REPORT NUMBER: SINCAP-CAL-20-013

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

Toyota Motor Manufacturing Indiana, Inc.
2020 Toyota Highlander
Five Door SUV

NHTSA No: M20205102

PREPARED BY:
CALSPAN CORPORATION
P.O. BOX 400
BUFFALO, NEW YORK 14225

November 6, 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: Matthew Pronko Date: November 6, 2020
Matthew Pronko, Test Engineer

Approved by: Vanessa Hansen Date: November 6, 2020
Vanessa Hansen, Operations Manager

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: _____

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Matthew Pronko, Test Engineer Vanessa Hansen , Operations Manager	**8. Performing Organization Report No.** CAL-DOT-2020-013
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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 Toyota Highlander SUV 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 August 11, 2020.

The impact velocity of the Moving Deformable Barrier (MDB) was 61.89 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 198mm 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	55.460
Maximum Thoracic Rib Deflection	mm	44	8.229
Total Abdominal Force	N	2500	353.334
Pubic Symphysis Force	N	6000	1335.294

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC_{36})	N/A	1000	113.905
Lower Spine Resultant Acceleration	G	82	36.977
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	677.530
Maximum Thoracic Rib Deflection	mm	38*	13.555
Maximum Abdominal Rib Deflection	mm	45*	17.336

* *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	18. Distribution Statement
New Car Assessment Program (NCAP) Side Impact MDB ES-2re SID-IIs	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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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 Toyota Highlander SUV. 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 Toyota Highlander SUV 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 61.89 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 August 11, 2020. 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	55.460
Maximum Thorax Rib Deflection	mm	44	8.229
Combined Abdominal Force	N	2500	353.334
Pubic Symphysis Force	N	6000	1335.294

Measurement Description	Passenger ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC36)		1000	113.905
Lower Spine (T12) Resultant Acceleration	G	82	36.977
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	677.530
Maximum Thoracic Rib Deflection	mm	38*	13.555
Maximum Abdominal Rib Deflection	mm	45*	17.336

*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 – F033
2. P4 serial number – 300

Data Anomalies:

The following channel was questionable for

- Left Front Sill Y Acceleration, Exceeded calibration range at 30.6 ms
- Left B-Pillar Lower Y Acceleration, Exceeded calibration range and saturated at 12.6 ms
- Left B-Pillar Middle Y Acceleration, Exceeded calibration range at 9.6 ms 14.7 ms 19.4 ms

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 Toyota Highlander SUV NHTSA No.: M20205102
Test Program: NCAP Side MDB Impact Test Test Date: 8/11/2020

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20205102
Model Year	2020
Make	Toyota
Model	Highlander
Body Style	SUV
VIN	5TDCZRAH7LS509743
Body Color	Silver
Odometer Reading (km/mi)	6 mi
Engine Displacement (L)	3.5
Type/No. Cylinders	V6
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	8-Speed
Overdrive	Yes
Final Drive	Front Wheel Drive
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
Anti-Lock Brakes (ABS)	Yes

Traction Control System (TCS)	Yes
Auto-Leveling System	No
Automatic Door Locks (ADL)	Yes
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
Front Pass. Seat Cushion Airbag	Yes

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

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Manufacturing, Indiana, Inc.
Date of Manufacture	06/20
Vehicle Type	MPV

GVWR (kg)	2645
GAWR Front (kg)	1635
GAWR Rear (kg)	1635

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3	3	8	
Capacity Weight (VCW) (kg)				622	(A)
DSC X 68.04 kg				544.32	(B)
Cargo Weight (RCLW) (kg)				77.68	(A-B)

VEHICLE SEAT TYPE

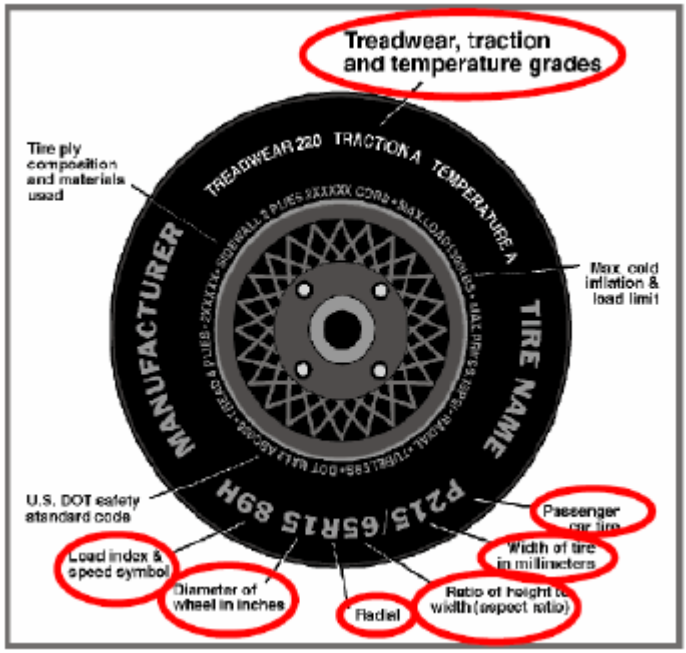
Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front Seat	X						X
Rear or Second Row Seat			X			X	
Third Row seat			X			X	

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

Test Vehicle:	2020 Toyota Highlander SUV	NHTSA No.:	M20205102
Test Program:	NCAP Side MDB Impact Test	Test Date:	8/11/2020

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)	250	250
Recommended Tire Size	235/65R18	235/65R18
Tire Size on Vehicle	235/65R18	235/65R18
Tire Manufacturer	Bridgestone	Bridgestone
Tire Model	Alenza Sport	Alenza Sport
Treadwear	500	500
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Nylon	2 Polyester, 2 Steel, 1 Nylon
Load Index/Speed Symbol	106V	106V
Tire Material	Rubber	Rubber
DOT Safety Code Left	1W2LMALA12120	1W2LMALA12120
DOT Safety Code Right	1W2LMALA12120	1W2LMALA12120

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

Test Vehicle: 2020 Toyota Highlander SUV NHTSA No.: M20205102
Test Program: NCAP Side MDB Impact Test Test Date: 8/11/2020

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	260	250	260	261
Tire Placard	kPa	250	250	250	250
Owner's Manual	kPa	250	250	250	250
As Tested	kPa	250	250	250	250

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	411	543		567	495		513	573	
Right	kg	532	394		562.5	452.5		554	449	
Ratio	%	50	50		54	46		51	49	
Totals	kg	943	937	1880	1129.5	947.5	2077	1067	1022	2089

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1880	(A)
Sum of Actual Weight of 1 ES2re and 1 P572 ATD (SID-IIs)	kg	127	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	77.68	(C)
Calculated Target Vehicle Test Weight (TVTW)	kg	2084.68	(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	875	878	Yes
RF	mm	882	883	Yes
RR	mm	891	891	Yes
LR	mm	883	885	Yes
Vehicle CG (Aft of Front Axle)	mm	1397	1303	
Vehicle CG (Left(+)/Right(-) from Longitudinal Centerline)	mm	33	19	

*** 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 Toyota Highlander SUV NHTSA No.: M20205102
Test Program: NCAP Side MDB Impact Test Test Date: 8/11/2020

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	10
Jack	3
Ballast / Equipment Added	31

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

Test Vehicle:	2020 Toyota Highlander SUV	NHTSA No.:	M20205102
Test Program:	NCAP Side MDB Impact Test	Test Date:	8/11/2020

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	15.1	6.7	10.9
Front Passenger Seat	Not Adjustable		
Front Center Seat*			
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	10.9	3	Max	51	53	54
			Mid	27	28	29
			Min	2	3	4
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 Toyota Highlander SUV
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20205102
Test Date: 8/11/2020

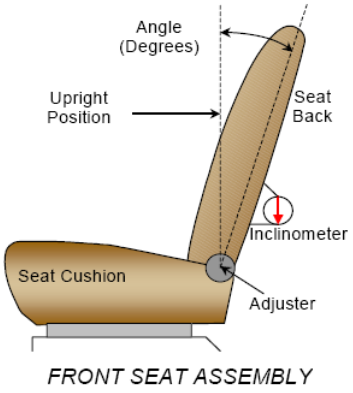
SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forwardmost Position	
	mm	Detents*	mm	Detent*
Driver Seat	240	N/A	120	N/A
Front Passenger Seat	240	25 (0-24)	120	12
Front Center Seat*	N/A	N/A	N/A	N/A
Struck Side Rear Seat	180	19 (0-18)	180	18
Non-Struck Side Rear Seat	180	19 (0-18)	180	18
Rear Center Seat*	180	19 (0-18)	180	18

**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	-5.6 to 45.9	-	1.1	-
Front Passenger Seat	-9.5 to 44.6	-	0.6	5
Front Center Seat*	N/A	N/A	N/A	N/A
Struck Side Rear Seat w/ Seated Dummy	3.6 to 20.8	8 (0-7)	4.8	0
Non-Struck Side Rear Seat	2.8 to 18.8	8 (0-7)	4.8	0
Rear Center Seat*	2.8 to 18.8	8 (0-7)	4.8	0

**if applicable*

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

Test Vehicle: 2020 Toyota Highlander SUV NHTSA No.: M20205102
Test Program: NCAP Side MDB Impact Test Test Date: 8/11/2020

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)	0
Rear Seat	Fixed	Fixed

HEAD RESTRAINT ADJUSTMENT

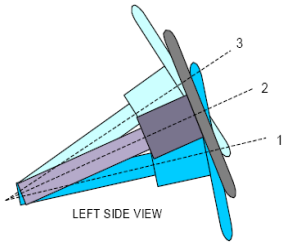
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	3 (0-2)	0 - Uppermost
Rear Seat	1	1

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	21.9	
Geometric Center – Position 2	24.1	
Uppermost – Position 3	26.3	
Telescoping Steering Wheel Travel		60
Test Position	24.1	30

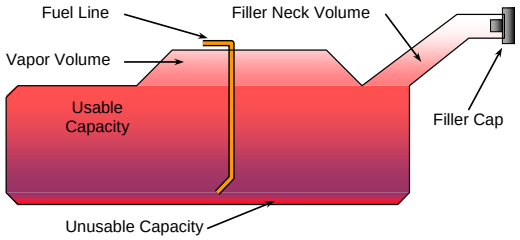


STEERING COLUMN ASSEMBLY

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 left 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 Toyota Highlander SUV NHTSA No.: M20205102
Test Program: NCAP Side MDB Impact Test Test Date: 8/11/2020

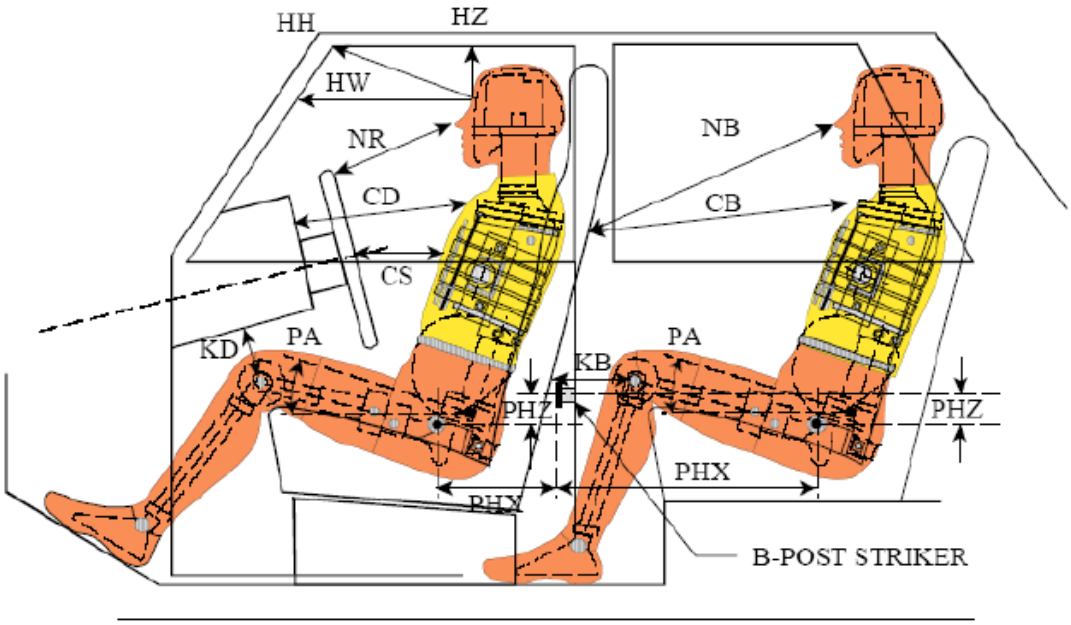
FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	68.13
Usable Capacity of "Optional Tank" (see Form No. 1)	N/A
Usable Capacity of Standard Tank (see Owner's Manual)	68.0
Usable Capacity of Optional Tank (see Owner's Manual)	N/A
93% of Usable Capacity	63.3
Actual Amount of Solvent Used in Test	63.3
1/3 of Usable Capacity	22.6

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 Toyota Highlander SUV	NHTSA No.:	M20205102
Test Program:	NCAP Side MDB Impact Test	Test Date:	8/11/2020



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

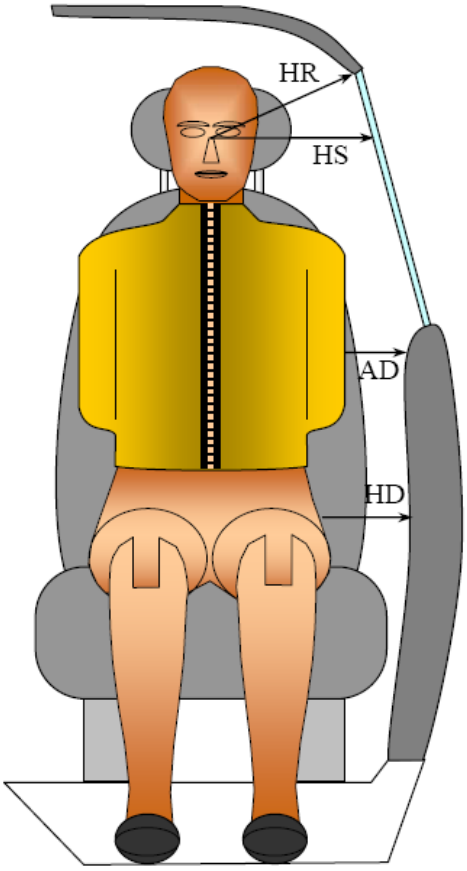
LEFT SIDE VIEW

DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Pass. Code	Description	Driver (Serial No. F033)		Passenger (Serial No.300)	
			Length (mm)	Angle	Length (mm)	Angle
HH		Header to Header	364			
HW		Header to Windshield	595			
HZ	HZ	Head to Roof Liner	202		296	
NR	NB	Nose to Rim/Seat Back	430		617	
CD	CB	Chest to Dash/Seat Back	560		636	
CS		Chest to Steering Wheel	335			
KD(L)/KDA(L)°	KB(L)/KBA(L)°	Left Knee to Dash/Seat Back	196	21.8	369	0
KD(R)/KDA(R)°	KB(R)/KBA(R)°	Right Knee to Dash/Seat Back	178	18.8	372	0
PAX°	PAX°	Pelvic Tilt Angle X		20.2		21.2
	PAY°	Pelvic Tilt Angle Y				0.3
PHX	PHX	Hip Point to Striker (X-Axis)	179		300	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	207		300	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle:	2020 Toyota Highlander SUV	NHTSA No.:	M20205102
Test Program:	NCAP Side MDB Impact Test	Test Date:	8/11/2020



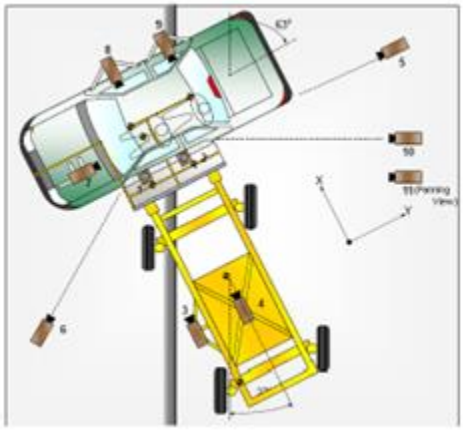
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver (Serial No. F033)	Passenger (Serial No. 300)
HR	Head to Side Header	mm	225	278
HS	Head to Side Window	mm	355	383
AD	Arm to Door	mm	110	182
HD	Hip Point to Door	mm	180	191

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2020 Toyota Highlander SUV NHTSA No.: M20205102
Test Program: NCAP Side MDB Impact Test Test Date: 8/11/2020



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	0	0	-8353	12.5	1000
2	Overhead Close-up	0	550	-8353	24	1000
3	Left Impact Point (MDB)	-1470	0	-847	25	1000
4	Side Overall (MDB)	-1140	878	-1587	8	1000
5	Rear	0	9127	-1422	24	1000
6	Left Front	-3961	5048	-1432	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.*

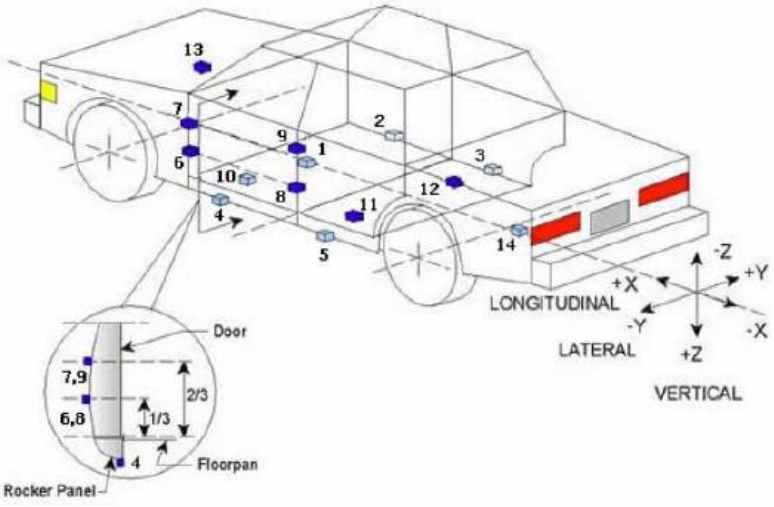
If applicable, explain why camera(s) did not operate as intended: All cameras operated normally

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 Toyota Highlander SUV NHTSA No.: M20205102
Test Program: NCAP Side MDB Impact Test Test Date: 8/11/2020



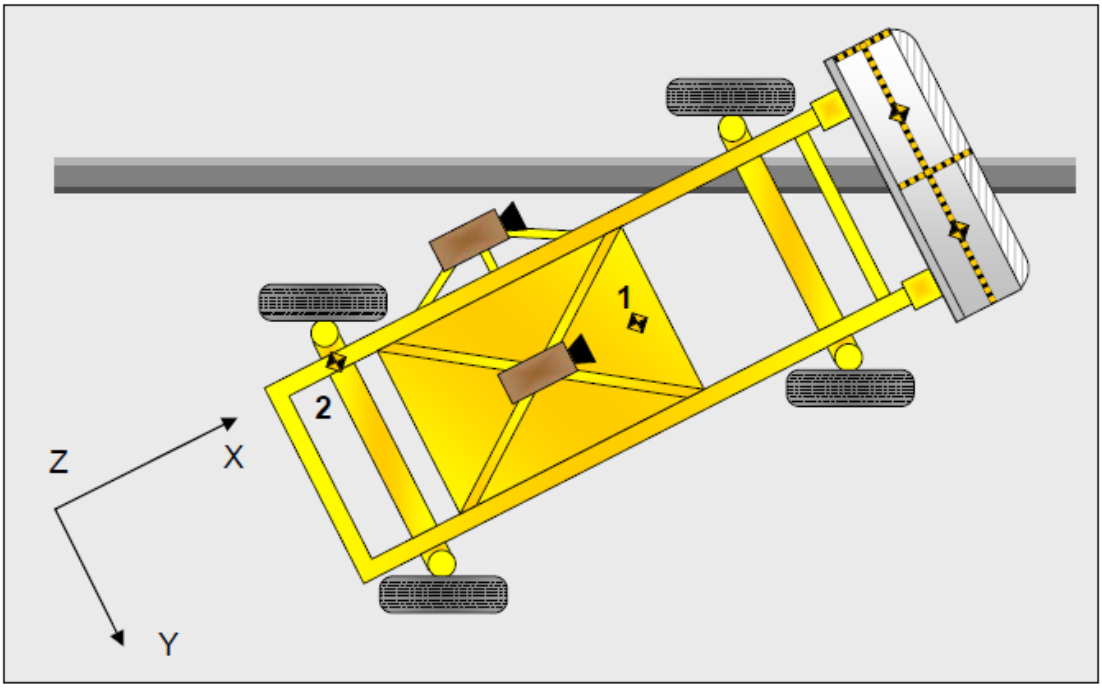
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2689	-4	53
2	Right Sill at Front Seat	3064	684	257
3	Right Sill at Rear Seat	2113	681	244
4	Left Sill at Front Door	3037	-688	263
5	Left Sill at Rear Door	2124	-684	238
6	A-Post Lower	3479	-630	6
7	A-Post Middle	3314	-662	-556
8	B-Post Lower	2432	-700	-140
9	B-Post Middle	2356	-682	-507
10	Front Seat Track	2675	-572	157
11	Rear Seat Structure	1994	-494	95
12	Rt. Rear Occ. Compartment	2198	398	266
13	Engine Block	3999	170	-295
14	Rear Above Axle	1267	14	85

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 Toyota Highlander SUV	NHTSA No.:	M20205102
Test Program:	NCAP Side MDB Impact Test	Test Date:	8/11/2020



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 Toyota Highlander SUV NHTSA No.: M20205102
Test Program: NCAP Side MDB Impact Test Test Date: 8/11/2020

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	Curtain Airbag	None
Top of Head	Side Headliner	Curtain Airbag & Center Seatback
Left Side of Head	Curtain Airbag	Curtain Airbag
Back of Head	Side Headliner & Headrest	Curtain Airbag & Center Seatback
Left Shoulder	Curtain Airbag	Passenger Door & Seatback
Upper Torso	Seatback & Torso/Pelvis Airbag	Passenger Door
Lower Torso	Seatback	Passenger Door
Left Hip	Torso/Pelvis Airbag	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

*Tailgate opened during impact but is still operational.

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 Buckled
Sill Separation	None
Windshield Damage	None
Side Window Damage	Rear Passenger Window Shattered
Other Notable Effects	None

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

Test Vehicle: 2020 Toyota Highlander SUV NHTSA No.: M20205102
Test Program: NCAP Side MDB Impact Test Test Date: 8/11/2020

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		2856
Vertical Impact Reference Line (Aft of Front Axle - Intended Impact Point)	mm		488
Actual Impact Point (Aft of Frontal Axle)	mm		491
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact Point	-3
Vertical Offset (+ down / - up)	mm	+/- 20 of Intended Impact Point	+4

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle: 2020 Toyota Highlander SUV
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20205102
Test Date: 8/11/2020

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

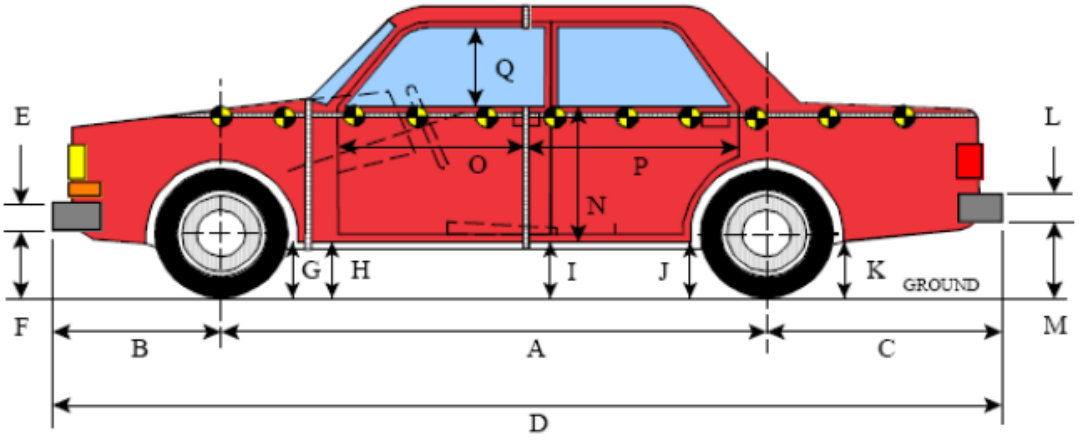
Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.10 to 62.70	61.89
Trap No. 2 Velocity (Redundant)	km/h	61.10 to 62.70	61.83
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.0
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63.0
MDB Crabbed angle 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	287
B	Top of Bumper	533	800	Right	190
C	Mid-Level	686	200	Right	138
D	Top of Stack	813	100	Right	138

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2020 Toyota Highlander SUV
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20205102
Test Date: 8/11/2020



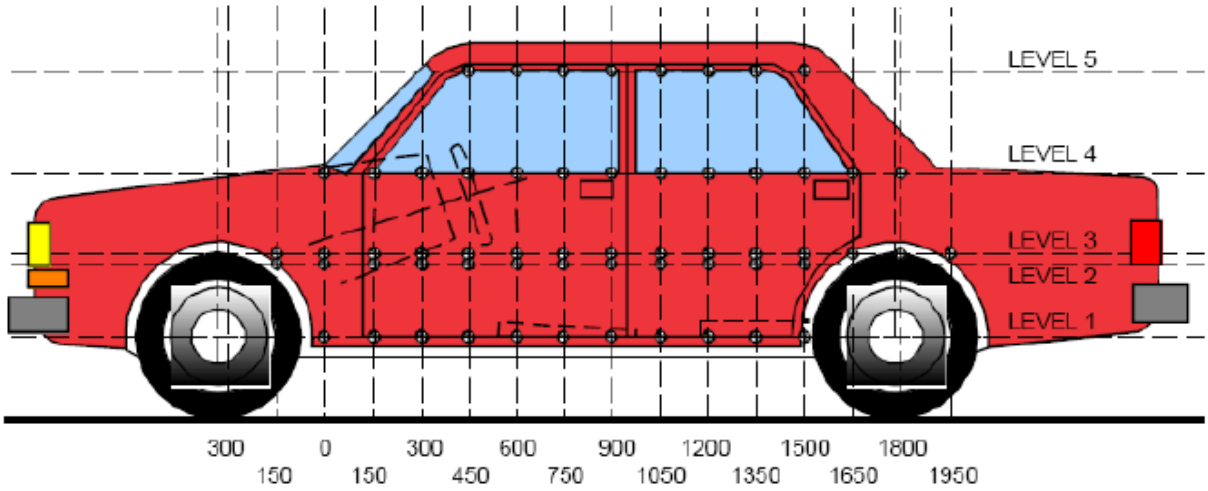
LEFT SIDE VIEW
All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3mm

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2856	2857	1
B	Front Axle to FSOV	986	980	-6
C	Rear Axle to RSOV	1107	1110	3
D	Total Length at Centerline	4949	4947	-2
E	Front Bumper Thickness	140	140	0
F	Front Bumper Bottom to Ground	495	503	8
G	Sill Height at Front Wheel Well	253	261	8
H	Sill Height at Front Door Leading Edge	257	265	8
I	Sill Height at B Pillar	319	313	-6
J1	Sill Height at Rear Wheel Well	296	300	4
J2	Pinch Weld Height at Rear Wheel Well	284	285	1
K	Sill Height Aft of Rear Wheel Well	310	315	5
L	Rear Bumper Thickness	185	185	0
M	Rear Bumper Bottom to Ground	436	441	5
N	Sill Height to Window Bottom of Front Window Sill	908	916	8
O	Front Door Leading Edge to Impact CL	824	820	-4
P	Rear Door Trailing Edge to Impact CL	1344	1295	-49
Q	Front Window Opening	460	479	19
R	Right Side Length	4892	4889	-3
S	Left Side Length	4891	4885	-6
T	Maximum Vehicle Width	1912	1789	-123

DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 Toyota Highlander SUV
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20205102
Test Date: 8/11/2020



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	347	39	1200
2	Driver Hip Point	mm	724	185	1650
3	Mid-Door	mm	788	198	1500
4	Window Sill	mm	1154	149	1650
5	Window Top	mm	1632	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 Toyota Highlander SUV NHTSA No.: M20205102
Test Program: NCAP Side MDB Impact Test Test Date: 8/11/2020

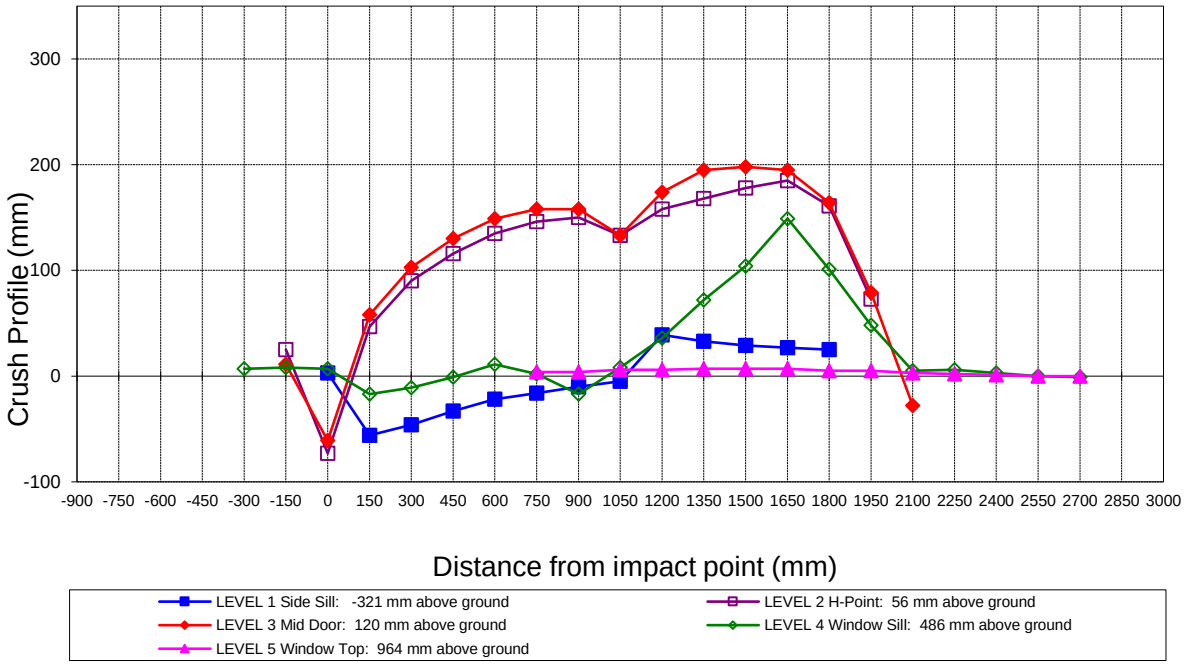
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	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				832					825					7	
-150		966	964	843			941	953	835			25	11	8	
0	941	966	966	846		938	1039	1025	839		3	-73	-59	7	
150	933	955	956	844		989	908	898	861		-56	47	58	-17	
300	935	951	954	845		981	861	851	856		-46	90	103	-11	
450	938	950	955	853		971	834	825	854		-33	116	130	-1	
600	940	950	955	859		962	815	806	848		-22	135	149	11	
750	939	948	954	862	651	955	802	796	860	647	-16	146	158	2	4
900	935	947	952	866	662	945	797	794	883	658	-10	150	158	-17	4
1050	930	945	950	869	668	935	812	817	861	662	-5	133	133	8	6
1200	924	941	946	873	671	885	783	772	837	665	39	158	174	36	6
1350	917	937	941	880	672	884	769	746	808	665	33	168	195	72	7
1500	912	932	937	886	672	883	754	739	782	665	29	178	198	104	7
1650	913	945	939	889	672	886	760	744	740	665	27	185	195	149	7
1800	920	960	957	891	671	895	799	793	790	666	25	161	164	101	5
1950		964	967	881	669		891	888	833	664		73	79	48	5
2100			965	890	664			993	885	661			-28	5	3
2250				887	658				881	656				6	2
2400				882	651				879	650				3	1
2550				874	639				874	639				0	0
2700				865	621				866	621				-1	0
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

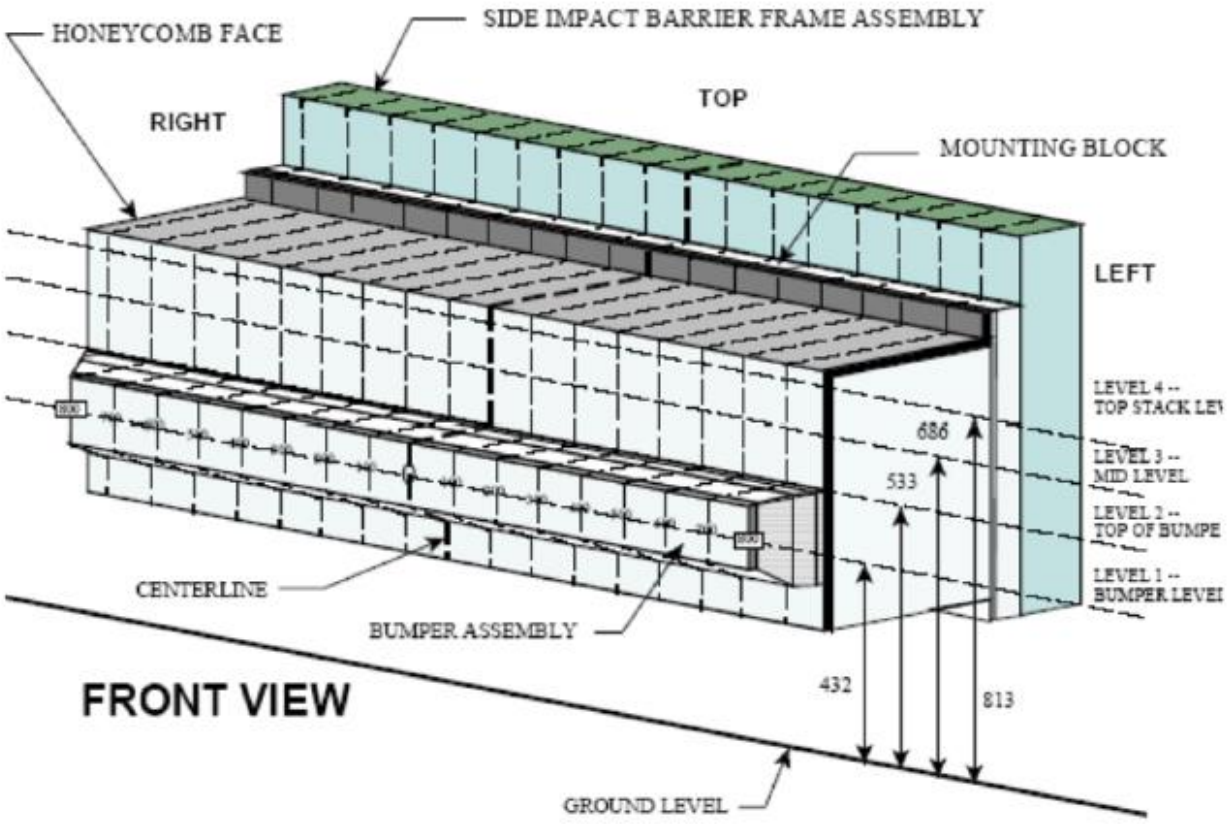
Test Vehicle:	2020 Toyota Highlander SUV	NHTSA No.:	M20205102
Test Program:	NCAP Side MDB Impact Test	Test Date:	8/11/2020



Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle:	2020 Toyota Highlander SUV	NHTSA No.:	M20205102
Test Program:	NCAP Side MDB Impact Test	Test Date:	8/11/2020



NOTE: Dimensions are shown in millimeters, mm

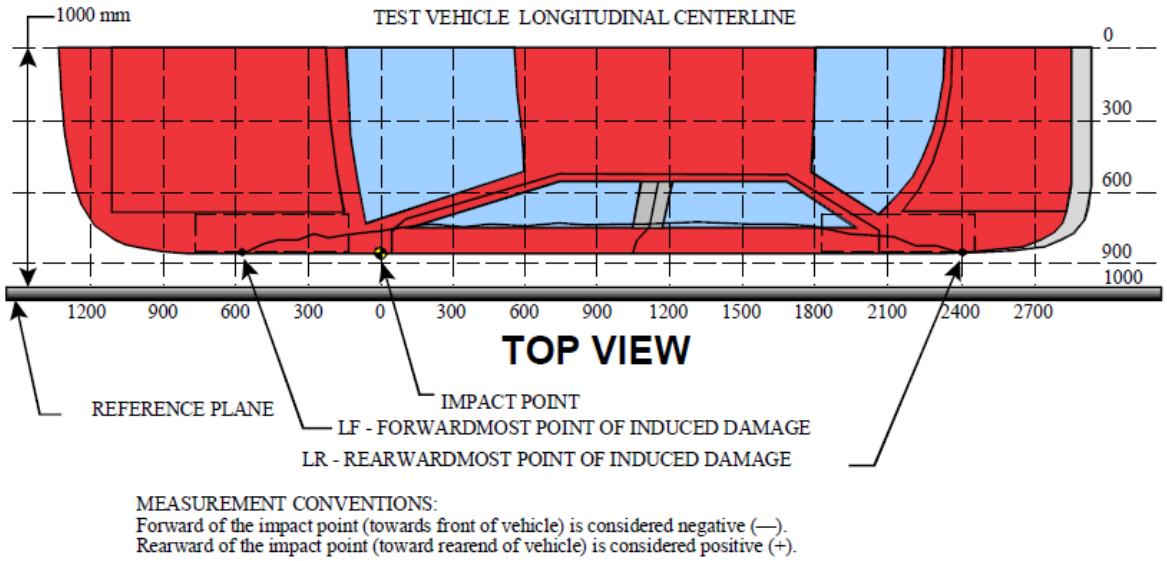
DEFORMABLE BARRIER STATIC CRUSH

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	287	284	281	278	277	274	271	269	268	263	258	255	253	249	247	244	234
2	190	190	187	182	180	176	174	171	168	159	153	150	145	141	139	136	133
3	126	105	104	116	115	106	138	116	113	77	70	66	64	64	68	75	93
4	108	73	67	68	78	91	118	138	121	98	77	72	80	87	90	103	126

DATA SHEET NO. 13
VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle:	2020 Toyota Highlander SUV	NHTSA No.:	M20205102
Test Program:	NCAP Side MDB Impact Test	Test Date:	8/11/2020

For guidance regarding damage profile distance measurements, pelase 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	47	36	11
2	300	3	149	46	103
3	750	3	204	46	158
4	1200	3	228	54	174
5	1650	3	256	61	195
6	2100	3	7	35	-28

MDB DAMAGE PROFILE DISTANCES

DPD	Distance From Center of MDB	Level	Post-Test (mm)*
1	800 mm left of center	1	234
2	480 mm left of center	1	250
3	160 mm left of center	1	260
4	160 mm right of center	1	270
5	480 mm right of center	1	278
6	800 mm right of center	1	287

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

Test Vehicle:	2020 Toyota Highlander SUV	NHTSA No.:	M20205102
Test Program:	NCAP Side MDB Impact Test	Test Date:	8/11/2020
Test Time:	10:10 AM	Temperature:	21˚C

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

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

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

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°	70	300	370
90° to 180°	74	300	374
180° to 270°	71	300	371
270° to 360°	69	300	369

FMVSS NO. 301 ROLLOVER SPILLAGE TABLE

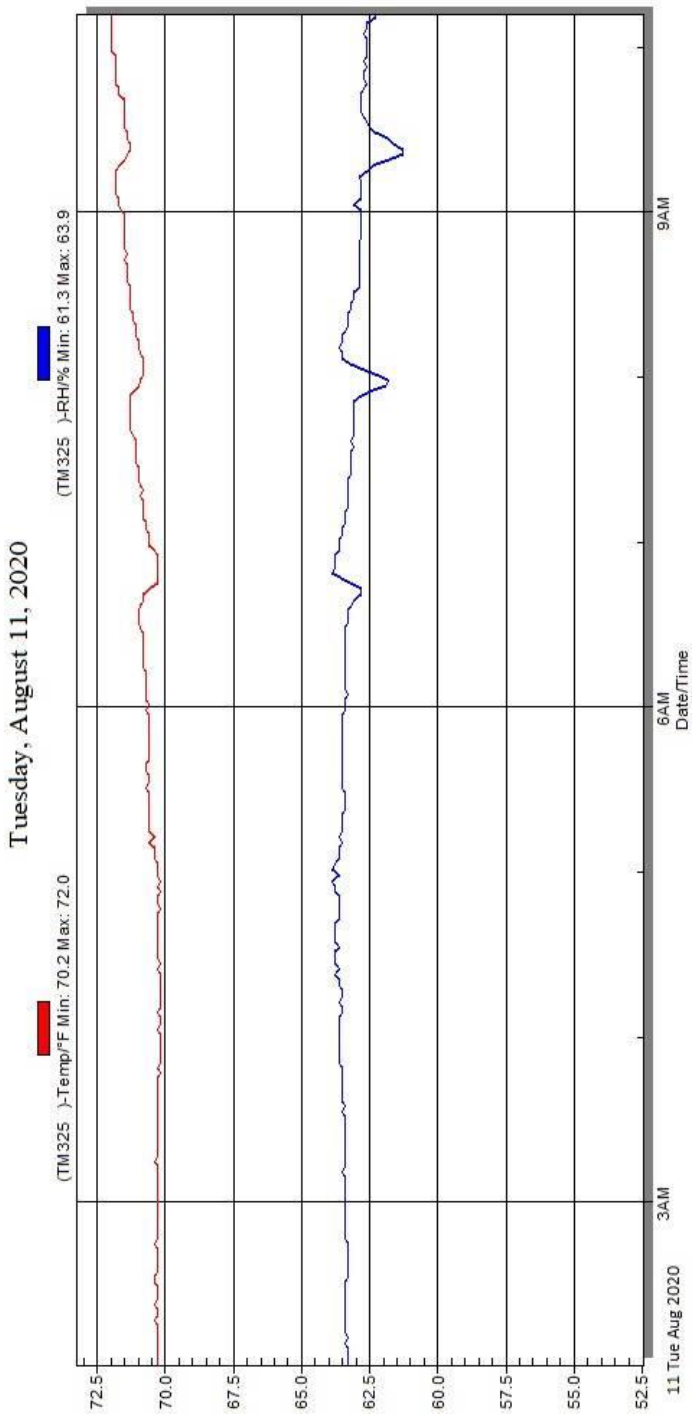
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

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 Toyota Highlander SUV	NHTSA No.:	M20205102
Test Program:	NCAP Side MDB Impact Test	Test Date:	8/11/2020



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

APPENDIX A

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

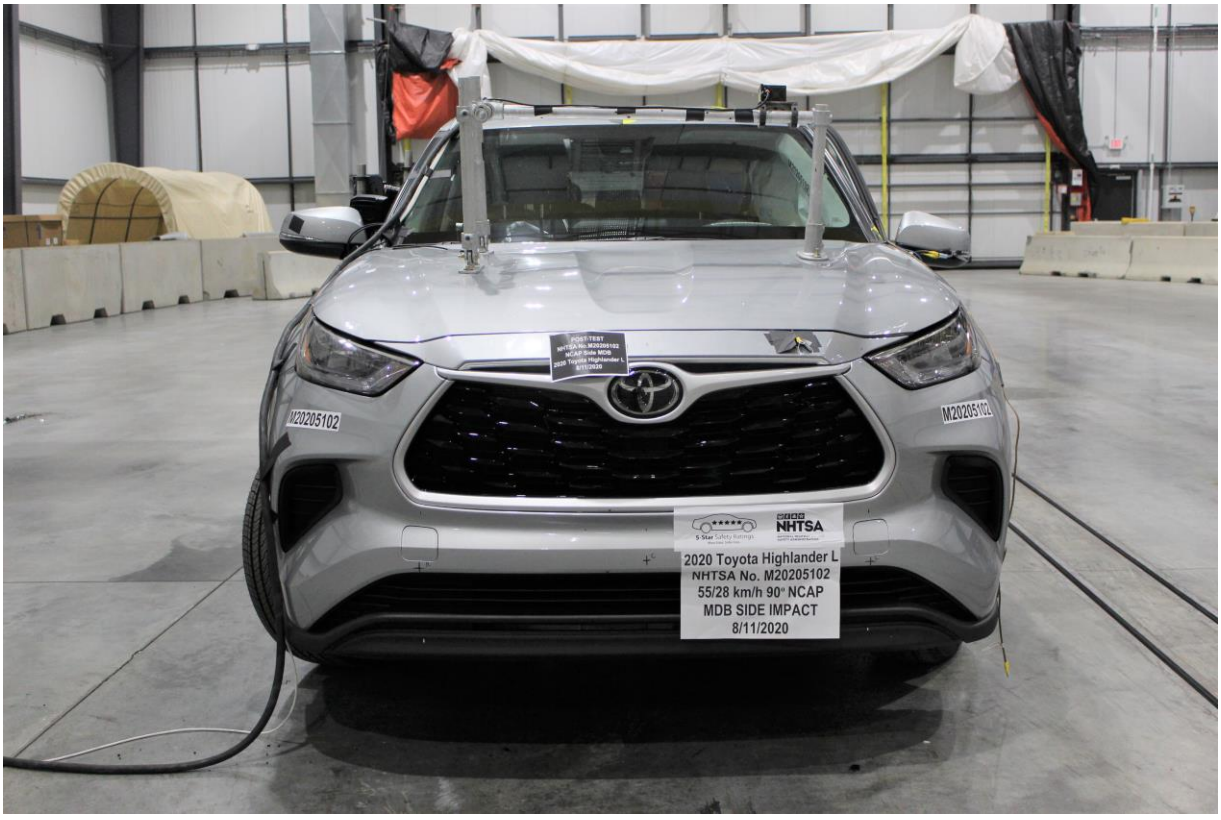


Figure A-4: Post-Test Frontal View of Test Vehicle

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

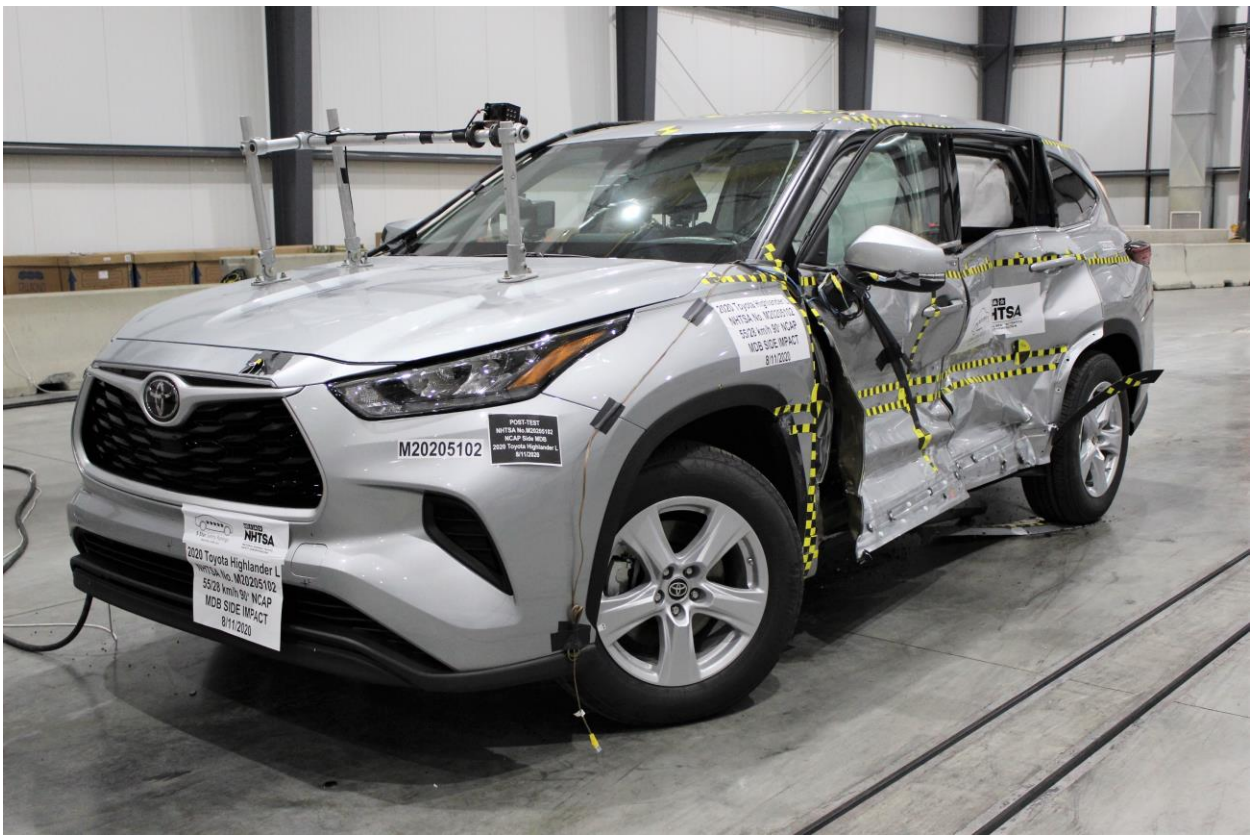


Figure A-6: Post-Test Left Front ¾ View of Test Vehicle

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

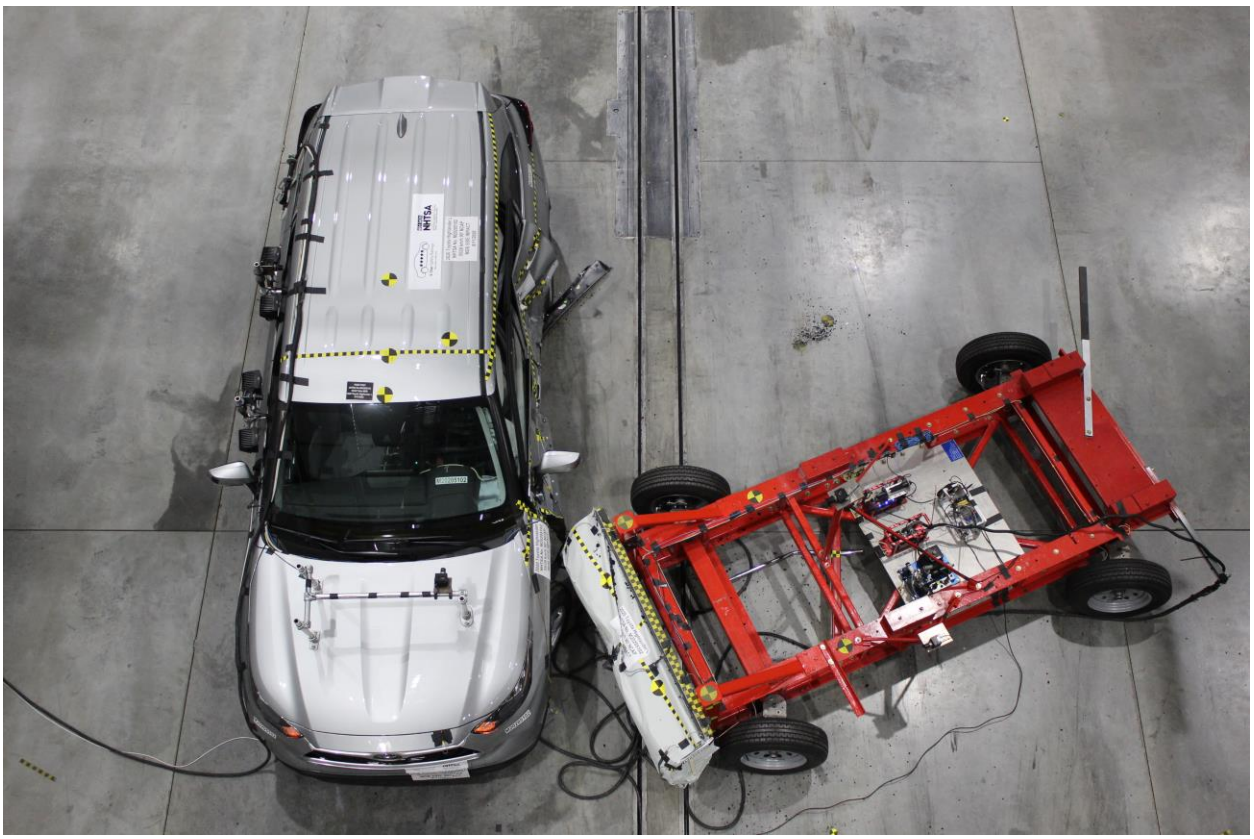
Figure A-11: Pre-Test Rear View of Test Vehicle

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



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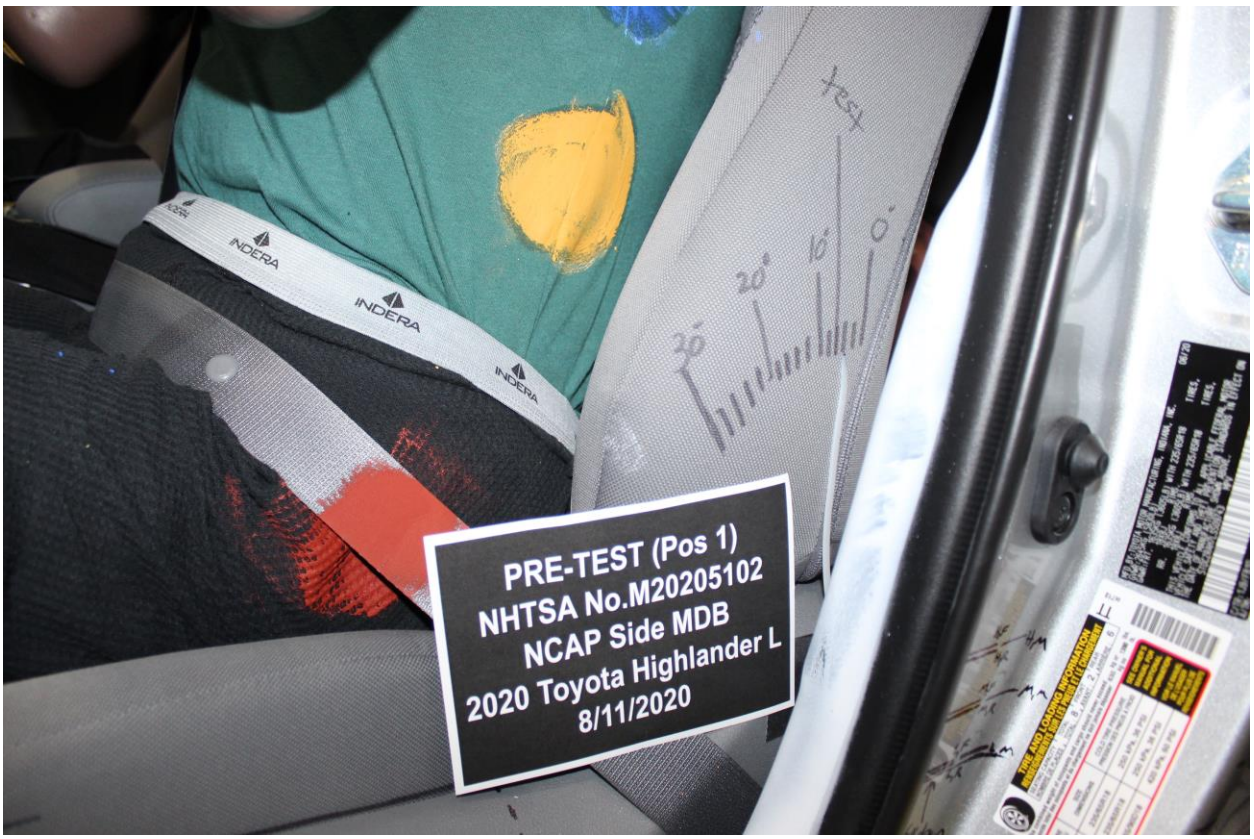

