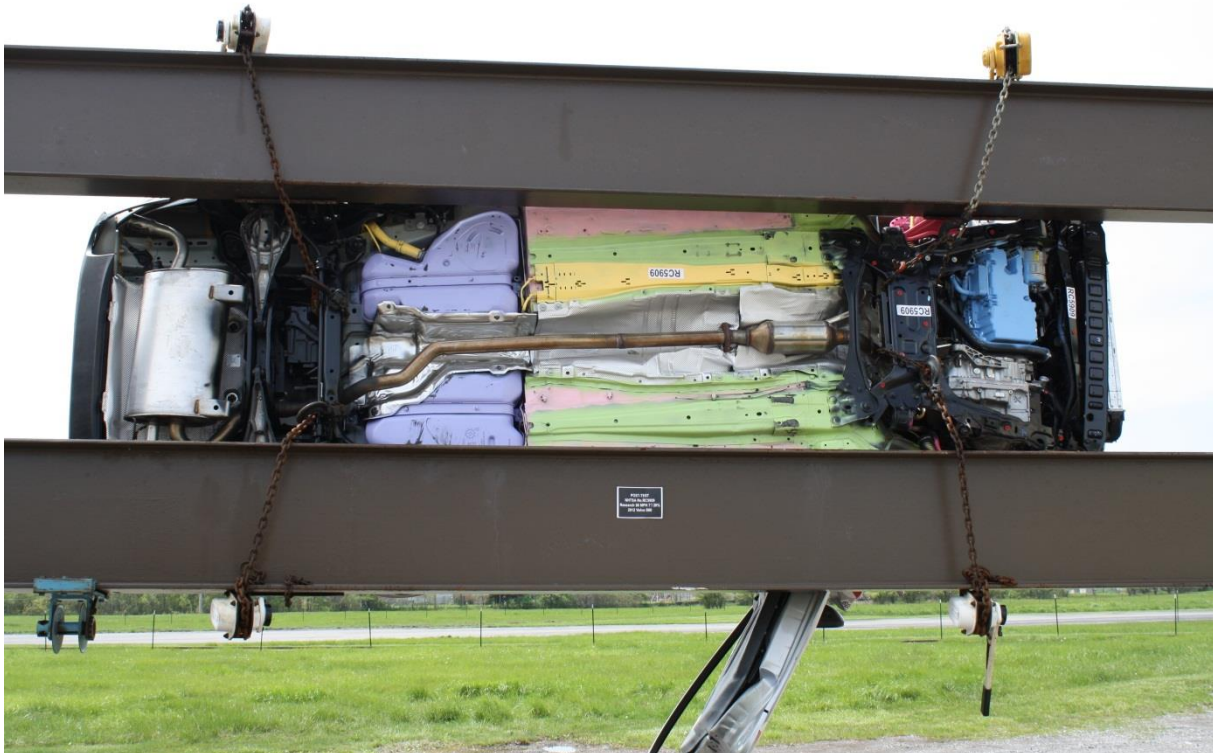
No. 136 Vehicle at 0 Degrees on Static Rollover Device



No. 137 Vehicle at 90 Degrees on Static Rollover Device



No. 138 Vehicle at 180 Degrees on Static Rollover Device



No. 139 Vehicle at 270 Degrees on Static Rollover Device



No. 140 Vehicle at 360 Degrees on Static Rollover Device



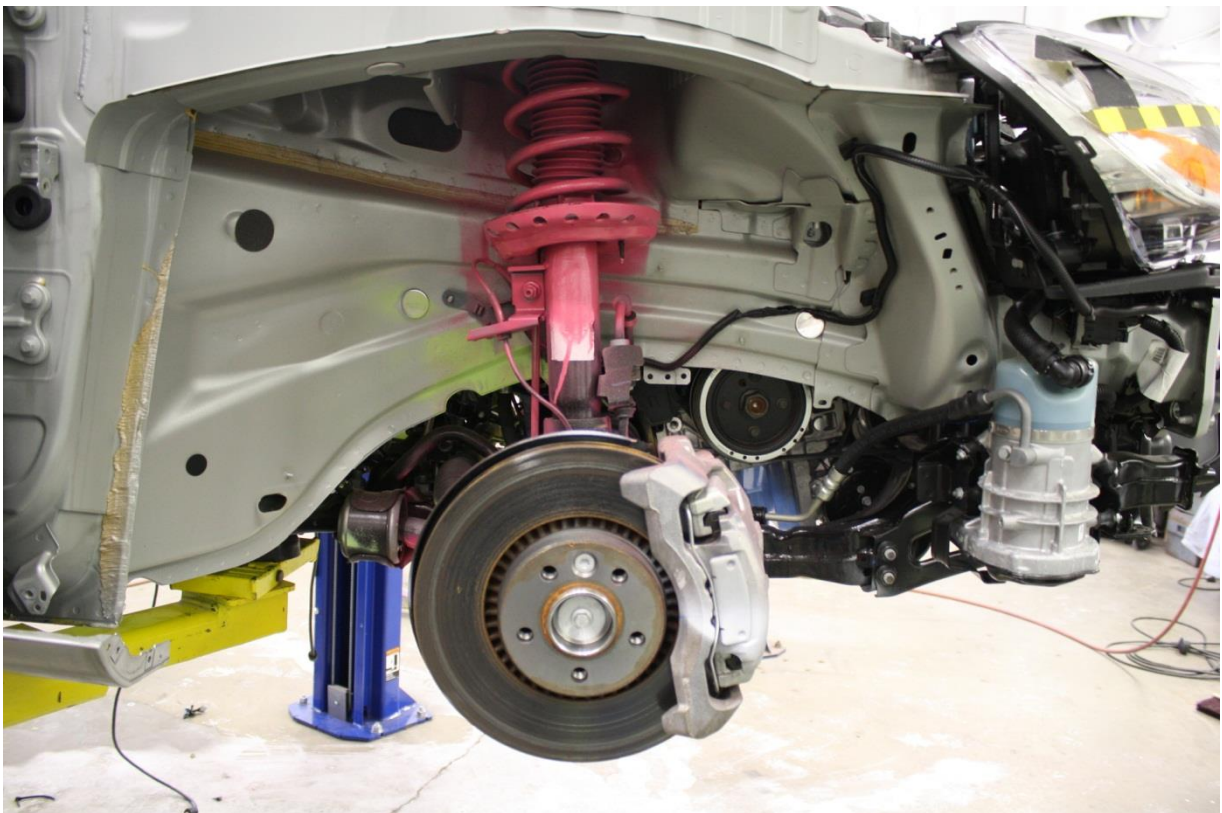
No. 141 Right Side Underbody View



No. 142 Vehicle Right Side $\frac{3}{4}$ View of Wheel Well



No. 143 Vehicle Right Side Close up View of Suspension



No. 144 Right Front Wheel Well



No. 145 Vehicle Right Side ¾ View of the back of the Wheel Well



No. 146 Vehicle Right Side ¾ View of top of shotgun



No. 147 Right Side $\frac{3}{4}$ View of Shotgun

APPENDIX B
VEHICLE & DUMMY RESPONSE DATA TRACES

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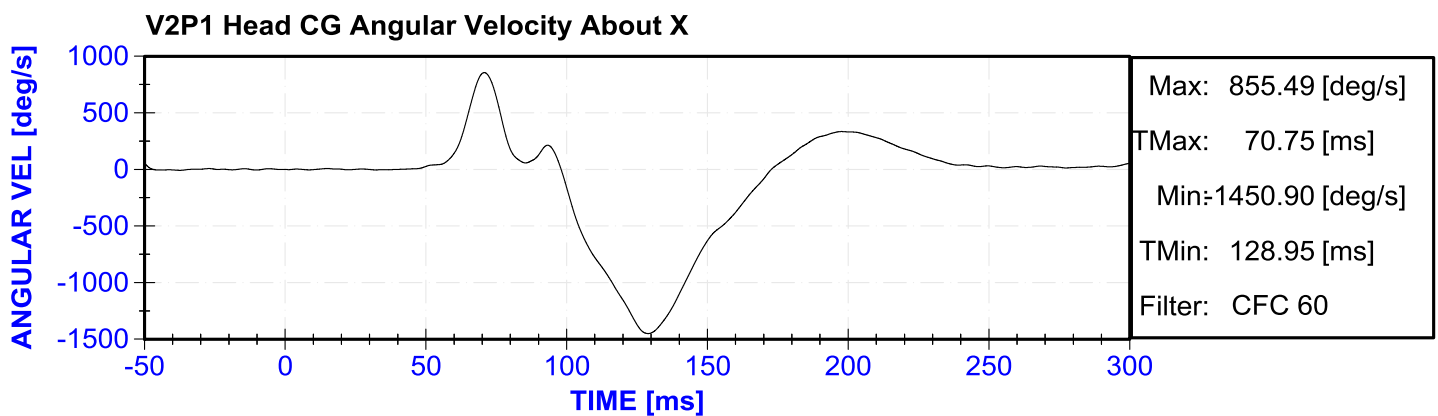
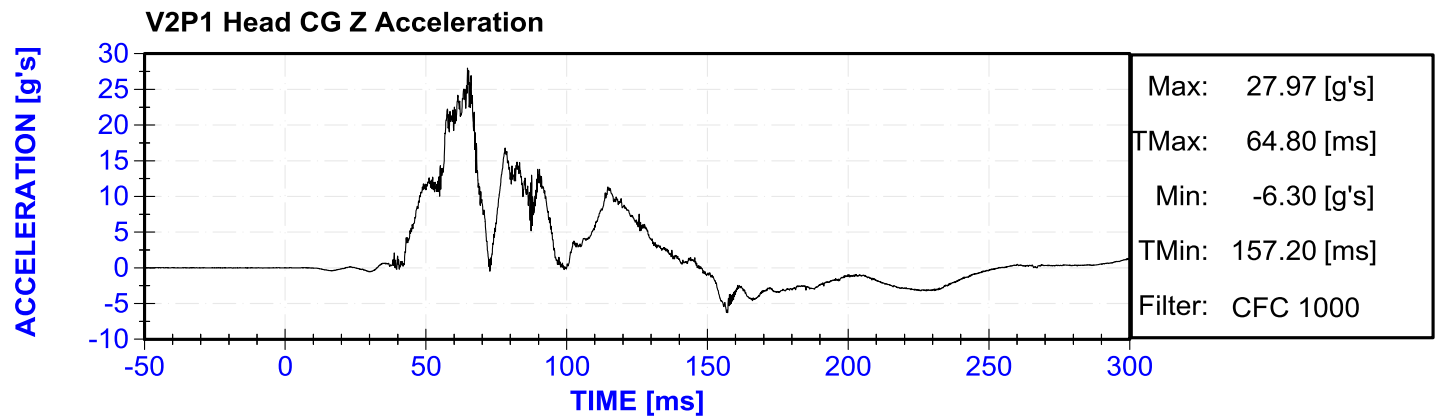
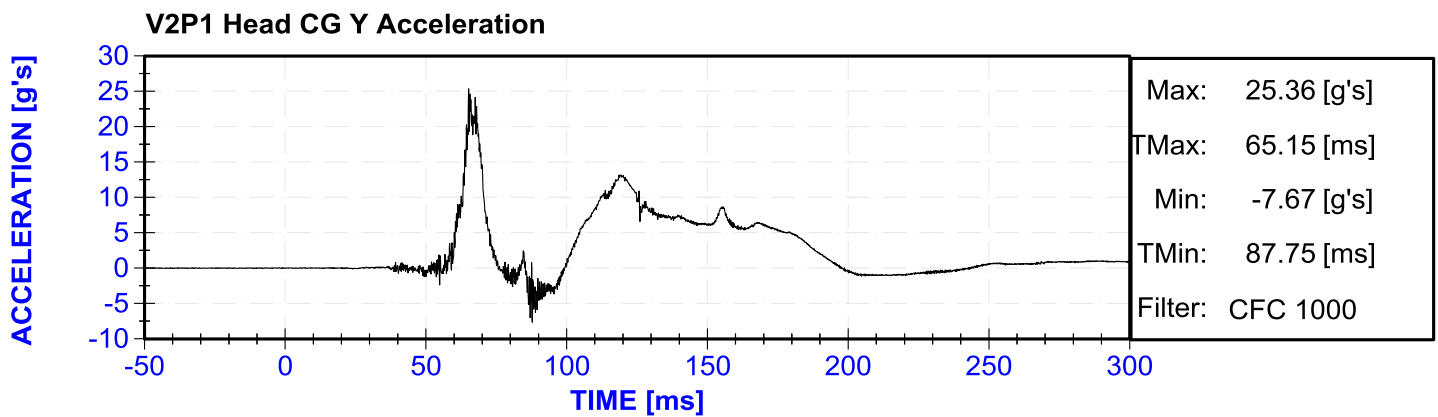
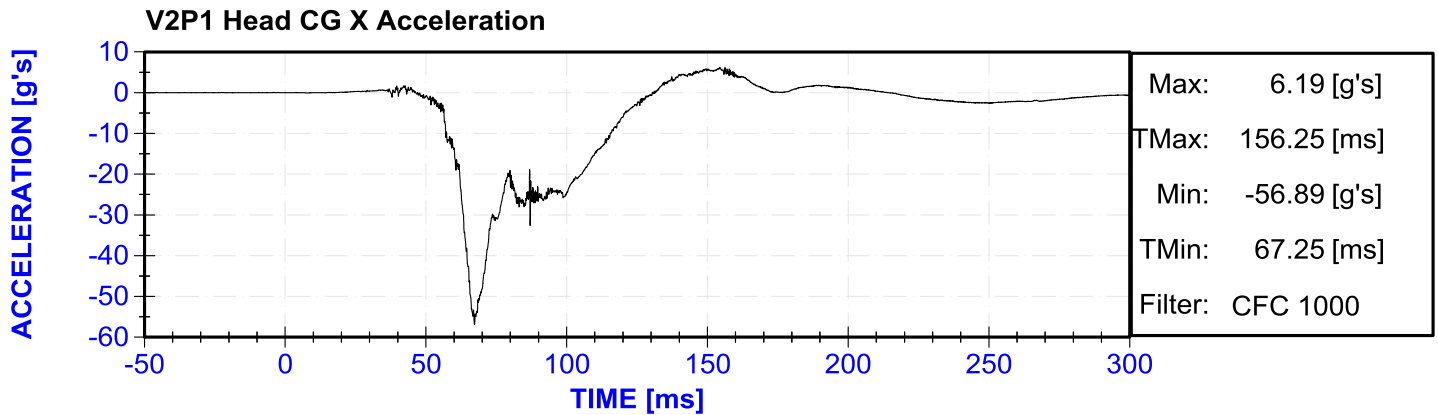
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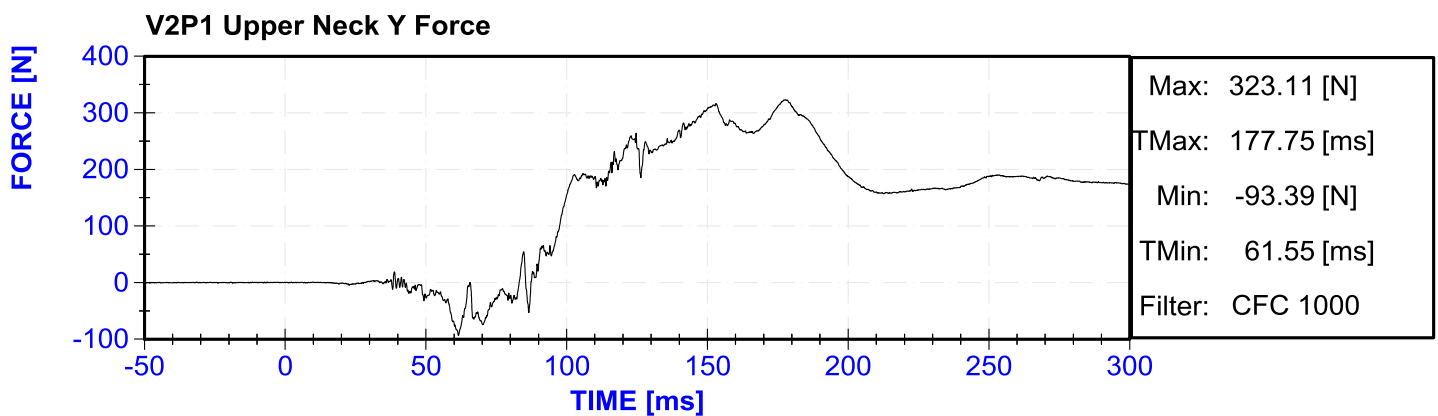
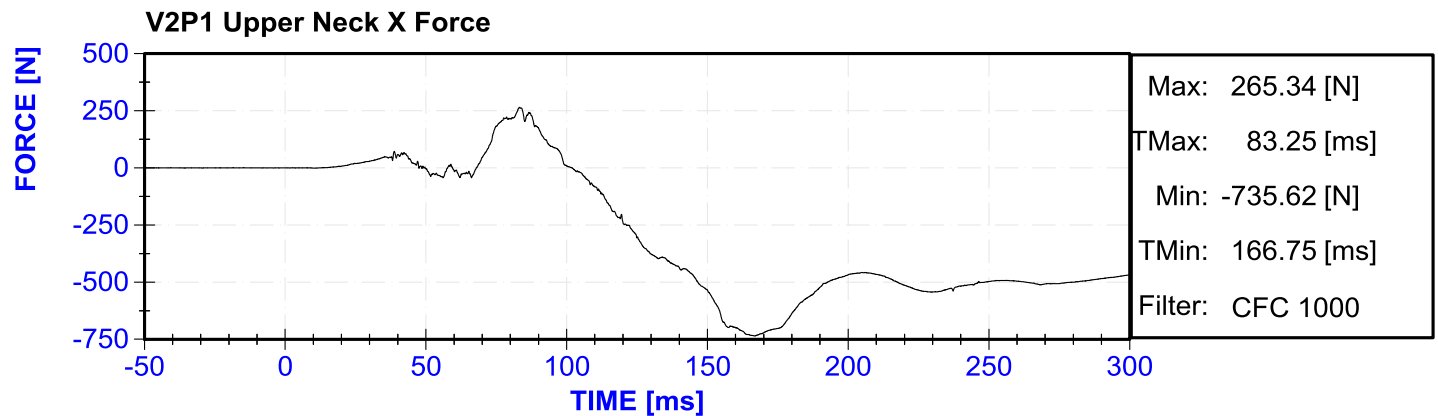
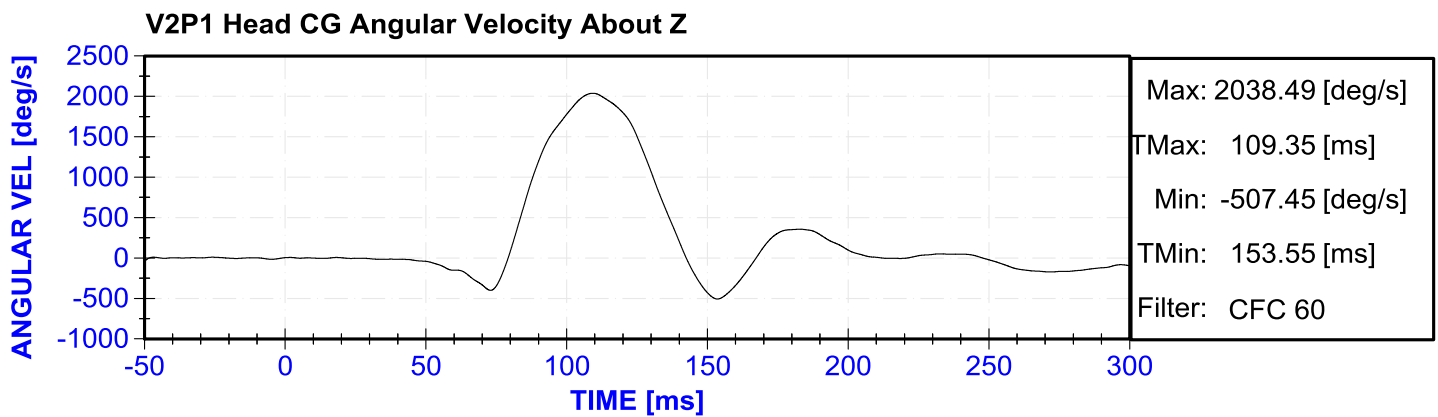
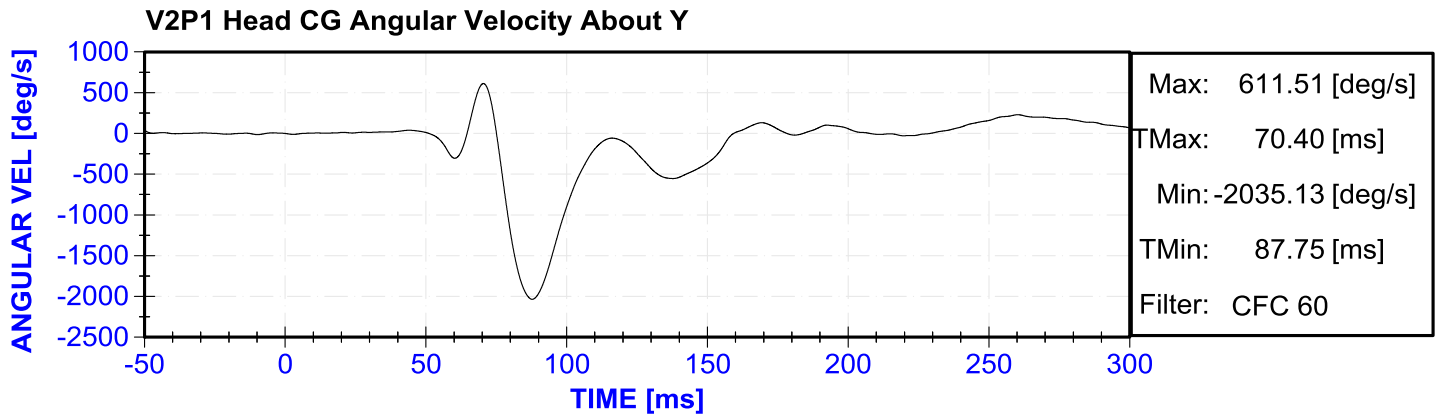
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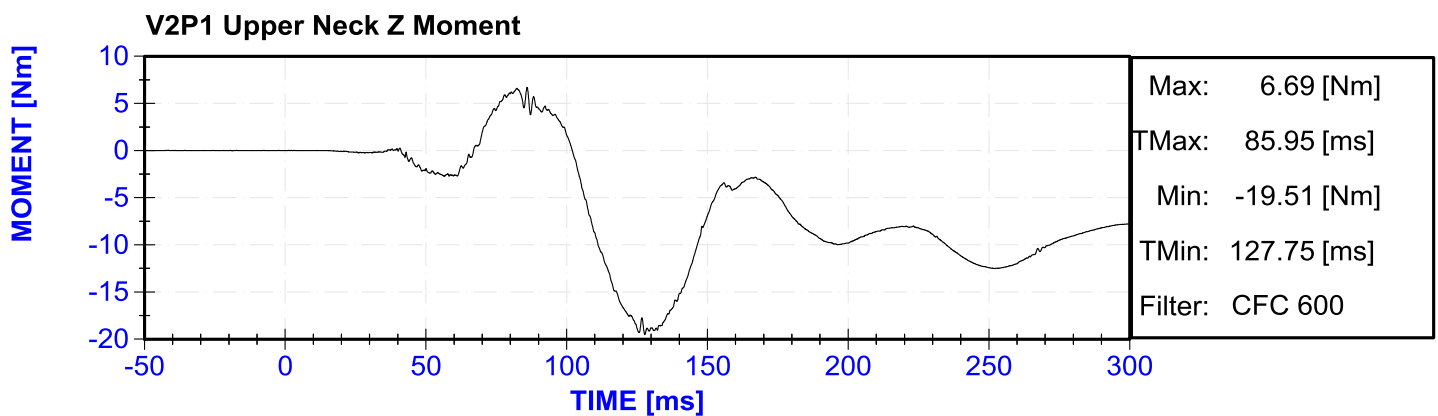
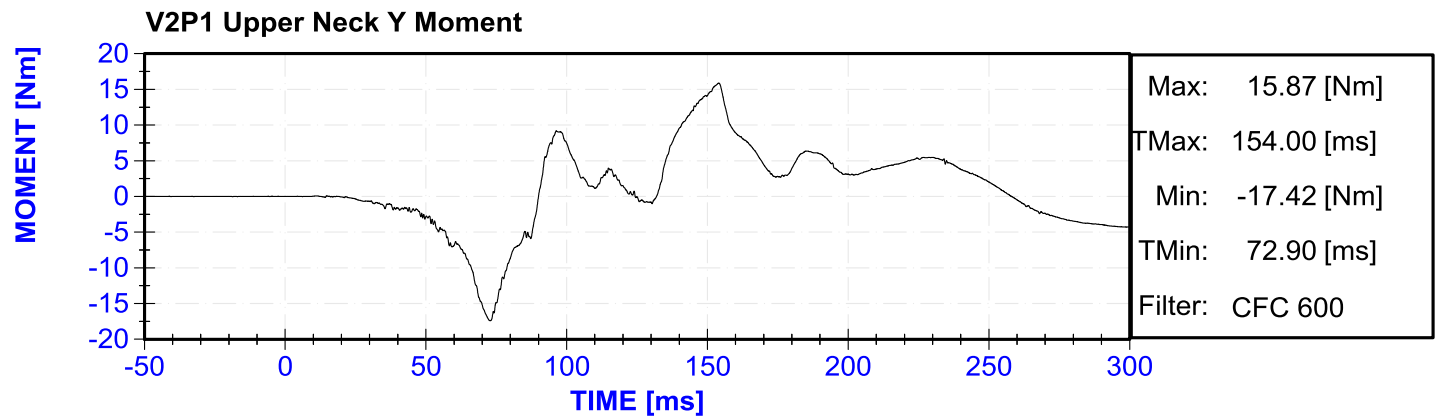
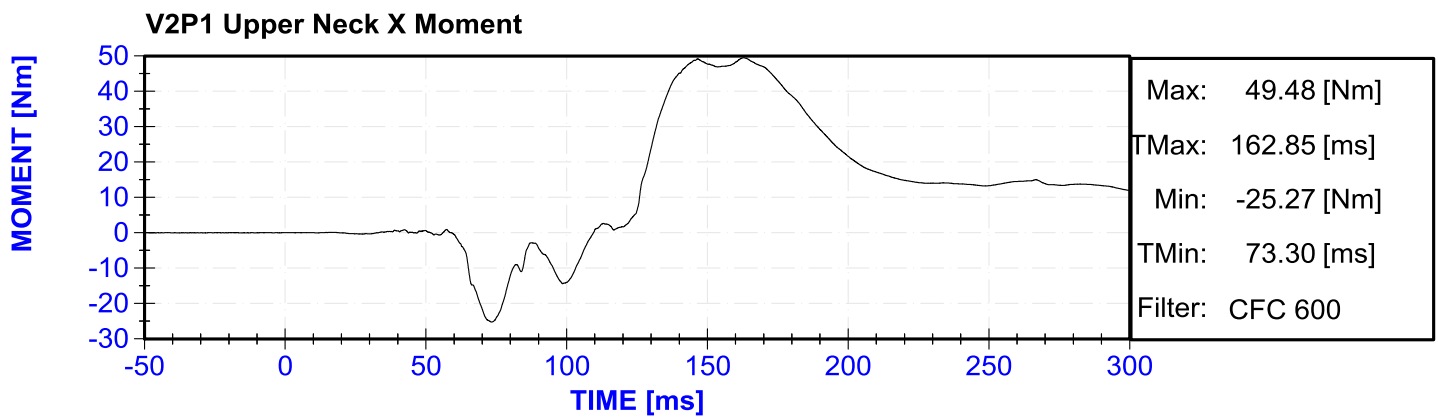
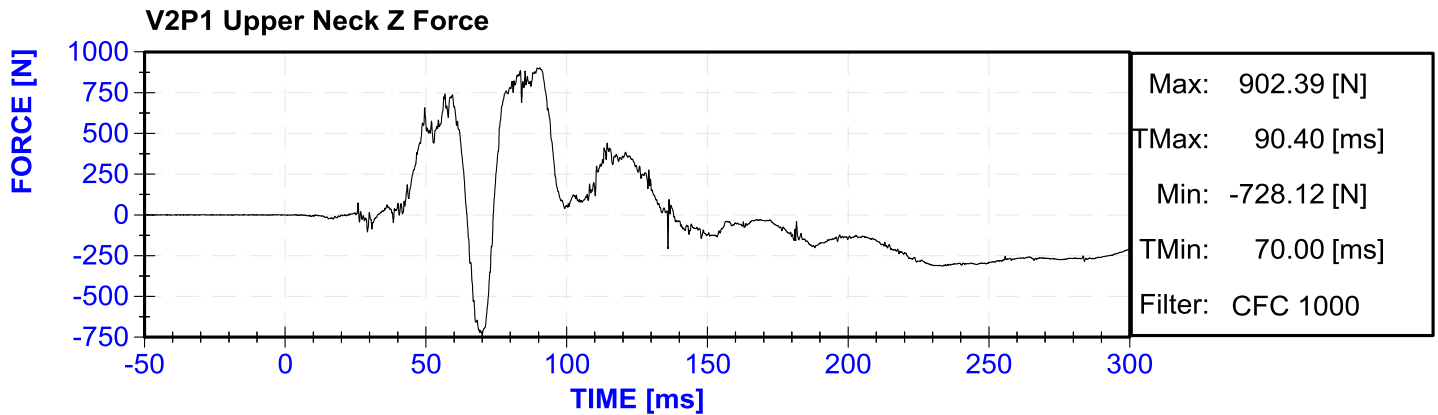
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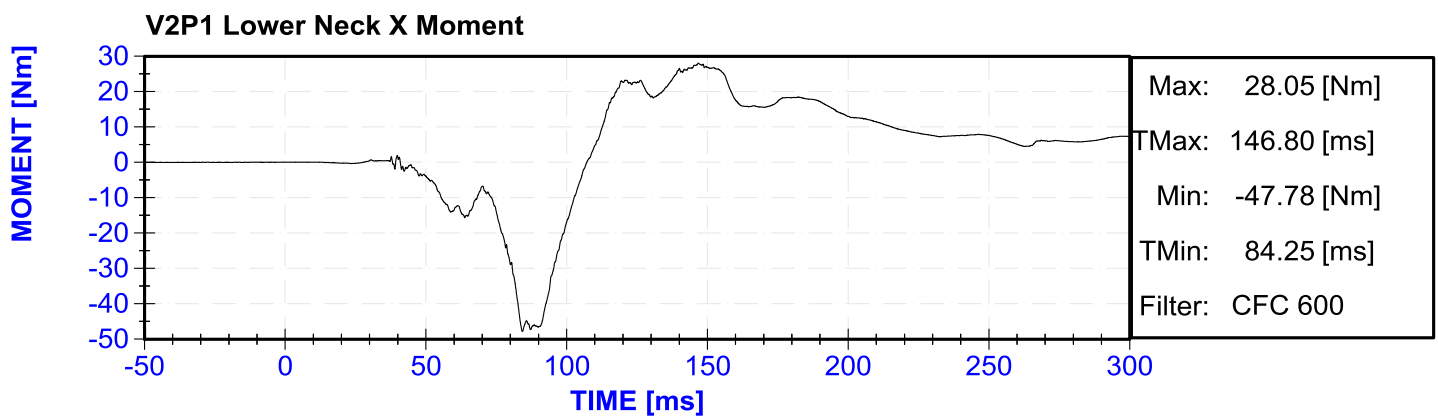
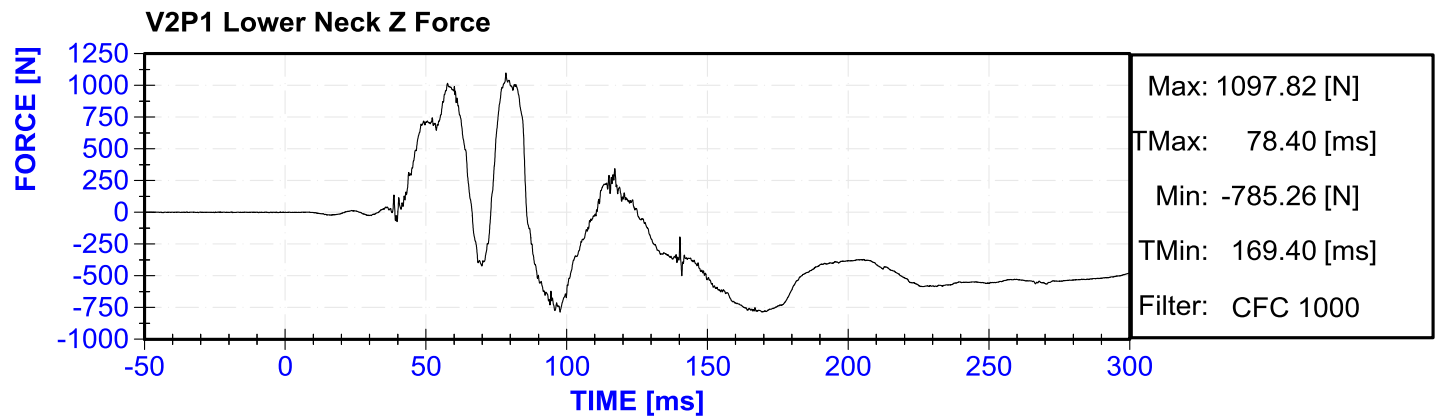
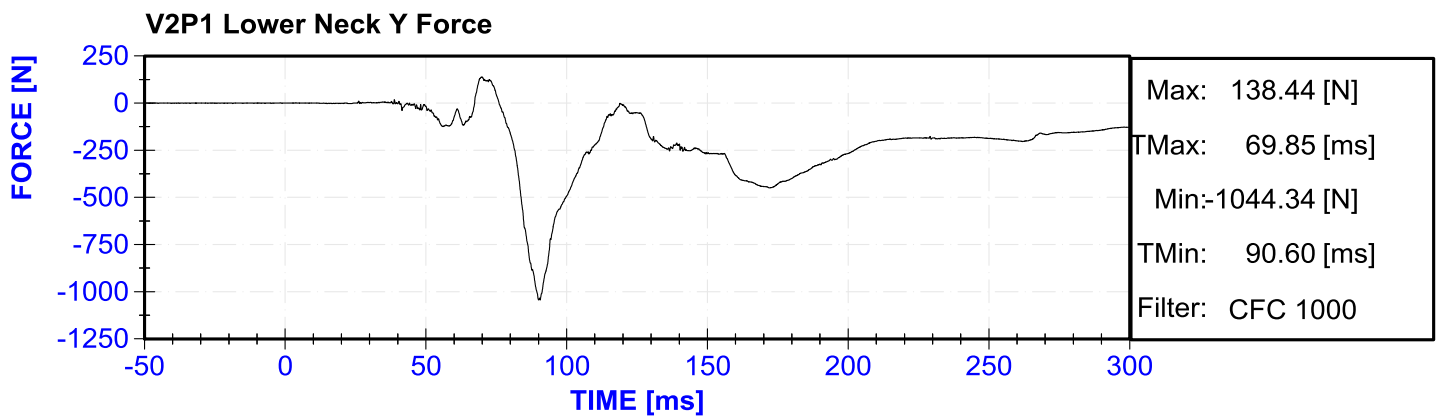
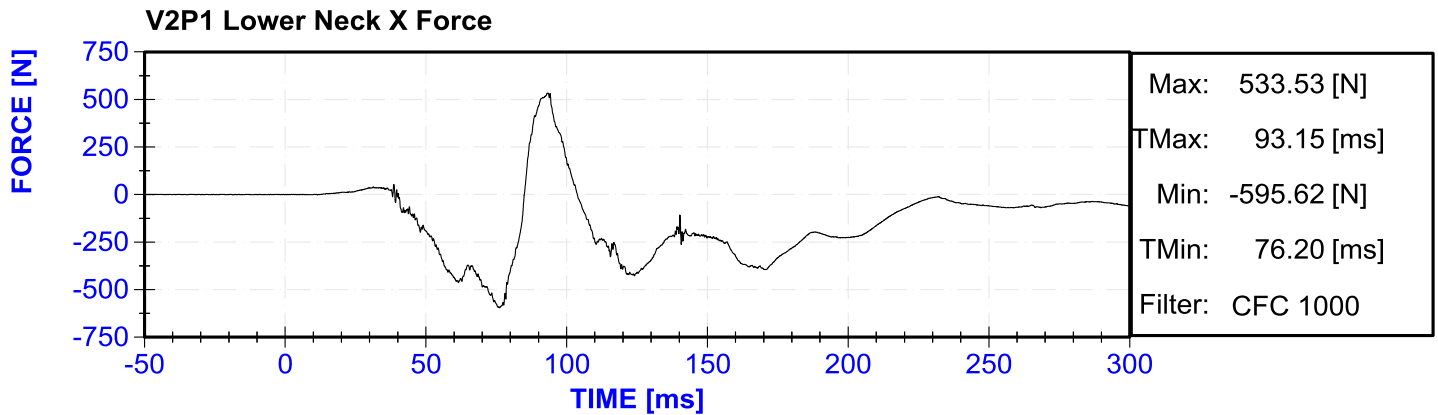
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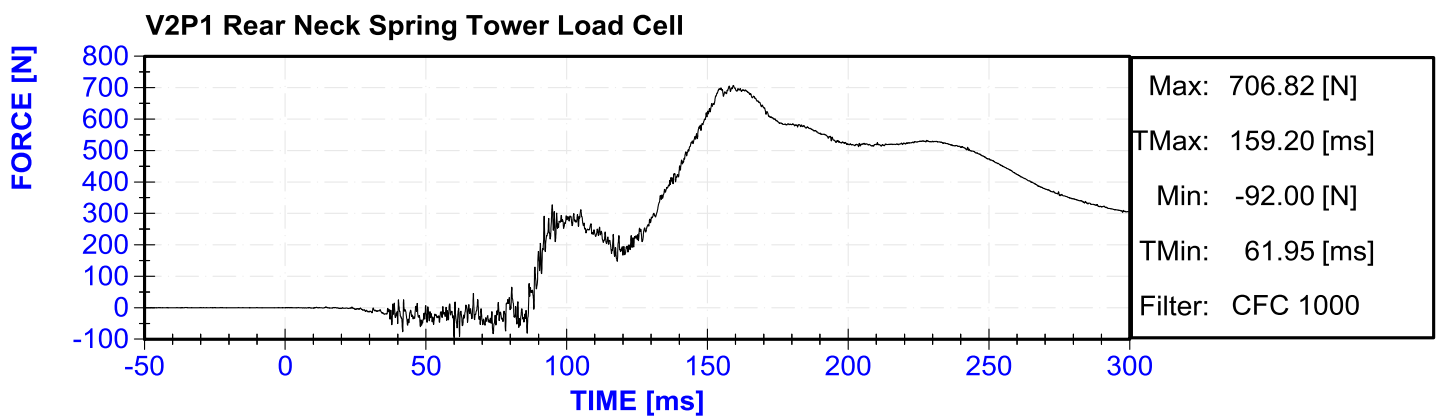
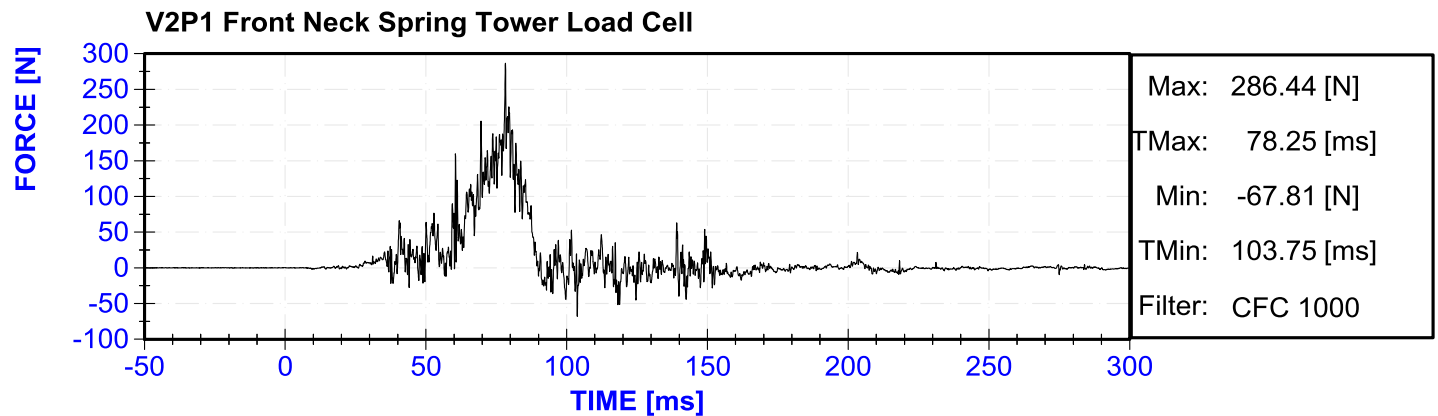
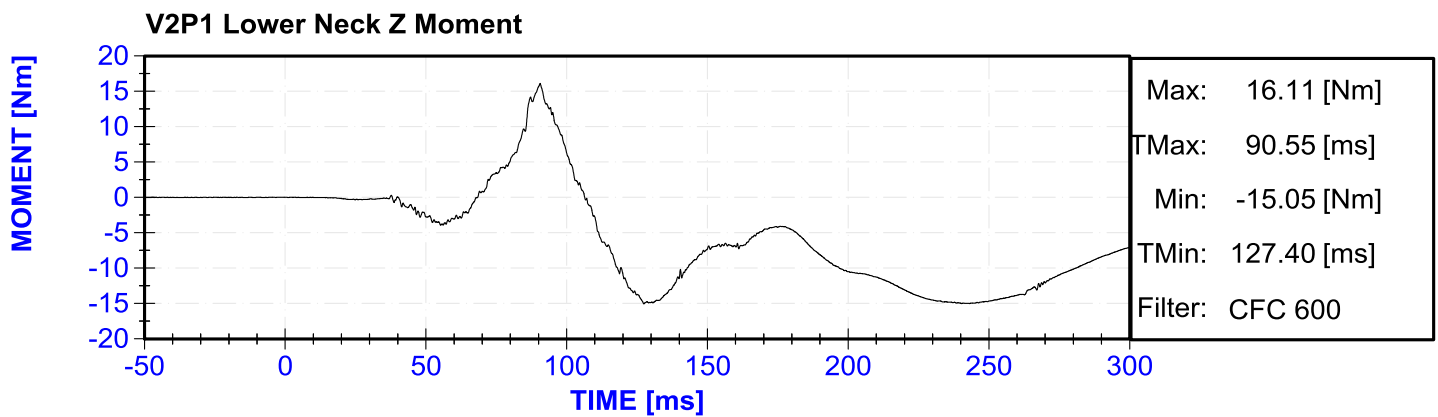
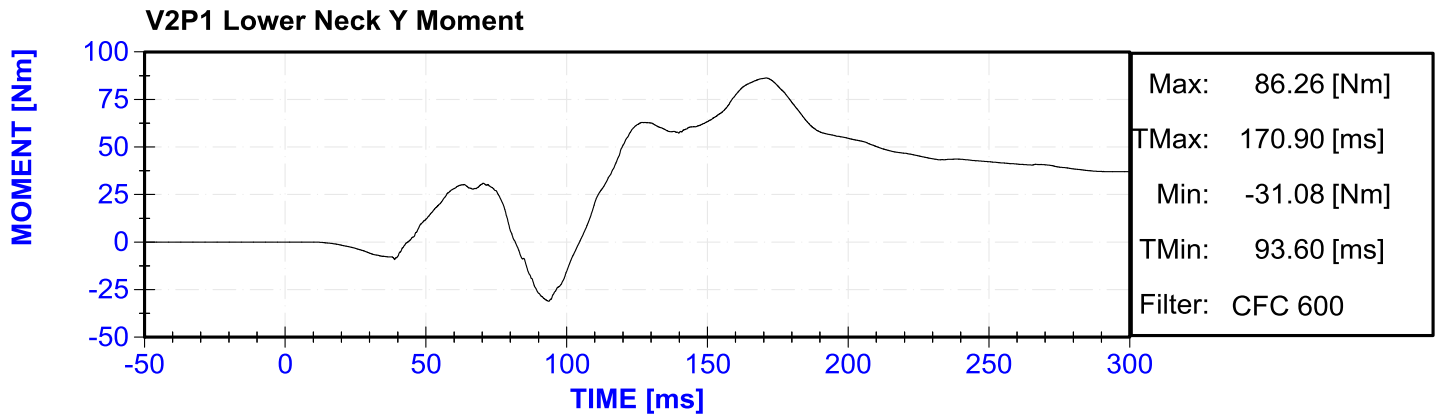
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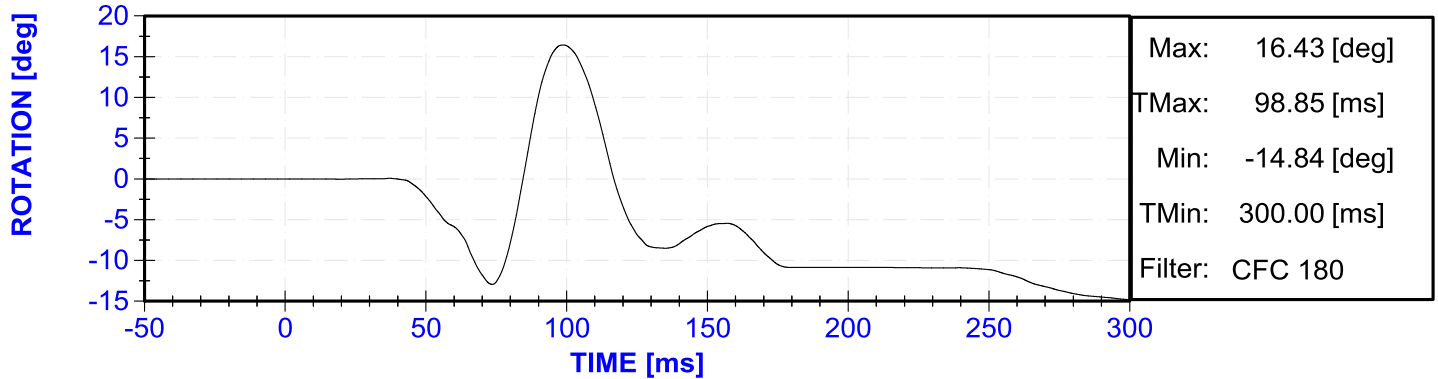




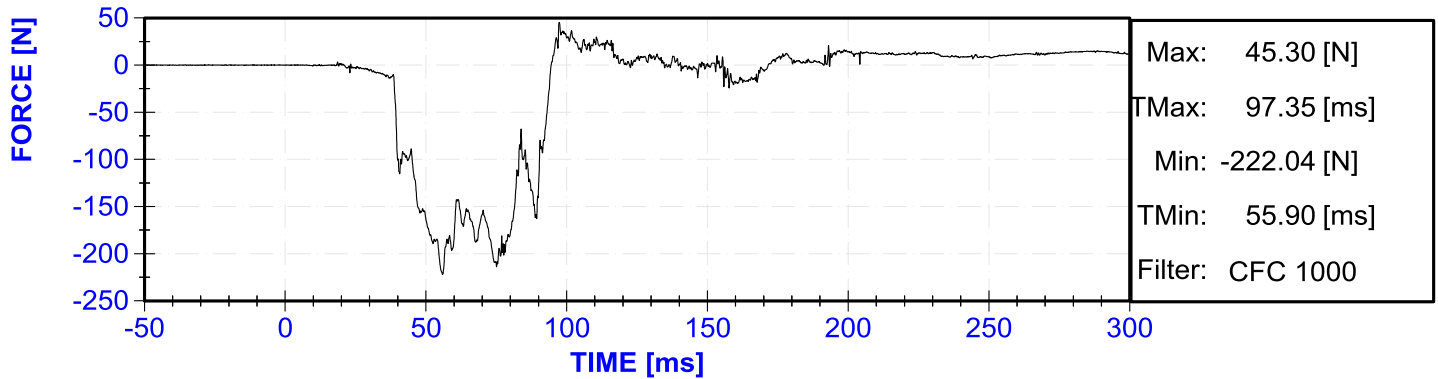




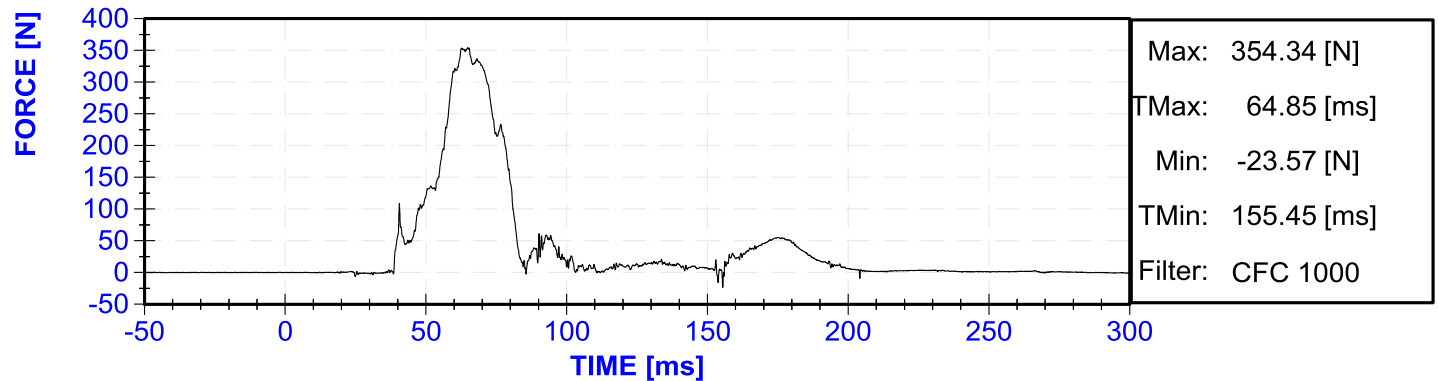
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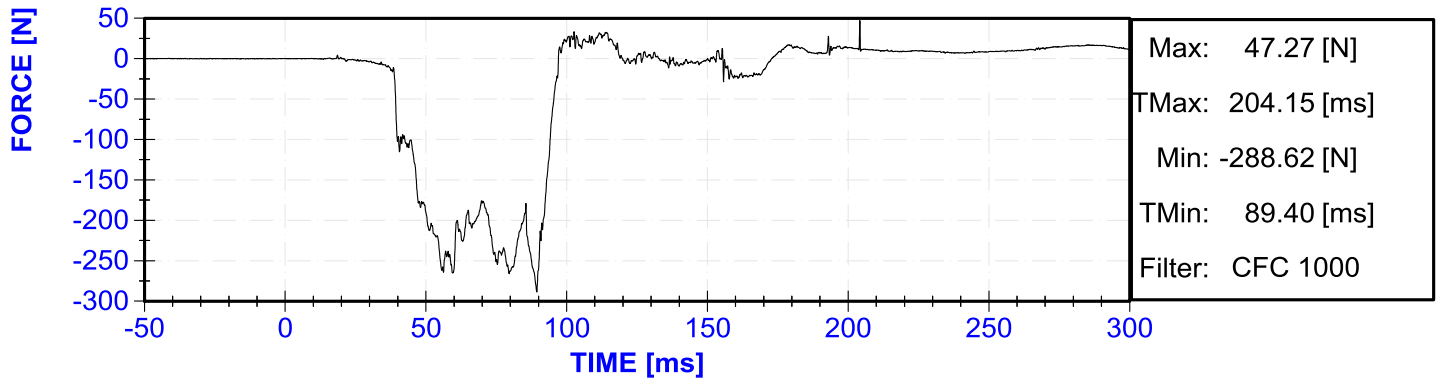
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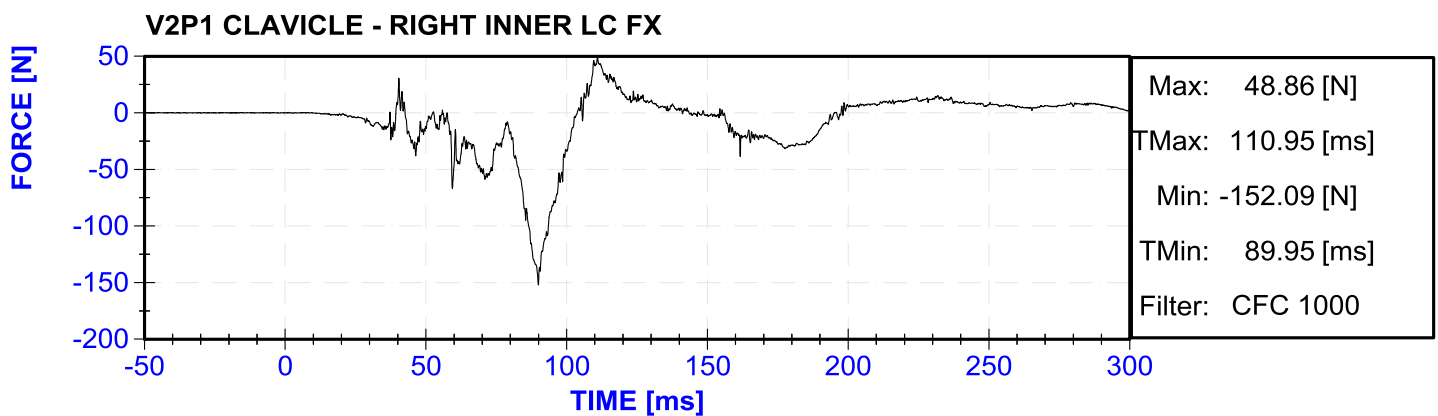
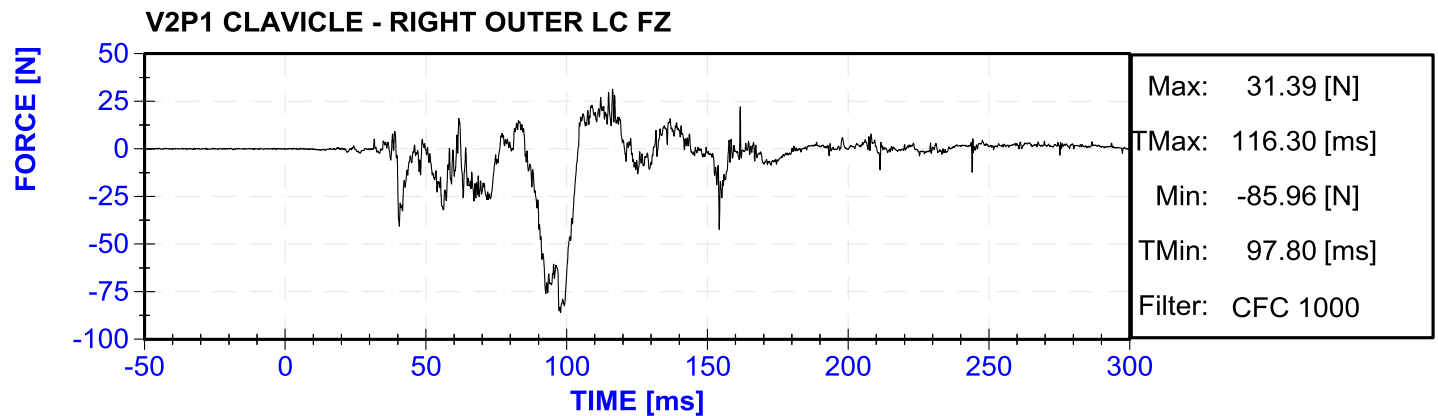
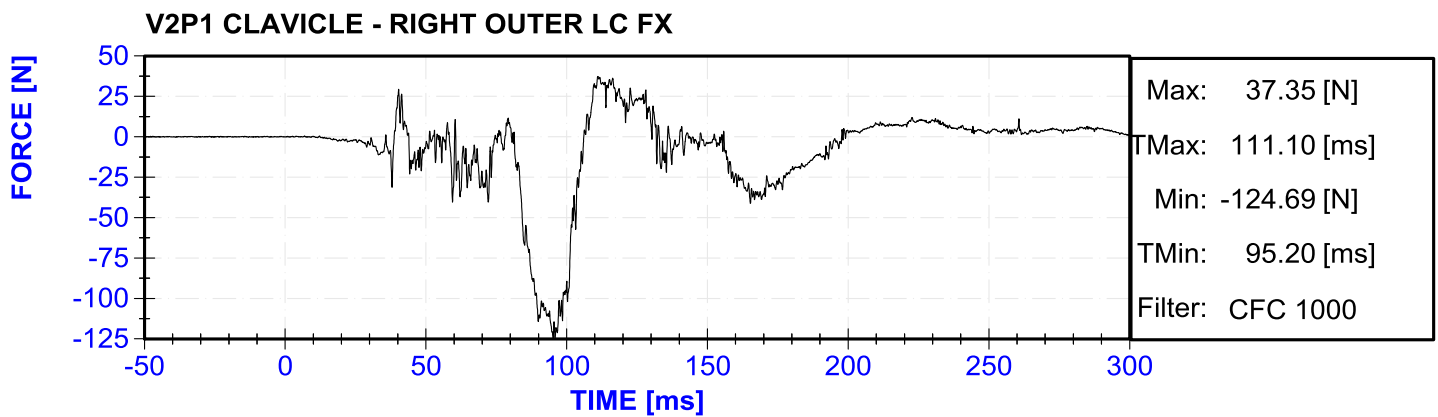
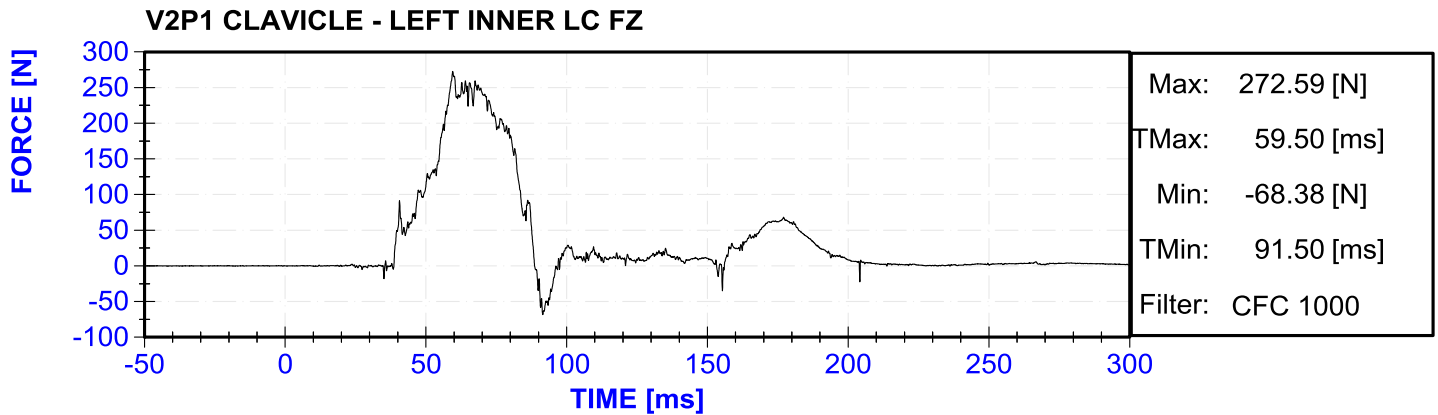


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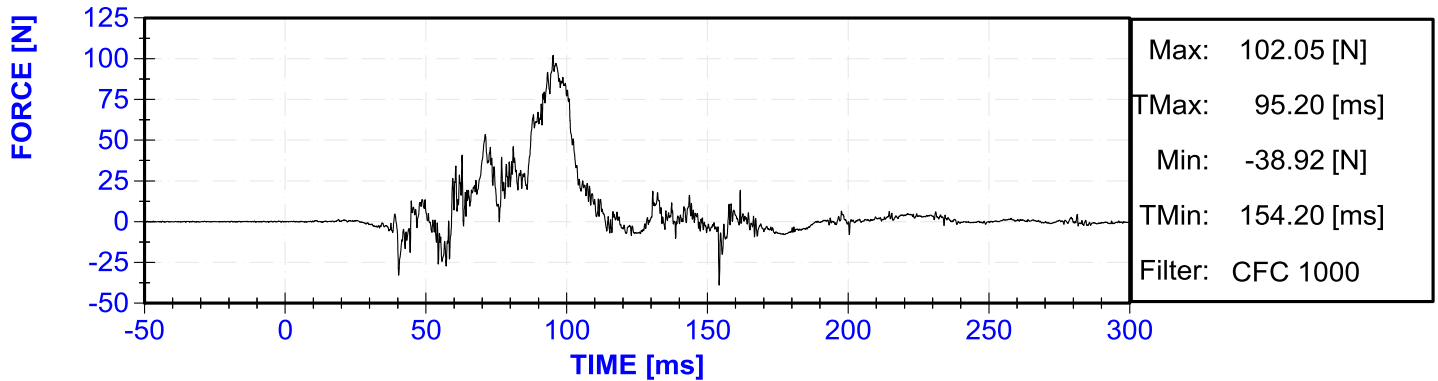


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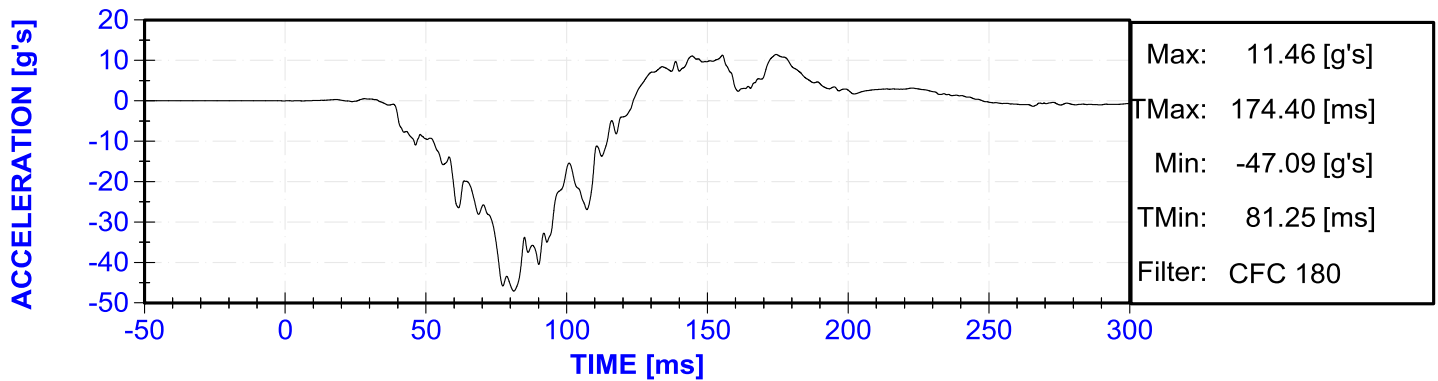




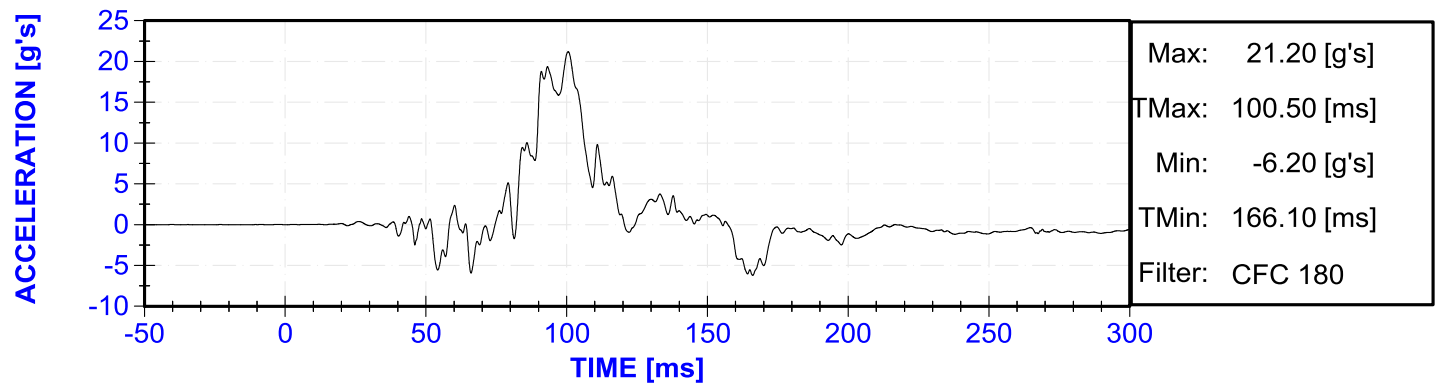
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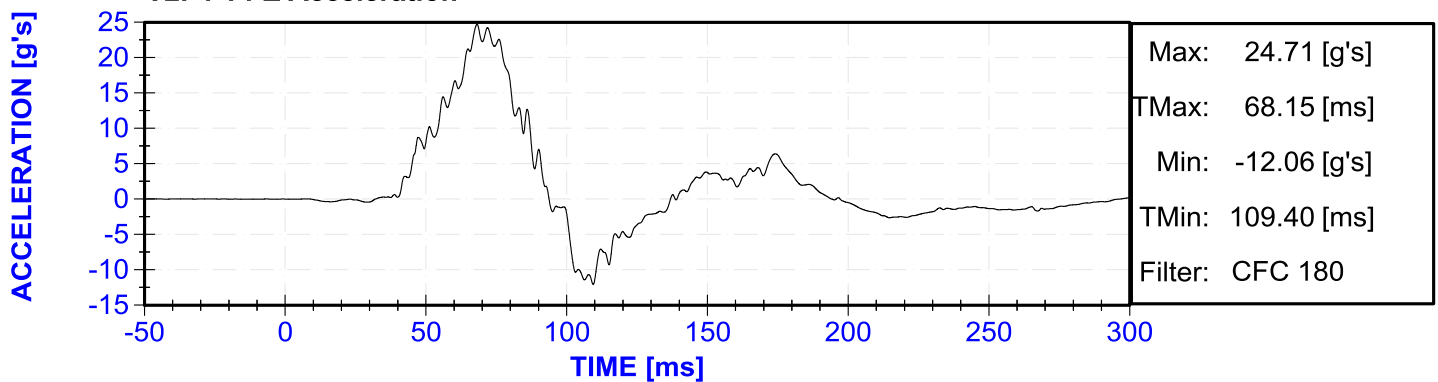
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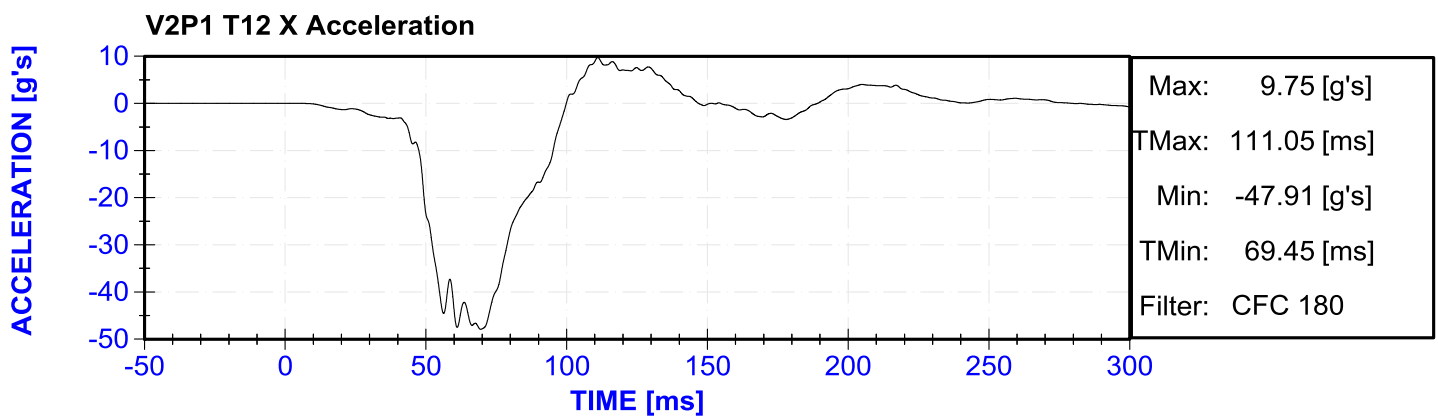
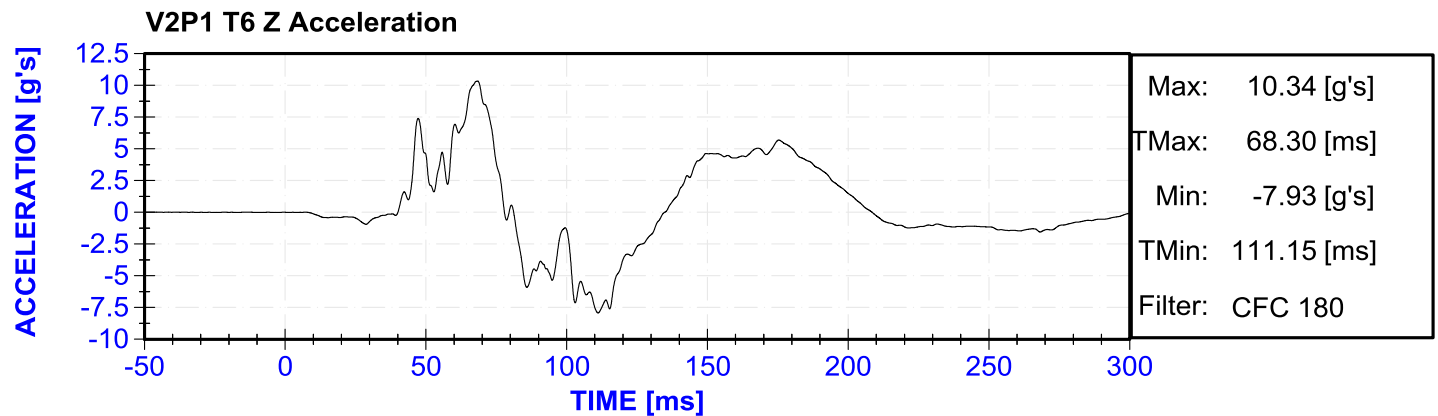
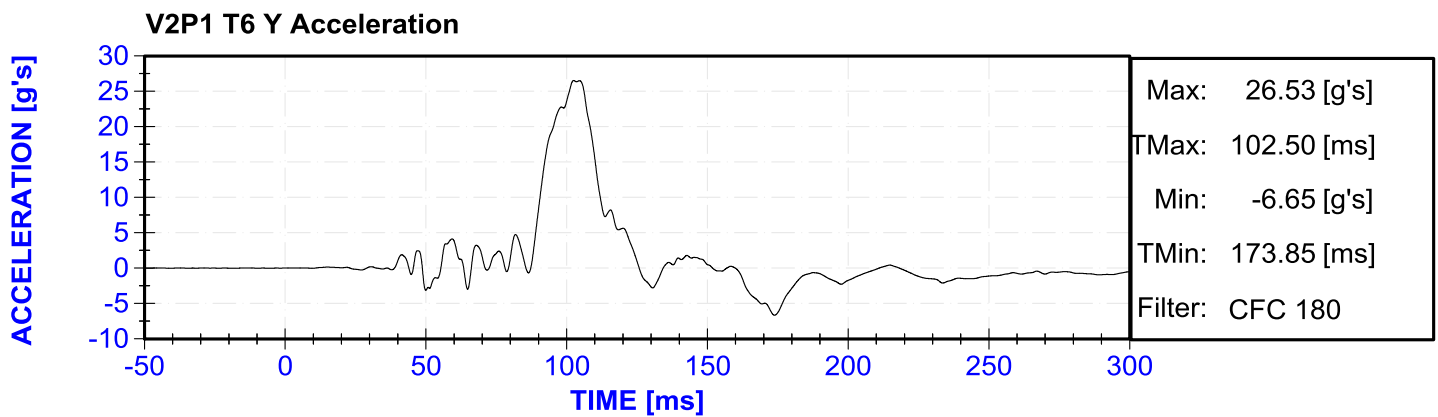
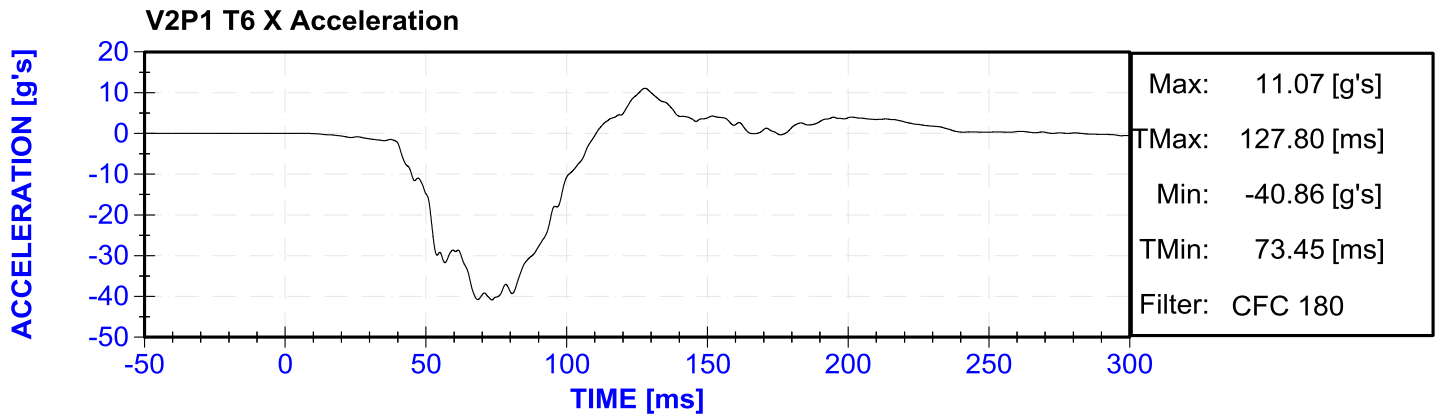


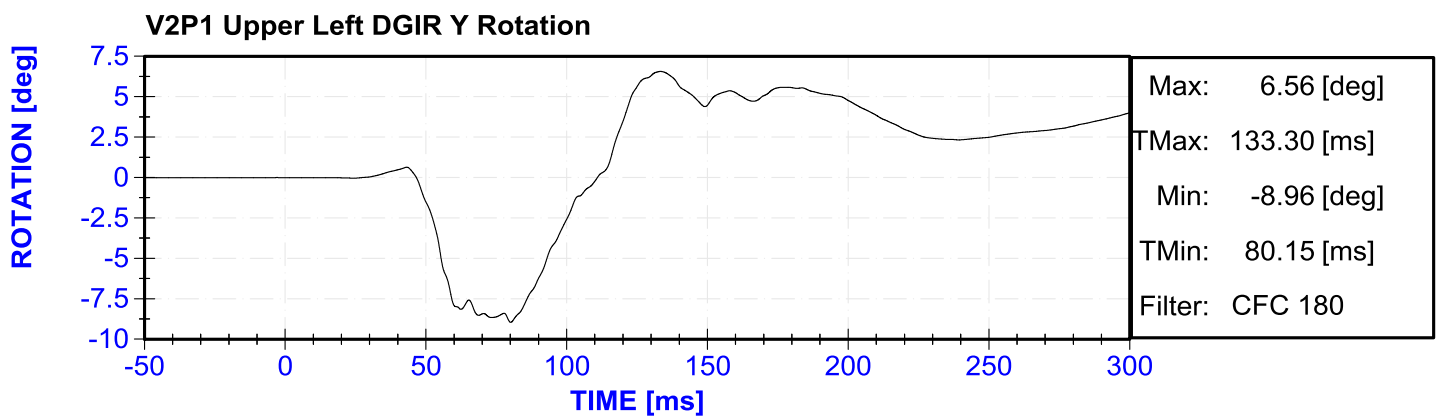
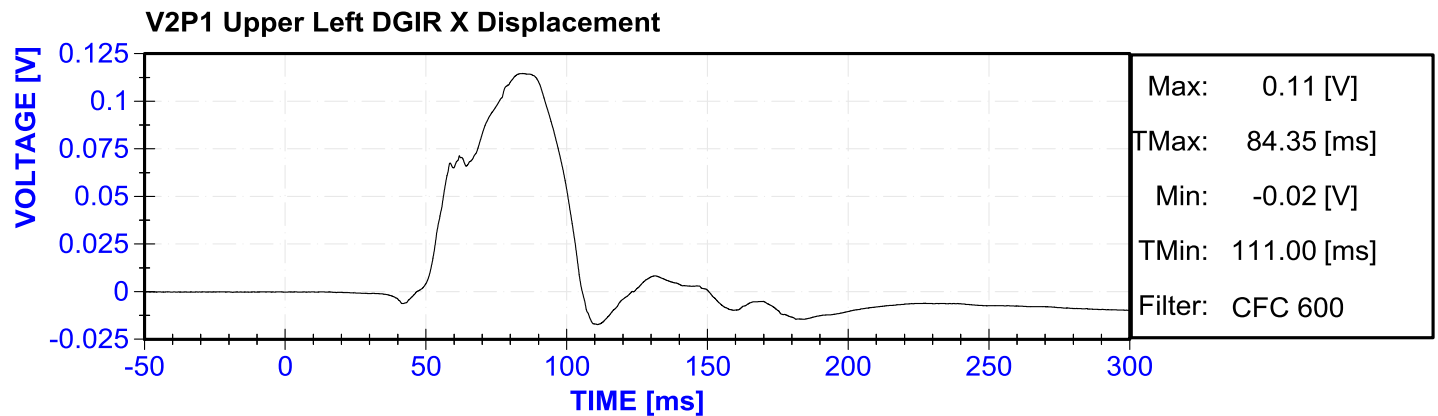
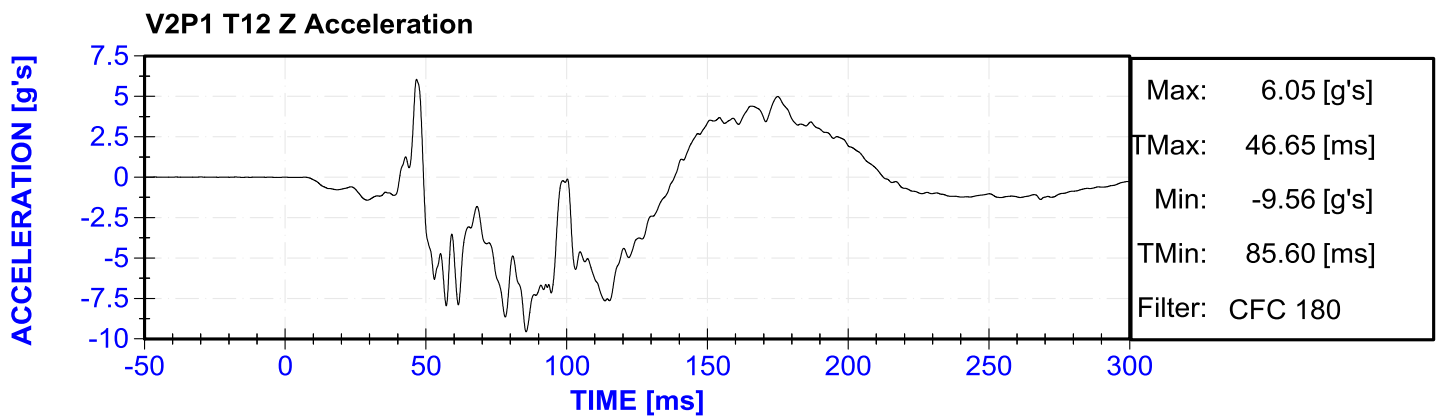
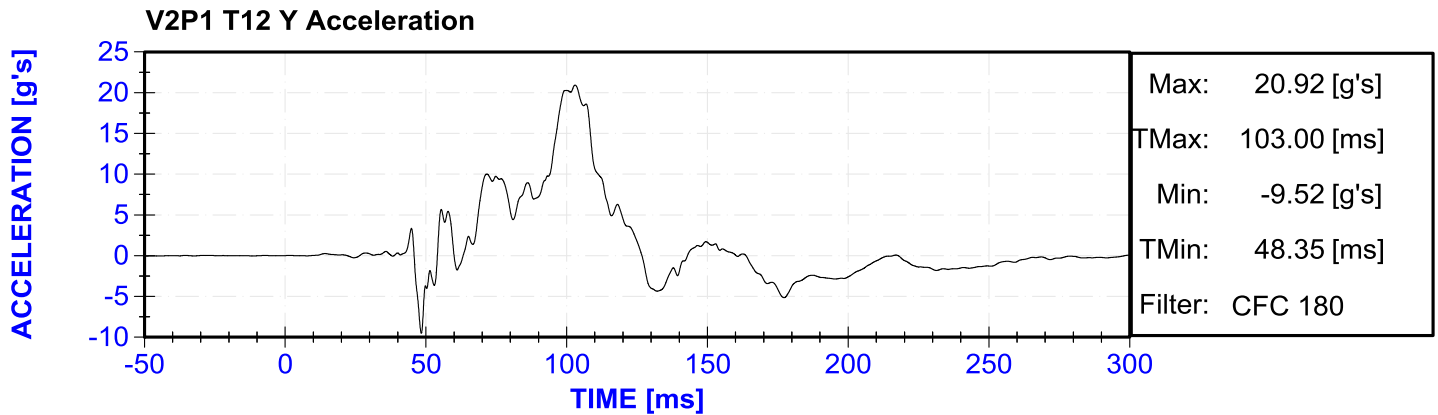
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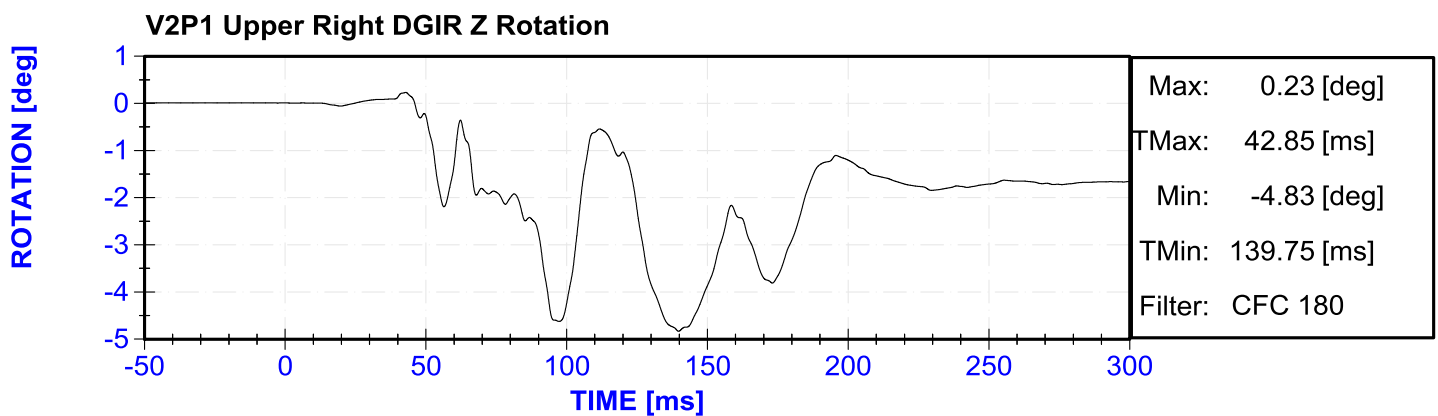
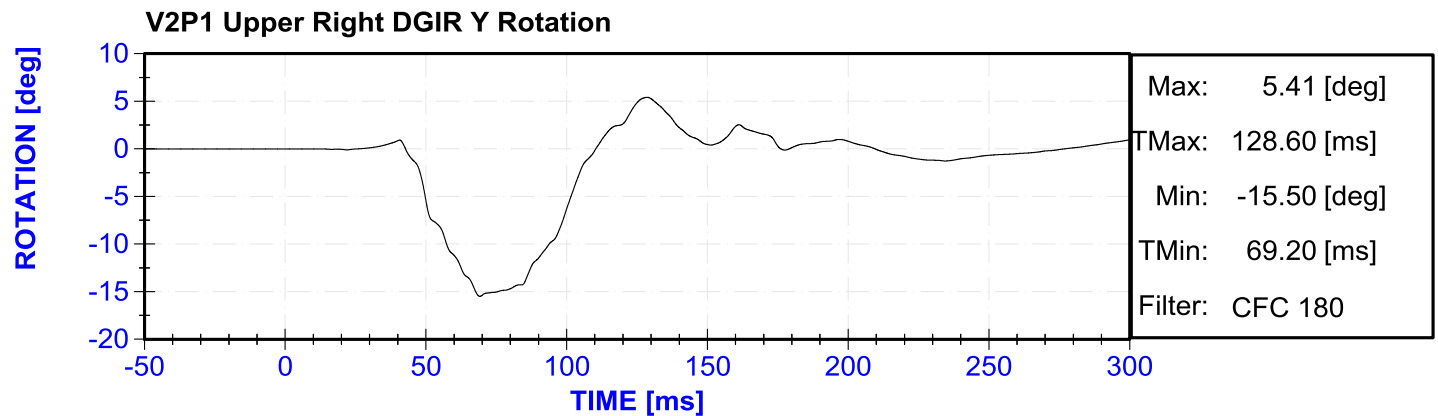
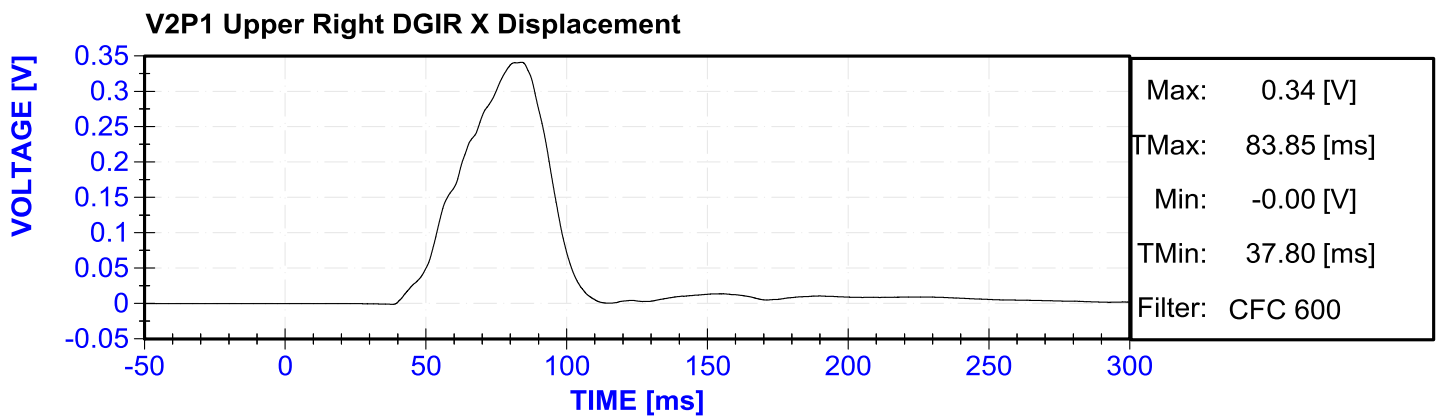
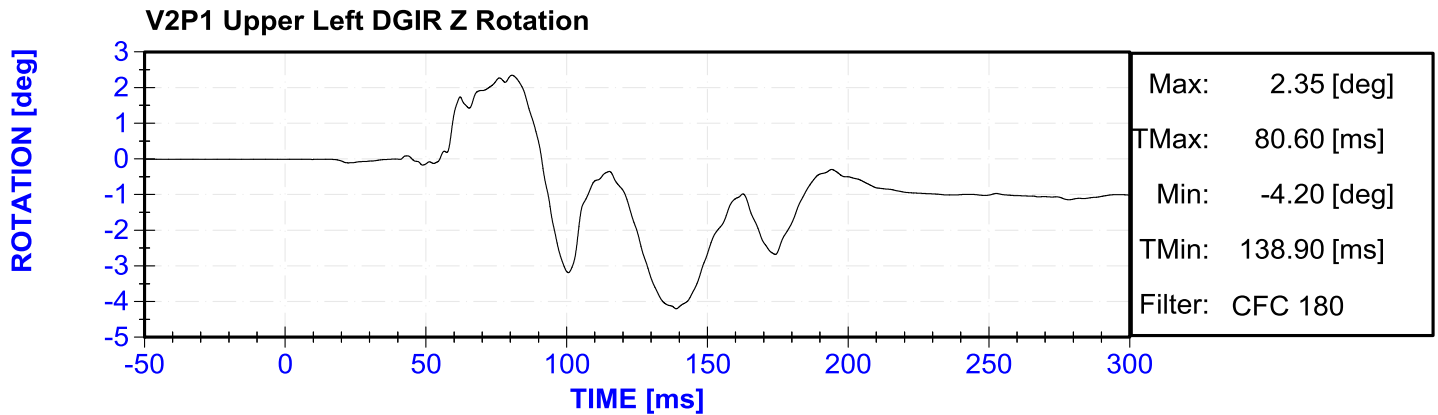


