REPORT NUMBER: SINCAP-CAL-20-002

NEW CAR ASSESSMENT PROGRAM (NCAP)
MOVING DEFORMABLE BARRIER SIDE IMPACT TEST

Subaru Corporation
2020 Subaru WRX
Four Door Sedan

NHTSA No: M20205502

PREPARED BY:
CALSPAN CORPORATION
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February 20, 2020

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
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Prepared by: Vanessa Hansen Date: February 20, 2020
Vanessa Hansen, Operations Manager

Approved by: Edward Dutton Date: February 20, 2020
Edward Dutton, Director

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

_____
COTR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. SINCAP-CAL-20-002	***2. Government Accession No.***	***3. Recipient's Catalog No.***
4. Title and Subtitle Final Report of New Car Assessment Program Side Impact MDB Testing of a 2020 Subaru WRX four door sedan NHTSA No.: M20205502		***5. Report Date*** February 20, 2020 ***6. Performing Organization Code*** CAL
Vanessa Hansen, Operations Manager Edward Dutton, Director		***8. Performing Organization Report No.*** CAL-DOT-2020-002
9. Performing Organization Name and Address Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225		***10. Work Unit No.*** ***11. Contract or Grant No.*** DTNH22-14-D-00352
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave., SE, Room W43-410 Washington, D.C. 20590		***13. Type of Report and Period Covered:*** Final Test Report December 3, 2019 - February 20, 2020 ***14. Sponsoring Agency Code*** NRM-110
15. *Supplementary Notes*		

16. Abstract

A 55/28, (61.90kph / 38.5 mph), 90^0 Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 2020 Subaru WRX four door sedan in accordance with the specifications of the Office of Crashworthiness Standards Test Procedure for the generation of consumer information on vehicle side crash protection. This test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on December 3, 2019.

The impact velocity of the Moving Deformable Barrier (MDB) was 61.87 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21°C. The target vehicle's maximum post-test static crush was 231mm located at level 3. The test vehicle's occupant performance data is as follows:

Measurement Description	Driver ATD (ES-2re)		
	Units	IARV	Result
Head Injury Criteria (HIC_{36})	N/A	1000	117.803
Maximum Thoracic Rib Deflection	mm	44	28.912
Total Abdominal Force	N	2500	687.208
Pubic Symphysis Force	N	6000	1969.633

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC_{36})	N/A	1000	234.548
Lower Spine Resultant Acceleration	G	82	64.532
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2161.347
Maximum Thoracic Rib Deflection	mm	38*	25.381
Maximum Abdominal Rib Deflection	mm	45*	33.155

* *Proposed IARV*

The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.

17. Key Words New Car Assessment Program (NCAP) Side Impact MDB ES-2re SID-IIs	***18. Distribution Statement*** Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave. SE Washington, D.C. 20590

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UNCLASSIFIED	UNCLASSIFIED	192	

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SECTION 1

TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test is part of the MY 2020 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number DTNH22-14-D-00352. The purpose of this test is to generate comparative side impact performance in a 2020 Subaru WRX four door sedan. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure dated October 2015.

SECTION 2

SUMMARY OF TEST RESULTS

A 2020 Subaru WRX four door sedan was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 61.87 km/h. The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by the Calspan Corporation's Transportation Test Operations Center in Buffalo, New York on December 3, 2019. Pre-test and post-test photographs of the test vehicle, the MDB and the dummies (ES-2re and SID-IIs) are included in this report.

Dummies were placed in the driver and left rear designated seating positions according to instructions specified in the OCWS Side Impact Laboratory Test Procedure, dated October 2015. The side impact event was documented by 9 high-speed and 2 real-time cameras. Camera locations are included in this report.

The Dummies were instrumented in the following manner:

DRIVER ATD (ES-2re)
Primary and redundant head CG tri-axial accelerometers
Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers
Abdomen forward, middle, and rear y-axis load cells
Lower spine (T12) tri-axial accelerometers
Public symphysis y-axis load cell

PASSENGER ATD (SID-IIs)
Primary and redundant head CG tri-axial accelerometers
Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers
Abdomen upper rib and lower rib y-axis displacement potentiometers
Lower spine (T12) tri-axial accelerometers
Acetabulum and iliac wing y-axis load cells

Appendix B contains the vehicle and dummy response data. Dummy configuration and performance verification data can be found in APPENDIX C of this report. Appendix D of this report contains the test equipment and instrumentation calibration data.

DUMMY INJURY VALUES

Measurement Description	Driver ATD (ES-2re)		
	Units	Threshold	Result
Head Injury Criteria (HIC36)		1000	117.803
Maximum Thorax Rib Deflection	mm	44	28.912
Combined Abdominal Force	N	2500	687.208
Pubic Symphysis Force	N	6000	1969.633

Measurement Description	Passenger ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC36)		1000	234.548
Lower Spine (T12) Resultant Acceleration	G	82	64.532
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2161.347
Maximum Thoracic Rib Deflection	mm	38*	25.381
Maximum Abdominal Rib Deflection	mm	45*	33.155

*Proposed IARV

SUPPLEMENTAL RESTRAINT INFORMATION

Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Frontal Air bag	Yes	No		
Knee Air bag	Yes	No		
Side Air bag 1 - Curtain	Yes	Yes	Yes	Yes
Side Air bag 2 – Torso/Pelvis Air bag	Yes	Yes	No	N/A
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Yes	No	N/A
Other				

GENERAL COMMENTS:

1. P1 serial number – F034
2. P4 serial number – 300

Data Anomalies:

- Left B-Pillar Middle Y Acceleration, Exceeded calibration range and saturated at 10.1ms

SECTION 3

OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

Data Sheet No. 1 - General Test and Vehicle Parameter Data

Data Sheet No. 2 – Seat, Seat Belt, Steering Wheel Adjustment and Fuel System Data

Data Sheet No. 3 – Dummy Longitudinal Clearance Dimensions

Data Sheet No. 4 – Dummy Lateral Clearance Dimensions

Data Sheet No. 5 – Camera and Instrumentation Data

Data Sheet No. 6 – Test Vehicle Accelerometer Locations

Data Sheet No. 7 – MDB Accelerometer Locations

Data Sheet No. 8 – Post-Test Observations

Data Sheet No. 9 – MDB Summary of Results

Data Sheet No. 10 – Test Vehicle Profile Measurements

Data Sheet No. 11 – Test Vehicle Exterior Crush Measurements

Data Sheet No. 12 – MDB Exterior Static Crush Measurements

Data Sheet No. 13 – Vehicle and MDB Damage Profile Distances

Data Sheet No. 14 – FMVSS No. 301 Static Rollover Results

Data Sheet No. 15 – Dummy/Vehicle Temperature and Humidity Stabilization Data

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Subaru WRX four door sedan NHTSA No.: M20205502
Test Program: NCAP Side MDB Impact Test Test Date: 12/3/2019

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20205502
Model Year	2020
Make	Subaru
Model	WRX
Body Style	Four Door Sedan
VIN	JF1VA1A62L9801577
Body Color	Blue
Odometer Reading (km/mi)	178 mi
Engine Displacement (L)	2.0
Type/No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Manual
Transmission Speeds	6-Speed
Overdrive	Yes
Final Drive	All Wheel Drive
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes

Traction Control System (TCS)	Yes
Auto-Leveling System	No
Automatic Door Locks (ADL)	No
Power Window Auto-Reverse	No
Other Optional Feature	-
Driver Front Air bag	Yes
Driver Curtain Air bag	Yes
Driver Head/Torso Air bag	No
Driver Torso Air bag	No
Driver Torso/Pelvis Air bag	Yes
Driver Pelvis Air bag	No
Driver Knee Air bag	Yes
Rear Pass. Curtain Air bag	Yes
Rear Pass. Head/Torso Air bag	No
Rear Pass. Torso Air bag	No
Rear Pass. Torso/Pelvis Air bag	No
Rear Pass. Pelvis Air bag	No
Driver Seat Belt Pretensioners	Yes
Rear Pass. Seat Belt Pretensioners	No
Driver Load Limiter	Yes
Rear Pass. Load Limiter	No
Other Safety Restraint	-

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

DATA FROM CERTIFICATION LABEL

Manufactured By	Subaru Corporation
Date of Manufacture	08/19
Vehicle Type	Passenger Car

GVWR (kg)	2000
GAWR Front (kg)	1075
GAWR Rear (kg)	1040

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3	-	5	
Capacity Weight (VCW) (kg)				385	(A)
DSC X 68.04 kg				340.2	(B)
Cargo Weight (RCLW) (kg)				44.8	(A-B)

VEHICLE SEAT TYPE

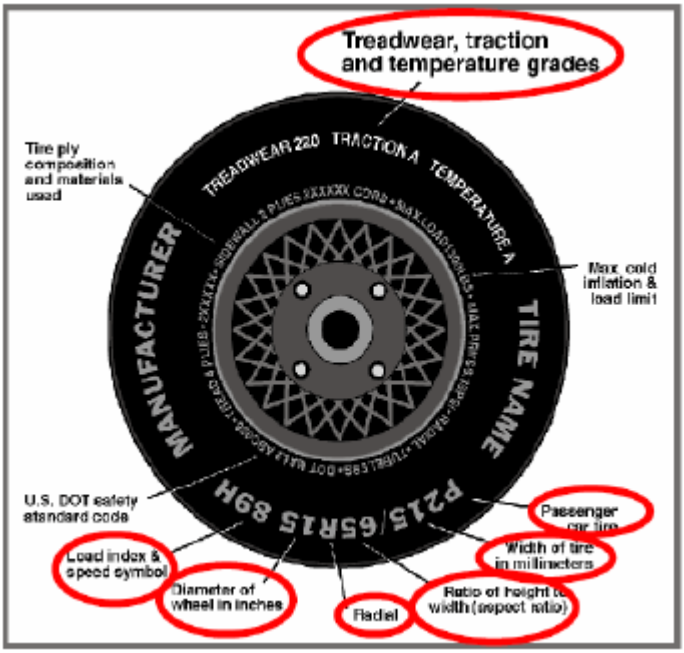
Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front Seat	X					X	
Rear or Second Row Seat			X		X		
Third Row seat							

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

Test Vehicle:	2020 Subaru WRX four door sedan	NHTSA No.:	M20205502
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/3/2019

VEHICLE TIRE INFORMATION

Collected for year, make, model, & VIN, all items circled in red, tire manufacturer and tire name.



TIRE SIDEWALL INFORMATION

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	230	220
Recommended Tire Size	235/45R17	235/45R17
Tire Size on Vehicle	235/45R17	235/45R17
Tire Manufacturer	Dunlop	Dunlop
Tire Model	Sport Maxx RT	Sport Maxx RT
Treadwear	240	240
Traction	AA	AA
Temperature Grade	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	94W	94W
Tire Material	Rubber	Rubber
DOT Safety Code Left	U20LA2YR3019	U20LA2YR3019
DOT Safety Code Right	U20LA2YR3019	U20LA2YR3019

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

Test Vehicle: 2020 Subaru WRX four door sedan NHTSA No.: M20205502
Test Program: NCAP Side MDB Impact Test Test Date: 12/3/2019

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	235	232	229	232
Tire Placard	kPa	230	230	220	220
Owner's Manual	kPa	230	230	220	220
As Tested	kPa	230	230	220	220

MDB TIRE SPECIFICATIONS

	Units	Requirement	LF	RF	LR	RR
Tire Size		P205/75R15	P205/75R15	P205/75R15	P205/75R15	P205/75R15
Tire Pressure	kPa	200 ± 21	207	207	207	207

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	453	309		507	357		494	387	
Right	kg	445	290		468	330		460	333	
Ratio	%	60	40		59	41		57	43	
Totals	kg	898	599	1497	975	687	1662	954	720	1674

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1497	(A)
Sum of Actual Weight of 1 ES2re and 1 P572 ATD (SID-IIs)	kg	127	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	44.8	(C)
Calculated Target Vehicle Test Weight (TVTW)	kg	1668.8	(A+B+C)

Does the measured As Test Vehicle Weight lie within the required weight range

(i.e. Calculated Test Vehicle Target Weight – 4.5 kg to – 9 kg)? [X] **Yes** [ ] **No**

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	Fully Loaded	As Tested	Meets Requirement**
LF	mm	678	676	Yes
RF	mm	687	680	Yes
RR	mm	683	677	Yes
LR	mm	669	668	Yes
Vehicle CG (Aft of Front Axle)	mm	1140	1095	
Vehicle CG (Left(+)/Right(-) from Longitudinal Centerline)	mm	40	31	

**** The "As Tested" vehicle attitude measurements must be equal to or within ± 10mm of the "Fully Loaded" vehicle attitude measurements at each wheel well. Indicate "Yes" or "No" for "Meets Requirements".*

Test height adjustable suspension setting, if applicable: N/A

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

Test Vehicle:	2020 Subaru WRX four door sedan	NHTSA No.:	M20205502
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/3/2019

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	7.5
Spare Tire	14
Jack	3.0
Tail Light	2.5
Passenger Side Door Internals	N/A
Ballast / Equipment Added	22.7

DATA SHEET NO. 2
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

Test Vehicle:	2020 Subaru WRX four door sedan	NHTSA No.:	M20205502
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/3/2019

SEAT POSITIONING

The driver's seat, front center seat (if applicable), and right front passenger's seat should be set to the mid-track, lowest, mid-angle position. The struck-side rear passenger's seat, rear center seat, and non-struck side rear passengers' seats should be set to the rear-most, lowest, mid-angle position.

SCRL ANGLE RANGE

Seat	SCRL (°)		
	Max	Min	Mid
Driver Seat	17.1	13.3	15.2
Front Passenger Seat	Not Adjustable		
Front Center Seat*	N/A	N/A	N/A
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed
Rear Center Seat*	Fixed	Fixed	Fixed

**if applicable*

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rearmost	Mid-Fore/Aft	Forward-Most
Driver Seat	15.2	32	Max	-	-	-
			Mid	22	32	42
			Min	-	-	-
Front Passenger Seat	Not Adjustable		Max	-	-	-
			Mid	-	-	-
			Min	-	-	-
Front Center Seat*	N/A	N/A	Max	-	-	-
			Mid	-	-	-
			Min	-	-	-
Struck Side Rear Seat	Fixed	Fixed	Max	-	-	-
			Mid	-	-	-
			Min	-	-	-
Non-Struck Side Rear Seat	Fixed	Fixed	Max	-	-	-
			Mid	-	-	-
			Min	-	-	-
Rear Center Seat*	Fixed	Fixed	Max	-	-	-
			Mid	-	-	-
			Min	-	-	-

**if applicable*

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

Test Vehicle: 2020 Subaru WRX four door sedan NHTSA No.: M20205502
Test Program: NCAP Side MDB Impact Test Test Date: 12/3/2019

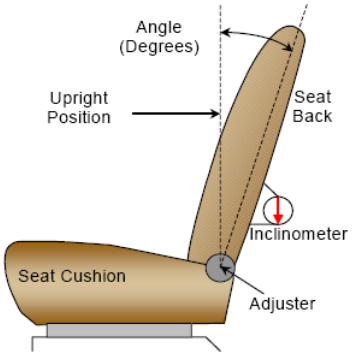
SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forwardmost Position	
	mm	Detents*	mm	Detent*
Driver Seat	240	25 (0-24)	120	12
Front Passenger Seat	240	25 (0-24)	120	12
Front Center Seat*	N/A	N/A	N/A	N/A
Struck Side Rear Seat	FIXED	FIXED	FIXED	FIXED
Non-Struck Side Rear Seat	FIXED	FIXED	FIXED	FIXED
Rear Center Seat*	FIXED	FIXED	FIXED	FIXED

**if applicable*

SEAT BACK ANGLE ADJUSTMENT

The driver's seat back is positioned to the manufacturer's designated design angle. The front center and front passenger's seat backs are positioned in a similar manner as the driver's seat back. The struck side rear seat back is positioned such that the dummy's head is level. The rear center and non-struck side rear outboard seat backs are positioned in a similar manner as the struck-side rear seat back.



FRONT SEAT ASSEMBLY

Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents*	Degrees	Detents*
Driver Seat w/ Seated Dummy	70.2	-	-0.2	5
Front Passenger Seat	69.6	-	-1.0	5
Front Center Seat*	N/A	N/A	N/A	N/A
Struck Side Rear Seat w/ Seated Dummy	FIXED	FIXED	FIXED	FIXED
Non-Struck Side Rear Seat	FIXED	FIXED	FIXED	FIXED
Rear Center Seat*	FIXED	FIXED	FIXED	FIXED

**if applicable*

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

Test Vehicle: 2020 Subaru WRX four door sedan NHTSA No.: M20205502
Test Program: NCAP Side MDB Impact Test Test Date: 12/3/2019

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1. For this test zero is defined as the uppermost position.

	Total # of Positions	Placed in Position #
Driver Seat	4 (0-3)	1
Rear Seat	Fixed	Fixed

HEAD RESTRAINT ADJUSTMENT

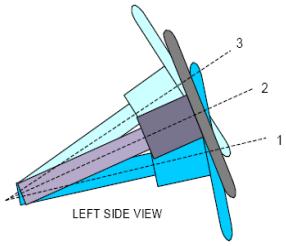
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	4 (0-3)	Uppermost
Rear Seat	Fixed	Fixed

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves through its full range of motion.

	Degrees	Fore/Aft Position (mm)
Lowermost – Position 1	22.8	
Geometric Center – Position 2	24.3	
Uppermost – Position 3	25.8	
Telescoping Steering Wheel Travel		40
Test Position	24.3	20

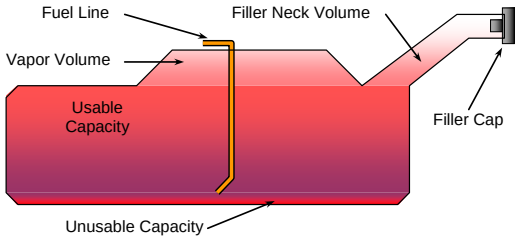


STEERING COLUMN ASSEMBLY

FUEL PUMP

Describe the fuel pump type, details about how it operates, and the location of the fuel filler neck.

The vehicle is equipped with an electric fuel pump. The fuel filler neck is on the right side of the vehicle. The pump creates positive pressure in the fuel lines, pushing the gasoline to the engine. See form 1 for more information.



VEHICLE FUEL TANK ASSEMBLY

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

Test Vehicle: 2020 Subaru WRX four door sedan NHTSA No.: M20205502
Test Program: NCAP Side MDB Impact Test Test Date: 12/3/2019

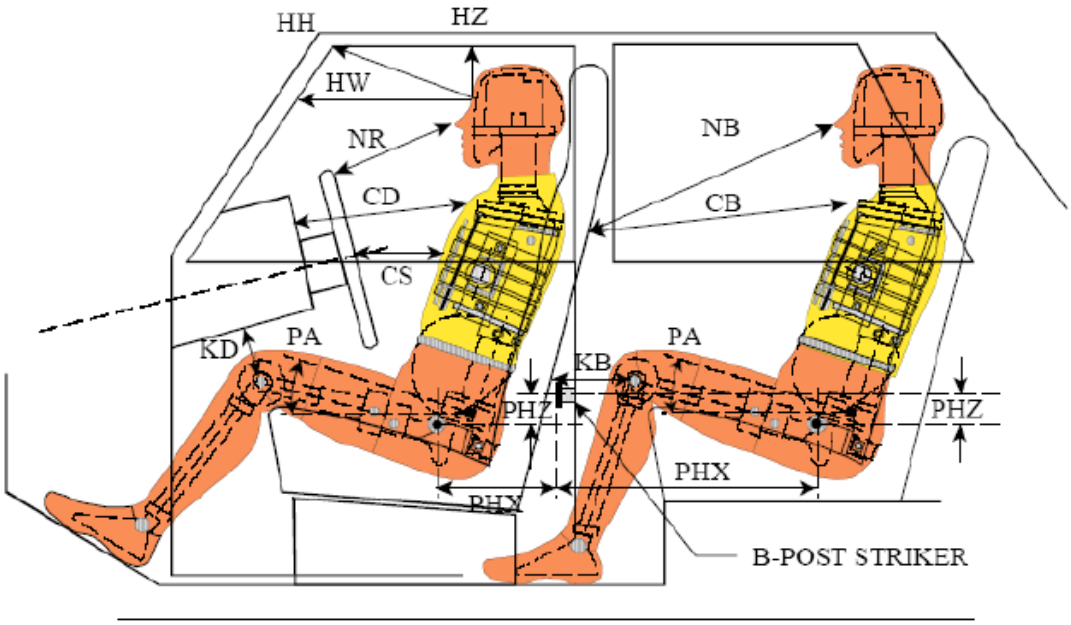
FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	60
Usable Capacity of "Optional Tank" (see Form No. 1)	N/A
Usable Capacity of Standard Tank (see Owner's Manual)	60
Usable Capacity of Optional Tank (see Owner's Manual)	N/A
93% of Usable Capacity	55.8
Actual Amount of Solvent Used in Test	55.8
1/3 of Usable Capacity	20

Is the Actual Amount of Solvent Used in the test equal to 93% ± 1% of the Usable Capacity stated in Form No. 1? [X] **Yes** [ ] **No**

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle:	2020 Subaru WRX four door sedan	NHTSA No.:	M20205502
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/3/2019



NOTE: 2-DOOR VEHICLE SHOWN. REAR DUMMY PHX & PHZ MEASUREMENTS FOR A 4-DOOR VEHICLE WOULD USE THE C-POST STRIKER AS A REFERENCE POINT

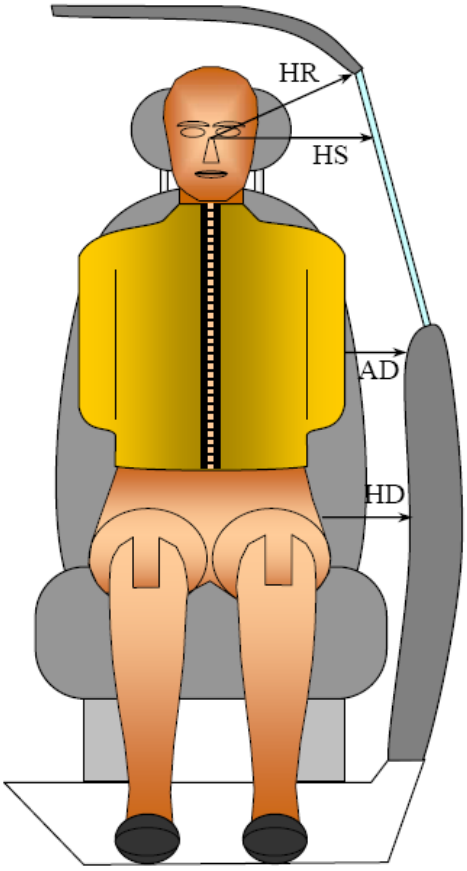
LEFT SIDE VIEW

DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Pass. Code	Description	Driver (Serial No. F034)		Passenger (Serial No.300)	
			Length (mm)	Angle	Length (mm)	Angle
HH		Header to Header	324			
HW		Header to Windshield	605			
HZ	HZ	Head to Roof Liner	171		252	
NR	NB	Nose to Rim/Seat Back	412		549	
CD	CB	Chest to Dash/Seat Back	533		552	
CS		Chest to Steering Wheel	322			
KD(L)/KDA(L)°	KB(L)/KBA(L)°	Left Knee to Dash/Seat Back	160	18.6	321	5.0
KD(R)/KDA(R)°	KB(R)/KBA(R)°	Right Knee to Dash/Seat Back	165	11.2	320	5.2
PAX°	PAX°	Pelvic Tilt Angle X		23.3		18.7
	PAY°	Pelvic Tilt Angle Y				0.2
PHX	PHX	Hip Point to Striker (X-Axis)	223		306	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	188		292	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle:	2020 Subaru WRX four door sedan	NHTSA No.:	M20205502
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/3/2019



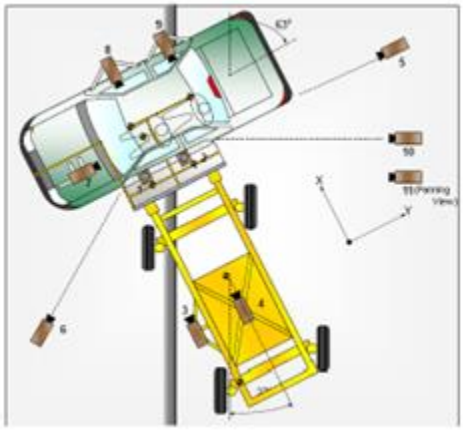
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver (Serial No. F034)	Passenger (Serial No. 300)
HR	Head to Side Header	mm	195	235
HS	Head to Side Window	mm	304	344
AD	Arm to Door	mm	82	123
HD	Hip Point to Door	mm	148	160

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2020 Subaru WRX four door sedan NHTSA No.: M20205502
Test Program: NCAP Side MDB Impact Test Test Date: 12/3/2019



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	0	519	-8347	12.5	1000
2	Overhead Close-up	-175	859	-8347	28	1000
3	Left Impact Point (MDB)	-1470	0	-847	25	1000
4	Side Overall (MDB)	-1140	878	-1587	8	1000
5	Rear	0	8752	-1178	24	1000
6	Left Front	-3003	-4762	-1249	24	1000
7	Driver Front (OB)				25	1000
8	Driver Side (OB)				12.5	1000
9	Passenger Side (OB)				12.5	1000
10	Real-time Left Rear				Zoom	60
11	Real-time In run				Zoom	60

Notes: *Reference: Impact Point projected to Ground*
+X = To Front of MDB, +Y = To Right of MDB, +Z = Down
**All measurements accurate to ± 6 mm.*

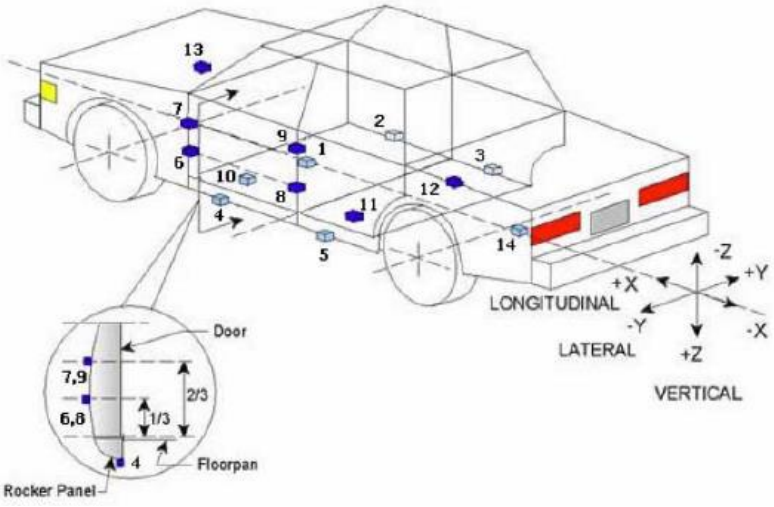
If applicable, explain why camera(s) did not operate as intended: All cameras operated normally

INSTRUMENTATION

Driver Dummy Channels	16
Passenger Dummy Channels	16
Vehicle Structure Accelerometers	23
MDB Accelerometers	7
Total	62

DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2020 Subaru WRX four door sedan NHTSA No.: M20205502
Test Program: NCAP Side MDB Impact Test Test Date: 12/3/2019



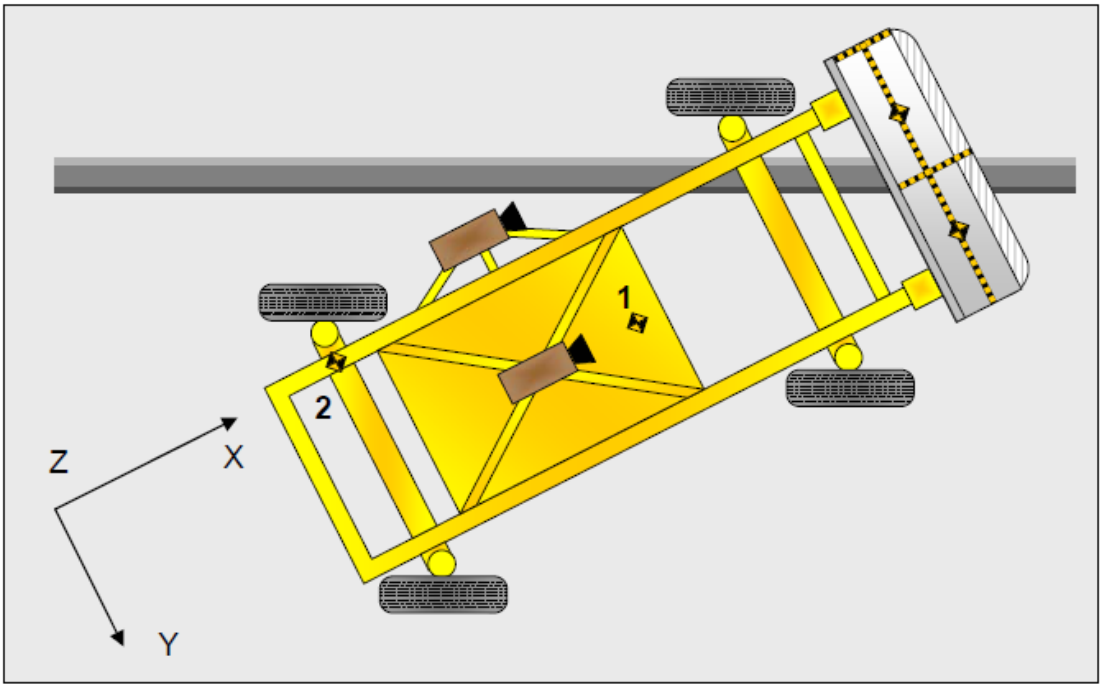
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2440	10	-56
2	Right Sill at Front Seat	2773	661	155
3	Right Sill at Rear Seat	1927	630	171
4	Left Sill at Front Door	2873	-659	159
5	Left Sill at Rear Door	1948	-630	180
6	A-Post Lower	3174	-631	-51
7	A-Post Middle	3149	-648	-512
8	B-Post Lower	2123	-666	-24
9	B-Post Middle	2067	-670	-369
10	Front Seat Track	2318	-528	152
11	Rear Seat Structure	1802	-349	145
12	Rt. Rear Occ. Compartment	1952	393	228
13	Engine Block	4045	-104	-260
14	Rear Above Axle	900	12	4

Reference: X – Rear surface of vehicle (+ forward)
Y – Vehicle centerline (+ to right)
Z – Ground plane (+ down)

DATA SHEET NO. 7
MDB ACCELEROMETER LOCATIONS

Test Vehicle:	2020 Subaru WRX four door sedan	NHTSA No.:	M20205502
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/3/2019



MDB ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	MDB CG	1859	0	-330
2	MDB Rear	386	-660	-660

Reference: X – Face of MDB (+ forward)
Y – MDB centerline (+ to right)
Z – Ground plane (+ down)

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2020 Subaru WRX four door sedan NHTSA No.: M20205502
Test Program: NCAP Side MDB Impact Test Test Date: 12/3/2019

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	Curtain Airbag	Curtain Airbag
Top of Head	Side Header	Side Header
Left Side of Head	Curtain Airbag & Side Header	Curtain Airbag
Back of Head	Side Header & Headrest	Side Header, Headrest, Curtain Airbag
Left Shoulder	Torso/Pelvis & Curtain Airbag	Passenger Door
Upper Torso	Seatback & Torso/Pelvis Airbag	Passenger Door
Lower Torso	Seatback & Torso/Pelvis Airbag	Passenger Door
Left Hip	Seatpan, Driver Door, Torso/Pelvis Airbag	Seatpan & Passenger Door
Left Knee	Driver Door	Passenger Door

POST-TEST DOOR PERFORMANCE

Description	Struck Side		Non-Struck Side		Rear Hatch/ Other*
	Front	Rear	Front	Rear	
Remained Closed and Operational	No	No	Yes	Yes	Yes
Total Separation from Vehicle at Hinges or Latches	No	No	No	No	No
Latch or Hinge Systems Pulled Out of Their Anchorages	No	No	No	No	No
Disengaged from Latched Position	No	No	No	No	No
Latch Separated from Striker	No	No	No	No	No
Jammed Shut	Yes	Yes	No	No	No
If Door Opened at Striker, Width of Opening at Striker (mm)	0	0	0	0	0

POST-TEST SEAT PERFORMANCE

Description	Struck Side		Non-Struck Side	
	Front	Rear	Front	Rear
Seat Movement Along Seat Track	No	No	No	No
Seat Disengagement from Floor Pan	No	No	No	No
Seat Back Movement from Initial Position	No	No	No	No
Seat Back Collapse	No	No	No	No

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	B-Pillar & C-Pillar buckled
Sill Separation	None
Windshield Damage	None
Side Window Damage	Impact side driver window and rear passenger shattered
Other Notable Effects	None

DATA SHEET NO. 8 … (CONTINUED)
POST-TEST OBSERVATIONS

Test Vehicle: 2020 Subaru WRX four door sedan NHTSA No.: M20205502
Test Program: NCAP Side MDB Impact Test Test Date: 12/3/2019

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Air bag	Yes	No		
Knee Air bag	Yes	No		
Side Air bag 1 - Curtain	Yes	Yes	Yes	Yes
Side Air bag 2 - Torso/Pelvis Air bag	Yes	Yes	No	N/A
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Yes	No	N/A
Other				

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		2650
Vertical Impact Reference Line (Aft of Front Axle - Intended Impact Point)	mm		385
Actual Impact Point (Aft of Frontal Axle)	mm		383
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact Point	2
Vertical Offset (+ down / - up)	mm	+/- 20 of Intended Impact Point	0

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle: 2020 Subaru WRX four door sedan NHTSA No.: M20205502
Test Program: NCAP Side MDB Impact Test Test Date: 12/3/2019

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1,250
Overall Length Including Honeycomb Frame	4,120
Wheelbase of Framework Carriage	2,600
CG Location of Front Axle	1,120

MDB WEIGHTS

	Units	Front Axle	Rear Axle	Total
Left	kg	392.5	297.5	690.0
Right	kg	386.0	291.5	677.5
Ratio	%	57.4%	42.6%	100.0%
Totals	kg	778.5	589.0	1367.5

SPEED AND ANGLE AT IMPACT DATA

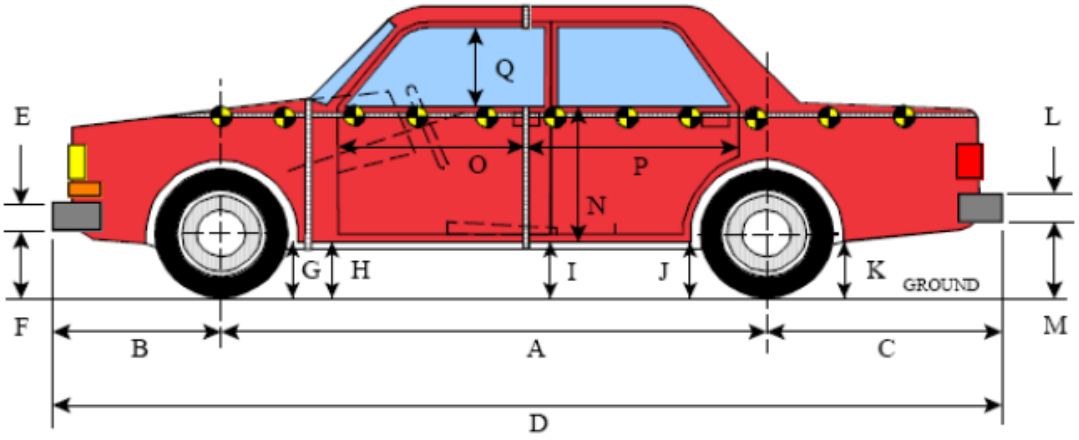
Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.10 to 62.70	61.87
Trap No. 2 Velocity (Redundant)	km/h	61.10 to 62.70	61.88
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.0
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63.0
MDB Crabbed angle to MDB Forward Line of Motion	degrees	26.0 to 28.0	27.0

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

Vertical Location			From Centerline		Maximum Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	800	Right	190
B	Top of Bumper	533	800	Left	127
C	Mid-Level	686	800	Left	154
D	Top of Stack	813	800	Left	164

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2020 Subaru WRX four door sedan
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20205502
Test Date: 12/3/2019



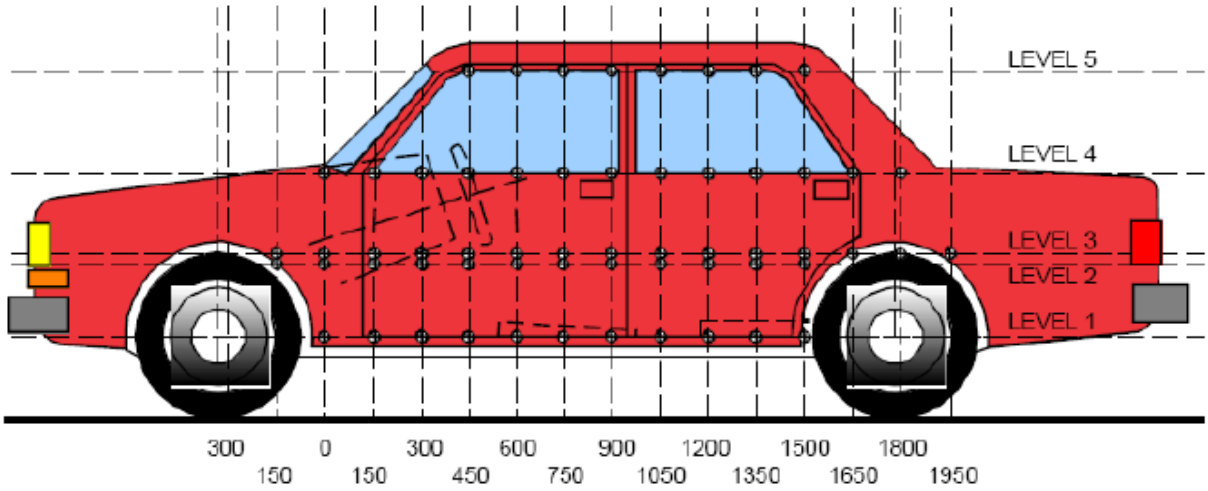
LEFT SIDE VIEW
All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3mm

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2650	2652	2
B	Front Axle to FSOV	952	958	6
C	Rear Axle to RSOV	995	989	-6
D	Total Length at Centerline	4599	4599	0
E	Front Bumper Thickness	130	130	0
F	Front Bumper Bottom to Ground	385	383	-2
G	Sill Height at Front Wheel Well	165	177	12
H	Sill Height at Front Door Leading Edge	168	175	7
I	Sill Height at B Pillar	138	155	17
J1	Sill Height at Rear Wheel Well	168	180	12
J2	Pinch Weld Height at Rear Wheel Well	139	159	20
K	Sill Height Aft of Rear Wheel Well	203	202	-1
L	Rear Bumper Thickness	170	170	0
M	Rear Bumper Bottom to Ground	427	426	-1
N	Sill Height to Window Bottom of Front Window Sill	824	815	-9
O	Front Door Leading Edge to Impact CL	738	724	-14
P	Rear Door Trailing Edge to Impact CL	1391	1348	-43
Q	Front Window Opening	369	353	-16
R	Right Side Length	4537	4536	-1
S	Left Side Length	4536	4536	0
T	Maximum Vehicle Width	1723	1551	-172

DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 Subaru WRX four door sedan NHTSA No.: M20205502
Test Program: NCAP Side MDB Impact Test Test Date: 12/3/2019



LEFT SIDE VIEW

MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	280	65	1200
2	Driver Hip Point	mm	537	227	1650
3	Mid-Door	mm	656	231	1650
4	Window Sill	mm	898	171	1650
5	Window Top	mm	1391	7	1350

*window top level bent outward from original position

NOTE: *The above measurements should be taken along the vertical impact reference line. Vehicle measurements forward of the vertical impact reference line are negative.*

DATA SHEET NO. 11 … (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 Subaru WRX four door sedan NHTSA No.: M20205502
Test Program: NCAP Side MDB Impact Test Test Date: 12/3/2019

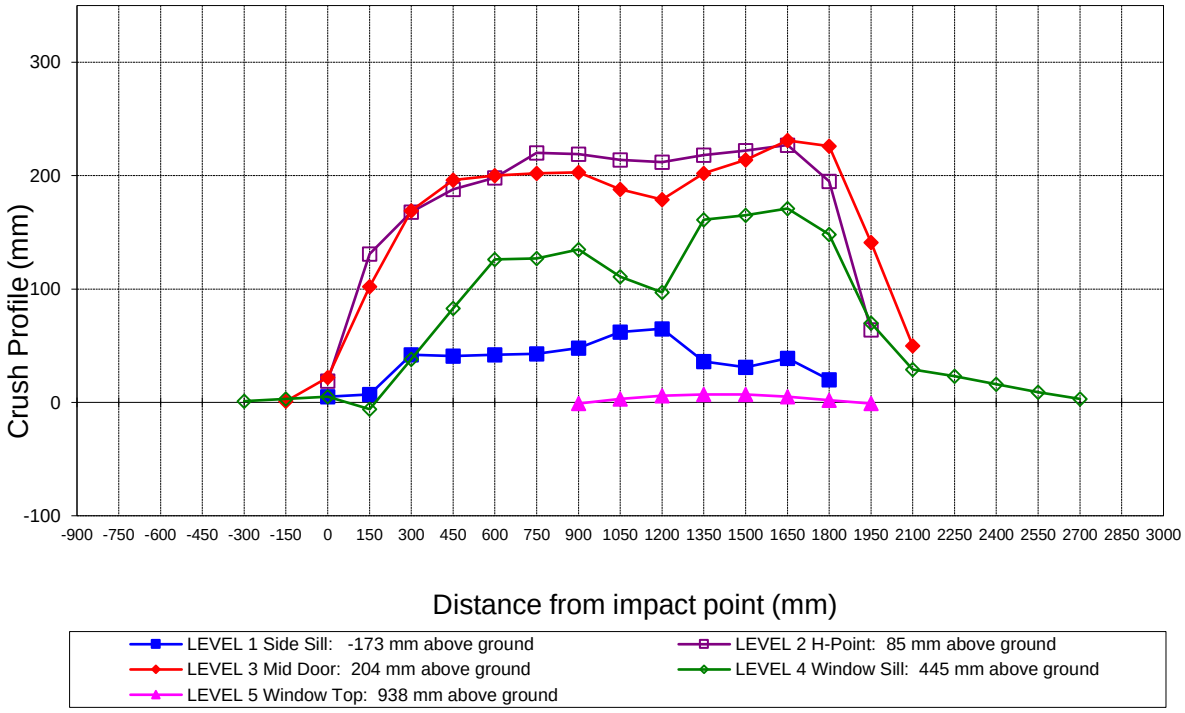
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900															
-750															
-600															
-450															
-300				800					799					1	
-150			898	807				897	804				1	3	
0	875	892	892	792		870	873	858	787		5	19	34	5	
150	831	864	864	798		824	733	762	804		7	131	102	-6	
300	825	864	865	838		783	696	696	800		42	168	169	38	
450	824	865	867	815		783	677	671	732		41	188	196	83	
600	823	866	869	821		781	668	669	695		42	198	200	126	
750	823	868	871	826		780	648	669	699		43	220	202	127	
900	823	868	872	831	613	775	649	669	696	614	48	219	203	135	-1
1050	824	868	872	834	622	762	654	684	723	619	62	214	188	111	3
1200	824	866	871	836	622	759	654	692	739	616	65	212	179	97	6
1350	825	864	870	837	621	789	646	668	676	614	36	218	202	161	7
1500	825	864	869	835	619	794	642	655	670	612	31	222	214	165	7
1650	837	872	872	833	616	798	645	641	662	611	39	227	231	171	5
1800	864	885	879	830	604	844	690	653	682	602	20	195	226	148	2
1950		895	889	816	568		831	748	746	569		64	141	70	-1
2100			899	819				849	790				50	29	
2250				816					793					23	
2400				811					795					16	
2550				806					797					9	
2700				798					795					3	
2850															
3000															

NOTE: *Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition.*
Vehicle measurements forward of the vertical impact reference line are negative.
The crush profile grid is established prior to test based on an estimated impact point.

DATA SHEET NO. 11 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

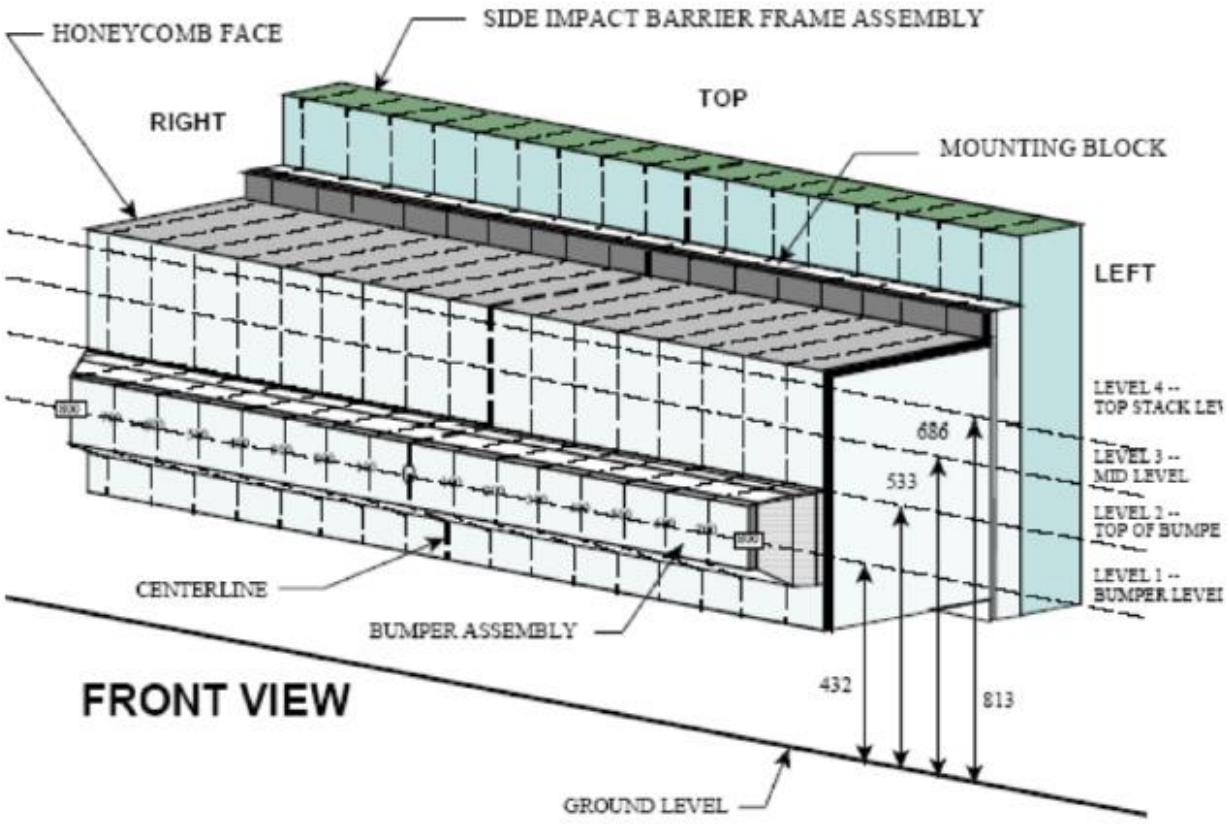
Test Vehicle:	2020 Subaru WRX four door sedan	NHTSA No.:	M20205502
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/3/2019



Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle:	2020 Subaru WRX four door sedan	NHTSA No.:	M20205502
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/3/2019



NOTE: Dimensions are shown in millimeters, mm

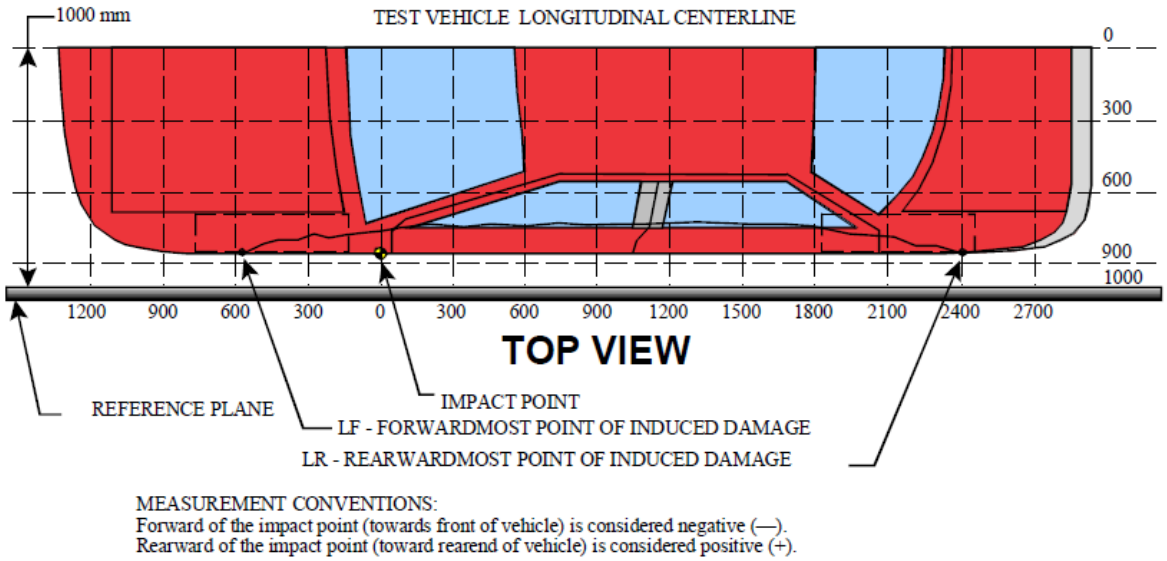
DEFORMABLE BARRIER STATIC CRUSH

Stack Level	Distance Right of Center								C/L	Distance Left of Center							
	800	700	600	500	400	300	200	100	0	100	200	300	400	500	600	700	800
1	190	185	173	167	167	168	162	158	152	149	148	147	147	148	157	179	189
2	78	75	76	72	70	75	85	95	88	77	85	85	84	85	89	102	127
3	50	21	14	18	24	38	69	60	39	27	22	22	26	33	48	92	154
4	54	22	14	21	37	73	99	83	53	36	42	29	38	55	92	134	164

DATA SHEET NO. 13
VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle:	2020 Subaru WRX four door sedan	NHTSA No.:	M20205502
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/3/2019

For guidance regarding damage profile distance measurements, please refer to the latest version of the *NHTSA Test Reference Guide, Volume 1: Vehicle Tests.*



MEASUREMENT CONVENTIONS:
Forward of the impact point (towards front of vehicle) is considered negative (—).
Rearward of the impact point (toward rearend of vehicle) is considered positive (+).

VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance From Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	-150	3	103	102	1
2	300	3	304	135	169
3	750	3	331	129	202
4	1200	3	308	129	179
5	1650	3	359	128	231
6	2100	3	151	101	50

MDB DAMAGE PROFILE DISTANCES

DPD	Distance From Center of MDB	Level	Post-Test (mm)*
1	800 mm left of center	1	189
2	480 mm left of center	1	148
3	160 mm left of center	1	148
4	160 mm right of center	1	160
5	480 mm right of center	1	167
6	800 mm right of center	1	190

DATA SHEET NO. 14
FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle:	2020 Subaru WRX four door sedan	NHTSA No.:	M20205502
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/3/2019
Test Time:	10:48 AM	Temperature:	21˚C

A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable is 1 oz.)

B. For the 5-minute period after motion ceases: 0 oz.
(Maximum allowable is 5 oz.)

C. For the following 25 minutes: 0 oz.
(Maximum allowable is 1 oz./minute)

D. Spillage Details: No Spillage Occurred

FMVSS NO. 301 STATIC ROLLOVER DATA

ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	68	300	368
90° to 180°	65	300	365
180° to 270°	65	300	365
270° to 360°	67	300	367

FMVSS NO. 301 ROLLOVER SPILLAGE TABLE

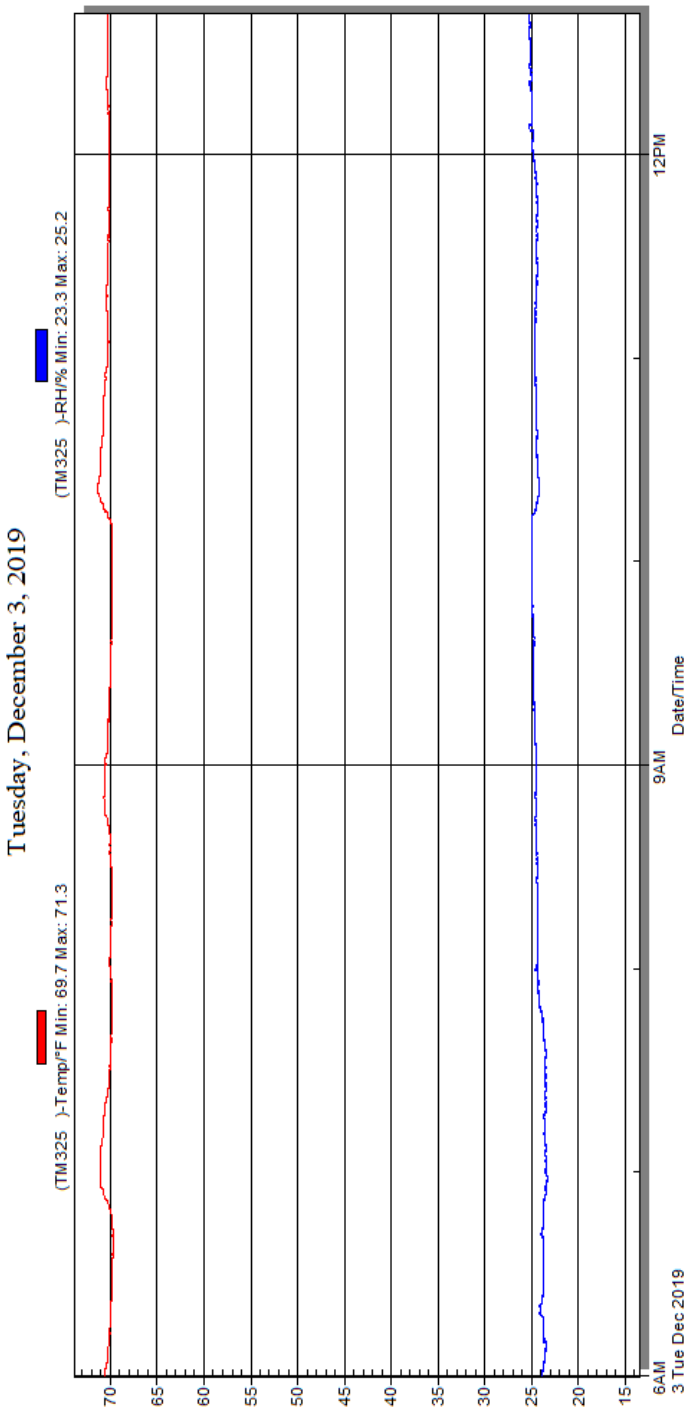
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 15
DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle:	2020 Subaru WRX four door sedan	NHTSA No.:	M20205502
Test Program:	NCAP Side MDB Impact Test	Test Date:	12/3/2019



Temperature and Humidity Stabilization Chart/Data for Dummies and Test Vehicle

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Figure A-1: As-Delivered Right Front 3/4 View of Test Vehicle

