REPORT NUMBER: SPNCAP-CAL-20-009

NEW CAR ASSESSMENT PROGRAM (NCAP)
SIDE IMPACT POLE TEST

KIA Motors Corporation
2020 KIA Stinger GT-Line
Four Door Sedan

NHTSA No: M20204216

PREPARED BY:
CALSPAN CORPORATION
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June 16, 2020

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
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Prepared by: Matthew Pronko Date: June 16, 2020
Matthew Pronko, Test Engineer

Approved by: Vanessa Hansen Date: June 16, 2020
Vanessa Hansen, Operations Manager

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

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4. Title and Subtitle Final Report of New Car Assessment Program Side Impact Pole Testing of a 2020 KIA Stinger GT-Line four door sedan NHTSA No.: M20204216		***5. Report Date*** June 16, 2020 ***6. Performing Organization Code*** CAL
7. Author(s) Matthew Pronko, Test Engineer Vanessa Hansen, Operations Manager		***8. Performing Organization Report No.*** CAL-DOT-2020-009
9. Performing Organization Name and Address Calspan Corporation Transportation Test Operation 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, April 20, 2020 - June 16, 2020 ***14. Sponsoring Agency Code*** NRM-110
15. *Supplementary Notes*		

16. Abstract

A 32.20 km/h (20 mph), 75˚ oblique impact Side NCAP Test was conducted on the subject 2020 KIA Stinger GT-Line four door sedan in accordance with the specifications of the Office of Crashworthiness Standards Side NCAP Pole Laboratory Test Procedure for the generation of consumer information on vehicle side pole crash protection. This test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on April 20, 2020.

The impact velocity of the vehicle was 32.22 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle was 21°C. The target vehicle's maximum post-test static crush was 334 mm located at level 3. The test vehicle's occupant performance data is as follows:

Measurement Description	Driver ATD (SID-IIs) (Serial No. DG8012)		
	Units	Threshold	Result
Head Injury Criteria (HIC_{36})		1000	309.764
Resultant Lower Spine Acceleration	G	82	35.864
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3347.095
Maximum Thoracic Rib Deflection	mm	38	22.432
Maximum Abdomen Rib Deflection	mm	45	24.523

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 Pole Part 572V SID-IIs	***18. Distribution Statement*** Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division 1200 New Jersey Ave. SE Washington, D.C. 20590

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Form DOT F1700.7 (8-72)

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SECTION 1

TEST PURPOSE AND PROCEDURE

This side impact test was conducted as part of the MY 2020 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-14-D-00352. The purpose of this test is to generate comparative side impact performance in a 2020 KIA Stinger GT-Line four door sedan. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP Pole Laboratory Test Procedure, dated October 2015.

SECTION 2

SUMMARY OF TEST RESULTS

A rigid pole side impact test was conducted on a 2020 KIA Stinger GT-Line four door sedan. The subject vehicle was towed into the rigid pole at an angle of 75^{o} and a velocity of 32.22 km/h. The test was conducted by Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on April 20, 2020. Pre-test and post-test photographs of the test vehicle and side impact dummy (SID-IIs) are included in Appendix A of this report.

One Part 572V (SID-IIs) dummy was placed in the driver designated seating position according to instructions specified in the OCWS Side NCAP Pole Laboratory Test Procedure, dated October 2015. Camera locations and other pertinent camera information are included on page 3-11 in this report.

The Part 572V (SID-IIs) dummy was instrumented accordingly:

Head CG tri-axial accelerometers
Thorax upper, middle, and lower rib displacement potentiometers
Abdomen upper and lower rib displacement potentiometers
Lower spine tri-axial accelerometers
Iliac load cell
Acetabulum load cell

Appendix B contains the dummy response data. Dummy configuration and performance verification data can be found in Appendix C of this report. Appendix D identifies all serial numbers, manufacturers, and calibration dates for test equipment, dummy sensors, potentiometers, and load cells used to collect data during the test.

Injury readings for the SID-IIs dummy were recorded as follows:

INJURY READINGS

Measurement Description	Driver ATD (SID-IIs)		
	Units	IARV	Result
Head Injury Criteria (HIC_{36})		1000	309.764
Resultant Lower Spine Acceleration	g	82	35.864
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3347.095
Maximum Thoracic Rib Deflection	mm	38*	22.432
Maximum Abdominal Rib Deflection	mm	45*	24.523

*****Proposed IARV

Supplemental restraint information was recorded as follows:

SUPPLEMENTAL RESTRAINT INFORMATION

Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	Yes	No		
Side Airbag 1 - Curtain	Yes	Yes	Yes	Yes
Side Airbag 2 – Torso/Pelvis	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 – DG8012
2. Vehicle body design is considered a four door sedan however the vehicle's rear compartment functions like a hatchback

Data Anomalies:

- Left Front Sill Y Acceleration, Exceeded calibration range at 18.8 ms 45.2 ms
- Left Sill B-Pillar Y Acceleration, Exceeded calibration range at 48.4 ms

SECTION 3

OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

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

Data Sheet No. 2 – Seat, Seat Belt, Steering Wheel Adjustment and Fuel Systems 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 – Vehicle Accelerometer Data

Data Sheet No. 7 – Rigid Pole Load Cell Data

Data Sheet No. 8 – Post-Test Observations

Data Sheet No. 9 – Test Vehicle Profile Measurements

Data Sheet No. 10 – Test Vehicle Exterior Crush Measurements

Data Sheet No. 11 – Vehicle Damage Profile Distances

Data Sheet No. 12 – FMVSS No. 301 Static Rollover Results

Data Sheet No. 13 – Dummy / Vehicle Temperature and Humidity Stabilization Data

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 KIA Stinger GT-Line four door sedan
NHTSA No.: M20204216
Test Program: NCAP Side Pole Impact Test
Test Date: 4/20/2020

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20204216
Model Year	2020
Make	KIA
Model	Stinger GT-Line
Body Style	Five Door Hatchback
VIN	KNAE15LA4L6073813
Body Color	Black
Odometer Reading (km/mi)	105 mi
Engine Displacement (L)	2.0
Type / No. Cylinders	I4 Turbo
Engine Placement	Inline
Transmission Type	Automatic
Transmission Speeds	8-Speed
Overdrive	Yes
Final Drive	Rear Wheel Drive
Roof Rack	No
Sunroof / T-Top	Yes
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
Anti-Lock Brakes (ABS)	Yes

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

Does owner's manual provide instructions to turn off automatic door locks? No

DATA FROM CERTIFICATION LABEL

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

GVWR (kg)	2165
GAWR Front (kg)	1115
GAWR Rear (kg)	1230

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3	N/A	5	
Capacity Weight (VCW) (kg)				410	(A)
DSC X 68.04 kg				340.2	(B)
Cargo Weight (RCLW) (kg)				69.8	(A-B)

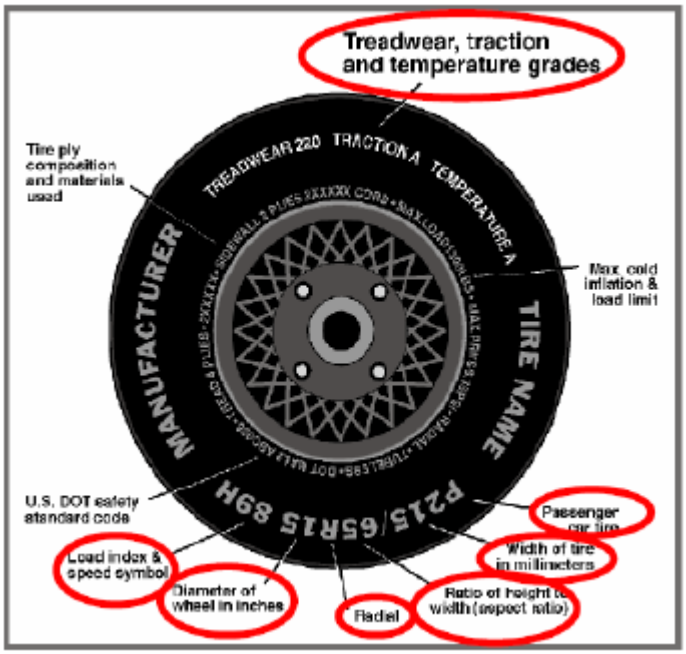
VEHICLE SEAT TYPE

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

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

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020

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



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	340	340
Cold Pressure (kPa)	250	270
Recommended Tire Size	225/45R18	225/45R18
Tire Size on Vehicle	225/45R18	225/45R18
Tire Manufacturer	Bridgestone	Bridgestone
Tire Model	Potenza	Potenza
Treadwear	400	400
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	1 Polyester, 2 Steel, 1 Nylon	1 Polyester, 2 Steel, 1 Nylon
Load Index/Speed Symbol	95V	95V
Tire Material	Rubber	Rubber
DOT Safety Code Left	EJJ7DAA4318	EJJ7DAA4318
DOT Safety Code Right	EJJ7DAA4318	EJJ7DAA4318

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

Test Vehicle: 2020 KIA Stinger GT-Line four door sedan NHTSA No.: M20204216
Test Program: NCAP Side Pole Impact Test Test Date: 4/20/2020

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	265	265	268	264
Tire Placard	kPa	250	250	270	270
Owner's Manual	kPa	250	250	270	270
As Tested	kPa	250	250	270	270

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	432	422		465	448		450	479	
Right	kg	429	416		433	466		435	462	
Ratio	%	50.7	49.3		49.6	50.4		48.5	51.5	
Totals	kg	861	838	1699	898	914	1812	885	941	1826

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	1699	(A)
Actual Weight of 1 P572V (SID-IIs) ATD Used	kg	50	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	69.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1818.8	(A+B+C)

Does the measured As Test Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Target Weight – 4.5 kg to – 9 kg)? [X] **Yes** [ ] **No**

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	As Delivered	As Tested	Fully Loaded	Meets Rqmt***
Driver Door Sill Angle (front-to-rear)*	Deg	-0.55	-0.30	-0.30	Yes
Front Passenger Sill Angle (front-to-rear)*	Deg	-0.40	-0.10	-0.05	Yes
Front Bumper-Line Angle (left-to-right)**	Deg	-0.05	-0.10	-0.15	Yes
Rear Bumper-Line Angle (left-to-right)**	Deg	-0.30	-0.30	-0.30	Yes
Vehicle CG (Aft of Front Axle)	mm	1434	1467	1499	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	4	6	14	

* ND = Nose Down (-), NU = Nose Up (+)
** LD = Left Down (-), LU = Left Up (+)
*** The "As Tested" vehicle attitude measurements must be equal to or between the "As Delivered" and "Fully Loaded" vehicle attitude measurements. Indicate "Yes" or "No" for Meets Requirement"

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

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	11
Spare Tire	14.5
Jack	3.5
Ballast / Equipment Added	45

Test Height – Adjustable Suspension Setting, if Applicable	N/A

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

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020

SEAT POSITIONING

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

SCRL ANGLE RANGE

Seat	SCRL (º)		
	Max	Min	Mid
Driver Seat	21	14.1	17.6
Front Passenger Seat	20.5	13.5	17.0
Front Center Seat	N/A	N/A	N/A
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (º)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rearmost	Mid-Fore / Aft	Forward-Most
Driver Seat	17.6	52	Max	60	71	81
			Mid	30	41	52
			Min	0	11	22
Front Passenger Seat	17.0	55	Max	63	75	87
			Mid	31	44	55
			Min	0	12	24
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	-	-	-

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

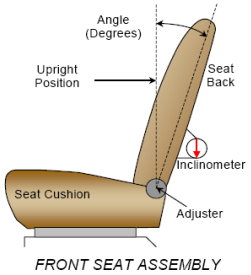
Test Vehicle: 2020 KIA Stinger GT-Line four door sedan NHTSA No.: M20204216
Test Program: NCAP Side Pole Impact Test Test Date: 4/20/2020

SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forward most Position	
	mm	Detents*	mm	Detents*
Driver Seat	240	N/A	0	N/A
Front Passenger Seat	240	N/A	0	N/A
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

SEAT BACK ANGLE ADJUSTMENT

The driver's seat back is positioned such that the dummy's head is level. 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 passenger seat back is positioned in accordance with the information provided by the manufacturer on Form No. 1 for the 5th percentile female dummy in a Side NCAP MDB test. The rear center and non-struck side rear passenger's seat back are set to match 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	60	N/A	2.2	N/A
Front Passenger Seat	58	N/A	2.1	N/A
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

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1. Zero is defined as the uppermost detent

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

HEAD RESTRAINT ADJUSTMENT

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

Seat	Total # of Positions	Placed in Position #
Driver Seat	6 (0-5)	Lowermost

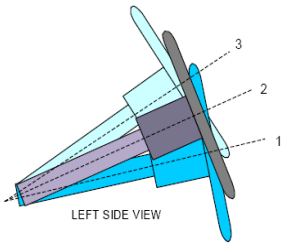
DATA SHEET NO. 2 … (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020

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	17.1	
Geometric Center – Position 2	19.5	
Uppermost – Position 3	21.9	
Telescoping Steering Wheel Travel		45
Test Position	19.5	22.5

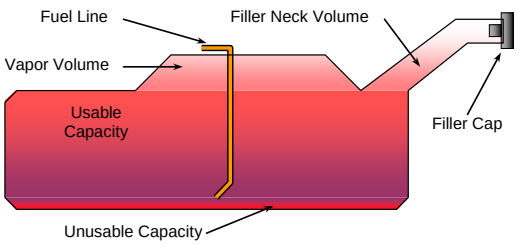


STEERING COLUMN ASSEMBLY

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

FUEL TANK CAPACITY DATA

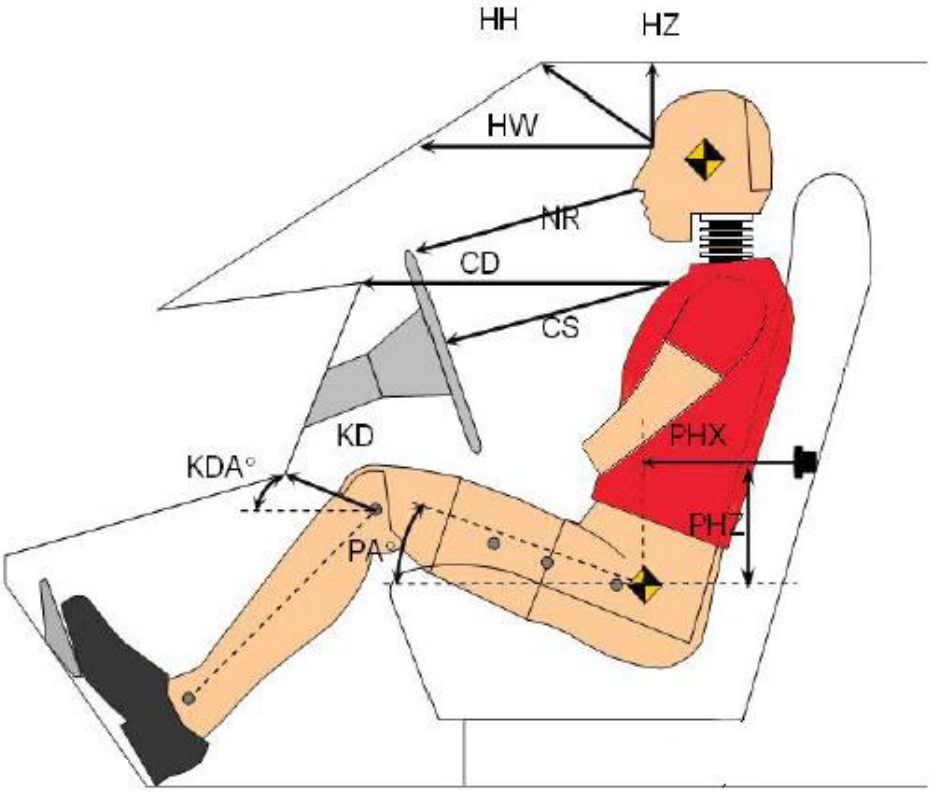
Description			Liters
Usable Capacity of “Standard Tank”	-	see Form No. 1	60
Usable Capacity of “Optional Tank”	-	see Form No. 1	N/A
Usable Capacity of “Standard Tank”	-	see Owner’s Manual	60
Usable Capacity of “Optional Tank”	-	see Owner’s Manual	N/A
93% of Usable Capacity			55.8
Actual Amount of Solvent Used in Test			55.8
1/3 of Usable Capacity			20

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

[X] Yes [ ] No

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020



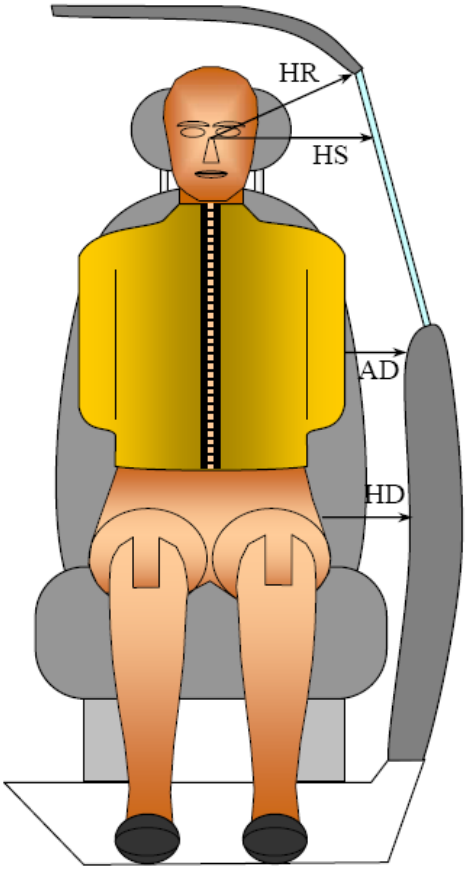
Left Side View

DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Description	Driver (Serial No. DG8012)	
		Length (mm)	Angle (◦)
HH	Head to Header	245	
HW	Head to Windshield	566	
HZ	Head to Roof Liner	150	
NR	Nose to Rim	235	
CD	Chest to Dash	406	
CS	Chest to Steering Wheel	195	
KD(L) / KDA(L)◦	Left Knee to Dash	147	26.9
KD(R) / KDA(R)◦	Right Knee to Dash	151	22.4
PAX◦	Pelvic Tilt Angle (X-Axis)		20.7
PAY◦	Pelvic Tilt Angle (Y-Axis)		0.3
PHX	Hip Point to Striker (X-Axis)	306	
PHZ	Hip Point to Striker (Z-Axis)	220	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020



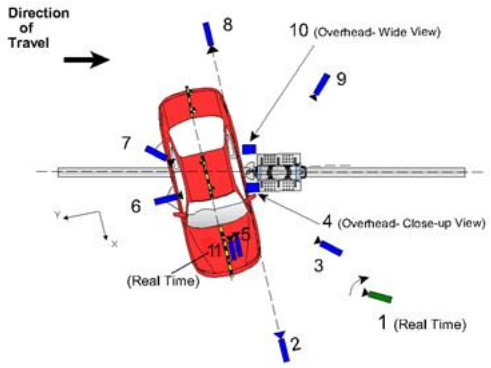
FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

Code	Measurement Description	Units	Driver - Length (Serial No. DG8012)
HR	Head To Side Header	mm	220
HS	Head to Side Window	mm	352
AD	Arm to Door	mm	158
HD	Hip Point to Door	mm	184

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2020 KIA Stinger GT-Line four door sedan NHTSA No.: M20204216
Test Program: NCAP Side Pole Impact Test Test Date: 4/20/2020



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Real-time (24 - 30 fps) pan view of impact				Zoom	60
2	Front ground level - impact view	7898	0	-1359	28	1000
3	Impact side 45º - forward pole view	5830	-1438	-1282	24	1000
4	Overhead Close-up view of impact	0	0	-9370	28	1000
5	Onboard - dummy front view				25	1000
6	Onboard - dummy side view				12.5	1000
7	Onboard - dummy rear oblique view				12.5	1000
8	Rear ground level - impact view	-7487	0	-1410	28	1000
9	Impact side 45º - rearward pole view	-4160	-3539	-1280	24	1000
10	Overhead wide - view of impact	0	0	-9370	12.5	1000
11	Real-time (24 - 30 fps) - dummy front view				Zoom	60

Notes: *Reference - From Point of Impact for X and Y; from Ground for Z*
+X = Forward of vehicle, +Y = Right of vehicle, +Z = Down
** All measurements accurate to ± 6 mm.* *Vehicle is at a 75º angle to the rigid pole.*

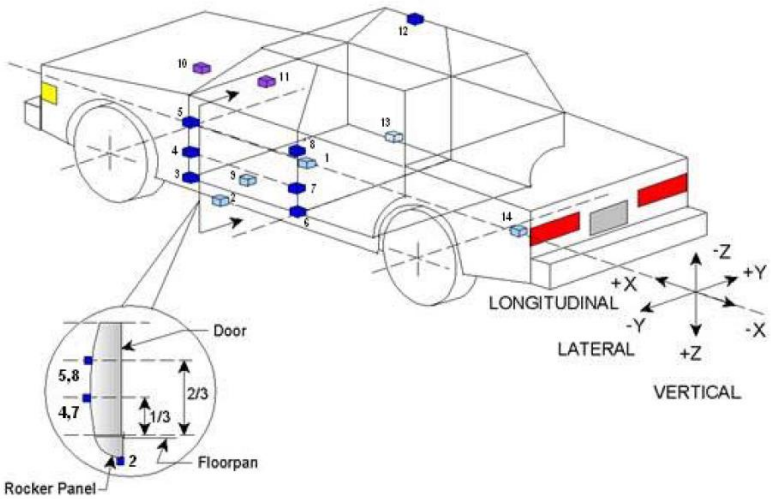
Comments: All cameras operated as intended.

INSTRUMENTATION

Description	Number of Channels
Driver Dummy Channels	16
Vehicle Structure Accelerometers	18
Pole Load Cells	8
Total	42

DATA SHEET NO. 6
VEHICLE ACCELEROMETER DATA

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020



TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2561	-7	-120
2	Left Floor Sill	2837	-695	122
3	A-Pillar Sill	3310	-647	117
4	A-Pillar Low	3328	-645	-77
5	A-Pillar Mid	3174	-655	-494
6	B-Pillar Sill	2260	-698	85
7	B-Pillar Low	2233	-683	-156
8	B-Pillar Mid	2183	-651	-462
9	Driver Seat Track	2348	-574	201
10	Engine Top	4037	71	-400
11	Firewall	3579	263	-253
12	Right Roof	2283	550	-904
13	Right Floor Sill	2834	691	128
14	Rear Floorpan	1024	-7	-93

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

DATA SHEET NO. 7
RIGID POLE LOAD CELL DATA

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020

POLE BARRIER

RIGID POLE LOAD CELL LOCATIONS

ID	Units	Height From Ground
1	mm	200
2	mm	590
3	mm	750
4	mm	1075
5	mm	1260
6	mm	1740
7	mm	1920
8	mm	2300

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2020 KIA Stinger GT-Line four door sedan NHTSA No.: M20204216
Test Program: NCAP Side Pole Impact Test Test Date: 4/20/2020

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Driver Seat Dummy (SID-IIs)
Face	Curtain Airbag
Top of Head	Curtain Airbag
Left Side of Head	Curtain Airbag
Back of Head	Headrest
Left Shoulder	Torso/Pelvis Airbag
Upper Torso	Seatback
Lower Torso	Seatback
Left Hip	Torso/Pelvis Airbag & Driver Door
Left Knee	None

POST-TEST DOOR PERFORMANCE

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

POST-TEST SEAT PERFORMANCE

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

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

Test Vehicle: 2020 KIA Stinger GT-Line four door sedan NHTSA No.: M20204216
Test Program: NCAP Side Pole Impact Test Test Date: 4/20/2020

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	A-Pillar & B-Pillar Buckled
Sill Separation	None
Windshield Damage	Cracks throughout with a hole at rearview mirror attachment
Side Window Damage	Driver window has cracks throughout
Other Notable Effects	Sunroof shattered

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

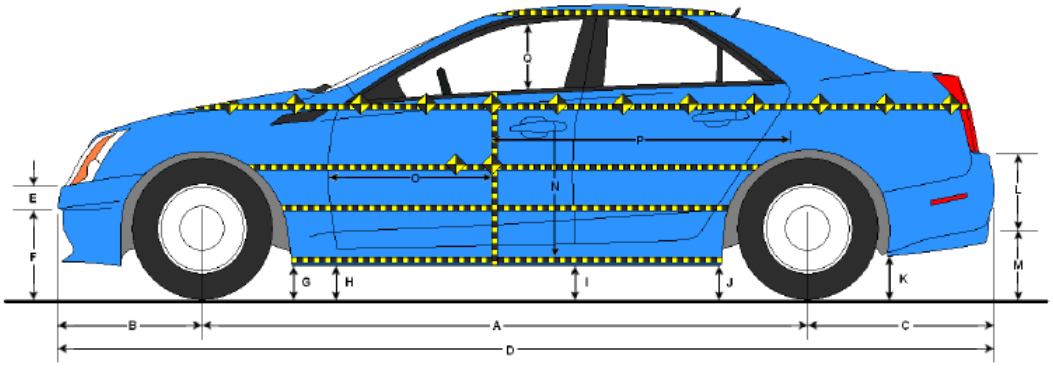
VEHICLE SPEED, VEHICLE ANGLE AT IMPACT AND IMPACT POINT LOCATION DATA

Measured Parameter		Units	Tolerance	Value
Vertical Impact Ref Line	- Aft of Front Axle, Intended Impact Pt	mm		1332
Actual Impact Point	- Aft of Front Axle	mm		1332
Horizontal Offset (+ forward / - rearward)		mm	+/- 38 *	0
Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion		deg	75 +/- 3	75.0
Trap No. 1 Velocity	- Primary	kph	31.4 to 33.0	32.22
Trap No. 2 Velocity	- Redundant	kph	31.4 to 33.0	32.25

* Of Intended Impact Point

DATA SHEET NO. 9
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020



LEFT SIDE VIEW

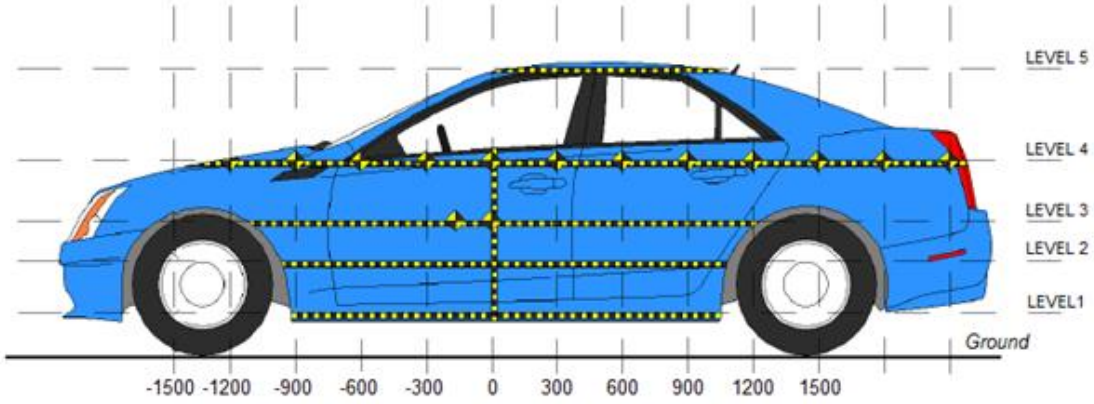
VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Description	Pre-Test	Post-Test	Difference
A	Vehicle Wheelbase	2908	2862	46
B	Front Axle to FSOV	827	849	-22
C	Rear Axle to RSOV	1098	1103	-5
D	Total Length at Centerline	4832	4814	18
E	Front Bumper Thickness	125	125	0
F	Front Bumper Bottom to Ground	390	423	-33
G	Sill Height at Front Wheel Well	156	144	12
H	Sill Height at Front Door Leading Edge	152	137	15
I	Sill Height at B-Pillar	161	151	10
J1	Sill Height at Rear Wheel Well	169	171	-2
J2	Pinch Weld Height at Rear Wheel Well	164	155	9
K	Sill Height Aft of Rear Wheel Well	209	202	7
L	Rear Bumper Thickness	130	130	0
M	Rear Bumper Bottom to Ground	449	451	-2
N	Sill Height to Bottom of Front Window Sill	798	796	2
O	Front Door Leading Edge to Impact CL	628	565	63
P	Rear Door Trailing Edge to Impact CL	1456	1392	64
Q	Front Window Opening	368	356	12
R	Right Side Length	4735	4745	-10
S	Left Side Length	4735	4712	23
T	Vehicle Width at B-Pillars	1816	1693	123

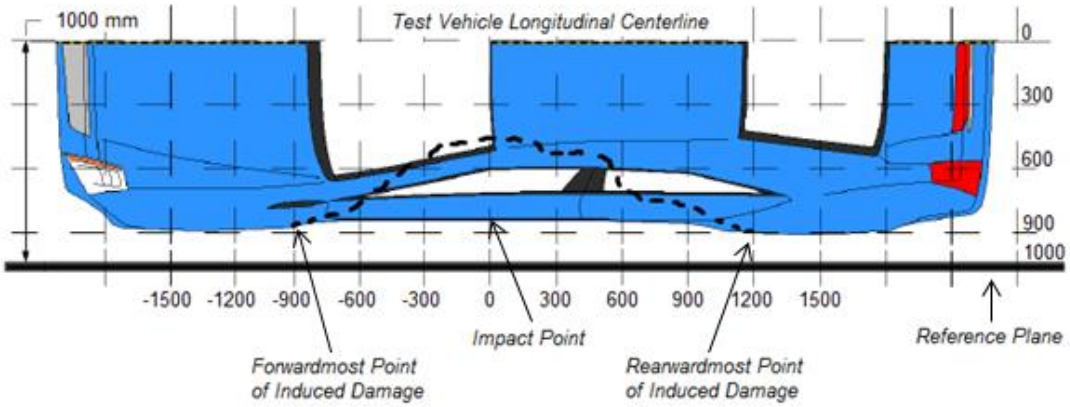
* All measurements in mm with tolerance of ± 3mm

DATA SHEET NO. 10
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020



Left Side View



Overhead View

MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	210	282	0
2	Occupant Hip Point	mm	511	317	0
3	Mid - Door	mm	615	334	0
4	Window Sill	mm	918	276	0
5	Window Top	mm	1336	99	150

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. 10 … (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 KIA Stinger GT-Line four door sedan NHTSA No.: M20204216
Test Program: NCAP Side Pole Impact Test Test Date: 4/20/2020

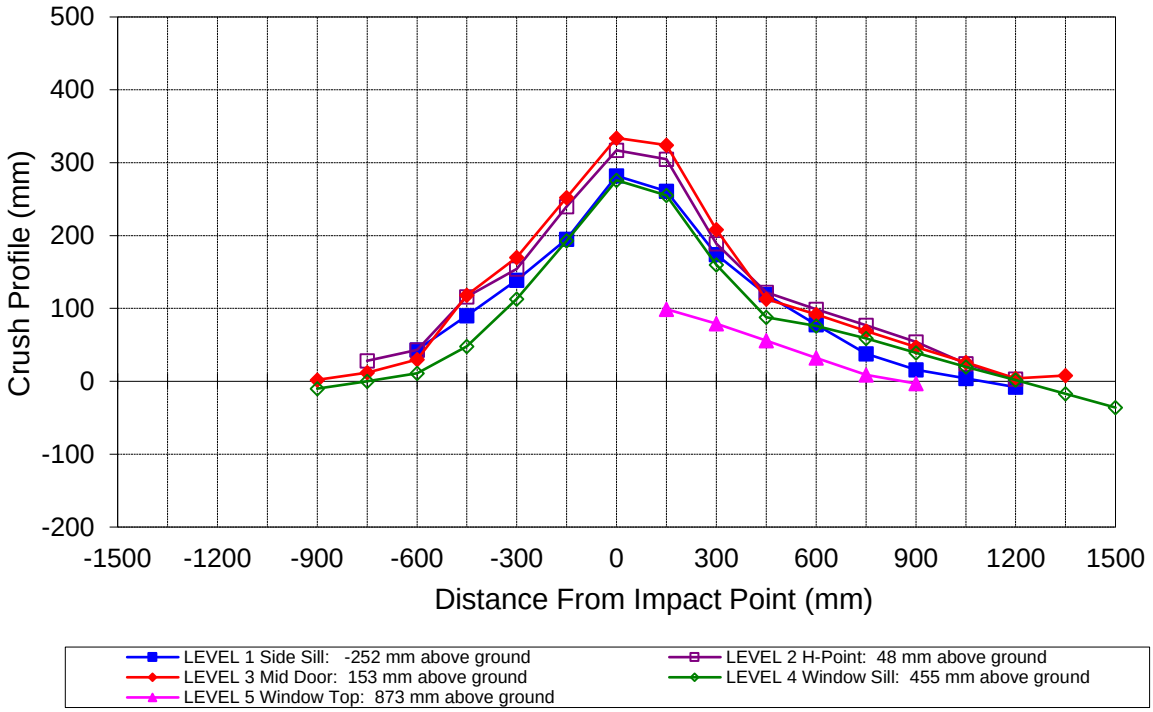
EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1500															
-1350															
-1200															
-1050															
-900			914	771				912	781				2	-10	
-750		914	915	786			886	903	786			28	12	0	
-600	884	904	916	798		841	861	886	787		43	43	30	11	
-450	886	905	917	805		796	789	799	757		90	116	118	48	
-300	887	905	917	814		748	751	747	701		139	154	170	113	
-150	888	904	916	820		693	664	664	627		195	240	252	193	
0	887	902	914	827		605	585	580	551		282	317	334	276	
150	889	903	913	832	591	628	598	589	577	492	261	305	324	255	99
300	890	901	912	837	603	716	712	704	677	524	174	189	208	160	79
450	891	901	909	840	603	772	779	796	752	547	119	122	113	88	56
600	892	899	907	841	599	814	800	815	765	567	78	99	92	76	32
750	893	898	904	842	590	855	821	835	783	581	38	77	69	59	9
900	894	897	902	842	573	878	843	855	803	576	16	54	47	39	-3
1050	896	902	903	843		892	878	877	823		4	24	26	20	
1200	911	929	920	848		919	926	916	846		-8	3	4	2	
1350			937	854				929	871				8	-17	
1500				859					895					-36	

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 the test based on an estimated impact point. The final distance from impact is determined after the final dummy positioning and the pole is aligned with the center of gravity of the dummy's head.*

DATA SHEET NO. 10 … (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020

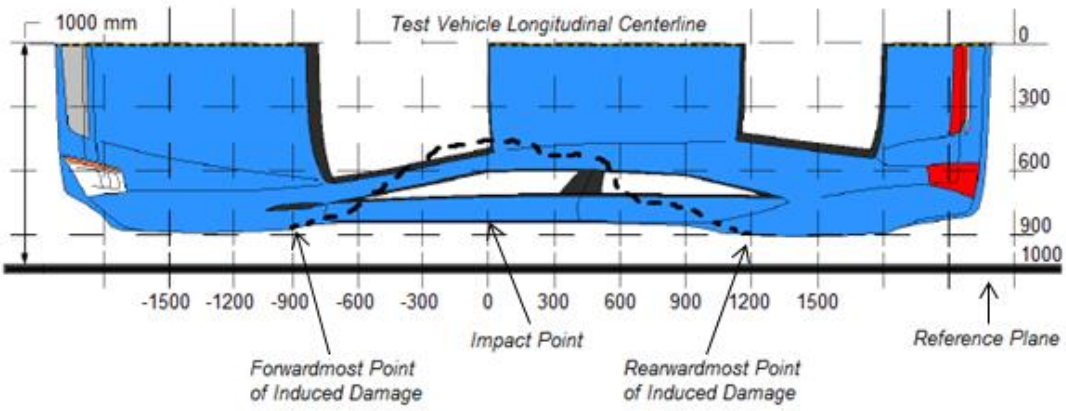


Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO. 11
VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020

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



Overhead View

VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance From Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	-900	3	88	86	2
2	-450	3	201	83	118
3	0	3	420	86	334
4	450	3	204	91	113
5	900	3	145	98	47
6	1350	3	71	63	8

DATA SHEET NO. 12
FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side MDB Impact Test	Test Date:	4/20/2020
Test Time:	9:04 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°	67	300	367
90° to 180°	64	300	364
180° to 270°	61	300	361
270° to 360°	71	300	371

