REPORT NUMBER: SINCAP-CAL-19-005

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

Toyota Motor Manufacturing Canada INC.
2019 Toyota RAV-4
Four Door SUV

NHTSA No: M20195103

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

May 29, 2019

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
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Prepared by: _____ Date: May 29, 2019
Zachary Granby, Test Engineer

Approved by: Vanessa Hansen Date: May 29, 2019
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: _____

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. SINCAP-CAL-19-005	***2. Government Accession No.***	***3. Recipient's Catalog No.***
4. Title and Subtitle Final Report of New Car Assessment Program Side Impact MDB Testing of a 2019 Toyota RAV-4 four door SUV NHTSA No.: M20195103		***5. Report Date*** May 29, 2019 ***6. Performing Organization Code*** CAL
Zachary Granby, Test Engineer Vanessa Hansen, Operations Manager		***8. Performing Organization Report No.*** CAL-DOT-2019-005
9. Performing Organization Name and Address Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225		***10. Work Unit No.*** ***11. Contract or Grant No.*** DTNH22-14-D-00352
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave., SE, Room W43-410 Washington, D.C. 20590		***13. Type of Report and Period Covered:*** Final Test Report March 7, 2019 - May 29, 2019 ***14. Sponsoring Agency Code*** NRM-110
15. *Supplementary Notes*		

16. Abstract

A 55/28, (61.90kph / 38.5 mph), 90^0 Moving Deformable Barrier NCAP Side Impact Test was conducted on the subject 2019 Toyota RAV-4 four door 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 March 7, 2019.

The impact velocity of the Moving Deformable Barrier (MDB) was 61.86 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 226mm 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	82.777
Maximum Thoracic Rib Deflection	mm	44	12.143
Total Abdominal Force	N	2500	614.473
Pubic Symphysis Force	N	6000	1092.397

Measurement Description	Passenger ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC_{36})	N/A	1000	145.597
Lower Spine Resultant Acceleration	G	82	48.540
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2257.568
Maximum Thoracic Rib Deflection	mm	38*	10.521
Maximum Abdominal Rib Deflection	mm	45*	25.377

* *Proposed IARV*

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

17. Key Words New Car Assessment Program (NCAP) Side Impact MDB ES-2re SID-IIs	***18. Distribution Statement*** Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave. SE Washington, D.C. 20590 e-mail: tis@nhtsa.dot.gov FAX: 202-493-2833

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UNCLASSIFIED	UNCLASSIFIED	192	

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SECTION 1

TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test is part of the MY 2019 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 2019 Toyota RAV-4 four door 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 2019 Toyota RAV-4 four door 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 61.86 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 March 7, 2019. Pre-test and post-test photographs of the test vehicle, the MDB and the dummies (ES-2re and SID-IIs) are included in this report.

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

The Dummies were instrumented in the following manner:

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

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

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

DUMMY INJURY VALUES

Measurement Description	Driver ATD (ES-2re)		
	Units	Threshold	Result
Head Injury Criteria (HIC36)		1000	82.777
Maximum Thorax Rib Deflection	mm	44	12.143
Combined Abdominal Force	N	2500	614.473
Pubic Symphysis Force	N	6000	1092.397

Measurement Description	Passenger ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC36)		1000	145.597
Lower Spine (T12) Resultant Acceleration	G	82	48.540
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2257.568
Maximum Thoracic Rib Deflection	mm	38*	10.521
Maximum Abdominal Rib Deflection	mm	45*	25.377

*Proposed IARV

SUPPLEMENTAL RESTRAINT INFORMATION

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

GENERAL COMMENTS:

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

Data Anomalies:

The following channel was questionable for

Driver Lower Spine T12 Y Acceleration, data loss after 27.2ms

Left B-Pillar Lower Y Acceleration, Exceeded calibration range at 12.5 ms

Left B-Pillar Middle Y Acceleration,Exceeded calibration range at 11.2 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: 2019 Toyota RAV-4 four door SUV
Test Program: NCAP Side MDB Impact Test
NHTSA No.: M20195103
Test Date: 3/7/2019

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20195103
Model Year	2019
Make	Toyota
Model	RAV-4
Body Style	SUV
VIN	2T3H1RFV3KW005554
Body Color	Red
Odometer Reading (km/mi)	108
Engine Displacement (L)	2.5
Type/No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	8-Speed
Overdrive	Yes
Final Drive	FWD
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes

Traction Control System (TCS)	Yes
Auto-Leveling System	No
Automatic Door Locks (ADL)	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 Passenger 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 Canada INC.
Date of Manufacture	01/19
Vehicle Type	MPV

GVWR (kg)	2090
GAWR Front (kg)	1150
GAWR Rear (kg)	1150

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3	-	5	
Capacity Weight (VCW) (kg)				410	(A)
DSC X 68.04 kg				340.2	(B)
Cargo Weight (RCLW) (kg)				69.3	(A-B)

VEHICLE SEAT TYPE

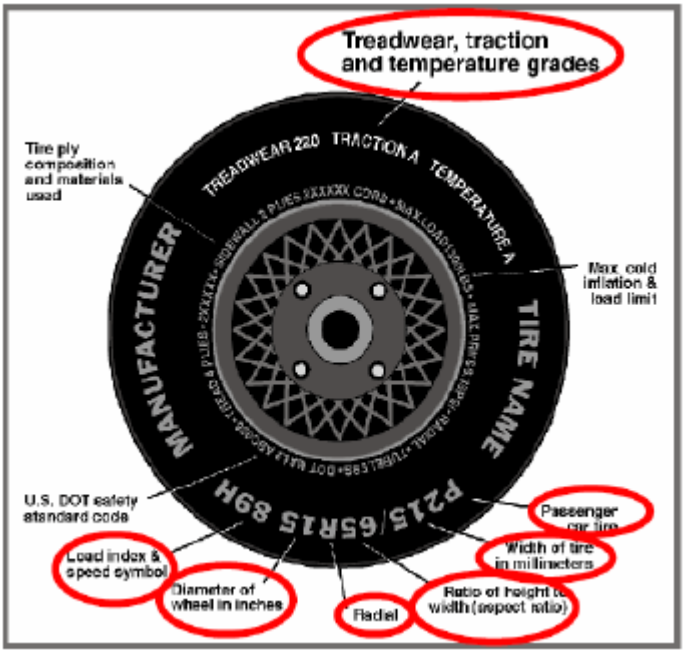
Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable W/ Lever	Adjustable W/ Knob
Front Seat	X					X	
Rear or Second Row Seat			X			X	
Third Row seat							

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

Test Vehicle:	2019 Toyota RAV-4 four door SUV	NHTSA No.:	M20195103
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/7/2019

VEHICLE TIRE INFORMATION

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



TIRE SIDEWALL INFORMATION

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	225/65R17	225/65R17
Tire Size on Vehicle	225/65R17	225/65R17
Tire Manufacturer	Dunlop	Dunlop
Tire Model	Grand Trek PT20	Grand Trek PT20
Treadwear	360	360
Traction	B	B
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Polyamide	2 Polyester, 2 Steel, 1 Polyamide
Load Index/Speed Symbol	102H	102H
Tire Material	Rubber	Rubber
DOT Safety Code Left	R8F5 DM9R3718	R8F5 DM9R3718
DOT Safety Code Right	R8F5 DM9R3718	R8F5 DM9R3718

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

Test Vehicle: 2019 Toyota RAV-4 four door SUV NHTSA No.: M20195103
Test Program: NCAP Side MDB Impact Test Test Date: 3/7/2019

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	305	300	300	300
Tire Placard	kPa	240	240	240	240
Owner's Manual	kPa	240	240	240	240
As Tested	kPa	240	240	240	240

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	458	311		503	392		498	392	
Right	kg	445	316		442	382		450	382	
Ratio	%	59	41		55	45		55	45	
Totals	kg	903	627	1530	945	774	1719	948	774	1722

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1530	(A)
Sum of Actual Weight of 1 ES2re and 1 P572 ATD (SID-IIs)	kg	127	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	69.3	(C)
Calculated Target Vehicle Test Weight (TVTW)	kg	1726.3	(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	878	876	Yes
RF	mm	881	882	Yes
RR	mm	882	877	Yes
LR	mm	874	870	Yes
Vehicle CG (Aft of Front Axle)	mm	1207	1209	
Vehicle CG (Left(+)/Right(-) from Longitudinal Centerline)	mm	27	33	

**** 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:	2019 Toyota RAV-4 four door SUV	NHTSA No.:	M20195103
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/7/2019

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	14
Spare Tire	15
Jack	5
Tail Light	1
Non Struck Windows	7
Ballast / Equipment Added	41

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

Test Vehicle:	2019 Toyota RAV-4 four door SUV	NHTSA No.:	M20195103
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/7/2019

SEAT POSITIONING

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

SCRL ANGLE RANGE

Seat	SCRL (°)		
	Max	Min	Mid
Driver Seat	15.0	9.8	12.4
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	12.4	13.5	Max	-	-	-
			Mid	12	13.5	15
			Min	-	-	-
Front Passenger Seat	Not Adjustable		Max	-	-	-
			Mid	-	-	-
			Min	-	-	-
Front Center Seat*	N/A	N/A	Max	-	-	-
			Mid	-	-	-
			Min	-	-	-
Struck Side Rear Seat	Fixed	Fixed	Max	-	-	-
			Mid	-	-	-
			Min	-	-	-
Non-Struck Side Rear Seat	Fixed	Fixed	Max	-	-	-
			Mid	-	-	-
			Min	-	-	-
Rear Center Seat*	Fixed	Fixed	Max	-	-	-
			Mid	-	-	-
			Min	-	-	-

**if applicable*

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

Test Vehicle: 2019 Toyota RAV-4 four door SUV NHTSA No.: M20195103
Test Program: NCAP Side MDB Impact Test Test Date: 3/7/2019

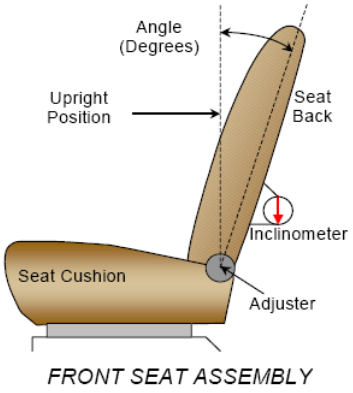
SEAT FORE / AFT POSITION

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

**if applicable*

SEAT BACK ANGLE ADJUSTMENT

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



FRONT SEAT ASSEMBLY

Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents*	Degrees	Detents*
Driver Seat w/ Seated Dummy	53.7	14 (0-13)	1.5	5
Front Passenger Seat	53.7	14 (0-13)	2.1	3
Front Center Seat*	N/A	N/A	N/A	N/A
Struck Side Rear Seat w/ Seated Dummy	6.0	2	11.4	0
Non-Struck Side Rear Seat	6.0	2	11.4	0
Rear Center Seat*	6.0	2	11.4	0

**if applicable*

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

Test Vehicle: 2019 Toyota RAV-4 four door SUV NHTSA No.: M20195103
Test Program: NCAP Side MDB Impact Test Test Date: 3/7/2019

SEAT BELT ANCHORAGE ADJUSTMENT

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

	Total # of Positions	Placed in Position #
Driver Seat	4	0
Rear Seat	Fixed	Fixed

HEAD RESTRAINT ADJUSTMENT

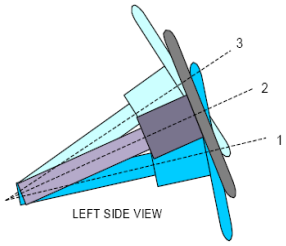
The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	3	0 – 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	20.6	
Geometric Center – Position 2	22.6	
Uppermost – Position 3	24.8	
Telescoping Steering Wheel Travel		60
Test Position	22.6	30

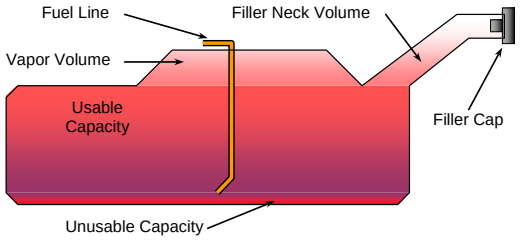


STEERING COLUMN ASSEMBLY

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: 2019 Toyota RAV-4 four door SUV NHTSA No.: M20195103
Test Program: NCAP Side MDB Impact Test Test Date: 3/7/2019

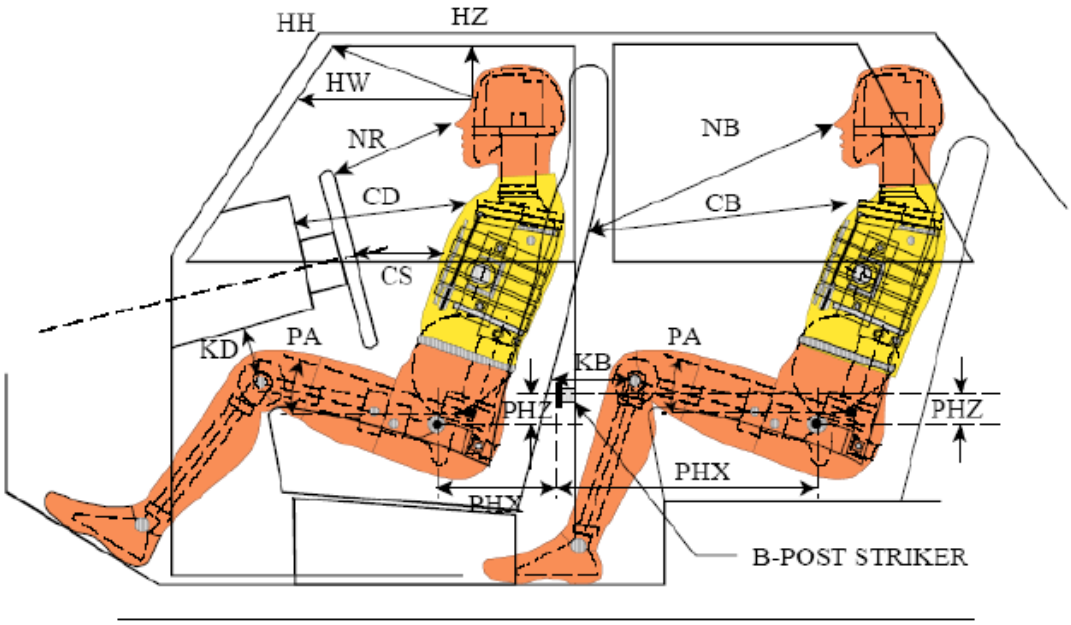
FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	55
Usable Capacity of "Optional Tank" (see Form No. 1)	N/A
Usable Capacity of Standard Tank (see Owner's Manual)	55
Usable Capacity of Optional Tank (see Owner's Manual)	N/A
93% of Usable Capacity	51.2
Actual Amount of Solvent Used in Test	51.2
1/3 of Usable Capacity	18.3

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:	2019 Toyota RAV-4 four door SUV	NHTSA No.:	M20195103
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/7/2019



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

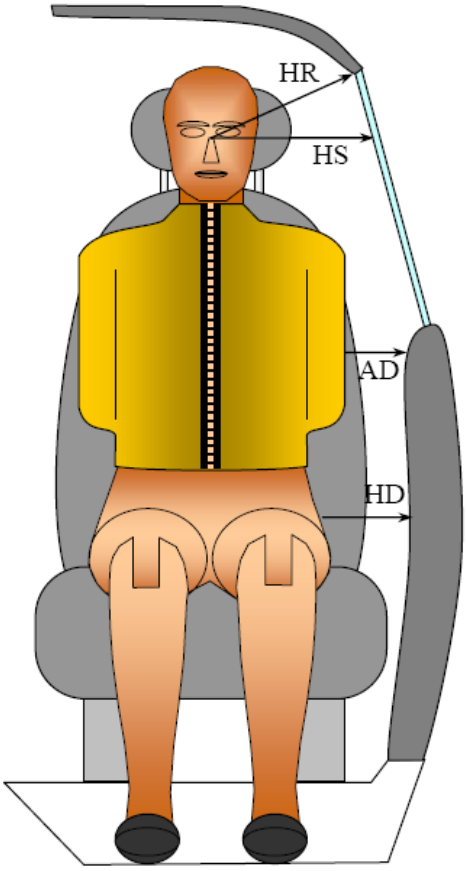
LEFT SIDE VIEW

DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Pass. Code	Description	Driver (Serial No. F034)		Passenger (Serial No.300)	
			Length (mm)	Angle	Length (mm)	Angle
HH		Header to Header	343			
HW		Header to Windshield	583			
HZ	HZ	Head to Roof Liner	162		320	
NR	NB	Nose to Rim/Seat Back	439		608	
CD	CB	Chest to Dash/Seat Back	524		596	
CS		Chest to Steering Wheel	326			
KD(L)/KDA(L)°	KB(L)/KBA(L)°	Left Knee to Dash/Seat Back	147	26.2	306	8.2
KD(R)/KDA(R)°	KB(R)/KBA(R)°	Right Knee to Dash/Seat Back	162	13.2	307	8.4
PAX°	PAX°	Pelvic Tilt Angle X		22.3		24.9
	PAY°	Pelvic Tilt Angle Y				0.3
PHX	PHX	Hip Point to Striker (X-Axis)	203		310	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	182		305	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle:	2019 Toyota RAV-4 four door SUV	NHTSA No.:	M20195103
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/7/2019



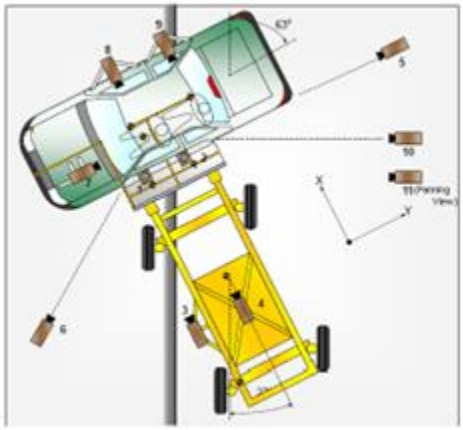
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver (Serial No. F034)	Passenger (Serial No. 300)
HR	Head to Side Header	mm	204	298
HS	Head to Side Window	mm	330	405
AD	Arm to Door	mm	100	170
HD	Hip Point to Door	mm	158	185

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2019 Toyota RAV-4 four door SUV NHTSA No.: M20195103
Test Program: NCAP Side MDB Impact Test Test Date: 3/7/2019



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	-292	366	-9370	12.5	1000
2	Overhead Close-up	-200	656	-9370	24	1000
3	Left Impact Point (MDB)	-1470	0	-847	25	1000
4	Side Overall (MDB)	-1140	878	-1587	8	1000
5	Rear	0	8388	-1364	24	1000
6	Left Front	-2943	5032	-1258	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.*

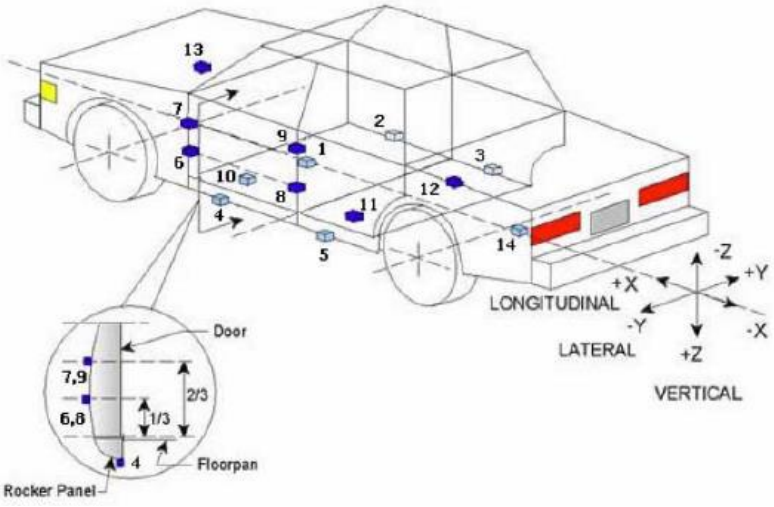
If applicable, explain why camera(s) did not operate as intended: All cameras operated normally

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: 2019 Toyota RAV-4 four door SUV NHTSA No.: M20195103
Test Program: NCAP Side MDB Impact Test Test Date: 3/7/2019



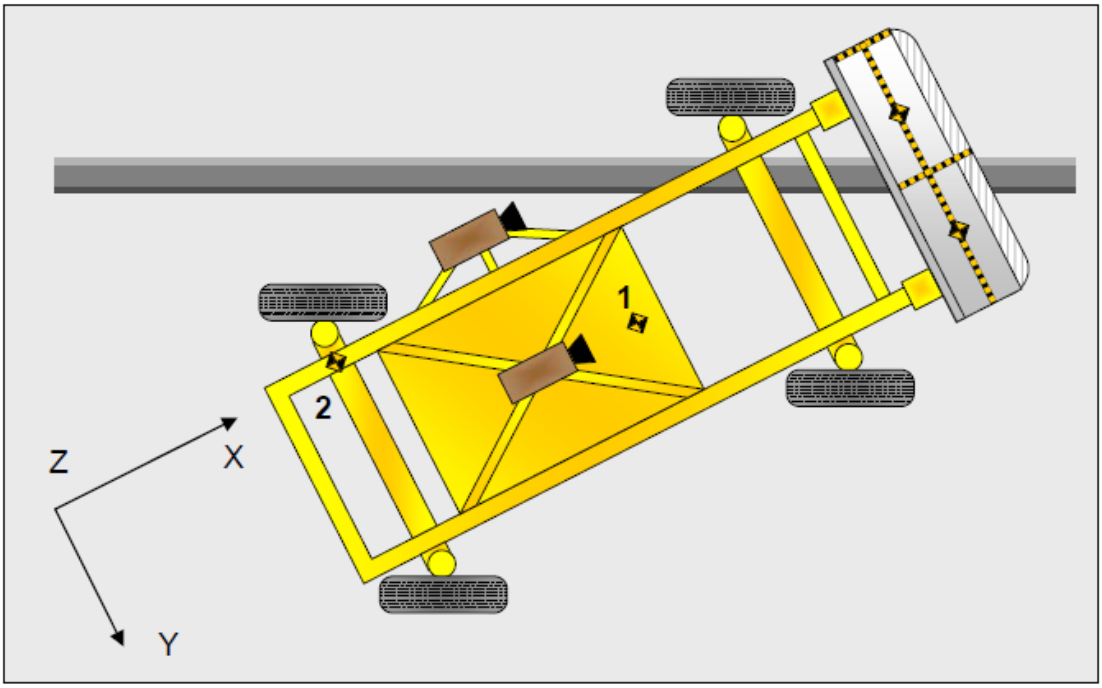
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2496	6	-86
2	Right Sill at Front Seat	2823	676	173
3	Right Sill at Rear Seat	1873	679	160
4	Left Sill at Front Door	2799	-671	178
5	Left Sill at Rear Door	1883	-672	166
6	A-Post Lower	3142	-650	-53
7	A-Post Middle	3119	-669	-563
8	B-Post Lower	2113	-685	-98
9	B-Post Middle	2074	-677	-516
10	Front Seat Track	2198	-564	133
11	Rear Seat Structure	1643	-505	174
12	Rt. Rear Occ. Compartment	1993	376	214
13	Engine Block	3838	171	-288
14	Rear Above Axle	887	-2	126

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:	2019 Toyota RAV-4 four door SUV	NHTSA No.:	M20195103
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/7/2019



MDB ACCELEROMETER LOCATIONS

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

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

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2019 Toyota RAV-4 four door SUV NHTSA No.: M20195103
Test Program: NCAP Side MDB Impact Test Test Date: 3/7/2019

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Seat Dummy (ES-2re)	Rear Seat Dummy (SID-IIs)
Face	Curtain Air Bag	Curtain Air Bag
Top of Head	Side Headliner	Curtain Air Bag, Headrest & Rear Center Seat Headrest
Left Side of Head	Curtain Airbag & Side Headliner	Curtain Air Bag
Back of Head	Head Restraint, Side Headliner & Curtain Air Bag	Head Restraint, Curtain Air Bag
Left Shoulder	Curtain Air Bag	Passenger Door
Upper Torso	Seat Back & Torso/Pelvis Air Bag	Passenger Door
Lower Torso	Seat Back & Torso/Pelvis Air Bag	Passenger Door
Left Hip	Seat Pan & Torso/Pelvis Air Bag	Passenger Door
Left Knee	Driver Door	No Contact

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 Window Shattered
Other Notable Effects	None

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

Test Vehicle: 2019 Toyota RAV-4 four door SUV NHTSA No.: M20195103
Test Program: NCAP Side MDB Impact Test Test Date: 3/7/2019

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		2687
Vertical Impact Reference Line (Aft of Front Axle - Intended Impact Point)	mm		403
Actual Impact Point (Aft of Frontal Axle)	mm		399
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact Point	4
Vertical Offset (+ down / - up)	mm	+/- 20 of Intended Impact Point	2

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle: 2019 Toyota RAV-4 four door SUV NHTSA No.: M20195103
Test Program: NCAP Side MDB Impact Test Test Date: 3/7/2019

MDB SPECIFICATIONS

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

MDB WEIGHTS

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

SPEED AND ANGLE AT IMPACT DATA

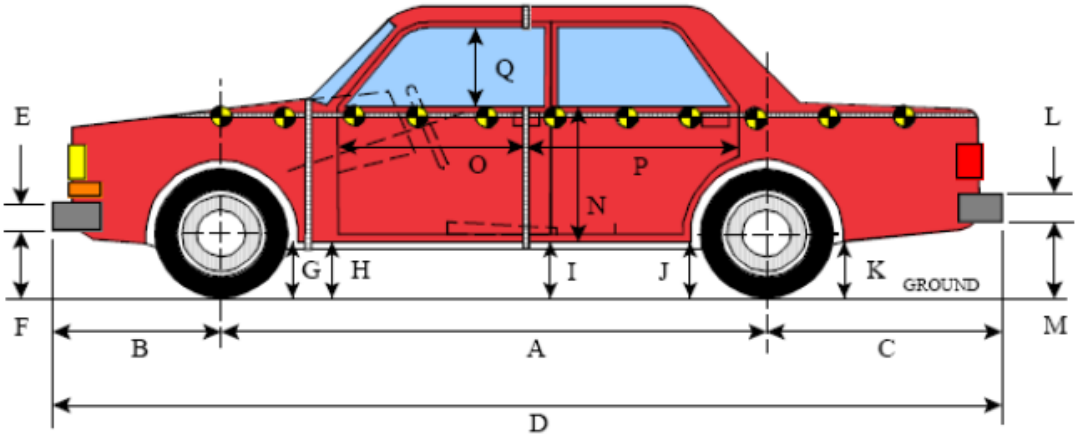
Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.10 to 62.70	61.86
Trap No. 2 Velocity (Redundant)	km/h	61.10 to 62.70	61.90
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.0
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63.0
MDB Crabbed angle 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	Left	246
B	Top of Bumper	533	800	Left	185
C	Mid-Level	686	800	Left	148
D	Top of Stack	813	800	Left	198

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle:	2019 Toyota RAV-4 four door SUV	NHTSA No.:	M20195103
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/7/2019



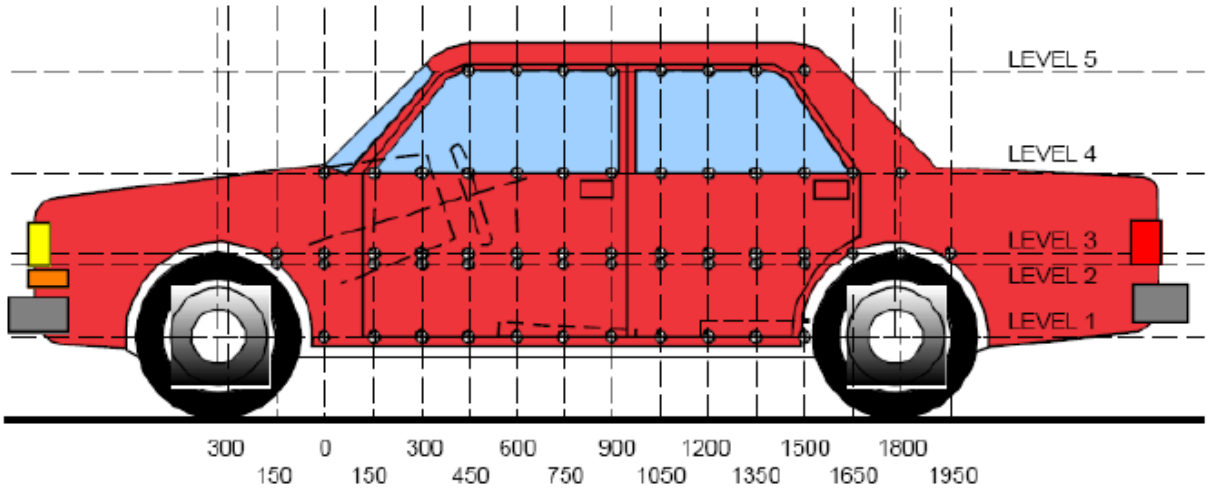
LEFT SIDE VIEW
All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3mm

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2687	2667	-20
B	Front Axle to FSOV	914	942	28
C	Rear Axle to RSOV	985	981	-4
D	Total Length at Centerline	4588	4590	2
E	Front Bumper Thickness	85	83	-2
F	Front Bumper Bottom to Ground	511	519	8
G	Sill Height at Front Wheel Well	291	280	-11
H	Sill Height at Front Door Leading Edge	271	302	31
I	Sill Height at B Pillar	273	275	2
J1	Sill Height at Rear Wheel Well	298	290	-8
J2	Pinch Weld Height at Rear Wheel Well	270	270	0
K	Sill Height Aft of Rear Wheel Well	302	307	5
L	Rear Bumper Thickness	165	170	5
M	Rear Bumper Bottom to Ground	433	440	7
N	Sill Height to Window Bottom of Front Window Sill	852	813	-39
O	Front Door Leading Edge to Impact CL	727	726	-1
P	Rear Door Trailing Edge to Impact CL	1385	1336	-49
Q	Front Window Opening	457	479	22
R	Right Side Length	4553	4559	6
S	Left Side Length	4552	4550	-2
T	Maximum Vehicle Width	1823	1688	-135

DATA SHEET NO. 11
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2019 Toyota RAV-4 four door SUV
NHTSA No.: M20195103
Test Program: NCAP Side MDB Impact Test
Test Date: 3/7/2019



LEFT SIDE VIEW

MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	370	86	1650
2	Driver Hip Point	mm	712	224	1650
3	Mid-Door	mm	782	226	1650
4	Window Sill	mm	1105	100	1650
5	Window Top	mm	1603	2	1650

*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: 2019 Toyota RAV-4 four door SUV NHTSA No.: M20195103
Test Program: NCAP Side MDB Impact Test Test Date: 3/7/2019

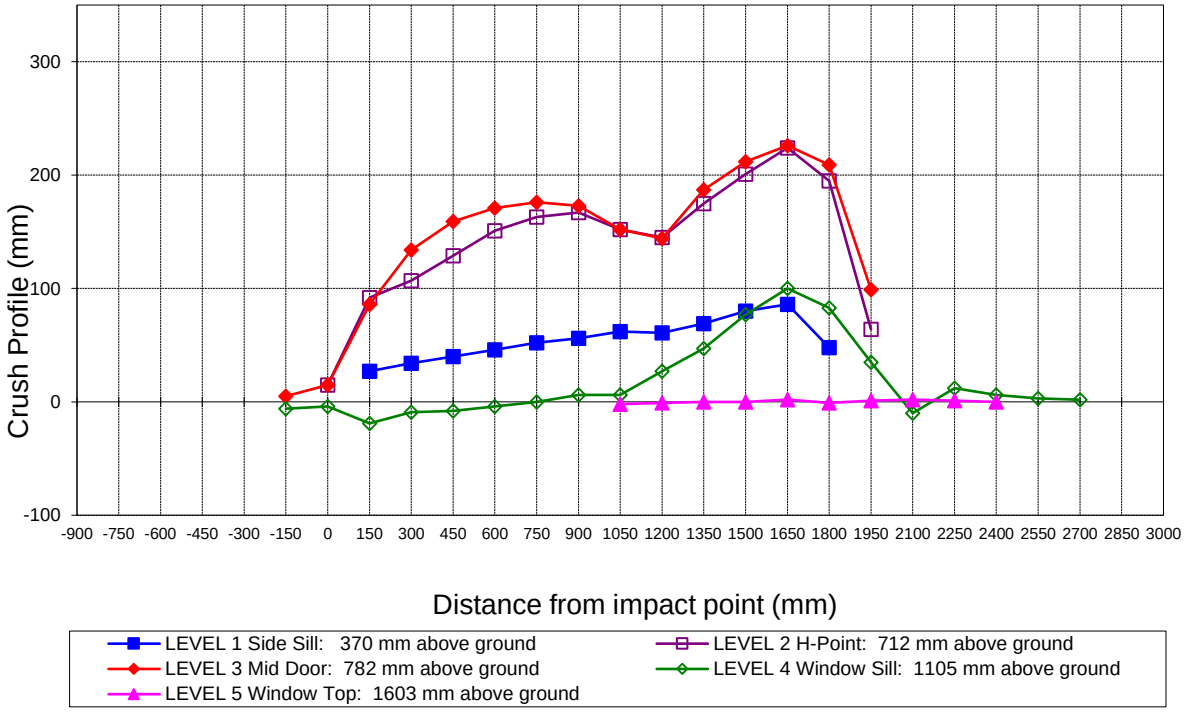
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900															
-750															
-600															
-450															
-300															
-150			927	798				922	804				5	-6	
0		922	922	819			907	909	823			15	13	-4	
150	881	917	915	821		854	825	829	840		27	92	86	-19	
300	886	916	916	821		852	809	782	830		34	107	134	-9	
450	889	917	917	824		849	788	758	832		40	129	159	-8	
600	892	916	924	836		846	765	753	840		46	151	171	-4	
750	894	916	925	846		842	753	749	846		52	163	176	0	
900	895	914	924	855		839	747	751	849		56	167	173	6	
1050	897	912	917	862	635	835	760	765	856	637	62	152	152	6	-2
1200	895	909	911	867	640	834	764	767	840	641	61	145	144	27	-1
1350	895	906	907	869	639	826	731	720	822	639	69	175	187	47	0
1500	892	909	907	872	637	812	708	695	795	637	80	201	212	77	0
1650	890	914	913	870	631	804	690	687	770	629	86	224	226	100	2
1800	887	922	921	867	626	839	727	712	784	627	48	195	209	83	-1
1950		927	927	857	620		863	828	822	619		64	99	35	1
2100				867	621				877	619				-10	2
2250				864	625				852	624				12	1
2400				865	605				859	605				6	0
2550				866					863					3	
2700				855					853					2	
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

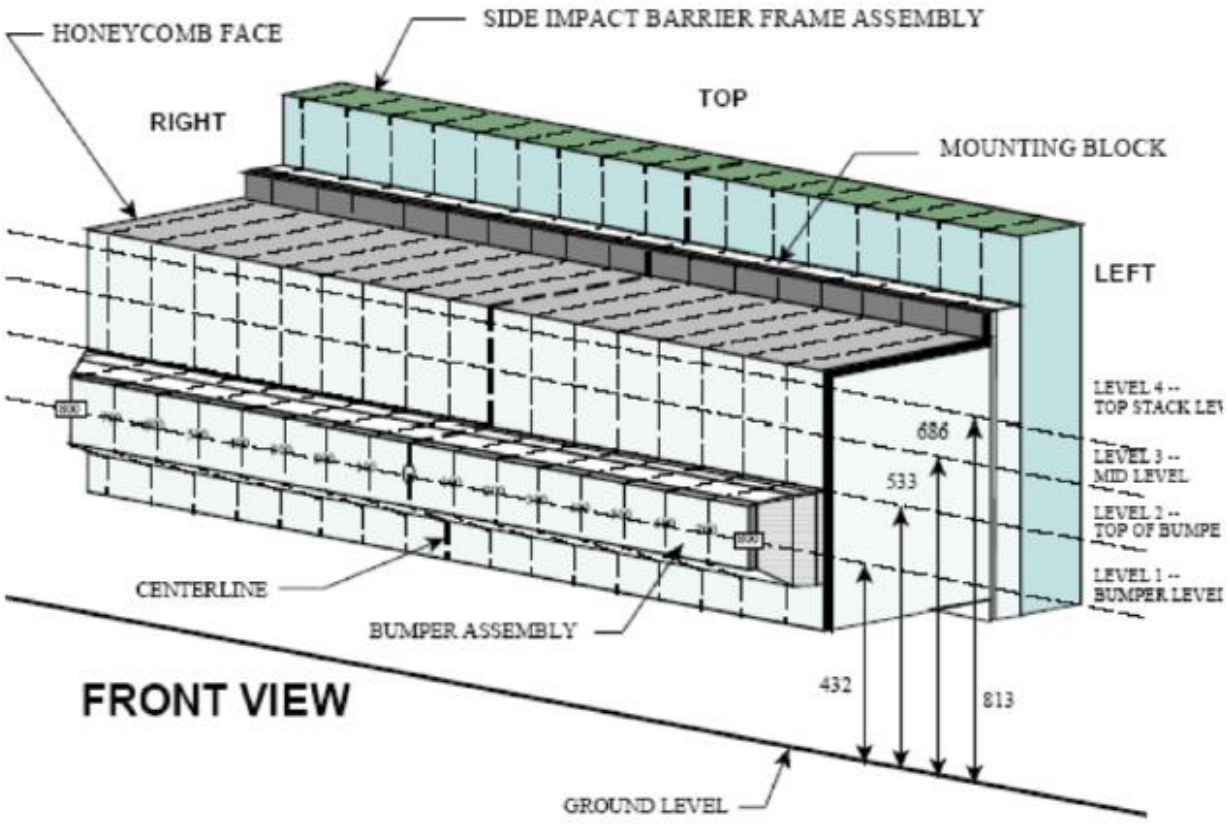
Test Vehicle:	2019 Toyota RAV-4 four door SUV	NHTSA No.:	M20195103
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/7/2019



Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle:	2019 Toyota RAV-4 four door SUV	NHTSA No.:	M20195103
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/7/2019



NOTE: Dimensions are shown in millimeters, mm

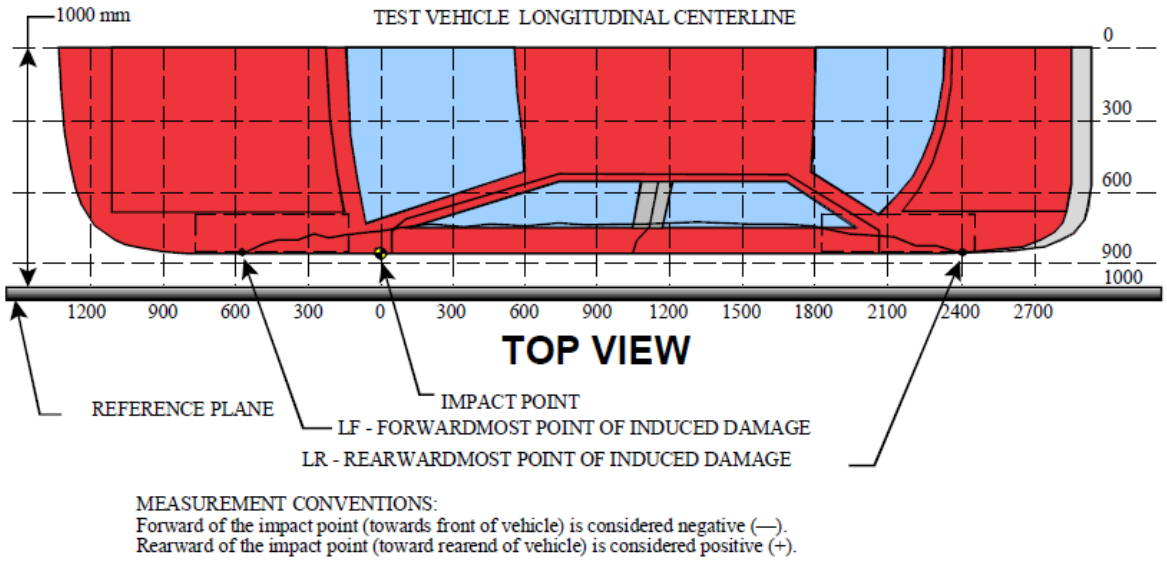
DEFORMABLE BARRIER STATIC CRUSH

Stack Level	Distance Right of Center								C/L	Distance Left of Center							
	800	700	600	500	400	300	200	100	0	100	200	300	400	500	600	700	800
1	205	204	203	204	206	207	209	210	213	215	216	216	217	218	221	230	246
2	119	124	125	128	129	122	132	135	131	134	133	135	137	138	139	145	185
3	43	31	39	52	67	94	95	93	74	66	67	71	76	93	110	122	148
4	39	27	35	50	72	104	123	103	96	75	79	86	90	104	116	157	198

DATA SHEET NO. 13
VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle:	2019 Toyota RAV-4 four door SUV	NHTSA No.:	M20195103
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/7/2019

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



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

VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance From Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	-150	3	78	73	5
2	270	3	209	84	125
3	690	3	249	75	174
4	1110	3	234	85	149
5	1530	3	307	92	215
6	1950	3	172	73	99

MDB DAMAGE PROFILE DISTANCES

DPD	Distance From Center of MDB	Level	Post-Test (mm)*
1	800 mm left of center	1	246
2	480 mm left of center	1	218
3	160 mm left of center	1	216
4	160 mm right of center	1	208
5	480 mm right of center	1	204
6	800 mm right of center	1	205

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

Test Vehicle:	2019 Toyota RAV-4 four door SUV	NHTSA No.:	M20195103
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/7/2019
Test Time:	10:18 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°	67	300	367
180° to 270°	64	300	364
270° to 360°	70	300	370

FMVSS NO. 301 ROLLOVER SPILLAGE TABLE

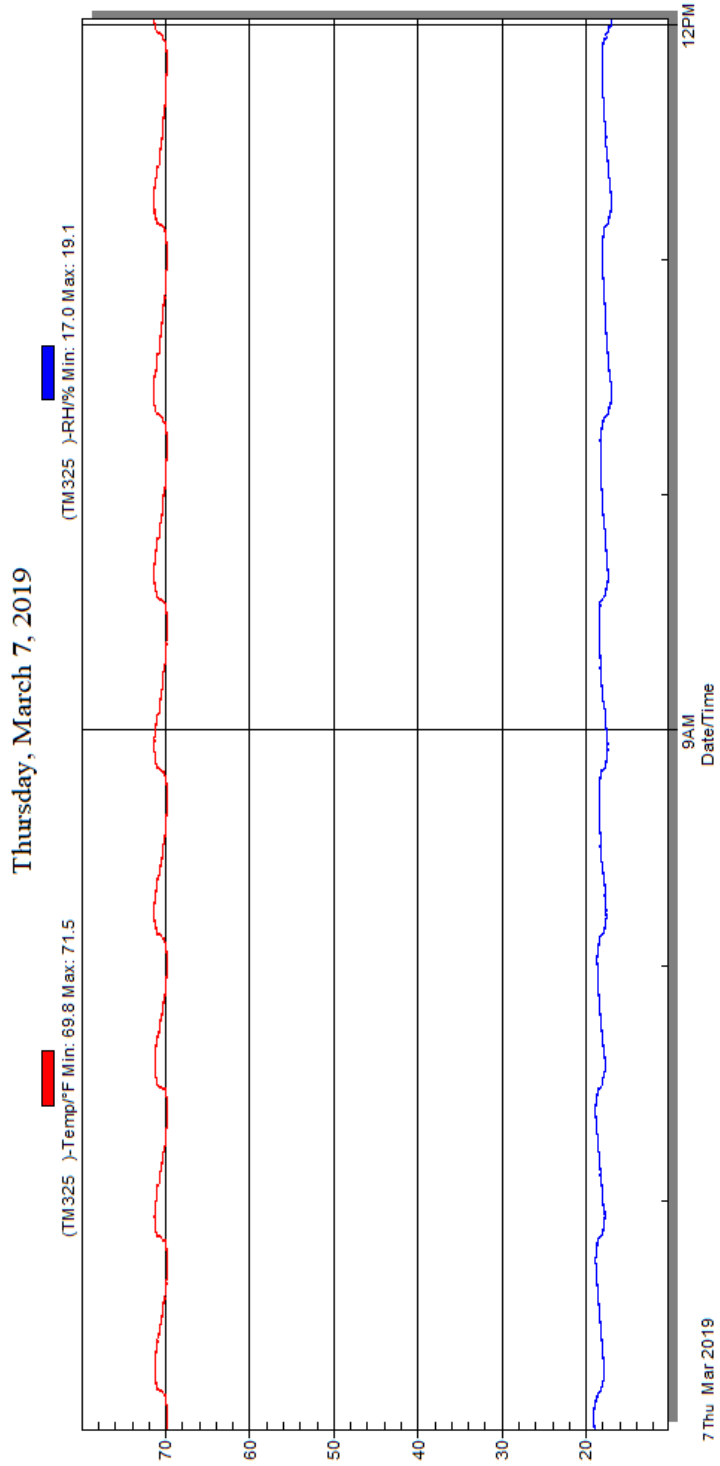
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

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:	2019 Toyota RAV-4 four door SUV	NHTSA No.:	M20195103
Test Program:	NCAP Side MDB Impact Test	Test Date:	3/7/2019



