

REPORT NUMBER: 214D-CAL-19-002

**SAFETY COMPLIANCE TESTING FOR FMVSS 214
SIDE IMPACT PROTECTION**

**Hyundai Motor Company
2019 Hyundai Veloster
Four Door Hatchback**

NHTSA No: C20194204

**PREPARED BY:
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February 5, 2019

FINAL REPORT

**PREPARED FOR:
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NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-17-D-00078.

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FINAL REPORT ACCEPTANCE BY OVSC:

James A. Jones

Accepted by

Date: 3-21-2019

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. 214D-CAL-19-002	2. Government Accession No.	3. Recipient's Catalog No.																								
4. Title and Subtitle Final Report of 214D Compliance Test Side Impact Protection Testing of 2019 Hyundai Veloster NHTSA No.: C20194204		5. Report Date February 5, 2019																								
		6. Performing Organization Code CAL																								
7. Author(s) Vanessa Hansen, Operations Manager Edward Dutton, Director of Transportation Test Operations		8. Performing Organization Report No. CAL-DOT-2019-002																								
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. DTNH22-17-D-00078																								
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Enforcement Office of Vehicle Safety Compliance 1200 New Jersey Ave., SE, Room W43-503 Washington, D.C. 20590		13. Type of Report and Period Covered: Final Test Report, December 14, 2018 - February 5, 2019																								
		14. Sponsoring Agency Code NEF-240																								
15. Supplementary Notes																										
16. Abstract A 48/24 kph 90° Impact (Moving Deformable Barrier) Compliance Tests was conducted on the subject 2019 Hyundai Veloster four door hatchback in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-214D-09 for the determination of FMVSS No. 214 Side Impact Protection compliance. The test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on December 14, 2018. The impact velocity of the Moving Deformable Barrier (MDB) was 52.68 kph, and the ambient temperature at the struck side (driver side) of the target vehicle at the time of impact was 21°C. The target vehicle post-test maximum crush was 167 mm at level 2. The test vehicle's occupant performance is as follows: <table border="1" data-bbox="209 1148 1398 1346"> <thead> <tr> <th rowspan="2">Measurement Description</th><th colspan="3">Driver ATD (ES-2re)</th></tr> <tr> <th>Units</th><th>IARV</th><th>Result</th></tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₃₆)</td><td>N/A</td><td>1000</td><td>187.782</td></tr> <tr> <td>Maximum Rib Deflection</td><td>mm</td><td>44</td><td>19.917</td></tr> <tr> <td>Sum of Abdominal Forces</td><td>N</td><td>2500</td><td>799.864</td></tr> <tr> <td>Pubic Symphysis Force</td><td>N</td><td>6000</td><td>1788.634</td></tr> </tbody> </table> 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.				Measurement Description	Driver ATD (ES-2re)			Units	IARV	Result	Head Injury Criteria (HIC ₃₆)	N/A	1000	187.782	Maximum Rib Deflection	mm	44	19.917	Sum of Abdominal Forces	N	2500	799.864	Pubic Symphysis Force	N	6000	1788.634
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17. Key Words Compliance Testing Side Impact Protection MDB ES-2re SID-IIs		18. Distribution Statement <u>Copies of this report are available from:</u> National Highway Traffic Safety Administration Technical Information Services (TIS) Room E12-100 East Bldg. 1200 New Jersey Ave. Washington, D.C. 20590 Telephone No. (202) 366-2588																								
19. Security Class. (of this report) UNCLASSIFIED	20. Security Class. (of this page) UNCLASSIFIED	21. No. of Pages 239	22. Price																							

Form DOT F1700.7 (8-72)

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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This moving deformable barrier side impact test was conducted as part of the MY 2019 214 Side Impact Protection Compliance Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-17-D-00078. The purpose of this test was to evaluate side impact protection in a 2019 Hyundai Veloster four door hatchback. The side impact test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure, TP-214D-09 dated September 2012.

SUMMARY

A 2019 Hyundai Veloster four door hatchback was impacted on the left side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 52.68 kph (32.73 mph). The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by the Calspan Corporation's Transportation Test Operations Center in Buffalo, New York on December 14, 2018. Pre-test and post test photographs of the test vehicle, the MDB and test dummies are included in this report.

Test dummies were placed in both the driver and left rear designated seating positions according to instructions specified in the OVSC Test Procedure data September 2012. The side impact event was documented by 9 cameras. Camera locations and other pertinent camera information are included in this report.

The ES2re male dummy was instrumented with triaxial accelerometer packs located in the head, three rib displacement transducers located in the chest, three load cells located in the abdomen and a load cell located in the pubic symphysis.

The SID-1Is female dummy for this test was a ballast dummy and was not instrumented. A summary of each dummy's configuration and performance verification test data has been included in this report along with the dummy response traces.

Injury readings for the dummies were recorded as follows:

INJURY READINGS

ES-2re Injury Criteria	Units	Max. Allowable IARV	Measured Value	Pass/Fail
HIC		1000	187.782	Pass
Upper Rib Deflection	mm	44	12.711	Pass
Mid Rib Deflection	mm		15.622	Pass
Lower Rib Deflection	mm		19.917	Pass
Abdominal Load (front)	N		148.203	
Abdominal Load (mid)	N		304.222	
Abdominal Load (rear)	N		370.935	
Sum of Abdomen Forces	N	2500	799.864	Pass
Pubic Symphysis	N	6000	1788.634	Pass

SECTION 2

OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

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DATA SHEET NO. 1
TEST VEHICLE INFORMATION AND OPTIONS

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20194204
 Test Date: 12/14/2018

TEST VEHICLE INFORMATION AND OPTIONS

Make	Hyundai	Anti-Lock Brakes (ABS)	Yes
Model	Veloster	All-Wheel Drive (AWD)	No
Body Style	4 Door Hatchback	Traction Control System (TCS)	Yes
VIN	KMHTG6AF6KU005788	Electric Stability Control (ECS)	Yes
Body Color	Black	Side Curtain Airbags	Yes
Engine Displacement (L)	2.0	Torso Airbags – Front Seats	Yes
Type/No. Cylinders	I4	Torso Airbags – Rear Seats	No
Engine Placement	Transverse	Combination/Head Torso Bag	No
Transmission Type	Automatic	Pelvic Airbag – Front Seats	No
Transmission Speeds	6-Speed	Pelvis Airbag – Rear Seats	No
Overdrive	Yes	Knee Airbag – Driver	No
Final Drive	Front Wheel Drive	Knee Airbag – Front Passenger	No
Odometer Reading	80 miles	Seat Belt Pretensioners – Front Seats	Yes
		Seat Belt Pretensioners – Rear Seats	No
		Seat Belt Load Limiter – Front Seats	Yes
		Seat Belt Load Limiter – Rear Seats	No
		Tire Pressure Monitoring System (TPMS)	Yes
		Tilt Steering Wheel	Yes
		Automatic Door Locks (ADL)	Yes
		Power Window Auto-reverse	No
		Power Seats	No

DATA FROM CERTIFICATION LABEL

Manufactured By	Hyundai Motor Company	GVWR (kg)	1700
Date of Manufacture	APR/27/18	GAWR Front (kg)	990
Vehicle Type	Passenger Car	GAWR Rear (kg)	820

VEHICLE SEATING AND CAPACITY WEIGHT DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats (Bench or Bucket)	Bucket	Split Bench	N/A	
Designated Seating Capacity (DSC)	2	2	-	4
Capacity Weight (VCW) (kg)				317

DATA SHEET NO. 1 (continued)

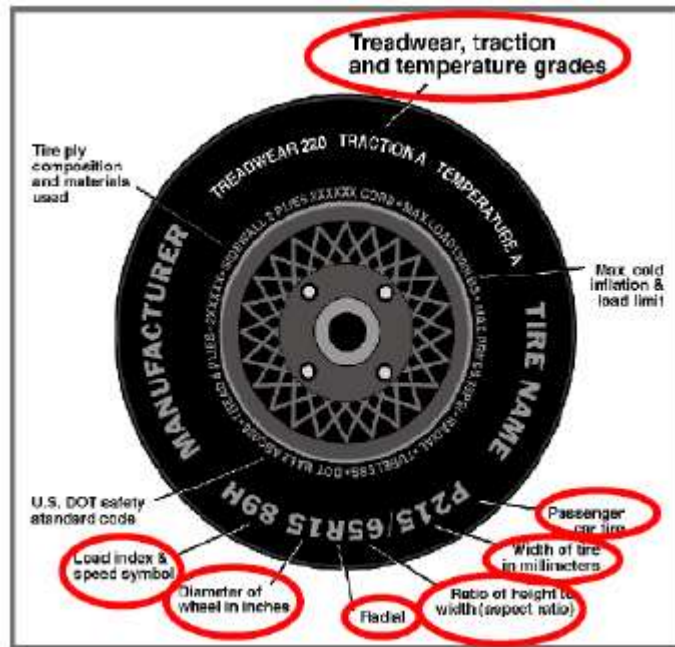
VEHICLE TIRE INFORMATION

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20194204
 Test Date: 12/14/2018

VEHICLE TIRE INFORMATION

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



TIRE SIDEWALL INFORMATION

Tire Placard	Front	Rear
Recommended Cold Pressure (kPa)	230	230
Recommended Tire Size	P215/45R17	P215/45R17
Tire Sidewall	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Tire Size on Vehicle	P215/45R17	P215/45R17
Tire Manufacturer Model	Kumho	Kumho
Tire Name	Solus	Solus
Tire Type	All Weather	All Weather
Tire Width	215	215
Aspect Ratio	45	45
Radial	Yes	Yes
Wheel Diameter	17 in	17 in
Load Index/Speed Symbol	87H	87H
Treadwear	500	500
Traction Grade	A	A
Temperature Grade	A	A

DATA SHEET NO. 2
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
Test Facility: Calspan

NHTSA No.: C20194204
Test Date: 12/14/2018

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	220	220	220	220
As Tested	kPa	230	230	230	230

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			Fully Loaded			As Tested		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	384	242		420	320		427	305	
Right	kg	382	230		399	275		386	284	
Ratio	%	62	38		58	42		58	42	
Totals	kg	766	472	1238	819	595	1414	813	589	1402

TEST VEHICLE TARGET WEIGHT (TVTW) CALCULATION

Measured Parameter	Units	Value	
As Delivered Weight (UVW)	kg	1238	(A)
Weight of 2 P572 ATDs	kg	127	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	44.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1409.8	(A+B+C)

TEST VEHICLE ATTITUDES AND CG

Wheel Opening Location	Distance (grd to ref. point above wheel opening in mm)		Difference (mm)	Meets Requirement**
	Fully Loaded	As Tested		
Left Front	673	674	1	Yes
Right Front	681	678	3	Yes
Left Rear	672	667	5	Yes
Right Rear	663	663	0	Yes

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

MDB IMPACT POINT DATA

Measured Parameter	Distance (mm)	Met Requirement
Test Vehicle Wheelbase	2651	
Target Vertical Impact Reference Line Aft of Front Axle	385	Yes
Actual Impact Point Location (fore-aft, above – below)	+8 / -3	Yes

Note: Fore or above the target impact point is positive (+). Aft or below the target impact point is negative (-)

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Front & Rear Facias	13
Trunk carpeting, spare tire, tail light	10
Non struck side windows	6
Ballast (if any)	0

DATA SHEET NO. 3
SEAT AND SEAT BELT ANCHORAGE ADJUSTMENT DATA

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
Test Facility: Calspan

NHTSA No.: C20194204
Test Date: 12/14/2018

SEAT BACK ANGLE ADJUSTMENT

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



Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents*	Degrees	Detents*
Driver Seat w/Seated Dummy	60.1	N/A	20.4*	7
Passenger w/Seated Dummy	60.1	N/A	20.4*	7

*Measured on seat back per Form 1

SEAT POSITIONING

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

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rearmost	Mid-Fore / Aft	Forward-Most
Driver Seat	16.95	8	Max	-	-	-
			Mid	0	8	16
			Min	-	-	-
Front Passenger Seat	18.3	Not Adjustable	Max	-	-	-
			Mid	-	-	-
			Min	-	-	-

SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forward most Position	
	mm	Detents*	mm	Detents*
Driver Seat	240	61 (0-60)	120	30
Front Passenger Seat	224	59 (0-58)	112	28

SEAT BELT ANCHORAGE ADJUSTMENT

Seat	Total # of Positions	Placed in Position #
Driver Seat	Fixed	Fixed

HEAD RESTRAINT ADJUSTMENT

Seat	Total # of Positions	Placed in Position #
Driver Seat	Fixed	Fixed

DATA SHEET NO. 4
FUEL SYSTEMS AND STEERING WHEEL POSITION DATA

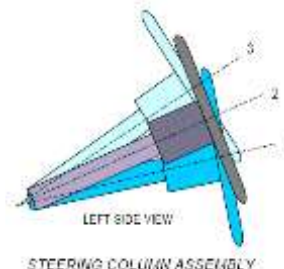
Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20194204
 Test Date: 12/14/2018

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.

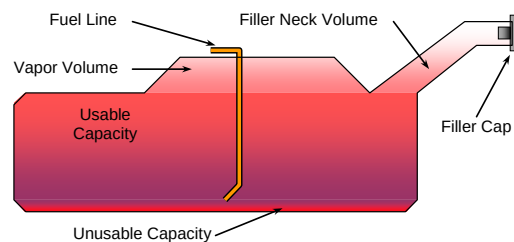
	Degrees	Fore / Aft Position (mm)
Lowermost – Position 1	19.3	0
Geometric Center – Position 2	21.75	25
Uppermost – Position 3	24.2	50
Telescoping Steering Wheel Travel		50
Test Position	21.8	25



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

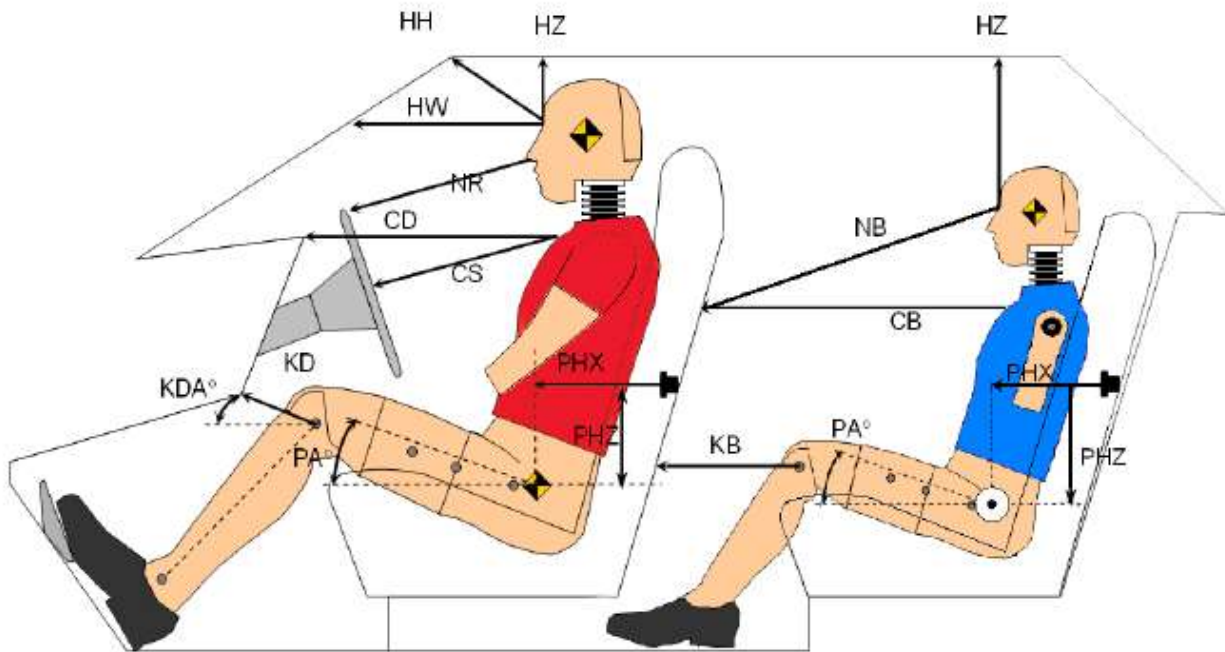
FUEL TANK CAPACITY DATA

Description	Liters
Usable Capacity - see Form No. 1	49.9
Usable Capacity - see Owner's Manual	49.9
92-94% of Usable Capacity	45.9 – 46.9
Actual Amount of Solvent Used in Test	46.4

DATA SHEET NO. 5
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20194204
 Test Date: 12/14/2018



DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

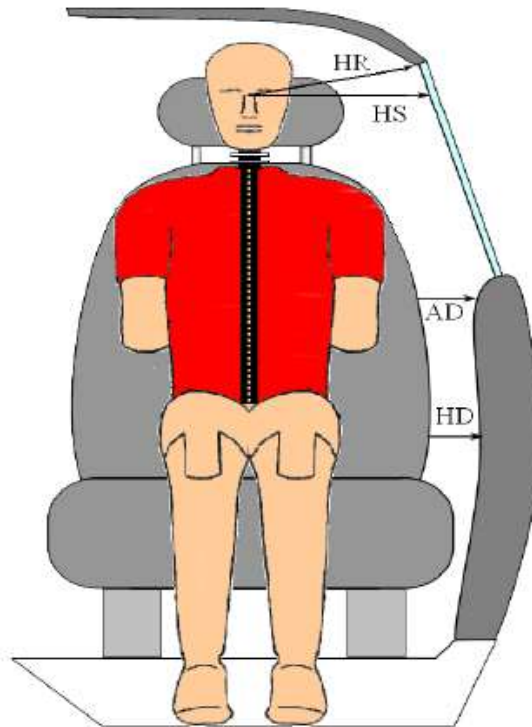
Code	Pass. Code	Description	ES2-re		SID-IIs	
			Length (mm)	Angle	Length (mm)	Angle
HH		Header to Header	362			
HW		Header to Windshield	676			
HZ	HZ	Head to Roof Liner	153		N/A	
NR	NB	Nose to Rim/Seat Back	417		N/A	
CD	CB	Chest to Dash/Seat Back	542		N/A	
CS		Chest to Steering Wheel	337			
KD(L)/KDA(L)°	KB(L)/KBA(L)°	Left Knee to Dash/Seat Back	188	25.8	N/A	N/A
KD(R)/KDA(R)°	KB(R)/KBA(R)°	Right Knee to Dash/Seat Back	180	25.5	N/A	N/A
PA°	PA°	Pelvic Tilt Angle		22.9		N/A
PHX	PHX	Hip Point to Striker (X-Axis)	423		N/A	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	256		N/A	

Note: For this test, an un-instrumented SID-II ATD was used as ballast and measurements were not taken per NHTSA COR's request.

DATA SHEET NO. 6
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
Test Facility: Calspan

NHTSA No.: C20194204
Test Date: 12/14/2018



FRONT VIEW OF DUMMY

DUMMY LATERAL CLEARANCE DIMENSION INFORMATION

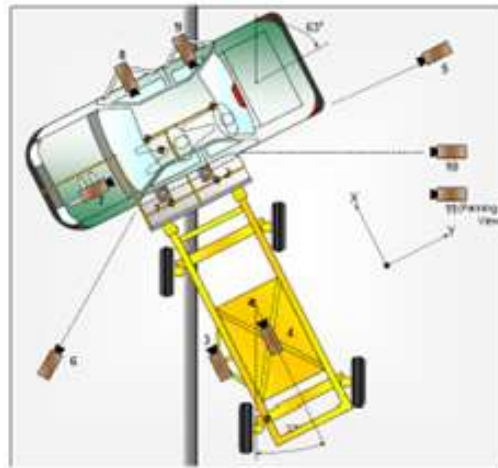
Code	Measurement Description	Units	Front Occupant	Rear Occupant
HR	Head To Side Header	mm	190	N/A
HS	Head to Side Window	mm	320	N/A
AD	Arm to Door	mm	98	N/A
HD	Hip Point to Door	mm	150	N/A

Note: For this test, an un-instrumented SID-II ATD was used as ballast and measurements were not taken per NHTSA COR's request.

DATA SHEET NO. 7 **LOCATION OF CAMERAS**

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
Test Facility: Calspan

NHTSA No.: C20194204
Test Date: 12/14/2018



CAMERA LOCATIONS AND DATA

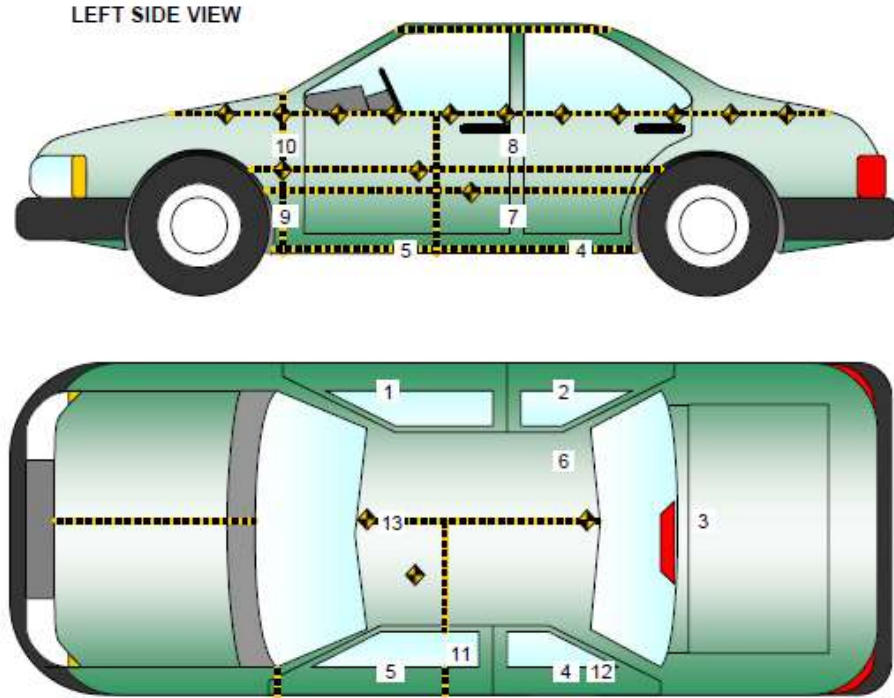
No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	254	1421	9370	12.5	1000
2	Overhead Close-up	0	854	9370	35	1000
3	Impact Point Close-up				25	1000
4	Centerline of Impact (MDB)				8	1000
5	Right Side View	0	7767	1135	24	1000
6	Left Side View	-3053	-5195	1260	24	1000
7	Front Seat Occupant-Frontal View (OB)				25	1000
8	Front Seat Occupant-Side View (OB)				8	1000
9	Rear Passenger-Side View (OB)				8	1000
10	Real-time Coverage				Zoom	60

Notes: *Reference: Impact Point projected to Ground*
 +X = To Front of MDB, +Y = To Right of MDB, +Z = Down

DATA SHEET NO. 8
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20194204
 Test Date: 12/14/2018



TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Left (or Rt.) Sill at Front Seat	2567	-681	304
2	Left (or Rt.) Sill at Rear Seat	1637	-672	299
3	Rear Floorpan Above Axle	921	75	104
4	Right Sill at Rear Door	1607	678	308
5	Right Sill at Front Door	2563	679	307
6	Left (or Rt.) Rear Occ. Compartment	1722	376	382
7	Left (or Rt.) B-Post Lower	1618	-676	184
8	Left (or Rt.) B-Post Middle	1597	-678	-66
9	Left (or Rt.) A-Post Lower	2887	-659	289
10	Left (or Rt.) A-Post Middle	2911	-652	67
11	Front Seat Track	1968	-565	334
12	Rear Seat Track or Structure	1555	-366	203
13	Vehicle CG	2122	34	167

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

DATA SHEET NO. 9
TEST VEHICLE ACCELEROMETER DATA SUMMARY

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

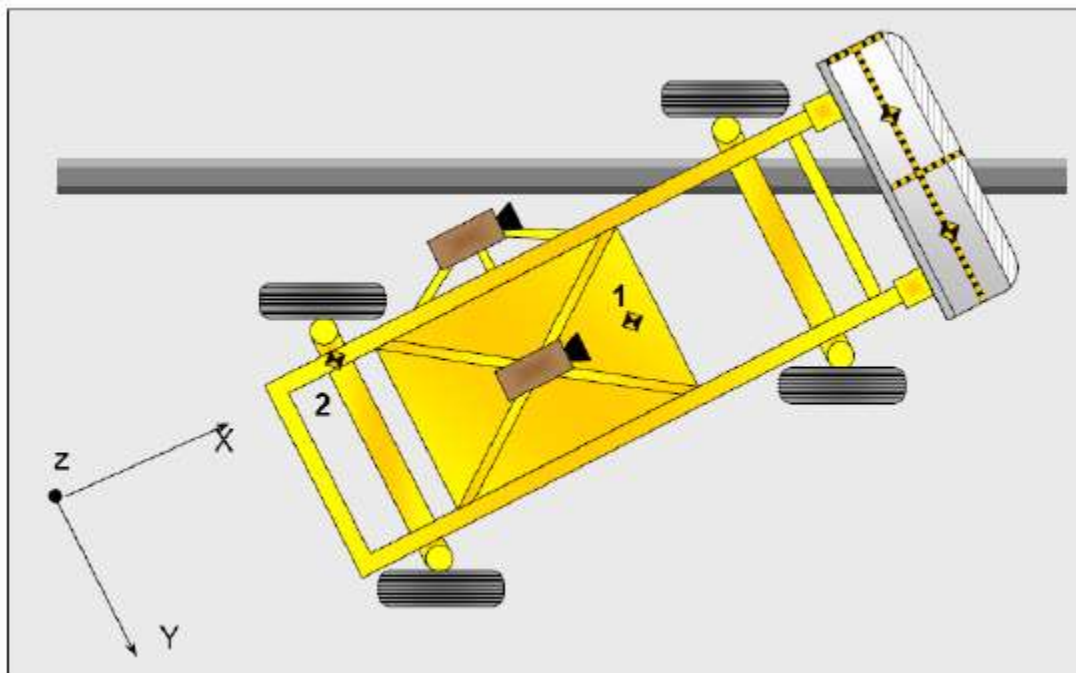
NHTSA No.: C20194204
 Test Date: 12/14/2018

Loc No.	Description	Axes	Units	Peak Values (g's)			
				Max	Time (ms)	Min	Time (ms)
1	Left (or Rt.) Sill at Front Seat	X	g	4.39	23.65	-5.71	14.15
		Y	g	27.24	6.60	-3.00	71.60
		Z	g	5.07	60.40	-7.10	12.45
		Resultant		28.08	6.65	0	-40.50
2	Left (or Rt.) Sill at Rear Seat	X	g	5.41	23.95	-6.09	14.40
		Y	g	27.43	29.80	-4.09	61.25
		Z	g	5.53	27.30	-12.21	17.95
		Resultant		27.65	29.70	0	-26.55
3	Rear Floorpan Above Axle	X	g	4.37	48.90	-5.85	16.75
		Y	g	27.74	29.20	-3.22	76.00
		Z	g	12.34	9.35	-8.95	14.45
		Resultant		27.85	29.45	0	-12.35
4	Left (or Rt.) Sill at Rear Door	Y	g	64.78	7.40	-2.20	94.00
5	Left (or Rt.) Sill at Front Door	Y	g	42.45	10.40	-4.73	14.65
6	Left (or Rt.) Rear Occ. Compartment	Y	g	27.17	30.35	-6.22	61.50
7	Left (or Rt.) B-Post Lower	Y	g	329.06	7.15	-166.47	11.15
8	Left (or Rt.) B-Post Middle	Y	g	179.70	6.50	-94.96	30.25
9	Left (or Rt.) A-Post Lower	Y	g	75.05	13.80	-30.51	17.55
10	Left (or Rt.) A-Post Middle	Y	g	87.05	13.80	-37.70	22.50
11	Front Seat Track	Y	g	35.23	11.40	-3.22	82.60
12	Rear Seat Track or Structure	Y	g	30.75	29.80	-4.14	76.55
13	Vehicle CG	X	g	5.37	22.80	-7.82	29.55
		Y	g	39.80	42.40	-9.91	197.10
		Z	g	17.93	36.65	-10.97	16.90
		Resultant		40.78	42.10	0	-31.15

DATA SHEET NO. 10
MDB ACCELEROMETER LOCATION DATA SUMMARY

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20194204
 Test Date: 12/14/2018



Loc No.	Description	Axes	Units	Peak Values (g's)			
				Max	Time (ms)	Min	Time (ms)
1	MDB CG	X	g	1.55	300	-20.39	31.15
		Y	g	2.66	54.70	-5.33	28.75
		Z	g	21.78	49.30	-21.20	41.45
		Resultant		27.44	41.50	0.04	-36.55
2	MDB Rear	X	g	1.36	75.45	-21.05	29.25
		Y	g	4.57	25.40	-2.12	56.45

DATA SHEET NO. 11
MDB SUMMARY OF RESULTS

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
Test Facility: Calspan

NHTSA No.: C20194204
Test Date: 12/14/2018

MDB SPECIFICATIONS

Measurement Description	Requirement	Value
Overall Width of Framework Carriage	1241 – 1261	1,250
Overall Length Including Honeycomb Frame	4140 – 3990	4,120
Wheelbase of Framework Carriage	2566 – 2616	2,600
CG Location Aft of Front Axle		1,120
MDB Front Axle Weight		764
MDB Rear Axle Weight		594
MDB Total Weight	1356.5 – 1365.5	1358

SPEED AND ANGLE AT IMPACT DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	52.10 to 53.70	52.68
Trap No. 2 Velocity (Redundant)	km/h	52.10 to 53.70	52.68
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90.0

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

Vertical Location			From Centerline		Maximum Crush (mm)
Row	Description	Height (mm)	Distance (mm)	Direction	
A	Center of Bumper	432	800	Left	150
B	Top of Bumper	533	700	Left	89
C	Mid-Level	686	800	Left	109
D	Top of Stack	813	800	Left	100

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact Point	+8
Vertical Offset (- down / + up)	mm	+/- 20 of Intended Impact Point	-3

DATA SHEET NO. 12
DUMMY INJURY RESPONSE DATA
(Subpart U, ES-2re)

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20194204
 Test Date: 12/14/2018

Dummy Serial No. DG5348

Description	Axes	Positive Direction		Negative Direction	
		MAX	TIME (ms)	MAX	TIME (ms)
HEAD ACCELERATION (g)					
Longitudinal	X	6.79	173.65	-10.94	42.60
Lateral	Y	45.51	47.10	-7.68	81.70
Vertical	Z	13.24	17.55	-8.76	56.65
Resultant	N/A	45.85	47.05		
HIC36 (t1, t2)	N/A	187.78		t1 = 37.50	t2 = 59.35
THORAX DEFLECTION (mm)					
Upper Rib	Y	12.71	43.20	-2.79	19.35
Middle Rib	Y	15.62	40.55	-0.20	264.35
Lower Rib	Y	19.92	39.50	-0.13	280.60
ABDOMINAL FORCES (N)					
Front	Y	148.20	31.00	-2.712	10.800
Middle	Y	304.22	25.00	25.0	-5.195
Rear	Y	370.94	31.35	31.35	-2.882
SUM	N/A	799.86	31.10		
PELVIS FORCES (N)					
Pubic Symphysis	Y	125.880	131.0	-1788.63	46.10

Reference: Positive Direction - Longitudinal (X) = forward
 - Lateral (Y) = to right
 - Vertical (Z) = down

DATA SHEET NO. 13
DUMMY INJURY RESPONSE DATA
(Subpart V, SIDIIs)

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20194204
 Test Date: 12/14/2018

Dummy Serial No. 224 – Ballast ATD

Description	Axes	Positive Direction		Negative Direction	
		MAX	TIME (ms)	MAX	TIME (ms)
HEAD ACCELERATION (g)					
Longitudinal	X	NA	NA	NA	NA
Lateral	Y	NA	NA	NA	NA
Vertical	Z	NA	NA	NA	NA
Resultant	N/A	NA	NA		
HIC36 (t1, t2)	N/A	NA		t1 = NA	t2 = NA
LOWER SPINE (g)					
Longitudinal	X	NA	NA	NA	NA
Lateral	Y	NA	NA	NA	NA
Vertical	Z	NA	NA	NA	NA
Resultant	N/A	NA	NA	NA	NA
PELVIS FORCES (N)					
Acetabular	Y	NA	NA		
Iliac	Y	NA	NA		

Reference: Positive Direction - Longitudinal (X) = forward
 - Lateral (Y) = to right
 - Vertical (Z) = down

Note: For this test, an un-instrumented SID-II ATD was used as ballast and injury response data was not collected per NHTSA COR's request.

DATA SHEET NO. 14
POST-TEST OBSERVATIONS

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
Test Facility: Calspan

NHTSA No.: C20194204
Test Date: 12/14/2018

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Occupant	Rear Occupant
Head Contact	Side Header, Curtain Airbag & Headrest	N/A
Upper Torso Contact	Torso Air Bag & Seatback	N/A
Lower Torso Contact	Seatback	N/A
Left Knee Contact	Driver Door	N/A
Right Knee Contact	Left Knee	N/A

POST-TEST DOOR PERFORMANCE

Description	Front	Rear
Left Side Doors	Jammed Shut	N/A
Right Side Doors	Remained Closed and Operational	Remained Closed and Operational
Hatch and Other Doors	Remained Closed and Operational	Remained Closed and Operational
Seat Movement	None	None
Seatback Failure	No	No

*Note: Description for door opening must be specific with the following three categories: Remained closed and operational, opened/unlatched during the crash, or jammed shut. Sometimes the door is jammed and unlatched. If the door cannot be opened, then note the door as jammed shut. If open, measurement must be taken for the width of the door opening (mm).

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	Remained in Good Condition
Sill Separation	None
Windshield Damage	None
Side Window Damage	Driver Window Shattered
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

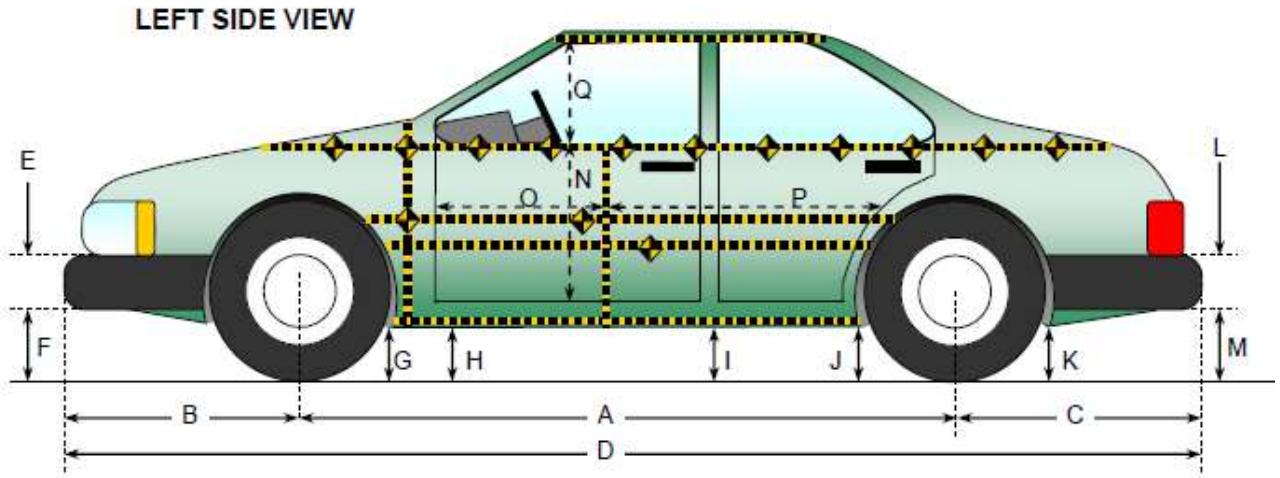
Restraint Type	Front Occupant		Rear Occupant	
	Installed	Deployed	Installed	Deployed
Frontal Airbag	Yes	No	No	N/A
Side Torso Airbag	Yes	Yes	No	N/A
Head Airbag	No	N/A	No	N/A
Curtain Airbag	Yes	Yes	Yes	Yes
Seat Belt Pretensioner	Yes	Yes	No	N/A
Other				

Note: For this test, an un-instrumented SID-II ATD was used as ballast and observations were not taken per NHTSA COR's request.

DATA SHEET NO. 15
VEHICLE PRE TEST AND POST TEST MEASUREMENTS

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20194204
 Test Date: 12/14/2018



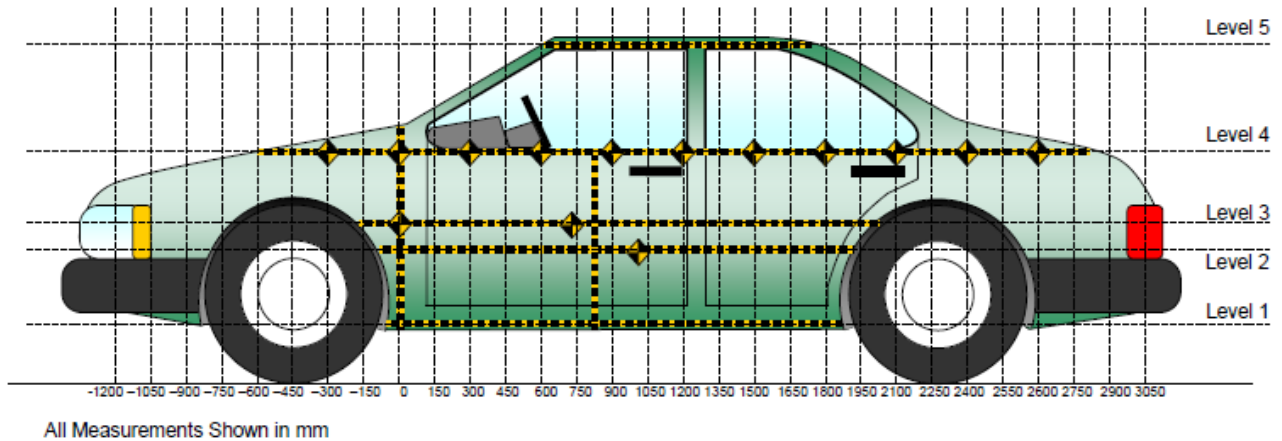
VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Description	Pre-Test	Post-Test	Difference
A	Vehicle Wheelbase	2650	2648	-2
B	Front Axle to FSOV	852	858	6
C	Rear Axle to RSOV	738	734	-4
D	Total Length at Centerline	4242	4240	-2
E	Front Bumper Thickness	105	105	0
F	Front Bumper Bottom to Ground	414	413	-1
G	Sill Height at Front Wheel Well	171	173	2
H	Sill Height at Front Door Leading Edge	153	155	2
I	Sill Height at B-Pillar	159	152	-7
J1	Sill Height at Rear Wheel Well	175	184	9
J2	Pinch Weld Height at Rear Wheel Well	157	162	5
K	Sill Height Aft of Rear Wheel Well	533	538	5
L	Rear Bumper Thickness	70	70	0
M	Rear Bumper Bottom to Ground	408	421	13
N	Sill Height to Bottom of Front Window Sill	742	694	-48
O	Front Door Leading Edge to Impact CL	669	666	-3
P	Rear Door Trailing Edge to Impact CL	637	634	-3
Q	Front Window Opening	383	375	-8
R	Right Side Length	4173	4176	3
S	Left Side Length	4176	4171	-5
T	Vehicle Width at B-Pillars	1785	1646	-139

DATA SHEET NO. 16
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20194204
 Test Date: 12/14/2018



MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	234	35	1200
2	Occupant Hip Point	mm	498	167	1650
3	Mid - Door	mm	630	148	1650
4	Window Sill	mm	930	98	1500
5	Window Top	mm	1327	5	1350

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. 17
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
Test Facility: Calspan

NHTSA No.: C20194204
Test Date: 12/14/2018

EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

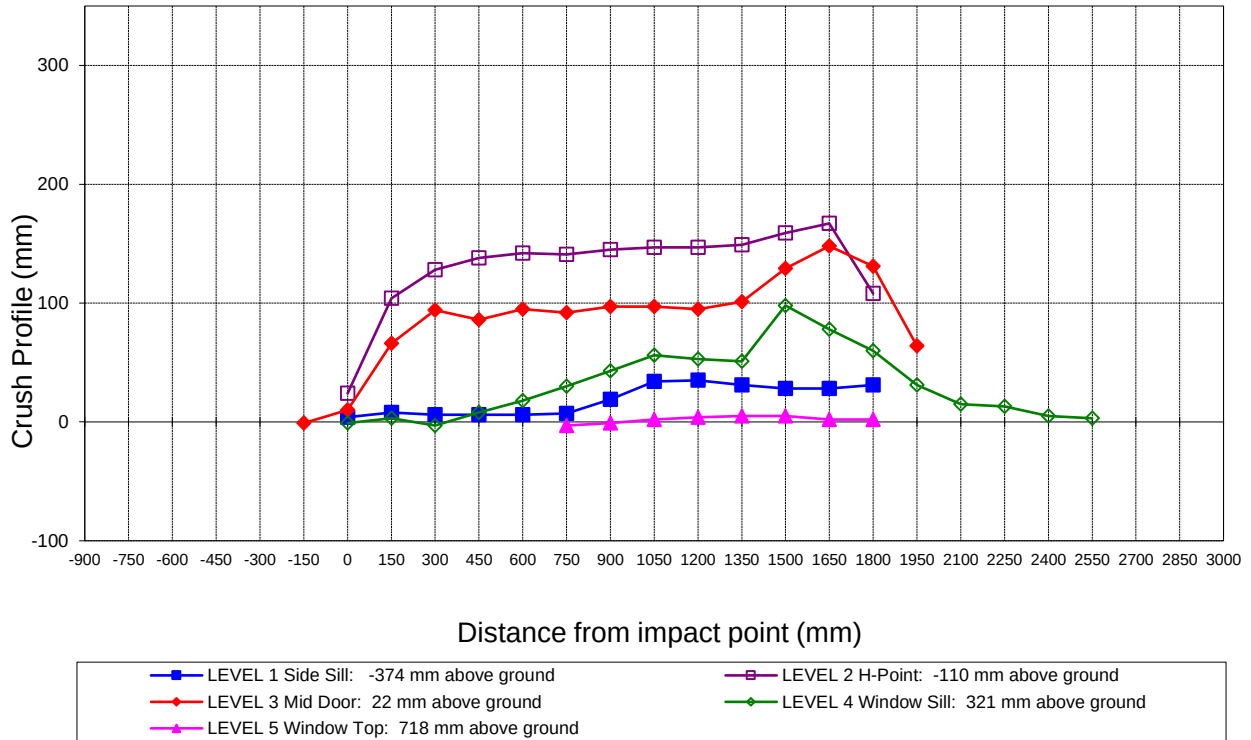
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900															
-750															
-600															
-450															
-300															
-150			898					899					-1		
0	880	895	895	772		876	871	881	773		4	24	14	-1	
150	859	886	885	780		851	782	819	777		8	104	66	3	
300	861	883	889	788		855	755	795	791		6	128	94	-3	
450	863	881	889	793		857	743	803	785		6	138	86	8	
600	864	879	889	798		858	737	794	780		6	142	95	18	
750	863	878	888	802	608	856	737	796	772	611	7	141	92	30	-3
900	861	879	886	806	619	842	734	789	763	620	19	145	97	43	-1
1050	859	879	884	808	620	825	732	787	752	618	34	147	97	56	2
1200	856	879	880	810	620	821	732	785	757	616	35	147	95	53	4
1350	854	878	876	811	617	823	729	775	760	612	31	149	101	51	5
1500	853	879	875	810	612	825	720	746	712	607	28	159	129	98	5
1650	850	880	878	810	600	822	713	730	732	598	28	167	148	78	2
1800	860	887	883	814	547	829	779	752	754	545	31	108	131	60	2
1950			893	821				829	790				64	31	
2100				825					810					15	
2250				818					805					13	
2400				796					791					5	
2550				760					757					3	
2700															
2850															
3000															

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

DATA SHEET NO. 17
TEST VEHICLE EXTERIOR CRUSH PROFILES (CONTINUED)

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20194204
 Test Date: 12/14/2018

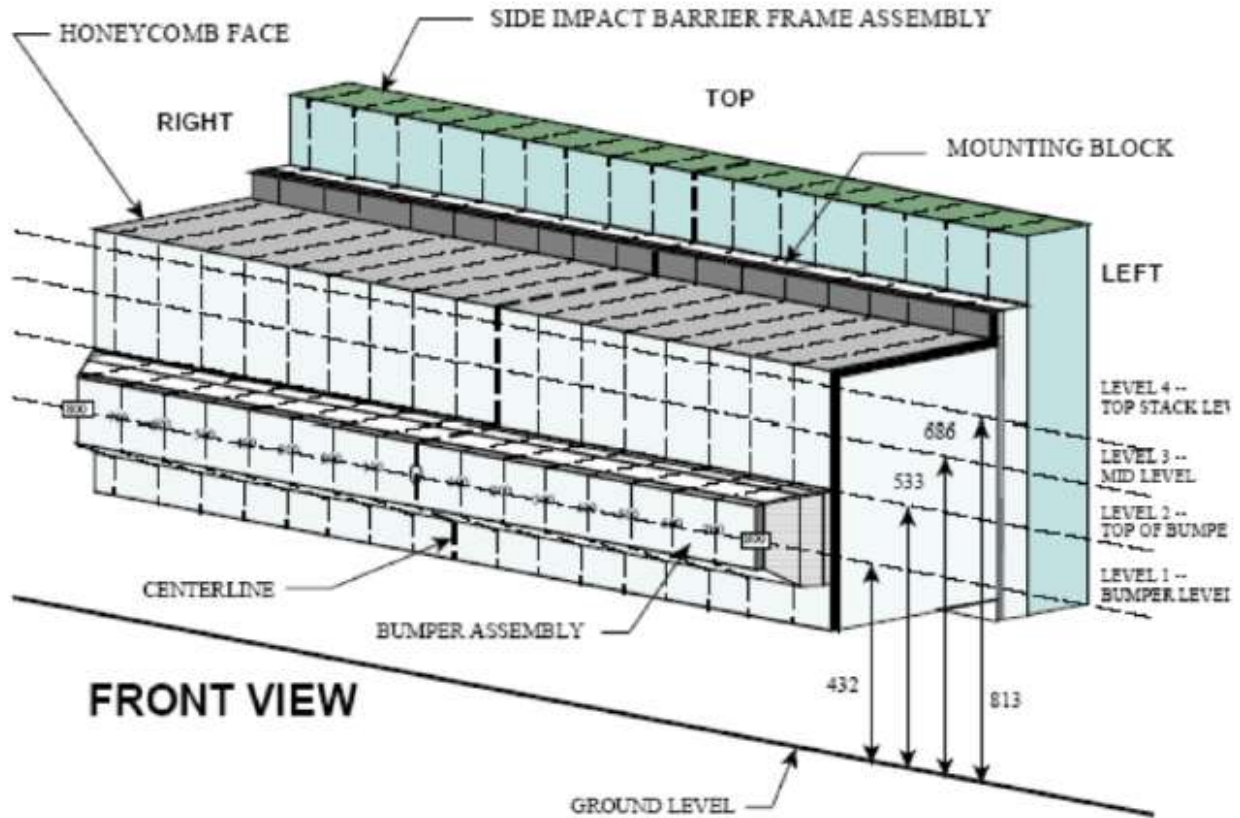


Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO. 18
EXTERIOR STATIC CRUSH FOR IMPACT FACE

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
 Test Facility: Calspan

NHTSA No.: C20194204
 Test Date: 12/14/2018



NOTE: Dimensions are shown in millimeters, mm

DEFORMABLE BARRIER STATIC CRUSH

Stack Level	Distance Right of Center								C/L	Distance Left of Center							
	800	700	600	500	400	300	200	100		100	200	300	400	500	600	700	800
1	94	90	90	92	96	93	86	81	82	84	87	90	93	99	115	150	143
2	37	41	44	46	48	43	37	38	41	42	45	47	51	55	64	77	89
3	-8	-8	1	25	12	6	5	5	6	6	9	14	19	26	35	59	109
4	-5	-16	-3	21	20	7	2	5	9	13	17	22	28	33	44	54	100

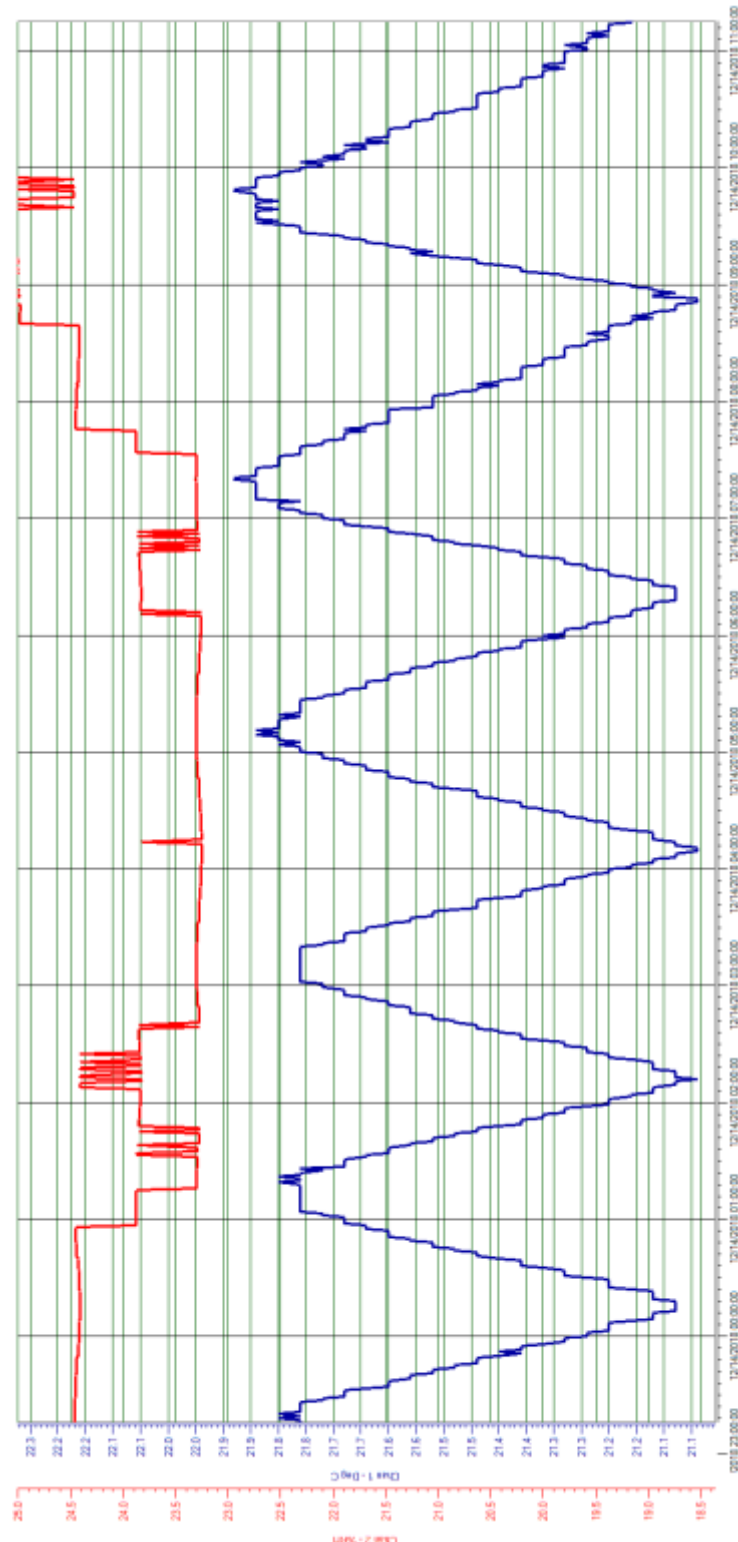
Reference:

+X = Forward
 +Y = To Right
 +Z = Down

DATA SHEET NO. 19
DUMMY / VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle: 2019 Hyundai Veloster Four Door Hatchback
Test Facility: Calspan

NHTSA No.: C20194204
Test Date: 12/14/2018



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

APPENDIX I
PHOTOGRAPHS

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Figure A-1: Pre-Test Frontal View of Test Vehicle



Figure A-2: Post-Test Frontal View of Test Vehicle



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



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



Figure A-5: Pre-Test Impacted Side View of Test Vehicle



Figure A-6: Post-Test Impacted Side View of Test Vehicle



Figure A-7: Pre-Test Frontal View of Impactor Face



Figure A-8: Post-Test Frontal View of Impactor Face



Figure A-9: Pre-Test Left Side View of Impactor Face



Figure A-10: Post-Test Left Side View of Impactor Face



Figure A-11: Pre-Test Right Side View of Impactor Face



Figure A-12: Post-Test Right Side View of Impactor Face



Figure A-13: Pre-Test Top View of Impactor Face



Figure A-14: Post-Test Top View of Impactor Face



Figure A-15: Pre-Test Overhead View of MDB Positioned Against Impact Side of Test Vehicle at Impact Location

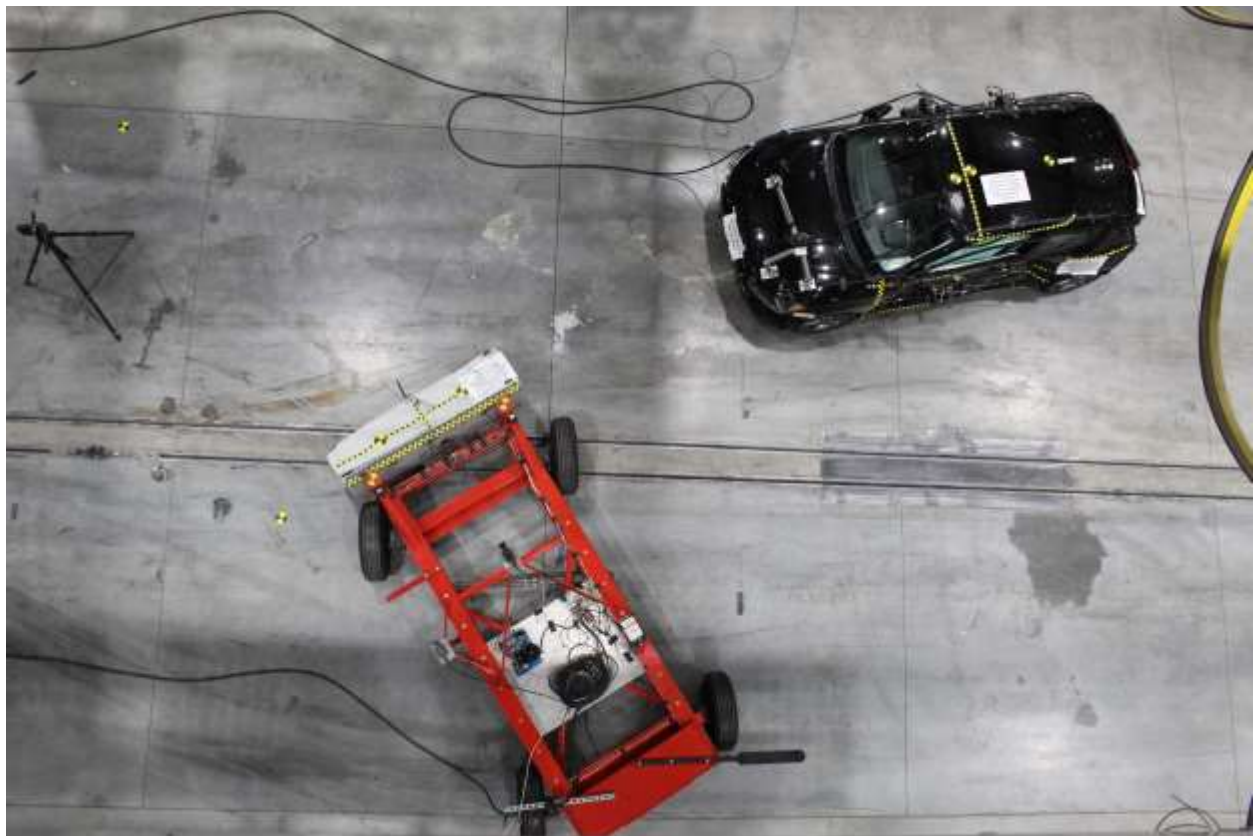


Figure A-16: Post-Test Overhead View of the MDB and Test Vehicle



Figure A-17: Pre-Test Front ES2-re – Final Seating Position (Door Open)



Figure A-18: Pre-Test Front ES2-re – Final Seating Position (Door Closed)



Figure A-19: Pre -Test Front ES2-re – Opposite Side View



Figure A-20: Post-Test Front ES2-re – Opposite Side View

Photo Not Applicable

Figure A-21: Pre-Test Rear SID – Final Seating Position (Door Open)



Figure A-22: Pre-Test Rear SID – Final Seating Position (Door Closed)



Figure A-23: Pre-Test Rear SID – Opposite Side View



Figure A-24: Post-Test Rear SID – Opposite Side View



Figure A-25: T(0) Impact Event



Figure A-26: Close-Up View of Impact Point Target



Figure A-27: Close-Up View of Vehicle's Certification Label



Figure A-28: Post-Test Front Seat Occupant Area Showing Head & Torso contact regions



Figure A-29: Post-Test Rear Seat Occupant Area Showing Head & Torso contact regions



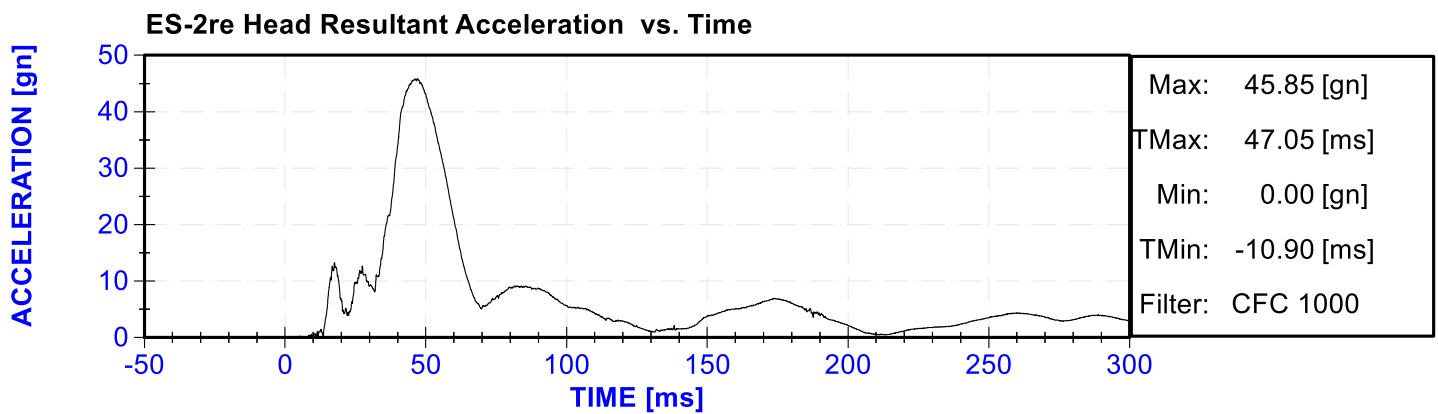
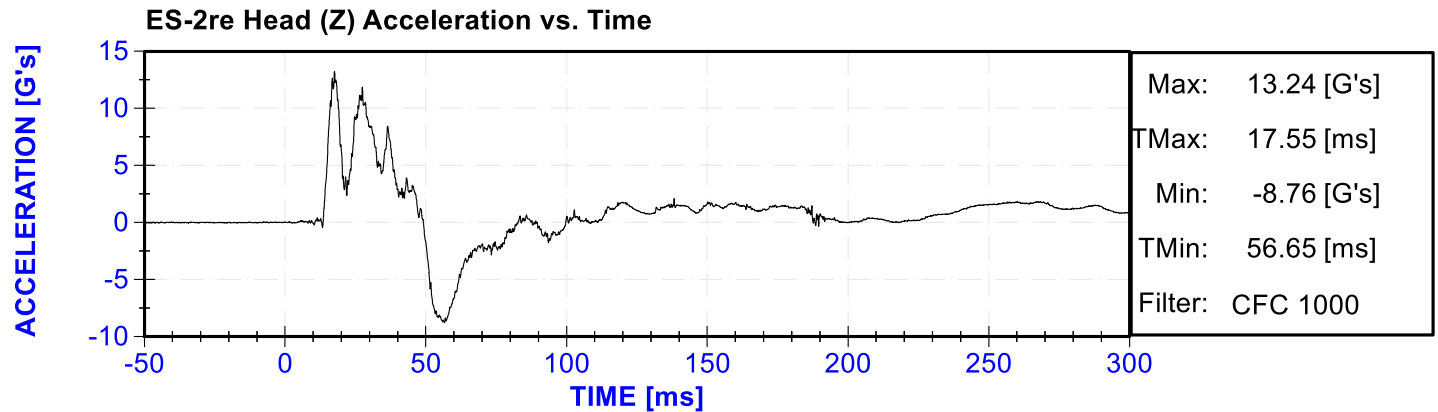
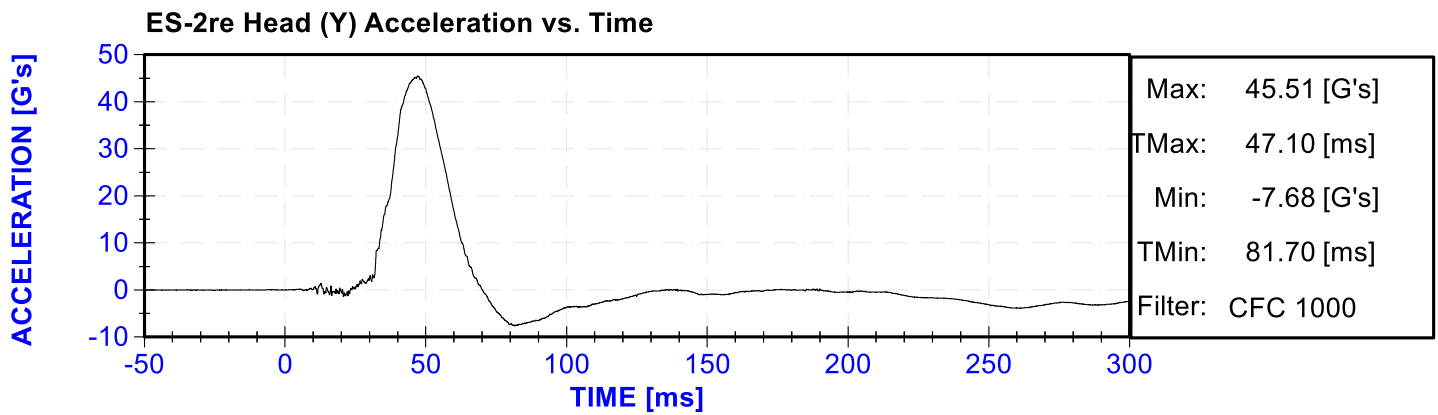
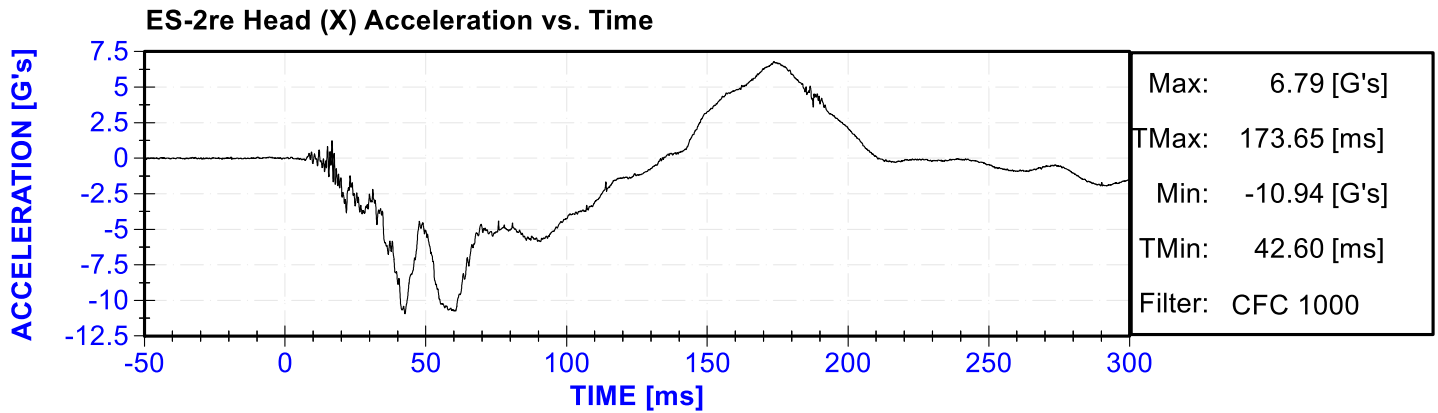
Figure A-30: Close-Up View of Vehicle's Tire Label

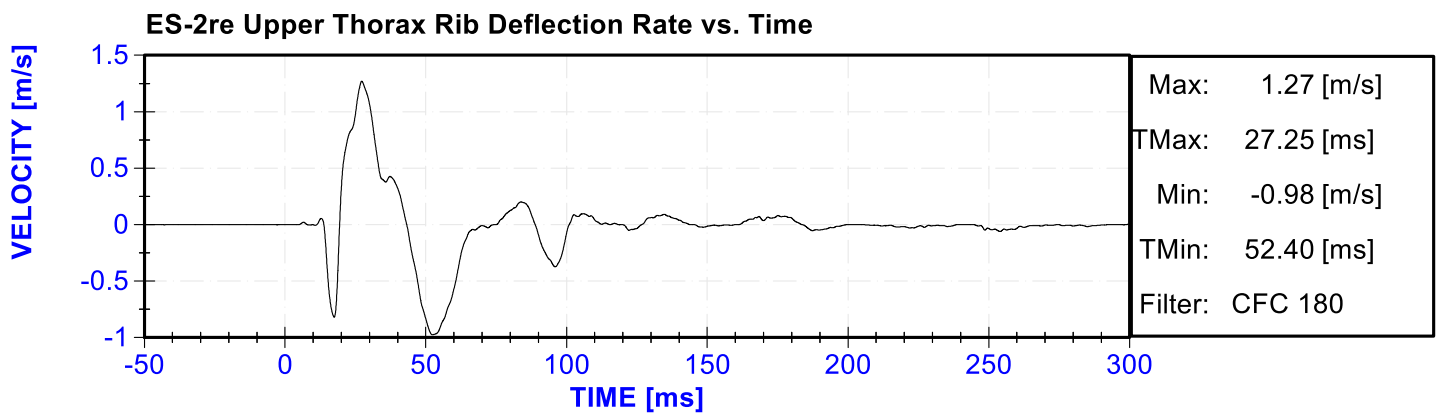
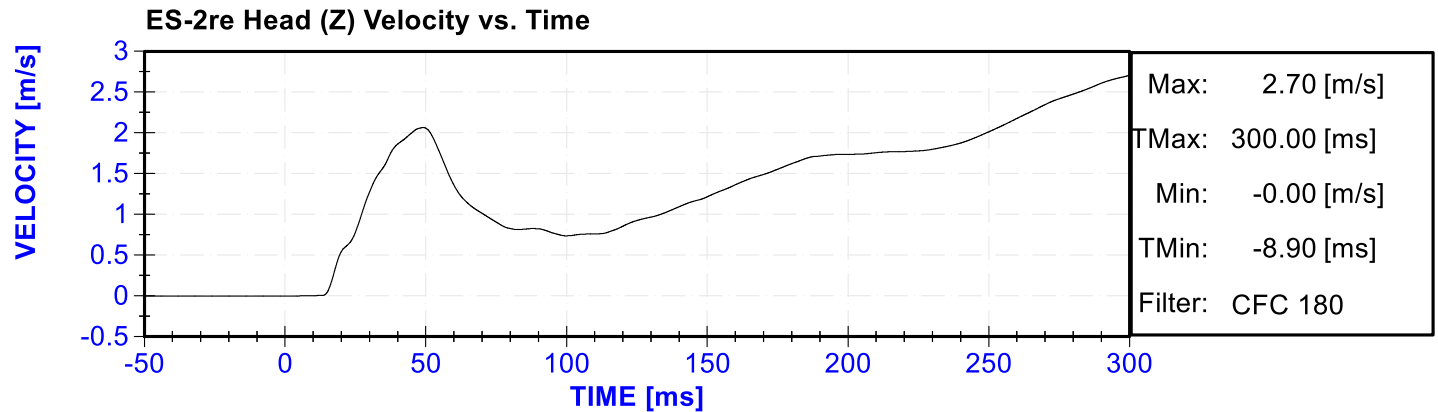
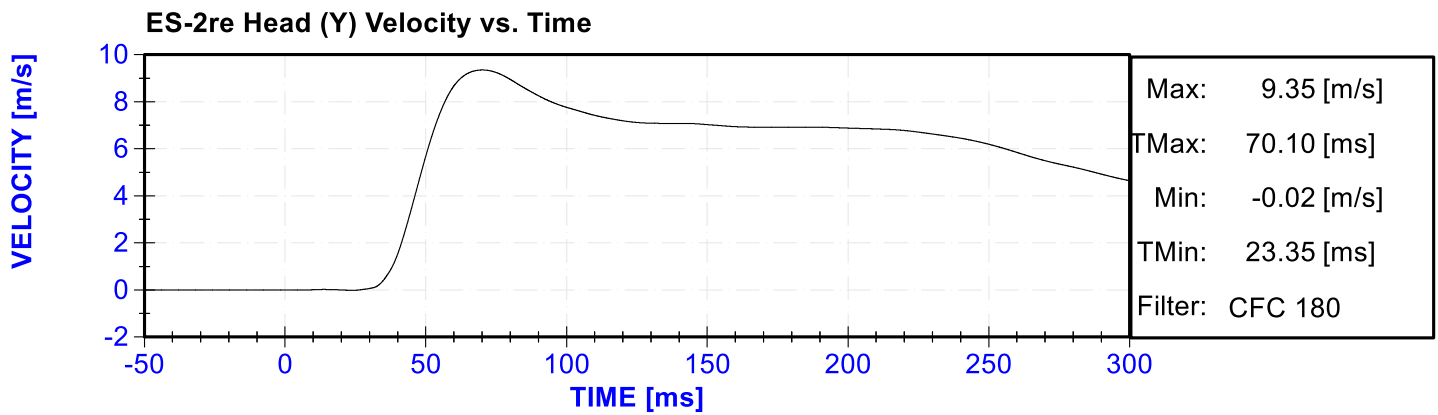
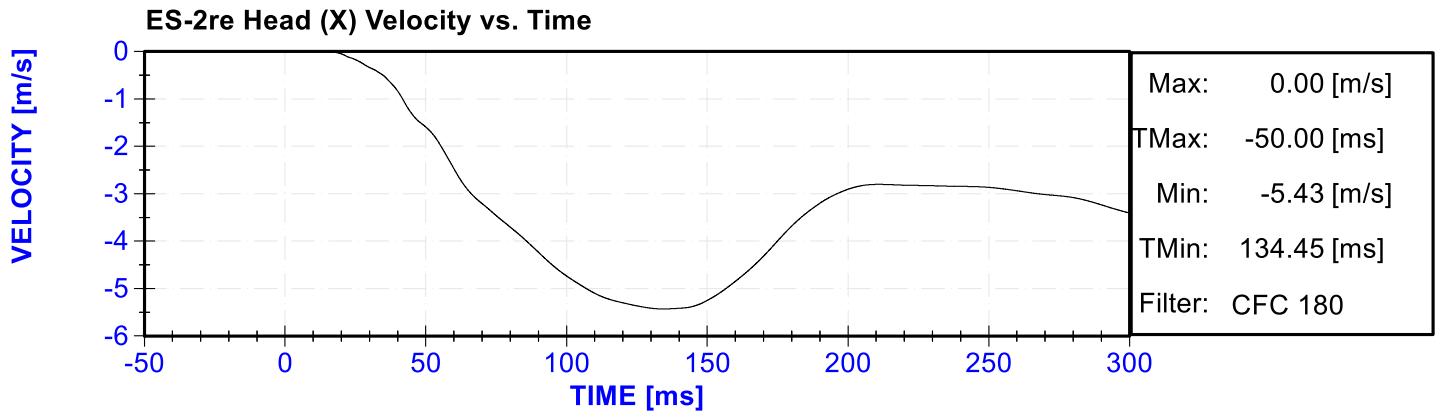
APPENDIX II

