

**RESEARCH FMVSS 214
RIGID POLE SIDE IMPACT TEST**

**HYUNDAI MOTOR MANUFACTURING ALABAMA, LLC
2020 Hyundai Santa Fe**

**PREPARED BY:
Transportation Research Center Inc.
10820 State Route 347
P. O. Box B-67
East Liberty, OH 43319**



Report Date: October 20, 2021

FINAL REPORT

**PREPARED FOR:
Vehicle Research and Test Center
P. O. Box 37
East Liberty, OH 43319**

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Project Manager, John Shultz

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Allison Loudon
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Vehicle Research & Test Center

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16. Abstract A 31.00 km/h, 75° Oblique Rigid Pole Research Side Impact Test was conducted on the subject 2020 Hyundai Santa Fe in accordance with the specifications of the Laboratory Test Procedure for the Research Side Impact Rigid Pole Test for the generation of consumer information on vehicle side pole crash protection. This test was conducted by Transportation Research Center Inc. in East Liberty, Ohio, on December 15, 2021. The impact velocity was 30.96 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21.0°C. The test vehicle post-test maximum crush was 318 mm at level 3. The test vehicle's performance was as follows: <table border="1" data-bbox="371 1123 1294 1436"> <thead> <tr> <th rowspan="2">Measurement Description</th><th colspan="2">Driver ATD (WorldSID-50M)</th></tr> <tr> <th>Units</th><th>Result</th></tr> </thead> <tbody> <tr> <td>Head Injury Criterion (HIC15)</td><td>N/A</td><td>250</td></tr> <tr> <td>Brain Injury Criterion (BrIC)</td><td>N/A</td><td>0.94</td></tr> <tr> <td>Peak Shoulder Force</td><td>N</td><td>-2045.4</td></tr> <tr> <td>Peak Thoracic Rib Deflection</td><td>mm</td><td>42.9</td></tr> <tr> <td>Peak Abdominal Rib Deflection</td><td>mm</td><td>37.1</td></tr> <tr> <td>Pubic Symphysis Force</td><td>N</td><td>-1124.7</td></tr> <tr> <td>Peak Resultant Sacro-Iliac Force</td><td>N</td><td>2983.1</td></tr> </tbody> </table>				Measurement Description	Driver ATD (WorldSID-50M)		Units	Result	Head Injury Criterion (HIC15)	N/A	250	Brain Injury Criterion (BrIC)	N/A	0.94	Peak Shoulder Force	N	-2045.4	Peak Thoracic Rib Deflection	mm	42.9	Peak Abdominal Rib Deflection	mm	37.1	Pubic Symphysis Force	N	-1124.7	Peak Resultant Sacro-Iliac Force	N	2983.1
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The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.																													
17. Key Words Side Impact Pole WorldSID-50M		18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave, SE Washington, DC 20590																											
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SECTION 1

PURPOSE AND TEST PROCEDURE

PURPOSE AND TEST PROCEDURE

This rigid pole side impact test is a part of the Federal Motor Vehicle Safety Standard 214 Side Impact Protection program. It was conducted for the National Highway Traffic Safety Administration's (NHTSA) under 693JJ918D000019 by Transportation Research Center Inc.. The purpose of this test was to evaluate the repeatability, reproducibility, and durability of the WorldSID 50th percentile male ATD (WorldSID-50M) equipped with RibEye™, to determine whether the dummy is a viable option to replace the EuroSID-2 dummy with rib extension modifiers (ES-2re) in future side impact rigid pole tests conducted by NHTSA. The test was conducted using NHTSA's 'LABORATORY TEST PROCEDURE FOR FMVSS No. 214, DYNAMIC SIDE IMPACT PROTECTION – Rigid Pole Side Impact Test' dated September 2012 as a guideline.

SECTION 2

SUMMARY OF TEST RESULTS

A rigid pole side impact test was conducted on a 2020 Hyundai Santa Fe. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 30.96 km/h. The test was conducted by the Transportation Research Center Inc. in East Liberty, Ohio, on December 15, 2021. Pre-test and post test photographs of the test vehicle and side impact dummy (WorldSID-50M with RibEye) are included in APPENDIX A of this report.

The test setup was conducted following the FMVSS 214 test procedure dated September 2012, including instrumentation and camera placement. One WorldSID-50M with RibEye dummy was placed in the driver designated seating position per NHTSA's "WorldSID 50th Male Dummy Seating Procedure, April 2019 (<https://rosap.nhtl.bts.gov/view/dot/41900>).

The dummy was instrumented in the following manner:

- Head CG tri-axial accelerometer
- Head angular rate sensor
- Upper and lower neck load cells
- Shoulder load cell
- RibEye measurement system in thorax ribs 1-3 and abdominal ribs 1 and 2, with three LEDs per rib
- Upper (T1), middle (T4), and lower spine (T12) tri-axial accelerometers
- Lumbar load cell
- Pelvic tri-axial accelerometers
- Pubic load cell
- Left and right sacroiliac load cells
- Left femur load cell

Appendix B contains the vehicle and dummy response data. Dummy configuration and performance verification data can be found in Appendix C of this report. Appendix D of this report contains the test equipment and instrumentation calibration data. Worksheets and plots found in Appendix E describe dummy positions in detail.

Dummy injury readings were recorded as follows:

Measurement Description	Driver ATD (WorldSID-50M)	
	Units	Result
Head Injury Criterion (HIC15)	N/A	250
Brain Injury Criterion (BrIC)	N/A	0.94
Peak Shoulder Force	N	-2045.4
Peak Thoracic Rib Deflection	mm	42.9
Peak Abdominal Rib Deflection	mm	37.1
Pubic Symphysis Force	N	-1124.7
Peak Resultant Sacro-Iliac Force	N	2983.1

Supplemental restraint information is given below:

Restraint Type	Left Front (Driver) Occupant Location 1	
	Mounted	Deployed
Frontal Airbag	Yes	No
Side Curtain Airbag	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes
Side Pelvis Airbag	No	N/A
Knee Airbag	No	N/A
Seat Belt Pretensioner	Yes	Yes
Seat Belt Load Limiter	Yes	Unknown
Other Safety Restraint	No	N/A

GENERAL COMMENTS

All doors remained closed throughout the test. No fuel spillage occurred during the impact and the static rollover test was not performed.

Data Acquisition Explanations

Left Lower B-Pillar Y-Axis Acceleration: Open after 35.0 ms

Left Mid B-Pillar Y-Axis Acceleration: Open after 35.0 ms

Left Front Door Mid Centerline (Y): QD throughout

REAR DECK ARS Z: Open after 70.0 ms

Ribeye Error Codes:

- 1 if the top sensor is blocked or sees too much ambient light
- 2 if the bottom sensor is blocked or sees too much ambient light
- 3 if both top and bottom sensors are blocked or see too much ambient light
- 4 if the middle sensor is blocked or sees too much ambient light
- 5 if the middle and top sensors are blocked or see too much ambient light
- 6 if the middle and bottom sensors are blocked or see too much ambient light
- 7 if all three sensors are blocked or see too much ambient light
- 8 if a divide-by-zero condition occurred in the data processing
- 9 if data goes past the end of the calibration curves

**error codes may be positive or negative in data and will occur to all x, y, and z channels*

Driver Thorax Rib 2 Front Led Position; Error Code 7 at 19.9-26.1 ms

Driver Thorax Rib 3 Rear Led Position; Questionable data at 48.9-58.96 ms

Driver Thorax Rib 3 Middle Led Position; Error Code 2 at 47.1-62.1 ms and Error Code 2 at 63.2-63.6 ms

Driver Thorax Rib 3 Front Led Position; Questionable data at 48.9-57.8 ms

SECTION 3
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Hyundai Santa Fe
 Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

TEST VEHICLE INFORMATION AND OPTIONS

Model Year	2020
Make	Hyundai
Model	Santa Fe
Body Style	MPV
VIN	5NMS23AD8LH262066
Body Color	Rainforest
Odometer Reading (km/mi)	15 mi.
Engine Displacement (L)	2.4
Type/No. Cylinders	Straight/4
Engine Placement	Front Transverse
Transmission Type	Automatic
Transmission Speeds	8
Overdrive	Yes
Final Drive	FWD
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
Anti-Lock Brakes (ABS)	Yes

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

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

No

DATA FROM CERTIFICATION LABEL

Manufactured By	HYUNDAI MOTOR MANUFACTURING ALABAMA, LLC
Date of Manufacturer	Aug/05/20
Vehicle Type	MPV

GWR (lbs)	4872
GAWR Front (lbs)	2866
GAWR Rear (lbs)	3075

VEHICLE SEATING AND WEIGHT CAPACITY DATA

	Front	Rear	Third	Total
Designated Seating Capacity (DSC)	2	3	N/A	5
Vehicle Capacity Weight (VCW) (kg)				408.0
DSC X 68.04 kg				340.2
Rated Cargo and Luggage Weight (RCLW) (kg)				139.8

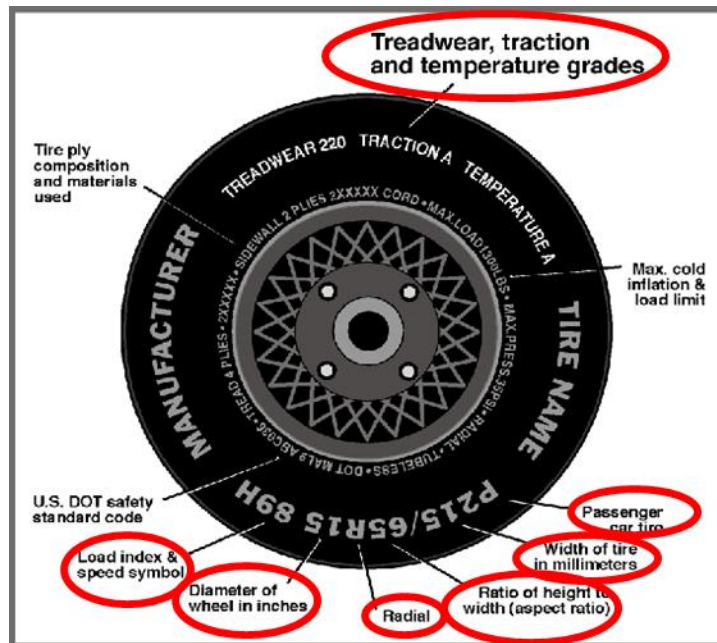
VEHICLE SEAT TYPE

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

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

Test Vehicle: 2020 Hyundai Santa Fe
 Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	235/65R17	235/65R17
Tire Size on Vehicle	235/65R17	235/65R17
Tire Manufacturer	Hankook	Hankook
Tire Model	Dynapro HP2	Dynapro HP2
Treadwear	540	540
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2	2
Tire Plies Body	5	5
Load Index/Speed Symbol	104H	104H
Tire Material	Polyester, Steel, Nylon	Polyester, Steel, Nylon
DOT Safety Code Left	15M8R RT H0 0220	15M8R RT H0 0220
DOT Safety Code Right	15M8R RT H0 0220	15M8R RT H0 0220

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

Test Vehicle: 2020 Hyundai Santa Fe
 Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	234	234	207	221
Tire Placard	kPa	240	240	240	240
Owner's Manual	kPa	240	240	240	240
As Tested	kPa	240	240	240	240

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	477.4	354.2		507.6	453.8		494.6	450.6	
Right	kg	466.2	333.4		448.4	424.6		472.6	424.4	
Ratio	%	57.8	42.2		52.1	47.9		52.5	47.5	
Totals	kg	943.6	687.6	1631.2	956.0	878.4	1834.4	967.2	875.0	1842.2

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	1631.2	(A)
Actual Weight of 1 WorldSID-50M with RibEye Dummy Used	kg	75.0	(B)
Rated Cargo/Luggage Weight (RCLW) ¹	kg	136.0	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1842.2	(A+B+C)

Does the measured As Tested Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Target Weight – 4.5 kg to 9 kg)? ☒ YES ☐ NO

TEST VEHICLE ATTITUDES AND CG

	Units	As Delivered	As Tested	Fully Loaded	Meets Requirement***
Driver Door Sill Angle (front-to-rear)*	Deg.	-0.1	0.0	+0.4	Yes
Front Passenger Sill Angle (front-to-rear)*	Deg.	-0.2	-0.1	+0.3	Yes
Front Bumper-Line Angle (left-to-right)**	Deg.	-0.2	-0.3	-0.3	Yes
Rear Bumper-Line Angle (left-to-right)**	Deg.	-0.2	-0.3	-0.5	Yes
Vehicle CG (Aft of Front Axle)	mm	1155	1312	1301	
Vehicle CG (Left (+) / Right (-) from longitudinal Centerline)	mm	+16	+40	+21	

*ND=Nose Down (-), NU=Nose Up (+) **LD=Left Down (-), LU=Left Up (+)

*** The "As Tested" vehicle attitude measurements must be equal to or between the "As Delivered" and "Fully Loaded" vehicle attitude measurements. Indicate "Yes" or "No" for "Meets Requirements".

Test height adjustable suspension setting, if applicable:

N/A

¹ Rated cargo and luggage weight limited to 136.0 kg or 300.0 lbs.

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

Test Vehicle: 2020 Hyundai Santa Fe
Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Ballast: Steel plate in cargo area	62.8
Components removed: None	0.0

DATA SHEET NO. 2

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

Test Vehicle: 2020 Hyundai Santa Fe

Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

SEAT POSITIONING

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

SCRL ANGLE RANGE

Seat	SCRL(°)		
	Max.	Min.	Mid
Driver Seat	14.4	11.7	13.0
Front Passenger Seat	N/A	N/A	14.6
Front Center Seat*	N/A	N/A	N/A
Struck Side Rear Seat	16.3	15.1	15.7
Non-Struck Side Rear Seat	16.5	15.6	16.0
Rear Center Seat*	13.9	14.6	14.2

* If applicable.

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rearmost	Mid Fore/Aft	Forward-Most
Driver Seat	13.0	206	Max	235	240	244
			Mid	203	206	209
			Min	192	196	201
Front Passenger Seat	14.6	192	Max	N/A	N/A	N/A
			Mid	188	192	195
			Min	N/A	N/A	N/A
Front Center Seat*	N/A	N/A	Max	N/A	N/A	N/A
			Mid	N/A	N/A	N/A
			Min	N/A	N/A	N/A
Struck Side Rear Seat	15.7	228	Max	N/A	N/A	N/A
			Mid	N/A	228	N/A
			Min	N/A	N/A	N/A
Non-Struck Side Rear Seat	14.8	225	Max	N/A	N/A	N/A
			Mid	N/A	225	N/A
			Min	N/A	N/A	N/A
Rear Center Seat*	14.2	313	Max	N/A	N/A	N/A
			Mid	N/A	313	N/A
			Min	N/A	N/A	N/A

* If applicable.

DATA SHEET NO. 2 (CONTINUED)

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

Test Vehicle: 2020 Hyundai Santa Fe

Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

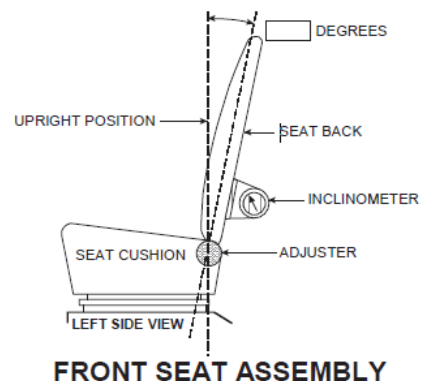
SEAT FORE/AFT POSITION

Seat	Total Fore/Aft Travel		Test Position from Forwardmost Position	
	mm	Detents*	mm	Detent*
Driver Seat	240	38	223	19
Front Passenger Seat	240	38	223	19
Front Center Seat*	N/A	N/A	N/A	N/A
Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Rear Center Seat*	Fixed	Fixed	Fixed	Fixed

* If applicable.

SEAT BACK ANGLE ADJUSTMENT

The driver's seat back was positioned according to the manufacturer's information as provided on Form 1; resulting in a head rest post angle of 1.2° at the head rest post. The front passenger seat was set to match the driver seat.



Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents*	Degrees	Detent*
Driver Seat w/ Seated Dummy	65.7	33	1.2	9
Front Passenger Seat	64.1	33	1.0	9
Front Center Seat*	N/A	N/A	N/A	N/A
Struck Side Rear Seat	20.3	11	4.8	0
Non-Struck Side Rear Seat	20.2	11	4.4	0
Rear Center Seat*	20.3	11	4.8	0

* If applicable.

DATA SHEET NO. 2 (CONTINUED)

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

Test Vehicle: 2020 Hyundai Santa Fe

Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

SEAT BELT ANCHORAGE ADJUSTMENT

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

	Total # of Positions	Placed in Position #
Driver Seat	4	1, Uppermost

HEAD RESTRAINT ADJUSTMENT

Head restraints are adjusted to the lowest and most full rearward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	3	7, Uppermost

DATA SHEET NO. 2 (CONTINUED)

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

Test Vehicle: 2020 Hyundai Santa Fe

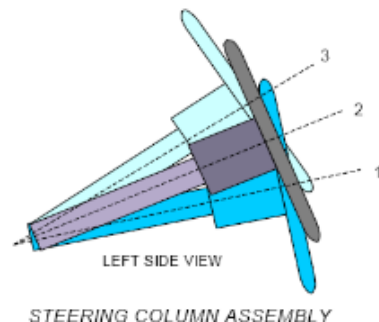
Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel geometric locus it describes when moved through its full range of motion.

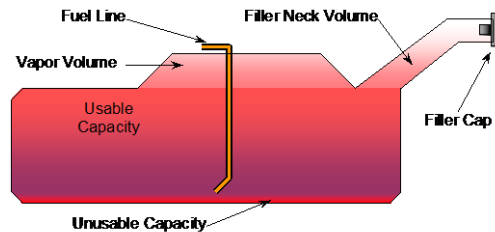
	Degrees	Fore/Aft Position, mm
Lowermost, Position No. 1	24.0	0
Geometric Center, Position No. 2	26.4	23
Uppermost, Position No. 3	28.8	46
Telescoping Steering Wheel Travel		46
Test Position	26.4	23



FUEL PUMP

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

Key is "ON" position



VEHICLE FUEL TANK ASSEMBLY

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	71.0
Usable Capacity of "Optional" Tank (see Form No. 1)	N/A
Usable Capacity of Standard Tank (see Owner's Manual)	71.0
Usable Capacity of Optional Tank (see Owner's Manual)	N/A
93% of Usable Capacity	66.0
Actual Amount of Solvent Used in Test	66.0
1/3 of Usable Capacity	23.7

Is the Actual Amount of Solvent Used in the test equal to 93% +/- 1% of the Usable Capacity stated on Form No. 1? ☒ YES ☐ NO

TABLE 1 WORLDSID-50M INSTRUMENTATION DATATest Vehicle: 2020 Hyundai Santa FeTest Program: Rigid Pole Side ImpactTest Date: 12/15/2020

Driver Dummy Serial Number: EB8888

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
Head Acceleration (g)	X	8.90	282.30	-26.23	252.25
	Y	51.39	57.75	-14.23	151.85
	Z	12.05	67.70	-15.00	38.45
	R	52.47	57.75		
Head Angular Rate (deg/sec)	X	1763.63	124.15	-1362.88	205.00
	Y	513.34	261.60	-667.78	235.90
	Z	930.57	297.45	-1930.83	223.00
Upper Neck Force (N)	X	267.94	273.15	-190.79	38.00
	Y	165.92	255.75	-585.77	152.90
	Z	788.67	38.20	-57.07	77.45
Upper Neck Moment (Nm)	X	8.34	95.40	-37.42	145.30
	Y	12.15	168.75	-24.27	114.15
	Z	28.83	240.95	-15.59	169.20
Lower Neck Force (N)	X	246.74	273.15	-259.91	41.05
	Y	429.87	64.90	-738.80	120.45
	Z	906.46	38.75	-555.30	156.15
Lower Neck Moment (Nm)	X	23.49	251.10	-128.53	141.35
	Y	18.32	39.35	-43.28	120.50
	Z	29.86	240.85	-13.69	97.05
Driver Shoulder Force (N)	X	114.90	137.10	-720.14	58.55
	Y	132.29	94.85	-2045.42	43.60
	Z	502.87	60.30	-185.71	110.35
Shoulder Rear Ribeye Position (mm)	X	17.83	60.65	-87.71	60.85
	Y	15.54	52.15	-88.75	162.30
	Z	15.85	60.65	-66.10	60.85
Length of Change (mm)		10.38	66.65	-3.85	221.55
Shoulder Middle Ribeye Position (mm)	X	-3.21	94.10	-44.95	58.75
	Y	-48.19	56.80	-97.30	212.90
	Z	-37.72	108.80	-64.55	146.15
Length of Change (mm)		41.60	56.30	-1.52	213.05
Shoulder Front Ribeye Position (mm)	X	29.78	93.75	-1.08	33.10
	Y	-29.58	59.60	-85.28	199.90
	Z	-43.51	109.60	-67.06	72.75
Length of Change (mm)		51.48	59.50	-2.07	92.90

TABLE 1 WORLDSID-50M INSTRUMENTATION DATA (CONTINUED)Test Vehicle: 2020 Hyundai Santa FeTest Program: Rigid Pole Side ImpactTest Date: 12/15/2020

Driver Dummy Serial Number: EB8888

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
Thorax Rib 1 Rear Ribeye Position (mm)	X	-33.01	93.00	-56.01	34.50
	Y	-72.32	57.50	-98.95	208.00
	Z	6.10	106.75	-10.04	65.10
Length of Change (mm)		19.79	57.55	-0.94	207.90
Thorax Rib 1 Middle Ribeye Position (mm)	X	4.41	95.40	-18.70	34.70
	Y	-66.31	57.50	-108.09	206.00
	Z	7.07	107.05	-9.84	65.10
Length of Change (mm)		40.69	57.20	-0.74	206.00
Thorax Rib 1 Front Ribeye Position (mm) ¹	X	41.78	98.85	23.61	33.90
	Y	-49.05	56.80	-98.20	17.80
	Z	4.75	106.35	-10.25	65.95
Length of Change (mm) ¹		42.90	56.90	-0.56	17.85
Thorax Rib 2 Rear Ribeye Position (mm)	X	-17.67	62.30	-36.59	29.55
	Y	-82.67	59.85	-99.86	20.10
	Z	46.54	36.65	27.62	65.80
Length of Change (mm)		18.74	60.60	-0.39	287.80
Thorax Rib 2 Middle Ribeye Position (mm)	X	22.19	62.20	-0.03	29.95
	Y	-84.00	59.85	-111.62	224.80
	Z	48.26	36.90	27.49	66.35
Length of Change (mm)		24.22	59.90	-1.49	224.90
Thorax Rib 2 Front Ribeye Position (mm) ¹	X	58.65	58.00	0.08	26.05
	Y	16.33	19.95	-114.09	19.75
	Z	52.80	36.40	-0.49	26.05
Length of Change (mm) ¹		17.75	59.85	-2.31	19.75
Thorax Rib 3 Rear Ribeye Position (mm) ¹	X	-33.30	62.50	-51.93	116.50
	Y	-77.89	58.90	-107.77	57.05
	Z	-30.75	35.55	-54.69	64.80
Length of Change (mm) ¹		18.07	59.00	-10.05	57.10
Thorax Rib 3 Middle Ribeye Position (mm) ¹	X	4.85	63.05	-18.70	140.70
	Y	21.75	47.15	-113.19	63.05
	Z	9.90	47.15	-62.60	63.05
Length of Change (mm) ¹		13.32	43.20	-8.53	63.10

¹See data acquisition explanation

TABLE 1 WORLDSID-50M INSTRUMENTATION DATA (CONTINUED)Test Vehicle: 2020 Hyundai Santa FeTest Program: Rigid Pole Side ImpactTest Date: 12/15/2020

Driver Dummy Serial Number: EB8888

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
Thorax Rib 3 Front Ribeye Position (mm) ¹	X	46.57	55.70	12.56	167.95
	Y	-69.97	58.90	-93.15	149.60
	Z	-30.67	35.55	-54.85	63.40
Length of Change (mm) ¹		6.81	32.35	-11.08	52.50
Abdomen Rib 1 Rear Ribeye Position (mm)	X	-18.82	62.55	-33.65	109.35
	Y	-65.53	54.35	-98.29	162.60
	Z	8.09	128.80	-19.09	62.70
Length of Change (mm)		31.68	55.75	-1.81	162.55
Abdomen Rib 1 Middle Ribeye Position (mm)	X	24.12	59.20	0.74	88.50
	Y	-63.08	55.00	-104.60	-34.20
	Z	8.97	130.45	-20.60	63.90
Length of Change (mm)		37.04	52.05	-0.24	-48.95
Abdomen Rib 1 Front Ribeye Position (mm)	X	62.16	57.50	34.05	6.40
	Y	-54.47	55.20	-96.18	-9.40
	Z	6.55	127.20	-21.04	63.10
Length of Change (mm)		19.62	51.80	-0.41	12.40
Abdomen Rib 2 Rear Ribeye Position (mm)	X	0.55	61.10	-21.30	96.25
	Y	-61.67	51.95	-93.87	-16.05
	Z	47.12	125.70	17.13	63.00
Length of Change (mm)		32.58	54.35	-2.63	94.05
Abdomen Rib 2 Middle Ribeye Position (mm)	X	42.10	57.60	8.90	95.80
	Y	-62.91	53.00	-104.07	-25.90
	Z	47.25	130.90	13.17	62.70
Length of Change (mm)		37.11	52.05	-0.62	94.10
Abdomen Rib 2 Front Ribeye Position (mm)	X	78.21	55.40	41.15	95.45
	Y	-55.89	55.80	-96.71	97.00
	Z	49.18	137.60	15.67	62.15
Length of Change (mm)		19.57	55.85	-0.50	12.95
T1 Acceleration (g)	X	7.43	52.70	-5.20	96.20
	Y	43.50	59.85	-16.78	106.35
	Z	12.01	53.95	-6.79	92.55
	R	44.75	59.80		

¹See data acquisition explanation

TABLE 1 WORLDSID-50M INSTRUMENTATION DATA (CONTINUED)Test Vehicle: 2020 Hyundai Santa FeTest Program: Rigid Pole Side ImpactTest Date: 12/15/2020

Driver Dummy Serial Number: EB8888

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
T4 Acceleration (g)	X	6.27	94.45	-7.99	53.65
	Y	14.80	101.30	-38.87	52.90
	Z	8.41	29.65	-5.16	165.80
	R	40.39	52.85		
T12 Acceleration (g)	X	5.60	33.90	-7.44	96.10
	Y	44.27	51.30	-16.67	94.65
	Z	9.35	20.30	-9.09	63.40
	R	44.38	51.30		
Pubic Symphysis (N)	Y	4.62	2.60	-1124.74	44.95
Left Sacro-Iliac Force (N)	X	108.92	16.95	-484.77	55.15
	Y	11.04	-26.65	-2935.65	46.40
	Z	6.65	0.75	-477.24	41.55
Left Sacro-Iliac Moment (Nm)	X	23.82	69.30	-43.89	44.40
	Y	27.56	54.90	-11.42	38.85
	Z	39.73	40.30	-23.80	63.55
Right Sacro-Iliac Force (N)	X	203.04	65.30	-261.97	40.25
	Y	17.08	184.80	-1637.52	46.45
	Z	503.30	67.10	-7.19	14.25
Right Sacro-Iliac Moment (Nm)	X	45.94	67.15	-16.31	44.35
	Y	9.37	16.65	-12.92	40.45
	Z	33.21	40.50	-23.32	62.80
Lumbar Force (N)	X	498.07	62.50	-214.94	16.90
	Y	653.59	50.25	-251.44	84.60
	Z	1447.12	62.60	-8.90	1.55
Lumbar Moment (Nm)	X	38.94	56.50	-13.27	95.70
	Y	8.06	17.05	-23.44	62.70
	Z	10.87	47.05	-11.28	106.60
Pelvis Acceleration (g)	X	13.46	16.30	-16.46	58.30
	Y	53.08	44.75	-17.91	74.10
	Z	13.88	39.05	-10.71	48.50
	R	53.27	44.75		

TABLE 1 WORLD SID-50M INSTRUMENTATION DATA (CONTINUED)Test Vehicle: 2020 Hyundai Santa FeTest Program: Rigid Pole Side ImpactTest Date: 12/15/2020

Driver Dummy Serial Number: EB8888

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
Left Femur Force (N)	X	52.60	288.60	-442.56	44.35
	Y	107.37	117.70	-57.26	77.40
	Z	871.08	46.60	-157.61	0.15
Left Femur Moment (Nm)	X	174.93	48.10	-8.23	299.10
	Y	48.66	47.70	-8.18	24.35
	Z	39.43	115.30	-2.36	208.45
Left Femoral Neck Force (N)	X	568.47	48.65	-16.10	207.85
	Y	7.32	14.60	-1917.22	46.45
	Z	184.19	286.95	-2103.22	46.55
Left Outer Knee Force (N)	Y	329.13	72.40	-80.95	32.85
Left Inner Knee Force (N)	Y	1340.56	72.55	-42.18	61.25

¹See data acquisition explanationPositive Direction

Longitudinal Forward
 Lateral Rightward
 Vertical Downward

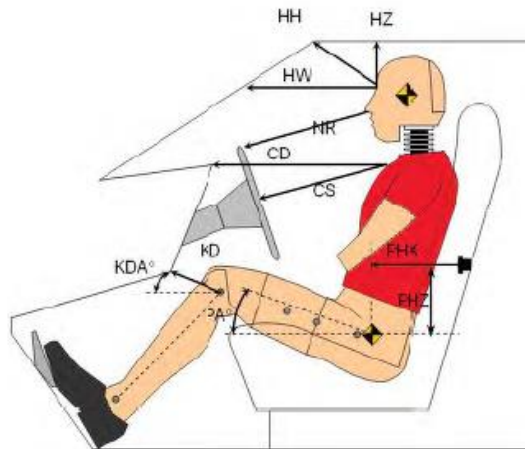
Negative Direction

Longitudinal Rearward
 Lateral Leftward
 Vertical Upward

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2020 Hyundai Santa Fe
 Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020



Code	Measurement Description	Driver WorldSID-50M SN # EB8888	
		Length (mm)	Angle
HH	Header to Header	401	
HW	Header to Windshield	652	
HZ	Head to Roof Liner	195	
NR	Nose to Rim/Seat Back	463	
CD	Chest to Dash/Seat Back	606	
CS	Chest to Steering Wheel	363	
KD(L)/KDA(L)°	Left Knee to Dash/Seat Back	129	40.2
KD(R)/KDA(R)°	Right Knee to Dash/Seat Back	69	21.7
PAX°	Pelvic Tilt Angle X		-0.5
PAY°	Pelvic Tilt Angle Y		1.4
PHX	Hip Point to Striker (X-Axis)	203	
PHZ	Hip Point to Striker (Z-Axis)	240	
HAX°	Head Tilt Angle X		-0.8
HAY ^{1o}	Head Tilt Angle Y		-1.5
TAX°	Thorax Tilt Angle X		0.0
TAY°	Thorax Tilt Angle Y		-0.2
	Head Rest Angle		1.2
	H-Point Tool Angle		41.5
	Torso Angle		14.0
	Windshield Angle		59.7

Note: All measurements are in millimeters. 2-door vehicle shown. Rear dummy HX, HZ, PHX and PHZ measurements for 4-door vehicle would use the C-post striker as a reference point.

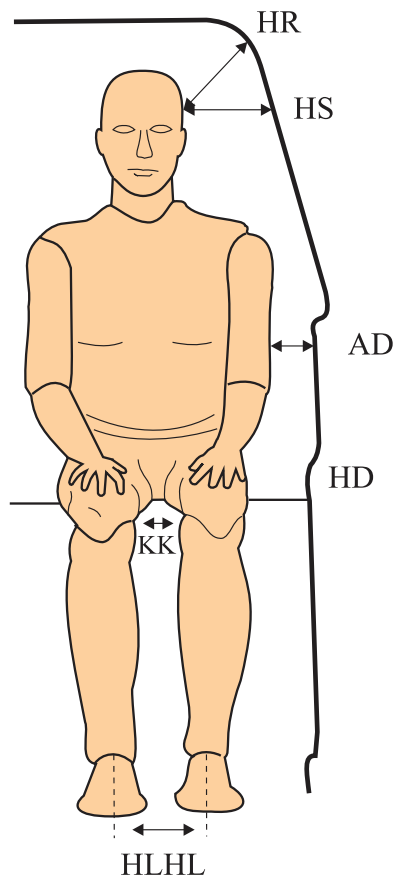
All tilt sensor angles are recorded digitally

WorldSID-50M neck was adjusted 0 notches

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2020 Hyundai Santa Fe
 Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020



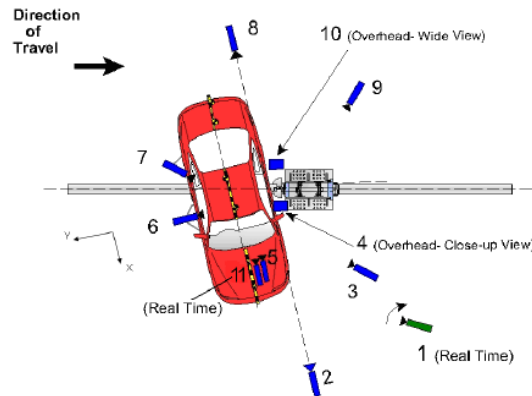
Code	Measurement Description	Driver WorldSID-50M SN # EB8888
HR	Head to Side Header	228
HS	Head to Side Window	343
AD	Arm to Door	144
HD	Hip Point to Door	126
KK	Knee to Knee	487
HLHL	Heel to Heel	390

Note: All measurements are in millimeters.

**DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA**

Test Vehicle: 2020 Hyundai Santa Fe
Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020



REFERENCE (from Point of Impact for X and Y; from Ground for Z):
+ X = Forward of vehicle, + Y = Right of vehicle, + Z = Down

CAMERA LOCATIONS AND DATA

Camera No.	View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Real time (24-30 fps) pan view of impact				Zoom	30
2	Front ground level – impact view	4232	0	-1852	20	1000
3	Impact side 45° – forward pole view	3485	-1502	-1741	20	1000
4	Overhead Close-up view of impact	-83	-351	-5771	28	1000
5	Onboard – dummy front view				12.5	1000
6	Onboard – dummy side view				12.5	1000
7	Onboard – dummy rear oblique view				12.5	1000
8	Rear ground level – impact view	-5204	0	-1450	20	1000
9	Impact side 45° – rearward pole view	-2608	-1754	-1601	20	1000
10	Overhead wide – view of impact	0	0	-5769	18	1000
11	Real time (24-30 fps) – dummy front view				Zoom	30

* All measurements accurate to ± 6 mm.

NOTE: Vehicle is at a 75° angle to the rigid pole.

If applicable, explain why camera(s) did not operate as intended: N/A

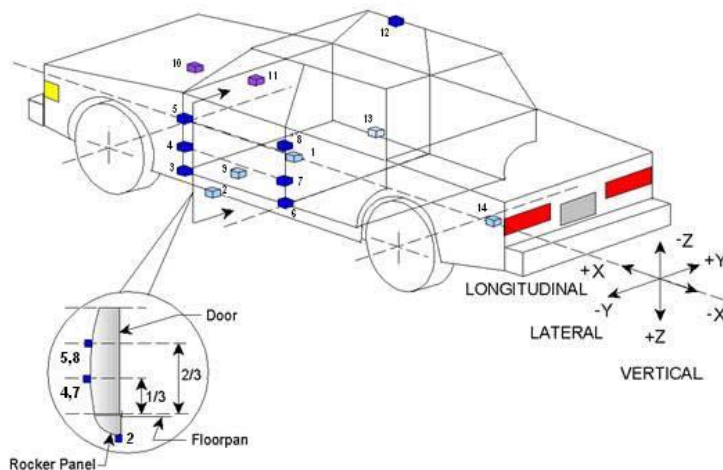
INSTRUMENTATION

Driver Dummy	135
Vehicle Structure	37
Pole Load Cells	8
Contact Channels	4
TOTAL	184

DATA SHEET NO. 6
VEHICLE ACCELEROMETER DATA

Test Vehicle: 2020 Hyundai Santa Fe
Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020



Location		Coordinates (mm)			Positive Direction		Negative Direction	
		X	Y	Z	Max	Time (ms)	Max	Time (ms)
1	Vehicle CG	2505	-62	-59				
	Longitudinal (g)				3.48	114.40	-5.88	53.75
	Lateral (g)				19.86	42.00	-0.67	166.75
	Vertical (g)				7.85	55.30	-7.78	40.15
	Resultant (g)				21.26	41.80		
2	Vehicle CG ARS	2530	-61	-59				
	Longitudinal (deg/s)				972.31	39.25	-165.04	146.45
	Lateral (deg/s)				111.98	74.40	-43.42	108.80
	Vertical (deg/s)				61.57	75.75	-45.79	47.00
3	Left Floor Sill Acceleration	2876	-769	-129				
	Lateral (g)				45.20	25.35	-17.72	38.30
4	Left A-Pillar Sill Acceleration	3168	-766	-128				
	Lateral (g)				34.43	19.15	-10.07	30.60
5	Left Lower A-Pillar Acceleration	3301	-735	-105				
	Lateral (g)				22.46	26.40	-0.55	266.00
6	Left Mid A-Pillar Acceleration	3293	-839	-440				
	Lateral (g)				24.09	46.90	-17.90	40.15
7	Left B-Pillar Sill Acceleration	2229	-743	-71				
	Lateral (g)				86.50	14.55	-21.23	65.70
8	Left Lower B-Pillar Acceleration	2274	-764	-240				
	Lateral (g)				___ ¹	___ ¹	___ ¹	___ ¹
9	Left Mid B-Pillar Acceleration	2245	-751	-533				
	Lateral (g)				___ ¹	___ ¹	___ ¹	___ ¹

¹See data acquisition explanation

DATA SHEET NO. 6 (CONTINUED)
VEHICLE ACCELEROMETER DATA

Test Vehicle: 2020 Hyundai Santa Fe
 Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

Location		Coordinates (mm)			Positive Direction		Negative Direction	
		X	Y	Z	Max	Time (ms)	Max	Time (ms)
10	Driver Seat Track at Dummy H-Point Acceleration	2373	-600	-89				
	Lateral (g)				93.56	33.00	-27.38	48.40
11	Engine Top Acceleration	4039	164	-301				
	Longitudinal (g)				4.75	46.45	-17.16	35.10
	Lateral (g)				17.45	32.10	-6.00	209.25
12	Firewall Center Acceleration	3752	0	-446				
	Lateral (g)				13.26	45.70	-1.11	4.75
13	Right Roof at Vertical Impact Reference Line Acceleration	2337	652	-1062				
	Lateral (g)				31.76	41.80	-1.28	292.30
14	Right Sill at Vertical Impact Reference Line Acceleration	2886	718	-126				
	Longitudinal (g)				2.75	114.15	-3.95	66.30
	Lateral (g)				14.58	49.10	-0.87	230.10
	Vertical (g)				4.80	49.85	-3.09	20.55
	Resultant (g)				15.39	49.30		
15	Right Sill at Rear Seat Acceleration	1826	720	-106				
	Longitudinal (g)				2.82	114.15	-4.25	66.45
	Lateral (g)				16.27	35.45	-0.57	238.95
	Vertical (g)				2.65	47.05	-5.93	25.75
	Resultant (g)				16.60	35.55		
16	Rear Floorpan Behind Rear Axle at Centerline Acceleration	1049	-910	-200				
	Longitudinal (g)				2.59	123.40	-6.94	73.25
	Lateral (g)				15.58	37.05	-0.74	199.00
17	Left Front Door Mid Centerline Acceleration	2733	-808	-239				
	Lateral (g)				--- ¹	--- ¹	--- ¹	--- ¹
18	Left Front Door Mid Rear Acceleration	2425	-779	-247				
	Lateral (g)				72.88	14.55	-43.05	10.05
19	Left Front Door Upper Centerline Acceleration	2692	-793	-542				
	Lateral (g)				72.29	8.00	-44.66	19.20

¹See data acquisition explanation

DATA SHEET NO. 6 (CONTINUED)
VEHICLE ACCELEROMETER DATA

Test Vehicle: 2020 Hyundai Santa Fe
 Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

Location		Coordinates (mm)			Positive Direction		Negative Direction	
		X	Y	Z	Max	Time (ms)	Max	Time (ms)
20	Left Rear Door Mid Rear Acceleration	1459	-789	-273				
	Lateral (g)				30.18	28.05	-2.36	8.65
21	Left Rear Door Upper Centerline Acceleration	1810	-784	-556				
	Lateral (g)				48.51	31.25	-14.10	65.65
22	Rear Deck Acceleration	179	-4	-88				
	Longitudinal (g)				3.15	136.90	-6.67	79.40
	Lateral (g)				16.34	48.80	-1.54	197.80
	Vertical (g)				5.18	79.20	-3.37	59.70
	Resultant (g)				17.03	48.85		
23	Rear Deck ARS	178	-28	-88				
	Longitudinal (deg/s)				62.36	38.65	-50.34	229.45
	Lateral (deg/s)				62.61	42.60	-50.10	94.05
	Vertical (deg/s)				---	---	---	---

*0,0,0 located at rear bumper

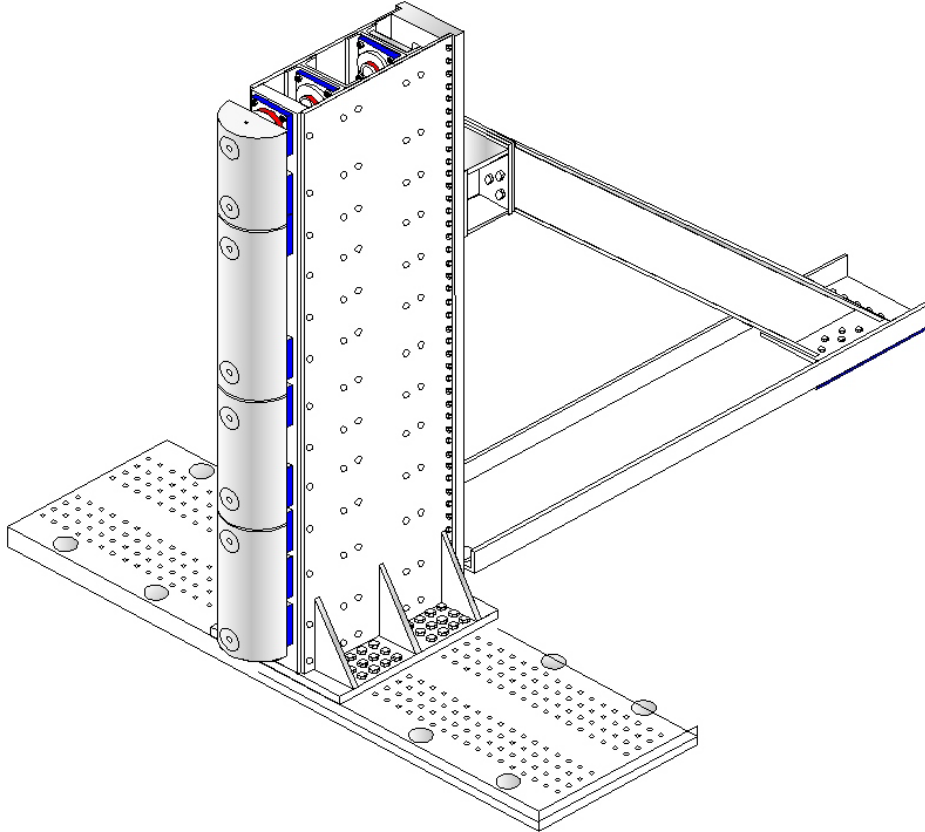
¹See data acquisition explanation

DATA SHEET NO. 7
RIGID POLE LOAD CELL DATA

Test Vehicle: 2020 Hyundai Santa Fe
Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

FOIL 300K RIGID POLE



Load Cell Locations	
ID	Height From Top of Carrier (mm)
1	87
2	468
3	648
4	978
5	1168
6	1651
7	1816
8	2057

DATA SHEET NO. 8
POST TEST OBSERVATIONS

Test Vehicle: 2020 Hyundai Santa Fe

Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Driver WorldSID-50M Dummy
Face	SCAB
Top of Head	SCAB, Head rest
Left Side of Head	SCAB
Back of head	Head rest
Left Shoulder	SAB
Upper Torso	Seatback bolster
Lower Torso	Seat back bolster, SAB
Left Hip	SAB, Door panel
Left Knee	Door panel

POST-TEST DOOR PERFORMANCE

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

* Indicate "Yes", "No", or "NA".

POST-TEST SEAT PERFORMANCE

Description	Struck Side		Non-Struck Side	
	Front	Rear	Front	Rear
Seat Movement Along Seat Track	No	N/A	No	N/A
Seat Disengagement from Floor pan	No	No	No	No
Seat Back Movement from Initial Position	No	No	No	No
Seat Back Collapse	No	No	No	No

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	Good
Sill Separation	None
Windshield Damage	Along left A pillar
Side Window Damage	Driver window broken out
Other Notable Effects	None

DATA SHEET NO. 8 (CONTINUED)
POST TEST OBSERVATIONS

Test Vehicle: 2020 Hyundai Santa Fe

Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side (Driver)		Struck Side (Rear Passenger)	
	Mounted	Deployed	Mounted	Deployed
Front Airbag	Yes	No		
Knee Airbag	No	N/A		
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	No	N/A
Side Torso Airbag	No	N/A	No	N/A
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Unknown	No	N/A
Other	No	N/A	No	N/A

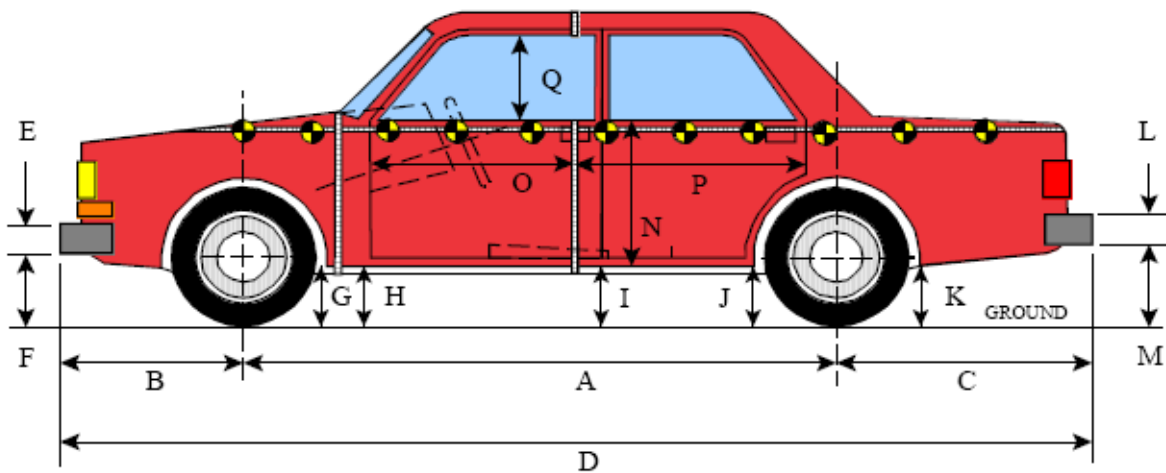
VEHICLE SPEED, VEHICLE ANGLE AT IMPACT, AND IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm		1308
Actual Impact Point (Aft of Front Axle)	mm		1314
Horizontal Offset (+ forward / - rearward)	mm	+/- 38 of Intended Impact Point	-6
Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion	Degrees	75 +/- 3	75
Trap No. 1 Velocity (Primary)	km/h	30.1 to 31.9	30.96
Trap No. 2 Velocity (Redundant)	km/h	30.1 to 31.9	30.96

DATA SHEET NO. 9
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2020 Hyundai Santa Fe
 Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020



LEFT SIDE VIEW

All MEASUREMENTS IN (mm) WITH TOLERANCE OF ± 3 mm

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

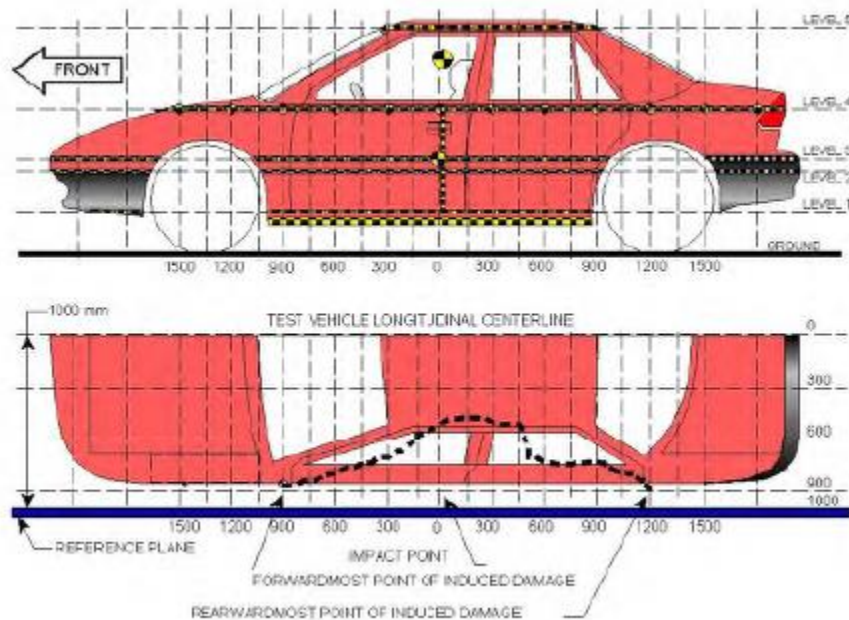
Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2740	2700	40
B	Front Axle to FSOV	1277	1277	0
C	Rear Axle to RSOV	1049	1049	0
D	Total Length at Centerline	4776	4723	53
E	Front Bumper Thickness	119	119	0
F	Front Bumper Bottom to Ground	450	477	-27
G	Sill Height at Front Wheel Well	413	430	-17
H	Sill Height at Front Door Leading Edge	410	450	-40
I	Sill Height at B Pillar	419	540	-121
J1	Sill Height at Rear Wheel Well	427	482	-55
J2	Pinch Weld Height at Rear Wheel Well	248	280	-32
K	Sill Height Aft of Rear Wheel Well	456	490	-34
L	Rear Bumper Thickness	122	122	0
M	Rear Bumper Bottom to Ground	525	550	-25
N	Sill Height to Bottom of Front Window Sill	735	845	-110
O	Front Door Leading Edge to Impact CL	807	708	99
P	Rear Door Trailing Edge to Impact CL	1354	1290	64
Q	Front Window Opening	439	430	9
R	Right Side Length	4666	4653	13
S	Left Side Length	4666	4570	96
T	Maximum Vehicle Width at B-Pillars	1880	1670	210
U	Maximum Vehicle Width	1893	1886	7

**All Dimensions in mm

DATA SHEET NO. 10
VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2020 Hyundai Santa Fe
 Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020



MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	406	280	150
2	Occupant H-Point	712	311	150
3	Mid-Door	899	318	150
4	Window Sill	1124	259	150
5	Window Top	1626	59	150

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

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

Test Vehicle: 2020 Hyundai Santa Fe
 Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020

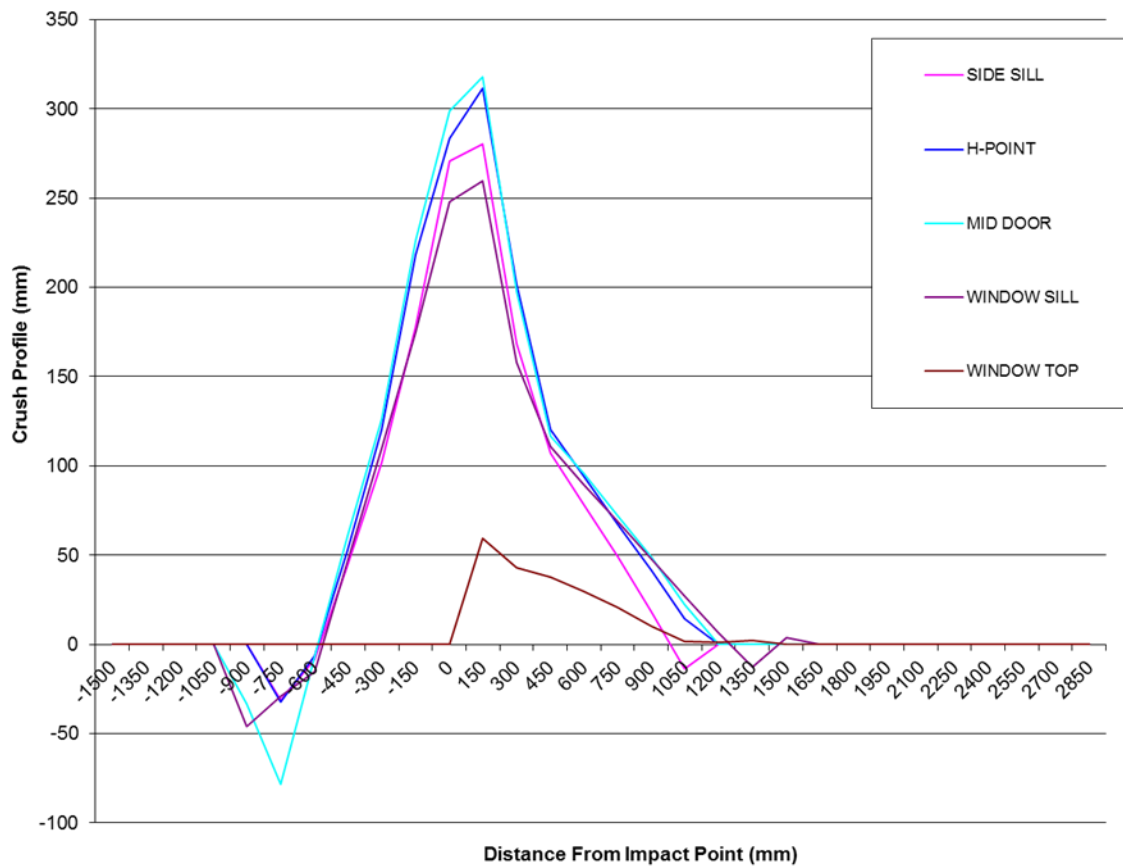
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900			948	817				981	863				-33	-46	
-750	922	942	945	823		953	974	1024	853		-31	-32	-79	-30	
-600	928	936	939	831		936	942	946	846		-8	-6	-7	-15	
-450	932	932	939	837		888	879	878	791		44	53	61	46	
-300	936	931	940	848		834	811	814	739		102	120	126	109	
-150	939	931	940	861		761	713	714	687		178	218	226	174	
0	939	930	940	877		668	647	641	629		271	283	299	248	
150	937	928	939	888	609	657	617	621	629	550	280	311	318	259	59
300	935	925	936	891	619	766	723	738	734	576	169	202	198	157	43
450	937	924	934	891	624	829	804	817	780	587	108	120	117	111	37
600	934	922	931	889	626	856	828	835	800	596	78	94	96	89	30
750	930	926	931	887	624	881	858	859	818	604	49	68	72	69	20
900	925	935	936	884	621	907	893	888	836	611	18	42	48	48	10
1050	922	946	945	881	617	936	932	923	853	616	-14	14	22	28	1
1200				876	612				870	611				6	1
1350				875	606				888	604				-13	2
1500				875	597				871	597				4	0

NOTE: Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition. Vehicle measurements forward of the vertical impact reference line are negative. The crush profile grid is established prior to the test based on an estimated impact point. The vertical impact reference line was set at (0, 0, 0).

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

Test Vehicle: 2020 Hyundai Santa Fe
Test Program: Rigid Pole Side Impact

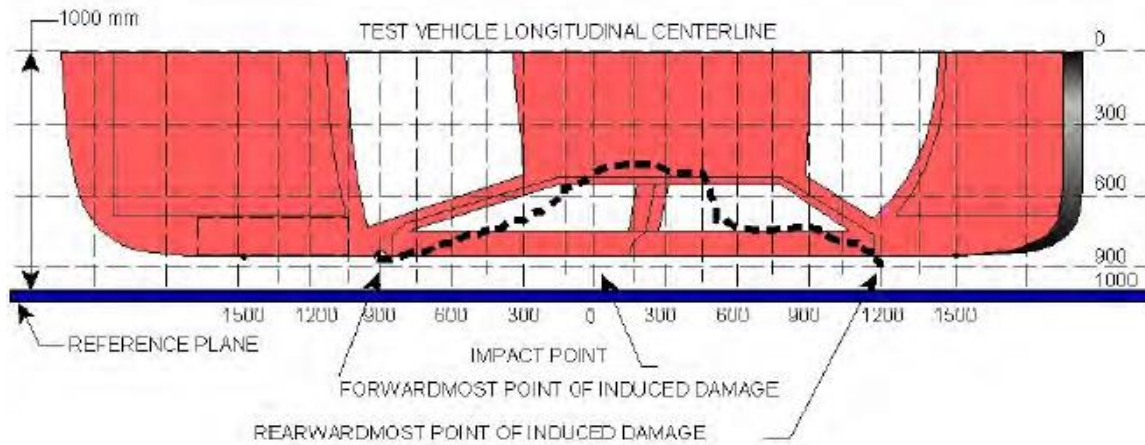
Test Date: 12/15/2020



DATA SHEET NO. 11
VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2020 Hyundai Santa Fe
 Test Program: Rigid Pole Side Impact

Test Date: 12/15/2020



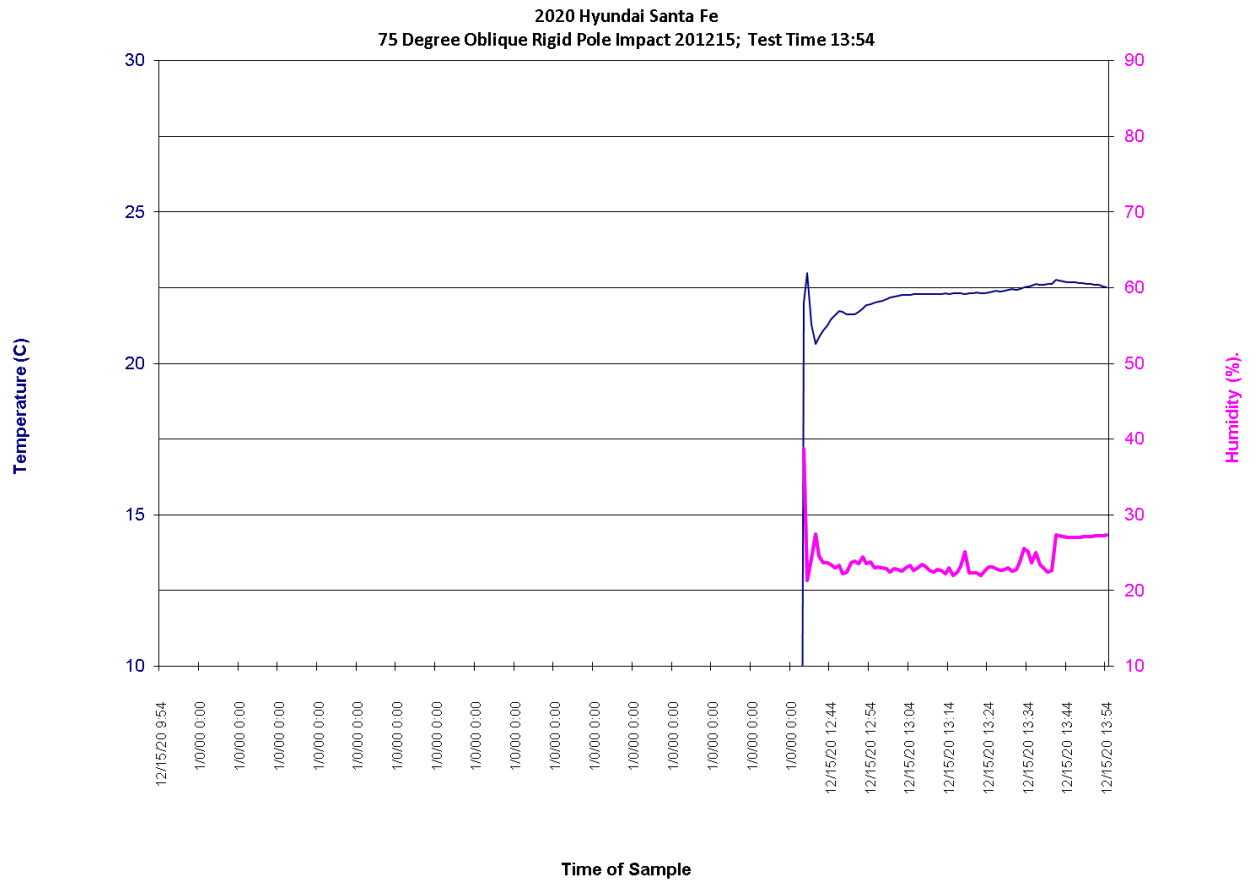
VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance From Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	1500	4	871	875	4
2	1050	4	853	881	28
3	750	3	859	931	72
4	300	2	723	925	202
5	0	3	641	940	299
6 ¹	-450	3	878	939	0

¹ DPD 6 is defined as zero crush since the crush does not extend to the end of the vehicle.