FMVSS NO. 301 ROLLOVER SPILLAGE TABLE

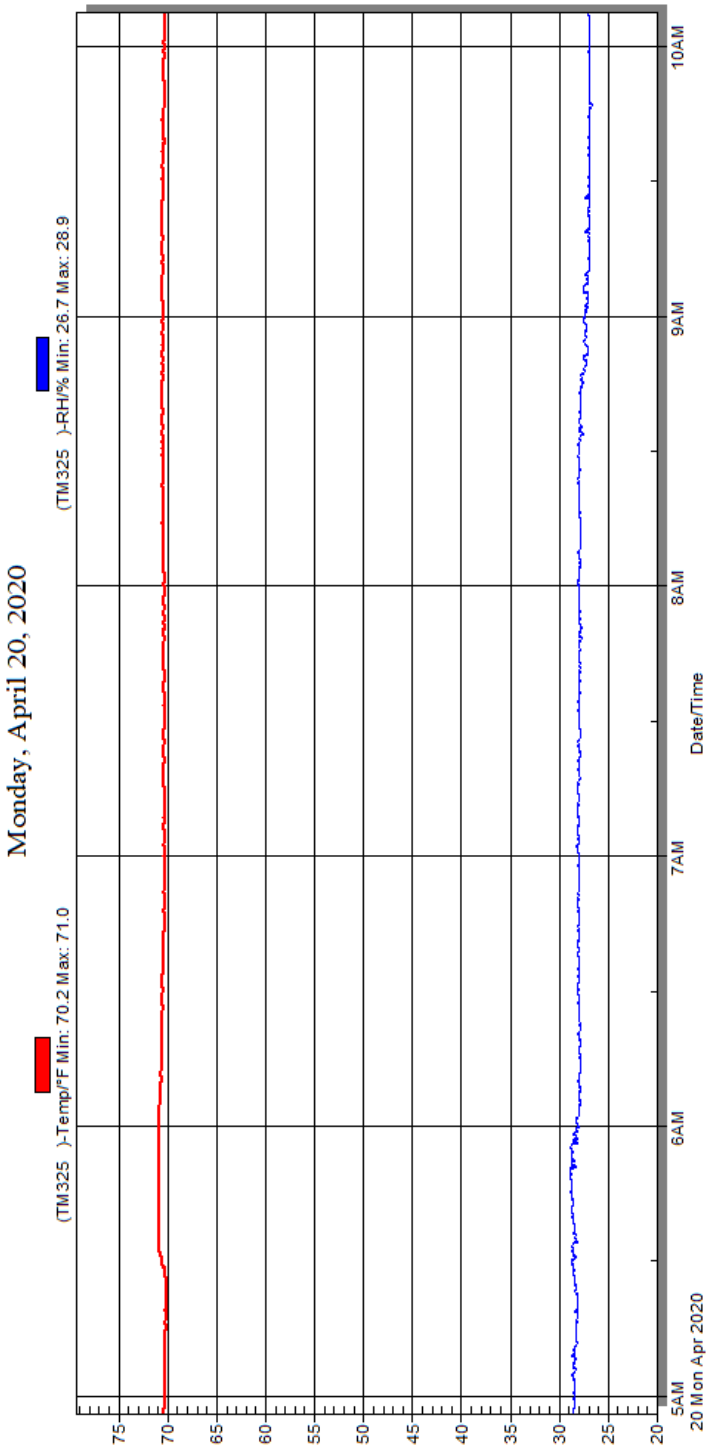
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 13
DUMMY / VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle:	2020 KIA Stinger GT-Line four door sedan	NHTSA No.:	M20204216
Test Program:	NCAP Side Pole Impact Test	Test Date:	4/20/2020



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

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Figure A-1: As Delivered Right Front ¾ View of Test Vehicle

Figure A-2: As Delivered Left Rear ¾ 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

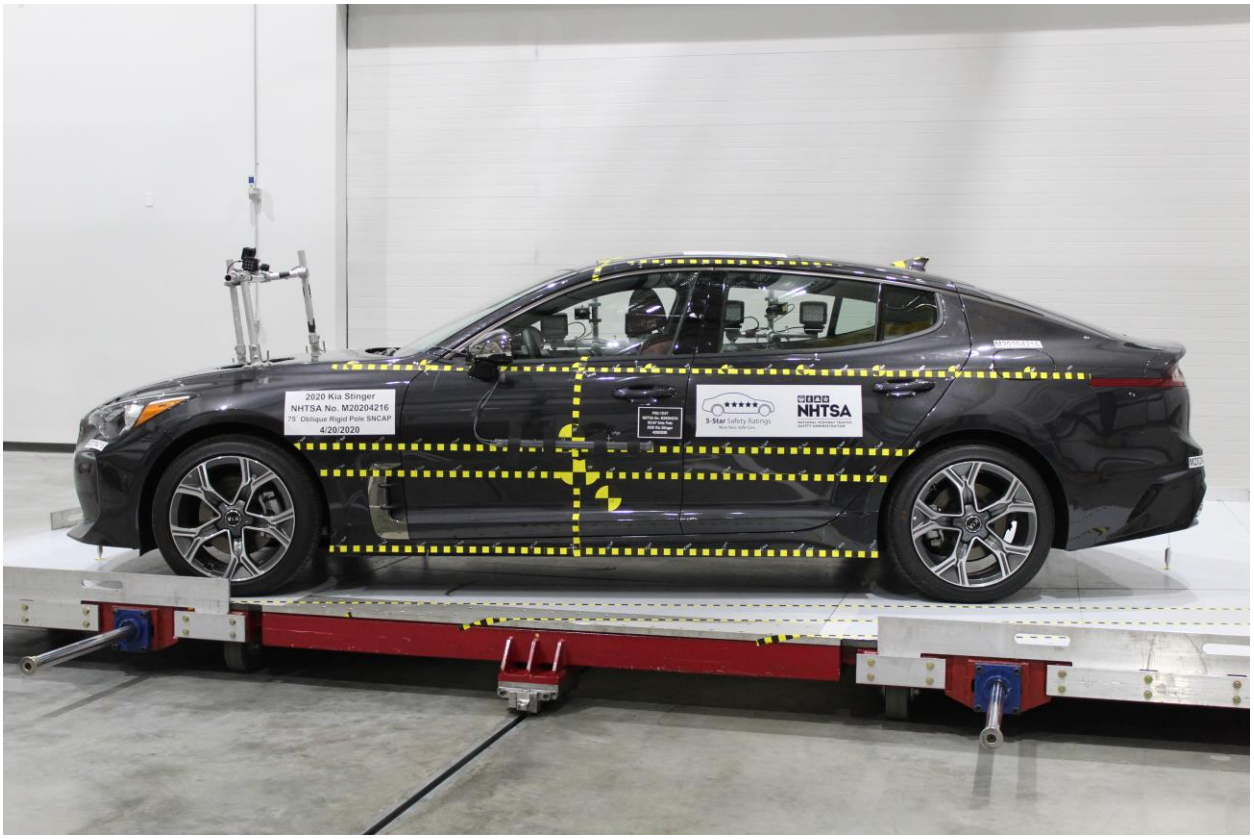


Figure A-7: Pre-Test Left Side View of Test Vehicle

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 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

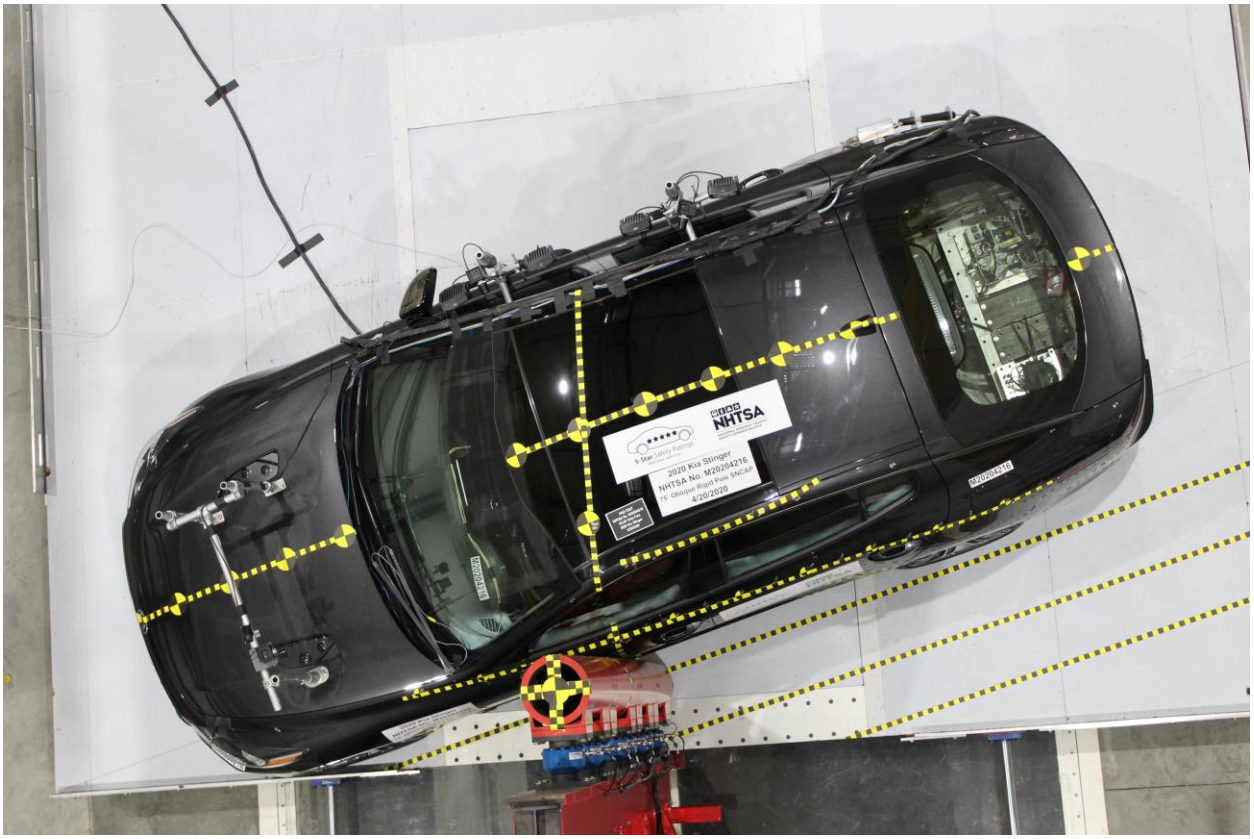


Figure A-15: Pre-Test Overhead View of Test Area

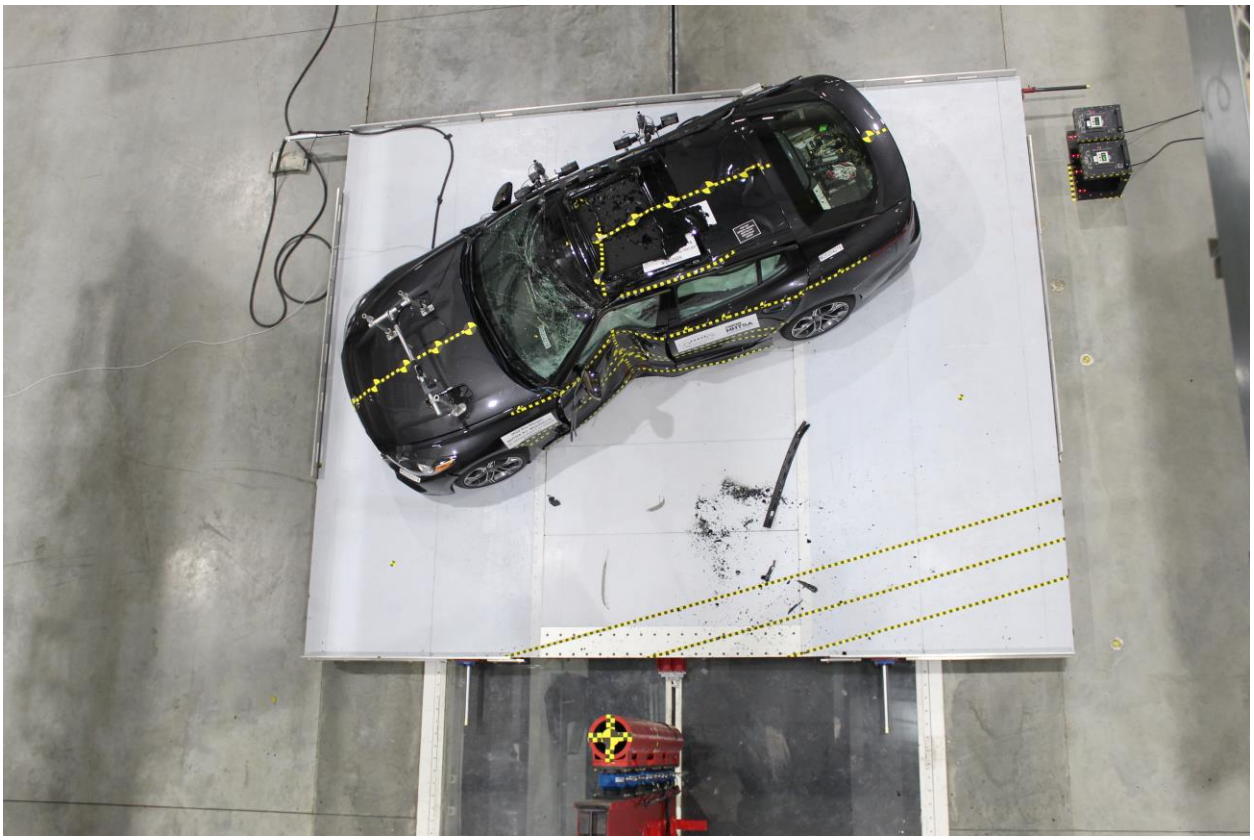


Figure A-16: Post-Test Overhead View of Test Area

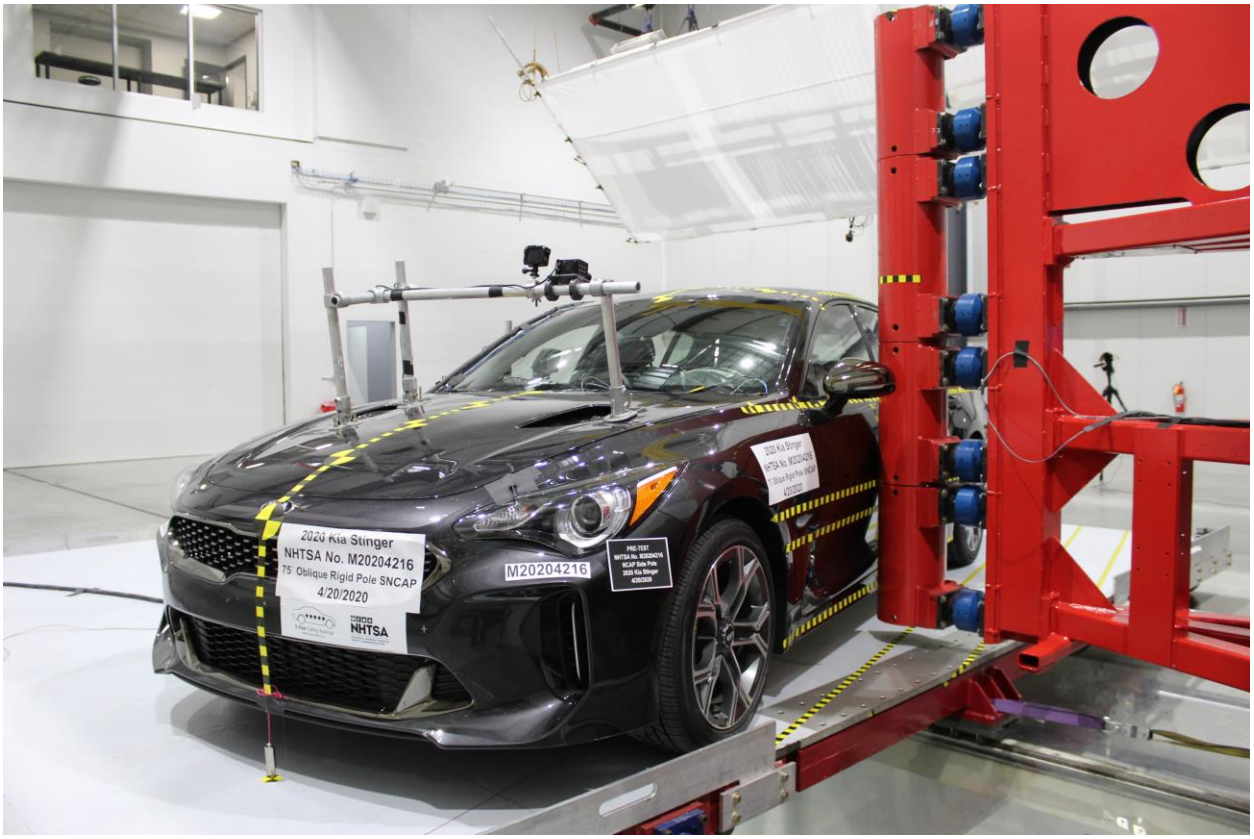


Figure A-17: Pre-Test Left Side View of Pole Positioned Against Side of Vehicle

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

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

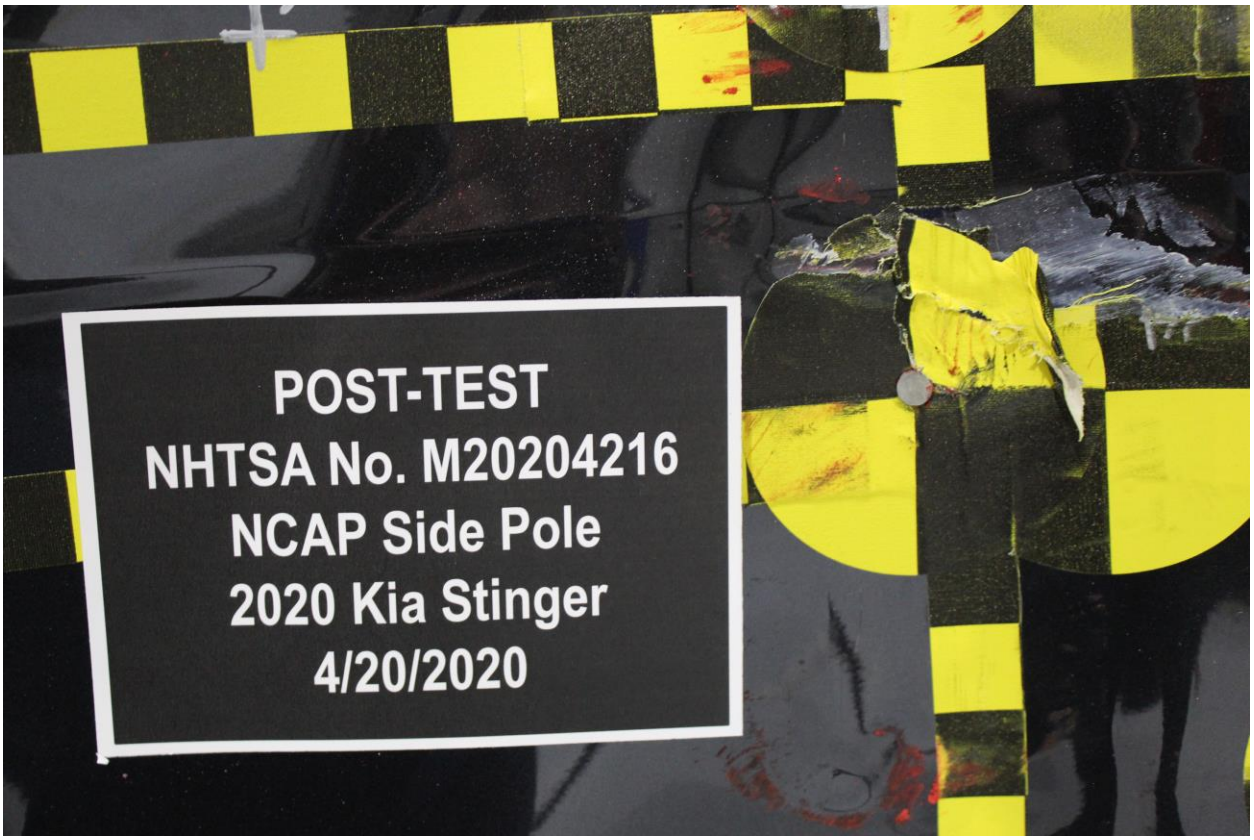


Figure A-20: Post-Test Close-Up View of Impact Point Target Showing Impact Location

Figure A-21: Pre-Test Front Close-Up View of Dummy Head and Chest

Figure A-22: Post-Test Front Close-Up View of Dummy

Figure A-23: Pre-Test Left Side View of Dummy Showing Belt and Chalking

Figure A-24: Pre-Test Left Side View of Dummy Shoulder and Door Top View

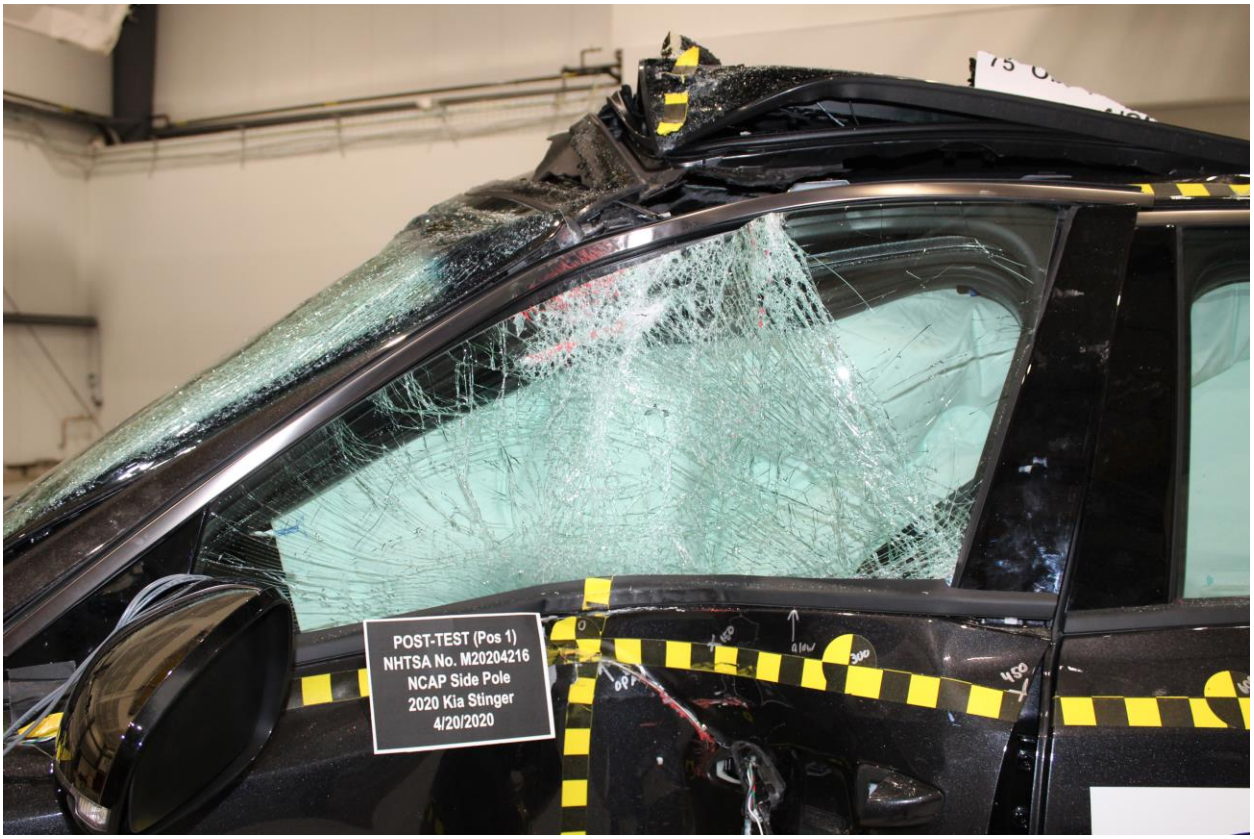


Figure A-25: Post-Test Left Side View of Dummy Shoulder and Door Top View

Figure A-26: Pre-Test Frontal View of Seat Back Prior to Dummy Positioning

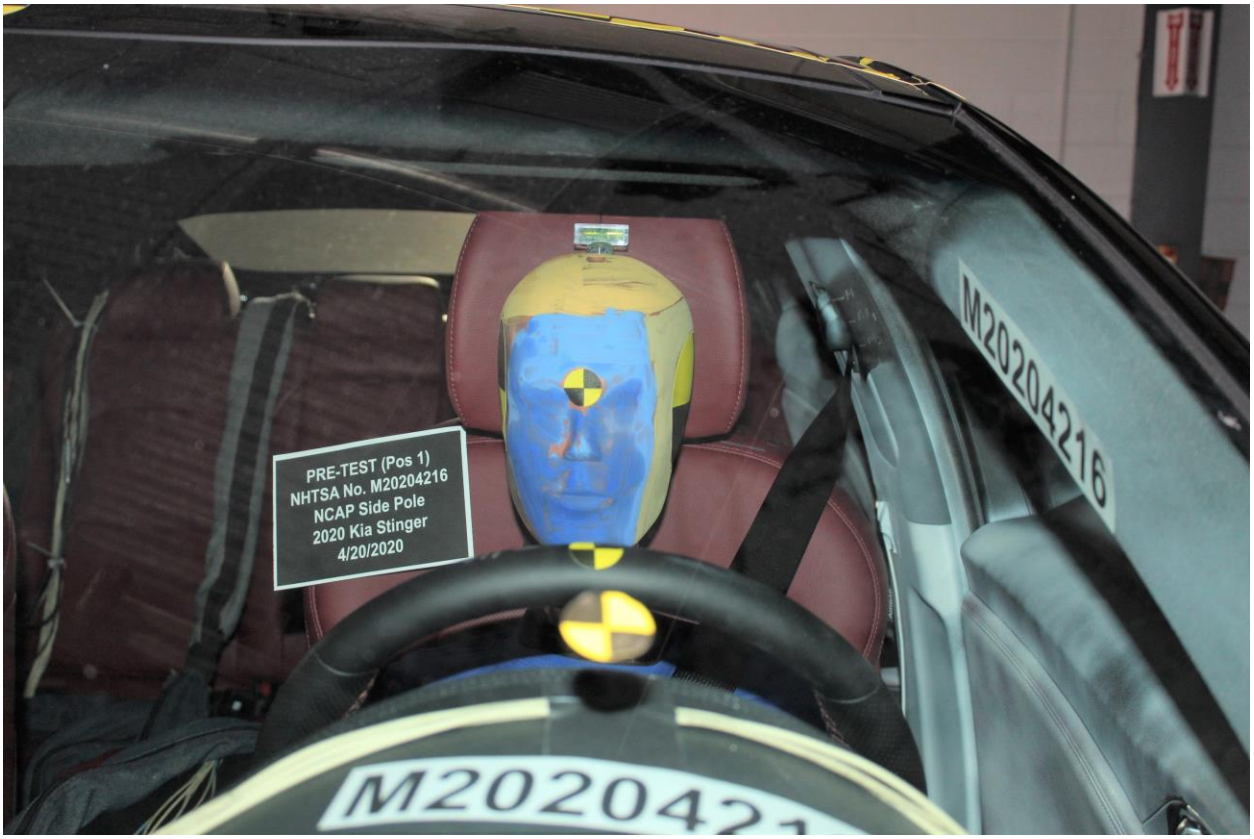


Figure A-27: Pre-Test Frontal Close-Up View of Dummy Head / Shoulders in Relation to Head Restraint

Figure A-28: Pre-Test Frontal View of Seat Pan Prior to Dummy Positioning

Figure A-29: Pre-Test Overhead View of Dummy Thighs on Seat Pan

Figure A-30: Pre-Test Left Side View of Dummy's Neck Showing Position of Adjustable Neck Bracket

Figure A-31: Pre-Test Left Side View of Dummy's Head Showing Dummy's Head is Level

Figure A-32: Pre-Test Placement of Dummy's Feet

Figure A-33: Pre-Test View of Belt Anchorage for Dummy

Figure A-34: Pre-Test Left Side View of Steering Wheel

Figure A-35: Pre-Test View of Disengaged Parking Brake

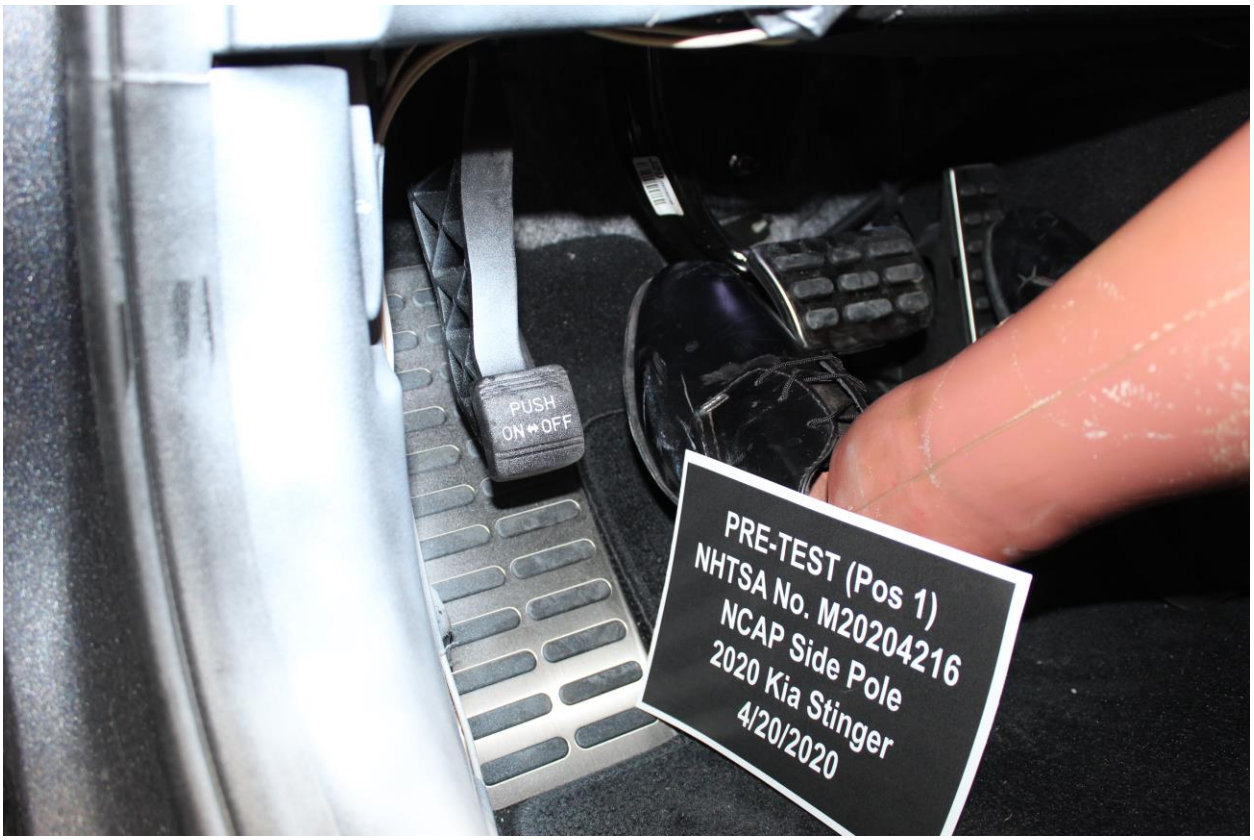


Figure A-36: Pre-Test View of Parking Brake

Figure A-37: Pre-Test Close-Up Left Side View of Driver Seat Track

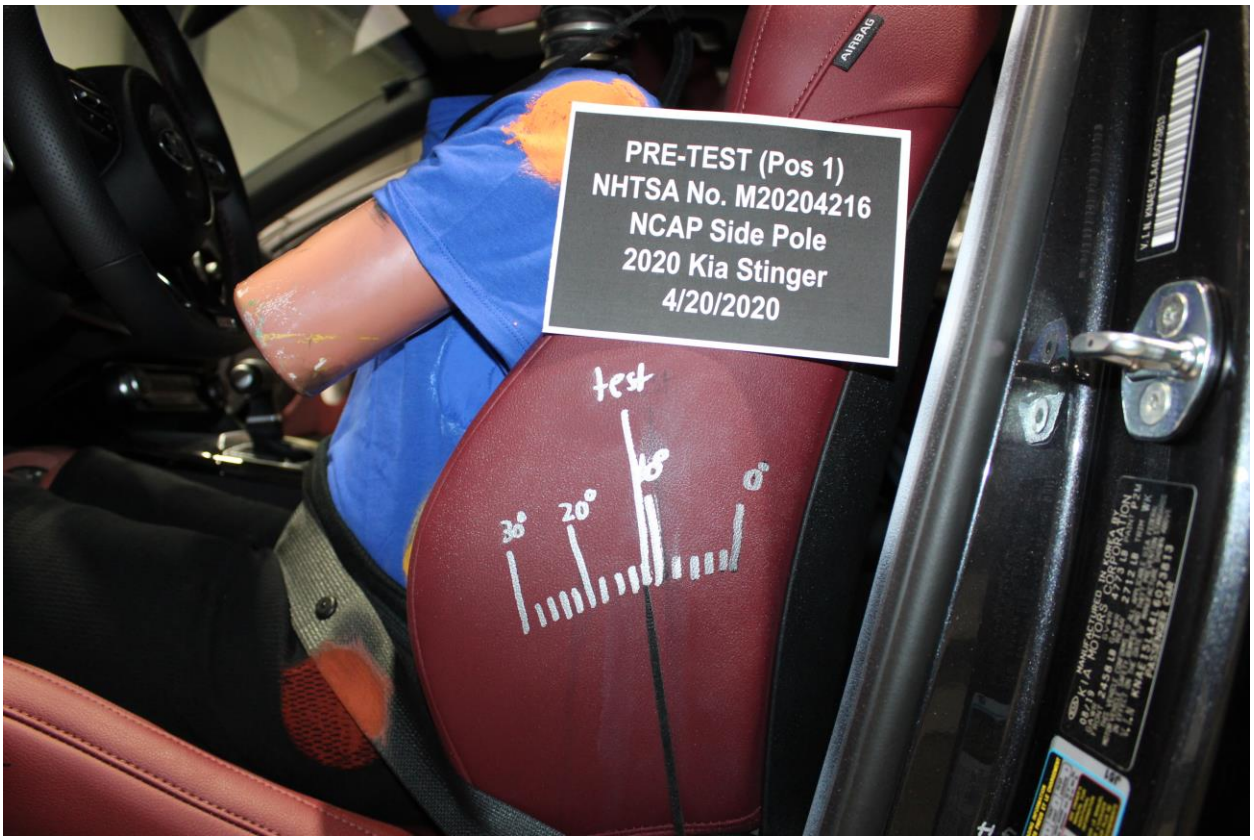


Figure A-38: Pre-Test Close-Up Left Side View of Driver Seat Back

Figure A-39: Pre-Test Close-Up View of Driver Seat Back or Head Restraint

Figure A-40: Pre-Test Dummy and Door Clearance View

Figure A-41: Post-Test Dummy and Door Clearance View

Figure A-42: Pre-Test Right Side View of Dummy and Front Seat of Occupant Compartment

Figure A-43: Post-Test Right Side View of Dummy and Front Seat of Occupant Compartment