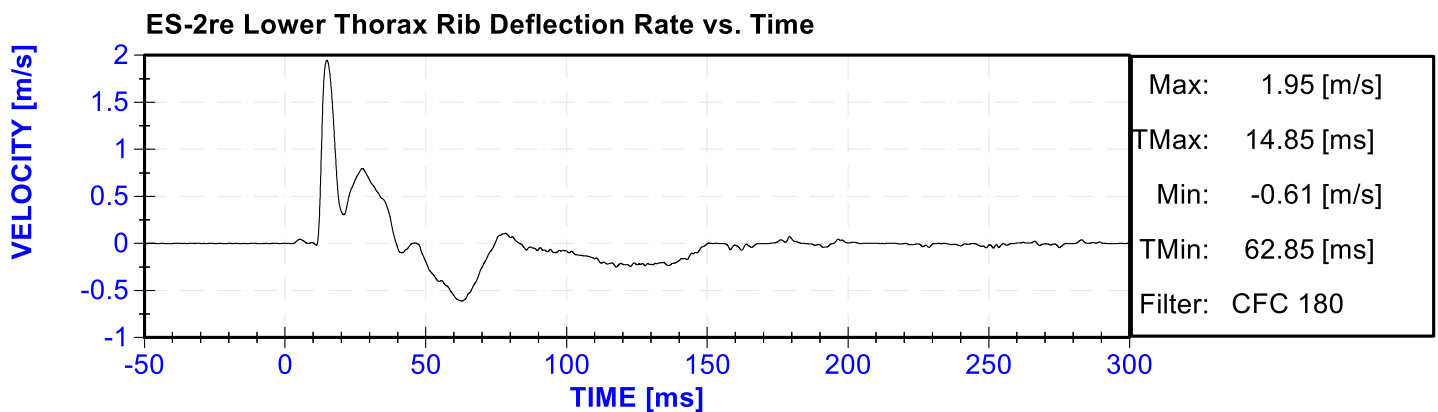
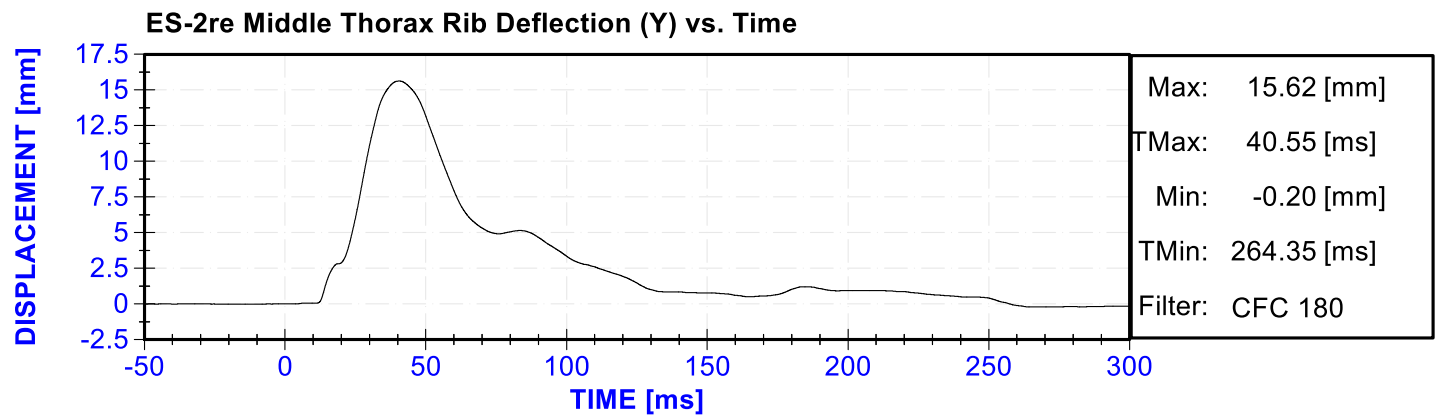
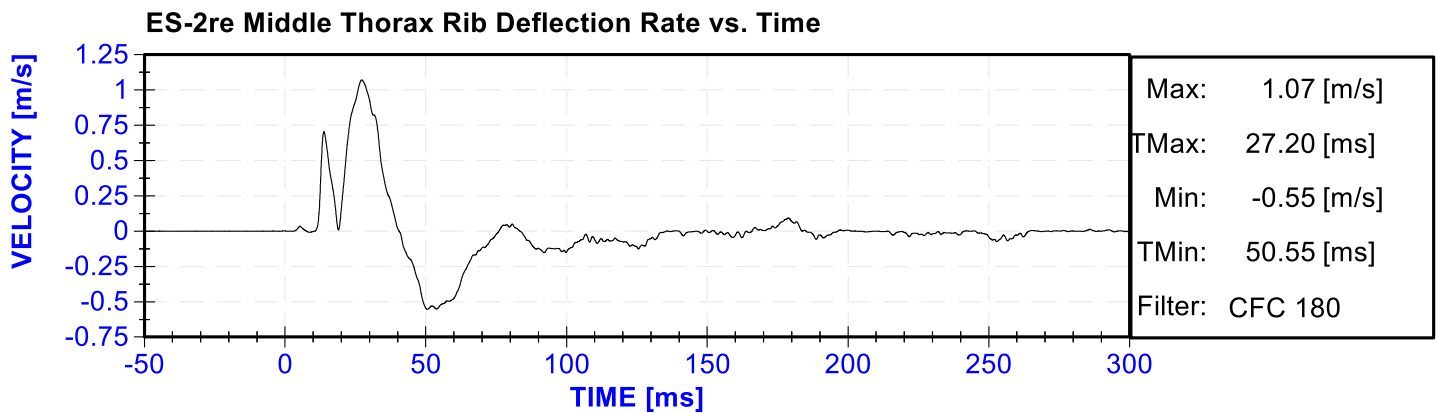
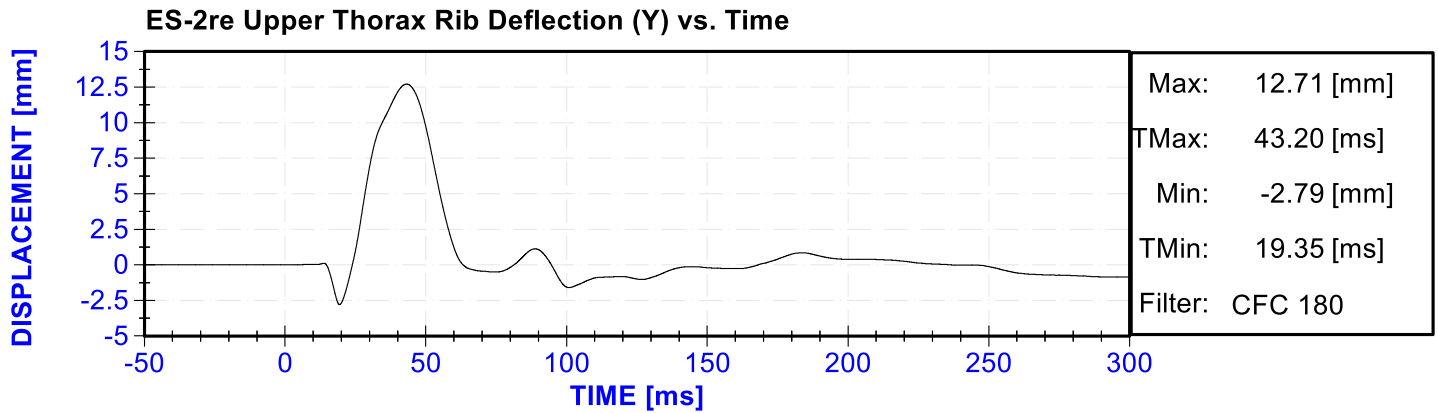
ES-2re DUMMY RESPONSE DATA

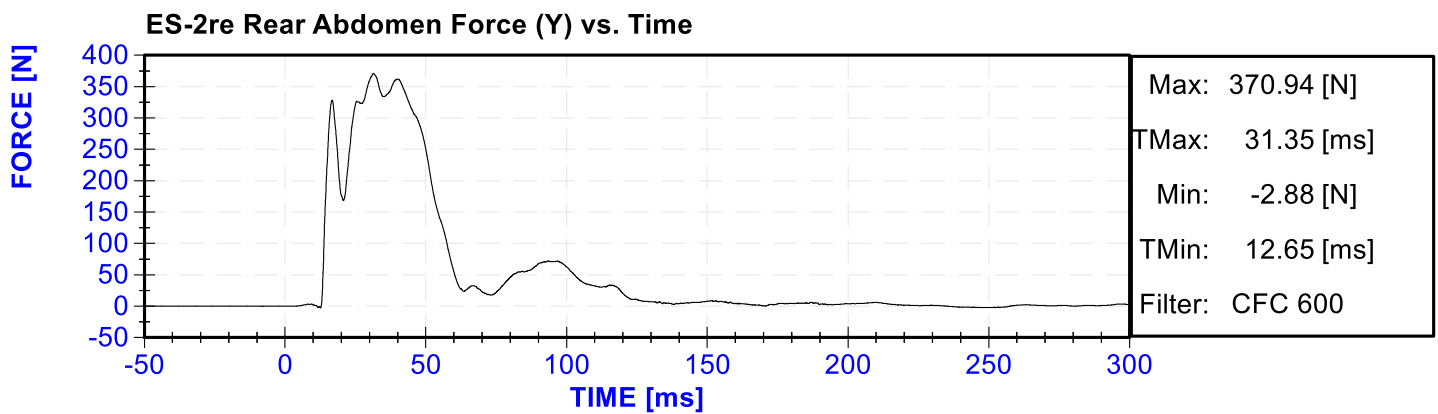
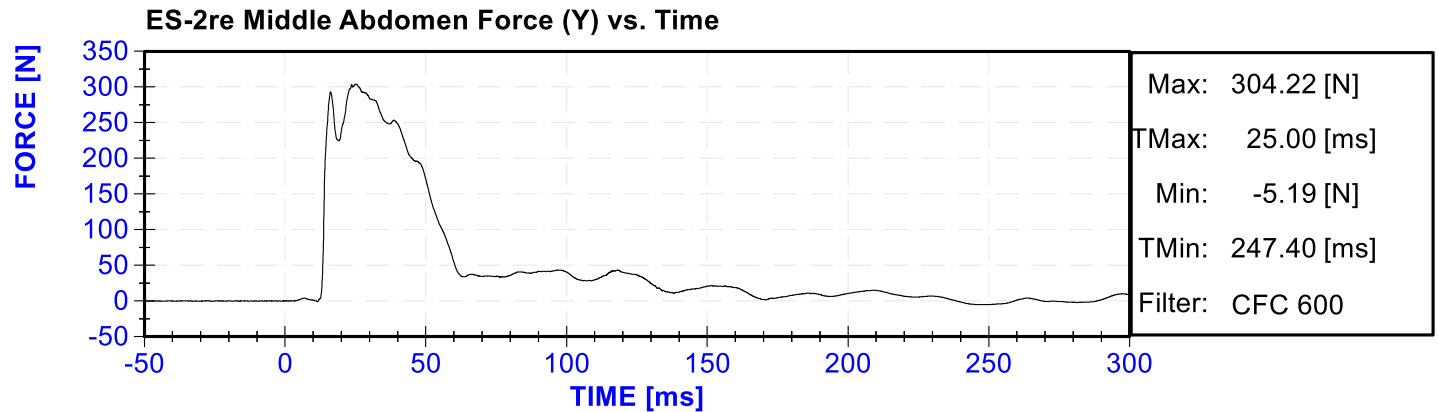
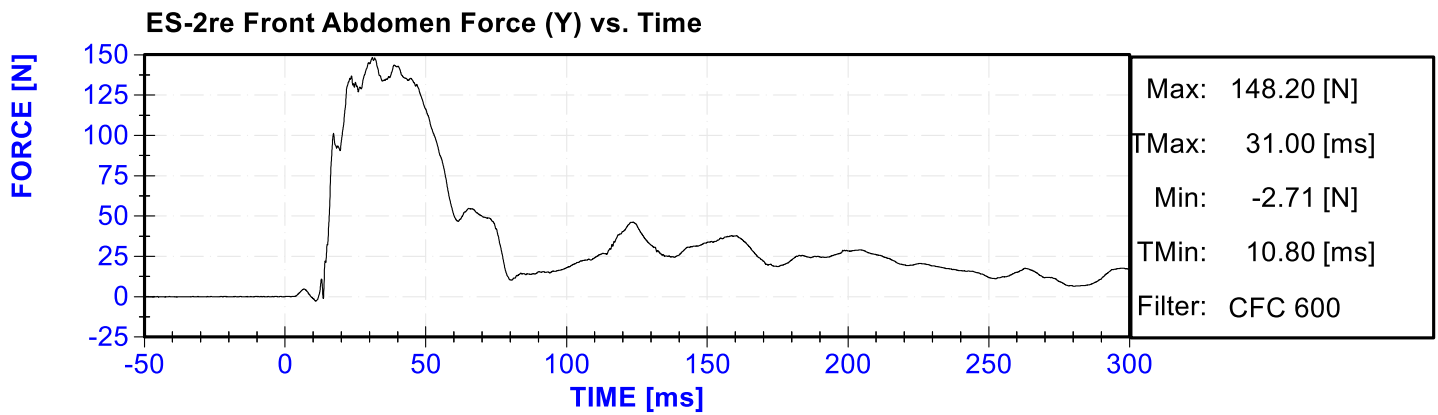
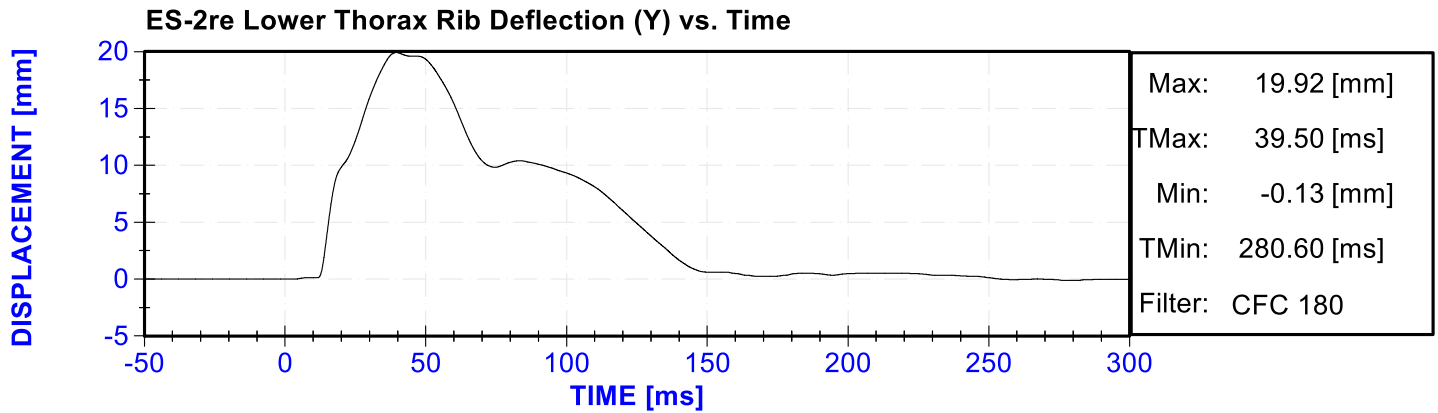
Table of Data Plots

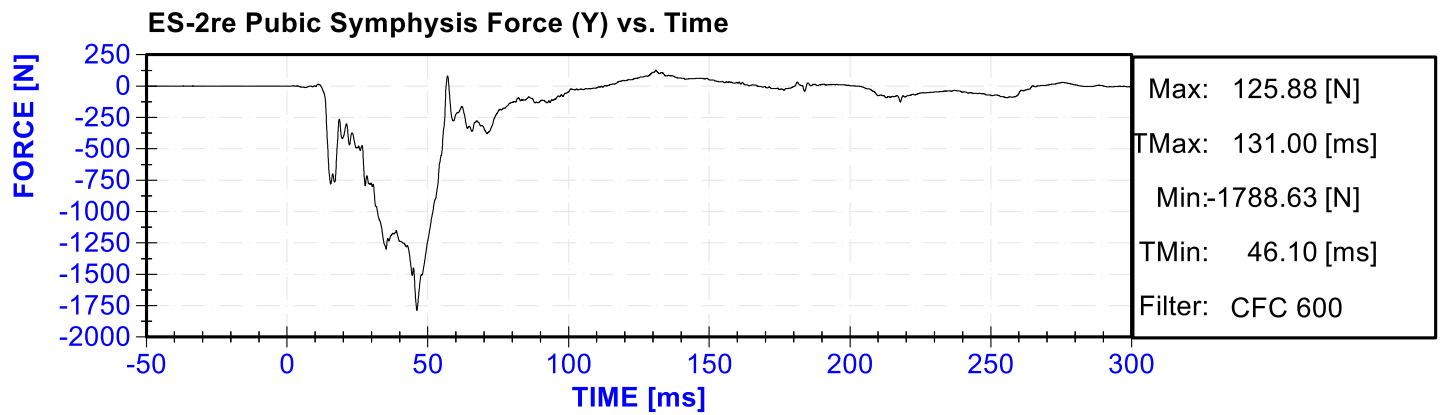
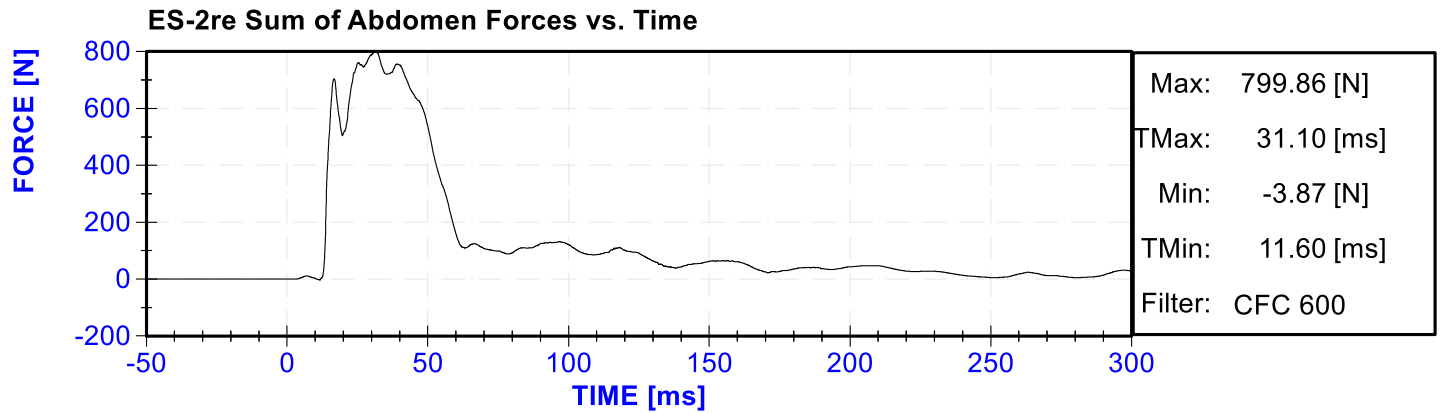
No.	Description	Page
Plot 1	ES-2re Head (X) Acceleration vs. Time	II-3
Plot 2	ES-2re Head (Y) Acceleration vs. Time	II-3
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Plot 9	ES-2re Upper Thorax Rib Deflection (Y) vs. Time	II-5
Plot 10	ES-2re Middle Thorax Rib Deflection Rate vs. Time	II-5
Plot 11	ES-2re Middle Thorax Rib Deflection (Y) vs. Time	II-5
Plot 12	ES-2re Lower Thorax Rib Deflection Rate vs. Time	II-5
Plot 13	ES-2re Lower Thorax Rib Deflection (Y) vs. Time	II-6
Plot 14	ES-2re Front Abdomen Force (Y) vs. Time	II-6
Plot 15	ES-2re Middle Abdomen Force (Y) vs. Time	II-6
Plot 16	ES-2re Rear Abdomen Force (Y) vs. Time	II-6
Plot 17	ES-2re Sum of Abdomen Forces vs. Time	II-7
Plot 18	ES-2re Pubic Symphysis Force (Y) vs. Time	II-7











APPENDIX III
SID-IIs DUMMY RESPONSE DATA

** Note: For this test, an un-instrumented SID-II ATD was used as ballast and injury response data was not collected per NHTSA COR's request.

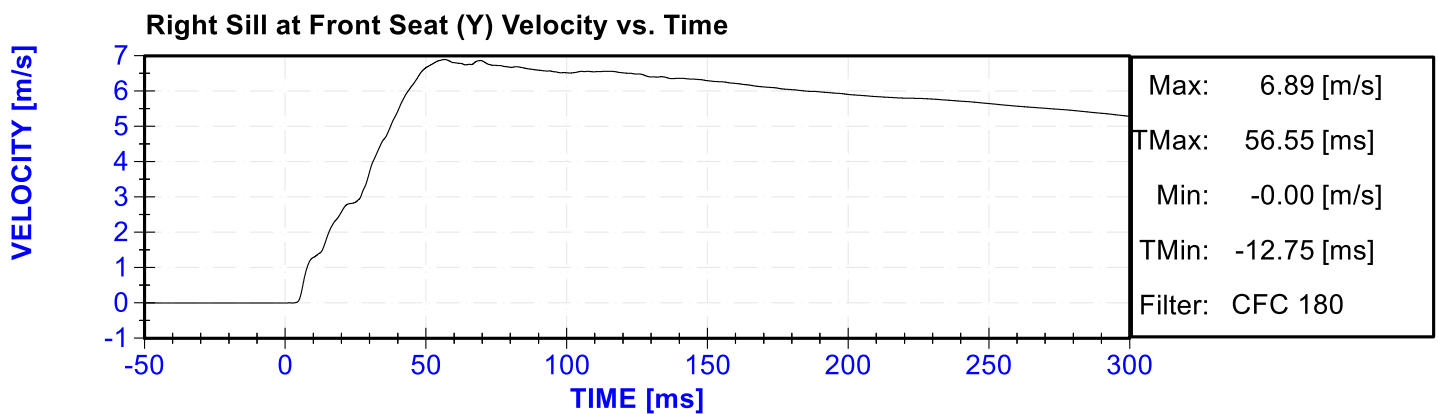
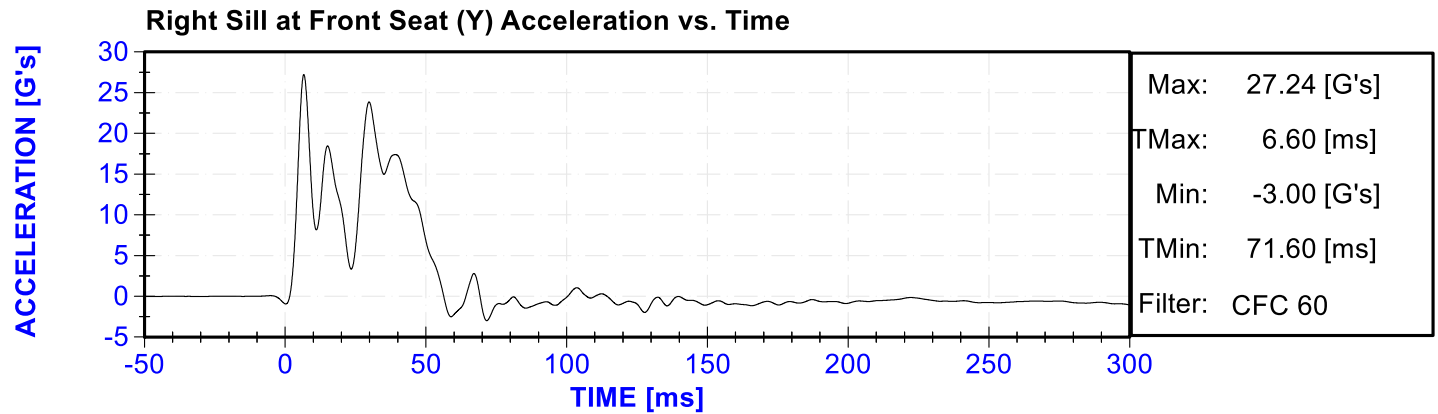
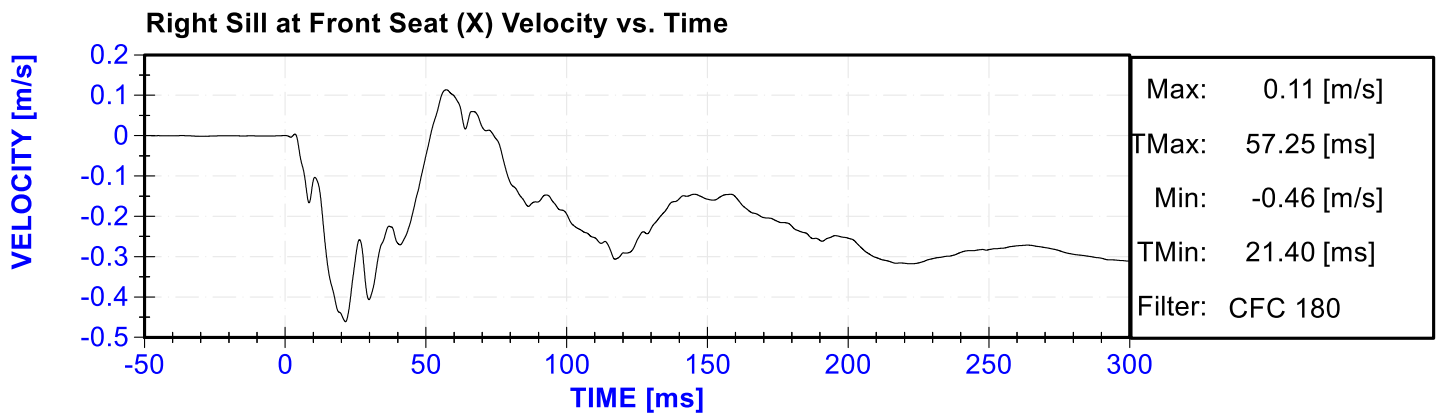
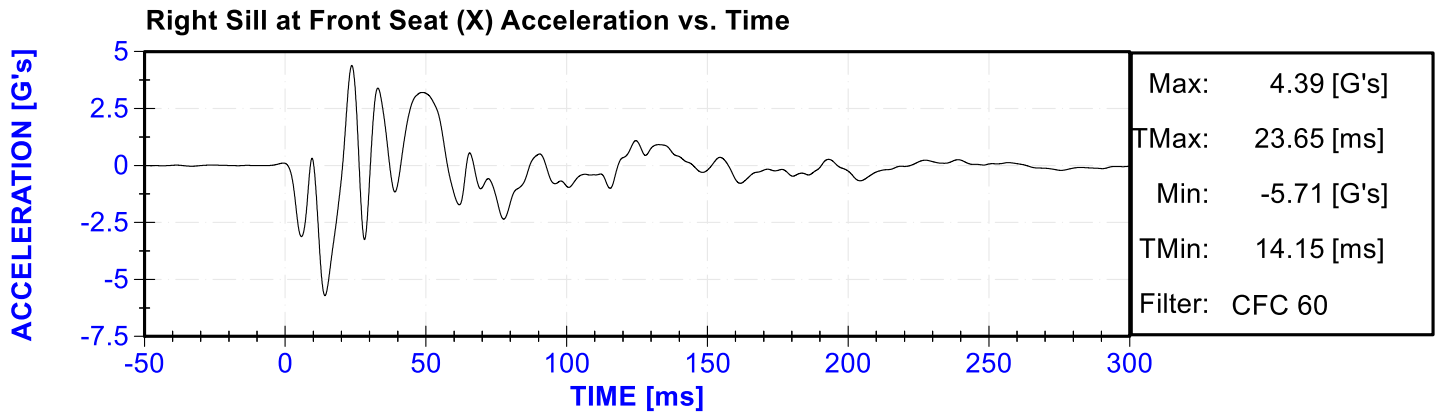
APPENDIX IV

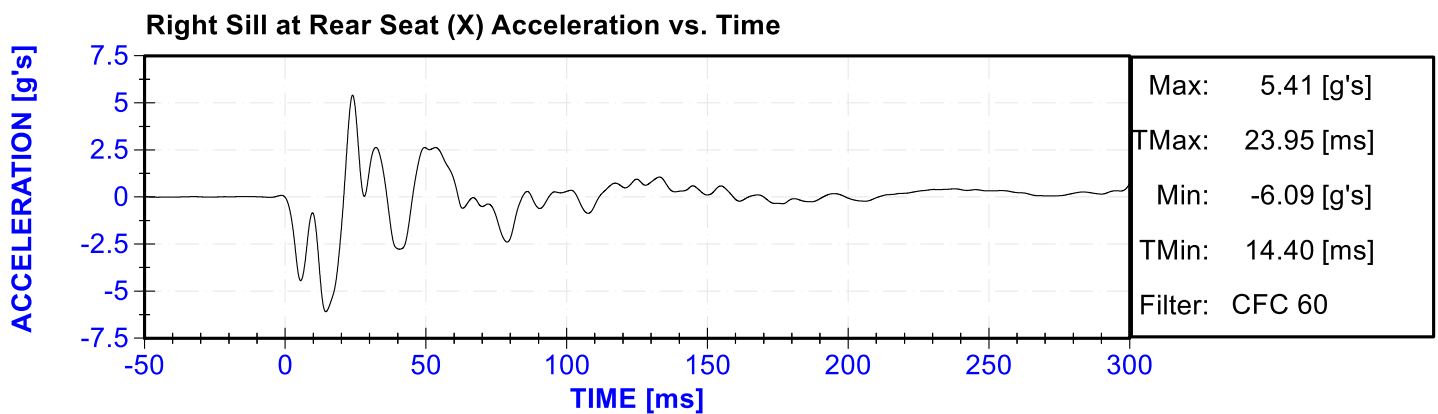
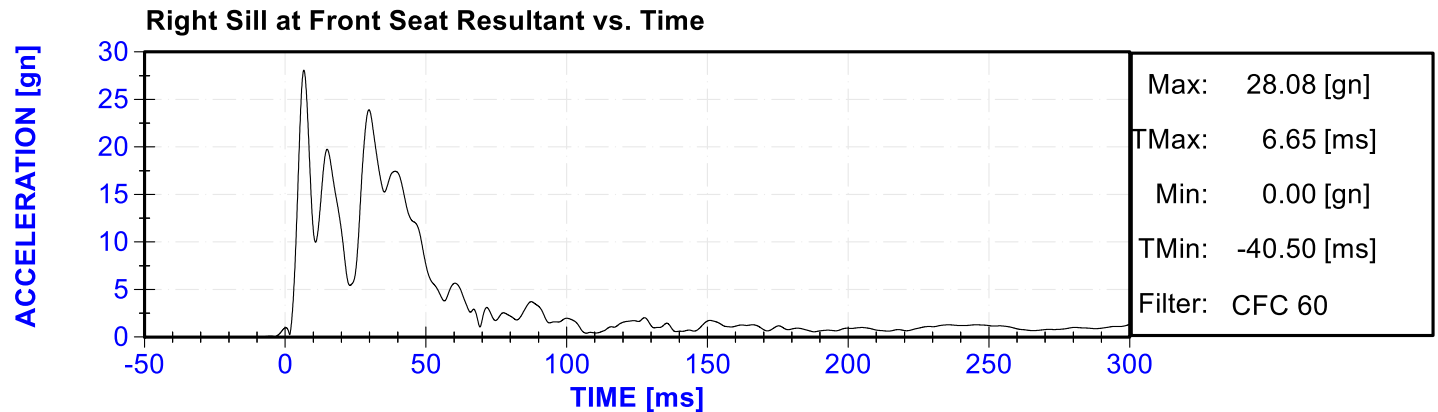
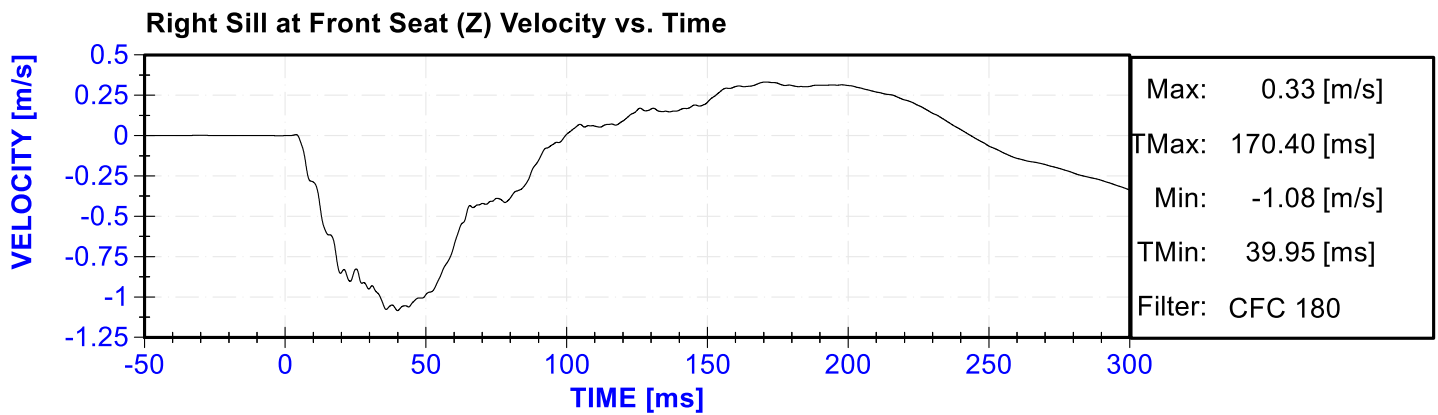
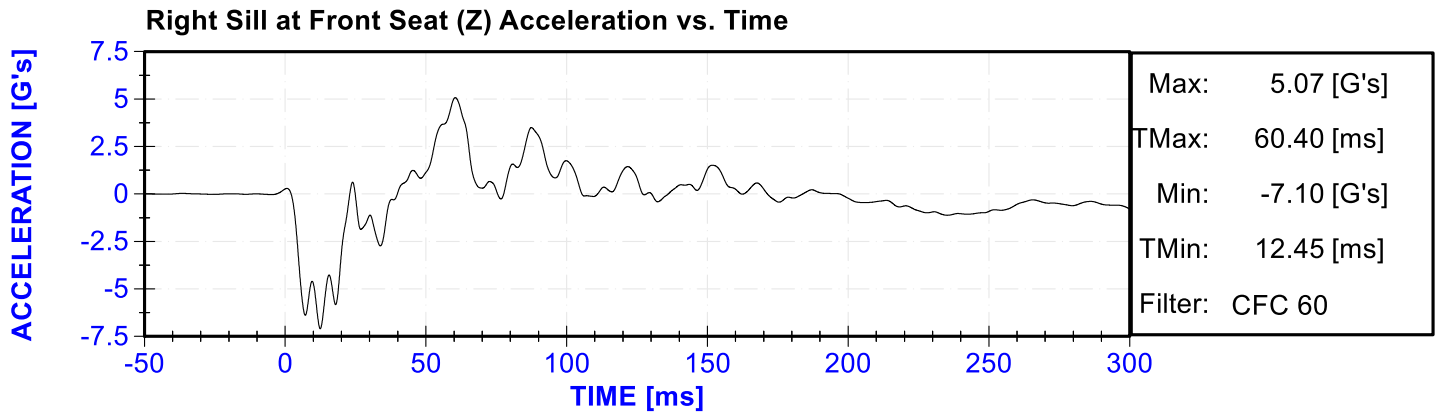
VEHICLE AND MDB ACCELEROMETER RESPONSE DATA

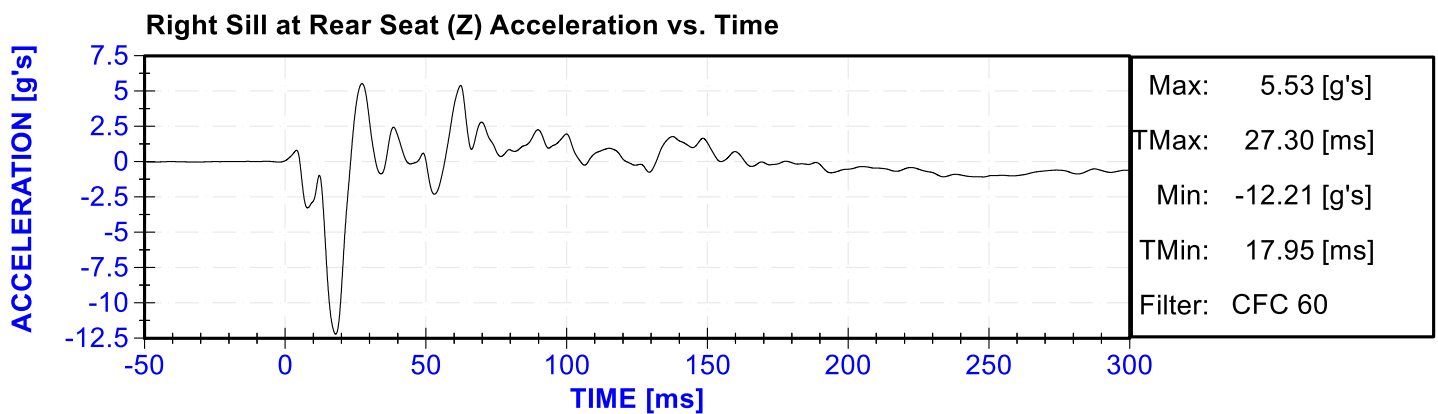
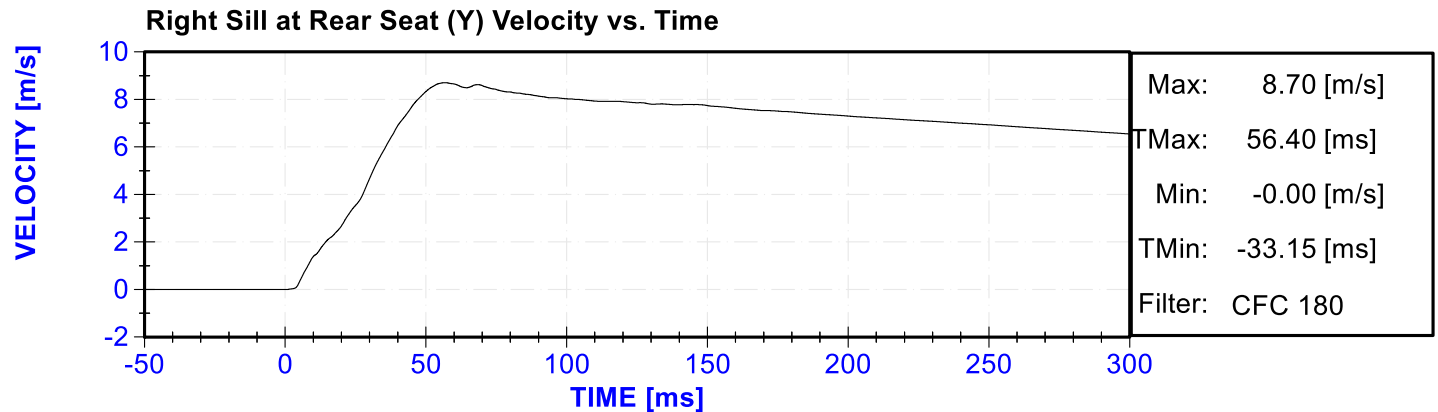
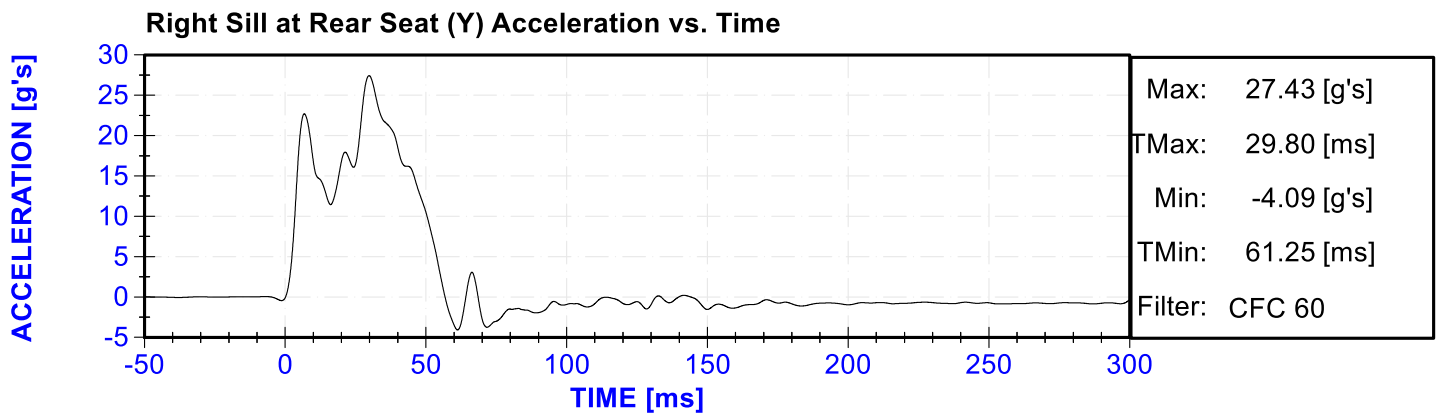
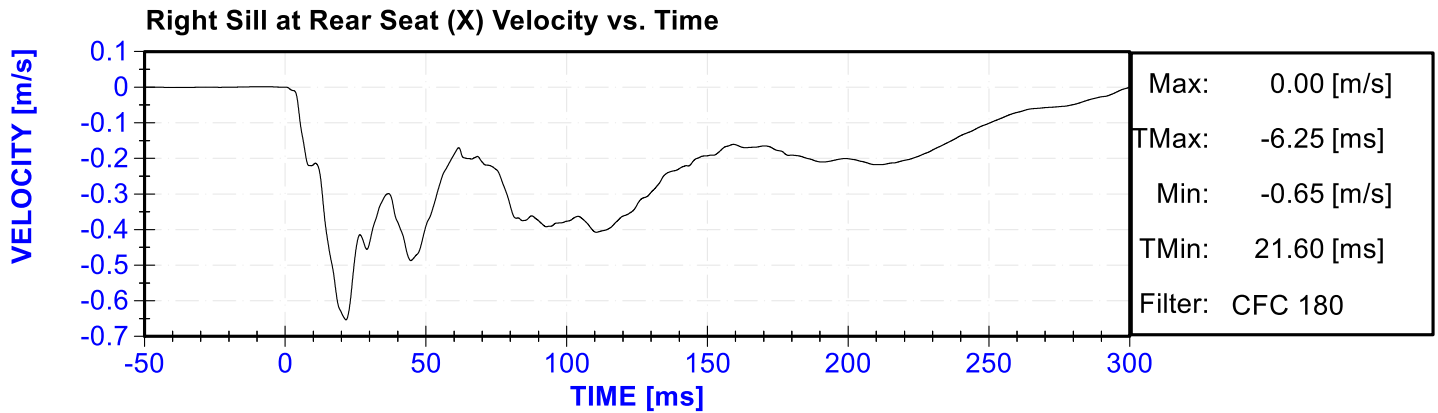
Table of Data Plots

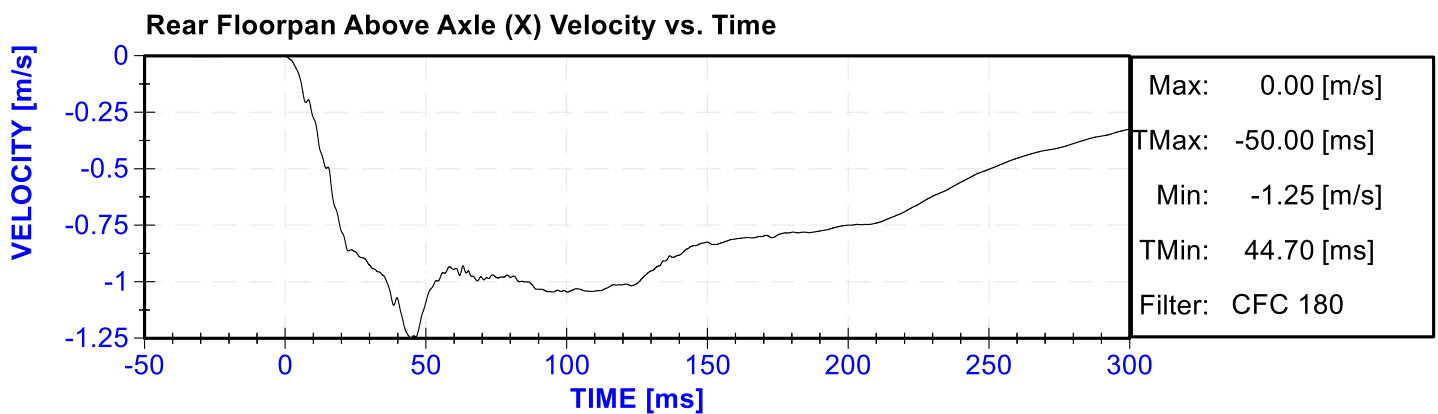
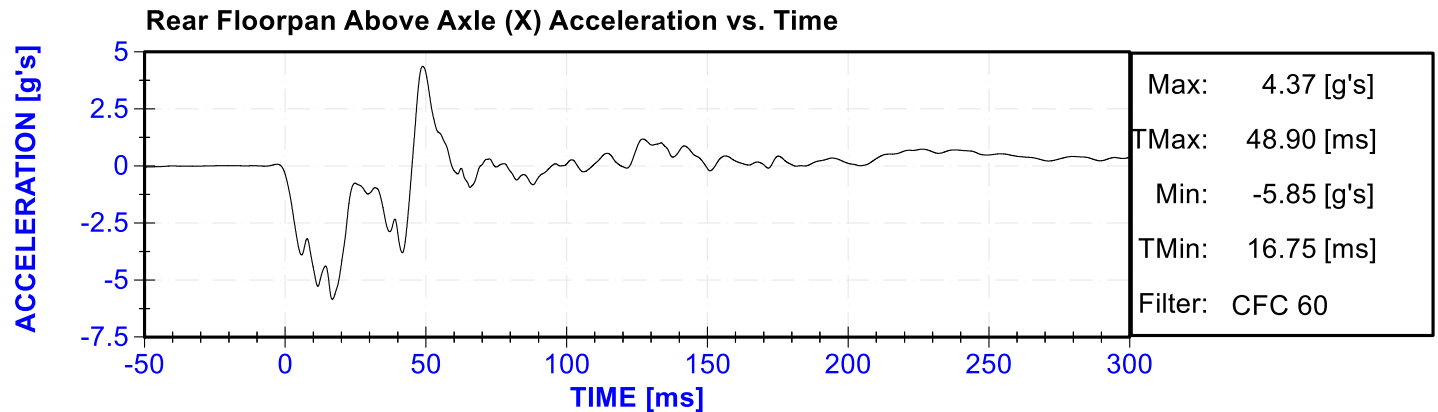
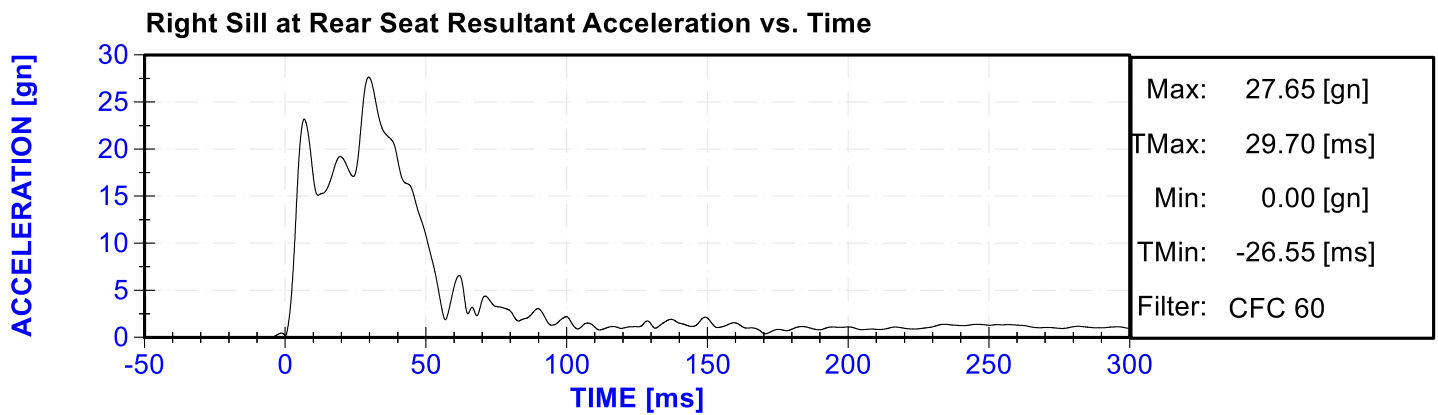
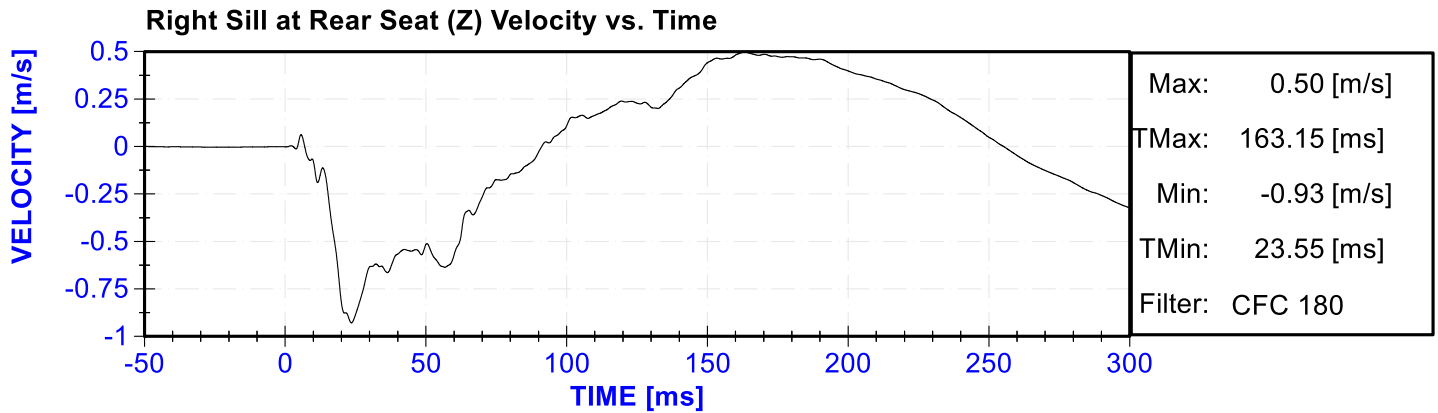
No.	Description	Page
Plot 1	Right Sill at Front Seat (X) Acceleration vs. Time	D-4
Plot 2	Right Sill at Front Seat (X) Velocity vs. Time	D-4
Plot 3	Right Sill at Front Seat (Y) Acceleration vs. Time	D-4
Plot 4	Right Sill at Front Seat (Y) Velocity vs. Time	D-4
Plot 5	Right Sill at Front Seat (Z) Acceleration vs. Time	D-5
Plot 6	Right Sill at Front Seat (Z) Velocity vs. Time	D-5
Plot 7	Right Sill at Front Seat Resultant vs. Time	D-5
Plot 8	Right Sill at Rear Seat (X) Acceleration vs. Time	D-5
Plot 9	Right Sill at Rear Seat (X) Velocity vs. Time	D-6
Plot 10	Right Sill at Rear Seat (Y) Acceleration vs. Time	D-6
Plot 11	Right Sill at Rear Seat (Y) Velocity vs. Time	D-6
Plot 12	Right Sill at Rear Seat (Z) Acceleration vs. Time	D-6
Plot 13	Right Sill at Rear Seat (Z) Velocity vs. Time	D-7
Plot 14	Right Sill at Rear Seat Resultant Acceleration vs. Time	D-7
Plot 15	Rear Floorpan Above Axle (X) Acceleration vs. Time	D-7
Plot 16	Rear Floorpan Above Axle (X) Velocity vs. Time	D-7
Plot 17	Rear Floorpan Above Axle (Y) Acceleration vs. Time	D-8
Plot 18	Rear Floorpan Above Axle (Y) Velocity vs. Time	D-8
Plot 19	Rear Floorpan Above Axle (Z) Acceleration vs. Time	D-8
Plot 20	Rear Floorpan Above Axle (Z) Velocity vs. Time	D-8
Plot 21	Rear Floorpan Above Axle Resultant Acceleration vs. Time	D-9
Plot 22	Left Sill at Rear Door (Y) Acceleration vs. Time	D-9
Plot 23	Left Sill at Rear Door (Y) Velocity vs. Time	D-9
Plot 24	Left Sill at Front Door (Y) Acceleration vs. Time.	D-9
Plot 25	Left Sill at Front Door (Y) Velocity vs. Time	D-10
Plot 26	Right Rear Occ. Compartment(Y) Acceleration vs. Time	D-10
Plot 27	Right Rear Occ. Compartment(Y) Velocity vs. Time	D-10
Plot 28	Left B-Post Lower (Y) Acceleration vs. Time	D-10
Plot 29	Left B-Post Lower (Y) Velocity vs. Time	D-11
Plot 30	Left B-Post Middle (Y) Acceleration vs. Time	D-11
Plot 31	Left B-Post Middle (Y) Velocity vs. Time	D-11
Plot 32	Left A-Post Lower(Y) Acceleration vs. Time	D-11
Plot 33	Left A-Post Lower(Y) Velocity vs. Time	D-12
Plot 34	Left A-Post Middle (Y) Acceleration vs. Time	D-12
Plot 35	Left A-Post Middle (Y) Velocity vs. Time	D-12
Plot 36	Front Seat Track (Y) Acceleration vs. Time	D-12
Plot 37	Front Seat Track (Y) Velocity vs. Time	D-13
Plot 38	Rear Seat Track or Structure (Y) Acceleration vs. Time	D-13
Plot 39	Rear Seat Track or Structure (Y) Velocity vs. Time	D-13
Plot 40	Vehicle CG (X) Acceleration vs. Time	D-13
Plot 41	Vehicle CG (X) Velocity vs. Time	D-14
Plot 42	Vehicle CG (Y) Acceleration vs. Time	D-14
Plot 43	Vehicle CG (Y) Velocity vs. Time	D-14
Plot 44	Vehicle CG (Z) Acceleration vs. Time	D-14
Plot 45	Vehicle CG (Z) Velocity vs. Time	D-15
Plot 46	Vehicle CG Resultant Acceleration vs. Time	D-15
Plot 47	MDB Center of Gravity (X) Acceleration vs. Time	D-15
Plot 48	MDB Center of Gravity (X) Velocity vs. Time	D-15
Plot 49	MDB Center of Gravity (Y) Acceleration vs. Time	D-16
Plot 50	MDB Center of Gravity (Y) Velocity vs. Time	D-16
Plot 51	MDB Center of Gravity (Z) Acceleration vs. Time	D-16
Plot 52	MDB Center of Gravity (Z) Velocity vs. Time	D-16

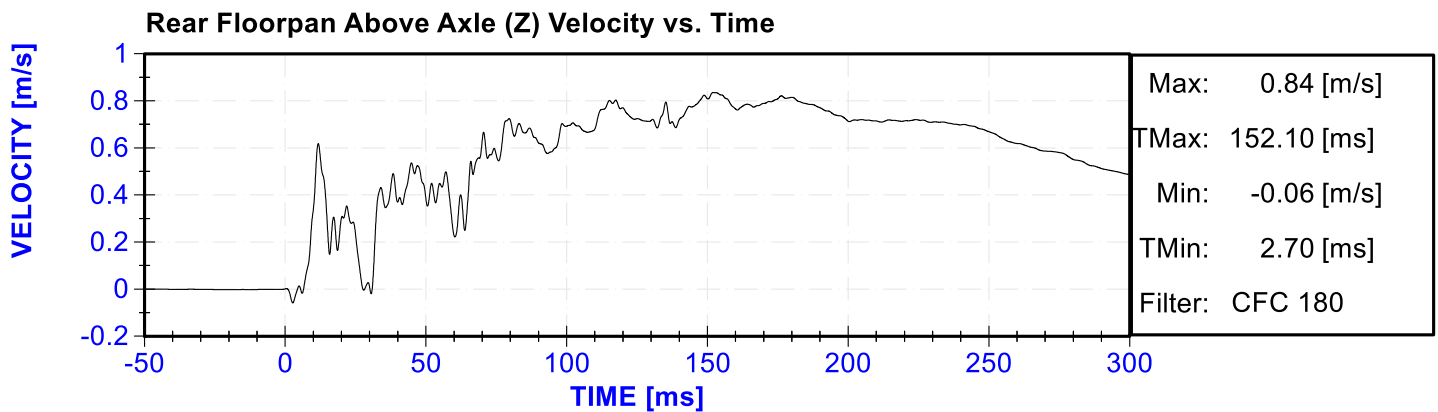
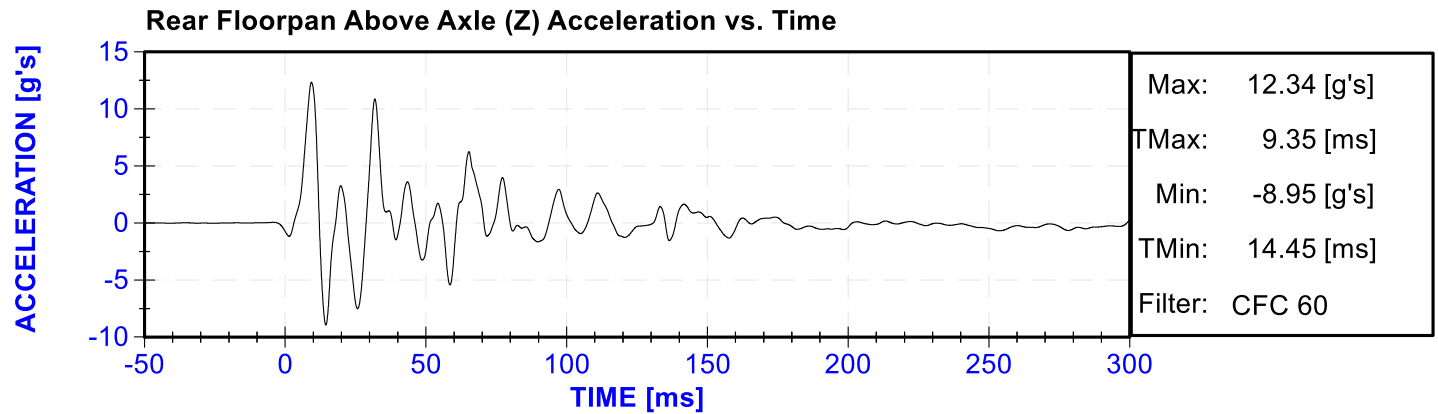
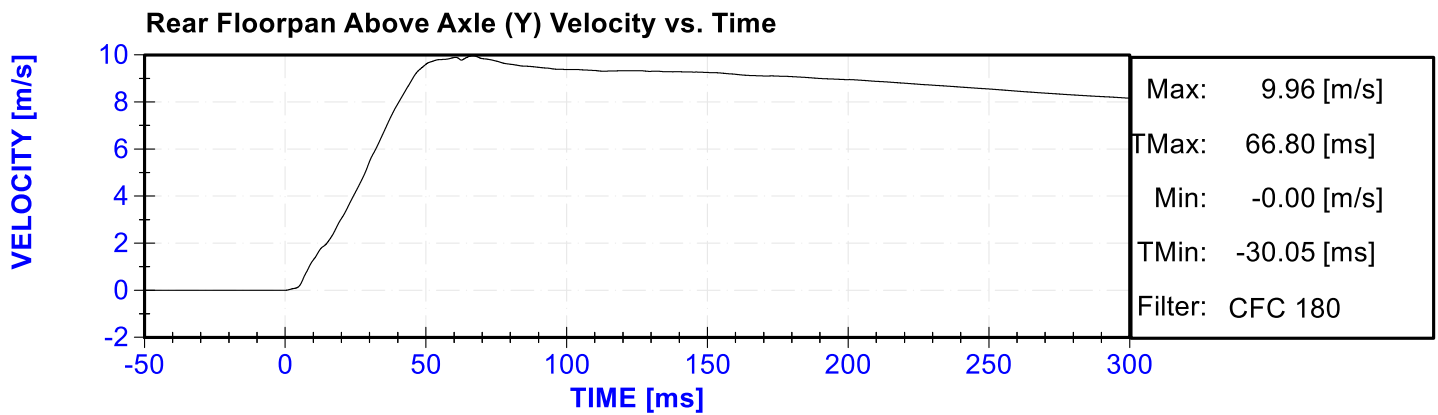
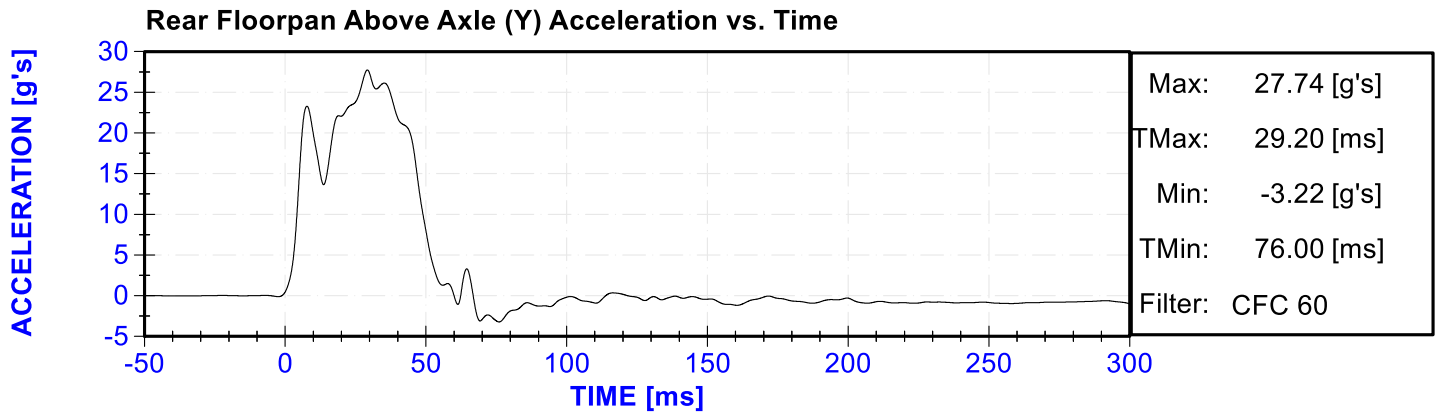
Plot 53	MDB Center of Gravity Resultant Acceleration vs. Time	D-17
Plot 54	MDB Rear (X) Acceleration vs. Time	D-17
Plot 55	MDB Rear (X) Velocity vs. Time	D-17
Plot 56	MDB Rear (Y) Acceleration vs. Time	D-17
Plot 57	MDB Rear (Y) Velocity vs. Time	D-18

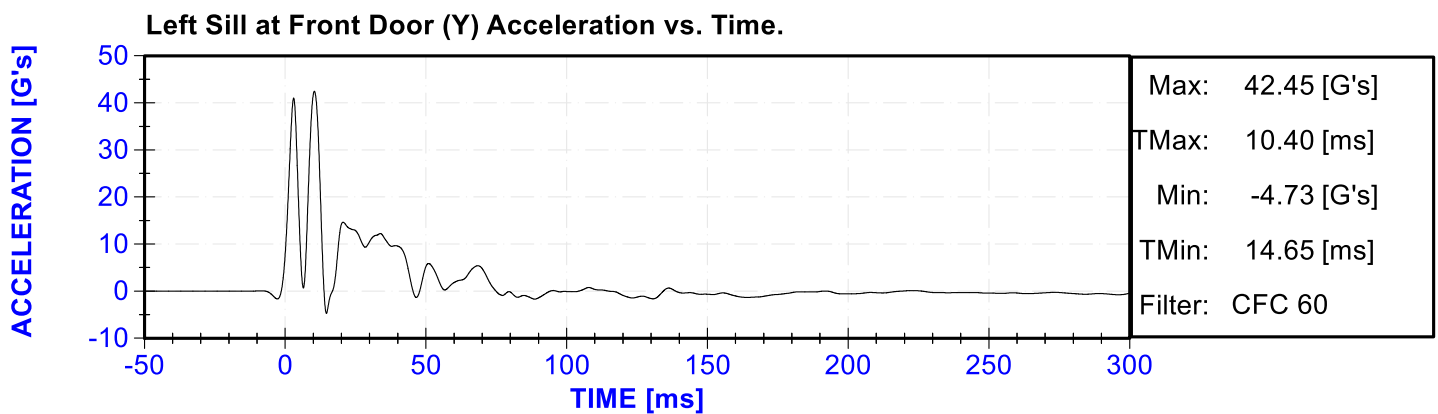
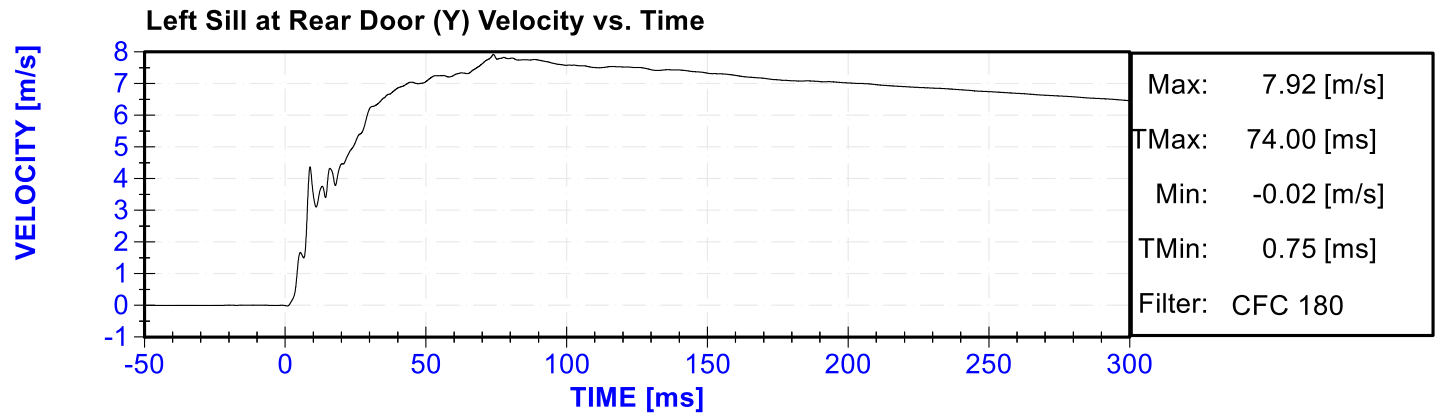
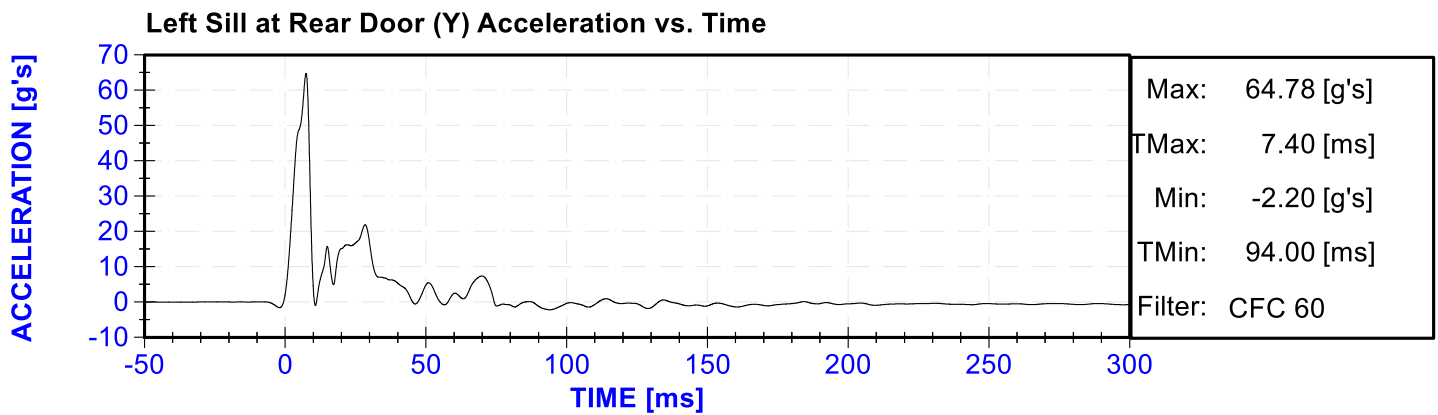
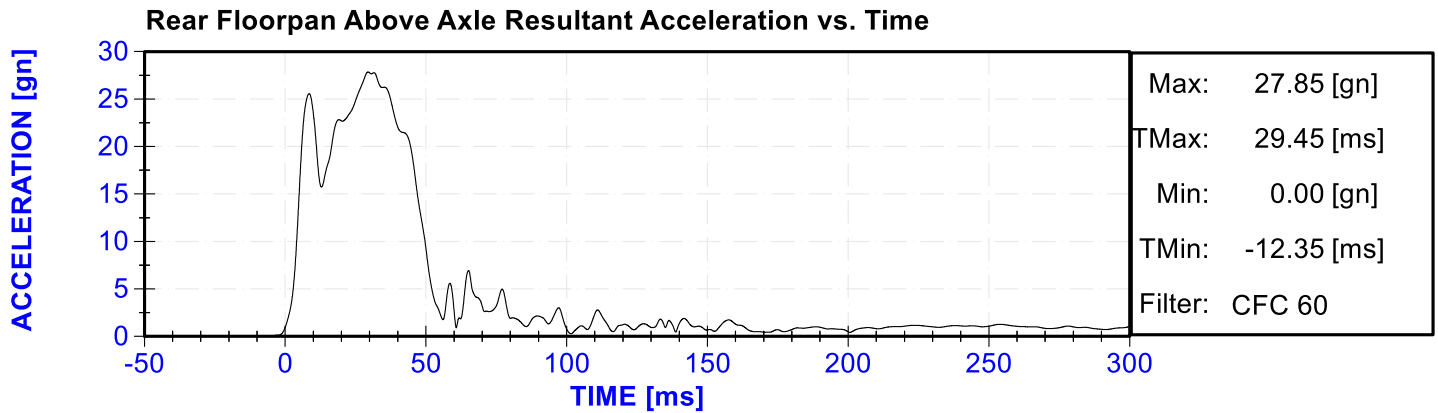