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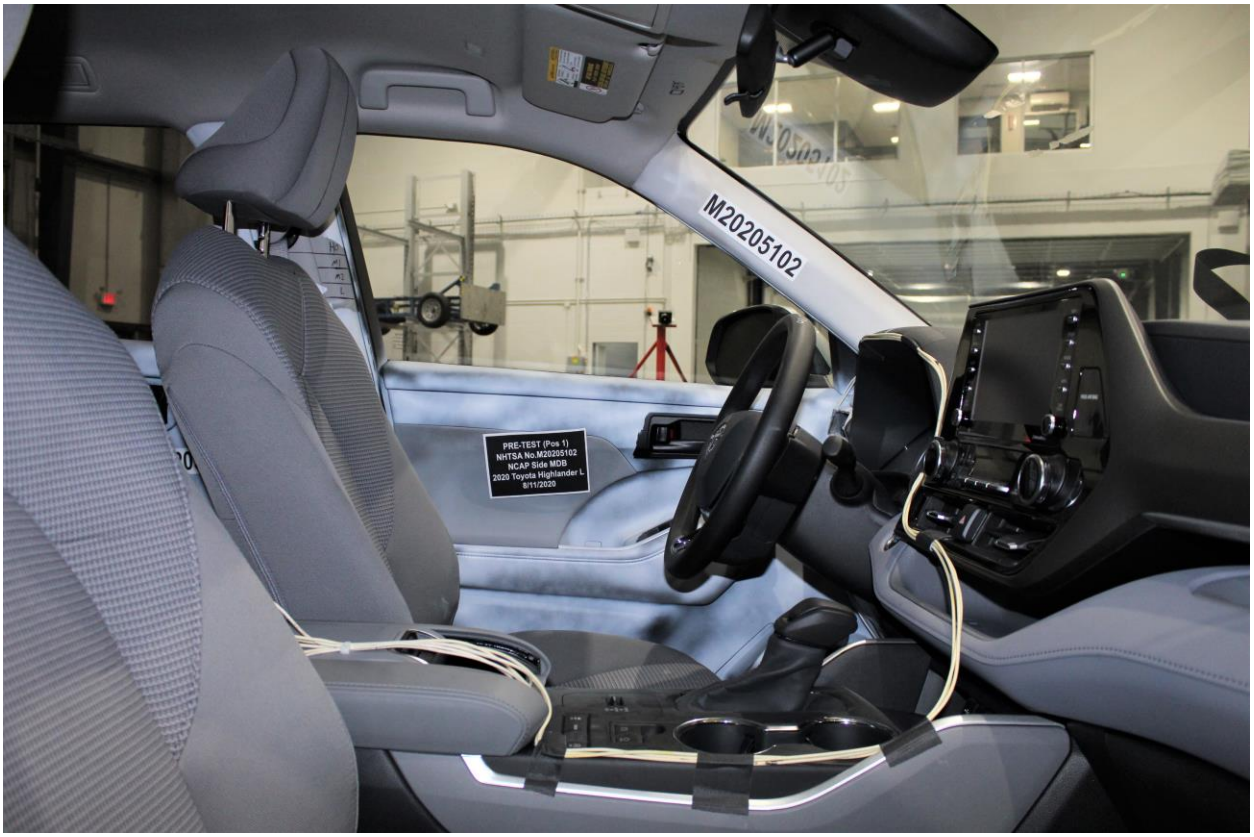

Figure A-46: Pre-Test Driver Inner Door Panel View

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 Air bag 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 Air bag View

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

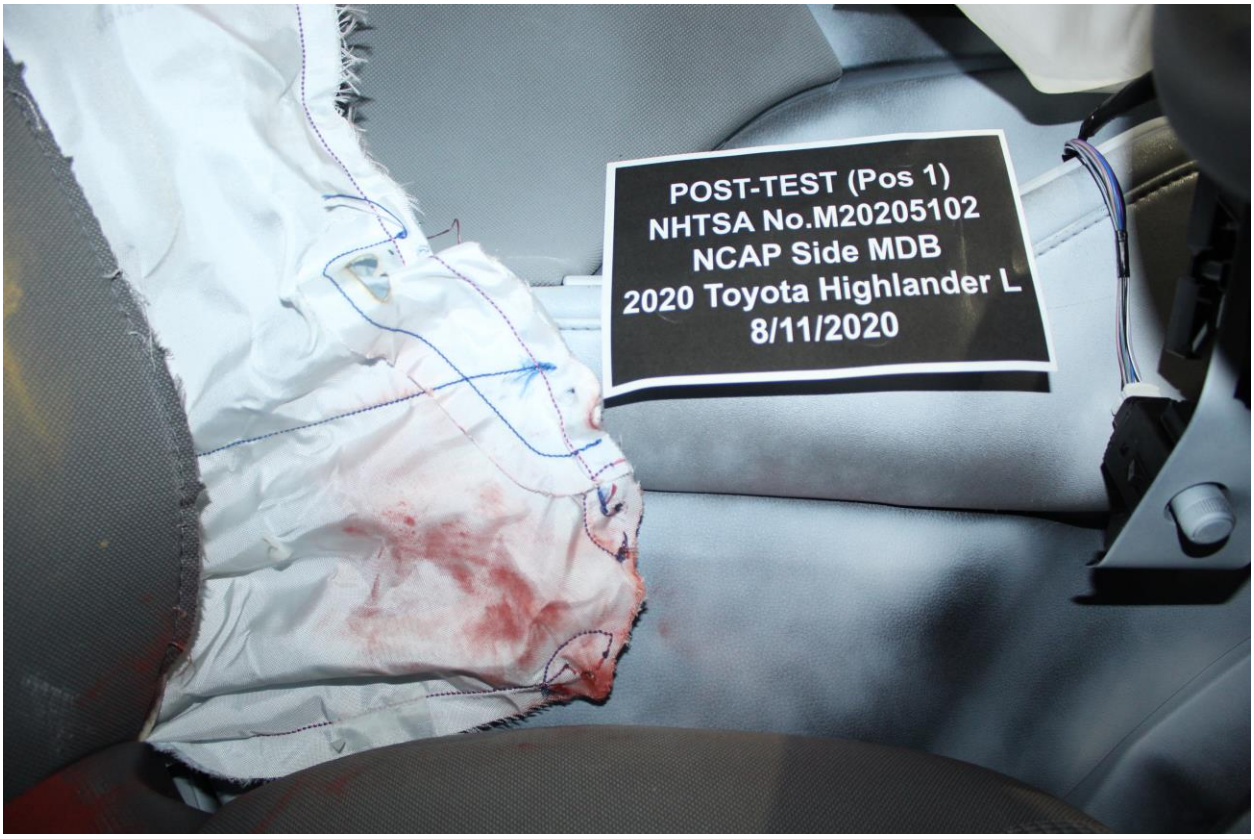

Figure A-53: Post-Test Driver Dummy Close-Up Pelvis Contact with Side Air bag View

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

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

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

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

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

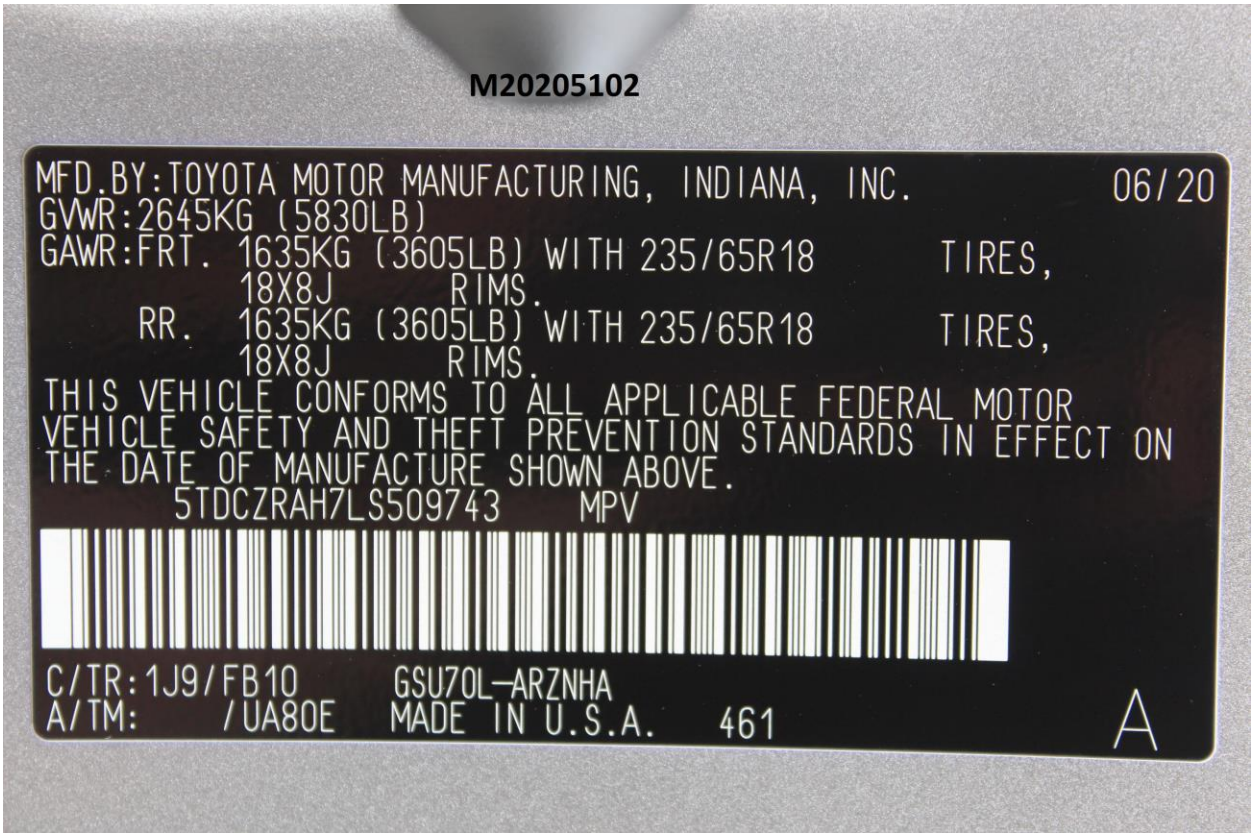

Figure A-92: Close-Up View of Vehicle's Certification Label

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

Figure A-93a: Close-Up View of Vehicle's Load Reduction 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

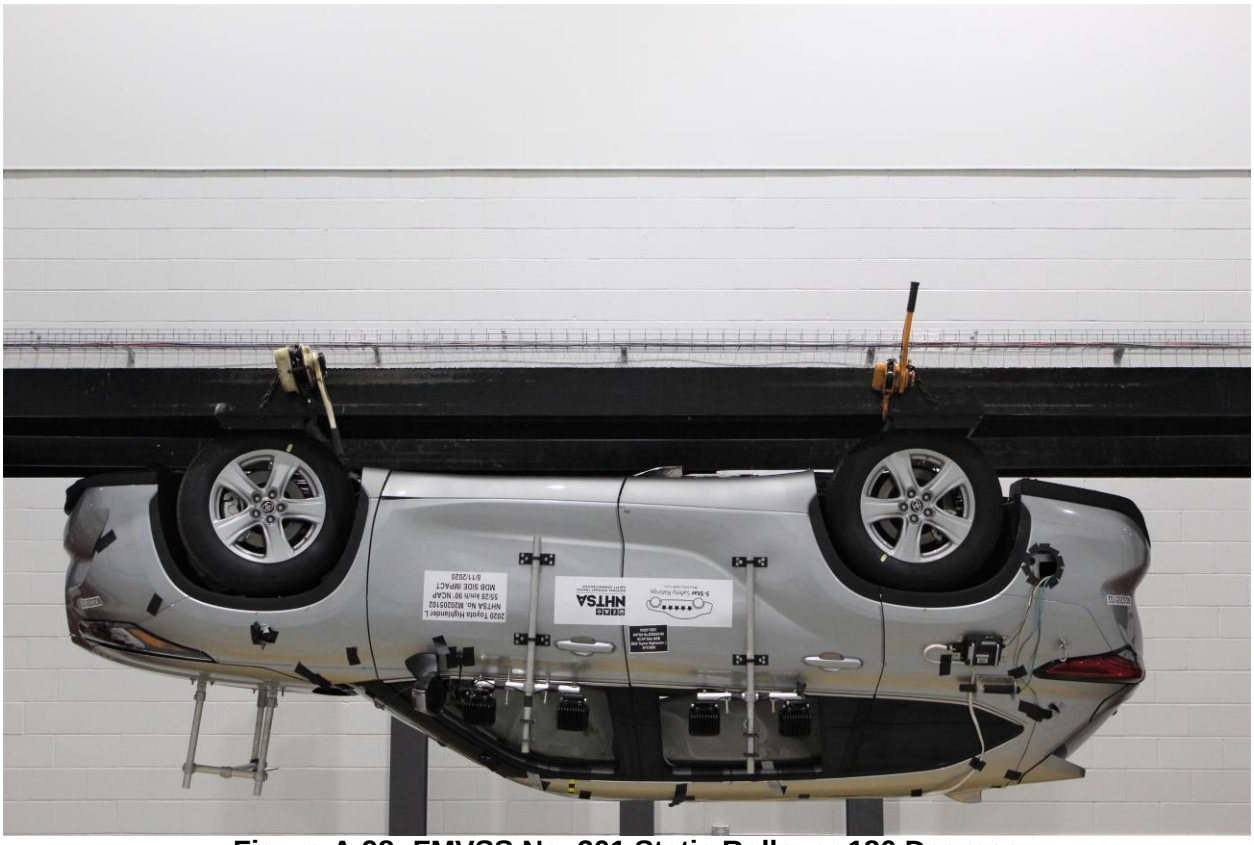

Figure A-98: FMVSS No. 301 Static Rollover 180 Degrees

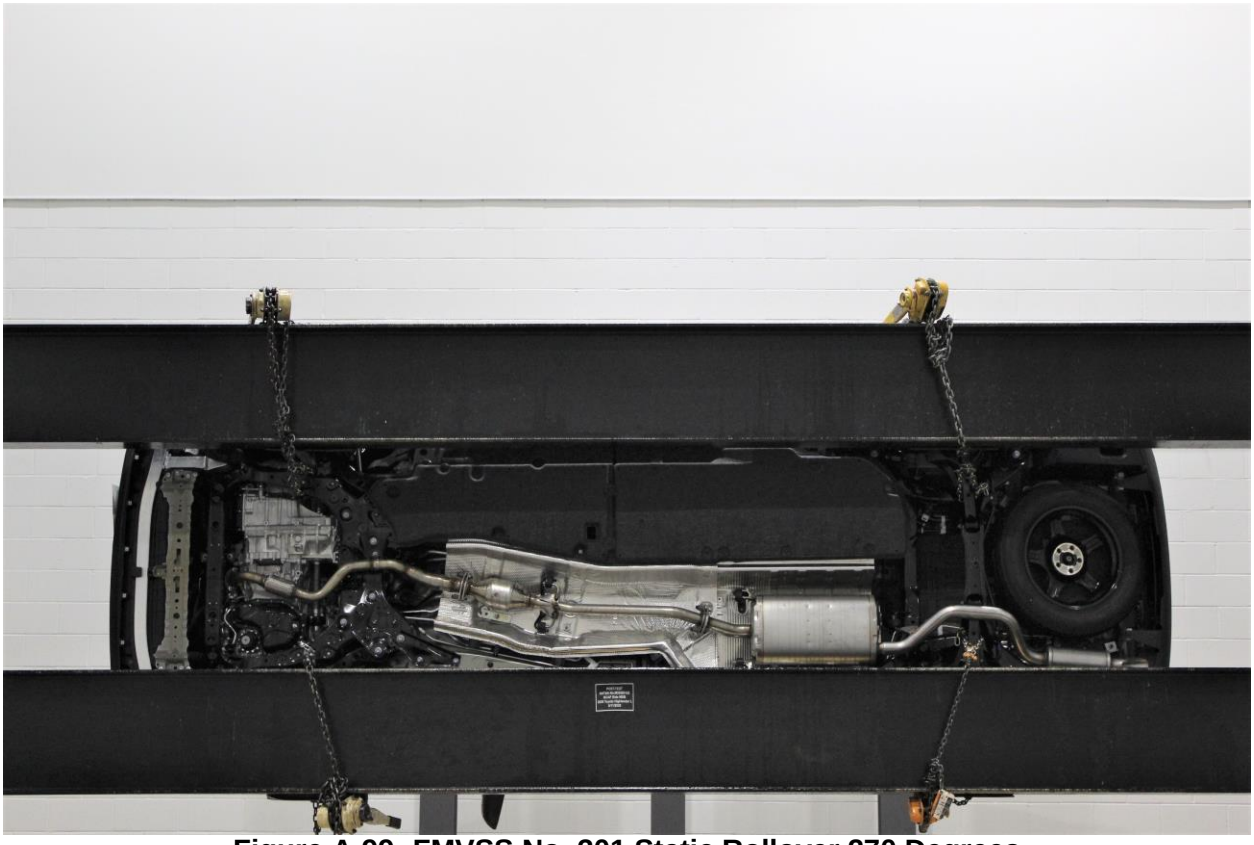

Figure A-99: FMVSS No. 301 Static Rollover 270 Degrees

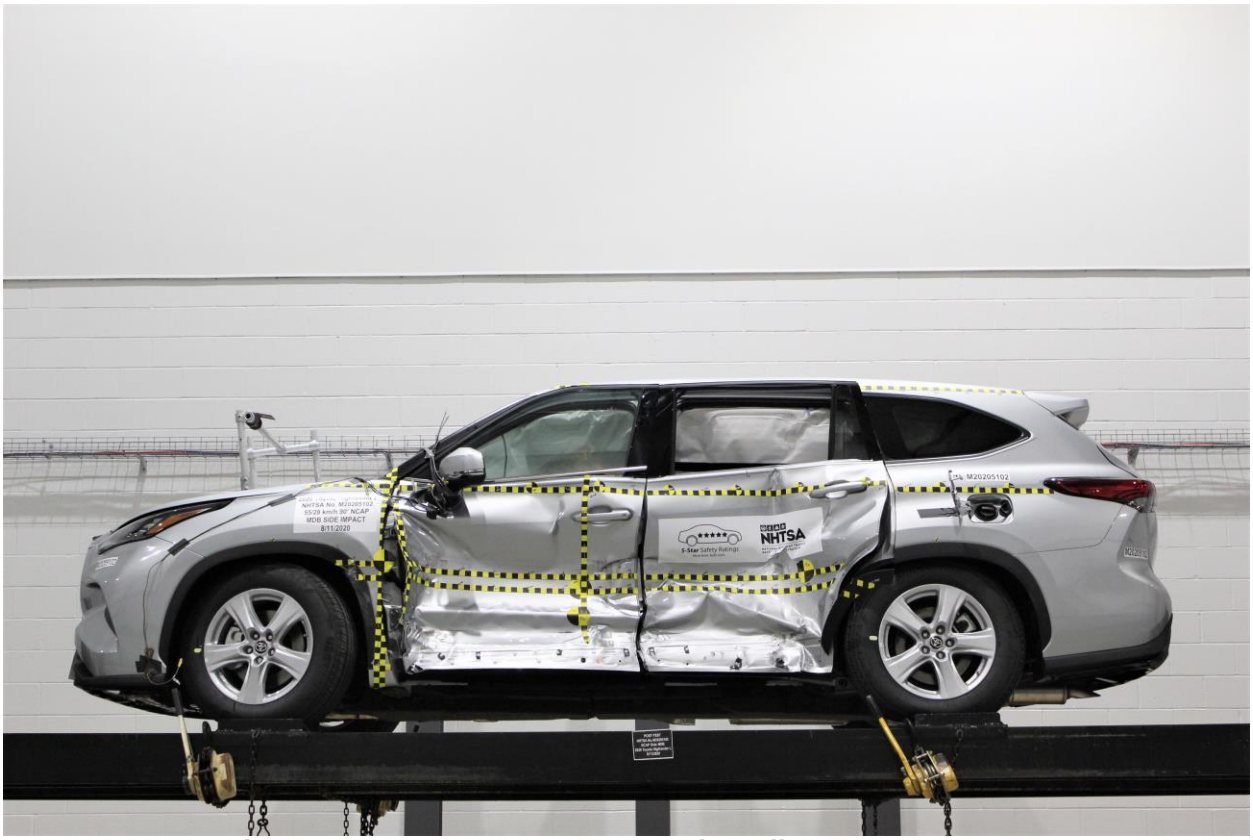

Figure A-100: FMVSS No. 301 Static Rollover 360 Degrees

Figure A-101: Impact Event

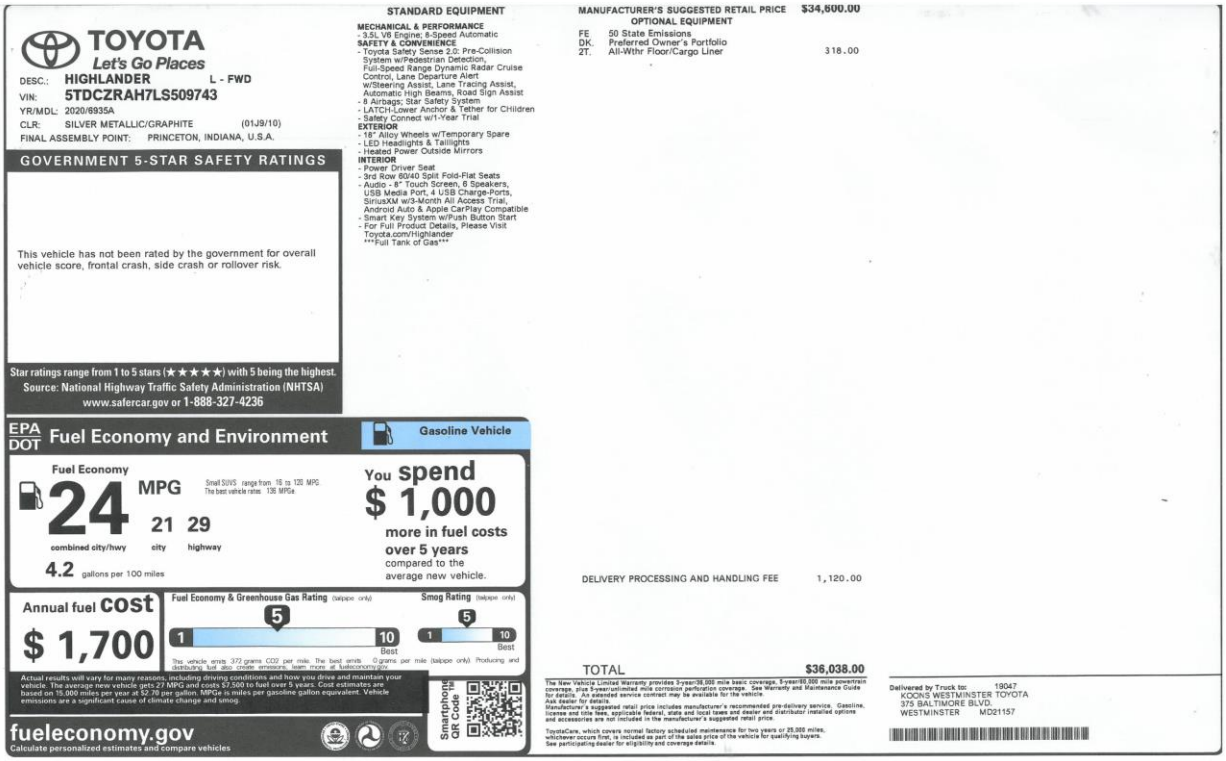

Figure A-102: Monroney Label

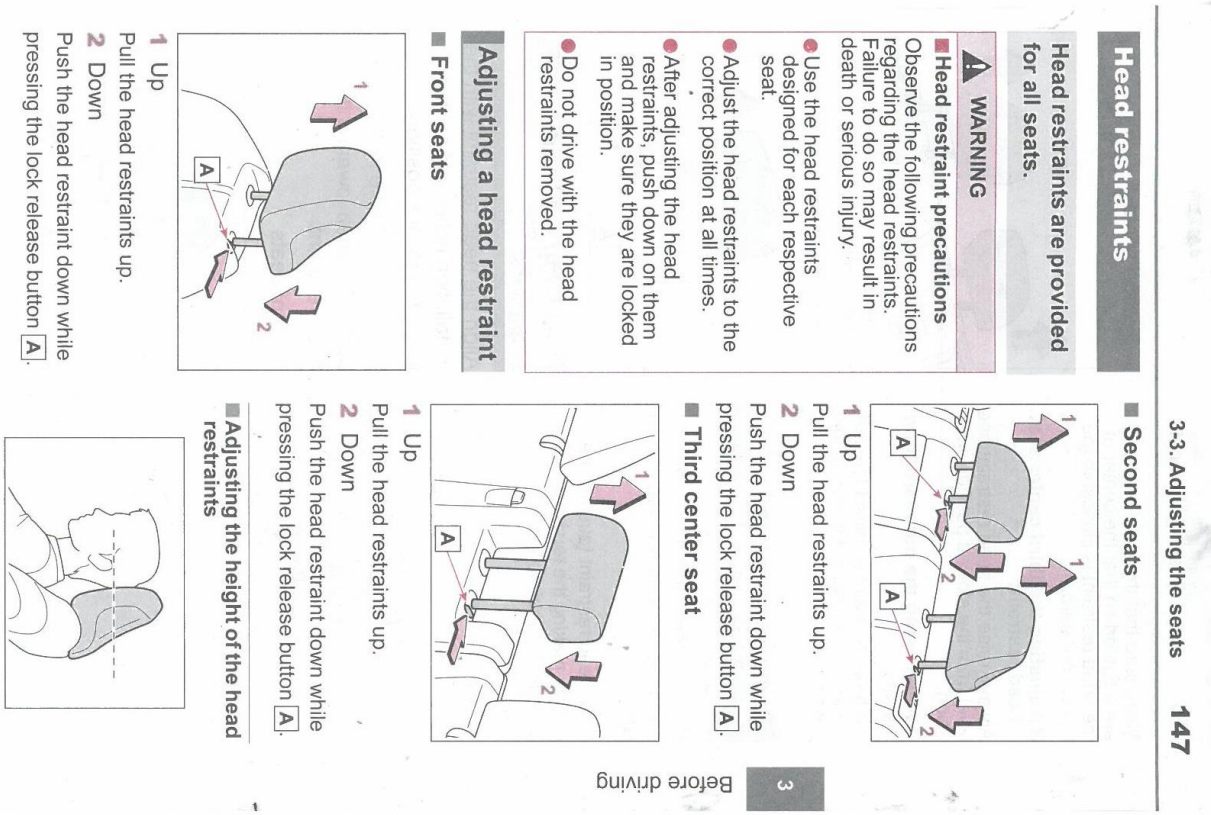

Figure A-103: Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

Head restraints

Head restraints are provided for all seats.

⚠ WARNING

■ Head restraint precautions

Observe the following precautions regarding the head restraints. Failure to do so may result in death or serious injury.

- Use the head restraints designed for each respective seat.
- Adjust the head restraints to the correct position at all times.
- After adjusting the head restraints, push down on them and make sure they are locked in position.
- Do not drive with the head restraints removed.

Adjusting a head restraint

■ Front seats

1 Up

Pull the head restraints up.

2 Down

Push the head restraint down while pressing the lock release button A.

■ Second seats

1 Up

Pull the head restraints up.

2 Down

Push the head restraint down while pressing the lock release button A.

■ Third center seat

1 Up

Pull the head restraints up.

2 Down

Push the head restraint down while pressing the lock release button A.

■ Adjusting the height of the head restraints

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

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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)

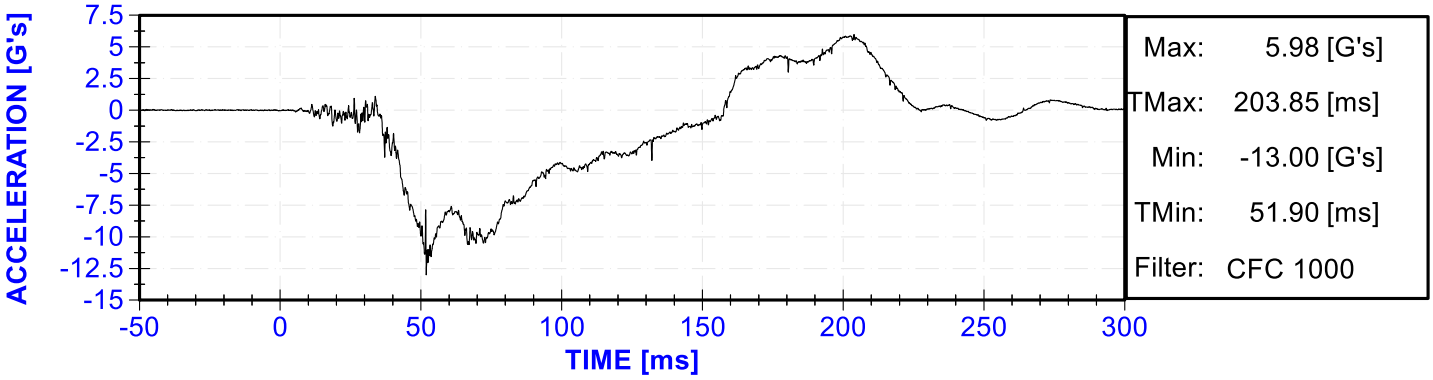
Vehicle Instrumentation Data

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)

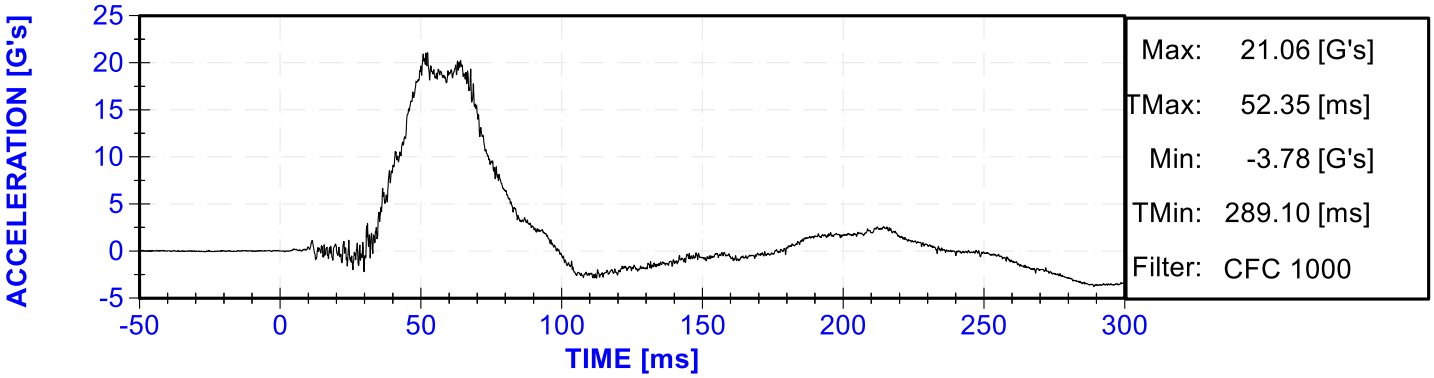
MDB Instrumentation Data

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

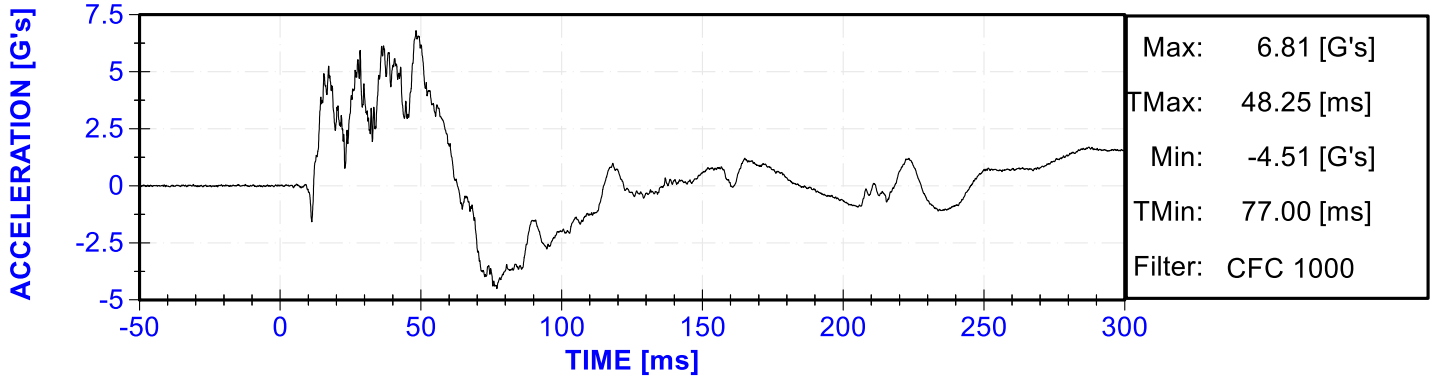
Driver Head Acceleration (X) Primary vs. Time



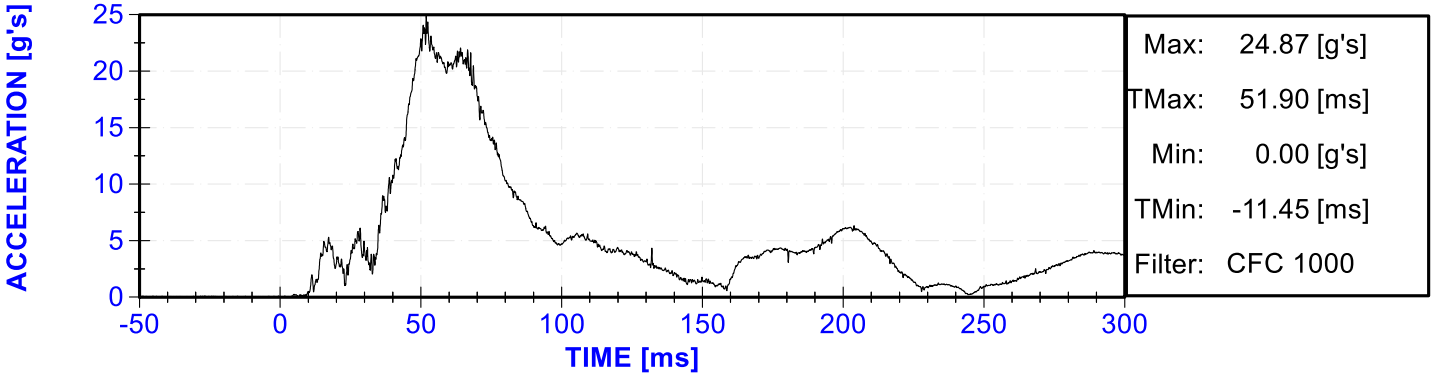
Driver Head Acceleration (Y) Primary vs. Time



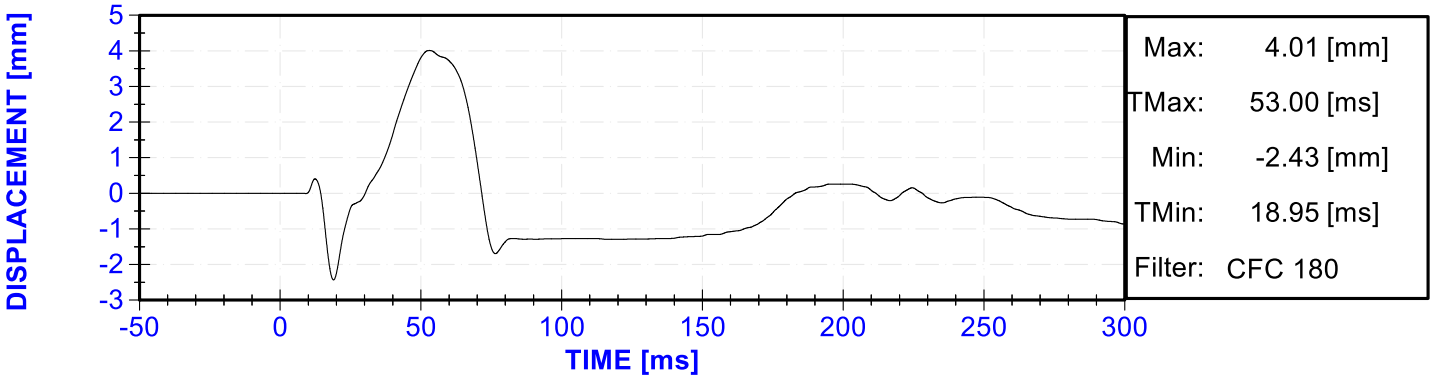
Driver Head Acceleration (Z) Primary vs. Time



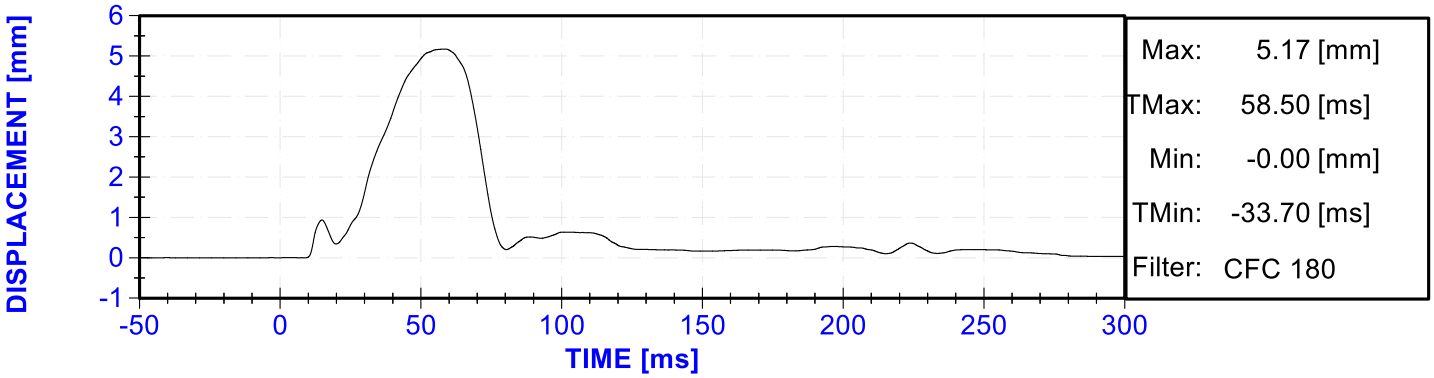
Driver Head Resultant Acceleration Primary vs. Time



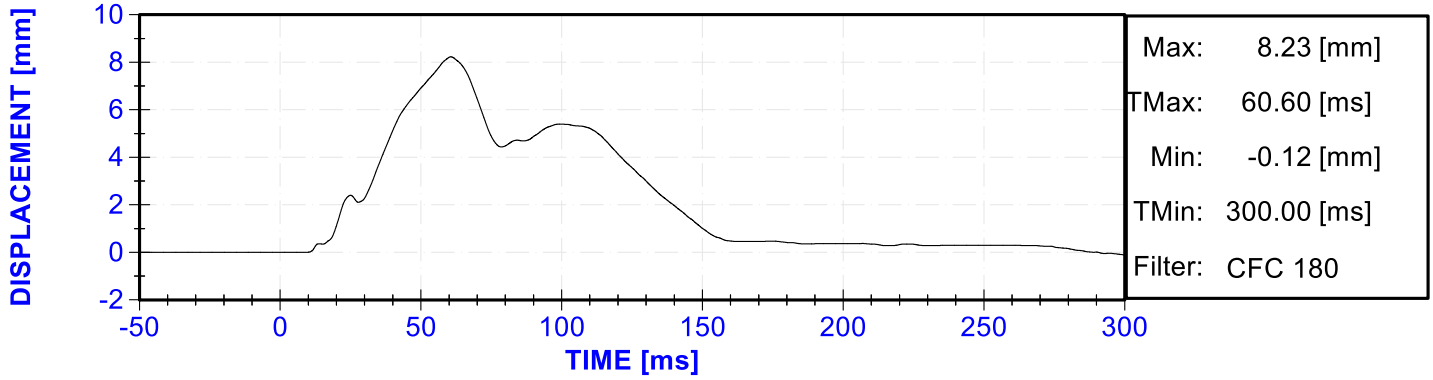
Driver Upper Thorax Rib Deflection (Y) vs. Time



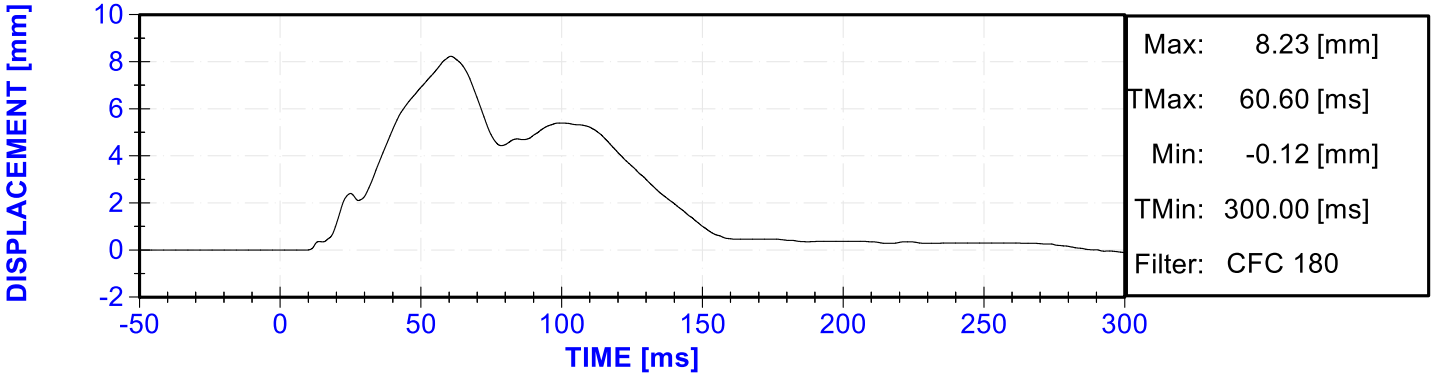
Driver Middle Thorax Rib Deflection (Y) vs. Time



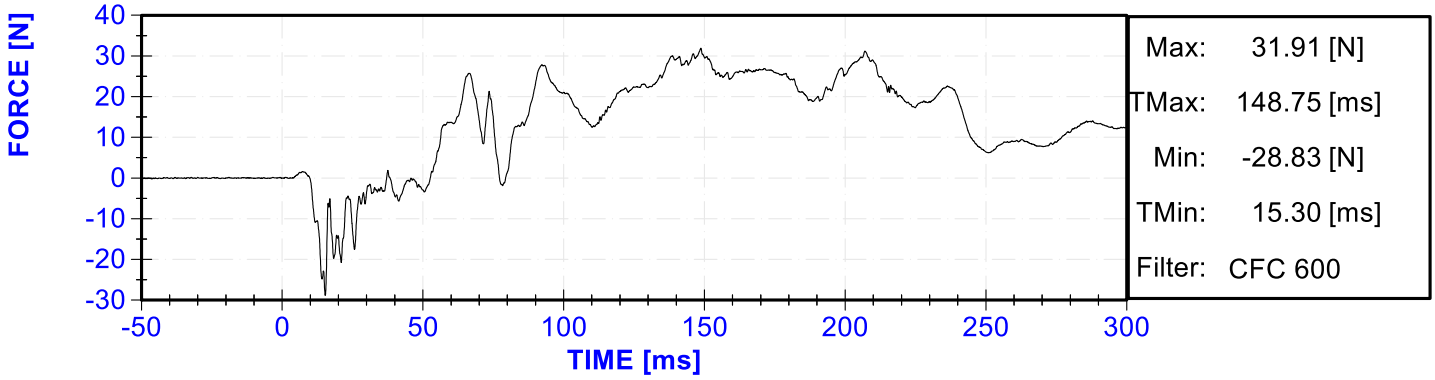
Driver Lower Thorax Rib Deflection (Y) vs. Time



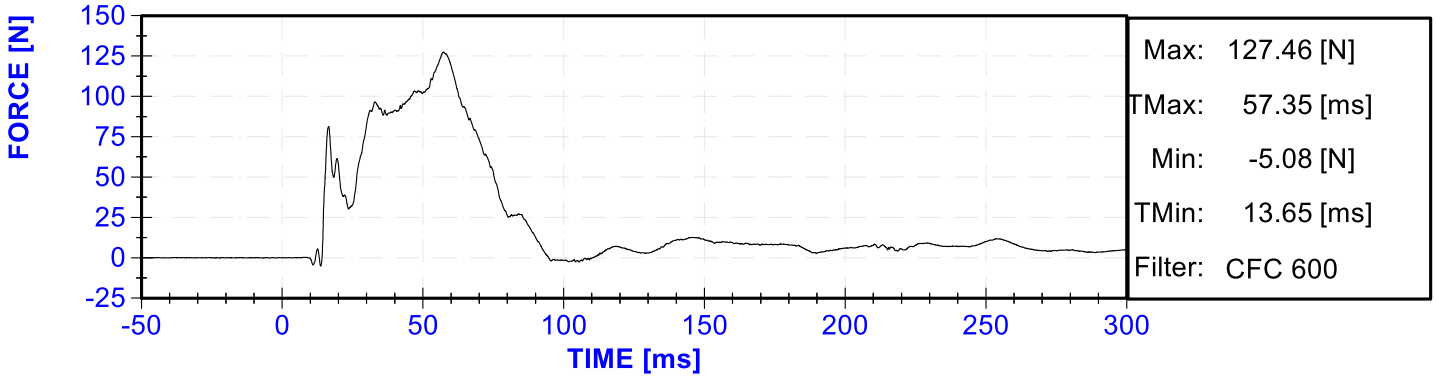
Driver Thorax Rib Deflection Maximum vs. Time



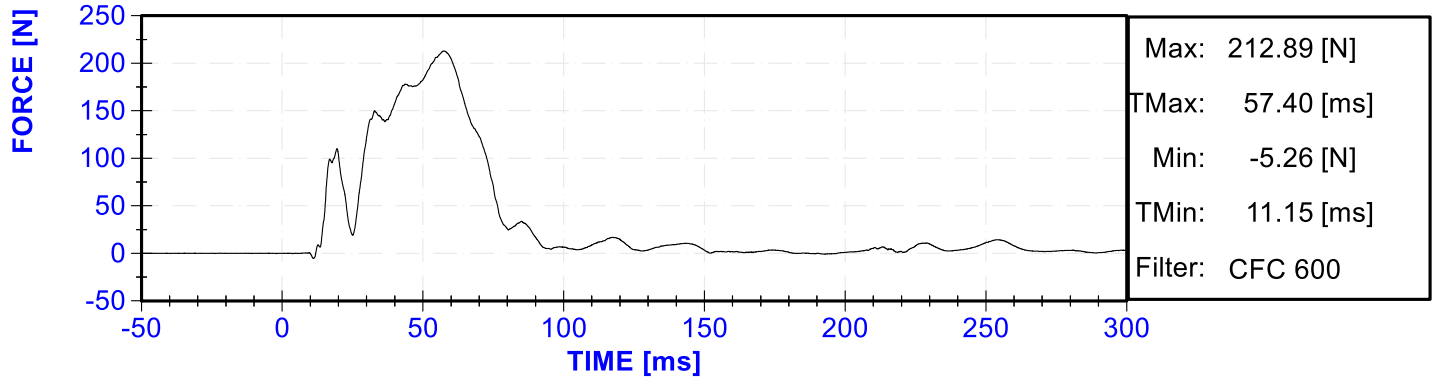
Driver Anterior Abdominal Force (Y) vs. Time



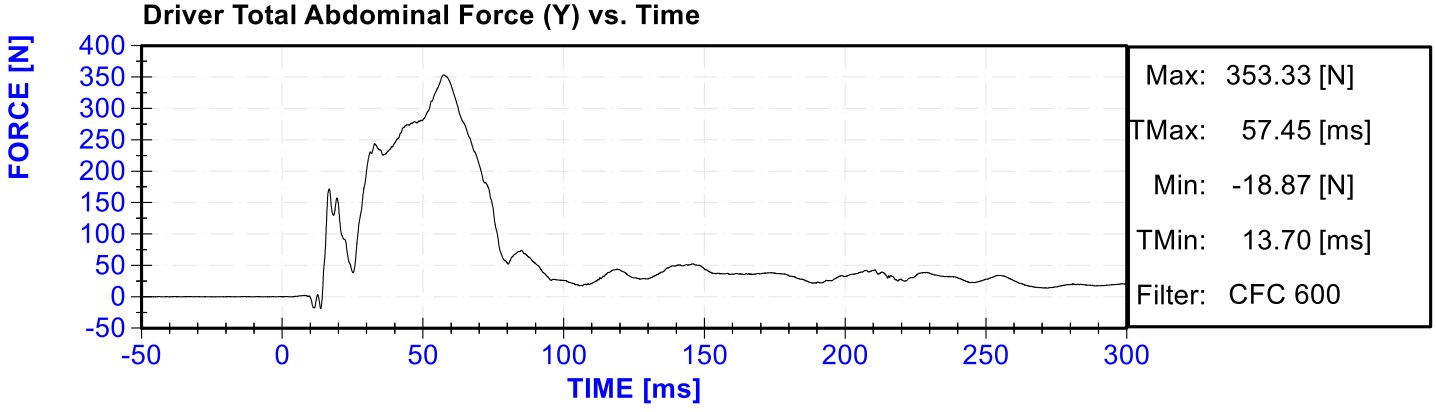
Driver Middle Abdominal Force (Y) vs. Time



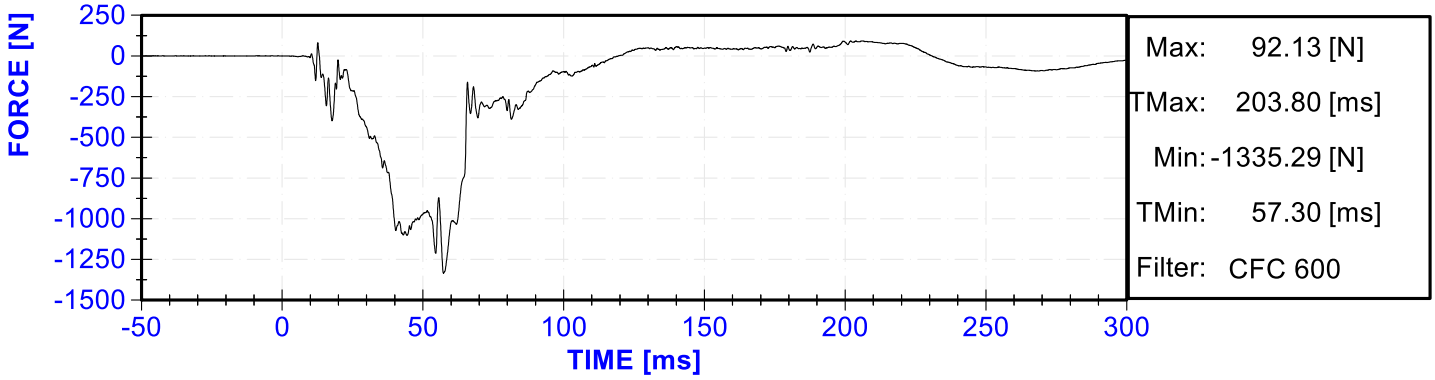
Driver Posterior Abdominal Force (Y) vs. Time



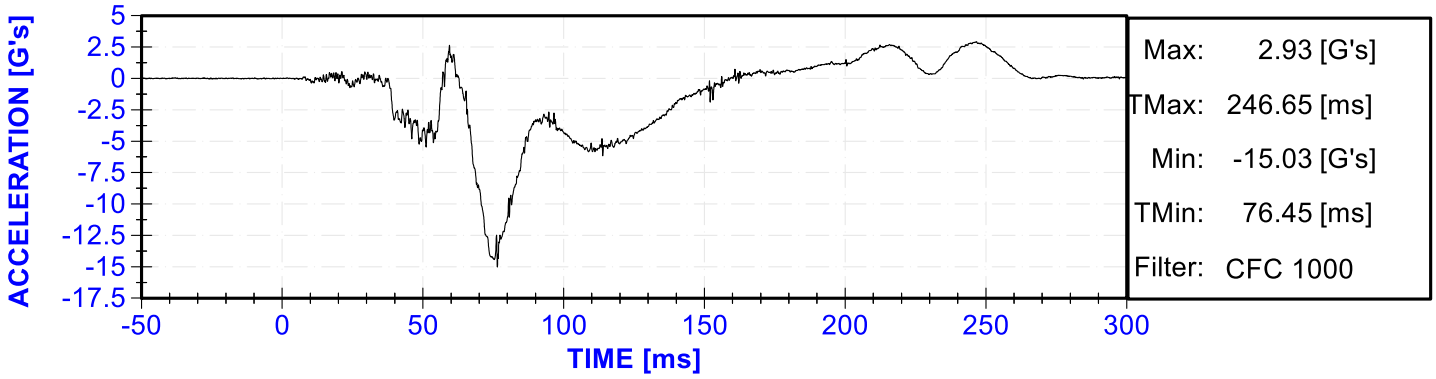
Driver Total Abdominal Force (Y) vs. Time



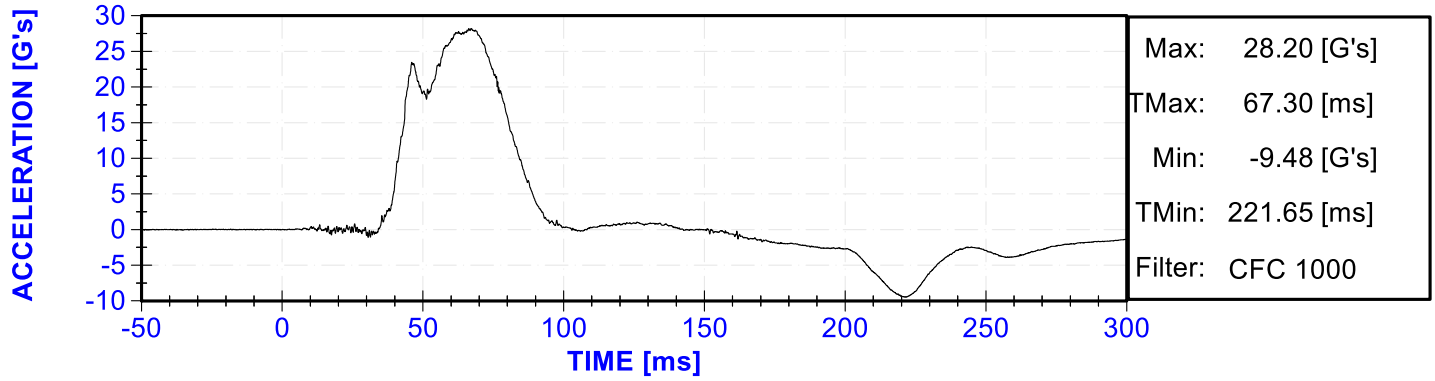
Driver Pubic Symphysis Force (Y) vs. Time