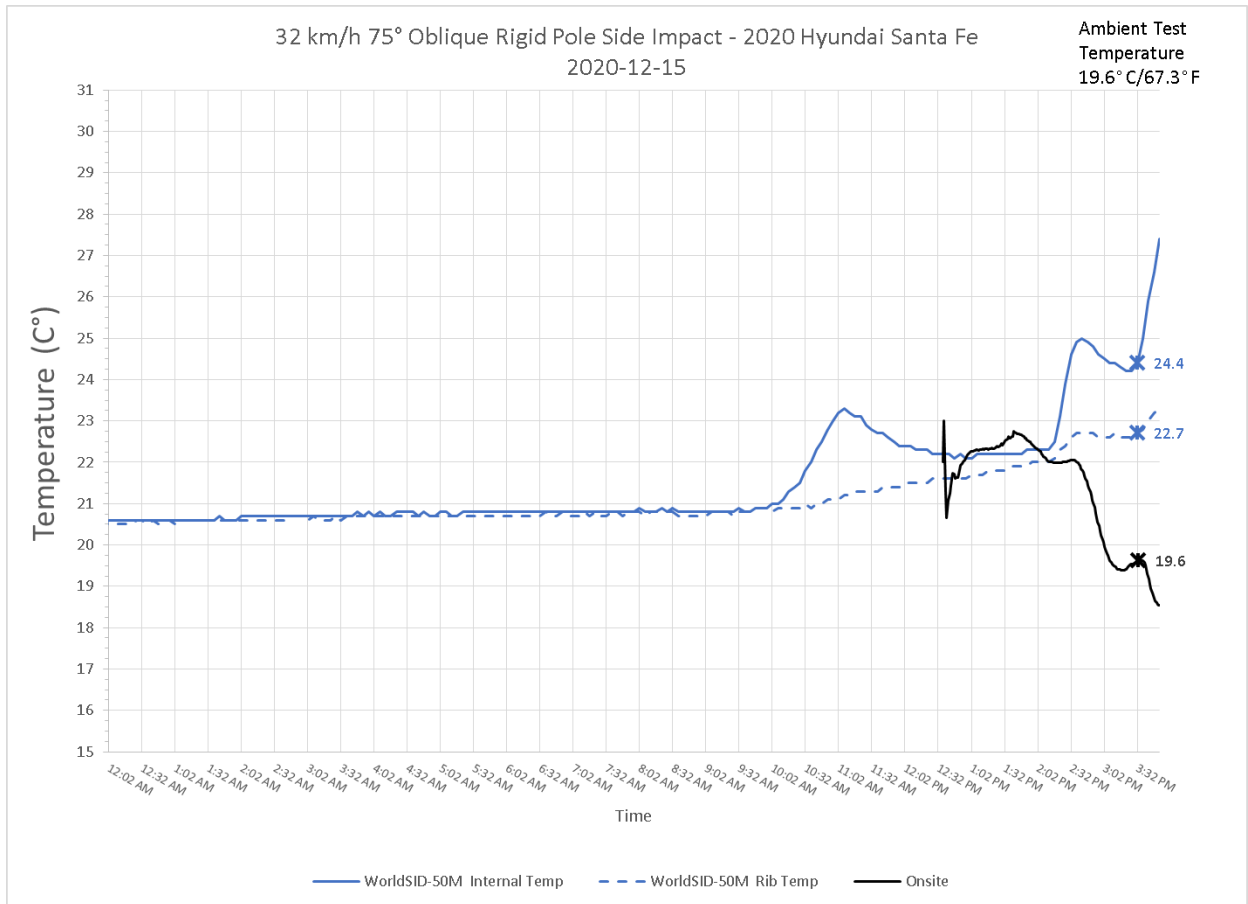
DATA SHEET NO. 12
DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle: 2020 Hyundai Santa Fe
Test Program: Rigid Pole Side Impact Test Date: 12/15/2020



DATA SHEET NO. 12, CONTINUED
DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle: 2020 Hyundai Santa Fe
 Test Program: Rigid Pole Side Impact Test Date: 12/15/2020



APPENDIX A
PHOTOGRAPHS

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4	Post-Test Frontal View of Test Vehicle	A-5
5	Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle	A-6
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10	Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle	A-8
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39	Pre-Test Close-Up View of Driver Seat Back or Head Restraint	A-23
40	Pre-Test Dummy and Door Clearance View	A-24
41	Post-Test Dummy and Door Clearance View	A-24
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No. 001 As Delivered Right Front $\frac{3}{4}$ View of Test Vehicle



No. 002 As Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle



No. 003 Pre-Test Frontal View of Test Vehicle



No. 004 Post-Test Frontal View of Test Vehicle



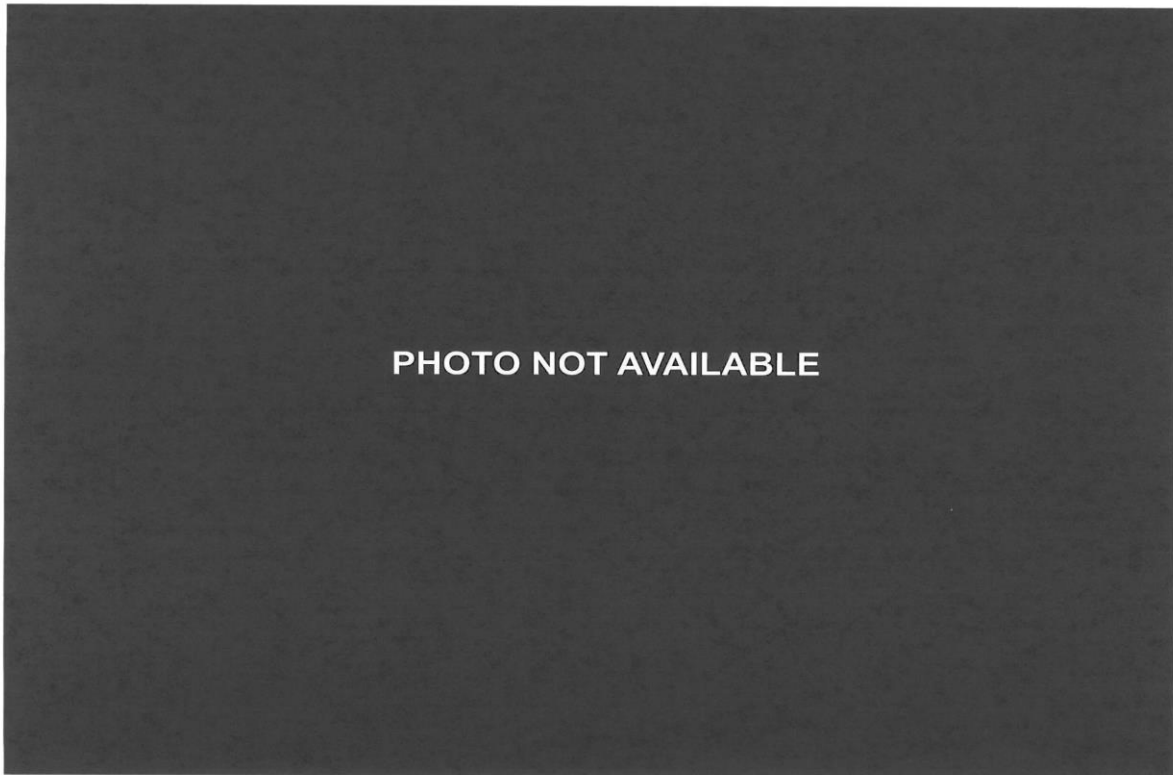
No. 005 Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle



No. 006 Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle



No. 007 Pre-Test Left Side View of Test Vehicle



No. 008 Post-Test Left Side View of Test Vehicle



No. 009 Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



No. 010 Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



No. 011 Pre-Test Rear View of Test Vehicle



No. 012 Post-Test Rear View of Test Vehicle



No. 013 Pre-Test Right Side View of Test Vehicle



No. 014 Post-Test Right Side View of Test Vehicle



No. 015 Pre-Test Overhead View of Test Area



No. 016 Post-Test Overhead View of Test Area



No. 017 Pre-Test Left Side View of Pole Positioned Against Side of Vehicle



No. 018 Pre-Test Right Side View of Pole Positioned Against Side of Vehicle



No. 019 Pre-Test Close-Up View of Impact Point Target



No. 020 Post-Test Close-Up View of Impact Point Target Showing Impact Location



No. 021 Pre-Test Front Close-Up View of Dummy Head and Chest



No. 022 Post-Test Front Close-Up View of Dummy



No. 023 Pre-Test Left Side View of Dummy Showing Belt and Chalking

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No. 024 Pre-Test Left Side View of Dummy Shoulder and Door Top View



No. 025 Post-Test Left Side View of Dummy Shoulder and Door Top View



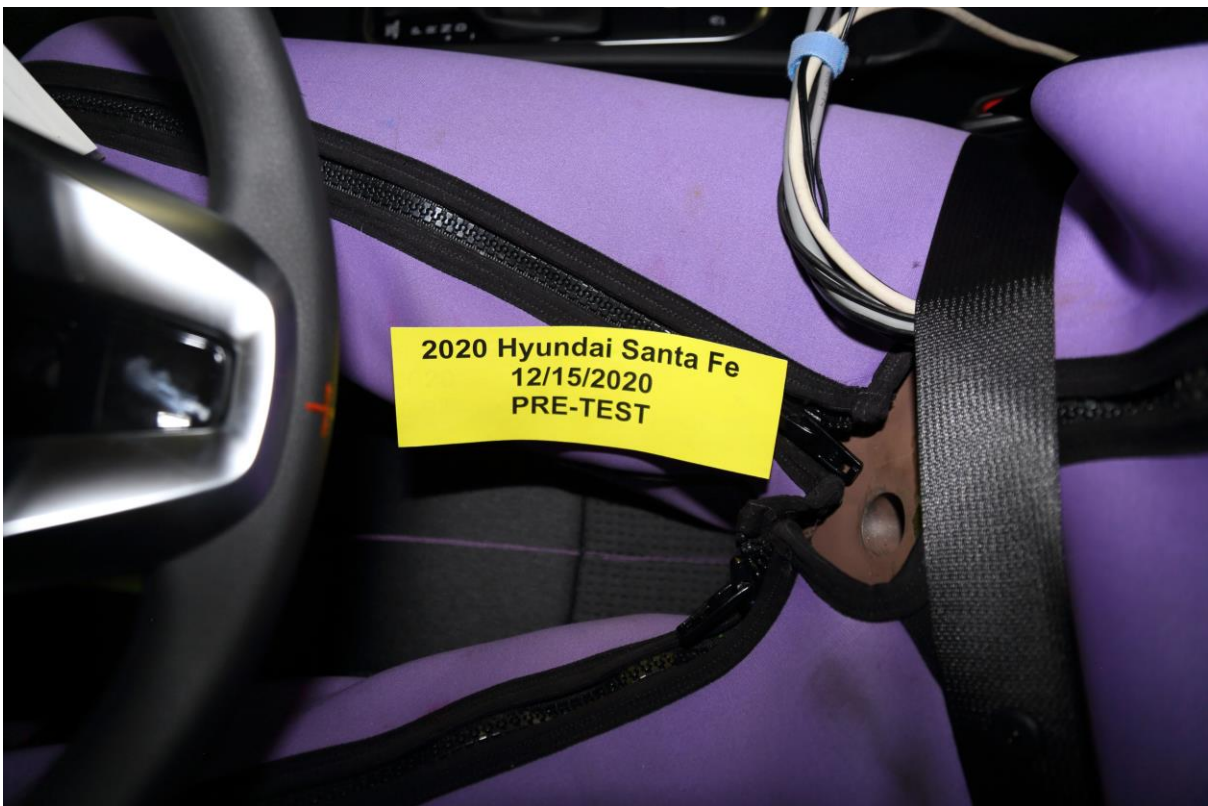
No. 026 Pre-Test Front View of Seat Back Prior to Dummy Positioning



No. 027 Pre-Test Front Close-Up View of Dummy Head and Shoulders in Relation to Head Restraint



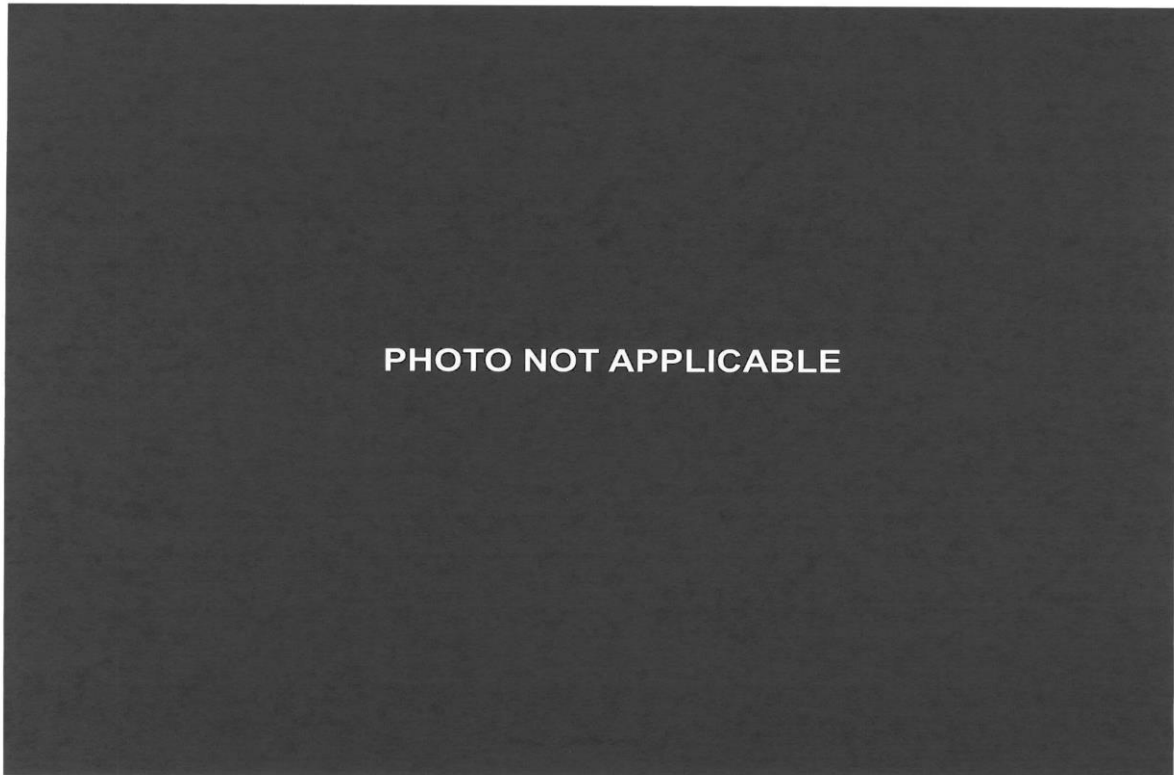
No. 028 Pre-Test Front View of Seat Pan Prior to Dummy Positioning



No. 029 Pre-Test Overhead View of Dummy Thighs on Seat Pan



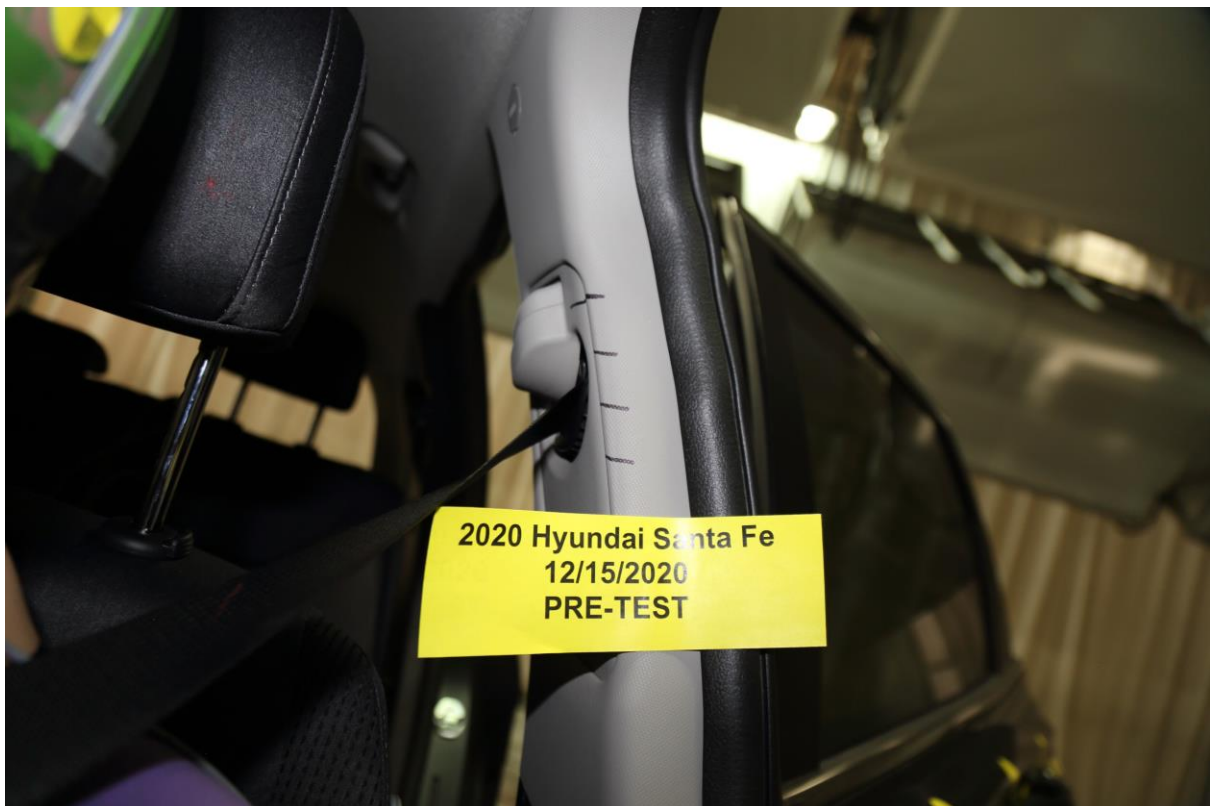
No. 030 Pre-Test Left Side View of Dummy Neck Showing Position of Adjustable Neck Bracket



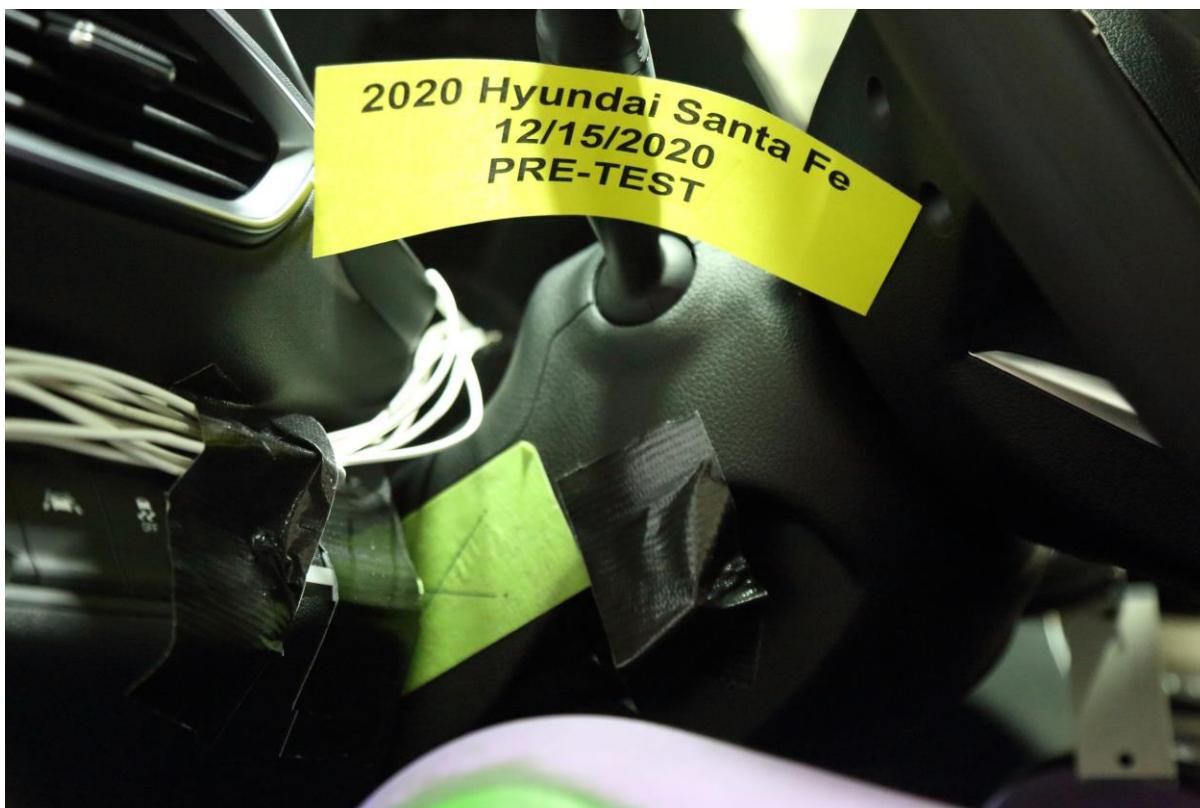
No. 031 Pre-Test Left Side View of Dummy Head Showing Dummy Head is Level



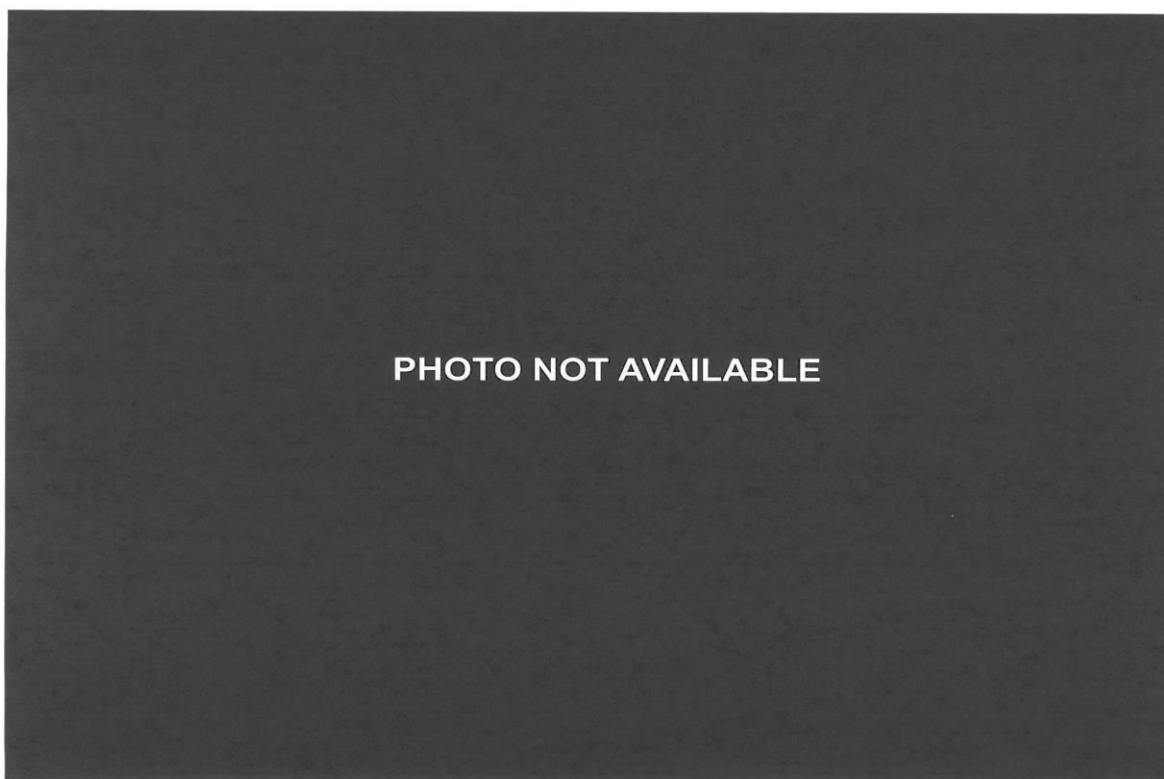
No. 032 Pre-Test Placement of Dummy Feet



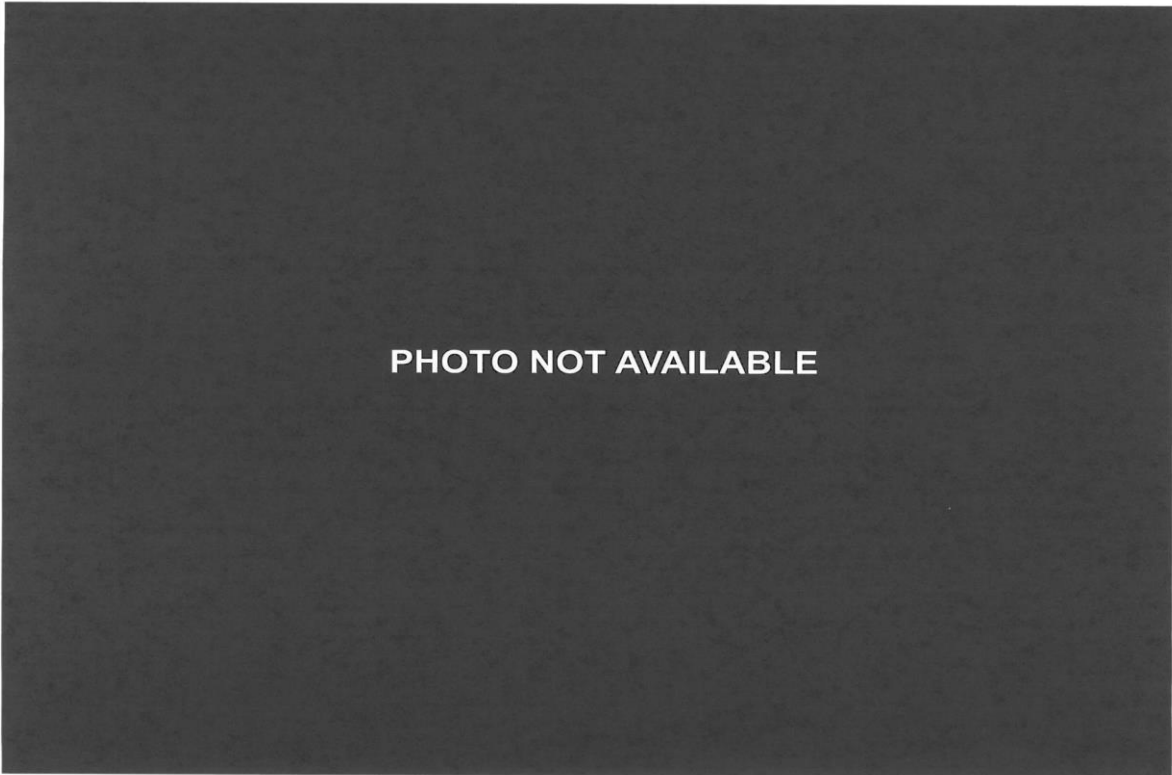
No. 033 Pre-Test View of Belt Anchorage for Dummy



No. 034 Pre-Test Left Side View of Steering Wheel



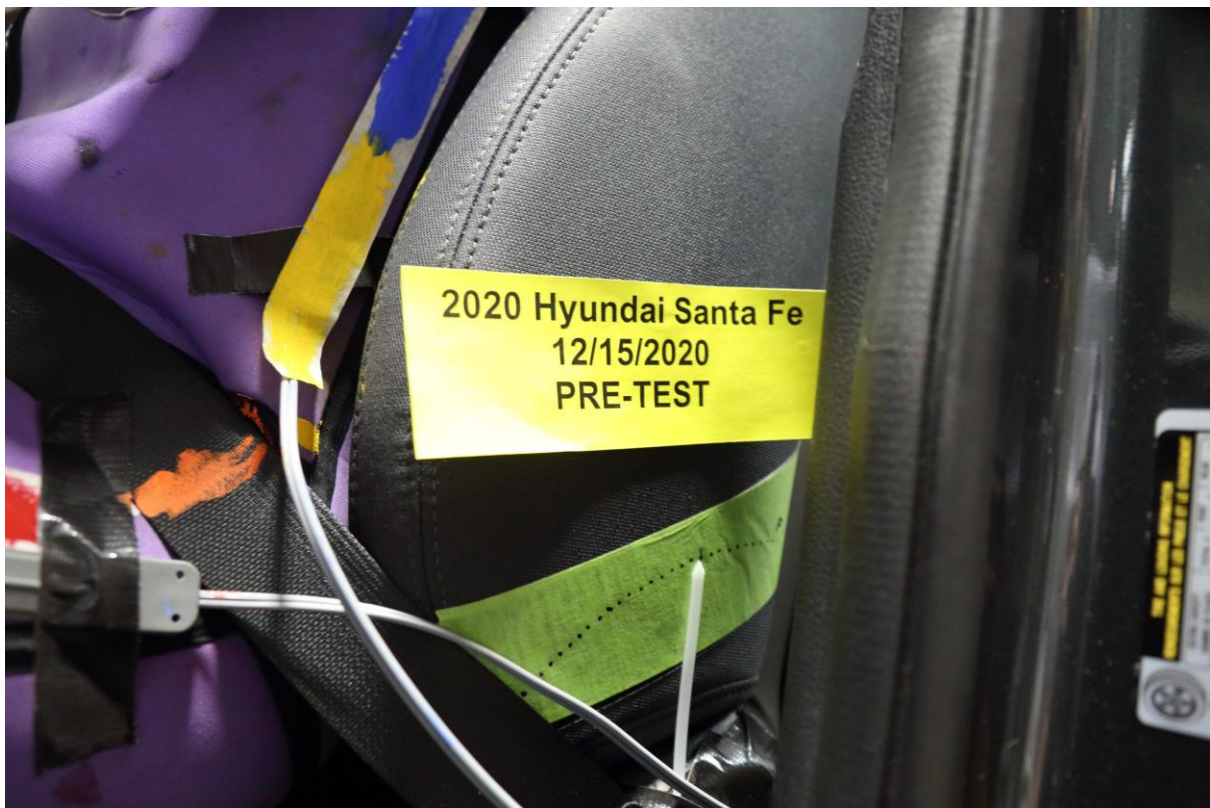
No. 035 Pre-Test View of Disengaged Parking Brake



No. 036 Pre-Test View of Parking Brake



No. 037 Pre-Test Close-Up Left Side View of Driver Seat Track



No. 038 Pre-Test Close-Up Left Side View of Driver Seat Back



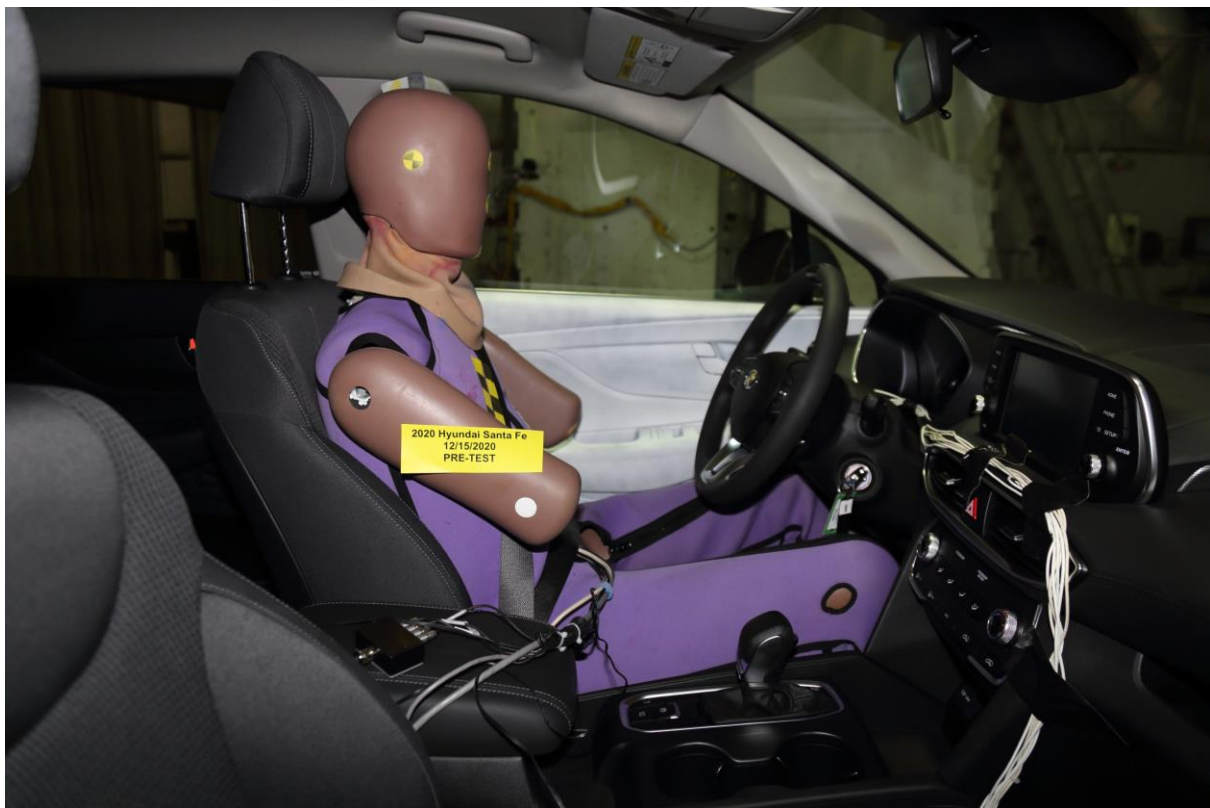
No. 039 Pre-Test Close-Up View of Driver Seat Back or Head Restraint



No. 040 Pre-Test Dummy and Door Clearance View



No. 041 Post-Test Dummy and Door Clearance View



No. 042 Pre-Test Right Side View of Dummy and Front Seat of Occupant Compartment



No. 043 Post-Test Right Side View of Dummy and Front Seat of Occupant Compartment



No. 044 Pre-Test Inner Door Panel View



No. 045 Post-Test Inner Door Panel View Showing Dummy Contact Location

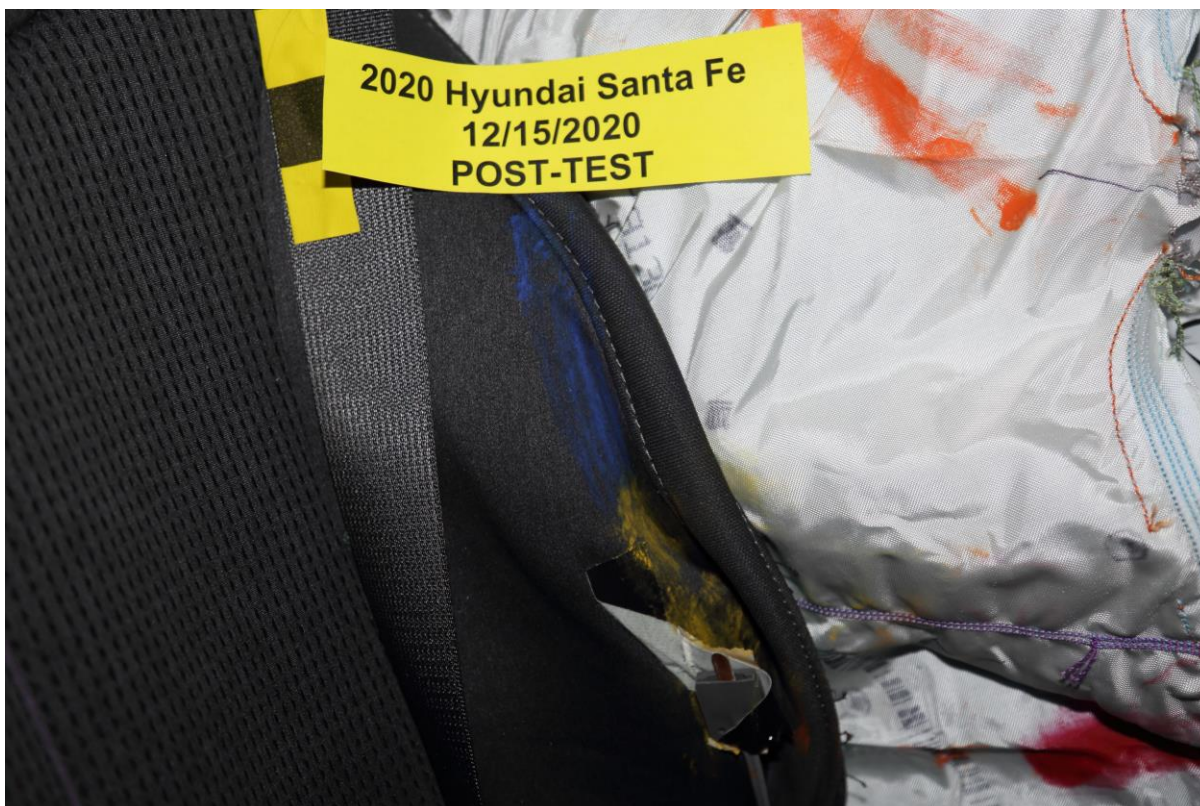


No. 046 Post-Test Dummy Close-Up Head Contact with Vehicle Interior View

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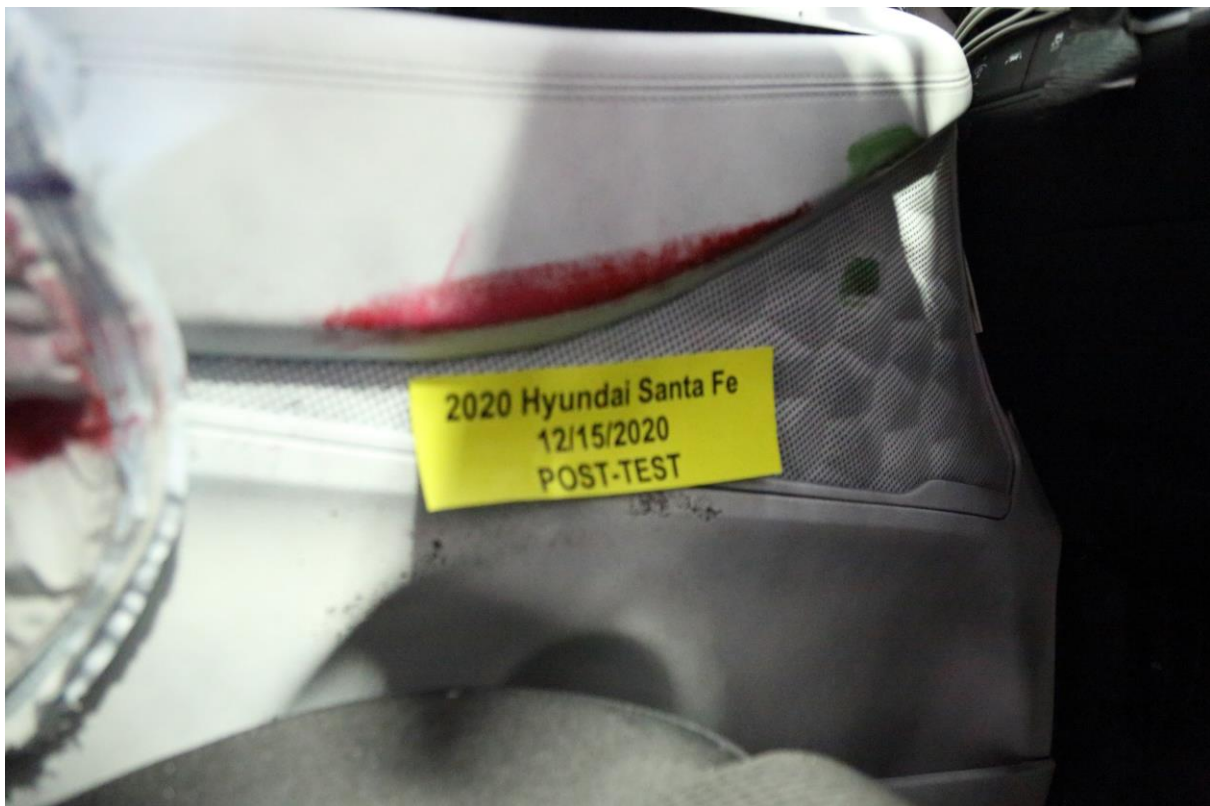
No. 047 Post-Test Dummy Close-Up Head Contact with Side Airbag View



No. 048 Post-Test Dummy Close-Up Torso Contact with Vehicle Interior View



No. 049 Post-Test Dummy Close-Up Torso Contact with Side Airbag View

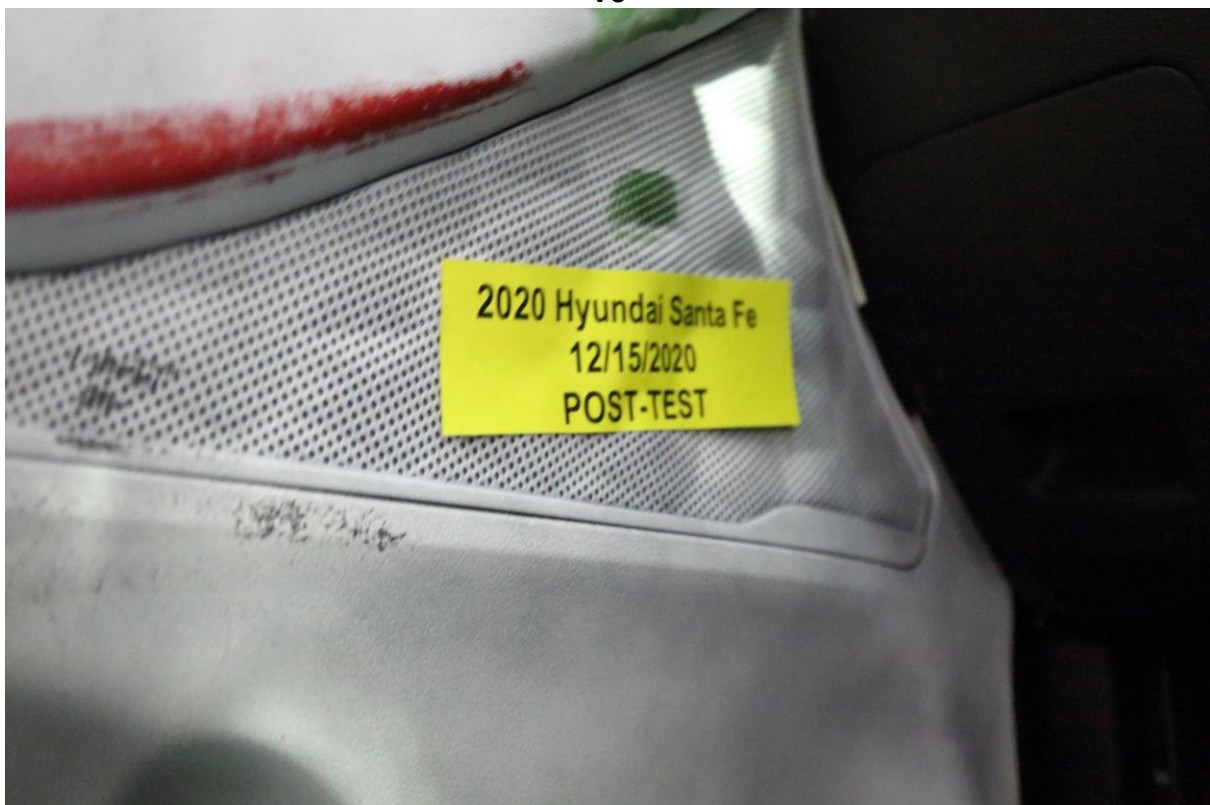


No. 050 Post-Test Dummy Close-Up Pelvis Contact with Vehicle Interior View



No. 051 Post-Test Dummy Close-Up Pelvis Contact with Side Airbag View

**No. 052 Post-Test Dummy Close-Up Knee Contact with
Ve**



hicle Interior View



No. 053 Post-Test Right Side View of Dummy and Rear Seat of Occupant Compartment

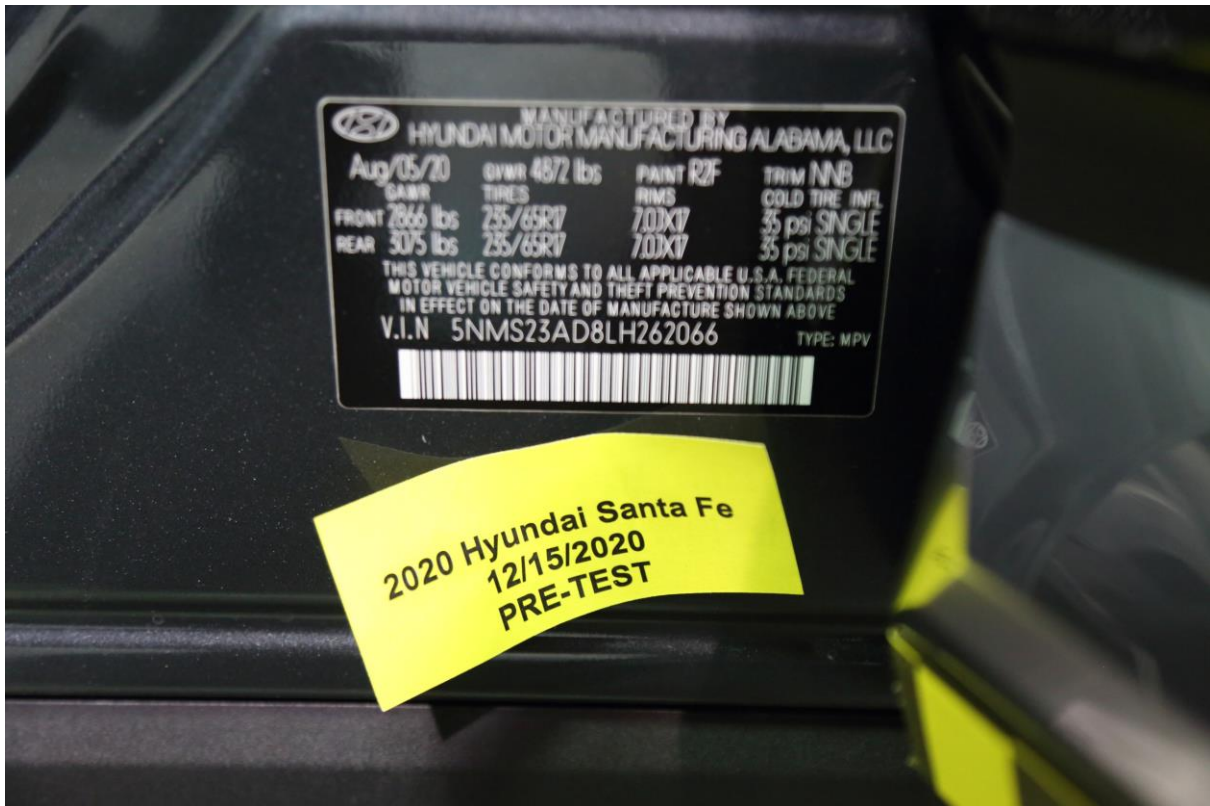
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No. 054 Pre-Test View of Fuel Filler Cap or Fuel Filler Neck



No. 055 Post-Test View of Fuel Filler Cap or Fuel Filler Neck



No. 056 Close-Up View of Vehicle Certification Label

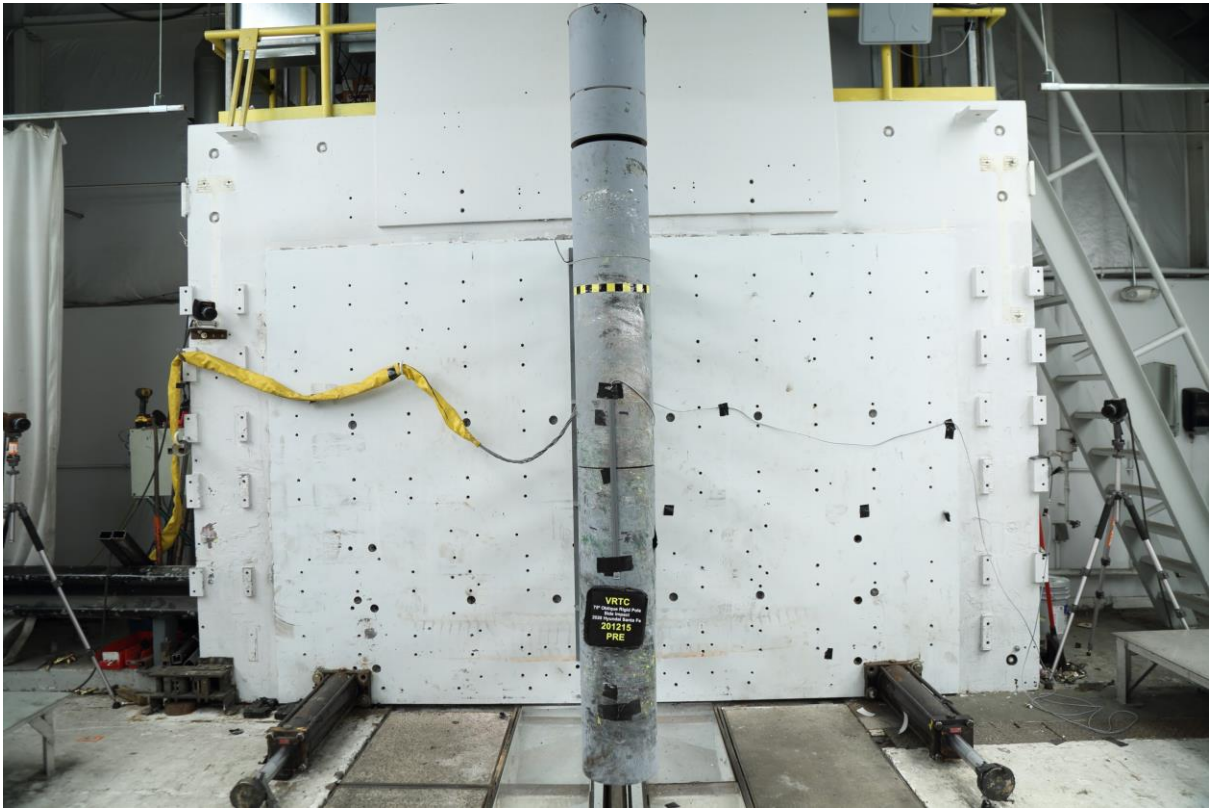


No. 056a Close-up View of Vehicle Reduced Load Carrying Capacity Label



No. 057 Close-Up View of Vehicle Tire Information Placard or Label

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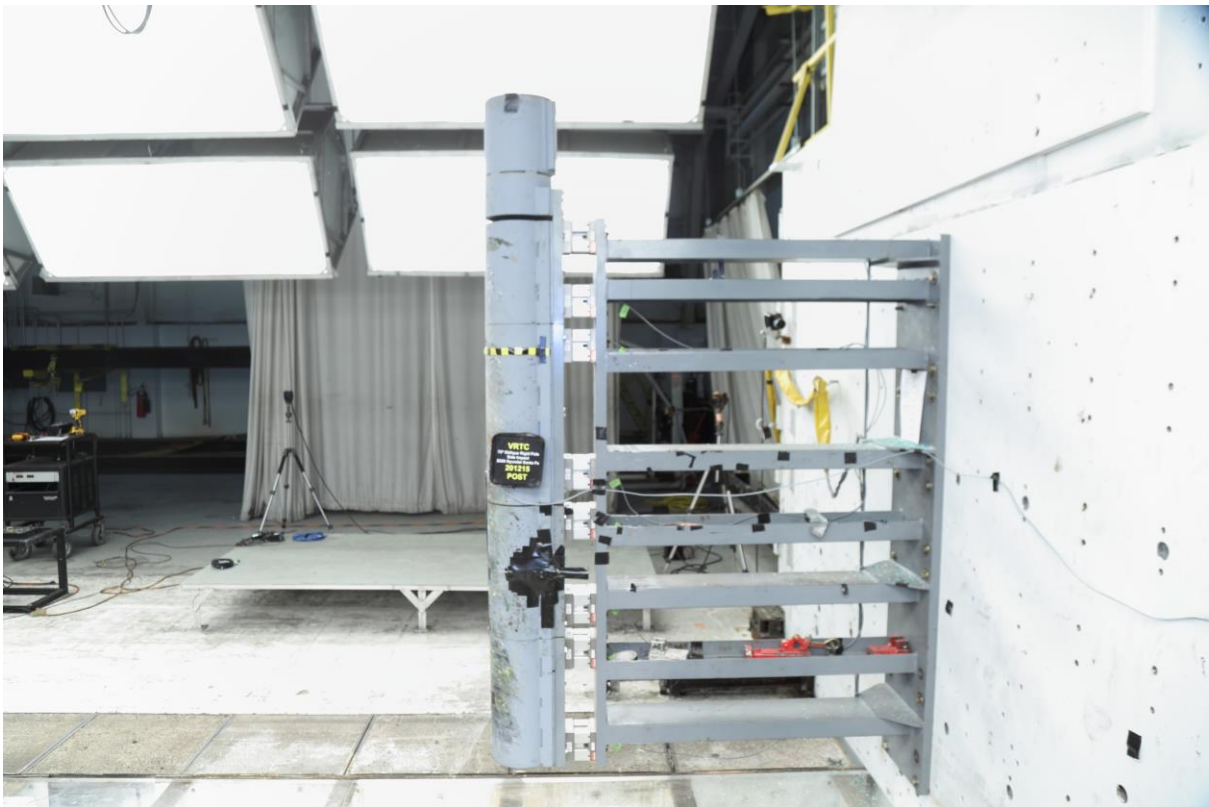
No. 058 Pre-Test Pole Barrier Front View



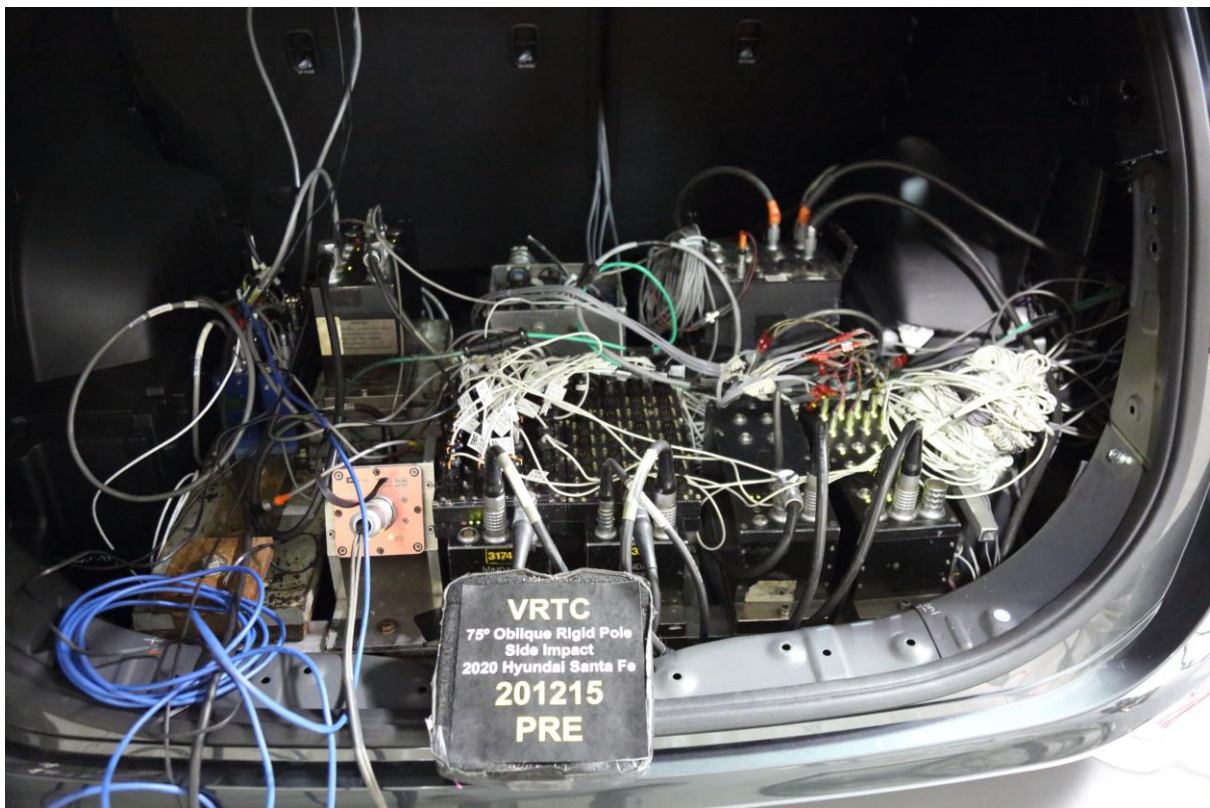
No. 059 Post-Test Pole Barrier Front View



No. 060 Pre-Test Pole Barrier Side View



No. 061 Post-Test Pole Barrier Side View



No. 062 Pre-Test Ballast View



No. 063 Post-Test Primary and Redundant Speed Trap Read Out

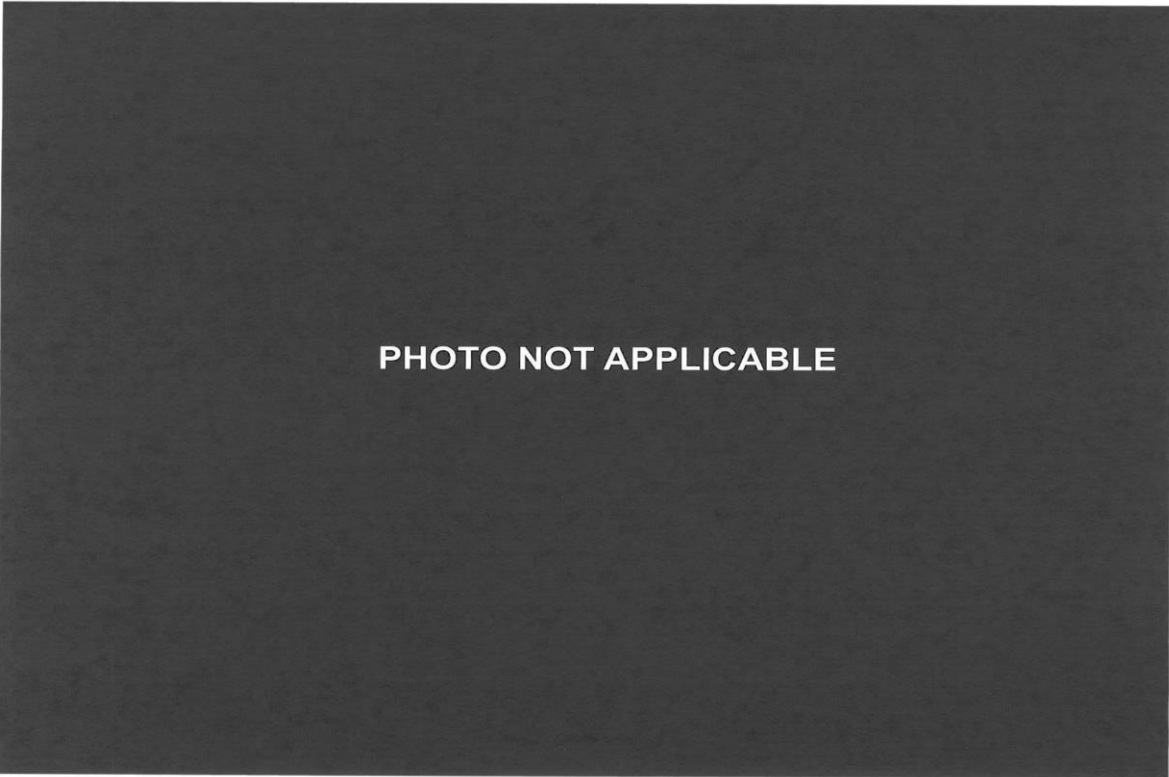


PHOTO NOT APPLICABLE

No. 064 FMVSS No. 301 Static Rollover 0 Degrees

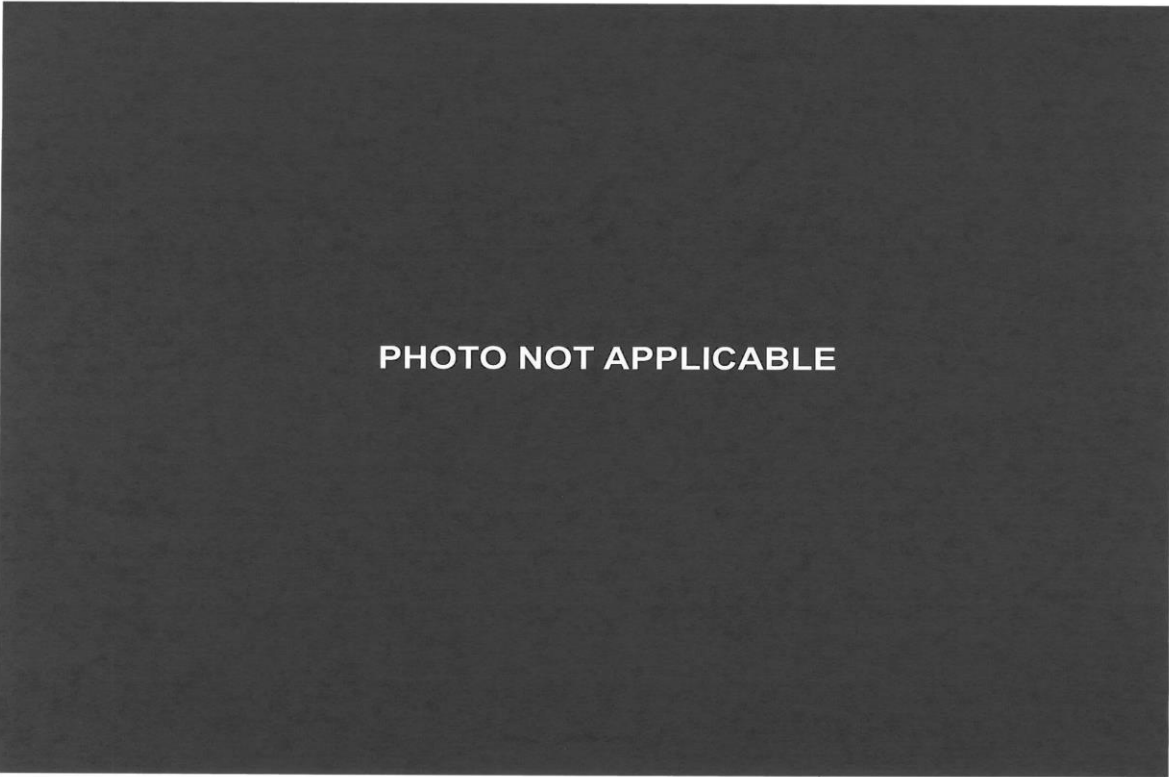


PHOTO NOT APPLICABLE

No. 065 FMVSS No. 301 Static Rollover 90 Degrees

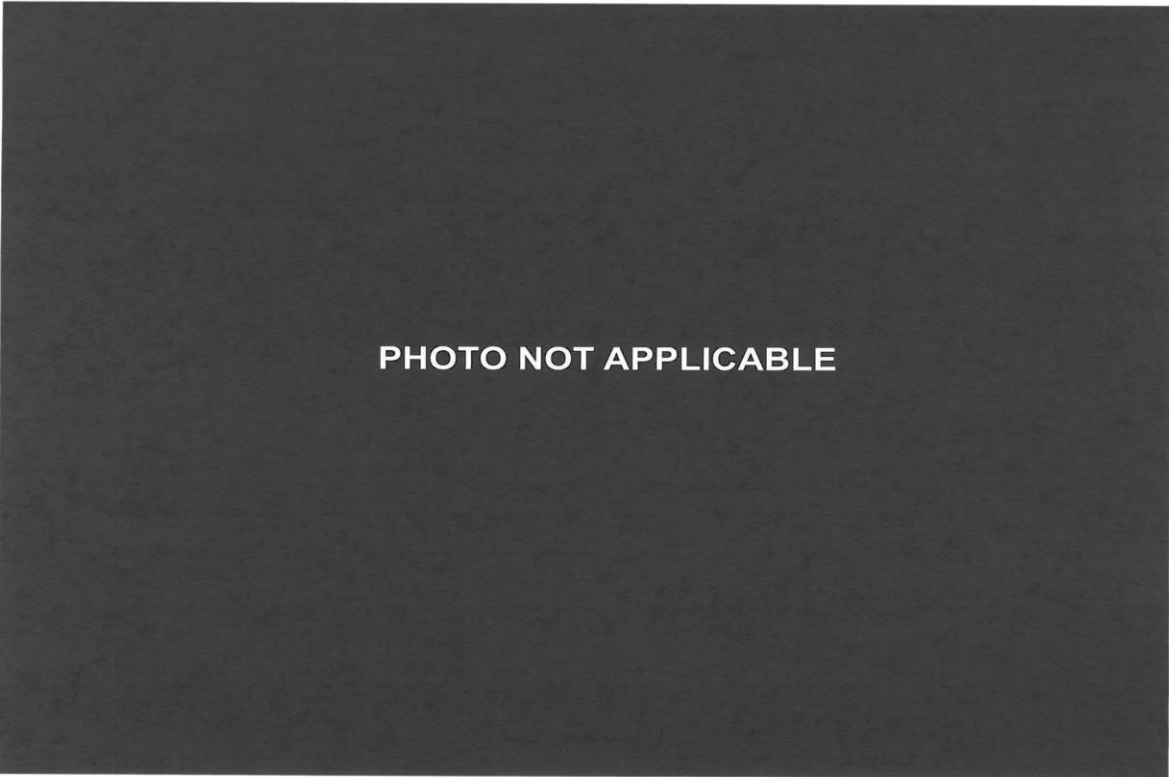


PHOTO NOT APPLICABLE

No. 066 FMVSS No. 301 Static Rollover 180 Degrees

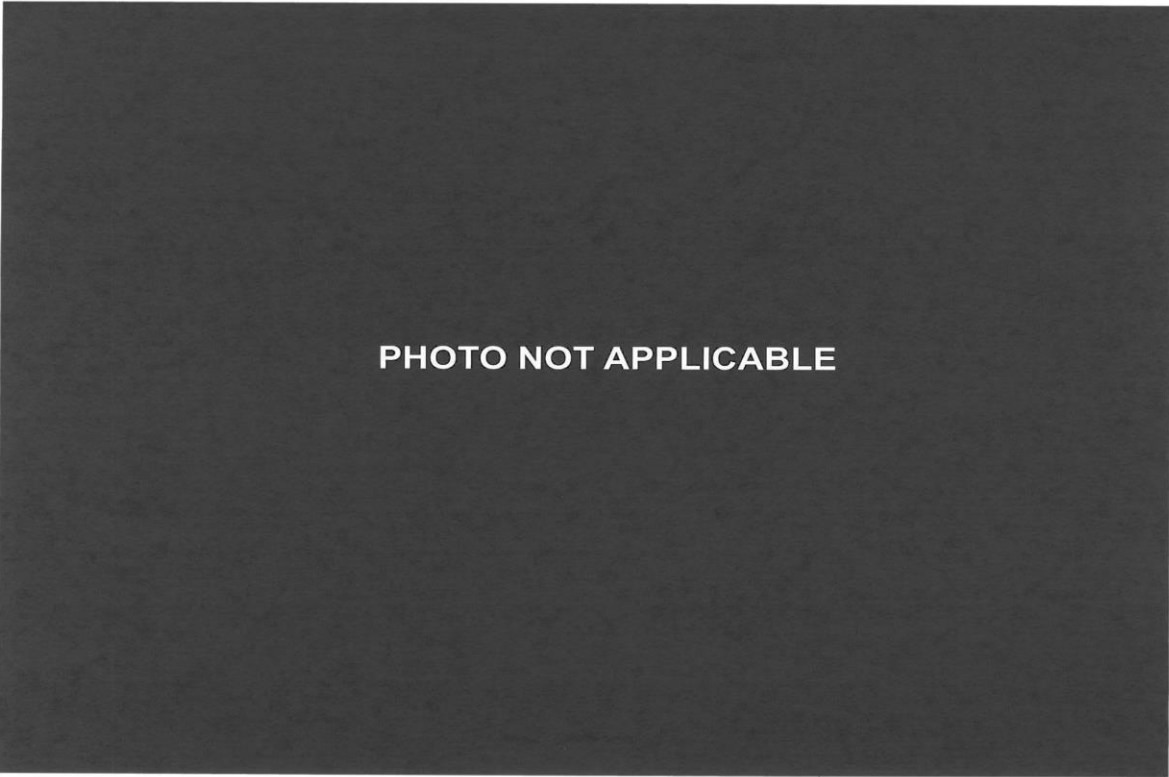


PHOTO NOT APPLICABLE

No. 067 FMVSS No. 301 Static Rollover 270 Degrees

PHOTO NOT APPLICABLE

No. 068 FMVSS No. 301 Static Rollover 360 Degrees



No. 069 Impact Event

[illegible]

No. 70 Monroney Label

OF034072N

Adjust the head restraints so the middle of the head restraint is at the same height as the height of the top of the eyes.

- **NEVER** adjust the head restraint position of the driver's seat when the vehicle is in motion.
- Adjust the head restraint as close to the passenger's head as possible. Do not use a seat cushion that holds the body away from the seatback.
- Make sure the head restraint locks into position after adjusting it.

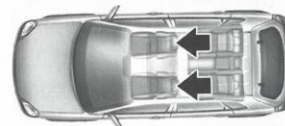
NOTICE

To prevent damage, NEVER hit or pull on the head restraints.

 CAUTION

When there is no occupant in the rear seats, adjust the height of the head restraint to the lowest position. The rear seat head restraint can reduce the visibility of the rear area.

Front seat head restraints



OOSEV038012L

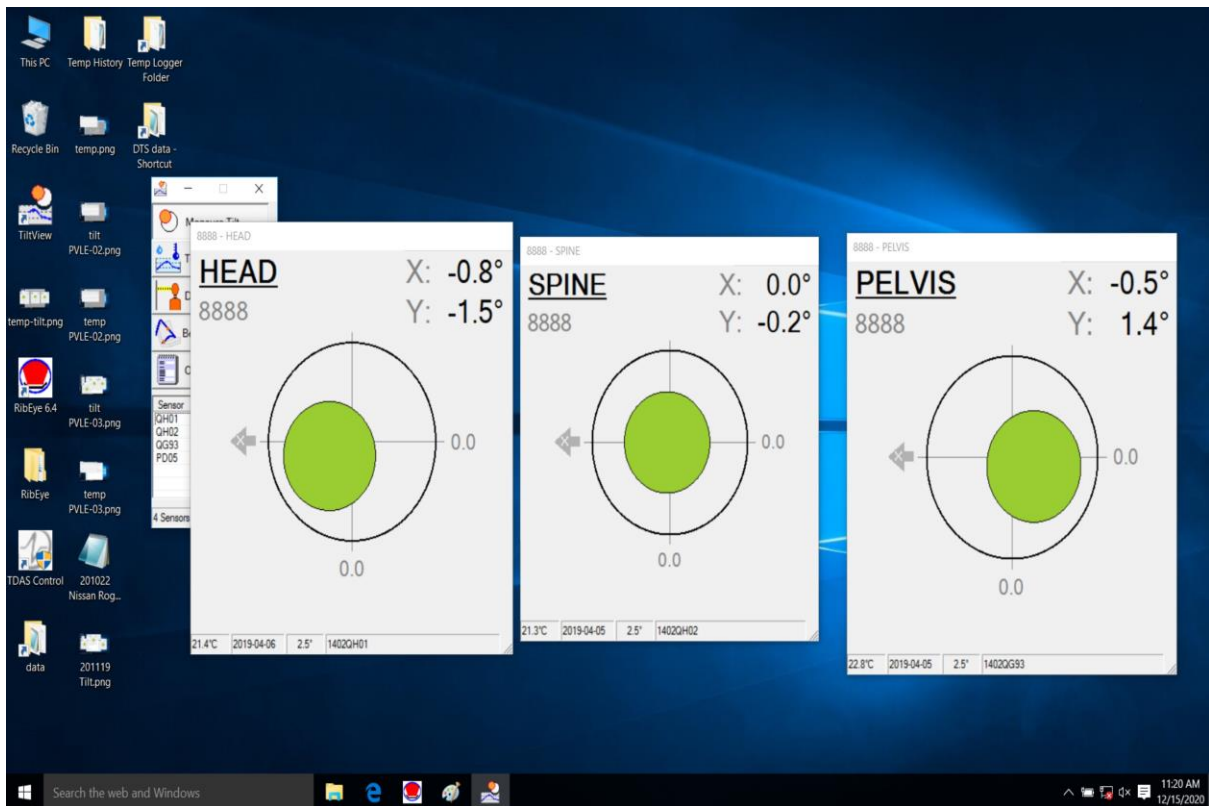
The vehicle's front and passenger's seats are equipped with adjustable head restraints for the passengers safety and comfort.