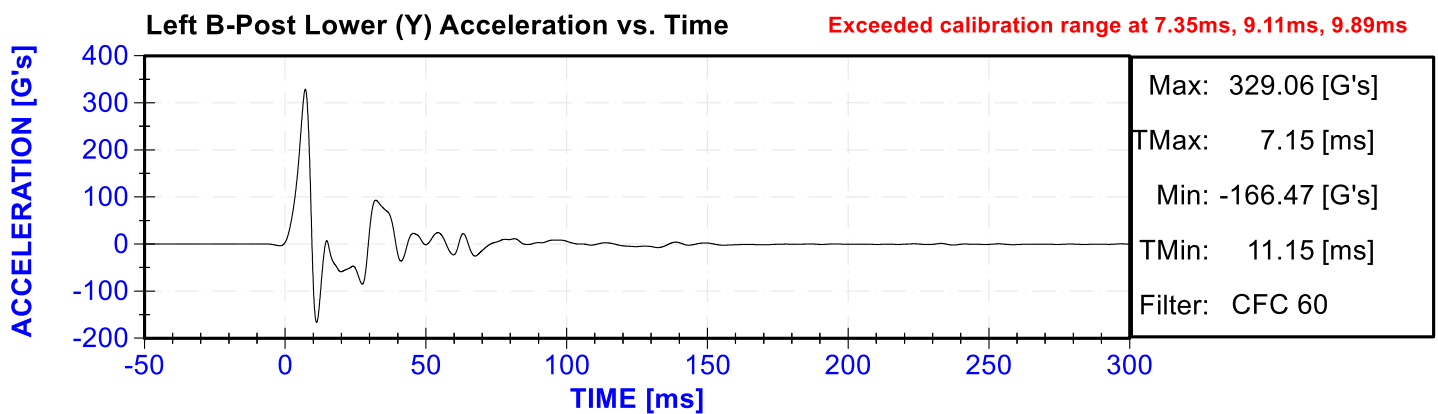
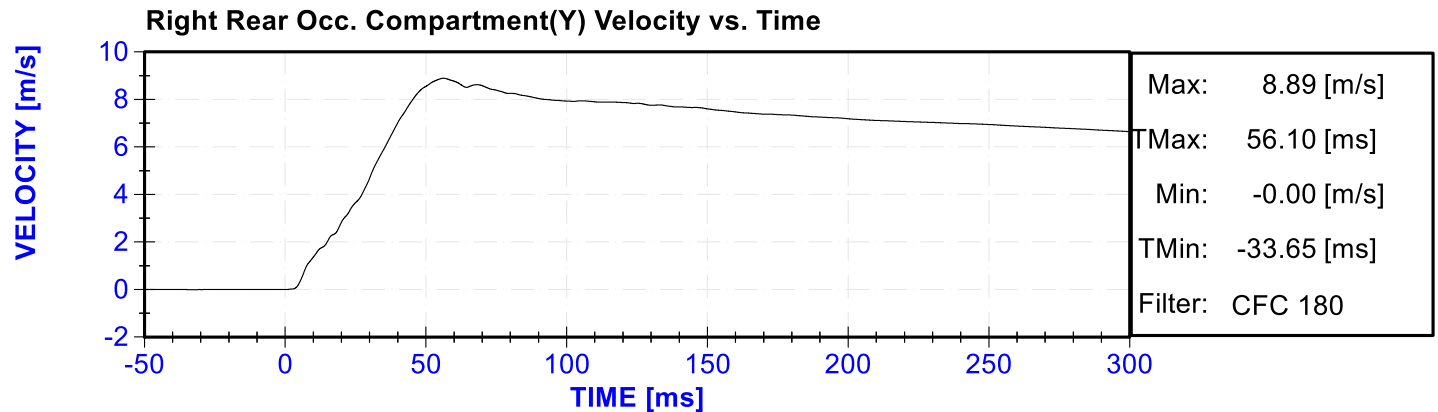
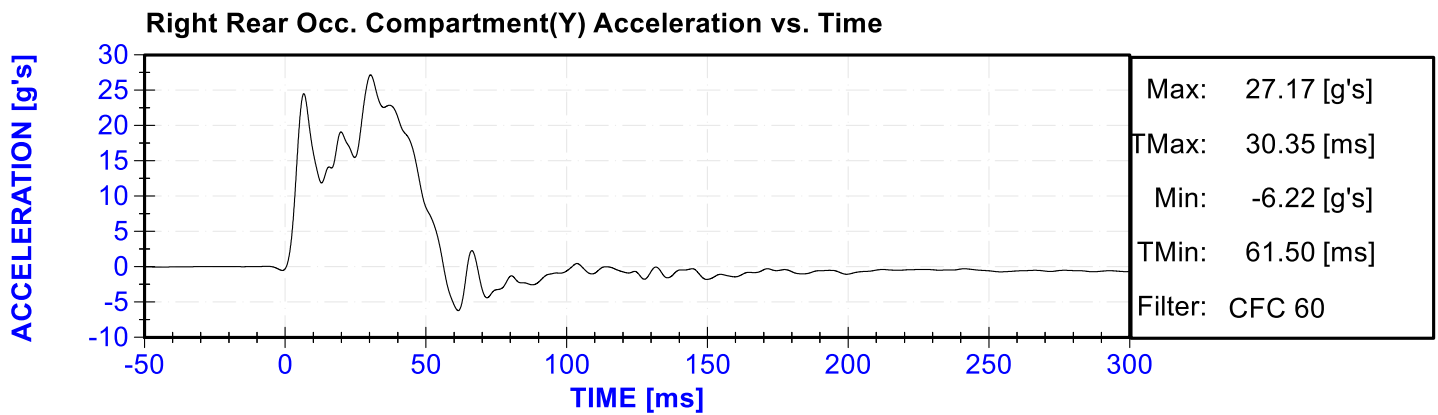
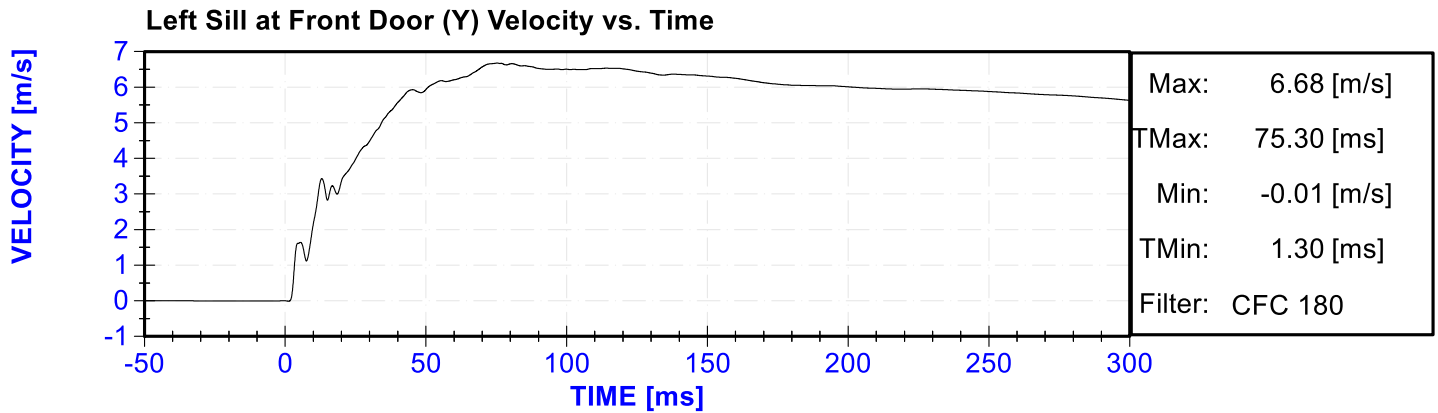


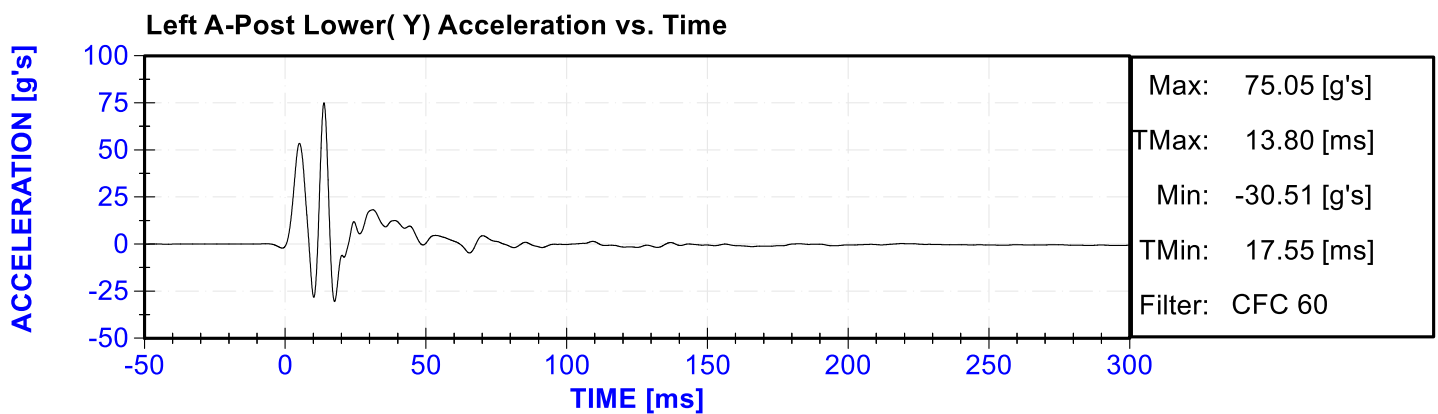
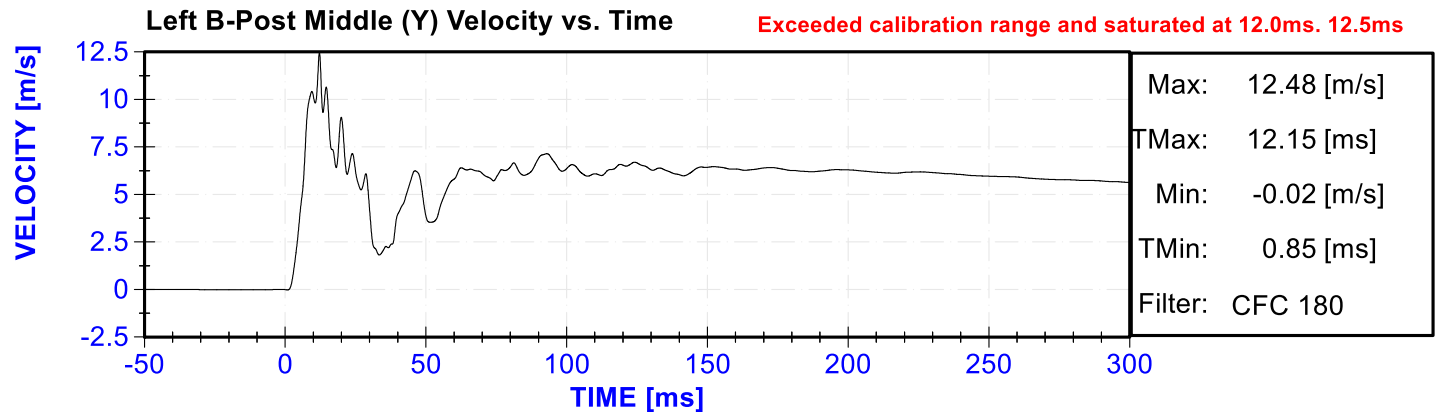
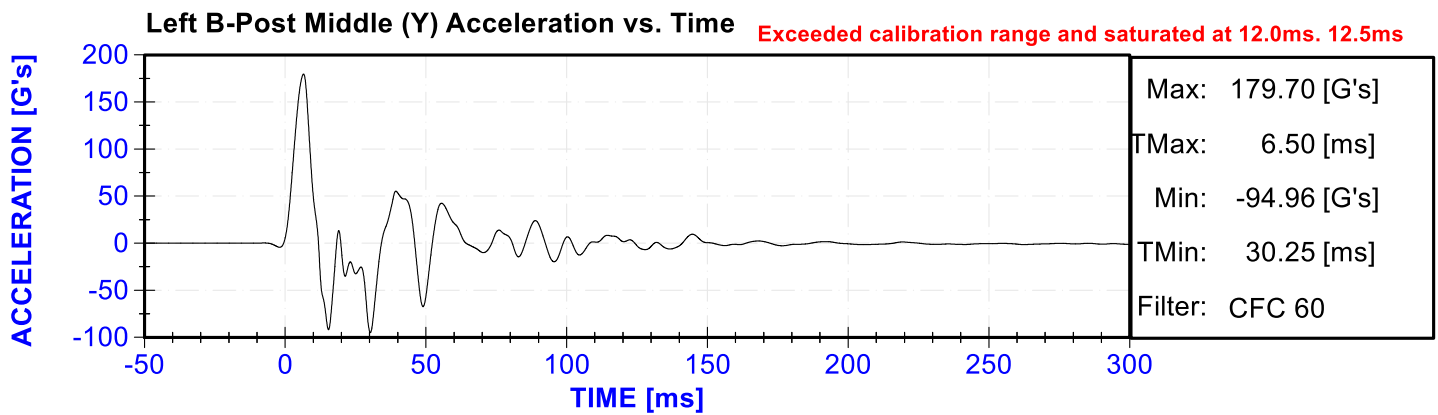
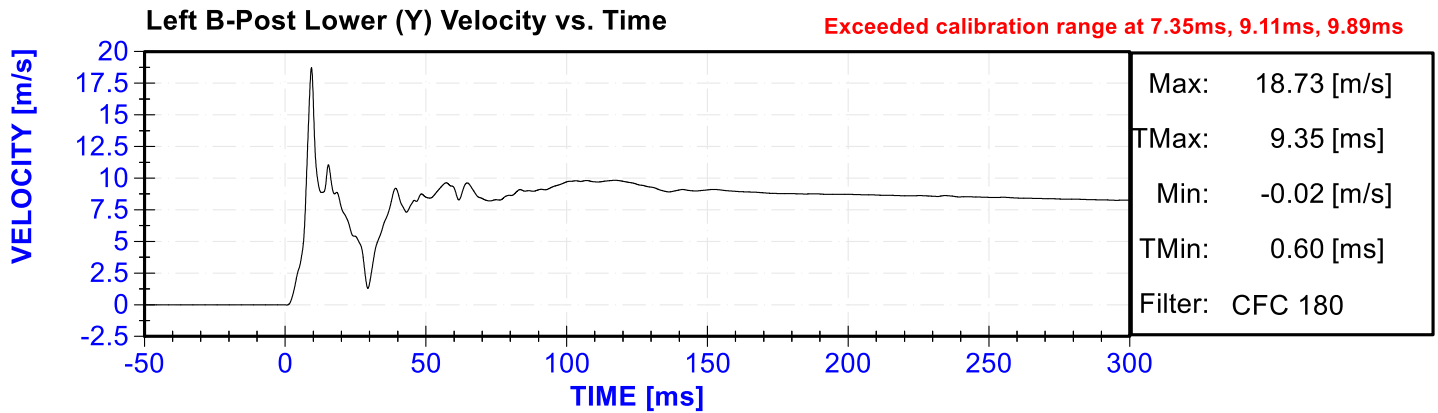


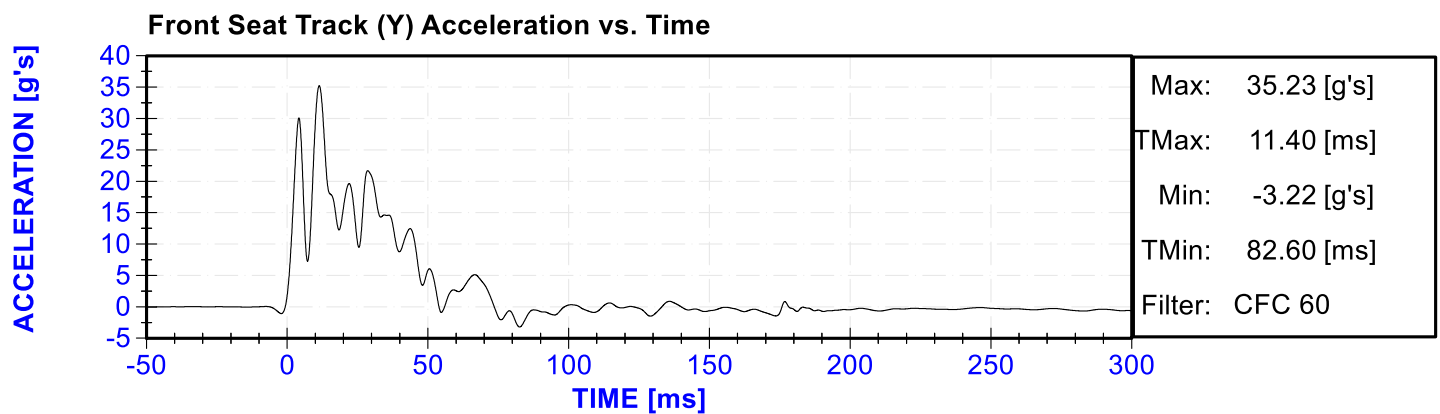
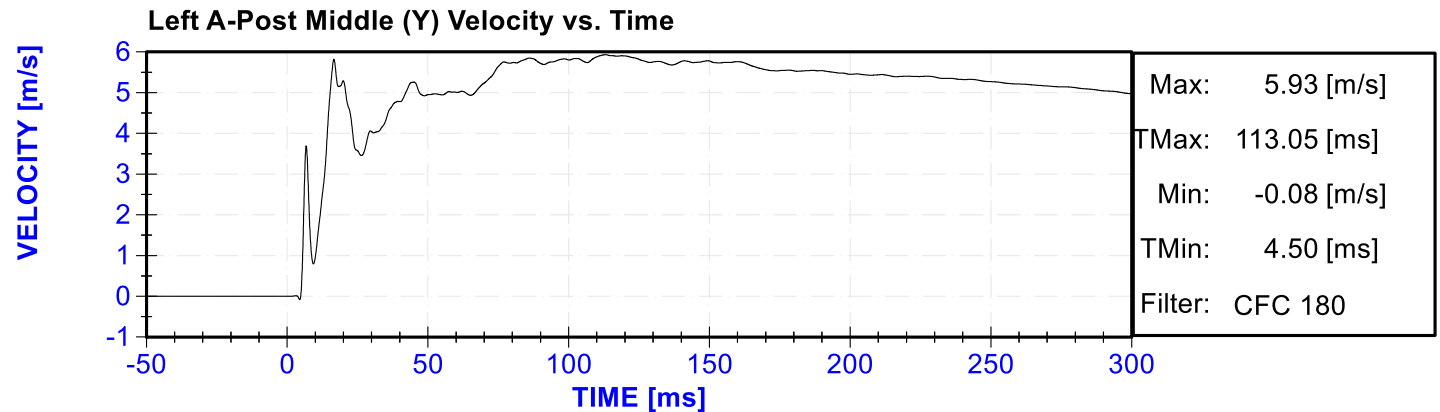
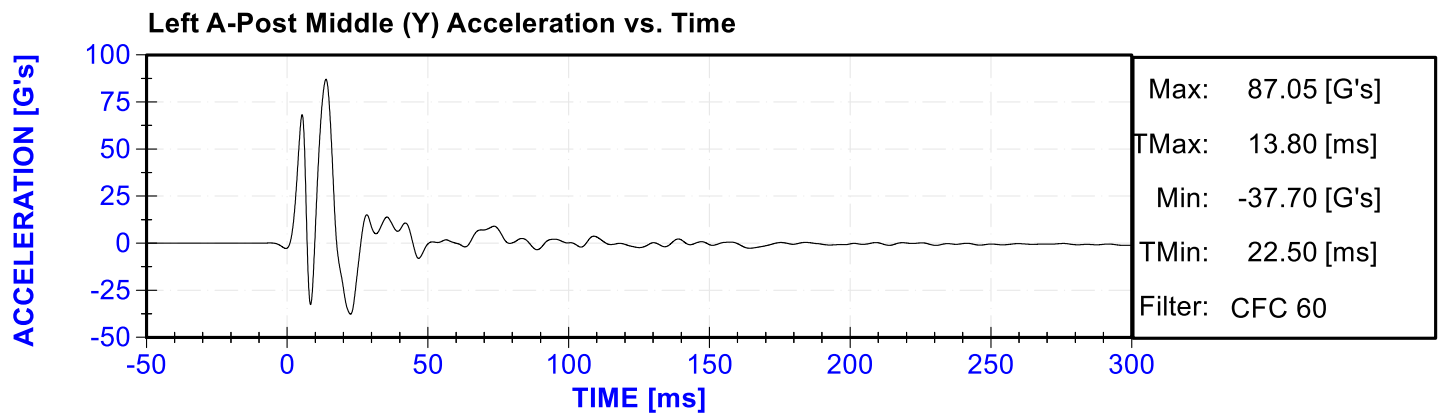
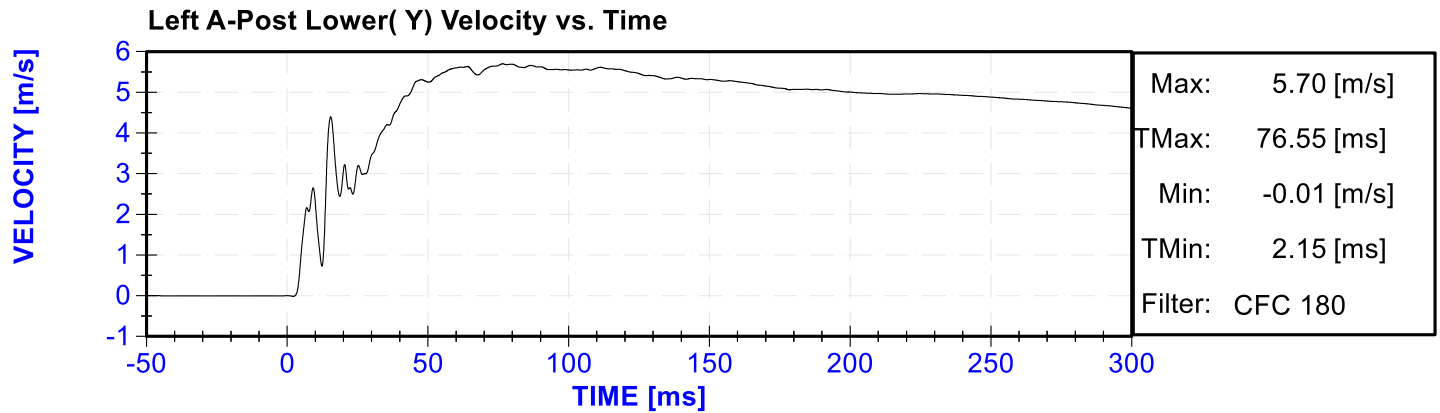


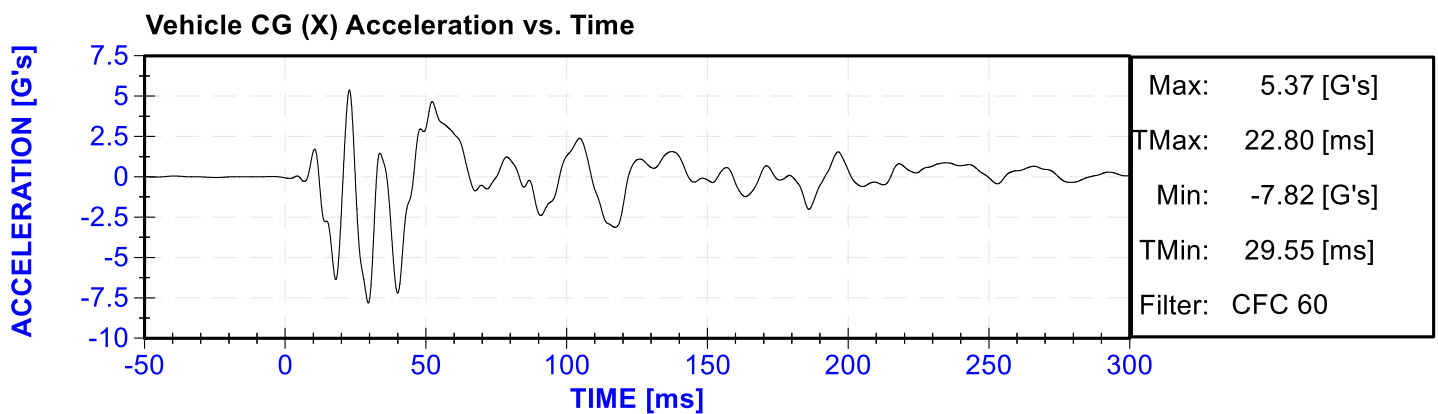
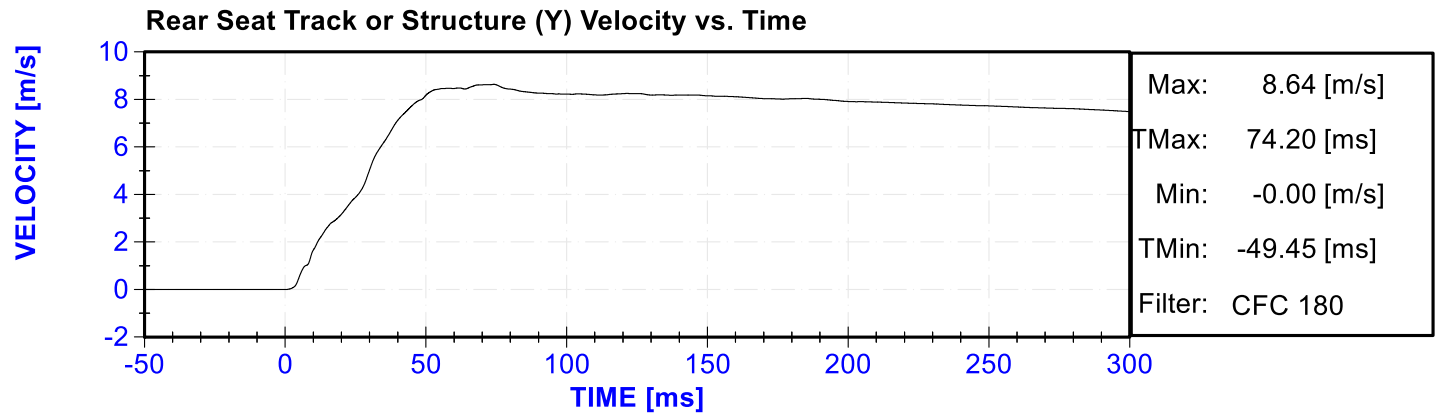
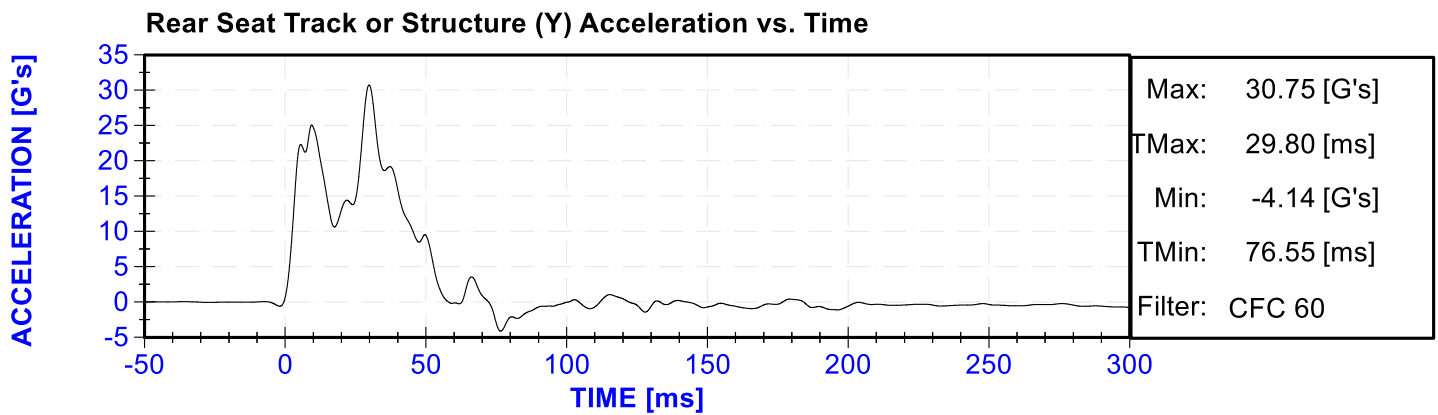
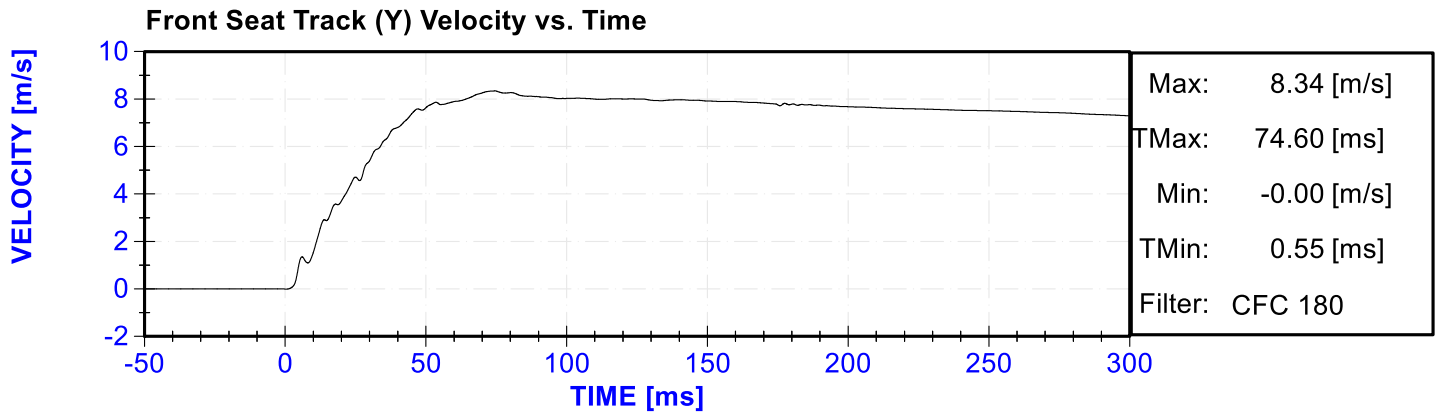


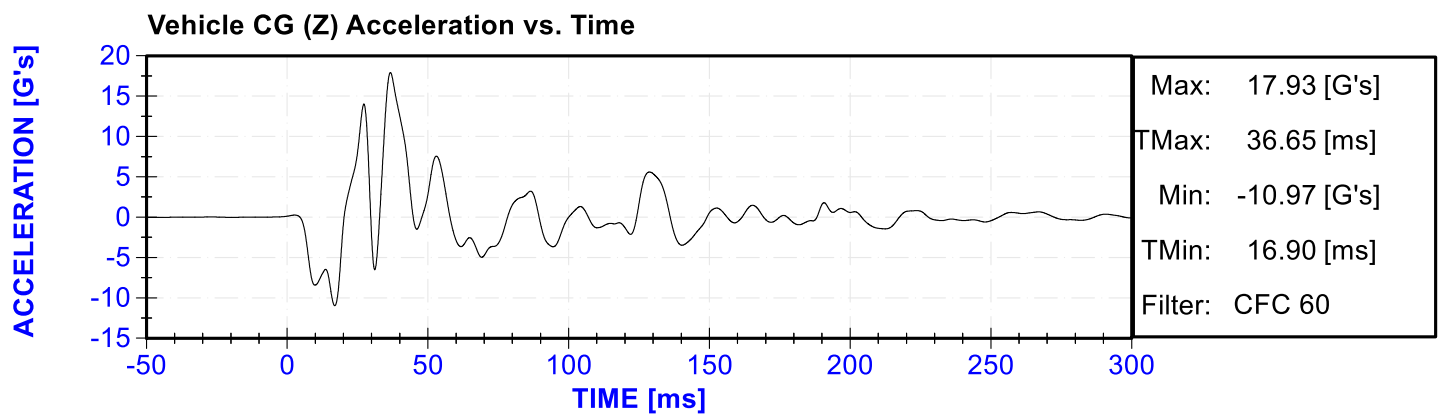
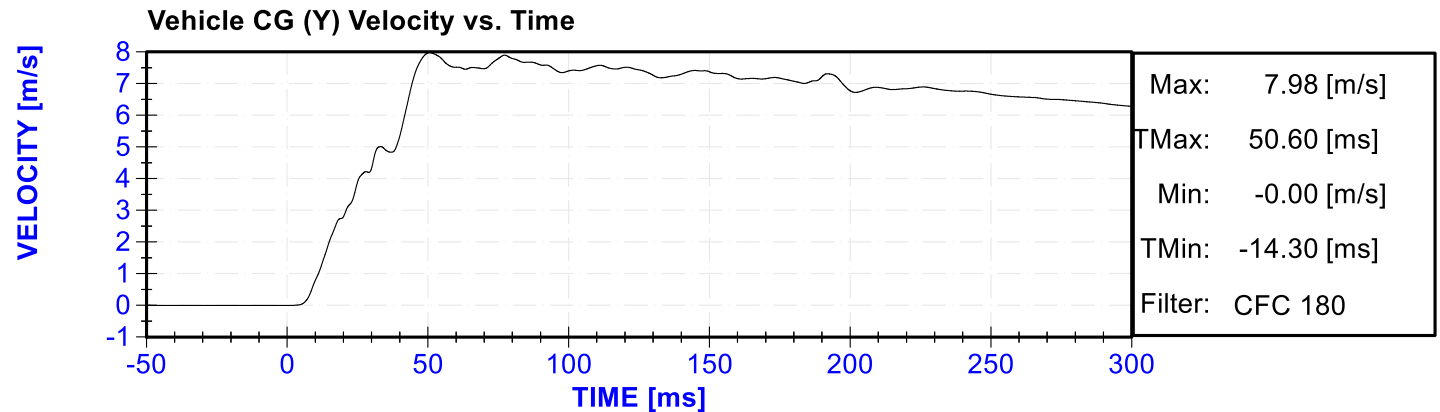
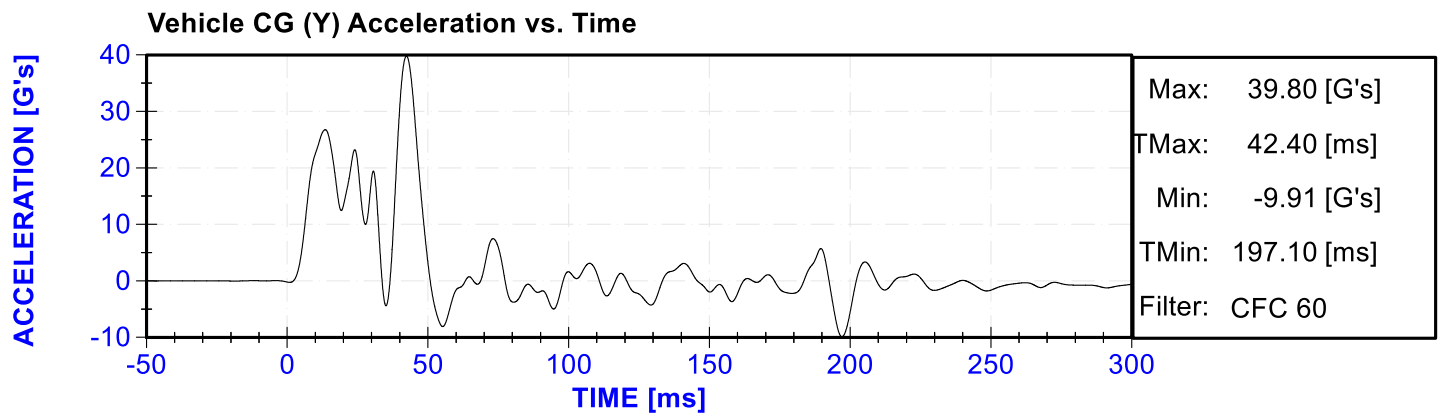
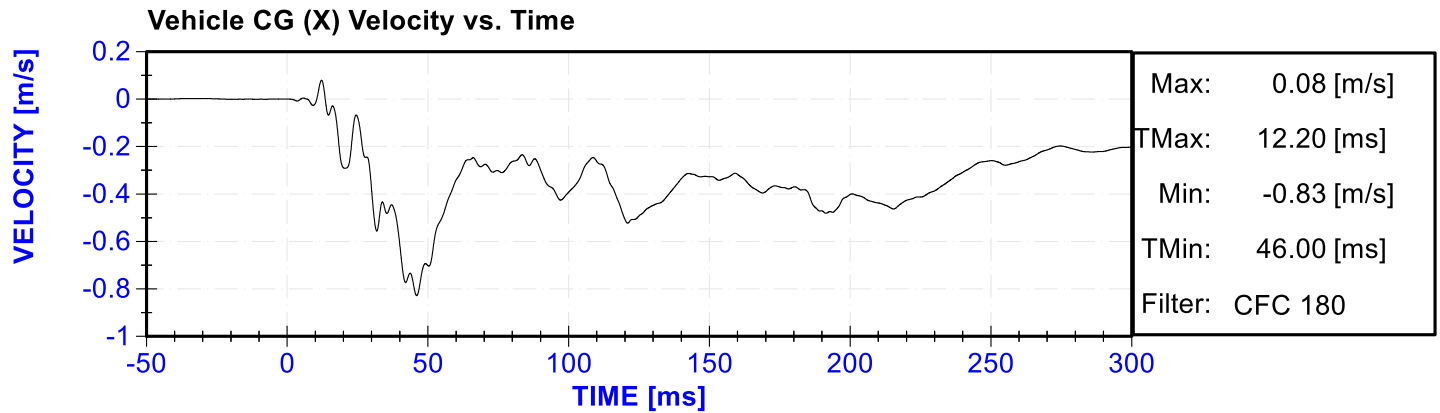


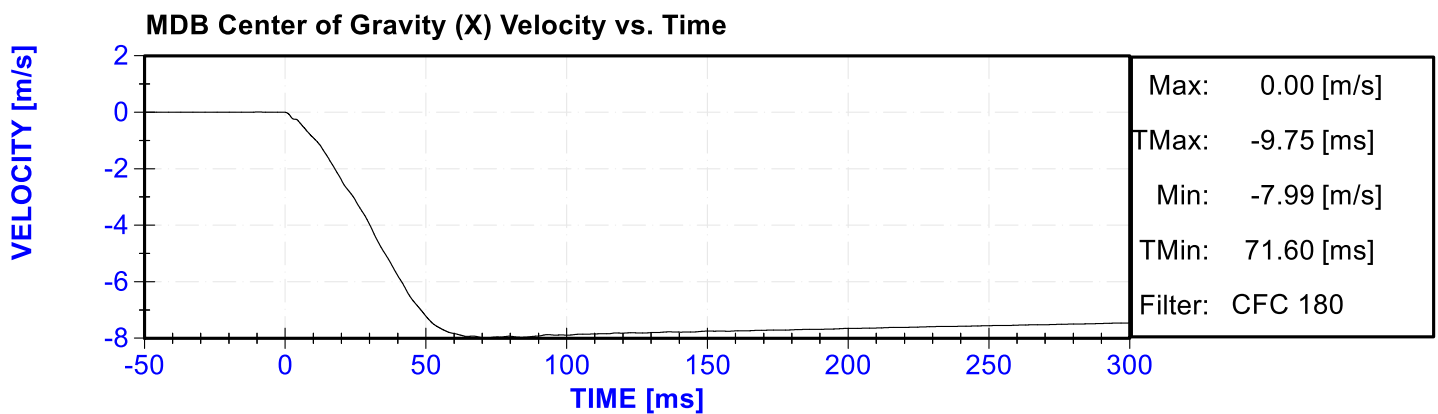
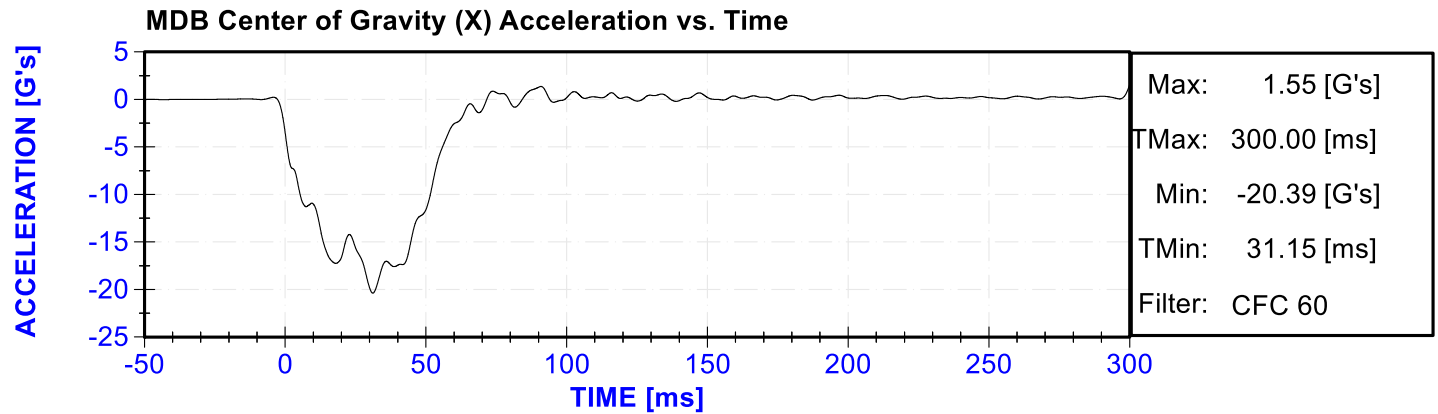
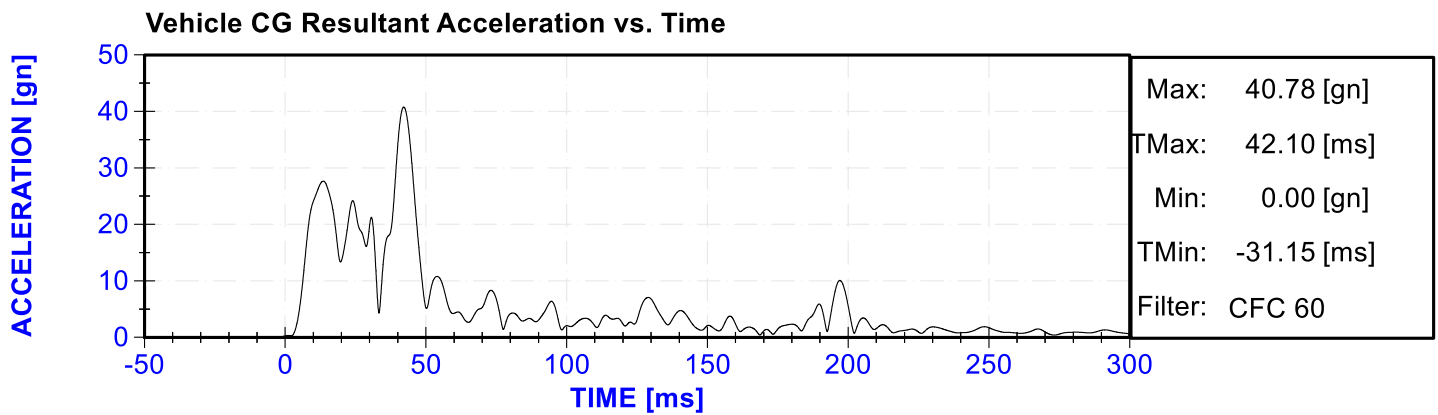
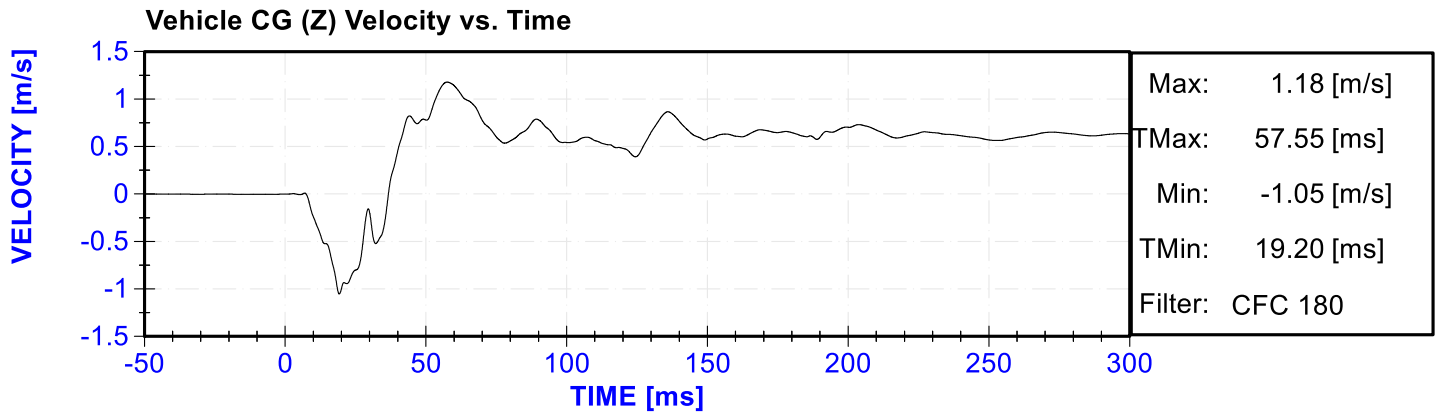


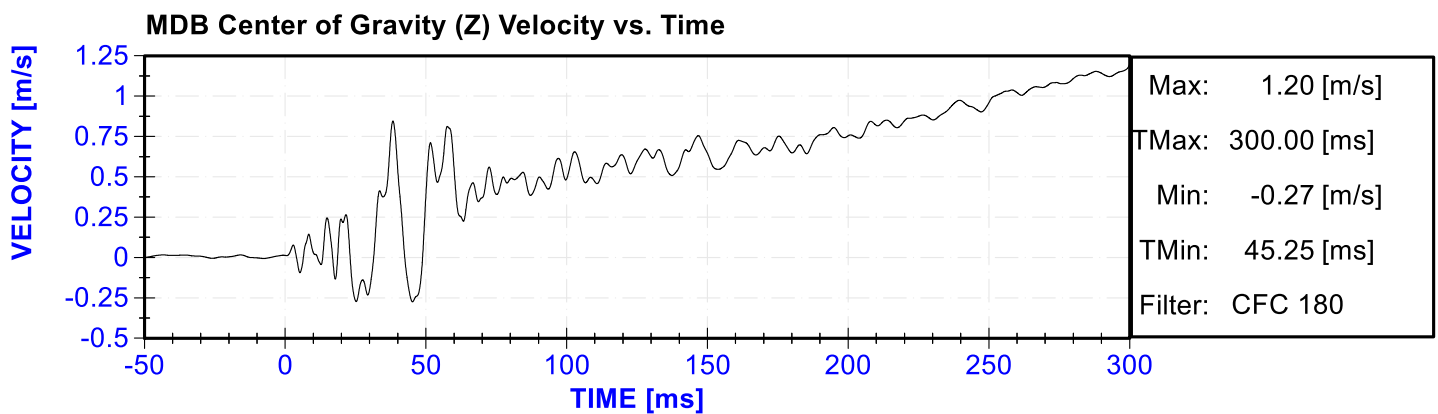
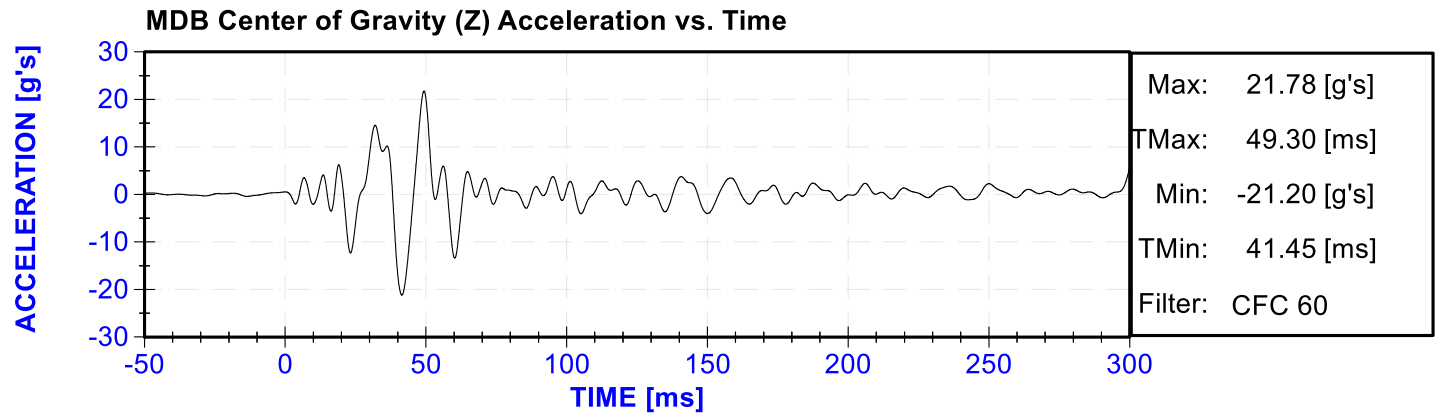
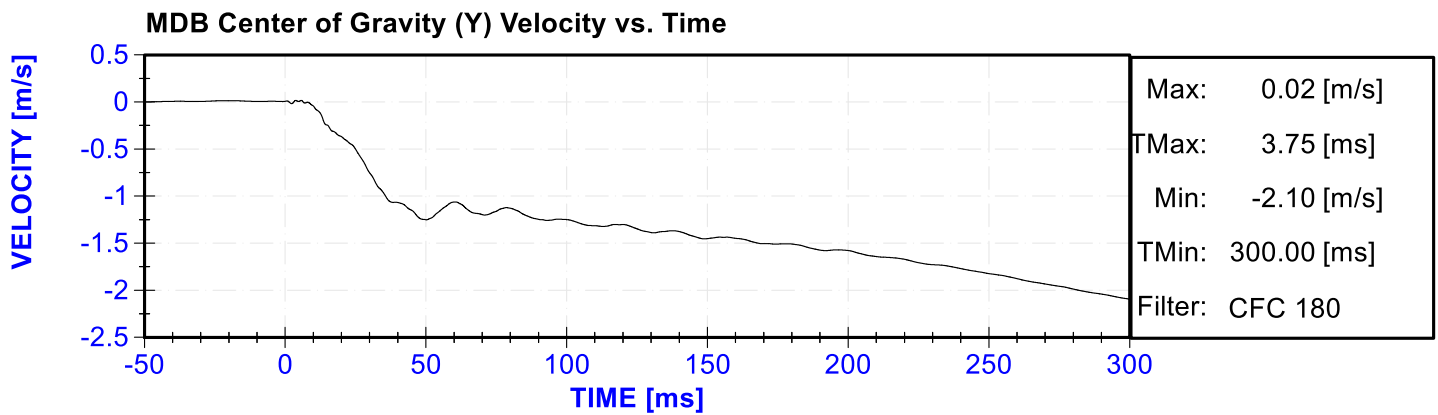
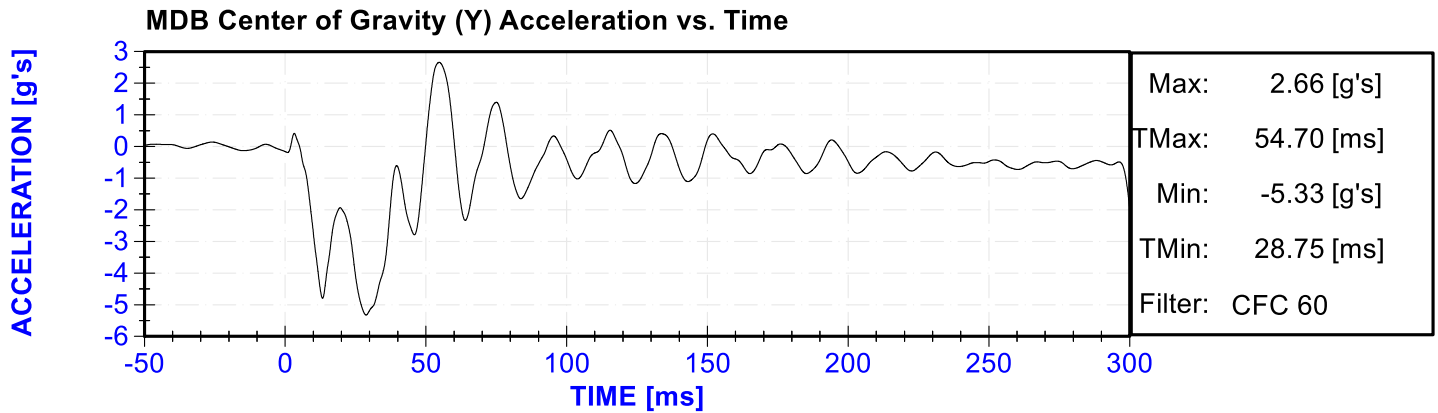


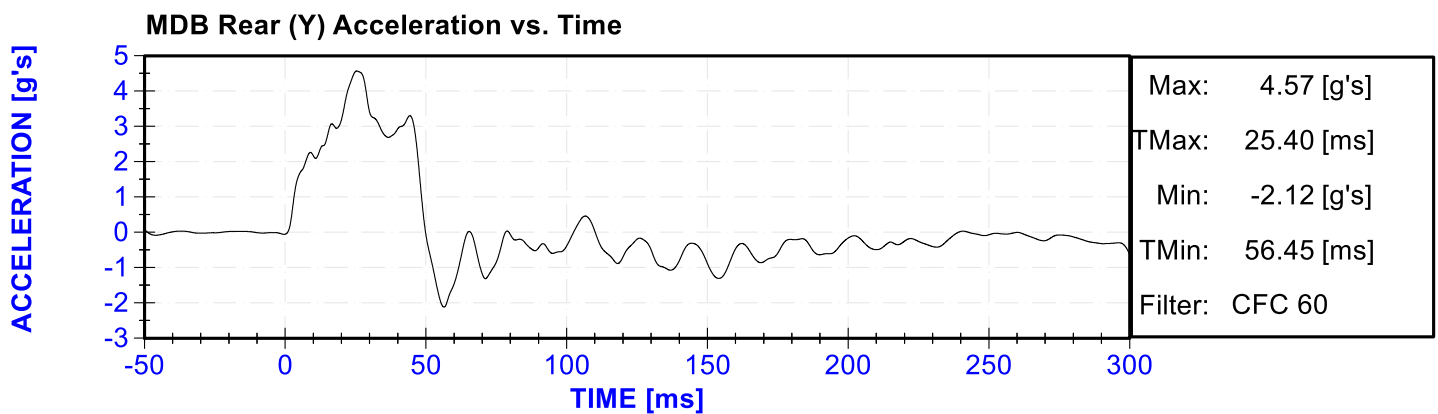
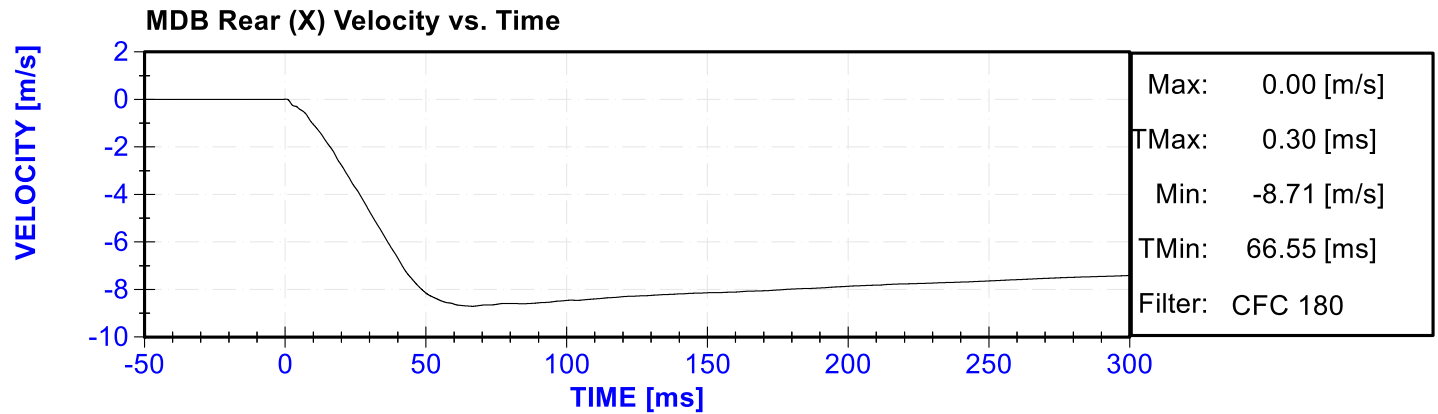
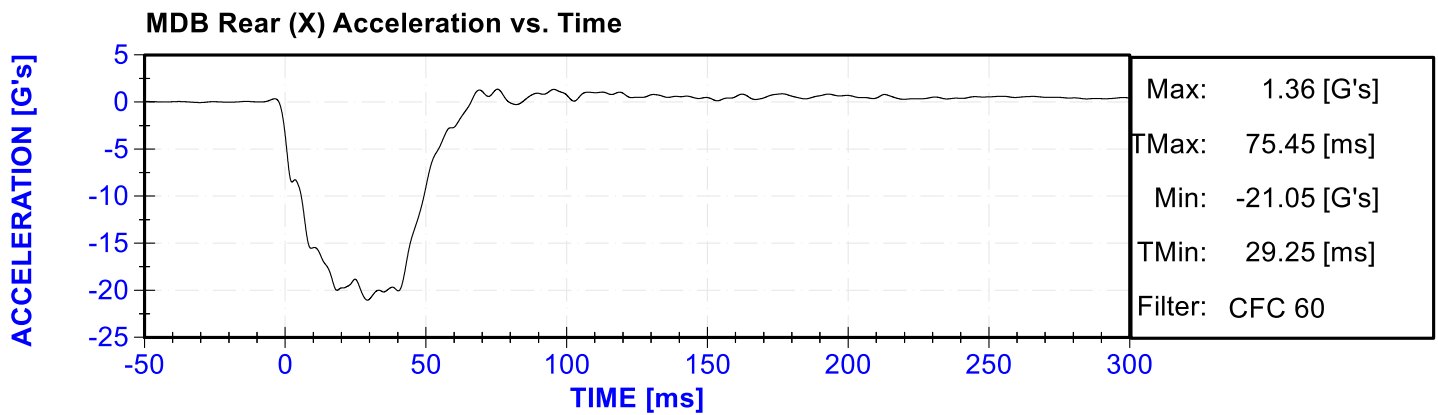
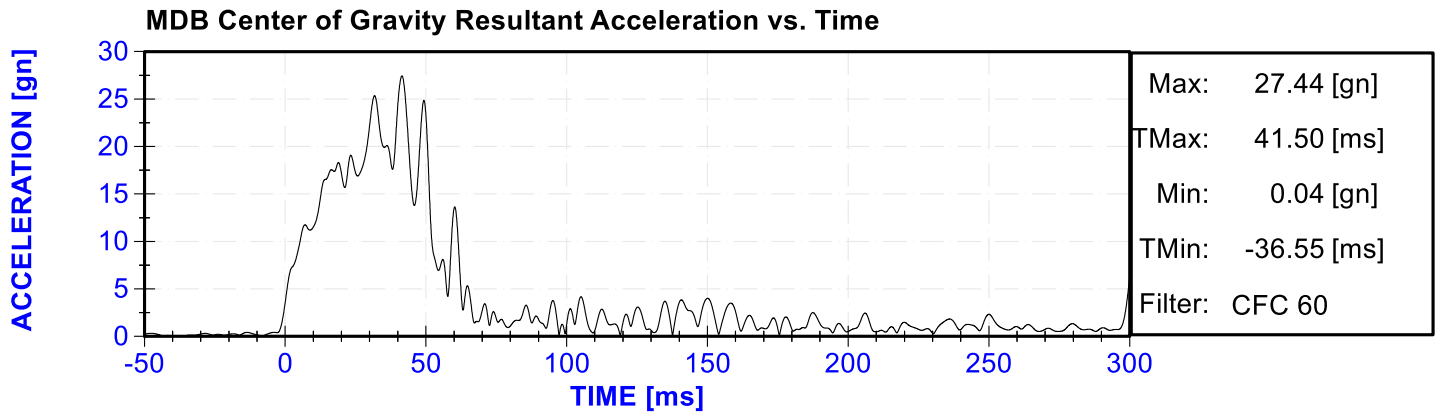


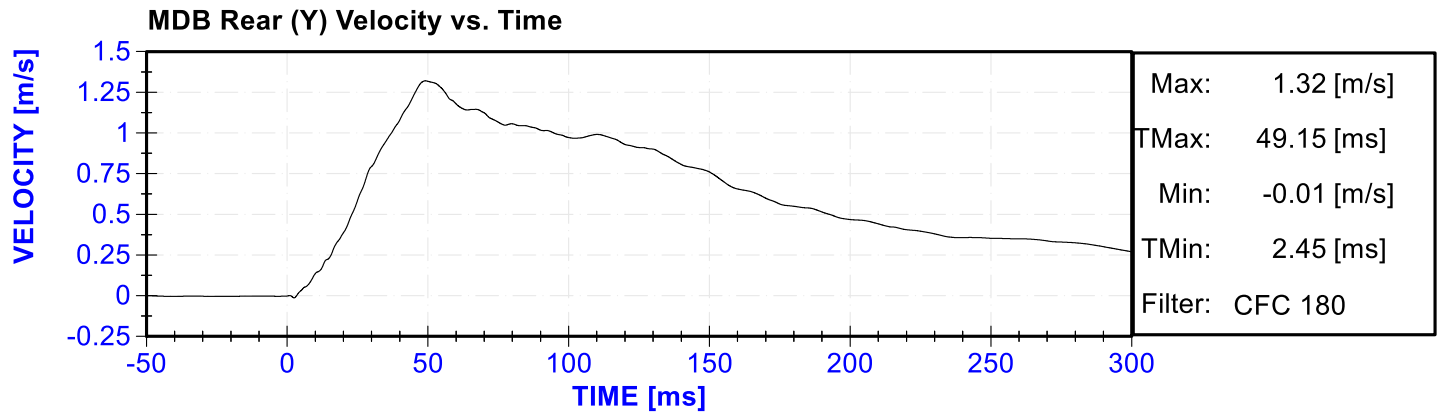












APPENDIX V

PRE-TEST

ES-2re PERFORMANCE CALIBRATION TEST DATA

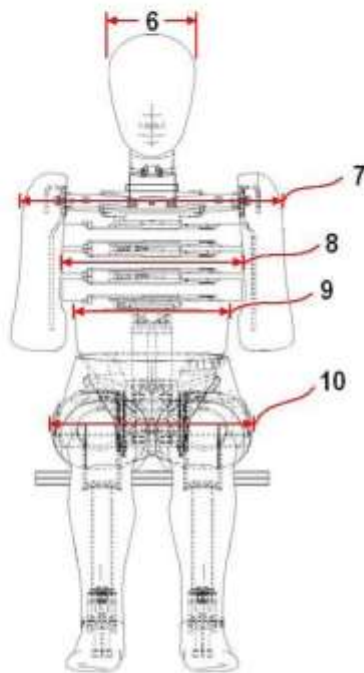


External Measurements - EuroSID-2re

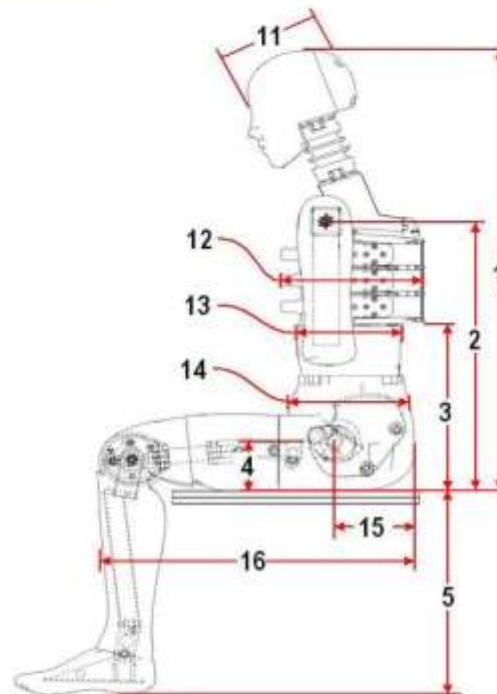
Technician: K. Dutton

Date: 11/28/2018

Dummy Serial Number: DG5348



FRONT VIEW



SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	912	Pass
2	Seat to Shoulder Joint	558	572	562	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	101	Pass
5	Sole to Seat, Sitting	333	451	407	Pass
6	Head Width	152	158	156	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	325	Pass
9	Abdomen Width	273	287	282	Pass
10	Pelvis Lap Width	359	373	365	Pass
11	Head Depth	196	206	202	Pass
12	Thorax Depth	262	272	267	Pass
13	Abdomen Depth	194	204	199	Pass
14	Pelvis Depth	235	245	242	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	154	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

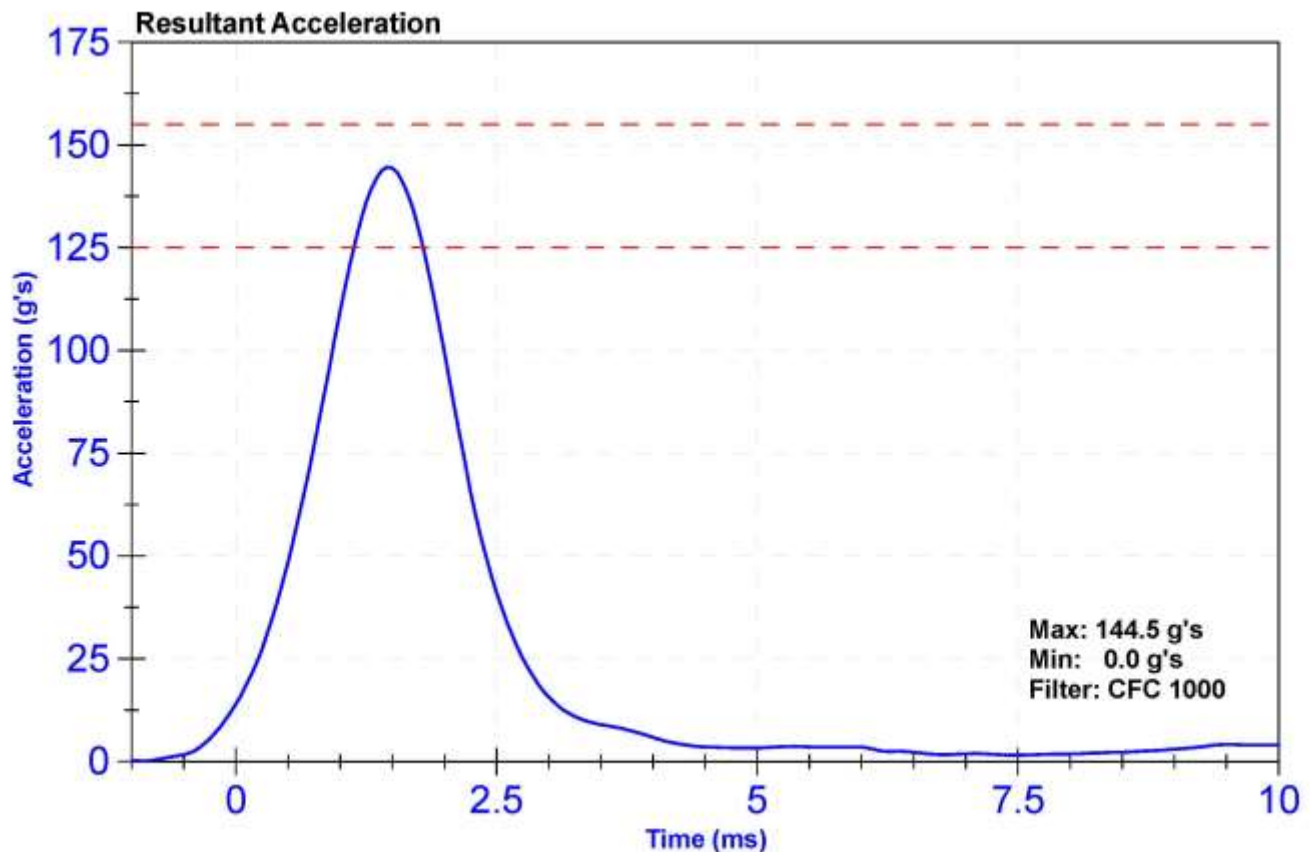
ATD Manufacturer	FTSS	Test Technician	D. Reinhard
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

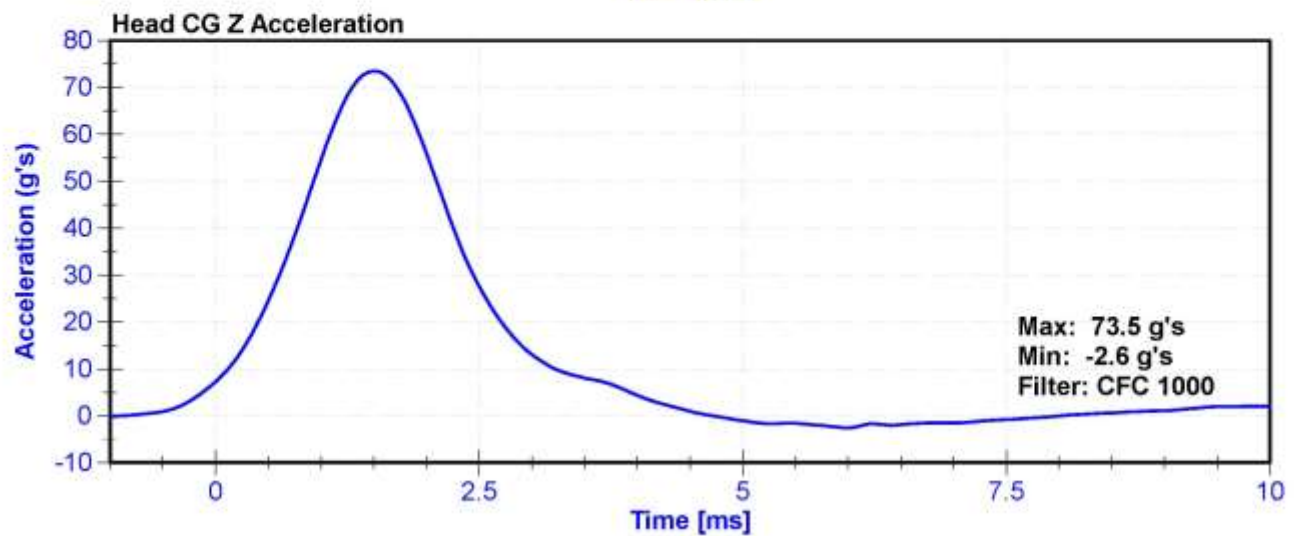
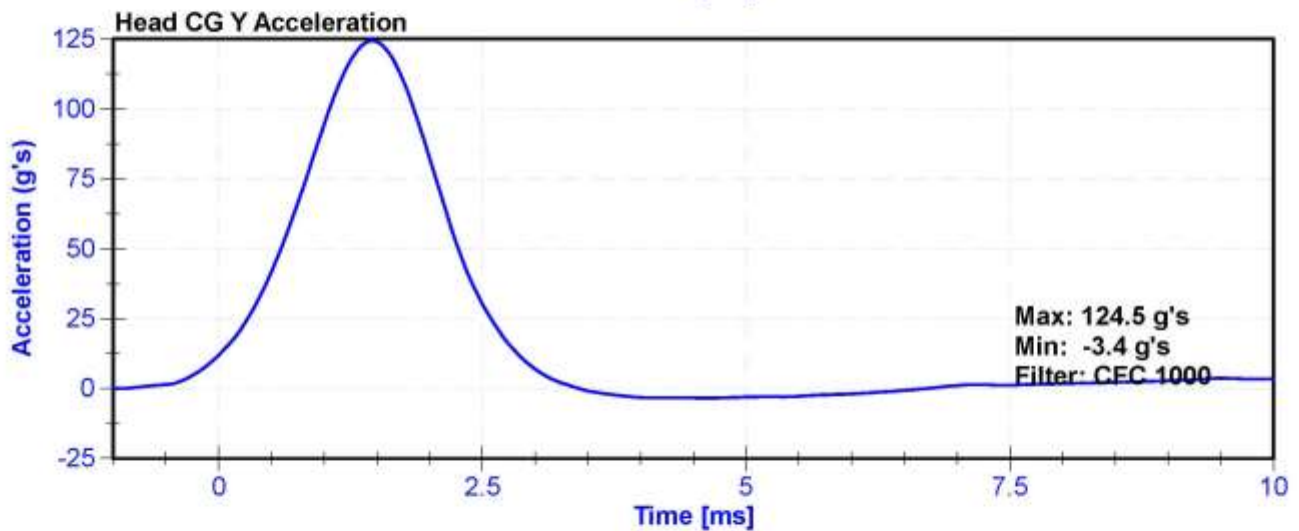
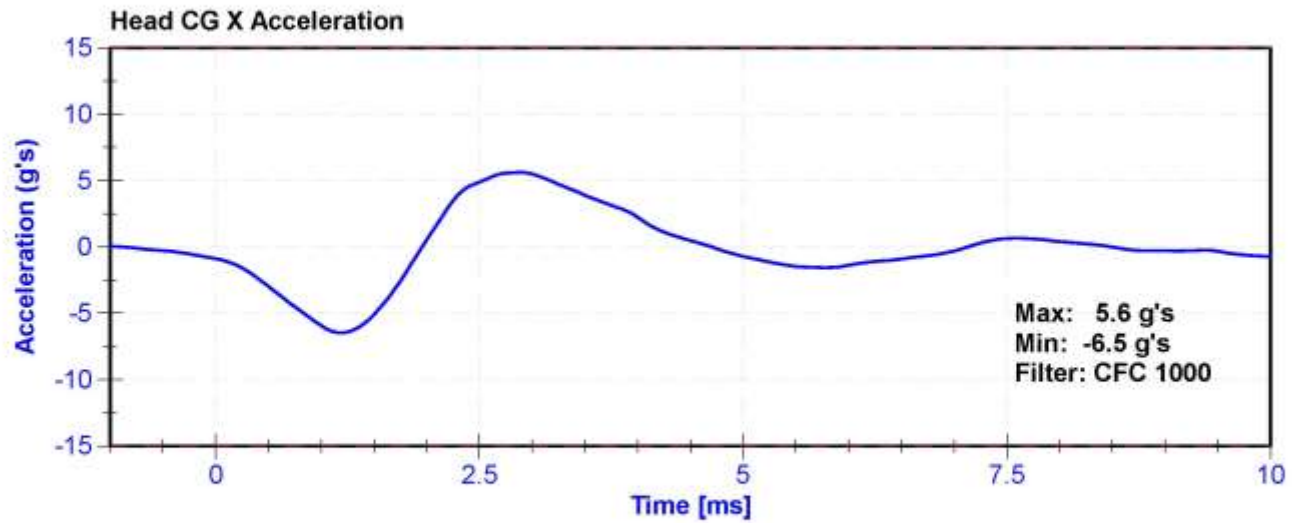
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.7	Pass
Humidity	10	70	%	49.0	Pass
Resultant Acceleration	125	155	g's	144.5	Pass
Oscillation	0	15	%	2.88	Pass
Fore-Aft Acceleration	-15	15	g's	5.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P66940	10/5/2018	4/5/2019
Y Accelerometer	MSI 64CM30	AC-MS25917	10/5/2017	4/5/2018
Z Accelerometer	Endevco 7264C	AC-P94090	10/5/2018	4/5/2019