Figure A-44: Pre-Test Inner Door Panel View

Figure A-45: Post-Test Inner Door Panel View Showing Dummy Contact Location

Figure A-46: Post-Test Dummy Close-Up Head Contact with Vehicle Interior View

Figure A-47: Post-Test Dummy Close-Up Head Contact with Side Airbag View

Figure A-48: Post-Test Dummy Close-Up Torso Contact with Vehicle Interior View

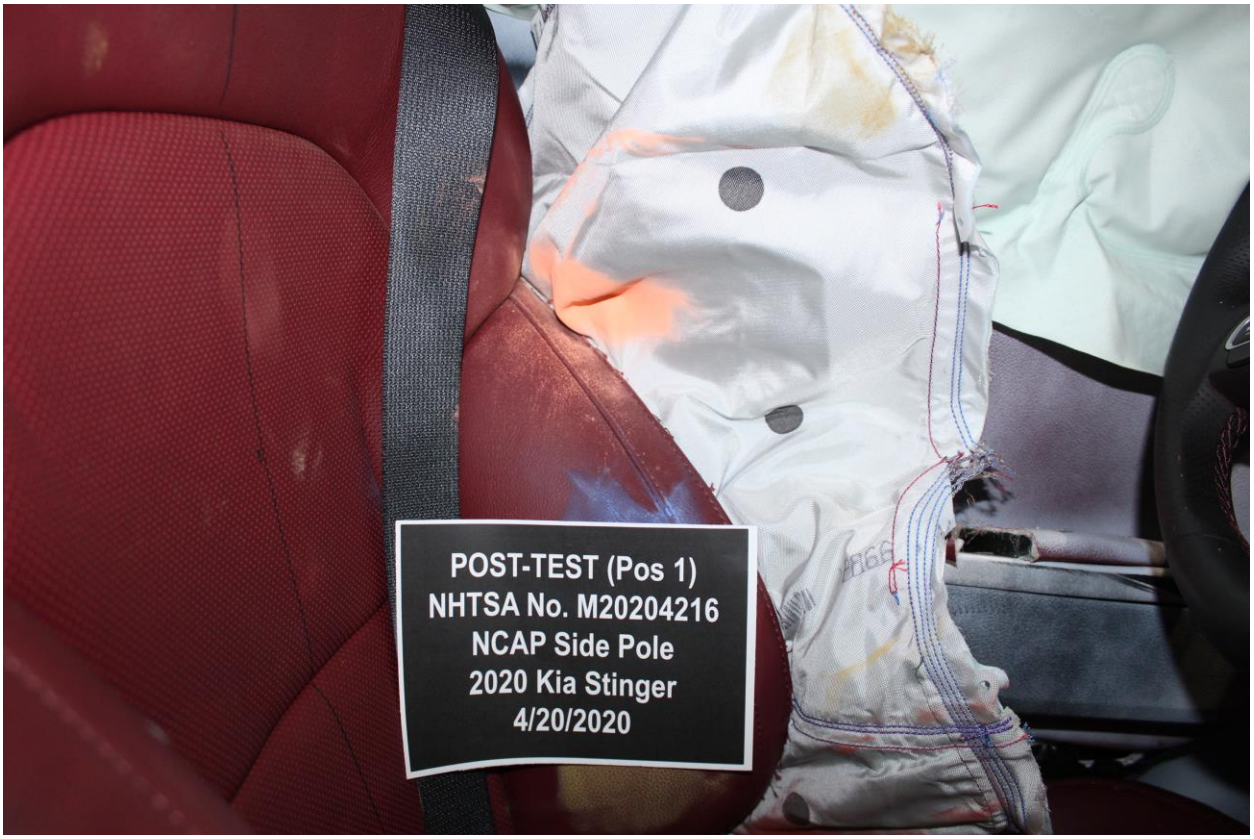


Figure A-49: Post-Test Dummy Close-Up Torso Contact with Side Airbag View

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

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

Photo Not Applicable

Figure A-52: Post-Test Dummy Close-Up Knee Contact with Vehicle Interior View

Figure A-53: Pre-Test View of Fuel Filler Cap or Fuel Filler Neck

Figure A-54: Post-Test View of Fuel Filler Cap or Fuel Filler Neck

Figure A-55: Close-Up View of Vehicle's Certification Label

Photo Not Applicable

Figure A-55a: Close-Up View of Reduced Load Capacity Label

Figure A-56: Close-Up View of Vehicle's Tire Information Placard or Label

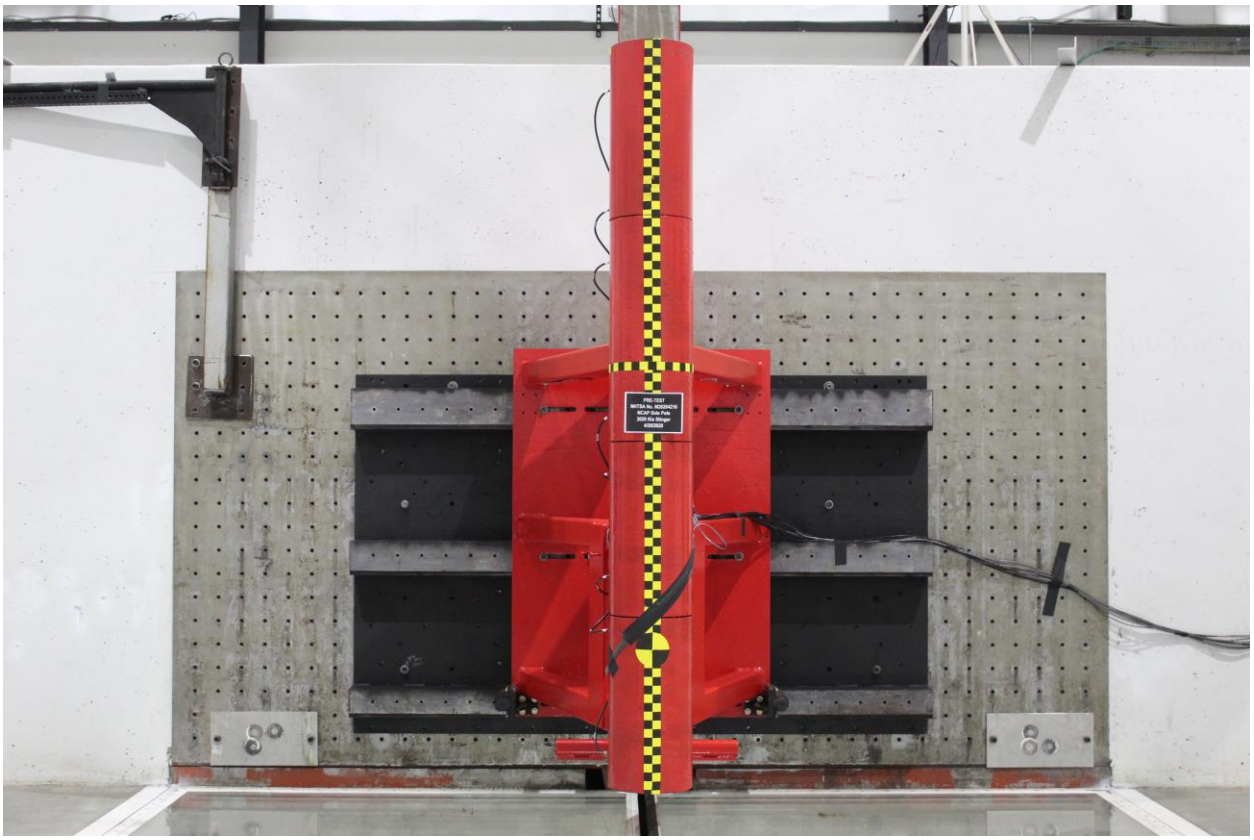


Figure A-57: Pre-Test Pole Barrier Front View

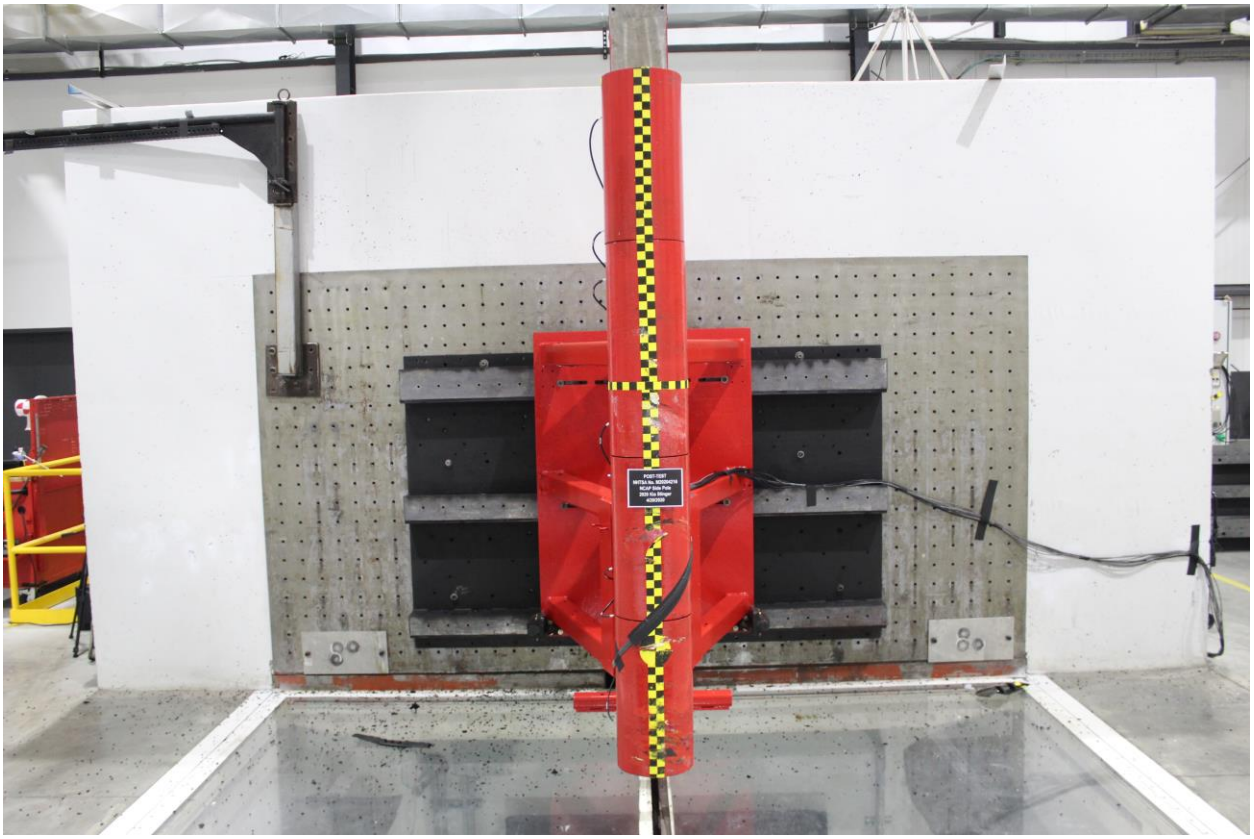


Figure A-58: Post-Test Pole Barrier Front View

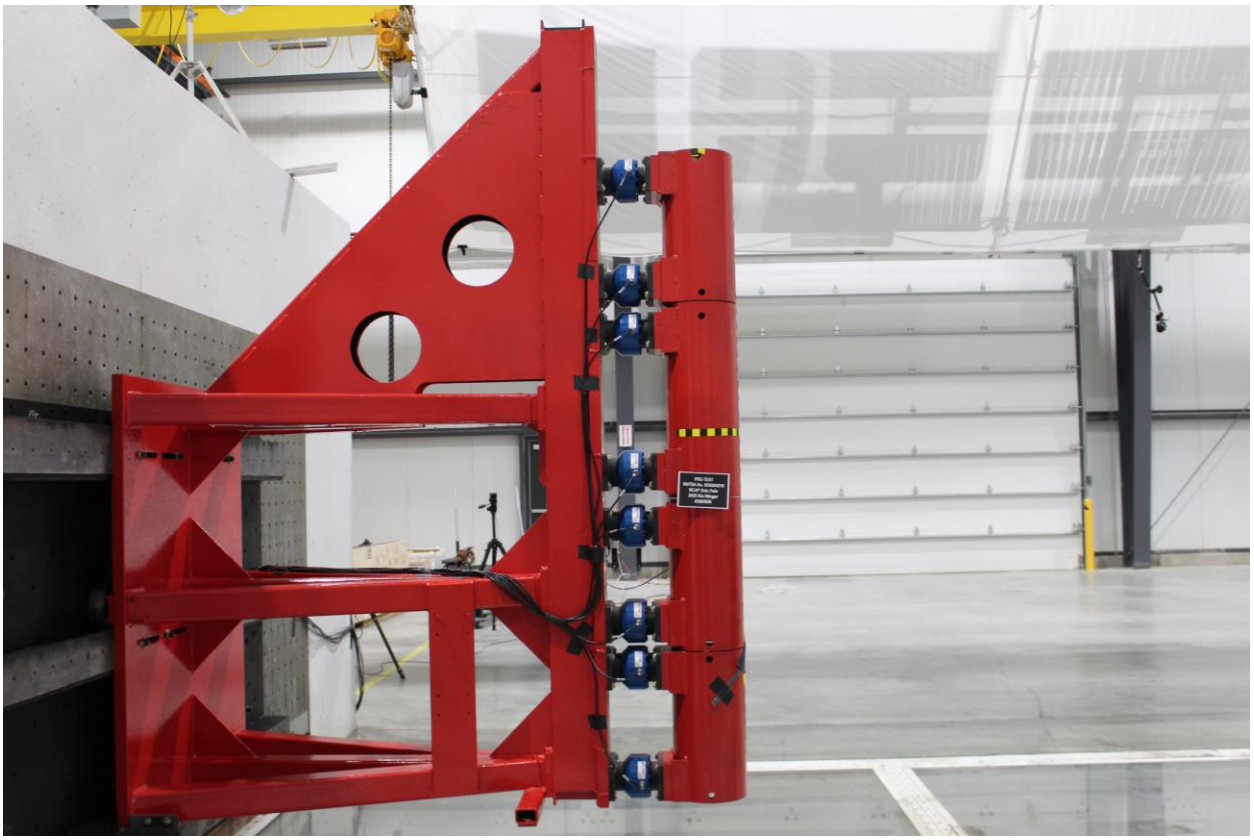


Figure A-59: Pre-Test Pole Barrier Side View

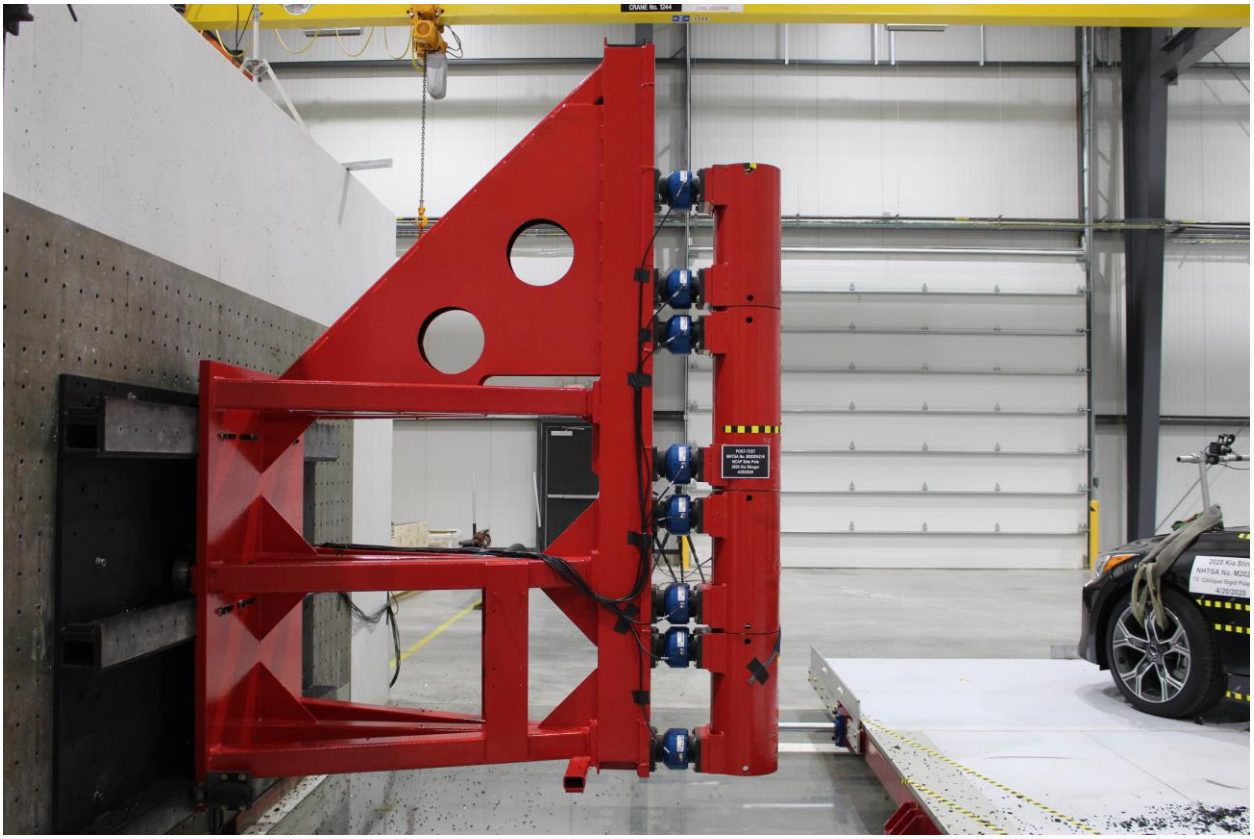


Figure A-60: Post-Test Pole Barrier Side View

Figure A-61: Pre-Test Ballast View

Figure A-62: Post-Test Primary and Redundant Speed Trap Read-Out

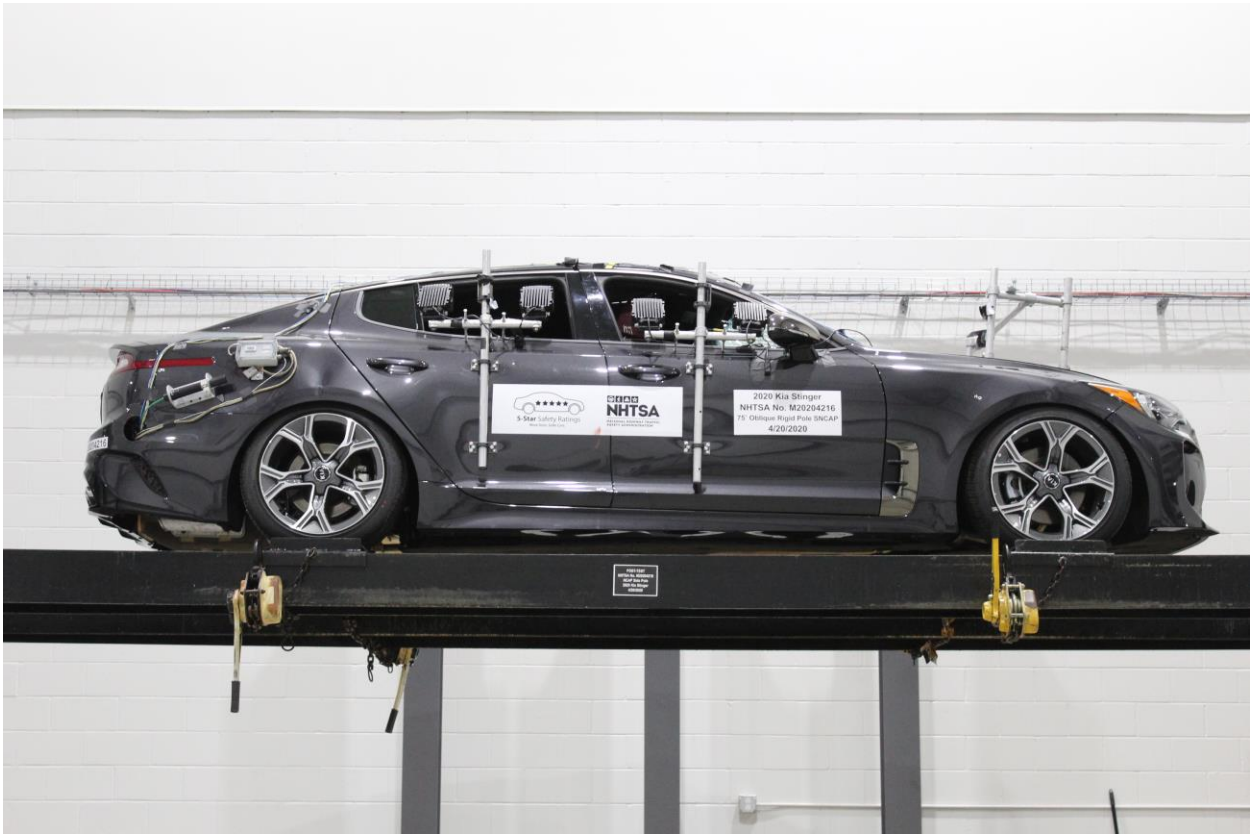


Figure A-63: FMVSS No. 301 Static Rollover 0 Degrees

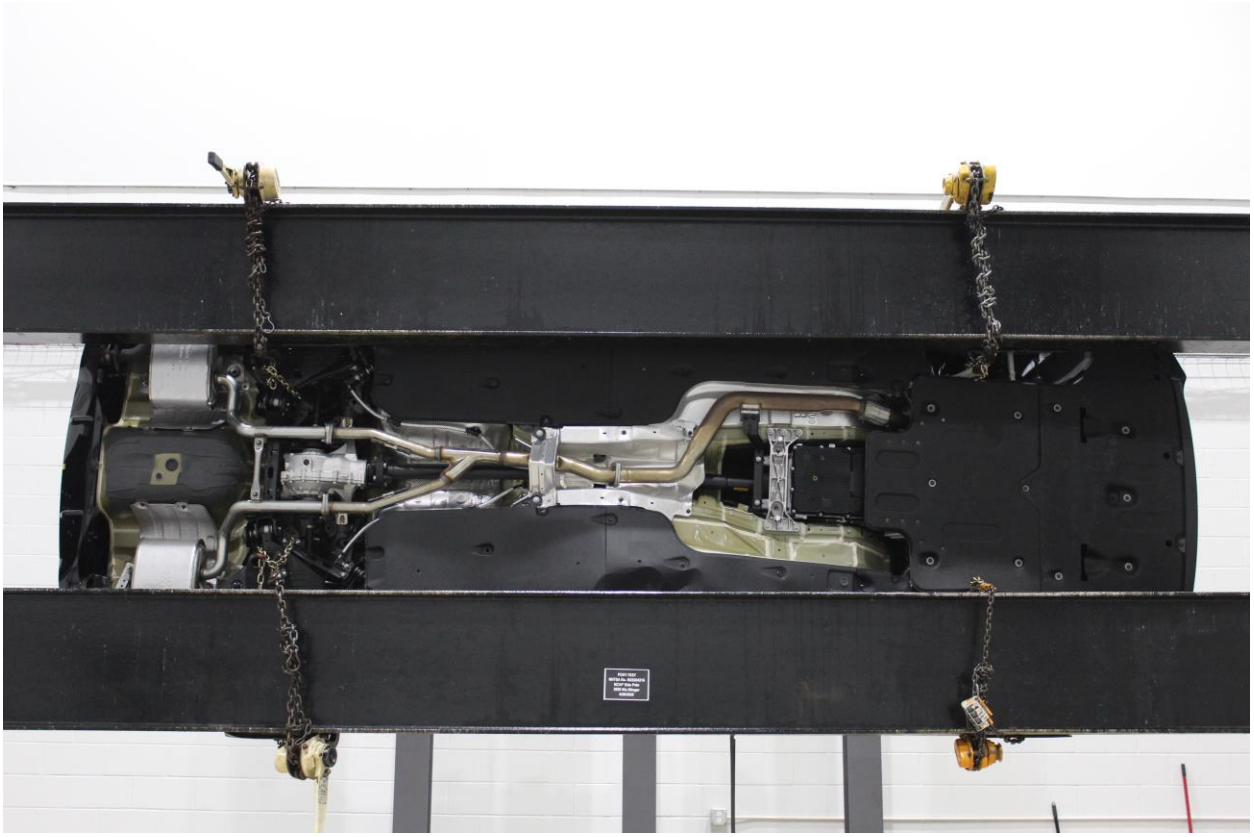


Figure A-64: FMVSS No. 301 Static Rollover 90 Degrees

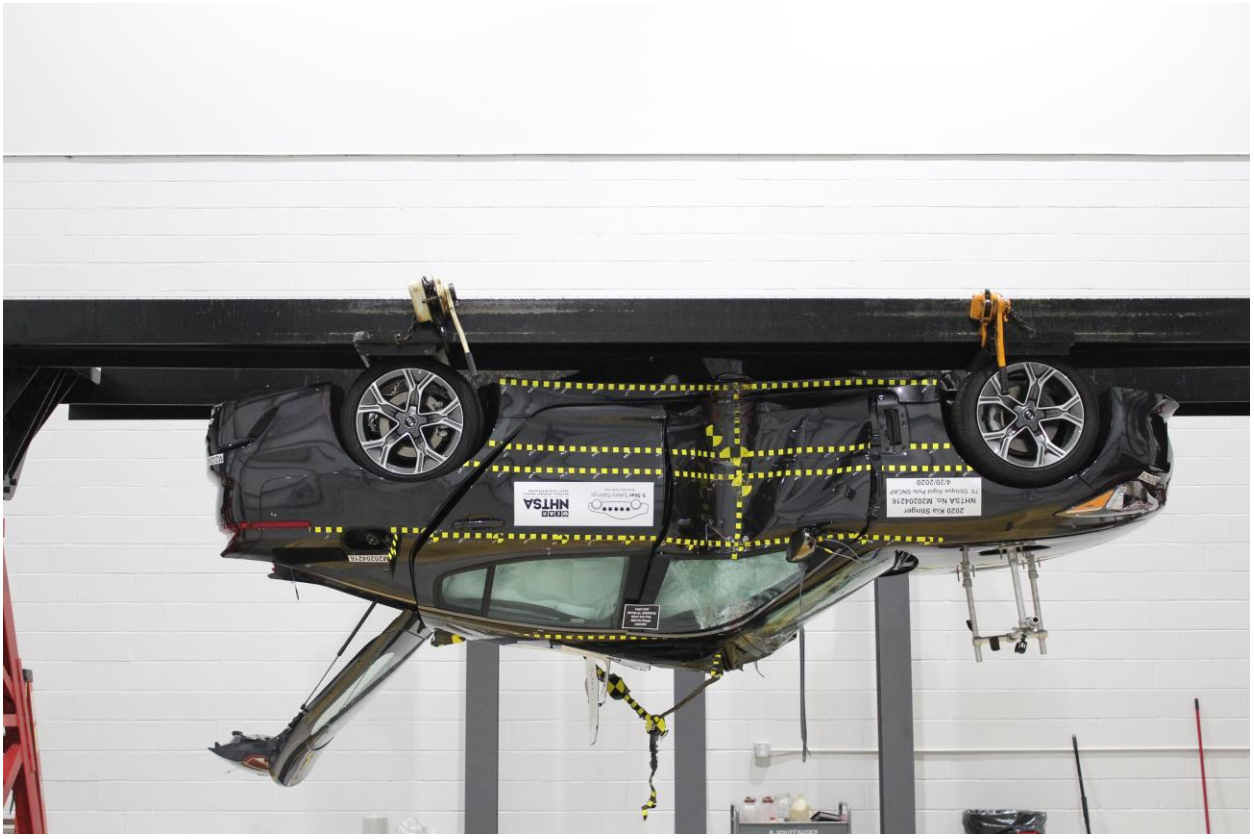


Figure A-65: FMVSS No. 301 Static Rollover 180 Degrees

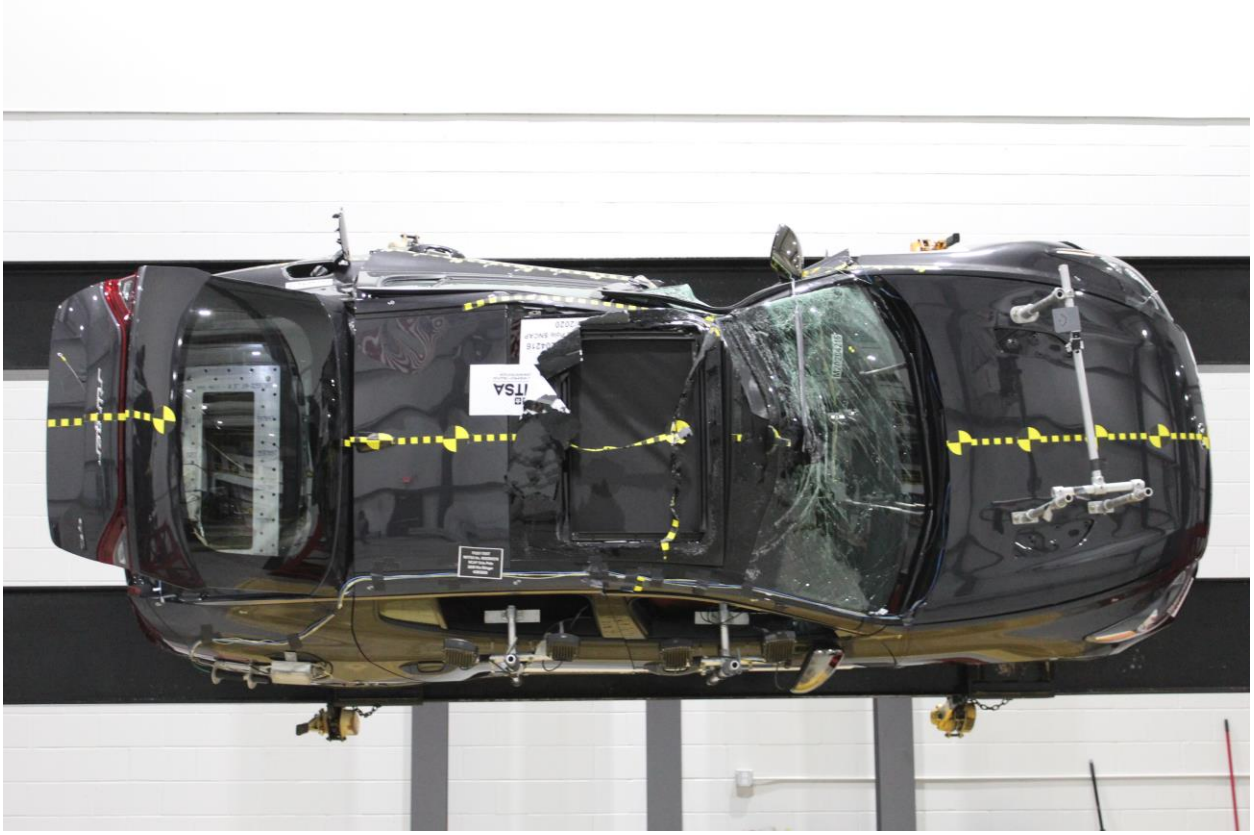


Figure A-66: FMVSS No. 301 Static Rollover 270 Degrees

Figure A-67: FMVSS No. 301 Static Rollover 360 Degrees

Figure A-68: Impact Event

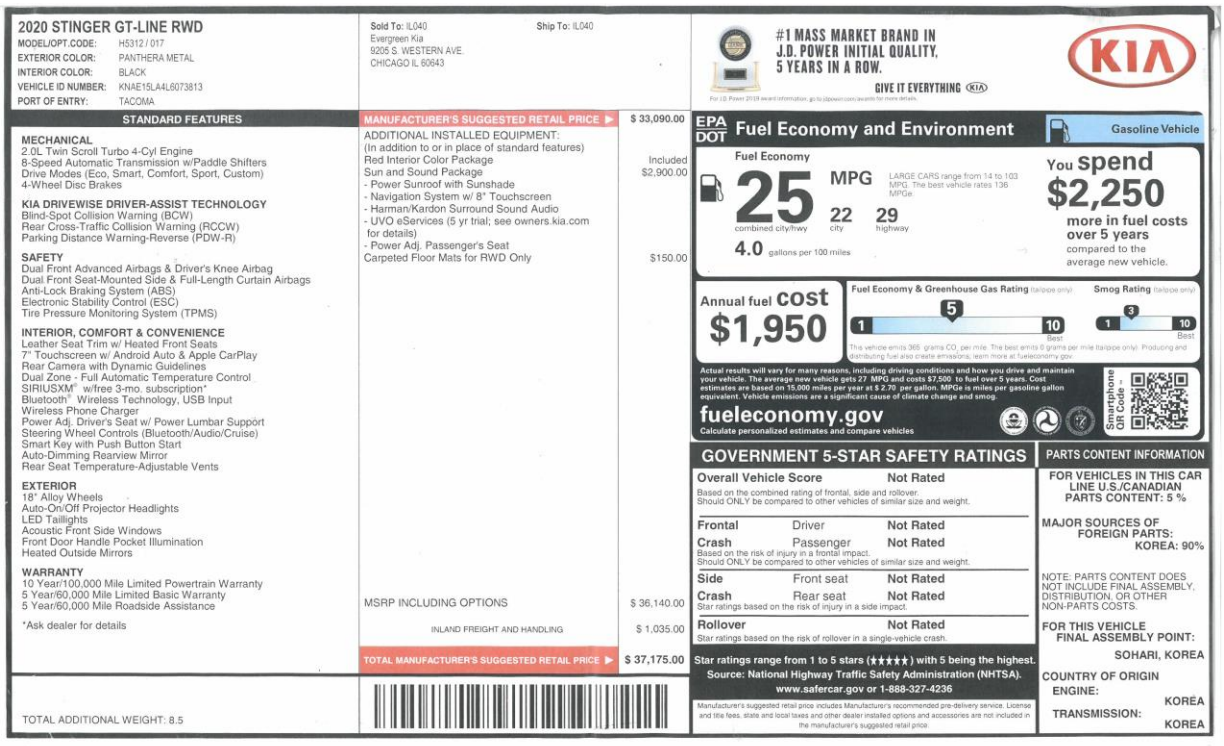


Figure A-69: Monroney Label

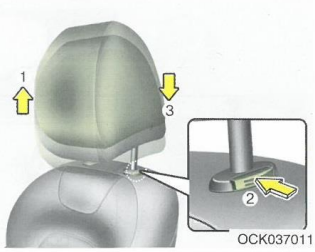
⚠ WARNING - Headrest removal/adjustment

- **Do not operate the vehicle with the headrests removed. Headrests can provide critical neck and head support in a crash.**
- **Do not adjust the headrest height while the vehicle is in motion. Driver may lose control of the vehicle.**

⚠ CAUTION

Excessive pulling or pushing may damage the headrest.

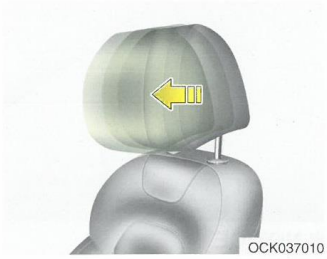
Adjusting the height up and down



OCK037011

To raise the headrest, pull it up to the desired position (1). To lower the headrest, push and hold the release button (2) on the headrest support and lower the headrest to the desired position (3).

Forward and backward adjustment



OCK037010

The headrest may be adjusted forward to 4 different positions by pulling the headrest forward to the desired detent.

To adjust the headrest to it's furthest backwards position,

Pull the headrest fully forward to the farthest position and release it.

Adjust the headrest so that it properly supports the head and neck.

Figure A-70: Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

Figure A-71: Post-Test View of Shattered Vehicle Inner Door Panel (if applicable)

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS

Driver 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 Dummy Instrumentation Data

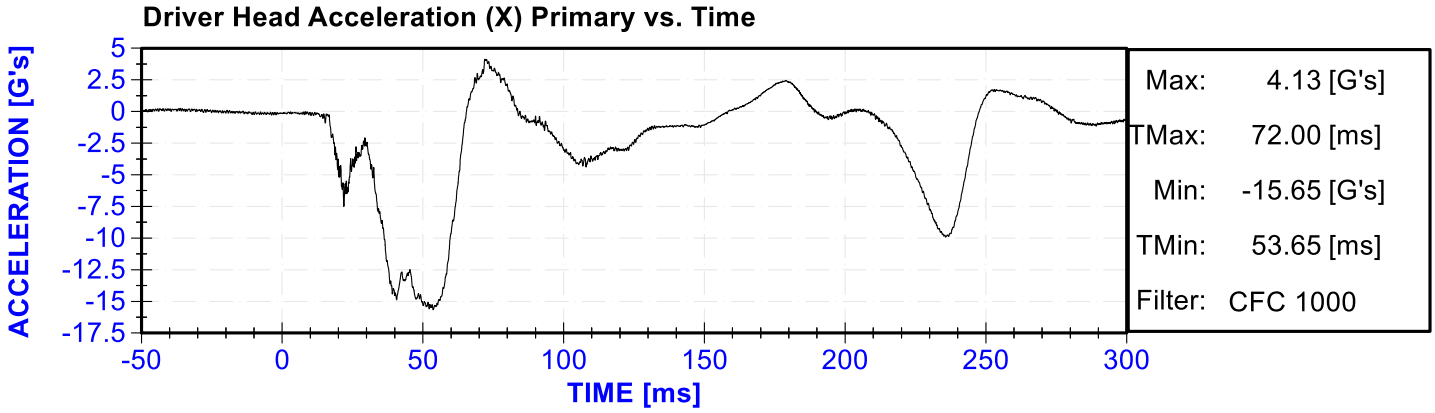
Driver Head Acceleration Redundant (X)
Driver Head Acceleration Redundant (Y)
Driver Head Acceleration Redundant (Z)
Driver Upper Thorax Rib Deflection (Y)
Driver Middle Thorax Rib Deflection (Y)
Driver Lower Thorax Rib Deflection (Y)
Driver Upper Abdomen Rib Deflection (Y)
Driver Lower Abdomen Rib Deflection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

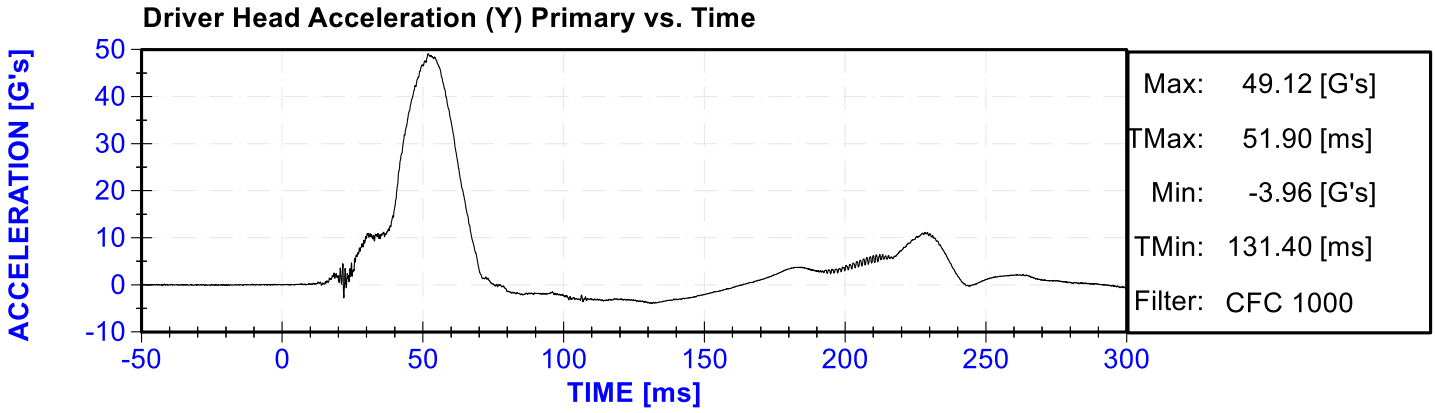
Vehicle Instrumentation Data

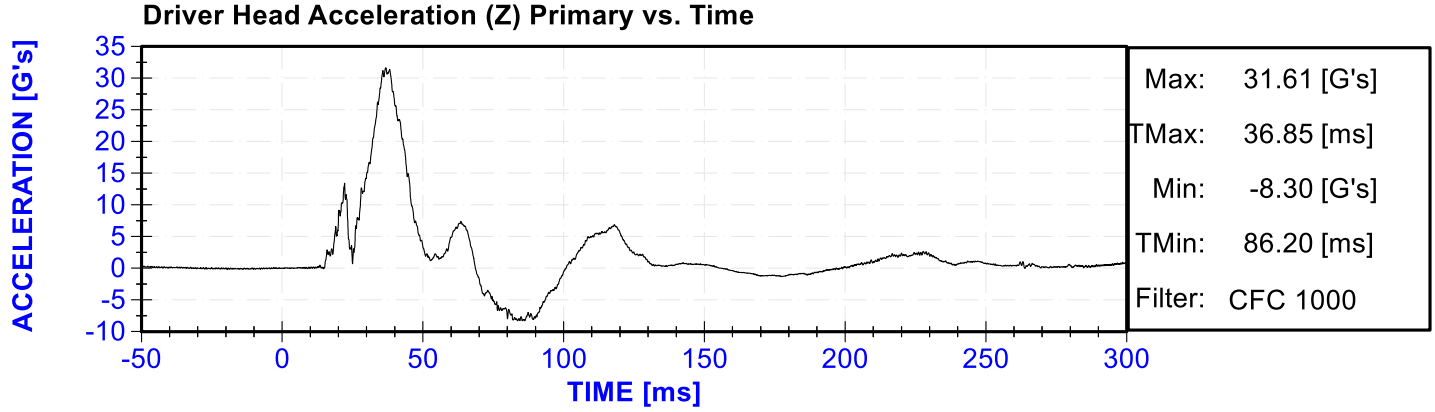
Vehicle Center of Gravity Acceleration (X)
Vehicle Center of Gravity Acceleration (Y)
Vehicle Center of Gravity Acceleration (Z)
Left Floor Sill Acceleration (Y)
Left A-Pillar Sill Acceleration (Y)
Left Lower A-Pillar Acceleration (Y)
Left Mid A-Pillar Acceleration (Y)
Left B-Pillar Sill Acceleration (Y)
Left Lower B-Pillar Acceleration (Y)
Left Mid B-Pillar Acceleration (Y)
Driver Seat Track at Dummy Hip Point Acceleration (Y)
Engine Top Acceleration (X)
Engine Top Acceleration (Y)
Firewall Center Acceleration (Y)
Right Roof at Vertical Impact Reference Line Acceleration (Y)
Right Sill at Vertical Impact Reference Line Acceleration (Y)
Rear Floorpan Behind Rear Axle at Centerline Acceleration (X)
Rear Floorpan Behind Rear Axle at Centerline Acceleration (Y)