2

Safety system of your vehicle

PHOTO NOT APPLICABLE

No. 072 Post-Test View of Shattered Vehicle Inner Door Panel



No. 073 WorldSID-50M Pre-Test Tilt Sensor View

APPENDIX B
VEHICLE AND DUMMY RESPONSE DATA PLOTS

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Driver Dummy & Vehicle Instrumentation Plots

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2	Driver Head Acceleration (Y)	B-8
3	Driver Head Acceleration (Z)	B-8
4	Driver Head Resultant Acceleration	B-8
5	Driver Head Angular Rate (X)	B-9
6	Driver Head Angular Rate (Y)	B-9
7	Driver Head Angular Rate (Z)	B-9
8	Driver Upper Neck Force (X)	B-10
9	Driver Upper Neck Force (Y)	B-10
10	Driver Upper Neck Force (Z)	B-10
11	Driver Upper Neck Moment (X)	B-11
12	Driver Upper Neck Moment (Y)	B-11
13	Driver Upper Neck Moment (Z)	B-11
14	Driver Lower Neck Force (X)	B-12
15	Driver Lower Neck Force (Y)	B-12
16	Driver Lower Neck Force (Z)	B-12
17	Driver Lower Neck Moment (X)	B-13
18	Driver Lower Neck Moment (Y)	B-13
19	Driver Lower Neck Moment (Z)	B-13
20	Driver Shoulder Force (X)	B-14
21	Driver Shoulder Force (Y)	B-14
22	Driver Shoulder Force (Z)	B-14
23	Driver Shoulder Rear Displacement (X)	B-15
24	Driver Shoulder Rear Displacement (Y)	B-15
25	Driver Shoulder Rear Displacement (Z)	B-15
26	Driver Shoulder Rear Length Change	B-15
27	Driver Shoulder Middle Displacement (X)	B-16
28	Driver Shoulder Middle Displacement (Y)	B-16
29	Driver Shoulder Middle Displacement (Z)	B-16
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37	Driver Thorax Rib 1 Rear Displacement (Z)	B-18
38	Driver Thorax Rib 1 Rear Length Change	B-18
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40	Driver Thorax Rib 1 Middle Displacement (Y)	B-19
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42	Driver Thorax Rib 1 Middle Length Change	B-19
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45	Driver Thorax Rib 1 Front Displacement (Z)	B-20
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49	Driver Thorax Rib 2 Rear Displacement (Z)	B-21
50	Driver Thorax Rib 2 Rear Length Change	B-21
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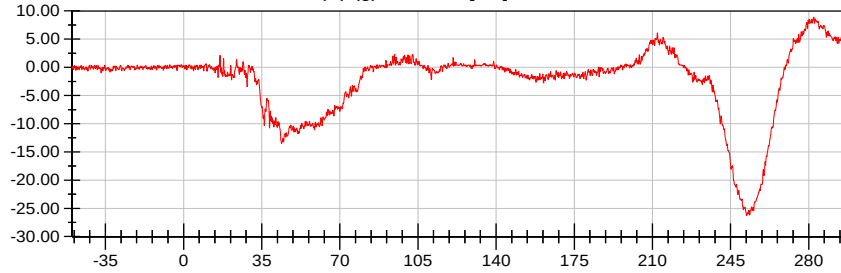
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Head Acceleration (X) (g) vs. Time [ms]



<Max>

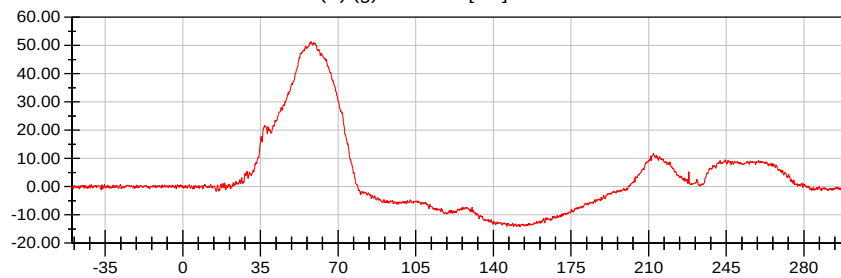
8.90 g at 282.30 ms

<Min>

-26.23 g at 252.25 ms

CFC_1000

Driver Head Acceleration (Y) (g) vs. Time [ms]



<Max>

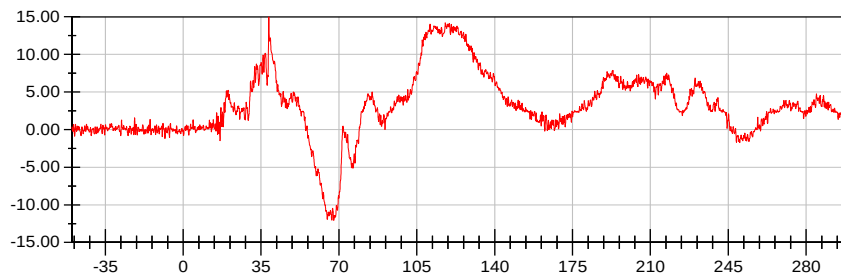
51.39 g at 57.75 ms

<Min>

-14.22 g at 151.85 ms

CFC_1000

Driver Head Acceleration (Z) (g) vs. Time [ms]



<Max>

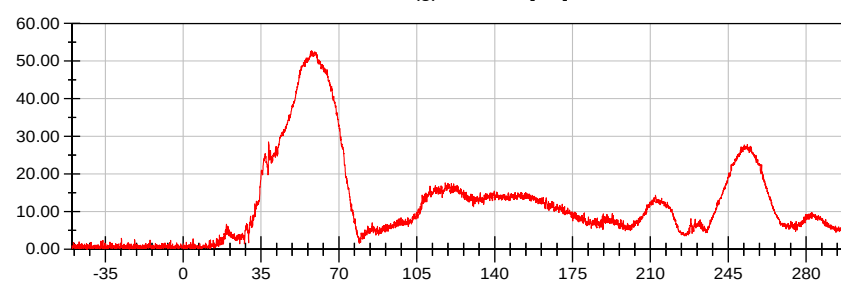
15.00 g at 38.45 ms

<Min>

-12.05 g at 67.70 ms

CFC_1000

Driver Head Acceleration Resultant (g) vs. Time [ms]



<Max>

52.77 g at 57.70 ms

<Min>

0.04 g at -43.30 ms

Prefiltered_> CFC 1000



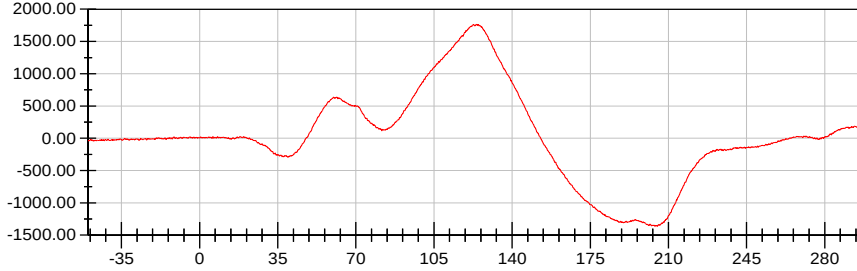
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Head Angular Rate (X) (deg/s) vs. Time [ms]



<Max>

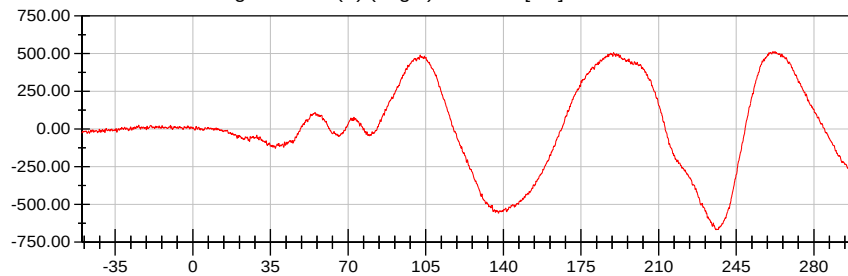
1,763.63 deg/s at 124.15 ms

<Min>

-1,362.88 deg/s at 205.00 ms

CFC_1000

Driver Head Angular Rate (Y) (deg/s) vs. Time [ms]



<Max>

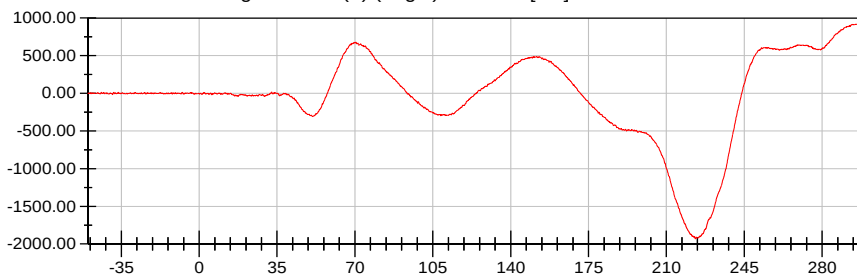
513.34 deg/s at 261.60 ms

<Min>

-667.78 deg/s at 235.90 ms

CFC_1000

Driver Head Angular Rate (Z) (deg/s) vs. Time [ms]



<Max>

930.57 deg/s at 297.45 ms

<Min>

-1,930.83 deg/s at 223.00 ms

CFC_1000



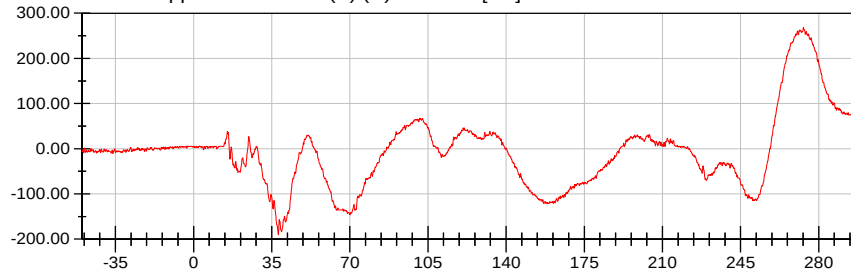
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Upper Neck Force (X) (N) vs. Time [ms]



<Max>

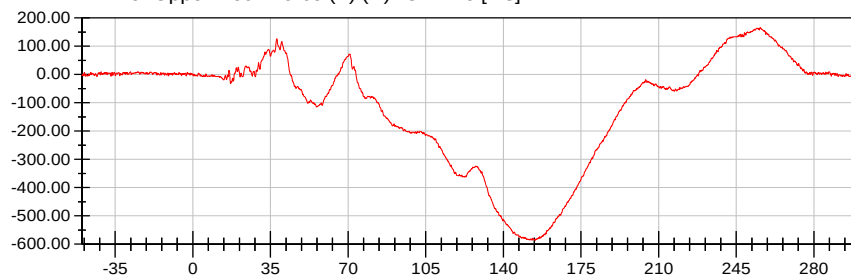
267.94 N at 273.15 ms

<Min>

-190.79 N at 38.00 ms

CFC_1000

Driver Upper Neck Force (Y) (N) vs. Time [ms]



<Max>

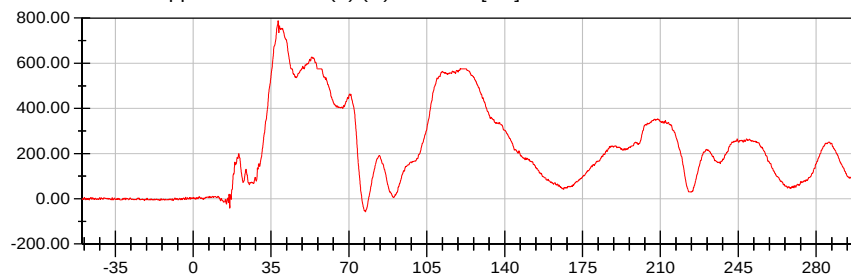
165.92 N at 255.75 ms

<Min>

-585.77 N at 152.90 ms

CFC_1000

Driver Upper Neck Force (Z) (N) vs. Time [ms]



<Max>

788.67 N at 38.20 ms

<Min>

-57.07 N at 77.45 ms

CFC_1000



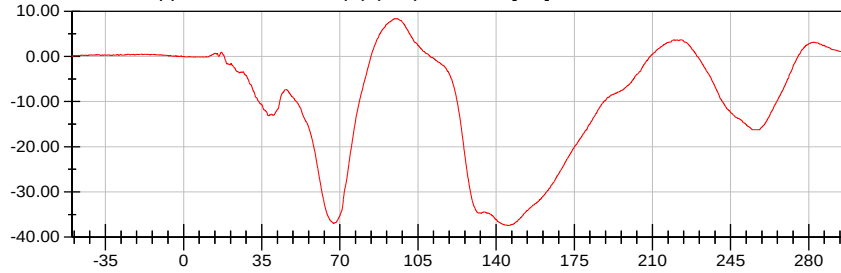
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Upper Neck Moment (X) (Nm) vs. Time [ms]



<Max>

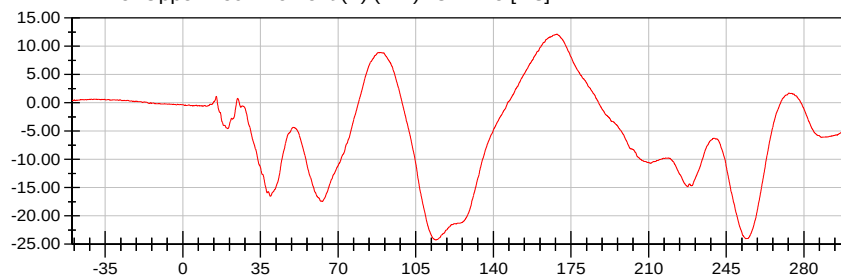
8.34 Nm at 95.40 ms

<Min>

-37.42 Nm at 145.30 ms

CFC_600

Driver Upper Neck Moment (Y) (Nm) vs. Time [ms]



<Max>

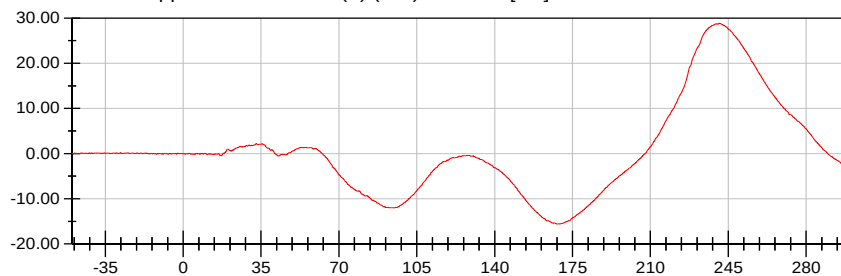
12.14 Nm at 168.75 ms

<Min>

-24.27 Nm at 114.15 ms

CFC_600

Driver Upper Neck Moment (Z) (Nm) vs. Time [ms]



<Max>

28.83 Nm at 240.95 ms

<Min>

-15.59 Nm at 169.20 ms

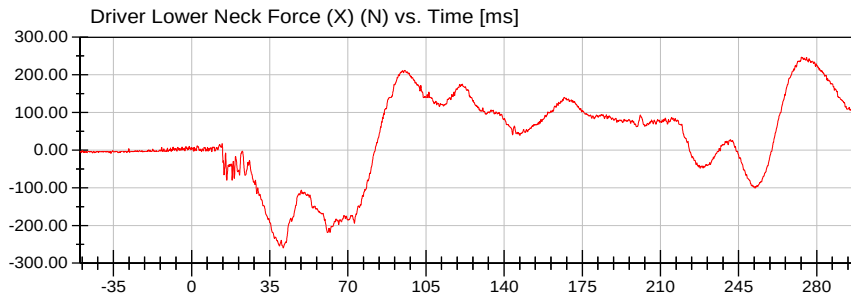
CFC_600



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



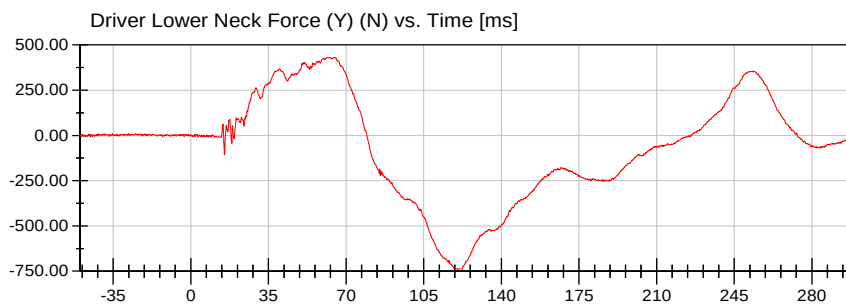
<Max>

246.74 N at 273.15 ms

<Min>

-259.91 N at 41.05 ms

CFC_1000



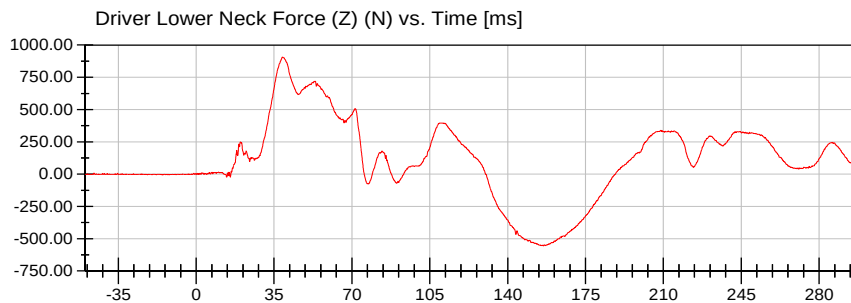
<Max>

429.87 N at 64.90 ms

<Min>

-738.80 N at 120.45 ms

CFC_1000



<Max>

906.46 N at 38.75 ms

<Min>

-555.30 N at 156.15 ms

CFC_1000

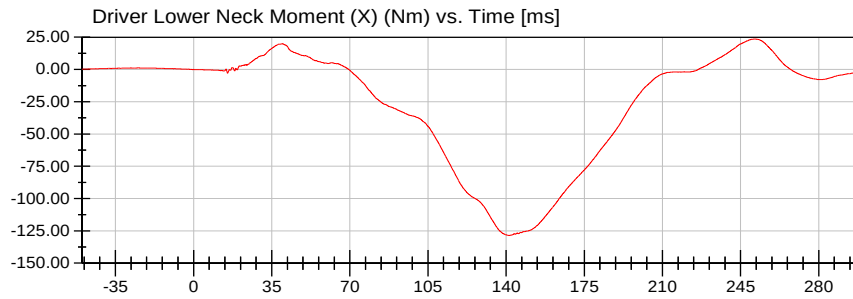


VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020



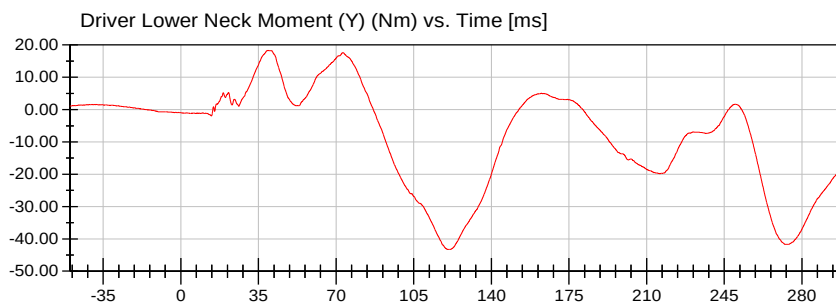
<Max>

23.49 Nm at 251.10 ms

<Min>

-128.53 Nm at 141.35 ms

CFC_600



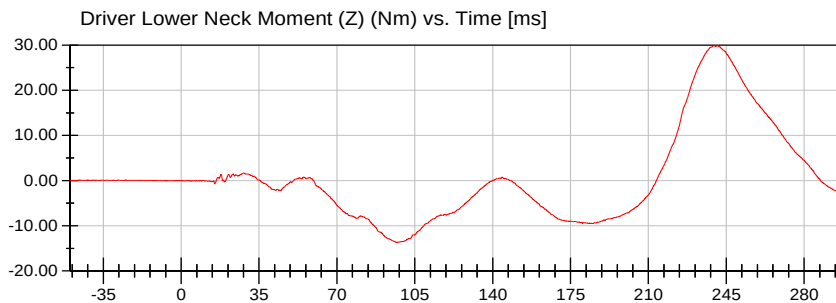
<Max>

18.32 Nm at 39.35 ms

<Min>

-43.28 Nm at 120.50 ms

CFC_600



<Max>

29.86 Nm at 240.85 ms

<Min>

-13.69 Nm at 97.05 ms

CFC_600

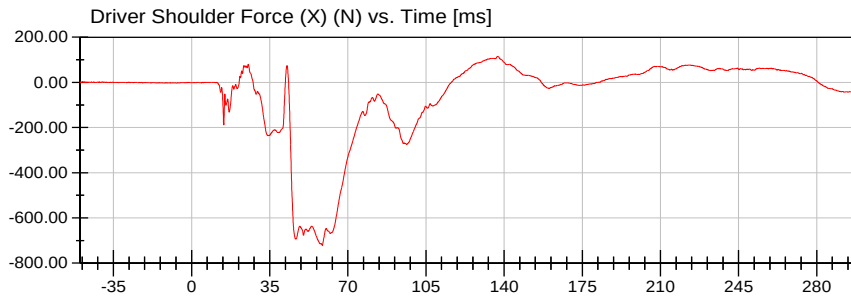


VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020



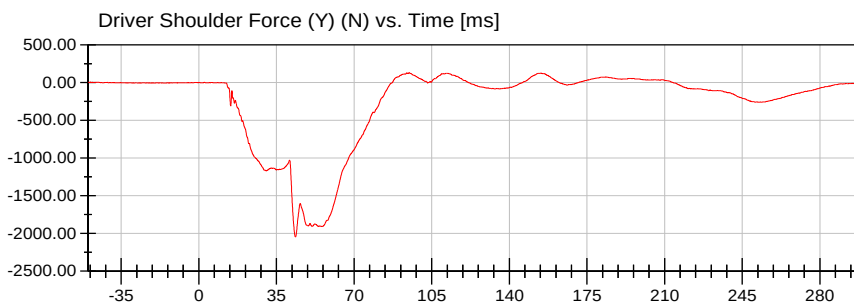
<Max>

114.90 N at 137.10 ms

<Min>

-720.14 N at 58.55 ms

CFC_600



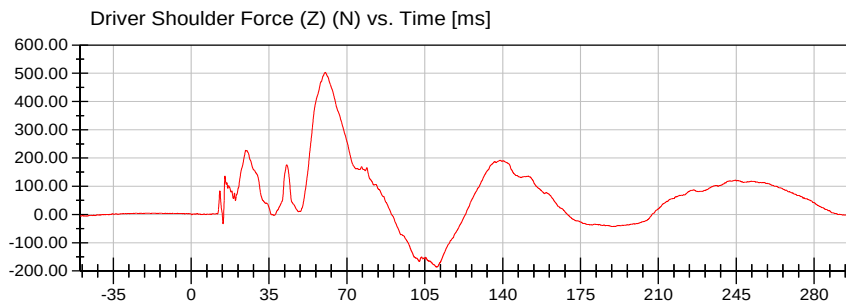
<Max>

132.29 N at 94.85 ms

<Min>

-2,045.42 N at 43.60 ms

CFC_600



<Max>

502.87 N at 60.30 ms

<Min>

-185.71 N at 110.35 ms

CFC_600



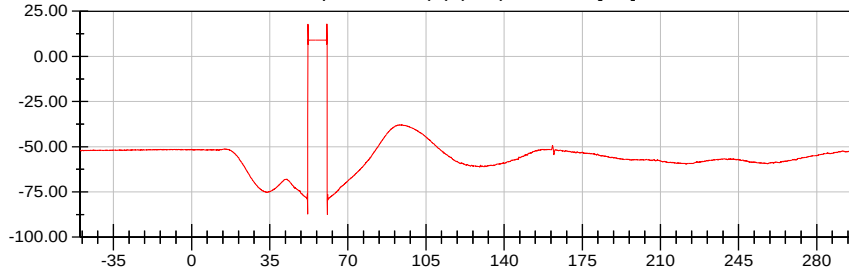
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Shoulder Rear Displacement (X) (mm) vs. Time [ms]



<Max>

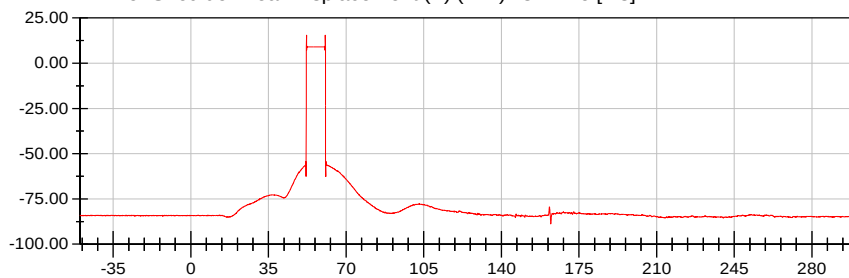
17.83 mm at 60.65 ms

<Min>

-87.71 mm at 60.85 ms

Unfiltered

Driver Shoulder Rear Displacement (Y) (mm) vs. Time [ms]



<Max>

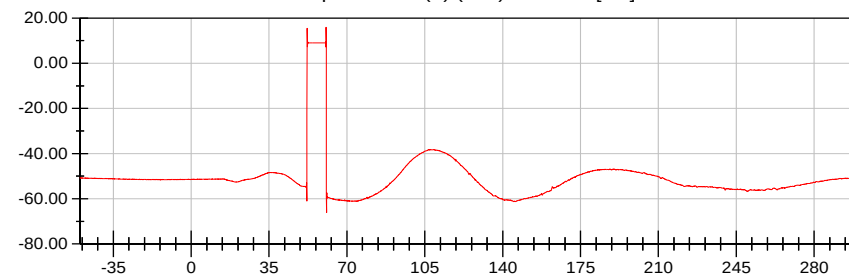
15.54 mm at 52.15 ms

<Min>

-88.75 mm at 162.30 ms

Unfiltered

Driver Shoulder Rear Displacement (Z) (mm) vs. Time [ms]



<Max>

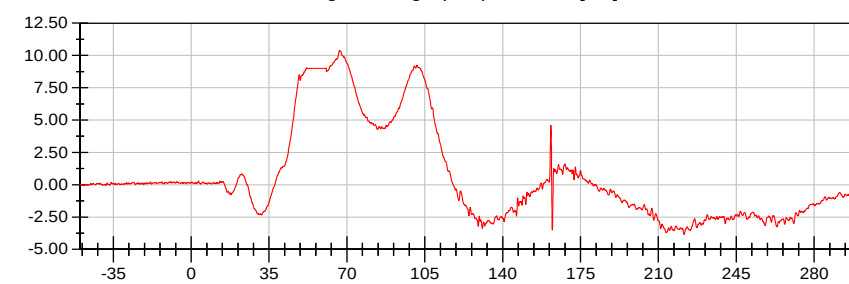
15.85 mm at 60.65 ms

<Min>

-66.10 mm at 60.85 ms

Unfiltered

Driver Shoulder Rear Length Change (mm) vs. Time [ms]



<Max>

10.38 mm at 66.65 ms

<Min>

-3.85 mm at 221.55 ms

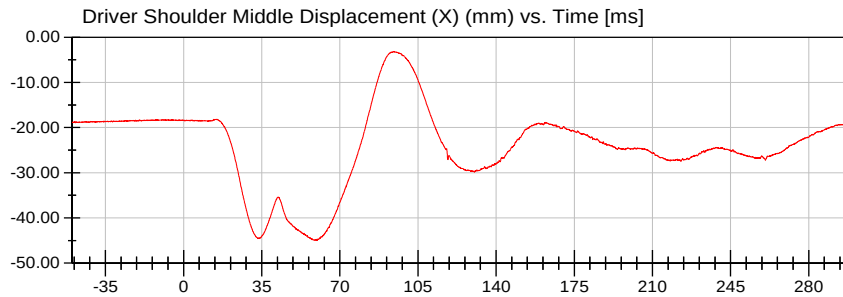
CFC_600



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



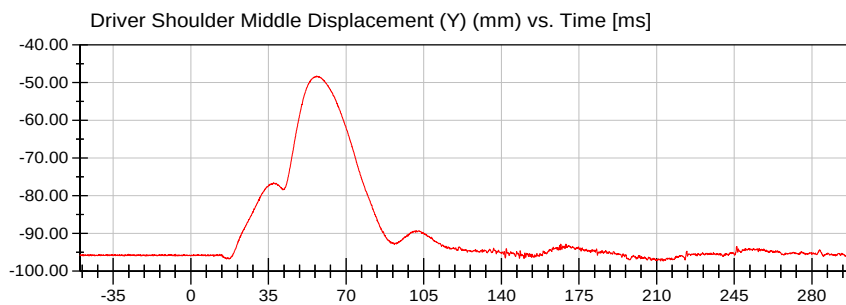
<Max>

-3.21 mm at 94.10 ms

<Min>

-44.95 mm at 58.75 ms

Unfiltered



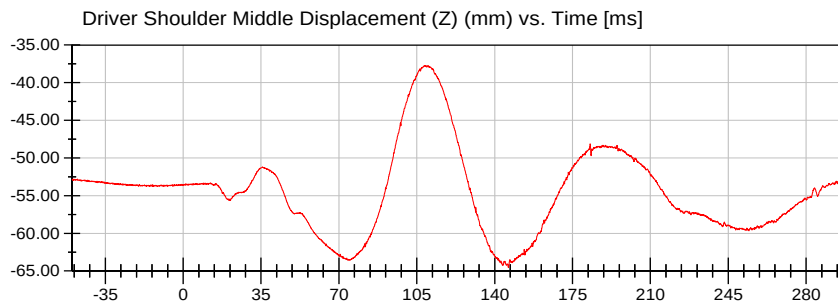
<Max>

-48.19 mm at 56.80 ms

<Min>

-97.30 mm at 212.90 ms

Unfiltered



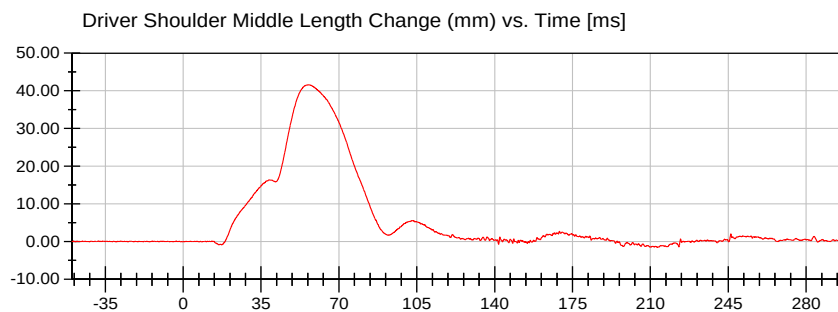
<Max>

-37.71 mm at 108.80 ms

<Min>

-64.55 mm at 146.15 ms

Unfiltered



<Max>

41.60 mm at 56.30 ms

<Min>

-1.52 mm at 213.05 ms

CFC_600



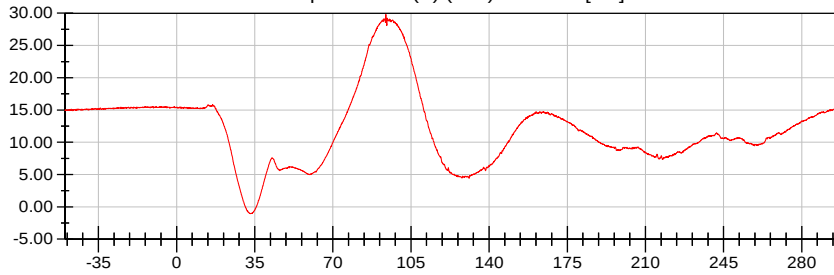
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Shoulder Front Displacement (X) (mm) vs. Time [ms]



<Max>

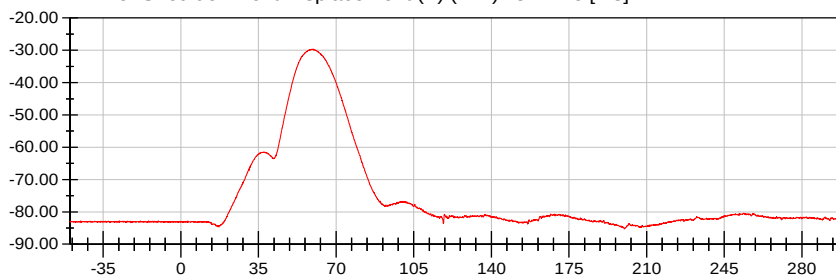
29.78 mm at 93.75 ms

<Min>

-1.08 mm at 33.10 ms

Unfiltered

Driver Shoulder Front Displacement (Y) (mm) vs. Time [ms]



<Max>

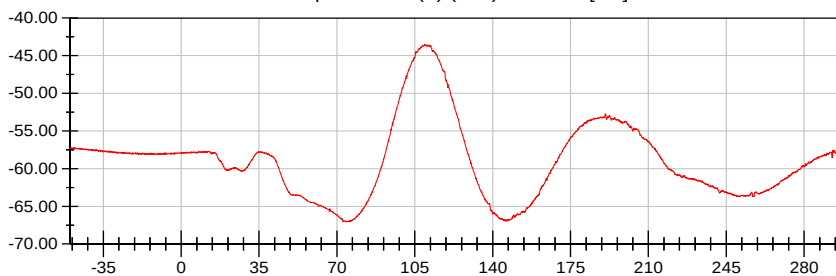
-29.58 mm at 59.60 ms

<Min>

-85.28 mm at 199.90 ms

Unfiltered

Driver Shoulder Front Displacement (Z) (mm) vs. Time [ms]



<Max>

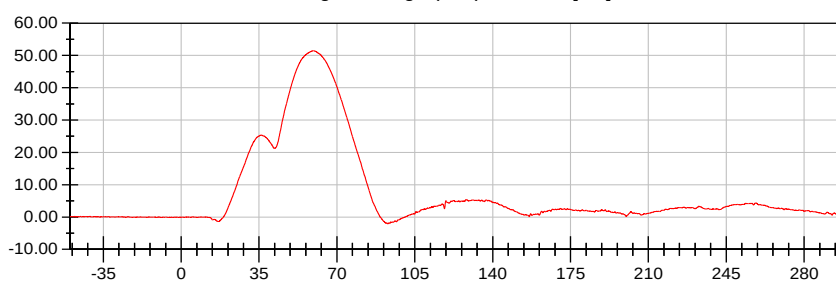
-43.51 mm at 109.60 ms

<Min>

-67.06 mm at 72.75 ms

Unfiltered

Driver Shoulder Front Length Change (mm) vs. Time [ms]



<Max>

51.48 mm at 59.50 ms

<Min>

-2.07 mm at 92.90 ms

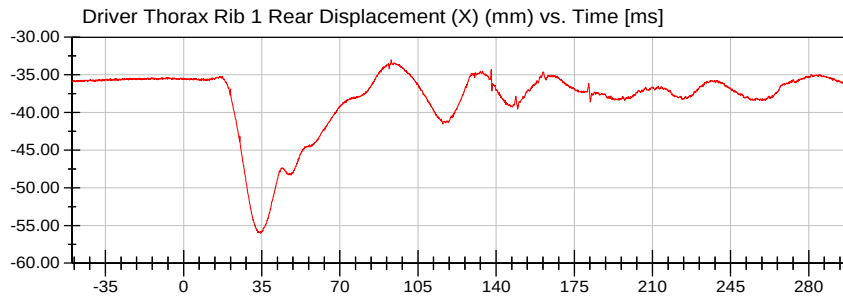
CFC_600



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



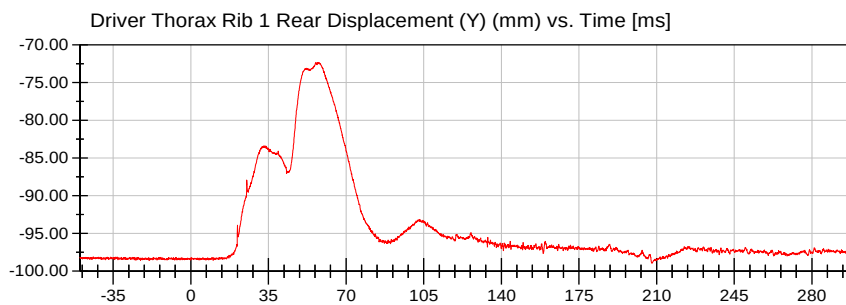
<Max>

-33.01 mm at 93.00 ms

<Min>

-56.01 mm at 34.50 ms

Unfiltered



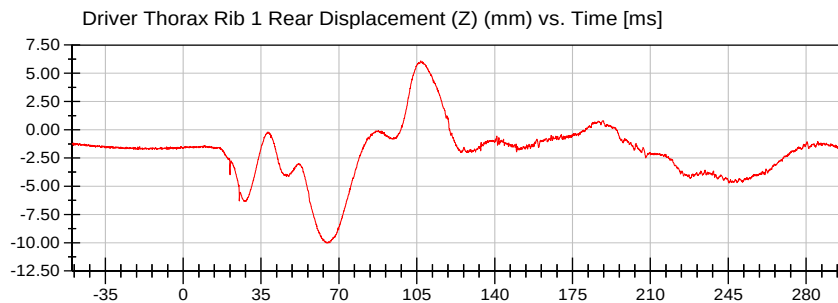
<Max>

-72.32 mm at 57.50 ms

<Min>

-98.95 mm at 208.00 ms

Unfiltered



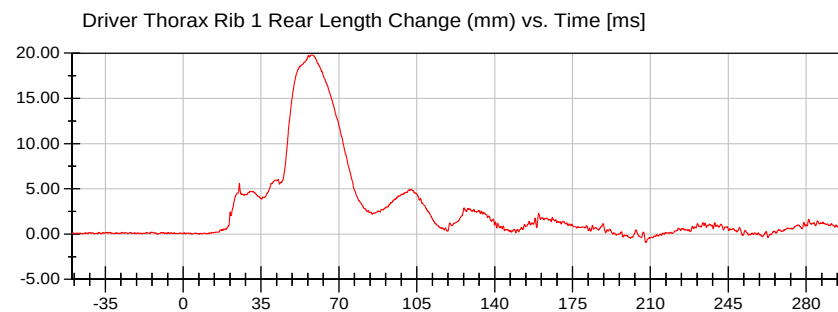
<Max>

6.10 mm at 106.75 ms

<Min>

-10.04 mm at 65.10 ms

Unfiltered



<Max>

19.79 mm at 57.55 ms

<Min>

-0.94 mm at 207.90 ms

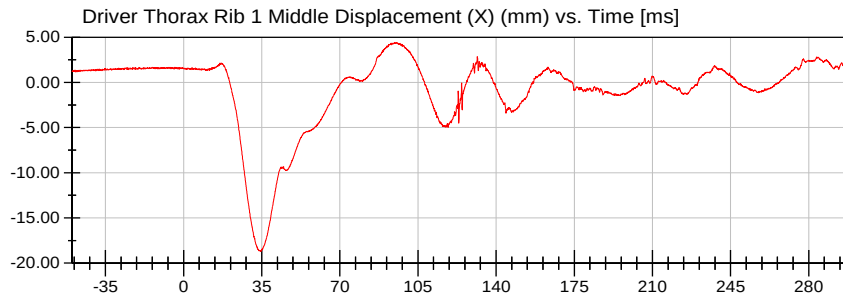
CFC_600



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



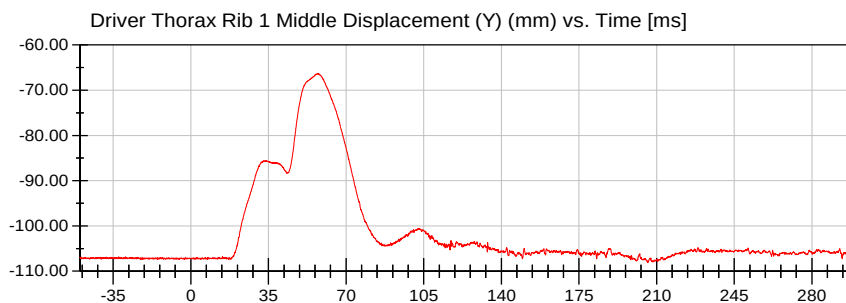
<Max>

4.41 mm at 95.40 ms

<Min>

-18.70 mm at 34.70 ms

Unfiltered



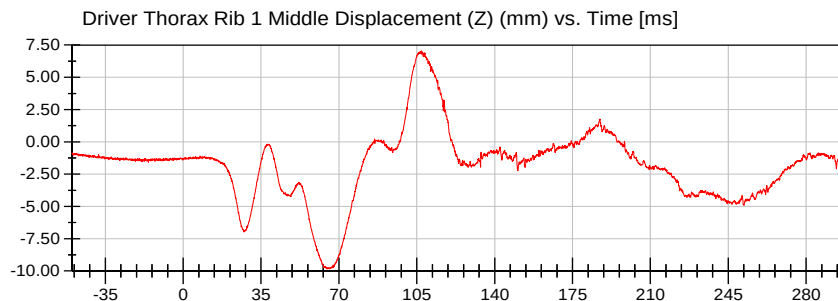
<Max>

-66.31 mm at 57.50 ms

<Min>

-108.09 mm at 206.00 ms

Unfiltered



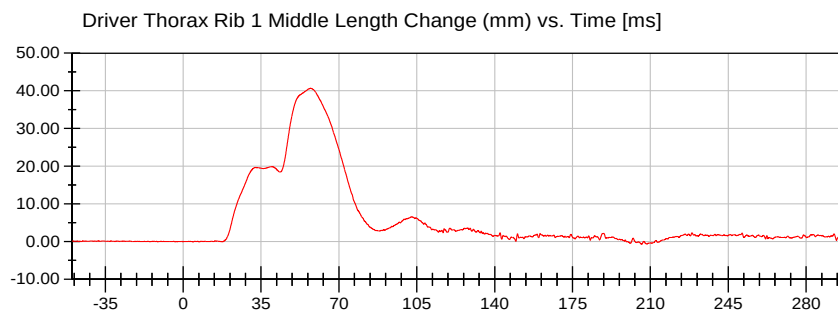
<Max>

7.07 mm at 107.05 ms

<Min>

-9.84 mm at 65.10 ms

Unfiltered



<Max>

40.69 mm at 57.20 ms

<Min>

-0.74 mm at 206.00 ms

CFC_600



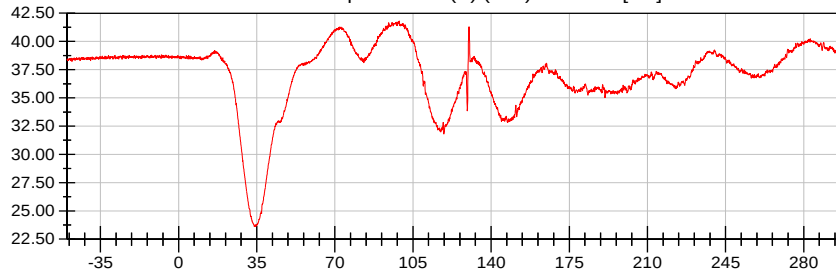
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Thorax Rib 1 Front Displacement (X) (mm) vs. Time [ms]



<Max>

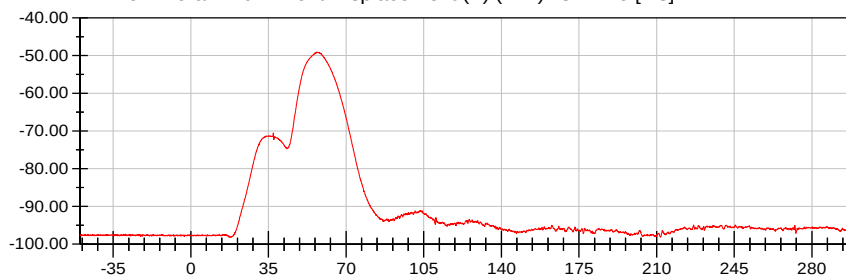
41.78 mm at 98.85 ms

<Min>

23.61 mm at 33.90 ms

Unfiltered

Driver Thorax Rib 1 Front Displacement (Y) (mm) vs. Time [ms]



<Max>

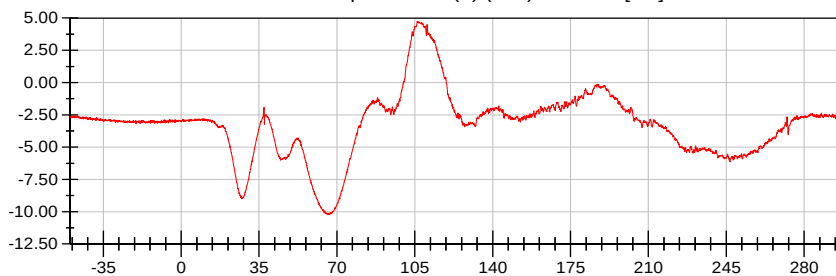
-49.05 mm at 56.80 ms

<Min>

-98.20 mm at 17.80 ms

Unfiltered

Driver Thorax Rib 1 Front Displacement (Z) (mm) vs. Time [ms]



<Max>

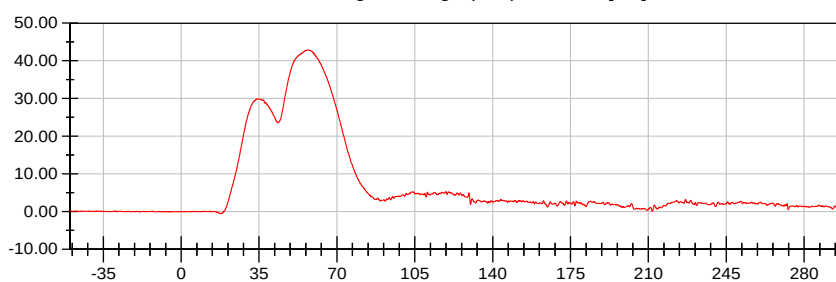
4.75 mm at 106.35 ms

<Min>

-10.25 mm at 65.95 ms

Unfiltered

Driver Thorax Rib 1 Front Length Change (mm) vs. Time [ms]



<Max>

42.90 mm at 56.90 ms

<Min>

-0.56 mm at 17.85 ms

CFC_600

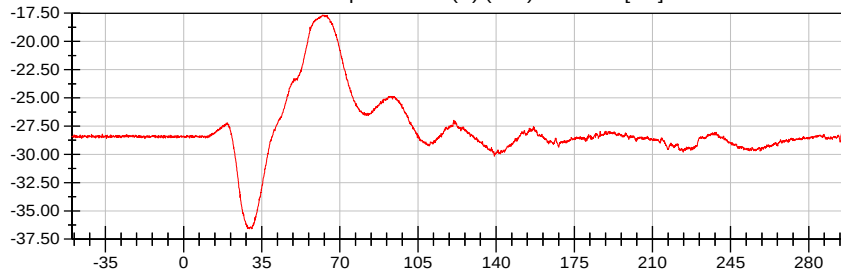


VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020

Driver Thorax Rib 2 Rear Displacement (X) (mm) vs. Time [ms]



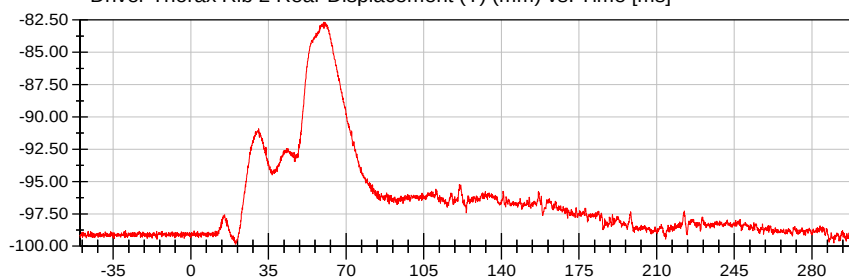
<Max>

-17.67 mm at 62.30 ms

<Min>

-36.59 mm at 29.55 ms

Driver Thorax Rib 2 Rear Displacement (Y) (mm) vs. Time [ms]



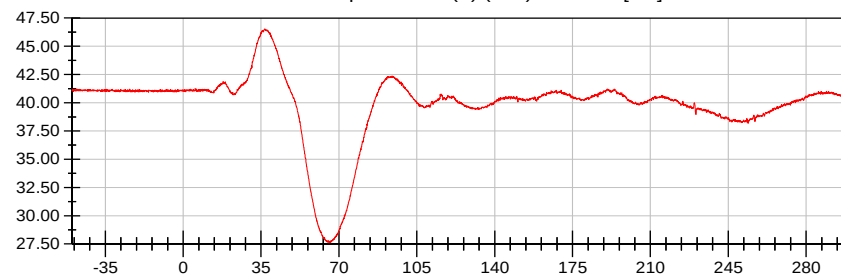
<Max>

-82.67 mm at 59.85 ms

<Min>

-99.86 mm at 20.10 ms

Driver Thorax Rib 2 Rear Displacement (Z) (mm) vs. Time [ms]



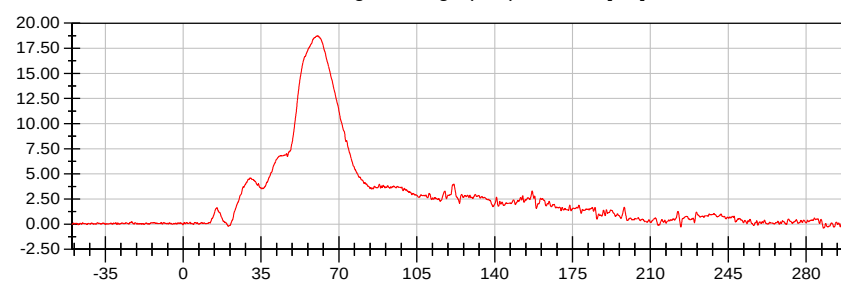
<Max>

46.54 mm at 36.65 ms

<Min>

27.62 mm at 65.80 ms

Driver Thorax Rib 2 Rear Length Change (mm) vs. Time [ms]



<Max>

18.74 mm at 60.60 ms

<Min>

-0.39 mm at 287.80 ms



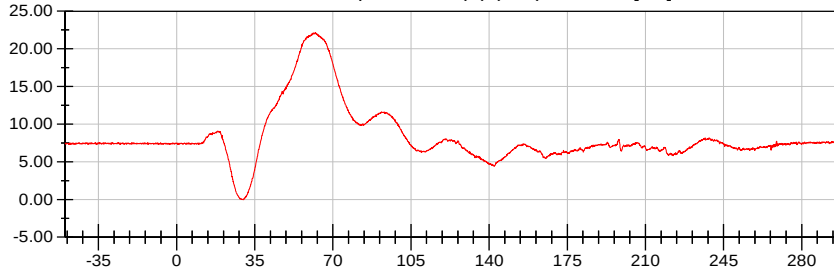
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Thorax Rib 2 Middle Displacement (X) (mm) vs. Time [ms]



<Max>

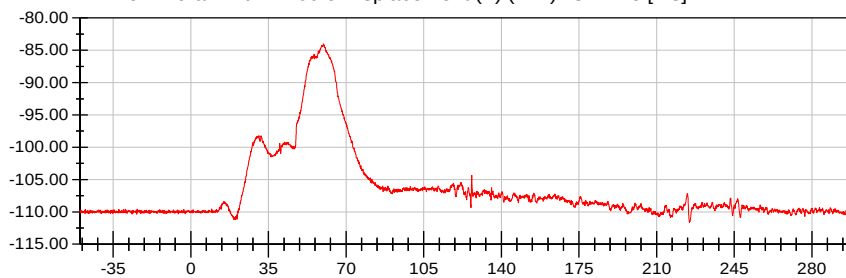
22.19 mm at 62.20 ms

<Min>

-0.03 mm at 29.95 ms

Unfiltered

Driver Thorax Rib 2 Middle Displacement (Y) (mm) vs. Time [ms]



<Max>

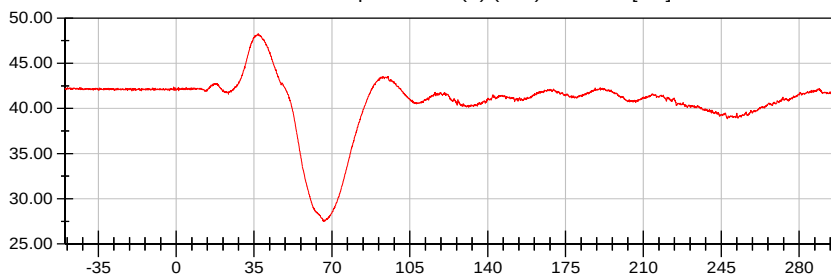
-84.00 mm at 59.85 ms

<Min>

-111.62 mm at 224.80 ms

Unfiltered

Driver Thorax Rib 2 Middle Displacement (Z) (mm) vs. Time [ms]



<Max>

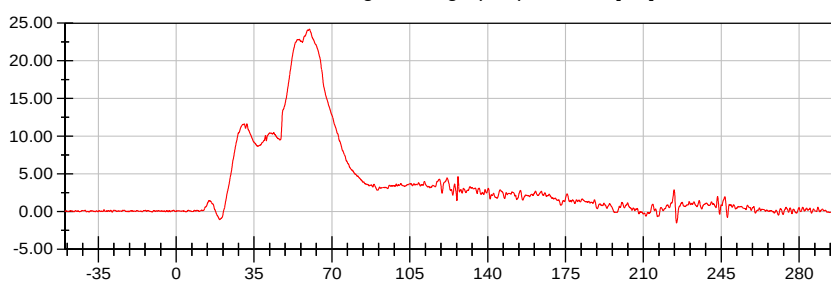
48.26 mm at 36.90 ms

<Min>

27.49 mm at 66.35 ms

Unfiltered

Driver Thorax Rib 2 Middle Length Change (mm) vs. Time [ms]



<Max>

24.22 mm at 59.90 ms

<Min>

-1.49 mm at 224.90 ms

CFC_600



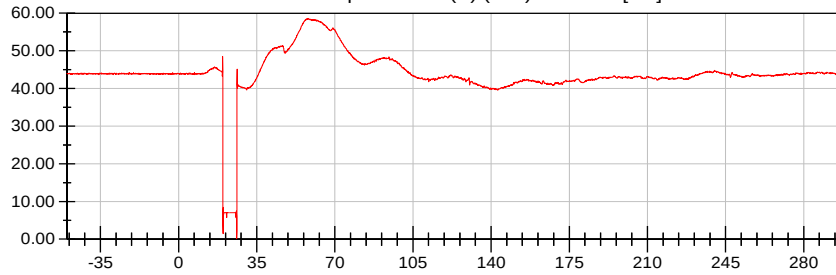
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Thorax Rib 2 Front Displacement (X) (mm) vs. Time [ms]



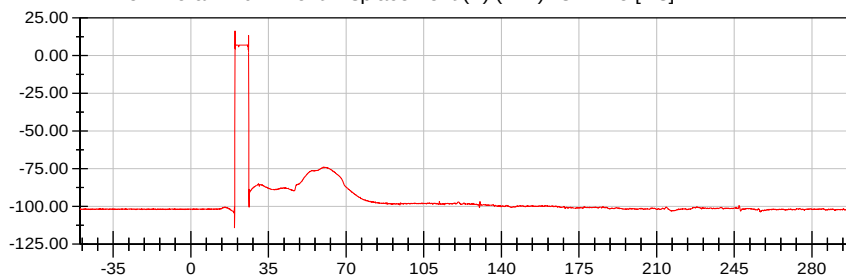
<Max>

58.64 mm at 58.00 ms

<Min>

0.08 mm at 26.05 ms

Driver Thorax Rib 2 Front Displacement (Y) (mm) vs. Time [ms]



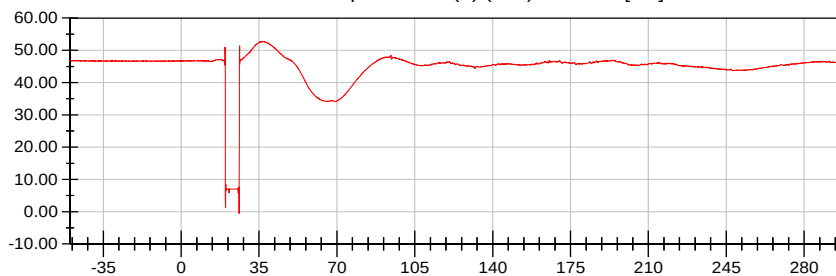
<Max>

16.33 mm at 19.95 ms

<Min>

-114.09 mm at 19.75 ms

Driver Thorax Rib 2 Front Displacement (Z) (mm) vs. Time [ms]



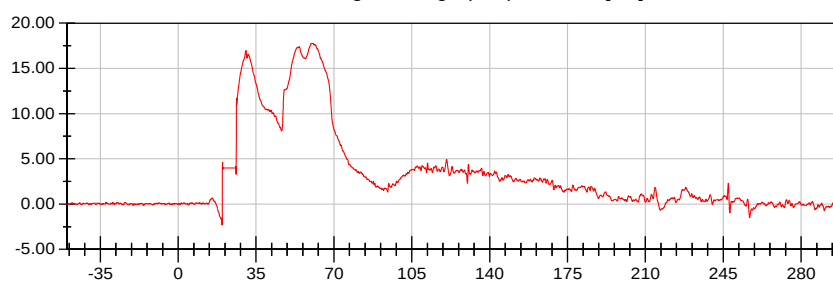
<Max>

52.79 mm at 36.40 ms

<Min>

-0.49 mm at 26.05 ms

Driver Thorax Rib 2 Front Length Change (mm) vs. Time [ms]



<Max>

17.75 mm at 59.85 ms

<Min>

-2.31 mm at 19.75 ms



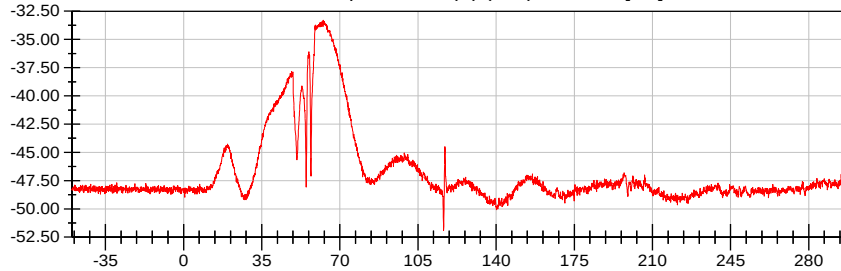
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Thorax Rib 3 Rear Displacement (X) (mm) vs. Time [ms]



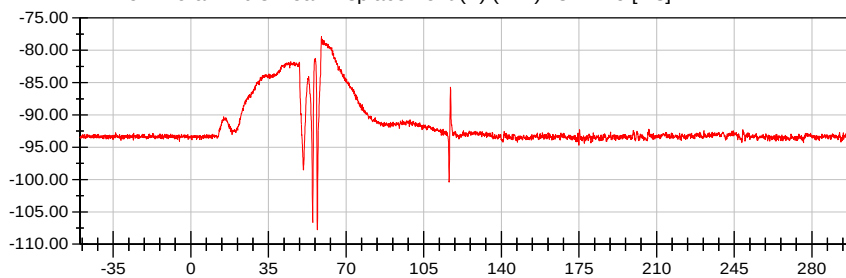
<Max>

-33.30 mm at 62.50 ms

<Min>

-51.93 mm at 116.50 ms

Driver Thorax Rib 3 Rear Displacement (Y) (mm) vs. Time [ms]



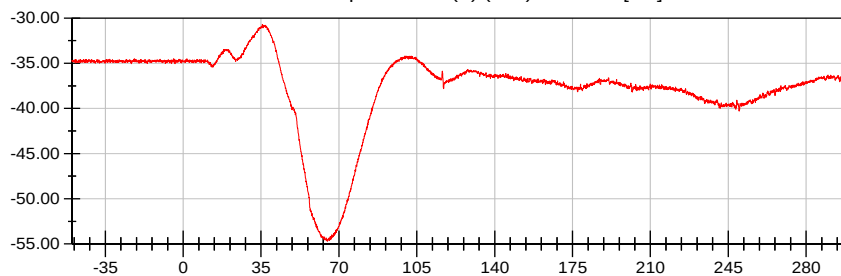
<Max>

-77.89 mm at 58.90 ms

<Min>

-107.77 mm at 57.05 ms

Driver Thorax Rib 3 Rear Displacement (Z) (mm) vs. Time [ms]



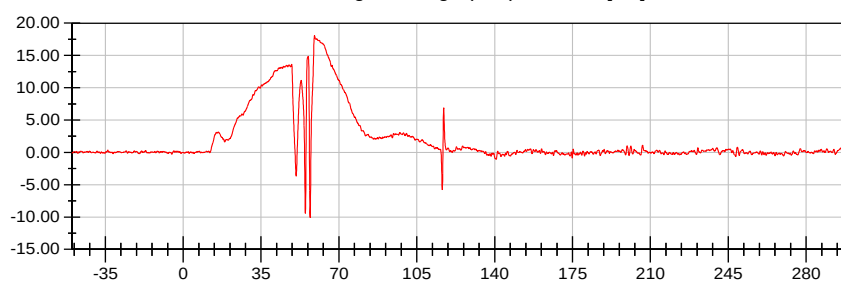
<Max>

-30.75 mm at 35.55 ms

<Min>

-54.69 mm at 64.80 ms

Driver Thorax Rib 3 Rear Length Change (mm) vs. Time [ms]



<Max>

18.07 mm at 59.00 ms

<Min>

-10.05 mm at 57.10 ms



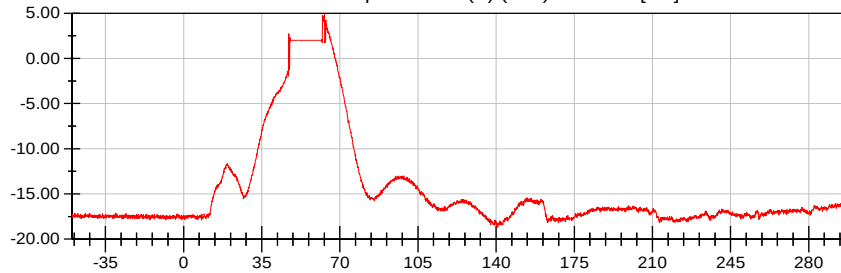
VRTC

Test Lab: CTF

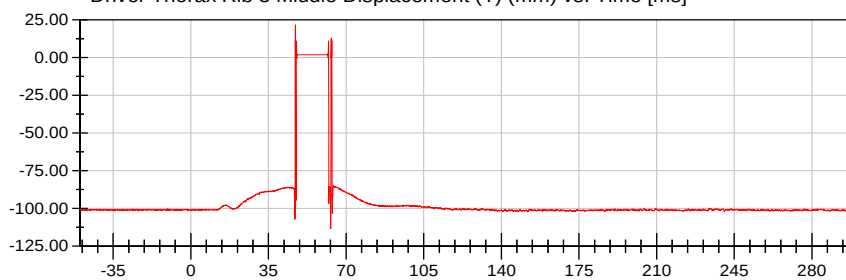
Test Number: 201215 ()

Test Date: 12/15/2020

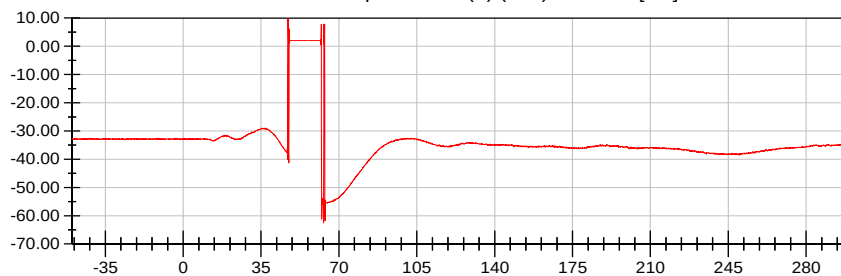
Driver Thorax Rib 3 Middle Displacement (X) (mm) vs. Time [ms]



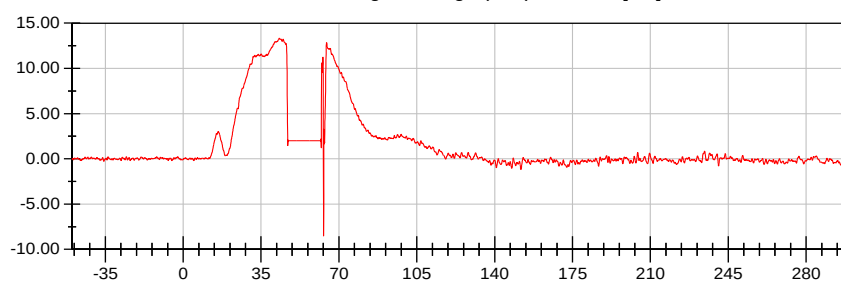
Driver Thorax Rib 3 Middle Displacement (Y) (mm) vs. Time [ms]



Driver Thorax Rib 3 Middle Displacement (Z) (mm) vs. Time [ms]



Driver Thorax Rib 3 Middle Length Change (mm) vs. Time [ms]

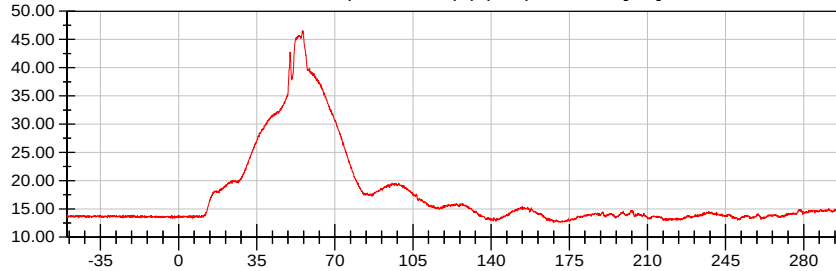


VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020

Driver Thorax Rib 3 Front Displacement (X) (mm) vs. Time [ms]