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

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

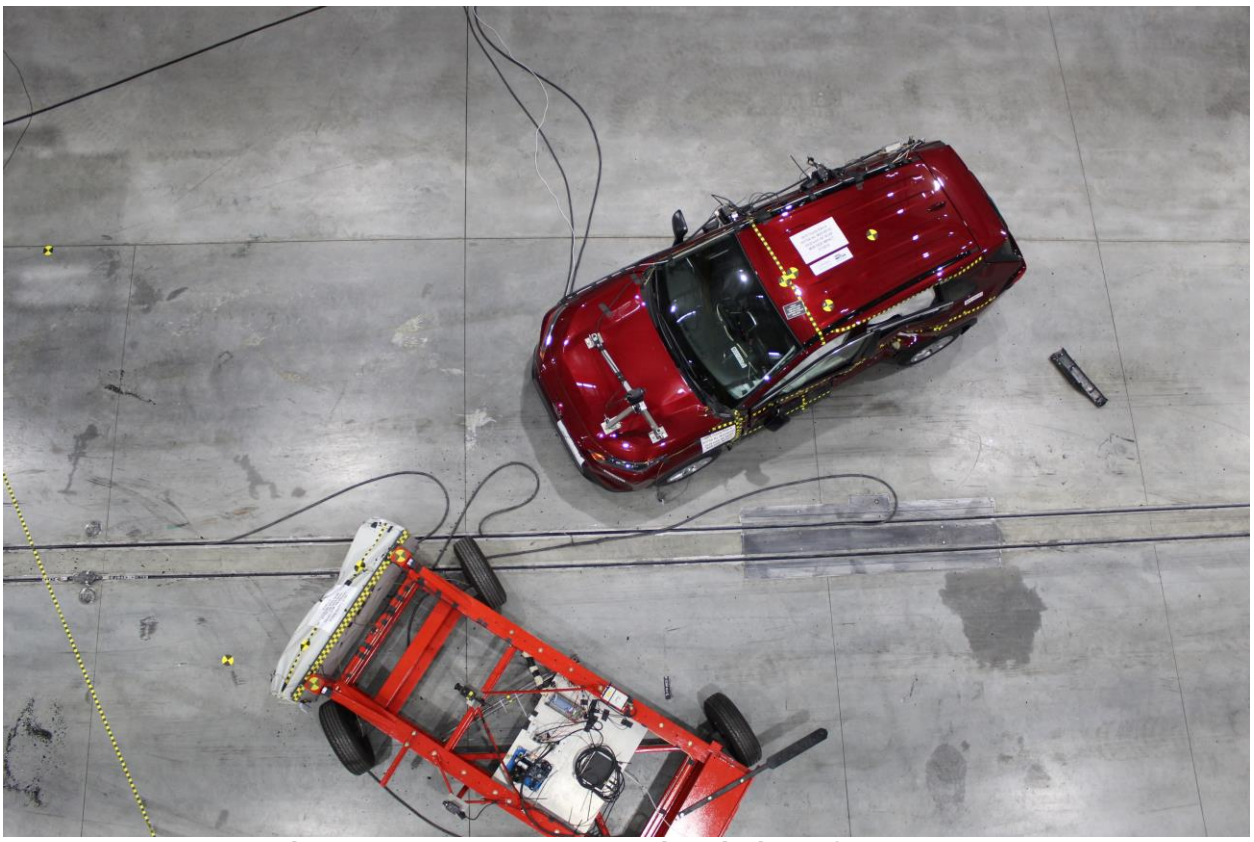


Figure A-16: Post-Test Overhead View of Test Area

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

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

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

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

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

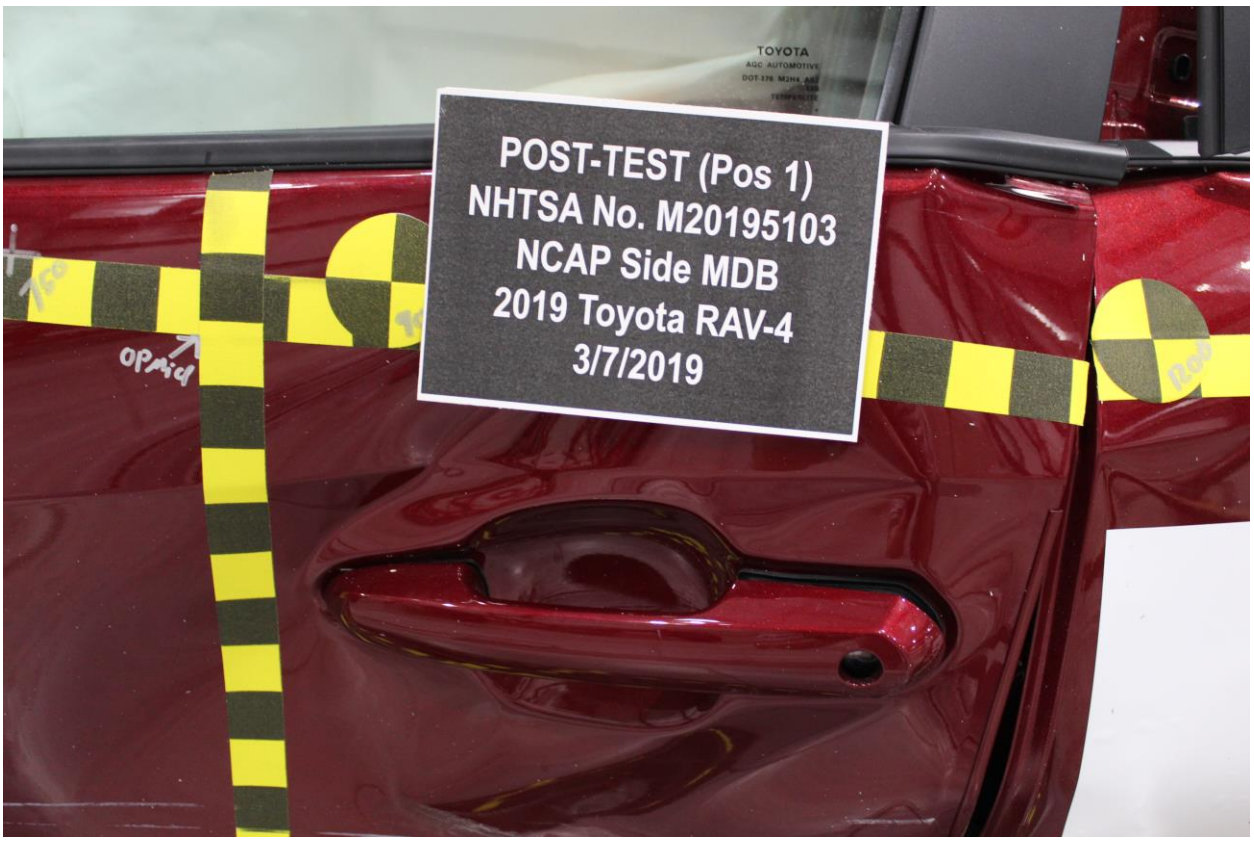


Figure A-22: Post-Test Left Front Door Latch Close-Up

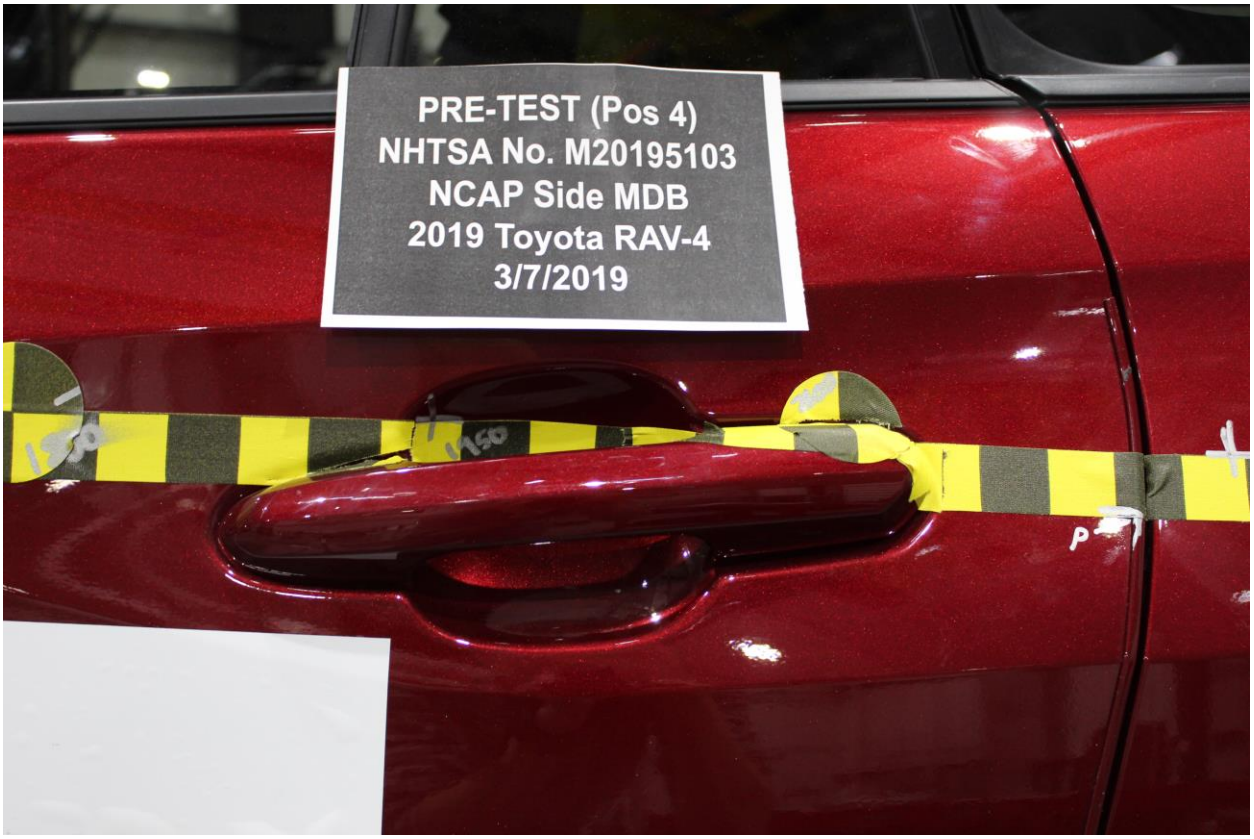


Figure A-23: Pre-Test Left Rear Door Latch Close-Up

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

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

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

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

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

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

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

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

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

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

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

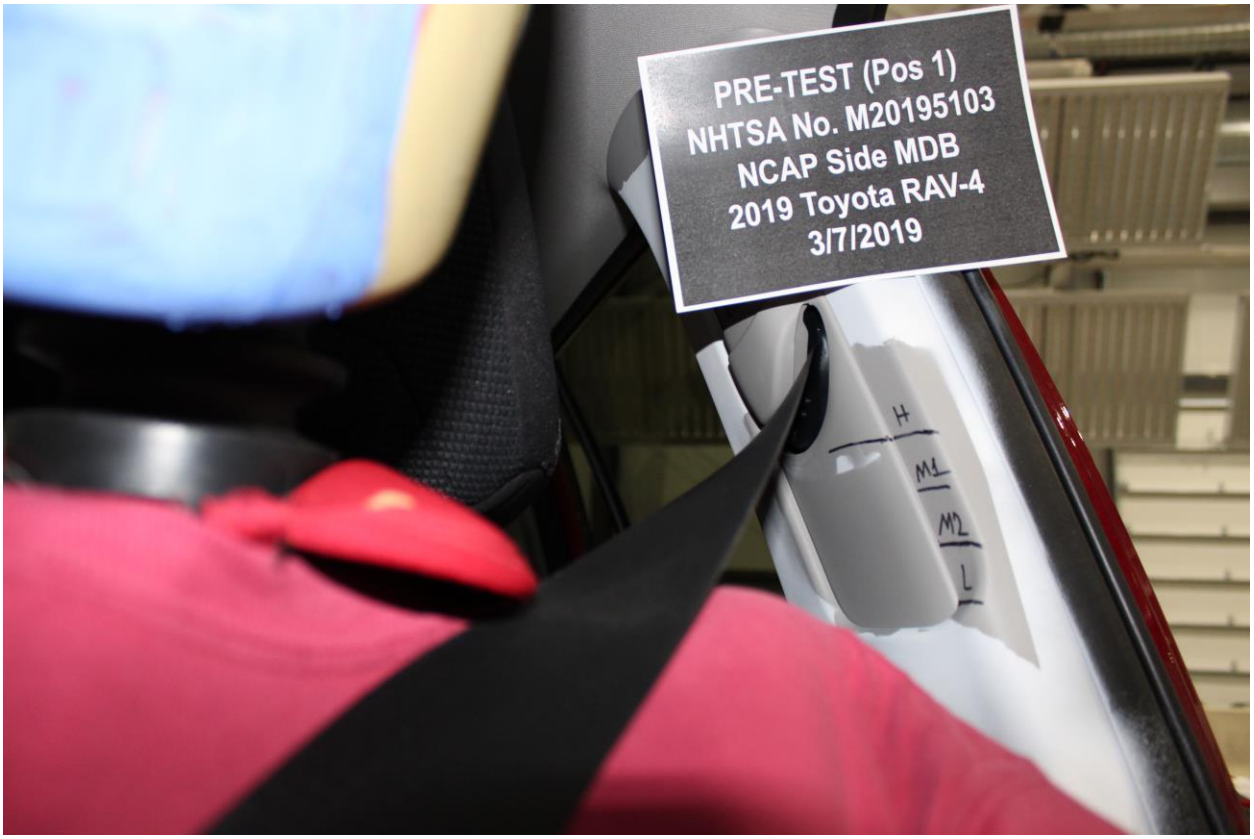


Figure A-35: Pre-Test View of Belt Anchorage for Driver Dummy

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

Figure A-37: View of Disengaged Parking Brake

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

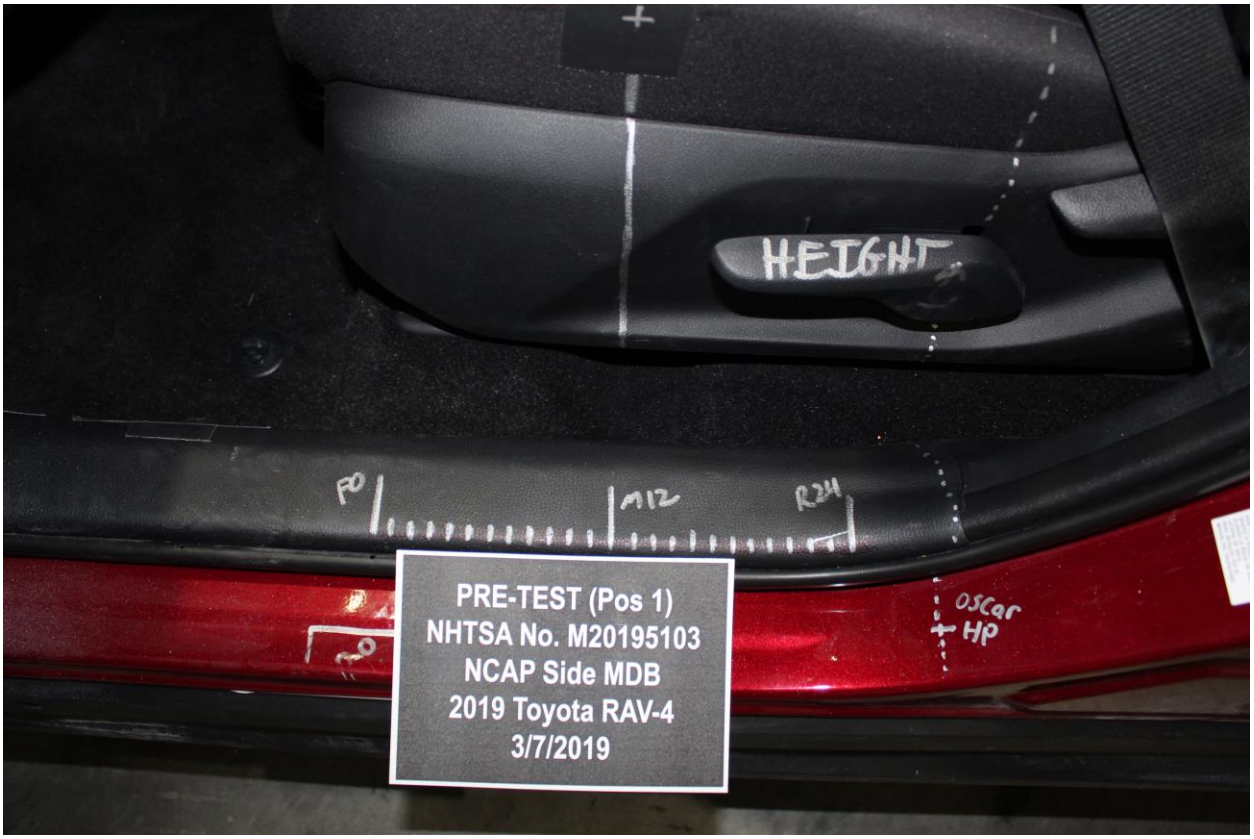


Figure A-39: Pre-test Close-Up Left Side View of Driver Seat Track

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

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

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

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

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

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

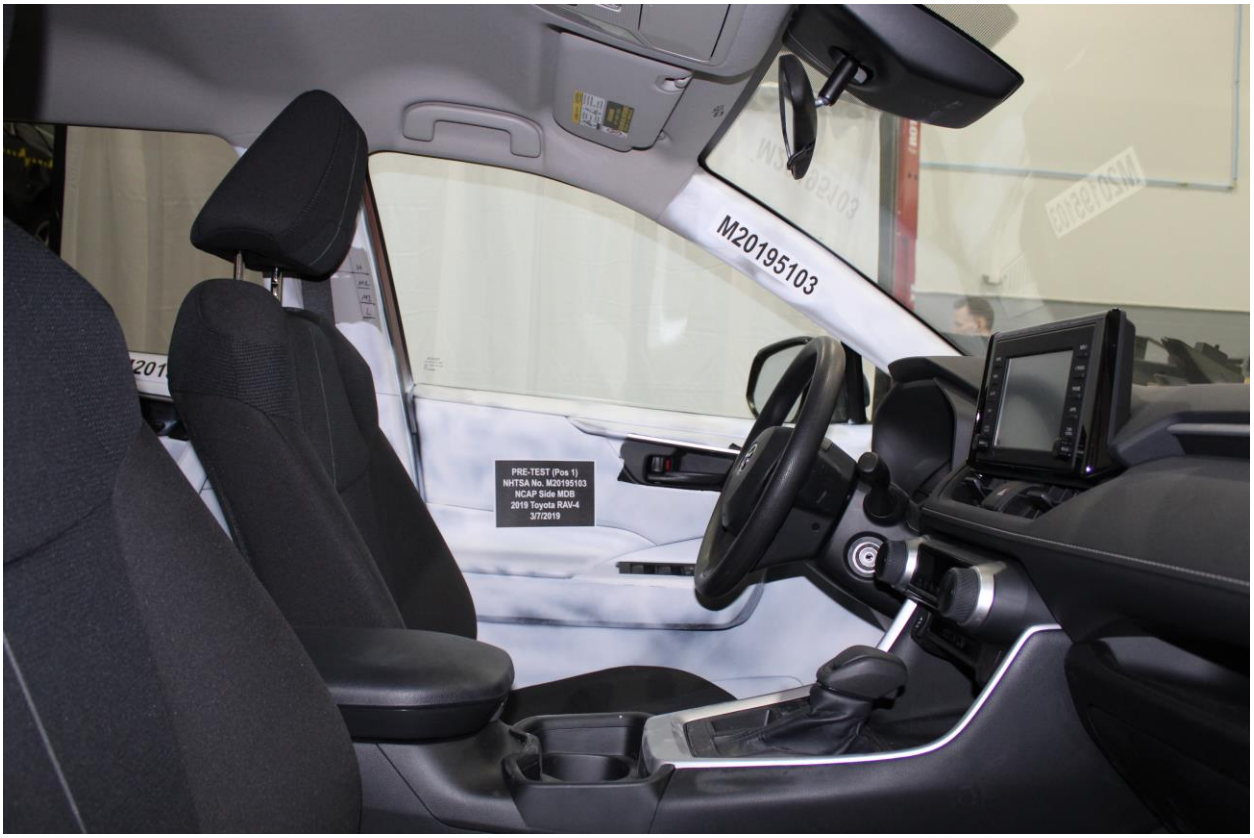


Figure A-46: Pre-Test Driver Inner Door Panel View

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

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

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

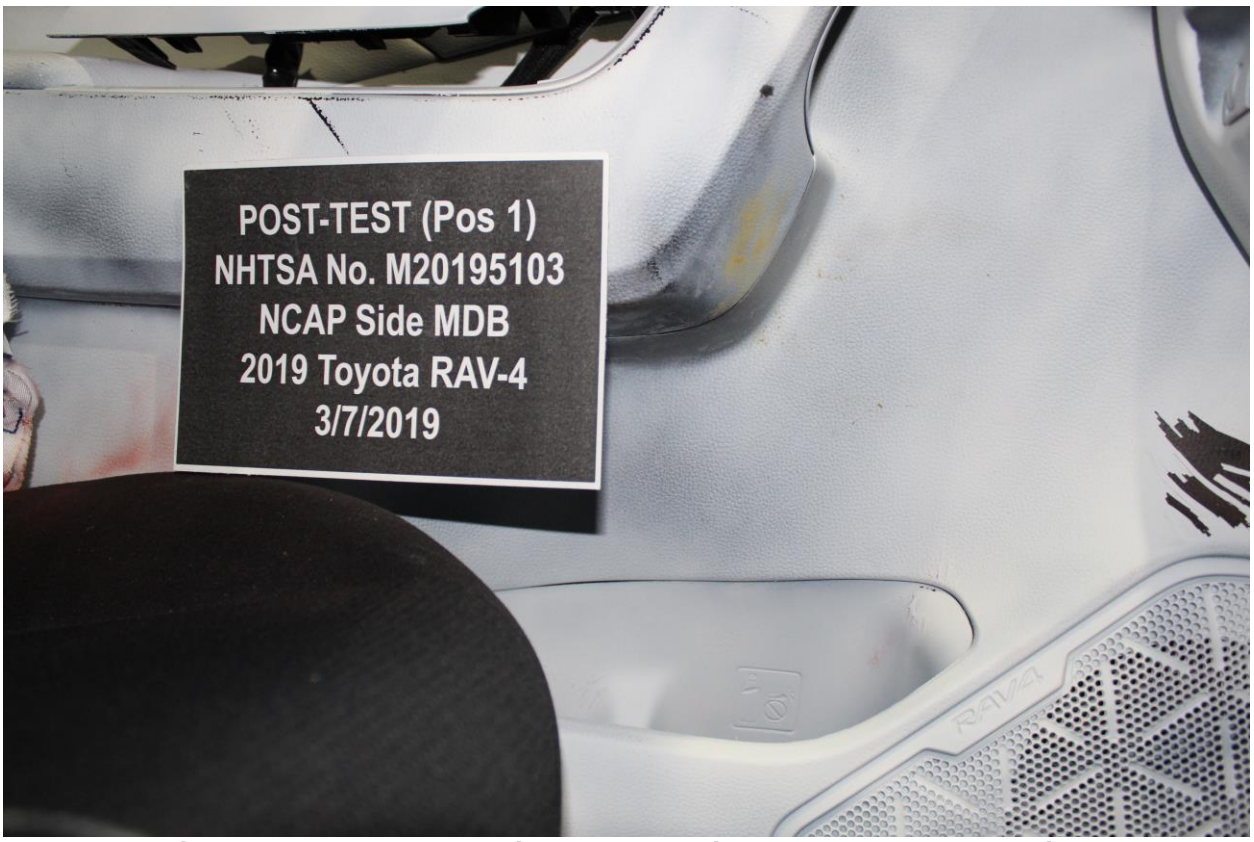


Figure A-54: Post-Test Driver Dummy Close-Up Knee Contact View

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

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

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

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

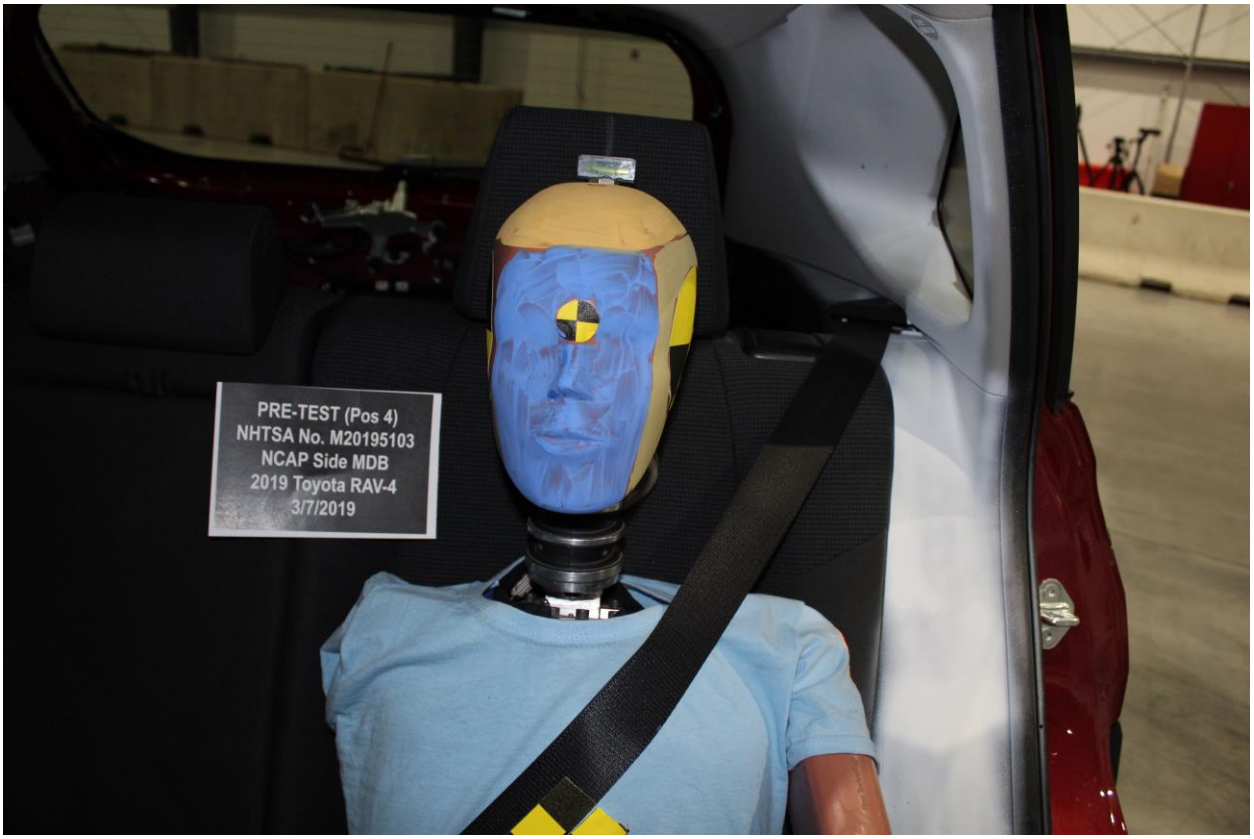


Figure A-59: Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint

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

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

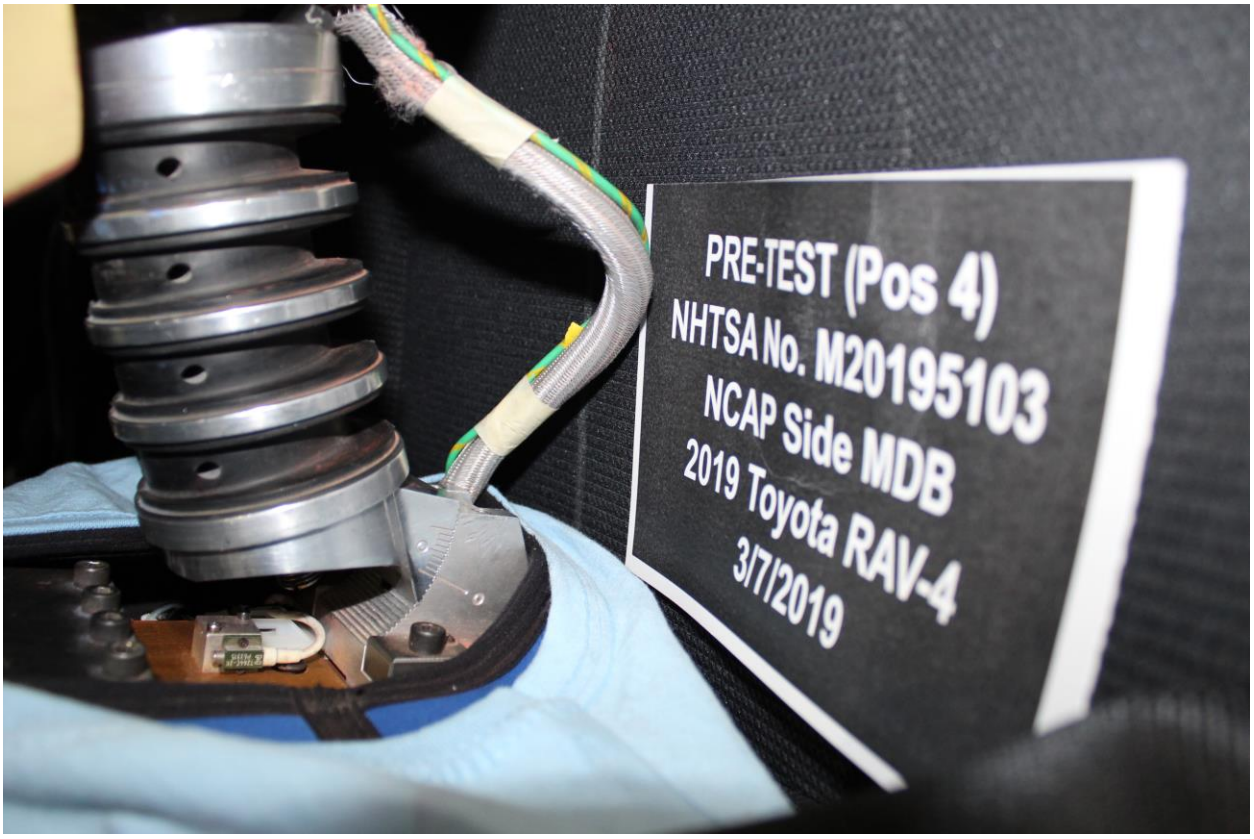


Figure A-62: Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket

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

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

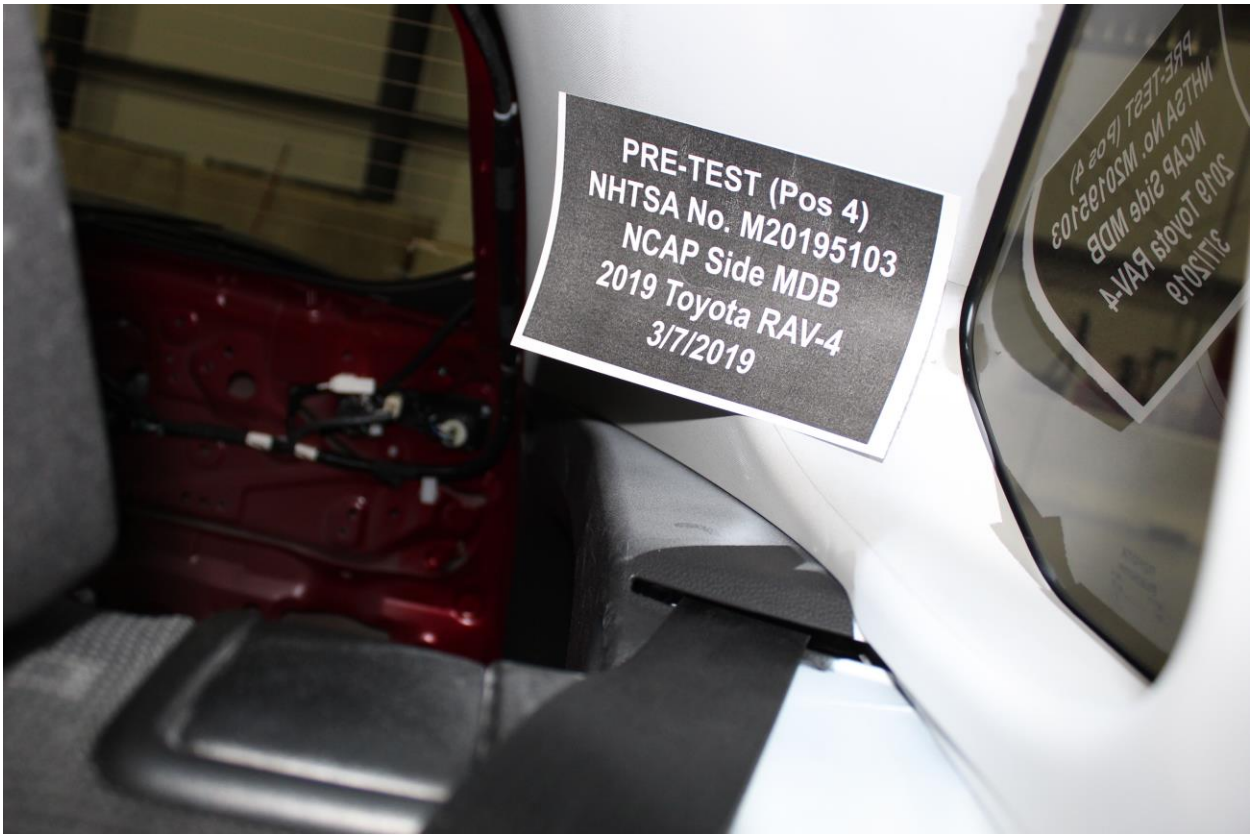


Figure A-65: Pre-Test View of Belt Anchorage for Rear Passenger Dummy

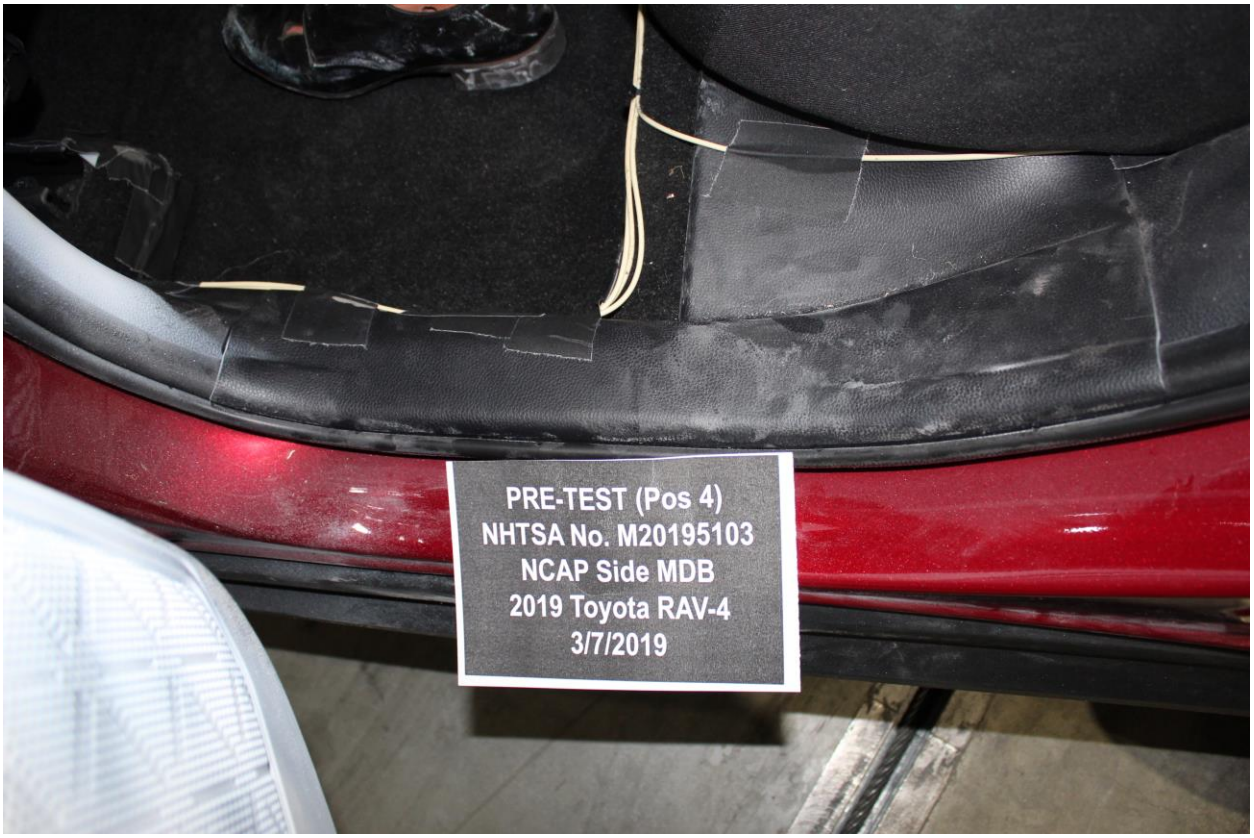


Figure A-66: Pre-Test Close-Up Left Side View of Rear Passenger Seat Track

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

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

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

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

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

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

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

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

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

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

Photo Not Applicable

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

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

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

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

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

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

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

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

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

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

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

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

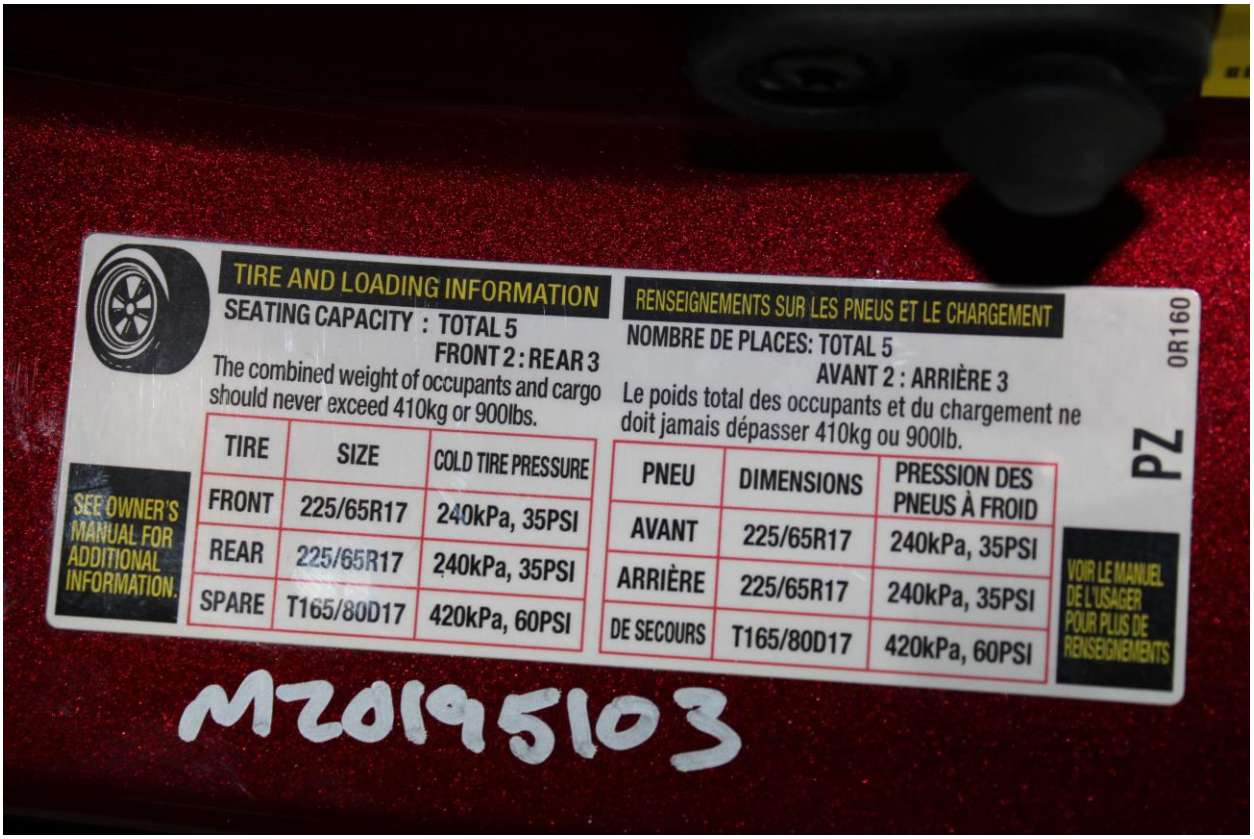


Figure A-93: Close-Up View of Vehicle's Tire Information Placard or Label

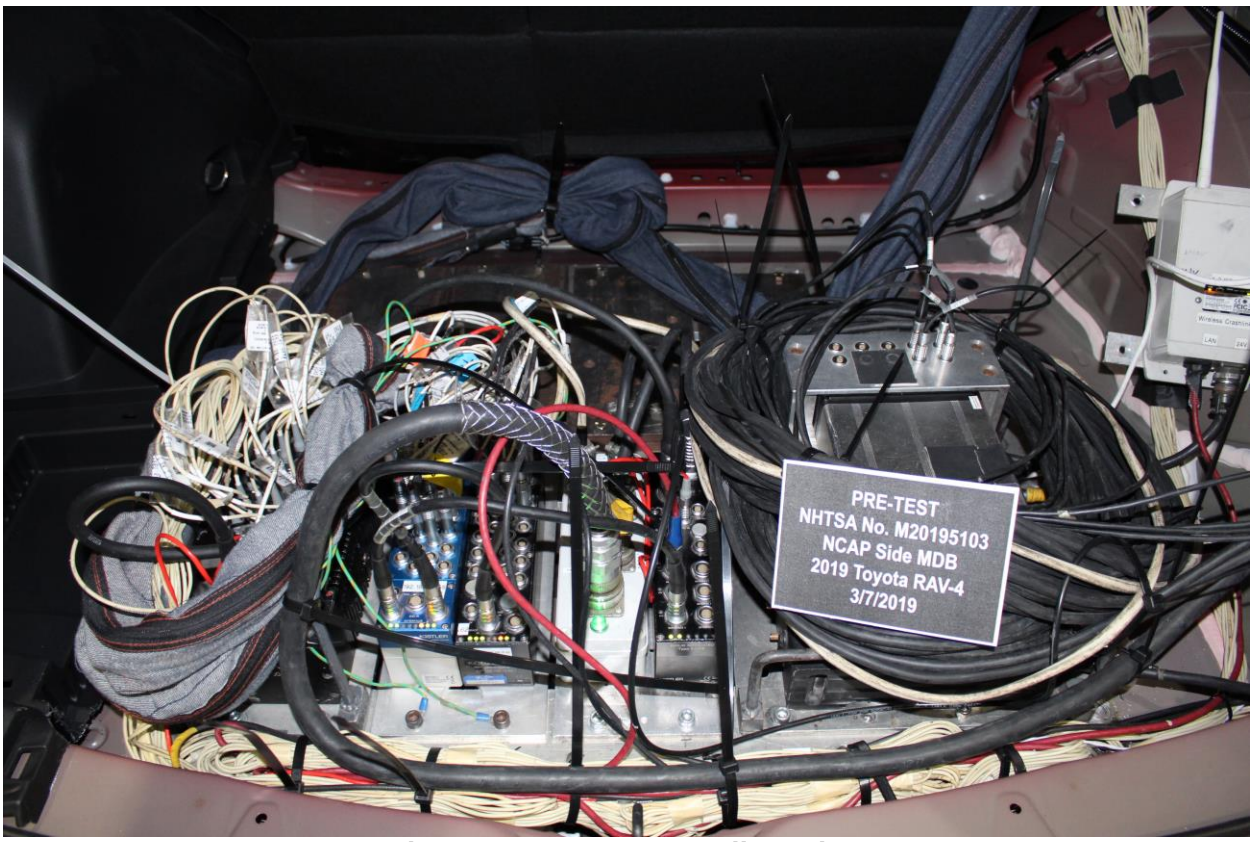


Figure A-94: Pre-Test Ballast View

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

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

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

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

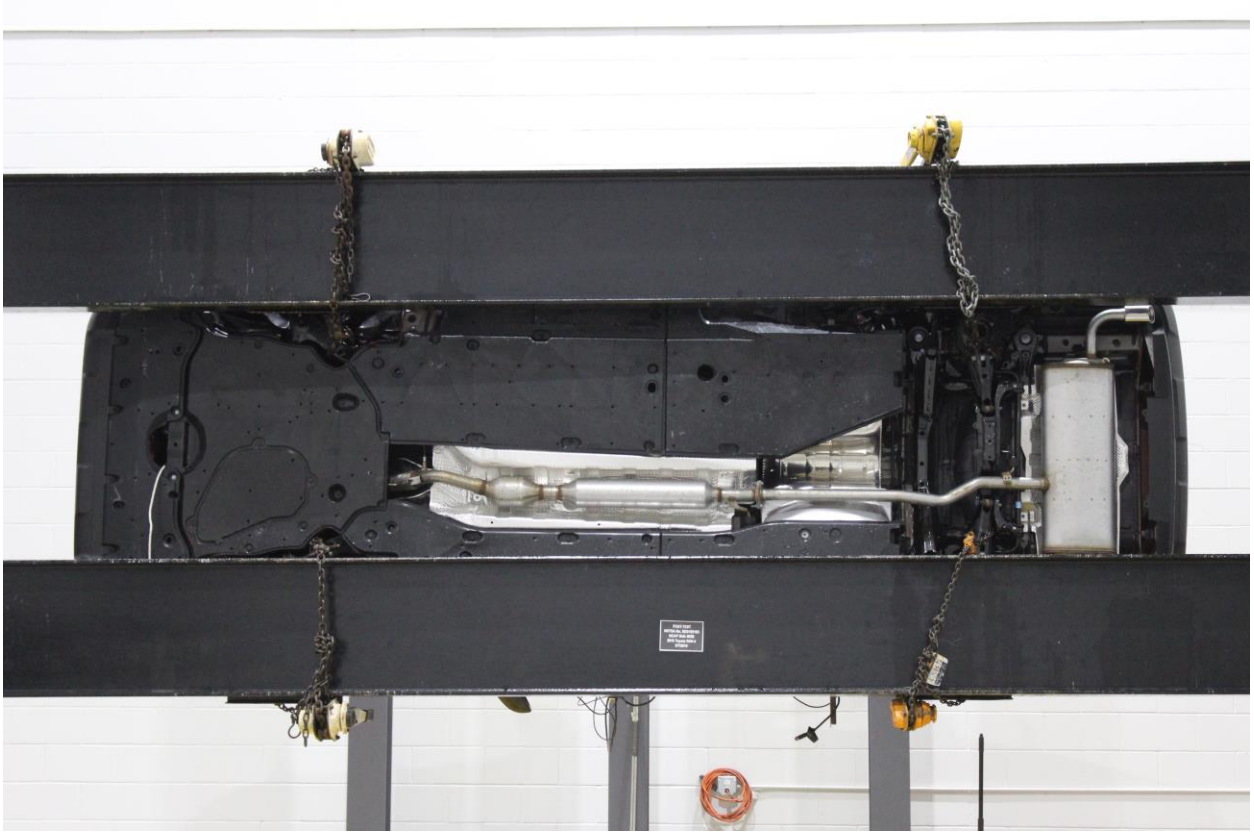


Figure A-99: FMVSS No. 301 Static Rollover 270 Degrees

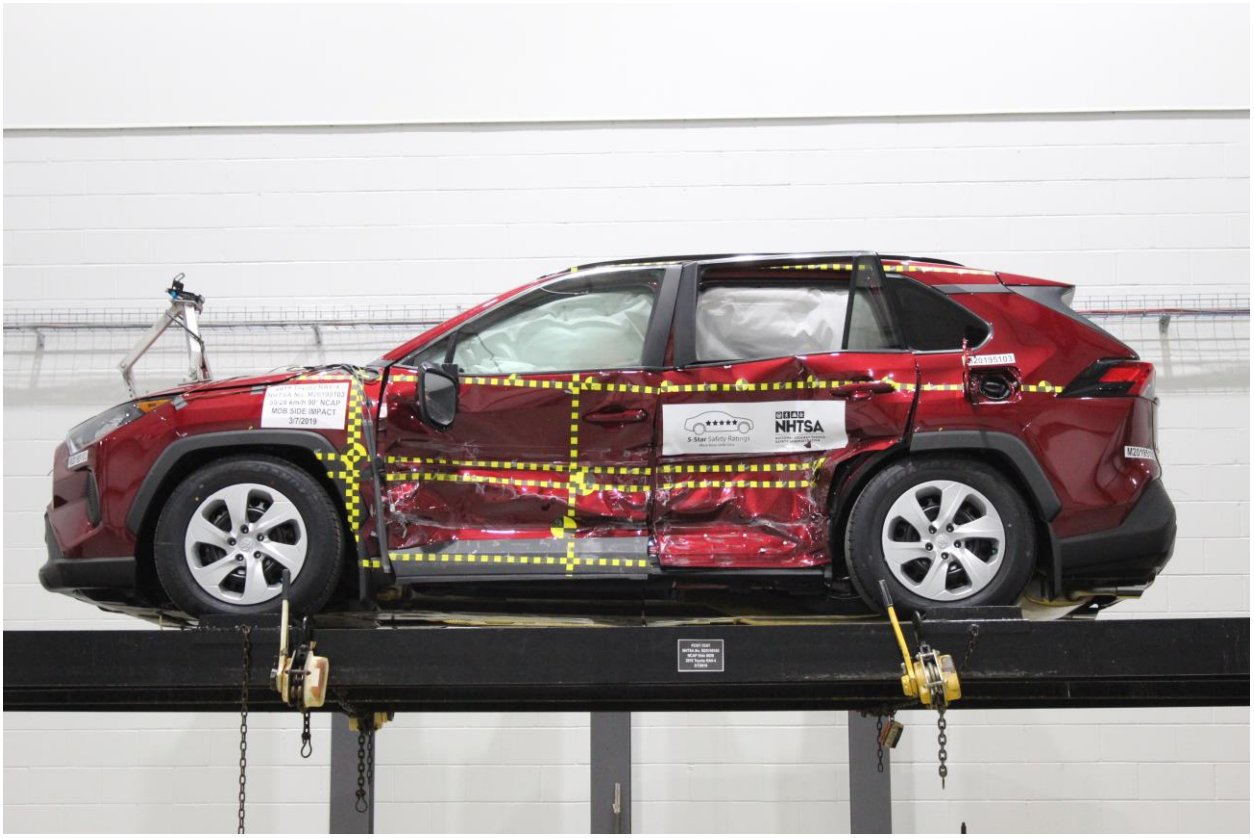
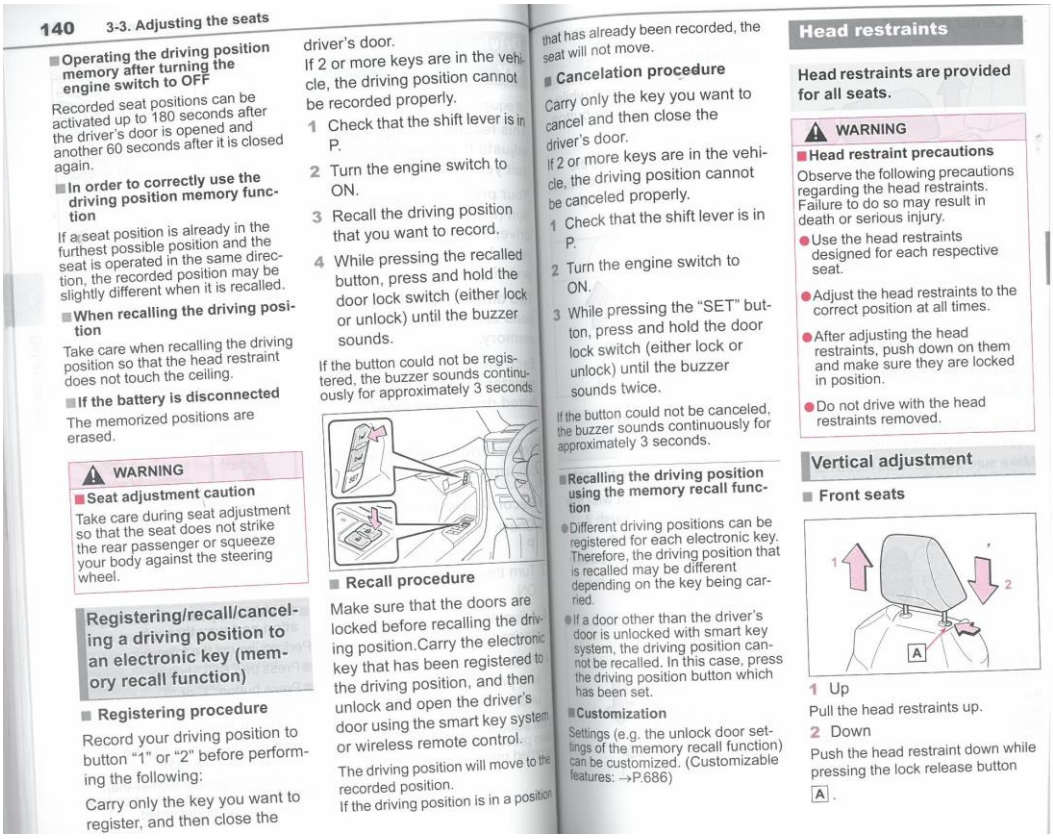


Figure A-100: FMVSS No. 301 Static Rollover 360 Degrees

Figure A-101: Impact Event

Figure A-102: Monroney Label



140 3-3. Adjusting the seats

■ Operating the driving position memory after turning the engine switch to OFF

Recorded seat positions can be activated up to 180 seconds after the driver's door is opened and another 60 seconds after it is closed again.

■ In order to correctly use the driving position memory function

If a seat position is already in the furthest possible position and the seat is operated in the same direction, the recorded position may be slightly different when it is recalled.

■ When recalling the driving position

Take care when recalling the driving position so that the head restraint does not touch the ceiling.

■ If the battery is disconnected

The memorized positions are erased.

WARNING

■ Seat adjustment caution

Take care during seat adjustment so that the seat does not strike the rear passenger or squeeze your body against the steering wheel.

Registering/recalling/canceling a driving position to an electronic key (memory recall function)

■ Registering procedure

Record your driving position to button "1" or "2" before performing the following:

Carry only the key you want to register, and then close the driver's door.

If 2 or more keys are in the vehicle, the driving position cannot be recorded properly.

1 Check that the shift lever is in P.

2 Turn the engine switch to ON.

3 Recall the driving position that you want to record.

4 While pressing the recalled button, press and hold the door lock switch (either lock or unlock) until the buzzer sounds.

If the button could not be registered, the buzzer sounds continuously for approximately 3 seconds.

■ Recall procedure

Make sure that the doors are locked before recalling the driving position.Carry the electronic key that has been registered to the driving position, and then unlock and open the driver's door using the smart key system or wireless remote control.

The driving position will move to the recorded position.

If the driving position is in a position that has already been recorded, the seat will not move.

■ Cancelation procedure

Carry only the key you want to cancel and then close the driver's door.

If 2 or more keys are in the vehicle, the driving position cannot be canceled properly.

1 Check that the shift lever is in P.

2 Turn the engine switch to ON.

3 While pressing the "SET" button, press and hold the door lock switch (either lock or unlock) until the buzzer sounds twice.

If the button could not be canceled, the buzzer sounds continuously for approximately 3 seconds.

■ Recalling the driving position using the memory recall function

- Different driving positions can be registered for each electronic key. Therefore, the driving position that is recalled may be different depending on the key being carried.
- If a door other than the driver's door is unlocked with smart key system, the driving position cannot be recalled. In this case, press the driving position button which has been set.

■ Customization

Settings (e.g. the unlock door settings of the memory recall function) can be customized. (Customizable features: →P.686)

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.

Vertical adjustment

■ Front seats

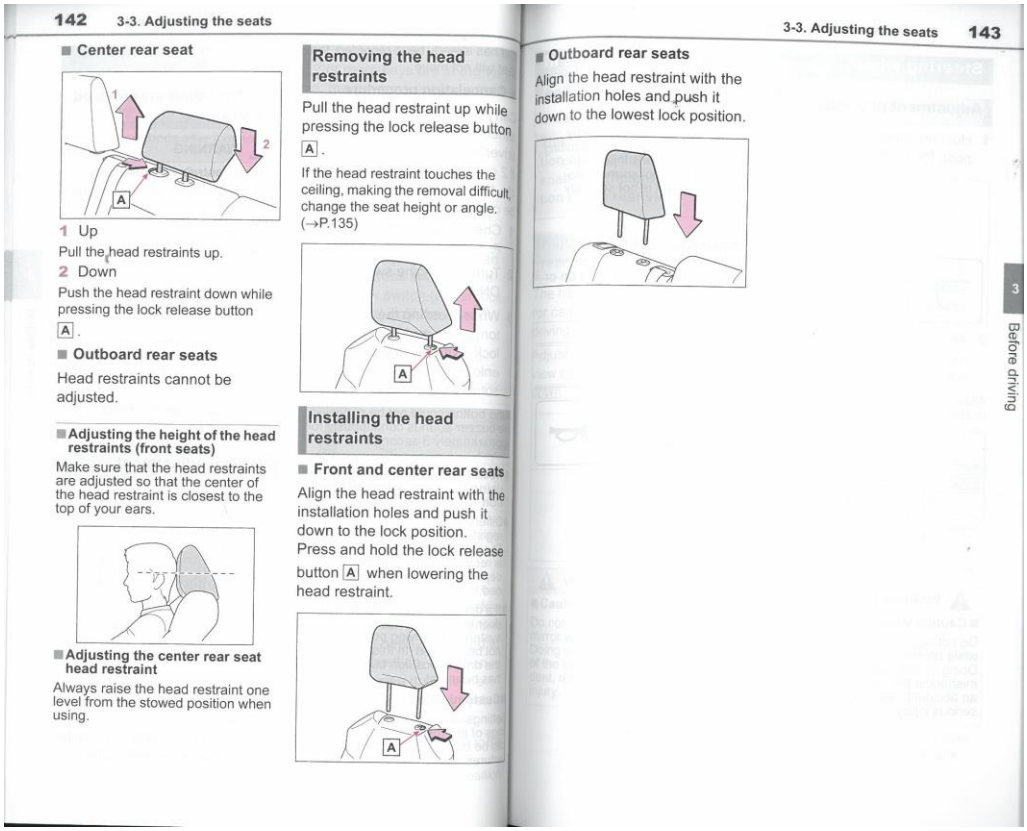
1 Up

Pull the head restraints up.

2 Down

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

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



142 3-3. Adjusting the seats

■ Center rear seat

1 Up

Pull the head restraints up.

2 Down

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

■ Outboard rear seats

Head restraints cannot be adjusted.

■ Adjusting the height of the head restraints (front seats)

Make sure that the head restraints are adjusted so that the center of the head restraint is closest to the top of your ears.

■ Adjusting the center rear seat head restraint

Always raise the head restraint one level from the stowed position when using.

Removing the head restraints

Pull the head restraint up while pressing the lock release button A.

If the head restraint touches the ceiling, making the removal difficult, change the seat height or angle. (→P.135)

Installing the head restraints

■ Front and center rear seats

Align the head restraint with the installation holes and push it down to the lock position.

Press and hold the lock release button A when lowering the head restraint.

3-3. Adjusting the seats 143

■ Outboard rear seats

Align the head restraint with the installation holes and push it down to the lowest lock position.

3 Before driving

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

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS

Driver & Passenger Dummy Instrumentation Plots

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

Additional Driver & Passenger Dummy Instrumentation Data

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

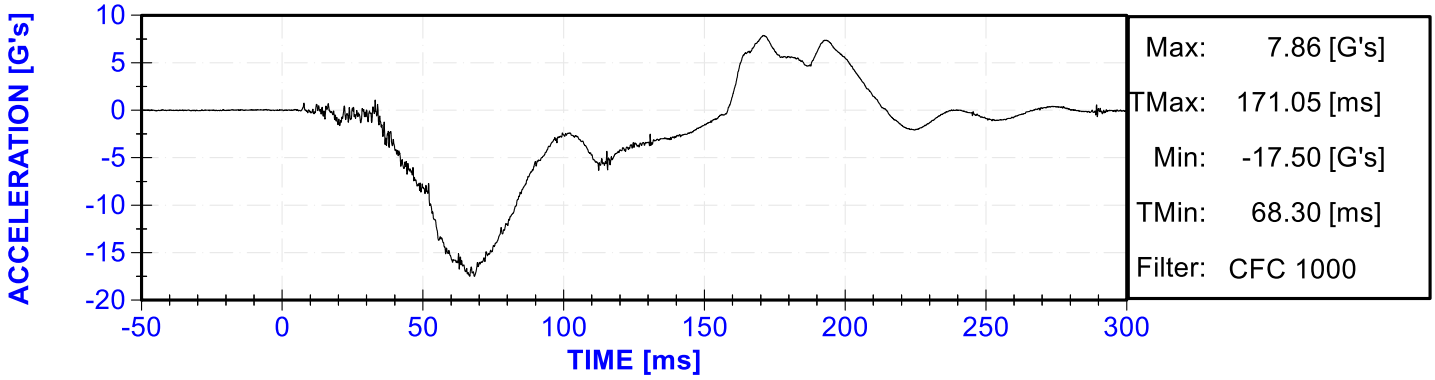
Vehicle Instrumentation Data

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

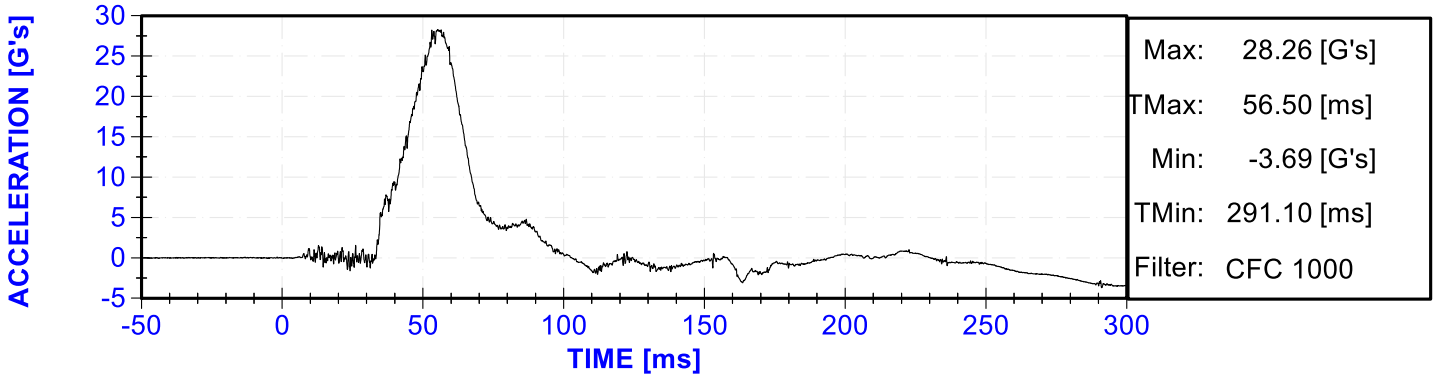
MDB Instrumentation Data

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

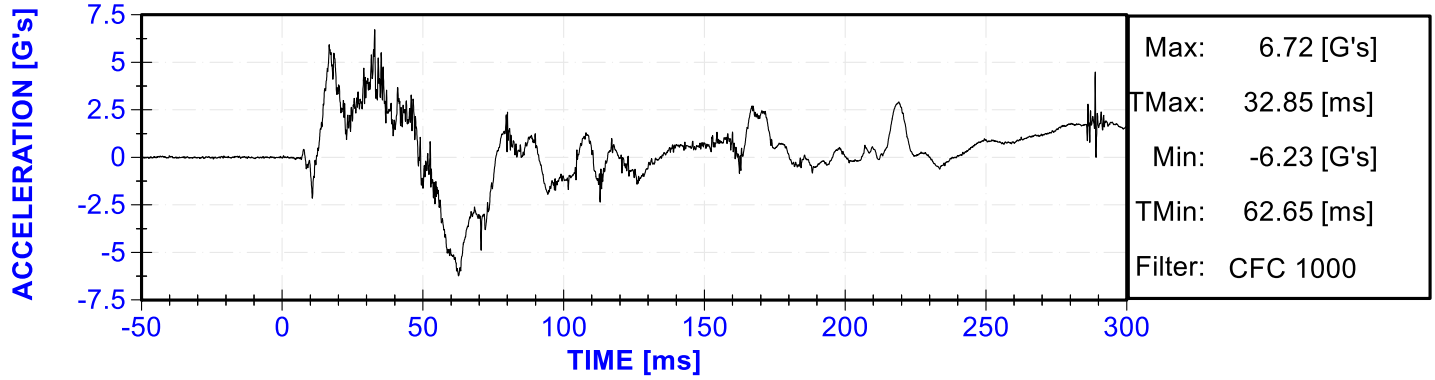
Driver Head Acceleration (X) Primary vs. Time



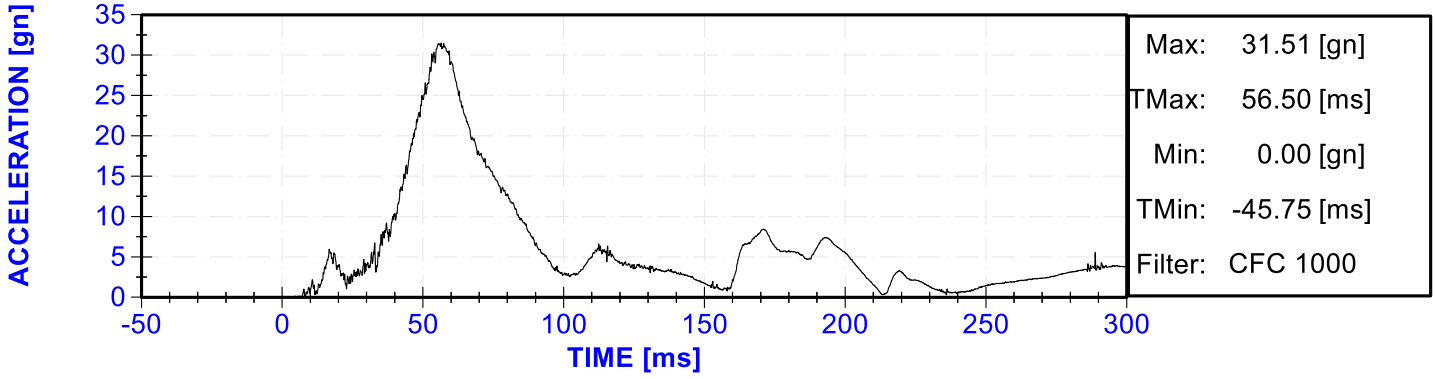
Driver Head Acceleration (Y) Primary vs. Time



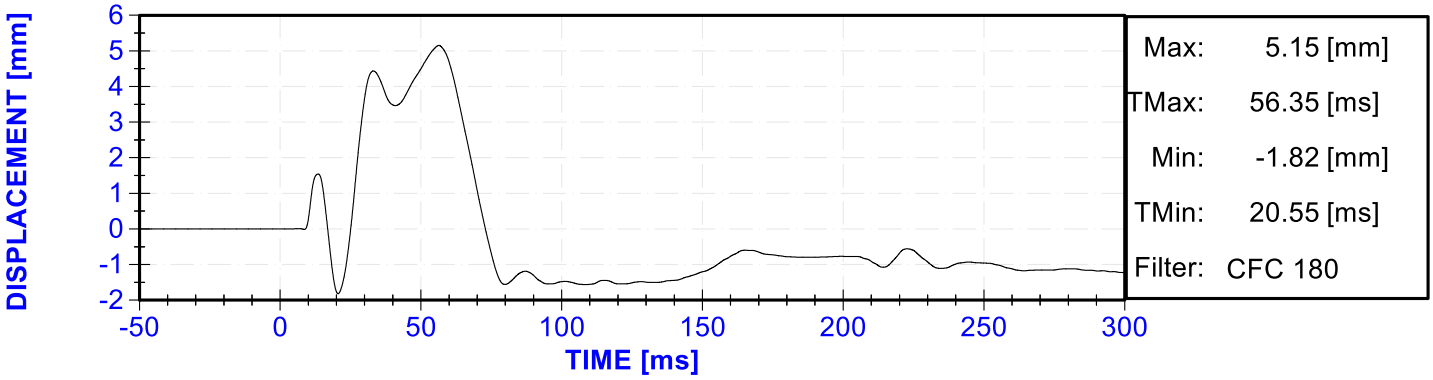
Driver Head Acceleration (Z) Primary vs. Time



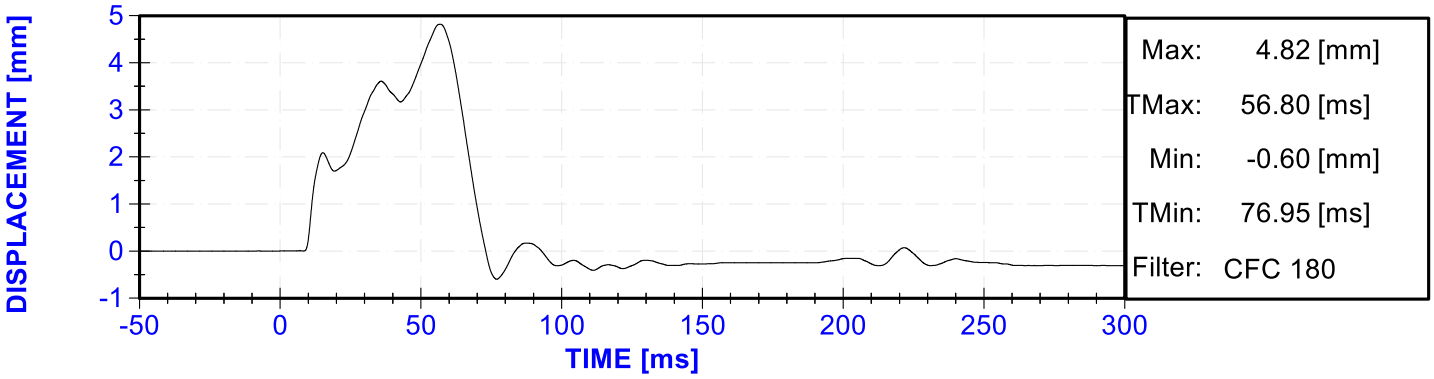
Driver Head Resultant Acceleration Primary vs. Time



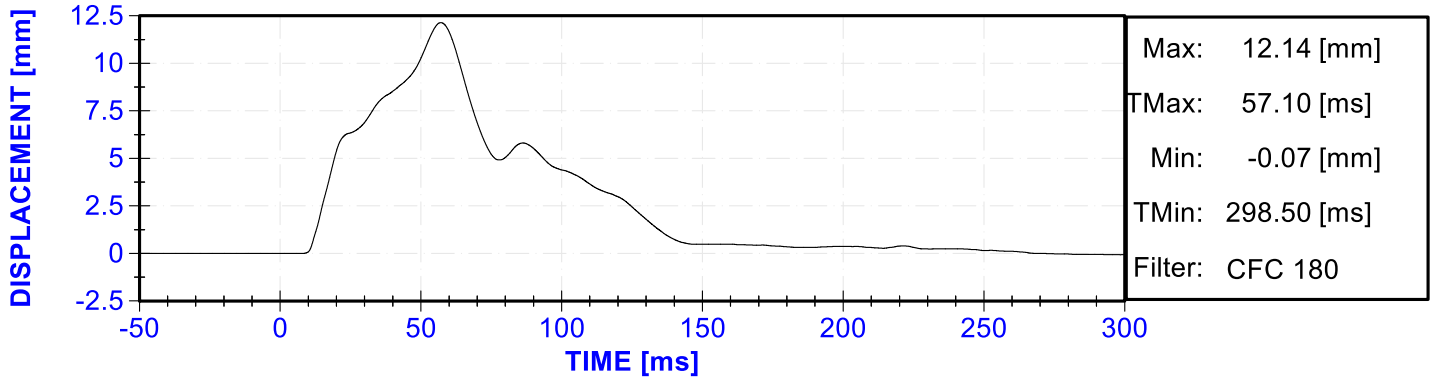
Driver Upper Thorax Rib Deflection (Y) vs. Time