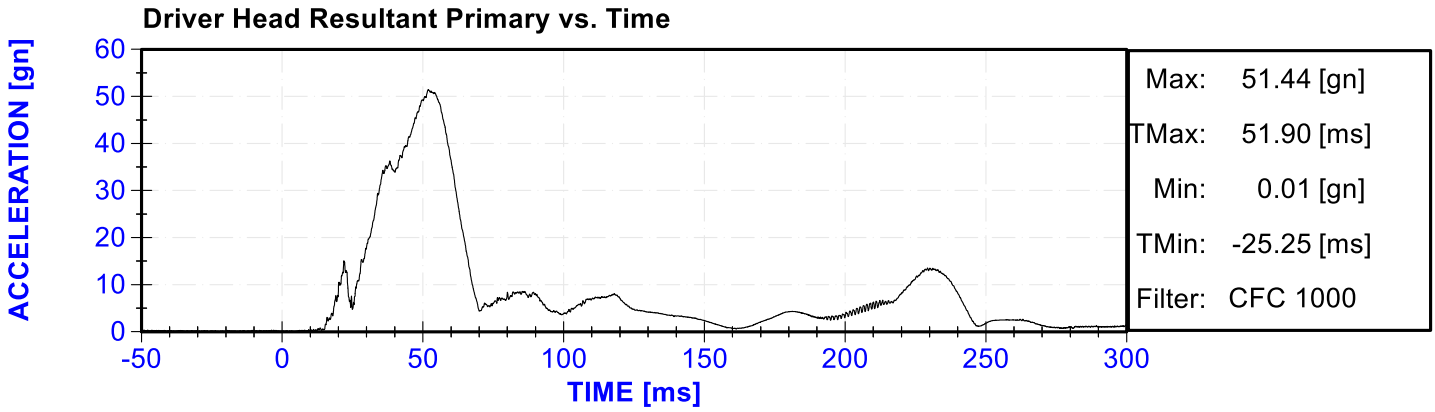
Pole Instrumentation Data

Load Cell Pole Barrier #1 Force (Y)
Load Cell Pole Barrier #2 Force (Y)
Load Cell Pole Barrier #3 Force (Y)
Load Cell Pole Barrier #4 Force (Y)
Load Cell Pole Barrier #5 Force (Y)
Load Cell Pole Barrier #6 Force (Y)
Load Cell Pole Barrier #7 Force (Y)
Load Cell Pole Barrier #8 Force (Y)

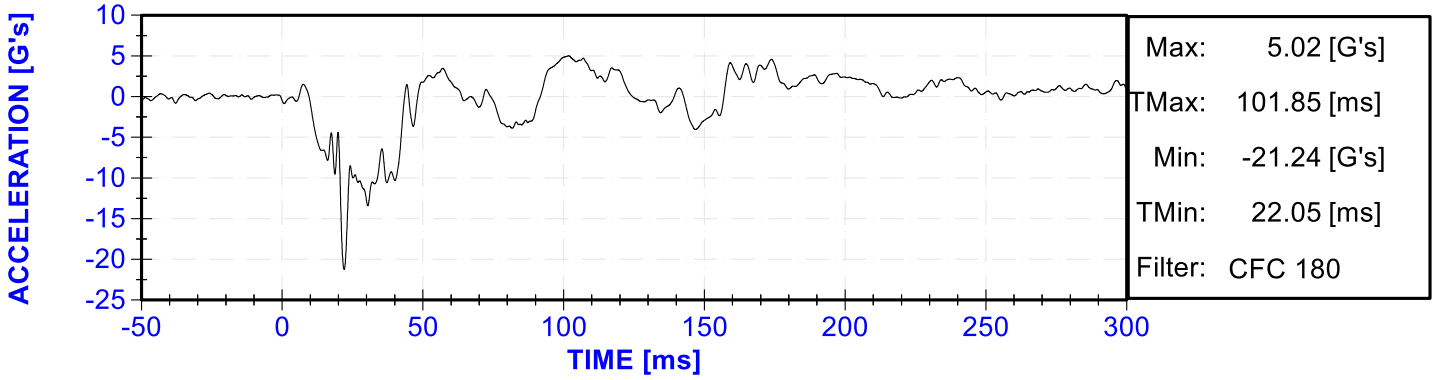

Driver Head Acceleration (X) Primary vs. Time
ACCELERATION [G's]
TIME [ms]
Max: 4.13 [G's]
TMax: 72.00 [ms]
Min: -15.65 [G's]
TMin: 53.65 [ms]
Filter: CFC 1000


Driver Head Acceleration (Y) Primary vs. Time
ACCELERATION [G's]
TIME [ms]
Max: 49.12 [G's]
TMax: 51.90 [ms]
Min: -3.96 [G's]
TMin: 131.40 [ms]
Filter: CFC 1000

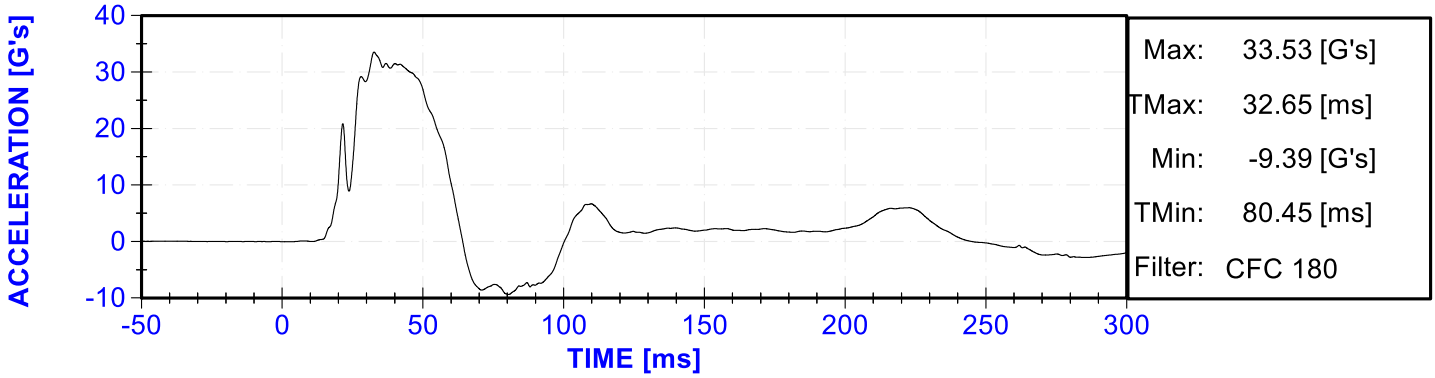

Driver Head Acceleration (Z) Primary vs. Time
ACCELERATION [G's]
TIME [ms]
Max: 31.61 [G's]
TMax: 36.85 [ms]
Min: -8.30 [G's]
TMin: 86.20 [ms]
Filter: CFC 1000


Driver Head Resultant Primary vs. Time
ACCELERATION [gn]
TIME [ms]
Max: 51.44 [gn]
TMax: 51.90 [ms]
Min: 0.01 [gn]
TMin: -25.25 [ms]
Filter: CFC 1000

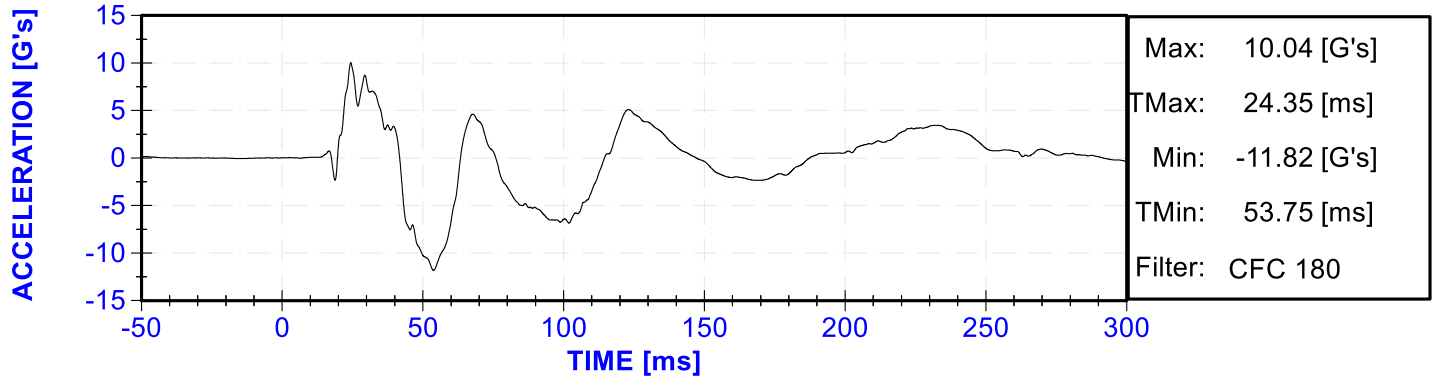
Driver Lower Spine T12 Acceleration (X) vs. Time



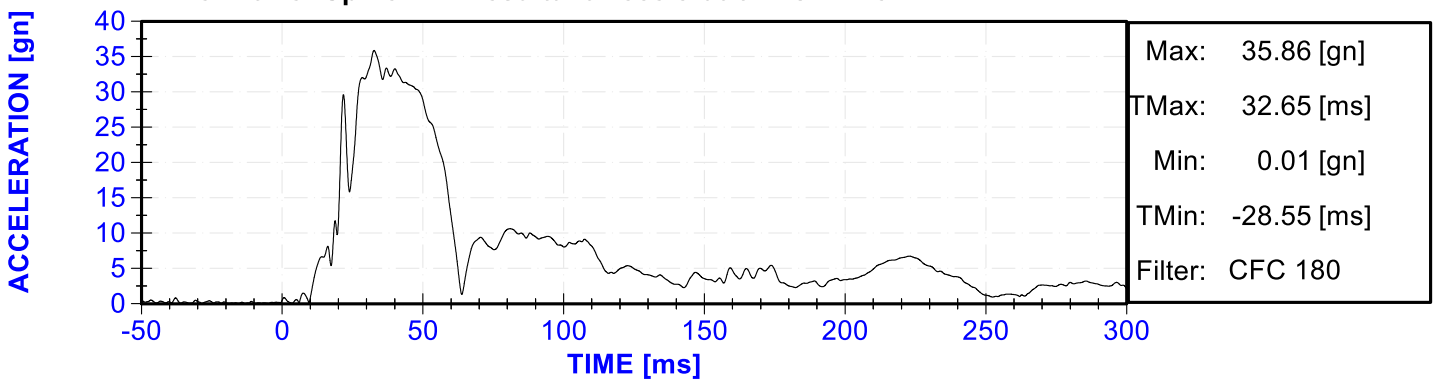
Driver Lower Spine T12 Acceleration (Y) vs. Time



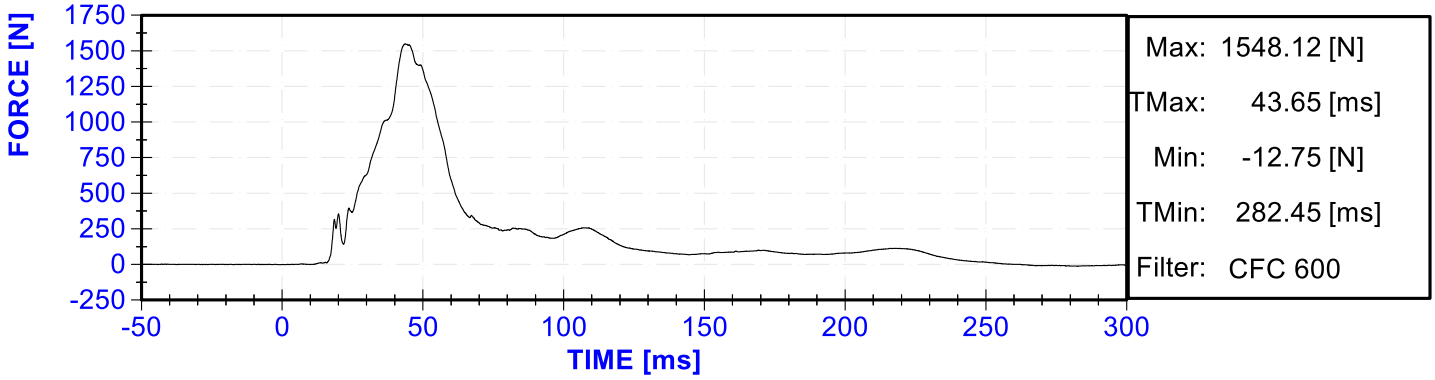
Driver Lower Spine T12 Acceleration (Z) vs. Time



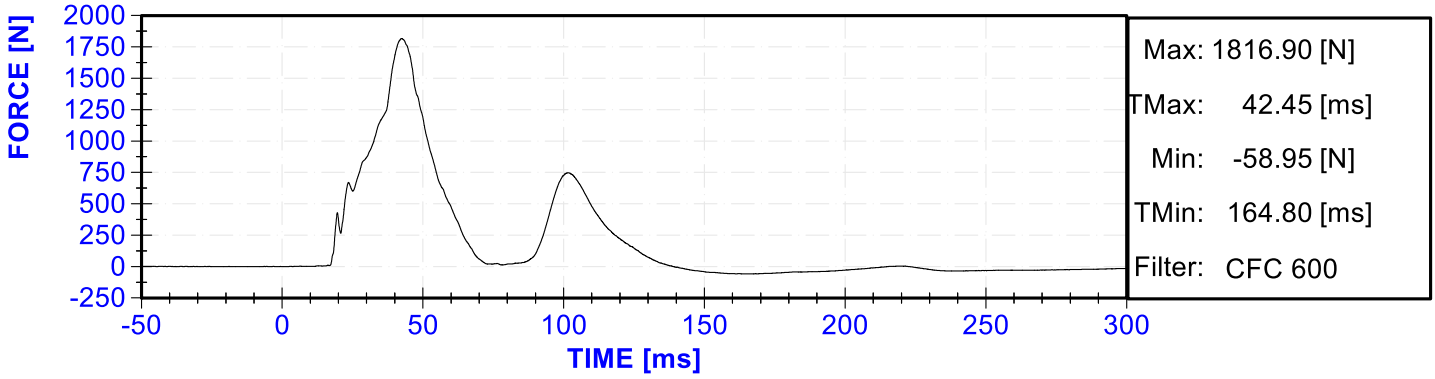
Driver Lower Spine T12 Resultant Acceleration vs. Time



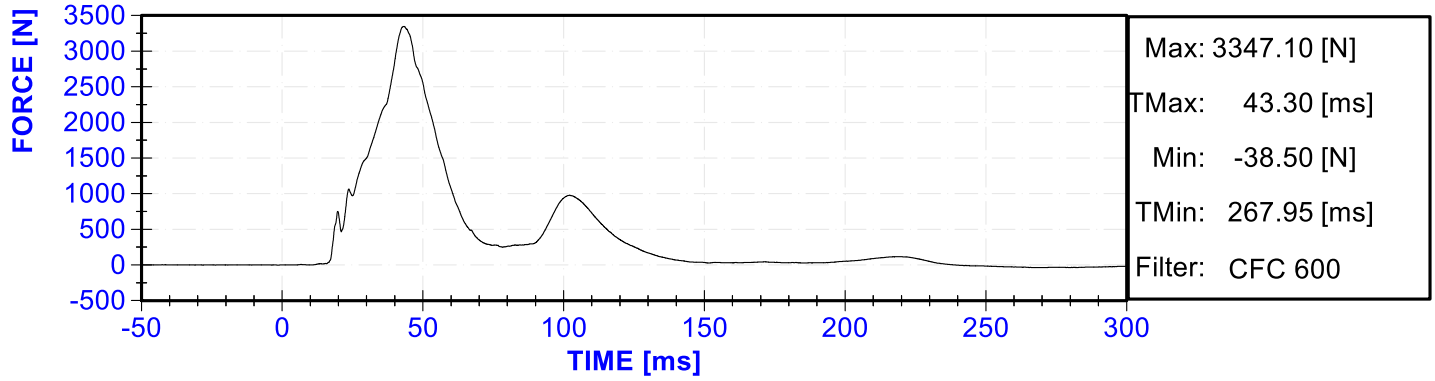
Driver Iliac Wing Force on Impact Side (Y) vs. Time



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



Driver Total Pelvis Force on Impact Side (Y) vs. Time



APPENDIX C

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - DRIVER ATD

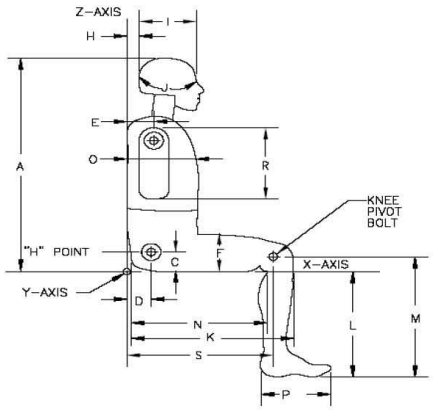
SERIAL NO: DG8012

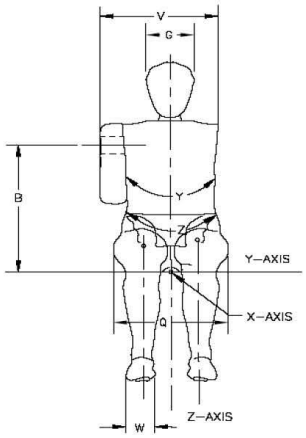
(CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - SID-IIs

Technician: K. Dutton Date: 04/06/2020

Dummy Serial Number: DG8012





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	779	Pass
B	Shoulder Pivot Height	437	453	446	Pass
C	H-point Height	79	89	85	Pass
D	H-point from seatback	141	151	146	Pass
E	Shoulder Pivot from Backline	97	107	103	Pass
F	Thigh Clearance	119	135	126	Pass
G	Head Breadth	140	148	144	Pass
H	Head Back from Backline	40	46	44	Pass
I	Head Depth	178	188	183	Pass
J	Head Circumference	541	551	547	Pass
K	Buttock to Knee Length	514	540	533	Pass
L	Popliteal Height	343	369	357	Pass
M	Knee Pivot to floor height	392	409	404	Pass
N	Buttock Popliteal Length	416	442	433	Pass
O	Chest Depth w/o jacket	195	211	205	Pass
P	Foot Length	216	232	222	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	318	Pass
R	Arm Length	249	259	255	Pass
S	Knee Joint to seatback	477	493	486	Pass
V	Shoulder Width	341	357	345	Pass
W	Foot Width	78	94	85	Pass
Y	Chest Circumference w/jacket	851	881	867	Pass
Z	Waist Circumference	761	791	781	Pass

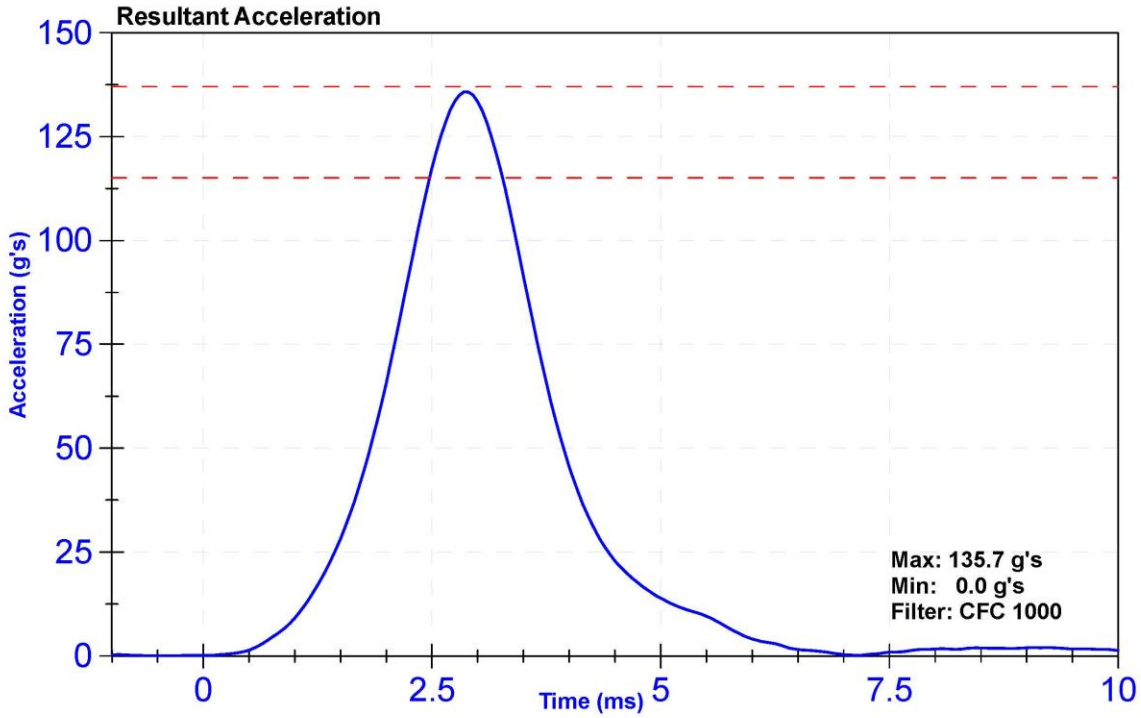
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

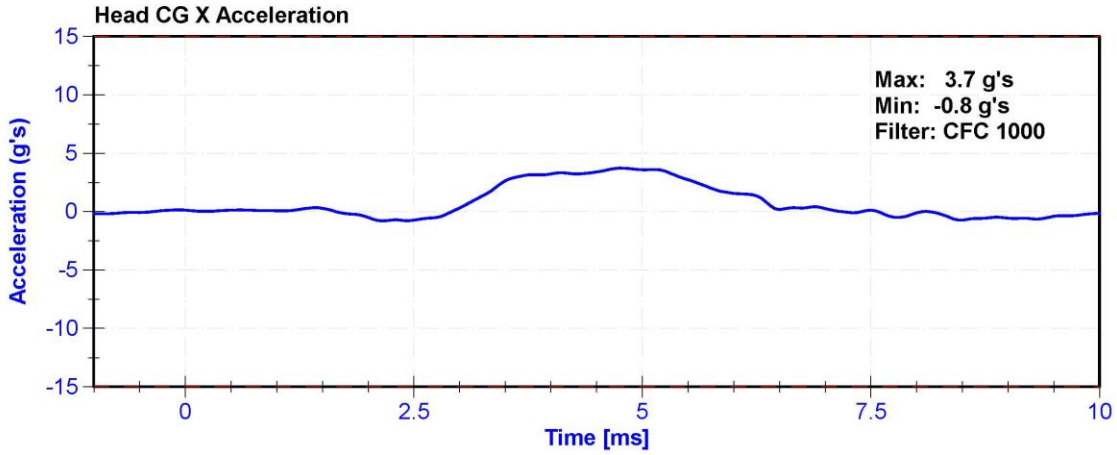
Results

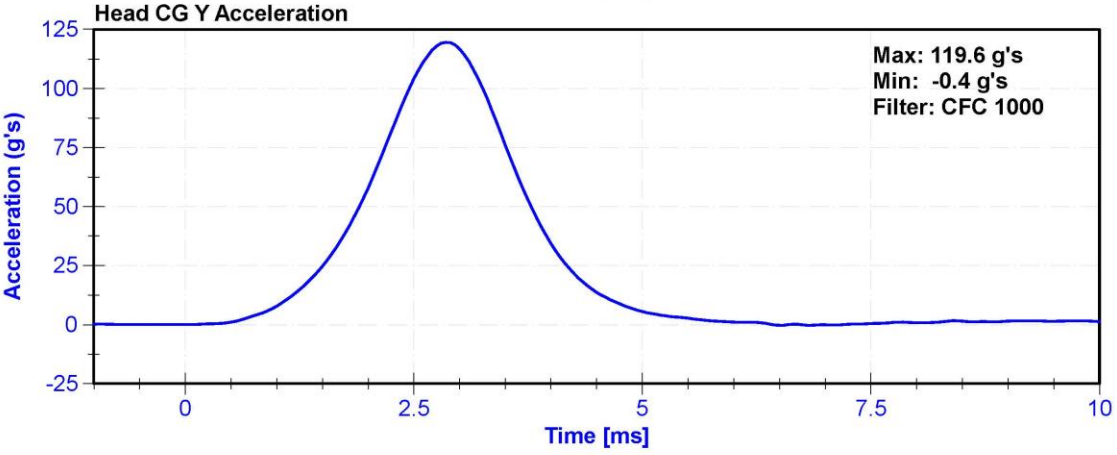
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	21.8	Pass
Resultant Acceleration	115	137	g's	135.7	Pass
Oscillation	0	15	%	1.5	Pass
Fore-Aft Acceleration	-15	15	g's	3.7	Pass

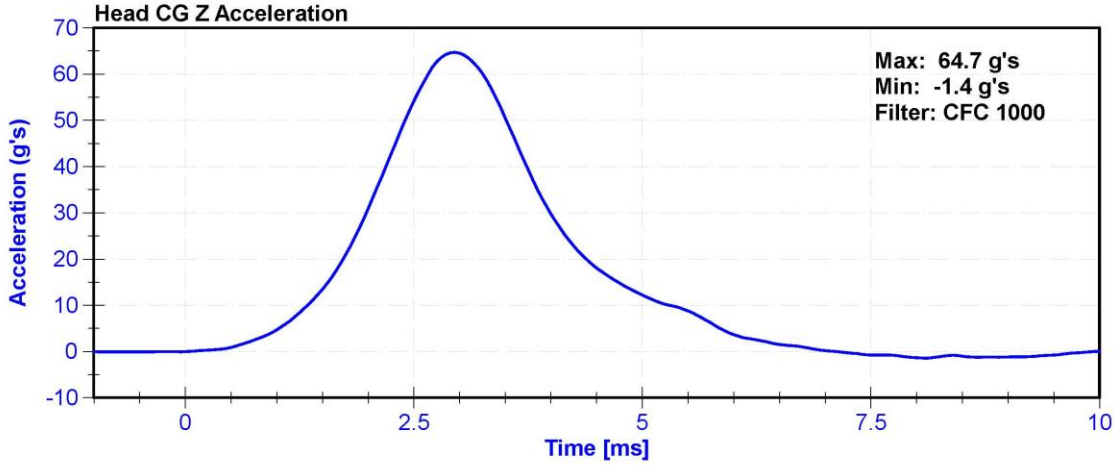
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264	AC-P74788	4/16/2020	10/15/2020
Y Accelerometer	ENDEVCO 7264CT	AC-P83432	4/16/2020	10/15/2020
Z Accelerometer	ENDEVCO 7264	AC-P83319	4/16/2020	10/15/2020




Head CG X Acceleration
Max: 3.7 g's
Min: -0.8 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: 119.6 g's
Min: -0.4 g's
Filter: CFC 1000
Acceleration (g's)
125
100
75
50
25
0
-25
0
2.5
5
7.5
10
Time [ms]


Head CG Z Acceleration
Max: 64.7 g's
Min: -1.4 g's
Filter: CFC 1000
Acceleration (g's)
70
60
50
40
30
20
10
0
-10
0
2.5
5
7.5
10
Time [ms]

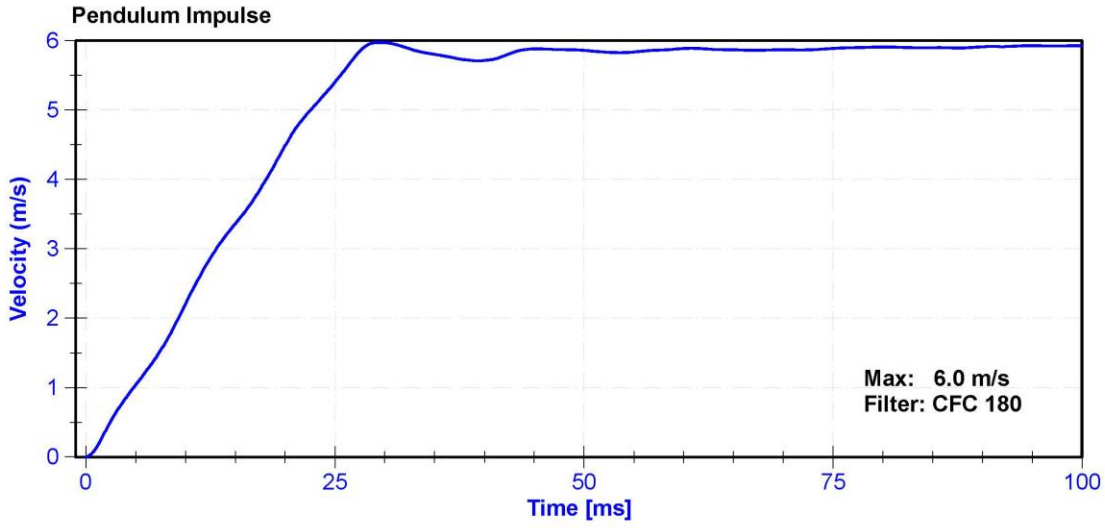
ATD Manufacturer	FTSS	Test Technician	E. Helenbrook
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

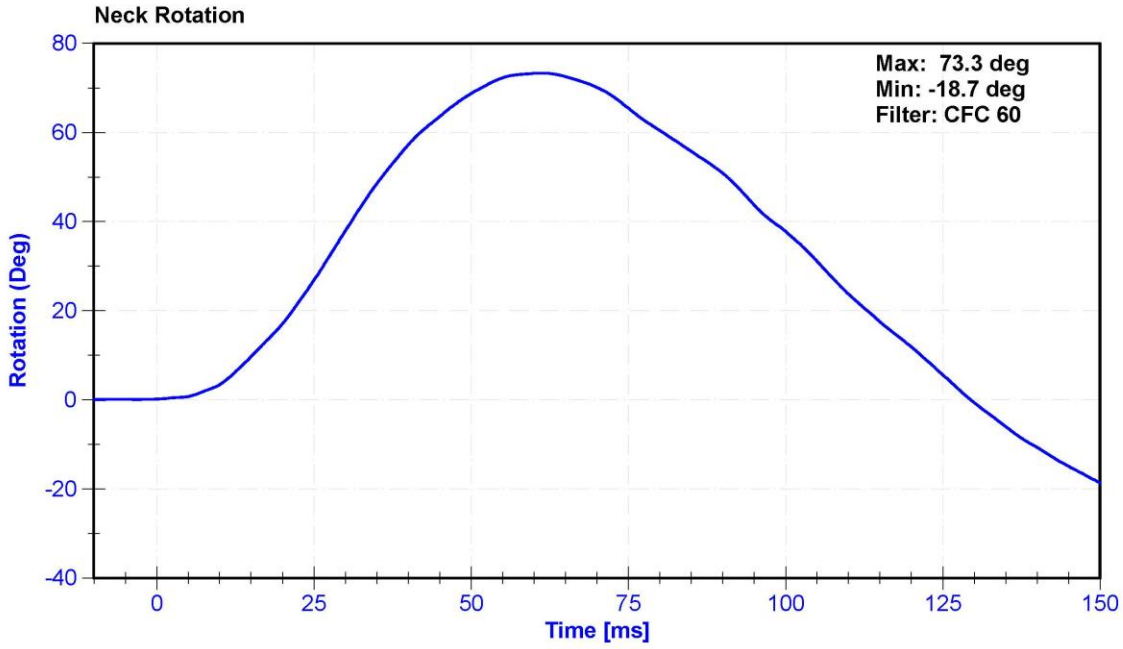
Results

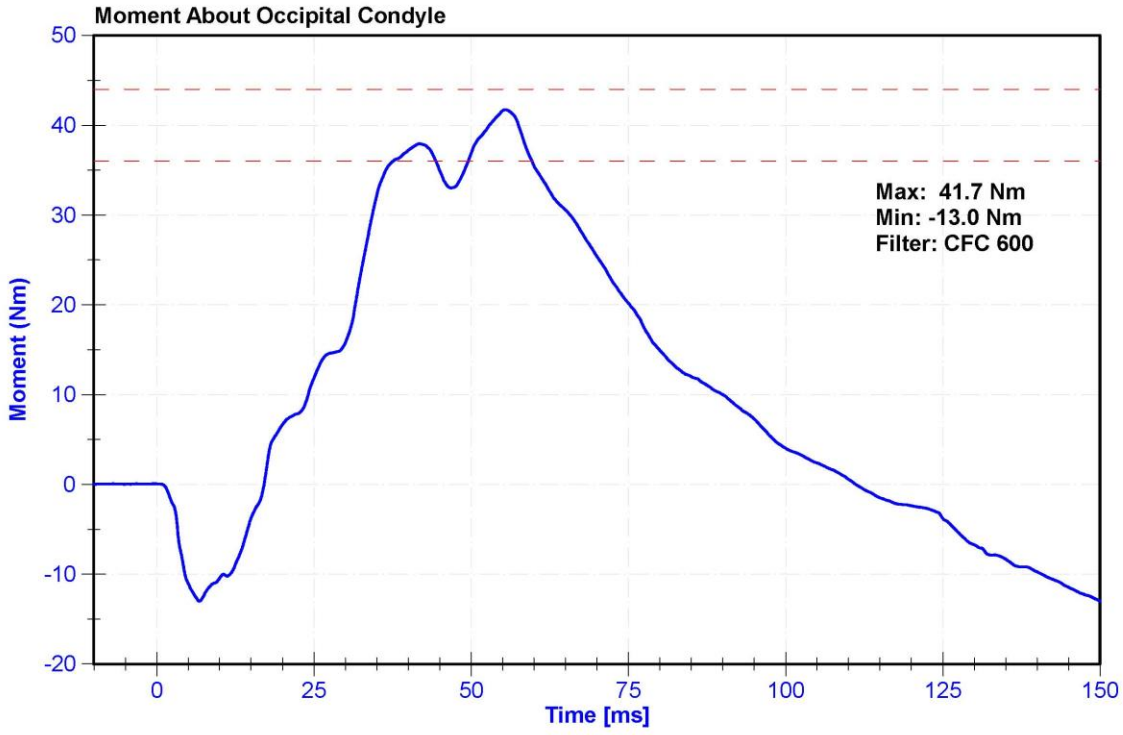
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.7	Pass
Humidity	10	70	%	32.1	Pass
Velocity	5.51	5.63	m/s	5.584	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.21	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.36	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.48	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.40	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.97	Pass
Neck Rotation	71	81	deg	73.3	Pass
Time at Maximum Rotation	50	70	ms	61.3	Pass
Moment about the OC	36	44	Nm	41.7	Pass
Moment Decay to 0 Nm	102	126	ms	111.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/30/2020	1/29/2021
Pendulum Potentiometer	Denton 78051-342	DS-184Pend	11/4/2019	11/3/2020
Condyle Potentiometer	Denton 78051-342	DS-185Pend	11/4/2019	11/3/2020
Upper Neck Load Cell	Denton 1716A	LC-2192Fy	6/20/2019	6/19/2020




Neck Rotation
Max: 73.3 deg
Min: -18.7 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: 41.7 Nm
Min: -13.0 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

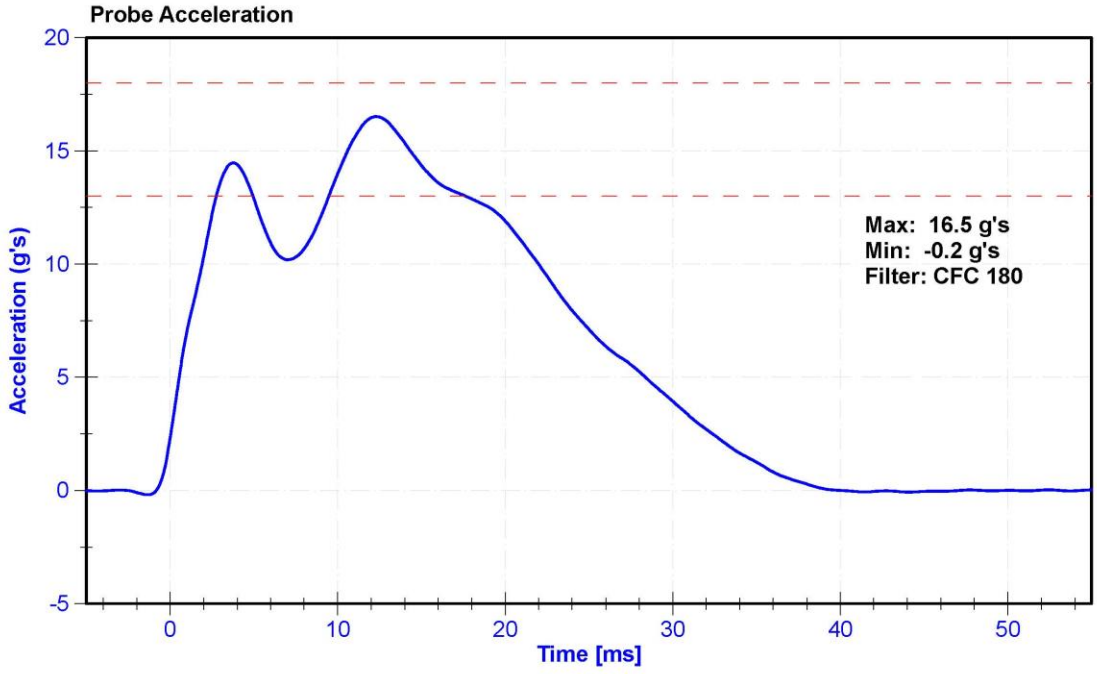
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