<Max>

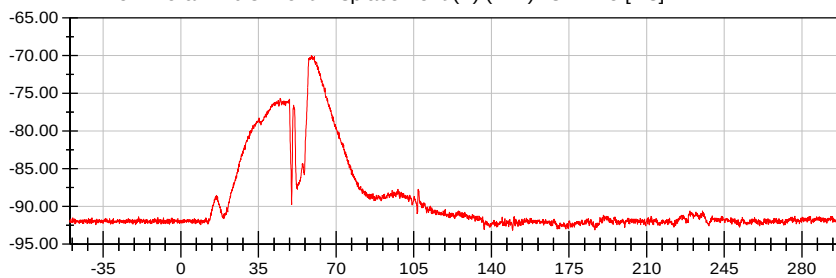
46.57 mm at 55.70 ms

<Min>

12.56 mm at 167.95 ms

Unfiltered

Driver Thorax Rib 3 Front Displacement (Y) (mm) vs. Time [ms]



<Max>

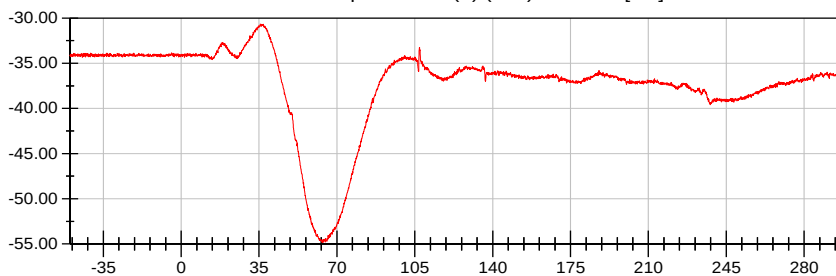
-69.97 mm at 58.90 ms

<Min>

-93.15 mm at 149.60 ms

Unfiltered

Driver Thorax Rib 3 Front Displacement (Z) (mm) vs. Time [ms]



<Max>

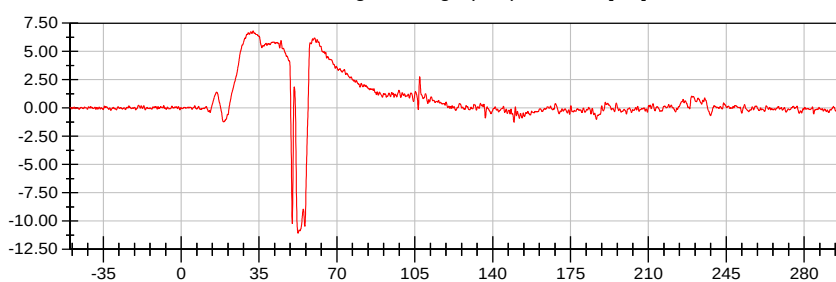
-30.67 mm at 35.55 ms

<Min>

-54.85 mm at 63.40 ms

Unfiltered

Driver Thorax Rib 3 Front Length Change (mm) vs. Time [ms]



<Max>

6.81 mm at 32.35 ms

<Min>

-11.08 mm at 52.50 ms

CFC_600



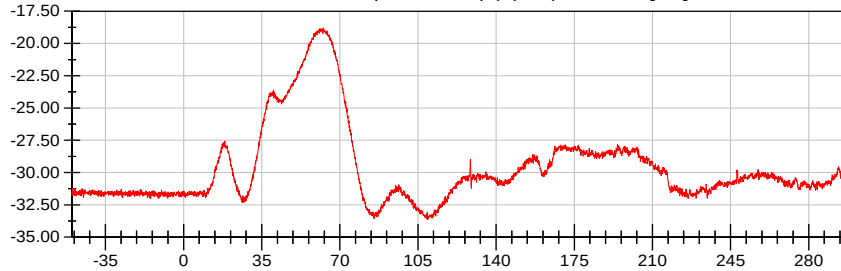
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Abdomen Rib 1 Rear Displacement (X) (mm) vs. Time [ms]



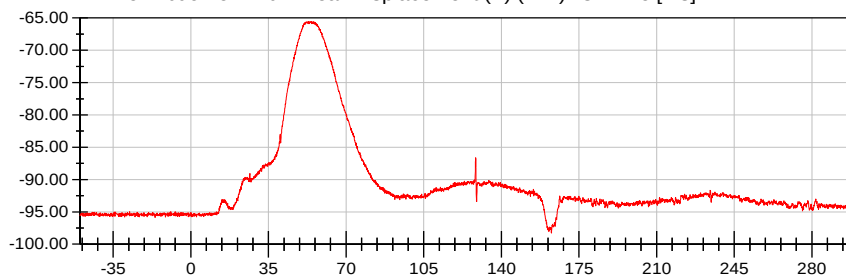
<Max>

-18.82 mm at 62.55 ms

<Min>

-33.65 mm at 109.35 ms

Driver Abdomen Rib 1 Rear Displacement (Y) (mm) vs. Time [ms]



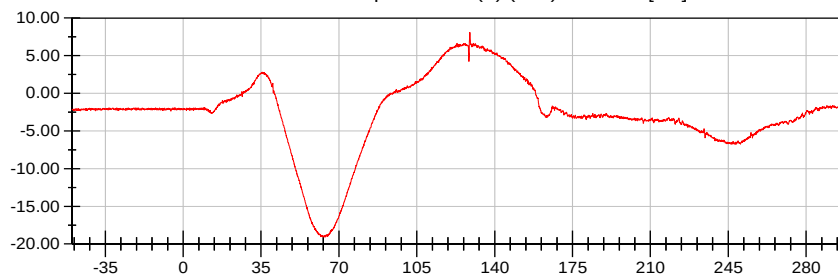
<Max>

-65.53 mm at 54.35 ms

<Min>

-98.29 mm at 162.60 ms

Driver Abdomen Rib 1 Rear Displacement (Z) (mm) vs. Time [ms]



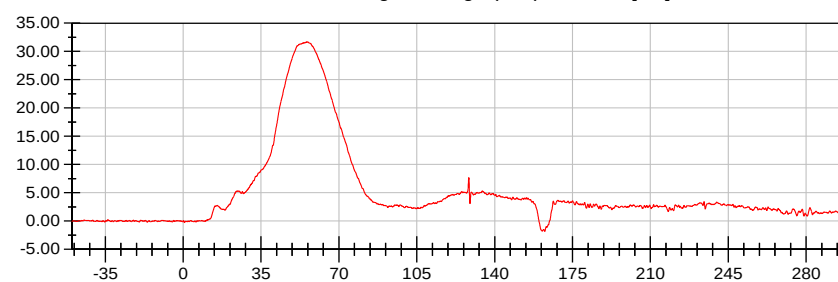
<Max>

8.09 mm at 128.80 ms

<Min>

-19.09 mm at 62.70 ms

Driver Abdomen Rib 1 Rear Length Change (mm) vs. Time [ms]



<Max>

31.68 mm at 55.75 ms

<Min>

-1.81 mm at 162.55 ms



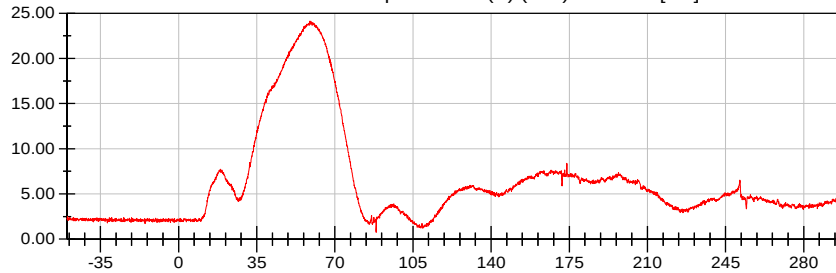
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Abdomen Rib 1 Middle Displacement (X) (mm) vs. Time [ms]



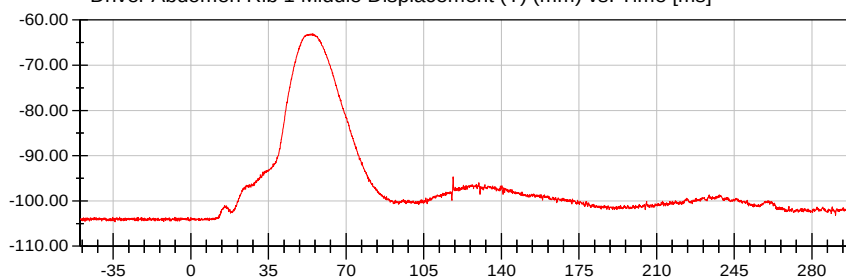
<Max>

24.12 mm at 59.20 ms

<Min>

0.74 mm at 88.50 ms

Driver Abdomen Rib 1 Middle Displacement (Y) (mm) vs. Time [ms]



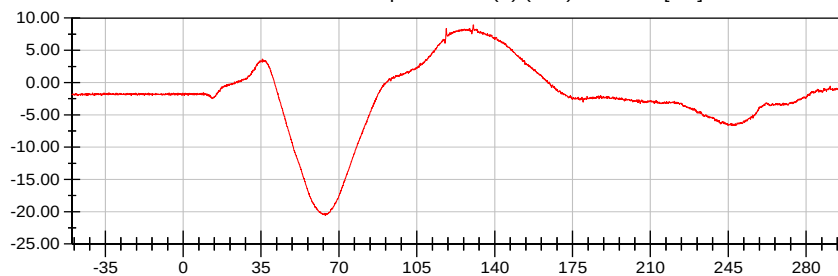
<Max>

-63.08 mm at 55.00 ms

<Min>

-104.60 mm at -34.20 ms

Driver Abdomen Rib 1 Middle Displacement (Z) (mm) vs. Time [ms]



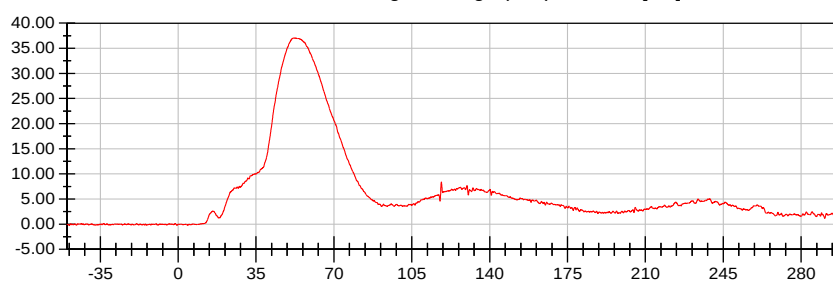
<Max>

8.96 mm at 130.45 ms

<Min>

-20.60 mm at 63.90 ms

Driver Abdomen Rib 1 Middle Length Change (mm) vs. Time [ms]



<Max>

37.04 mm at 52.05 ms

<Min>

-0.24 mm at -48.95 ms

CFC_600



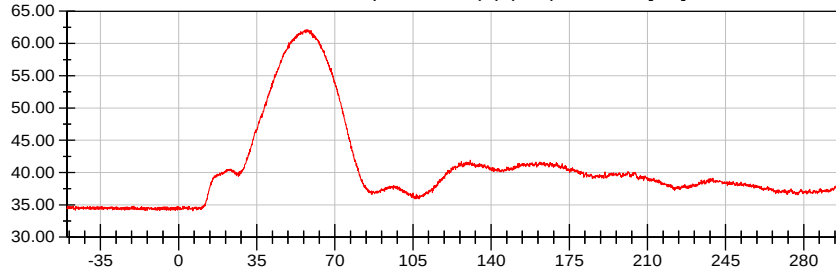
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Abdomen Rib 1 Front Displacement (X) (mm) vs. Time [ms]



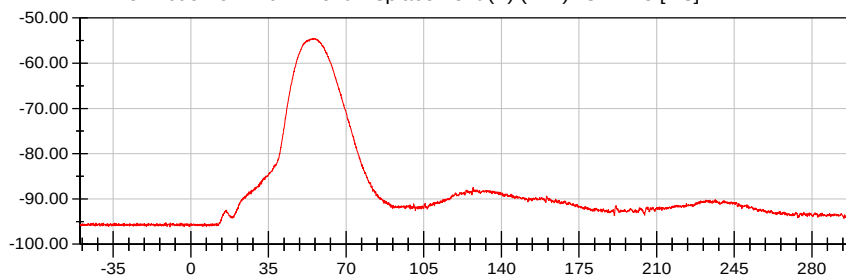
<Max>

62.16 mm at 57.50 ms

<Min>

34.05 mm at 6.40 ms

Driver Abdomen Rib 1 Front Displacement (Y) (mm) vs. Time [ms]



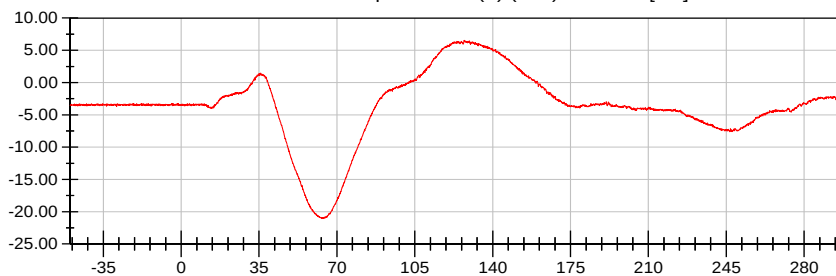
<Max>

-54.47 mm at 55.20 ms

<Min>

-96.17 mm at -9.40 ms

Driver Abdomen Rib 1 Front Displacement (Z) (mm) vs. Time [ms]



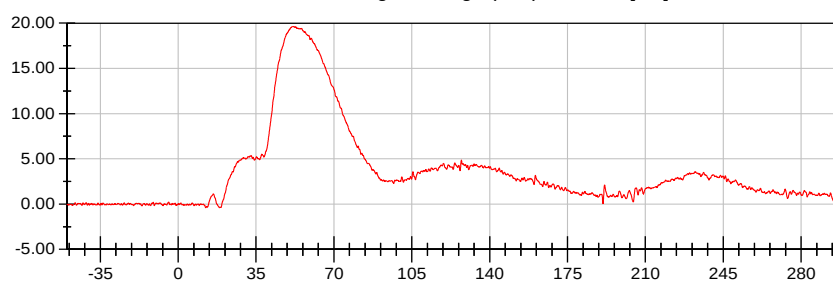
<Max>

6.55 mm at 127.20 ms

<Min>

-21.04 mm at 63.10 ms

Driver Abdomen Rib 1 Front Length Change (mm) vs. Time [ms]



<Max>

19.62 mm at 51.80 ms

<Min>

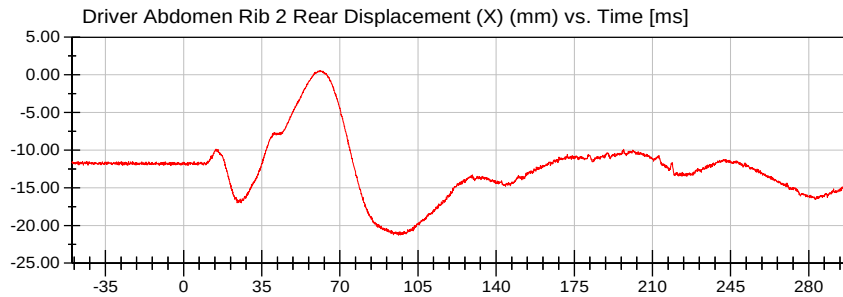
-0.41 mm at 12.40 ms



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



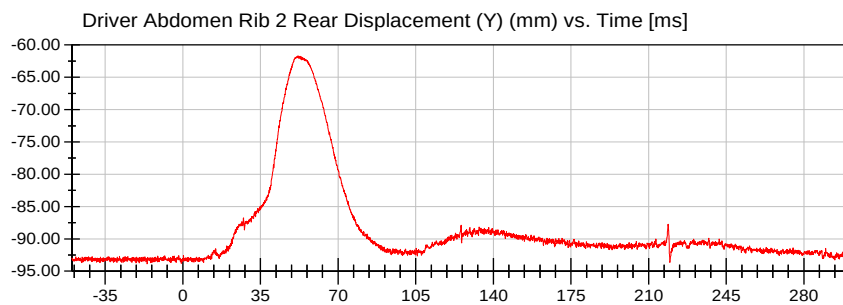
<Max>

0.55 mm at 61.10 ms

<Min>

-21.30 mm at 96.25 ms

Unfiltered



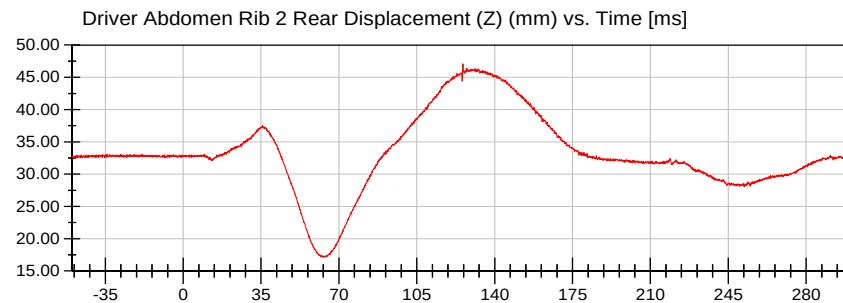
<Max>

-61.67 mm at 51.95 ms

<Min>

-93.87 mm at -16.05 ms

Unfiltered



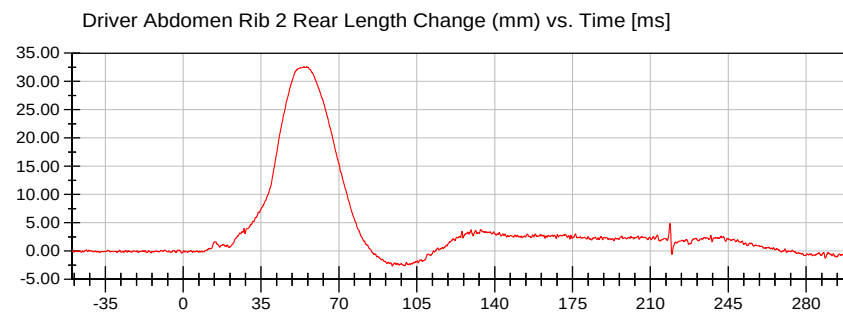
<Max>

47.12 mm at 125.70 ms

<Min>

17.13 mm at 63.00 ms

Unfiltered



<Max>

32.58 mm at 54.35 ms

<Min>

-2.63 mm at 94.05 ms

CFC_600



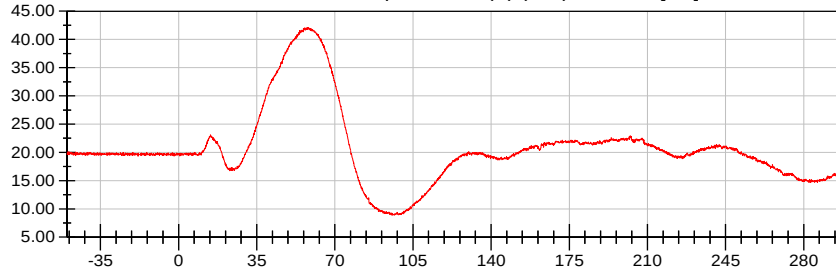
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Abdomen Rib 2 Middle Displacement (X) (mm) vs. Time [ms]



<Max>

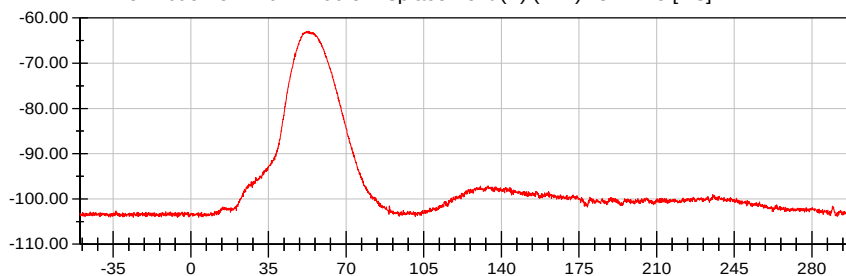
42.10 mm at 57.60 ms

<Min>

8.90 mm at 95.80 ms

Unfiltered

Driver Abdomen Rib 2 Middle Displacement (Y) (mm) vs. Time [ms]



<Max>

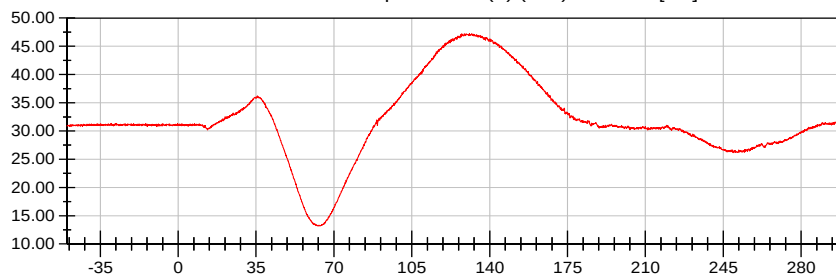
-62.91 mm at 53.00 ms

<Min>

-104.07 mm at -25.90 ms

Unfiltered

Driver Abdomen Rib 2 Middle Displacement (Z) (mm) vs. Time [ms]



<Max>

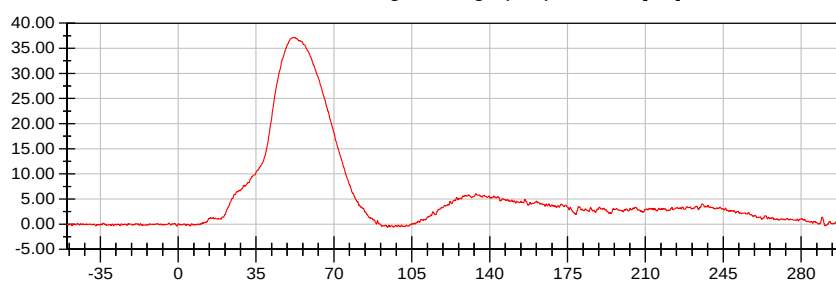
47.25 mm at 130.90 ms

<Min>

13.17 mm at 62.70 ms

Unfiltered

Driver Abdomen Rib 2 Middle Length Change (mm) vs. Time [ms]



<Max>

37.11 mm at 52.05 ms

<Min>

-0.62 mm at 94.10 ms

CFC_600



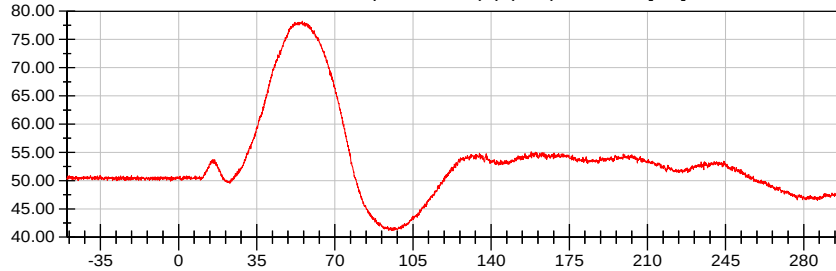
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Abdomen Rib 2 Front Displacement (X) (mm) vs. Time [ms]



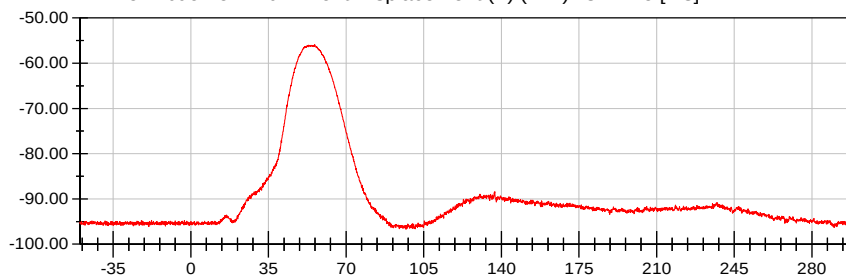
<Max>

78.21 mm at 55.40 ms

<Min>

41.15 mm at 95.45 ms

Driver Abdomen Rib 2 Front Displacement (Y) (mm) vs. Time [ms]



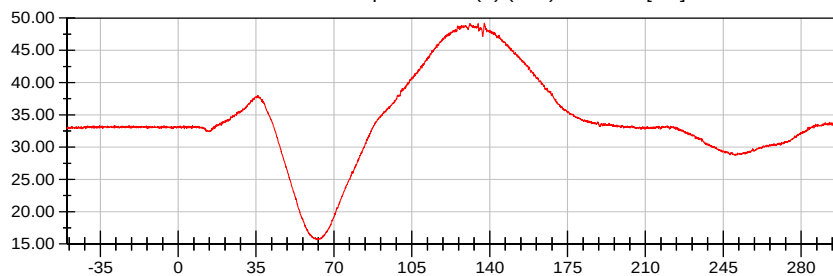
<Max>

-55.89 mm at 55.80 ms

<Min>

-96.71 mm at 97.00 ms

Driver Abdomen Rib 2 Front Displacement (Z) (mm) vs. Time [ms]



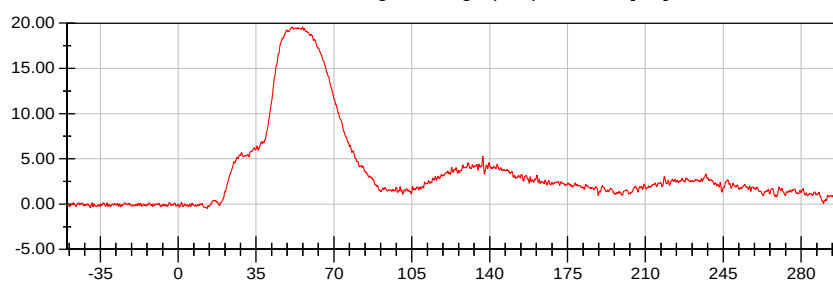
<Max>

49.18 mm at 137.60 ms

<Min>

15.67 mm at 62.15 ms

Driver Abdomen Rib 2 Front Length Change (mm) vs. Time [ms]



<Max>

19.57 mm at 55.85 ms

<Min>

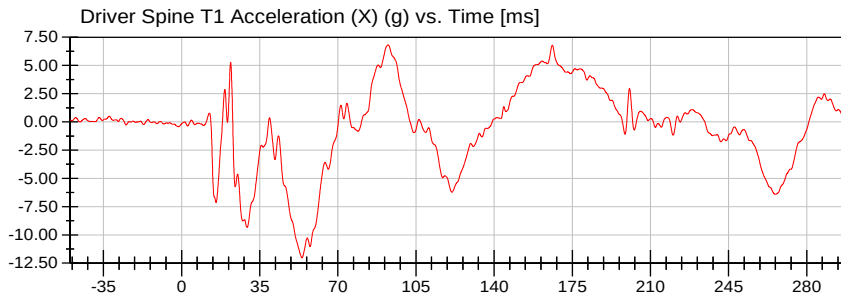
-0.50 mm at 12.95 ms



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



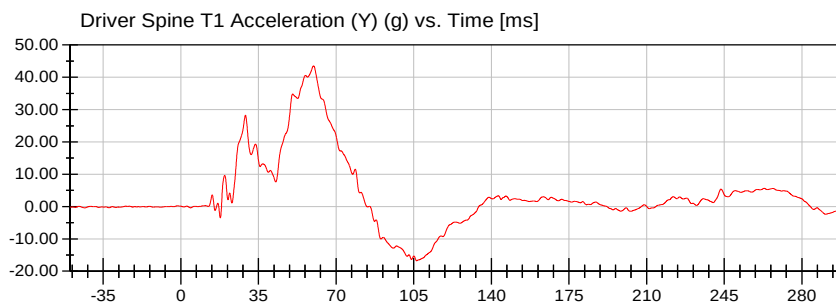
<Max>

6.81 g at 92.55 ms

<Min>

-12.04 g at 53.95 ms

CFC_180



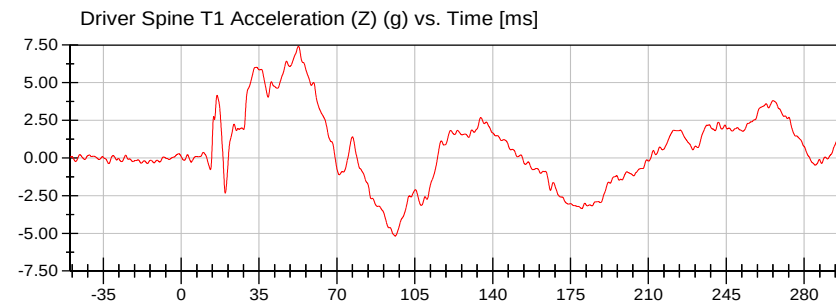
<Max>

43.50 g at 59.85 ms

<Min>

-16.78 g at 106.35 ms

CFC_180



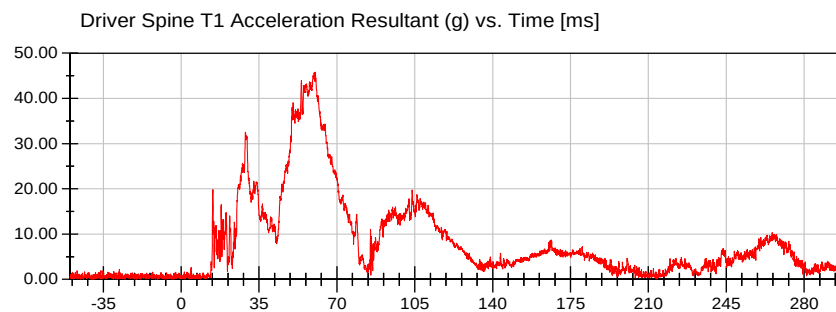
<Max>

7.41 g at 52.70 ms

<Min>

-5.19 g at 96.20 ms

CFC_180



<Max>

45.78 g at 60.25 ms

<Min>

0.07 g at -46.35 ms

Prefiltered_> CFC 1000



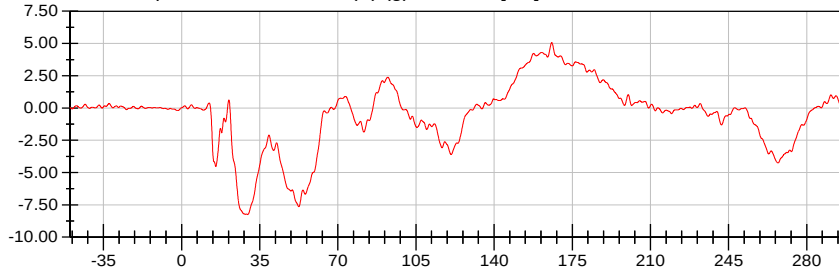
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Spine T4 Acceleration (X) (g) vs. Time [ms]



<Max>

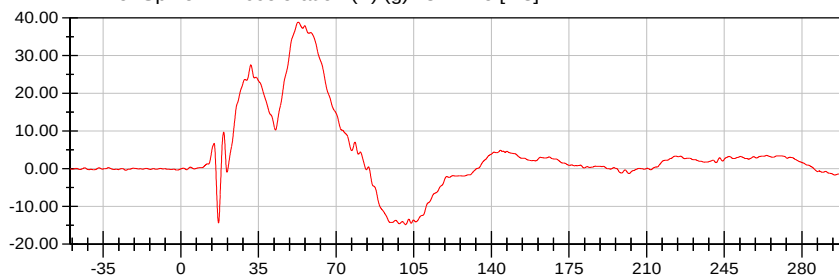
5.06 g at 165.80 ms

<Min>

-8.25 g at 29.65 ms

CFC_180

Driver Spine T4 Acceleration (Y) (g) vs. Time [ms]



<Max>

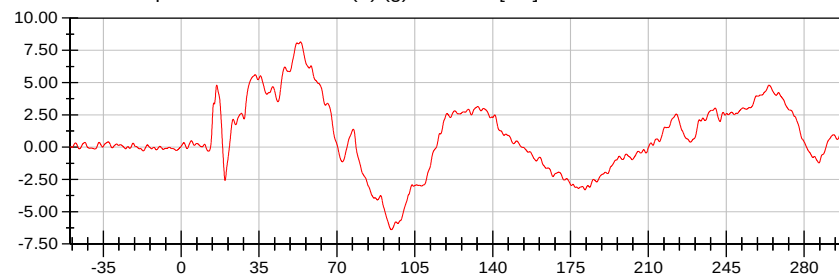
38.87 g at 52.90 ms

<Min>

-14.80 g at 101.30 ms

CFC_180

Driver Spine T4 Acceleration (Z) (g) vs. Time [ms]



<Max>

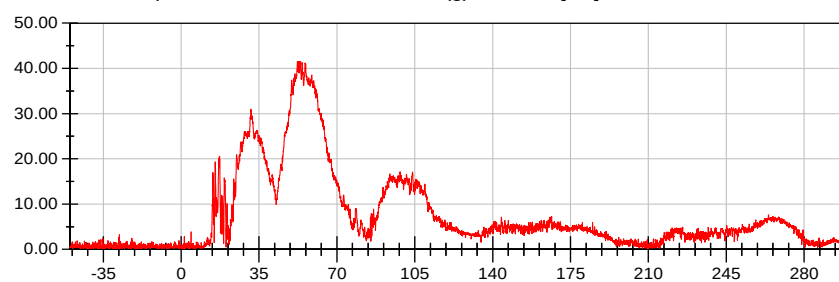
8.15 g at 53.65 ms

<Min>

-6.39 g at 94.45 ms

CFC_180

Driver Spine T4 Acceleration Resultant (g) vs. Time [ms]



<Max>

41.55 g at 52.30 ms

<Min>

0.08 g at -22.35 ms

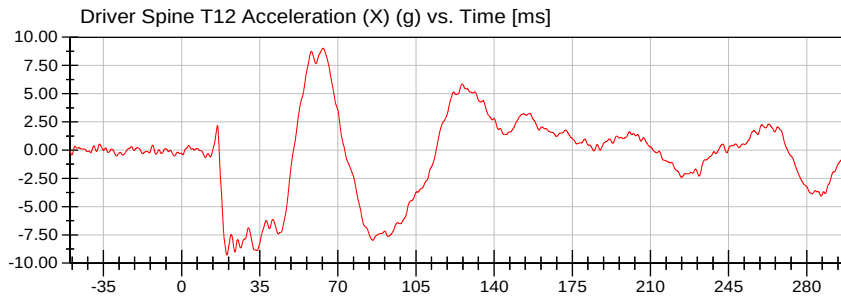
Prefiltered_> CFC 1000



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



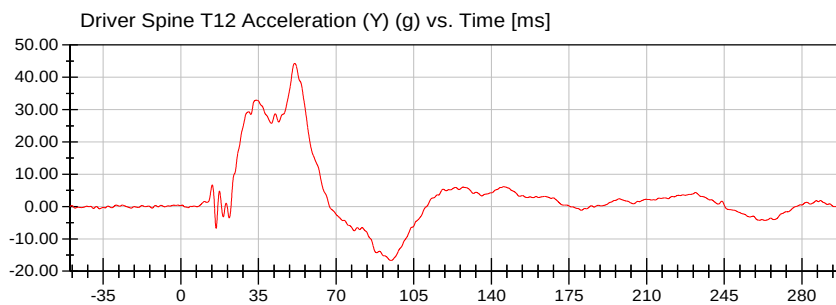
<Max>

9.03 g at 63.40 ms

<Min>

-9.28 g at 20.30 ms

CFC_180



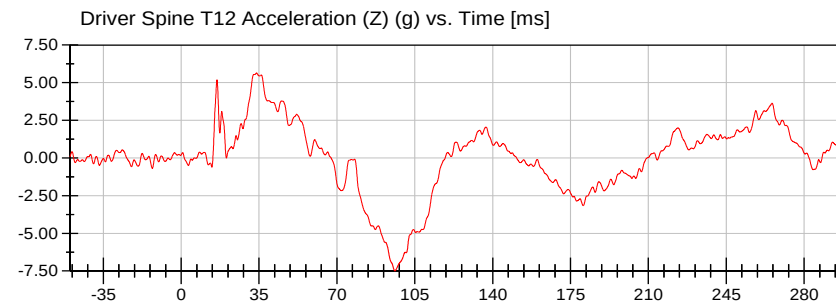
<Max>

44.27 g at 51.30 ms

<Min>

-16.67 g at 94.65 ms

CFC_180



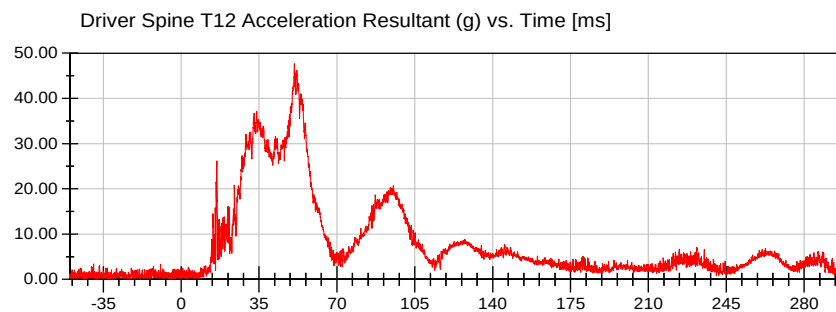
<Max>

5.64 g at 33.90 ms

<Min>

-7.49 g at 96.10 ms

CFC_180



<Max>

47.63 g at 50.90 ms

<Min>

0.20 g at -38.10 ms

Prefiltered_> CFC 1000

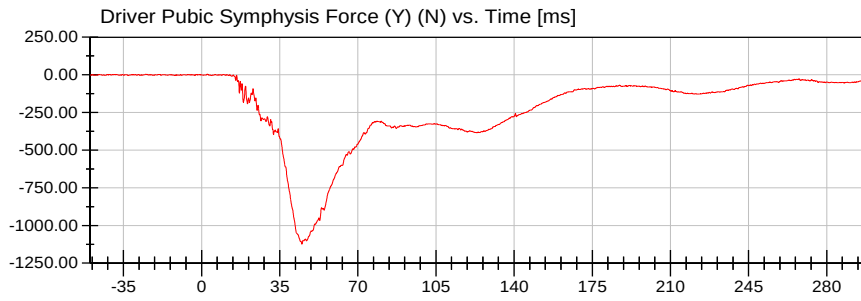


VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020



<Max>

4.62 N at 2.60 ms

<Min>

-1,124.74 N at 44.95 ms

CFC_600



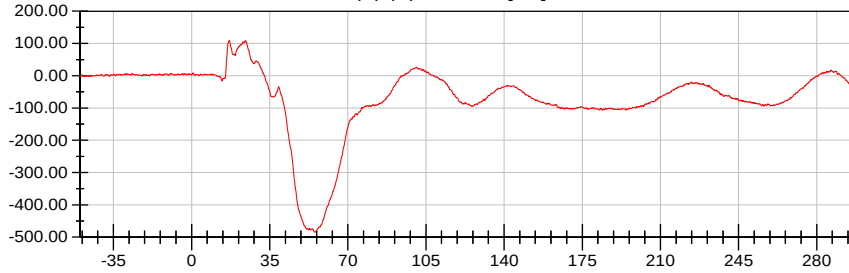
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Sacro-iliac Left Force (X) (N) vs. Time [ms]



<Max>

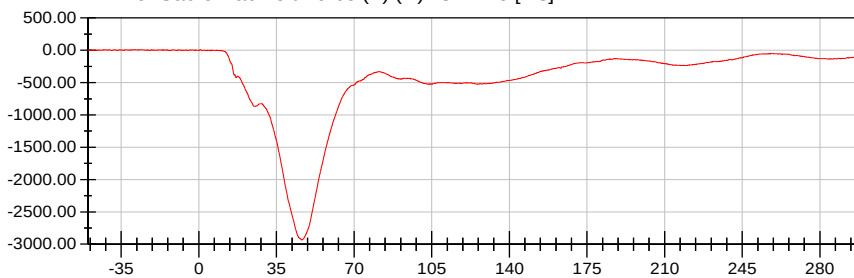
108.92 N at 16.95 ms

<Min>

-484.76 N at 55.15 ms

CFC_600

Driver Sacro-iliac Left Force (Y) (N) vs. Time [ms]



<Max>

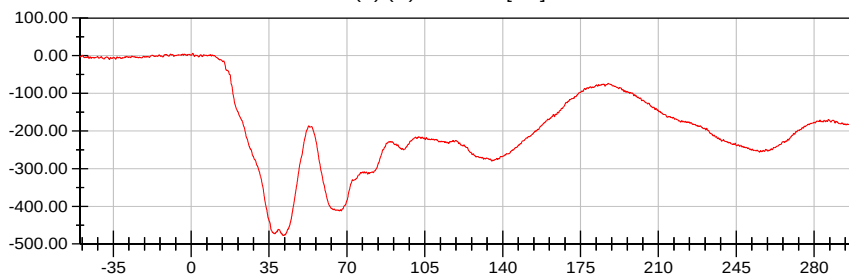
11.04 N at -26.65 ms

<Min>

-2,935.65 N at 46.40 ms

CFC_600

Driver Sacro-iliac Left Force (Z) (N) vs. Time [ms]



<Max>

6.65 N at 0.75 ms

<Min>

-477.24 N at 41.55 ms

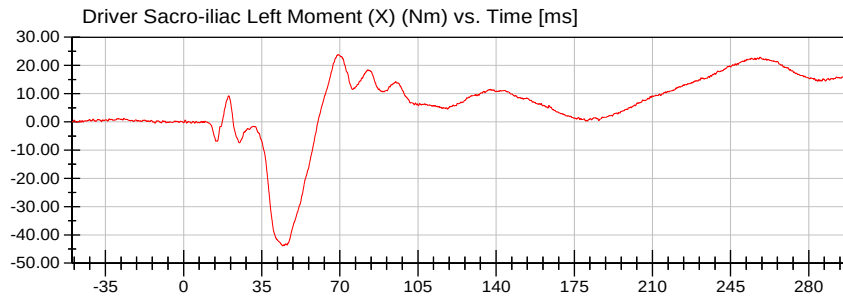
CFC_600



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



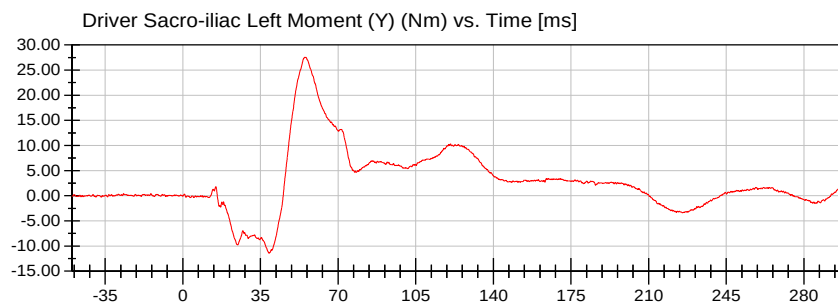
<Max>

23.81 Nm at 69.30 ms

<Min>

-43.89 Nm at 44.40 ms

CFC_600



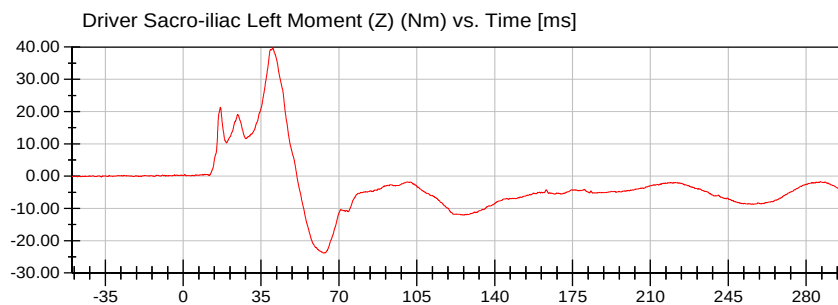
<Max>

27.56 Nm at 54.90 ms

<Min>

-11.42 Nm at 38.85 ms

CFC_600



<Max>

39.73 Nm at 40.30 ms

<Min>

-23.80 Nm at 63.55 ms

CFC_600



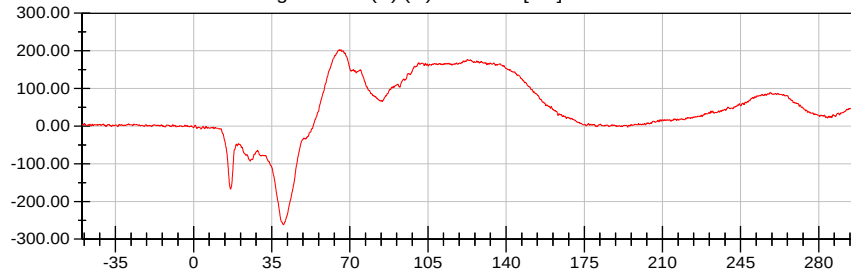
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Sacro-iliac Right Force (X) (N) vs. Time [ms]



<Max>

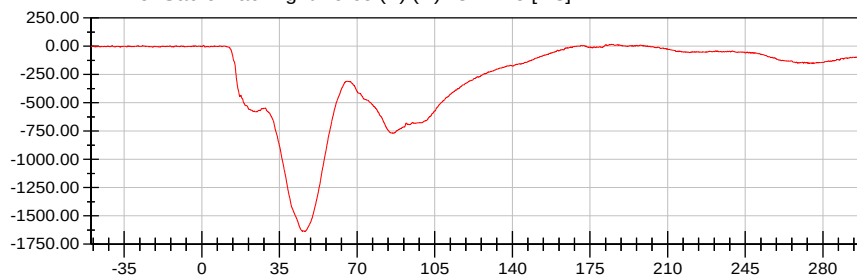
203.04 N at 65.30 ms

<Min>

-261.97 N at 40.25 ms

CFC_600

Driver Sacro-iliac Right Force (Y) (N) vs. Time [ms]



<Max>

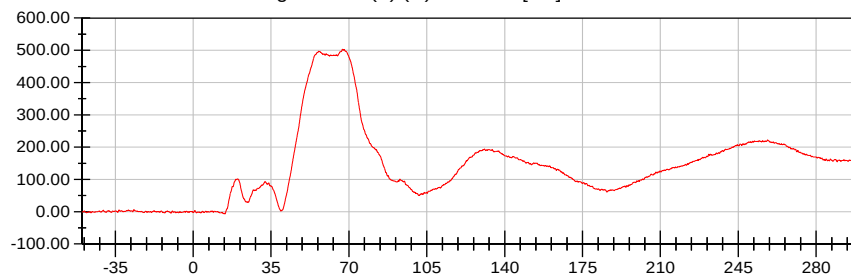
17.08 N at 184.80 ms

<Min>

-1,637.52 N at 46.45 ms

CFC_600

Driver Sacro-iliac Right Force (Z) (N) vs. Time [ms]



<Max>

503.30 N at 67.10 ms

<Min>

-7.19 N at 14.25 ms

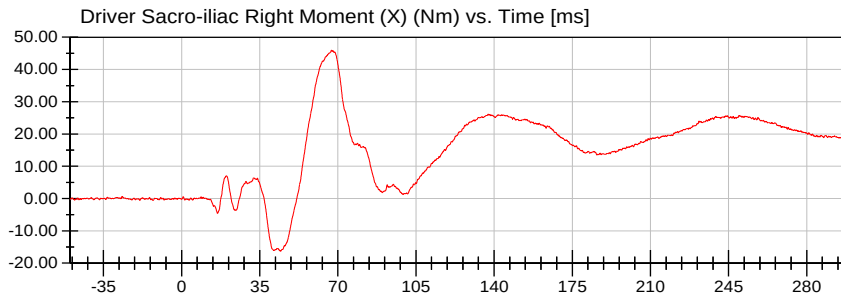
CFC_600



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



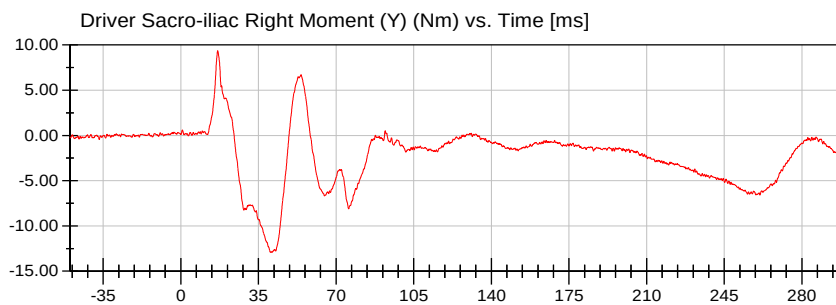
<Max>

45.94 Nm at 67.15 ms

<Min>

-16.31 Nm at 44.35 ms

CFC_600



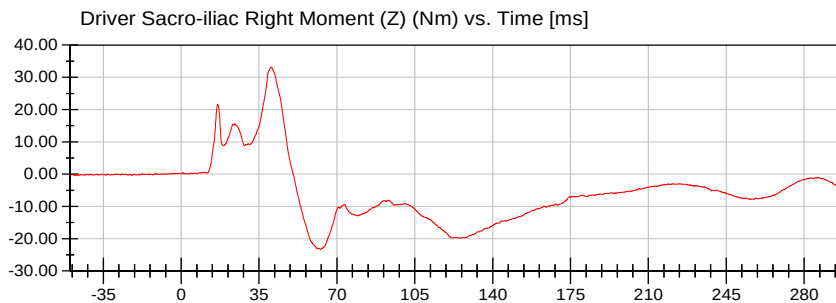
<Max>

9.37 Nm at 16.65 ms

<Min>

-12.92 Nm at 40.45 ms

CFC_600



<Max>

33.21 Nm at 40.50 ms

<Min>

-23.32 Nm at 62.80 ms

CFC_600

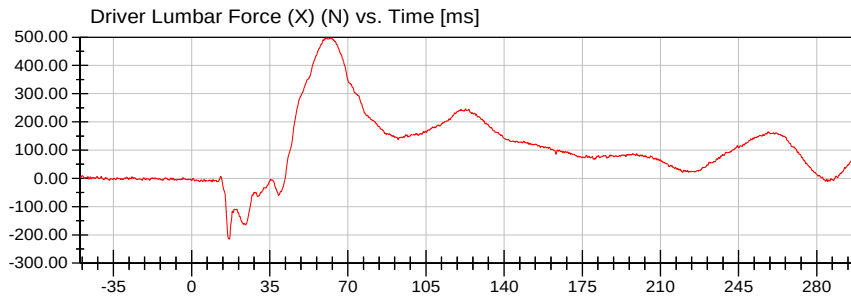


VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020



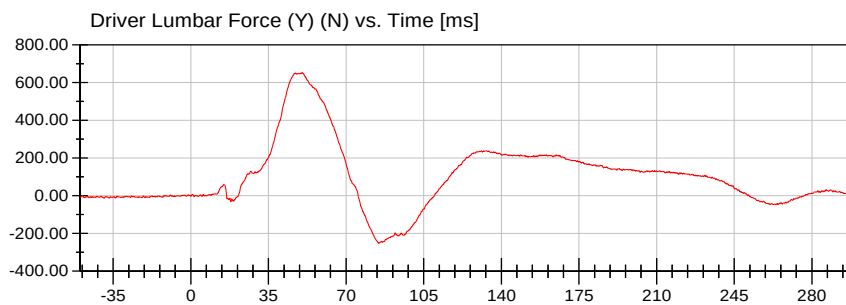
<Max>

498.07 N at 62.50 ms

<Min>

-214.94 N at 16.90 ms

CFC_600



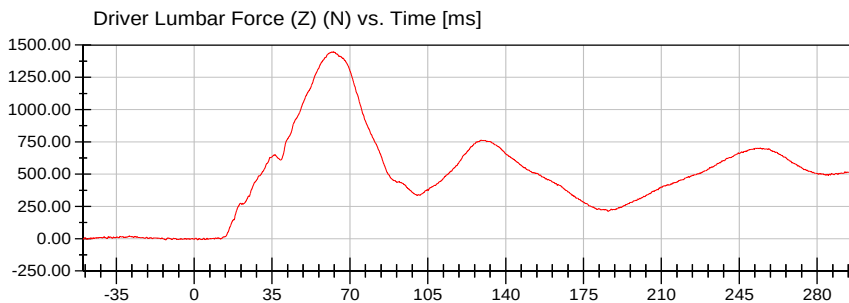
<Max>

653.59 N at 50.25 ms

<Min>

-251.44 N at 84.60 ms

CFC_600



<Max>

1,447.12 N at 62.60 ms

<Min>

-8.90 N at 1.55 ms

CFC_600

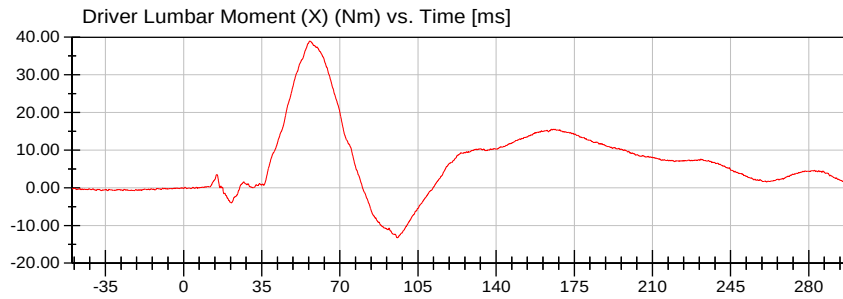


VRTC

Test Date: 12/15/2020

Test Lab: CTF

Test Number: 201215 ()



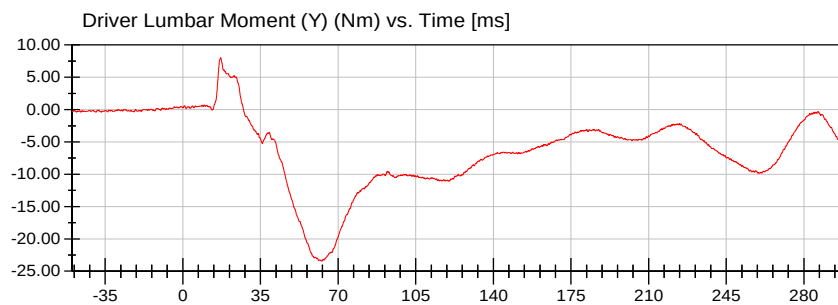
<Max>

38.94 Nm at 56.50 ms

<Min>

-13.27 Nm at 95.70 ms

CFC_600



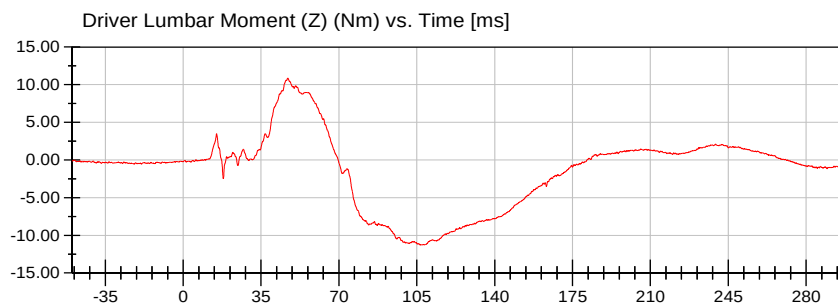
<Max>

8.06 Nm at 17.05 ms

<Min>

-23.44 Nm at 62.70 ms

CFC_600



<Max>

10.87 Nm at 47.05 ms

<Min>

-11.28 Nm at 106.60 ms

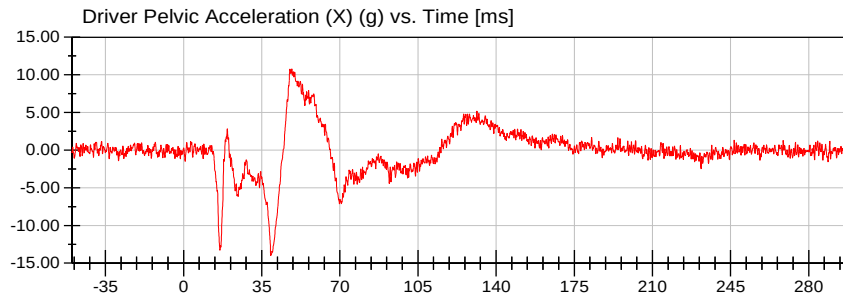
CFC_600



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



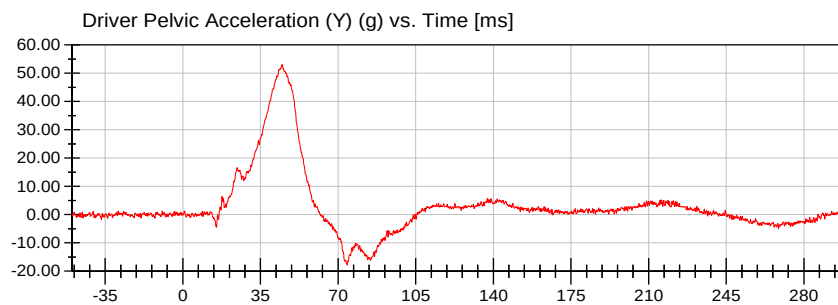
<Max>

10.80 g at 48.50 ms

<Min>

-14.00 g at 39.05 ms

CFC_1000



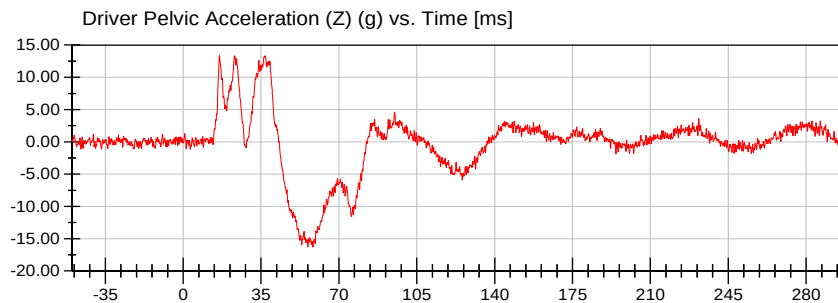
<Max>

53.08 g at 44.75 ms

<Min>

-17.91 g at 74.10 ms

CFC_1000



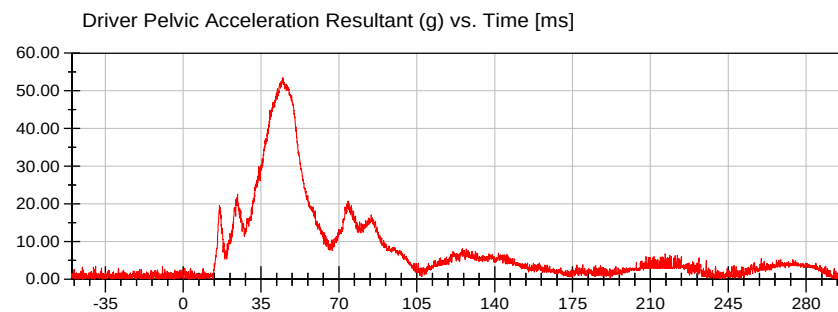
<Max>

13.34 g at 16.30 ms

<Min>

-16.32 g at 58.30 ms

CFC_1000



<Max>

53.39 g at 44.75 ms

<Min>

0.09 g at -45.20 ms

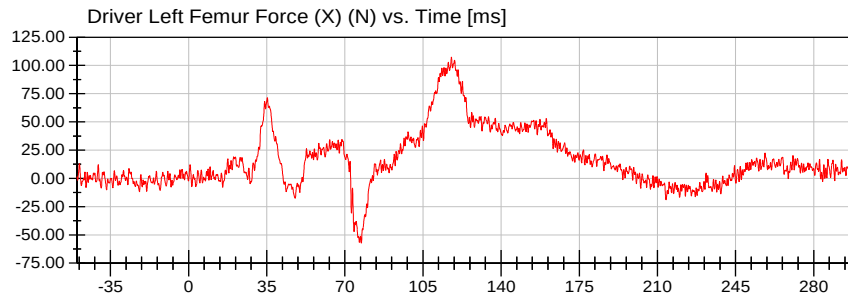
Prefiltered_> CFC 1000



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



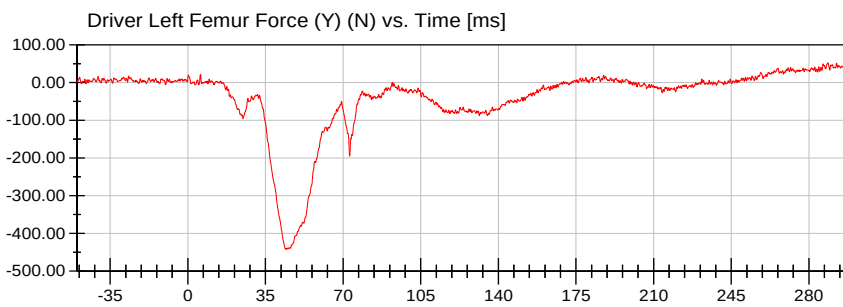
<Max>

107.37 N at 117.70 ms

<Min>

-57.26 N at 77.40 ms

CFC_600



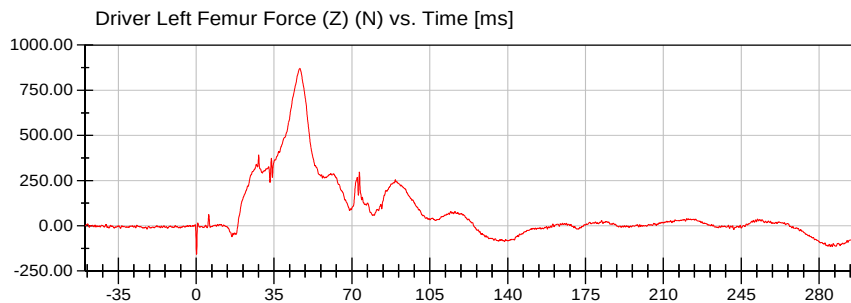
<Max>

52.60 N at 288.60 ms

<Min>

-442.55 N at 44.35 ms

CFC_600



<Max>

871.08 N at 46.60 ms

<Min>

-157.61 N at 0.15 ms

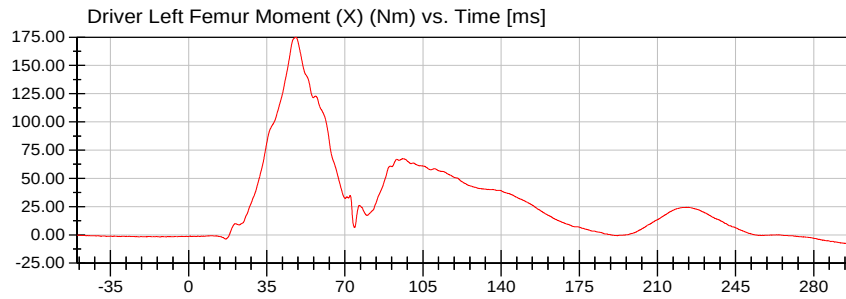
CFC_600



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



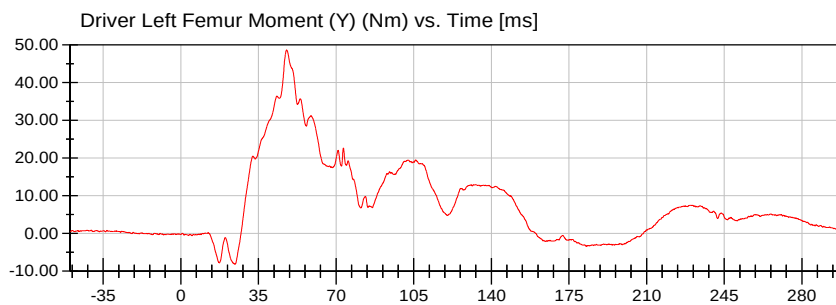
<Max>

174.93 Nm at 48.10 ms

<Min>

-8.22 Nm at 299.10 ms

CFC_600



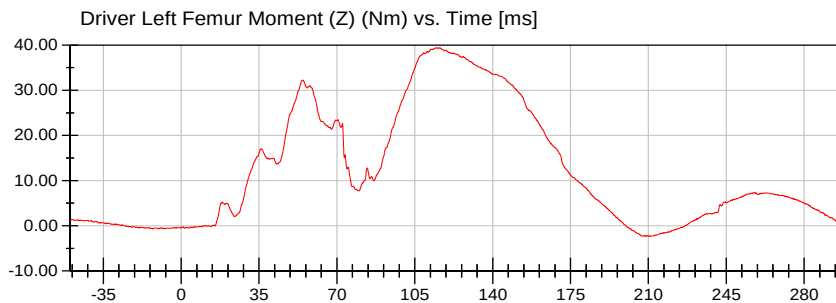
<Max>

48.66 Nm at 47.70 ms

<Min>

-8.17 Nm at 24.35 ms

CFC_600



<Max>

39.43 Nm at 115.30 ms

<Min>

-2.36 Nm at 208.45 ms

CFC_600



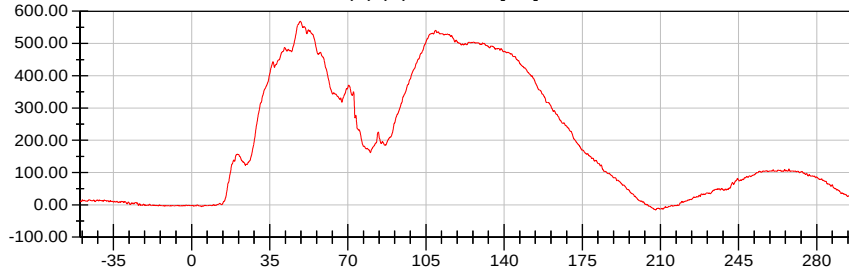
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Driver Femoral Neck Force (X) (N) vs. Time [ms]



<Max>

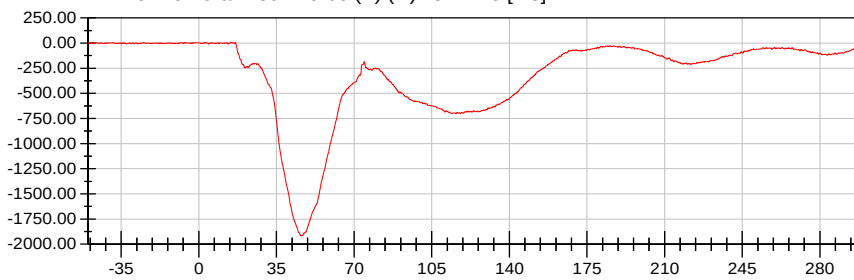
568.46 N at 48.65 ms

<Min>

-16.10 N at 207.85 ms

CFC_600

Driver Femoral Neck Force (Y) (N) vs. Time [ms]