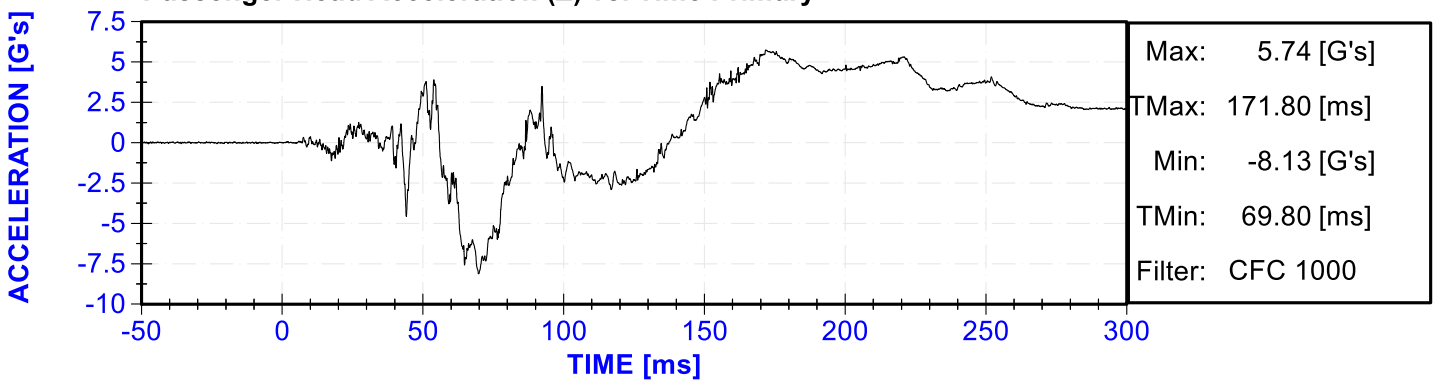
Passenger Head Acceleration (X) vs. Time Primary



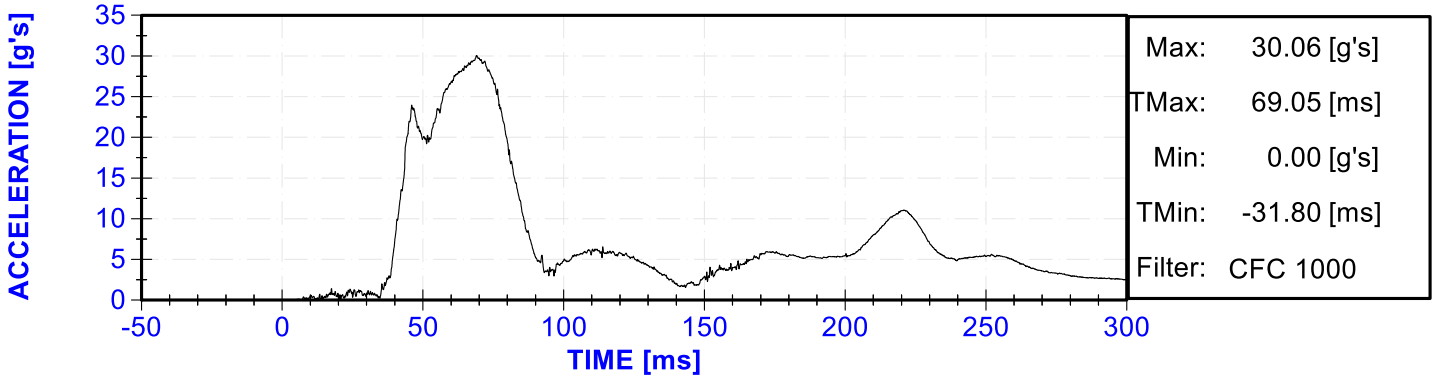
Passenger Head Acceleration (Y) vs. Time Primary



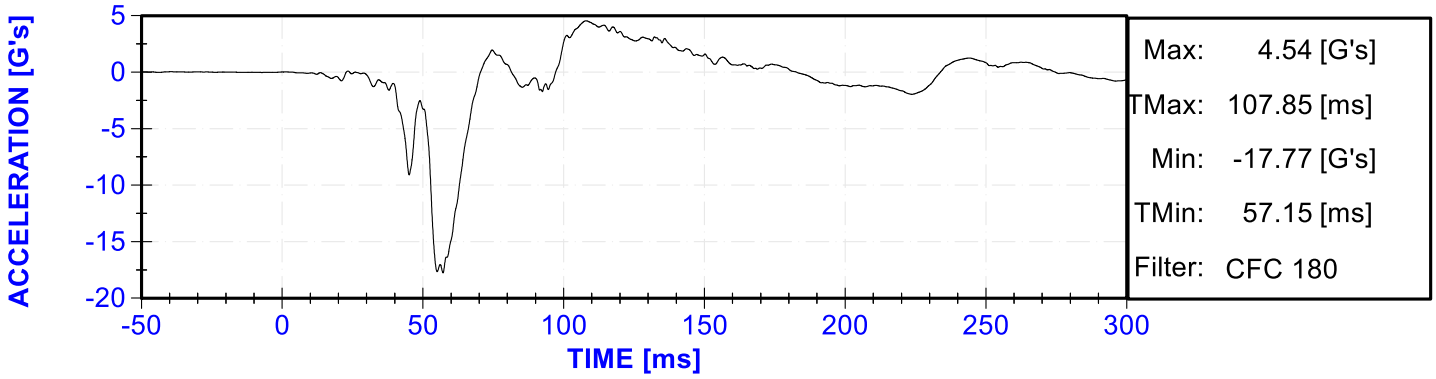
Passenger Head Acceleration (Z) vs. Time Primary



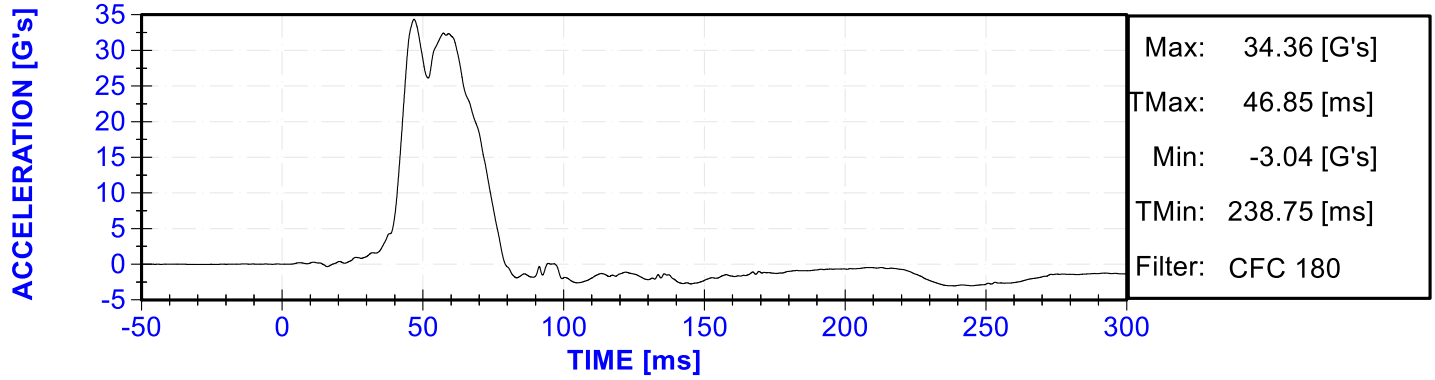
Passenger Head Resultant Acceleration Primary vs. Time



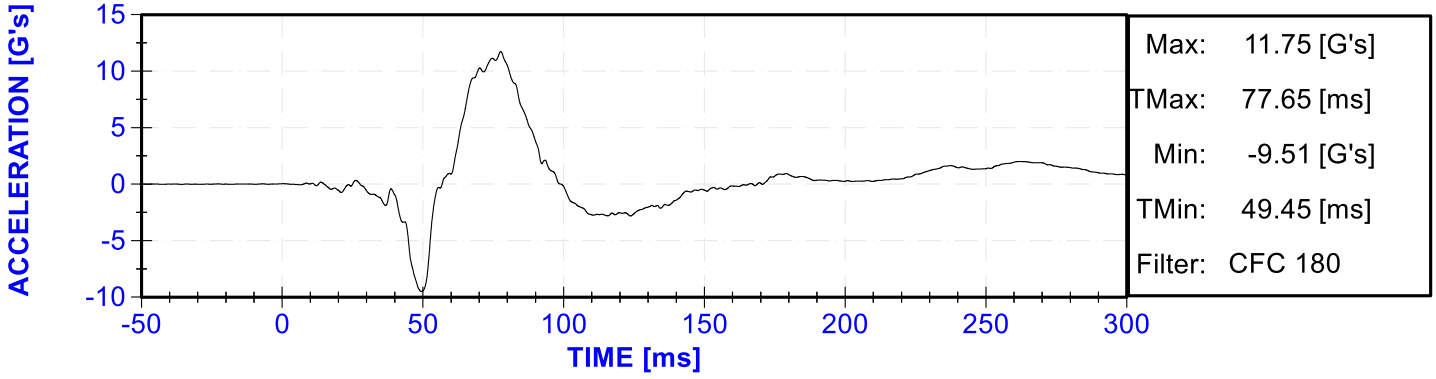
Passenger Lower Spine T12 Acceleration (X) vs. Time



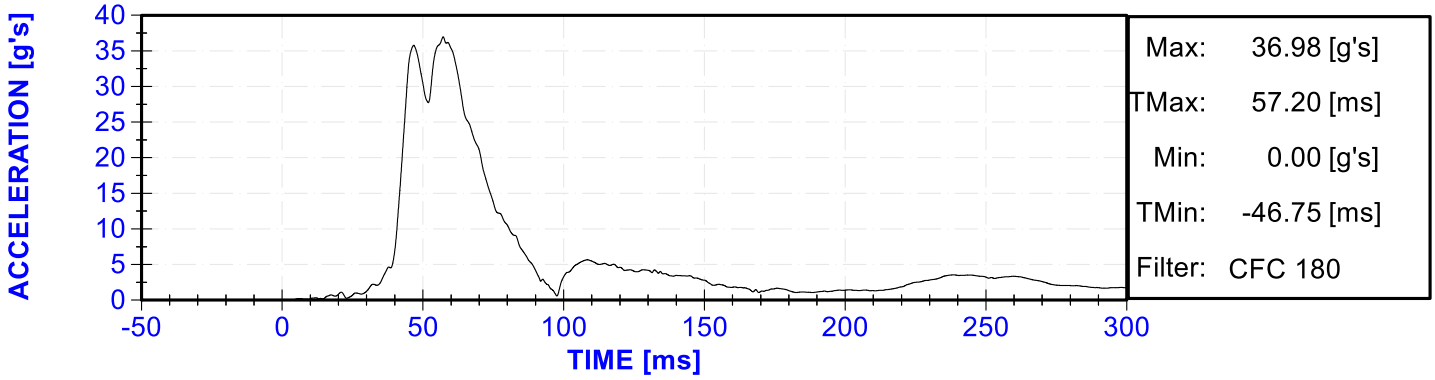
Passenger Lower Spine T12 Acceleration (Y) vs. Time



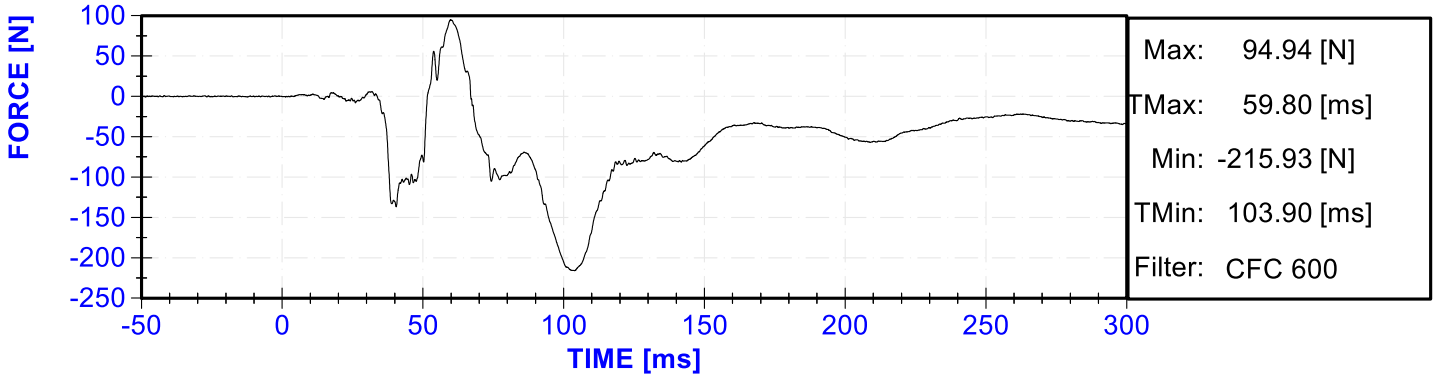
Passenger Lower Spine T12 Acceleration (Z) vs. Time



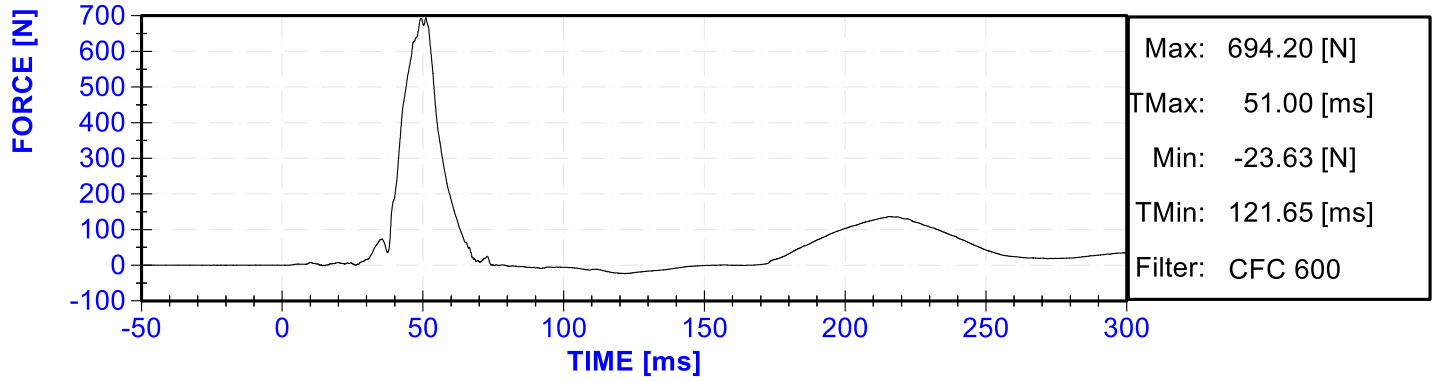
Passenger Lower Spine T12 Resultant Acceleration vs. Time



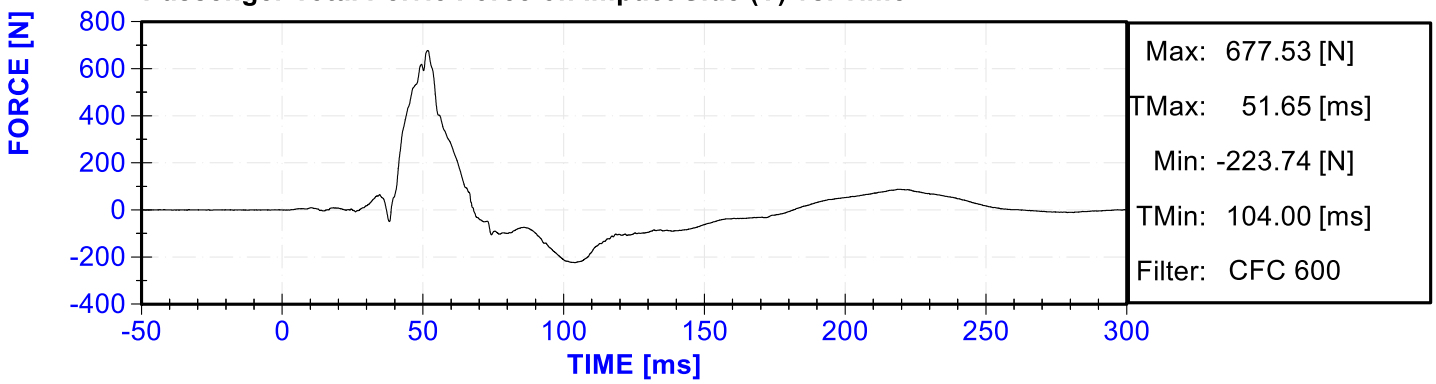
Passenger Iliac Force on Impact Side (Y) vs. Time



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

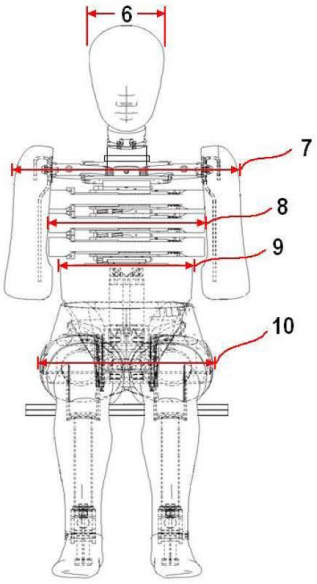
SERIAL NO: F033

(CONFIGURED FOR LEFT SIDE IMPACT)

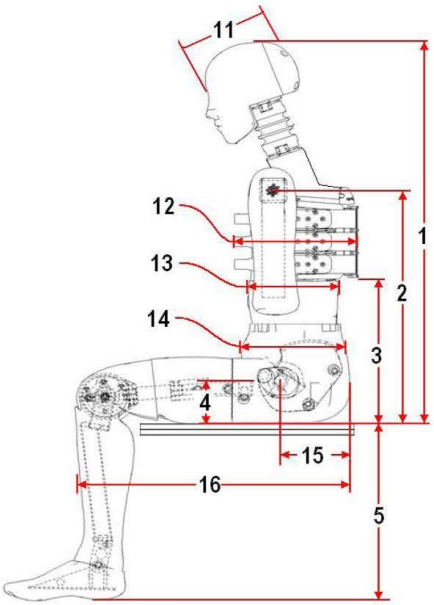
External Measurements - EuroSID-2re

Technician: K. Dutton Date: 08/05/2020

Dummy Serial Number: F033



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	100	Pass
5	Sole to Seat, Sitting	333	451	424	Pass
6	Head Width	152	158	154	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	328	Pass
9	Abdomen Width	273	287	285	Pass
10	Pelvis Lap Width	359	373	365	Pass
11	Head Depth	196	206	201	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	202	Pass
14	Pelvis Depth	235	245	240	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

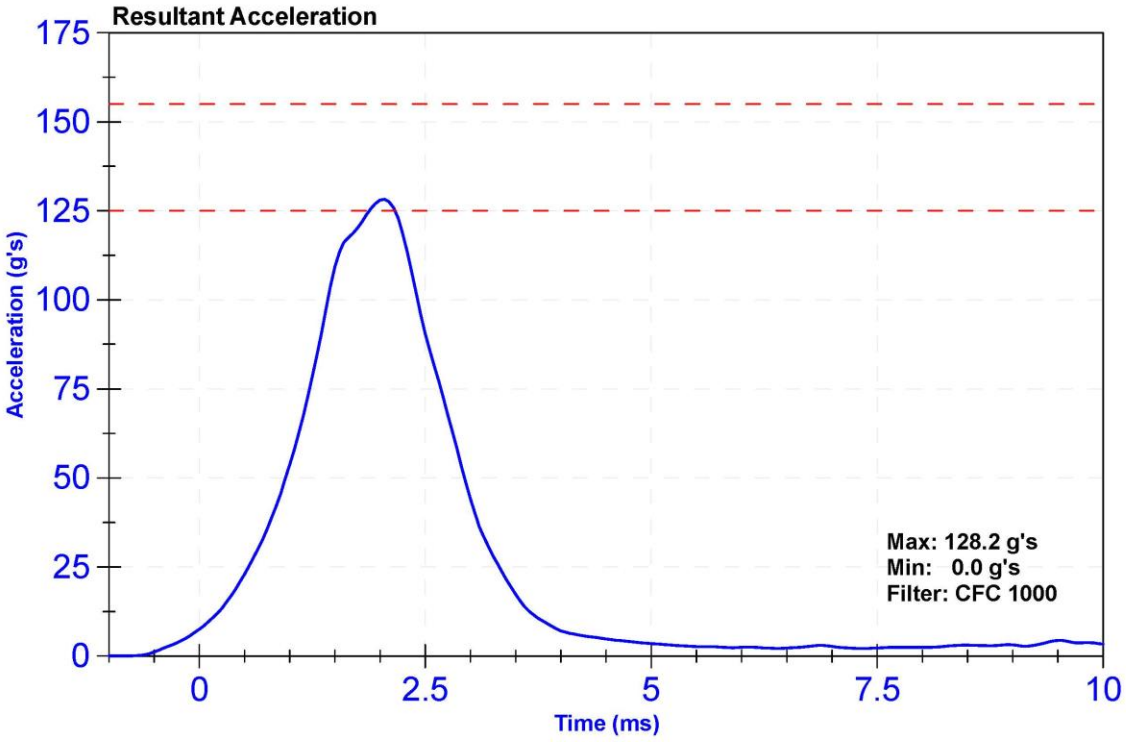
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

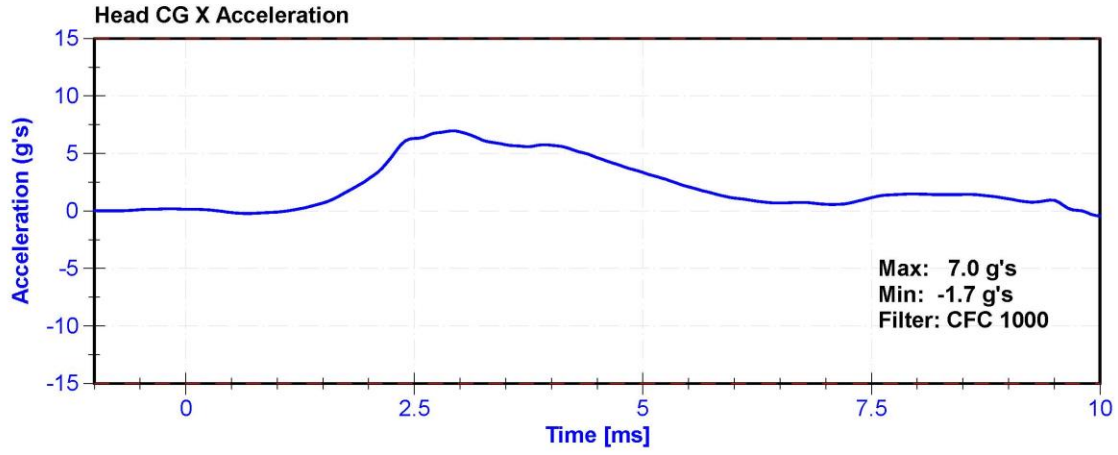
Results

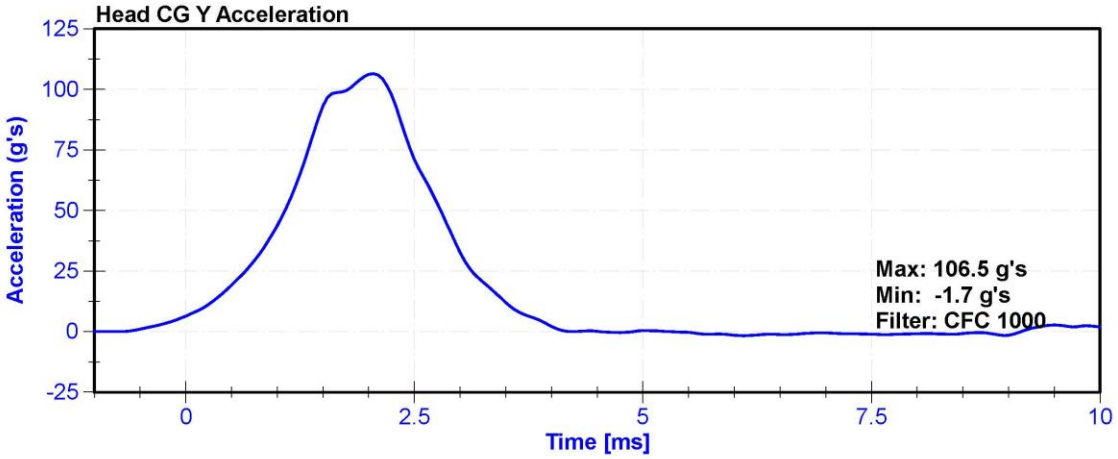
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	60.1	Pass
Resultant Acceleration	125	155	g's	128.2	Pass
Oscillation	0	15	%	3.42	Pass
Fore-Aft Acceleration	-15	15	g's	7.0	Pass

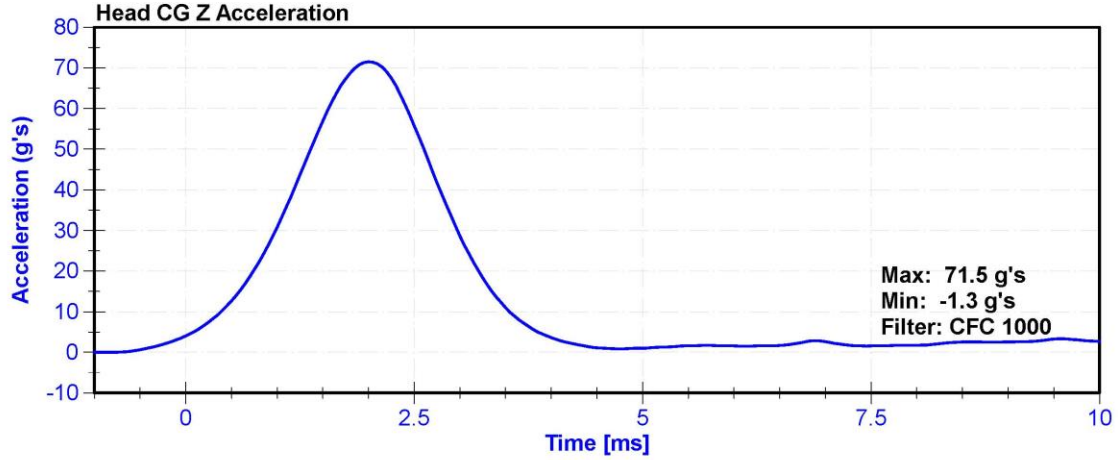
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P63861	5/19/2020	11/17/2020
Y Accelerometer	ENDEVCO 7264CT	AC-P49216	5/19/2020	11/17/2020
Z Accelerometer	ENDEVCO 7264	AC-P51303	5/19/2020	11/17/2020




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 7.0 g's
Min: -1.7 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: 106.5 g's
Min: -1.7 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
80
70
60
50
40
30
20
10
0
-10
0
2.5
5
7.5
10
Time [ms]
Max: 71.5 g's
Min: -1.3 g's
Filter: CFC 1000

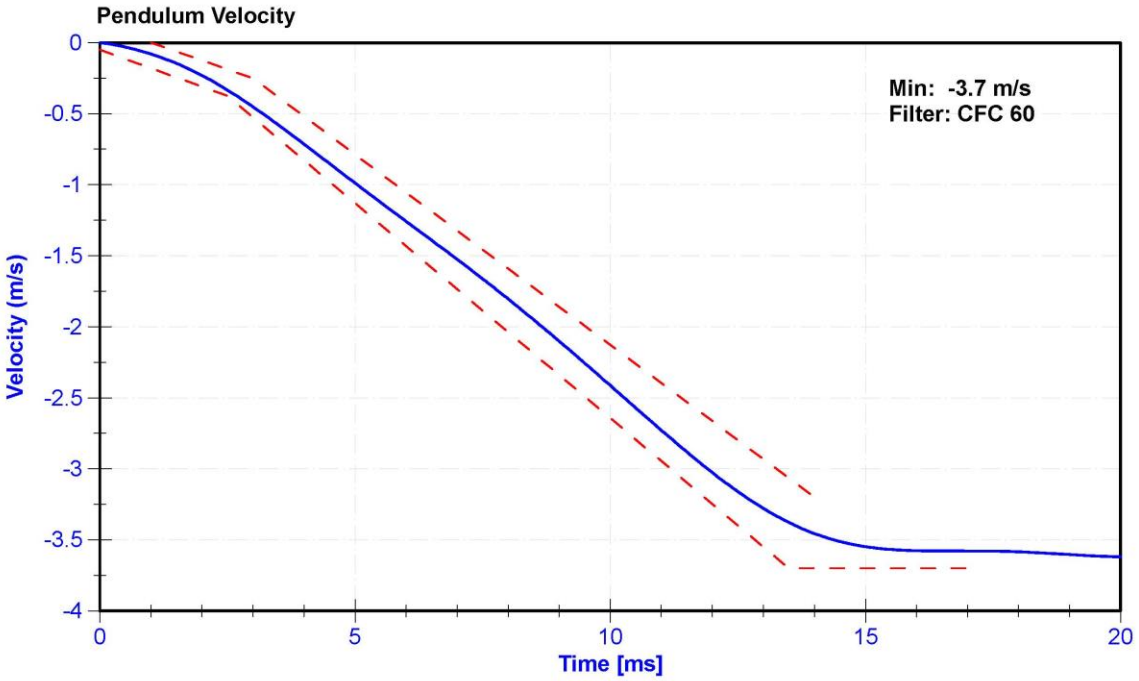
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

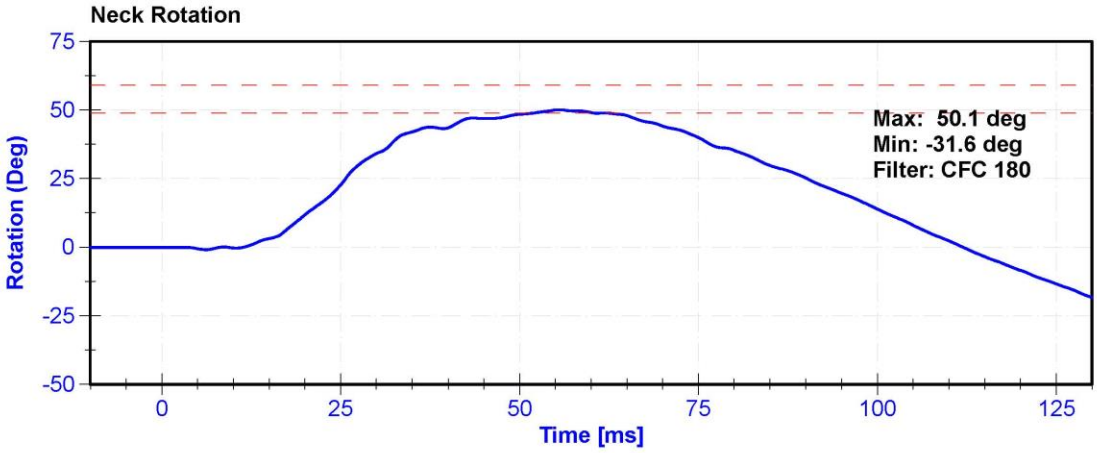
Results

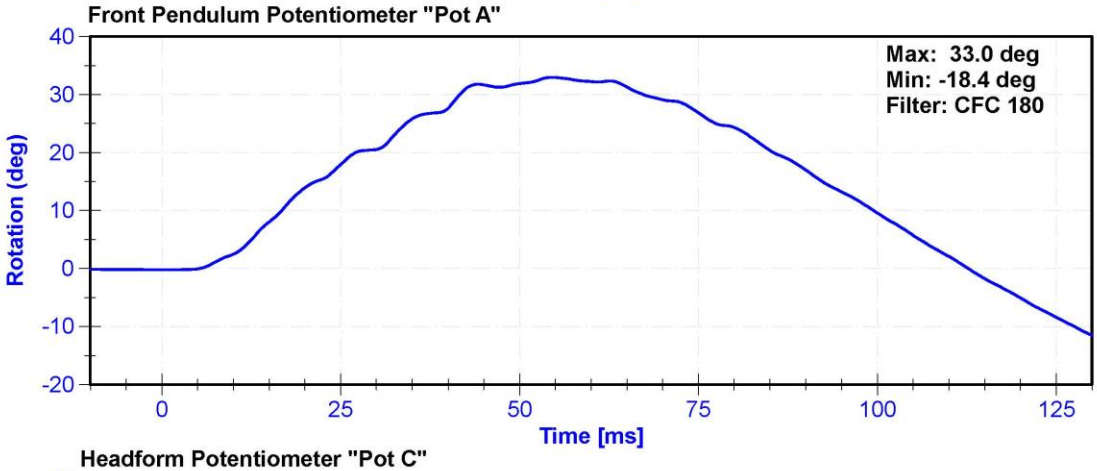
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	60.7	Pass
Velocity	3.3	3.5	m/s	3.35	Pass
Lateral Neck Rotation	49	59	deg	50.1	Pass
Time at Maximum Rotation	54	66	ms	55.5	Pass
Time of Rotation Decay from Maximum	53	88	ms	56.5	Pass

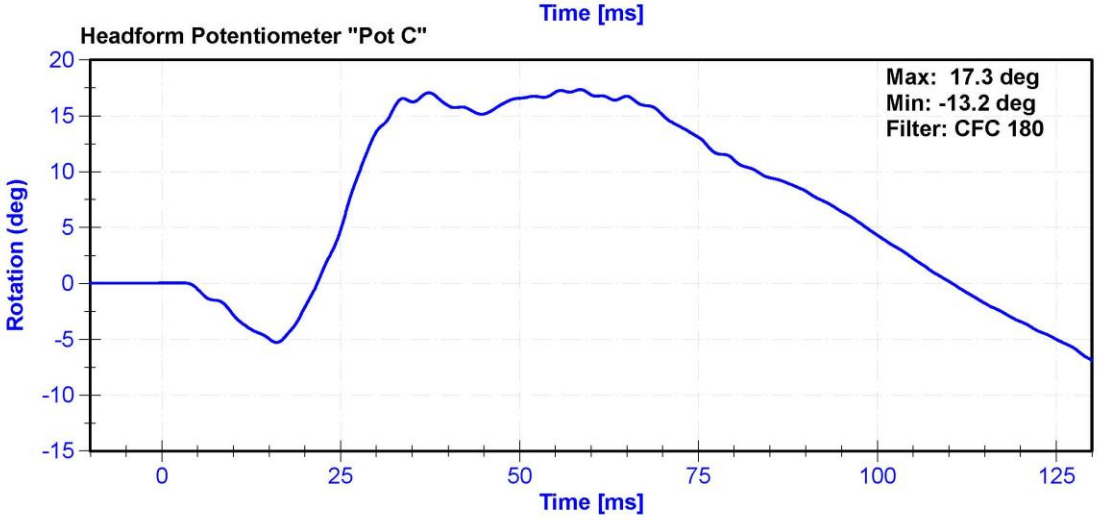
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CTAC-AH5M9 Pend		1/30/2020	1/29/2021
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: 50.1 deg
Min: -31.6 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 33.0 deg
Min: -18.4 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 17.3 deg
Min: -13.2 deg
Filter: CFC 180

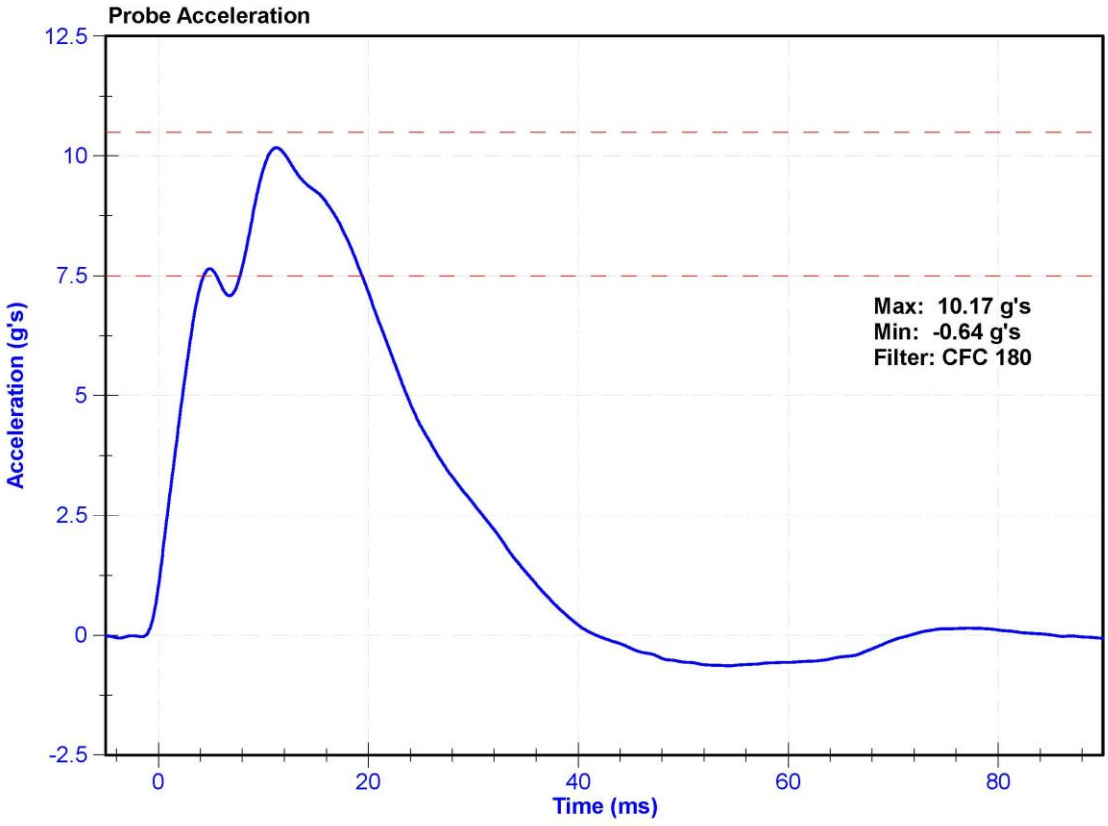
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	54.0	Pass
Velocity	4.2	4.4	m/s	4.38	Pass
Probe Acceleration	7.5	10.5	g's	10.17	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A286228	1/29/2020	1/28/2021



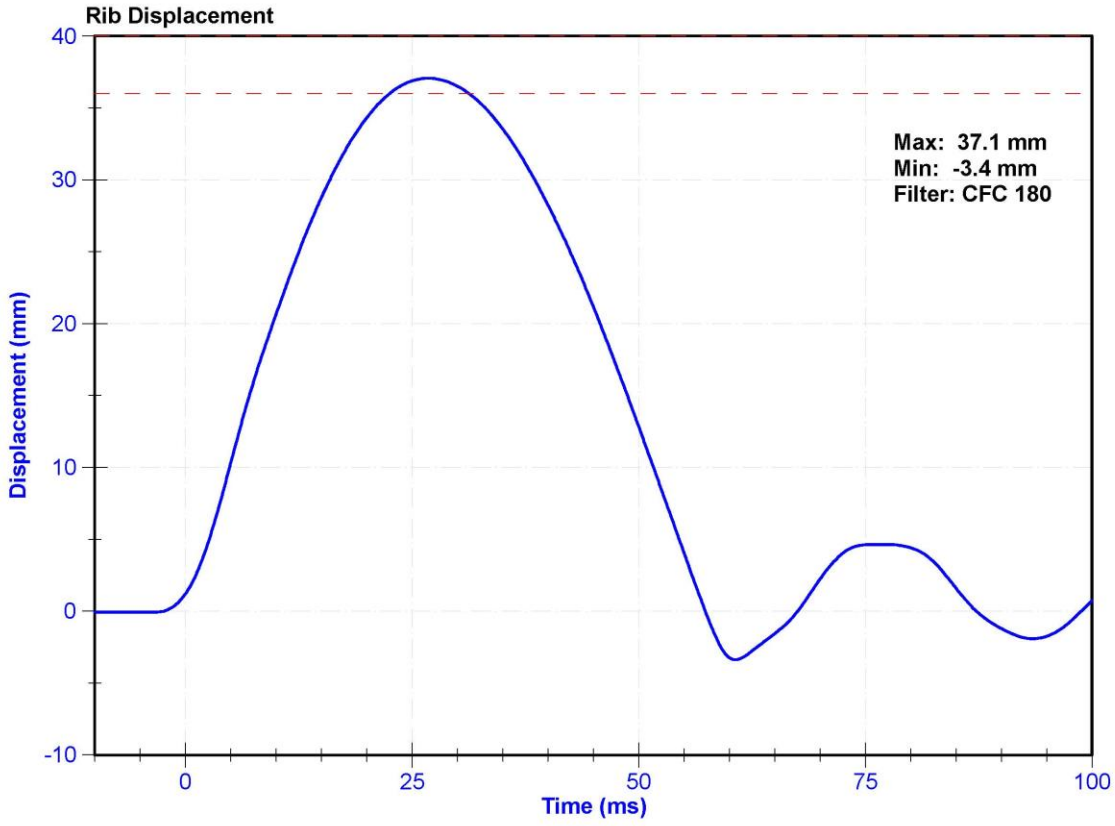
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	65.7	Pass
Rib Displacement	36	40	mm	37.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-179GFE	5/20/2020	11/18/2020



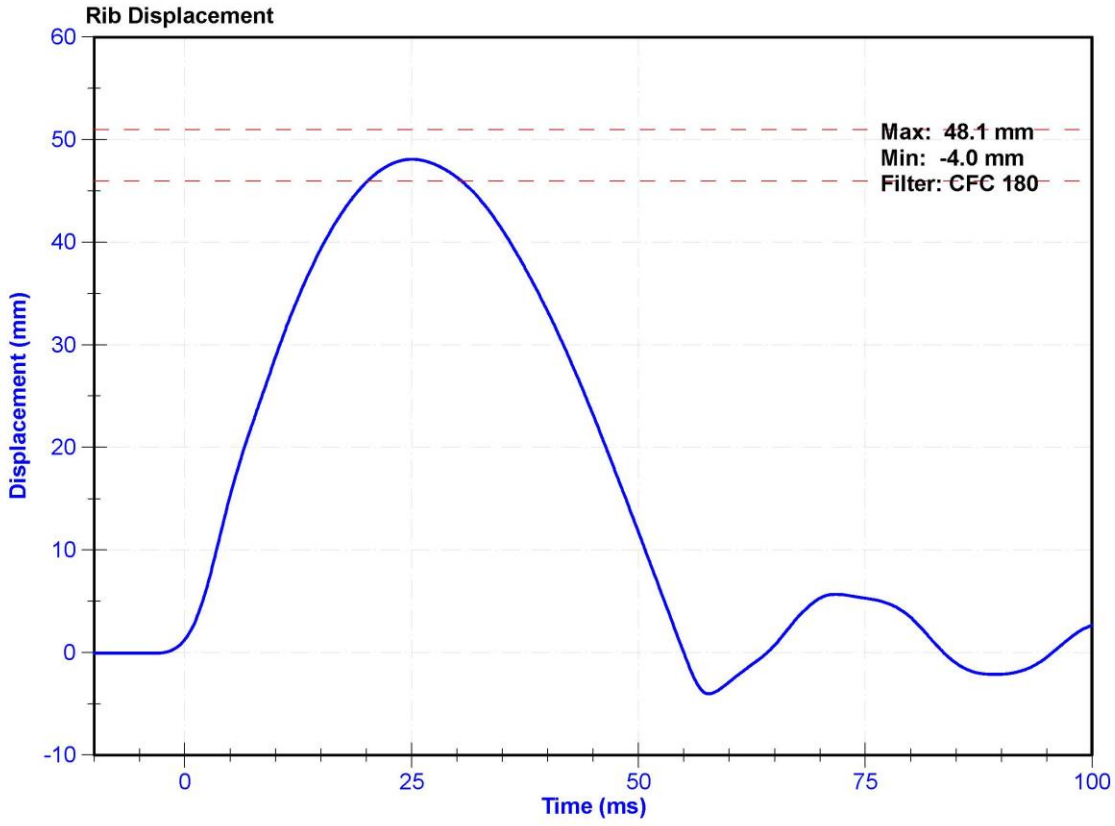
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	65.7	Pass
Rib Displacement	46	51	mm	48.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-179GFE	5/20/2020	11/18/2020



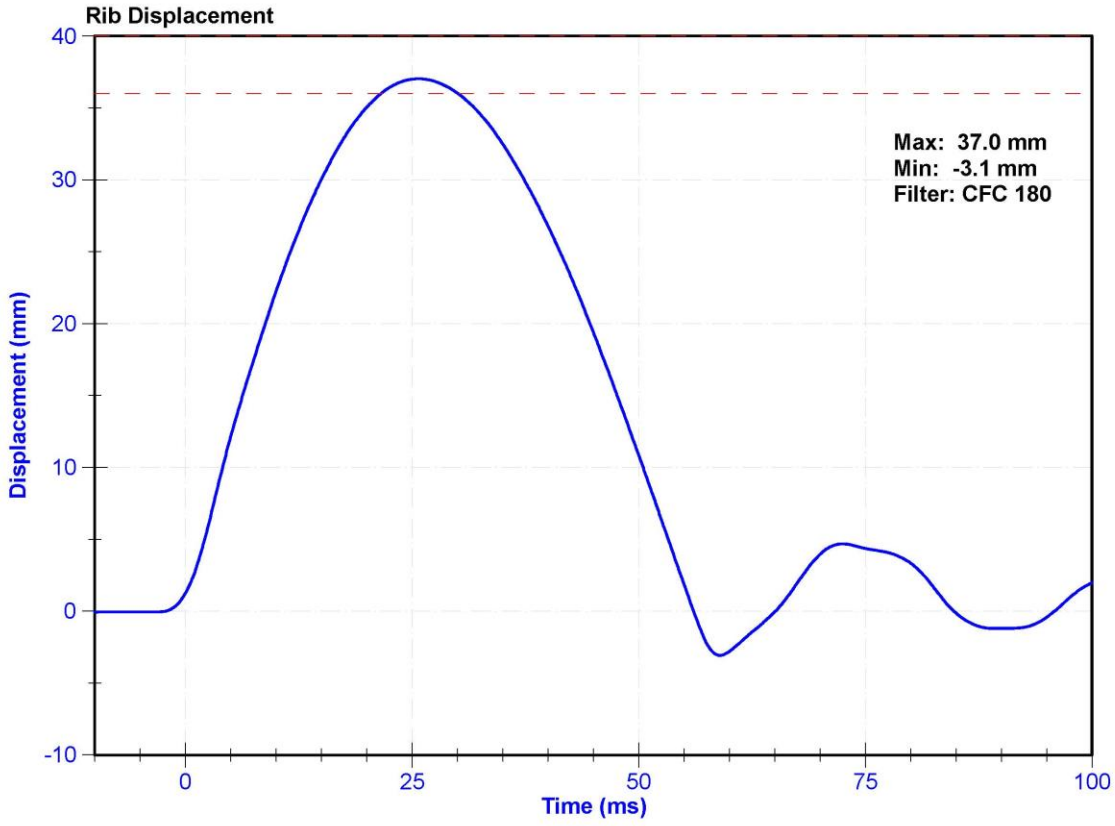
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	60.7	Pass
Rib Displacement	36	40	mm	37.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-185GFE	5/20/2020	11/18/2020



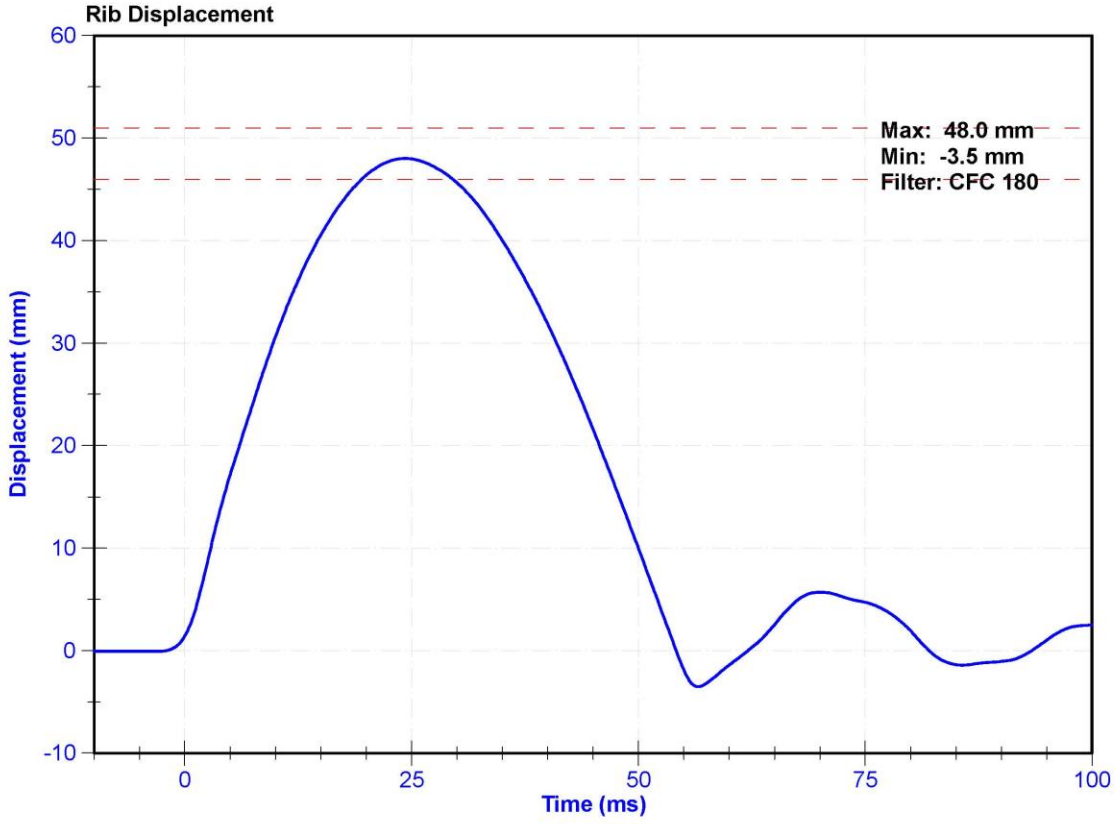
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	62.5	Pass
Rib Displacement	46	51	mm	48.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-185GFE	5/20/2020	11/18/2020



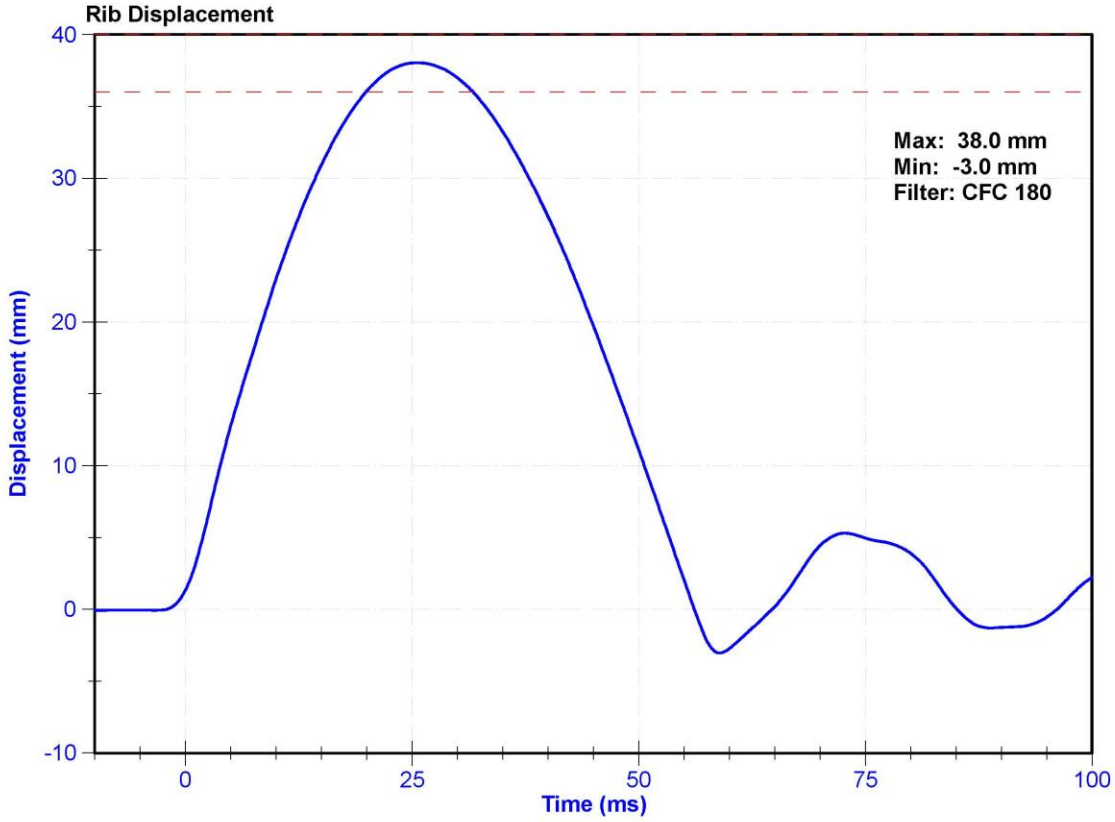
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	60.7	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-178GFE	5/20/2020	11/18/2020



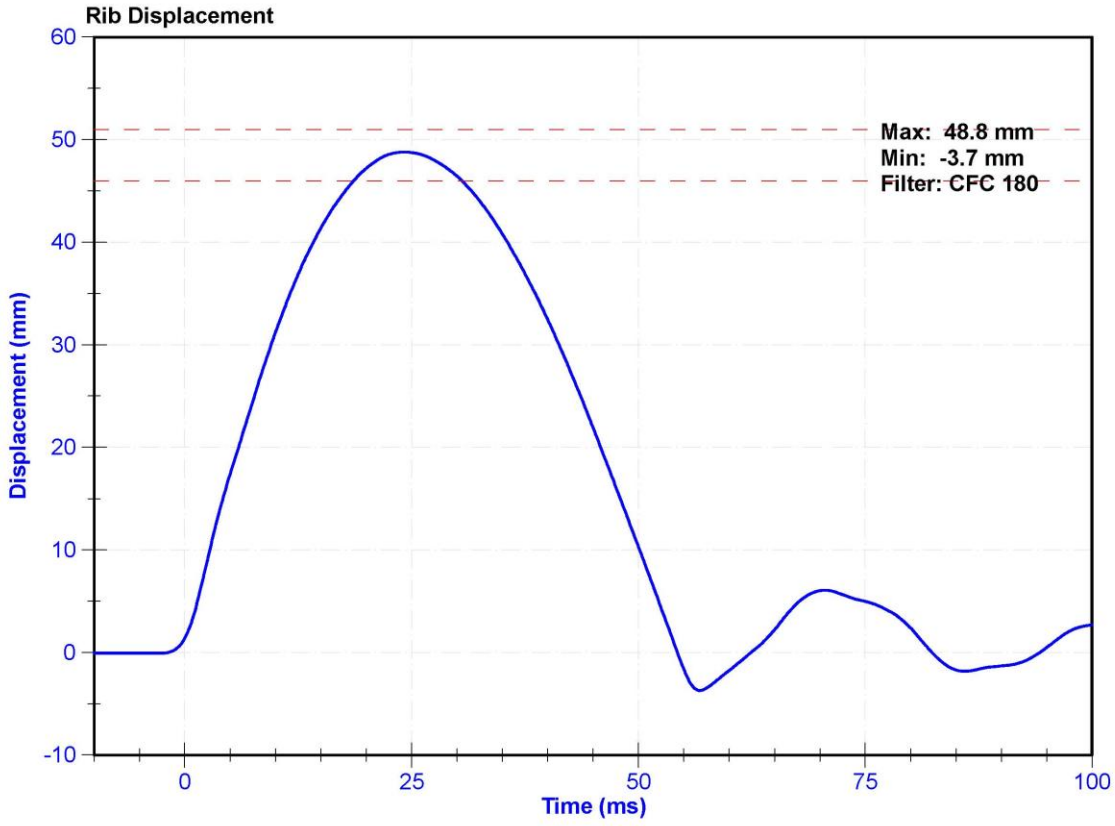
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	60.7	Pass
Rib Displacement	46	51	mm	48.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-178GFE	5/20/2020	11/18/2020