Figure A-2: As-Delivered Left Rear 3/4 View of Test Vehicle

Figure A-3: Pre-Test Frontal View of Test Vehicle

Figure A-4: Post-Test Frontal View of Test Vehicle

Figure A-5: Pre-Test Left Front ¾ View of Test Vehicle

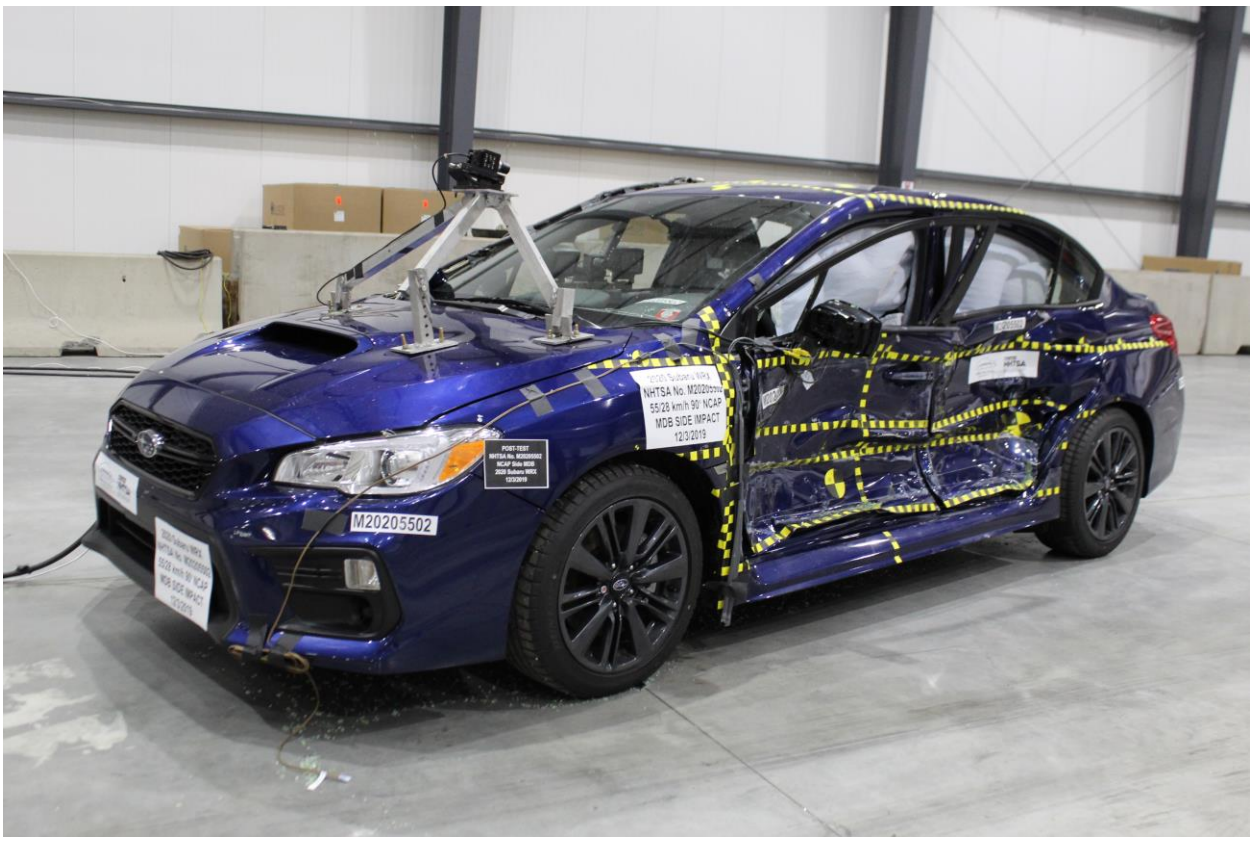


Figure A-6: Post-Test Left Front ¾ View of Test Vehicle

Figure A-7: Pre-Test Left Side View of Test Vehicle

Figure A-8: Post-Test Left Side View of Test Vehicle

Figure A-9: Pre-Test Left Rear ¾ View of Test Vehicle

Figure A-10: Post-Test Left Rear ¾ View of Test Vehicle

Figure A-11: Pre-Test Rear View of Test Vehicle

Figure A-12: Post-Test Rear Side View of Test Vehicle

Figure A-13: Pre-Test Right Side View of Test Vehicle

Figure A-14: Post-Test Right Side View of Test Vehicle

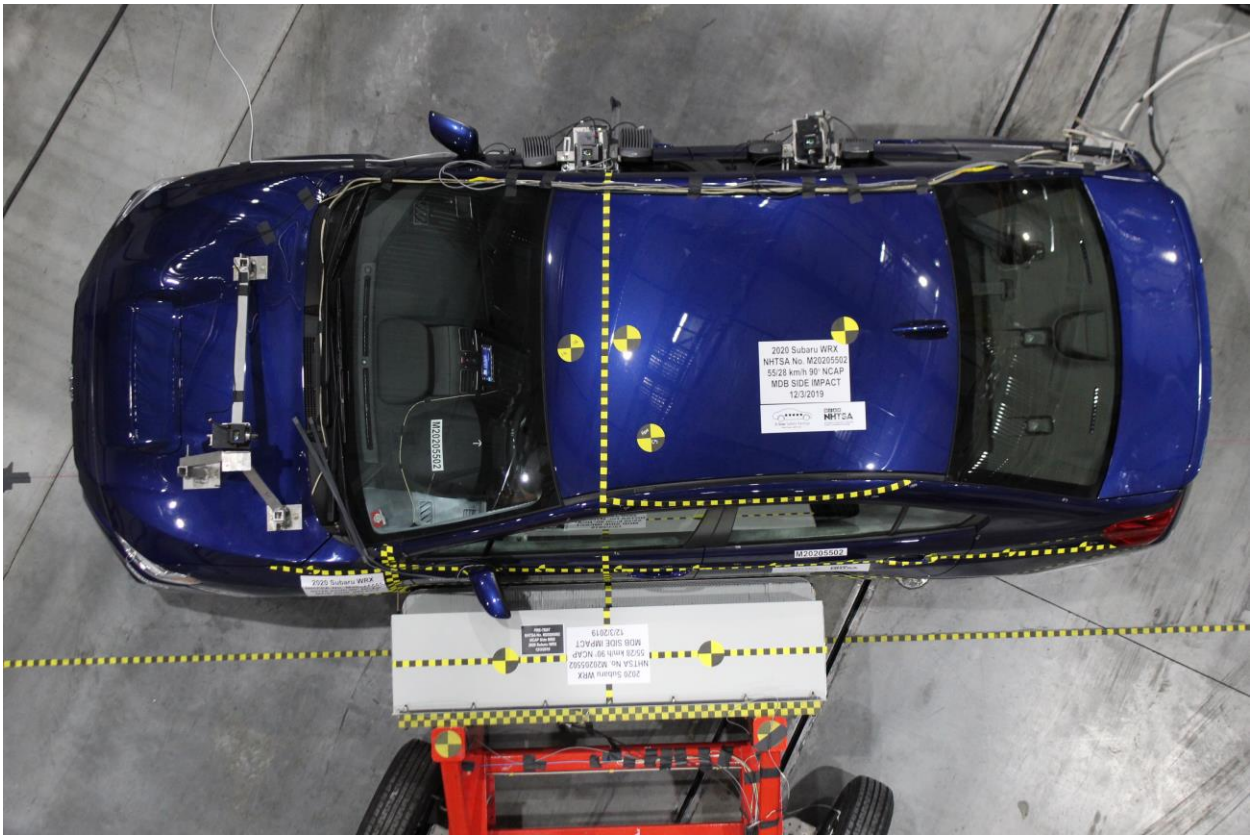


Figure A-15: Pre-Test Overhead View of the Test Area

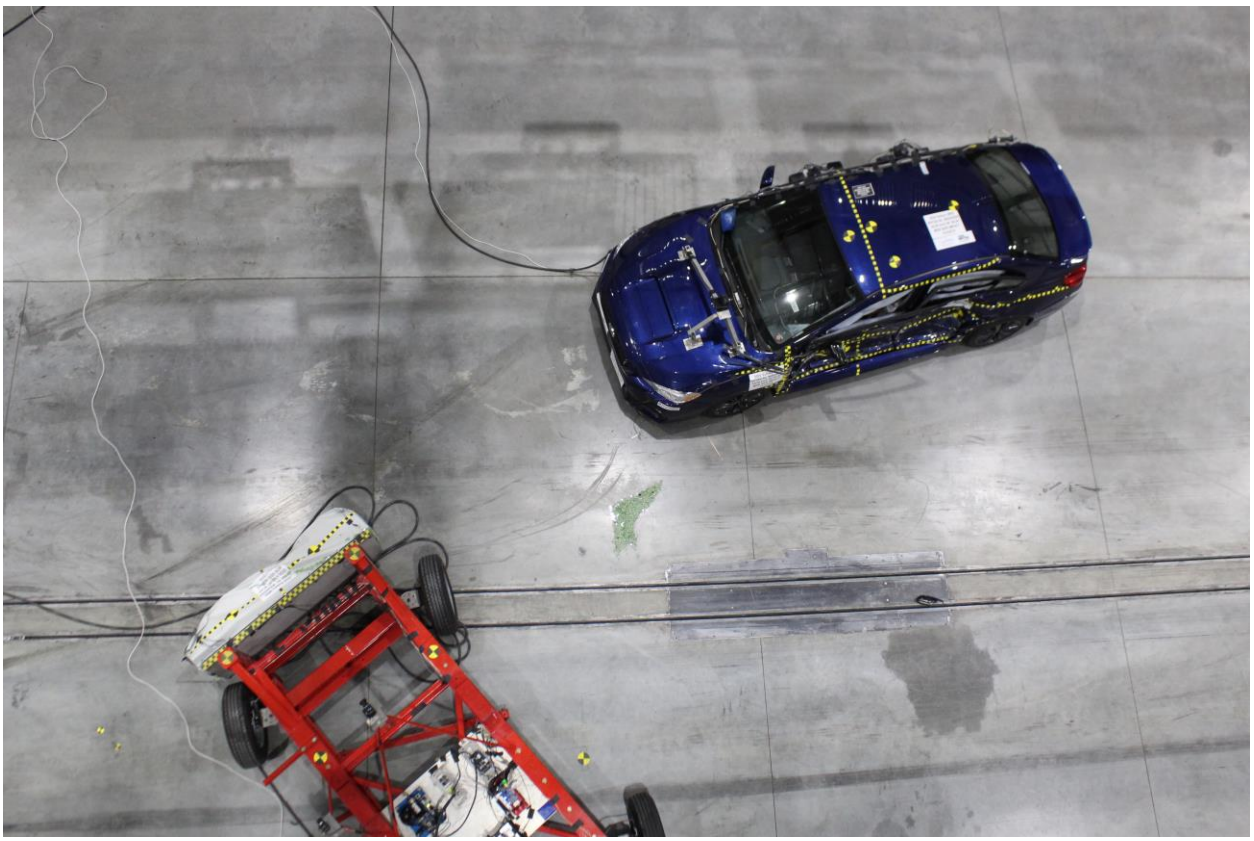


Figure A-16: Post-Test Overhead View of Test Area

Figure A-17: Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle

Figure A-18: Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle

Figure A-19: Pre-Test Close-up View of Impact Point Target

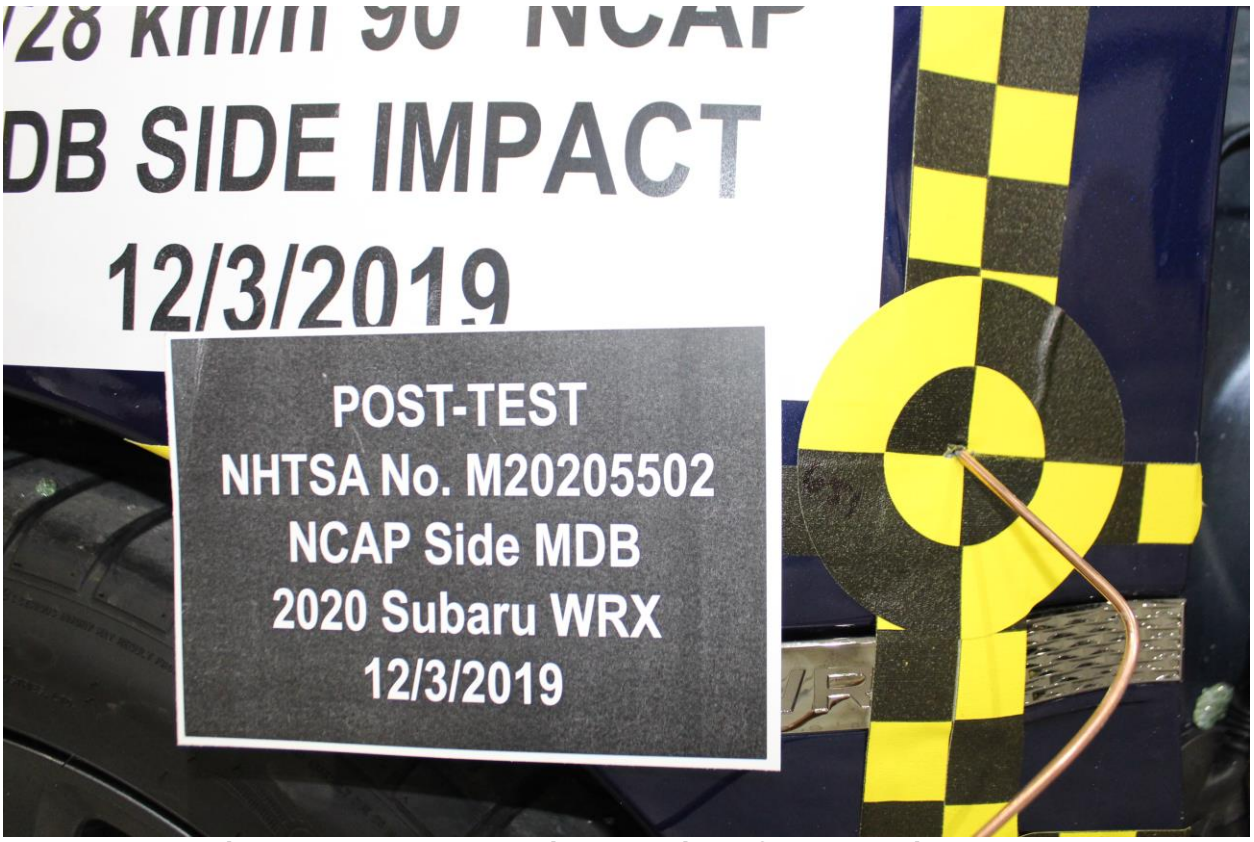


Figure A-20: Post-Test Close-up View of Impact Point Target

Figure A-21: Pre-Test Left Front Door Latch Close-Up

Figure A-22: Post-Test Left Front Door Latch Close-Up

Figure A-23: Pre-Test Left Rear Door Latch Close-Up

Figure A-24: Post-Test Left Rear Door Latch Close-Up

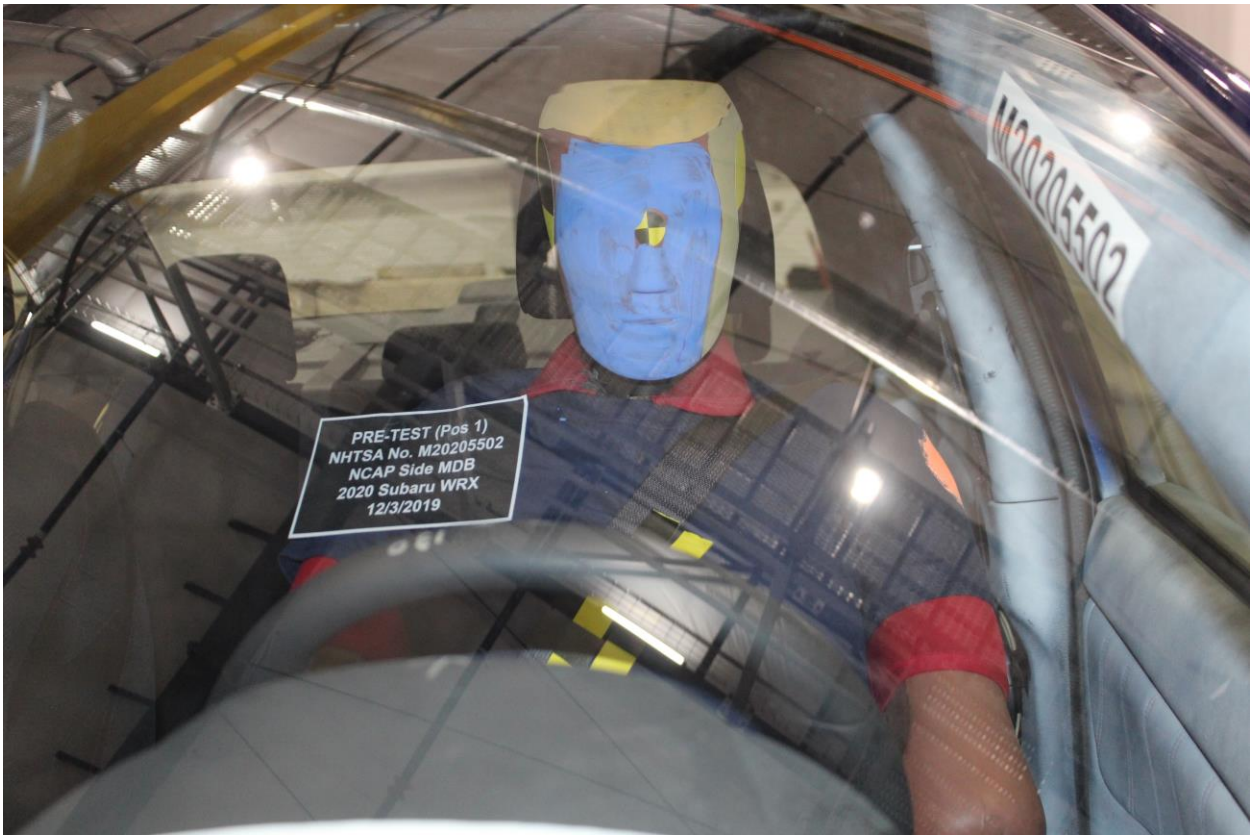


Figure A-25: Pre-Test Front Close-up View of Driver Dummy

Figure A-26: Post-Test Front Close-up View of Driver Dummy

Figure A-27: Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking

Figure A-28: Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View

Figure A-29: Post-Test Left Side View of Driver Dummy Shoulder and Door Top View

Figure A-30: Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning

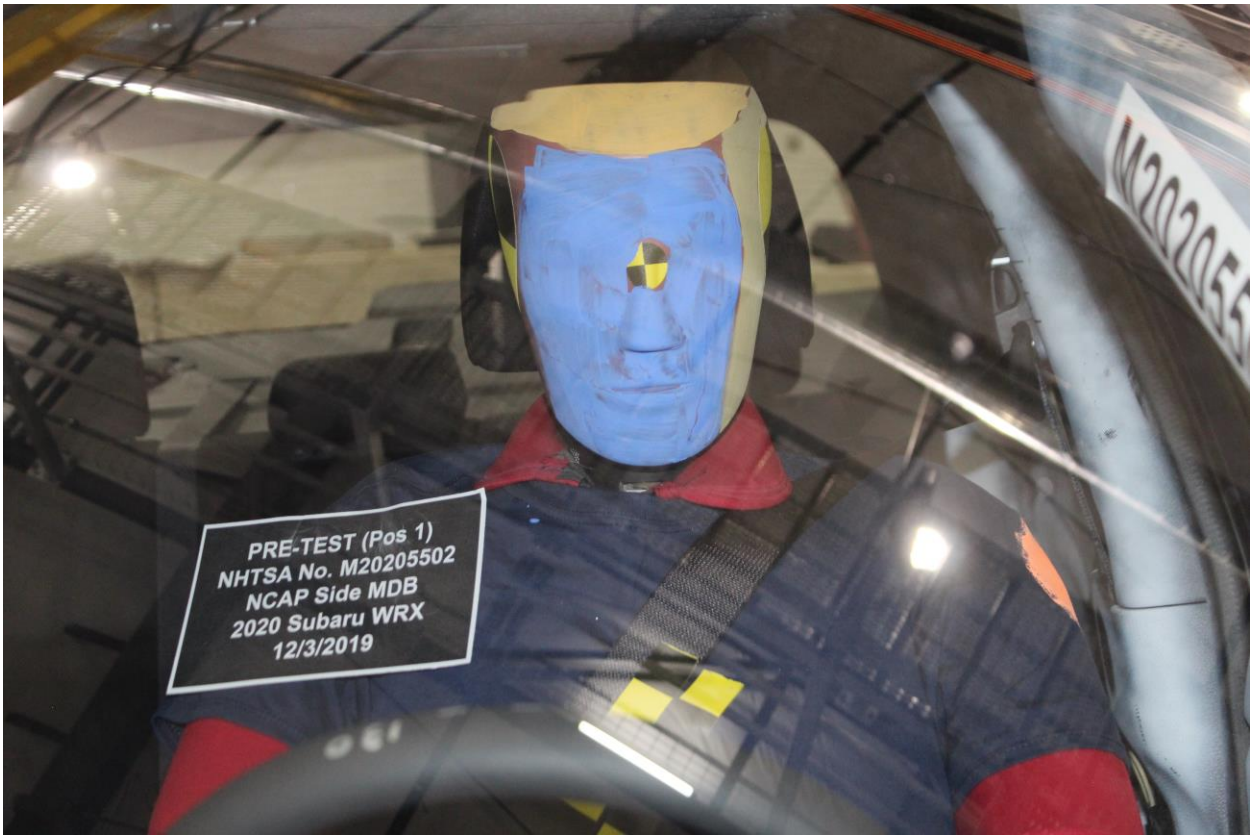


Figure A-31: Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint

Figure A-32: Pre-Test Frontal View of Driver Seat Pan Prior to Dummy Positioning

Figure A-33: Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan

Figure A-34: Pre-Test Placement of Driver Dummy's Feet

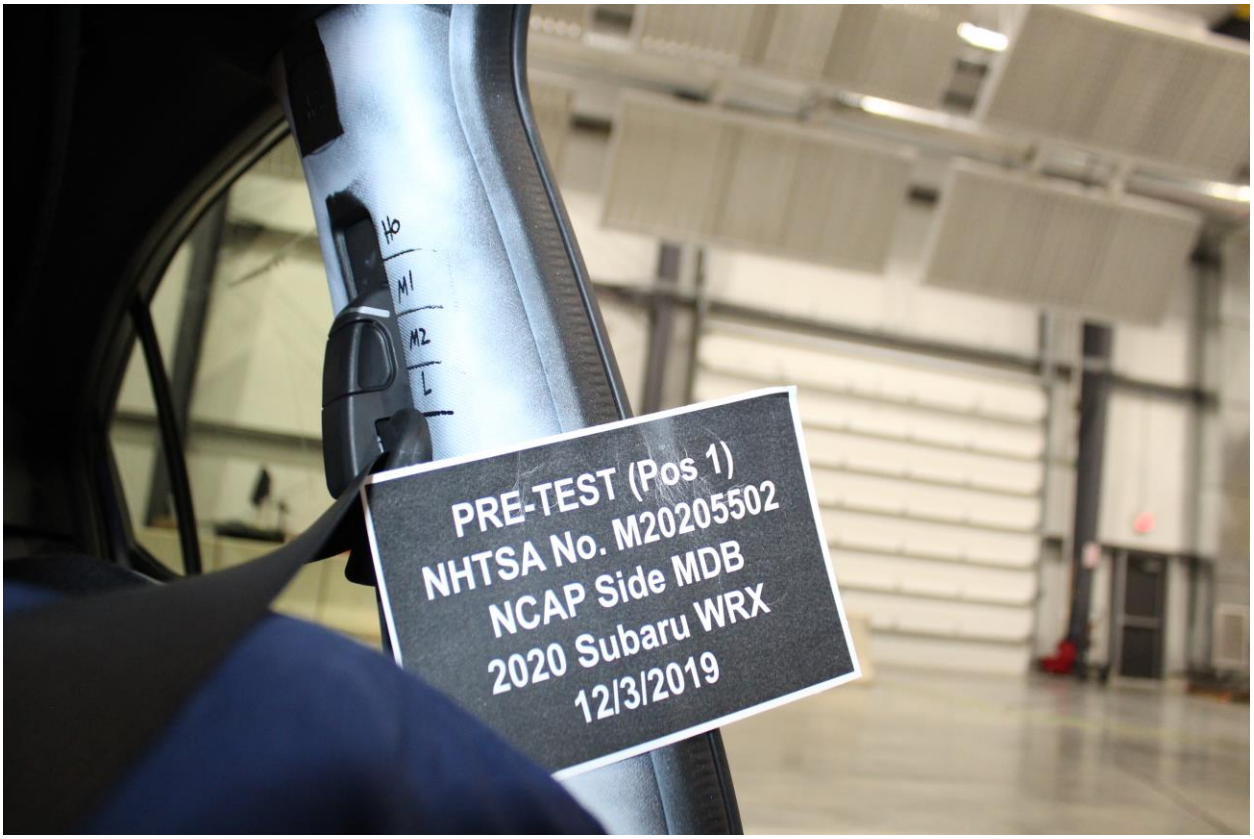


Figure A-35: Pre-Test View of Belt Anchorage for Driver Dummy

Figure A-36: Pre-Test Left Side View of Steering Wheel

Figure A-37: View of Disengaged Parking Brake

Figure A-38: Pre-Test View of Parking Brake

Figure A-39: Pre-test Close-Up Left Side View of Driver Seat Track

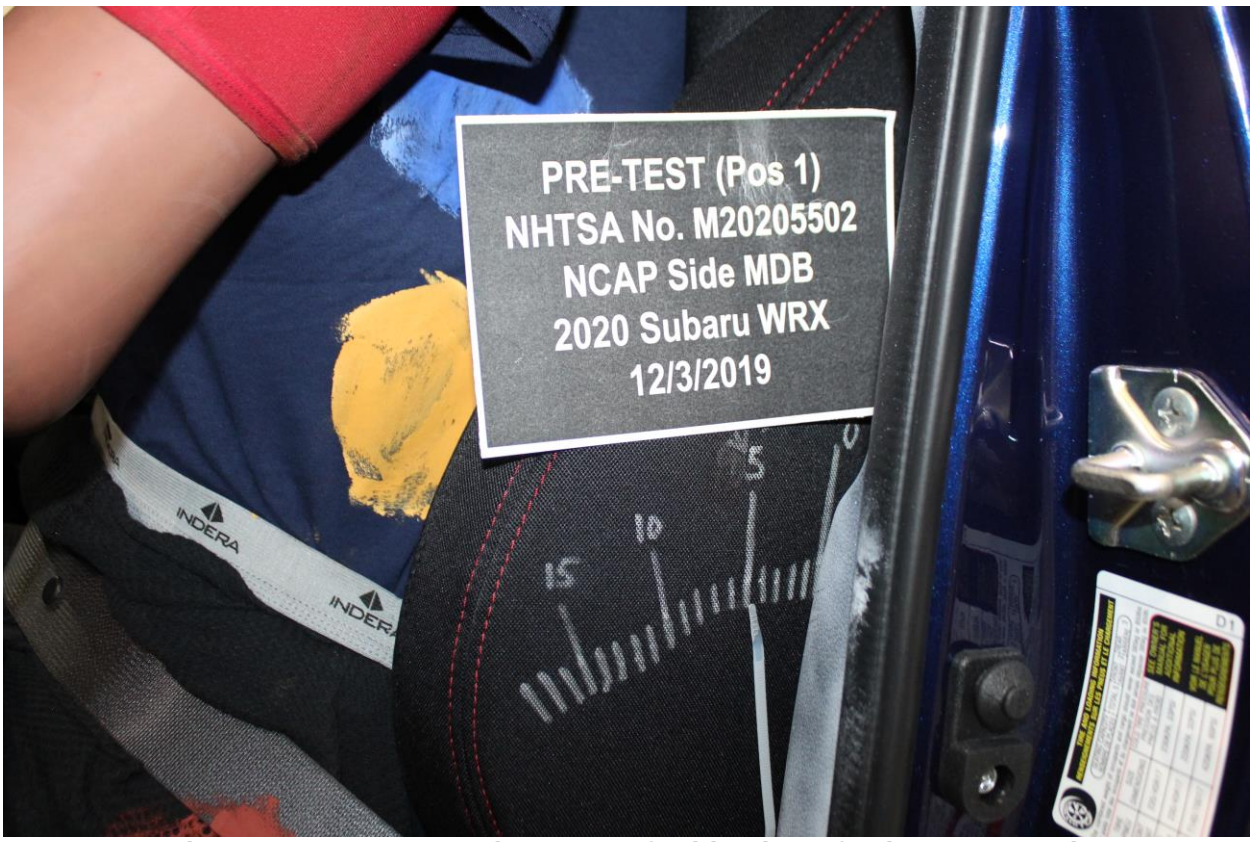


Figure A-40: Pre-Test Close-Up Left Side View of Driver Seat Back

Figure A-41: Pre-Test Close-Up View of Driver Seat Back or Head Restraint

Figure A-42: Pre-Test Driver Dummy and Door Clearance View

Figure A-43: Post-Test Driver Dummy and Door Clearance View

Figure A-44: Pre-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment

Figure A-45: Post-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment

Figure A-46: Pre-Test Driver Inner Door Panel View

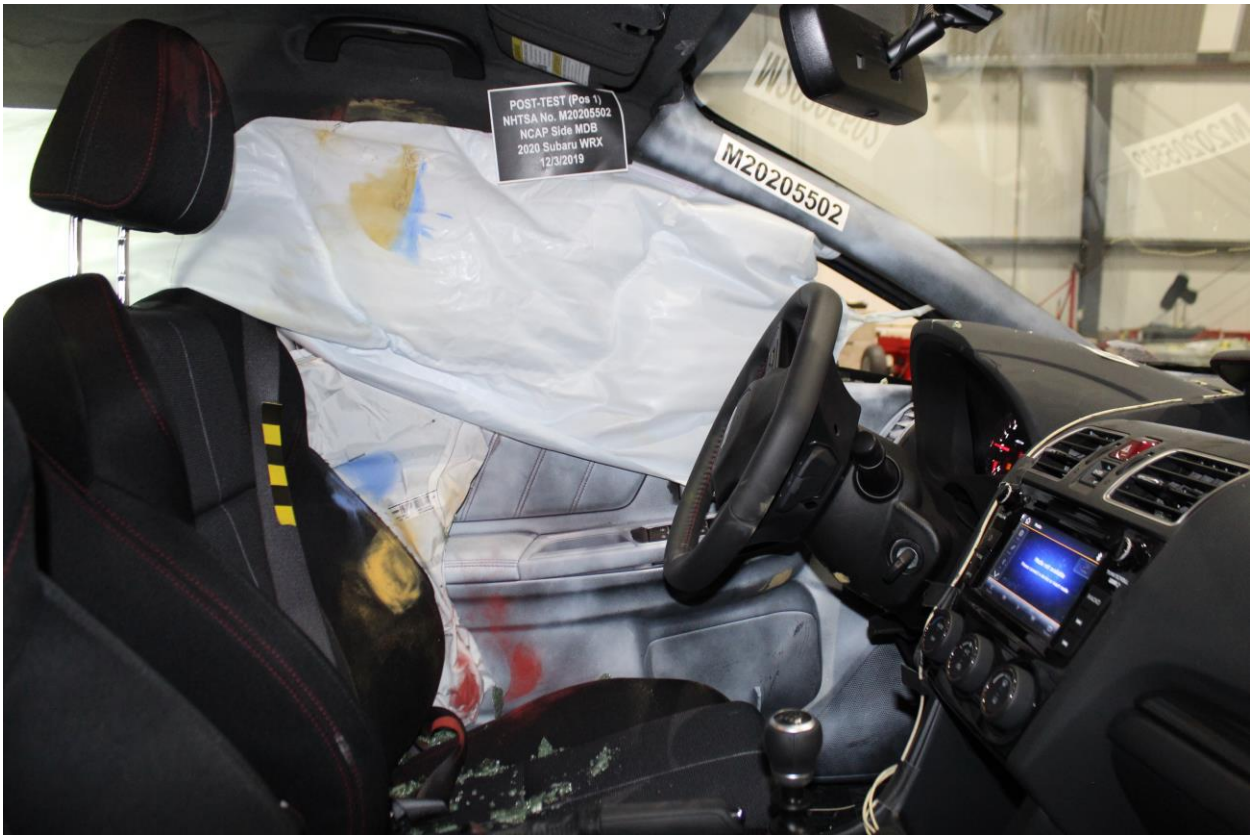


Figure A-47: Post-Test Driver Inner Door Panel View Showing Driver Dummy Contact Locations

Figure A-48: Post-Test Driver Dummy Close-Up Head Contact with Vehicle View

Figure A-49: Post-Test Driver Dummy Close-Up Head Contact with Side Airbag View

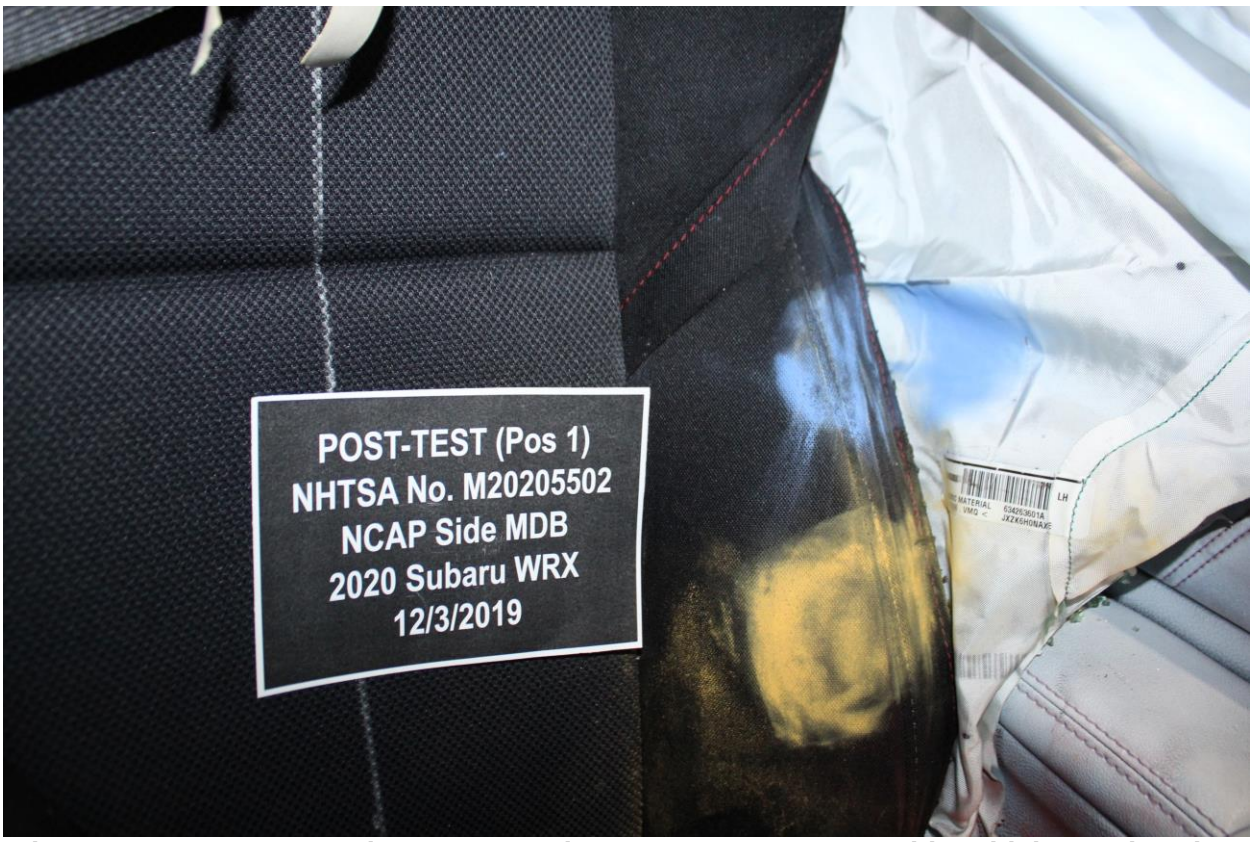


Figure A-50: Post-Test Driver Dummy Close-Up Torso Contact with Vehicle Interior View

Figure A-51: Post-Test Driver Dummy Close-Up Torso Contact with Side Airbag View

Figure A-52: Post-Test Driver Dummy Close-Up Pelvis Contact View

Figure A-53: Post-Test Driver Dummy Close-Up Pelvis Contact with Side Airbag View

Figure A-54: Post-Test Driver Dummy Close-Up Knee Contact View

Figure A-55: Pre-Test Left Side View of Rear Passenger Dummy Showing Belt and Chalking

Figure A-56: Pre-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View

Figure A-57: Post-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View

Figure A-58: Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning

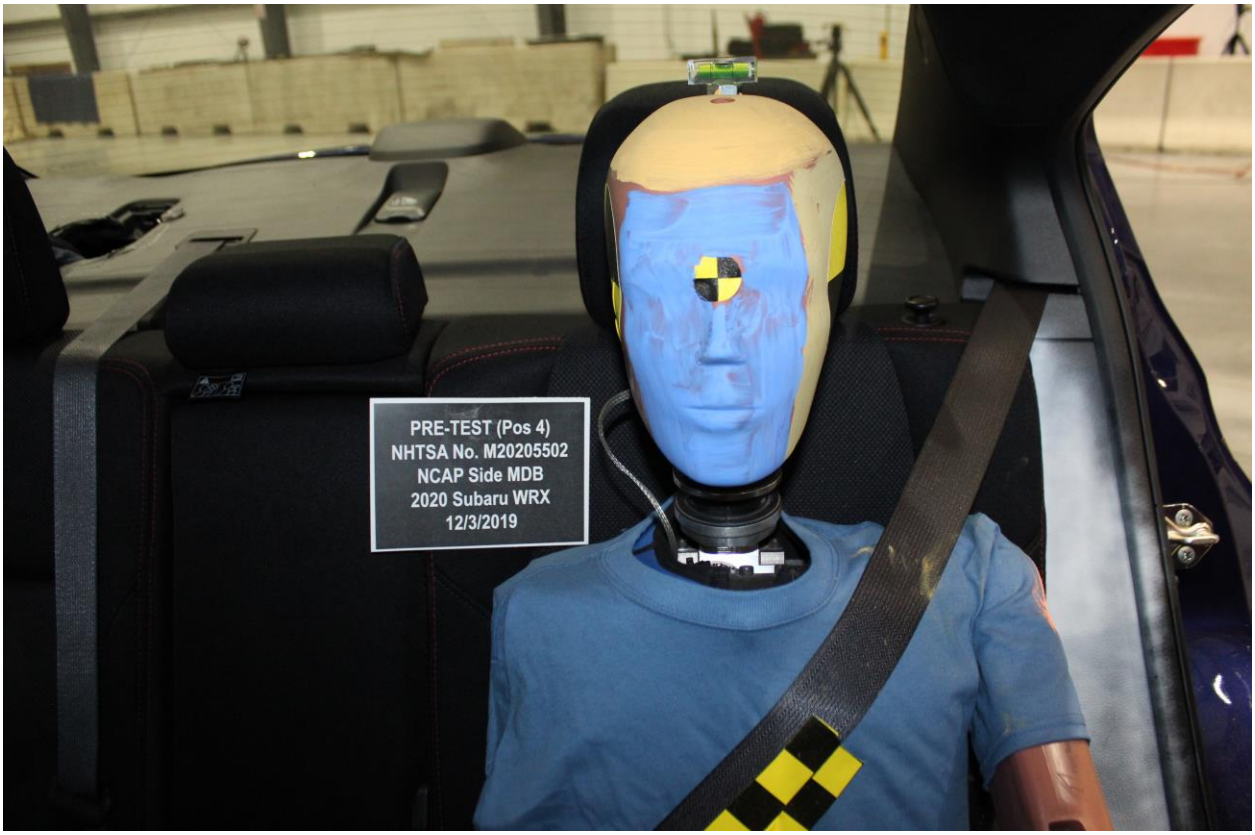


Figure A-59: Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint

Figure A-60: Pre-Test Overhead View of Rear Passenger Seat Pan Prior to Dummy Positioning

Figure A-61: Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan

Figure A-62: Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket

Figure A-63: Pre-Test View of Rear Passenger Dummy's Head Showing Dummy's Head is Level

Figure A-64: Pre-Test Placement of Rear Passenger Dummy's Feet

Figure A-65: Pre-Test View of Belt Anchorage for Rear Passenger Dummy

Figure A-66: Pre-Test Close-Up Left Side View of Rear Passenger Seat Track

Figure A-67: Pre-Test Close-Up Left Side View of Rear Passenger Seat Back

Figure A-68: Pre-Test Close-Up View of Rear Passenger Seat Back or Head Restraint

Figure A-69: Pre-Test Rear Passenger Dummy and Door Clearance View

Figure A-70: Post-Test Rear Passenger Dummy and Door Clearance View

Figure A-71: Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment

Figure A-72: Post-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment

Figure A-73: Pre-Test Rear Passenger Inner Door Panel View

Figure A-74: Post-Test Rear Passenger Inner Door Panel View Showing Rear Passenger Dummy Contact Locations

Figure A-75: Post-Test Rear Passenger Dummy Close-Up Head Contact with Vehicle View

Figure A-76: Post-Test Rear Passenger Dummy Close-Up Head Contact with Side Airbag View

Figure A-77: Post-Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Interior View

Photo Not Applicable

Figure A-78: Post-Test Rear Passenger Dummy Close-Up Torso Contact with Side Airbag View

Figure A-79: Post-Test Rear Passenger Dummy Close-Up Pelvis Contact View

Photo Not Applicable

Figure A-80: Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Side Airbag View

Figure A-81: Post-Test Rear Passenger Dummy Close-Up Knee Contact View

Figure A-82: Pre-Test View of Fuel Filler Cap or Fuel Filler Neck

Figure A-83: Post-Test View of Fuel Filler Cap or Fuel Filler Neck

Figure A-84: Pre-Test Front View of MDB Impactor Face

Figure A-85: Post-Test Front View of MDB Impactor Face

Figure A-86: Pre-Test Top View of MDB Impactor Face

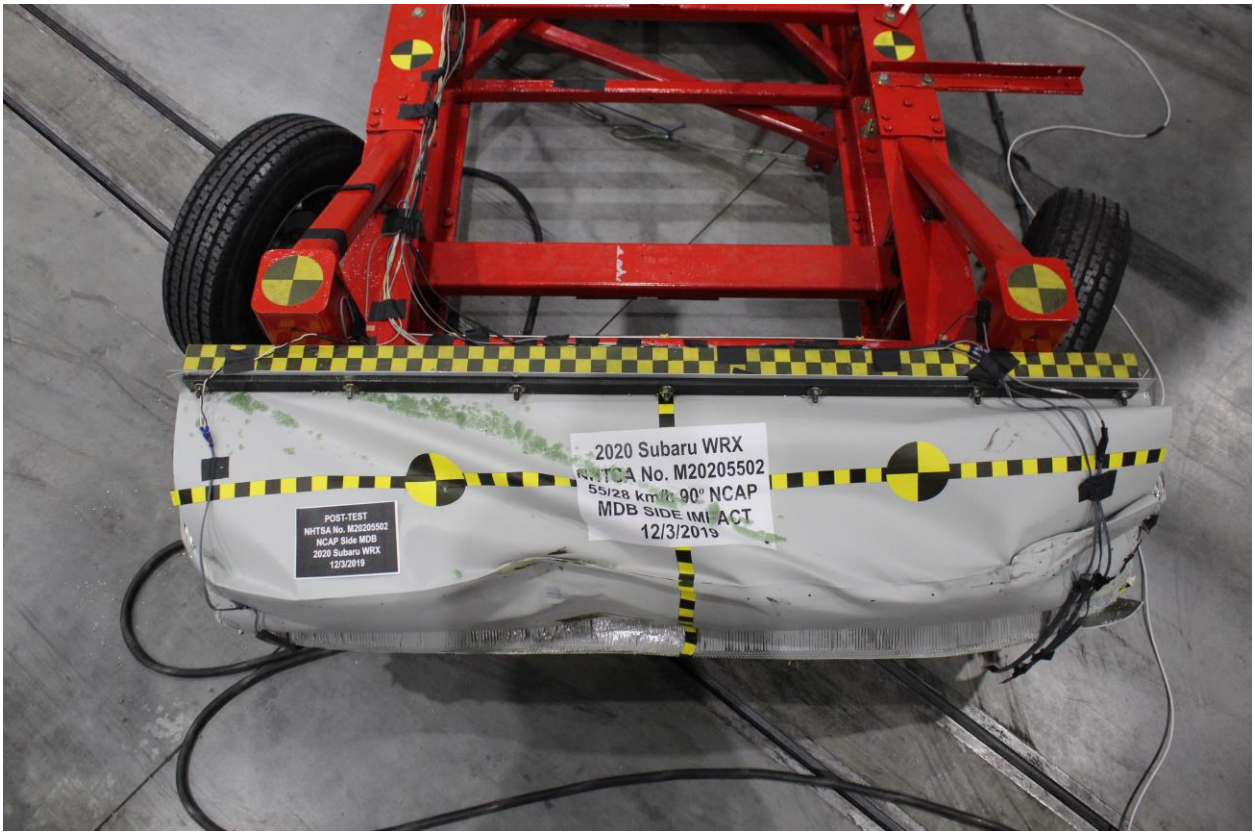


Figure A-87: Post-Test Top View of MDB Impactor Face

Figure A-88: Pre-Test Left Side View of MDB Impactor Face

Figure A-89: Post-Test Left Side View of MDB Impactor Face

Figure A-90: Pre-Test Right Side View of MDB Impactor Face

Figure A-91: Post-Test Right Side View of MDB Impactor Face

Figure A-92: Close-Up View of Vehicle's Certification Label

Figure A-93: Close-Up View of Vehicle's Tire Information Placard or Label

Figure A-94: Pre-Test Ballast View

Figure A-95: Post-Test Primary and Redundant Speed Trap Read-Out

Figure A-96: FMVSS No. 301 Static Rollover 0 Degrees

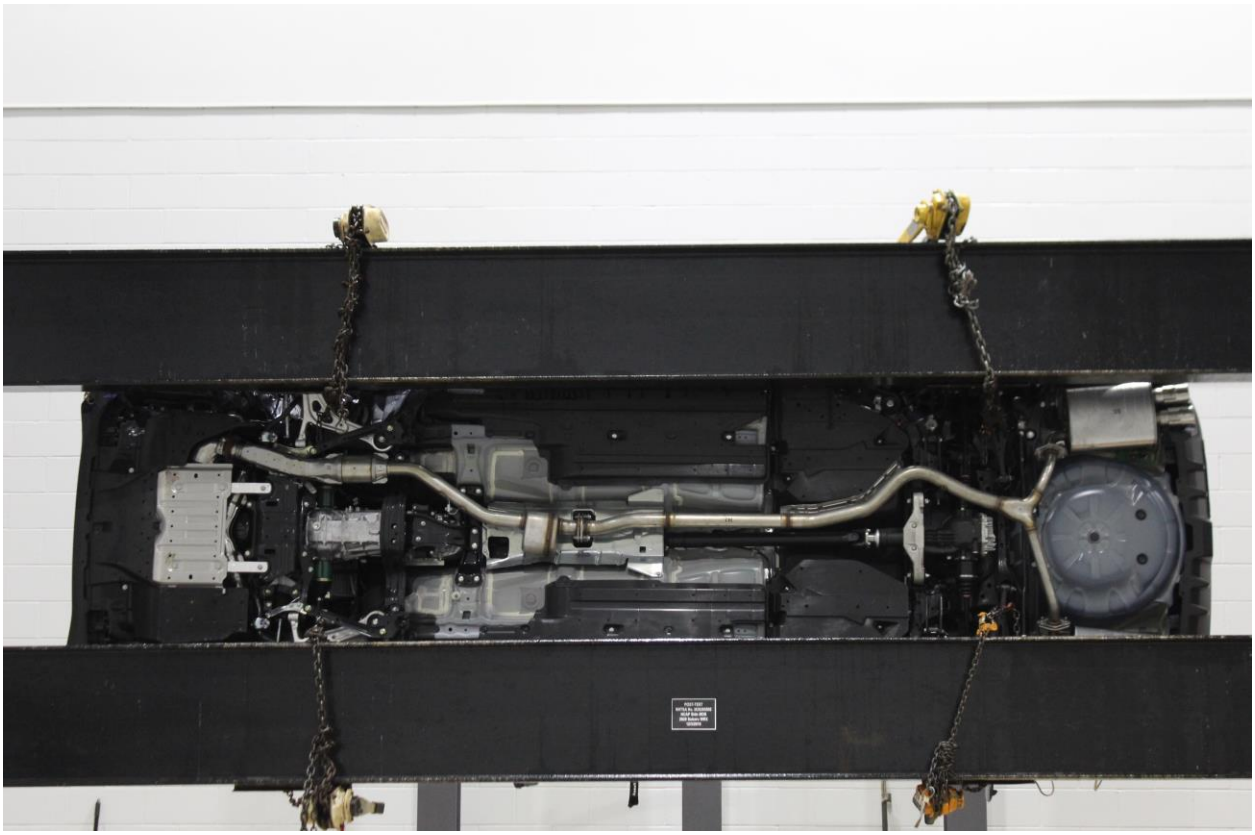


Figure A-97: FMVSS No. 301 Static Rollover 90 Degrees

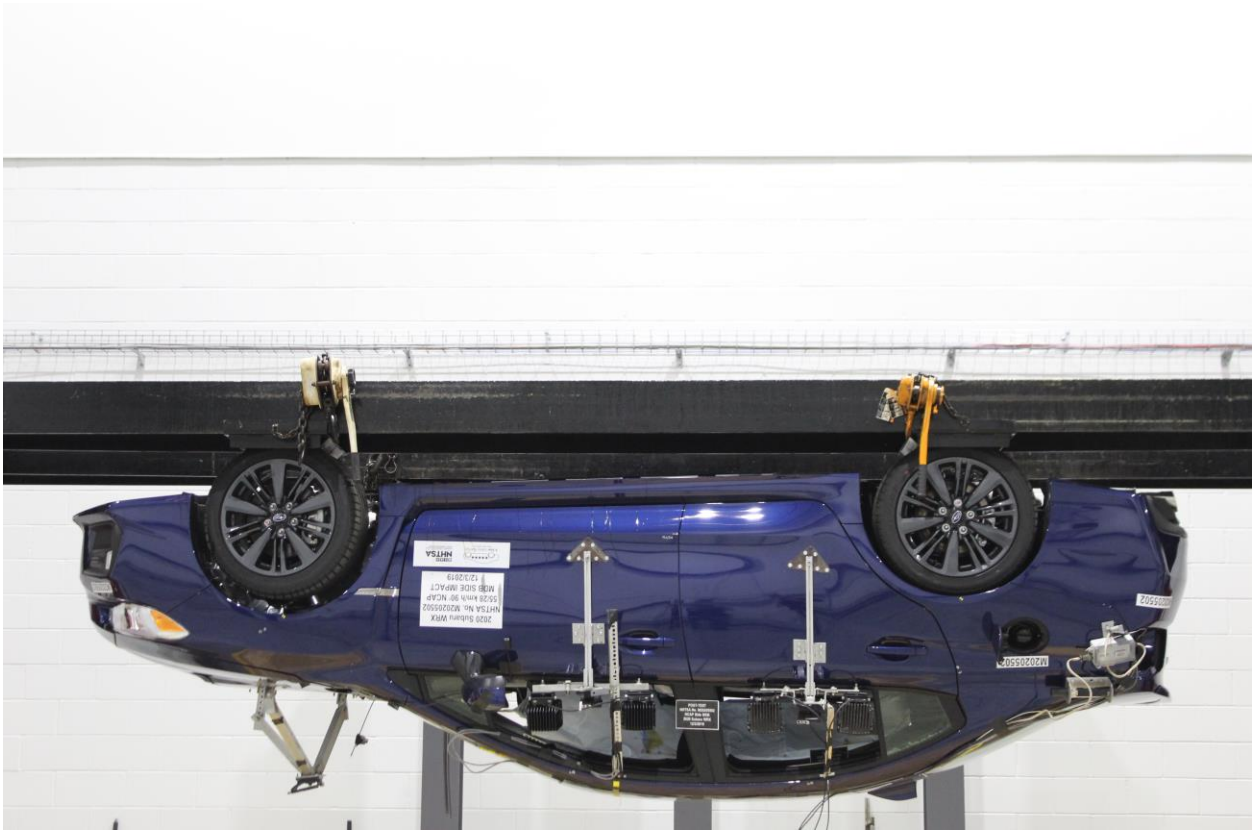


Figure A-98: FMVSS No. 301 Static Rollover 180 Degrees

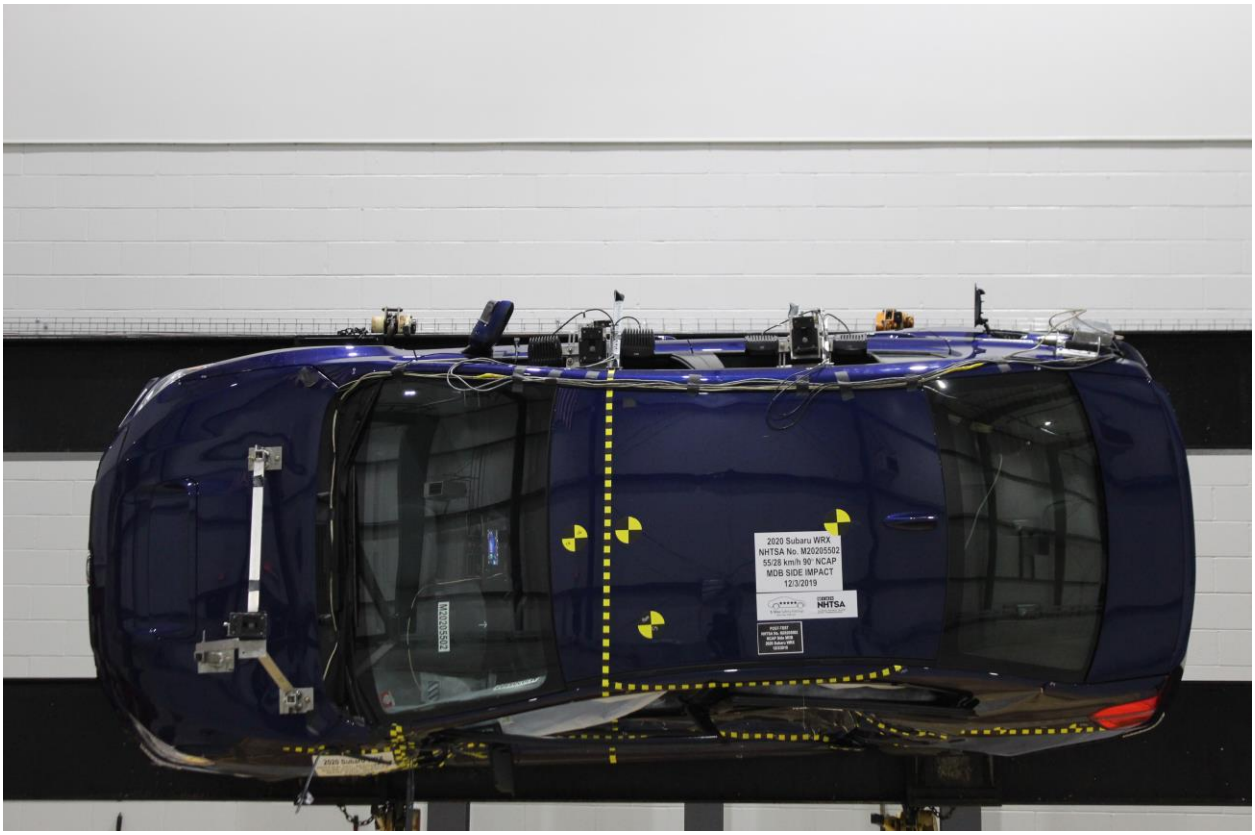


Figure A-99: FMVSS No. 301 Static Rollover 270 Degrees

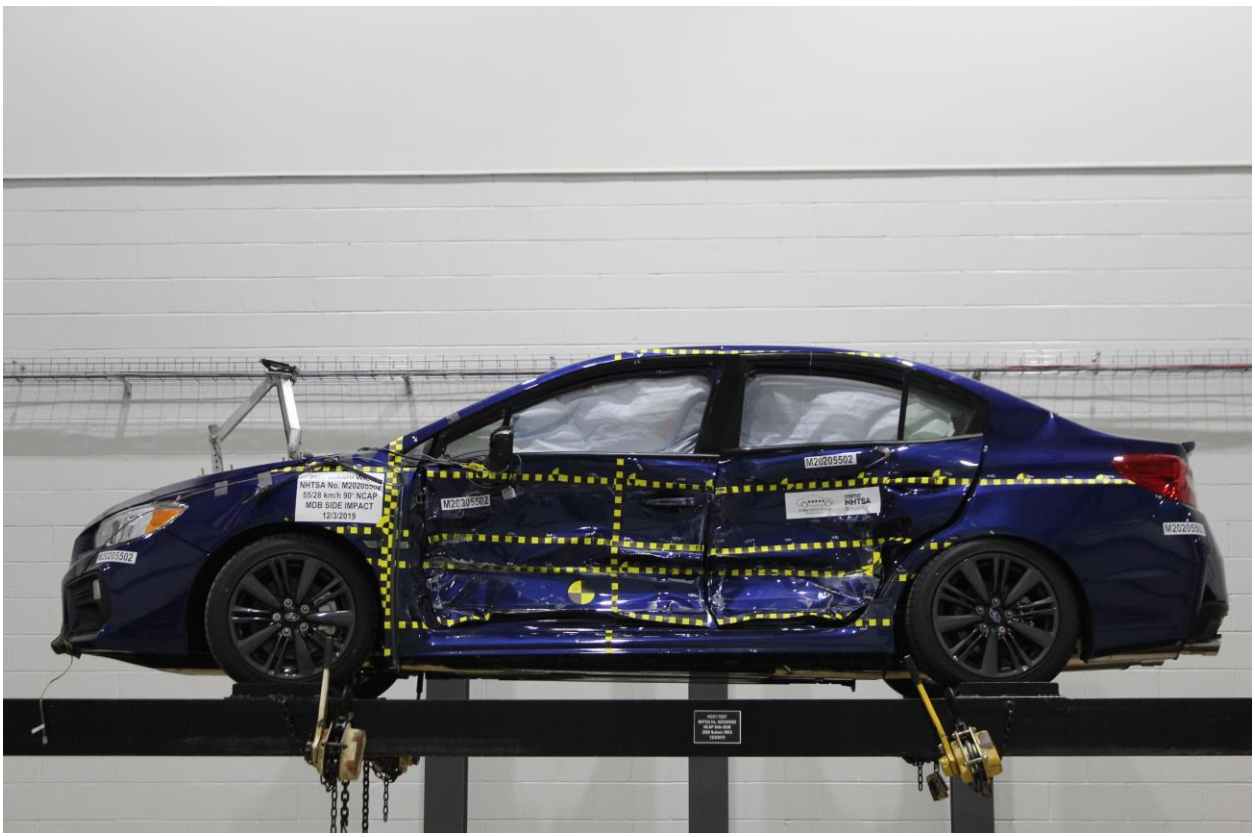


Figure A-100: FMVSS No. 301 Static Rollover 360 Degrees

Figure A-101: Impact Event

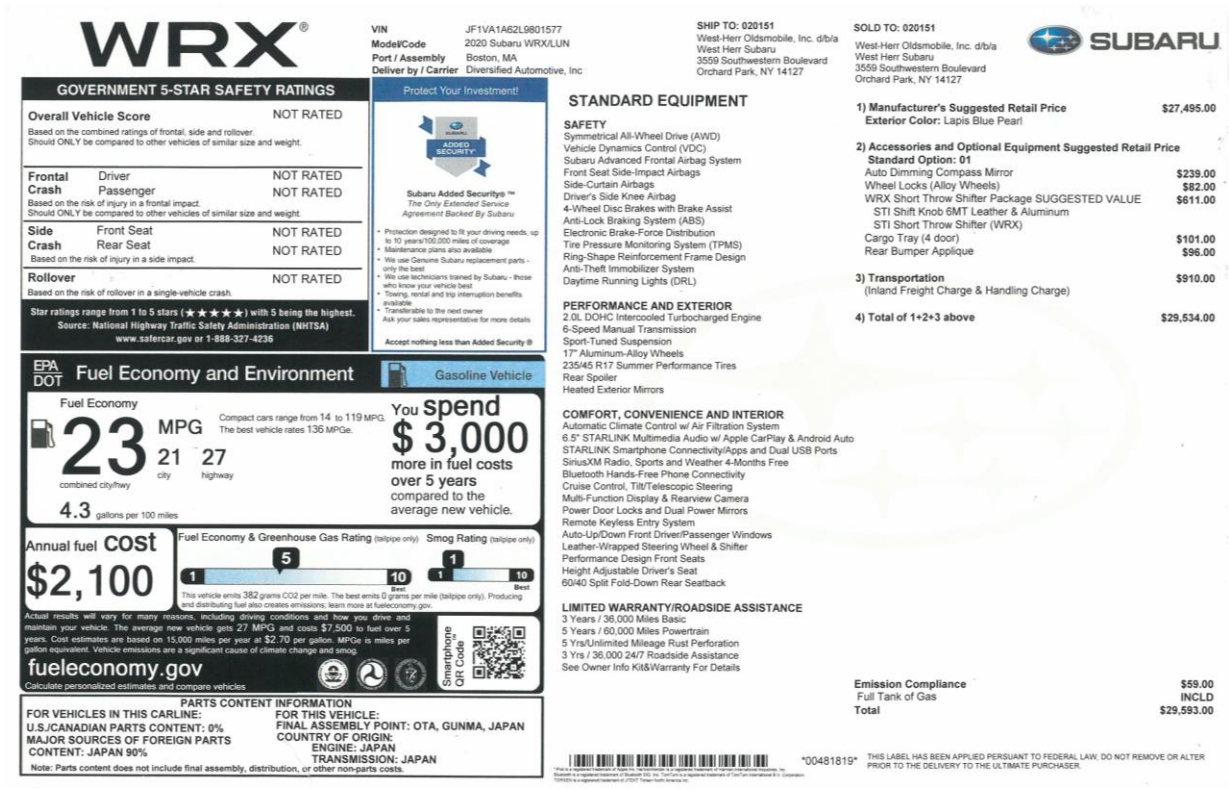
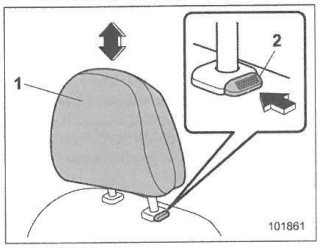


Figure A-102: Monroney Label

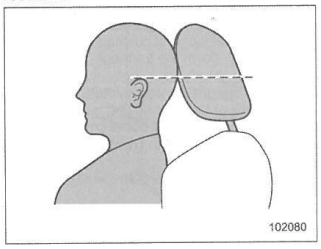
ble in the following ways.

▼ **Head restraint height adjustment**



1) Head restraint
2) Release button

To raise:
Pull the head restraint up.
To lower:
Push the head restraint down while pressing the release button on the top of the seatback.
To remove:
While pressing the release button, pull out the head restraint.
To install:
Install the head restraint into the holes that are located on the top of the seatback until the head restraint locks. Press and hold the release button to lower the head restraint.

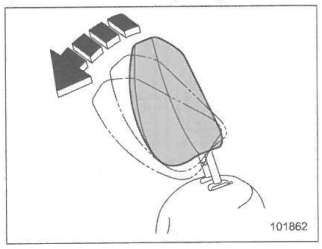


Adjust each head restraint so that the center of the head restraint is closest to the top of the occupant's ears.

NOTE

When the head restraint will not move in or out due to insufficient clearance between the head restraint and the roof, tilt the seat and then perform the installation and removal tasks.

▼ **Head restraint angle adjustment**



It is possible to adjust the angle of the head restraint in several steps. While maintaining a suitable driving posture, adjust the head restraint to a position where the back of your head is as close to the head restraint as possible.

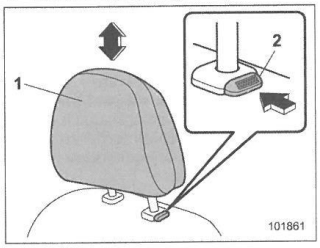
To tilt:
Tilt the head restraint by hand to the preferred position. A click will be audible when the head restraint is locked.
To return:
Tilt the head restraint once as far forward as it can go. The head restraint will automatically return to the fully upright position. Then, adjust the head restraint again to the preferred angle.

Figure A-103: Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

1-6 Seat, seatbelt and SRS airbags/Front seats

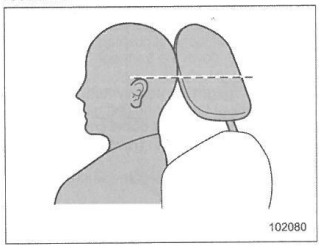
ble in the following ways.

▼ Head restraint height adjustment



1) Head restraint
2) Release button

To raise:
Pull the head restraint up.
To lower:
Push the head restraint down while pressing the release button on the top of the seatback.
To remove:
While pressing the release button, pull out the head restraint.
To install:
Install the head restraint into the holes that are located on the top of the seatback until the head restraint locks. Press and hold the release button to lower the head restraint.

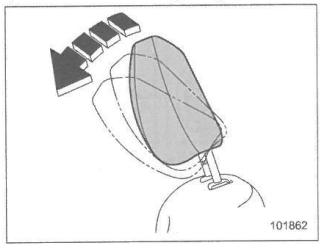


Adjust each head restraint so that the center of the head restraint is closest to the top of the occupant's ears.

NOTE

When the head restraint will not move in or out due to insufficient clearance between the head restraint and the roof, tilt the seat and then perform the installation and removal tasks.

▼ Head restraint angle adjustment



It is possible to adjust the angle of the head restraint in several steps. While maintaining a suitable driving posture, adjust the head restraint to a position where the back of your head is as close to the head restraint as possible.

To tilt:
Tilt the head restraint by hand to the preferred position. A click will be audible when the head restraint is locked.
To return:
Tilt the head restraint once as far forward as it can go. The head restraint will automatically return to the fully upright position. Then, adjust the head restraint again to the preferred angle.

Figure A-104: Left Rear Passenger Head Restraint Use and Adjustment Information from Vehicle Owner's Manual-Rear Restraints Not Adjustable

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS

Driver & Passenger Dummy Instrumentation Plots

The following additional data for this test can be obtained from the Research and Development section of the NHTSA website. The website can be found at www.NHTSA.gov.