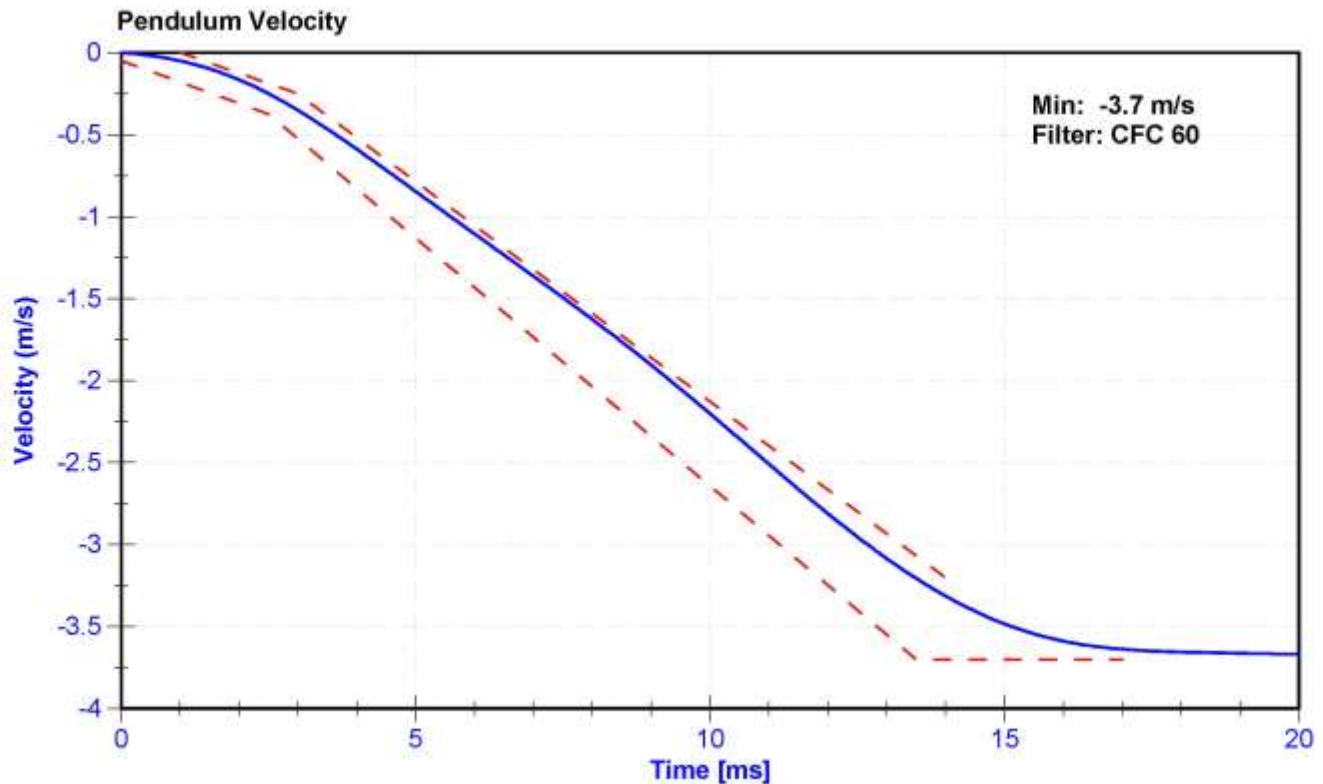
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

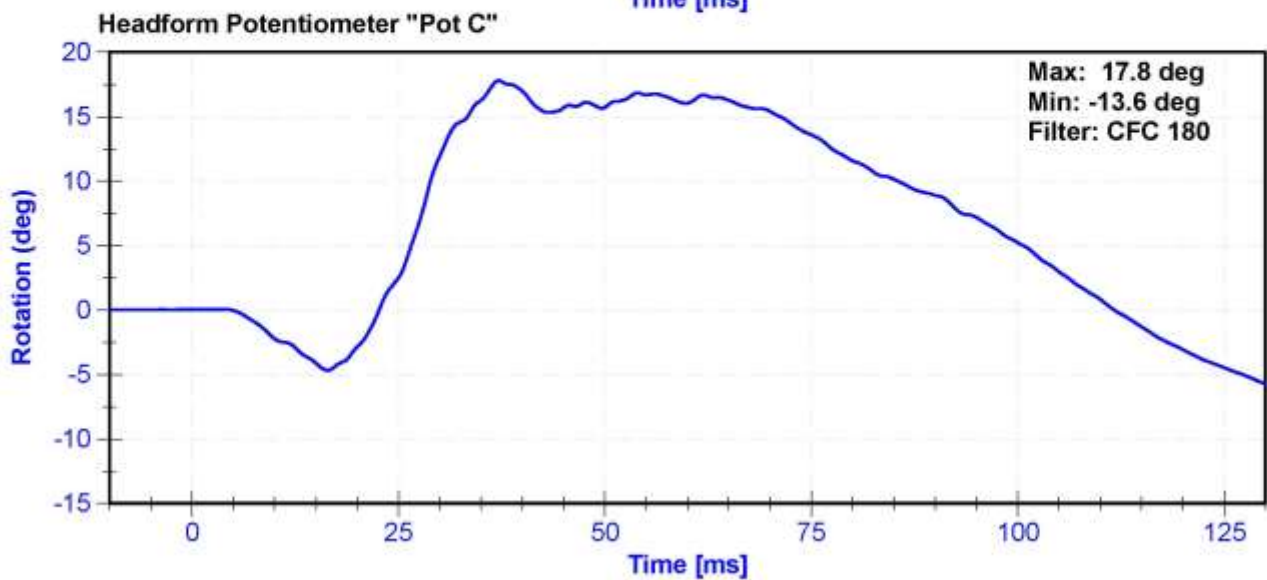
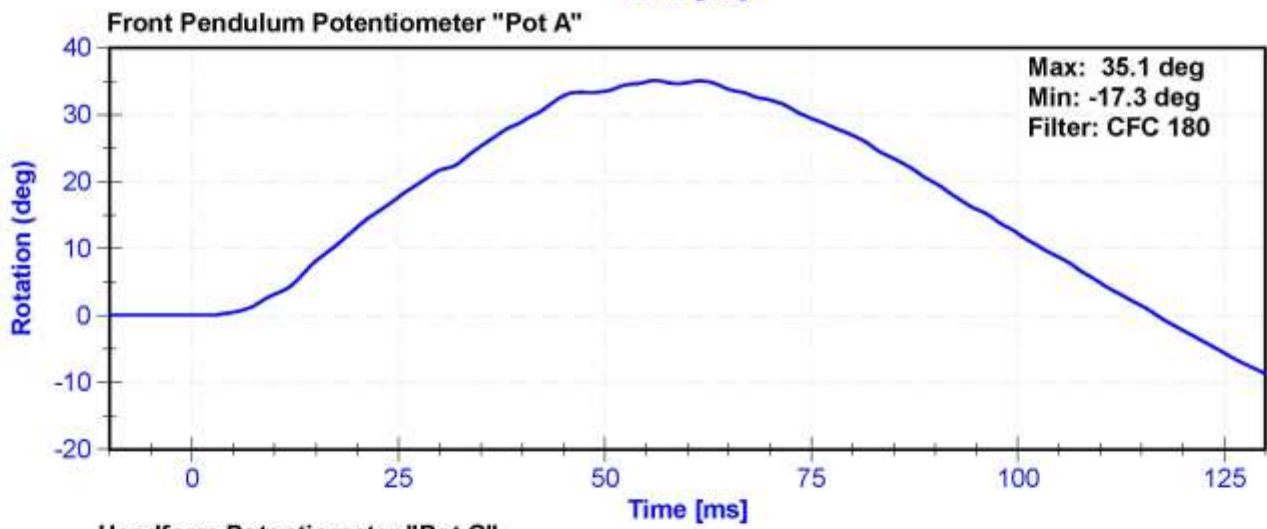
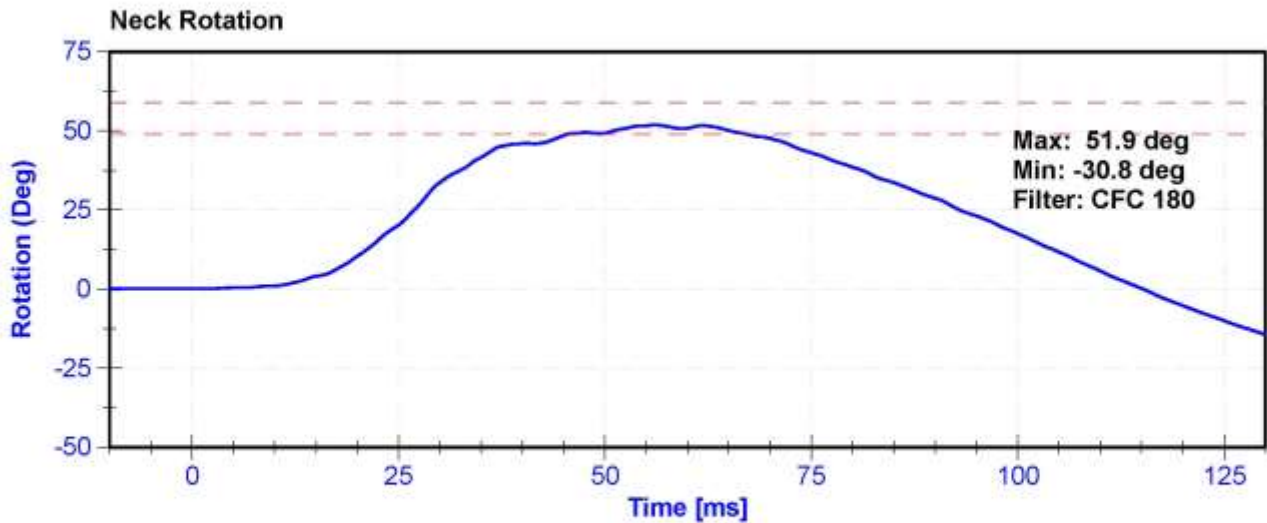
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	25.9	Pass
Velocity	3.3	3.5	m/s	3.40	Pass
Lateral Neck Rotation	49	59	deg	51.9	Pass
Time at Maximum Rotation	54	66	ms	56.0	Pass
Time of Rotation Decay from Maximum	53	88	ms	59.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5F3	5/11/2018	5/11/2019
Front Pendulum Potentiometer	SP22G	DS-094	10/31/2018	10/31/2019
Headform Potentiometer	SP22G	DS-095	10/31/2018	10/31/2019







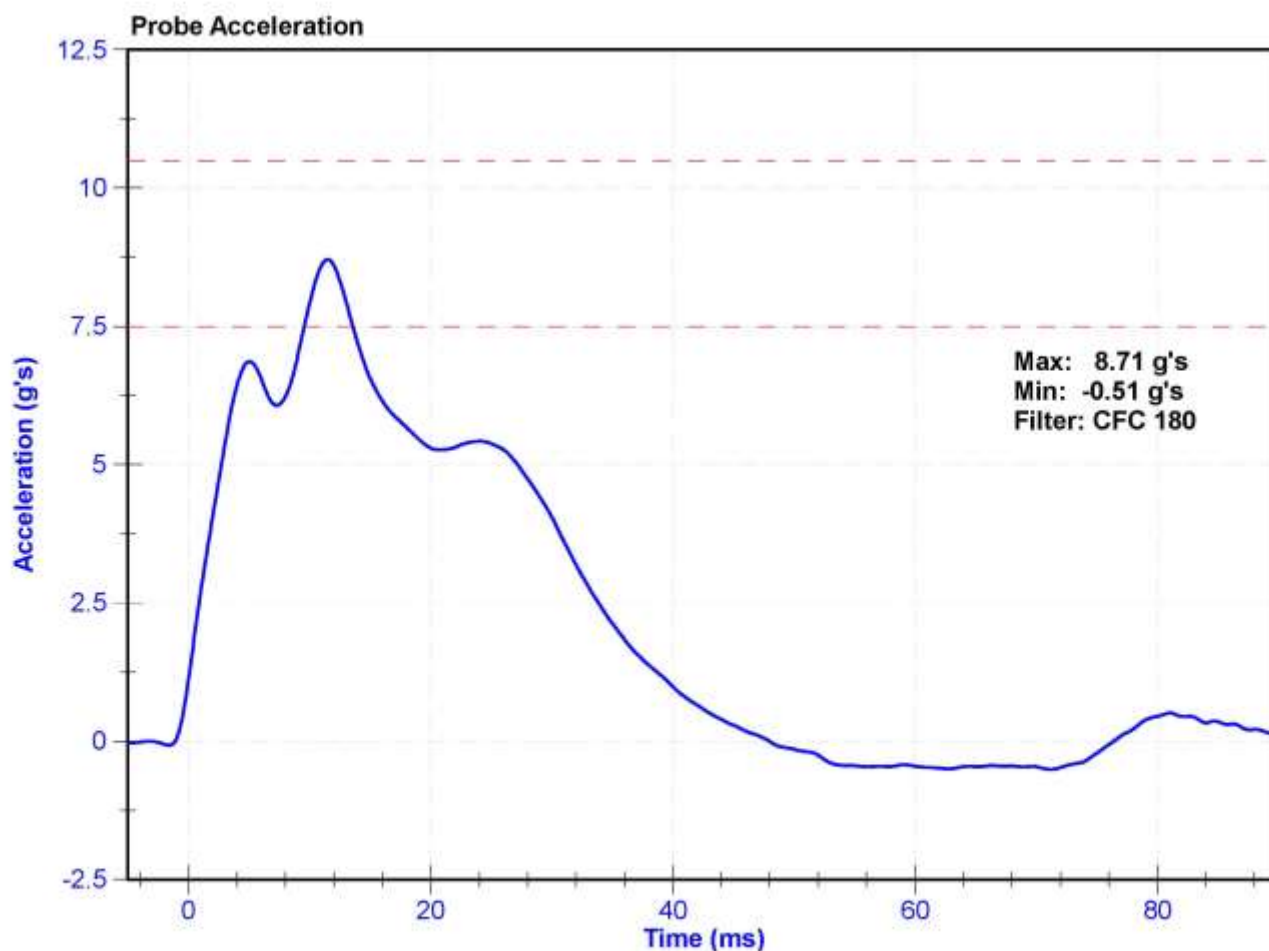
ATD Manufacturer	FTSS	Test Technician	D. Reinhard
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.2	Pass
Humidity	10	70	%	31.5	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Probe Acceleration	7.5	10.5	g's	8.71	Pass

Transducer Calibrations

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



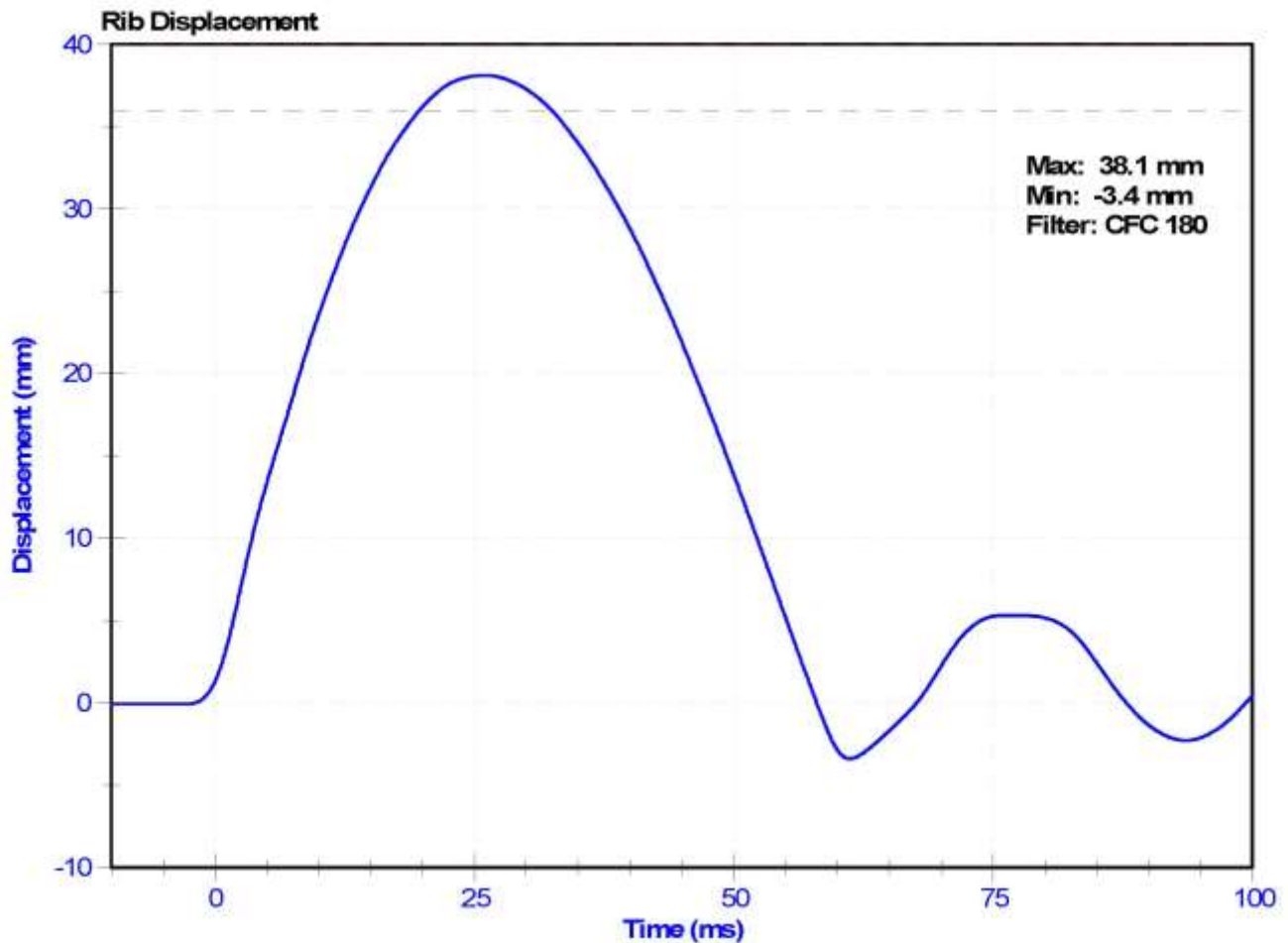
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.1	Pass
Humidity	10	70	%	24.7	Pass
Rib Displacement	36	40	mm	38.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-268GFE	11/27/2018	11/27/2019



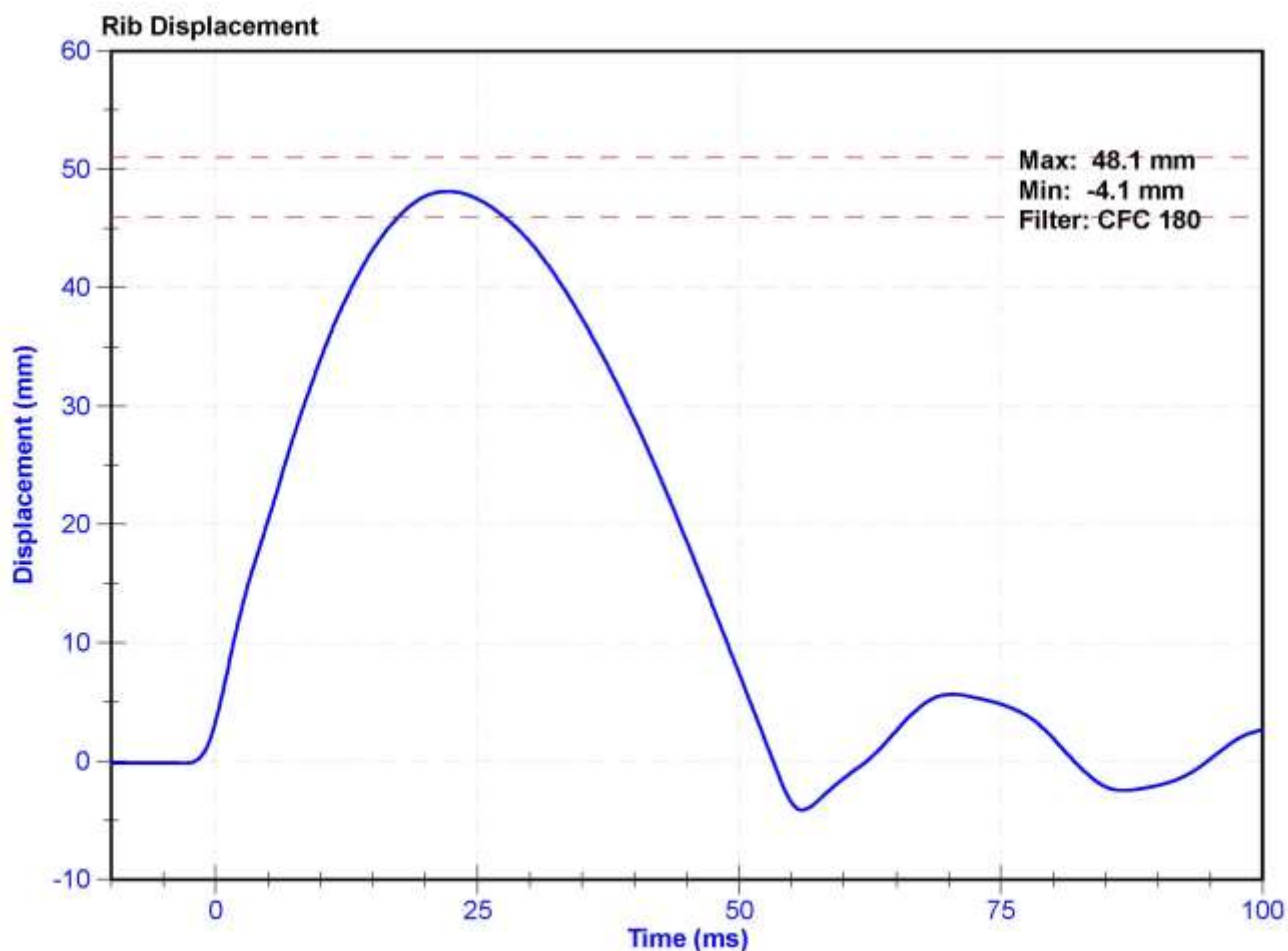
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.0	Pass
Humidity	10	70	%	22.8	Pass
Rib Displacement	46	51	mm	48.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-268GFE	11/27/2018	11/27/2019



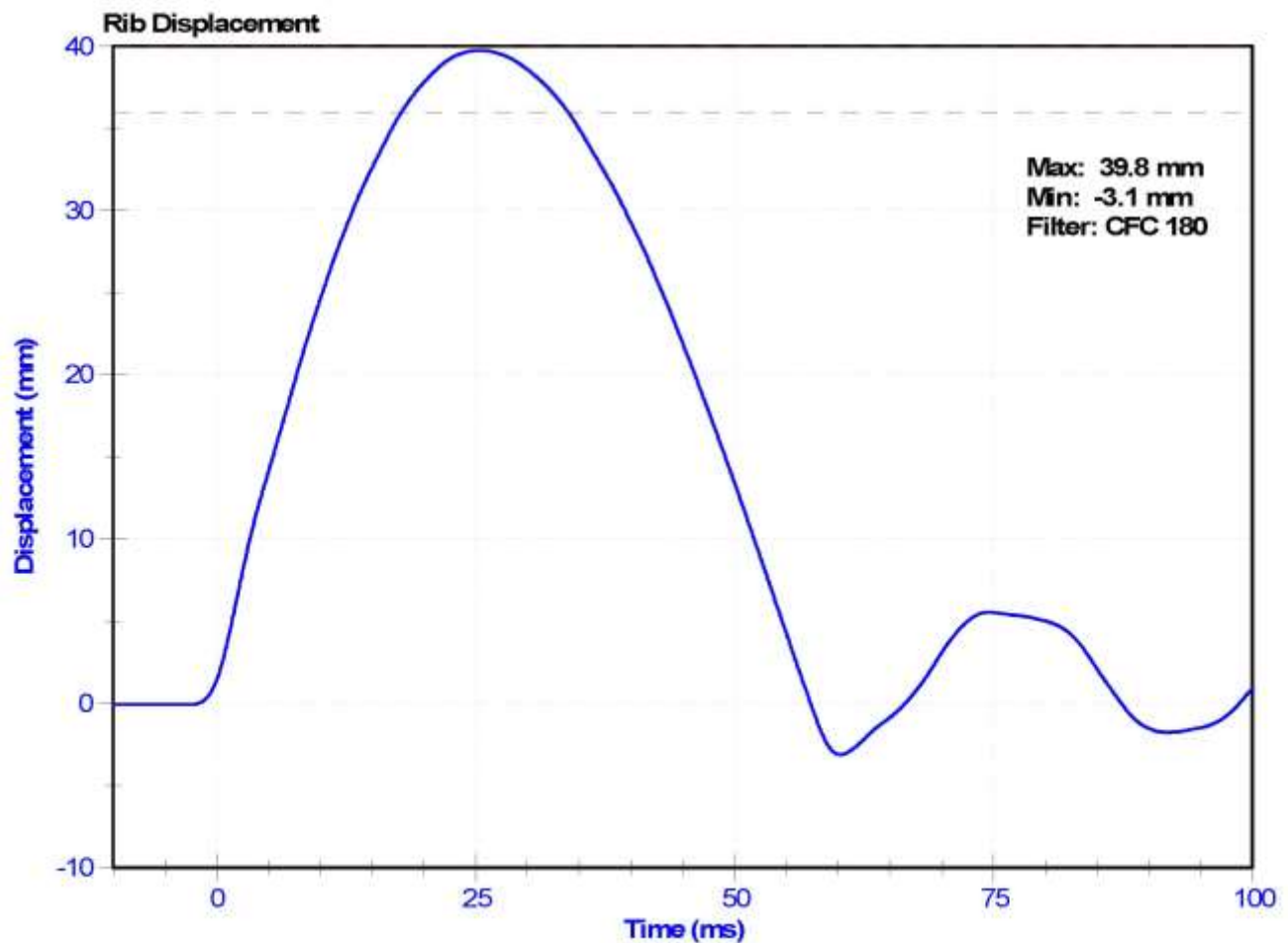
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.1	Pass
Humidity	10	70	%	27.3	Pass
Rib Displacement	36	40	mm	39.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-269GFE	11/27/2018	11/27/2019



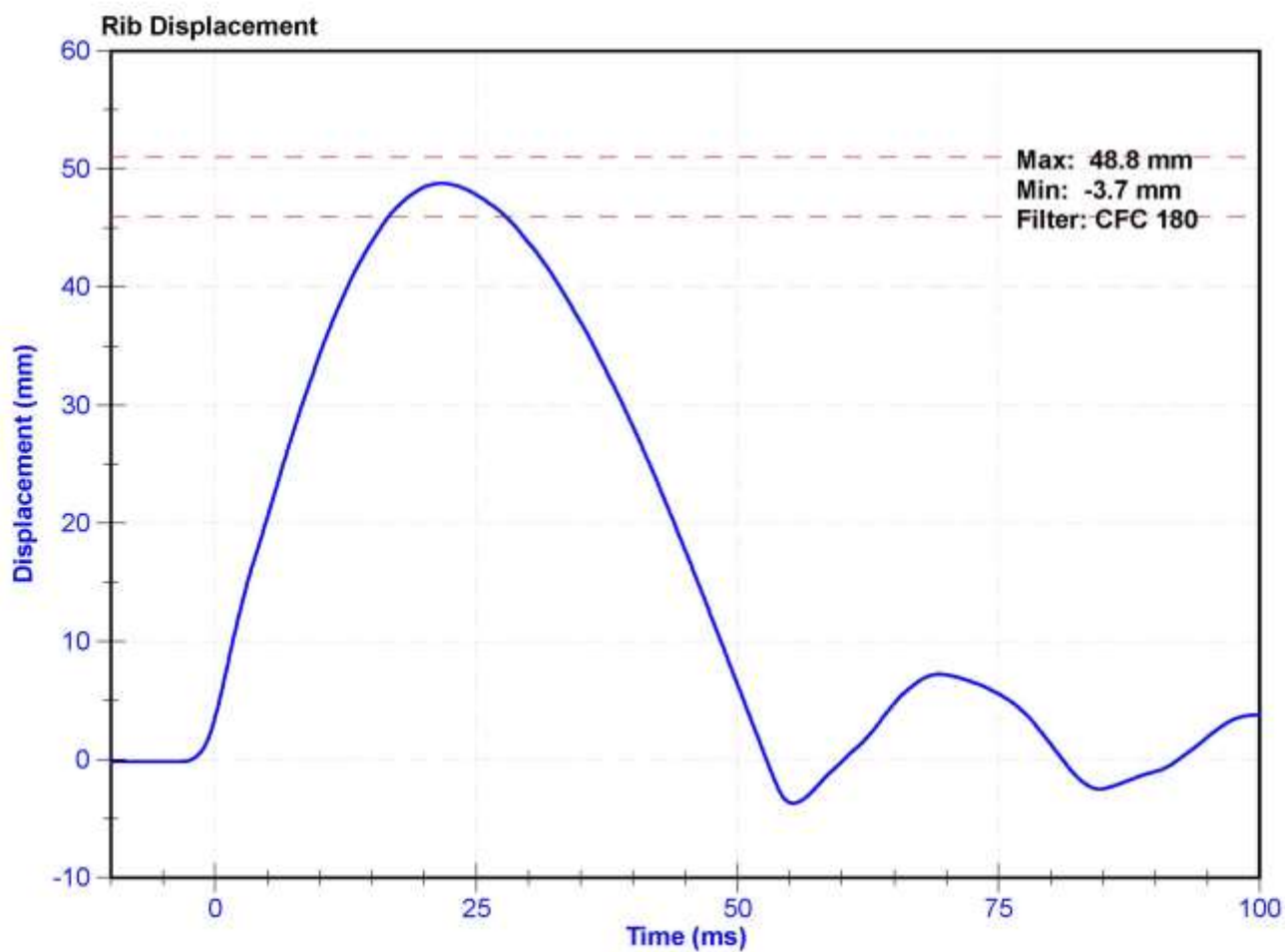
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.0	Pass
Humidity	10	70	%	22.6	Pass
Rib Displacement	46	51	mm	48.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-269GFE	11/27/2018	11/27/2019



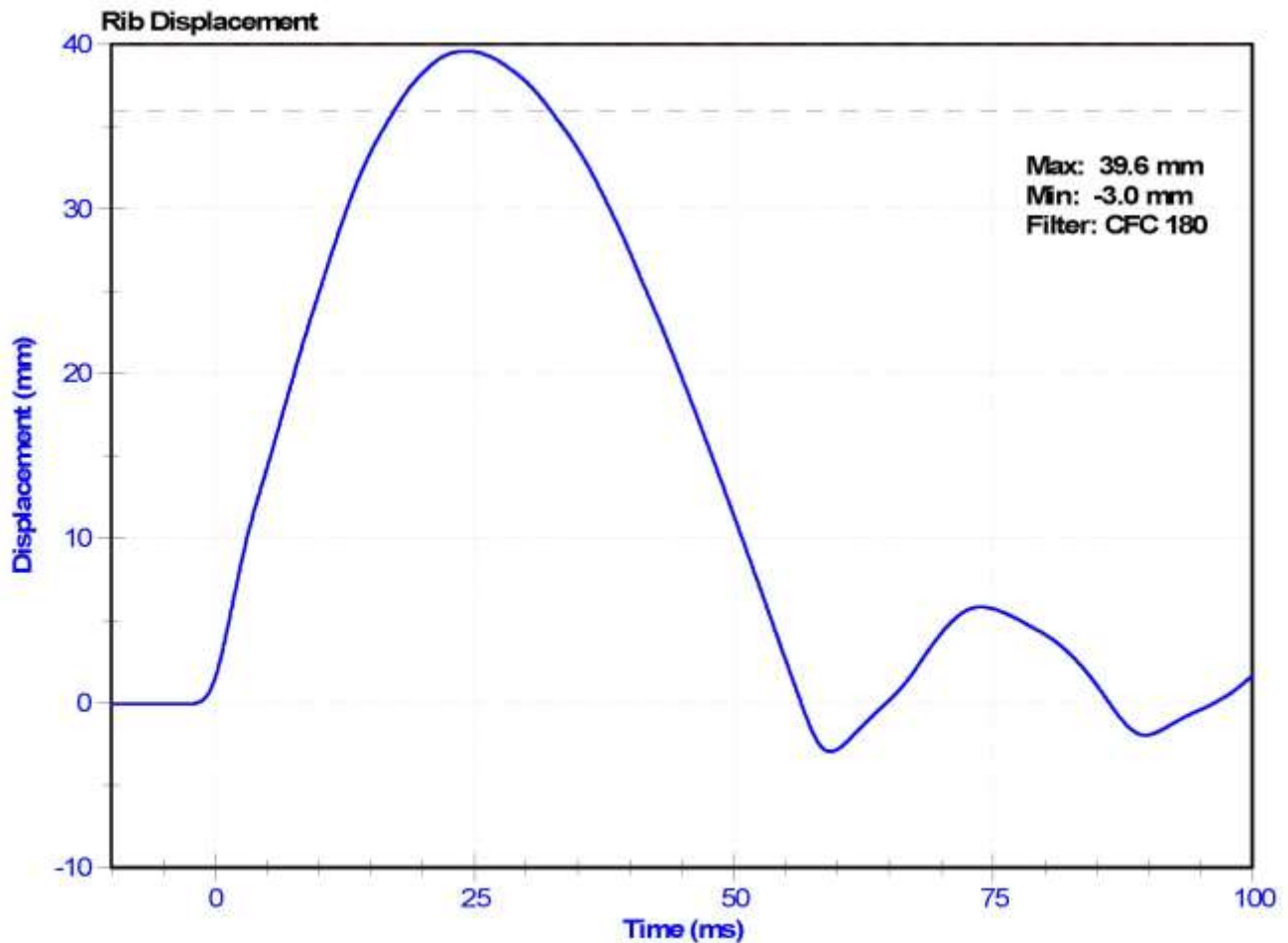
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.1	Pass
Humidity	10	70	%	26.4	Pass
Rib Displacement	36	40	mm	39.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-270GFE	11/27/2018	11/27/2019



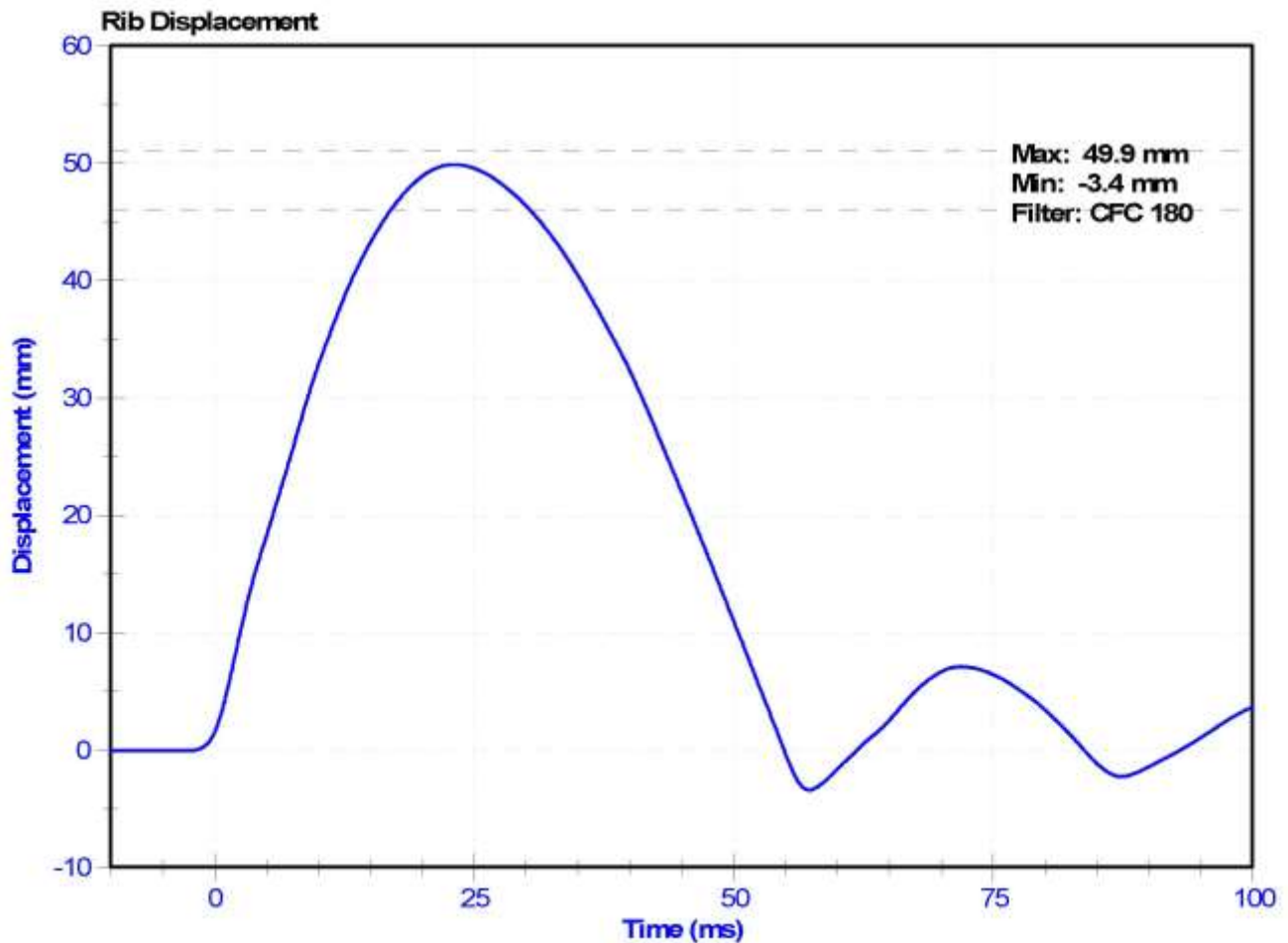
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.1	Pass
Humidity	10	70	%	25.2	Pass
Rib Displacement	46	51	mm	49.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-270GFE	11/27/2018	11/27/2019



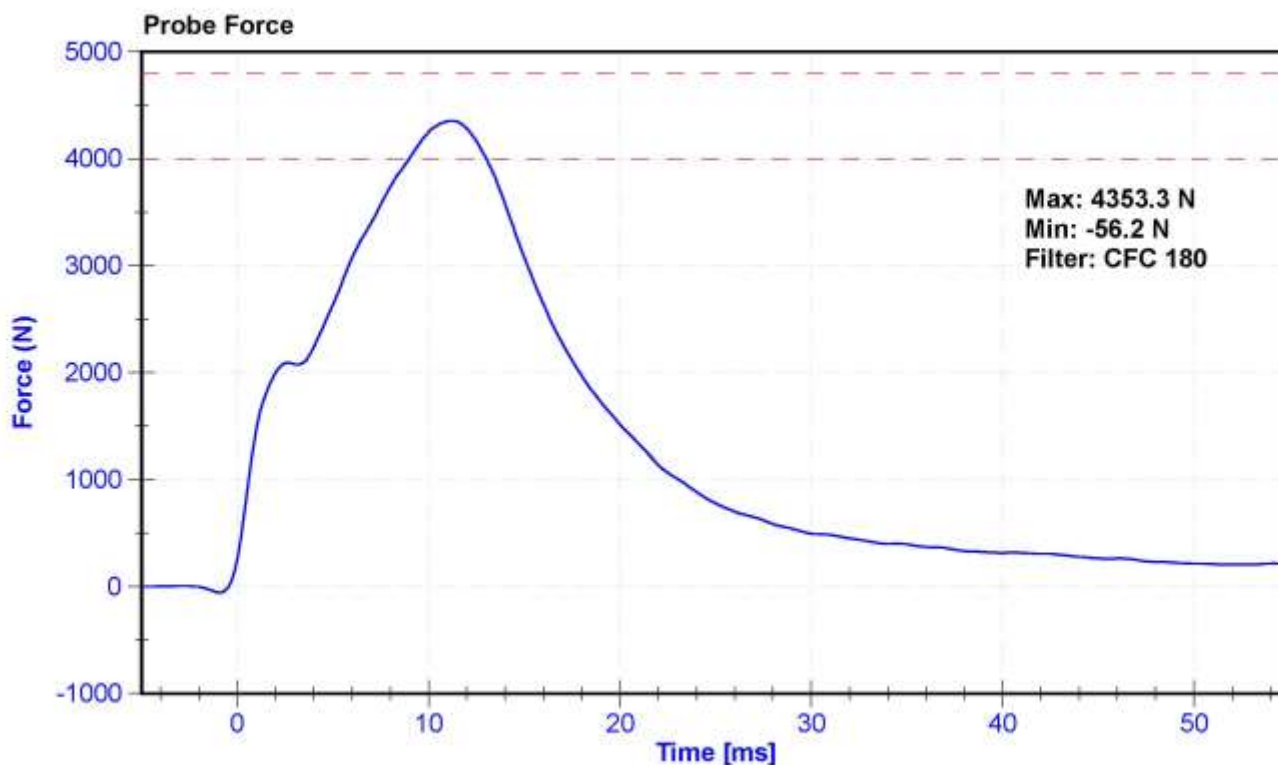
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

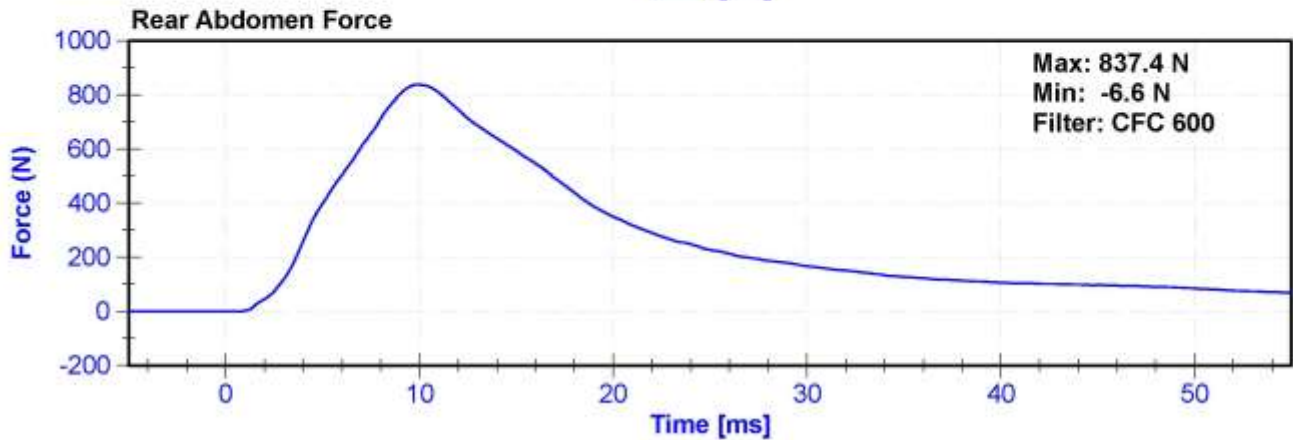
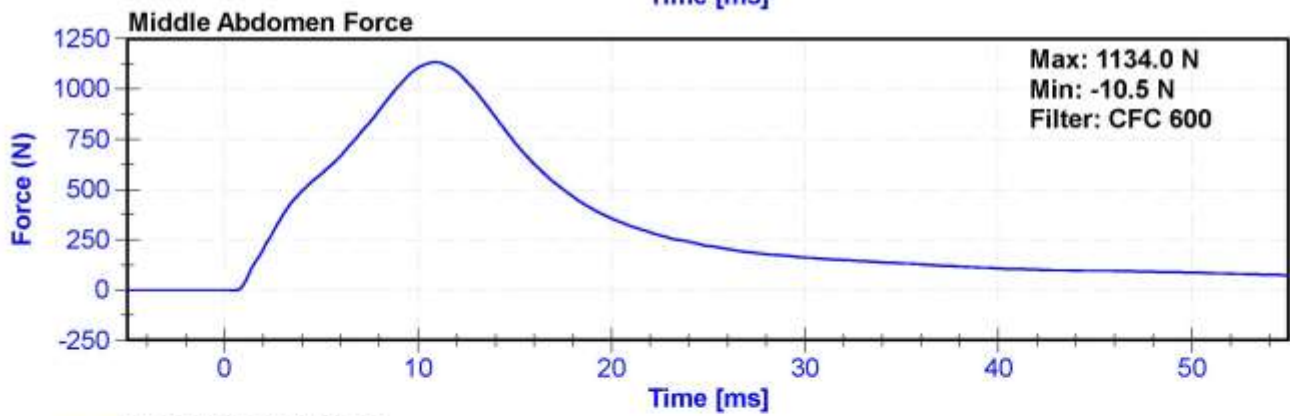
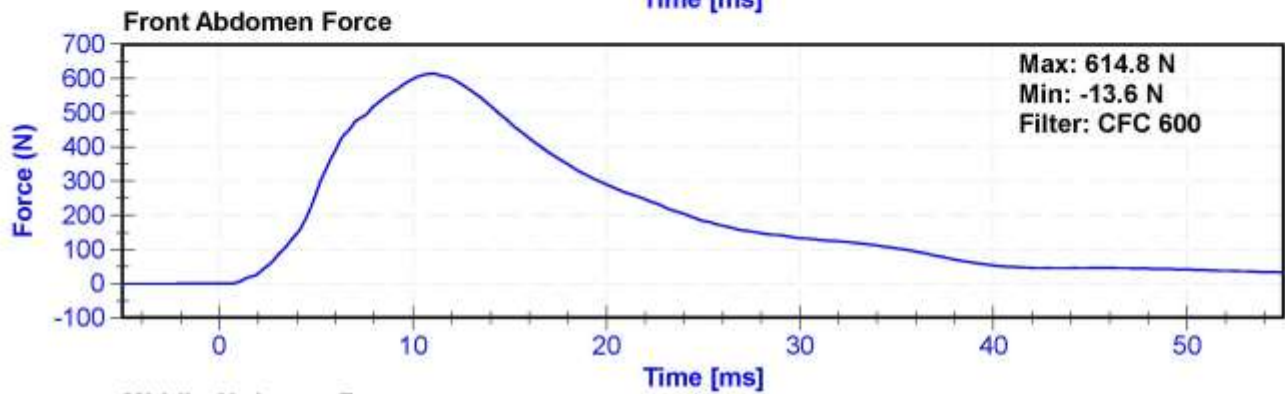
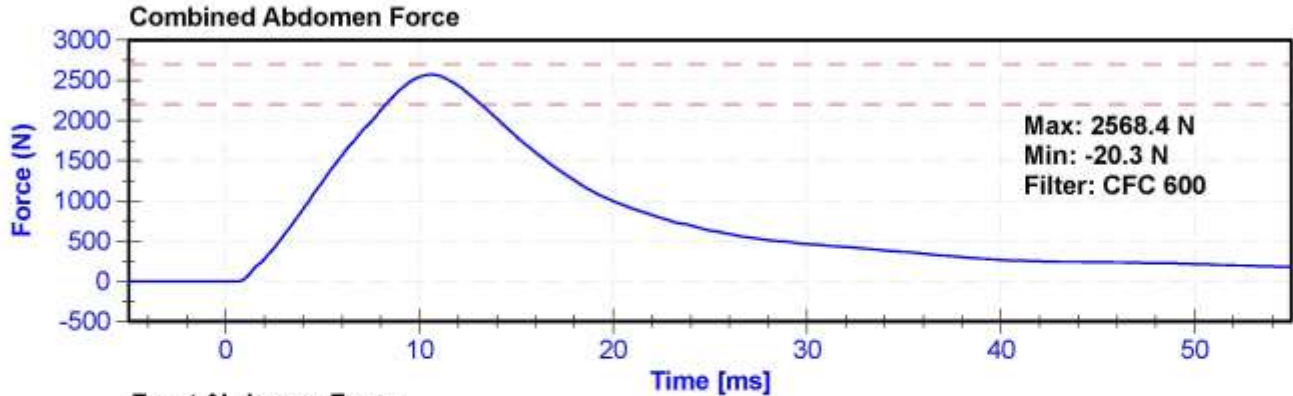
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.2	Pass
Humidity	10	70	%	20.2	Pass
Velocity	3.9	4.1	m/s	4.09	Pass
Combined Abdomen Force	2200	2700	N	2568.4	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.60	Pass
Resistive Probe Force	4000	4800	N	4353.3	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.20	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Front Abdomen Load Cell	FTSS 2631	LC-1509	10/4/2018	10/4/2019
Middle Abdomen Load Cell	DENTON 2631	LC-1508	10/4/2018	10/4/2019
Rear Abdomen Load Cell	FTSS 2631	LC-1507	10/4/2018	10/4/2019





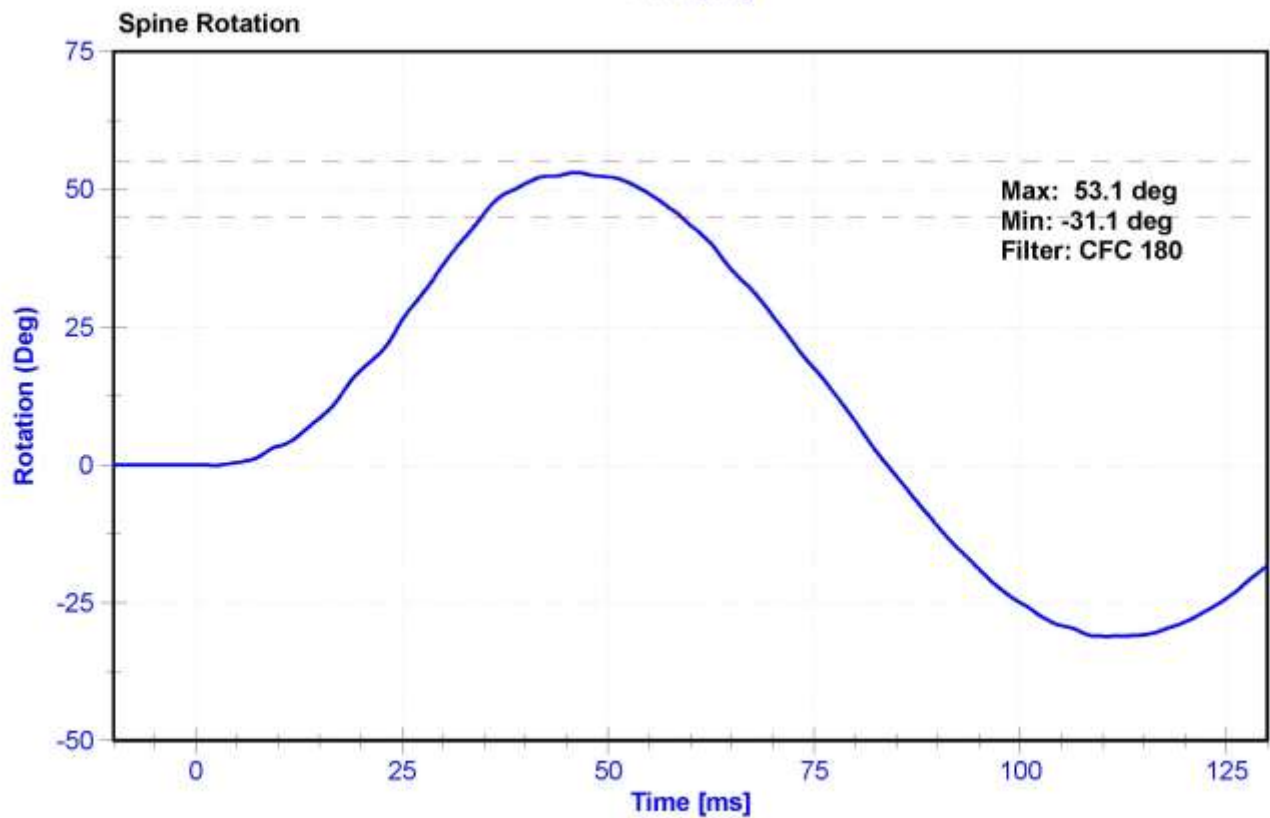
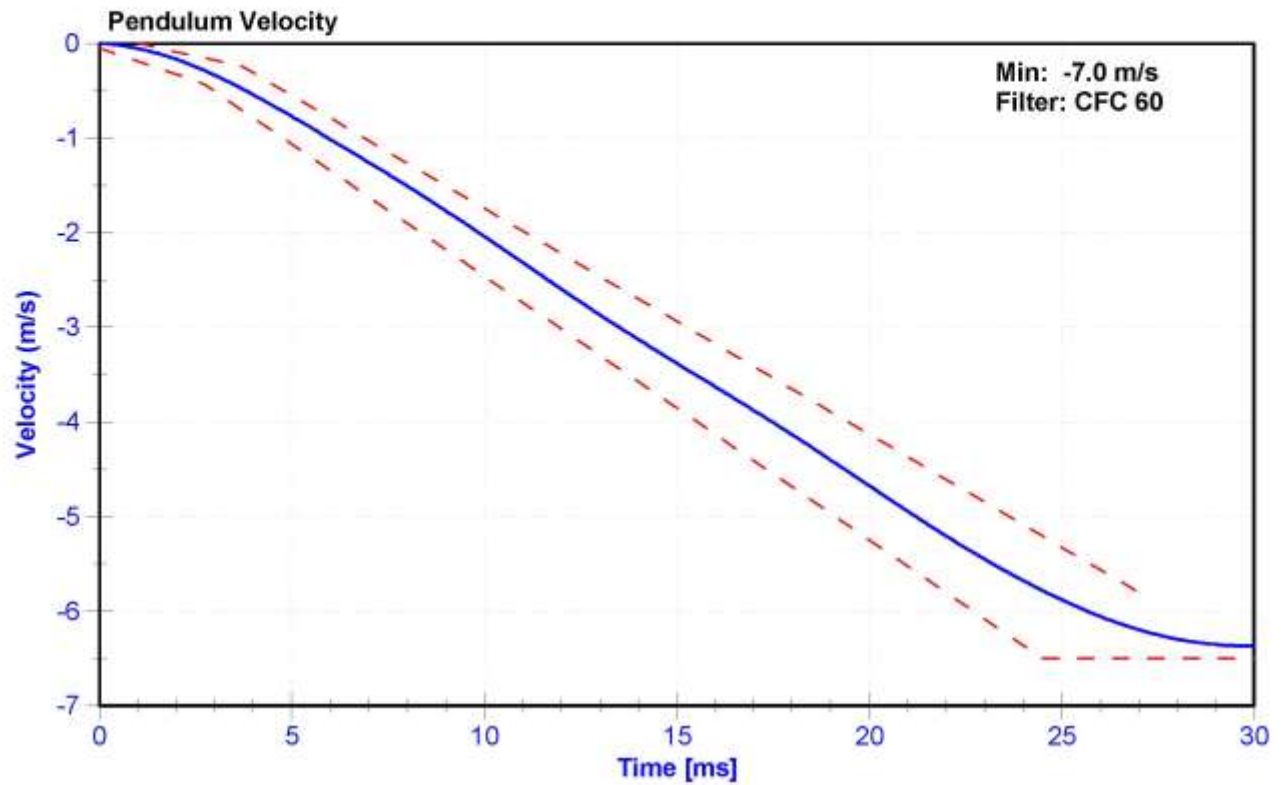
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

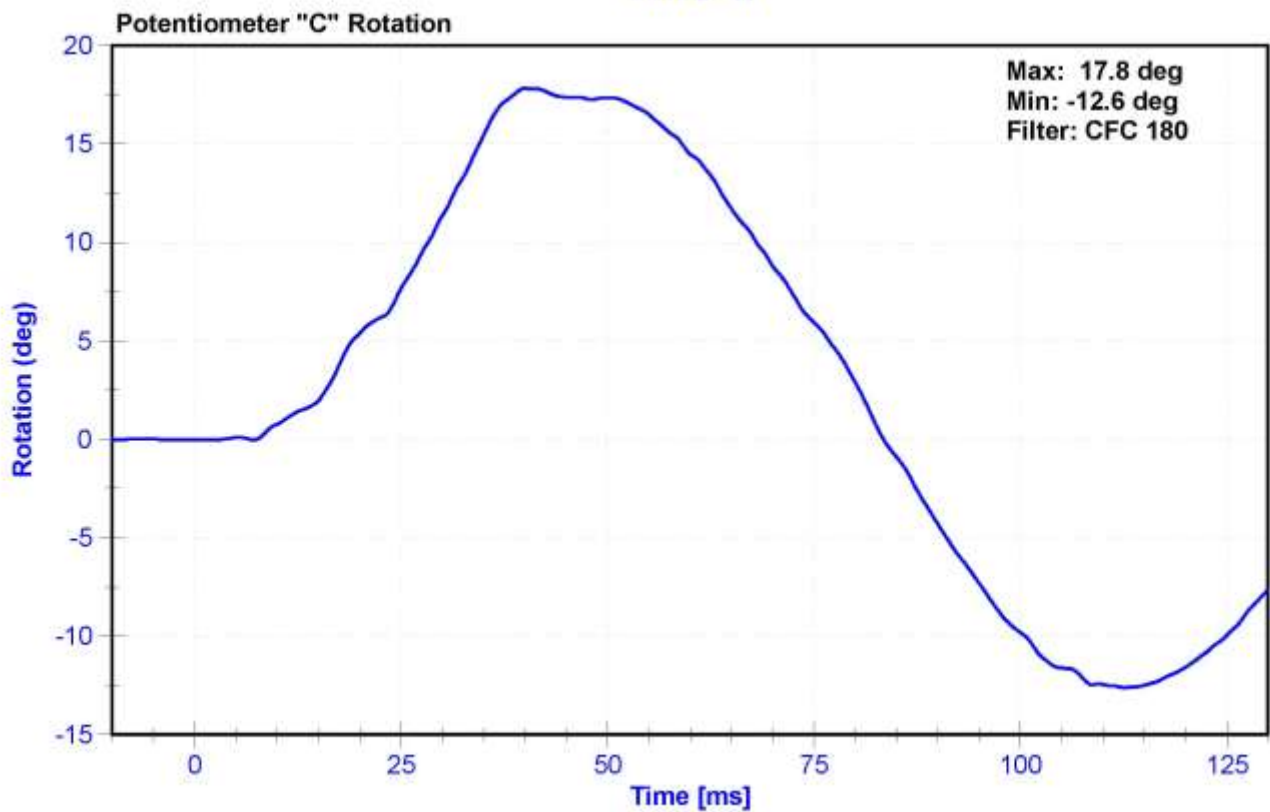
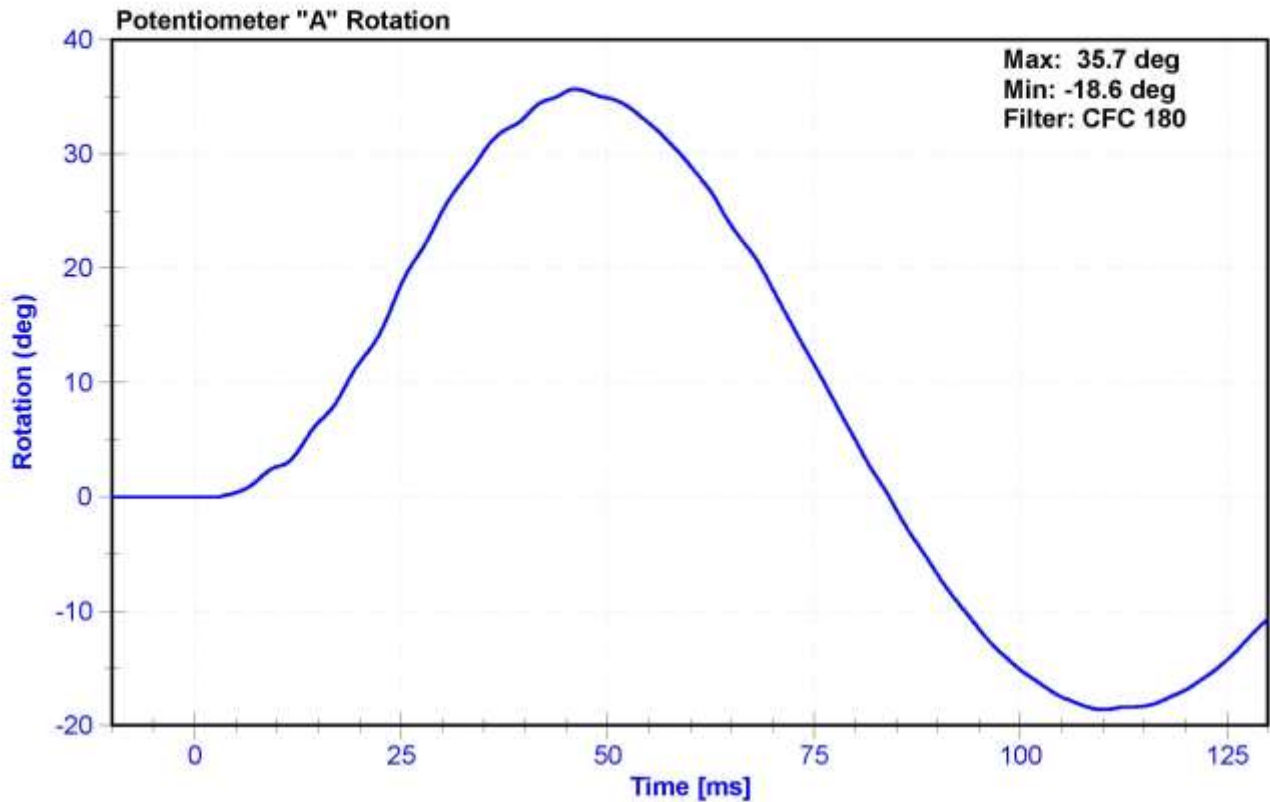
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	24.7	Pass
Velocity	5.95	6.15	m/s	6.113	Pass
Lateral Spine Rotation	45	55	deg	53.1	Pass
Time at Maximum Rotation	39	53	ms	46.1	Pass
Time of Decay to Zero Degrees	37	57	ms	37.8	Pass
Pulse within Corridor?	-	-	-		

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5F3	5/11/2018	5/11/2019
Pendulum "A" Potentiometer	SP22G	DS-094	10/31/2018	10/31/2019
Condyle "B" Potentiometer	SP22G	DS-095	10/31/2018	10/31/2019





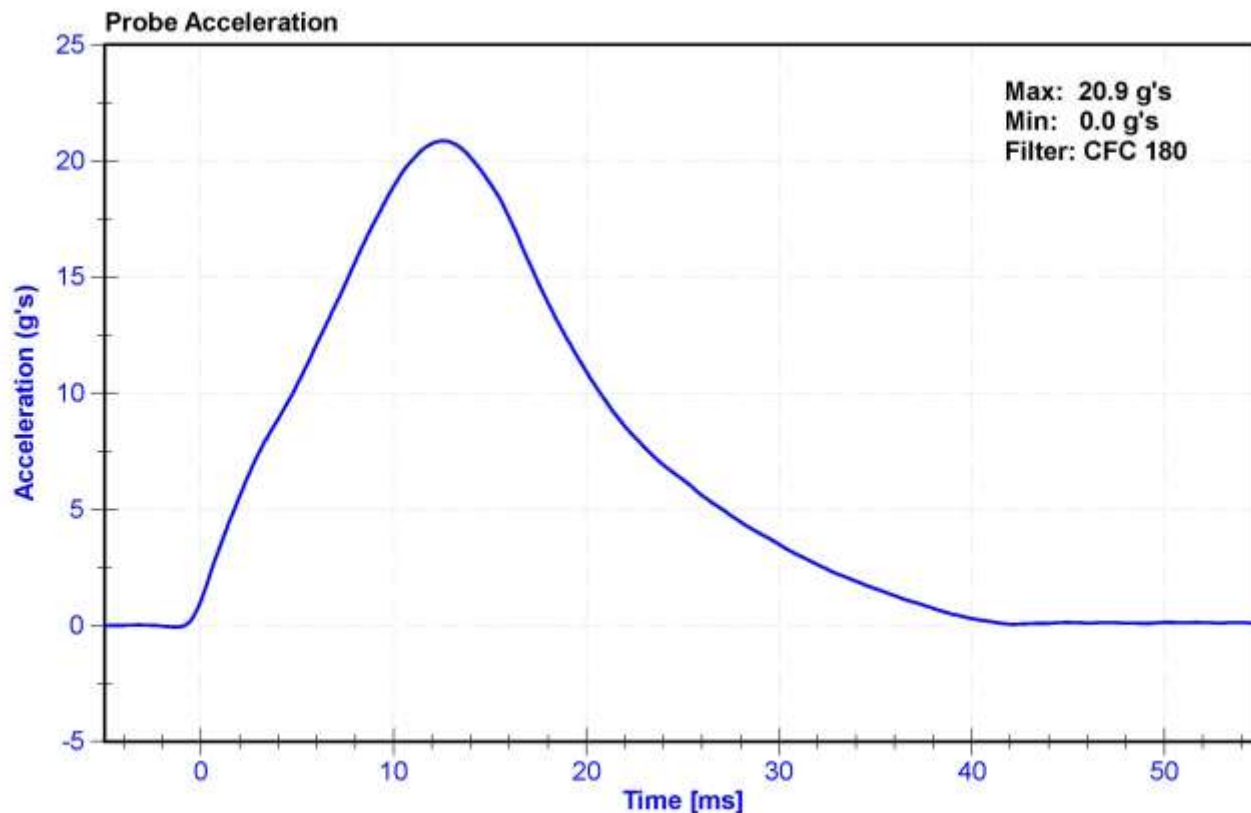
ATD Manufacturer	FTSS	Test Technician	D. Reinhard
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

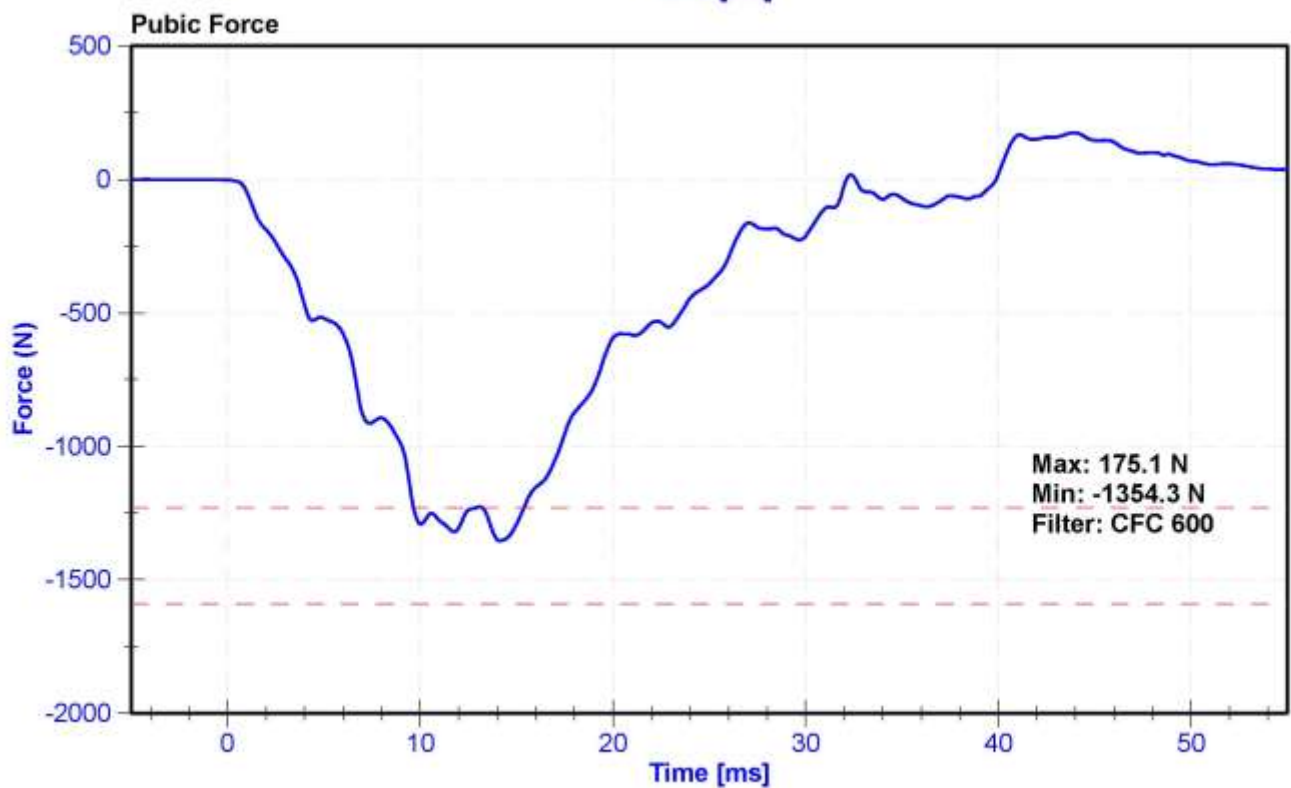
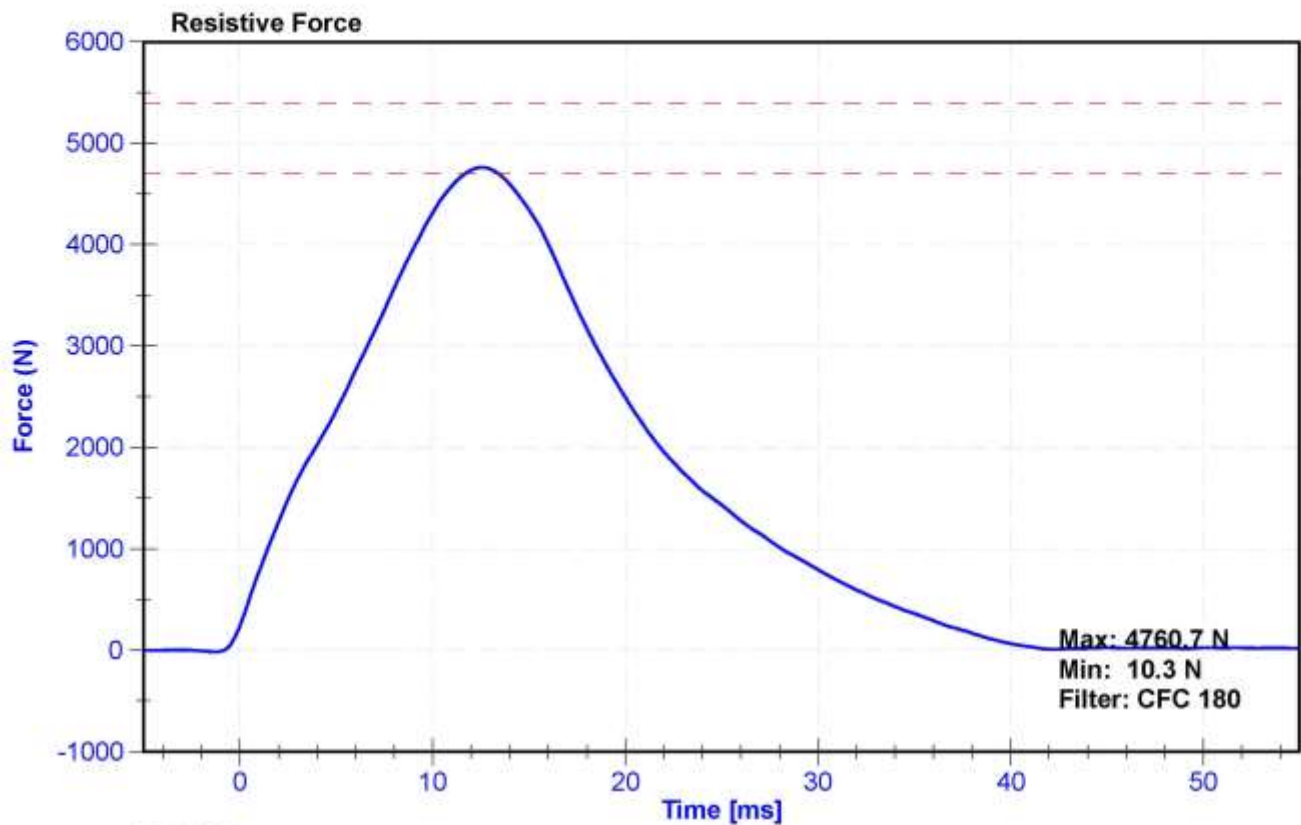
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.2	Pass
Humidity	10	70	%	23.9	Pass
Velocity	4.2	4.4	m/s	4.39	Pass
Resistive Force	4700	5400	N	4760.7	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.55	Pass
Pubic Force	-1590	-1230	N	-1354.3	Pass
Time at Peak Pubic Force	12.2	17.0	ms	14.15	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Pubic Load Cell	FTSS 3096	LC-458	10/4/2018	10/4/2019