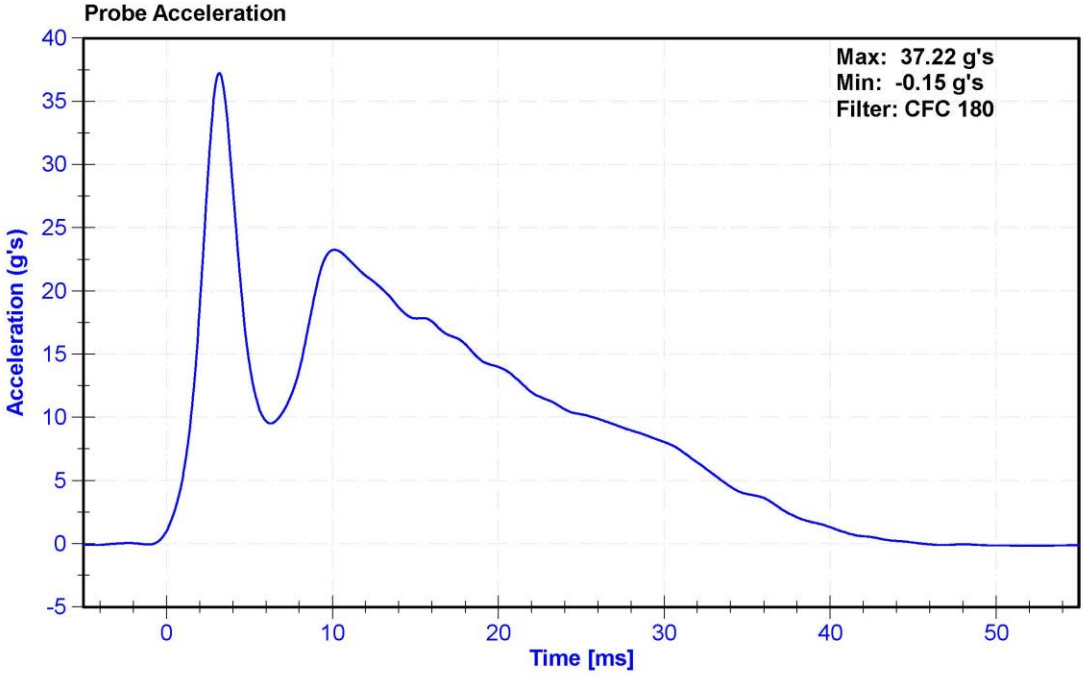
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

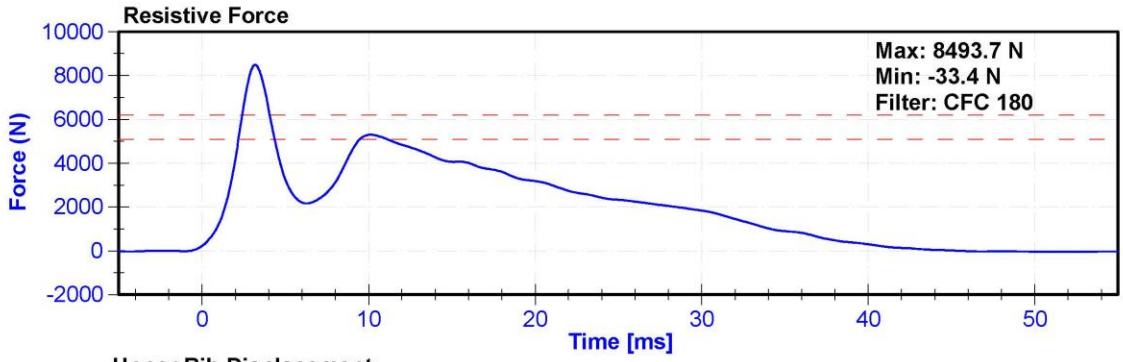
Results

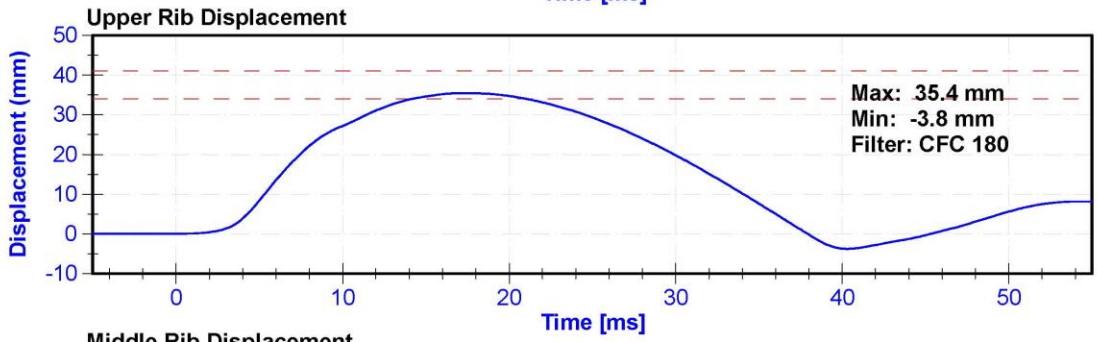
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	55.0	Pass
Velocity	5.4	5.6	m/s	5.46	Pass
Resistive Force after 6ms	5100	6200	N	5306.2	Pass
Upper Thorax Rib Deflection	34	41	mm	35.4	Pass
Mid Thorax Rib Deflection	37	45	mm	40.7	Pass
Lower Thorax Rib Deflection	37	44	mm	41.3	Pass

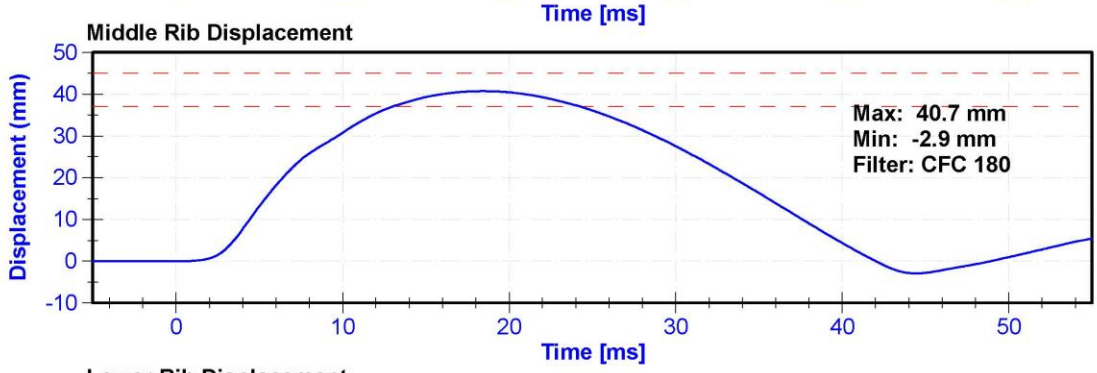
Transducer Calibrations

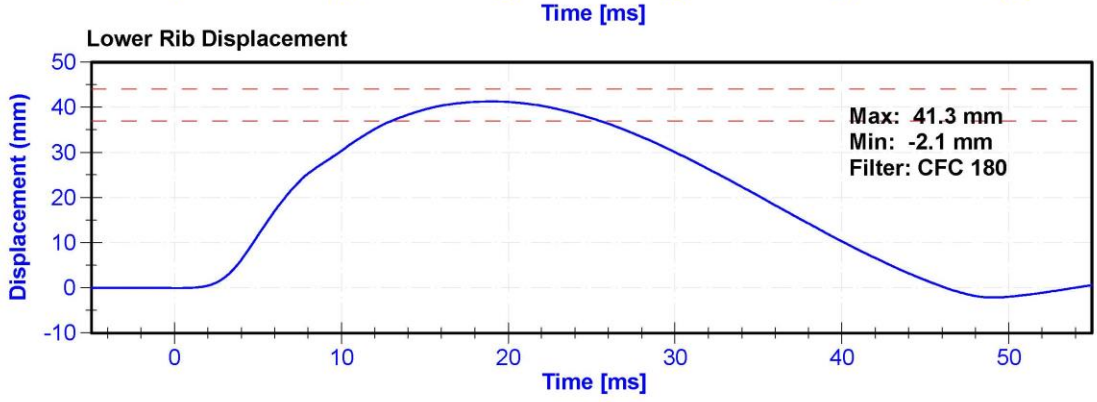
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A286228	1/29/2020	1/28/2021
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-179GFE	5/20/2020	11/18/2020
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-185GFE	5/20/2020	11/18/2020
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-178GFE	5/20/2020	11/18/2020




Resistive Force
Max: 8493.7 N
Min: -33.4 N
Filter: CFC 180
Force (N)
10000
8000
6000
4000
2000
0
-2000
0
10
20
30
40
50
Time [ms]


Upper Rib Displacement
Max: 35.4 mm
Min: -3.8 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]


Middle Rib Displacement
Max: 40.7 mm
Min: -2.9 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]


Lower Rib Displacement
Max: 41.3 mm
Min: -2.1 mm
Filter: CFC 180
Displacement (mm)
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]

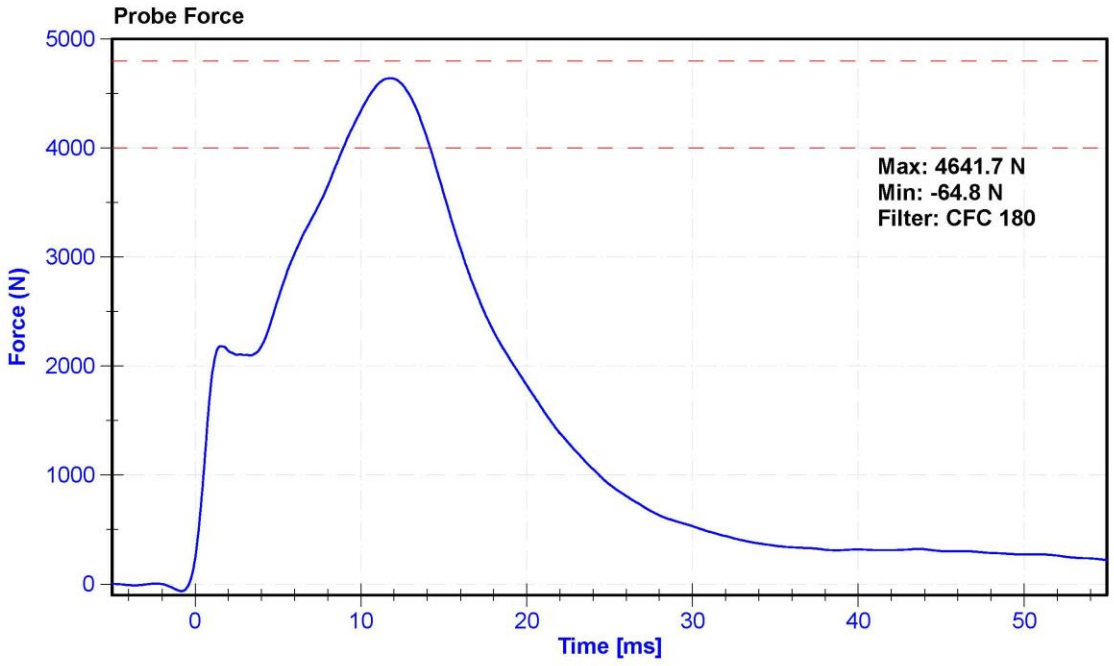
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K.Brogan

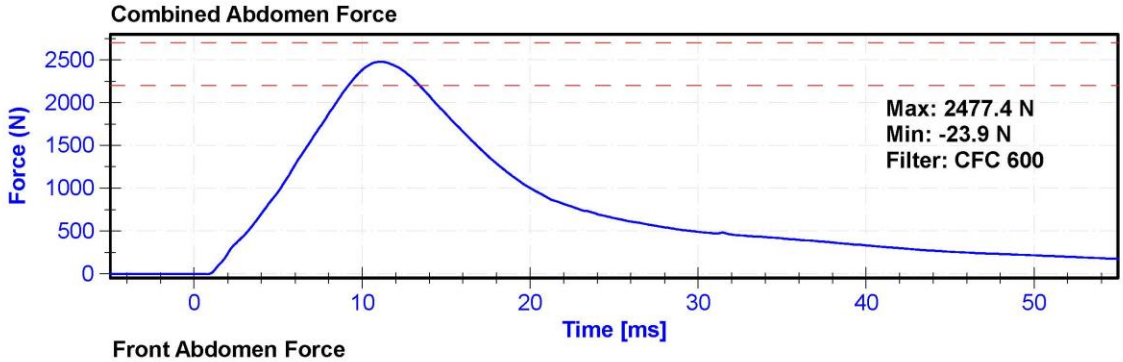
Results

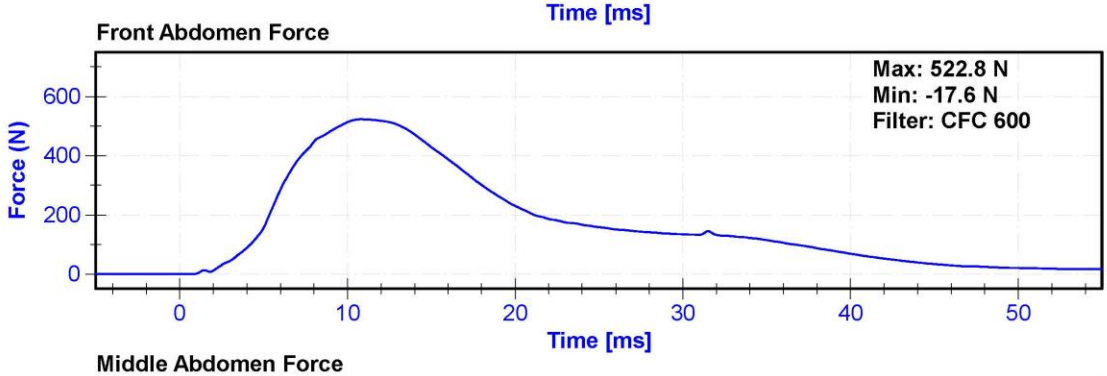
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	63	Pass
Velocity	3.9	4.1	m/s	4.08	Pass
Resistive Probe Force	4000	4800	N	4641.7	Pass
Time at Peak Probe Force	10.6	13.0	ms	11.75	Pass
Combined Abdomen Force	2200	2700	N	2477.4	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.10	Pass

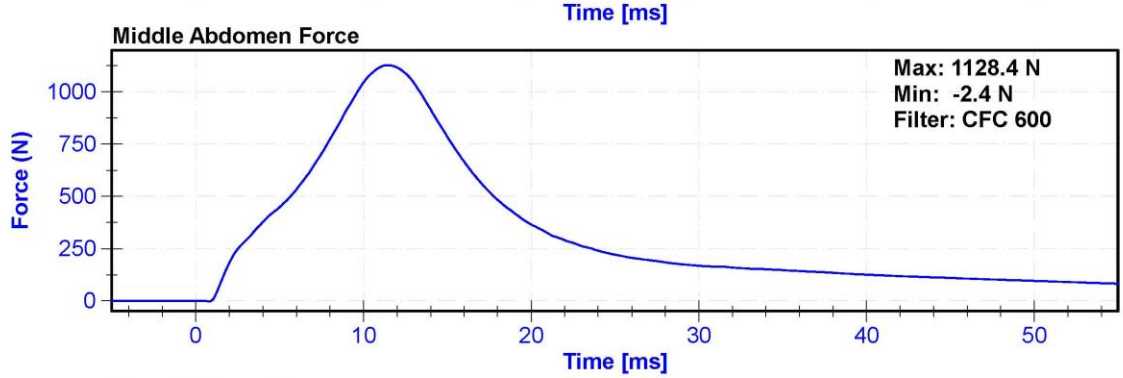
Transducer Calibrations

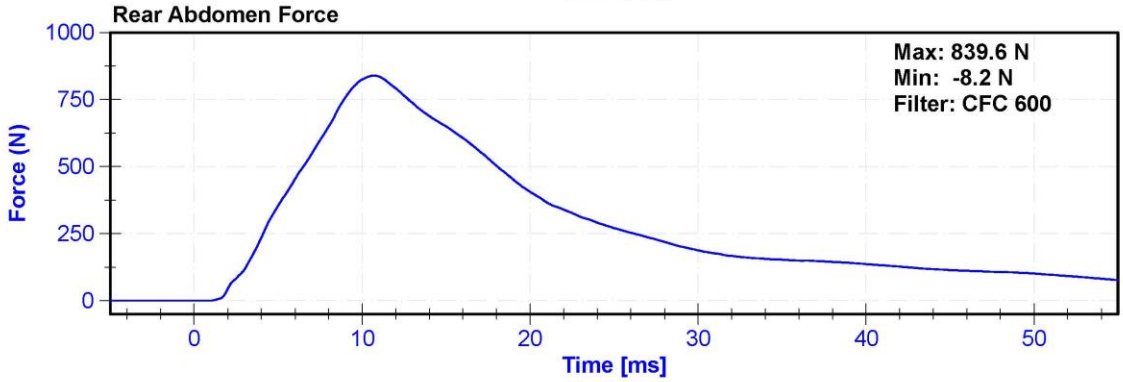
Channel	Manufacturer	Serial Number	Calibratio Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	1/28/2021
Front Abdomen Load Cell	DENTON 2631J	26311512 GFE	3/19/2020	3/19/2021
Middle Abdomen Load Cell	DENTON 2631J	26311526 GFE	3/19/2020	3/19/2021
Rear Abdomen Load Cell	DENTON 2631J	26311516 GFE	3/19/2020	3/19/2021




Combined Abdomen Force
Force (N)
2500
2000
1500
1000
500
0
0
10
20
30
40
50
Time [ms]
Max: 2477.4 N
Min: -23.9 N
Filter: CFC 600


Front Abdomen Force
Force (N)
600
400
200
0
0
10
20
30
40
50
Time [ms]
Max: 522.8 N
Min: -17.6 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
1000
750
500
250
0
0
10
20
30
40
50
Time [ms]
Max: 1128.4 N
Min: -2.4 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
1000
750
500
250
0
0
10
20
30
40
50
Time [ms]
Max: 839.6 N
Min: -8.2 N
Filter: CFC 600

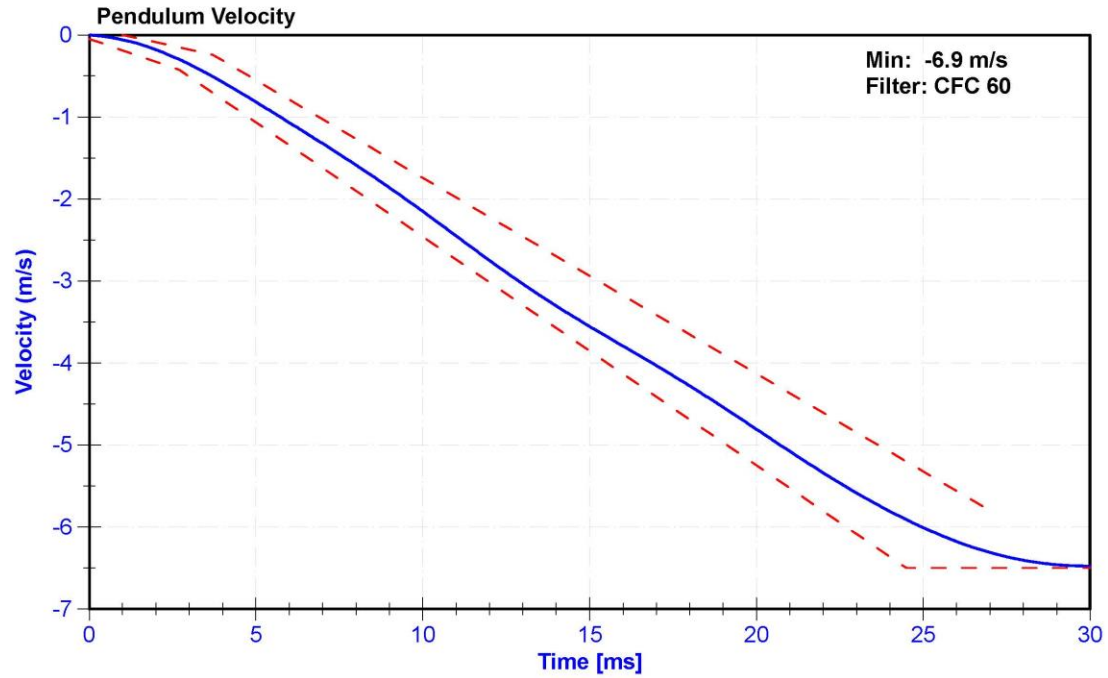
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

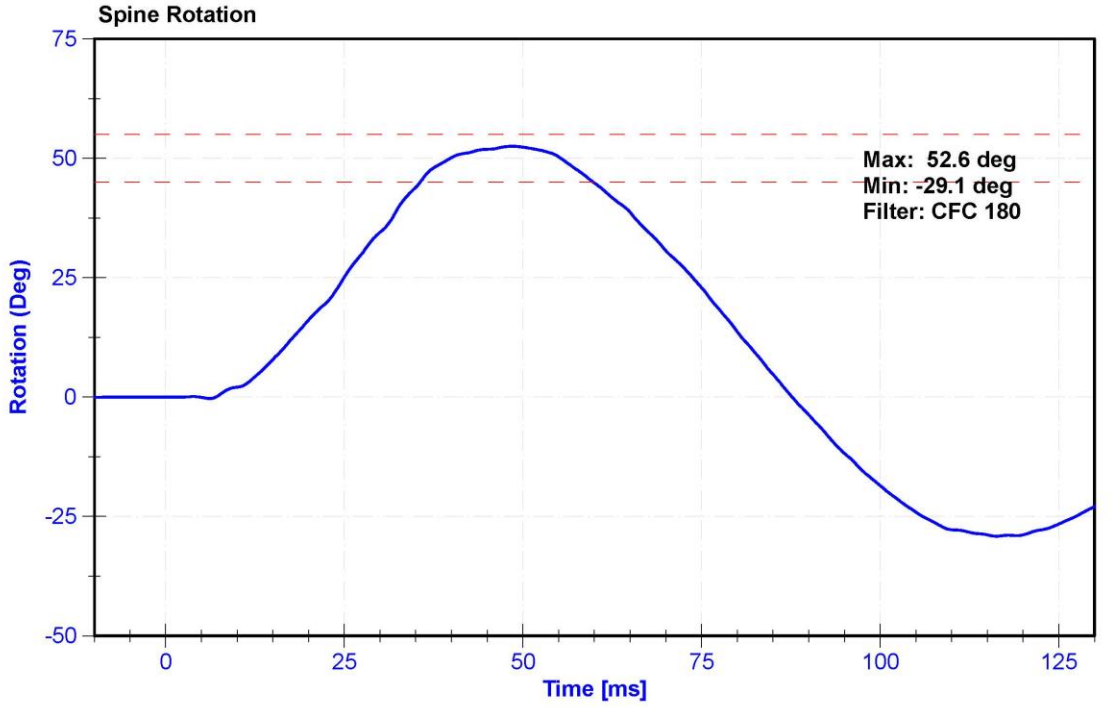
Results

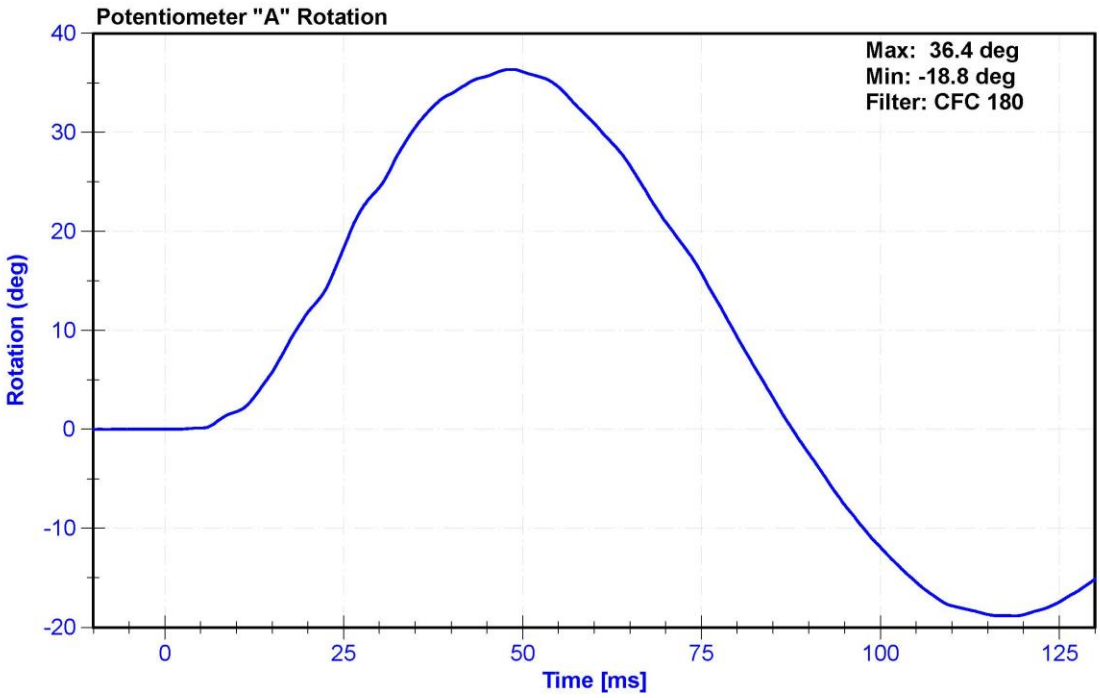
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	60.6	Pass
Velocity	5.95	6.15	m/s	6.005	Pass
Lateral Spine Rotation	45	55	deg	52.6	Pass
Time at Maximum Rotation	39	53	ms	48.6	Pass
Time of Decay to Zero Degrees	37	57	ms	39.1	Pass
Pulse within Corridor?	-	-	-		

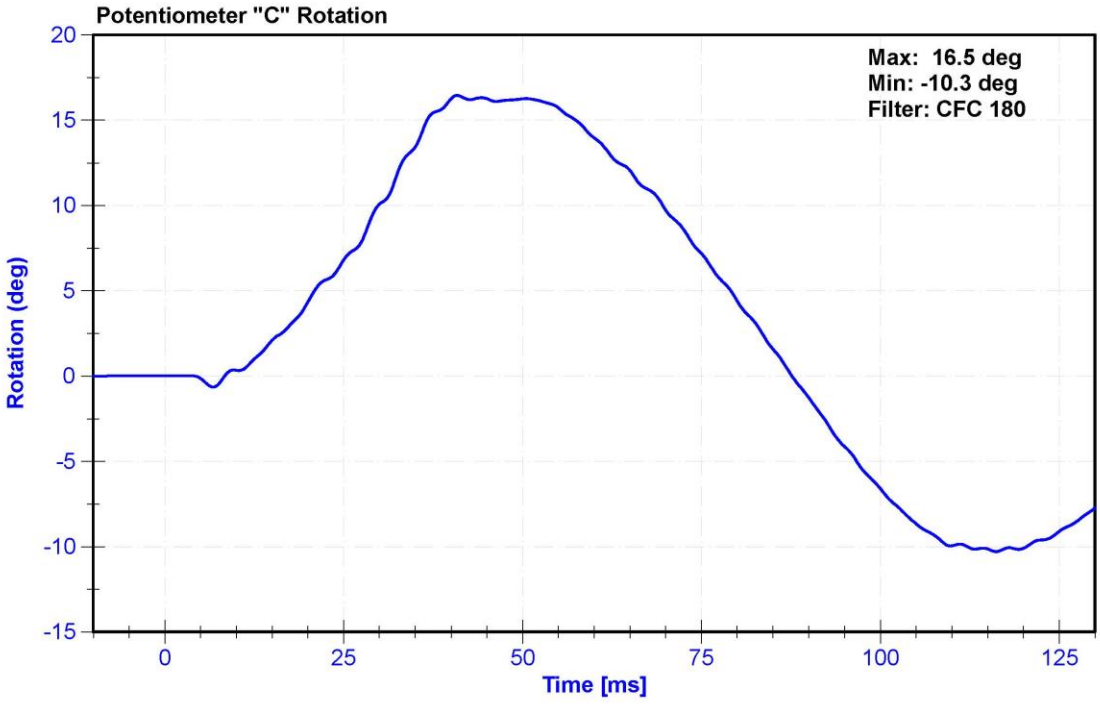
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/30/2020	1/29/2021
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: -6.9 m/s
Filter: CFC 60
Velocity (m/s)
0
-1
-2
-3
-4
-5
-6
-7
0
5
10
15
20
25
30
Time [ms]


Spine Rotation
Max: 52.6 deg
Min: -29.1 deg
Filter: CFC 180
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 36.4 deg
Min: -18.8 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: 16.5 deg
Min: -10.3 deg
Filter: CFC 180
Rotation (deg)
20
15
10
5
0
-5
-10
-15
0
25
50
75
100
125
Time [ms]

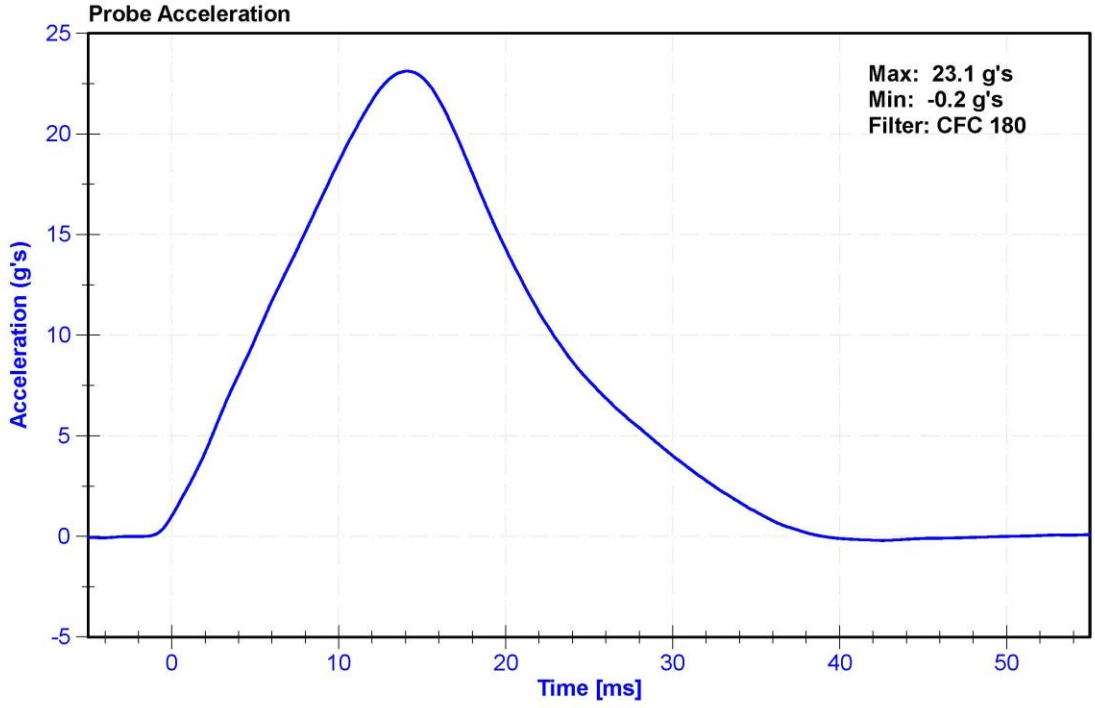
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

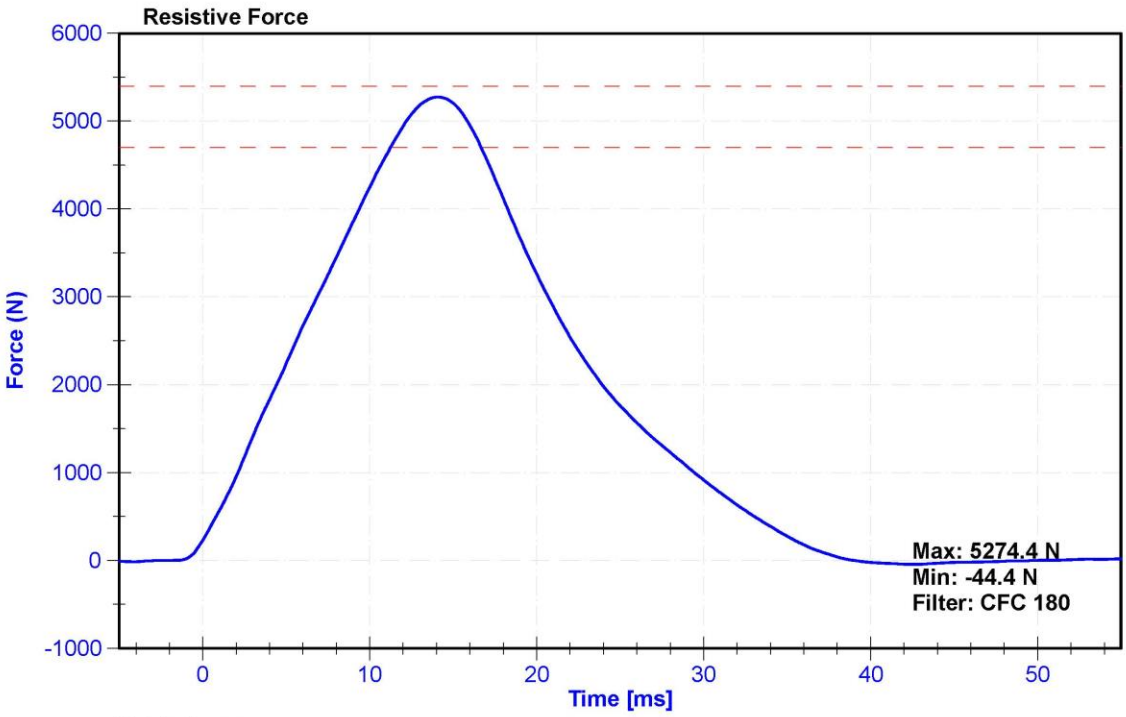
Results

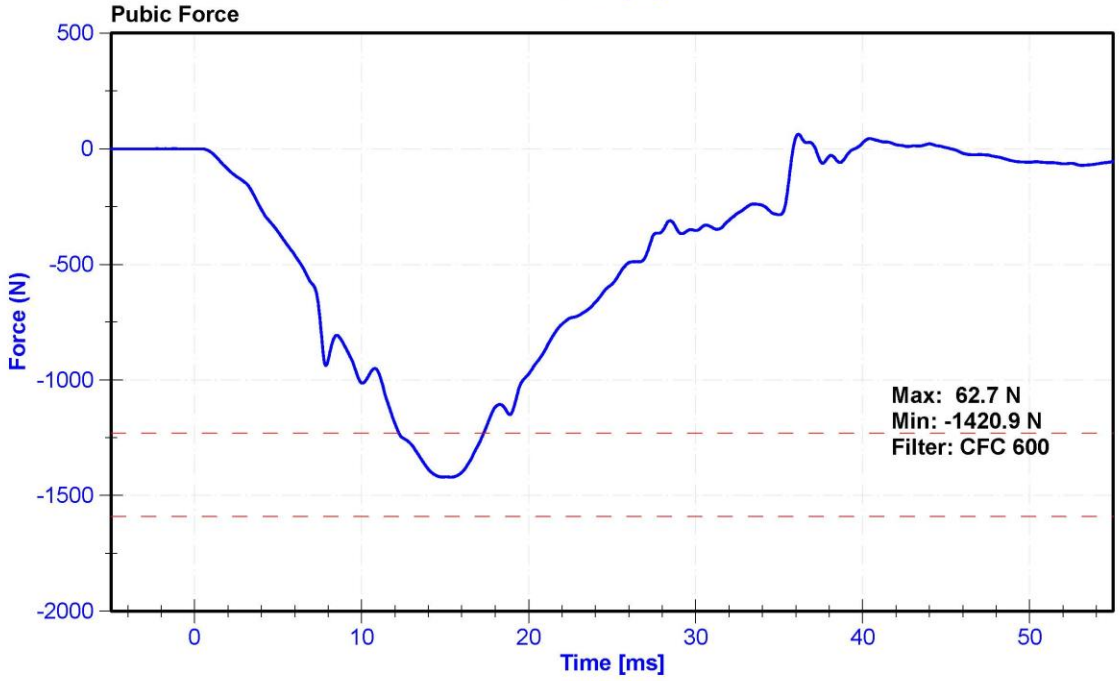
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	63.0	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Resistive Force	4700	5400	N	5274.4	Pass
Time at Peak Resistive Force	11.8	16.1	ms	14.10	Pass
Pubic Force	-1590	-1230	N	-1420.9	Pass
Time at Peak Pubic Force	12.2	17.0	ms	15.35	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	1/28/2021
Pubic Load Cell	Denton 3096JFL	LC-456Fy	3/19/2020	3/19/2021




Resistive Force
Force (N)
Time [ms]
Max: 5274.4 N
Min: -44.4 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 62.7 N
Min: -1420.9 N
Filter: CFC 600

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

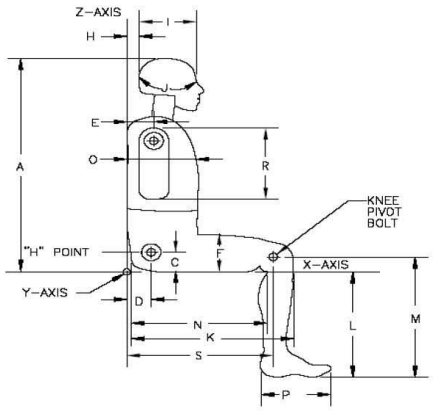
SERIAL No: 300

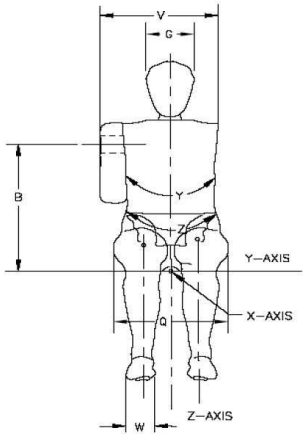
(CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - SID-IIs

Technician: K. Dutton Date: 08/05/2020

Dummy Serial Number: 300





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	782	Pass
B	Shoulder Pivot Height	437	453	449	Pass
C	H-point Height	79	89	86	Pass
D	H-point from seatback	141	151	145	Pass
E	Shoulder Pivot from Backline	97	107	102	Pass
F	Thigh Clearance	119	135	126	Pass
G	Head Breadth	140	148	144	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	187	Pass
J	Head Circumference	541	551	544	Pass
K	Buttock to Knee Length	514	540	533	Pass
L	Popliteal Height	343	369	361	Pass
M	Knee Pivot to floor height	392	409	401	Pass
N	Buttock Popliteal Length	416	442	431	Pass
O	Chest Depth w/o jacket	195	211	207	Pass
P	Foot Length	216	232	220	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	318	Pass
R	Arm Length	249	259	253	Pass
S	Knee Joint to seatback	477	493	484	Pass
V	Shoulder Width	341	357	352	Pass
W	Foot Width	78	94	83	Pass
Y	Chest Circumference w/jacket	851	881	875	Pass
Z	Waist Circumference	761	791	773	Pass

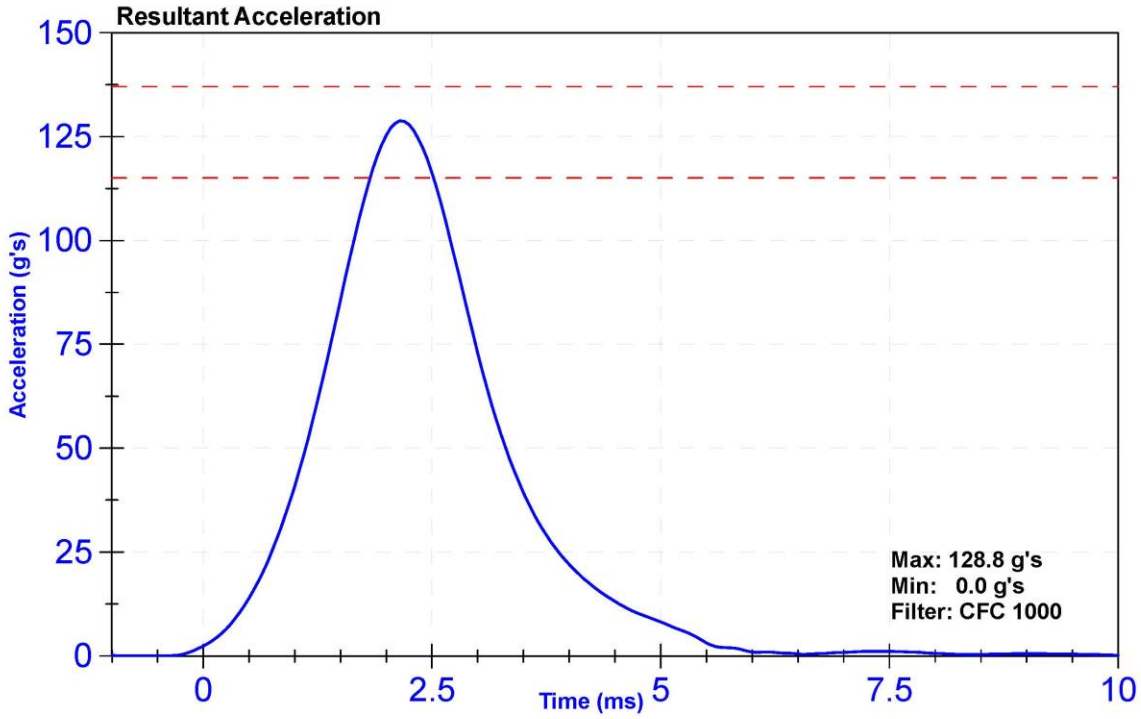
ATD Manufacturer	FTSS	Test Technician	E. Helenbrook
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

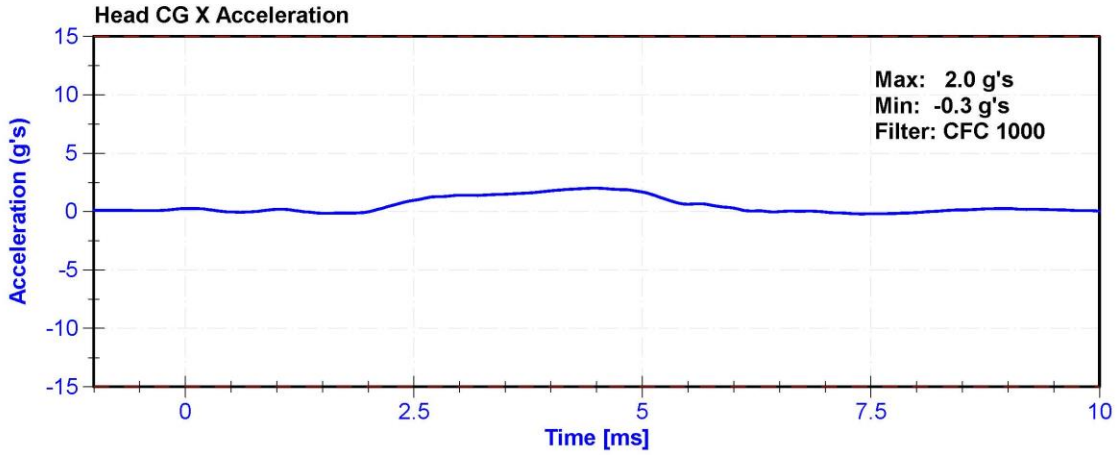
Results

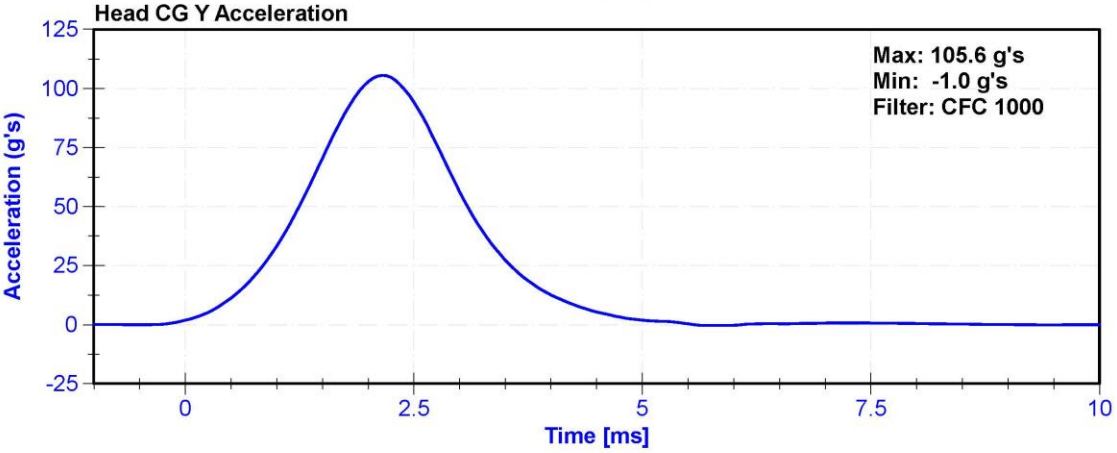
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	53.2	Pass
Resultant Acceleration	115	137	g's	128.8	Pass
Oscillation	0	15	%	0.8	Pass
Fore-Aft Acceleration	-15	15	g's	2.0	Pass

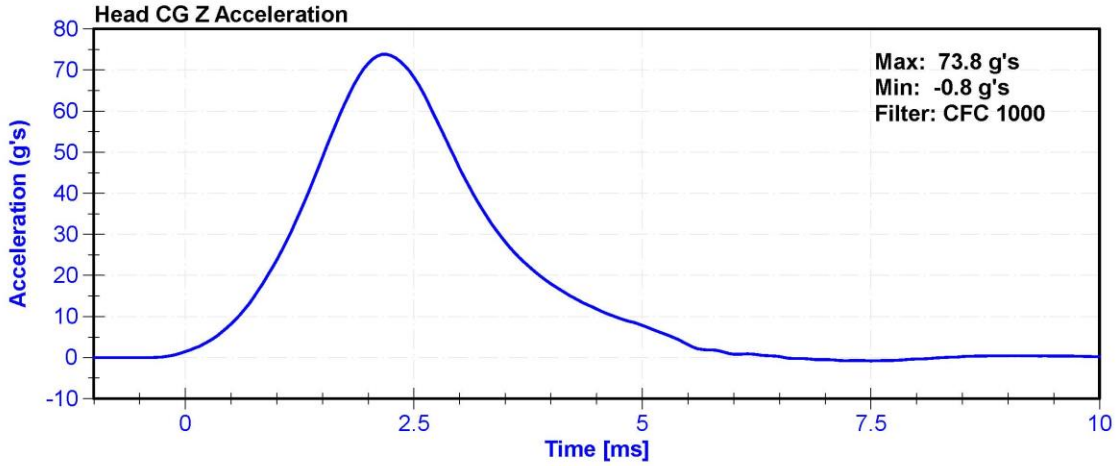
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P59018	4/20/2020	10/19/2020
Y Accelerometer	ENDEVCO 7264	AC-P79189	4/20/2020	10/19/2020
Z Accelerometer	ENDEVCO 7264CT	AC-P58777	4/20/2020	10/19/2020




Head CG X Acceleration
Max: 2.0 g's
Min: -0.3 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: 105.6 g's
Min: -1.0 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: 73.8 g's
Min: -0.8 g's
Filter: CFC 1000
Acceleration (g's)
80
70
60
50
40
30
20
10
0
-10
0
2.5
5
7.5
10
Time [ms]

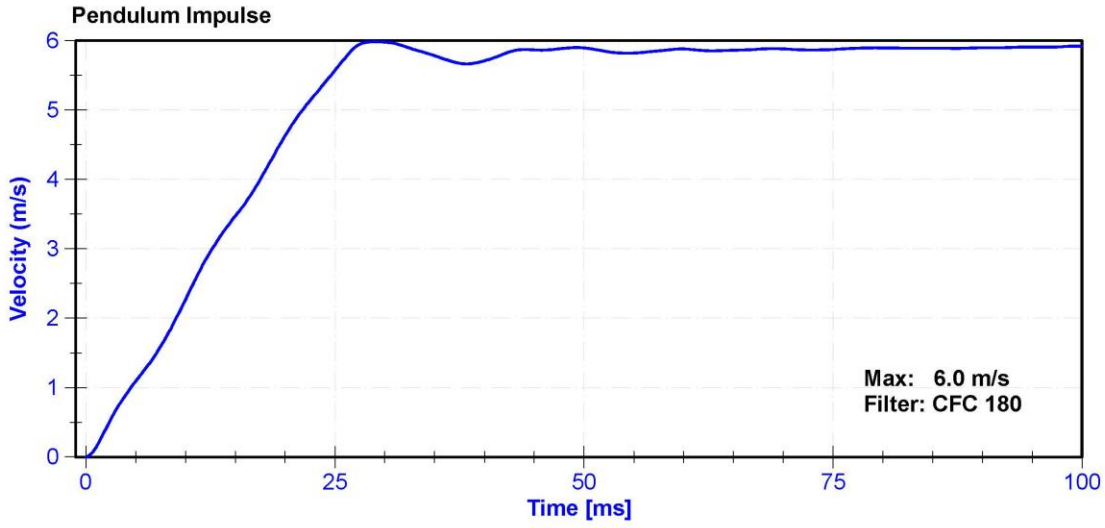
ATD Manufacturer	FTSS	Test Technician	E. Helenbrook
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

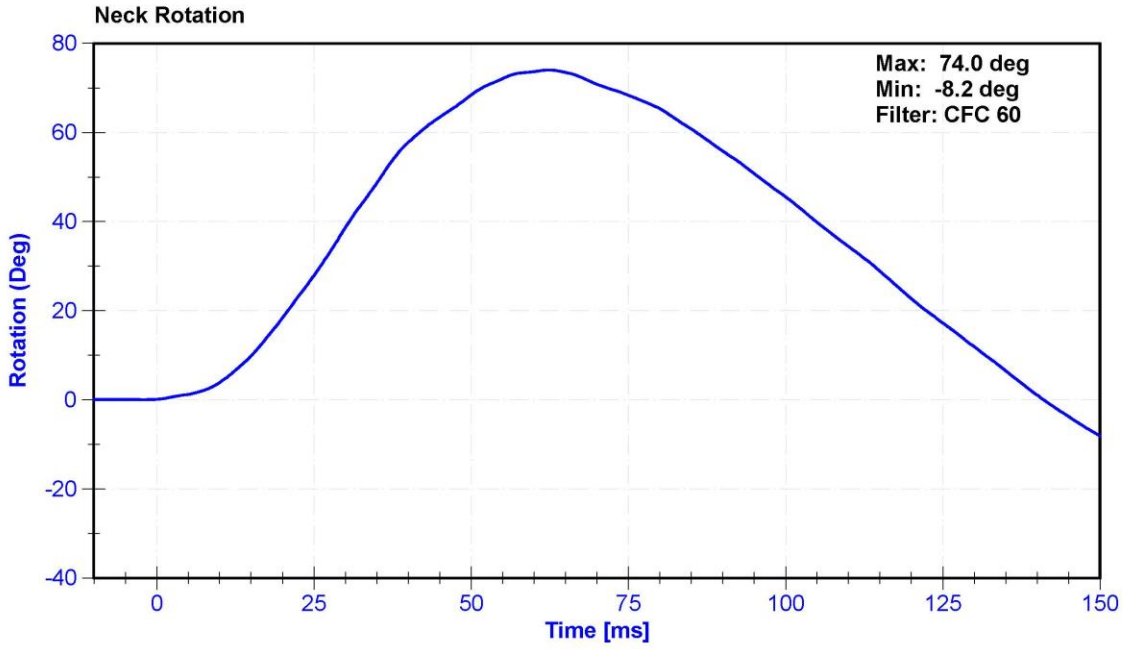
Results

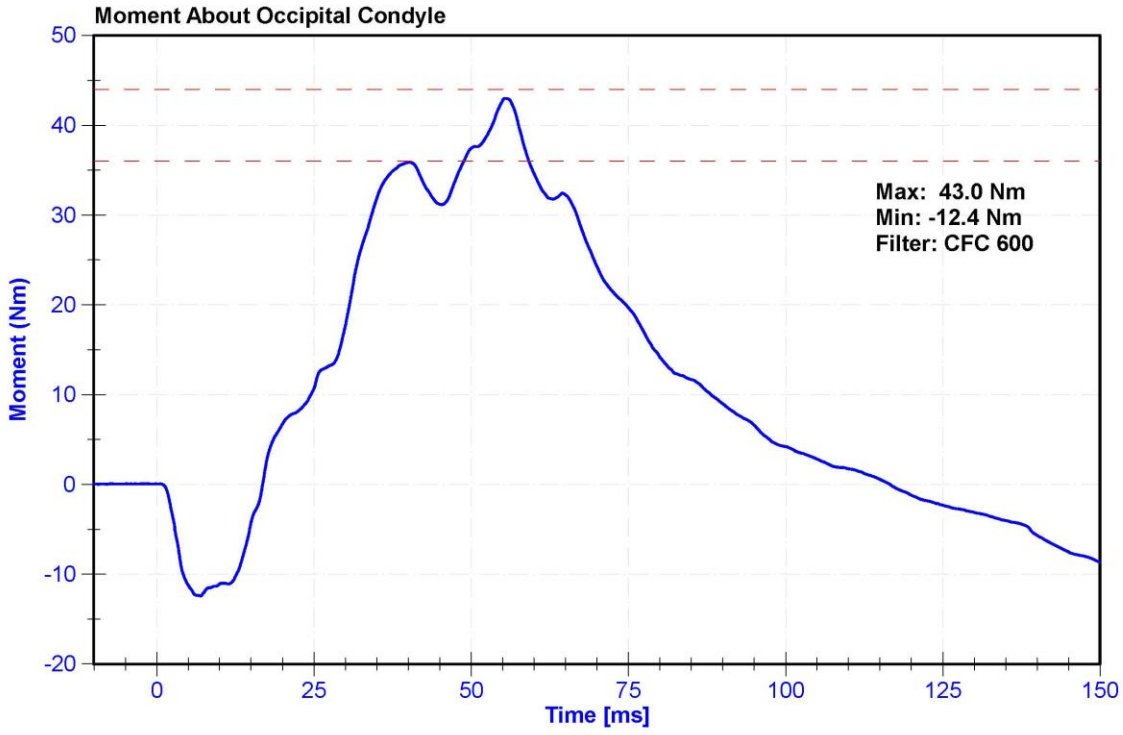
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	54.3	Pass
Velocity	5.51	5.63	m/s	5.584	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.27	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.47	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.63	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.57	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.98	Pass
Neck Rotation	71	81	deg	74.0	Pass
Time at Maximum Rotation	50	70	ms	62.3	Pass
Moment about the OC	36	44	Nm	43.0	Pass
Moment Decay to 0 Nm	102	126	ms	116.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/30/2020	1/29/2021
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 1716	17162019 FY	3/18/2020	3/18/2021




Neck Rotation
Max: 74.0 deg
Min: -8.2 deg
Filter: CFC 60
Rotation (Deg)
80
60
40
20
0
-20
-40
0
25
50
75
100
125
150
Time [ms]


Moment About Occipital Condyle
Max: 43.0 Nm
Min: -12.4 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