<Max>

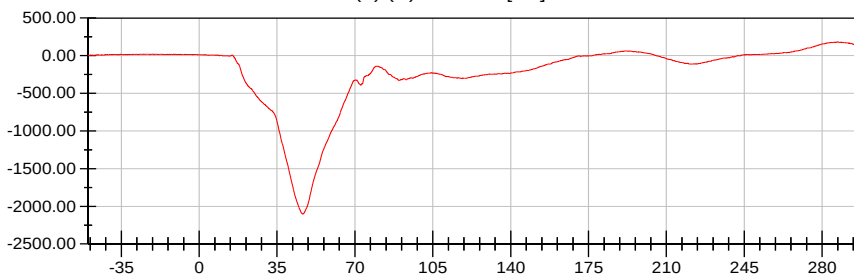
7.32 N at 14.60 ms

<Min>

-1,917.22 N at 46.45 ms

CFC_600

Driver Femoral Neck Force (Z) (N) vs. Time [ms]



<Max>

184.19 N at 286.95 ms

<Min>

-2,103.22 N at 46.55 ms

CFC_600

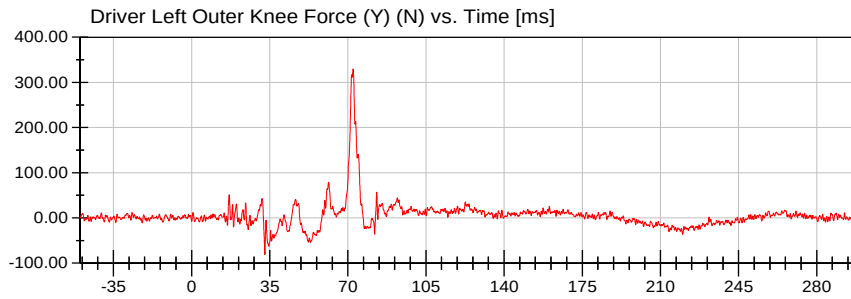


VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020



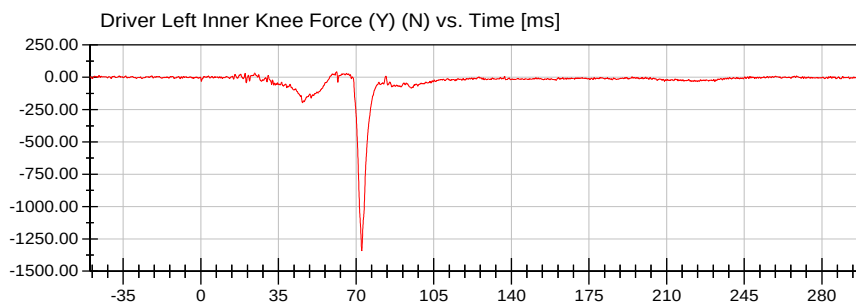
<Max>

329.12 N at 72.40 ms

<Min>

-80.95 N at 32.85 ms

CFC_600



<Max>

42.18 N at 61.25 ms

<Min>

-1,340.56 N at 72.55 ms

CFC_600

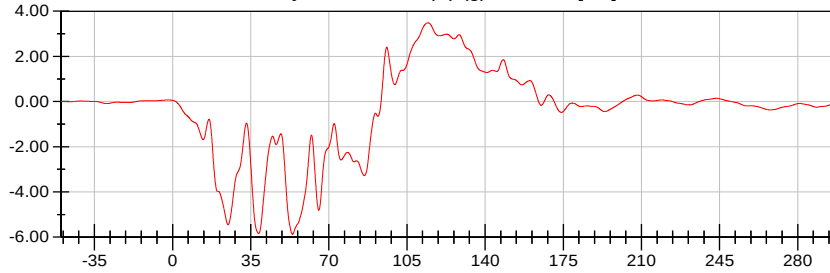


VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020

Vehicle Center of Gravity Acceleration (X) (g) vs. Time [ms]



<Max>

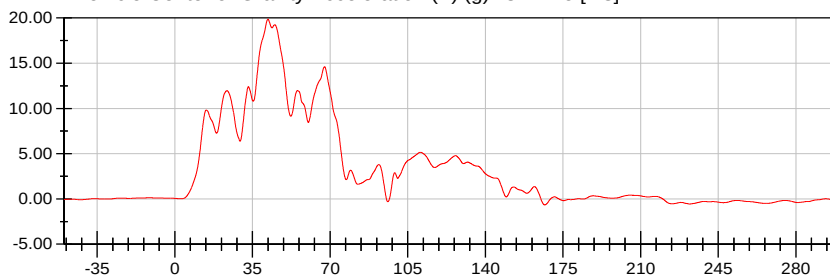
3.48 g at 114.40 ms

<Min>

-5.88 g at 53.75 ms

CFC_60

Vehicle Center of Gravity Acceleration (Y) (g) vs. Time [ms]



<Max>

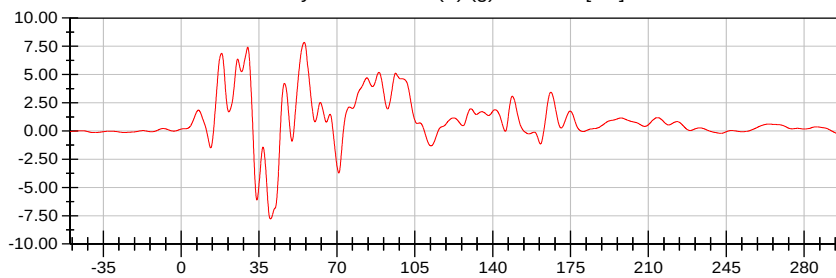
19.86 g at 42.00 ms

<Min>

-0.66 g at 166.75 ms

CFC_60

Vehicle Center of Gravity Acceleration (Z) (g) vs. Time [ms]



<Max>

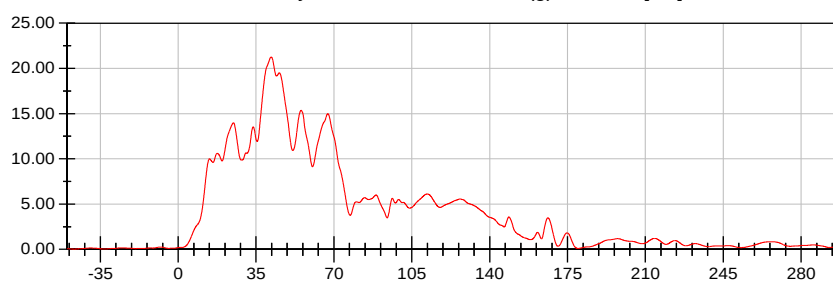
7.85 g at 55.30 ms

<Min>

-7.78 g at 40.15 ms

CFC_60

Vehicle Center of Gravity Acceleration Resultant (g) vs. Time [ms]



<Max>

21.26 g at 41.80 ms

<Min>

0.02 g at -46.65 ms

CFC_60



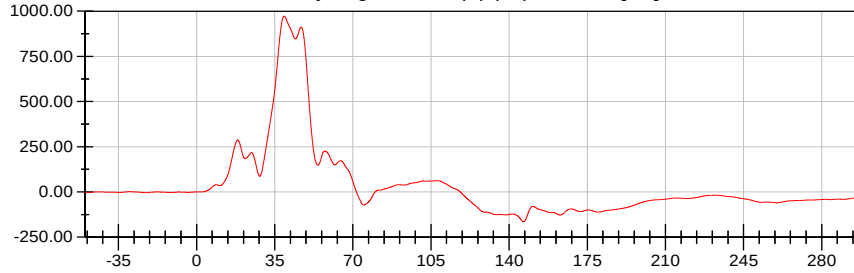
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Vehicle Center of Gravity Angular Rate (X) (°/s) vs. Time [ms]



<Max>

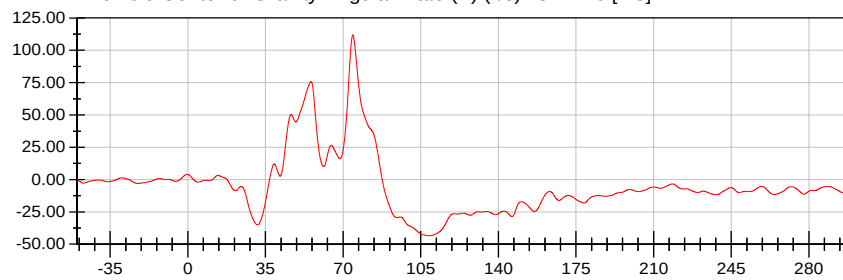
972.31 °/s at 39.25 ms

<Min>

-165.04 °/s at 146.45 ms

CFC_60

Vehicle Center of Gravity Angular Rate (Y) (°/s) vs. Time [ms]



<Max>

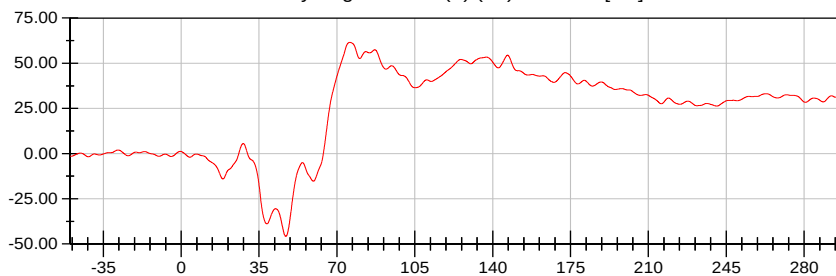
111.98 °/s at 74.40 ms

<Min>

-43.42 °/s at 108.80 ms

CFC_60

Vehicle Center of Gravity Angular Rate (Z) (°/s) vs. Time [ms]



<Max>

61.57 °/s at 75.75 ms

<Min>

-45.79 °/s at 47.00 ms

CFC_60



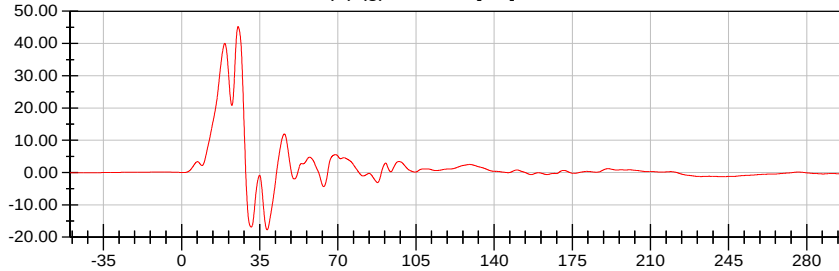
VRTC

Test Date: 12/15/2020

Test Lab: CTF

Test Number: 201215 ()

Left Floor Sill Acceleration (Y) (g) vs. Time [ms]



<Max>

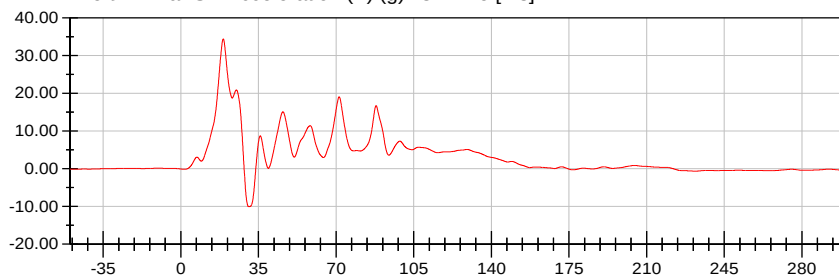
45.19 g at 25.35 ms

<Min>

-17.72 g at 38.30 ms

CFC_60

Left A-Pillar Sill Acceleration (Y) (g) vs. Time [ms]



<Max>

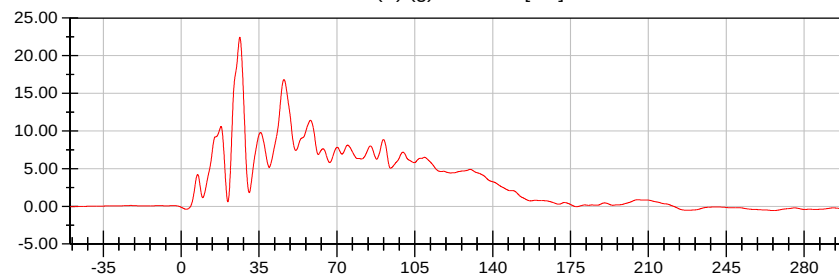
34.43 g at 19.15 ms

<Min>

-10.07 g at 30.60 ms

CFC_60

Left Lower A-Pillar Acceleration (Y) (g) vs. Time [ms]



<Max>

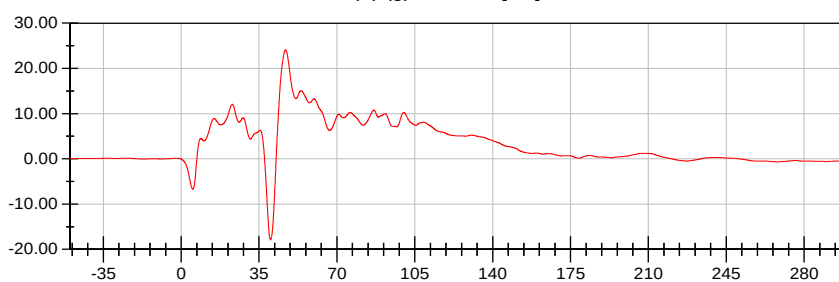
22.46 g at 26.40 ms

<Min>

-0.55 g at 266.00 ms

CFC_60

Left Mid A-Pillar Acceleration (Y) (g) vs. Time [ms]



<Max>

24.09 g at 46.90 ms

<Min>

-17.90 g at 40.15 ms

CFC_60



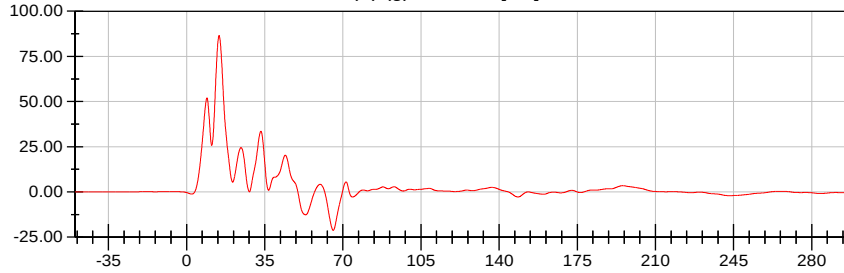
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Left B-Pillar Sill Acceleration (Y) (g) vs. Time [ms]



<Max>

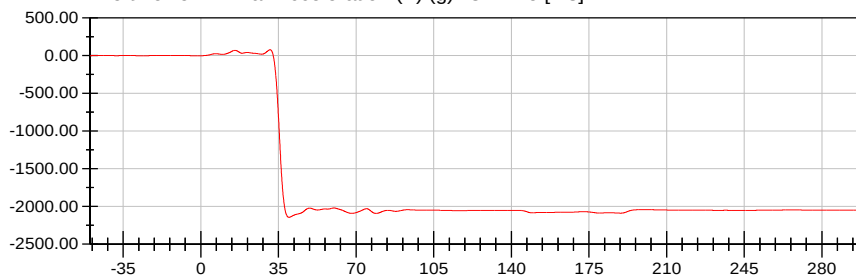
86.50 g at 14.55 ms

<Min>

-21.23 g at 65.70 ms

CFC_60

Left Lower B-Pillar Acceleration (Y) (g) vs. Time [ms]



<Max>

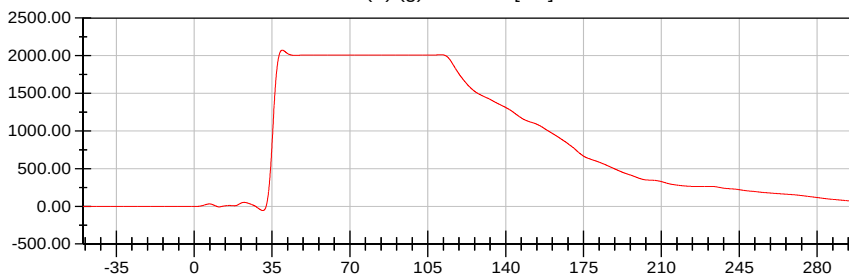
78.61 g at 31.20 ms

<Min>

-2,143.50 g at 39.70 ms

CFC_60

Left Mid B-Pillar Acceleration (Y) (g) vs. Time [ms]



<Max>

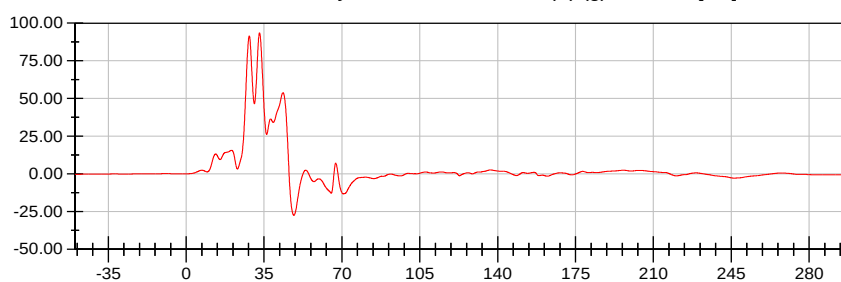
2,073.84 g at 39.60 ms

<Min>

-55.91 g at 30.85 ms

CFC_60

Driver Seat Track at Dummy H-Point Acceleration (Y) (g) vs. Time [ms]



<Max>

93.56 g at 33.00 ms

<Min>

-27.38 g at 48.40 ms

CFC_60

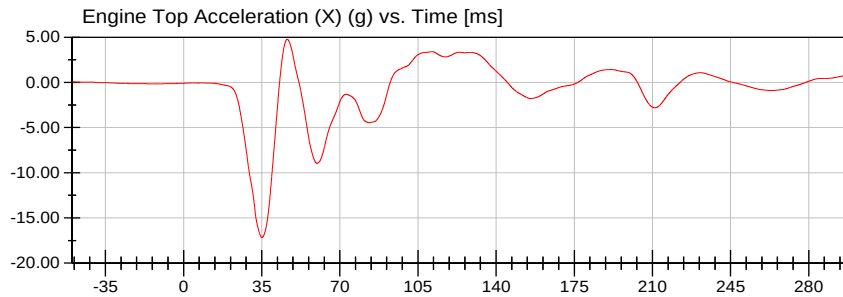


VRTC

Test Date: 12/15/2020

Test Lab: CTF

Test Number: 201215 ()



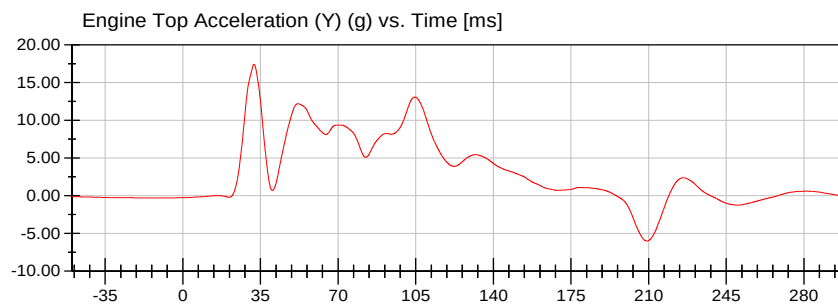
<Max>

4.75 g at 46.45 ms

<Min>

-17.16 g at 35.10 ms

CFC_60



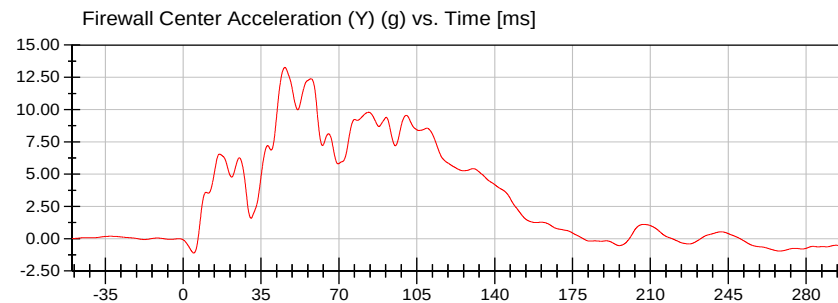
<Max>

17.45 g at 32.10 ms

<Min>

-6.00 g at 209.25 ms

CFC_60



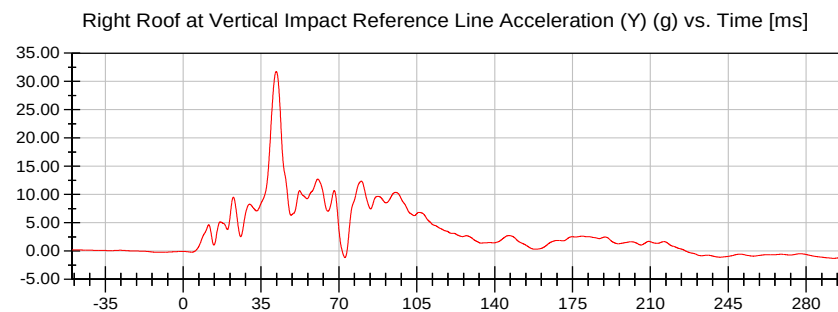
<Max>

13.26 g at 45.70 ms

<Min>

-1.11 g at 4.75 ms

CFC_60



<Max>

31.76 g at 41.80 ms

<Min>

-1.28 g at 292.30 ms

CFC_60



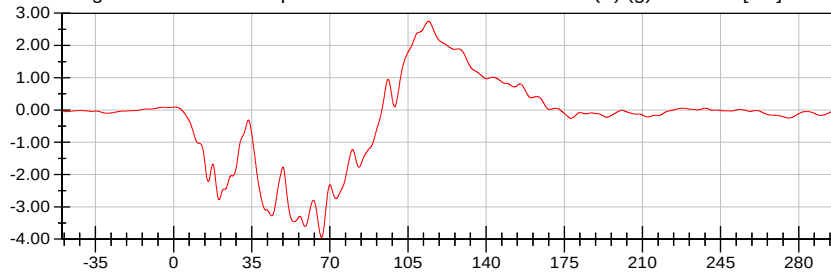
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Right Sill at Vertical Impact Reference Line Acceleration (X) (g) vs. Time [ms]



<Max>

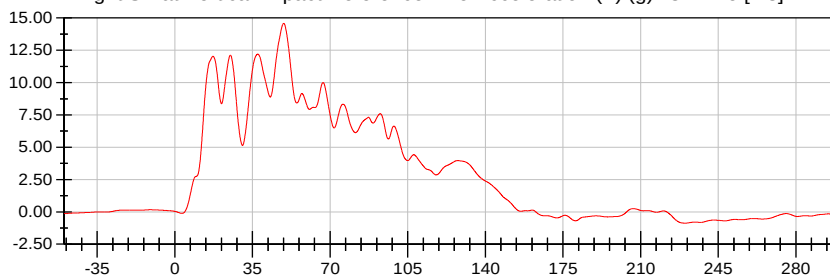
2.75 g at 114.15 ms

<Min>

-3.95 g at 66.30 ms

CFC_60

Right Sill at Vertical Impact Reference Line Acceleration (Y) (g) vs. Time [ms]



<Max>

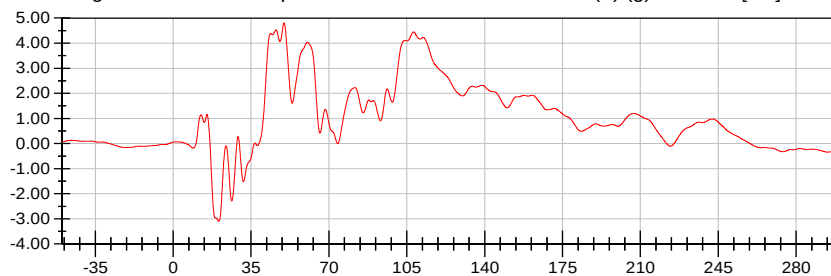
14.58 g at 49.10 ms

<Min>

-0.87 g at 230.10 ms

CFC_60

Right Sill at Vertical Impact Reference Line Acceleration (Z) (g) vs. Time [ms]



<Max>

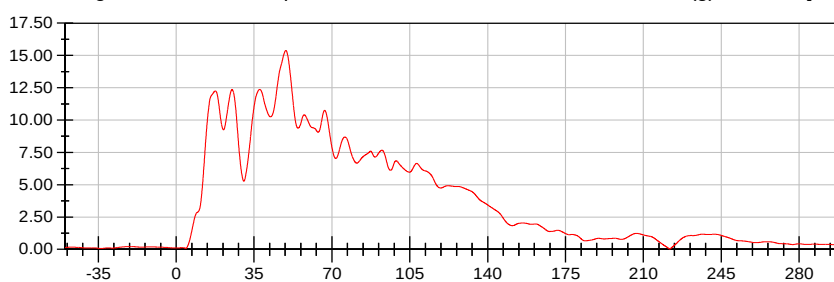
4.80 g at 49.85 ms

<Min>

-3.09 g at 20.55 ms

CFC_60

Right Sill at Vertical Impact Reference Line Acceleration Resultant (g) vs. Time [ms]



<Max>

15.39 g at 49.30 ms

<Min>

0.03 g at 221.80 ms

CFC_60



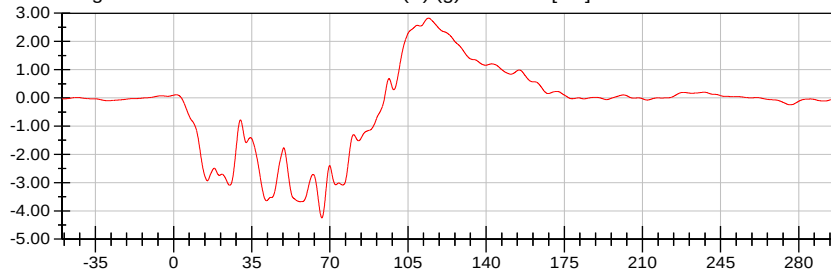
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Right Sill at Rear Seat Acceleration (X) (g) vs. Time [ms]



<Max>

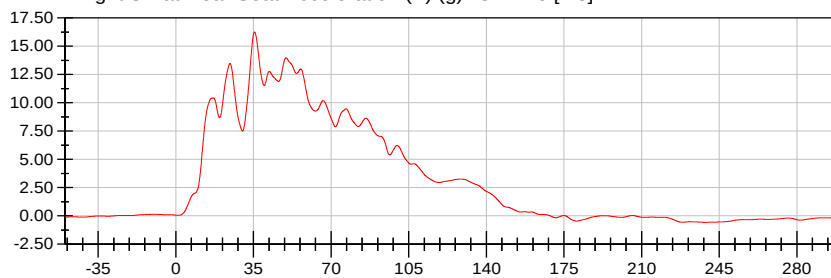
2.82 g at 114.15 ms

<Min>

-4.25 g at 66.45 ms

CFC_60

Right Sill at Rear Seat Acceleration (Y) (g) vs. Time [ms]



<Max>

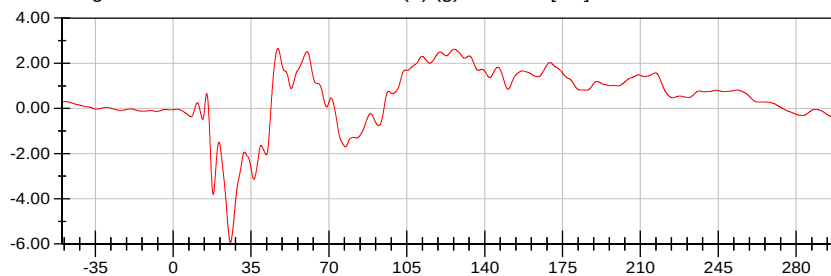
16.27 g at 35.45 ms

<Min>

-0.57 g at 238.95 ms

CFC_60

Right Sill at Rear Seat Acceleration (Z) (g) vs. Time [ms]



<Max>

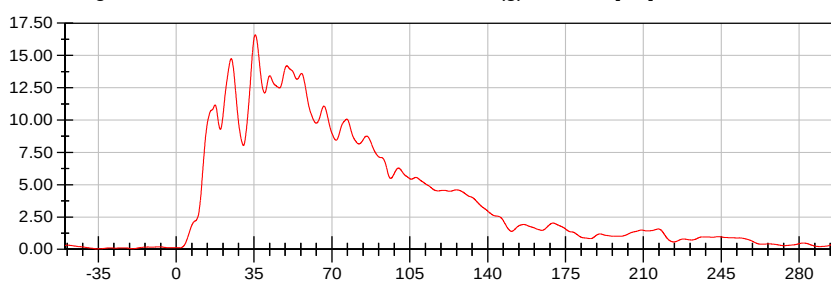
2.65 g at 47.05 ms

<Min>

-5.93 g at 25.75 ms

CFC_60

Right Sill at Rear Seat Acceleration Resultant (g) vs. Time [ms]



<Max>

16.60 g at 35.55 ms

<Min>

0.04 g at -35.75 ms

CFC_60



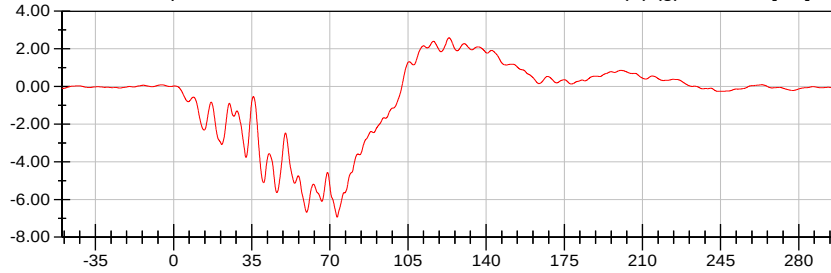
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

Rear Floorpan Behind Rear Axle at Centerline Acceleration (X) (g) vs. Time [ms]



<Max>

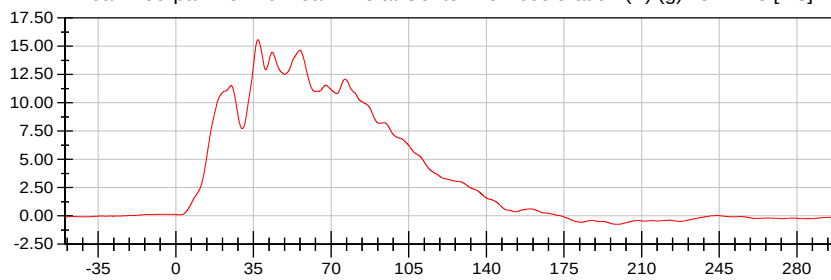
2.59 g at 123.40 ms

<Min>

-6.94 g at 73.25 ms

CFC_60

Rear Floorpan Behind Rear Axle at Centerline Acceleration (Y) (g) vs. Time [ms]



<Max>

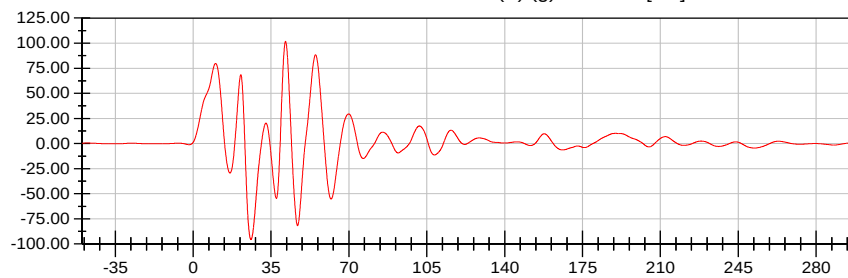
15.58 g at 37.05 ms

<Min>

-0.74 g at 199.00 ms

CFC_60

Left Front Door Mid Centerline Acceleration (Y) (g) vs. Time [ms]



<Max>

101.74 g at 41.50 ms

<Min>

-95.51 g at 26.00 ms

CFC_60



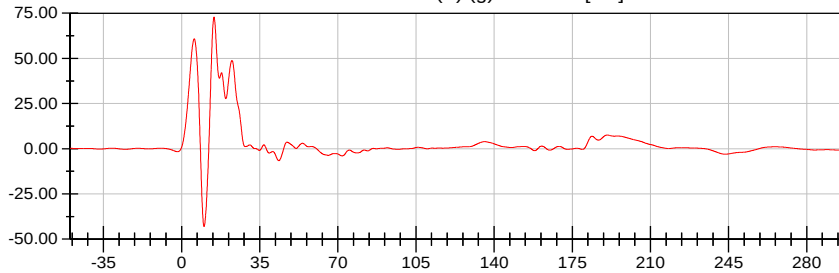
VRTC

Test Date: 12/15/2020

Test Lab: CTF

Test Number: 201215 ()

Left Front Door Mid Rear Acceleration (Y) (g) vs. Time [ms]



<Max>

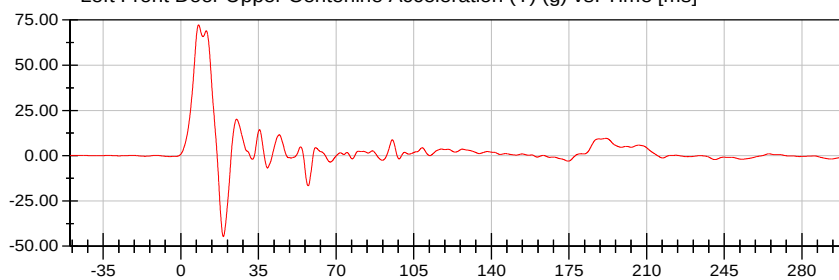
72.88 g at 14.55 ms

<Min>

-43.04 g at 10.05 ms

CFC_60

Left Front Door Upper Centerline Acceleration (Y) (g) vs. Time [ms]



<Max>

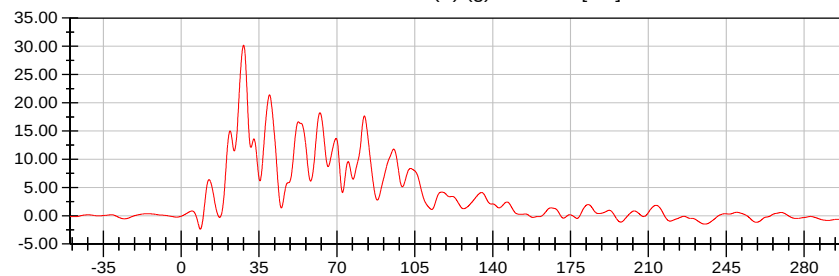
72.29 g at 8.00 ms

<Min>

-44.66 g at 19.20 ms

CFC_60

Left Rear Door Mid Rear Acceleration (Y) (g) vs. Time [ms]



<Max>

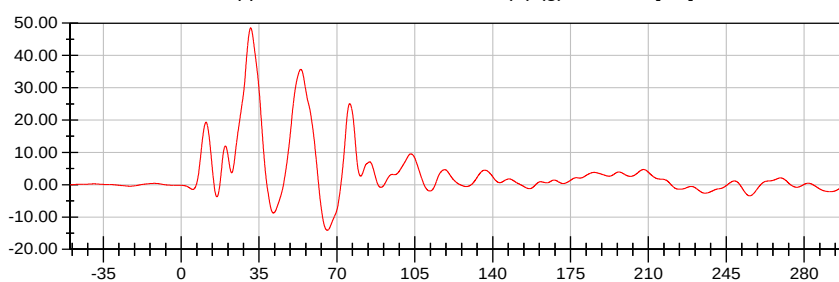
30.18 g at 28.05 ms

<Min>

-2.36 g at 8.65 ms

CFC_60

Left Rear Door Upper Centerline Acceleration (Y) (g) vs. Time [ms]



<Max>

48.51 g at 31.25 ms

<Min>

-14.10 g at 65.65 ms

CFC_60

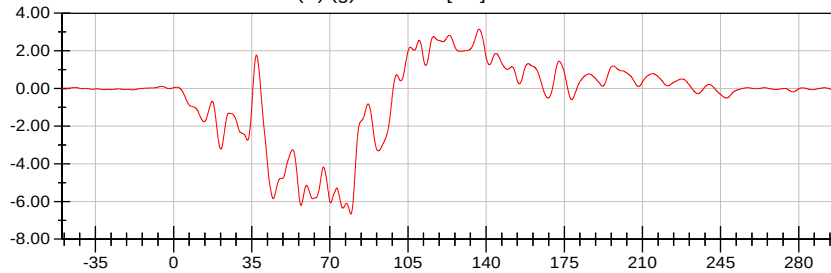


VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020

Rear Deck Acceleration (X) (g) vs. Time [ms]



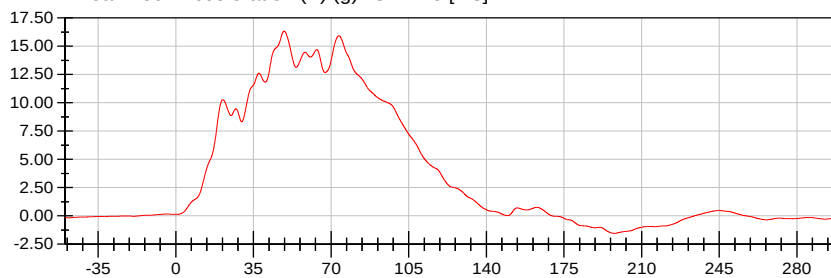
<Max>

3.15 g at 136.90 ms

<Min>

-6.67 g at 79.40 ms

Rear Deck Acceleration (Y) (g) vs. Time [ms]



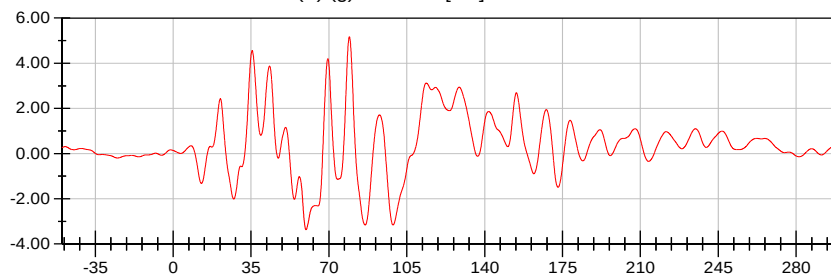
<Max>

16.34 g at 48.80 ms

<Min>

-1.54 g at 197.80 ms

Rear Deck Acceleration (Z) (g) vs. Time [ms]



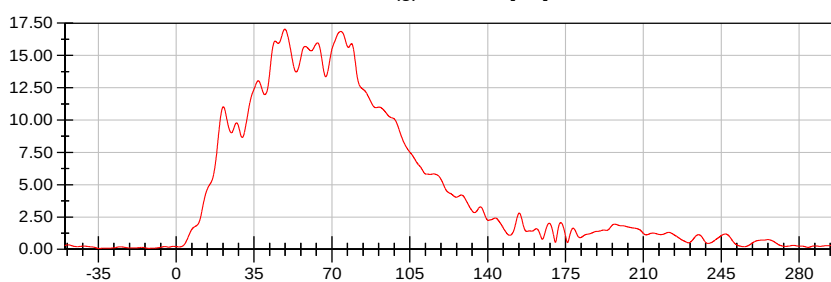
<Max>

5.18 g at 79.20 ms

<Min>

-3.37 g at 59.70 ms

Rear Deck Acceleration Resultant (g) vs. Time [ms]



<Max>

17.03 g at 48.85 ms

<Min>

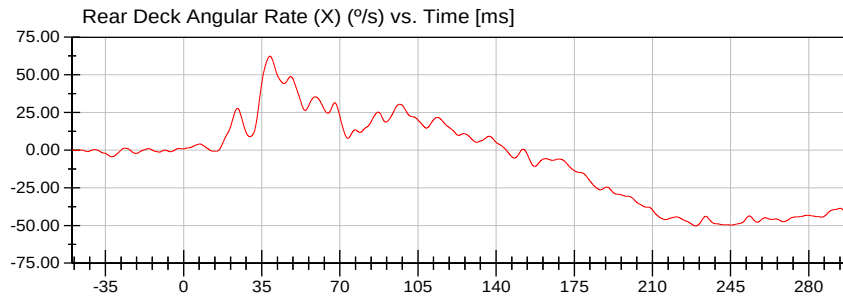
0.06 g at -34.80 ms



VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020



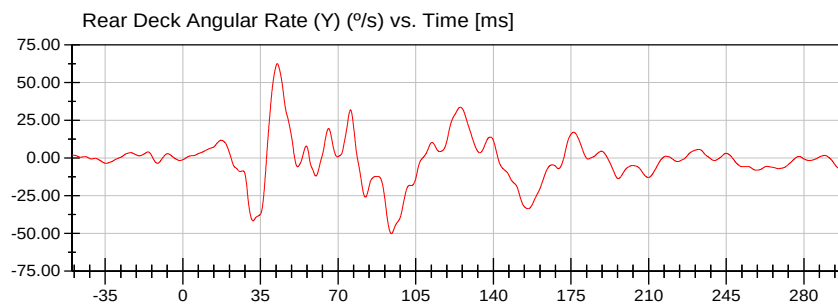
<Max>

62.36 °/s at 38.65 ms

<Min>

-50.34 °/s at 229.45 ms

CFC_60



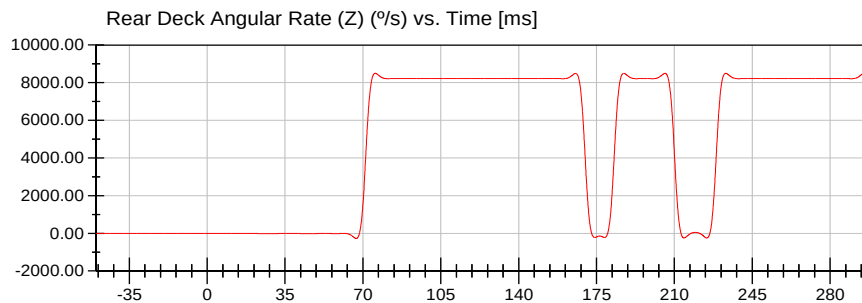
<Max>

62.61 °/s at 42.60 ms

<Min>

-50.09 °/s at 94.05 ms

CFC_60



<Max>

8,499.51 °/s at 75.55 ms

<Min>

-273.44 °/s at 67.00 ms

CFC_60



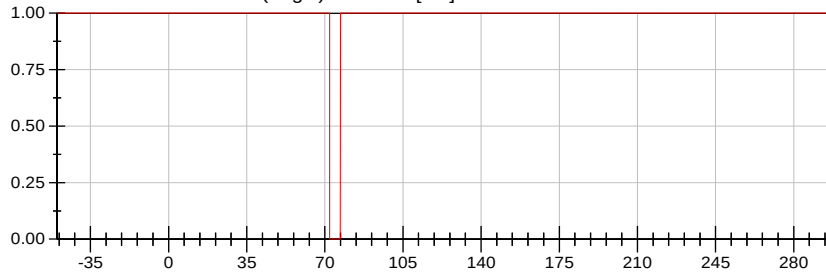
VRTC

Test Date: 12/15/2020

Test Lab: CTF

Test Number: 201215 ()

Driver Head Contact (Logic) vs. Time [ms]



<Max>

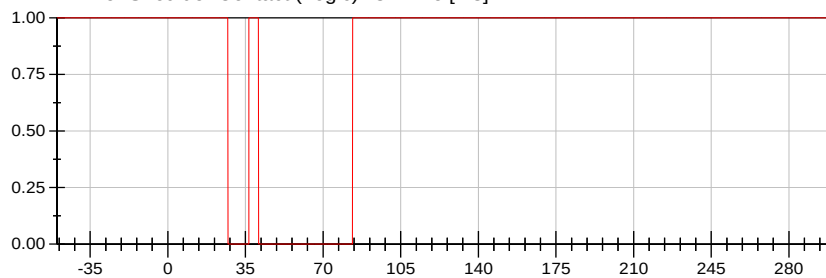
1.00 Logic at -50.00 ms

<Min>

0.00 Logic at 72.20 ms

Unfiltered

Driver Shoulder Contact (Logic) vs. Time [ms]



<Max>

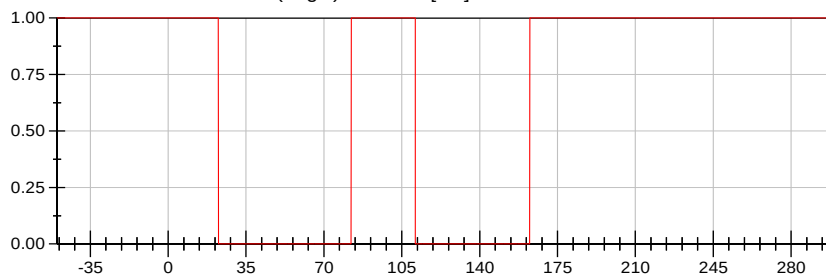
1.00 Logic at -50.00 ms

<Min>

0.00 Logic at 27.10 ms

Unfiltered

Driver Thorax Contact (Logic) vs. Time [ms]



<Max>

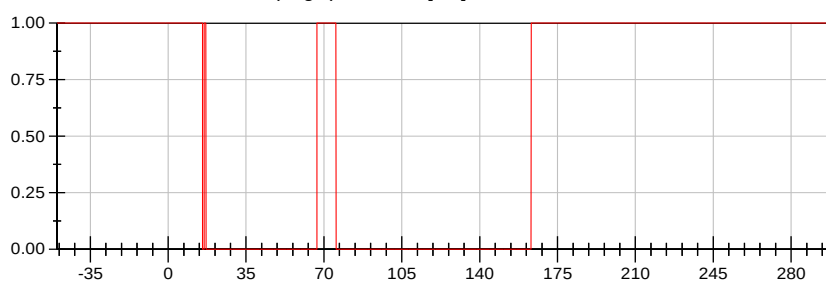
1.00 Logic at -50.00 ms

<Min>

0.00 Logic at 22.60 ms

Unfiltered

Driver Pelvis Contact (Logic) vs. Time [ms]



<Max>

1.00 Logic at -50.00 ms

<Min>

0.00 Logic at 15.50 ms

Unfiltered

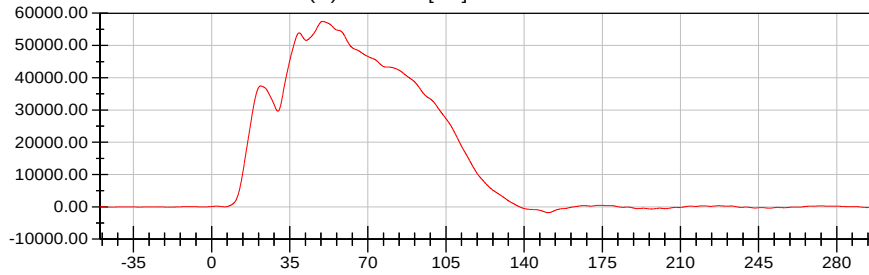


VRTC

Test Lab: CTF
Test Number: 201215 ()

Test Date: 12/15/2020

POLE LOAD CELL 1 (N) vs. Time [ms]



<Max>

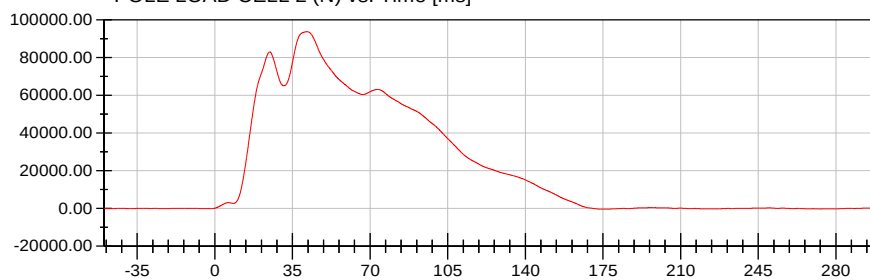
57,462.51 N at 49.75 ms

<Min>

-1,798.71 N at 150.80 ms

CFC_60

POLE LOAD CELL 2 (N) vs. Time [ms]



<Max>

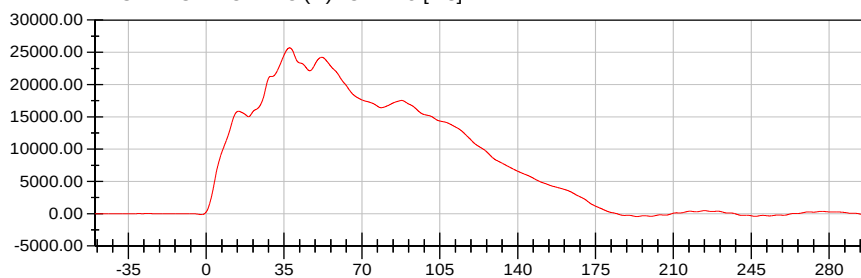
93,785.20 N at 41.50 ms

<Min>

-325.63 N at 174.20 ms

CFC_60

POLE LOAD CELL 3 (N) vs. Time [ms]



<Max>

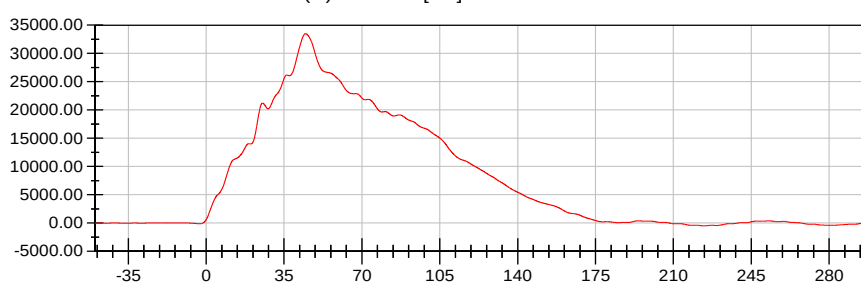
25,699.46 N at 37.45 ms

<Min>

-440.66 N at 193.65 ms

CFC_60

POLE LOAD CELL 4 (N) vs. Time [ms]



<Max>

33,479.95 N at 44.70 ms

<Min>

-492.98 N at 223.85 ms

CFC_60



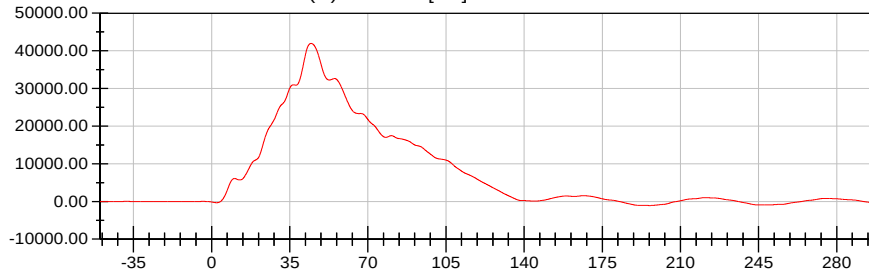
VRTC

Test Lab: CTF

Test Number: 201215 ()

Test Date: 12/15/2020

POLE LOAD CELL 5 (N) vs. Time [ms]



<Max>

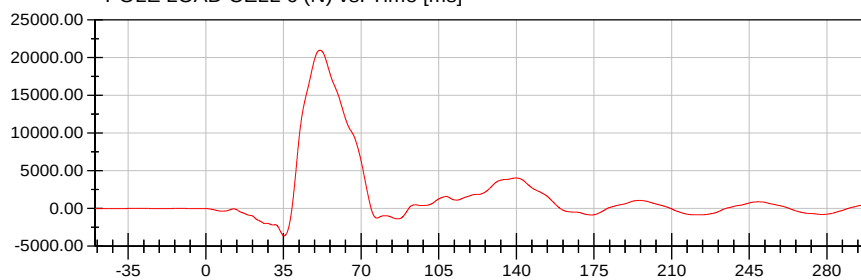
41,951.65 N at 44.60 ms

<Min>

-1,075.98 N at 196.20 ms

CFC_60

POLE LOAD CELL 6 (N) vs. Time [ms]



<Max>

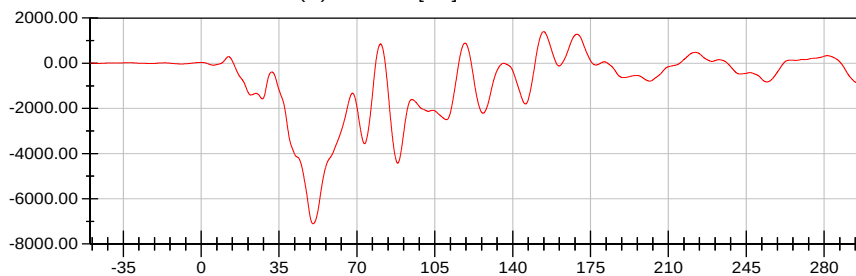
20,986.87 N at 51.45 ms

<Min>

-3,629.09 N at 35.30 ms

CFC_60

POLE LOAD CELL 7 (N) vs. Time [ms]



<Max>

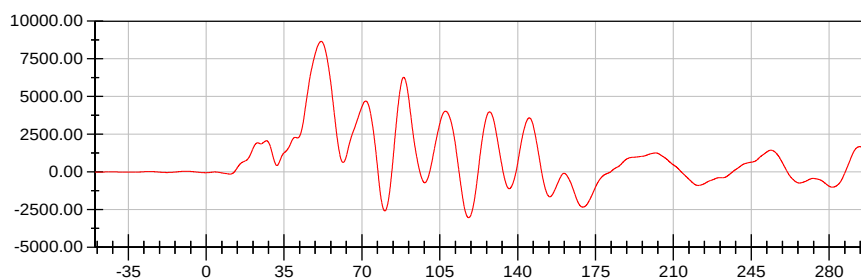
1,400.85 N at 153.95 ms

<Min>

-7,103.57 N at 50.30 ms

CFC_60

POLE LOAD CELL 8 (N) vs. Time [ms]



<Max>

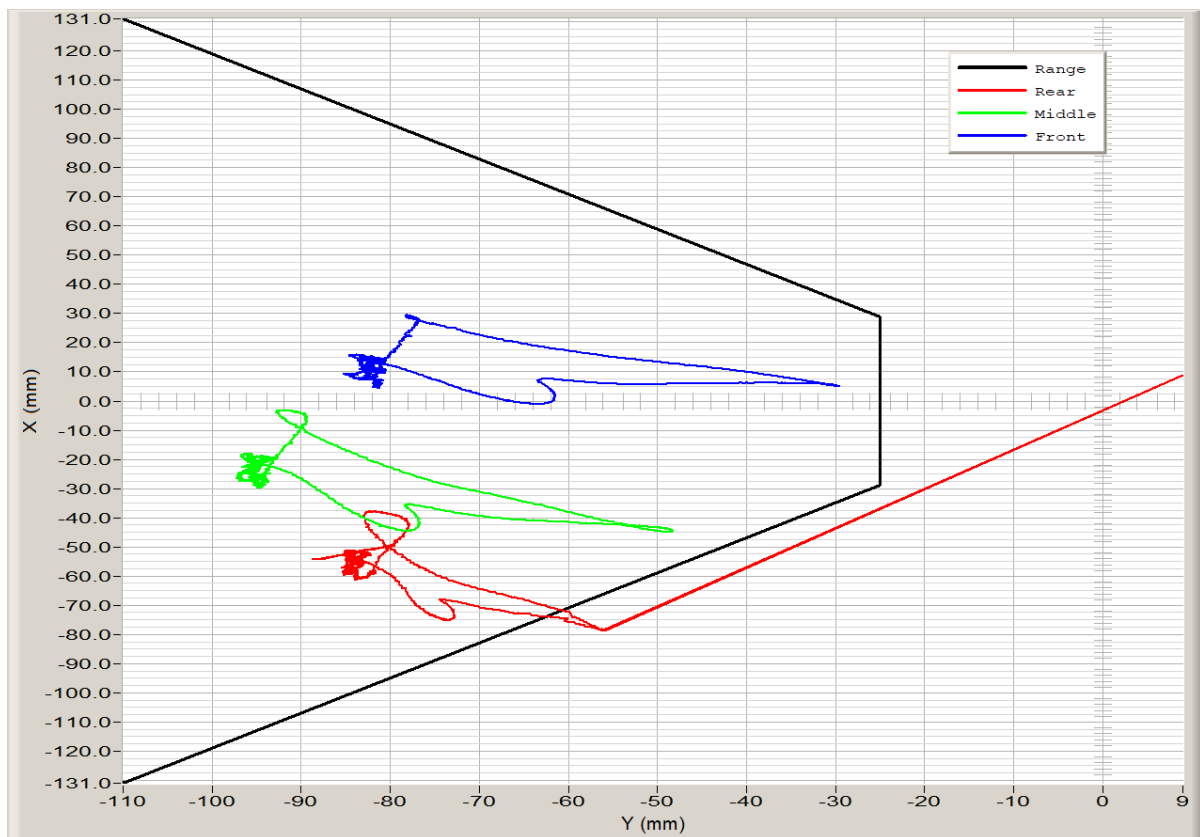
8,655.66 N at 51.70 ms

<Min>

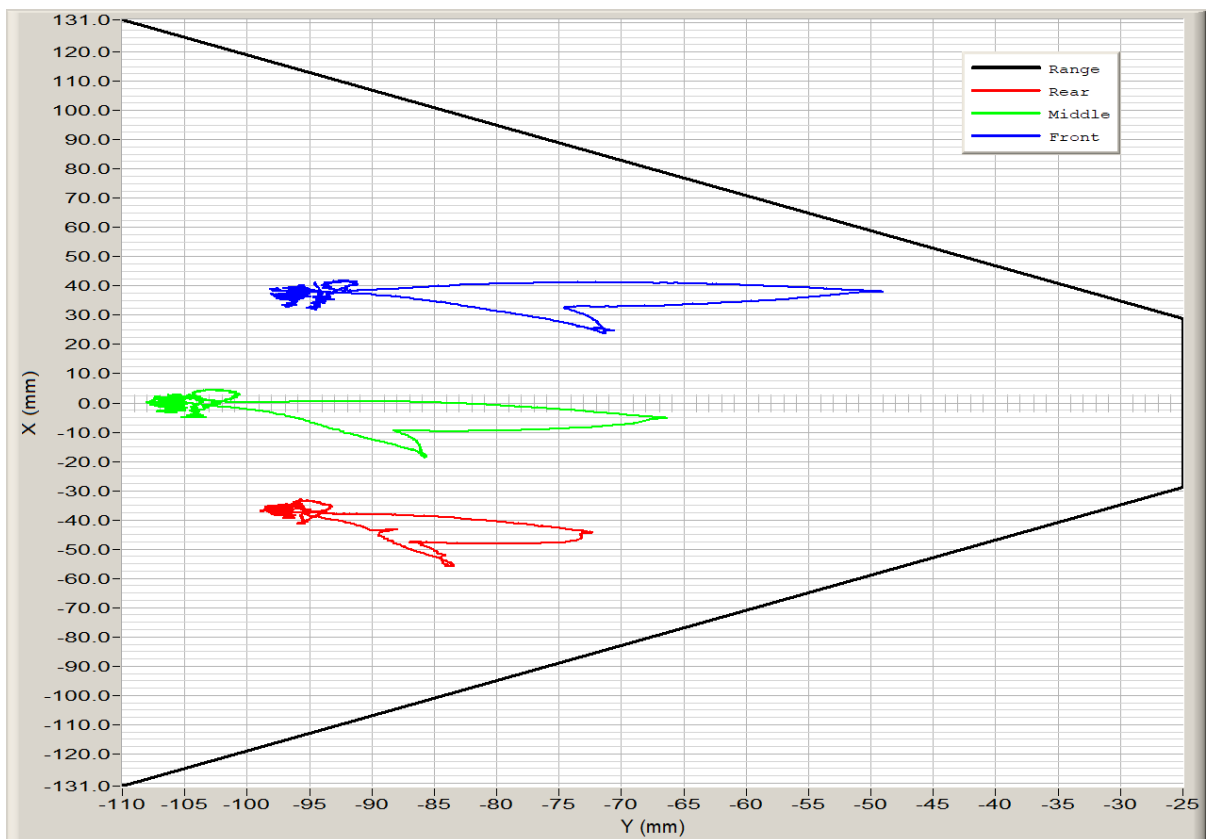
-3,031.50 N at 117.95 ms

CFC_60

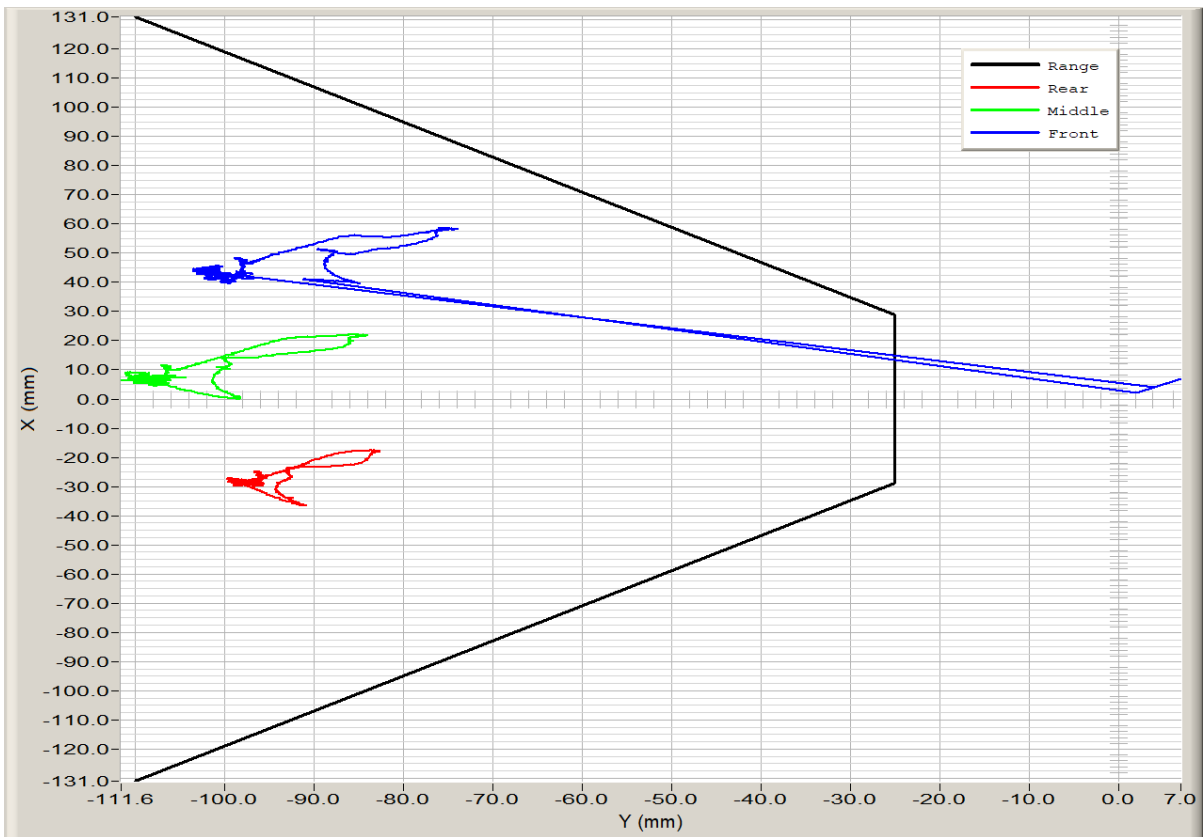




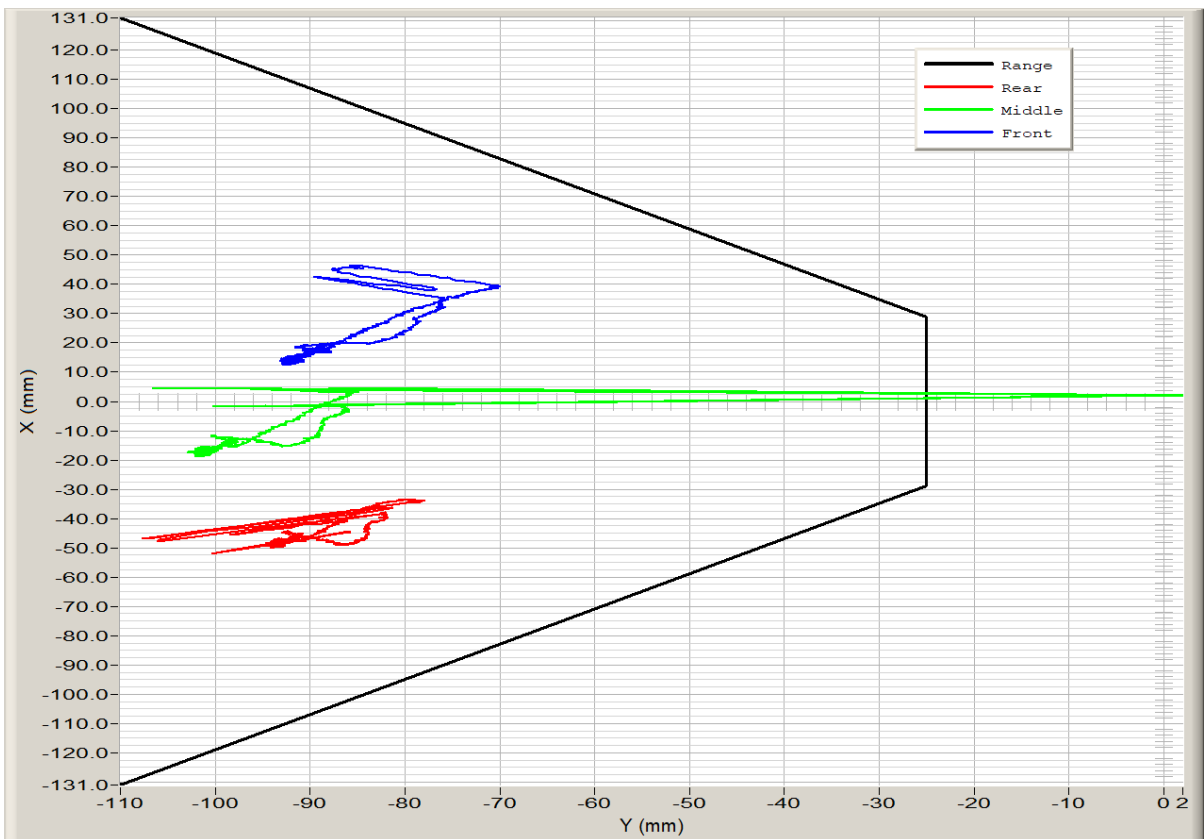
Shoulder_XY



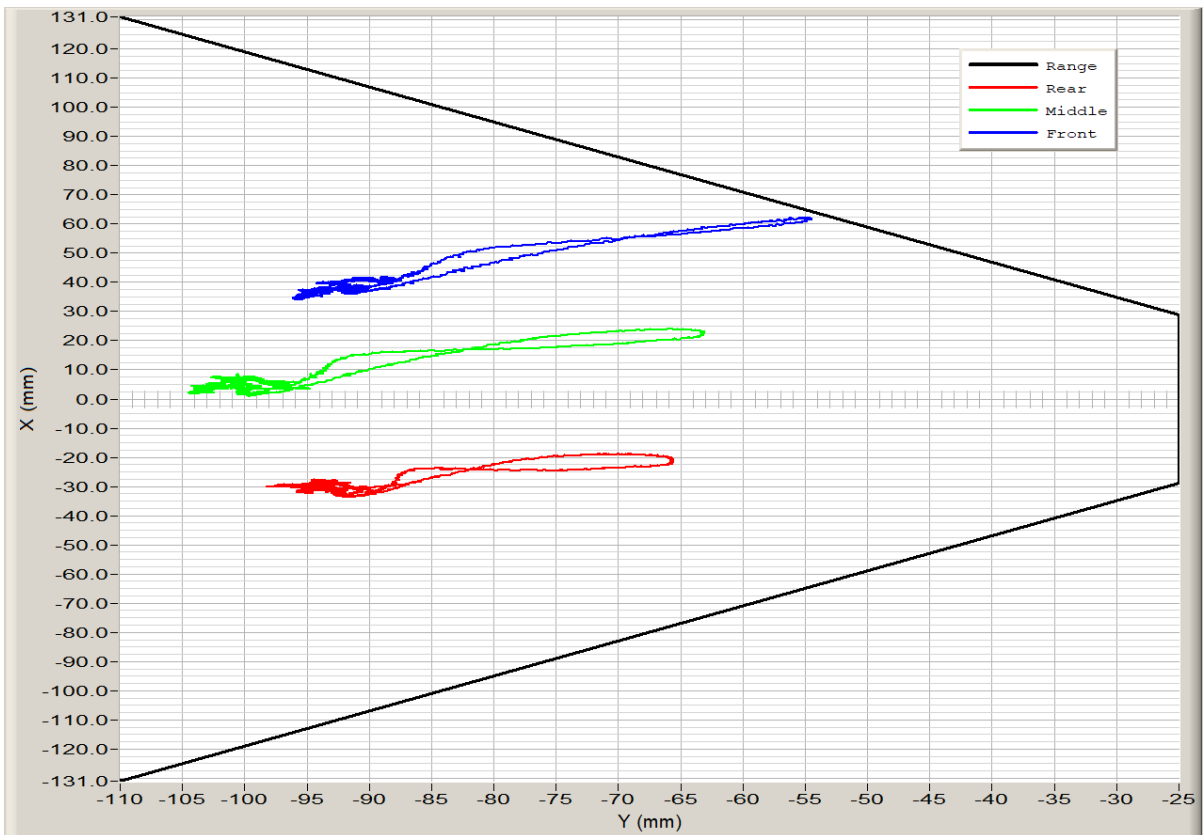
Thorax_1_XY



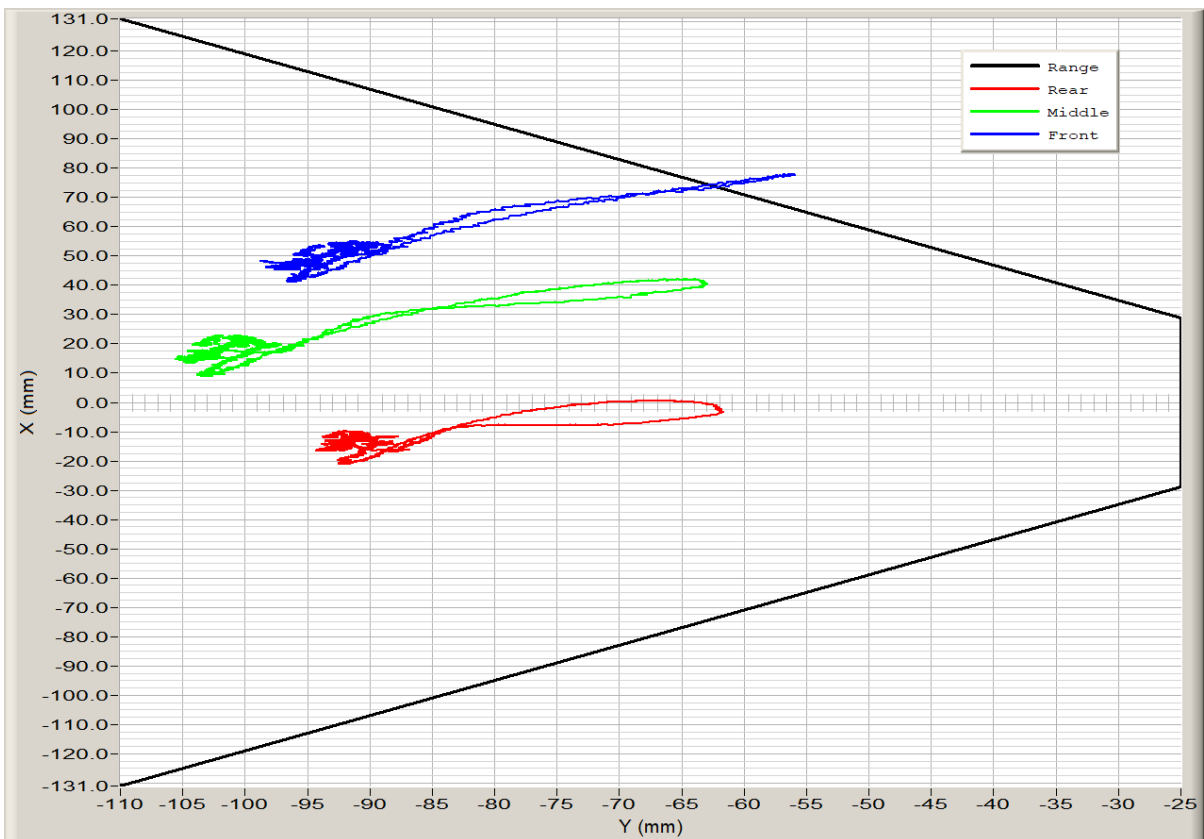
Thorax_2_XY



Thorax_3_XY



Abdomen_1_XY



Abdomen_2_XY

APPENDIX C
DUMMY PERFORMANCE QUALIFICATION TEST DATA

TABLE OF QUALIFICATION MEASUREMENTS AND PLOTS

WorldSID-50M (Driver) Dummy

Description

Table 1. External Measurements

Table 2. Front Head Drop Test

Resultant Head Acceleration (G's) vs. Time (ms)