Additional Driver & Passenger Dummy Instrumentation Data

Driver Lower Spine T12 Acceleration (X)
Driver Lower Spine T12 Acceleration (Y)
Driver Lower Spine T12 Acceleration (Z)
Passenger Upper Thorax Rib Deflection (Y)
Passenger Middle Thorax Rib Deflection (Y)
Passenger Lower Thorax Rib Deflection (Y)
Passenger Upper Abdomen Rib Deflection (Y)
Passenger Lower Abdomen Rib Deflection (Y)
Driver Head Acceleration Redundant (X)
Driver Head Acceleration Redundant (Y)
Driver Head Acceleration Redundant (Z)
Passenger Head Acceleration Redundant (X)
Passenger Head Acceleration Redundant (Y)
Passenger Head Acceleration Redundant (Z)

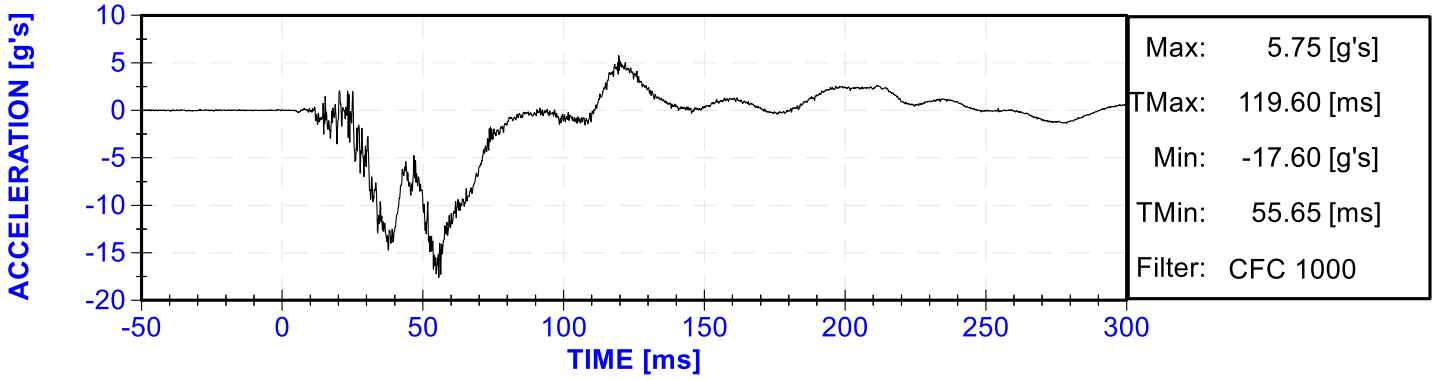
Vehicle Instrumentation Data

Vehicle Center of Gravity Acceleration (X)
Vehicle Center of Gravity Acceleration (Y)
Vehicle Center of Gravity Acceleration (Z)
Right Side Sill at Front Seat Acceleration (X)
Right Side Sill at Front Seat Acceleration (Y)
Right Side Sill at Front Seat Acceleration (Z)
Right Side Sill at Rear Seat Acceleration (X)
Right Side Sill at Rear Seat Acceleration (Y)
Right Side Sill at Rear Seat Acceleration (Z)
Left Side Sill at Front Seat Acceleration (Y)
Left Side Sill at Rear Seat Acceleration (Y)
Lower A-Post Acceleration (Y)
Middle A-Post Acceleration (Y)
Lower B-Post Acceleration (Y)
Middle B-Post Acceleration (Y)
Front Seat Track Acceleration (Y)
Rear Seat Structure Acceleration (Y)
Right Rear Occupant Compartment Acceleration (Y)
Engine Block (X)
Engine Block (Y)
Rear Floorpan Above Axle Acceleration (X)
Rear Floorpan Above Axle Acceleration (Y)
Rear Floorpan Above Axle Acceleration (Z)

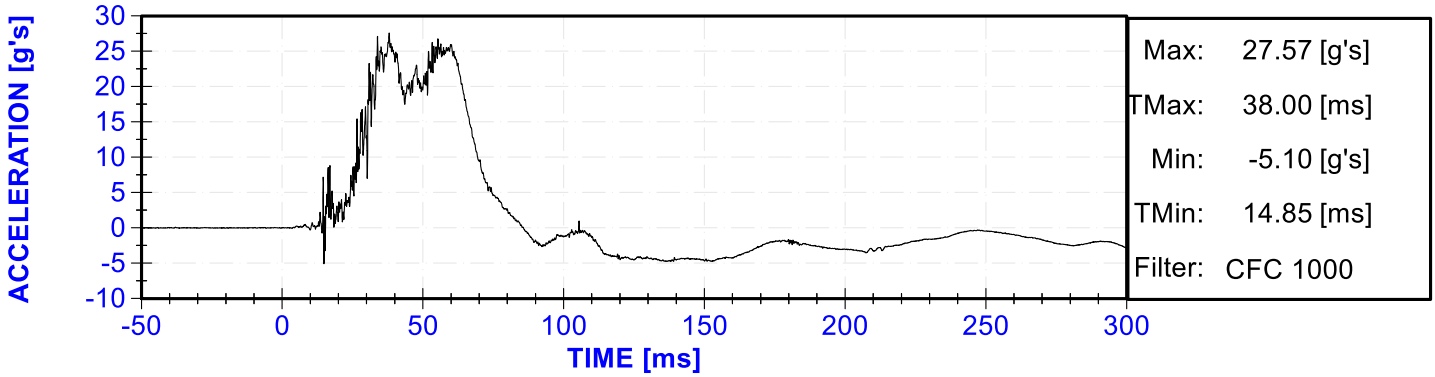
MDB Instrumentation Data

MDB Center of Gravity Acceleration (X)
MDB Center of Gravity Acceleration (Y)
MDB Center of Gravity Acceleration (Z)
MDB Rear Acceleration (X)
MDB Rear Acceleration (Y)
Left MDB Contact Switch
Right MDB Contact Switch

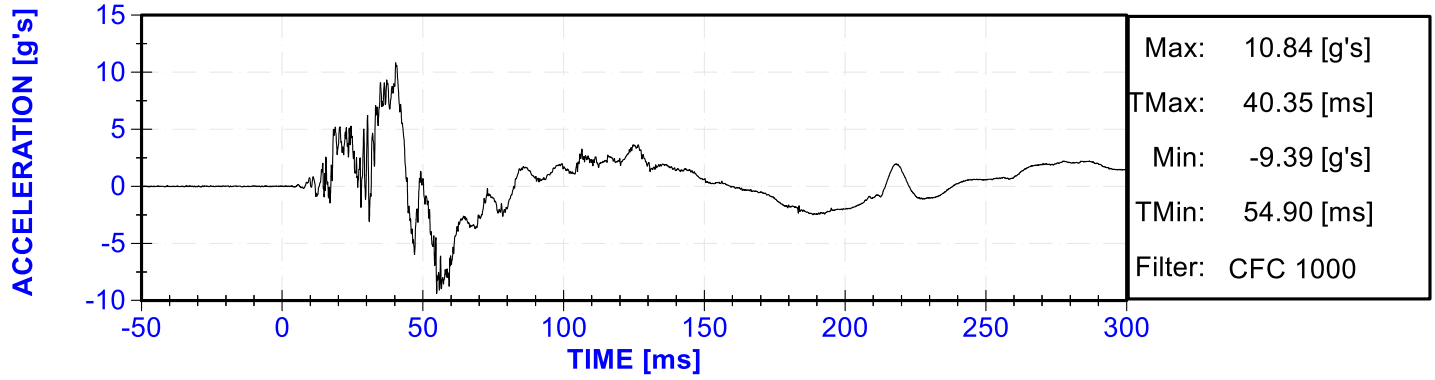
Driver Head Acceleration (X) Primary vs. Time



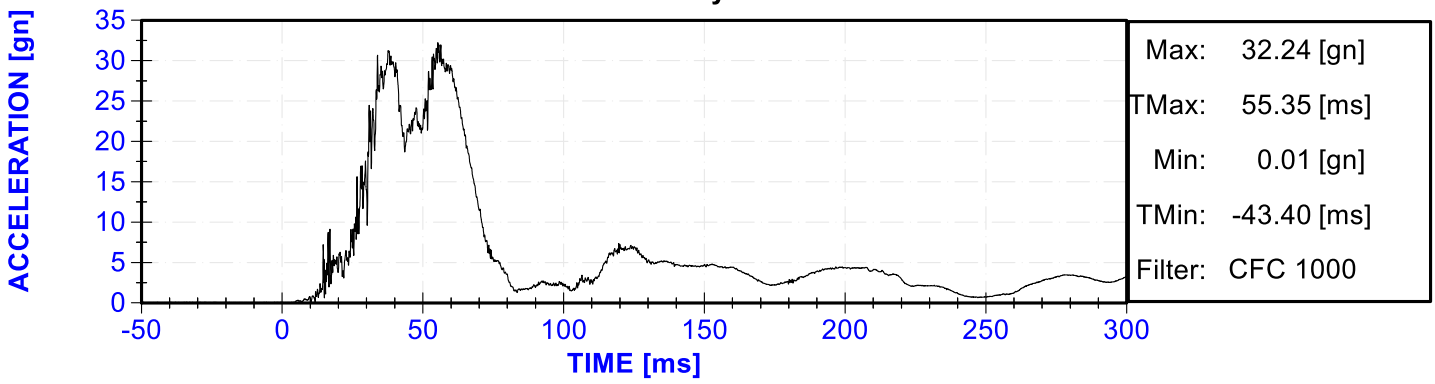
Driver Head Acceleration (Y) Primary vs. Time



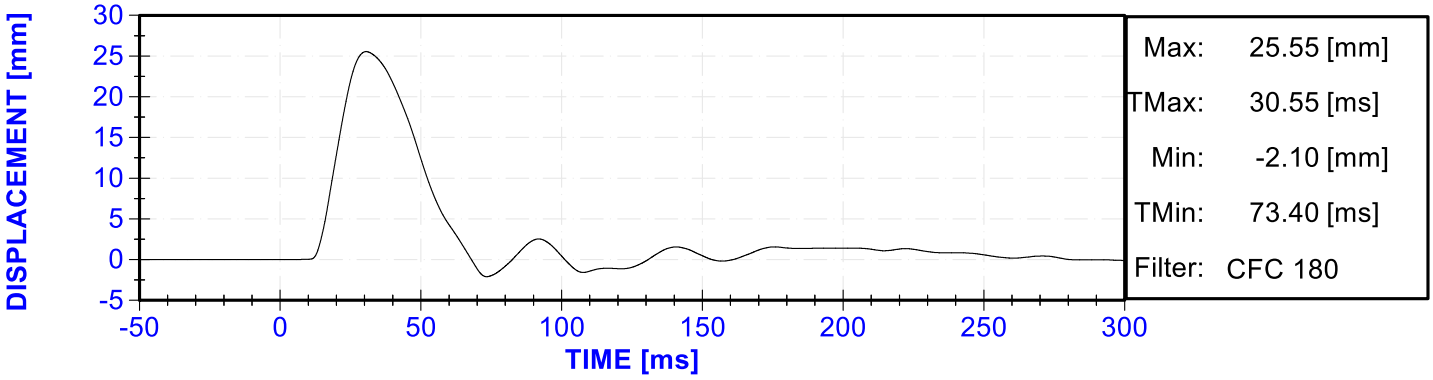
Driver Head Acceleration (Z) Primary vs. Time



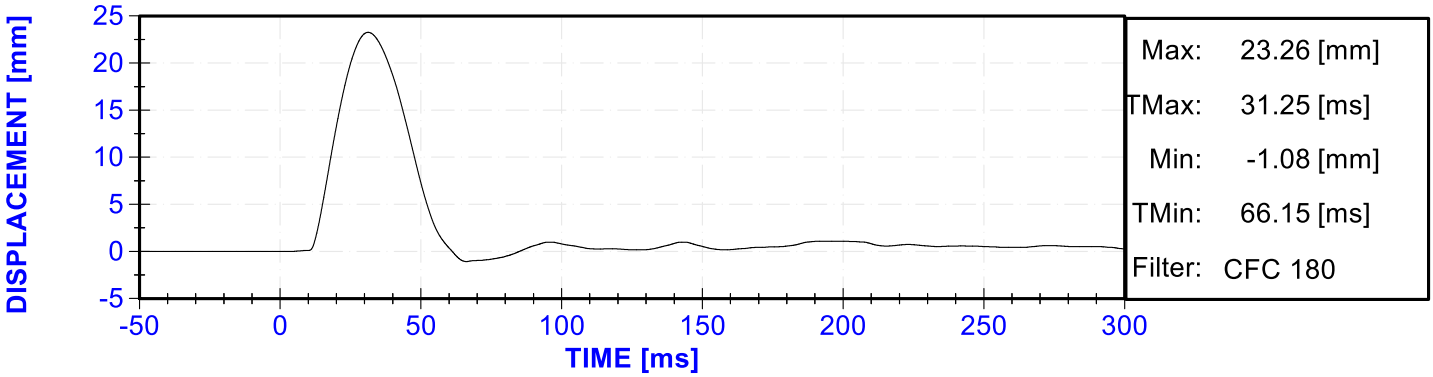
Driver Head Resultant Acceleration Primary vs. Time



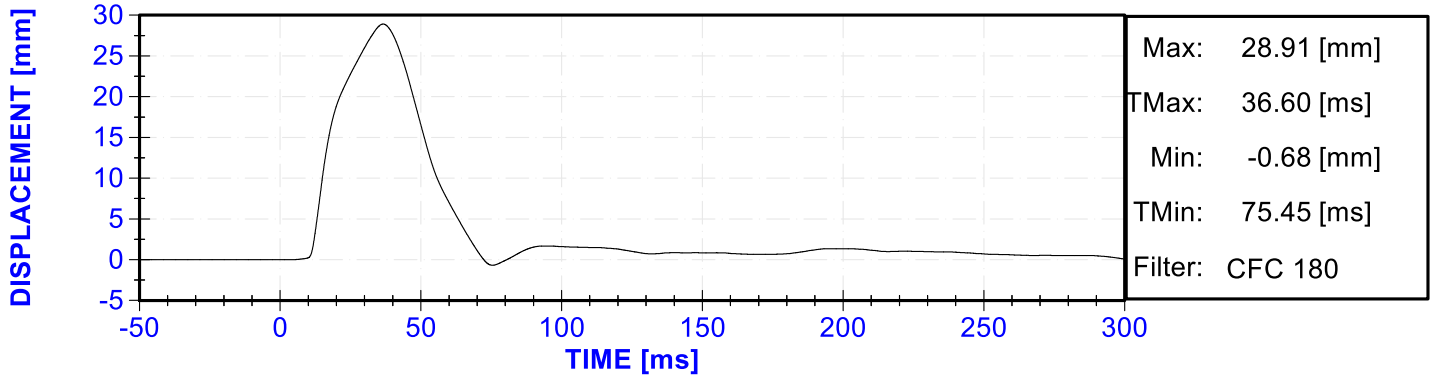
Driver Upper Thorax Rib Deflection (Y) vs. Time



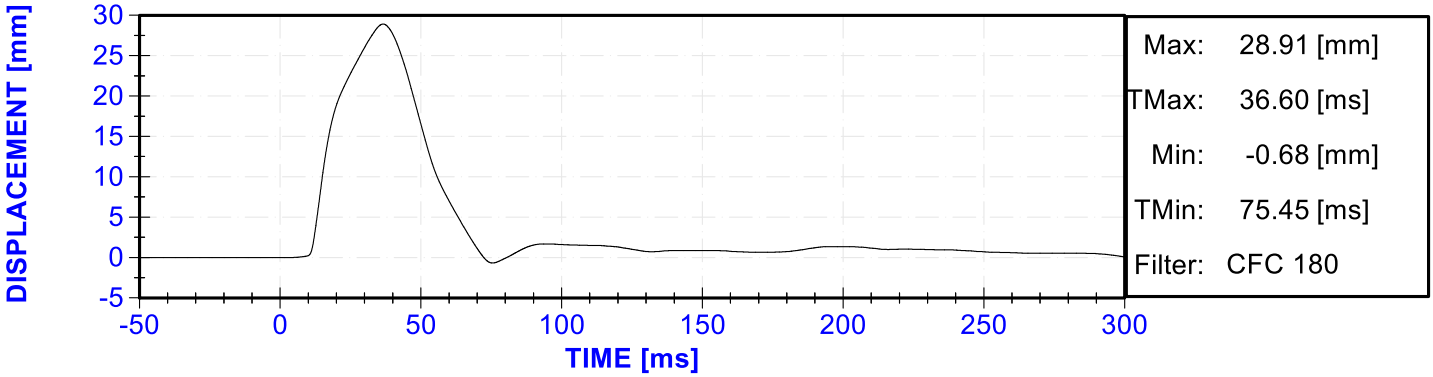
Driver Middle Thorax Rib Deflection (Y) vs. Time



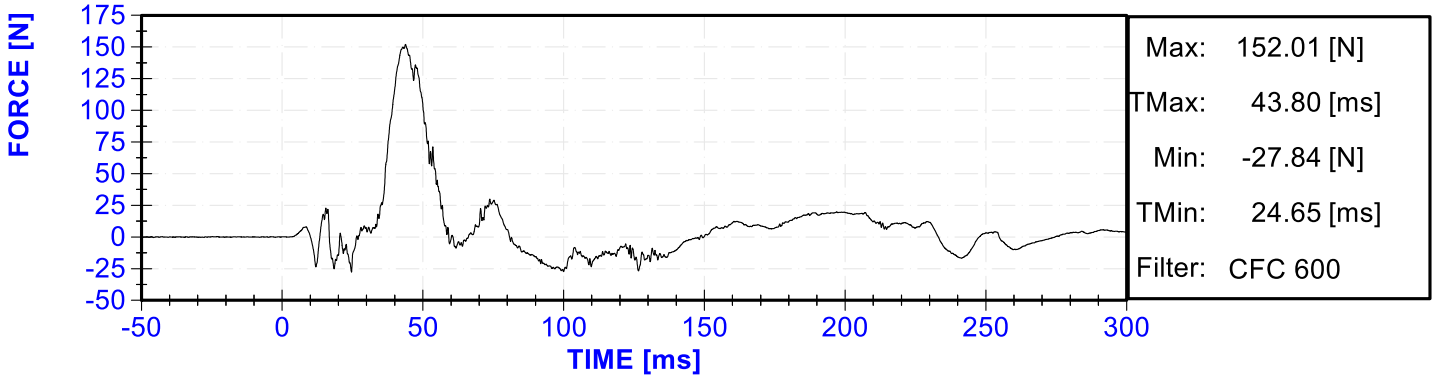
Driver Lower Thorax Rib Deflection (Y) vs. Time



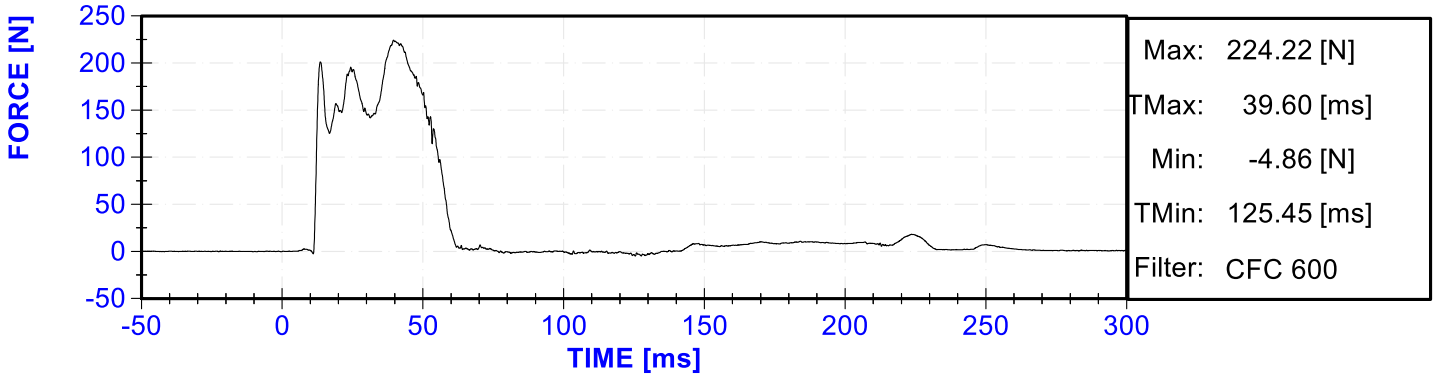
Driver Thorax Rib Deflection Maximum vs. Time



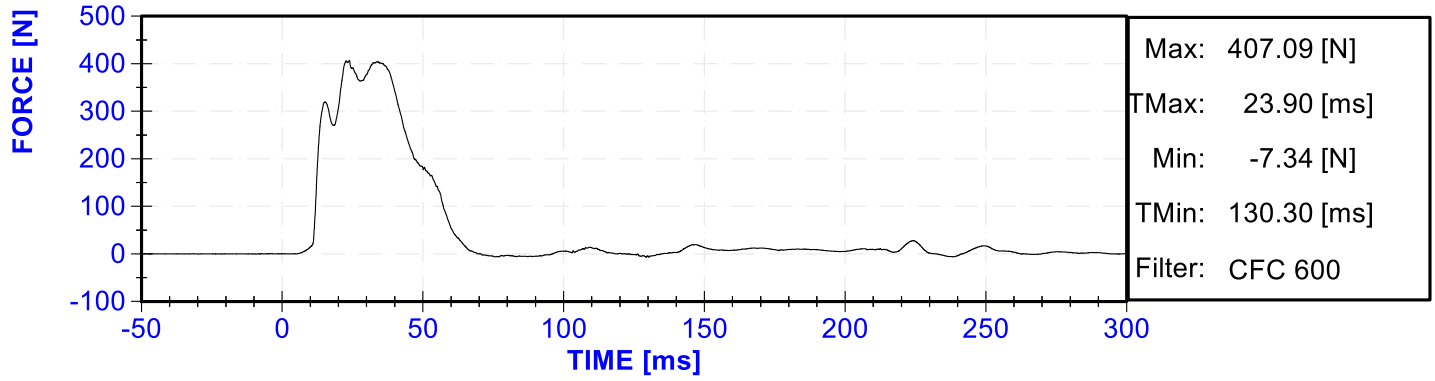
Driver Anterior Abdominal Force (Y) vs. Time



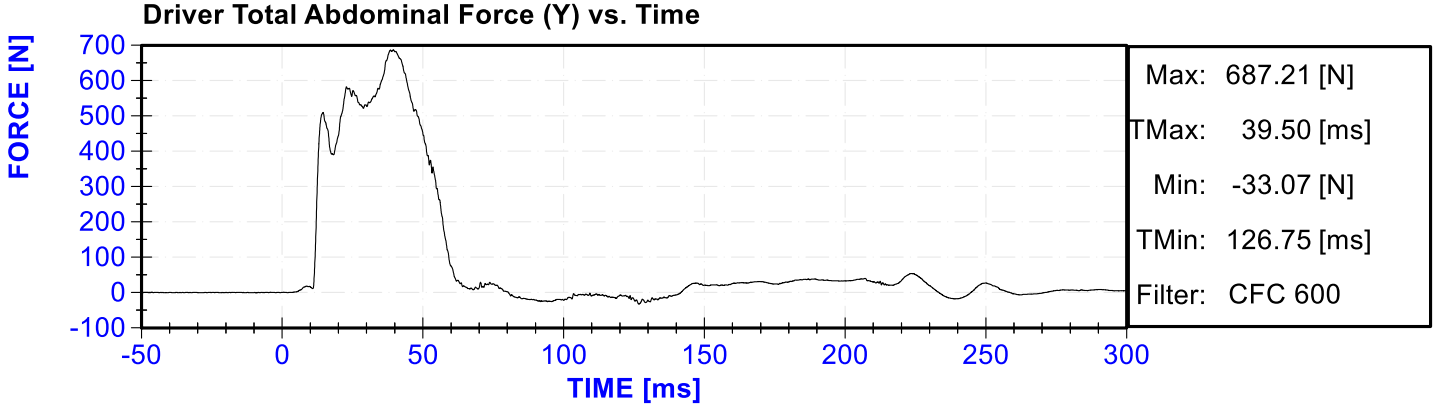
Driver Middle Abdominal Force (Y) vs. Time



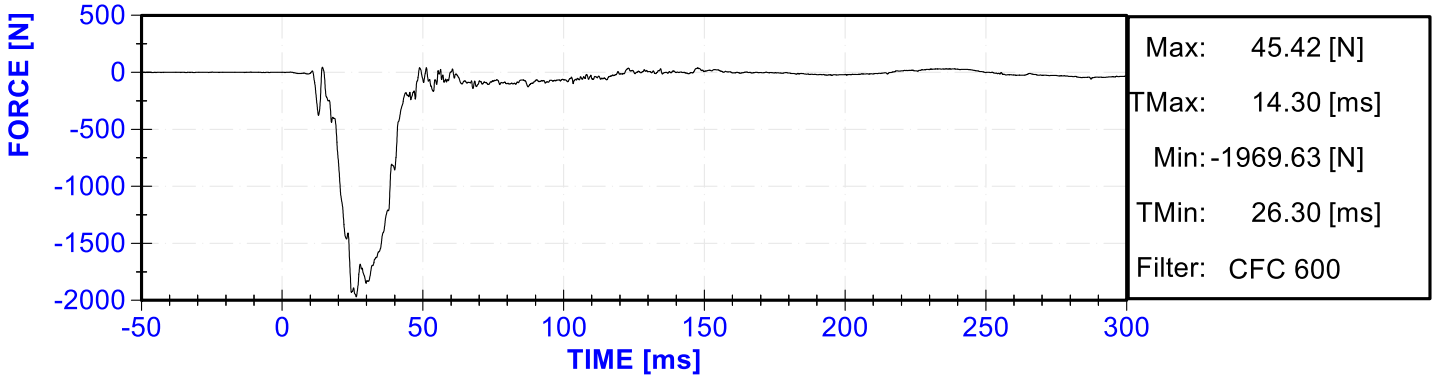
Driver Posterior Abdominal Force (Y) vs. Time



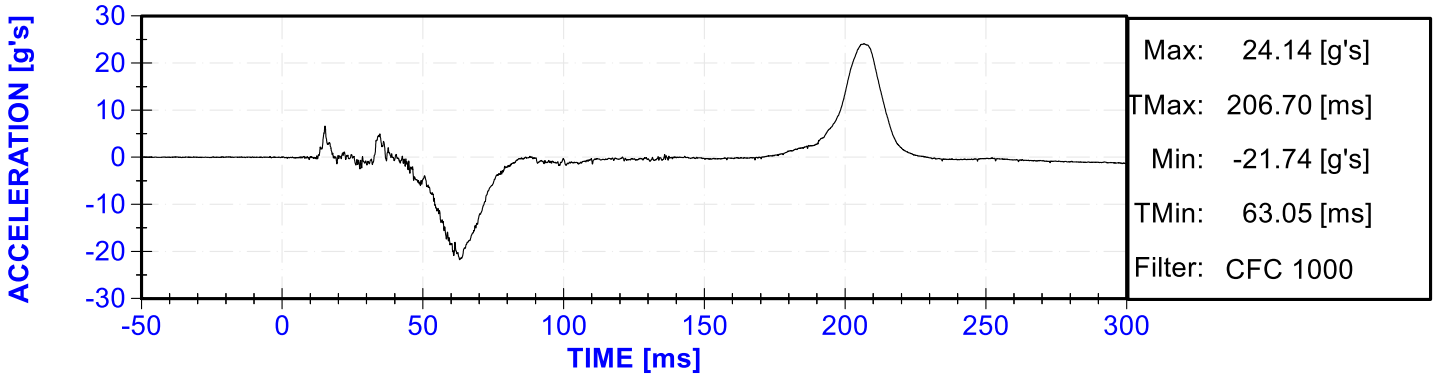
Driver Total Abdominal Force (Y) vs. Time



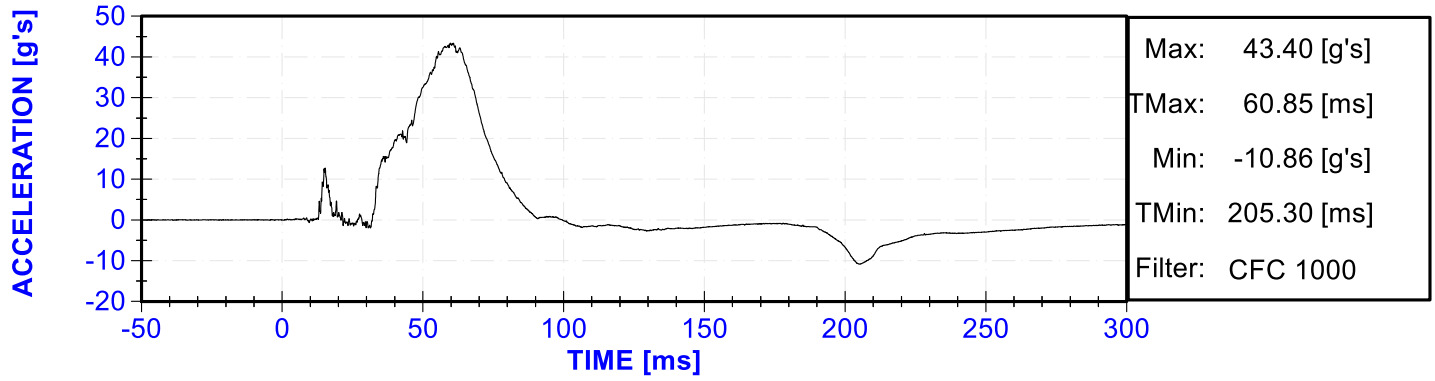
Driver Pubic Symphysis Force (Y) vs. Time



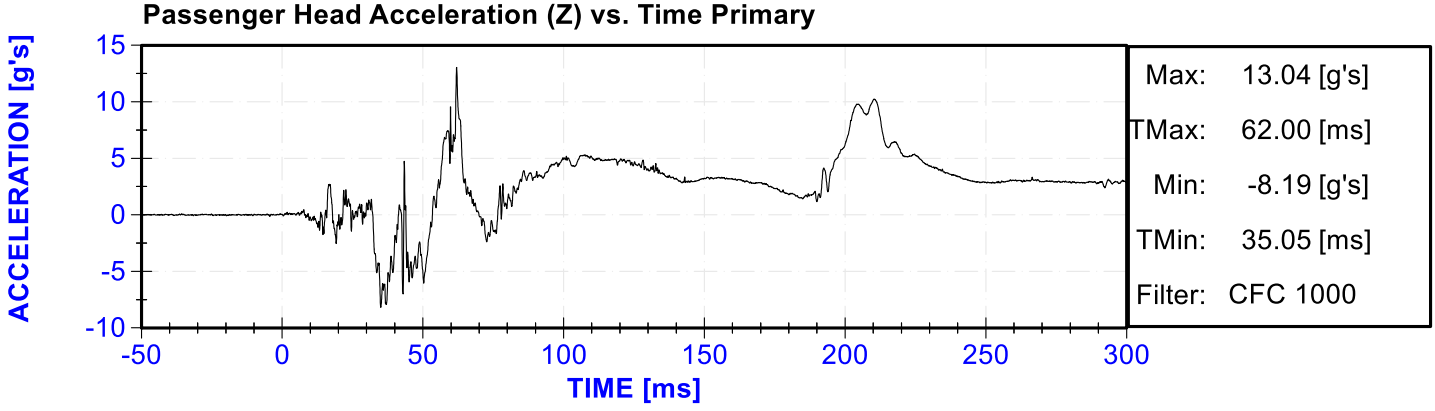
Passenger Head Acceleration (X) vs. Time Primary



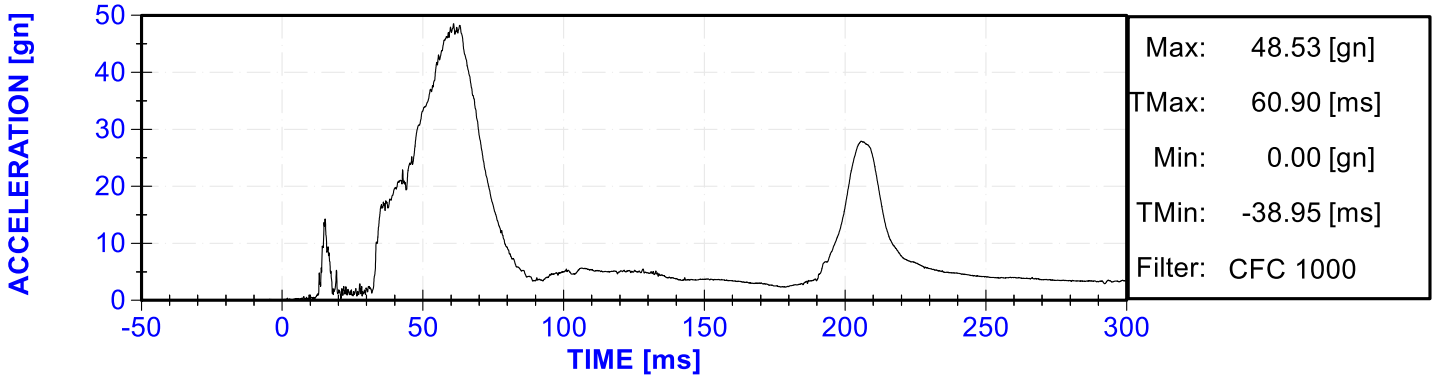
Passenger Head Acceleration (Y) vs. Time Primary



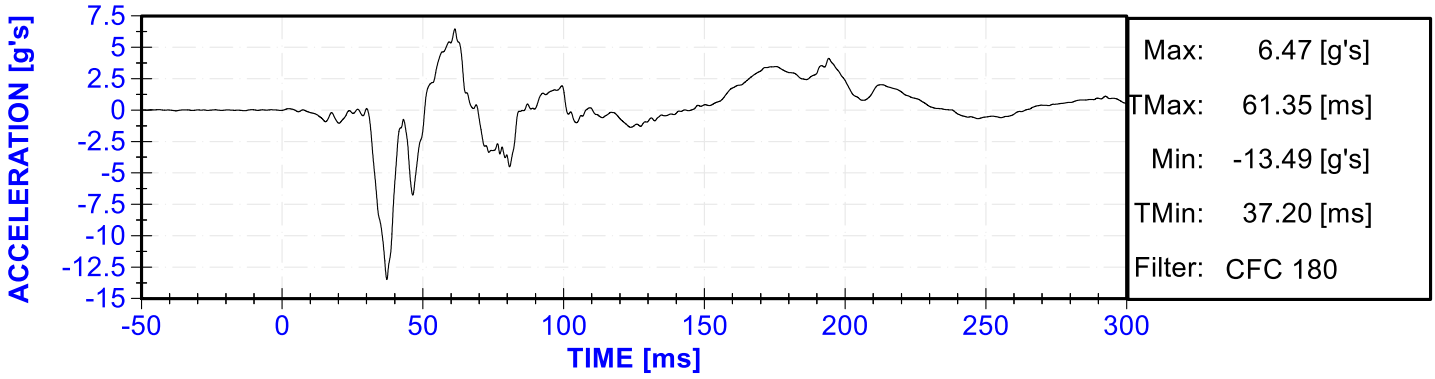
Passenger Head Acceleration (Z) vs. Time Primary



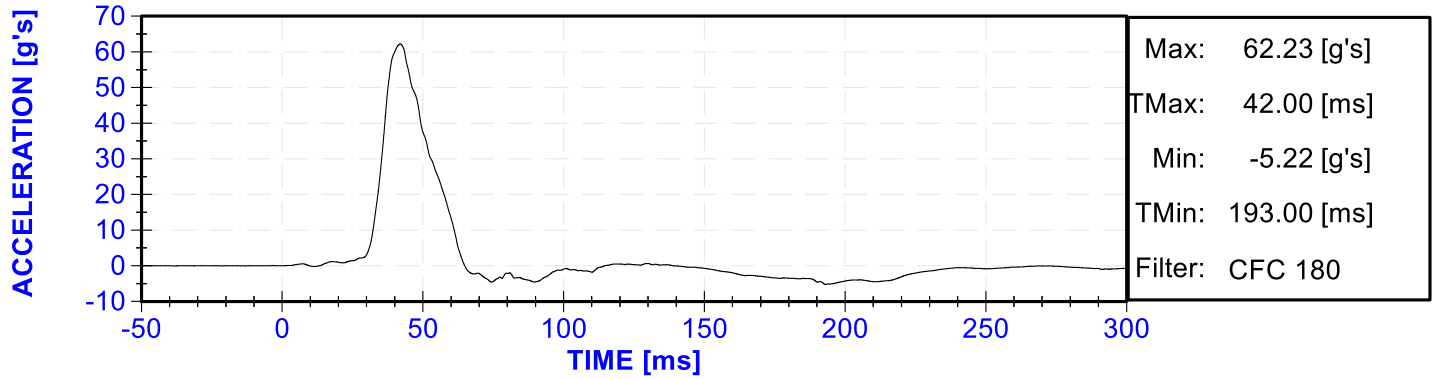
Passenger Head Resultant Acceleration Primary vs. Time



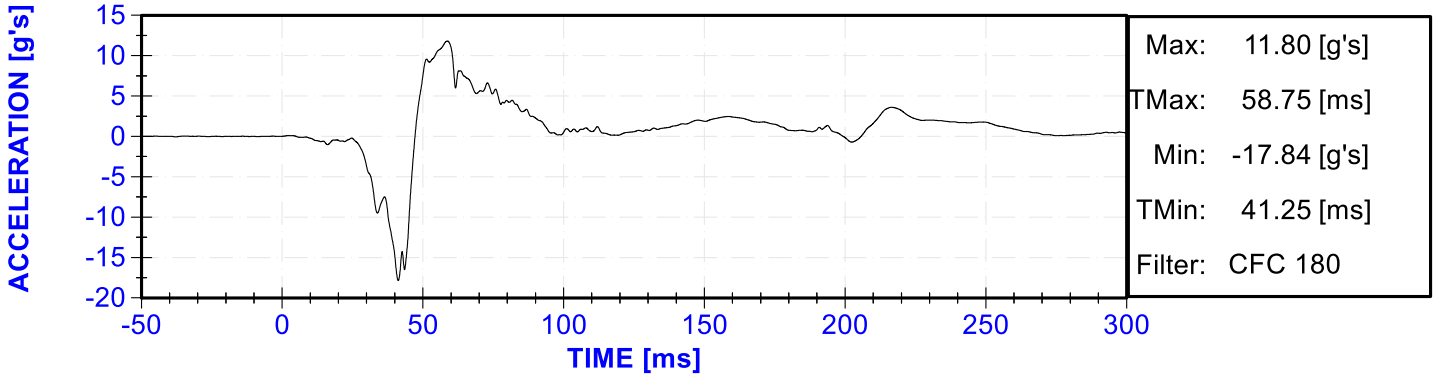
Passenger Lower Spine T12 Acceleration (X) vs. Time



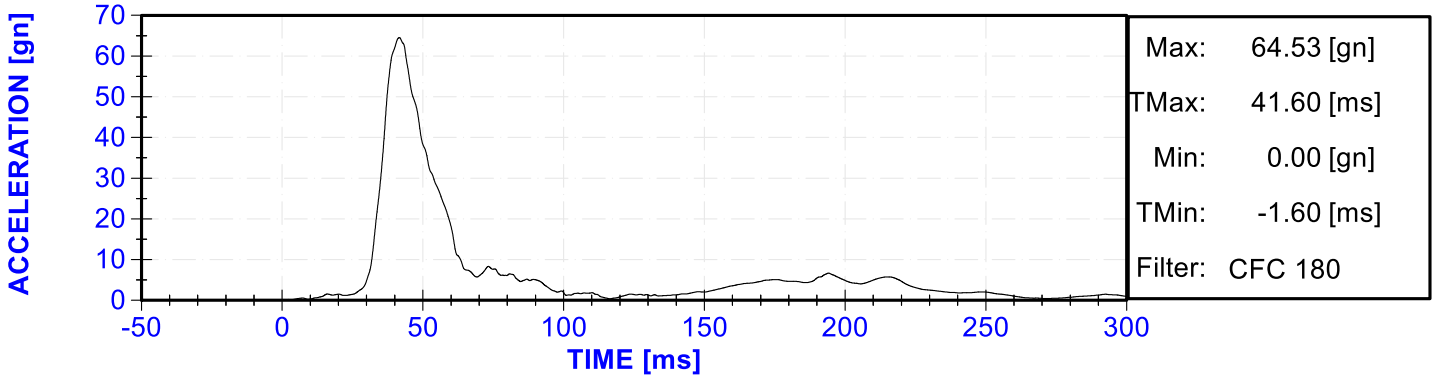
Passenger Lower Spine T12 Acceleration (Y) vs. Time



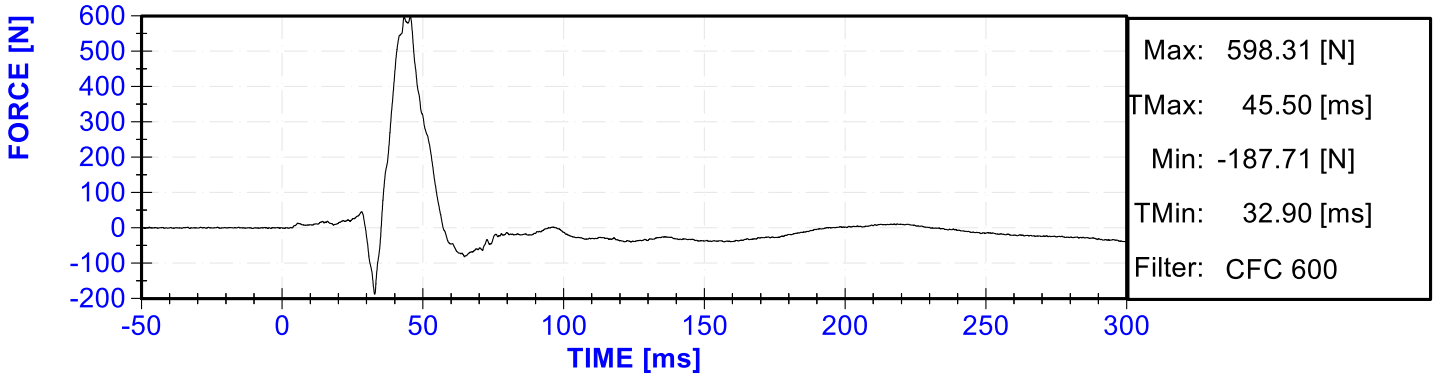
Passenger Lower Spine T12 Acceleration (Z) vs. Time



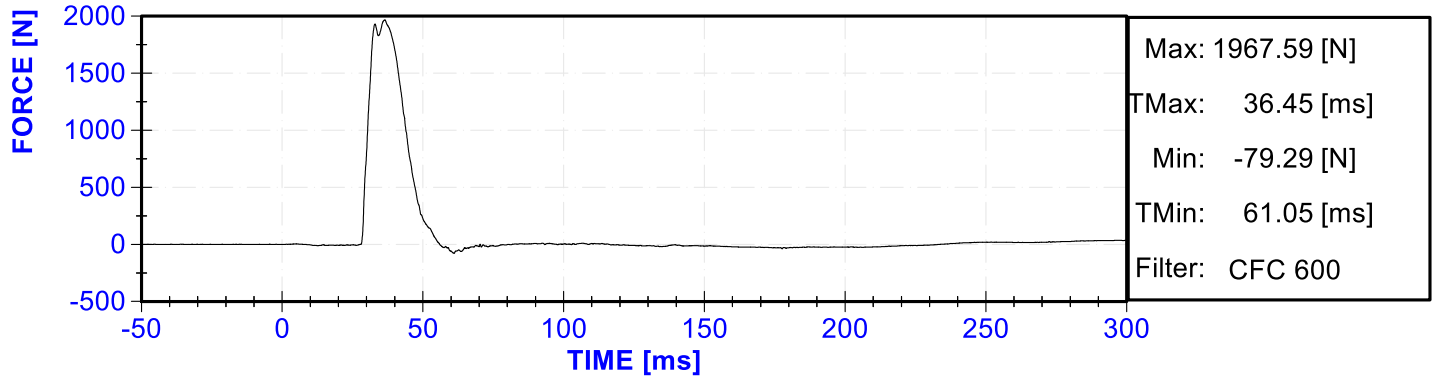
Passenger Lower Spine T12 Resultant Acceleration vs. Time



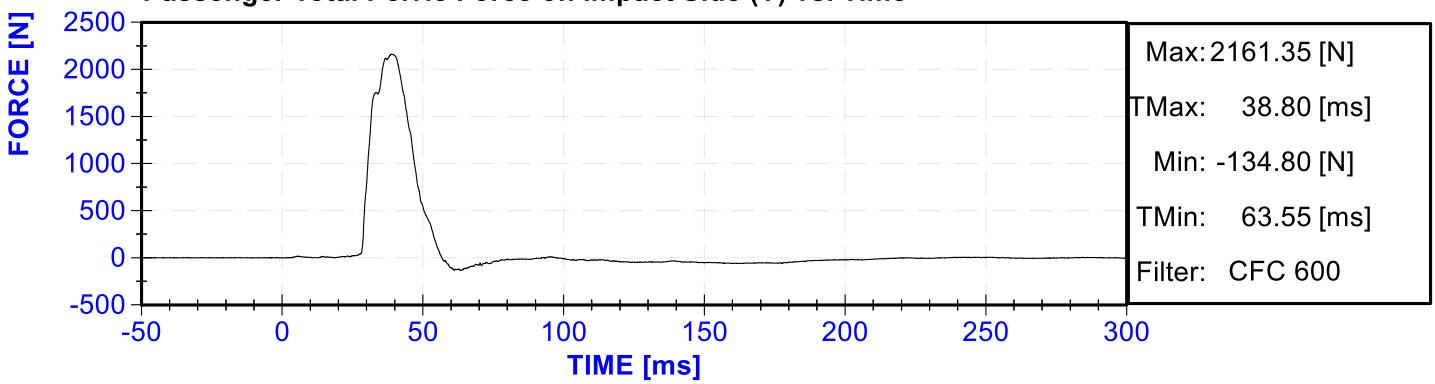
Passenger Iliac Force on Impact Side (Y) vs. Time



Passenger Acetabulum Force on Impact Side (Y) vs. Time



Passenger Total Pelvic Force on Impact Side (Y) vs. Time



APPENDIX C

DUMMY PERFORMANCE CALIBRATION TEST DATA

CALIBRATION TEST RESULTS

PRE-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

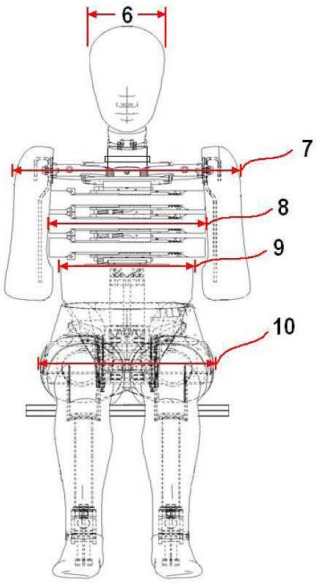
SERIAL NO: F034

(CONFIGURED FOR LEFT SIDE IMPACT)

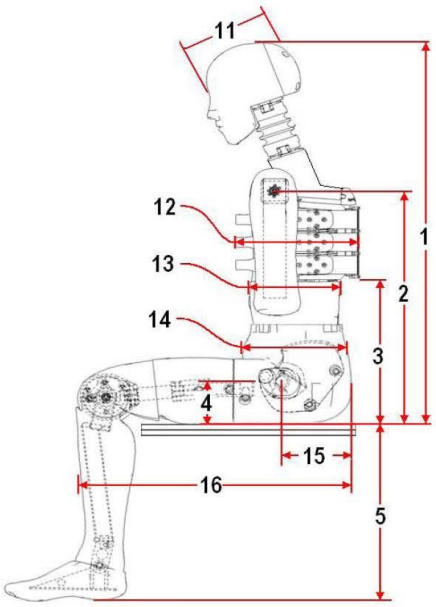
External Measurements - EuroSID-2re

Technician: K. Dutton Date: 11/05/2019

Dummy Serial Number: F034



FRONT VIEW



SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	910	Pass
2	Seat to Shoulder Joint	558	572	569	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	99	Pass
5	Sole to Seat, Sitting	333	451	419	Pass
6	Head Width	152	158	154	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	327	Pass
9	Abdomen Width	273	287	283	Pass
10	Pelvis Lap Width	359	373	366	Pass
11	Head Depth	196	206	202	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	201	Pass
14	Pelvis Depth	235	245	242	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

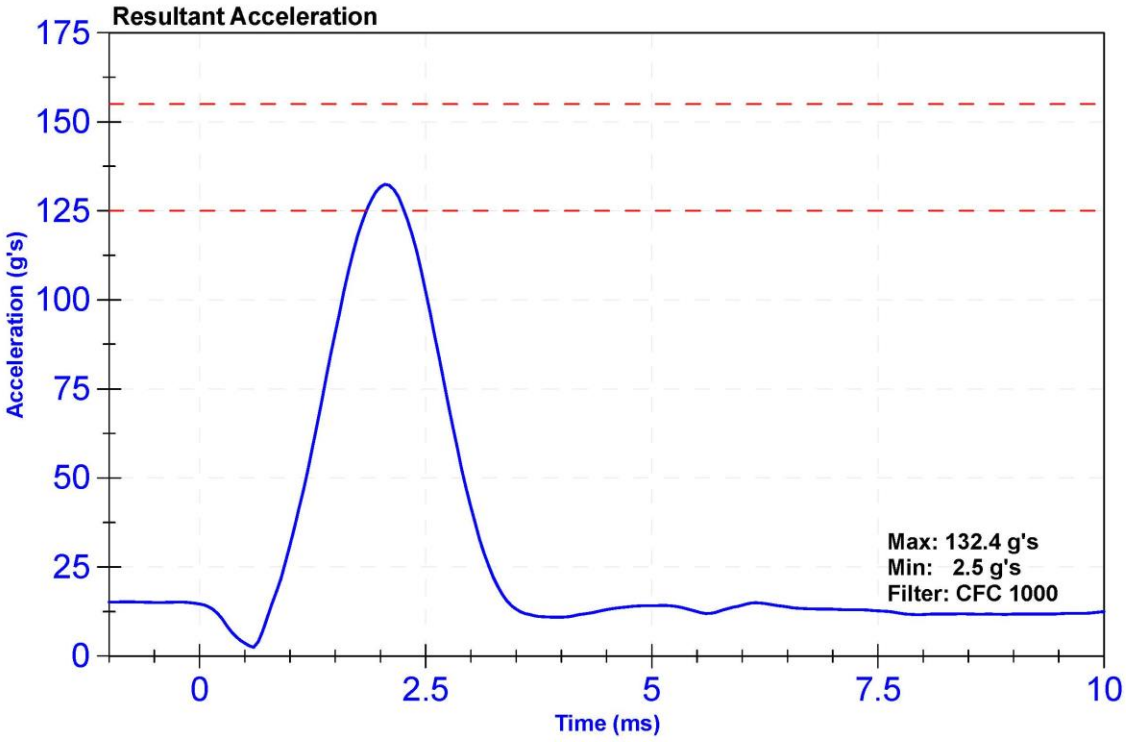
ATD Manufacturer	FTSS	Test Technician	E. Helenbrook
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

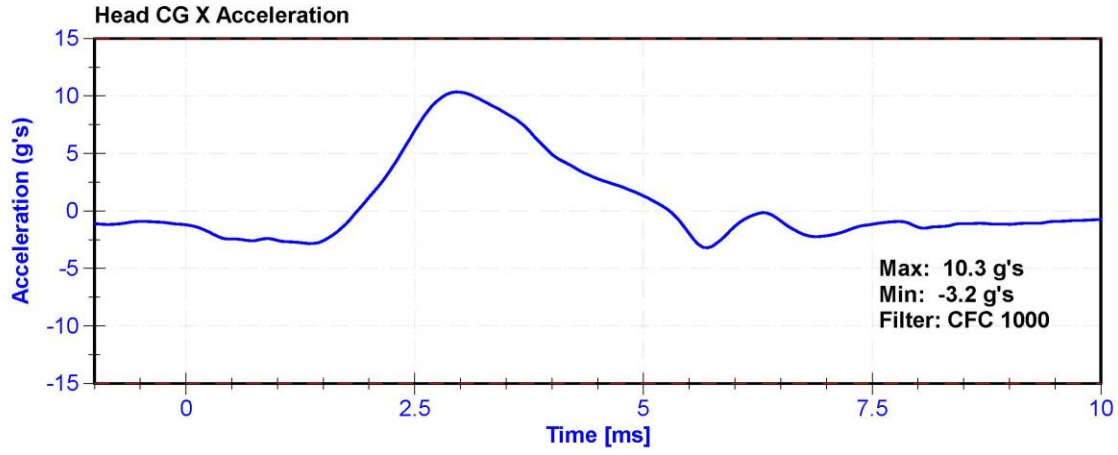
Results

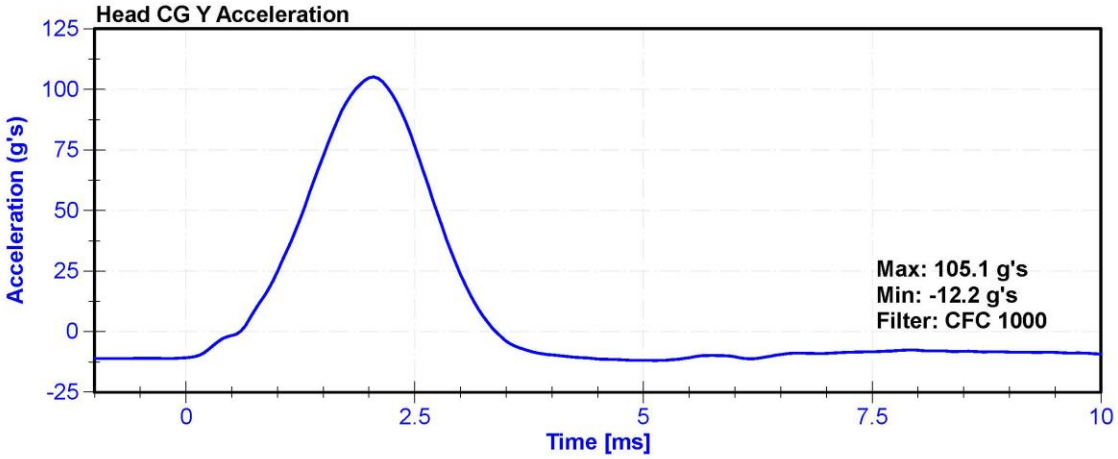
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	27.8	Pass
Resultant Acceleration	125	155	g's	132.4	Pass
Oscillation	0	15	%	12.20	Pass
Fore-Aft Acceleration	-15	15	g's	10.3	Pass

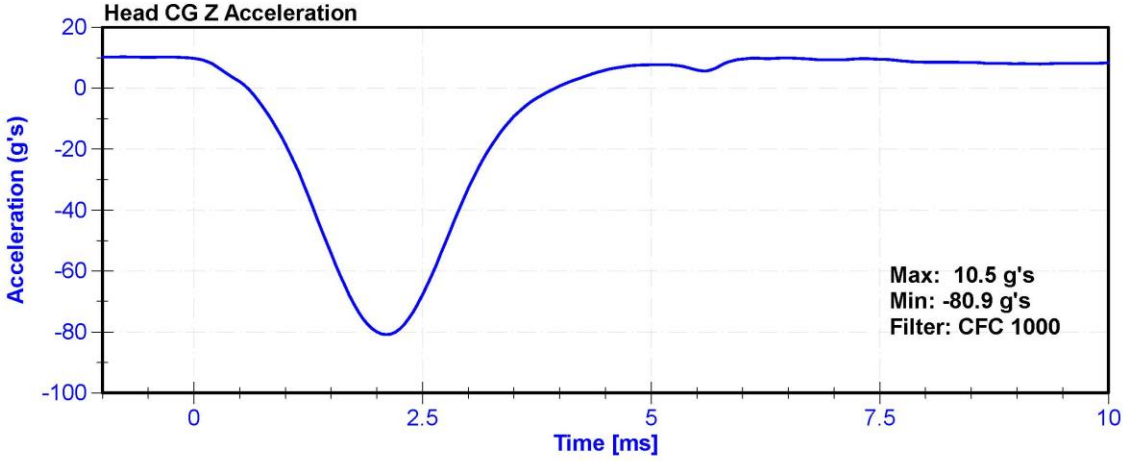
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	P49204	10/29/2019	4/29/2020
Y Accelerometer	Endevco	P63981	10/29/2019	4/29/2020
Z Accelerometer	Endevco	P64007	10/29/2019	4/29/2020




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 10.3 g's
Min: -3.2 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 105.1 g's
Min: -12.2 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
20
0
-20
-40
-60
-80
-100
0
2.5
5
7.5
10
Time [ms]
Max: 10.5 g's
Min: -80.9 g's
Filter: CFC 1000

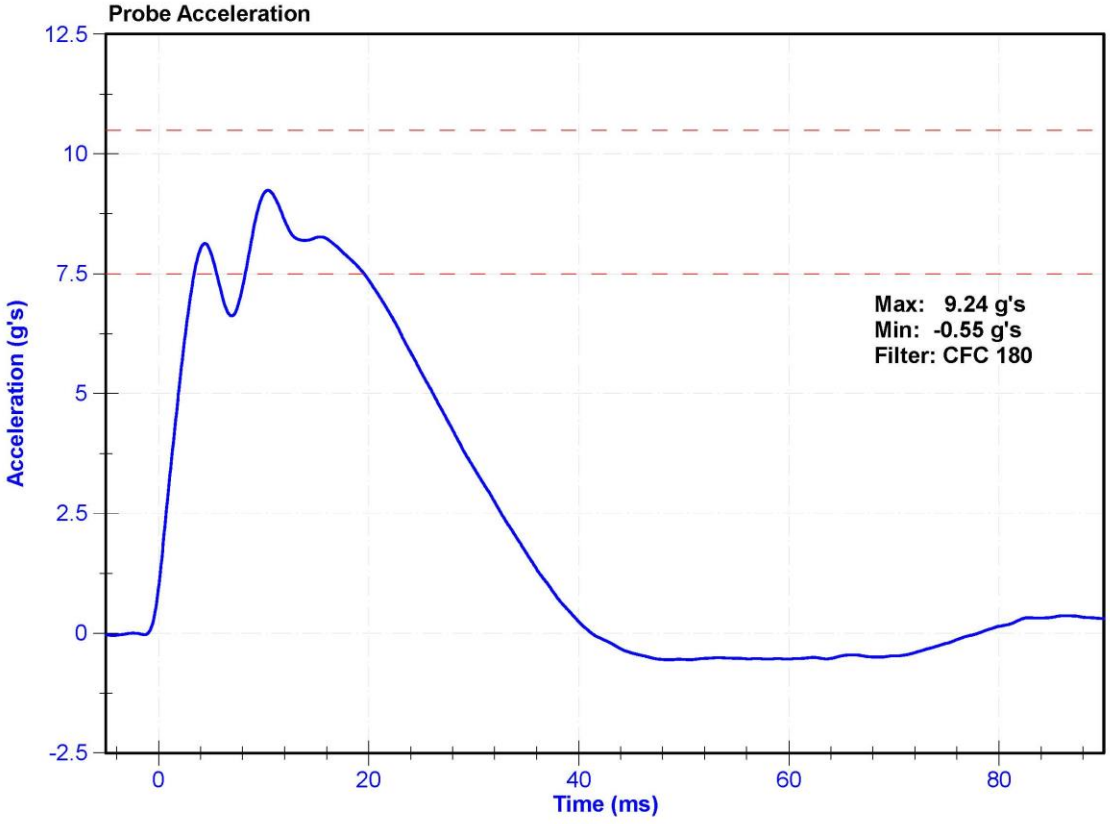
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	28.0	Pass
Velocity	4.2	4.4	m/s	4.23	Pass
Probe Acceleration	7.5	10.5	g's	9.24	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A260487	8/22/2019	2/20/2020



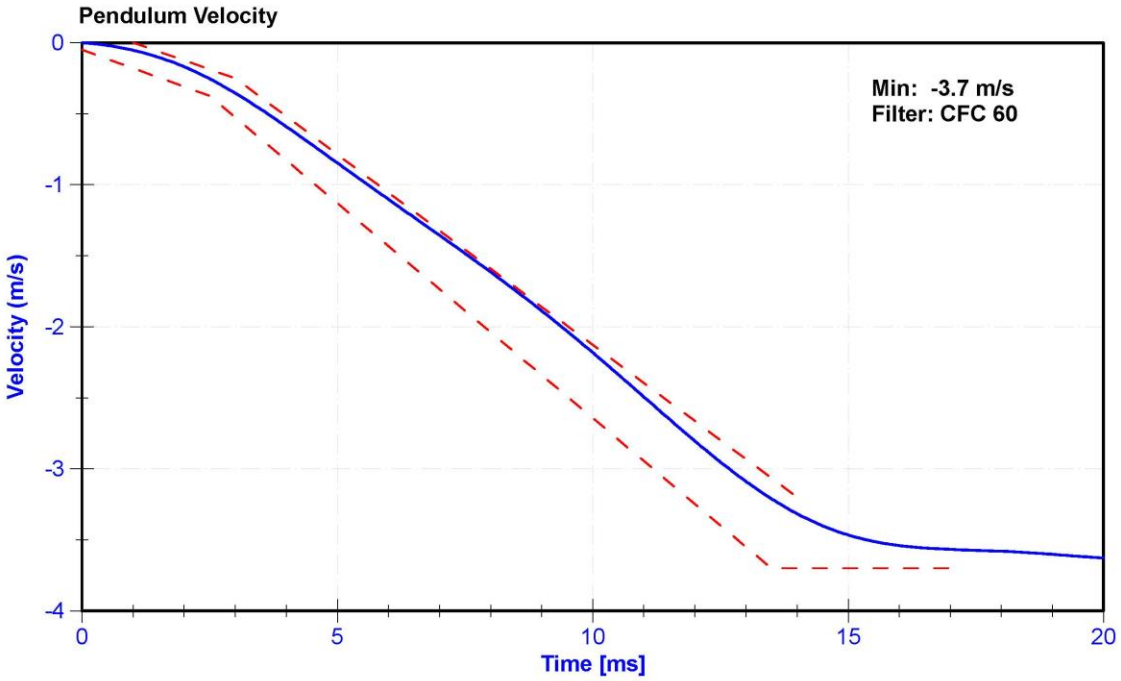
ATD Manufacturer	FTSS	Test Technician	M. Dudek
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