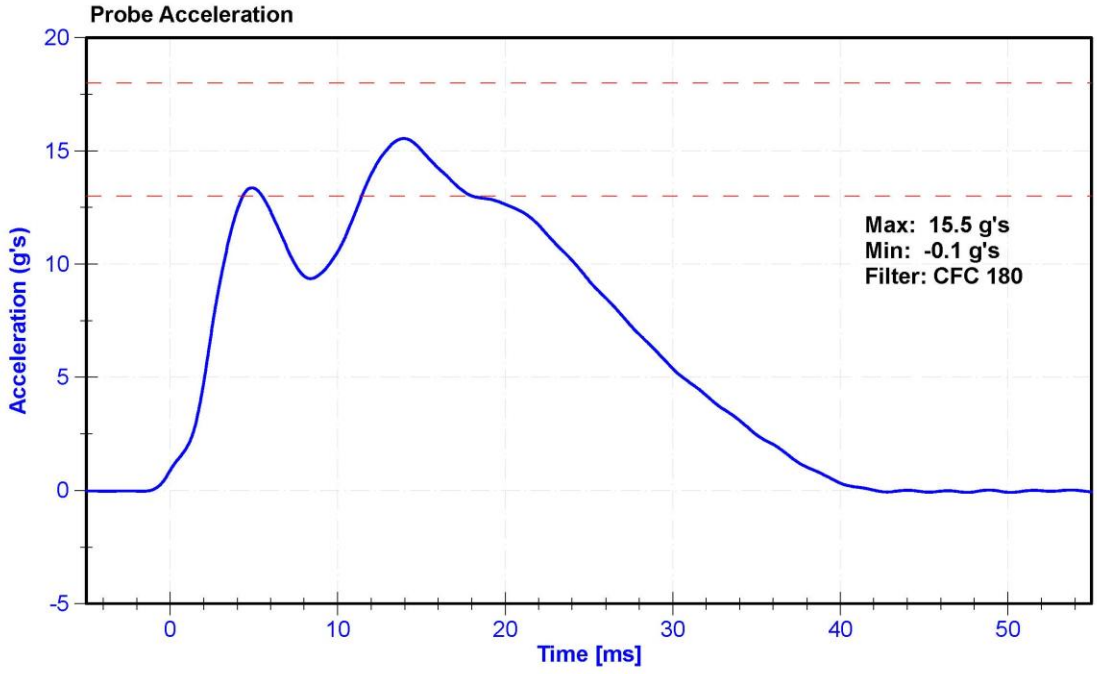
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

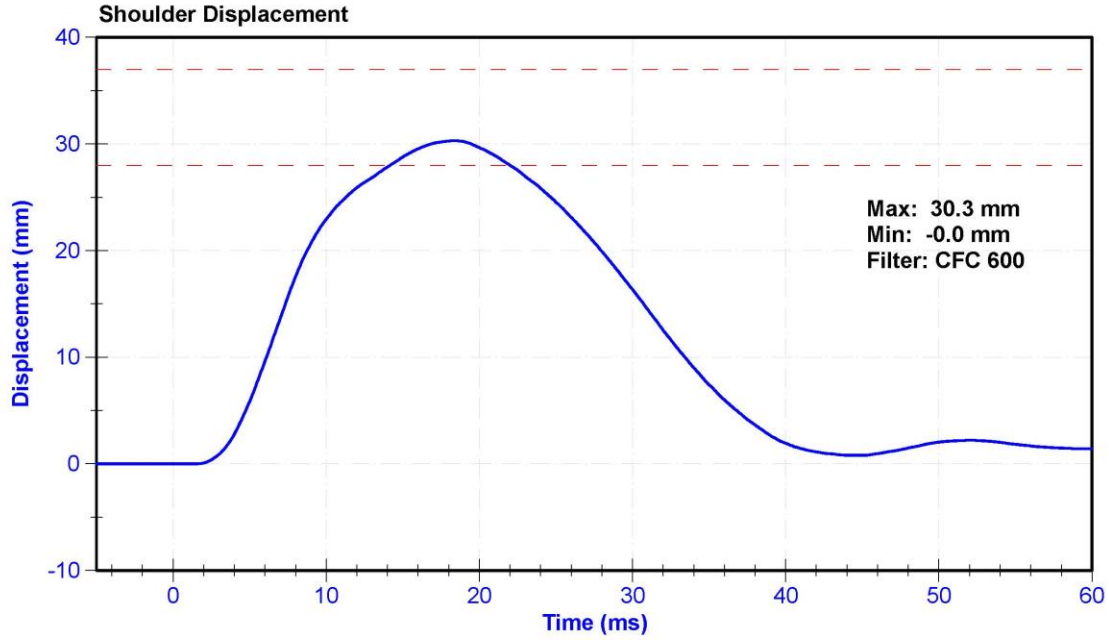
Results

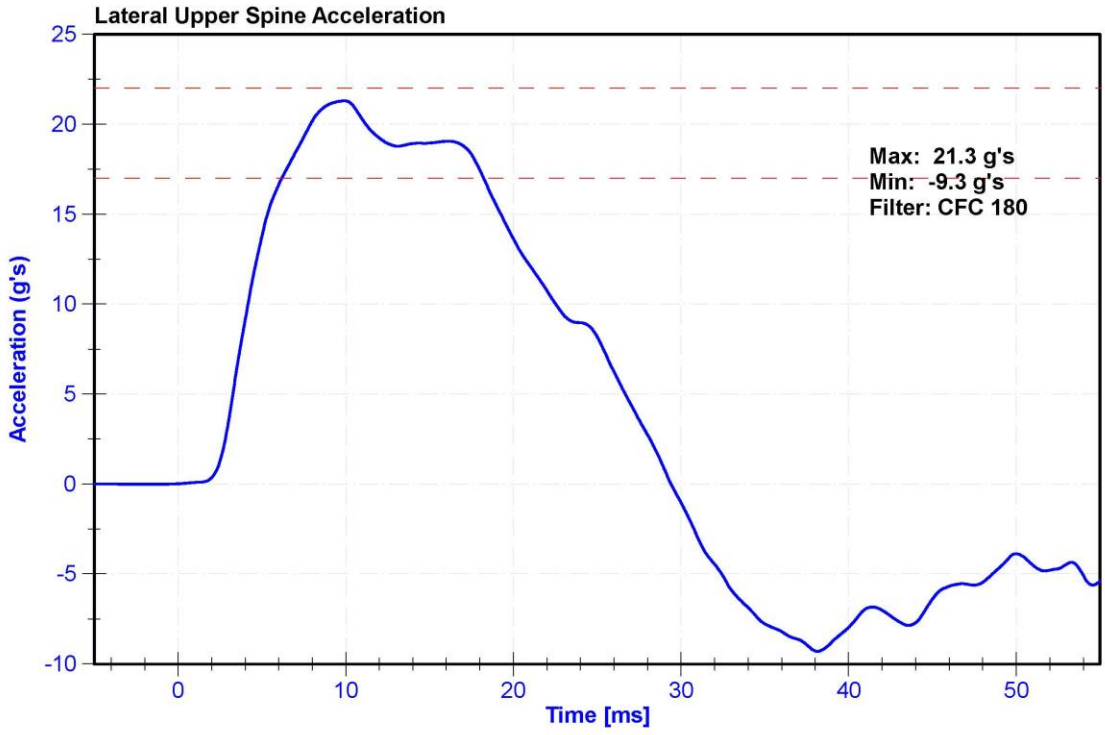
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	63	Pass
Velocity	4.2	4.4	m/s	4.29	Pass
Probe Acceleration	13	18	g's	15.5	Pass
Shoulder Deflection	28	37	mm	30.3	Pass
Lateral Upper Spine Acceleration	17	22	g's	21.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	1/28/2021
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	4/30/2020	10/29/2020
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P71281	7/30/2020	1/28/2021




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 30.3 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 21.3 g's
Min: -9.3 g's
Filter: CFC 180

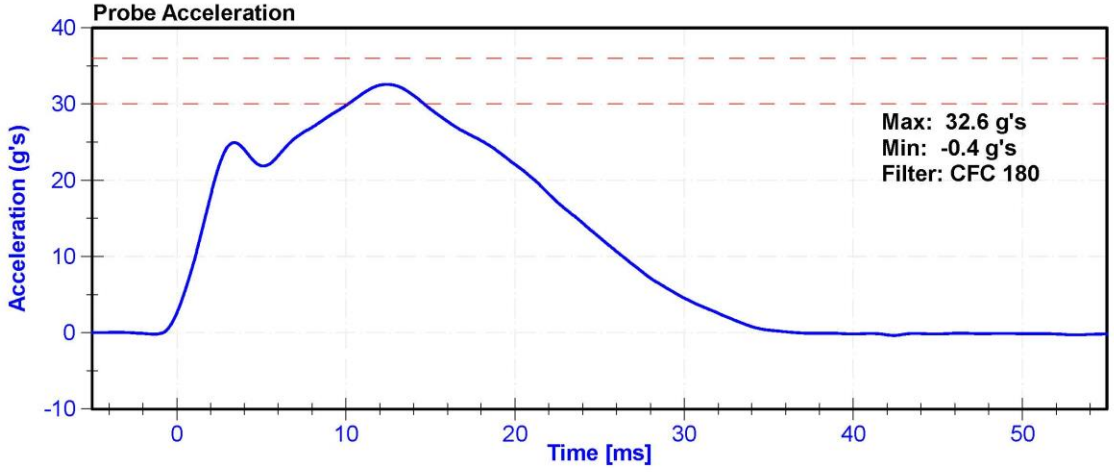
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

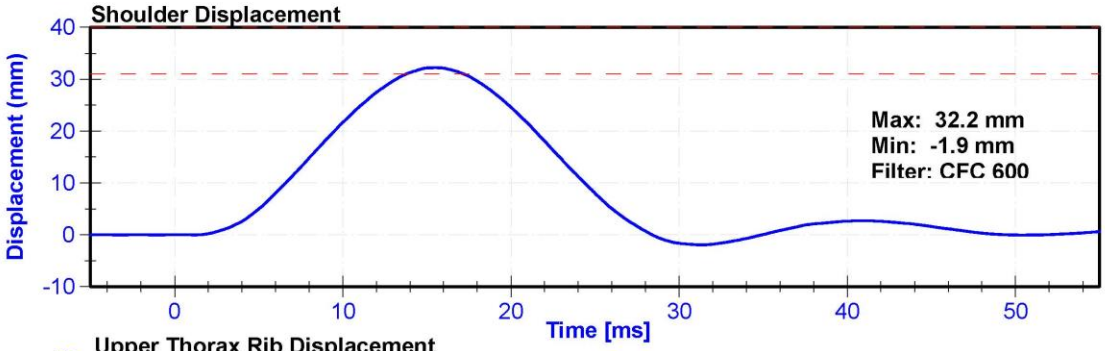
Results

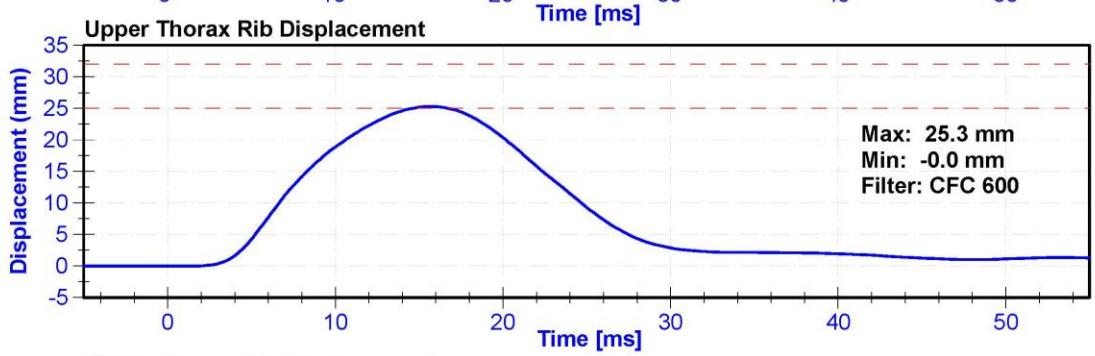
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	55.0	Pass
Velocity	6.6	6.8	m/s	6.71	Pass
Probe Acceleration after 5 ms	30	36	g's	32.6	Pass
Lateral Upper Spine Acceleration	34	43	g's	41.1	Pass
Lateral Lower Spine Acceleration	29	37	g's	30.9	Pass
Shoulder Deflection	31	40	mm	32.2	Pass
Upper Thorax Rib Deflection	25	32	mm	25.3	Pass
Mid Thorax Rib Deflection	30	36	mm	31.8	Pass
Lower Thorax Rib Deflection	32	38	mm	34.3	Pass

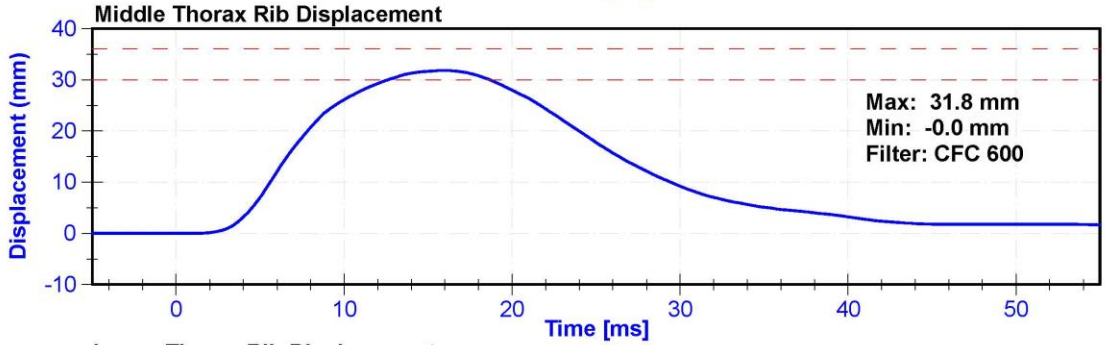
Transducer Calibrations

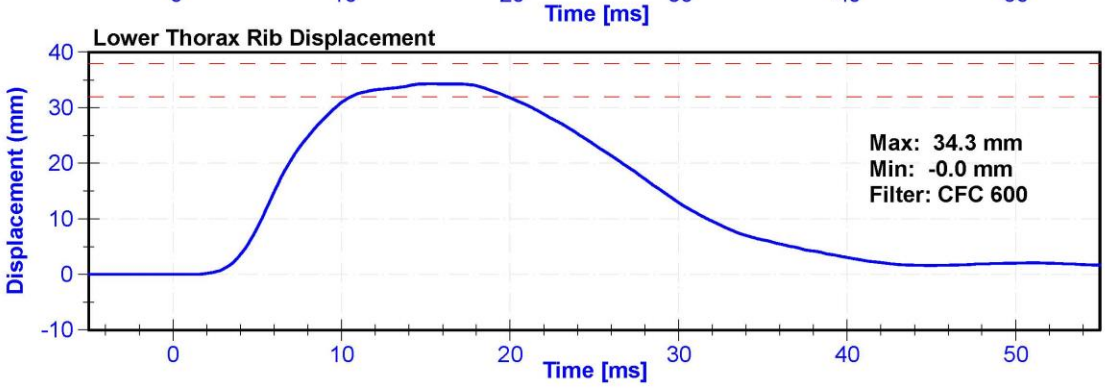
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	1/28/2021
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P71281	7/30/2020	1/28/2021
Upper Spine T12 Y Accelerometer	ENDEVCO 7264	AC-P64147	4/20/2020	10/19/2020
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	4/30/2020	10/29/2020
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	4/30/2020	10/29/2020
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	4/30/2020	10/29/2020
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	4/30/2020	10/29/2020

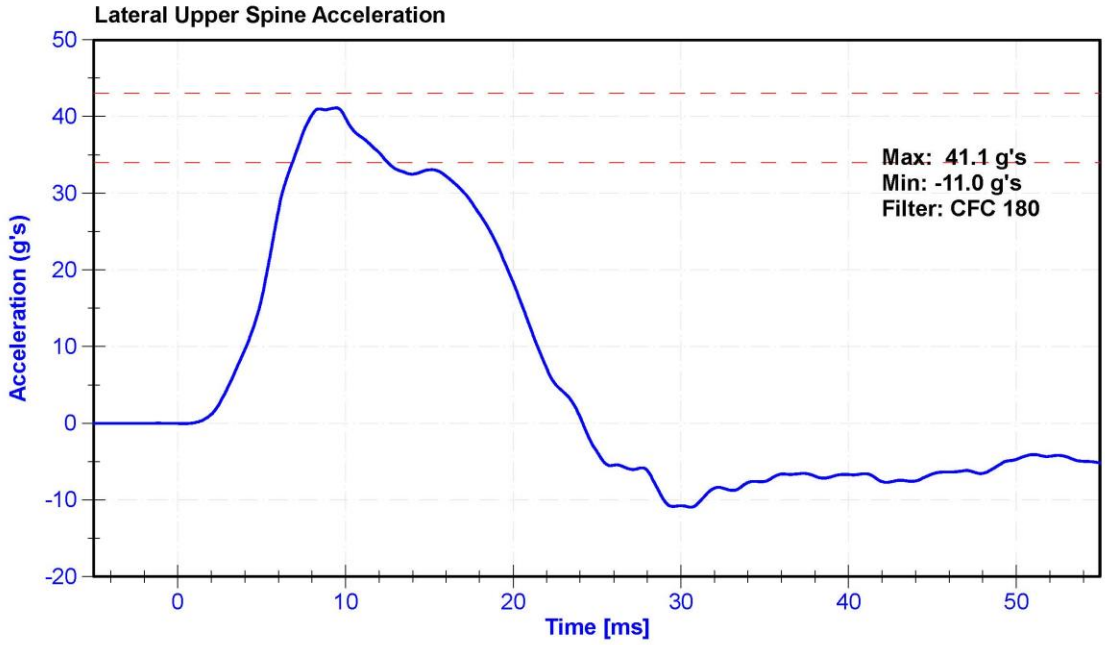


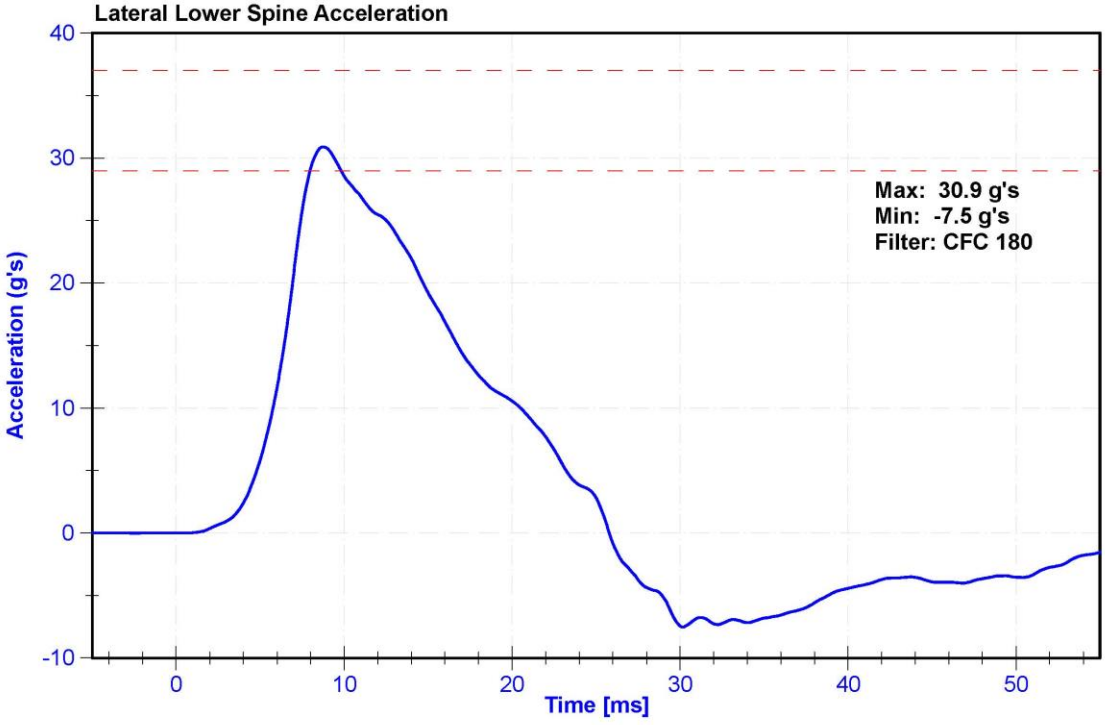

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 32.2 mm
Min: -1.9 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 25.3 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 31.8 mm
Min: -0.0 mm
Filter: CFC 600


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


Lateral Upper Spine Acceleration
Max: 41.1 g's
Min: -11.0 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]


Lateral Lower Spine Acceleration
Max: 30.9 g's
Min: -7.5 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]

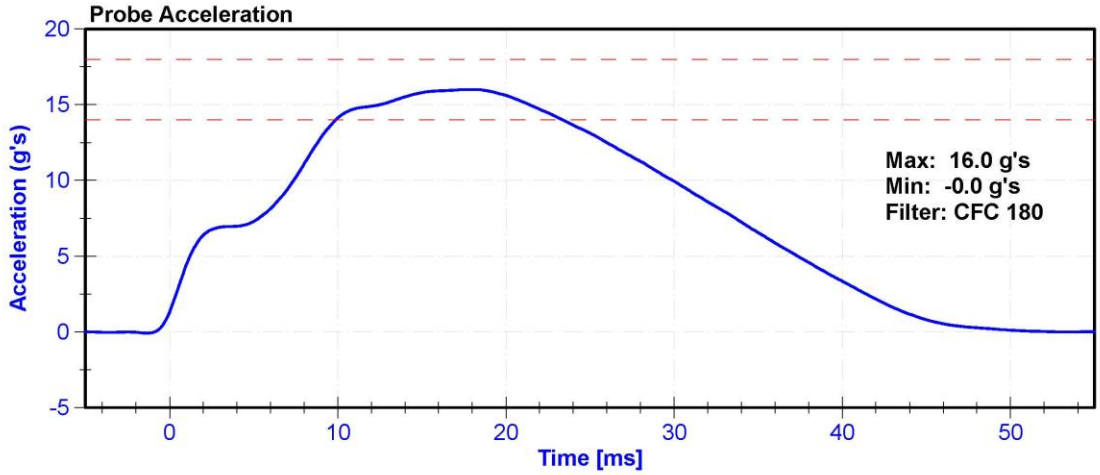
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

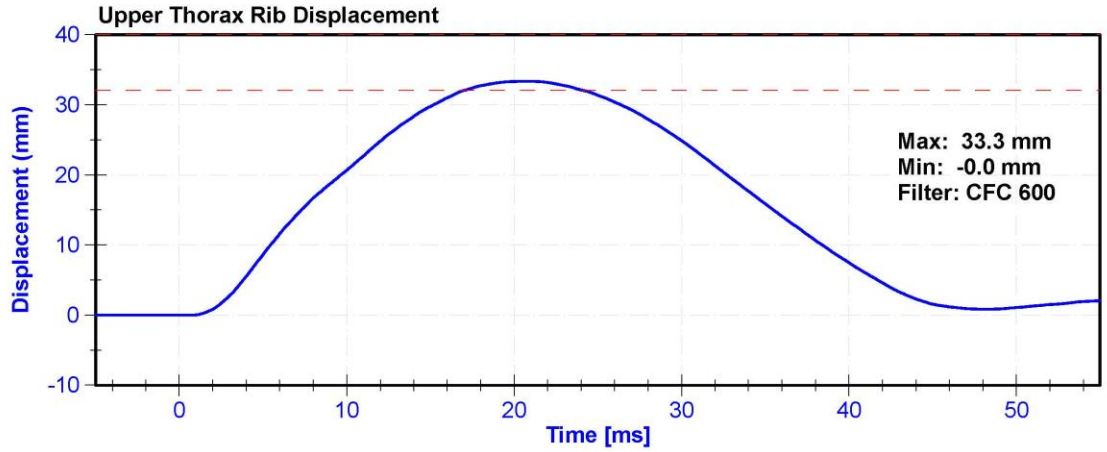
Results

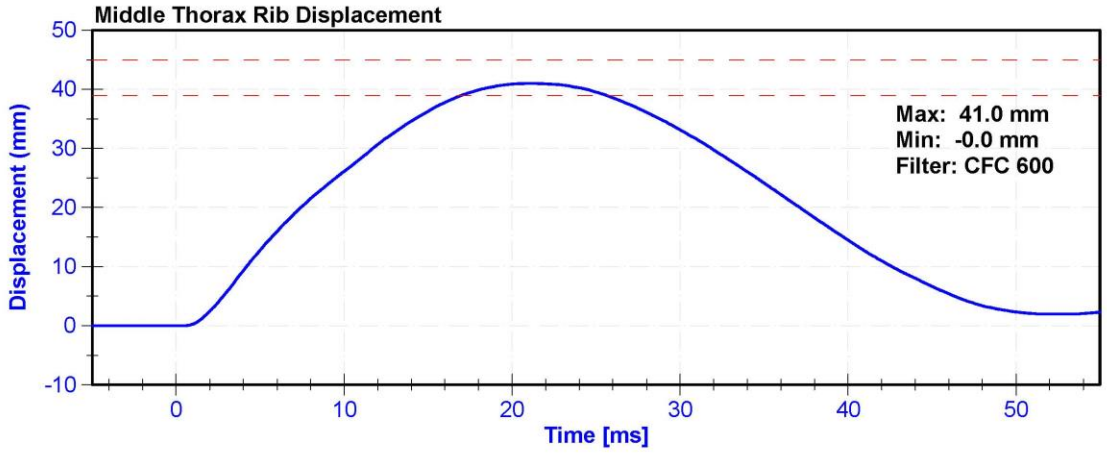
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	55	Pass
Velocity	4.2	4.4	m/s	4.35	Pass
Probe Acceleration	14	18	g's	16.0	Pass
Lateral Upper Spine Acceleration	13	17	g's	15.2	Pass
Lateral Lower Spine Acceleration	7	11	g's	10.6	Pass
Upper Thorax Rib Deflection	32	40	mm	33.3	Pass
Middle Thorax Rib Deflection	39	45	mm	41.0	Pass
Lower Thorax Rib Deflection	35	43	mm	39.1	Pass

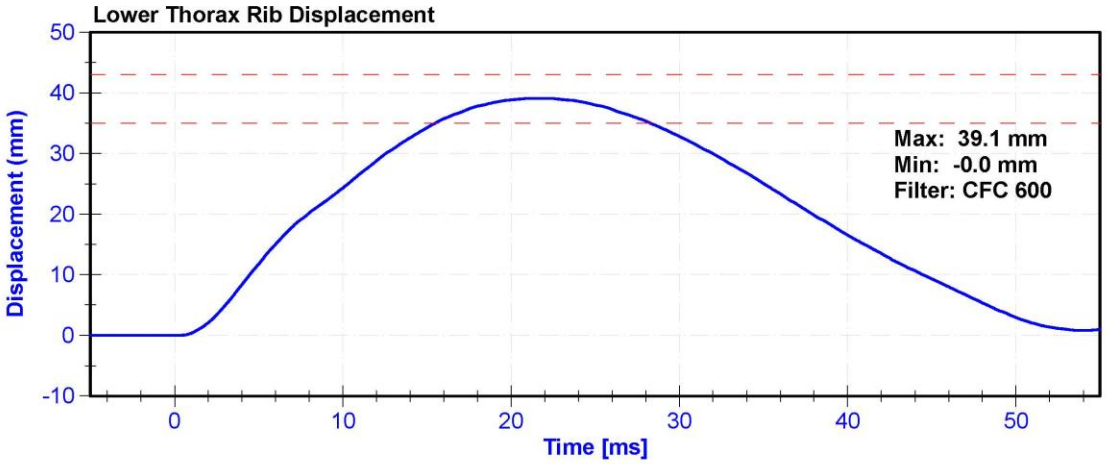
Transducer Calibrations

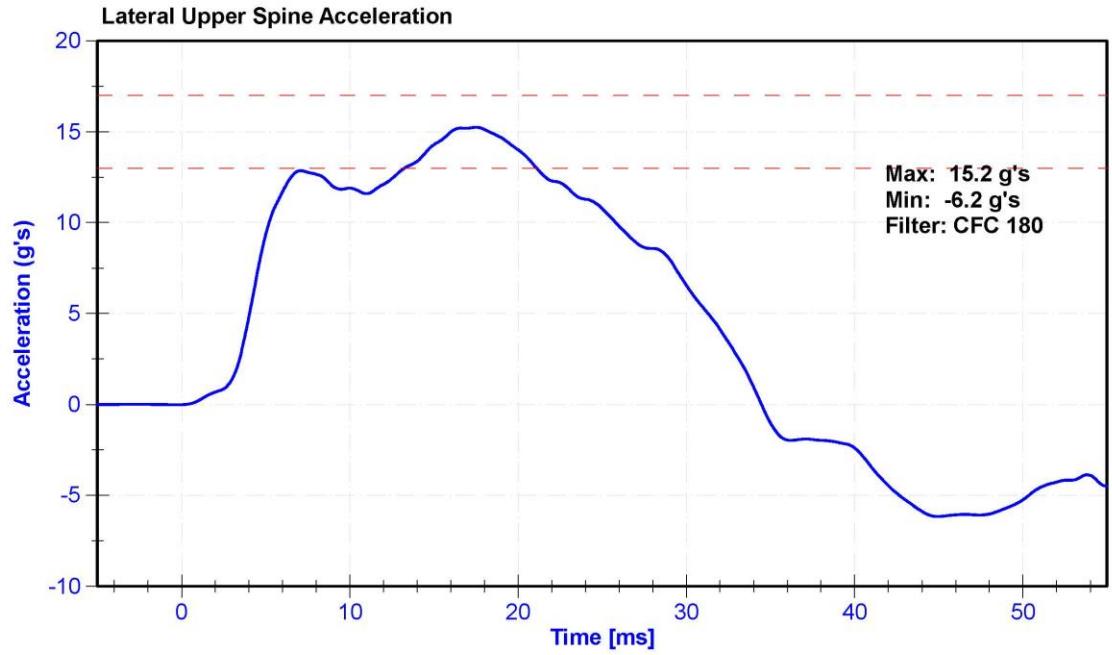
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	1/28/2021
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P71281	7/30/2020	1/28/2021
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	4/20/2020	10/19/2020
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	4/30/2020	10/29/2020
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	4/30/2020	10/29/2020
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	4/30/2020	10/29/2020

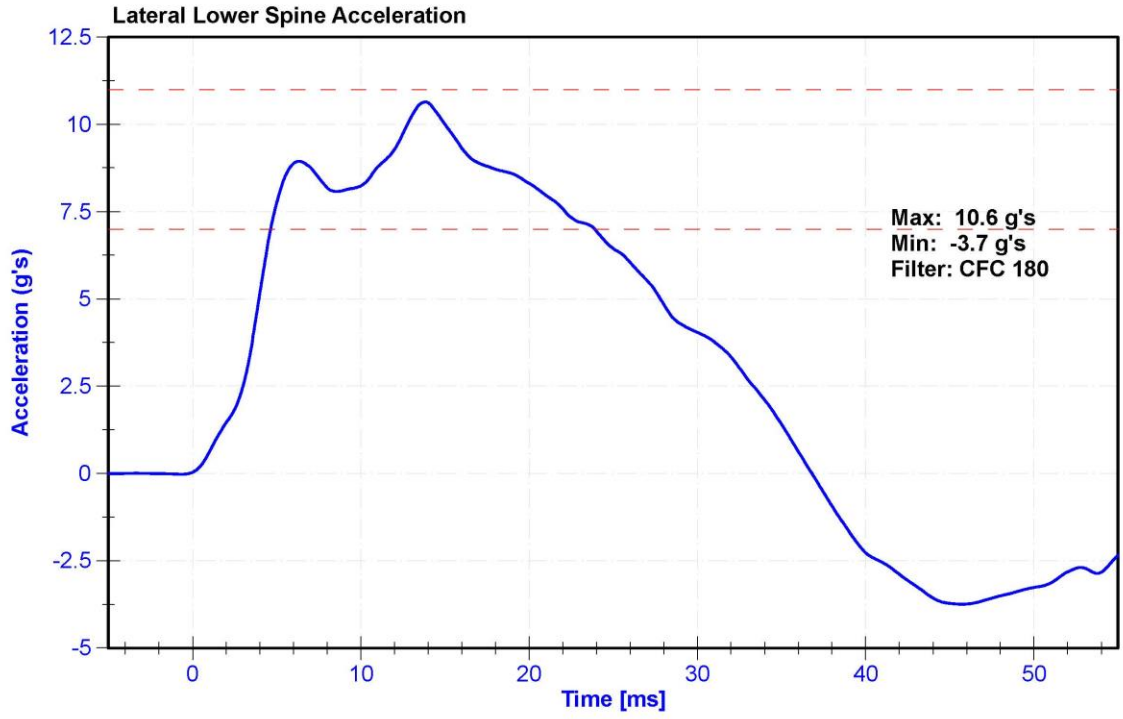



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 33.3 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.0 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 39.1 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 15.2 g's
Min: -6.2 g's
Filter: CFC 180


Lateral Lower Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 10.6 g's
Min: -3.7 g's
Filter: CFC 180

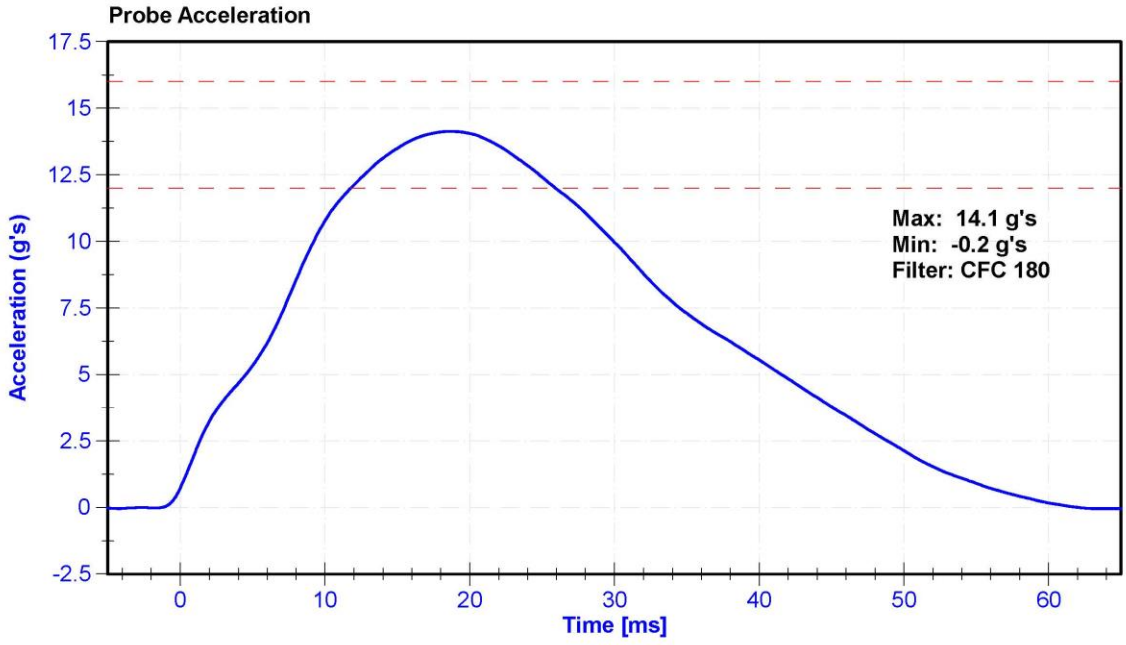
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

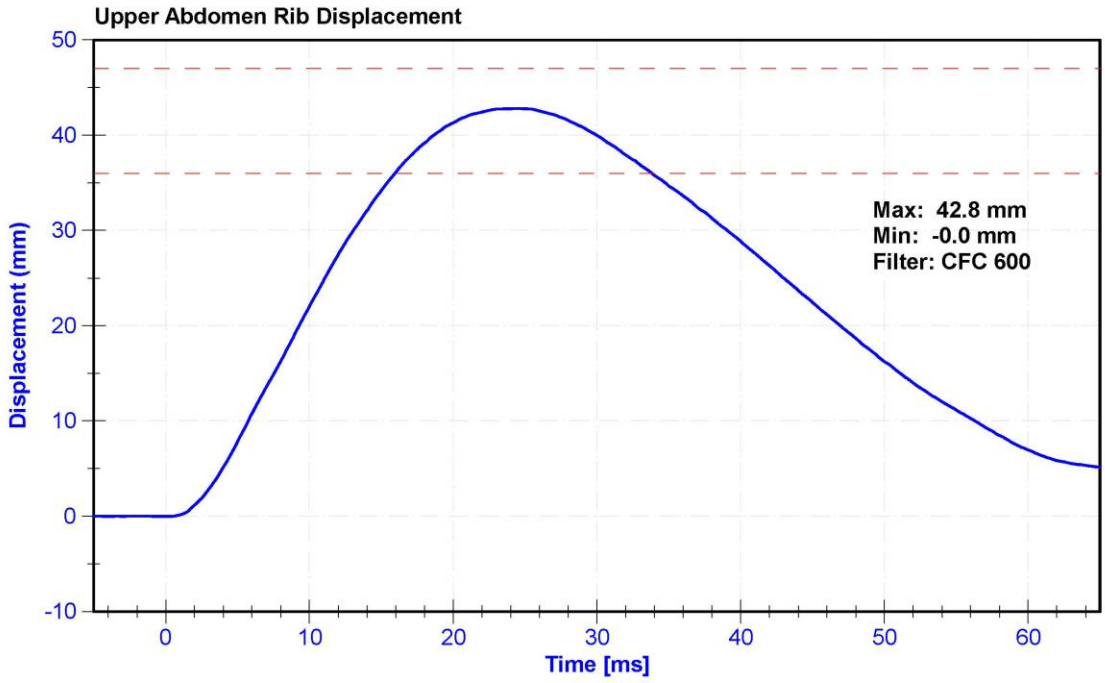
Results

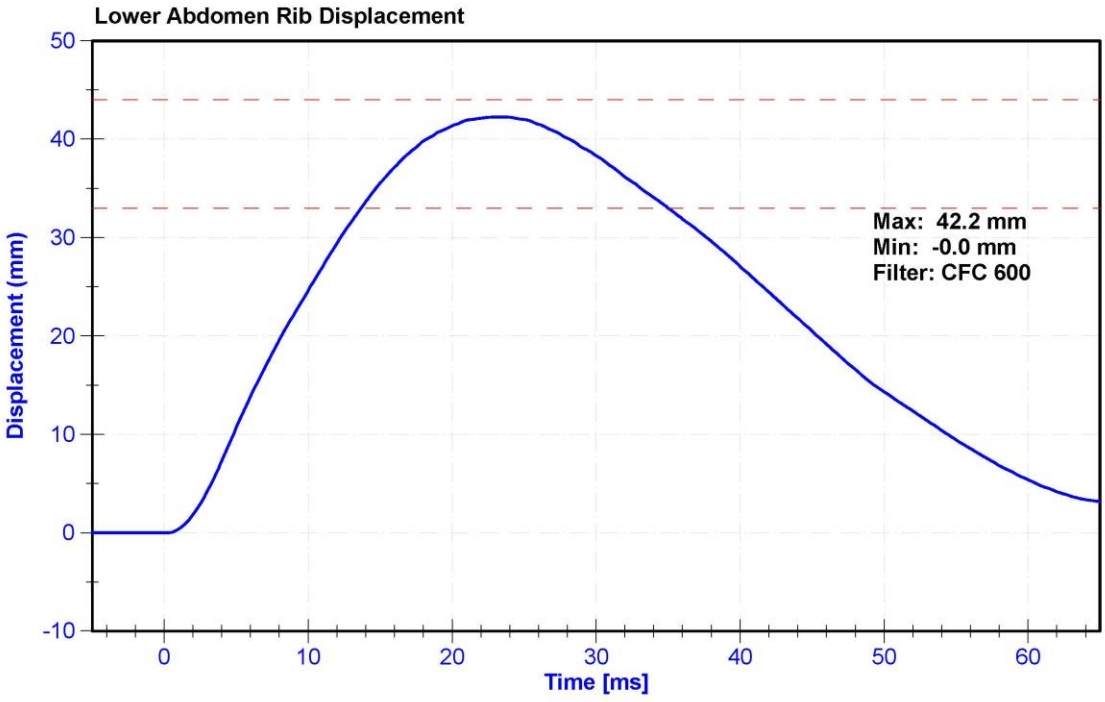
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	55.0	Pass
Velocity	4.2	4.4	m/s	4.28	Pass
Probe Acceleration	12	16	g's	14.1	Pass
Lateral Lower Spine Acceleration	9	14	g's	11.0	Pass
Upper Abdomen Rib Deflection	36	47	mm	42.8	Pass
Lower Abdomen Rib Deflection	33	44	mm	42.2	Pass

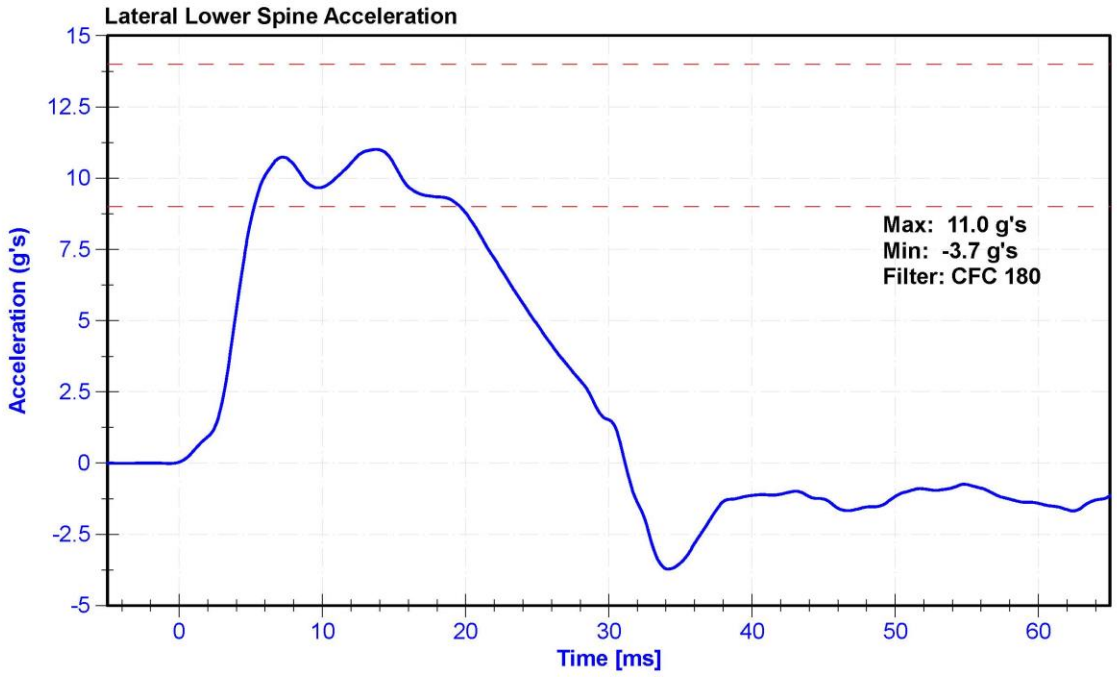
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A286228	1/29/2020	1/28/2021
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	4/20/2020	10/19/2020
Upper Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-308GFE	4/30/2020	10/29/2020
Lower Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-307GFE	4/30/2020	10/29/2020




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: 42.2 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: 11.0 g's
Min: -3.7 g's
Filter: CFC 180

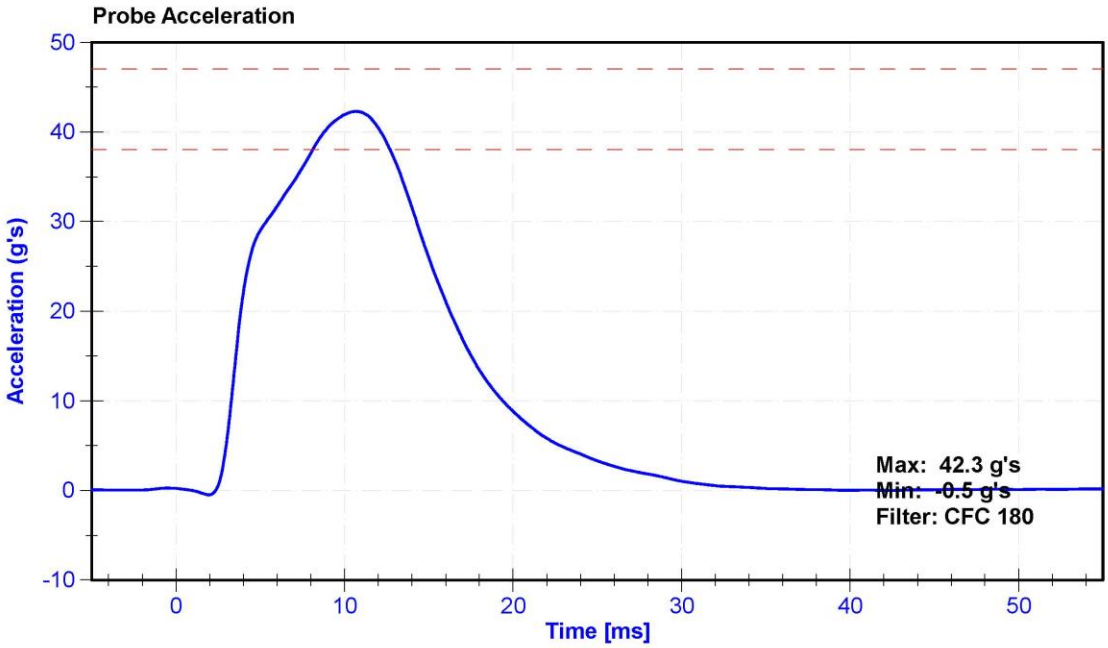
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

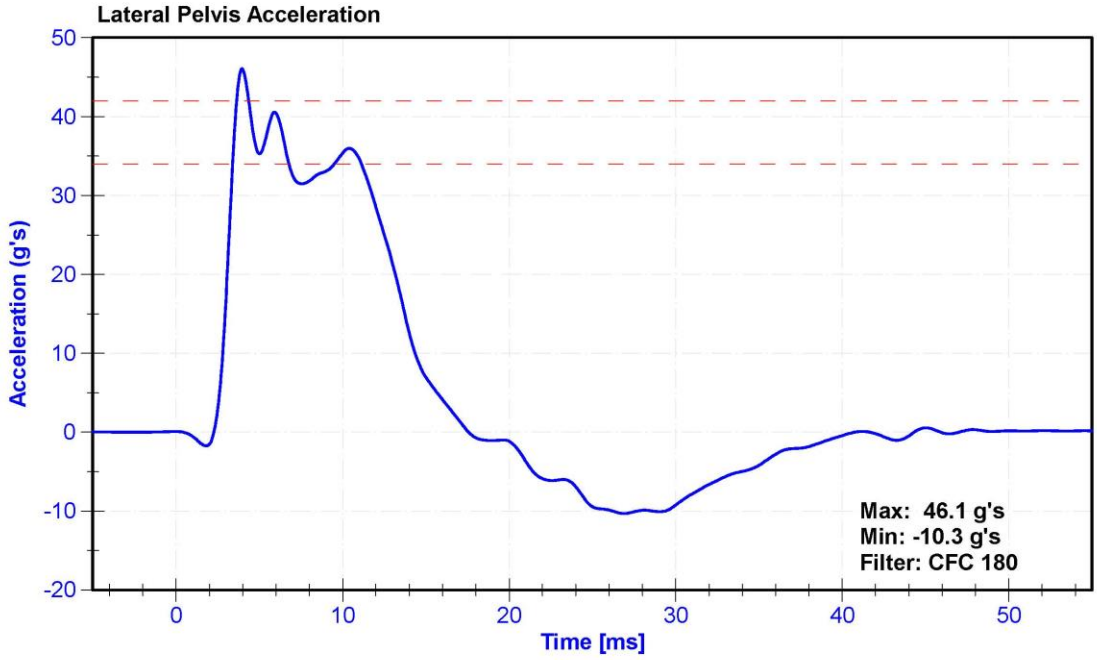
Results

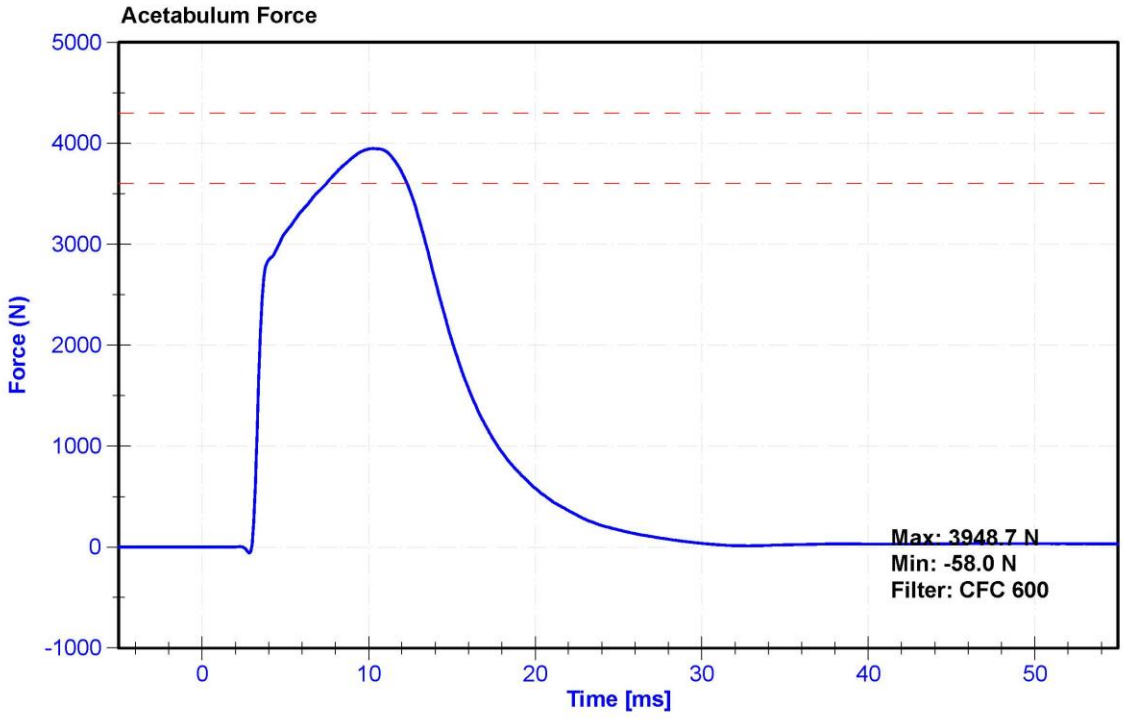
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	55	Pass
Velocity	6.6	6.8	m/s	6.66	Pass
Probe Acceleration	38	47	g's	42.3	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	40.4	Pass
Acetabulum Force	3600	4300	N	3948.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	1/28/2021
Pelvis Y Accelerometer	ENDEVCO 7264C-2K-TZ2	AC-P51731	4/20/2020	10/19/2020
Acetabulum Load Cell	Denton IF-520	LC-236Fy	3/18/2020	3/18/2021
Certification Plug	SACO	13182	8/8/2019	N/A
Crash Test Plug	SACO	13228	8/12/2019	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: 46.1 g's
Min: -10.3 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: 3948.7 N
Min: -58.0 N
Filter: CFC 600

300 crush 8/5/2020

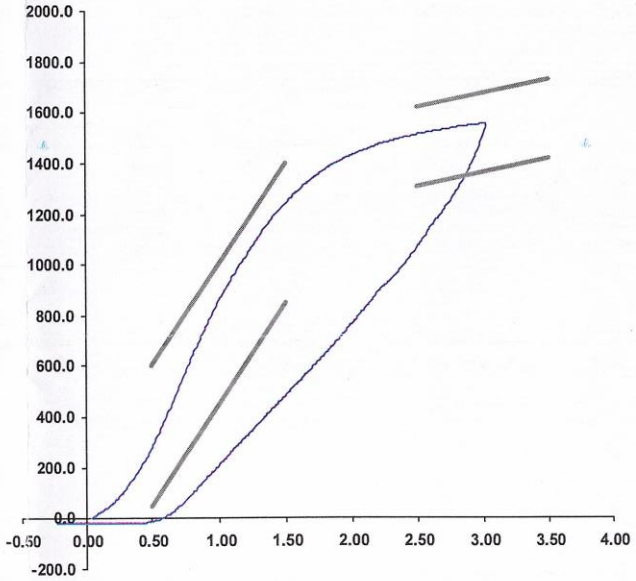
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 13228
Test Number 10650
Report Number 10686
Test Date 8/12/2019 7:45:59 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	297.56	50.00	600.00
Force @ 1.5 mm (N)	1,239.23	850.00	1,400.00
Force @ 2.5 mm (N)	1,511.75	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,555.61	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 12-Aug-19
SACO Research

By : DC Date : 8/12/2019

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

300 certy 8/5/2020

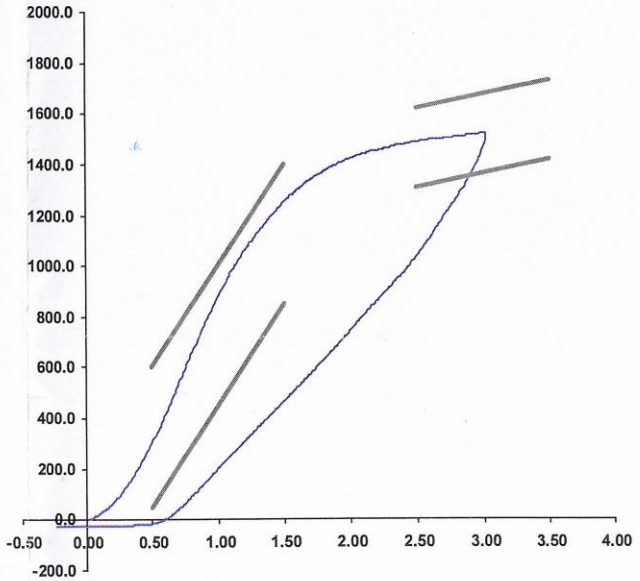
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 13182
Test Number 10577
Report Number 10612
Test Date 8/8/2019 11:26:54 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	313.25	50.00	600.00
Force @ 1.5 mm (N)	1,256.02	850.00	1,400.00
Force @ 2.5 mm (N)	1,487.45	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,519.09	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 131

Part Number 180-4450

Template No 107 08-Aug-19
SACO Research

By : DC Date : 8/8/2019

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

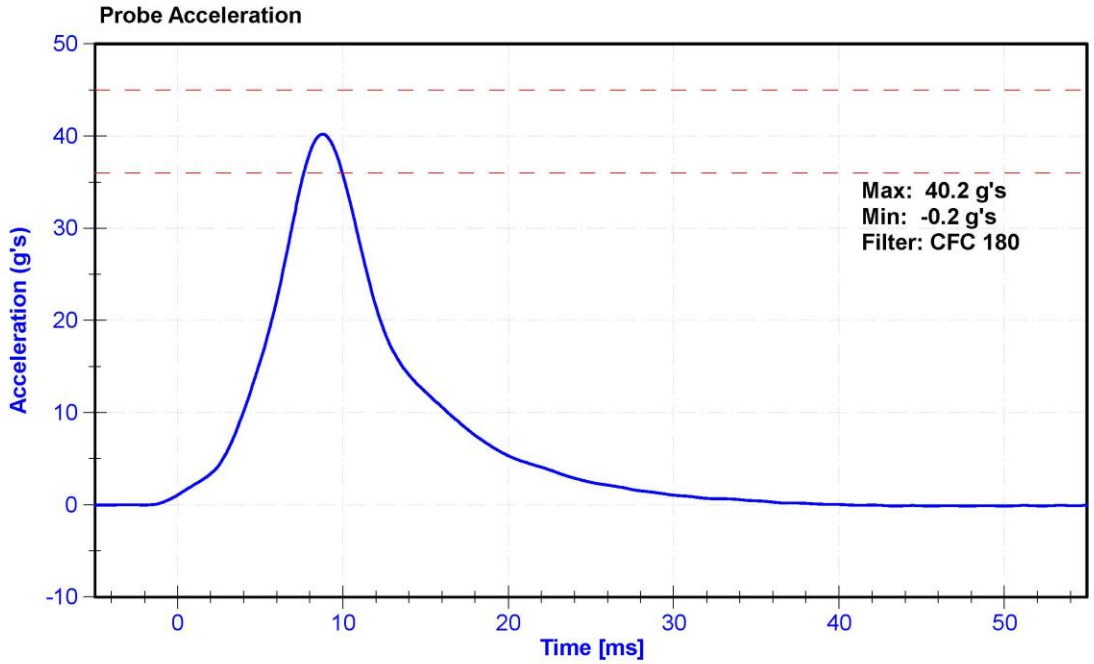
ATD Manufacturer	FTSS	Test Technician	K. Brogan
ATD Serial Number	300	Laboratory Supervisor	D.Reinhard