Head (X) Acceleration (G's) vs. Time (ms)

Head (Y) Acceleration (G's) vs. Time (ms)

Head (Z) Acceleration (G's) vs. Time (ms)

Table 3. Left Lateral Head Drop Test

Resultant Head Acceleration (G's) vs. Time (ms)

Head (X) Acceleration (G's) vs. Time (ms)

Head (Y) Acceleration (G's) vs. Time (ms)

Head (Z) Acceleration (G's) vs. Time (ms)

Table 4. Right Lateral Head Drop Test

Resultant Head Acceleration (G's) vs. Time (ms)

Head (X) Acceleration (G's) vs. Time (ms)

Head (Y) Acceleration (G's) vs. Time (ms)

Head (Z) Acceleration (G's) vs. Time (ms)

Table 5. Left Lateral Neck Pendulum Test

Pendulum Acceleration (G's) vs. Time (ms)

Pendulum Velocity (m/s) vs. Time (ms)

Flexion Angle (°) vs. Time (ms)

Forward Potentiometer Rotation at Base of Pendulum (°) vs. Time (ms)

Rear Potentiometer Rotation at Base of Pendulum (°) vs. Time (ms)

Center Headform Potentiometer Rotation at CG (°) vs. Time (ms)

Neck Force Y (N) vs. Time (ms)

Neck Force Y (N) Filtered for Total Neck Occipital Condyle Moment Calculation vs. Time (ms)

Neck Moment X (Nm) vs. Time (ms)

Total Neck Occipital Condyle Moment X (Nm) vs. Time (ms)

Table 6. Right Lateral Neck Pendulum Test

Pendulum Acceleration (G's) vs. Time (ms)

Pendulum Velocity (m/s) vs. Time (ms)

Flexion Angle (°) vs. Time (ms)

Forward Potentiometer Rotation at Base of Pendulum (°) vs. Time (ms)

Rear Potentiometer Rotation at Base of Pendulum (°) vs. Time (ms)

Center Headform Potentiometer Rotation at CG (°) vs. Time (ms)

Neck Force Y (N) vs. Time (ms)

Neck Force Y (N) Filtered for Total Neck Occipital Condyle Moment Calculation vs. Time (ms)

Neck Moment X (Nm) vs. Time (ms)

Total Neck Occipital Condyle Moment X (Nm) vs. Time (ms)

Table 7. Left Lateral Shoulder Impact Test

Impactor Acceleration (G's) vs. Time (ms)

Impactor Force (N) vs. Time (ms)

Shoulder Displacement (mm) vs. Time (ms)

Table 8. Left Lateral Thorax with Arm Impact Test

Impactor Acceleration (G's) vs. Time (ms)

Impactor Force (N) vs. Time (ms)

TABLE OF QUALIFICATION MEASUREMENTS AND PLOTS (CONTUNUED)

WorldSID-50M (Driver) Dummy

Description

Upper Spine Acceleration (G's) vs. Time (ms)

Lower Spine Acceleration (G's) vs. Time (ms)

Upper Thorax Rib Displacement (mm) vs. Time (ms)

Center Thorax Rib Displacement (mm) vs. Time (ms)

Lower Thorax Rib Displacement (mm) vs. Time (ms)

Table 9. Left Lateral Thorax without Arm Impact Test

Impactor Acceleration (G's) vs. Time (ms)

Impactor Force (N) vs. Time (ms)

Upper Spine Acceleration (G's) vs. Time (ms)

Lower Spine Acceleration (G's) vs. Time (ms)

Upper Thorax Rib Displacement (mm) vs. Time (ms)

Center Thorax Rib Displacement (mm) vs. Time (ms)

Lower Thorax Rib Displacement (mm) vs. Time (ms)

Table 10. Left Lateral Abdomen Impact Test

Impactor Acceleration (G's) vs. Time (ms)

Impactor Force (N) vs. Time (ms)

Upper Abdominal Rib Displacement (mm) vs. Time (ms)

Lower Abdominal Rib Displacement (mm) vs. Time (ms)

Lower Spine Acceleration (G's) vs. Time (ms)

Table 11. Left Lateral Pelvis Impact Test

Impactor Acceleration (G's) vs. Time (ms)

Impactor Force (N) vs. Time (ms)

Pelvis Acceleration Y (G's) vs. Time (ms)

Lower Spine Acceleration Y (G's) vs. Time (ms)

Pre-Test Calibration Sheets
Driver S/N EB8888

Transportation Research Center Inc.
WorldSID-50M
External Measurements
Serial No. EB8888 Certification No. 05

WorldSID-50M Angular Reference Measurements					
Parameter	Symbol	Tilt Sensor (°)	Inclinometer (°)		
			Center	Left	Right
Head X-Axis	A1	0	n/a	n/a	n/a
Head Y-Axis	A2	2.2	n/a	2	Note 1
Neck Bracket X-Axis	A3	n/a	-0.5	n/a	n/a
Neck Bracket Y-Axis	A4	n/a	-3.1	n/a	n/a
Thorax X-Axis	A5	1.3	n/a	n/a	n/a
Thorax Y-Axis	A6	3.9	n/a	n/a	n/a
Pelvis X-Axis	A7	0.7	n/a	n/a	n/a
Pelvis Y-Axis	A8	10.2	n/a	n/a	n/a
H-point Tool	A9	n/a	n/a	32.8	33.7

WorldSID-50M External Linear Dimensions				
Parameter	Symbol	Specification (mm)		
		Center	Left	Right
Seated Height	L1	870	n/a	n/a
Hip Pivot Height	L2	n/a	89	89
Hip Pivot to Back Line	L3	n/a	187	176
Thigh Clearance	L4	n/a	181	180
Knee Height	L5	n/a	580	583
Knee to Backline	L6	n/a	667	670
Head Back to Seat Back	L7	156	n/a	n/a
Thorax Rib 1 Front to Back	L8	n/a	209	209
Abdomen Rib 2 Front to Back	L9	n/a	223	226
Arm Length	L10	n/a	330	330
Width Across Arms	L11	482	n/a	n/a
Waist Width	L12	341	n/a	n/a

Note 1: No land marks on the right side of head. Unable to align level.

Transportation Research Center Inc.

Front Head Drop

WorldSID 50th Serial No. EB8888 Certification No. 4-1

Test Date: 10/28/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.3 °C	Yes
Relative Humidity	10 - 70 %	42 %	Yes
Peak Head Resultant Acceleration	211 - 261 g	230.0 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	4.3 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	< 10 %	1.48 %	Yes

Test meets specifications.

Condition: Used

Comments:

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

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11.29.2020 14:55:46 952

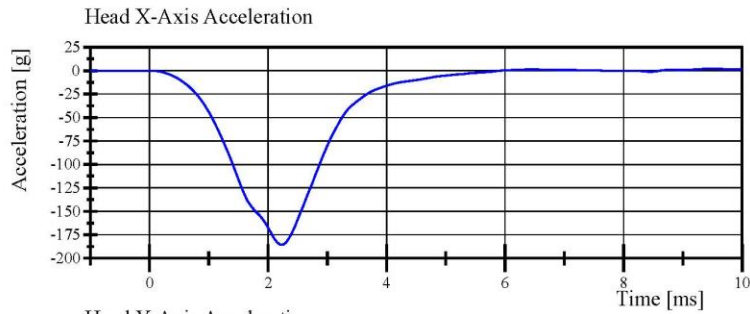


Transportation Research Center Inc.

Front Head Drop

WorldSID 50th Serial No. EB8888 Certification No. 4-1

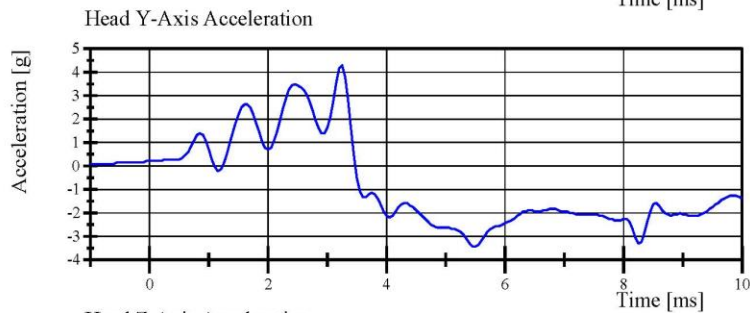
Test Date: 10/28/2020



Filter Class: CFC_1000

Max: 2.2 g at 9.5 ms

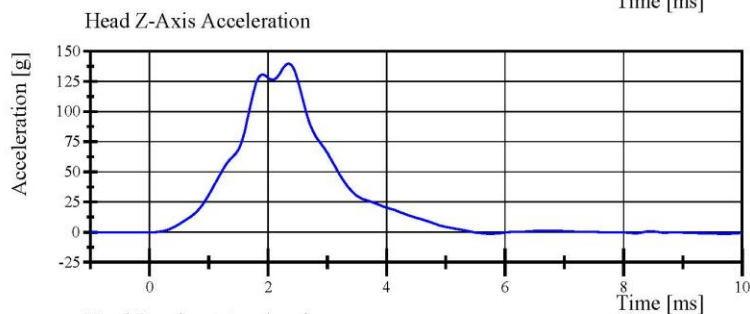
Min: -185.6 g at 2.3 ms



Filter Class: CFC_1000

Max: 4.3 g at 3.3 ms

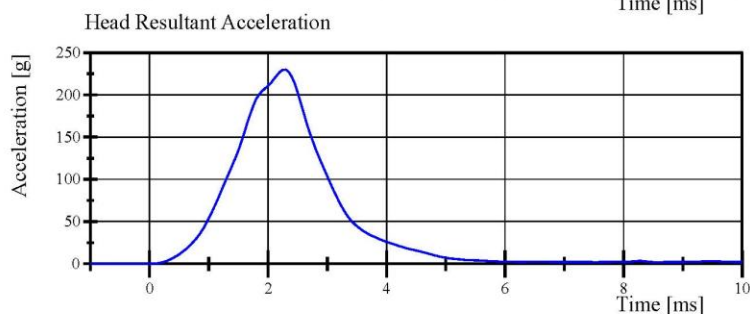
Min: -3.4 g at 5.5 ms



Filter Class: CFC_1000

Max: 140.1 g at 2.4 ms

Min: -1.4 g at 5.8 ms



Filter Class: CFC_1000

Max: 230.0 g at 2.3 ms

Min: 0.1 g at -1.0 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

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Transportation Research Center Inc.

Left Lateral Head Drop

WorldSID 50th Serial No. EB8888 Certification No. 4-1

Test Date: 10/28/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.5 °C	Yes
Relative Humidity	10 - 70 %	42 %	Yes
Peak Head Resultant Acceleration	107 - 126 g	117.4 g	Yes
Peak Head Longitudinal Acceleration	(-15) - 15 g	-2.8 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	< 10 %	1.89 %	Yes

Test meets specifications.

Condition: Used

Comments:

Specification Source: WorldSID 50th(W5) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

Report Number: EB8888_WSH04

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11.29.2020 15:09:47 946

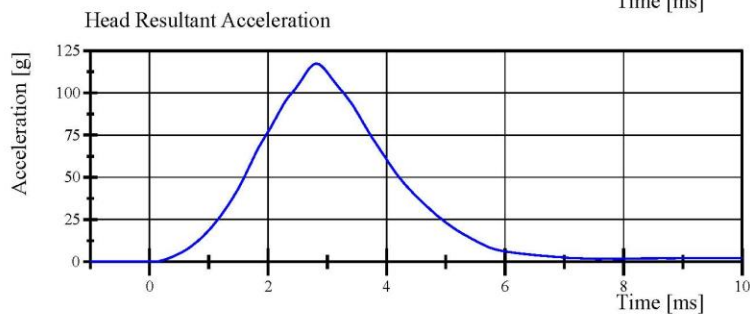
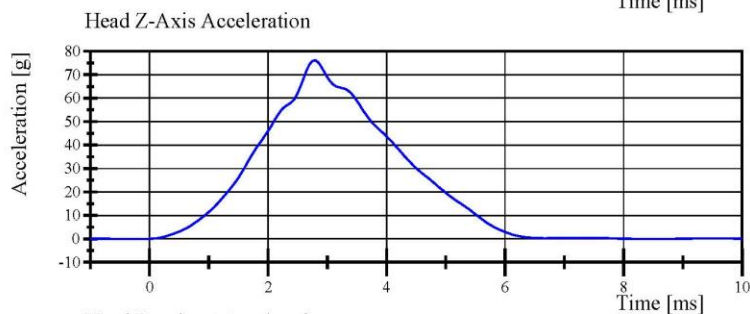
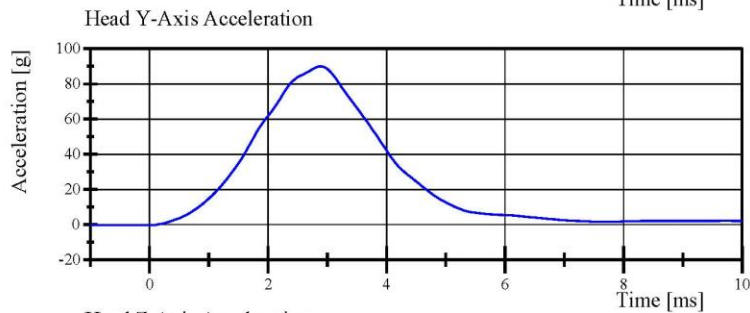
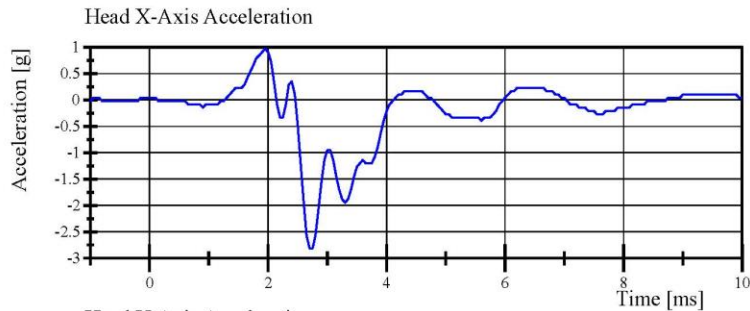


Transportation Research Center Inc.

Left Lateral Head Drop

WorldSID 50th Serial No. EB8888 Certification No. 4-1

Test Date: 10/28/2020



Specification Source: WorldSID 50th(W5) VRTC Nov 2020.xlsx
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Transportation Research Center Inc.

Right Lateral Head Drop

WorldSID 50th Serial No. EB8888 Certification No. 4-1

Test Date: 10/28/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	41 %	Yes
Peak Head Resultant Acceleration	107 - 126 g	112.3 g	Yes
Peak Head Longitudinal Acceleration	(-15) - 15 g	-3.9 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	< 10 %	1.88 %	Yes

Test meets specifications.

Condition: Used

Comments:

Specification Source: WordSID 50th(W5) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

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11.29.2020 15:14:24 944

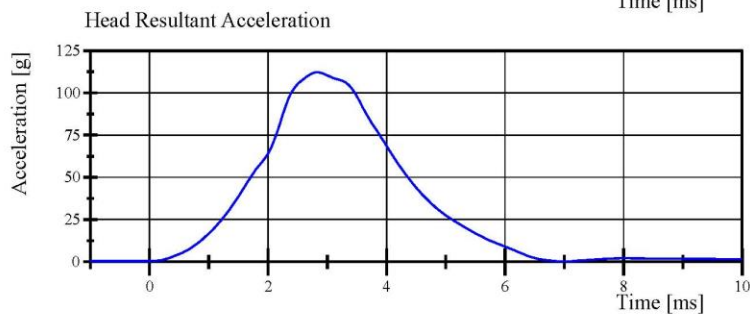
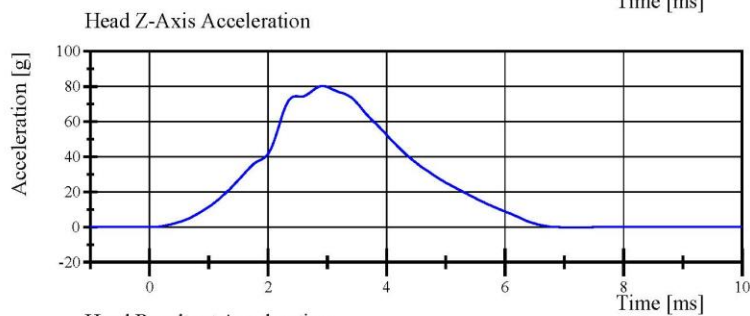
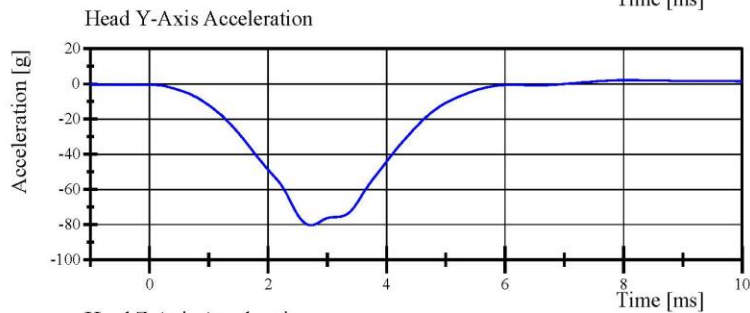
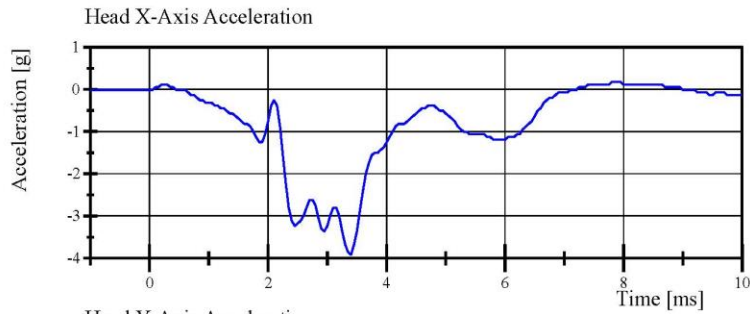


Transportation Research Center Inc.

Right Lateral Head Drop

WorldSID 50th Serial No. EB8888 Certification No. 4-1

Test Date: 10/28/2020



Specification Source: WorldSID 50th(WS) VRTC Nov 2020.xlsx
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Transportation Research Center Inc.

Left Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 4-5

Test Date: 11/6/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	40 %	Yes
Pendulum Velocity	(-3.30) - (-3.50) m/s	-3.332 m/s	Yes
Pendulum Integrated Velocity Change at 4 ms	0.87 - 1.09 m/s	0.999 m/s	Yes
Change at 8 ms	1.72 - 2.1 m/s	2.003 m/s	Yes
Change at 12 ms	2.63 - 3.17 m/s	3.001 m/s	Yes
Maximum Headform Flexion	(-50) - (-61) deg	-55.3 deg	Yes
Headform Flexion Decay - from Peak to Zero Degrees	58 - 72 ms	61.0 ms	Yes
Total Neck Occipital Condyles Moment	54 - 67 N·m	60.8 N·m	Yes
Total Neck Occipital Condyles Moment Decay Time to 0 N·m	71 - 87 ms	77.4 ms	Yes
Maximum Forward Pot Rotation			
Peak	(-32) - (-39) °	-35.9 °	Yes
Time of Peak	56 - 68 ms	62.2 ms	Yes
Maximum Rear Pot Rotation			
Peak	(-29) - (-36) °	-32.0 °	Yes
Time of Peak	56 - 68 ms	64.0 ms	Yes
Maximum Headform Angular Rate	(-2,047) - (-2,503) °/s	-2,307.3 °/s	Yes

Test meets specifications.

Condition: Used

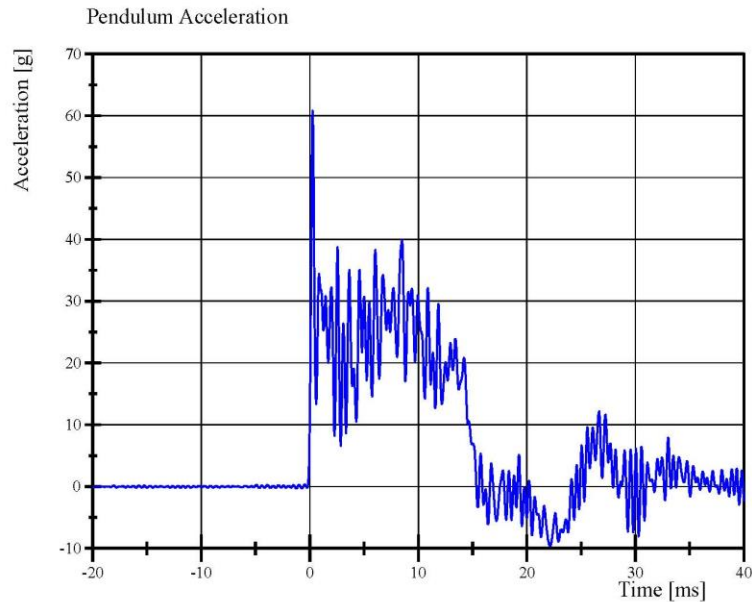
Comments:

Transportation Research Center Inc.

Left Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 4-5

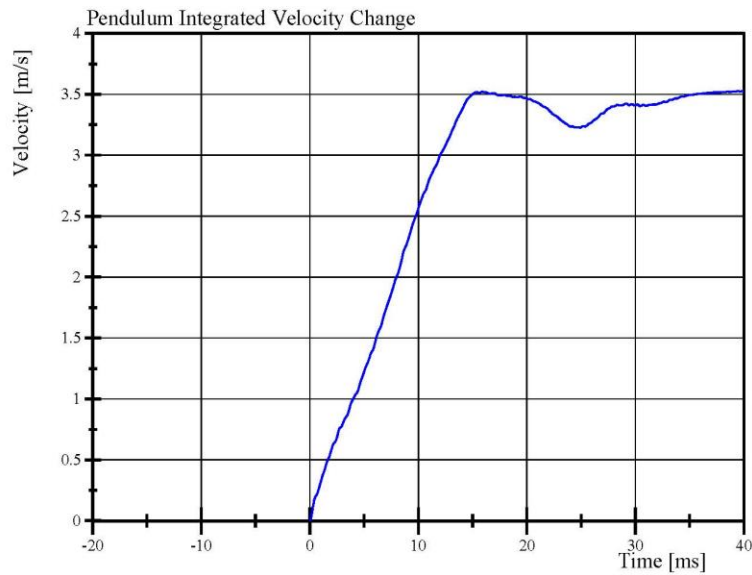
Test Date: 11/6/2020



Filter Class: CFC_1000

Max: 60.8 g at 0.3 ms

Min: -9.6 g at 22.2 ms



Filter Class: CFC_1000

Max: 3.5 m/s at 39.5 ms

Min: 0.0 m/s at -0.0 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
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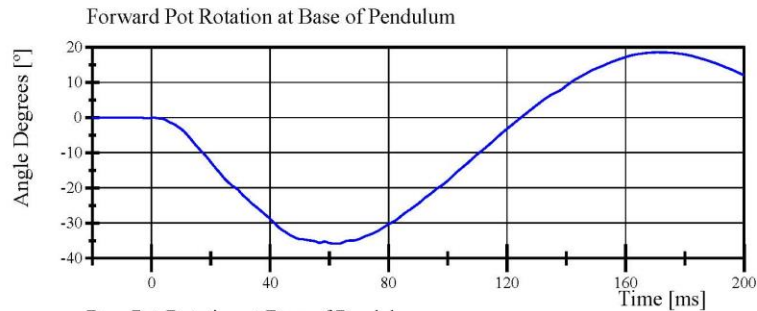


Transportation Research Center Inc.

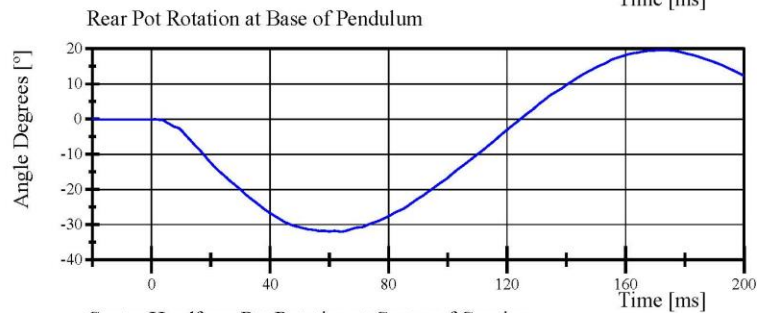
Left Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 4-5

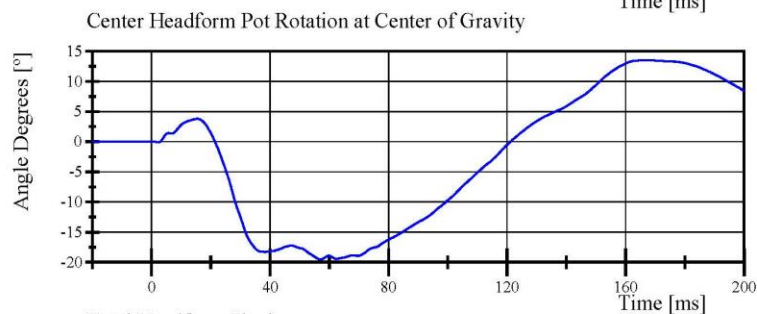
Test Date: 11/6/2020



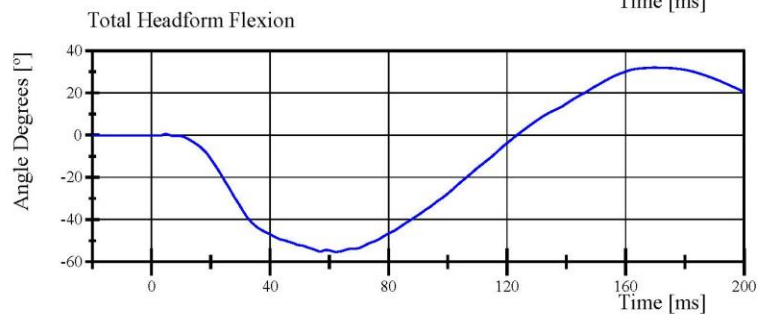
Filter Class: CFC_180
Max: 18.6 ° at 170.7 ms
Min: -35.9 ° at 62.2 ms



Filter Class: CFC_180
Max: 19.6 ° at 172.9 ms
Min: -32.0 ° at 64.0 ms



Filter Class: CFC_180
Max: 13.5 ° at 168.6 ms
Min: -19.5 ° at 57.0 ms



Filter Class: CFC_180
Max: 32.0 ° at 169.7 ms
Min: -55.3 ° at 62.3 ms

Specification Source: WordSID 50th(W5) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

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Report Number: EB8888_WSH04

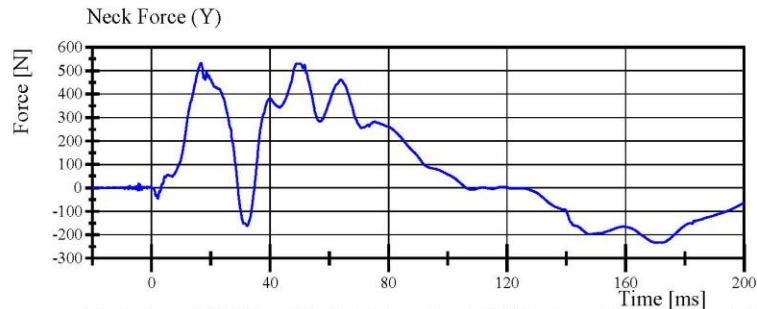
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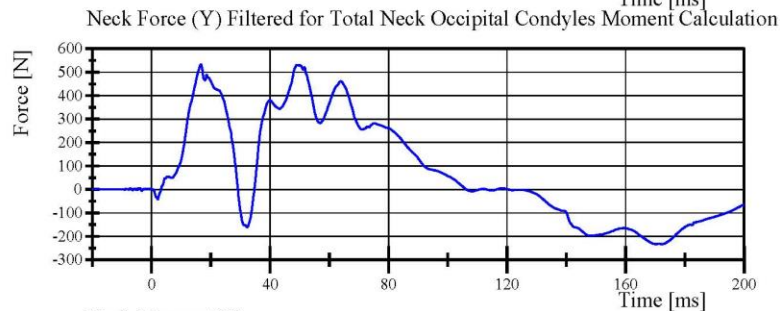
Left Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 4-5

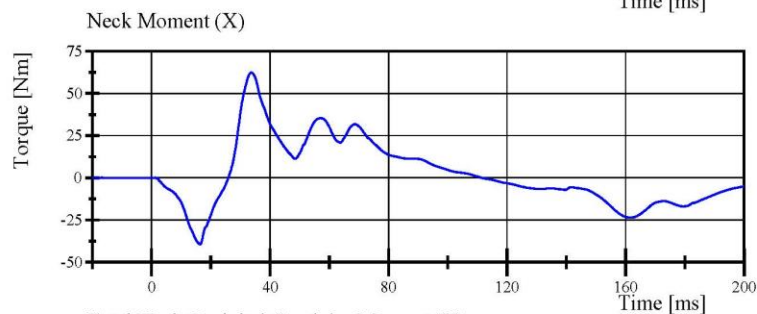
Test Date: 11/6/2020



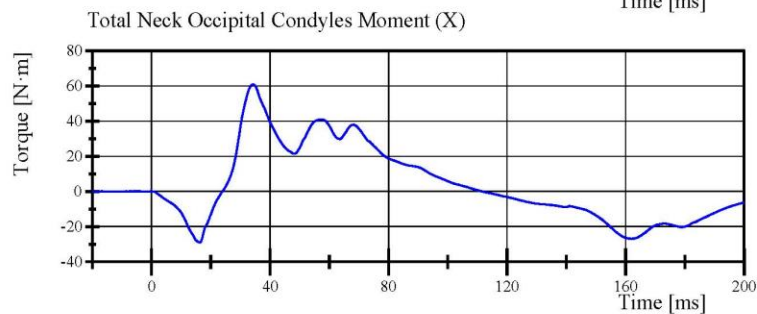
Filter Class: CFC_1000
Max: 532.9 N at 16.7 ms
Min: -233.8 N at 172.2 ms



Filter Class: CFC_600
Max: 532.4 N at 16.7 ms
Min: -233.4 N at 172.2 ms



Filter Class: CFC_600
Max: 62.4 Nm at 33.7 ms
Min: -39.2 Nm at 16.4 ms



Filter Class: Without_(Consta
Max: 60.8 N·m at 34.2 ms
Min: -29.0 N·m at 16.3 ms

Specification Source: WordSID 50th(W5) VRTC Nov 2020.xlsx
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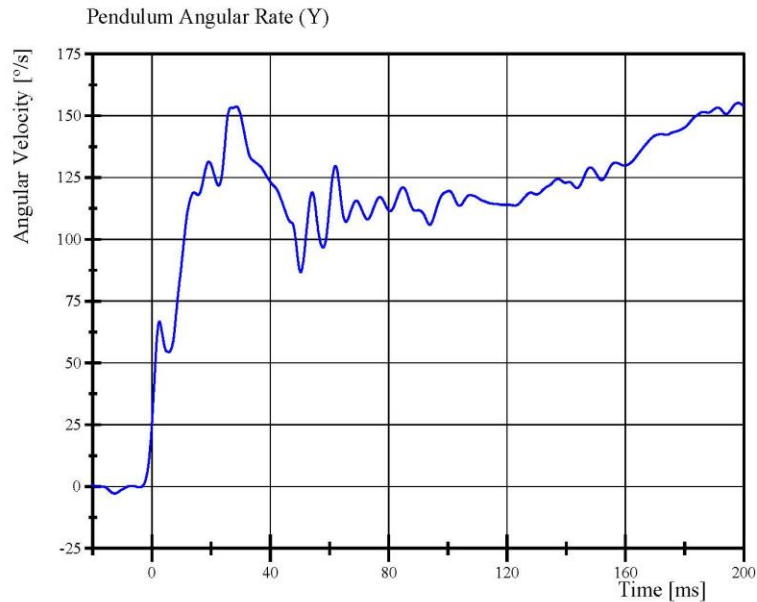


Transportation Research Center Inc.

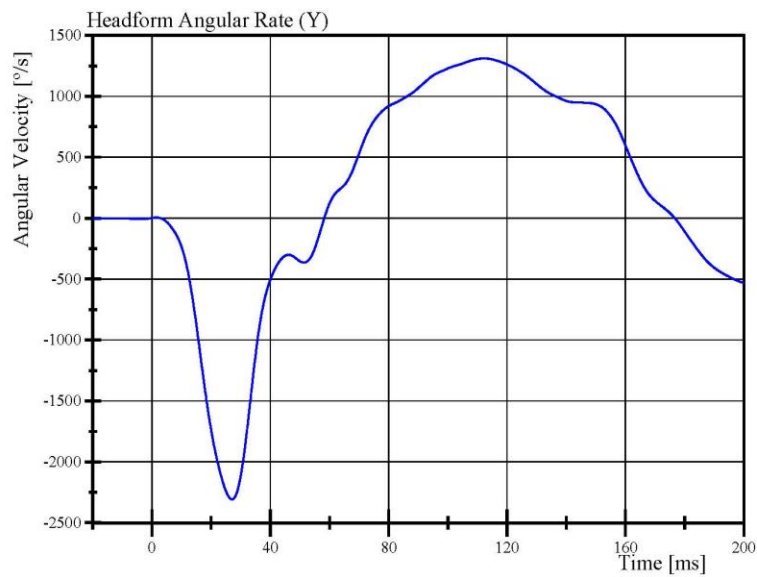
Left Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 4-5

Test Date: 11/6/2020



Filter Class: CFC_60
Max: 155.1 °/s at 198.1 ms
Min: -2.8 °/s at -12.6 ms



Filter Class: CFC_60
Max: 1,311.0 °/s at 112.2 ms
Min: -2,307.3 °/s at 27.1 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qualification Manual 11_09_2020

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Transportation Research Center Inc.

Right Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 4-2

Test Date: 11/5/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	40 %	Yes
Pendulum Velocity	3.30 - 3.50 m/s	3.322 m/s	Yes
Pendulum Integrated Velocity Change at 4 ms	(-0.87) - (-1.09) m/s	-0.984 m/s	Yes
Change at 8 ms	(-1.72) - (-2.1) m/s	-1.948 m/s	Yes
Change at 12 ms	(-2.63) - (-3.17) m/s	-2.941 m/s	Yes
Maximum Headform Flexion	50 - 61 deg	52.9 deg	Yes
Headform Flexion Decay - from Peak to Zero Degrees	58 - 72 ms	60.2 ms	Yes
Total Neck Occipital Condyles Moment	(-54) - (-67) N·m	-61.5 N·m	Yes
Total Neck Occipital Condyles Moment Decay Time to 0 N·m	71 - 87 ms	77.1 ms	Yes
Maximum Forward Pot Rotation			
Peak	32 - 39 °	34.2 °	Yes
Time of Peak	56 - 68 ms	62.3 ms	Yes
Maximum Rear Pot Rotation			
Peak	29 - 36 °	30.6 °	Yes
Time of Peak	56 - 68 ms	60.4 ms	Yes
Maximum Headform Angular Rate	2,047 - 2,503 °/s	2,257.1 °/s	Yes

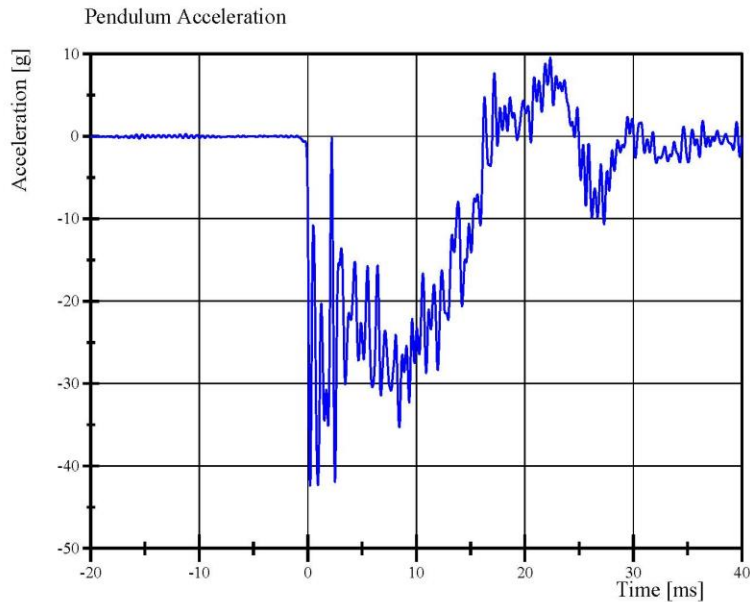
Test meets specifications.

Condition: Used

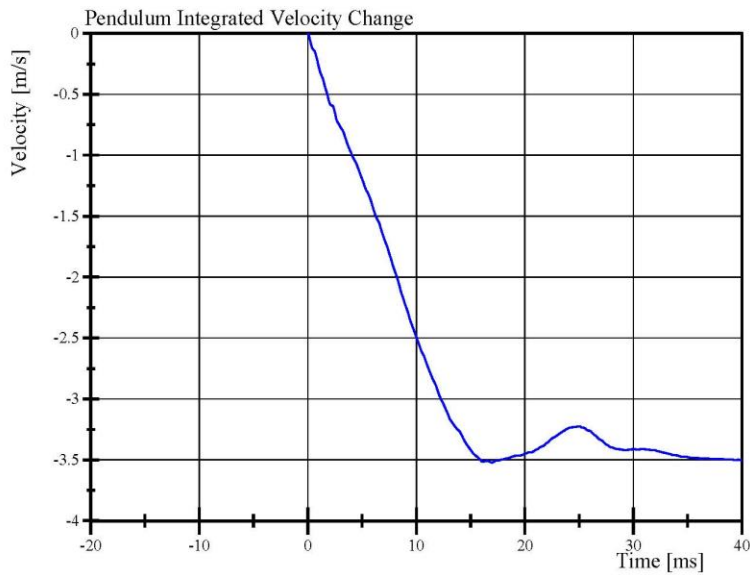
Comments:

Transportation Research Center Inc.

Right Lateral Neck
WorldSID 50th Serial No. EB8888 Certification No. 4-2
Test Date: 11/5/2020



Filter Class: CFC_1000
Max: 9.5 g at 22.4 ms
Min: -42.4 g at 0.2 ms



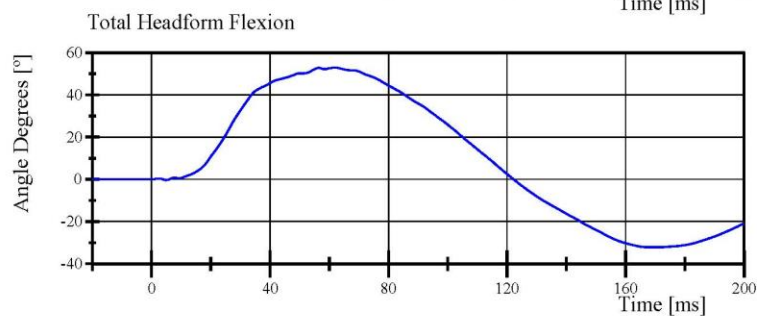
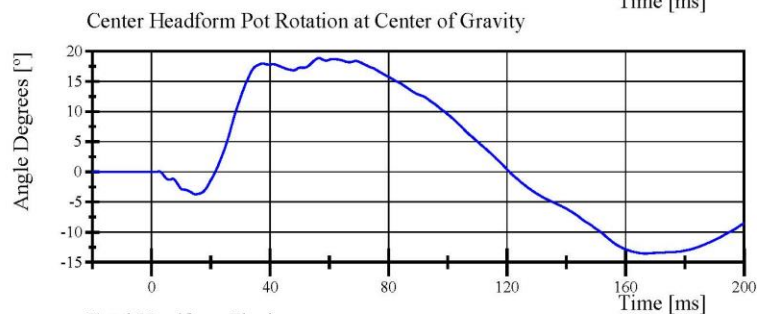
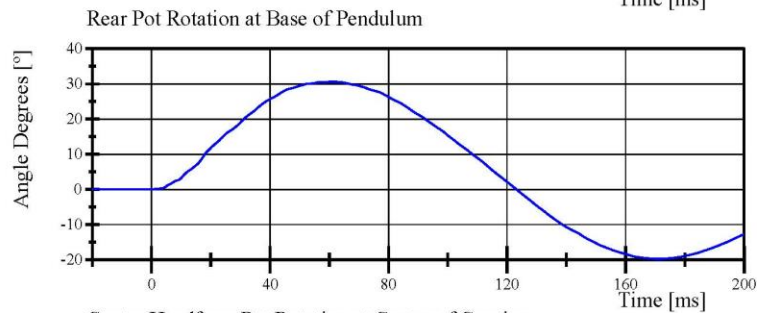
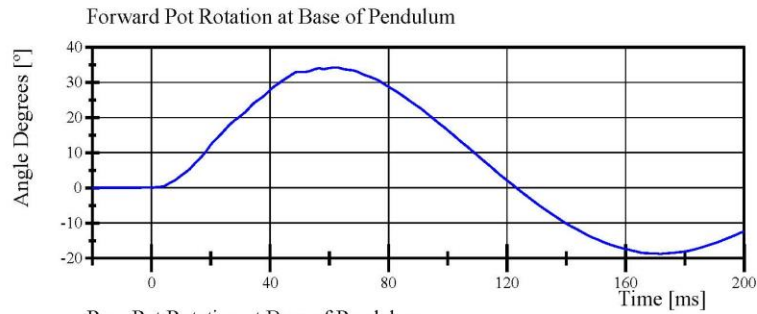
Filter Class: CFC_1000
Max: 0.0 m/s at 0.0 ms
Min: -3.5 m/s at 17.0 ms

Transportation Research Center Inc.

Right Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 4-2

Test Date: 11/5/2020



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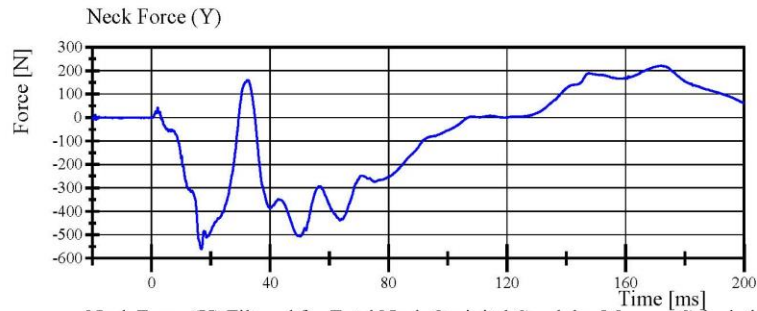


Transportation Research Center Inc.

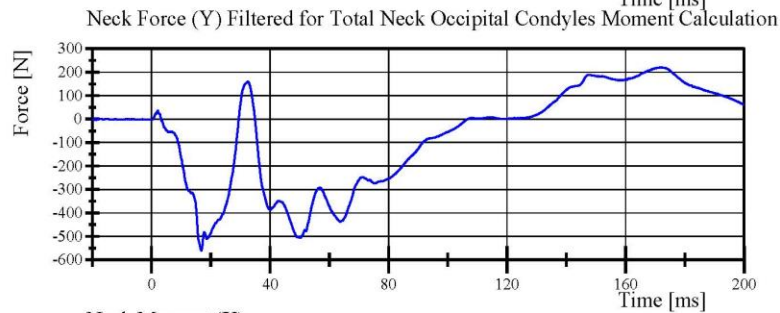
Right Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 4-2

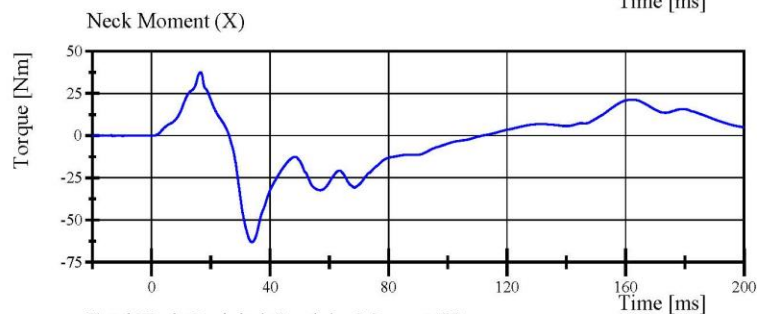
Test Date: 11/5/2020



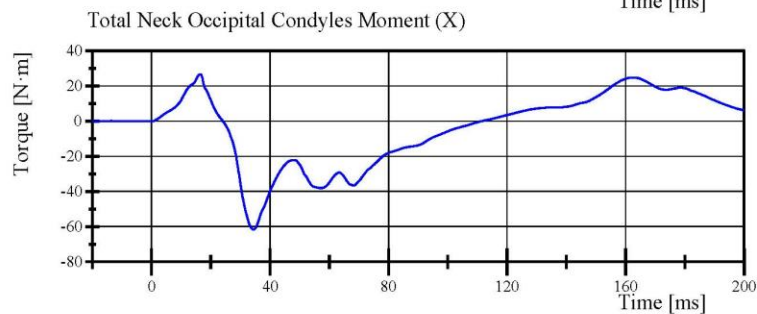
Filter Class: CFC_1000
Max: 221.4 N at 172.0 ms
Min: -560.9 N at 16.8 ms



Filter Class: CFC_600
Max: 220.9 N at 172.0 ms
Min: -560.9 N at 16.8 ms



Filter Class: CFC_600
Max: 37.5 Nm at 16.6 ms
Min: -63.0 Nm at 33.9 ms



Filter Class: Without_(Consta
Max: 26.7 N·m at 16.5 ms
Min: -61.5 N·m at 34.4 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
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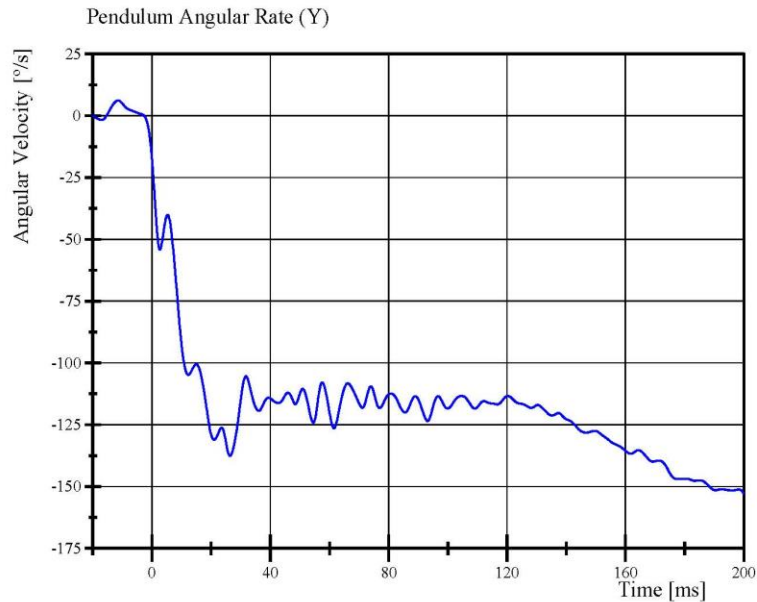


Transportation Research Center Inc.

Right Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 4-2

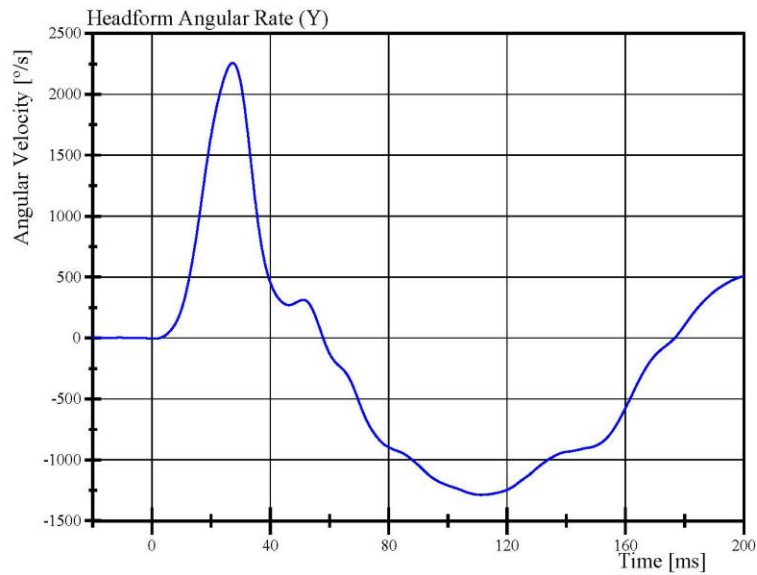
Test Date: 11/5/2020



Filter Class: CFC_60

Max: 6.2 °/s at -11.5 ms

Min: -152.9 °/s at 200.0 ms



Filter Class: CFC_60

Max: 2,257.1 °/s at 27.3 ms

Min: -1,287.4 °/s at 111.2 ms

Specification Source: WordSID 50th(W5) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

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Transportation Research Center Inc.

Left Neck Torsion
WorldSID 50th Serial No. EB8888 Certification No. 4-3
Test Date:10/30/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.3 °C	Yes
Relative Humidity	10 - 70 %	40 %	Yes
Pendulum Velocity	5.1 - 5.3 m/s	5.18 m/s	Yes
Pendulum Integrated Velocity Change at 10 ms	2.09 - 2.37 m/s	2.261 m/s	Yes
Change at 15 ms	3.19 - 3.63 m/s	3.436 m/s	Yes
Change at 20 ms	4.27 - 4.87 m/s	4.575 m/s	Yes
Peak Fixture Rotation	(-41.5) - (-51) °	-47.83 °	Yes
Decay Time to 0 deg from Peak Angle	35 - 43 ms	39.7 ms	Yes
Peak Head Angular Velocity Z-axis	(-1,345) - (-1,655) °/s	-1,548.3 °/s	Yes
Peak Lower Neck Moment Z-axis	34 - 42 N·m	38.5 N·m	Yes

Test meets specifications.

Condition: Used

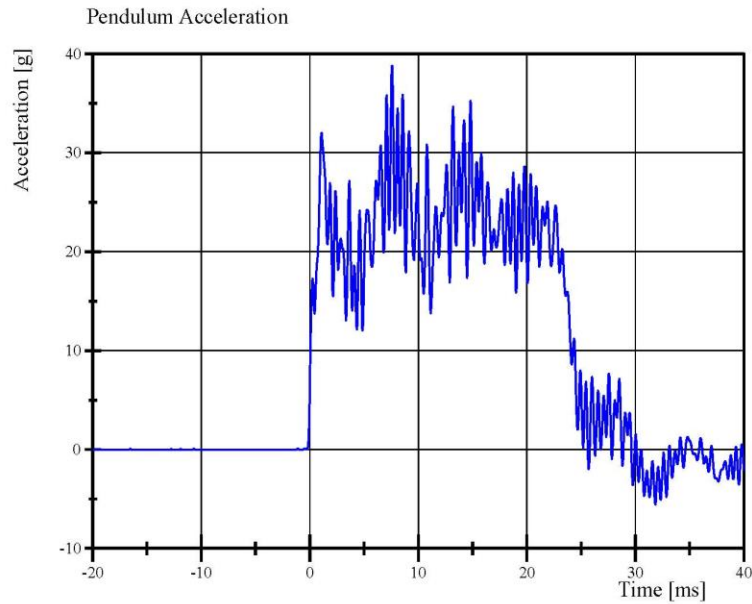
Comments:

Transportation Research Center Inc.

Left Lateral

WorldSID 50th Serial No. EB8888 Certification No. 4-3

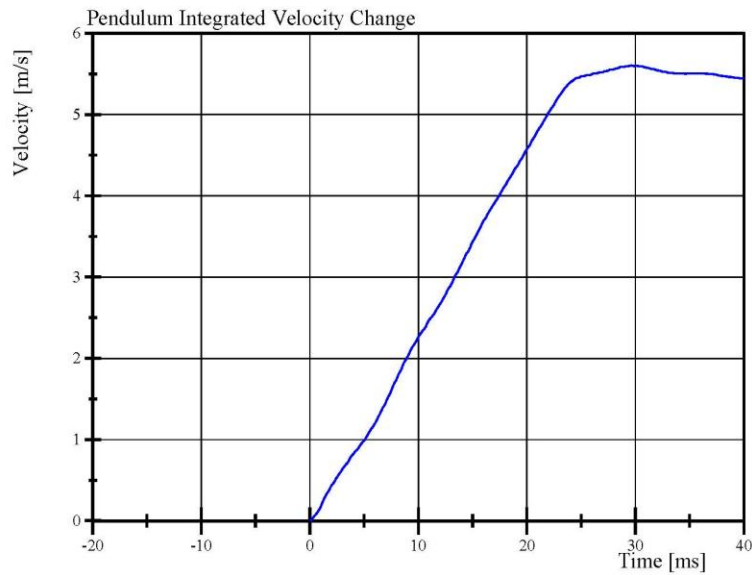
Test Date: 10/30/2020



Filter Class: CFC_1000

Max: 38.8 g at 7.6 ms

Min: -5.6 g at 31.9 ms



Filter Class: CFC_1000

Max: 5.6 m/s at 29.7 ms

Min: 0.0 m/s at 0.0 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

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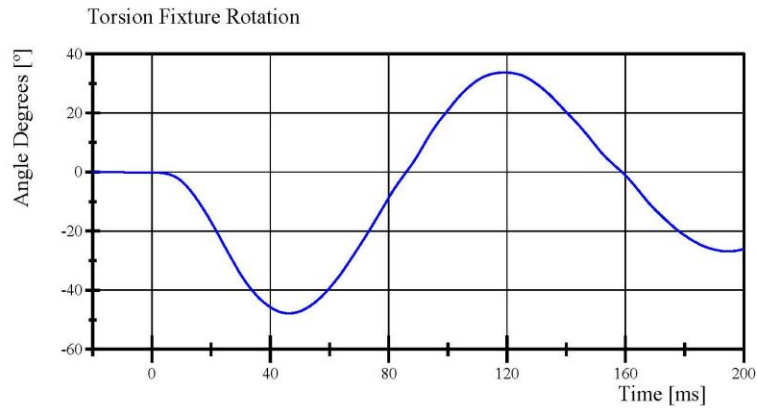


Transportation Research Center Inc.

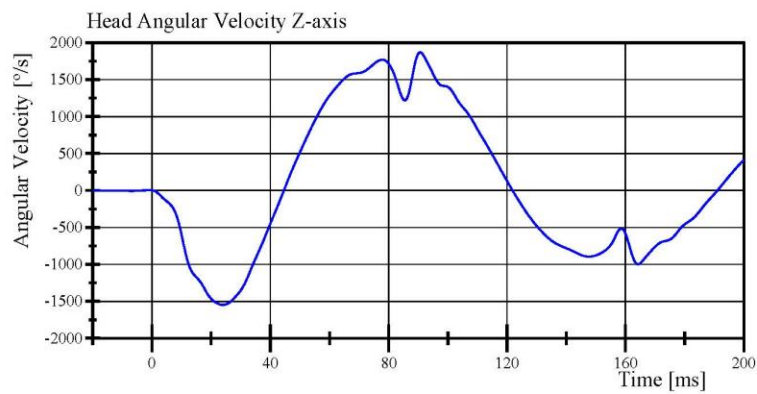
Left Lateral

WorldSID 50th Serial No. EB8888 Certification No. 4-3

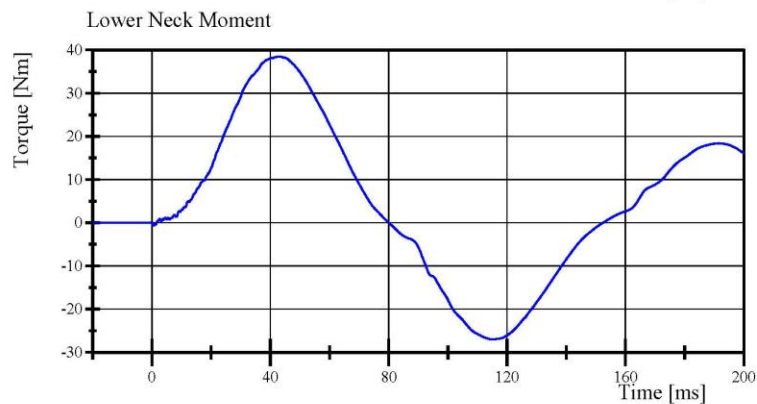
Test Date: 10/30/2020



Filter Class: CFC_60
Max: 33.7 ° at 119.1 ms
Min: -47.8 ° at 46.3 ms



Filter Class: CFC_60
Max: 1,868.8 °/s at 90.6 ms
Min: -1,548.3 °/s at 24.0 ms



Filter Class: CFC_600
Max: 38.5 Nm at 43.3 ms
Min: -26.9 Nm at 115.3 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qualification Manual 11_09_2020

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Transportation Research Center Inc.

Right Neck Torsion
WorldSID 50th Serial No. EB8888 Certification No. 4-6
Test Date: 11/4/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	41 %	Yes
Pendulum Velocity	5.1 - 5.3 m/s	5.19 m/s	Yes
Pendulum Integrated Velocity Change at 10 ms	2.09 - 2.37 m/s	2.239 m/s	Yes
Change at 15 ms	3.19 - 3.63 m/s	3.386 m/s	Yes
Change at 20 ms	4.27 - 4.87 m/s	4.544 m/s	Yes
Peak Fixture Rotation	41.5 - 51 °	46.80 °	Yes
Decay Time to 0 deg from Peak Angle	35 - 43 ms	39.2 ms	Yes
Peak Head Angular Velocity Z-axis	1,345 - 1,655 %/s	1,557.8 %/s	Yes
Peak Lower Neck Moment Z-axis	(-34) - (-42) N·m	-38.7 N·m	Yes

Test meets specifications.

Condition: Used

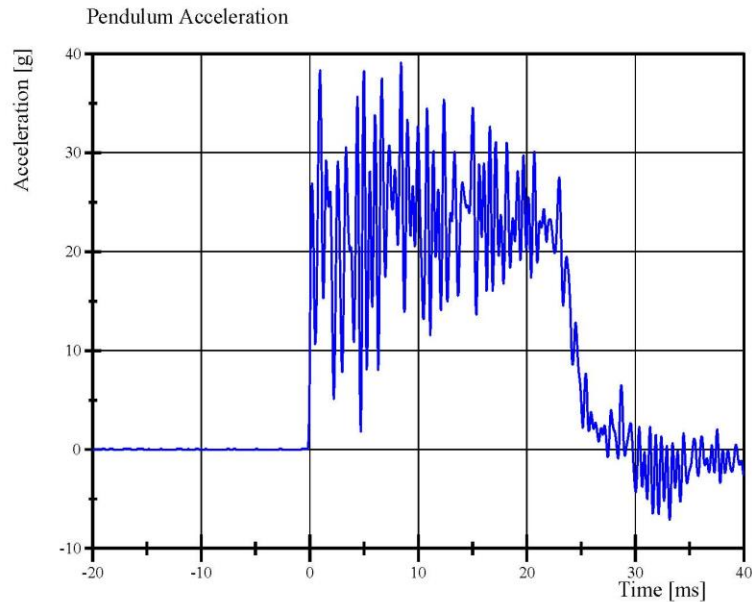
Comments:

Transportation Research Center Inc.