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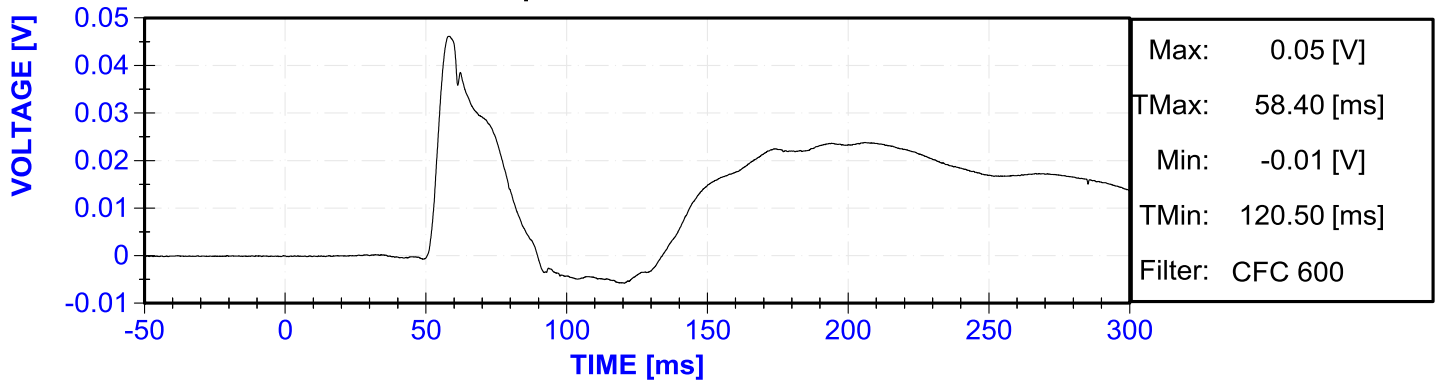




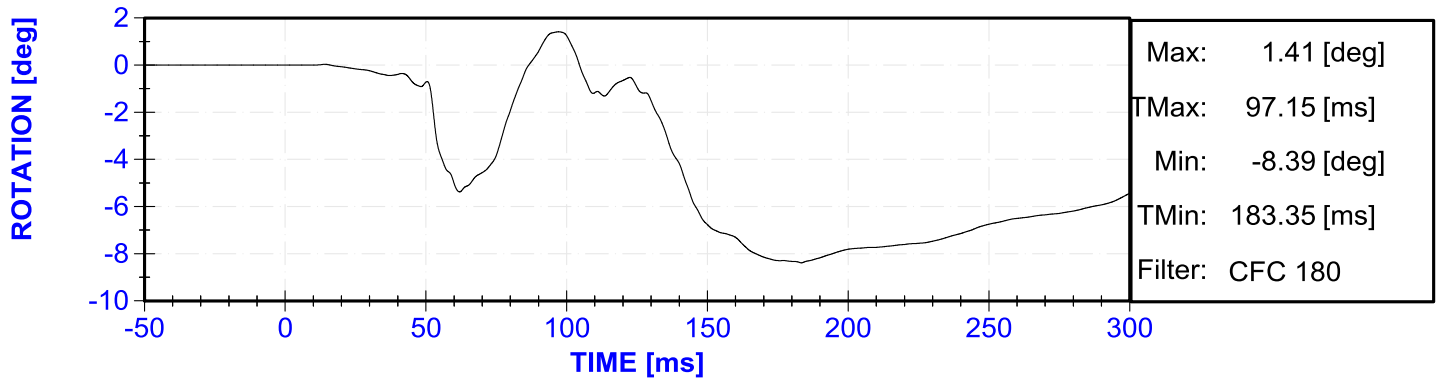




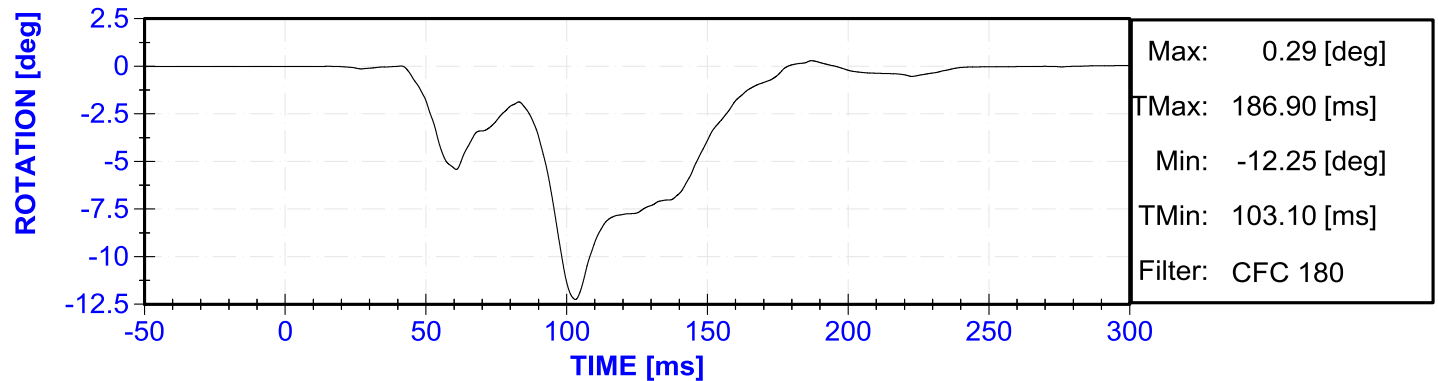
V2P1 Lower Left DGIR X Displacement



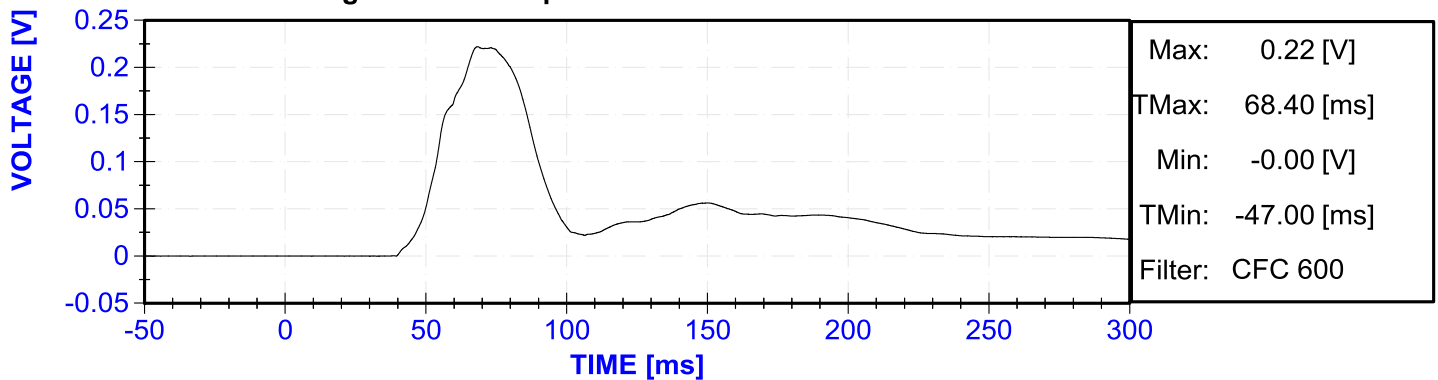
V2P1 Lower Left DGIR Y Rotation

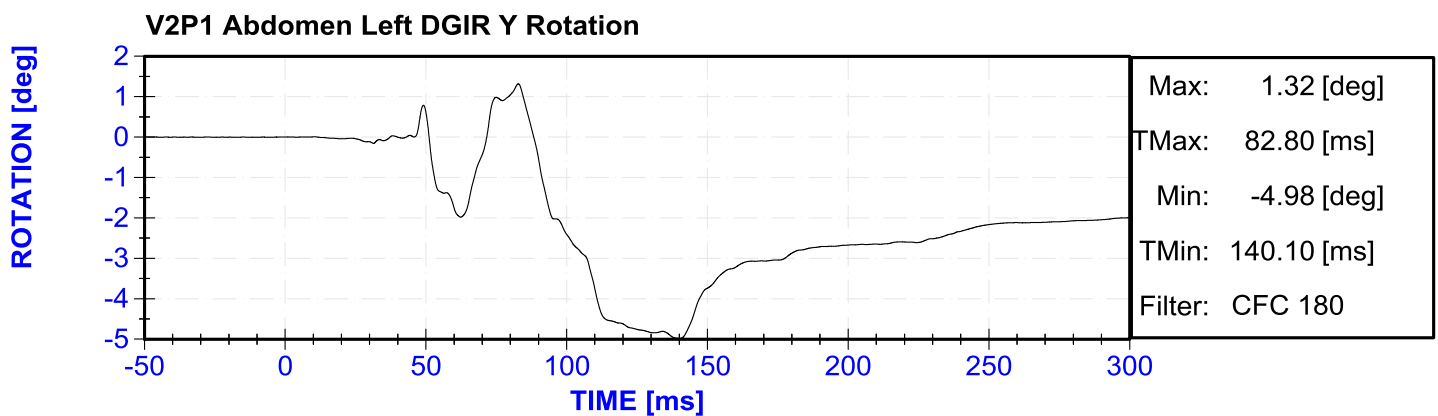
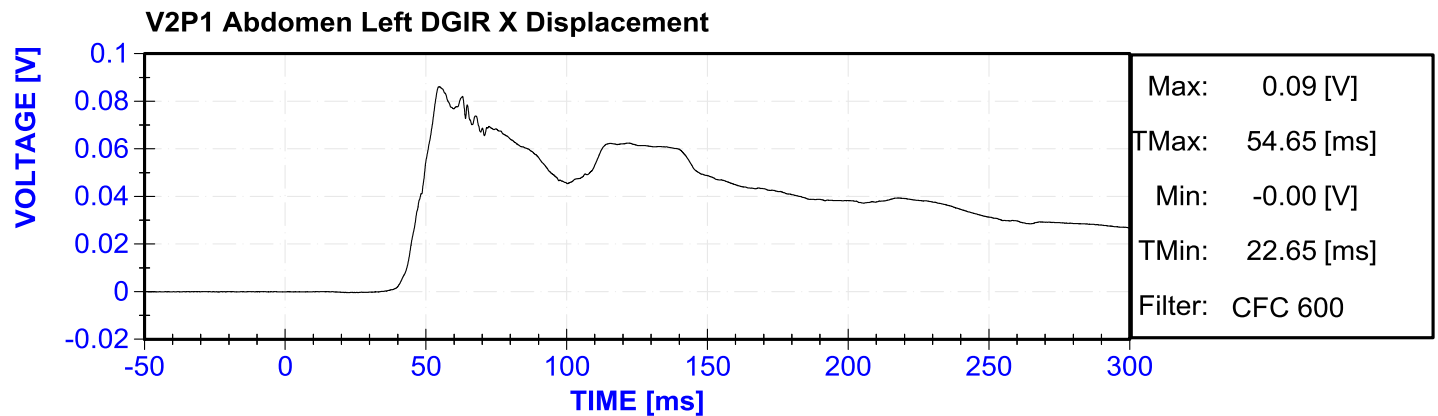
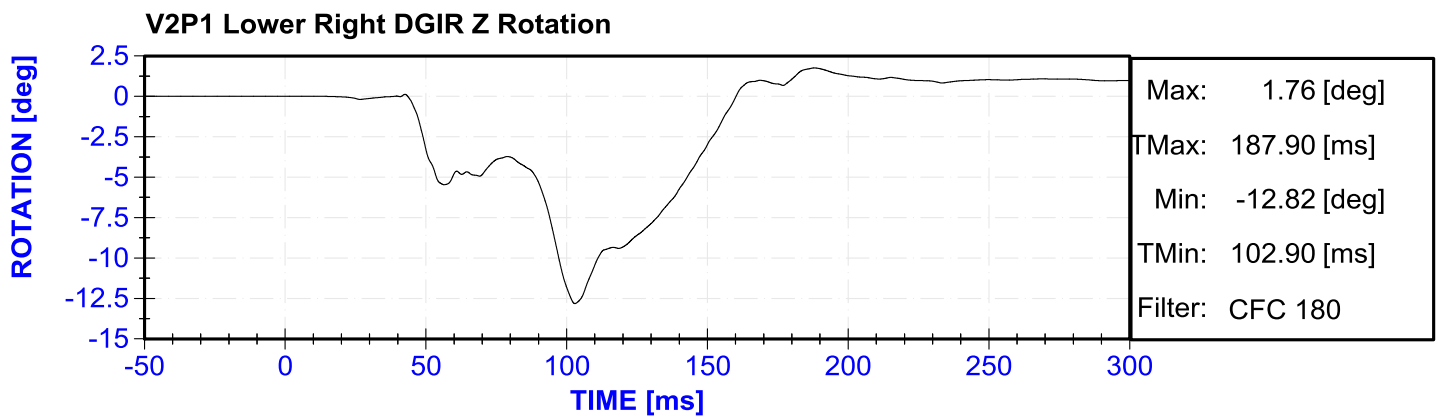
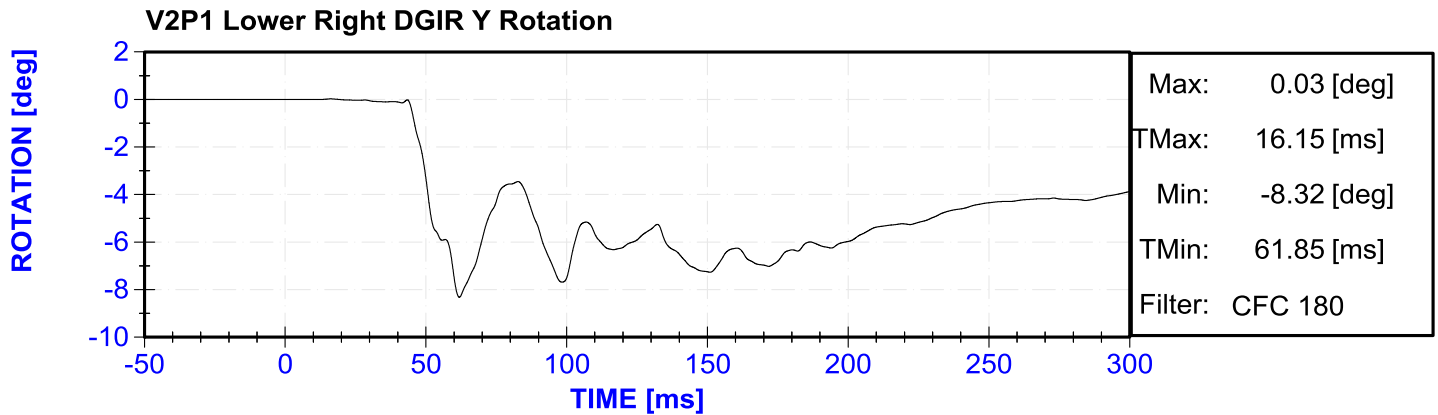


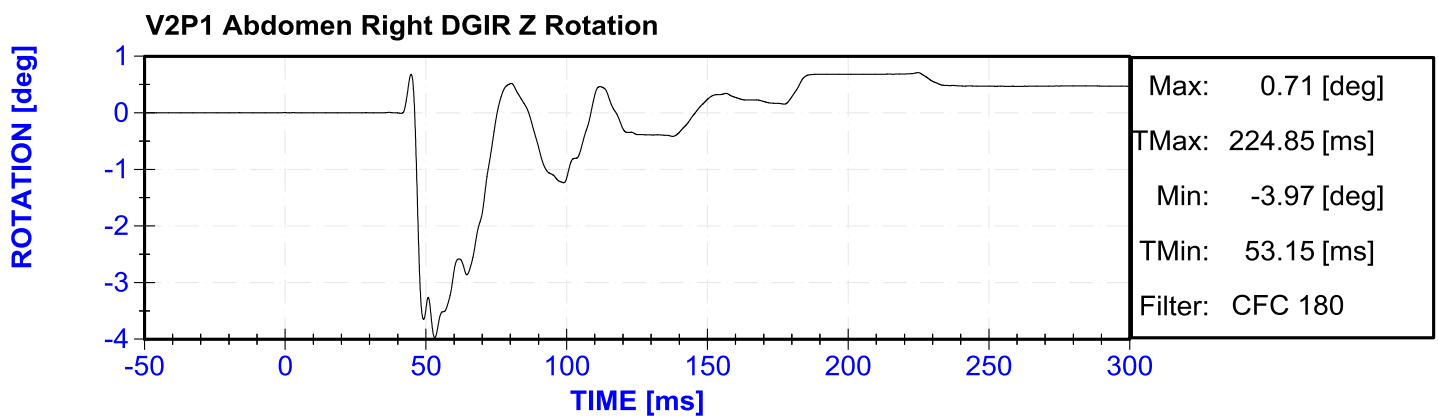
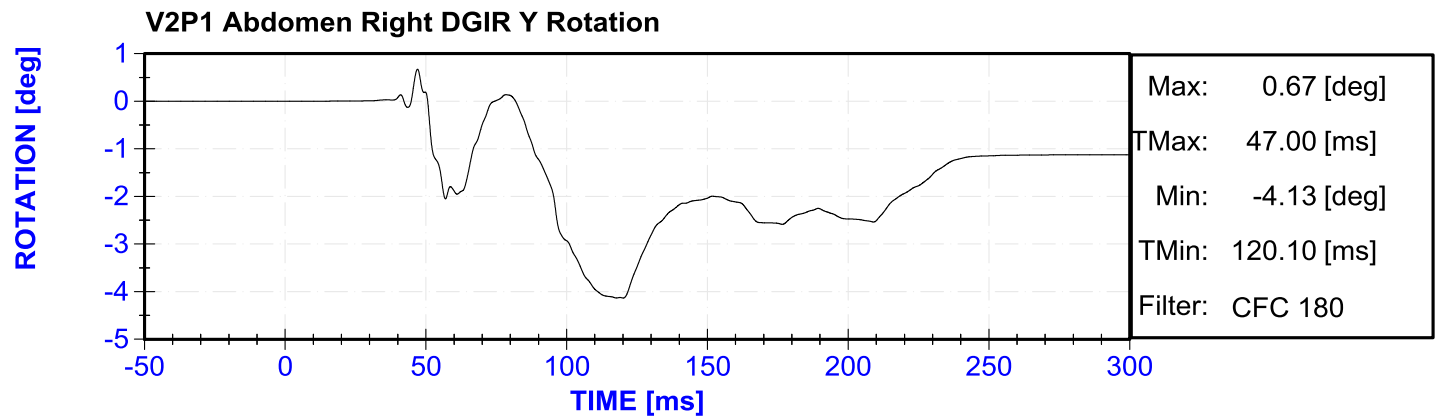
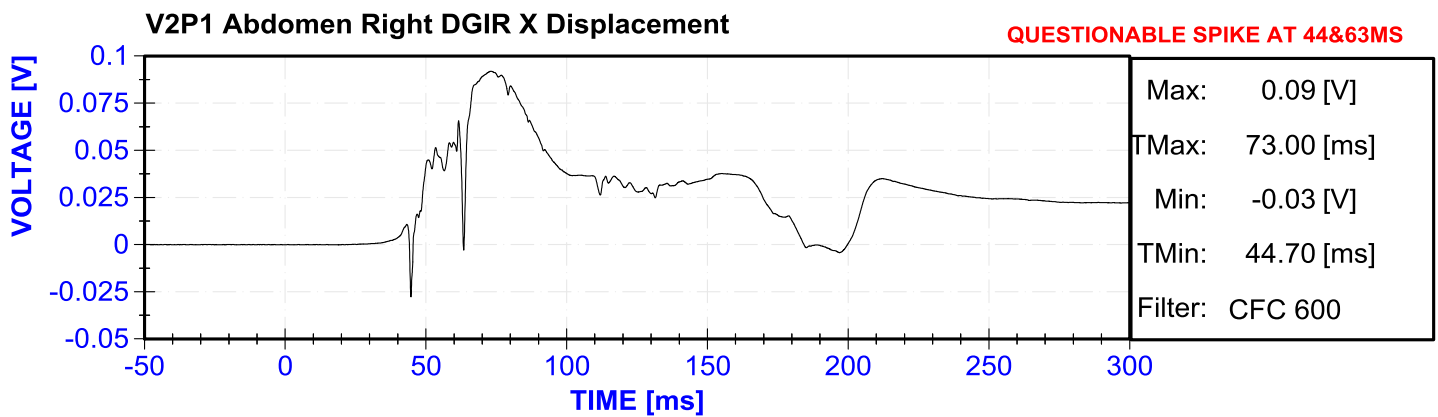
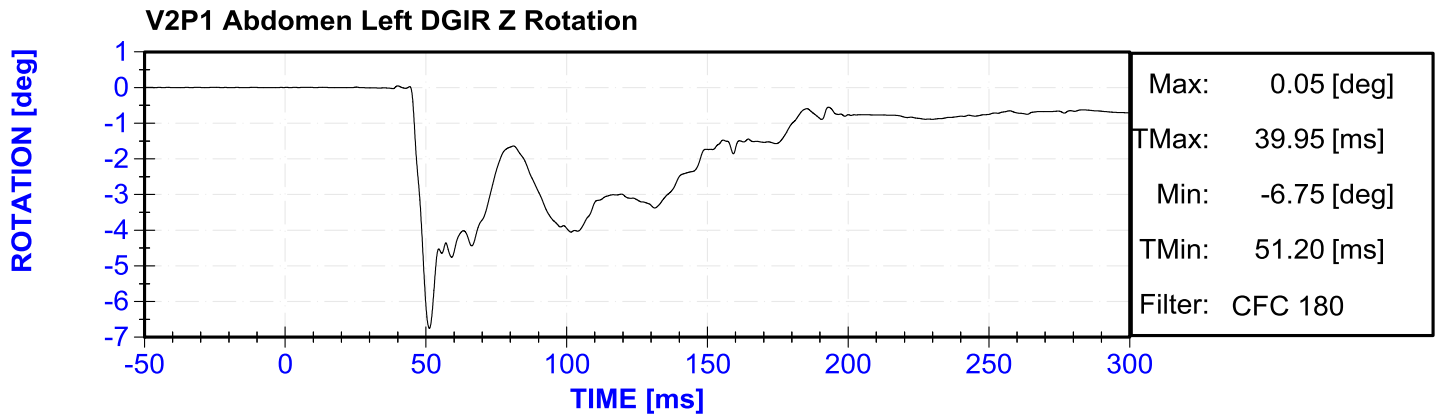
V2P1 Lower Left DGIR Z Rotation

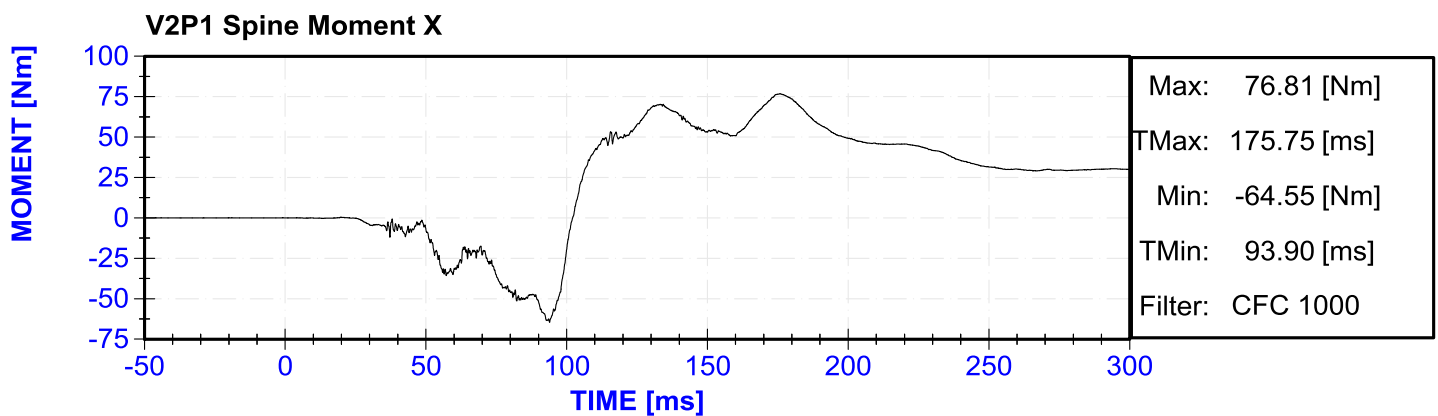
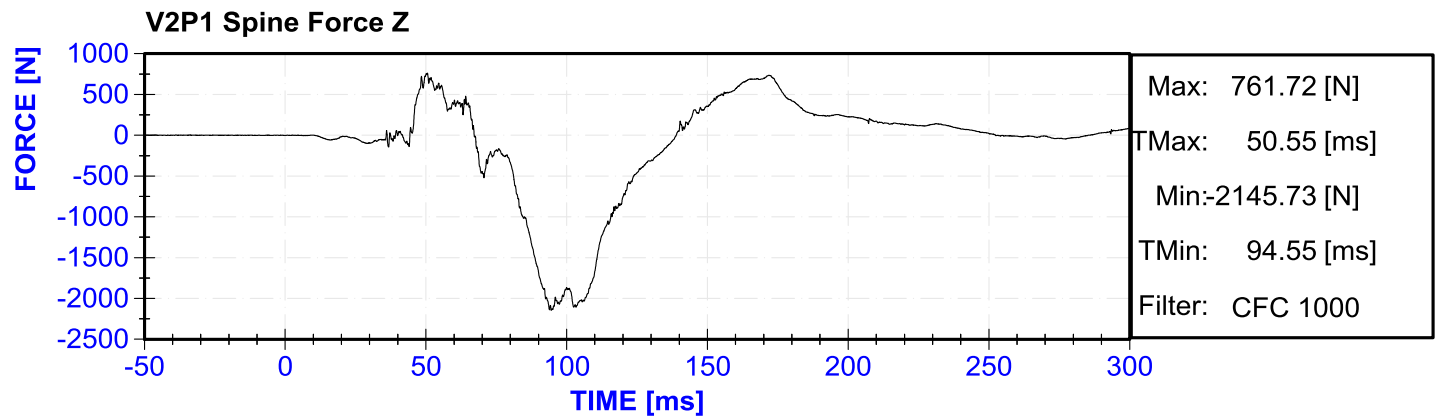
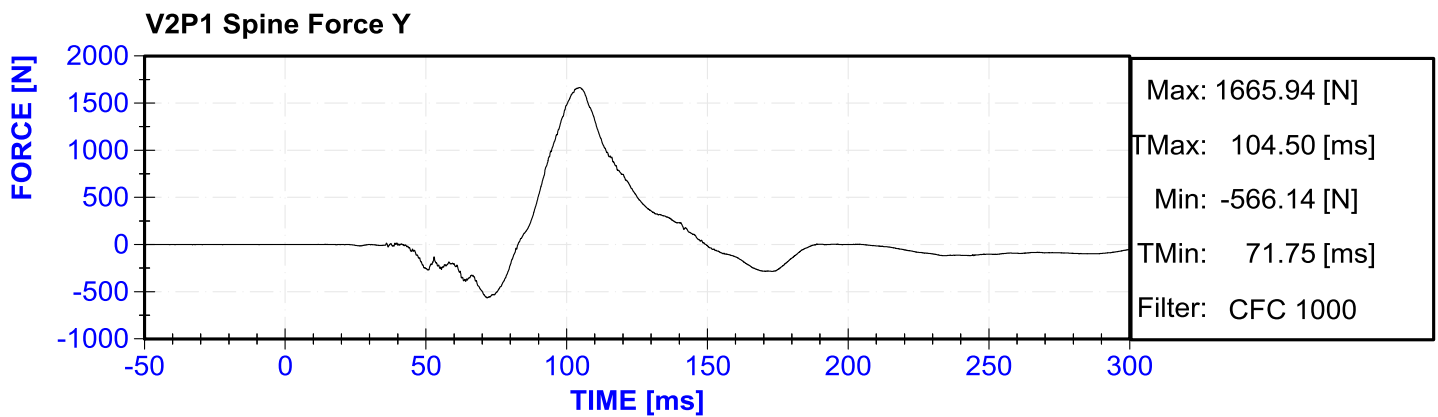
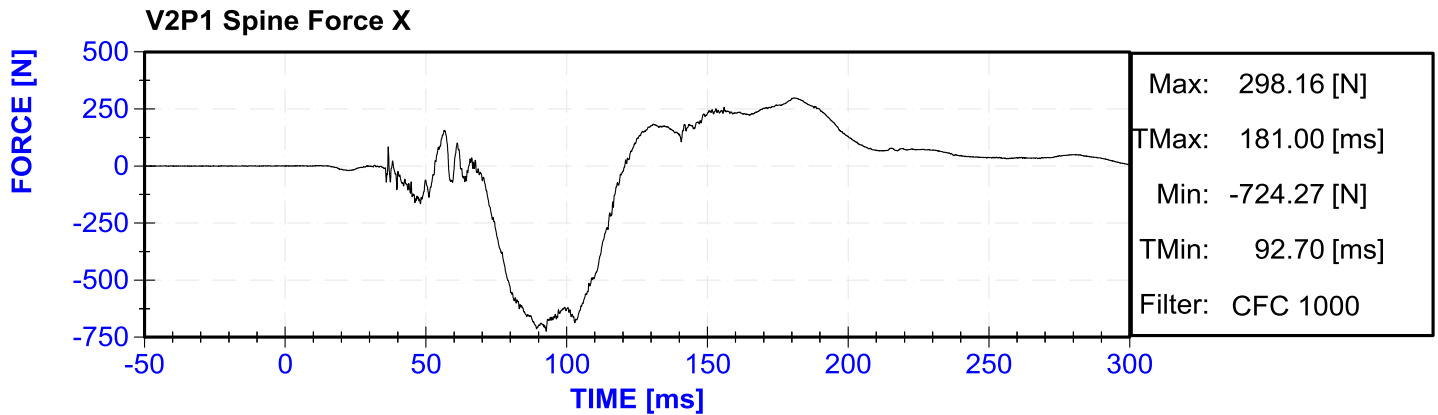


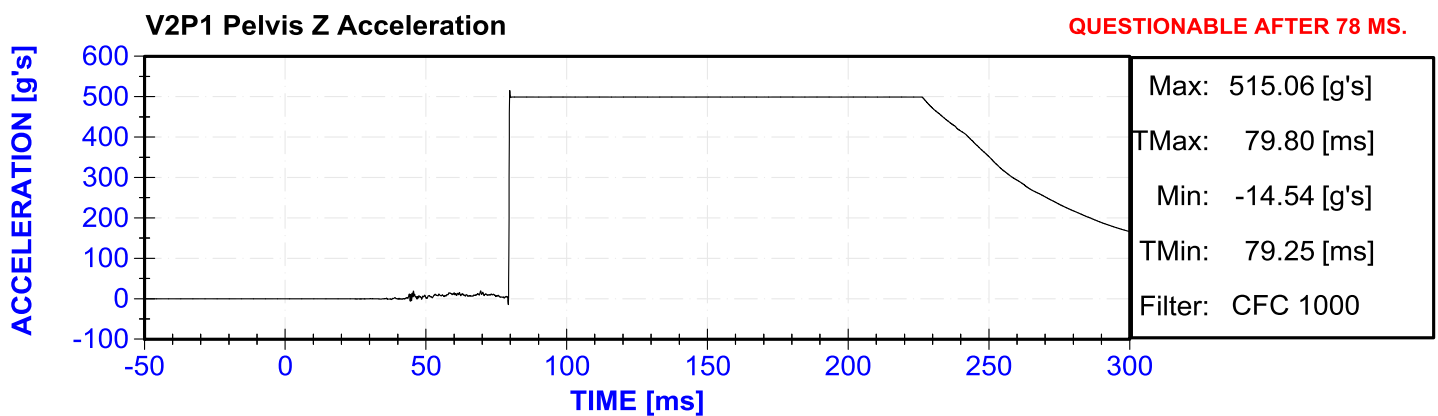
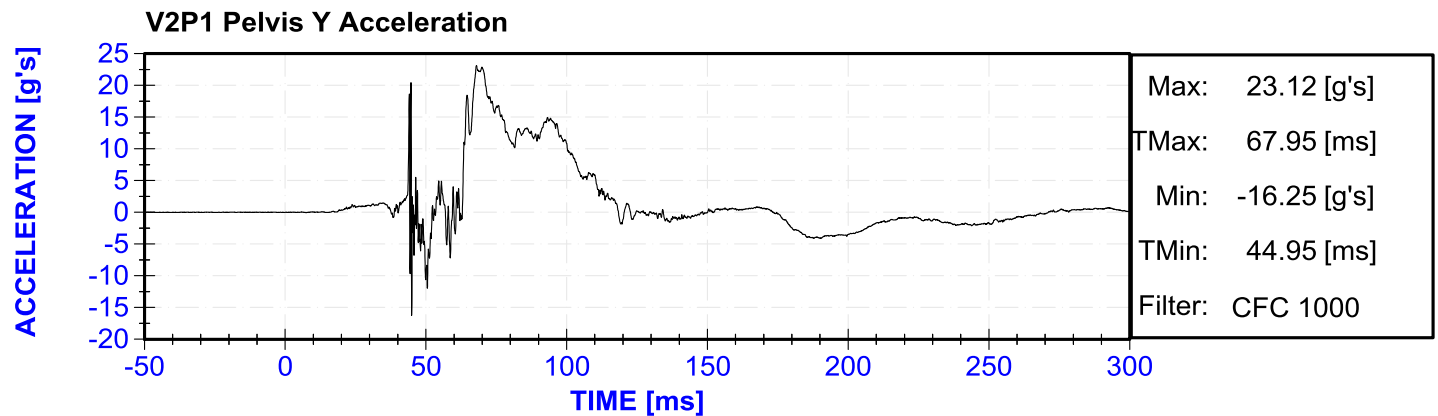
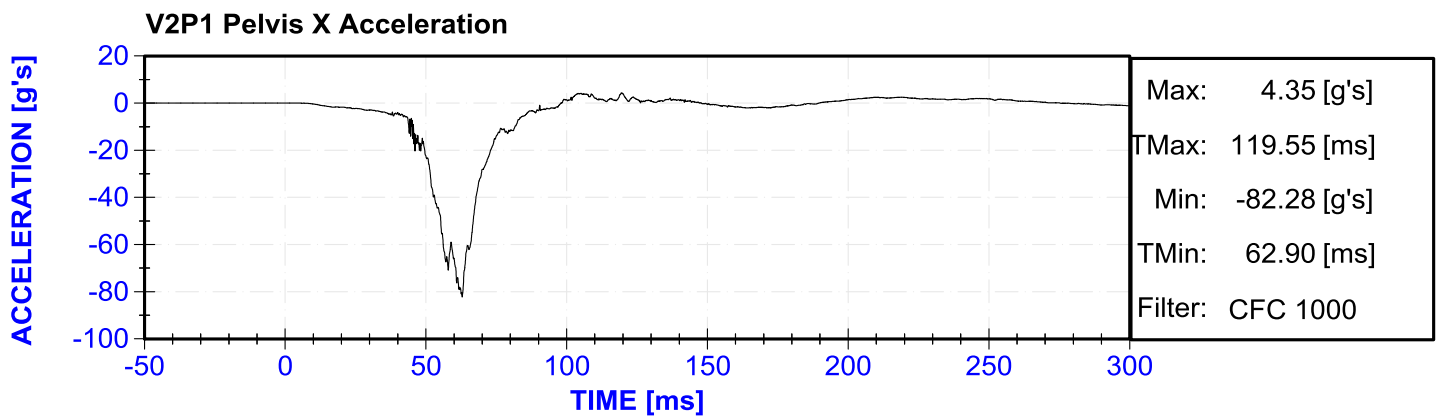
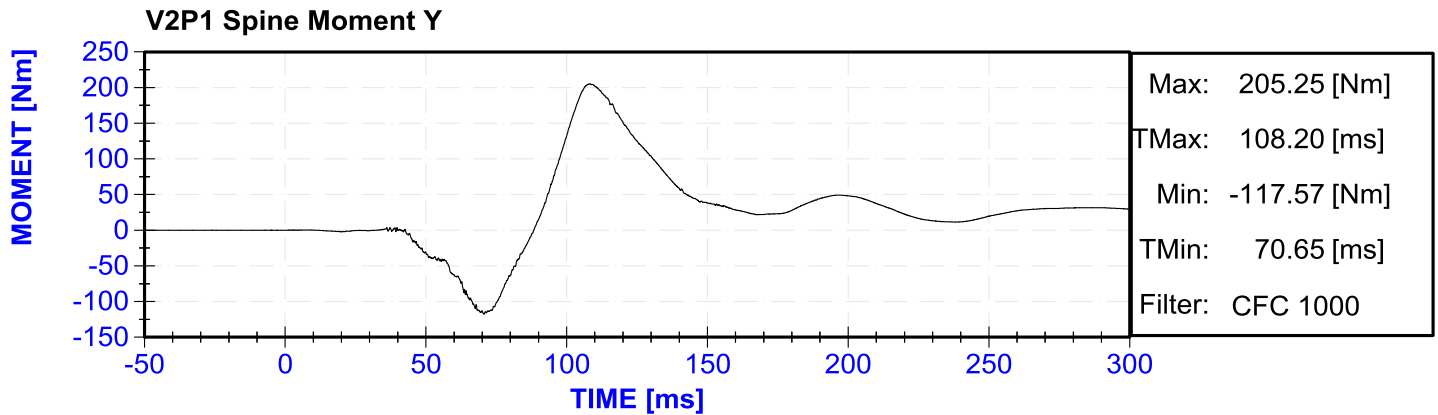
V2P1 Lower Right DGIR X Displacement

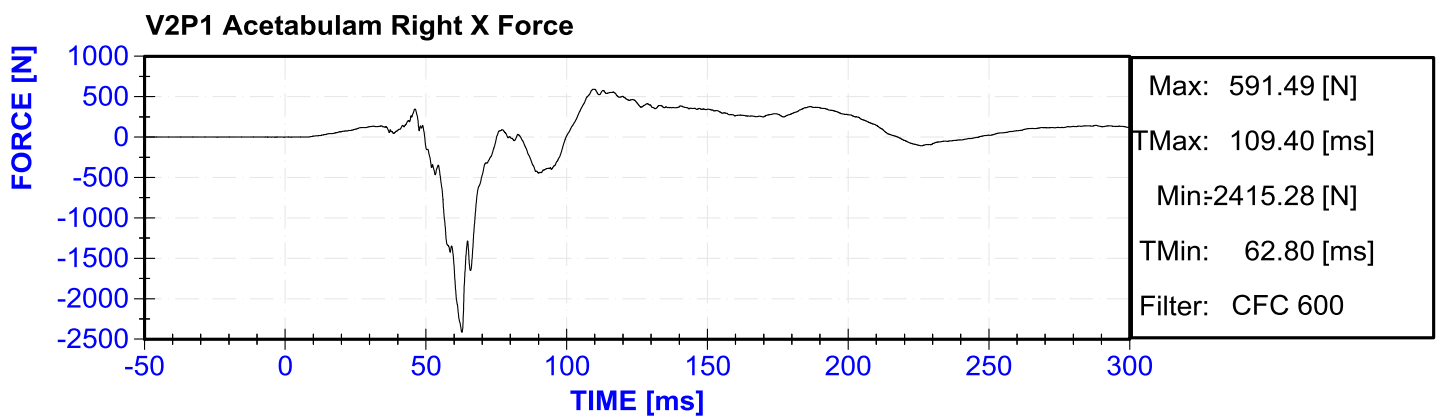
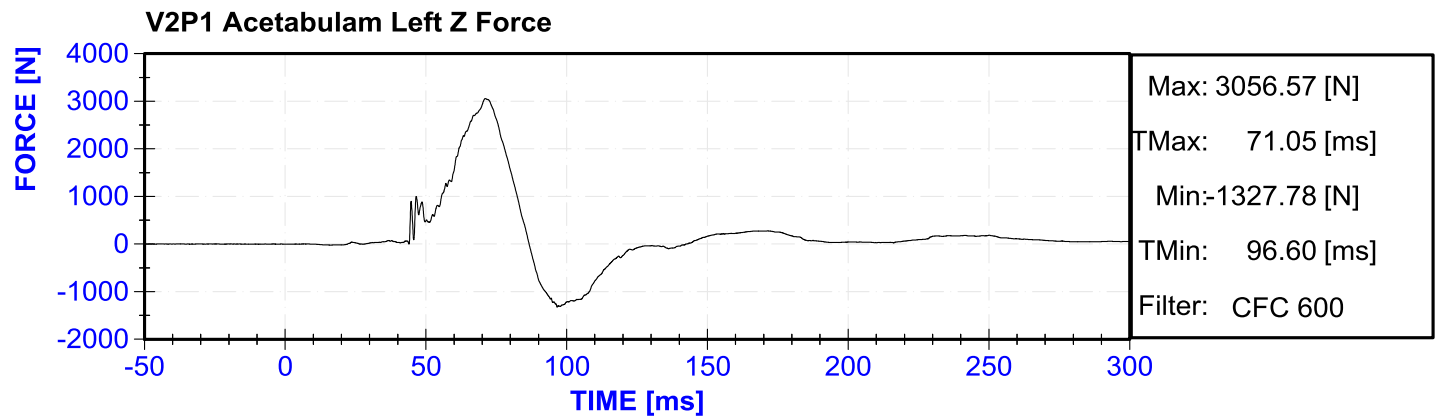
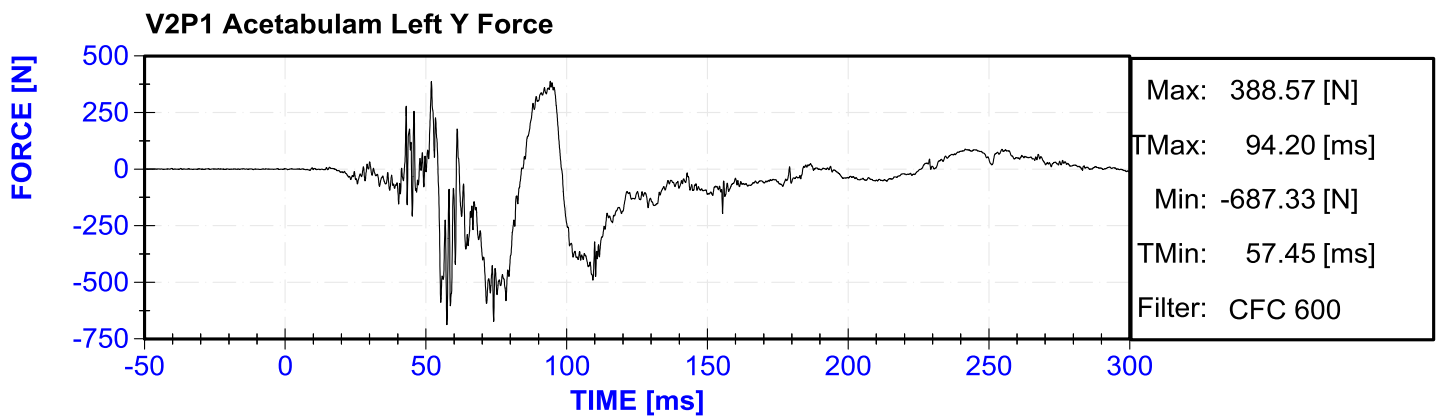
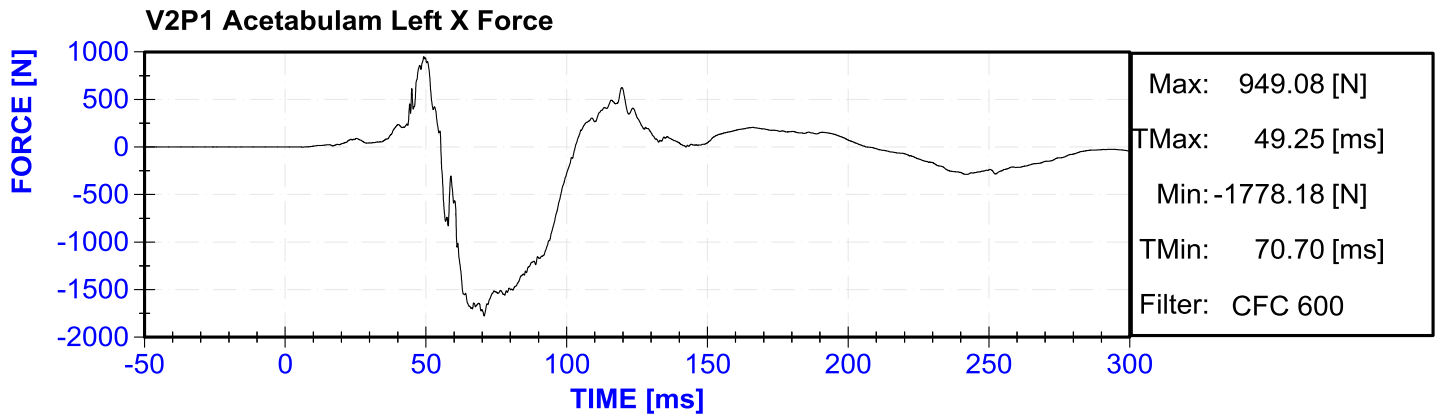


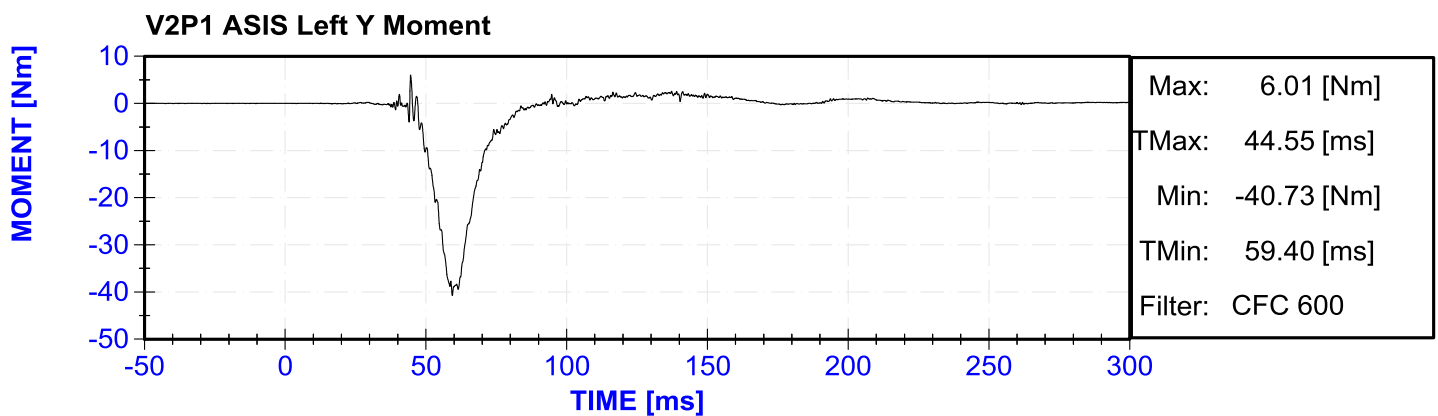
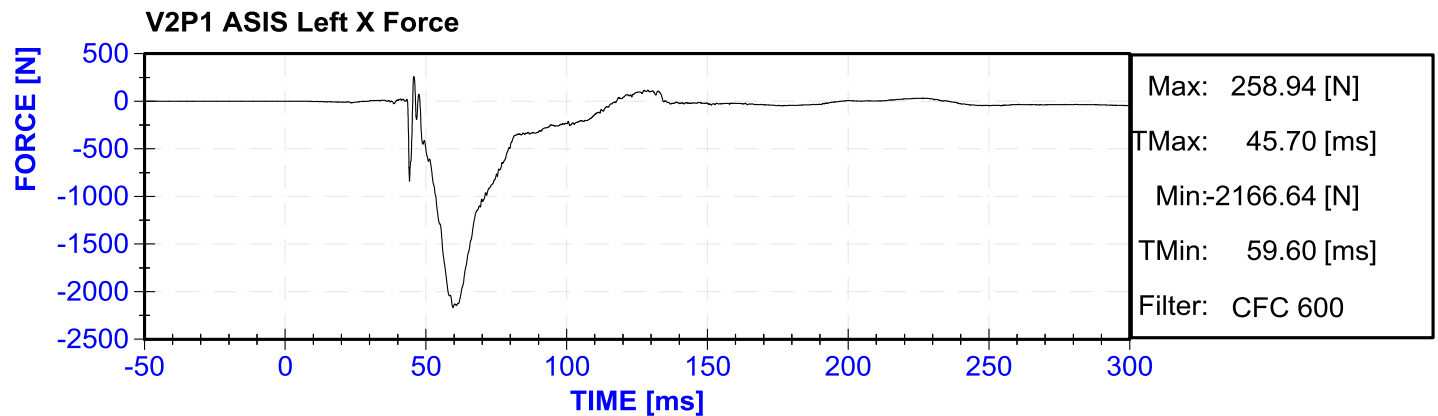
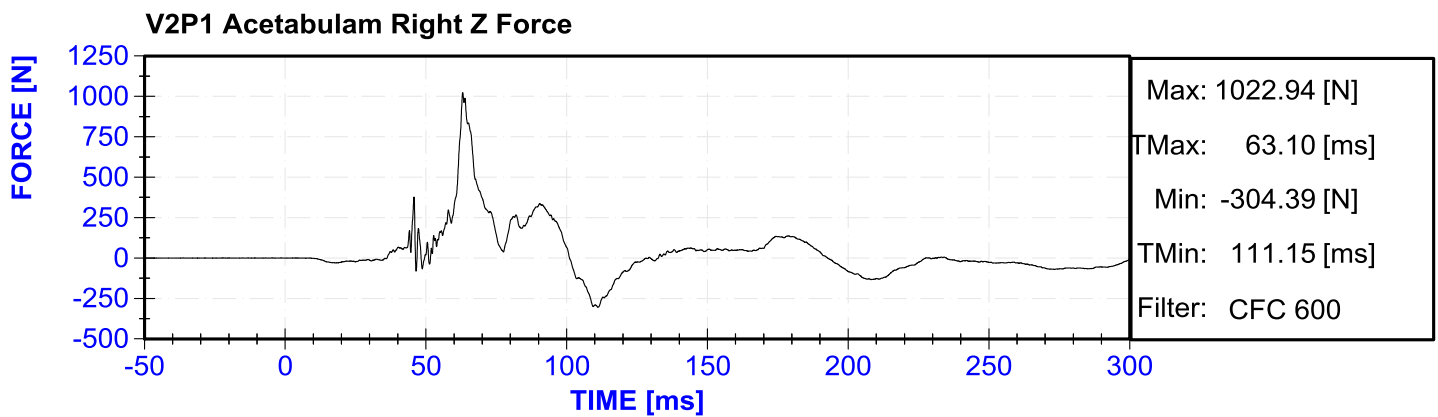
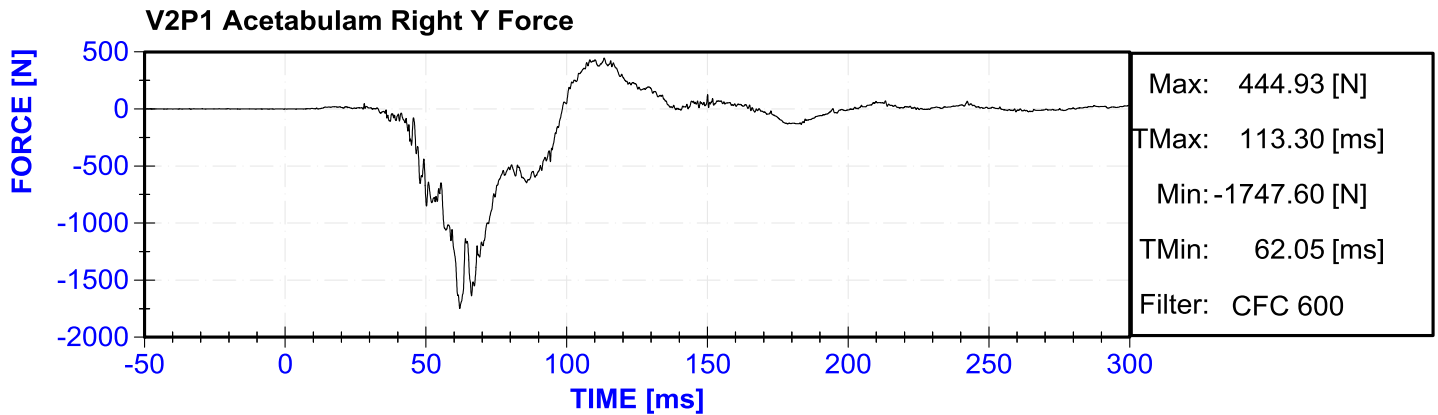


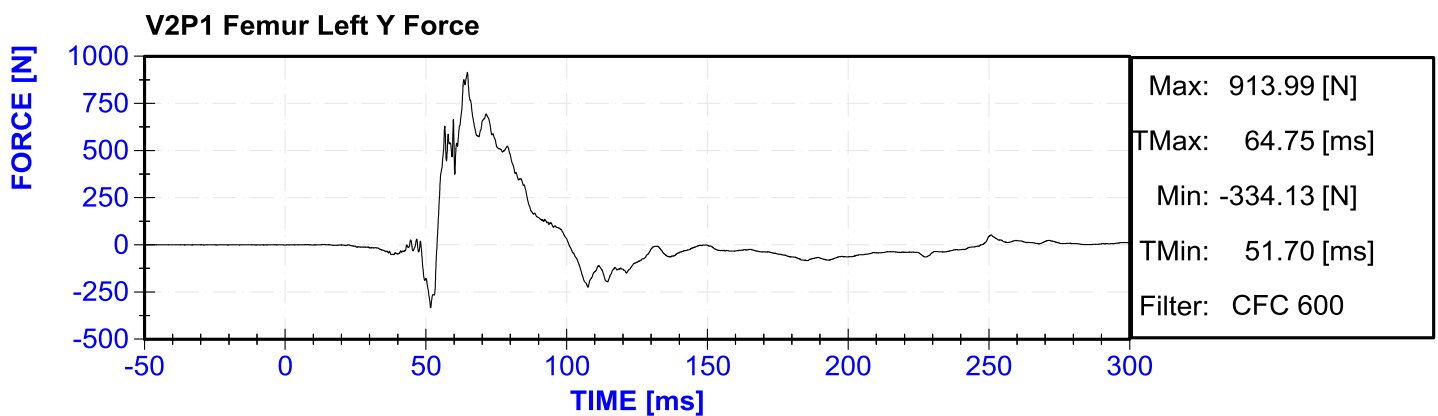
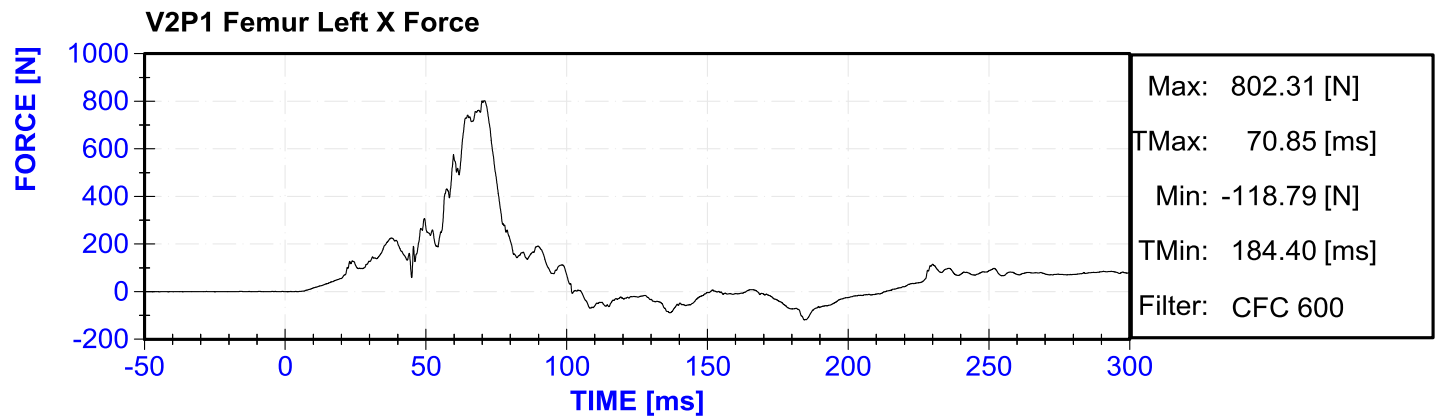
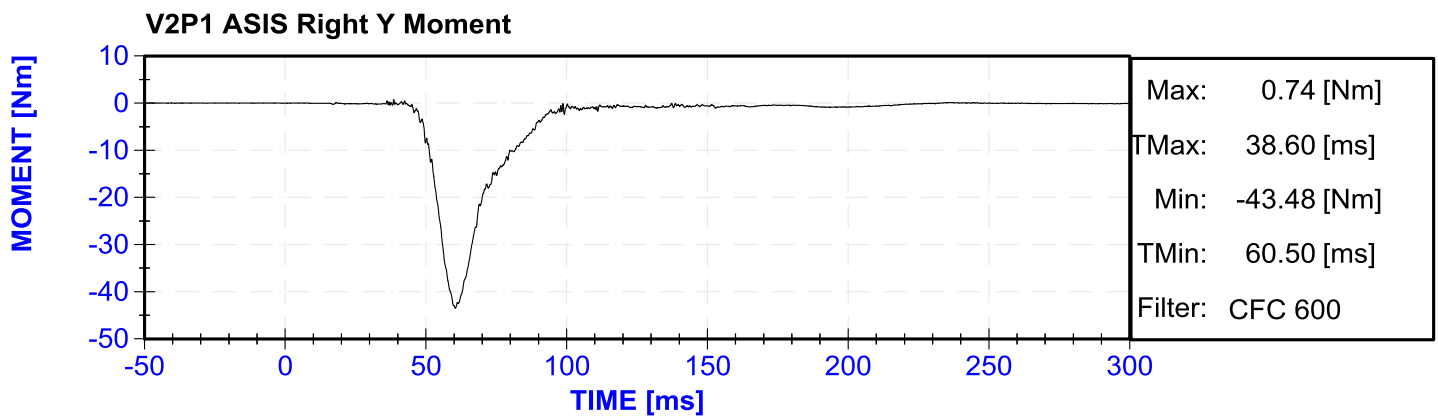
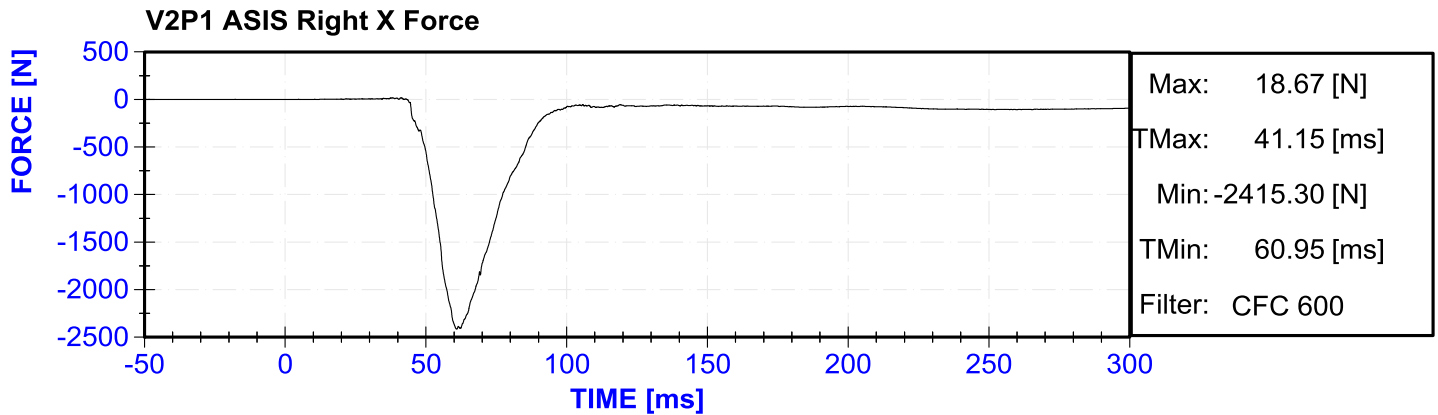


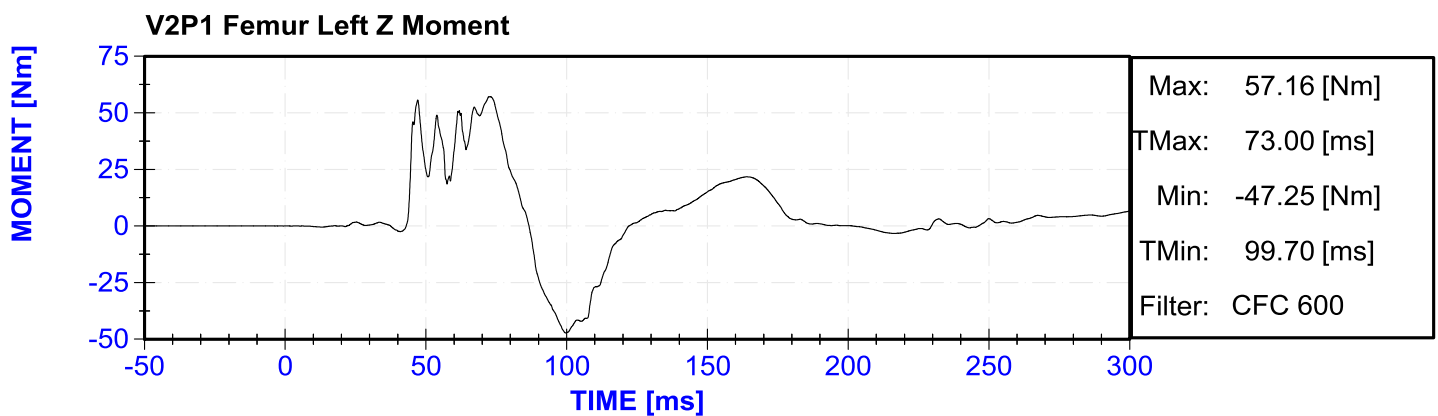
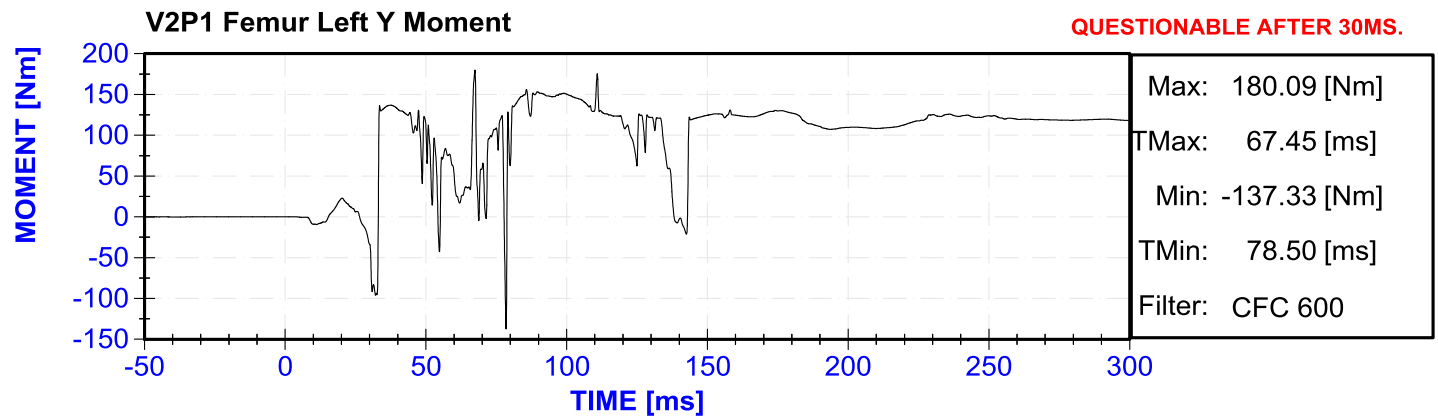
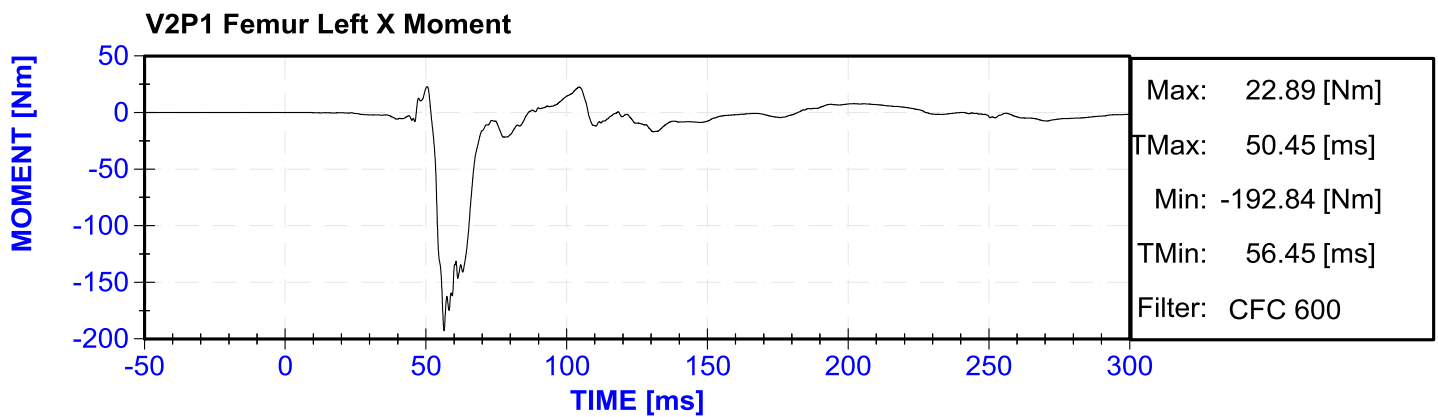
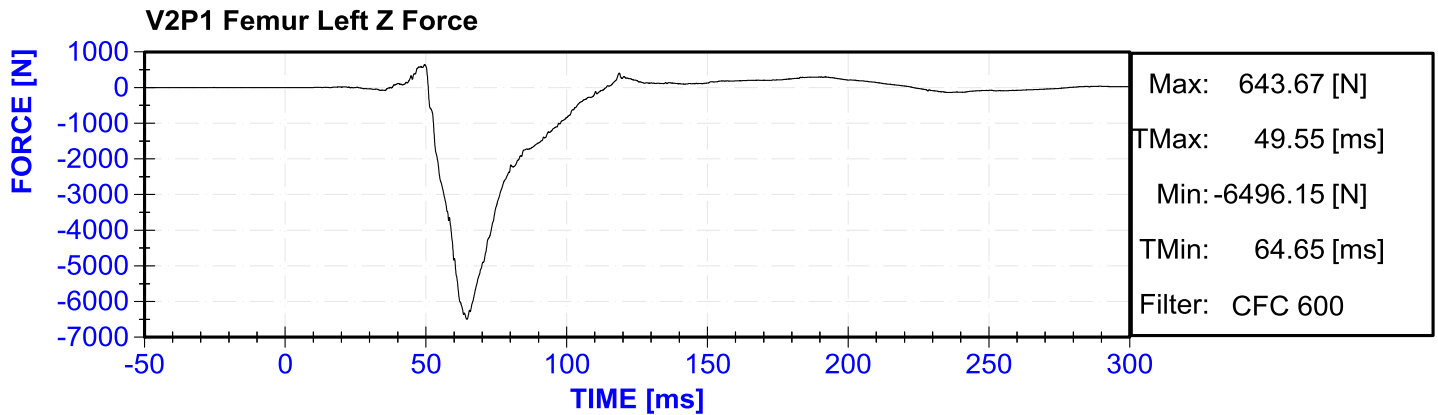


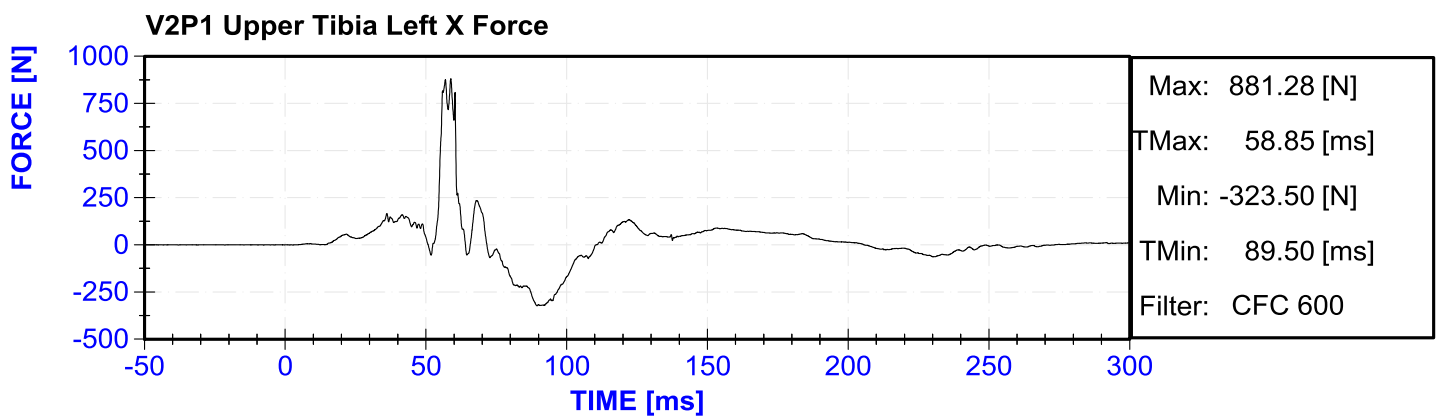
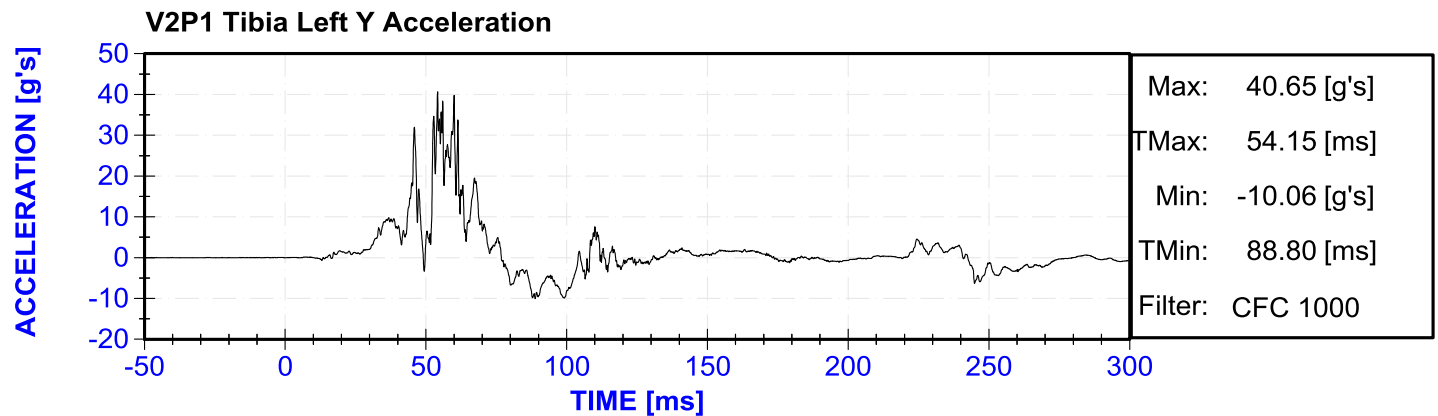
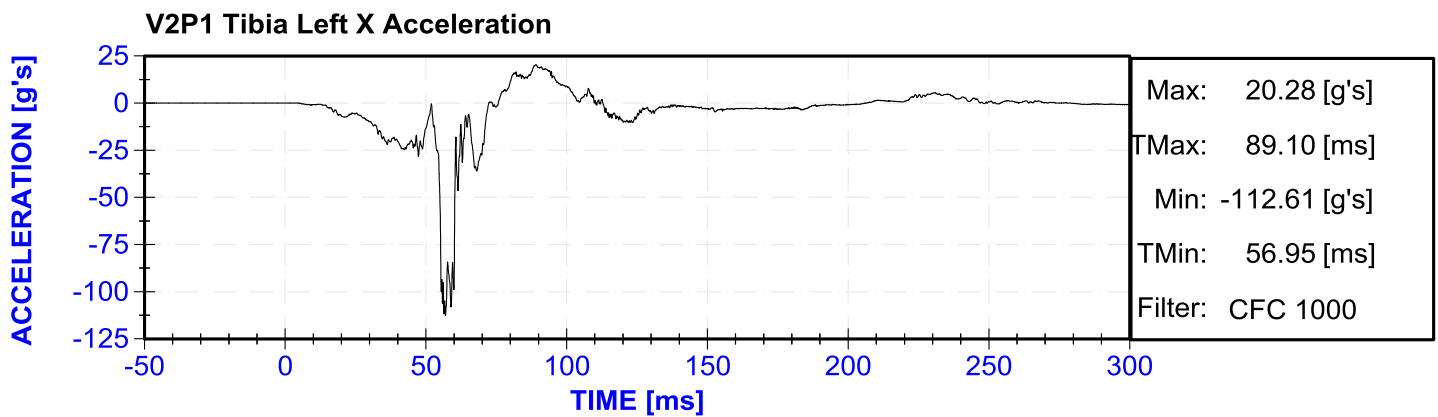
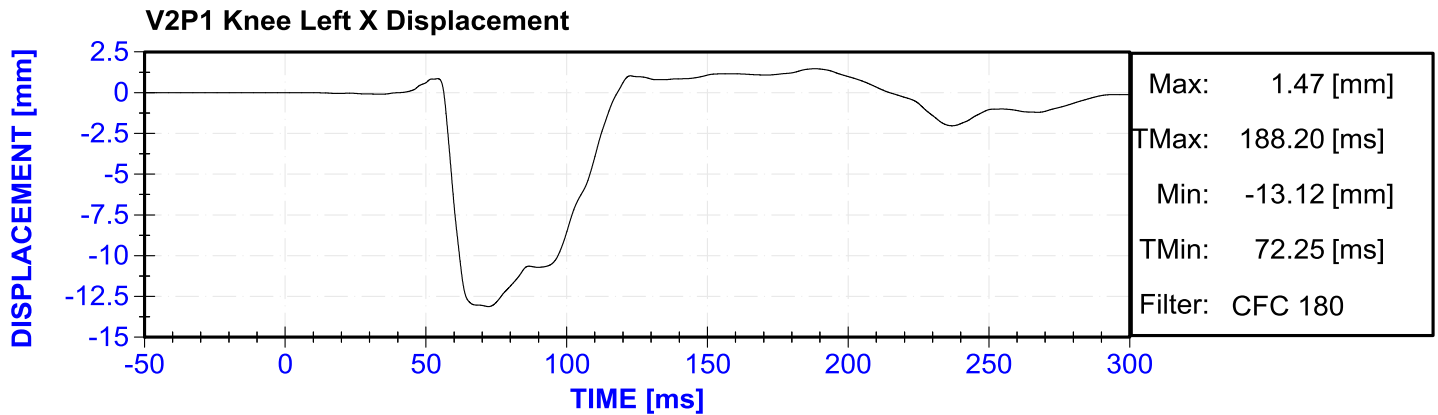