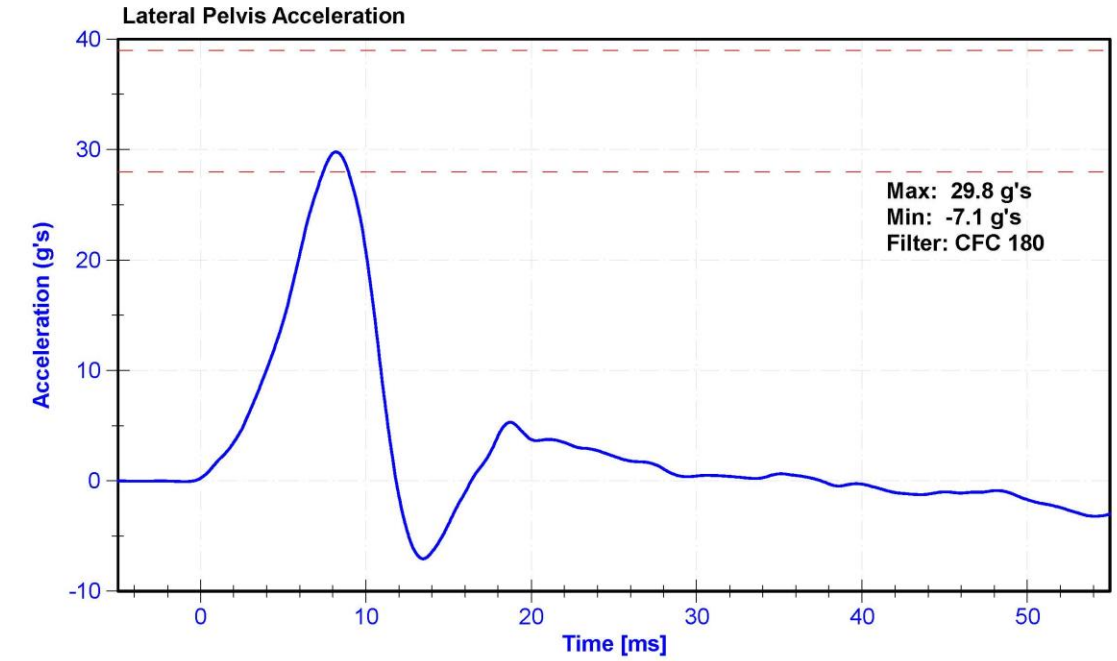
Results

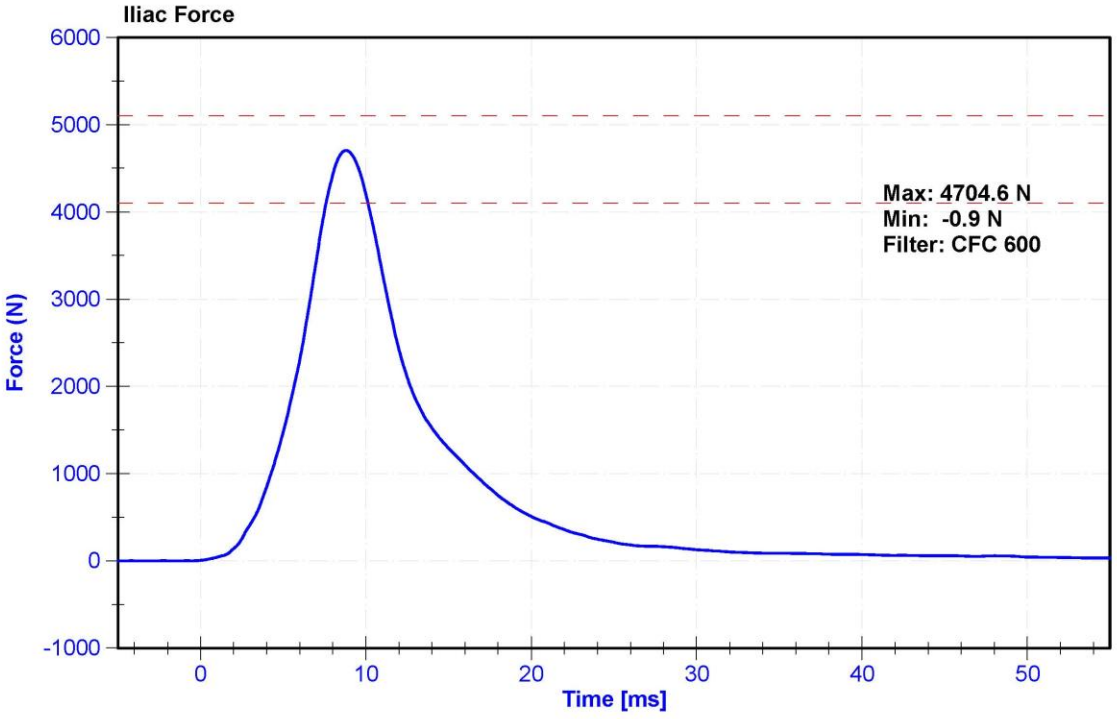
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	62.0	Pass
Velocity	4.2	4.4	m/s	4.24	Pass
Probe Acceleration	36	45	g's	40.2	Pass
Lateral Pelvis Acceleration	28	39	g's	29.8	Pass
Iliac Force	4100	5100	N	4704.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	1/28/2021
Pelvis Y Accelerometer	ENDEVCO 7264C-2K	AC-P51731	4/20/2020	10/19/2020
Iliac Load Cell	DENTON 3228J	LC-281Fy	3/19/2020	3/19/2021




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 29.8 g's
Min: -7.1 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4704.6 N
Min: -0.9 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

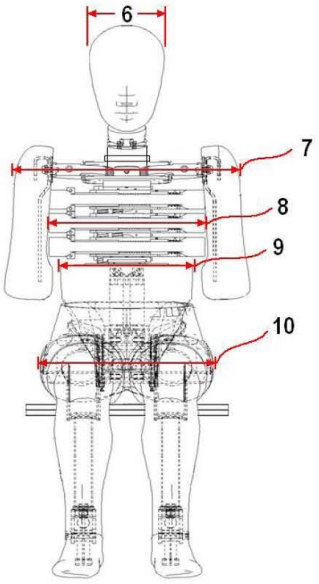
SERIAL NO: F033

(CONFIGURED FOR LEFT SIDE IMPACT)

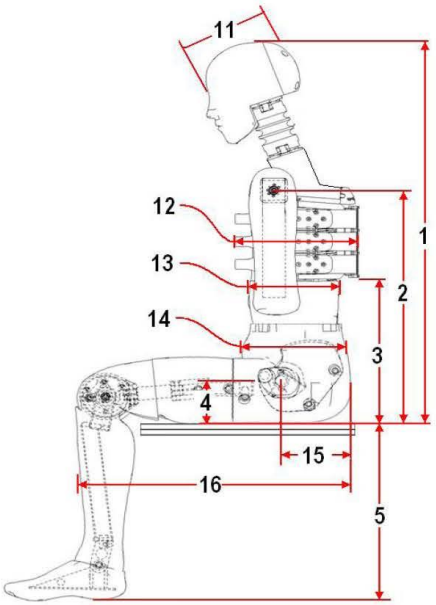
External Measurements - EuroSID-2re

Technician: K. Dutton Date: 08/14/2020

Dummy Serial Number: F033



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	101	Pass
5	Sole to Seat, Sitting	333	451	424	Pass
6	Head Width	152	158	154	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	328	Pass
9	Abdomen Width	273	287	285	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	202	Pass
14	Pelvis Depth	235	245	240	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

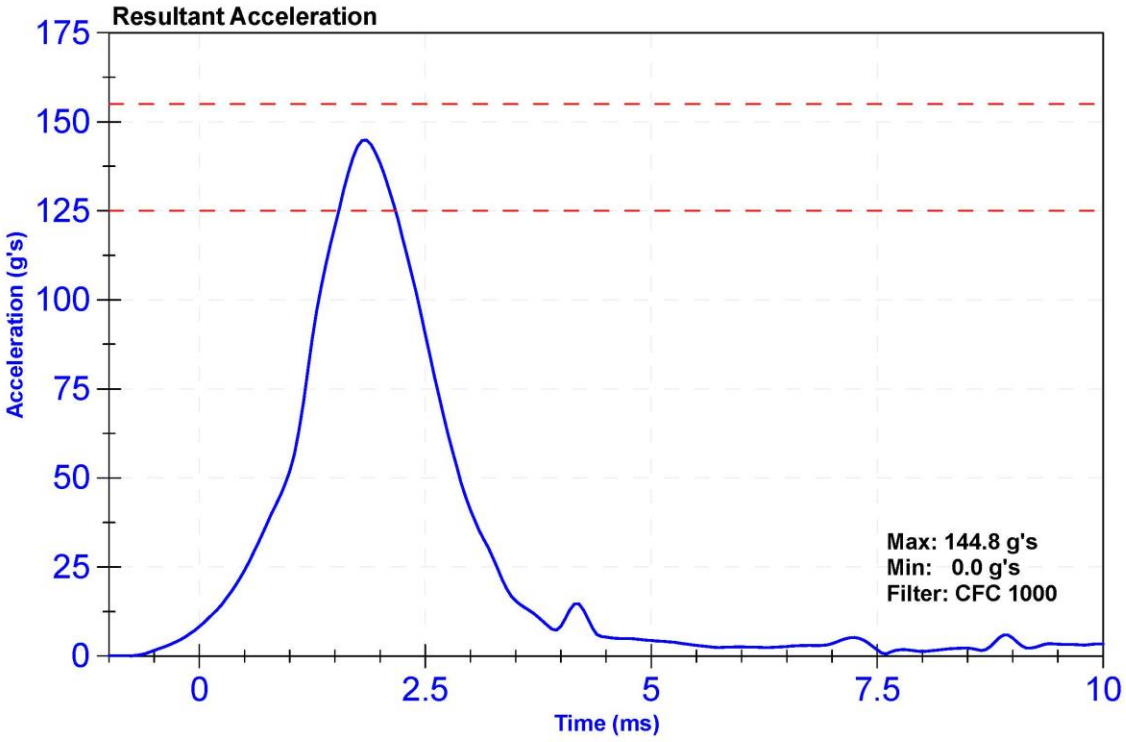
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

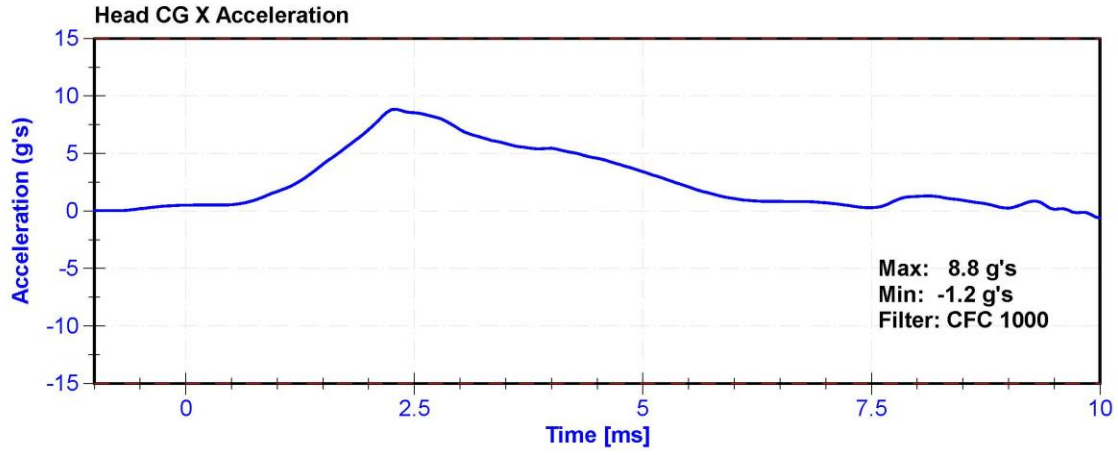
Results

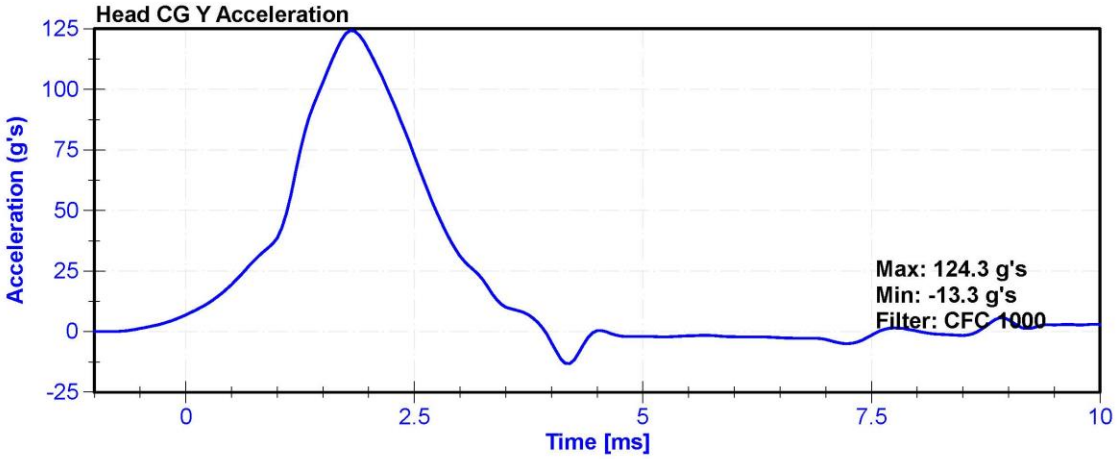
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	59.0	Pass
Resultant Acceleration	125	155	g's	144.8	Pass
Oscillation	0	15	%	10.11	Pass
Fore-Aft Acceleration	-15	15	g's	8.8	Pass

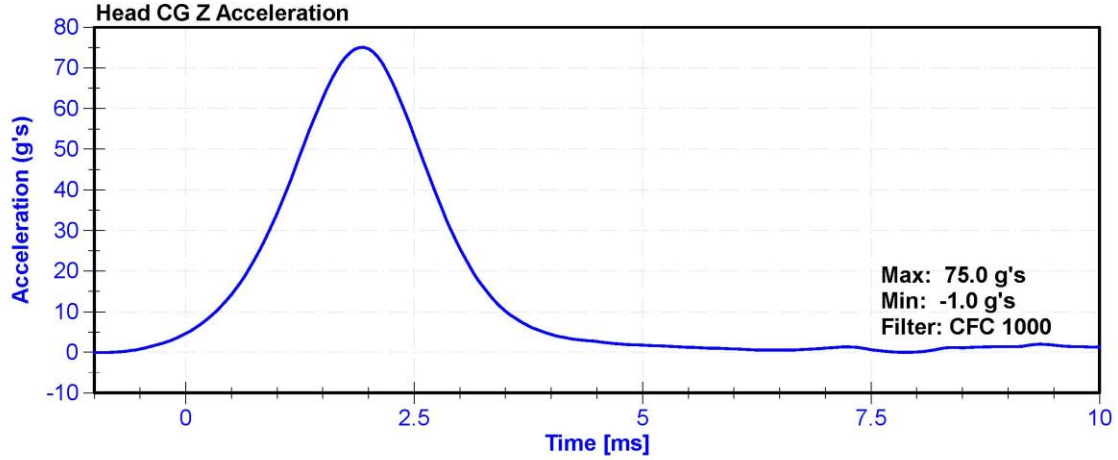
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P63861	5/19/2020	11/17/2020
Y Accelerometer	ENDEVCO 7264CT	AC-P49216	5/19/2020	11/17/2020
Z Accelerometer	ENDEVCO 7264	AC-P51303	5/19/2020	11/17/2020




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 8.8 g's
Min: -1.2 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: 124.3 g's
Min: -13.3 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
80
70
60
50
40
30
20
10
0
-10
0
2.5
5
7.5
10
Time [ms]
Max: 75.0 g's
Min: -1.0 g's
Filter: CFC 1000

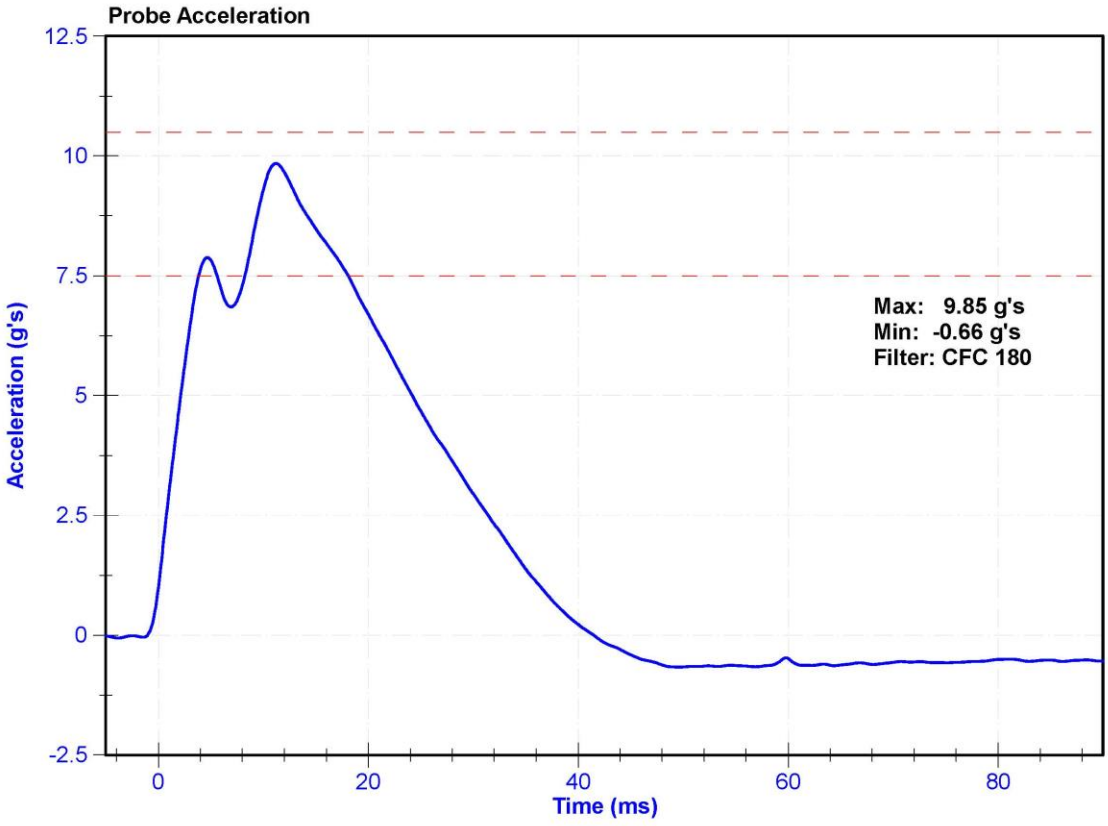
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	59.0	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	7.5	10.5	g's	9.85	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A279031	5/8/2020	5/8/2021



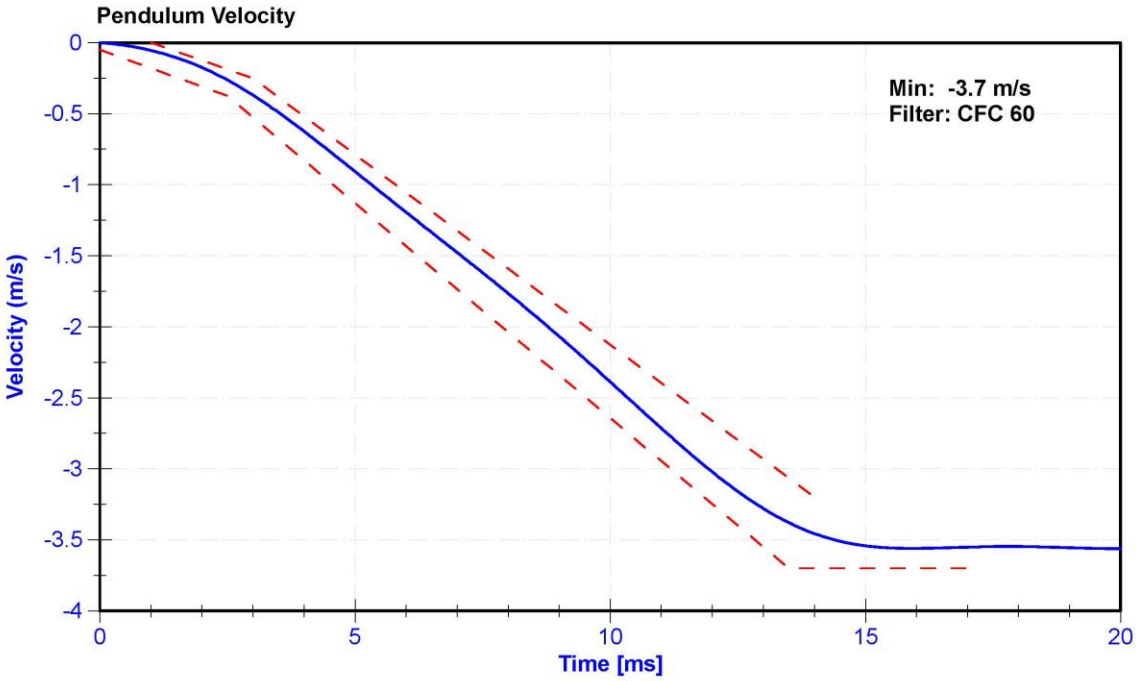
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

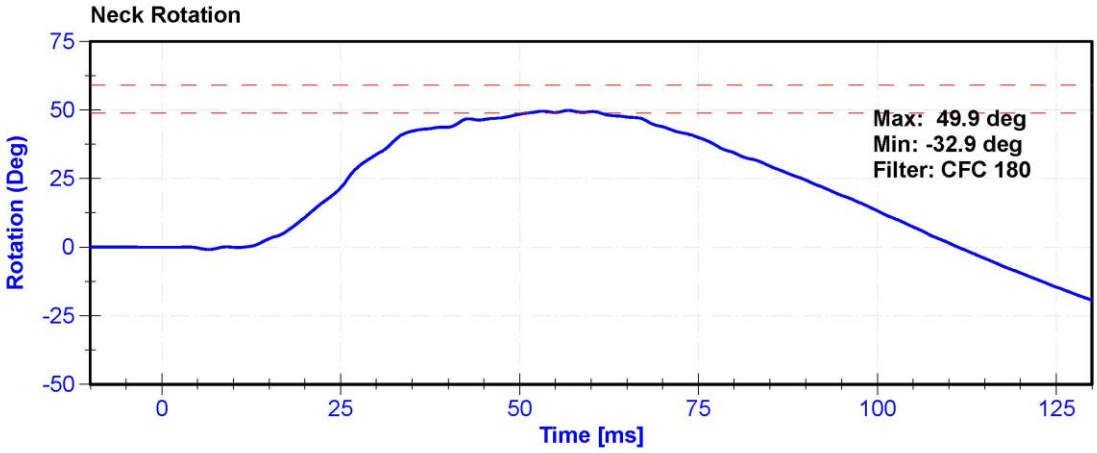
Results

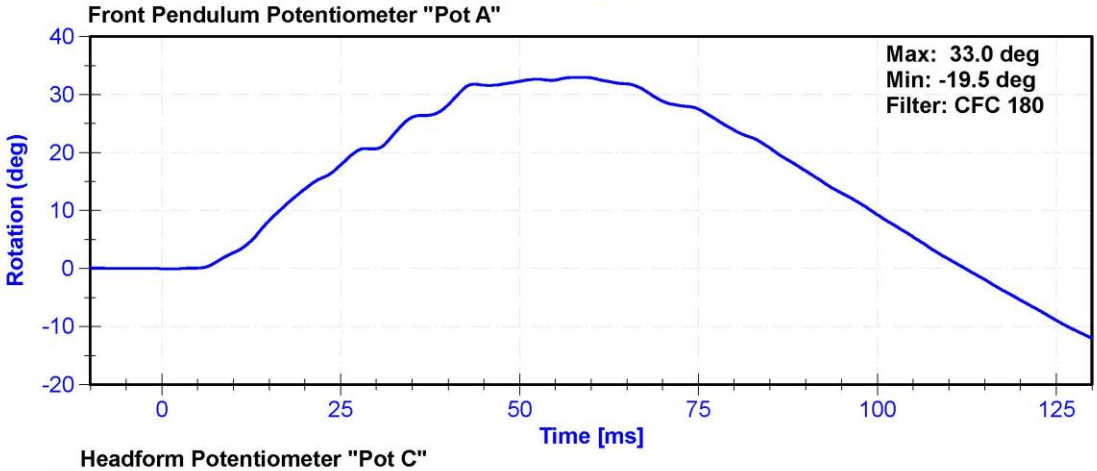
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	62.1	Pass
Velocity	3.3	3.5	m/s	3.33	Pass
Lateral Neck Rotation	49	59	deg	49.9	Pass
Time at Maximum Rotation	54	66	ms	56.8	Pass
Time of Rotation Decay from Maximum	53	88	ms	54.5	Pass

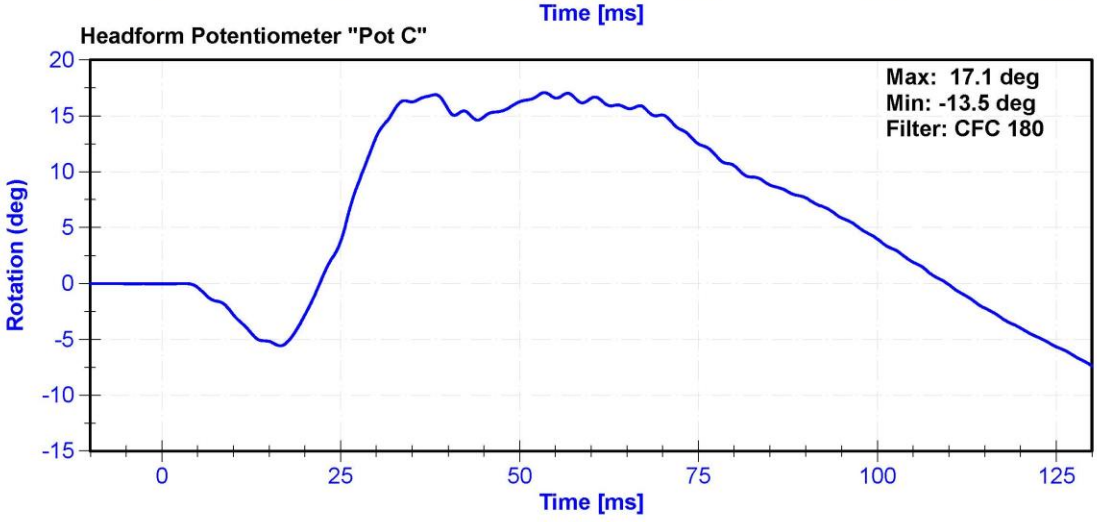
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CTAC-AH5M9 Pend		1/30/2020	1/29/2021
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: 49.9 deg
Min: -32.9 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 33.0 deg
Min: -19.5 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 17.1 deg
Min: -13.5 deg
Filter: CFC 180

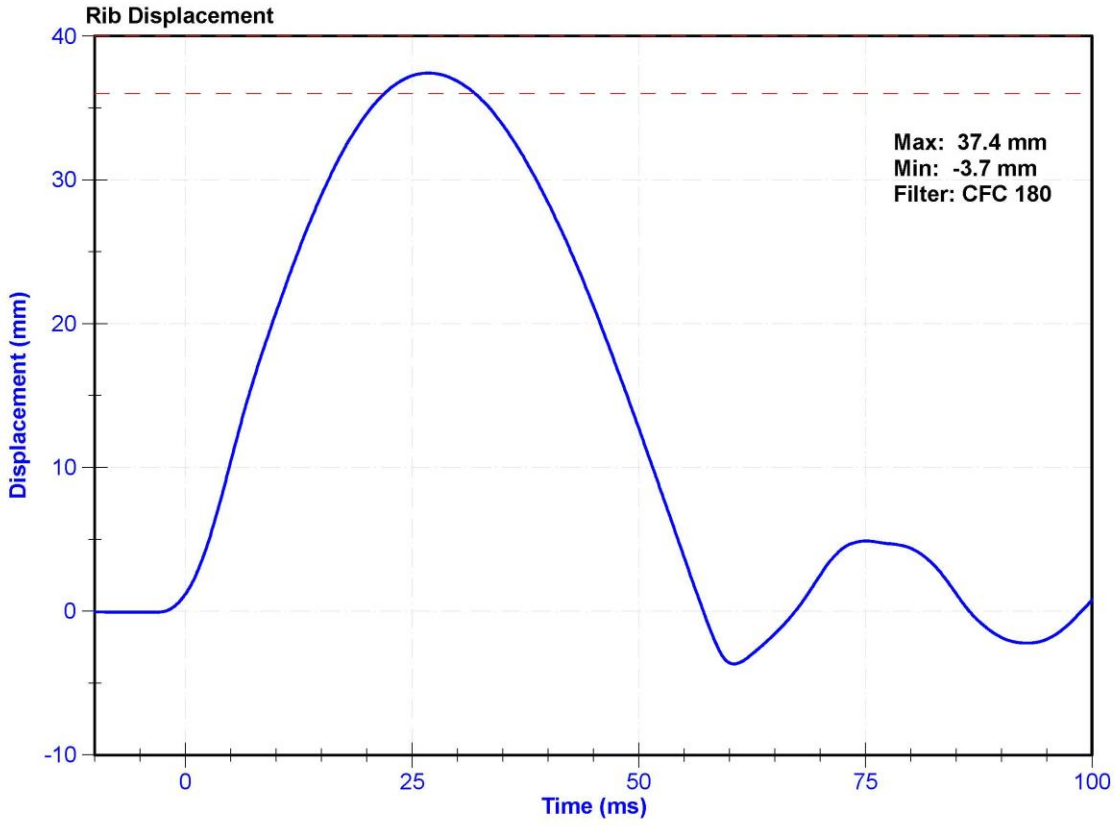
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	57.0	Pass
Rib Displacement	36	40	mm	37.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-179GFE	5/20/2020	11/18/2020



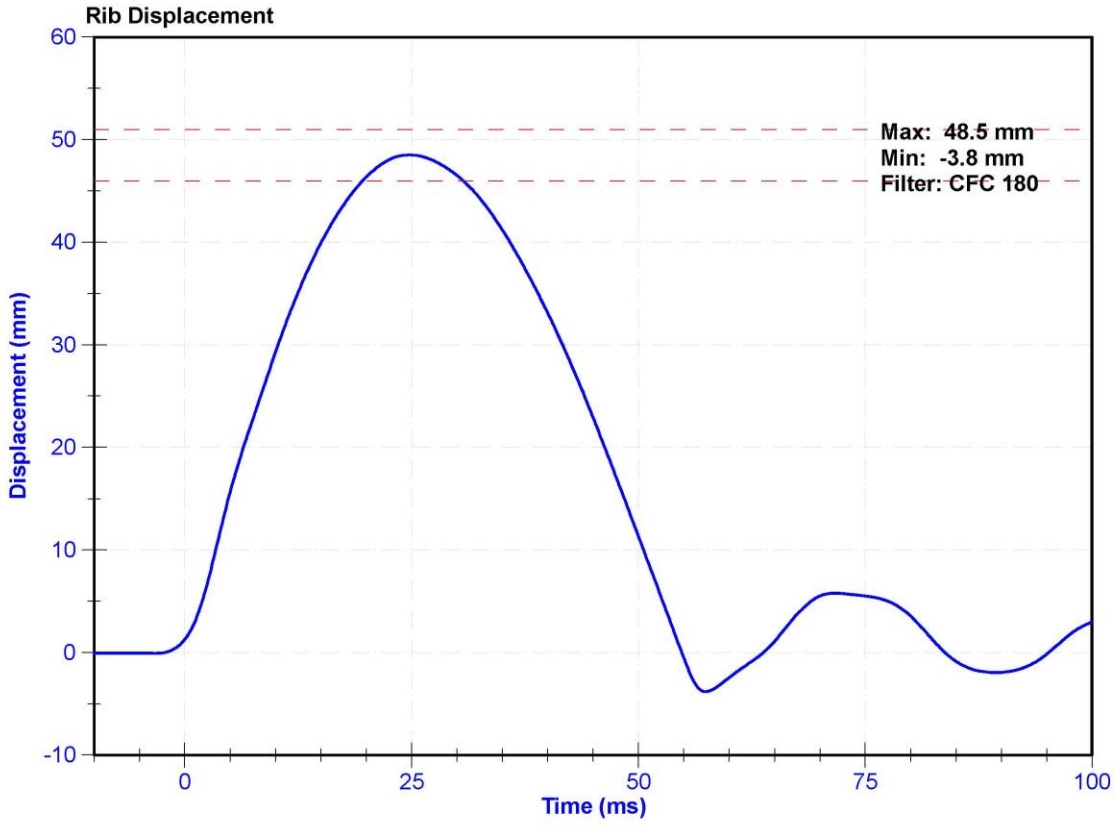
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	58.0	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-179GFE	5/20/2020	11/18/2020



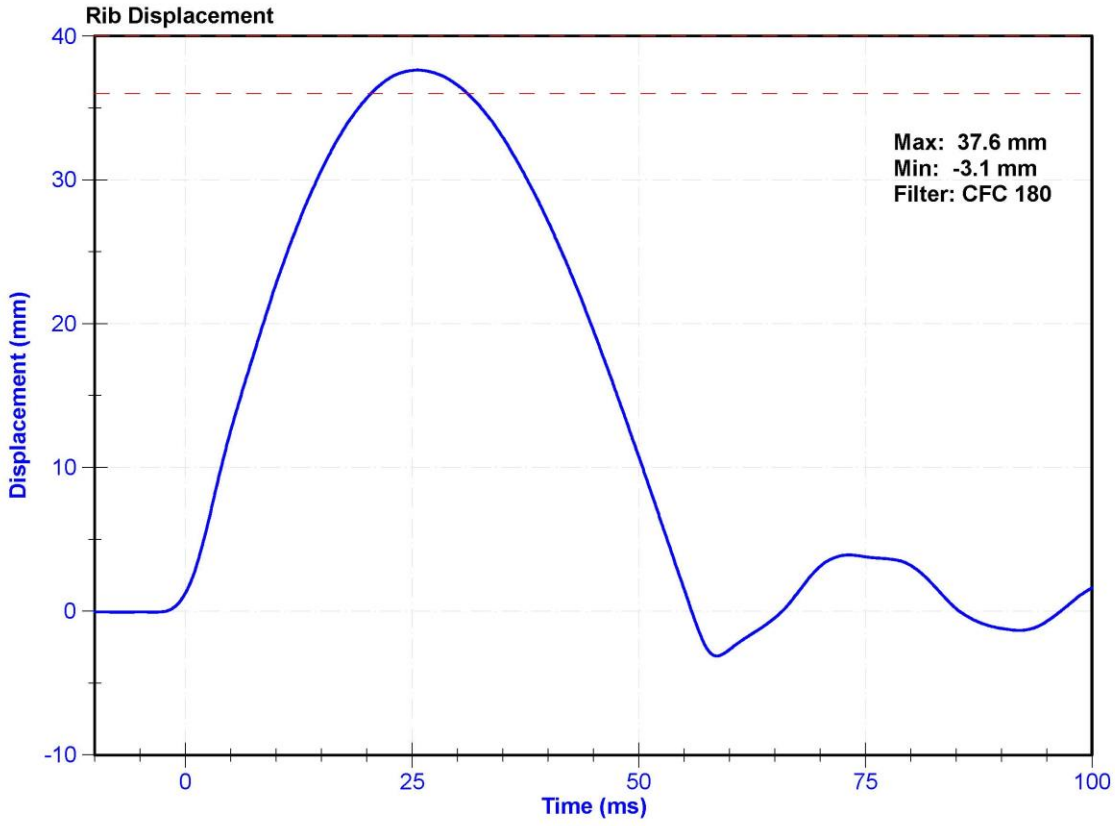
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	58.0	Pass
Rib Displacement	36	40	mm	37.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-185GFE	5/20/2020	11/18/2020



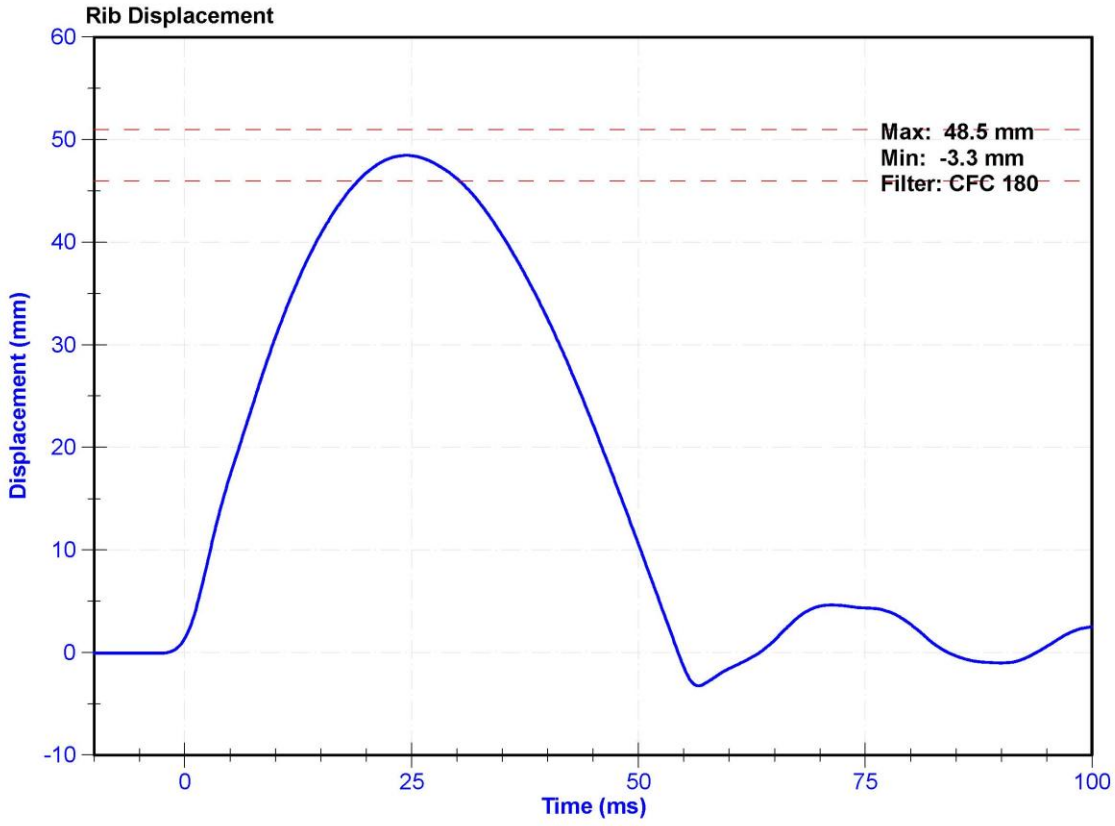
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	59.0	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-185GFE	5/20/2020	11/18/2020



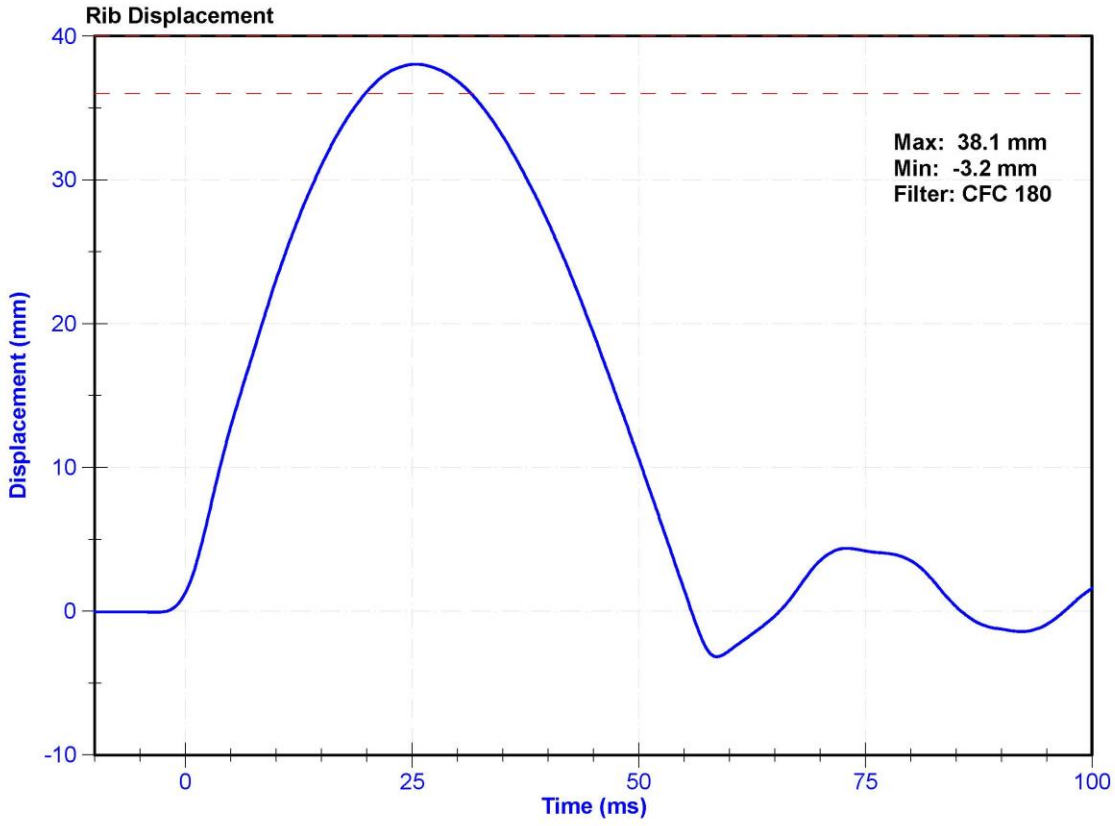
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	57.0	Pass
Rib Displacement	36	40	mm	38.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-178GFE	5/20/2020	11/18/2020



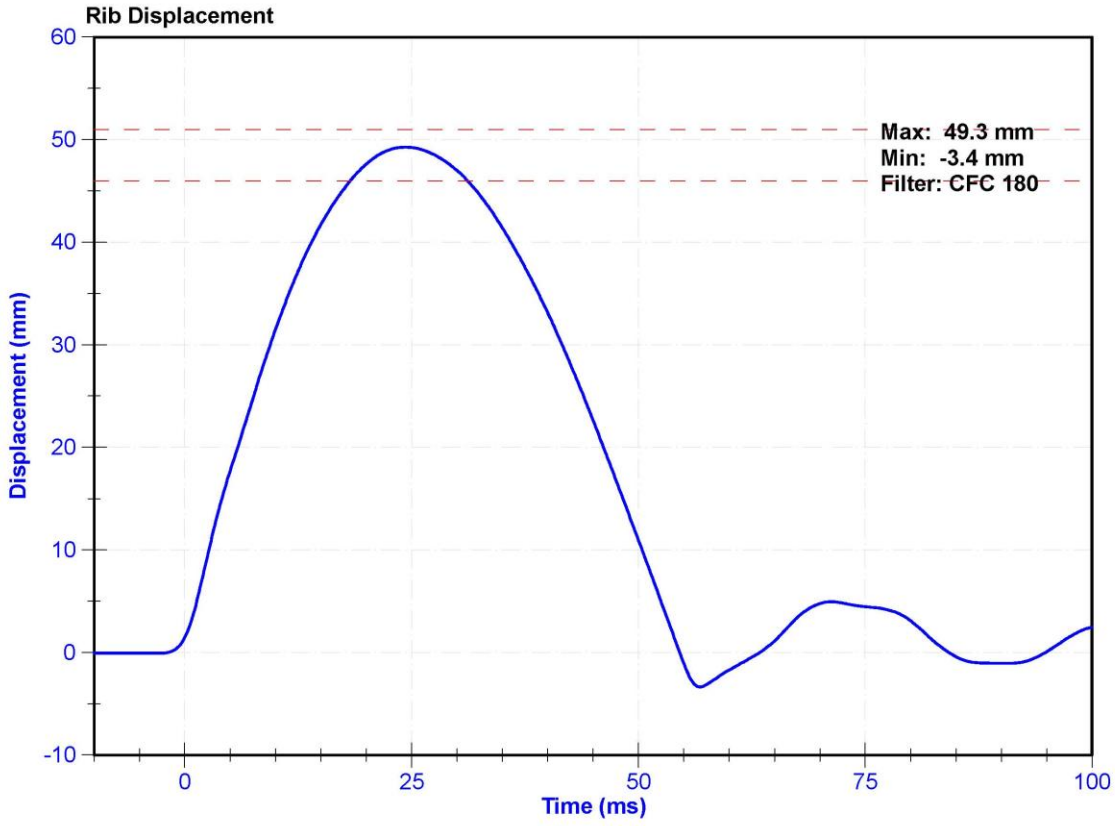
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	57.0	Pass
Rib Displacement	46	51	mm	49.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-178GFE	5/20/2020	11/18/2020



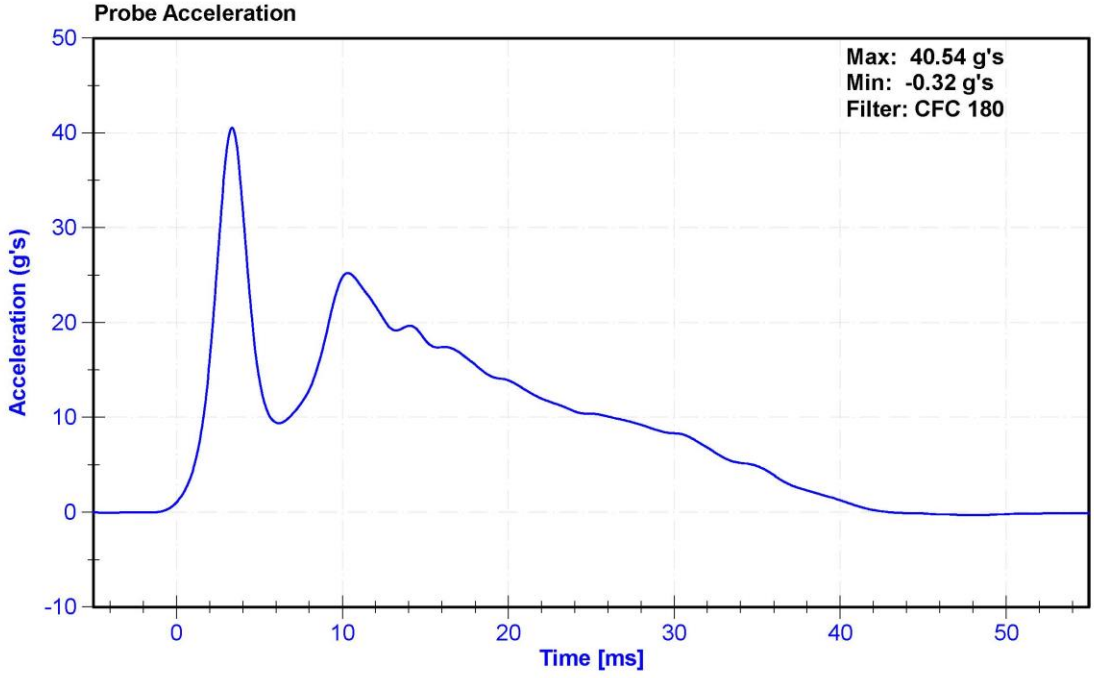
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

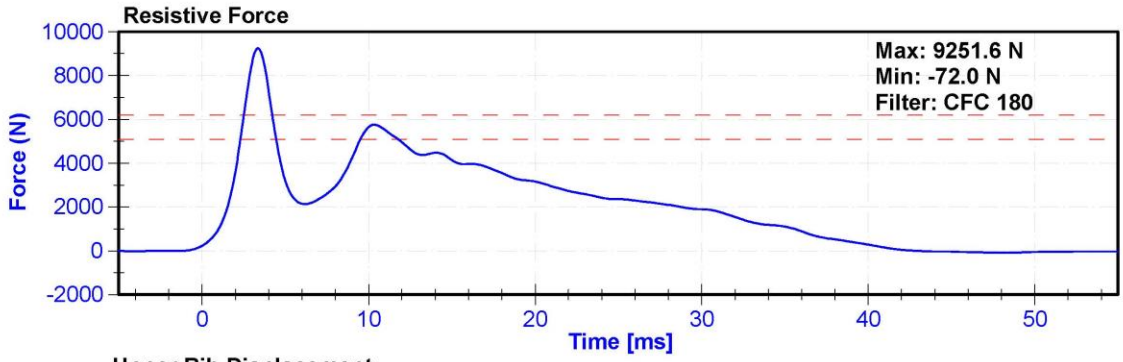
Results

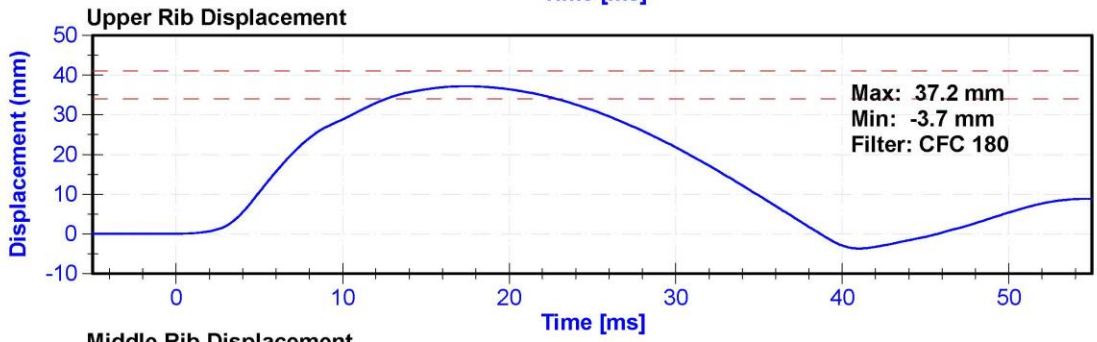
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	57.0	Pass
Velocity	5.4	5.6	m/s	5.41	Pass
Resistive Force after 6ms	5100	6200	N	5756.7	Pass
Upper Thorax Rib Deflection	34	41	mm	37.2	Pass
Mid Thorax Rib Deflection	37	45	mm	40.1	Pass
Lower Thorax Rib Deflection	37	44	mm	39.2	Pass

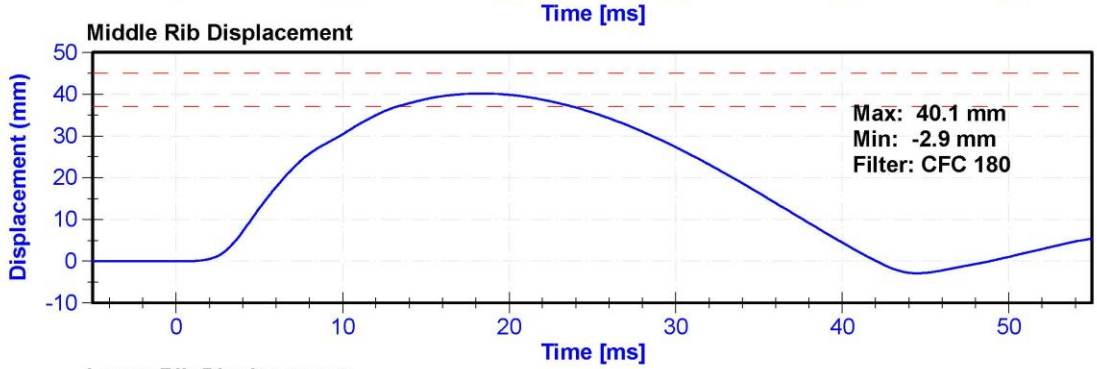
Transducer Calibrations

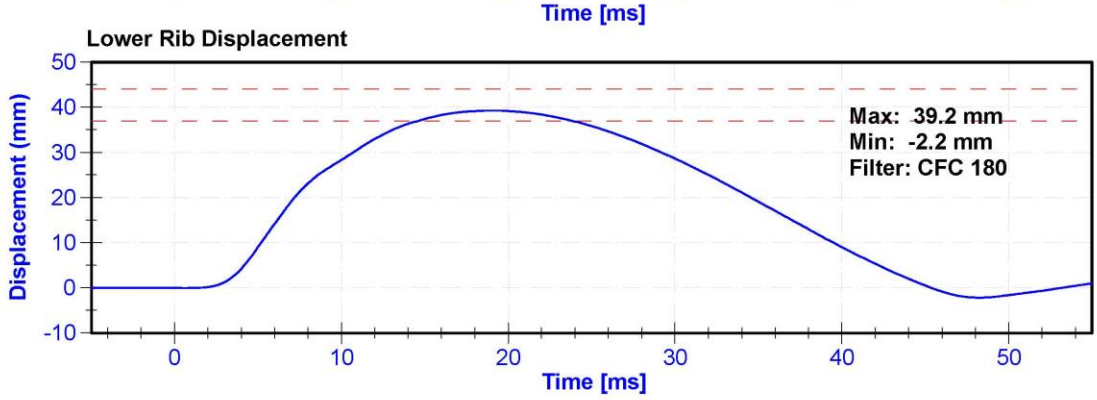
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A279031	5/8/2020	5/8/2021
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-179GFE	5/20/2020	11/18/2020
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-185GFE	5/20/2020	11/18/2020
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-178GFE	5/20/2020	11/18/2020




Resistive Force
Max: 9251.6 N
Min: -72.0 N
Filter: CFC 180
Force (N)
Time [ms]


Upper Rib Displacement
Max: 37.2 mm
Min: -3.7 mm
Filter: CFC 180
Displacement (mm)
Time [ms]


Middle Rib Displacement
Max: 40.1 mm
Min: -2.9 mm
Filter: CFC 180
Displacement (mm)
Time [ms]


Lower Rib Displacement
Max: 39.2 mm
Min: -2.2 mm
Filter: CFC 180
Displacement (mm)
Time [ms]

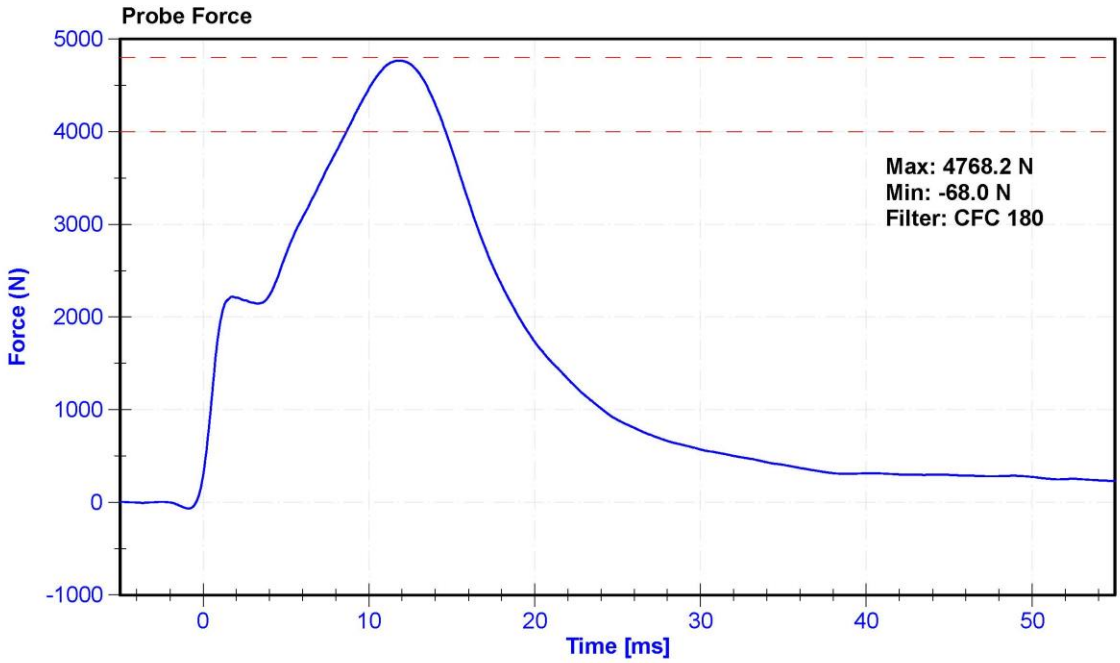
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K.Brogan