Right Lateral

WorldSID 50th Serial No. EB8888 Certification No. 4-6

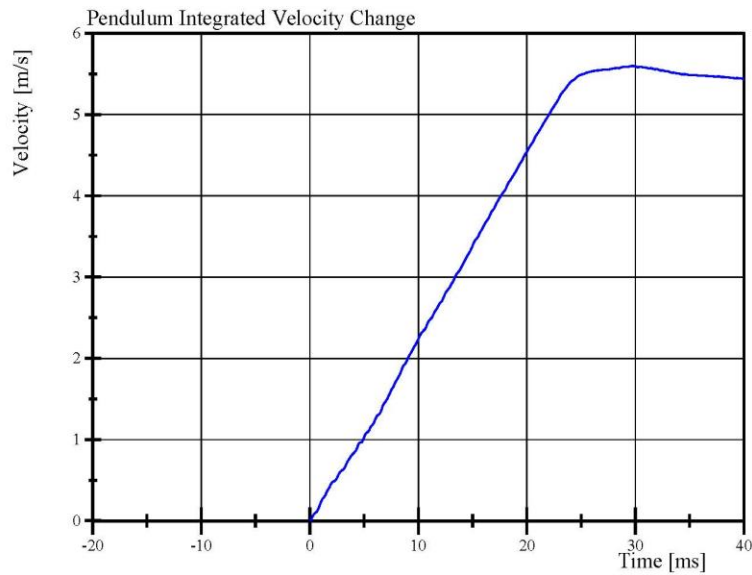
Test Date: 11/4/2020



Filter Class: CFC_1000

Max: 39.1 g at 8.4 ms

Min: -7.1 g at 33.2 ms



Filter Class: CFC_1000

Max: 5.6 m/s at 29.8 ms

Min: 0.0 m/s at 0.0 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

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11.29.2020 17:31:07 4008

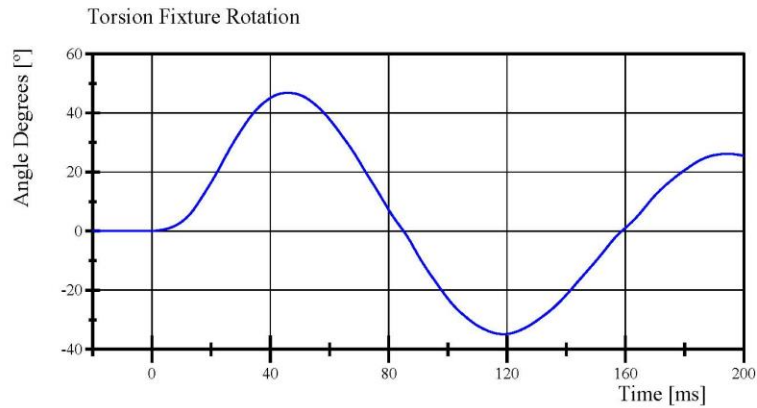


Transportation Research Center Inc.

Right Lateral

WorldSID 50th Serial No. EB8888 Certification No. 4-6

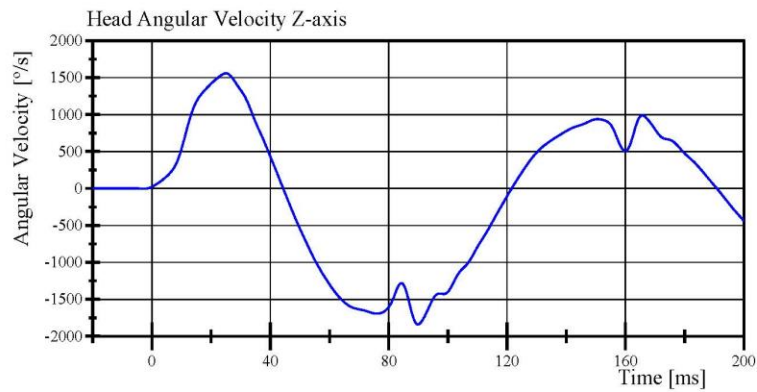
Test Date: 11/4/2020



Filter Class: CFC_60

Max: 46.8 ° at 45.9 ms

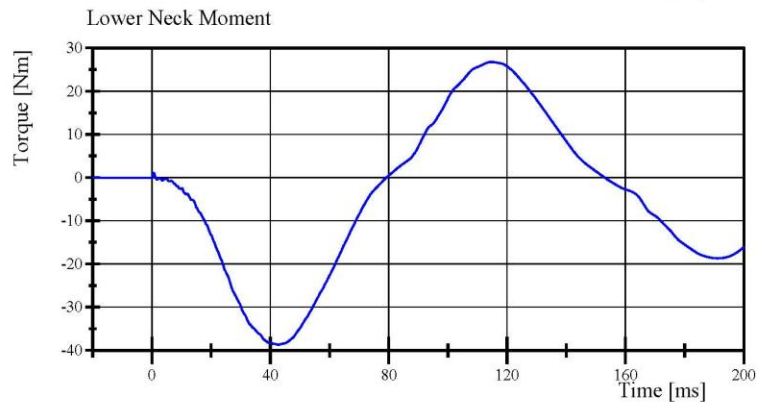
Min: -34.9 ° at 118.8 ms



Filter Class: CFC_60

Max: 1,557.8 °/s at 25.0 ms

Min: -1,840.1 °/s at 89.9 ms



Filter Class: CFC_600

Max: 26.7 Nm at 114.9 ms

Min: -38.7 Nm at 42.7 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qualification Manual 11_09_2020

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11.29.2020 17:31:07 4008



Transportation Research Center Inc.

Left Lateral Shoulder

WorldSID 50th Serial No. EB8888 Certification No. 4-2

Test Date: 10/27/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	36 %	Yes
Impactor Velocity	4.2 - 4.4 m/s	4.31 m/s	Yes
Impactor Force	2,600 - 3,300 N	3,090.7 N	Yes
Shoulder Force	(-1,470) - (-1,800) N	-1,553.9 N	Yes
S1 RibEye Max	37 - 46 mm	43.6 mm	Yes

Test meet specifications.

Condition: Used

Comments:

Internal Temp: 22.1°C

Specification Source: WordSID 50th(W5) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

Report Number: EB8888_WSH04

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11.29.2020 17:39:41 1000



Transportation Research Center Inc.

Left Lateral Shoulder

WorldSID 50th Serial No. EB8888 Certification No. 5-5

Test Date: 11/6/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.8 °C	Yes
Relative Humidity	10 - 70 %	41 %	Yes
Impactor Velocity	4.2 - 4.4 m/s	4.32 m/s	Yes
Impactor Force	2,600 - 3,300 N	2,815.7 N	Yes
Shoulder Force	(-1,470) - (-1,800) N	-1,652.8 N	Yes
S1 RibEye Max	37 - 46 mm	39.3 mm	Yes

Test meets specifications.

Condition: Used

Comments:

Internal Temp: 21.1°C

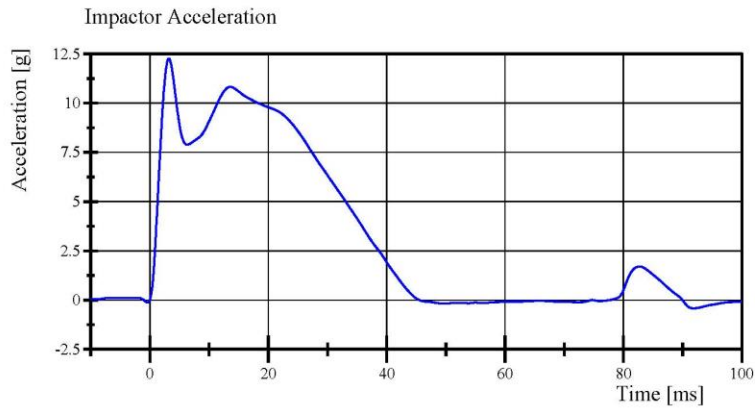
Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

11.30.2020 20:03:11 997

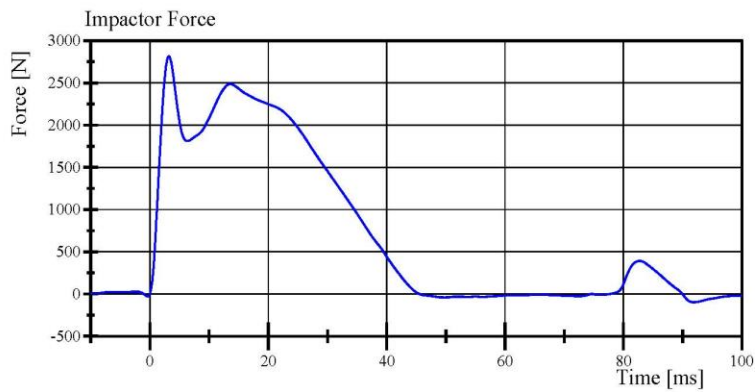


Transportation Research Center Inc.

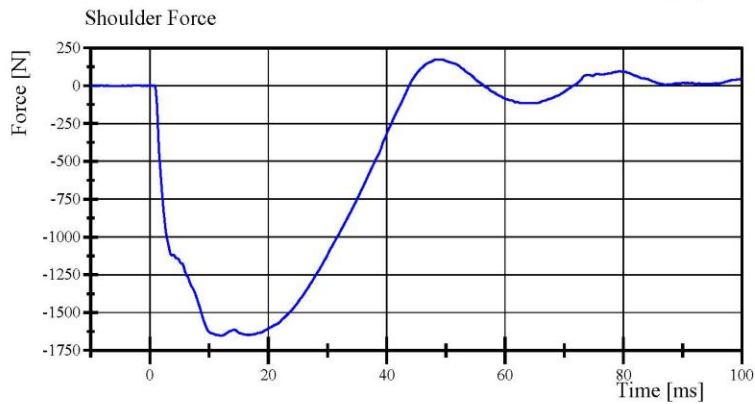
Left Lateral Shoulder
WorldSID 50th Serial No. EB8888 Certification No. 5-5
Test Date: 11/6/2020



Filter Class: CFC_180
Max: 12.3 g at 3.2 ms
Min: -0.4 g at 91.9 ms



Filter Class: CFC_180
Max: 2,815.7 N at 3.2 ms
Min: -96.8 N at 91.9 ms



Filter Class: CFC_600
Max: 174.7 N at 49.1 ms
Min: -1,652.8 N at 12.1 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

11.30.2020 20:03:34 997



Transportation Research Center Inc.

Left Lateral Thorax with Arm

WorldSID 50th Serial No. EB8888 Certification No. 5-5

Test Date: 11/10/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	40 %	Yes
Impactor Velocity	6.6 - 6.8 m/s	6.74 m/s	Yes
Impactor Force	5,300 - 6,200 N	5,803.2 N	Yes
Upper Thorax Rib Displacement	35 - 47 mm	35.1 mm	Yes
Center Thorax Rib Displacement	46 - 56 mm	49.6 mm	Yes
Lower Thorax Rib Displacement	33.5 - 40.5 mm	35.41 mm	Yes
Upper Spine Lateral Acceleration	28 - 37 g	32.9 g	Yes
Lower Spine Lateral Acceleration	22 - 28 g	24.8 g	Yes

Test meets specifications.

Condition: Used

Comments:

Internal Temp: 22.9°C

Specification Source: WordSID 50th(W5) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

12.01.2020 16:04:14 1000

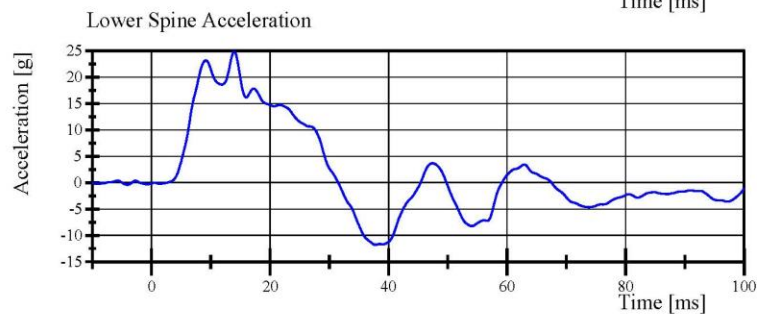
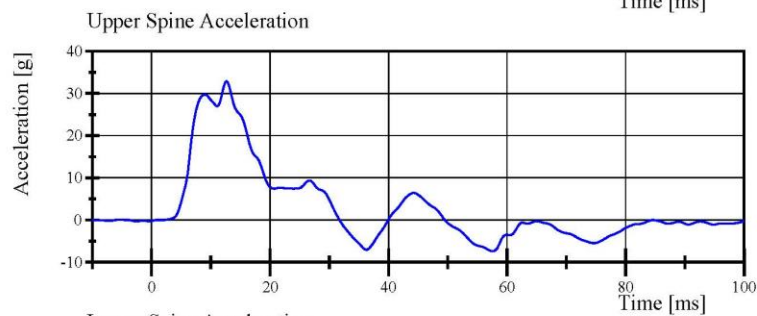
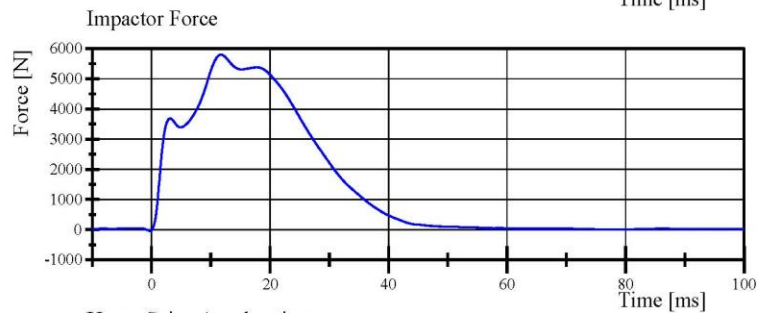
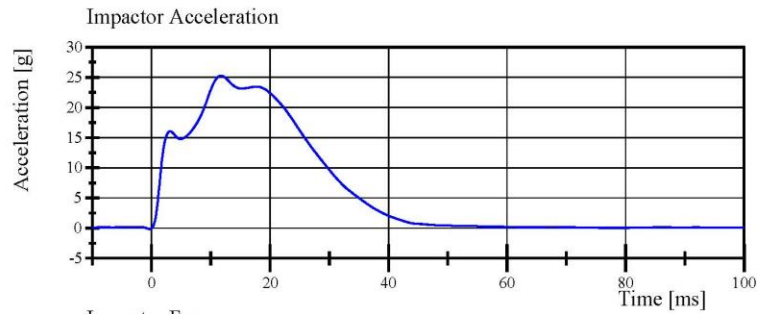


Transportation Research Center Inc.

Left Lateral Thorax with Arm

WorldSID 50th Serial No. EB8888 Certification No. 5-5

Test Date: 11/10/2020



Specification Source: WorldSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qualification Manual 11_09_2020

12.01.2020 16:04:56 1000

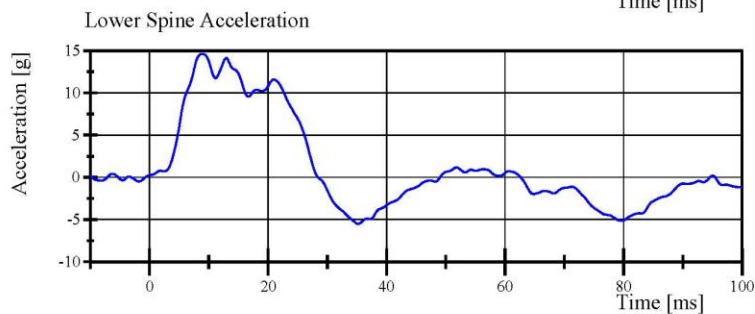
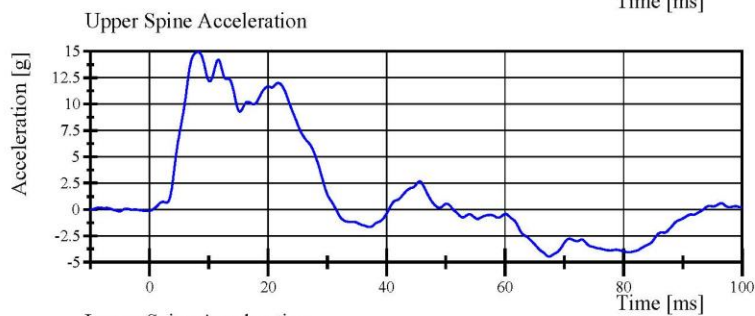
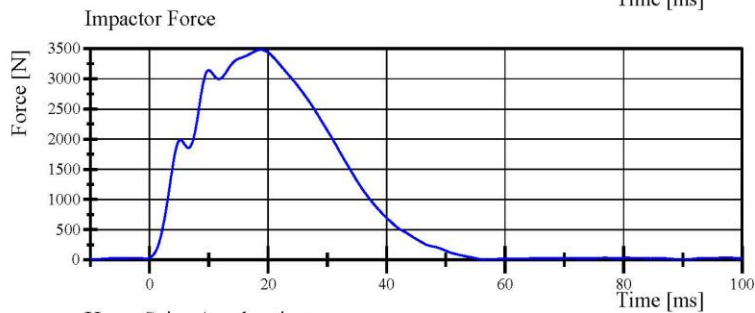
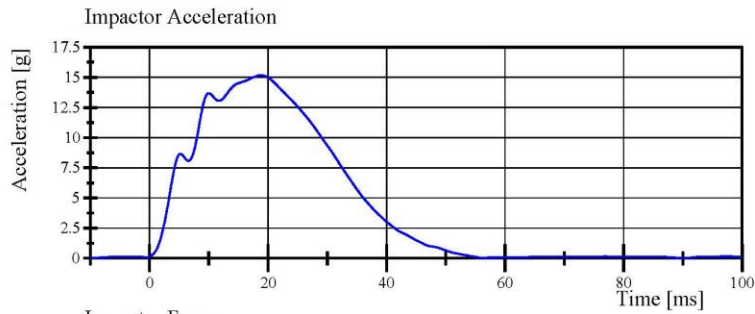


Transportation Research Center Inc.

Left Lateral Thorax without Arm

WorldSID 50th Serial No. EB8888 Certification No. 4-2

Test Date: 10/26/2020



Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qualification Manual 11_09_2020

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11.29.2020 18:03:27 1000



Transportation Research Center Inc.

Left Lateral Abdomen

WorldSID 50th Serial No. EB8888 Certification No. 4-1

Test Date: 10/27/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	37 %	Yes
Impactor Velocity	4.2 - 4.4 m/s	4.33 m/s	Yes
Impactor Force	2,700 - 3,100 N	2,996.5 N	Yes
Upper Abdominal Rib Displacement	32.5 - 39.5 mm	33.82 mm	Yes
Lower Abdominal Rib Displacement	32 - 38 mm	33.1 mm	Yes
Lower Spine Lateral Acceleration	14.5 - 19.5 g	17.99 g	Yes

Test meets specifications.

Condition: Used

Comments:

Internal Temp: 21°C

Specification Source: WordSID 50th(W5) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

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11.29.2020 14:51:31 1001

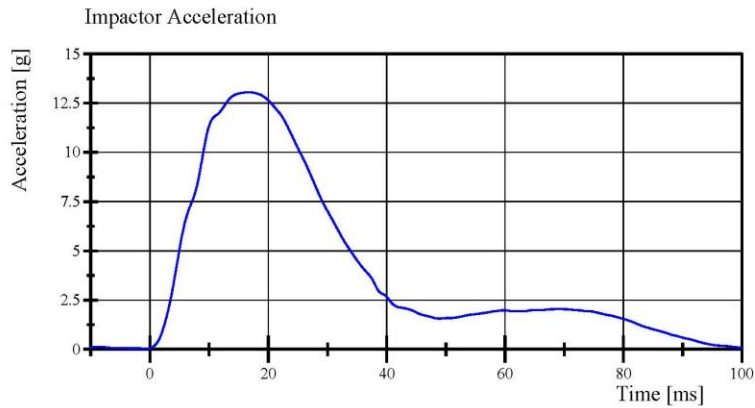


Transportation Research Center Inc.

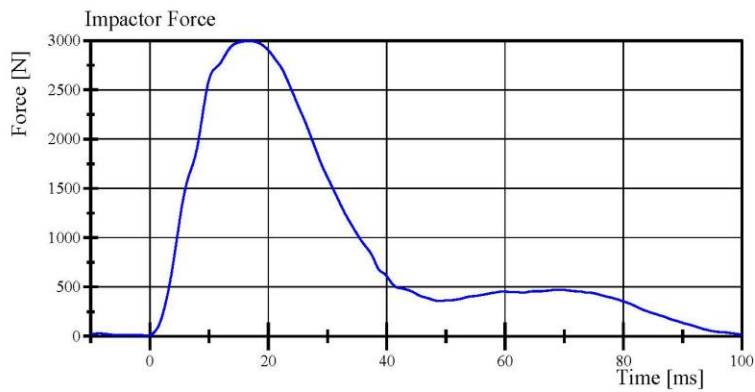
Left Lateral Abdomen

WorldSID 50th Serial No. EB8888 Certification No. 4-1

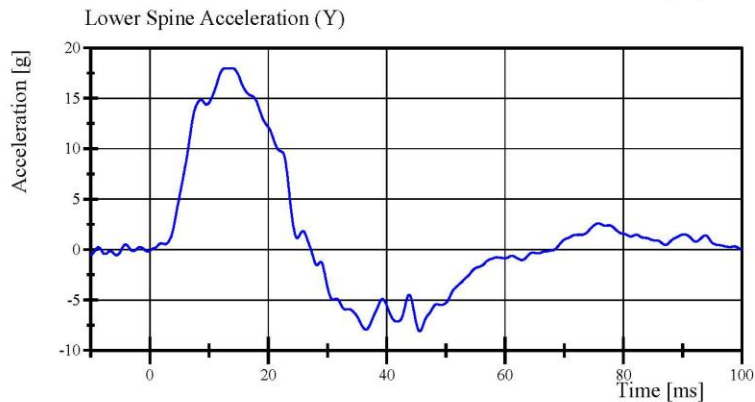
Test Date: 10/27/2020



Filter Class: CFC_180
Max: 13.1 g at 16.7 ms
Min: 0.0 g at -0.5 ms



Filter Class: CFC_180
Max: 2,996.5 N at 16.7 ms
Min: 7.8 N at -0.5 ms



Filter Class: CFC_180
Max: 18.0 g at 14.0 ms
Min: -8.1 g at 45.6 ms

Specification Source: WorldSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qualification Manual 11_09_2020

Report Number: EB8888_WSH04

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11.29.2020 14:52:20 1001



Transportation Research Center Inc.

Left Lateral Pelvis

WorldSID 50th Serial No. EB8888 Certification No. 4-1

Test Date: 10/27/2020

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.5 °C	Yes
Relative Humidity	10 - 70 %	35 %	Yes
Impactor Velocity	6.6 - 6.8 m/s	6.71 m/s	Yes
Impactor Force	6,800 - 8,200 N	7,329.8 N	Yes
Pelvis Lateral Acceleration	38.5 - 48.5 g	40.75 g	Yes
Lower Spine Lateral Acceleration	10 - 14 g	12.0 g	Yes
Pubic Lateral Force	(-1,300) - (-1,590) N	-1,361.4 N	Yes
Sacroiliac Lateral Force	(-1,860) - (-2,280) N	-2,051.1 N	Yes

Test meets specifications.

Condition: Used

Comments:

Intenal Temp: 24.5°C

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
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11.29.2020 17:35:04 999

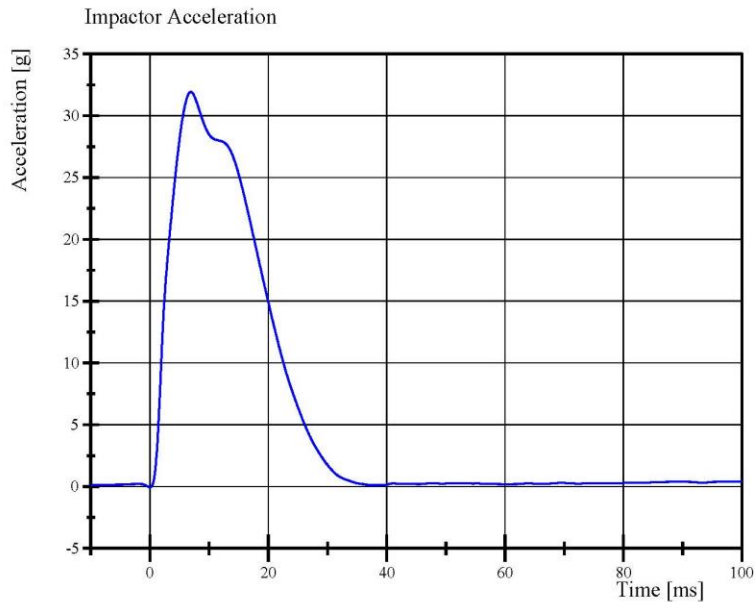


Transportation Research Center Inc.

Left Lateral Pelvis

WorldSID 50th Serial No. EB8888 Certification No. 4-1

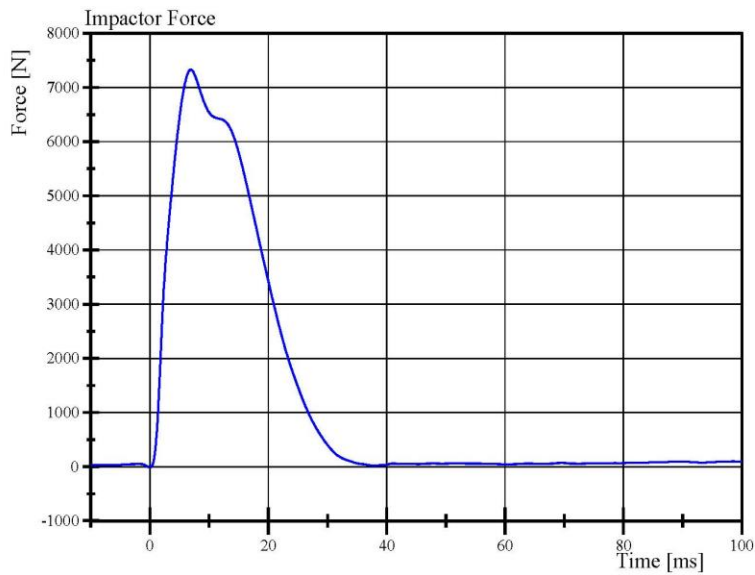
Test Date: 10/27/2020



Filter Class: CFC_180

Max: 31.9 g at 6.9 ms

Min: -0.1 g at 0.0 ms



Filter Class: CFC_180

Max: 7,329.8 N at 6.9 ms

Min: -13.1 N at 0.0 ms

Specification Source: WordSID 50th(W5) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

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11.29.2020 17:35:41 999

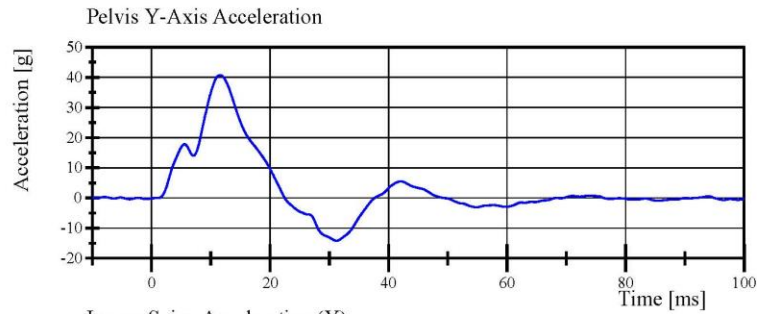


Transportation Research Center Inc.

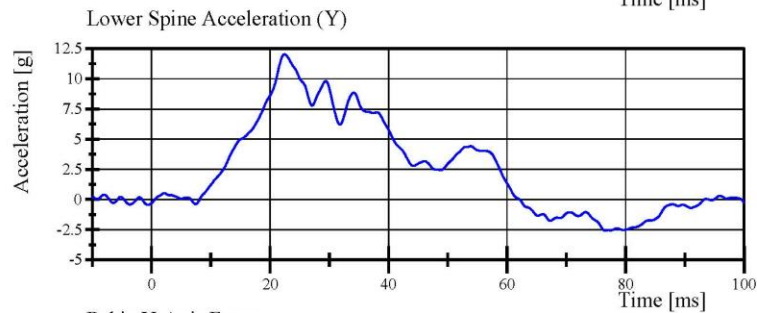
Left Lateral Pelvis

WorldSID 50th Serial No. EB8888 Certification No. 4-1

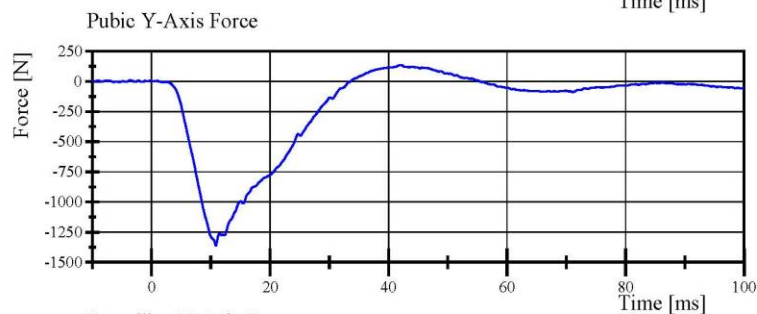
Test Date: 10/27/2020



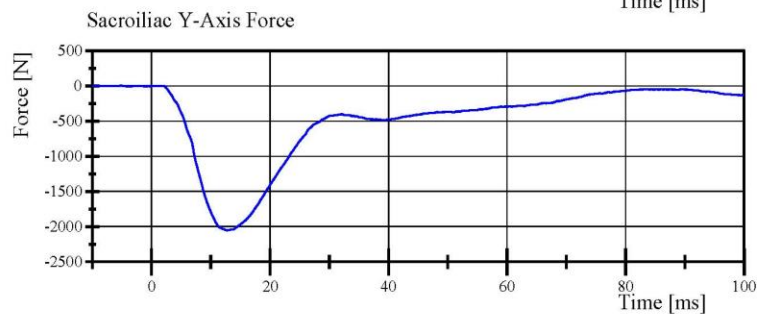
Filter Class: CFC_180
Max: 40.8 g at 11.6 ms
Min: -14.2 g at 31.3 ms



Filter Class: CFC_180
Max: 12.0 g at 22.5 ms
Min: -2.6 g at 76.6 ms



Filter Class: CFC_600
Max: 136.2 N at 42.1 ms
Min: -1,361.4 N at 10.9 ms



Filter Class: CFC_600
Max: 3.9 N at -5.2 ms
Min: -2,051.1 N at 12.8 ms

Specification Source: WordSID 50th(W5) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

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Post-Test Calibration Sheets
Driver S/N EB8888

Transportation Research Center Inc.
WorldSID-50M
External Measurements
Serial No. EB8888 Certification No. 05

WorldSID-50M Angular Reference Measurements					
Parameter	Symbol	Tilt Sensor (°)	Inclinometer (°)		
			Center	Left	Right
Head X-Axis	A1	0	n/a	n/a	n/a
Head Y-Axis	A2	2.2	n/a	2	Note 1
Neck Bracket X-Axis	A3	n/a	-0.5	n/a	n/a
Neck Bracket Y-Axis	A4	n/a	-3.1	n/a	n/a
Thorax X-Axis	A5	1.3	n/a	n/a	n/a
Thorax Y-Axis	A6	3.9	n/a	n/a	n/a
Pelvis X-Axis	A7	0.7	n/a	n/a	n/a
Pelvis Y-Axis	A8	10.2	n/a	n/a	n/a
H-point Tool	A9	n/a	n/a	33.1	33.9

WorldSID-50M External Linear Dimensions				
Parameter	Symbol	Specification (mm)		
		Center	Left	Right
Seated Height	L1	870	n/a	n/a
Hip Pivot Height	L2	n/a	89	89
Hip Pivot to Back Line	L3	n/a	187	177
Thigh Clearance	L4	n/a	181	180
Knee Height	L5	n/a	580	583
Knee to Backline	L6	n/a	667	670
Head Back to Seat Back	L7	156	n/a	n/a
Thorax Rib 1 Front to Back	L8	n/a	209	209
Abdomen Rib 2 Front to Back	L9	n/a	223	226
Arm Length	L10	n/a	330	330
Width Across Arms	L11	482	n/a	n/a
Waist Width	L12	341	n/a	n/a

Note 1: No land marks on the right side of head. Unable to align level.

Transportation Research Center Inc.

Front Head Drop

WorldSID 50th Serial No. EB8888 Certification No. 6-2

Test Date: 1/18/2021

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Peak Head Resultant Acceleration	211 - 261 g	219.4 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	3.9 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	< 10 %	1.58 %	Yes

Test meets specifications.

Condition: Used

Comments:

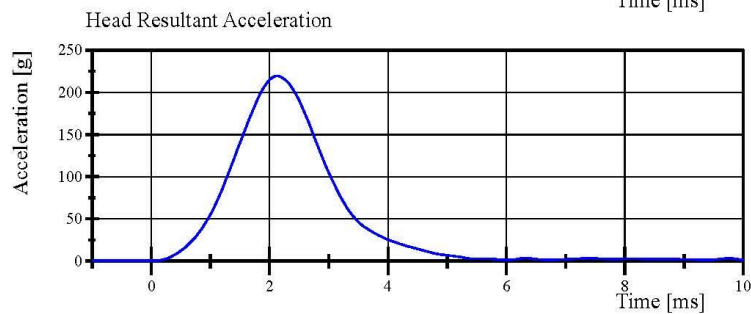
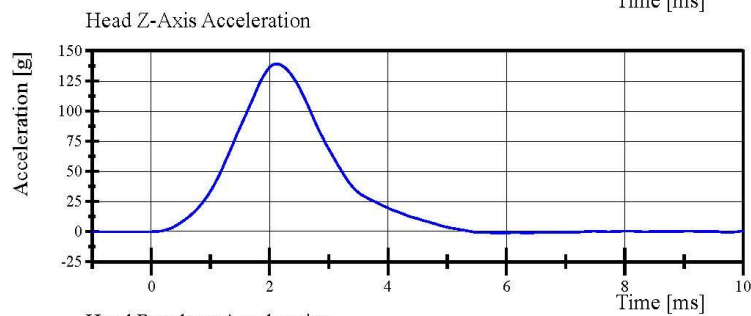
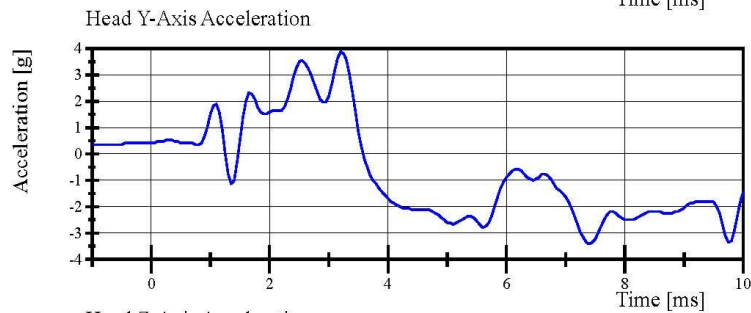
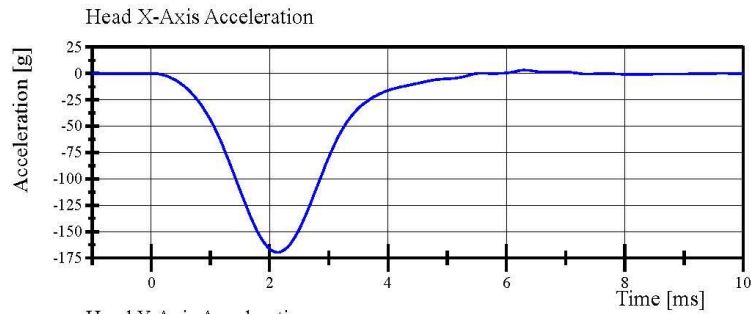
Head Skin S/N: EG2845

Transportation Research Center Inc.

Front Head Drop

WorldSID 50th Serial No. EB8888 Certification No. 6-2

Test Date: 1/18/2021



Transportation Research Center Inc.

Left Lateral Head Drop

WorldSID 50th Serial No. EB8888 Certification No. 6-1

Test Date: 1/18/2021

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	40 %	Yes
Peak Head Resultant Acceleration	107 - 126 g	110.9 g	Yes
Peak Head Longitudinal Acceleration	(-15) - 15 g	-1.1 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	< 10 %	2.87 %	Yes

Test meets specifications.

Condition: Used

Comments:

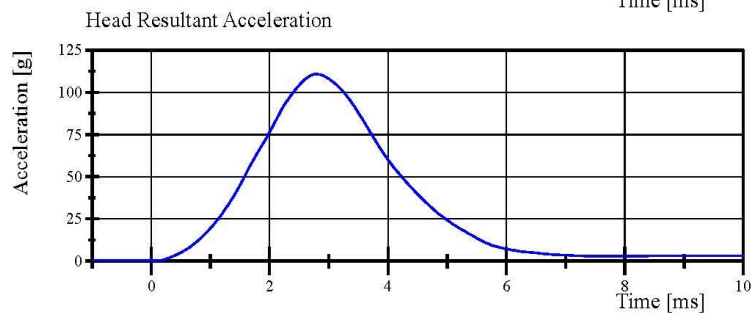
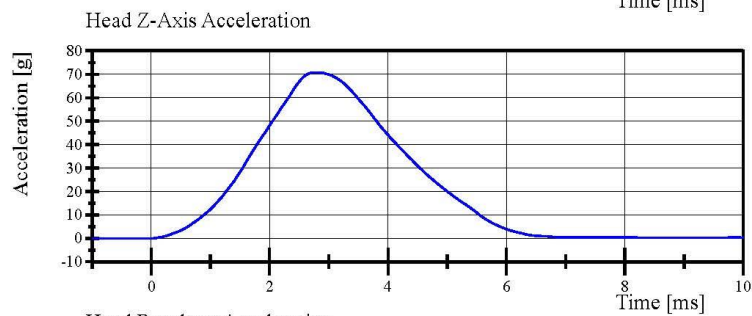
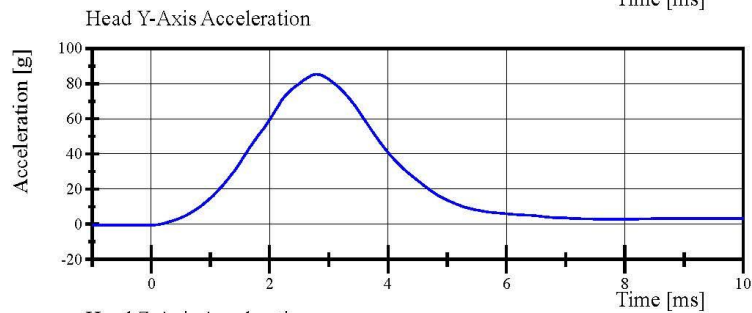
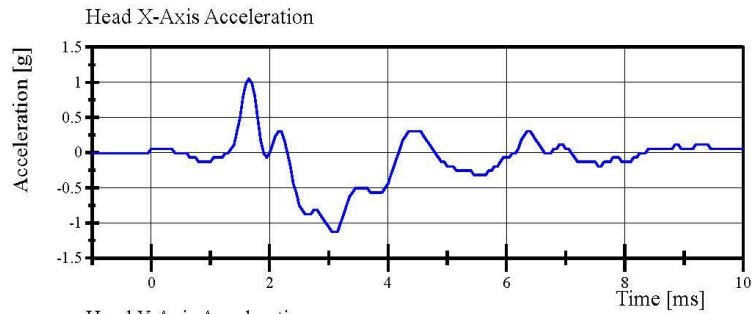
Head Skin S/N: EG2845

Transportation Research Center Inc.

Left Lateral Head Drop

WorldSID 50th Serial No. EB8888 Certification No. 6-1

Test Date: 1/18/2021



Transportation Research Center Inc.

Right Lateral Head Drop

WorldSID 50th Serial No. EB8888 Certification No. 6-1

Test Date: 1/18/2021

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.3 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Peak Head Resultant Acceleration	107 - 126 g	113.8 g	Yes
Peak Head Longitudinal Acceleration	(-15) - 15 g	-5.8 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	< 10 %	2.64 %	Yes

Test meets specifications.

Condition: Used

Comments:

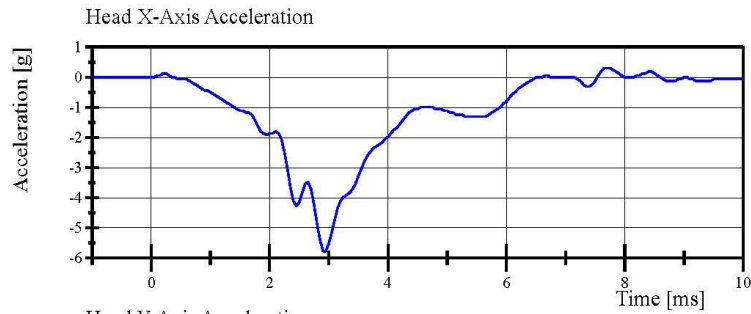
Head Skin S/N: EG2845

Transportation Research Center Inc.

Right Lateral Head Drop

WorldSID 50th Serial No. EB8888 Certification No. 6-1

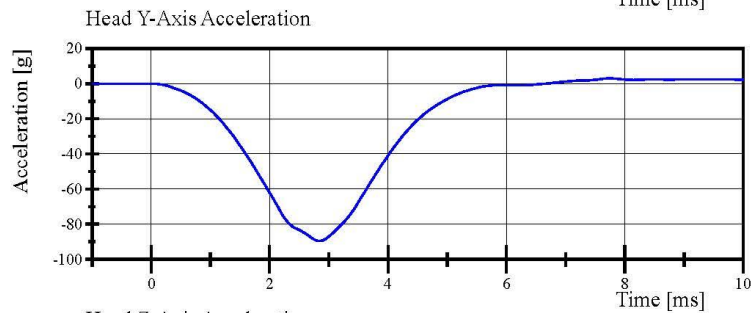
Test Date: 1/18/2021



Filter Class: CFC_1000

Max: 0.3 g at 7.7 ms

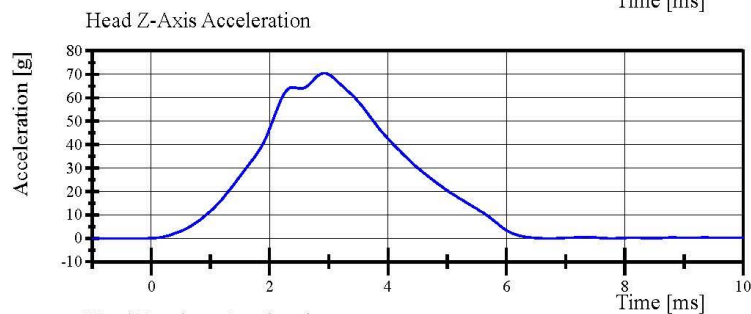
Min: -5.8 g at 2.9 ms



Filter Class: CFC_1000

Max: 3.0 g at 7.8 ms

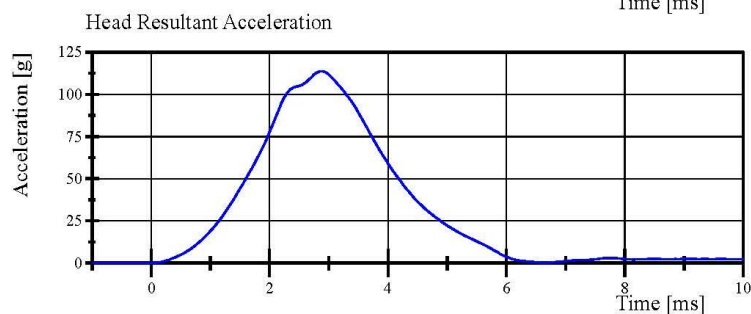
Min: -89.5 g at 2.9 ms



Filter Class: CFC_1000

Max: 70.5 g at 2.9 ms

Min: -0.1 g at 7.8 ms



Filter Class: CFC_1000

Max: 113.8 g at 2.9 ms

Min: 0.0 g at -0.3 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

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01.18.2021 08:26:47 946



Transportation Research Center Inc.

Left Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 6-1

Test Date: 1/15/2021

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.3 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Pendulum Velocity	(-3.30) - (-3.50) m/s	-3.334 m/s	Yes
Pendulum Integrated Velocity Change at 4 ms	0.87 - 1.09 m/s	0.976 m/s	Yes
Change at 8 ms	1.72 - 2.1 m/s	1.899 m/s	Yes
Change at 12 ms	2.63 - 3.17 m/s	2.884 m/s	Yes
Maximum Headform Flexion	(-50) - (-61) deg	-54.7 deg	Yes
Headform Flexion Decay - from Peak to Zero Degrees	58 - 72 ms	61.0 ms	Yes
Total Neck Occipital Condyles Moment	54 - 67 N·m	62.4 N·m	Yes
Total Neck Occipital Condyles Moment Decay Time to 0 N·m	71 - 87 ms	75.9 ms	Yes
Maximum Forward Pot Rotation			
Peak	(-32) - (-39) °	-35.2 °	Yes
Time of Peak	56 - 68 ms	60.9 ms	Yes
Maximum Rear Pot Rotation			
Peak	(-29) - (-36) °	-31.5 °	Yes
Time of Peak	56 - 68 ms	62.2 ms	Yes
Maximum Headform Angular Rate	(-2,047) - (-2,503) °/s	-2,287.4 °/s	Yes

Test meets specifications.

Condition: Used

Comments:

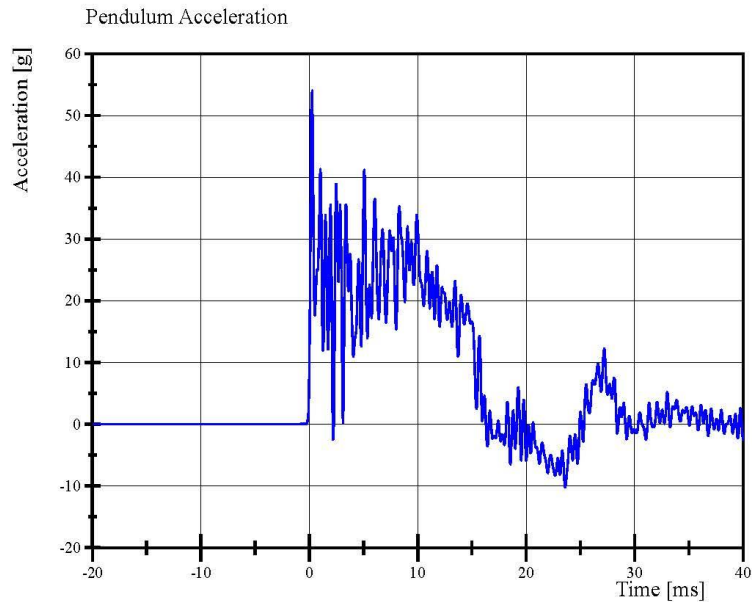
Neck S/N: EE8804

Transportation Research Center Inc.

Left Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 6-1

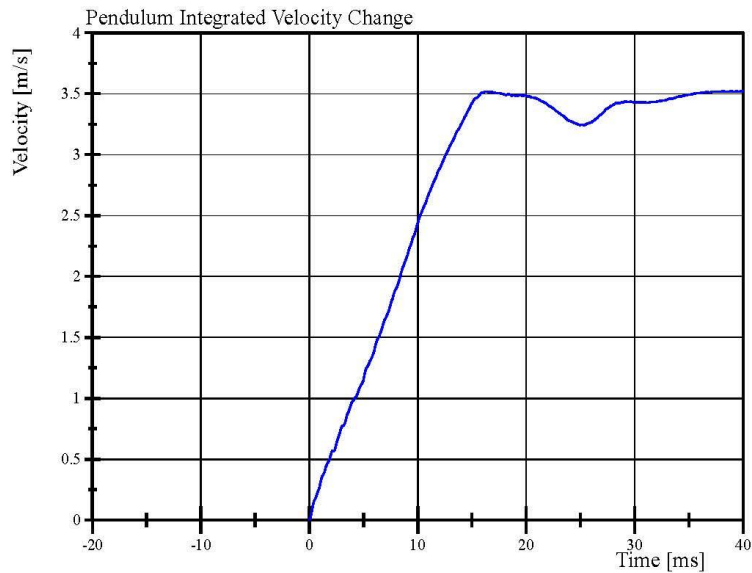
Test Date: 1/15/2021



Filter Class: CFC_1000

Max: 54.0 g at 0.3 ms

Min: -10.2 g at 23.6 ms



Filter Class: CFC_1000

Max: 3.5 m/s at 39.9 ms

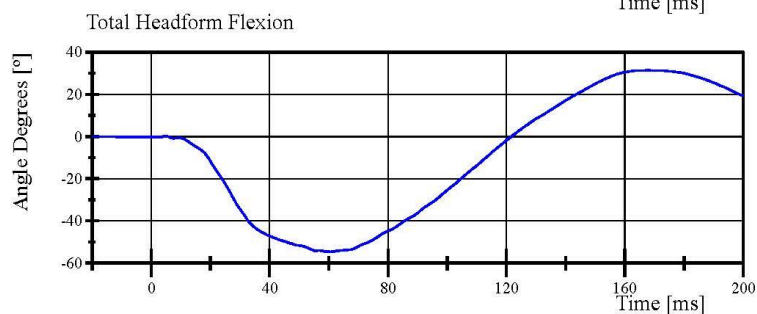
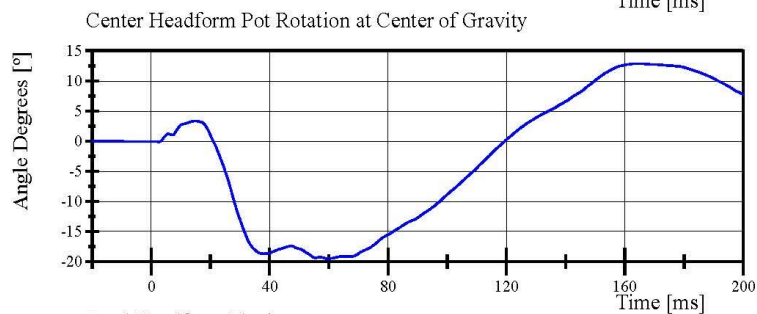
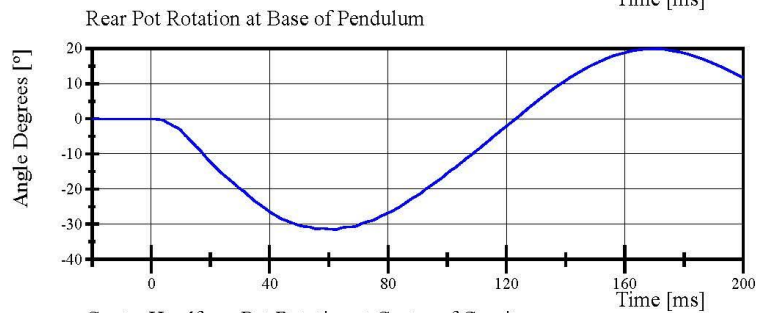
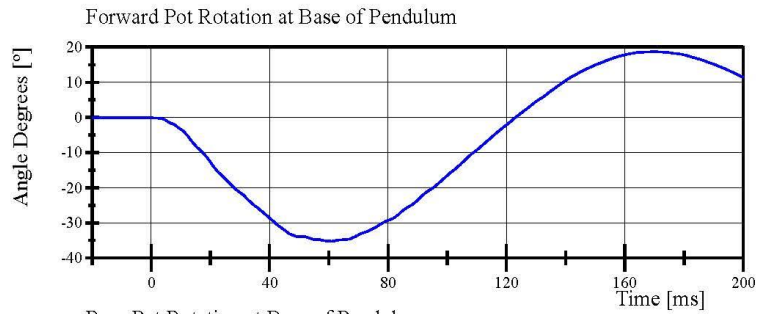
Min: 0.0 m/s at -0.0 ms

Transportation Research Center Inc.

Left Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 6-1

Test Date: 1/15/2021

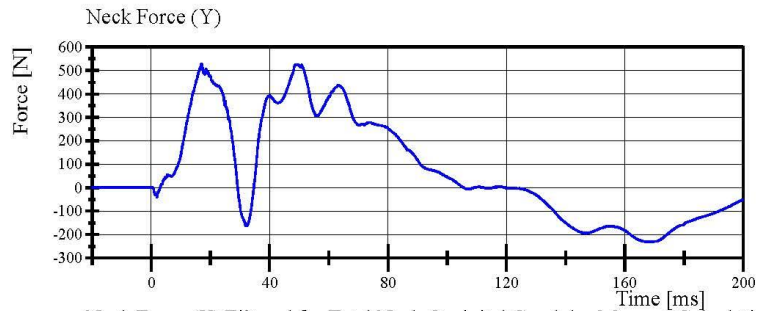


Transportation Research Center Inc.

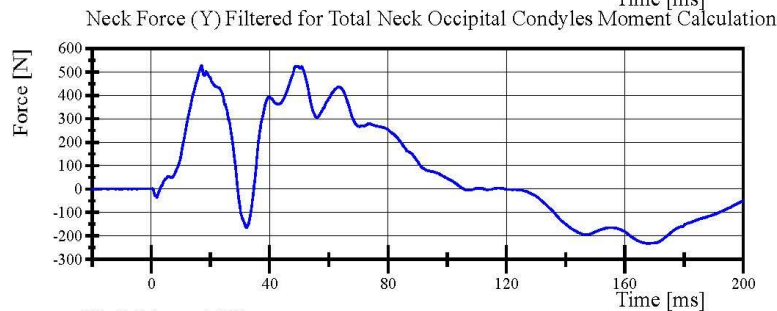
Left Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 6-1

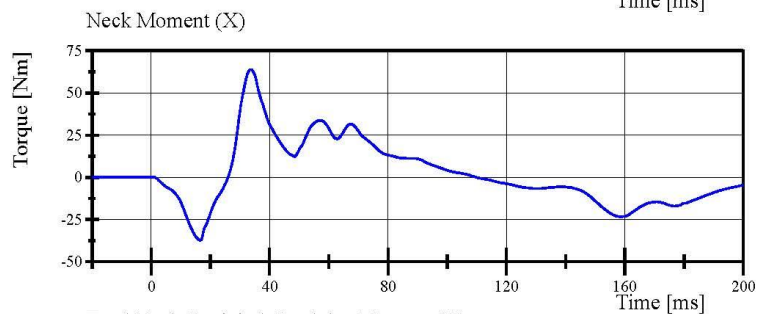
Test Date: 1/15/2021



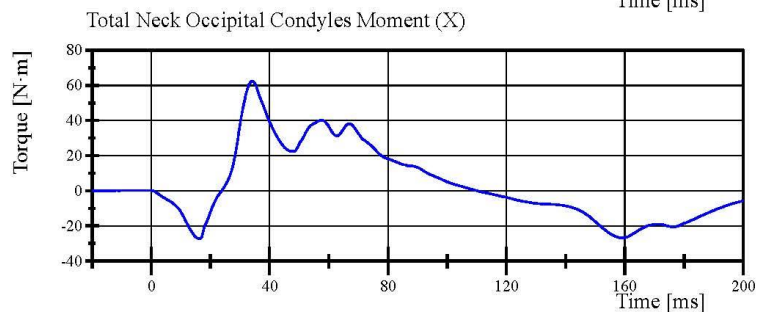
Filter Class: CFC_1000
Max: 528.2 N at 17.0 ms
Min: -232.0 N at 167.8 ms



Filter Class: CFC_600
Max: 526.9 N at 17.0 ms
Min: -231.8 N at 167.8 ms



Filter Class: CFC_600
Max: 64.0 Nm at 33.6 ms
Min: -37.2 Nm at 16.6 ms



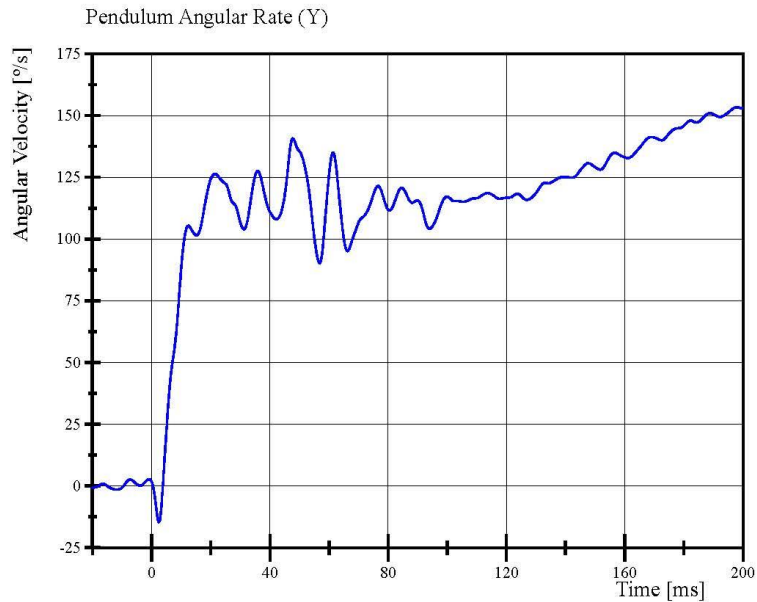
Filter Class: Without_(Constar
Max: 62.4 N·m at 34.1 ms
Min: -27.3 N·m at 16.2 ms

Transportation Research Center Inc.

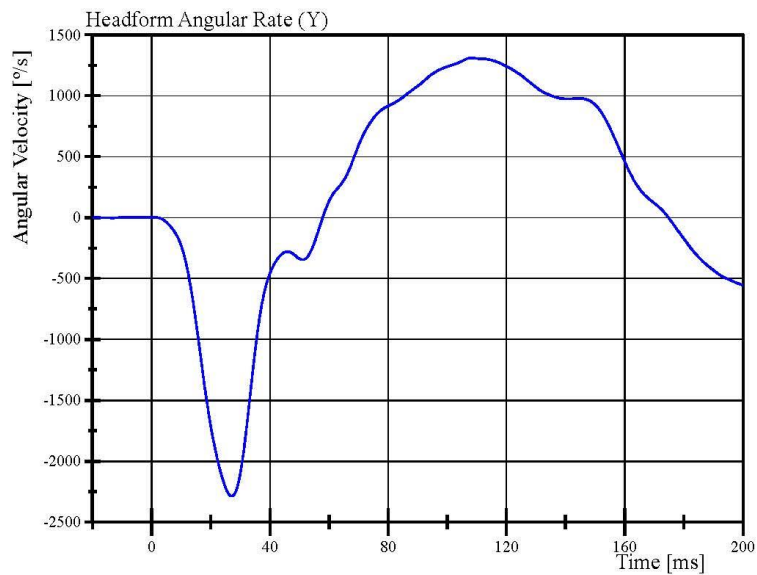
Left Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 6-1

Test Date: 1/15/2021



Filter Class: CFC_60
Max: 153.4 °/s at 197.9 ms
Min: -14.6 °/s at 2.5 ms



Filter Class: CFC_60
Max: 1,309.1 °/s at 108.0 ms
Min: -2,287.4 °/s at 27.1 ms

Transportation Research Center Inc.

Right Lateral Neck
WorldSID 50th Serial No. EB8888 Certification No. 6-1
Test Date: 1/18/2021

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	41 %	Yes
Pendulum Velocity	3.30 - 3.50 m/s	3.333 m/s	Yes
Pendulum Integrated Velocity Change at 4 ms	(-0.87) - (-1.09) m/s	-1.021 m/s	Yes
Change at 8 ms	(-1.72) - (-2.1) m/s	-1.981 m/s	Yes
Change at 12 ms	(-2.63) - (-3.17) m/s	-3.016 m/s	Yes
Maximum Headform Flexion	50 - 61 deg	53.8 deg	Yes
Headform Flexion Decay - from Peak to Zero Degrees	58 - 72 ms	60.1 ms	Yes
Total Neck Occipital Condyles Moment	(-54) - (-67) N·m	-63.6 N·m	Yes
Total Neck Occipital Condyles Moment Decay Time to 0 N·m	71 - 87 ms	76.7 ms	Yes
Maximum Forward Pot Rotation			
Peak	32 - 39 °	34.8 °	Yes
Time of Peak	56 - 68 ms	60.9 ms	Yes
Maximum Rear Pot Rotation			
Peak	29 - 36 °	30.8 °	Yes
Time of Peak	56 - 68 ms	59.9 ms	Yes
Maximum Headform Angular Rate	2,047 - 2,503 °/s	2,302.2 °/s	Yes

Test meets specifications.

Condition: Used

Comments:

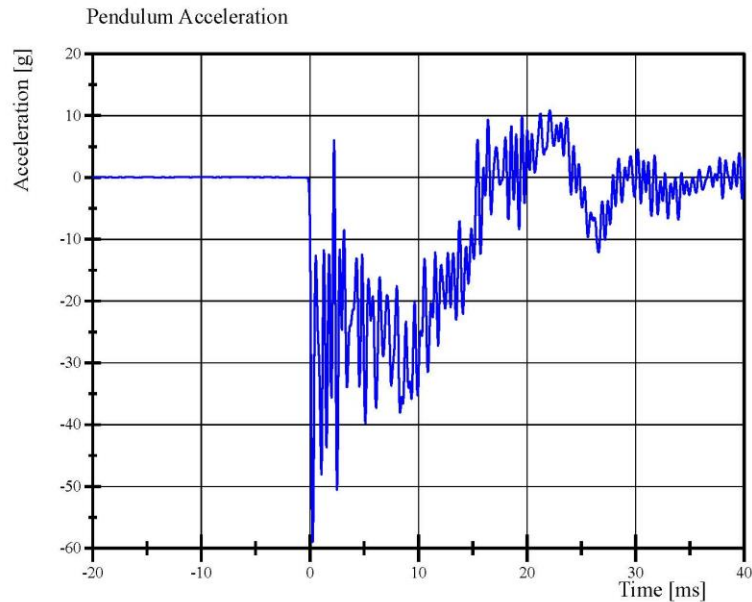
Neck S/N: EE8804

Transportation Research Center Inc.

Right Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 6-1

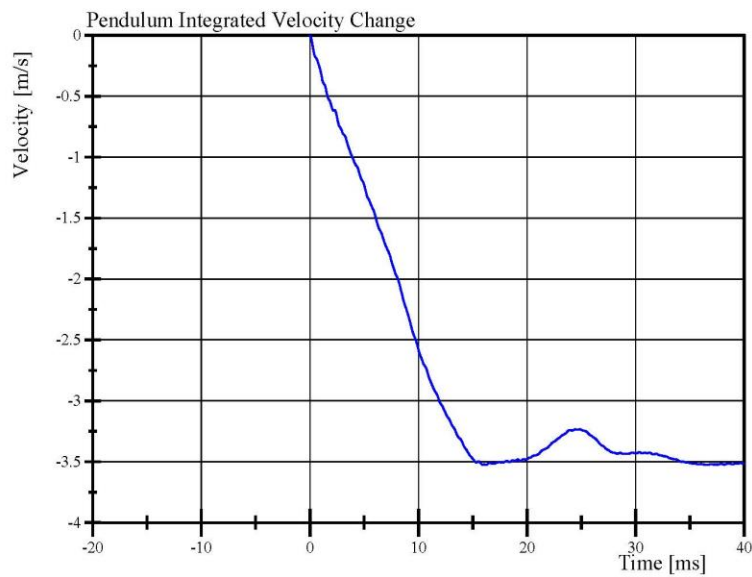
Test Date: 1/18/2021



Filter Class: CFC_1000

Max: 10.9 g at 22.1 ms

Min: -59.0 g at 0.3 ms



Filter Class: CFC_1000

Max: 0.0 m/s at 0.0 ms

Min: -3.5 m/s at 16.3 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

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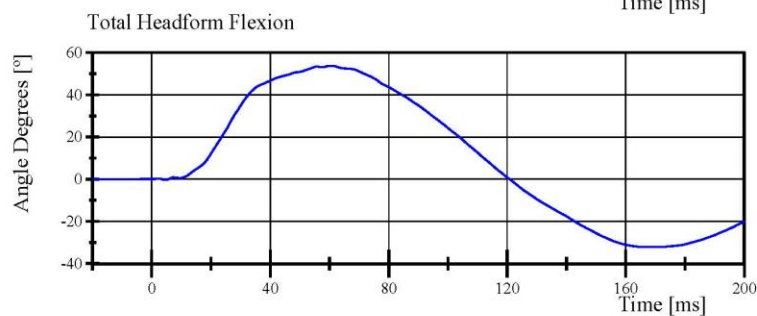
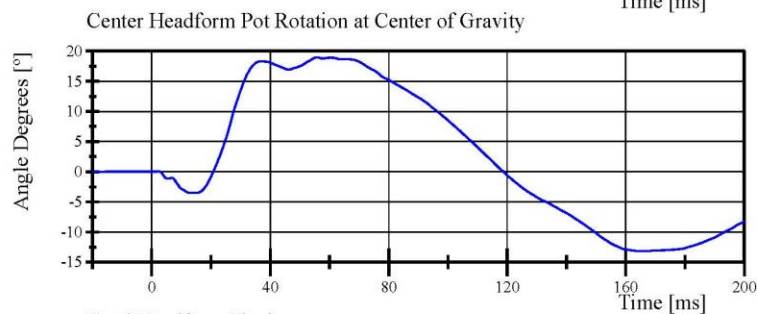
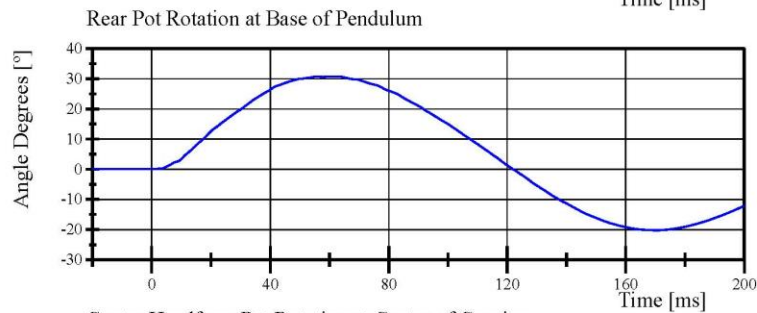
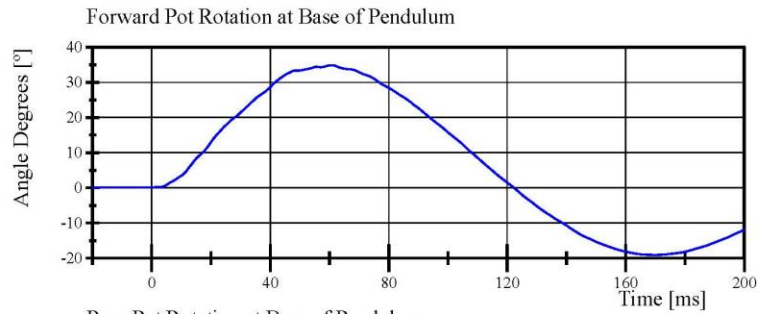


Transportation Research Center Inc.