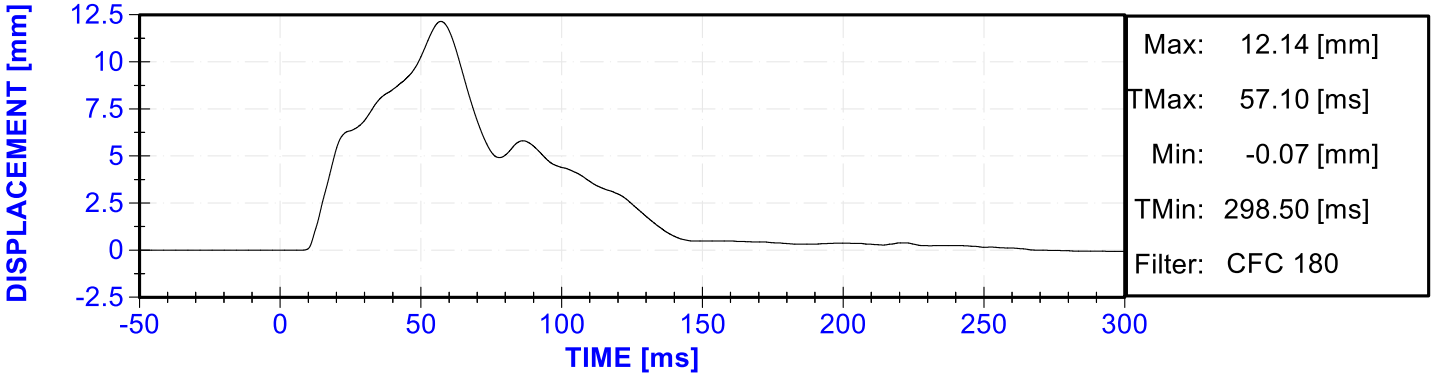
Driver Middle Thorax Rib Deflection (Y) vs. Time



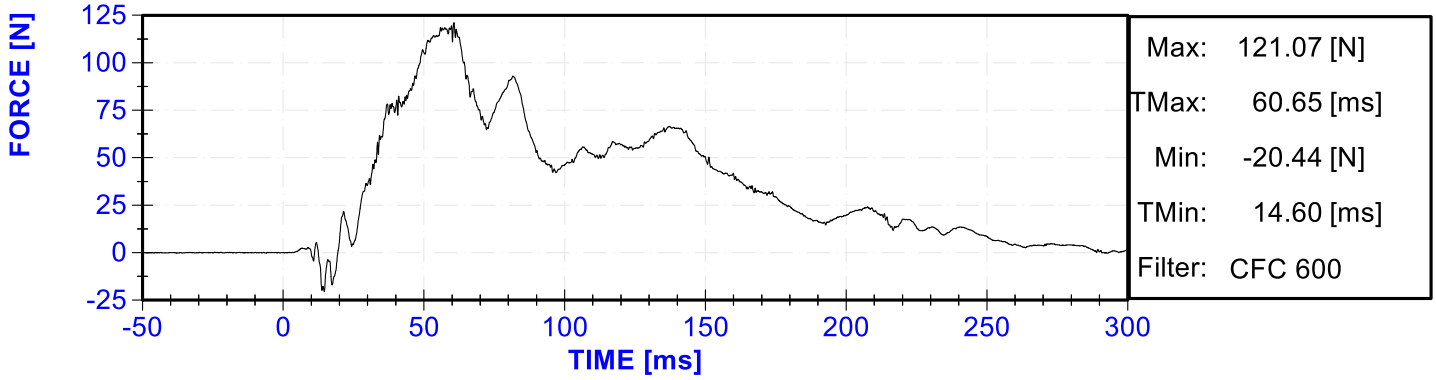
Driver Lower Thorax Rib Deflection (Y) vs. Time



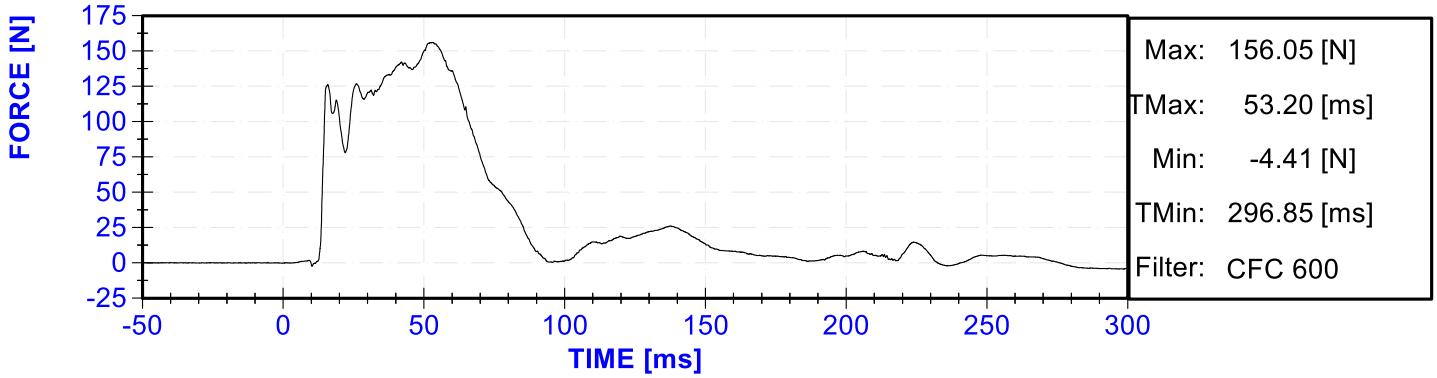
Driver Thorax Rib Deflection Maximum vs. Time



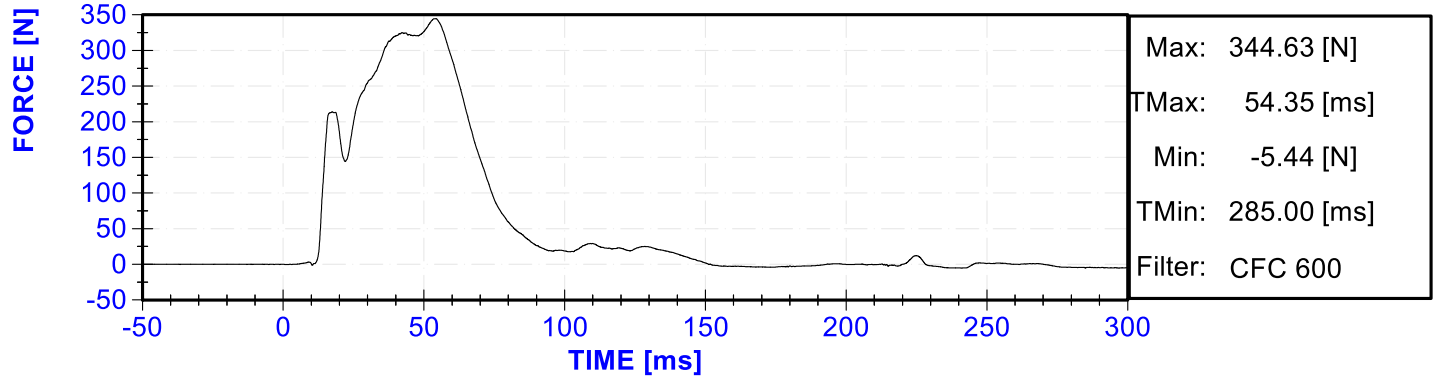
Driver Anterior Abdominal Force (Y) vs. Time



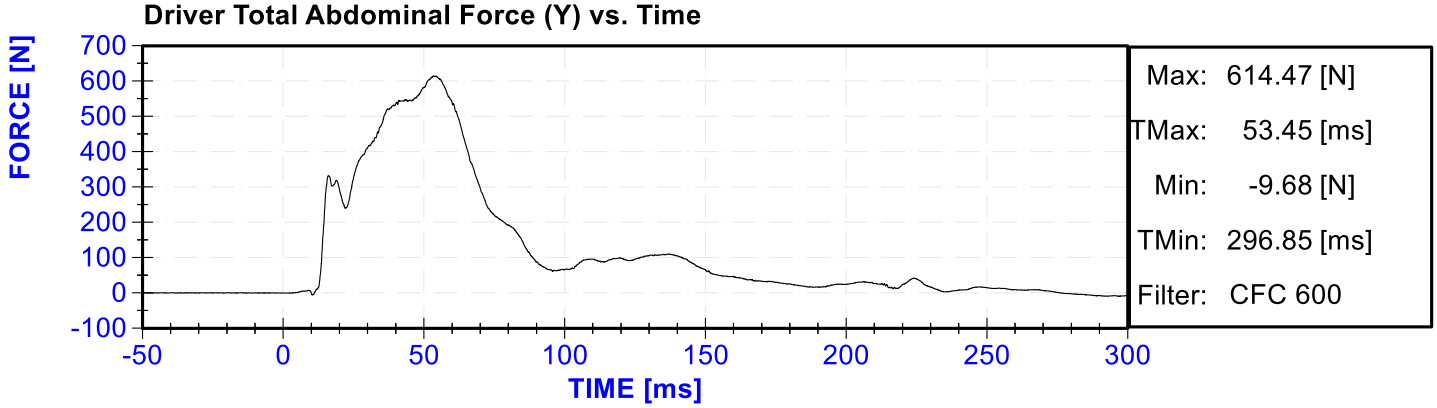
Driver Middle Abdominal Force (Y) vs. Time



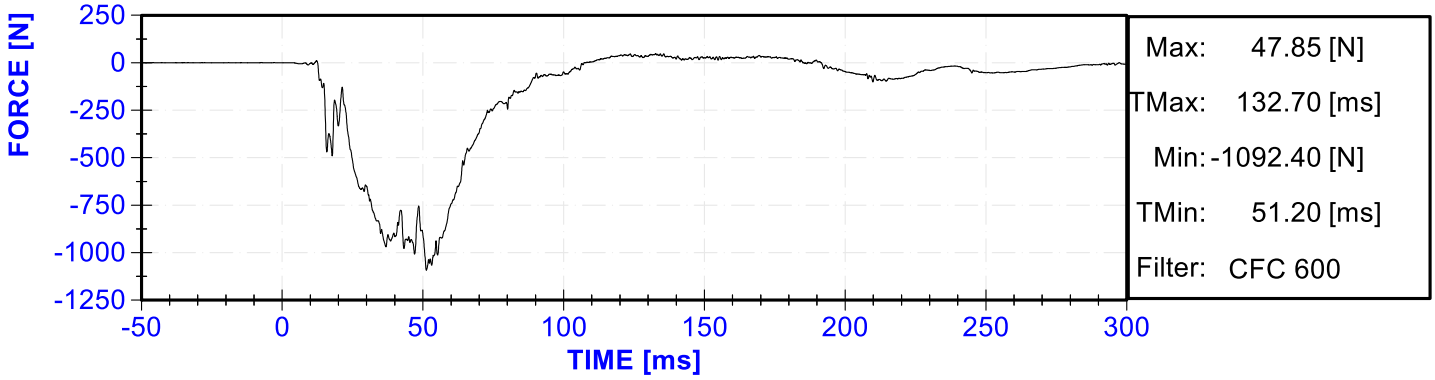
Driver Posterior Abdominal Force (Y) vs. Time



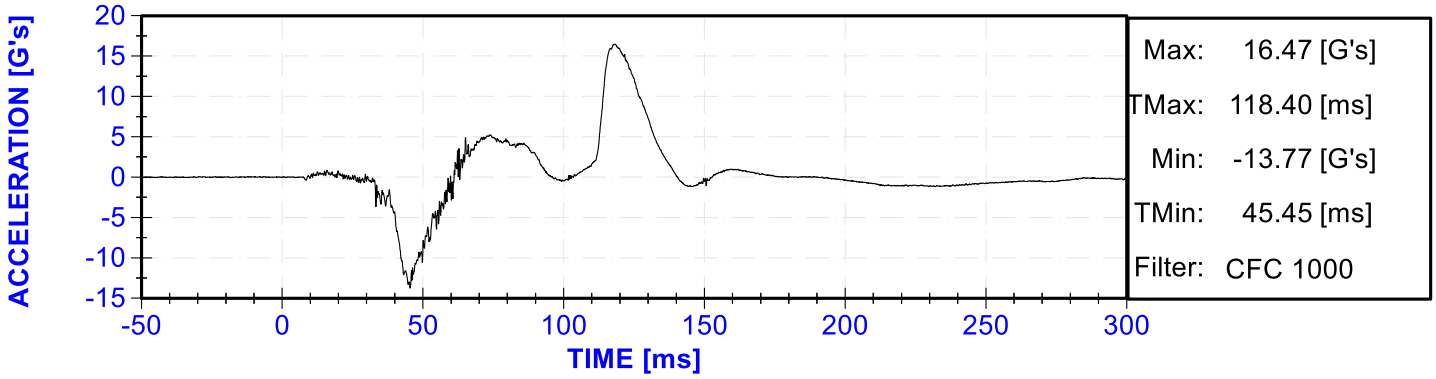
Driver Total Abdominal Force (Y) vs. Time



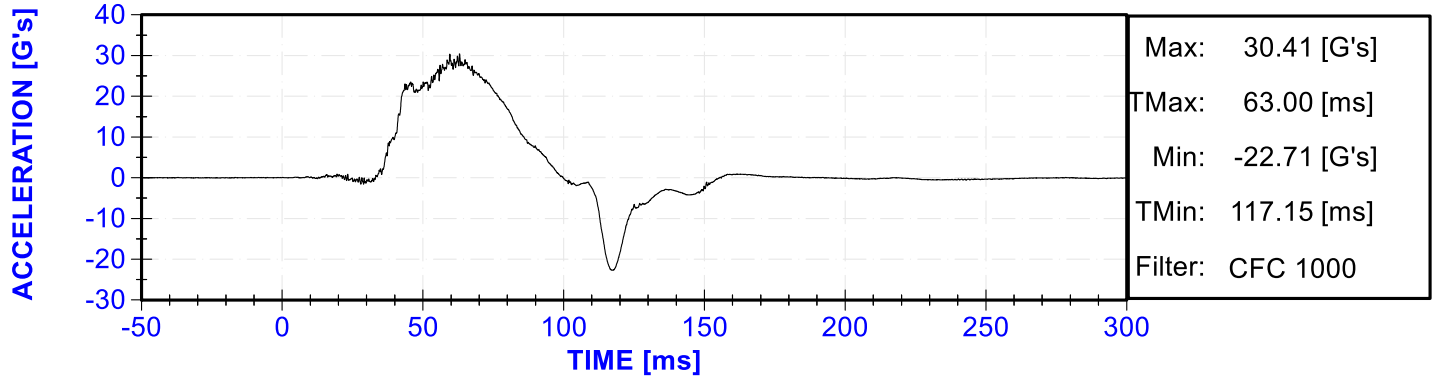
Driver Pubic Symphysis Force (Y) vs. Time



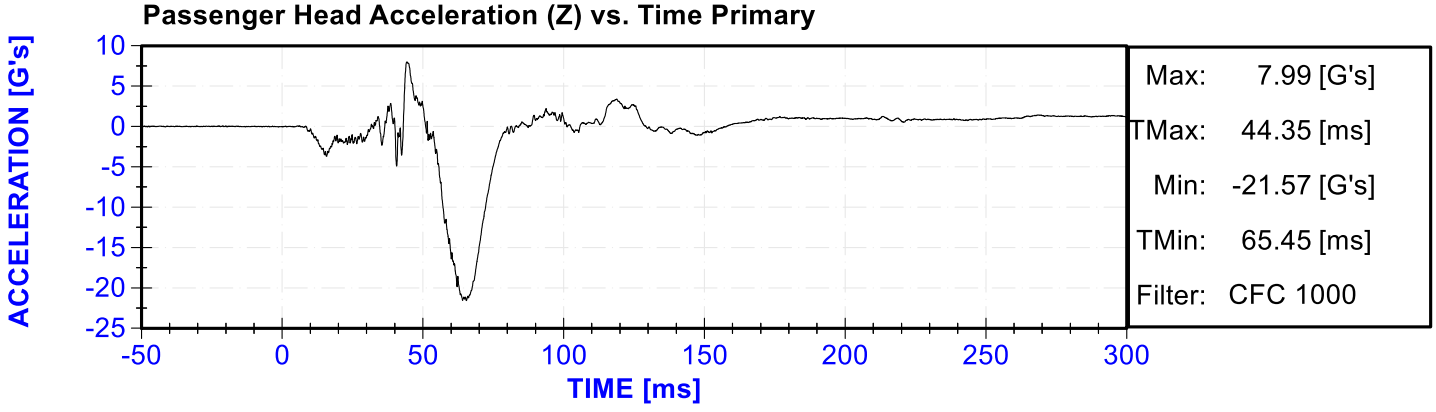
Passenger Head Acceleration (X) vs. Time Primary



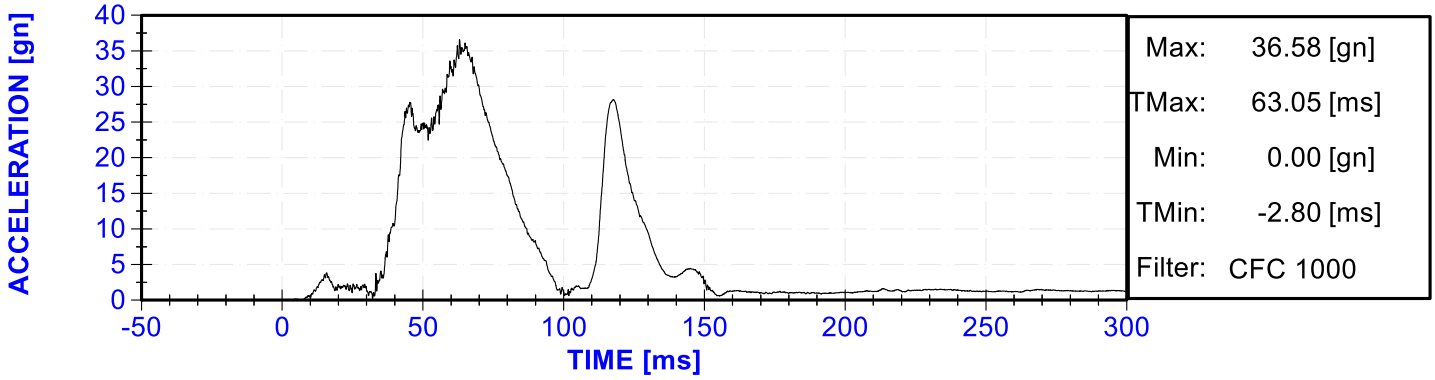
Passenger Head Acceleration (Y) vs. Time Primary



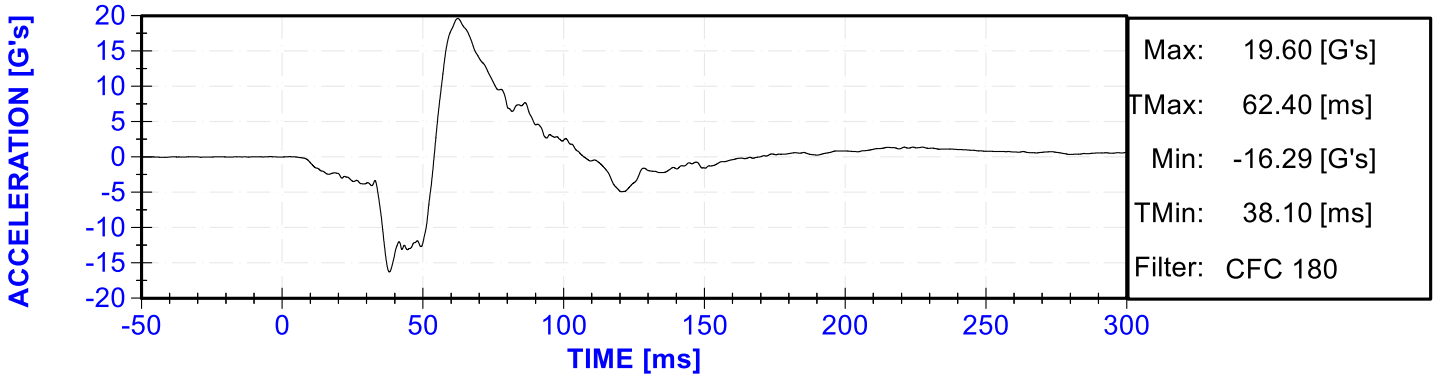
Passenger Head Acceleration (Z) vs. Time Primary



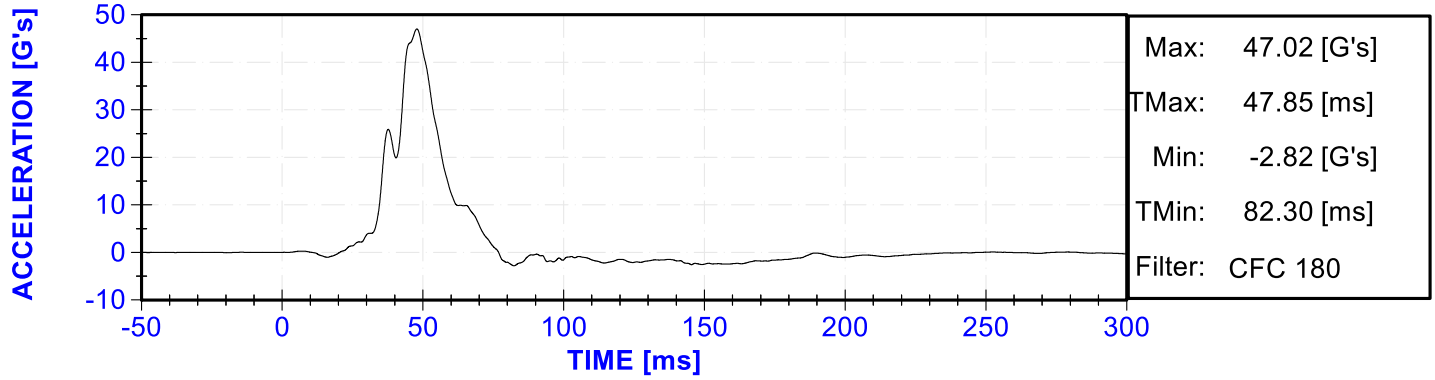
Passenger Head Resultant Acceleration Primary vs. Time



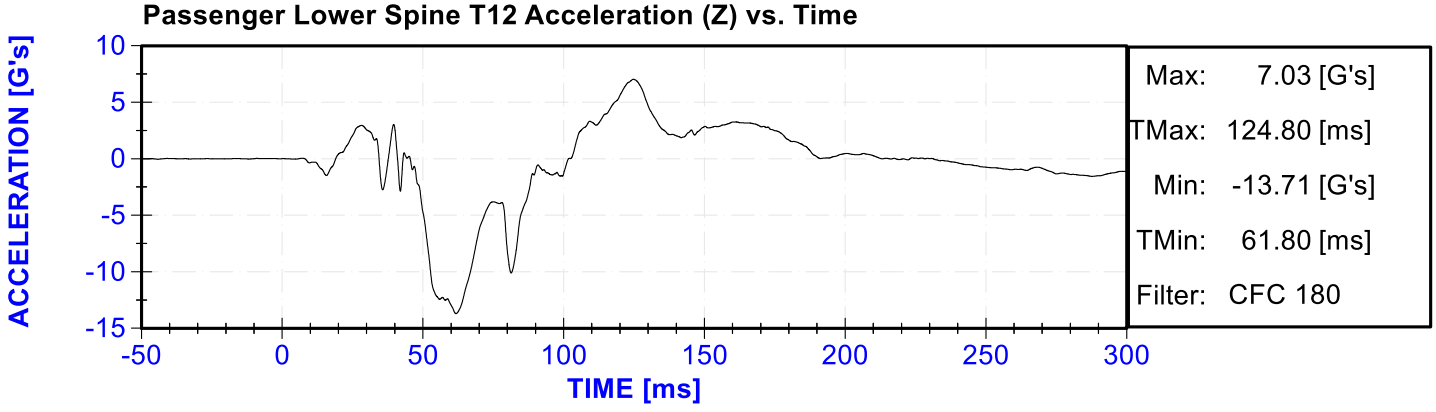
Passenger Lower Spine T12 Acceleration (X) vs. Time



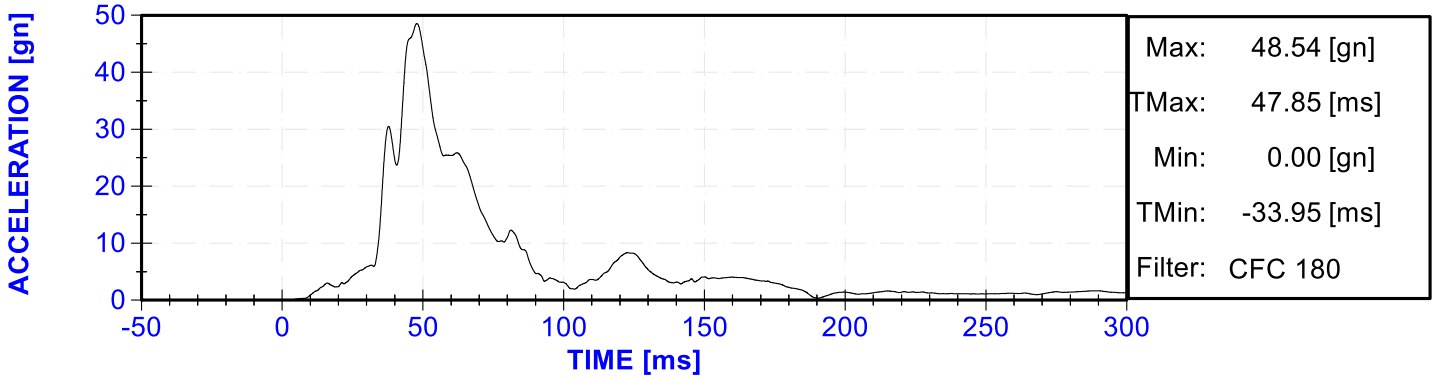
Passenger Lower Spine T12 Acceleration (Y) vs. Time



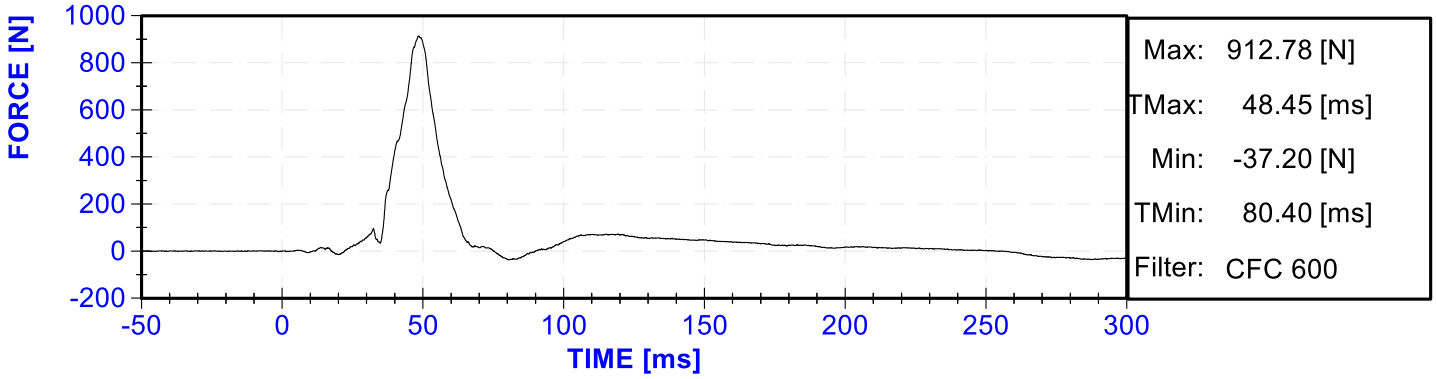
Passenger Lower Spine T12 Acceleration (Z) vs. Time



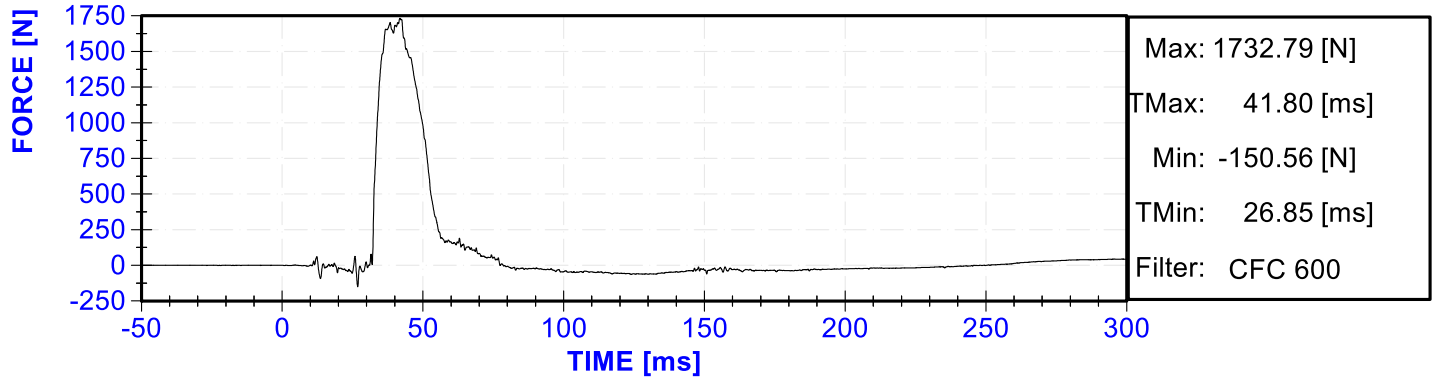
Passenger Lower Spine T12 Resultant Acceleration vs. Time



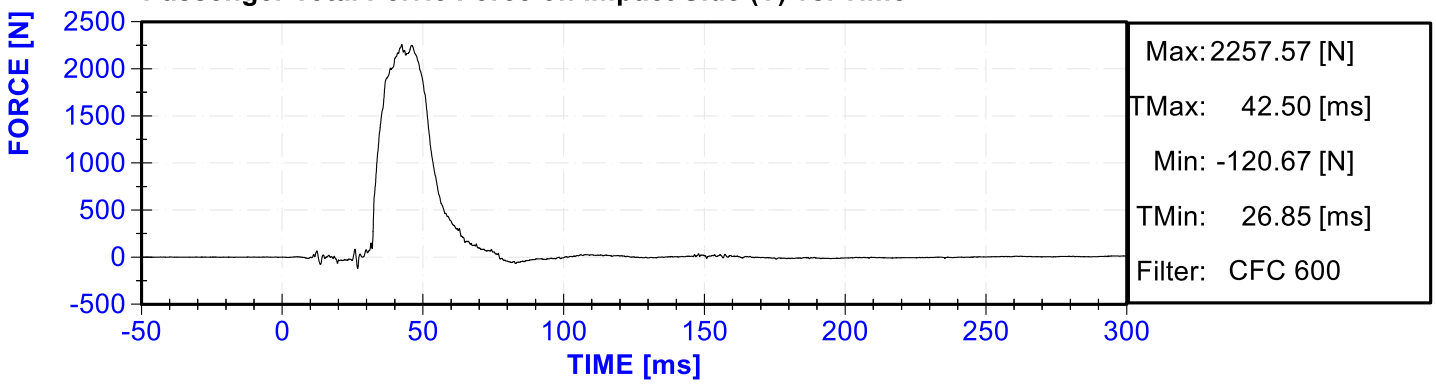
Passenger Iliac Force on Impact Side (Y) vs. Time



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



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



APPENDIX C

DUMMY PERFORMANCE CALIBRATION TEST DATA

CALIBRATION TEST RESULTS

PRE-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

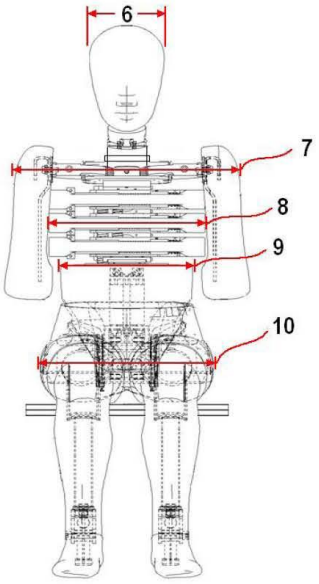
SERIAL NO: F034

(CONFIGURED FOR LEFT SIDE IMPACT)

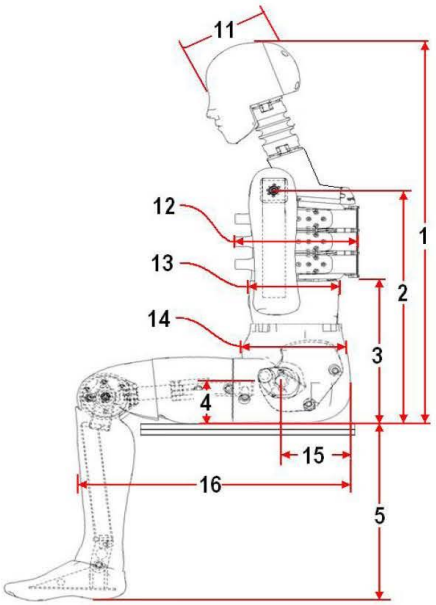
External Measurements - EuroSID-2re

Technician: K. Dutton Date: 2/22/2019

Dummy Serial Number: F034



FRONT VIEW



SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	910	Pass
2	Seat to Shoulder Joint	558	572	567	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	419	Pass
6	Head Width	152	158	154	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	329	Pass
9	Abdomen Width	273	287	280	Pass
10	Pelvis Lap Width	359	373	365	Pass
11	Head Depth	196	206	200	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	201	Pass
14	Pelvis Depth	235	245	242	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

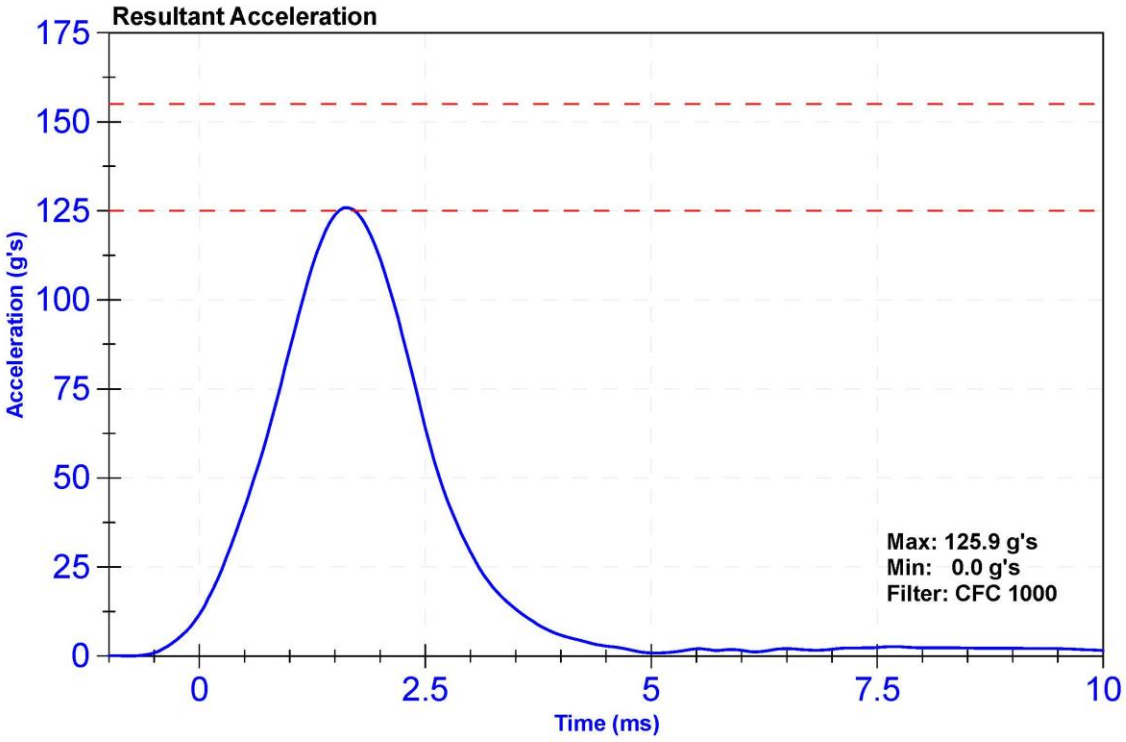
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

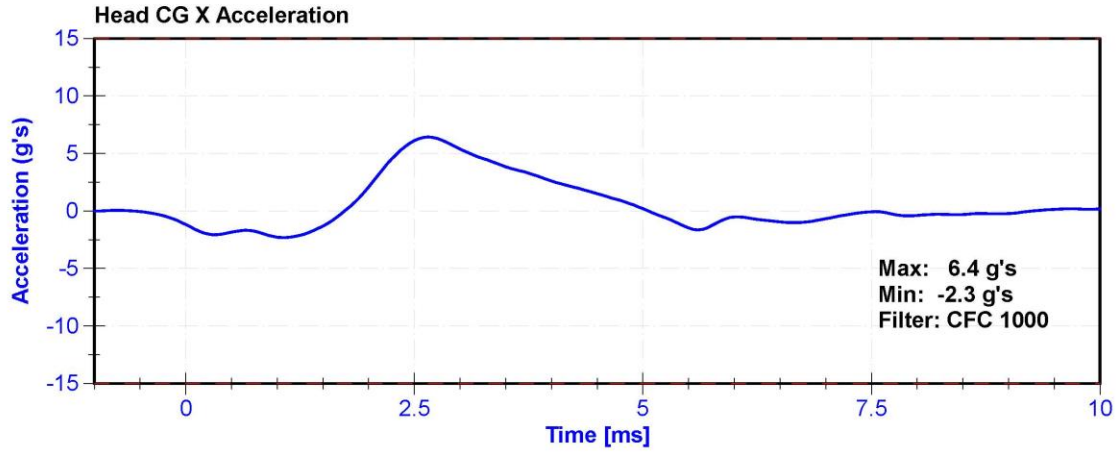
Results

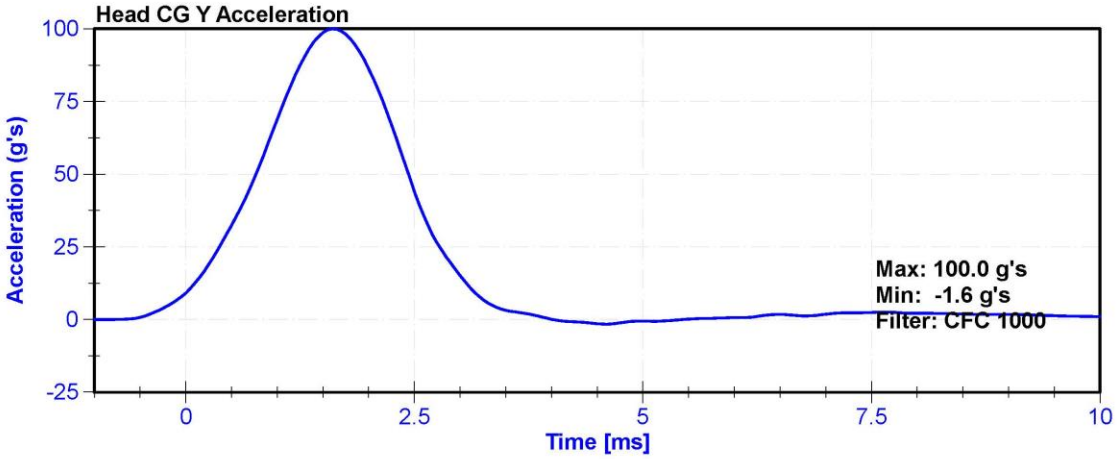
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	28.7	Pass
Resultant Acceleration	125	155	g's	125.9	Pass
Oscillation	0	15	%	2.13	Pass
Fore-Aft Acceleration	-15	15	g's	6.4	Pass

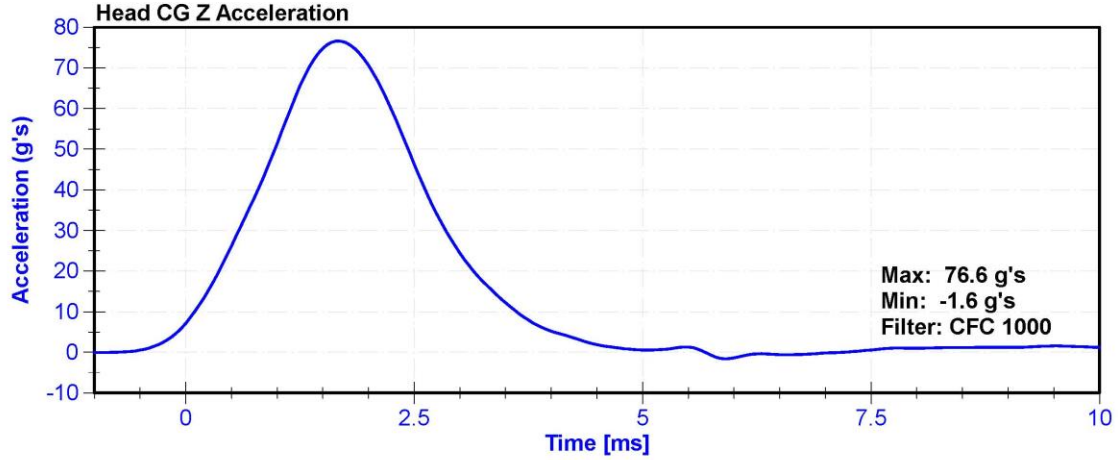
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P58904	10/5/2018	4/5/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P58911	10/5/2018	4/5/2019
Z Accelerometer	ENDEVCO 7264CT	AC-P58776	10/5/2018	4/5/2019




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 6.4 g's
Min: -2.3 g's
Filter: CFC 1000


Head CG Y Acceleration
Acceleration (g's)
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]
Max: 100.0 g's
Min: -1.6 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: 76.6 g's
Min: -1.6 g's
Filter: CFC 1000

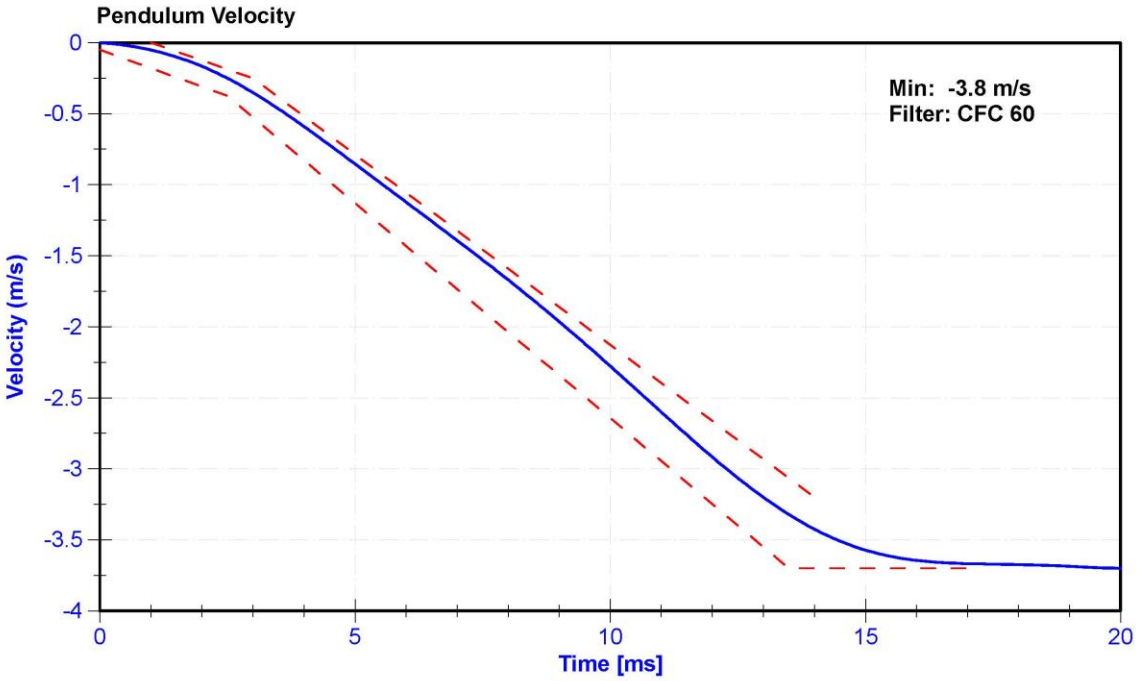
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

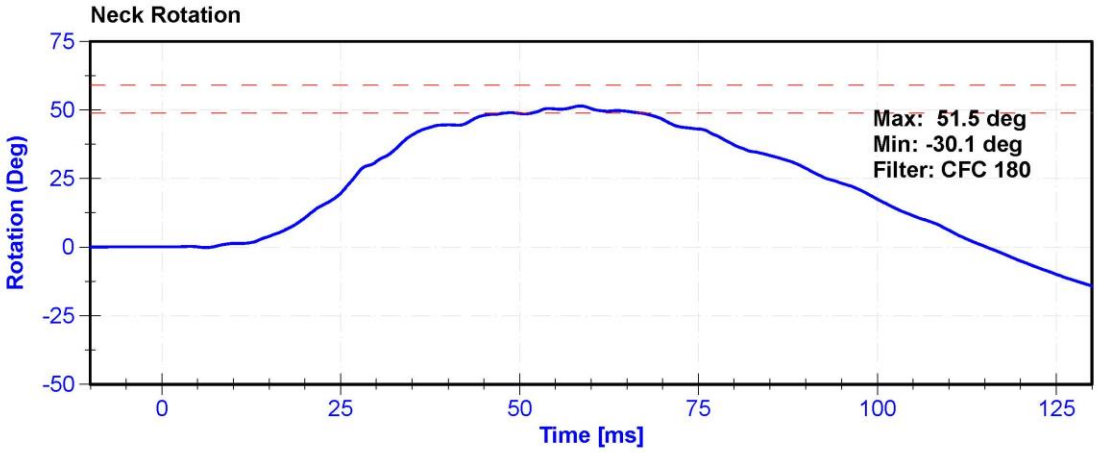
Results

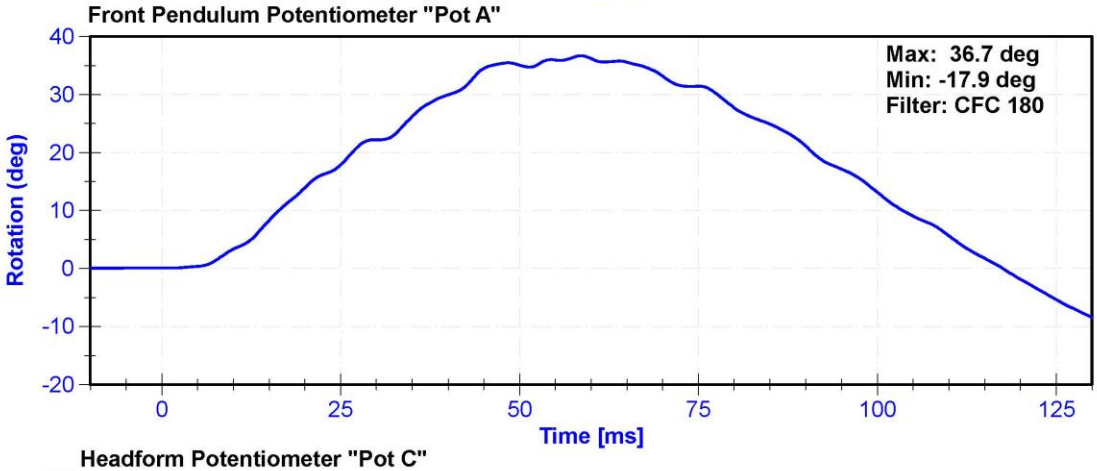
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	23.7	Pass
Velocity	3.3	3.5	m/s	3.38	Pass
Lateral Neck Rotation	49	59	deg	51.5	Pass
Time at Maximum Rotation	54	66	ms	58.5	Pass
Time of Rotation Decay from Maximum	53	88	ms	56.8	Pass

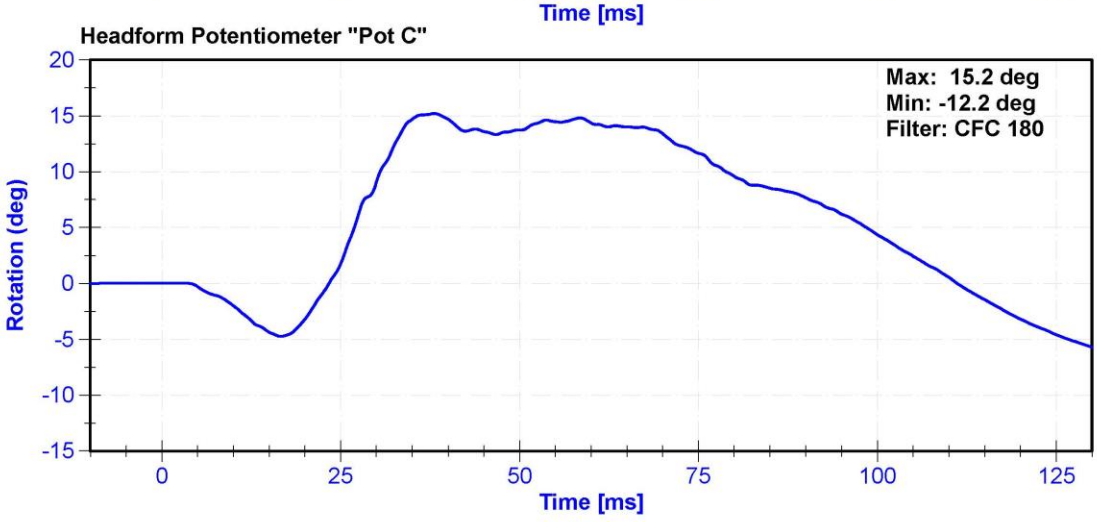
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9	1/29/2019	1/29/2020
Front Pendulum Potentiometer	SP22G	DS-094	10/31/2018	10/31/2019
Headform Potentiometer	SP22G	DS-095	10/31/2018	10/31/2019




Neck Rotation
Rotation (Deg)
Time [ms]
Max: 51.5 deg
Min: -30.1 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 36.7 deg
Min: -17.9 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 15.2 deg
Min: -12.2 deg
Filter: CFC 180

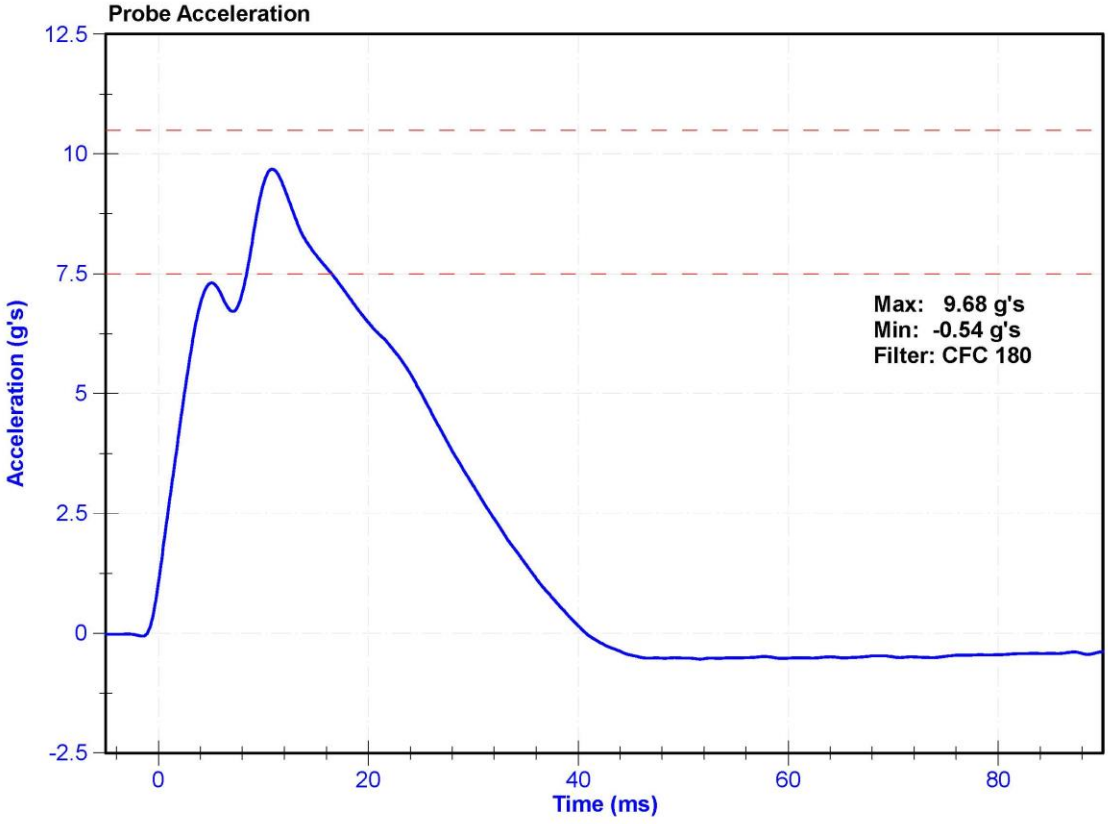
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	25.0	Pass
Velocity	4.2	4.4	m/s	4.20	Pass
Probe Acceleration	7.5	10.5	g's	9.68	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019



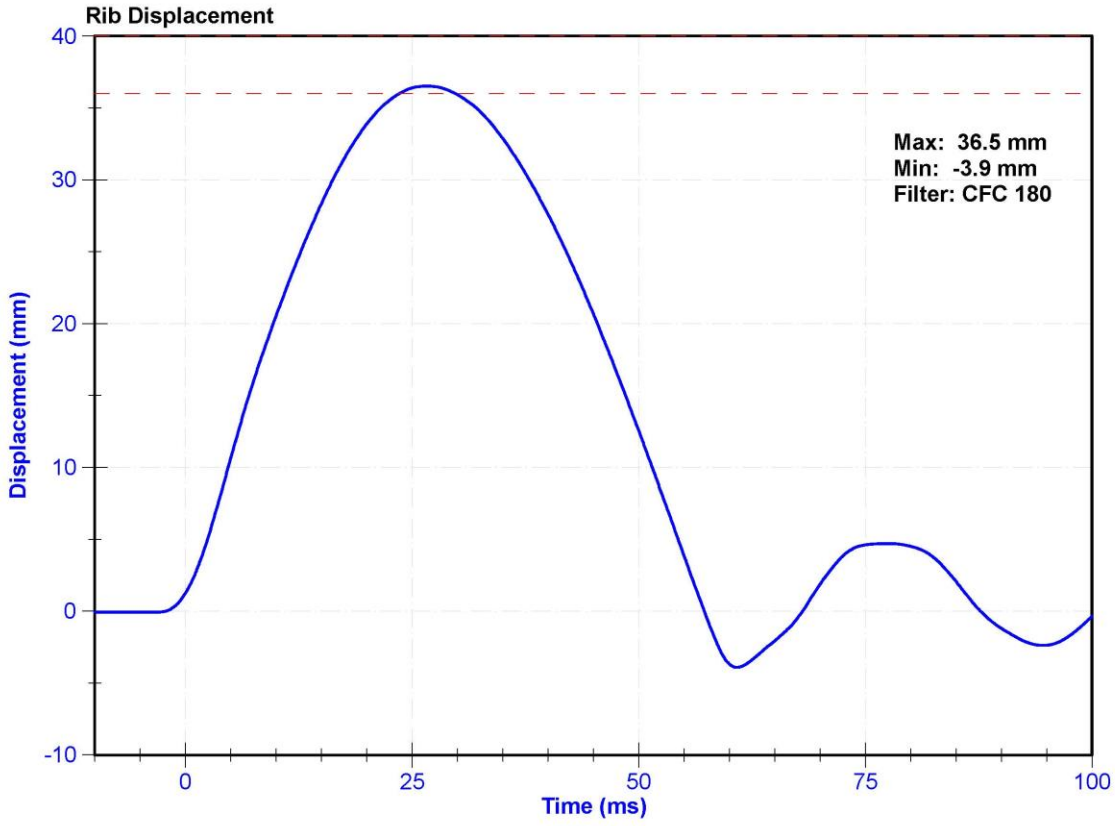
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	23.0	Pass
Rib Displacement	36	40	mm	36.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019



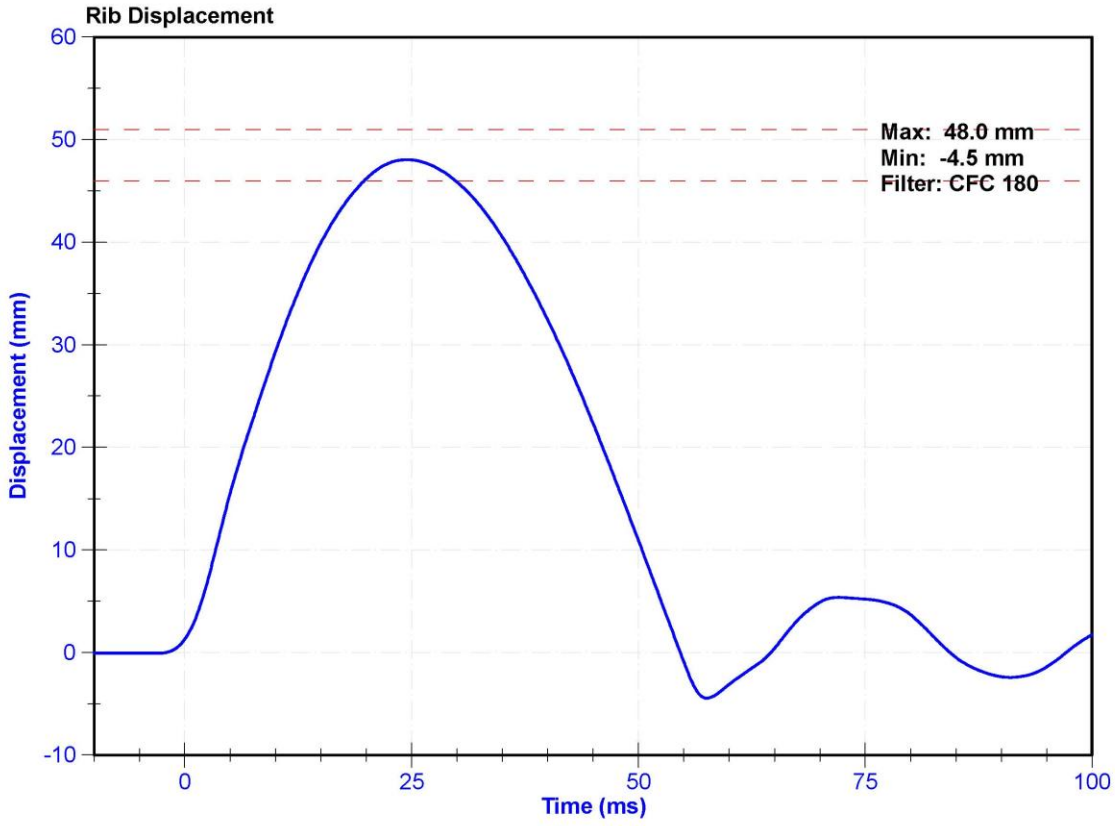
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	23.0	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-183GFE	10/10/2018	10/10/2019