POST-TEST
ES-2re PERFORMANCE CALIBRATION TEST DATA

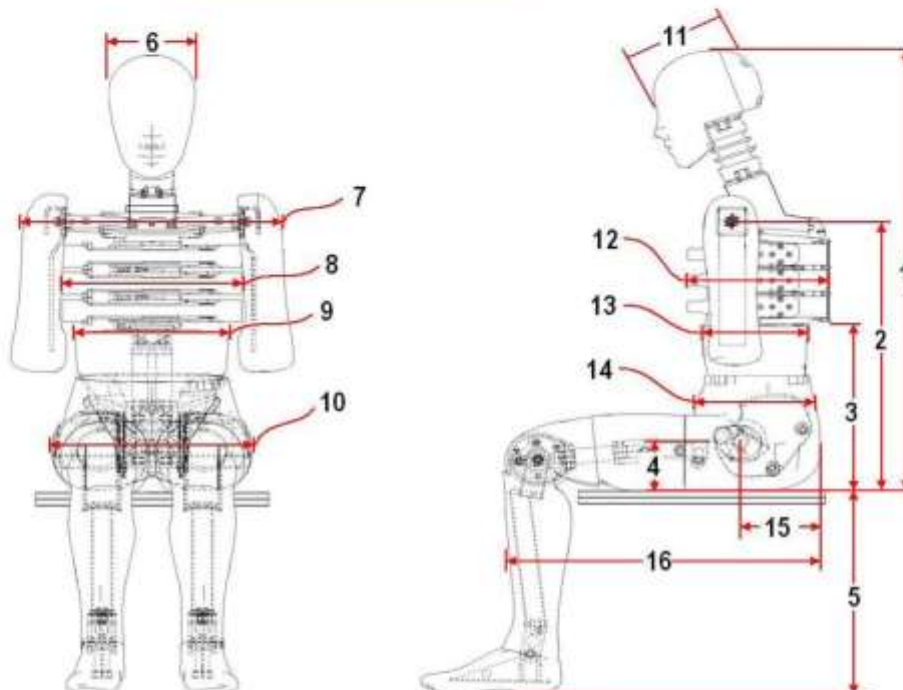


External Measurements - EuroSID-2re

Technician: K. Dutton

Date: 12/15/2018

Dummy Serial Number: DG5348



FRONT VIEW

SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	911	Pass
2	Seat to Shoulder Joint	558	572	562	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	100	Pass
5	Sole to Seat, Sitting	333	451	410	Pass
6	Head Width	152	158	156	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	325	Pass
9	Abdomen Width	273	287	282	Pass
10	Pelvis Lap Width	359	373	365	Pass
11	Head Depth	196	206	201	Pass
12	Thorax Depth	262	272	267	Pass
13	Abdomen Depth	194	204	200	Pass
14	Pelvis Depth	235	245	242	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	154	Pass
16	Back of Buttocks to Front Knee	597	615	606	Pass

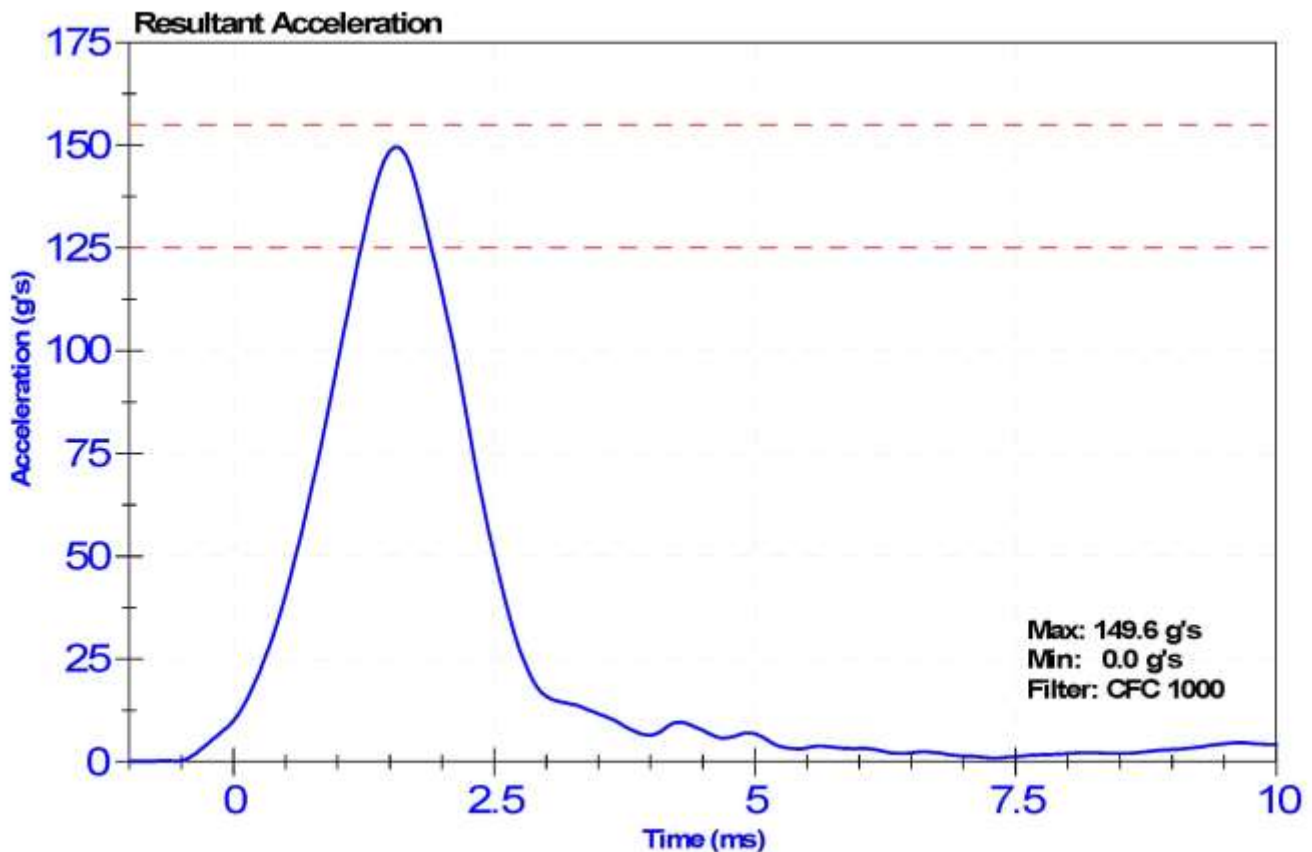
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

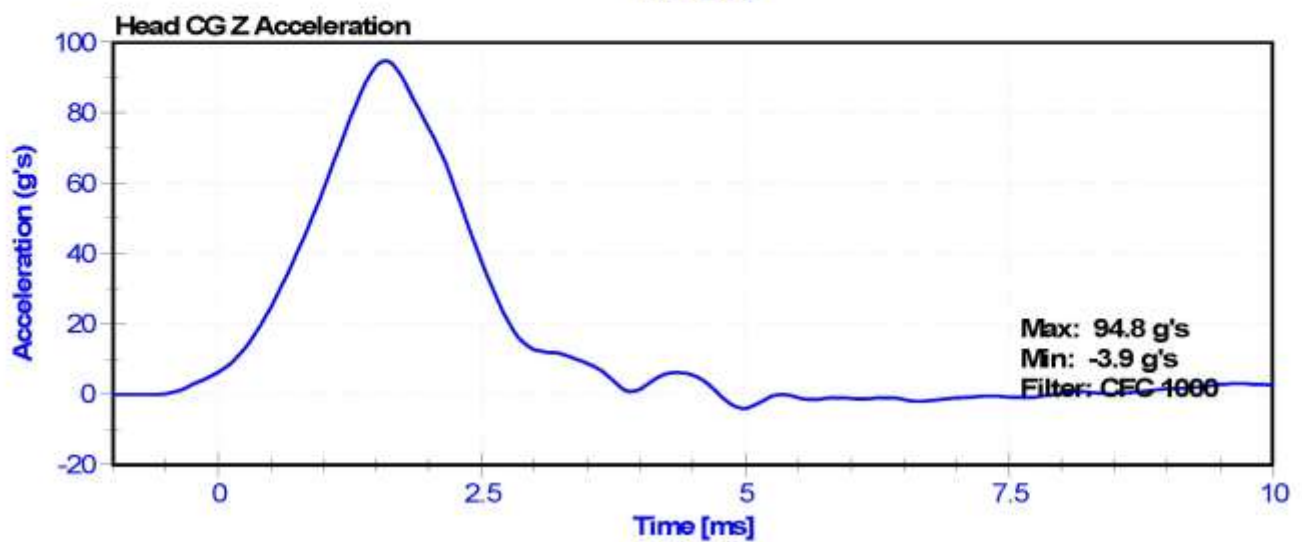
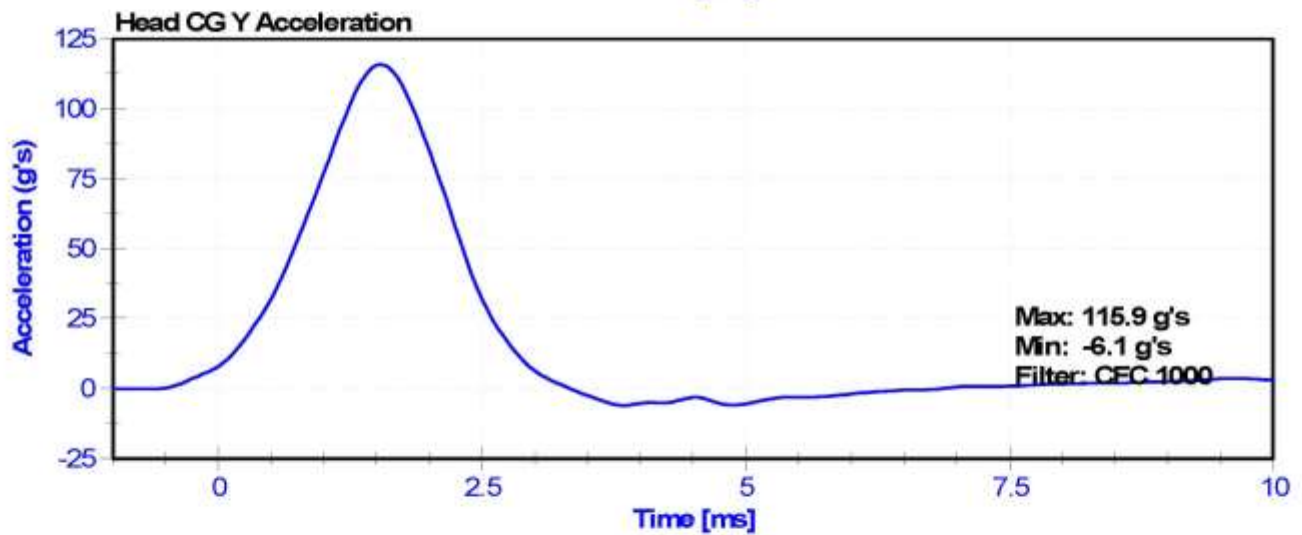
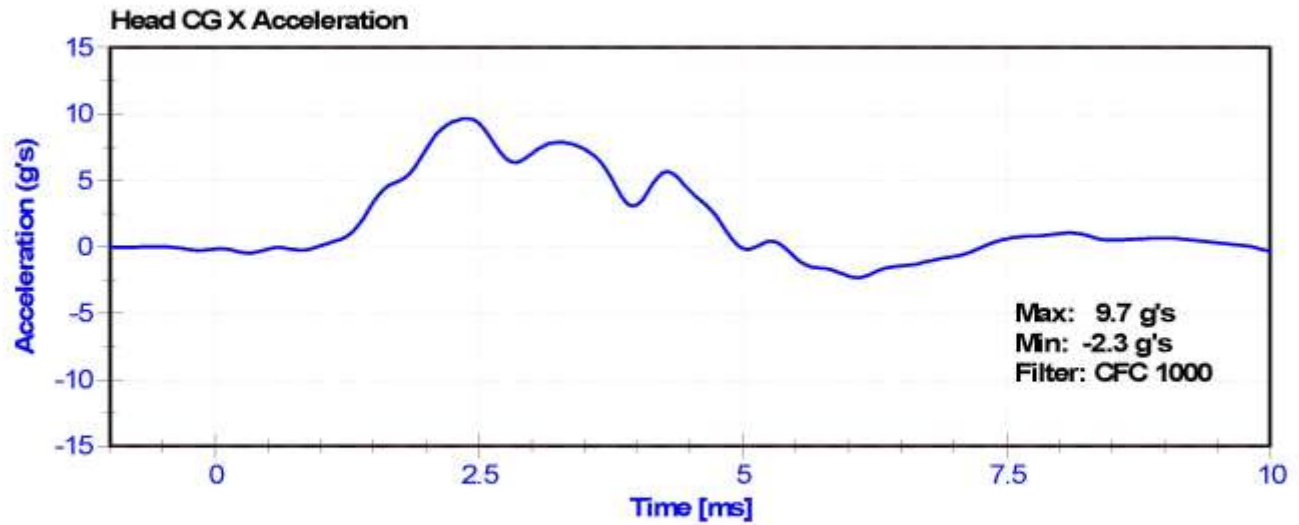
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.0	Pass
Humidity	10	70	%	27.2	Pass
Resultant Acceleration	125	155	g's	149.6	Pass
Oscillation	0	15	%	6.42	Pass
Fore-Aft Acceleration	-15	15	g's	9.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	ENDEVCO 7264CT	AC-P58757	10/17/2018	4/17/2019
Y Accelerometer	ENDEVCO 7264CT	AC-P68062	10/17/2018	4/17/2019
Z Accelerometer	ENDEVCO 7264CT	AC-P68066	10/17/2018	4/17/2019





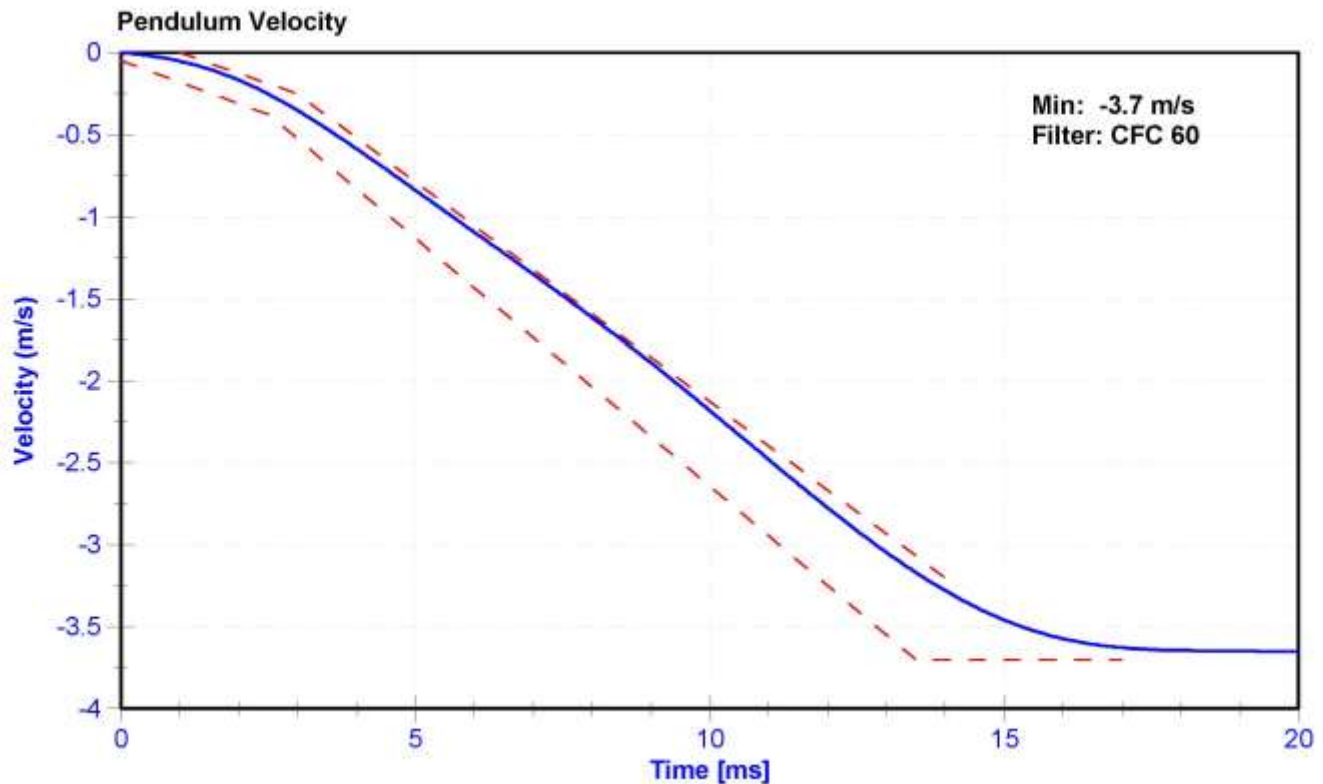
ATD Manufacturer	FTSS	Test Technician	K. Dutton
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

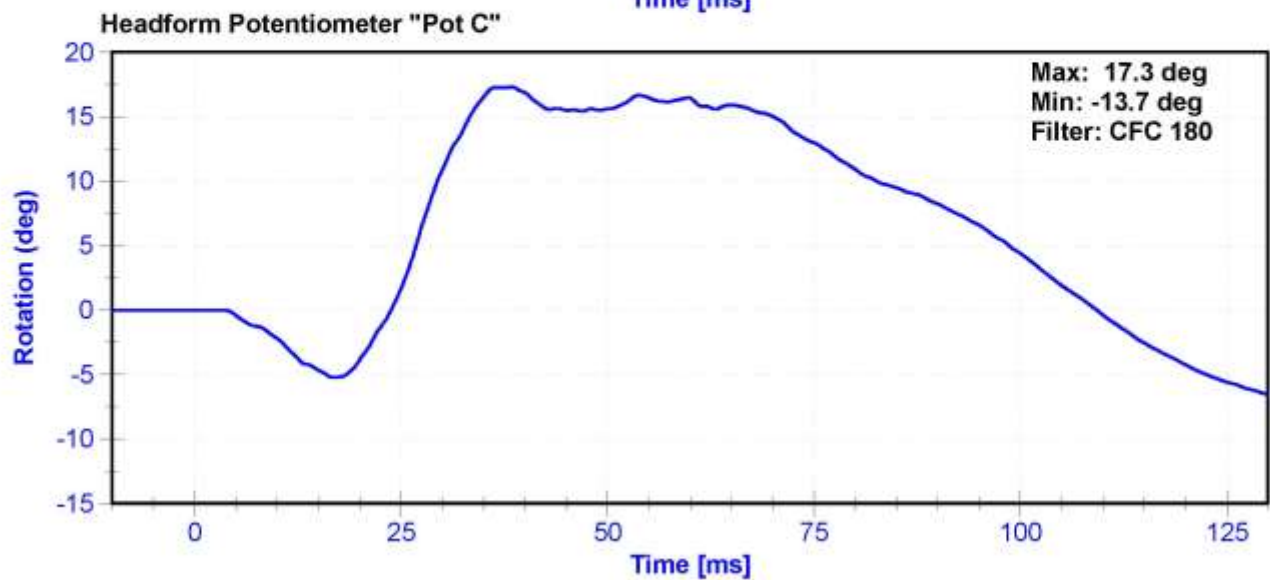
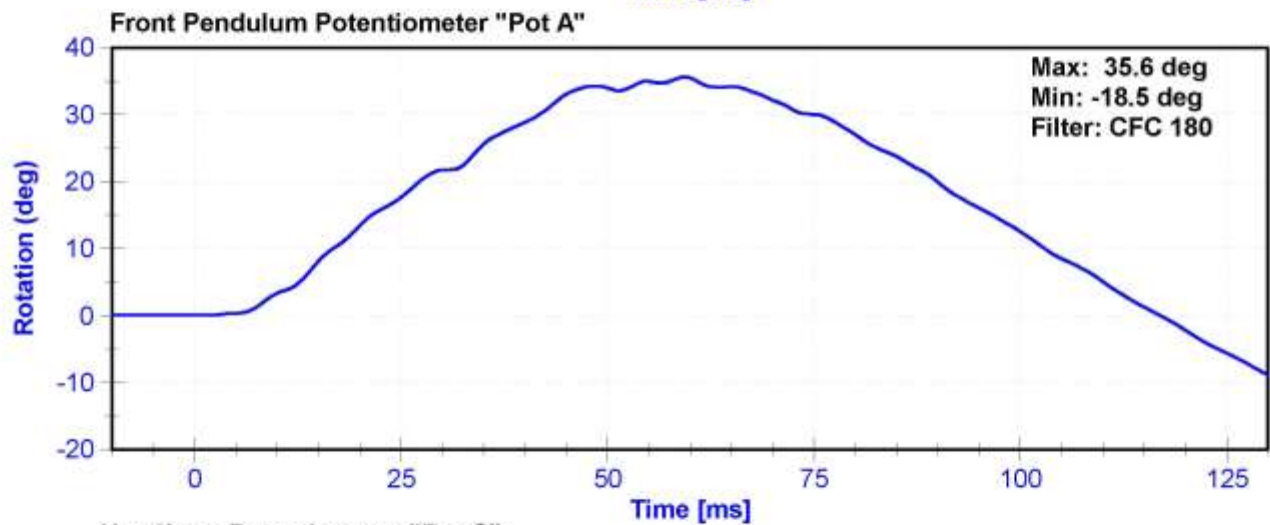
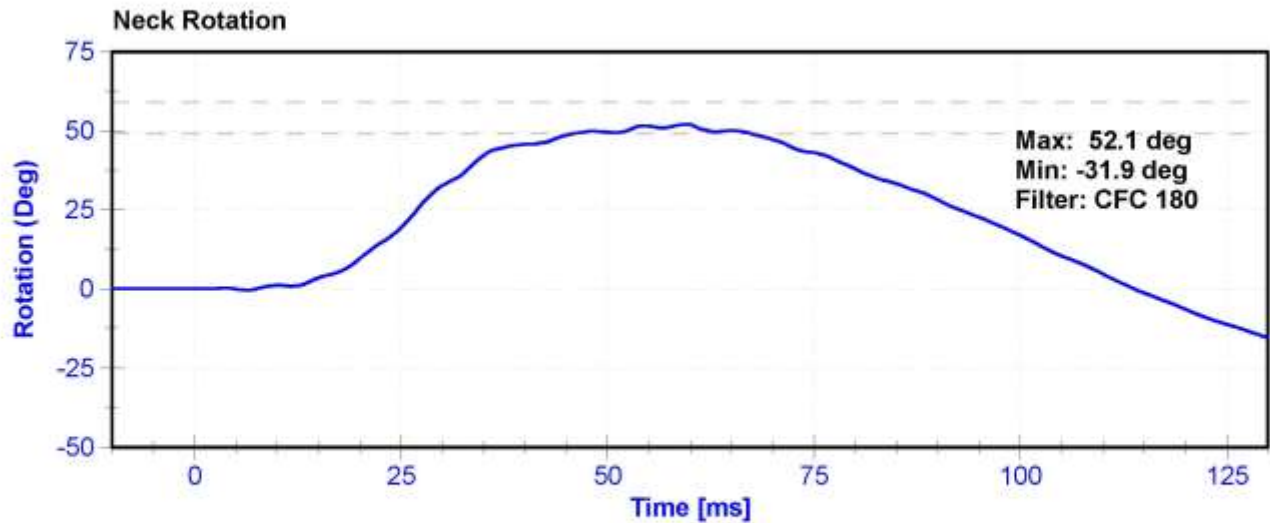
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	31.6	Pass
Velocity	3.3	3.5	m/s	3.40	Pass
Lateral Neck Rotation	49	59	deg	52.1	Pass
Time at Maximum Rotation	54	66	ms	59.6	Pass
Time of Rotation Decay from Maximum	53	88	ms	54.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5F3	5/11/2018	5/11/2019
Front Pendulum Potentiometer	SP22G	DS-094	10/31/2018	10/31/2019
Headform Potentiometer	SP22G	DS-095	10/31/2018	10/31/2019





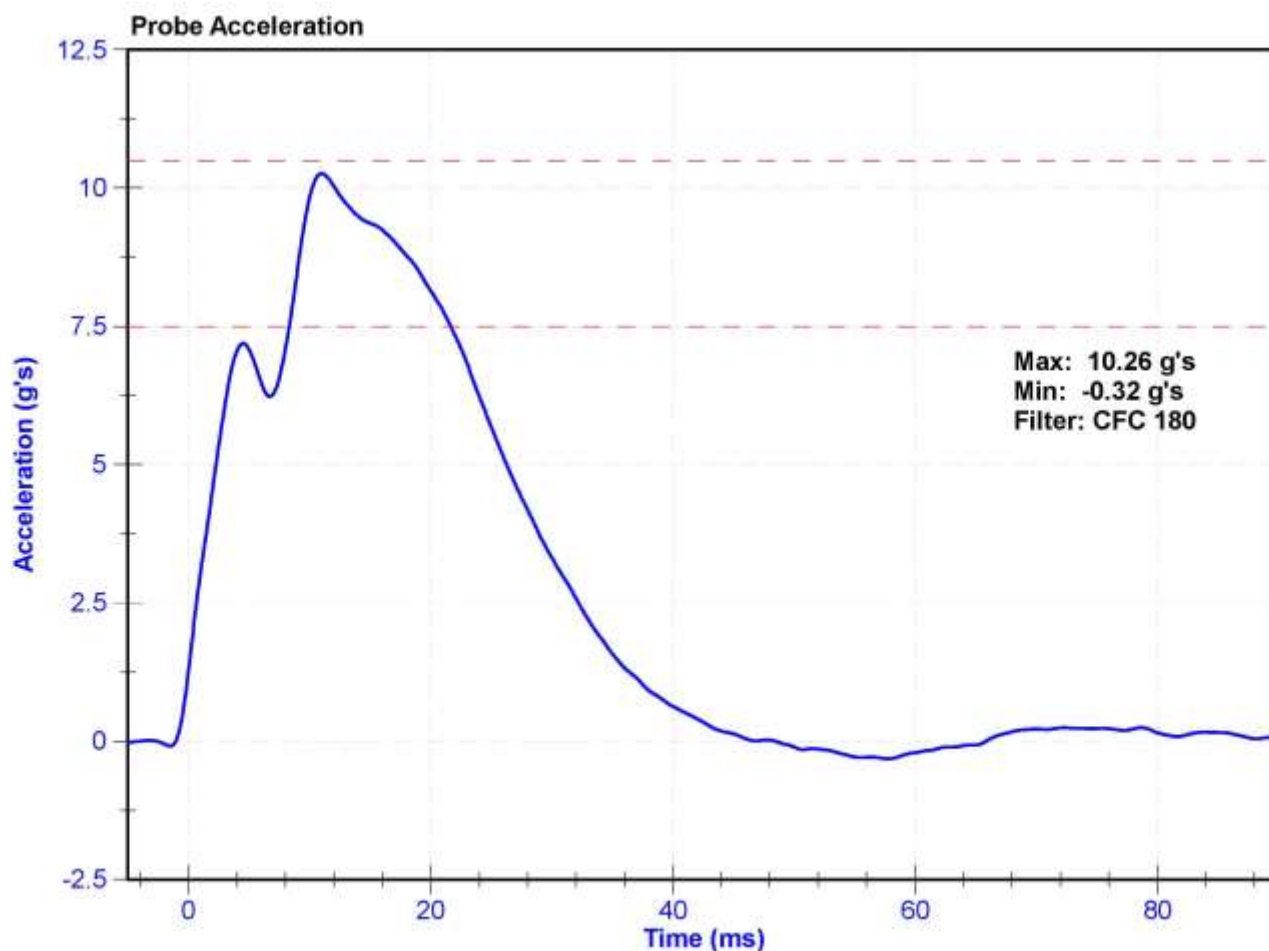
ATD Manufacturer	FTSS	Test Technician	D. Reinhard
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.0	Pass
Humidity	10	70	%	20.6	Pass
Velocity	4.2	4.4	m/s	4.40	Pass
Probe Acceleration	7.5	10.5	g's	10.26	Pass

Transducer Calibrations

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



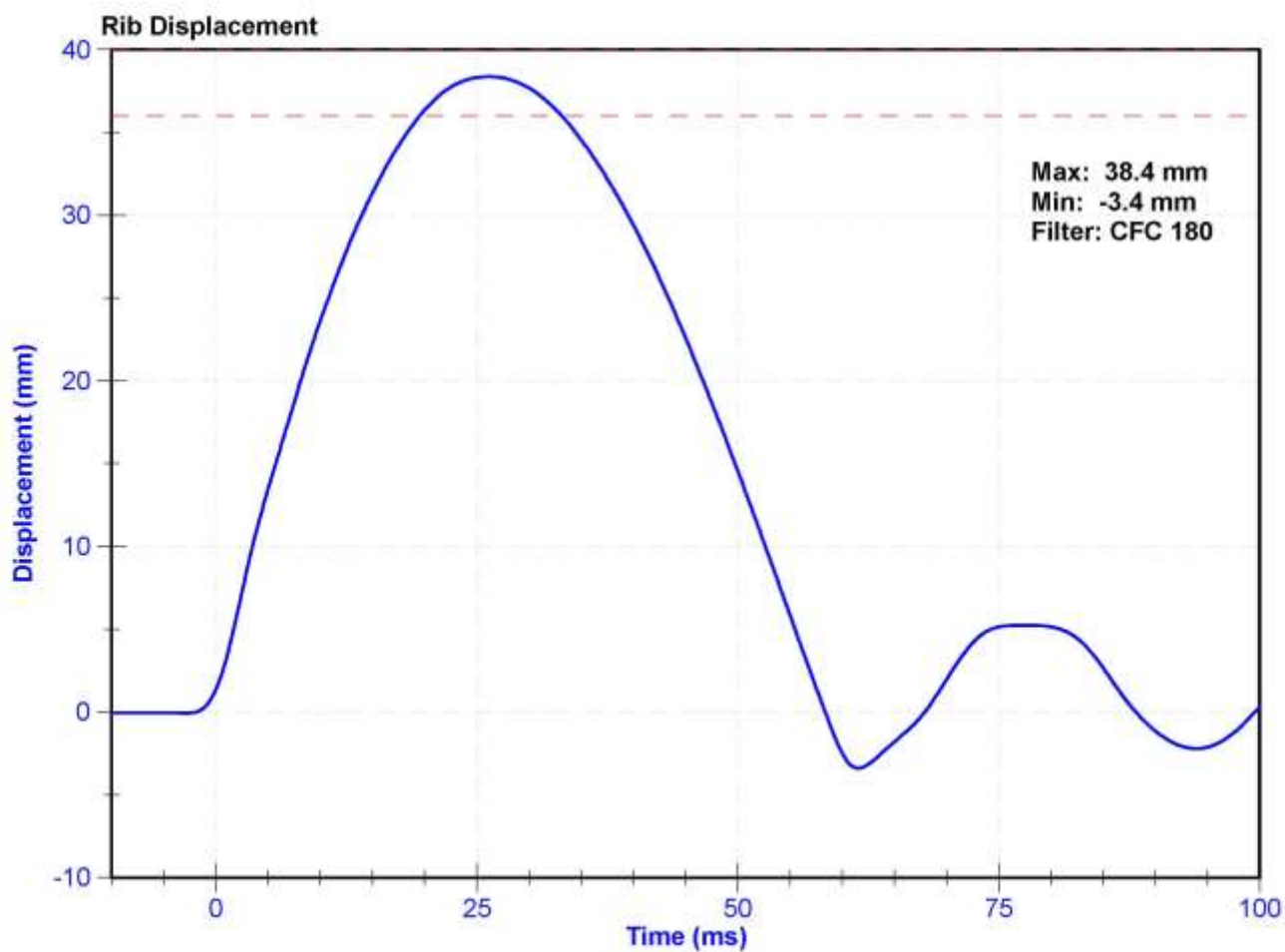
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.9	Pass
Humidity	10	70	%	20.6	Pass
Rib Displacement	36	40	mm	38.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-268GFE	11/27/2018	11/27/2019



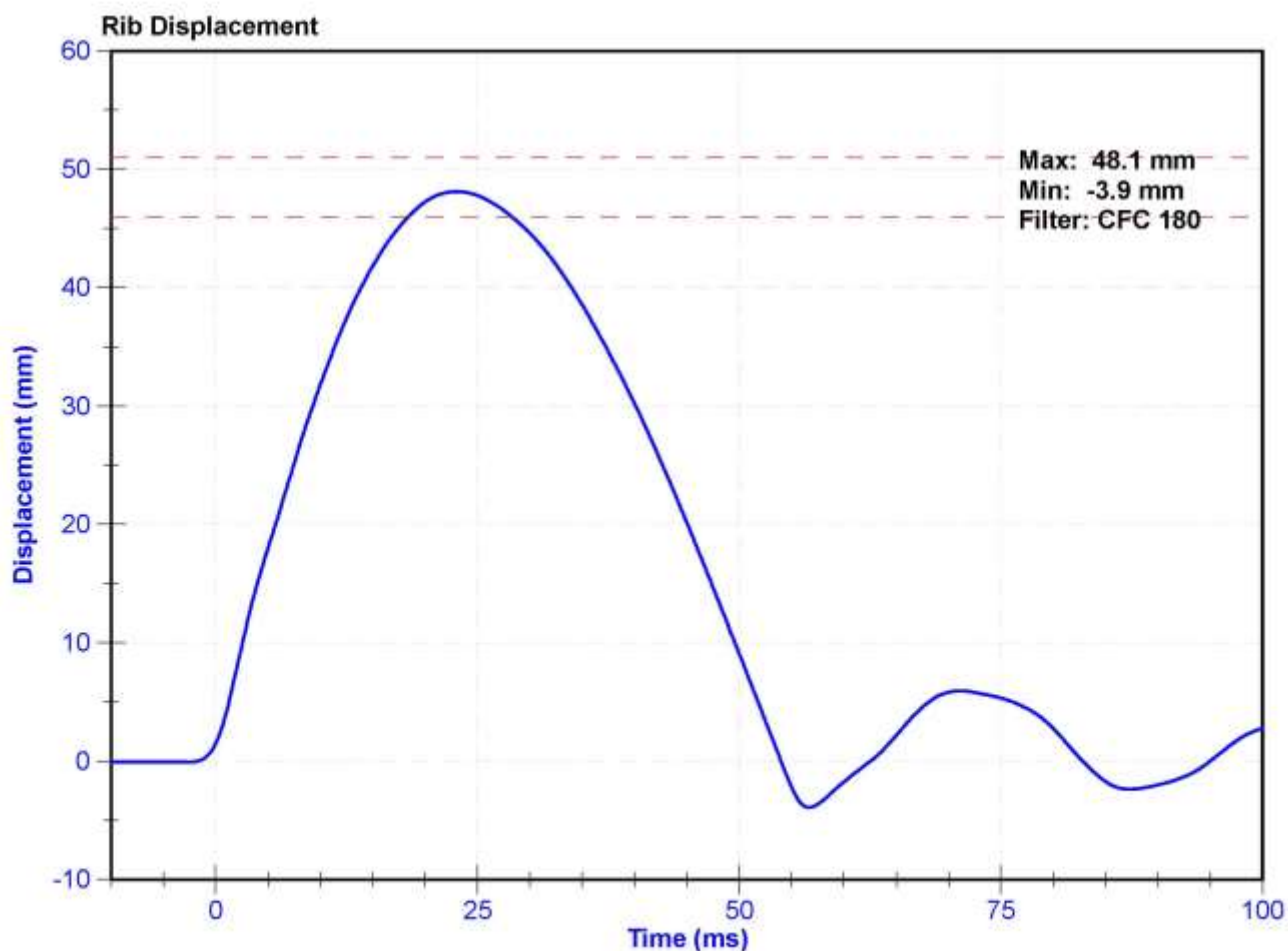
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.9	Pass
Humidity	10	70	%	20.6	Pass
Rib Displacement	46	51	mm	48.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-268GFE	11/27/2018	11/27/2019



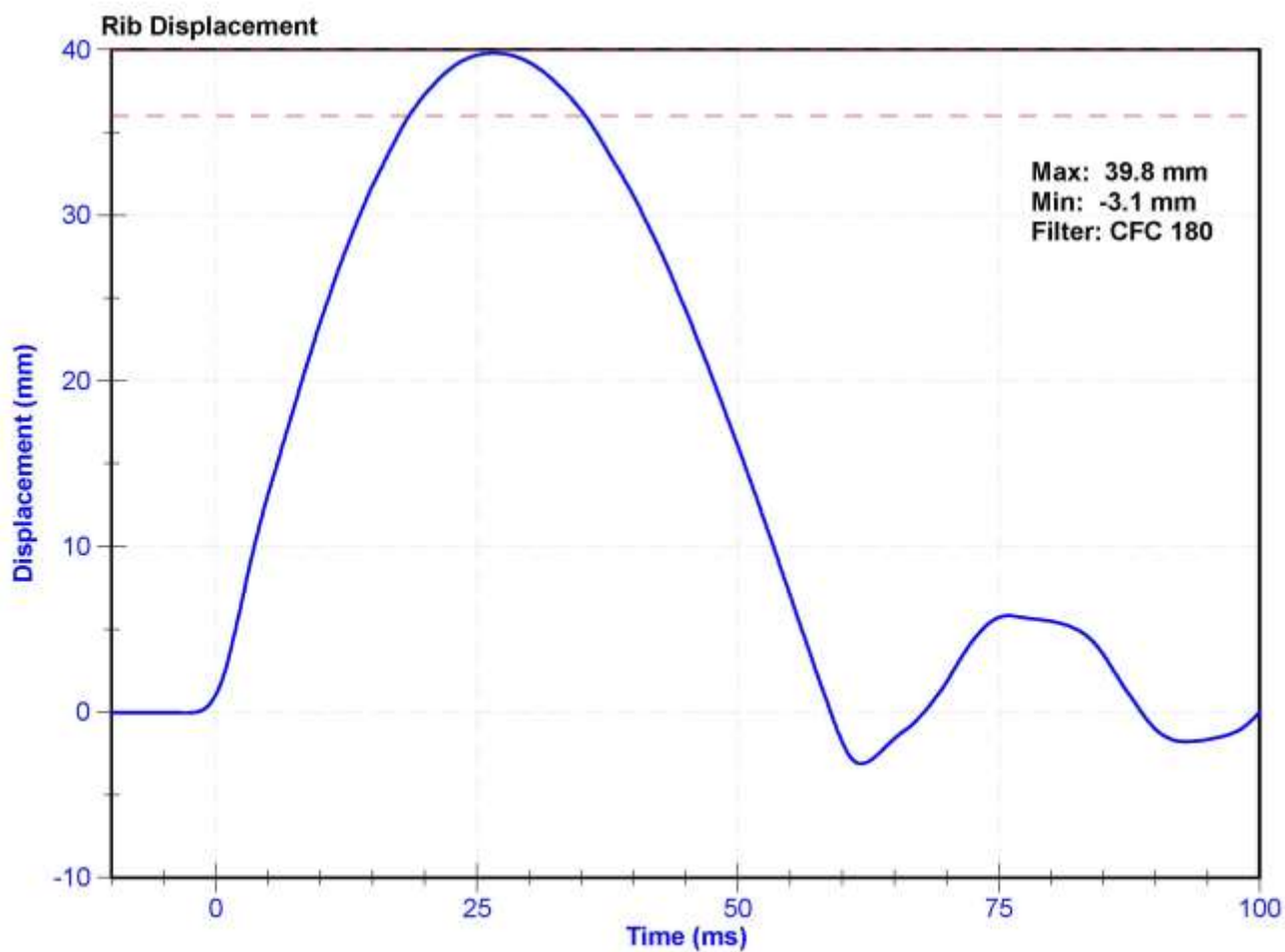
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.0	Pass
Humidity	10	70	%	20.6	Pass
Rib Displacement	36	40	mm	39.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-269GFE	11/27/2018	11/27/2019



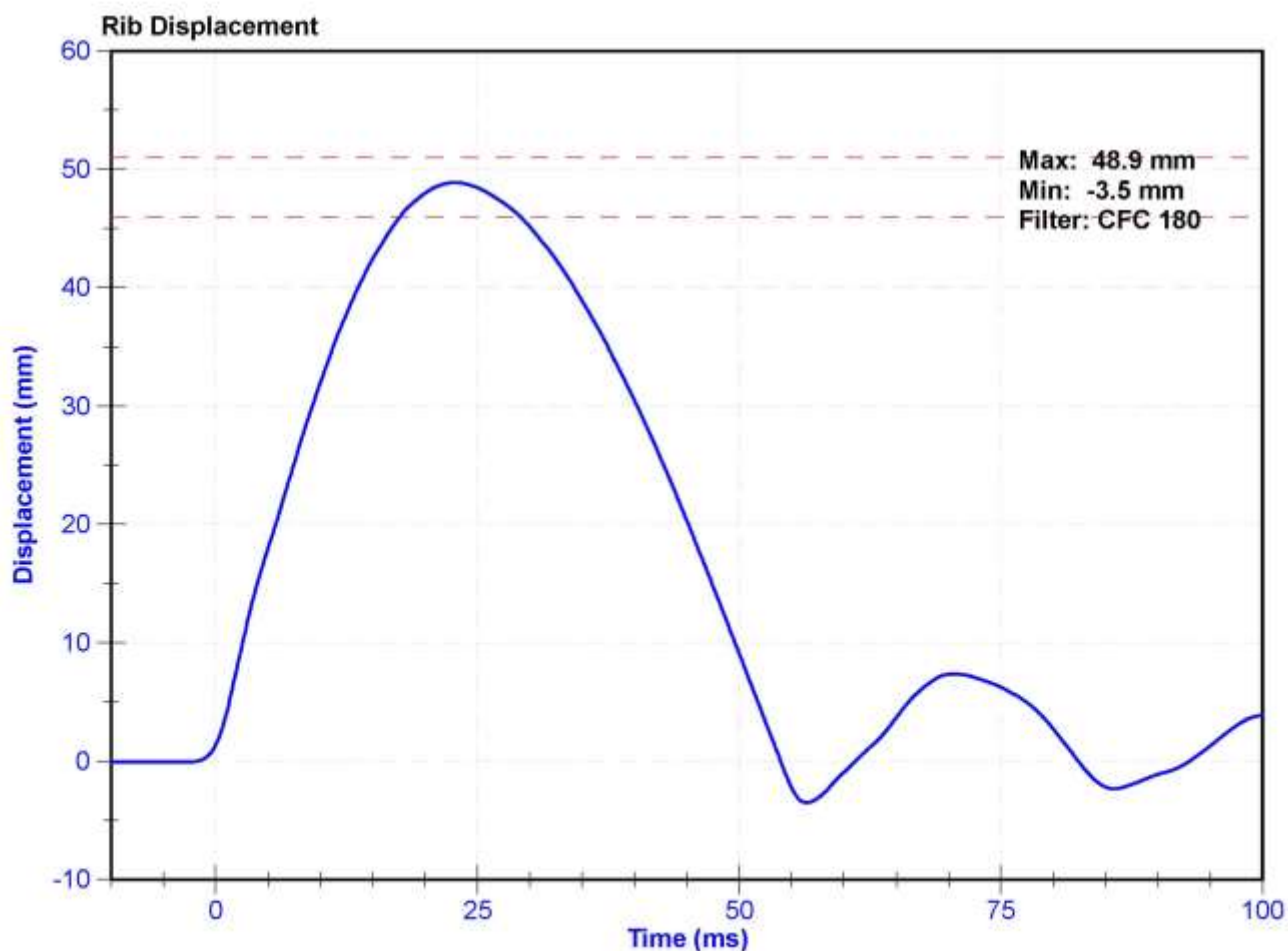
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.0	Pass
Humidity	10	70	%	20.6	Pass
Rib Displacement	46	51	mm	48.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-269GFE	11/27/2018	11/27/2019



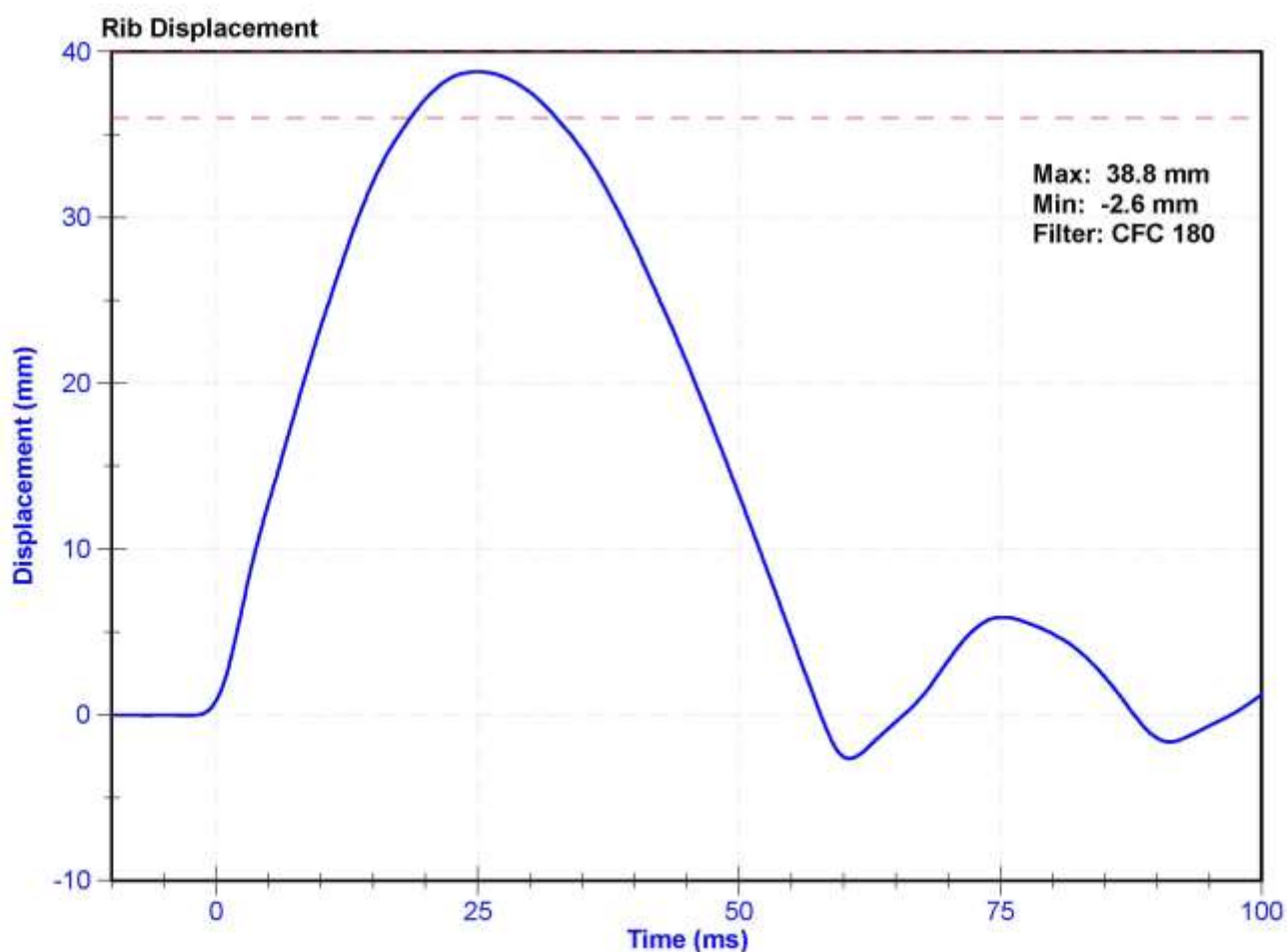
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	20.0	Pass
Rib Displacement	36	40	mm	38.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-270GFE	11/27/2018	11/27/2019



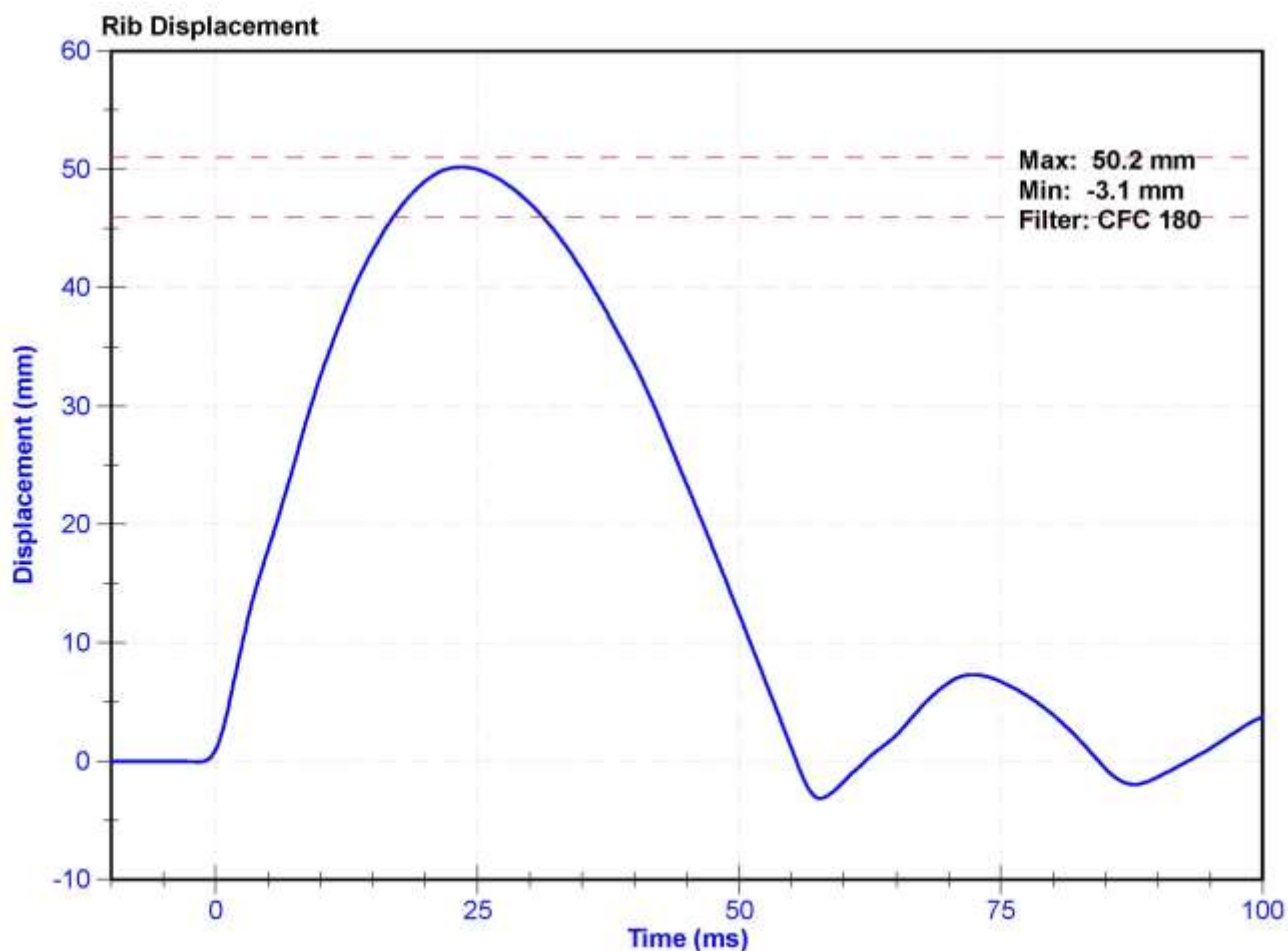
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.0	Pass
Humidity	10	70	%	20.6	Pass
Rib Displacement	46	51	mm	50.2	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell MLT-38000203	DS-270GFE	11/27/2018	11/27/2019



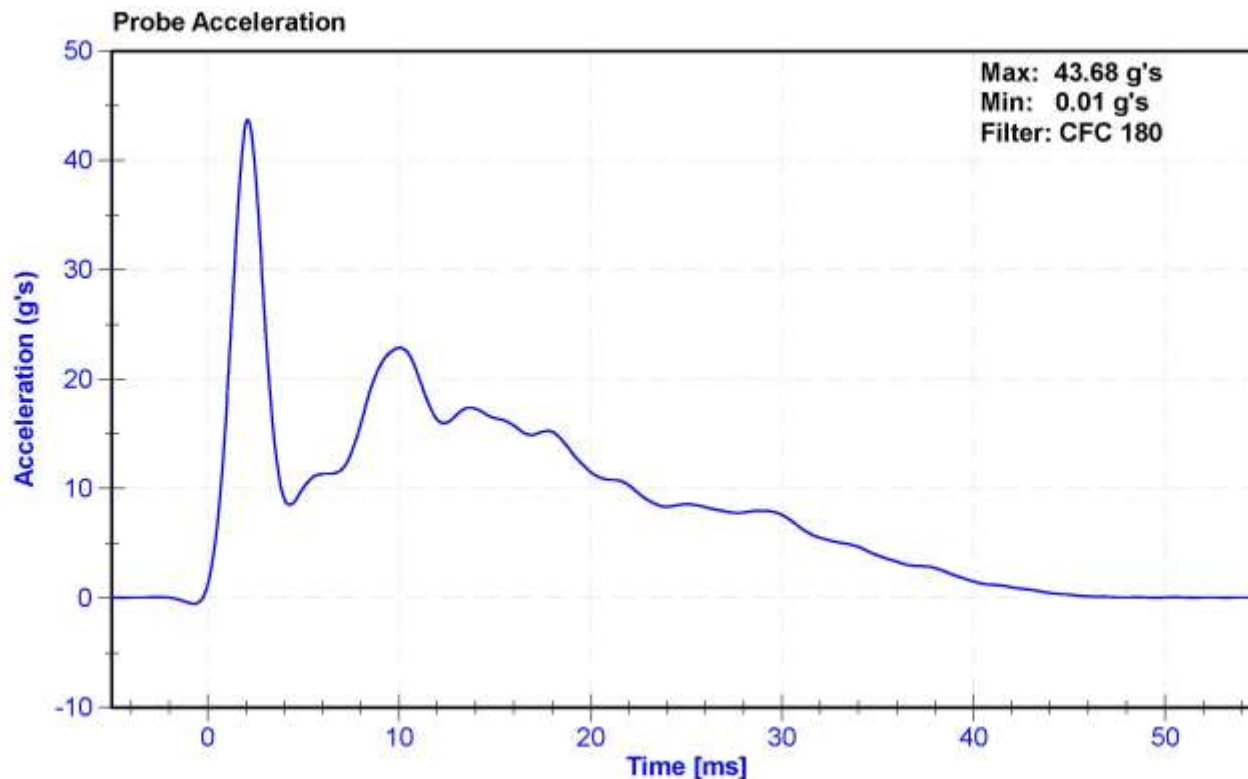
ATD Manufacturer	FTSS	Test Technician	D. Reinhard
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

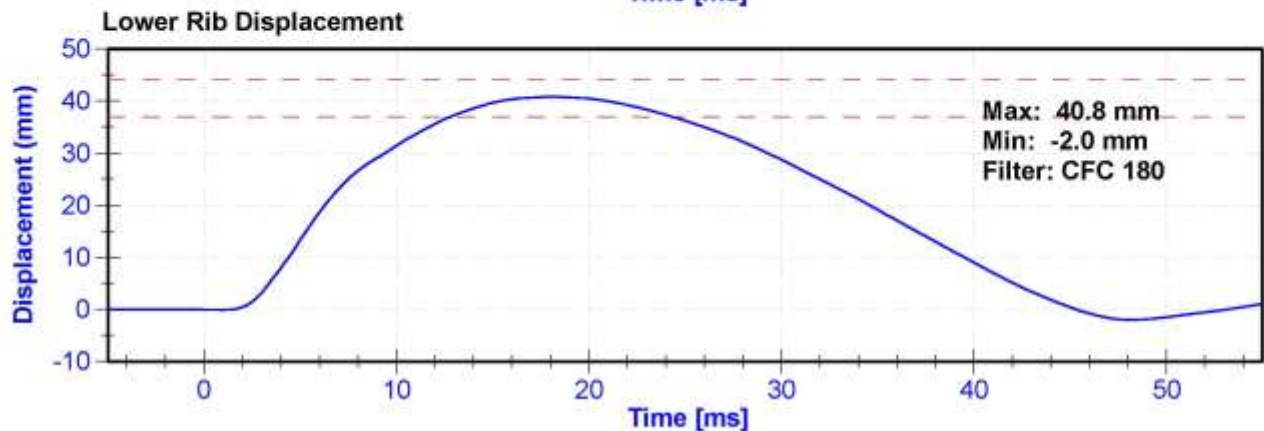
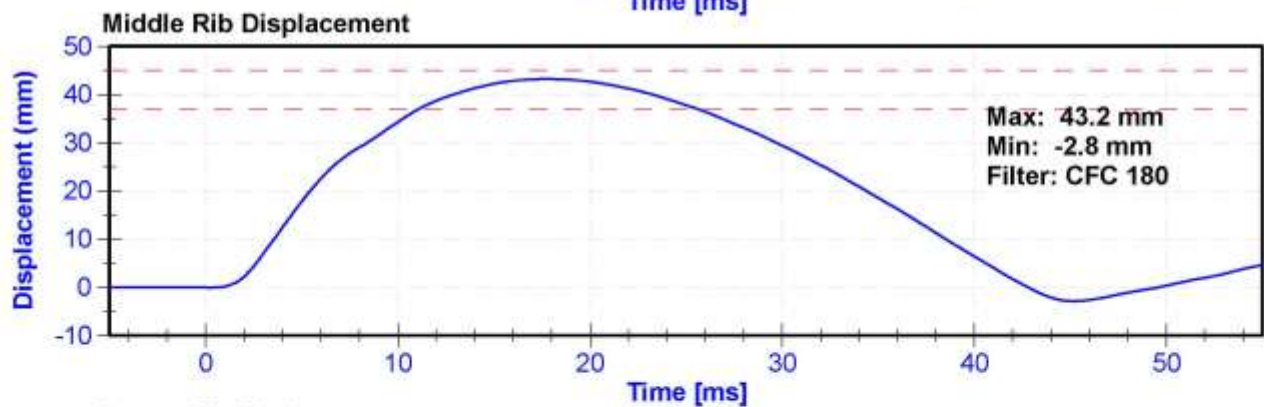
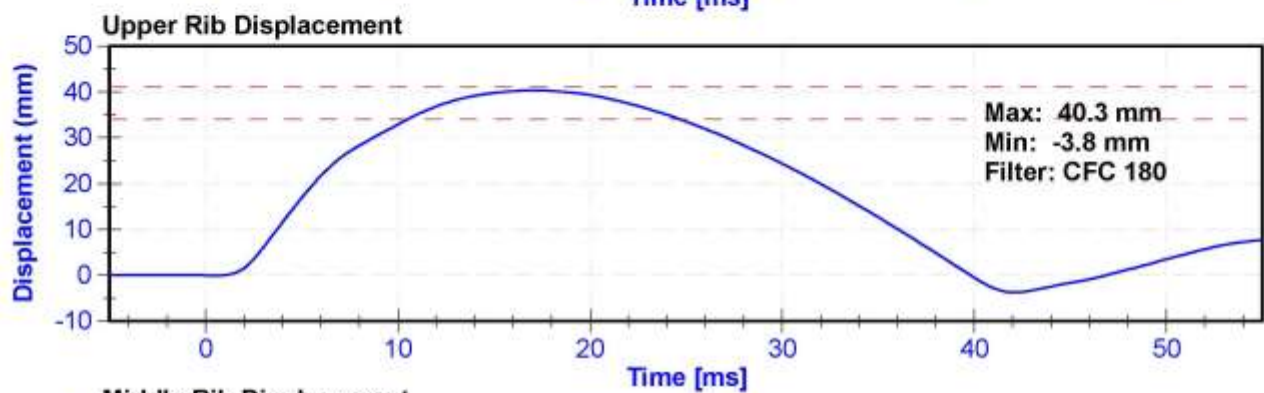
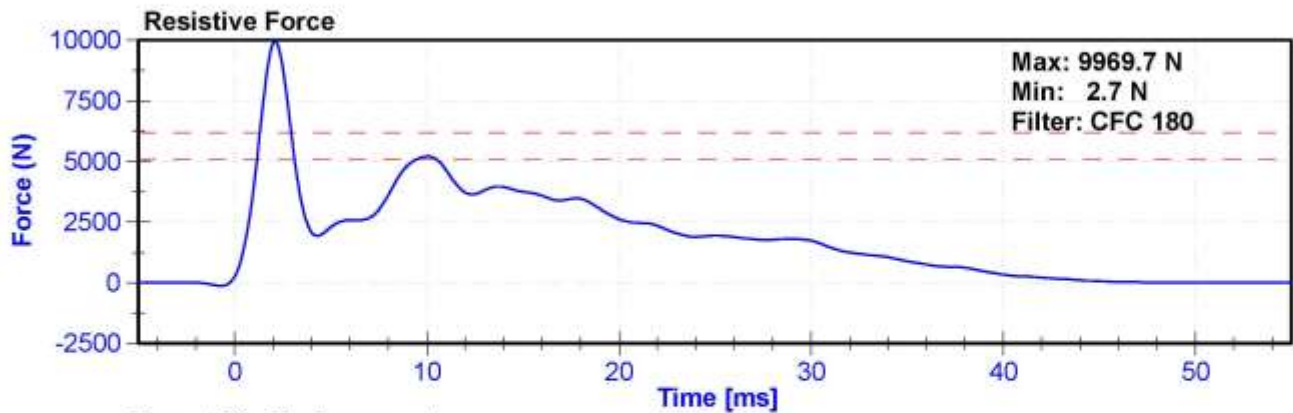
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	22.0	Pass
Humidity	10	70	%	20.6	Pass
Velocity	5.4	5.6	m/s	5.56	Pass
Resistive Force after 6ms	5100	6200	N	5214.4	Pass
Upper Thorax Rib Deflection	34	41	mm	40.3	Pass
Mid Thorax Rib Deflection	37	45	mm	43.2	Pass
Lower Thorax Rib Deflection	37	44	mm	40.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Upper Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-268GFE	11/27/2018	11/27/2019
Middle Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-269GFE	11/27/2018	11/27/2019
Lower Thorax Rib Potentiometer	Honeywell MLT-38000203	DS-270GFE	11/27/2018	11/27/2019





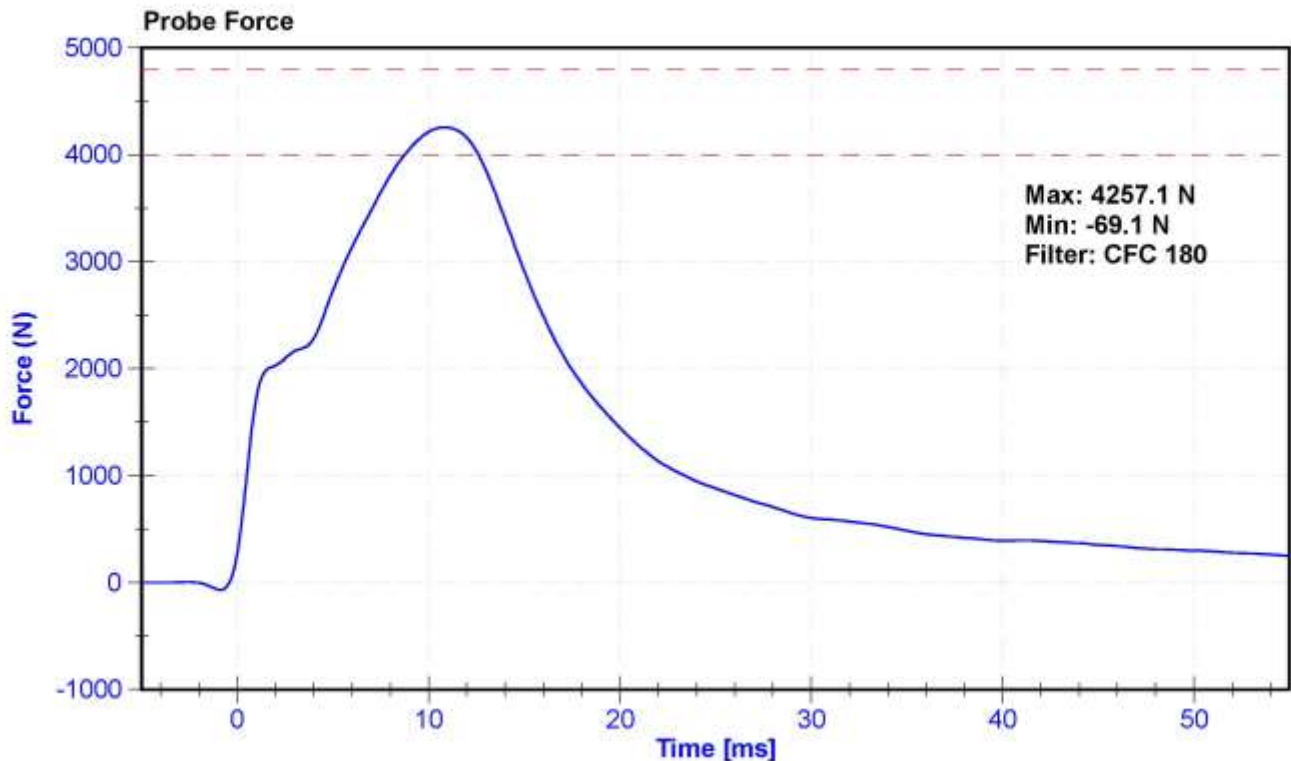
ATD Manufacturer	FTSS	Test Technician	D.Reinhard
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

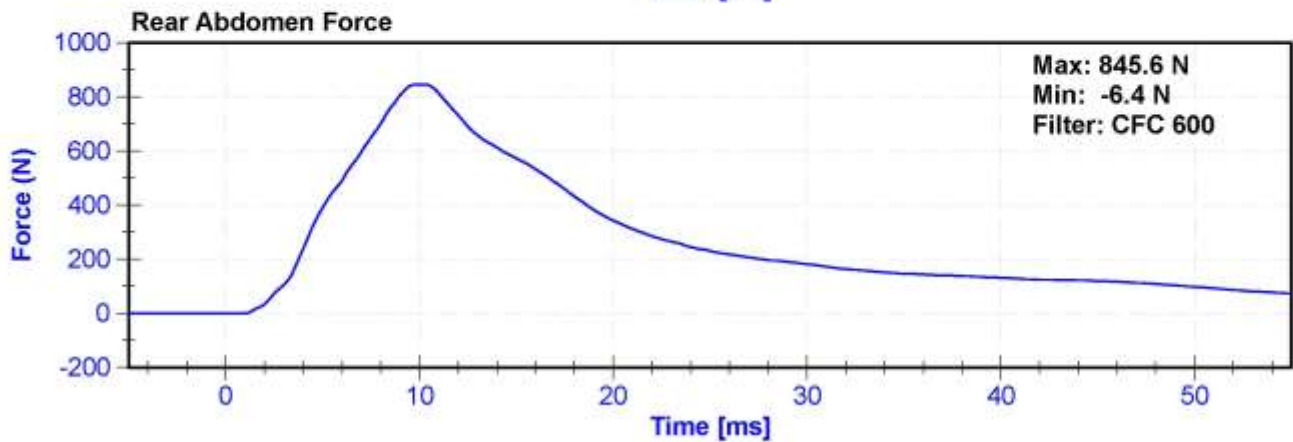
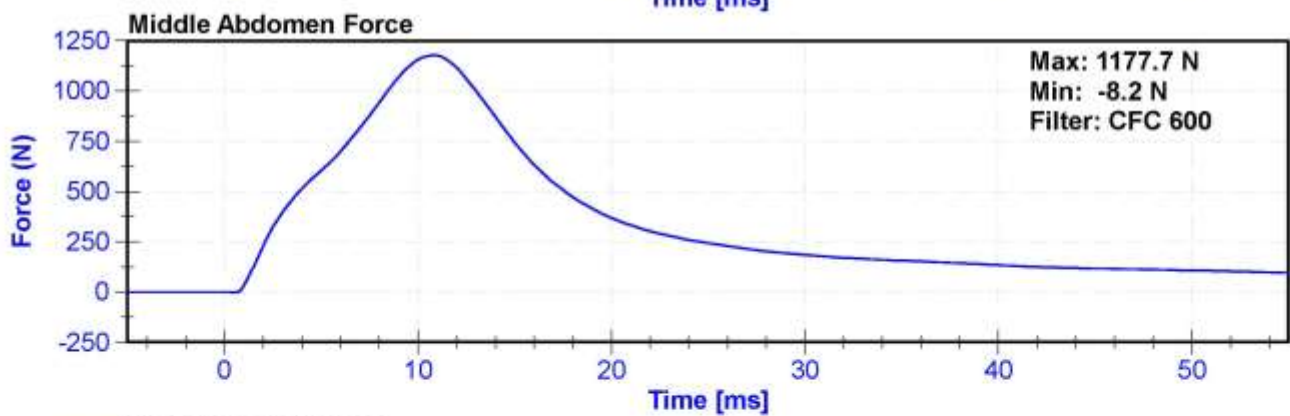
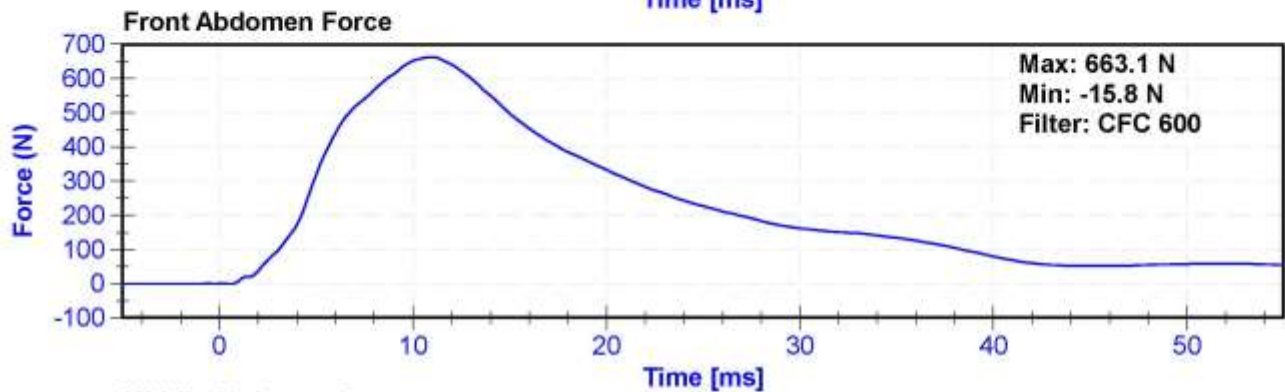
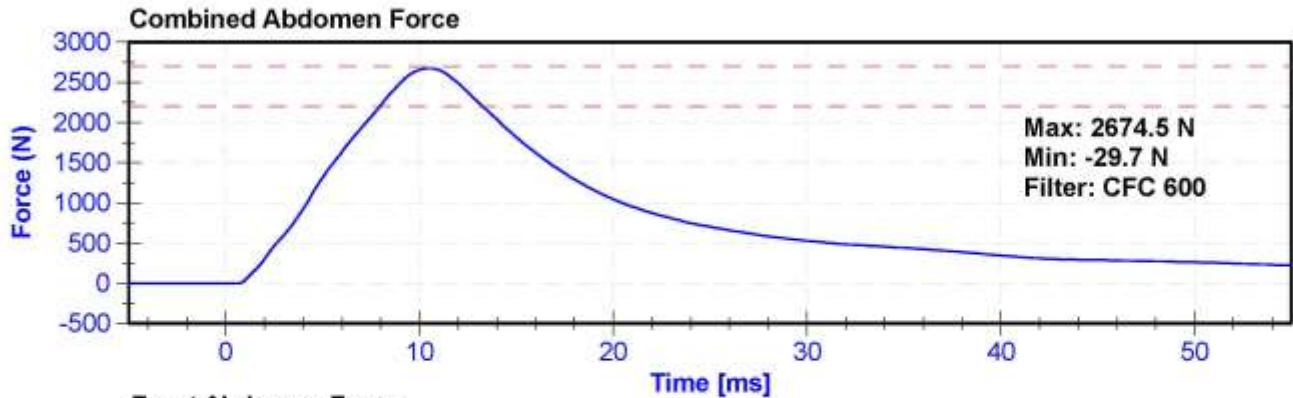
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	21.7	Pass
Velocity	3.9	4.1	m/s	4.09	Pass
Combined Abdomen Force	2200	2700	N	2674.5	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	10.50	Pass
Resistive Probe Force	4000	4800	N	4257.1	Pass
Time at Peak Resistive Force	10.6	13.0	ms	10.80	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Front Abdomen Load Cell	FTSS 2631	LC-1509	10/4/2018	10/4/2019
Middle Abdomen Load Cell	DENTON 2631	LC-1508	10/4/2018	10/4/2019
Rear Abdomen Load Cell	FTSS 2631	LC-1507	10/4/2018	10/4/2019