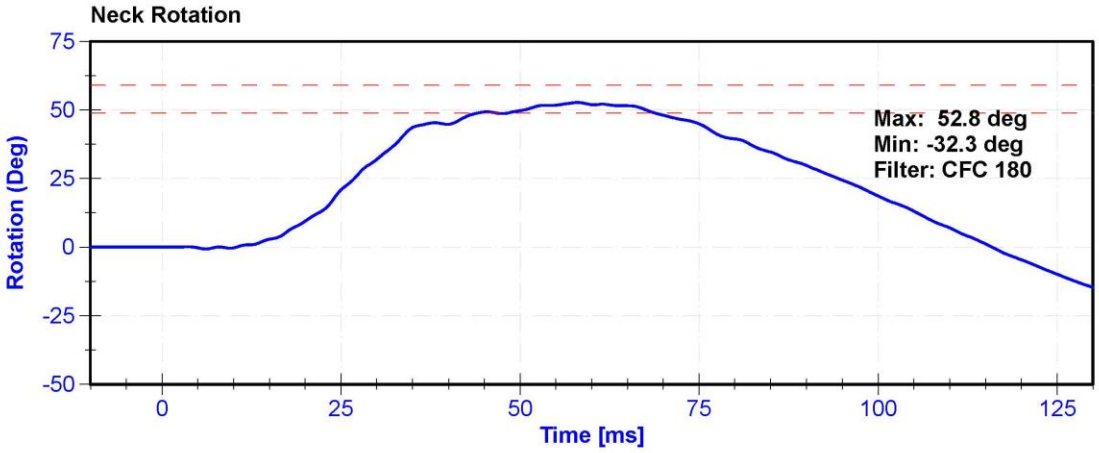
Results

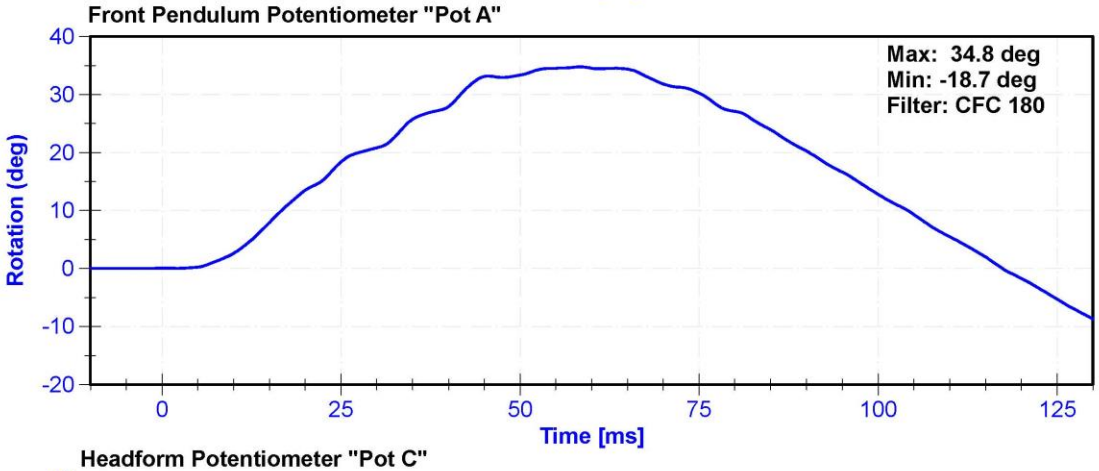
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	28	Pass
Velocity	3.3	3.5	m/s	3.32	Pass
Lateral Neck Rotation	49	59	deg	52.8	Pass
Time at Maximum Rotation	54	66	ms	58.1	Pass
Time of Rotation Decay from Maximum	53	88	ms	57.9	Pass

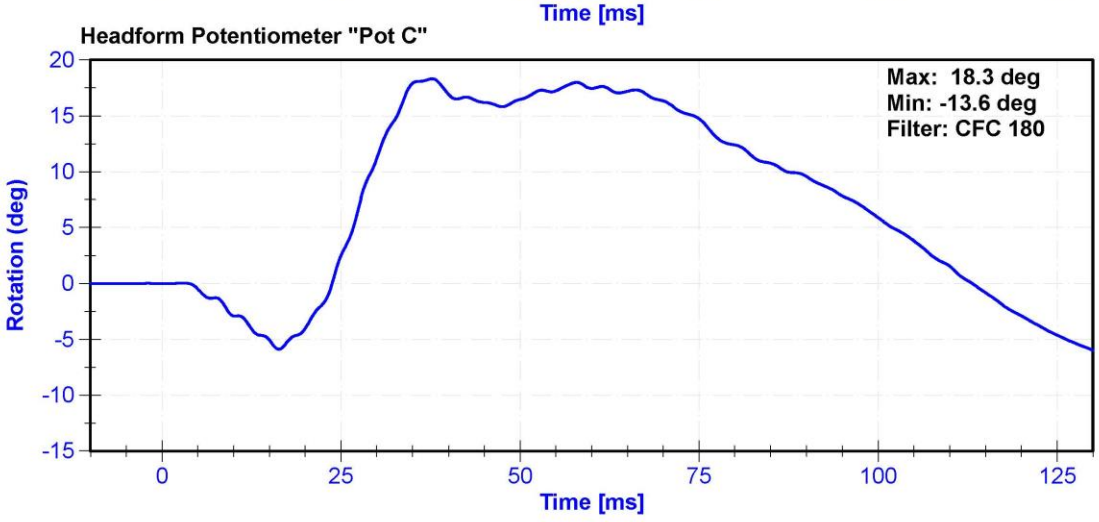
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9	1/29/2019	1/29/2020
Front Pendulum Potentiometer	SP22G	DS-094	10/31/2019	10/30/2020
Headform Potentiometer	SP22G	DS-095	10/31/2019	10/30/2020




Neck Rotation
Rotation (Deg)
Time [ms]
Max: 52.8 deg
Min: -32.3 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 34.8 deg
Min: -18.7 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 18.3 deg
Min: -13.6 deg
Filter: CFC 180

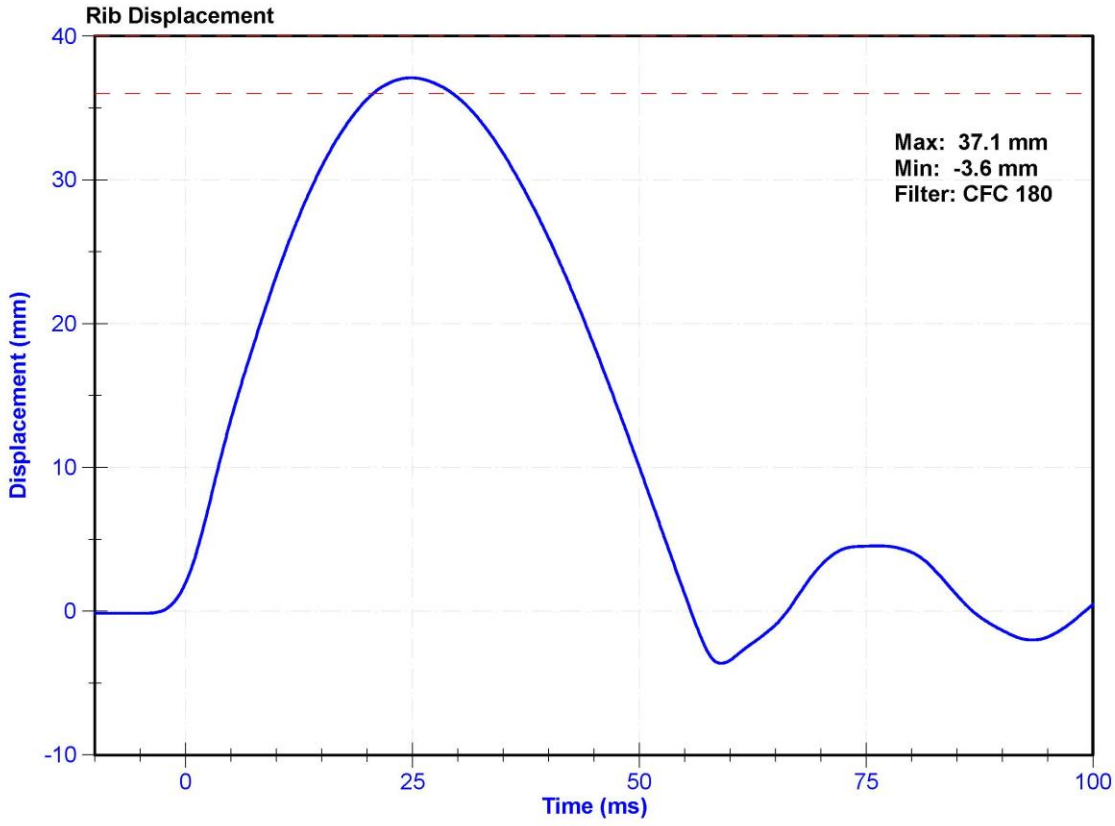
ATD Manufacturer	FTSS	Test Technician	E. Helenbrook
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	33.8	Pass
Rib Displacement	36	40	mm	37.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	183GFE	10/31/2019	4/31/2020



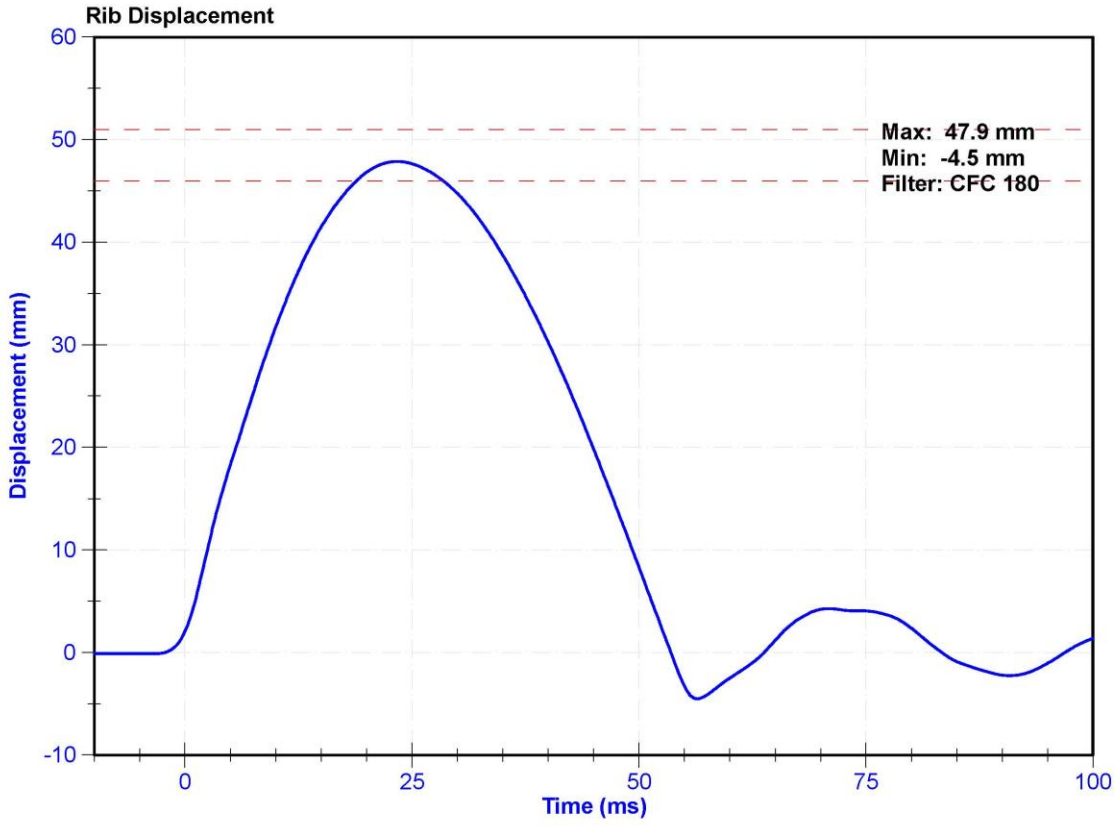
ATD Manufacturer	FTSS	Test Technician	E. Helenbrook
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	33.8	Pass
Rib Displacement	46	51	mm	47.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	183GFE	10/31/2019	4/31/2020



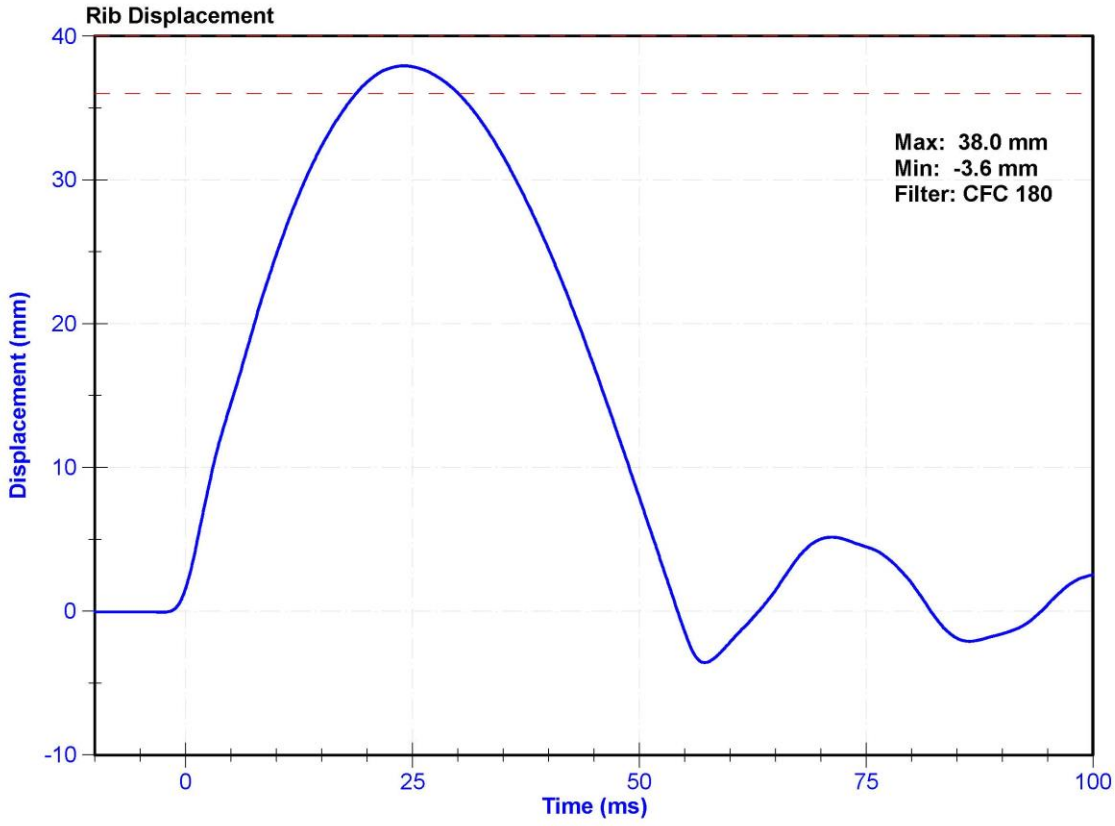
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	27.0	Pass
Rib Displacement	36	40	mm	38.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/31/2019	4/30/2020



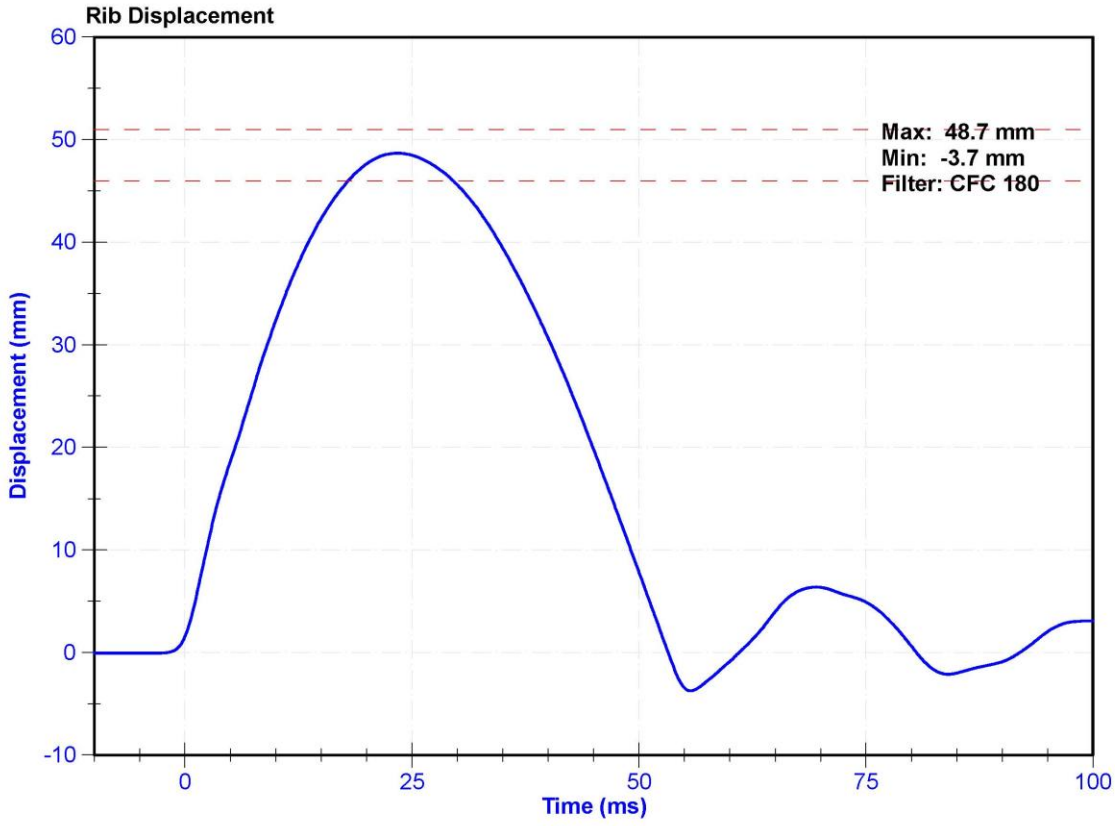
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	28.0	Pass
Rib Displacement	46	51	mm	48.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/31/2019	4/30/2020



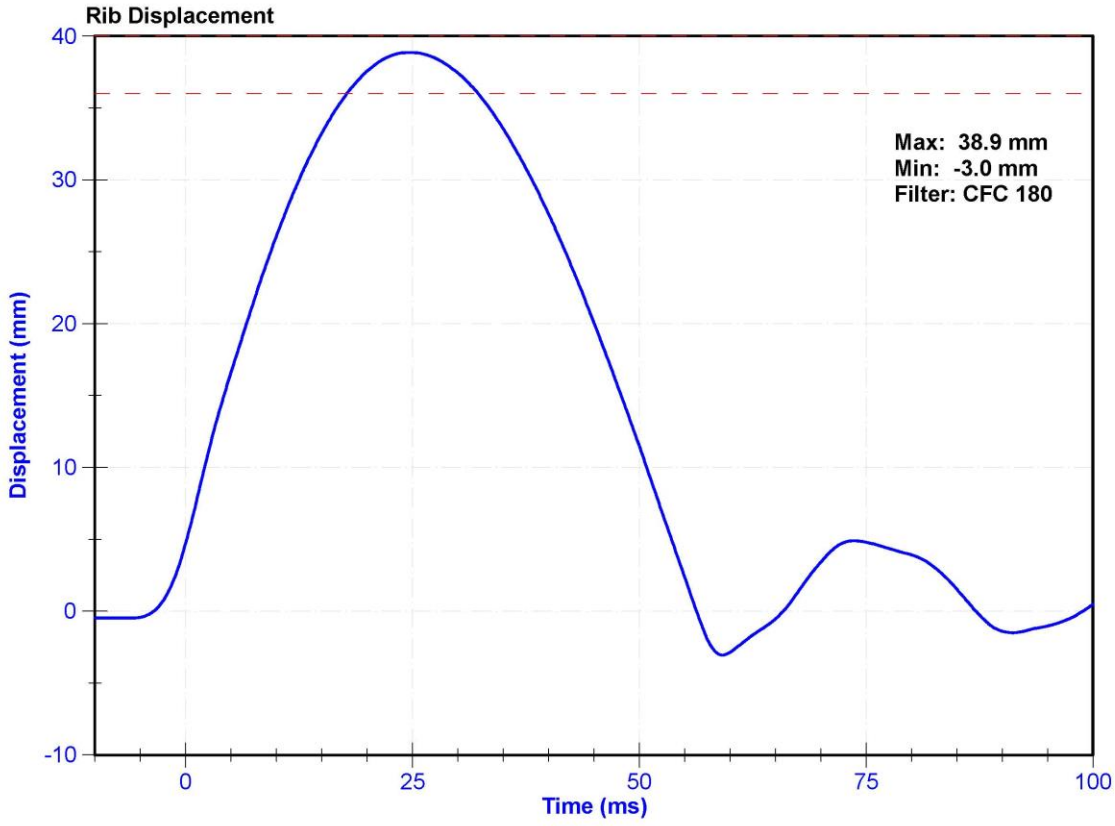
ATD Manufacturer	FTSS	Test Technician	E. Helenbrook
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	33.8	Pass
Rib Displacement	36	40	mm	38.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	182GFE	10/31/2019	4/31/2020



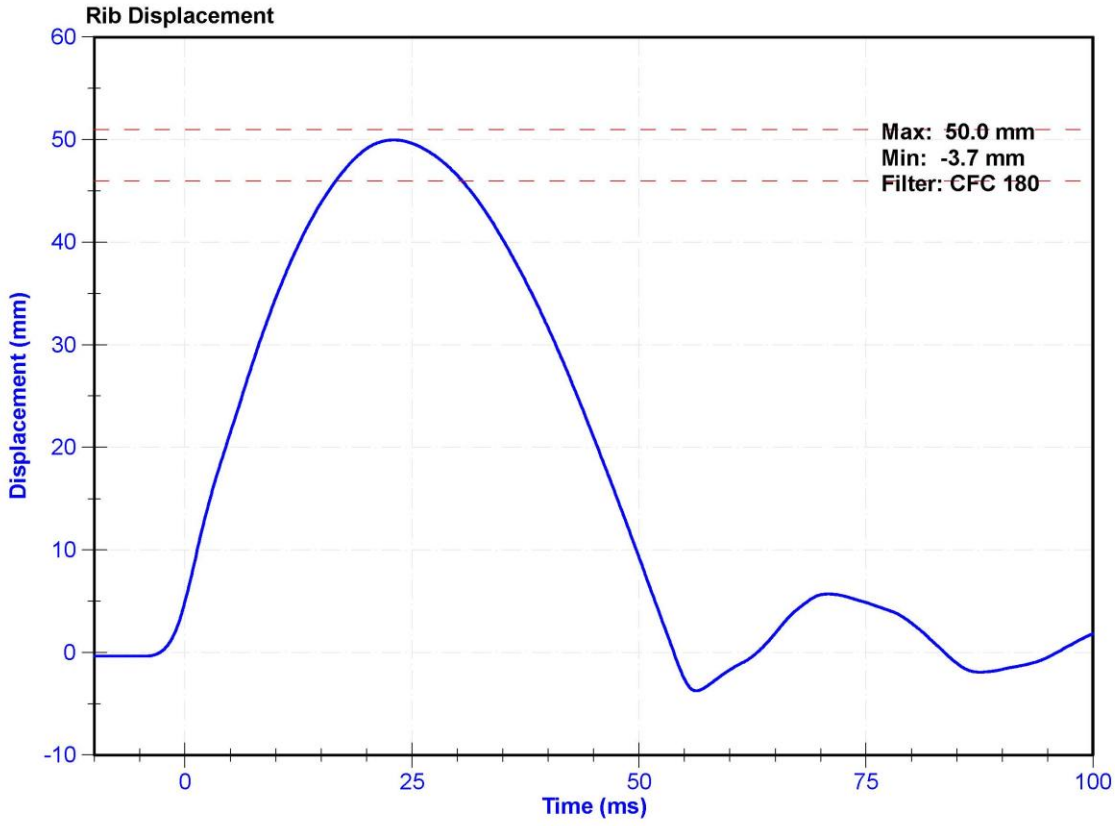
ATD Manufacturer	FTSS	Test Technician	E. Helenbrook
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	33.8	Pass
Rib Displacement	46	51	mm	50.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	182GFE	10/31/2019	4/31/2020



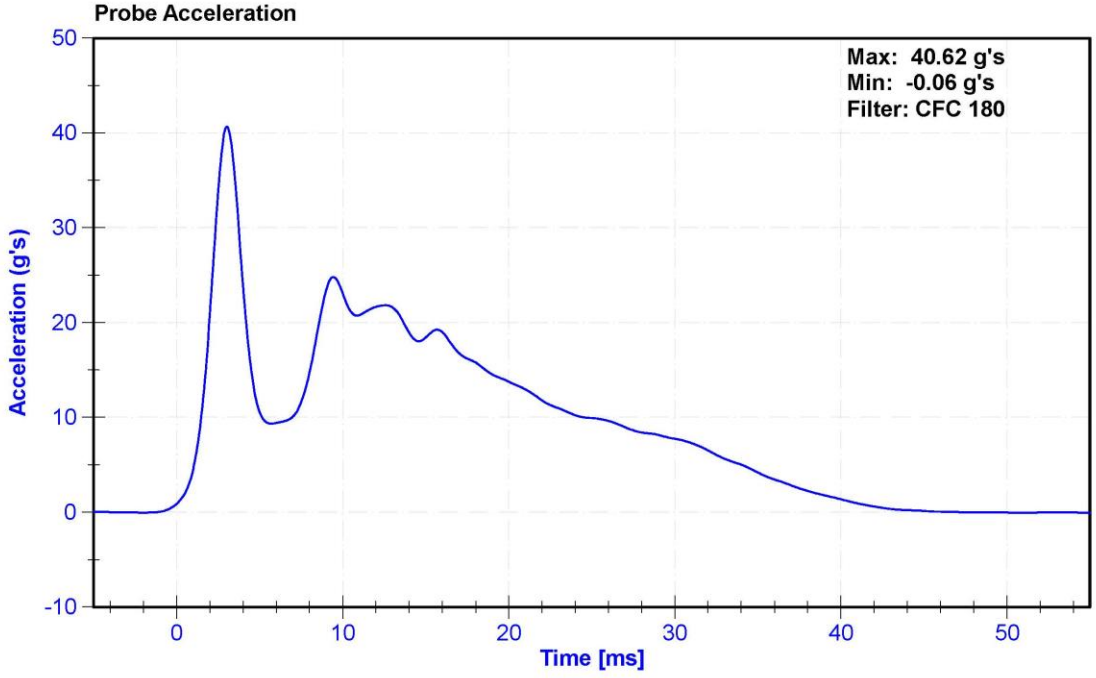
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

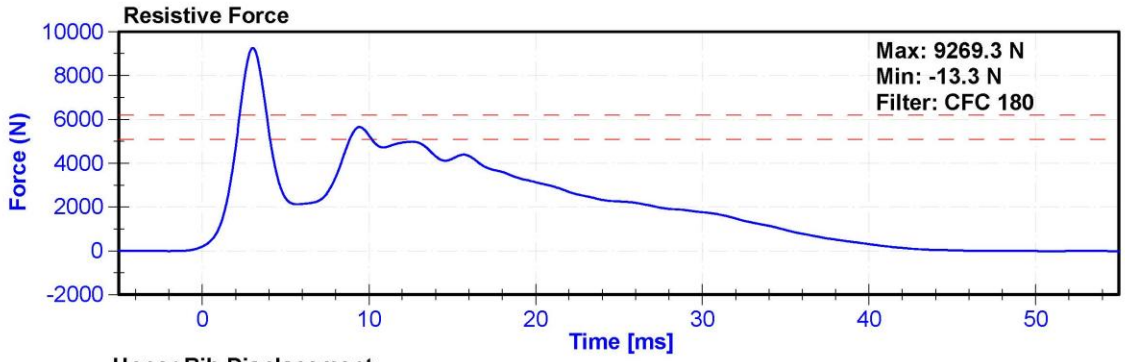
Results

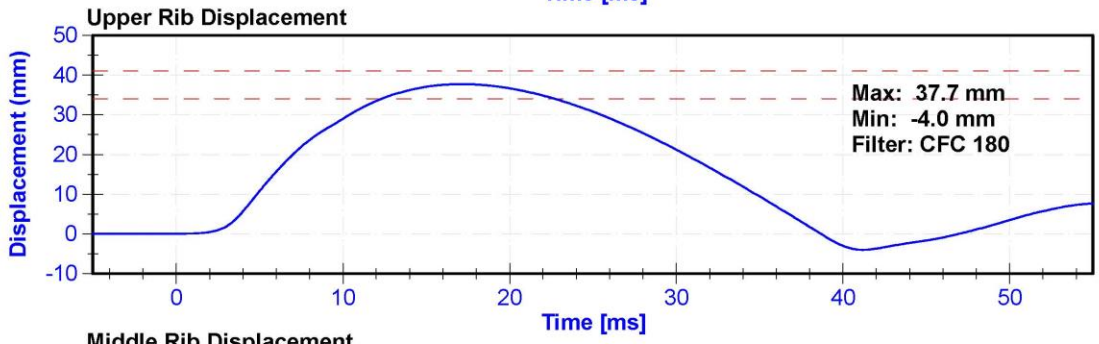
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	28.0	Pass
Velocity	5.4	5.6	m/s	5.46	Pass
Resistive Force after 6ms	5100	6200	N	5655.4	Pass
Upper Thorax Rib Deflection	34	41	mm	37.7	Pass
Mid Thorax Rib Deflection	37	45	mm	41.6	Pass
Lower Thorax Rib Deflection	37	44	mm	41.1	Pass

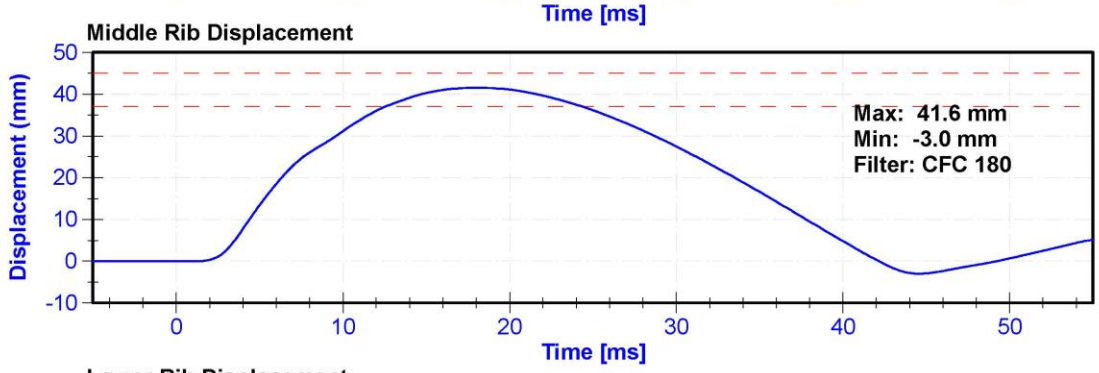
Transducer Calibrations

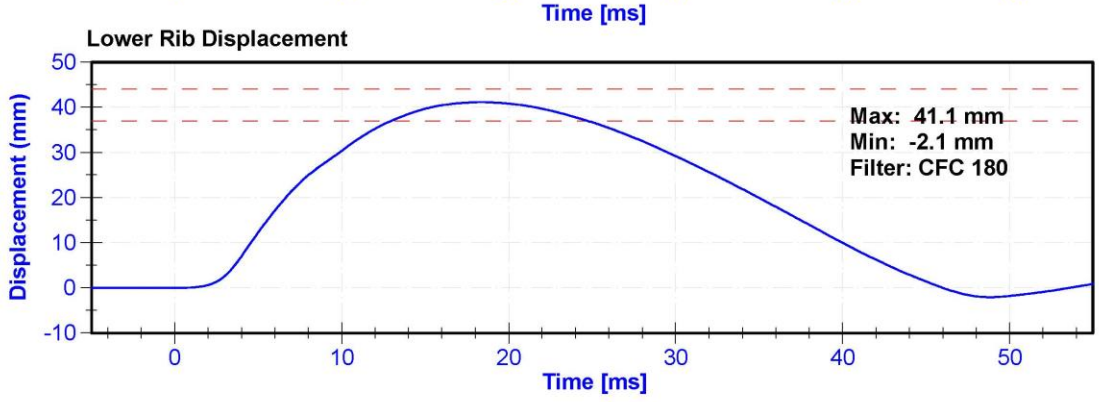
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A260487	8/22/2019	2/20/2020
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/31/2019	4/30/2020
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/31/2019	4/30/2020
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/31/2019	4/30/2020




Resistive Force
Max: 9269.3 N
Min: -13.3 N
Filter: CFC 180
Force (N)
Time [ms]


Upper Rib Displacement
Max: 37.7 mm
Min: -4.0 mm
Filter: CFC 180
Displacement (mm)
Time [ms]


Middle Rib Displacement
Max: 41.6 mm
Min: -3.0 mm
Filter: CFC 180
Displacement (mm)
Time [ms]


Lower Rib Displacement
Max: 41.1 mm
Min: -2.1 mm
Filter: CFC 180
Displacement (mm)
Time [ms]

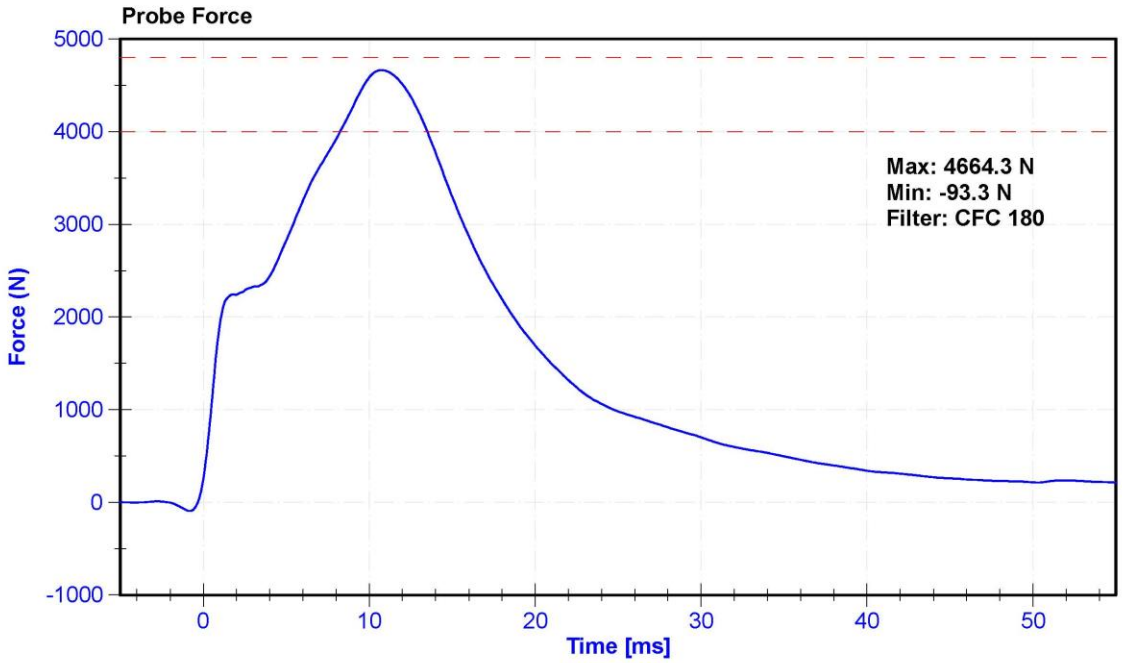
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

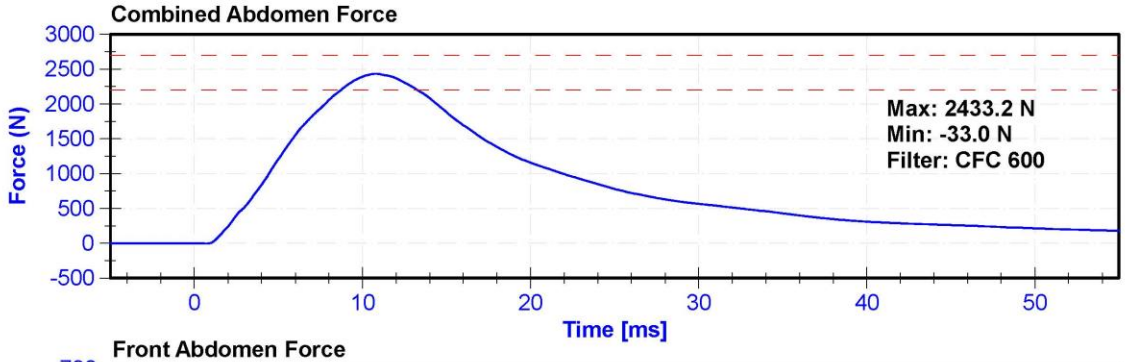
Results

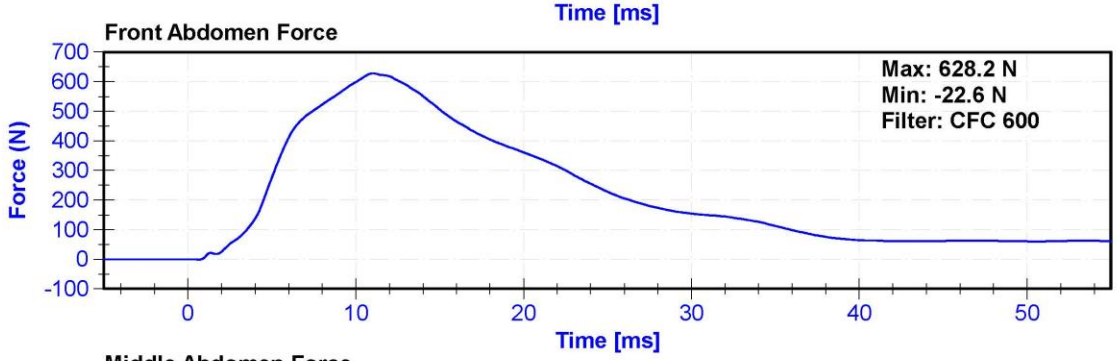
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	28	Pass
Velocity	3.9	4.1	m/s	4.09	Pass
Combined Abdomen Force	2200	2700	N	2433.2	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.80	Pass
Resistive Probe Force	4000	4800	N	4664.3	Pass
Time at Peak Resistive Force	10.6	13.0	ms	10.75	Pass

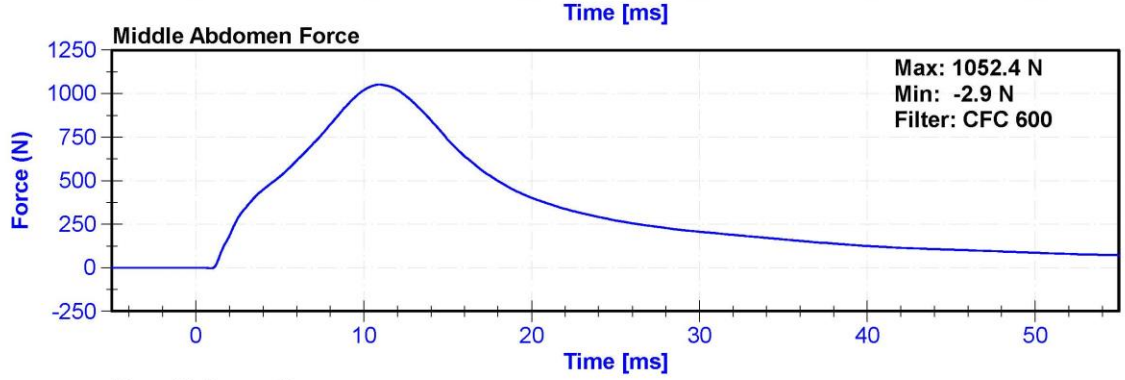
Transducer Calibrations

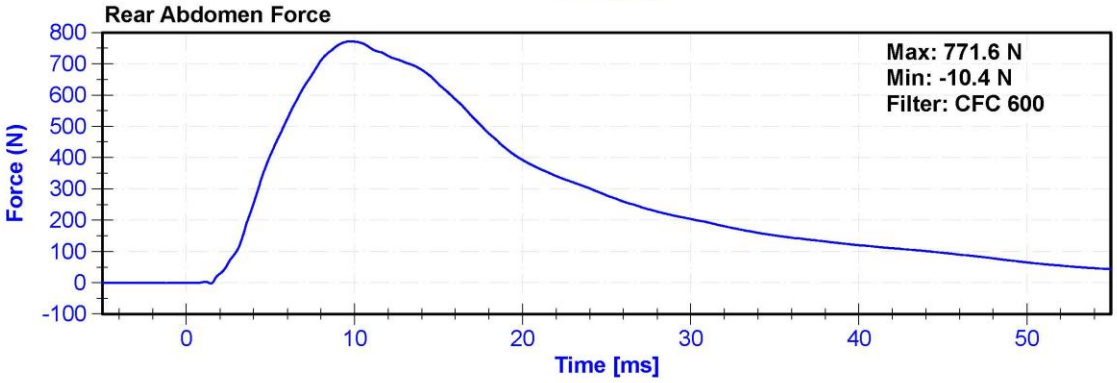
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	8/22/2019	2/20/2020
Front Abdomen Load Cell	DENTON 2631	LC-1440	6/14/2019	6/13/2020
Middle Abdomen Load Cell	DENTON 2631	LC-1525	6/5/2019	6/4/2020
Rear Abdomen Load Cell	DENTON 2631	LC-1528	6/14/2019	6/13/2020




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2433.2 N
Min: -33.0 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 628.2 N
Min: -22.6 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1052.4 N
Min: -2.9 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 771.6 N
Min: -10.4 N
Filter: CFC 600

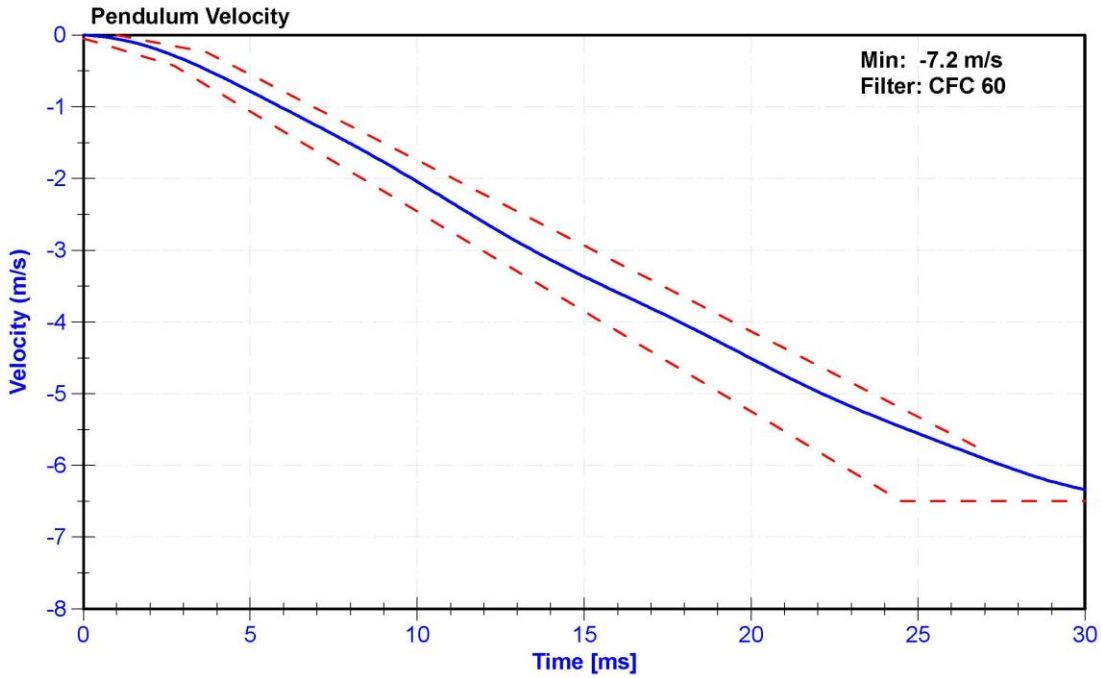
ATD Manufacturer	FTSS	Test Technician	M. Dudek
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

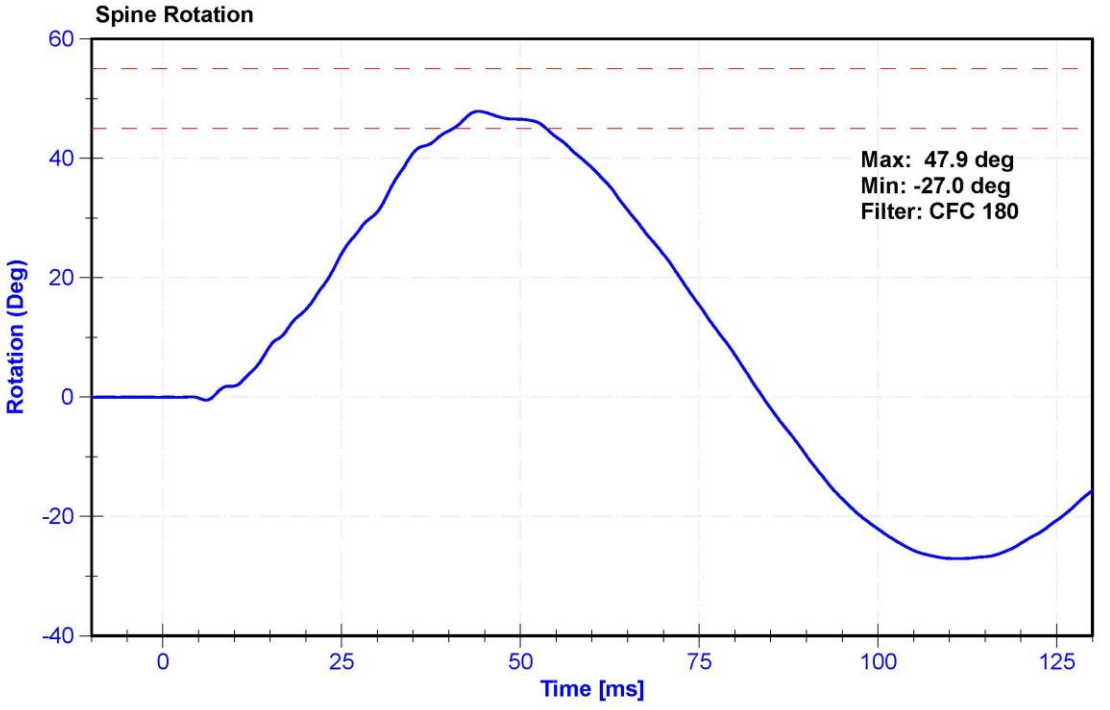
Results

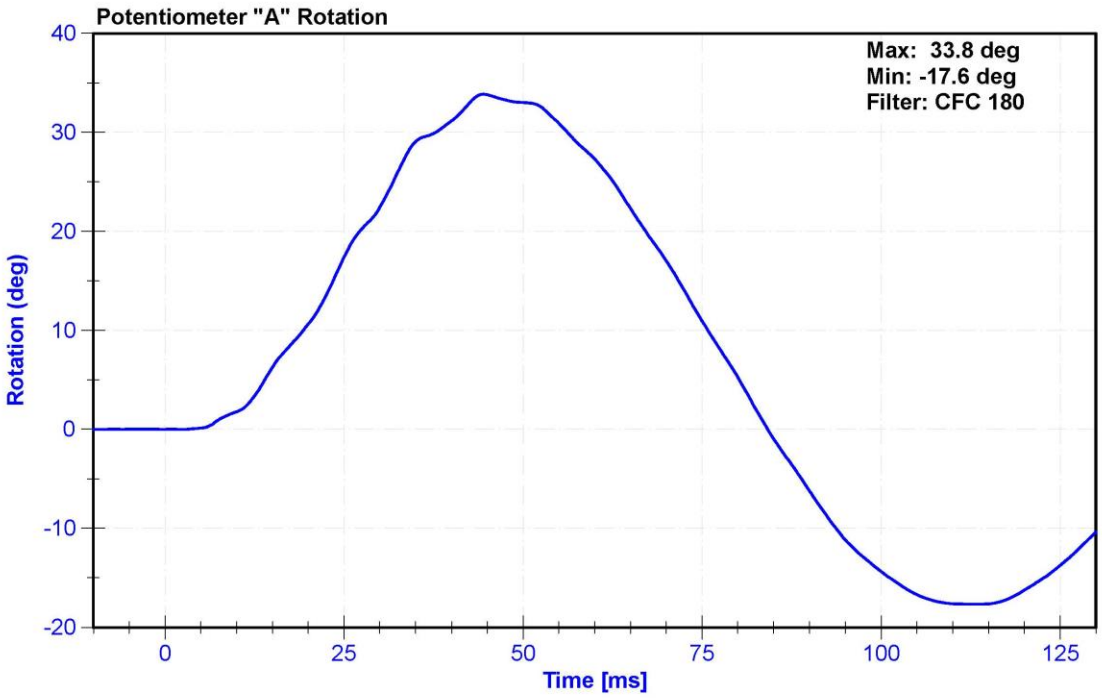
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	28.0	Pass
Velocity	5.95	6.15	m/s	5.964	Pass
Lateral Spine Rotation	45	55	deg	47.9	Pass
Time at Maximum Rotation	39	53	ms	44.1	Pass
Time of Decay to Zero Degrees	37	57	ms	39.8	Pass
Pulse within Corridor?	-	-	-		

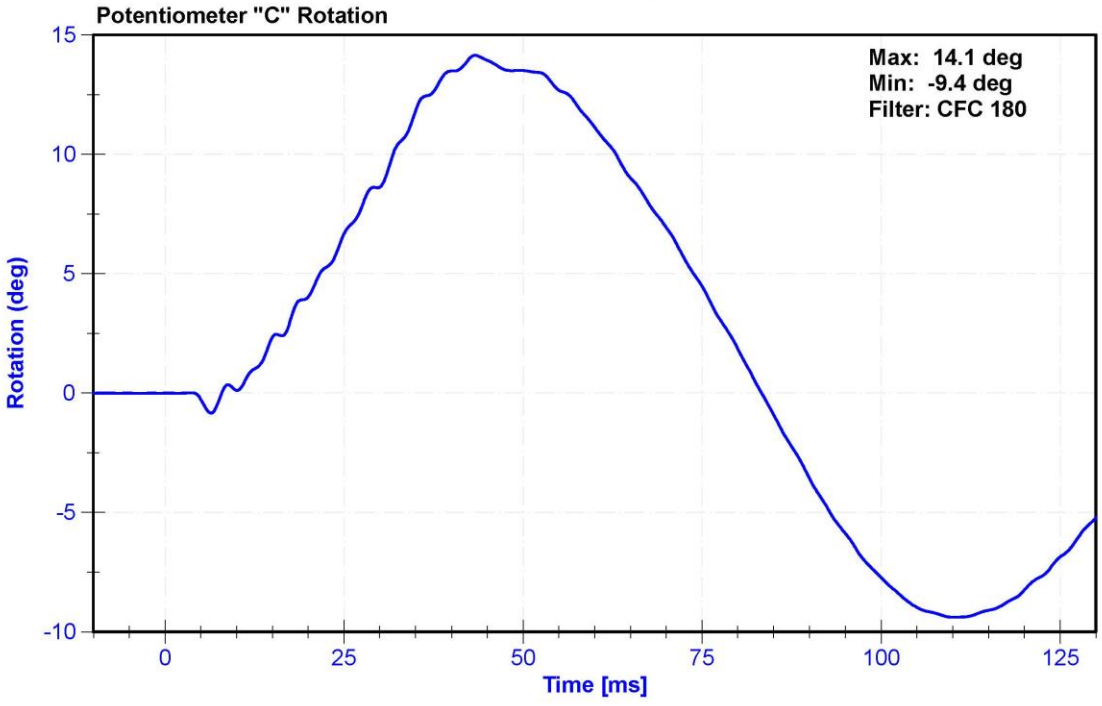
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
Pendulum "A" Potentiometer	SP22G	DS-094	10/31/2019	10/30/2020
Condyle "B" Potentiometer	SP22G	DS-095	10/31/2019	10/30/2020


Pendulum Velocity
Min: -7.2 m/s
Filter: CFC 60
Velocity (m/s)
0
-1
-2
-3
-4
-5
-6
-7
-8
0
5
10
15
20
25
30
Time [ms]


Spine Rotation
Max: 47.9 deg
Min: -27.0 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 33.8 deg
Min: -17.6 deg
Filter: CFC 180
Rotation (deg)
40
30
20
10
0
-10
-20
0
25
50
75
100
125
Time [ms]


Potentiometer "C" Rotation
Max: 14.1 deg
Min: -9.4 deg
Filter: CFC 180
Rotation (deg)
15
10
5
0
-5
-10
0
25
50
75
100
125
Time [ms]

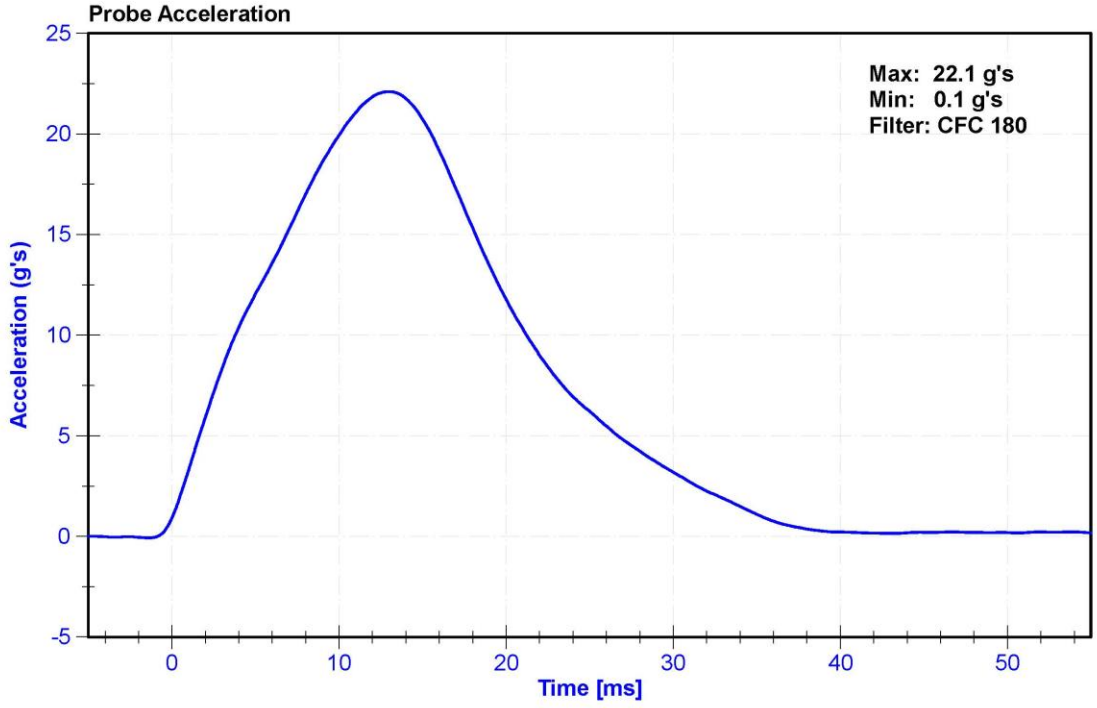
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

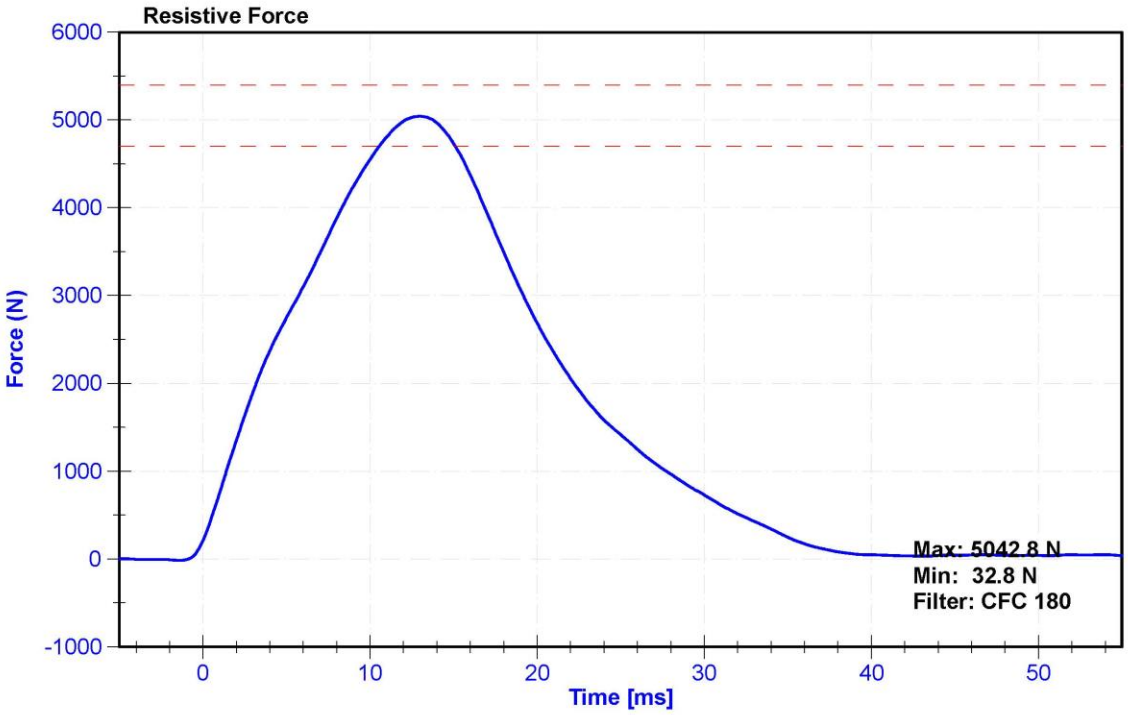
Results

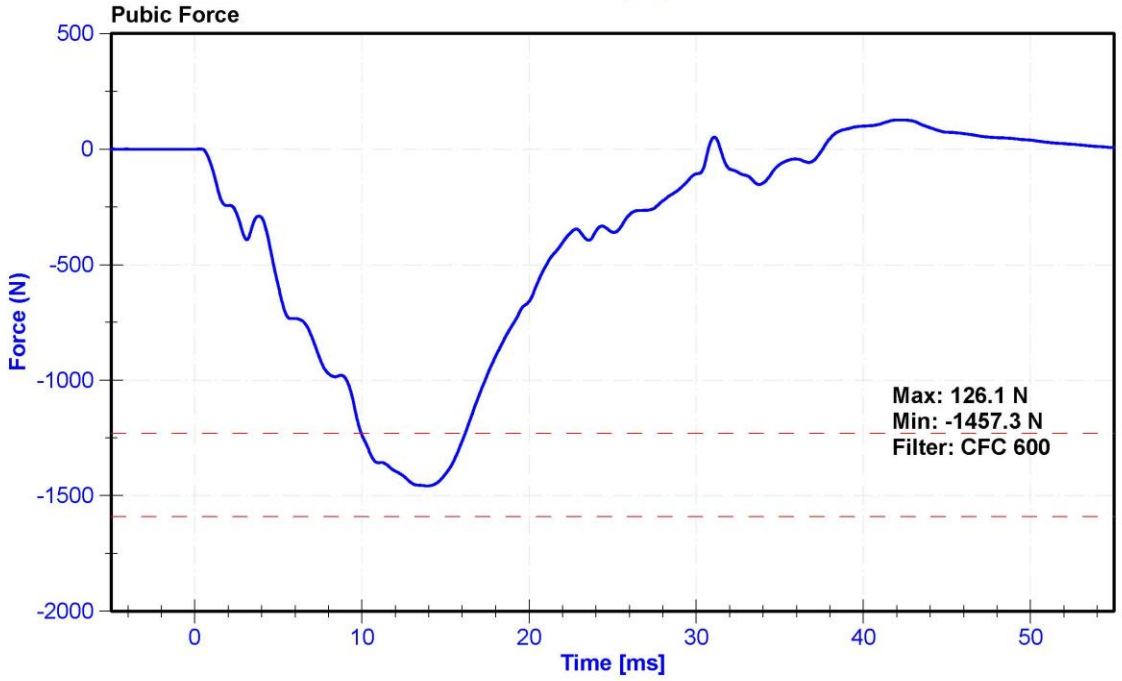
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	28.0	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Resistive Force	4700	5400	N	5042.8	Pass
Time at Peak Resistive Force	11.8	16.1	ms	13.00	Pass
Pubic Force	-1590	-1230	N	-1457.3	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.90	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	8/22/2019	2/20/2020
Pubic Load Cell	Denton 3096JFL	LC-464fy	6/14/2019	6/13/2020