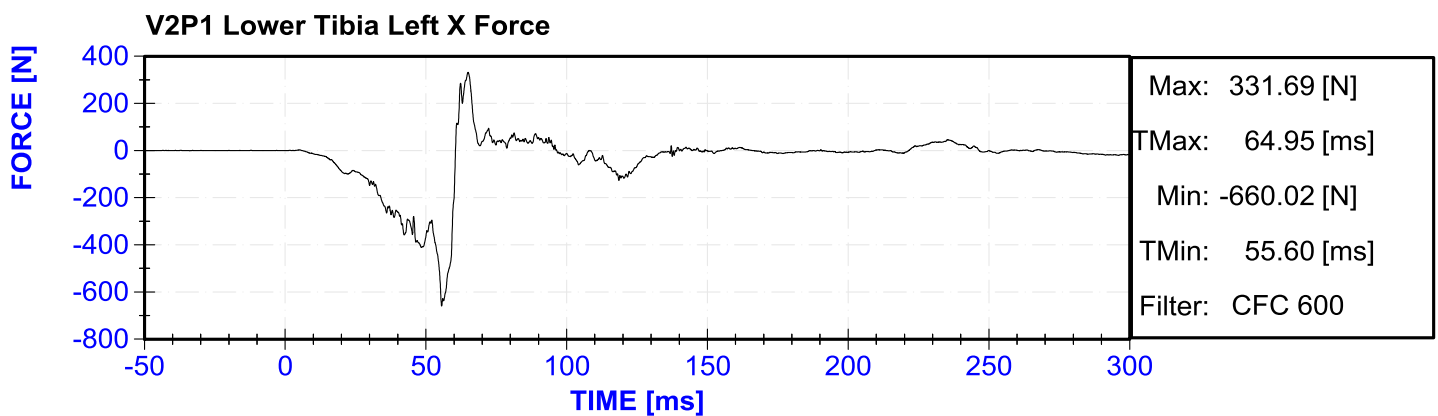
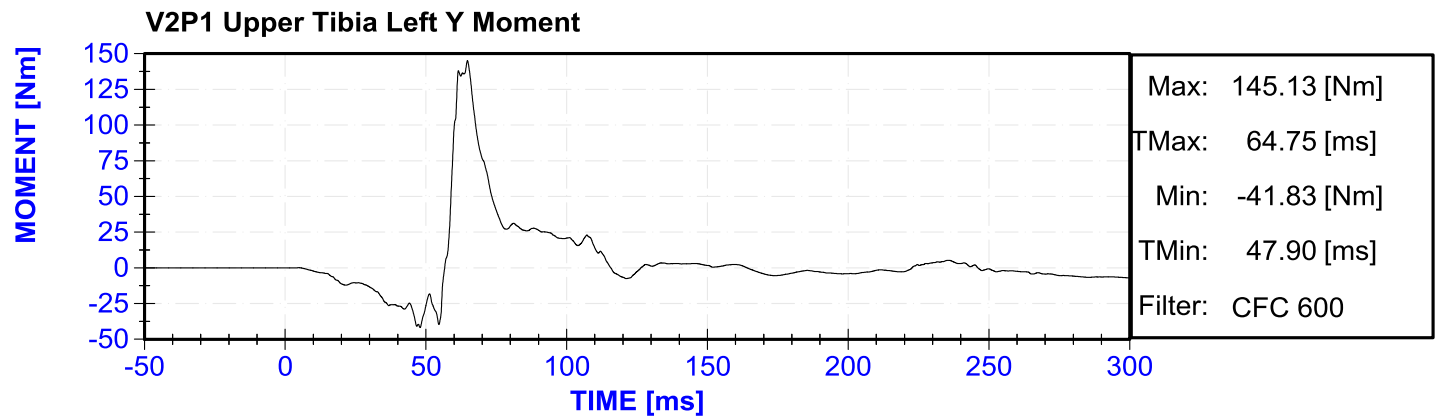
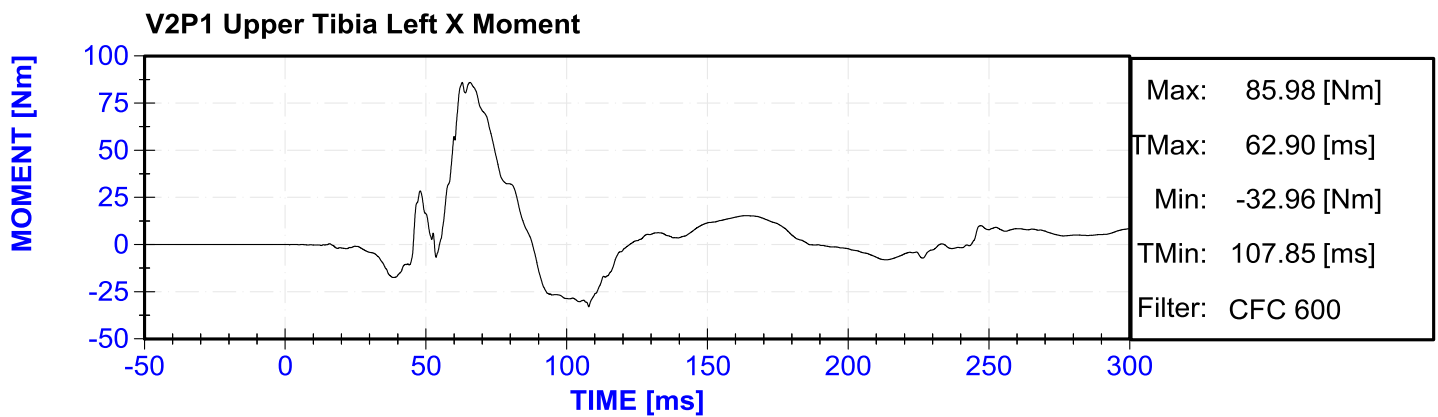
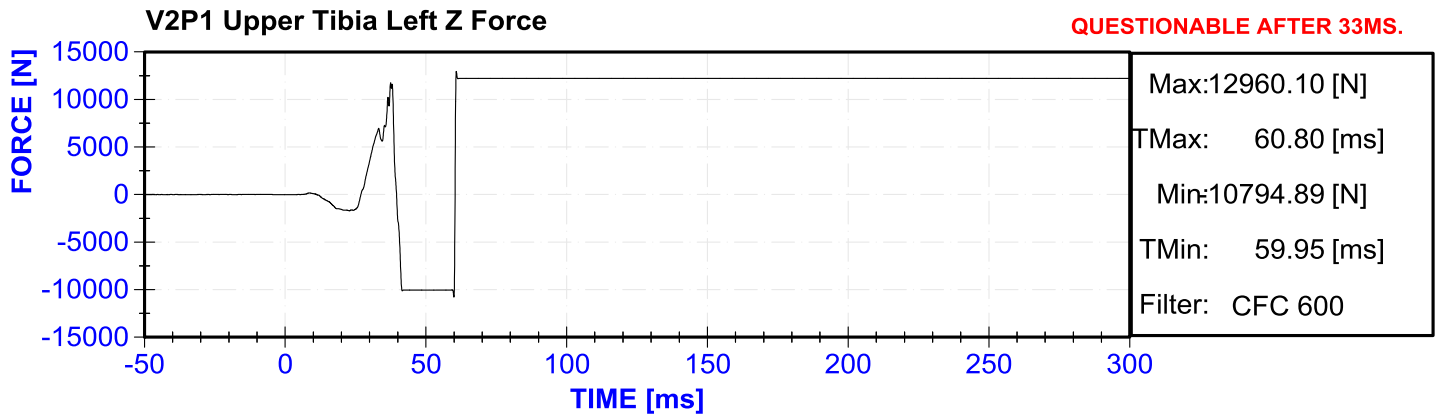


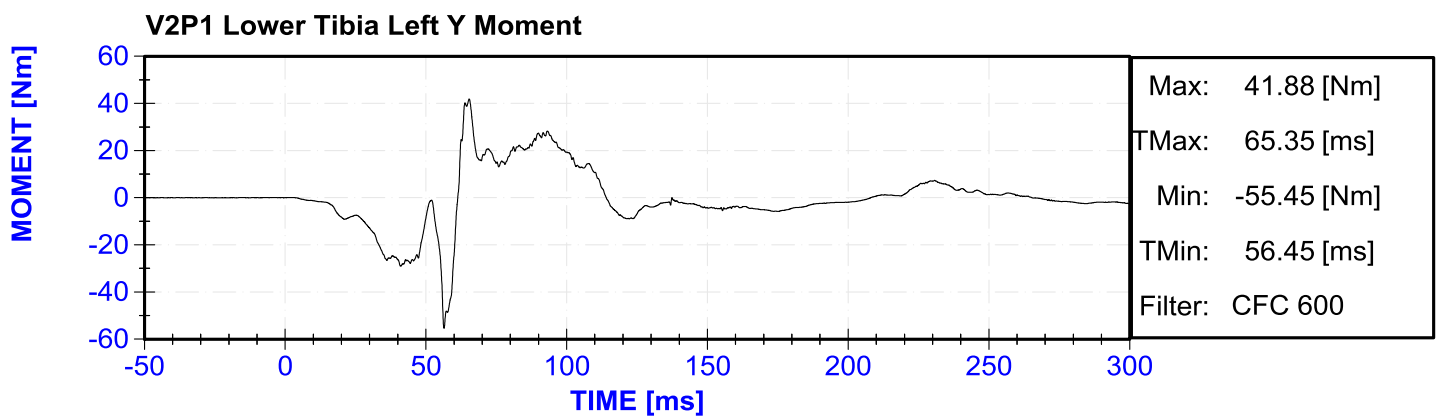
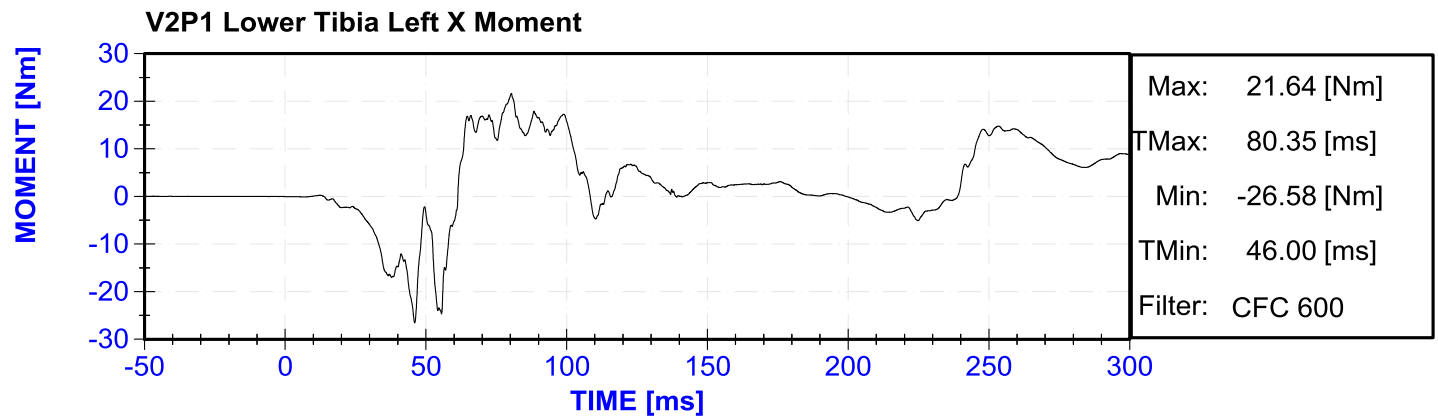
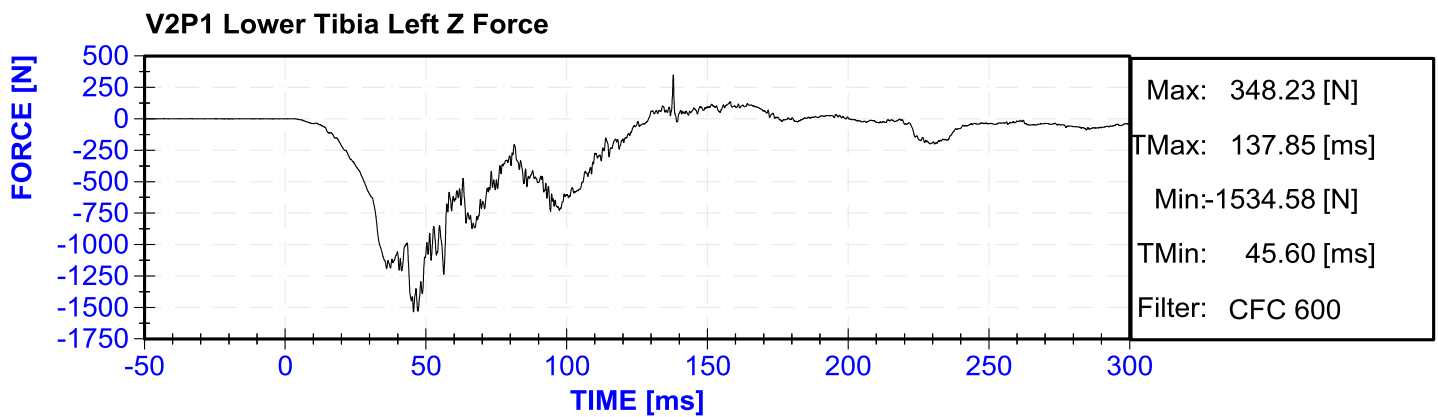
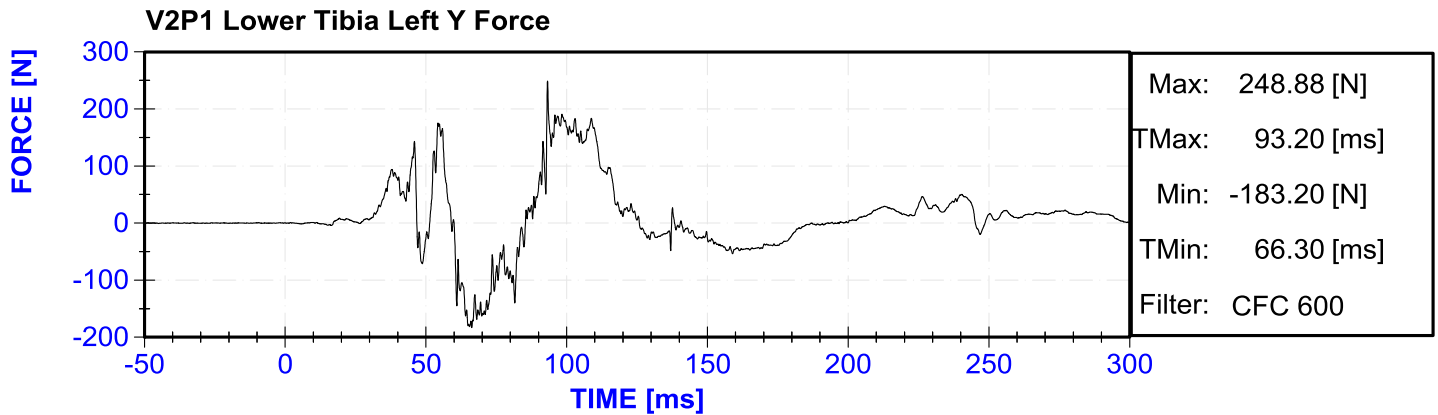


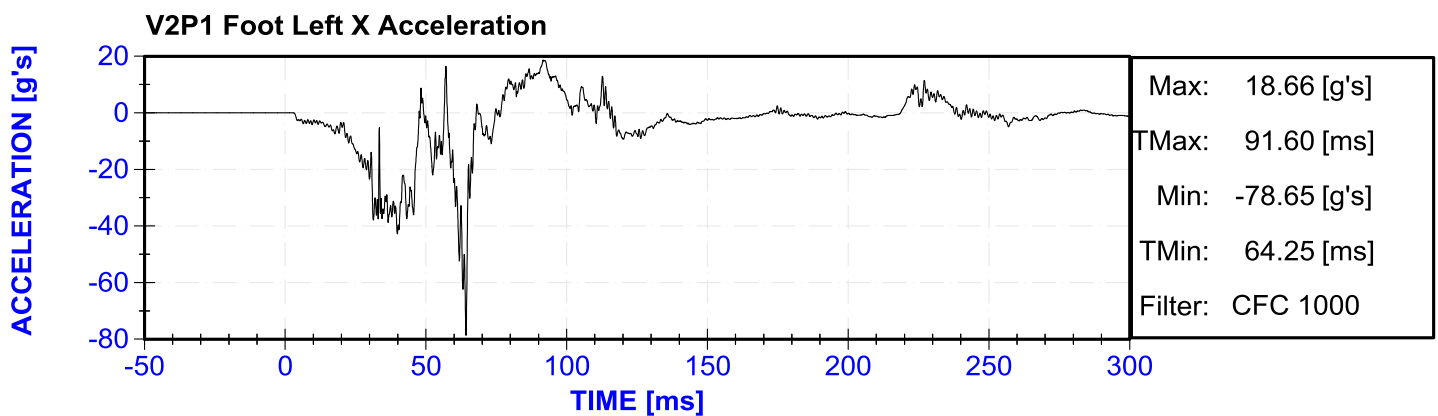
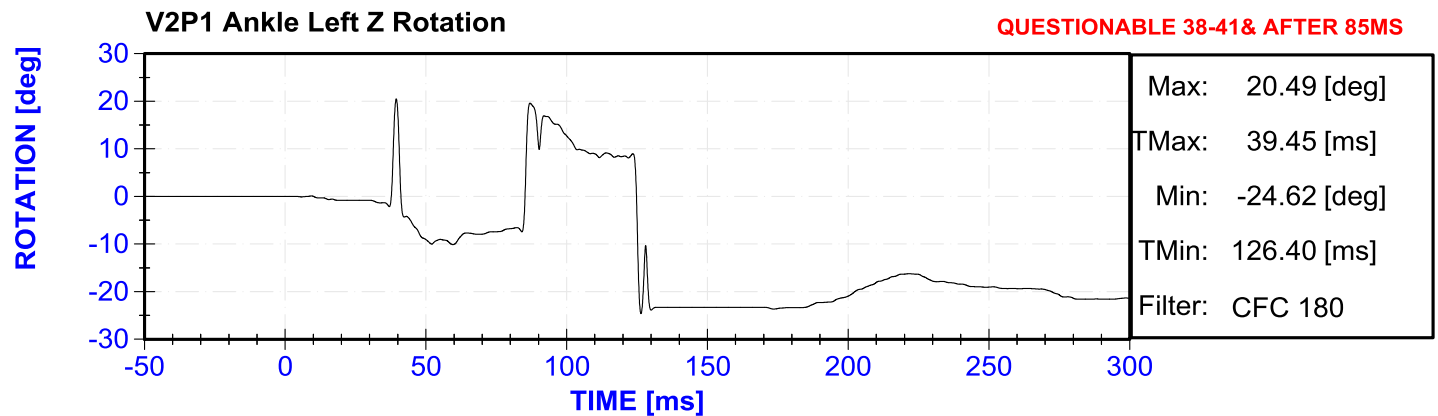
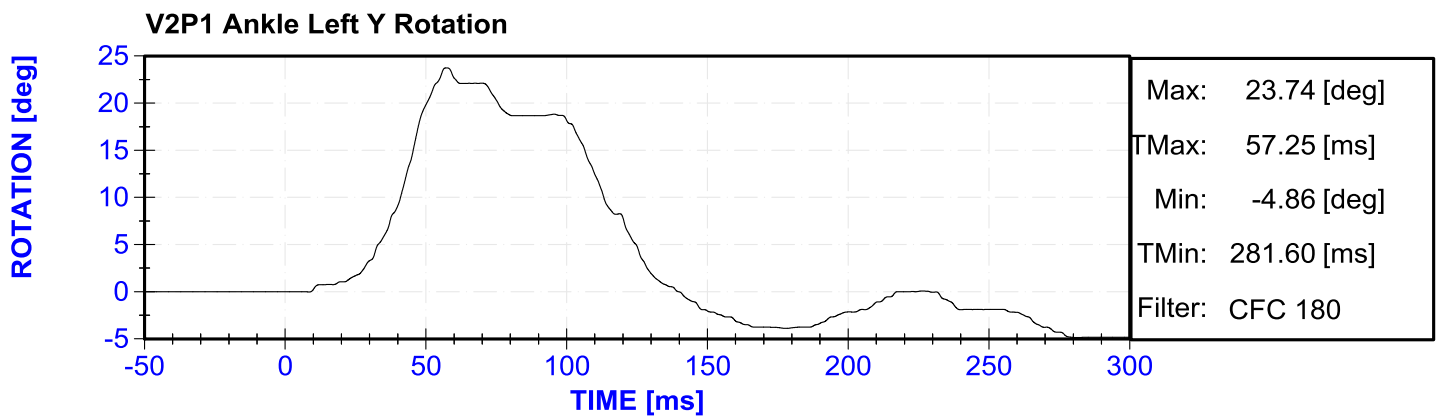
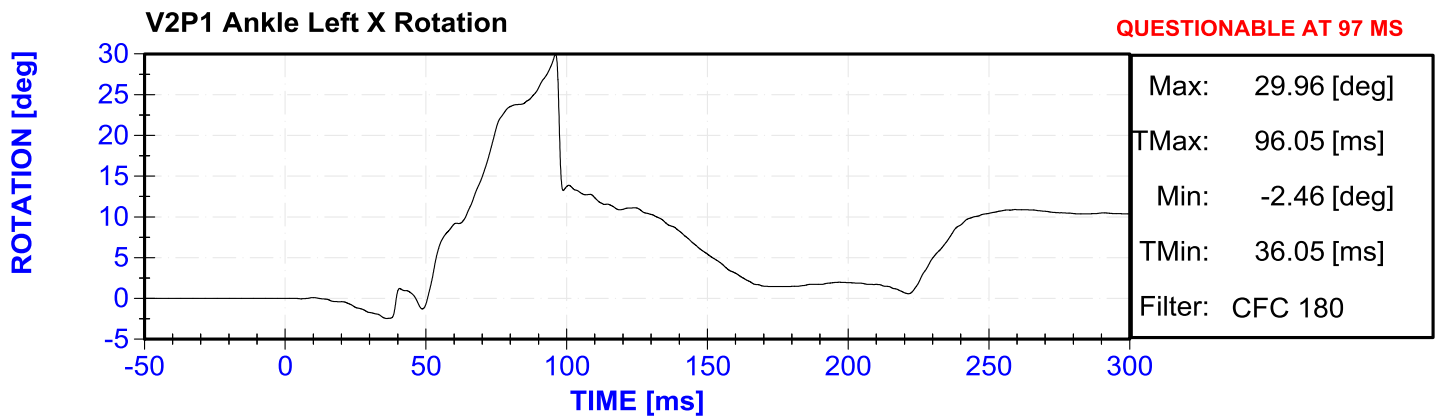


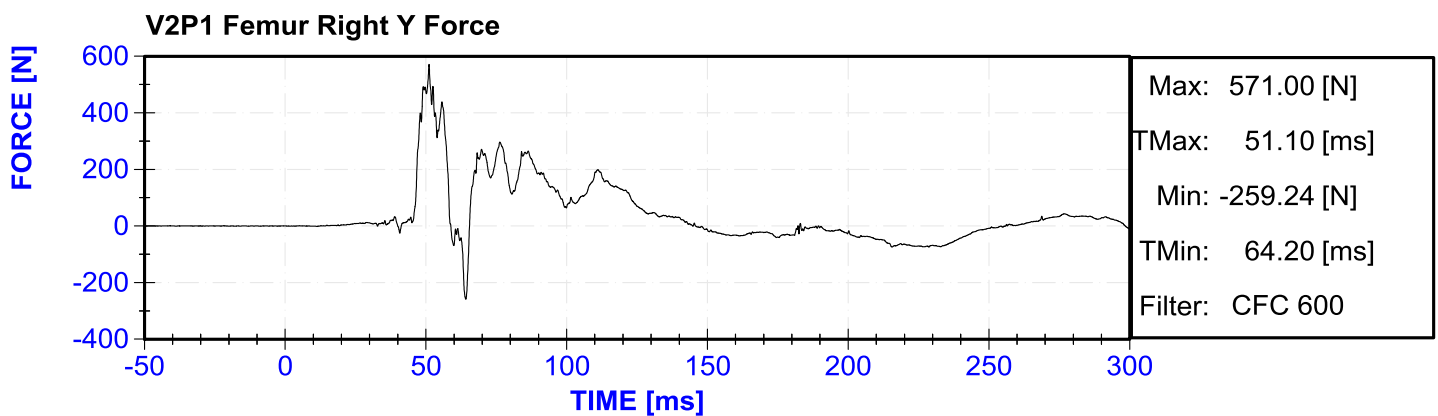
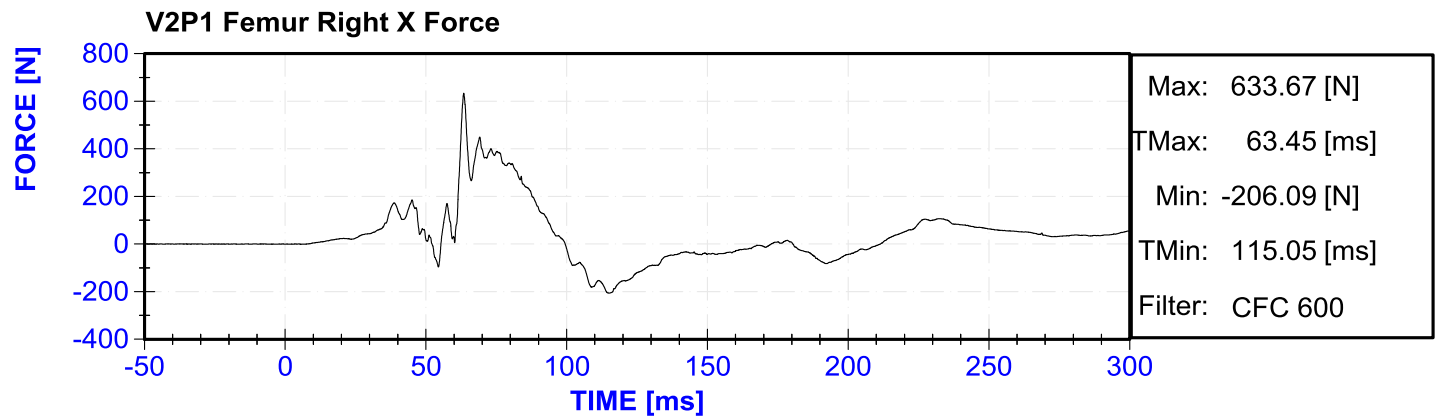
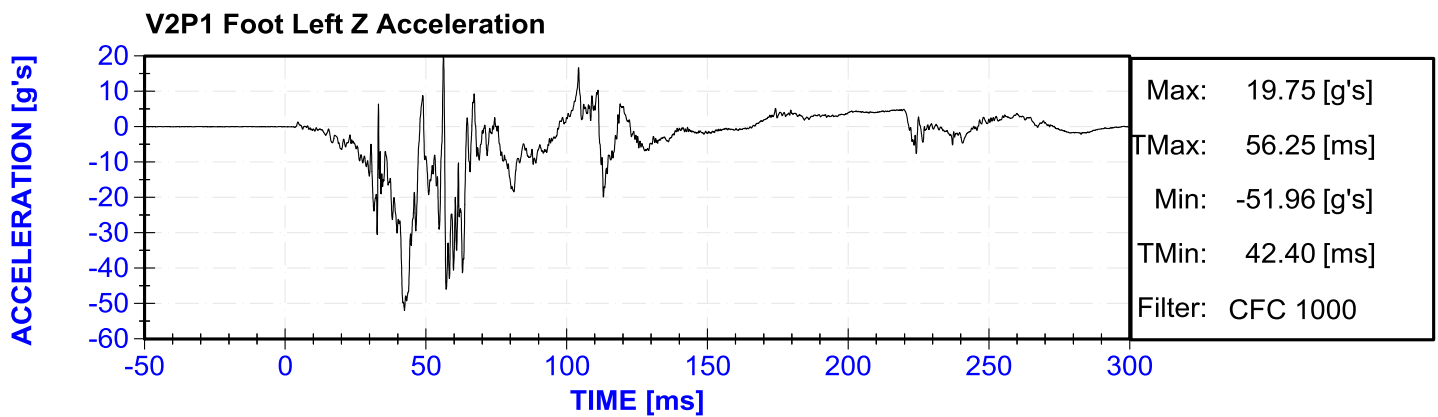
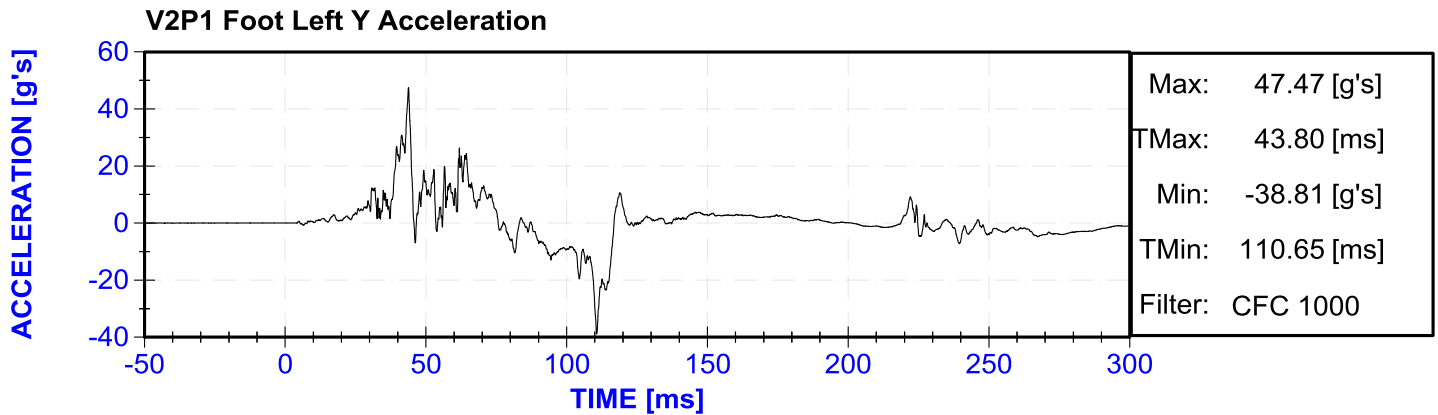


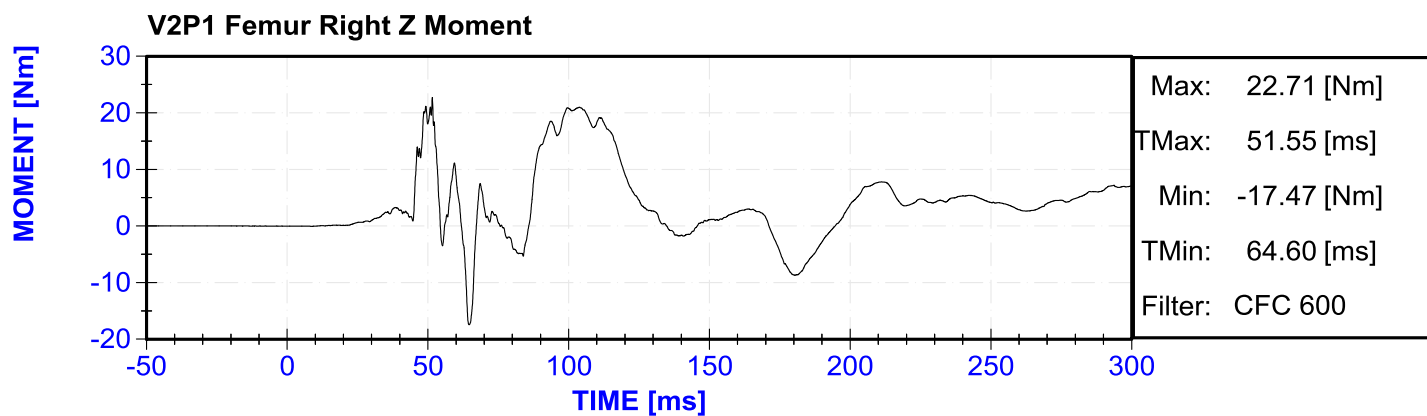
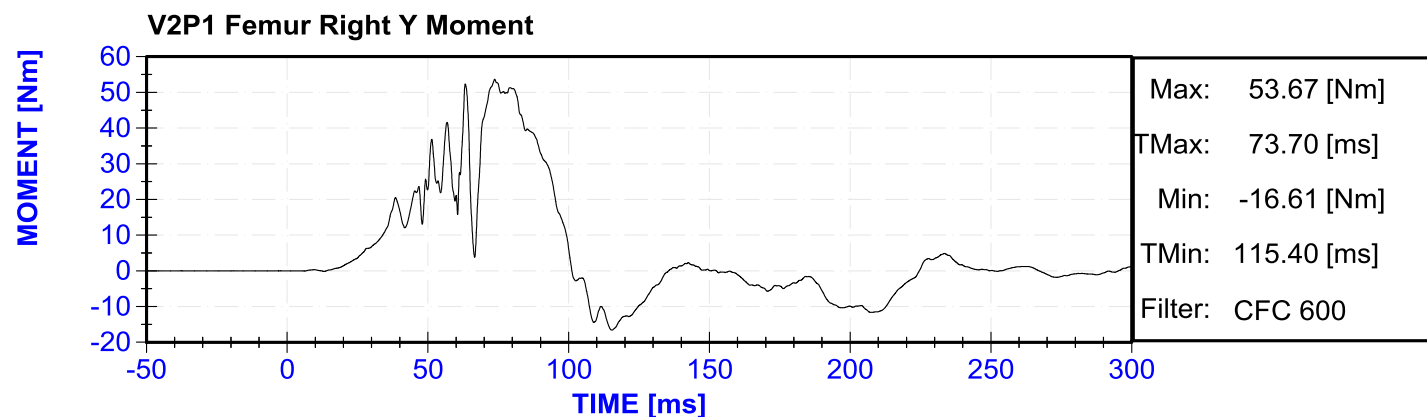
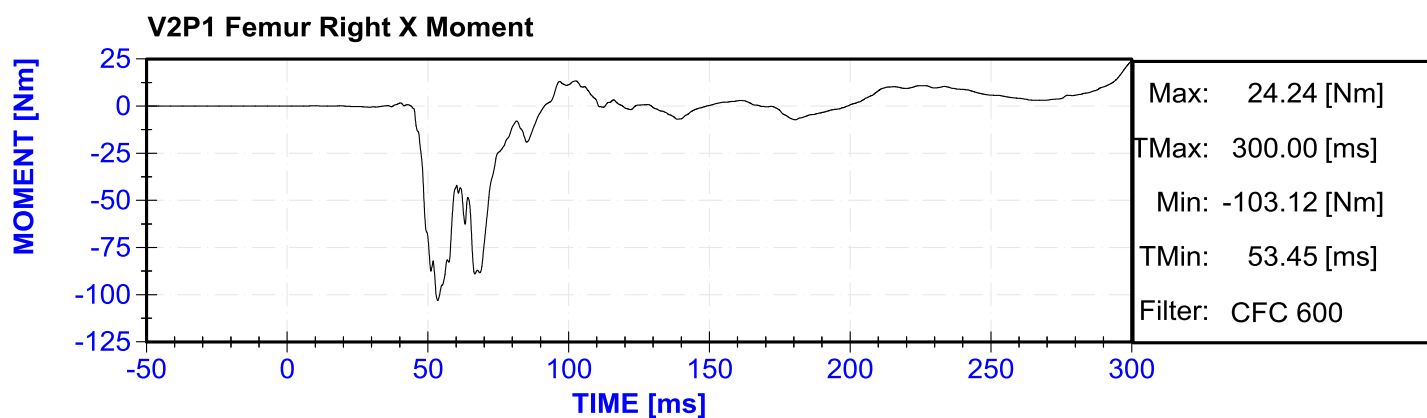
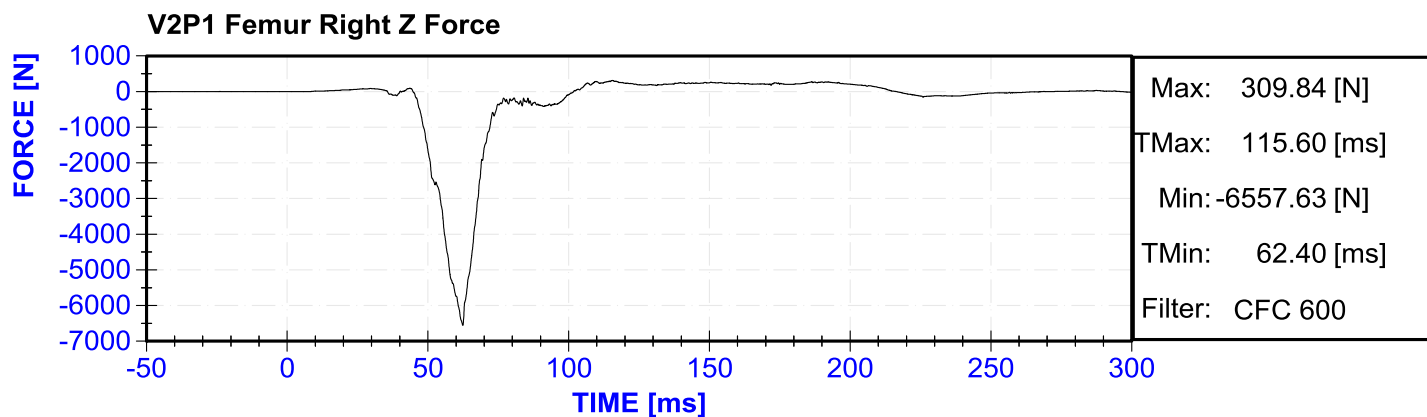


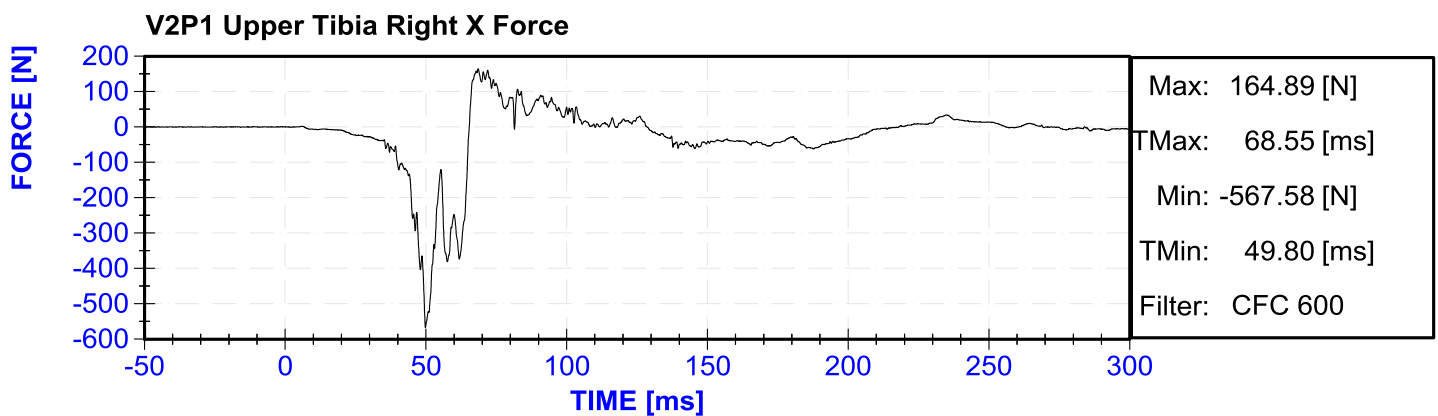
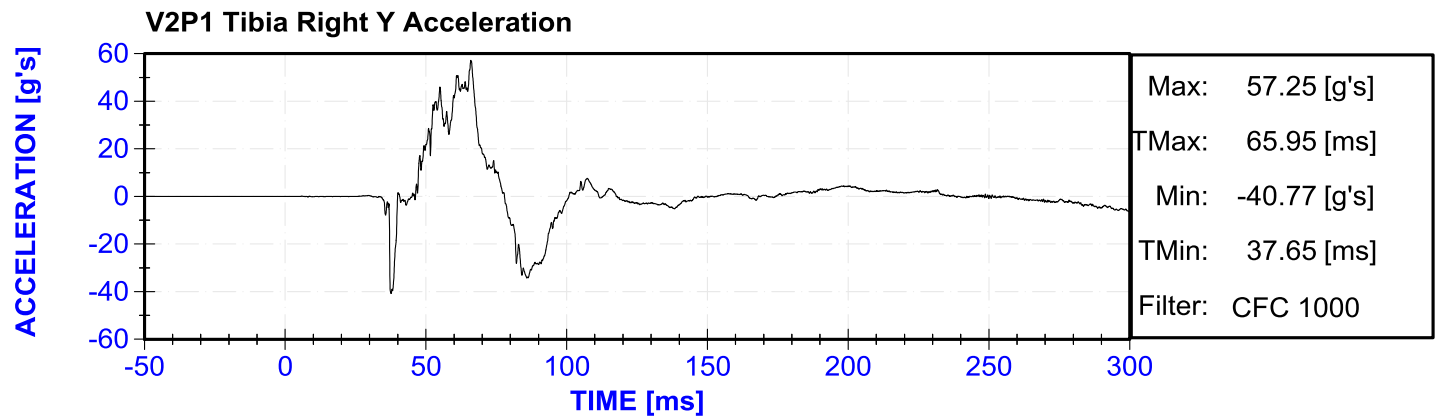
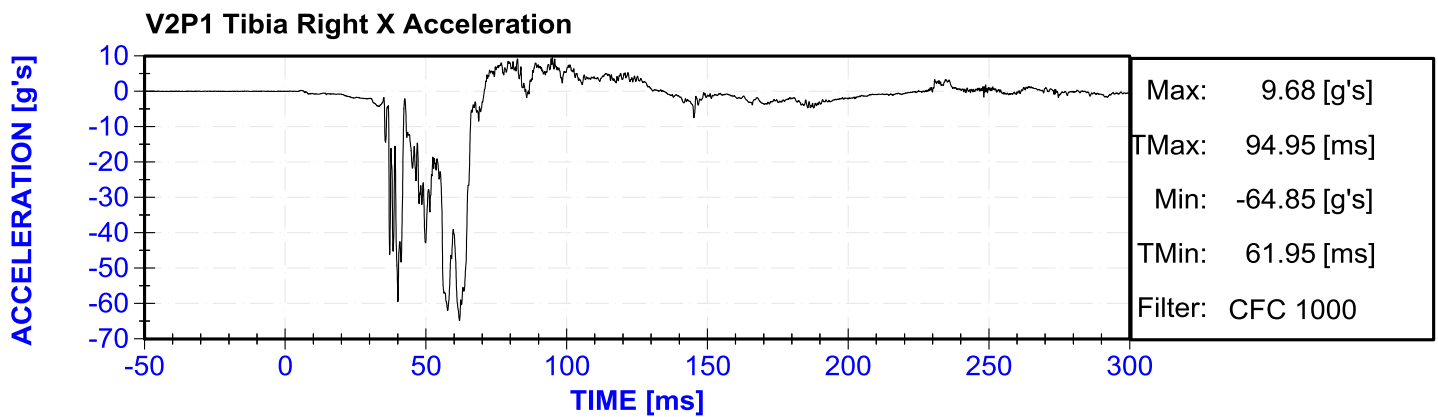
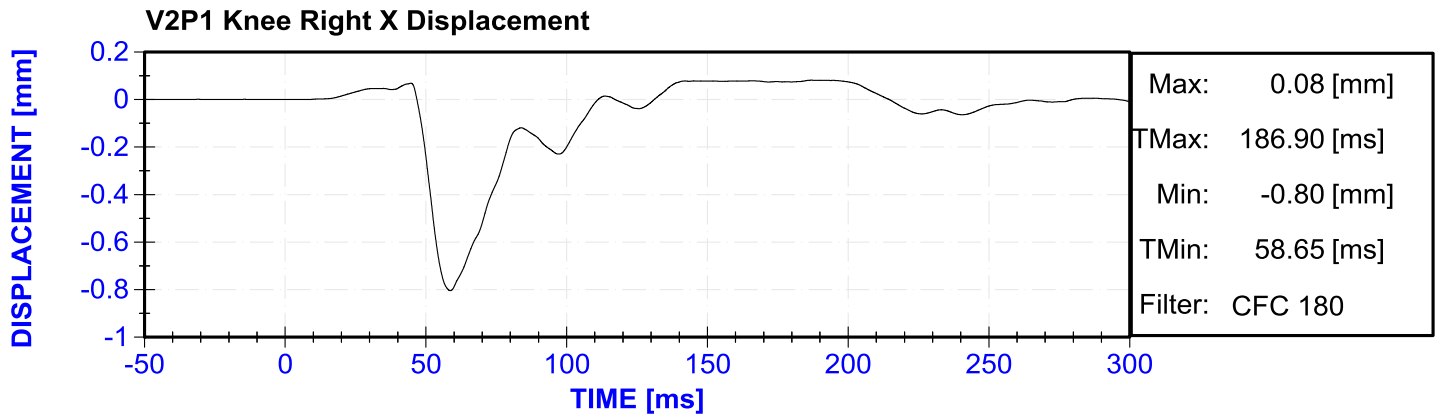


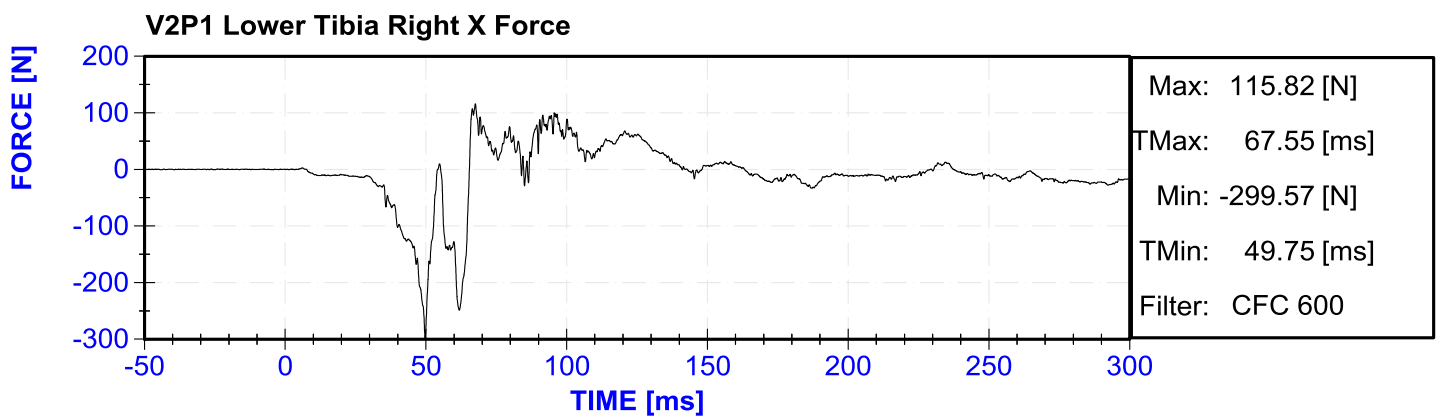
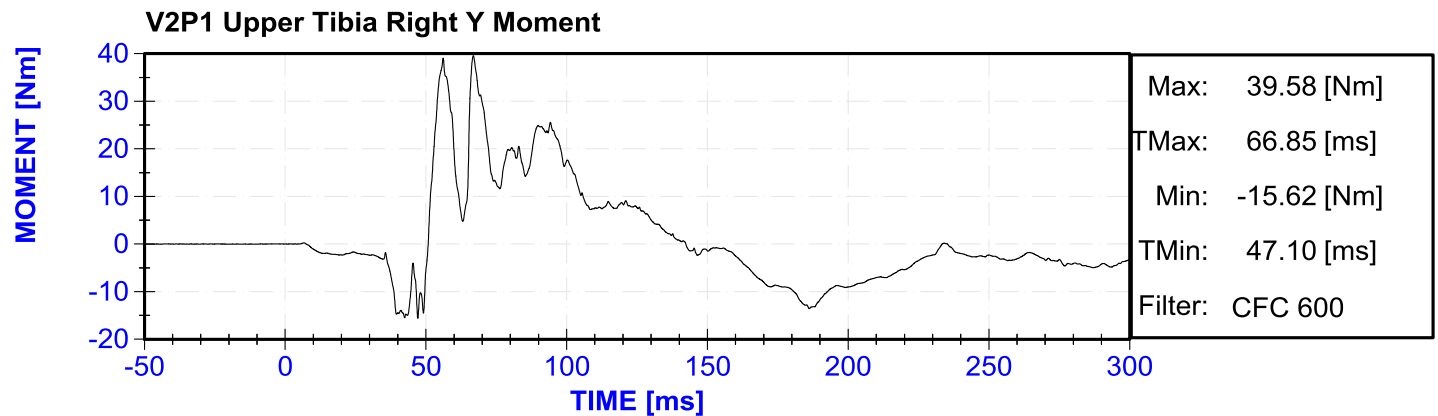
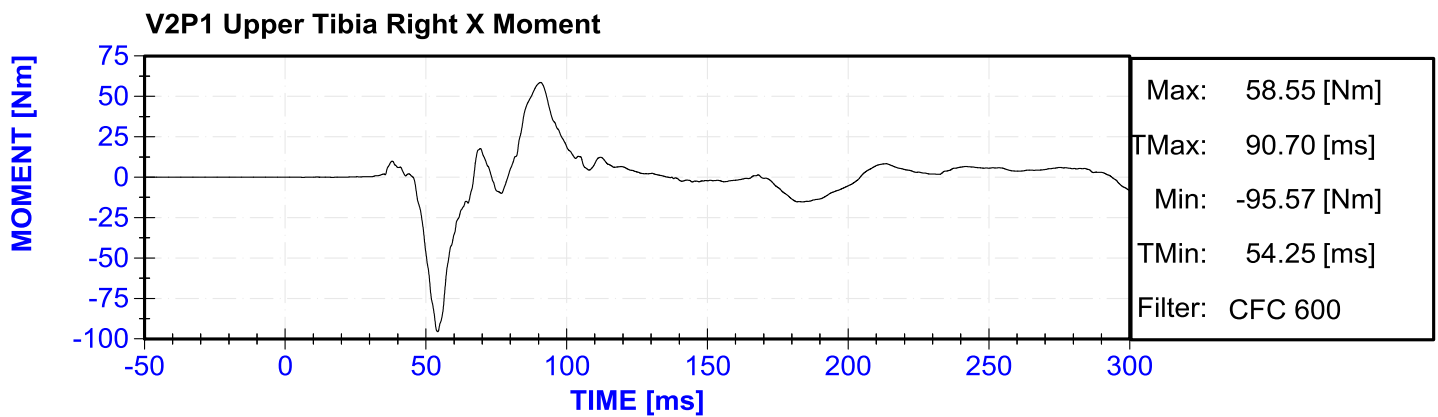
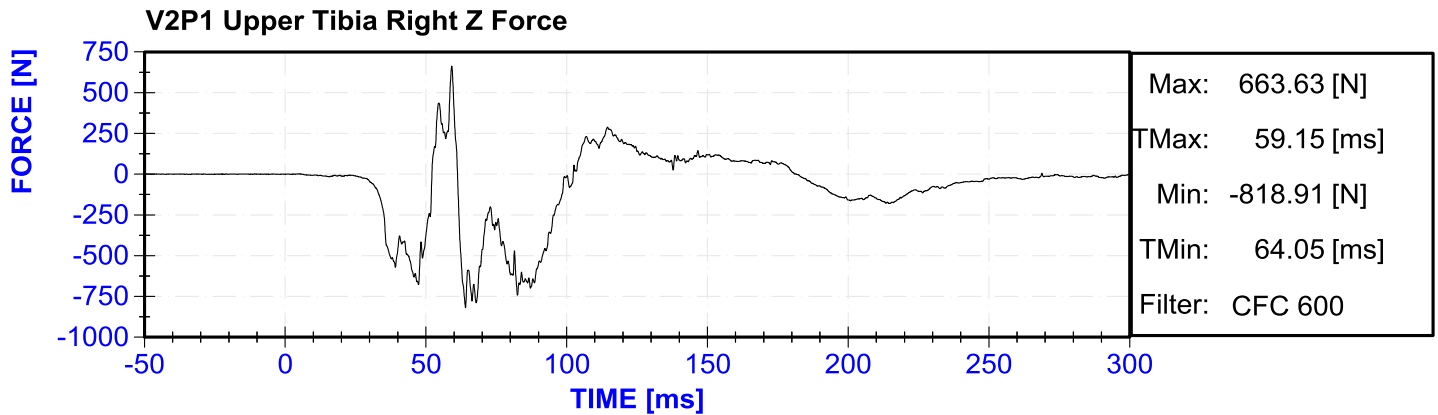


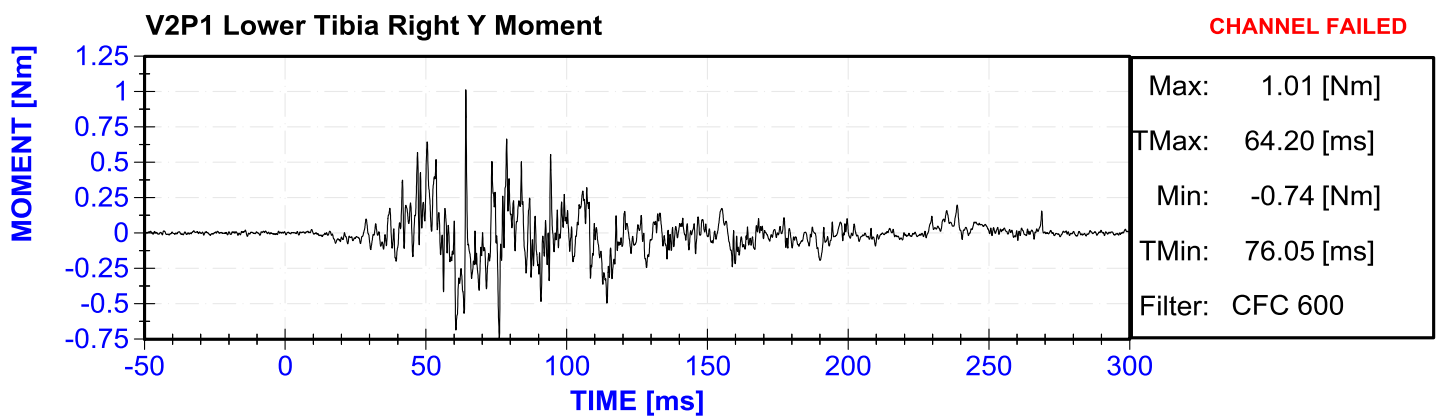
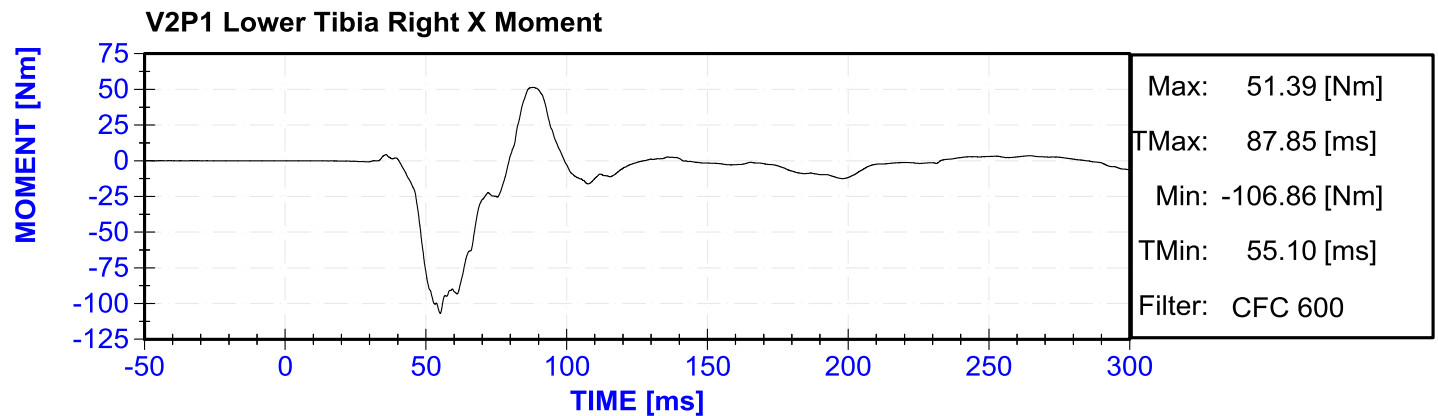
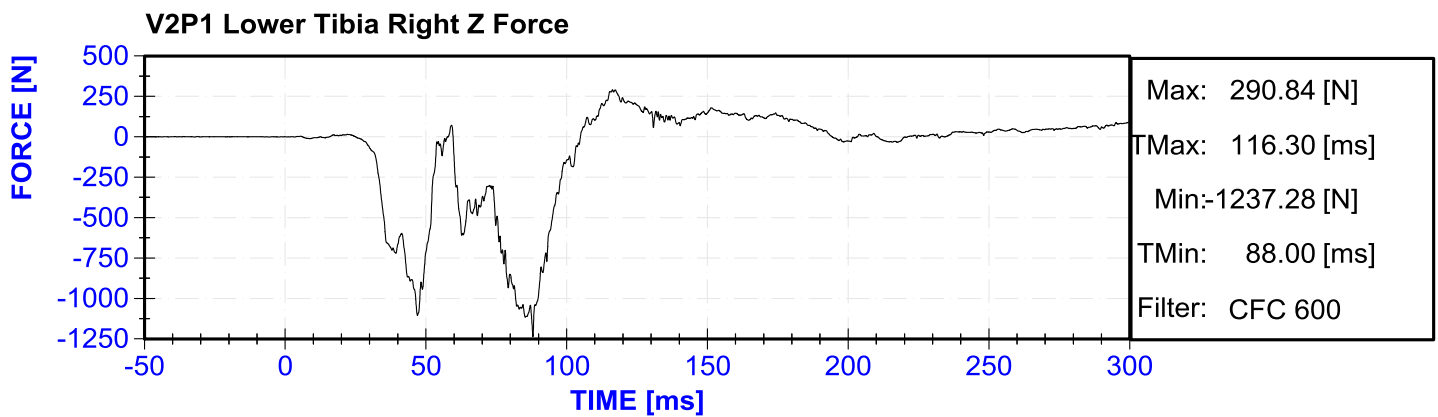
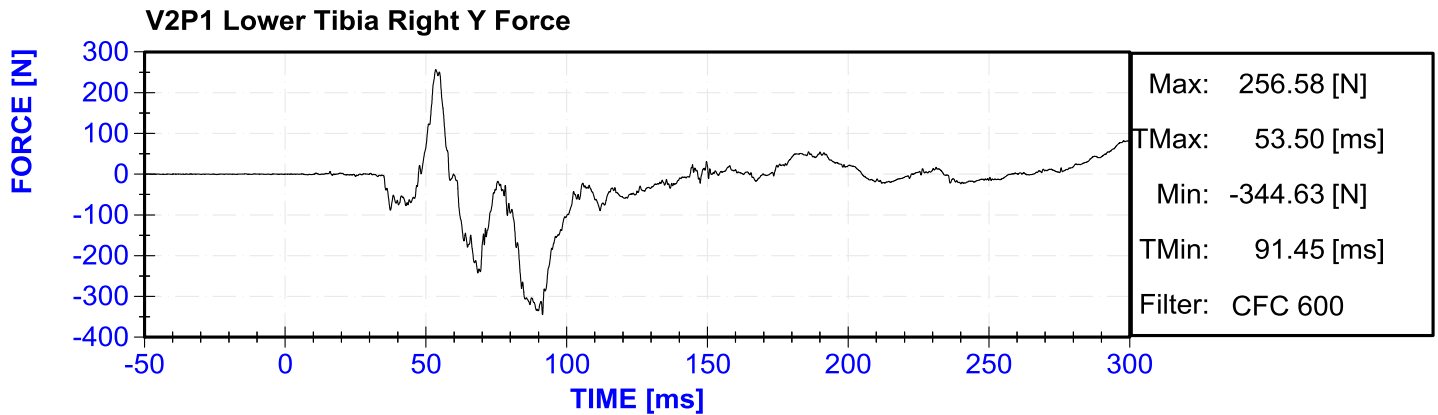


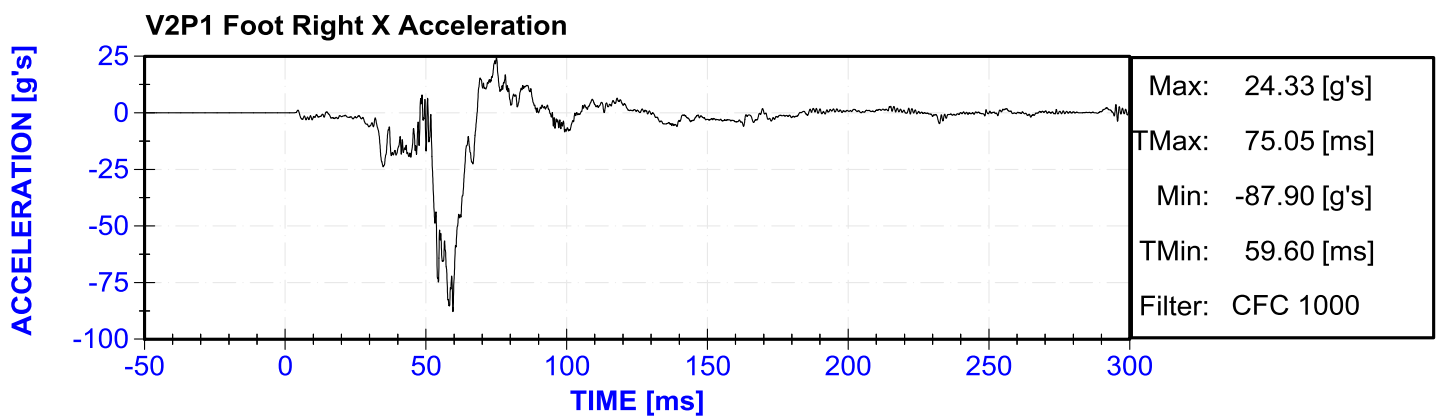
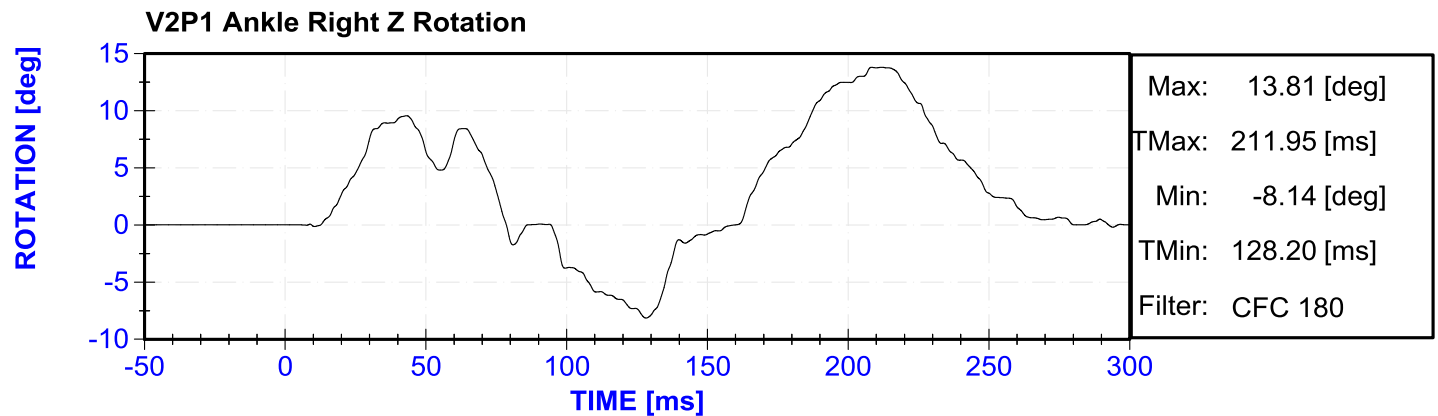
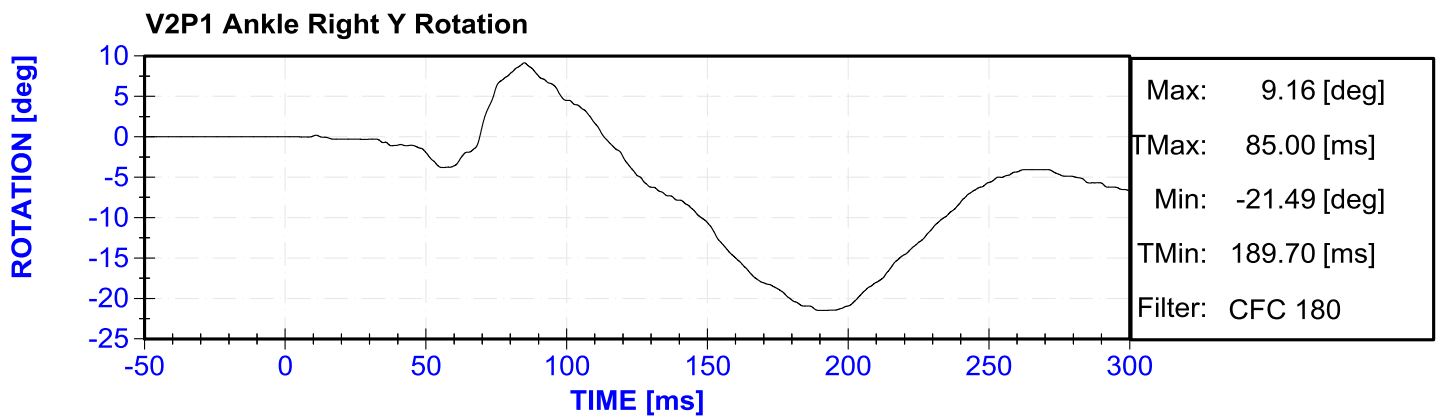
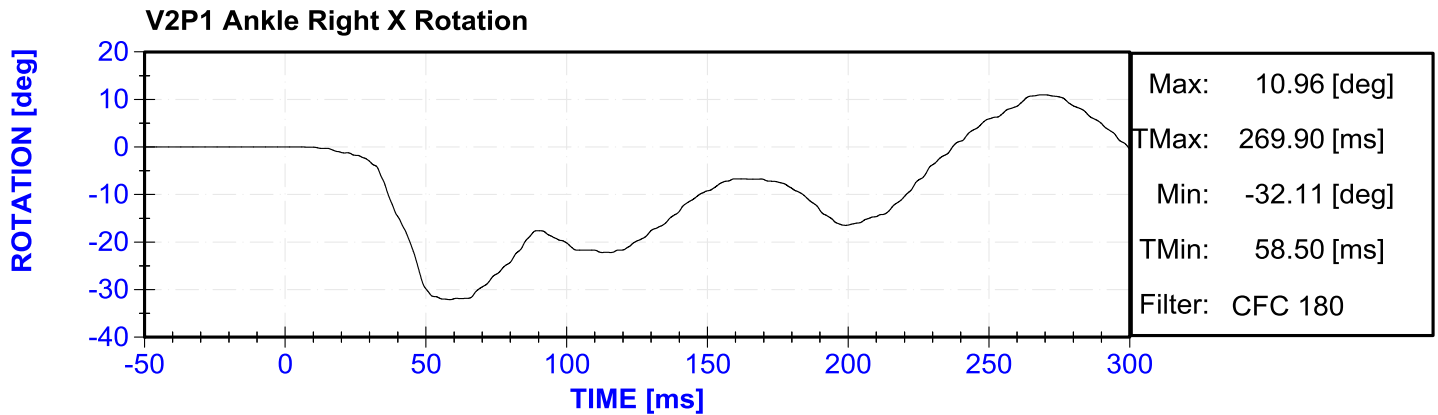


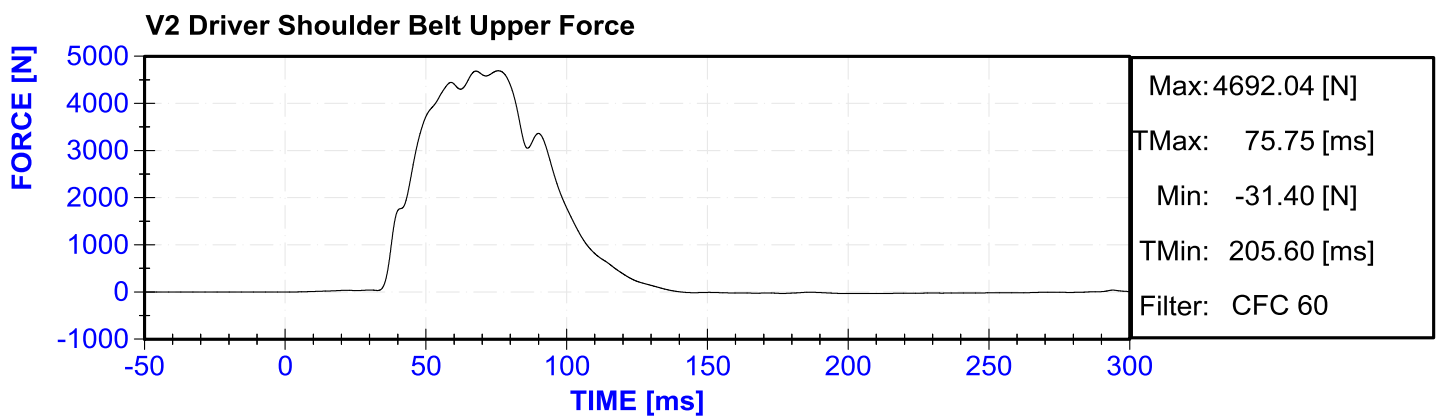
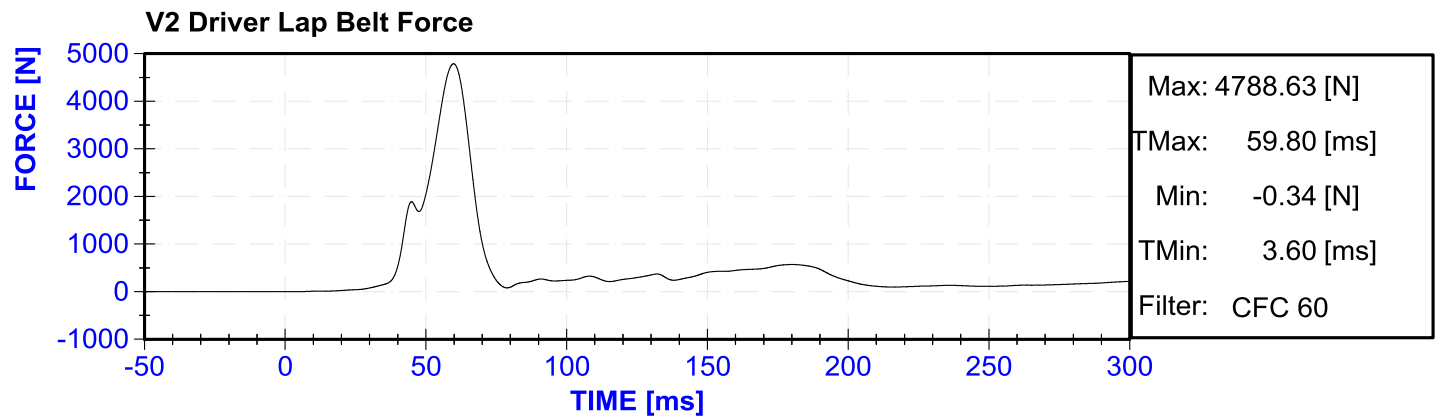
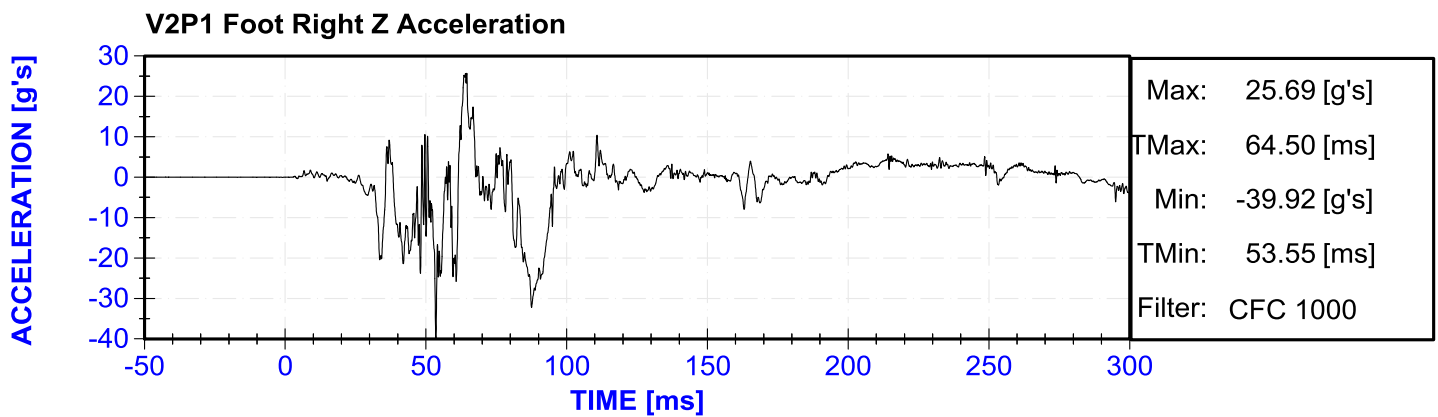
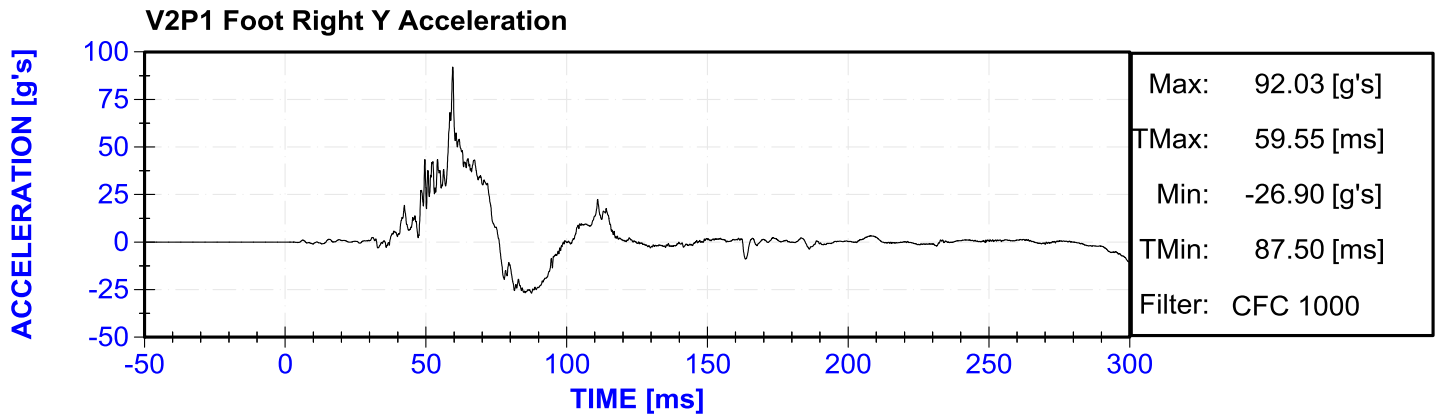


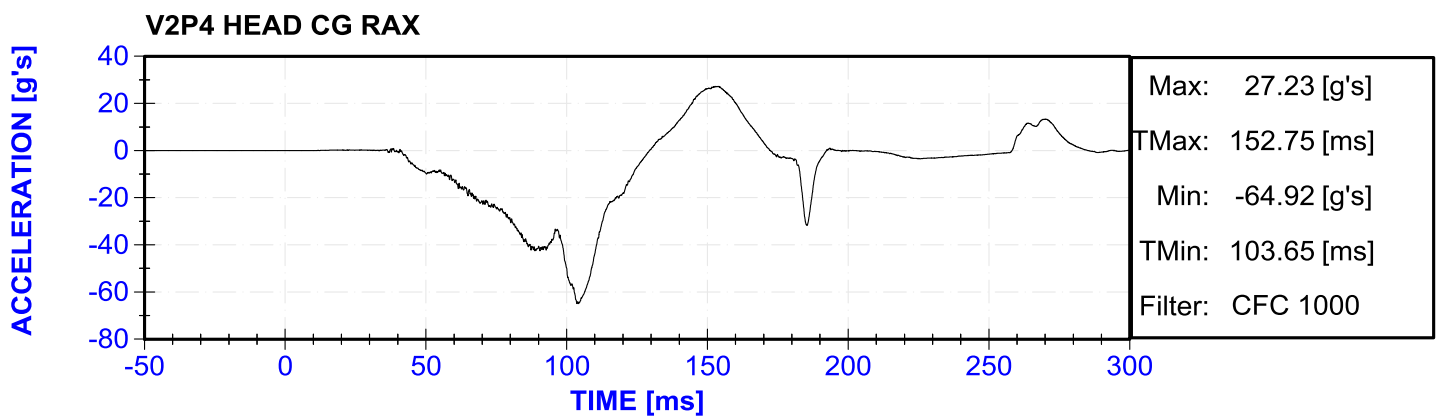
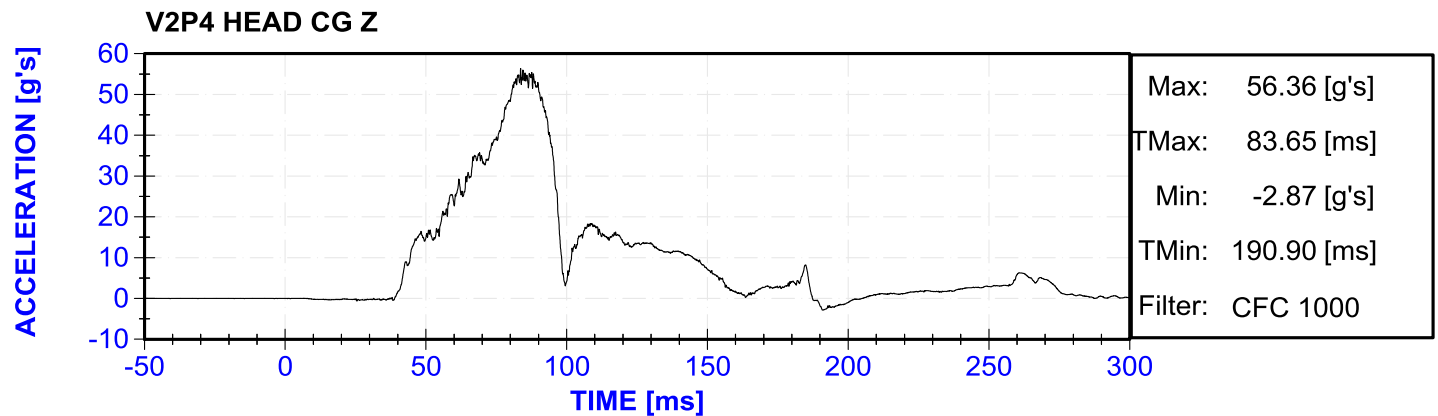
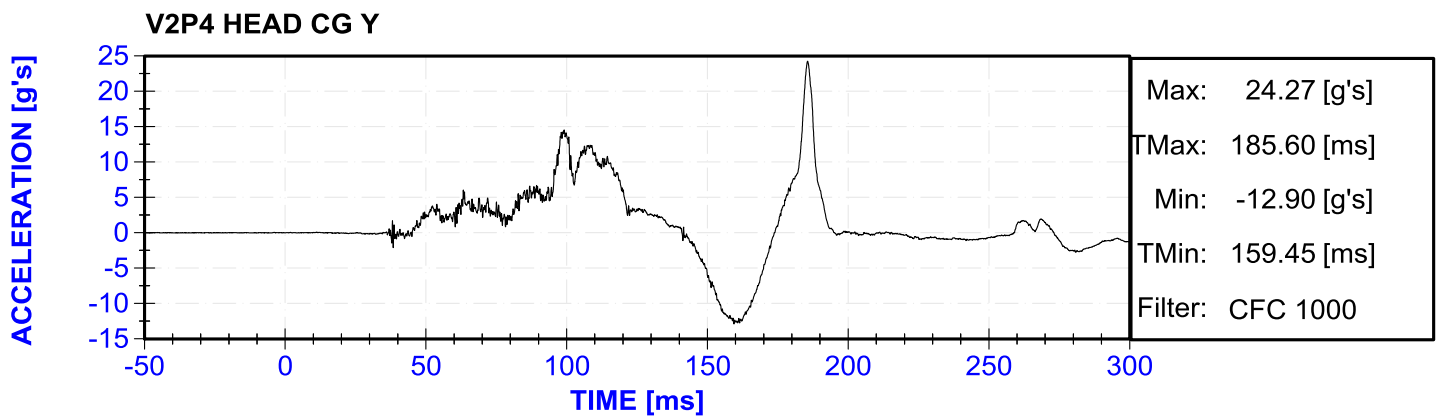
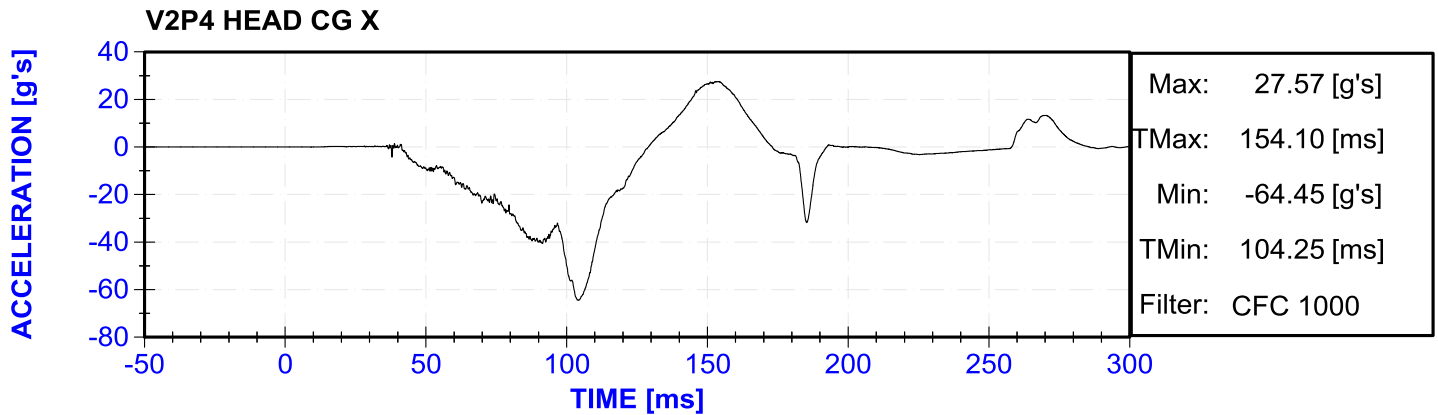