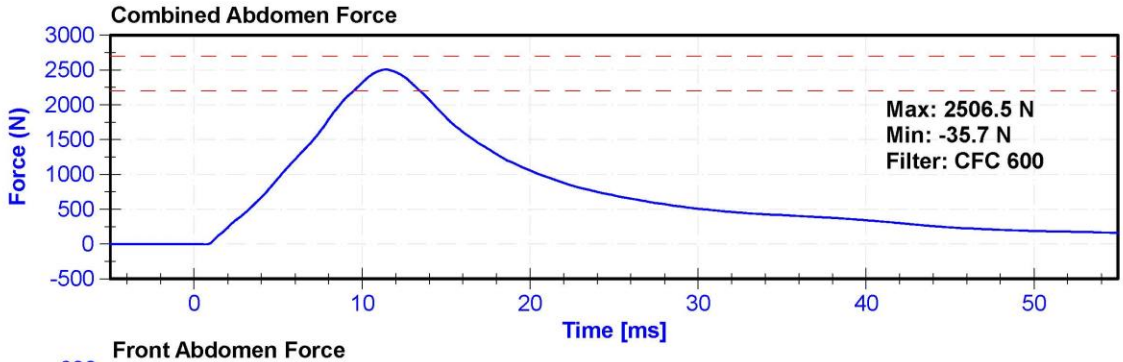
Results

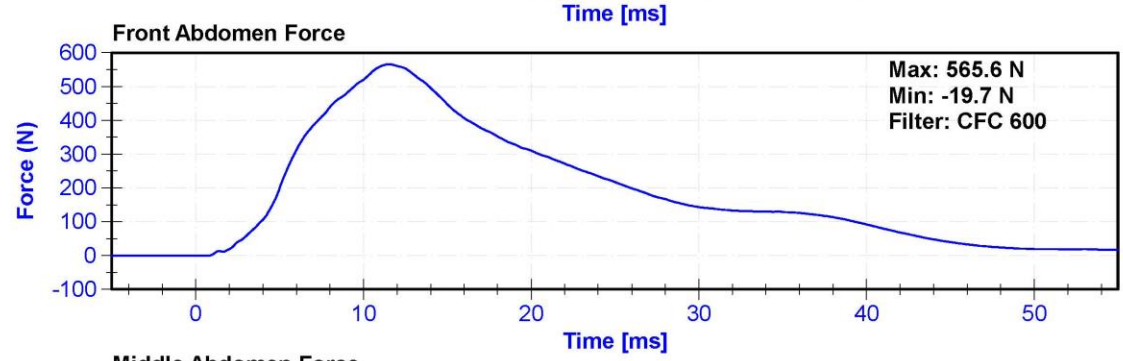
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	56	Pass
Velocity	3.9	4.1	m/s	4.10	Pass
Combined Abdomen Force	2200	2700	N	2506.5	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.40	Pass
Resistive Probe Force	4000	4800	N	4768.2	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.85	Pass

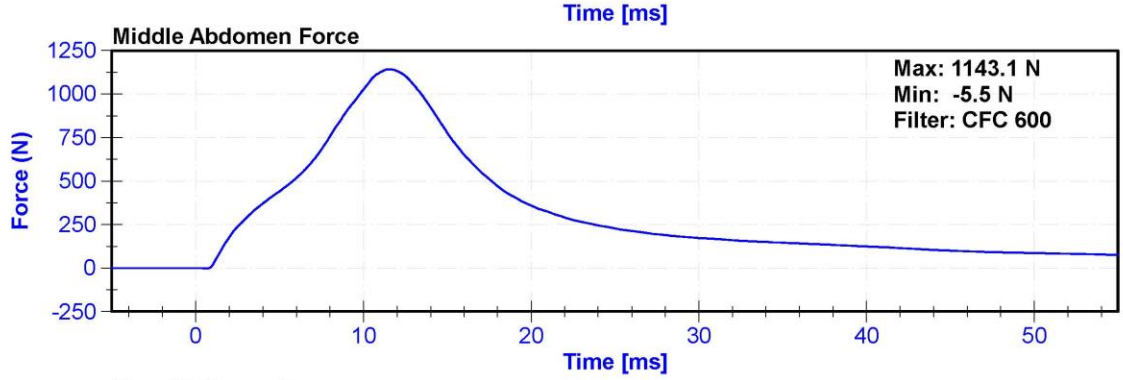
Transducer Calibrations

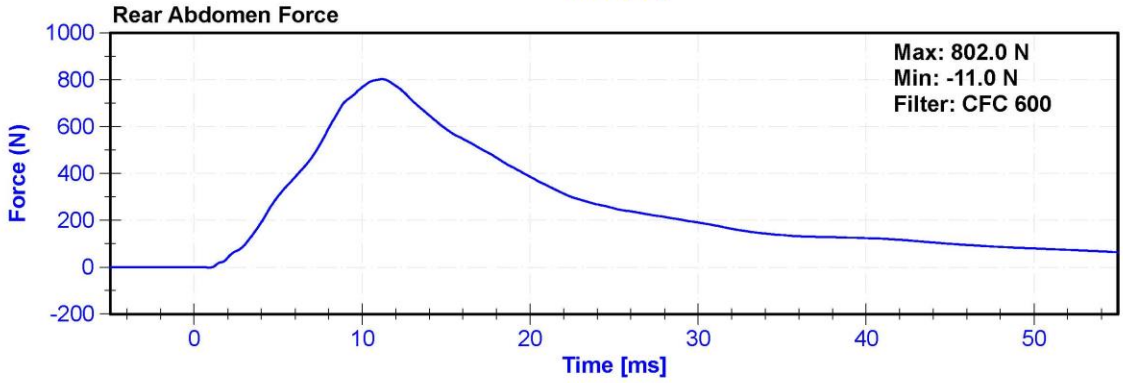
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A279031	5/8/2020	5/8/2021
Front Abdomen Load Cell	DENTON 2631J	26311512 GFE	3/19/2020	3/19/2021
Middle Abdomen Load Cell	DENTON 2631J	26311526 GFE	3/19/2020	3/19/2021
Rear Abdomen Load Cell	DENTON 2631J	26311516 GFE	3/19/2020	3/19/2021




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2506.5 N
Min: -35.7 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 565.6 N
Min: -19.7 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1143.1 N
Min: -5.5 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 802.0 N
Min: -11.0 N
Filter: CFC 600

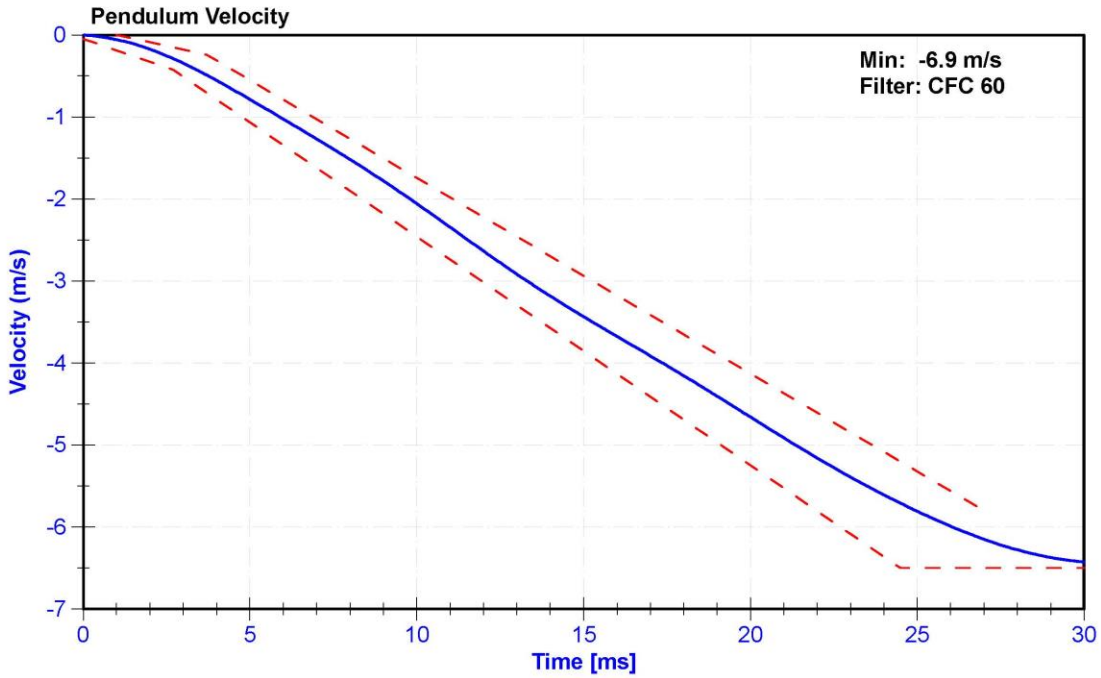
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

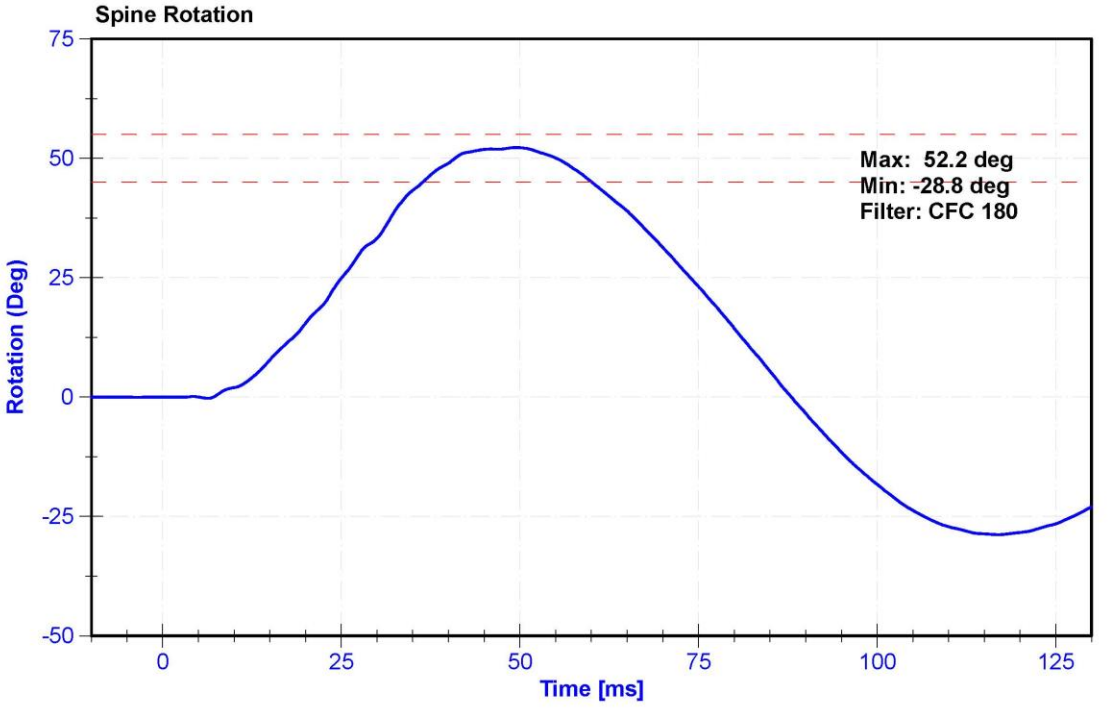
Results

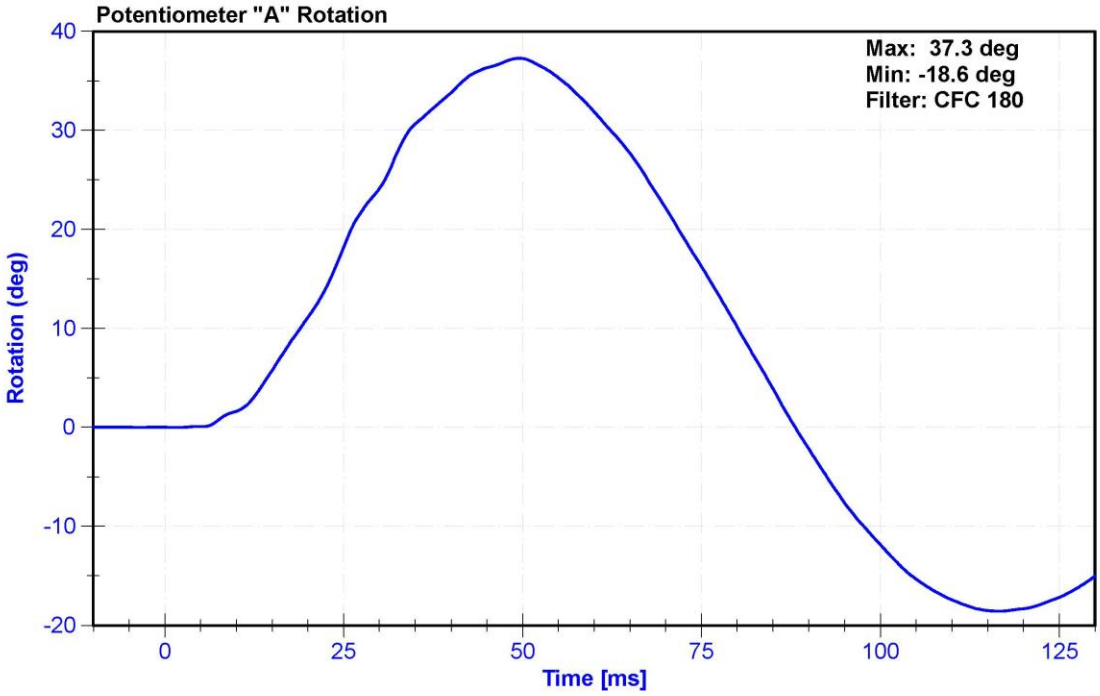
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	60.6	Pass
Velocity	5.95	6.15	m/s	5.964	Pass
Lateral Spine Rotation	45	55	deg	52.2	Pass
Time at Maximum Rotation	39	53	ms	49.4	Pass
Time of Decay to Zero Degrees	37	57	ms	38.6	Pass
Pulse within Corridor?	-	-	-		

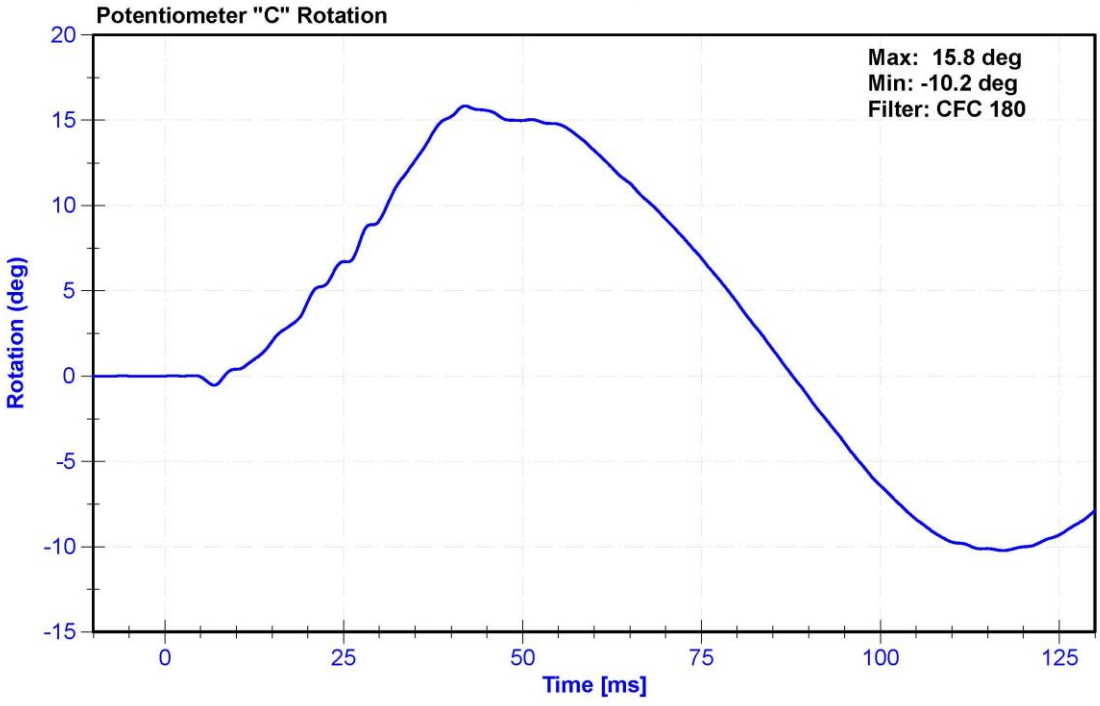
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/30/2020	1/29/2021
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: -6.9 m/s
Filter: CFC 60
Velocity (m/s)
0
-1
-2
-3
-4
-5
-6
-7
0
5
10
15
20
25
30
Time [ms]


Spine Rotation
Max: 52.2 deg
Min: -28.8 deg
Filter: CFC 180
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 37.3 deg
Min: -18.6 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: 15.8 deg
Min: -10.2 deg
Filter: CFC 180
Rotation (deg)
20
15
10
5
0
-5
-10
-15
0
25
50
75
100
125
Time [ms]

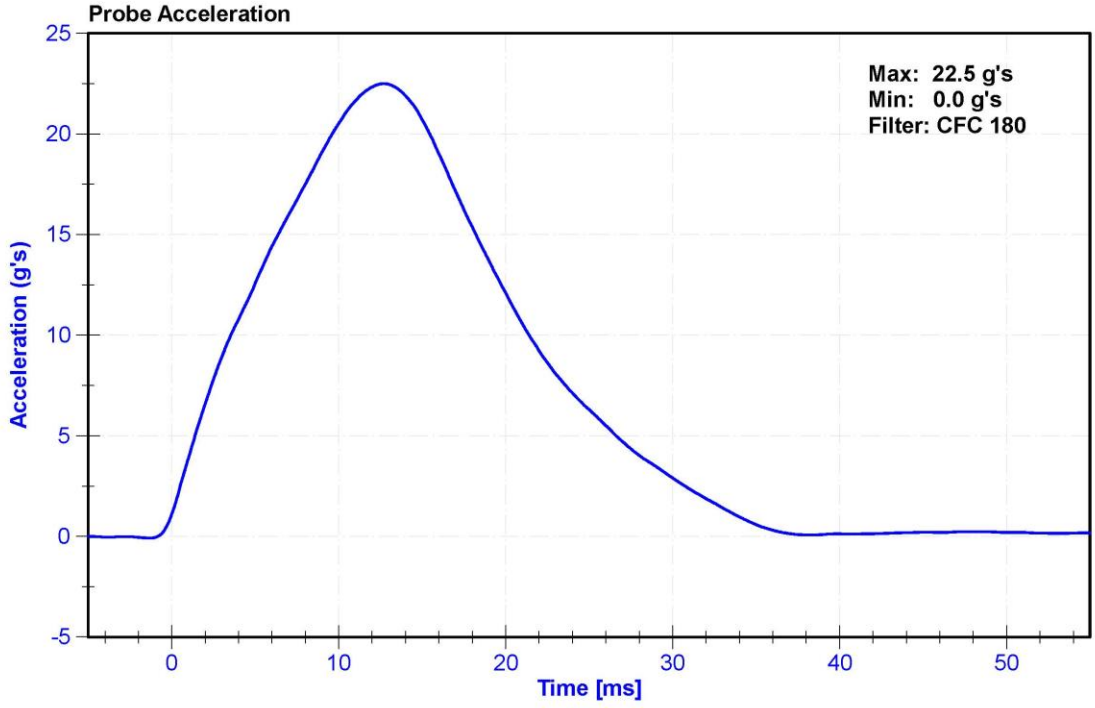
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	F033	Laboratory Supervisor	K. Brogan

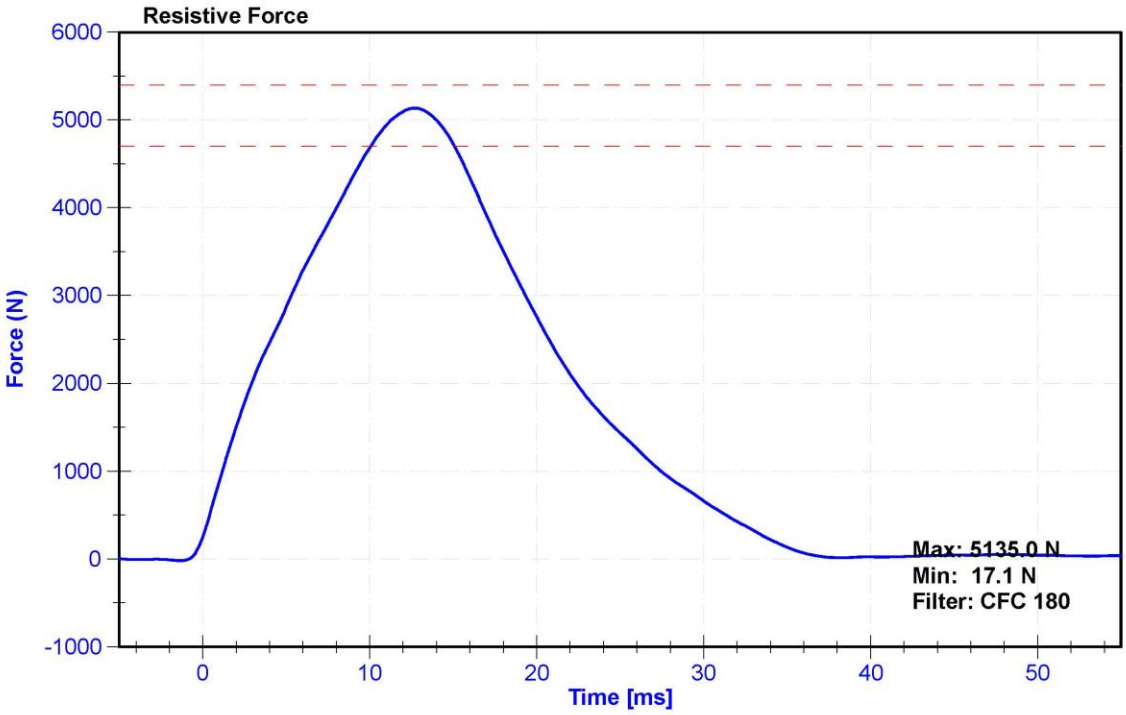
Results

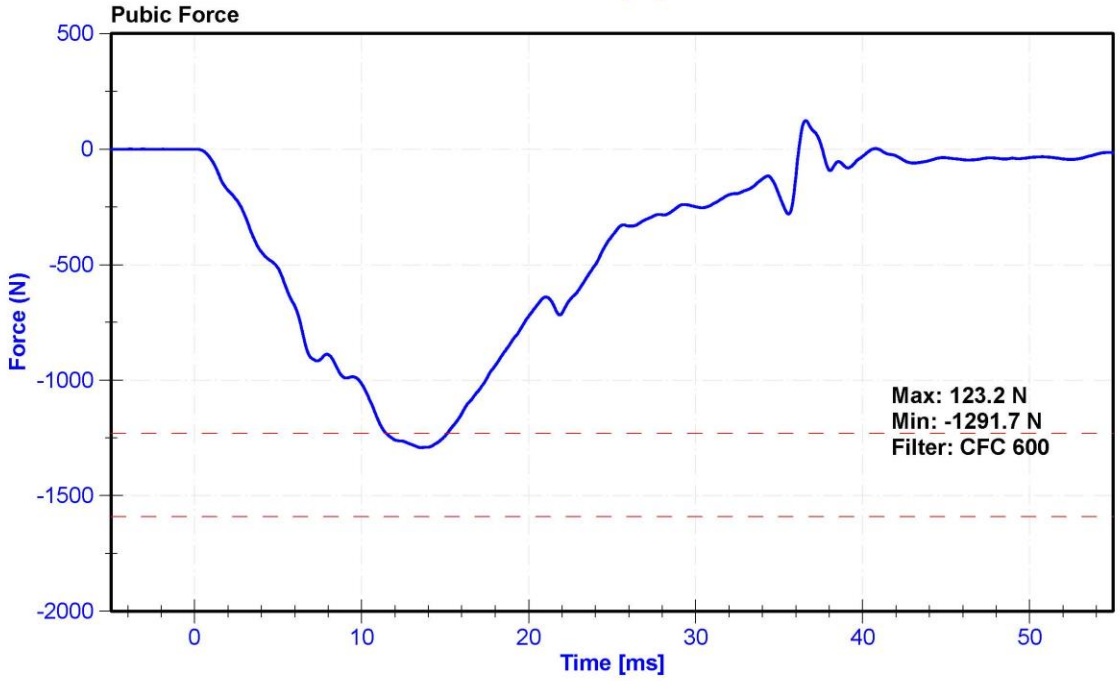
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	59.0	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Resistive Force	4700	5400	N	5135.0	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.70	Pass
Pubic Force	-1590	-1230	N	-1291.7	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.55	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A279031	5/8/2020	5/8/2021
Pubic Load Cell	Denton 3096JFL	LC-456Fy	3/19/2020	3/19/2021




Resistive Force
Force (N)
Time [ms]
Max: 5135.0 N
Min: 17.1 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 123.2 N
Min: -1291.7 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

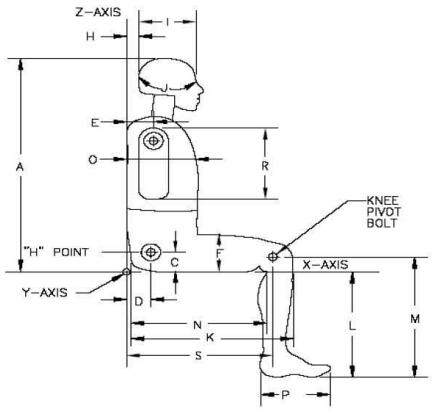
SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

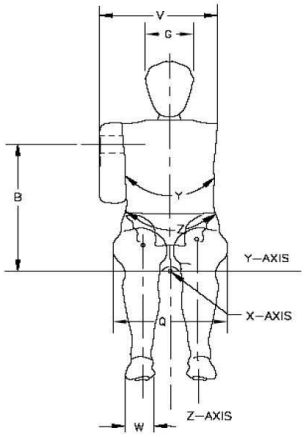
SERIAL No: 300

External Measurements - SID-IIs

Technician: K. Dutton Date: 08/13/2020

Dummy Serial Number: 300





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	782	Pass
B	Shoulder Pivot Height	437	453	449	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	101	Pass
F	Thigh Clearance	119	135	126	Pass
G	Head Breadth	140	148	144	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	187	Pass
J	Head Circumference	541	551	544	Pass
K	Buttock to Knee Length	514	540	533	Pass
L	Popliteal Height	343	369	361	Pass
M	Knee Pivot to floor height	392	409	401	Pass
N	Buttock Popliteal Length	416	442	431	Pass
O	Chest Depth w/o jacket	195	211	207	Pass
P	Foot Length	216	232	220	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	317	Pass
R	Arm Length	249	259	253	Pass
S	Knee Joint to seatback	477	493	484	Pass
V	Shoulder Width	341	357	352	Pass
W	Foot Width	78	94	83	Pass
Y	Chest Circumference w/jacket	851	881	875	Pass
Z	Waist Circumference	761	791	773	Pass

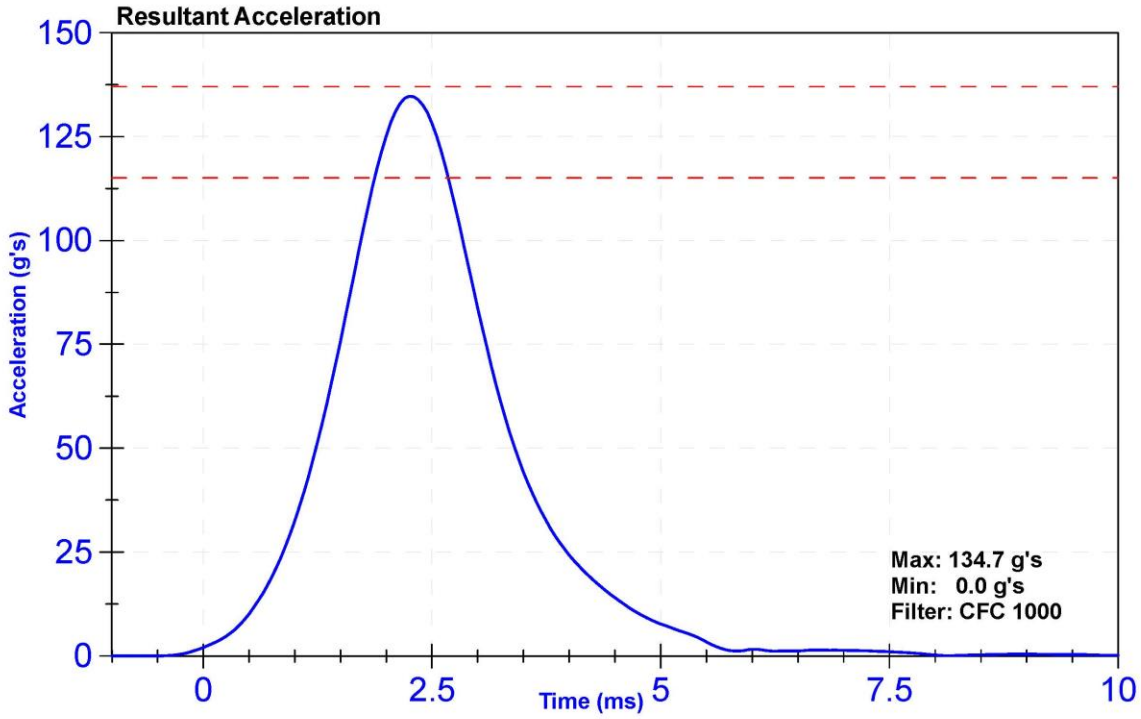
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

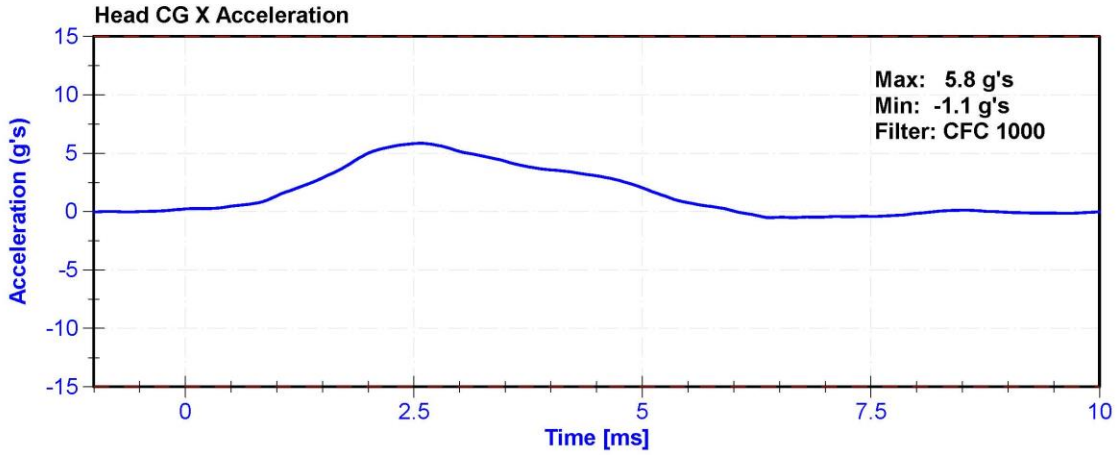
Results

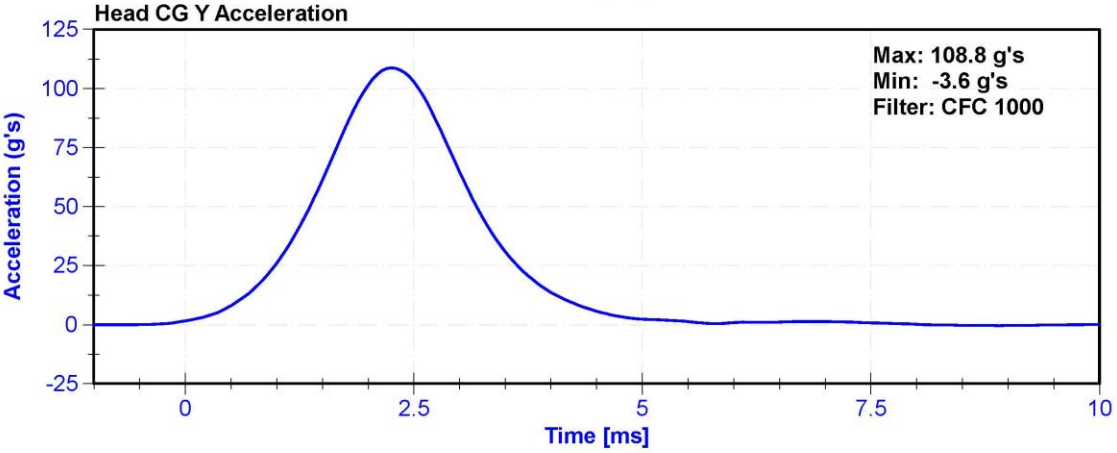
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	57	Pass
Resultant Acceleration	115	137	g's	134.7	Pass
Oscillation	0	15	%	3.5	Pass
Fore-Aft Acceleration	-15	15	g's	5.8	Pass

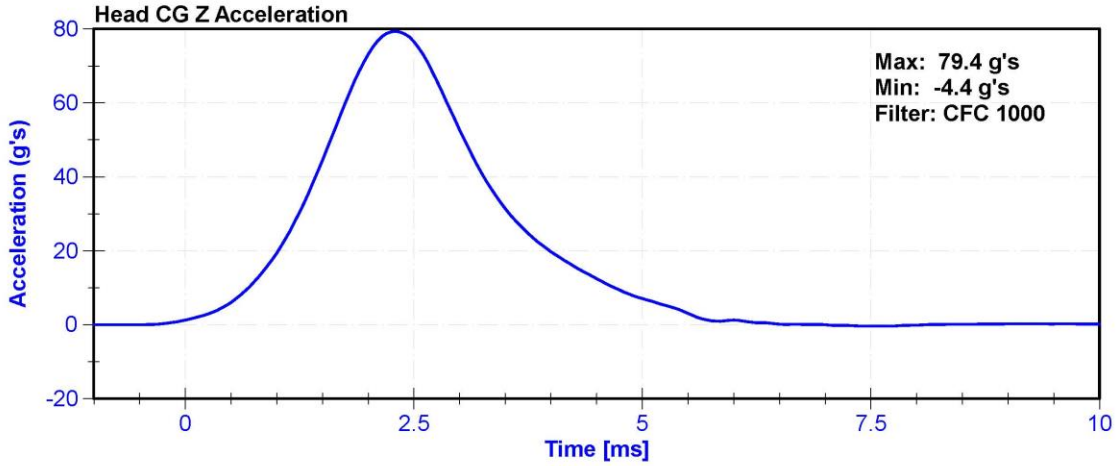
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P59018	4/20/2020	10/19/2020
Y Accelerometer	ENDEVCO 7264	AC-P79189	4/20/2020	10/19/2020
Z Accelerometer	ENDEVCO 7264CT	AC-P58777	4/20/2020	10/19/2020




Head CG X Acceleration
Max: 5.8 g's
Min: -1.1 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: 108.8 g's
Min: -3.6 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: 79.4 g's
Min: -4.4 g's
Filter: CFC 1000
Acceleration (g's)
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]

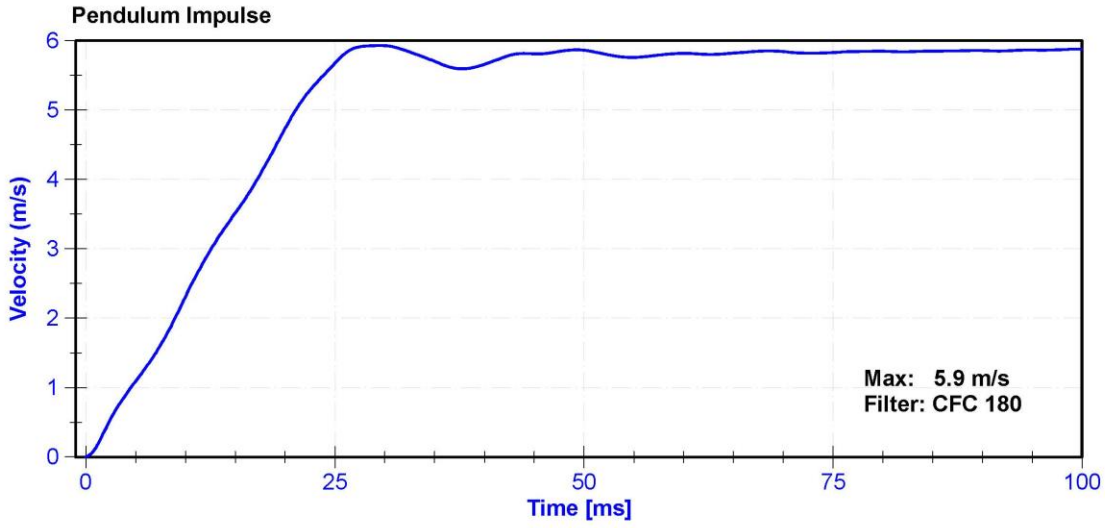
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

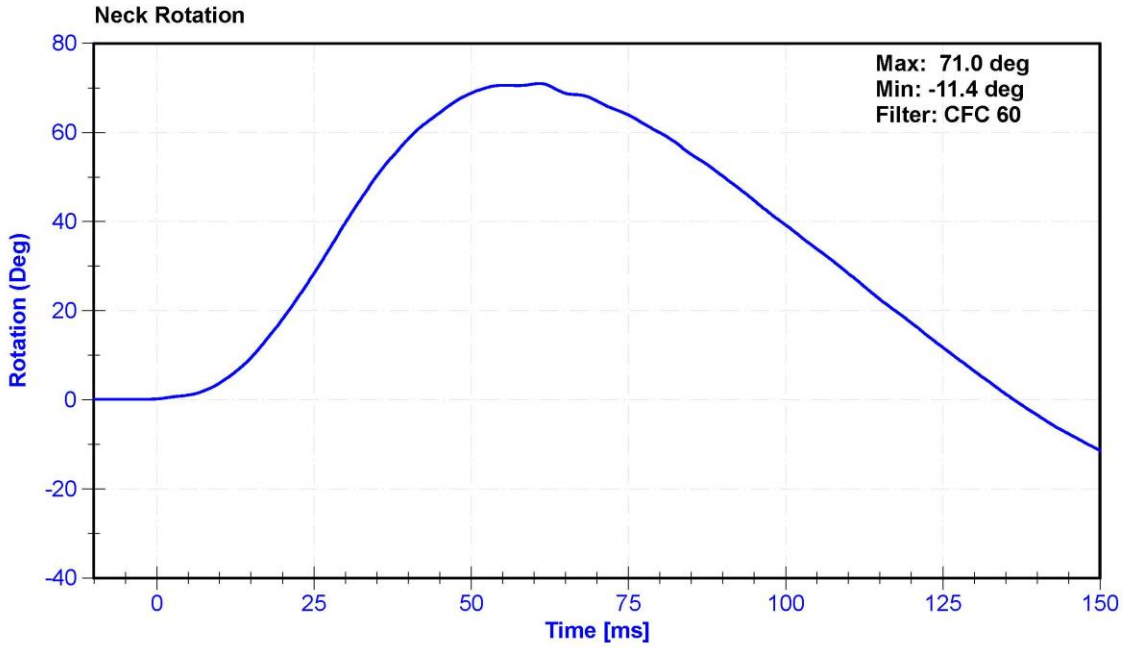
Results

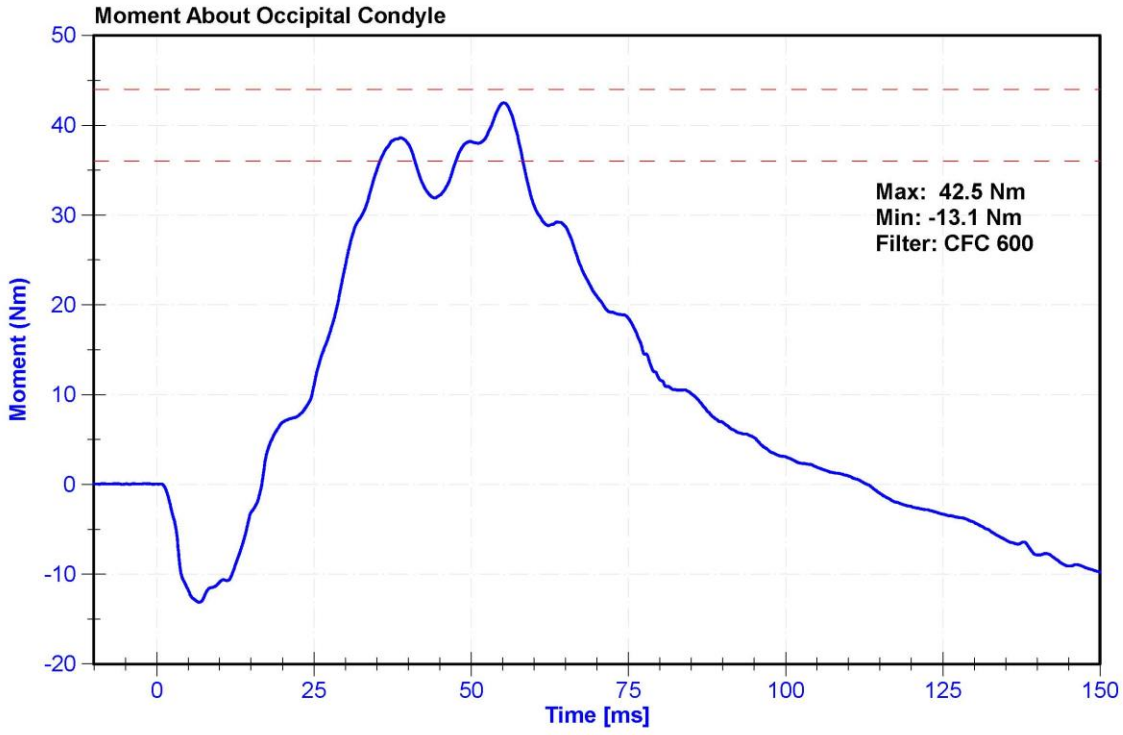
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	62.3	Pass
Velocity	5.51	5.63	m/s	5.549	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.31	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.51	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.73	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.67	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.92	Pass
Neck Rotation	71	81	deg	71.0	Pass
Time at Maximum Rotation	50	70	ms	60.9	Pass
Moment about the OC	36	44	Nm	42.5	Pass
Moment Decay to 0 Nm	102	126	ms	113.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/30/2020	1/29/2021
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 1716	17162019 FY	3/18/2020	3/18/2021




Neck Rotation
Max: 71.0 deg
Min: -11.4 deg
Filter: CFC 60
Rotation (Deg)
80
60
40
20
0
-20
-40
0
25
50
75
100
125
150
Time [ms]


Moment About Occipital Condyle
Max: 42.5 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]

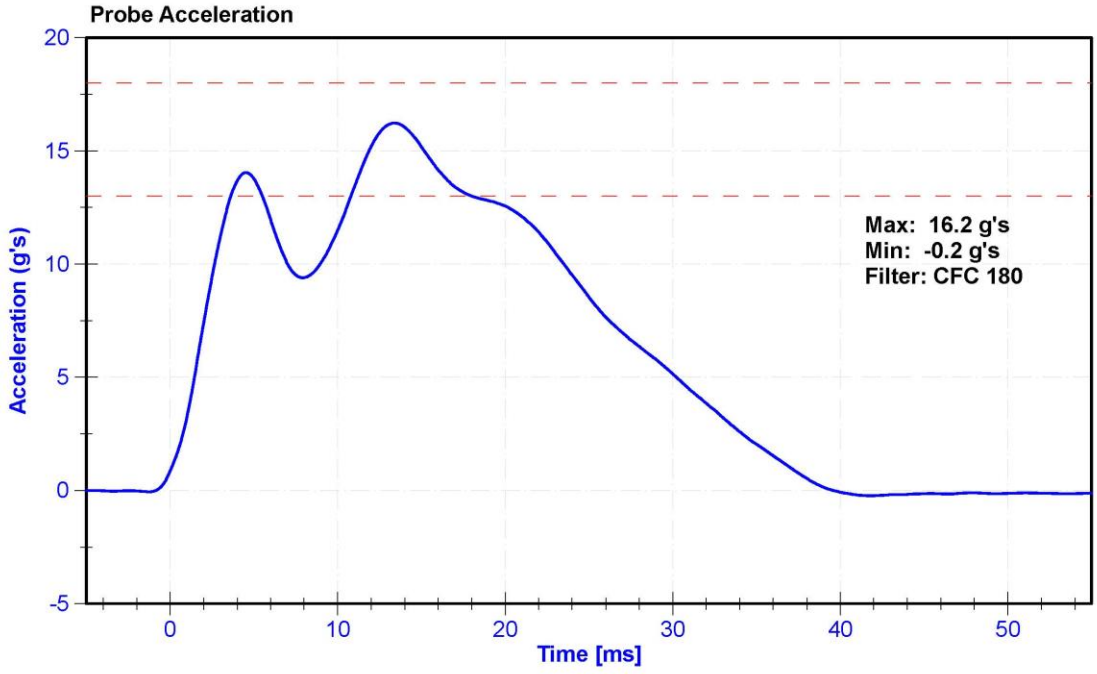
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

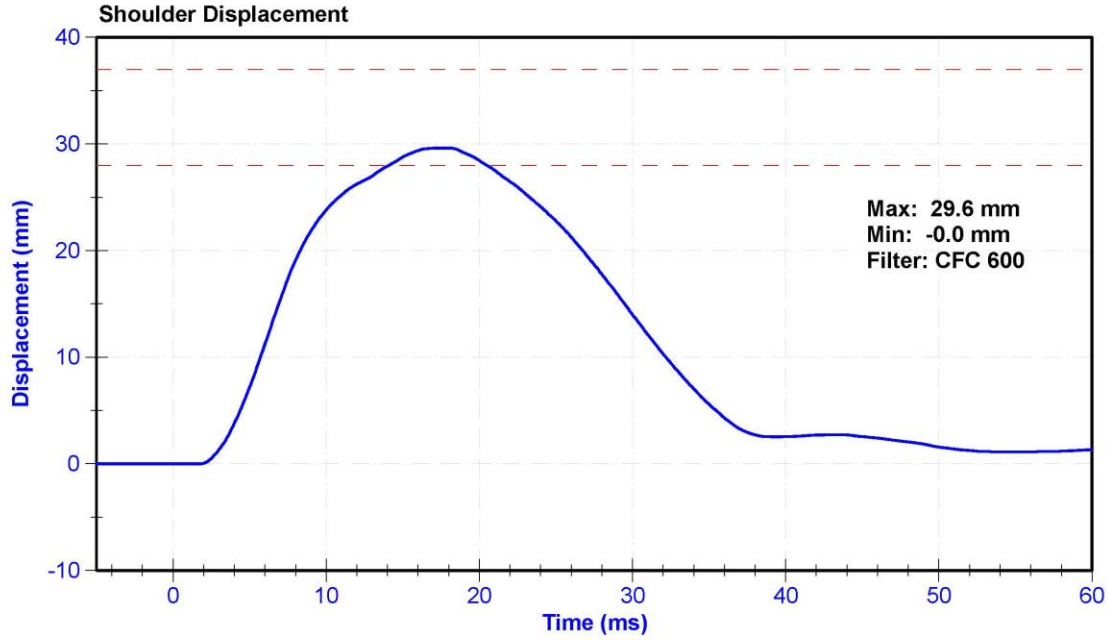
Results

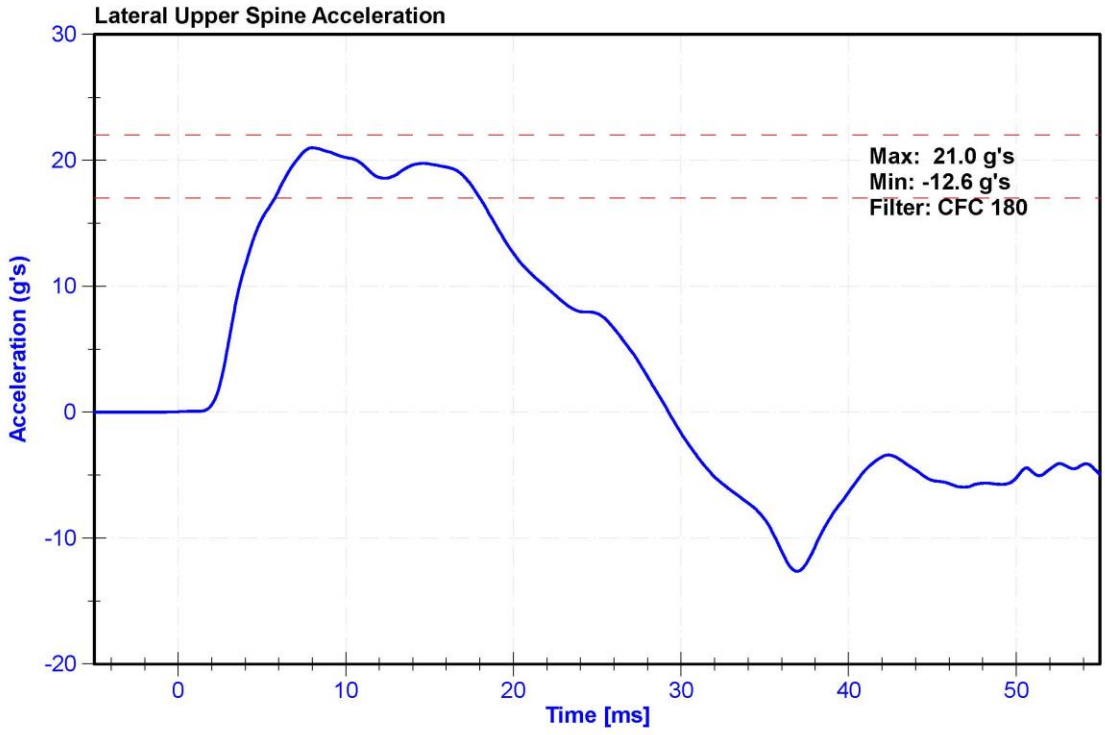
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	57	Pass
Velocity	4.2	4.4	m/s	4.29	Pass
Probe Acceleration	13	18	g's	16.2	Pass
Shoulder Deflection	28	37	mm	29.6	Pass
Lateral Upper Spine Acceleration	17	22	g's	21.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A279031	5/8/2020	5/8/2021
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	4/30/2020	10/29/2020
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P71281	7/30/2020	1/28/2021




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 29.6 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: 21.0 g's
Min: -12.6 g's
Filter: CFC 180
30
20
10
0
-10
-20
0
10
20
30
40
50

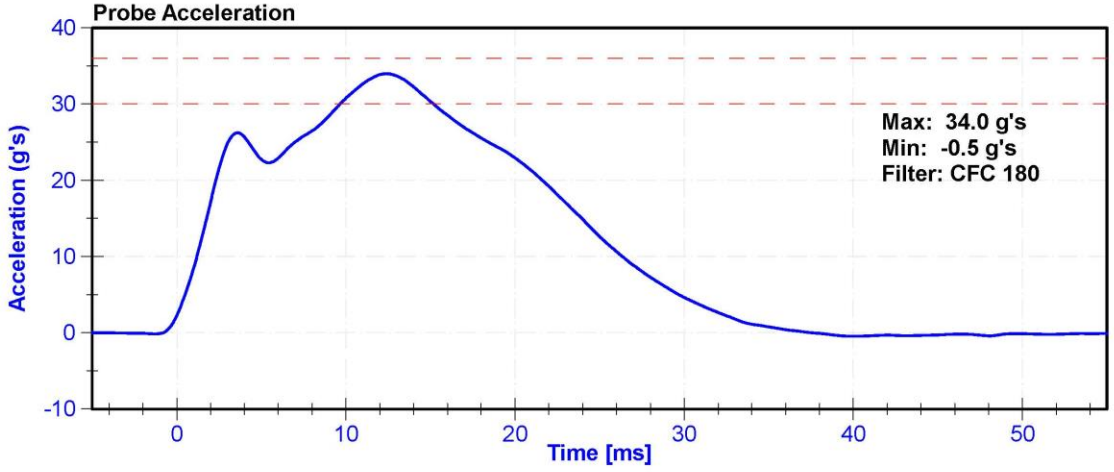
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

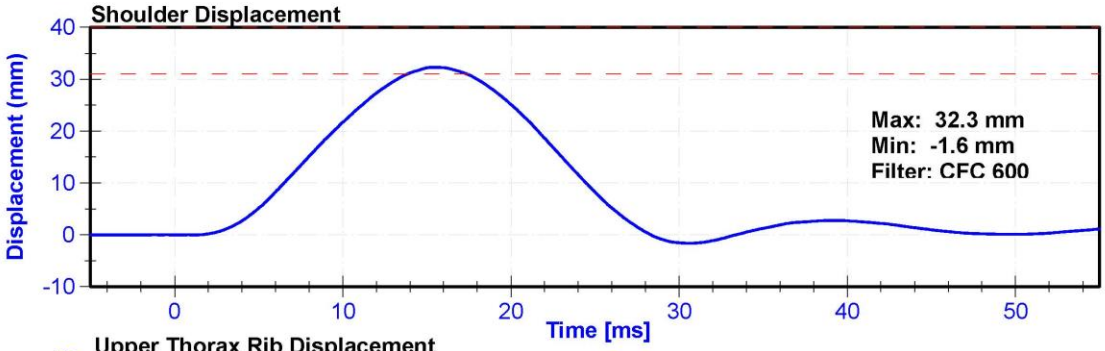
Results

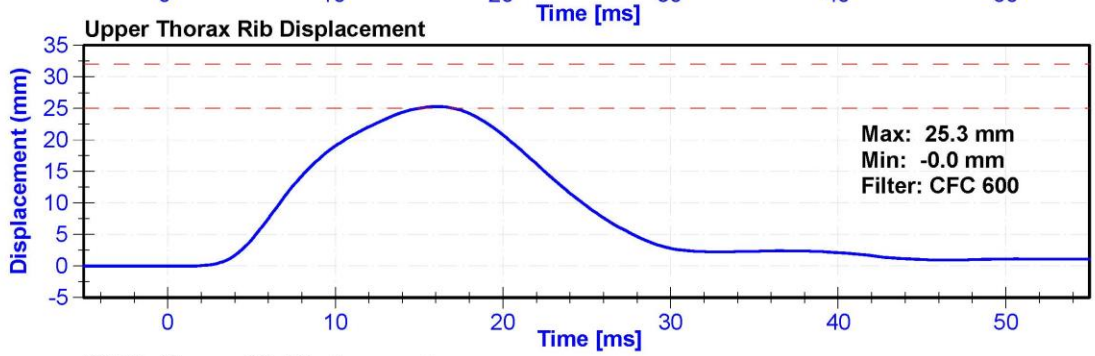
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	57.0	Pass
Velocity	6.6	6.8	m/s	6.67	Pass
Probe Acceleration after 5 ms	30	36	g's	34.0	Pass
Lateral Upper Spine Acceleration	34	43	g's	41.7	Pass
Lateral Lower Spine Acceleration	29	37	g's	32.0	Pass
Shoulder Deflection	31	40	mm	32.3	Pass
Upper Thorax Rib Deflection	25	32	mm	25.3	Pass
Mid Thorax Rib Deflection	30	36	mm	31.4	Pass
Lower Thorax Rib Deflection	32	38	mm	34.2	Pass