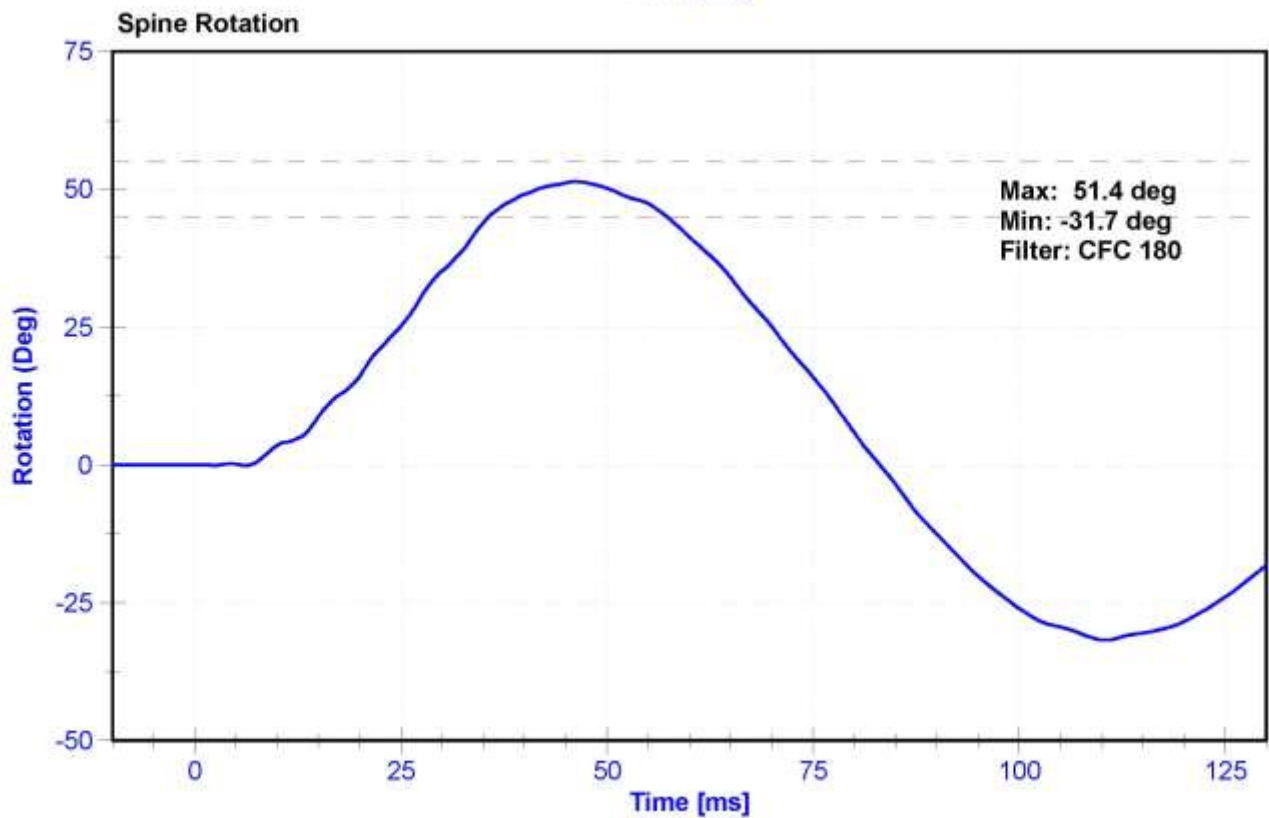
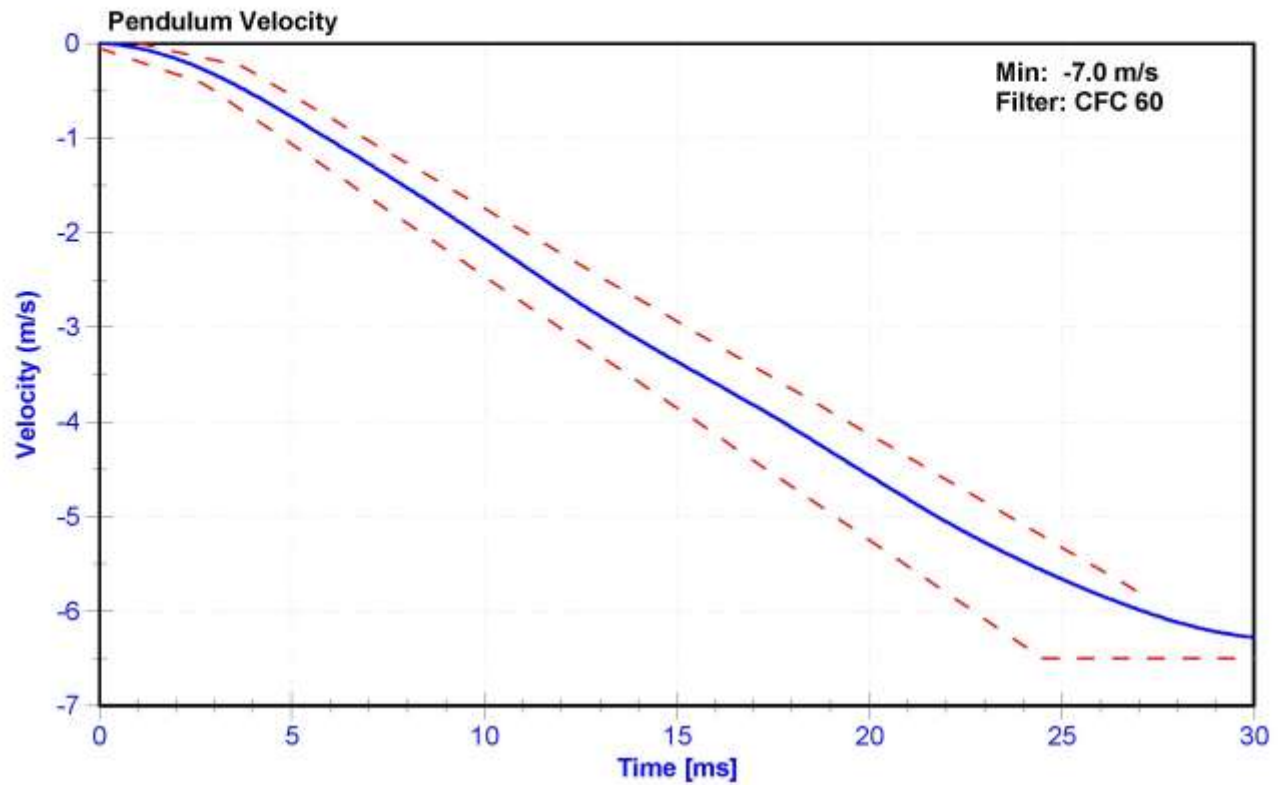
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

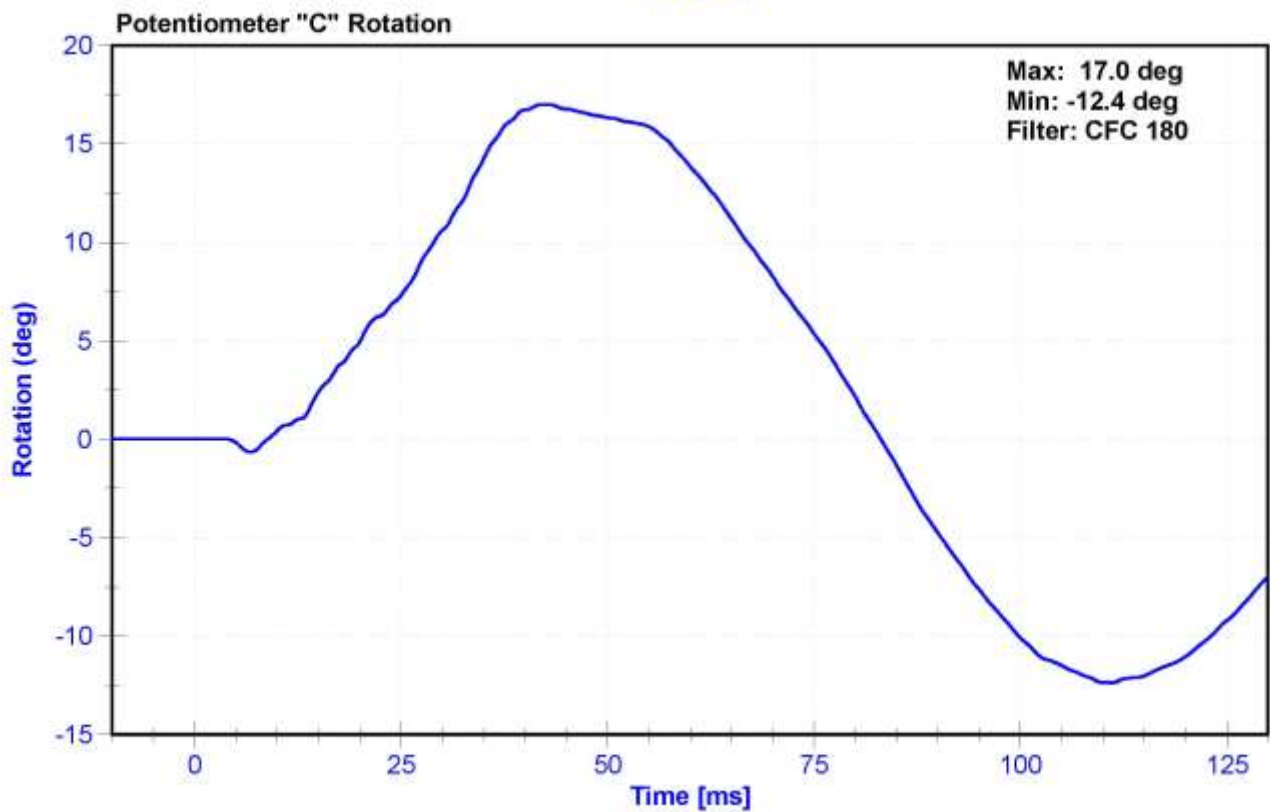
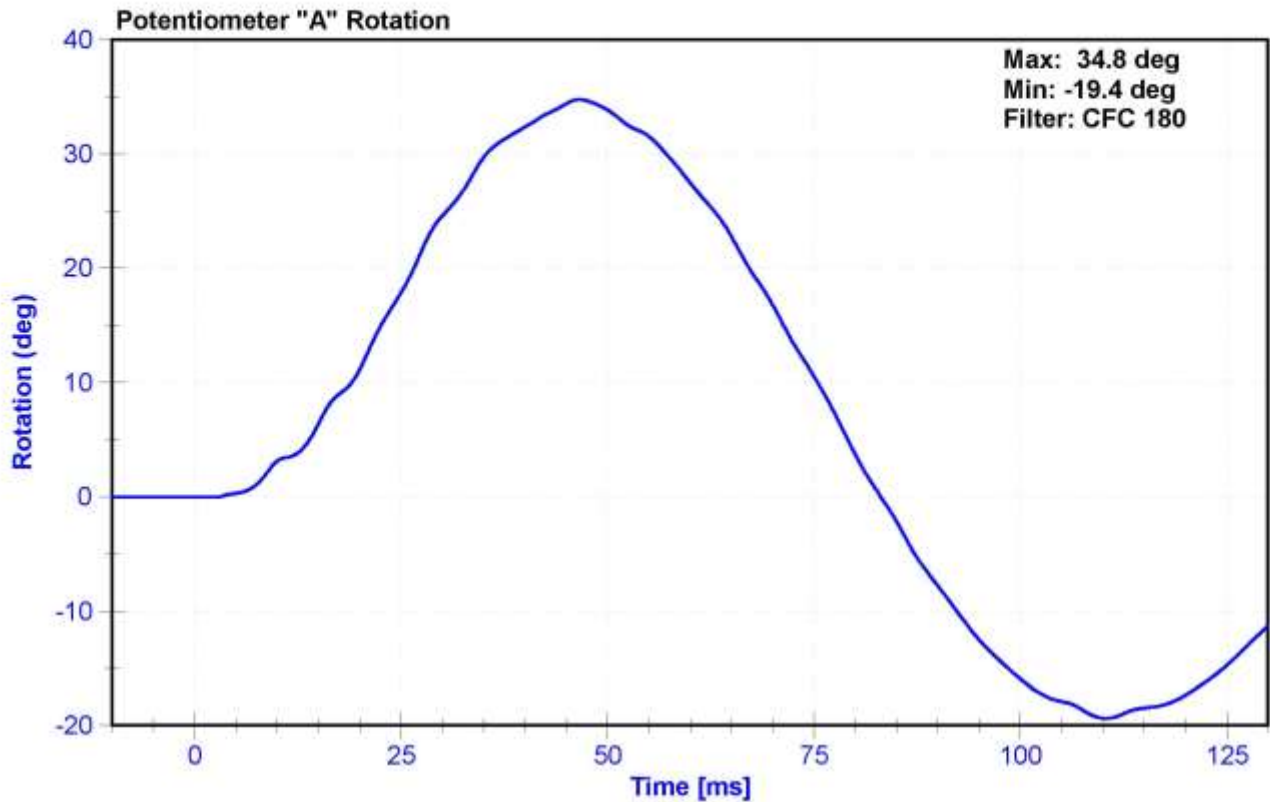
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	32.2	Pass
Velocity	5.95	6.15	m/s	6.113	Pass
Lateral Spine Rotation	45	55	deg	51.4	Pass
Time at Maximum Rotation	39	53	ms	46.1	Pass
Time of Decay to Zero Degrees	37	57	ms	37.0	Pass
Pulse within Corridor?	-	-	-		

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-AH5F3	5/11/2018	5/11/2019
Pendulum "A" Potentiometer	SP22G	DS-094	10/31/2018	10/31/2019
Condyle "B" Potentiometer	SP22G	DS-095	10/31/2018	10/31/2019





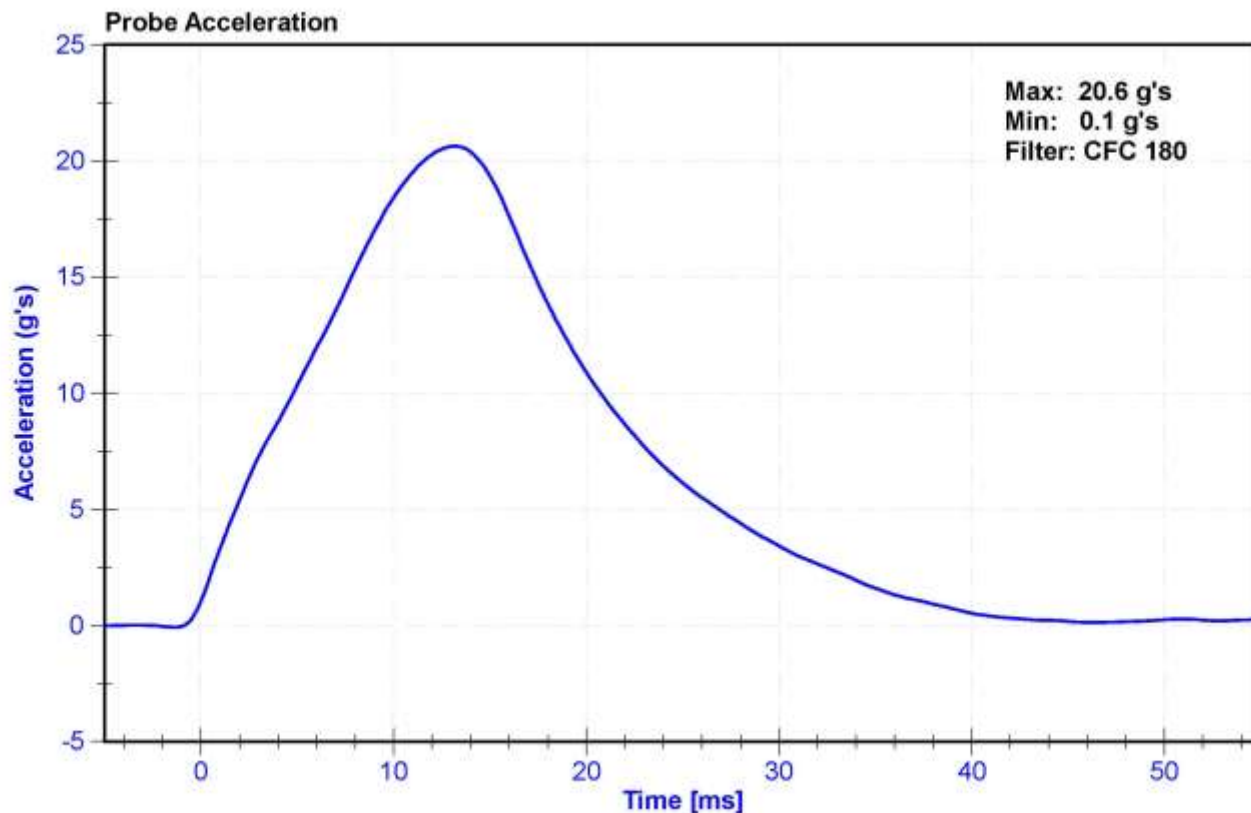
ATD Manufacturer	FTSS	Test Technician	D. Reinhard
ATD Serial Number	DG5348	Laboratory Supervisor	K. Brogan

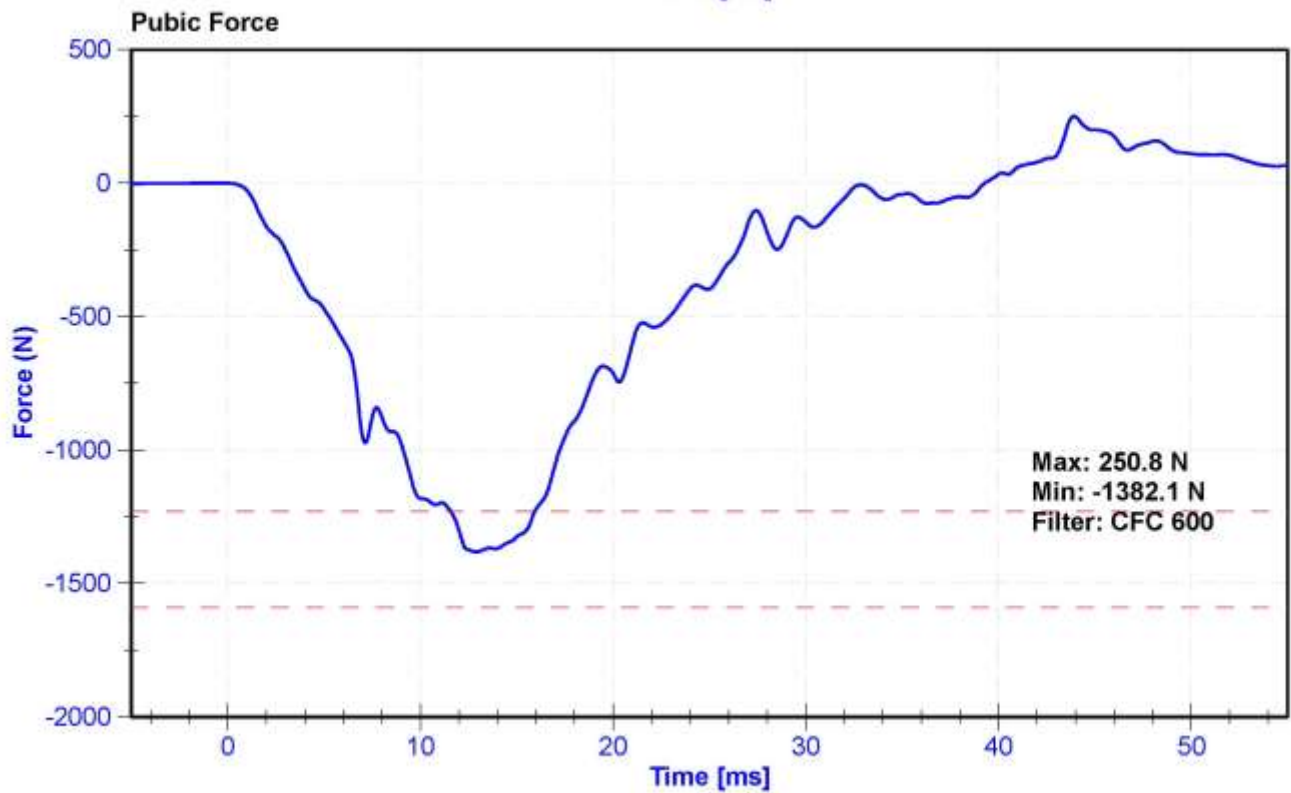
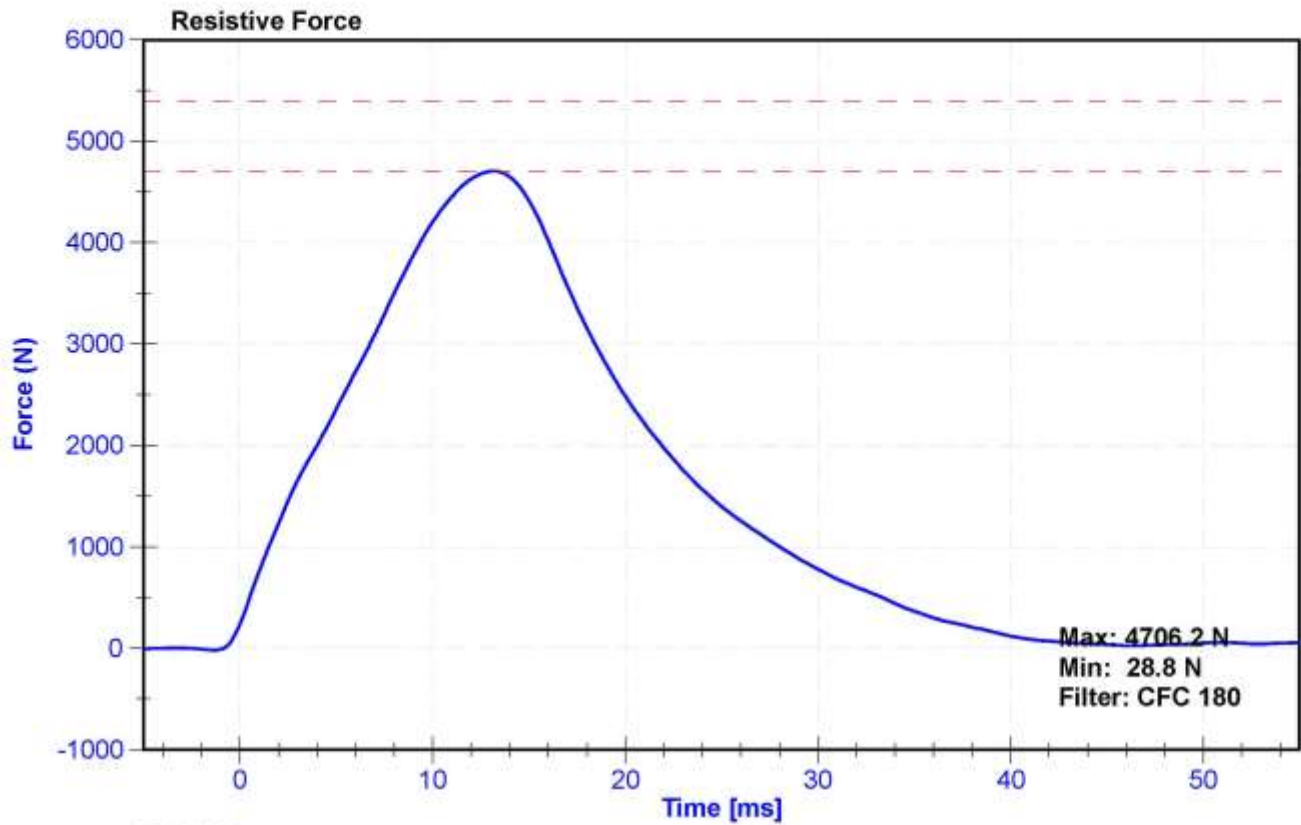
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	23.9	Pass
Velocity	4.2	4.4	m/s	4.38	Pass
Resistive Force	4700	5400	N	4706.2	Pass
Time at Peak Resistive Force	11.8	16.1	ms	13.20	Pass
Pubic Force	-1590	-1230	N	-1382.1	Pass
Time at Peak Pubic Force	12.2	17.0	ms	12.90	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7264CT	AC-P23904	11/1/2018	5/2/2019
Pubic Load Cell	FTSS 3096	LC-458	10/4/2018	10/4/2019





APPENDIX VI
SID-IIs PERFORMANCE CALIBRATION TEST DATA

**** Note: For this test, an un-instrumented SID-II ATD was used as ballast and injury response data was not collected per NHTSA COR's request.

APPENDIX VII

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

TABLE 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N DG5348		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary	X	AC-P58757	ENDEVCO	10/17/2018
		Y	AC-P68062	ENDEVCO	10/17/2018
		Z	AC-P68066	ENDEVCO	10/17/2018
	Redundant	X	AC-P51635	ENDEVCO	10/17/2018
		Y	AC-P59001	ENDEVCO	10/17/2018
		Z	AC-P16576	ENDEVCO	12/4/2018
Thorax Rib Displacement Potentiometers	Upper	Y	DS-268GFE	Honeywell	11/27/2018
	Middle	Y	DS-269GFE	Honeywell	11/27/2018
	Lower	Y	DS-270GFE	Honeywell	11/27/2018
Abdomen Load Cells	Forward	Y	LC-1509	FTSS 2631	10/4/2018
	Middle	Y	LC-1508	DENTON	10/4/2018
	Rear	Y	LC-1507	DENTON	10/4/2018
Lower Spine Accelerometers (T12)		X	AC-P94951	ENDEVCO	11/16/2018
		Y	AC-MS25941	MSI 64CM30	11/16/2018
		Z	AC-MS25879	MSI 64CM30	11/16/2018
Pubic Symphysis Load Cell		Y	LC-458	FTSS 3096	10/4/2018

TABLE 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N 224 (Ballast)		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers		Primary	X	NA	NA	NA
			Y	NA	NA	NA
			Z	NA	NA	NA
		Redundant	X	NA	NA	NA
			Y	NA	NA	NA
			Z	NA	NA	NA
Displacement Potentiometers	Thoracic Rib	Upper	Y	NA	NA	NA
		Middle	Y	NA	NA	-
		Lower	Y	NA	NA	-
	Abdominal Rib	Upper	Y	NA	NA	NA
		Lower	Y	NA	NA	NA
Lower Spine Accelerometers (T12)			X	NA	NA	NA
			Y	NA	NA	NA
			Z	NA	NA	NA
Acetabulum Load Cell			Y	NA	NA	NA
Iliac Wing Load Cell			Y	NA	NA	NA
Pelvis Plug (struck side)				NA	NA	NA
Pelvis Plug (non-struck side)				NA	NA	NA

TABLE 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	AC-A197037	MSI 1201-1000	10/4/2018
	Vehicle Center of Gravity	Y	AC-A217575	MSI 1201-1000	10/4/2018
	Vehicle Center of Gravity	Z	AC-A222636	MSI 1201-1000	10/4/2018
2	Right Sill at Front Seat	X	AC-A196604	MSI 1201-1000	8/7/2018
	Right Sill at Front Seat	Y	AC-A217555	MSI 1201-1000	10/29/2018
	Right Sill at Front Seat	Z	AC-A229244	MSI 1201-1000	10/31/2018
3	Right Sill at Rear Seat	X	AC-A247202	MSI 1201-1000	8/27/2018
	Right Sill at Rear Seat	Y	AC-A247206	MSI 1201-1000	8/27/2018
	Right Sill at Rear Seat	Z	AC-A247193	MSI 1201-1000	8/27/2018
4	Left Sill at Front Door	Y	AC-A217573	MSI 1201-1000	11/16/2018
5	Left Sill at Rear Door	Y	AC-A250383	MSI 1201-1000	6/20/2018
6	Left A-Post Lower	Y	AC-A262040	MSI 1201-1000	11/2/2018
7	Left A-Post Middle	Y	AC-A203877	MSI 1201-1000	10/3/2018
8	Left B-Post Lower	Y	AC-A189600	MSI 1201-1000	8/22/2018
9	Left B-Post Middle	Y	AC-A229239	MSI 1201-1000	10/31/2018
10	Front Seat Track	Y	AC-A262067	MSI 1201-1000	11/19/2018
11	Rear Seat Track or Structure	Y	AC-A229238	MSI 1201-1000	11/13/2018
12	Right Rear Occ. Compartment	Y	AC-A250356	MSI 1201-1000	11/16/2018
13	Engine Block	X	AC-A211599	MSI 1201-1000	10/4/2018
	Engine Block	Y	AC-A217535	MSI 1201-1000	10/3/2018
14	Rear Floorpan Above Axle	X	AC-A250357	MSI 1201-1000	8/22/2018
	Rear Floorpan Above Axle	Y	AC-A262065	MSI 1201-1000	9/20/2018
	Rear Floorpan Above Axle	Z	AC-A250384	MSI 1201-1000	9/20/2018

TABLE 4 – MDB Instrumentation

MDB Instrumentation		Serial Number	Manufacturer	Calibration Date
Vehicle CG Acceleration vs. Time	X	AC-A222648	MSI 1201-1000	8/22/2018
Vehicle CG Acceleration vs. Time	Y	AC-A255839	MSI 1201-1000	10/3/2018
Vehicle CG Velocity vs. Time	Y	AC-A255839	MSI 1201-1000	10/3/2018
Vehicle CG Acceleration vs. Time	Z	AC-A255863	MSI 1201-1000	3/23/2018
Vehicle CG Velocity vs. Time	Z	AC-A255863	MSI 1201-1000	3/23/2018
Vehicle CG Resultant Acceleration vs. Time	R	Calculated	Calculated	Calculated

APPENDIX VIII
CHECK SHEETS

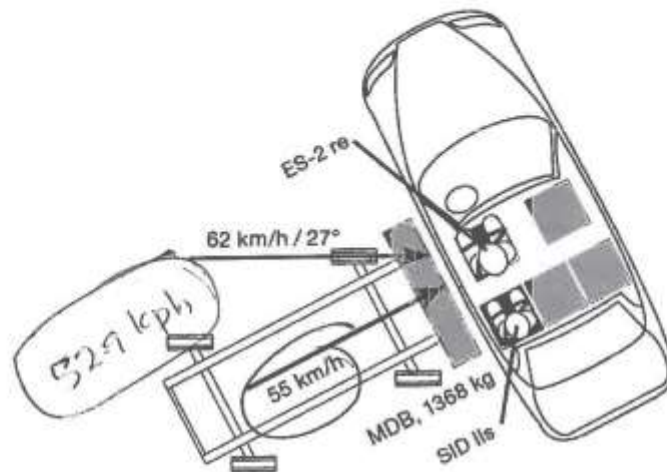
2019 Hyundai Veloster

KMHTG6AF6KU005788

CV2140.1002.4204

Conditions:

New Car Assessment Program Side Impact Moving Deformable Barrier Test



Work Instructions Aligned with U.S. D.O.T. National Highway Traffic Safety Administration's
Laboratory Test Procedure for the New Car Assessment Program:
Side Impact Moving Deformable Barrier

This workbook has been issued for use by: Zach Granby Date: 11/7/18

This workbook has been approved for use by: Ed Dutton Date: 11/8/18

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A large, dark gray graphic consisting of two curved, overlapping shapes that resemble a stylized 'N' or a wing, positioned above the text "Prepare Vehicle".

Prepare Vehicle



Incoming Vehicle Checklist:

Performed By:

Andy Flewniak

Date:

12/18/18

Instruction: Fill in the following fields:

Dealer	Northtown Hyundai
Date vehicle arrived:	9/17/18
Model Year	2019
Make	Hyundai
Model	Veloster

Instructions: Verify the following and place a checkmark in the appropriate box. Any variances must be reported to the Test Engineer within 2 working days of the vehicle's arrival:

Yes No

- | | | |
|-------------------------------------|--------------------------|---|
| ☒ | ☐ | All options listed on the 'window sticker' are present on the test vehicle. |
| ☒ | ☐ | Tires and wheel rims are the same as listed. |
| ☒ | ☐ | There are no dents or other interior or exterior flaws. |
| ☒ | ☐ | The vehicle has been properly prepared and is in running condition. |
| ☒ | ☐ | The glove box contains an owner's manual, warranty document, consumer information, and extra set of keys. |
| ☒ | ☐ | Proper fuel filler cap is supplied on the test vehicle. |
| ☒ | ☐ | Spare tire, jack, lug wrench and tool kit (if applicable) is located in the vehicle cargo area. |
| ☒ | ☐ | The odometer reflects that the vehicle has been driven less than or equal to 200 miles. |
| ☒ | ☐ | The VIN (vehicle identification number) matches the number supplied by NHTSA. |
| ☒ | ☐ | Vehicle is equipped / matches description provided by NHTSA. |
| ☒ | ☐ | Vehicle warning lights (i.e. check engine, SRS, etc.) are not illuminated. |
| ☒ | ☐ | Are there floor mats in the front and rear seats of the vehicle? |

Vehicle Condition Checklist:

Performed By:

Andy Plavnick

Date: 12/13/18

Instruction:

Enter the following information and check any boxes corresponding with a feature found on this vehicle.

Checklist	
<u>C20194204</u>	NHTSA No.
<u>2019</u>	Model Year ¹
<u>Hyundai</u>	Make
<u>Veloster</u>	Model
<u>KMHTG6AF6KU005788</u>	Body Style
<u>Sedan</u>	VIN
<u>Black</u>	Body Color
<u>80</u>	Odometer Reading (miles)
<u>Front 2.0</u>	Engine Displacement (liters)
<u>4</u>	Type / No. Cylinders
<u>Front Transverse</u>	Engine Placement
<u>Auto</u>	Transmission Type
<u>10-Speed</u>	Transmission Speeds
<u>FWD</u>	Final Drive ¹
☒	Overdrive ¹
☒	Roof Rack
☒	Sunroof/T-Top
☒	Running Boards ¹
☒	Tilt Steering Wheel ¹
☒	Power Seats ¹
☒	Anti-Lock Brakes
☒	All-Wheel Drive (AWD)

Checklist

Y/N

☒	Traction Control System (TCS) ¹
☒	Auto-Leveling System ¹
☒	Automatic Door locks (ADL) ¹
☒	Power Window Auto-Reverse ¹
☐	Other Optional Feature ¹
☒	Power Steering
☒	Driver Front Airbag
☒	Driver Curtain Airbag
☒	Driver Head / Torso Airbag
☒	Driver Torso Airbag
☒	Driver Torso / Pelvis Airbag ¹
☒	Driver Pelvis Airbag ¹
☒	Driver Knee Airbag ¹
☒	Rear Passenger Curtain Airbag
☒	Rear Passenger Head / Torso Airbag
☒	Rear Passenger Torso Airbag
☒	Rear Passenger Torso / Pelvis Airbag ¹
☒	Rear Passenger Pelvis Airbag ¹
☒	Driver Seat Belt Pre-tensioner
☒	Rear Passenger Seat Belt Pre-tensioner
☒	Driver Load Limiter
☒	Rear Passenger Load Limiter
☐	Other Safety Restraint ¹

¹ These items are in addition to the Report of Vehicle Condition and are required for The Data Sheet No. 1 General Test and Vehicle Parameters.

Instruction: Check any boxes corresponding with a feature found on this vehicle.

Checklist

Y/N

- | | |
|--|---|
| ☒ Tinted Glass | ☒ Air Conditioner |
| ☒ Power Brakes | ☒ AM/FM CD |
| ☒ Front Disc | ☒ Power Windows |
| ☒ Rear Disc | ☒ Other |
| ☒ Bucket Seats | |

Instruction: Create and print photo placard. Then take the following photographs:

Reference sample photo set on network (if needed).

Checklist

- ☒ Close up view of Vehicle's Tire Information Placard or Label (No. 56)
- ☒ Close up view of Vehicle Certification Label (No. 055)
- ☒ Front View
- ☒ Left Front ¾ View
- ☒ Left Side View
- ☒ Left Rear ¾ View
- ☒ Rear View
- ☒ Right Rear ¾ View
- ☒ Right Side View
- ☒ Right Front ¾ View
- ☒ Right Front ¾ View at a Distance from Vehicle (for NHTSA webpage)
- ☒ View of Disengaged Parking Brake (No. 035)

Instruction: Using the copier, scan in the following pages. Save in *.jpeg format.

Checklist

- ☒ Head Restraint Use and Adjustment Information from Vehicle Owner's Manual (No. 069)
- ☒ Monroney Label or window sticker (No. 068)

Checklist

- ☒ Enter the vehicle information found on the previous two pages into the Vehicle Database. *If a field does not exist in the database, enter the information next to the missing subject. Save a copy of the Incoming Vehicle Inspection report on the network.*
- ☒ Forward copy of Vehicle Condition Report to Contracts



General Vehicle Data:

Performed By:

Andy Plewniak

Date:

12/13/18

Instruction: Fill in the following sections.

Yes

No



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

Data from Certification Label

Manufactured By	Hyundai Motor Company	GVWR	1700	kg
Date of Manufacture	4/27/18	GAWR Front	990	kg
Vehicle Type	Passenger car	GAWR Rear	820	kg

Vehicle Seating and Weight Capacity Data

	Front	Rear	Third	Total
Designated Seating Capacity (DSC)	2	2	-	4
Vehicle Weight Reduction (If Applicable)				(A) — kg
Vehicle Capacity Weight (VCW)				(B) 317 kg
DSC x 68.04 kg				(C) 44.8 272.16 kg
Rated Cargo and Luggage Weight (RCLW)				((B-A) - C) 44.8 kg

Vehicle Seat Type (Check one of the following)

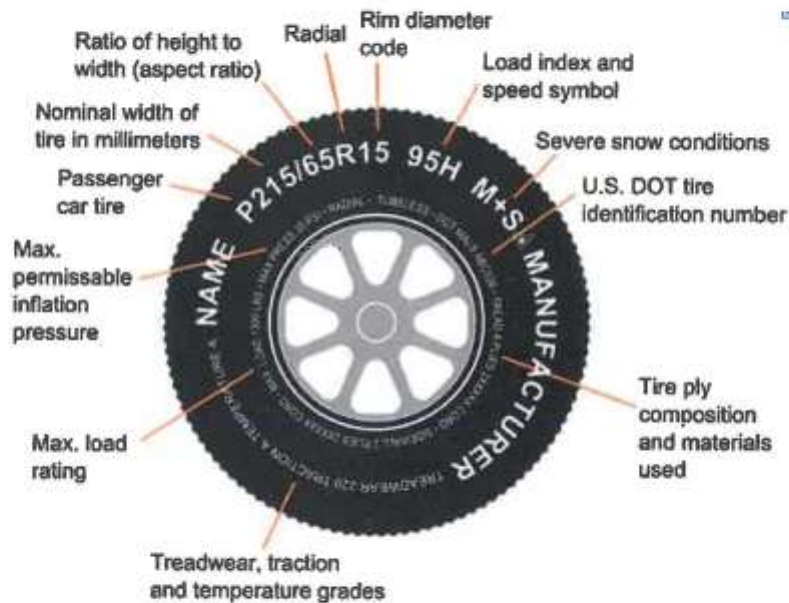
Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable w/Lever	w/Knob
Front Seat	☒	☐	☐	☐	☐	☒	☐
Rear or Second Row Seat	☐	☐	☒	☐	☒	☐	☐
Third Row Seat	☐	☐	☐	☐	☐	☐	☐

Please list other pertinent Optional Equipment below:

None

Tire Placard Information	Front	Rear
Recommended Cold Tire Pressure (kPa)	230	230
Recommended Tire Size	215/45/R17	215/45/R17

Tire Sidewall Information	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Tire Size on Vehicle	215/45/17	215/45/17
Tire Manufacturer	KUMHO	KUMHO
Tire Name	SOLUS	SOLUS
Tire Type	M+S	M+S
Tire Width	215	215
Aspect Ratio	45	45
Radial	17	17
Wheel Diameter	17	17
Load Index / Speed Symbol	87H	87H
Treadwear	500	500
Traction Grade	A	A
Temperature Grade	A	A
Tire Material	Steel, polyester, polyamide	Steel, polyester, polyamide
DOT for LEFT Tire	Y07R Y4Y1 1418	Y07R Y4Y1 1418
DOT for RIGHT Tire	Y07R Y4Y1 1418	Y07R Y4Y1 1418
Tire Ply (Sidewall / Carcass)	2 polyester →	
Tire Ply (Belts and Cap Ply)	2 steel, 2 polyester 2 polyamide →	





Notify Customer & Form 1:

Engineer's Name:

Zach Granby

Date:

9/17/18

Instructions: Complete each task, and then check the appropriate box below.
When finished, **place a copy of the Form 1 after this page.**

Vehicle Condition Checklist:

☒ Vehicle is ACCEPTABLE

Date: 9/17/18

☐ Vehicle is NOT ACCEPTABLE and contacted NHTSA

Date: _____

Test Date Checklist:

☒ Provided NHTSA with test date

Date: 11/7/18

Form 1 Checklist:

☒ Request Form 1

Date: 11/7 9/17/18

☒ Received Form 1

Date: 11/7/18

☒ Check Form 1 to determine whether side airbags on the non-struck side will deploy during test. If yes, determine whether OEM will assist in disabling airbags on test day and if necessary request disabling instructions from NHTSA.

Date: 11/7/18

☒ Check Form 1 to determine whether airbag sensor will detect presence of ATD in seat.

Date: 11/7/18

☒ Reviewed and determined information is ACCEPTABLE

Date: 11/7/18

☐ Reviewed and determined information is NOT ACCEPTABLE

Date: _____

If not acceptable, actions taken:

☐ Issue resolved & information is now ACCEPTABLE

Date: _____

Attendance for Test Checklist:

☒ Requested list of OEM and NHTSA personnel who will be present for test and date / time of arrival.

Date: 11/7/18

Attitude - As Delivered Condition:

Performed By:

Travis Hutchison

Date:

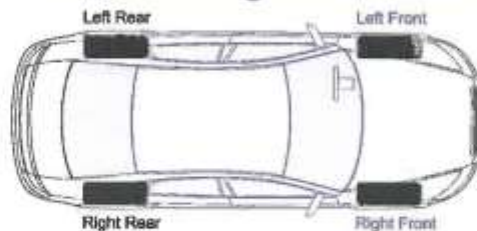
12DEC18

Note: Do not lift the vehicle off the ground until the attitude measurements have been taken.

Checklist

- ☒ If the vehicle was received with floor mats, **leave them in the vehicle** as they are need for dummy positioning.
- ☒ Check the battery voltage; if not acceptable put on charger and notify Test Engineer.
- ☒ Fill the transmission with transmission fluid to full capacity.
- ☒ Fill the coolant system to capacity.
- ☒ Fill the engine with motor oil to the maximum mark on the dip stick.
- ☒ Fill the brake reservoir with brake fluid to its normal level.
- ☒ Fill the windshield washer reservoir to capacity.
- ☒ Record the As Delivered tire pressure for each tire in the space provided below.
- ☒ Record the cold tire pressure as indicated on the tire placard, for each tire, in the space provided below.
- ☒ Record the cold tire pressure as indicated in the vehicle's owner's manual, for each tire, in the space provided below.
- ☒ Inflate each tire to the indicated cold tire pressure as indicated on the tire placard.

	Units	Left Front	Right Front	Left Rear	Right Rear
As Delivered	kpa	220	220	220	220
Tire Placard	kpa	230	230	230	230
Owner's Manual	kpa	N/A	N/A	N/A	N/A
Pressure Gauge Unique Identifier:		400620			



Checklist

- ☒ With the vehicle in the "As Delivered" weight condition, place it on a flat, level surface.
- ☒ Place transmission in neutral.

Note: If the vehicle has an Auto-Leveling, the ignition must be set to the "on" position. If the vehicle is equipped with a self-adjusting hydraulic system, set the vehicle to the mode specified in the vehicle manufacturer's test setup information (Form1)

- ☒ Exercise the suspension by rolling the vehicle forward and rearward approximately 4 to 6 feet. Repeat this step three to four additional times.
- ☒ Mark an attitude reference point just above the **left front wheel** well opening (on the body's sheet metal) that is directly above the center of the wheel. This point should be roughly 10 mm above the well opening, on a flat surface and not on any decorative trim. Place a ½" target on this attitude reference point.
- ☒ Measure the distance between the ground and this reference point. Record this measurement in the below table.
- ☒ Mark an attitude reference point just above the **right front wheel** well opening (on the body's sheet metal) that is directly above the center of the wheel. This point should be roughly 10 mm above the well opening, on a flat surface and not on any decorative trim. Place a ½" target on this attitude reference point.
- ☒ Measure the distance between the ground and this reference point. Record this measurement in the below table.
- ☒ Mark an attitude reference point just above the **right rear wheel** well opening (on the body's sheet metal) that is directly above the center of the wheel. This point should be roughly 10 mm above the well opening, on a flat surface and not on any decorative trim. Place a ½" target on this attitude reference point.
- ☒ Measure the distance between the ground and this reference point. Record this measurement in the below table.
- ☒ Mark an attitude reference point just above the **left rear wheel** well opening (on the body's sheet metal) that is directly above the center of the wheel. This point should be roughly 10 mm above the well opening, on a flat surface and not on any decorative trim. Place a ½" target on this attitude reference point.
- ☒ Measure the distance between the ground and this reference point. Record this measurement in the below table.

Test Vehicle Attitudes – As Delivered	Units	As Delivered
Left Front	mm	685
Right Front	mm	682
Right Rear	mm	689
Left Rear	mm	684/690
Tape Measure Unique Identifier:		402014

Weight & CG - As Delivered Condition:

Performed By:

Travis Hutchison

Date:

120EC18

Checklist

- ☒ Remove **ALL** weights from the vehicle. (If Applicable)
- ☒ If the vehicle was received with floor mats, **leave them in the vehicle** as they are need for dummy positioning.
- ☒ Weigh the vehicle at each wheel and record the weight measurements in the space provided below to determine the "As Delivered" (or "Unloaded Vehicle") weight.

		As Delivered (UVW)		
	Units	Front Axle	Rear Axle	Total
Left	kg	384	242	W _{Left} = 626
Right	kg	382	230	W _{Right} = 612
Ratio	%	62%	38%	
Totals	kg	W _F = 766	W _R = 472	1238
Scales Unique Identifier:		400323		

Checklist

- ☒ For trucks, MPV's or Buses - If the RCLW calculated above is greater than 136 kg, use 136 kg as the RCLW below in the Target Test Weight calculation.
- ☒ Calculate the Test Vehicle Target Weight by adding the "As Delivered" weight, the RCLW, and the weight of the fully instrumented SID-IIs dummy in the space provided below.

Rated Cargo and Luggage Weight Calculation	Units	Value	
Vehicle Capacity Weight (VCW - From Vehicle Placard)	kg	317	(A)
Reduced Load Capacity (if Applicable)	kg	N/A	(B)
Designated Seating Capacity (DSC - From Vehicle Placard)		4	(C)
Rated Cargo and Luggage Weight (RCLW)	kg	44.8	(C x 68.04 kg) - (A-B)
Is the RCLW > 136 kg? If yes use 136 kg as RCLW	kg	NO	

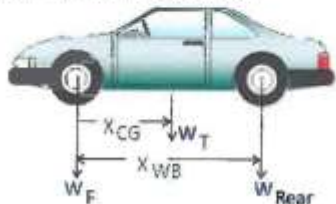
Target Test Weight Calculation	Units	Value	
Total As Delivered Weight (UVW = Unloaded Vehicle Wgt.)	kg	1238	(A)
Actual Weight of 1 ES2re and 1 P572V ATD (SID-IIs)	kg	127	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	44.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1409.8	(A+B+C)
Target Test Weight (min):	kg	1400.8	(A+B+C) - 9.0 kg
Target Test Weight (max):	kg	1405.3	(A+B+C) - 4.5 kg

Checklist

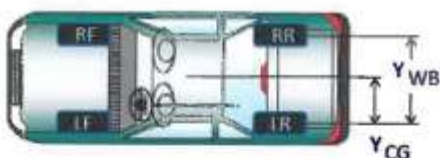


Re-measure or utilized the measurements from the previous section and enter those measurements and the weight measurements from above to calculate the vehicle CG aft of the front axle and left (+) / right (-) from the longitudinal centerline.

Center of Gravity Calculation:



$$X_{CG} \text{ mm} = \frac{2651 \text{ mm} \times 472 \text{ kg}}{1238 \text{ kg}}$$



$$Y_{CG} \text{ mm} = \frac{156 \text{ mm} \times 612 \text{ kg}}{1238 \text{ kg}}$$

Test Vehicle Center of Gravity (CG)

	Units	As Delivered	
Vehicle CG (Aft of Front Axle)	mm	1011	X _{CG}
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	+8	Y _{CG}

Attitude – Fully Loaded Condition:

Performed By:

Travis Hutchison

Date:

12 DEC 18

Checklist

- ☒ Calculate the Rated Cargo and Luggage Weight (RCLW) in the space provided below.

Rated Cargo and Luggage Weight Calculation	Units	Value	
Vehicle Capacity Weight (VCW - From Vehicle Placard)	kg	317	(A)
Vehicle Weight Reduction (If Applicable)		N/A	(B)
Designated Seating Capacity (DSC - From Vehicle Placard)	kg	4	(C)
Rated Cargo and Luggage Weight (RCLW)	kg	44.8	(C x 68.04 kg) - (A-B)

Checklist

- ☒ With the vehicle in the "As Delivered" weight condition, load the vehicle with ballast equal to the RCLW (calculated above). Place weights in the luggage or load carrying/cargo area; centered over the longitudinal centerline of the vehicle.
- ☒ Place 172 lbs of weight (equivalent to a fully instrumented ES2-re with clothes and shoes) into the driver's seating position.
- ☒ Place 108 lbs of weight (equivalent to a fully instrumented SID IIs with clothes and shoes) into the rear passenger position (directly behind the driver).
- ☒ Now that the vehicle is in the "Fully Loaded" weight condition, place it on a flat, level surface.
- Note: If the vehicle has an Auto-Leveling, the ignition must be set to the "on" position. If the vehicle is equipped with a self-adjusting hydraulic system, set the vehicle to the mode specified in the vehicle manufacturer's test setup information (Form1)*
- ☒ Exercise the suspension by rolling the vehicle forward and rearward approximately 4 to 6 feet. Repeat this step three to four additional times.
- ☒ For each wheel well, measure the distance between the ground and each of the reference points. Record each measurement in the table below.

Test Vehicle Attitudes – Fully Loaded	Units	Fully Loaded
Left Front	mm	673
Right Front	mm	681
Right Rear	mm	672
Left Rear	mm	663
Tape Measure Unique Identifier:		400014

Weight & CG – Fully Loaded Condition:

Performed By:

Travis Hutchison

Date:

120 DEC 18

Checklist

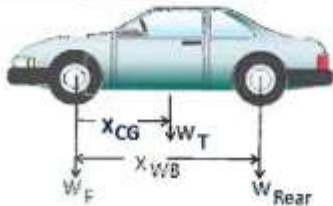
- ☒ Weigh the vehicle at each wheel and enter the values in the space provided below.

Fully Loaded				
	Units	Front Axle	Rear Axle	Total
Left	kg	420	320	$W_{Left} = 740$
Right	kg	399	275	$W_{Right} = 674$
Ratio	%	58%	42%	
Totals	kg	$W_F = 819$	$W_R = 595$	1414
Scale Unique Identifier:		400323		

Checklist

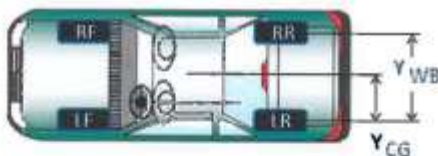
- ☒ Re-measure or utilized the measurements from the previous section and enter those measurements and the weight measurements from above to calculate the vehicle CG aft of the front axle and left (+) / right (-) from the longitudinal centerline.

Center of Gravity Calculation:



$$X_{CG} = \frac{X_{WB} \times W_{Rear}}{W_{Total}}$$

mm = $\frac{2651 \text{ mm} \times 595 \text{ kg}}{1414 \text{ kg}}$



$$Y_{CG} = \frac{Y_{WB} \times W_{Right}}{W_{Total}}$$

mm = $\frac{1505 \text{ mm} \times 674 \text{ kg}}{1414 \text{ kg}}$

Test Vehicle Center of Gravity (CG)

	Units	Fully Loaded	
Vehicle CG (Aft of Front Axle)	mm	1115	X_{CG}
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	30	Y_{CG}

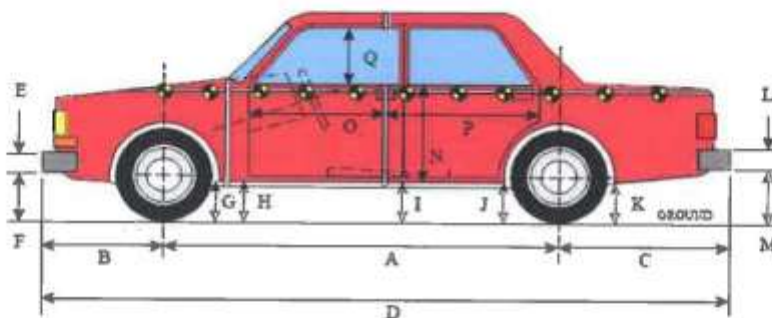
Pre-Test Hand Measurements:

Performed By:

ED

Date:

12/14/18



Left Side View – All measurements in (mm) with tolerance of +/- 3 mm

Tape Measure Identifier:

Checklist

- | | | | |
|---|----|--|------------------------|
|  | E | Front Bumper Thickness - (The vertical height of the front bumper fascia) | 105 mm |
|  | F | Front Bumper Bottom to Ground - (Vertical distance from ground to the bottom of the front bumper fascia) | 414 mm |
|  | G | Sill Height at Front Wheel Well - (Vertical distance from ground to the sill at the front wheel well opening) | 171 mm |
|  | H | Sill Height at Front Door Leading Edge -(Vertical distance from ground to the sill at the front door seam) | 153 mm |
|  | I | Sill Height at B-Pillar - (Vertical distance from ground to the sill in line with the front door striker or B-pillar if no striker exists) | 159 mm |
|  | J1 | Sill Height at Rear Wheel Well - (Vertical distance from ground to the sill at the rear wheel well opening) | 175 mm |
|  | J2 | Pinch Weld Height at Rear Wheel Well - (Vertical distance from ground to the pinch weld at the rear wheel well opening) | 157 mm |
|  | K | Sill Height Aft of Rear Wheel Well - (Vertical distance from ground to the vehicle sheet body at the rear of the rear tire's wheel well) | 533 mm |
|  | L | Thickness or height of rear bumper at center. | 70 ^{EO} 70 mm |
|  | M | Distance from bottom of bumper to ground at center. | 408 mm |

Mechanical Preparation:

Performed By:

Travis Hutchison

Date:

12DEC18

Pump Unique Identifier:

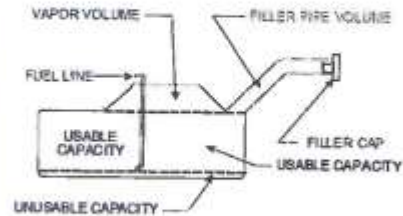
400605

Checklist

- ☒ If the vehicle was received with floor mats, **leave them in the vehicle** as they are needed for dummy positioning.
- ☒ Running boards should be removed if they are optional equipment prior to determining test vehicle As Delivered weight.
- ☒ Drain the fuel from the fuel tank.
- ☒ Run engine until all fuel remaining in the fuel delivery system is used and engine stops.
- ☒ Describe the fuel pump type, details about how it operates and the location of the fuel filler neck in the space provided below.

Electric, left side

VEHICLE FUEL TANK ASSEMBLY



☒ **Yes**

☐ **No**

Is the vehicle equipped with an electric fuel pump?

☒ **Yes**

☐ **No**

If yes, does the pump normally operate when the vehicle's electrical system is activated?

Checklist

- ☒ Record the usable fuel tank capacity of both standard and optional (if applicable) fuel tanks in the space provided below.
- ☒ Record the fuel tank capacity of both standard and optional (if applicable) fuel tanks as supplied in the owner's manual in the space provided below.
- ☒ Calculate 1/3 of the usable capacity of the tank(s) (as supplied on Form 1) and record the calculated value in the space provided below.
- ☒ Calculate 93% of the usable capacity of the fuel tank(s) and record the calculated value in the space provided below.
- ☒ Using purple dyed Stoddard solvent*, fill the fuel tank to 100% of the usable capacity as supplied on Form 1.
- ☒ Record the amount of solvent added for the "As Delivered" weight condition in the space provided below.

* Stoddard solvent shall be free of debris. It is considered debris-free only if upon filtering with a 10 micron filter, no solid debris is retained on the filter media or in any conduit, container or vessel upstream from the filter paper (e.g. debris is not allowed to be present in the funnel, pump or container).

Fuel Tank Capacity Data

Usable Capacity of "Standard Tank" (see Form No. 1)	49.9	liters
Usable Capacity of "Optional Tank" (see Form No. 1)	N/A	liters
Usable Capacity of Standard Tank (see Owner's Manual)	N/A	liters
Usable Capacity of Optional Tank (see Owner's Manual)	N/A	liters
1/3 of Usable Capacity	16.4	liters
93% of Usable Capacity	46.4	liters
Stoddard to Achieve 100% of Capacity (As Delivered)	49.9	liters

Checklist

- ☒ Crank the engine to fill the fuel delivery system with Stoddard solvent.
- ☒ With the test vehicle in the "Fully Loaded" weight condition, drain the fuel tank. Use caution when draining the fuel. Do not damage or remove any fuel system components without notifying the Test Engineer.
- ☒ Using purple dyed Stoddard solvent fill the tank to 93 % ($\pm 1\%$) of the usable capacity as supplied on Form 1 found in a previous section.
- ☒ Record this amount of Stoddard solvent in the space provided below.
- ☒ Record this amount on the inside of the fuel filler lid.

Actual Amount of Solvent Used in Test	46.4	liters
---------------------------------------	------	--------

- Yes ☒ No ☐ Is the Actual Amount of Solvent Used in the test equal to 93% $\pm$ 1% of the Usable Capacity stated in on Form No. 1?

Checklist

- ☒ Drain the engine oil *
- ☒ Drain the transmission fluid *
- ☒ Drain the transfer case (4WD) *
- ☒ Drain the engine coolant *
- ☒ Drain the windshield washer fluid *
- ☒ Drain the power steering fluid *

** Note: Ensure that no fluids are leaking from the vehicle after being drained. Seal any leaks before vehicle is transported to the test track.*

- ☒ Reinstall any underbody shields that were removed to drain fluids.
- ☒ Disable vehicle Daytime Running Lights (if equipped).
- ☒ Paint vehicle interior surfaces such as the A, B, C-pillars and trim panels, interior door trim panels, etc., on the impact side of the vehicle with flat white paint.

Note: The area around surfaces where an air bag or dynamic system deploys shall NOT be painted. In addition, the air bag or dynamic system indicator light on the instrument panel shall NOT be painted so as to be visible prior to testing for both driver and front passenger.

- ☒ Remove trunk carpeting, spare tire and jack (in trunk). Note: Per the NHTSA procedure, the spare tire, rear radio speakers, interior door trim and windows on the non-struck side, outboard mirrors on non-struck side taillights and rear bumper can be removed – IF NECESSARY. Verify components to be removed with the manufacturers FORM 1.
- ☒ Indicate in the space provided below the equipment that was removed and its associated weight.

Equipment that is no longer on the test vehicle:

Description	Weight	
Trunk carpeting	6	kg
Spare tire	N/A 2	kg
Jack	N/A	kg
Rear speaker	N/A	kg
Tail light	2	kg
Nonstruck windows	6	kg

Description	Weight
	kg
	kg
	kg
	kg
	kg
	kg

Explanation for equipment removal:

Checklist

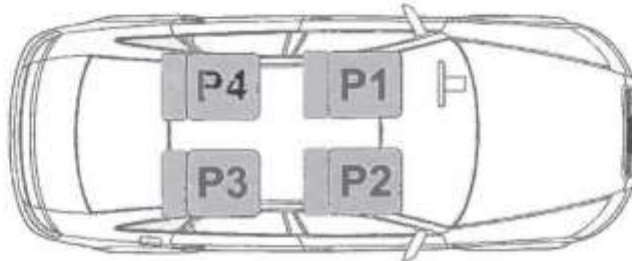
- ☒ Install side impact instrumentation plate in trunk; allowing room for 4 KT mounts. Note location of all fuel components and use caution when drilling holes. (Note: Brake abort is not needed for this test)
- ☒ Attach string for trunk release.
- ☒ Attach safety wire to hood release mechanism so the vehicle hood latch can be released from the vehicle exterior after the impact. Secure cable to vehicle so the hood will not open during the impact event.
- ☒ Mount camera support on hood along centerline of front occupant and facing front occupant.
- ☒ Remove non-struck passenger windows.
- ☒ Mount camera supports on driver and passenger doors (opposite the impact side) viewing the ES-2re and SID IIs. – Do Not bend the vehicle door panels with camera mounts.
- ☒ Attach aluminum angle to side door camera mounts for bracing cameras to the vehicle. Sheet metal screw angle into vehicle roof or door frame. Note that the un-struck side doors should be operable with braces in position.
- ☒ Remove rear speaker opposite the impact side (or cut 6" hole in rear deck if necessary) for instrumentation cables. For pick-up trucks, cut a 6" hole between the bed and cab about the size of the speaker (large enough to pass the umbilicals through).
- ☒ Place tape or plastic channel around speaker opening to eliminate sharp edges.
- ☒ Remove tail light (or cut hole in quarter panel if necessary) on side opposite the impact side for umbilical cables.
- ☒ Place tape or plastic channel around opening to eliminate sharp edges.
- ☒ Remove owner's manual and spare keys and hand them directly to the Test Engineer.
- ☒ Mount wireless data box.
- ☒ Run two trigger cables to the Drivers door. Do not run cabling across the vehicle roof. Make sure there is enough slack to place at the first contact point with the barrier.

1st Row Seat Positioning – Reference Marks:

Performed By: Jason Pely

Date: 12/12/18

Instructions: In this section there are three sets of check marks. The first row corresponds with the front driver seat (P1), the second row corresponds with the front center seat (P5) and the third row corresponds with the front passenger seat (P2).



Establishing Reference Marks - Driver, Front Center, and Front Passenger Seats

Prior to placing the dummy in the driver position, mark for reference the seat adjustment:

Checklist

- ☒ ☐ ☒ Adjustable Supports - Position the seat's adjustable lumbar supports so that they are in the lowest, retracted or deflated adjustment positions.
- ☒ ☐ ☒ Adjustable Supports - Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position.
- ☒ ☐ ☒ Adjustable Supports - Place any adjustable leg support system in its rearmost position.
- ☒ ☐ ☒ Adjustable Head Restraints - Use any adjustment of the head restraint to position it at its highest and most full forward in use position.

If the head restraint rotates, rotate it such that the head restraint extends as far forward as possible. **Mark the head restraint at its fully retracted and full forward positions to demonstrate range of motion.**

- ☒ ☐ ☒ Measure the lowest position of the bottom edge of the head restraint from a fixed point on the seat back along a vertical plane perpendicular to the longitudinal centerline of the test vehicle.
- ☒ ☐ ☒ Mark the point on the seat back where the measurement was taken for future reference. **Note the position of the driver's head restraint in the space provided below.**

Head Restraint Adjustment	Total # of Positions	Placed in Position #
Driver Seat	<u>6</u>	<u>highest</u>

Checklist



Vehicle Seat Centerlines - If adjustable, place the seat back in its most vertical (upright) position.

For bucket seats, draw a line along the intersection of a vertical longitudinal plane that passes through the SgRP (Seat Reference Point) and the seat cushion upper surface, seat back, and head restraint.

For bench seats, draw a line along the intersection of a vertical longitudinal plane that passes through the centerline of the steering wheel and the seat cushion upper surface, seat back, and head restraint.



Seat Adjustment Reference Marks - Before marking, move seat through its full range of motion using all available controls. Separately, operate each control to determine whether it moves the seat and/or seat cushion primarily in the fore-aft or up-down directions. **Draw arrows on these controls to demonstrate how each one operates.**



(1) With the seat's adjustable lumbar supports in the lowest, retracted or deflated adjustment positions, and any adjustable parts of the seat that provide additional support in the lowest or most open adjustment position, mark a point (seat cushion reference point - SCRP) on the side of the seat cushion that is between 150 mm and 250 mm from the front outermost edge of the seat cushion. For seat cushions that move up and down independently from the seat housing, mark the point on the side of the cushion in an area that will not be obscured by the seat housing when the seat cushion is at its lowest height position.



(2) Draw a horizontal line (seat cushion reference line - SCRL) through the SCRP.



(3) Using only the controls that primarily move the seat in the fore-aft direction, move the SCRP to the rearmost position.



(4) If the seat cushion adjusts fore-aft, independent of the seat back, use only the controls that primarily move the seat cushion in the fore-aft direction to move the SCRP to the rearmost position.



(5) Using any part of any control, other than the parts just used for fore-aft positioning, determine and **record the range of angles of the SCRL and set the SCRL at the mid-angle. Record the maximum, minimum, and mid-angles in the space provided at the end of this section.**



(6) If the seat and/or seat cushion height is adjustable, use any part of any control other than those which primarily move the seat or seat cushion fore-aft, to put the SCRP in its lowest position with the SCRL line angle at the mid-angle found in step (5)



(7) Using only the controls that primarily move the seat in the fore-aft direction, verify the seat is in the rearmost position.



(8) Using only the controls that primarily move the seat in the fore-aft direction, mark for future reference the fore-aft seat positions. Mark each position so that there is a visual indication when the seat is at a particular position. For manual seats, move the seat forward one detent at a time and mark each detent. For power seats (no detents), move the seat forward 10 mm at a time and mark each increment. Then label the rearmost, middle, and foremost positions as: F for foremost, M for mid-position (if there is no mid-position, label the closest adjustment position to the rear of the mid-point), and R for rearmost. **Record the total fore-aft seat movement in millimeters and detents, (if applicable), in the space provided at the end of this section.**

Checklist

☒ ☐ ☒

(9) Use only the controls that primarily move the SCRCP to the fore-aft direction to place the seat in the rearmost position.

☒ ☐ ☒

(10) Using any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, find and visually mark for future reference the maximum, minimum, and middle heights of the SCRCP with the SCRL at the mid-angle determined in step (5) by measuring from the SCRCP to a reference point on the floor pan or sill. **Record the maximum, minimum, and middle heights in the space provided at the end of this section.**

☒ ☐ ☒

(11) Using only the controls that primarily move the seat and/or seat cushion in the fore-aft direction, place the SCRCP at the mid-fore-aft position.

☒ ☐ ☒

(12) Using any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, find and visually mark for future reference the maximum, minimum, and middle heights of the SCRCP with the SCRL at the mid-angle determined in step (5) by measuring from the SCRCP to a reference point on the floor pan or sill. **Record the maximum, minimum, and middle heights in the space provided at the end of this section.**

☒ ☐ ☒

(13) Using only the controls that primarily move the seat in the fore-aft direction, place the SCRCP in the foremost position.

☒ ☐ ☒

(14) Using any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, find and visually mark for future reference the maximum, minimum, and middle height of the SCRCP with the SCRL at the mid-angle determined in step (5) by measuring from the SCRCP to a reference point on the floor pan or sill. **Record the maximum, minimum, and middle heights in the space provided at the end of this section.**

Continued on next page.

Checklist



- (15) For adjustable seat backs, position the seat back at the foremost stop. Mark each position of adjustment from the foremost to rearmost stops so that there is a visual indication when the seat back is at a particular position.

For manually adjustable seat backs (with detents), move the seat back rearward one detent at a time and mark each detent. Label the rearmost, middle, and foremost positions with the measured detent. If no middle detent exists, label the next most-rearward detent to the middle position.

For power seat backs (no detents), move the seat back rearward one degree at a time and mark each angle. Angles should be measured at the location on the seat (head restraint, seat back, plastic trim, etc.) as indicated by the manufacturer on Form No. 1. Label the rearmost, middle, and foremost positions with the measured angle.

Record the range of angles in degrees and detents heights in the space provided at the end of this section. Visually mark and label for future reference the front seat back angle, if adjustable, as provided by the manufacturer on Form No. 1.

Repeat steps (1) through (15) of this section to determine the reference marks for the front outboard passenger seat as well unless the front outboard passenger seat does not adjust independently of the driver's seat. Also, repeat (1) through (15) of this section to determine the reference marks for the front center seat if the front center seat adjusts independently of the front passenger seat.

NOTE: If the front outboard passenger seat does not adjust independently of the driver's seat, the driver's seat shall control the final position of the passenger seat and there is no need to repeat steps (1) through (15) of this section for the front outboard passenger seat. If the front center seat does not adjust independently of the front passenger's seat, the front passenger's seat shall control the final position of the front center seat and there is no need to repeat (1) through (15) of this section for the front center seat.

2nd Row Seat Positioning – Reference Marks:

Performed By: _____

Date: _____

Instructions: In this section there are three sets of check marks. The first row corresponds with the rear struck side seat (left rear seat P4), the second row corresponds with the rear center seat (P6) and the third row corresponds with the rear outboard passenger seat (P3).

Establishing Reference Marks - Rear Struck Side Seat, Rear Center, and Rear Outboard Seats

Prior to placing the dummy in the rear passenger position, mark for reference the seat adjustment:

The position of the rear center and rear outboard passenger seats will be dictated by the information provided by the manufacturer on Form No. 1 for the 5th percentile female dummy in the rear seat of the Side NCAP MDB test. Mark for reference the seat adjustment for second and third row rear seats on the struck side of the vehicle as follows:

Checklist:

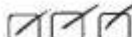


Adjustable Head Restraints - Use any adjustment of the head restraint to position it at its lowest and most full forward in use position.

If the head restraint rotates, rotate it such that the head restraint extends as far forward as possible. **Mark the head restraint at its fully retracted and full forward positions to demonstrate range of motion.**

If it is possible to achieve a position lower than the effective detent range, the head restraint shall be set to its lowest possible position.

Only positions intended for occupant use as defined by FMVSS No. 202a shall be considered. Any nonuse position is excluded from being considered as the lowest possible position. This information should also be included in the manufacturer's data supplied by the COTR.



Measure the lowest position of the bottom edge of the head restraint from a fixed point on the seat back along a vertical plane perpendicular to the longitudinal centerline of the test vehicle.



Mark the point on the seat back where the measurement was taken for future reference. **Note the position of the driver's head restraint in the space provided below.**

Head Restraint Adjustment	Total # of Positions	Placed in Position #
Rear Passenger Seat	Fixed _____	_____

Checklist:



- (1) With the seat's adjustable lumbar supports in the lowest, retracted or deflated adjustment positions, and any adjustable parts of the seat that provide additional support in the lowest or most open adjustment position, mark a point (seat cushion reference point - SCRP) on the side of the seat cushion that is between 150 mm and 250 mm from the front outermost edge of the seat cushion.

For seat cushions that move up and down independently from the seat housing, mark the point on the side of the cushion in an area that will not be obscured by the seat housing when the seat cushion is at its lowest height position.



- (2) Draw a horizontal line (seat cushion reference line - SCRL) through the seat SCRP.