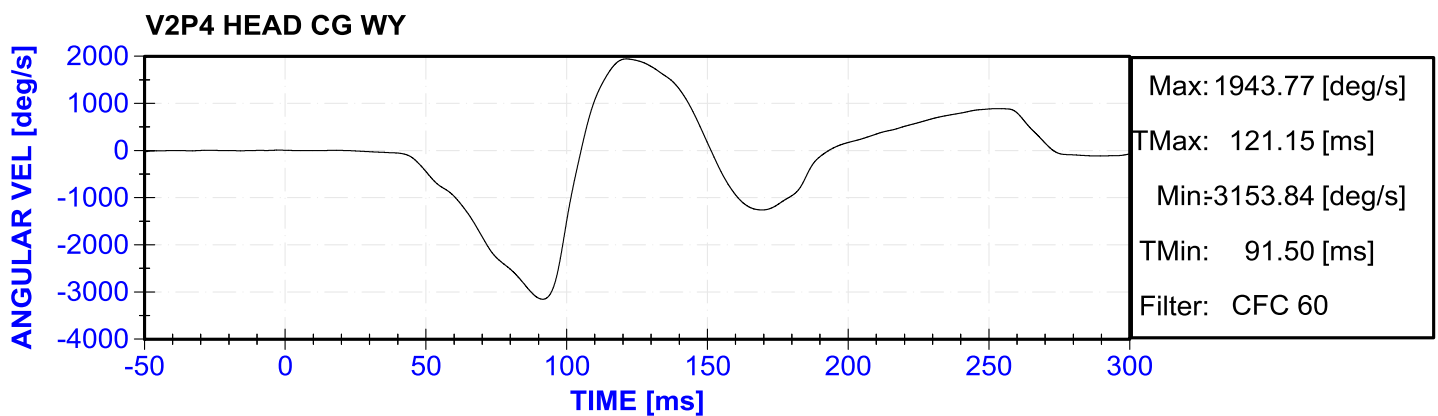
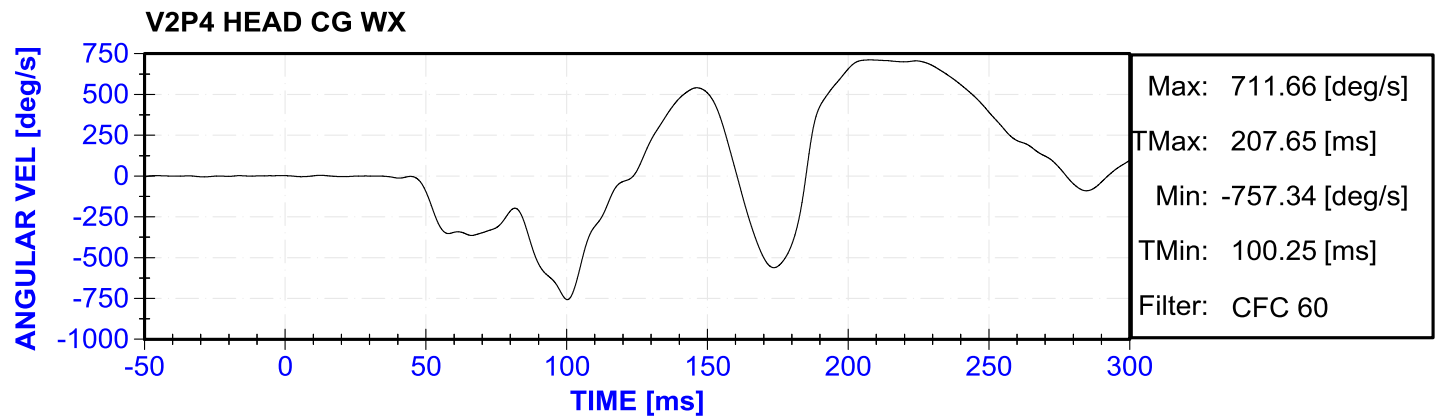
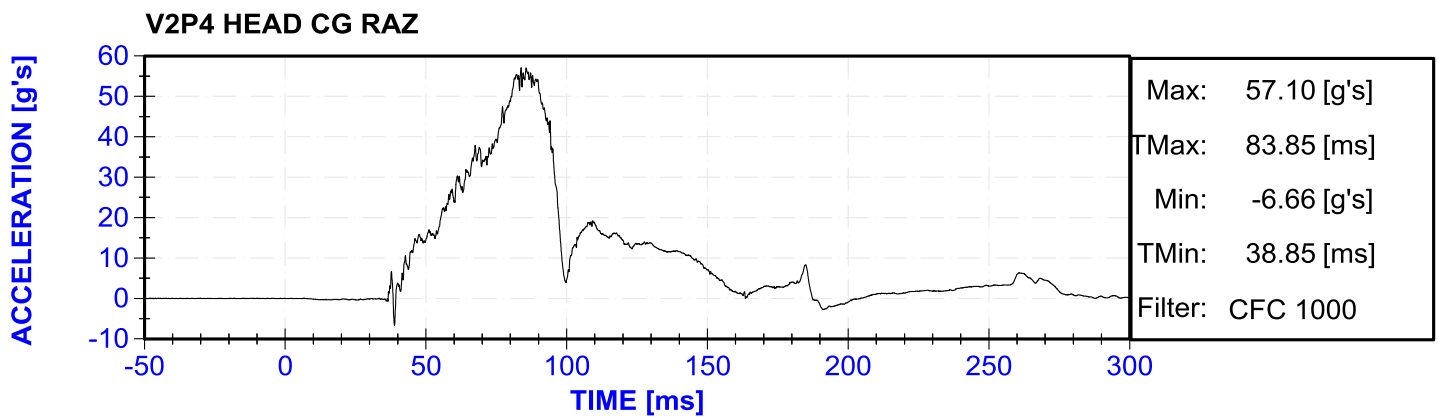
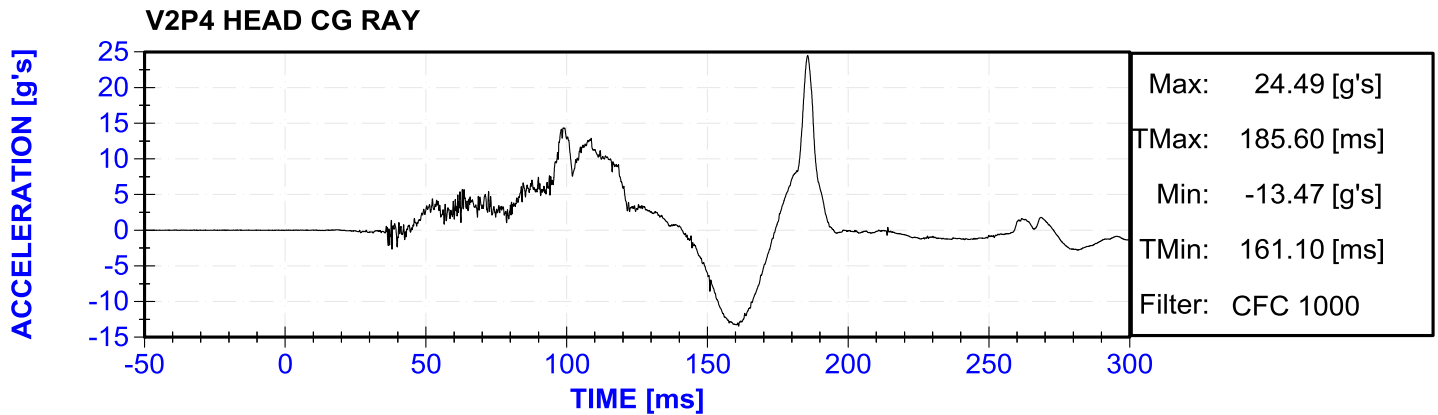


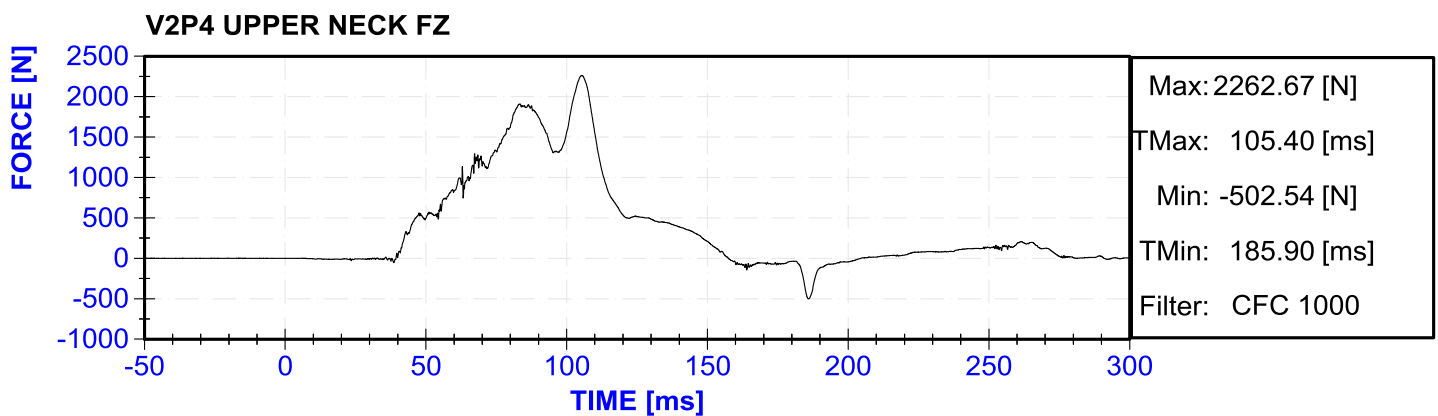
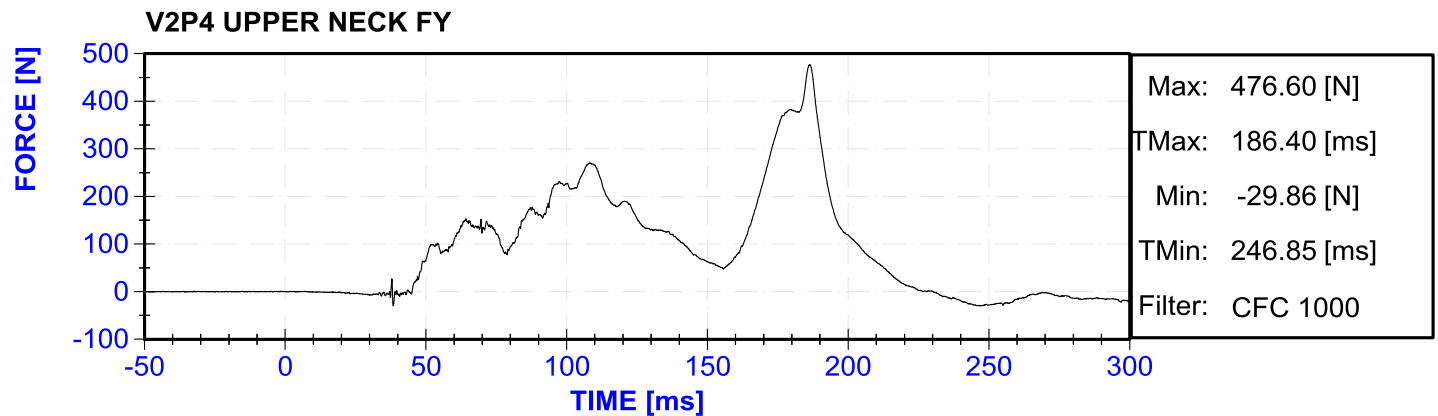
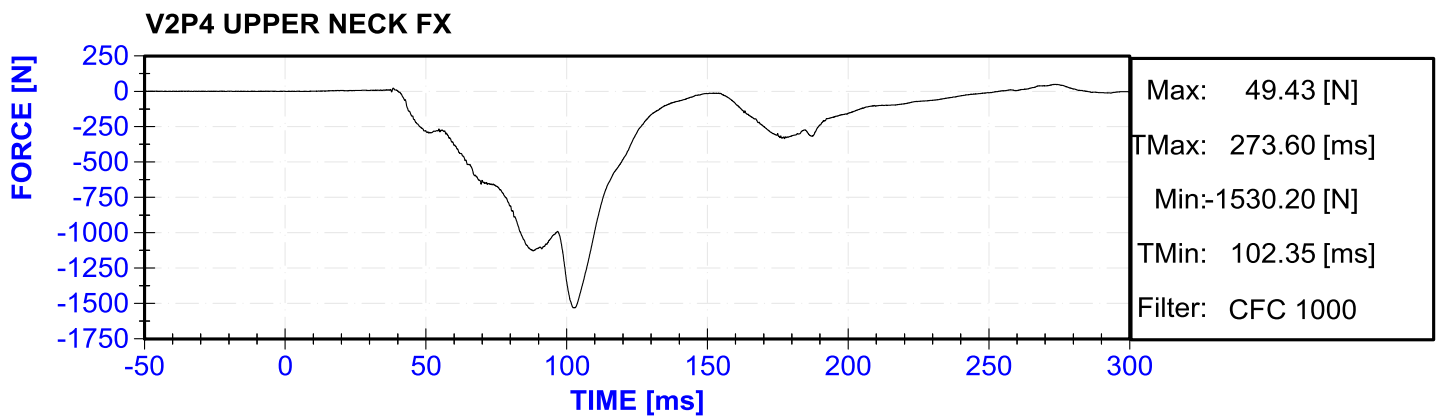
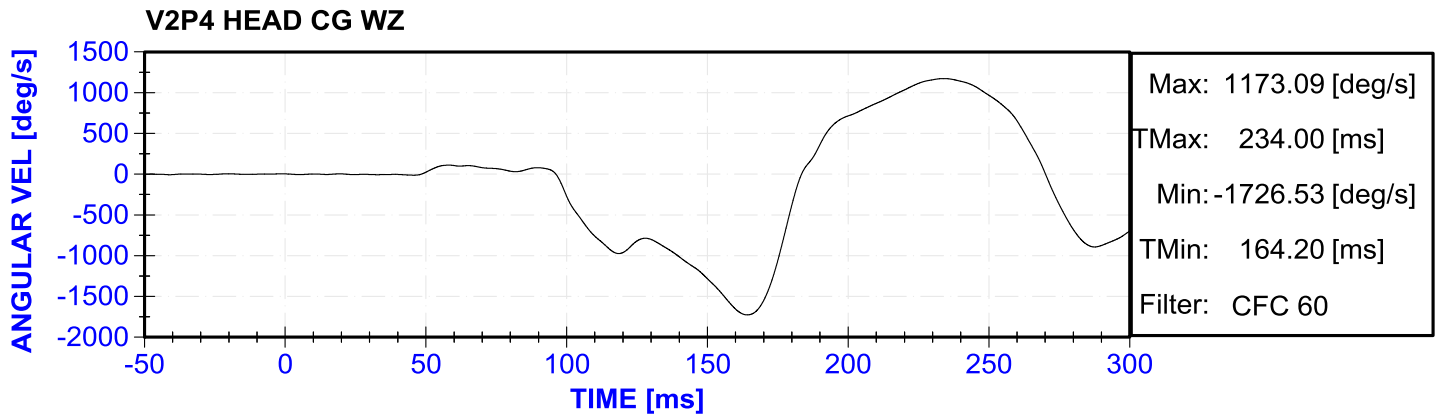


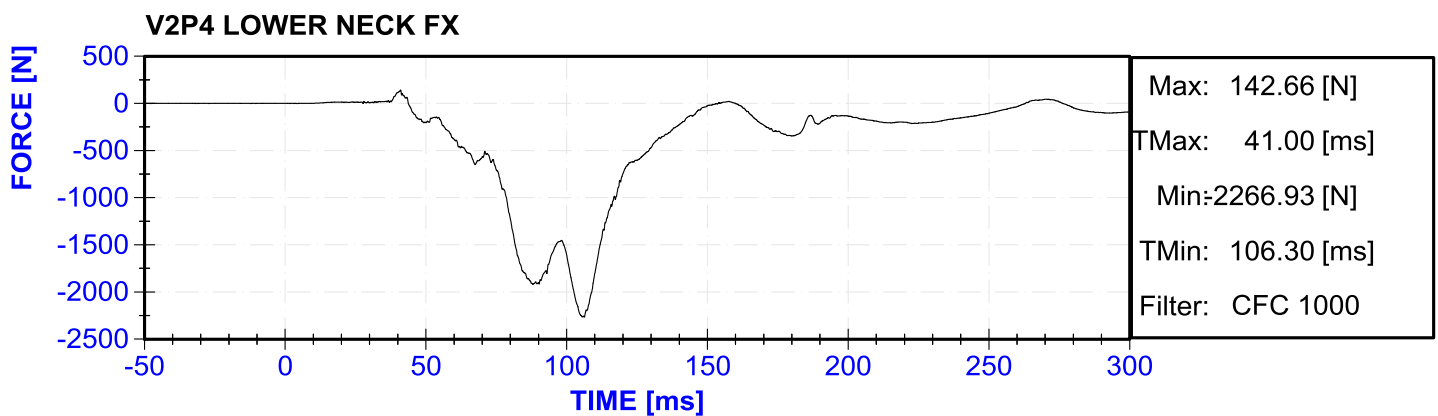
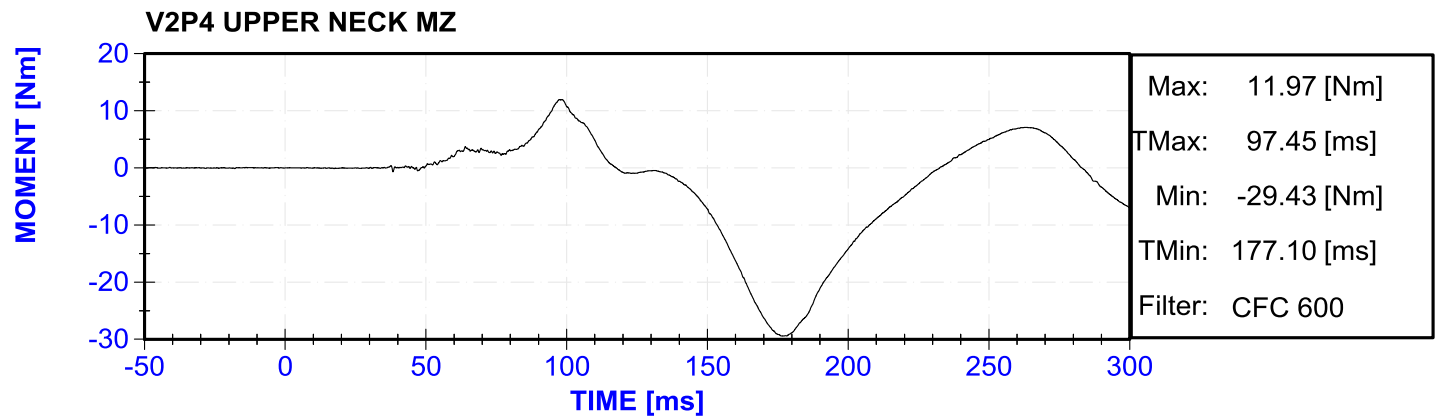
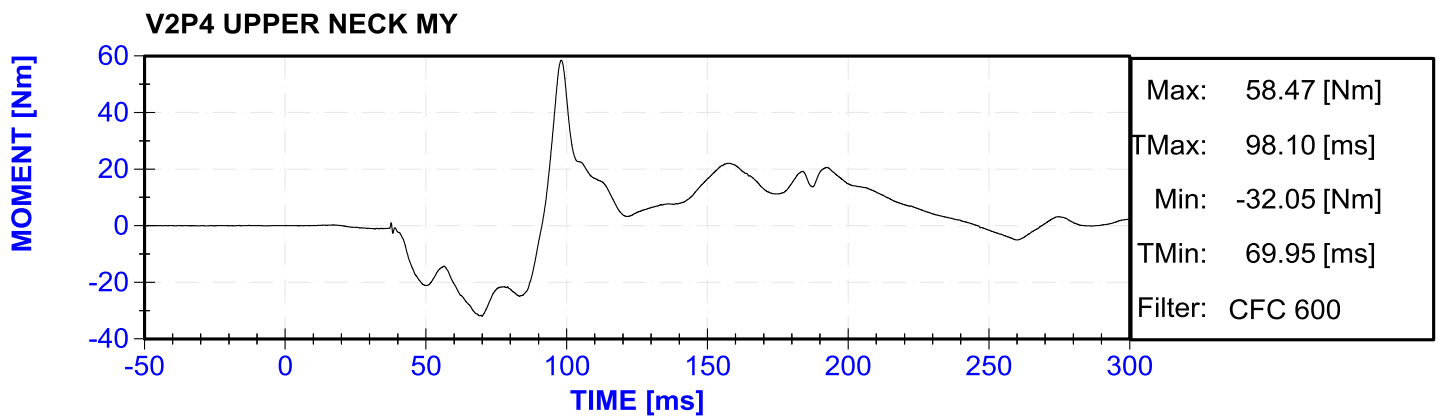
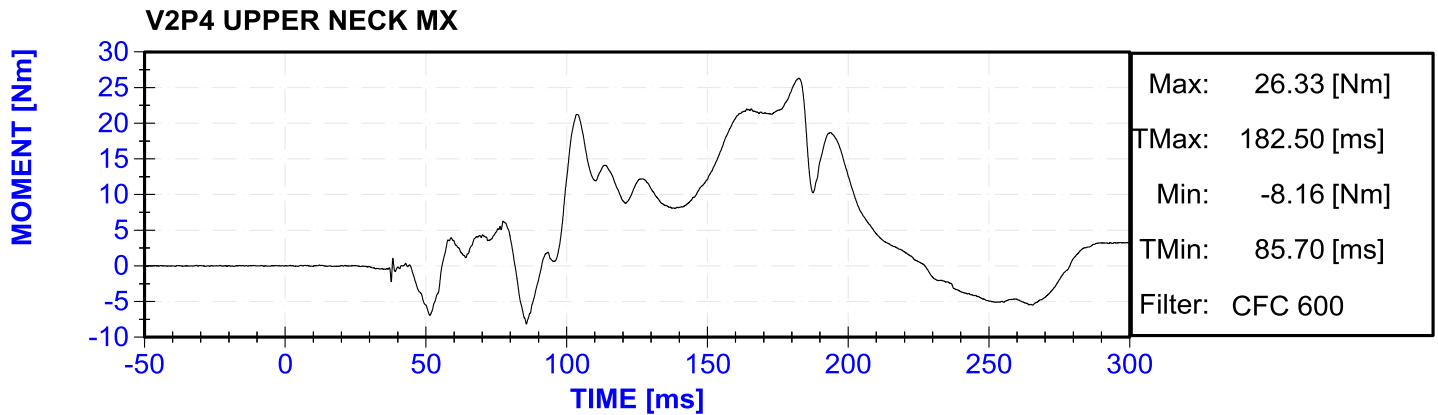


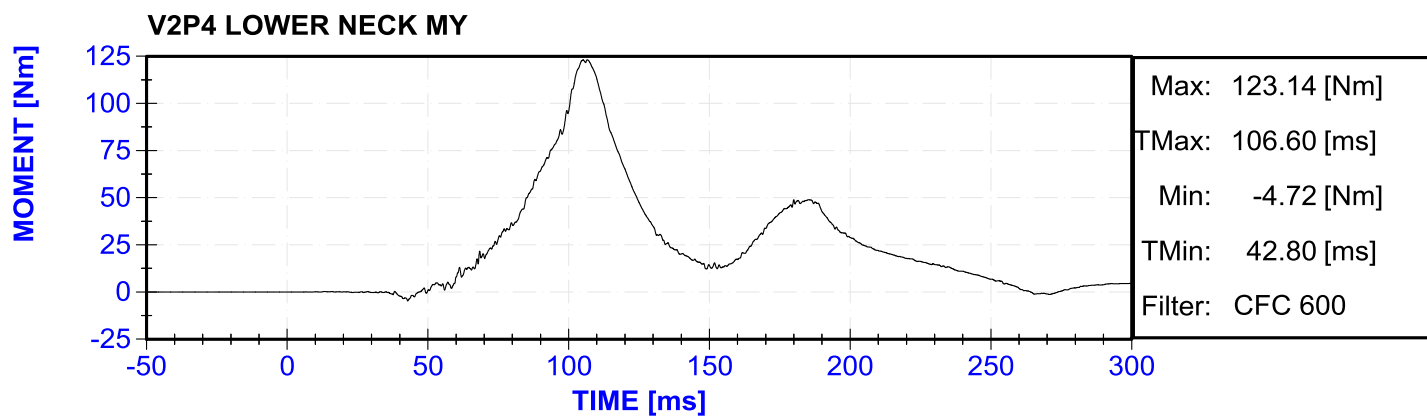
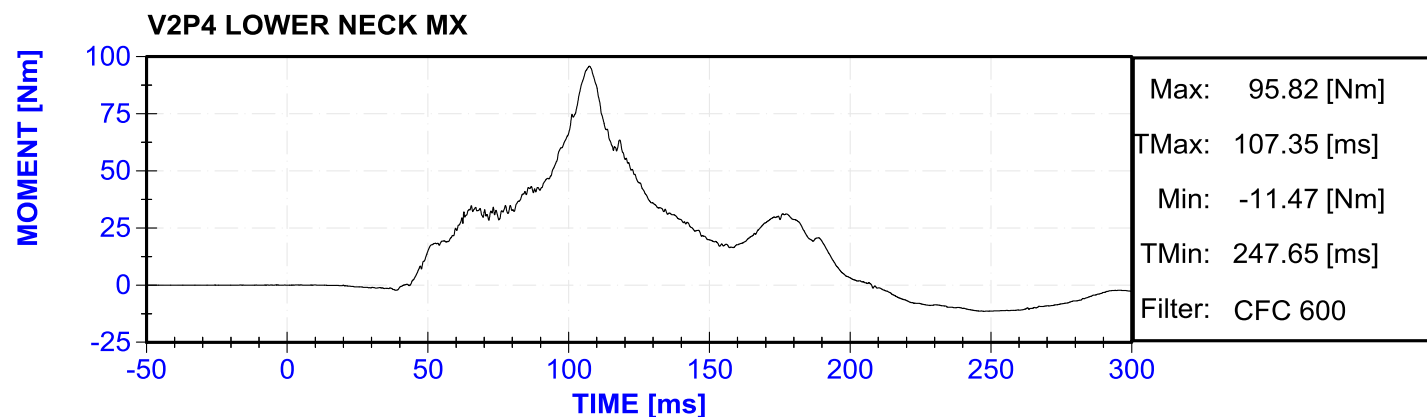
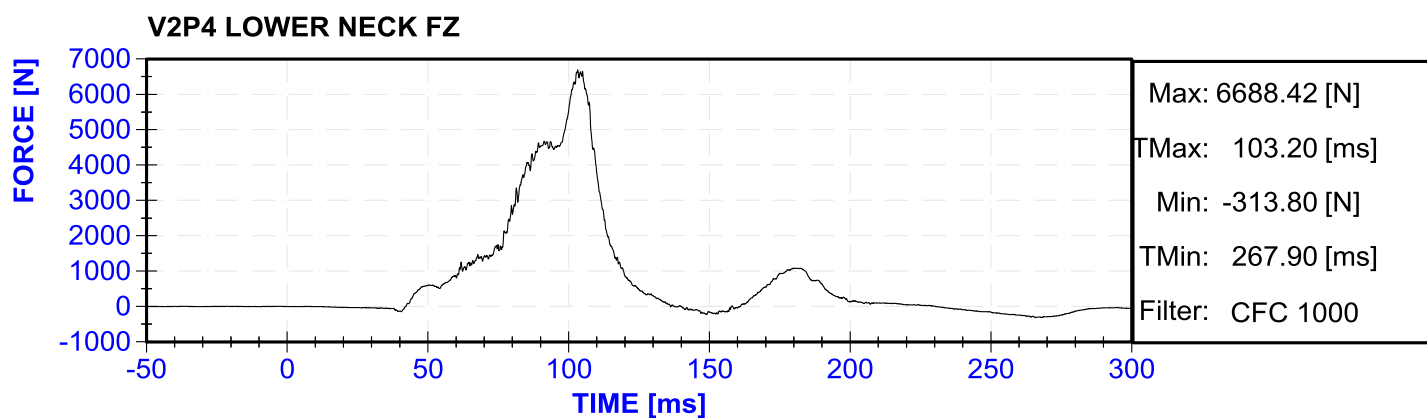
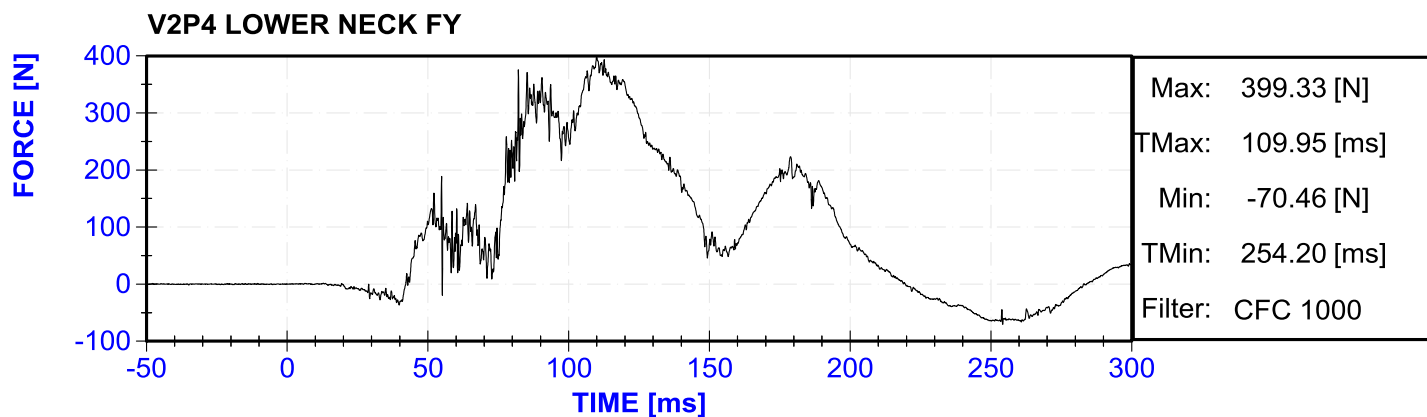


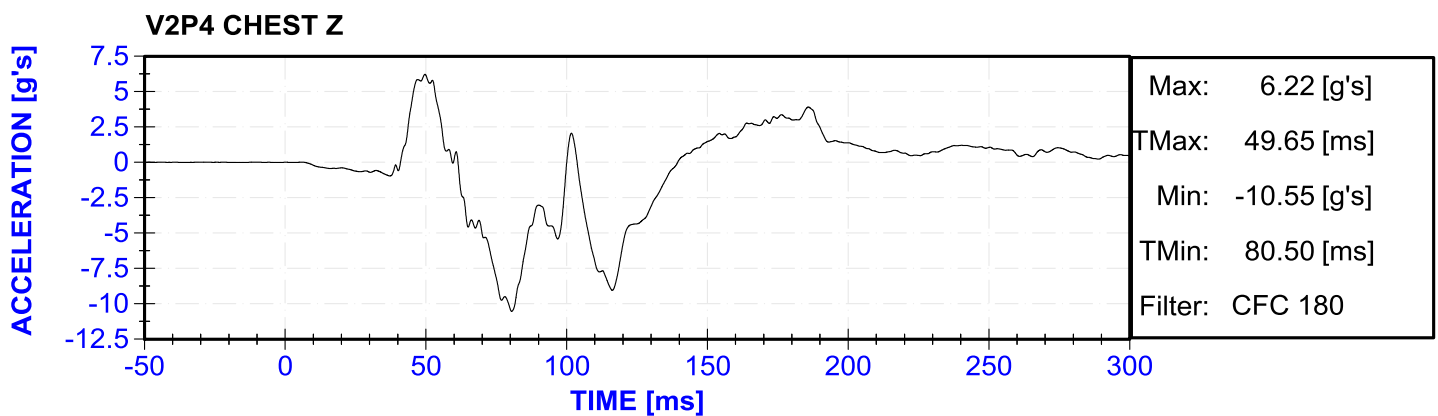
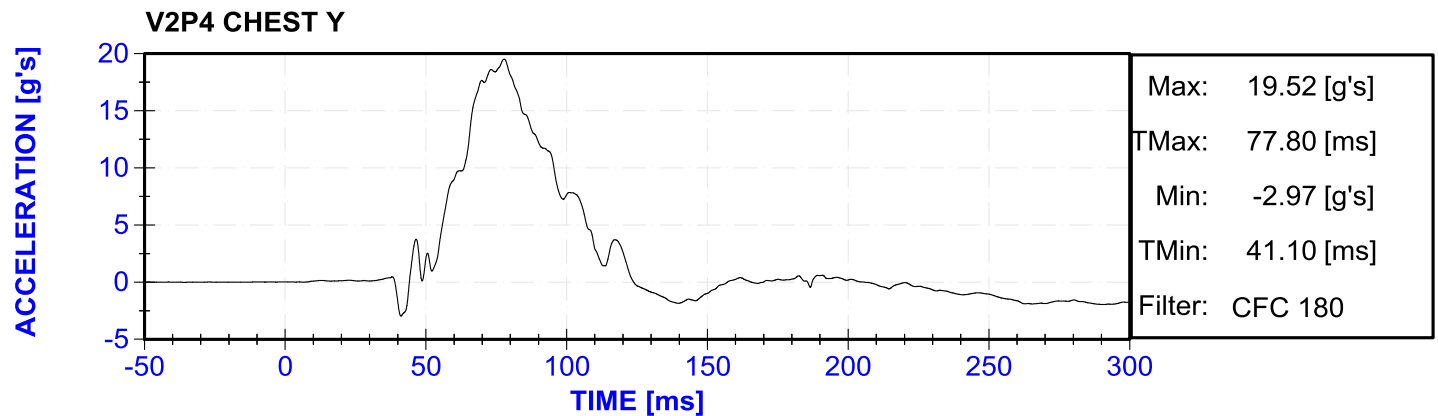
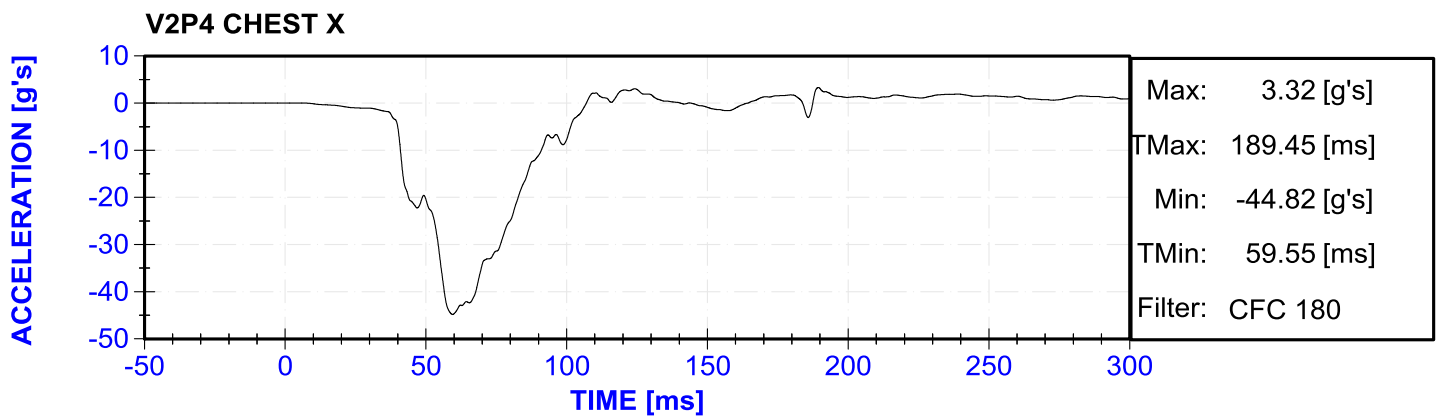
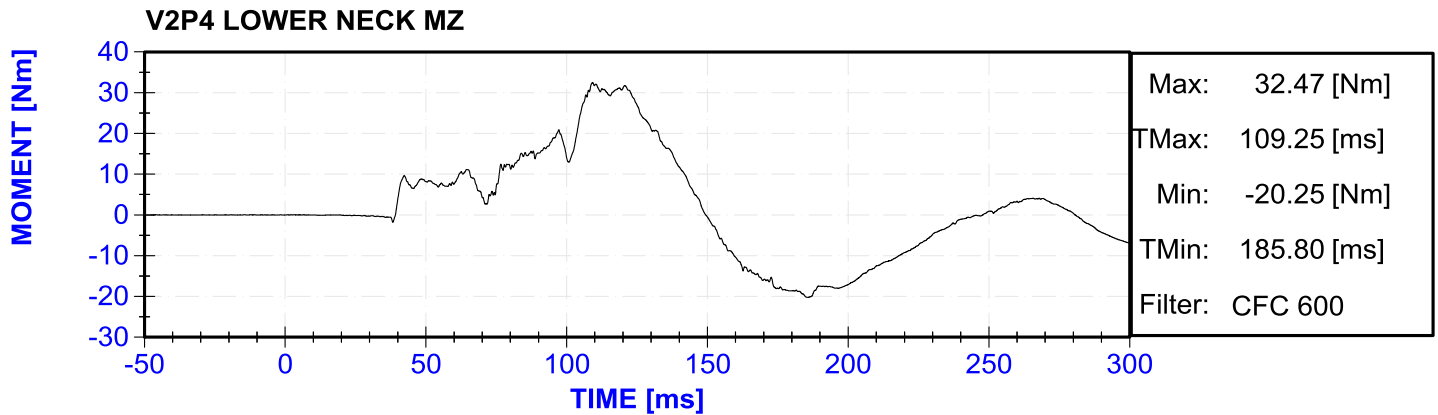


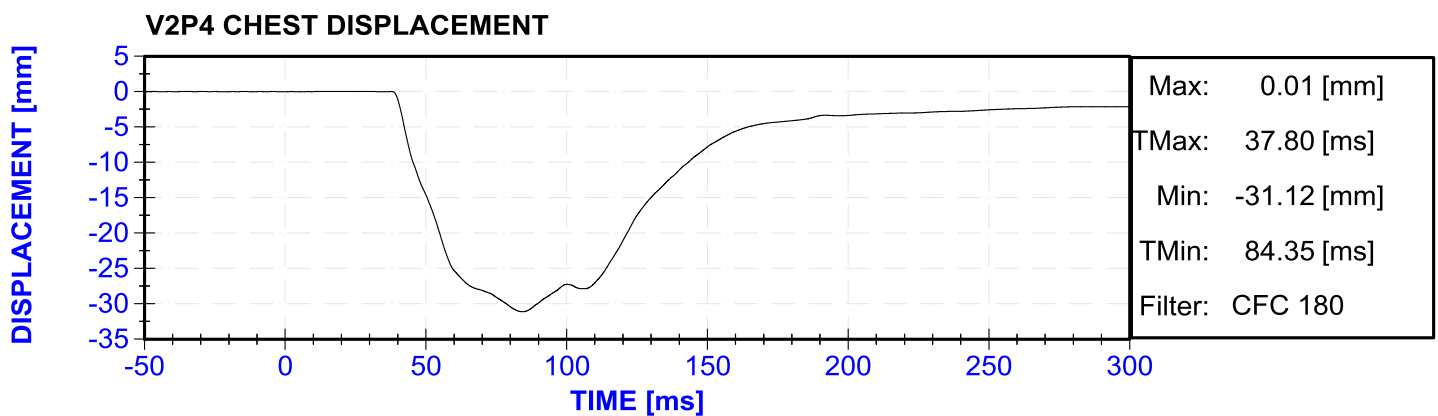
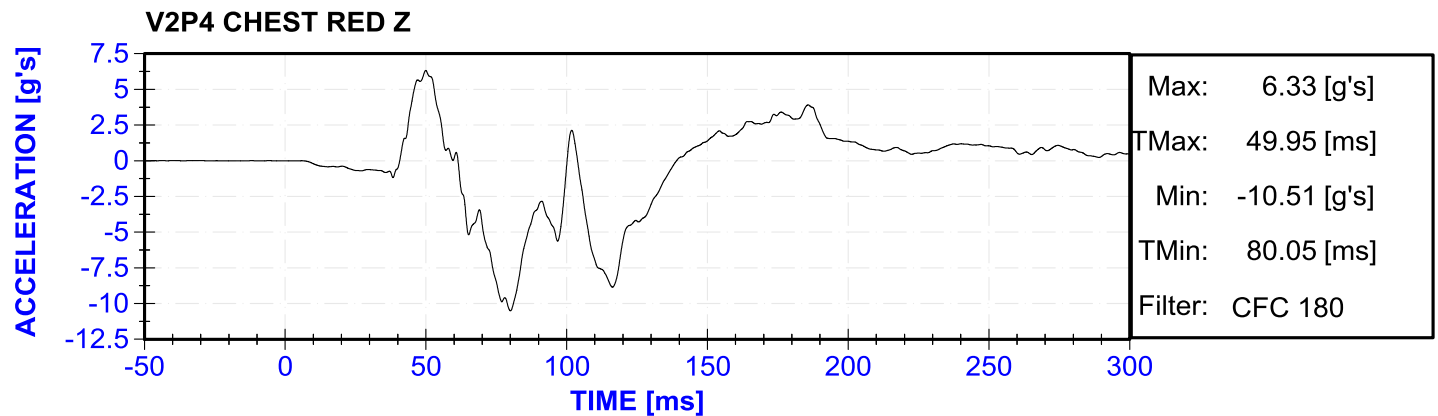
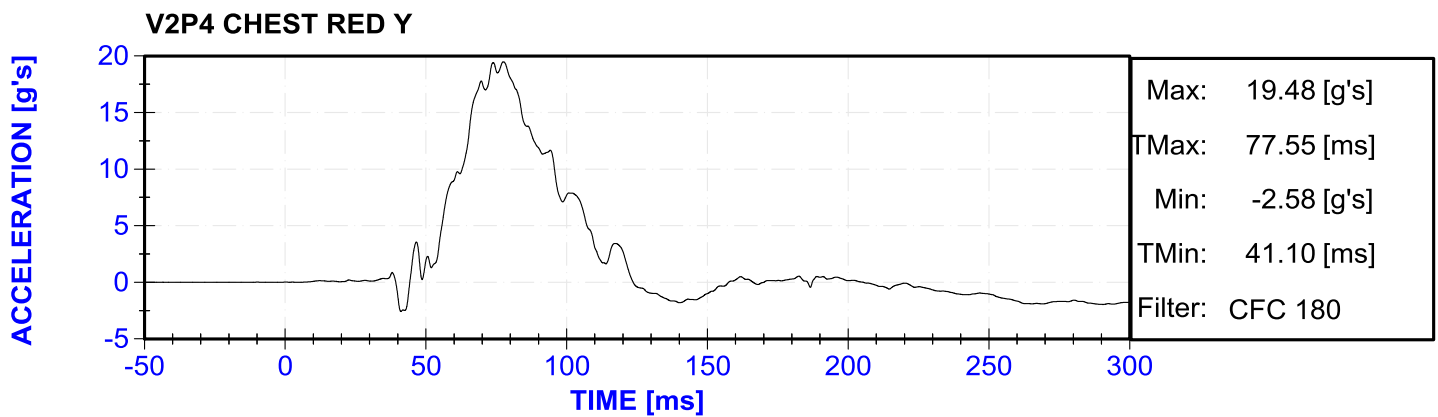
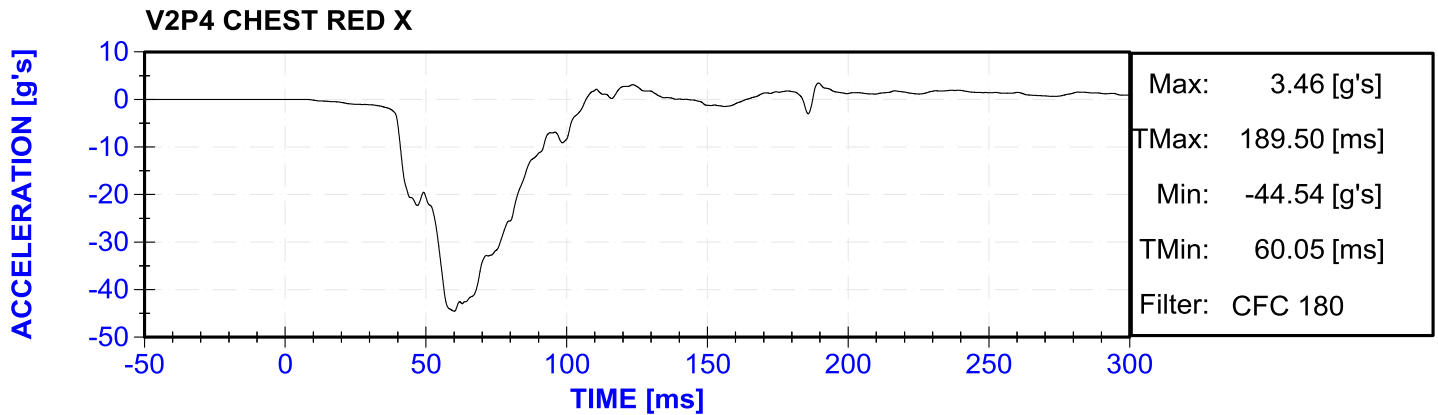




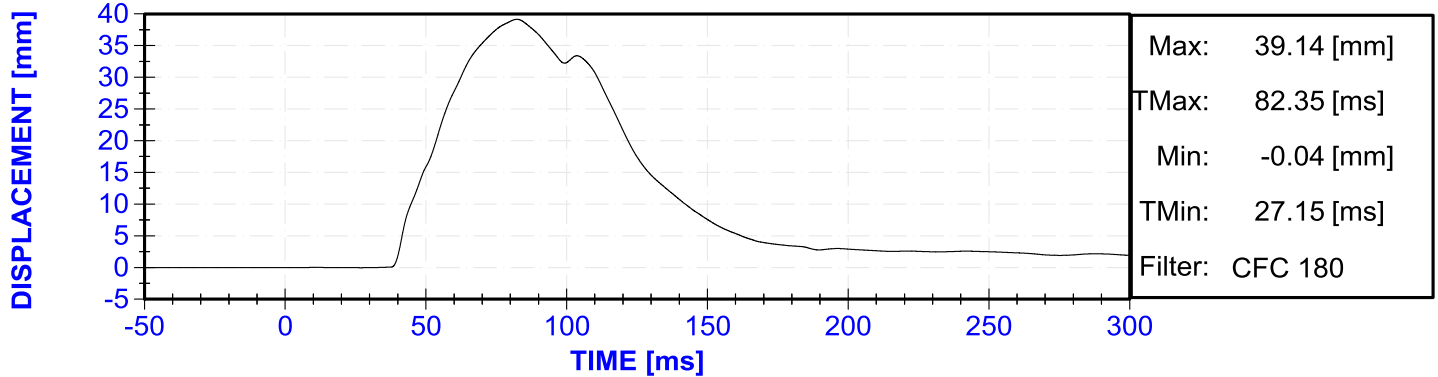




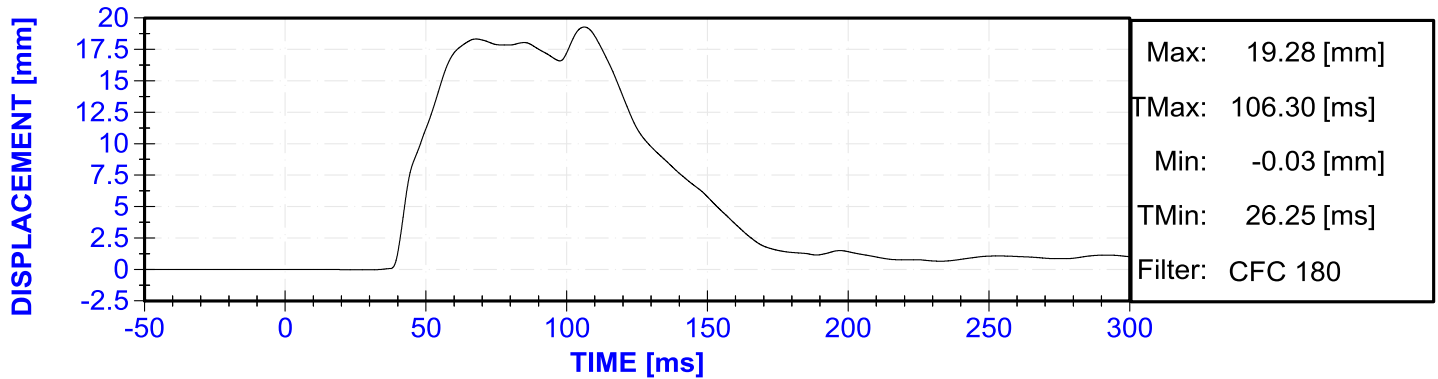




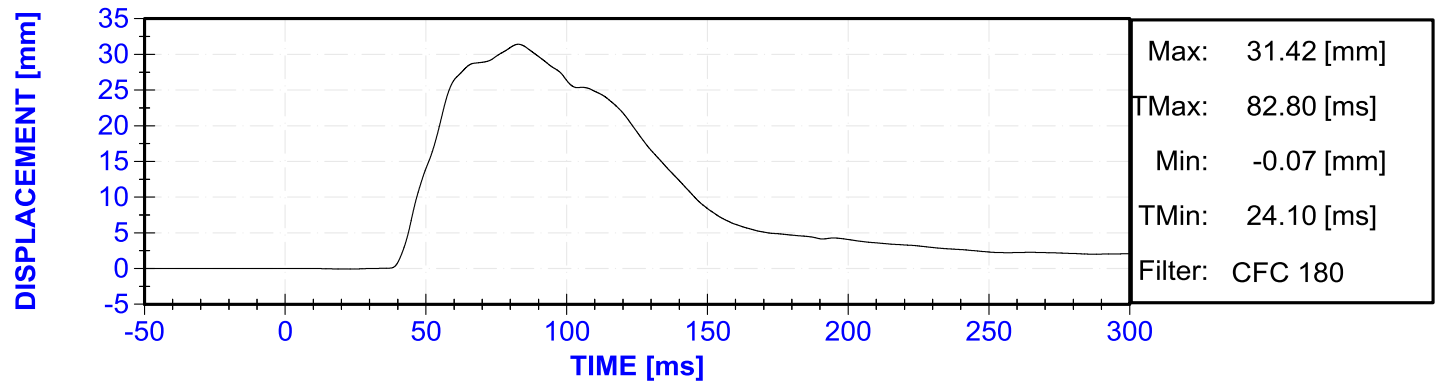
V2P4 8 STRING POD - UR TOP



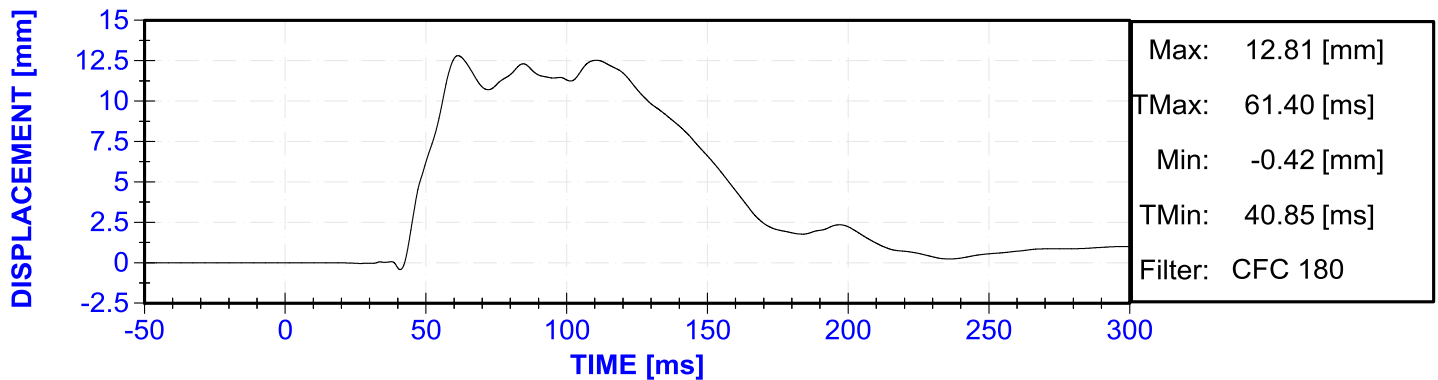
V2P4 8 STRING POD - UR MID

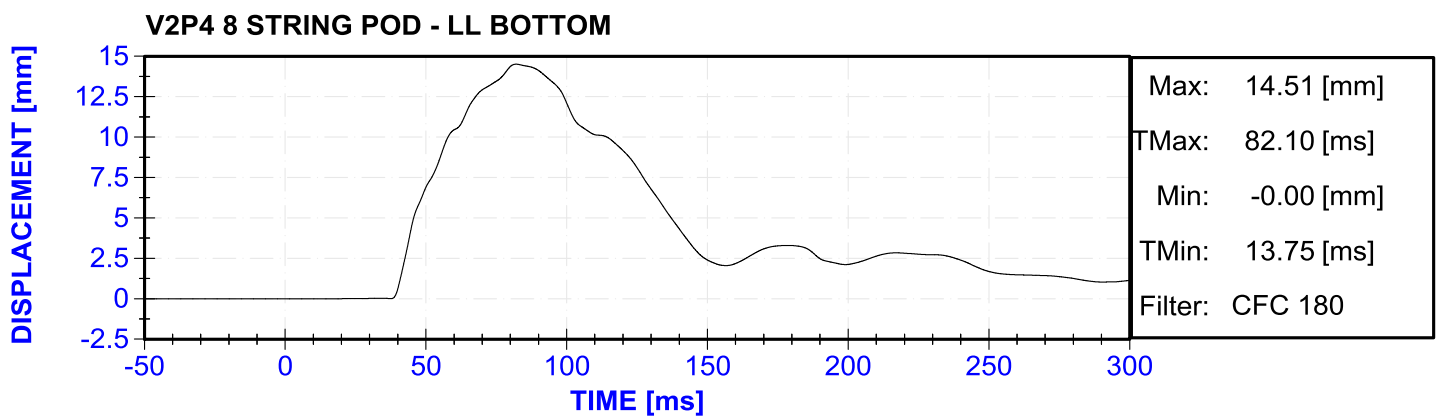
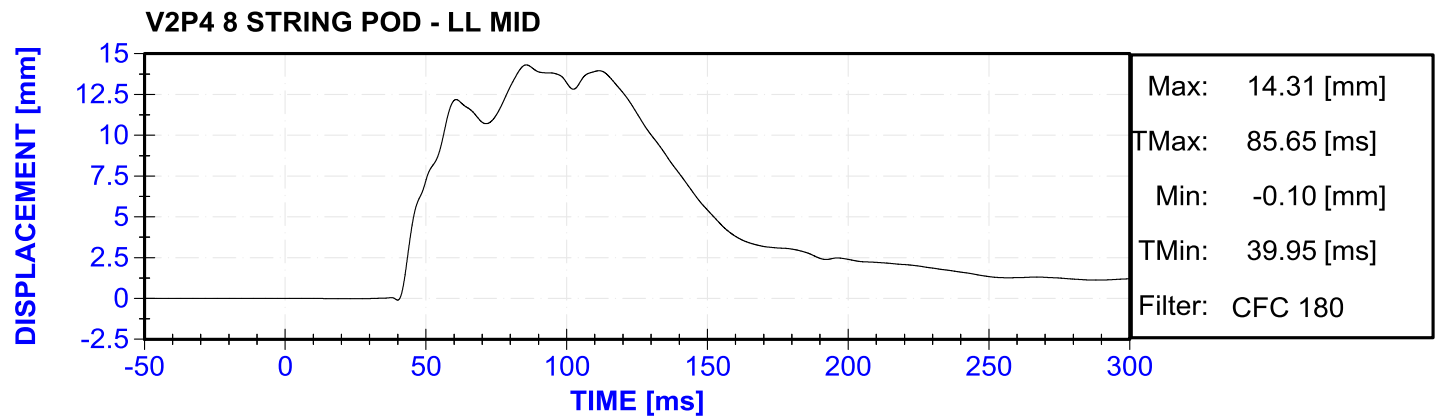
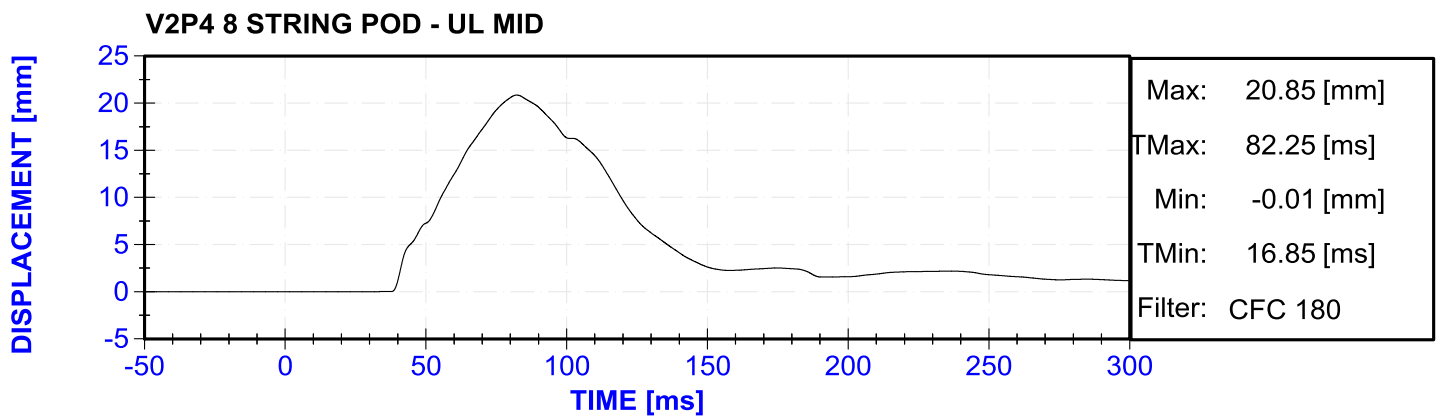
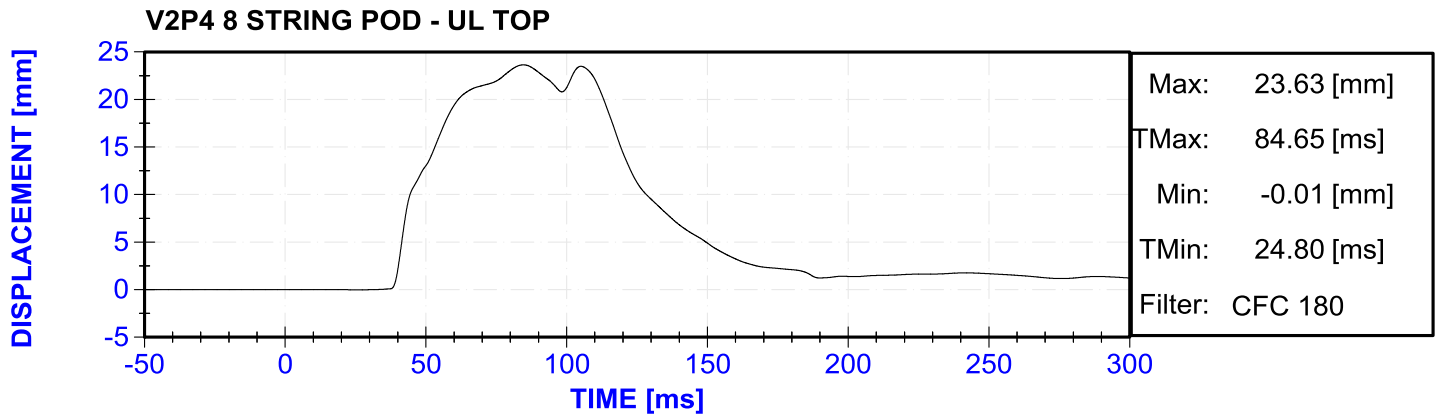


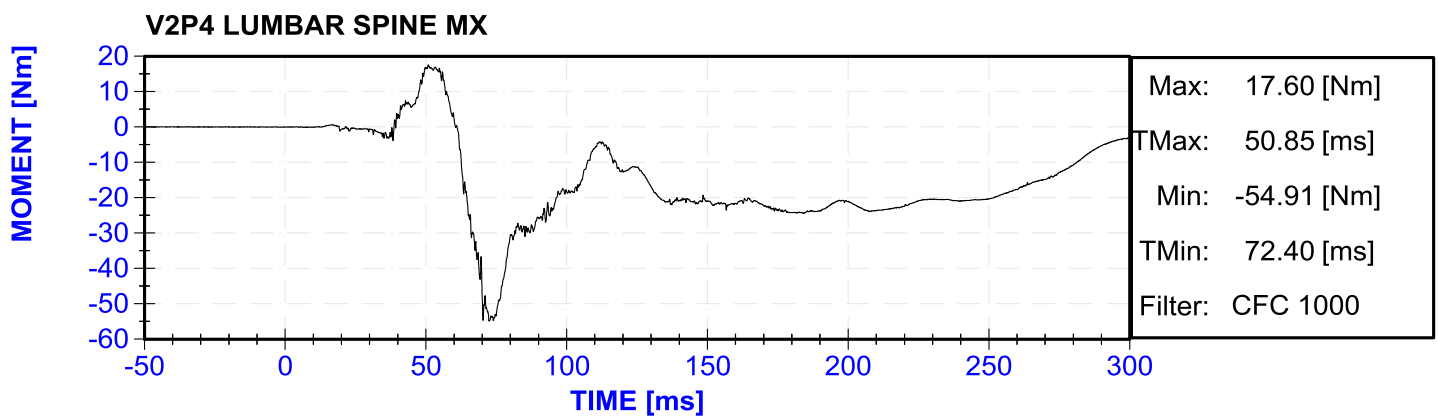
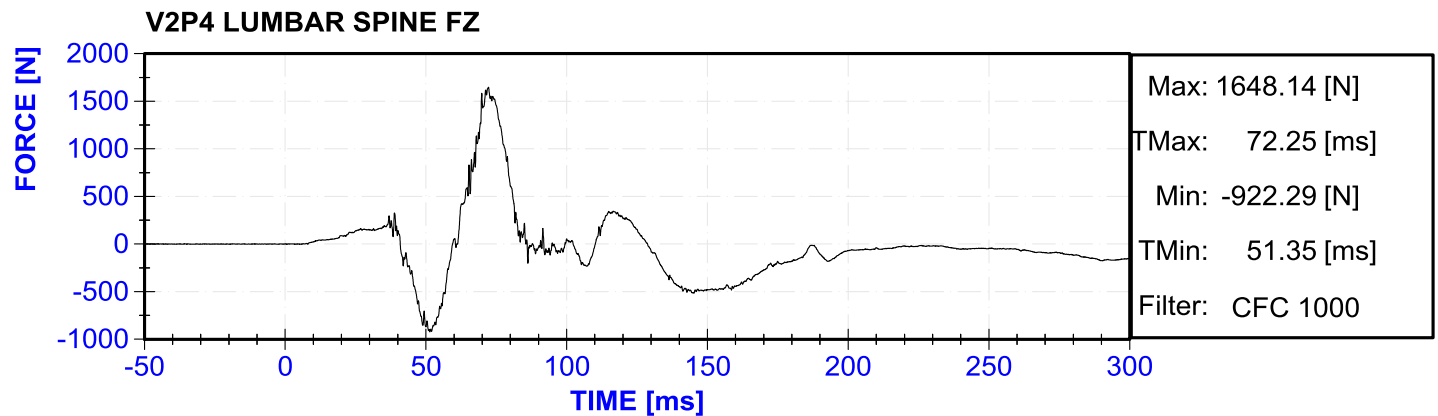
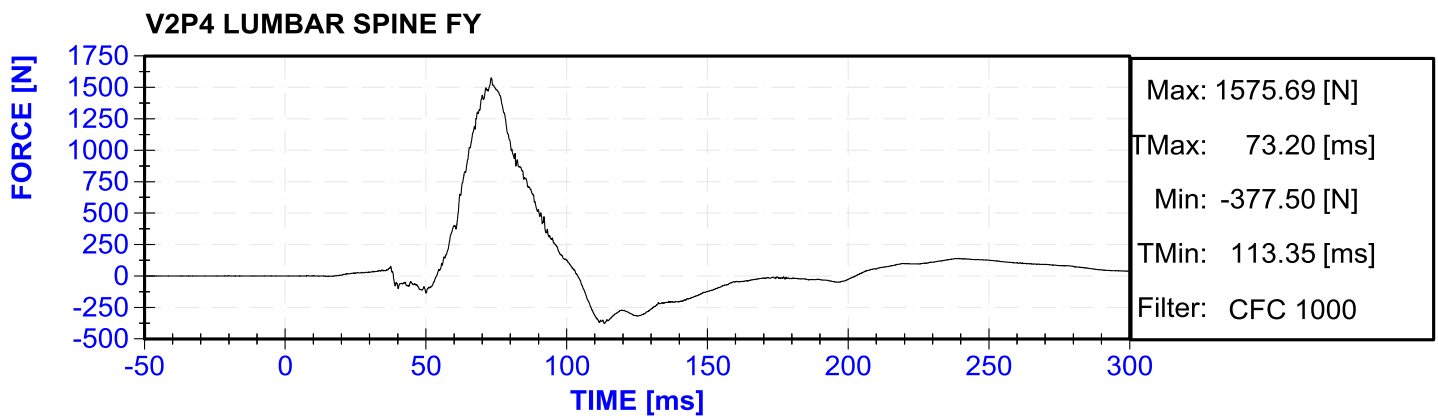
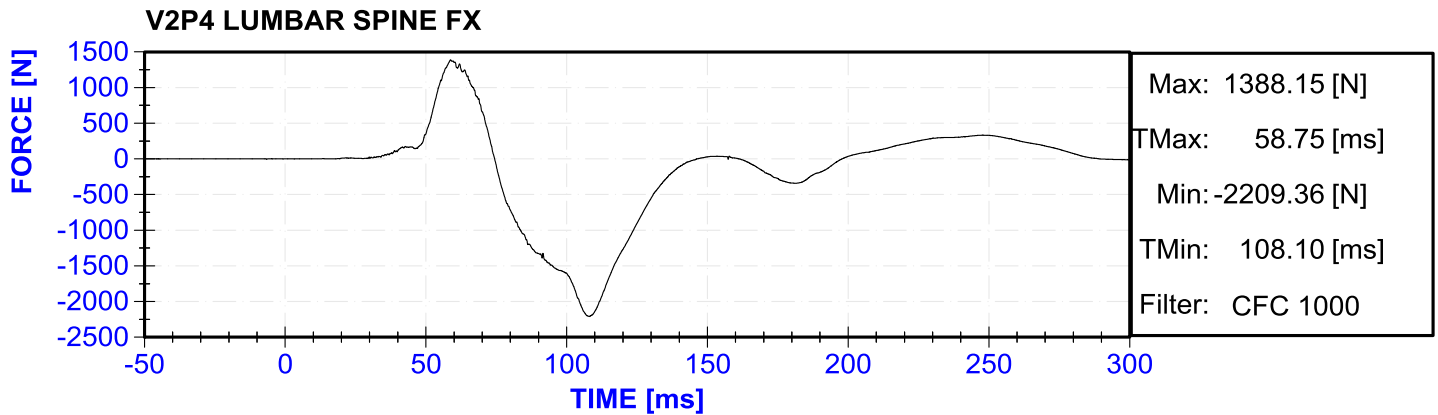
V2P4 8 STRING POD - LR MID



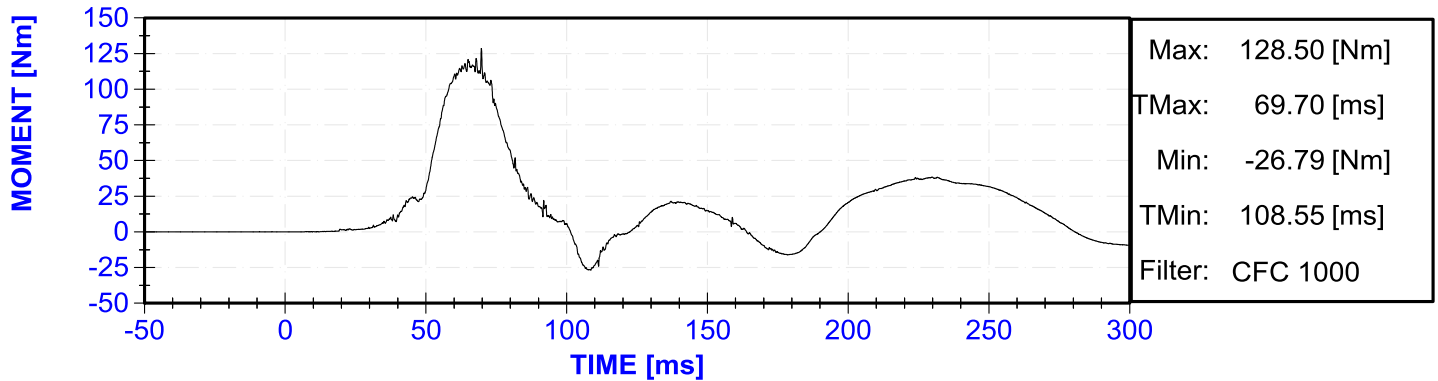
V2P4 8 STRING POD - LR BOTTOM



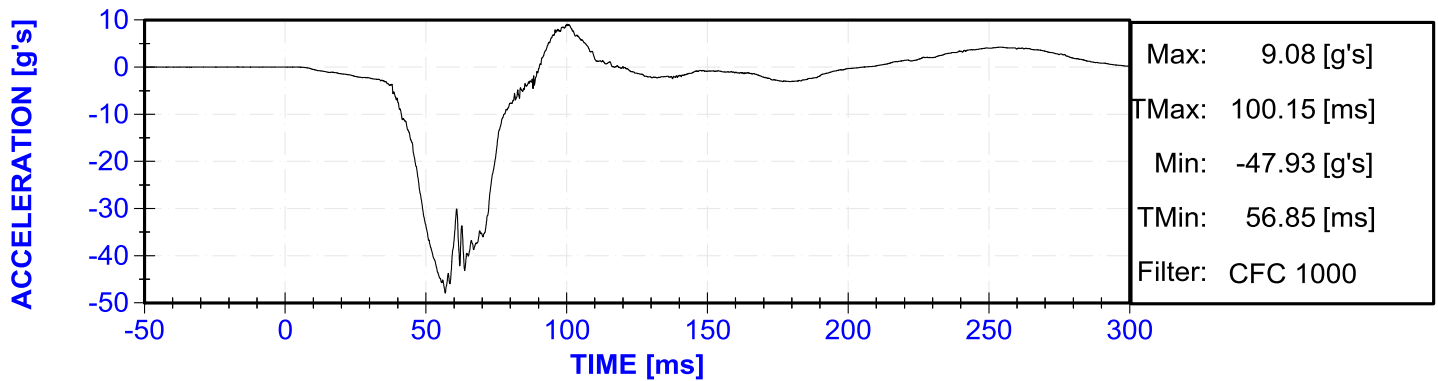




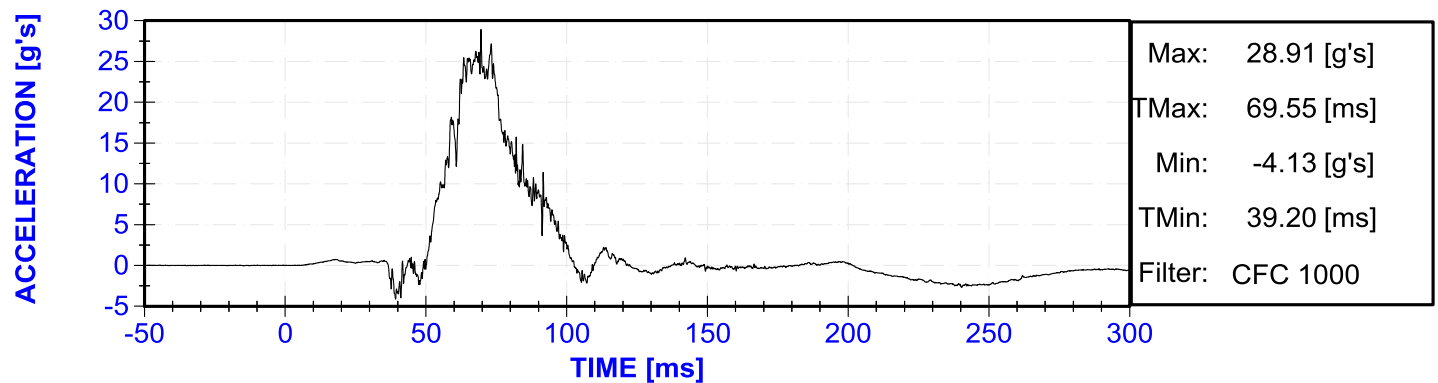
V2P4 LUMBAR SPINE MY



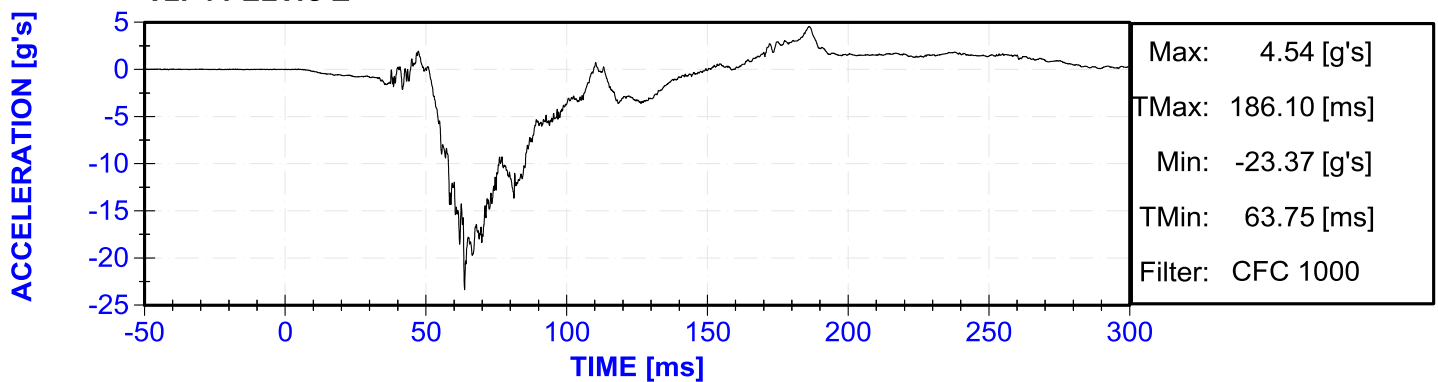
V2P4 PELVIC X

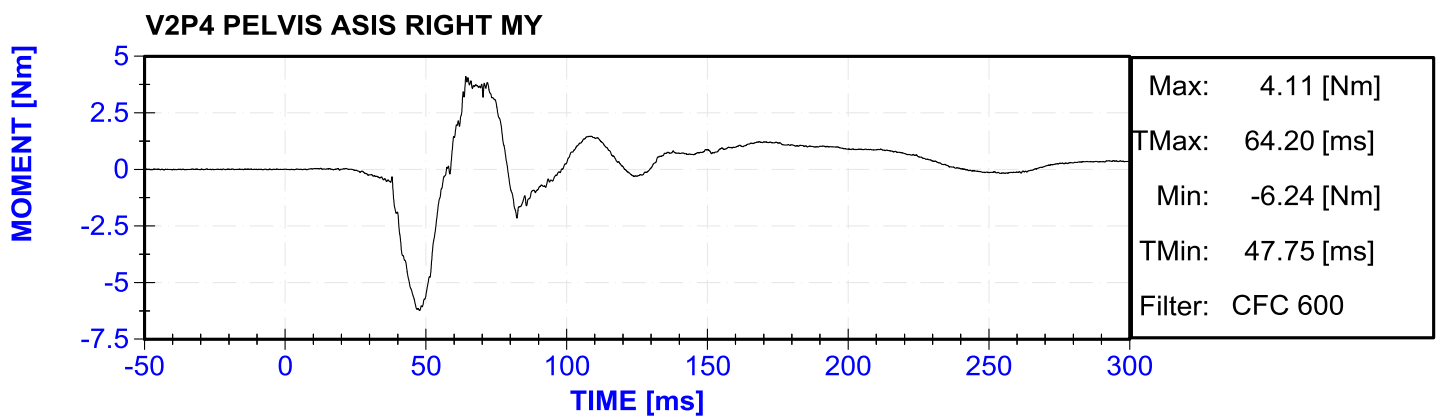
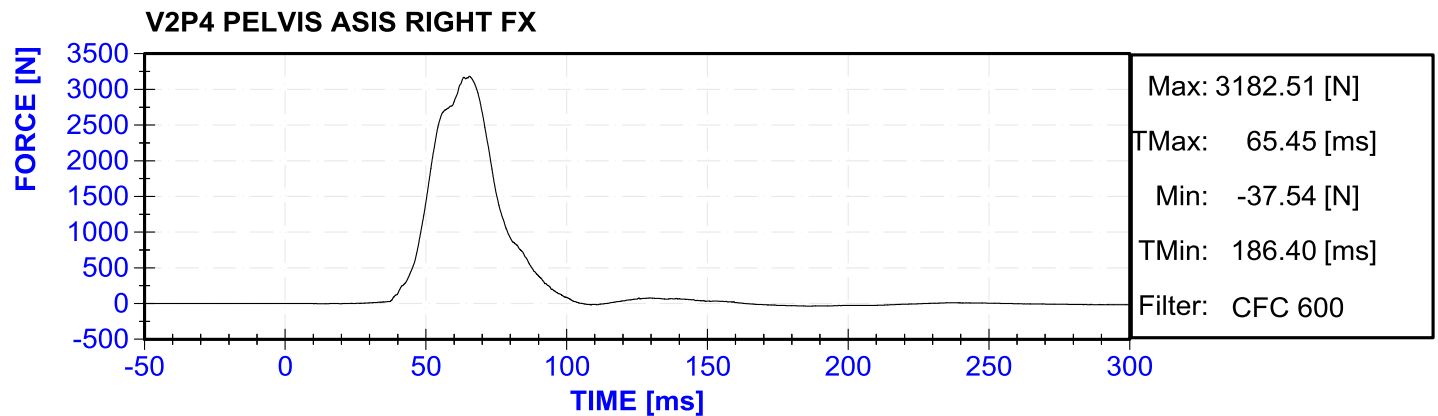
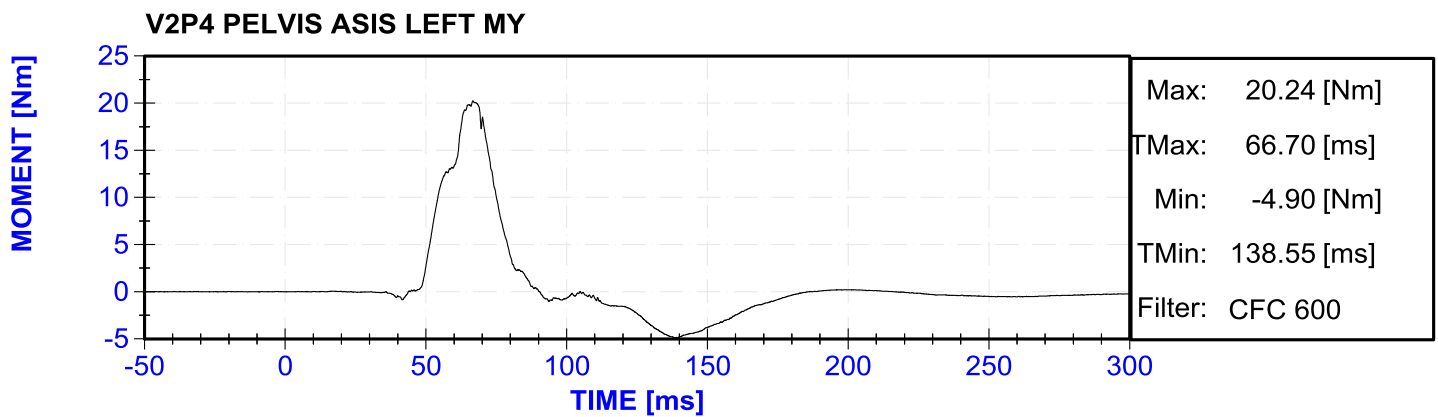
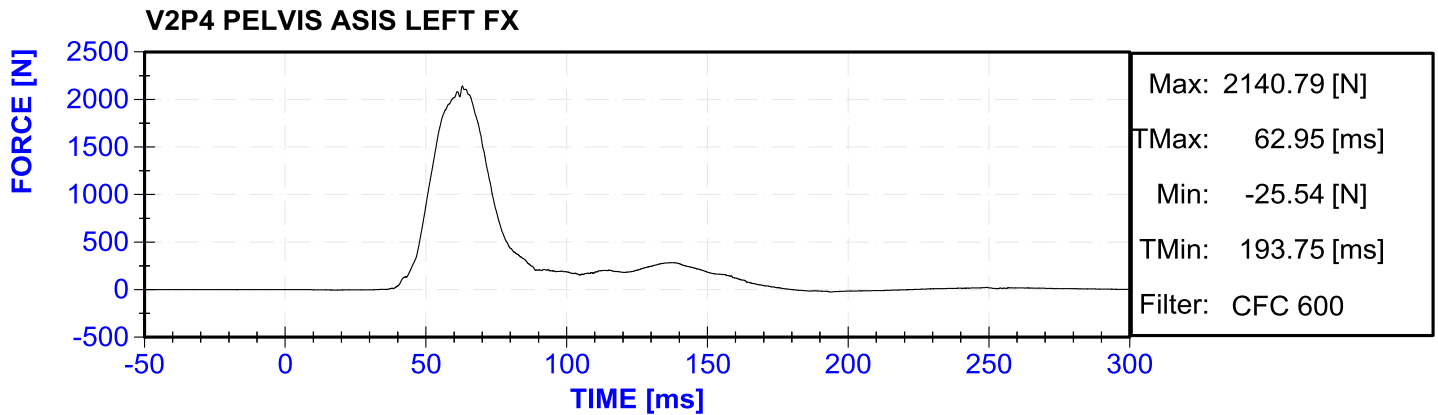