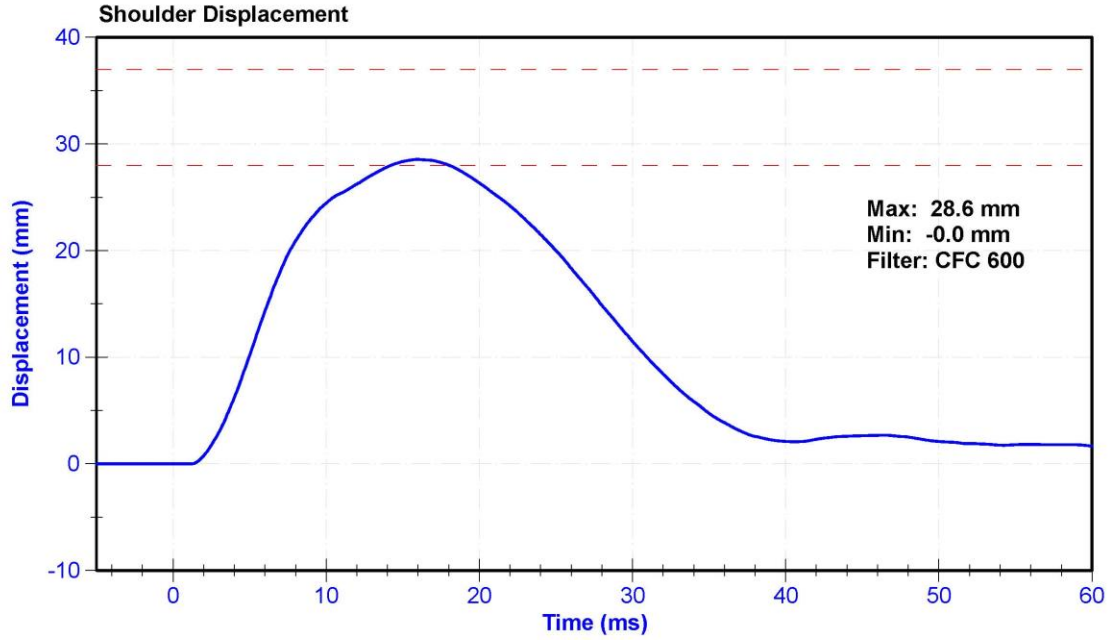
Results

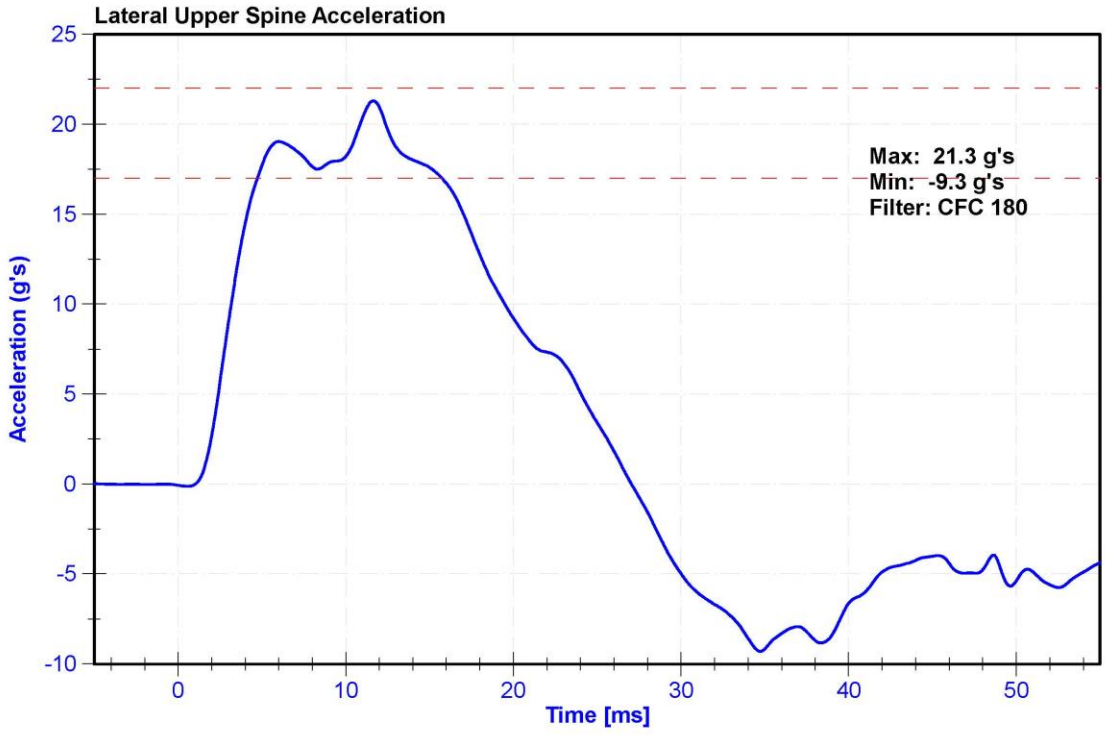
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21	Pass
Humidity	10	70	%	37.7	Pass
Velocity	4.2	4.4	m/s	4.38	Pass
Probe Acceleration	13	18	g's	16.5	Pass
Shoulder Deflection	28	37	mm	28.6	Pass
Lateral Upper Spine Acceleration	17	22	g's	21.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	7/29/2020
Shoulder Potentiometer	Servo 08TC1-3745	DS-1845GFE	10/28/2019	4/27/2020
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P64148	10/28/2019	4/27/2020




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 28.6 mm
Min: -0.0 mm
Filter: CFC 600
40
30
20
10
0
-10
0
10
20
30
40
50
60


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 21.3 g's
Min: -9.3 g's
Filter: CFC 180
25
20
15
10
5
0
-5
-10
0
10
20
30
40
50

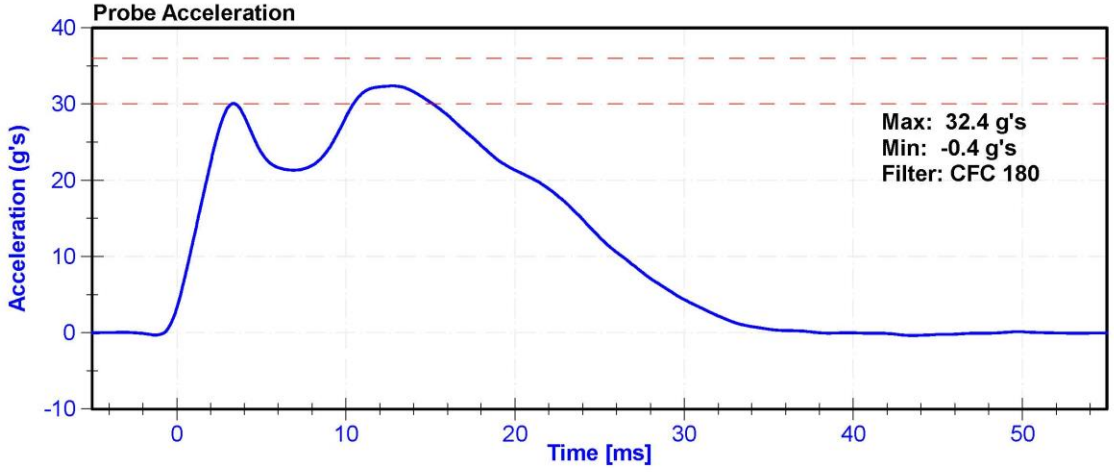
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

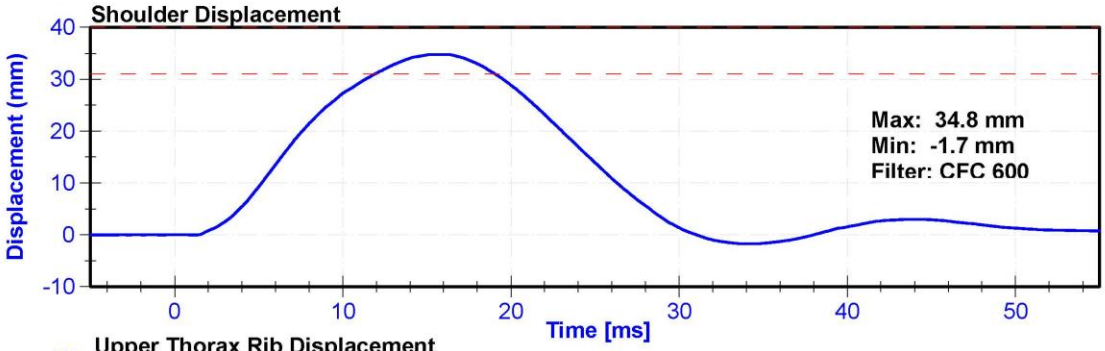
Results

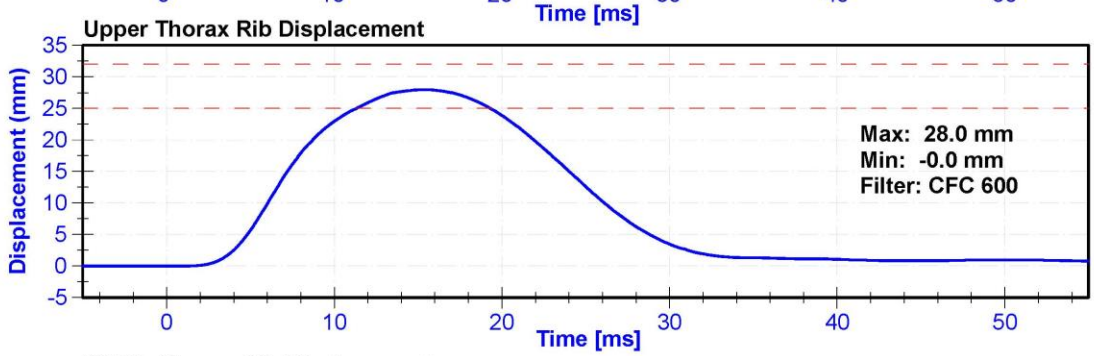
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	37.2	Pass
Velocity	6.6	6.8	m/s	6.79	Pass
Probe Acceleration after 5 ms	30	36	g's	32.4	Pass
Lateral Upper Spine Acceleration	34	43	g's	36.1	Pass
Lateral Lower Spine Acceleration	29	37	g's	29.3	Pass
Shoulder Deflection	31	40	mm	34.8	Pass
Upper Thorax Rib Deflection	25	32	mm	28.0	Pass
Mid Thorax Rib Deflection	30	36	mm	32.3	Pass
Lower Thorax Rib Deflection	32	38	mm	36.3	Pass

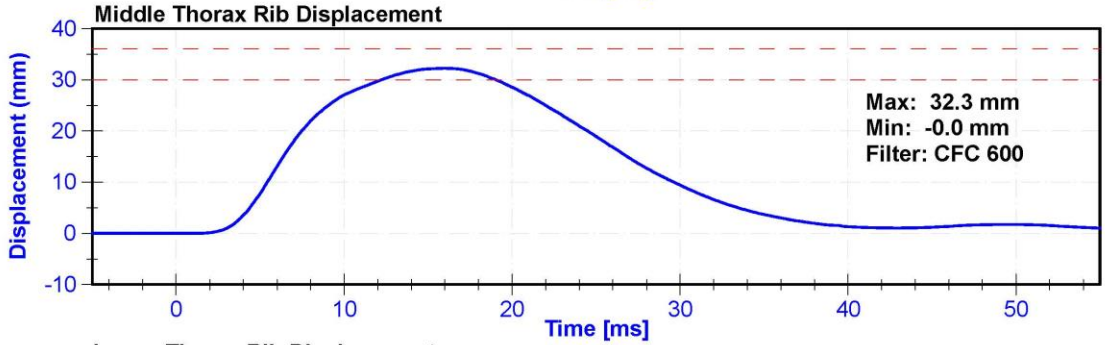
Transducer Calibrations

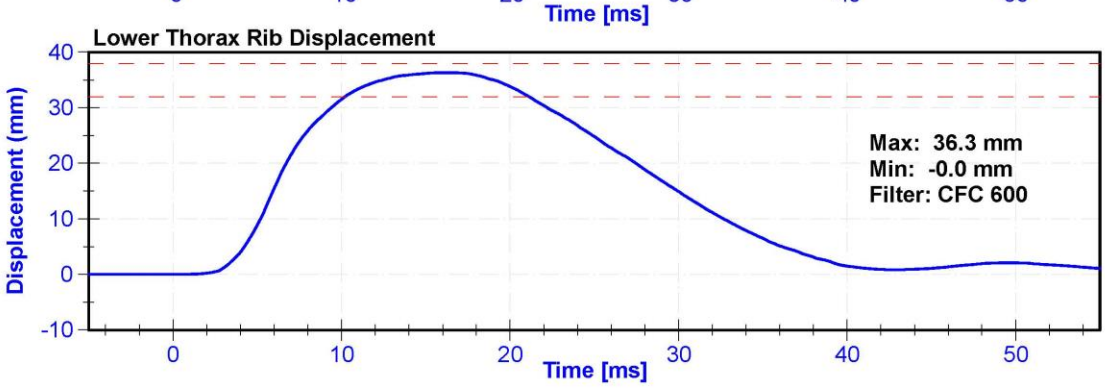
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	7/29/2020
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P64148	10/28/2019	4/27/2020
Upper Spine T12 Y Accelerometer	ENDEVCO 7264CT	AC-P51327	3/30/2020	9/28/2020
Shoulder Potentiometer	Servo 08TC1-3745	DS-1845GFE	10/28/2019	4/27/2020
Upper Thorax Rib Potentiometer	Servo 1246	DS-2165GFE	10/28/2019	4/27/2020
Middle Thorax Rib Potentiometer	Servo 08TC1-3621	DS-45 GFE	10/28/2019	4/27/2020
Lower Thorax Rib Potentiometer	Servo 08TC1-3787	DS-011GFE	10/28/2019	4/27/2020

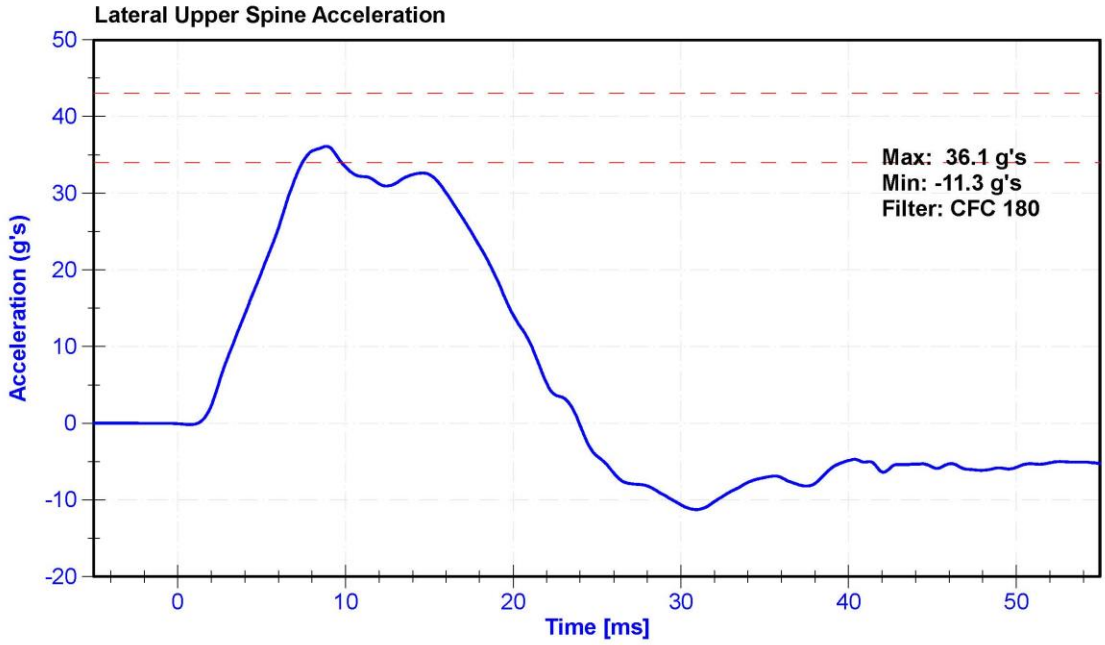


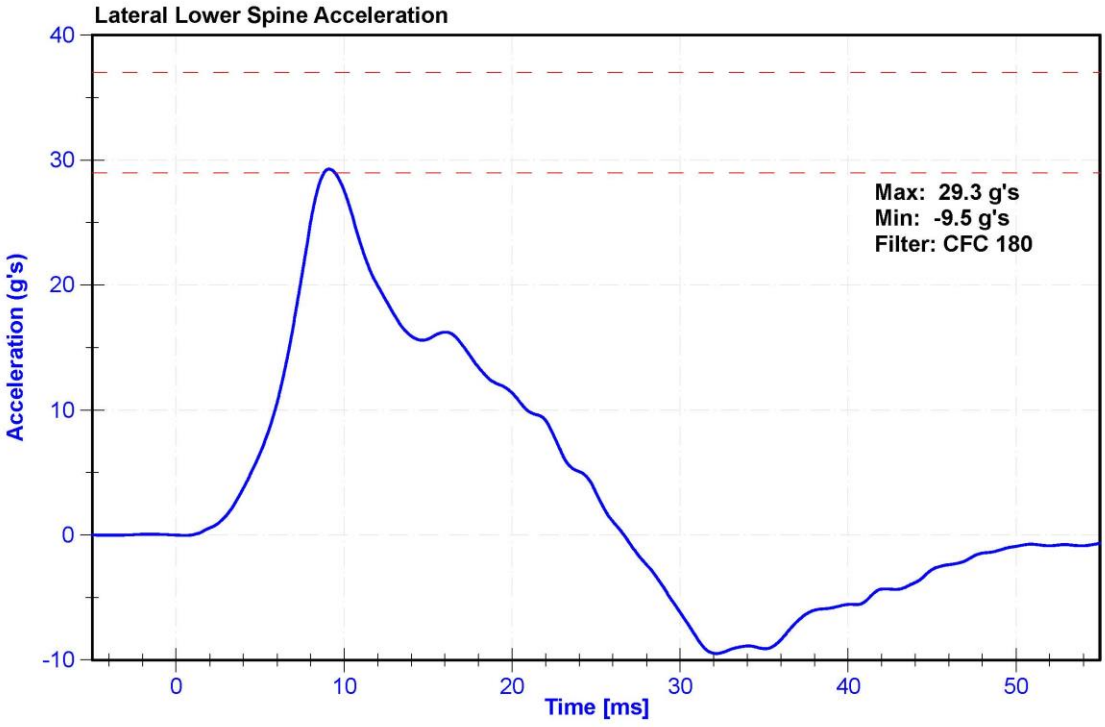

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 34.8 mm
Min: -1.7 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 28.0 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 32.3 mm
Min: -0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 36.3 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 36.1 g's
Min: -11.3 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]


Lateral Lower Spine Acceleration
Max: 29.3 g's
Min: -9.5 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]

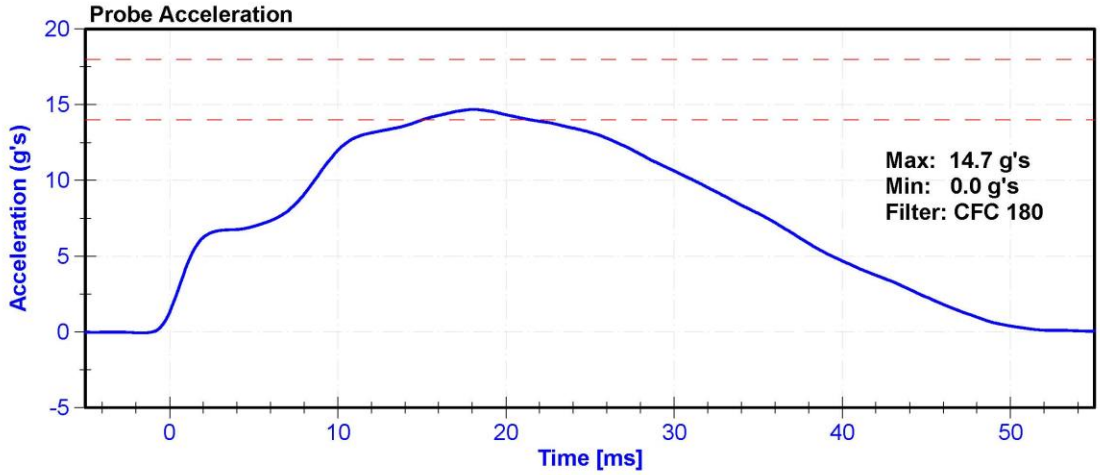
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

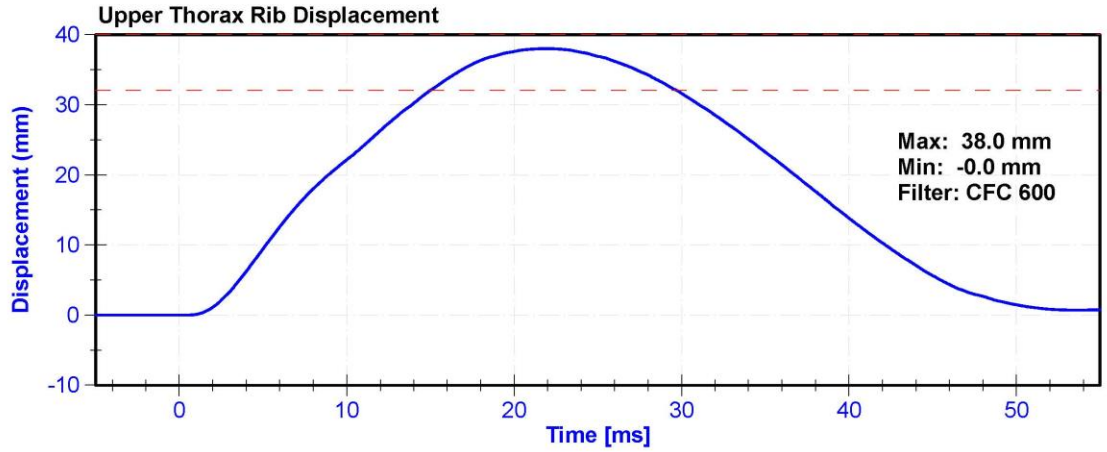
Results

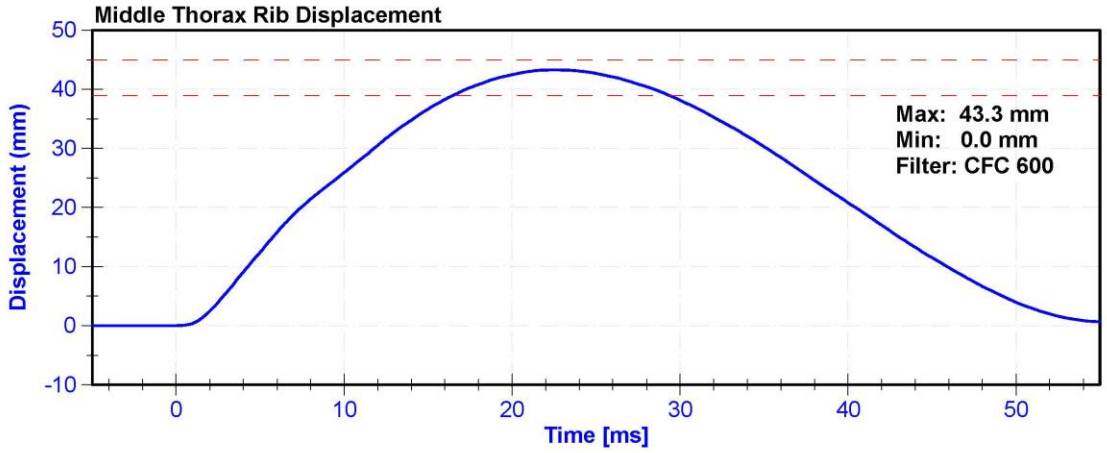
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	36.1	Pass
Velocity	4.2	4.4	m/s	4.22	Pass
Probe Acceleration	14	18	g's	14.7	Pass
Lateral Upper Spine Acceleration	13	17	g's	13.2	Pass
Lateral Lower Spine Acceleration	7	11	g's	7.5	Pass
Upper Thorax Rib Deflection	32	40	mm	38.0	Pass
Middle Thorax Rib Deflection	39	45	mm	43.3	Pass
Lower Thorax Rib Deflection	35	43	mm	42.8	Pass

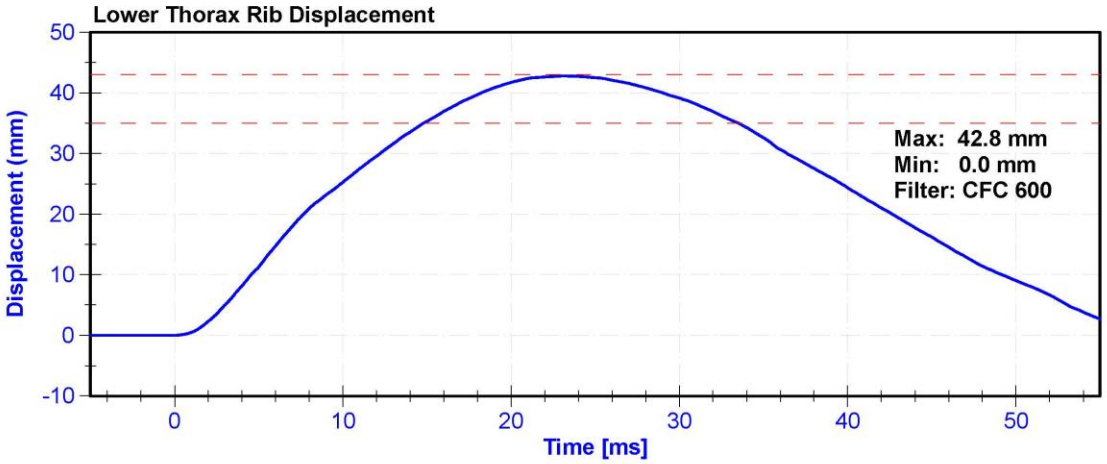
Transducer Calibrations

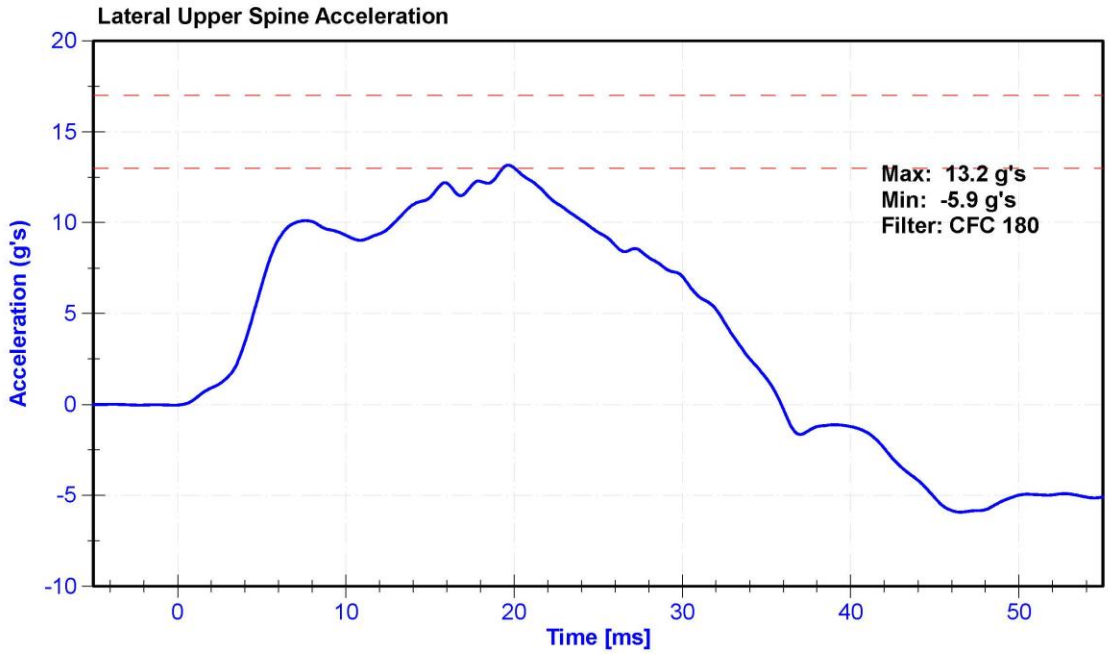
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	7/29/2020
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P64148	10/28/2019	4/27/2020
Lower Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51327	3/30/2020	9/28/2020
Upper Thorax Rib Potentiometer	Servo 1246	DS-2165GFE	10/28/2019	4/27/2020
Middle Thorax Rib Potentiometer	Servo 08TC1-3621	DS-45 GFE	10/28/2019	4/27/2020
Lower Thorax Rib Potentiometer	Servo 08TC1-3787	DS-011GFE	10/28/2019	4/27/2020

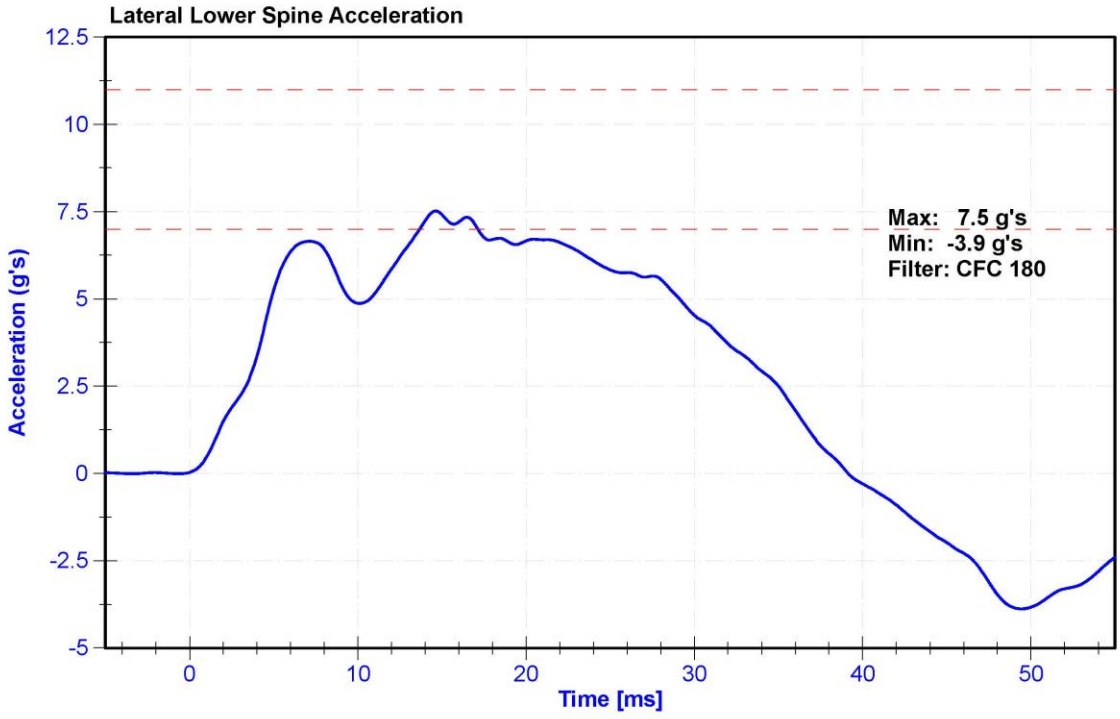



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 38.0 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 43.3 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 42.8 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 13.2 g's
Min: -5.9 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
20
15
10
5
0
-5
-10
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 7.5 g's
Min: -3.9 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50

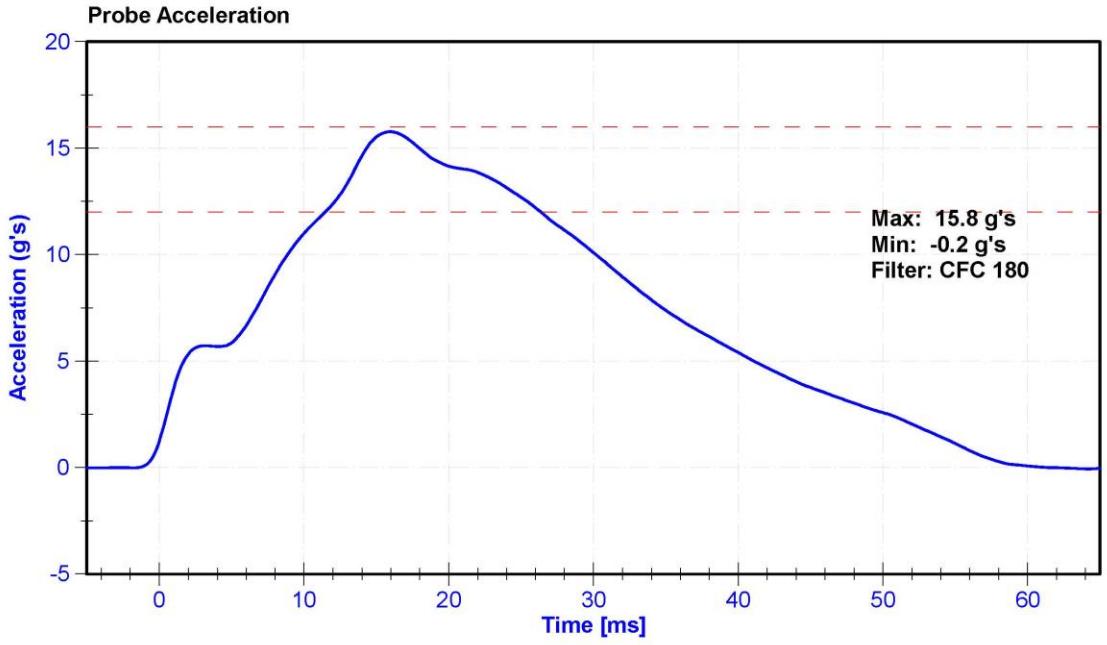
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

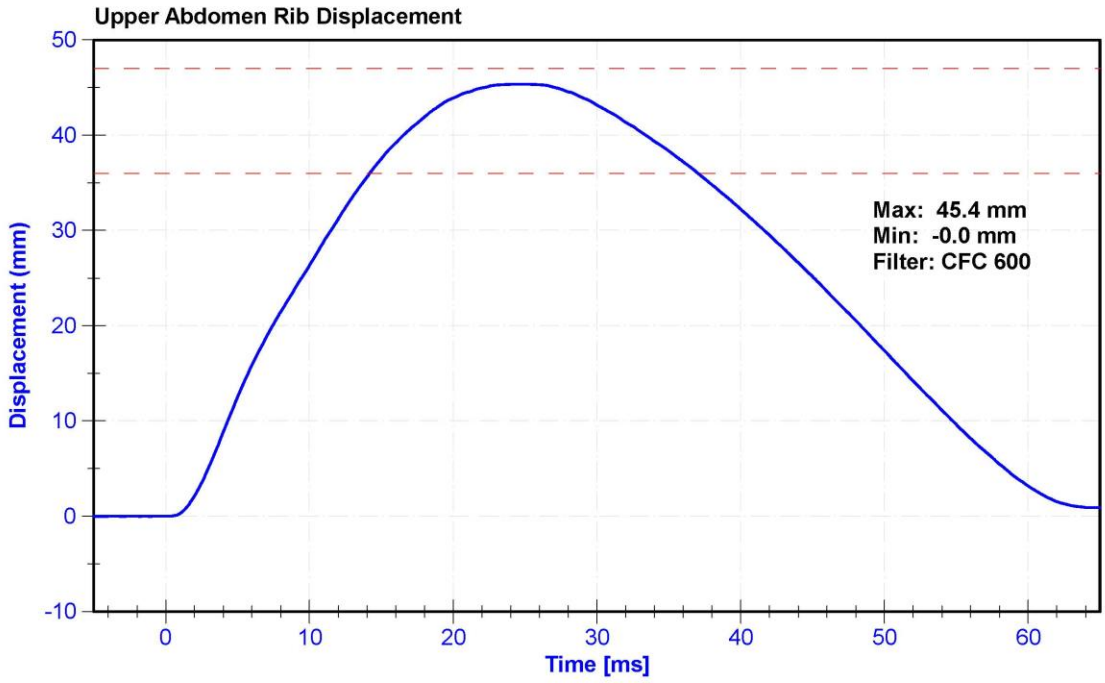
Results

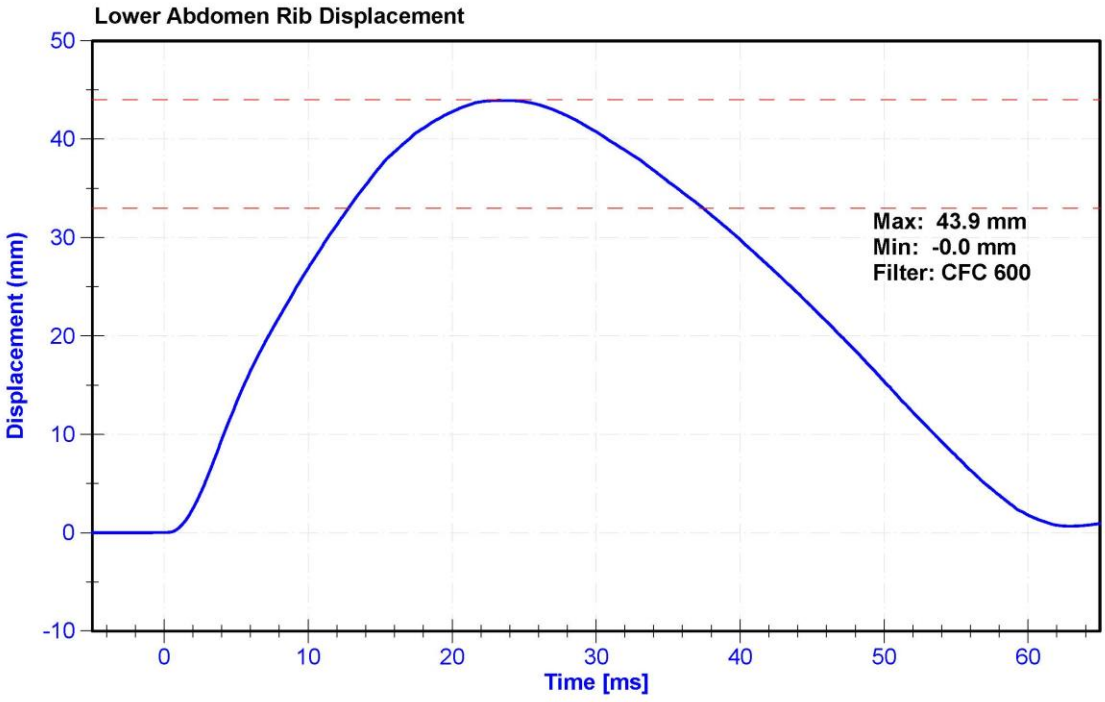
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	35.6	Pass
Velocity	4.2	4.4	m/s	4.22	Pass
Probe Acceleration	12	16	g's	15.8	Pass
Lateral Lower Spine Acceleration	9	14	g's	10.7	Pass
Upper Abdomen Rib Deflection	36	47	mm	45.4	Pass
Lower Abdomen Rib Deflection	33	44	mm	43.9	Pass