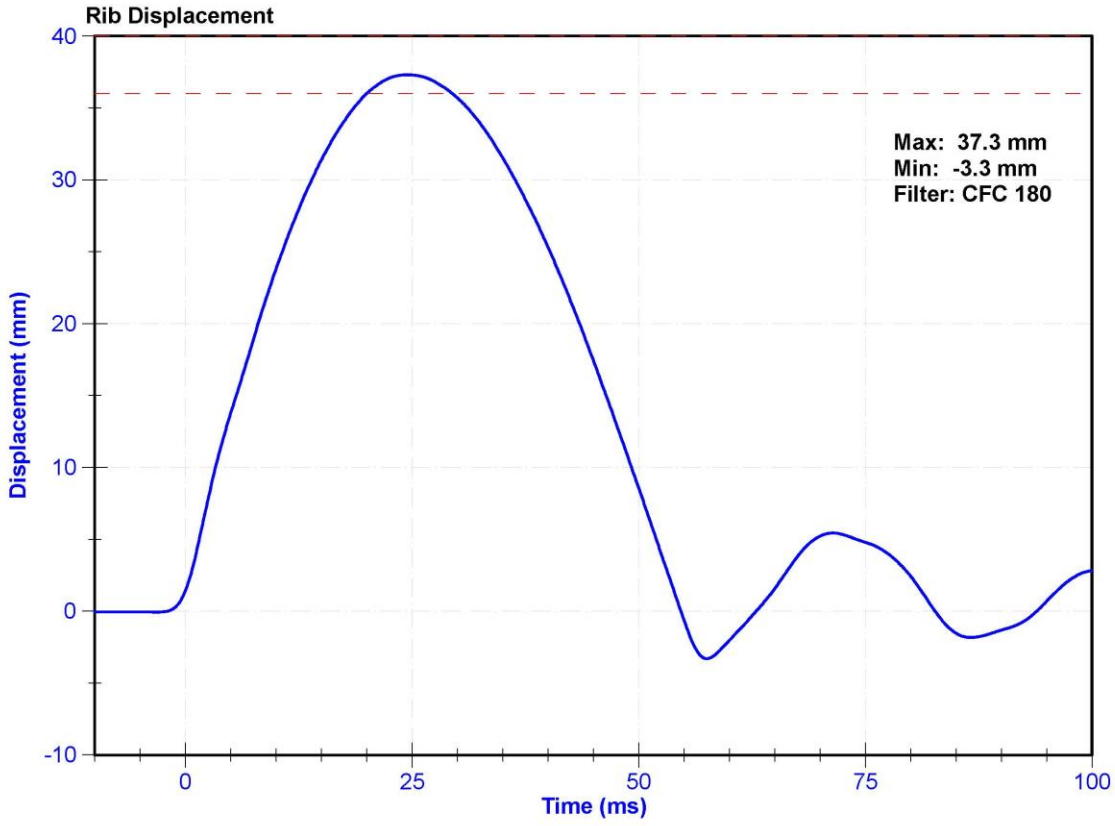
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	23.2	Pass
Rib Displacement	36	40	mm	37.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019



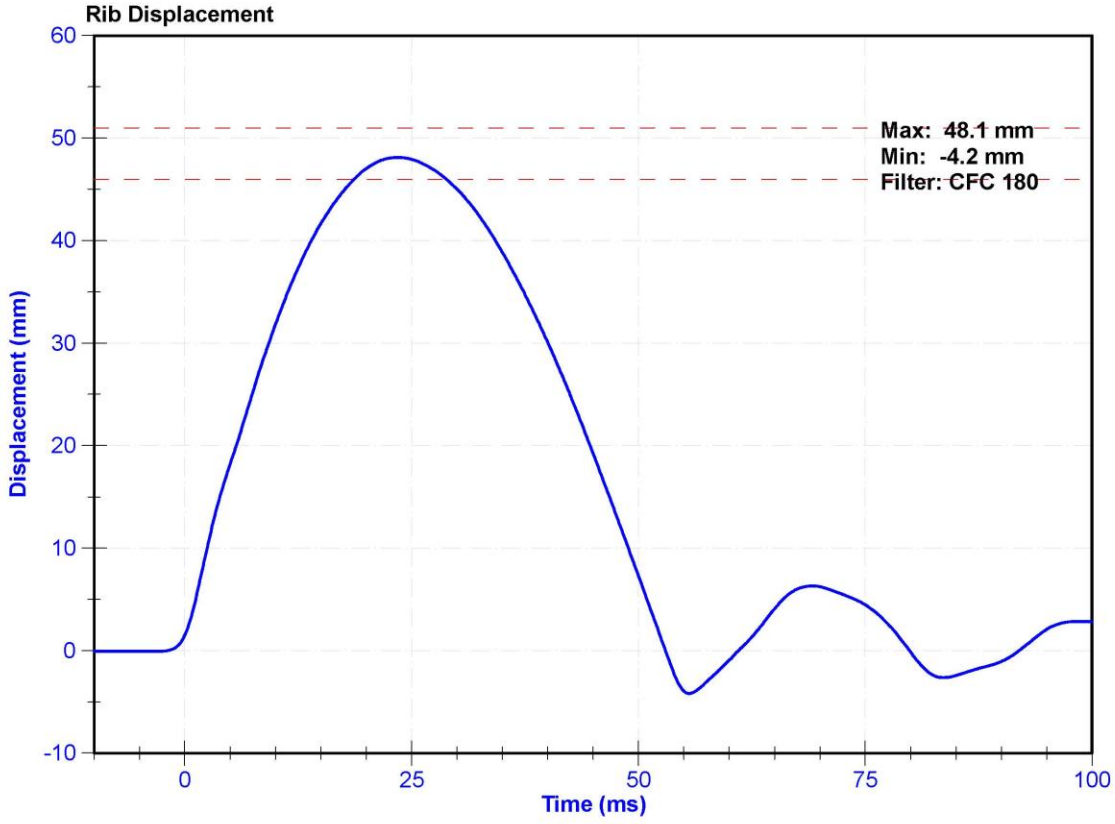
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	25.5	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-184GFE	10/11/2018	10/11/2019



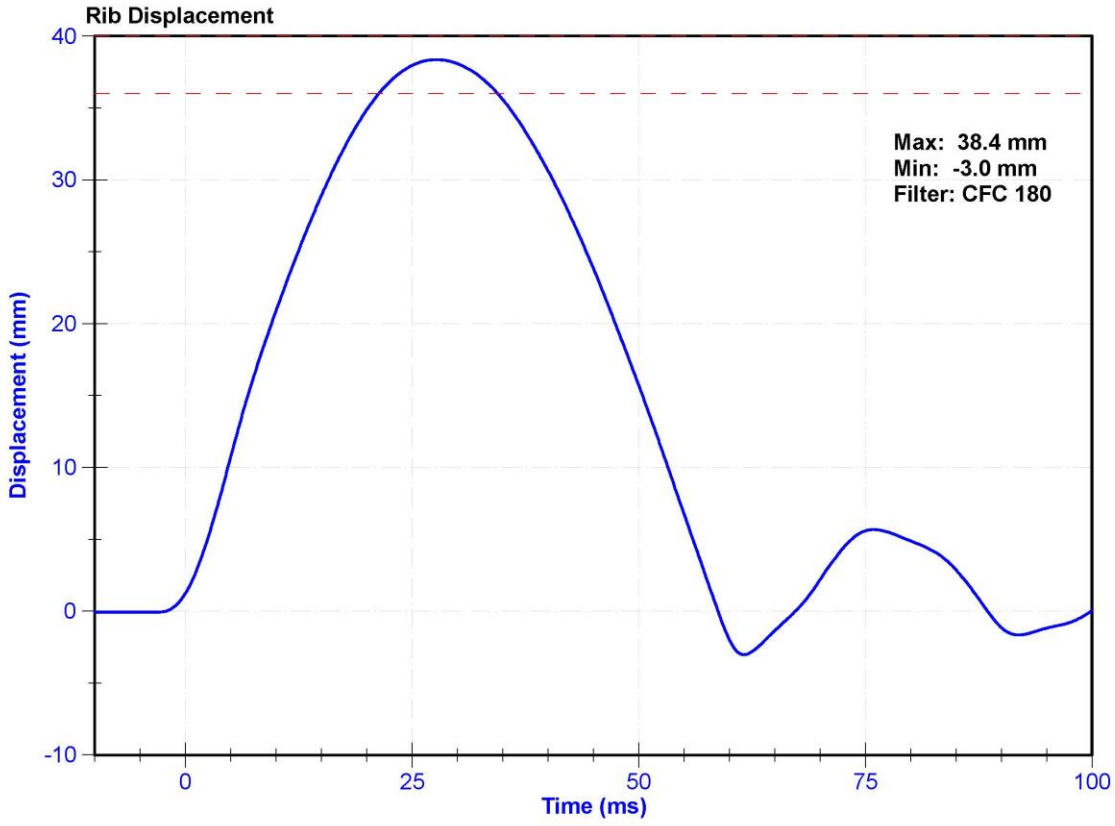
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	25.5	Pass
Rib Displacement	36	40	mm	38.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019



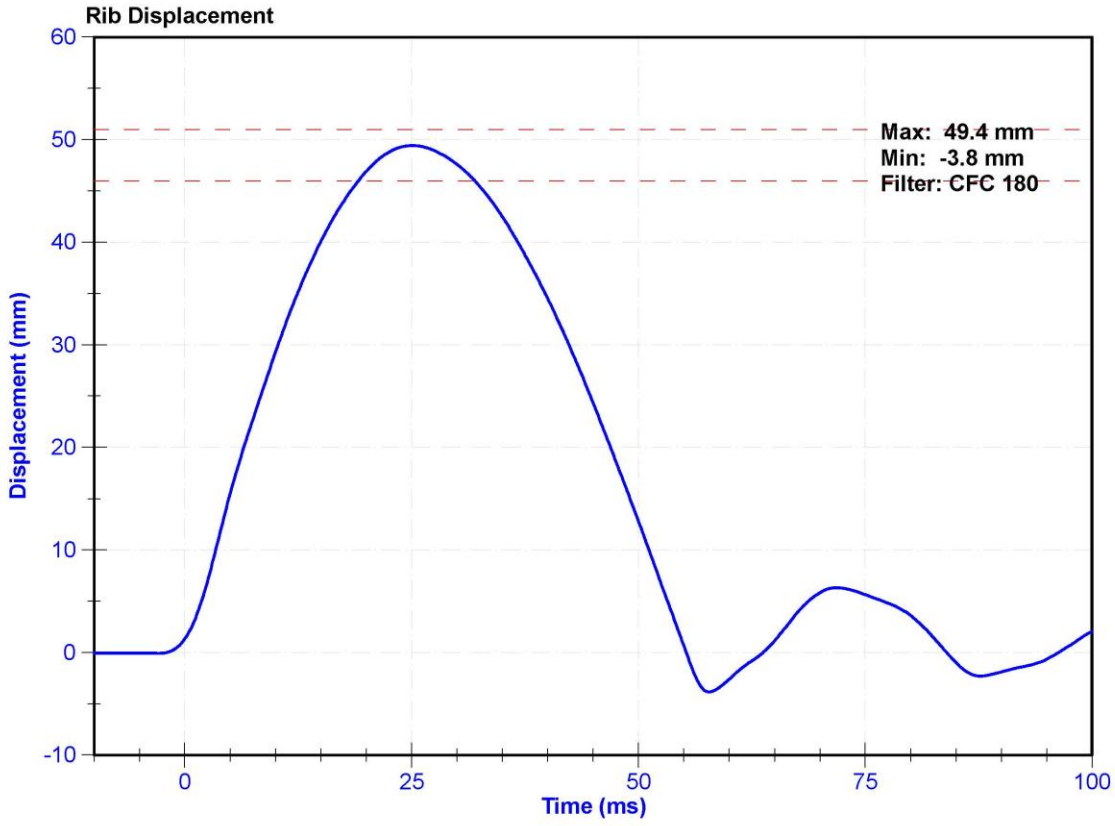
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	25.5	Pass
Rib Displacement	46	51	mm	49.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019



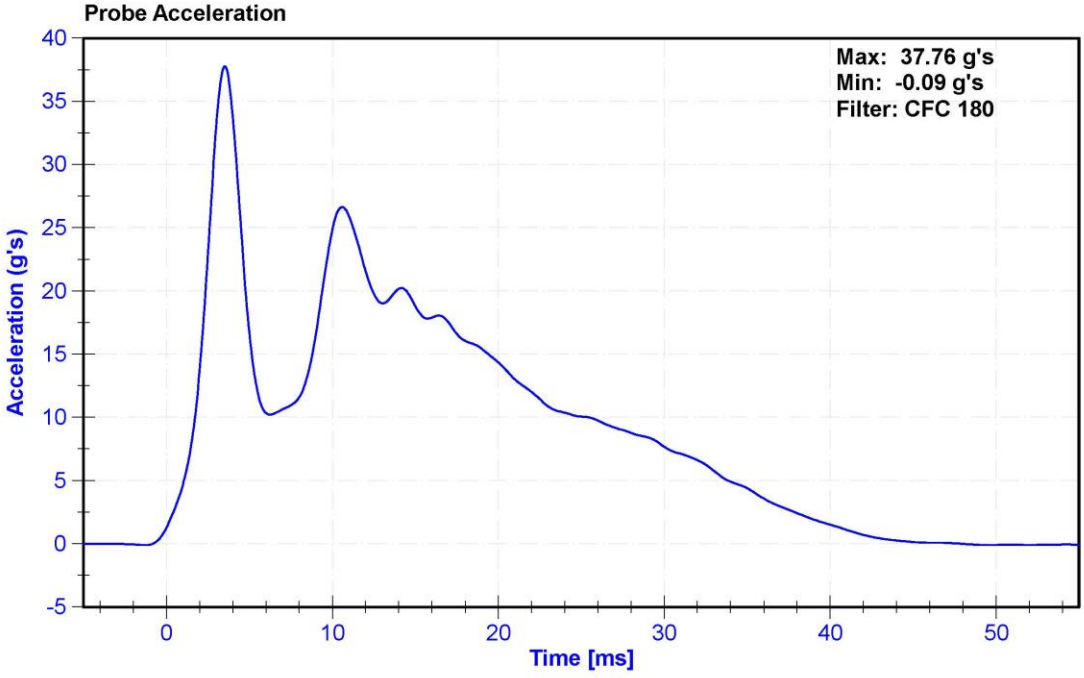
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

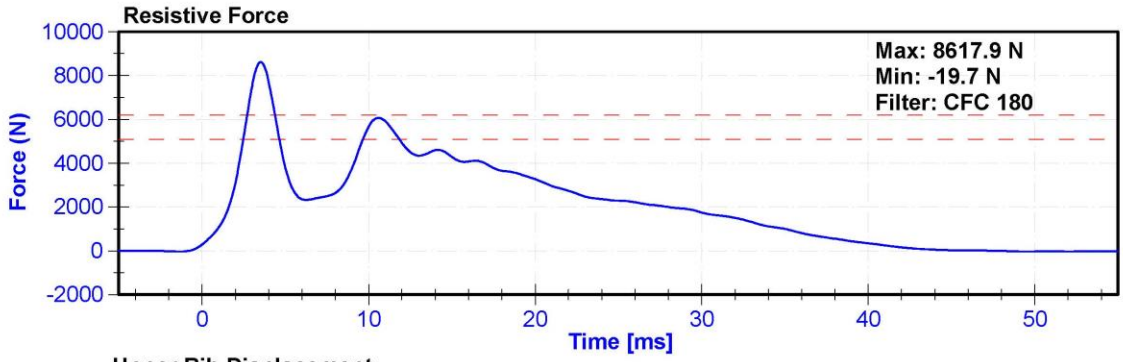
Results

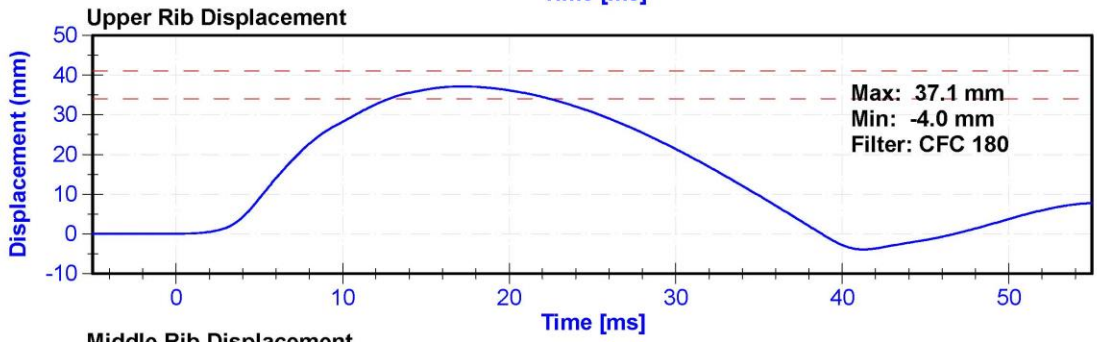
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	25.9	Pass
Velocity	5.4	5.6	m/s	5.52	Pass
Resistive Force after 6ms	5100	6200	N	6078.2	Pass
Upper Thorax Rib Deflection	34	41	mm	37.1	Pass
Mid Thorax Rib Deflection	37	45	mm	40.7	Pass
Lower Thorax Rib Deflection	37	44	mm	40.7	Pass

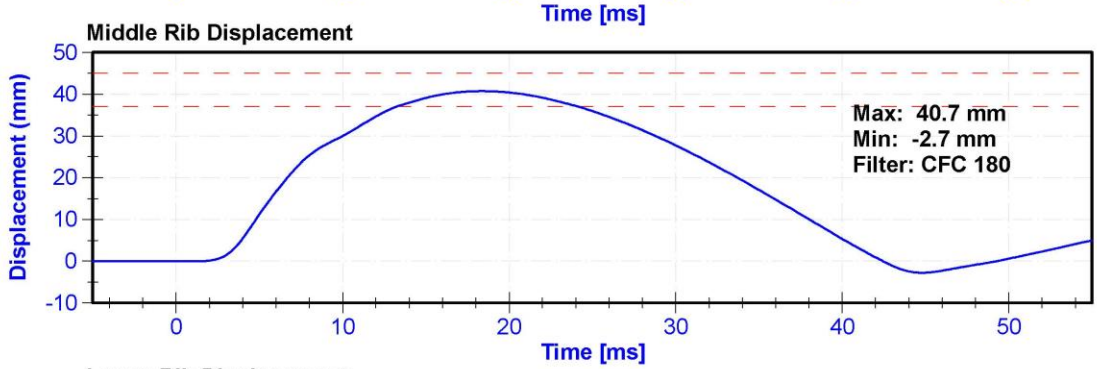
Transducer Calibrations

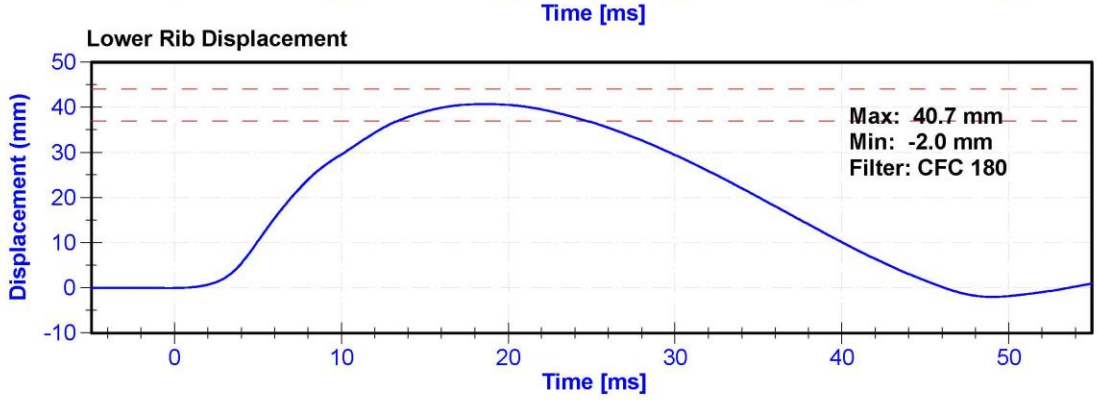
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019




Resistive Force
Max: 8617.9 N
Min: -19.7 N
Filter: CFC 180
Force (N)
Time [ms]


Upper Rib Displacement
Max: 37.1 mm
Min: -4.0 mm
Filter: CFC 180
Displacement (mm)
Time [ms]


Middle Rib Displacement
Max: 40.7 mm
Min: -2.7 mm
Filter: CFC 180
Displacement (mm)
Time [ms]


Lower Rib Displacement
Max: 40.7 mm
Min: -2.0 mm
Filter: CFC 180
Displacement (mm)
Time [ms]

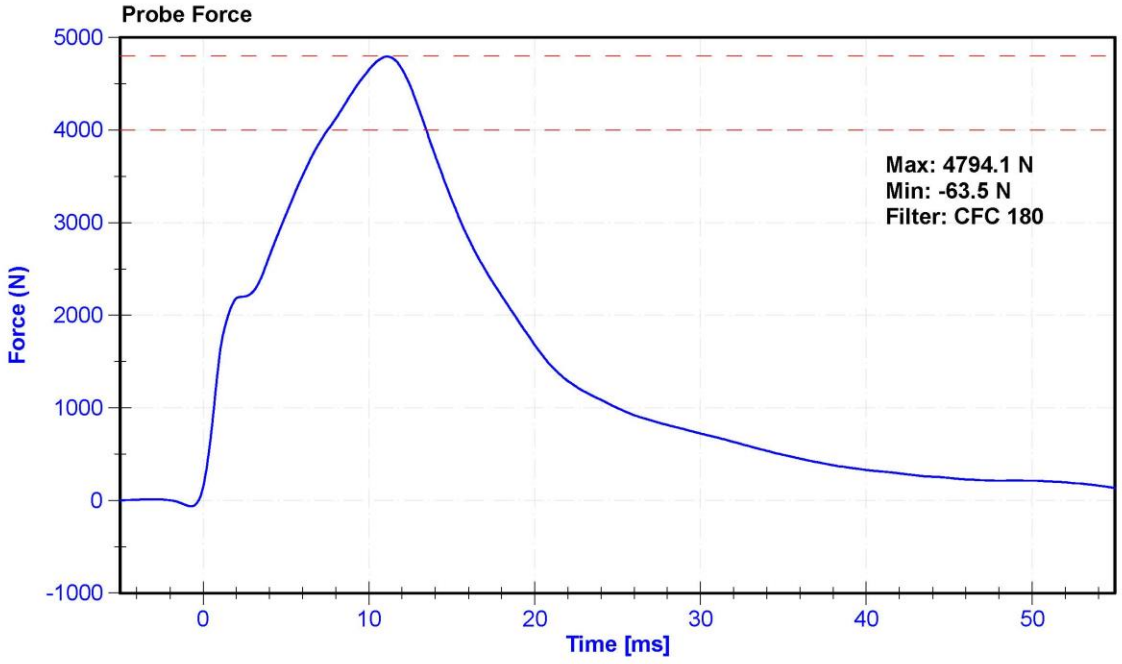
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	FO34	Laboratory Supervisor	K.Brogan

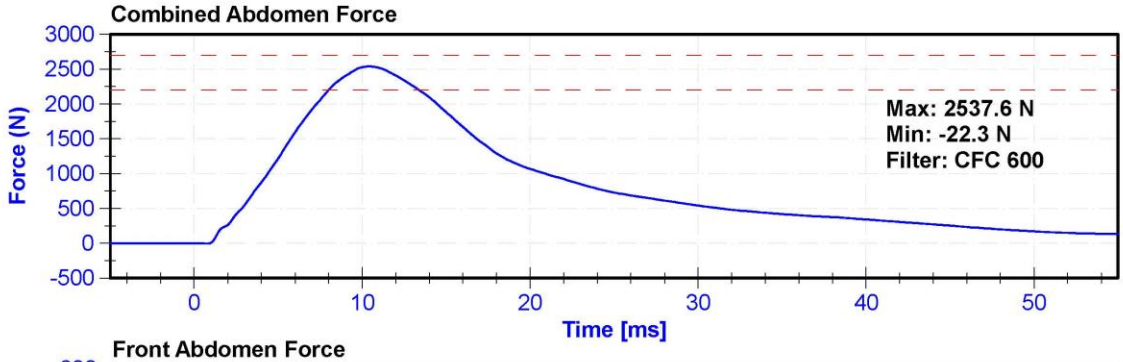
Results

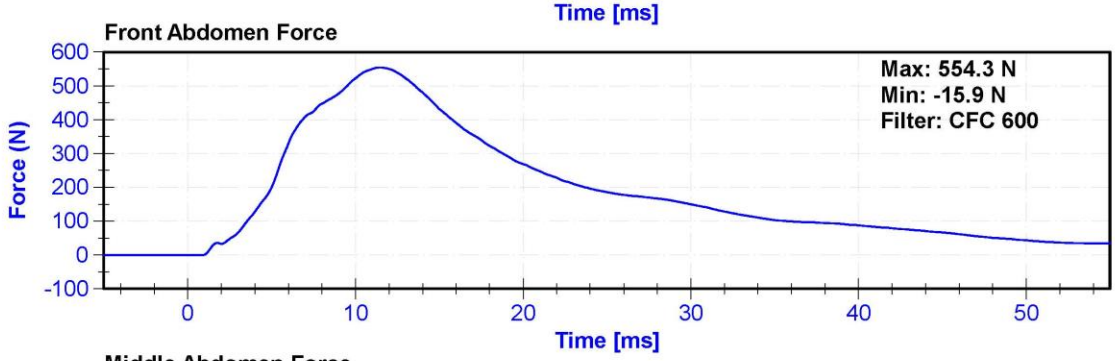
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	25.8	Pass
Velocity	3.9	4.1	m/s	4.09	Pass
Combined Abdomen Force	2200	2700	N	2537.6	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.45	Pass
Resistive Probe Force	4000	4800	N	4794.1	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.10	Pass

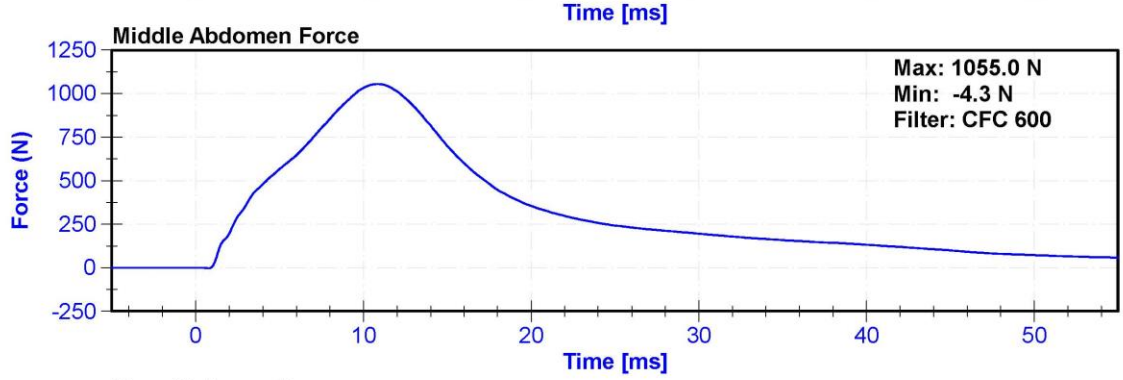
Transducer Calibrations

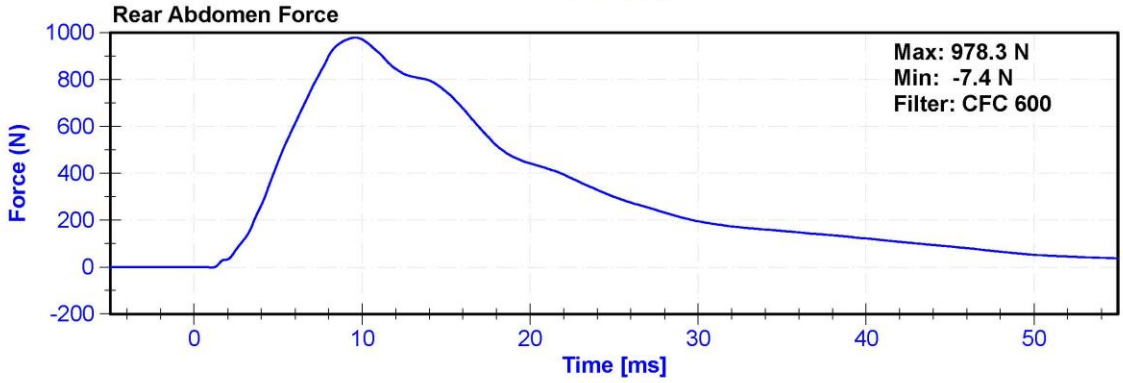
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Front Abdomen Load Cell	DENTON 2631	LC-1440	6/4/2018	6/4/2019
Middle Abdomen Load Cell	DENTON 2631	LC-1525	6/4/2018	6/4/2019
Rear Abdomen Load Cell	DENTON 2631	LC-1528	6/4/2018	6/4/2019




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2537.6 N
Min: -22.3 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 554.3 N
Min: -15.9 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1055.0 N
Min: -4.3 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 978.3 N
Min: -7.4 N
Filter: CFC 600

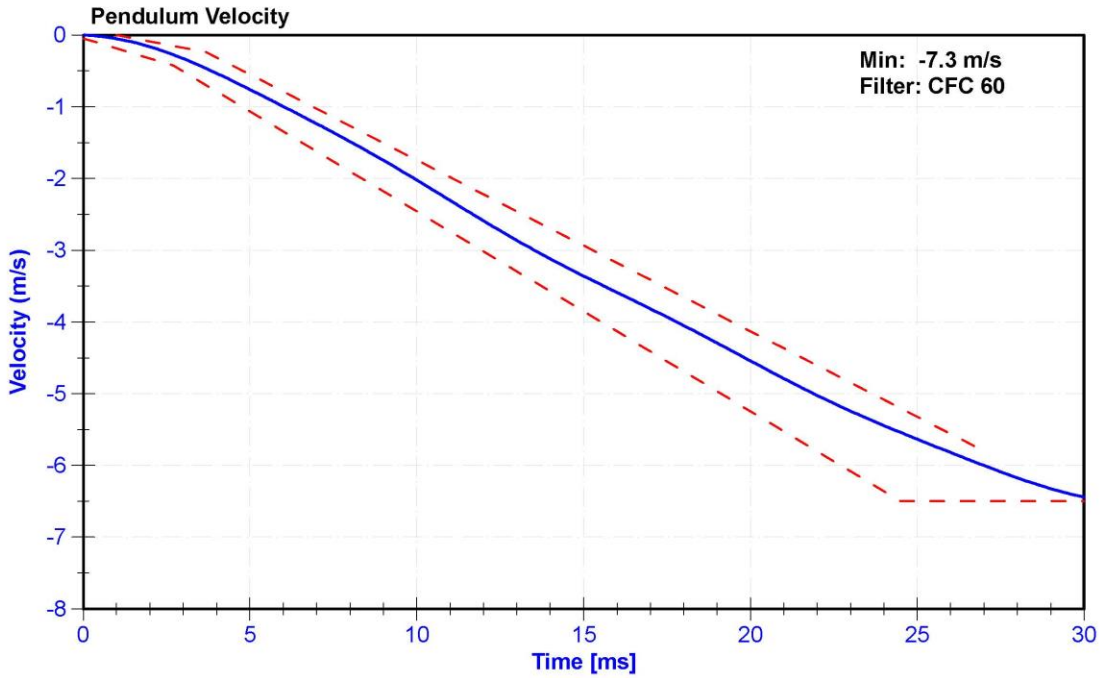
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

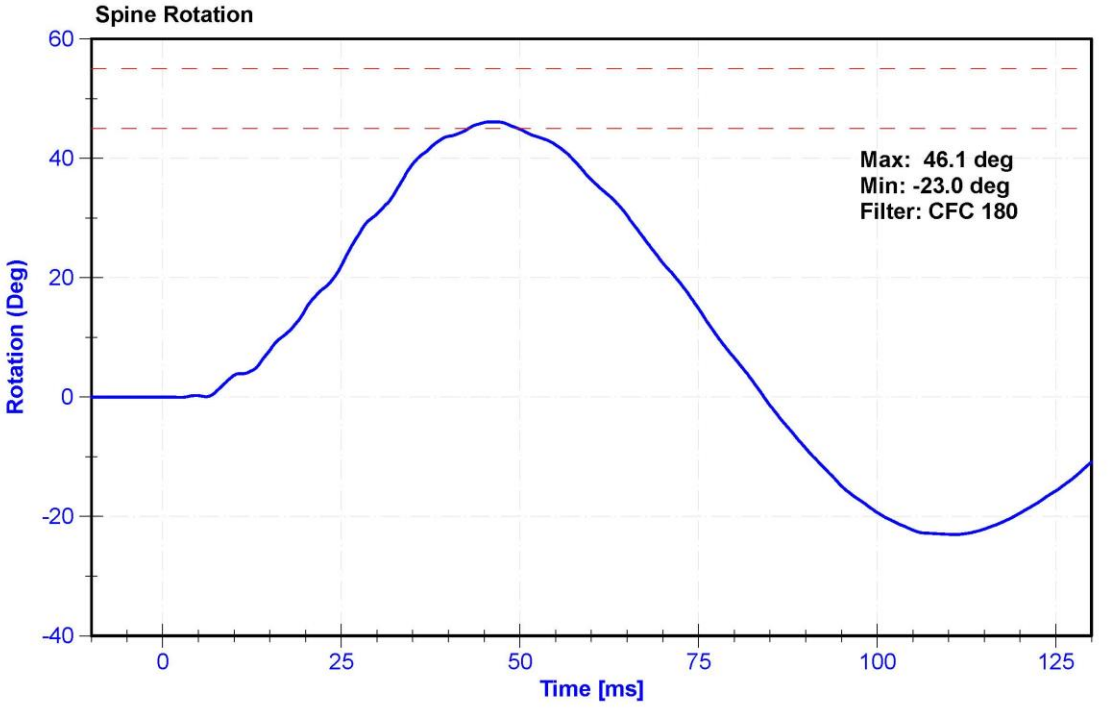
Results

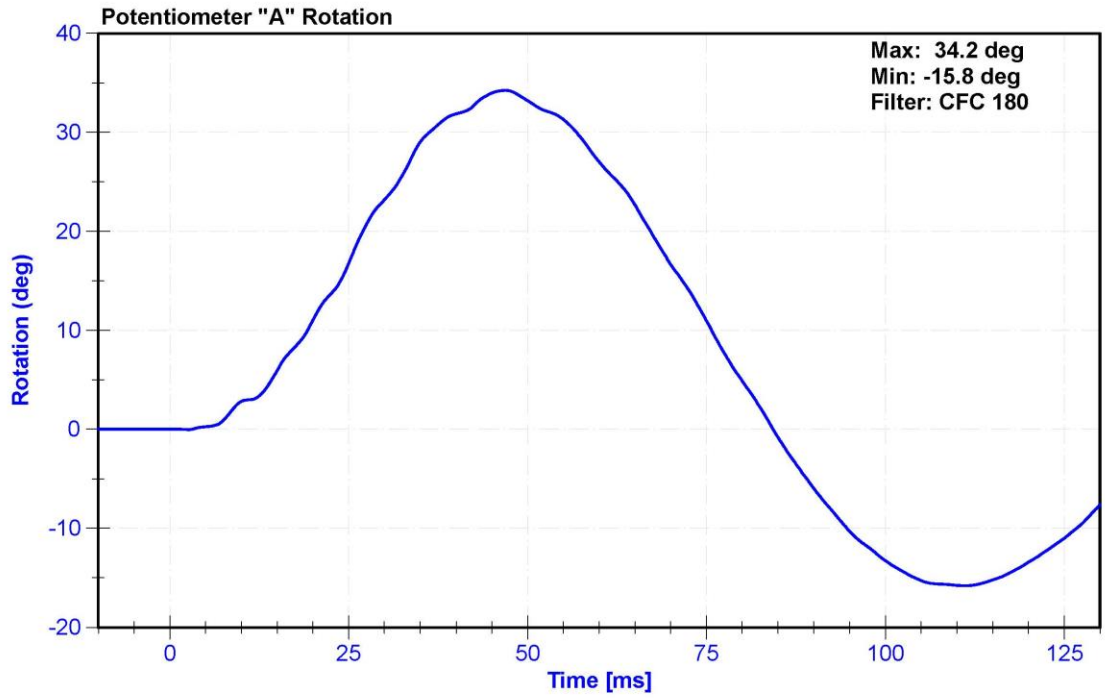
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	23.2	Pass
Velocity	5.95	6.15	m/s	6.046	Pass
Lateral Spine Rotation	45	55	deg	46.1	Pass
Time at Maximum Rotation	39	53	ms	45.8	Pass
Time of Decay to Zero Degrees	37	57	ms	38.3	Pass
Pulse within Corridor?	-	-	-		

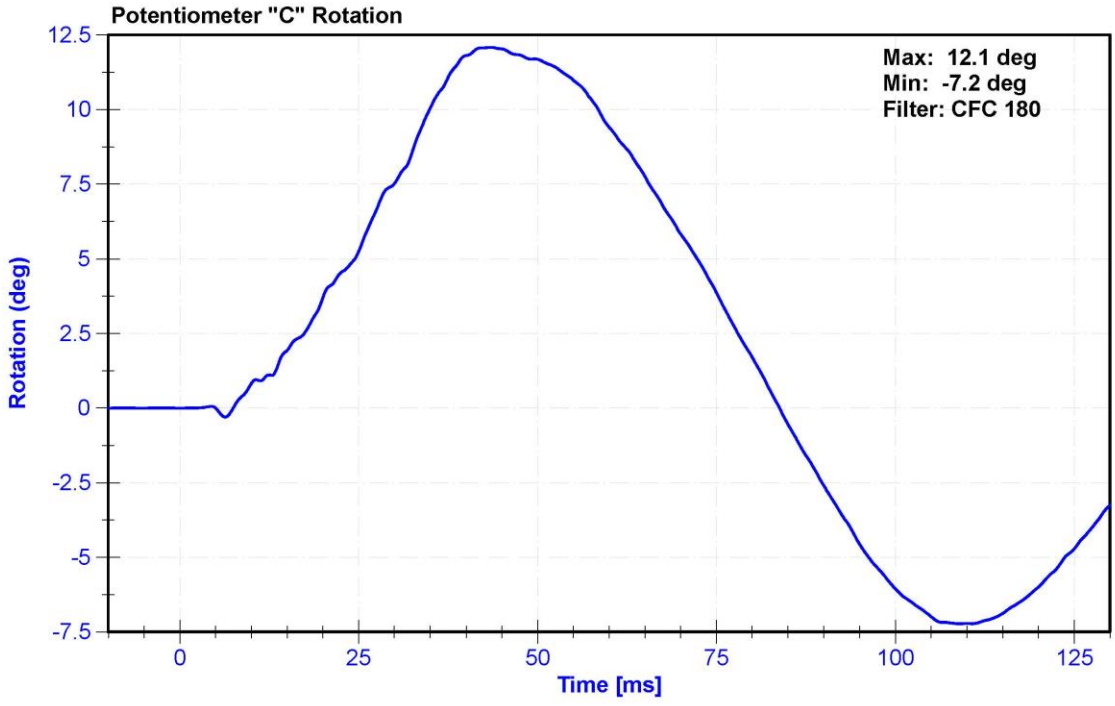
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
Pendulum "A" Potentiometer	SP22G	DS-094	10/31/2018	10/31/2019
Condyle "B" Potentiometer	SP22G	DS-095	10/31/2018	10/31/2019


Pendulum Velocity
Min: -7.3 m/s
Filter: CFC 60
Velocity (m/s)
0
-1
-2
-3
-4
-5
-6
-7
-8
0
5
10
15
20
25
30
Time [ms]


Spine Rotation
Max: 46.1 deg
Min: -23.0 deg
Filter: CFC 180
Rotation (Deg)
60
40
20
0
-20
-40
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 34.2 deg
Min: -15.8 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: 12.1 deg
Min: -7.2 deg
Filter: CFC 180
Rotation (deg)
12.5
10
7.5
5
2.5
0
-2.5
-5
-7.5
0
25
50
75
100
125
Time [ms]

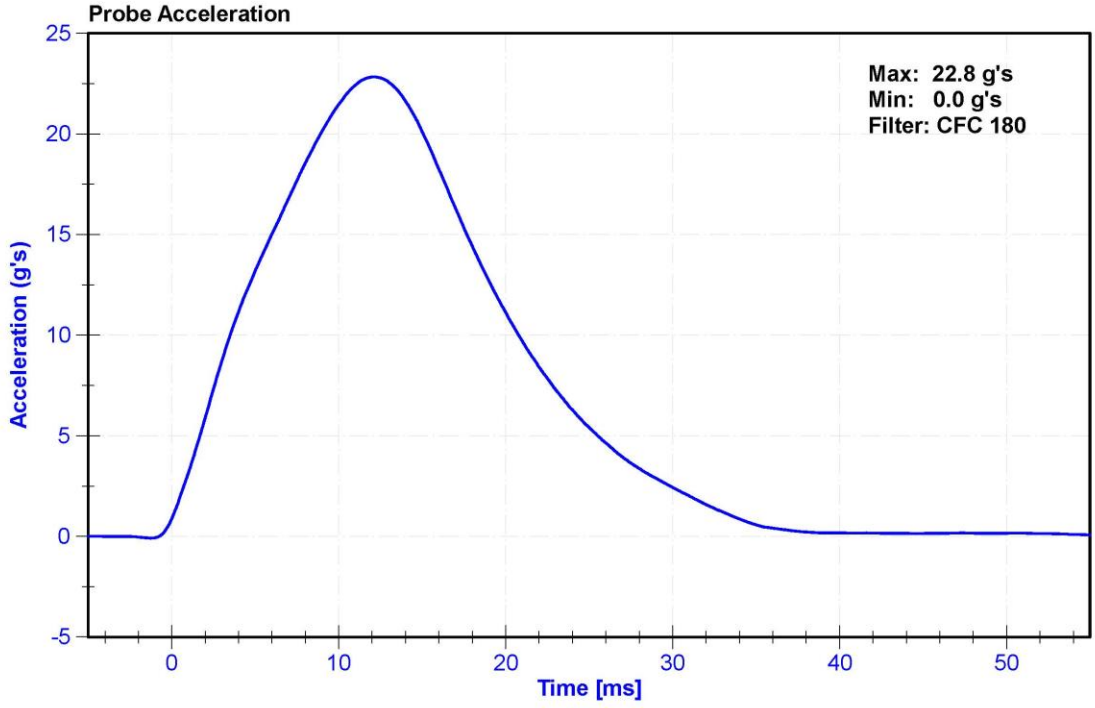
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

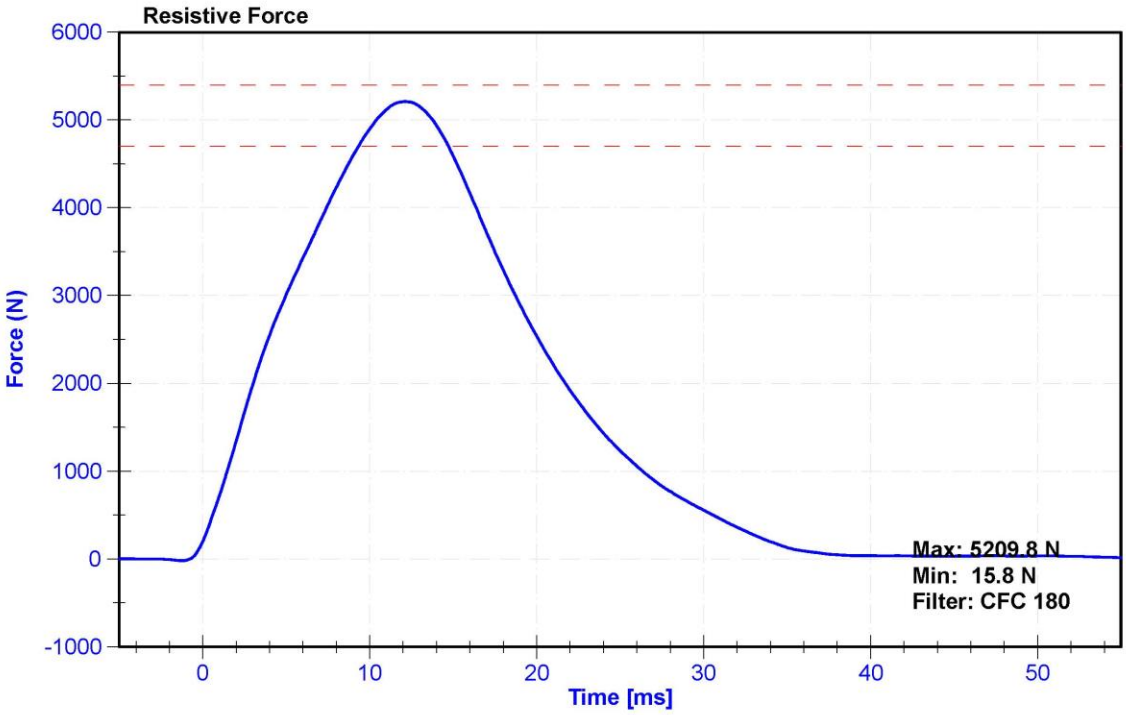
Results

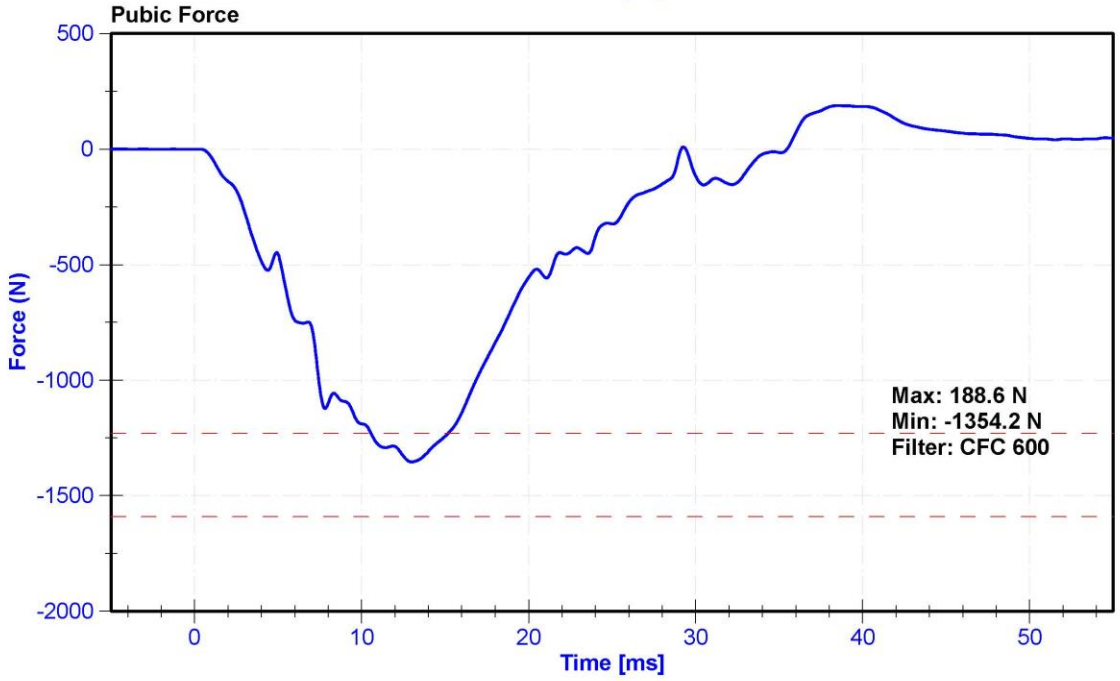
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	26.2	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Resistive Force	4700	5400	N	5209.8	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.10	Pass
Pubic Force	-1590	-1230	N	-1354.2	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.00	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Pubic Load Cell	Denton 3096JFL	LC-464fy	6/4/2018	6/4/2019




Resistive Force
Force (N)
Time [ms]
Max: 5209.8 N
Min: 15.8 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 188.6 N
Min: -1354.2 N
Filter: CFC 600

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

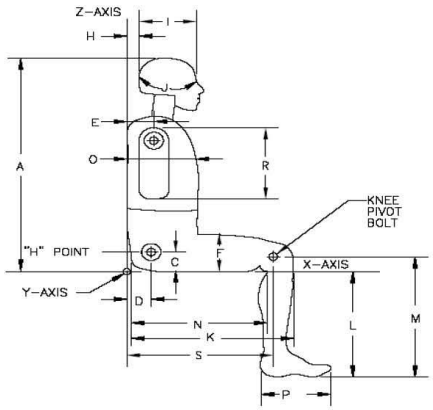
SERIAL No: 300

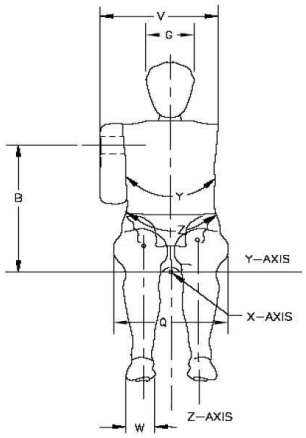
(CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - SID-IIs

Technician: K. Dutton Date: 2/22/2019

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	447	Pass
C	H-point Height	79	89	85	Pass
D	H-point from seatback	141	151	144	Pass
E	Shoulder Pivot from Backline	97	107	104	Pass
F	Thigh Clearance	119	135	124	Pass
G	Head Breadth	140	148	144	Pass
H	Head Back from Backline	40	46	42	Pass
I	Head Depth	178	188	186	Pass
J	Head Circumference	541	551	547	Pass
K	Buttock to Knee Length	514	540	529	Pass
L	Popliteal Height	343	369	358	Pass
M	Knee Pivot to floor height	392	409	402	Pass
N	Buttock Popliteal Length	416	442	432	Pass
O	Chest Depth w/o jacket	195	211	204	Pass
P	Foot Length	216	232	223	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	319	Pass
R	Arm Length	249	259	253	Pass
S	Knee Joint to seatback	477	493	485	Pass
V	Shoulder Width	341	357	351	Pass
W	Foot Width	78	94	83	Pass
Y	Chest Circumference w/jacket	851	881	872	Pass
Z	Waist Circumference	761	791	770	Pass

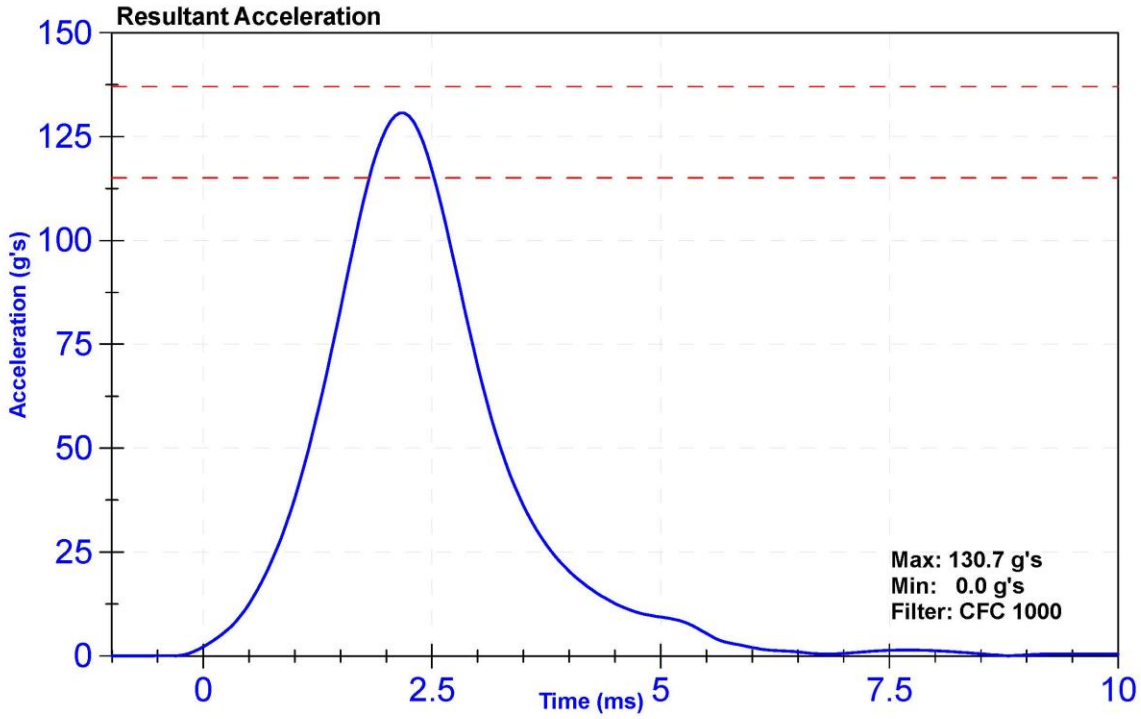
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

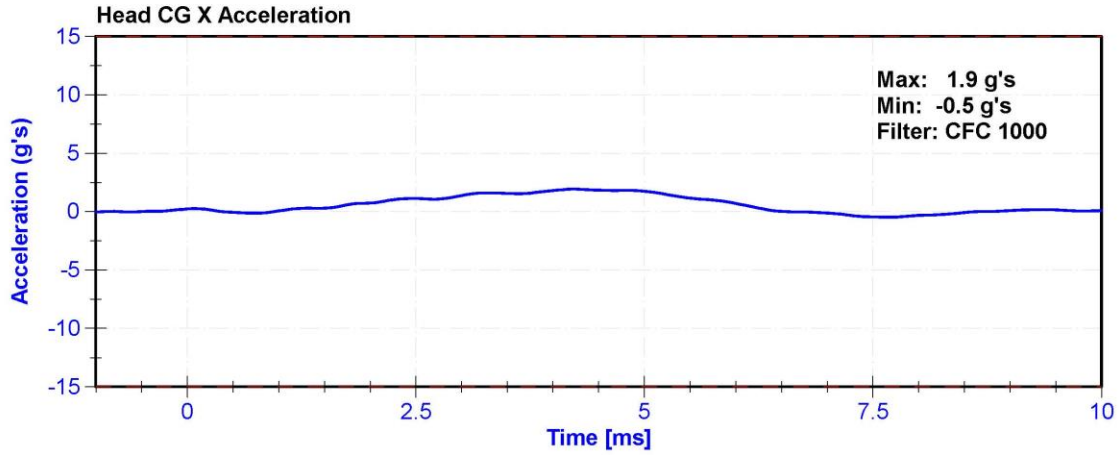
Results

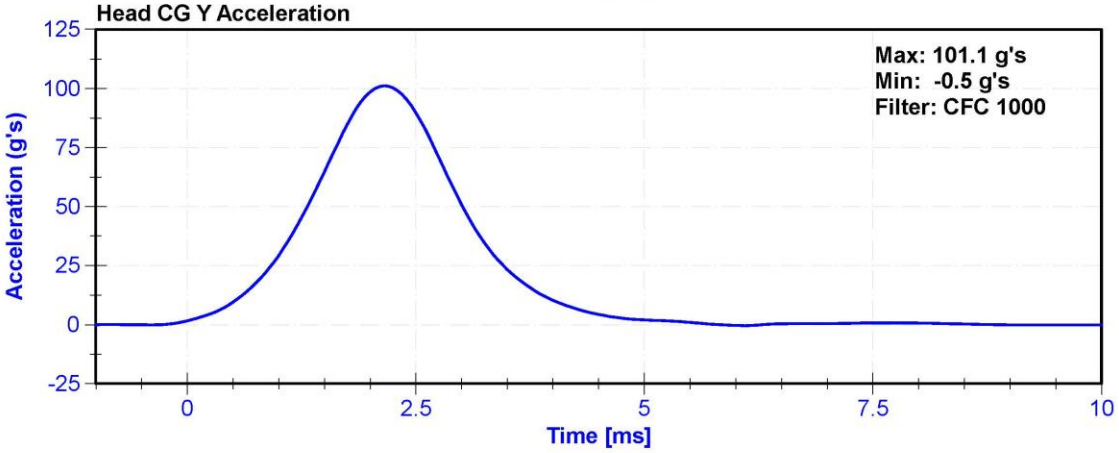
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	24.4	Pass
Resultant Acceleration	115	137	g's	130.7	Pass
Oscillation	0	15	%	1.1	Pass
Fore-Aft Acceleration	-15	15	g's	1.9	Pass

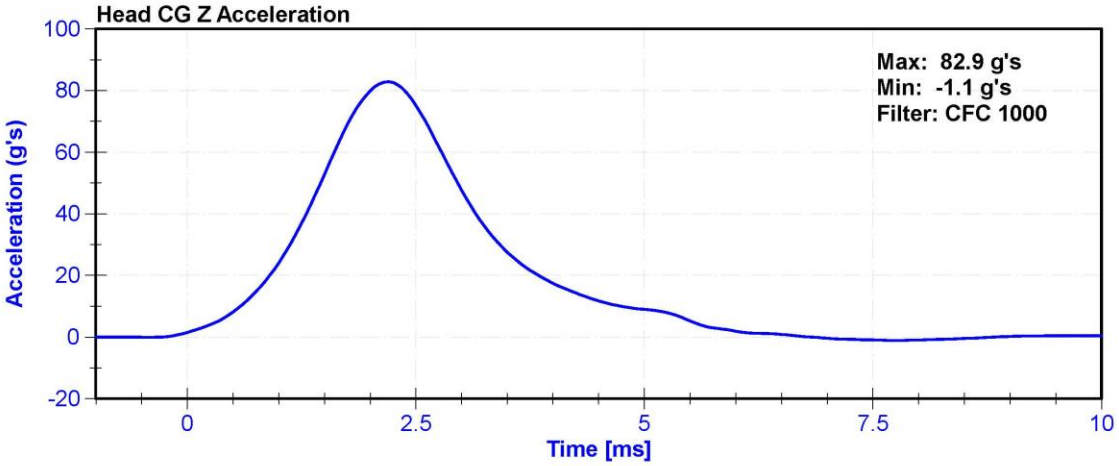
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P58777	10/5/2018	4/5/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P59018	10/5/2018	4/5/2019
Z Accelerometer	ENDEVCO 7264	AC-P79189	10/5/2018	4/5/2019