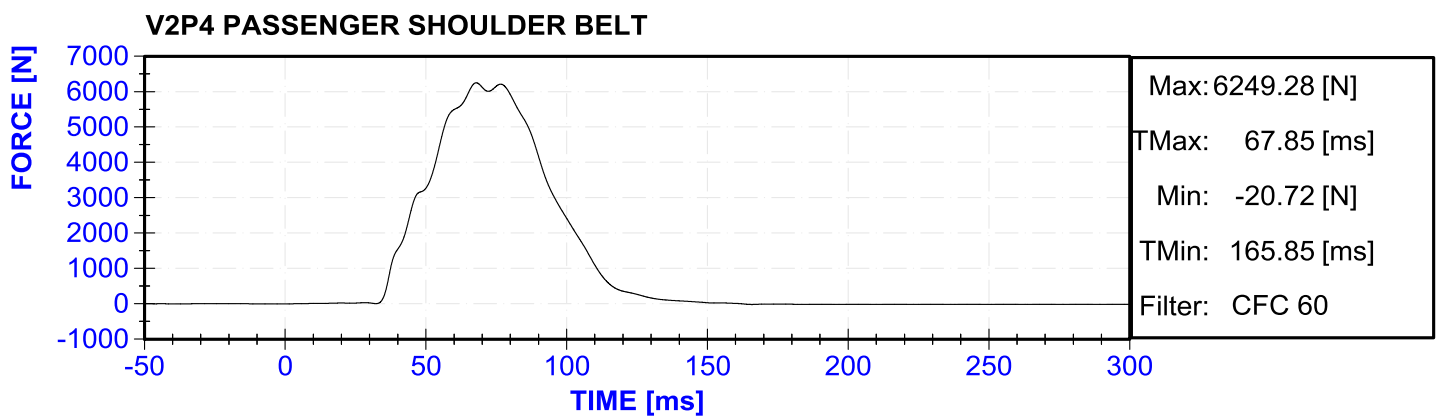
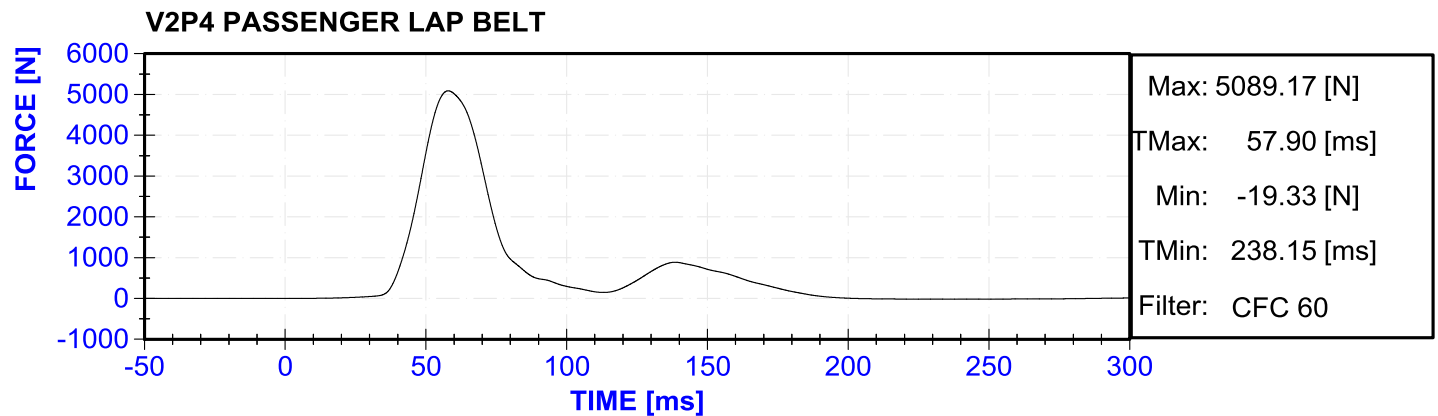
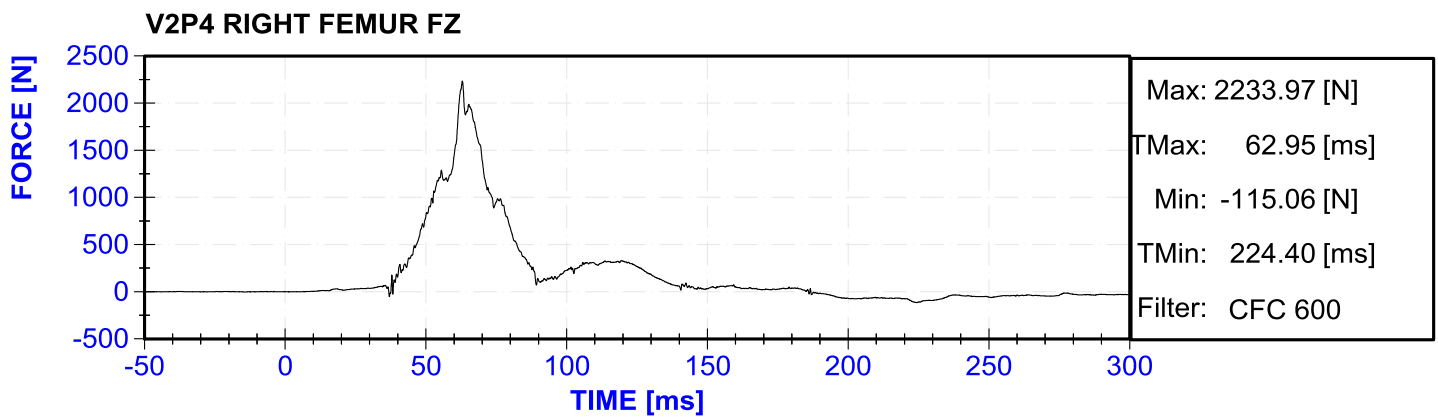
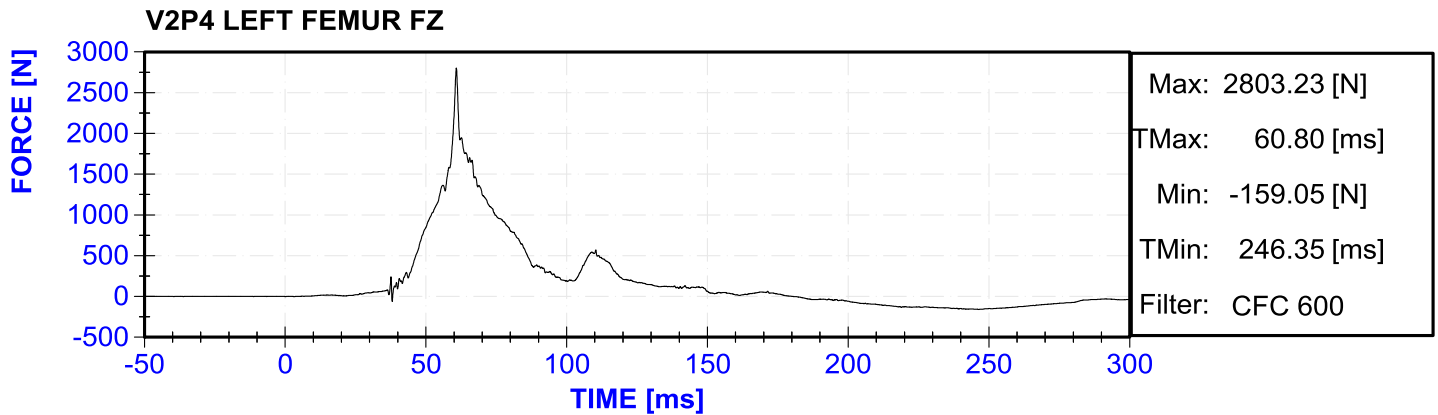
V2P4 PELVIC Y

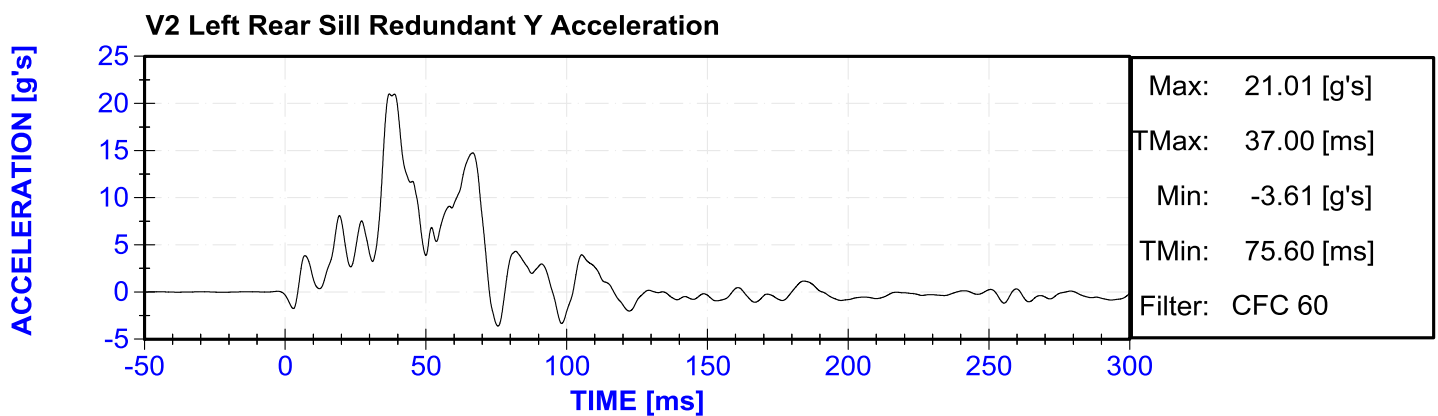
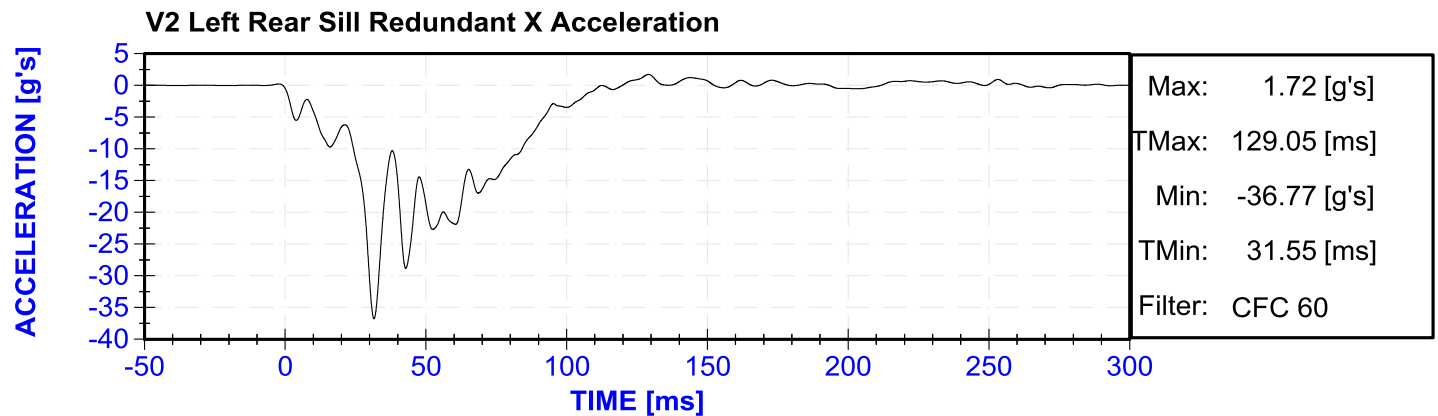
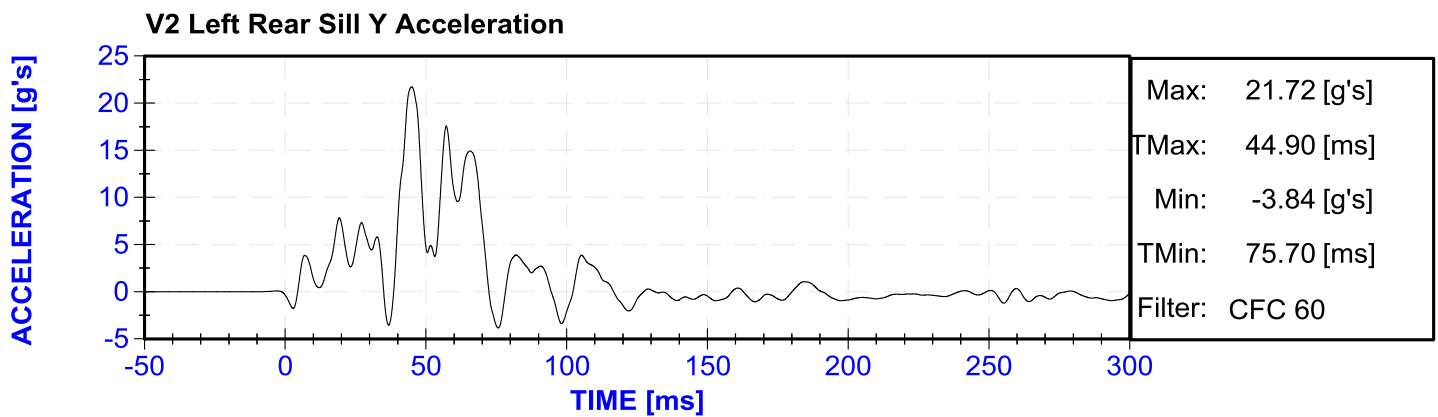
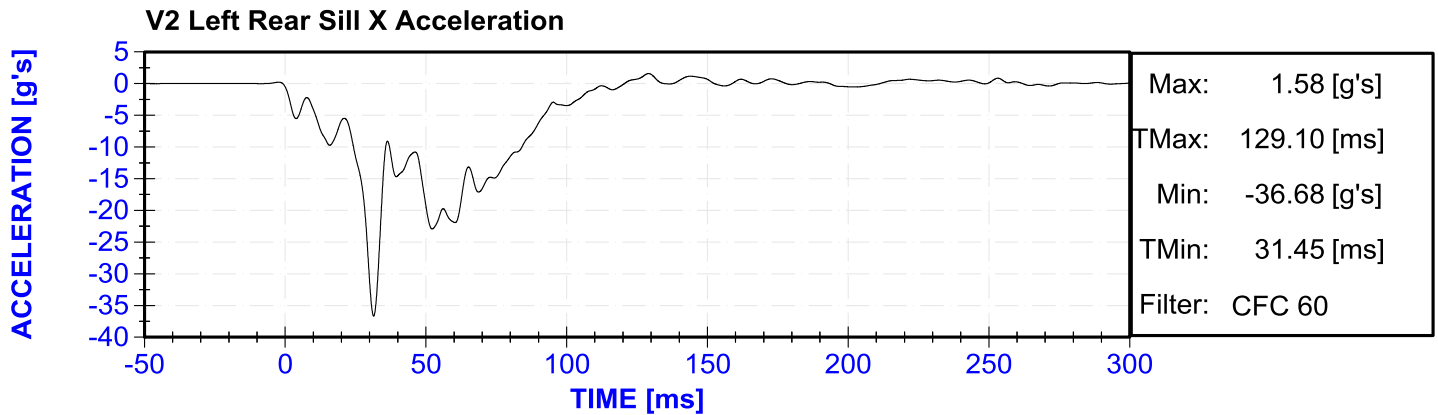


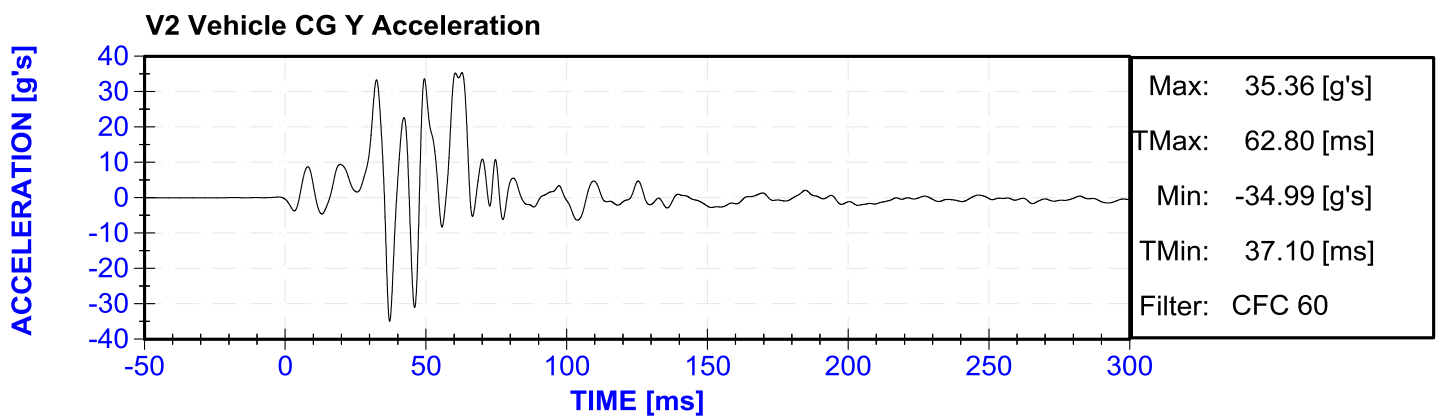
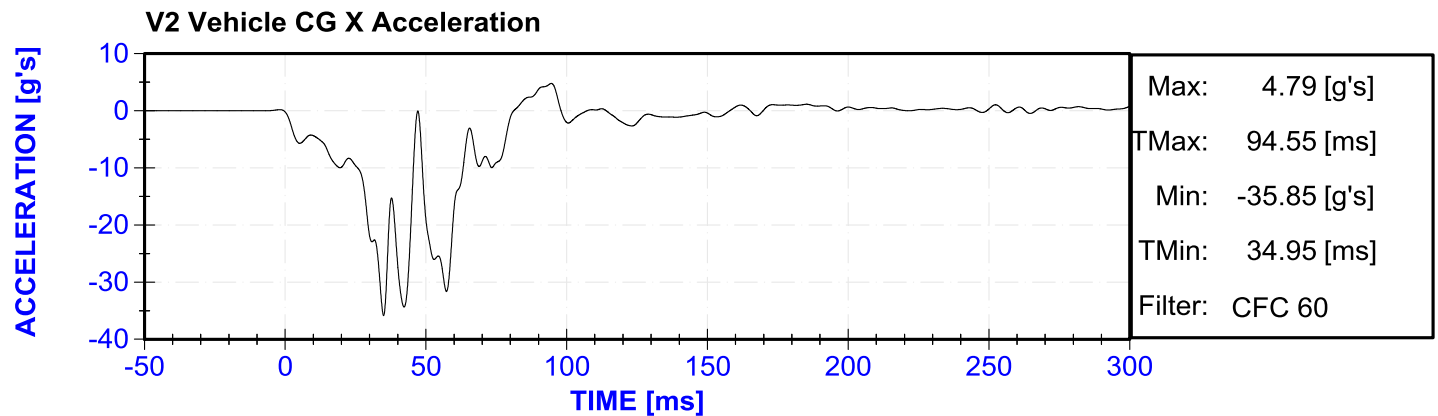
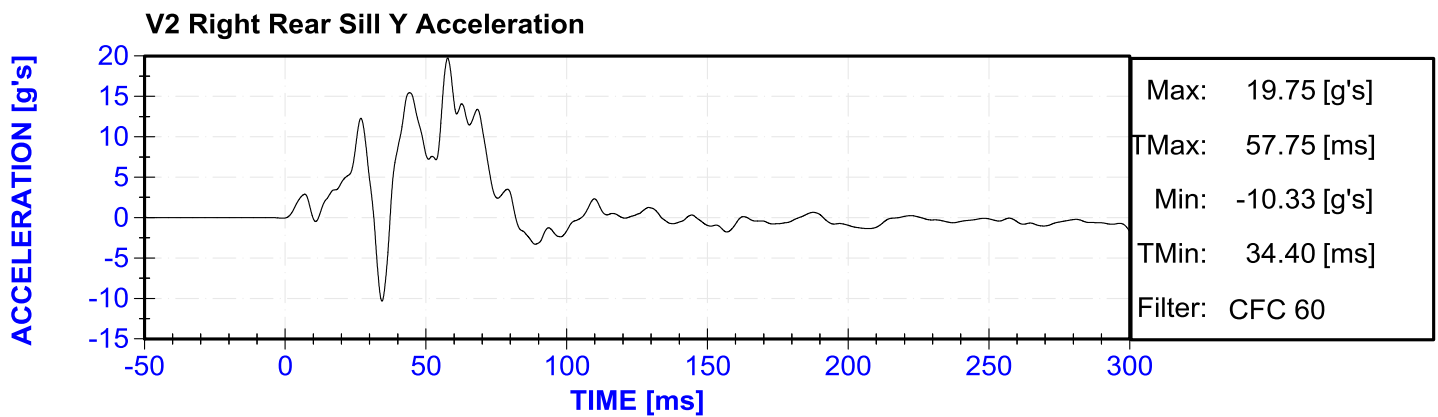
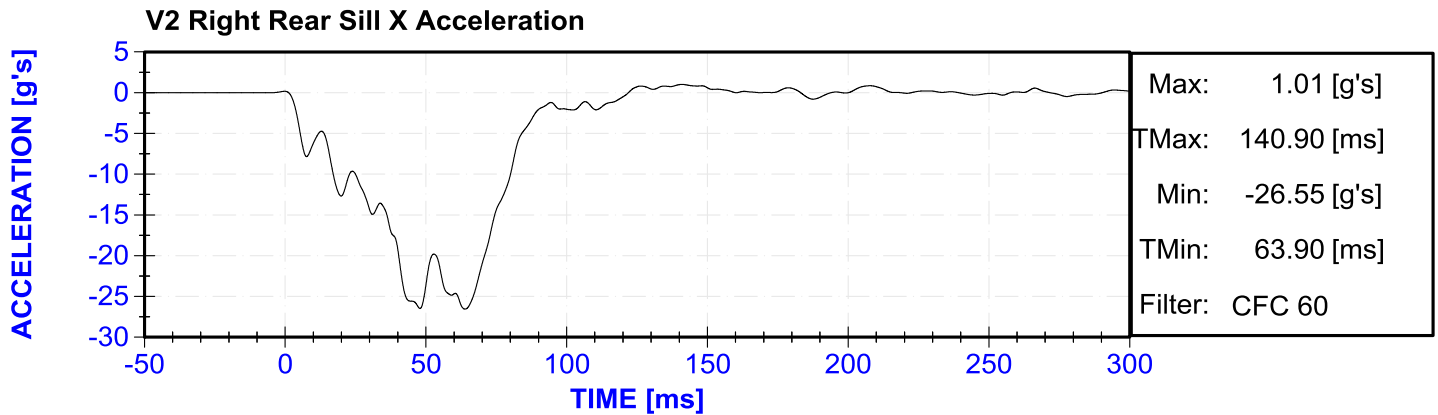
V2P4 PELVIC Z

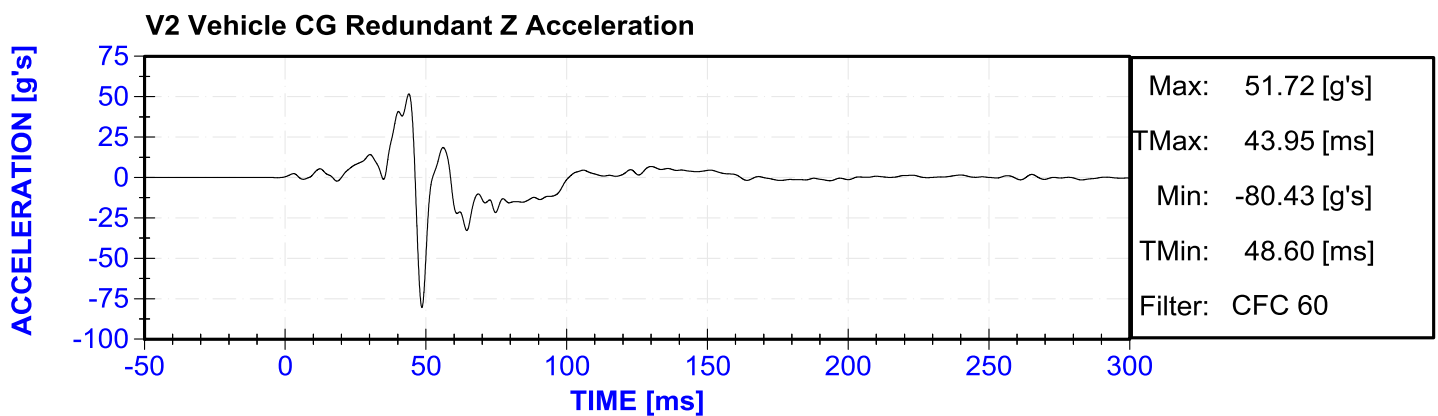
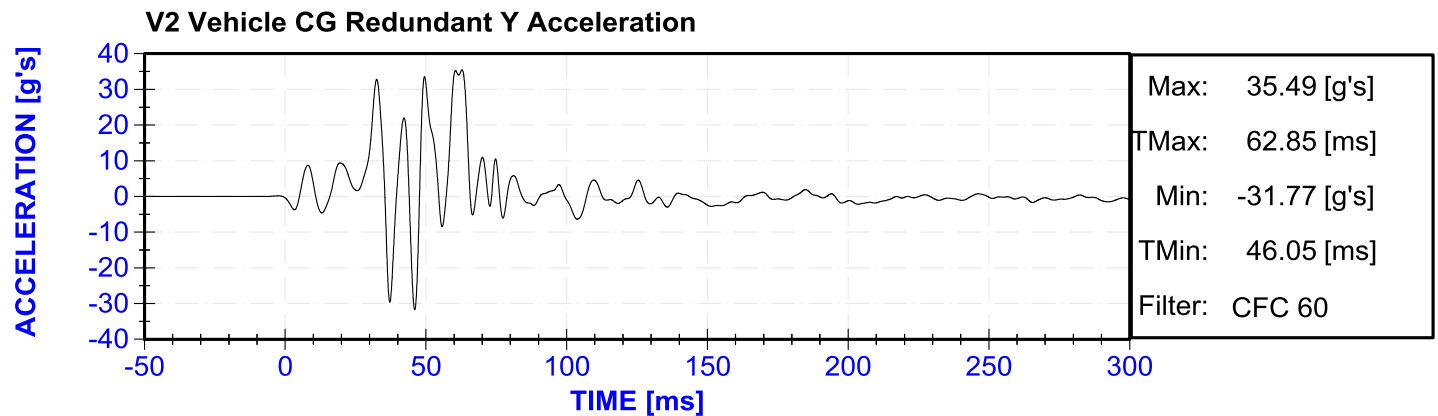
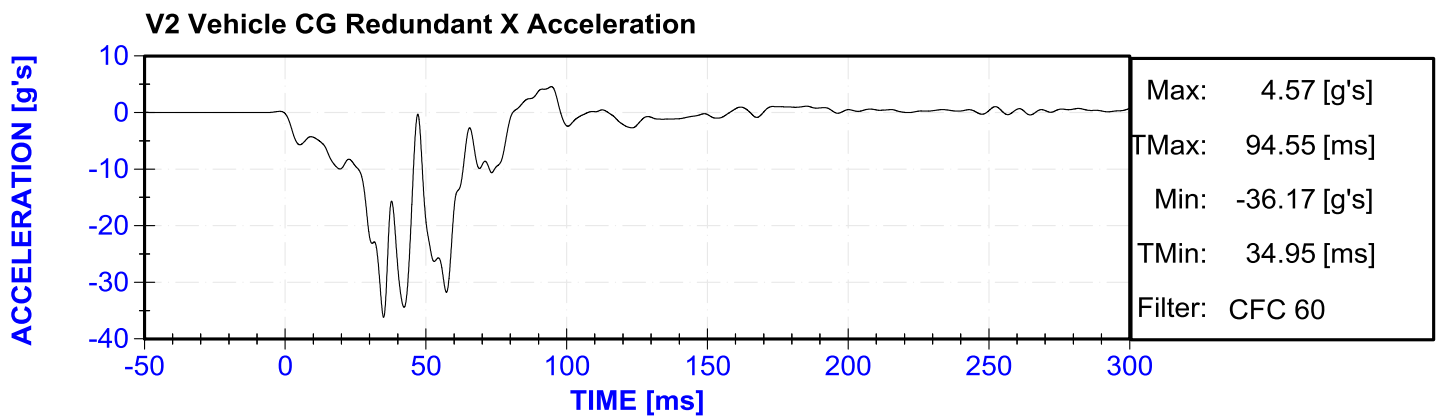
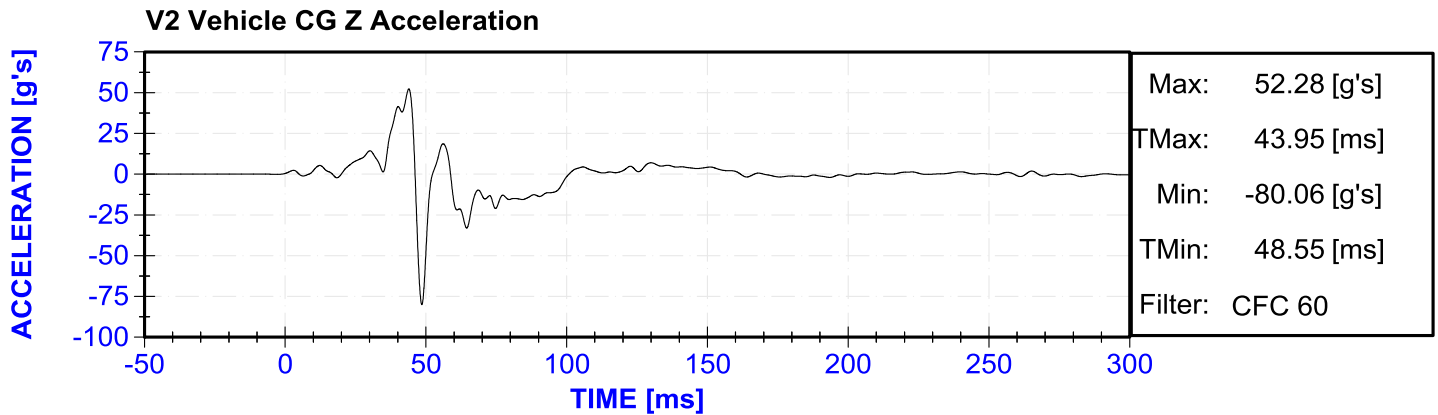






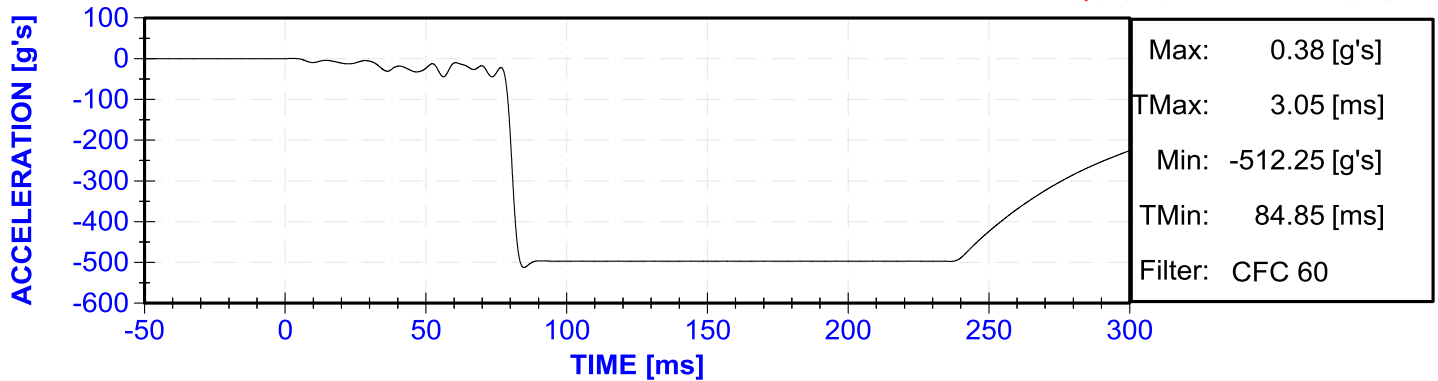




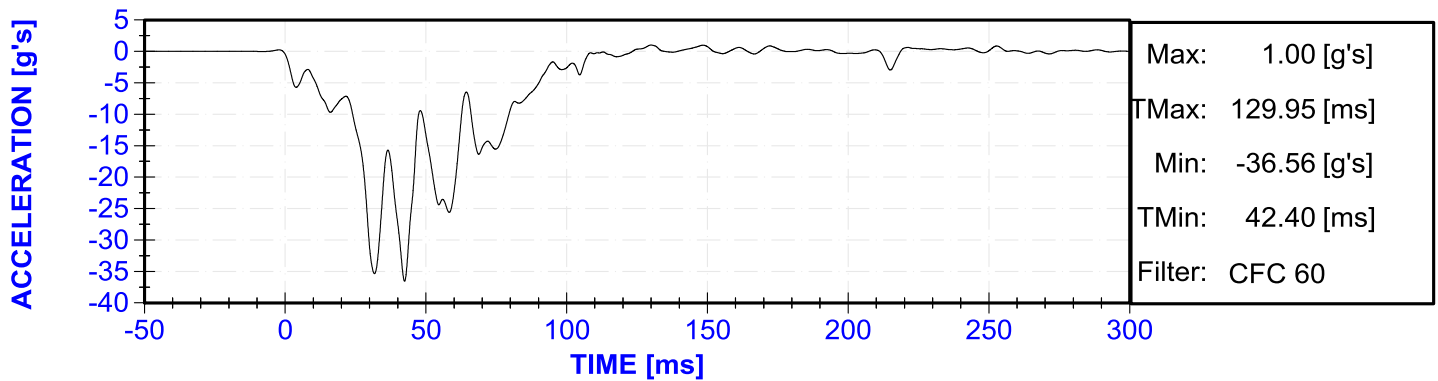


V2 Instrument Panel X Acceleration

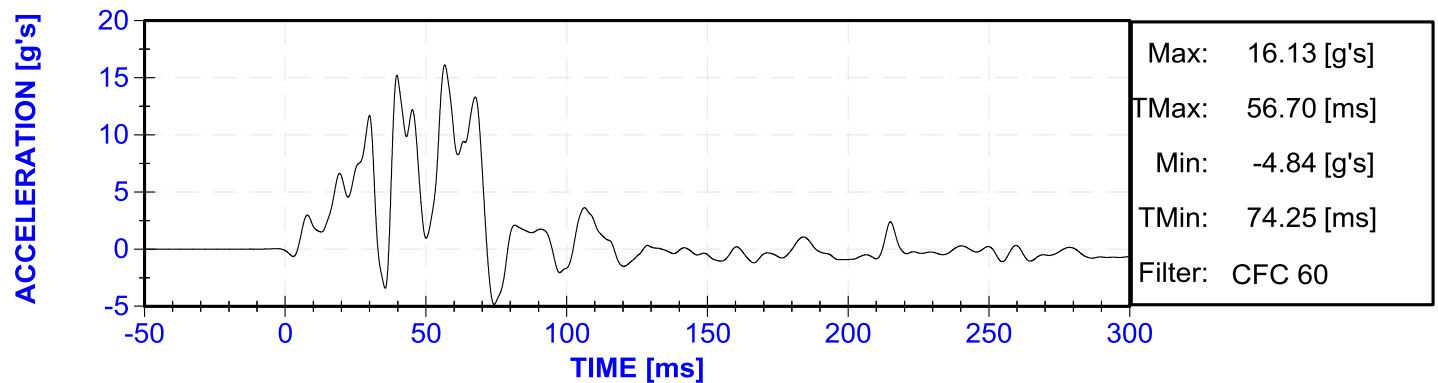
QUESTIONABLE AFTER 80MS.



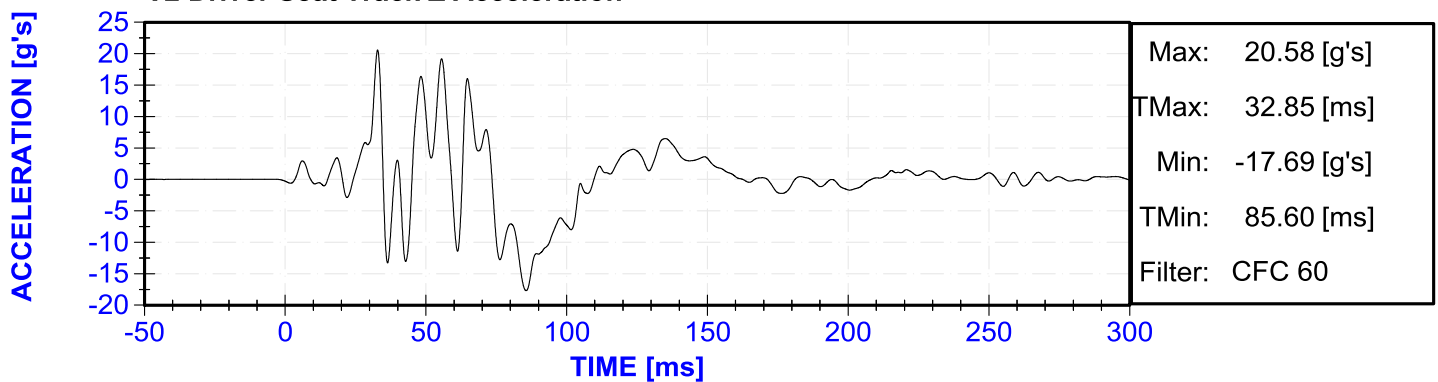
V2 Driver Seat Track X Acceleration

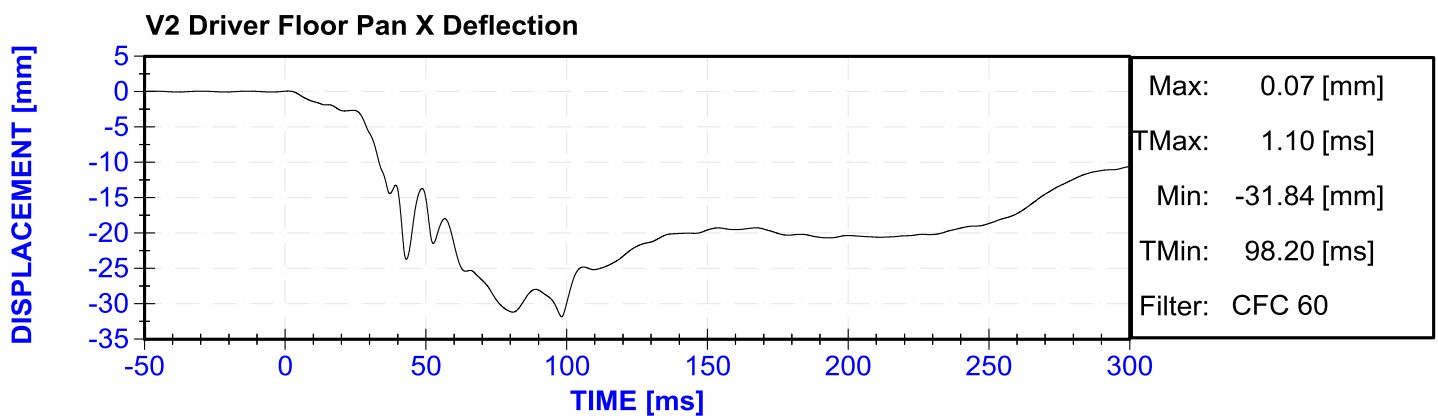
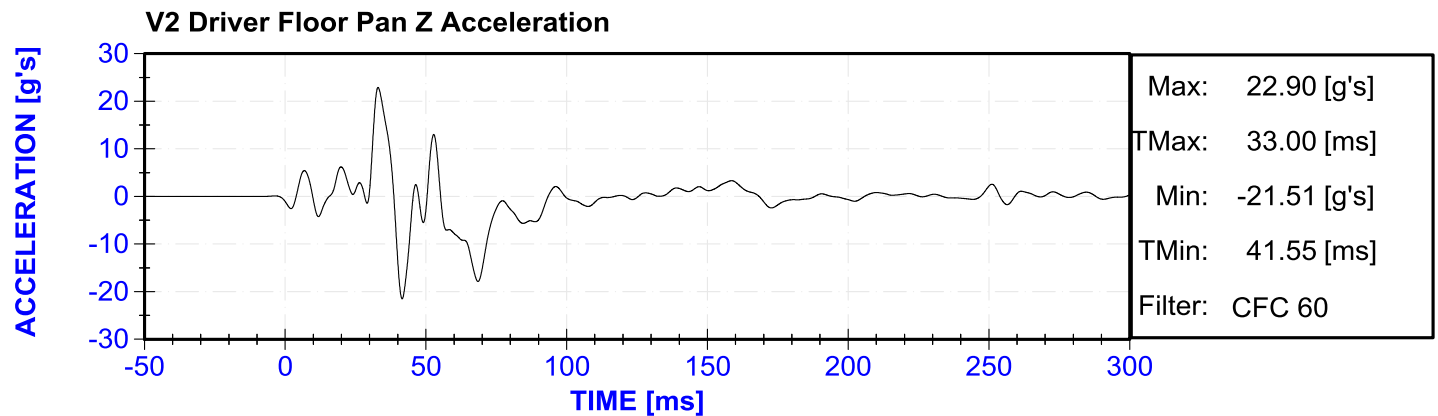
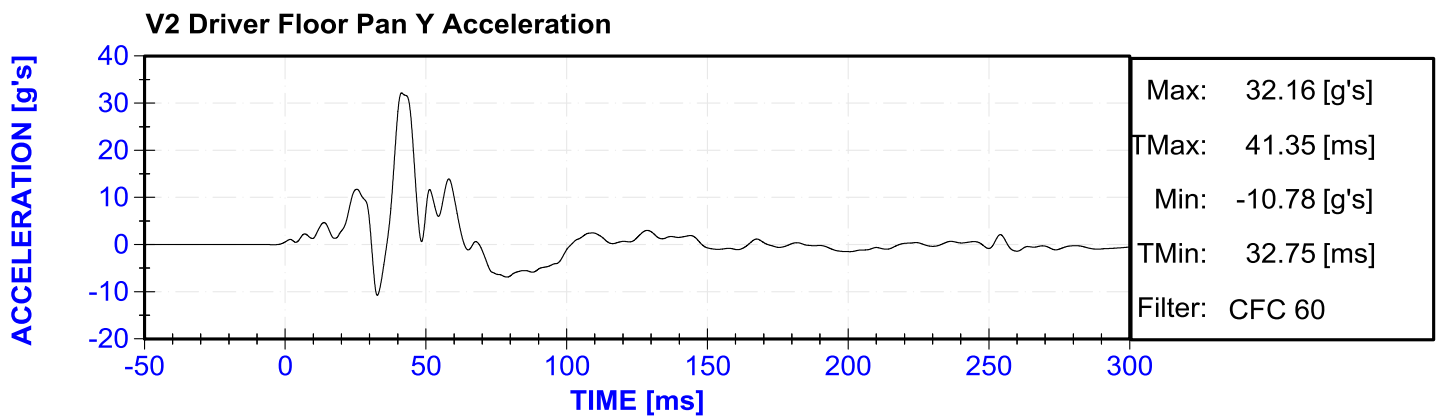
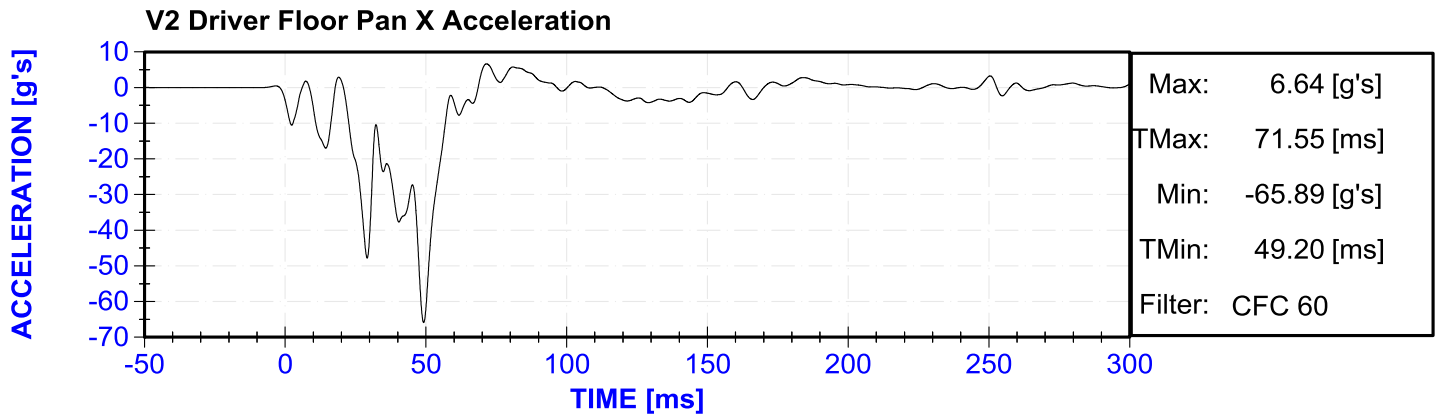


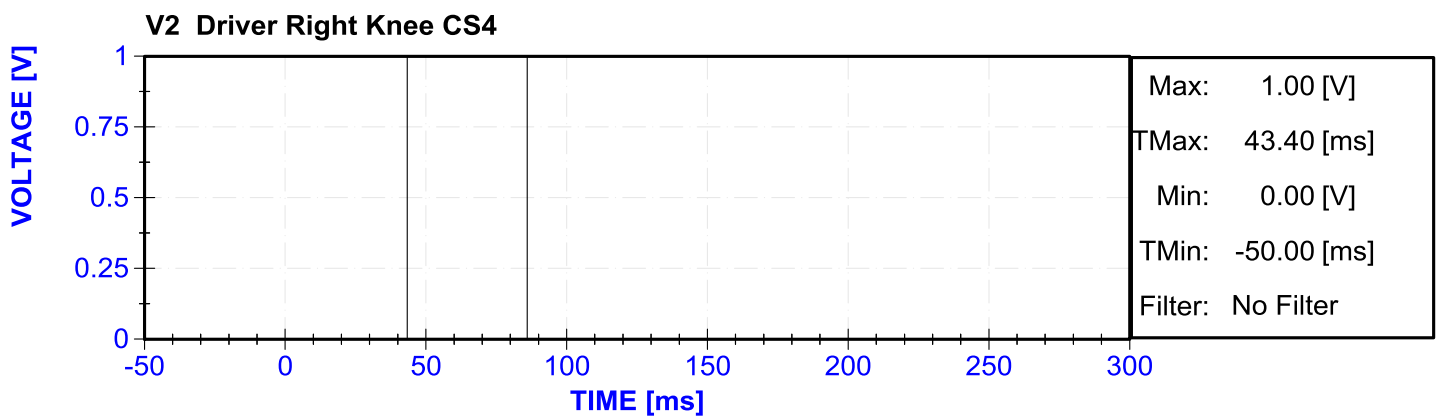
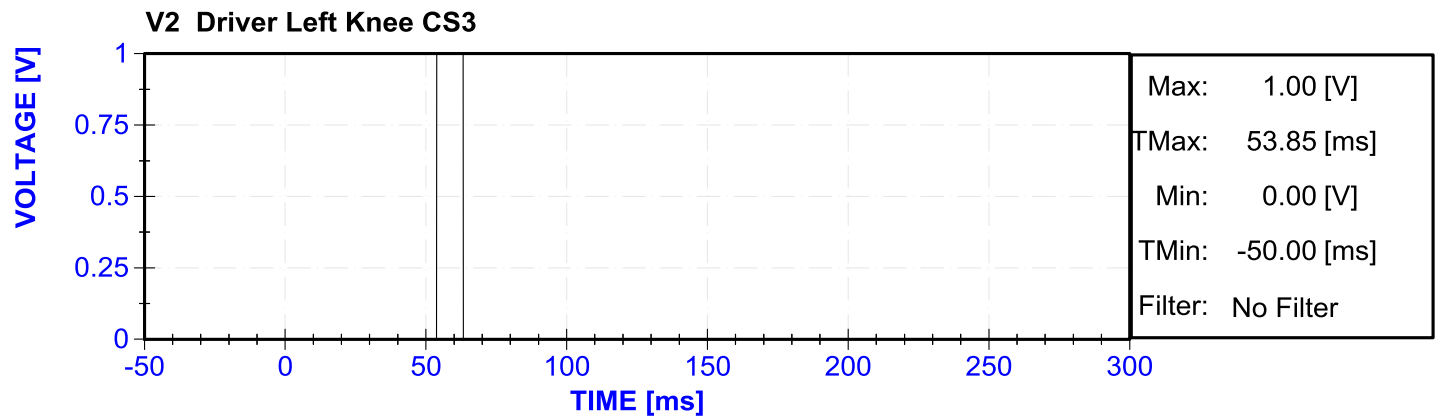
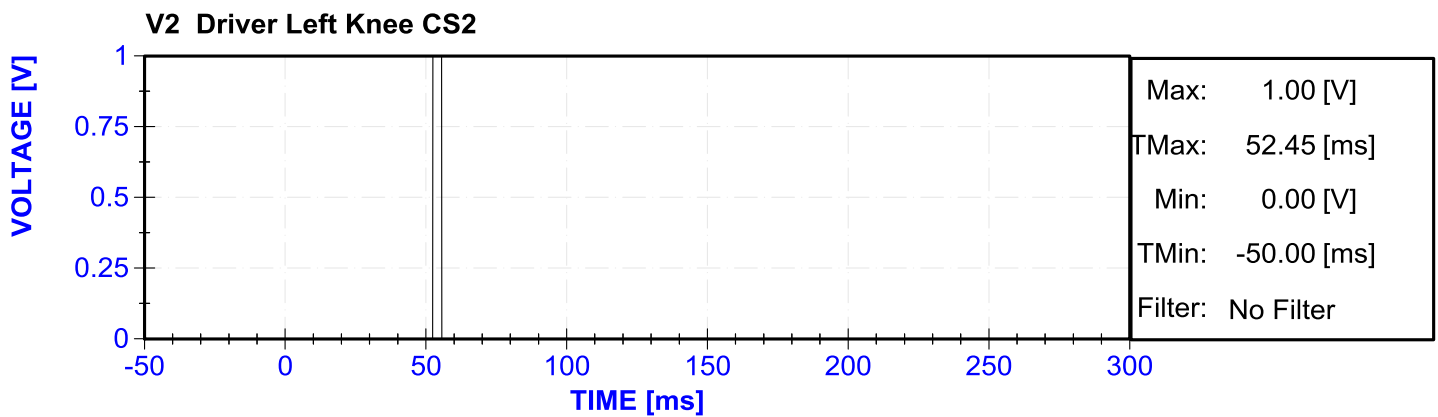
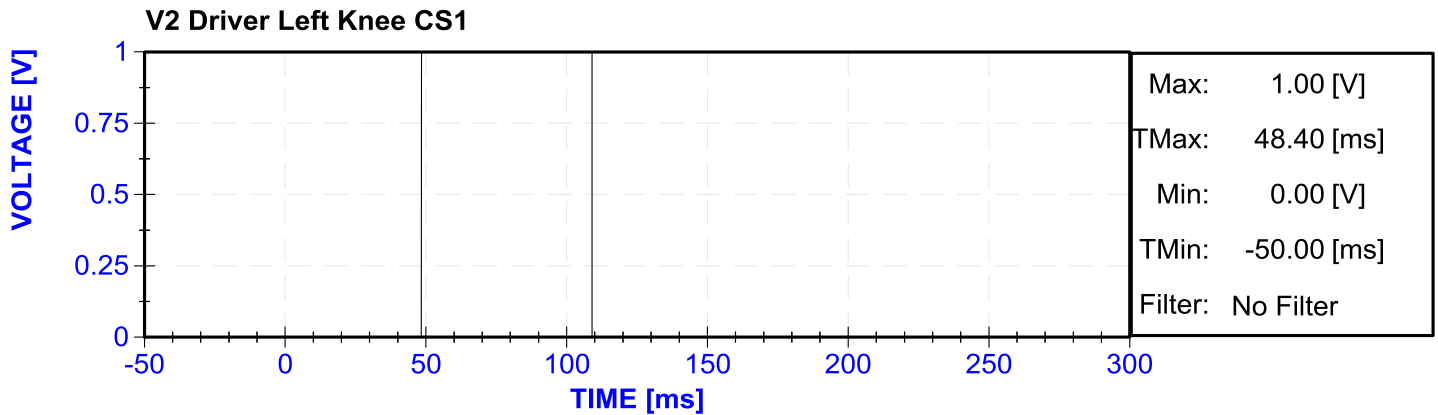
V2 Driver Seat Track Y Acceleration

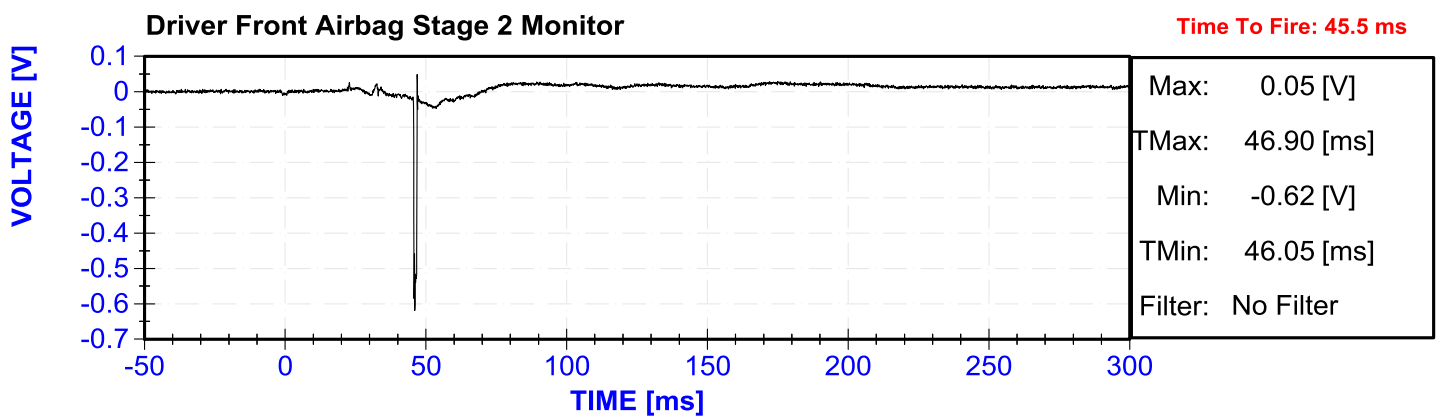
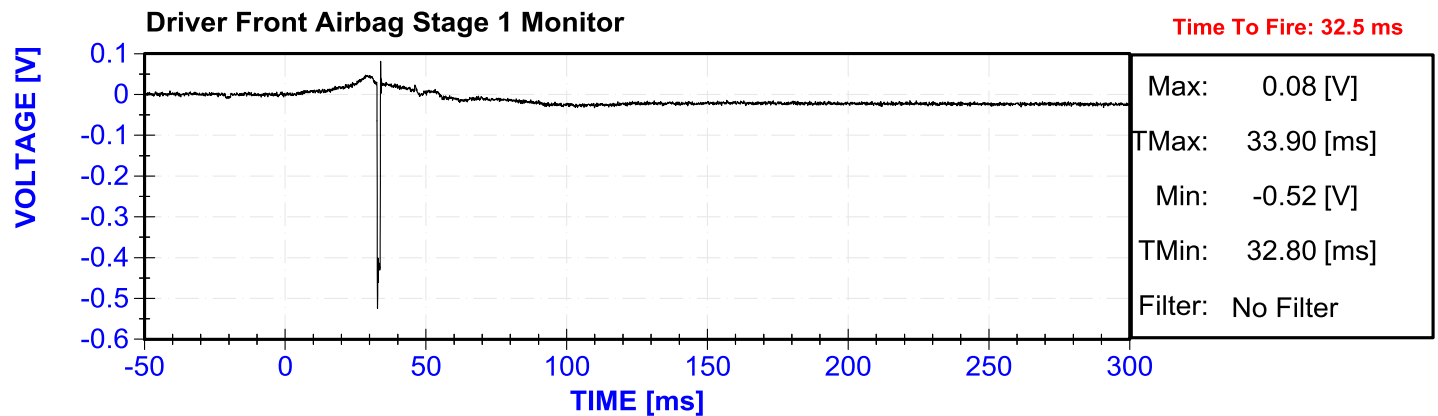
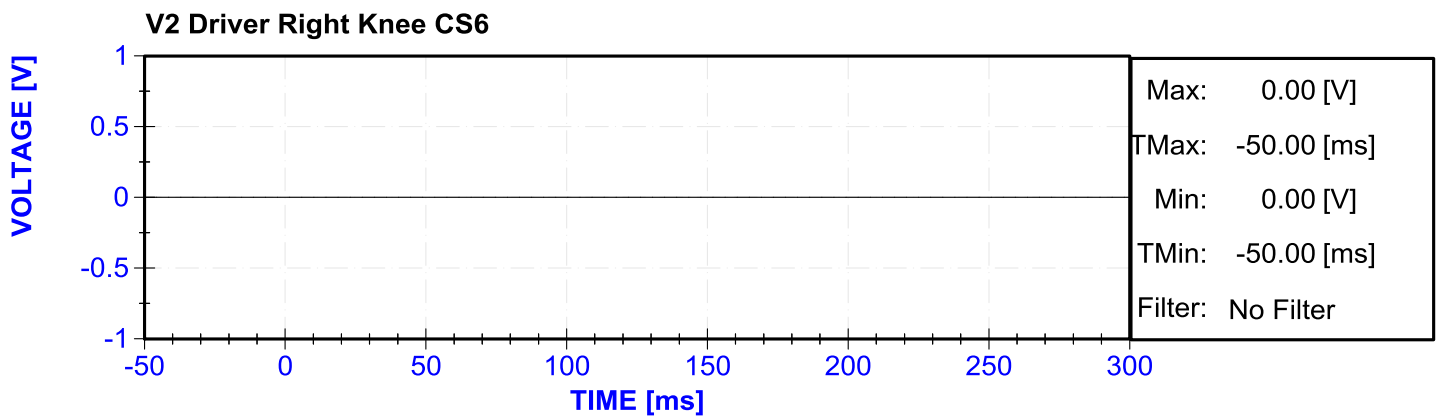
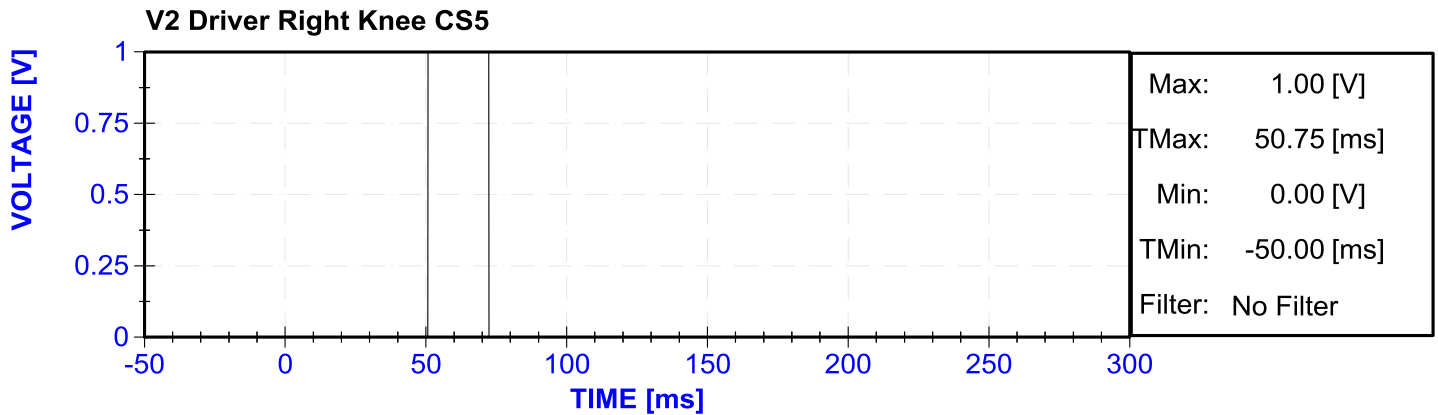


V2 Driver Seat Track Z Acceleration



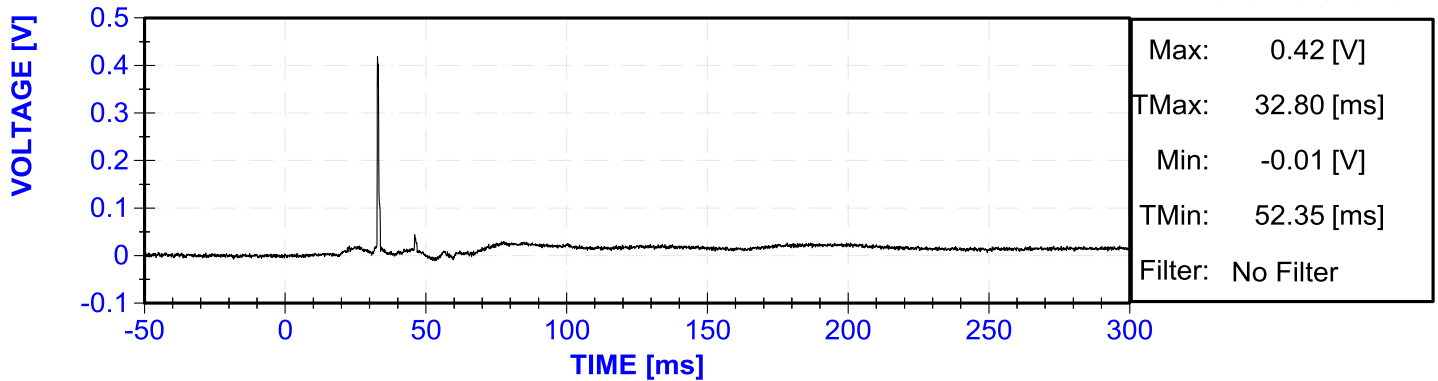






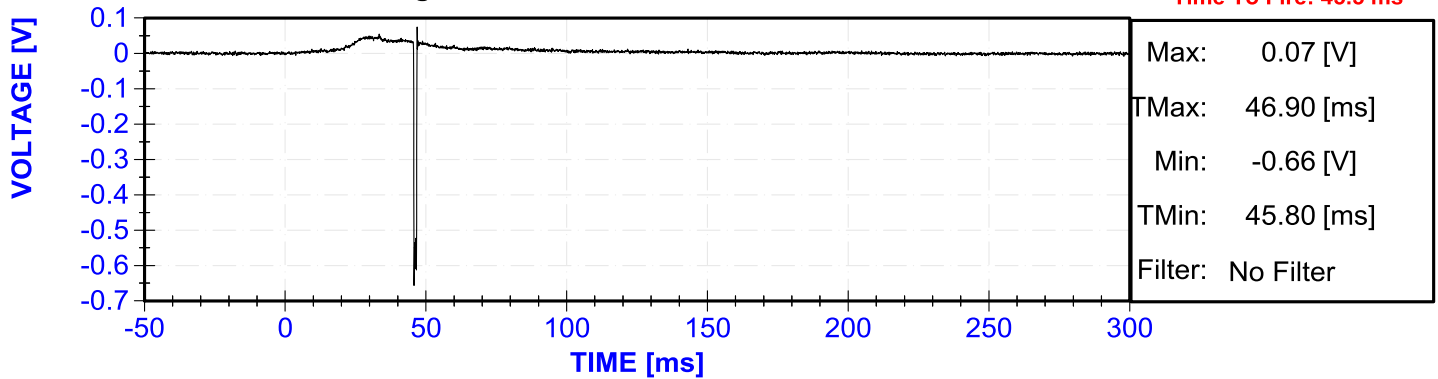
STG COL. DEFORMATION PIN IGNITER

Time To Fire: 32.5 ms



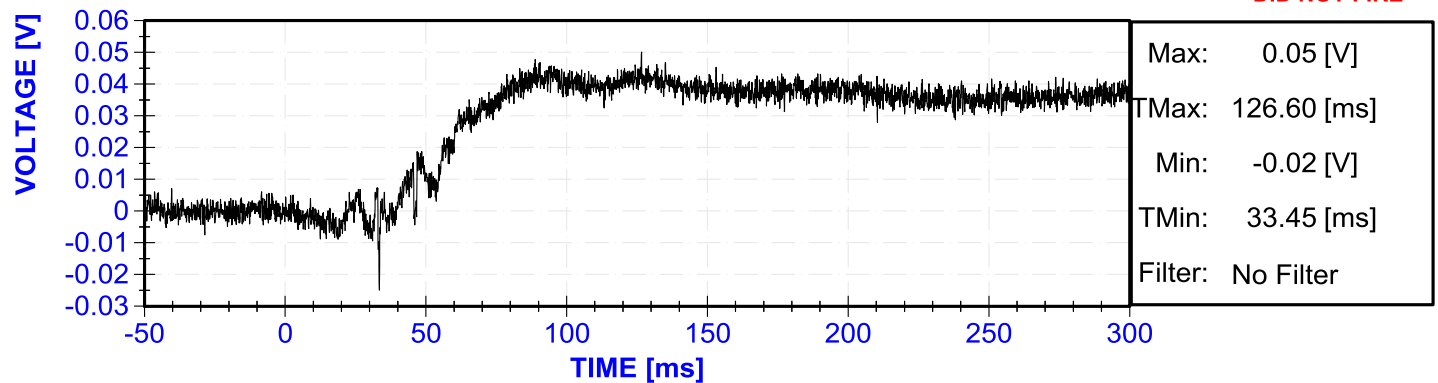
Driver Curtain Airbag Monitor

Time To Fire: 45.5 ms



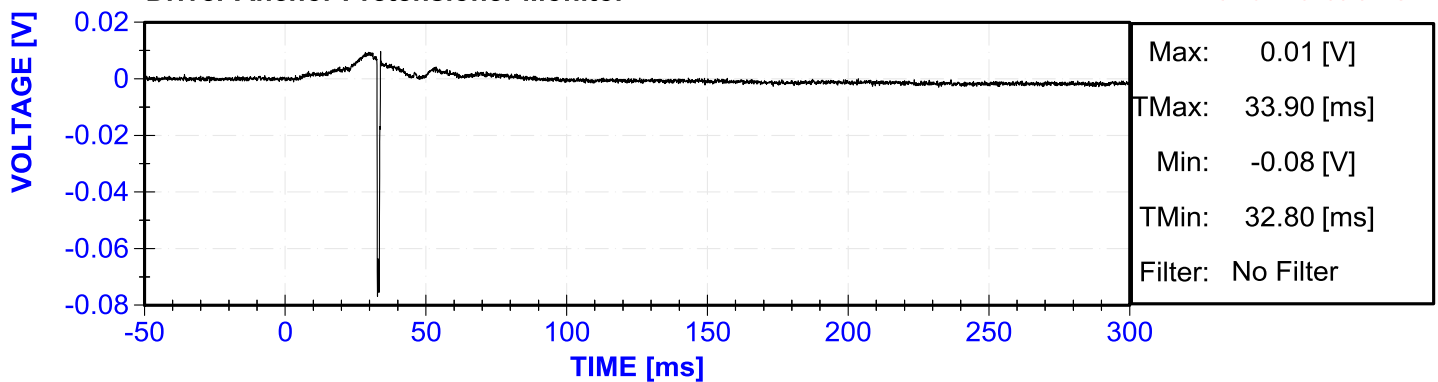
V2 DRIVER HEAD/TORSO/PELVIS

DID NOT FIRE



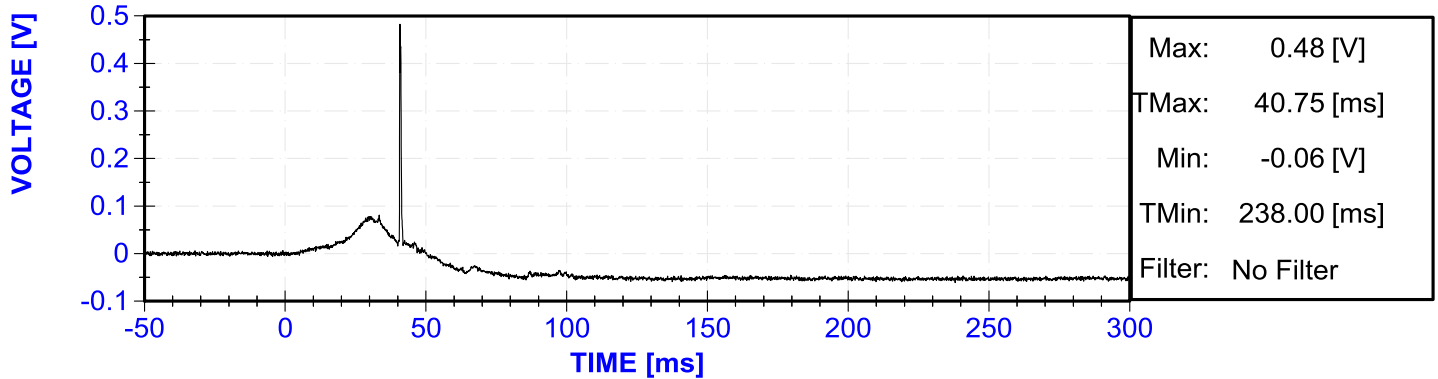
Driver Anchor Pretensioner Monitor

Time To Fire: 33.5 ms

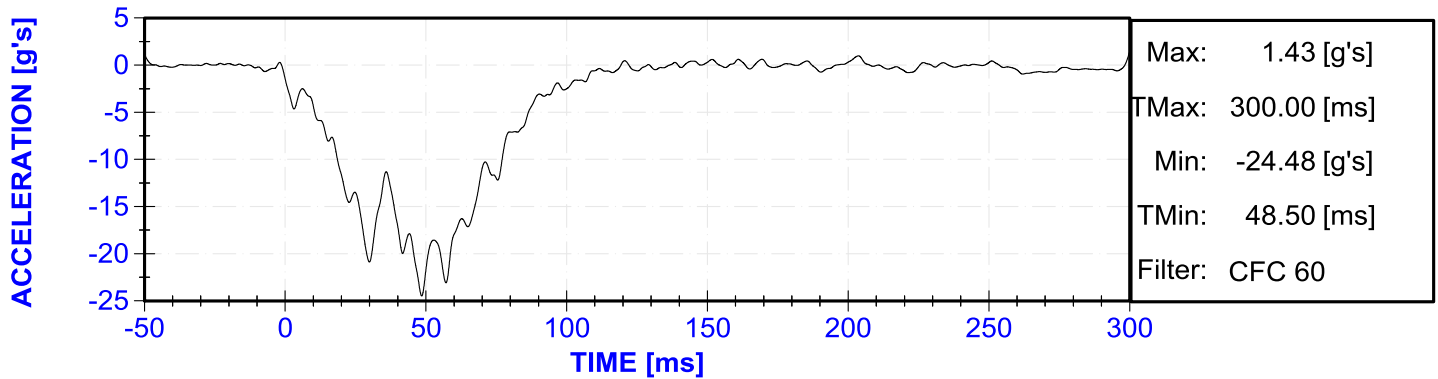


V2 DRIVER LAP BELT PRETENSIONER

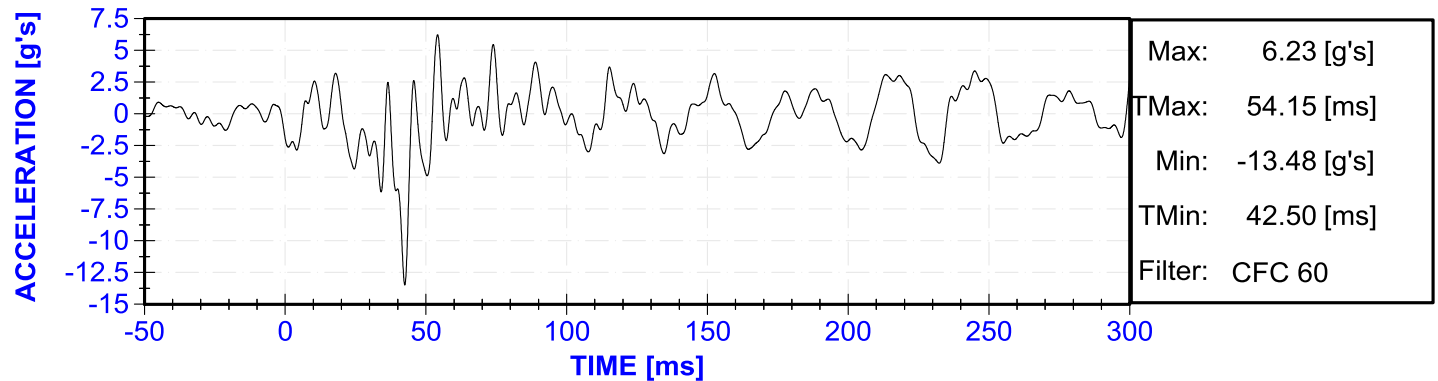
Time To Fire: 33.5 ms



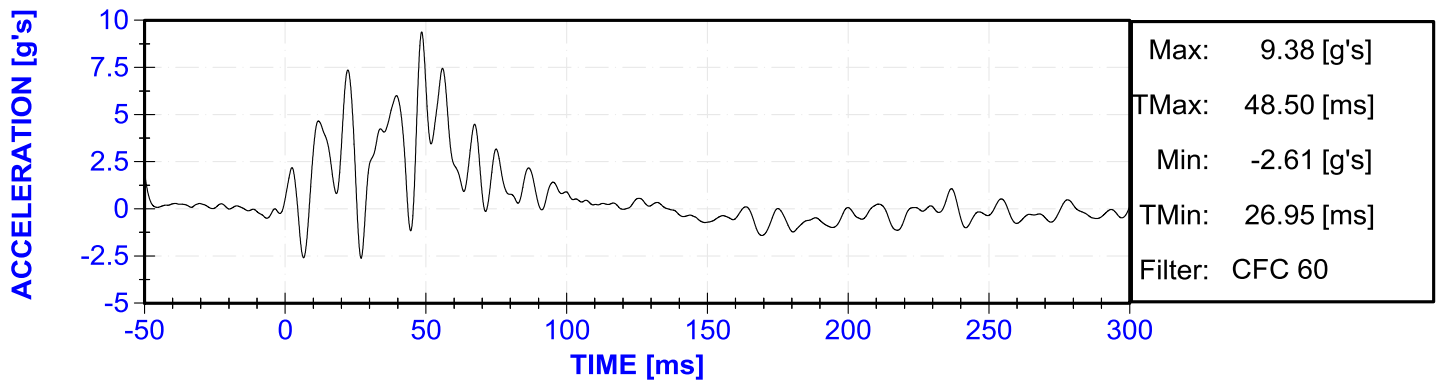
V1 CG AX

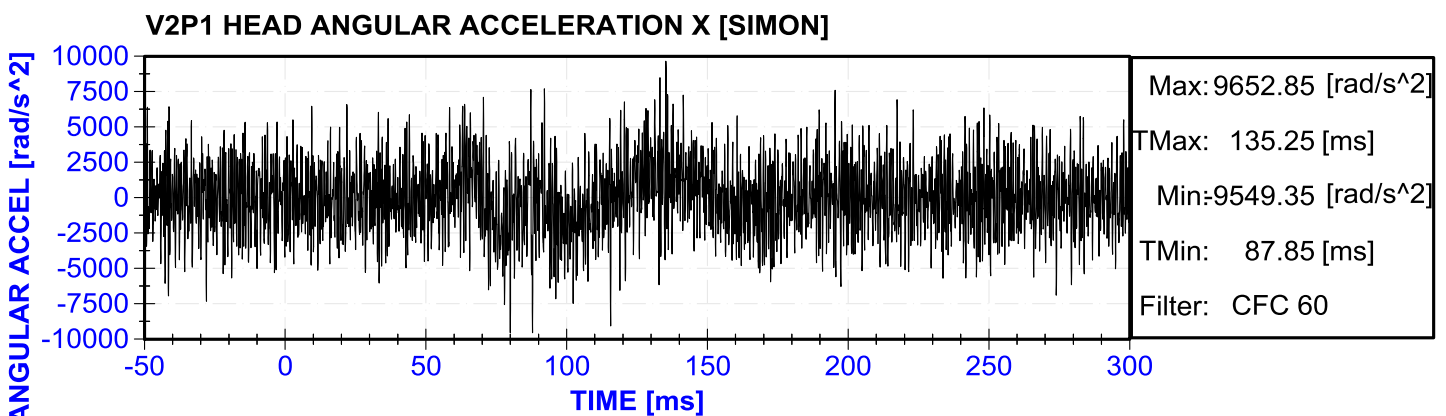
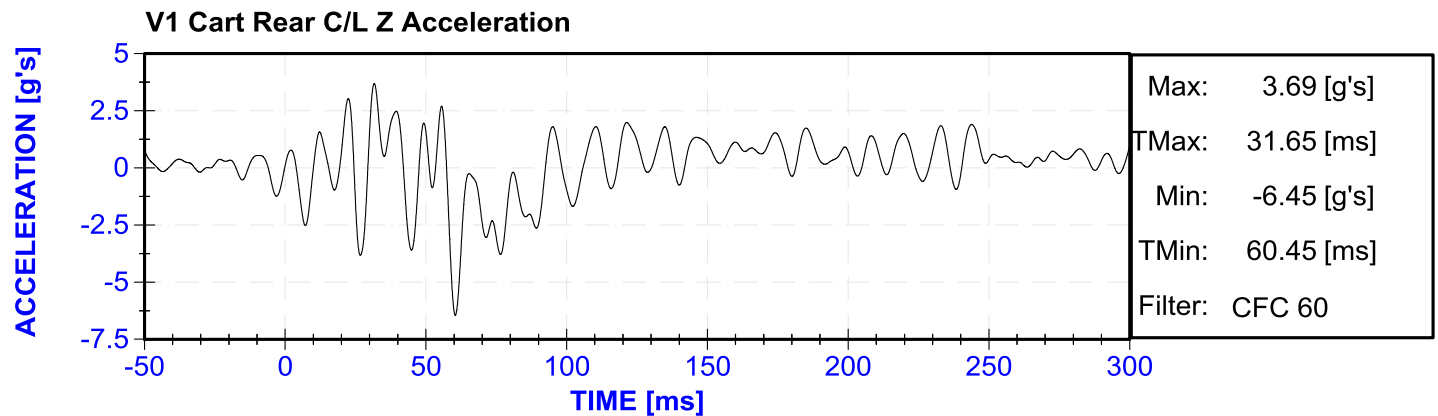
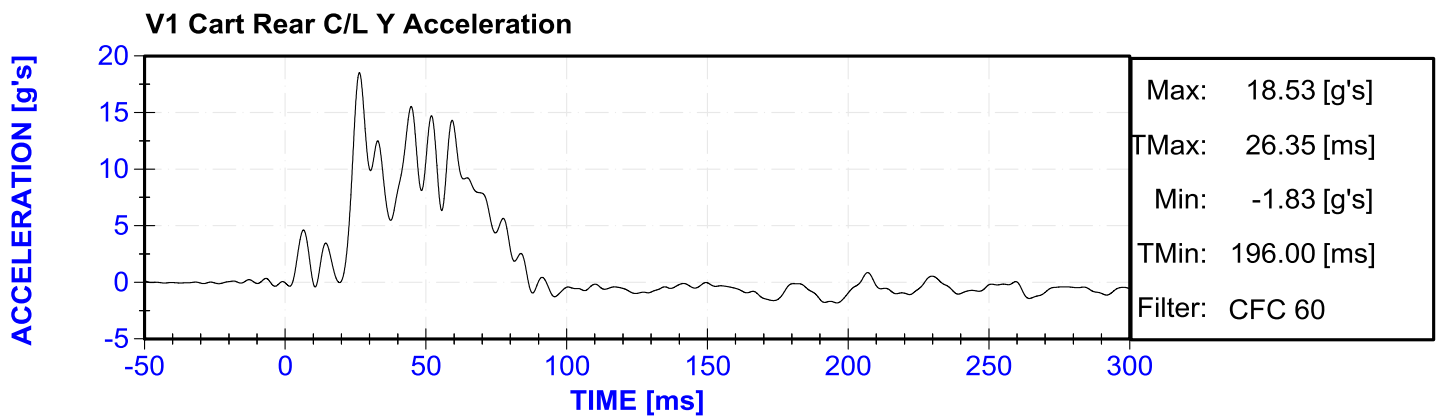
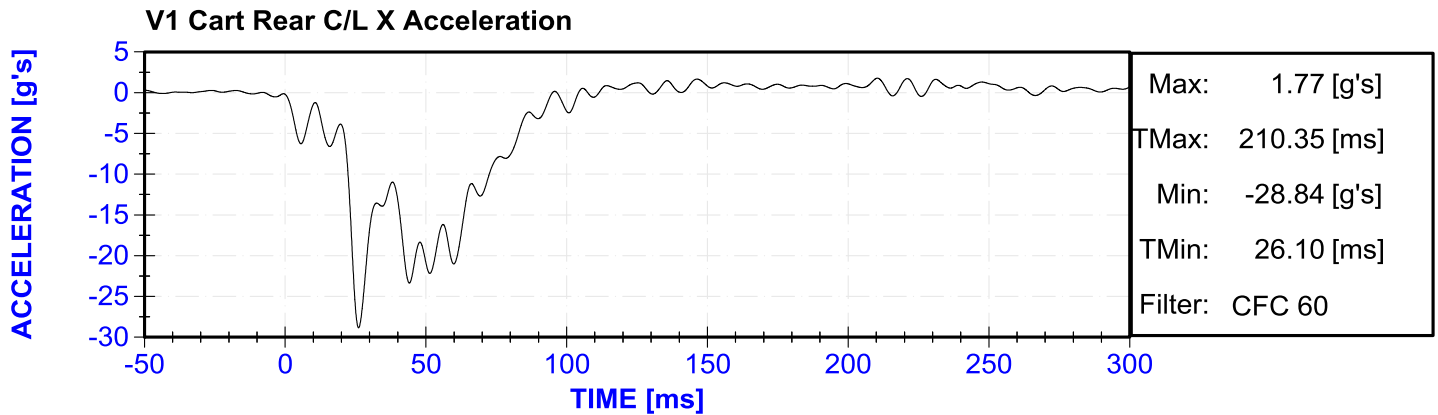