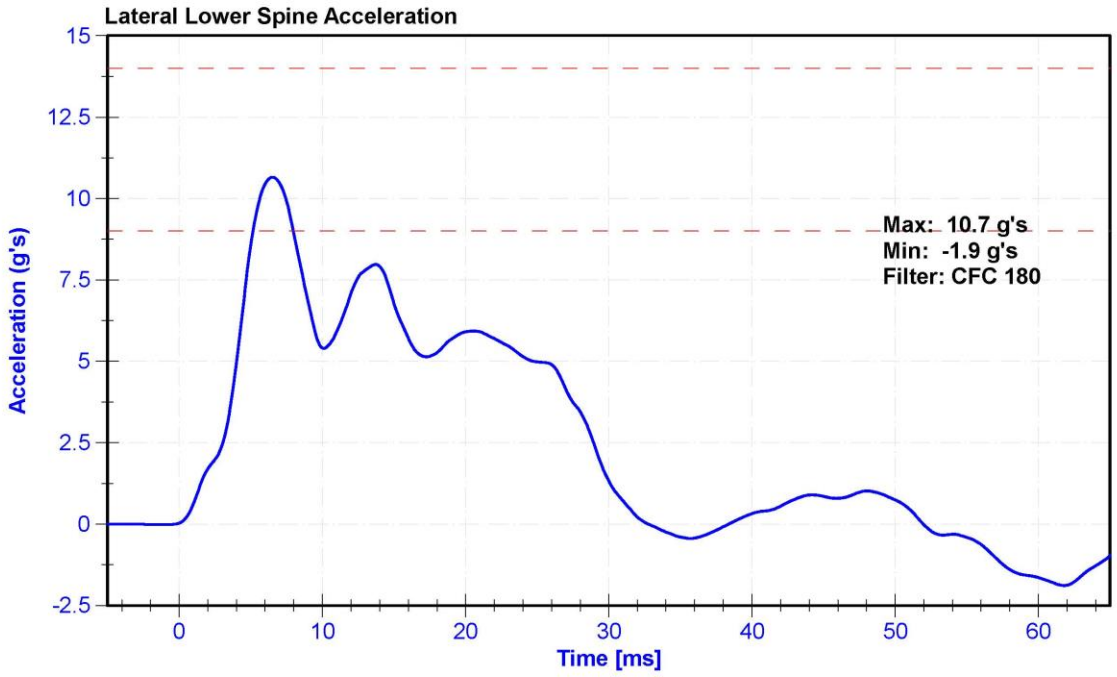
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A286228	1/29/2020	7/29/2020
Lower Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51327	3/30/2020	9/28/2020
Upper Abdomen Rib Potentiometer	Servo 08TC1-3725	DS-008GFE	10/28/2019	4/27/2020
Lower Abdomen Rib Potentiometer	Servo 08TC1-3745	DS-1774GFE	10/28/2019	4/27/2020




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 45.4 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 43.9 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
0
10
20
30
40
50
60
Time [ms]
Max: 10.7 g's
Min: -1.9 g's
Filter: CFC 180

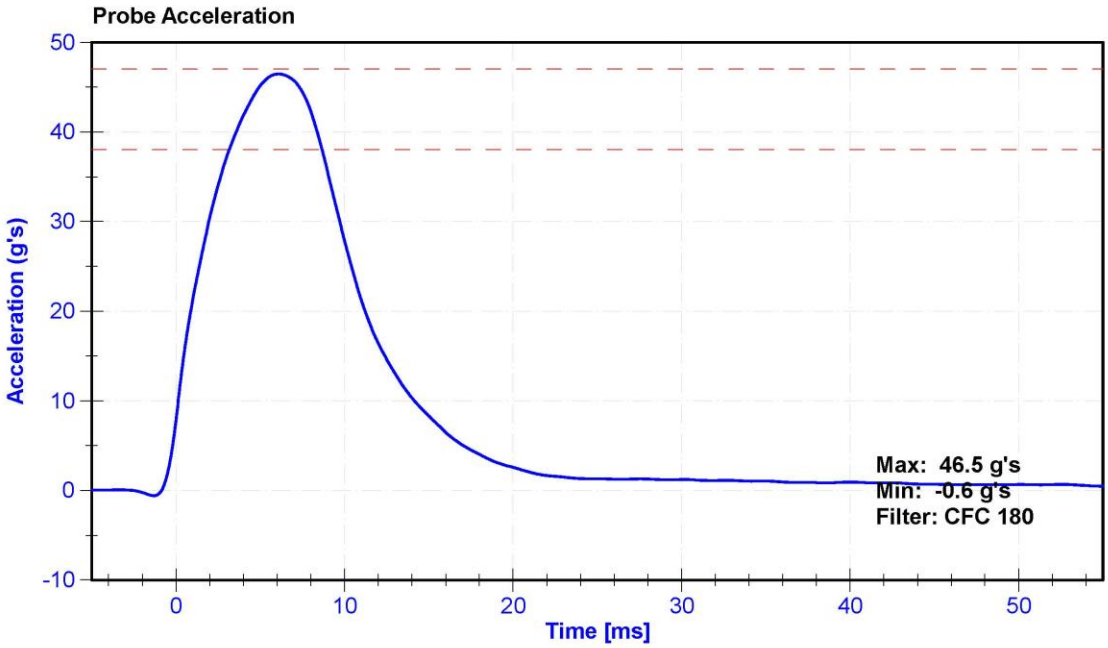
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

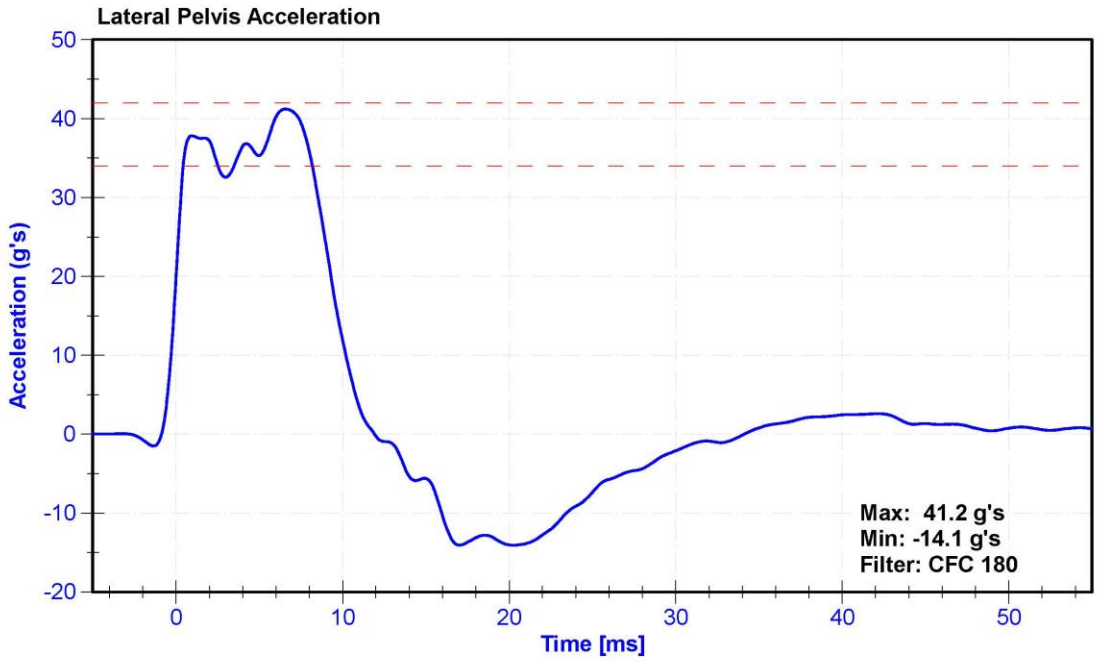
Results

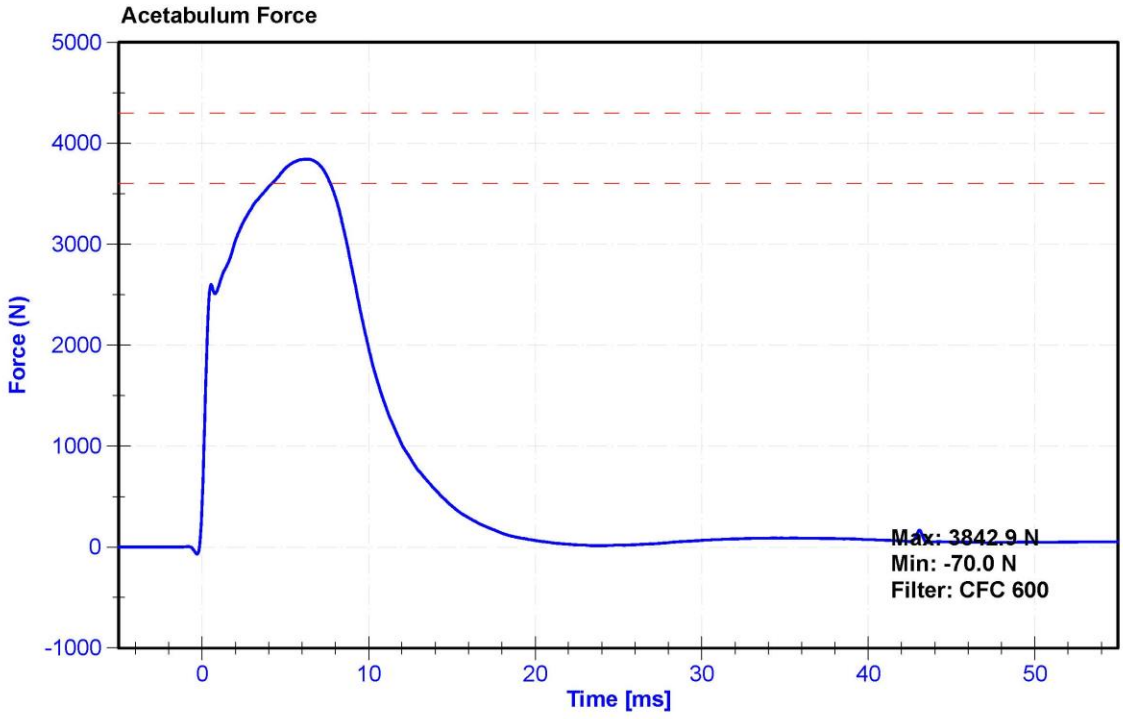
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	38.2	Pass
Velocity	6.6	6.8	m/s	6.63	Pass
Probe Acceleration	38	47	g's	46.5	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	41.2	Pass
Acetabulum Force	3600	4300	N	3842.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	7/29/2020
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51875	10/28/2019	4/27/2020
Acetabulum Load Cell	Denton 3249J	LC-4986Fy	6/14/2019	6/13/2020
Certification Plug	SACO	13415	9/20/2019	N/A
Crash Test Plug	SACO	11917	1/31/2018	N/A




Lateral Pelvis Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]
Max: 41.2 g's
Min: -14.1 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: 3842.9 N
Min: -70.0 N
Filter: CFC 600

Crash DG8012 4/8/2020

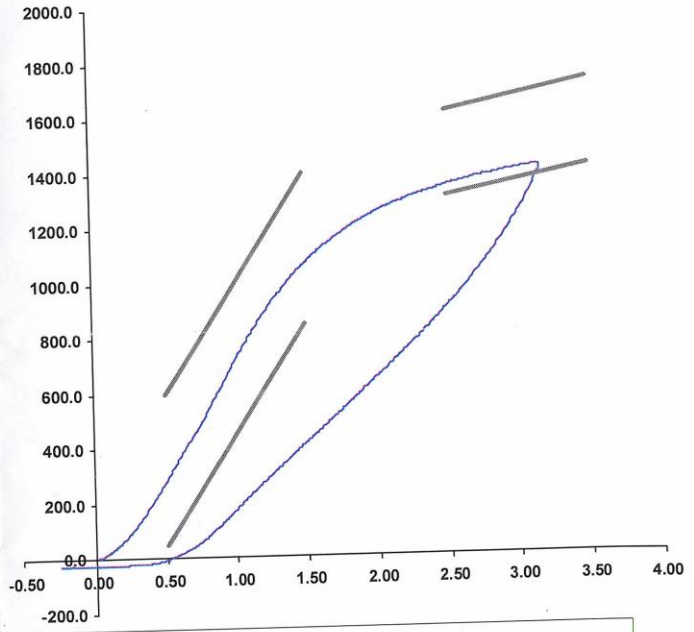
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 11917
Test Number 6079
Report Number 6095
Test Date 1/31/2018 1:55:06 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	278.33	50.00	600.00
Force @ 1.5 mm (N)	1,071.83	850.00	1,400.00
Force @ 2.5 mm (N)	1,346.87	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,402.61	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



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

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

Notes:

Operator

Part Number 180-4450

Template No 107 31-Jan-18
SACO Research

By : DC Date : 1/31/18

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

Certy DG8(4/8/2020

SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 13415
Test Number 11057
Report Number 11095
Test Date 9/20/2019 7:25:44 AM

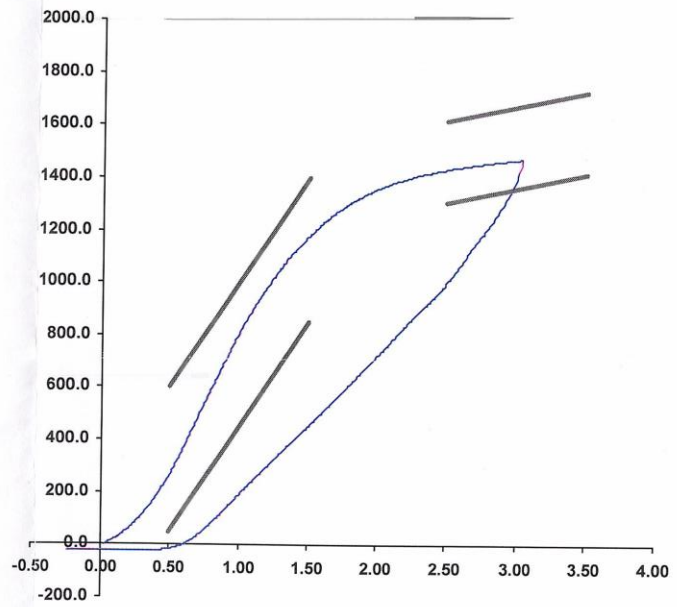
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	268.31	50.00	600.00
Force @ 1.5 mm (N)	1,175.29	850.00	1,400.00
Force @ 2.5 mm (N)	1,434.35	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,471.52	1,361.00	1,673.00

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

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

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 20-Sep-19
SACO Research

By : DC Date : 9/20/2019

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

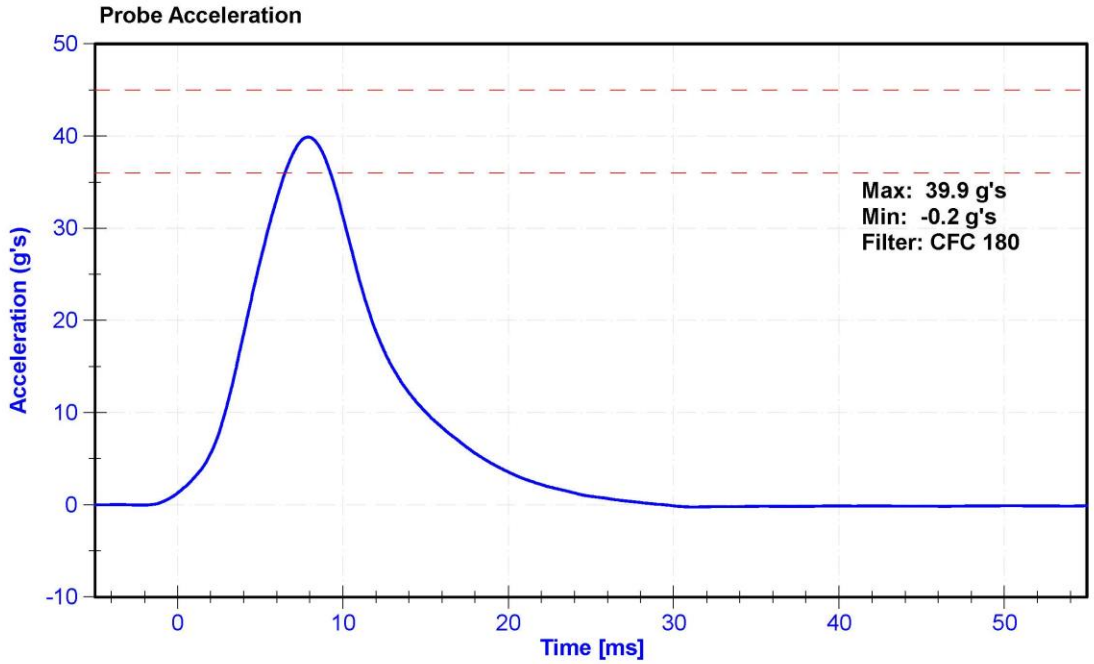
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

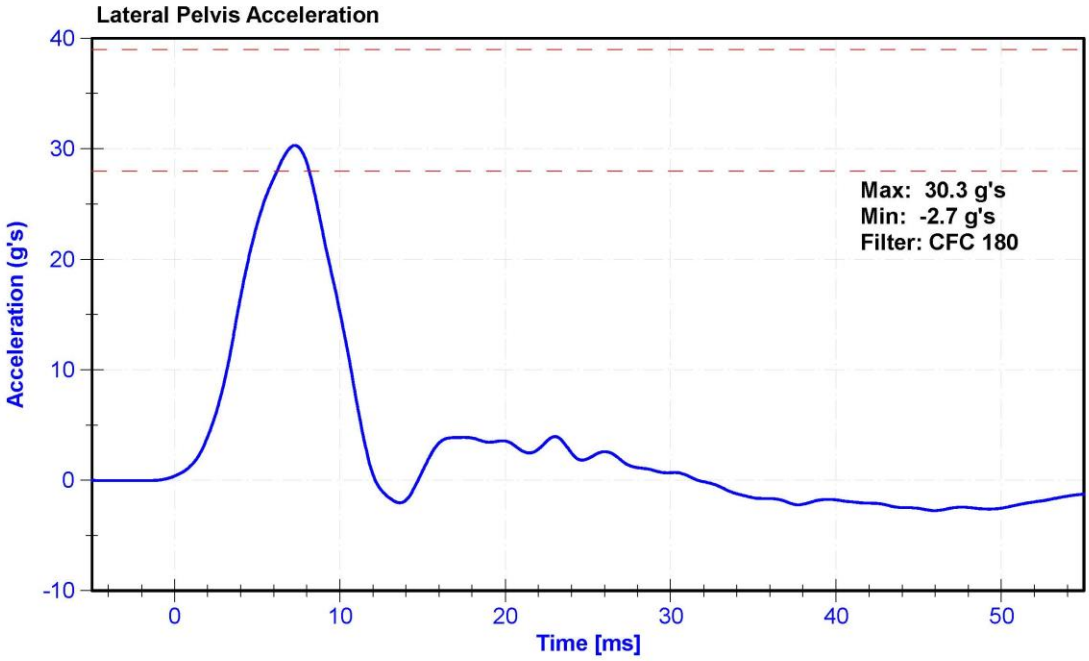
Results

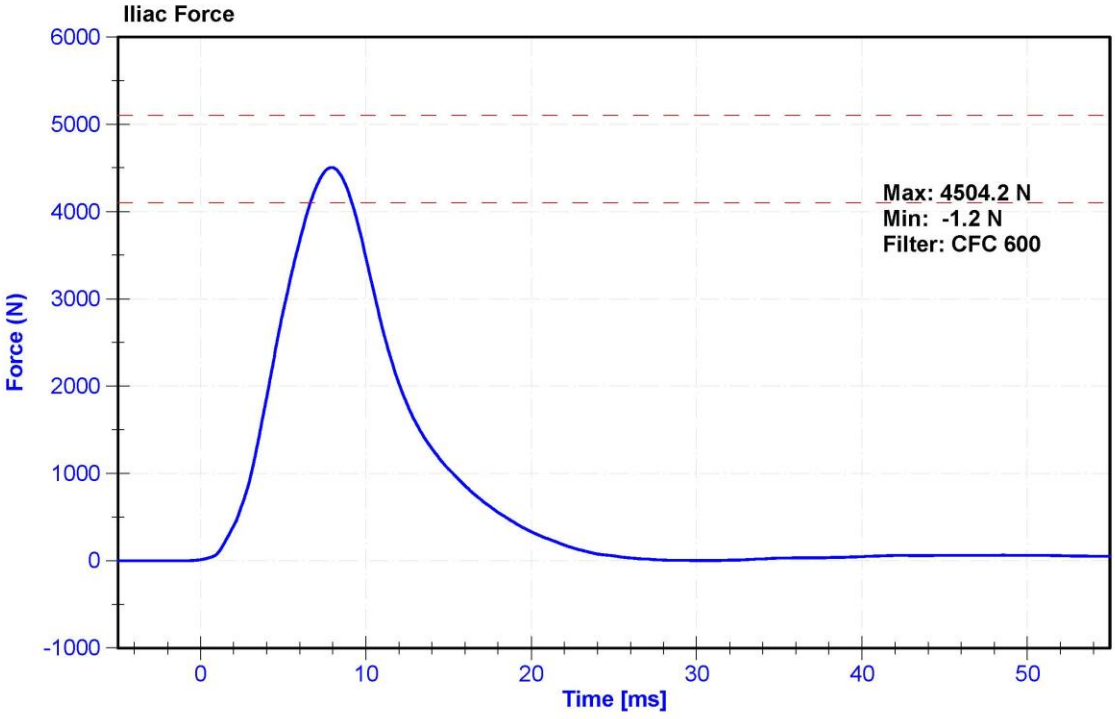
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	39.2	Pass
Velocity	4.2	4.4	m/s	4.37	Pass
Probe Acceleration	36	45	g's	39.9	Pass
Lateral Pelvis Acceleration	28	39	g's	30.3	Pass
Iliac Force	4100	5100	N	4504.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	7/29/2020
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51875	10/28/2019	4/27/2020
Iliac Load Cell	DENTON 3228J	LC-290Fy	9/25/2019	9/24/2020




Lateral Pelvis Acceleration
Max: 30.3 g's
Min: -2.7 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
0
10
20
30
40
50


Iliac Force
Max: 4504.2 N
Min: -1.2 N
Filter: CFC 600
Force (N)
Time [ms]
6000
5000
4000
3000
2000
1000
0
-1000
0
10
20
30
40
50

CALIBRATION TEST RESULTS

POST-TEST

SID-IIS 5TH PERCENTILE FEMALE - DRIVER ATD

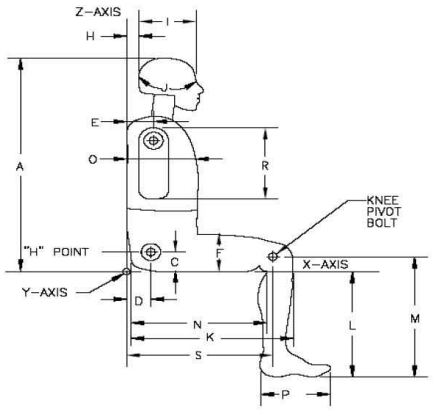
SERIAL NO: DG8012

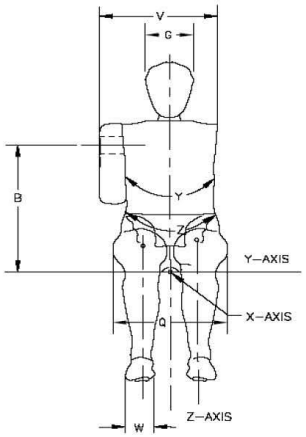
(CONFIGURED FOR LEFT SIDE IMPACT)

External Measurements - SID-IIs

Technician: K. Dutton Date: 04/21/2020

Dummy Serial Number: DG8012





Symbol	Description	Specification (mm)		Result (mm)	Pass/Fail
A	Sitting Height	772	788	779	Pass
B	Shoulder Pivot Height	437	453	446	Pass
C	H-point Height	79	89	85	Pass
D	H-point from seatback	141	151	146	Pass
E	Shoulder Pivot from Backline	97	107	103	Pass
F	Thigh Clearance	119	135	126	Pass
G	Head Breadth	140	148	144	Pass
H	Head Back from Backline	40	46	43	Pass
I	Head Depth	178	188	183	Pass
J	Head Circumference	541	551	547	Pass
K	Buttock to Knee Length	514	540	537	Pass
L	Popliteal Height	343	369	357	Pass
M	Knee Pivot to floor height	392	409	404	Pass
N	Buttock Popliteal Length	416	442	433	Pass
O	Chest Depth w/o jacket	195	211	205	Pass
P	Foot Length	216	232	222	Pass
Q	Hip Breadth (w/pelvic plugs)	313	323	318	Pass
R	Arm Length	249	259	255	Pass
S	Knee Joint to seatback	477	493	486	Pass
V	Shoulder Width	341	357	345	Pass
W	Foot Width	78	94	85	Pass
Y	Chest Circumference w/jacket	851	881	867	Pass
Z	Waist Circumference	761	791	781	Pass

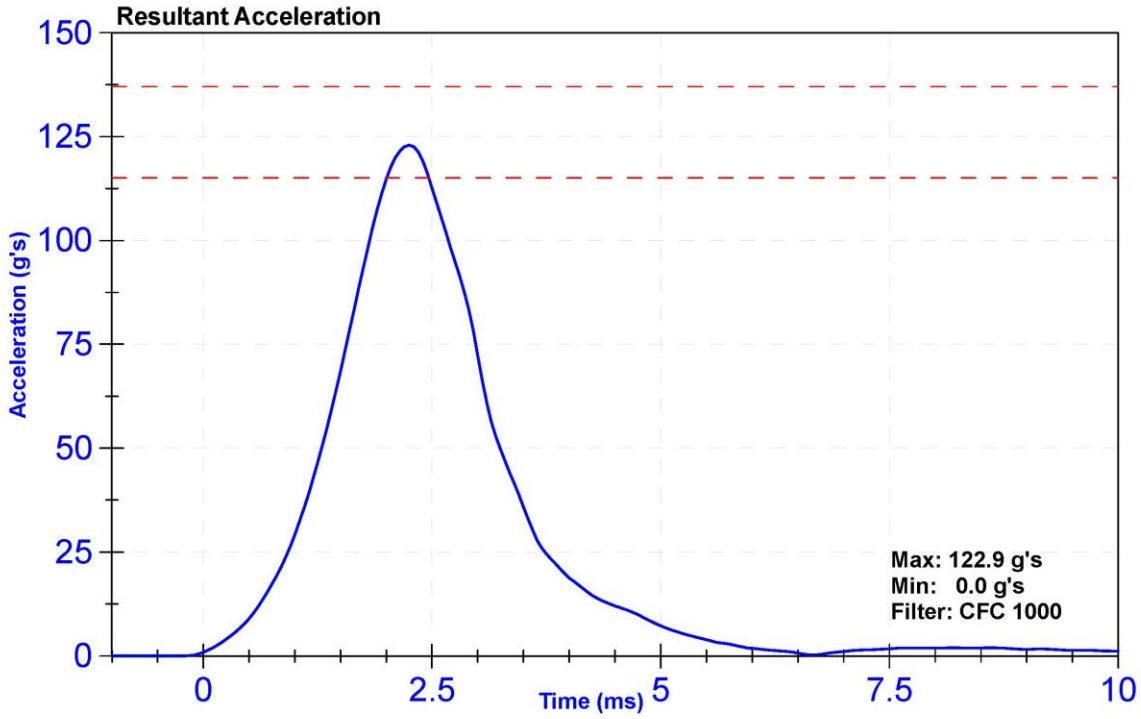
ATD Manufacturer	FTSS	Test Technician	M. Dudek
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

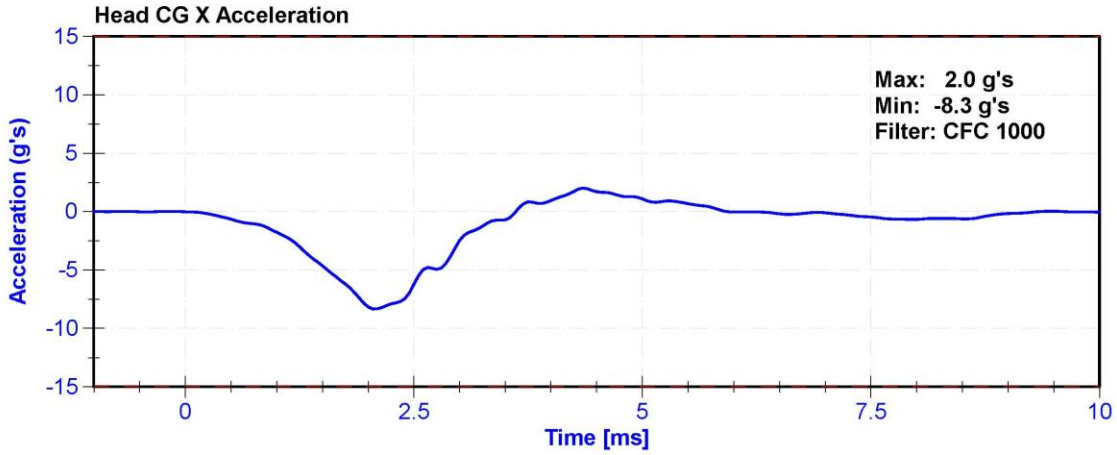
Results

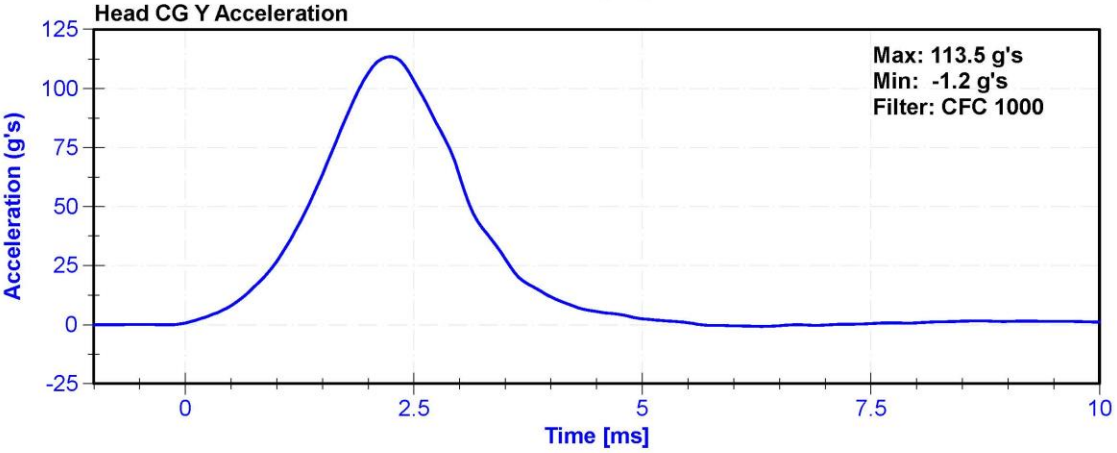
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	29.2	Pass
Resultant Acceleration	115	137	g's	122.9	Pass
Oscillation	0	15	%	1.6	Pass
Fore-Aft Acceleration	-15	15	g's	-8.3	Pass

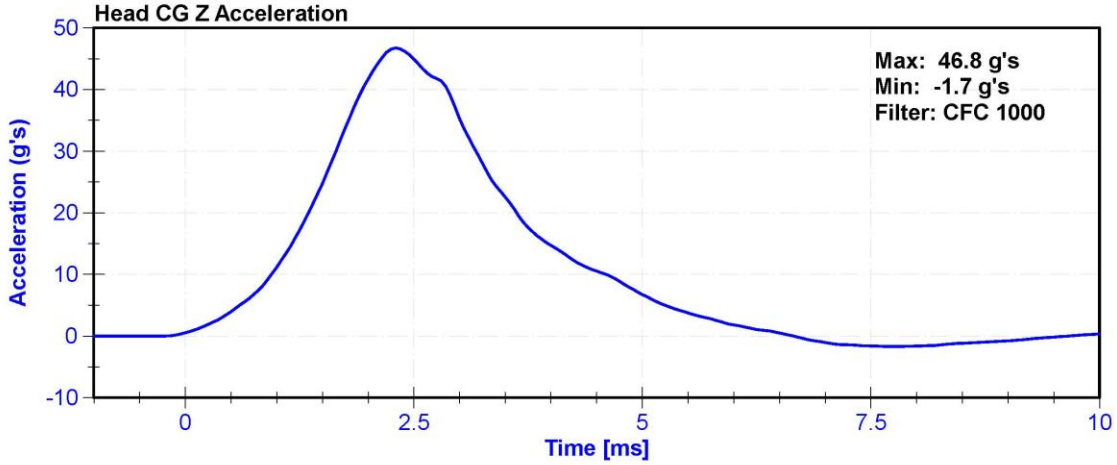
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264	AC-P74788	4/16/2020	10/15/2020
Y Accelerometer	ENDEVCO 7264CT	AC-P83432	4/16/2020	10/15/2020
Z Accelerometer	ENDEVCO 7264	AC-P83319	4/16/2020	10/15/2020




Head CG X Acceleration
Max: 2.0 g's
Min: -8.3 g's
Filter: CFC 1000
Acceleration (g's)
15
10
5
0
-5
-10
-15
0
2.5
5
7.5
10
Time [ms]


Head CG Y Acceleration
Max: 113.5 g's
Min: -1.2 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: 46.8 g's
Min: -1.7 g's
Filter: CFC 1000
Acceleration (g's)
50
40
30
20
10
0
-10
0
2.5
5
7.5
10
Time [ms]

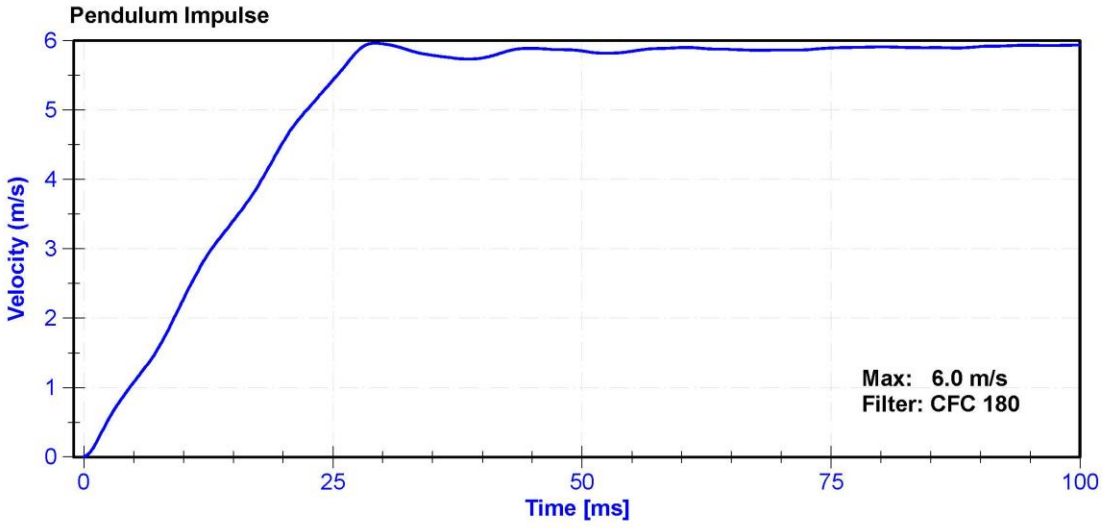
ATD Manufacturer	FTSS	Test Technician	M. Dudek
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