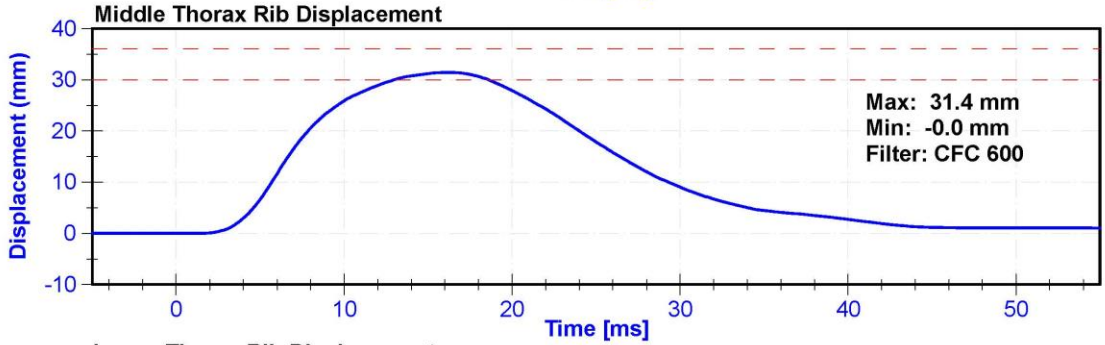
Transducer Calibrations

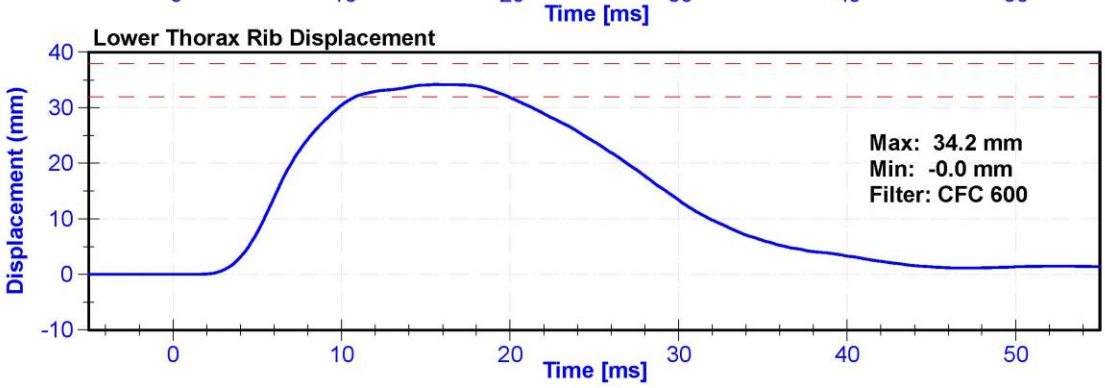
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A279031	5/8/2020	5/8/2021
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P71281	7/30/2020	1/28/2021
Upper Spine T12 Y Accelerometer	ENDEVCO 7264	AC-P64147	4/20/2020	10/19/2020
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	4/30/2020	10/29/2020
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	4/30/2020	10/29/2020
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	4/30/2020	10/29/2020
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	4/30/2020	10/29/2020

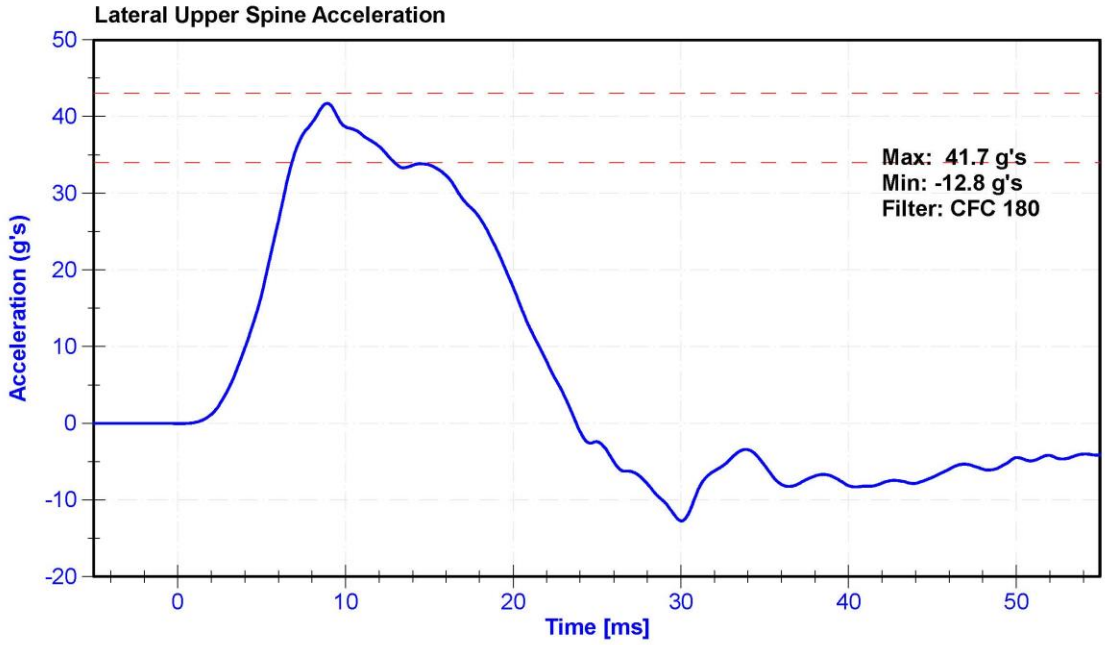


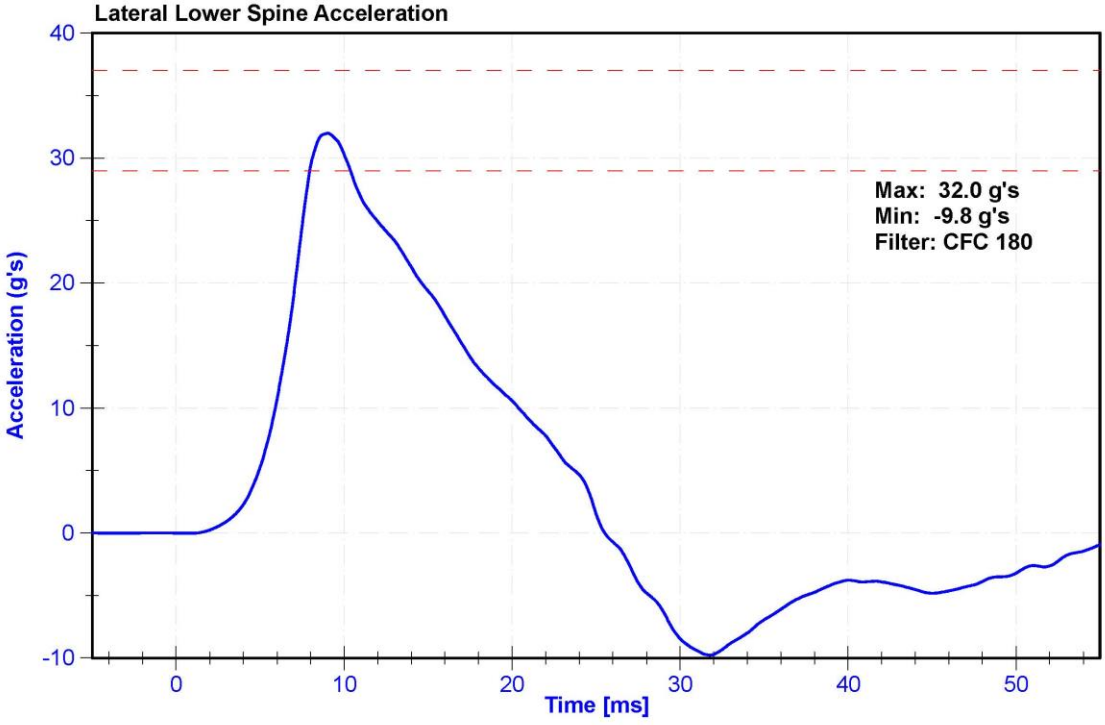

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 32.3 mm
Min: -1.6 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 25.3 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 31.4 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 34.2 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 41.7 g's
Min: -12.8 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]


Lateral Lower Spine Acceleration
Max: 32.0 g's
Min: -9.8 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]

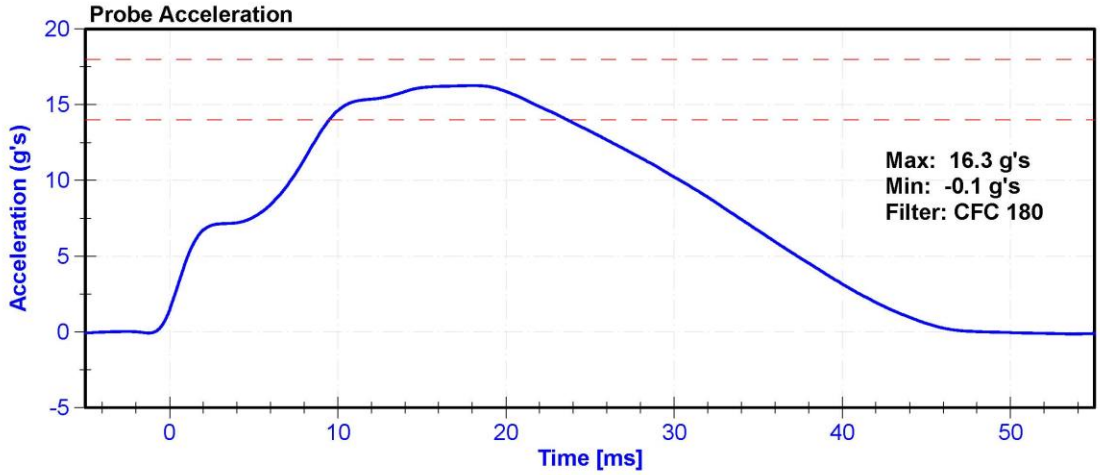
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

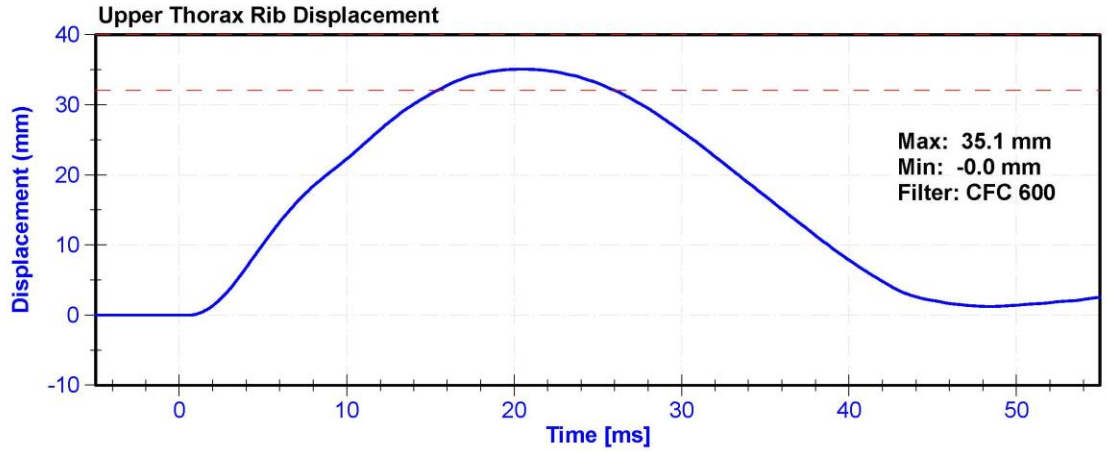
Results

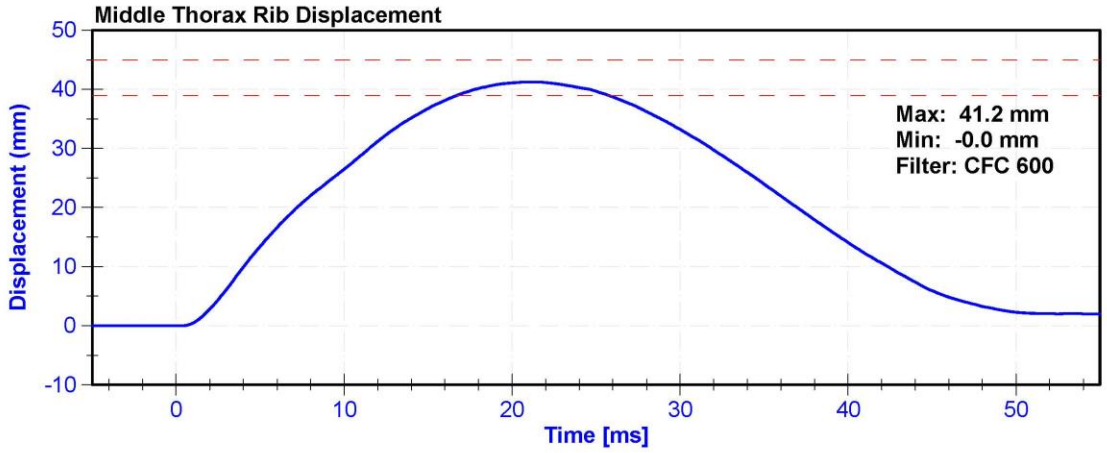
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	58	Pass
Velocity	4.2	4.4	m/s	4.36	Pass
Probe Acceleration	14	18	g's	16.3	Pass
Lateral Upper Spine Acceleration	13	17	g's	14.8	Pass
Lateral Lower Spine Acceleration	7	11	g's	10.3	Pass
Upper Thorax Rib Deflection	32	40	mm	35.1	Pass
Middle Thorax Rib Deflection	39	45	mm	41.2	Pass
Lower Thorax Rib Deflection	35	43	mm	37.9	Pass

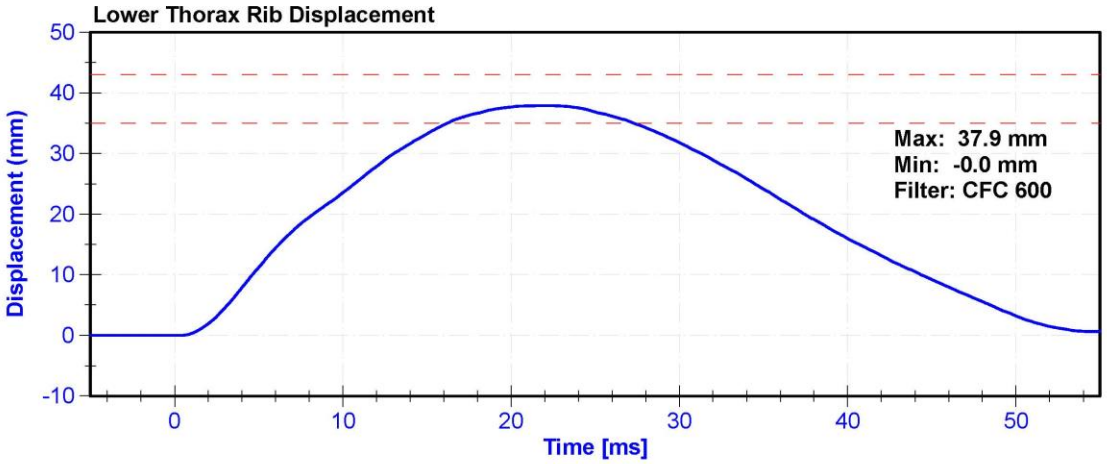
Transducer Calibrations

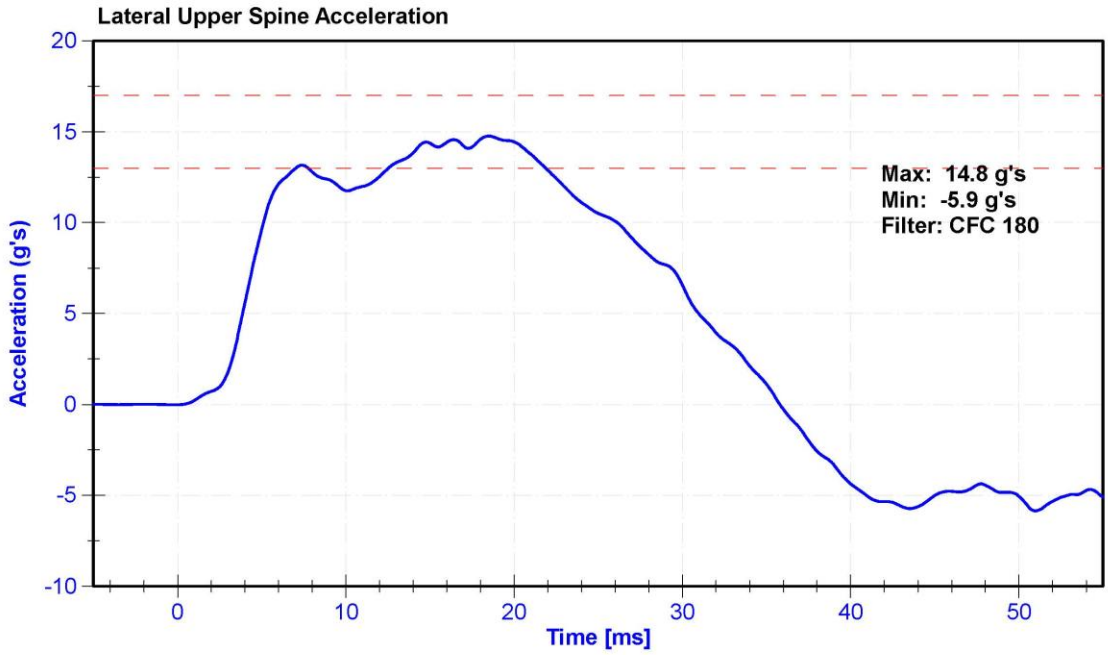
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A279031	5/8/2020	5/8/2021
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P71281	7/30/2020	1/28/2021
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	4/20/2020	10/19/2020
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	4/30/2020	10/29/2020
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	4/30/2020	10/29/2020
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	4/30/2020	10/29/2020

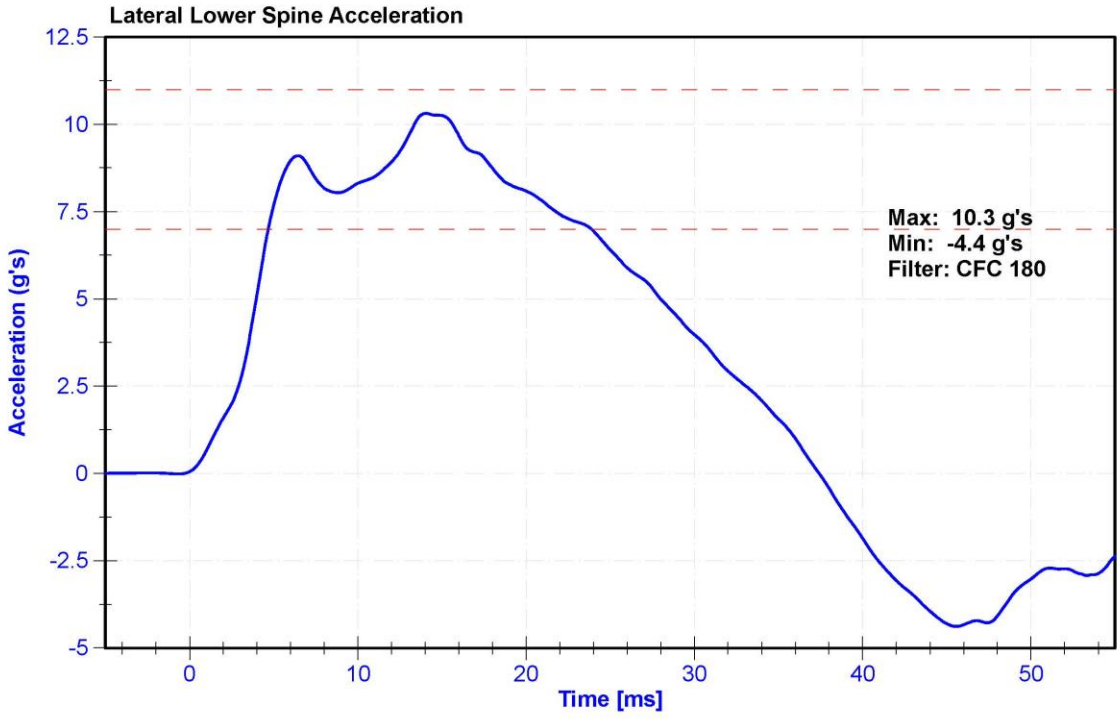



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 35.1 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.2 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.9 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 14.8 g's
Min: -5.9 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: -4.4 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

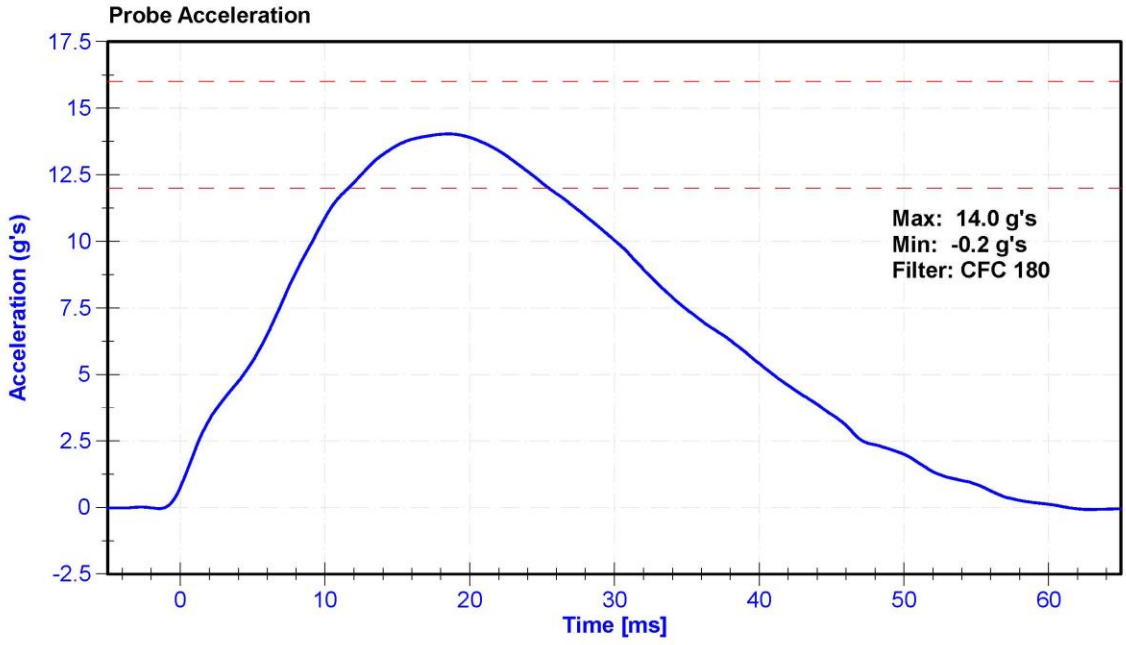
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

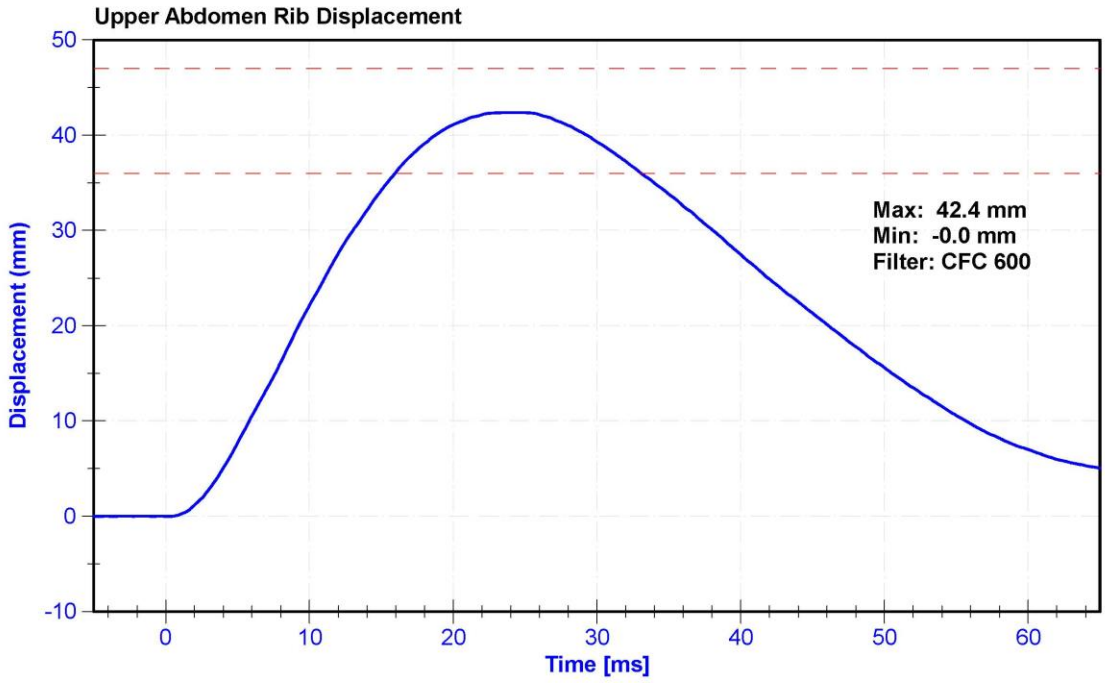
Results

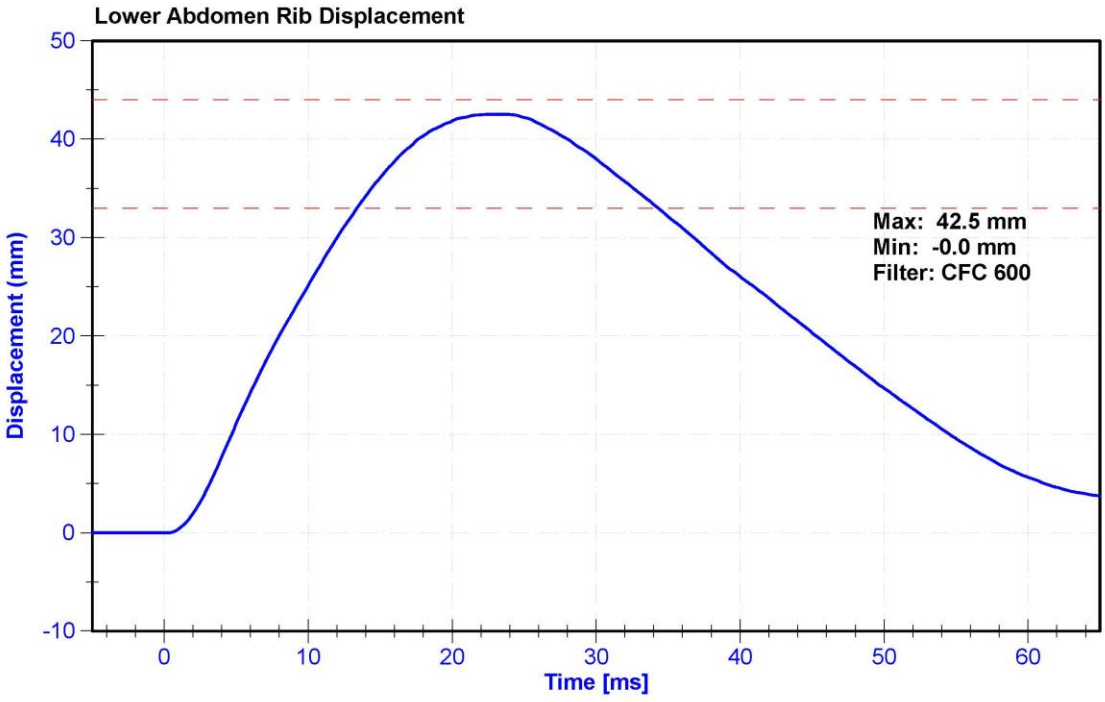
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	57.0	Pass
Velocity	4.2	4.4	m/s	4.32	Pass
Probe Acceleration	12	16	g's	14.0	Pass
Lateral Lower Spine Acceleration	9	14	g's	10.6	Pass
Upper Abdomen Rib Deflection	36	47	mm	42.4	Pass
Lower Abdomen Rib Deflection	33	44	mm	42.5	Pass

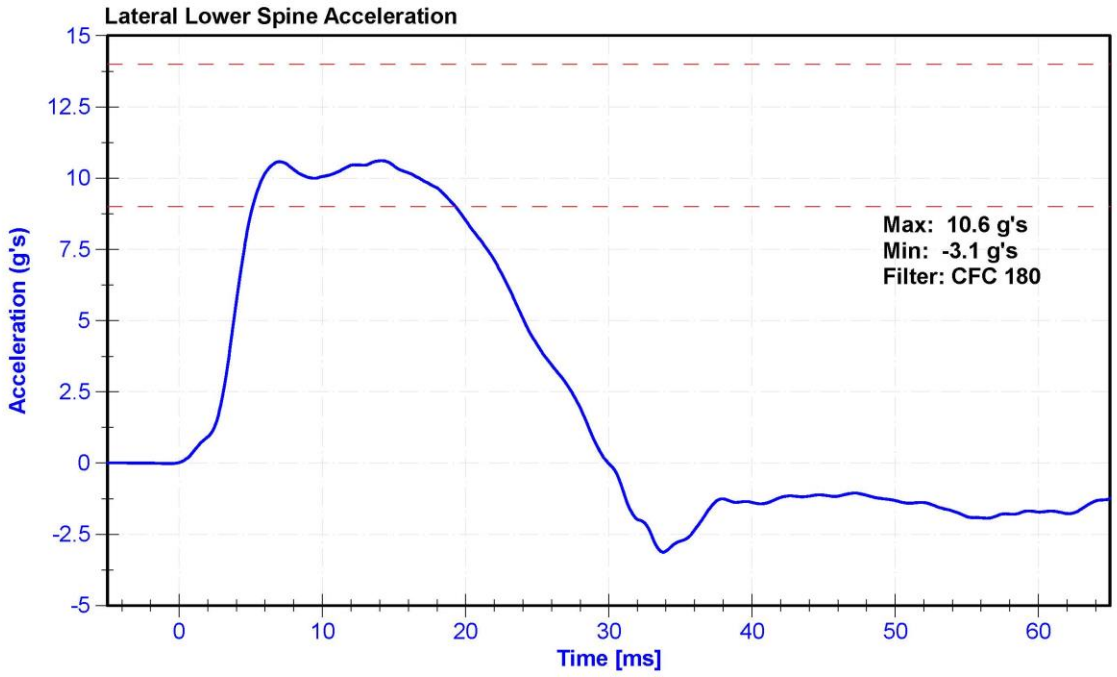
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A279031	5/8/2020	5/8/2021
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	4/20/2020	10/19/2020
Upper Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-308GFE	4/30/2020	10/29/2020
Lower Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-307GFE	4/30/2020	10/29/2020




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 42.4 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 42.5 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: 10.6 g's
Min: -3.1 g's
Filter: CFC 180

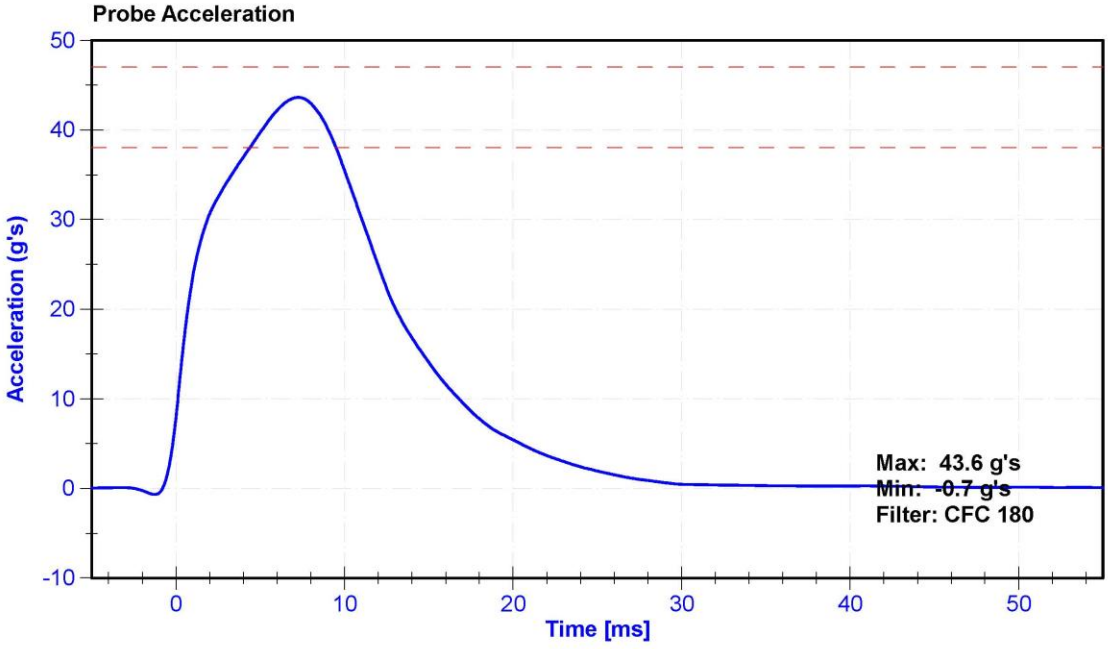
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

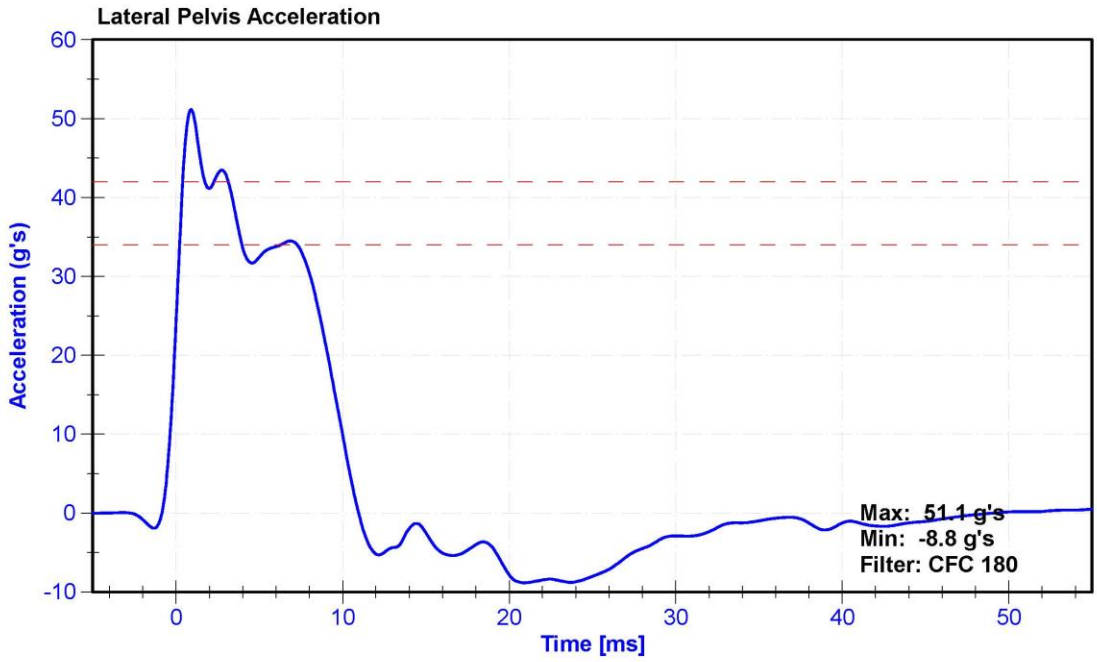
Results

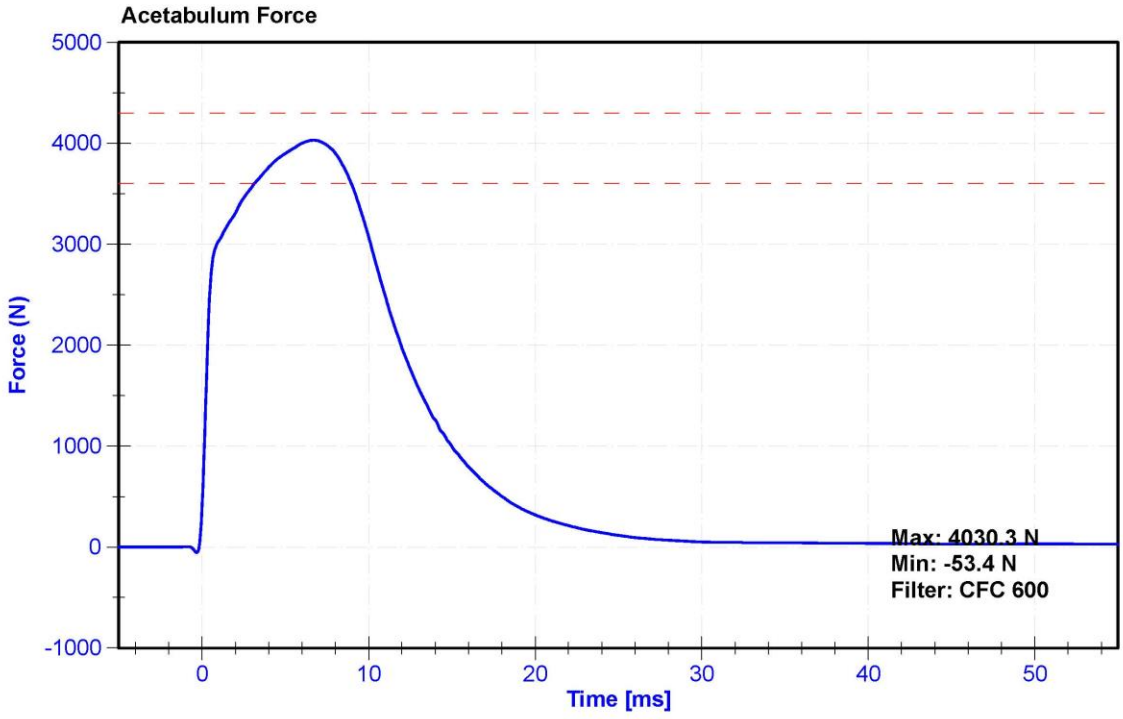
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	57	Pass
Velocity	6.6	6.8	m/s	6.64	Pass
Probe Acceleration	38	47	g's	43.6	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	34.5	Pass
Acetabulum Force	3600	4300	N	4030.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A279031	5/8/2020	5/8/2021
Pelvis Y Accelerometer	ENDEVCO 7264C	AC-P51731	4/20/2020	10/19/2020
Acetabulum Load Cell	Denton IF-520	LC-236Fy	3/18/2020	3/18/2021
Certification Plug	SACO	13194	8/8/2019	N/A
Crash Test Plug	SACO	13268	8/12/2019	N/A




Lateral Pelvis Acceleration
Acceleration (g's)
60
50
40
30
20
10
0
-10
0
10
20
30
40
50
Time [ms]
Max: 51.1 g's
Min: -8.8 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: 4030.3 N
Min: -53.4 N
Filter: CFC 600

SACO RESEARCH

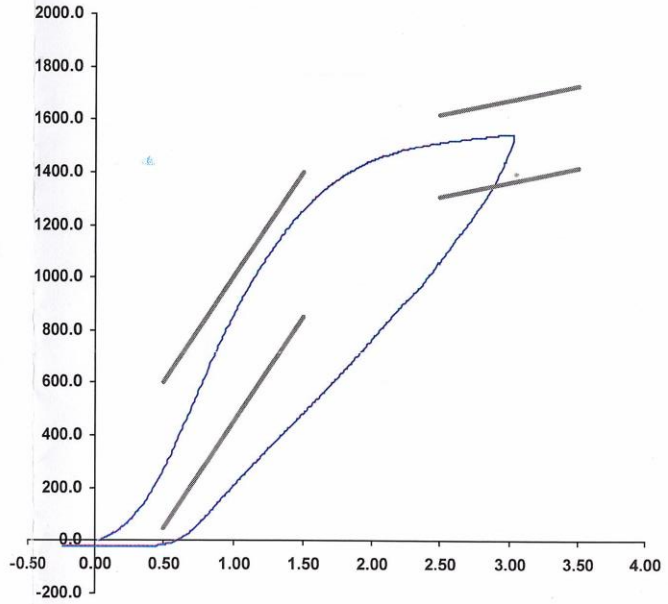
300
Crush
8/13/2020

SID-IIs Pelvis Plug Certification Test

Plug S/N 13268
Test Number 10691
Report Number 10728
Test Date 8/12/2019 10:19:00 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	287.48	50.00	600.00
Force @ 1.5 mm (N)	1,258.98	850.00	1,400.00
Force @ 2.5 mm (N)	1,513.66	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,544.45	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 Rat 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator

Part Number 180-4450

Template No 107 12-Aug-19
SACO Research

By : DC Date : 8/12/2019

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

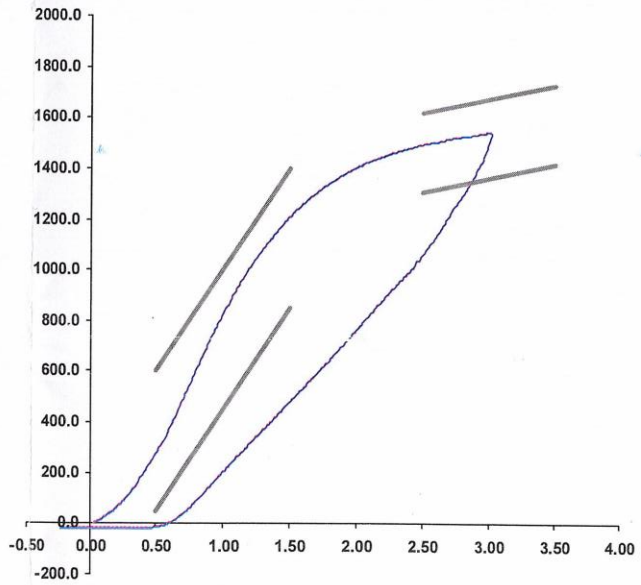
300 Cert 2
6/14/2020

SID-IIs Pelvis Plug Certification Test

Plug S/N 13194
Test Number 10589
Report Number 10624
Test Date 8/8/2019 12:50:37 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	287.41	50.00	600.00
Force @ 1.5 mm (N)	1,214.87	850.00	1,400.00
Force @ 2.5 mm (N)	1,494.96	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,542.77	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 131

Part Number 180-4450

Template No 107 08-Aug-19
SACO Research

By : DC Date : 8/8/2019

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

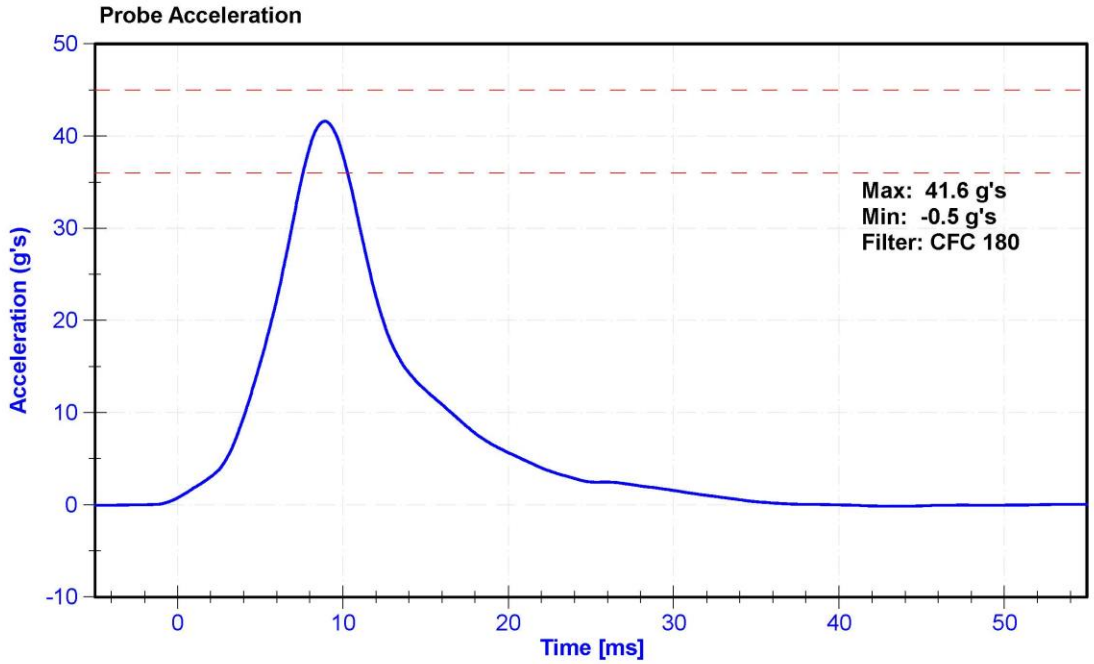
ATD Manufacturer	FTSS	Test Technician	K. Brogan
ATD Serial Number	300	Laboratory Supervisor	D.Reinhard

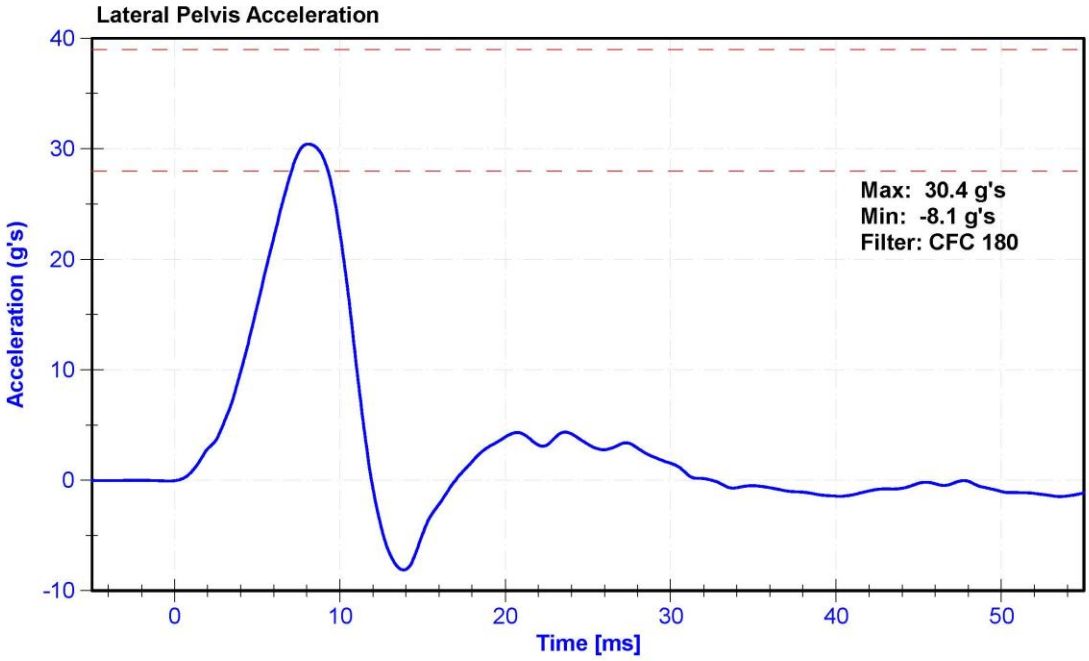
Results

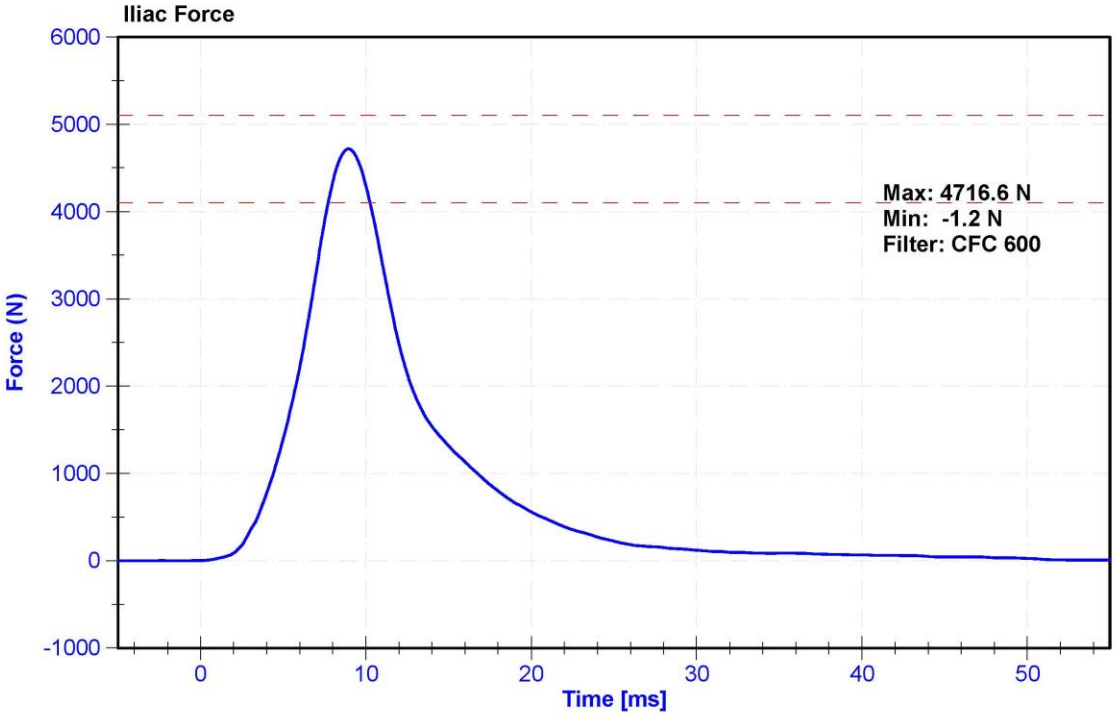
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	56.0	Pass
Velocity	4.2	4.4	m/s	4.22	Pass
Probe Acceleration	36	45	g's	41.6	Pass
Lateral Pelvis Acceleration	28	39	g's	30.4	Pass
Iliac Force	4100	5100	N	4716.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A279031	5/8/2020	5/8/2021
Pelvis Y Accelerometer	ENDEVCO 7264C	AC-P51731	4/20/2020	10/19/2020
Iliac Load Cell	DENTON 3228J	LC-281Fy	3/19/2020	3/19/2021




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 30.4 g's
Min: -8.1 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4716.6 N
Min: -1.2 N
Filter: CFC 600

APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N: F033		
			Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers	Primary	X	AC-P63861	ENDEVCO	5/19/2020
		Y	AC-P49216	ENDEVCO	5/19/2020
		Z	AC-P51303	ENDEVCO	5/19/2020
	Redundant	X	AC-P58868	ENDEVCO	5/19/2020
		Y	AC-P16755	ENDEVCO	5/19/2020
		Z	AC-P52132	ENDEVCO	5/19/2020
Thorax Rib Displacement Potentiometers	Upper	Y	DS-179GFE	Honeywell	5/20/2020
	Middle	Y	DS-185GFE	Honeywell	5/20/2020
	Lower	Y	DS-178GFE	Honeywell	5/20/2020
Abdomen Load Cells	Forward	Y	26311512 GFE	DENTON	3/19/2020
	Middle	Y	26311526 GFE	DENTON	3/19/2020
	Rear	Y	26311516 GFE	DENTON	3/19/2020
Lower Spine Accelerometers (T12)		X	AC-P52009	ENDEVCO	5/15/2020
		Y	AC-P49163	ENDEVCO	5/15/2020
		Z	AC-P52033	ENDEVCO	5/15/2020
Pubic Symphysis Load Cell		Y	LC-456Fy	DENTON	3/19/2020

Table 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N: 300		
				Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers		Primary	X	AC-P59018	ENDEVCO	4/20/2020
			Y	AC-P79189	ENDEVCO	4/20/2020
			Z	AC-P58777	ENDEVCO	4/20/2020
		Redundant	X	AC-P68057	ENDEVCO	4/20/2020
			Y	AC-P58986	ENDEVCO	4/20/2020
			Z	AC-P52025	ENDEVCO	4/20/2020
Displacement Potentiometers	Thoracic Rib	Upper	Y	DS-451GFE	Servo	4/30/2020
		Middle	Y	DS-040GFE	Servo	4/30/2020
		Lower	Y	DS-1156GFE	Servo	4/30/2020
	Abdominal Rib	Upper	Y	DS-308GFE	Servo	4/30/2020
		Lower	Y	DS-307GFE	Servo	4/30/2020
Lower Spine Accelerometers (T12)			X	AC-P64003	ENDEVCO	4/20/2020
			Y	AC-P64147	ENDEVCO	4/20/2020
			Z	AC-P58786	ENDEVCO	4/20/2020
Acetabulum Load Cell			Y	LC-236Fy	DENTON	3/18/2020
Iliac Wing Load Cell			Y	LC-281Fy	DENTON	3/19/2020
Pelvis Plug (struck side)				13228	SACO	8/12/2019
Pelvis Plug (non-struck side)				-	-	-

Table 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	A255112	MSI 1201-1000	5/5/2020
	Vehicle Center of Gravity	Y	A255126	MSI 1201-1000	5/5/2020
	Vehicle Center of Gravity	Z	A255143	MSI 1201-1000	5/5/2020
2	Right Sill at Front Seat	X	A229241	MSI 1201-1000	5/1/2020
	Right Sill at Front Seat	Y	A262051	MSI 1201-1000	5/1/2020
	Right Sill at Front Seat	Z	A280191	MSI 1201-1000	5/1/2020
3	Right Sill at Rear Seat	X	A217566	MSI 1201-1000	5/1/2020
	Right Sill at Rear Seat	Y	A280403	MSI 1201-1000	5/1/2020
	Right Sill at Rear Seat	Z	A280874	MSI 1201-1000	3/24/2020
4	Left Sill at Front Door	Y	A315994	MSI 1201-1000	3/9/2020
5	Left Sill at Rear Door	Y	A280000	MSI 1201-1000	5/5/2020
6	Left A-Post Lower	Y	A315780	MSI 1201-1000	3/31/2020
7	Left A-Post Middle	Y	A315078	MSI 1201-1000	3/31/2020
8	Left B-Post Lower	Y	A284322	MSI 1201-1000	5/6/2020
9	Left B-Post Middle	Y	A280873	MSI 1201-1000	3/24/2020
10	Front Seat Track	Y	A280920	MSI 1201-1000	3/31/2020
11	Rear Seat Track or Structure	Y	A280886	MSI 1201-1000	3/27/2020
12	Right Rear Occ. Compartment	Y	A315103	MSI 1201-1000	3/31/2020
13	Engine Block	X	A315821	MSI 1201-1000	4/1/2020
	Engine Block	Y	A315929	MSI 1201-1000	3/31/2020
14	Rear Floorpan Above Axle	X	A284351	MSI 1201-1000	5/6/2020
	Rear Floorpan Above Axle	Y	A315746	MSI 1201-1000	3/30/2020
	Rear Floorpan Above Axle	Z	A315989	MSI 1201-1000	3/20/2020

TABLE 4 – MDB Instrumentation

MDB Instrumentation		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	A315087	MSI 1201-1000	3/16/2020
MDB Center of Gravity	Y	A315096	MSI 1201-1000	3/17/2020
MDB Center of Gravity	Z	A315733	MSI 1201-1000	3/17/2020
Left Frame at Rear Axle Centerline	X	A315182	MSI 1201-1000	3/30/2020
Left Frame at Rear Axle Centerline	Y	A315715	MSI 1201-1000	3/30/2020