V1 CG AY

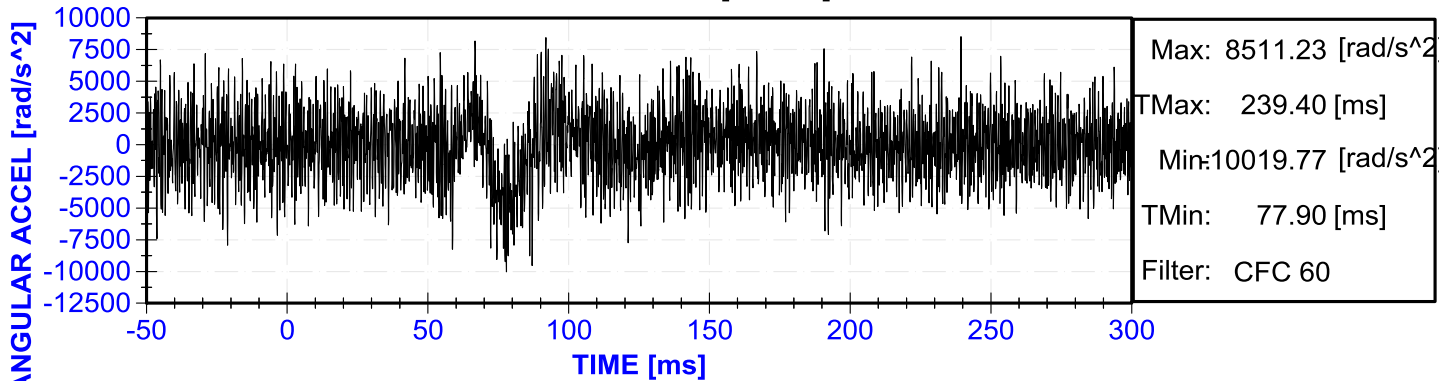


V1 CG AZ

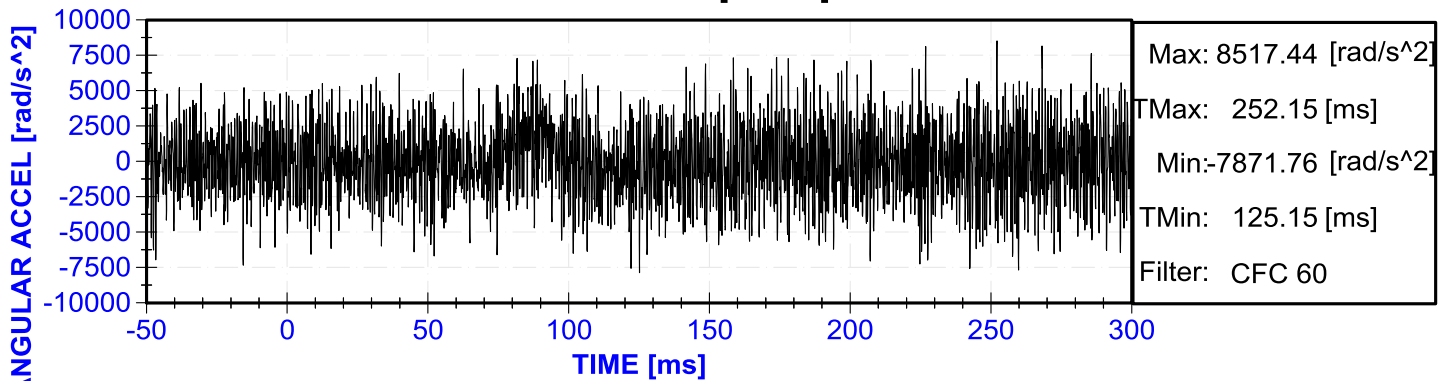




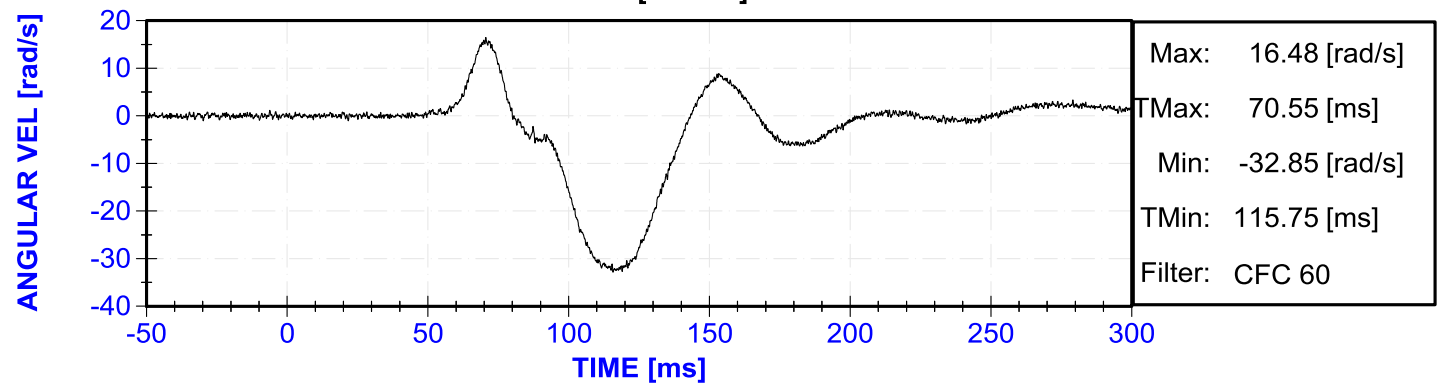
V2P1 HEAD ANGULAR ACCELERATION Y [SIMON]



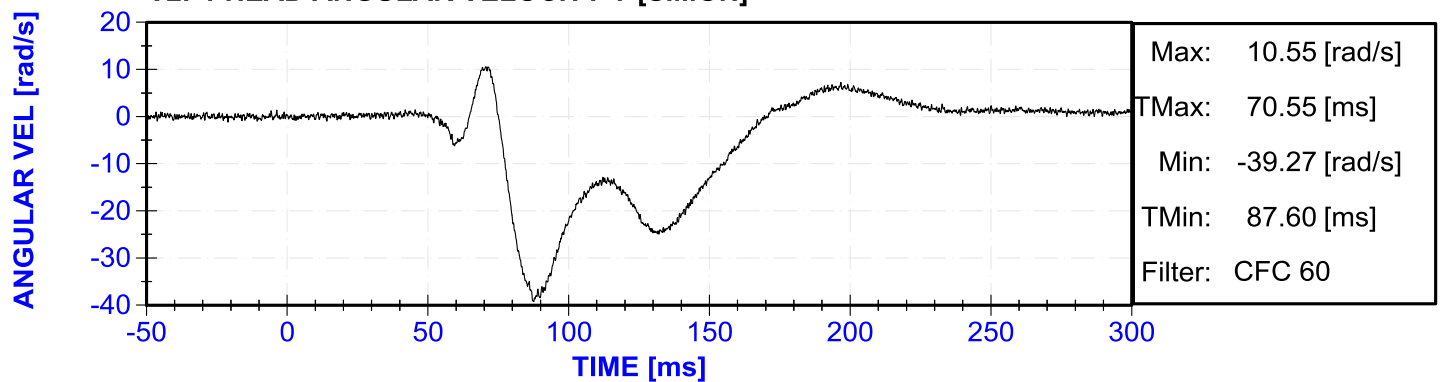
V2P1 HEAD ANGULAR ACCELERATION Z [SIMON]

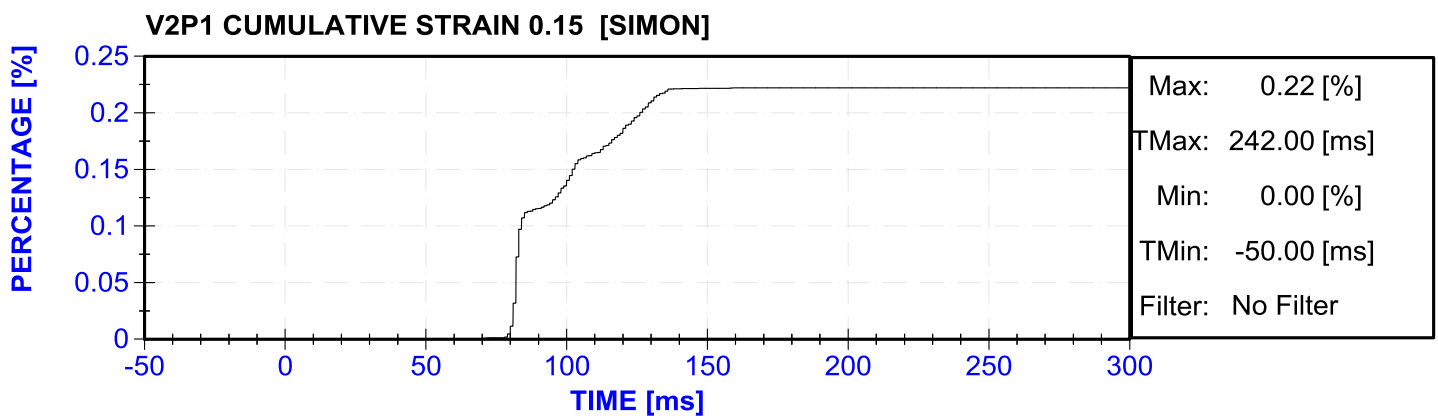
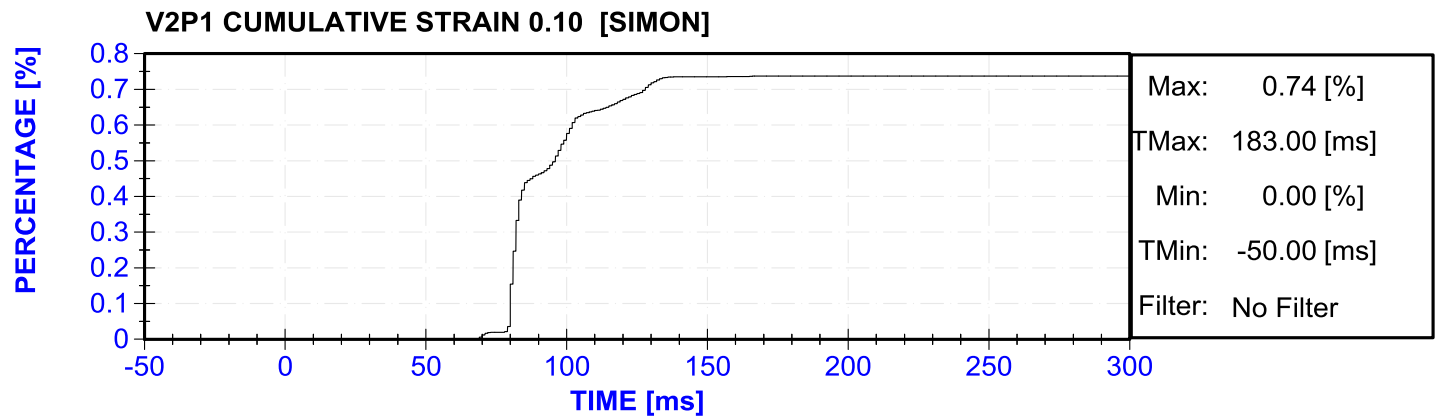
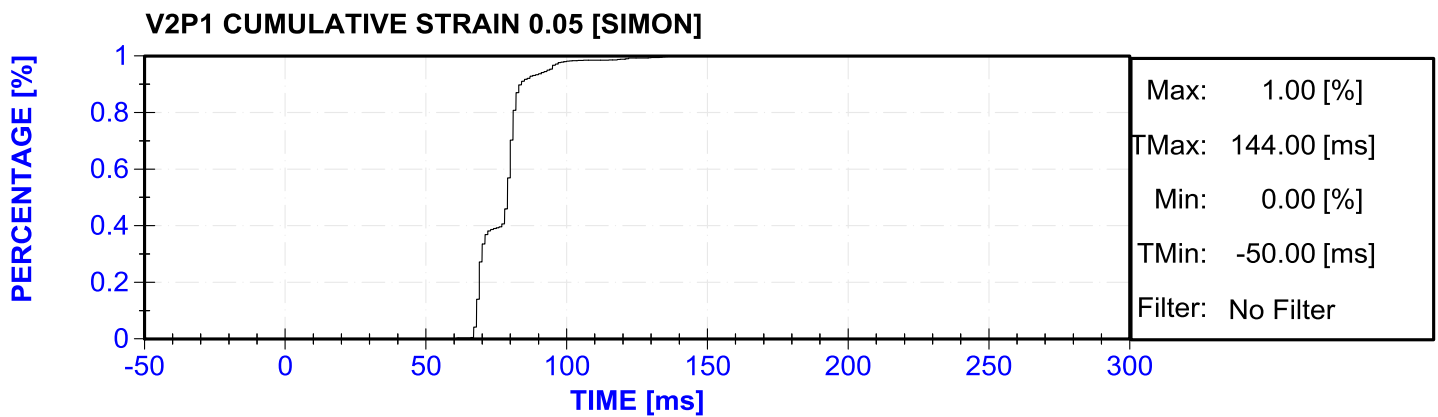
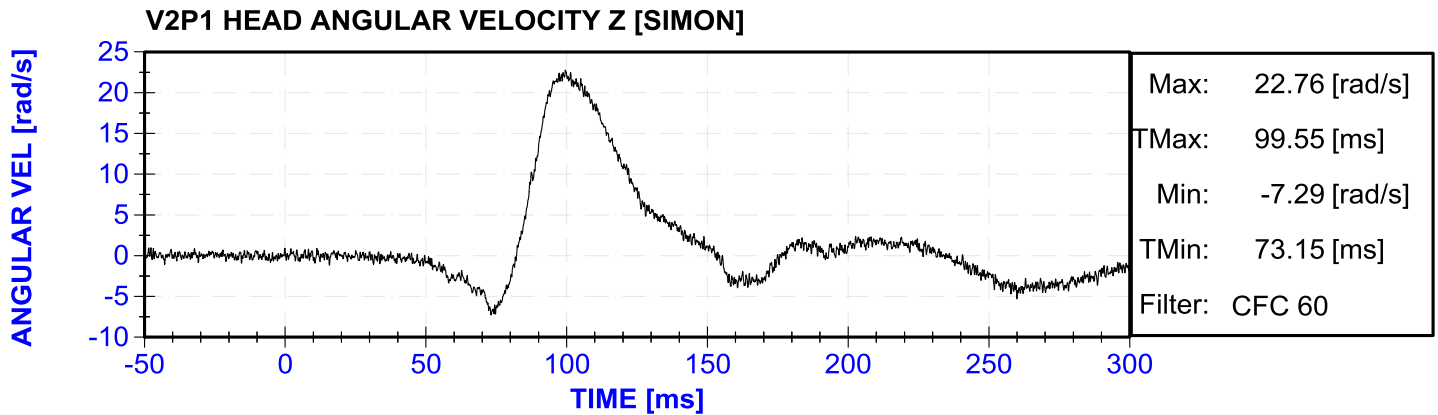


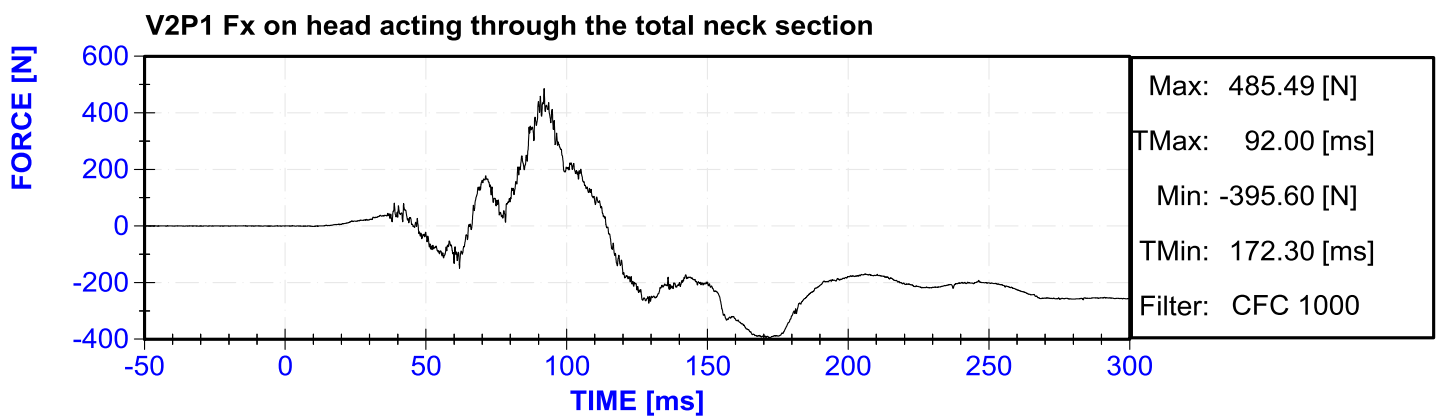
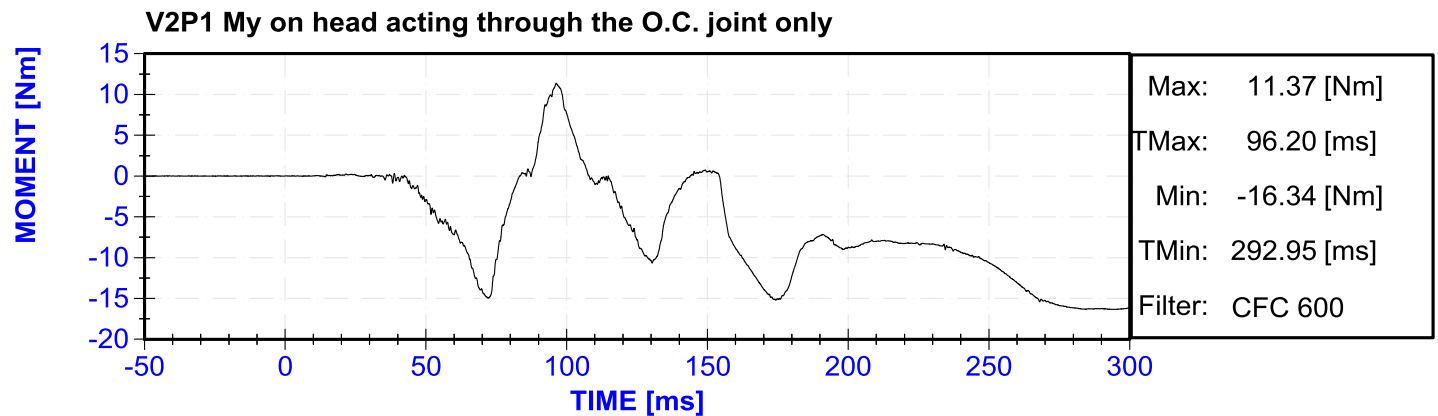
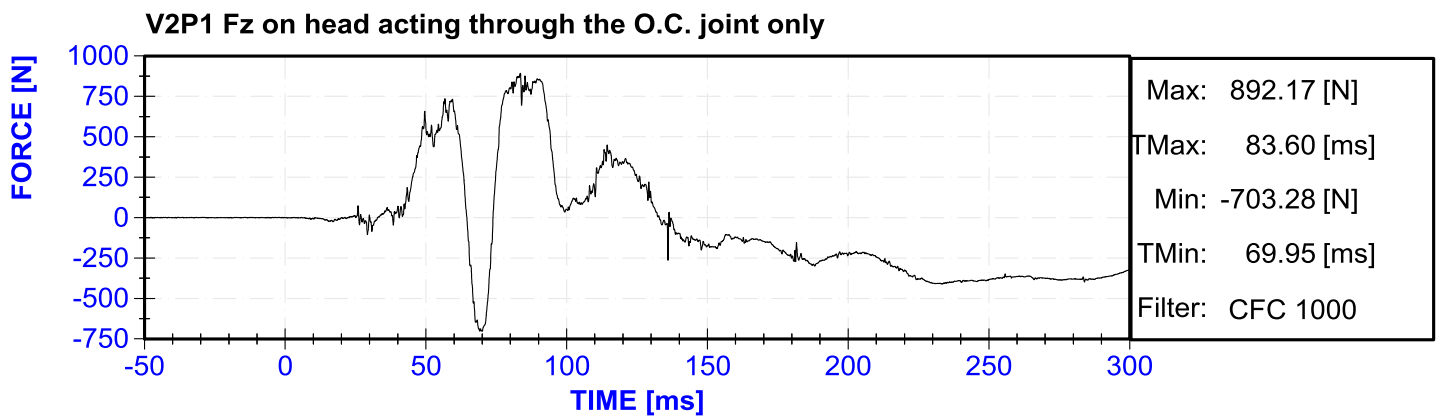
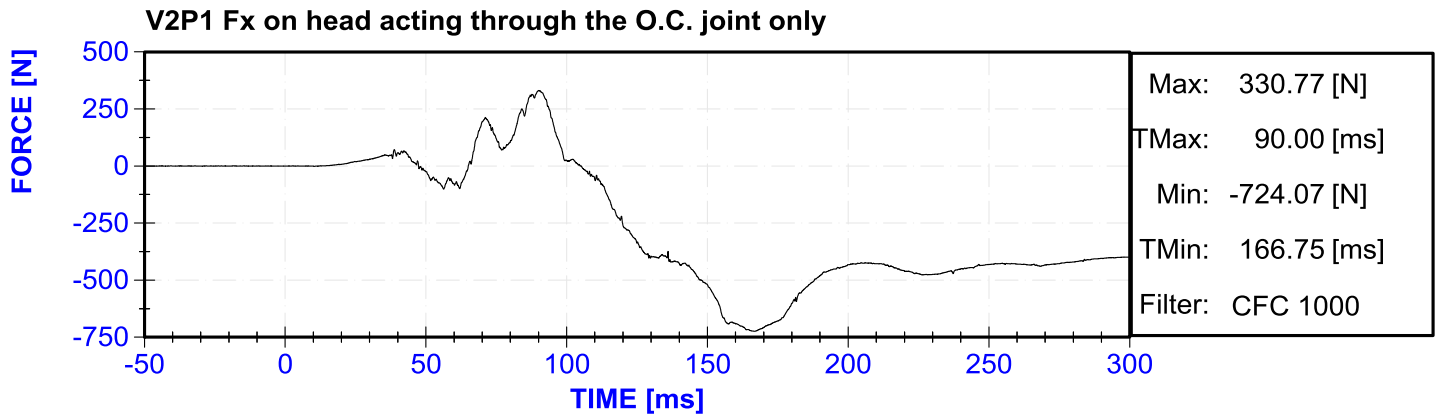
V2P1 HEAD ANGULAR VELOCITY X [SIMON]



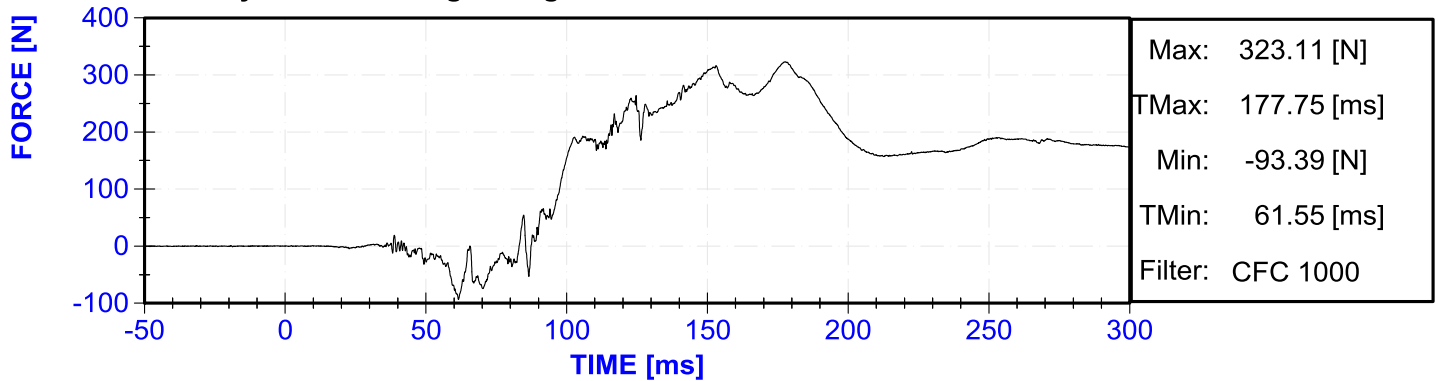
V2P1 HEAD ANGULAR VELOCITY Y [SIMON]



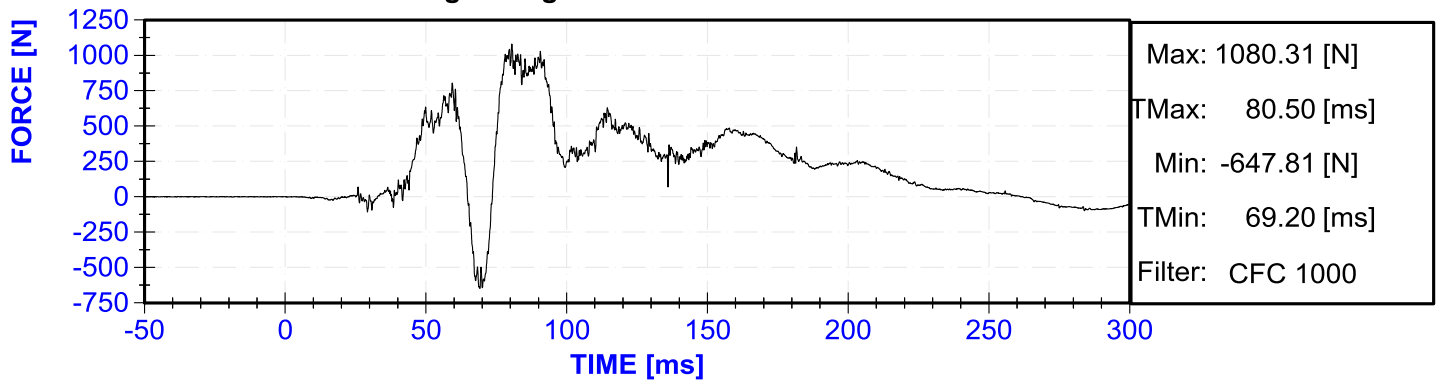




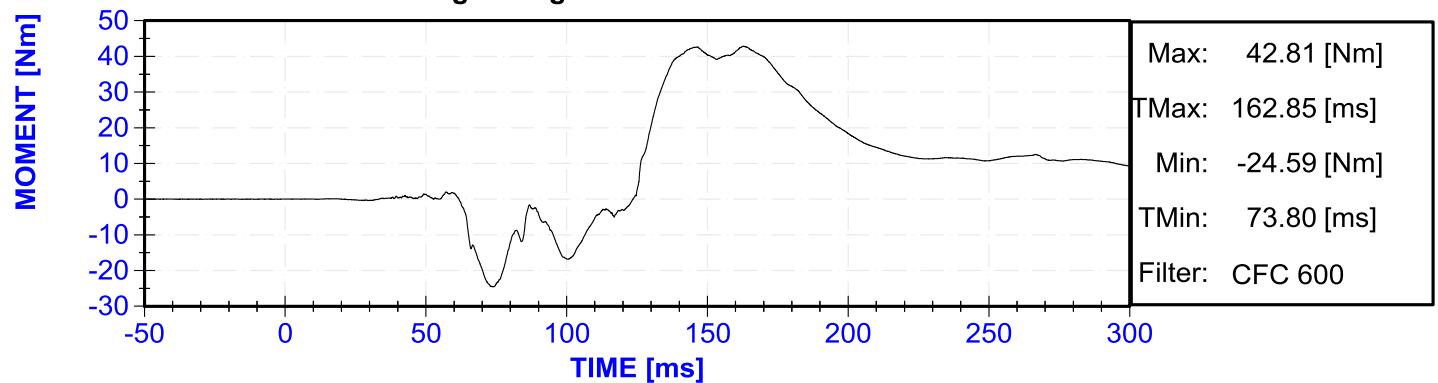
V2P1 Fy on head acting through the total neck section



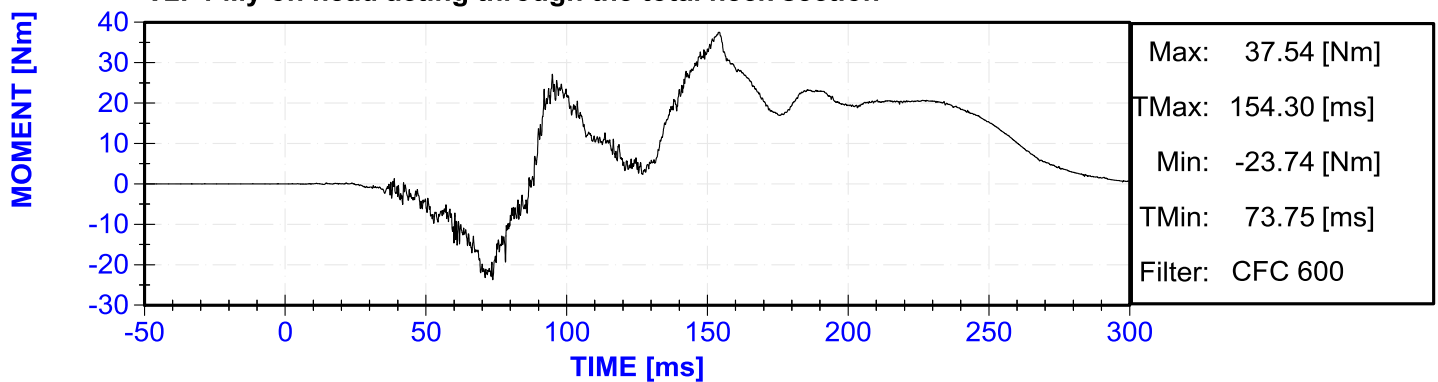
V2P1 Fz on head acting through the total neck section



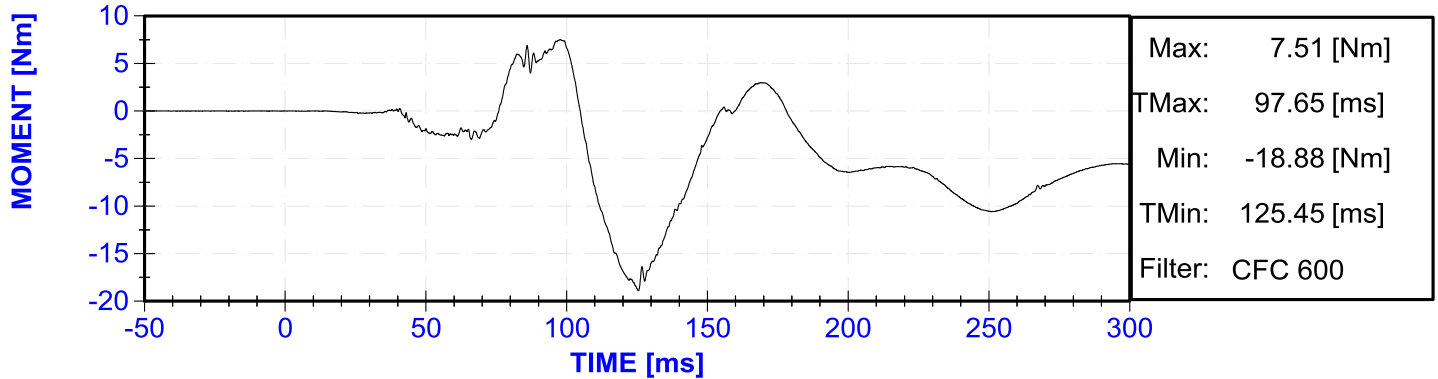
V2P1 Mx on head acting through the total neck section



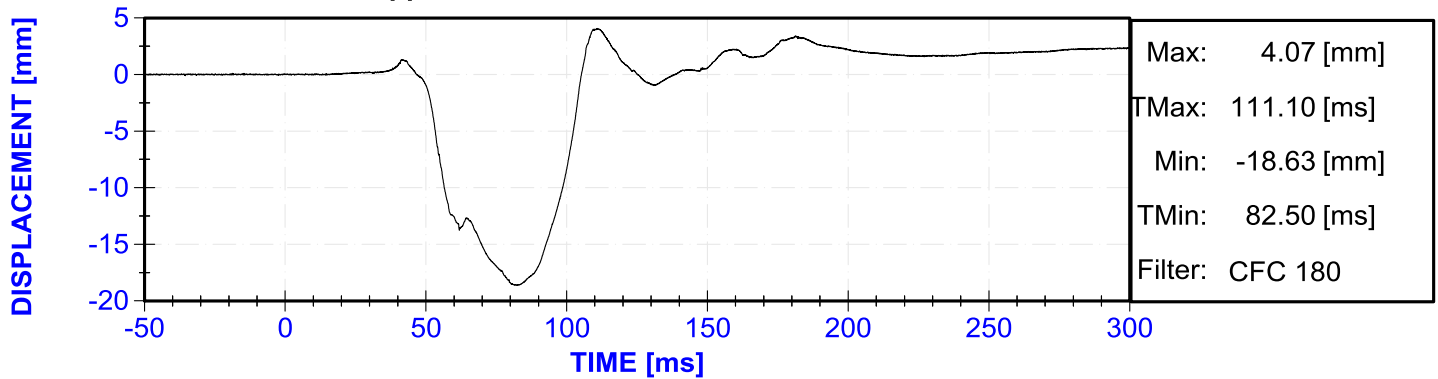
V2P1 My on head acting through the total neck section



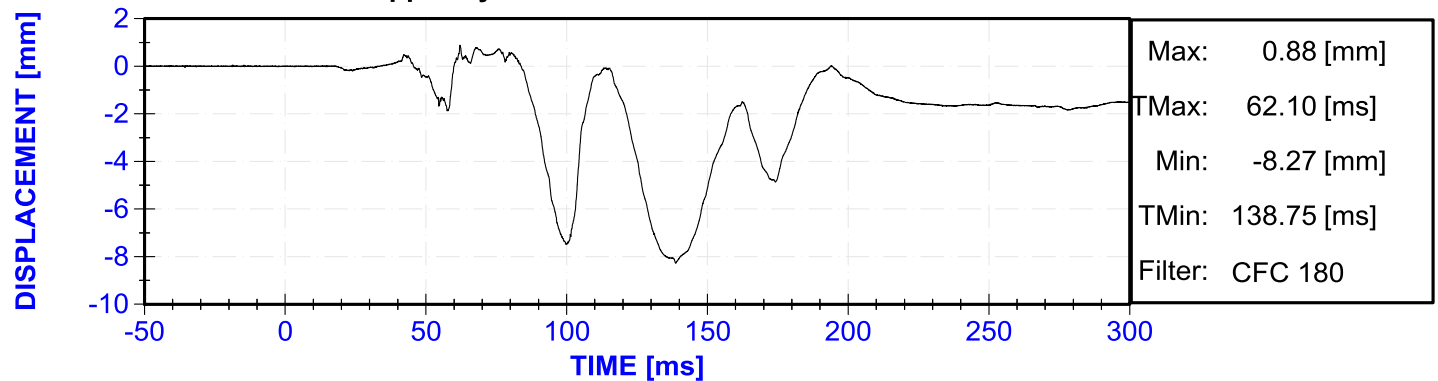
V2P1 Mz on head acting through the total neck section



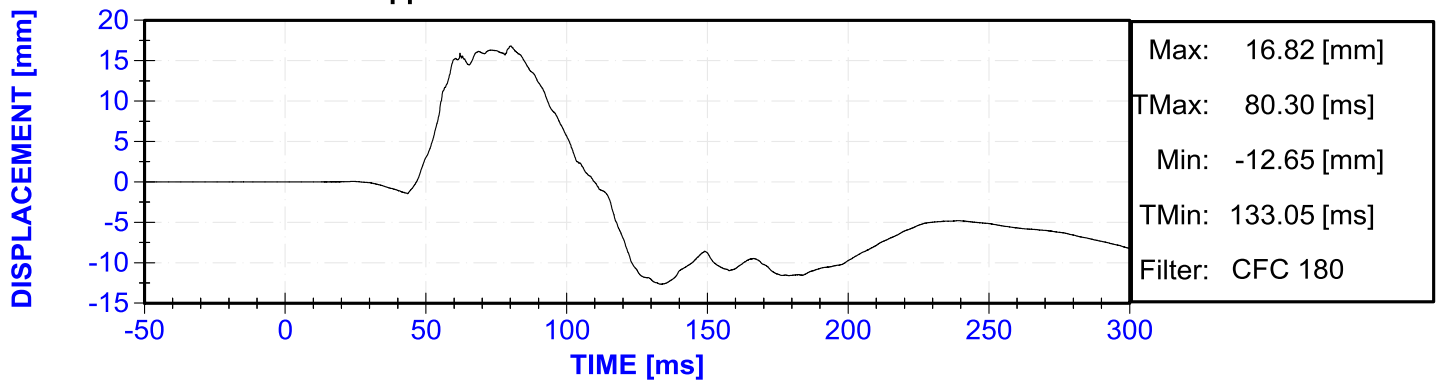
V2P1 Chest Left Upper Dx

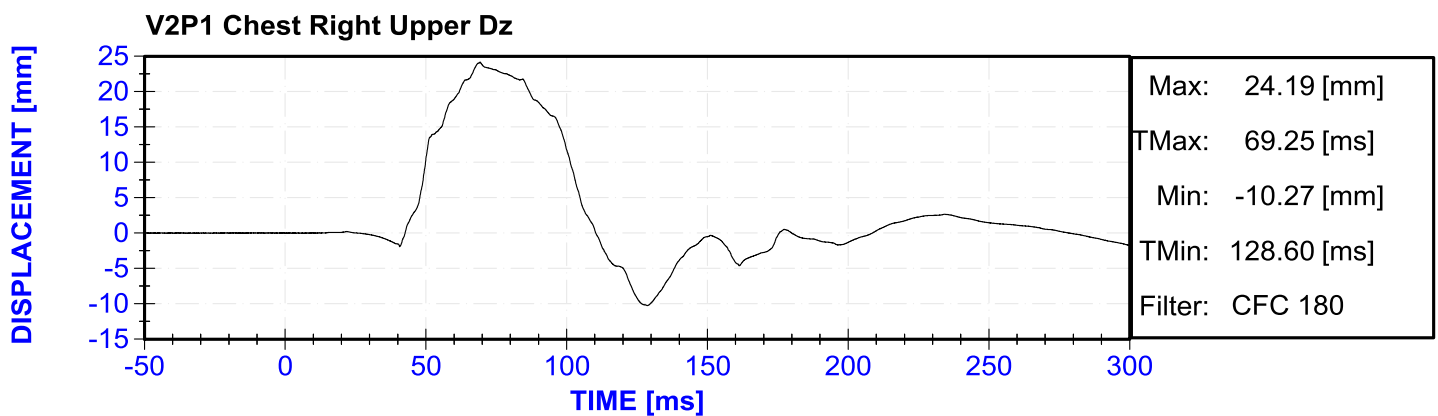
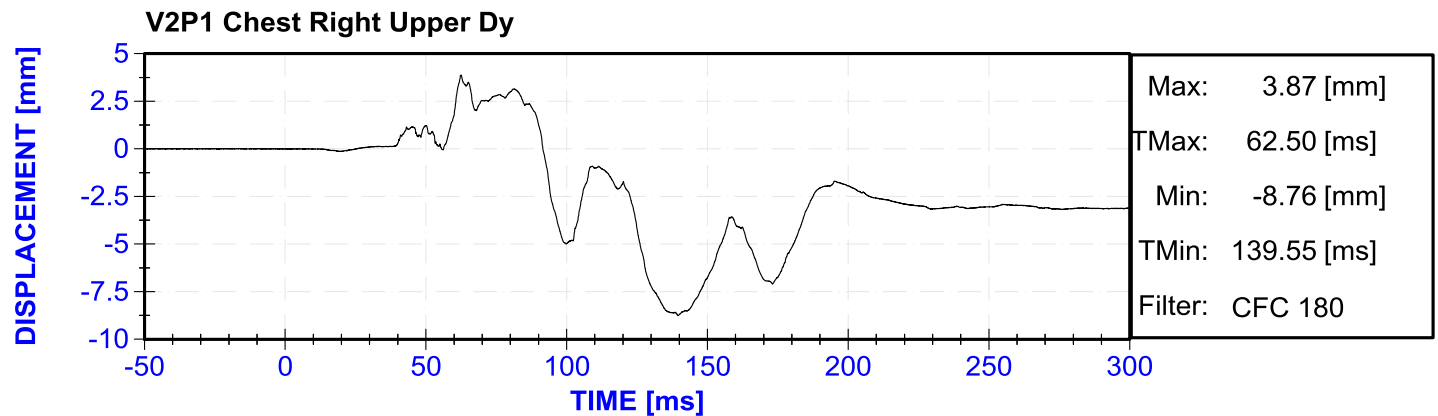
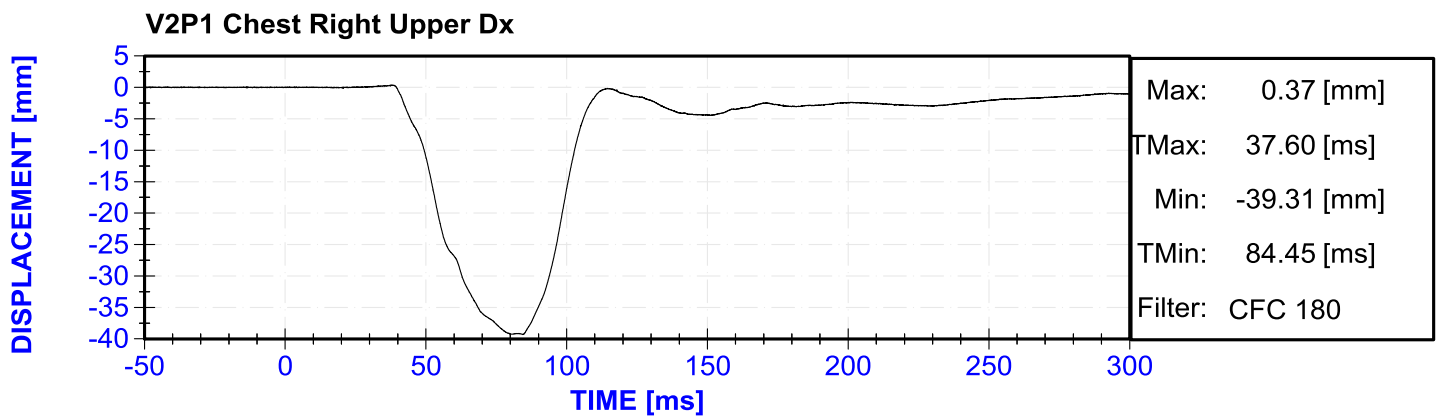
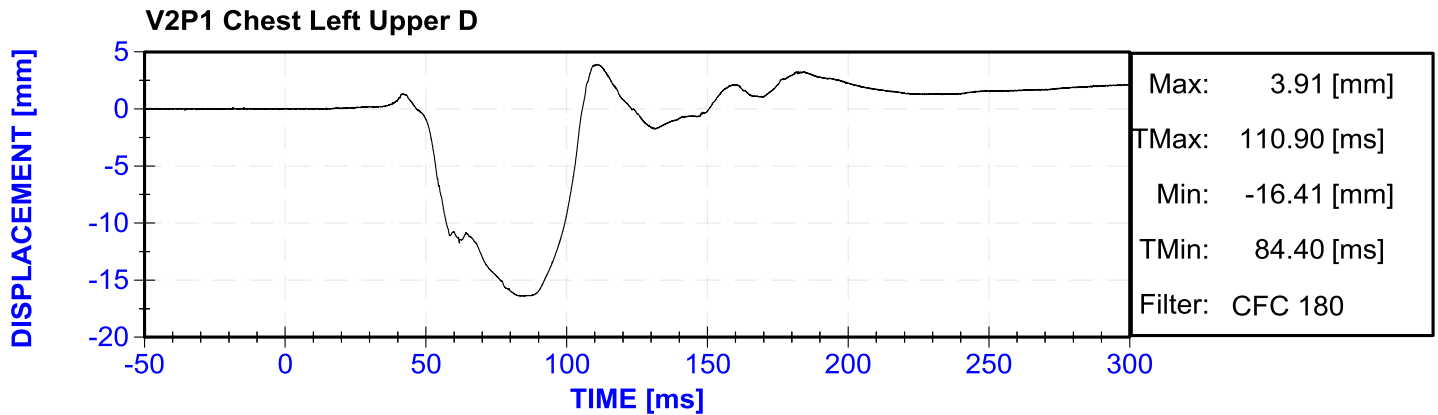


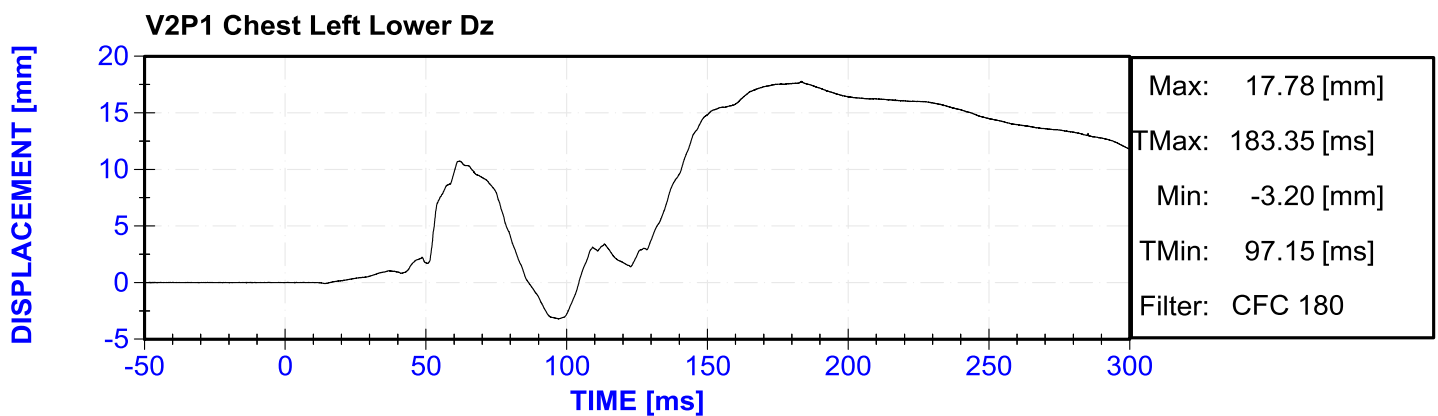
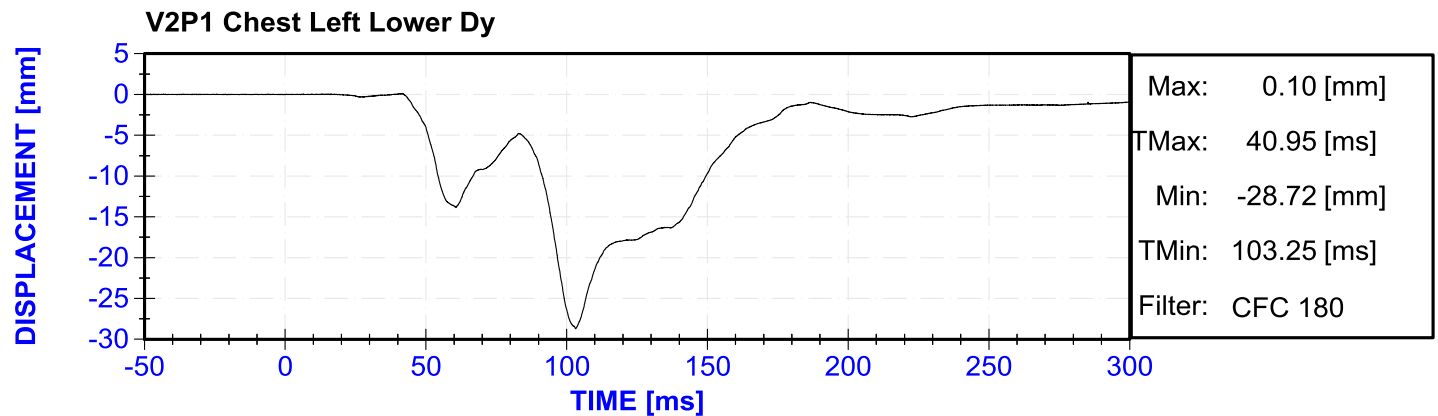
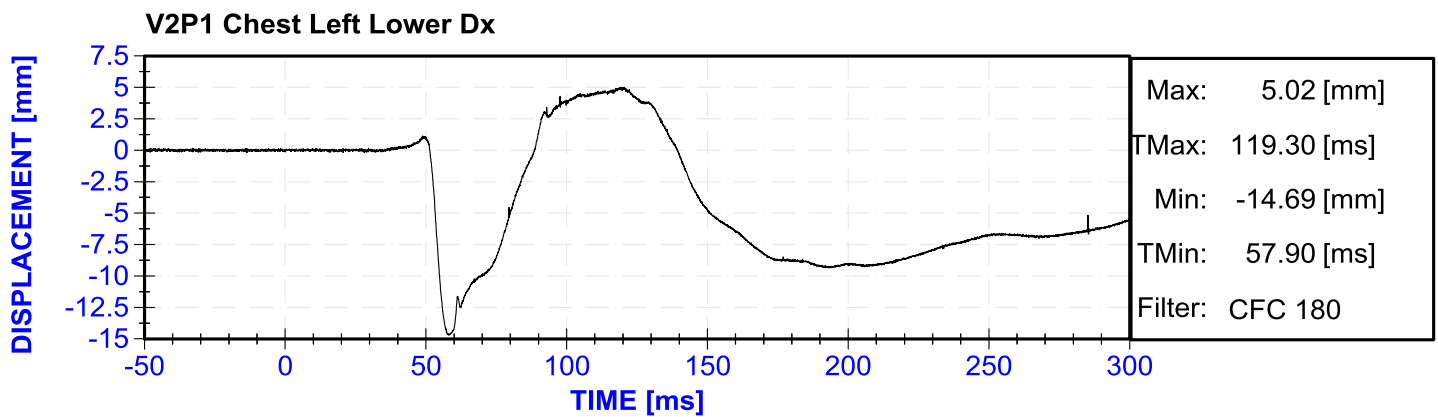
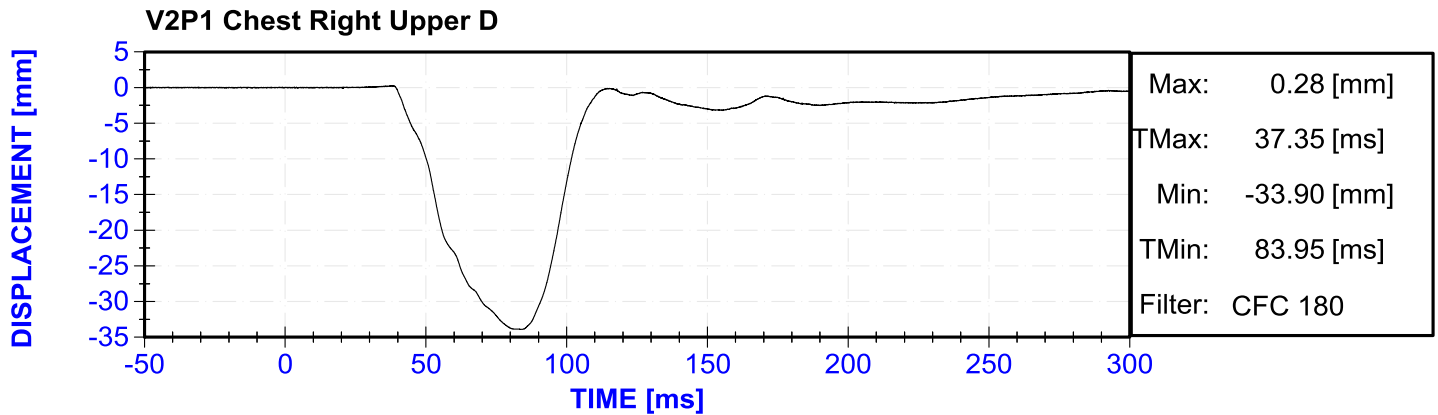
V2P1 Chest Left Upper Dy

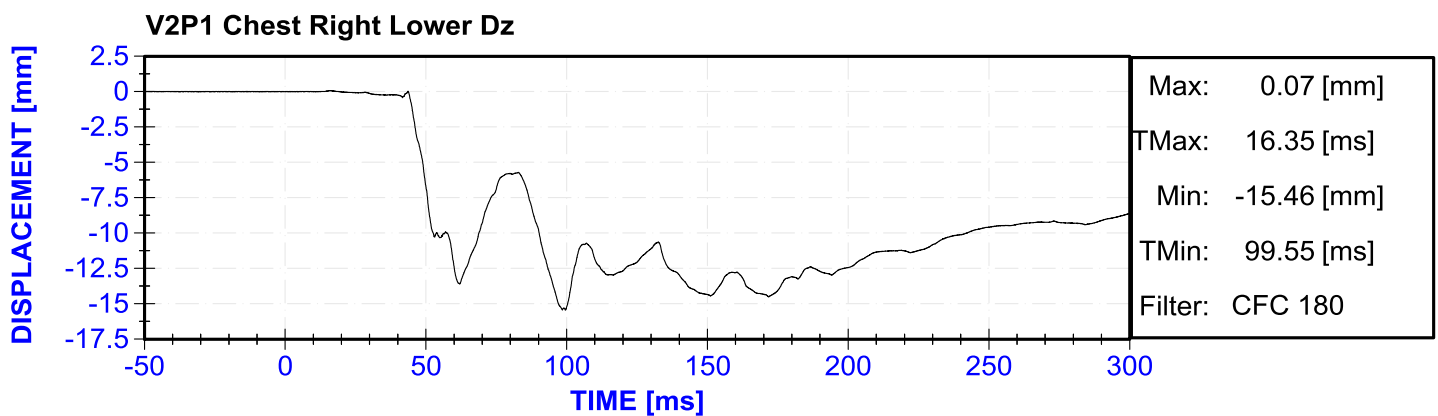
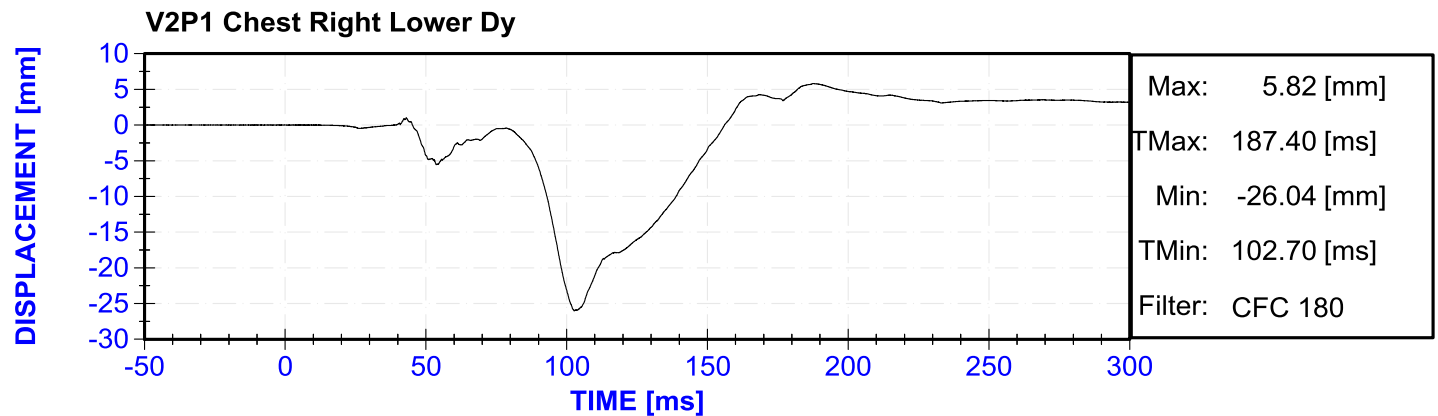
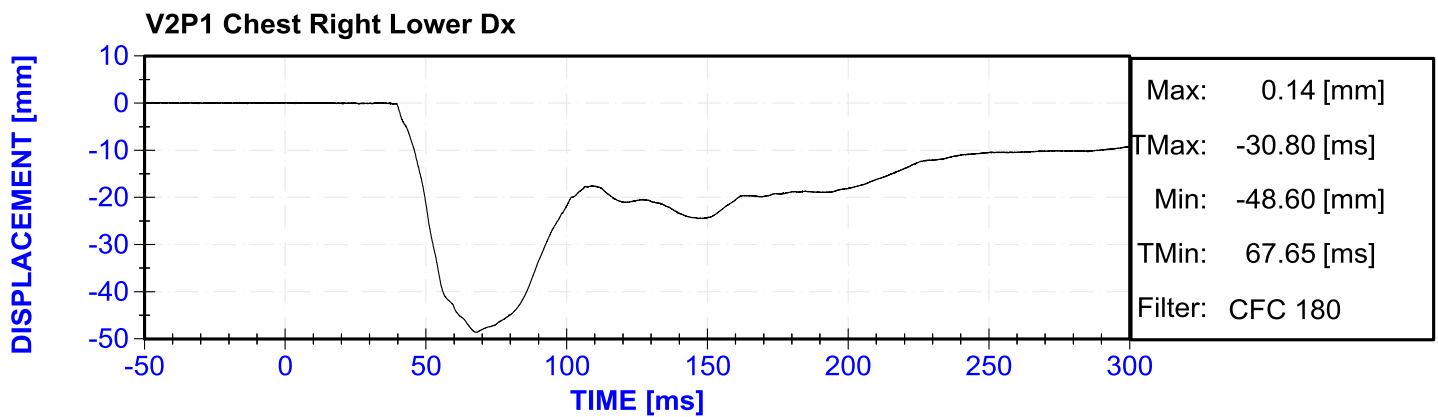
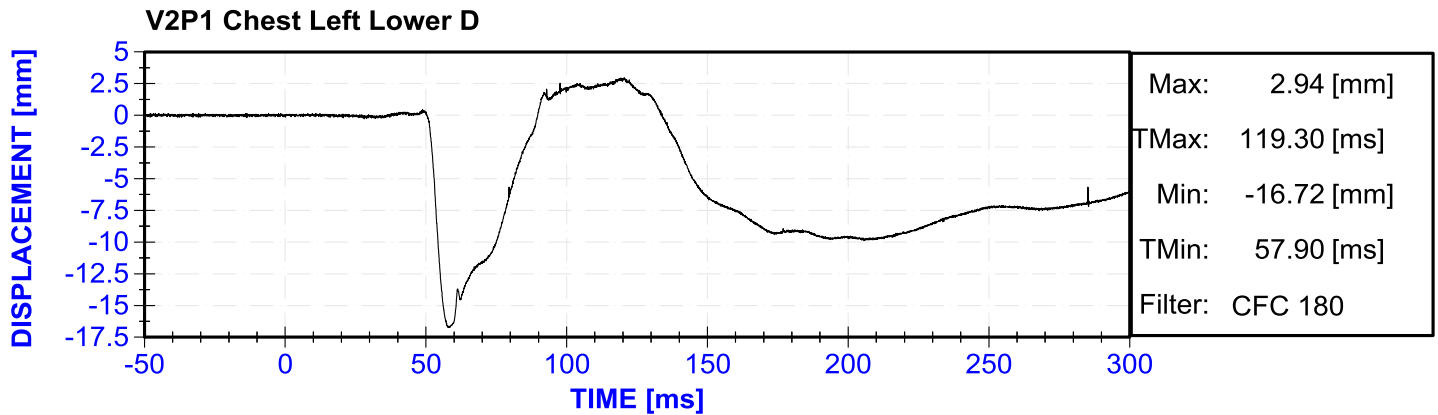


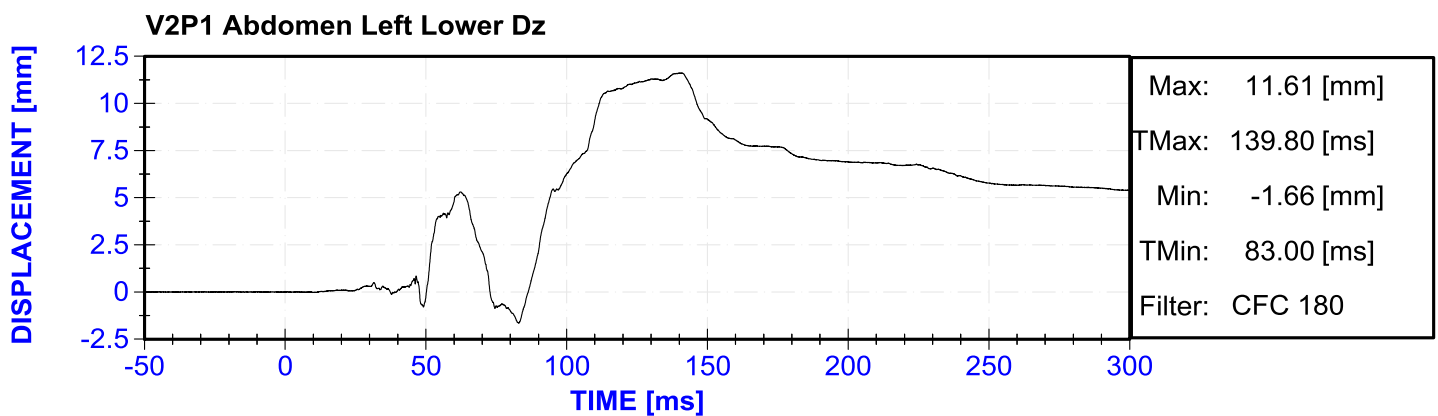
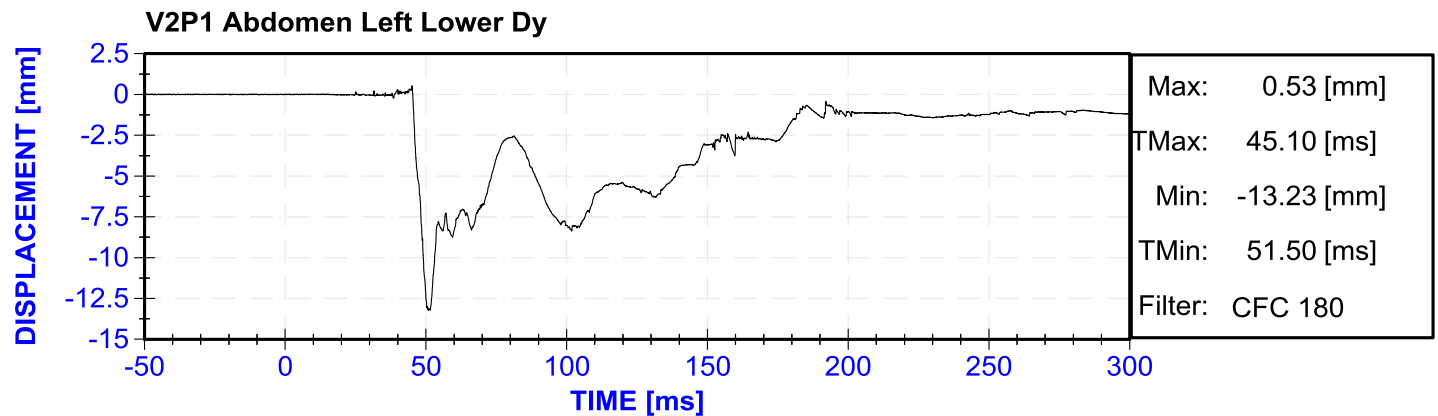
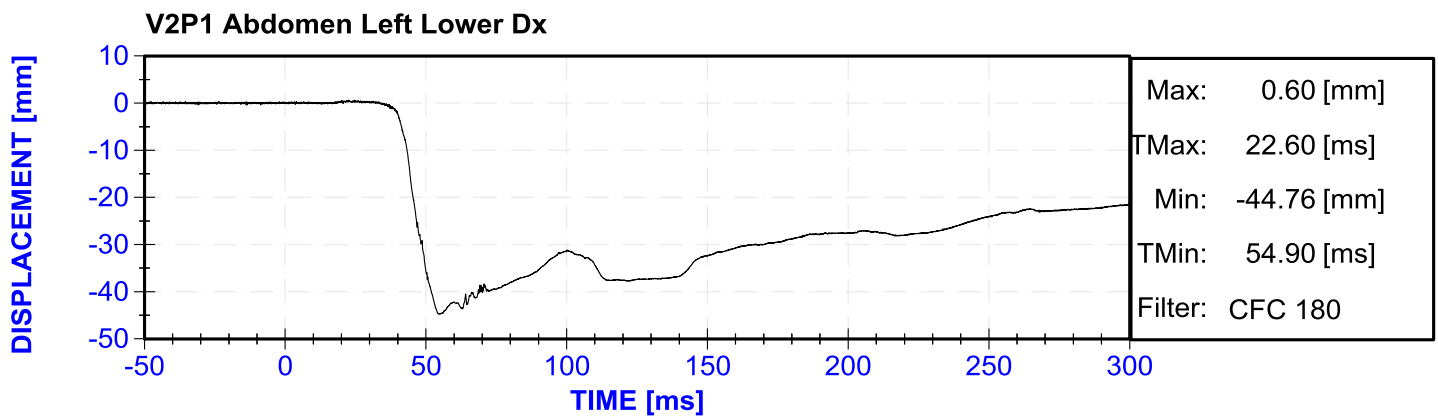
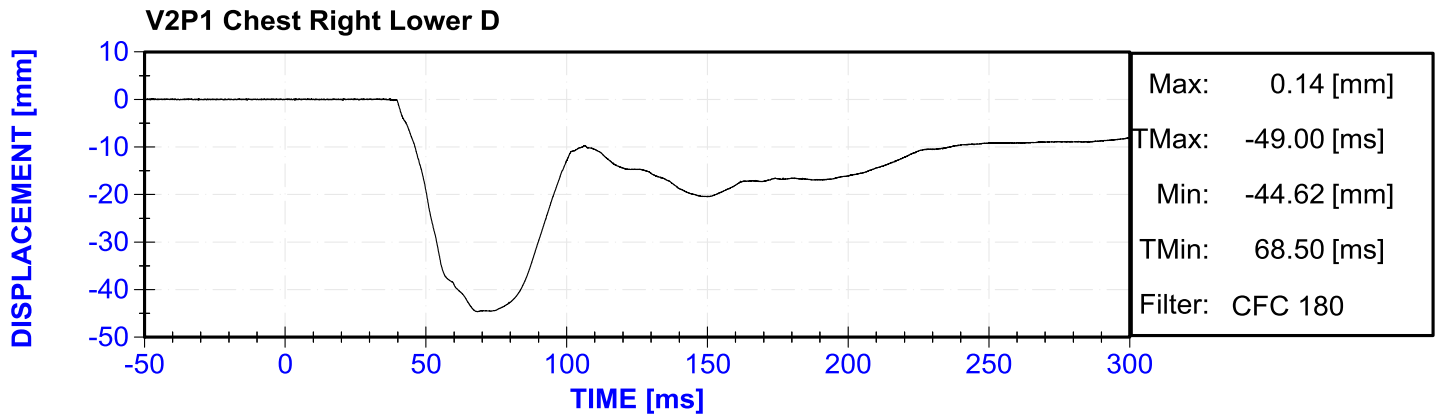
V2P1 Chest Left Upper Dz

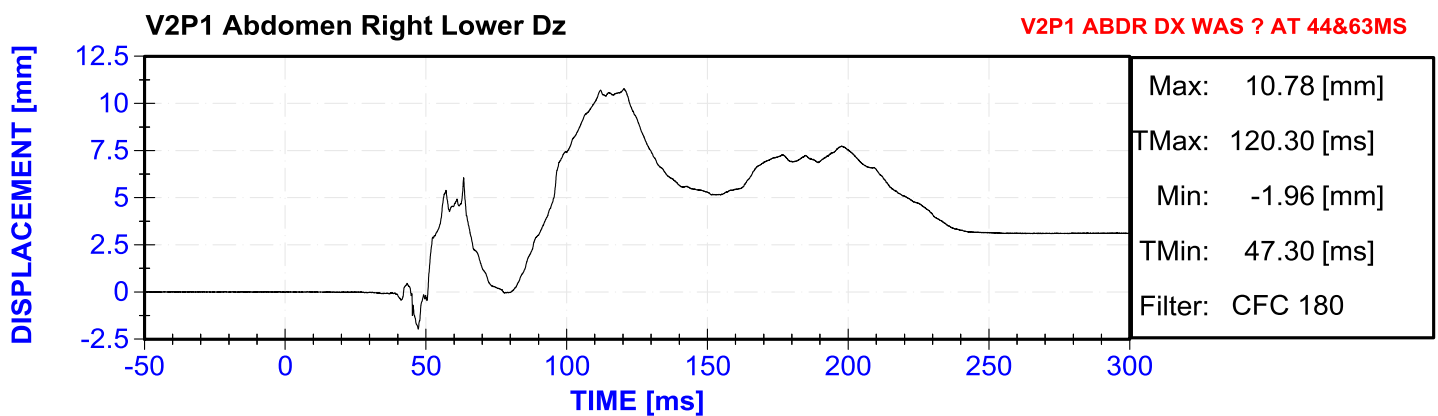
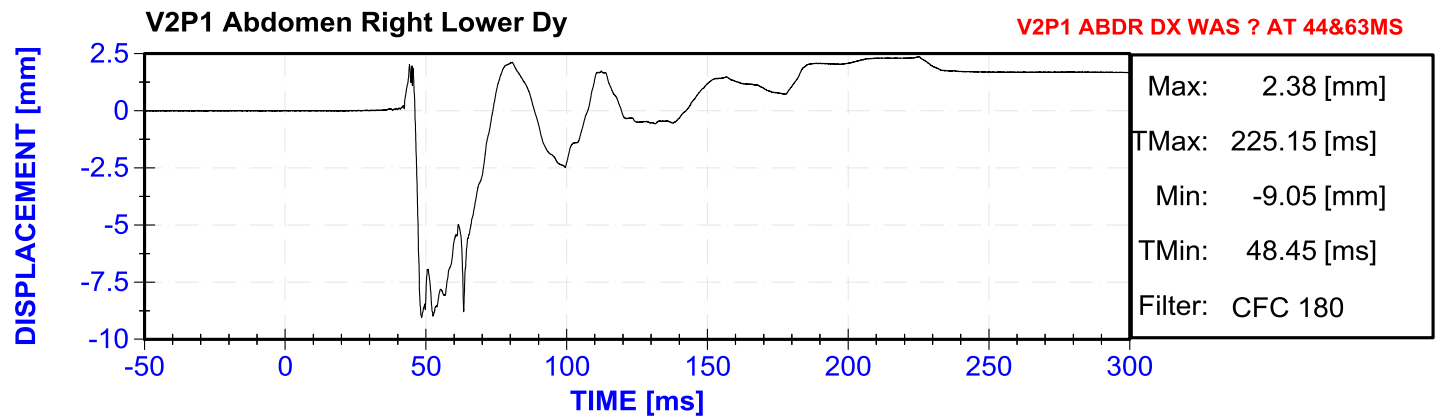
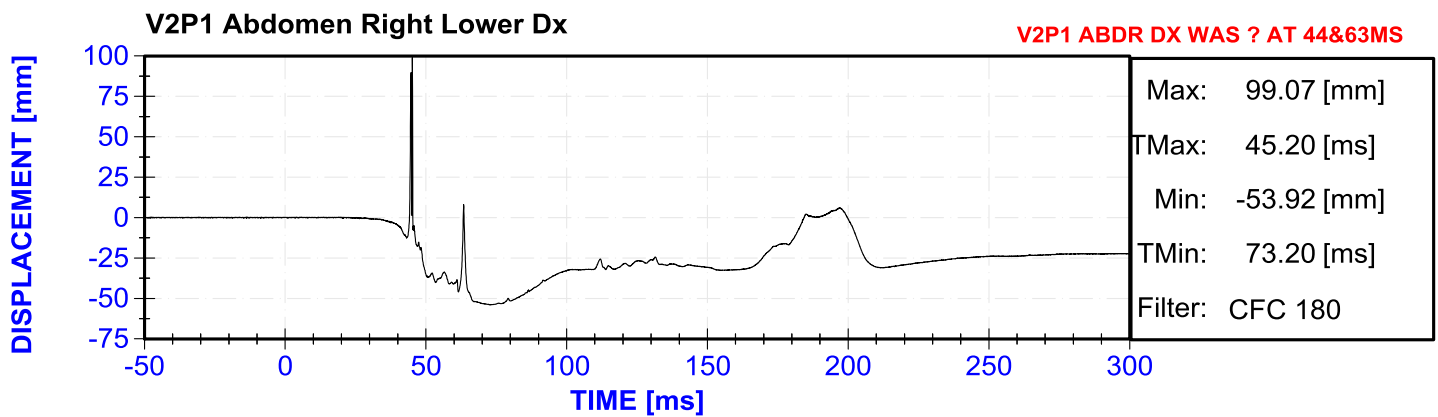
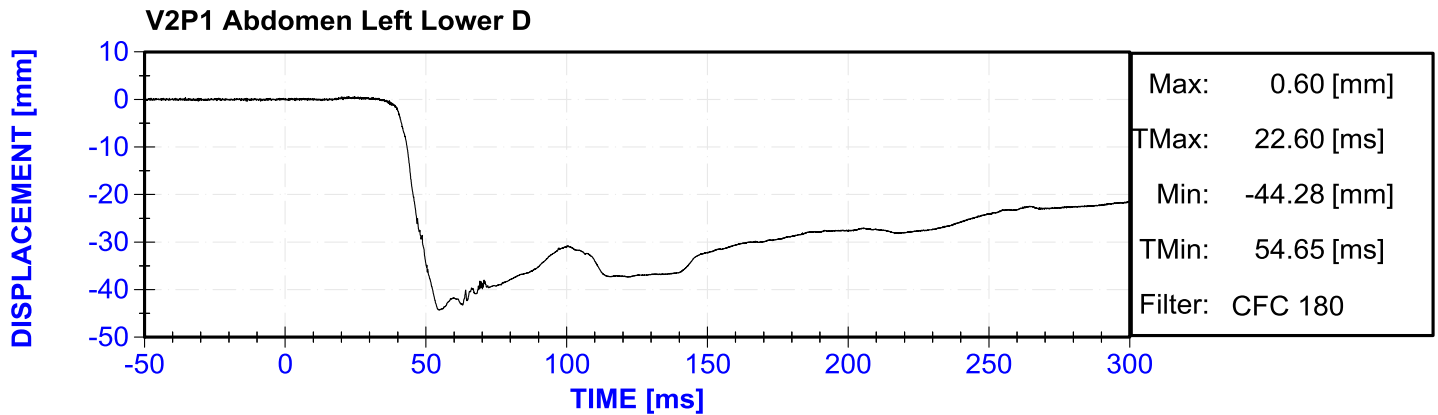


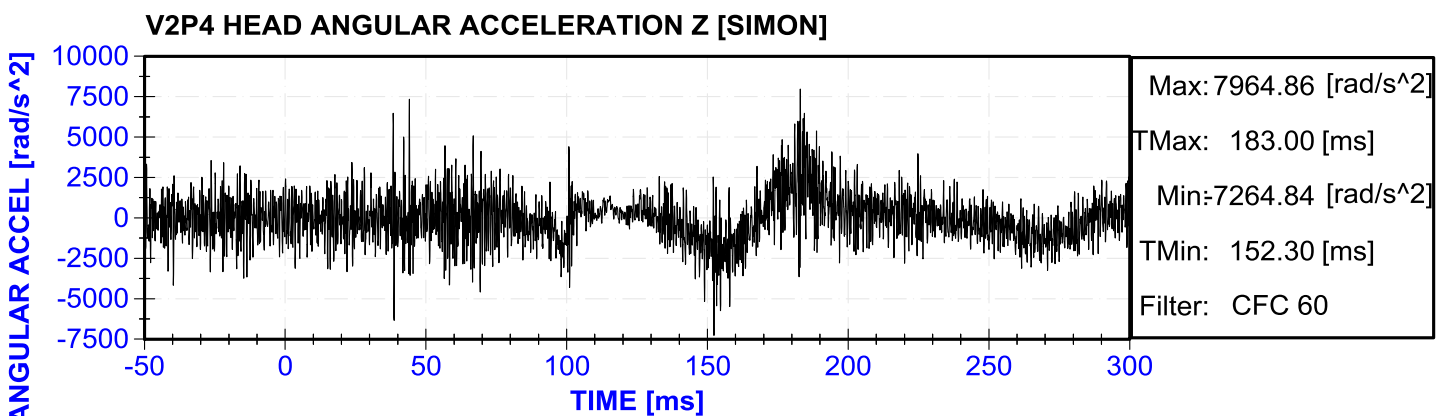
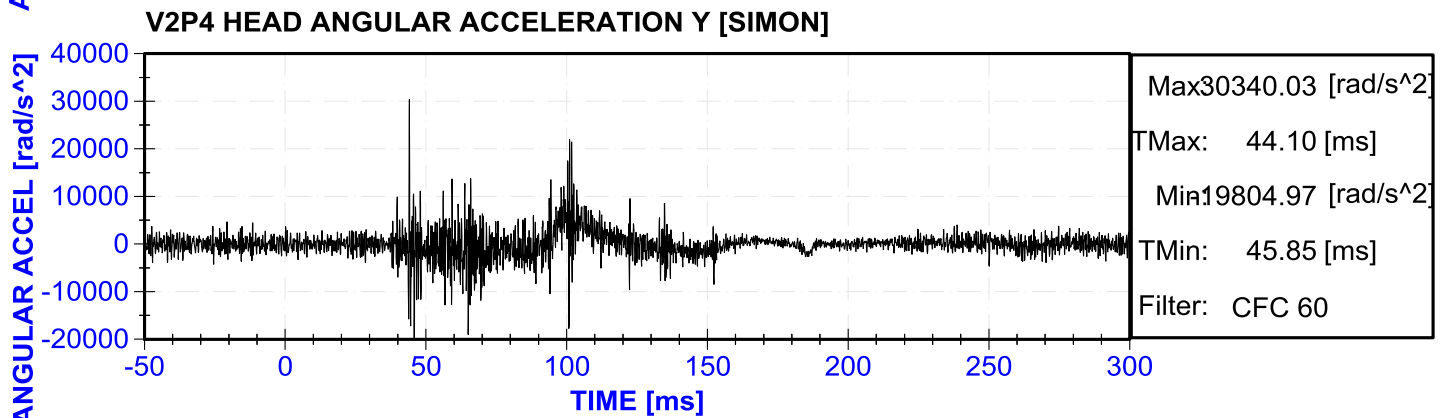
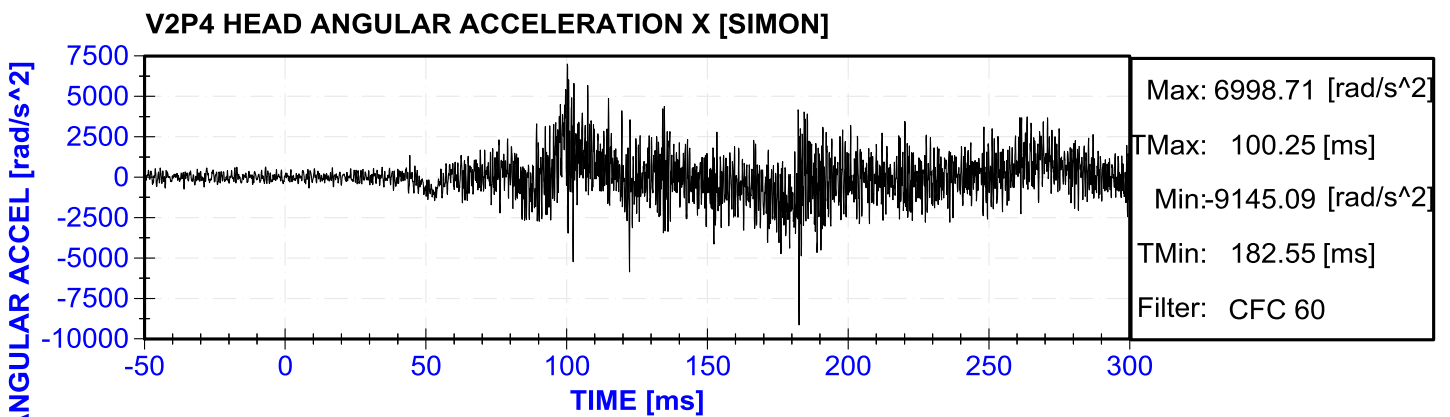
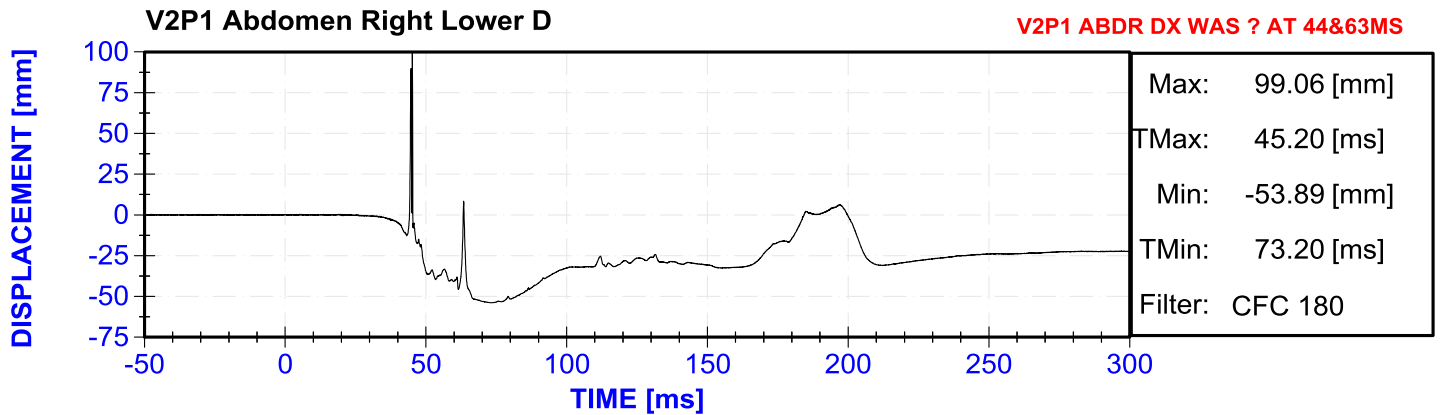