Resistive Force
Force (N)
Time [ms]
Max: 5042.8 N
Min: 32.8 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 126.1 N
Min: -1457.3 N
Filter: CFC 600

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

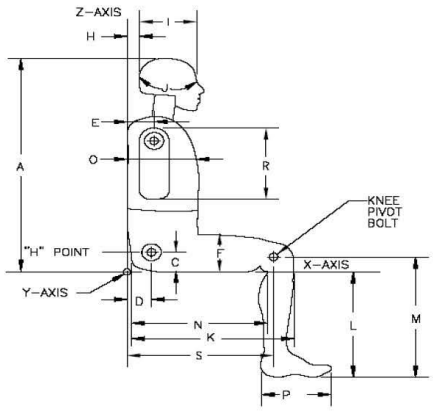
SERIAL No: 300

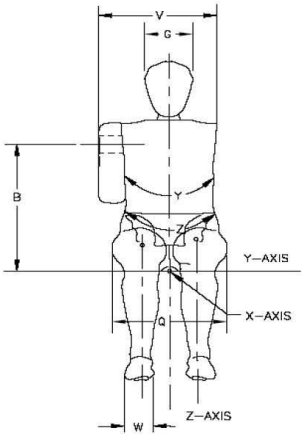
(CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - SID-IIs

Technician: K. Dutton Date: 11/05/2019

Dummy Serial Number: 300





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	779	Pass
B	Shoulder Pivot Height	437	453	450	Pass
C	H-point Height	79	89	85	Pass
D	H-point from seatback	141	151	145	Pass
E	Shoulder Pivot from Backline	97	107	103	Pass
F	Thigh Clearance	119	135	127	Pass
G	Head Breadth	140	148	145	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	185	Pass
J	Head Circumference	541	551	546	Pass
K	Buttock to Knee Length	514	540	530	Pass
L	Popliteal Height	343	369	356	Pass
M	Knee Pivot to floor height	392	409	402	Pass
N	Buttock Popliteal Length	416	442	431	Pass
O	Chest Depth w/o jacket	195	211	203	Pass
P	Foot Length	216	232	222	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	319	Pass
R	Arm Length	249	259	253	Pass
S	Knee Joint to seatback	477	493	485	Pass
V	Shoulder Width	341	357	351	Pass
W	Foot Width	78	94	84	Pass
Y	Chest Circumference w/jacket	851	881	870	Pass
Z	Waist Circumference	761	791	769	Pass

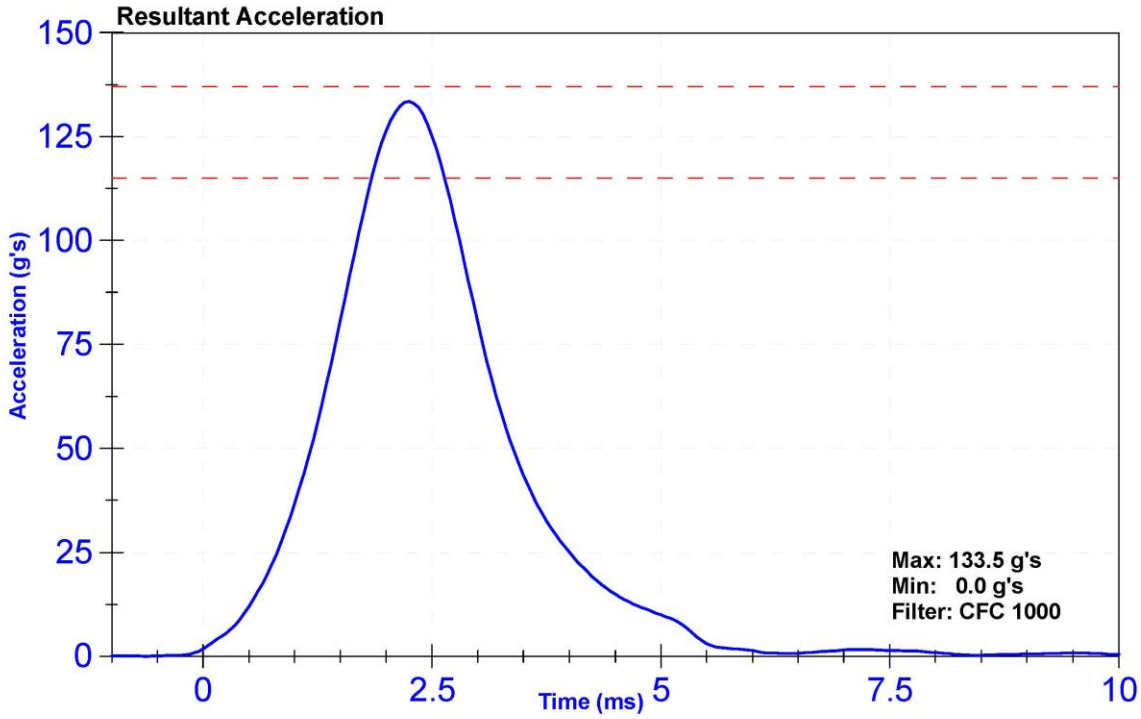
ATD Manufacturer	FTSS	Test Technician	E. Helenbrook
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

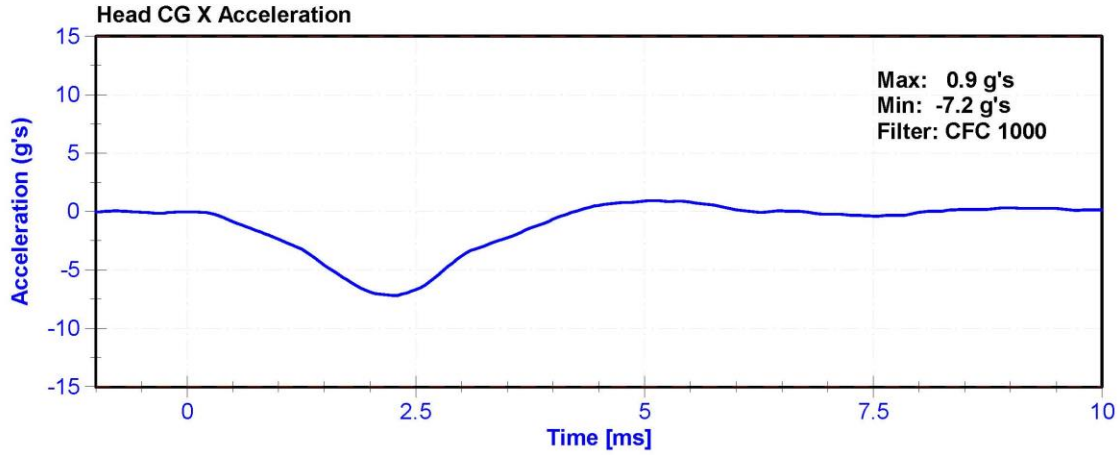
Results

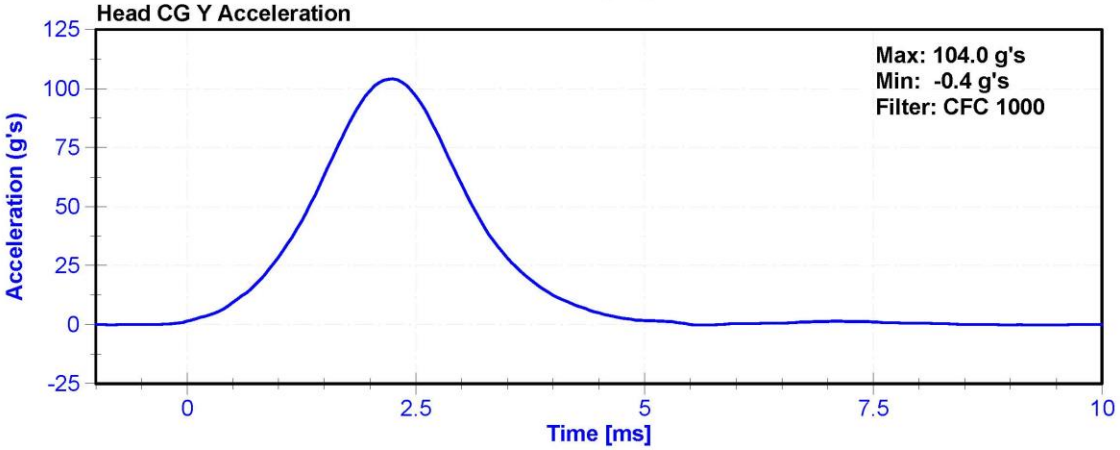
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	29.1	Pass
Resultant Acceleration	115	137	g's	133.5	Pass
Oscillation	0	15	%	1.2	Pass
Fore-Aft Acceleration	-15	15	g's	-7.2	Pass

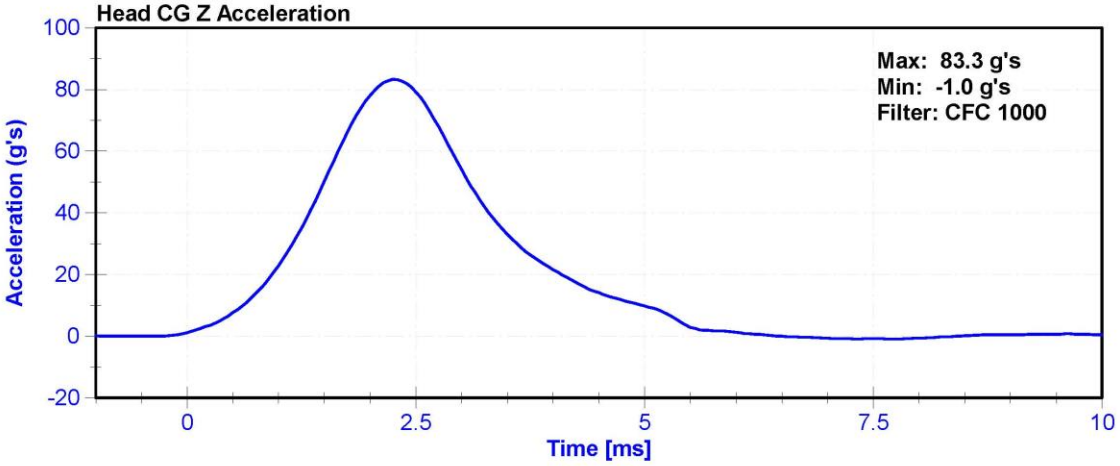
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	P68057	10/29/2019	4/29/2019
Y Accelerometer	Endevco	P79189	10/29/2019	4/29/2019
Z Accelerometer	Endevco	P52095	10/29/2019	4/29/2019




Head CG X Acceleration
Max: 0.9 g's
Min: -7.2 g's
Filter: CFC 1000
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]


Head CG Y Acceleration
Max: 104.0 g's
Min: -0.4 g's
Filter: CFC 1000
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]


Head CG Z Acceleration
Max: 83.3 g's
Min: -1.0 g's
Filter: CFC 1000
Acceleration (g's)
100
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]

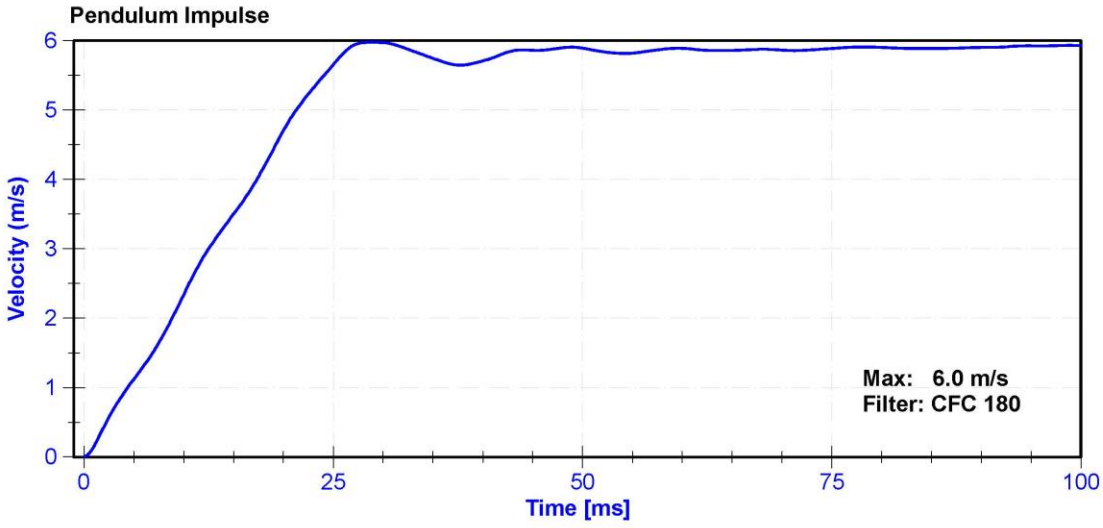
ATD Manufacturer	FTSS	Test Technician	M. Dudek
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

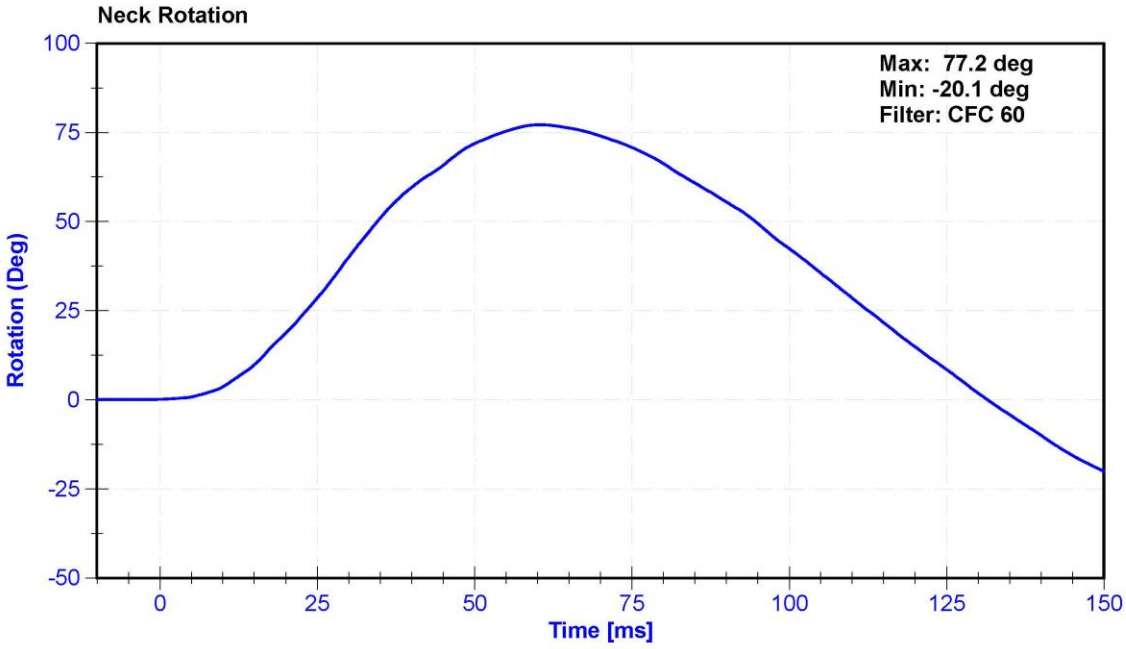
Results

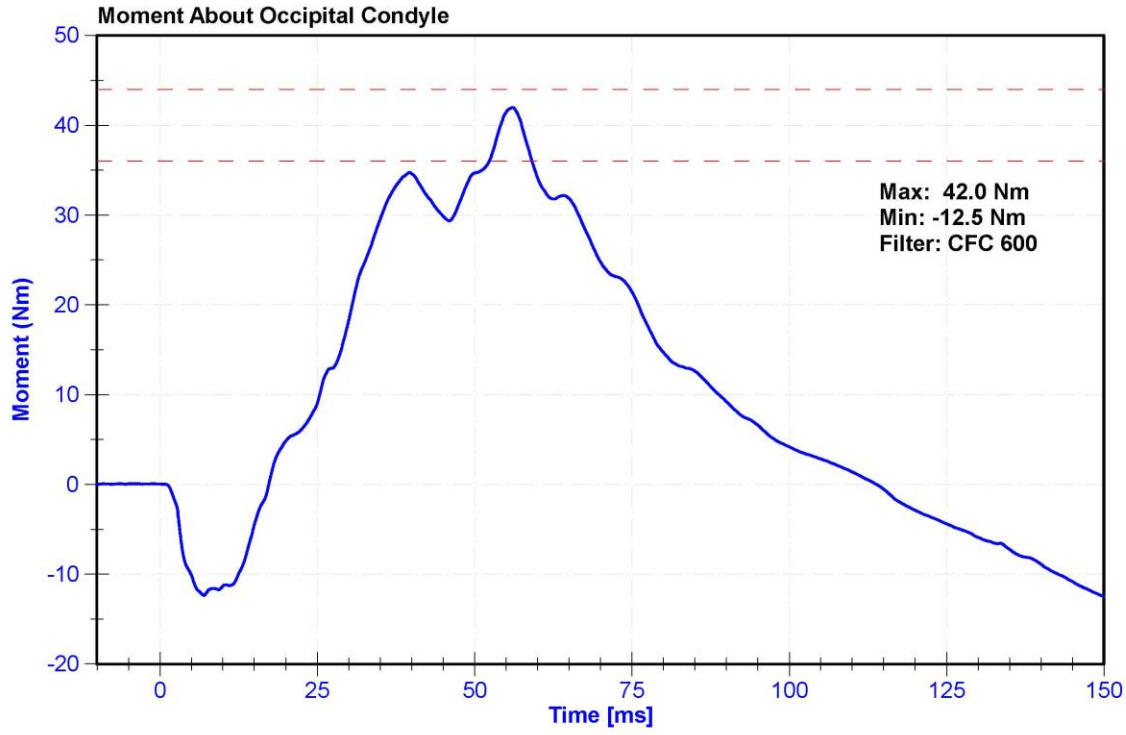
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	36.7	Pass
Velocity	5.51	5.63	m/s	5.549	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.34	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.50	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.70	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.65	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.98	Pass
Neck Rotation	71	81	deg	77.2	Pass
Time at Maximum Rotation	50	70	ms	60.4	Pass
Moment about the OC	36	44	Nm	42.0	Pass
Moment Decay to 0 Nm	102	126	ms	113.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
Pendulum Potentiometer	Denton 78051-342	DS-184Pend	11/4/2019	11/3/2020
Condyle Potentiometer	Denton 78051-342	DS-185Pend	11/4/2019	11/3/2020
Upper Neck Load Cell	Denton 1716A	LC-2192Fy	6/20/2019	6/19/2020




Neck Rotation
Max: 77.2 deg
Min: -20.1 deg
Filter: CFC 60
Rotation (Deg)
Time [ms]
100
75
50
25
0
-25
-50
0
25
50
75
100
125
150


Moment About Occipital Condyle
Max: 42.0 Nm
Min: -12.5 Nm
Filter: CFC 600
Moment (Nm)
Time [ms]
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150

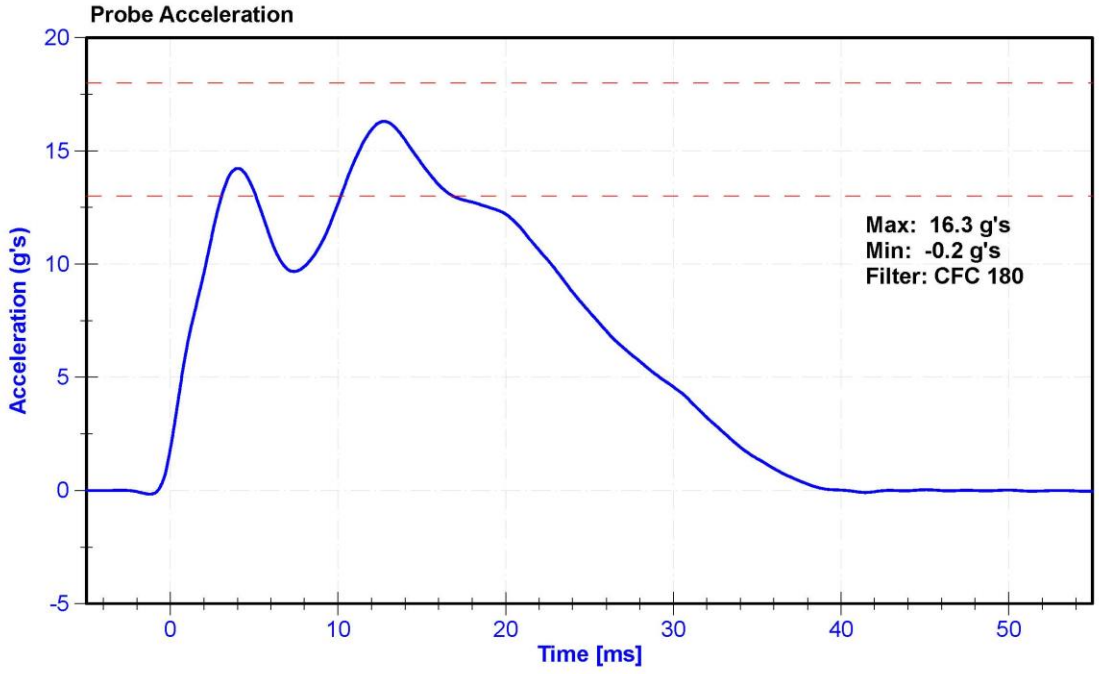
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

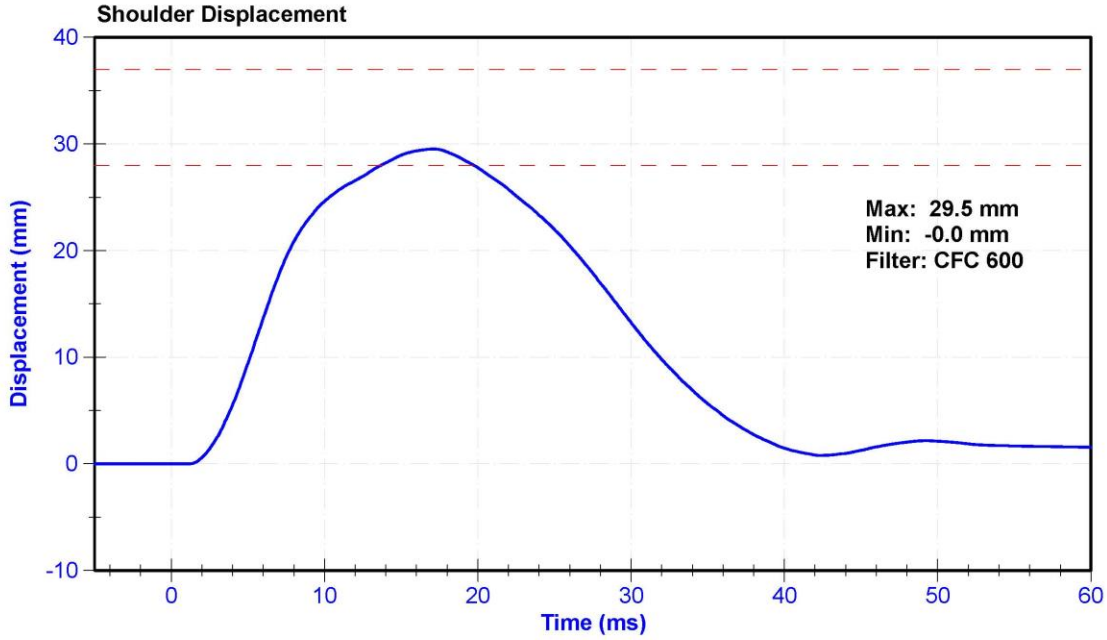
Results

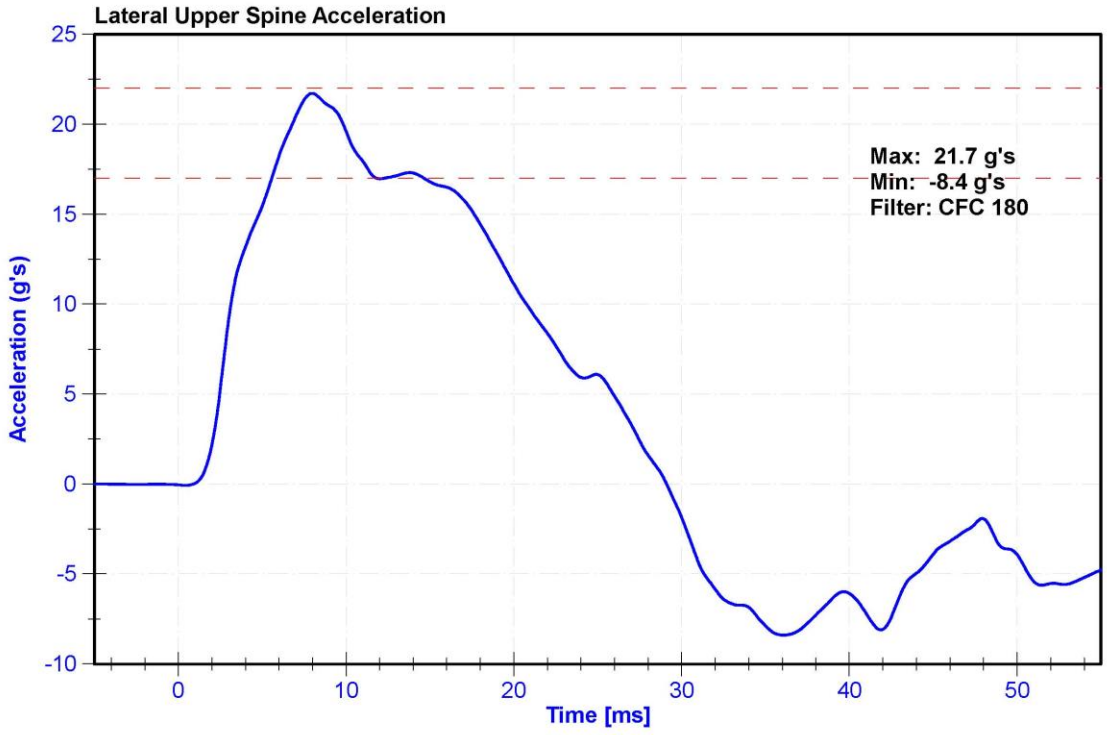
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	34.9	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Probe Acceleration	13	18	g's	16.3	Pass
Shoulder Deflection	28	37	mm	29.5	Pass
Lateral Upper Spine Acceleration	17	22	g's	21.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	8/22/2019	2/20/2020
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	10/29/2019	4/28/2020
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/29/2019	4/28/2020




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 29.5 mm
Min: -0.0 mm
Filter: CFC 600
40
30
20
10
0
-10
0
10
20
30
40
50
60


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 21.7 g's
Min: -8.4 g's
Filter: CFC 180
25
20
15
10
5
0
-5
-10
0
10
20
30
40
50

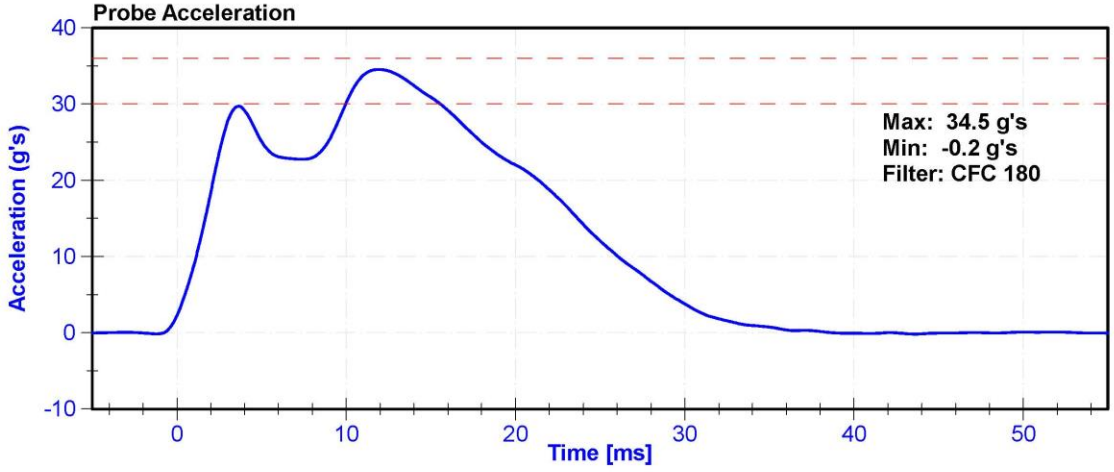
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

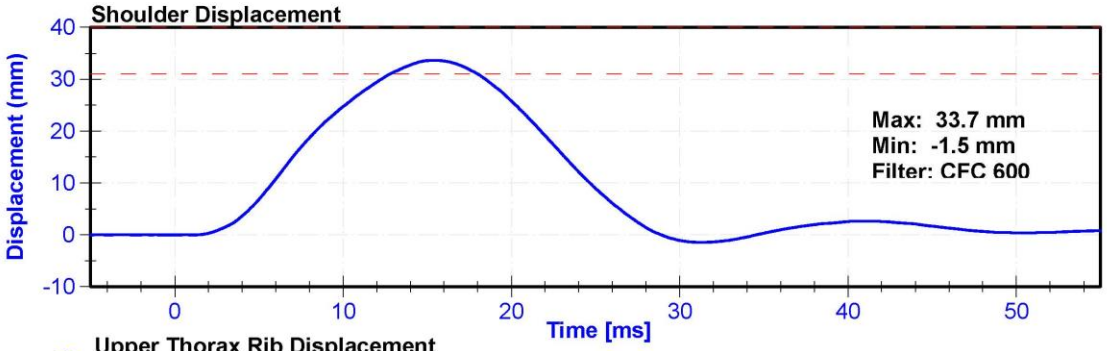
Results

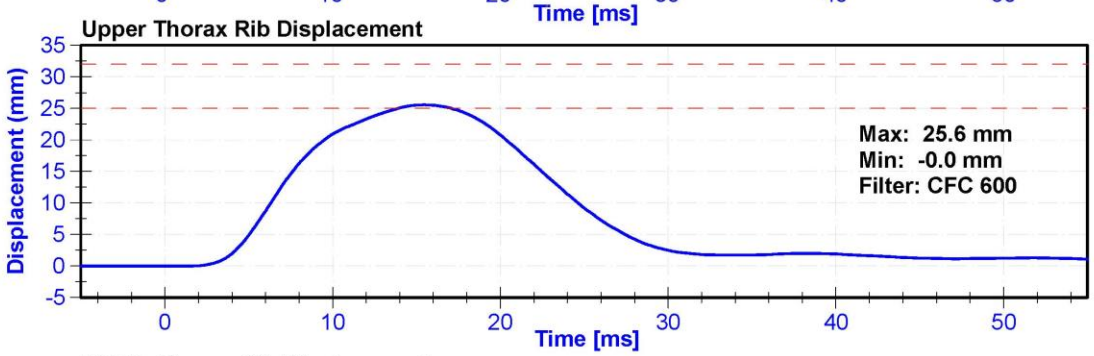
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	27.9	Pass
Velocity	6.6	6.8	m/s	6.74	Pass
Probe Acceleration after 5 ms	30	36	g's	34.5	Pass
Lateral Upper Spine Acceleration	34	43	g's	38.5	Pass
Lateral Lower Spine Acceleration	29	37	g's	33.9	Pass
Shoulder Deflection	31	40	mm	33.7	Pass
Upper Thorax Rib Deflection	25	32	mm	25.6	Pass
Mid Thorax Rib Deflection	30	36	mm	31.0	Pass
Lower Thorax Rib Deflection	32	38	mm	33.9	Pass

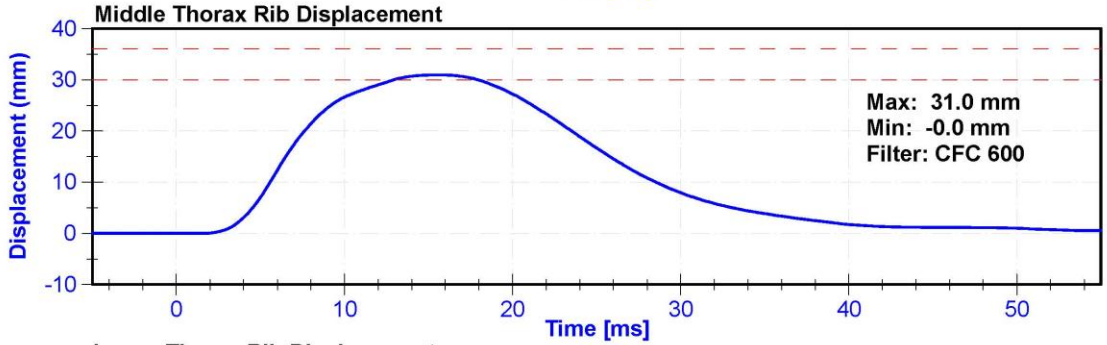
Transducer Calibrations

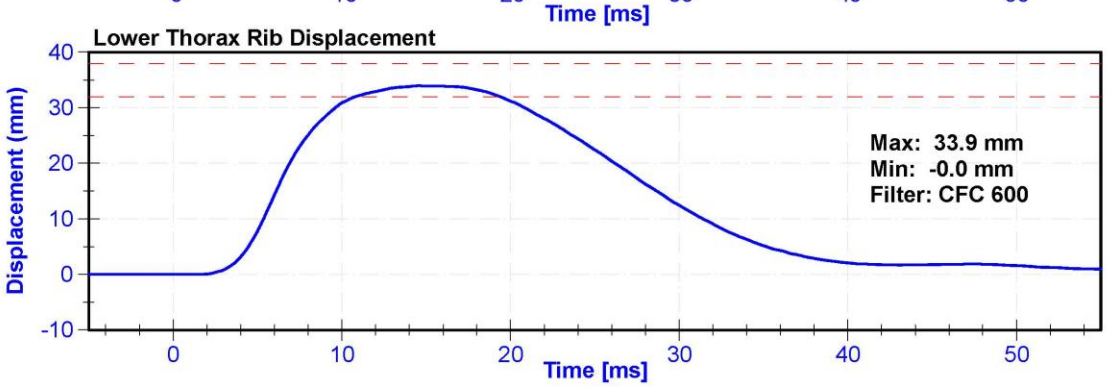
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	8/22/2019	2/20/2020
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/29/2019	4/28/2020
Upper Spine T12 Y Accelerometer	ENDEVCO 7264	AC-P64147	10/29/2019	4/28/2020
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	10/29/2019	4/28/2020
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	10/29/2019	4/28/2020
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	10/29/2019	4/28/2020
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	10/29/2019	4/28/2020

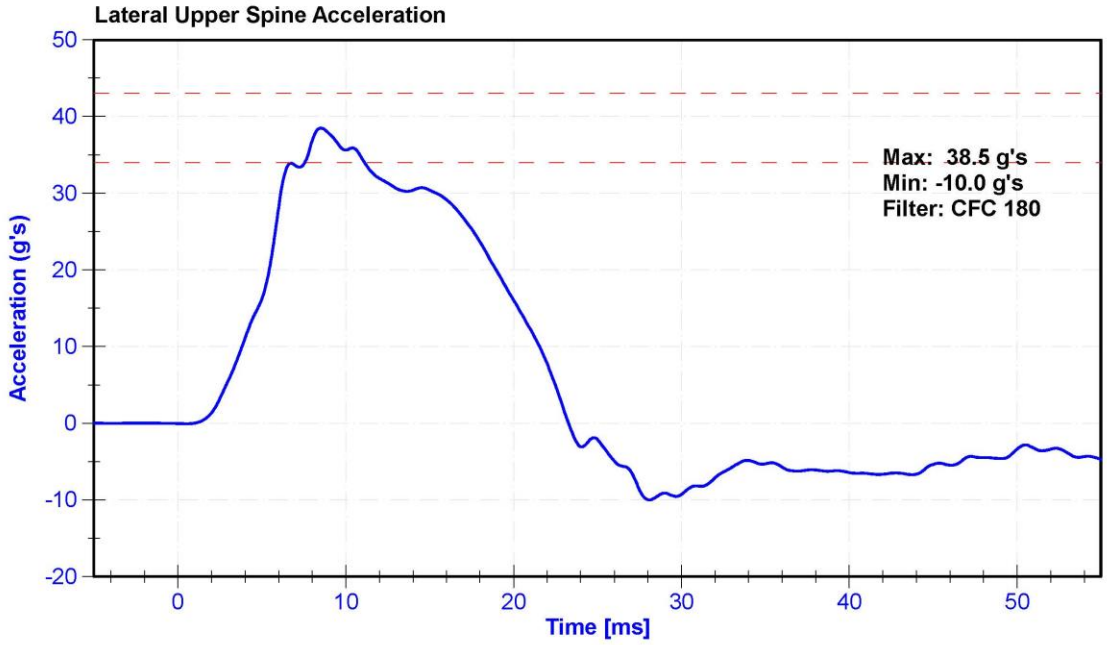


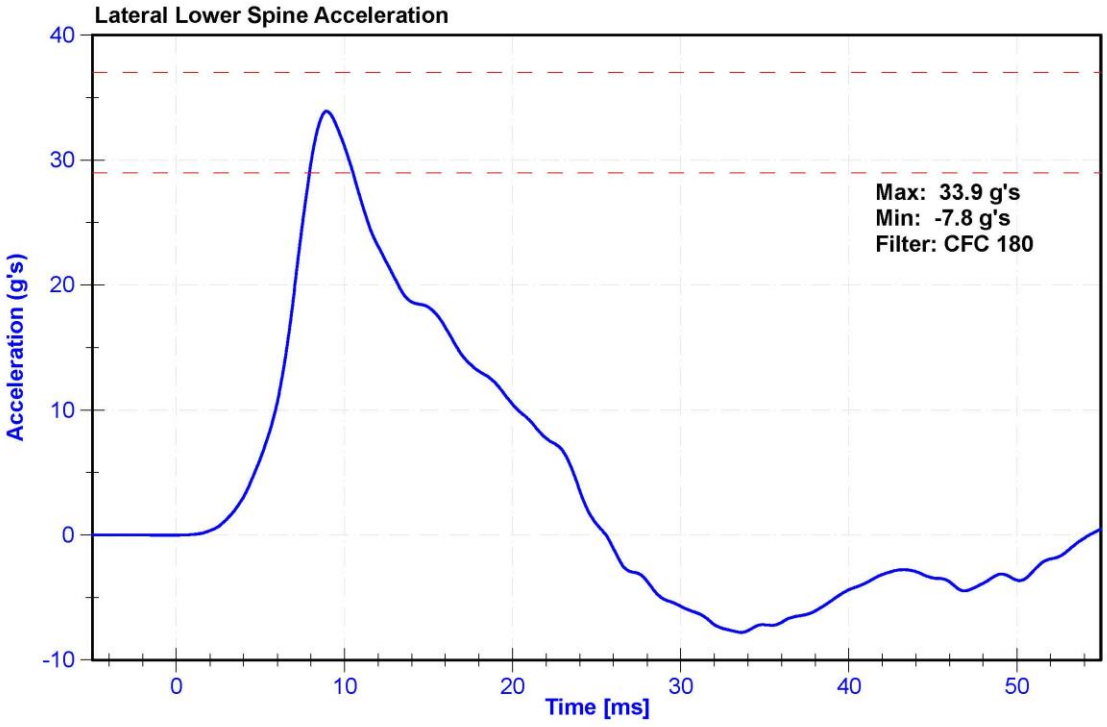

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 33.7 mm
Min: -1.5 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 25.6 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 31.0 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 33.9 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 38.5 g's
Min: -10.0 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 33.9 g's
Min: -7.8 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
0
10
20
30
40
50

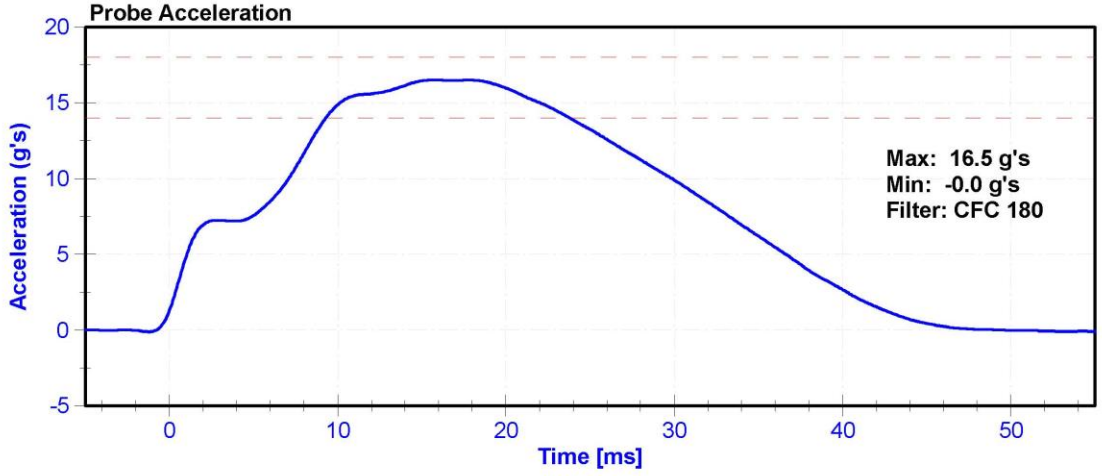
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

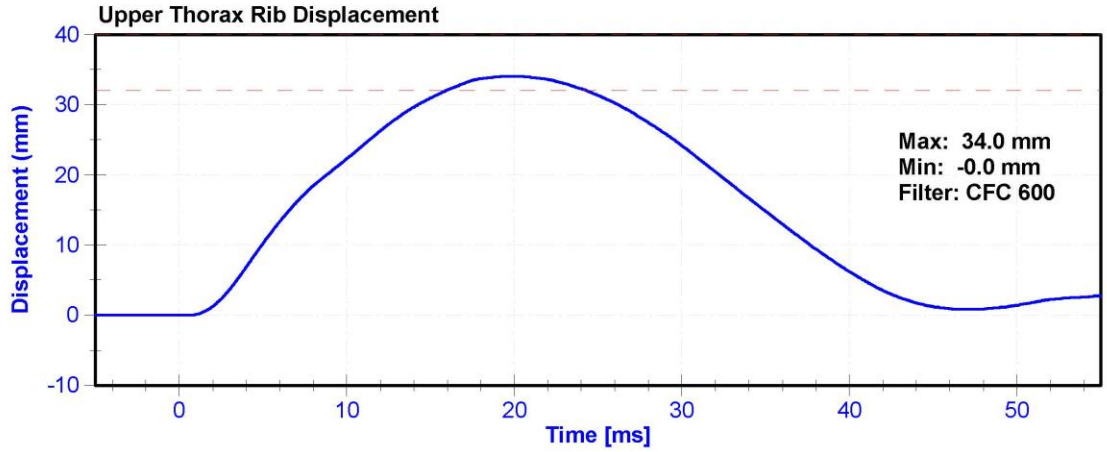
Results

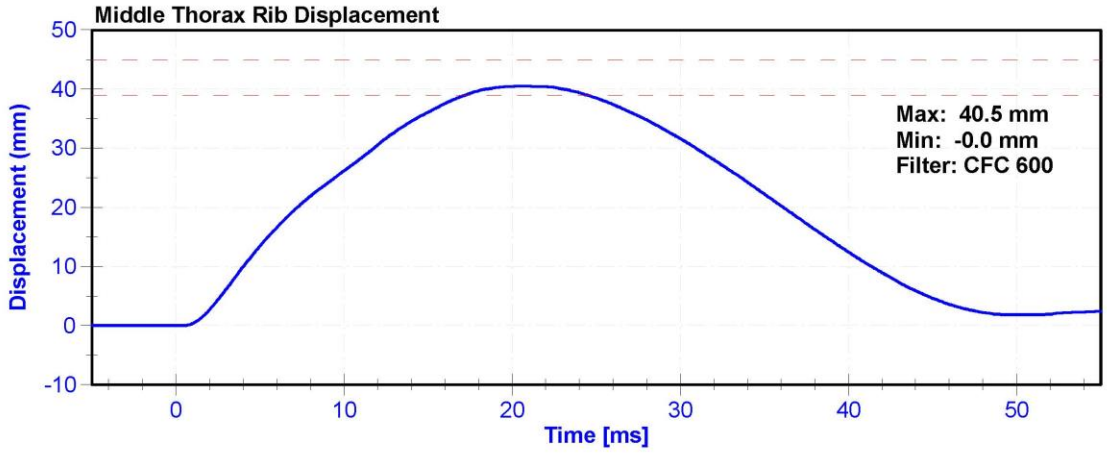
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.1	Pass
Humidity	10	70	%	27.6	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	14	18	g's	16.5	Pass
Lateral Upper Spine Acceleration	13	17	g's	14.0	Pass
Lateral Lower Spine Acceleration	7	11	g's	10.3	Pass
Upper Thorax Rib Deflection	32	40	mm	34.0	Pass
Middle Thorax Rib Deflection	39	45	mm	40.5	Pass
Lower Thorax Rib Deflection	35	43	mm	37.4	Pass

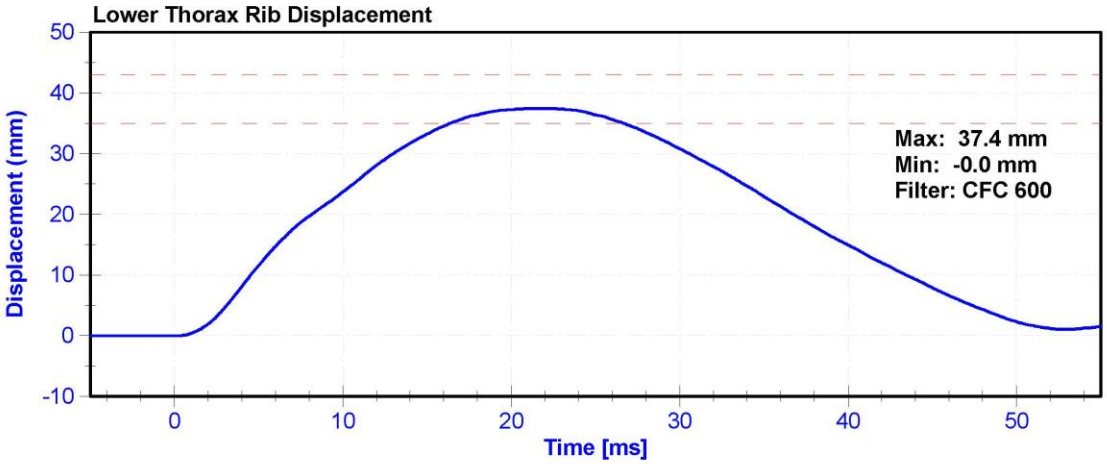
Transducer Calibrations

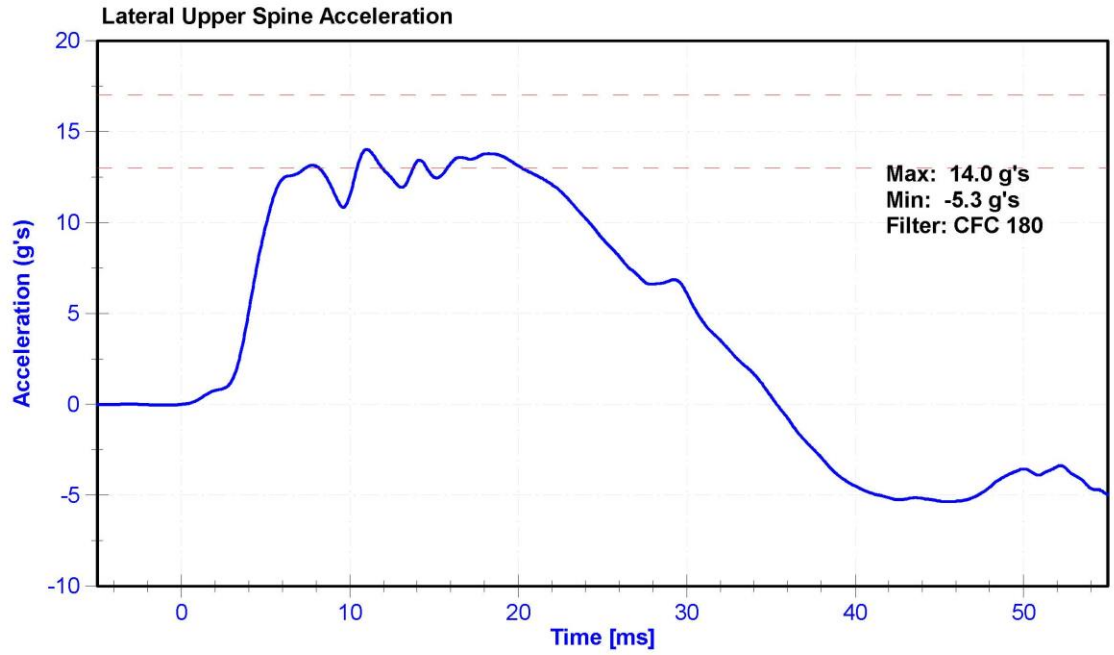
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	8/22/2019	2/20/2020
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/29/2019	4/28/2020
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	10/29/2019	4/28/2020
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	10/29/2019	4/28/2020
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	10/29/2019	4/28/2020
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	10/29/2019	4/28/2020

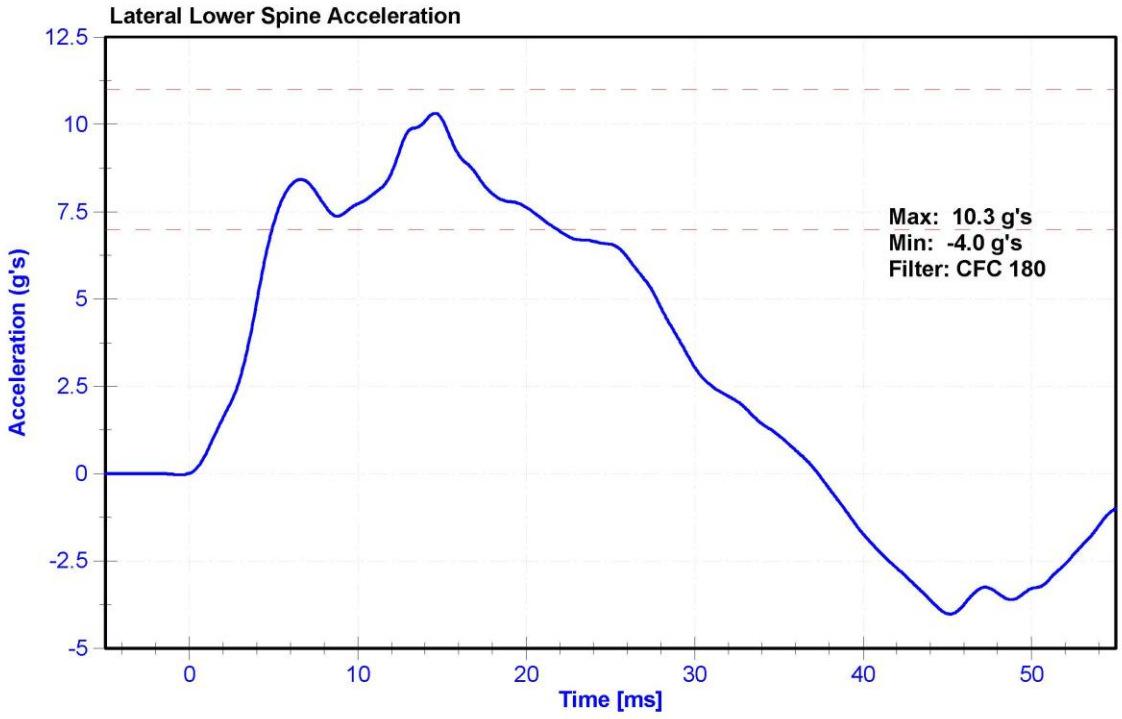



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 34.0 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.5 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.4 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 14.0 g's
Min: -5.3 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
20
15
10
5
0
-5
-10
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 10.3 g's
Min: -4.0 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50

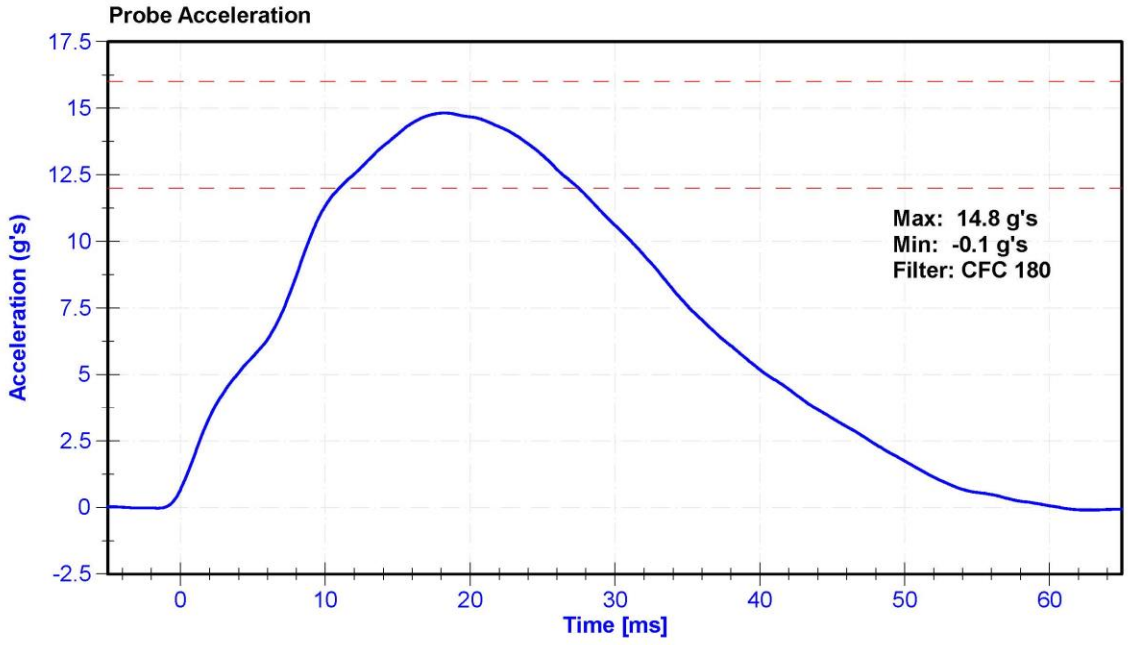
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

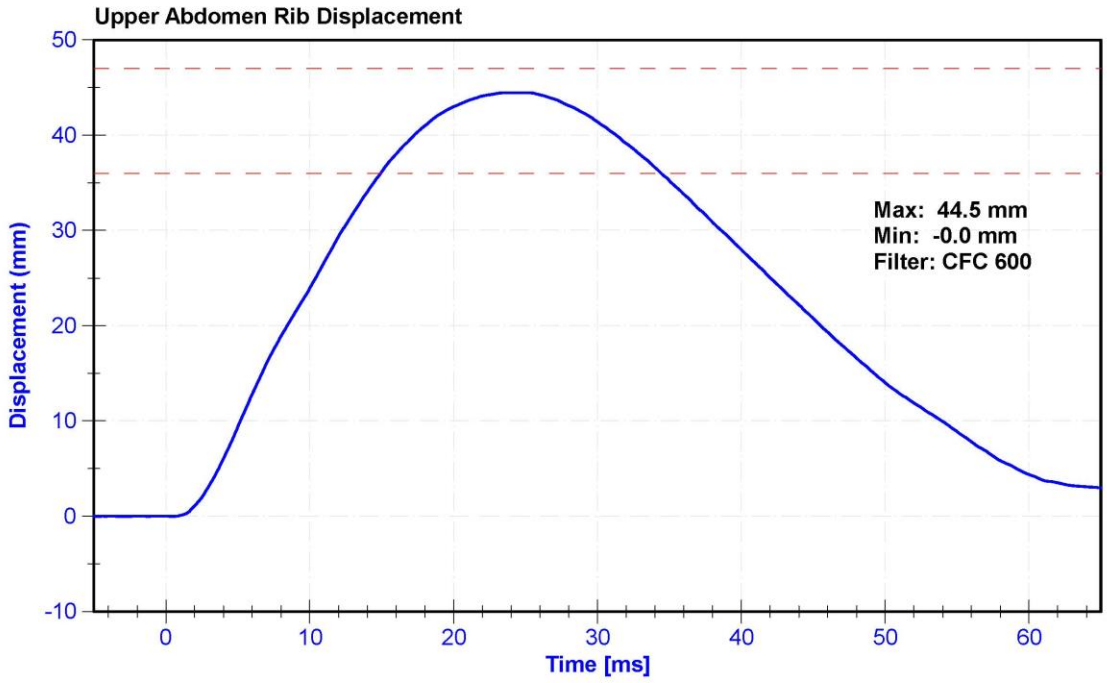
Results

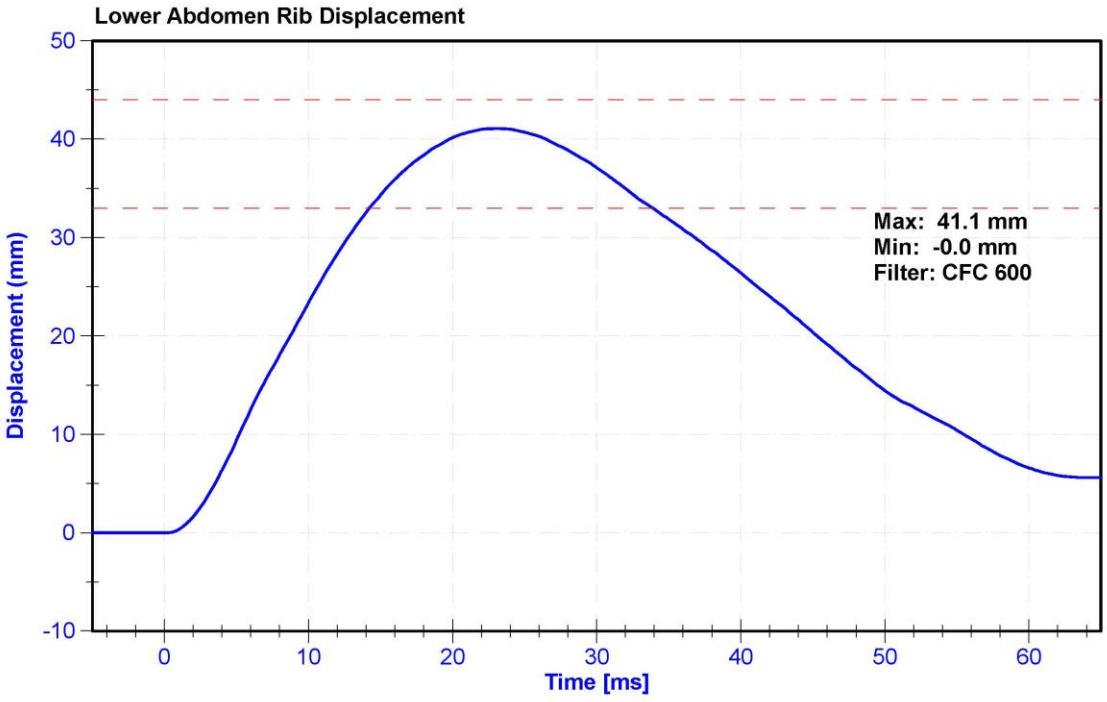
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	27.5	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Probe Acceleration	12	16	g's	14.8	Pass
Lateral Lower Spine Acceleration	9	14	g's	11.5	Pass
Upper Abdomen Rib Deflection	36	47	mm	44.5	Pass
Lower Abdomen Rib Deflection	33	44	mm	41.1	Pass