Head CG X Acceleration
Max: 1.9 g's
Min: -0.5 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: 101.1 g's
Min: -0.5 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: 82.9 g's
Min: -1.1 g's
Filter: CFC 1000
Acceleration (g's)
100
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]

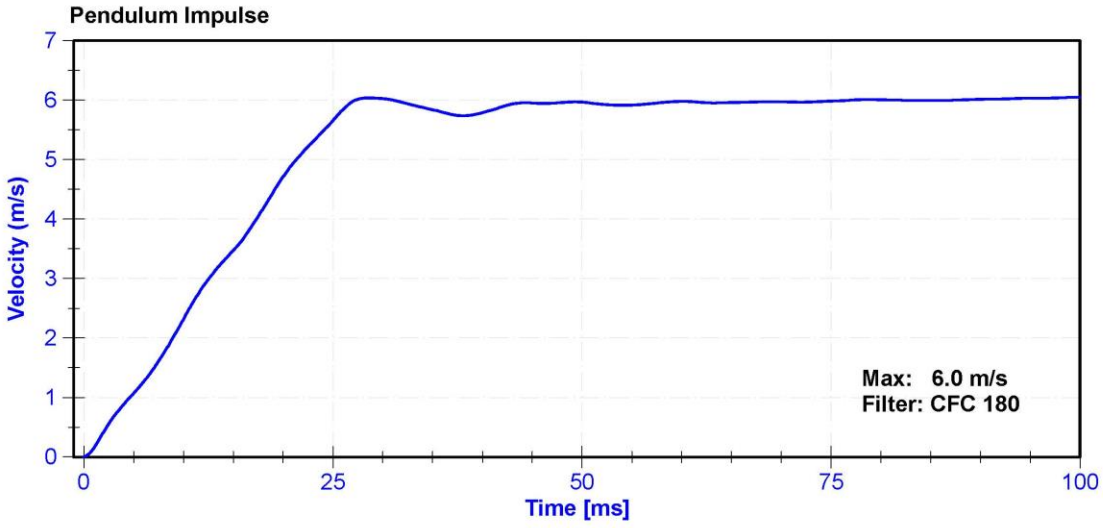
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

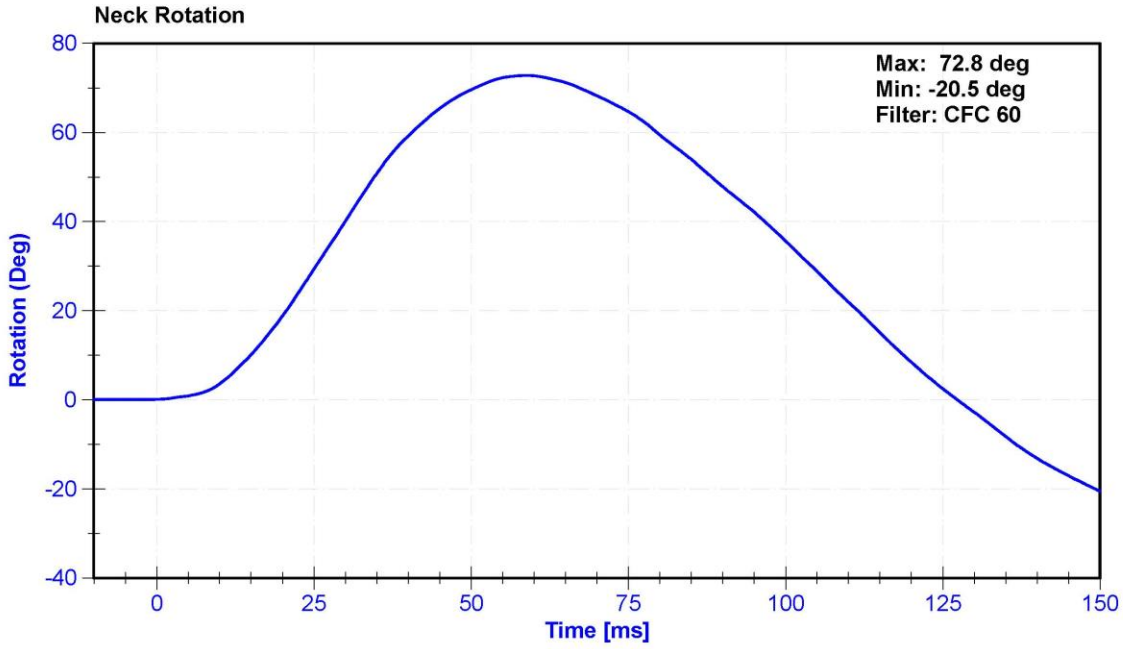
Results

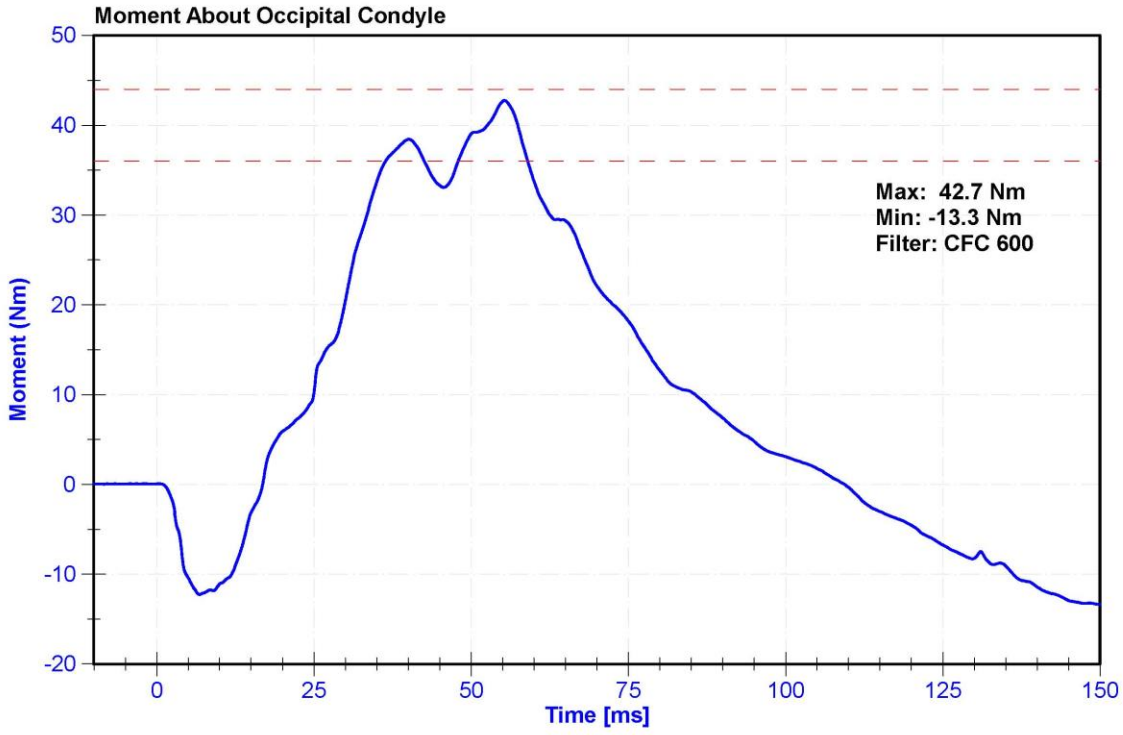
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	23.5	Pass
Velocity	5.51	5.63	m/s	5.514	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.32	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.47	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.71	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.65	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	6.04	Pass
Neck Rotation	71	81	deg	72.8	Pass
Time at Maximum Rotation	50	70	ms	58.9	Pass
Moment about the OC	36	44	Nm	42.7	Pass
Moment Decay to 0 Nm	102	126	ms	109.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
Pendulum Potentiometer	Denton 78051-342	DS-184Pend	11/1/2018	11/1/2019
Condyle Potentiometer	Denton 78051-342	DS-185Pend	11/1/2018	11/1/2019
Upper Neck Load Cell	Denton 1716	LC-2018 FY	9/28/2018	9/28/2019




Neck Rotation
Max: 72.8 deg
Min: -20.5 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: 42.7 Nm
Min: -13.3 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

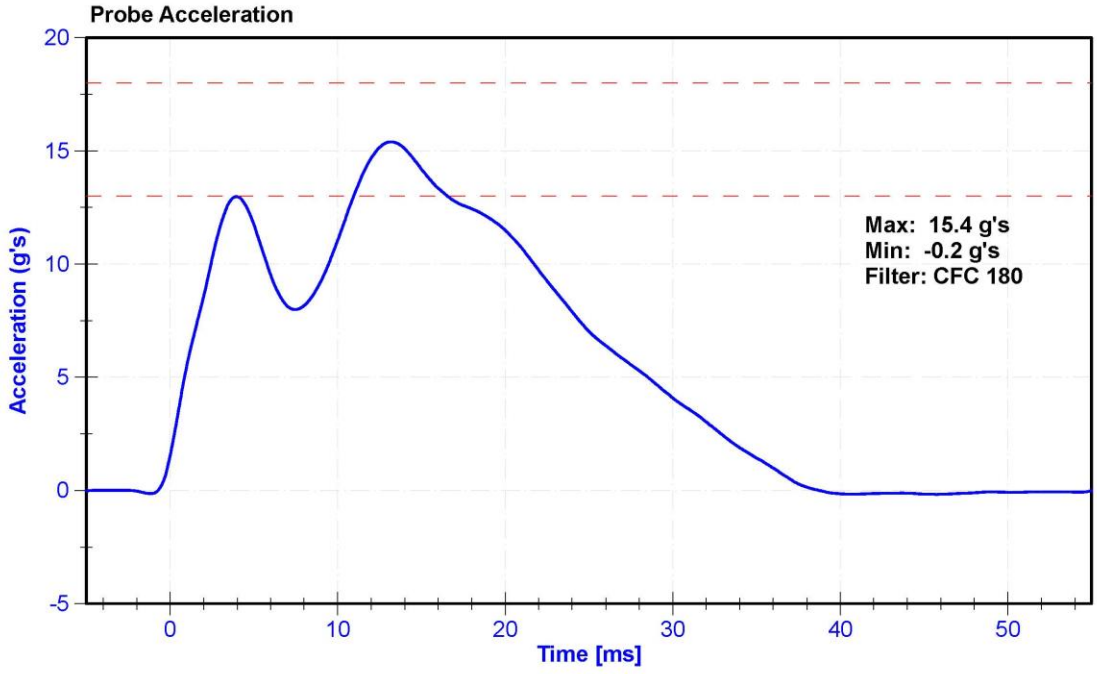
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

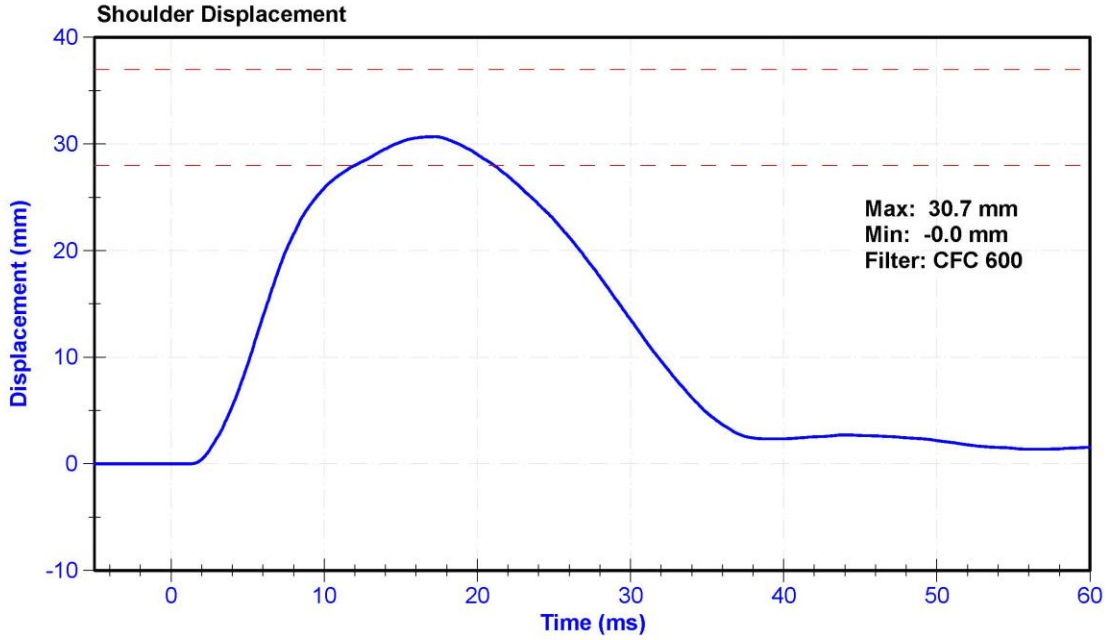
Results

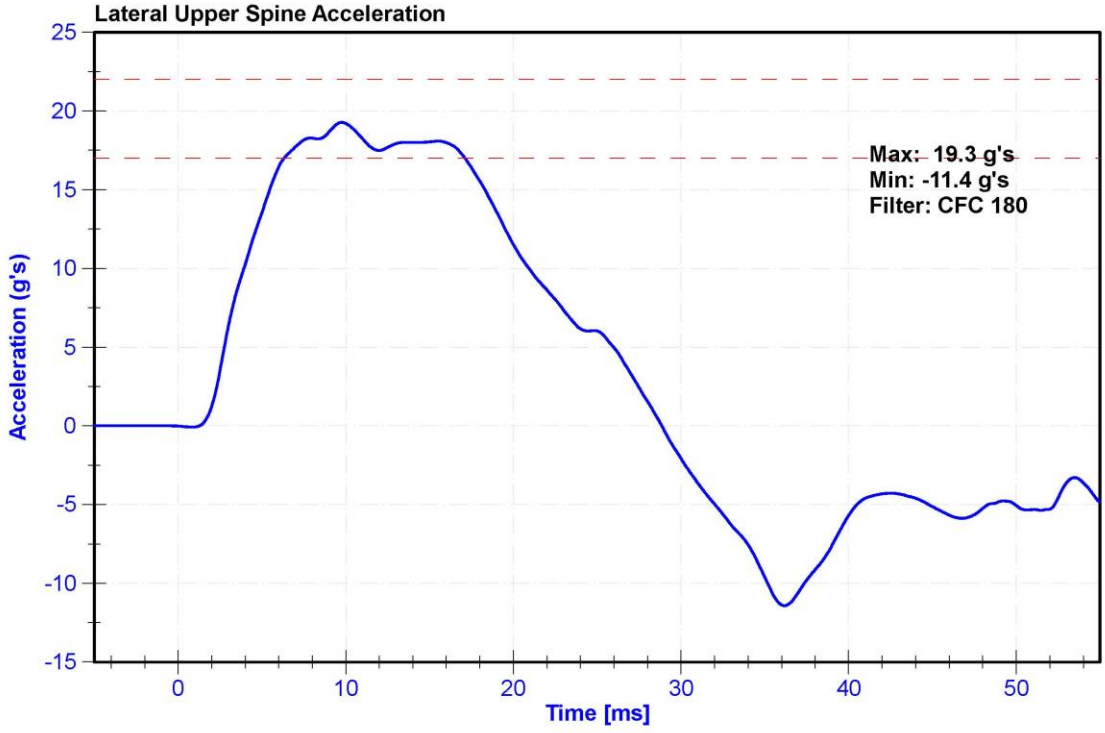
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	24.9	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	13	18	g's	15.4	Pass
Shoulder Deflection	28	37	mm	30.7	Pass
Lateral Upper Spine Acceleration	17	22	g's	19.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	10/30/2018	10/30/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P63315	10/24/2018	4/24/2019




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 30.7 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 19.3 g's
Min: -11.4 g's
Filter: CFC 180

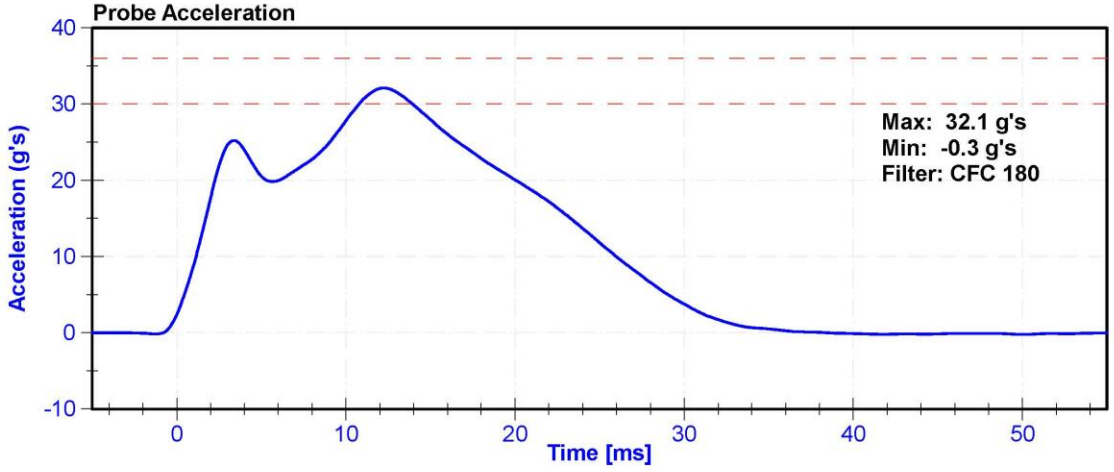
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

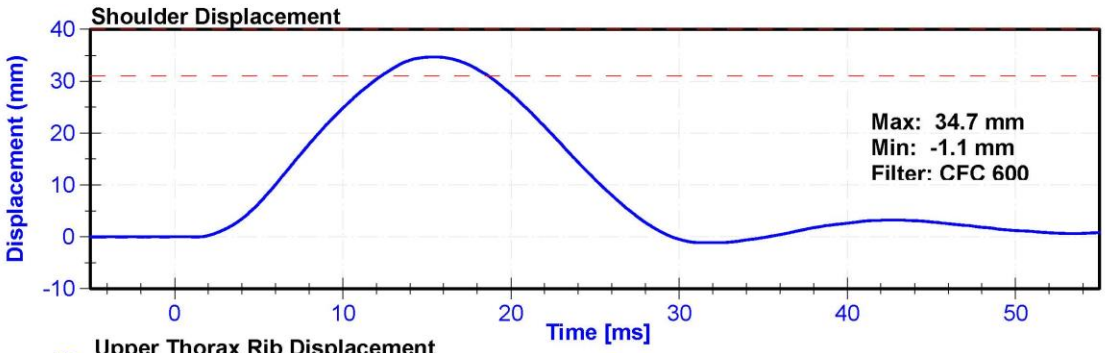
Results

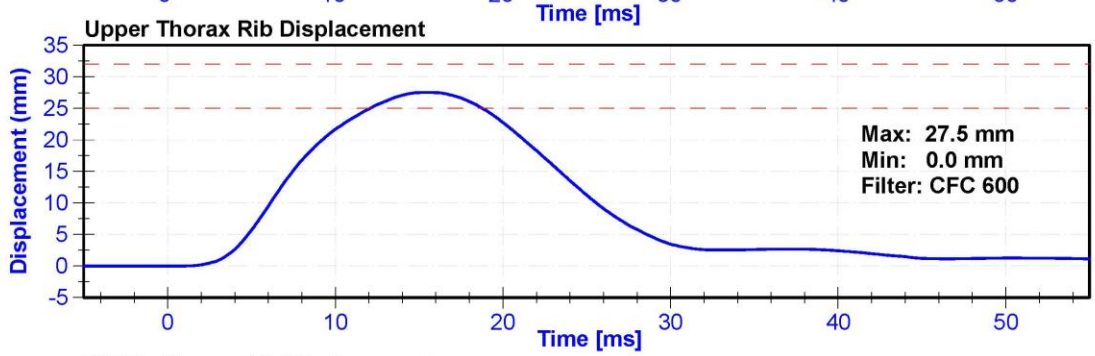
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	27.8	Pass
Velocity	6.6	6.8	m/s	6.74	Pass
Probe Acceleration after 5 ms	30	36	g's	32.1	Pass
Lateral Upper Spine Acceleration	34	43	g's	36.1	Pass
Lateral Lower Spine Acceleration	29	37	g's	34.7	Pass
Shoulder Deflection	31	40	mm	34.7	Pass
Upper Thorax Rib Deflection	25	32	mm	27.5	Pass
Mid Thorax Rib Deflection	30	36	mm	31.5	Pass
Lower Thorax Rib Deflection	32	38	mm	33.4	Pass

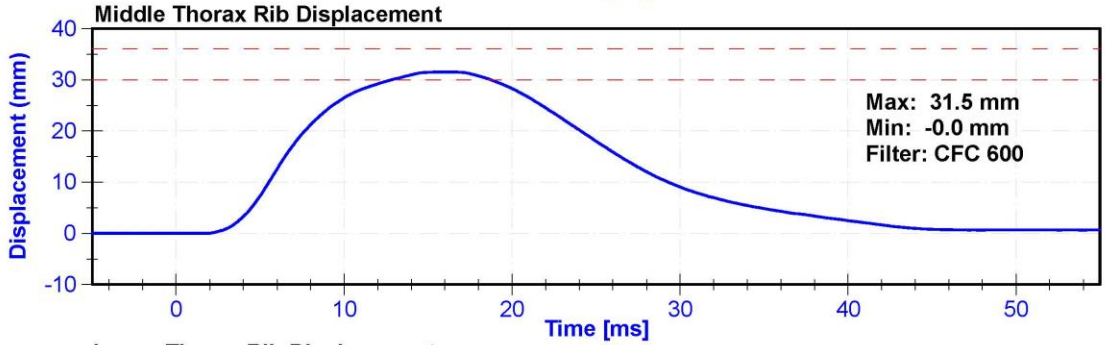
Transducer Calibrations

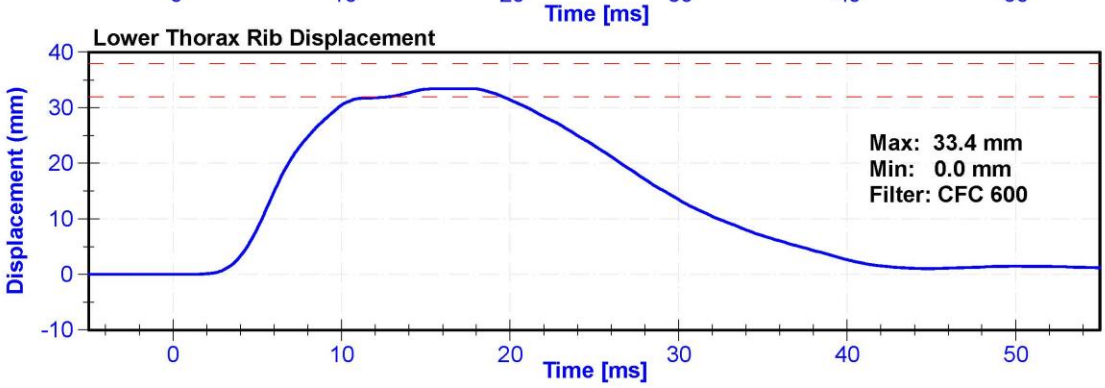
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P63315	10/24/2018	4/24/2019
Upper Spine T12 Y Accelerometer	ENDEVCO 7264	AC-P64147	1/10/2019	7/11/2019
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	10/30/2018	10/30/2019
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	10/10/2018	10/10/2019

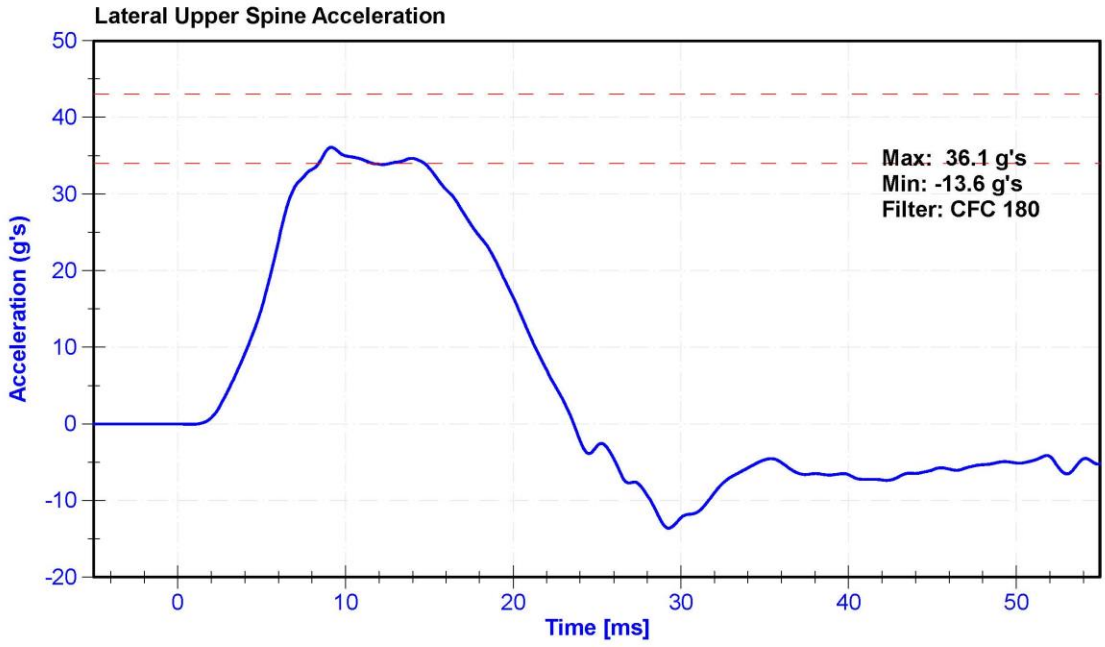


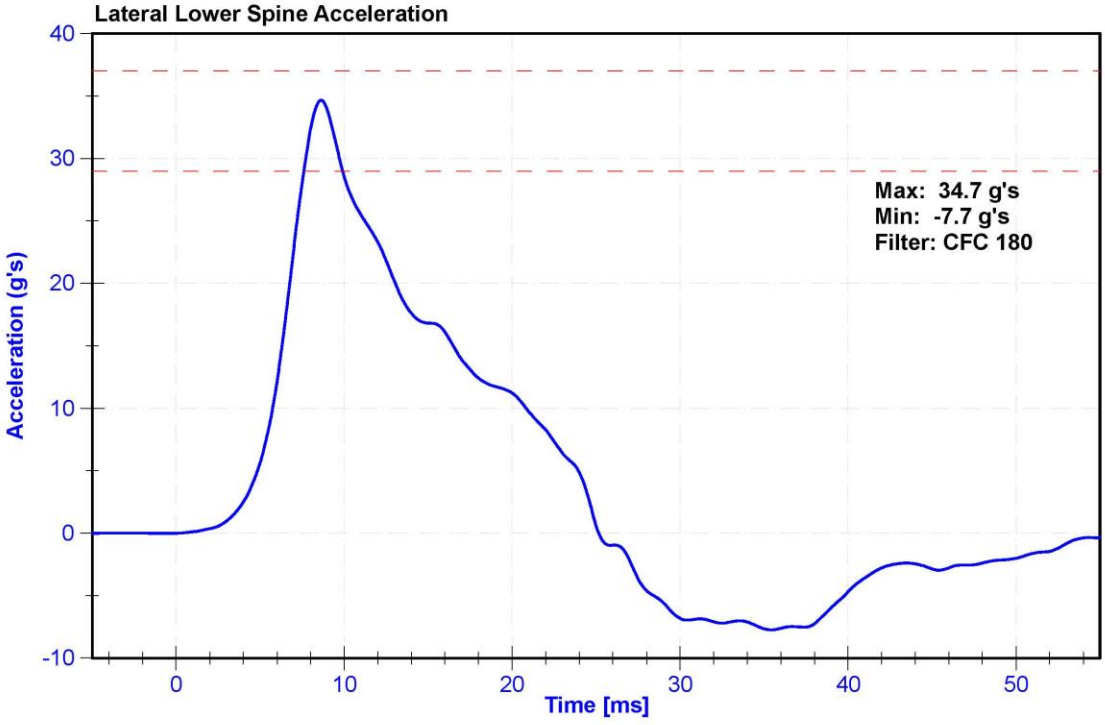

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 34.7 mm
Min: -1.1 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 27.5 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 31.5 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 33.4 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 36.1 g's
Min: -13.6 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 34.7 g's
Min: -7.7 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
0
10
20
30
40
50

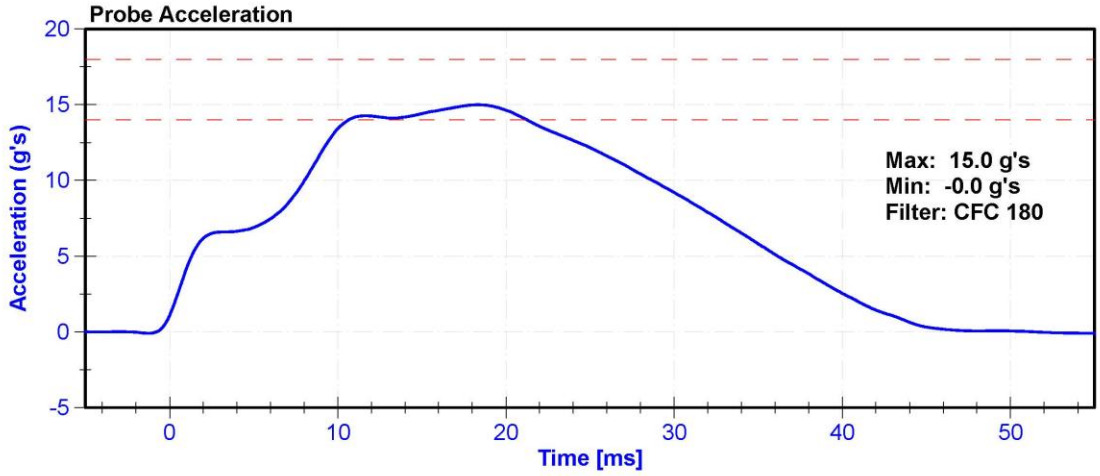
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

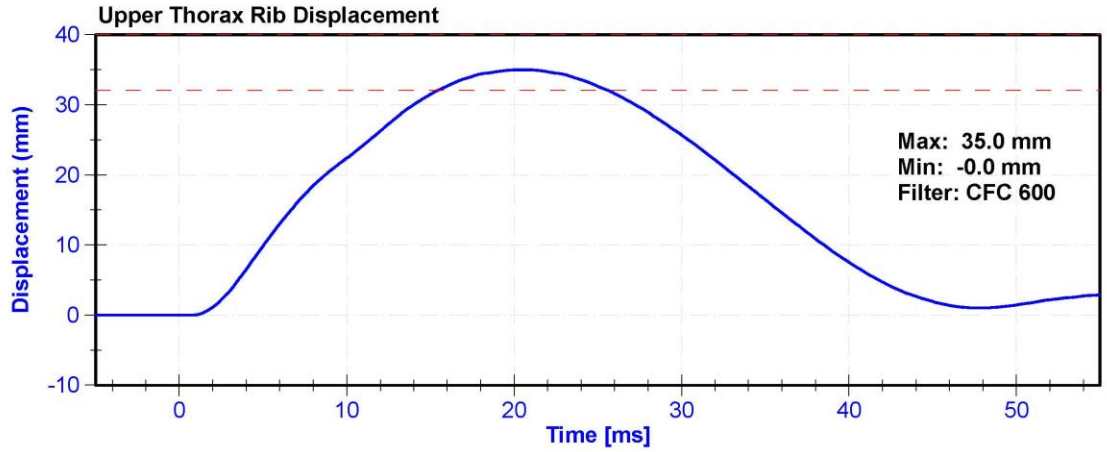
Results

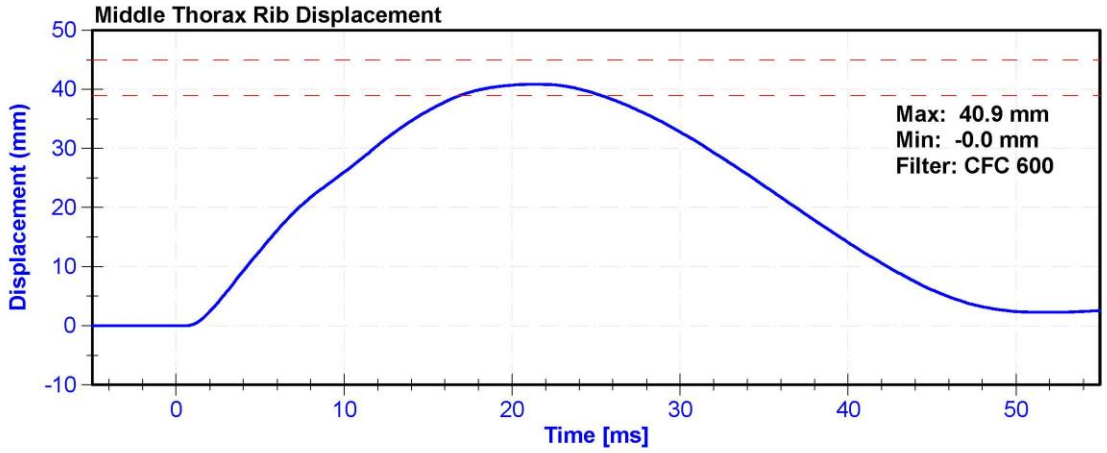
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	35.7	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Probe Acceleration	14	18	g's	15.0	Pass
Lateral Upper Spine Acceleration	13	17	g's	14.9	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.6	Pass
Upper Thorax Rib Deflection	32	40	mm	35.0	Pass
Middle Thorax Rib Deflection	39	45	mm	40.9	Pass
Lower Thorax Rib Deflection	35	43	mm	38.1	Pass

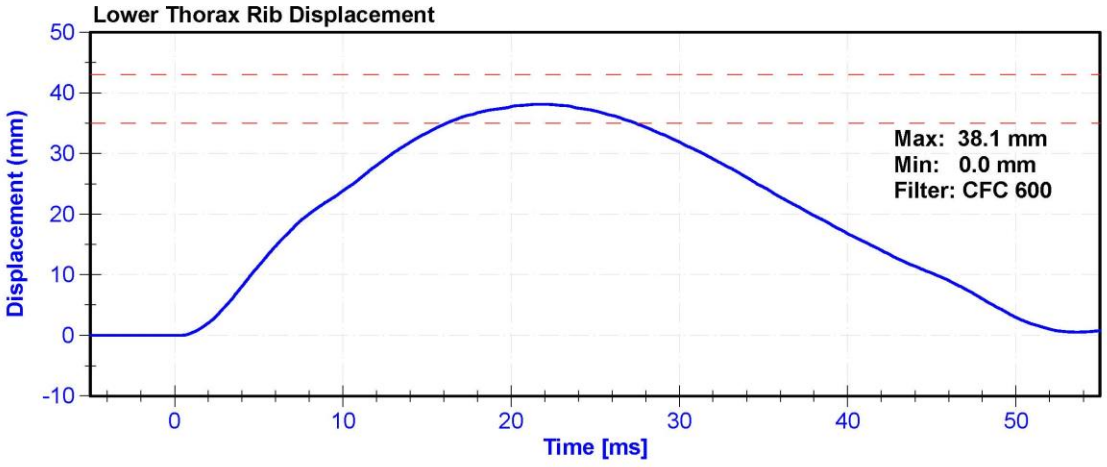
Transducer Calibrations

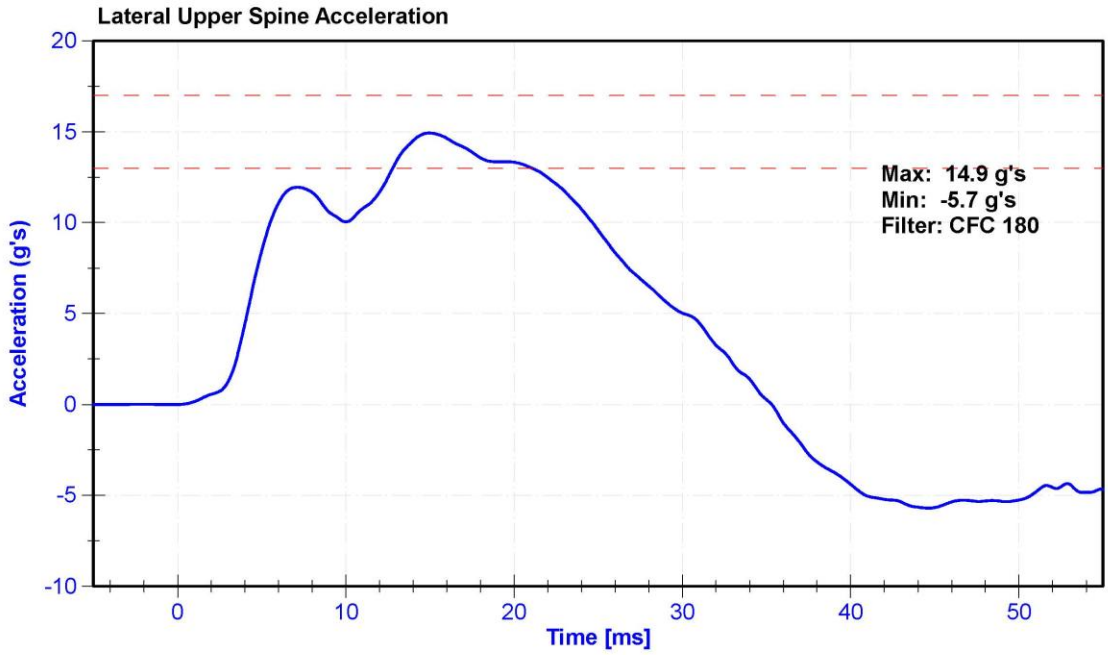
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P63315	10/24/2018	4/24/2019
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	1/10/2019	7/11/2019
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	10/10/2018	10/10/2019

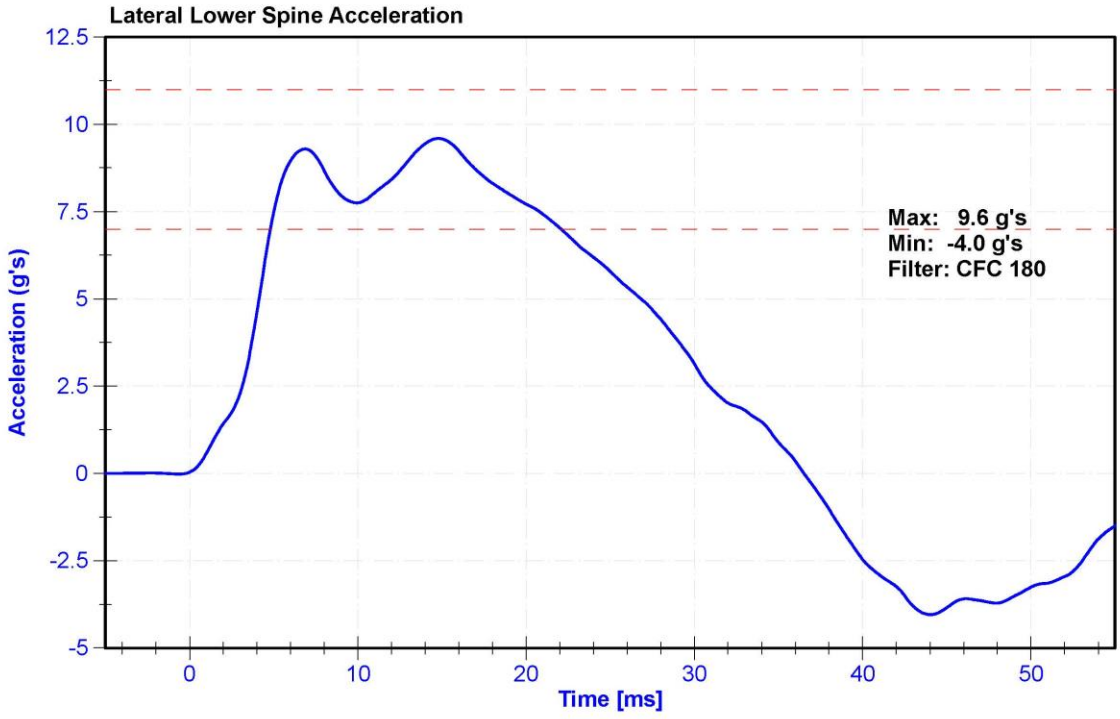



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 35.0 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.9 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 38.1 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 14.9 g's
Min: -5.7 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
20
15
10
5
0
-5
-10
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 9.6 g's
Min: -4.0 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50

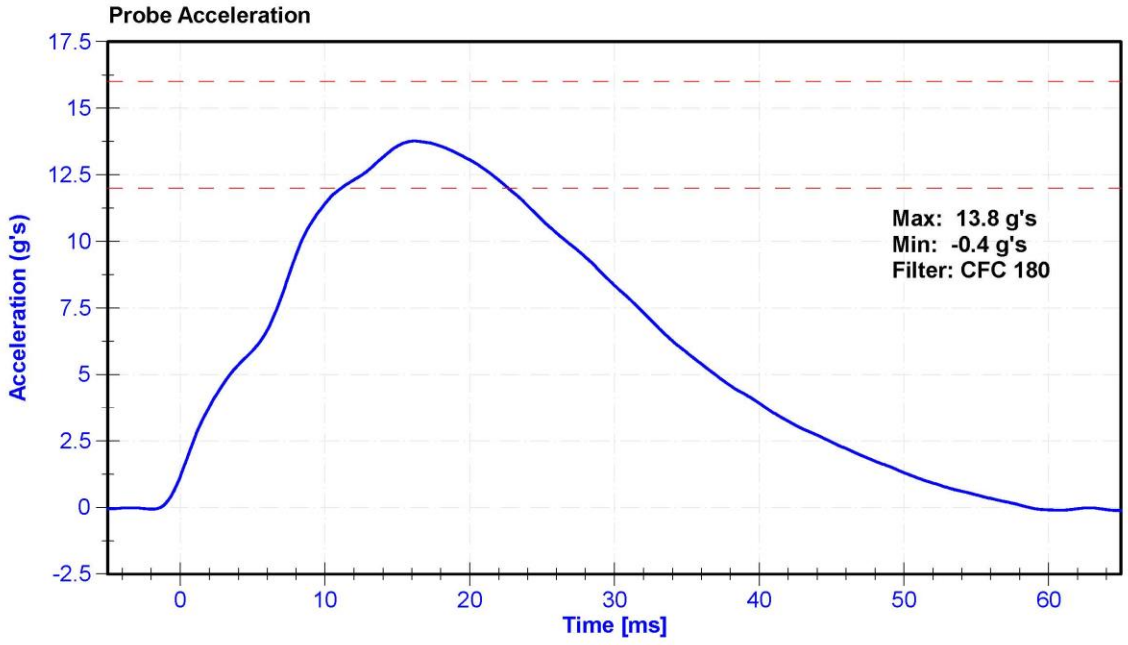
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

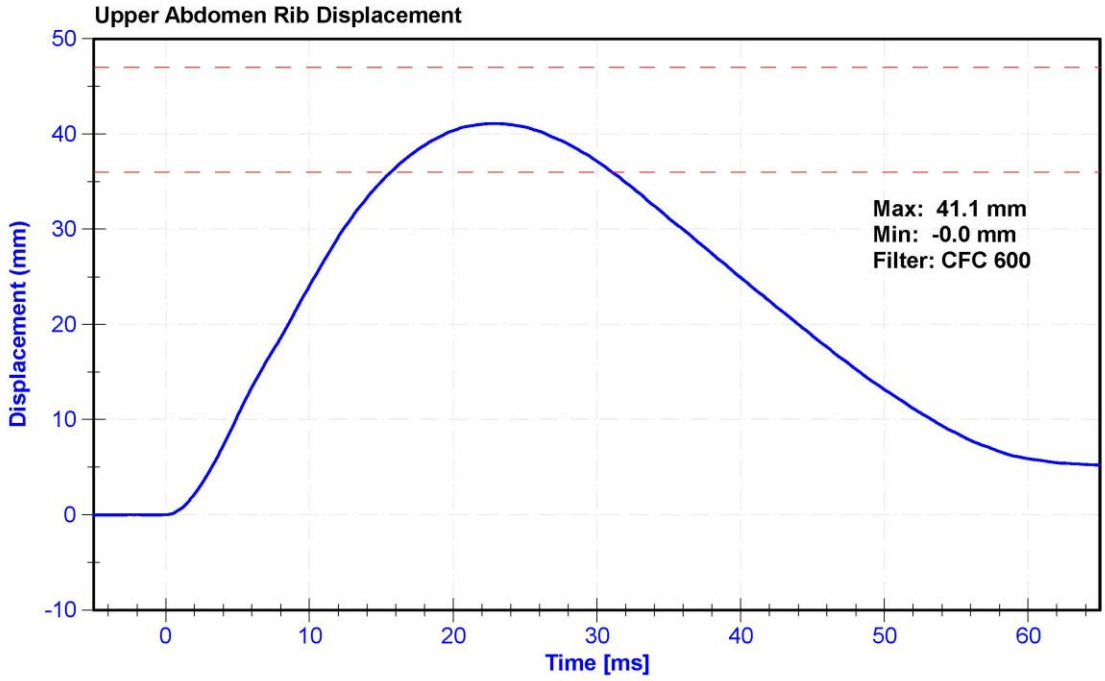
Results

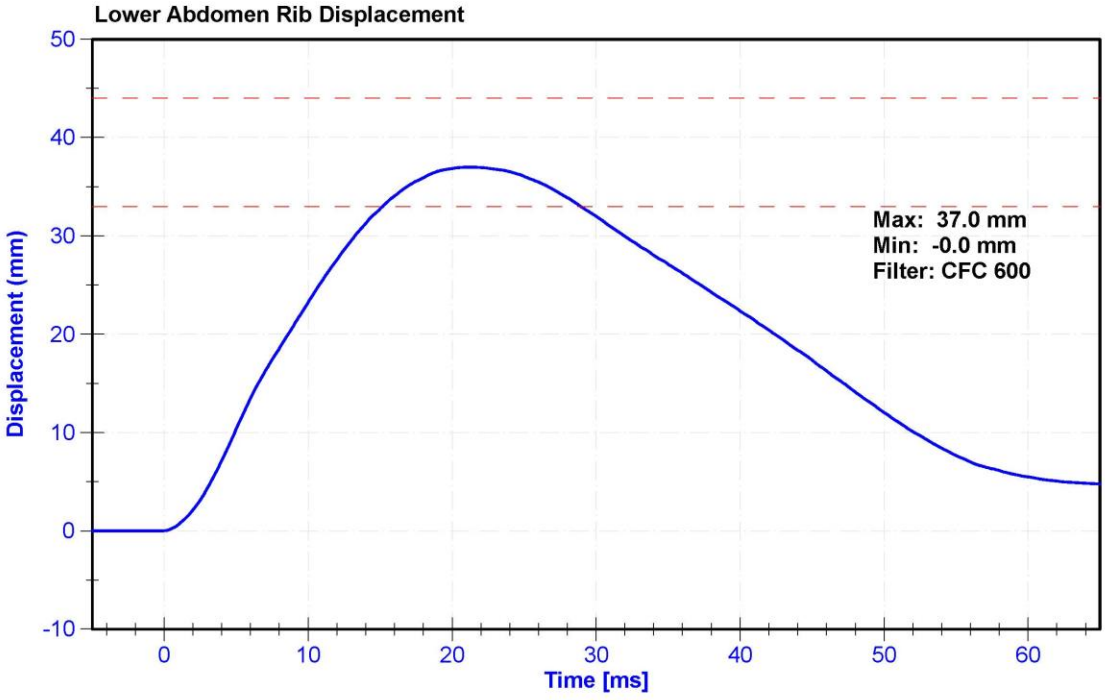
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.1	Pass
Humidity	10	70	%	20.7	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Probe Acceleration	12	16	g's	13.8	Pass
Lateral Lower Spine Acceleration	9	14	g's	11.3	Pass
Upper Abdomen Rib Deflection	36	47	mm	41.1	Pass
Lower Abdomen Rib Deflection	33	44	mm	37.0	Pass

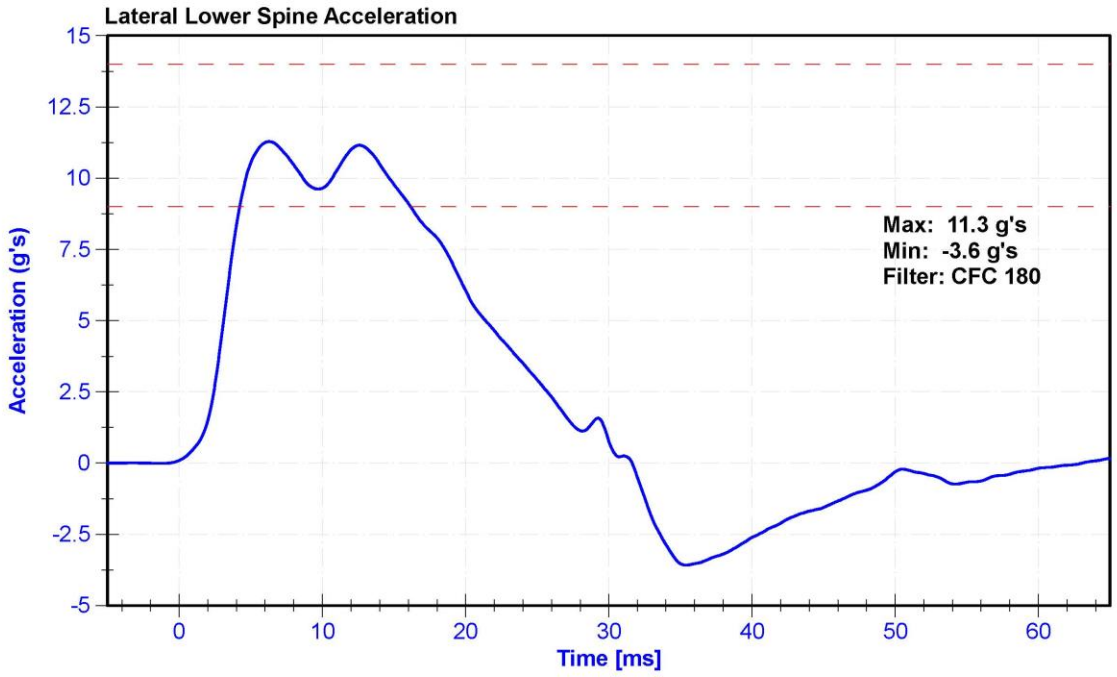
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	1/10/2019	7/11/2019
Upper Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-308GFE	10/10/2018	10/10/2019
Lower Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-307GFE	10/11/2018	10/11/2019




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


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.0 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: 11.3 g's
Min: -3.6 g's
Filter: CFC 180

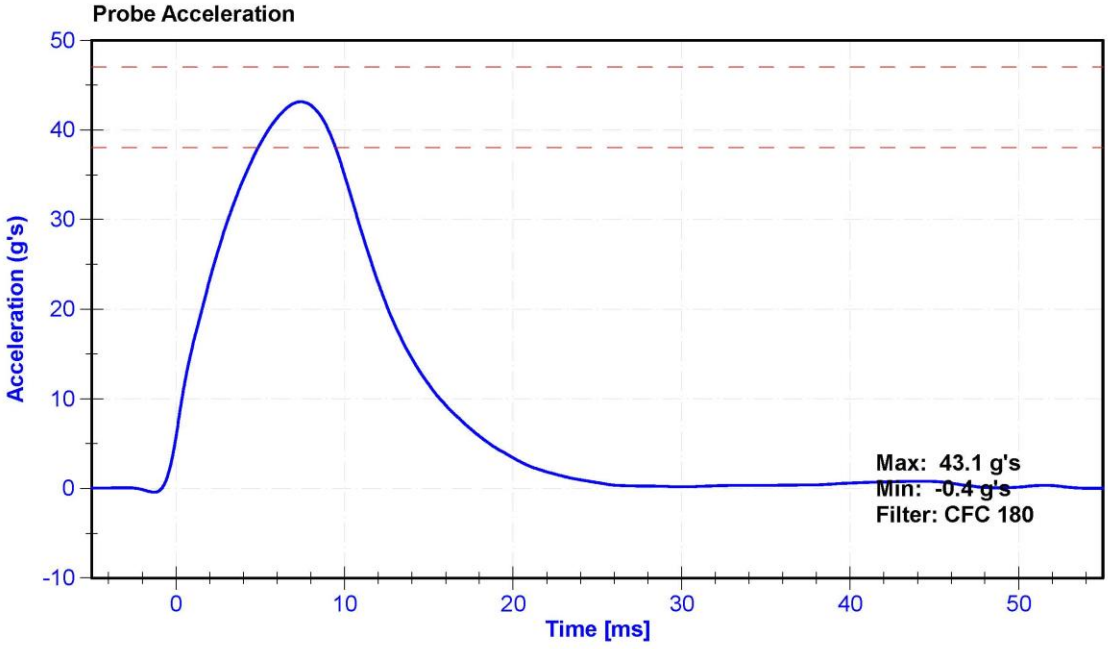
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

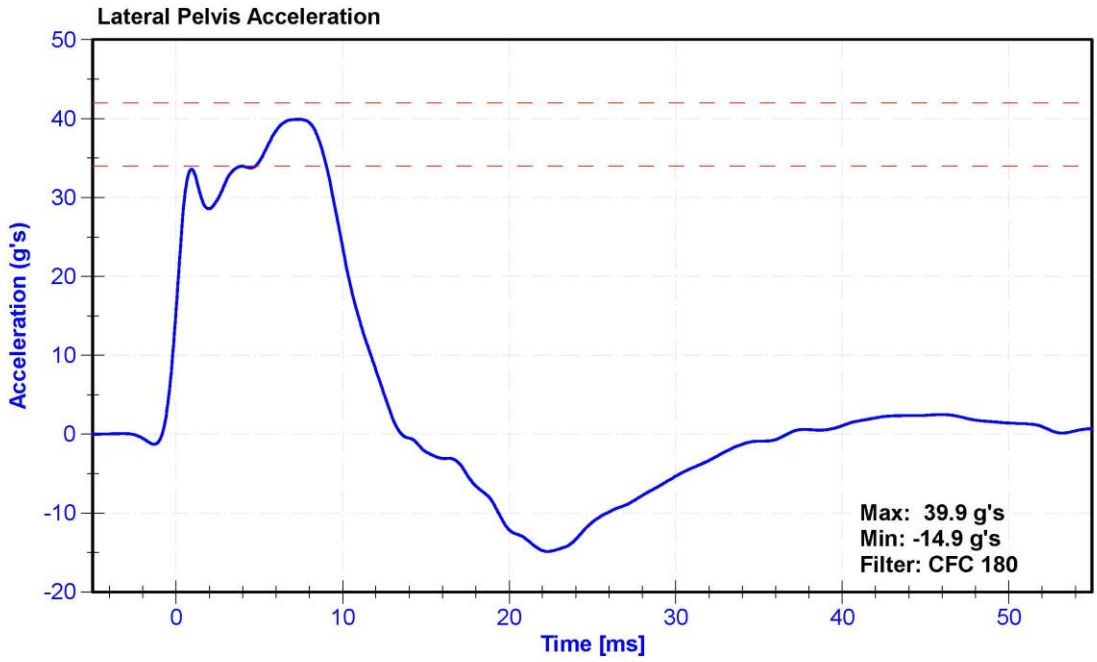
Results

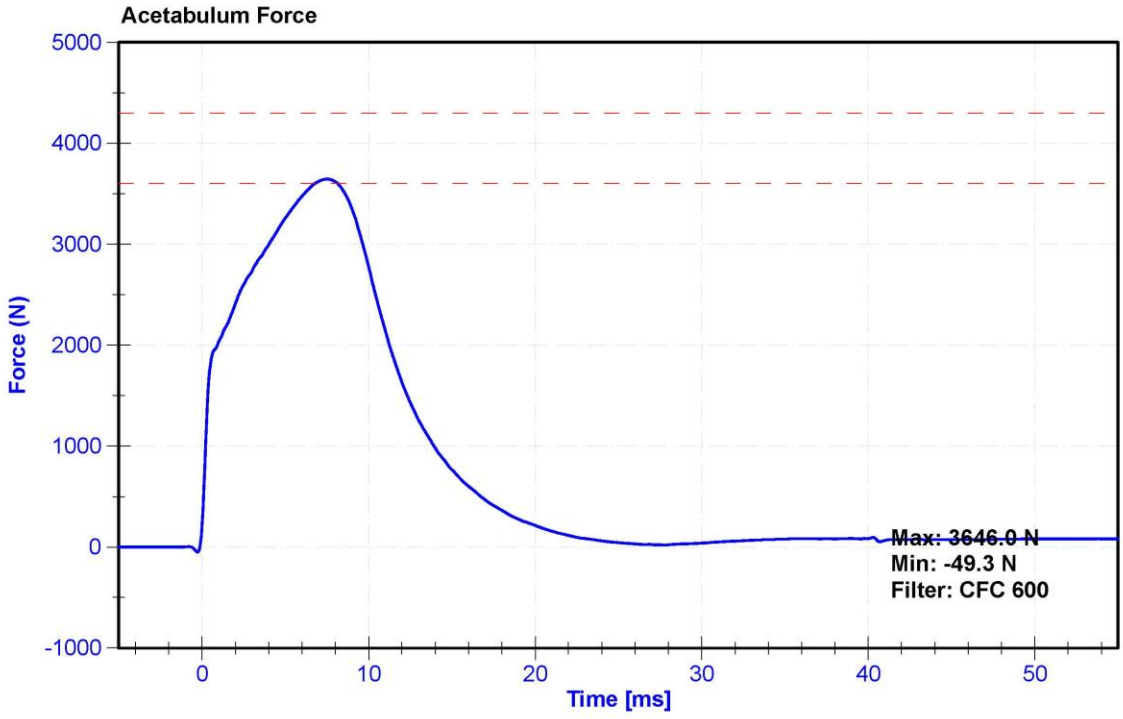
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	20.3	Pass
Velocity	6.6	6.8	m/s	6.63	Pass
Probe Acceleration	38	47	g's	43.1	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	39.9	Pass
Acetabulum Force	3600	4300	N	3646.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/24/2018	4/24/2019
Acetabulum Load Cell	DENTON 3249J	LC-275Fy	10/4/2018	10/4/2019
Certification Plug	Humanetics	11997	2/6/2018	N/A
Crash Test Plug	Humanetics	11475	8/31/2016	N/A