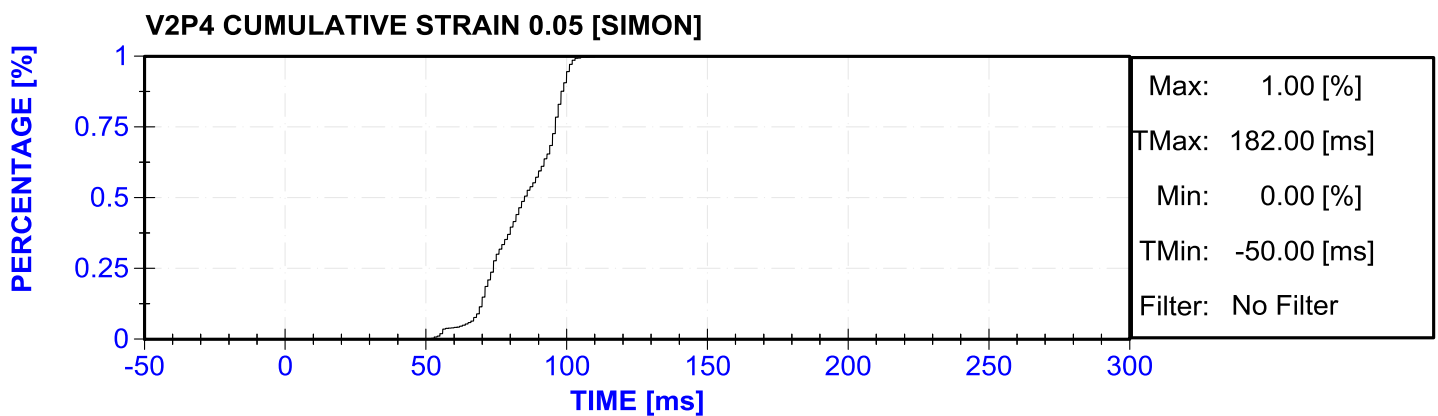
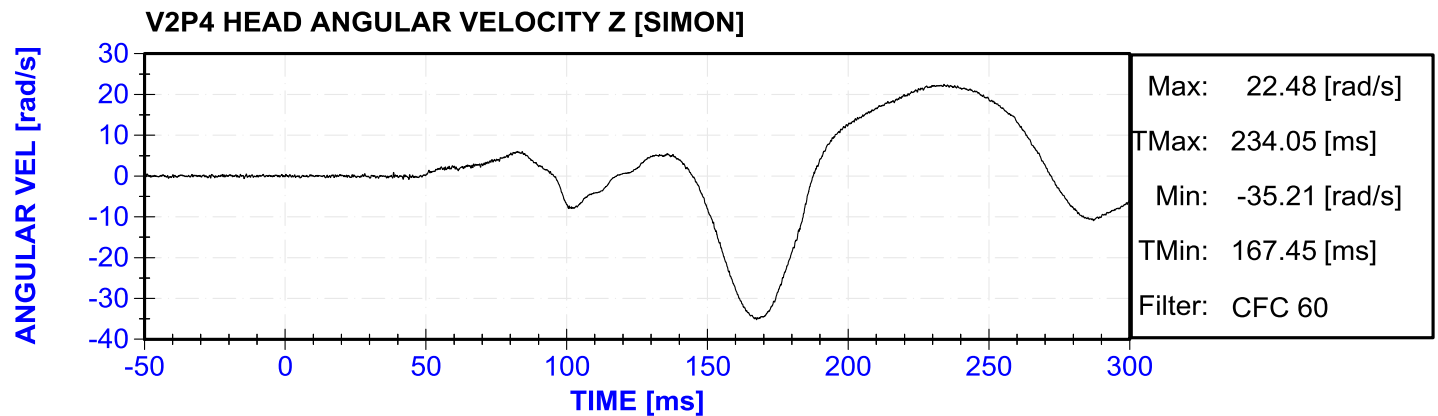
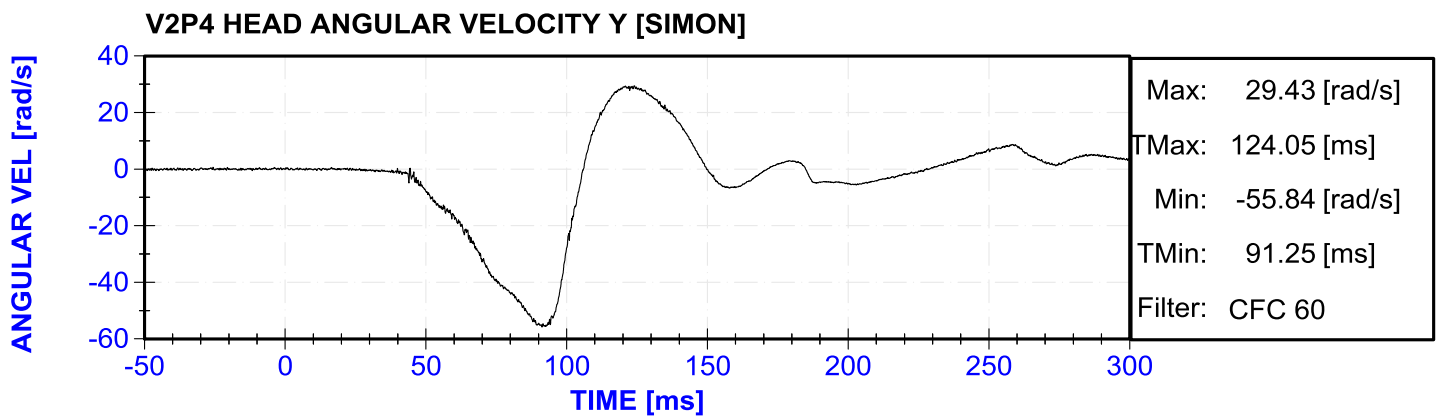
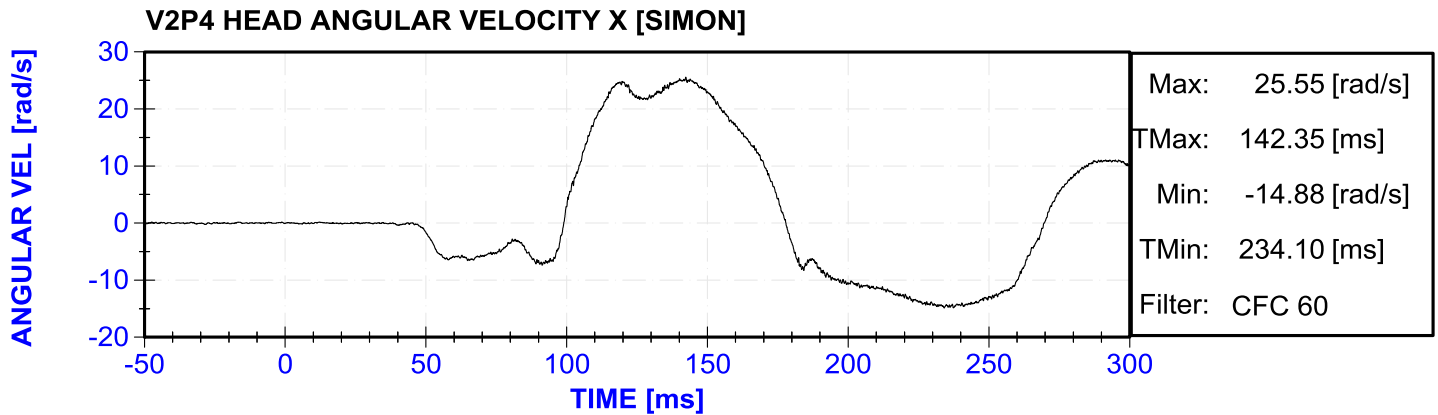


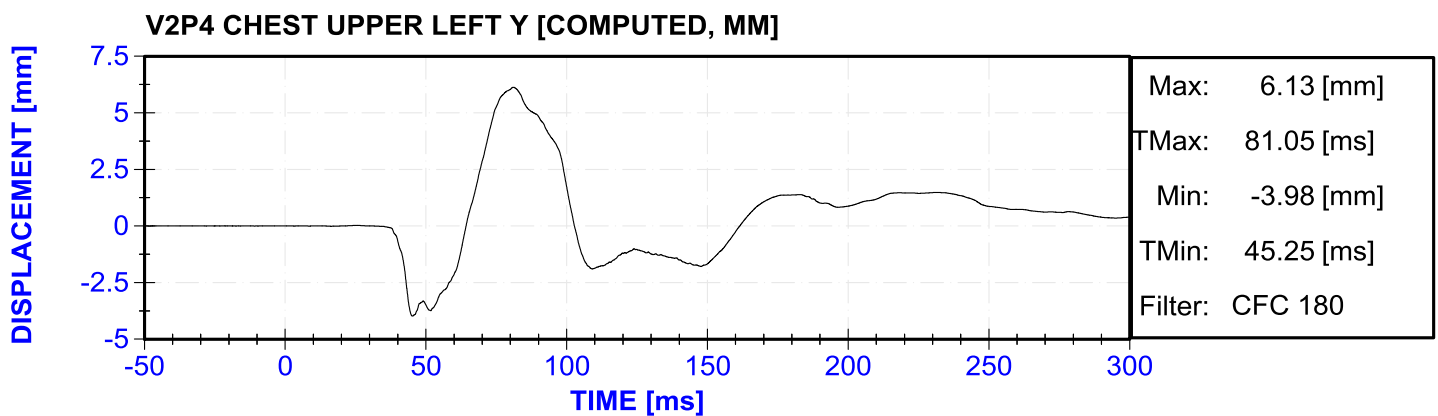
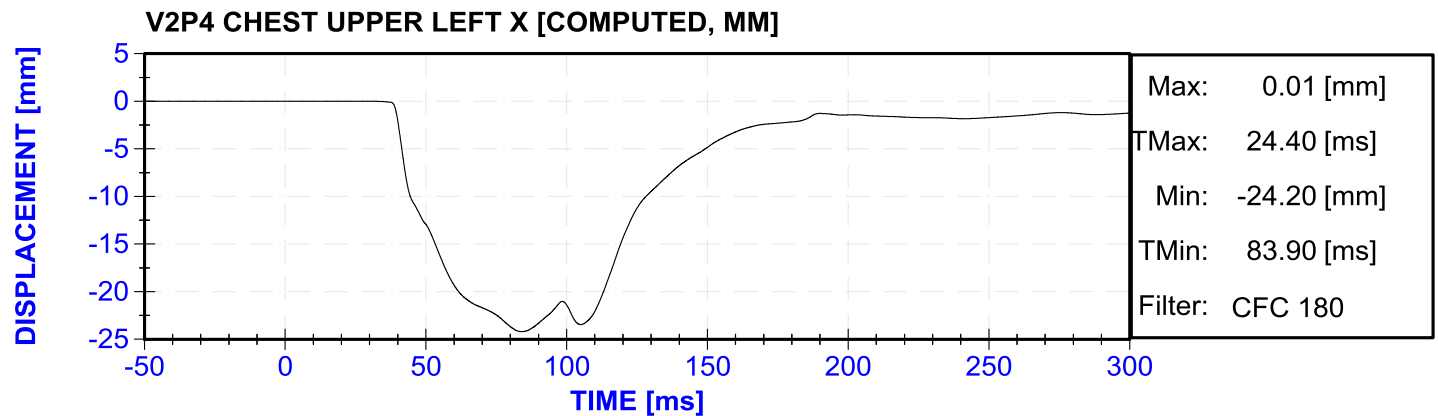
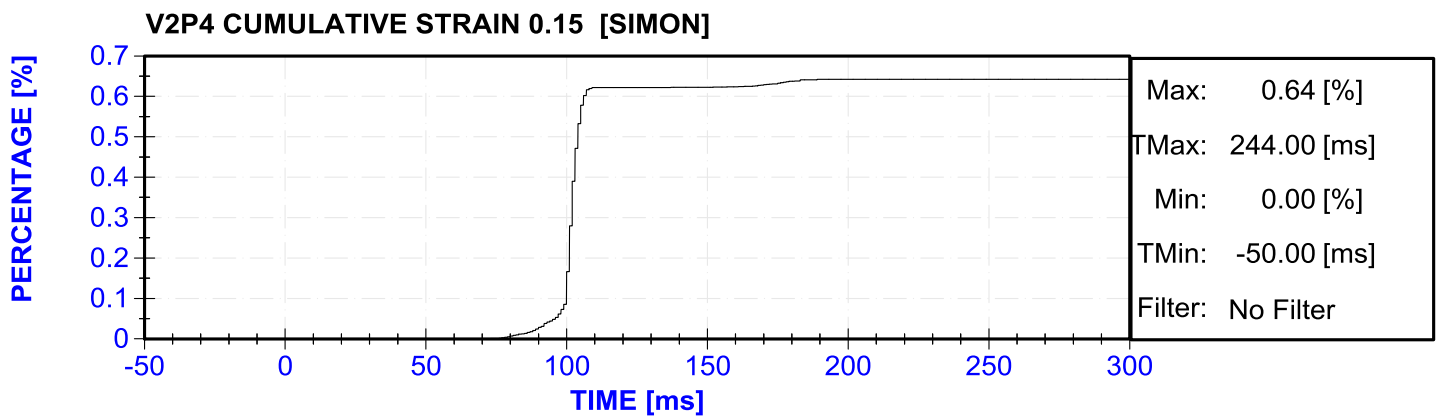
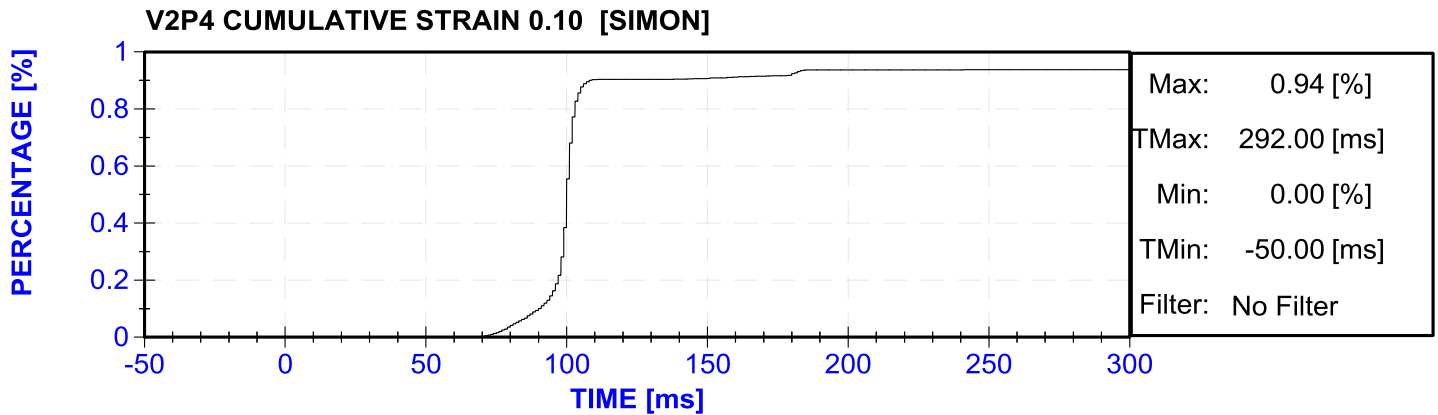


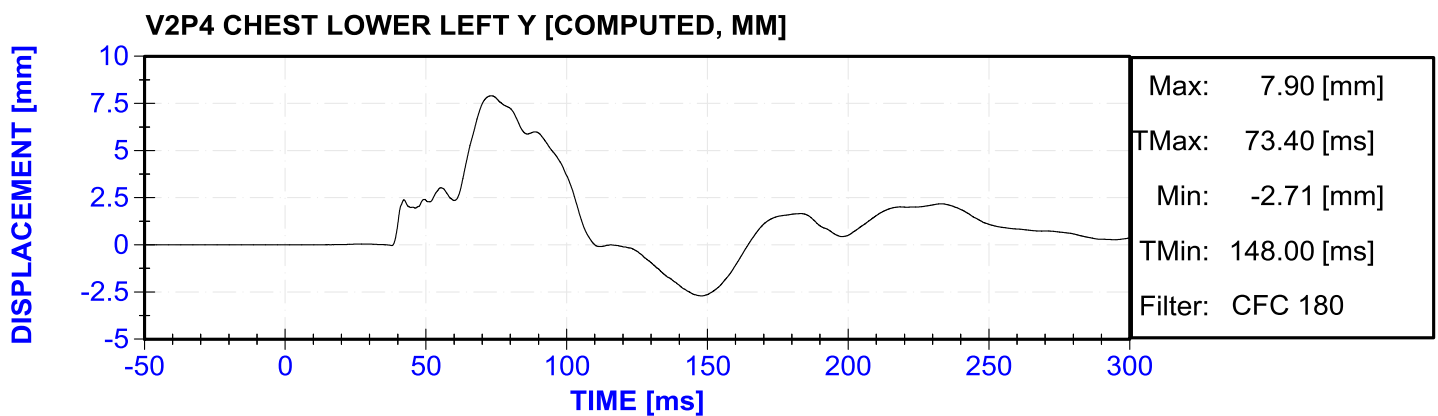
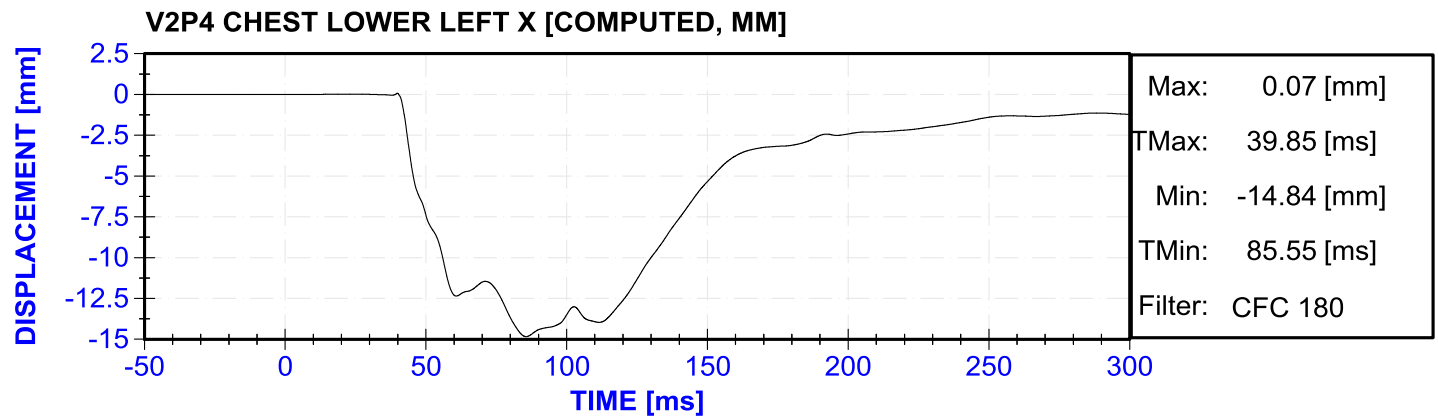
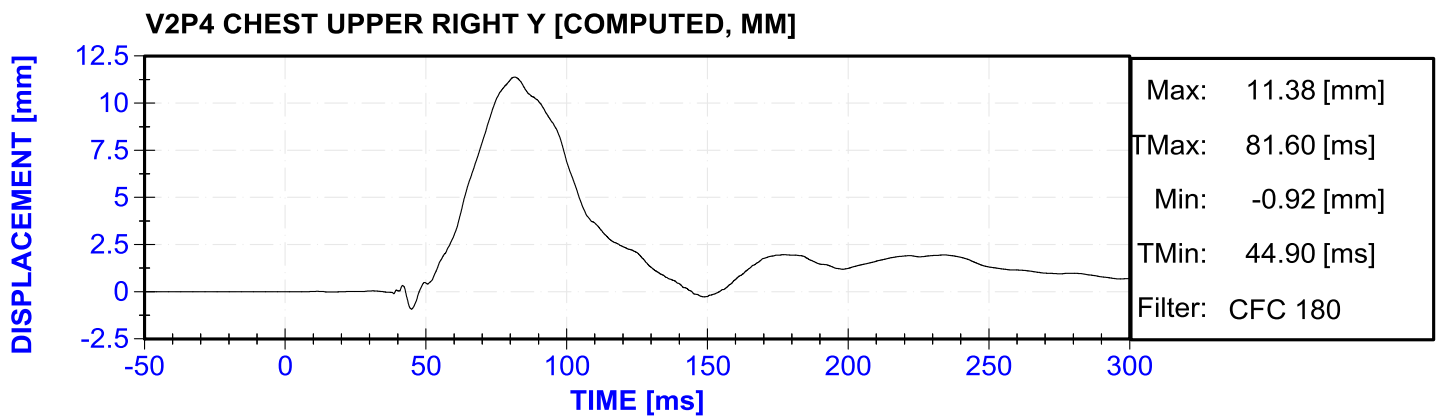
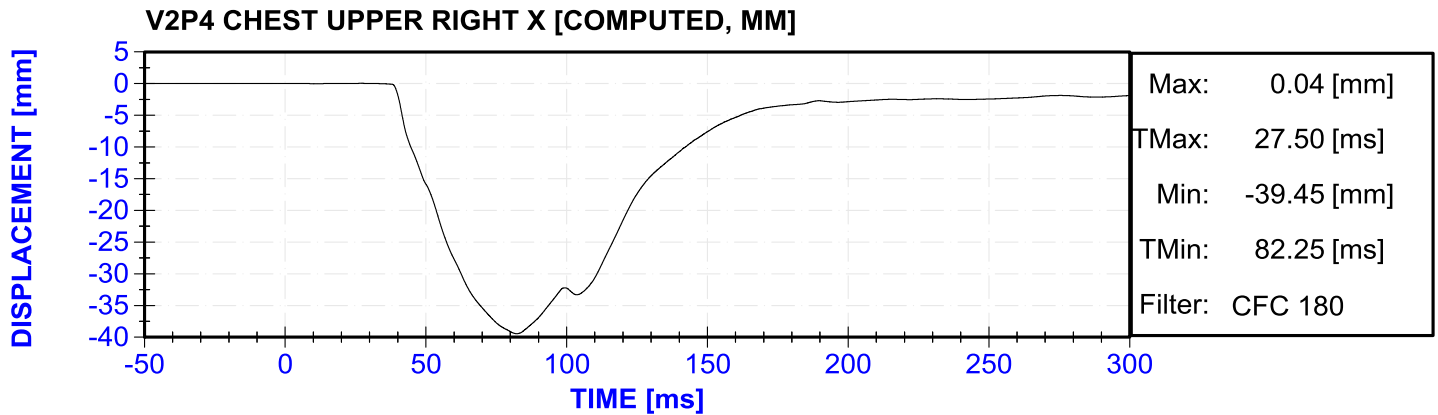


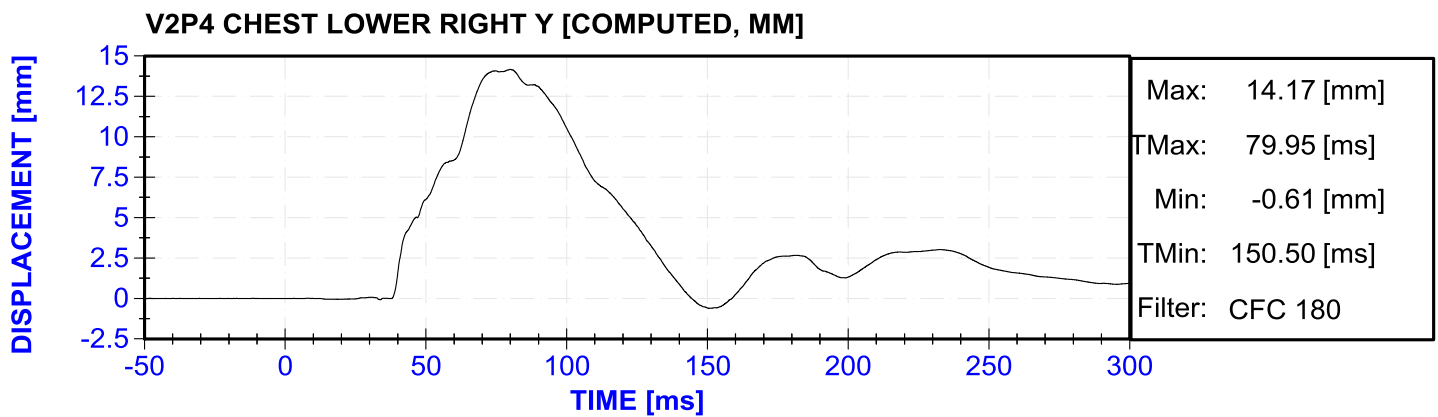
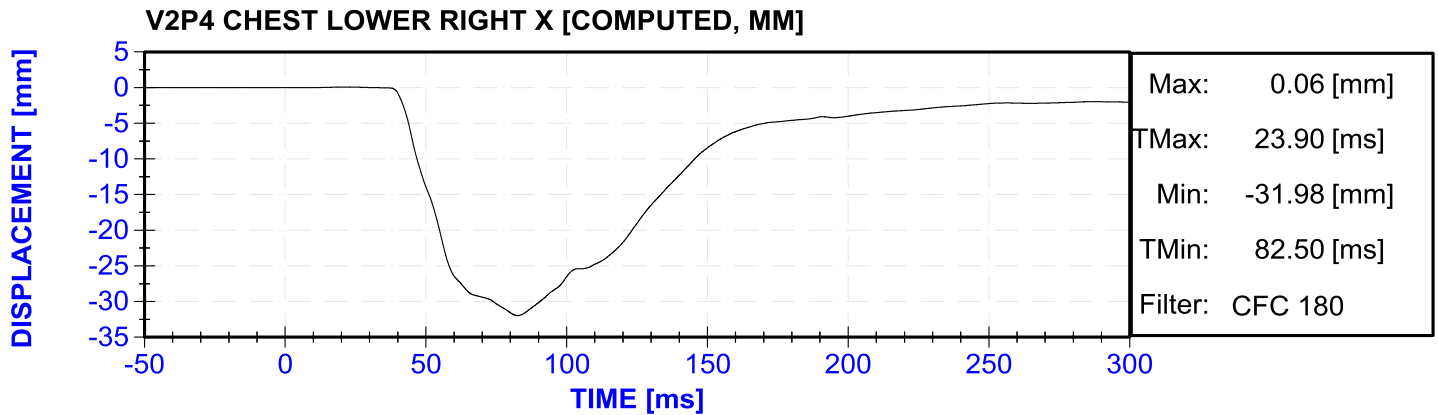












APPENDIX C

PART 572 E/O DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA SHEETS

Table 1 – Dummy Information

TYPE	DESCRIPTION	SERIAL NUMBER
THOR TK	50 TH Male	0007
Hybrid III	5 th Female	070

Table 2 – THOR Ankle offset File

LFTX	LFTY	LFTZ	RFTX	RFTY	RFTZ
Left Ankle X Rotation	Left Ankle Y Rotation	Left Ankle Z Rotation	Right Ankle X Rotation	Right Ankle Y Rotation	Right Ankle Z Rotation
-0.54849	15.178	39.871	-0.08422	-10.497	78.334

Table 3 - THOR Dummy Initial Set-Up Information

THOR – TK S/N: 0007								
Sensor	Manufacturer/ Serial #	Capacity	Units (M)	Units (E)	Range	CFC	Sensitivity (mv/V/EU)	Initial Offset (EU)
HEAD CG X	MFG: ENDEVCO S/N: P74967	1000	g	g	+500	1000	0.01776	0
HEAD CG Y	MFG: ENDEVCO S/N: P71875	1000	g	g	+500	1000	0.02073	0
HEAD CG Z	MFG: ENDEVCO S/N: P74784	1000	g	g	+500	1000	0.01724	0
HDCG Wx	MFG: DTS S/N: ARS4075	36000	deg/s	deg/s	+18000	1000	0.09195	0
HDCG Wy	MFG: DTS S/N: ARS4062	36000	deg/s	deg/s	+18000	1000	0.09185	0
HDCG Wz	MFG: DTS S/N: ARS4072	36000	deg/s	deg/s	+18000	1000	0.09459	0
NEKU Fx	MFG: Denton S/N: 94	4000	lbf	N	+2000	1000	0.0010704	0
NEKU Fy	MFG: Denton S/N: 94	4000	lbf	N	+2000	1000	0.0010713	0
NEKU Fz	MFG: Denton S/N: 94	6000	lbf	N	+3000	1000	-0.0003802	0
NEKU Mx	MFG: Denton S/N: 94	5000	in-lbf	N-m	+2500	600	0.0006608	0
NEKU My	MFG: Denton S/N: 94	5000	in-lbf	N-m	+2500	600	0.0006884	0
NEKU Mz	MFG: Denton S/N: 94	5000	in-lbf	N-m	+2500	600	0.0011074	0
NEKL Fx	MFG: DENTON S/N: 88	6000	lbf	N	+3000	1000	-0.0007702	0
NEKL Fy	MFG: DENTON S/N: 88	6000	lbf	N	+3000	1000	0.0007709	0
NEKL Fz	MFG: DENTON S/N: 88	6000	lbf	N	+3000	1000	-0.0003071	0
NEKL Mx	MFG: DENTON S/N: 88	8000	in-lbf	N-m	+4000	600	-0.0004719	0
NEKL My	MFG: DENTON S/N: 88	8000	in-lbf	N-m	+4000	600	0.000476	0
NEKL Mz	MFG: DENTON S/N: 88	8000	in-lbf	N-m	+4000	600	0.0007797	0
NKCF Fz	MFG: DENTON S/N: 93	2000	lbf	N	+1000	1000	0.0023275	0
NKCR Fz	MFG: DENTON S/N: 132	2000	lbf	N	+1000	1000	0.0021359	0
HDOT RDy	MFG: Sfernice S/N: 0942	180	deg	deg	0-180	180	3.038	0
LCLS Fx	MFG: Denton S/N: 75	900	lbf	N	+450	1000	-0.0021309	0
LCLS Fz	MFG: Denton S/N: 75	900	lbf	N	+450	1000	0.0022188	0
LCLT Fx	MFG: Denton S/N: 75	900	lbf	N	+450	1000	-0.0020167	0
LCLT Fz	MFG: Denton S/N: 75	900	lbf	N	+450	1000	0.0020993	0

THOR – TK (Continued) S/N: 0007								
Sensor	Manufacturer/ Serial #	Capacity	Units (M)	Units (E)	Range	CFC	Sensitivity (mv/V/EU)	Initial Offset (EU)
RCLS Fx	MFG: Denton S/N: 75	900	lbf	N	+ -450	1000	-0.0020571	0
RCLS Fz	MFG: Denton S/N: 75	900	lbf	N	+ -450	1000	0.002102	0
RCLT Fx	MFG: Denton S/N: 75	900	lbf	N	+ -450	1000	-0.0019974	0
RCLT Fz	MFG: Denton S/N: 75	900	lbf	N	+ -450	1000	0.0021601	0
CHLU Dx	MFG: FTSS S/N: AC3556	90	V	mm	3.3V	180	1000	
CHLU Ry	MFG: Sfernice S/N: AC6043	150	deg	deg	+ -450	180	3.0087	0
CHLU Rz	MFG: Sfernice S/N: AC6041	150	deg	deg	3.3V	180	3.0074	0
CHRU Dx	MFG: FTSS S/N: AC2288	90	V	mm	+ -450	180	1000	
CHRU Ry	MFG: Sfernice S/N: AC6045	150	deg	deg	3.3V	180	3.0077	0
CHRU Rz	MFG: Sfernice S/N: AC6044	150	deg	deg	+ -450	180	3.0199	0
CHLL Dx	MFG: FTSS S/N: AC3555	90	V	mm	3.3V	180	1000	
CHLL Ry	MFG: Sfernice S/N: AC6158	150	deg	deg	+ -450	180	3.0211	0
CHLL Rz	MFG: Sfernice S/N: AC6159	150	deg	deg	3.3V	180	3.013	0
CHRL Dx	MFG: FTSS S/N: AC2287	90	V	mm	+ -450	180	1000	
CHRL Ry	MFG: Sfernice S/N: AC6042	150	deg	deg	3.3V	180	3.016	0
CHRL Rz	MFG: Sfernice S/N: AC6040	150	deg	deg	+ -450	180	3.0217	0
ABDL Dx	MFG: Denton S/N: DI4779	120	V	mm	3.3V	180	1000	
ABDL Ry	MFG: Sfernice S/N: DI2388	150	deg	deg	+ -450	180	3.0829	-2.796
ABDL Rz	MFG: Sfernice S/N: DI2387	150	deg	deg	3.3V	180	3.0552	2.99
ABDR Dx	MFG: Denton S/N: DI4778	120	V	mm	+ -450	180	1000	
ABDR Ry	MFG: Sfernice S/N: 2389	150	deg	deg	3.3V	180	3.0544	4.046
ABDR Rz	MFG: Sfernice S/N: 6580	150	deg	deg	+ -450	180	3.0571	-1.935
SPNU Ax	MFG: ENDEVCO S/N: P74970	1000	g	g	3.3V	180	0.01842	0
SPNU Ay	MFG: ENDEVCO S/N: P74979	1000	g	g	+ -450	180	0.01743	0
SPNU Az	MFG: ENDEVCO S/N: P75158	1000	g	g	3.3V	180	0.01881	0
SPNM Ax	MFG: ENDEVCO S/N: P75155	1000	g	g	+ -450	180	0.018	0
SPNM Ay	MFG: ENDEVCO S/N: P75150	1000	g	g	3.3V	180	0.01839	0
SPNM Az	MFG: ENDEVCO S/N: P75153	1000	g	g	+ -450	180	0.01673	0
SPNL Ax	MFG: ENDEVCO S/N: P75154	1000	g	g	3.3V	180	0.01847	0
SPNL Ay	MFG: ENDEVCO S/N: P75156	1000	g	g	+ -450	180	0.01829	0
SPNL Az	MFG: ENDEVCO S/N: P75157	1000	g	g	3.3V	180	0.01802	0
SPNL Fx	MFG: Denton S/N: 122	6000	lbf	N	+ -450	1000	-0.000619	0
SPNL Fy	MFG: Denton S/N: 122	6000	lbf	N	3.3V	1000	0.0006203	0
SPNL Fz	MFG: Denton S/N: 122	8000	lbf	N	+ -450	1000	-0.0002354	0
SPNL Mx	MFG: Denton S/N: 122	12000	in-lbf	N-m	3.3V	1000	-0.0002368	0
SPNL My	MFG: Denton S/N: 122	16000	in-lbf	N-m	+ -450	1000	0.0002067	0
PVCG Ax	MFG: ENDEVCO S/N: P74965	1000	g	g	+ -500	1000	0.01837	0
PVCG Ay	MFG: ENDEVCO S/N: P74976	1000	g	g	+ -500	1000	0.0178	0
PVCG Az	MFG: ENDEVCO S/N: P51695	1000	g	g	+ -500	1000	0.02334	0
PVAL Fx	MFG: DENTON S/N: 75	10000	lbf	N	+ -5000	600	-0.0005328	0
PVAL Fy	MFG: DENTON S/N: 75	6000	lbf	N	+ -3000	600	-0.0002651	0
PVAL Fz	MFG: DENTON S/N: 75	6000	lbf	N	+ -3000	600	-0.0007271	0
PVAR Fx	MFG: DENTON S/N: 75	10000	lbf	N	+ -5000	600	0.0005363	0
PVAR Fy	MFG: DENTON S/N: 75	6000	lbf	N	+ -3000	600	-0.0002672	0

THOR – TK (Continued) S/N: 0007								
Sensor	Manufacturer/ Serial #	Capacity	Units (M)	Units (E)	Range	CFC	Sensitivity (mv/V/EU)	Initial Offset (EU)
PVAR Fz	MFG: DENTON S/N: 75	6000	lbf	N	+/-3000	600	0.0007239	0
PILL Fx	MFG: Denton S/N: 75	5845	lbf	N	+/-2922.5	1000	-0.0005391	0
PILL My	MFG: Denton S/N: 75	5753	in-lbf	N-m	+/-2876.5	1000	0.0004289	0
PILR Fx	MFG: Denton S/N: 76	5845	lbf	N	+/-2922.5	1000	-0.0005369	0
PILR My	MFG: Denton S/N: 76	5753	in-lbf	N-m	+/-2876.5	1000	0.0004252	0
FMRL Fx	MFG: Denton S/N: 108	30000	N	N	+/-15000	600	0.000145	0
FMRL Fy	MFG: Denton S/N: 108	30000	N	N	+/-15000	600	0.0001459	0
FMRL Fz	MFG: Denton S/N: 108	30000	N	N	+/-15000	600	-0.0000751	0
FMRL Mx	MFG: Denton S/N: 108	700	N-m	N-m	+/-350	600	0.0065128	0
FMRL My	MFG: Denton S/N: 108	700	N-m	N-m	+/-350	600	0.0065785	0
FMRL Mz	MFG: Denton S/N: 108	600	N-m	N-m	+/-300	600	0.0095255	0
KNEL Dx	MFG: Space Age Controls S/N: 025670	30	mm	mm	0-30	180	22.123	0
TIBL Ax	MFG: ENDEVCO S/N: P58896	1000	g	g	+/-500	1000	0.02216	0
TIBL Ay	MFG: ENDEVCO S/N: P52001	1000	g	g	+/-500	1000	0.01971	0
TBLU Fx	MFG: DENTON S/N: 76Fx	22240	N	N	+/-11120	600	0.000169	0
TBLU Fz	MFG: DENTON S/N: 76Fz	22240	N	N	+/-11120	600	0.0000937	0
TBLU Mx	MFG: DENTON S/N: 76Fy	800	N-m	N-m	+/-400	600	0.007312	0
TBLU My	MFG: DENTON S/N: 76Fy	800	N-m	N-m	+/-400	600	0.0072791	0
TBLL Fx	MFG: Denton S/N: 80Fx	22240	N	N	+/-11120	600	0.0001697	0
TBLL Fy	MFG: Denton S/N: 80Fy	22240	N	N	+/-11120	600	0.0001689	0
TBLL Fz	MFG: Denton S/N: 80Fz	22240	N	N	+/-11120	600	0.0000955	0
TBLL Mx	MFG: Denton S/N: 80Mx	800	N-m	N-m	+/-400	600	0.0074493	0
TBLL My	MFG: Denton S/N: 80My	800	N-m	N-m	+/-400	600	0.007423	0
ANKL Rx	MFG: Contelec S/N: ANKLX- 0371	200	deg	deg	+/-100	180	3.04982	-0.54849
ANKL Ry	MFG: Contelec S/N: ANKLY- 0367	200	deg	deg	+/-100	180	2.96419	15.178
ANKL Rz	MFG: Contelec S/N: ANKLZ- 0477	200	deg	deg	+/-100	180	2.974	39.871
FOTL Ax	MFG: ENDEVCO S/N: P64149	1000	g	g	+/-500	1000	0.02061	0
FOTL Ay	MFG: ENDEVCO S/N: P64144	1000	g	g	+/-500	1000	0.01865	0
FOTL Az	MFG: ENDEVCO S/N: P51684	1000	g	g	+/-500	1000	0.01951	0
FMRR Fx	MFG: Denton S/N: 107	30000	N	N	+/-15000	600	0.000142	0
FMRR Fy	MFG: Denton S/N: 107	30000	N	N	+/-1500	600	0.000142	0
FMRR Fz	MFG: Denton S/N: 107	30000	N	N	+/-15000	600	-0.0000739	0
FMRR Mx	MFG: Denton S/N: 107	700	N-m	N-m	+/-350	600	0.006364	0
FMRR My	MFG: Denton S/N: 107	700	N-m	N-m	+/- 350	600	0.0064253	0
FMRR Mz	MFG: Denton S/N: 107	700	N-m	N-m	+/-350	600	0.0093003	0
KNER Dx	MFG: Space Age Controls S/N: 019588	30	mm	mm	0-30	180	-23.168	0
TIBR Ax	MFG: ENDEVCO S/N: P52062	1000	g	g	+/-500	1000	0.01808	0
TIBR Ay	MFG: ENDEVCO S/N: P64141	1000	g	g	+/-500	1000	0.01963	0
TBRU Fx	MFG: DENTON S/N: 97Fx	22240	N	N	+/-11120	600	0.000173	0
TBRU Fz	MFG: DENTON S/N: 97Fz	22240	N	N	+/-11120	600	0.0000928	0
TBRU Mx	MFG: DENTON S/N: 97Mx	800	N-m	N-m	+/-400	600	0.0072535	0
TBRU My	MFG: DENTON S/N: 97My	800	N-m	N-m	+/-400	600	0.0073723	0

THOR – TK (Continued) S/N: 0007								
Sensor	Manufacturer/ Serial #	Capacity	Units (M)	Units (E)	Range	CFC	Sensitivity (mv/V/EU)	Initial Offset (EU)
TBRL Fx	MFG: Denton S/N: 140Fx	22240	N	N	+ -11120	600	0.0001759	0
TBRL Fy	MFG: Denton S/N: 140Fy	22240	N	N	+ -11120	600	0.000175	0
TBRL Fz	MFG: Denton S/N: 140Fz	22240	N	N	+ -11120	600	0.0000958	0
TBRL Mx	MFG: Denton S/N: 140Mx	800	N-m	N-m	+ -400	600	0.0075631	0
TBRL My	MFG: Denton S/N: 140My	800	N-m	N-m	+ -400	600	0.0074486	0
ANKR Rx	MFG: Contelec S/N: ANKRX-0368	200	deg	deg	+ -100	180	3.13066	-0.08422
ANKR Ry	MFG: Contelec S/N: ANKRY-0369	200	deg	deg	+ -100	180	2.95682	-10.497
ANKR Rz	MFG: Contelec S/N: ANKRZ-0370	200	deg	deg	+ -100	180	-1.958	78.334
FOTR Ax	MFG: ENDEVCO S/N: P64100	1000	g	g	+ -500	1000	0.02138	0
FOTR Ay	MFG: ENDEVCO S/N: P59000	1000	g	g	+ -500	1000	0.0193	0
FOTR Az	MFG: ENDEVCO S/N: P51978	1000	g	g	+ -500	1000	0.01798	0

Table 4 - THOR Dummy Initial Set-Up Information (IR-TRACC)

THOR – TK S/N: 0007			
Sensor	IR-Tracc Exponent	IR-Tracc Slope	IR-Tracc Intercept
CHLU Dx	-0.4675	-34.009493	120.7103
CHRU Dx	-0.4675	-34.009493	120.7103
CHLL Dx	-0.4675	-34.009493	120.7103
CHRL Dx	-0.4675	-34.009493	120.7103
ABDL Dx	-0.3880	-0.0252	4.1854
ABDR Dx	-0.3880	-0.0252	4.1854

Table 5 - THOR IR-TRACC Polarity

In order to reduce the risk of damage to instrumentation, it is recommended that the 3D IR-TRACC units are not disconnected from the rib cage to conduct the polarity test. An alternate procedure for checking the IR-TRACC polarity is described below.

1. Using the data acquisition system control software, open a live view of each channel. If possible, view the DX, RY, and RZ components of a given quadrant simultaneously.
2. Record the initial reading of each channel
3. Perform the following motions on each of the four rib attachment locations and two abdomen attachment locations (specified by the hexagonal bolt attaching the blue ribs).
 - a. DX: Push inward (front-to-back). The IR-TRACC tube voltage should increase.
 - b. RY: Push downward (head-to-pelvis). The Y-axis potentiometer reading should decrease.
 - c. RZ: Push rightward (left-to-right). The Z-axis potentiometer should increase.
4. Record the final reading of each channel
5. If the “Measured” value (increase or decrease) does not match the “Expected” value, the polarity of the channel must be inverted.

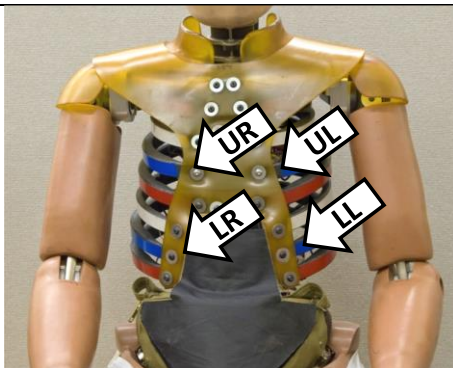
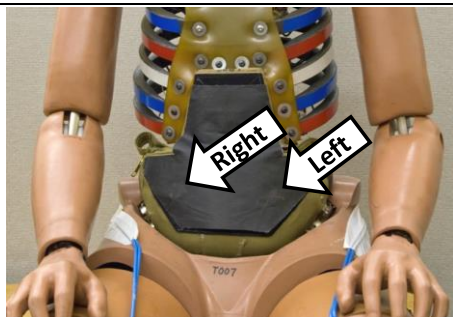


Figure 1. Manipulation to determine thoracic IR-TRACC polarity.

UR				UL			
Channel	Initial	Final	Measured	Channel	Initial	Final	Measured
			Expected				Expected
DX (V)	0.168	0.220	Increase	DX (V)	0.168	0.20	Increase
			Increase				Increase
RY (Deg)	-6	0	Increase	RY (Deg)	5.62	0	Decrease
			Decrease				Decrease
RZ (Deg)	9	6	Decrease	RZ (Deg)	-12.5	-14	Decrease
			Increase				Increase
LR				LL			
Channel	Initial	Final	Measured	Channel	Initial	Final	Measured
			Expected				Expected
DX (V)	0.098	0.14	Increase	DX (V)	0.10	0.13	Increase
			Increase				Increase
RY (Deg)	1.7	3.3	Increase	RY (Deg)	0	-3	Decrease
			Decrease				Decrease
RZ (Deg)	7.5	2.0	Decrease	RZ (Deg)	10	17	Increase
			Increase				Increase



Abdomen Left				Abdomen Right			
Channel	Initial	Final	Measured Expected	Channel	Initial	Final	Measured Expected
DX (V)	0.04	0.09	Increase	DX (V)	0.045	0.09	Increase
			Increase				Increase
RY (Deg)	0.49	-4.78	Decrease	RY (Deg)	1.66	7.5	Increase
			Decrease				Decrease
RZ (Deg)	1.40	7.0	Increase	RZ (Deg)	0.71	-2	Decrease
			Increase				Increase

PRE-TEST

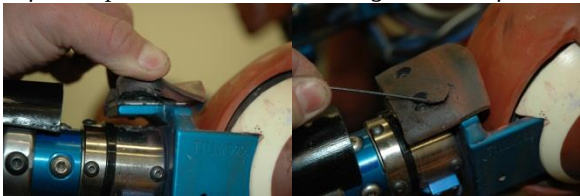
THOR Inspection Checklist

Date: 4/25/2012
NHTSA Representative: James Saunders
Witness(es):
Inspection type (circle one): PRE POST
Dummy S/N: 007
Dummy Description: THOR 50 th Male
Date of last Certification or Inspection: 4/21/2012
<u>Tests conducted since last full certification or inspection:</u> RB0181 – 2011 Chevrolet Cruze
<u>Known errors in data channels (no data, clipping, unexpected drops):</u>
<u>Physical evidence of damage:</u>
<u>Anecdotal evidence of damage:</u>
<u>Equipment delivered to Borrower:</u>

HEAD	
☒ Y / ☐ N	Rear head cap mounts securely to head
☒ Y / ☐ N	Head skin fits securely over skull
☐ Y / ☒ N	Head skin shows no sign of tears or damage <i>Gouge left side of forehead – damage from last research testing series. Light scuff on top left of head skin from dash impact (RB0182)</i>
☒ Y / ☐ N	Interior components of skull cavity (ballast, accelerometer mount, accelerometers) securely attached
☒ Y / ☐ N	Head securely mounted to OC joint <i>Tightened set screws to alleviate loose OC Joint (RB0181)</i>
OTHER	
NECK	
☒ Y / ☐ N	Neck cables slide freely through holes in neck plates
☒ Y / ☐ N	Neck cables show no sign of fraying, broken strands, or kinking
☐ Y / ☒ N	No evidence of debonding between neck pucks and plates If N – indicate which interface (where plate/puck 1 attach to upper neck load cell): <i>Slight debonding between pucks 4 and 5, posterior surface</i>
☒ Y / ☐ N	No evidence of debonding or permanent compression in neck soft stop assemblies
☒ Y / ☐ N	Neck securely attached to upper neck load cell
☒ Y / ☐ N	Neck securely attached to lower neck load cell
☒ Y / ☐ N	Neck pitch change joint mechanism mating teeth are engaged
OTHER	
SPINE	
☒ Y / ☐ N	No evidence of debonding between thoracic spine flex joint and metal plates
☒ Y / ☐ N	No evidence of debonding between lumbar spine flex joint and metal plates
☒ Y / ☐ N	Lumbar spine pitch change joint mechanism mating teeth are engaged
OTHER	

SHOULDER	
Y / ☒ N	Urethane shoulder pads show no evidence of contact <i>Scuffing/rubbing on both pads, cut on left shoulder</i> 
☒ Y / N	Clavicles securely attached to sternum and shoulder
Y / ☒ N	No evidence of debonding, tearing, or permanent compression of posterior soft stops <i>Left shoulder posterior stop slight debonding from mount</i>
OTHER	
THORAX	
Y / ☒ N	No evidence of contact at top, bottom, or interior faces of rib damping material <i>Anterior face of rib 4 Left and right side contact</i>
☒ Y / N	No evidence of debonding between rib damping material and ribs
☒ Y / N	IRTRACC anterior arms securely attached to anterior ribs
Y / ☒ N	IRTRACC posterior arms securely attached to double gimbals, spine <i>Four bolts attaching intrac to outer casing loose tightened</i>
☒ Y / N	Urethane bib is securely attached to ribs with no sign of tearing or washer penetration
☒ Y / N	Ribs securely attached to posterior spine
Y / ☒ N	Rib stiffeners show no evidence of bending (no gaps between ribs and stiffeners) <i>Very small gap, right side rib #5 Left side #4 and # 1</i>
OTHER	

ABDOMEN	
☒ Y / N	No evidence of tearing, cuts, or broken stitches in upper abdomen bag and zipper
☒ Y / N	Upper abdomen insert securely attached to spine
☒ Y / N	Upper abdomen insert shows no evidence of permanent set
Y / ☒ N	No evidence of tearing, cuts, or broken stitches in lower abdomen bag and zipper <i>Small hole, 1" tear at zipper seam left side, 1" tear at zipper seam right side</i>
☒ Y / N	Lower abdomen insert securely attached to spine
☒ Y / N	Lower abdomen insert shows no evidence of permanent set

OTHER	
PELVIS	
☒ Y / N	Pelvis flesh fits securely over pelvis bones
☒ Y / N	H-point tool fits securely into hole on both sides of pelvis
OTHER	
FEMUR	
☒ Y / N	Acetabular load cells firmly attached
☒ Y / N	Femur load cells firmly attached
☒ Y / N	No evidence of deformation of knee slider bump stop
Y / ☒ N	No cuts, tears, or scuffing of knee flesh <i>Both knees show scuffing and penetrating cuts</i>
OTHER	<i>Left knee pad has a cut and starting to detach from metal.</i> 

LOWER EXTREMITY (LX)	
☒ Y / N	Rotational potentiometers in ankle securely attached
☒ Y / N	Achilles tendon provides resistance to dorsiflexion
☒ Y / N	No evidence of debonding, tearing, or permanent compression of ankle soft stops
OTHER	
JACKET	
☒ Y / N	Rib stiffeners show no sign of permanent deformation
☒ Y / N	No evidence of tears or holes in jacket fabric, velcro, or zippers
OTHER	

POST-TEST

THOR Inspection Checklist

Date: 5/2/2012	
NHTSA Representative: James Saunders	
Witness(es):	
Inspection type (circle one):	PRE POST
Dummy S/N: 007	
Dummy Description: THOR 50 th Male	
Date of last Certification or Inspection: 4/25/2012	
<u>Tests conducted since last full certification or inspection:</u>	
RC5909 – 2012 Volvo S60	
<u>Known errors in data channels (no data, clipping, unexpected drops):</u>	
See attached notes at end of checklist	
<u>Physical evidence of damage:</u>	
See attached notes at end of email	
<u>Anecdotal evidence of damage:</u>	
<u>Equipment delivered to Borrower:</u>	

HEAD	
☒ Y / ☐ N	Rear head cap mounts securely to head
☒ Y / ☐ N	Head skin fits securely over skull
Y / ☒ N	Head skin shows no sign of tears or damage <i>Gouge left side of forehead – damage from last research testing series. Light scuff on top left of head skin from dash impact (RB0182)</i>
☒ Y / ☐ N	Interior components of skull cavity (ballast, accelerometer mount, accelerometers) securely attached
☒ Y / ☐ N	Head securely mounted to OC joint
OTHER	
NECK	
☒ Y / ☐ N	Neck cables slide freely through holes in neck plates
☒ Y / ☐ N	Neck cables show no sign of fraying, broken strands, or kinking
Y / ☒ N	No evidence of debonding between neck pucks and plates If N – indicate which interface (where plate/puck 1 attach to upper neck load cell): <i>Slight debonding between pucks 4 and 5, posterior surface</i>
☒ Y / ☐ N	No evidence of debonding or permanent compression in neck soft stop assemblies
☒ Y / ☐ N	Neck securely attached to upper neck load cell
☒ Y / ☐ N	Neck securely attached to lower neck load cell
☒ Y / ☐ N	Neck pitch change joint mechanism mating teeth are engaged
OTHER	<i>Superficial gouge on metal part of neck vertebrae 3rd down from upper neck loadcell</i>
SPINE	
☒ Y / ☐ N	No evidence of debonding between thoracic spine flex joint and metal plates
☒ Y / ☐ N	No evidence of debonding between lumbar spine flex joint and metal plates
☒ Y / ☐ N	Lumbar spine pitch change joint mechanism mating teeth are engaged
OTHER	

SHOULDER	
Y / ☒ N	Urethane shoulder pads show no evidence of contact <i>Scuffing/rubbing on both pads, cut on left shoulder</i> 
☒ Y / N	Clavicles securely attached to sternum and shoulder
Y / ☒ N	No evidence of debonding, tearing, or permanent compression of posterior soft stops <i>Left shoulder posterior stop slight debonding from mount</i>
OTHER	
THORAX	
Y / ☒ N	No evidence of contact at top, bottom, or interior faces of rib damping material <i>Anterior face of rib 4 Left and right side contact</i>
☒ Y / N	No evidence of debonding between rib damping material and ribs
☒ Y / N	IRTRACC anterior arms securely attached to anterior ribs
Y / ☒ N	IRTRACC posterior arms securely attached to double gimbals, spine <i>-Lower right IRTRACC mount at potentiometer was loose – tightened mounting screw to correct problem</i>
☒ Y / N	Urethane bib is securely attached to ribs with no sign of tearing or washer penetration
☒ Y / N	Ribs securely attached to posterior spine
Y / ☒ N	Rib stiffeners show no evidence of bending (no gaps between ribs and stiffeners) <i>Very small gap, right side rib #5 Left side #4 and # 1</i>
OTHER	
ABDOMEN	
☒ Y / N	No evidence of tearing, cuts, or broken stitches in upper abdomen bag and zipper
☒ Y / N	Upper abdomen insert securely attached to spine
☒ Y / N	Upper abdomen insert shows no evidence of permanent set
Y / ☒ N	No evidence of tearing, cuts, or broken stitches in lower abdomen bag and zipper <i>Small hole, 1" tear at zipper seam left side, 1" tear at zipper seam right side</i> <i>Stitching starting to come undone on left front just below left Velcro.</i> 
☒ Y / N	Lower abdomen insert securely attached to spine

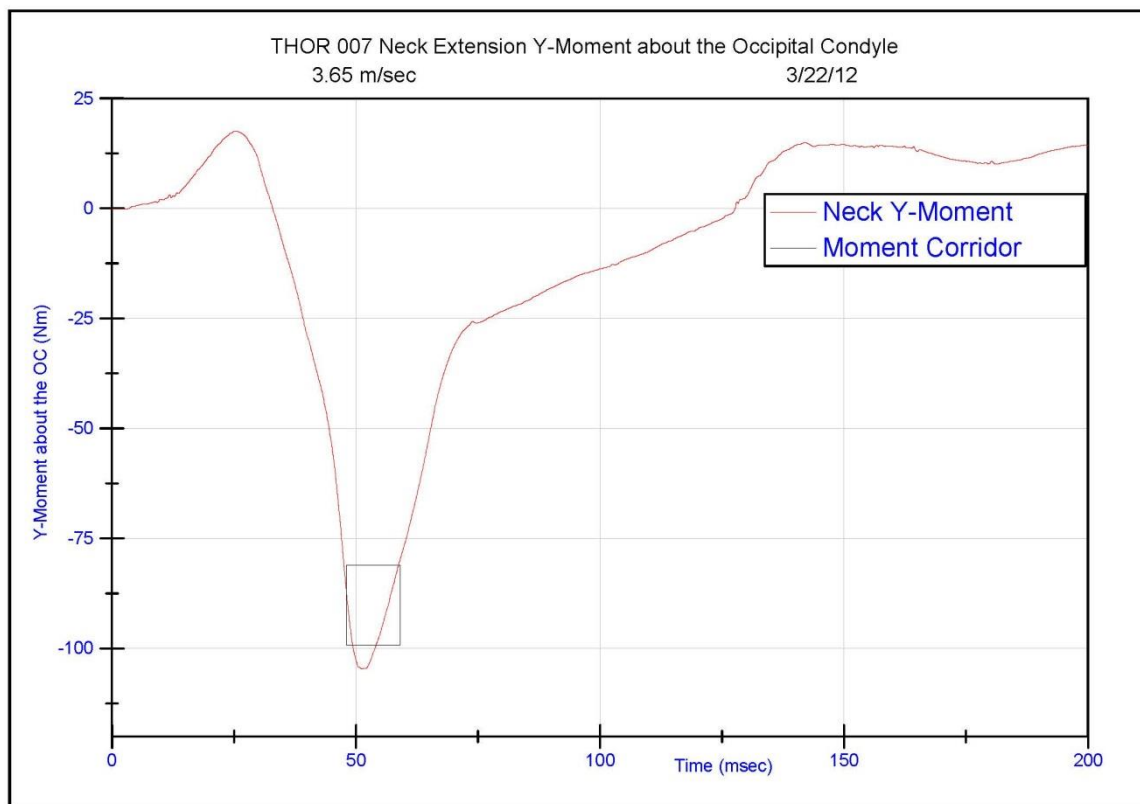
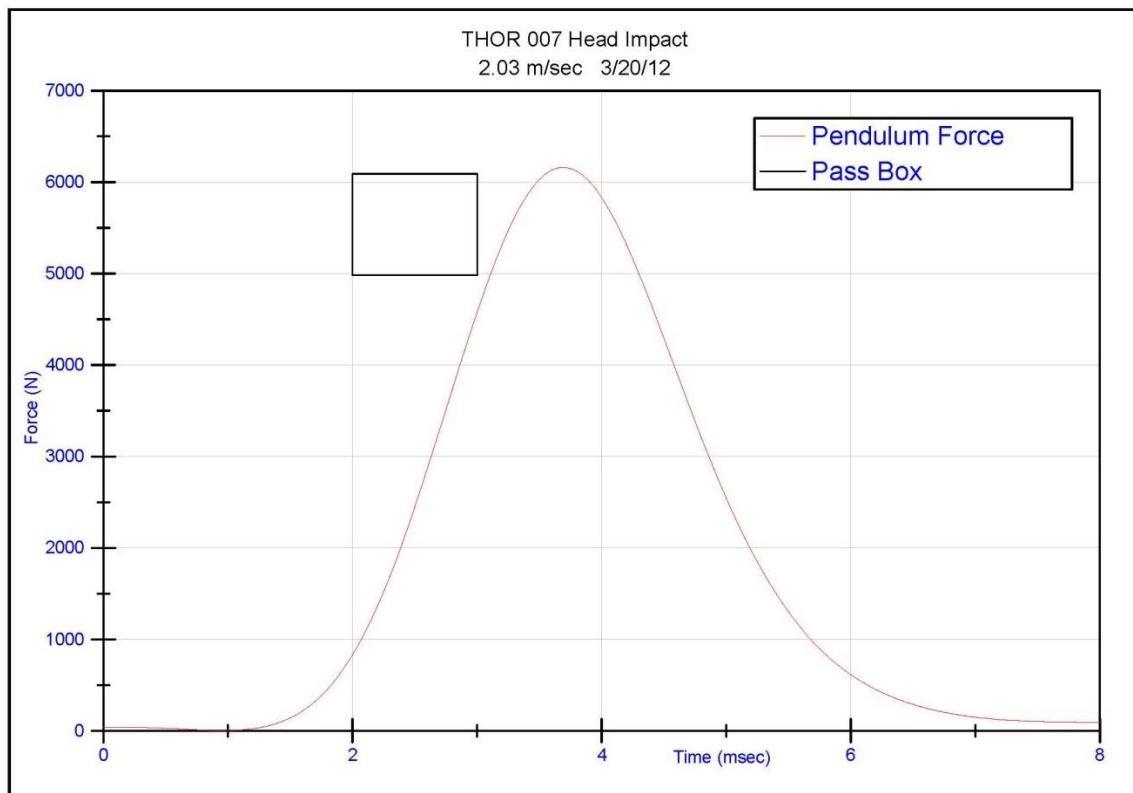
☒ Y ☐ N	Lower abdomen insert shows no evidence of permanent set
OTHER	
PELVIS	
☒ Y ☐ N	Pelvis flesh fits securely over pelvis bones
☒ Y ☐ N	H-point tool fits securely into hole on both sides of pelvis
OTHER	
FEMUR	
☒ Y ☐ N	Acetabular load cells firmly attached
☒ Y ☐ N	Femur load cells firmly attached
☒ Y ☐ N	No evidence of deformation of knee slider bump stop
Y ☒ N	No cuts, tears, or scuffing of knee flesh <i>Both knees show scuffing and penetrating cuts</i>
OTHER	<i>Left knee pad has a cut and starting to detach from metal.</i> <i>Right side of femur skin ripping apart zipper detaching from skin. Left leg has a gash in the Femur skin.</i> 

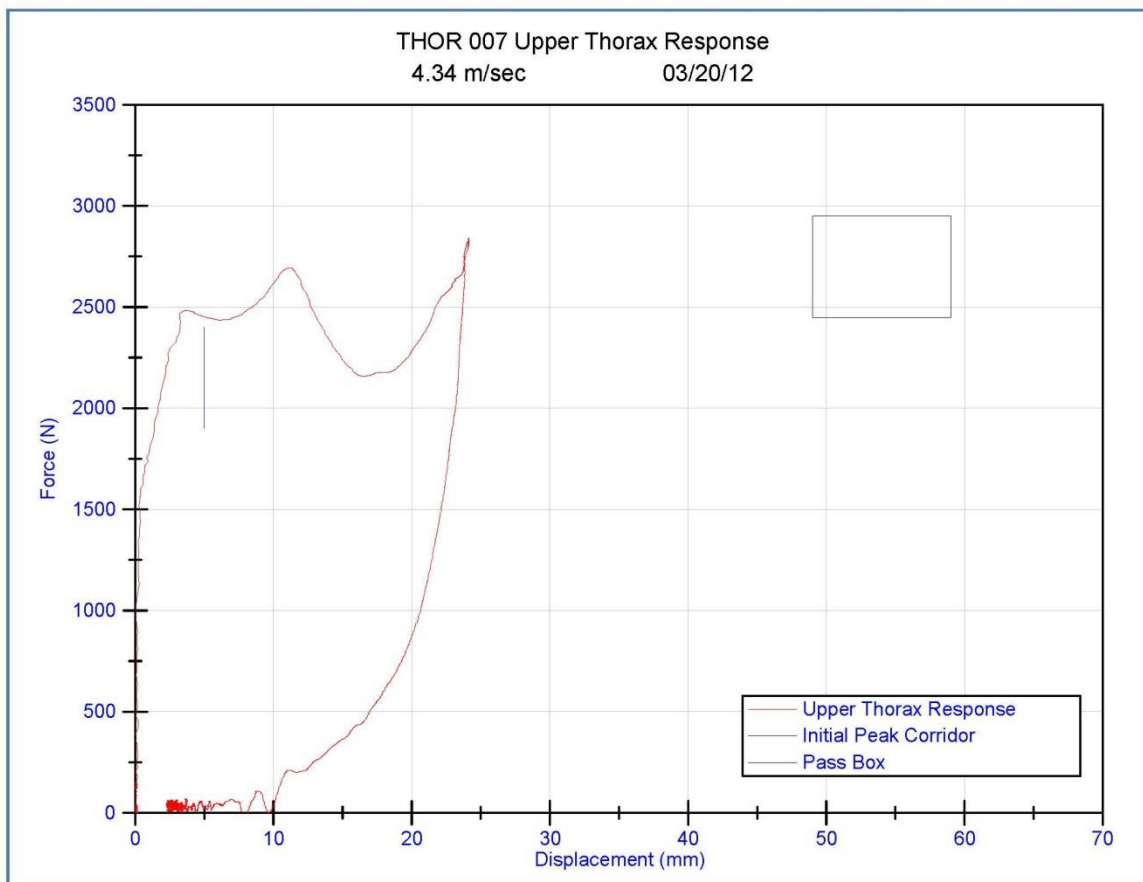
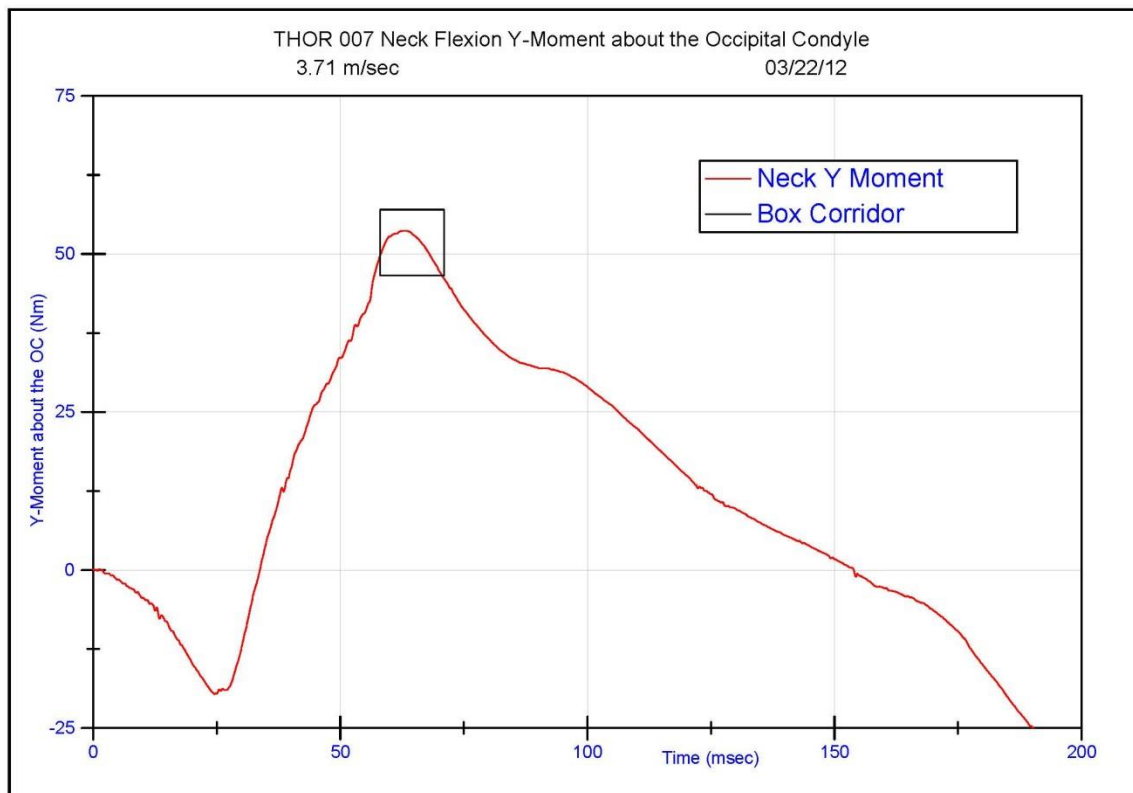
LOWER EXTREMITY (LX)	
☒ Y ☐ N	Rotational potentiometers in ankle securely attached
☒ Y ☐ N	Achilles tendon provides resistance to dorsiflexion
☒ Y ☐ N	No evidence of debonding, tearing, or permanent compression of ankle soft stops
OTHER	

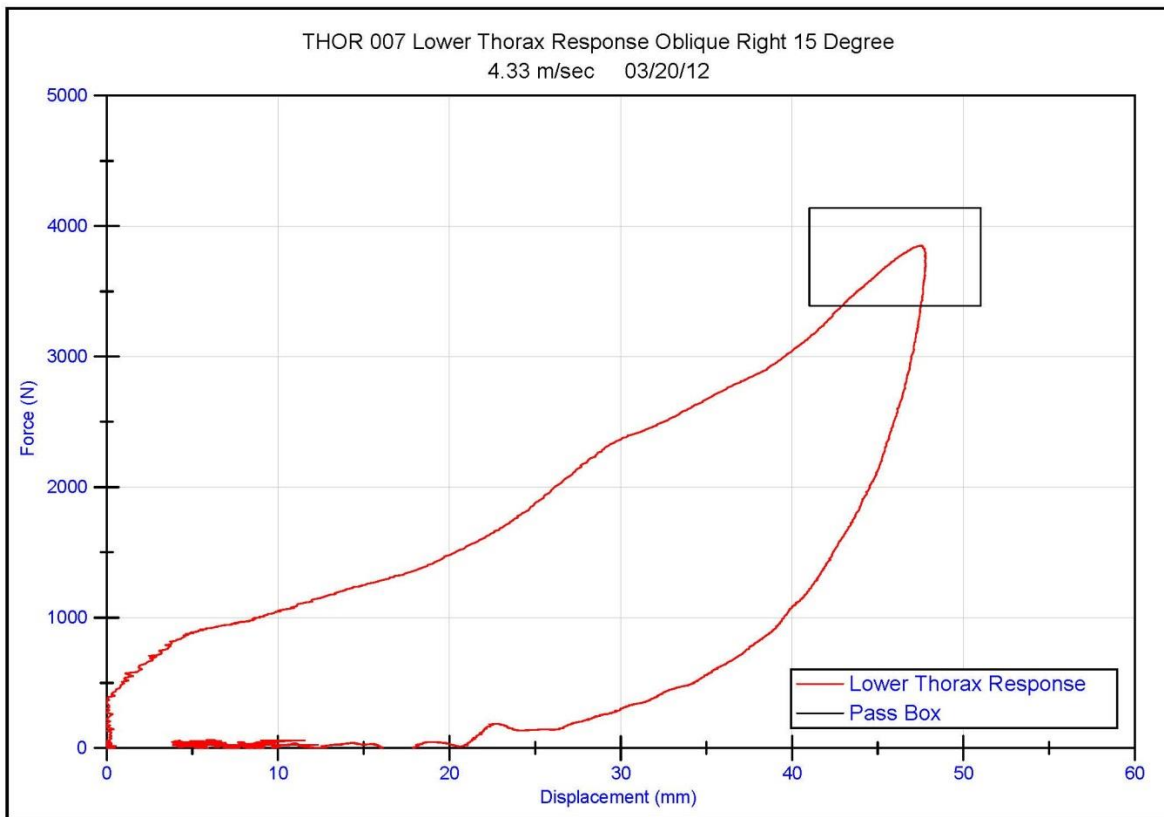
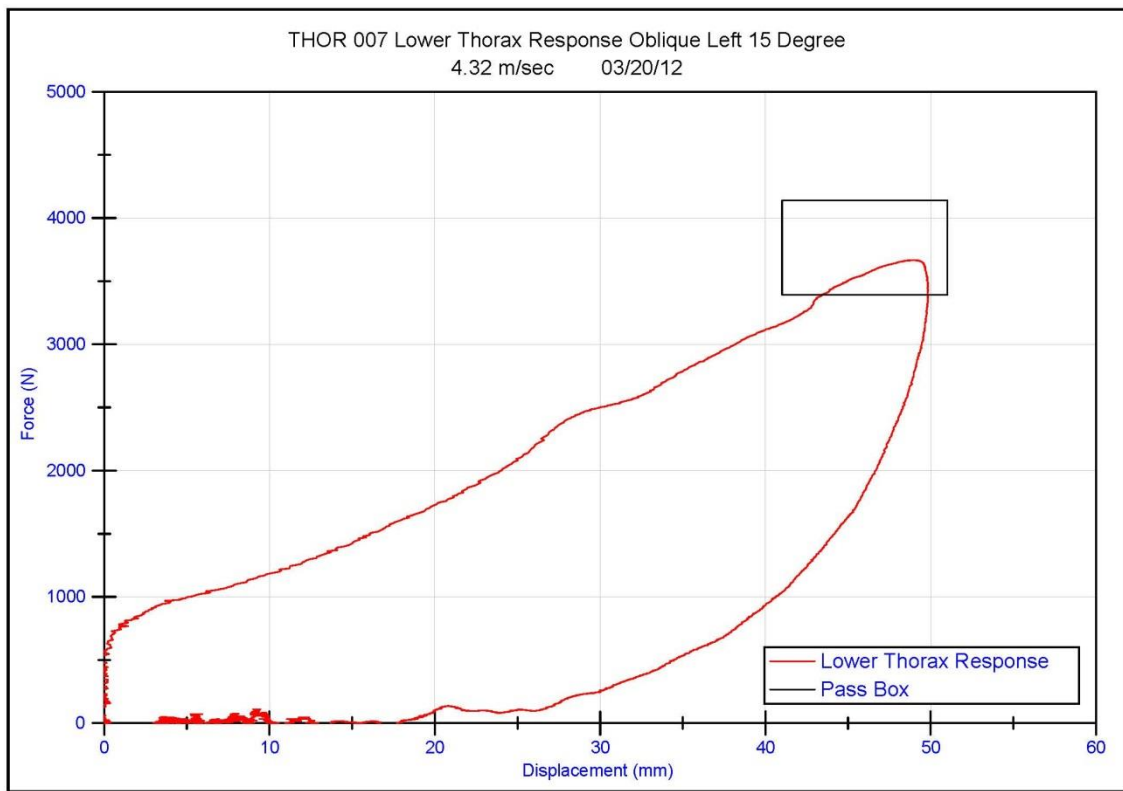
JACKET	
☒ Y / N	Rib stiffeners show no sign of permanent deformation
☒ Y / N	No evidence of tears or holes in jacket fabric, velcro, or zippers
OTHER	

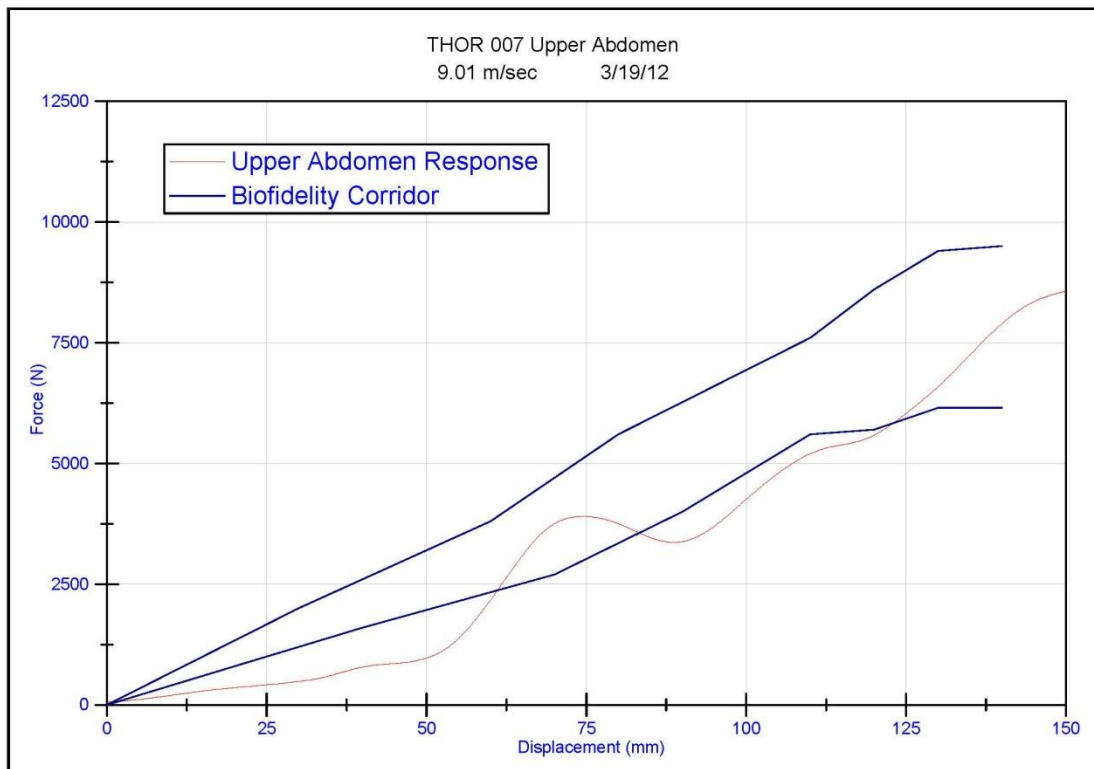
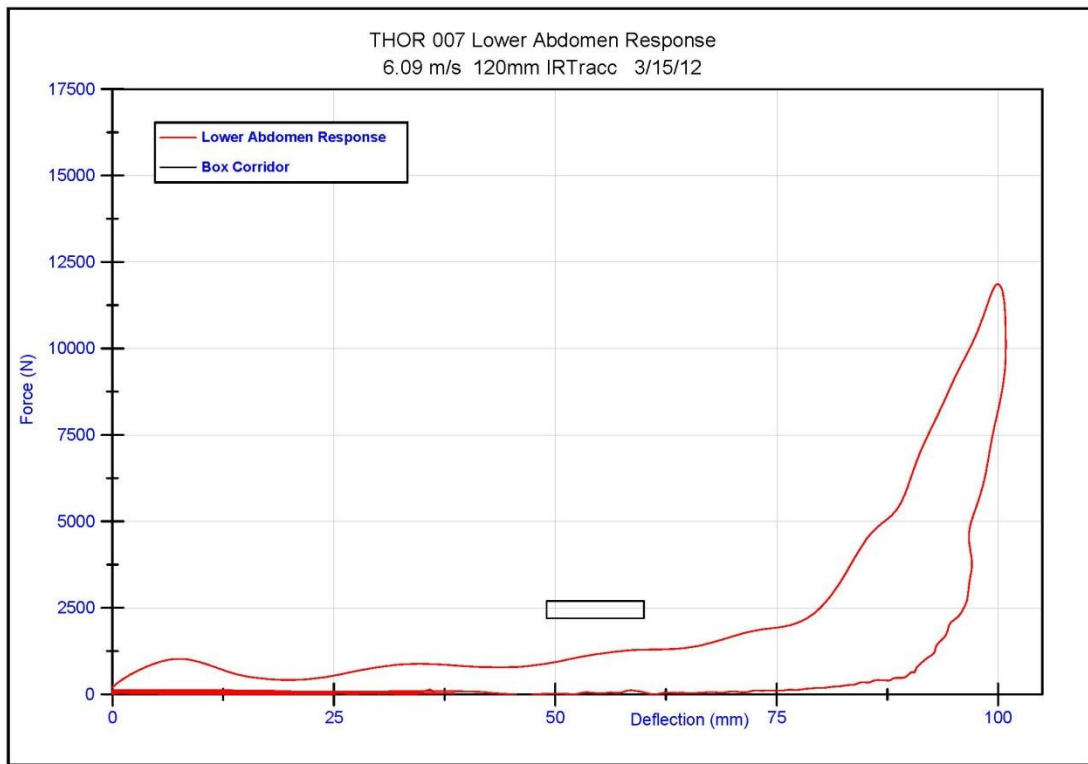
DUMMY CALIBRATIONS

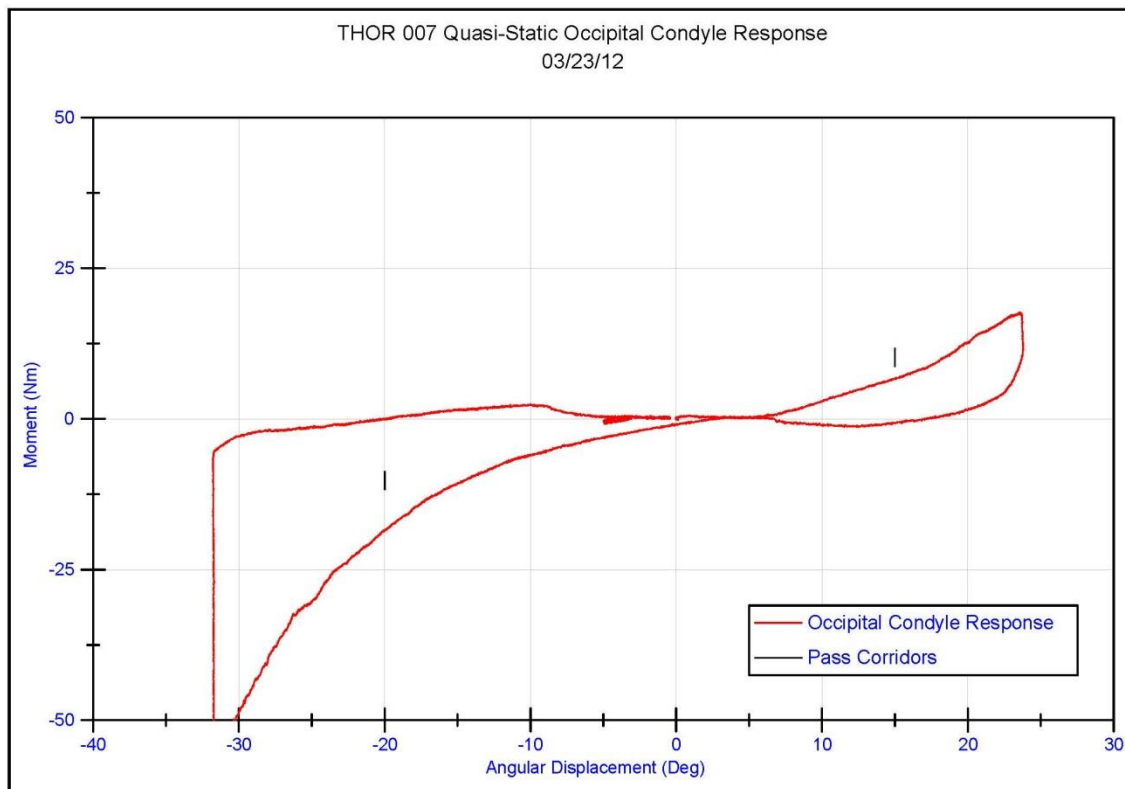
**50% ADULT MALE THOR DUMMY CALIBRATIONS
SERIAL NO.: 007**



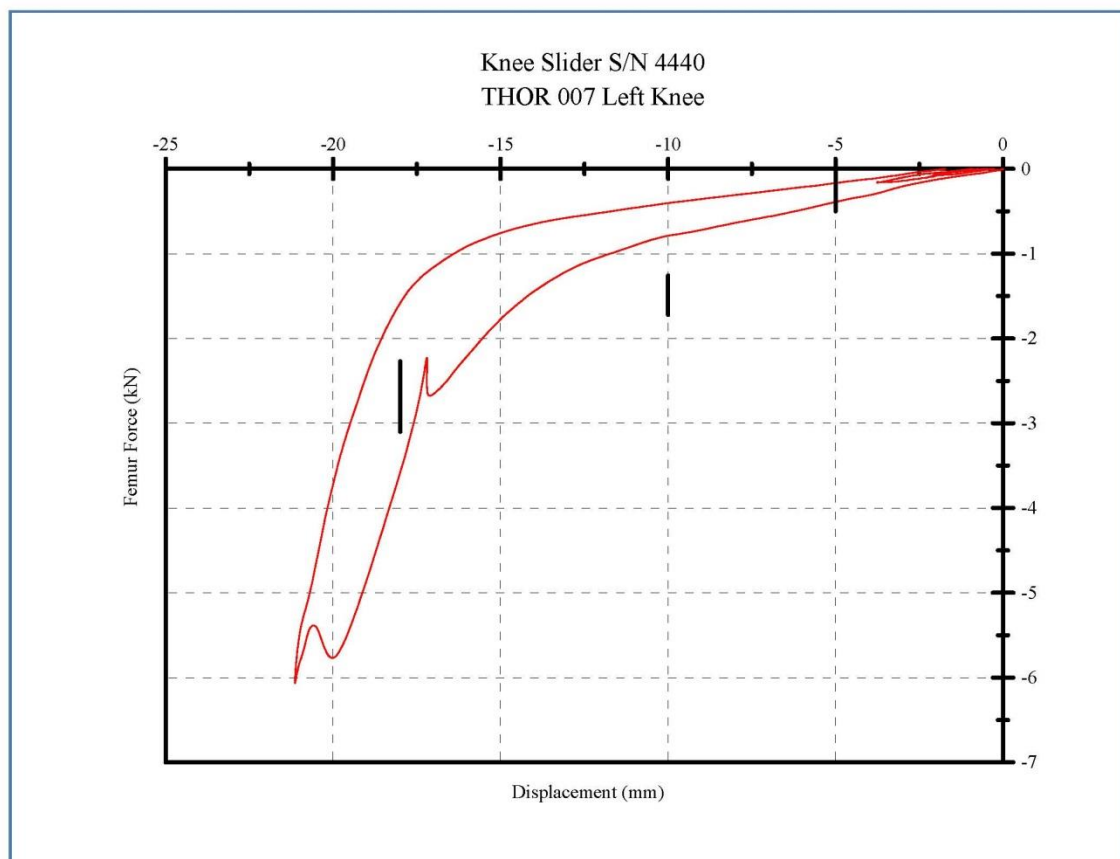




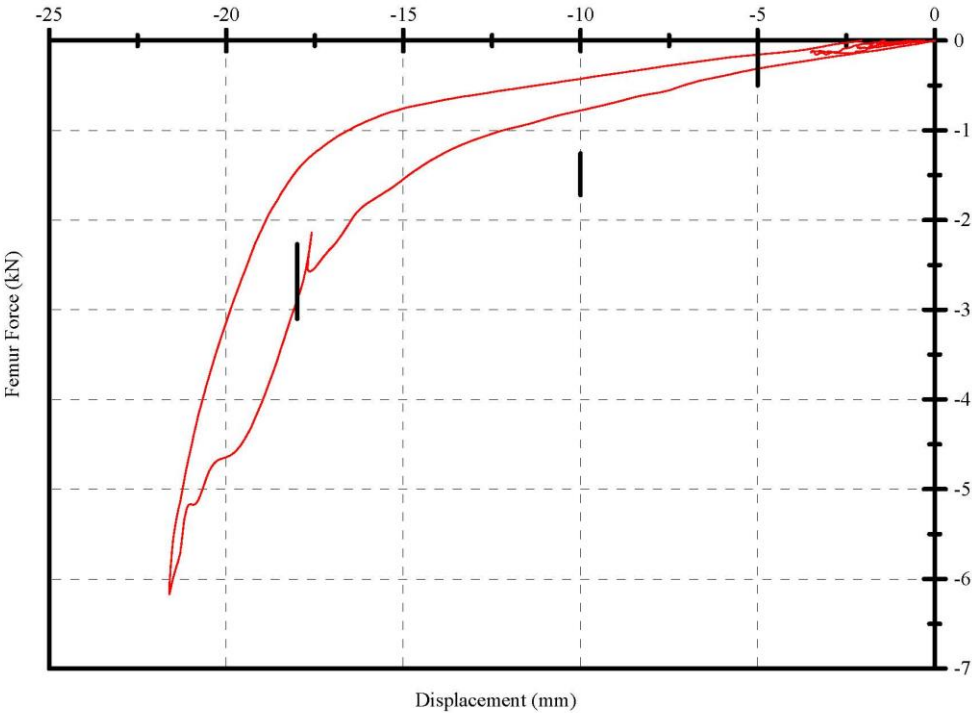




S



Knee Slider S/N 4439
THOR 007 Right Knee



THOR 007 LEG CALIBRATIONS
LX0036 / LX0037



TRANSPORTATION RESEARCH CENTER INC.