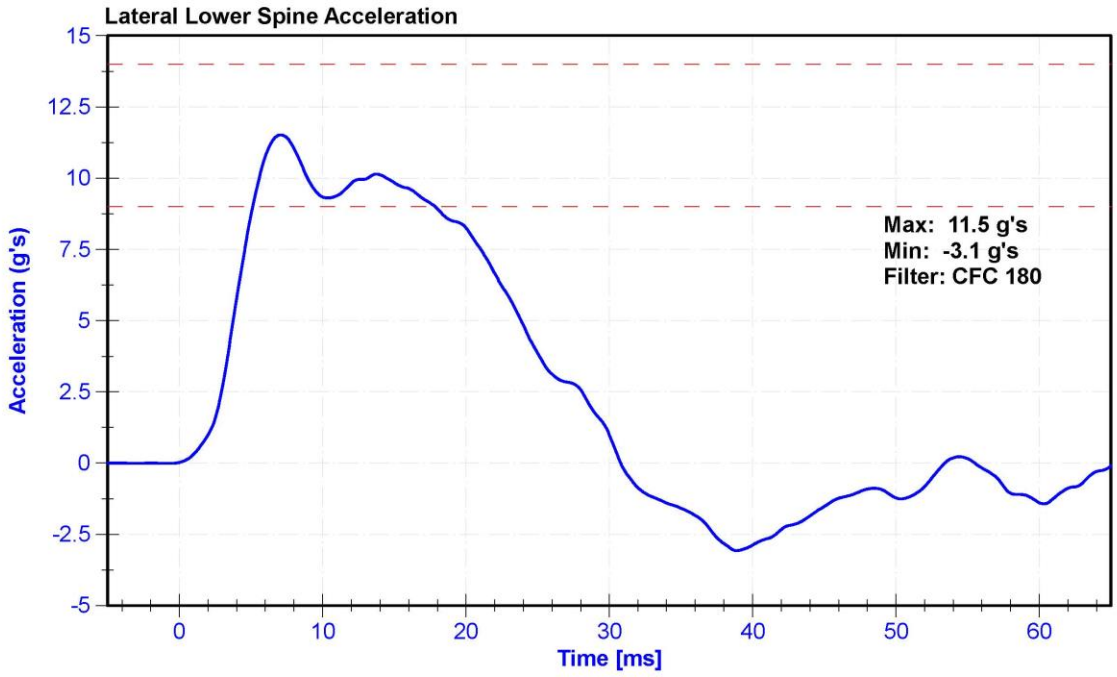
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A260487	8/22/2019	2/20/2020
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	10/29/2019	4/28/2020
Upper Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-308GFE	10/29/2019	4/28/2020
Lower Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-307GFE	10/29/2019	4/28/2020




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 44.5 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.1 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Lower Spine Acceleration
Acceleration (g's)
15
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50
60
Time [ms]
Max: 11.5 g's
Min: -3.1 g's
Filter: CFC 180

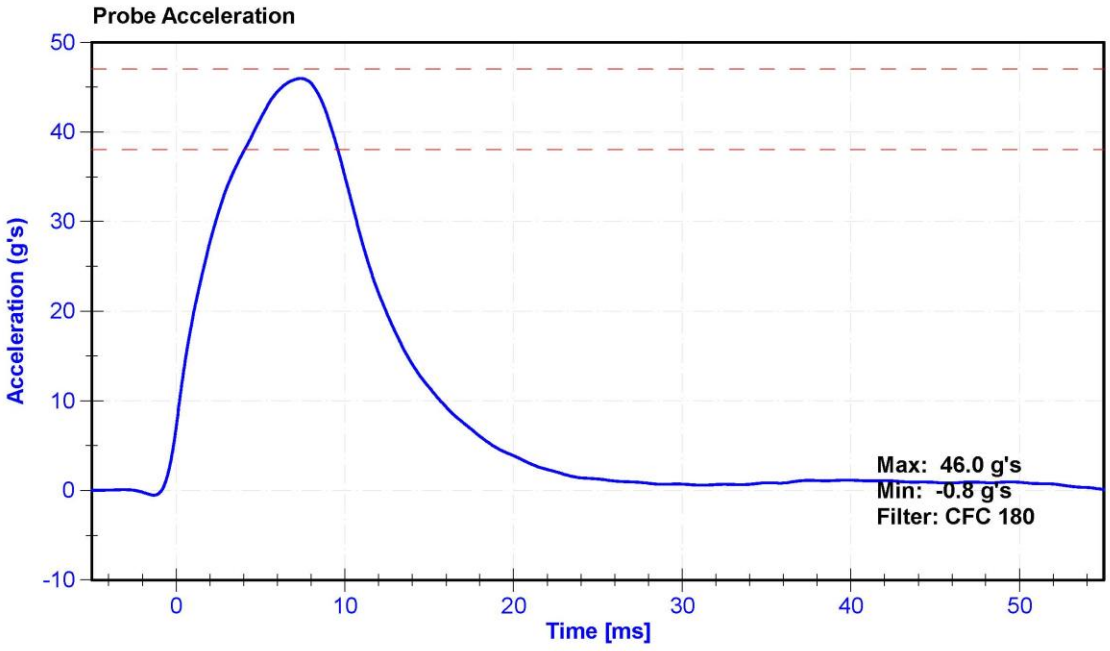
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

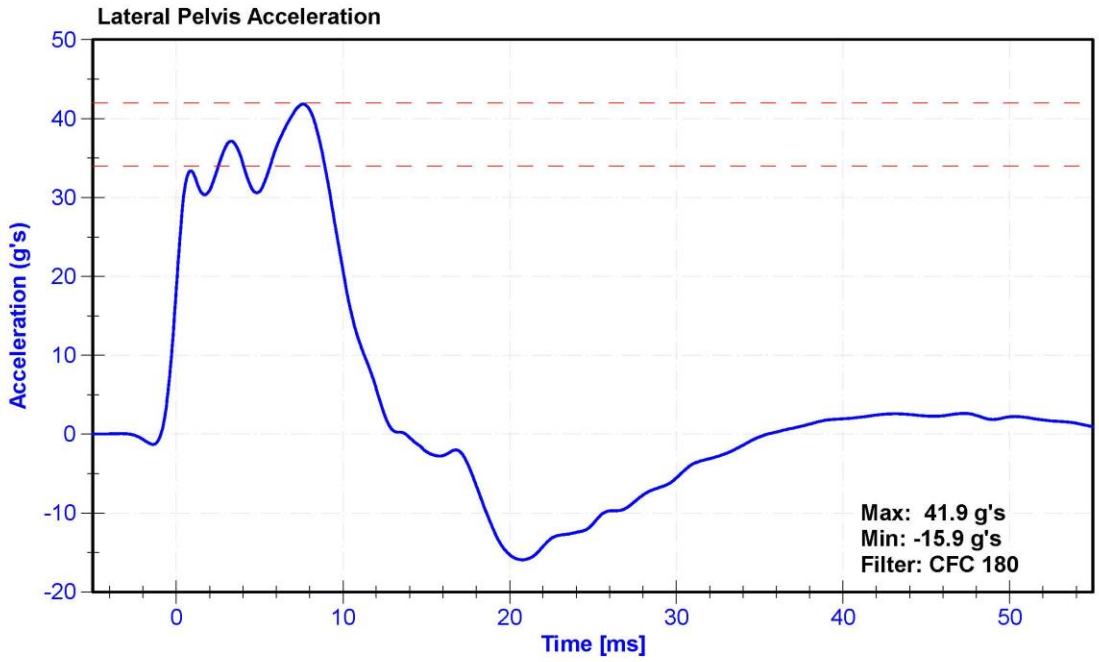
Results

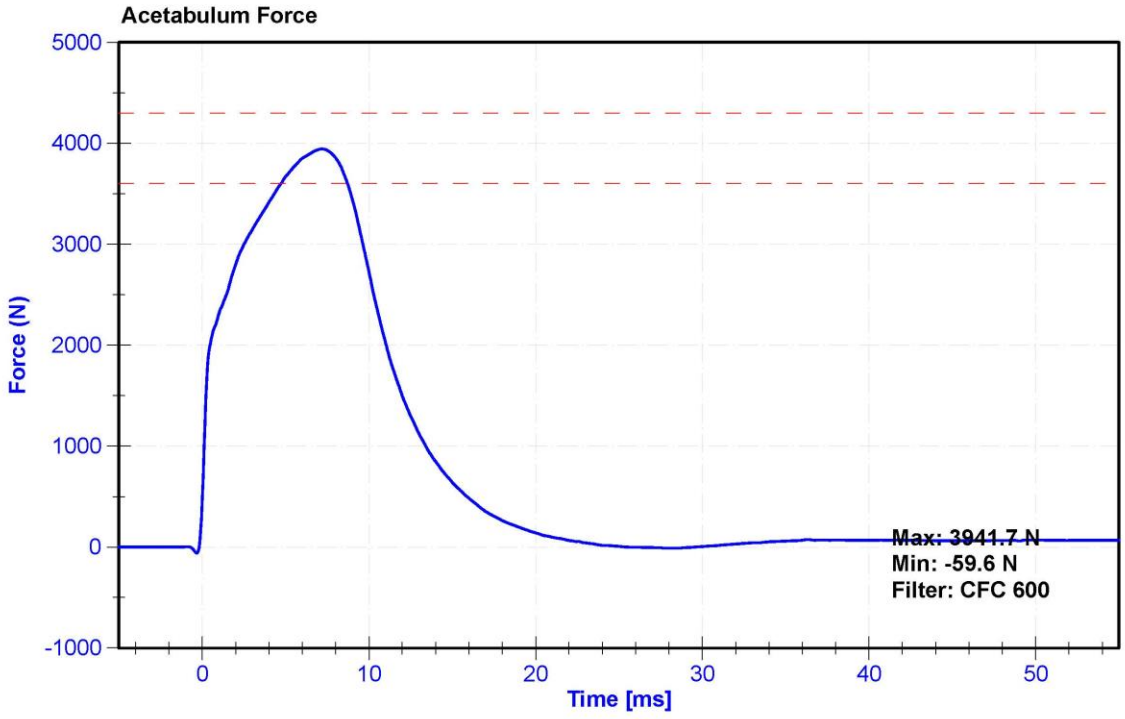
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	28.2	Pass
Velocity	6.6	6.8	m/s	6.67	Pass
Probe Acceleration	38	47	g's	46.0	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	41.9	Pass
Acetabulum Force	3600	4300	N	3941.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	8/22/2019	2/20/2020
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51731	10/29/2019	4/28/2020
Acetabulum Load Cell	Denton 3249J	LC-276Fy	9/24/2019	9/23/2020
Certification Plug	SACO	12495	10/02/2018	N/A
Crash Test Plug	SACO	11590	10/04/2016	N/A




Lateral Pelvis Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]
Max: 41.9 g's
Min: -15.9 g's
Filter: CFC 180


Acetabulum Force
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 3941.7 N
Min: -59.6 N
Filter: CFC 600

SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 11590
Test Number 3133
Report Number 3126
Test Date 10/4/2016 12:36:56 PM

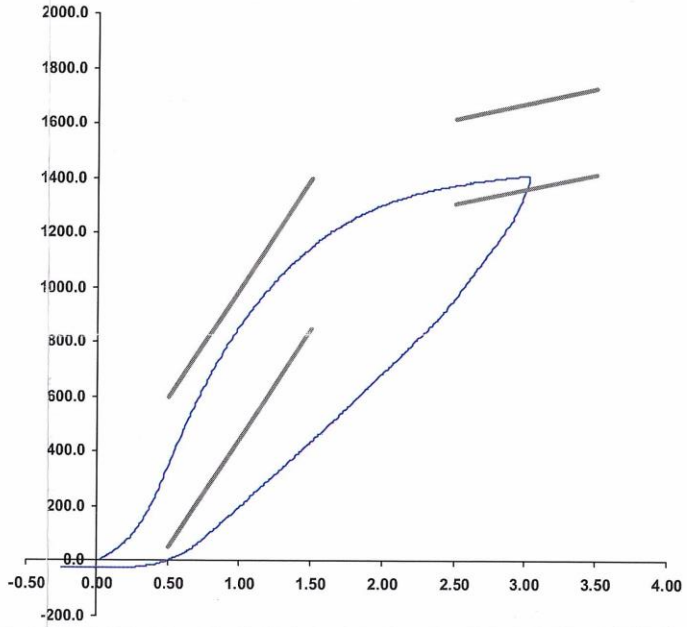
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	347.21	50.00	600.00
Force @ 1.5 mm (N)	1,150.68	850.00	1,400.00
Force @ 2.5 mm (N)	1,374.21	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,409.08	1,361.00	1,673.00

Testing Machine STM-20 5965542
Load Cell S/N (TI240813), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Force (-N) vs Extension (-mm)



Operator DC

Part Number 180-4450

Template No 107 04-Oct-16
SACO Research

By : DC Date : 10/4/16

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

300 cert 2 11/6/19 Pass

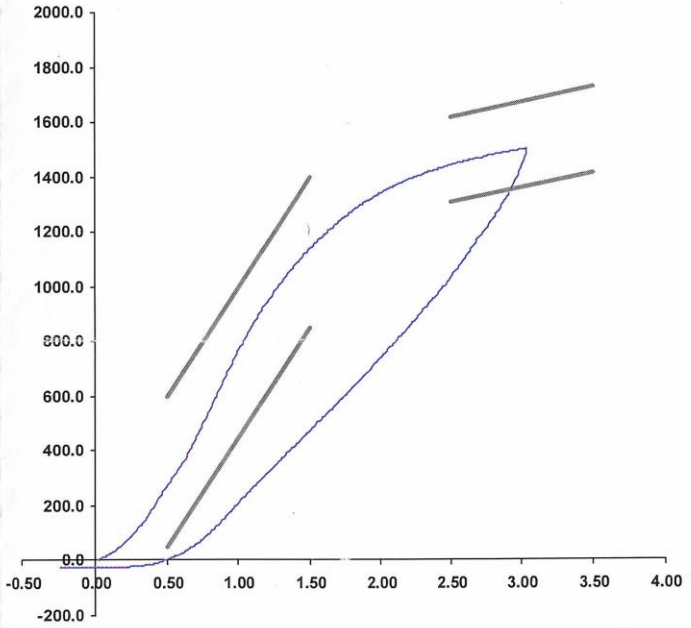
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 12495
Test Number 7422
Report Number 7436
Test Date 10/2/2018 7:58:50 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	269.09	50.00	600.00
Force @ 1.5 mm (N)	1,135.67	850.00	1,400.00
Force @ 2.5 mm (N)	1,441.89	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,500.79	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator DC

Part Number 180-4450

Template No 107 02-Oct-18
SACO Research

By : DC Date : 10/2/18

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

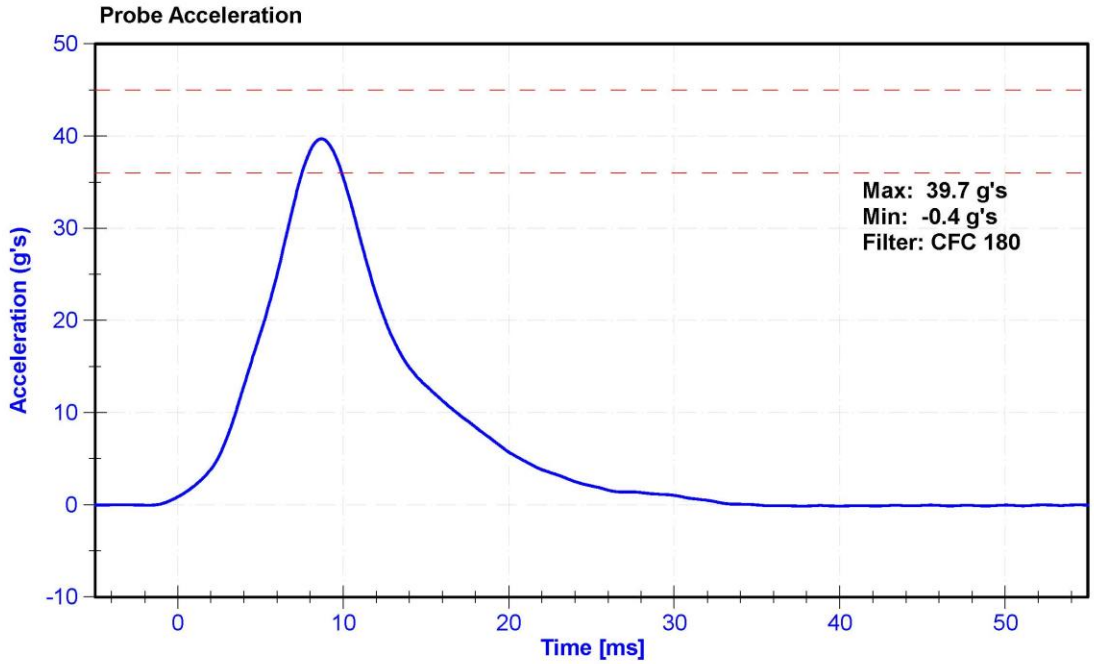
ATD Manufacturer	FTSS	Test Technician	K. Brogan
ATD Serial Number	300	Laboratory Supervisor	D.Reinhard

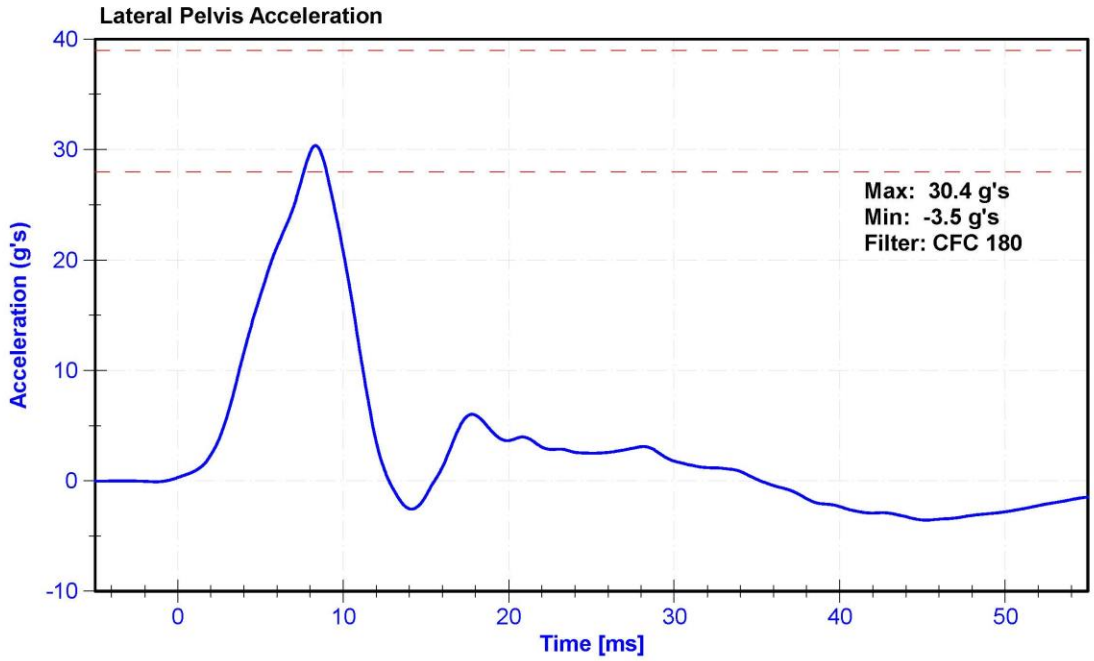
Results

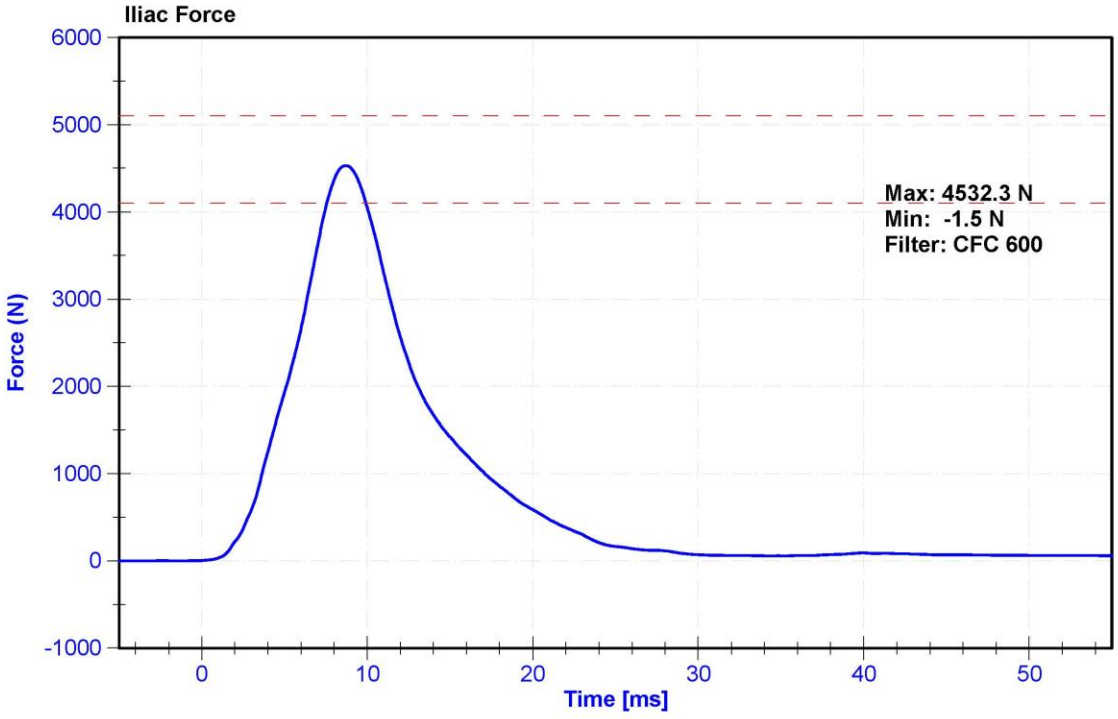
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	28.5	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	36	45	g's	39.7	Pass
Lateral Pelvis Acceleration	28	39	g's	30.4	Pass
Iliac Force	4100	5100	N	4532.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260487	8/22/2019	2/20/2020
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51731	10/29/2019	4/28/2020
Iliac Load Cell	DENTON 3228J	LC-280Fy	6/20/2019	6/19/2020




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 30.4 g's
Min: -3.5 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4532.3 N
Min: -1.5 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

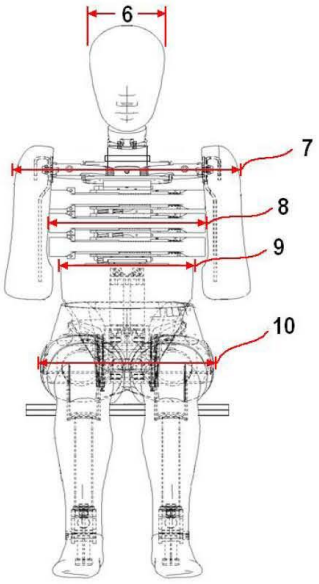
SERIAL NO: F034

(CONFIGURED FOR LEFT SIDE IMPACT)

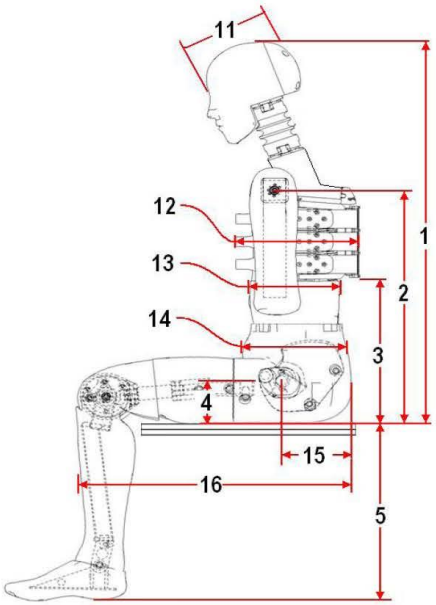
External Measurements - EuroSID-2re

Technician: K. Dutton Date: 12/04/2019

Dummy Serial Number: F034



FRONT VIEW



SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	910	Pass
2	Seat to Shoulder Joint	558	572	569	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	99	Pass
5	Sole to Seat, Sitting	333	451	419	Pass
6	Head Width	152	158	154	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	327	Pass
9	Abdomen Width	273	287	283	Pass
10	Pelvis Lap Width	359	373	365	Pass
11	Head Depth	196	206	202	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	201	Pass
14	Pelvis Depth	235	245	242	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

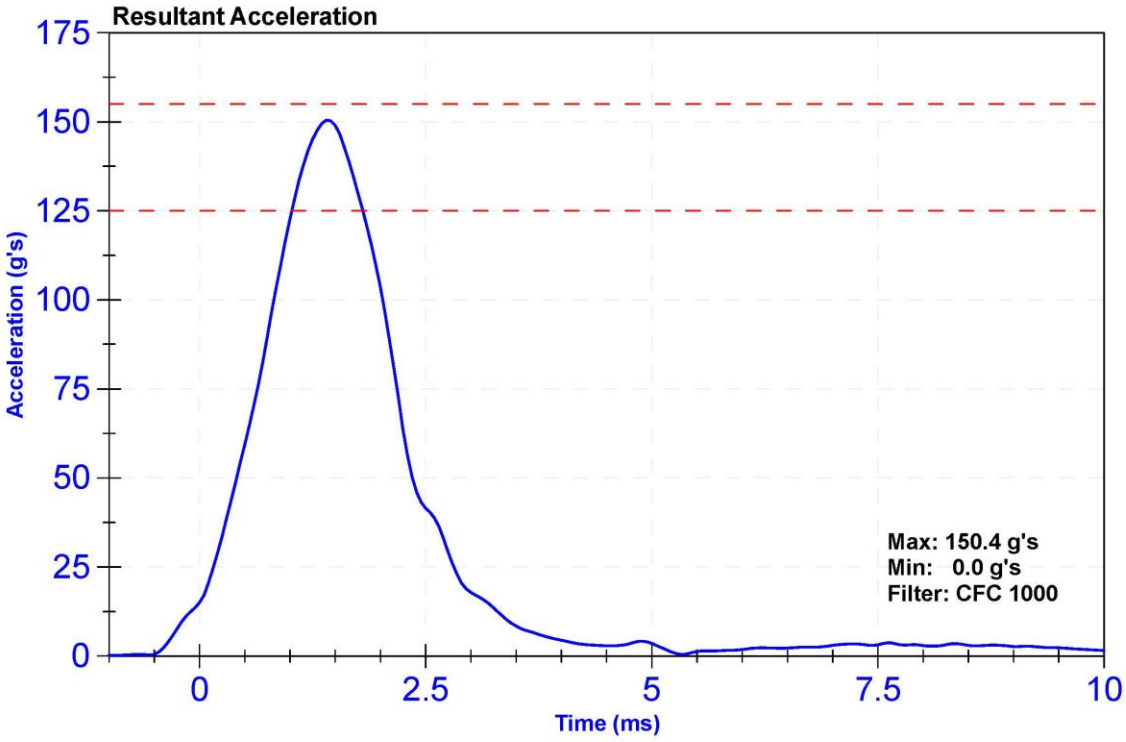
ATD Manufacturer	FTSS	Test Technician	E. Helenbrook
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

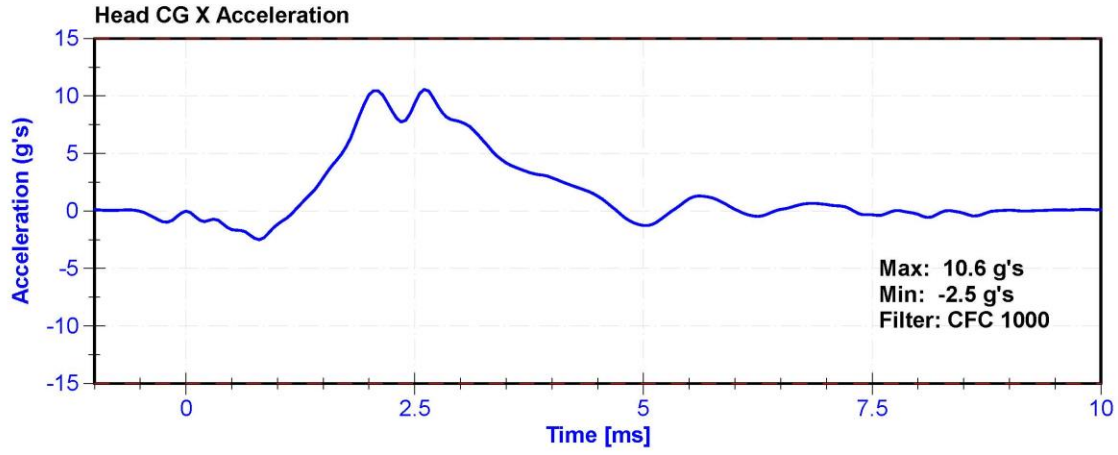
Results

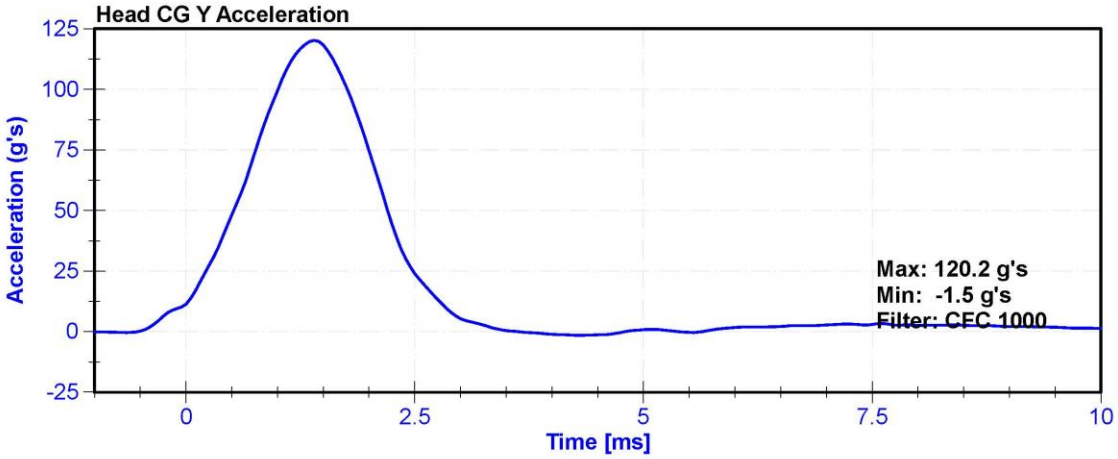
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	31.1	Pass
Resultant Acceleration	125	155	g's	150.4	Pass
Oscillation	0	15	%	2.76	Pass
Fore-Aft Acceleration	-15	15	g's	10.6	Pass

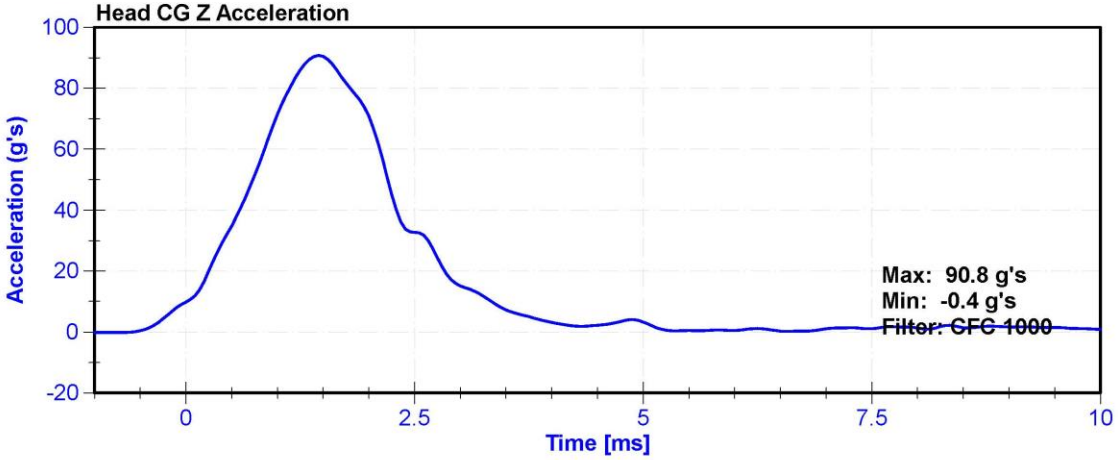
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	P49204	10/29/2019	4/29/2020
Y Accelerometer	Endevco	P63981	10/29/2019	4/29/2020
Z Accelerometer	Endevco	P64007	10/29/2019	4/29/2020




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 10.6 g's
Min: -2.5 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 120.2 g's
Min: -1.5 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
100
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]
Max: 90.8 g's
Min: -0.4 g's
Filter: CFC 1000

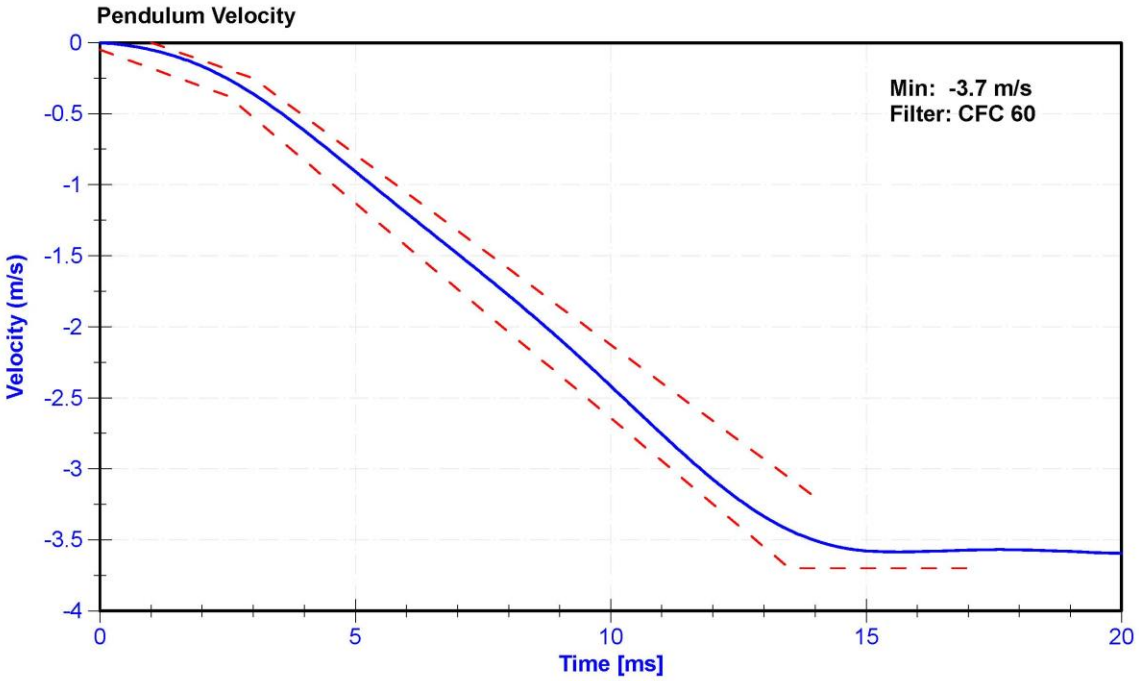
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

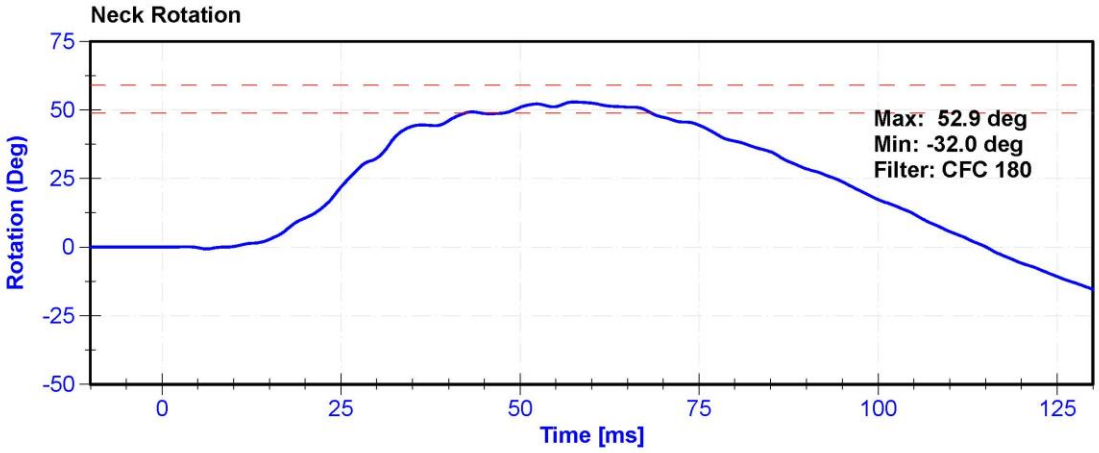
Results

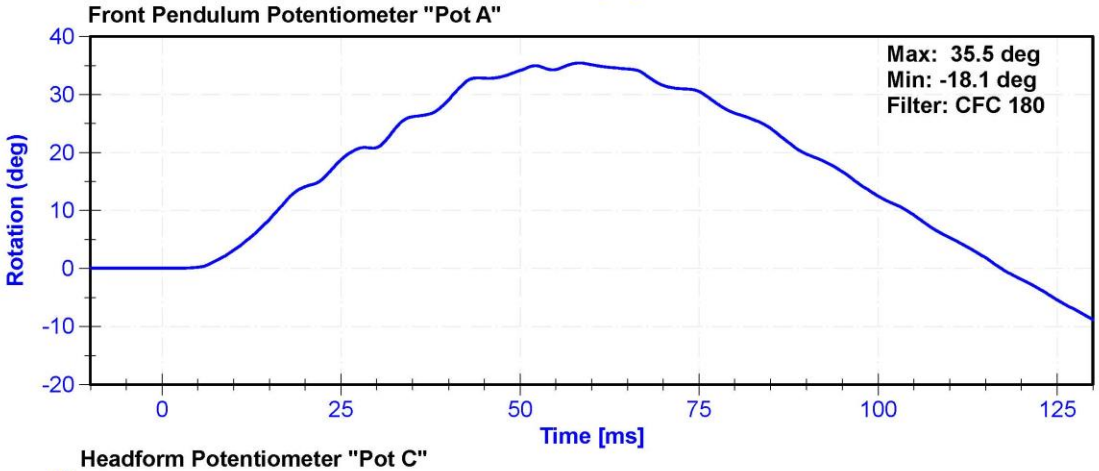
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21	Pass
Humidity	10	70	%	23	Pass
Velocity	3.3	3.5	m/s	3.33	Pass
Lateral Neck Rotation	49	59	deg	52.9	Pass
Time at Maximum Rotation	54	66	ms	57.5	Pass
Time of Rotation Decay from Maximum	53	88	ms	57.6	Pass

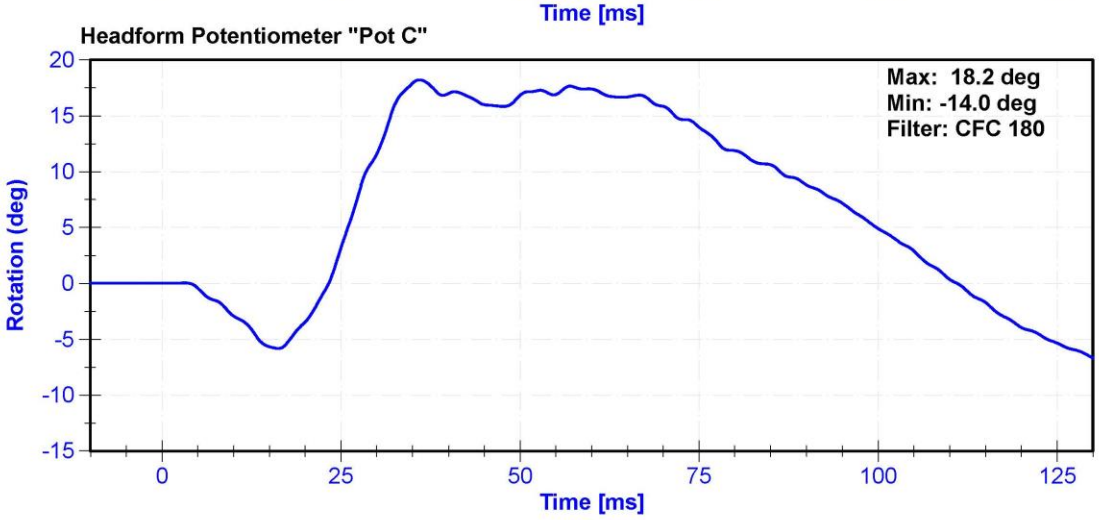
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9	1/29/2019	1/29/2020
Front Pendulum Potentiometer	SP22G	DS-094	10/31/2019	10/30/2020
Headform Potentiometer	SP22G	DS-095	10/31/2019	10/30/2020




Neck Rotation
Rotation (Deg)
Time [ms]
Max: 52.9 deg
Min: -32.0 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 35.5 deg
Min: -18.1 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 18.2 deg
Min: -14.0 deg
Filter: CFC 180

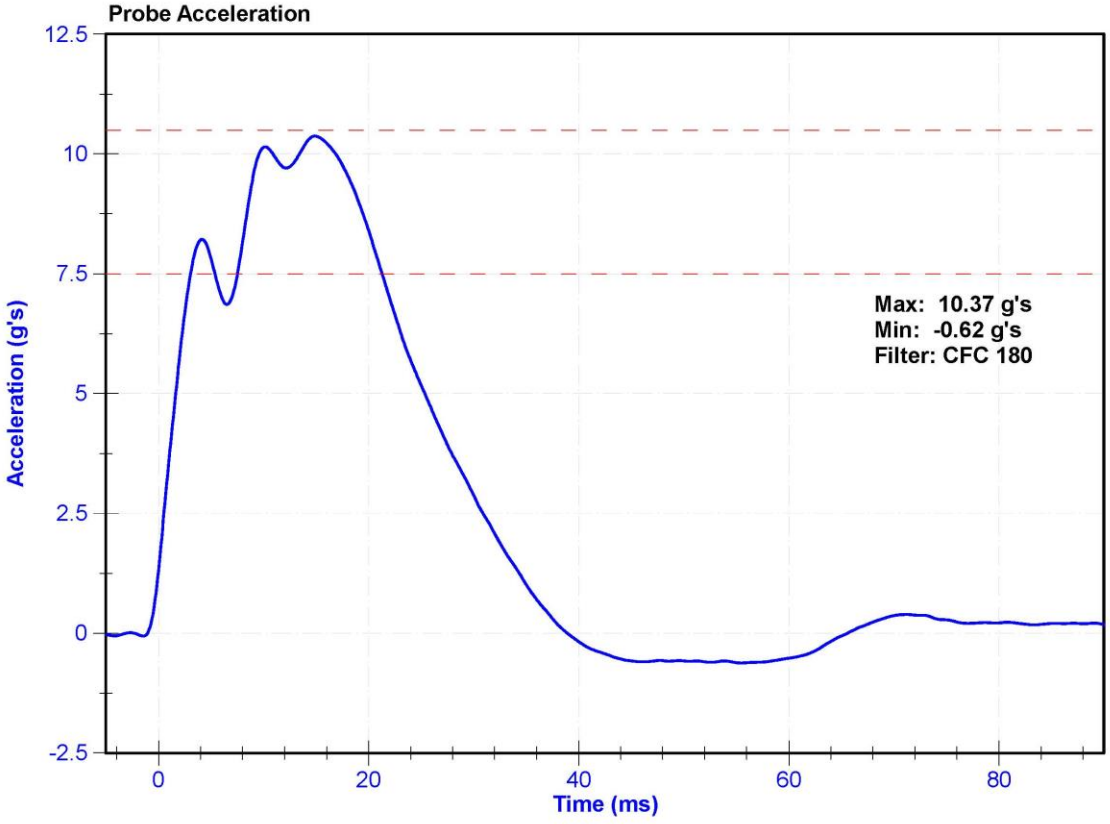
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	30.0	Pass
Velocity	4.2	4.4	m/s	4.23	Pass
Probe Acceleration	7.5	10.5	g's	10.37	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A260568	7/29/2019	1/27/2020



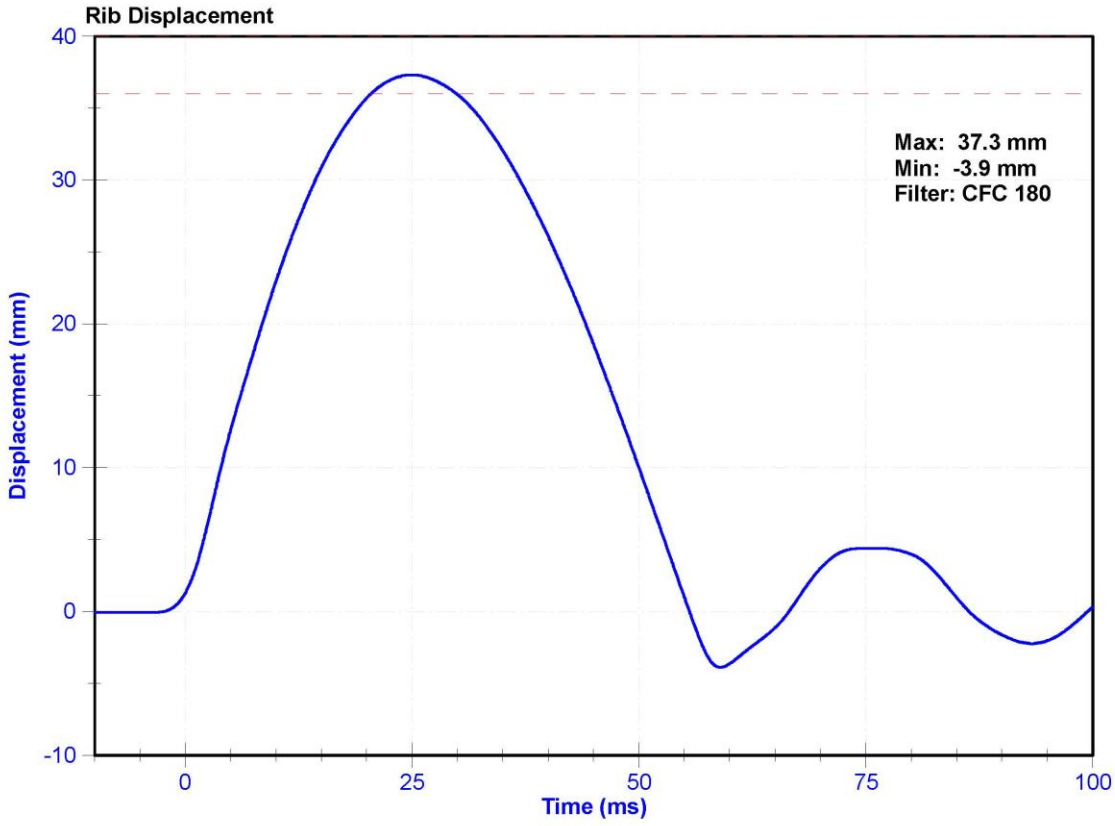
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	34.5	Pass
Rib Displacement	36	40	mm	37.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/31/2019	4/30/2020



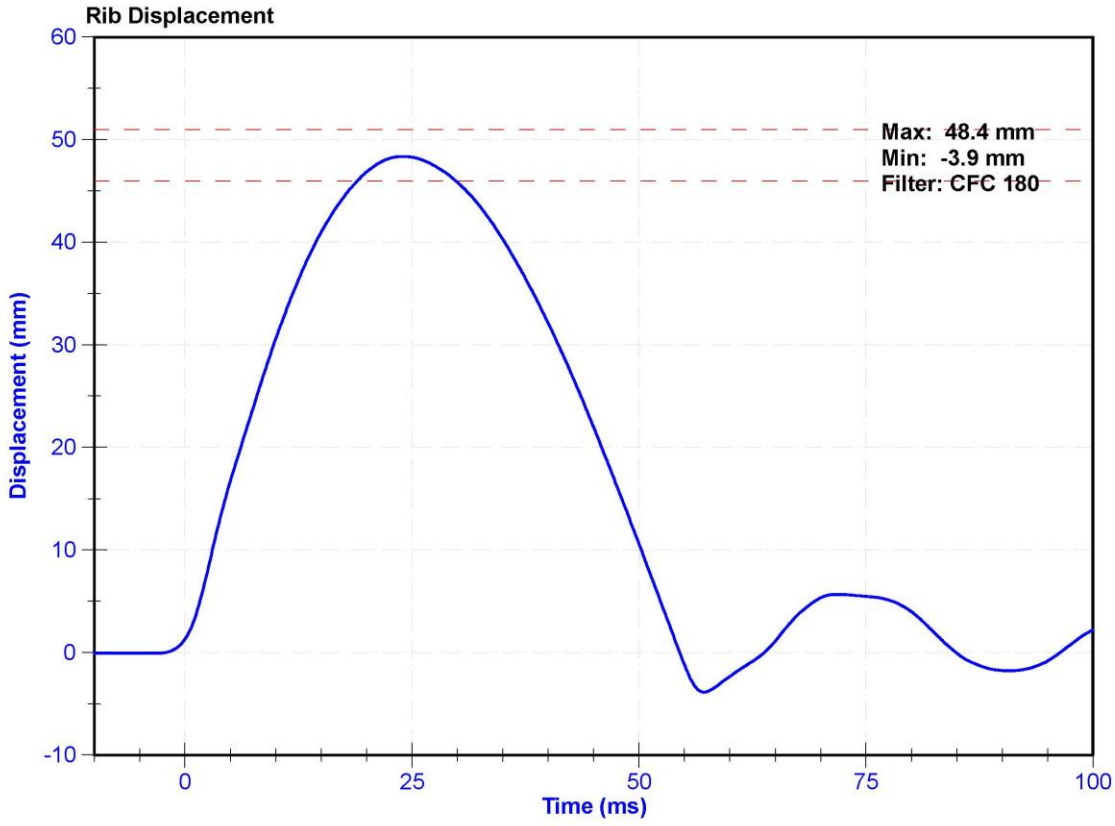
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	34.5	Pass
Rib Displacement	46	51	mm	48.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/31/2019	4/30/2020



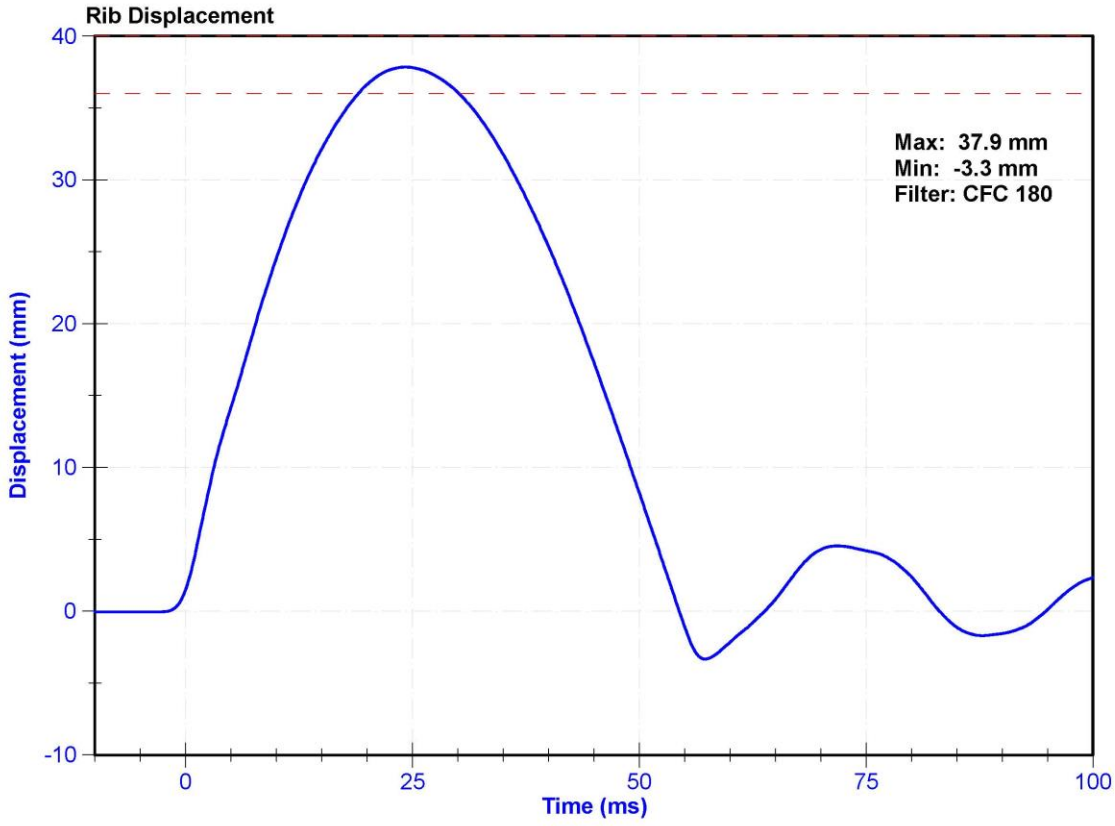
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	48.1	Pass
Rib Displacement	36	40	mm	37.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/31/2019	4/30/2020



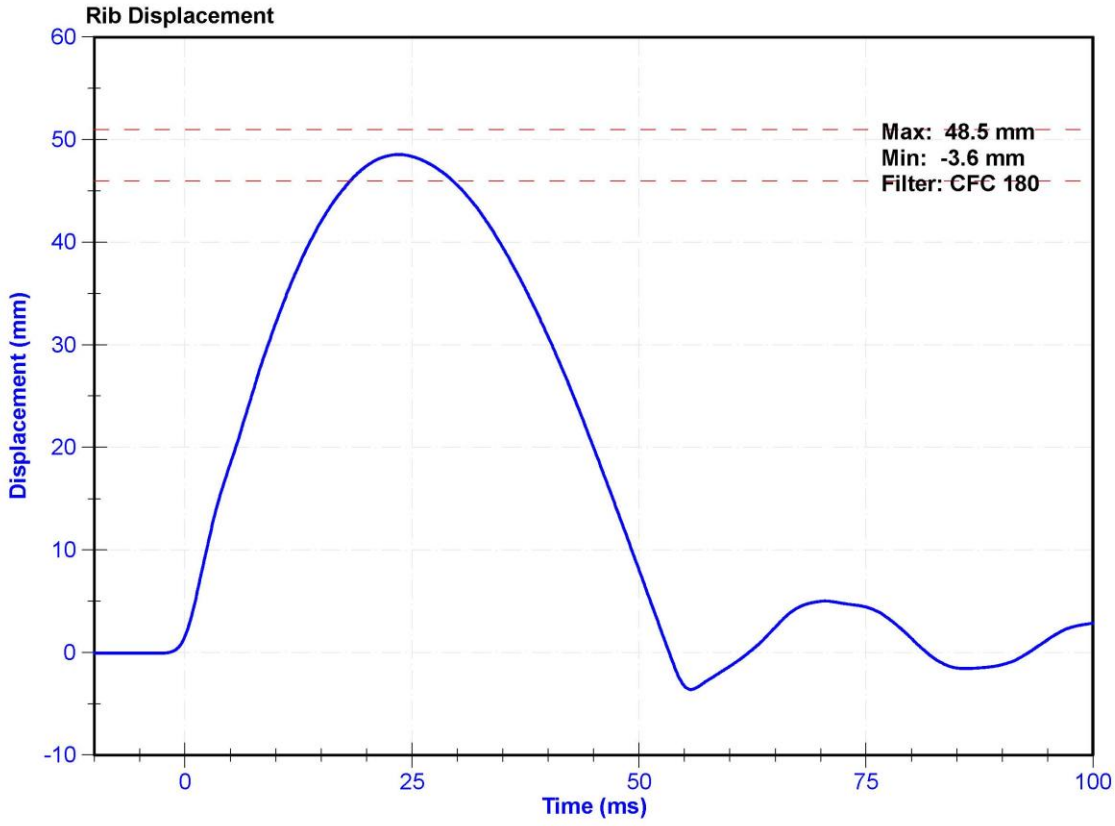
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	33.3	Pass
Rib Displacement	46	51	mm	48.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/31/2019	4/30/2020



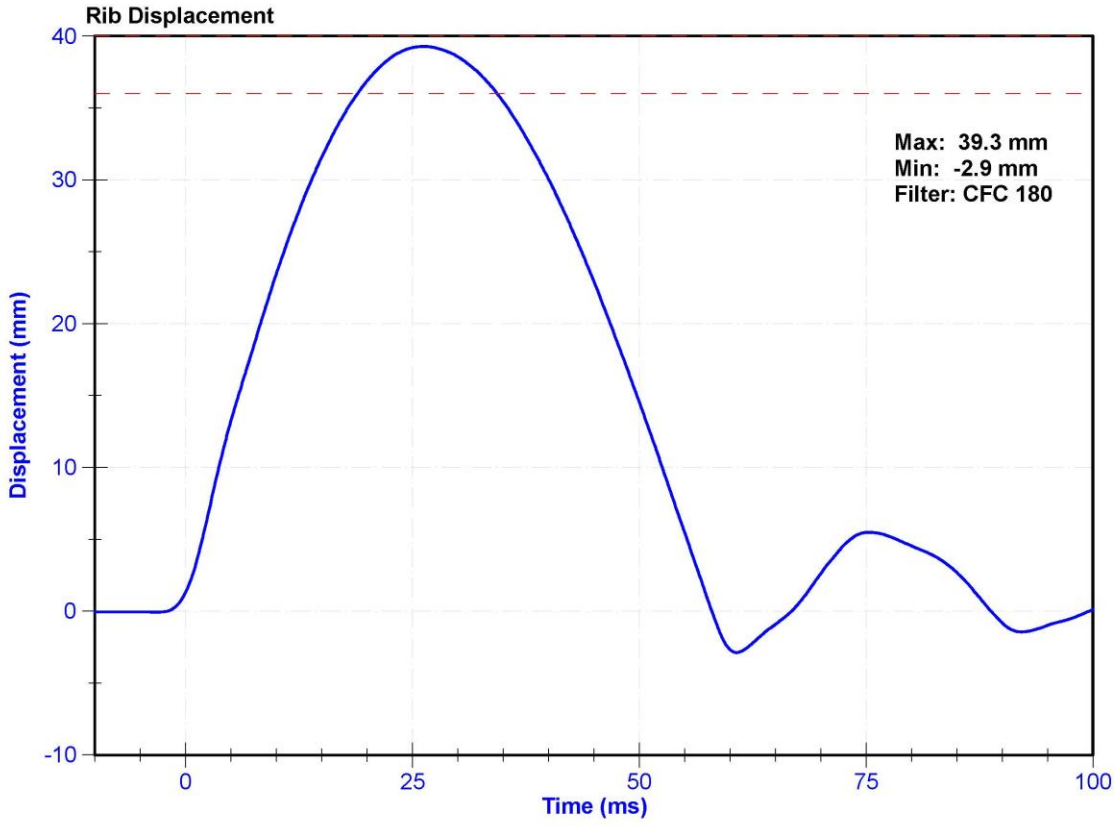
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.1	Pass
Humidity	10	70	%	32.9	Pass
Rib Displacement	36	40	mm	39.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/31/2019	4/30/2020



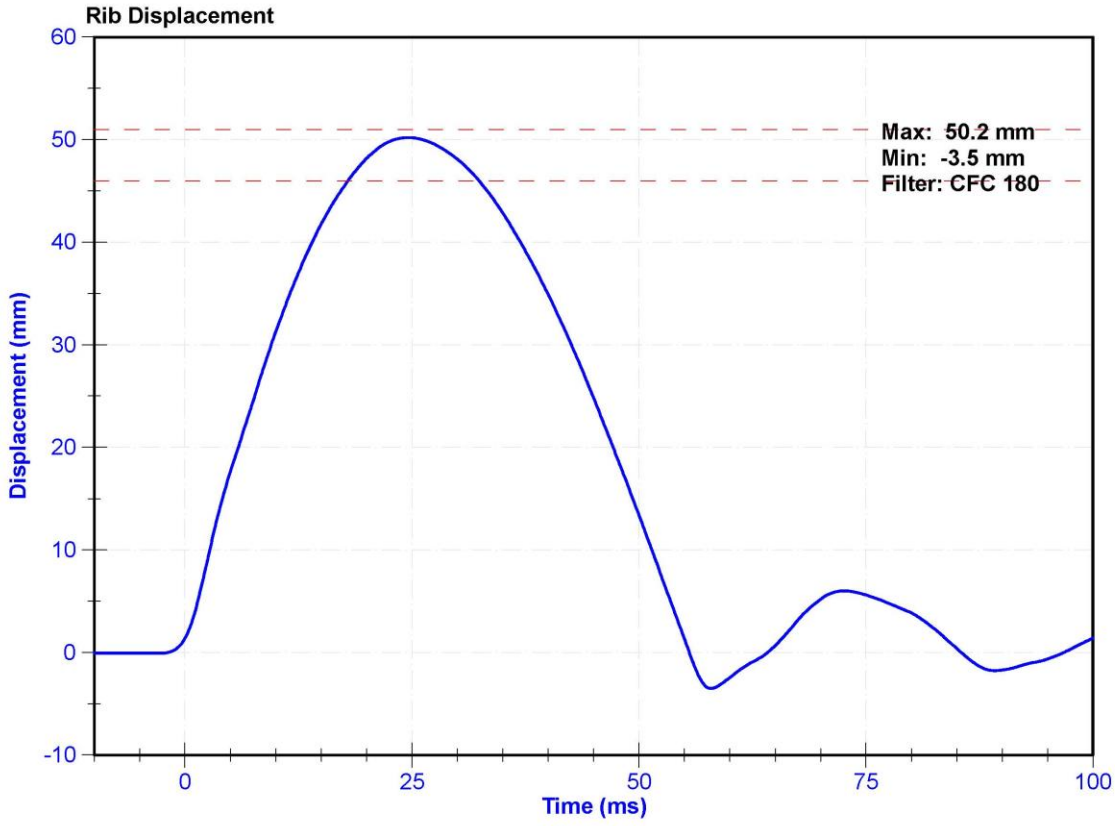
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	33.9	Pass
Rib Displacement	46	51	mm	50.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/31/2019	4/30/2020