Lateral Pelvis Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]
Max: 39.9 g's
Min: -14.9 g's
Filter: CFC 180


Acetabulum Force
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 3646.0 N
Min: -49.3 N
Filter: CFC 600

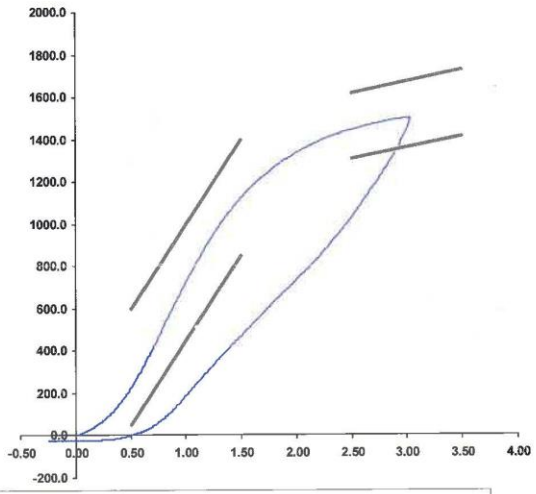
Cert 2
2/25/19

SID-IIs Pelvis Plug Certification Test

Plug S/N 11997
Test Number 6214
Report Number 6231
Test Date 2/6/2018 9:52:44 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	226.43	50.00	600.00
Force @ 1.5 mm (N)	1,124.06	850.00	1,400.00
Force @ 2.5 mm (N)	1,446.07	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,500.89	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000
Preload Value (-N) 22.24
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 08-Feb-18
SACO Research

By : DC Date : 2/6/18

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

SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 11475
Test Number 2982
Report Number 2979
Test Date 8/31/2016 8:54:30 AM

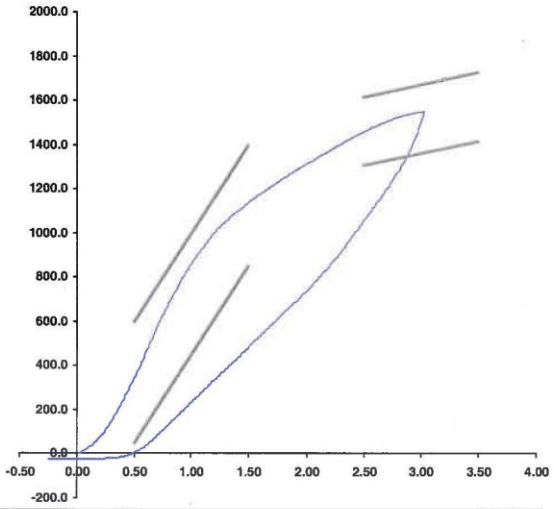
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	342.62	50.00	600.00
Force @ 1.5 mm (N)	1,138.61	850.00	1,400.00
Force @ 2.5 mm (N)	1,459.00	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,548.57	1,361.00	1,673.00

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

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

Notes:

Force (-N) vs Extension (-mm)



Crash Plug

Operator DC

Part Number 180-4450

Template No 107 31-Aug-16
SACO Research

By : DC Date : 8/31/16

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

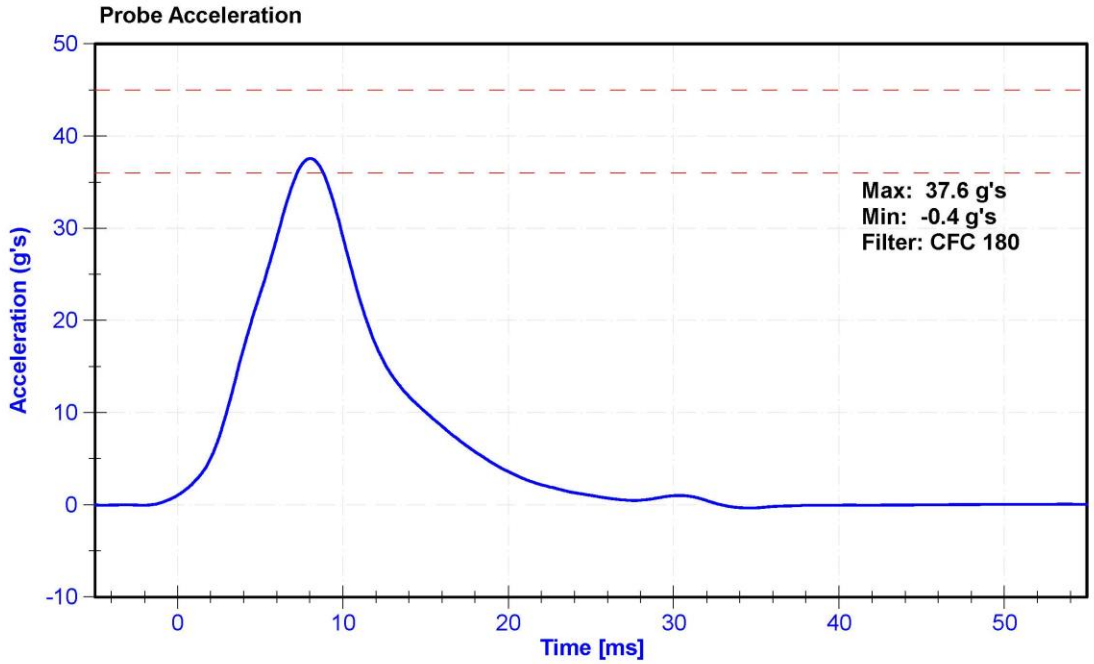
ATD Manufacturer	FTSS	Test Technician	K. Brogan
ATD Serial Number	300	Laboratory Supervisor	K. Dutton

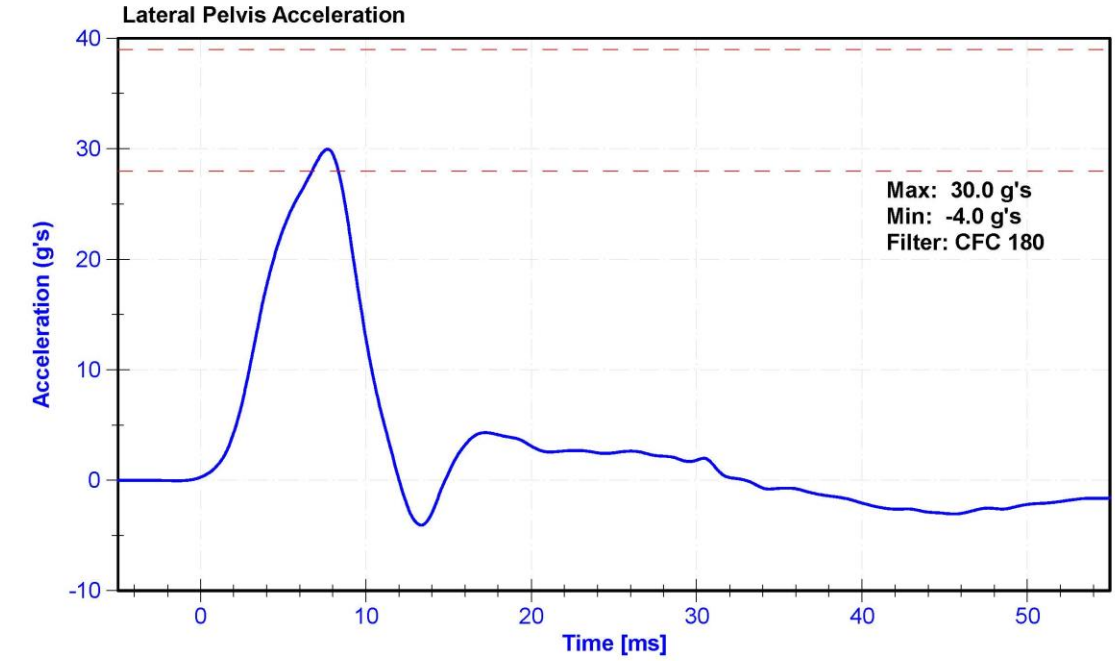
Results

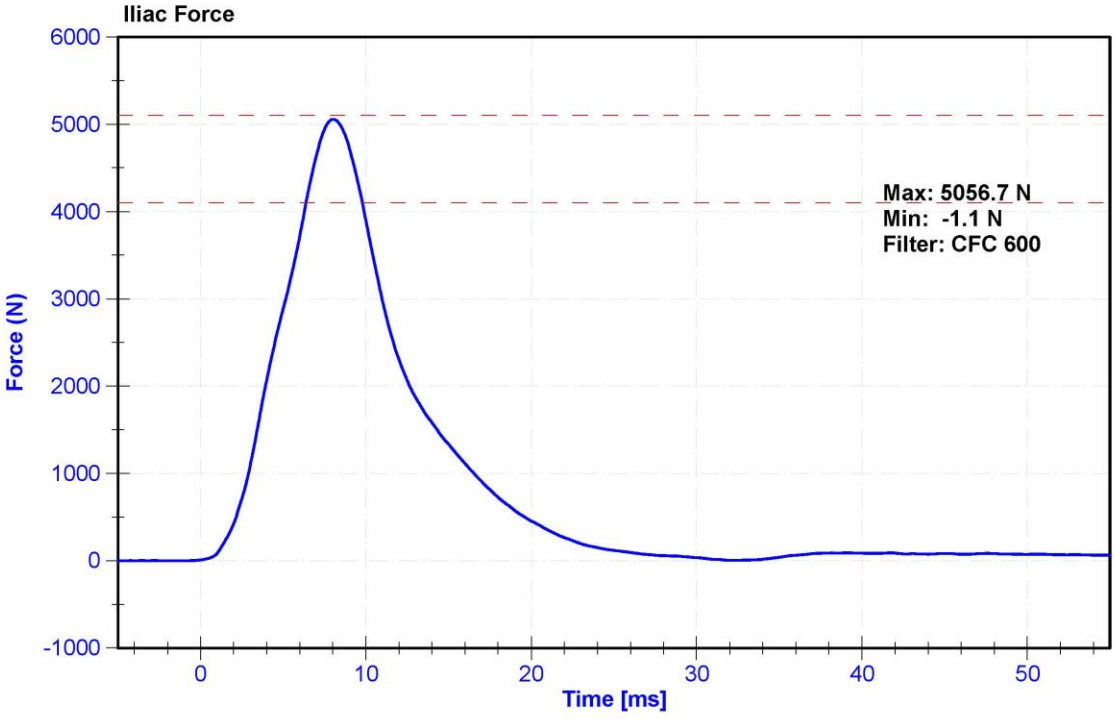
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	19.4	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	36	45	g's	37.6	Pass
Lateral Pelvis Acceleration	28	39	g's	30.0	Pass
Iliac Force	4100	5100	N	5056.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/24/2018	4/24/2019
Iliac Load Cell	Kistler 3228J	LC-DM5054 Fy	2/6/2019	2/6/2020




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 30.0 g's
Min: -4.0 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 5056.7 N
Min: -1.1 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

EUROSID 2 (ES-2RE) MALE – DRIVER ATD

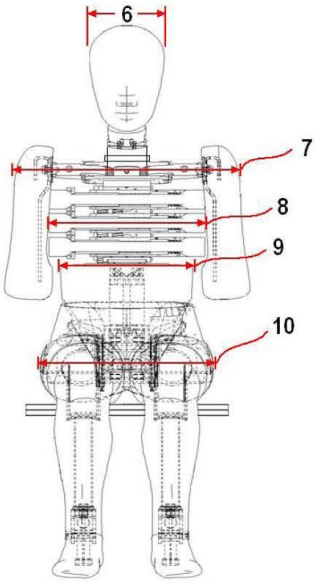
SERIAL NO: F034

(CONFIGURED FOR LEFT SIDE IMPACT)

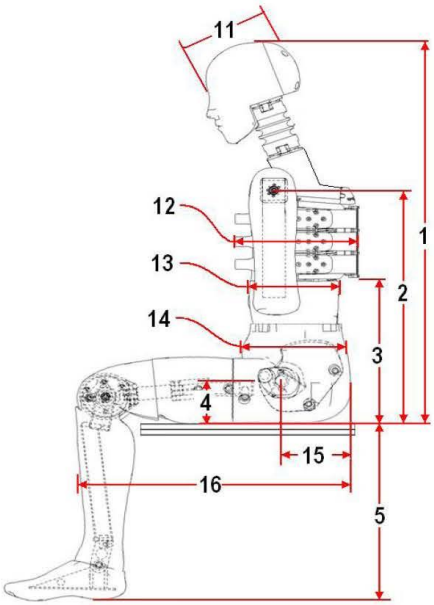
External Measurements - EuroSID-2re

Technician: K. Dutton Date: 3/07/2019

Dummy Serial Number: F034



FRONT VIEW



SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	911	Pass
2	Seat to Shoulder Joint	558	572	566	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	102	Pass
5	Sole to Seat, Sitting	333	451	419	Pass
6	Head Width	152	158	154	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	328	Pass
9	Abdomen Width	273	287	280	Pass
10	Pelvis Lap Width	359	373	365	Pass
11	Head Depth	196	206	200	Pass
12	Thorax Depth	262	272	268	Pass
13	Abdomen Depth	194	204	201	Pass
14	Pelvis Depth	235	245	242	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	155	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

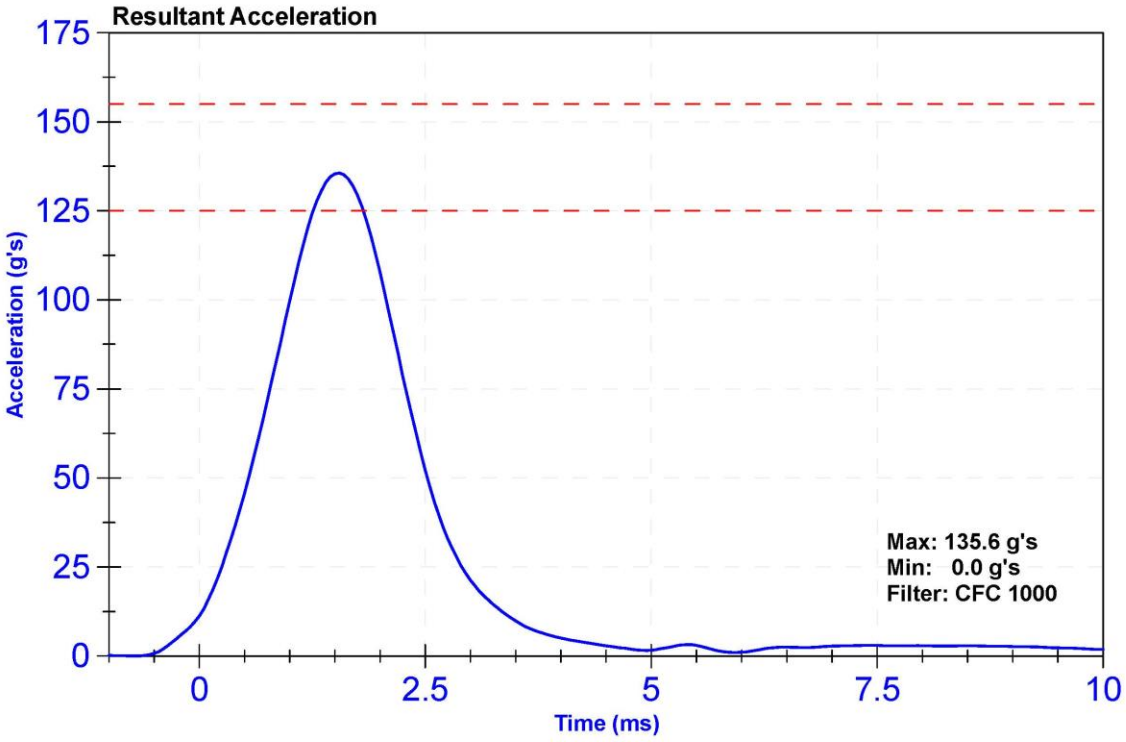
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

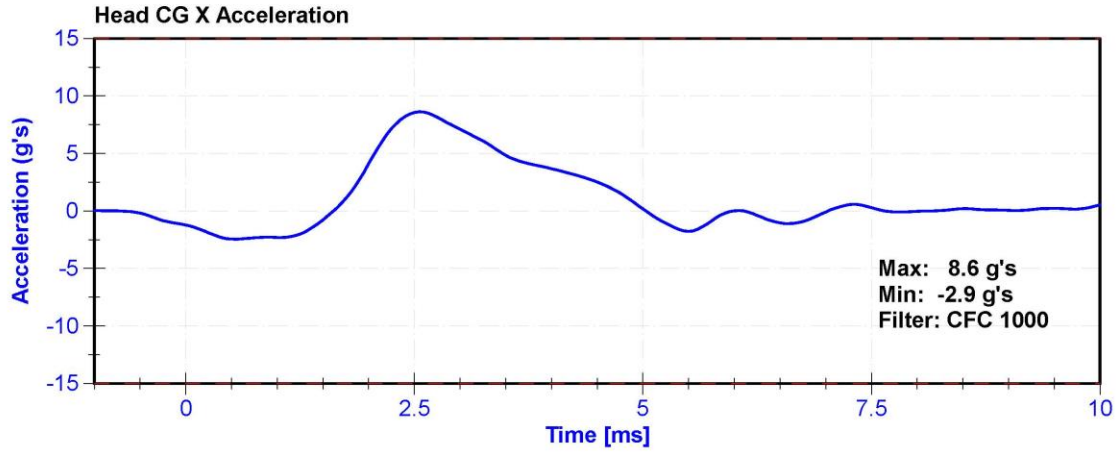
Results

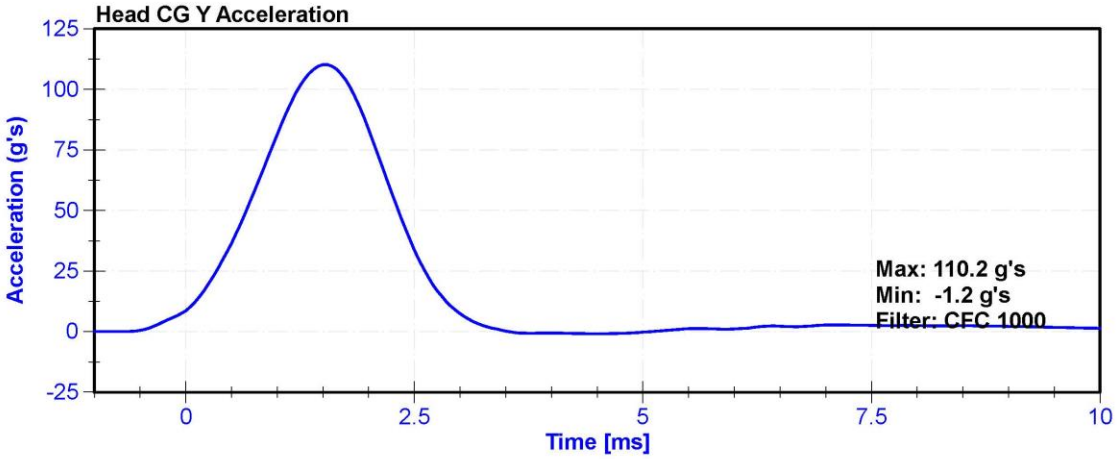
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	17.5	Pass
Resultant Acceleration	125	155	g's	135.6	Pass
Oscillation	0	15	%	2.63	Pass
Fore-Aft Acceleration	-15	15	g's	8.6	Pass

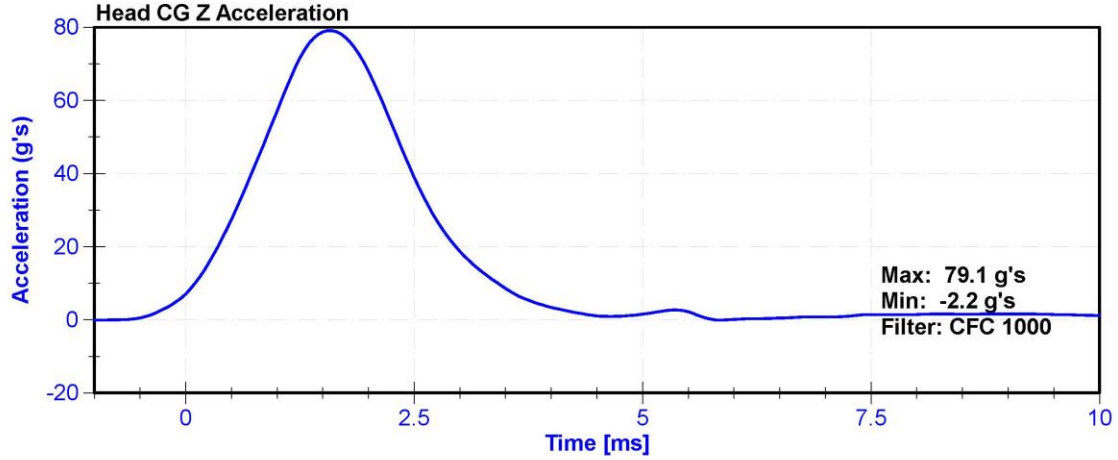
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P58904	10/5/2018	4/5/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P58911	10/5/2018	4/5/2019
Z Accelerometer	ENDEVCO 7264CT	AC-P58776	10/5/2018	4/5/2019




Head CG X Acceleration
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]
Max: 8.6 g's
Min: -2.9 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: 110.2 g's
Min: -1.2 g's
Filter: CFC 1000


Head CG Z Acceleration
Acceleration (g's)
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]
Max: 79.1 g's
Min: -2.2 g's
Filter: CFC 1000

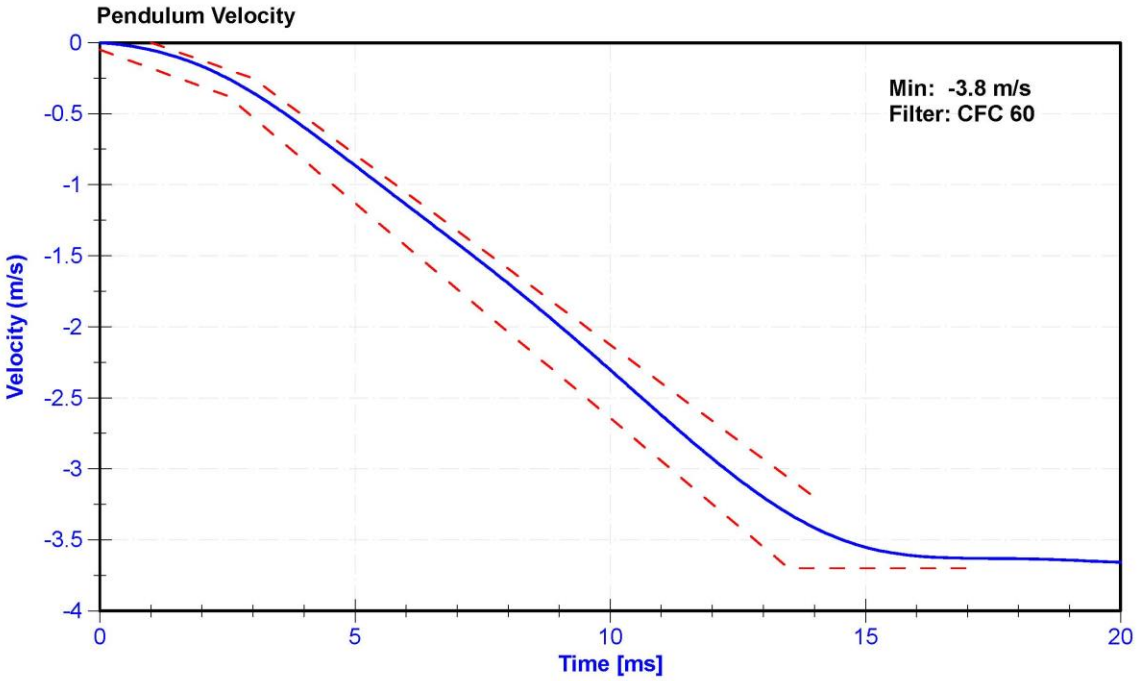
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K.Brogan

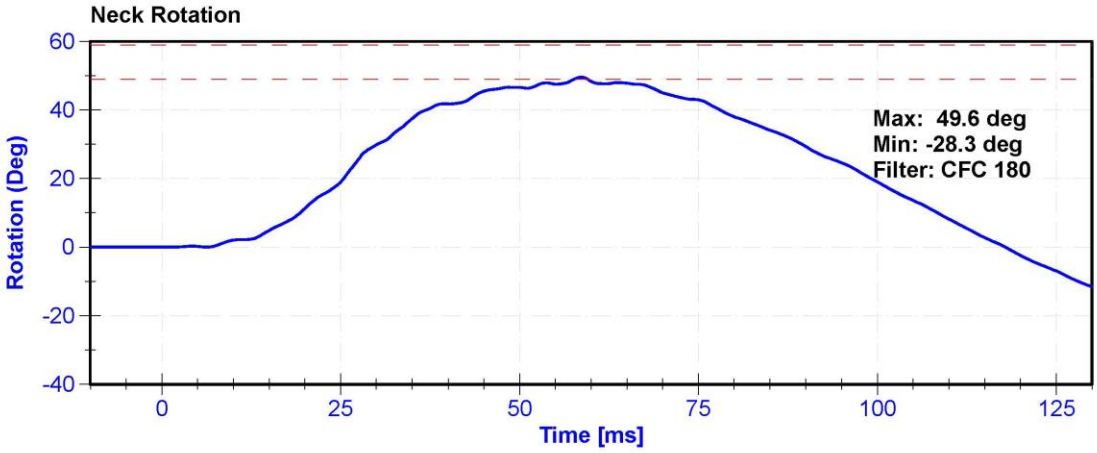
Results

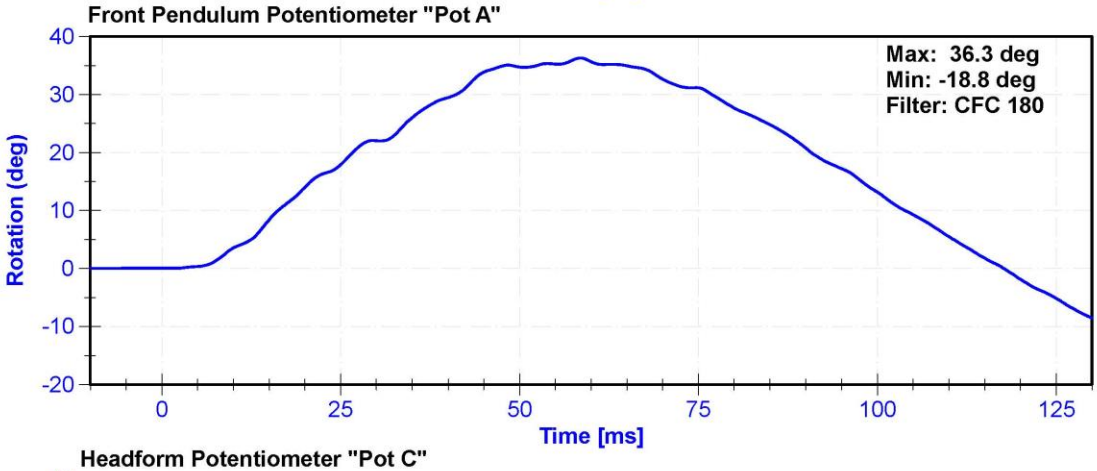
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	16.8	Pass
Velocity	3.3	3.5	m/s	3.35	Pass
Lateral Neck Rotation	49	59	deg	49.6	Pass
Time at Maximum Rotation	54	66	ms	58.7	Pass
Time of Rotation Decay from Maximum	53	88	ms	59.3	Pass

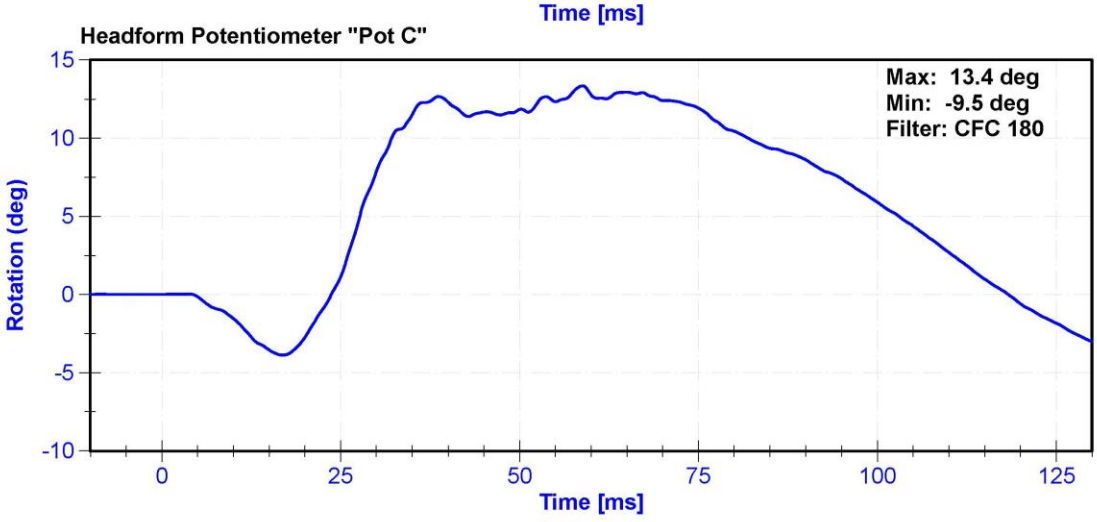
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9	1/29/2019	1/29/2020
Front Pendulum Potentiometer	SP22G	DS-094	10/31/2018	10/31/2019
Headform Potentiometer	SP22G	DS-095	10/31/2018	10/31/2019




Neck Rotation
Rotation (Deg)
Time [ms]
Max: 49.6 deg
Min: -28.3 deg
Filter: CFC 180


Front Pendulum Potentiometer "Pot A"
Rotation (deg)
Time [ms]
Max: 36.3 deg
Min: -18.8 deg
Filter: CFC 180


Headform Potentiometer "Pot C"
Rotation (deg)
Time [ms]
Max: 13.4 deg
Min: -9.5 deg
Filter: CFC 180

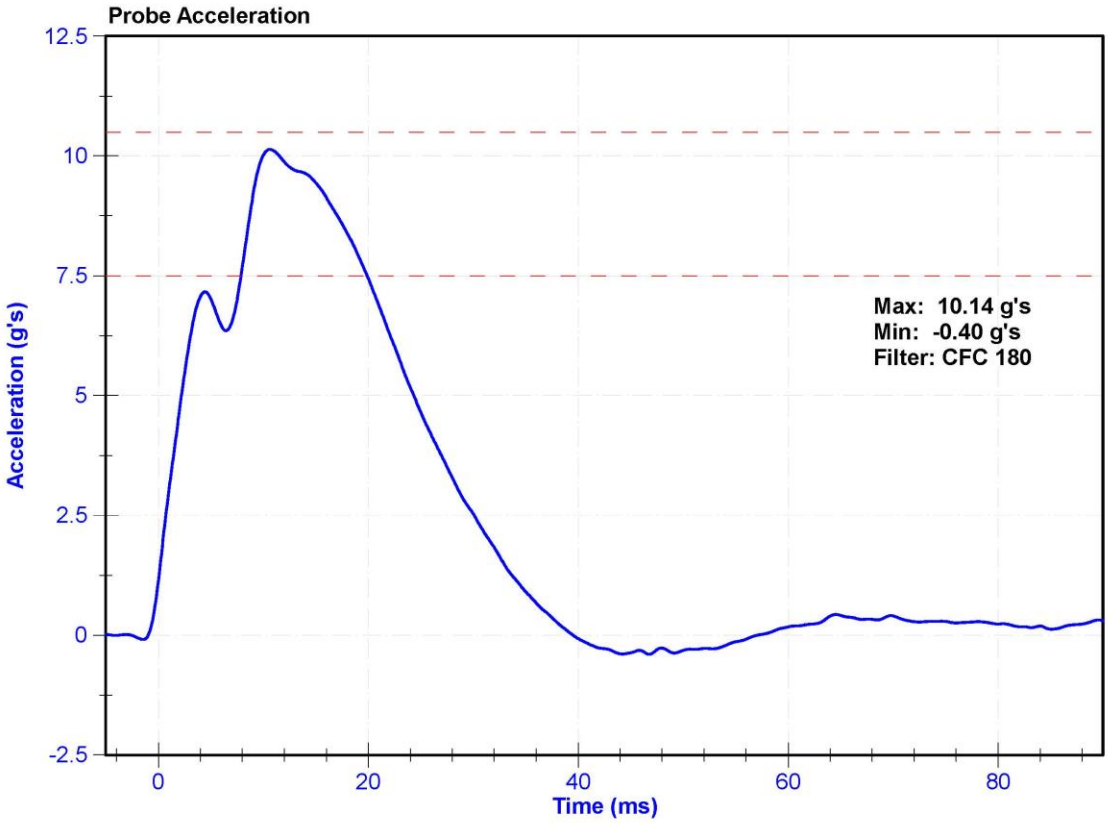
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	18.4	Pass
Velocity	4.2	4.4	m/s	4.20	Pass
Probe Acceleration	7.5	10.5	g's	10.14	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019



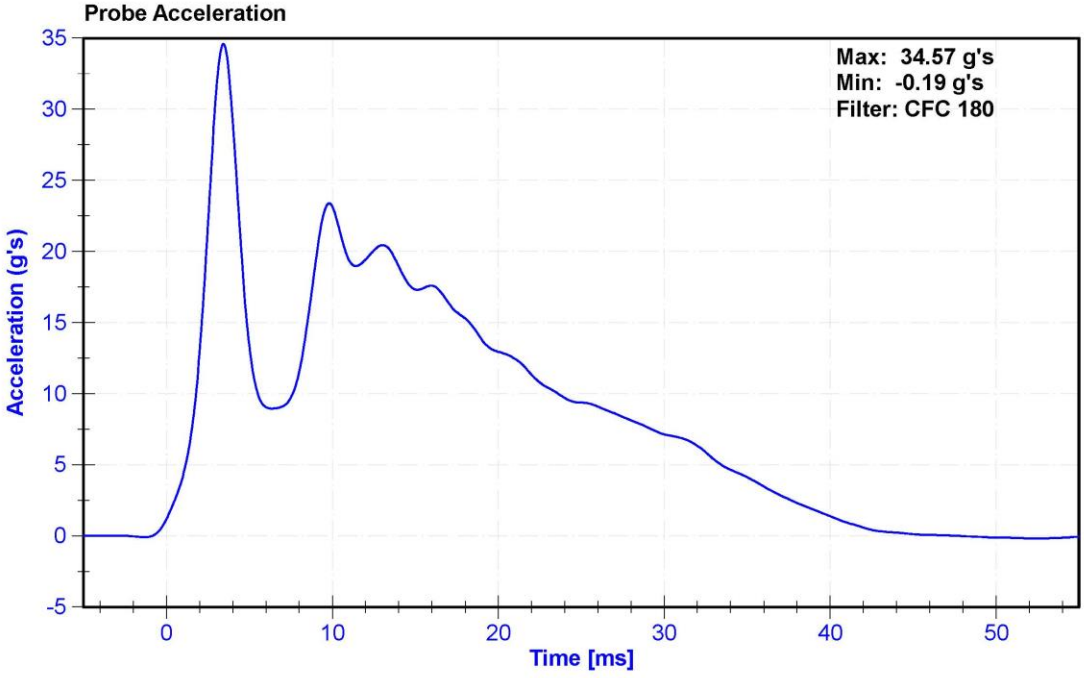
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

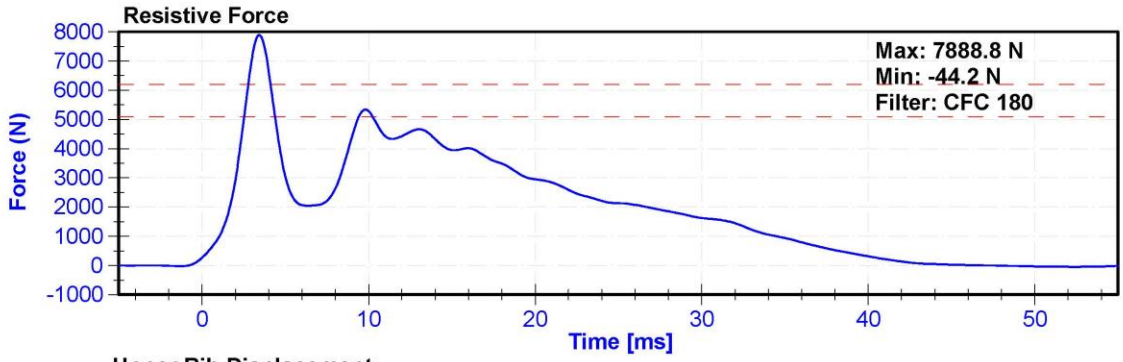
Results

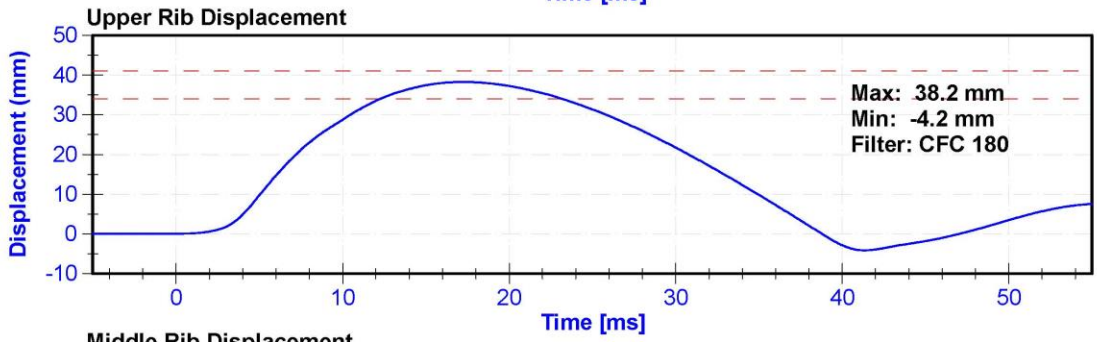
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	15.5	Pass
Velocity	5.4	5.6	m/s	5.49	Pass
Resistive Force after 6ms	5100	6200	N	5337.4	Pass
Upper Thorax Rib Deflection	34	41	mm	38.2	Pass
Mid Thorax Rib Deflection	37	45	mm	41.1	Pass
Lower Thorax Rib Deflection	37	44	mm	41.3	Pass

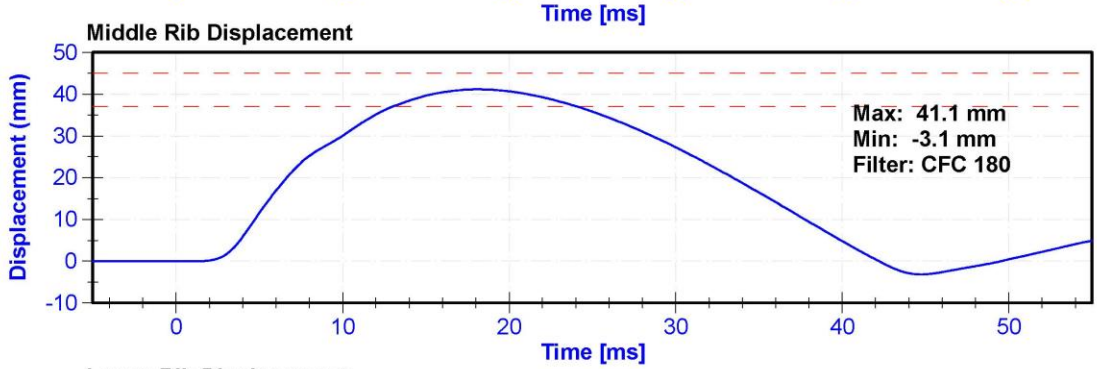
Transducer Calibrations

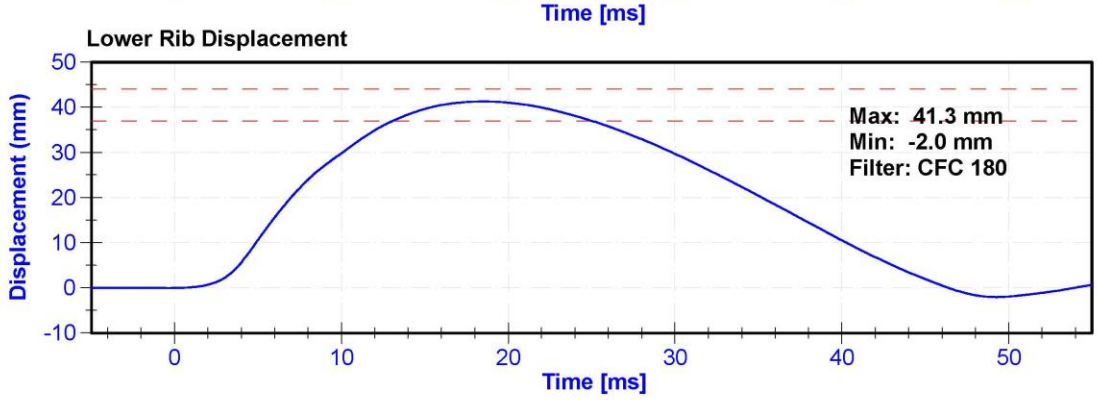
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019




Resistive Force
Force (N)
Time [ms]
Max: 7888.8 N
Min: -44.2 N
Filter: CFC 180


Upper Rib Displacement
Displacement (mm)
Time [ms]
Max: 38.2 mm
Min: -4.2 mm
Filter: CFC 180


Middle Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.1 mm
Min: -3.1 mm
Filter: CFC 180


Lower Rib Displacement
Displacement (mm)
Time [ms]
Max: 41.3 mm
Min: -2.0 mm
Filter: CFC 180

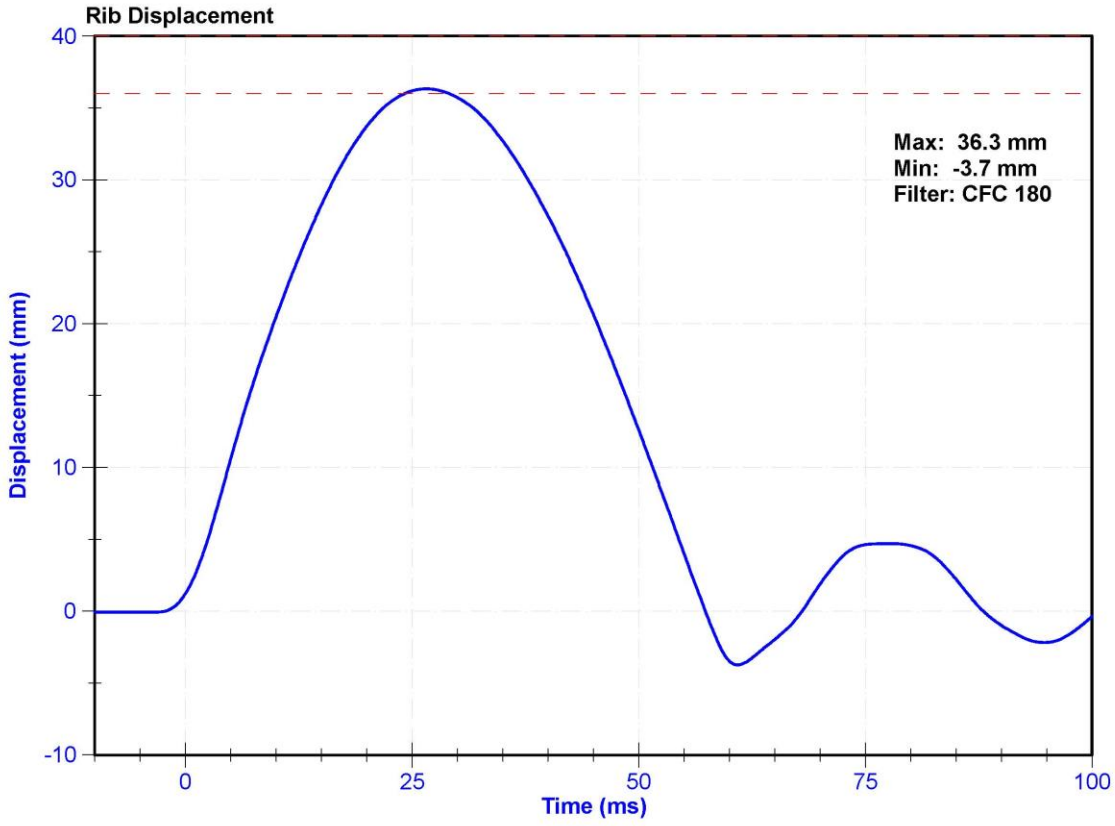
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	17.5	Pass
Rib Displacement	36	40	mm	36.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019



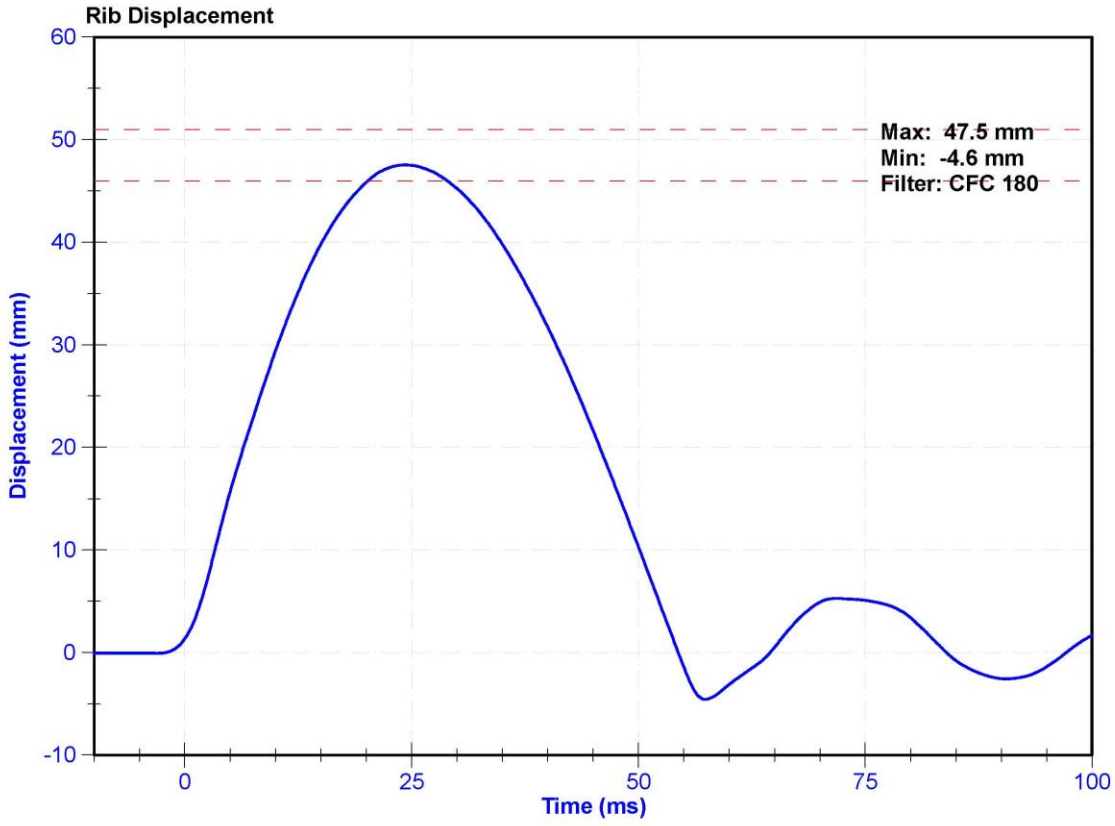
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	17.5	Pass
Rib Displacement	46	51	mm	47.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-183GFE	10/10/2018	10/10/2019



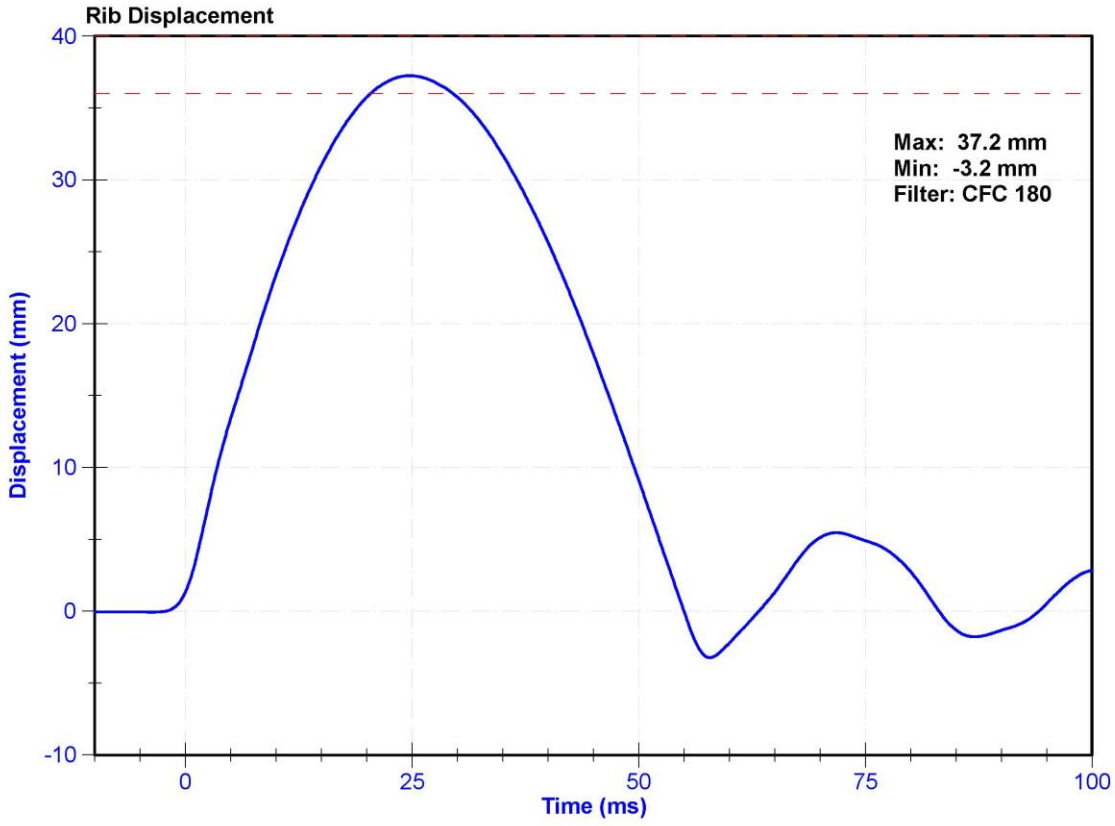
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	17.8	Pass
Rib Displacement	36	40	mm	37.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-184GFE	10/11/2018	10/11/2019



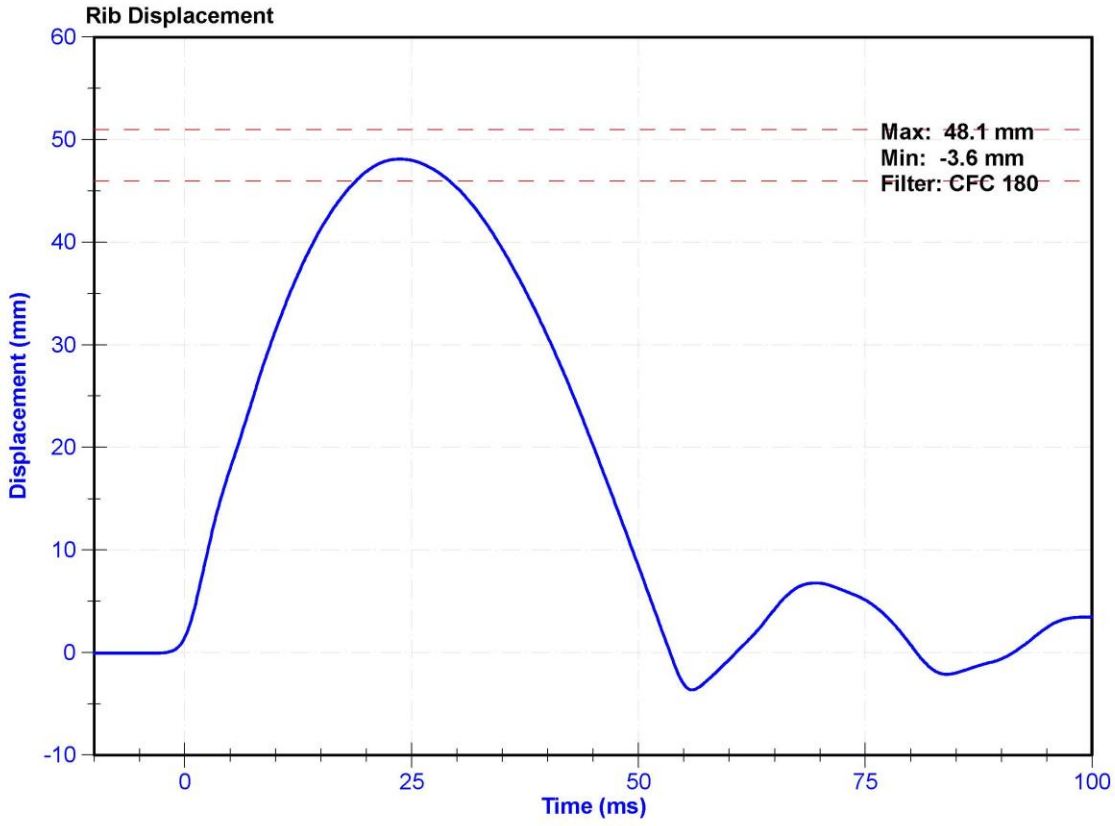
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	17.8	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-184GFE	10/11/2018	10/11/2019



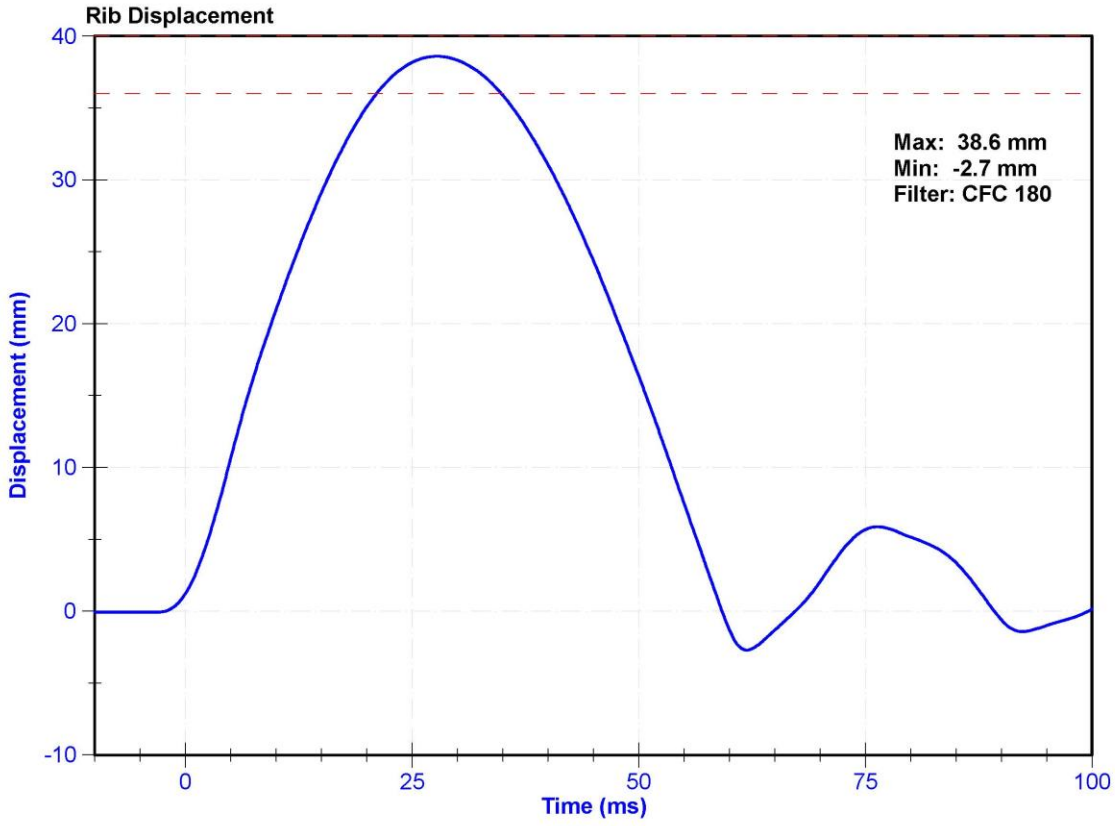
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	18.0	Pass
Rib Displacement	36	40	mm	38.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019