- (3) If possible, using only the controls that primarily move the seat in the fore-aft direction, move the SCRP to the rearmost position.



- (4) If the seat cushion adjusts fore-aft, independent of the seat back, use only the controls that primarily move the seat cushion in the fore-aft direction to move the SCRP to the rearmost position.



- (5) Using any part of any control, other than the parts just used for fore-aft positioning, determine and record the range of angles of the SCRL and set the SCRL at the mid-angle. **Record the maximum, minimum, and mid-angles heights in the space provided at the end of this section.**



- (6) If the seat and/or seat cushion height is adjustable, use any part of any control other than those which primarily move the seat or seat cushion fore-aft, to put the SCRP in its lowest position with the SCRL line angle at the mid-angle found in step (5).



- (7) Using only the controls that primarily move the seat in the fore-aft direction, verify the seat is in the rearmost position.



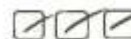
- (8) Using only the controls that primarily move the seat in the fore-aft direction, mark for future reference the fore-aft seat positions. Mark each position so that there is a visual indication when the seat is at a particular position.

For manual seats, move the seat forward one detent at a time and mark each detent.

For power seats (no detents), move the seat forward 10 mm at a time and mark each increment. Then label the rearmost, middle, and foremost positions as: F for foremost, M for mid-position (if there is no mid-position, label the closest adjustment position to the rear of the mid-point), and R for rearmost. **Record the total fore-aft seat movement in millimeters and detents, if applicable, in the space provided at the end of this section.**



- (9) Use only the controls that primarily move the SCRP to the fore-aft direction to place the seat in the rearmost position.



- (10) Using any part of any control, other than the parts which primarily move the seat or seat cushion fore-aft, find and visually mark for future reference the maximum, minimum, and middle height of the SCRP with the SCRL at the mid-angle determined in step (5) by measuring from the SCRP to a reference point on the floor pan or sill. **Record the maximum, minimum, and middle heights in the space provided at the end of this section.**

Checklist:



- (11) For adjustable seat backs, position the seat back at the foremost stop. Mark each position of adjustment from the foremost to rearmost stops so that there is a visual indication when the seat back is at a particular position.

For manually adjustable seat backs (with detents), move the seat back rearward one detent at a time and mark each detent. Label the rearmost, middle, and foremost positions with the measured detent. If no middle detent exists, label the next most-rearward detent to the middle position.

For power seat backs (no detents), move the seat back rearward one degree at a time and mark each angle. Angles should be measured at the location on the seat (head restraint, seat back, plastic trim, etc.) as indicated by the manufacturer on Form No. 1. Label the rearmost, middle, and foremost positions with the measured angle.

Record the range of angles in degrees and detents in the space provided at the end of this section. Visually mark and label for future reference the rear seat back angle, if adjustable, as provided by the manufacturer on Form No. 1.

Repeat steps (1) through (11) of this section to determine the reference marks for the non-struck side rear outboard passenger seat as well unless the rear outboard non-struck side passenger seat does not adjust independently of the struck side rear passenger seat. Also, repeat steps (1) through (11) of this section to determine the reference marks for the rear center seat if the rear center seat adjusts independently of the rear outboard non-struck side passenger seat.

NOTE: If the rear passenger seat on the non-struck side of the vehicle does not adjust independently of the struck side rear passenger seat, the struck side rear passenger seat shall control the final position of the rear non-struck side passenger seat and there is no need to repeat steps (1) through (11) of this section for the rear passenger seat on the non-struck side. If the rear center seat does not adjust independently of the rear non-struck side passenger's seat, the rear non-struck side passenger's seat shall control the final position of the rear center seat and there is no need to repeat steps (1) through (11) of this section for the rear center seat.

1st Row Seat Positioning – Setting Seats:

Performed By: Jason Fely

Date: 12/12/18

Instructions: In this section there are three sets of check marks. The first row corresponds with the front driver seat (P1), the second row corresponds with the front center seat (P5) and the third row corresponds with the front passenger seat (P2).

Setting the Seats - Driver, Front Center, and Front Passenger Seats

Set the driver, front center (if applicable), and front passenger seats accordingly:

Checklist



- (1) Using only the control that primarily moves the seat and seat cushion fore and aft move the SCRP to the mid-travel position. If an adjustment position does not exist midway between the forward most and rearmost positions, set the seat in the closest adjustment position to the rear of the midpoint. Record the fore-aft test position with respect to the forward most position on Data Sheet No.2



- (2) If the seat or seat cushion height is adjustable, other than by the controls that primarily move the seat or seat cushion fore and aft, set the height of the SCRP to the minimum height, with the SCRL set as closely as possible to the mid-angle. Record the "As-Tested" SCRL angle and SCRP height in the data tables following this section.

Mark this position for future reference. It is the pre-determined test position. **Record the "As-Tested" SCRL angle and SCRP height in the space provided at the end of this section. Also, record the test detent and/or fore-aft position of the seat at the test position in the space provided at the end of this section.**

NOTE: If the front outboard passenger seat does not adjust independently of the driver's seat, the driver's seat shall control the final position of the front passenger's seat. If the non-struck-side passenger's seat does adjust independently of the driver's seat, repeat steps 1 and 4 of this section to set the non-struck-side seat. If the front center seat does not adjust independently of the front passenger's seat, the front passenger's seat shall control the final position of the front center seat. The seat back angle for the driver's seat shall control the seat back angle for the front passenger seat. If the front center seat does adjust independently of the front passenger's seat, repeat steps 1 and 4 of this section to set the front center seat. The seat back angle for the driver's seat shall control the seat back angle for the front center seat.



- (3) If adjustable, set the seat back angle at the manufacturer's nominal design riding position for a 50th percentile adult male in the manner specified by the manufacturer. If the position is not specified, set the seat back at the first detent rearward of 25 degrees from the vertical.

2nd Row Seat Positioning – Setting Seats:

Performed By:

Jason Pely

Date:

12/12/18

Instructions: In this section there are three sets of check marks. The first row corresponds with the rear struck side seat (left rear seat P4), the second row corresponds with the rear center seat (P6) and the third row corresponds with the rear outboard passenger seat (P3).

Setting the Seats - Rear Struck Side Seat, Rear Center, and Rear Outboard Seats

Using the reference marks determined in the previous section, set the seats accordingly:

Checklist



- (1) Using only the control that primarily moves the seat fore and aft, move the SCRP to the full rearward position. **Record the fore-aft test position with respect to the forward most position in the table at the end of this section.**



- (2) If the seat or seat cushion height is adjustable, other than by the controls that primarily move the seat or seat cushion fore and aft, set the height of the SCRP to the minimum height, with the SCRL set as closely as possible to the mid-angle. **Record the "As-Tested" SCRL angle and SCRP height in the space provided at the end of this section. Also, record the total fore/aft travel and test detent and/or fore/aft position of the seat at the test position in the space provided at the end of this section.**



- (3) If adjustable, set the seat back angle in accordance with the rear seat back angle provided by the manufacturer on Form No. 1 for the 5th percentile female dummy in a Side NCAP MDB test. **Record the seat back angle in degrees and detents, if applicable, for the test configuration in the space provided at the end of this section.**

NOTE: If the rear passenger seat on the non-struck side does not adjust independently of the struck side rear passenger seat, the struck side rear passenger seat shall control the final position of the non-struck side rear passenger seat. If the nonstruck-side seat does adjust independently of the struck side seat, repeat steps 1 and 2 of this section to set the non-struck-side seat. If the rear center seat does not adjust independently of the rear passenger's seat on the non-struck side, the rear passenger's seat on the non-struck side shall control the final position of the rear center seat. The seat back angle for the struck side rear passenger's seat shall control the seat back angle for the non-struck side rear passenger seat. If the rear center seat does adjust independently of the nonstruck side rear passenger's seat, repeat steps 1 and 2 of this section to set the rear center seat. The seat back angle for the struck side rear passenger's seat shall control the seat back angle for the rear center seat.

Seat Positioning – Data Sheets:

Performed By:

Jason Pely

Date:

12/12/18

Tape Measure Unique Identifier:	<i>13882</i>
Inclinometer Unique Identifier:	<i>400640</i>

Seat Positioning

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

Seat Cushion Reference Line (SCRL) Angle Range

Seat	SCRL (°)		
	Max	Min	Mid
Driver Seat	<i>18.5</i>	<i>15.4</i>	<i>16.95</i>
Front Passenger Seat	<i>Fixed</i>		<i>18.3</i>
Front Center Seat*	<i>NA</i>		
Struck Side Rear Seat	<i>Fixed</i>		
Non-Struck Side Rear Seat	<i>Fixed</i>		
Rear Center Seat*	<i>Fixed</i>		

Seat Cushion Reference Line (SCRL)

A line on the side of the seat cushion, passing through the seat cushion reference point, whose projection in the vehicle vertical longitudinal plane is straight and has a known angle with respect to the horizontal.

* If applicable

Seat Height and Angle

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCR Height (mm)	SCR Height Position	SCR Height (mm)		
				Rearmost	Mid-Fore/Aft	Forward- Most
Driver Seat	16.95	8	Max	NA		
			Mid	0	8	16
			Min	NA		
Front Passenger Seat	18.3	Fixed	Max	Fixed	Fixed	Fixed
			Mid			
			Min			
Front Center Seat *	NA		Max	NA	NA	NA
			Mid			
			Min			
Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid			
			Min			
Non-Struck Side Rear Seat			Max			
			Mid			
			Min			
Rear Center Seat *			Max			
			Mid			
			Min			

Seat Cushion Reference Point (SCR)

A point placed on the outboard side of the seat cushion at a horizontal distance between 150 mm (5.9 in.) and 250 mm (9.8 in.) from the front edge of the seat, which is used as a guide in positioning the seat.

* If applicable

Seat Fore / Aft Position

Seat	Total Fore / Aft Travel		Test Position from Forward most Position	
	mm	Detents *	mm	Detent *
Driver Seat	240	0-60	120	30
Front Passenger Seat	224	0-58	112	28
Front Center Seat *	NA			
Struck Side Rear Seat	Fixed			
Non-Struck Side Rear Seat	Fixed			
Rear Center Seat *	Fixed			

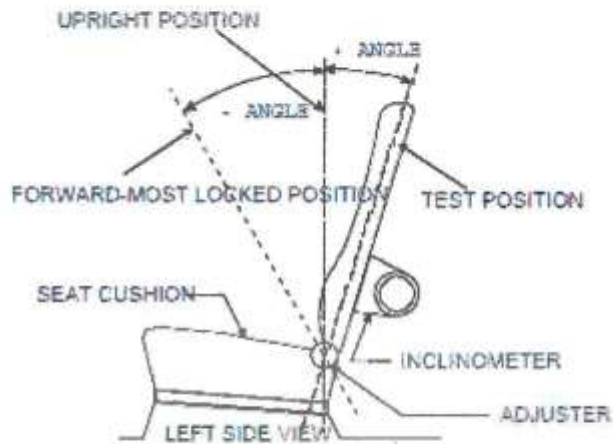
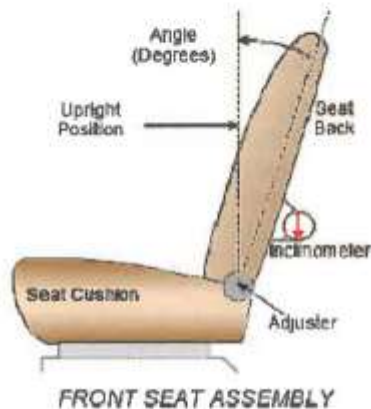
* If applicable

Seat Back Angle Adjustment

The driver's seat back is positioned per manufacturer's FORM 1. 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 is set to match the struck-side rear seat back.

Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents *	Degree	Detent *
Driver Seat w/ Seated Dummy	60.1	NA	20.4° s.b.	7
Front Passenger Seat	60.1	NA	20.4 s.B.	7
Front Center Seat *	NA			
Struck Side Rear Seat	Fixed			
Non-Struck Side Rear Seat	Fixed			
Rear Center Seat *	Fixed			

* If applicable



H-Point Left Front Seat (Position 1):

Performed By: Jason Pely

Date: 12/11/18

Checklist

- ☒ Place a piece of muslin cloth over seat area.
- ☒ Place H-point machine in center of seat.

Note: If vehicle is a bench seat, then the center is aligned with the center of the steering column. For the passenger seat, the center is found by placing the machine the same distance outboard from the vehicle centerline as for the driver seat. If the seat is a bucket, place the H-point machine on the seat centerline.

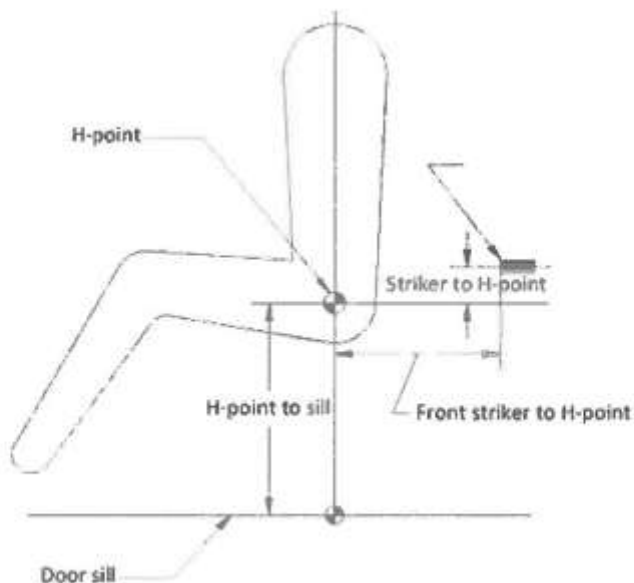
- ☒ Attach leg assemblies. T-bar parallel to ground and perpendicular to vehicle centerline. T-bar set at 15.8, legs set at 16.3 for 50th percentile.
- ☒ Position right driver's foot on un-depressed accelerator pedal. Insert pin in right foot to ensure angle is not less than 87 degrees. Sole on pedal and heel as far forward as possible. Left knee is placed same distance from H-point machine centerline as right knee.
- ☒ Position knees 10 inches apart. Place feet as far forward as possible.
- ☒ Apply lower leg and thigh weights.
- ☒ Tilt back pan forward. Pull T-bar forward then release to allow machine to slide back into seat.
- ☒ Apply a 22 pound rearward load at the intersection of hip angle and T-bar. Apply load twice.
- ☒ Return back plane to seat back.
- ☒ Prevent H-point machine from sliding forward for the rest of the procedure.
- ☒ Install buttock and torso weights.
- ☒ Move back plane forward and rock 3 times over a 10 degree arc.
- ☒ Lift each leg and allow it to fall into place. Make sure seat pan is level (i.e. no roll) and return back pan to seat back.
- ☒ Apply force to the back pan to either: 1. Increase hip angle 3 degrees. 2. Maximum of 15 pounds.
- ☒ Record H-Point Machine Torso Angle in the space provided below.
- ☒ Record H-Point Machine Hip Point location in the space provided below.
- ☒ Place H-point target sticker on outside of vehicle door.

Tape Measure Identifier: 13882

H-Point Machine Torso Angle (degrees) 21.5° degrees

Hip Point: X (fore/aft of striker) 425 mm

Z (above/below striker) 258 mm



Hip Point: Striker to H-Point 258 mm

H-Point to Sill 157 mm

Front striker to H-Point 425 mm

Setting Steering Wheel, etc.

Performed By: Jason By

Date: 12/12/18

Steering Wheel Adjustment - If the steering wheel is adjustable up and down and/or in and out complete the following steps to set the final steering wheel location:

Tape Measure Unique Identifier:	
Inclinometer Unique Identifier:	400640

Checklist

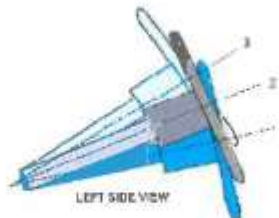
- ☒ Determine each up and down position. Mark and label three of the positions with the following: H for highest, M for mid-position (if there is no mid-position, label the next lowest adjustment position), and L for lowest. **Record the tilt angle of each position in the space provided below.**
- ☒ Determine each in and out position. Mark and label three of the positions with the following: F for foremost, M for mid-position (if there is no mid-position, label the next rearmost adjustment position), and R for rearmost. **Record the fore/aft measurement of each position in the space provided below.**
- ☒ Place the steering wheel in the mid up/down and mid in/out position. If no up and- down mid-position exists, place the steering wheel in the next lowest adjustment position to the mid-position. If no in-and-out mid-position exists, place the steering wheel in the next rearmost adjustment position to the mid position. **Record the fore/aft measurement and tilt angle of the test position in the space provided below.**

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 No. 1	19.3	
Geometric Center, Position No. 2	21.75	
Uppermost, Position No. 3	24.2	
Telescoping Steering Wheel Travel		50
Test Position	21.8	25

Reference distance from ceiling to center of steering wheel. Mark point in ceiling.	402	mm
Reference distance from front of dash to steering wheel. Mark points on dash and steering wheel.	100	mm



Adjustable Seat Belt Anchorages

- ☒ Place adjustable seat belt anchorages in the nominal adjustment position in accordance with the manufacturer's data on Form No. 1 for a 50th percentile Male and 5th percentile female adult occupant.
- ☒ Mark and label each position with the following: H for highest, M"X" for mid-positions (where "X" stands for 1, 2, 3, etc. and 1 is used for the highest mid-position), and L for lowest
- ☒ Record the total number of positions and test position in the space provided below

Seat Belt Anchorage Adjustment

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on the Form No. 1.

	Total # of Positions	Placed in Position #
Driver Seat	Fixed _____	_____
Rear Passenger Seat	Fixed _____	_____

Seat Belt Guides

- ☒ Usage of seat belt guides should be set in accords with instructions included in the Form No. 1 or in the vehicle owner's manual.

Adjustable Armrests

- ☒ Place any adjustable armrest / console in the retracted position.

Accelerator Pedal

- ☒ If the vehicle has an adjustable accelerator pedal, adjust it to the full forward position.

Doors

- ☒ Place all doors (including a hatchback or tailgate) in the fully closed and latched position.

Floor Mats

- ☒ If the vehicle was received with floor mats, place them in their proper locations.

Windows / Sun Roof

- ☒ Place any moveable window and vents located on the struck side of the vehicle in the fully closed position.
- ☒ Place sun roofs in the fully closed position

Photographic Tape & Measurements:

Performed By: Jason Fay

Date: 12/11

Checklist

- ☒ Align the left edge of 25 mm (1 inch) wide yellow/black checkerboard tape along the vertical impact reference line as defined below. Reference illustrations can be found on the next page.

For passenger vehicles:

Test Vehicle Wheelbase Length	Vertical Impact Reference Line Location
Less than or equal to 2,896 mm	940 mm +/- 5 mm forward of wheelbase centerline
Greater than 2,896 mm	508 mm +/- 5 mm rearward of front axle centerline

For multipurpose vehicles, sport utility vehicles, light trucks and vans:

Test Vehicle Wheelbase Length	Vertical Impact Reference Line Location
Less than or equal to 2,489 mm	305 mm +/- 5 mm rearward of front axle centerline
Greater than 2,489 mm but less than 2,896 mm	940 mm +/- 5 mm forward of wheelbase centerline
Greater than 2,896 mm	508 mm +/- 5 mm rearward wheelbase centerline

Note: For different wheelbase versions of the same model vehicle, the vertical impact reference line may be determined by the following procedure:

- Select the shortest wheelbase version of the same model and locate the vertical impact reference line as described above.
- Measure the distance between the SgRP and the vertical impact reference line.
- Maintain the same distance between the seating reference point and the vertical impact reference line for the version being tested as that distance between the seating reference point and vertical impact reference line for the shortest wheelbase version.

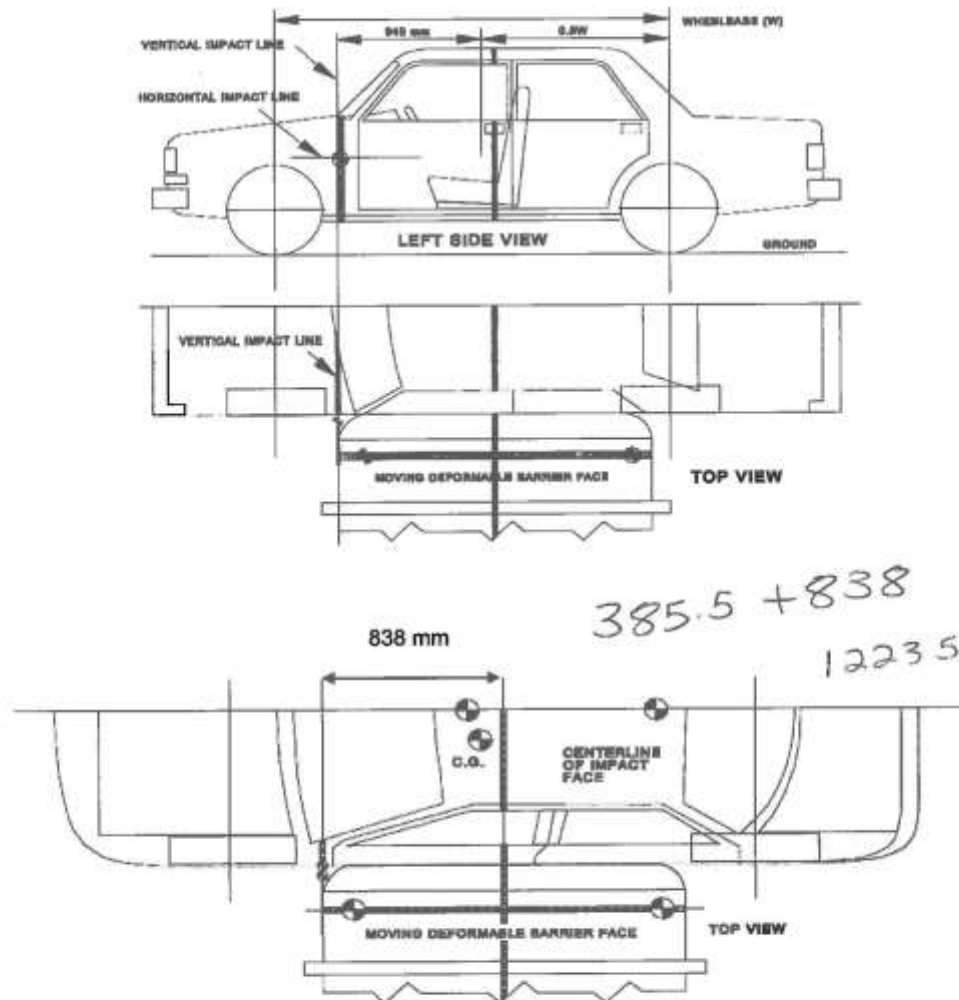
- ☒ Measure the distance from the front axle to the edge of the tape used to denote the vertical impact reference line and record the measurement in the space provided below.

Impact Point Location:	Units	Value
Vehicle Wheel Base	mm	2651
Wheelbase Midpoint	mm	1325.5
Vertical Impact Reference Line Location (Taken from above table) If Wheel Base is greater than 2,896 mm than use 508 mm	mm	-940
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm	385.5
FARO Unique Identifier:	13382 13882	

Checklist

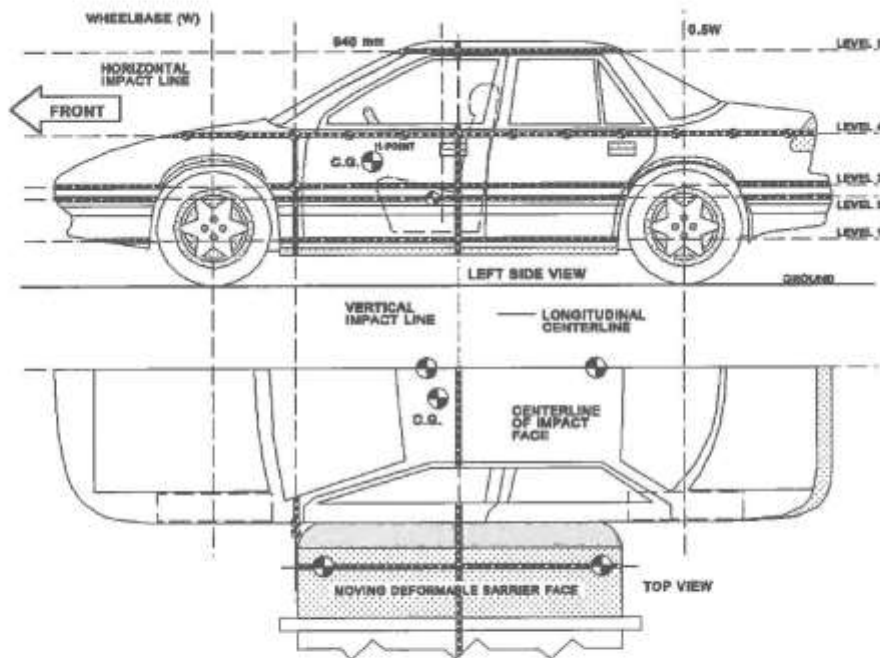
- ☒ Place 25 mm (1 inch) wide yellow/black checkerboard tape shall be placed on the vehicle such that when the barrier is properly aligned with the test for impact, the tape coincides with the vertical centerline of the barrier's impact face. See below figures.

The tape should be extended across the roof of the vehicle (90° angle to the test vehicle longitudinal centerline) to provide a reference for the overhead camera coverage.



Checklist

- ☒ Affix 25 mm (1 inch) wide yellow/black checkerboard tape horizontally along the impact side of the test vehicle at LEVEL 1 – Top of side sill: Affix tape along the door sill from the front to the rear wheel-wells.
- ☒ Affix 25 mm (1 inch) wide yellow/black checkerboard tape horizontally along the impact side of the test vehicle at LEVEL 2 – Driver Hip Point: Project the location of the driver dummy's hip point laterally through the door to its exterior panel. Affix tape to the side body panels so that the tape intersects the hip point.
- ☒ Affix 25 mm (1 inch) wide yellow/black checkerboard tape horizontally along the impact side of the test vehicle at LEVEL 3 – Mid-door: Measure the height of the front door body panel at two different locations that are at least 600 mm apart. Take the average of the two measurements. Mark this point on the exterior door panel. Affix tape to the side body panels so that the tape intersects this point.
- ☒ Affix 25 mm (1 inch) wide yellow/black checkerboard tape horizontally along the impact side of the test vehicle at LEVEL 4 – Window sill: Affix tape just below the front door window sill.
- ☒ Affix 25 mm (1 inch) wide yellow/black checkerboard tape horizontally along the impact side of the test vehicle at LEVEL 5 – Top of window: Affix tape just above the top of the front door window.





Note: The following measurements should be taken along the vertical impact reference line. Vehicle measurements forward of the vertical impact reference line are negative. All measurements are in millimeters (mm). Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition. The crush profile grid is established prior to the test based on an estimated impact point.

Checklist

- ☒ Place a 51 mm (2 inch) diameter target on the vehicle at mid-door height and along the left edge of the vertical impact reference line. The tip of the welding rod will be located in the center of the target.
- ☒ Affix targets, labeled appropriately (if applicable), along LEVEL 4, window sill tape line, at every 300 mm. Use 50 mm (2 inch) diameter targets.

Pre-FARO Measurements:

Performed By:

Jason Frey

Date:

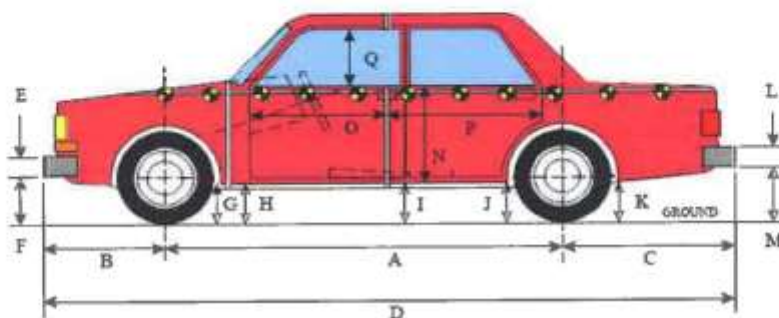
12/12/18

FARO Unique Identifier:

13882

Checklist

- ☒ Using the FARO arm, take Level 1 measurements every 150 mm (i.e. L1 900 to L1 2850) - Top of side sill (top edge of the tapeline)
- ☒ Using the FARO arm, take Level 2 measurements every 150 mm (i.e. L2 900 to L2 2850) - Occupant Hip Point (top edge of the tapeline)
- ☒ Using the FARO arm, take Level 3 measurements every 150 mm (i.e. L3 900 to L3 2850) - Mid-door (top edge of the tapeline)
- ☒ Using the FARO arm, take Level 4 measurements every 150 mm (i.e. L4 900 to L4 2850) - Window sill (top edge of the tapeline)
- ☒ Using the FARO arm, take Level 5 measurements every 150 mm (L5 900 to L5 2850) - Top of window (top edge of the tapeline)



Left Side View – All measurements in (mm) with tolerance of +/- 3 mm

Take the following additional FARO arm measurements:

Checklist

FARO ID

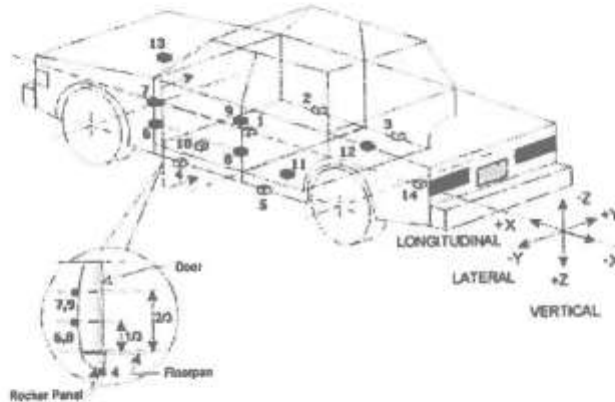
☒	LFW	Left Front Wheel
☒	LRW	Left Rear Wheel
☒	RFW	Right Front Wheel
☒	RRW	Right Rear Wheel
☒	RFRONT	Right Front
☒	CFRONT	Center of Front
☒	LFRONT	Left Front
☒	RREAR	Right Rear
☒	CREAR	Center of Rear
☒	LREAR	Left Rear
☒	NUP	N Upper Point
☒	NLOW	N Lower Point
☒	O FRNT	O Front Point
☒	OPMID	O Rear Point / P Front Point
☒	P REAR	P Rear Point
☒	QUP	Q Top Point
☒	QLOW	Q Bottom Point
☒	RBPW	Right B Pillar Point <i>(Taken at vertical tangency point)</i>
☒	LBPW	Left B Pillar Point <i>(Taken at vertical tangency point)</i>
☒	P1STRIKER	Center of P1 Striker Bolt
☒	P2STRIKER	Center of P Striker Bolt

Mark & Measure Accelerometer Locations:

Performed By: Jason Pely

Date: 12/12/18

Instructions: Mark out and then measure the location for all vehicle accelerometers using the FARO arm.



Checklist	FARO ID	Key	Location
☒	ACC 1	1	Vehicle CG
☒	ACC 2	2	Right Front Side Sill
☒	ACC 3	3	Right Rear Side Sill
☒	ACC 4	4	Left Front Side Sill
☒	ACC 5	5	Left Rear Side Sill
☒	ACC 6	6	Left Lower A-Pillar
☒	ACC 7	7	Left Middle A-Pillar
☒	ACC 8	8	Left Lower B-Pillar
☒	ACC 9	9	Left Middle B-Pillar
☒	ACC 10	10	Front Seat Track
☒	ACC 11	11	Rear Seat Structure
☒	ACC 12	12	Right Rear Occupant Compartment
☒	ACC 13	13	Engine Block
☒	ACC 14	14	Rear Floor Pan Above Axle



Vehicle Instrumentation Calibration:

Performed By: _____

SK

Date: _____

12/13/18

Note: It is the Technician's responsibility to verify that all instrumentation and associated wiring is in good working condition and calibrated. This section MUST be completed prior to installation to prevent unnecessary delays.

Checklist



Verify that (4) KT data acquisition boxes to be utilized are calibrated.



Verify that (2) KT break-out boxes function and that the unit and its wiring are in good condition.



Enter the following vehicle assembly into the Autolab software as "NCAP Side Vehicle Make/Model" and place a copy following this page.



Print out and attach the Autolab vehicle assembly sheet to show Accelerometer number, location, and calibration dates and place a copy following this page.

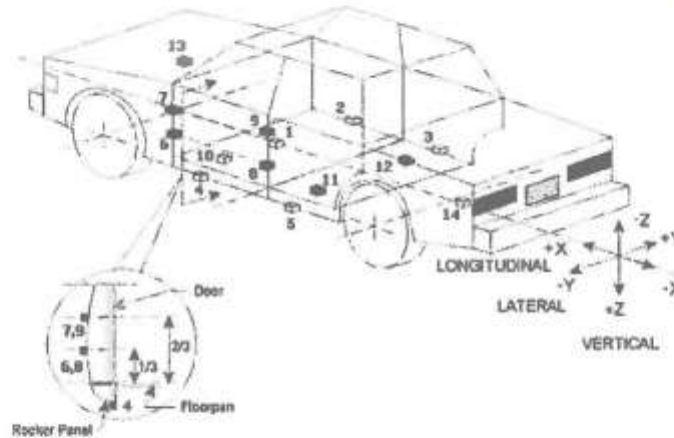
tr3362 - C20194204 - 2019 Hyundai Veloster - FMVSS 214 Side MDB

1	ENGNTPO000ACXP	Engine Top X Acceleration	AC-A211599	4/4/2019
2	ENGNTPO000ACYP	Engine Top Y Acceleration	AC-A217535	4/3/2019
3	APILLEMI000ACYP	Left A-Pillar Middle Y Acceleration	AC-A203877	4/3/2019
4	APILLELO000ACYP	Left A-Pillar Lower Y Acceleration	AC-A262040	5/3/2019
5	SILBLEFRO00ACYP	Left Front Sill Y Acceleration	AC-A217573	5/17/2019
6	SILBRIFRO00ACXP	Right Front Sill X Acceleration	AC-A196604	2/5/2019
7	SILBRIFRO00ACYP	Right Front Sill Y Acceleration	AC-A217555	4/29/2019
8	SILBRIFRO00ACZP	Right Front Sill Z Acceleration	AC-A229244	5/1/2019
9	TUNNCG0000ACXP	Vehicle CG X Acceleration	AC-A197037	4/4/2019
10	TUNNCG0000ACYP	Vehicle CG Y Acceleration	AC-A217575	4/4/2019
11	TUNNCG0000ACZP	Vehicle CG Z Acceleration	AC-A222636	4/4/2019
12	SETRLEFRO00ACYP	Driver Seat Track Y Acceleration	AC-A262067	5/20/2019
13	BPILLELO000ACYP	Left B-Pillar Lower Y Acceleration	AC-A189600	2/20/2019
14	BPILLEMI000ACYP	Left B-Pillar Middle Y Acceleration	AC-A229239	5/1/2019
15	SILBLERE000ACYP	Left Rear Sill Y Acceleration	AC-A250383	12/19/2018
16	SILBRIRE000ACXP	Right Rear Sill X Acceleration	AC-A247202	2/25/2019
17	SILBRIRE000ACYP	Right Rear Sill Y Acceleration	AC-A247206	2/25/2019
18	SILBRIRE000ACZP	Right Rear Sill Z Acceleration	AC-A247193	2/25/2019
19	SECMLERE000ACYP	Left Rear Seat Track/Structure Y Acceleration	AC-A229238	5/14/2019
20	SECMRIRE000ACYP	Right Rear Compartment Y Acceleration	AC-A250356	5/17/2019
21	FORACY0000ACXP	Rear Floorpan X Acceleration	AC-A250357	2/20/2019
22	FORACY0000ACYP	Rear Floorpan Y Acceleration	AC-A262065	3/21/2019
23	FORACY0000ACZP	Rear Floorpan Z Acceleration	AC-A250384	3/21/2019
24	BATT000000VO00	Battery Voltage Monitor	BAT-V3	n/a

Vehicle Instrumentation Installation:

Performed By: mk

Date: 12/13/18



Checklist

- ☒ Mount KT Minidau data acquisition boxes (3) on instrumentation plate. **Make sure boxes are protected with cages and that the cages are covered in protective wrap to protect cables.**
- ☒ Mount KT breakout box on instrumentation plate.
- ☒ Mount Ax, Ay, Az (tri-axial) accelerometer to the floor pan at the longitudinal and lateral location of the vehicle CG – **Vehicle CG: location 1.**
- ☒ Mount Ax, Ay, Az (tri-axial) accelerometer on the opposite side to the impacted side sill at the front seat – **Right Front Side Sill: Location 2**
- ☒ Mount Ax, Ay, Az (tri-axial) accelerometer on the opposite side to the impacted side sill at the rear seat – **Right Rear Side Sill: Location 3**
- ☒ Mount Ay (uniaxial) accelerometer on the impacted side sill in line longitudinally with the center of the widest portion of the front door and located under the sill inward of pinch welds – **Left Front Side Sill: Location 4**
- ☒ Mount Ay (uniaxial) accelerometer on the impacted side sill in line longitudinally with the center of the widest portion of the rear door and located under the sill inward of pinch welds – **Left Rear Side Sill: Location 5**
- ☒ Mount Ay (uniaxial) accelerometer mounted on the impacted lower A-Pillar located 1/3 the distance from the floor to the bottom of the doors window opening – **Left Lower A-Pillar: Location 6**
- ☒ Mount Ay (uniaxial) accelerometer on the impacted middle A-Pillar located 2/3 the distance from the floor to the bottom of the doors window opening – **Left Middle A-Pillar: Location 7**
- ☒ Mount Ay (uniaxial) accelerometer on the impacted lower B-Pillar located 1/3 the distance from the floor to the bottom of the door's window opening – **Left Lower B-Pillar: Location 8**

Checklist

- ☒ Mount Ay (uniaxial) accelerometer on the impacted middle B-Pillar located 2/3 the distance from the floor to the bottom of the doors window opening – **Left Middle B-Pillar: Location 9**
- ☒ Mount Ay (uniaxial) accelerometer on the front seat track nearest the impacted door and approximately aligned with the driver hip point – **Front Seat Track: Location 10**
- ☒ Mount Ay (uniaxial) accelerometer on the rear seat structure (if easily accessible) nearest the impacted door and approximately aligned with the dummy's hip pivot point – **Rear Seat Structure: Location 11**
- ☒ Mount Ay (uniaxial) accelerometer in the rear occupant compartment – **Right Rear Occupant Compartment: Location 12**
- ☒ Mount Ax, Ay (biaxial) accelerometer on the top of the engine – **Engine Block: Location 13**
- ☒ Mount Ax, Ay, Az (tri-axial) accelerometer on the rear floor pan above the axle – **Rear Floor Pan Above Axle: Location 14**

Vehicle Instrumentation Polarity Check:

Performed By: SIC

Date: 12/13/18

Checklist

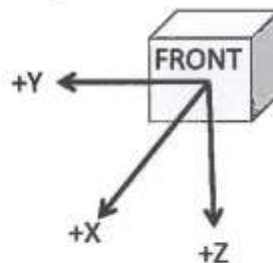


Open the track runs folder on the network that has the Accelerometer Installation Photos.



Use the provided photos to complete a polarity check on all accelerometers listed on the next page to ensure they are installed correctly. Place a check in the box next to each transducer once the check has been completed.

Note: To test the polarity, lightly tap the front of an accelerometer from the positive side of the mounted Axis. The data should show a positive pulse.



Channel Description	ISO Name	Polarity Checklist
Engine Block - X Acceleration	ENGNT0000ACXP	☒
Engine Block - Y Acceleration	ENGNT0000ACYP	☒
Left Lower A-Pillar - Y Acceleration	APILLE000ACYP	☒
Left Middle A-Pillar - Y Acceleration	APILLEMI00ACYP	☒
Left Front Sill - Y Acceleration	SILBLEFR00ACYP	☒
Right Front Sill - X Acceleration	SILBRIFR00ACXP	☒
Right Front Sill - Y Acceleration	SILBRIFR00ACYP	☒
Right Front Sill - Z Acceleration	SILBRIFR00ACZP	☒
Vehicle CG - X Acceleration	TUNNCG0000ACXP	☒
Vehicle CG - Y Acceleration	TUNNCG0000ACYP	☒
Vehicle CG - Z Acceleration	TUNNCG0000ACZP	☒
Front Seat Track - Y Acceleration	SETRLEFR00ACYP	☒
Left Lower B-Pillar - Y Acceleration	BPILLE000ACYP	☒
Left Middle B-Pillar - Y Acceleration	BPILLEMI00ACYP	☒
Left Rear Sill - Y Acceleration	SILBLERE00ACYP	☒
Right Rear Sill - X Acceleration	SILBRIRE00ACXP	☒
Right Rear Sill - Y Acceleration	SILBRIRE00ACYP	☒
Right Rear Sill - Z Acceleration	SILBRIRE00ACZP	☒
Rear Seat Structure - Y Acceleration	CRMELE000ACYP	☒
Right Rear Occupant - Y Acceleration	CRMERIRE00ACYP	☒
Rear Floor Pan Above Axle X Acceleration	FORA000000ACXP	☒
Rear Floor Pan Above Axle Y Acceleration	FORA000000ACYP	☒
Rear Floor Pan Above Axle Z Acceleration	FORA000000ACZP	☒

Weight & CG – As Tested Condition:

Performed By:

Andy Penick

Date:

12/13/12

Checklist



Load the 172 lbs (equivalent to an ES2-re with umbilical cord) into the driver's seating position and the 108 lbs (equivalent to a SID IIs with umbilical cord) into the left rear passenger's seat.



Weigh the vehicle at each wheel and add the weights to determine the "As Tested" weight.



Record the weight measurements in the space provided below.



Verify that the "As Tested" weight is within the Target Test Weight (min) and Target Test Weight (max) determined in the Weight – As Delivered section.

Note: Adjust the weight of the test vehicle by either adding ballast or removing vehicle components in accordance with the manufacturer's data provided by the COTR on Form No. 1. If the calculated Test Vehicle Target Weight is exceeded immediately contact the Test Engineer.



Record the weight of any added ballast in the space provided below.



Record any vehicle components that were removed and their associated total weight in the space provided on the next page.

		As Tested		
	Units	Front Axle	Rear Axle	Total
Left	kg	427	305	$W_{Left} = 732$
Right	kg	386	284	$W_{Right} = 670$
Ratio	%	58	42	
Totals	kg	$W_F = 813$	$W_R = 589$	1402
Scales Unique Identifier:		400323		

Target Test Weight Minimum	1400.8	kg
Target Test Weight Maximum	1405.3	kg

Weight of ballast added to meet TVTW

Description	Weight
Ballast	<u>1/2</u> kg

Yes



No



Does the measured As Tested Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Weight -4.5 kg to -9.0 kg)?

Checklist

NHTSA NCAP: C20194204: 2019 Hyundai Veloster (VIN: KMHTG6AF6KU005788)

Page 52 of 121



If no, indicate in the space provided below the equipment that was removed and its associated weight to meet this requirement.

Equipment that was removed to meet target test weight:

NP

Vehicle components removed to meet TVTW

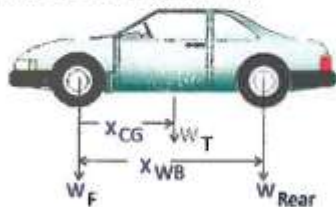
Description	Weight
Front Fascia	6.5 kg
Rear Fascia	6.5 kg
	kg

Checklist

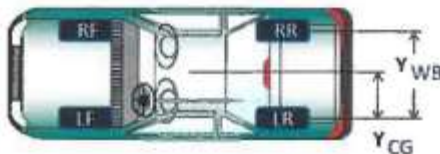


Re-measure or utilized the measurements from the previous section and enter those measurements and the weight measurements from above to calculate the vehicle CG aft of the front axle and left (+) / right (-) from the longitudinal centerline.

Center of Gravity Calculation:



$$1114 \text{ mm} = \frac{2651 \text{ mm} \times 559 \text{ kg}}{1402 \text{ kg}}$$



$$Y_{CG} = \frac{1565 \text{ mm} \times 748 \text{ kg}}{1402 \text{ kg}} = 845 \text{ mm}$$

Test Vehicle Center of Gravity (CG)

	Units	As Tested	
Vehicle CG (Aft of Front Axle)	mm	1114	X _{CG}
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	+34.5	Y _{CG}



Pre-Transport Photos:

Performed By: Amila Pareen Date: 12/14/2018

Note: Clear and properly focused digital still photographs in .jpg format with a minimum dots-per-inch (DPI) of 180 shall be taken. A vehicle information placard placed parallel with the camera, identifying the test vehicle model as well as the barrier and NHTSA number, along with an indication of whether the photo was taken pre-test shall appear in each photograph and be legible. All photographs must be in landscape view / orientation. **Reference sample photo set on network (if needed).**

Checklist

- ☒ No. 037 – View of Disengaged Parking Brake (*taken at the same time as As-Delivered photos*)
- ☒ No. 038 – View of Engaged Parking Brake (parking brake to be engaged!)
- ☒ No. 046 – Pre-Test Driver Inner Door Panel View (with door closed)
- ☒ No. 073 – Pre-Test Rear Passenger Inner Door Panel View (with door closed)

Confirm ATD Readiness:

Engineer's Name: SK

Date: 12/13/18

Instructions: Reference each workbook that accompanies the ATDs utilized for this test when completing the below sections. Note: These workbooks contain sensor calibration, dummy certification, polarity check and ring out.

Checklist



Indicate in the space provided below, the ATD serial number and manufacturer:

ES-2re Serial Number 065348 Manufacturer: FTSS
SID IIs Serial Number 224 Manufacturer: FTSS



Review the ES-2re (Driver) workbook to verify that the following has been completed.

- External measurements
- Head drop test
- Neck pendulum test
- Shoulder impact test
- Thorax – upper rib drop test
- Thorax – middle rib drop test
- Thorax – lower rib drop test
- Thorax – full body impact test
- Abdomen impact test
- Lumbar spine flexion test
- Pelvis impact test



Review the SID IIs (Rear Pass.) workbook to verify that the following has been completed.

- External measurements
- Head drop test
- Lateral neck pendulum test
- Shoulder impact test
- Thorax (with arm) impact test
- Thorax (without arm) impact test
- Abdomen impact test
- Pelvis plug quasi-static test*
- Pelvis acetabulum impact test
- Pelvis Iliac impact test



Verify that all accelerometers are calibrated (must be calibrated every 6 months).



Verify that the ES-2re ATD has the minimum instrumentation:

- (1) Primary and redundant tri-axial head accelerometers
- (2) Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers
- (3) Abdomen forward, middle and rear y-axis load cells
- (4) Lower spine (T12) tri-axial accelerometers
- (5) Pubic symphysis y-axis load cells
- (6) Tilt sensor installed

Checklist

- ☒ Verify that the SID-IIs ATD has the minimum instrumentation:
- (1) Primary and redundant tri-axial head accelerometers
 - (2) Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers
 - (3) Abdomen upper rib and lower rib y-axis displacement potentiometers
 - (4) Lower spine (T12) tri-axial accelerometers
 - (5) Acetabulum and iliac wing y-axis load cells
- ☒ Verify that all load cells are calibrated (must be calibrated every 12 months).
- ☒ Verify that the ATDs are clothed in a short sleeved form fitting cotton stretch top, knee length pants (each ATD should have contrasting colors) and shoes. All articles of clothing must be clean prior to testing and should not exhibit evidence of extreme wear. Shoes should not show separations at the seams and clothing should not be ripped or torn.
- ☒ Verify ATD is in an environment that is maintained between 18.9°C – 25.5°C (66°F - 78°F) and whose relative humidity is between 10%-70%.
- ☒ Verify temperature trace has been started. Record date and starting time.

Date: 12/13/18

Start Time: 4:00 pm

Confirm Track Readiness:

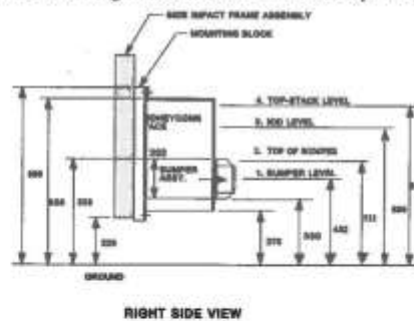
Engineer's Name: TOM P + ED

Date: 12/14/2018

Checklist

- ☒ Review the completeness of the Track's checklist for NCAP Side MDB tests.
- If not complete, list the issues below and bring to the attention of the responsible individual for resolution.

- ☒ Facility is neat, clean and arranged in an orderly manner.
- ☒ Confirm that the temperature inside the Abort House / Prep House is between 20.6°C and 22.2°C (69°F and 72°F).
- ☒ Confirm 25 mm (1 inch) wide yellow/black checkerboard tape is along the top and front of the honeycomb barrier face centerline and along the top and front of the left edge of the honeycomb barrier face to align with the vertical impact reference line on the test vehicle.
- ☒ Confirm 4" targets are on top of the barrier face 400 mm from the barrier centerline.
- ☒ Confirm that a 4" target is on the MDB at the rear cross member accelerometer's location on the left side of the frame.
- ☒ Confirm that a sharpened welding rod is available.
- ☒ Confirm (1) KT data acquisition box, (1) KT breakout box, (1) vehicle abort and power cable have been installed on the MDB cart.
- ☒ Check FMVSS 214 Cart ride height is level and meets requirements.





Test Execution



Review with Test Crew:

Engineer's Name: Ed Sutton Date: 12/14/2018

No individuals, other than contractor personnel directly involved in the testing program, shall be allowed to witness any vehicle test unless specifically authorized by NHTSA.

No vehicle manufacturer's representative(s) or anyone other than Calspan personnel working this project shall be allowed to inspect vehicles or witness vehicle preparations without prior permission from NHTSA. Such permission can never be assumed.

Calspan shall not release crash test results or data without the permission of the NHTSA. The Contractor may, however, provide the Quick Look (not including data plots) to the vehicle manufacturer post-test. Only this one-page Quick Look may be provided to the vehicle manufacturer without permission from NHTSA.

Unless otherwise specified, the vehicle manufacturer's representative(s) shall only be authorized to visit Calspan's test facility on the day that the test is scheduled, and the representative(s) must be escorted by NHTSA and/or Calspan personnel.

Test vehicle inspection by the vehicle manufacturer's representative(s) shall be limited to 30 minutes prior to the start of vehicle impact.

Post-test inspection shall be limited to one hour after Calspan personnel have completed their test tasks. No parts shall be removed from the vehicle during the post-test inspection without the approval of NHTSA.

Calspan personnel shall not respond to any questions from the manufacturer's representatives regarding the test.

Names of personnel:

Amila Nitin
Zach
Steve

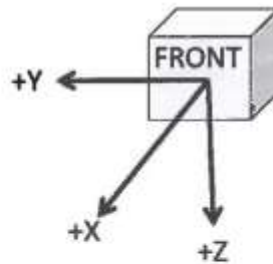
Vehicle Instrumentation Electrical Check:

Performed By: SK

Date: 12/14/18

Checklist

- ☒ Connect the power and data cables to the installed breakout box.
- ☒ Open a test in the Autolab software and load the vehicle instrumentation assembly.
- ☒ Complete an electrical check on all transducers listed on the next page. Place a check in the box next to each transducer once the check has been completed.





Channel Description	ISO Name	Electrical Checklist
Engine Block - X Acceleration	ENGNTPO000ACXP	☒
Engine Block - Y Acceleration	ENGNTPO000ACYP	☐
Left Lower A-Pillar - Y Acceleration	APILLELO00ACYP	☐
Left Middle A-Pillar - Y Acceleration	APILLEMI00ACYP	☐
Left Front Sill - Y Acceleration	SILBLEFR00ACYP	☐
Right Front Sill - X Acceleration	SILBRIFR00ACXP	☐
Right Front Sill - Y Acceleration	SILBRIFR00ACYP	☐
Right Front Sill - Z Acceleration	SILBRIFR00ACZP	☐
Vehicle CG - X Acceleration	TUNNCG0000ACXP	☐
Vehicle CG - Y Acceleration	TUNNCG0000ACYP	☐
Vehicle CG - Z Acceleration	TUNNCG0000ACZP	☐
Front Seat Track - Y Acceleration	SETRLEFR00ACYP	☐
Left Lower B-Pillar - Y Acceleration	BPILLELO00ACYP	☐
Left Middle B-Pillar - Y Acceleration	BPILLEMI00ACYP	☐
Left Rear Sill - Y Acceleration	SILBLERE00ACYP	☐
Right Rear Sill - X Acceleration	SILBRIRE00ACXP	☐
Right Rear Sill - Y Acceleration	SILBRIRE00ACYP	☐
Right Rear Sill - Z Acceleration	SILBRIRE00ACZP	☐
Rear Seat Structure - Y Acceleration	CRMELERE00ACYP	☐
Right Rear Occupant - Y Acceleration	CRMERIRE00ACYP	☐
Rear Floor Pan Above Axle X Acceleration	FORA000000ACXP	☐
Rear Floor Pan Above Axle Y Acceleration	FORA000000ACYP	☐
Rear Floor Pan Above Axle Z Acceleration	FORA000000ACZP	☒

Camera Equipment Set-up:

Performed By: 26

Date: 12/19/18

General Requirements:

High-speed digital video cameras that operate at a minimum speed of 1000 frames per second (fps) for at least 50 ms before the MDB contacts the vehicle and for at least 300 ms after the MDB contacts the vehicle. The minimum resolution for these cameras must be 1024 x 1024 pixels

A time zero (T(0)) impact event marker to indicate when the MDB contacts the test vehicle must be present in each high speed video camera view.

Each video frame shall contain the camera speed and the frame number, beginning with the time zero frame labeled as "Frame 0". The frame numbers prior to time zero shall be negative numbers.

The test laboratory's name or logo shall not appear in any high-speed videos. Note that for the real time, the test laboratory's name shall only appear in the documentary real-time video as part of the title frame.

Locate the following cameras and set field of view, set up cameras, time zero flash units, trigger switches.

Checklist



Camera 1: Overhead Wide View - High-Speed overhead camera to view target vehicle dynamics and positioned directly above the impact plane between the target vehicle and the MDB.

UNIQUE IDENTIFIER = _____



Camera 2: Overhead Close-Up View - A high-speed overhead camera to provide close-up view of the impact plane (should include view of photograph targets on centerline of test vehicle and photograph targets on top of MDB barrier face) and positioned adjacent to Camera No. 1

UNIQUE IDENTIFIER = _____



Camera 3: Impact Point - A high-speed digital camera positioned along the impactor's face left vertical edge to cover target vehicle impact point during side impact event.

UNIQUE IDENTIFIER = _____



Camera 4: Struck-Side View at Impact - A high-speed digital camera, positioned on MDB's centerline to view struck side of test vehicle during the side impact event

UNIQUE IDENTIFIER = _____



Camera 5: Rear Impact View of Struck Side - A high-speed right side view camera to cover both the MDB and the target vehicle during the side impact event

UNIQUE IDENTIFIER = _____

- ☒ **Camera 6: Front Oblique Impact View of Struck Side** - A high-speed left side view camera to cover the motion of the target vehicle after impact

UNIQUE IDENTIFIER = _____

- ☒ **Camera 7: Driver Dummy Front View (Onboard)** - A high-speed camera to provide front view of the front dummy through the vehicles windshield from above the engine compartment. (Should be sufficiently raised above the hood structure and positioned such that it shows not only curtain air bag deployment in relation to the dummy's head, but also torso air bag deployment in relation to the dummy's chest, if applicable.)

UNIQUE IDENTIFIER = _____

- ☒ **Camera 8: Driver Dummy Side View (Onboard)** - A high-speed camera to view across the test vehicle's occupant compartment to record the lateral motion of the front dummy during and after side impact.

UNIQUE IDENTIFIER = _____

- ☒ **Camera 9: Rear Passenger Dummy Side View (Onboard)** - A high-speed camera to view across the test vehicle's occupant compartment to record the lateral motion of the rear dummy during and after side impact.

UNIQUE IDENTIFIER = _____

ocate the following cameras and set field of view:

Checklist

- ☒ **Camera 10: Real-Time Rear View of Impact**- Real-time (24-30 fps) camera to provide a left rear view of the MDB impacting the target vehicle.

UNIQUE IDENTIFIER = _____

- ☒ **Camera 11: Real-Time Pan View of Impact** - Real-time (24-30 fps) camera to provide the following pre-test, test, and post-test coverage:
- (1) Side panned view of the moving deformable barrier traveling down the track and impacting the test vehicle
 - (2) Impact side, front, non-impact side and rear of test vehicle, and condition of the moving deformable barrier prior to impact
 - (3) Pre-test position of dummies (including, but not limited to the placement of lap and shoulder belt on the dummies)
 - (4) Cycling of air bag indicator light
 - (5) Door closings (including any rear hatchback or tailgate)
 - (6) Lab technician installing fuel filler cap onto the filler neck and the rotation of the cap to the installed position
 - (7) Speed traps, post-test
 - (8) Front, front oblique view of impact side, impact side, rear oblique view of impact side rear, and non-impact side of test vehicle, and condition of the MDB after impact
 - (9) Post-test position of dummies
 - (10) Chalk markings on air bag(s)
 - (11) Static rollover
 - (12) Other vehicle failures or anomalies, including door openings and any fluid spillage (along with its collection after impact).

Pre-Test Photo & Video Prior to Seating:

Performed By:

Amela Pera

Date:

12/14/20

Note: Clear and properly focused digital still photographs in .jpg format with a minimum dots-per-inch (DPI) of 180 shall be taken. A vehicle information placard placed parallel with the camera, identifying the test vehicle model as well as the barrier and NHTSA number, along with an indication of whether the photo was taken pre-test shall appear in each photograph and be legible. All photographs must be in landscape view / orientation. *Reference sample photo set on network (if needed).*

Checklist: Photos of Vehicle Positioned Against MDB

- ☒ No. 015 – Pre-Test Overhead View of Test Area *with MDB positioned against test vehicle.*
- ☒ No. 017 – Pre-Test Left Side View of MDB Positioned *at ideal impact point* Against Side of Test Vehicle
- ☒ No. 018 – Pre-Test Right Side View of MDB Positioned Against Side of Test Vehicle
- ☒ No. 019 – Pre-Test Close-Up View of Impact Point Target (*impact reference line should be clearly indicated; (photo should be taken w/ MDB against Test Vehicle)*)
- ☒ No. 030 – Pre-Test Frontal View of Drivers Seat Back *Prior to Dummy Positioning (should show head restraint and seat centerline)*
- ☒ No. 032 – Pre-Test Overhead View of Drivers Seat Pan *Prior to Dummy Positioning (should show head restraint and seat centerline)*
- ☒ No. 058 – Pre-Test Frontal View of Rear Passenger Seat Back *Prior to Dummy Positioning (should show seat centerline)*
- ☒ No. 060 – Pre-Test Overhead View of Rear Passenger Seat Pan *Prior to Dummy Positioning (should show seat centerline)*
- ☒ Move MDB back from vehicle and then take below photos and real time video.

Checklist: Photos of MDB

- ☒ No. 084 – Pre-Test Front View of MDB Impactor Face
- ☒ No. 086 – Pre-Test Top View of MDB Impactor Face
- ☒ No. 088 – Pre-Test Left Side View of MDB Impactor Face
- ☒ No. 090 – Pre-Test Right Side View of MDB Impactor Face



Checklist: Video of MDB

- ☒ View of Left side of MDB
- ☒ View of Right Side of MDB
- ☒ View of Front of MDB
- ☒ Overhead View of MDB

Checklist:

- ☒ Move MDB to start position, attach tow and abort cables and check onboard abort.

Confirm ATD Readiness:

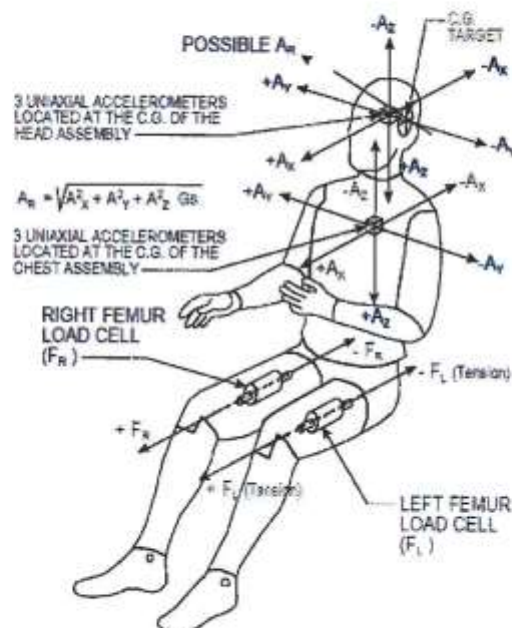
Performed By: SK

Date: 12/14/18

Reference each workbook that accompanies the ATDs utilized for this test when completing the below sections.

Checklist

- ☒ Confirm polarity check was completed on all ATD sensors.
- ☒ Confirm complete functionality check using a force gauge was completed.
- ☒ Confirm that the tilt sensor was installed in the ES-2re (Driver) dummy
- ☒ Confirm the ATD limb joints were set between 1 and 2 g.
- ☒ Confirm a 100 mm (4") diameter target is on the head of the ATD at the CG location on the struck side.
- ☒ Confirm a 25.4 mm (1") targets on the front of the ATD's head / face at the head CG location.
- ☒ If vehicle has side airbags, ask OEM will the side airbags on the non-struck side deploy in a side MDB test? If yes, please request OEM to disable the side airbags on the non-struck side on test day. If OEM is not present, used instructions provided by OEM.



Positioning SID-IIs in Rear Left Position:

Performed By:

ED Dutton

Date:

12/14/2017

Tape Measure Unique Identifier:	
Inclinometer Unique Identifier:	

Checklist



A. Set the rear outboard seat at the full rearward, lowest height, mid-angle position.



B. Verify that the fixed lower neck load cell is not installed. Adjust the dummy's upper and lower neck brackets to align the zero degree index marks.



C. Fully recline the seat back, if adjustable. Place the dummy in the rear passenger's seat, such that when the legs are positioned 120 degrees to the thighs, the calves of the legs are not touching the seat cushion. If necessary, use a fixed gauge, inserted into the hip, knee, and ankle joints, to maintain the 120 degree angle.

If a 120 degree angle between the legs and the thighs cannot be achieved due to interference with the front seat back when the front seat is set to the mid-fore/aft full down position and the front seat back is set to the manufacturer's nominal design riding position for a 50th percentile adult male, move the front seat to its full-forward position, and adjust the front seat back to its most upright position. If a 120 degree angles between the legs and the thighs still cannot be achieved due to interference with the front seat back, place the legs at the largest angle possible while allowing the feet to just contact the front seat back; record this angle.

Leg Angle =

120



D. On bucket or contoured seats, center the dummy on the seat cushion so that its mid-sagittal plane is vertical and passes within ± 10 mm (± 0.4 in) of the longitudinal centerline markings on the seat cushion upper surface, seat back, and head restraint that lie in the same vertical longitudinal plane as the SgRP.

On bench seats, position the midsagittal plane of the dummy vertical and parallel to the vehicle's longitudinal centerline and is aligned within ± 10 mm (± 0.4 in) of the longitudinal centerline markings on the seat cushion upper surface, seat back, and head restraint that lie in the same vertical longitudinal plane.



E. Hold the dummy's thighs down and push rearward on the upper torso to maximize the dummy's pelvic angle.



F. While maintaining a leg-thigh angle of 120 degrees, set the initial transverse distance between the longitudinal centerlines at the front of the dummy's knees at 160 to 170 mm (6.3 to 6.7 in), with the thighs and legs of the dummy in vertical planes. Center the knee separation with respect to the longitudinal centerline markings of the seat cushion.

- ☒ G. Without allowing the angle between the thighs and lower legs to change, push rearward on the dummy's knees to force the pelvis into the seat so there is no gap between the pelvis and the seat back or until contact occurs between the back of the dummy's calves and the front of the seat cushion. If a gap still exists between the pelvis and the seat back after this step has been performed, and the back of the dummy's calves have not yet contacted the front of the seat cushion, perform one of the following steps until there is no gap between the pelvis and the seat back, or until contact occurs between the back of the dummy's calves and the front of the seat cushion, whichever occurs first:

1) Pull forward slightly on the dummy's upper torso while holding the dummy at the base of the back of the neck, and rock the torso from side-to-side while pushing back on the dummy's knees.

(2) Lift the dummy from beneath the buttocks and slide the pelvis rearward into the seat.

Note: In vehicles with long seat pans, the dummy's pelvis may not contact the seat back even when the back of the calves are touching the front of the seat cushion.

- ☒ H. If the dummy's calves make contact with the front of the seat cushion and prohibit the pelvis from contacting the seat back in step G, and a 120 degree angle between the legs and thighs could not be achieved in step C due to interference with the front seat back, attempt to once again achieve a 120 degree angle between the legs and the thighs. Verify that the transverse distance between the longitudinal centerlines at the front of the dummy's knees is still set to 160 to 170 mm, with the thighs and legs of the dummy in vertical planes. If a 120 degree angle between the legs and the thighs still cannot be achieved due to interference with the front seat back, place the legs at the largest angle possible while allowing the feet to just contact the front seat back; record this angle. If the leg angle is adjusted, repeat step G.

- ☒ I. Gently rock the upper torso relative to the lower torso laterally in a side to side motion three times through a ± 5 degree arc (approximately 51 mm (2 in) side to side) three times to reduce friction between the dummy and the seat. Return the dummy's upper torso to the seat back.

- ☒ J. If needed, extend the legs slightly so that the feet are not in contact with the floor pan. Let the thighs rest on the seat cushion to the extent permitted by the foot movement. Verify that the transverse distance between the longitudinal centerlines at the front of the dummy's knees is still set to 160 to 170 mm with the thighs and the legs of the dummy in vertical planes. With the feet perpendicular to the legs, place the heels on the floor pan. After initial positioning, it should be possible to lift the legs behind the ankles and, when slowly released, the legs should return to the original position with the heel contacting the floor. If a heel will not contact the floor pan, place it as close to the floor pan as possible.

- ☒ K. Head leveling - When leveling the head, the dummy's torso should be resting on the seat back and / or the dummy's head should be resting on the head restraint.

(1) Vehicles with fixed seat backs. Adjust the lower neck bracket to level the transverse instrumentation platform angle of the head to within ± 0.5 degrees. If it is not possible to level the transverse instrumentation platform to within ± 0.5 degrees, select the neck bracket adjustment position that minimizes the difference between the transverse instrumentation platform angle and level.

(2) Vehicles with adjustable seat backs. While holding the thighs in place, rotate the seat back forward until the transverse instrumentation platform angle of the head is level to within ± 0.5 degrees, making sure that the pelvis does not interfere with the seat bight and the head does not get pinched under the head restraint. If the pelvis interferes with the seat bight, shift the pelvis forward slightly on the seat cushion and complete steps to level the head. If the head gets pinched under the head restraint, it may be

necessary to pull the dummy's torso forward slightly as the seat back is raised and then return the torso to the seat back. If it is not possible to level the transverse instrumentation platform to within ± 0.5 degrees, select the seat back adjustment position that minimizes the difference between the transverse instrumentation platform angle and level, then adjust the neck bracket to level the transverse instrumentation platform angle to within ± 0.5 degrees, if possible. If it is still not possible to level the transverse instrumentation platform to within ± 0.5 degrees, select the neck bracket angle position that minimizes the difference between the transverse instrumentation platform angle and level.

- ☒ L. Measure and set the dummy's pelvic angle to 20.0 degrees ± 2.5 degrees using the pelvic angle gage. If the dummy's pelvic angle is within the specified range at the head angle determined in step K, continue to step M. If the dummy's pelvic angle is outside of the specified range at the head angle determined in step K, adjust the pelvic angle as close to 20.0 degrees as possible by performing the applicable step listed below while keeping the transverse instrumentation platform of the head as level as possible, as specified in step K. **If it is not possible to achieve both the head level and the specified pelvic angle, priority goes to leveling the head.**

- (1) If the pelvic angle is above the specified range, decrease the pelvic angle by rotating the torso forward and then holding the dummy's thighs down and slowly rotating the torso rearward until it is supported by the seat back and / or the head is supported by the head restraint. Record the pelvic angle and head angle, making sure the transverse instrumentation platform angle of the head can still be leveled to within ± 0.5 degrees or, at most, to the angle determined in step J. Adjustment of the neck bracket is permitted to level the transverse instrumentation platform of angle of the head to within ± 0.5 degrees. Proceed to step M.

If the pelvic angle is still outside of the range, and the seat back is adjustable, rotate the seat back forward while holding the dummy's thighs in place until the dummy's pelvic angle is within the specified range, or until the head can no longer be leveled to within ± 0.5 degrees (or, at most, to the angle determined in step K), whichever occurs first. Adjustment of the neck bracket is permitted to level the transverse instrumentation platform of angle of the head to within ± 0.5 degrees. When rotating the seat back forward, make sure that the pelvis does not interfere with the seat bight and the head does not get pinched under the head restraint. If the pelvis interferes with the seat bight, shift the pelvis forward slightly on the seat cushion and complete steps to level the head. If the head gets pinched under the head restraint, it may be necessary to pull the dummy's torso forward slightly as the seat back is raised and then return the torso to the seat back. Record pelvic angle and head angle. Proceed to step M.

- (2) If the pelvic angle is below the specified range, increase the pelvic angle by holding the dummy's thighs down and pushing rearward on the upper torso. Record the pelvic angle and head angle, making sure the transverse instrumentation platform angle of the head can still be leveled to within ± 0.5 degrees or, at most, to the angle determined in step J. Adjustment of the neck bracket is permitted to level the transverse instrumentation platform of angle of the head to within ± 0.5 degrees. Proceed to step M.

Pelvis Angle = 22.9

- ☒ M. Foot positioning – Set the front seat to the mid-fore/aft full down position and set the front seat back to the manufacturer's nominal design riding position for a 50th percentile adult male.
- (1) Place the rear seat passenger's feet flat on the floor pan and beneath the front seat as far as possible without front seat interference.
- (2) If either foot does not contact the floor pan, place the foot parallel to the floor and place the leg as perpendicular to the thigh as possible, even if this causes the dummy's calf to contact the front of the seat cushion.
- ☒ N. Place the seat belt around the dummy and fasten the latch. Check again the alignment of the dummy and verify that the head is level. If everything is in position, set the arm. If not, repeat the steps to get the head as level as possible. The head angle should not be larger than the angle determined in Step K.
- ☒ O. Arm Positioning - Place the dummy's upper arm such that the angle between the projection of the arm centerline on the midsagittal plane of the dummy and the torso reference line is 45 +/- 5 degrees. The torso reference line is defined as the thoracic spine centerline. The shoulder-arm joint allows for discrete arm positions at 0, ± 40, ± 90, ± 140, and 180 degree settings where positive is forward of the spine.
- ☒ P. Belt in cabling / umbilicals

Positioning ES-2re Male in Driver Position:

Performed By:

ED

Date:

12-11-14/2018

Tape Measure Unique Identifier:	
Inclinometer Unique Identifier:	

Checklist

- ☒ A. Using the reference marks on the seat, set the driver's seat at the mid-fore/aft, full down, mid seat cushion angle position.
- ☒ B. If adjustable, set the seat back angle at the manufacturer's nominal design riding position for a 50th percentile adult male in the manner specified by the manufacturer. IF the position is not specified, set the seat back at the first detent rearward of 25 degrees from the vertical.
- ☒ C. Upper Torso – Once the H-point has been determined, position a calibration ES-2re test dummy in the driver's seat.
 - (1) Place the dummy in the seat such that the plane of symmetry (ie. Mid-sagittal plane) of the dummy coincides with the longitudinal centerline marking on the seat cushion upper surface, seat back, and head restraint of the driver's seat. **NOTE: Move the seat and seat back rearward as necessary to get the test dummy in the seat.**
 - (2) Bend the upper torso forward and then lay it back against the seat back. Push the shoulders of the dummy fully rearward.
- ☒ D. Pelvis
 - (1) Remove the foam blocks from the pelvis flesh
 - (2) Position the dummy so that it sits square and level in the seat.
 - (3) If the seat was adjusted in positioning of the rear passenger, set the seat at the mid-fore/aft position and the seat back to the manufacturer's nominal design riding angle
 - (4) The correct position of the dummy's pelvis may be checked relative to the H-point determined by the H-point machine. Locate the M3 holes in the H-point back plates at each side of the pelvis. Position the dummy's pelvis such that the M3 holes are located within a circle of radius 10mm around the H-point location (x,z) of the H-point machine. Note that the hip point of the dummy is located 21 mm forward of the H-point determined by the H-point machine.
 - (5) Position the pelvis of the dummy such that a horizontal (lateral) line passing through the dummy hip pivot center is perpendicular to the longitudinal center plane of the seat. Verify that the line through the dummy H-points is horizontal with a maximum inclination of ± 2 degrees. The dummy may be equipped with tilt sensors in the thorax and the pelvis. These instruments can help to obtain the desired position. If the pelvic tilt angle (Y) is not within specification (± 2 degrees), go back to step C1 and repeat steps to re-adjust the position of the test dummy.