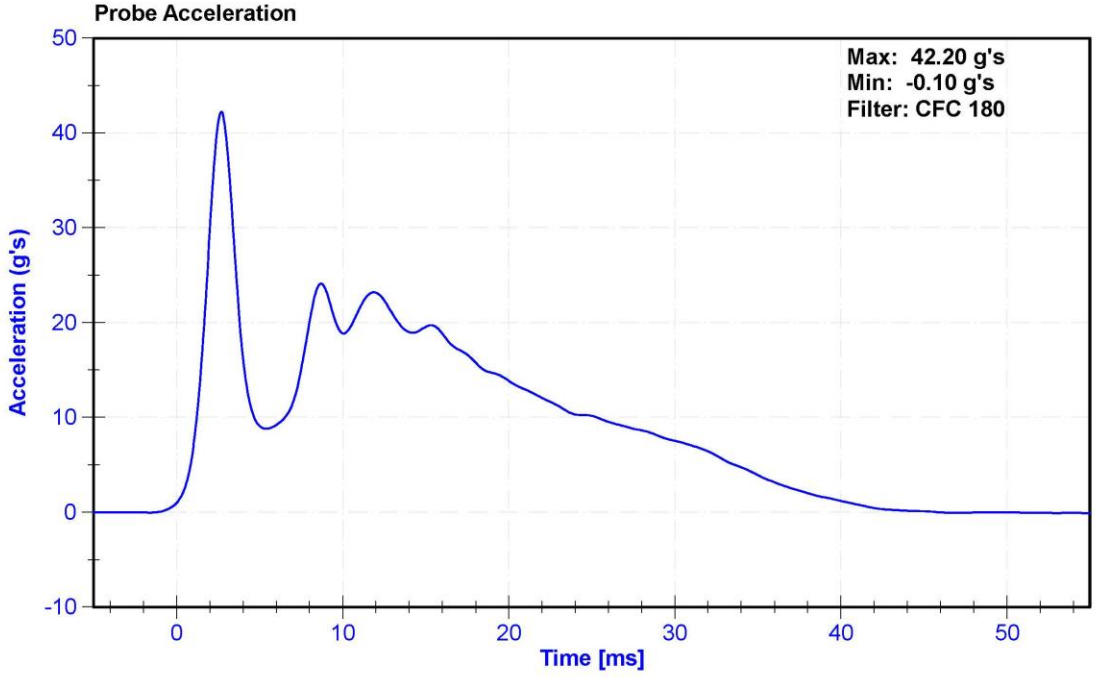
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

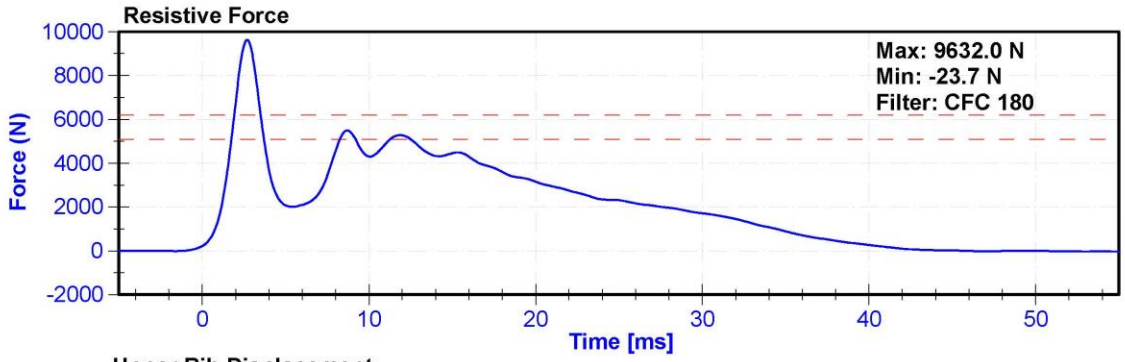
Results

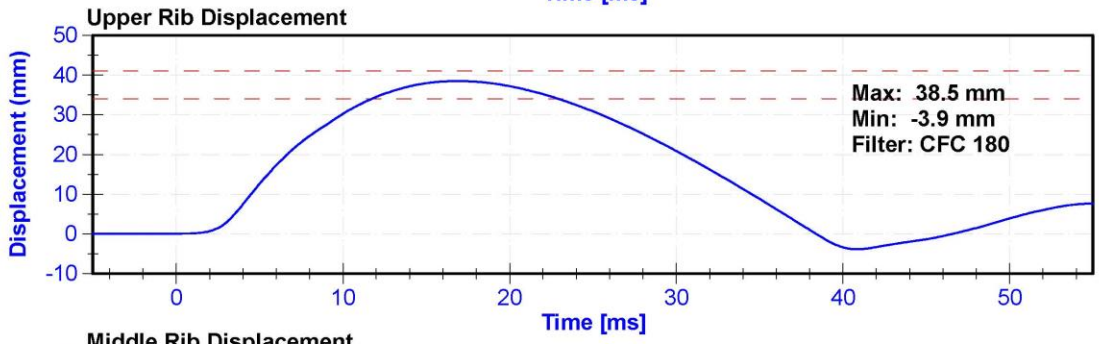
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	29.7	Pass
Velocity	5.4	5.6	m/s	5.40	Pass
Resistive Force after 6ms	5100	6200	N	5499.3	Pass
Upper Thorax Rib Deflection	34	41	mm	38.5	Pass
Mid Thorax Rib Deflection	37	45	mm	41.7	Pass
Lower Thorax Rib Deflection	37	44	mm	41.2	Pass

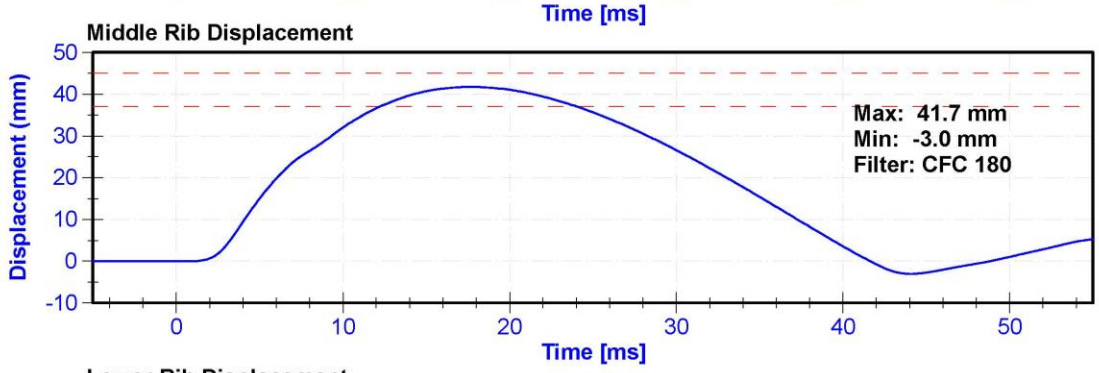
Transducer Calibrations

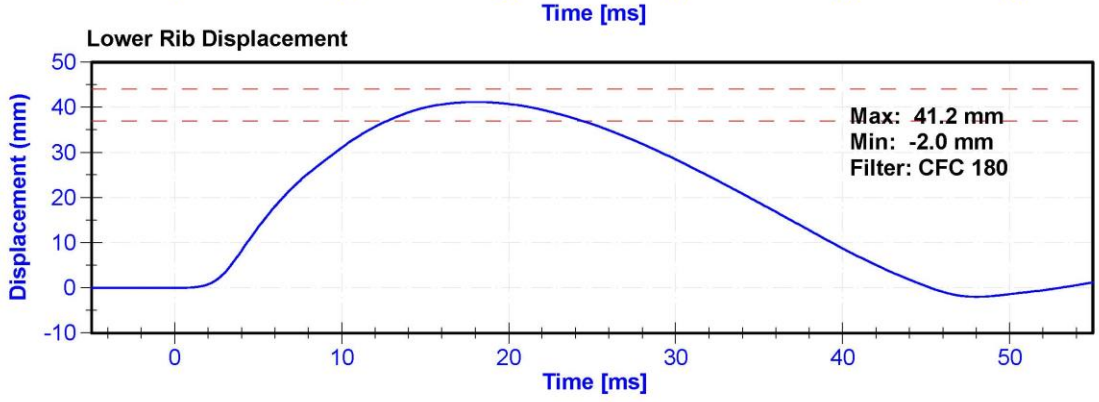
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A260568	7/29/2019	1/27/2020
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/31/2019	4/30/2020
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/31/2019	4/30/2020
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/31/2019	4/30/2020




Resistive Force
Force (N)
Time [ms]
Max: 9632.0 N
Min: -23.7 N
Filter: CFC 180


Upper Rib Displacement
Displacement (mm)
Time [ms]
Max: 38.5 mm
Min: -3.9 mm
Filter: CFC 180


Middle Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.7 mm
Min: -3.0 mm
Filter: CFC 180


Lower Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.2 mm
Min: -2.0 mm
Filter: CFC 180

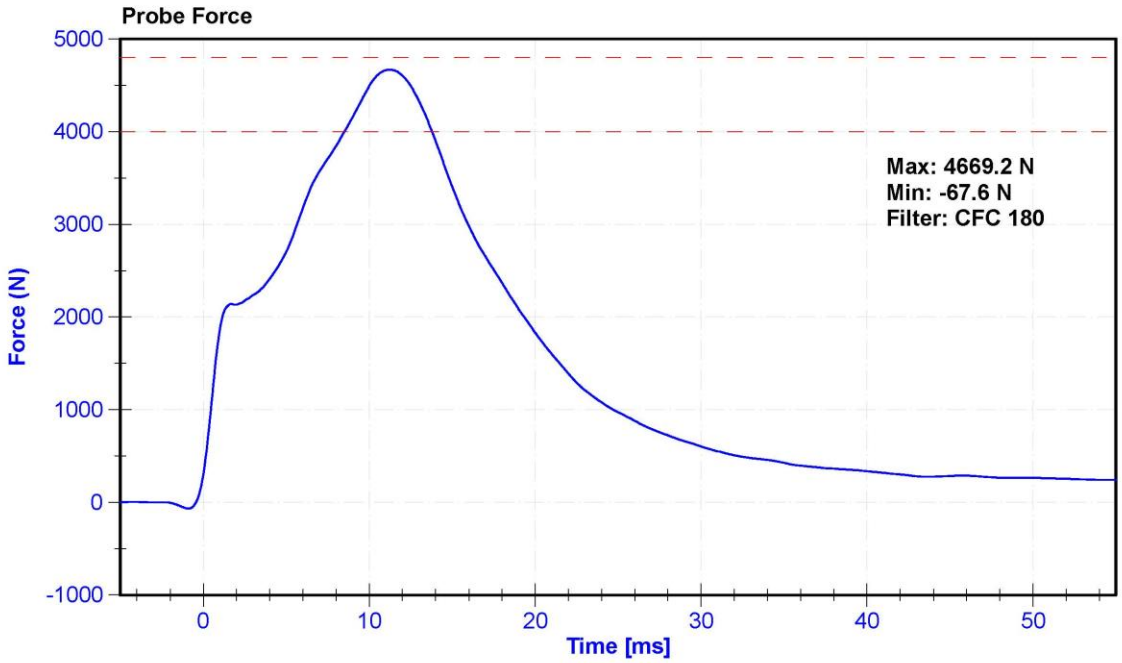
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

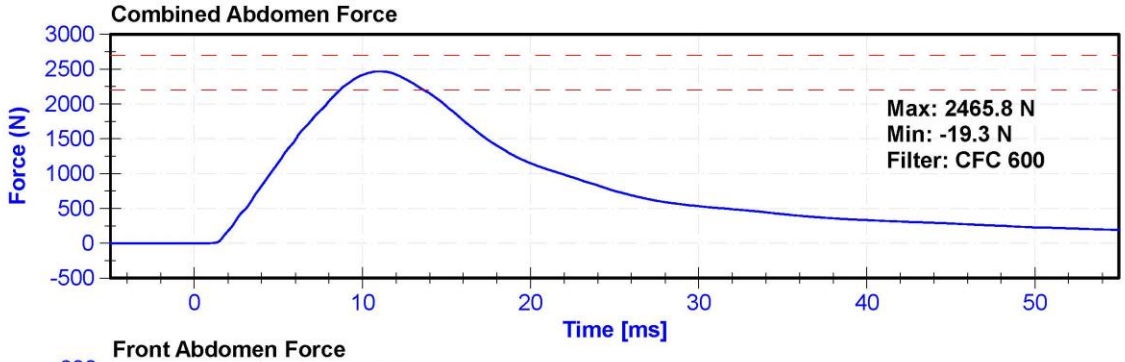
Results

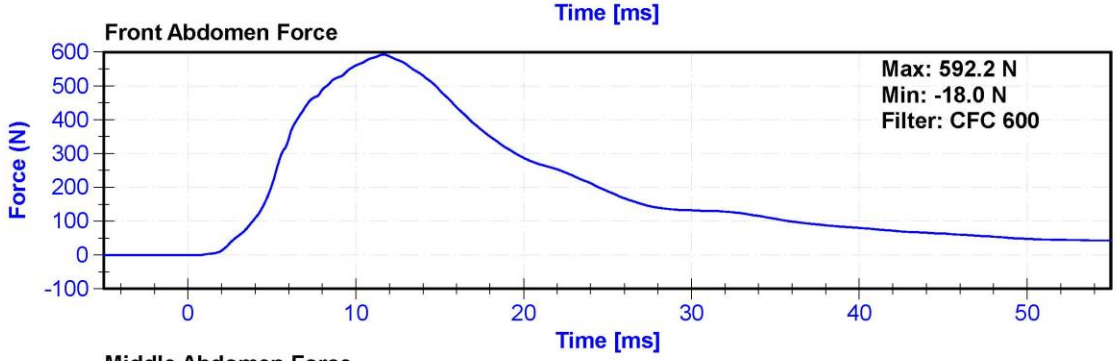
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	34	Pass
Velocity	3.9	4.1	m/s	4.08	Pass
Combined Abdomen Force	2200	2700	N	2465.8	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.90	Pass
Resistive Probe Force	4000	4800	N	4669.2	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.25	Pass

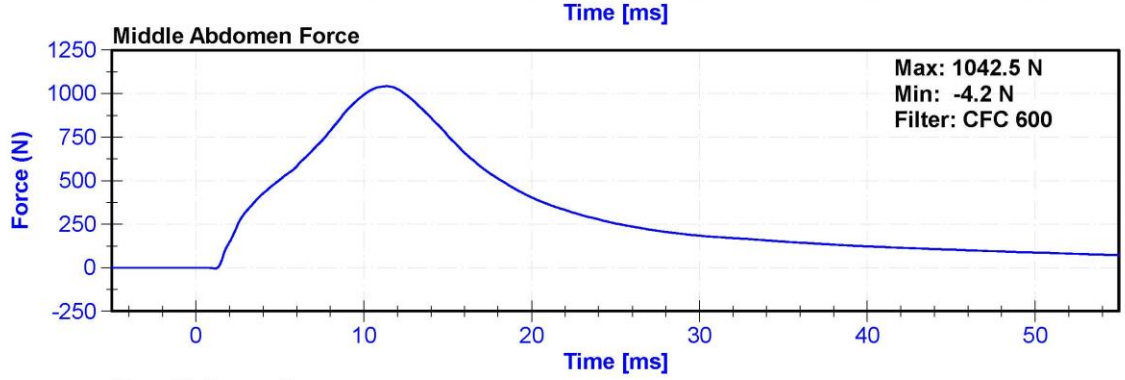
Transducer Calibrations

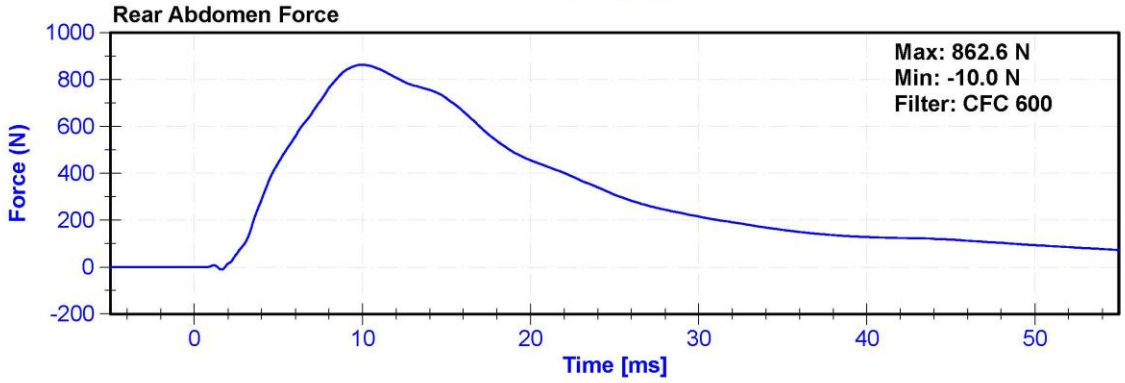
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260568	7/29/2019	1/27/2020
Front Abdomen Load Cell	DENTON 2631	LC-1440	6/14/2019	6/13/2020
Middle Abdomen Load Cell	DENTON 2631	LC-1525	6/5/2019	6/4/2020
Rear Abdomen Load Cell	DENTON 2631	LC-1528	6/14/2019	6/13/2020




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2465.8 N
Min: -19.3 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 592.2 N
Min: -18.0 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1042.5 N
Min: -4.2 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 862.6 N
Min: -10.0 N
Filter: CFC 600

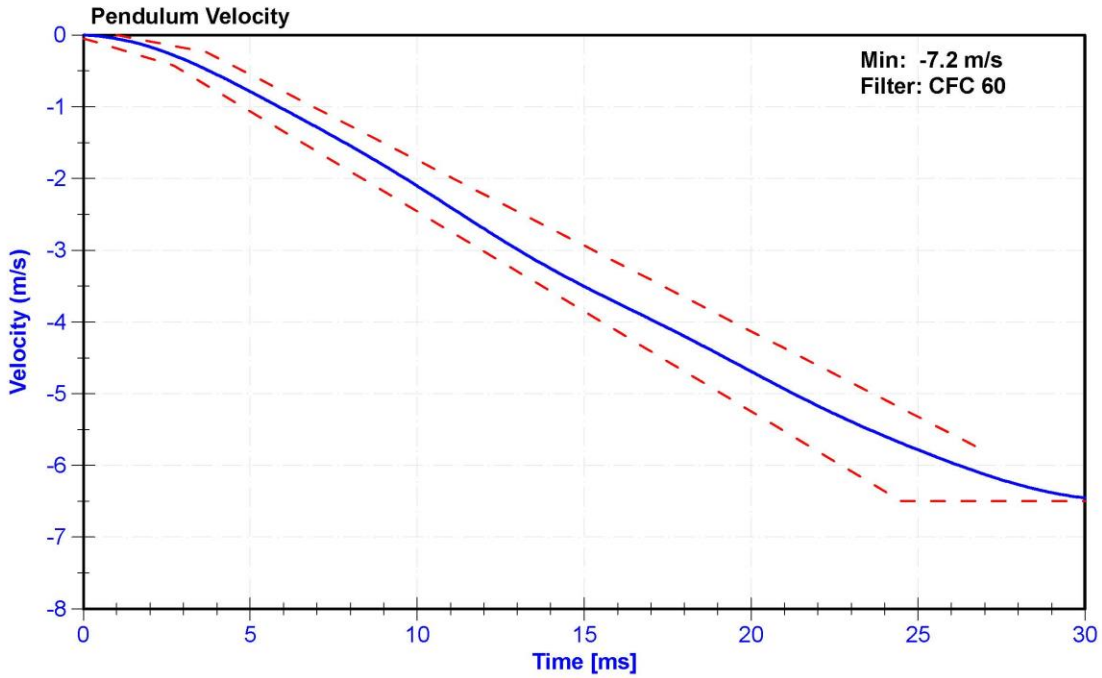
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

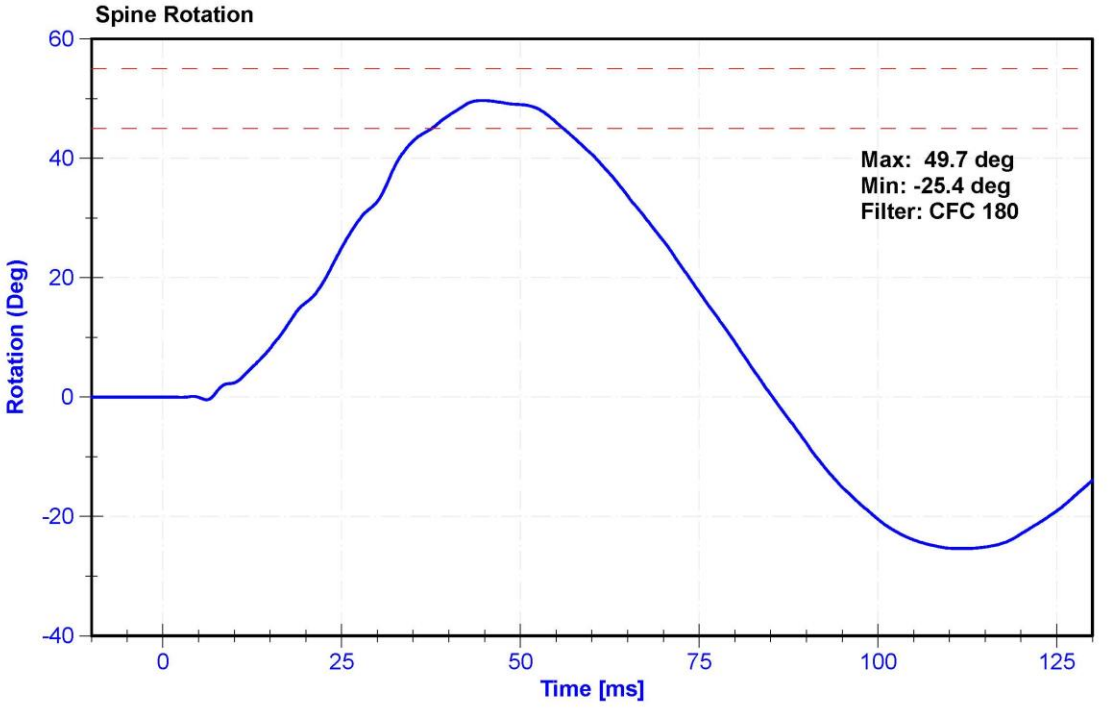
Results

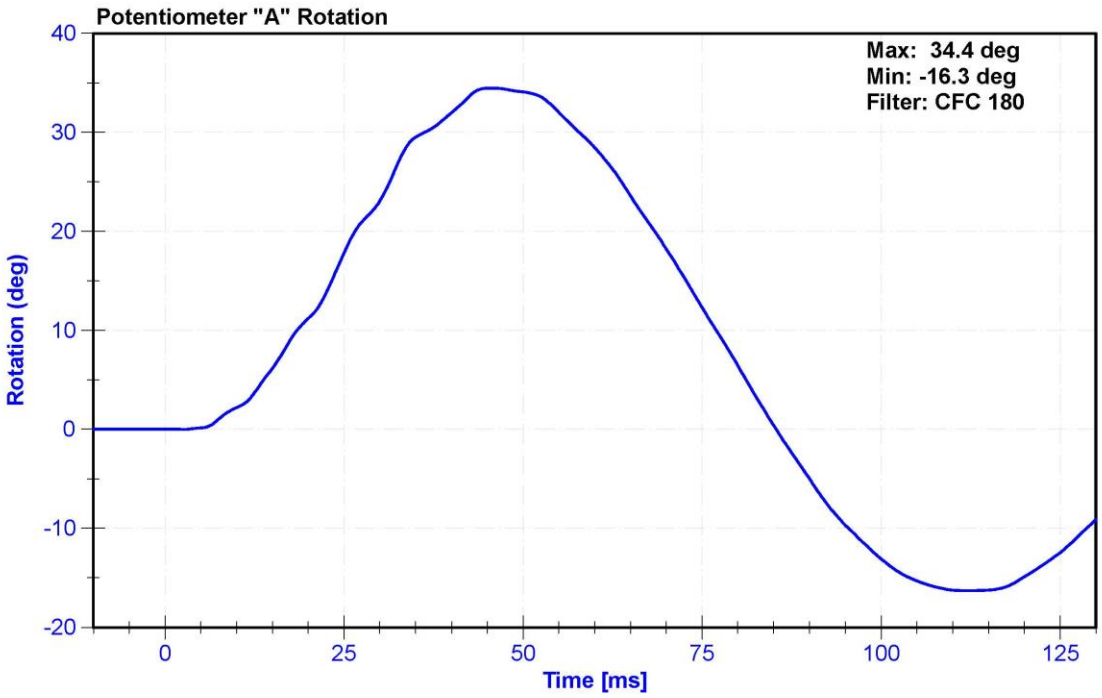
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.0	Pass
Humidity	10	70	%	24.3	Pass
Velocity	5.95	6.15	m/s	6.005	Pass
Lateral Spine Rotation	45	55	deg	49.7	Pass
Time at Maximum Rotation	39	53	ms	44.7	Pass
Time of Decay to Zero Degrees	37	57	ms	40.6	Pass
Pulse within Corridor?	-	-	-		

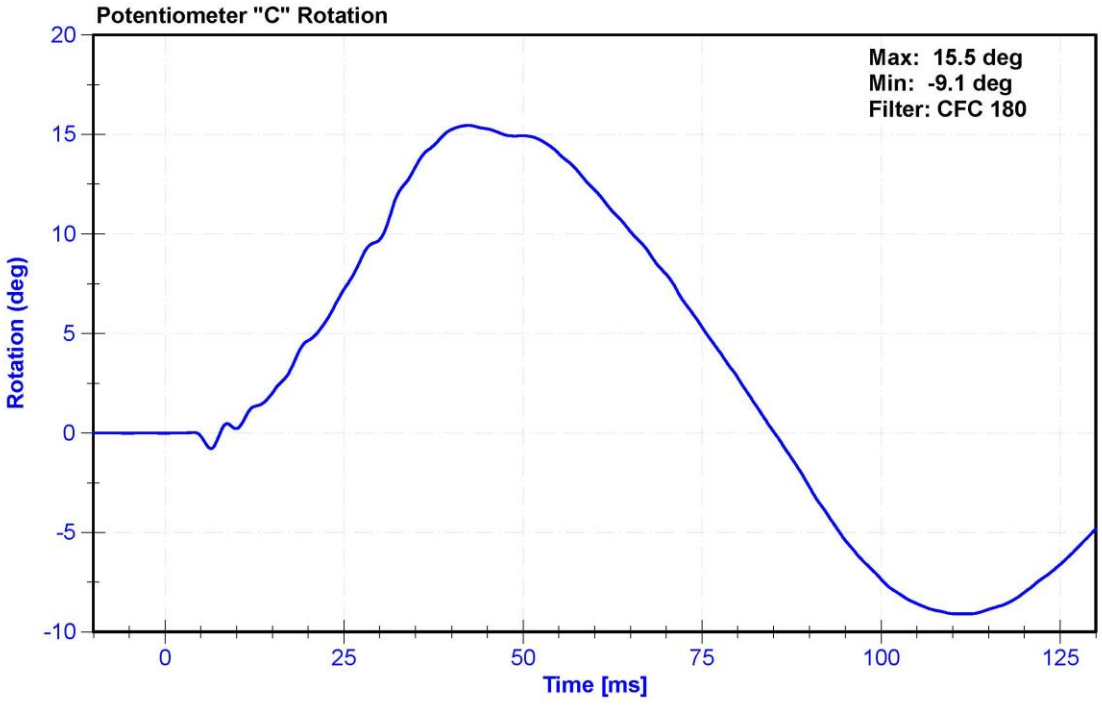
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
Pendulum "A" Potentiometer	SP22G	DS-094	10/31/2019	10/30/2020
Condyle "B" Potentiometer	SP22G	DS-095	10/31/2019	10/30/2020


Pendulum Velocity
Min: -7.2 m/s
Filter: CFC 60
Velocity (m/s)
0
-1
-2
-3
-4
-5
-6
-7
-8
0
5
10
15
20
25
30
Time [ms]


Spine Rotation
Max: 49.7 deg
Min: -25.4 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 34.4 deg
Min: -16.3 deg
Filter: CFC 180
Rotation (deg)
40
30
20
10
0
-10
-20
0
25
50
75
100
125
Time [ms]


Potentiometer "C" Rotation
Max: 15.5 deg
Min: -9.1 deg
Filter: CFC 180
Rotation (deg)
20
15
10
5
0
-5
-10
0
25
50
75
100
125
Time [ms]

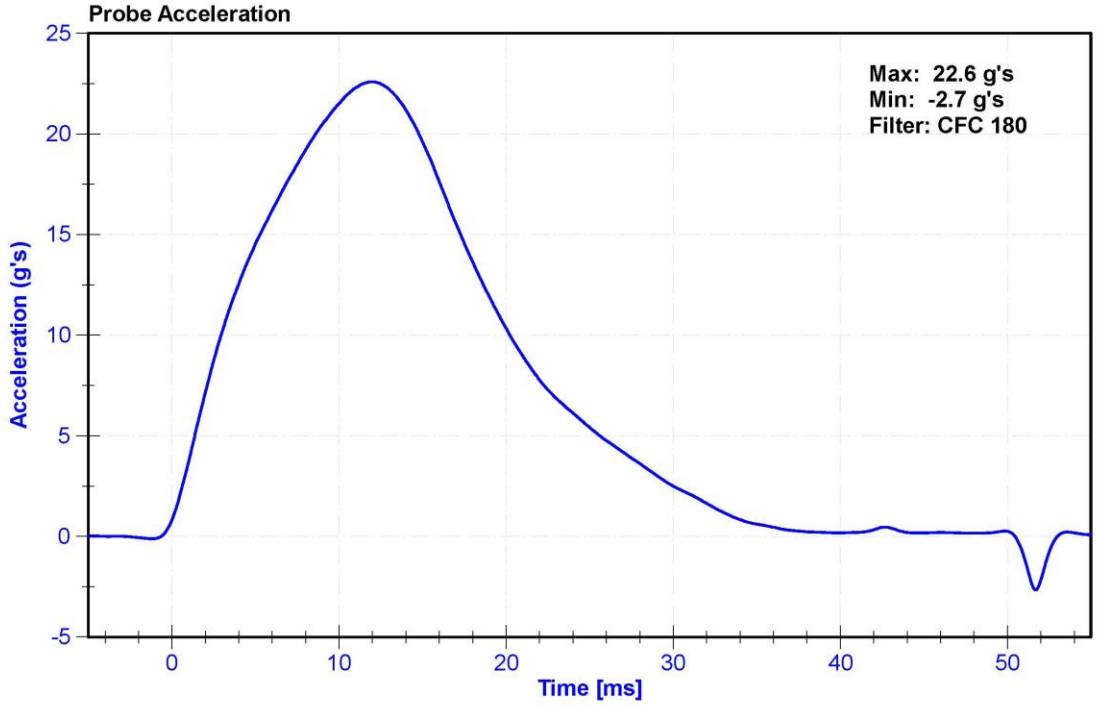
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

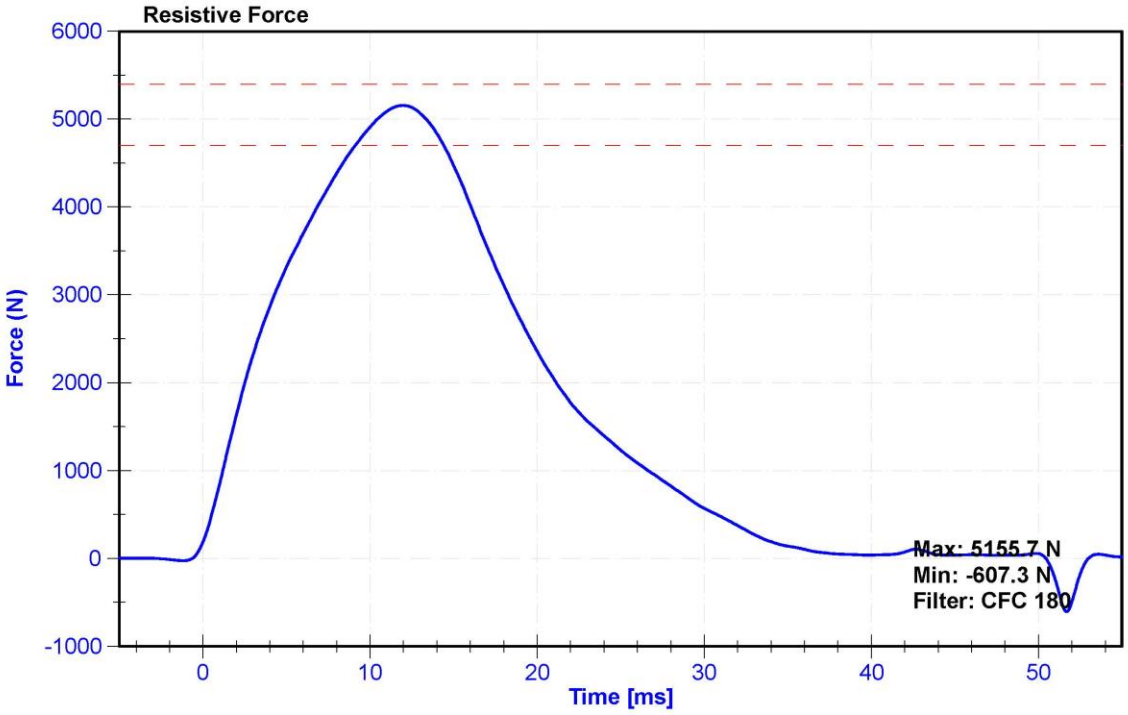
Results

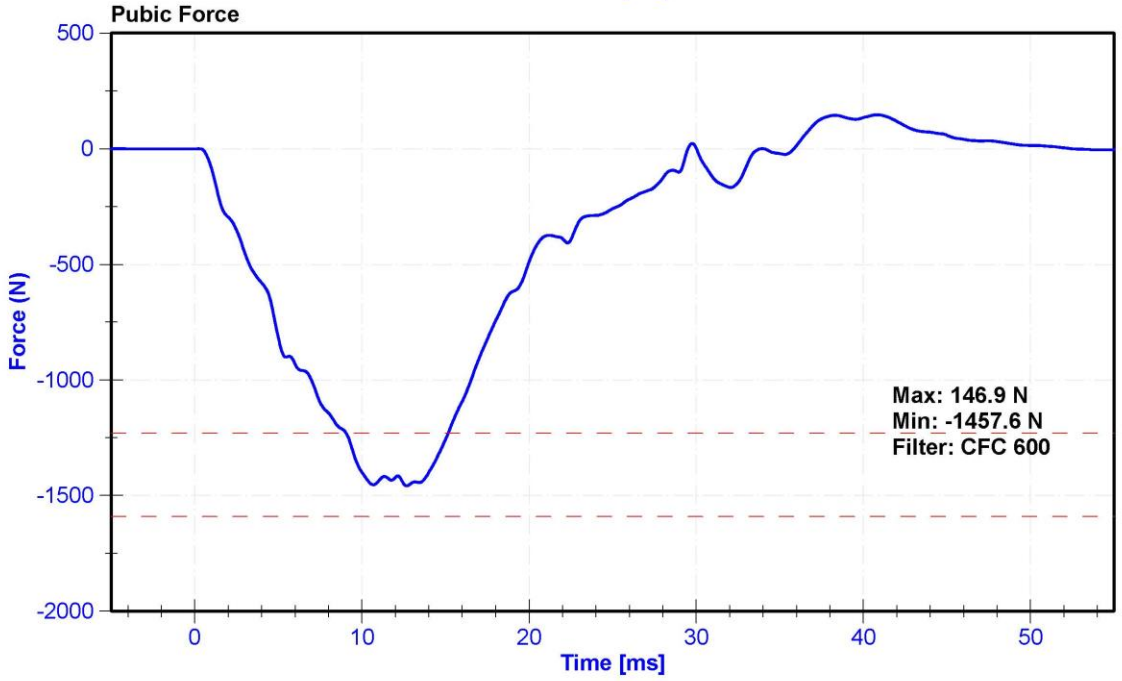
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.1	Pass
Humidity	10	70	%	31.0	Pass
Velocity	4.2	4.4	m/s	4.37	Pass
Resistive Force	4700	5400	N	5155.7	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.00	Pass
Pubic Force	-1590	-1230	N	-1457.6	Pass
Time at Peak Pubic Force	12.2	17.0	ms	12.70	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A260568	7/29/2019	1/27/2020
Pubic Load Cell	Denton 3096JFL	LC-464fy	6/14/2019	6/13/2020




Resistive Force
Force (N)
Time [ms]
Max: 5155.7 N
Min: -607.3 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 146.9 N
Min: -1457.6 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

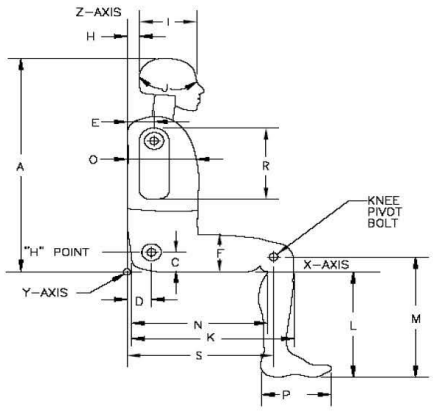
SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

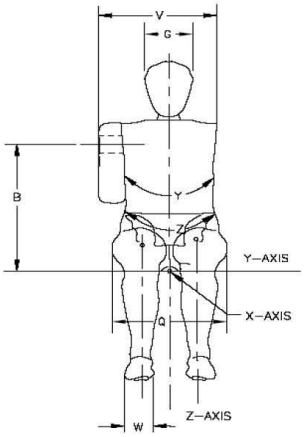
SERIAL No: 300

External Measurements - SID-IIs

Technician: K. Dutton Date: 12/04/2019

Dummy Serial Number: 300





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	779	Pass
B	Shoulder Pivot Height	437	453	450	Pass
C	H-point Height	79	89	85	Pass
D	H-point from seatback	141	151	145	Pass
E	Shoulder Pivot from Backline	97	107	103	Pass
F	Thigh Clearance	119	135	127	Pass
G	Head Breadth	140	148	144	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	185	Pass
J	Head Circumference	541	551	546	Pass
K	Buttock to Knee Length	514	540	530	Pass
L	Popliteal Height	343	369	356	Pass
M	Knee Pivot to floor height	392	409	402	Pass
N	Buttock Popliteal Length	416	442	431	Pass
O	Chest Depth w/o jacket	195	211	203	Pass
P	Foot Length	216	232	222	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	319	Pass
R	Arm Length	249	259	253	Pass
S	Knee Joint to seatback	477	493	485	Pass
V	Shoulder Width	341	357	351	Pass
W	Foot Width	78	94	84	Pass
Y	Chest Circumference w/jacket	851	881	870	Pass
Z	Waist Circumference	761	791	769	Pass

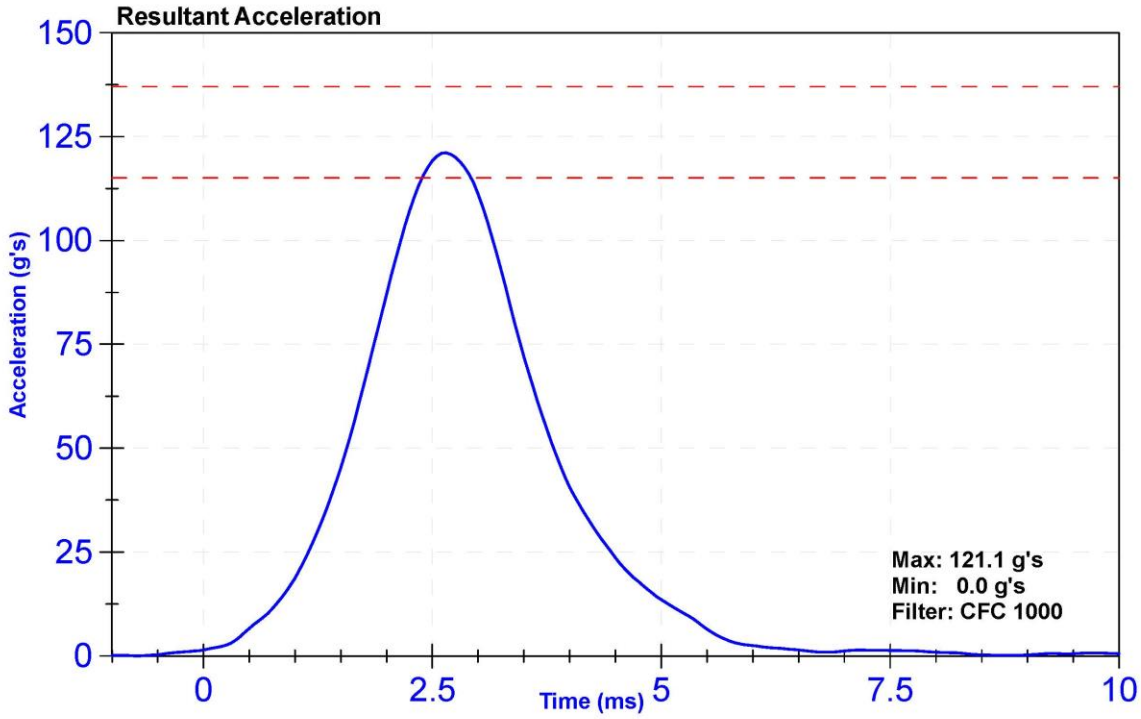
ATD Manufacturer	FTSS	Test Technician	E. Helenbrook
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

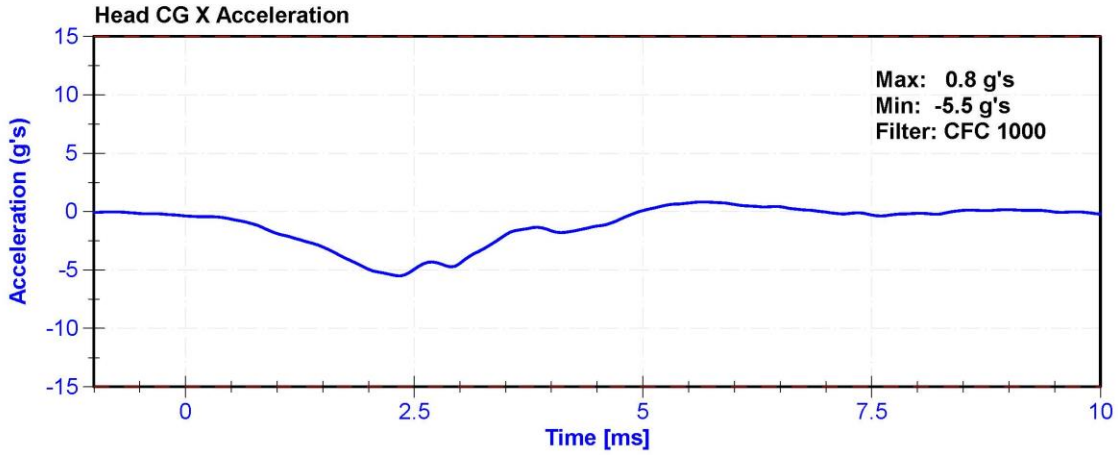
Results

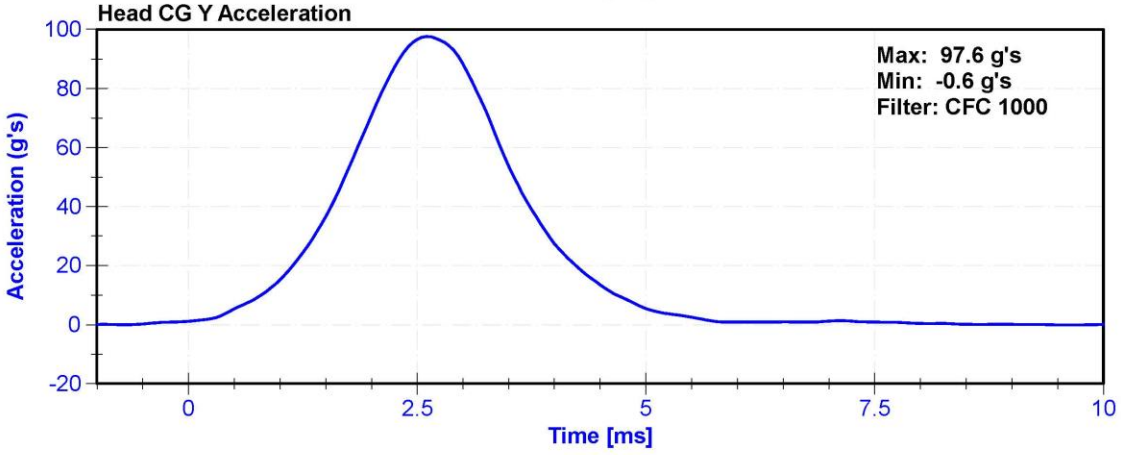
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	31.1	Pass
Resultant Acceleration	115	137	g's	121.1	Pass
Oscillation	0	15	%	1.1	Pass
Fore-Aft Acceleration	-15	15	g's	-5.5	Pass

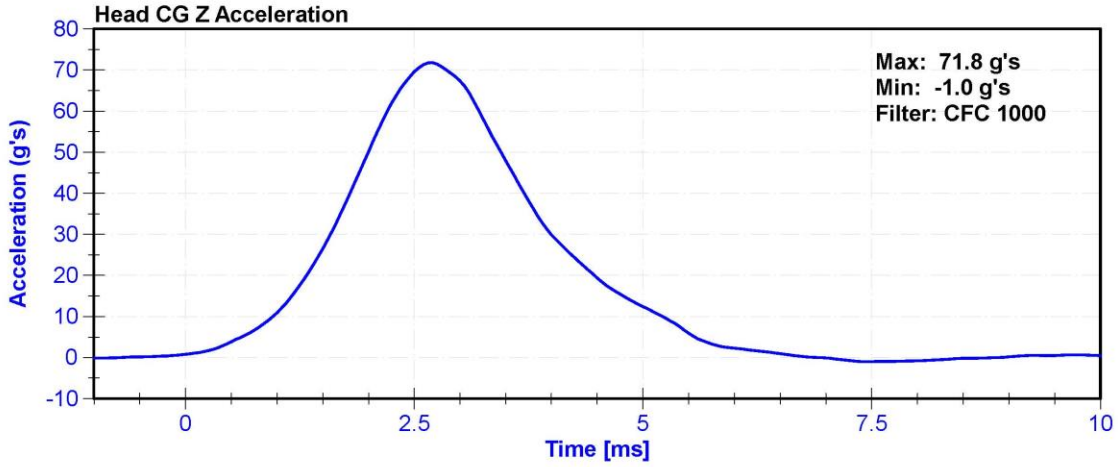
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	P68057	10/29/2019	4/29/2020
Y Accelerometer	Endevco	P79189	10/29/2019	4/29/2020
Z Accelerometer	Endevco	P52095	10/29/2019	4/29/2020




Head CG X Acceleration
Max: 0.8 g's
Min: -5.5 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]


Head CG Y Acceleration
Max: 97.6 g's
Min: -0.6 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]


Head CG Z Acceleration
Max: 71.8 g's
Min: -1.0 g's
Filter: CFC 1000
Acceleration (g's)
Time [ms]

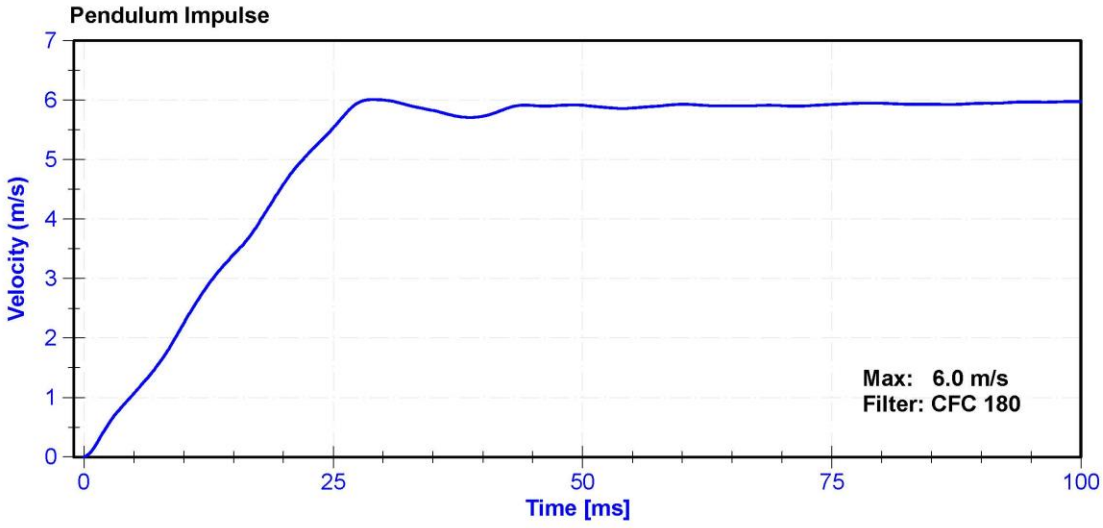
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

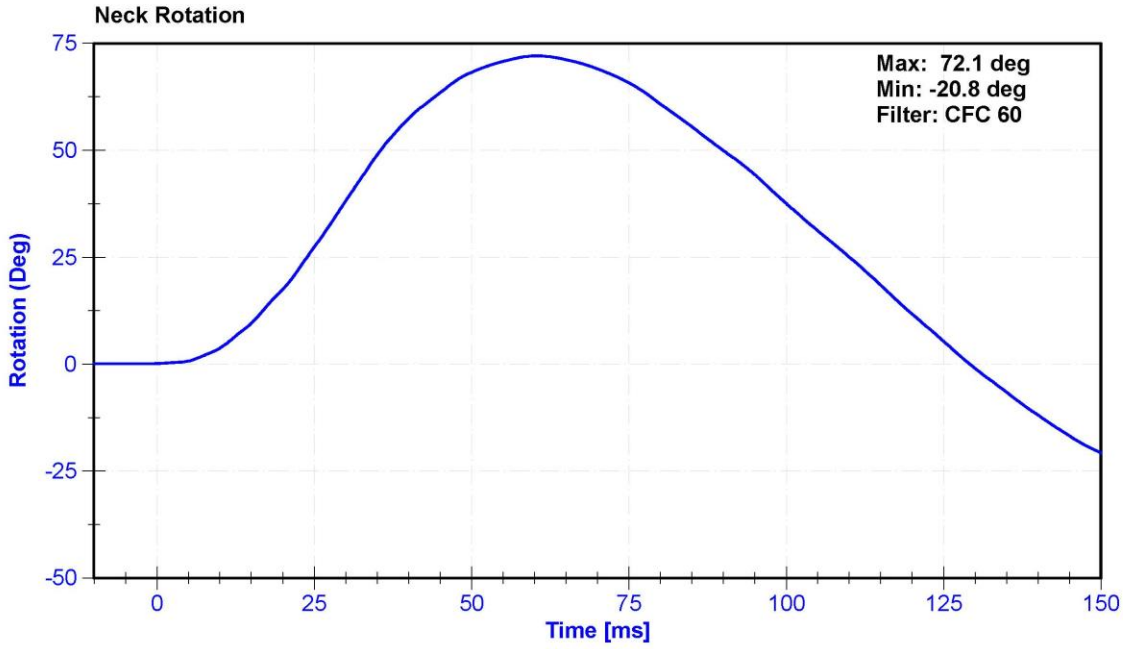
Results

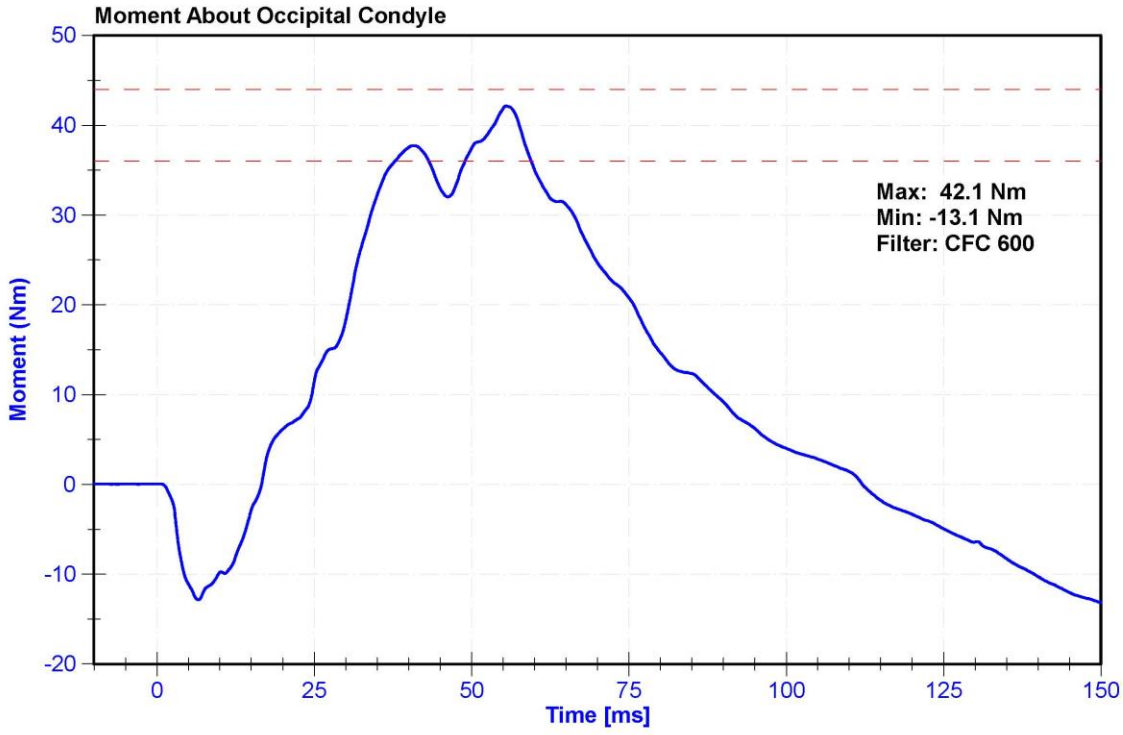
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	31.4	Pass
Velocity	5.51	5.63	m/s	5.584	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.25	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.40	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.58	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.53	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	6.00	Pass
Neck Rotation	71	81	deg	72.1	Pass
Time at Maximum Rotation	50	70	ms	60.4	Pass
Moment about the OC	36	44	Nm	42.1	Pass
Moment Decay to 0 Nm	102	126	ms	112.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
Pendulum Potentiometer	Denton 78051-342	DS-184Pend	11/4/2019	11/3/2020
Condyle Potentiometer	Denton 78051-342	DS-185Pend	11/4/2019	11/3/2020
Upper Neck Load Cell	Denton 1716A	LC-2192Fy	6/20/2019	6/19/2020




Neck Rotation
Max: 72.1 deg
Min: -20.8 deg
Filter: CFC 60
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]


Moment About Occipital Condyle
Max: 42.1 Nm
Min: -13.1 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

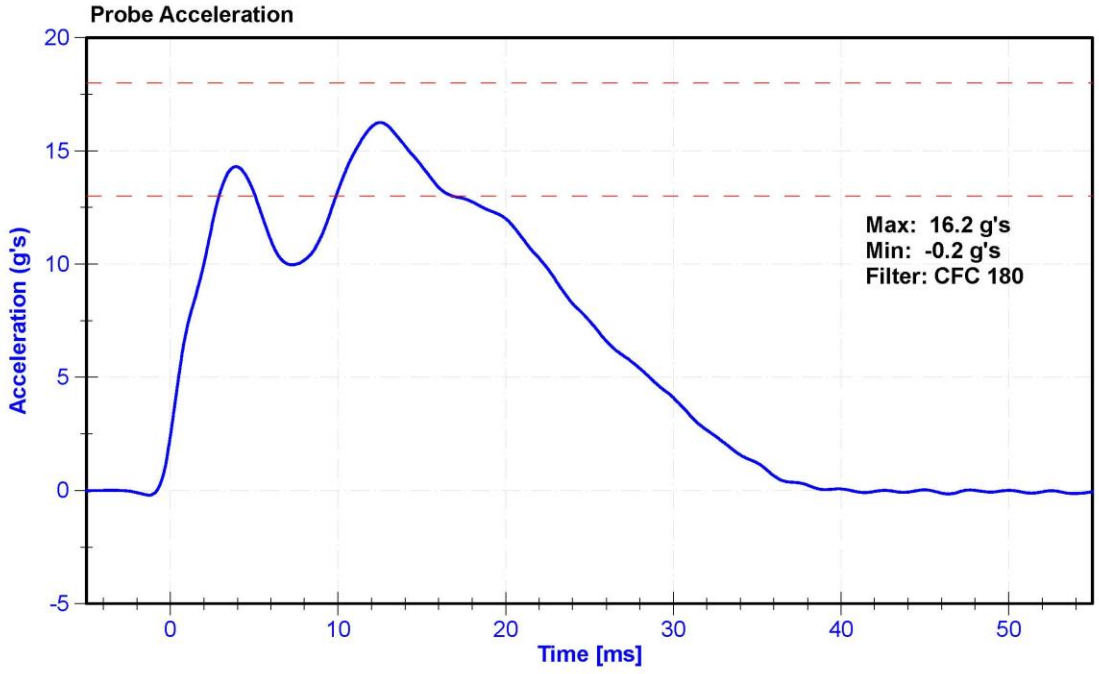
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

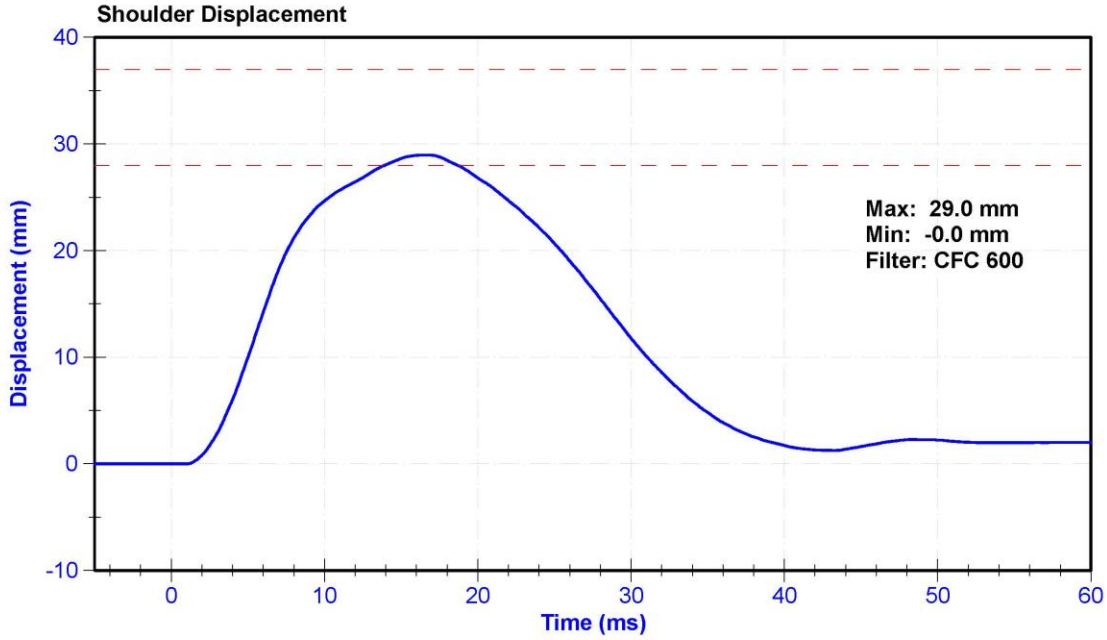
Results

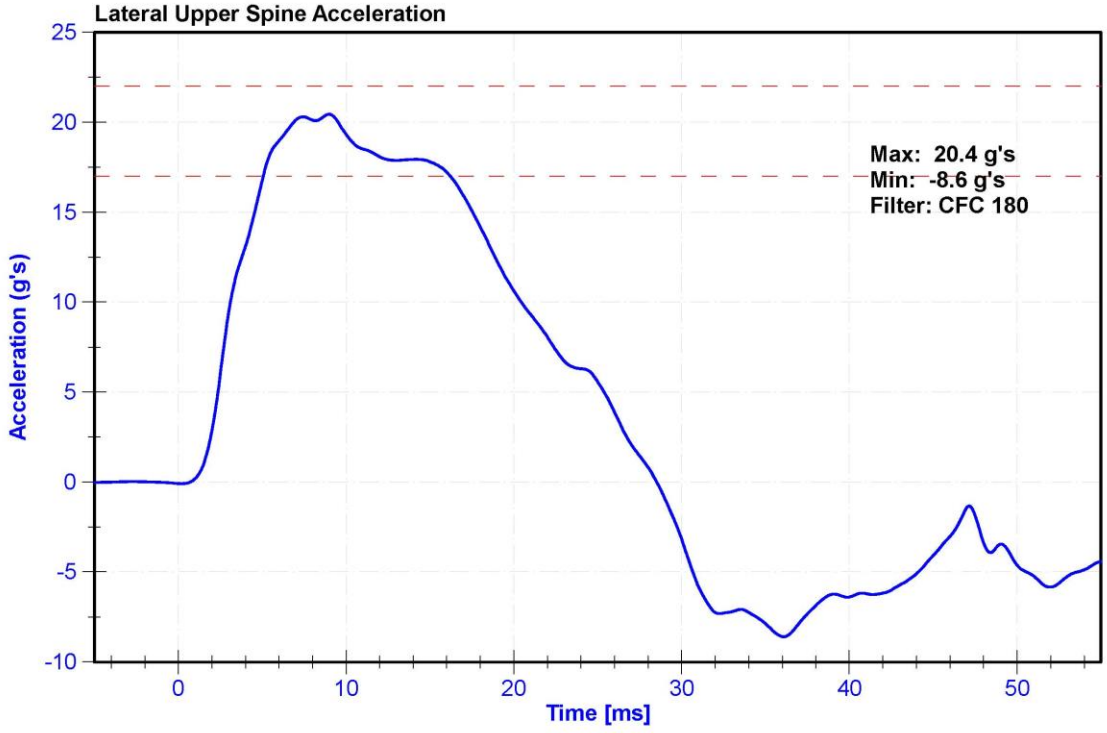
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	34.9	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Probe Acceleration	13	18	g's	16.2	Pass
Shoulder Deflection	28	37	mm	29.0	Pass
Lateral Upper Spine Acceleration	17	22	g's	20.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	9/27/2019	3/27/2020
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	10/29/2019	4/28/2020
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/29/2019	4/28/2020