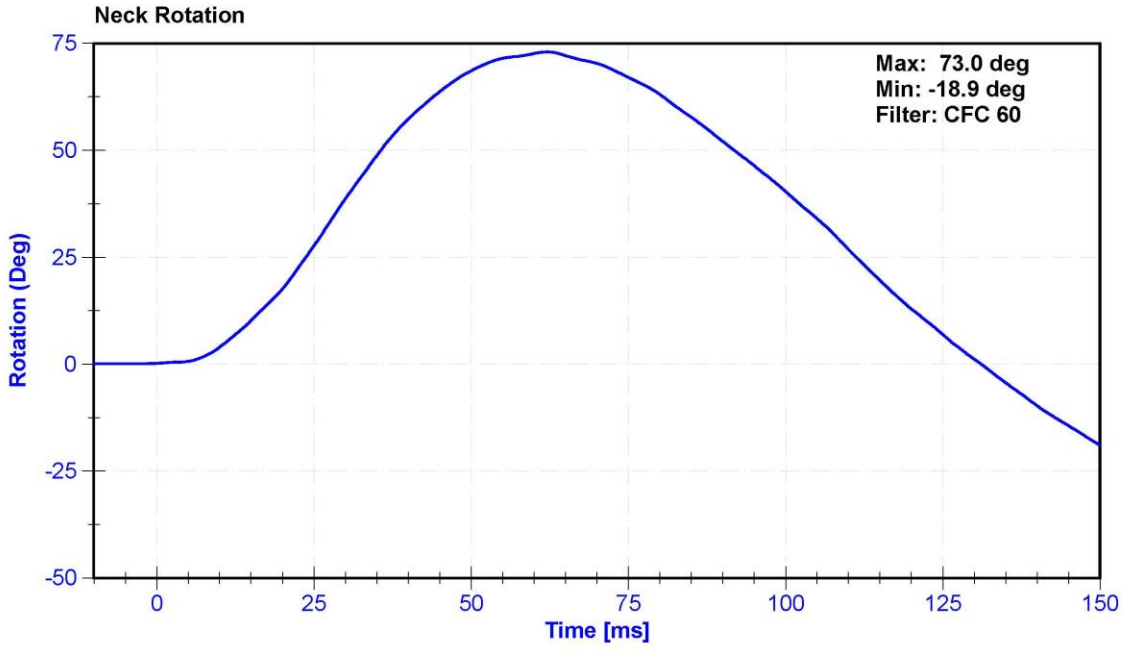
Results

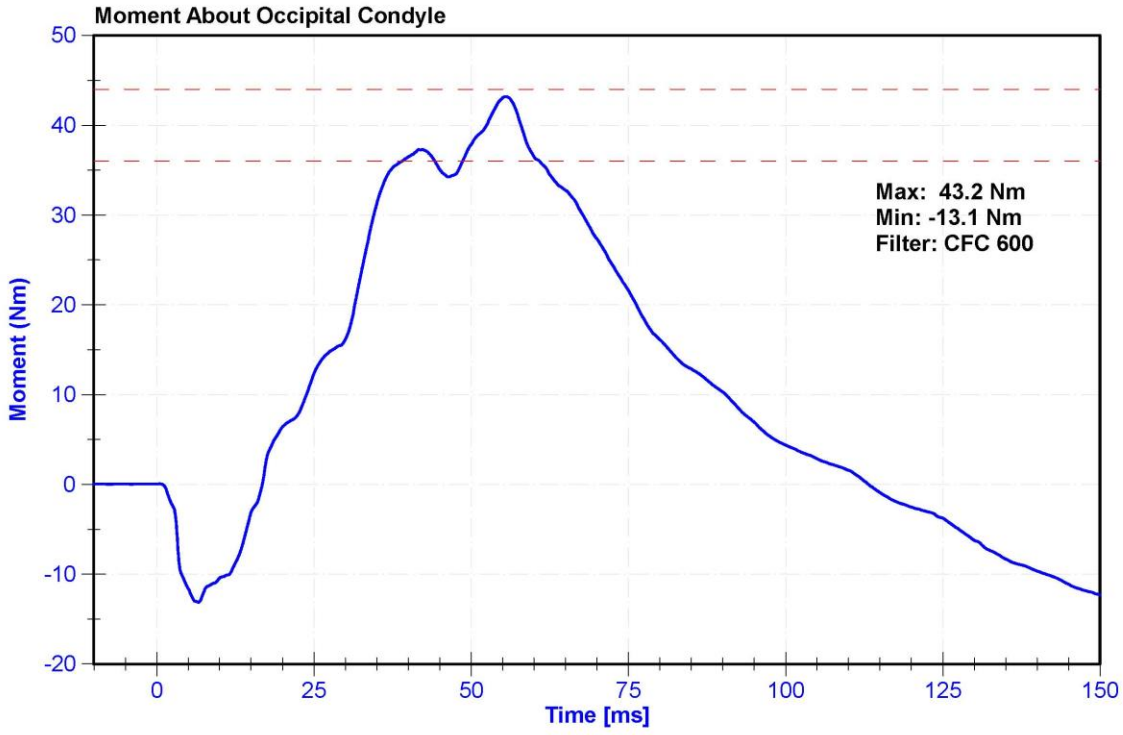
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	21.7	Pass
Velocity	5.51	5.63	m/s	5.549	Pass
Pendulum Impulse at 10ms	2.2	2.8	m/s	2.28	Pass
Pendulum Impulse at 15ms	3.3	4.1	m/s	3.40	Pass
Pendulum Impulse at 20ms	4.4	5.4	m/s	4.54	Pass
Pendulum Impulse at 25ms	5.4	6.1	m/s	5.43	Pass
Pendulum Impulse from 25 to 100ms	5.5	6.2	m/s	5.96	Pass
Neck Rotation	71	81	deg	73.0	Pass
Time at Maximum Rotation	50	70	ms	62.1	Pass
Moment about the OC	36	44	Nm	43.2	Pass
Moment Decay to 0 Nm	102	126	ms	113.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5M9 Pend	1/30/2020	1/29/2021
Pendulum Potentiometer	Denton 78051-342	DS-184Pend	11/4/2019	11/3/2020
Condyle Potentiometer	Denton 78051-342	DS-185Pend	11/4/2019	11/3/2020
Upper Neck Load Cell	Denton 1716A	LC-2192Fy	6/20/2019	6/19/2020




Neck Rotation
Max: 73.0 deg
Min: -18.9 deg
Filter: CFC 60
Rotation (Deg)
75
50
25
0
-25
-50
0
25
50
75
100
125
150
Time [ms]


Moment About Occipital Condyle
Max: 43.2 Nm
Min: -13.1 Nm
Filter: CFC 600
Moment (Nm)
50
40
30
20
10
0
-10
-20
0
25
50
75
100
125
150
Time [ms]

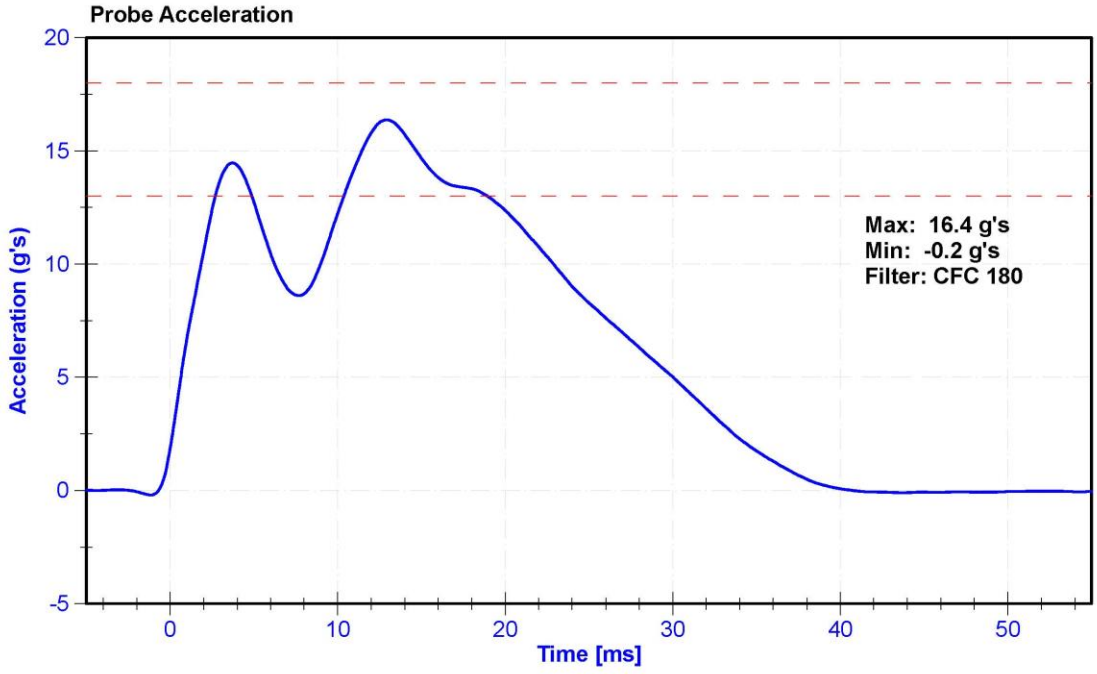
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

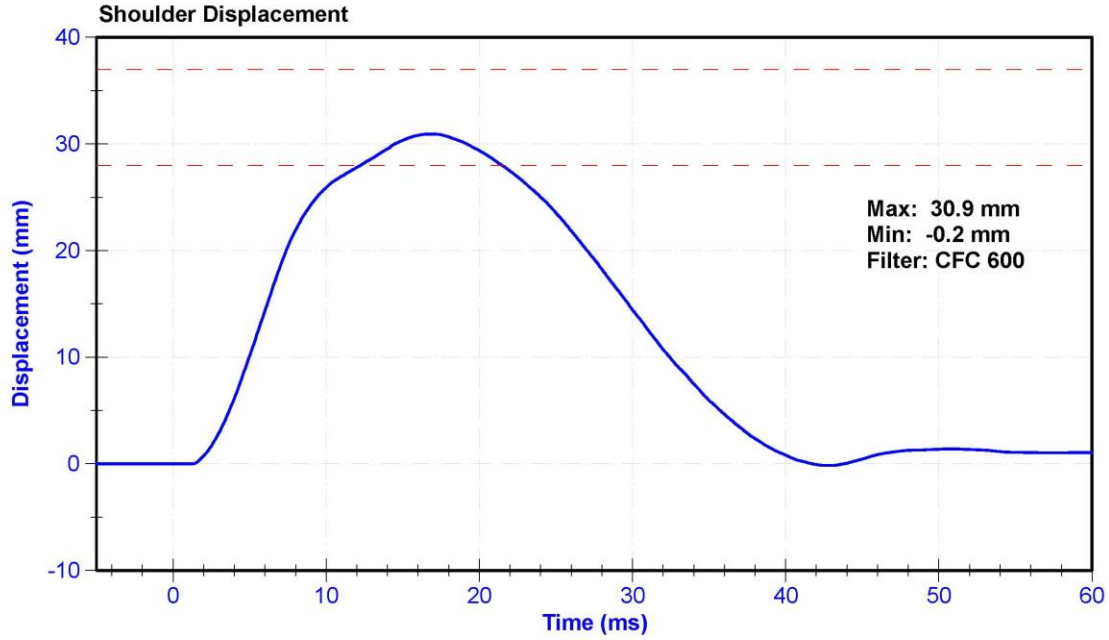
Results

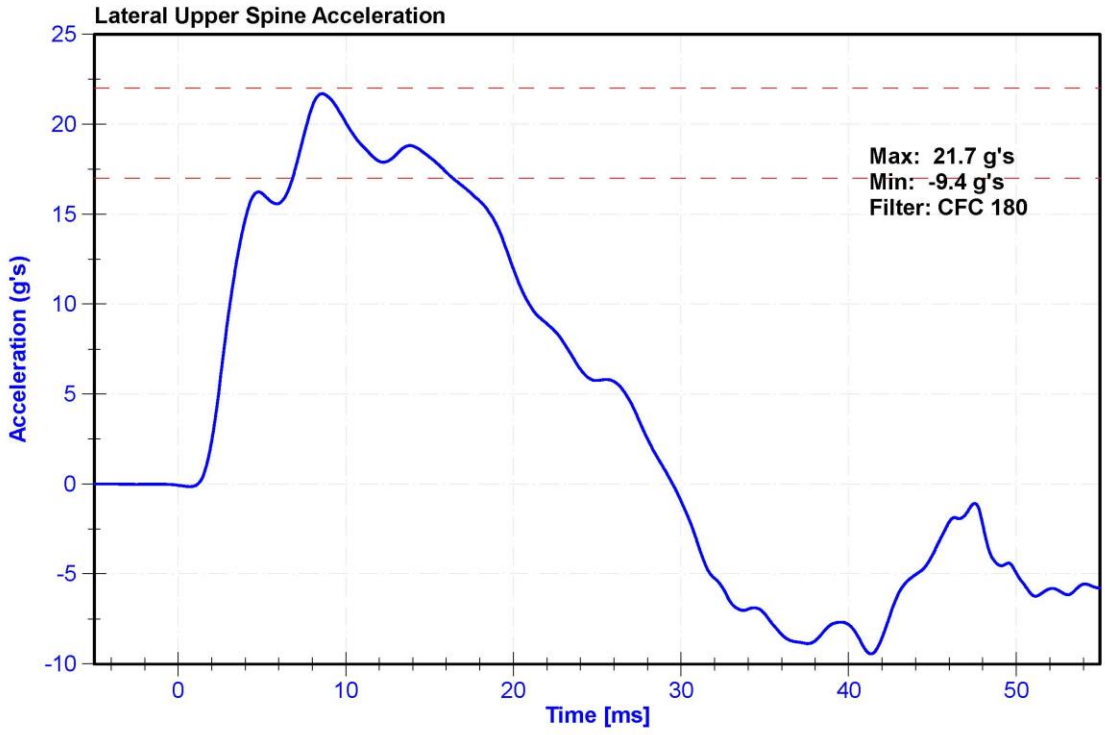
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	21.6	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Probe Acceleration	13	18	g's	16.4	Pass
Shoulder Deflection	28	37	mm	30.9	Pass
Lateral Upper Spine Acceleration	17	22	g's	21.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	7/29/2020
Shoulder Potentiometer	Servo 08TC1-3745	DS-1845GFE	10/28/2019	4/27/2020
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P64148	4/16/2020	10/15/2020




Shoulder Displacement
Displacement (mm)
Time (ms)
Max: 30.9 mm
Min: -0.2 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Acceleration (g's)
Time [ms]
Max: 21.7 g's
Min: -9.4 g's
Filter: CFC 180

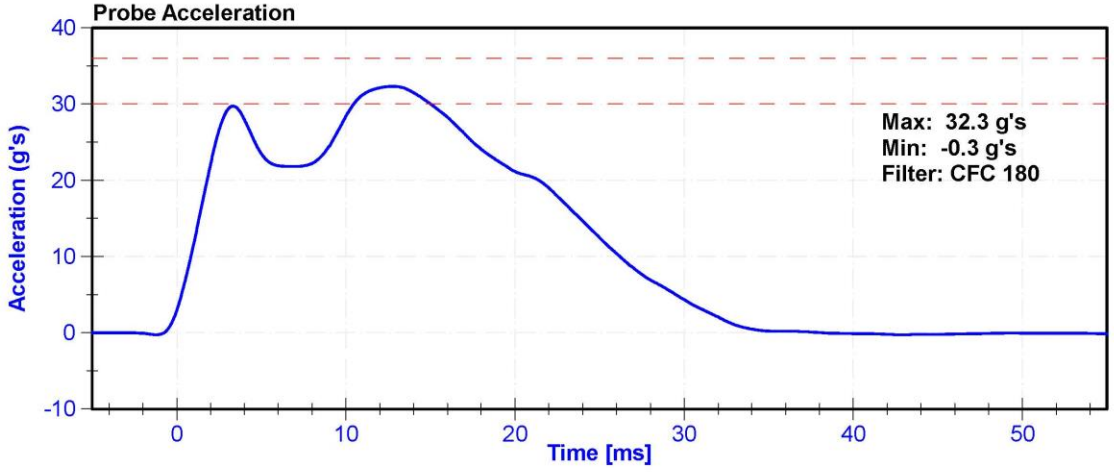
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

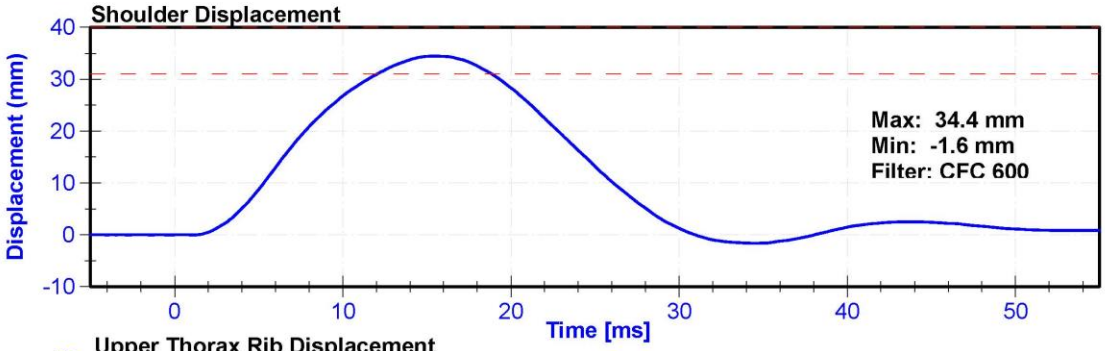
Results

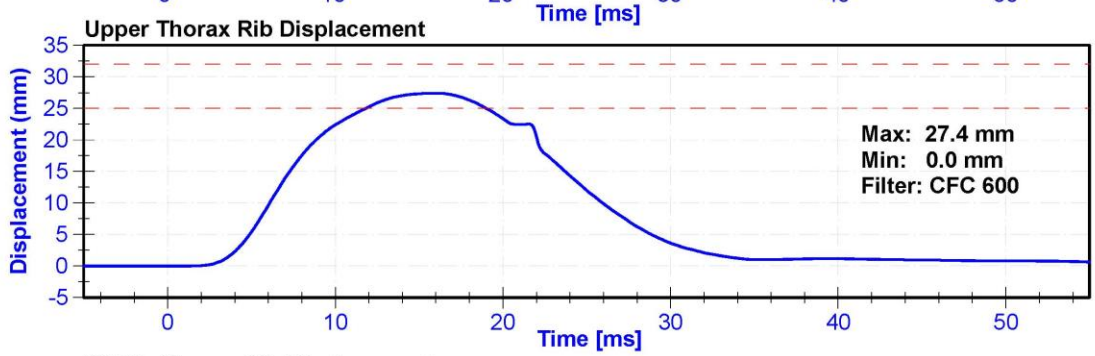
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	21.2	Pass
Humidity	10	70	%	20.6	Pass
Velocity	6.6	6.8	m/s	6.79	Pass
Probe Acceleration after 5 ms	30	36	g's	32.3	Pass
Lateral Upper Spine Acceleration	34	43	g's	39.6	Pass
Lateral Lower Spine Acceleration	29	37	g's	32.4	Pass
Shoulder Deflection	31	40	mm	34.4	Pass
Upper Thorax Rib Deflection	25	32	mm	27.4	Pass
Mid Thorax Rib Deflection	30	36	mm	31.9	Pass
Lower Thorax Rib Deflection	32	38	mm	35.9	Pass

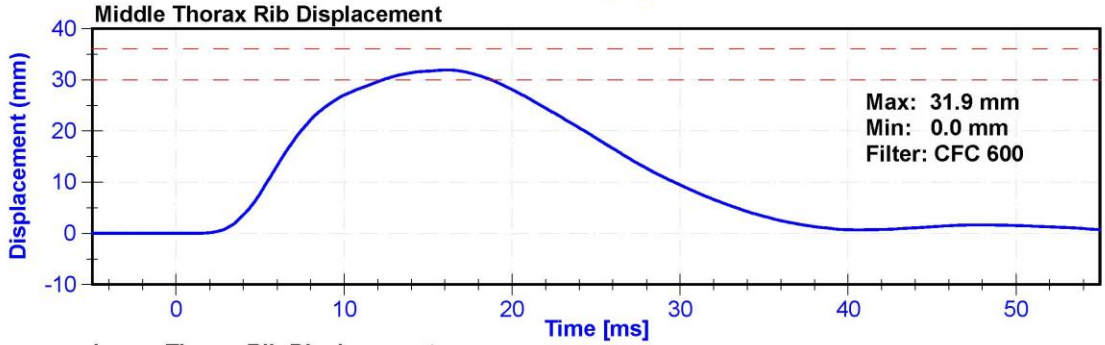
Transducer Calibrations

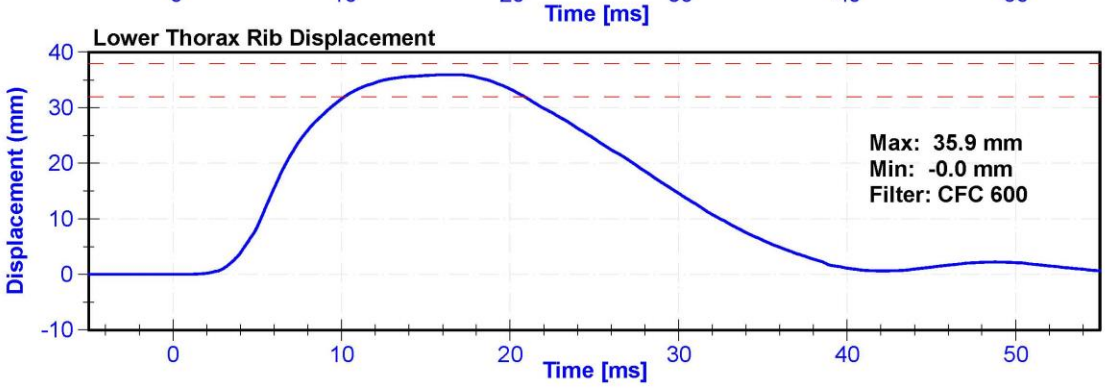
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	7/29/2020
Upper Spine T1 Y Accelerometer	ENDEVCO 7264CT	AC-P64148	4/16/2020	10/15/2020
Upper Spine T12 Y Accelerometer	ENDEVCO 7264CT	AC-P51327	4/16/2020	10/15/2020
Shoulder Potentiometer	Servo 08TC1-3745	DS-1845GFE	10/28/2019	4/27/2020
Upper Thorax Rib Potentiometer	Servo 1246	DS-2165GFE	10/28/2019	4/27/2020
Middle Thorax Rib Potentiometer	Servo 08TC1-3621	DS-45 GFE	10/28/2019	4/27/2020
Lower Thorax Rib Potentiometer	Servo 08TC1-3787	DS-011GFE	10/28/2019	4/27/2020

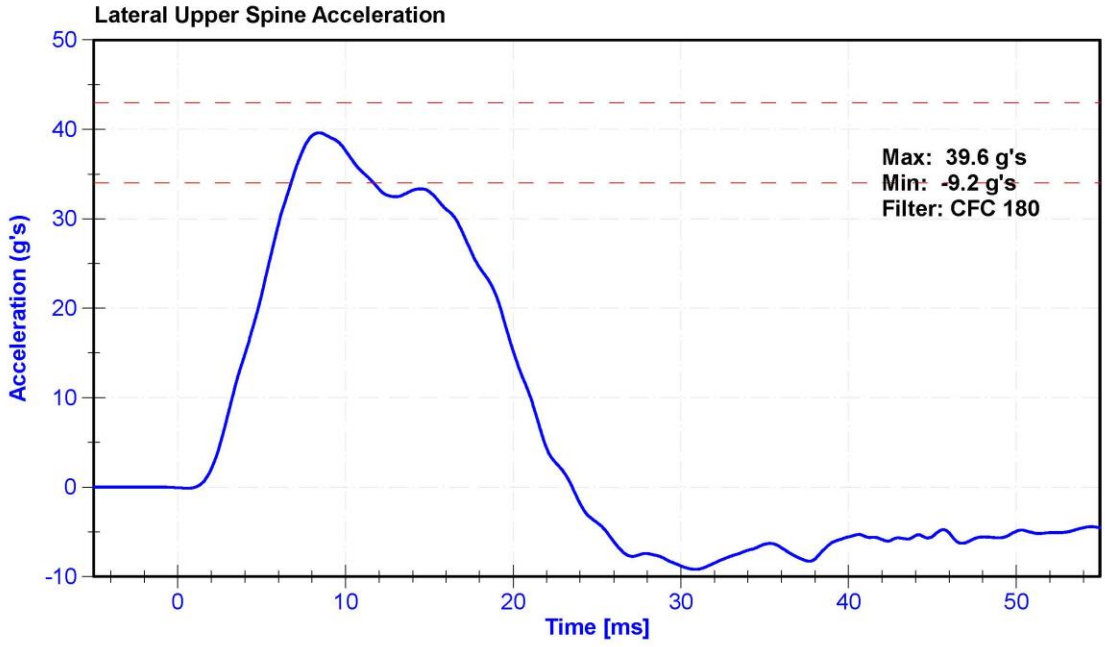


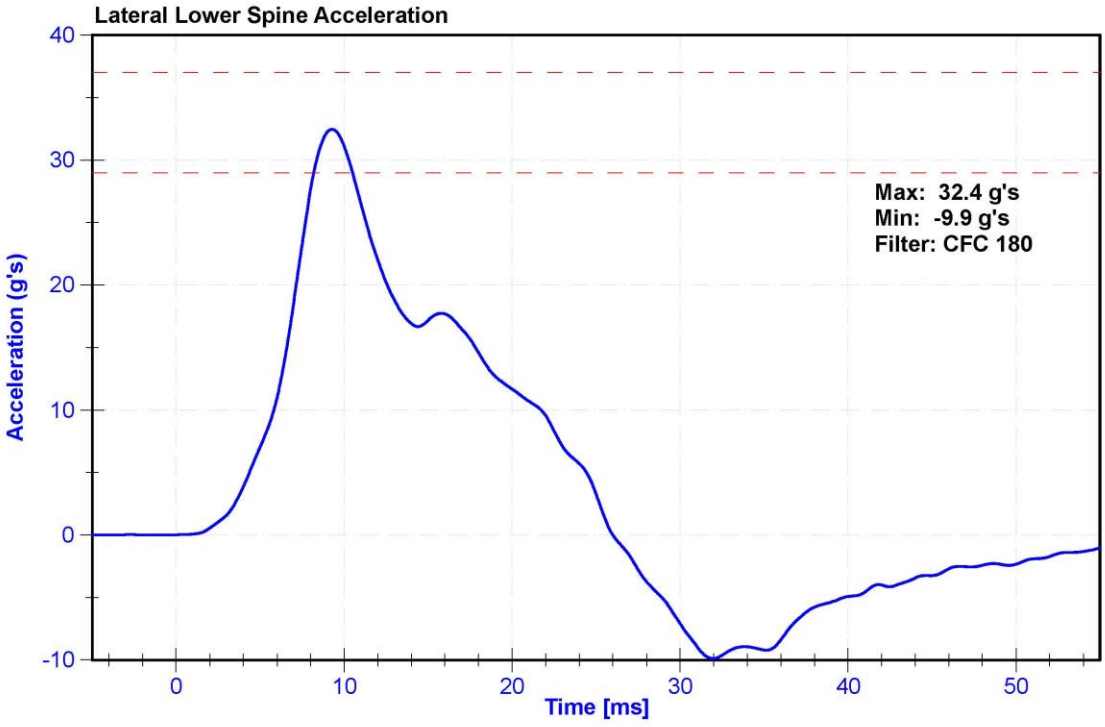

Shoulder Displacement
Displacement (mm)
Time [ms]
Max: 34.4 mm
Min: -1.6 mm
Filter: CFC 600


Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 27.4 mm
Min: 0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 31.9 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 35.9 mm
Min: -0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 39.6 g's
Min: -9.2 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
50
40
30
20
10
0
-10
0
10
20
30
40
50


Lateral Lower Spine Acceleration
Max: 32.4 g's
Min: -9.9 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
40
30
20
10
0
-10
0
10
20
30
40
50

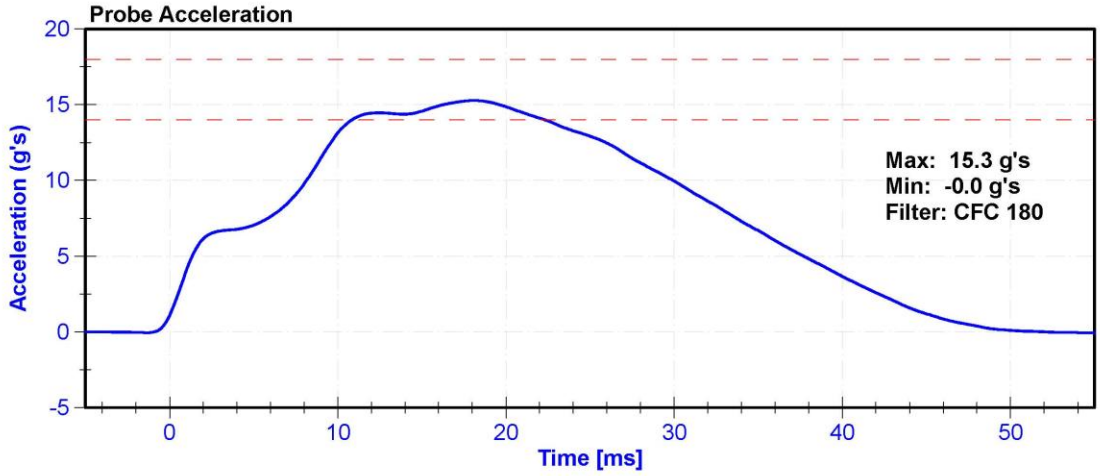
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

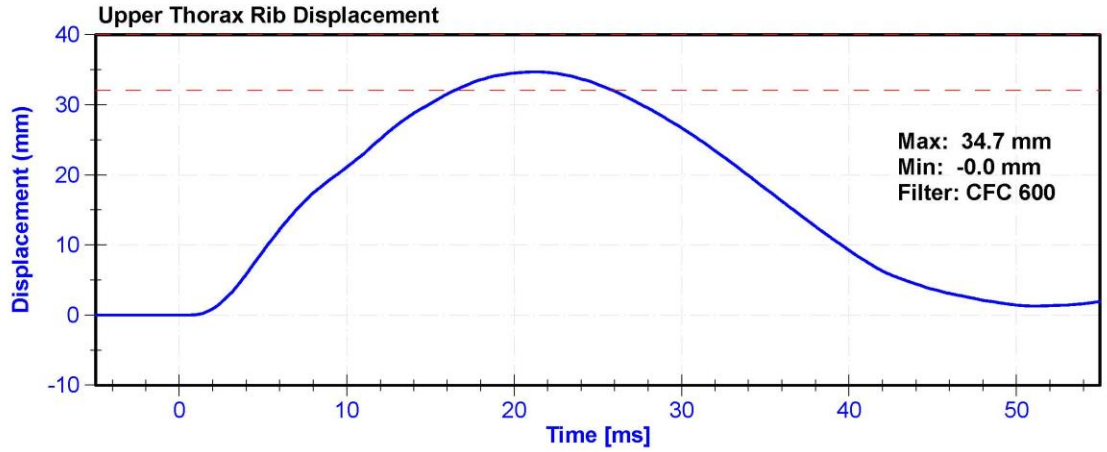
Results

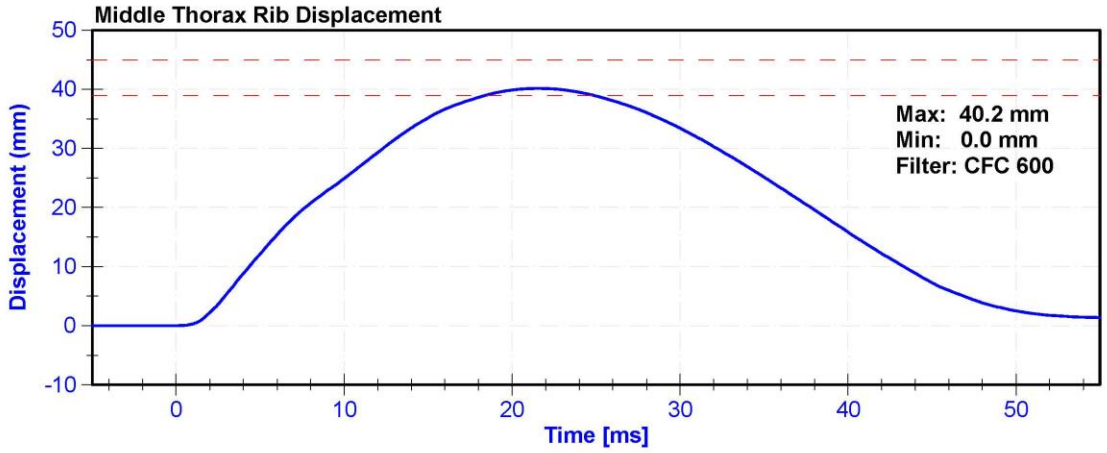
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.9	Pass
Humidity	10	70	%	20.5	Pass
Velocity	4.2	4.4	m/s	4.23	Pass
Probe Acceleration	14	18	g's	15.3	Pass
Lateral Upper Spine Acceleration	13	17	g's	14.1	Pass
Lateral Lower Spine Acceleration	7	11	g's	8.9	Pass
Upper Thorax Rib Deflection	32	40	mm	34.7	Pass
Middle Thorax Rib Deflection	39	45	mm	40.2	Pass
Lower Thorax Rib Deflection	35	43	mm	39.8	Pass

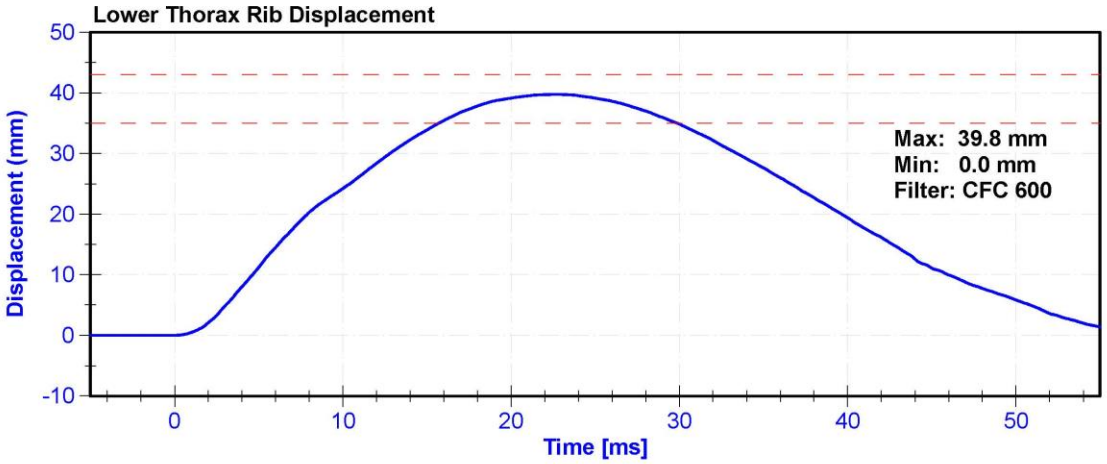
Transducer Calibrations

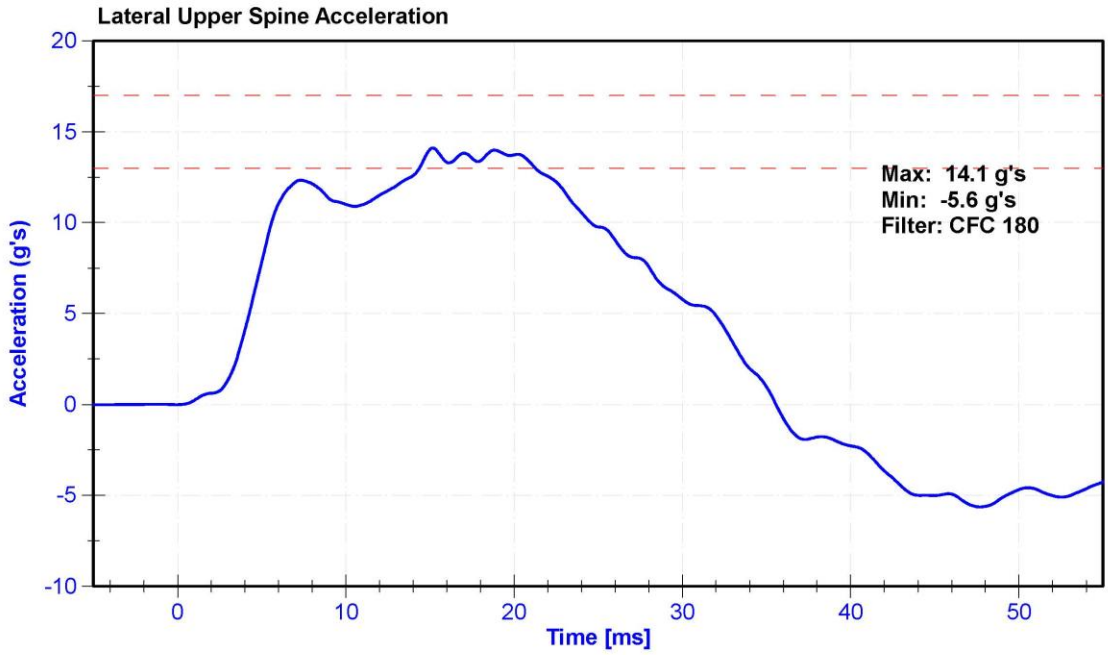
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	7/29/2020
Upper Spine Y Accelerometer	ENDEVCO 7264CT	AC-P64148	4/16/2020	10/15/2020
Lower Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51327	4/16/2020	10/15/2020
Upper Thorax Rib Potentiometer	Servo 1246	DS-2165GFE	10/28/2019	4/27/2020
Middle Thorax Rib Potentiometer	Servo 08TC1-3621	DS-45 GFE	10/28/2019	4/27/2020
Lower Thorax Rib Potentiometer	Servo 08TC1-3787	DS-011GFE	10/28/2019	4/27/2020