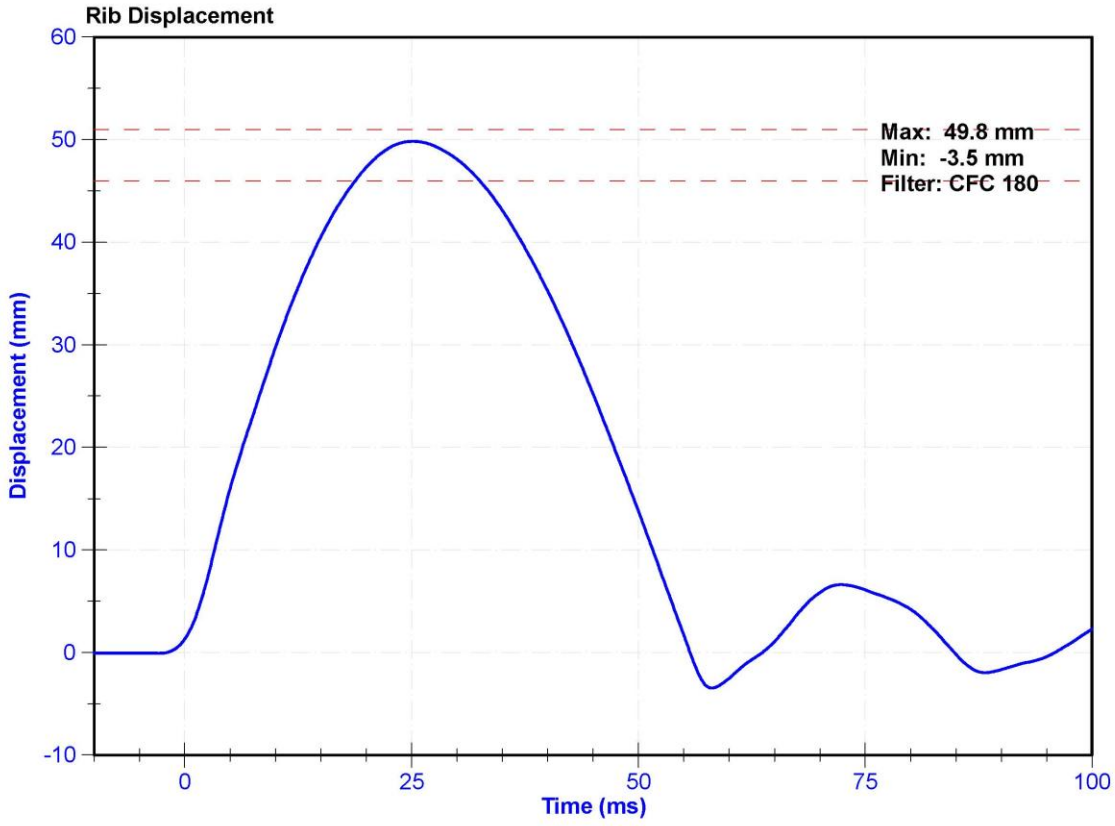
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22.0	Pass
Humidity	10	70	%	18.0	Pass
Rib Displacement	46	51	mm	49.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-182GFE	10/10/2018	10/10/2019



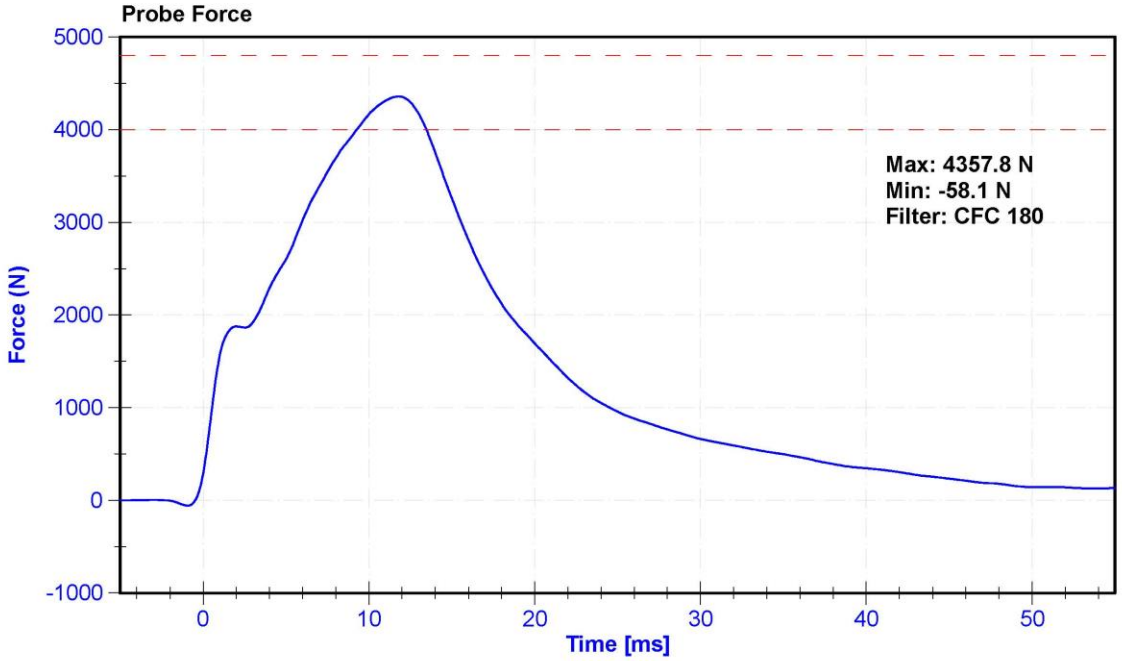
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	FO34	Laboratory Supervisor	K.Brogan

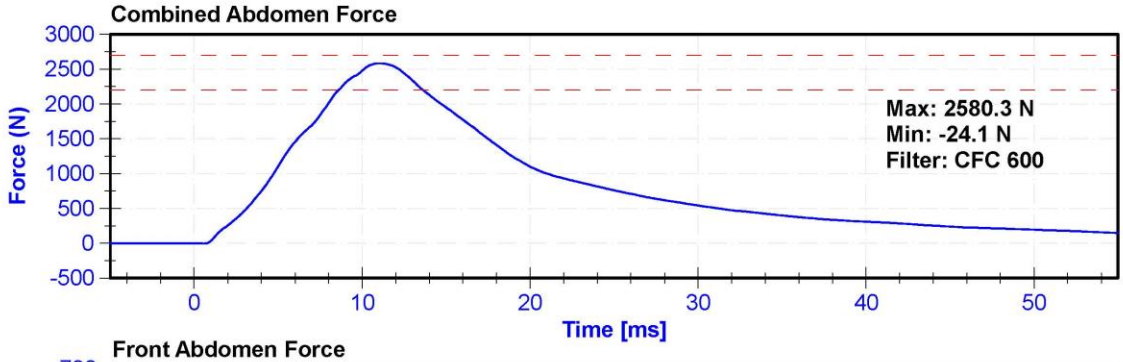
Results

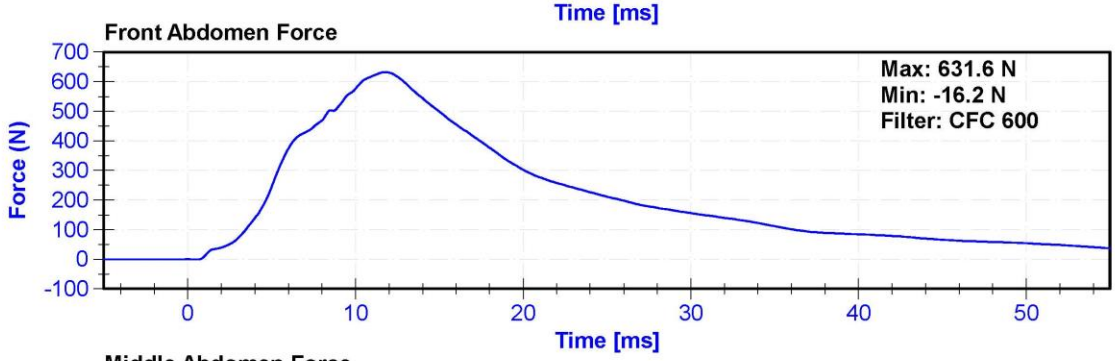
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	15.6	Pass
Velocity	3.9	4.1	m/s	4.10	Pass
Combined Abdomen Force	2200	2700	N	2580.3	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.05	Pass
Resistive Probe Force	4000	4800	N	4357.8	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.80	Pass

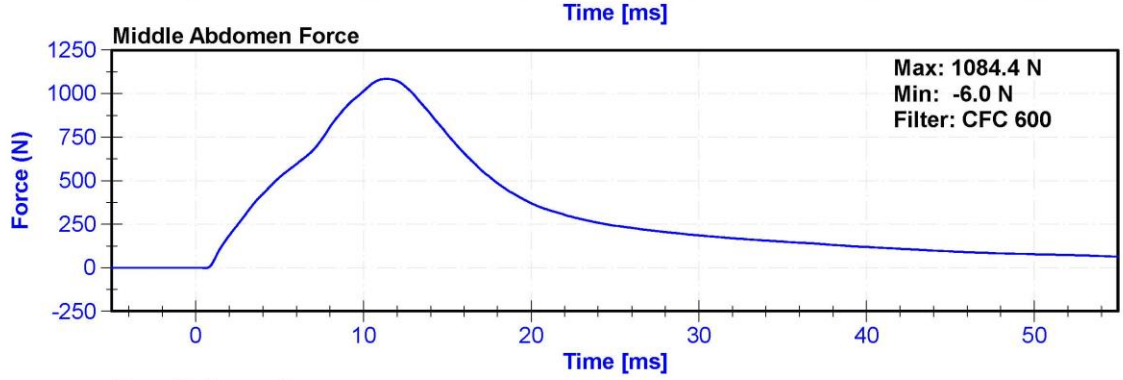
Transducer Calibrations

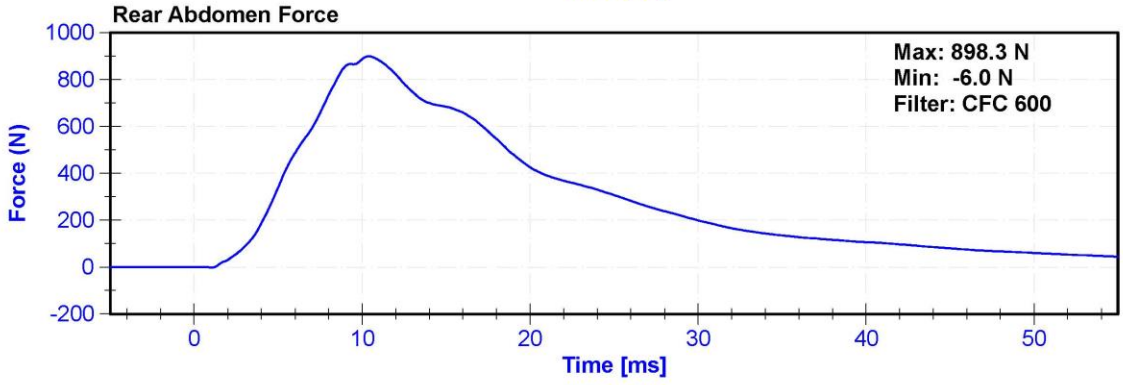
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Front Abdomen Load Cell	DENTON 2631	LC-1440	6/4/2018	6/4/2019
Middle Abdomen Load Cell	DENTON 2631	LC-1525	6/4/2018	6/4/2019
Rear Abdomen Load Cell	DENTON 2631	LC-1528	6/4/2018	6/4/2019




Combined Abdomen Force
Force (N)
Time [ms]
Max: 2580.3 N
Min: -24.1 N
Filter: CFC 600


Front Abdomen Force
Force (N)
Time [ms]
Max: 631.6 N
Min: -16.2 N
Filter: CFC 600


Middle Abdomen Force
Force (N)
Time [ms]
Max: 1084.4 N
Min: -6.0 N
Filter: CFC 600


Rear Abdomen Force
Force (N)
Time [ms]
Max: 898.3 N
Min: -6.0 N
Filter: CFC 600

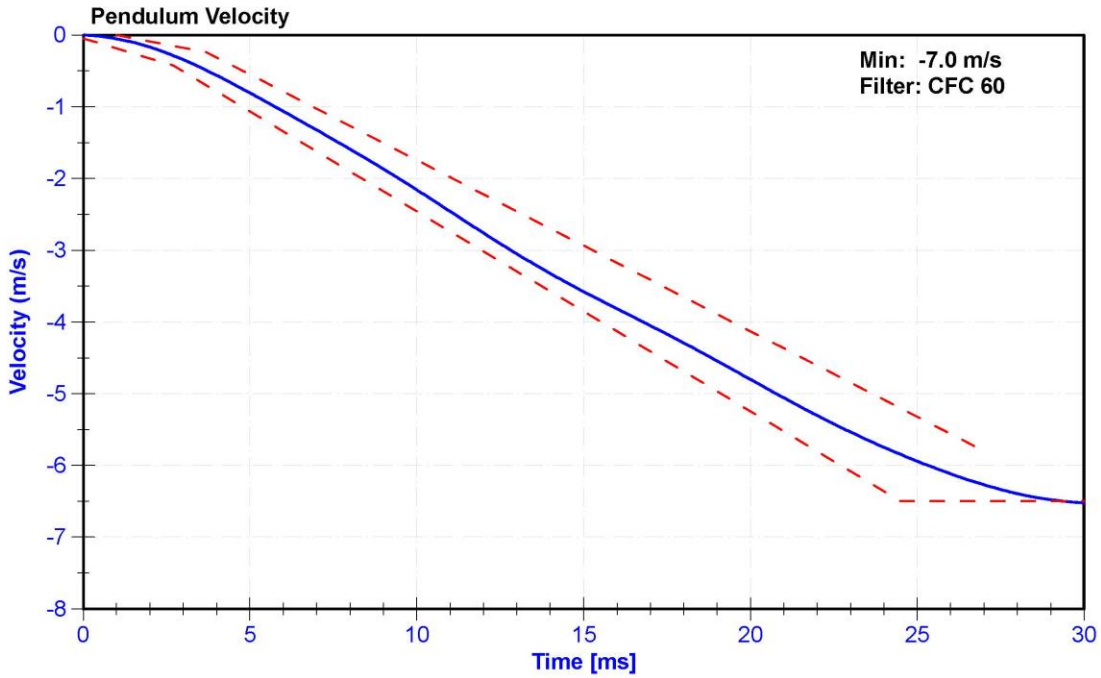
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

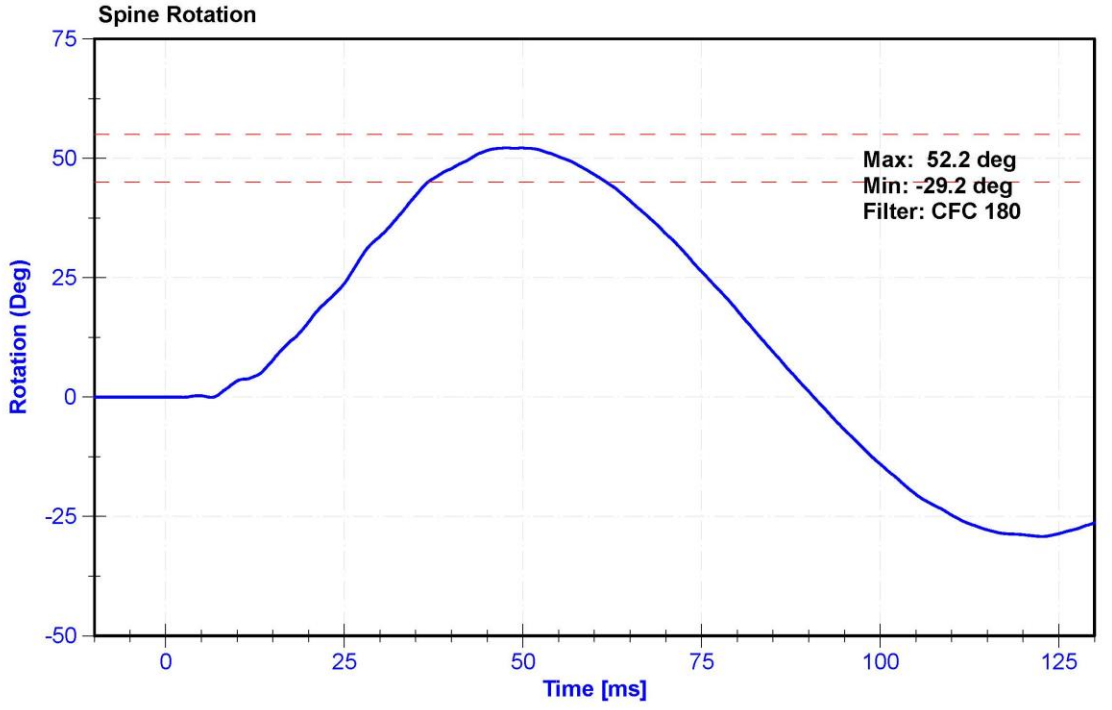
Results

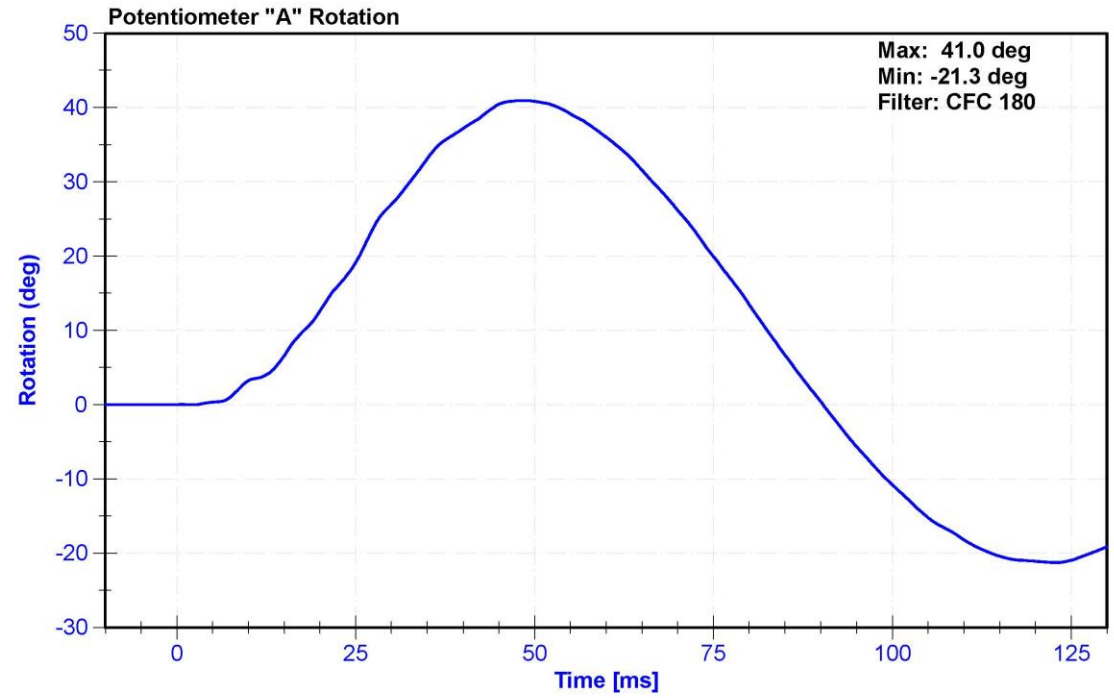
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.3	Pass
Humidity	10	70	%	23.9	Pass
Velocity	5.95	6.15	m/s	6.005	Pass
Lateral Spine Rotation	45	55	deg	52.2	Pass
Time at Maximum Rotation	39	53	ms	47.7	Pass
Time of Decay to Zero Degrees	37	57	ms	43.0	Pass
Pulse within Corridor?	-	-	-		

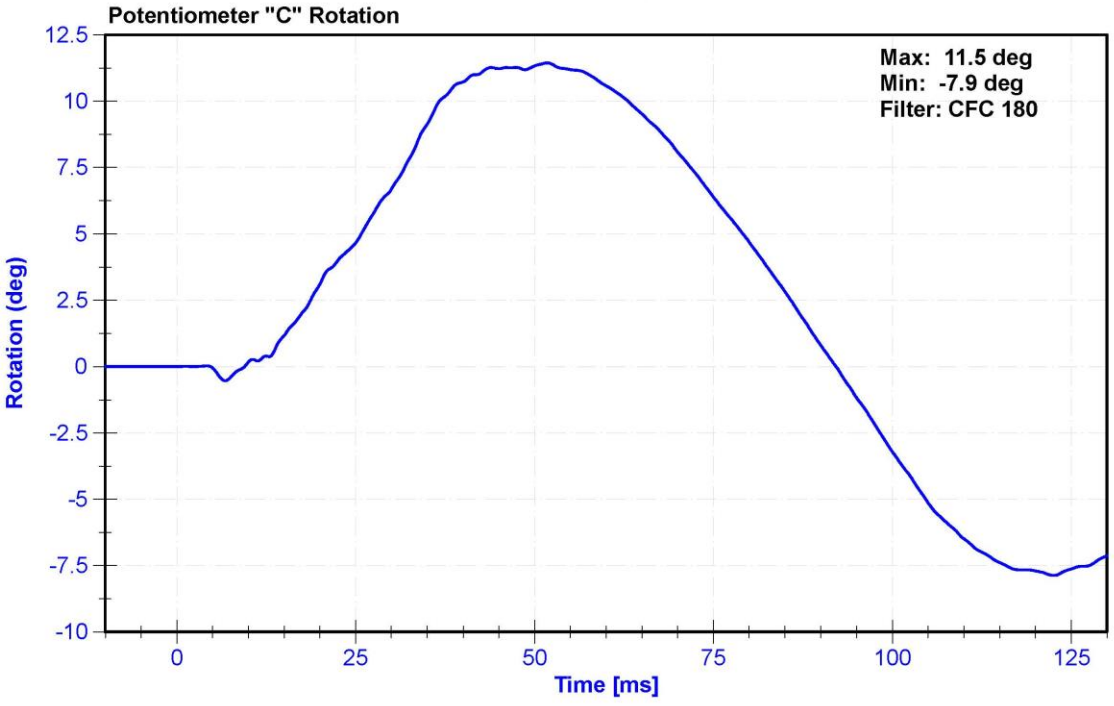
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
Pendulum "A" Potentiometer	SP22G	DS-094	10/31/2018	10/31/2019
Condyle "B" Potentiometer	SP22G	DS-095	10/31/2018	10/31/2019


Pendulum Velocity
Min: -7.0 m/s
Filter: CFC 60
Velocity (m/s)
0
-1
-2
-3
-4
-5
-6
-7
-8
0
5
10
15
20
25
30
Time [ms]


Spine Rotation
Max: 52.2 deg
Min: -29.2 deg
Filter: CFC 180
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
Time [ms]


Potentiometer "A" Rotation
Max: 41.0 deg
Min: -21.3 deg
Filter: CFC 180
Rotation (deg)
50
40
30
20
10
0
-10
-20
-30
0
25
50
75
100
125
Time [ms]


Potentiometer "C" Rotation
Max: 11.5 deg
Min: -7.9 deg
Filter: CFC 180
Rotation (deg)
12.5
10
7.5
5
2.5
0
-2.5
-5
-7.5
-10
0
25
50
75
100
125
Time [ms]

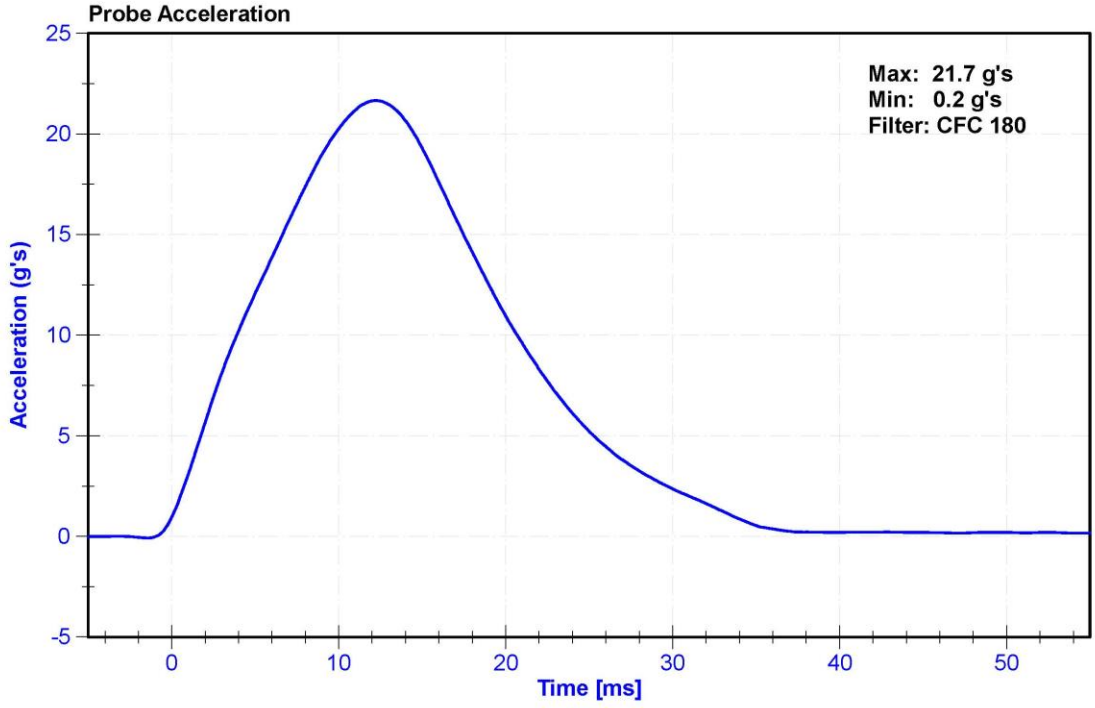
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	K. Brogan

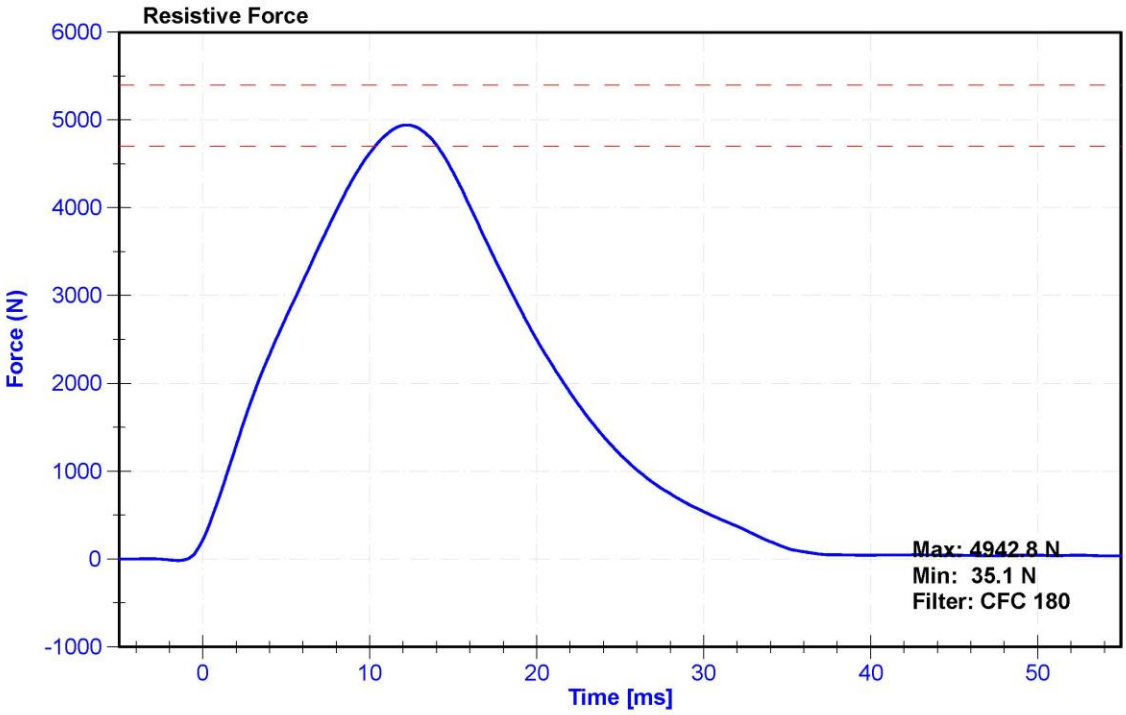
Results

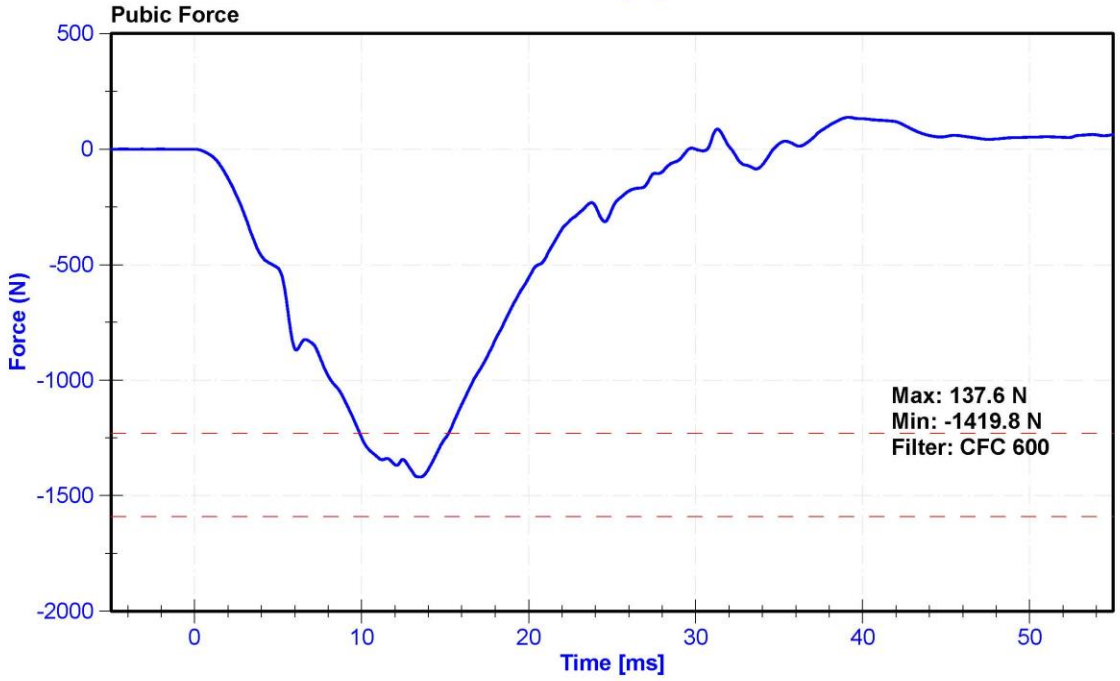
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.5	Pass
Humidity	10	70	%	15.3	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Resistive Force	4700	5400	N	4942.8	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.20	Pass
Pubic Force	-1590	-1230	N	-1419.8	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.45	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Pubic Load Cell	Denton 3096JFL	LC-464fy	6/4/2018	6/4/2019




Resistive Force
Force (N)
Time [ms]
Max: 4942.8 N
Min: 35.1 N
Filter: CFC 180


Pubic Force
Force (N)
Time [ms]
Max: 137.6 N
Min: -1419.8 N
Filter: CFC 600

CALIBRATION TEST RESULTS

POST-TEST

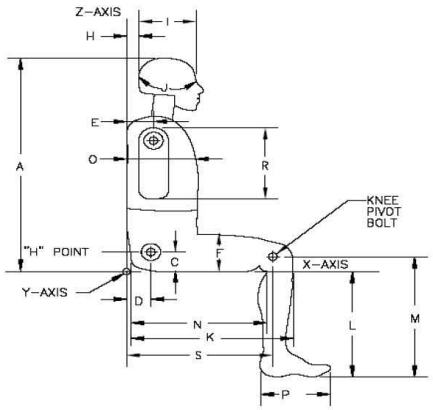
SID-IIS 5TH PERCENTILE FEMALE - PASSENGER ATD

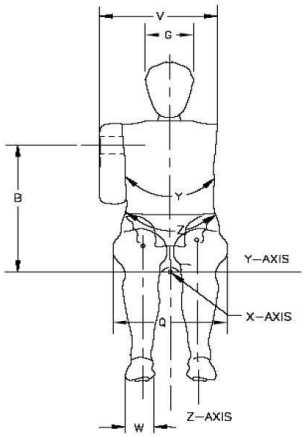
SERIAL No: 300

External Measurements - SID-IIs

Technician: K. Dutton Date: 3/07/2019

Dummy Serial Number: 300





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	780	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	104	Pass
F	Thigh Clearance	119	135	124	Pass
G	Head Breadth	140	148	145	Pass
H	Head Back from Backline	40	46	42	Pass
I	Head Depth	178	188	186	Pass
J	Head Circumference	541	551	547	Pass
K	Buttock to Knee Length	514	540	531	Pass
L	Popliteal Height	343	369	358	Pass
M	Knee Pivot to floor height	392	409	402	Pass
N	Buttock Popliteal Length	416	442	432	Pass
O	Chest Depth w/o jacket	195	211	204	Pass
P	Foot Length	216	232	223	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	319	Pass
R	Arm Length	249	259	254	Pass
S	Knee Joint to seatback	477	493	485	Pass
V	Shoulder Width	341	357	351	Pass
W	Foot Width	78	94	83	Pass
Y	Chest Circumference w/jacket	851	881	872	Pass
Z	Waist Circumference	761	791	770	Pass

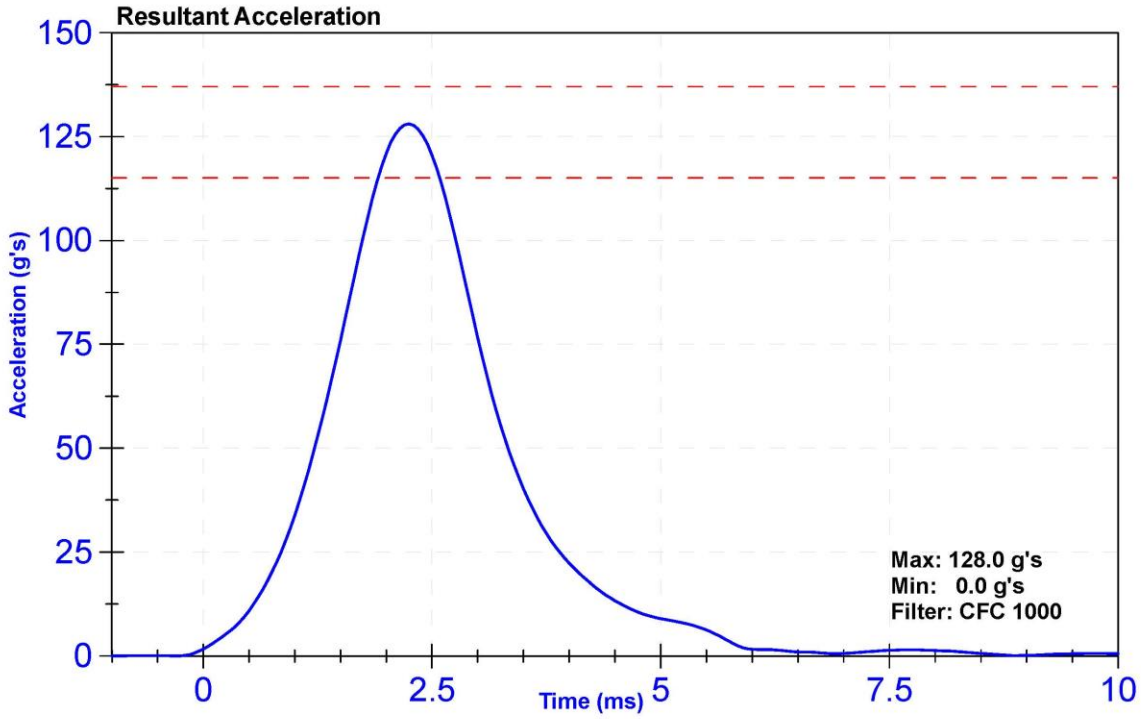
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

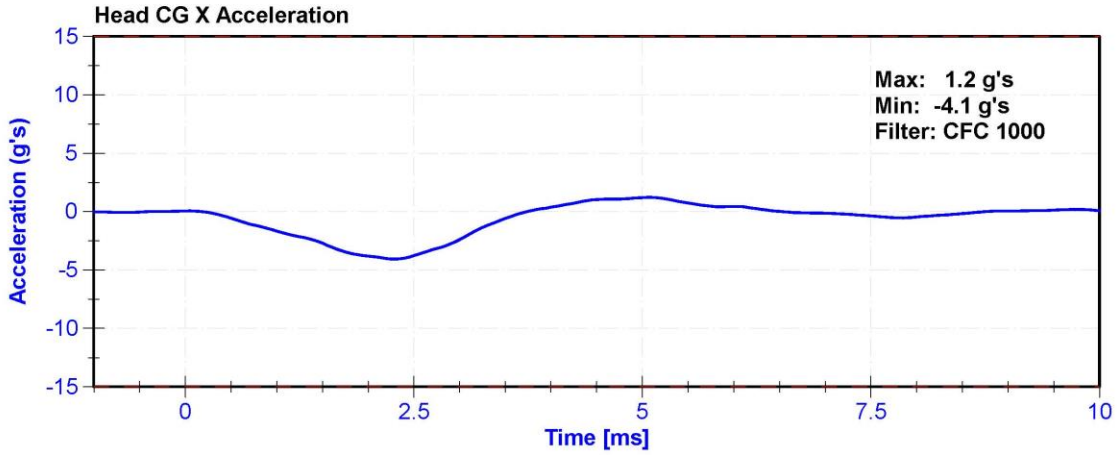
Results

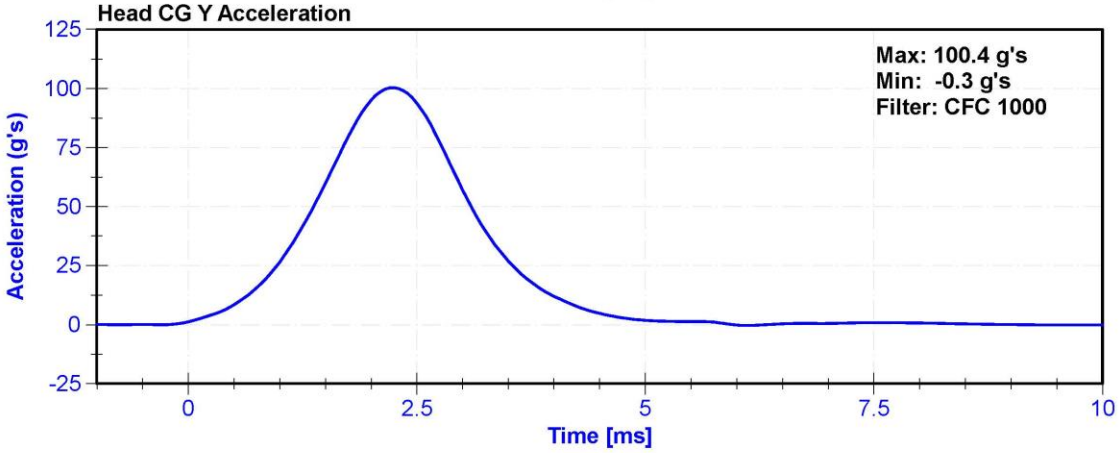
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	22	Pass
Humidity	10	70	%	17.5	Pass
Resultant Acceleration	115	137	g's	128.0	Pass
Oscillation	0	15	%	1.1	Pass
Fore-Aft Acceleration	-15	15	g's	-4.1	Pass

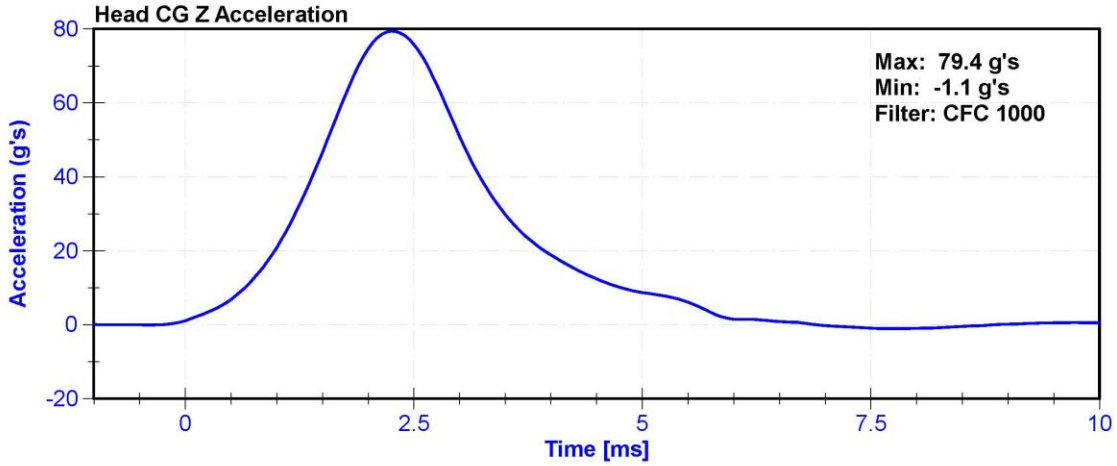
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P58777	10/5/2018	4/5/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P59018	10/5/2018	4/5/2019
Z Accelerometer	ENDEVCO 7264	AC-P79189	10/5/2018	4/5/2019




Head CG X Acceleration
Max: 1.2 g's
Min: -4.1 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: 100.4 g's
Min: -0.3 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: -1.1 g's
Filter: CFC 1000
Acceleration (g's)
80
60
40
20
0
-20
0
2.5
5
7.5
10
Time [ms]

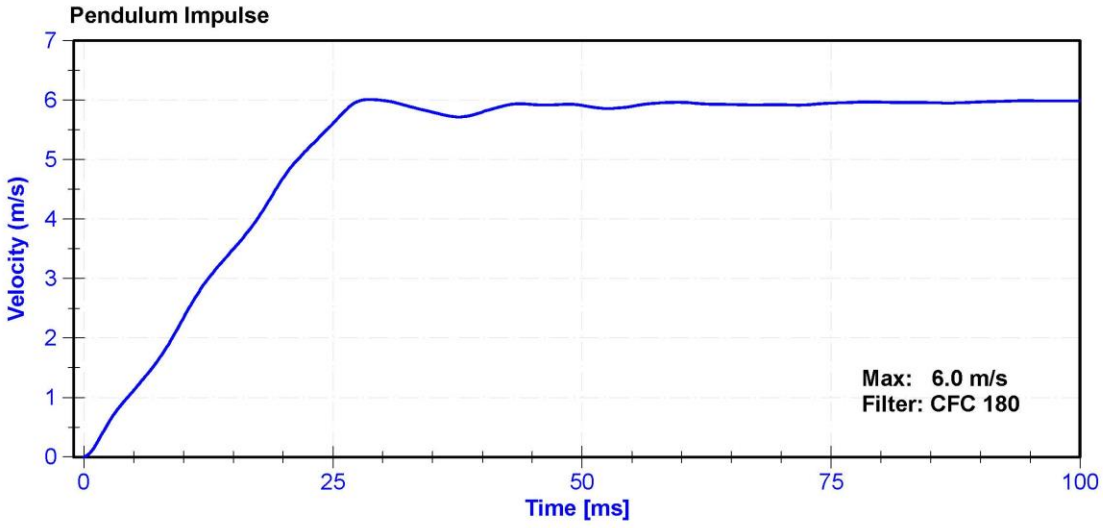
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

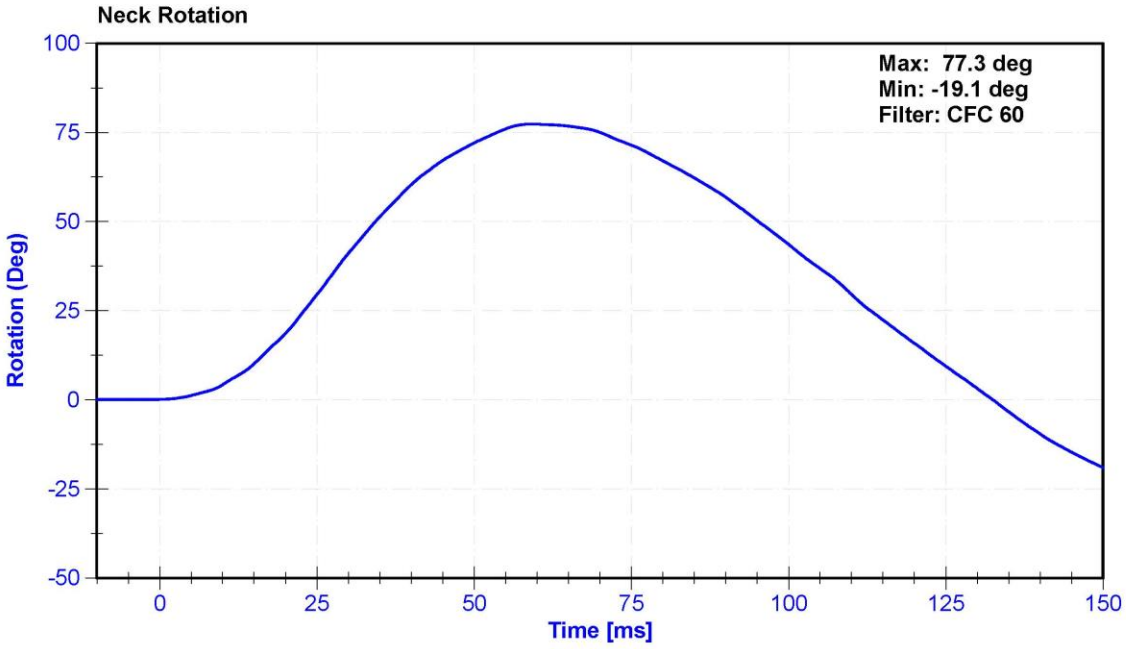
Results

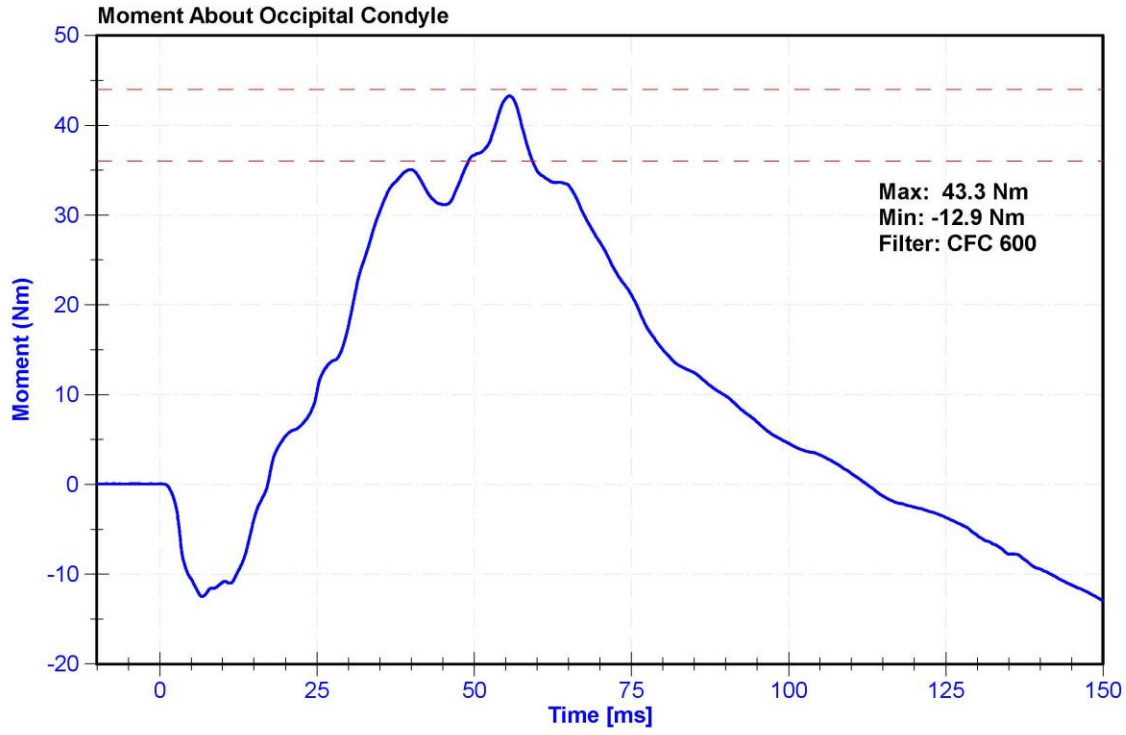
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	16.5	Pass
Velocity	5.51	5.63	m/s	5.514	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.34	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.49	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.69	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.61	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	6.01	Pass
Neck Rotation	71	81	deg	77.3	Pass
Time at Maximum Rotation	50	70	ms	59.0	Pass
Moment about the OC	36	44	Nm	43.3	Pass
Moment Decay to 0 Nm	102	126	ms	112.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/29/2019	1/29/2020
Pendulum Potentiometer	Denton 78051-342	DS-184Pend	11/1/2018	11/1/2019
Condyle Potentiometer	Denton 78051-342	DS-185Pend	11/1/2018	11/1/2019
Upper Neck Load Cell	Denton 1716	LC-2018 FY	9/28/2018	9/28/2019




Neck Rotation
Max: 77.3 deg
Min: -19.1 deg
Filter: CFC 60
Rotation (Deg)
Time [ms]
100
75
50
25
0
-25
-50
0
25
50
75
100
125
150


Moment About Occipital Condyle
Max: 43.3 Nm
Min: -12.9 Nm
Filter: CFC 600
Moment (Nm)
Time [ms]
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150

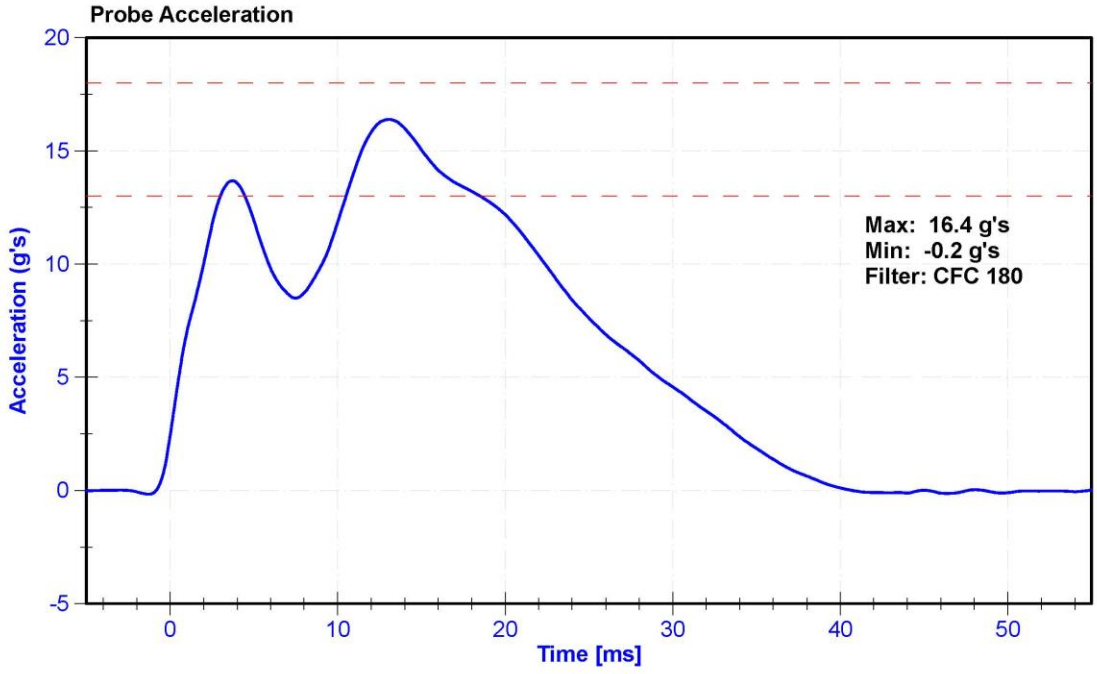
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

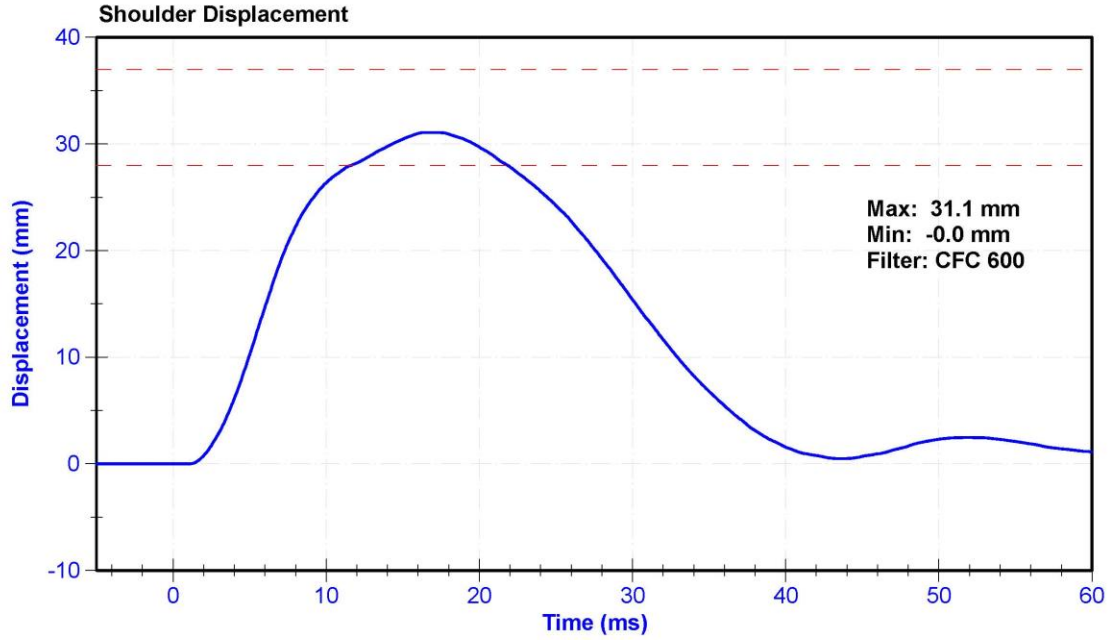
Results

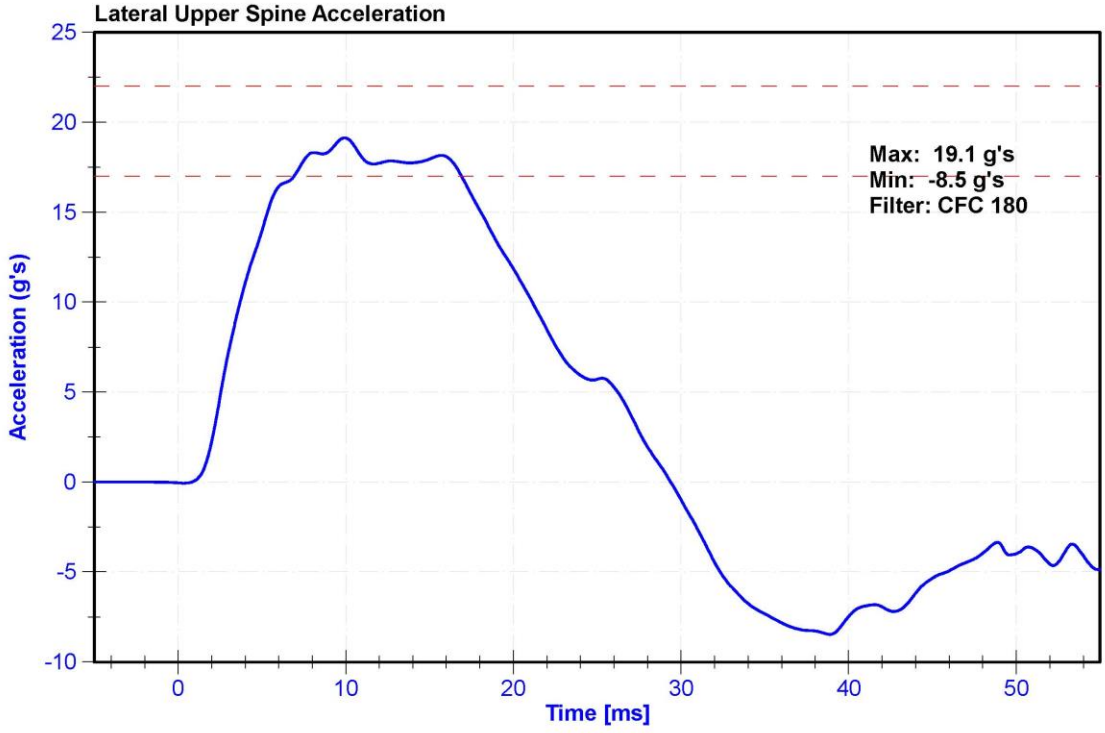
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.6	Pass
Humidity	10	70	%	17.6	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	13	18	g's	16.4	Pass
Shoulder Deflection	28	37	mm	31.1	Pass
Lateral Upper Spine Acceleration	17	22	g's	19.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	10/30/2018	10/30/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P63315	10/24/2018	4/24/2019




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 31.1 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 19.1 g's
Min: -8.5 g's
Filter: CFC 180

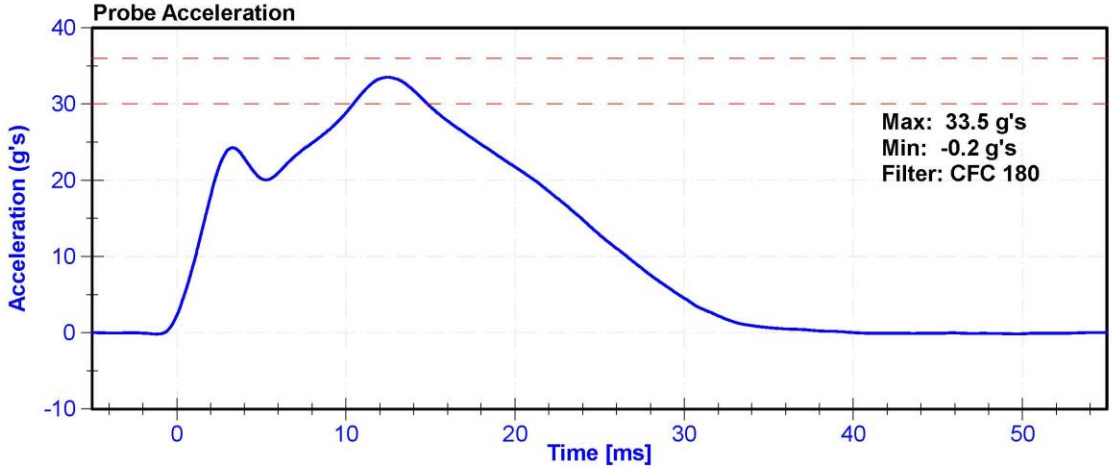
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