10820 State Route 347
 East Liberty, Ohio 43319-0367
 Phone: 937-666-2011 Fax: 937-666-5705
 www.trcpg.com

Calibration Report Uni-Directional Calibration

Automated Load Cell Calibration System
 Copyright (c) 1987-1997 Robert A. Denton, Inc.

Calibration No.	T6103002	Date	Jul 18, 2011	Due	Jul 17, 2012
Model No.	4353	Fixture No.	2171	Serial No.	76
Technician	S. Bazzle	Temp (C) / Hum. (%)	24.0 / 55.0	Last Calibrated	Jul 18, 2011
Customer	VRTC	Manufacturer	Denton	Excitation (V)	9.7
Description	Upper Tibia				

Voltage Calibration

Bridge	Capacity	Zero Offset	Nonlinearity	Hysteresis	Output @ Capacity	Sensitivity	% Change
FX	11120 N	0.0026 mV/V	0.35% FS	0.50 % FS	1.8797 mV/V	0.0001690 mV/V/N	0.00% FS
FZ	11120 N	0.0112 mV/V	0.13% FS	0.29 % FS	-1.0417 mV/V	-0.0000937 mV/V/N	0.00% FS
MX	395 Nm	0.0020 mV/V	0.32% FS	0.06 % FS	2.8912 mV/V	0.0073120 mV/V/Nm	0.00% FS
MY	395 Nm	0.0578 mV/V	0.14% FS	0.07 % FS	2.8782 mV/V	0.0072791 mV/V/Nm	0.00% FS

Shunt

Bridge	Shunt Value	Equivalent Load	Bridge Resistance (nom)
FX	60.0 K Ohms	8739.5 N	350.0 Ohms
FZ	100.0 K Ohms	18924.3 N	700.0 Ohms
MX	60.0 K Ohms	202.6 Nm	350.0 Ohms
MY	60.0 K Ohms	203.8 Nm	350.0 Ohms

NOTE: Positive shunt is between +Exc_+Sig Negative shunt is between -Exc_+Sig

Wire Color Codes

FX-MX		FY-MY		FZ-MZ	
Brown	+ Exc.	Red Stripe	+ Exc.	Green	+ Exc.
Red	+ Sig.	Black	+ Sig.	Blue	+ Sig.
Orange	- Exc.	White	- Exc.	Violet	- Exc.
Yellow	- Sig.	Black Stripe	- Sig.	Green	- Sig.

Reference Load Cell

Manufacturer	Model No.	Serial No.	Calibration Due Date
Interface	1610DBK-10K	215677	Apr 18, 2012

System Measurement Uncertainty 0.02% of Reading (95% Confidence)

This is to certify that the equipment and reference load cells used during the calibration of this transducer are traceable to the National Institute of Standards and Technology (NIST).
 Morehouse Instrument Company Report No. 215677D0609



CALIBRATION REPORT

Uni-Directional Calibration Crosstalk Summary

Automated Load Cell Calibration System
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Calibration Number	T6103002	This Calibration	11:29:22	Jul 18, 2011
Model Number	4353	Calibration Due		Jul 17, 2012
Serial Number	76	Last Calibrated		Jul 18, 2011
Description	Upper Tibia	Temp (C) / Hum. (%)		24.0 / 55.0
Customer	VRTC	Customer Tag Number		N/A

Raw Crosstalk Data (mv/V)

Bridge		FX	FZ	MX	MY	N/A	N/A
	<u>Applied Load</u>	11120.5 N	11120.5 N	395.4 Nm	395.4 Nm	0.0 N/A	0.0 N/A
FX	11120.5 N	1.8797	0.0266	-0.0301	0.0064	0.0000	0.0000
FZ	11120.5 N	-0.0017	-1.0417	-0.0095	0.0011	0.0000	0.0000
MX	395.4 Nm	0.0394	0.0412	2.8912	-0.0014	0.0000	0.0000
MY	395.4 Nm	1.2708	0.0415	-0.0084	2.8782	0.0000	0.0000
N/A	0.0 N/A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N/A	0.0 N/A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

%FS Crosstalk *

Bridge		FX	FZ	MX	MY	N/A	N/A
	<u>Applied Load</u>	11120.5 N	11120.5 N	395.4 Nm	395.4 Nm	0.0 N/A	0.0 N/A
FX	11120.5 N	0.00%	-2.55%	-1.04%	0.22%	0.00%	0.00%
FZ	11120.5 N	-0.09%	0.00%	-0.33%	0.04%	0.00%	0.00%
MX	395.4 Nm	2.09%	-3.95%	0.00%	-0.05%	0.00%	0.00%
MY	395.4 Nm	2.38%	-3.98%	-0.29%	0.00%	0.00%	0.00%
N/A	0.0 N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
N/A	0.0 N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

* Percentage crosstalk for force channels applying moments are corrected for the applied force.

File: UXTALK.FP
Technician: S. Bazzle

Page: 1

07/18/11 11:57:59



TRANSPORTATION RESEARCH CENTER INC.

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 East Liberty, Ohio 43319-0367
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Calibration Report

Uni-Directional Calibration

Automated Load Cell Calibration System
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Calibration No.	T6103003	Date	Jul 18, 2011	Due	Jul 17, 2012
Model No.	4929J	Fixture No.	4989	Serial No.	80
Technician	S. Bazzle	Temp (C) / Hum. (%)	24.0 / 55.0		
Customer	VRTC	Last Calibrated	Jul 18, 2011		
Description	Lower Tibia	Manufacturer	Denton		
		Excitation (V)	9.7		

Voltage Calibration

Bridge	Capacity	Zero Offset	Nonlinearity	Hysteresis	Output @ Capacity	Sensitivity	% Change
FX	11120 N	0.0129 mV/V	1.32% FS	0.21 % FS	1.8874 mV/V	0.0001697 mV/V/N	0.00% FS
FY	11120 N	0.0108 mV/V	1.22% FS	0.61 % FS	1.8788 mV/V	0.0001689 mV/V/N	0.00% FS
FZ	11120 N	0.0388 mV/V	0.14% FS	0.22 % FS	-1.0620 mV/V	-0.0000955 mV/V/N	0.00% FS
MX	395 Nm	-0.0304 mV/V	0.16% FS	0.11 % FS	2.9455 mV/V	0.0074493 mV/V/Nm	0.00% FS
MY	395 Nm	0.0298 mV/V	0.54% FS	0.33 % FS	2.9351 mV/V	0.0074230 mV/V/Nm	0.00% FS

Shunt

Bridge	Shunt Value	Equivalent Load	Bridge Resistance (nom)
FX	60.0 K Ohms	8728.9 N	350.0 Ohms
FY	60.0 K Ohms	8766.2 N	350.0 Ohms
FZ	100.0 K Ohms	18477.9 N	700.0 Ohms
MX	60.0 K Ohms	198.8 Nm	350.0 Ohms
MY	60.0 K Ohms	199.5 Nm	350.0 Ohms

NOTE: Positive shunt is between +Exc_+Sig Negative shunt is between -Exc_+Sig

Wire Color Codes

N/A	N/A	N/A	N/A
N/A	+ Exc.	N/A	+ Exc.
N/A	+ Sig.	N/A	+ Sig.
N/A	- Exc.	N/A	- Exc.
N/A	- Sig.	N/A	- Sig.

Reference Load Cell

Manufacturer	Model No.	Serial No.	Calibration Due Date
Interface	1610DBK-10K	215677	Apr 18, 2012

System Measurement Uncertainty 0.02% of Reading (95% Confidence)

This is to certify that the equipment and reference load cells used during the calibration of this transducer are traceable to the National Institute of Standards and Technology (NIST).
 Morehouse Instrument Company Report No. 215677D0609



CALIBRATION REPORT

Uni-Directional Calibration Crosstalk Summary

Automated Load Cell Calibration System
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Calibration Number	T6103003	This Calibration	12:14:12	Jul 18, 2011
Model Number	4929J	Calibration Due		Jul 17, 2012
Serial Number	80	Last Calibrated		Jul 18, 2011
Description	Lower Tibia	Temp (C) / Hum. (%)		24.0 / 55.0
Customer	VRTC	Customer Tag Number		N/A

Raw Crosstalk Data (mv/V)

Bridge		FX	FY	FZ	MX	MY	N/A
	<u>Applied Load</u>	11120.5	11120.5	11120.5	395.4	395.4	0.0
		<u>N</u>	<u>N</u>	<u>N</u>	<u>Nm</u>	<u>Nm</u>	<u>N/A</u>
FX	11120.5 N	1.8874	0.0002	0.0140	0.0058	0.0453	0.0000
FY	11120.5 N	-0.0169	1.8788	0.0233	-0.0172	0.0004	0.0000
FZ	11120.5 N	-0.0012	-0.0029	-1.0620	-0.0254	0.0213	0.0000
MX	395.4 Nm	0.0081	0.0167	-1.4245	2.9455	0.0549	0.0000
MY	395.4 Nm	-0.0335	0.0272	-1.4458	-0.0213	2.9351	0.0000
N/A	0.0 N/A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

%FS Crosstalk *

Bridge		FX	FY	FZ	MX	MY	N/A
	<u>Applied Load</u>	11120.5	11120.5	11120.5	395.4	395.4	0.0
		<u>N</u>	<u>N</u>	<u>N</u>	<u>Nm</u>	<u>Nm</u>	<u>N/A</u>
FX	11120.5 N	0.00%	0.01%	-1.32%	0.20%	1.54%	0.00%
FY	11120.5 N	-0.90%	0.00%	-2.20%	-0.59%	0.01%	0.00%
FZ	11120.5 N	-0.06%	-0.16%	0.00%	-0.86%	0.72%	0.00%
MX	395.4 Nm	0.43%	0.89%	5.85%	0.00%	1.87%	0.00%
MY	395.4 Nm	-1.77%	1.45%	3.84%	-0.72%	0.00%	0.00%
N/A	0.0 N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

* Percentage crosstalk for force channels applying moments are corrected for the applied force.

File: UXTALK.FP
Technician: S. Bazzle

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07/18/11 12:59:25



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 East Liberty, Ohio 43319-0367
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Calibration Report Uni-Directional Calibration

Automated Load Cell Calibration System
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Calibration No.	T6103001	Date	Jul 18, 2011	Due	Jul 17, 2012
Model No.	4353	Fixture No.	2171	Serial No.	97
Technician	S. Bazzle	Temp (C) / Hum. (%)	24.0 / 52.0	Last Calibrated	Jul 18, 2011
Customer	VRTC	Manufacturer	Denton	Excitation (V)	9.7
Description	Upper Tibia				

Voltage Calibration

Bridge	Capacity	Zero Offset	Nonlinearity	Hysteresis	Output @ Capacity	Sensitivity	% Change
FX	11120 N	0.0022 mV/V	0.09% FS	0.14 % FS	1.9242 mV/V	0.0001730 mV/V/N	0.00% FS
FZ	11120 N	-0.0388 mV/V	0.10% FS	0.42 % FS	-1.0324 mV/V	-0.0000928 mV/V/N	0.00% FS
MX	395 Nm	-0.0069 mV/V	0.32% FS	0.05 % FS	2.8680 mV/V	0.0072535 mV/V/Nm	0.00% FS
MY	395 Nm	0.0138 mV/V	0.19% FS	0.08 % FS	2.9150 mV/V	0.0073723 mV/V/Nm	0.00% FS

Shunt

Bridge	Shunt Value	Equivalent Load	Bridge Resistance (nom)
FX	60.0 K Ohms	8547.6 N	350.0 Ohms
FZ	100.0 K Ohms	19014.6 N	700.0 Ohms
MX	60.0 K Ohms	204.1 Nm	350.0 Ohms
MY	60.0 K Ohms	200.7 Nm	350.0 Ohms

NOTE: Positive shunt is between +Exc_+Sig Negative shunt is between -Exc_+Sig

Wire Color Codes

FX-MX		FY-MY		FZ-MZ	
Brown	+ Exc.	Red Stripe	+ Exc.	Green	+ Exc.
Red	+ Sig.	Black	+ Sig.	Blue	+ Sig.
Orange	- Exc.	White	- Exc.	Violet	- Exc.
Yellow	- Sig.	Black Stripe	- Sig.	Green	- Sig.

Reference Load Cell

Manufacturer	Model No.	Serial No.	Calibration Due Date
Interface	1610DBK-10K	215677	Apr 18, 2012

System Measurement Uncertainty 0.02% of Reading (95% Confidence)

This is to certify that the equipment and reference load cells used during the calibration of this transducer are traceable to the National Institute of Standards and Technology (NIST).
 Morehouse Instrument Company Report No. 215677D0609



CALIBRATION REPORT

Uni-Directional Calibration Crosstalk Summary

Automated Load Cell Calibration System
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Calibration Number	T6103001	This Calibration	09:30:05	Jul 18, 2011
Model Number	4353	Calibration Due		Jul 17, 2012
Serial Number	97	Last Calibrated		Jul 18, 2011
Description	Upper Tibia	Temp (C) / Hum. (%)	24.0 / 52.0	
Customer	VRTC	Customer Tag Number		N/A

Raw Crosstalk Data (mv/V)

Bridge		FX	FZ	MX	MY	N/A	N/A
	<u>Applied Load</u>	11120.5	11120.5	395.4	395.4	0.0	0.0
		<u>N</u>	<u>N</u>	<u>Nm</u>	<u>Nm</u>	<u>N/A</u>	<u>N/A</u>
FX	11120.5 N	1.9242	0.0099	0.0121	-0.0088	0.0000	0.0000
FZ	11120.5 N	0.0065	-1.0324	0.0010	-0.0017	0.0000	0.0000
MX	395.4 Nm	-0.0115	0.0291	2.8680	-0.0039	0.0000	0.0000
MY	395.4 Nm	1.2805	0.0159	0.0156	2.9150	0.0000	0.0000
N/A	0.0 N/A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N/A	0.0 N/A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

%FS Crosstalk *

Bridge		FX	FZ	MX	MY	N/A	N/A
	<u>Applied Load</u>	11120.5	11120.5	395.4	395.4	0.0	0.0
		<u>N</u>	<u>N</u>	<u>Nm</u>	<u>Nm</u>	<u>N/A</u>	<u>N/A</u>
FX	11120.5 N	0.00%	-0.96%	0.42%	-0.30%	0.00%	0.00%
FZ	11120.5 N	0.34%	0.00%	0.03%	-0.06%	0.00%	0.00%
MX	395.4 Nm	-0.60%	-2.82%	0.00%	-0.13%	0.00%	0.00%
MY	395.4 Nm	3.44%	-1.54%	0.54%	0.00%	0.00%	0.00%
N/A	0.0 N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
N/A	0.0 N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

* Percentage crosstalk for force channels applying moments are corrected for the applied force.

File: UXTALK.FP
Technician: S. Bazzle

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07/18/11 10:17:08



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Calibration Report Uni-Directional Calibration

Automated Load Cell Calibration System
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Calibration No.	T6103007	Date	Jul 18, 2011	Due	Jul 17, 2012
Model No.	4929J	Fixture No.	4989	Serial No.	140
Technician	S. Bazzle	Temp (C) / Hum. (%)			24.0 / 52.0
Customer	VRTC	Last Calibrated			Jul 18, 2011
Description	Lower Tibia	Manufacturer			Denton
		Excitation (V)			9.7

Voltage Calibration

Bridge	Capacity	Zero Offset	Nonlinearity	Hysteresis	Output @ Capacity	Sensitivity	% Change
FX	11120N	0.0161 mV/V	0.87% FS	0.19 % FS	1.9560 mV/V	0.0001759 mV/V/N	0.00% FS
FY	11120N	-0.0032 mV/V	1.13% FS	0.77 % FS	1.9460 mV/V	0.0001750 mV/V/N	0.00% FS
FZ	11120N	0.0585 mV/V	0.13% FS	0.28 % FS	-1.0655 mV/V	-0.0000958 mV/V/N	0.00% FS
MX	395 Nm	0.2852 mV/V	0.10% FS	0.06 % FS	2.9904 mV/V	0.0075631 mV/V/Nm	0.00% FS
MY	395 Nm	0.1277 mV/V	0.34% FS	0.26 % FS	2.9452 mV/V	0.0074486 mV/V/Nm	0.00% FS

Shunt

Bridge	Shunt Value	Equivalent Load	Bridge Resistance (nom)
FX	60.0 K Ohms	8412.5 N	350.0 Ohms
FY	60.0 K Ohms	8449.1 N	350.0 Ohms
FZ	100.0 K Ohms	18415.0 N	700.0 Ohms
MX	60.0 K Ohms	195.9 Nm	350.0 Ohms
MY	60.0 K Ohms	199.0 Nm	350.0 Ohms

NOTE: Positive shunt is between +Exc_+Sig Negative shunt is between -Exc_+Sig

Wire Color Codes

N/A	N/A	N/A	N/A
N/A	+ Exc.	N/A	+ Exc.
N/A	+ Sig.	N/A	+ Sig.
N/A	- Exc.	N/A	- Exc.
N/A	- Sig.	N/A	- Sig.

Reference Load Cell

Manufacturer	Model No.	Serial No.	Calibration Due Date
Interface	1610DBK-10K	215677	Apr 18, 2012

System Measurement Uncertainty 0.02% of Reading (95% Confidence)

This is to certify that the equipment and reference load cells used during the calibration of this transducer are traceable to the National Institute of Standards and Technology (NIST).
 Morehouse Instrument Company Report No. 215677D0609



CALIBRATION REPORT

Uni-Directional Calibration Crosstalk Summary

Automated Load Cell Calibration System
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Calibration Number	T6103007	This Calibration	14:24:29	Jul 18, 2011
Model Number	4929J	Calibration Due		Jul 17, 2012
Serial Number	140	Last Calibrated		Jul 18, 2011
Description	Lower Tibia	Temp (C) / Hum. (%)	24.0 / 52.0	
Customer	VRTC	Customer Tag Number		N/A

Raw Crosstalk Data (mv/V)

Bridge		FX	FY	FZ	MX	MY	N/A
	<u>Applied Load</u>	11120.5	11120.5	11120.5	395.4	395.4	0.0
		<u>N</u>	<u>N</u>	<u>N</u>	<u>Nm</u>	<u>Nm</u>	<u>N/A</u>
FX	11120.5 N	1.9560	0.0156	0.0102	0.0121	0.0172	0.0000
FY	11120.5 N	-0.0191	1.9460	0.0279	0.0102	0.0275	0.0000
FZ	11120.5 N	-0.0014	0.0054	-1.0655	0.0220	0.0087	0.0000
MX	395.4 Nm	-0.0014	0.0187	-1.4579	2.9904	0.0708	0.0000
MY	395.4 Nm	-0.0165	0.0035	-1.4558	-0.0677	2.9452	0.0000
N/A	0.0 N/A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

% FS Crosstalk *

Bridge		FX	FY	FZ	MX	MY	N/A
	<u>Applied Load</u>	11120.5	11120.5	11120.5	395.4	395.4	0.0
		<u>N</u>	<u>N</u>	<u>N</u>	<u>Nm</u>	<u>Nm</u>	<u>N/A</u>
FX	11120.5 N	0.00%	0.80%	-0.96%	0.40%	0.59%	0.00%
FY	11120.5 N	-0.98%	0.00%	-2.62%	0.34%	0.93%	0.00%
FZ	11120.5 N	-0.07%	0.28%	0.00%	0.73%	0.29%	0.00%
MX	395.4 Nm	-0.07%	0.96%	3.15%	0.00%	2.40%	0.00%
MY	395.4 Nm	-0.84%	0.18%	3.35%	-2.27%	0.00%	0.00%
N/A	0.0 N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

* Percentage crosstalk for force channels applying moments are corrected for the applied force.

File: UXTALK.FP
Technician: S. Bazzle

Page: 1

07/18/11 14:42:35

HIII 5TH FEMALE CALIBRATIONS
SERIAL NUMBER: 070



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VERIFICATION REPORT

Test Name:	Head Drop	Revision:	7/15/2002
Sub Test Name:		Spec Type:	NHTSA
ATD Type:	Hybrid III 5'th		
ATD Serial Number:	070		
Test ID:		Test Date:	4/13/2012
Test Number:	1	Test Time:	1:48:36 PM

Component Part Number	Component Serial Number
Head Skin - 78051-228	06211

Test Parameters	Test Specifications	Test Results
Temperature	18.9 -- 25.6	22.1 deg C P
Humidity	10 -- 70	25 %RH P
Resultant Acceleration	250 -- 300	268 g P
Oscillation	0.0 -- 10.0	0.0 % P
Lateral Acceleration	-15.00 -- 15.00	2.78 g P

All test parameters are within specifications

Technician: **M. Goehle**

Supervisor: **D. Travale**

Test Time: **1:48:36 PM**

Test Date: **4/13/2012**

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VERIFICATION REPORT

REFERENCE EQUIPMENT

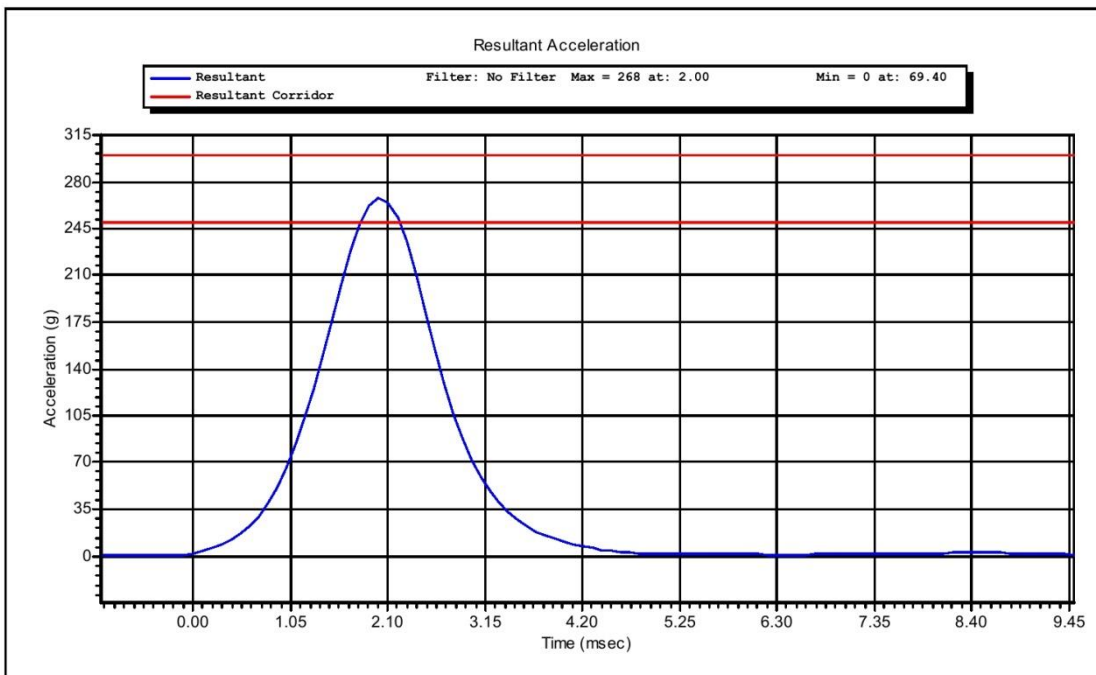
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Endevco	7264-2000	P71281	1/18/2012
Endevco	7264-2000	P71298	1/18/2012

Test Time: 1:48:36 PM

Test Date: 4/13/2012

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Test Name:	Head Drop	Revision:	7/15/2002
Sub Test Name:		Spec Type:	NHTSA
ATD Type:	Hybrid III 5'th		
ATD Serial Number:	070		
Test ID:		Test Date:	4/13/2012
Test Number:	1	Test Time:	1:48:36 PM



Test Time: **1:48:36 PM**

Test Date: **4/13/2012**

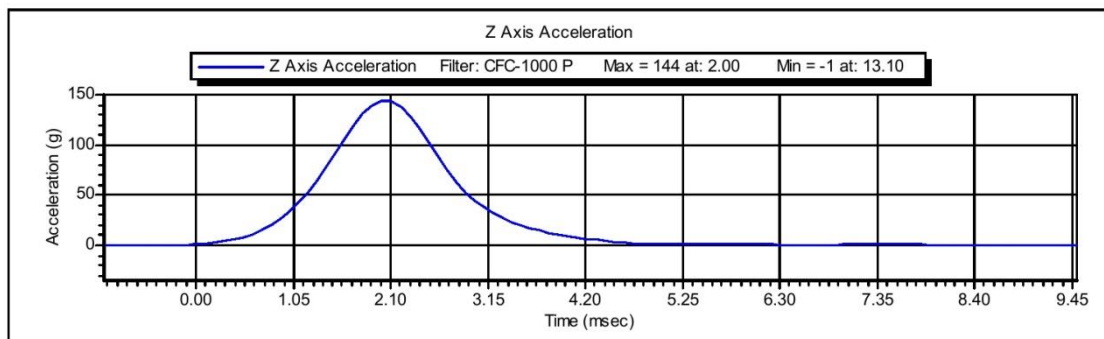
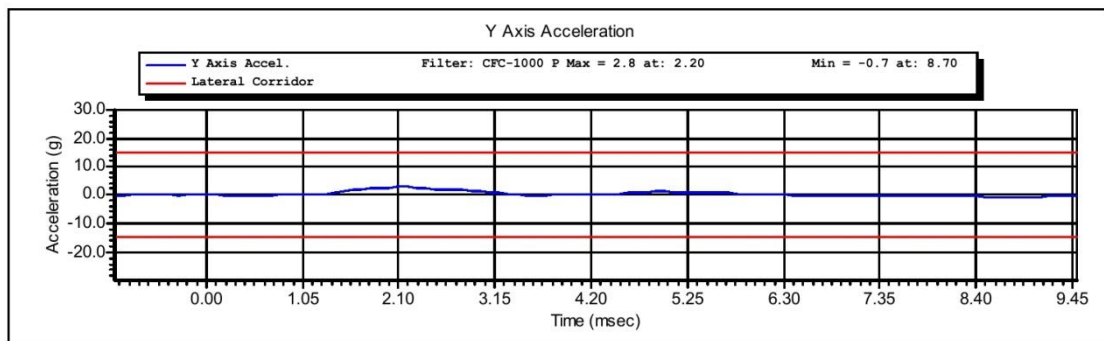
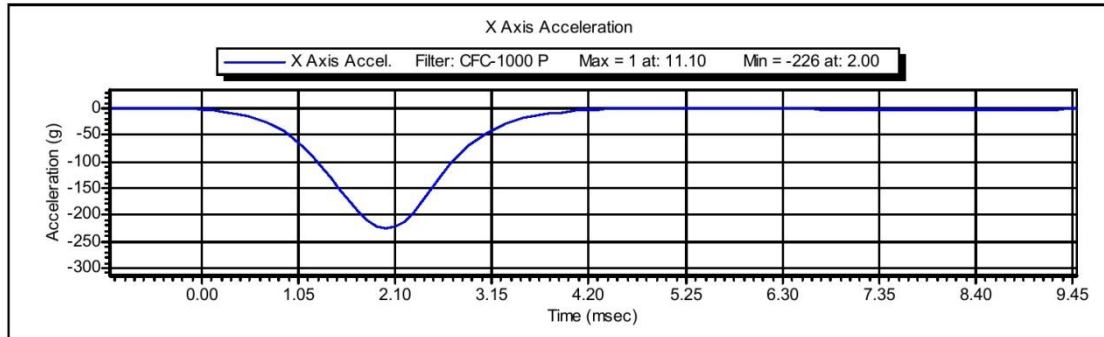
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Test Time: 1:48:36 PM

Test Date: 4/13/2012

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VERIFICATION REPORT

Test Name:	Neck Flexion	Revision:	7/15/2002
Sub Test Name:		Spec Type:	NHTSA
ATD Type:	Hybrid III 5'th		
ATD Serial Number:	070		
Test ID:		Test Date:	4/13/2012
Test Number:	1	Test Time:	2:55:50 PM

Component Part Number	Component Serial Number
Neck - 880105-255	DJ2788

Test Parameters	Test Specifications	Test Results
Temperature	20.6 -- 22.2	22.2 deg C P
Humidity	10 -- 70	24 %RH P
Velocity	6.89 -- 7.13	7.09 m/s P
Pendulum Impulse at 10 ms	2.10 -- 2.50	2.16 m/s P
Pendulum Impulse at 20 ms	4.00 -- 5.00	4.38 m/s P
Pendulum Impulse at 30 ms	5.80 -- 7.00	6.11 m/s P
D Plane Rotation	-91.0 -- -77.0	-77.6 degrees P
Moment During Rotation Interval	69.0 -- 83.0	70.6 Nm P
Moment Decay to 10.0 Nm	80.0 -- 100.0	88.4 ms P

All test parameters are within specifications

Technician: **M. Goehle**
 Supervisor: **D. Travale**

Test Time: **2:55:50 PM**

Test Date: **4/13/2012**

VERIFICATION REPORT

REFERENCE EQUIPMENT

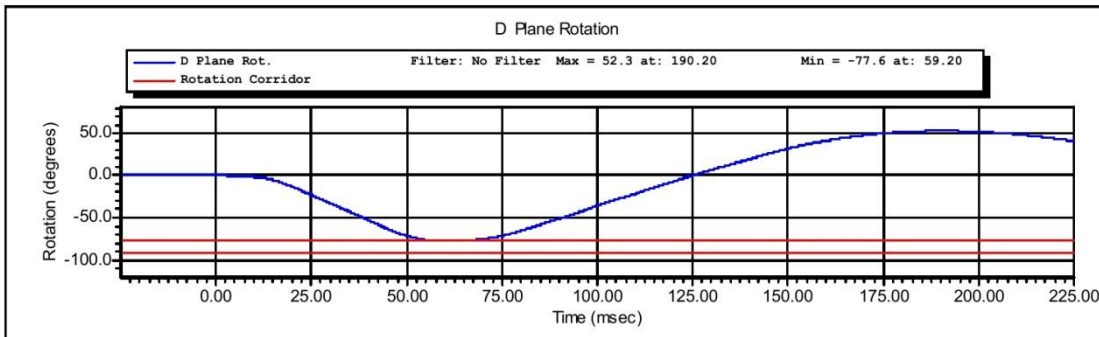
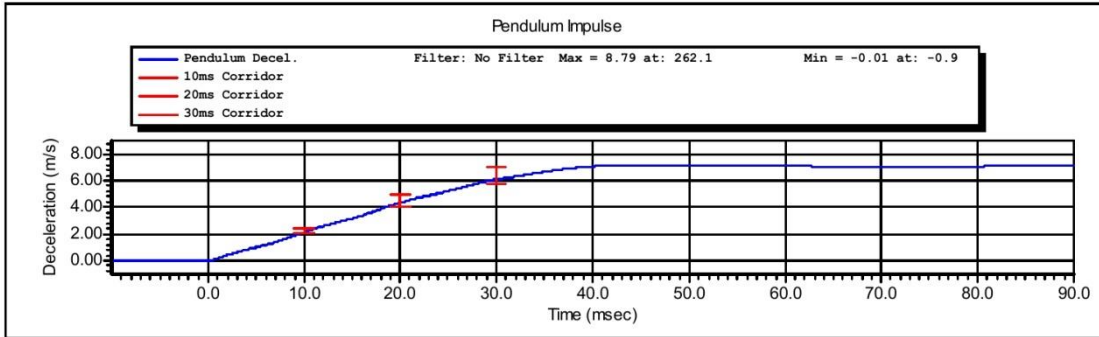
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DentonATD	Velocity Trap	1	1/11/2012
Endevco	7231CT	C15016	2/8/2012
DentonATD	78051-342	PENDULUM POT	1/25/2012
DentonATD	78051-342	CONDYLE POT	1/25/2012
Denton	1716A	LC-2255My	5/18/2011
Denton	1716A	LC-2255Fx	5/18/2011

Test Time: 2:55:50 PM

Test Date: 4/13/2012

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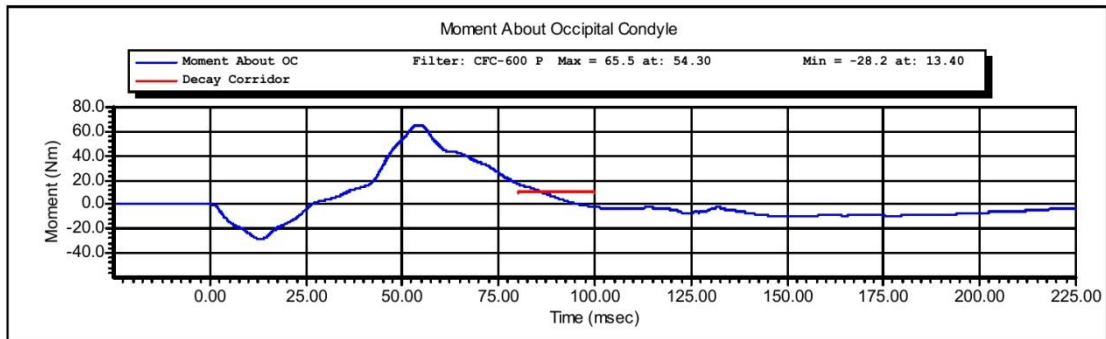
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Sub Test Name:		Spec Type:	NHTSA
ATD Type:	Hybrid III 5'th		
ATD Serial Number:	070		
Test ID:		Test Date:	4/13/2012
Test Number:	1	Test Time:	2:55:50 PM



Test Time: **2:55:50 PM**

Test Date: **4/13/2012**

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Test Time: **2:55:50 PM**

Test Date: **4/13/2012**

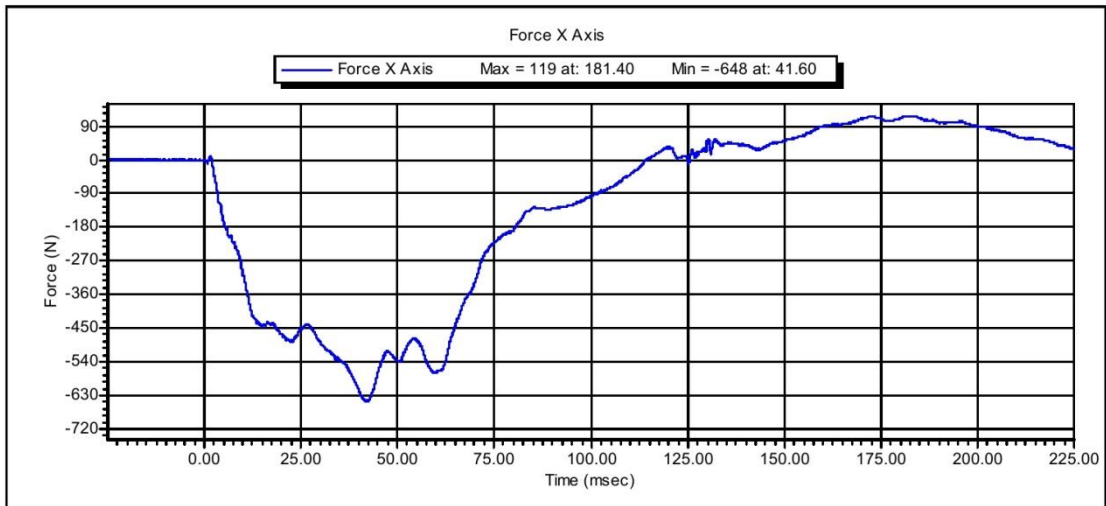
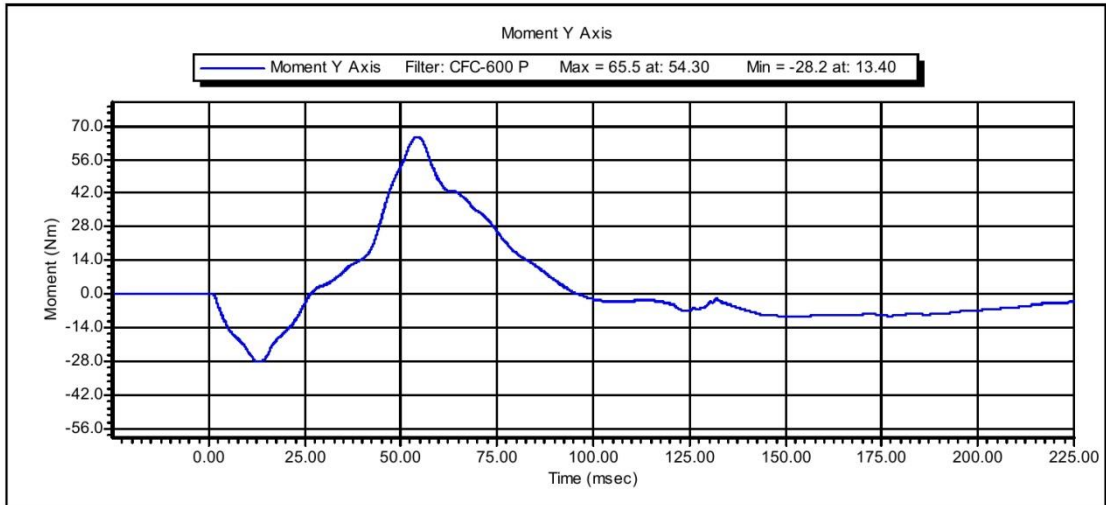
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Test Time: 2:55:50 PM

Test Date: 4/13/2012

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VERIFICATION REPORT

Test Name:	Neck Extension	Revision:	7/15/2002
Sub Test Name:		Spec Type:	NHTSA
ATD Type:	Hybrid III 5'th		
ATD Serial Number:	070		
Test ID:		Test Date:	4/13/2012
Test Number:	1	Test Time:	3:35:47 PM

Component Part Number	Component Serial Number
Neck - 880105-255	DJ2788

Test Parameters	Test Specifications	Test Results
Temperature	20.6 -- 22.2	22.2 deg C P
Humidity	10 -- 70	24 %RH P
Velocity	5.95 -- 6.19	6.08 m/s P
Pendulum Impulse at 10 ms	1.50 -- 1.90	1.70 m/s P
Pendulum Impulse at 20 ms	3.10 -- 3.90	3.50 m/s P
Pendulum Impulse at 30 ms	4.60 -- 5.60	5.16 m/s P
D Plane Rotation	99.0 -- 114.0	108.6 degrees P
Moment During Rotation Interval	-65.0 -- -53.0	-54.1 Nm P
Moment Decay to -10.0 Nm	94.0 -- 114.0	104.1 ms P

All test parameters are within specifications

 Technician: **M. Goehle**
 Supervisor: **D. Travale**

 Test Time: **3:35:47 PM**

 Test Date: **4/13/2012**

VERIFICATION REPORT

REFERENCE EQUIPMENT

<u>Manufacturer</u>	<u>Model</u>	<u>Serial Number</u>	<u>Calibration Date</u>
DentonATD	Velocity Trap	1	1/11/2012
Endevco	7231CT	C15016	2/8/2012
DentonATD	78051-342	PENDULUM POT	1/25/2012
DentonATD	78051-342	CONDYLE POT	1/25/2012
Denton	1716A	LC-2255My	5/18/2011
Denton	1716A	LC-2255Fx	5/18/2011

Test Time: **3:35:47 PM**Test Date: **4/13/2012**

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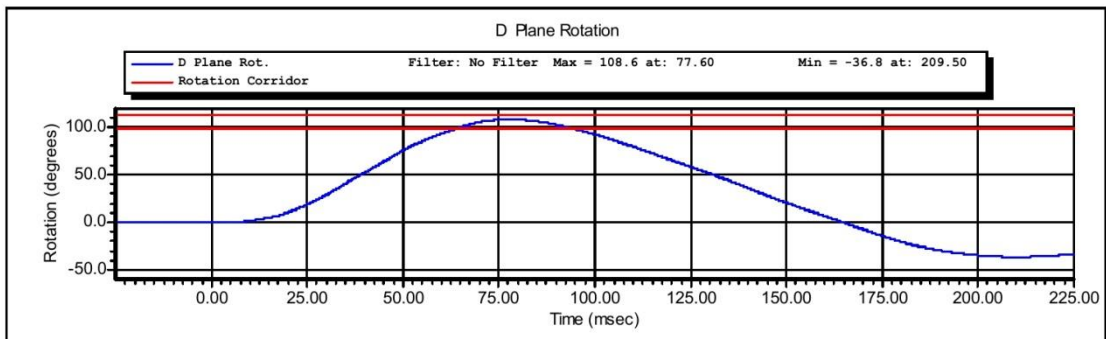
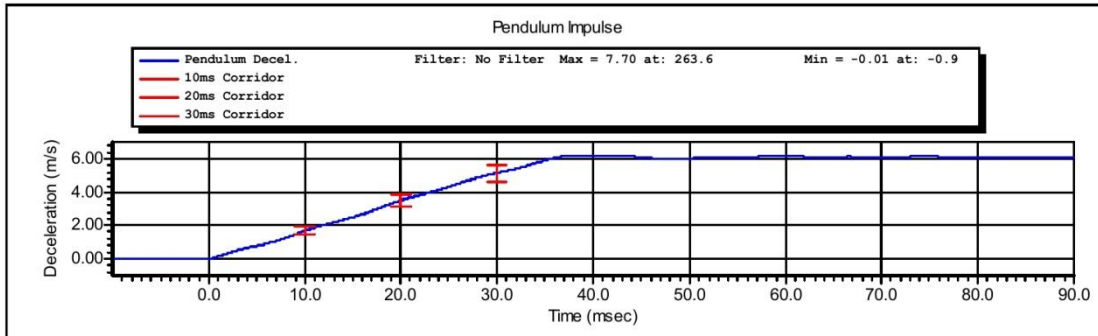


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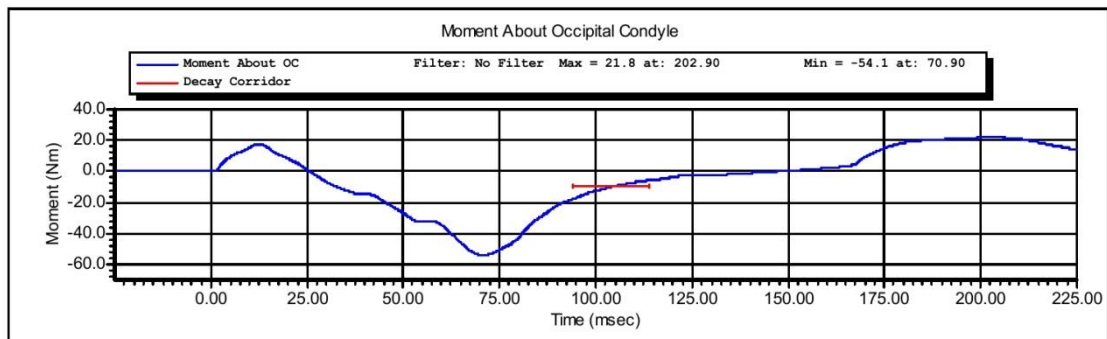
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Sub Test Name:		Spec Type:	NHTSA
ATD Type:	Hybrid III 5'th		
ATD Serial Number:	070		
Test ID:		Test Date:	4/13/2012
Test Number:	1	Test Time:	3:35:47 PM



Test Time: 3:35:47 PM

Test Date: 4/13/2012

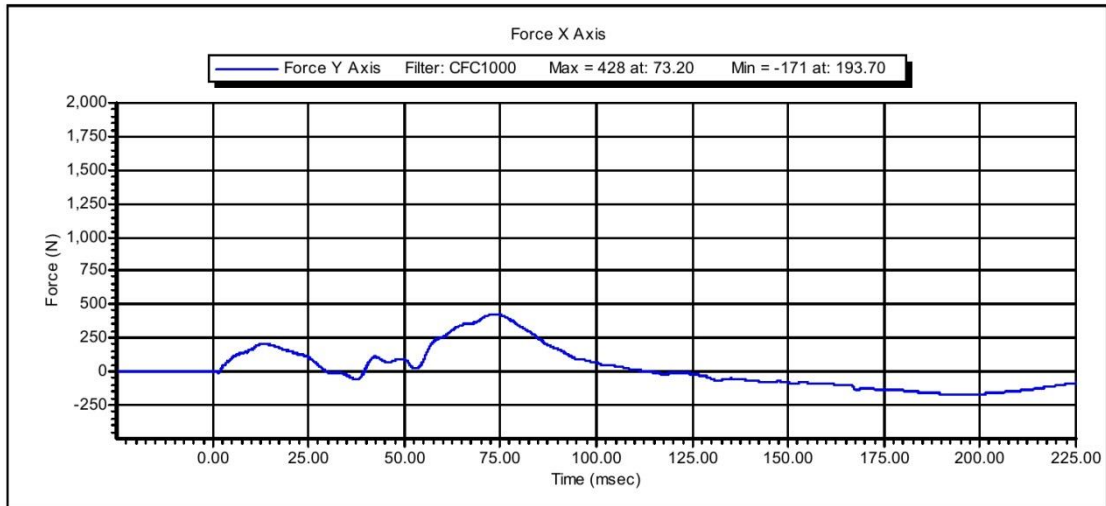
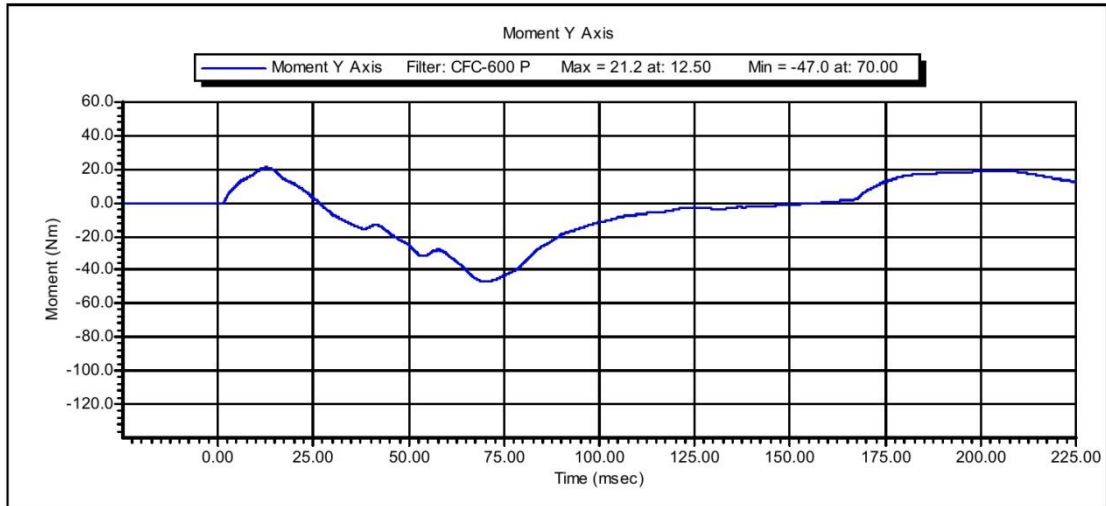
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Test Time: 3:35:47 PM

Test Date: 4/13/2012

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Test Time: **3:35:47 PM**

Test Date: **4/13/2012**

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VERIFICATION REPORT

Test Name:	Thorax Impact	Revision:	7/15/2002
Sub Test Name:		Spec Type:	NHTSA
ATD Type:	Hybrid III 5'th		
ATD Serial Number:	070		
Test ID:		Test Date:	4/16/2012
Test Number:	1	Test Time:	8:53:17 AM

Component Part Number	Component Serial Number
Ribs 880105-RS	
Chest Jacket - 880105-355-E	
Lumbar Spine - 880105-1095	

Test Parameters	Test Specifications	Test Results
Temperature	20.6 -- 22.2	22.2 deg C P
Humidity	10.0 -- 70.0	50.4 %RH P
Velocity	6.59 -- 6.83	6.70 m/s P
Sternum Displacement	-58.0 -- -50.0	-50.5 mm P
Force During Displacement Interval	-4400 -- -3900	-4269 N P
Force -18.0 to -50.0 Displacement	-4600 -- 0	-4443 N P
Hysteresis	69 -- 85	76 % P

All test parameters are within specifications

Technician: **S. Zito**

Supervisor: **D. Travale**

Test Time: **8:53:17 AM**

Test Date: **4/16/2012**

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VERIFICATION REPORT

REFERENCE EQUIPMENT

<u>Manufacturer</u>	<u>Model</u>	<u>Serial Number</u>	<u>Calibration Date</u>
DentonATD	Velocity Trap	1	1/11/2012
Endevco	7231CT	C14953	2/8/2012
SERVO	14CB1-2897	DS-202	5/18/2011

Test Time: 8:53:17 AM

Test Date: 4/16/2012

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Test Name:	Thorax Impact	Revision:	7/15/2002
Sub Test Name:		Spec Type:	NHTSA
ATD Type:	Hybrid III 5'th		
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Test ID:		Test Date:	4/16/2012
Test Number:	1	Test Time:	8:53:17 AM



Test Time: 8:53:17 AM

Test Date: 4/16/2012

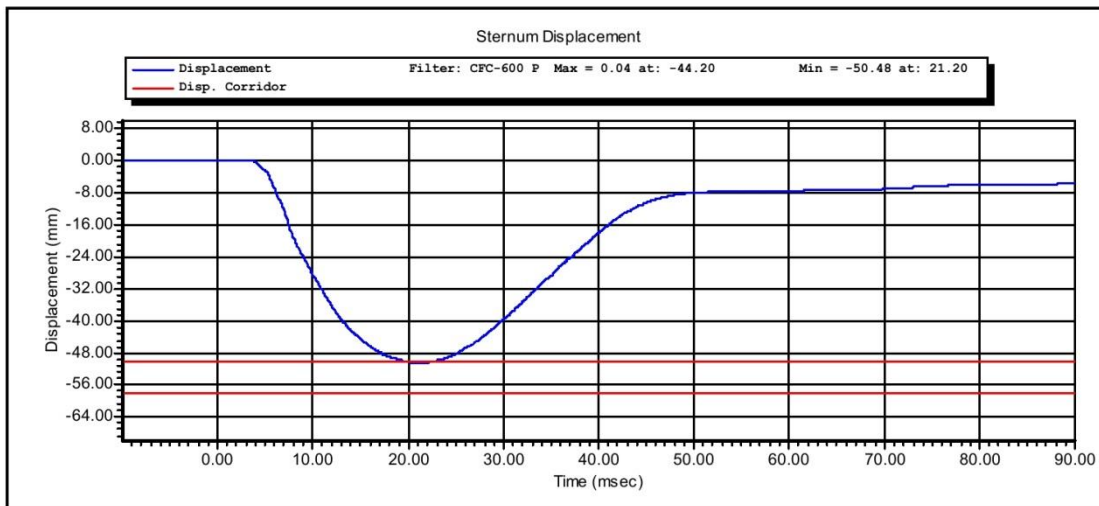
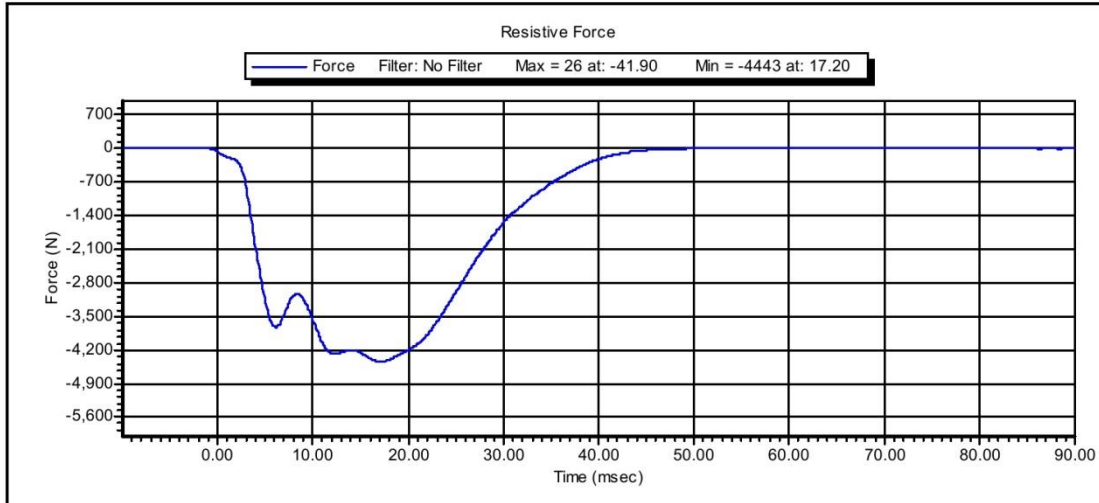
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Test Time: 8:53:17 AM

Test Date: 4/16/2012

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Torso Flexion Test

Technician: MPG
Calibration Date: 4/16/2012

ATD Serial Number: NHTSA 5th Female 070

Test Results			
Test Condition	Parameters	Results	Status
Temperature	18.9-25.6° C	22.1° C	Pass
Lab Humidity: 38%	10-70%	51.4%	Pass
Max Force @ 45 deg	320 – 390N	351N	Pass
Torso rotation rate	0.5 °/s ≤ rate ≤ 1.5 °/s	1.0 °/s	Pass
Initial reference angle	≤20 deg	14.4°	Pass
Final ref plane angle	Initial ref plane ± 8 deg	21.3°	Pass

VERIFICATION REPORT

Test Name:	Knee Impact PENDULUM	Revision:	7/15/2002
Sub Test Name:		Spec Type:	NHTSA
ATD Type:	Hybrid III 5'th		
ATD Serial Number:	070		
Test ID:		Test Date:	4/16/2012
Test Number:	1	Test Time:	10:56:55 AM

Component Part Number	Component Serial Number
Knee Skin - 880105-508	2281

Test Parameters	Test Specifications	Test Results
Temperature	18.9 -- 25.6	22.2 deg C P
Humidity	10.0 -- 70.0	50.4 %RH P
Velocity	2.07 -- 2.13	2.07 m/s P
Resistive Force	-4060 -- -3450	-3841 N P

All test parameters are within specifications

Technician: **S. Zito**Supervisor: **D. Travale**Test Time: **10:56:55 AM**Test Date: **4/16/2012**



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VERIFICATION REPORT

REFERENCE EQUIPMENT

<u>Manufacturer</u>	<u>Model</u>	<u>Serial Number</u>	<u>Calibration Date</u>
DentonATD	Velocity Trap	1	1/11/2012
Endevco	7264-2000	P66927	12/10/2011

Test Time: 10:56:55 AM

Test Date: 4/16/2012

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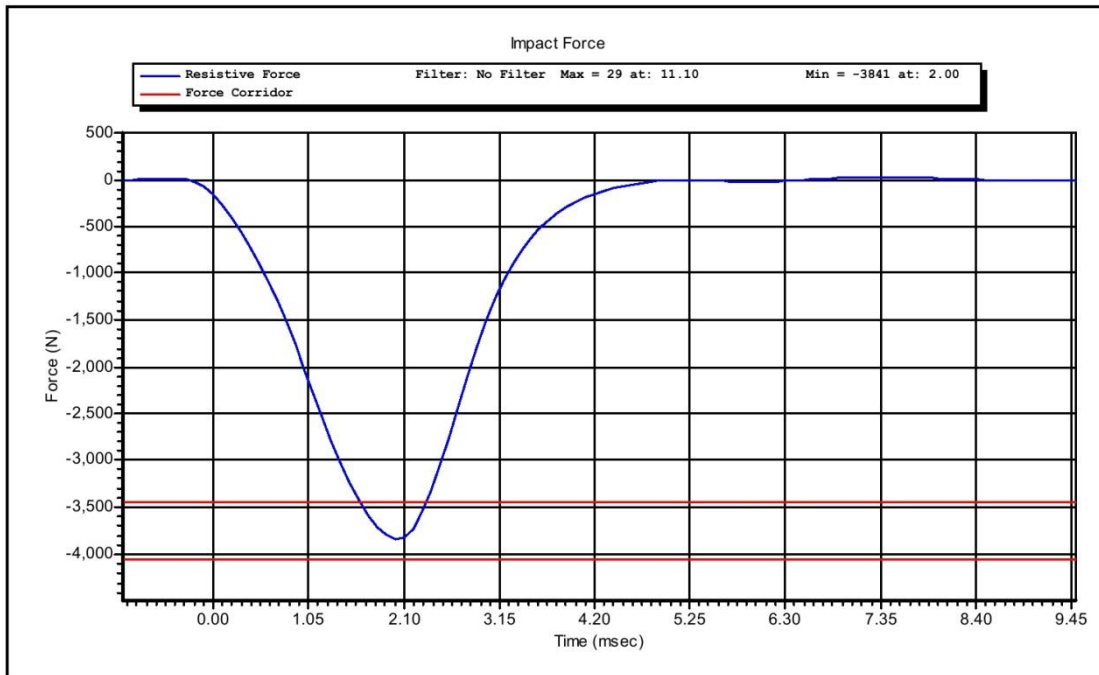


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Test Name:	Knee Impact PENDULUM	Revision:	7/15/2002
Sub Test Name:		Spec Type:	NHTSA
ATD Type:	Hybrid III 5'th		
ATD Serial Number:	070		
Test ID:		Test Date:	4/16/2012
Test Number:	1	Test Time:	10:56:55 AM



Test Time: 10:56:55 AM

Test Date: 4/16/2012

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VERIFICATION REPORT

Test Name:	Knee Impact PENDULUM	Revision:	7/15/2002
Sub Test Name:		Spec Type:	NHTSA
ATD Type:	Hybrid III 5'th		
ATD Serial Number:	070		
Test ID:		Test Date:	4/16/2012
Test Number:	1	Test Time:	11:14:29 AM

Component Part Number	Component Serial Number
Knee Skin - 880105-508	2497

Test Parameters	Test Specifications	Test Results
Temperature	18.9 -- 25.6	22.2 deg C P
Humidity	10.0 -- 70.0	50.4 %RH P
Velocity	2.07 -- 2.13	2.11 m/s P
Resistive Force	-4060 -- -3450	-3823 N P

All test parameters are within specifications

Technician: **S. Zito**
Supervisor: **D. Travale**

Test Time: **11:14:29 AM**

Test Date: **4/16/2012**

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VERIFICATION REPORT

REFERENCE EQUIPMENT

<u>Manufacturer</u>	<u>Model</u>	<u>Serial Number</u>	<u>Calibration Date</u>
DentonATD	Velocity Trap	1	1/11/2012
Endevco	7264-2000	P66927	12/10/2011

Test Time: 11:14:29 AM

Test Date: 4/16/2012

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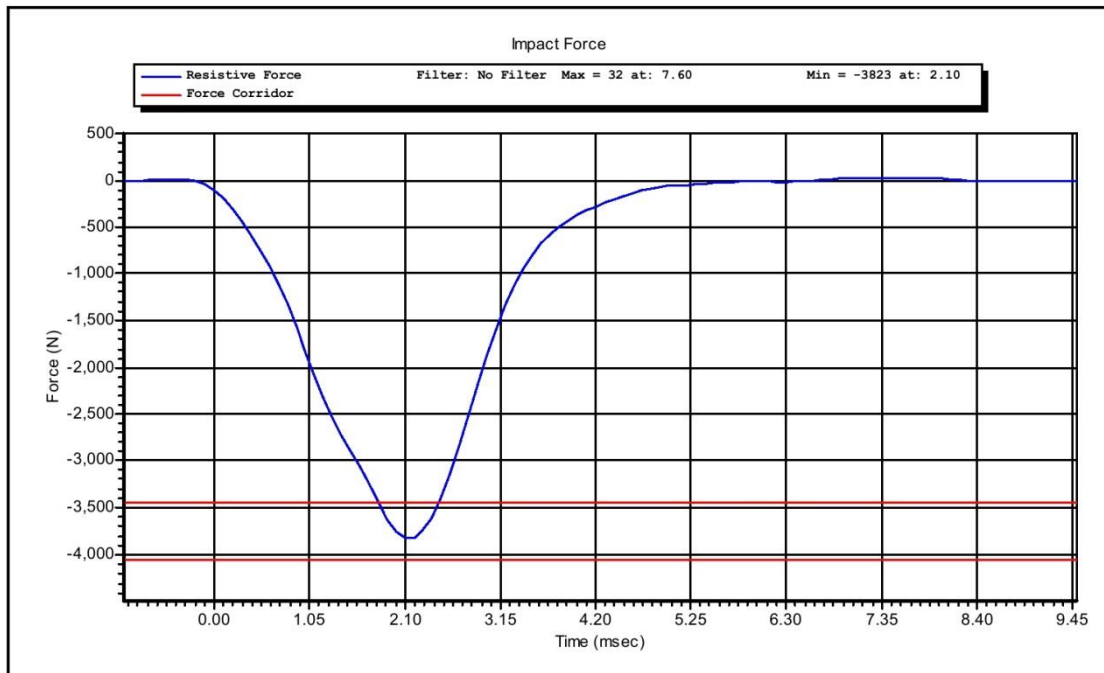


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4455 Genesee Street, Buffalo, New York 14225 - Phone (716)632-7500

Test Name:	Knee Impact PENDULUM	Revision:	7/15/2002
Sub Test Name:		Spec Type:	NHTSA
ATD Type:	Hybrid III 5'th		
ATD Serial Number:	070		
Test ID:		Test Date:	4/16/2012
Test Number:	1	Test Time:	11:14:29 AM



Test Time: 11:14:29 AM

Test Date: 4/16/2012

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External Measurements

Research 5th Female SN 070

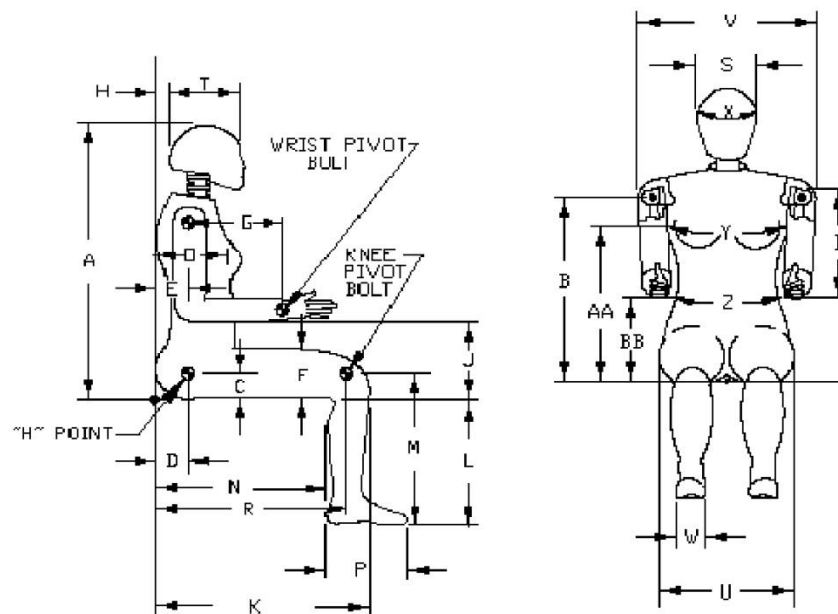
Symbol	Description	Specification	Results	Pass
		mm	mm	
A	Sitting Height	774.7 – 800.1	785	Yes
B	Shoulder Pivot Height	431.8 – 457.2	450	Yes
C	H-Point Height	81.3 – 86.3	83	Yes
D	H-Point from Backline	144.8 – 149.8	147	Yes
E	Shoulder Pivot from Backline	68.6-83.8	80	Yes
F	Thigh Clearance	119.4 – 134.6	130	Yes
G	Back of Elbow to Wrist Pivot	243.9 – 259.1	247	Yes
H	Head Back to Backline	43.2 – 48.2	45	Yes
I	Shoulder to Elbow Length	276.8 – 297.2	282	Yes
J	Elbow Rest Height	182.8 – 203.2	193	Yes
K	Buttock to Knee Length	520.7 – 546.1	540	Yes
L	Popliteal Height	355.6 - 376	359	Yes
M	Knee Pivot Height	393.7 – 419.1	406	Yes
N	Buttock Popliteal Length	414 – 439.4	424	Yes
O	Chest Depth without Jacket	175.3 – 190.5	185	Yes
P	Foot Length (right)	218.5 – 233.7	221	Yes
R	Buttock To Knee Pivot Length	457.2 – 482.6	464	Yes
S	Head Breadth	137.1 – 147.3	142	Yes
T	Head Depth	177.8 - 188	184	Yes
U	Hip Breadth	299.7 – 314.9	308	Yes
V	Shoulder Breadth	350.5 – 365.7	361	Yes
W	Foot Breadth	78.8 - 94	85	Yes
X	Head Circumference	528.3 – 548.7	542	Yes
Y	Chest Circumference with Jacket	850.9 – 881.3	869	Yes
Z	Waist Circumference	759.5 – 789.9	782	Yes
AA	Reference Location (Chest Circumference)	332.7 – 358.1	350	Yes
BB	Reference Location (Waist Circumference)	160.1 – 170.2	168	Yes

Technician: SZ

Date: 04/16/2012

Hybrid III 5th Female External Measurements

Reference Diagram



APPENDIX D:

Positioning Procedure for rear seat Part 572O 5th female ATD

The rear seat 5th female was positioned using a combination of the FMVSS 214D side impact and FMVSS 208 seating procedures.

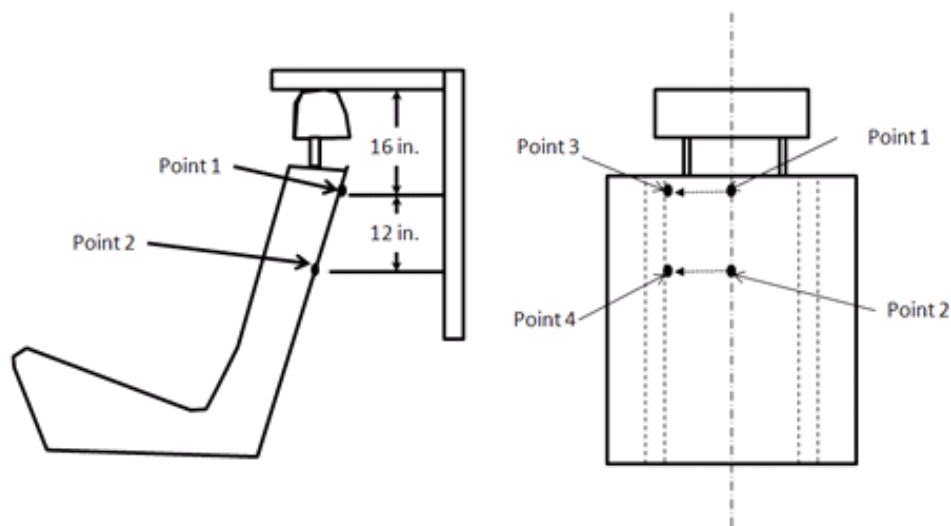
The lateral seat centerline was determined by following the FMVSS 214D seating procedures for the rear seat. Once the Part 572O 5th female dummy was located on the lateral centerline, the dummy was positioned following FMVSS 208 as if would be if it were in the front seating position. The legs would be positioned at the 120 degree angle and the pelvis would be pushed back against the seatback until the calves contacted the seat cushion. If the seatback was adjustable, the seatback would be raised to level the head. The 5th female dummy used in this test series had a lower neck transducer which prevented using the neck bracket as an adjustment to level the head.

APPENDIX E:
CMM MEASUREMENT PROCEDURES

SECTION E.1 SEAT BACK MEASUREMENT PROCEDURE

The following procedure was used in obtaining the required seat back measurements, please see the below diagram for additional clarification:

1. Measure Points 3 and 4 on the using the following method after positioning the dummy and head restraint:
2. Place a level at the center of the head restraint and make sure it is level to the horizontal
3. Measure down 16 inches from the bottom of the level in the vertical direction
4. Project a line in the longitudinal direction until contact with seat and mark point 1 with a marker
5. Project another line in the longitudinal direction until contact with seat and mark point 2 with a marker
6. Push on the seat fabric at point 1 and determine if there is any structure. Do not push in the longitudinal direction more than an inch
7. If no structure found push on the seat cloth and move in the lateral direction toward the outboard of the seat until seat structure is found
8. Cut a slit in the seat fabric
9. Mark Point 3 at the begin on the structure and measure the point
10. Perform the same procedure to determine Point 4 using Point 2



SECTION E.2

DOOR SILL INTRUSION MEASUREMENT PROCEDURE

The following procedure was conducted in order to obtain the required door sill intrusion measurements for this test. Please see the below picture for further clarifications:

1. Put steering wheel in center position. Create a horizontal plane (plane 1) that passes through the center of the steering wheel.
2. Point 1: Mark the sheet metal at the intersection of plane 1 and the outer edge of rubber part of the door sill running down the A-pillar.
3. Point 22: Mark the sheet metal at the intersection of plane 1 and the outer edge of rubber part of the door sill running down the B-pillar.
4. Mark 20 evenly spaced points between points 1 and 22 along the outer edge of the rubber door sill on the sheet metal. (A tape measure can be used to mark these points).
5. Mark 20 evenly spaced points between points 22 and 1 along the outer edge of the rubber door sill on the sheet metal. (A tape measure can be used to mark these points).
6. Measure points using CMM
7. Record in the appropriate data sheet and calculate the difference by subtracting the post-test minus the pre-test. A picture with the points labeled shall be included on the data sheet. All points shall be visible in the pictures.
8. Repeat on the passenger door.



SECTION E.3 VEHICLE EXTERIOR CRUSH PROFILE PROCEDURE

1. Expose the bumper beam and level the vehicle such that all attitudes are within 5 mm.
2. Cross section A-A is defined as a horizontal plane passing through the center of the front bumper beam at the centerline of the vehicle (Figure E.3.1). Record the height of this plane (d1) and take enough points at this height to create an exterior cross-section of the vehicle.
3. Perform the same procedure for cross-section B-B. Cross section B-B is defined as a plane passing through the top the upper radiator support.
4. Post-test put the vehicle back to its original coordinate system (Figure E.3.2). Take enough points at the height of d1 and d2 to create a post-test cross-section A-A and B-B. There can be more points measured posttest than pre-test (Figure E.3.3). Record these points in the appropriate data sheet.

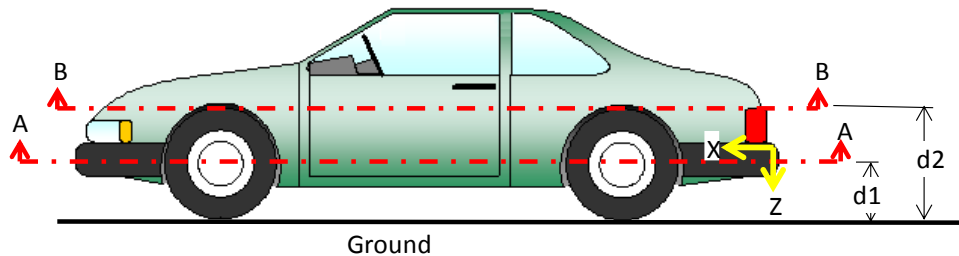


Figure E.3.1 - Pre-Test Cross-Sections

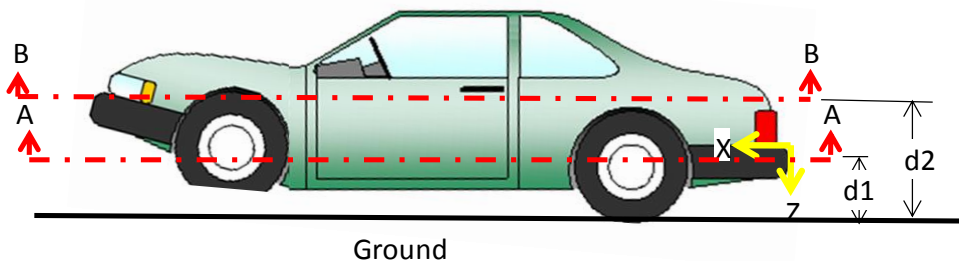


Figure E.3.2 - Post-Test Cross-Sections

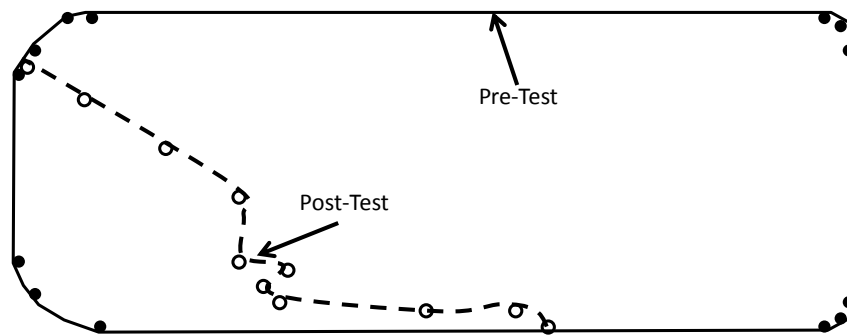


Figure E.3.3 - Plot of Cross-Section

SECTION E.4

DASH PROFILE MEASUREMENT PROCEDURE

The following procedure was used in order to obtain the dash profile measurements required for this test. Please see the diagram on the following page for further clarifications:

1. Left Plane: create a vertical plane that is parallel to the longitudinal axis of the vehicle and is located 150mm to the left of the center of the steering wheel (Figure 31).
2. Left Line: create a line on the IP/Knee Bolster at the intersection of the Left Plane and the IP/KneeBolster
3. L1: create a point on the dash that is located on the Left Line and is 450 mm above the floorboard (with floor mats removed). Note this is the Left IP point for the IP5 file and IP Left in DATA SHEET NO.13 (CONTINUED) - VEHICLE INTRUSION MEASUREMENTS.
4. Lt1: From L1 move up the Left Line 50 mm
5. Lt2: From Lt1 move up the Left Line 50 mm
6. Ltn: Mark points at 50 mm increments along Left Line until the window sill is reached.
7. Lb1: From L1 move down the Left Line 50 mm
8. Lb2: From Lb1 move down the Left Line 50 mm
9. Lbn: Mark points at 50 mm increments along Left Line until the bottom of the IP/Knee Bolster is reached.
10. Right Plane: create a vertical plane that is parallel to the longitudinal axis of the vehicle and is located 150mm to the right of the center of the steering wheel (Figure 31).
11. Right Line: create a line on the IP/Knee Bolster at the intersection of the Right Plane and the IP/KneeBolster
12. R1: create a point on the dash that is located on the Right Line and is 450 mm above the floorboard (with floor mats removed). Note this is the Right IP point for the IP5 file and IP Right in DATA SHEET NO.13 (CONTINUED) - VEHICLE INTRUSION MEASUREMENTS.
13. Rt1: From R1 move up the Right Line 50 mm
14. Rt2: From Rt1 move up the Right Line 50 mm
15. Rtn: Mark points at 50 mm increments along Right Line until the window sill is reached.
16. Rb1: From R1 move down the Right Line 50 mm
17. Rb2: From Rb1 move down the Right Line 50 mm
18. Rbn: Mark points at 50 mm increments along Right Line until the bottom of the IP/Knee Bolster is reached.

19. If dash panel or knee bolster loosens or breaks away in the crash, the post-test measurements are taken by pressing and holding the panel against the underlying structure. Record in the appropriate data sheet and calculate the difference by subtracting the post-test minus the pre-test. A picture with the points labeled shall be included on the data sheet. All points shall be visible in the picture.