$\alpha : 423$
 $2 : 256$

22.9°
 0.6°

Checklist



E. Legs and Feet

- (1) Without inducing pelvis or torso movement, place the right foot of the dummy on the undepressed accelerator pedal with the heel resting as far forward as possible on the floor pan.
- (2) Set the left foot perpendicular to the lower leg with the heel resting on the floor pan in the same lateral line as the right heel
- (3) Set the knees of the dummy such that their outside surfaces are 150 ± 10 mm from the plane of symmetry of the dummy. If possible within these constraints, place the thighs of the dummy in contact with the seat cushion.



F. Arms – Place the dummy's upper arms such that the angle between the projection of the arm centerline on the mid-sagittal plane of the dummy and the torso reference line is $40^\circ \pm 5^\circ$. The torso reference line is defined as the thoracic spine centerline. The shoulder-arm joint allows for discrete arm position at 0, 40, and 90 degree settings forward of the spine.



G. Place seat belt around the dummy and fasten the latch



H. Belt in Cabling / umbilical's



I. Affix targets, labeled appropriately (if applicable) to the front door to denote the vehicle CG location. Use a 100 mm (4 inch) diameter target and label with "CG".



J. Affix targets, labeled appropriately (if applicable) to the roof to mark the test dummy's head CG location. Use a 100 mm (4 inch) diameter target and label with "CG".



K. Affix targets, labeled appropriately (if applicable) to the front door or side panel to denote the hip pivot center of the test driver and rear passenger dummy. Use a 100 mm (4 inch) diameter target and label with "HP".

Align Vehicle:

Performed By:

Amila EEP Dutton

Date:

12/14/2014

Checklist



Verify that vehicle's tire pressures match the tire pressures listed on the tire placard. If a tire is low, add air and notify Test Engineer.

Tire Pressures	Units	LF	RF	LR	RR
As Tested	kpa	230	230	230	230
Pressure Gauge Unique Identifier:					

Checklist



Position vehicle on the side impact pad along 27 degree line and align with MDB



Hold vehicle in place with parking brake.



Place automatic transmission in NEUTRAL, manual in SECOND gear



Check if vehicle attitudes fall into test range. (If attitude is lower than fully loaded condition, vehicle wheels may need to be momentarily lifted off ground)



Attach plumb bobs to center of front and rear vehicle bumpers.



Mark cement beneath vehicle plumb bobs

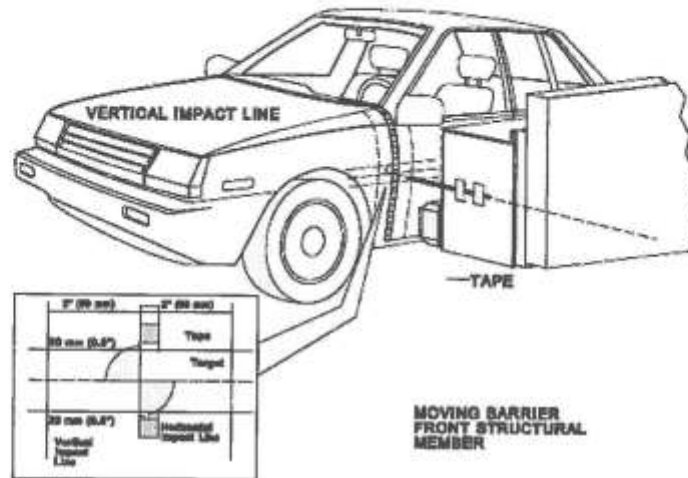


Re-attach battery charger to vehicle.



Attach sharpened welding rod along the left side vertical surface of the honeycomb barrier in the horizontal plane level with the mid-door of the test vehicle (Level 3 target). Welding rod shall be positioned and attached with duct tape so as to contact the test vehicle body sheet metal during pre-test setup when MDB is positioned against the side of the test vehicle. The tip should be located in the center of the target.

Continued on next page.



Checklist

- ☒ Place inch tape on barrier sides at H-point level
- ☒ Measure and record the vertical height of level 3 impact targets
Left Side: 622 mm
- ☒ Check speed trap and barrier release distance
- ☒ Locate camera start and engine kill switch pads
- ☒ Install contact switches on the right and left side of the MDB honeycomb barrier.

ATD Position Measurements:

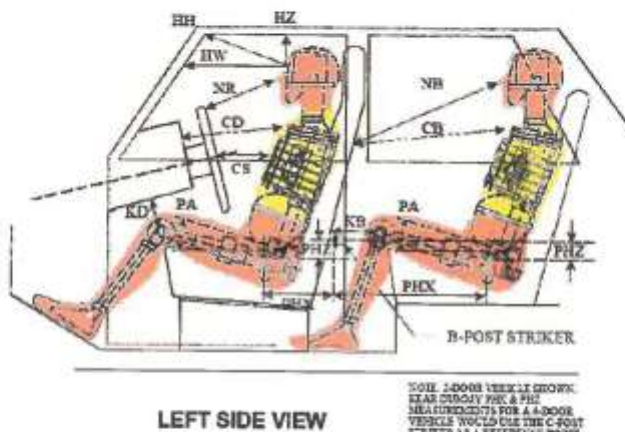
Performed By: Amila

Date: 12/14/2018

Tape Measure Unique Identifier:	
Inclinometer Unique Identifier:	

Checklist

- ☒ Once the dummy is properly positioned, and the seat belt has been fastened over the dummy's chest, align a 150 mm (6-inch) segment of yellow/red checkerboard tape with the outboard edge of the shoulder belt portion of the seat belt such that it will be visible in Camera View No. 11.
- ☒ Place a second 150 mm (6-inch) segment of yellow/red checkerboard tape on the dummy's chest such that it is aligned with the first segment that was placed along the outboard edge of the shoulder belt. The two checkerboard tape segments should be cut and positioned such that the colors for each square-inch section alternate on either side of the edge of the shoulder belt.
- ☒ Record the final position of the dummy after it is seated in the test vehicle by taking the measurements indicated on the next page (accurate to ± 3 mm).



HH HEAD TO HEADER – Measure the distance from the point where the dummy's nose meets his forehead (between the eyes) to the furthest point forward on the header.

HW HEAD TO WINDSHIELD – Measure the distance from the point where the dummy's nose meets his forehead (between the eyes) to a point on the windshield directly in front of it. Use a level or plumb-bob.

NR HEAD TO ROOF LINER – Measure the distance from the point where the dummy's nose meets his forehead (between the eyes) to the point on the roof directly above it. Use a level or plumb-bob.

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IR NOSE TO RIM – Measure the distance from the tip of the dummy's nose to the closest point on the top of the steering wheel rim.

CD CHEST TO DASHBOARD – Place a tape measure on the tip of the dummy's chin and rotate 125 mm of it downward toward the dummy to the point of contact on the transverse center of the dummy's chest. Mark this point with a 25 mm (1 inch) diameter target. Measure the distance from this point to the closest point on the dashboard either between the upper part of the steering wheel between the hub and the rim, or measure to the dashboard placing the tape measure above the rim, whichever is a shorter measurement.

CS CHEST TO STEERING WHEEL – Measure the distance from the center of the steering wheel hub to the dummy's chest. Use a level. Mark this location on the dummy's chest with a 25 mm (1 inch) diameter target.

KDL/KDR LEFT AND RIGHT KNEES TO DASHBOARD – Measure the distance from the center of the knee pivot bolt's outer surface to the closest point forward acquired by swinging the tape measure in continually larger arcs until it contacts the dashboard.

KDAL/KDAR KNEE TO DASHBOARD ANGLE – Using the line representing the length measurement of the knee to the dashboard above, measure the angle between that line and the horizontal.

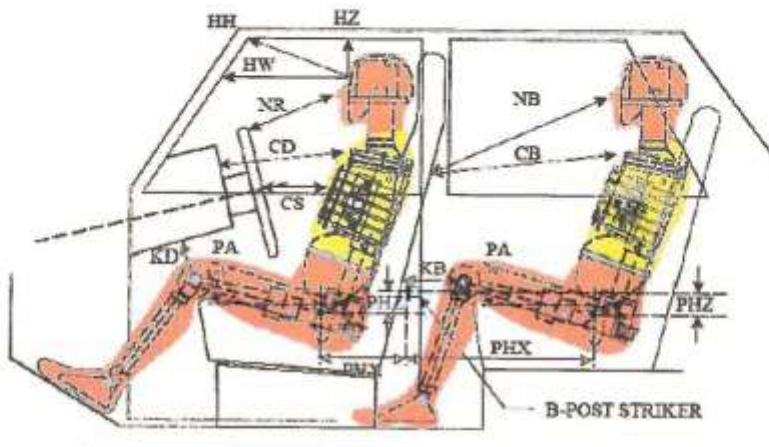
PAX PELVIC TILT ANGLE (X) – Measure by inserting the pelvic angle gauge into the Hip Point gauging hole (actual pivot center of the dummy's torso and thighs) on the dummy and taking this angle with respect to the horizontal. Alternatively, record the pelvic tilt angle X measured by tilt sensors installed in the test dummy.

PAY PELVIC TILT ANGLE (Y) – Measure by inserting the pelvic angle gauge into the Hip Point gauging hole (actual pivot center of the dummy's torso and thighs) on the dummy and taking this angle with respect to the vertical. Alternatively, record the pelvic tilt angle Y measured by tilt sensors installed in the test dummy.

PHX HIP POINT TO STRIKER (X) – Locate a point on the front door striker and project this point (with a level) vertically downward. Measure the distance horizontally from the pivot center of the dummy's torso and thigh to the point it intersects with the level.

PHZ HIP POINT TO STRIKER (Z) – Locate a point on the front door striker and project this point (preferably, with a level) horizontally toward the pivot center of the dummy's torso and thigh. Measure the distance vertically from the pivot center of the dummy's torso and thigh to the point it intersects with the level.

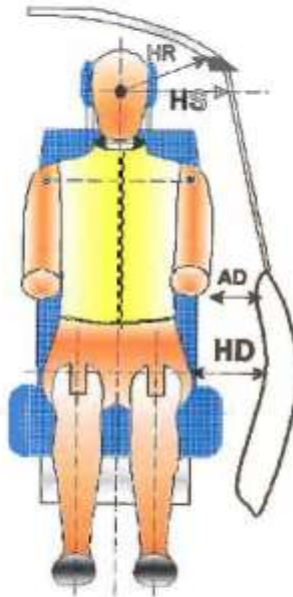
Note: The B-pillar striker will be used as the reference point for PHX & PHZ measurements.



LEFT SIDE VIEW

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

Code	Measurement Description	Driver		Rear Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
HH	Head to Header	362			
HW	Head to Windshield	676			
HZ	Head to Roof Liner	153		Beilias	
NR	Nose to Rim/Seat Back	417			
CD	Chest to Dashboard/Seat Back	542			
CS	Chest to Steering Wheel	337			
KDL/KDAL°	Left Knee to Dash/Seat Back	188	25.8		
KDR/KDAR°	Right Knee to Dash/Seat Back	180	25.5		
PAX°	Pelvic Tilt Angle (X-axis)		22.9		
PAY°	Pelvic Tilt Angle (Y-Axis)				
PHX	Hip Point to Striker (X-Axis)	423			
PHZ	Hip Point to Striker (Z-axis)	256			



Code	Measurement Location	Units	Driver	Rear Passenger
HR	Head to Side Header	mm	190	↑
HS	Head to Side Window	mm	320	Ballast
AD	Arm to Door	mm	98	↓
HD	Hip Point to Door	mm	150	↓

HR HEAD TO SIDE HEADER – Measure the shortest distance from the point where the dummy's nose meets his forehead (between the eyes) to the side edge of the header just above the window frame, directly adjacent to the dummy.

HS HEAD TO SIDE WINDOW – Measure the distance horizontally from the point where the dummy's nose meets his forehead (between the eyes) to the outside of the side window. In order to take this measurement, roll the window down to the exact height that allows a level measurement. Use a level.

AD ARM TO DOOR – Measure the distance from the center of the bottom of the outboard arm segment where it meets the driver or passenger dummy's torso to the closest point on the door.

HD HIP POINT TO DOOR – Project a point horizontally from the pivot center of the dummy's torso and thigh, outward to the edge of the pelvis plug. Measure the distance horizontally from this point to the closest point on the door panel. Use a level.

Camera Field of View & Focus Confirmation:

Performed By:

26

Date:

12/13/18

General Requirements:

High-speed digital video cameras that operate at a minimum speed of 1000 frames per second (fps) for at least 50 ms before the MDB contacts the vehicle and for at least 300 ms after the MDB contacts the vehicle. The minimum resolution for these cameras must be 1024 x 1024 pixels

A time zero (T(0)) impact event marker to indicate when the MDB contacts the test vehicle must be present in each high speed video camera view.

Each video frame shall contain the camera speed and the frame number, beginning with the time zero frame labeled as "Frame 0". The frame numbers prior to time zero shall be negative numbers.

The test laboratory's name or logo shall not appear in any high-speed videos. Note that for the real time, the test laboratory's name shall only appear in the documentary real-time video as part of the title frame.

Check the field of view, focus and verify time zero flash units are visible.

Checklist



Camera 1: Overhead Wide View - High-Speed overhead camera to view target vehicle dynamics and positioned directly above the impact plane between the target vehicle and the MDB.



Camera 2: Overhead Close-Up View - A high-speed overhead camera to provide close-up view of the impact plane (should include view of photograph targets on centerline of test vehicle and photograph targets on top of MDB barrier face) and positioned adjacent to Camera No.1



Camera 3: Impact Point - A high-speed digital camera positioned along the impactor's face left vertical edge to cover target vehicle impact point during side impact event.



Camera 4: Struck-Side View at Impact - A high-speed digital camera, positioned on MDB's centerline to view struck side of test vehicle during the side impact event



Camera 5: Rear Impact View of Struck Side - A high-speed right side view camera to cover both the MDB and the target vehicle during the side impact event



Camera 6: Front Oblique Impact View of Struck Side - A high-speed left side view camera to cover the motion of the target vehicle after impact



Camera 7: Driver Dummy Front View (Onboard) - A high-speed camera to provide front view of the front dummy through the vehicles windshield from above the engine compartment. (Should be sufficiently raised above the hood structure and positioned such that it shows not only curtain air bag deployment in relation to the dummy's head, but also torso air bag deployment in relation to the dummy's chest, if applicable.)



Camera 8: Driver Dummy Side View (Onboard) - A high-speed camera to view across the test vehicle's occupant compartment to record the lateral motion of the front dummy during and after side impact.



Camera 9: Rear Passenger Dummy Side View (Onboard)- A high-speed camera to view across the test vehicle's occupant compartment to record the lateral motion of the rear dummy during and after side impact.

Locate the following cameras and set field of view:

Checklist

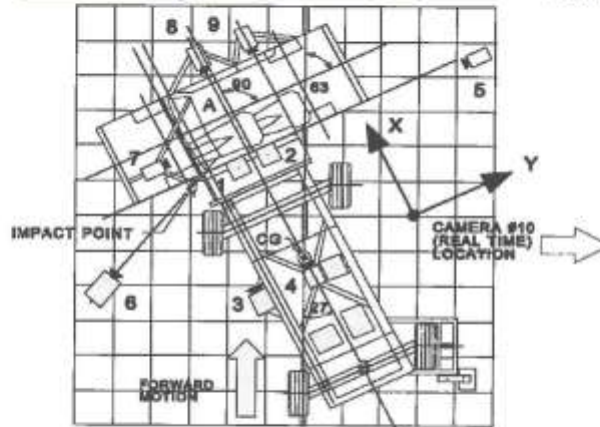
- ☒ **Camera 10: Real-Time Rear View of Impact**- Real-time (24-30 fps) camera to provide a left rear view of the MDB impacting the target vehicle.
- ☒ **Camera 11: Real-Time Pan View of Impact** - Real-time (24-30 fps) camera to provide the following pre-test, test, and post-test coverage:
 - ☒ Focus Camera 1: First focus in field of view, then zoom in to check focus.*
 - ☒ Focus Camera 2: First focus in field of view, then zoom in to check focus.*
 - ☒ Focus Camera 3: First focus in field of view, then zoom in to check focus.*
 - ☒ Focus Camera 4: First focus in field of view, then zoom in to check focus.*
 - ☒ Focus Camera 5: First focus in field of view, then zoom in to check focus.*
 - ☒ Focus Camera 6: First focus in field of view, then zoom in to check focus.*
 - ☒ Focus Camera 7: First focus in field of view, then zoom in to check focus.*
 - ☒ Focus Camera 8: First focus in field of view, then zoom in to check focus.*
 - ☒ Focus Camera 9: First focus in field of view, then zoom in to check focus.*
 - ☐ Position time zero flash units (must be present in each camera view)
 - ☒ Position speed trap and camera start tape switch.
 - ☒ Verify high-speed cameras show green ready light.
 - ☒ Record camera locations & lens focal lengths for all cameras (data sheet on the next page).
 - ☒ Verify NHTA Numbers are in each camera view.

* Reminder: Focus on ATD's and not placards.

Camera Location - Data Sheet:

Performed By: 26

Date: 12/13/18



Measurement Device Unique Identifier:

Camera Locations:

	View	X (mm)	Y (mm)	Z (mm)	Lens (mm)	Speed (fps)
1	Overhead Overall	254	1421	9370	12.5	1000
2	Overhead Close-Up	0	254	9370	35	
3	Left Impact Point (MDB)	—	—	—	25	
4	Side Overall (MDB)	—	—	—	8	
5	Rear	0	7767	1135	24	
6	Left Front	-3053	-5195	1260	24	
7	Driver Front – Onboard				12.5/25	
8	Driver Side – Onboard				8	
9	Passenger Side – Onboard				8	↓
10	Real-Time Left Rear				N/A 30mm	30
11	Real-Time In run				N/A 30mm	30

Specifically, the X and Y coordinates shall reference the designated impact point on the target vehicle's struck side and the Z coordinate shall reference the ground (+X = forward of impact, +Y = right of impact, +Z = Down). The coordinate system shall be aligned with the test vehicle's struck side.

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Secure Equipment & Chalk ATD:

Performed By:

Amila Perera

Date:

12/14/2018

Checklist



Secure all cables.



Chalk ATD

Parts of the anthropomorphic test device shall be coated with colored chalk/water solutions to show contact points with the vehicle's door and interior components. The chalk/water solution shall be applied after final dummy positioning. **In the event that the chalk/water solution is partially covered by a latched seat belt, the solution shall be applied to the seat belt as well to ensure any interior contact is evident post-test.**

Face	Blue
Top of Head (stop painting at skull cap)	Yellow
Left Side of Head	Green
Back of Head (skull cap)	Red
Left Shoulder	Orange
Upper Torso	Blue
Lower Torso	Yellow
Left Hip	Red
Left Knee	Green

Confirm Attitude - As Tested Condition:

Performed By:

ED

Date:

12/14/2018

Checklist

- ☒ With the vehicle in the "As Tested" weight condition, place it on a flat, level surface.
- ☒ Verify that the "As Tested" vehicle attitude measurements are equal to or within +/- 10 mm of the "Fully Loaded" vehicle attitude measurements at each wheel well. If any "As Tested" attitude measurements do not meet this requirement, adjust the load by shifting ballast, instrumentation, and/or cameras. If, after repeating these steps, any of the "As Tested" attitude measurements do not meet the requirement, contact the Technical Director.

Note: The "As Tested" vehicle attitude measurements shall be taken within an hour of impact to ensure the proper attitude is met.

Note: If the vehicle has an Auto-Leveling, the ignition must be set to the "on" position. If the vehicle is equipped with a self-adjusting hydraulic system, set the vehicle to the mode specified in the vehicle manufacturer's test setup information (Form1)

Tape Measure Unique Identifier:

Test Vehicle Attitudes and CG	Units	Fully Loaded	As Tested	Meets Requirements ***	
				Yes	No
Left Front	mm	673	674	Yes	
Right Front	mm	681	678	Yes	
Right Rear	mm	672	667	Yes	
Left Rear	mm	663	663	Yes	
Vehicle CG (Aft of Front Axle)	mm	1114			
Vehicle CG (Left(+)/Right(-) from Longitudinal Centerline)	mm	+34.5			

*** The "As Tested" vehicle attitude measurements must be equal to or within +/- 10 mm of the "Fully Loaded" vehicle attitude measurements at each wheel well.

Pre-Test Photos:

Performed By:

Amila Penn

Date:

12/14/2011

Note: Clear and properly focused digital still photographs in .jpg format with a minimum dots-per-inch (DPI) of 180 shall be taken. A vehicle information placard placed parallel with the camera, identifying the test vehicle model as well as the barrier and NHTSA number, along with an indication of whether the photo was taken pre-test shall appear in each photograph and be legible. All photographs must be in landscape view / orientation. **Reference sample photo set on network (if needed).**

Checklist: Photos With Driver Positioned in Vehicle

- ☒ No. 025 – Pre-Test Front Close-Up View of Driver Dummy *(taken through front windshield)*.
Note: Bubble level on head should be rotated so that the photo shows the dummy is sitting level in the seat from side to side.
- ☒ No. 031 – Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint. Note: Bubble level on head should be rotated so that the photo shows the dummy is sitting level in the seat from side to side.
- ☒ No. 027 – Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking (door open).
Note: Bubble level on head should be rotated so that the photo shows the dummy's head is level fore-aft.
- ☒ No. 028 – Pre-Test Left Side View of Driver Dummy Shoulder and Door Top View. Note: Bubble level on head should be rotated so that the photo shows the dummy's head is level fore-aft.
- ☒ No. 033 – Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan (should be taken through the steering wheel, if possible)
- ☒ No. 034 – Pre-Test Placement of Driver Dummy's Feet
- ☒ No. 035 – Pre-Test Left Side View of Belt Anchorage for Driver Dummy
- ☒ No. 036 – Pre-Test Left Side View of Steering Wheel
- ☒ No. 039 – Pre-Test Close-Up Left Side View of Driver Seat Track
- ☒ No. 040 – Pre-Test Close-Up Left Side View of Driver Seat Back *(Should show the test position of the seat back. Detent or millimeter markings should be shown and labeled)*
- ☒ No. 041 – Pre-Test Close-Up Left Side View of Driver Back or Head Restraint *(Should show test position and include a level)*
- ☒ No. 042 – Pre-Test Driver Dummy and Door Clearance View
- ☒ No. 044 – Pre-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment *(Should be taken through the vehicle with the right front passenger door open)*

Checklist: Photos With Rear Passenger Positioned in Vehicle

- ☒ No. 055 – Pre-Test Left Side View of Rear Passenger Dummy Showing Belt and Chalking (door open)
- ☒ No. 056 – Pre-Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View
- ☒ No. 059 – Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint
- ☒ No. 061 – Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan (should be taken through the steering wheel, if possible)
- ☒ No. 062 – Pre-Test View of Rear Passenger Dummy's Neck Showing Position of Adjustable Neck Bracket
- ☒ No. 063 – Pre-Test View of Rear Passenger Dummy's Head Showing Dummy's Head is Level *(A level should be in this photograph)*
- ☒ No. 064 – Pre-Test Placement of Rear Passenger Dummy's Feet
- ☒ No. 065 – Pre-Test Left Side View of Belt Anchorage for Rear Passenger Dummy
- ☒ No. 066 – Pre-Test Close-Up Left Side View of Rear Passenger Seat Track
- ☒ No. 067 – Pre-Test Close-Up Left Side View of Rear Passenger Seat Back *(Should show the test position of the seat back. Detent or millimeter markings should be shown and labeled)*
- ☒ No. 068 – Pre-Test Close-Up Left Side View of Rear Passenger Back or Head Restraint *(Should show test position and include a level)*
- ☒ No. 069 – Pre-Test Rear Passenger Dummy and Door Clearance View
- ☒ No. 071 – Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat of Occupant Compartment *(Should be taken through the vehicle with the right rear passenger door open)*

Checklist: Vehicle Surrounds

- ☒ No. 003 – Pre-Test Frontal View of Test Vehicle
- ☒ No. 005 – Pre-Test Left Front 3-4 View of Vehicle
- ☒ No. 007 – Pre-Test Left Side View of Test Vehicle (Struck Side)
- ☒ No. 009 – Pre-Test Left Rear 3-4 View of Test Vehicle
- ☒ No. 011 – Pre-Test Rear View of Test Vehicle
- ☒ No. 013 – Pre-Test Right Side View of Test Vehicle (Non-Struck Side)
- ☒ No. 021 – Pre-Test Left Front Door Latch Close-Up
- ☒ No. 023 – Pre-Test Left Rear Door Latch Close-Up



Checklist: Vehicle before Test Proceeds

- ☒ No. 082 – Pre-Test View of Fuel Filler Cap
- ☒ No. 094 – Pre-Test Ballast View

Pre-Test Video Checklist:

Performed By:

Amelia P...

Date:

12/14/20

Obtain pre-test real-time coverage of vehicle and dummies after final positioning:

Checklist: Videos of Vehicle

- ☒ View of front of vehicle
- ☒ Front ¾ view of struck-side of vehicle
- ☒ View of struck-side of vehicle
- ☒ Rear ¾ view of struck-side of vehicle
- ☒ View of rear of vehicle
- ☒ View of non-struck-side of vehicle

Checklist: Videos of Dummy Position (including, placement of lap and shoulder belt on the dummy)

- ☒ Left side view of ES-2re in front seat (struck-side door open)
- ☒ Left side view of SID-IIs in rear seat (struck-side door open)
- ☒ Left side view of ES-2re in front seat (struck-side door closed)
- ☒ Left side view of SID-IIs in rear seat (struck-side door closed)
- ☒ Right side view of ES-2re in front seat (non-struck-side door open)
- ☒ Right side view of SID-IIs in rear seat (non-struck-side door open)
- ☒ Right side view of ES-2re in front seat (non-struck-side door closed)
- ☒ Right side view of SID-IIs in rear seat (non-struck-side door closed)
- ☒ Cycling of air bag indicator light (to include full view of instrument panel)
- ☒ View of Passenger air bag indicator light (include the full view of instrument panel)
- ☒ Door closings (including any rear hatchback or tailgate)
- ☒ Lab technician installing fuel filler cap onto the filler neck and the rotation of the cap to the installed position.
- ☒ Real - Time Pan Coverage of Impact Event

Data Acquisition Software Setup:

Performed By:

SK

Date:

12/14/18

Checklist

- ☒ Verify signals from critical channels are operational and reasonable BEFORE installing ATD.
- ☒ Verify dummies are attached to data acquisition boxes and are grounded.
- ☒ Verify power and communication umbilicals are attached to the vehicle.
- ☒ Verify KT interface shows 30-36 volts at the vehicle.

Record Vehicle 1 Voltage: 36

Record Vehicle 2 Voltage: 36

- ☒ Verify KT data channels CAC's and polarities.
- ☒ Load the Autolab NCAP Side Impact Template.
- ☒ Add the ES2-re, SID-IIs, Vehicle, and Mobile Barrier assemblies to the Signals tab.
- ☒ Perform electrical check on Signals tab and verify there are no errors.

Record Number of Channels: 50

- ☒ Perform electrical check on Samplers tab and verify there are no errors.

Record Vehicle DAU Serial Numbers: 294 305

Record MDB DAU Serial Number 287

- ☒ Perform electrical check on Triggers tab to test the trigger and verify there are no errors.
- ☒ Select Auto-ID from the Signals tab and verify there are no transducers identified.

Verify Vehicle & Set-Up:

Performed By:

Amela Pura

Date:

12/14/200

Checklist:

- ☒ Verify vehicle battery power is sufficient without charger on (wait 1 minute then should have at least 12.75 volts and stable). Then turn charger back on.
- ☒ Verify speed trap is reset.
- ☒ Verify cameras are ready. (Cart, Onboard Vehicle & Off board Vehicle)
- ☒ Perform on board light system check.
- ☒ Verify no questions / concerns with set-up by Visitor(s).
- ☒ Windows – Verify that any movable windows and vents that are located on the struck side of the vehicle are in the fully closed position.
- ☒ Sunroof – Verify sunroof(s) are in the fully closed position.
- ☒ Convertible Tops – Verify that convertible tops are in the closed passenger compartment configuration (i.e. top-up).
- ☒ Confirm level 3 impact target vertical height (pull up on vehicle wheel wells to adjust if necessary) and record vehicle ride attitude.
- ☒ Verify all onboard cameras show power is on and functioning properly.
- ☒ Doors – Verify all doors (including a hatchback or tailgate) in the fully closed and latched position. Check instrument panel telltales just prior to the test to ensure that all doors and hatches are closed.
Note: If the test vehicle comes equipped with standard Automatic Door Locks (ADLs) and the vehicle owner's manual does not provide instructions on how to disable this feature (and only the dealer can deactivate the door locks), the struck-side doors shall be locked pre-test. If the vehicle owner's manual provides instructions on how to disable this feature, the struck-side doors should NOT be locked pre-test. If the test vehicle is not equipped with ADLs or if ADLs are considered optional equipment, the struck-side doors should NOT be locked pre-test. In all instances, non-struck-side doors should be unlocked pre-test.
- ☒ Transmission Engagement – Verify that manual transmissions are in 2nd gear and automatic transmissions are in neutral.
- ☒ Verify parking brake is engaged.
- ☒ Turn ignition on (assure the ignition is in the "power on" position) and have SRS light observed by visitor. Escort visitor to the Observation Area in the Crash Building.
- ☒ If there is any delay over 5 minutes, verify SRS light is still OK.
- ☒ Confirm fuel collectors are ready at the barrier.

Tow System & DAS Checklist:

Tow Engineer's Name:

Nitin

Date:

12/14/2017

DAS Engineer's Name:

Steve

Date:

12/14/2017

Note:

- For this test, the Tow Engineer will be referencing the Drive Operations checklist. This checklist should be placed at the end of this section.
- For this test, the DAS Engineer will be referencing the Data Acquisition checklist. This checklist should be placed at the end of this section.
- For this test, the DAS Engineer will be referencing the Data Processing and Quality Check checklist. This checklist should be placed at the end of this section.

Speed Requirement: 32.87 mph $\pm$ 0.5 mph

52.90 kph $\pm$ 0.80 kph



Go / No-Go to Execute Test:

Engineer's Name: Amila Pera

Date: 12/14/2019

Checklist

- ☒ Vehicle Preparation Complete
- ☒ ATD's Checked Out
- ☒ All Instrumentation has been Calibrated & Polarity / Electrical Checks have been conducted
- ☒ MDB Ready for Test
- ☒ Vehicle Aligned
- ☒ ATD Positioned & Measurements Taken
- ☒ ATD Chalked
- ☒ Cameras Set-up, Focused & Measured
- ☒ Pre-Test Photos and Video Taken
- ☒ Trigger Check
- ☒ Abort Check
- ☒ Speed Trap Check
- ☒ Safety Check
- ☒ Facility Ready for Test

- ☒ **READY** for test
- ☐ **NOT READY** to be tested

Date: 12/14/2019

- ☐ Corrections made now **READY** for test
- ☐ **NOT READY** for test

Date: _____

Impact Speed:

Performed By:

EP

Date:

12/14/2010

Checklist:

- ☒ Remind the DAS operator to look over the Quick Look to determine whether data is near its limits or not. If yes, the operator should look at the traces (i.e. spike or wave form). If a redundant exists, the redundant data should be reviewed to determine whether its traces are the same or different. If it is determined that something is not right with the primary, the operator should use the redundant in the Quick Look and to include a note in the comments section that the redundant was used.
- ☒ Immediately after impact, record the time of impact in the space provided below.
- ☒ Immediately after impact, take photo No. 093 – Post-Test Primary and Redundant Speed Trap Read-Out (primary and redundant speeds should be labeled and photo should include placard that displays NHTSA No.). *Reference sample photo set on network (if needed).*
- ☒ Immediately after impact, record the speed trap values in the space provided below.
- ☒ Take video of the primary and redundant speed traps (include NHTSA No. placard) displaying the test speed.
- ☒ Remind Tow operator to perform a screen capture to document the secondary display of the vehicle speed at impact should there be any issued with the display on the vehicle speed trap. Request file to be saved in the appropriate Track Runs folder on the network.

Time of Impact:

9:52 AM

Vehicle Speed Trap Readout:

52.68

kph

Primary

52.68

kph

Redundant

Speed Trap Unique Identifier:

400472

Laser Readout (Reference Point Only)

N/A

mph

Impact Location:

Performed By:

Ed Dutton

Date:

12/14/2018

Checklist:



Record the measurement and location of the impact in the spaces provided below

Impact Location:

377.5 mm

Actual impact point (aft of front axle)

8 mm

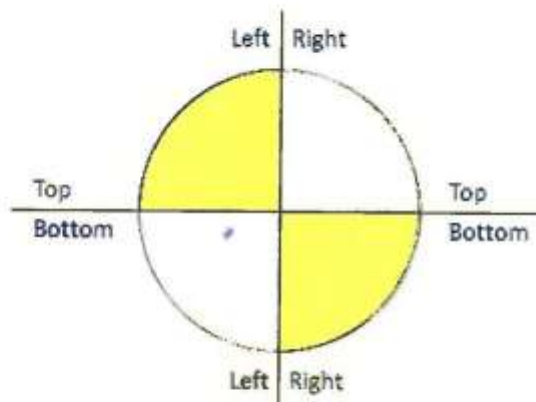
to Right / Left (Circle One)

3 mm

Up / Down (Circle One)

Tape Measure Unique Identifier:

Looking at the impacted target, draw / indicate the location of the impact on this illustration:



+/- 50 mm Horizontal ("+" = Forward, "-" = Rearward)
+/- 20 mm Vertical ("+" = Down, "-" = Up)

FMVSS 301 Post Impact:

Performed By:

Ed Sutton

Date:

12/14/2013

Checklist:

- ☒ Immediately after impact, record the temperature in the space provided below.
- ☒ Collect stoddard solvent spillage, if any, using the most efficient method available. Weigh the total amount of spillage.
- ☒ Take photo of post-test stoddard solvent spillage location, if observed.

FMVSS 301 Fuel System Integrity Post Impact Data:

70

°F Temperature at Time of Impact

Temperature Recorder Unique Identifier:	—
Fluid Measurement Unique Identifier:	—

Stoddard Solvent Spillage Measurements:

0	oz.	From impact until vehicle motion ceases (maximum allowable = 1 oz.)
0	oz.	For the 5-minute period after motion ceases (maximum allowable = 5 oz.)
0	oz.	For the following 25 minutes (maximum allowable = 1 oz./minute)
0	oz.	Spillage

Note: Keep the test vehicle under constant observation for Stoddard leakage during the transition between impact and static rollover testing. The static rollover test must be performed within 2 hours after the vehicle impact.

Post-Test Photos – Vehicle As Is:

Performed By:

Amila

Date:

12/14/2018

Note: Clear and properly focused digital still photographs in .jpg format with a minimum dots-per-inch (DPI) of 180 shall be taken. A vehicle information placard placed parallel with the camera, identifying the test vehicle model as well as the barrier and NHTSA number, along with an indication of whether the photo was taken pre-test shall appear in each photograph and be legible. All photographs must be in landscape view / orientation. Glare or light from any illuminated or reflective surface shall be minimized while taking photographs. *Reference sample photo set on network (if needed).*

Checklist: Vehicle

- ☒ No. 004 – Post-test Frontal View of Test Vehicle
- ☒ No. 006 – Post-Test Left Front 3-4 View of Test Vehicle
- ☒ No. 008 – Post-Test Left Side View of Test Vehicle
- ☒ No. 010 – Post-Test Left Rear 3-4 View of Test Vehicle
- ☒ No. 012 – Post-Test Rear View of Test Vehicle
- ☒ No. 014 – Post-Test Right Side View of Test Vehicle
- ☒ No. 016 – Post-Test Overhead View of Test Area (to include test vehicle and MDB, if possible)
- ☒ No. 020 – Post-Test Close-Up View of Impact Point Target Showing Impact Location (impact reference line and impact point should be clearly indicated)
- ☐ N/A No. 022 – Post-Test Left Front Door Latch Close-Up
- ☐ N/A No. 024 – Post-Test Left Rear Door Latch Close-Up
- ☐ N/A No. 083 – Post-Test View of Fuel Filler Cap or Fuel Filler Neck
- ☒ No. 095 – Post-Test Primary and Redundant Speed Trap Read-Out

Checklist: Photos of MDB

- ☒ No. 085 – Post-Test Front View of MDB Impactor Face
- ☒ No. 087 – Post -Test Top View of MDB Impactor Face
- ☒ No. 089 – Post -Test Left Side View of MDB Impactor Face
- ☒ No. 091 – Post -Test Right Side View of MDB Impactor Face

Checklist: With Dummy's Positioned in Vehicle

- ☒ No. 026 – Post-Test Front Close-Up View of Driver Dummy *(taken through front windshield)*
- ☒ No. 029 – Post -Test Left Side View of Driver Dummy Shoulder and Door Top View
- ☒ No. 043 – Post -Test Driver Dummy and Door Clearance View
- ☒ No. 045 – Post -Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment *(Should be taken through the vehicle with the right front passenger door open)*
- ☒ No. 057 – Post -Test Left Side View of Rear Passenger Dummy Shoulder and Door Top View
- ☒ No. 070 – Post -Test Rear Passenger Dummy and Door Clearance View
- ☒ No. 072 – Post -Test Right Side View of Rear Passenger Dummy and Rear Seat of Occupant Compartment *(Should be taken through the vehicle with the right front passenger door open)*

Post-Test Video – Vehicle As Is:

Performed By:

Alex

Date:

12/14/16

Checklist: With Dummy's Positioned in Vehicle

- ☒ View of Primary and redundant speed traps (include NHTSA No. Placard)
- ☒ Vehicle – View of Front of Vehicle
- ☒ Vehicle – View of Front ¾ View of Struck Side
- ☒ Vehicle – View of Struck Side
- ☒ Vehicle – View of Impact Point (Close-Up)
- ☒ Vehicle – View of Rear ¾ of Struck Side
- ☒ Vehicle – View of Rear
- ☒ Vehicle – View of Non-Struck Side
- ☒ Dummy – View of Front ES-2re – Parallel to Impact Door
- ☒ Dummy – View of Rear SID-IIs – Parallel to Impact Door
- ☒ Dummy – View of Front ES-2re – Through Opposite Window
- ☒ Dummy – View of Rear SID-IIs – Through Opposite Window

Post-Test Hand Measurements:

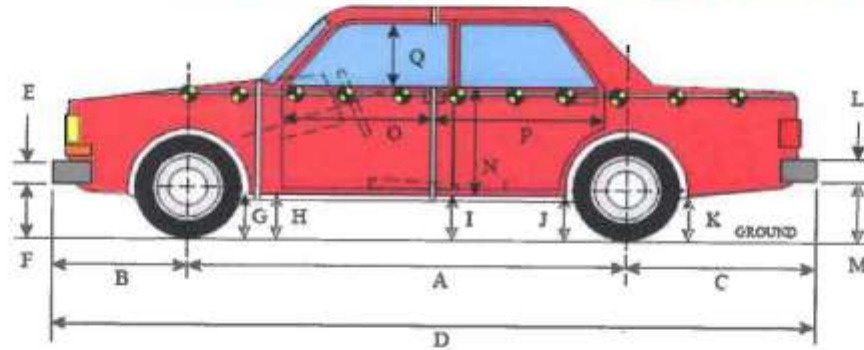
Performed By:

Ed

Date:

12/14/2018

Note: All measurements must be taken in the As Tested Condition (Fully loaded with instrumentation & ATDs)



Tape Measure Unique Identifier:

Checklist

- | | | | |
|---|----|--|--------|
|  | E | Front Bumper Thickness - (The vertical height of the front bumper fascia) | 105 mm |
|  | F | Front Bumper Bottom to Ground - (Vertical distance from ground to the bottom of the front bumper fascia) | 413 mm |
|  | G | Sill Height at Front Wheel Well - (Vertical distance from ground to the sill at the front wheel well opening) | 173 mm |
|  | H | Sill Height at Front Door Leading Edge - (Vertical distance from ground to the sill at the front door seam) | 155 mm |
|  | I | Sill Height at B-Pillar - (Vertical distance from ground to the sill in line with the front door striker or B-pillar if no striker exists) | 152 mm |
|  | J1 | Sill Height at Rear Wheel Well - (Vertical distance from ground to the sill at the rear wheel well opening) | 184 mm |
|  | J2 | Pinch Weld Height at Rear Wheel Well - (Vertical distance from ground to the pinch weld at the rear wheel well opening) | 162 mm |
|  | K | Sill Height Aft of Rear Wheel Well - (Vertical distance from ground to the vehicle sheet body at the rear of the rear tire's wheel well) | 538 mm |
|  | L | Thickness or height of rear bumper at center. | 70 mm |
|  | M | Distance from bottom of bumper to ground at center. | 421 mm |

Post-Test Photos – ATDs Removed

Performed By:

Amela P

Date:

12/14/18

Note: Clear and properly focused digital still photographs in .jpg format with a minimum dots-per-inch (DPI) of 180 shall be taken. A vehicle information placard placed parallel with the camera, identifying the test vehicle model as well as the barrier and NHTSA number, along with an indication photo was taken post-test. All photographs must be in landscape view / orientation. Glare or light from any illuminated or reflective surface shall be minimized while taking photographs. **Reference sample photo set on network (if needed).**

Checklist: With Dummy's Not in Vehicle

- ☒ No. 047 – Post-Test Driver Inner Door Panel View Showing Driver Dummy Contact Locations
(Should be taken through the vehicle with the right front passenger door open)
- ☐ No. 048 – Post -Test Driver Dummy Close-Up Head Contact with Vehicle View
- ☐ No. 049 – Post -Test Driver Dummy Close-Up Head Contact with Side Air Bag View
- ☐ No. 050 – Post -Test Driver Dummy Close-Up Torso Contact with Vehicle Interior View
- ☐ No. 051 – Post -Test Driver Dummy Close-Up Torso Contact with Side Air Bag View
- ☐ No. 052 – Post -Test Driver Dummy Close-Up Pelvis Contact View
- ☐ No. 053 – Post -Test Driver Dummy Close-Up Pelvis Contact with Side Air Bag View
- ☐ No. 054 – Post -Test Driver Dummy Close-Up Knee Contact View
- ☒ No. 074 – Post -Test Rear Passenger Inner Door Panel View Showing Rear Passenger Contact Locations (Should be taken through the vehicle with the right rear passenger door open)
- ☐ No. 075 – Post -Test Rear Passenger Dummy Close-Up Head Contact with Vehicle View
- ☐ No. 076 – Post -Test Rear Passenger Dummy Close-Up Head Contact with Side Air Bag View
- ☐ No. 077 – Post -Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Interior View
- ☐ No. 078 – Post -Test Rear Passenger Dummy Close-Up Torso Contact with Side Air Bag View
- ☐ No. 079 – Post -Test Rear Passenger Dummy Close-Up Pelvis Contact View
- ☐ No. 080 – Post -Test Rear Passenger Dummy Close-Up Pelvis Contact with Side Air Bag View
- ☐ No. 081 – Post-Test Rear Passenger Dummy Close-Up Knee Contact View
- ☒ No. 101 – Impact Event

Post-Test Video – ATDs Removed

Performed By:

Alex R

Date:

12/14/18

Note: Clear and properly focused digital video shall be taken. A vehicle information placard should be placed parallel with the camera, identifying the test vehicle model, NHTSA number, along with an indication of post-test. All videos must be in landscape view / orientation. Glare or light from any illuminated or reflective surface shall be minimized while taking video.

Video Checklist

- ☒ Air bags - View of struck side of vehicle (dummy removed)
- ☒ Air bags - View of inside front door showing chalk marks on air bag(s) (dummy removed)
- ☐ Air bags - View of inside rear door showing chalk marks on air bag(s) (dummy removed)
- ☒ MDB – View of Left Side of MDB
- ☒ MDB – View of Front of MDB
- ☒ MDB – View of Right Side of MDB
- ☒ MDB – Overhead View of MDB and Vehicle
- ☒ Any Vehicle failures or anomalies (show tape measure from latch to door is door opening)

Post-Test Observations

Performed By: _____

Date: _____

Dummy Contact Points

Prior to removing the ATD from the vehicle, note the locations where ATD body parts made contact with the vehicle's door, interior components, other body parts, and air bags, as indicated by chalk markings that have transferred to the contacted surfaces. Where applicable, confirm contact these locations by using high speed video analysis.

Instructions: Please completely fill in the below tables. Include any observations and be descriptive as possible. If no contact occurred for a particular body region, indicate as "No contact". If unsure, take additional photographs.

Dummy Contact Location	Driver	Rear Passenger
Face Contact	Curtain AB	N/A - Ballast ATD
Top of Head Contact	Headliner - Side	
Left Side of Head Contact	Side Header + Curtain AB	
Back of Head Contact	Side Header + Headrest	
Left Shoulder Contact		
Upper Torso Contact	Torso AB + Seatback	
Lower Torso Contact	Seatback	
Left Knee Contact	Driver Door	
Left Hip Contact		

Doors

For each door, note whether: the door remained closed and operational, whether the door totally separated from the vehicle at the hinges or latches, the door disengaged from the latched position, the latch separated from the striker, the hinge components separated from each other, the latch or hinge systems pulled out of their anchorages, or the door was jammed shut. All applicable conditions should be noted. Video analysis should also be used to verify whether any door, including the rear hatch, opened during the impact event.

Checklist:

- ☒ Inspect the door at the striker, if the door is open at the striker post, take measurements of the door opening at the location and record it in the space provided below.

0 mm

- ☒ Inspect the If there is a failure with any door, door component, or door opening, notify the Data Processing Engineer to include such information on the Quick Look Report.

Instructions: For the next two tables, indicate "Yes", "No" or "N/A"

Post Test Door Performance	Struck Side		Non-Struck Side		Rear Hatch / Other Door
	Front	Rear	Front	Rear	
Remained closed and operational	N	N/A	Y	Y	Y
Total separation from vehicle at hinges or latches	N	N/A	N	N	N
Latch or hinge systems pulled out of their anchorages	N	N/A	N	N	N
Latch separated from striker	N	N/A	N	N	N
Jammed shut	Y	N/A	N	N	N
If door opened at striker, record width of opening at striker (mm)	0	0	0	0	0

Seat Movement and Structural Observations

In the space provided below, note any seat or seat back movement or disengagement. Also, note any structural observations pertaining to the pillars, sill, window, and windshield. In particular, describe the amount of deformation to the struck-side pillars and struck side sill. Note whether there was damage to the front windshield area and if so, where the damage occurred. A similar assessment should be made for the side windows. Any other notable effects from the impact should also be indicated.

Instructions: For the next two tables, indicate "Yes", "No" or "N/A"

Post Test Seat Performance	Struck Side		Non-Struck Side	
	Front	Rear	Front	Rear
Seat movement along seat track	N	N	N	N
Seat disengagement from floor pan	N	N	N	N
Seat back movement from initial position	N	N	N	N
Seat back collapse	N	N	N	N

Post Test Structural Observations	Observations and Conclusions
Pillar performance	Remained in Good Condition
Sill separation	None
Windshield damage	None
Side window damage	Driver Window Shattered
Other notable effects	None

Supplemental Restraint Systems

In the space provided below, note whether the vehicle was equipped with the supplemental restraint systems listed and the deployment status of each associated restraint system. Verify that the restraint systems for the driver occupant deployed within 20 ms of impact using high speed video analysis, and provide descriptive comments for any air bag that failed to deploy, deployed late, or appeared not to have inflated to full volume during impact.

Supplemental Restraint System	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal airbag	Y	N		
Knee airbag	N	N/A		
Curtain Airbag	Y	Y	Y	Y
Torso/Pelvis Airbag	N	N/A	N	N/A
Torso Airbag	Y	Y	N	N/A
Seat belt pretensioner	Y	Y	N	N/A
Seat belt load limiter	Y	Y	N	N/A
Other	-	-	-	-

Checklist

- ☒ Verify with DAS operator that all ATD and sensor data has been successfully downloaded before disconnecting any power or data cabling.
- ☒ Verify with DAS operator that there are no questionable channels. If questionable channels exist, inspect connection between Lemo and DAS. Note any observations below.

Lemo IDs / Channels	Observations
10BPILLELOO00AC	Exceeded calibration range
10BPILLEMI00ACYP	Exceeded calibration range

- ☒ Verify with Technician that all high speed video data has been successfully downloaded before disconnecting any power or data cabling.
- ☒ Download vehicle temperature data.
- ☒ Carefully remove all zip ties, tape, and any additional cabling tie downs ensuring not to damage any instrumentation. Disconnect ATDs lemos from DAS and remove from vehicle.
- ☒ Disconnect ATDs lemos from DAS and carefully remove ATDs from vehicle.
- ☒ Power down onboard cameras by pressing power button twice and disconnect cabling.



Post-Test Datasheet

Performed By:

Anita P

Date:

12/14/18

Test Notes:

None

Data Anomalies Noted:

Left B-Pillar Lower Y + Middle Y exceeded Calibration Range

ATD Damage:

None

Critical Results:

Engineer's Name: _____

VH

Date: _____

12/14/18

The following deliverables were met:

- ☒ Impact speed within ^{52.9}~~61.9~~ km/h ± 0.8 km/h (^{32.7}~~38.5~~ mph ± 0.5 mph).

Dummy Injury Data: (Using the Quick Look generated following instructions in Deliverables section)

- ☒ Head – Head Injury Criterion (HIC) (36) may not exceed 1000. (ES2re & SID IIs)
- ☒ Lower Spine – The resultant spine acceleration may not exceed 82 g. (ES2re & SID IIs)
- ☒ Chest – The max rib deflection may not exceed 44 mm (1.73 in) (ES2re)
- ☒ Abdominal – The max total of abdominal forces shall not exceed 2,500N (562 lbs). (ES2re)
- ☒ Pelvis – The peak pubic symphysis force shall not exceed 6,000 N (1350 lbs). (ES2re)
- ☒ Pelvis – The sum of acetabulum and iliac pelvic forces may not exceed 5,525 N (1,242 lb.). SID IIs

Door Opening Criteria

- ☒ Any side door that is struck by the MDB shall not separate totally from the vehicle.
- ☒ Any door (including a rear hatchback or tailgate) that is not struck by the MDB must meet the following requirements:
 - The door shall not disengage from the latched position.
 - The latch shall not separate from the striker, and the hinge components shall not separate from each other or from their attachment to the vehicle.
 - Neither the latch nor the hinge systems of the door shall pull out of their anchorages.

FMVSS NO. 301 – Stoddard Spillage

- ☒ Due To MDB Barrier Crush:
Stoddard spillage shall not exceed 28 g from impact until motion of the vehicle has ceased, and shall not exceed a total of 142 g in the 5-minute period following cessation of motion. For the subsequent period of time that elapses prior to the static rollover, fuel spillage during any 1 minute interval shall not exceed 28 g.
- ☒ DUE TO STATIC ROLLOVER:
Stoddard spillage in any rollover test, from the onset of rotational motion, shall not exceed a total of 142 g for the first 5 minutes of testing at each successive 90° increment. For the remaining test period, at each increment of 90°, Stoddard spillage during any 1 minute interval shall not exceed 28g.

Comments:



Notify Customer – Test Executed:

Engineer's Name:

Amila P

Date:

12/14/16

Informed COTR that test was conducted:



Via e-mail

Date:

12/14/16



Via voice mail message



Via live conversation

TOM Comments:

FMVSS 301 Static Rollover:

Performed By: VH

Date: 12/14/18

Reminders

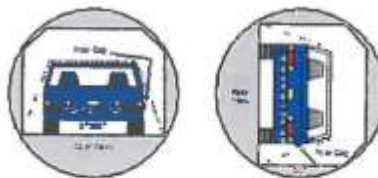
- ☒ **Note:** Test should occur within 2 hours of the impact event.
- ☐ Keep the test vehicle under constant observation for Stoddard or leakage during the transition between impact and static rollover tests.
- ☐ **Note: If any of the following occurs, contact the Test Engineer for direction:**
 - There is an indication of a test anomaly or door opening;
 - The vehicle exceeds any of the injury criteria stipulated by FMVSS No. 214 during the side impact MDB test;
 - The vehicle exceeds maximum allowable solvent requirements in accords with FMVSS No. 301 post-impact;
- ☐ To avoid damage to the underbody of the test vehicle when moving the vehicle to the static rollover device, ensure that the forklift is only permitted to make contact with the body sills of the vehicle. Accordingly, it may be necessary to place a stabilizer block made of rubber, wood, or polypropylene between the body sills and the forks of the forklift. This is particularly important for electric vehicles in order to avoid electric shock.
- ☐ Carefully secure the test vehicle on the static rollover device so as not to cause any damage to fuel system components or fuel lines.
- ☐ **Note:** The test vehicle should be rotated on the Static Rollover Device to each successive increment of 90° through 360° at a uniform rate, with a full 90° of rotation taking place in any time interval from 1 to 3 minutes. After reaching each 90° increment the vehicle is held in that position for 5 minutes.

Checklist

- ☐ Take photograph No. 094 – FMVSS No. 301 Static Rollover 0 Degrees. **Reference sample photo set on network (if needed).**
- ☐ Take video of vehicle at 0° (before rotating).
- ☒ Using a stopwatch, record the time required to rotate the vehicle clockwise for the first 90° increment. Enter this time in the space provided below.

Solvent Collection Time Table

Increment	Rotation Time (Seconds)
0° to 90°	—



0° TO 90°

Checklist

- ☒ Hold the vehicle in this position for 5 minutes after rotation ends.
- ☐ Take real time video, View of static rollover – 90 degrees
- ☐ Take photograph No. 096 – FMVSS No. 301 Static Rollover 90 Degrees. *Reference sample photo set on network (if needed).*
- ☒ Collect Stoddard solvent spillage, if any, from the onset of rotation or the time rotation began up to 5 minutes thereafter and record in the table provided below. *Note: If there is an indication of a test failure during any 90° increment of the rollover test, immediately contact the Test Engineer for further instruction.*

Spillage & Location

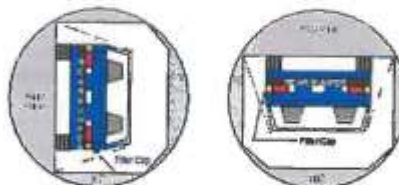
Test Phase	First 5 Minutes	Spillage Location
0° to 90°	—	—

Checklist

- ☒ Using a stopwatch, record the time required to rotate the vehicle clockwise to the 180° increment. Enter this time in the space provided below.

Solvent Collection Time Table

Increment	Rotation Time (Seconds)
90° to 180°	—



90° TO 180°

Checklist

- ☒ Change collection containers. Record any spillage that occurs during the 6th minute after the onset of rotation or when rotation began and record in the table provided below.
- ☐ If required, change collection containers. Record any spillage that occurs during the 7th minute after the onset of rotation or when rotation began and record in the table provided below.
- ☒ If required, change collection containers. Record any spillage that occurs during the 8th minute after the onset of rotation or when rotation began and record in the table provided below.

FMVSS 301 Spillage Table

Test Phase	Sixth Minute	Seventh Minute	Eighth Minute
90° to 180°	—	—	—

Checklist

- ☐ Hold the vehicle in this position for 5 minutes after rotation ends.
- ☒ Take real time video, View of static rollover – 180 degrees

☒ Take photograph No. 097 – FMVSS No. 301 Static Rollover 180 Degrees. *Reference sample photo set on network (if needed).*

☒ Collect Stoddard solvent spillage, if any, from the onset of rotation or the time rotation began up to 5 minutes thereafter. *Note: If there is an indication of a test failure during any 90° increment of the rollover test, Immediately contact the Test Engineer for further instruction.*

Spillage & Location

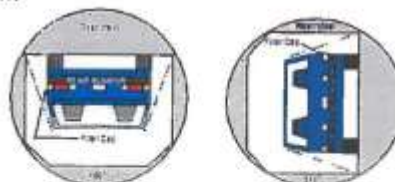
Test Phase	First 5 Minutes	Spillage Location
90° to 180°	—	—

Checklist

☒ Using a stopwatch, record the time required to rotate the vehicle clockwise for the first 270° increment. Enter this time in the space provided below.

Solvent Collection Time Table

Increment	Rotation Time (Seconds)
180° to 270°	—



180° TO 270°

Checklist

☒ Change collection containers. Record any spillage that occurs during the 6th minute after the onset of rotation or when rotation began and record in the table provided below.

☐ If required, change collection containers. Record any spillage that occurs during the 7th minute after the onset of rotation or when rotation began and record in the table provided below.

☒ If required, change collection containers. Record any spillage that occurs during the 8th minute after the onset of rotation or when rotation began and record in the table provided below.

FMVSS 301 Spillage Table

Test Phase	Sixth Minute	Seventh Minute	Eighth Minute
180° to 270°	—	—	—

Checklist

☒ Hold the vehicle in this position for 5 minutes after rotation ends.

☐ Take real time video, View of static rollover – 270 degrees

☐ Take photograph No. 098 – FMVSS No. 301 Static Rollover 270 Degrees. *Reference sample photo set on network (if needed).*

☒ Collect Stoddard solvent spillage, if any, from the onset of rotation or the time rotation began up to 5 minutes thereafter. *Note: If there is an indication of a test failure during any 90° increment of the rollover test, Immediately contact the Test Engineer for further instruction.*

Spillage & Location

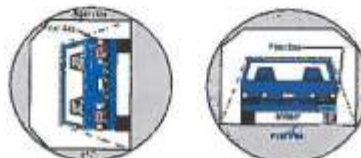
Test Phase	First 5 Minutes	Spillage Location
180° to 270°	—	—

Checklist

- ☒ ☒ Using a stopwatch, record the time required to rotate the vehicle clockwise for the first 360° increment. Enter this time in the space provided below.

Solvent Collection Time Table

Increment	Rotation Time (Seconds)
270° to 360°	—



Checklist

- ☒ ☒ Change collection containers. Record any spillage that occurs during the 6th minute after the onset of rotation or when rotation began and record in the table provided below.
- ☐ If required, change collection containers. Record any spillage that occurs during the 7th minute after the onset of rotation or when rotation began and record in the table provided below.
- ☒ If required, change collection containers. Record any spillage that occurs during the 8th minute after the onset of rotation or when rotation began and record in the table provided below.

270° TO 360°

FMVSS 301 Spillage Table

Test Phase	Sixth Minute	Seventh Minute	Eighth Minute
270° to 360°	—	—	—

Checklist

- ☒ ☒ Hold the vehicle in this position for 5 minutes after rotation ends.
- ☐ Take real time video, View of static rollover – 360 degrees. Note: final frame should state "The End"
- ☐ Take photograph No. 099 – FMVSS No. 301 Static Rollover 360 Degrees. *Reference sample photo set on network (if needed).*
- ☒ Collect Stoddard solvent spillage, if any, from the onset of rotation or the time rotation began up to 5 minutes thereafter. *Note: If there is an indication of a test failure during any 90° increment of the rollover test, Immediately contact the Test Engineer for further instruction.*

Spillage & Location

Test Phase	First 5 Minutes	Spillage Location
270° to 360°	—	—

Note: PASS OR FAIL CRITERIA - Stoddard solvent spillage, from the onset of rotational motion, shall not exceed a total of 142 grams for the first 5 minutes of testing at each successive 90° increment. For the remaining testing period, at each increment of 90°, solvent spillage during any 1-minute interval shall not exceed 28 grams.

Post Test Measurements

Performed By:

Jasen Pely

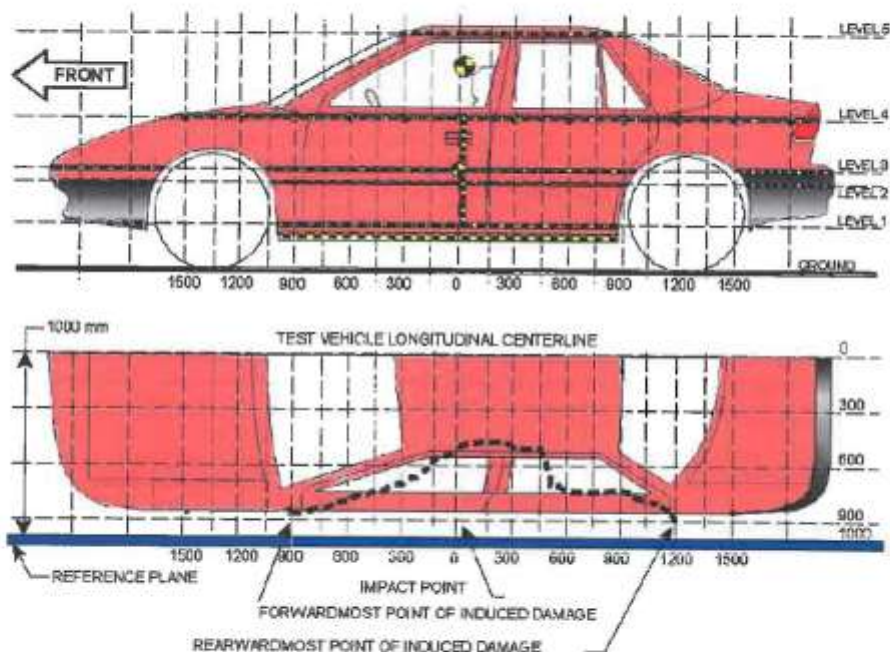
Date:

12/14/16

FARO Unique Identifier:

Checklist

- ☒ Using the FARO arm, take Level 1 measurements every 150 mm (i.e. L1 900P to L1 2850P) - Top of side sill (top edge of the tapeline)
- ☒ Using the FARO arm, take Level 2 measurements every 150 mm (i.e. L2 900P to L2 2850P) - Occupant Hip Point (top edge of the tapeline)
- ☒ Using the FARO arm, take Level 3 measurements every 150 mm (i.e. L3 900P to L3 2850P) - Mid-door (top edge of the tapeline)
- ☒ Using the FARO arm, take Level 4 measurements every 150 mm (i.e. L4 900P to L4 2850P) - Window sill (top edge of the tapeline)
- ☒ Using the FARO arm, take Level 5 measurements every 150 mm (L5 900P to L5 2850P) - Top of window (top edge of the tapeline)



Left Side View – All measurements in (mm) with tolerance of +/- 3 mm

Checklist

	FARO ID	
☒	LFWP	Left Front Wheel
☒	LRWP	Left Rear Wheel
☒	RFWP	Right Front Wheel
☒	RRWP	Right Rear Wheel
☒	RFRONTP	Right Front
☒	CFRONTP	Center of Front
☒	LFRONTP	Left Front
☒	RREARP	Right Rear
☒	CREARP	Center of Rear
☒	LREARP	Left Rear
☒	NUPP	N Upper Point
☒	NLOWP	N Lower Point
☒	O FRNTP	O Front Point
☒	OPMIDP	O Rear Point / P Front Point
☒	P REARP	P Rear Point
☒	QUPP	Q Top Point
☒	QLOWP	Q Bottom Point
☒	RBPWP	Right B Pillar Point (<i>Taken at vertical tangency point</i>)
☒	LBPWP	Left B Pillar Point (<i>Taken at vertical tangency point</i>)
☒	P1 STRIKERP	Center of P1 Striker Bolt
☒	P2 STRIKERP	Center of P Striker Bolt

Post-Test Vehicle Instrumentation Inspection:

Performed By: Steve Keller

Date: 12/14/15

To ensure quality data and prevent future issues, any questionable channels must be evaluated before instrumentation is unplugged or removed from the vehicle.

Checklist

- ☒ Verify that processed crash test data has been reviewed to determine questionable vehicle channels. Place a copy of this email after this section.

Data reviewed by: Mike

Date: 12/14/15

Was there any Questionable Channels? (check only one):

- ☒ Yes, there are questionable vehicle channels. If yes, complete the following Troubleshooting sections (Physical Inspection, Electrical Inspection) and the Summary table, before removing any instrumentation).
- ☐ No, there are no questionable vehicle channels to inspect. If no, place an "N/A" through the Trouble shooting sections and proceed with instrumentation removal.

Troubleshooting: Physical Inspection Checklist

Note: If there are any visible concerns, photos should be taken and placed in the appropriate track runs folder on the network.

- ☒ Visually inspect questionable transducers, cabling, and connectors for potential damage.
- ☒ Confirm the physical attachment between the questionable transducers and vehicle.
- ☒ Inspect the area around the questionable transducers for objects that may have impacted the transducer during the test.
- ☒ Confirm the questionable transducers' connectors are locked into the data acquisition hardware.
- ☒ Photos have been taken and saved

Troubleshooting: Electrical Inspection Checklist

- ☒ Connect power and data cables to the data acquisition units and reload the actual crash Autolab test setup.
- ☒ Click "Continue Series" to open a new test with the same parameters.
- ☒ Perform an electrical check on the signals tab and compare offset values to the crash test offsets.
- ☒ Open the scope live view in Autolab and perform a "shake test" on the connector and cable to the transducer.
- ☒ Perform physical action to view the live data from the transducer (Tap accelerometers, press on load cells).

Troubleshooting: Summary Checklist



Enter findings below in the summary table, tag damaged transducers with a description of damage, and place in the "Repairs" bin in the VERF storage room. If immediate repairs are required, deliver the damaged transducer to the ATD laboratory.

Troubleshooting: Summary Table

Questionable Channel Name*	Questionable Duration*	Serial Number*	Diagnosis
10B PILLER LAGACY P		A189600	Impact Zone
16B PILLER MID ACT P		A229239	Impact Zone

*Fields are provided by on the attached questionable channels email

Instrumentation Removal checklist:



Remove all instrumentation and cables from the vehicle.



Inspect and tag any damaged trigger cables, battery monitor cables, camera cables, DAU cables, start-record cables, and brake abort cables



Test accelerometers for function using a signal conditioner coupled to oscilloscope in the storage room



Verify that physical locks on LEMO connectors lock appropriately



Verify that the signal conditioner value reads under 0.4V



Verify that tapping the accelerometer results in an oscilloscope spike



Verify that cable insulation is intact



Verify that accelerometers are not crushed or deformed from battery acid



Any accelerometers that do not pass these 5 tests are to be labeled and placed in the "Repairs" bin



Inspect and tag damaged trigger cables, battery monitor cables, camera cables, DAU cables, start-record cables, and brake abort cables



Test accelerometers for function using a signal conditioner coupled to oscilloscope in the storage room

Note : If you see any questionable instrumentation or cabling that you are unsure of or cannot repair, please notify the ATD Laboratory to inspect.

Dummy Post Test Inspection:

Post-test ATD inspection is conducted in the ATD Lab, where all required documentation is completed and filed for future reference. This includes but is not limited to all physical and electrical inspections and repairs. Refer to the binders that accompany the specific ATDs utilized in this test.

Equipment Removal & Inspection

Performed By:

Larry Hunter

Date:

12-15-18

Checklist:

- ☒ Remove airbag monitoring cables. Inspect for damage and place in the appropriate "Repair" or "Needs Tested" bin.
- ☒ Remove onboard cameras, lights, mounts, and check for damage. Make any necessary repairs.
- ☒ Remove battery monitor box and trigger cable. If trigger cable is damaged, discard. If no visible damage, place in "Needs Tested" bin.
- ☒ Remove all DAS equipment and inspect for damage. If no damage is found, either put in next test vehicle or in DAS storage cabinet.
- ☒ Once DAS and all cabling have been removed and accounted for, remove instrumentation plate from the vehicle. Save all hardware and place back into the appropriate storage bins.
- ☒ Connect portable 12v battery to the fuel pump. Then begin draining stoddard back into the barrel labeled "Stoddard".
- ☒ Once all test equipment and instrumentation has been removed, clean out any debris from the test vehicle.

Test Vehicle Storage

Performed By:

TOM PETER

Date:

12/17/15

Checklist:

- ☒ Place inside the vehicle (preferably in the trunk) only the components that were removed from this test vehicle.
- ☒ Write the last 4 numbers of the vehicle's VIN and the NHTSA number on the vehicle's roof in paint pen.
- ☒ Cover the test placard with clear packaging tape to protect the label from the elements
- ☒ Raise all windows on the test vehicle and close any hatches (if possible). Exposed openings should be covered with a covering that will protect the test vehicle from the elements for a period of one year (example: self-adhesive polyethylene plastic film).
- ☒ Write last 4 numbers of the vehicle's VIN and the NHTSA number on the deformable barrier in paint pen.
- ☒ At the appropriate time, securely attach via screws the deformable barrier to the truck of the test vehicle.
- ☒ Using the fork truck, pick up the vehicle using wood blocks between the forks and vehicle's frame. Make sure to leave room between the fork truck's mast and the side of the vehicle.
- ☒ Place vehicle in boneyard leaving enough space between vehicles so that the doors can be opened.
- ☒ Document the vehicle's location in the boneyard excel sheet and input all required vehicle information for contract.

P:\verf support\Databases\Bone Yard

Deliverable Summary:

Test Deliverable	Procedure Section	File Format & Naming Convention	Time Requirement	Submit Via	Submit To
QuickLook Report	13.5, B	.pdf with filename format: <NHTSANO><Model Year><Make & Model><Body><SPNCAP>-Quicklook.pdf	One (1) day from test	E-mail	OCWS
Data Tape	13.5, C	.zip with filename format: <NHTSANO><Model Year><Make & Model><Body><SPNCAP>-DataTape.zip	Three (3) business days from test	E-mail	OCWS
Quality Control Package (QuickLook Report, Report of Vehicle Condition form, data tape, web photo and video, high speed and real time videos, all pre- and post-test photographs, and dummy calibration data)	13.5, D	.zip with filename format: <NHTSANO><Model Year><Make & Model><Body><SPNCAP>-QCPackage.zip	Five (5) business days from test	FTP	FTP
Draft Test Report	13.5, E	.pdf with filename format: <NHTSANO><Model Year><Make & Model><Body><SPNCAP>-DraftReport.pdf	Two (2) weeks from test date	E-mail/FTP depending on file size	OCWS/ FTP
Final Test Report, photos, and high speed and real time videos	13.5, F	.zip with filename format: <NHTSANO><Model Year><Make & Model><Body><SPNCAP>-FinalDeliverables.zip	Two (2) weeks after receiving corrections to preliminary test report	FTP	FTP

Conversions:

SI* (MODERN METRIC) CONVERSION FACTORS				
Table of APPROXIMATE CONVERSIONS TO SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in ²	square inches	645.2	square millimeters	mm ²
ft ²	square feet	0.093	square meters	m ²
yd ²	square yards	0.836	square meters	m ²
ac	acres	0.405	hectares	ha
mi ²	square miles	2.59	square kilometers	km ²
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft ³	cubic feet	0.028	cubic meters	m ³
yd ³	cubic yards	0.765	cubic meters	m ³
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE				
°F	Fahrenheit	$5 \times (F-32) \div 9$ or $(F-32) \div 1.8$	Temperature is in exact degrees Celsius	°C
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m ²	cd/m ²
Force and Pressure or Stress				
lbf	pound-force	4.45	newtons	N
lbf/in ²	pound-force per square inch	6.89	kilopascals	kPa

Revision History:

Revision Level:	Revision Date:	Comments:
00	7/19/13	Initial Issue as Work Instruction Test Template
01	4/18/2014	- Revised order of tasks to improve process flow. - Updated MDB set up photos - Removed redundant tasks that were not needed - Updated weight sections to refer to Form1 if there is an auto leveling system instead of the COTR - Confirmed all photos and video lists were up to date with new procedure - Updated Data Acquisition section to go along with new Autolab software
02	5/16/2014	Added additional content in the following sections: - Vehicle Instrumentation Calibration - Vehicle Instrumentation Polarity Check - ATD Confirmation - MDB Instrumentation Calibration - MDB Instrumentation Polarity Check - Data Acquisition Software Set-Up - Created new sections corresponding which each deliverable. - Refined order to improve efficiency.
03	5/19/2014	- Added dimension to clarify distance for inch tape. - Clarified seat setting instructions - Removed reference weight note
04	6/19/2017	Added the required documentation to be ISO 17025 and reorganized the mechanical preparation section.

Approved:

Ed Dutton, Crash Operations Manager

Date: ____/____/17