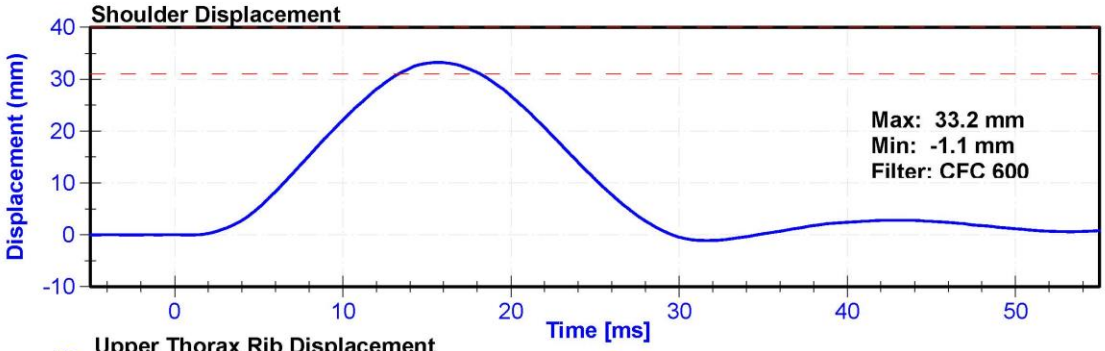
Results

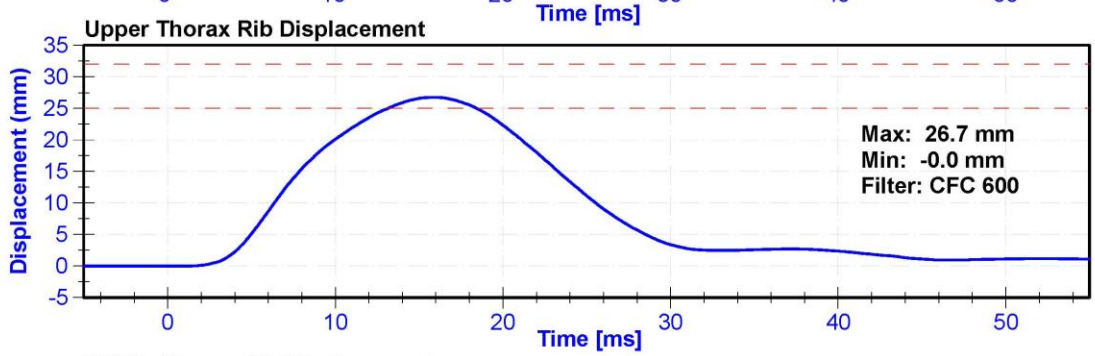
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.9	Pass
Humidity	10	70	%	27.7	Pass
Velocity	6.6	6.8	m/s	6.63	Pass
Probe Acceleration after 5 ms	30	36	g's	33.5	Pass
Lateral Upper Spine Acceleration	34	43	g's	34.5	Pass
Lateral Lower Spine Acceleration	29	37	g's	34.0	Pass
Shoulder Deflection	31	40	mm	33.2	Pass
Upper Thorax Rib Deflection	25	32	mm	26.7	Pass
Mid Thorax Rib Deflection	30	36	mm	31.7	Pass
Lower Thorax Rib Deflection	32	38	mm	34.0	Pass

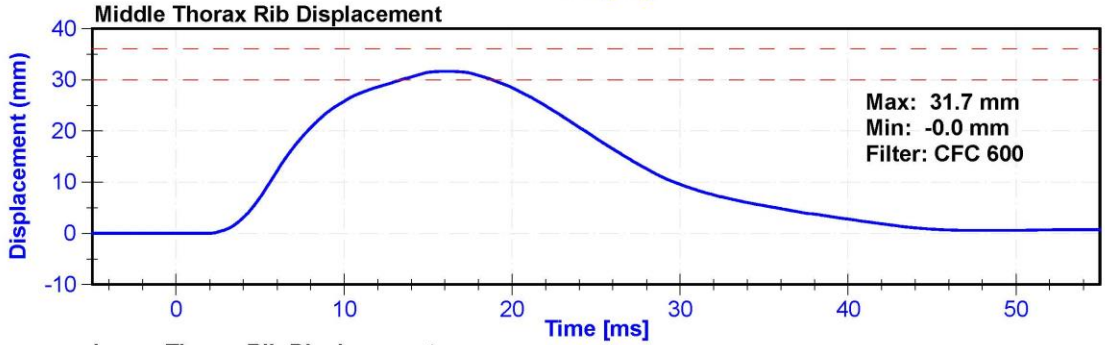
Transducer Calibrations

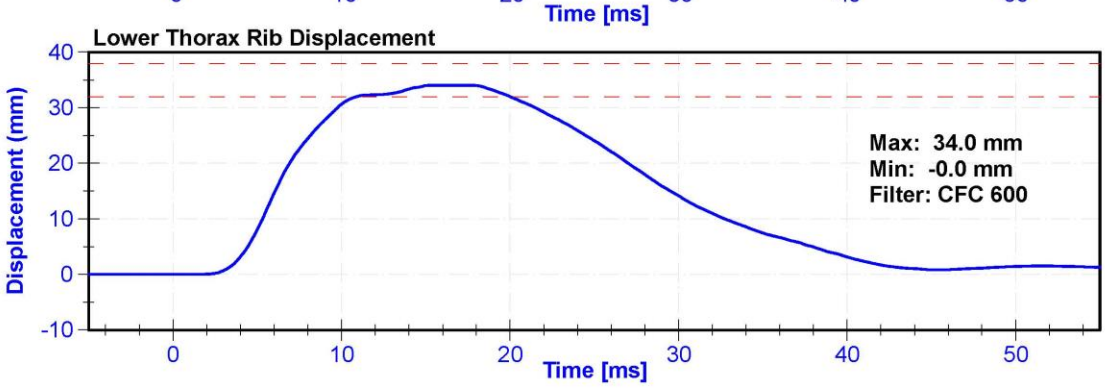
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P63315	10/24/2018	4/24/2019
Upper Spine T12 Y Accelerometer	ENDEVCO 7264	AC-P64147	1/10/2019	7/11/2019
Shoulder Potentiometer	Servo 08CT1-3725	DS-053 GFE	10/30/2018	10/30/2019
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	10/10/2018	10/10/2019

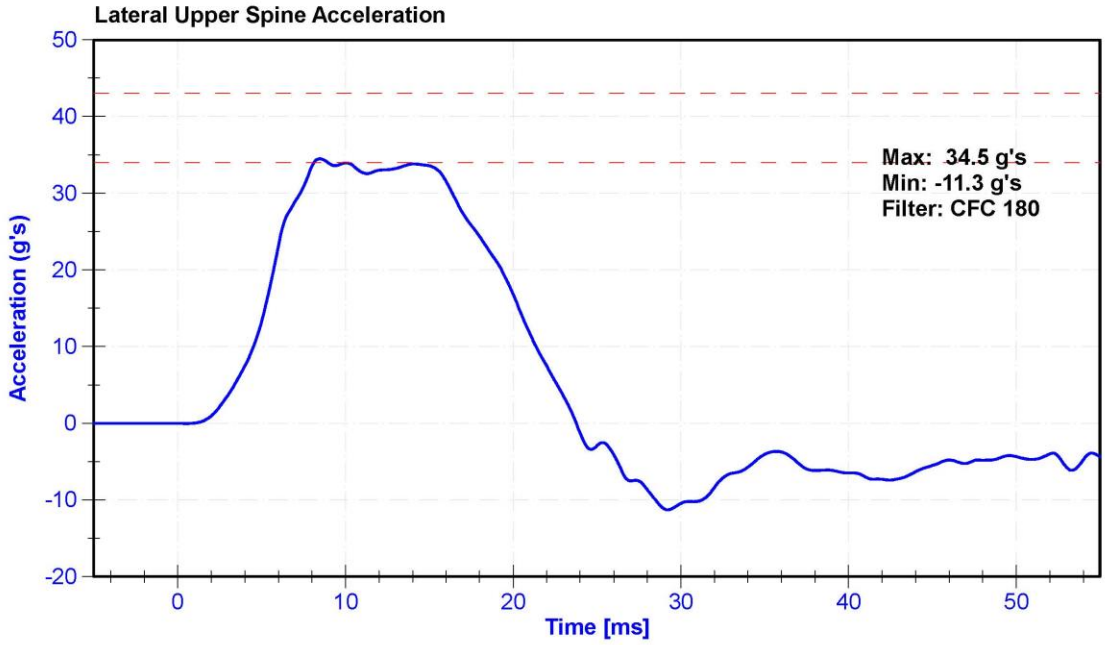


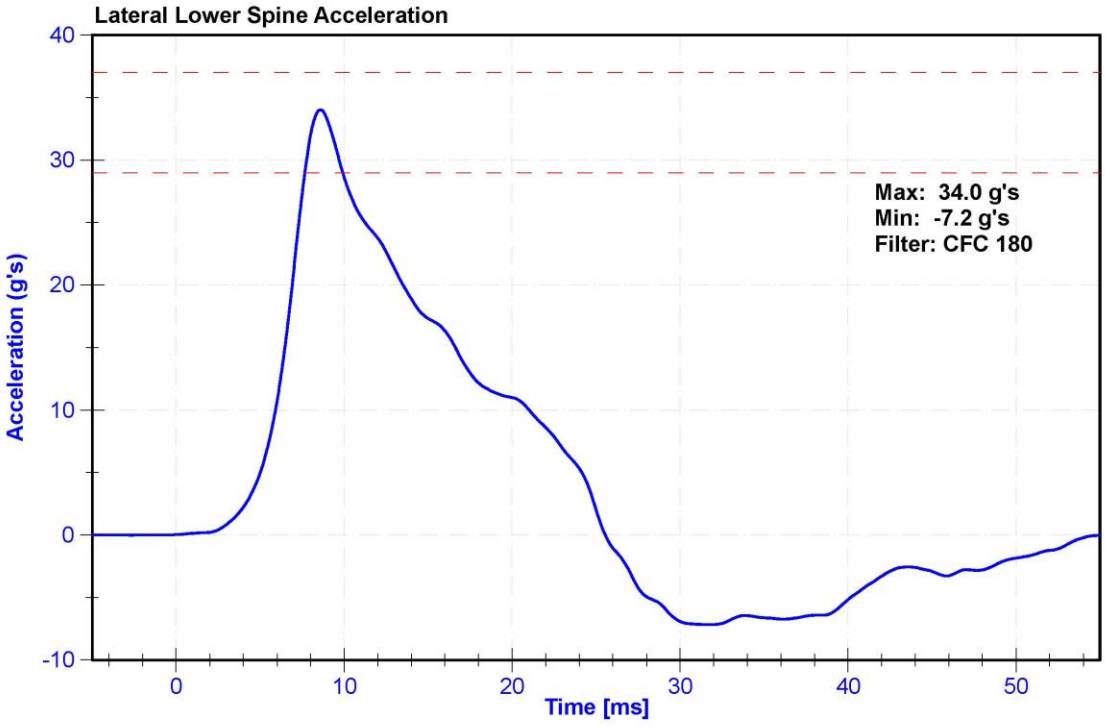

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 33.2 mm
Min: -1.1 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 26.7 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 31.7 mm
Min: -0.0 mm
Filter: CFC 600


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


Lateral Upper Spine Acceleration
Max: 34.5 g's
Min: -11.3 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 34.0 g's
Min: -7.2 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
0
10
20
30
40
50

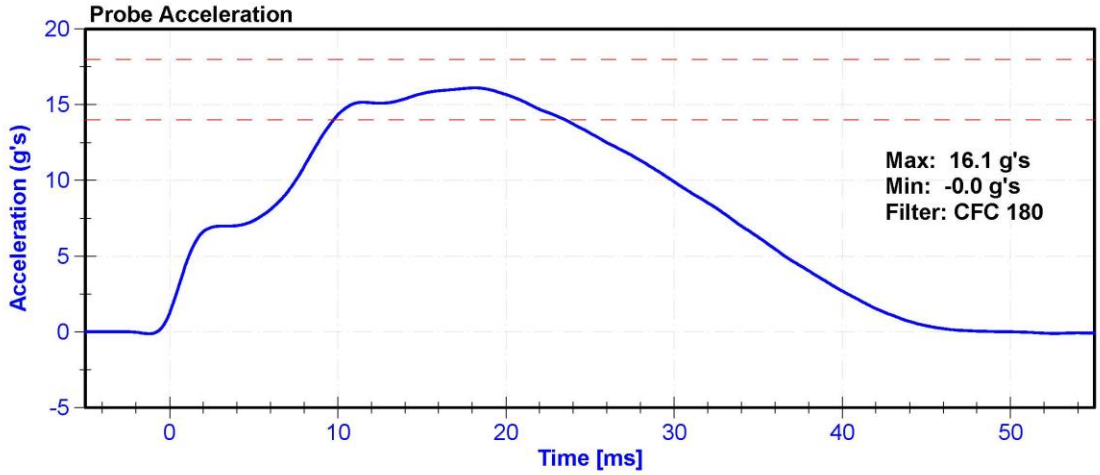
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

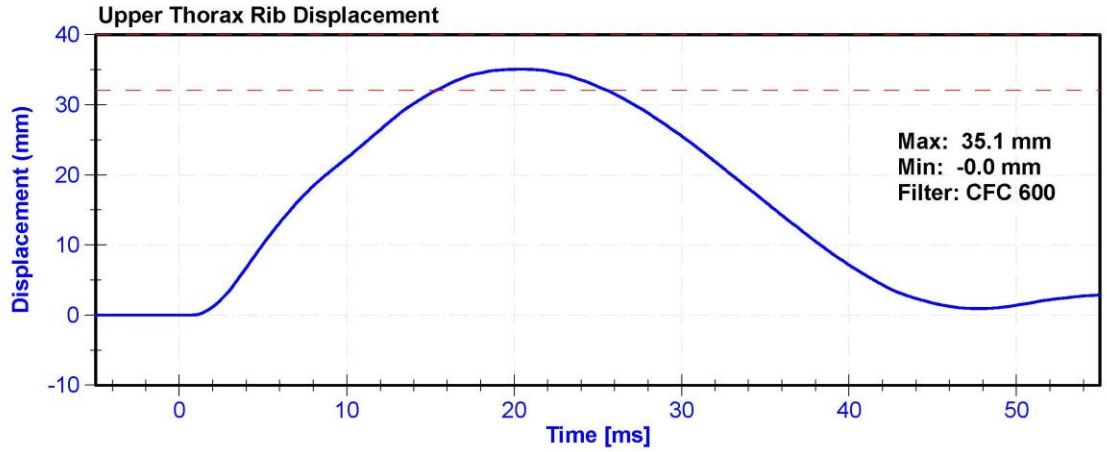
Results

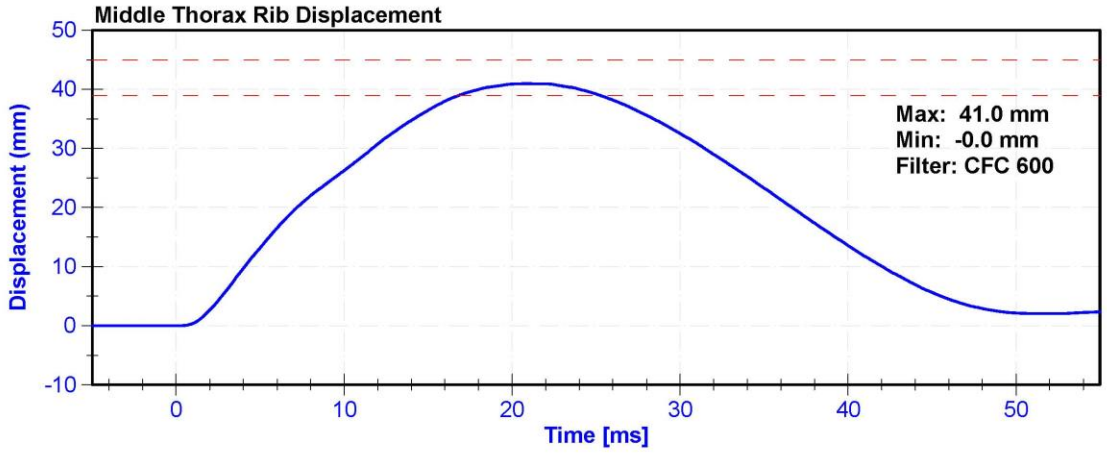
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	35.7	Pass
Velocity	4.2	4.4	m/s	4.33	Pass
Probe Acceleration	14	18	g's	16.1	Pass
Lateral Upper Spine Acceleration	13	17	g's	14.6	Pass
Lateral Lower Spine Acceleration	7	11	g's	9.4	Pass
Upper Thorax Rib Deflection	32	40	mm	35.1	Pass
Middle Thorax Rib Deflection	39	45	mm	41.0	Pass
Lower Thorax Rib Deflection	35	43	mm	38.1	Pass

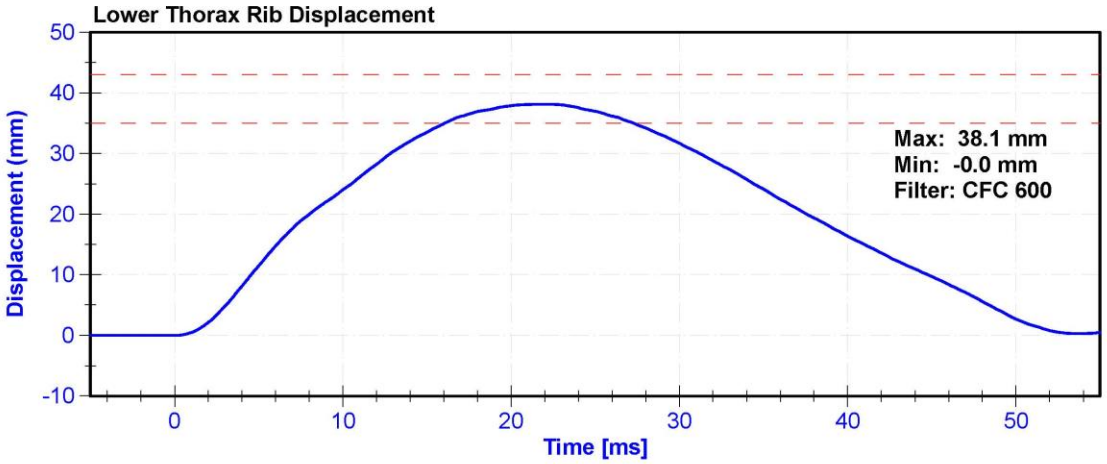
Transducer Calibrations

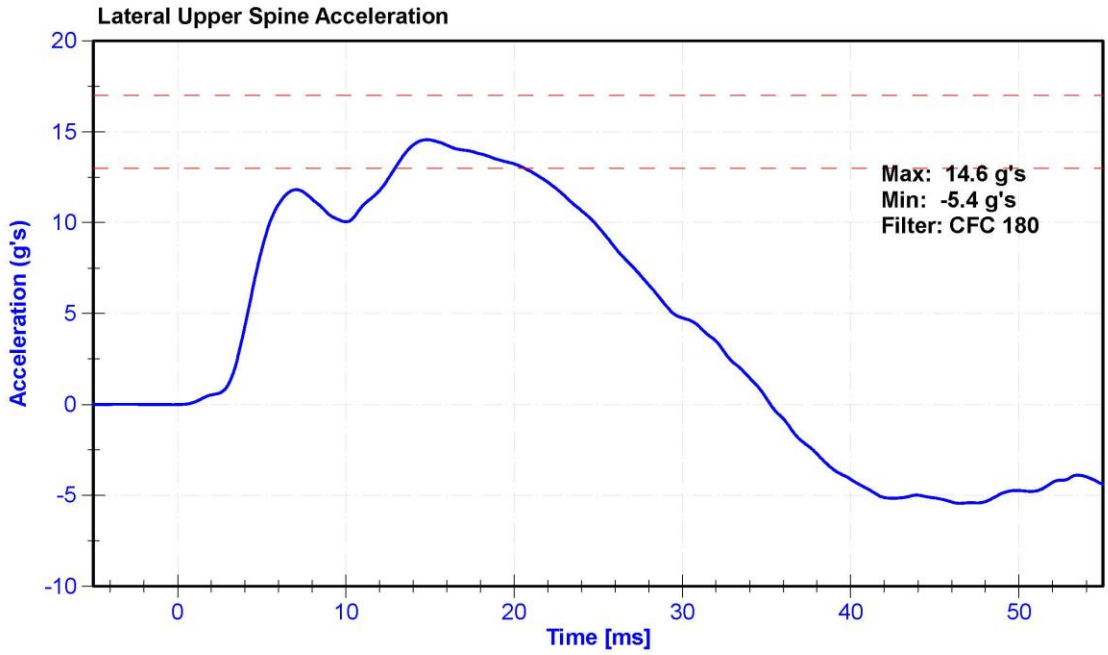
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P63315	10/24/2018	4/24/2019
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	1/10/2019	7/11/2019
Upper Thorax Rib Potentiometer	Servo 08CT1-3725	DS-451GFE	10/10/2018	10/10/2019
Middle Thorax Rib Potentiometer	Servo 08TC1-3745	DS-040GFE	10/11/2018	10/11/2019
Lower Thorax Rib Potentiometer	Servo 08TC1-3725	DS-1156GFE	10/10/2018	10/10/2019

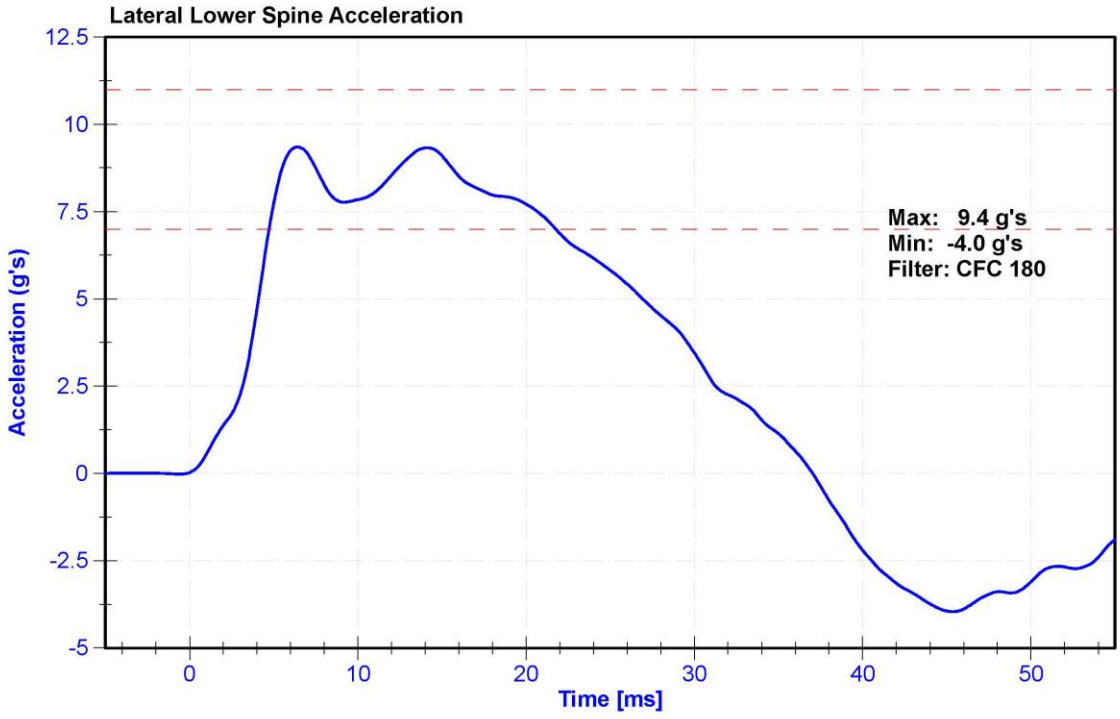



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 35.1 mm
Min: -0.0 mm
Filter: CFC 600


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


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 38.1 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 14.6 g's
Min: -5.4 g's
Filter: CFC 180


Lateral Lower Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 9.4 g's
Min: -4.0 g's
Filter: CFC 180

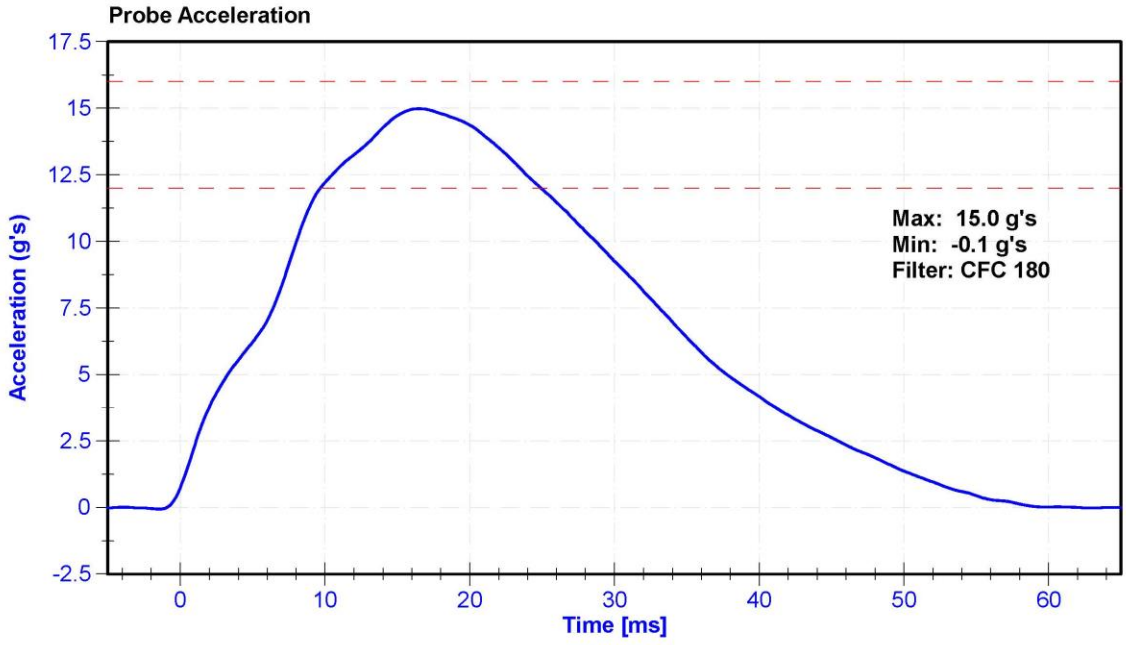
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

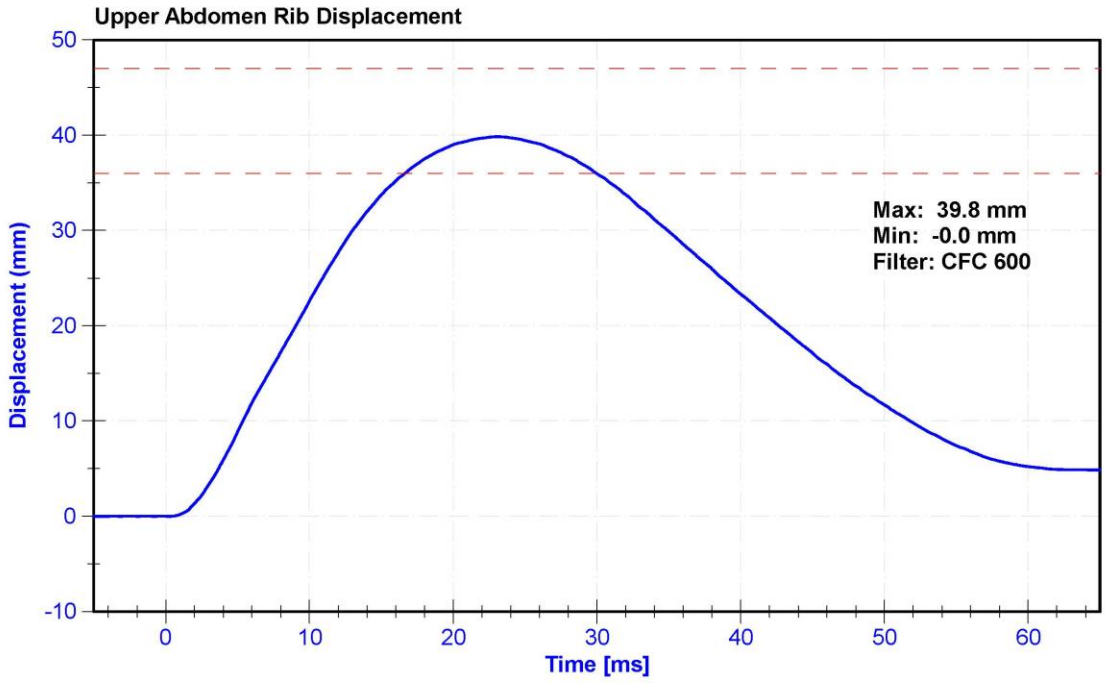
Results

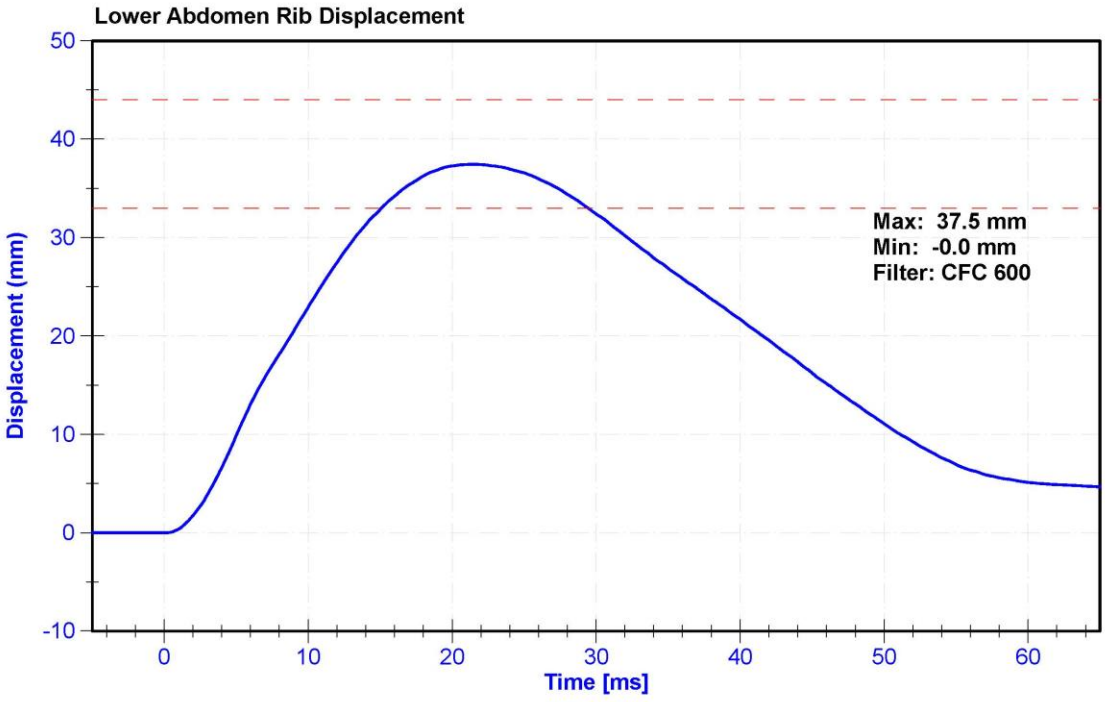
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.8	Pass
Humidity	10	70	%	18.0	Pass
Velocity	4.2	4.4	m/s	4.31	Pass
Probe Acceleration	12	16	g's	15.0	Pass
Lateral Lower Spine Acceleration	9	14	g's	11.5	Pass
Upper Abdomen Rib Deflection	36	47	mm	39.8	Pass
Lower Abdomen Rib Deflection	33	44	mm	37.5	Pass

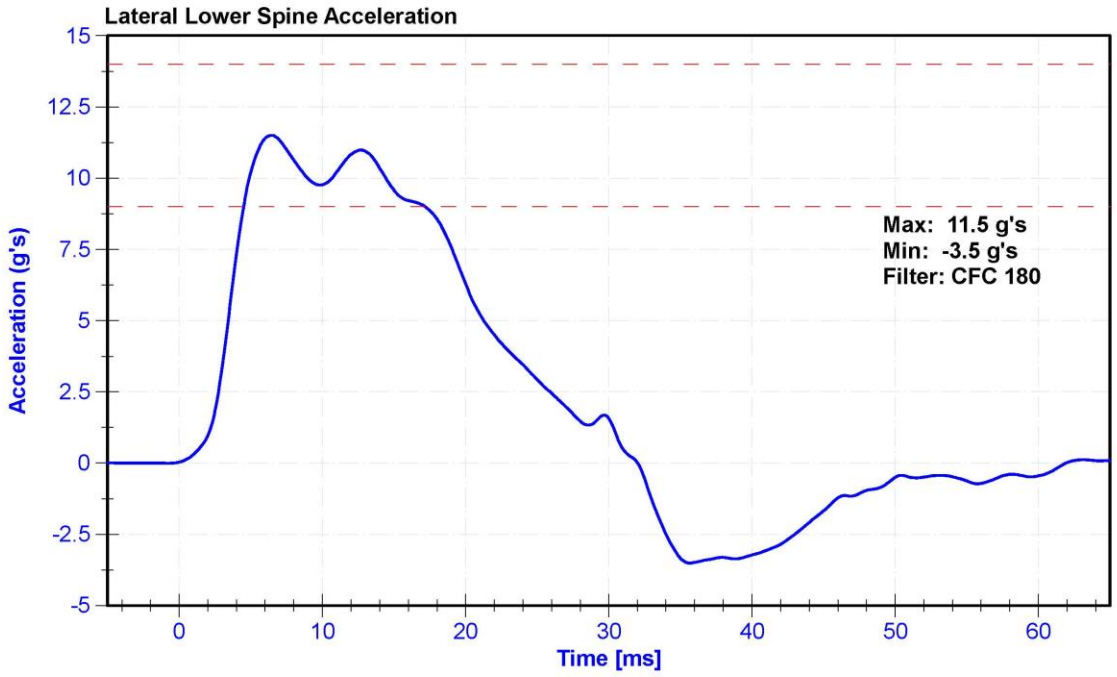
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Lower Spine Y Accelerometer	ENDEVCO 7264	AC-P64147	1/10/2019	7/11/2019
Upper Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-308GFE	10/10/2018	10/10/2019
Lower Abdomen Rib Potentiometer	Servo 08CT1-3725	DS-307GFE	10/11/2018	10/11/2019




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 39.8 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 37.5 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: 11.5 g's
Min: -3.5 g's
Filter: CFC 180

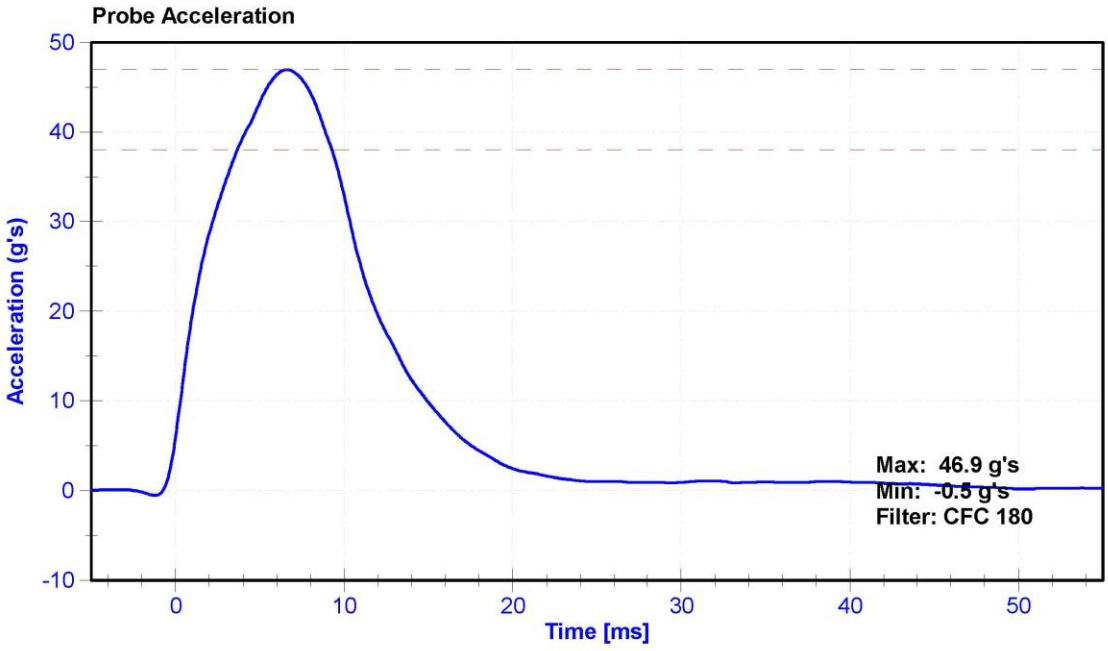
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	300	Laboratory Supervisor	K. Brogan

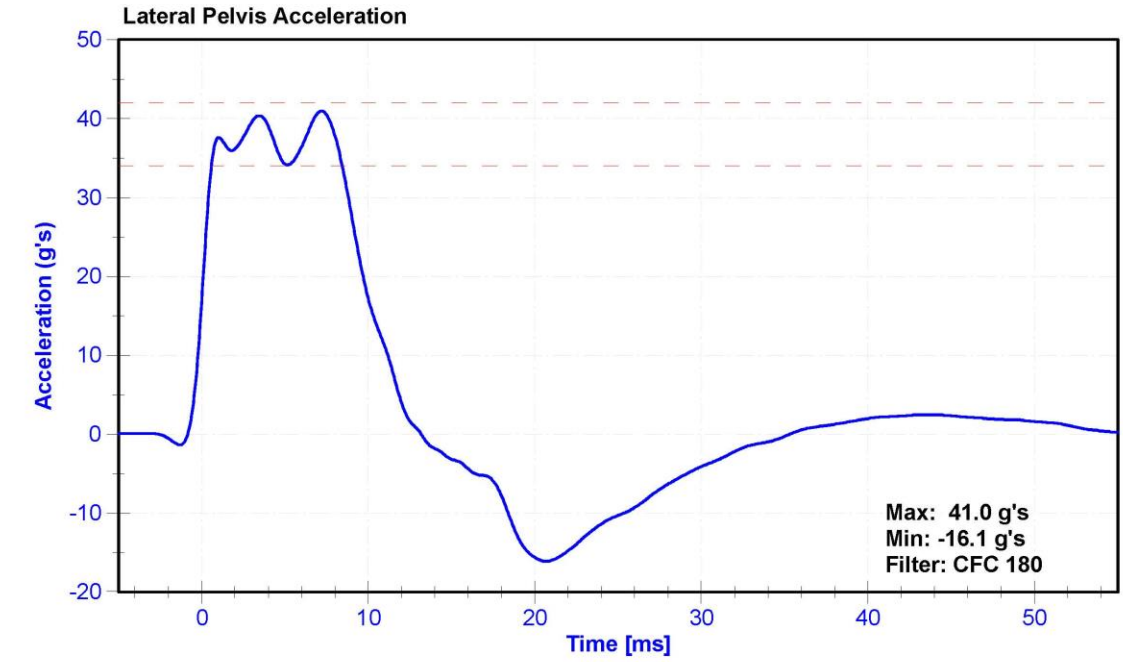
Results

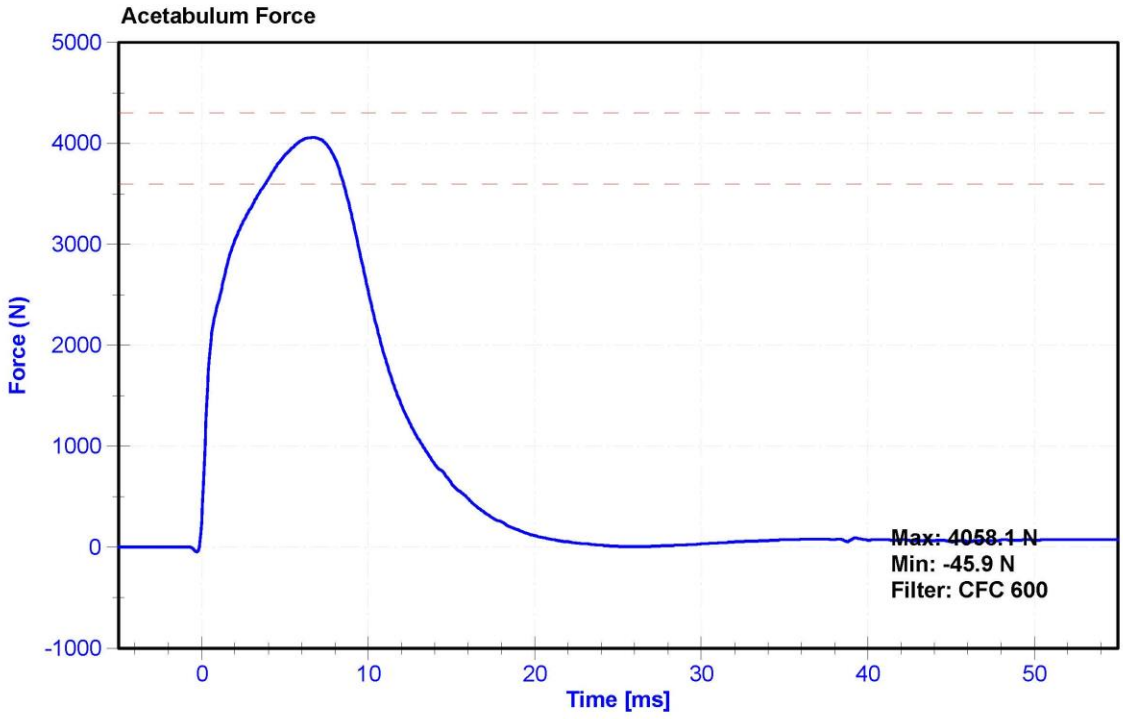
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.4	Pass
Humidity	10	70	%	14.5	Pass
Velocity	6.6	6.8	m/s	6.61	Pass
Probe Acceleration	38	47	g's	46.9	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	41.0	Pass
Acetabulum Force	3600	4300	N	4058.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/24/2018	4/24/2019
Acetabulum Load Cell	DENTON 3249J	LC-275Fy	10/4/2018	10/4/2019
Certification Plug	Humanetics	11796	1/22/2018	N/A
Crash Test Plug	Humanetics	11410	8/29/2016	N/A




Lateral Pelvis Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]
Max: 41.0 g's
Min: -16.1 g's
Filter: CFC 180


Acetabulum Force
Force (N)
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50
Time [ms]
Max: 4058.1 N
Min: -45.9 N
Filter: CFC 600

SID-IIs Pelvis Plug Certification Test

Plug S/N 11410
Test Number 2879
Report Number 2876
Test Date 8/29/2016 10:58:02 AM

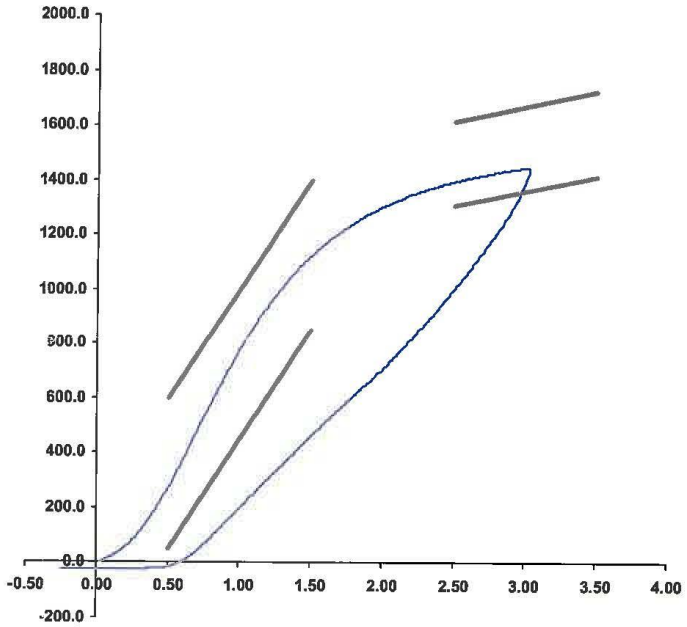
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	273.57	50.00	600.00
Force @ 1.5 mm (N)	1,123.91	850.00	1,400.00
Force @ 2.5 mm (N)	1,396.49	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,446.79	1,361.00	1,673.00

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

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

Notes:

Force (-N) vs Extension (-mm)



Operator DC

Part Number 180-4450

Template No 107 29-Aug-16
SACO Research

By : DC Date : 8/29/16

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

Cert 2 300 3/8/19

SID-IIs Pelvis Plug Certification Test

Plug S/N 11796
Test Number 5903
Report Number 5919
Test Date 1/22/2018 12:34:22 PM

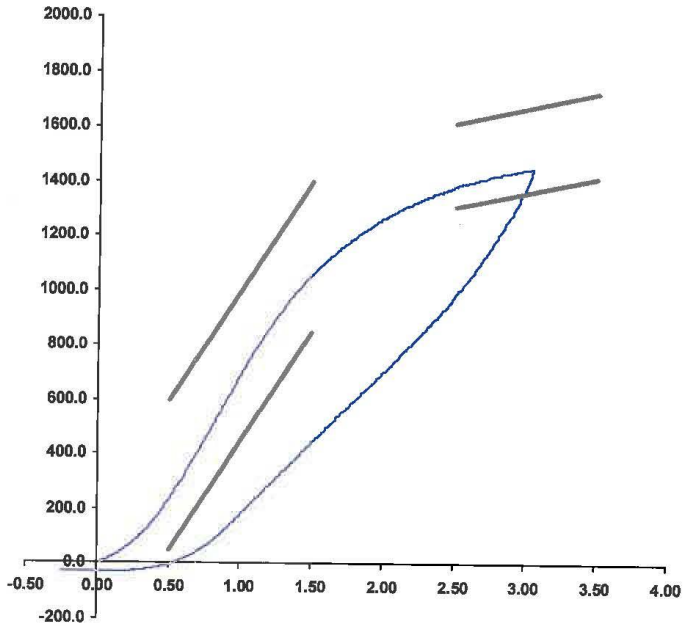
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	232.01	50.00	600.00
Force @ 1.5 mm (N)	1,061.35	850.00	1,400.00
Force @ 2.5 mm (N)	1,381.85	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,446.26	1,361.00	1,673.00

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:

Force (-N) vs Extension (-mm)



Operator DC

Part Number 180-4450

Template No 107 22-Jan-18
SACO Research

By : DC Date : 1/22/18

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

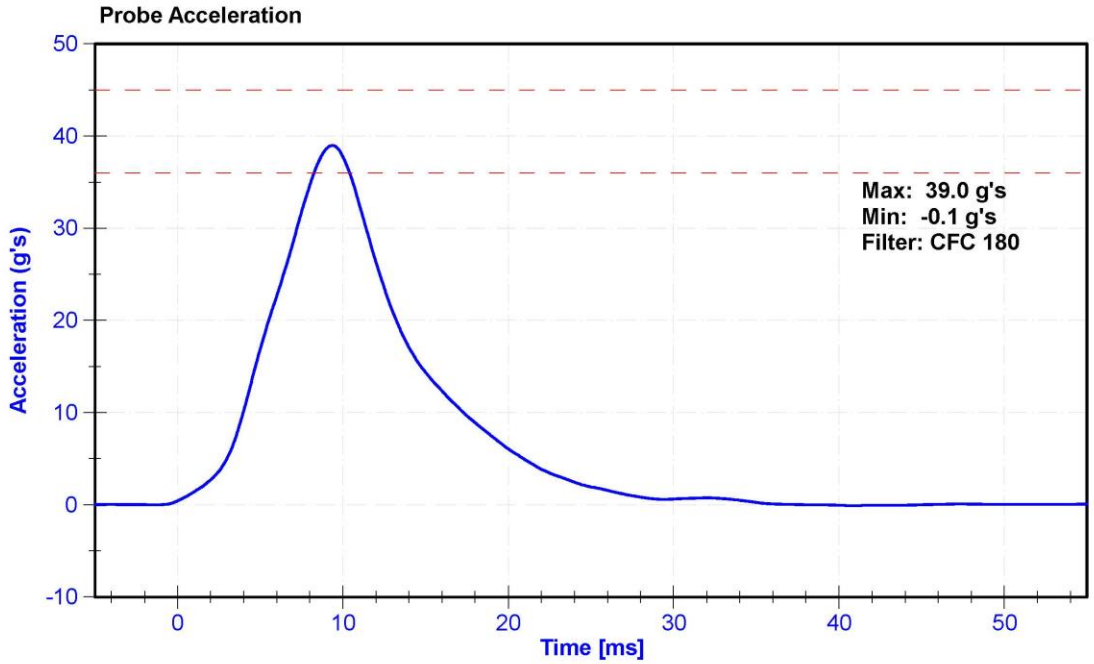
ATD Manufacturer	FTSS	Test Technician	K. Brogan
ATD Serial Number	300	Laboratory Supervisor	D.Reinhard

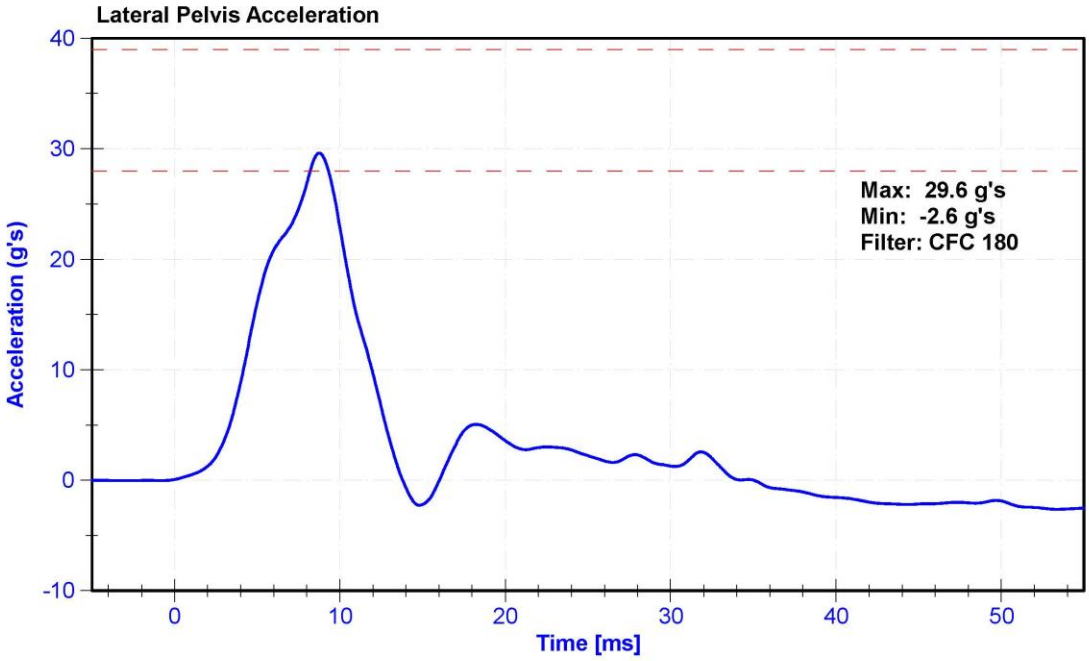
Results

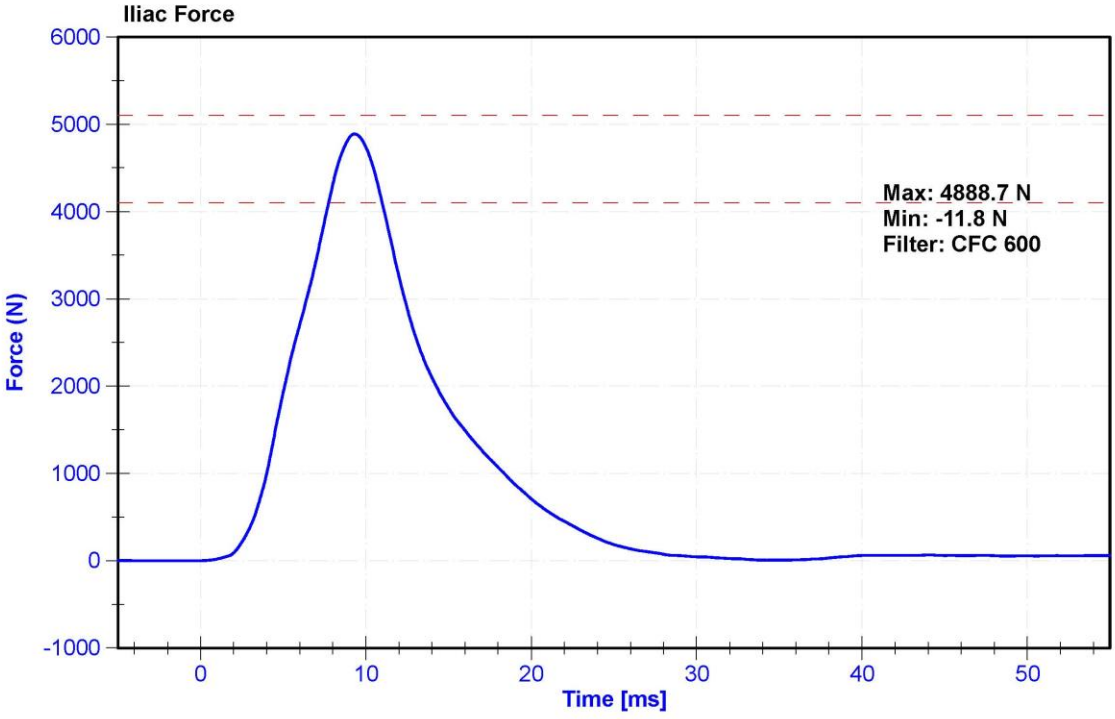
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	15.4	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	36	45	g's	39.0	Pass
Lateral Pelvis Acceleration	28	39	g's	29.6	Pass
Iliac Force	4100	5100	N	4888.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco 7264C	AC-P94667	11/1/2018	11/1/2019
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51668	10/24/2018	4/24/2019
Iliac Load Cell	Kistler 3228J	LC-DM5054 Fy	2/6/2019	2/6/2020




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 29.6 g's
Min: -2.6 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4888.7 N
Min: -11.8 N
Filter: CFC 600

APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N: F034		
			Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers	Primary	X	AC-P58904	ENDEVCO	10/5/2018
		Y	AC-P58911	ENDEVCO	10/5/2018
		Z	AC-P58776	ENDEVCO	10/5/2018
	Redundant	X	AC-P58887	ENDEVCO	10/5/2018
		Y	AC-P58888	ENDEVCO	10/5/2018
		Z	AC-P51734	ENDEVCO	10/5/2018
Thorax Rib Displacement Potentiometers	Upper	Y	DS-183GFE	Honeywell	10/10/2018
	Middle	Y	DS-184GFE	Honeywell	10/11/2018
	Lower	Y	DS-182GFE	Honeywell	10/10/2018
Abdomen Load Cells	Forward	Y	LC-1440	DENTON	6/4/2018
	Middle	Y	LC-1525	DENTON	6/4/2018
	Rear	Y	LC-1528	DENTON	6/4/2018
Lower Spine Accelerometers (T12)		X	AC-P52079	ENDEVCO	10/4/2018
		Y	AC-P51948	ENDEVCO	10/4/2018
		Z	AC-P51269	ENDEVCO	10/4/2018
Pubic Symphysis Load Cell		Y	LC-464fy	DENTON	6/4/2018

Table 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N: 300		
				Serial Number	**Manufacturer**	**Calibration Date**
Head Accelerometers		Primary	X	AC-P58777	ENDEVCO	10/5/2018
			Y	AC-P59018	ENDEVCO	10/5/2018
			Z	AC-P79189	ENDEVCO	10/5/2018
		Redundant	X	AC-P52095	ENDEVCO	10/5/2018
			Y	AC-P58986	ENDEVCO	10/5/2018
			Z	AC-P68057	ENDEVCO	10/5/2018
Displacement Potentiometers	Thoracic Rib	Upper	Y	DS-451GFE	Servo	10/10/2018
		Middle	Y	DS-040GFE	Servo	10/11/2018
		Lower	Y	DS-1156GFE	Servo	10/10/2018
	Abdominal Rib	Upper	Y	DS-308GFE	Servo	10/10/2018
		Lower	Y	DS-307GFE	Servo	10/11/2018
Lower Spine Accelerometers (T12)			X	AC-P58883	ENDEVCO	1/10/2019
			Y	AC-P64147	ENDEVCO	1/10/2019
			Z	AC-P58786	ENDEVCO	1/10/2019
Acetabulum Load Cell			Y	LC-275Fy	DENTON	10/4/2018
Iliac Wing Load Cell			Y	LC-DM5054 Fy	Kistler 3228J	2/6/2019
Pelvis Plug (struck side)				11475	SACO	8/31/2016
Pelvis Plug (non-struck side)				-	-	-

Table 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	AC-A280824	MSI 1201-1000	11/22/2018
	Vehicle Center of Gravity	Y	AC-A280846	MSI 1201-1000	11/21/2018
	Vehicle Center of Gravity	Z	AC-A280917	MSI 1201-1000	11/21/2018
2	Right Sill at Front Seat	X	AC-A255838	MSI 1201-1000	1/17/2019
	Right Sill at Front Seat	Y	AC-A262043	MSI 1201-1000	1/17/2019
	Right Sill at Front Seat	Z	AC-A262045	MSI 1201-1000	1/17/2019
3	Right Sill at Rear Seat	X	AC-A196999	MSI 1201-1000	11/30/2018
	Right Sill at Rear Seat	Y	AC-A279978	MSI 1201-1000	11/16/2018
	Right Sill at Rear Seat	Z	AC-A279982	MSI 1201-1000	11/10/2018
4	Left Sill at Front Door	Y	AC-A280207	MSI 1201-1000	11/13/2018
5	Left Sill at Rear Door	Y	AC-A206913	MSI 1201-1000	2/21/2019
6	Left A-Post Lower	Y	AC-A280363	MSI 1201-1000	11/15/2018
7	Left A-Post Middle	Y	AC-A280996	MSI 1201-1000	11/26/2018
8	Left B-Post Lower	Y	AC-A280921	MSI 1201-1000	11/21/2018
9	Left B-Post Middle	Y	AC-A280941	MSI 1201-1000	11/24/2018
10	Front Seat Track	Y	AC-A262038	MSI 1201-1000	12/10/2018
11	Rear Seat Track or Structure	Y	AC-A280973	MSI 1201-1000	2/21/2019
12	Right Rear Occ. Compartment	Y	AC-A280009	MSI 1201-1000	11/11/2018
13	Engine Block	X	AC-A217535	MSI 1201-1000	10/3/2018
	Engine Block	Y	AC-A222649	MSI 1201-1000	11/1/2018
14	Rear Floorpan Above Axle	X	AC-A255975	MSI 1201-1000	10/3/2018
	Rear Floorpan Above Axle	Y	AC-A255990	MSI 1201-1000	10/3/2018
	Rear Floorpan Above Axle	Z	AC-A255996	MSI 1201-1000	10/3/2018

TABLE 4 – MDB Instrumentation

MDB Instrumentation		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	AC-A251545	MSI 58-2000-360	11/1/2018
MDB Center of Gravity	Y	AC-A255130	MSI 58-2000-360	11/1/2018
MDB Center of Gravity	Z	AC-A255143	MSI 58-2000-360	11/1/2018
Left Frame at Rear Axle Centerline	X	AC-A280950	MSI 1201-1000	11/24/2018
Left Frame at Rear Axle Centerline	Y	AC-A280989	MSI 1201-1000	11/23/2018