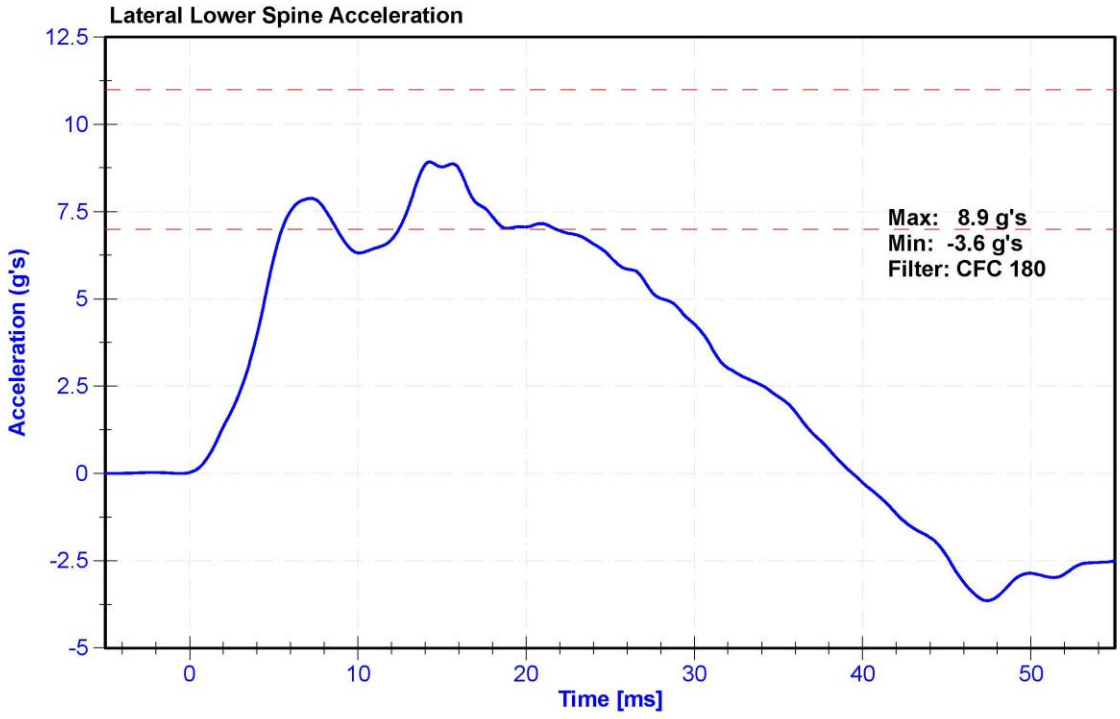



Upper Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 34.7 mm
Min: -0.0 mm
Filter: CFC 600


Middle Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 40.2 mm
Min: 0.0 mm
Filter: CFC 600


Lower Thorax Rib Displacement
Displacement (mm)
Time [ms]
Max: 39.8 mm
Min: 0.0 mm
Filter: CFC 600


Lateral Upper Spine Acceleration
Max: 14.1 g's
Min: -5.6 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: 8.9 g's
Min: -3.6 g's
Filter: CFC 180
Acceleration (g's)
Time [ms]
12.5
10
7.5
5
2.5
0
-2.5
-5
0
10
20
30
40
50

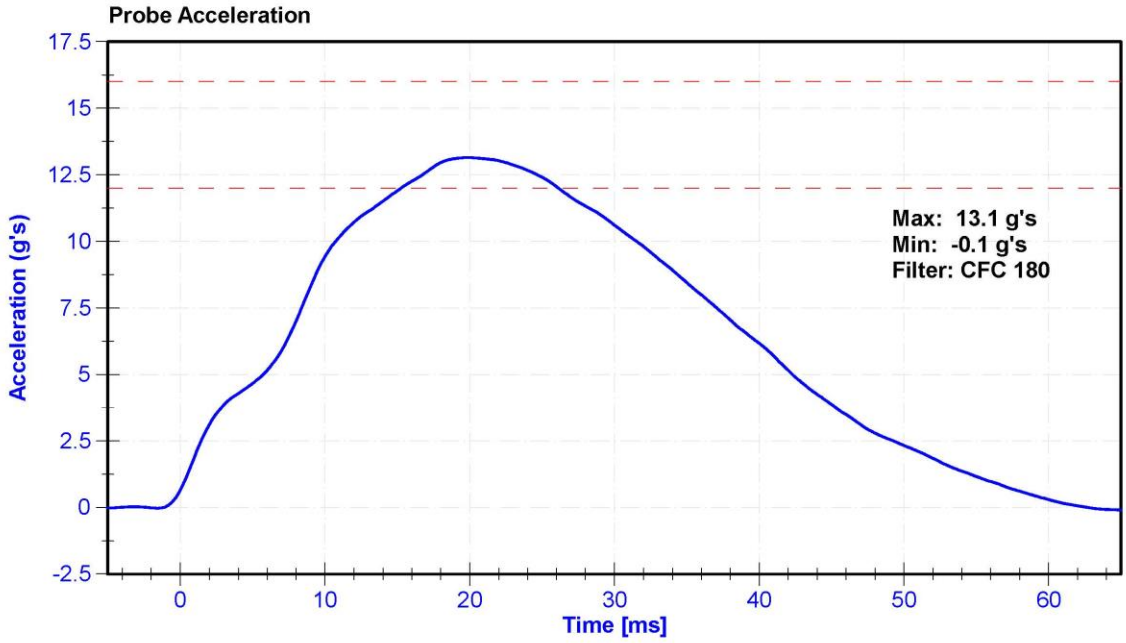
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

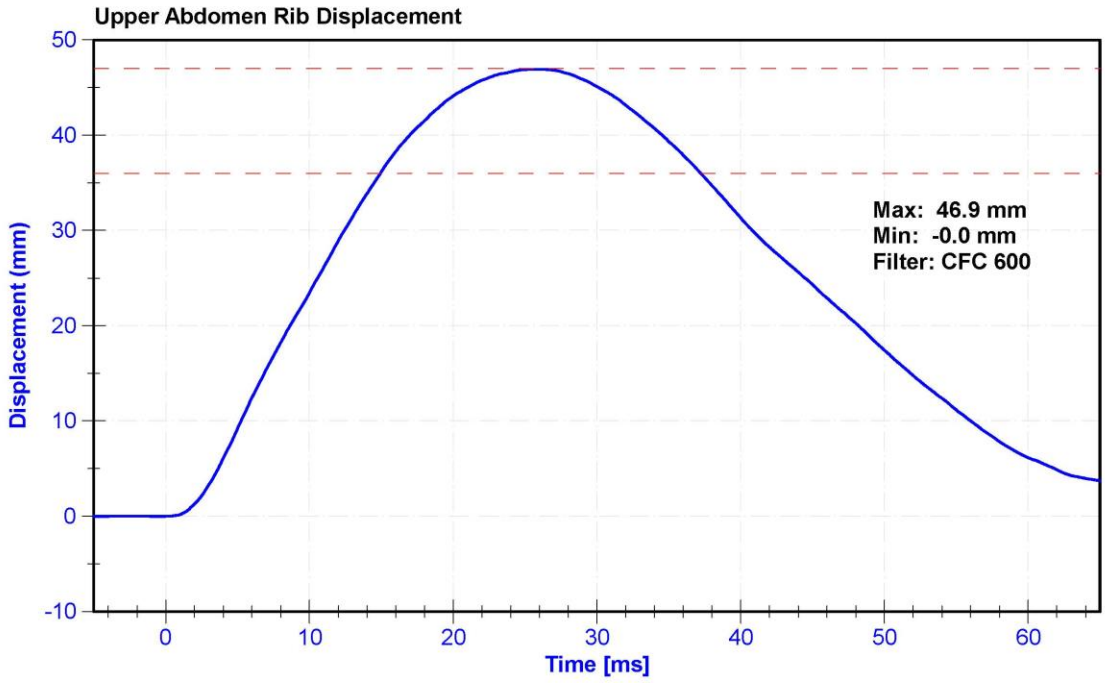
Results

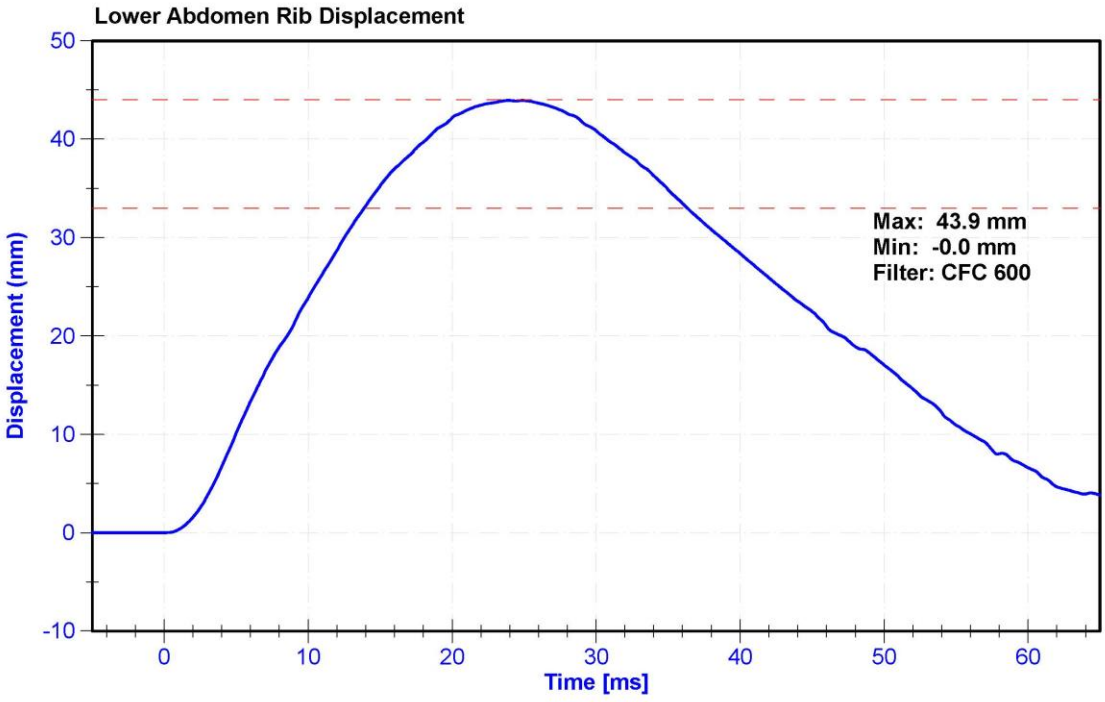
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.7	Pass
Humidity	10	70	%	20.3	Pass
Velocity	4.2	4.4	m/s	4.23	Pass
Probe Acceleration	12	16	g's	13.1	Pass
Lateral Lower Spine Acceleration	9	14	g's	10.0	Pass
Upper Abdomen Rib Deflection	36	47	mm	46.9	Pass
Lower Abdomen Rib Deflection	33	44	mm	43.9	Pass

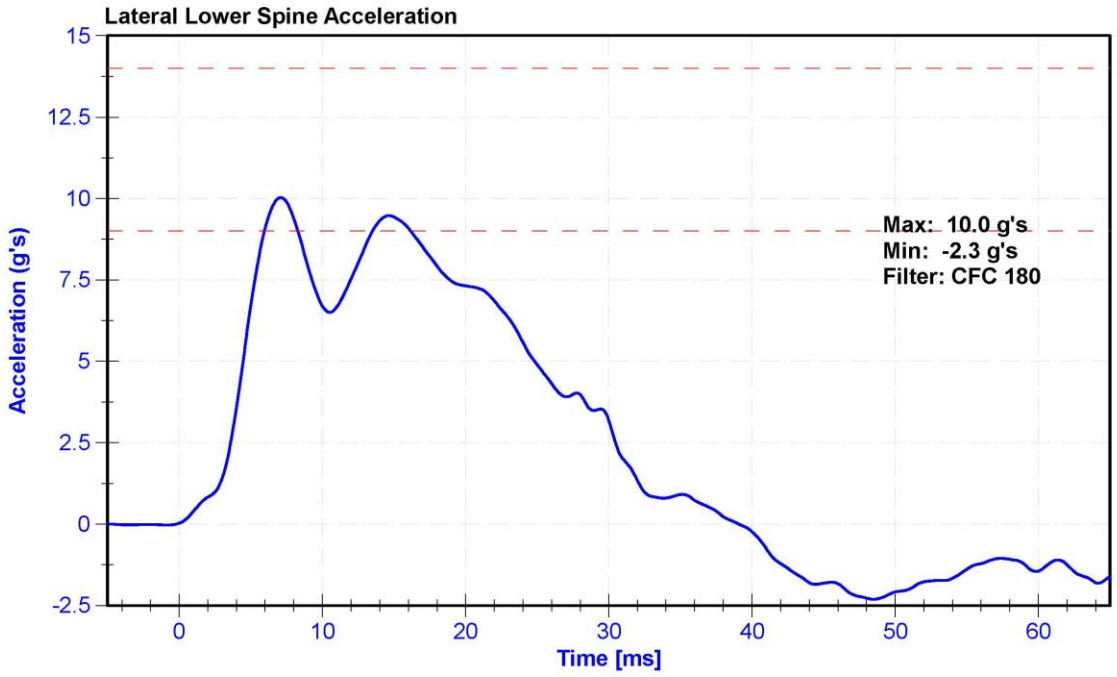
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	MSI 64C-2000	A286228	1/29/2020	7/29/2020
Lower Spine Y Accelerometer	ENDEVCO 7264CT	AC-P51327	4/16/2020	10/15/2020
Upper Abdomen Rib Potentiometer	Servo 08TC1-3725	DS-008GFE	10/28/2019	4/27/2020
Lower Abdomen Rib Potentiometer	Servo 08TC1-3745	DS-1774GFE	10/28/2019	4/27/2020




Upper Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 46.9 mm
Min: -0.0 mm
Filter: CFC 600


Lower Abdomen Rib Displacement
Displacement (mm)
Time [ms]
Max: 43.9 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
0
10
20
30
40
50
60
Time [ms]
Max: 10.0 g's
Min: -2.3 g's
Filter: CFC 180

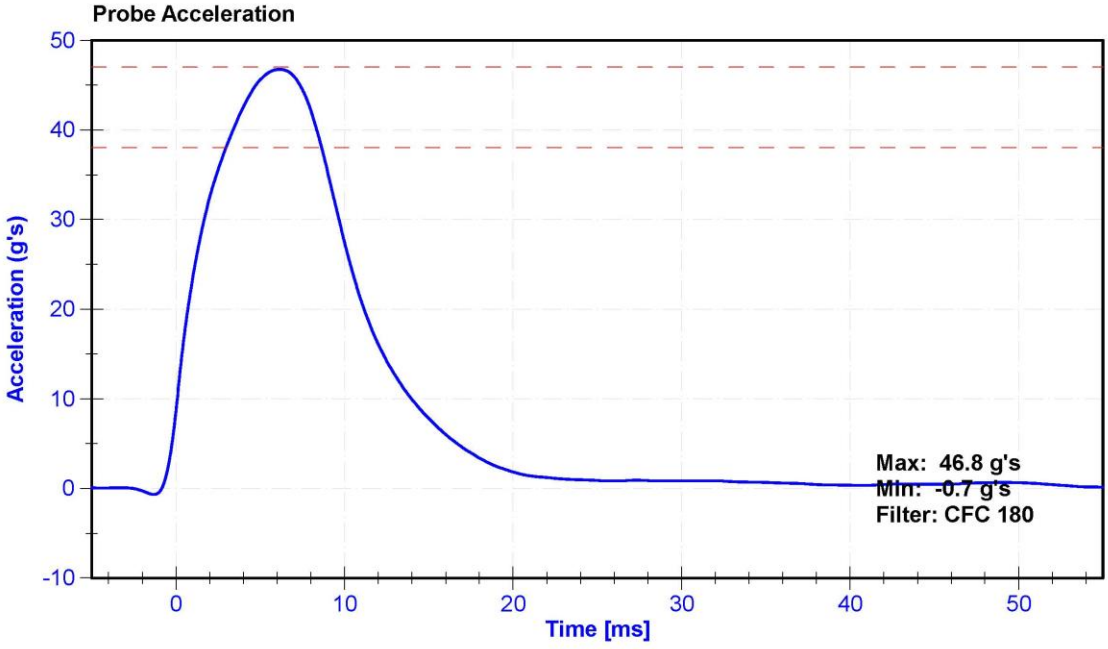
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

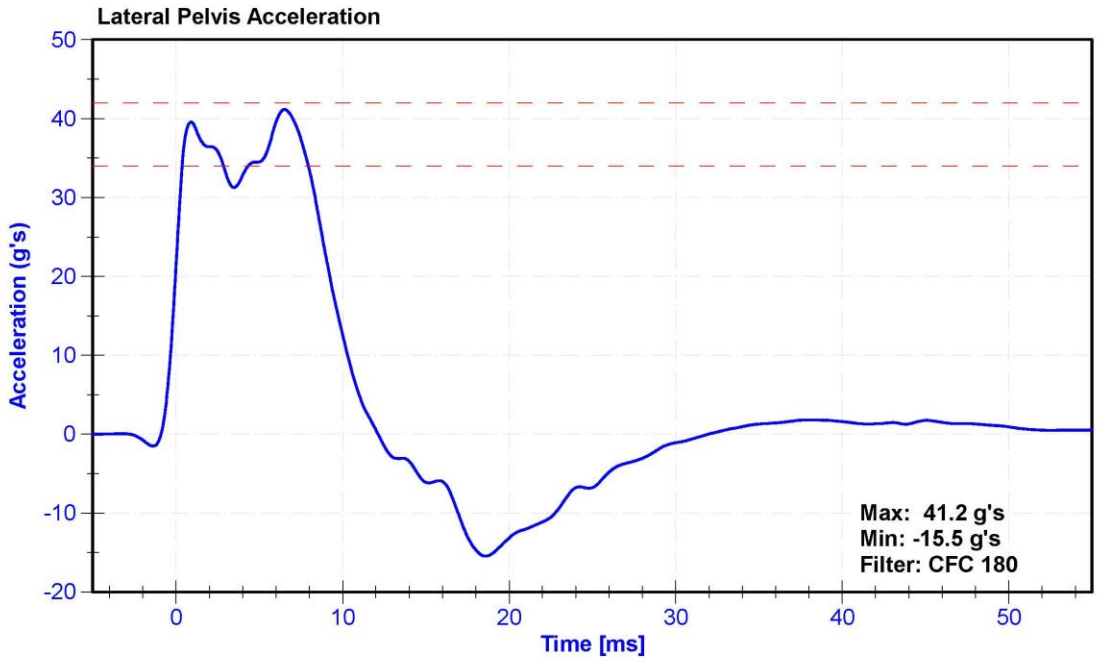
Results

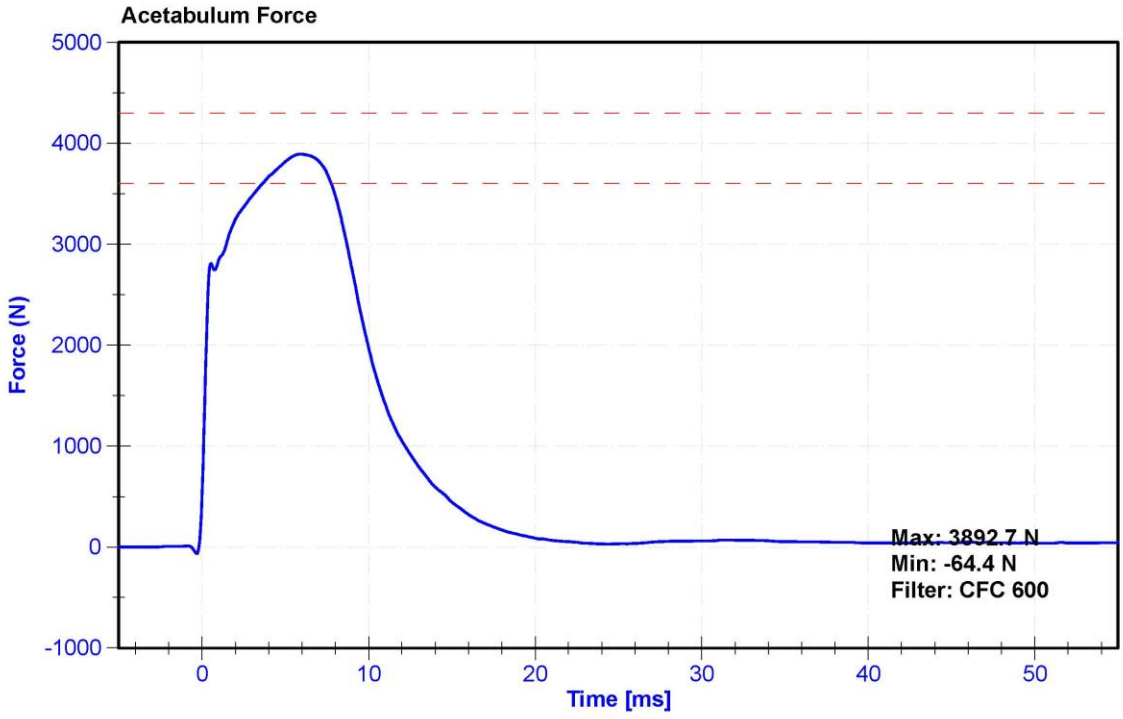
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.8	Pass
Humidity	10	70	%	38.2	Pass
Velocity	6.6	6.8	m/s	6.64	Pass
Probe Acceleration	38	47	g's	46.8	Pass
Lateral Pelvis Acceleration after 6ms	34	42	g's	41.2	Pass
Acetabulum Force	3600	4300	N	3892.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	7/29/2020
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51875	4/16/2020	10/15/2020
Acetabulum Load Cell	Denton 3249J	LC-4986Fy	6/14/2019	6/13/2020
Certification Plug	SACO	13403	9/20/2019	N/A
Crash Test Plug	SACO	13175	8/08/2019	N/A




Lateral Pelvis Acceleration
Acceleration (g's)
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
Time [ms]
Max: 41.2 g's
Min: -15.5 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: 3892.7 N
Min: -64.4 N
Filter: CFC 600

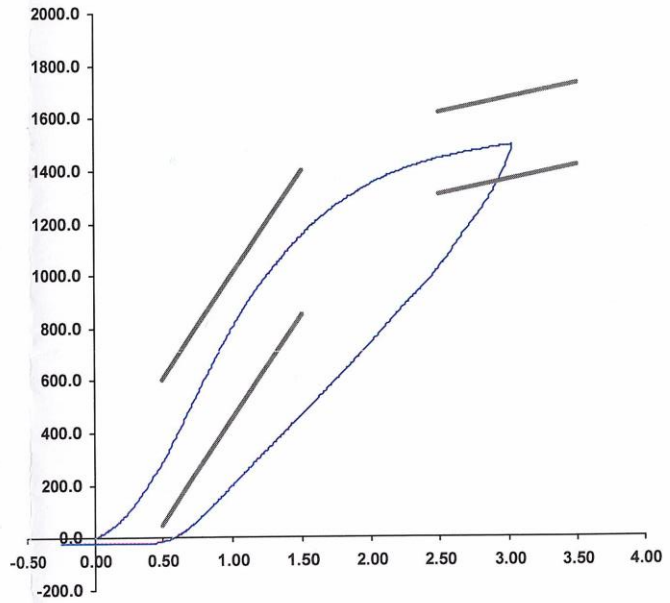
DG8012
Certy
4/22/2020

SID-IIs Pelvis Plug Certification Test

Plug S/N 13403
Test Number 11045
Report Number 11083
Test Date 9/20/2019 7:06:57 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	297.31	50.00	600.00
Force @ 1.5 mm (N)	1,156.05	850.00	1,400.00
Force @ 2.5 mm (N)	1,445.28	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,492.96	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



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

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

Notes:

Operator

Part Number 180-4450

Template No 107 20-Sep-19
SACO Research

By : DC Date : 9/20/2019

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

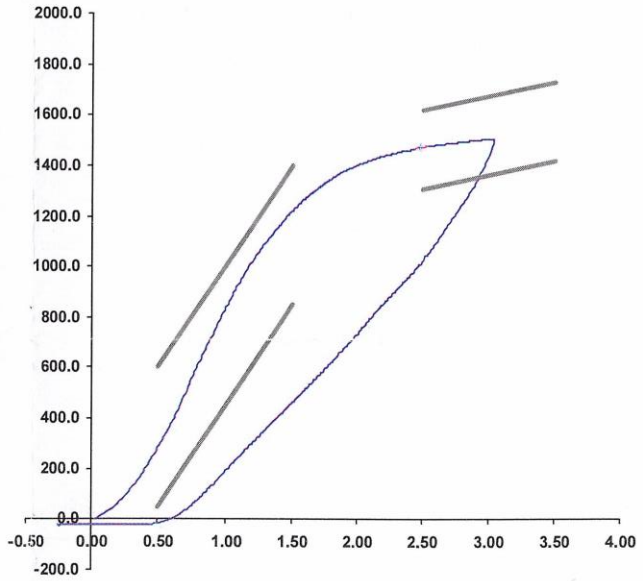
Crash DG 8012
4/22/20

SID-IIs Pelvis Plug Certification Test

Plug S/N 13175
Test Number 10570
Report Number 10605
Test Date 8/8/2019 11:15:18 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	289.05	50.00	600.00
Force @ 1.5 mm (N)	1,217.98	850.00	1,400.00
Force @ 2.5 mm (N)	1,471.35	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,504.60	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



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

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

Notes:

Operator

Part Number 180-4450

Template No 107 **08-Aug-19**
SACO Research

By : DC Date : 8/8/2019

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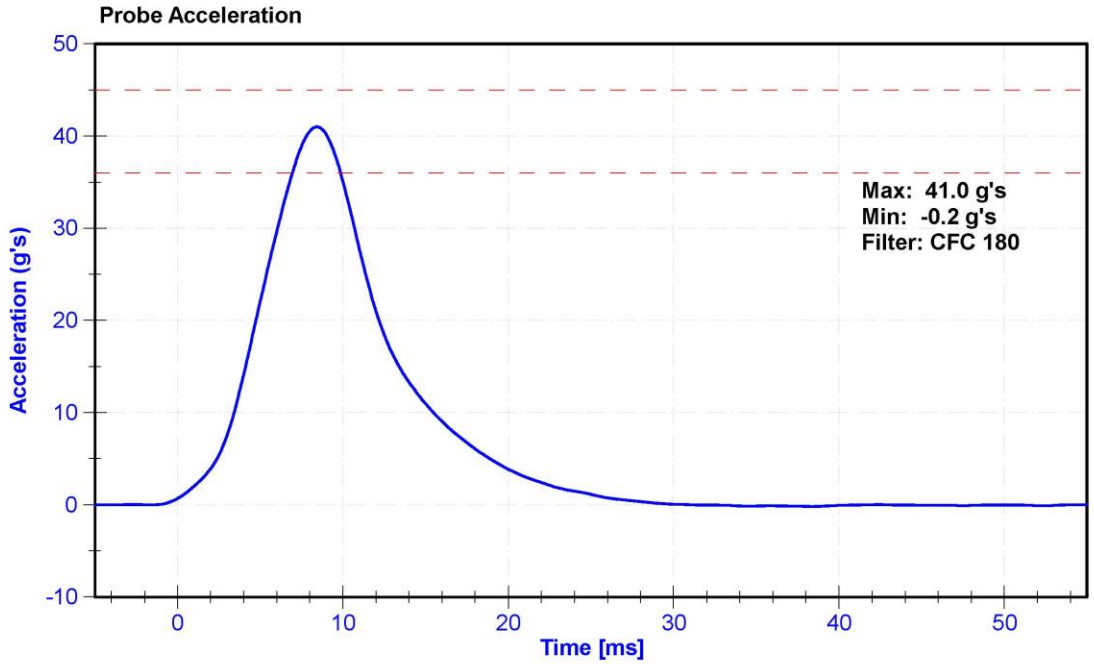
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG8012	Laboratory Supervisor	K. Brogan

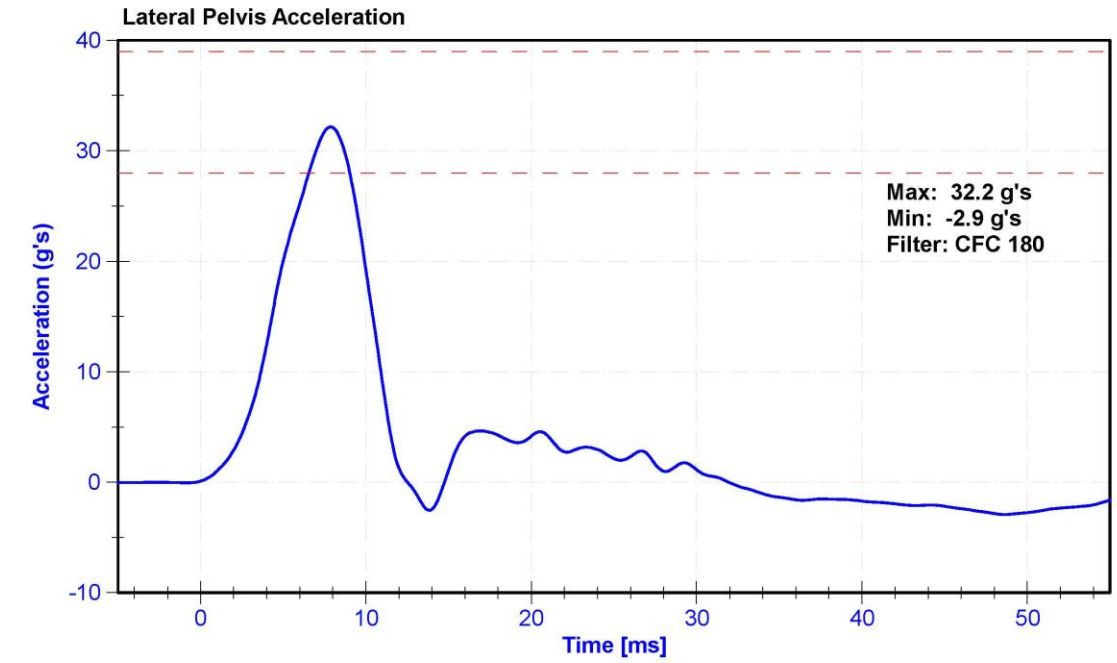
Results

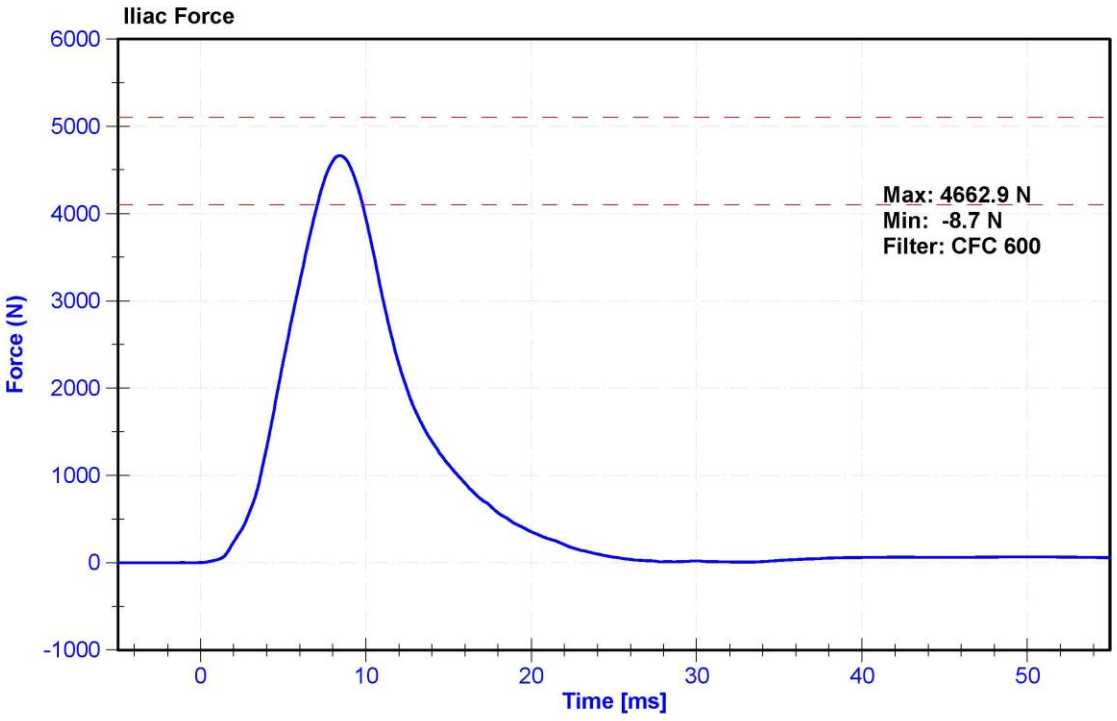
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	ºC	20.6	Pass
Humidity	10	70	%	22.7	Pass
Velocity	4.2	4.4	m/s	4.37	Pass
Probe Acceleration	36	45	g's	41.0	Pass
Lateral Pelvis Acceleration	28	39	g's	32.2	Pass
Iliac Force	4100	5100	N	4662.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	MSI 64C-2000	A286228	1/29/2020	7/29/2020
Pelvis Y Accelerometer	ENDEVCO 7264CT	AC-P51875	4/16/2020	10/15/2020
Iliac Load Cell	DENTON 3228J	LC-290Fy	9/25/2019	9/24/2020




Lateral Pelvis Acceleration
Acceleration (g's)
Time [ms]
Max: 32.2 g's
Min: -2.9 g's
Filter: CFC 180


Iliac Force
Force (N)
Time [ms]
Max: 4662.9 N
Min: -8.7 N
Filter: CFC 600

APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N: DG8012		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers			X	AC-P74788	ENDEVCO	4/16/2020
			Y	AC-P83432	ENDEVCO	4/16/2020
			Z	AC-P83319	ENDEVCO	4/16/2020
Head Accelerometers - Redundant			X	AC-P80334	ENDEVCO	4/16/2020
			Y	AC-P52155	ENDEVCO	4/16/2020
			Z	AC-P83322	ENDEVCO	4/16/2020
Displacement Potentiometer	Shoulder		Y			
	Thoracic Rib	Upper	Y	DS-2165GFE	Servo	10/28/2019
		Middle	Y	DS-45 GFE	Servo	10/28/2019
		Lower	Y	DS-011GFE	Servo	10/28/2019
	Abdominal Rib	Upper	Y	DS-008GFE	Servo	10/28/2019
		Lower	Y	DS-1774GFE	Servo	10/28/2019
Lower Spine Accelerometers (T12)			X	AC-P52040	ENDEVCO	4/16/2020
			Y	AC-P51327	ENDEVCO	4/16/2020
			Z	AC-P52067	ENDEVCO	4/16/2020
Acetabulum Load Cell			Y	LC-4986Fy	Denton	6/14/2019
Lilac Wing Load Cell			Y	LC-290Fy	Denton	9/25/2019
Pelvis Plug (Struck Side)				11917	SACO	1/31/2018
Pelvis Plug (Non-Struck Side)						

Table 2 – Vehicle Instrumentation

Vehicle Instrumentation		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	AC-A280188	MSI 1201-1000	3/30/2020
Vehicle Center of Gravity	Y	AC-A280928	MSI 1201-1000	2/22/2020
Vehicle Center of Gravity	Z	AC-A281012	MSI 1201-1000	2/22/2020
Left Floor Sill	Y	AC-A280939	MSI 1201-1000	2/22/2020
A-Pillar Sill	Y	AC-A280180	MSI 1201-1000	11/5/2019
A-Pillar Low	Y	A315839	MSI 1201-1000	2/4/2020
A-Pillar Mid	Y	A315848	MSI 1201-1000	1/28/2020
B-Pillar Sill	Y	AC-A280342	MSI 1201-1000	4/2/2020
B-Pillar Low	Y	AC-A280187	MSI 1201-1000	4/2/2020
B-Pillar Mid	Y	A315956	MSI 1201-1000	2/5/2020
Driver Seat	Y	AC-A280903	MSI 1201-1000	4/2/2020
Engine Top	X	AC-A280385	MSI 1201-1000	1/28/2020
Engine Top	Y	AC-A280964	MSI 1201-1000	1/28/2020
Firewall	Y	AC-A280901	MSI 1201-1000	2/26/2020
Right Roof	Y	AC-A279998	MSI 1201-1000	3/6/2020
Right Floor Sill	Y	A315082	MSI 1201-1000	3/26/2020
Rear Floorpan	X	A315941	MSI 1201-1000	3/7/2020
Rear Floorpan	Y	A315959	MSI 1201-1000	3/7/2020

Table 3 – Pole Instrumentation

Pole Instrumentation	Serial Number	Manufacturer	Calibration Date
Load Cell 1	LC_1117012	Interface	10/16/2019
Load Cell 2	LC_1117023	Interface	10/25/2019
Load Cell 3	LC_1117025	Interface	10/25/2019
Load Cell 4	LC_1117019	Interface	10/25/2019
Load Cell 5	LC_1117011	Interface	10/25/2019
Load Cell 6	LC_1117017	Interface	10/25/2019
Load Cell 7	LC_1117035	Interface	10/25/2019
Load Cell 8	LC_1117006	Interface	10/7/2019