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 29.0 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 20.4 g's
Min: -8.6 g's
Filter: CFC 180

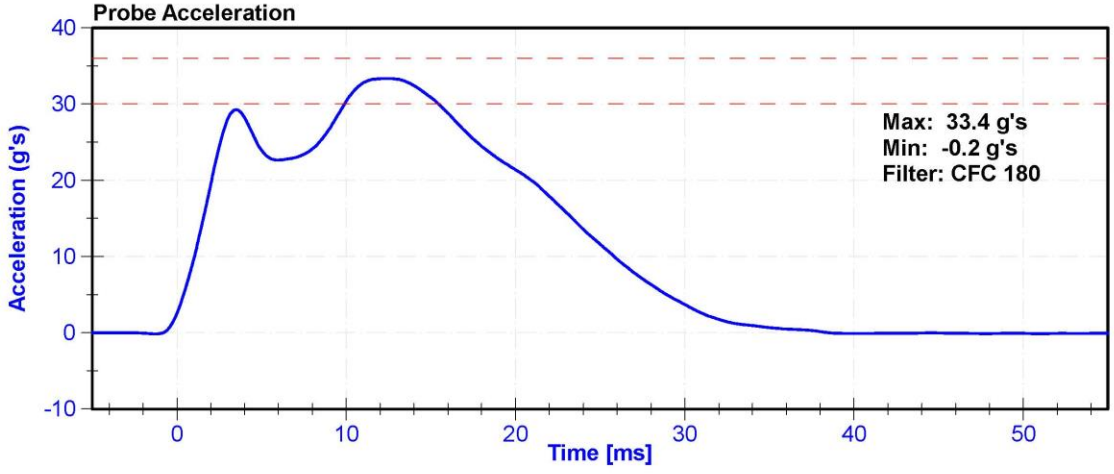
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

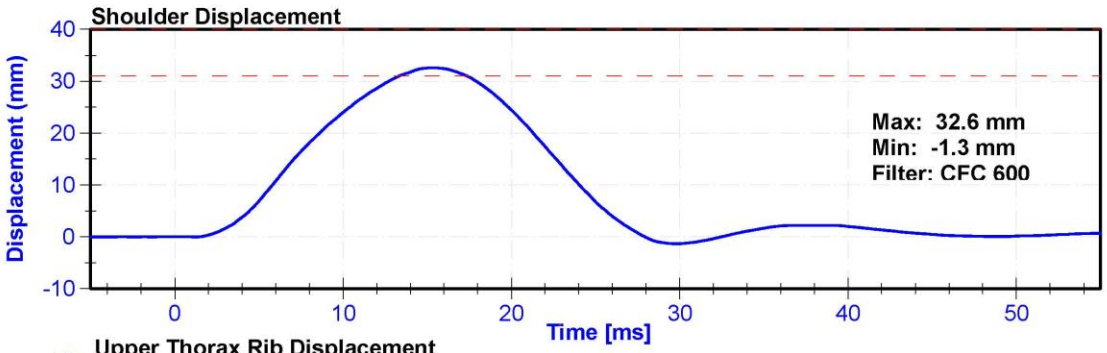
Results

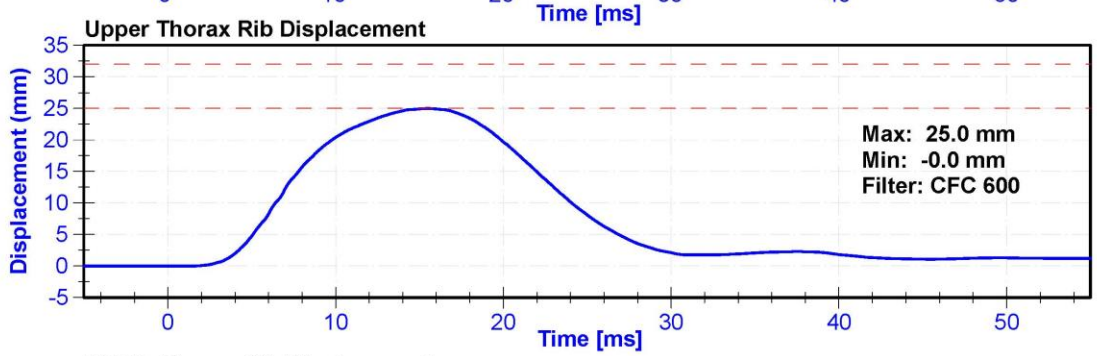
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	35.0	Pass
Velocity	6.6	6.8	m/s	6.76	Pass
Probe Acceleration after 5 ms	30	36	g's	33.4	Pass
Lateral Upper Spine Acceleration	34	43	g's	37.9	Pass
Lateral Lower Spine Acceleration	29	37	g's	34.5	Pass
Shoulder Deflection	31	40	mm	32.6	Pass
Upper Thorax Rib Deflection	25	32	mm	25.0	Pass
Mid Thorax Rib Deflection	30	36	mm	30.7	Pass
Lower Thorax Rib Deflection	32	38	mm	33.6	Pass

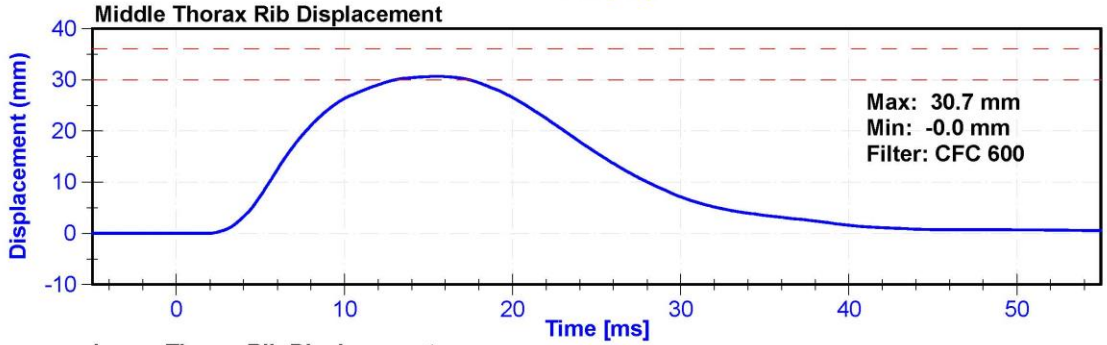
Transducer Calibrations

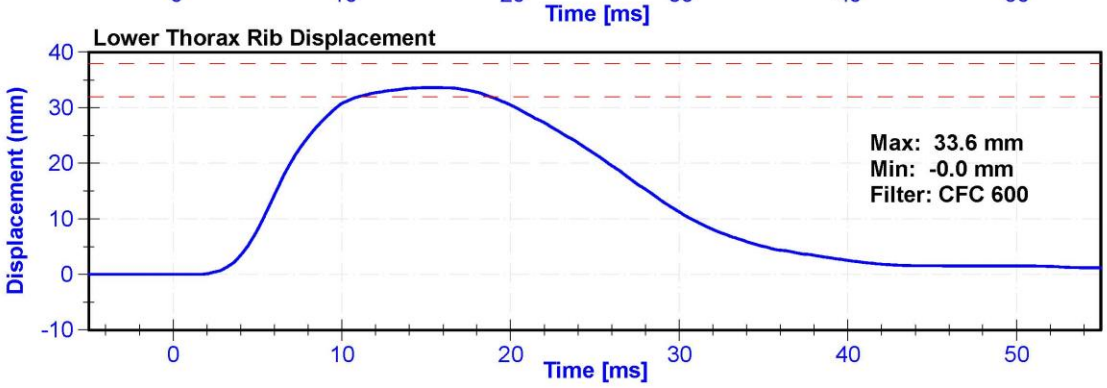
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	9/27/2019	3/27/2020
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/29/2019	4/28/2020
Upper Spine T12 Y Accelerometer	ENDEVCO 7264	AC-P64147	10/29/2019	4/28/2020
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	10/29/2019	4/28/2020
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	10/29/2019	4/28/2020
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	10/29/2019	4/28/2020
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	10/29/2019	4/28/2020

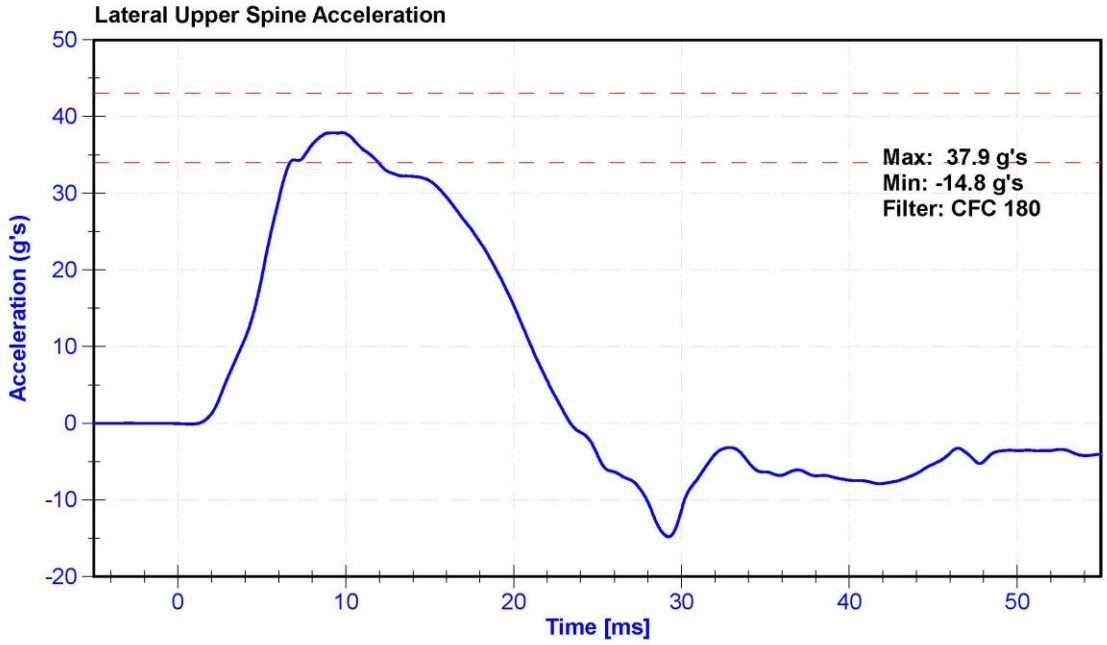


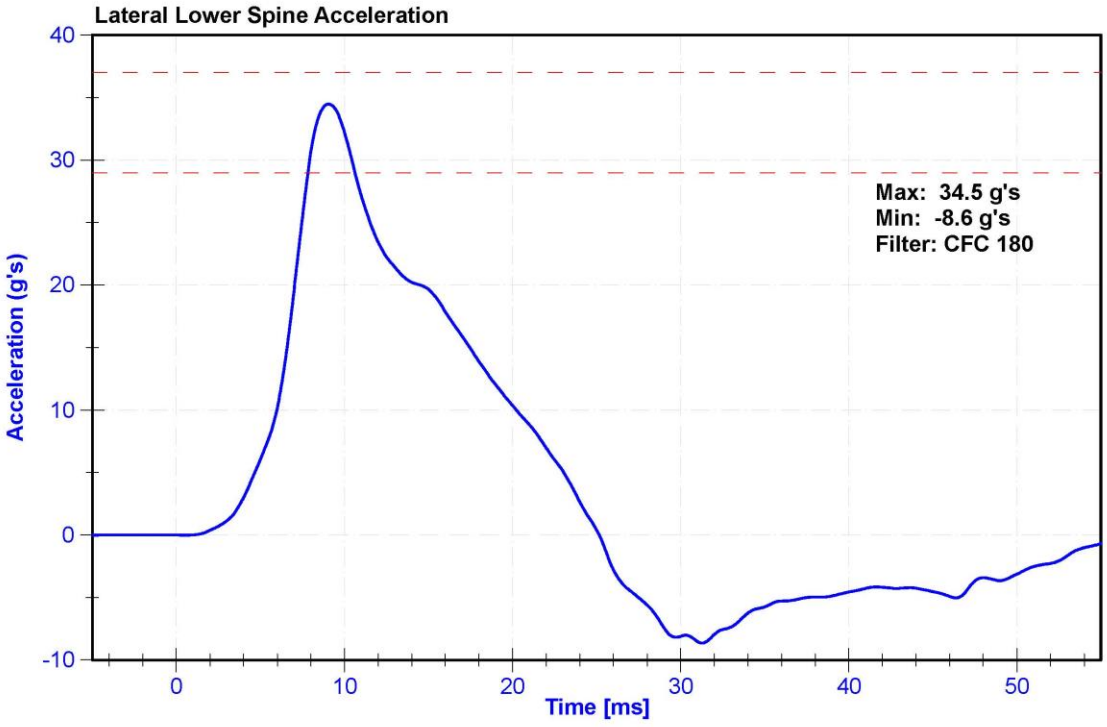

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 32.6 mm
Min: -1.3 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 25.0 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 30.7 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 33.6 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 37.9 g's
Min: -14.8 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 34.5 g's
Min: -8.6 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
0
10
20
30
40
50

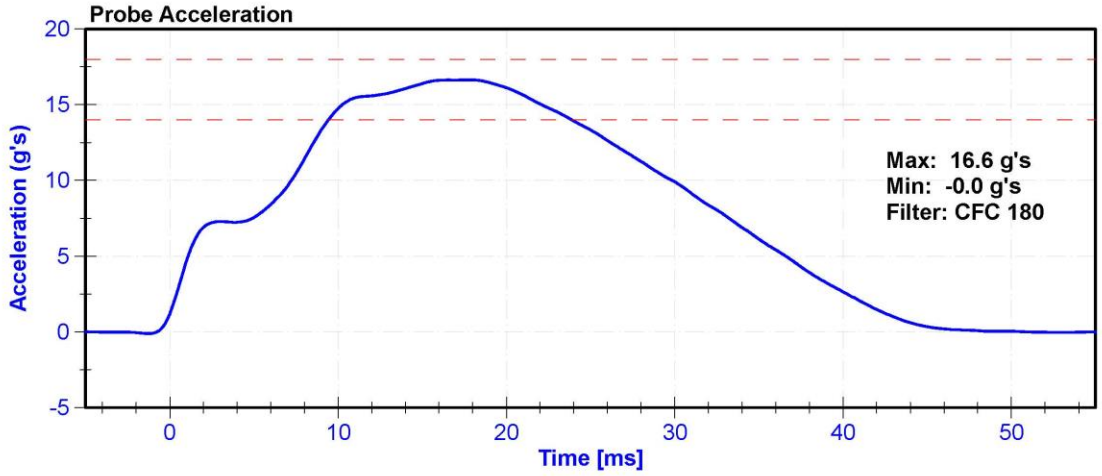
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

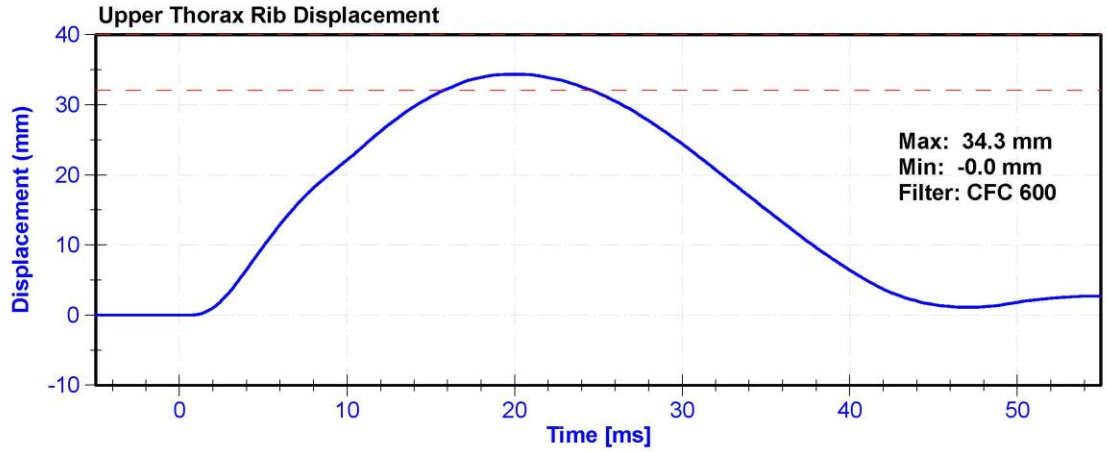
Results

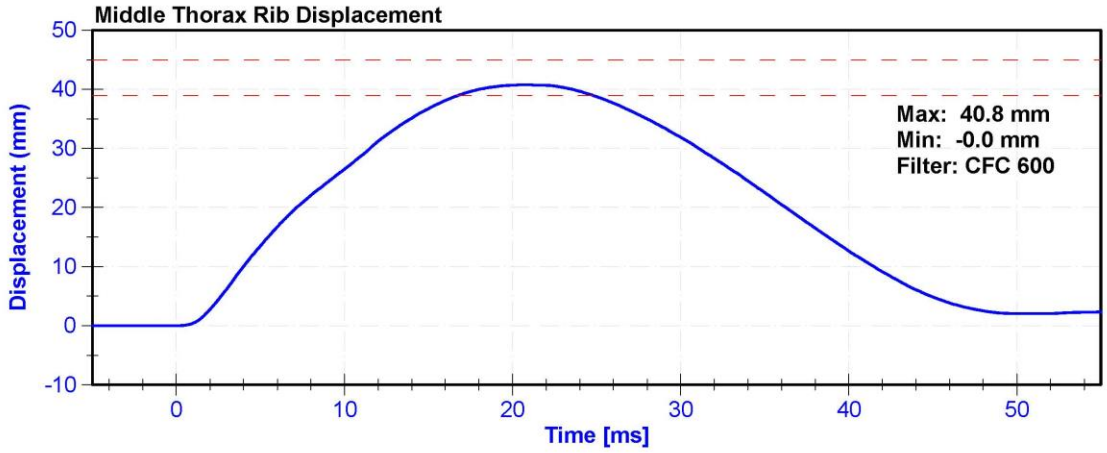
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.1	Pass
Humidity	10	70	%	29	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Probe Acceleration	14	18	g's	16.6	Pass
Lateral Upper Spine Acceleration	13	17	g's	15.4	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.7	Pass
Upper Thorax Rib Deflection	32	40	mm	34.3	Pass
Middle Thorax Rib Deflection	39	45	mm	40.8	Pass
Lower Thorax Rib Deflection	35	43	mm	37.6	Pass

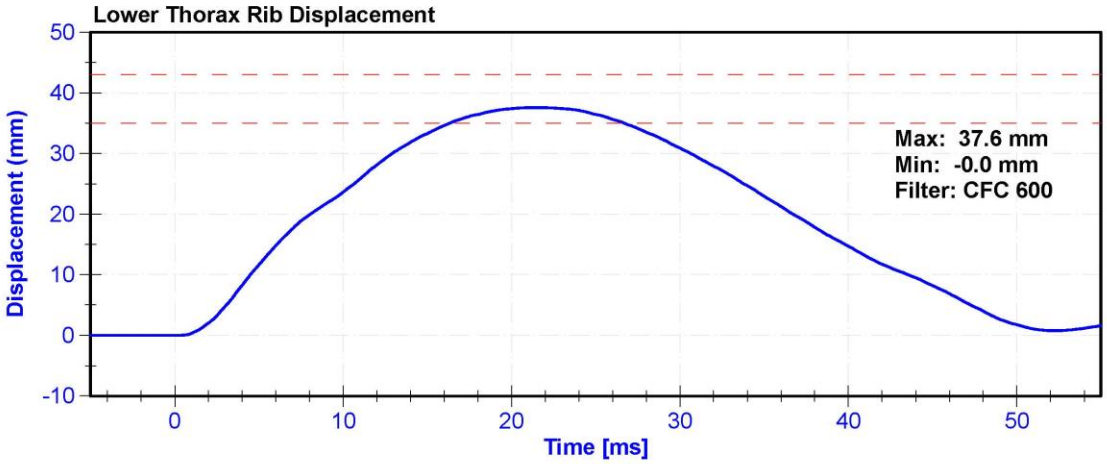
Transducer Calibrations

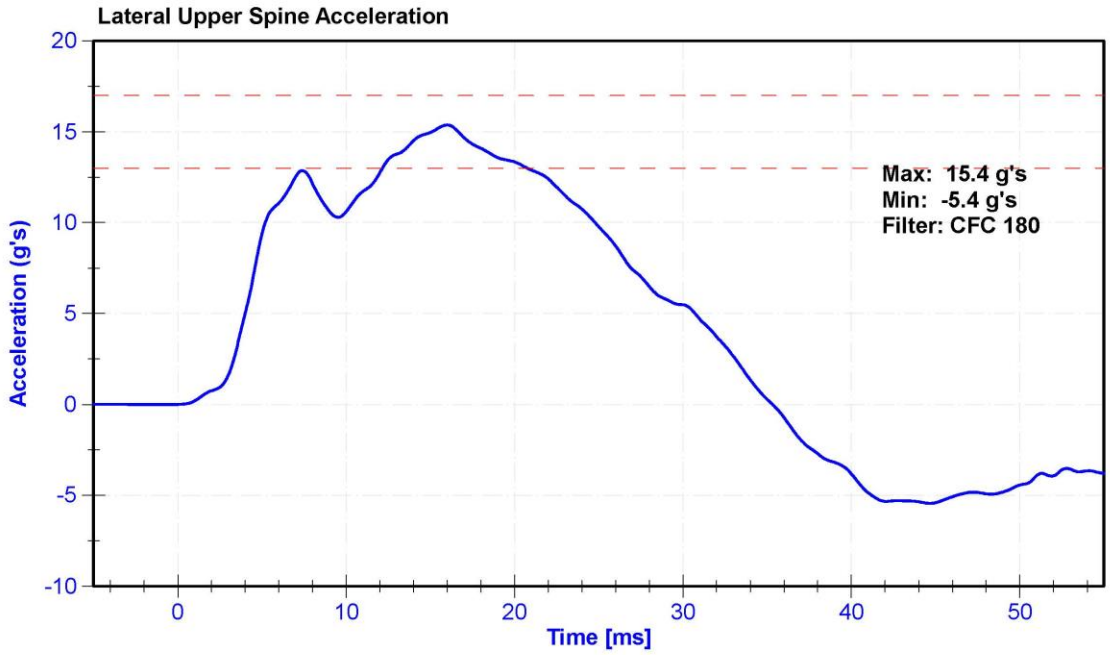
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	9/27/2019	3/27/2020
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/29/2019	4/28/2020
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	10/29/2019	4/28/2020
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	10/29/2019	4/28/2020
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	10/29/2019	4/28/2020
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	10/29/2019	4/28/2020

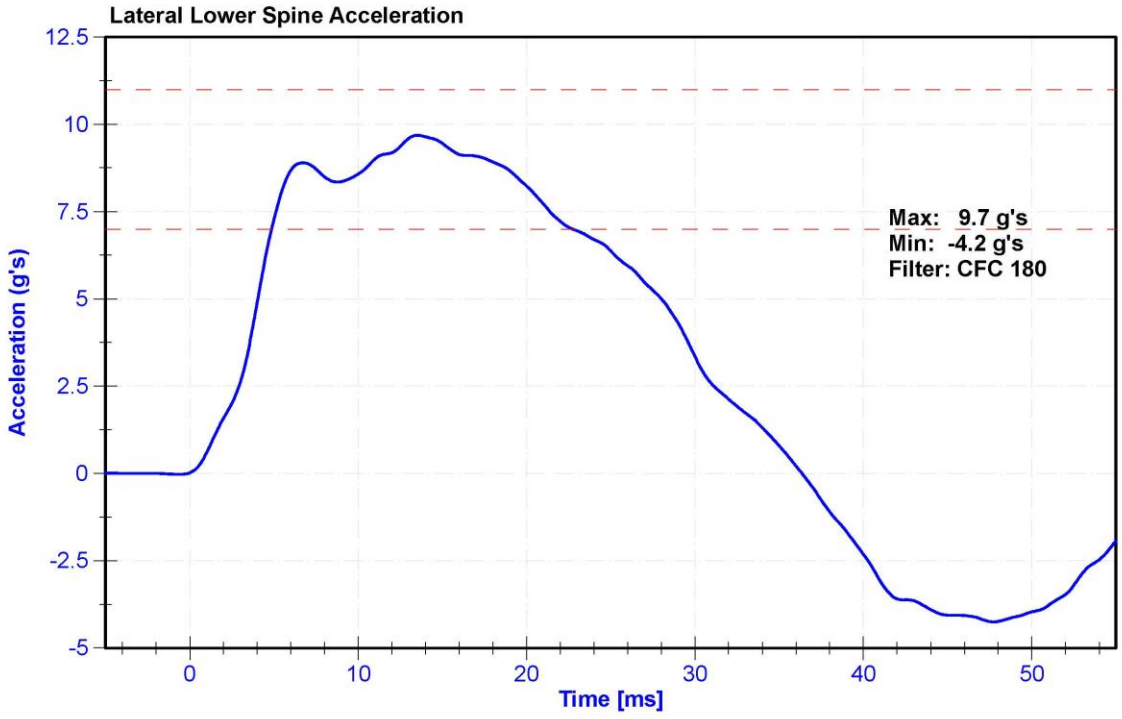



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 34.3 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.8 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.6 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 15.4 g's
Min: -5.4 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
20
15
10
5
0
-5
-10
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 9.7 g's
Min: -4.2 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50

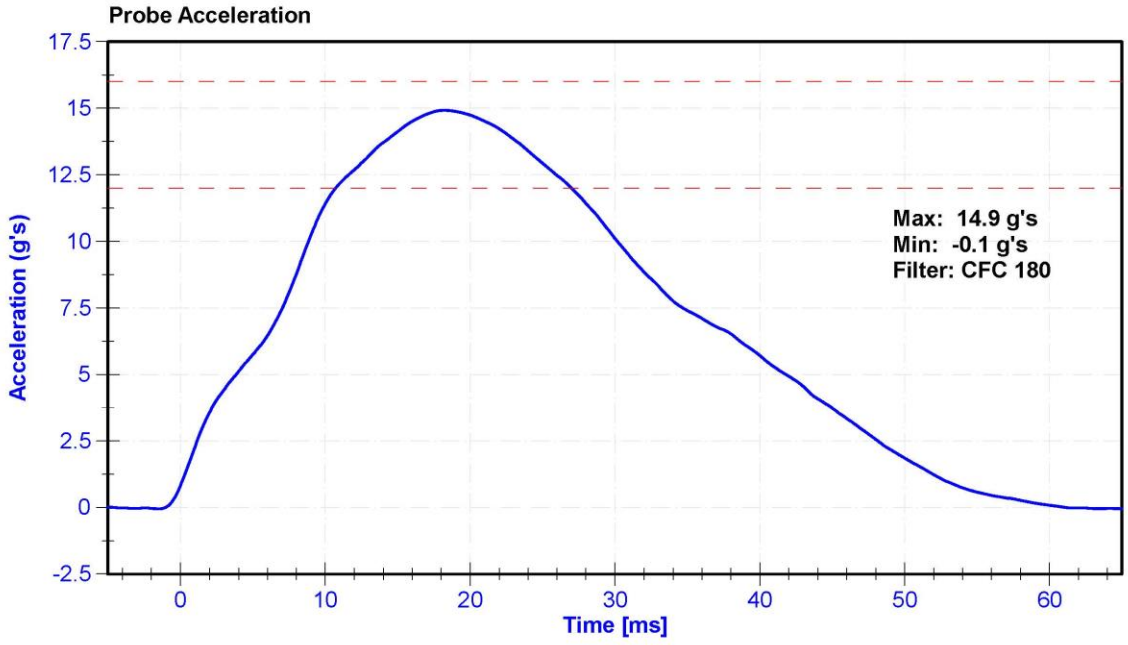
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

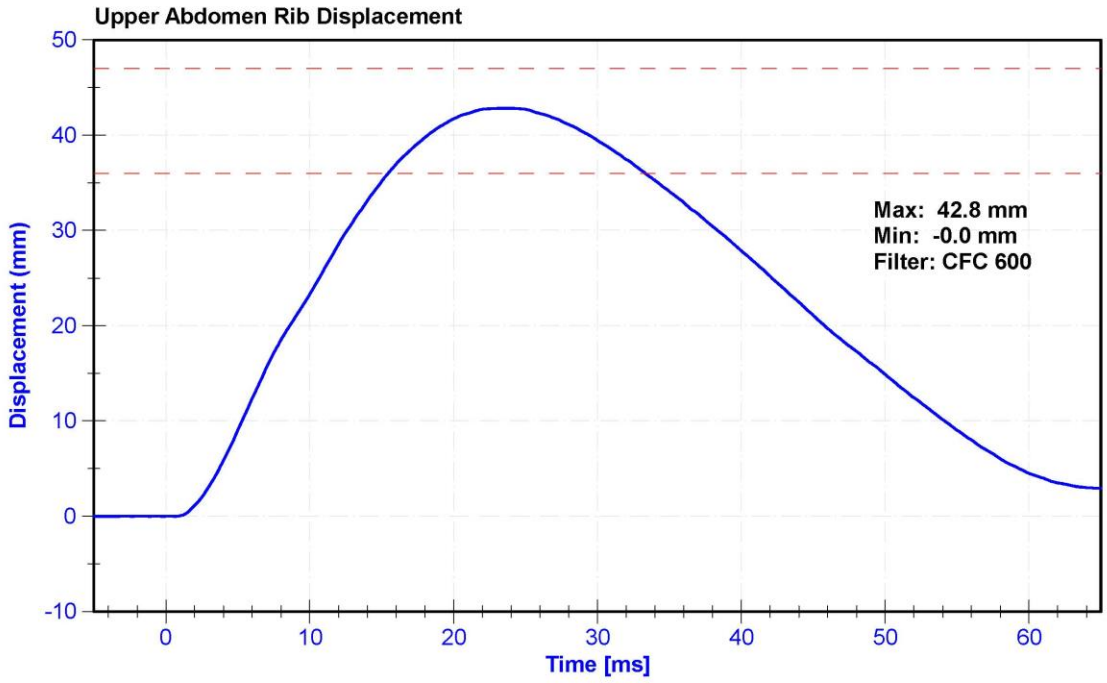
Results

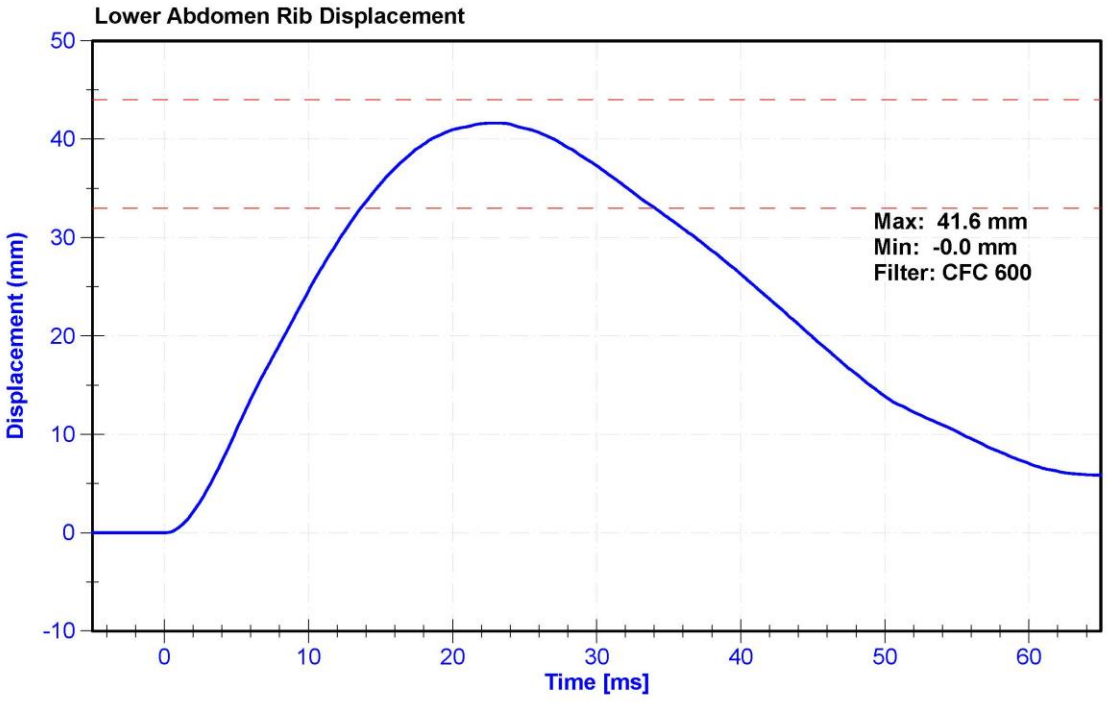
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	34.0	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Probe Acceleration	12	16	g's	14.9	Pass
Lateral Lower Spine Acceleration	9	14	g's	11.5	Pass
Upper Abdomen Rib Deflection	36	47	mm	42.8	Pass
Lower Abdomen Rib Deflection	33	44	mm	41.6	Pass

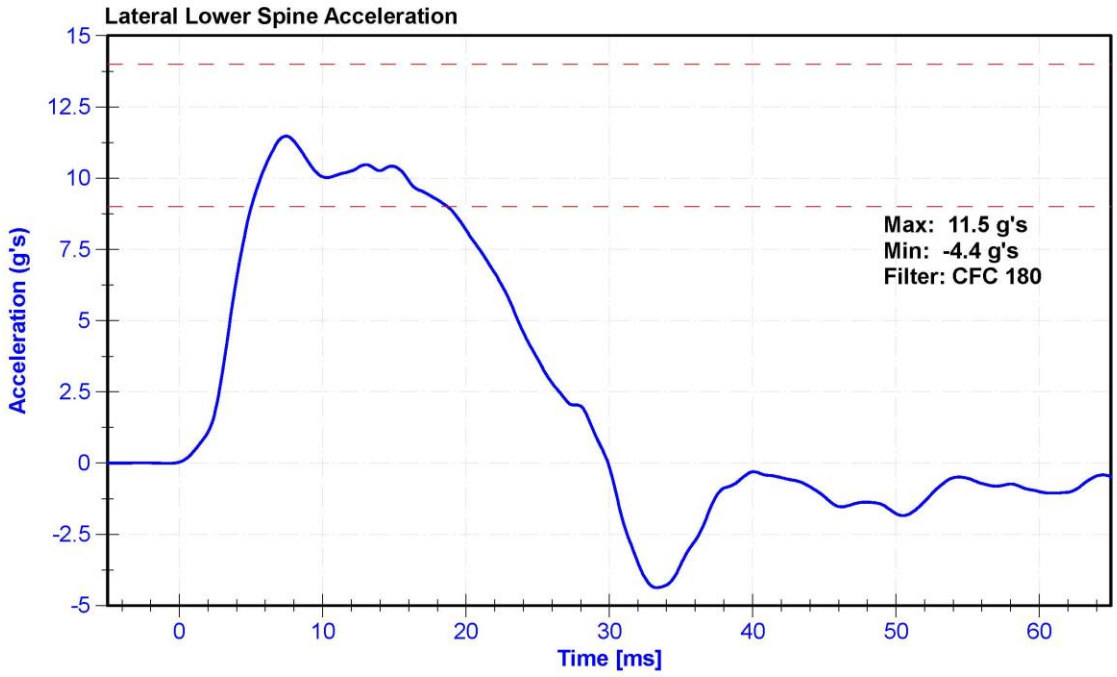
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A286228	9/27/2019	3/27/2020
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	10/29/2019	4/28/2020
Upper Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-308GFE	10/29/2019	4/28/2020
Lower Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-307GFE	10/29/2019	4/28/2020




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 42.8 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.6 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Lower Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 11.5 g's
Min: -4.4 g's
Filter: CFC 180
15
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50
60

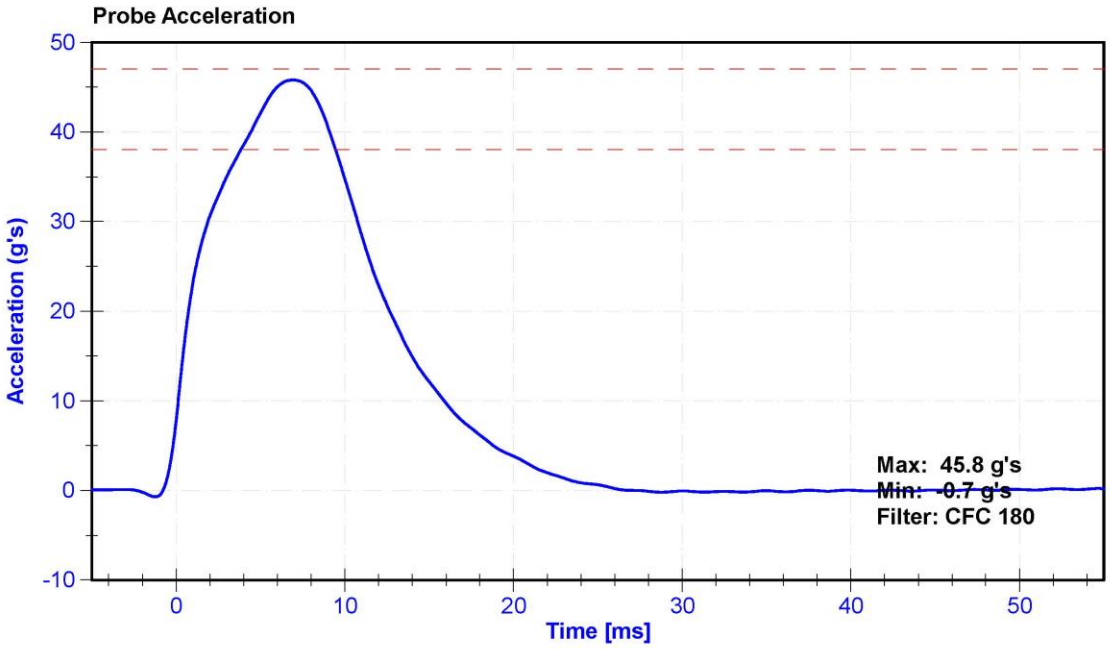
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

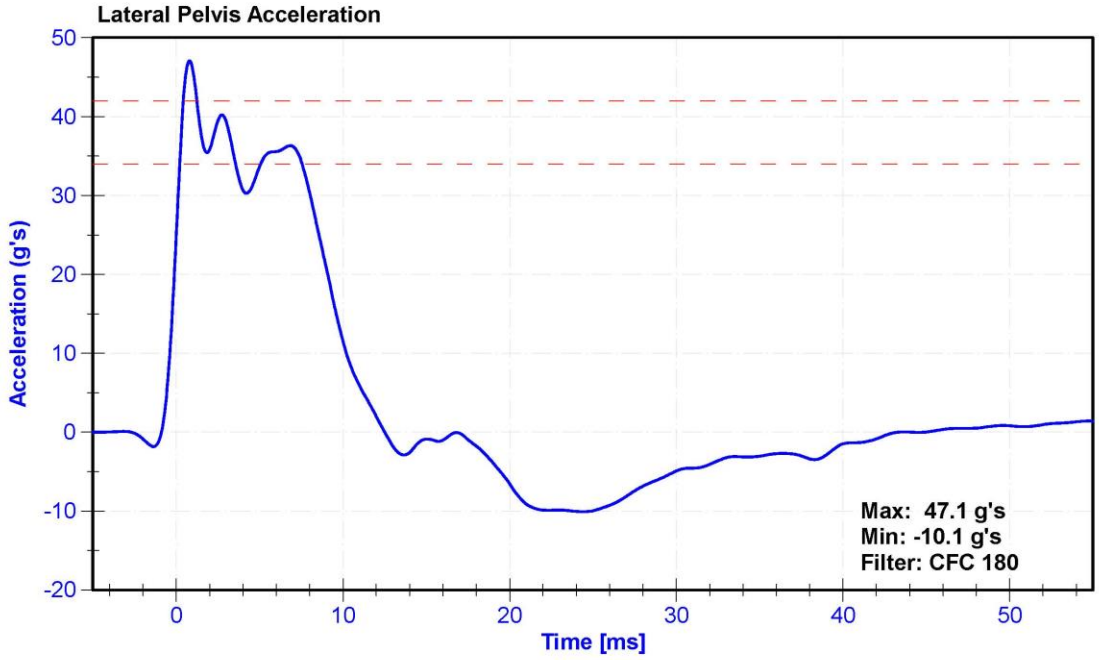
Results

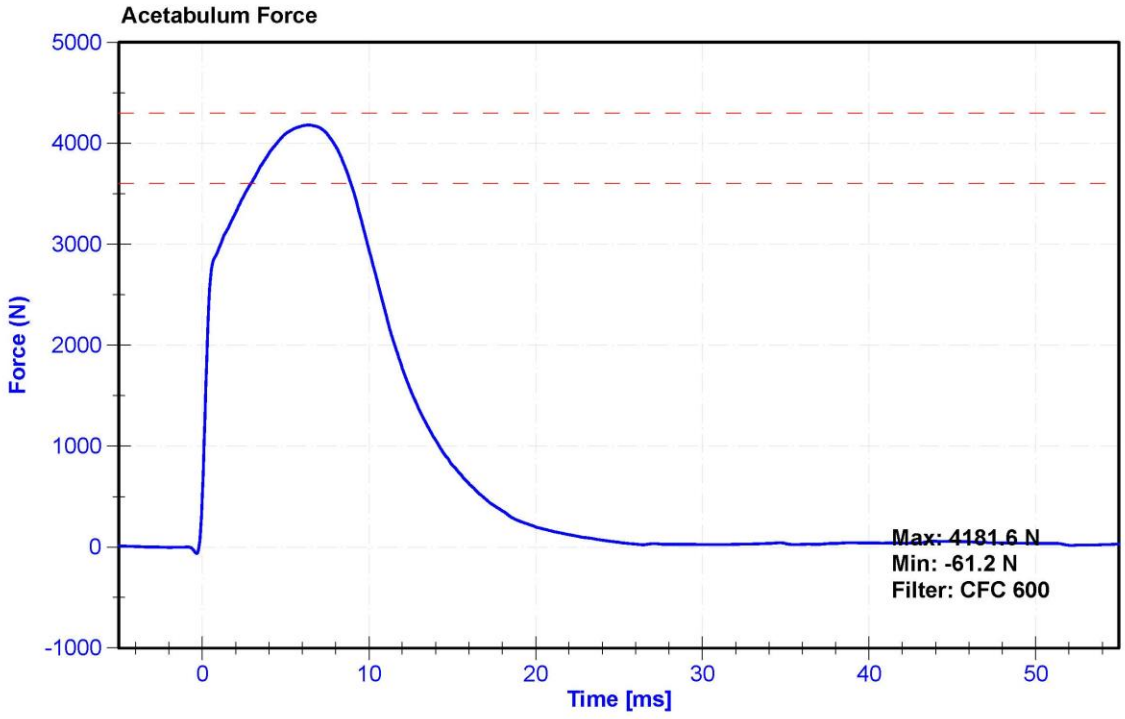
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	29	Pass
Velocity	6.6	6.8	m/s	6.67	Pass
Probe Acceleration	38	47	g's	45.8	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	36.3	Pass
Acetabulum Force	3600	4300	N	4181.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	9/27/2019	3/27/2020
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51731	10/29/2019	4/28/2020
Acetabulum Load Cell	Denton 3249J	LC-276Fy	9/24/2019	9/23/2020
Certification Plug	SACO	12610	10/3/2018	N/A
Crash Test Plug	SACO	12560	10/3/2018	N/A




Lateral Pelvis Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]
Max: 47.1 g's
Min: -10.1 g's
Filter: CFC 180


Acetabulum Force
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 4181.6 N
Min: -61.2 N
Filter: CFC 600

300 12/4/2019 Certy

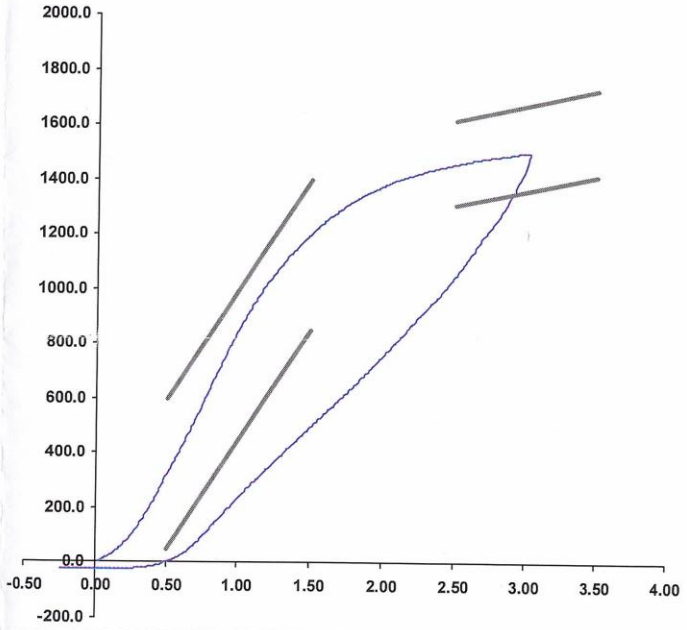
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 12610
Test Number 7540
Report Number 7555
Test Date 10/3/2018 10:52:16 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	327.44	50.00	600.00
Force @ 1.5 mm (N)	1,205.77	850.00	1,400.00
Force @ 2.5 mm (N)	1,457.10	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,500.46	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator

Part Number 180-4450

Template No 107 **03-Oct-18**
SACO Research

By : DC Date : 10/3/18

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

300 Crash 12/5/19

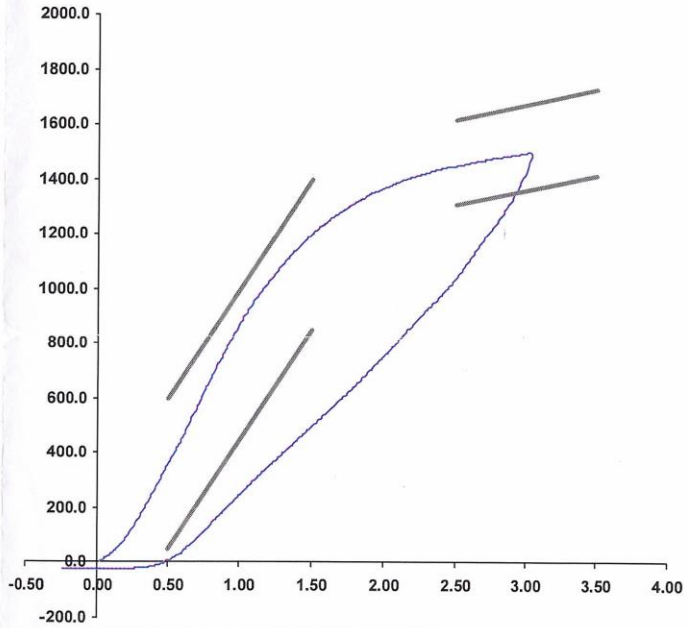
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 12560
Test Number 7488
Report Number 7503
Test Date 10/3/2018 8:25:19 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	363.05	50.00	600.00
Force @ 1.5 mm (N)	1,203.13	850.00	1,400.00
Force @ 2.5 mm (N)	1,448.01	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,496.67	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator

Part Number 180-4450

Template No 107 **03-Oct-18**
SACO Research

By : DC Date : 10/3/18

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

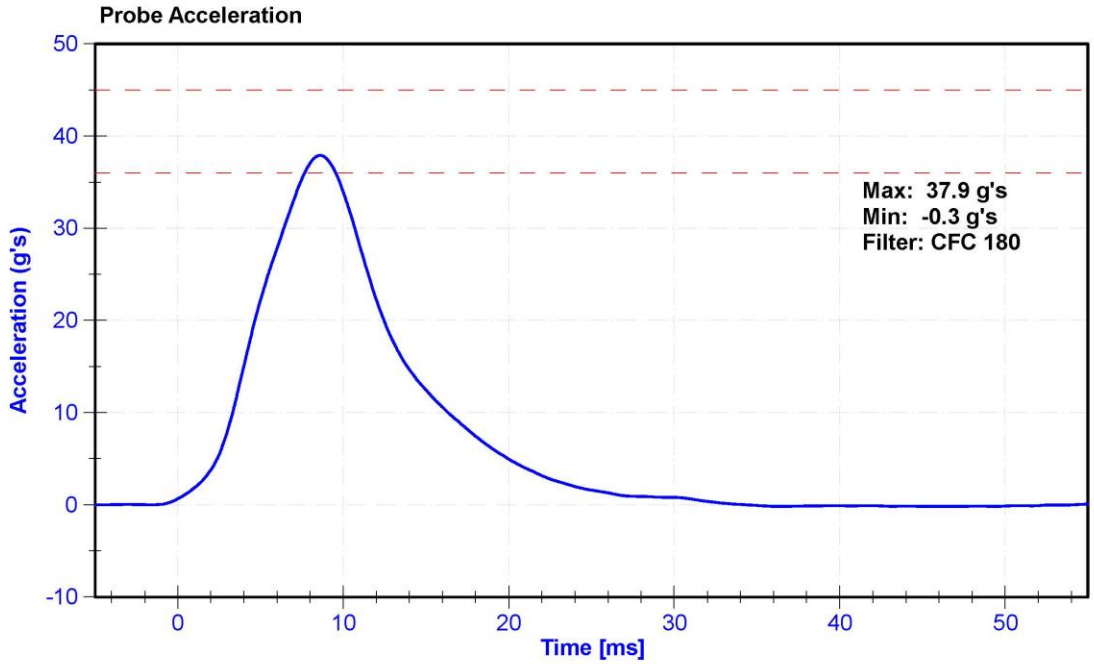
ATD Manufacturer	FTSS	Test Technician	K. Brogan
ATD Serial Number	300	Laboratory Supervisor	K. Dutton

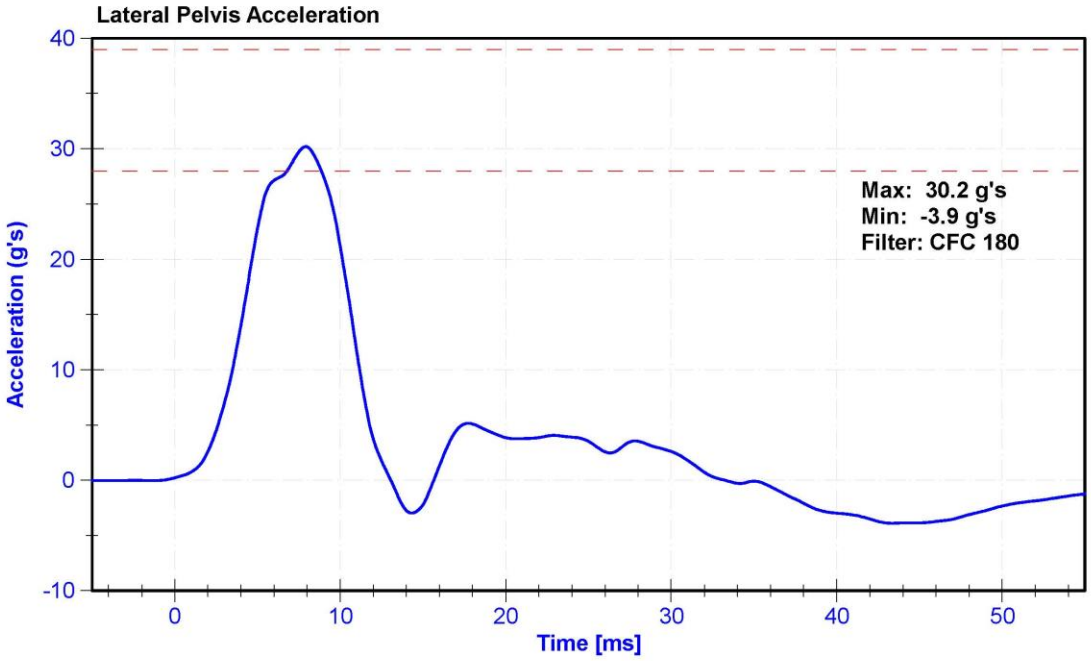
Results

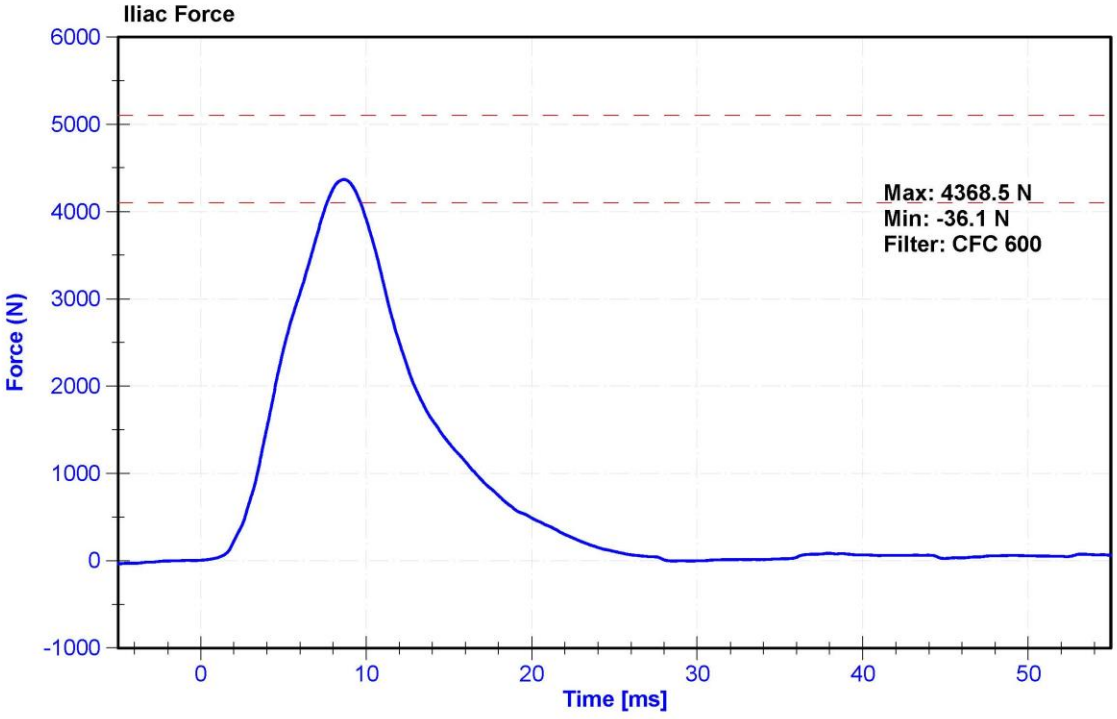
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	24.3	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	36	45	g's	37.9	Pass
Lateral Pelvis Acceleration	28	39	g's	30.2	Pass
Iliac Force	4100	5100	N	4368.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	9/27/2019	3/27/2020
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51731	10/29/2019	4/28/2020
Iliac Load Cell	DENTON 3228J	LC-280Fy	6/20/2019	6/19/2020




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 30.2 g's
Min: -3.9 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4368.5 N
Min: -36.1 N
Filter: CFC 600

APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N: F034		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X	AC-P49204	ENDEVCO	10/29/2019
		Y	AC-P63981	ENDEVCO	10/29/2019
		Z	AC-P64007	ENDEVCO	10/29/2019
	Redundant	X	AC-P52003	ENDEVCO	10/29/2019
		Y	AC-P64122	ENDEVCO	10/29/2019
		Z	AC-P51962	ENDEVCO	10/29/2019
Thorax Rib Displacement Potentiometers	Upper	Y	DS-183GFE	Honeywell	10/31/2019
	Middle	Y	DS-184GFE	Honeywell	10/31/2019
	Lower	Y	DS-182GFE	Honeywell	10/31/2019
Abdomen Load Cells	Forward	Y	LC-1440	DENTON	6/14/2019
	Middle	Y	LC-1525	DENTON	6/5/2019
	Rear	Y	LC-1528	DENTON	6/14/2019
Lower Spine Accelerometers (T12)		X	AC-P17299	ENDEVCO	10/29/2019
		Y	AC-P39731	ENDEVCO	10/29/2019
		Z	AC-P22639	ENDEVCO	10/29/2019
Pubic Symphysis Load Cell		Y	LC-464fy	DENTON	6/14/2019

Table 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N:300		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers		Primary	X	AC-P68057	ENDEVCO	10/29/2019
			Y	AC-P79189	ENDEVCO	10/29/2019
			Z	AC-P52095	ENDEVCO	10/29/2019
		Redundant	X	AC-P59018	ENDEVCO	10/29/2019
			Y	AC-P58986	ENDEVCO	10/29/2019
			Z	AC-P58777	ENDEVCO	10/29/2019
Displacement Potentiometers	Thoracic Rib	Upper	Y	DS-451GFE	Servo	10/29/2019
		Middle	Y	DS-040GFE	Servo	10/29/2019
		Lower	Y	DS-1156GFE	Servo	10/29/2019
	Abdominal Rib	Upper	Y	DS-308GFE	Servo	10/29/2019
		Lower	Y	DS-307GFE	Servo	10/29/2019
Lower Spine Accelerometers (T12)			X	AC-P58883	ENDEVCO	10/29/2019
			Y	AC-P64147	ENDEVCO	10/29/2019
			Z	AC-P58786	ENDEVCO	10/29/2019
Acetabulum Load Cell			Y	LC-276Fy	Denton	9/24/2019
Iliac Wing Load Cell			Y	LC-280Fy	Denton	6/20/2019
Pelvis Plug (struck side)				11590	SACO	10/4/2016
Pelvis Plug (non-struck side)				-	-	-

Table 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	AC-A280871	MSI 1201-1000	11/13/2019
	Vehicle Center of Gravity	Y	AC-A262039	MSI 1201-1000	11/13/2019
	Vehicle Center of Gravity	Z	A282635	MSI 1201-1000	11/13/2019
2	Right Sill at Front Seat	X	AC-A255837	MSI 1201-1000	10/25/2019
	Right Sill at Front Seat	Y	AC-A280355	MSI 1201-1000	10/25/2019
	Right Sill at Front Seat	Z	A284340	MSI 1201-1000	10/25/2019
3	Right Sill at Rear Seat	X	AC-A280349	MSI 1201-1000	9/5/2019
	Right Sill at Rear Seat	Y	AC-A280352	MSI 1201-1000	9/5/2019
	Right Sill at Rear Seat	Z	AC-A280347	MSI 1201-1000	11/8/2019
4	Left Sill at Front Door	Y	A284326	MSI 1201-1000	6/15/2019
5	Left Sill at Rear Door	Y	AC-A279994	MSI 1201-1000	8/15/2019
6	Left A-Post Lower	Y	A284237	MSI 1201-1000	6/15/2019
7	Left A-Post Middle	Y	AC-A280860	MSI 1201-1000	11/8/2019
8	Left B-Post Lower	Y	A282652	MSI 1201-1000	9/11/2019
9	Left B-Post Middle	Y	AC-A280982	MSI 1201-1000	10/15/2019
10	Front Seat Track	Y	AC-A255997	MSI 1201-1000	10/9/2019
11	Rear Seat Track or Structure	Y	AC-A262038	MSI 1201-1000	11/8/2019
12	Right Rear Occ. Compartment	Y	AC-A255839	MSI 1201-1000	10/18/2019
13	Engine Block	X	AC-A217581	MSI 1201-1000	10/9/2019
	Engine Block	Y	AC-A280986	MSI 1201-1000	10/9/2019
14	Rear Floorpan Above Axle	X	AC-A280914	MSI 1201-1000	9/9/2019
	Rear Floorpan Above Axle	Y	AC-A280209	MSI 1201-1000	9/9/2019
	Rear Floorpan Above Axle	Z	AC-A280871	MSI 1201-1000	11/13/2019

TABLE 4 – MDB Instrumentation

MDB Instrumentation		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	A250366	MSI 1201-1000	7/9/2019
MDB Center of Gravity	Y	A280851	MSI 1201-1000	7/9/2019
MDB Center of Gravity	Z	A281024	MSI 1201-1000	7/9/2019
Left Frame at Rear Axle Centerline	X	A254666	MSI 1201-1000	10/30/2019
Left Frame at Rear Axle Centerline	Y	A280866	MSI 1201-1000	10/30/2019