Right Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 6-1

Test Date: 1/18/2021



Specification Source: WorldSID 50th(W5) VRTC Nov 2020.xlsx
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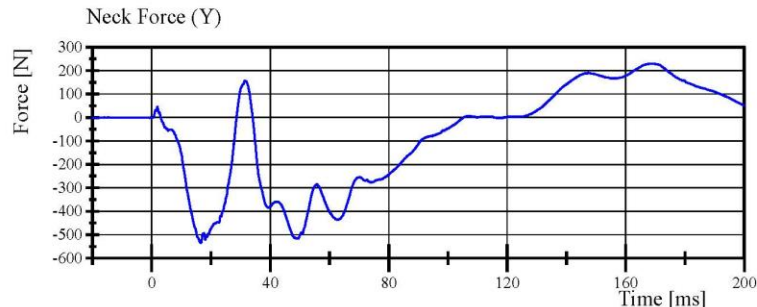


Transportation Research Center Inc.

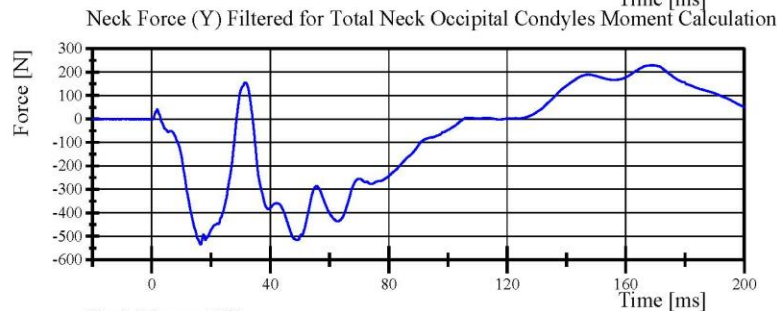
Right Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 6-1

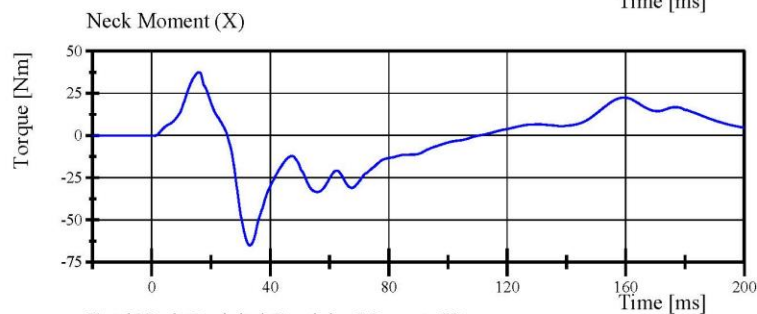
Test Date: 1/18/2021



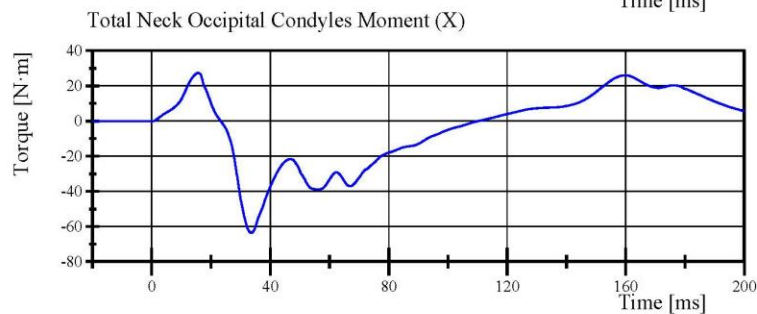
Filter Class: CFC_1000
Max: 229.7 N at 169.2 ms
Min: -534.5 N at 16.5 ms



Filter Class: CFC_600
Max: 229.5 N at 169.2 ms
Min: -534.9 N at 16.6 ms



Filter Class: CFC_600
Max: 37.4 Nm at 16.1 ms
Min: -65.1 Nm at 33.2 ms



Filter Class: Without_(Consta
Max: 27.3 N·m at 15.6 ms
Min: -63.6 N·m at 33.6 ms

Specification Source: WorldSID 50th(WS) VRTC Nov 2020.xlsx
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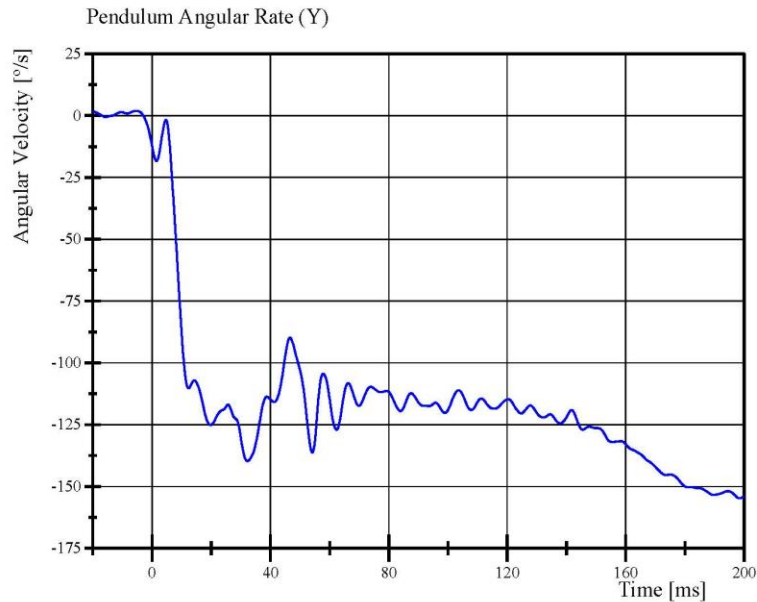


Transportation Research Center Inc.

Right Lateral Neck

WorldSID 50th Serial No. EB8888 Certification No. 6-1

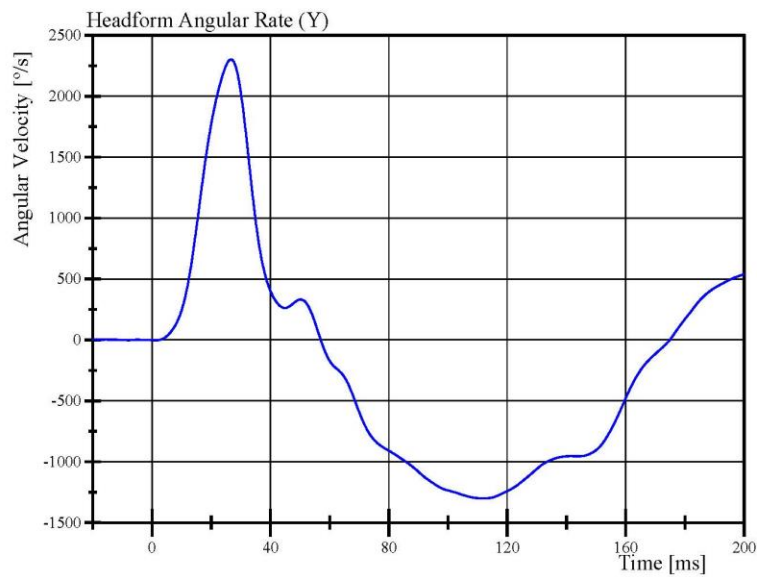
Test Date: 1/18/2021



Filter Class: CFC_60

Max: 1.9 °/s at -5.3 ms

Min: -154.7 °/s at 198.5 ms



Filter Class: CFC_60

Max: 2,302.2 °/s at 26.7 ms

Min: -1,301.7 °/s at 111.9 ms

Specification Source: WorldSID 50th(WS) VRTC Nov 2020.xlsx
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Transportation Research Center Inc.

Left Lateral Torsion

WorldSID 50th Serial No. EB8888 Certification No. 6-3

Test Date: 1/19/2021

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Pendulum Velocity	5.1 - 5.3 m/s	5.18 m/s	Yes
Pendulum Integrated Velocity Change at 10 ms	2.09 - 2.37 m/s	2.149 m/s	Yes
Change at 15 ms	3.19 - 3.63 m/s	3.246 m/s	Yes
Change at 20 ms	4.27 - 4.87 m/s	4.323 m/s	Yes
Peak Fixture Rotation	(-41.5) - (-51) °	-46.61 °	Yes
Decay Time to 0 deg from Peak Angle	35 - 43 ms	39.3 ms	Yes
Peak Head Angular Velocity Z-axis	(-1,345) - (-1,655) °/s	-1,504.4 °/s	Yes
Peak Lower Neck Moment Z-axis	34 - 42 N·m	37.5 N·m	Yes

Test meets specifications.

Condition: Used

Comments:

Neck S/N: EE8804

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
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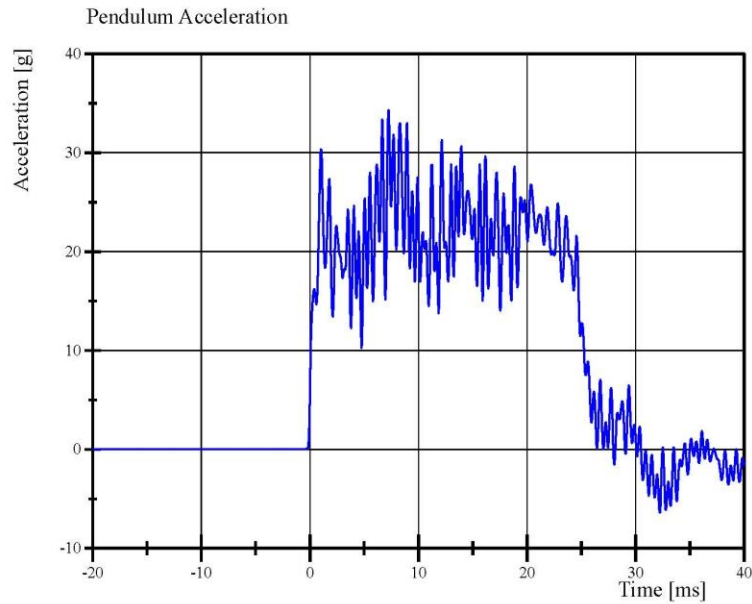


Transportation Research Center Inc.

Left Lateral

WorldSID 50th Serial No. EB8888 Certification No. 6-3

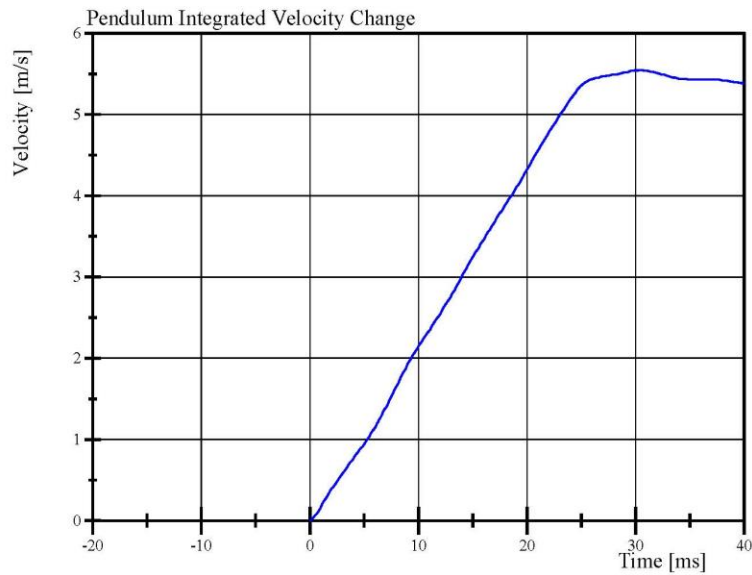
Test Date: 1/19/2021



Filter Class: CFC_1000

Max: 34.3 g at 7.3 ms

Min: -6.4 g at 32.2 ms



Filter Class: CFC_1000

Max: 5.5 m/s at 30.5 ms

Min: 0.0 m/s at 0.0 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
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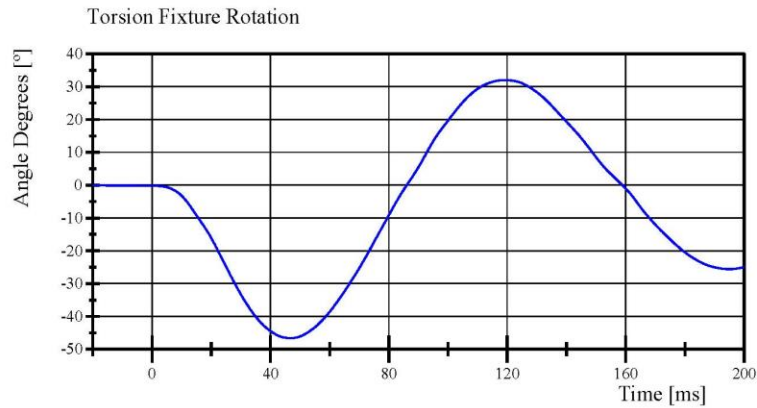


Transportation Research Center Inc.

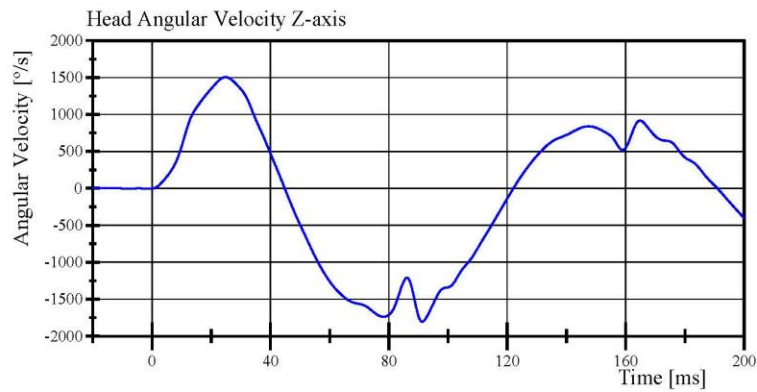
Left Lateral

WorldSID 50th Serial No. EB8888 Certification No. 6-3

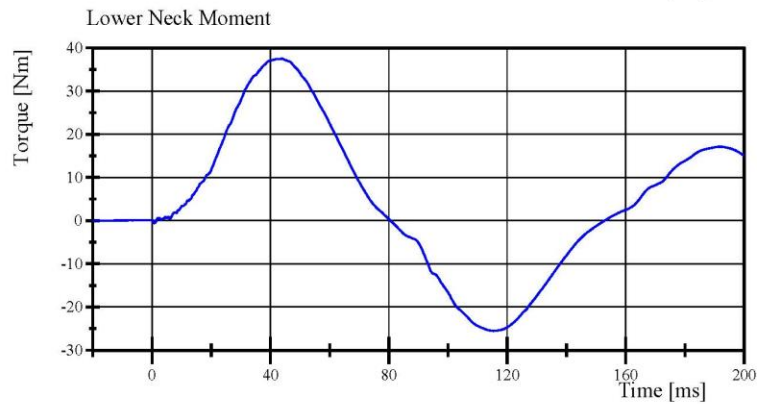
Test Date: 1/19/2021



Filter Class: CFC_60
Max: 32.0 ° at 119.2 ms
Min: -46.6 ° at 46.8 ms



Filter Class: CFC_60
Max: 1,504.4 °/s at 24.9 ms
Min: -1,804.8 °/s at 91.3 ms



Filter Class: CFC_600
Max: 37.5 Nm at 43.9 ms
Min: -25.5 Nm at 115.3 ms

Specification Source: WorldSID 50th(WS) VRTC Nov 2020.xlsx
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Transportation Research Center Inc.

Right Lateral Torsion

WorldSID 50th Serial No. EB8888 Certification No. 6-2

Test Date: 1/20/2021

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	40 %	Yes
Pendulum Velocity	5.1 - 5.3 m/s	5.18 m/s	Yes
Pendulum Integrated Velocity Change at 10 ms	2.09 - 2.37 m/s	2.241 m/s	Yes
Change at 15 ms	3.19 - 3.63 m/s	3.403 m/s	Yes
Change at 20 ms	4.27 - 4.87 m/s	4.574 m/s	Yes
Peak Fixture Rotation	41.5 - 51 °	46.23 °	Yes
Decay Time to 0 deg from Peak Angle	35 - 43 ms	39.0 ms	Yes
Peak Head Angular Velocity Z-axis	1,345 - 1,655 %/s	1,559.9 %/s	Yes
Peak Lower Neck Moment Z-axis	(-34) - (-42) N·m	-38.3 N·m	Yes

Test meets specifications.

Condition: Used

Comments:

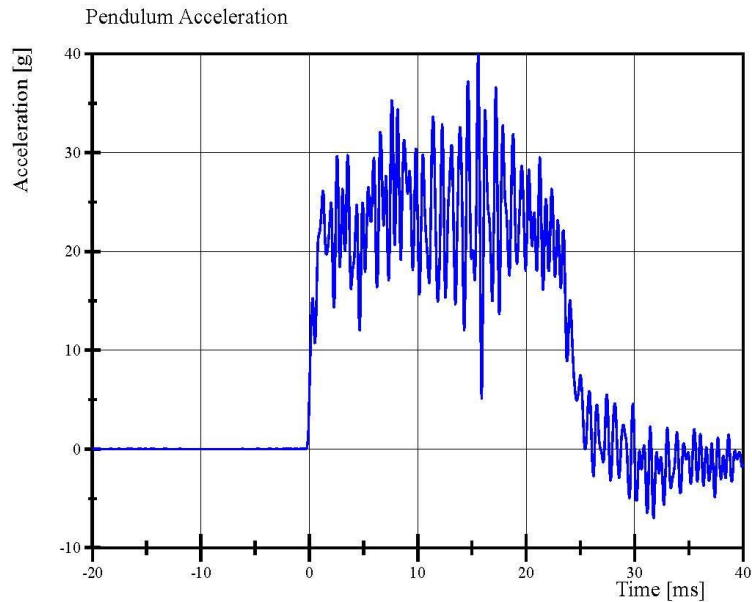
Neck S/N: EE8804

Transportation Research Center Inc.

Right Lateral

WorldSID 50th Serial No. EB8888 Certification No. 6-2

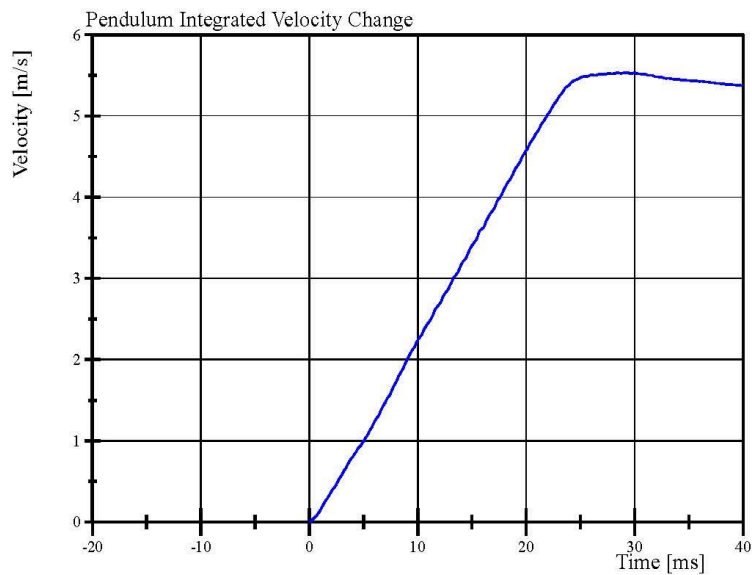
Test Date: 1/20/2021



Filter Class: CFC_1000

Max: 39.9 g at 15.6 ms

Min: -7.0 g at 31.8 ms



Filter Class: CFC_1000

Max: 5.5 m/s at 29.3 ms

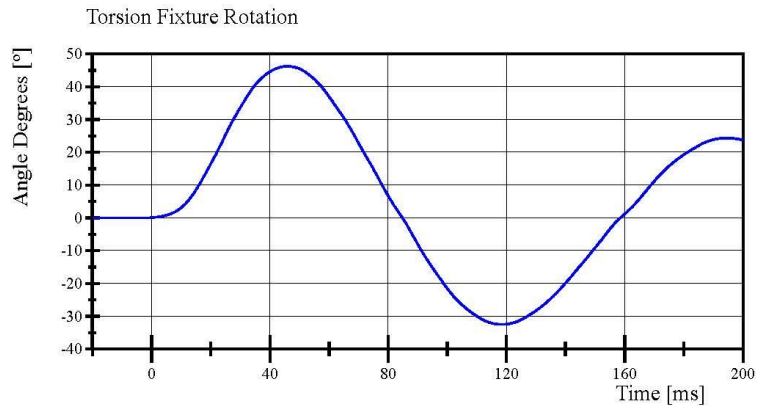
Min: 0.0 m/s at 0.0 ms

Transportation Research Center Inc.

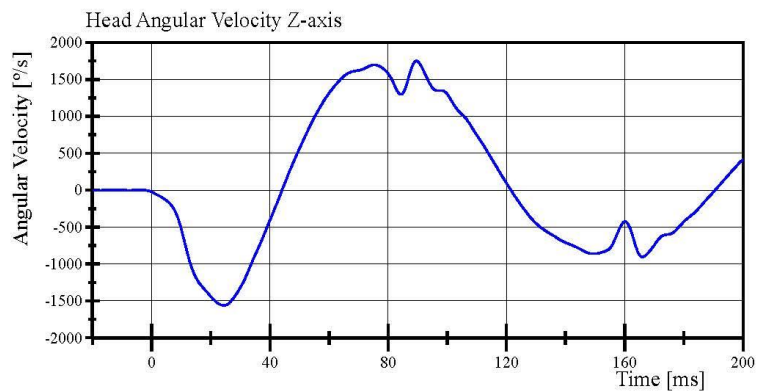
Right Lateral

WorldSID 50th Serial No. EB8888 Certification No. 6-2

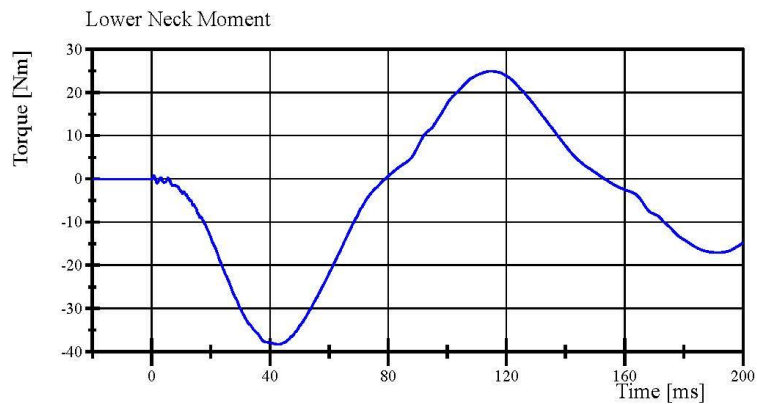
Test Date: 1/20/2021



Filter Class: CFC_60
Max: 46.2 ° at 45.9 ms
Min: -32.5 ° at 118.4 ms



Filter Class: CFC_60
Max: 1,749.6 °/s at 89.5 ms
Min: -1,559.9 °/s at 24.5 ms



Filter Class: CFC_600
Max: 24.9 Nm at 114.8 ms
Min: -38.3 Nm at 42.5 ms

Transportation Research Center Inc.

Left Lateral Shoulder

WorldSID 50th Serial No. EB8888 Certification No. 6-1

Test Date: 1/19/2021

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Impactor Velocity	4.2 - 4.4 m/s	4.30 m/s	Yes
Impactor Force	2,600 - 3,300 N	2,978.2 N	Yes
Shoulder Force	(-1,470) - (-1,800) N	-1,628.5 N	Yes
S1 RibEye Max	37 - 46 mm	39.9 mm	Yes

Test meets specifications.

Condition: Used

Comments:

Arm S/N: EG3799

Shoulder Rib S/N: DW1916

Tilt:

Head X -0.5

Y -0.6

Spine X 1.00

Y 1.00

Pelvis X 0.6

Y 5.1

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
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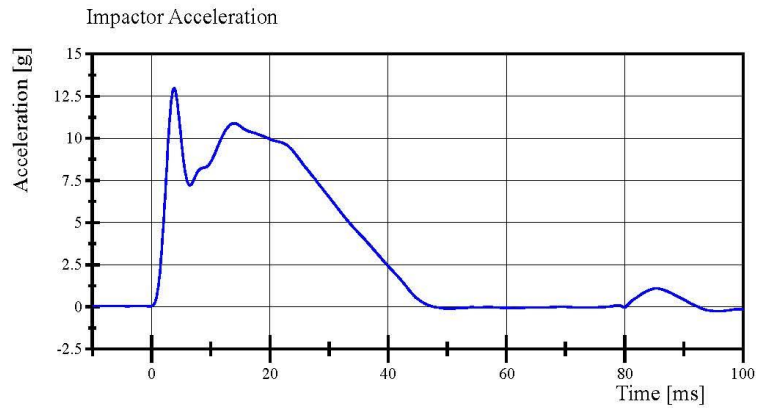


Transportation Research Center Inc.

Left Lateral Shoulder

WorldSID 50th Serial No. EB8888 Certification No. 6-1

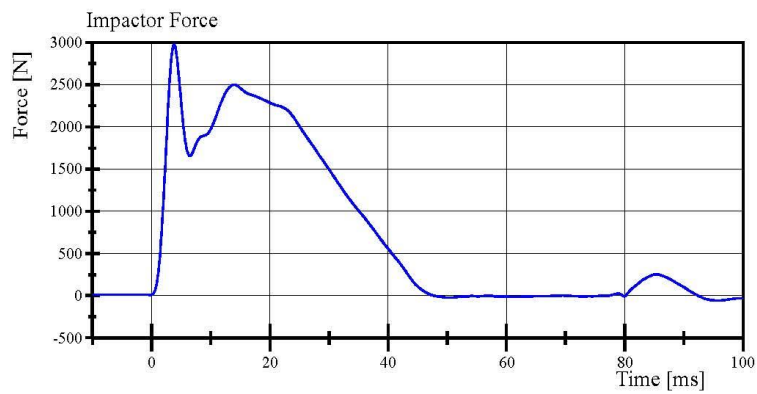
Test Date: 1/19/2021



Filter Class: CFC_180

Max: 13.0 g at 3.8 ms

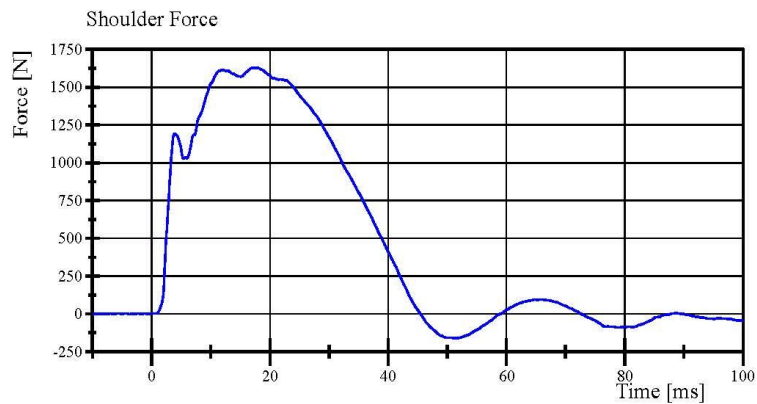
Min: -0.3 g at 95.8 ms



Filter Class: CFC_180

Max: 2,978.2 N at 3.8 ms

Min: -59.1 N at 95.8 ms



Filter Class: CFC_600

Max: 1,628.5 N at 17.6 ms

Min: -162.3 N at 51.3 ms

Transportation Research Center Inc.

Left Lateral Thorax with Arm
WorldSID 50th Serial No. EB8888 Certification No. 6-1
Test Date: 1/20/2021

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Impactor Velocity	6.6 - 6.8 m/s	6.69 m/s	Yes
Impactor Force	5,300 - 6,200 N	5,856.7 N	Yes
Upper Thorax Rib Displacement	35 - 47 mm	41.0 mm	Yes
Center Thorax Rib Displacement	46 - 56 mm	46.8 mm	Yes
Lower Thorax Rib Displacement	33.5 - 40.5 mm	35.57 mm	Yes
Upper Spine Lateral Acceleration	28 - 37 g	35.9 g	Yes
Lower Spine Lateral Acceleration	22 - 28 g	27.0 g	Yes

Test meets specifications.

Condition: Used

Comments:

Arm S/N: EG3799

Shoulder Rib S/N: DW1916

Thorax Rib 1 S/N: EB5400

Thorax Rib 2 S/N: EB5401

Thorax Rib 3 S/N: EB5402

RibEye S/N: 125

Tilt:

Head X -0.6

Y -0.5

Spine X -0.1

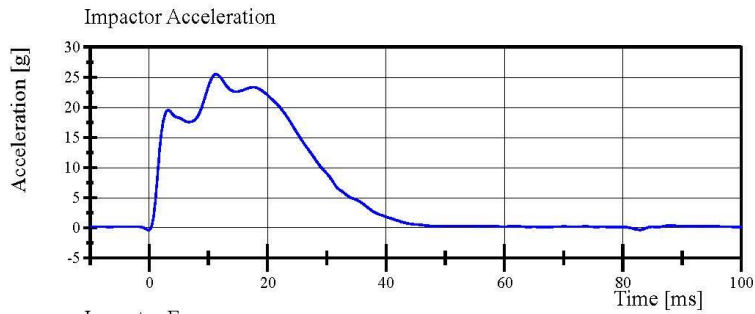
Y 1.4

Pelvis X -0.5

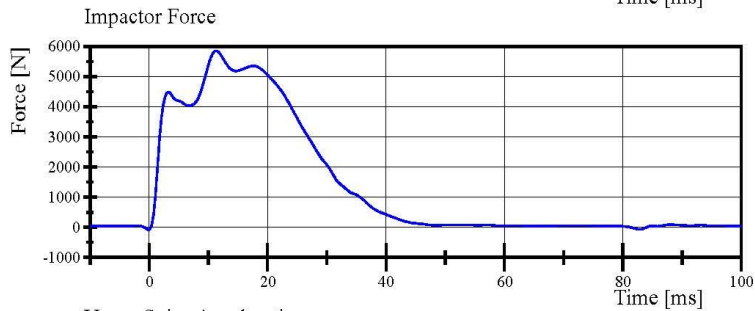
Y 4.9

Transportation Research Center Inc.

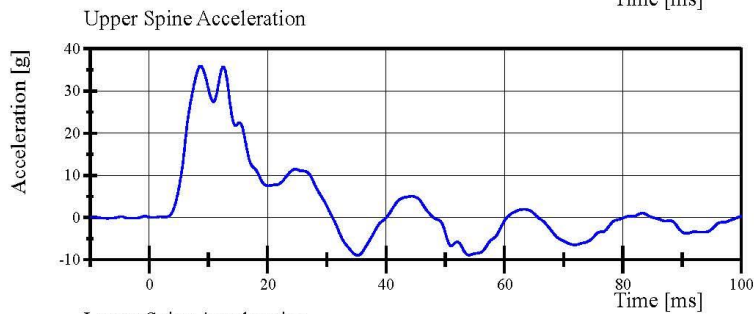
Left Lateral Thorax with Arm
WorldSID 50th Serial No. EB8888 Certification No. 6-1
Test Date: 1/20/2021



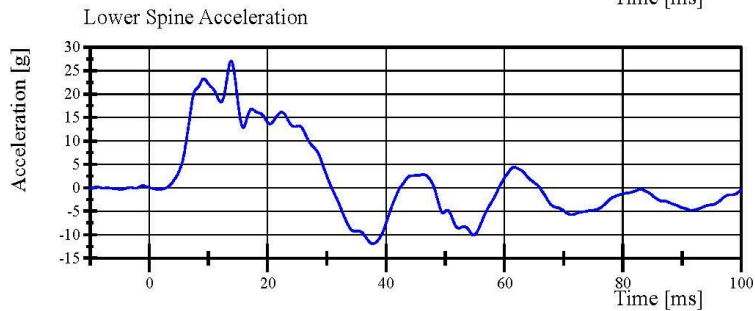
Filter Class: CFC_180
Max: 25.5 g at 11.3 ms
Min: -0.4 g at -0.1 ms



Filter Class: CFC_180
Max: 5,856.7 N at 11.3 ms
Min: -80.7 N at -0.1 ms



Filter Class: CFC_180
Max: 35.9 g at 8.7 ms
Min: -9.0 g at 35.2 ms



Filter Class: CFC_180
Max: 27.0 g at 13.9 ms
Min: -11.9 g at 37.8 ms

Transportation Research Center Inc.

Left Lateral Thorax without Arm
WorldSID 50th Serial No. EB8888 Certification No. 6-1
Test Date: 1/20/2021

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	37 %	Yes
Impactor Velocity	4.2 - 4.4 m/s	4.31 m/s	Yes
Impactor Force	3,200 - 3,800 N	3,506.3 N	Yes
Upper Thorax Rib Displacement	33 - 43 mm	36.8 mm	Yes
Center Thorax Rib Displacement	35 - 43 mm	41.3 mm	Yes
Lower Thorax Rib Displacement	32 - 40 mm	36.1 mm	Yes
Upper Spine Lateral Acceleration	14 - 20 g	17.1 g	Yes
Lower Spine Lateral Acceleration	14 - 22 g	16.8 g	Yes

Test meets specifications.

Condition: Used

Comments:

Thorax Rib 1 S/N: EB5400

Thorax Rib 2 S/N: EB5401

Thorax Rib 3 S/N: EB5402

RibEye S/N: 125

Tilt:

Head X -0.2

Y 0.0

Spine X 0.1

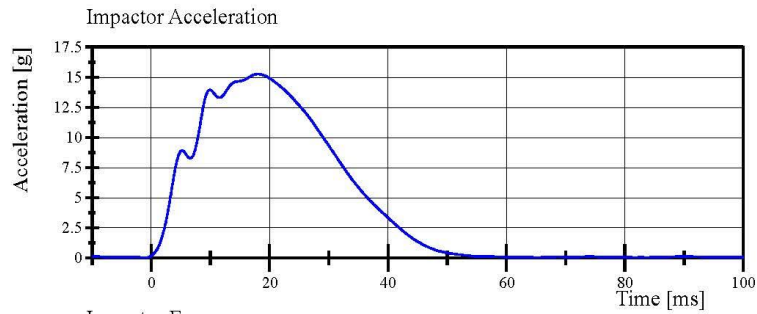
Y 1.8

Pelvis X 0.7

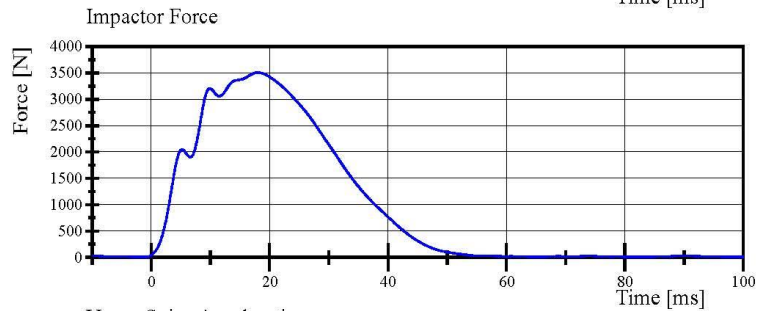
Y 4.6

Transportation Research Center Inc.

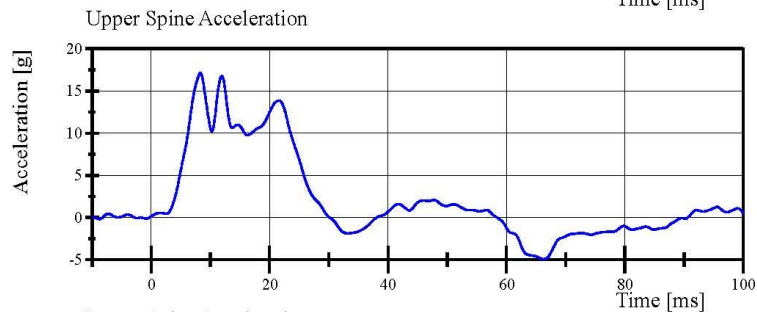
Left Lateral Thorax without Arm
WorldSID 50th Serial No. EB8888 Certification No. 6-1
Test Date: 1/20/2021



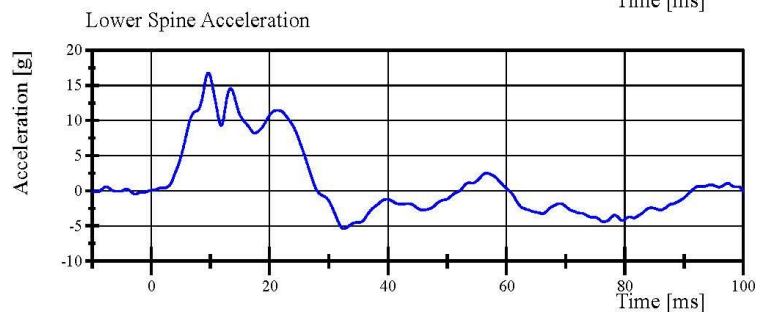
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Min: 0.0 g at -1.0 ms



Filter Class: CFC_180
Max: 3,506.3 N at 18.0 ms
Min: 6.4 N at -1.0 ms



Filter Class: CFC_180
Max: 17.1 g at 8.3 ms
Min: -4.9 g at 66.3 ms



Filter Class: CFC_180
Max: 16.8 g at 9.7 ms
Min: -5.4 g at 32.5 ms

Transportation Research Center Inc.

Left Lateral Abdomen

WorldSID 50th Serial No. EB8888 Certification No. 6-1

Test Date: 1/20/2021

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	40 %	Yes
Impactor Velocity	4.2 - 4.4 m/s	4.33 m/s	Yes
Impactor Force	2,700 - 3,100 N	2,853.6 N	Yes
Upper Abdominal Rib Displacement	32.5 - 39.5 mm	34.43 mm	Yes
Lower Abdominal Rib Displacement	32 - 38 mm	35.1 mm	Yes
Lower Spine Lateral Acceleration	14.5 - 19.5 g	17.25 g	Yes

Test meets specifications.

Condition: Used

Comments:

Abdomen Rib #1 S/N: DY5252

Abdomen Rib #2 S/N: DY5253

Tilt:

Head X 0.8

Y -0.8

Spine X 1.5

Y 1.1

Pelvis X 0.0

Y 4.5

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

Report Number: EB8888_WSH06

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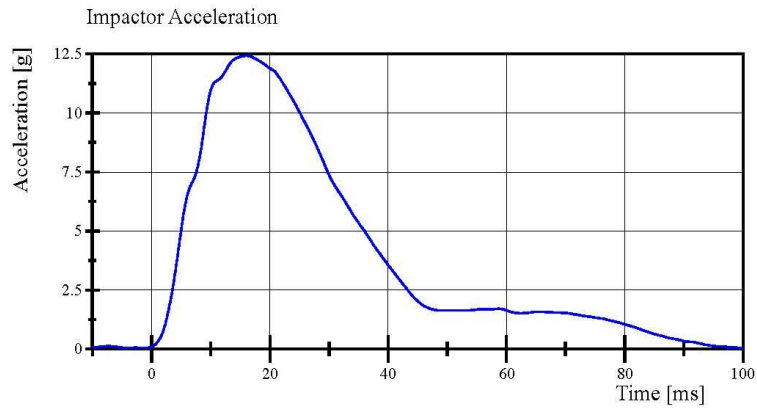


Transportation Research Center Inc.

Left Lateral Abdomen

WorldSID 50th Serial No. EB8888 Certification No. 6-1

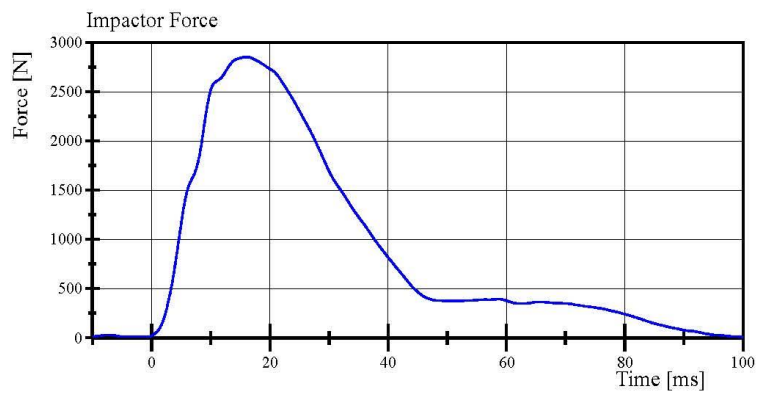
Test Date: 1/20/2021



Filter Class: CFC_180

Max: 12.4 g at 16.0 ms

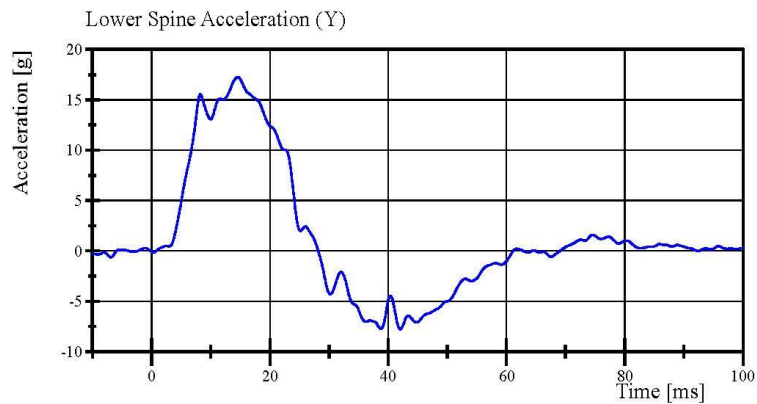
Min: 0.0 g at 100.0 ms



Filter Class: CFC_180

Max: 2,853.6 N at 16.0 ms

Min: 6.0 N at 100.0 ms



Filter Class: CFC_180

Max: 17.3 g at 14.6 ms

Min: -7.8 g at 42.1 ms

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qualification Manual 11_09_2020

Report Number: EB8888_WSH06

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Transportation Research Center Inc.

Left Lateral Pelvis

WorldSID 50th Serial No. EB8888 Certification No. 6-1

Test Date: 1/20/2021

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.8 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Impactor Velocity	6.6 - 6.8 m/s	6.74 m/s	Yes
Impactor Force	6,800 - 8,200 N	7,419.5 N	Yes
Pelvis Lateral Acceleration	38.5 - 48.5 g	39.38 g	Yes
Lower Spine Lateral Acceleration	10 - 14 g	11.2 g	Yes
Pubic Lateral Force	(-1,300) - (-1,590) N	-1,384.5 N	Yes
Sacroiliac Lateral Force	(-1,860) - (-2,280) N	-2,018.9 N	Yes

Test meets specifications.

Condition: Used

Comments:

Pelvis S/N: EC3628

Tilt:

Head X 0.3

Y -0.4

Spine X 1.9

Y 1.2

Pelvis X 0.3

Y 5.0

Specification Source: WordSID 50th(WS) VRTC Nov 2020.xlsx
WorldSID 50th_Qalification Manual 11_09_2020

Report Number: EB8888_WSH06

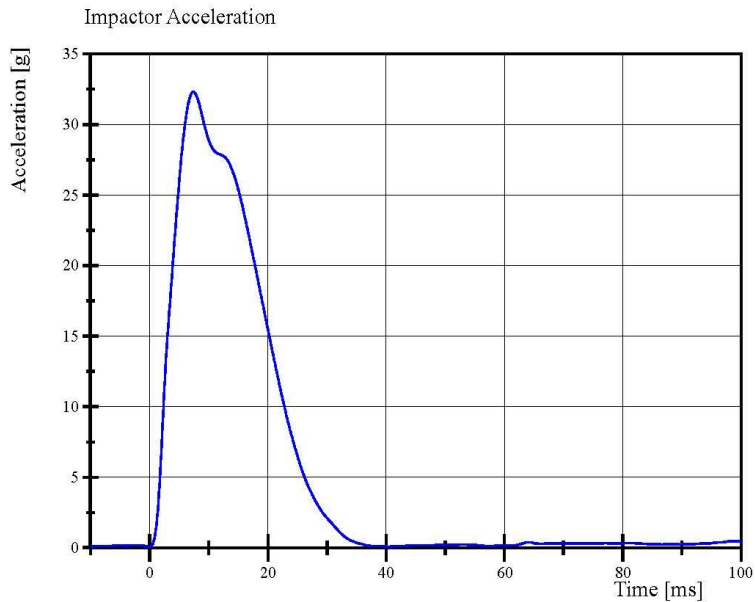
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01.20.2021 13:14:19 974

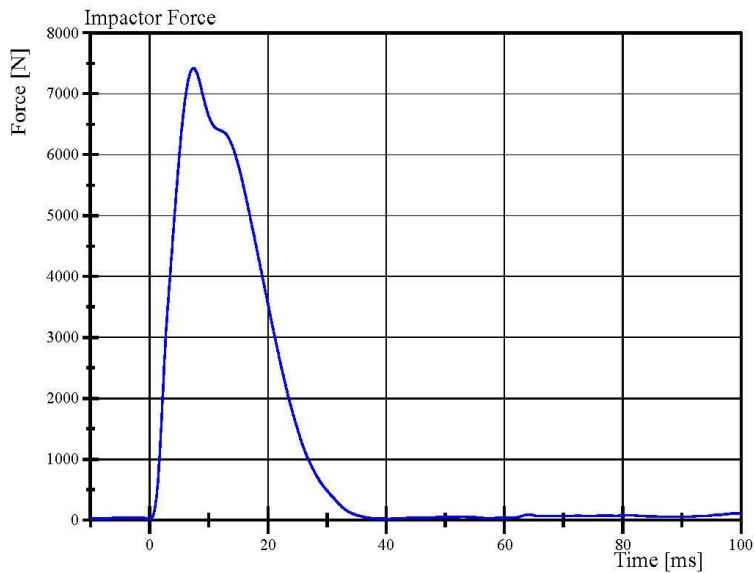


Transportation Research Center Inc.

Left Lateral Pelvis
WorldSID 50th Serial No. EB8888 Certification No. 6-1
Test Date: 1/20/2021



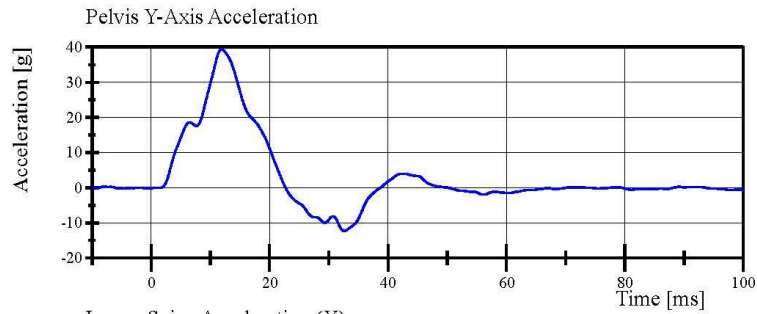
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Min: 0.1 g at -0.1 ms



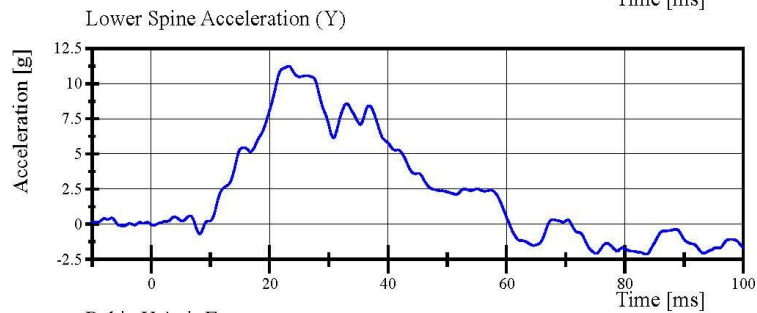
Filter Class: CFC_180
Max: 7,419.5 N at 7.4 ms
Min: 17.4 N at -0.1 ms

Transportation Research Center Inc.

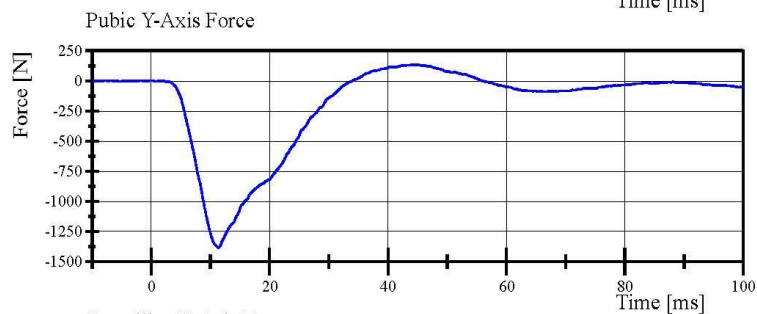
Left Lateral Pelvis
WorldSID 50th Serial No. EB8888 Certification No. 6-1
Test Date: 1/20/2021



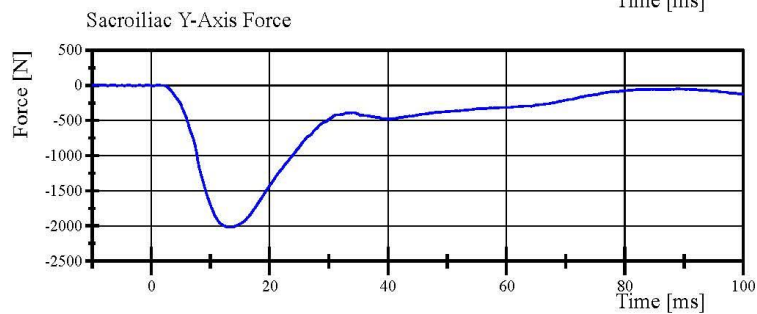
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Max: 39.4 g at 11.9 ms
Min: -12.3 g at 32.7 ms



Filter Class: CFC_180
Max: 11.2 g at 23.2 ms
Min: -2.1 g at 83.6 ms



Filter Class: CFC_600
Max: 133.8 N at 44.9 ms
Min: -1,384.5 N at 11.4 ms



Filter Class: CFC_600
Max: 5.9 N at -8.0 ms
Min: -2,018.9 N at 13.3 ms

APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

TABLE 1 – Dummy Instrumentation (WorldSID-50M with RibEye™)

		WorldSID-50M S/N EB8888		
		Serial Number	Manufacturer	Calibration Date
Head Accelerometers (g)	X	12324-1	Endevco	22-Jul-2020
	Y	12324-3	Endevco	22-Jul-2020
	Z	12324-2	Endevco	22-Jul-2020
Head Angular Rates Sensors (deg/sec)	X	ARS12047	DTS	4-Aug-2020
	Y	ARS15094	DTS	4-Aug-2020
	Z	ARS11060	DTS	4-Aug-2020
Upper Neck Force (N)	X	DO9753	Humanetics	23-Jul-2020
	Y	DO9753	Humanetics	23-Jul-2020
	Z	DO9753	Humanetics	23-Jul-2020
Upper Neck Moment (Nm)	X	DO9753	Humanetics	23-Jul-2020
	Y	DO9753	Humanetics	23-Jul-2020
	Z	DO9753	Humanetics	23-Jul-2020
Lower Neck Force (N)	X	EB8143	Humanetics	21-Jul-2020
	Y	EB8143	Humanetics	21-Jul-2020
	Z	EB8143	Humanetics	21-Jul-2020
Lower Neck Moment (Nm)	X	EB8143	Humanetics	21-Jul-2020
	Y	EB8143	Humanetics	21-Jul-2020
	Z	EB8143	Humanetics	21-Jul-2020
Shoulder Force (N)	X	EC1630	Humanetics	23-Jul-2020
	Y	EC1630	Humanetics	23-Jul-2020
	Z	EC1630	Humanetics	23-Jul-2020
Upper Spine Accelerometers (T1) (g)	X	12037-3	Endevco	22-Jul-2020
	Y	12037-2	Endevco	22-Jul-2020
	Z	12037-1	Endevco	22-Jul-2020
Middle Spine Accelerometers (T4) (g)	X	12352-3	Endevco	21-Jul-2020
	Y	12352-2	Endevco	21-Jul-2020
	Z	12352-1	Endevco	21-Jul-2020
Lower Spine Accelerometers (T12) (g)	X	12375-3	Endevco	22-Jul-2020
	Y	12375-2	Endevco	22-Jul-2020
	Z	12375-1	Endevco	22-Jul-2020
Pubic Symphysis Force (N)	Y	EC4386	Humanetics	23-Jul-2020
Sacro-Iliac Left Force (N)	X	EG4066	Humanetics	23-Jul-2020
	Y	EG4066	Humanetics	23-Jul-2020
	Z	EG4066	Humanetics	23-Jul-2020
Sacro-Iliac Left Moment (Nm)	X	EG4066	Humanetics	23-Jul-2020
	Y	EG4066	Humanetics	23-Jul-2020
	Z	EG4066	Humanetics	23-Jul-2020

TABLE 1 – Dummy Instrumentation (WorldSID-50M with RibEye™) (CONTINUED)

		WorldSID-50M S/N EB8888		
		Serial Number	Manufacturer	Calibration Date
Sacro-Iliac Right Force (N)	X	EG4066	Humanetics	23-Jul-2020
	Y	EG4066	Humanetics	23-Jul-2020
	Z	EG4066	Humanetics	23-Jul-2020
Sacro-Iliac Right Moment (Nm)	X	EG4066	Humanetics	23-Jul-2020
	Y	EG4066	Humanetics	23-Jul-2020
	Z	EG4066	Humanetics	23-Jul-2020
Lumbar Force (N)	X	EC2349	Humanetics	23-Jul-2020
	Y	EC2349	Humanetics	23-Jul-2020
	Z	EC2349	Humanetics	23-Jul-2020
Lumbar Moment (Nm)	X	EC2349	Humanetics	23-Jul-2020
	Y	EC2349	Humanetics	23-Jul-2020
	Z	EC2349	Humanetics	23-Jul-2020
Pelvis Accelerometers (g)	X	11905-3	Endevco	22-Jul-2020
	Y	11905-2	Endevco	22-Jul-2020
	Z	11905-1	Endevco	22-Jul-2020
Left Femur Force (N)	X	EA4925TPS	Humanetics	29-Jul-2020
	Y	EA4925TPS	Humanetics	29-Jul-2020
	Z	EA4925TPS	Humanetics	29-Jul-2020
Left Femur Moment (Nm)	X	EA4925TPS	Humanetics	29-Jul-2020
	Y	EA4925TPS	Humanetics	29-Jul-2020
	Z	EA4925TPS	Humanetics	29-Jul-2020
Left Femoral Neck Force (N)	X	EB6234T	Humanetics	23-Jul-2020
	Y	EB6234T	Humanetics	23-Jul-2020
	Z	EB6234T	Humanetics	23-Jul-2020
Driver Left Outer Knee Force (N)	Y	93	Humanetics	23-Jul-2020
Driver Left Inner Knee Force (N)	Y	95	Humanetics	23-Jul-2020

TABLE 1 – Dummy Instrumentation (WorldSID-50M with RibEye™) (CONTINUED)

			WorldSID-50M S/N EB8888		
			Serial Number	Manufacturer	Calibration Date
Shoulder RibEye (mm)	Front	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
	Middle	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
	Rear	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
Thorax Rib 1 RibEye (mm)	Front	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
	Middle	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
	Rear	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
Thorax Rib 2 RibEye (mm)	Front	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
	Middle	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
	Rear	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
Thorax Rib 3 RibEye (mm)	Front	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
	Middle	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
	Rear	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020

TABLE 1 – Dummy Instrumentation (WorldSID-50M with RibEye™) (CONTINUED)

			WorldSID-50M S/N EB8888		
			Serial Number	Manufacturer	Calibration Date
Abdomen Rib 1 RibEye (mm)	Front	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
	Middle	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
	Rear	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
Abdomen Rib 2 RibEye (mm)	Front	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
	Middle	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020
	Rear	X	124	Boxboro Systems	7-Jul-2020
		Y	124	Boxboro Systems	7-Jul-2020
		Z	124	Boxboro Systems	7-Jul-2020

TABLE 2 – VEHICLE INSTRUMENTATION

Vehicle Instrumentation		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity (g)	X	T23815	ENDEVCO	11-Sep-2020
	Y	T23789	ENDEVCO	15-Sep-2020
	Z	T23777	ENDEVCO	15-Sep-2020
Vehicle Center of Gravity Angular Rate (deg/sec)	X	ARS12511	DTS	11-Sep-2020
	Y	ARS12506	DTS	3-Mar-2020
	Z	ARS12500	DTS	11-Sep-2020
Left Floor Sill (g)	Y	T16723	ENDEVCO	27-Aug-2020
Left A-Pillar Sill (g)	Y	T23776	ENDEVCO	27-Aug-2020
Left Lower A-Pillar (g)	Y	T16785	ENDEVCO	29-Sep-2020
Left Mid A-Pillar (g)	Y	T11877	ENDEVCO	27-Aug-2020
Left B-Pillar Sill (g)	Y	T23811	ENDEVCO	27-Aug-2020
Left Lower B-Pillar (g)	Y	T16778	ENDEVCO	11-Sep-2020
Left Mid B-Pillar (g)	Y	T16765	ENDEVCO	11-Sep-2020
Driver Seat Track at Dummy H-Point (g)	Y	T23821	ENDEVCO	29-Sep-2020
Engine Top (g)	X	T23813	ENDEVCO	27-Aug-2020
	Y	T23832	ENDEVCO	27-Aug-2020
Firewall Center (g)	Y	T16770	ENDEVCO	27-Aug-2020
Right Roof at Vertical Impact Reference Line (g)	Y	T11871	ENDEVCO	27-Aug-2020
Right Sill at Vertical Impact Reference Line (g)	X	T23885	ENDEVCO	27-Aug-2020
	Y	T16772	ENDEVCO	20-Nov-2020
	Z	T11805	ENDEVCO	20-Nov-2020
Right Sill at Rear Seat Acceleration (g)	X	P94567	ENDEVCO	20-Nov-2020
	Y	P75115	ENDEVCO	23-Oct-2020
	Z	P33547	ENDEVCO	15-Sep-2020
Rear Floorpan Behind Rear Axle at Centerline (g)	X	T23855	ENDEVCO	20-Nov-2020
Rear Floorpan Behind Rear Axle at Centerline (g)	Y	T23862	ENDEVCO	20-Nov-2020
Left Front Door Mid Centerline (g)	Y	P74456	ENDEVCO	20-Nov-2020
Left Front Door Mid Rear (g)	Y	P58537	ENDEVCO	15-Sep-2020
Left Front Door Upper Centerline (g)	Y	P58494	ENDEVCO	15-Sep-2020
Left Rear Door Mid Rear (g)	Y	T23779	ENDEVCO	11-Sep-2020
Left Rear Door Upper Centerline (g)	Y	T23864	ENDEVCO	15-Sep-2020
Rear Deck (g)	X	T23797	ENDEVCO	15-Sep-2020
	Y	T23807	ENDEVCO	11-Sep-2020
	Z	T23837	ENDEVCO	11-Sep-2020
Rear Deck Angular Rate (deg/sec)	X	ARS9190	DTS	11-Sep-2020
	Y	ARS8714	DTS	27-Aug-2020
	Z	ARS8722	DTS	27-Aug-2020

TABLE 3 – POLE INSTRUMENTATION

Pole Instrumentation	Serial Number	Manufacturer	Calibration Date
Pole Load Cell 1	DK7091S	Humanetics	12-Nov-2020
Pole Load Cell 2	DK7120S	Humanetics	12-Nov-2020
Pole Load Cell 3	DK7118S	Humanetics	12-Nov-2020
Pole Load Cell 4	DK7124S	Humanetics	12-Nov-2020
Pole Load Cell 5	DK7111S	Humanetics	12-Nov-2020
Pole Load Cell 6	DK7126S	Humanetics	12-Nov-2020
Pole Load Cell 7	DK7112S	Humanetics	12-Nov-2020
Pole Load Cell 8	DK7074S	Humanetics	12-Nov-2020

Sign Convention
SAE J211 MAR95

Accelerometers:

+X: Forward
+Y: Rightward
+Z: Downward

Potentiometers:

+Chest longitudinal deflection: Outward
+Chest lateral deflection: Rightward
+Seat belt displacement: Outward
+Seat belt extension: Elongation
+Knee slider displacement: Distance between femur and tibia increased (in relation to a seated dummy)

Rotation potentiometers:

+About the X-axis: Left foot-eversion
Right foot-inversion
+About the Y-axis: Left/right foot-dorsiflexion
+About the Z-axis: Left foot-internal
Right foot-external

Load cells:

+Femur force: Tension
+Seat belt force: Tension
+Barrier force: Tension

Neck load cells:

+X force: Head pushed rearward
+Y force: Head pushed leftward
+Z force: Head pulled upward (tension on neck)
+X moment: Left ear rotating toward left shoulder
+Y moment: Chin rotating toward chest
+Z moment: Chin rotating toward left shoulder

Tibia load cells:

+X force: Ankle forward, knee rearward
+Y force: Ankle rightward, knee leftward
+Z force: Tension
+X moment: Bottom of tibia moving leftward
+Y moment: Bottom of tibia moving rearward

Sign Convention (Continued)
SAE J211 MAR95

<u>Lumbar load cells:</u>	+X force:	Chest rearward, pelvis forward
	+Y force:	Chest leftward, pelvis rightward
	+Z force:	Chest upward, pelvis downward
	+X moment:	Left shoulder toward left hip
	+Y moment:	Sternum toward front of legs
	+Z moment:	Right shoulder forward, left shoulder rearward

Frequency Response Classes
SAE J211 MAR95

<u>Typical Test Measurements</u>	<u>Channel Class</u>
Vehicle Structural Accelerations for use in:	
Total vehicle comparison	60
Collision simulation input	60
Component analysis	600
Integration for velocity or displacement	180
Barrier Face Forces	60
Belt Restraint System Loads	60
Anthropomorphic Test Device	
Head accelerations (linear and angular)	1000
Neck	
Forces	1000
Moments	600
Thorax	
Spine accelerations	180
Rib accelerations	1000
Sternum accelerations	1000
Deflections	600
Lumbar	
Forces	1000
Moments	1000
Pelvis	
Accelerations	1000
Forces	1000
Moments	1000
Femur/Knee/Tibia/Ankle	
Forces	600
Moments	600
Displacements	180
Sled Accelerations	60
Steering Column Loads	600
Head Form Accelerations	1000

Channel Number	ISO mnemonic	Channel Title	Filter Class	Flip	Zero	Full Scale
1	11HEADCG00WSACXP	Driver Head Acceleration (X)	1000	+	yes	2000
2	11HEADCG00WSACYP	Driver Head Acceleration (Y)	1000	+	yes	2000
3	11HEADCG00WSACZP	Driver Head Acceleration (Z)	1000	+	yes	2000
3A	11HEADCG00WSACRP	Driver Head Acceleration Resultant	1000			
4	11HEADCG00WSAVXP	Driver Head Angular Rate (X)	1000	+	yes	8000
5	11HEADCG00WSAVYP	Driver Head Angular Rate (Y)	1000	+	yes	8000
6	11HEADCG00WSAVZP	Driver Head Angular Rate (Z)	1000	+	yes	8000
7	11NECKUP00WSFOXP	Driver Upper Neck Force (X)	1000	+	yes	10000
8	11NECKUP00WSFOYP	Driver Upper Neck Force (Y)	1000	+	yes	10000
9	11NECKUP00WSFOZP	Driver Upper Neck Force (Z)	1000	+	yes	12000
10	11NECKUP00WSMOXP	Driver Upper Neck Moment (X)	600	+	yes	300
11	11NECKUP00WSMOYP	Driver Upper Neck Moment (Y)	600	+	yes	300
12	11NECKUP00WSMOZP	Driver Upper Neck Moment (Z)	600	+	yes	200
13	11NECKLO00WSFOXP	Driver Lower Neck Force (X)	1000	+	yes	10000
14	11NECKLO00WSFOYP	Driver Lower Neck Force (Y)	1000	+	yes	10000
15	11NECKLO00WSFOZP	Driver Lower Neck Force (Z)	1000	+	yes	12000
16	11NECKLO00WSMOXP	Driver Lower Neck Moment (X)	600	+	yes	300
17	11NECKLO00WSMOYP	Driver Lower Neck Moment (Y)	600	+	yes	300
18	11NECKLO00WSMOZP	Driver Lower Neck Moment (Z)	600	+	yes	200
19	11SHLDLE00WSFOXP	Driver Shoulder Force (X)	600	+	yes	5000
20	11SHLDLE00WSFOYP	Driver Shoulder Force (Y)	600	+	yes	10000
21	11SHLDLE00WSFOZP	Driver Shoulder Force (Z)	600	+	yes	5000
22	11SHRILEREWSDSX0	Driver Shoulder Rear Displacement (X)	0	+	no	60
23	11SHRILEREWSDSY0	Driver Shoulder Rear Displacement (Y)	0	+	no	60
24	11SHRILEREWSDSZ0	Driver Shoulder Rear Displacement (Z)	0	+	no	60
25	11SHRILEREWSDSL0	Driver Shoulder Rear Length Change	600	+	no	60
26	11SHRILEMIWSDSX0	Driver Shoulder Middle Displacement (X)	0	+	no	60
27	11SHRILEMIWSDSY0	Driver Shoulder Middle Displacement (Y)	0	+	no	60
28	11SHRILEMIWSDSZ0	Driver Shoulder Middle Displacement (Z)	0	+	no	60
29	11SHRILEMIWSDSL0	Driver Shoulder Middle Length Change	600	+	no	60
30	11SHRILEFRWSDSX0	Driver Shoulder Front Displacement (X)	0	+	no	60
31	11SHRILEFRWSDSY0	Driver Shoulder Front Displacement (Y)	0	+	no	60
32	11SHRILEFRWSDSZ0	Driver Shoulder Front Displacement (Z)	0	+	no	60
33	11SHRILEFRWSDSL0	Driver Shoulder Front Length Change	600	+	no	60

Channel Number	ISO mnemonic	Channel Title	Filter Class	Flip	Zero	Full Scale
34	11TRRILUREWSDSX0	Driver Thorax Rib 1 Rear Displacement (X)	0	+	no	60
35	11TRRILUREWSDSY0	Driver Thorax Rib 1 Rear Displacement (Y)	0	+	no	60
36	11TRRILUREWSDSZ0	Driver Thorax Rib 1 Rear Displacement (Z)	0	+	no	60
37	11TRRILUREWSDSLB	Driver Thorax Rib 1 Rear Length Change	600	+	no	60
38	11TRRILUMIWSDSX0	Driver Thorax Rib 1 Middle Displacement (X)	0	+	no	60
39	11TRRILUMIWSDSY0	Driver Thorax Rib 1 Middle Displacement (Y)	0	+	no	60
40	11TRRILUMIWSDSZ0	Driver Thorax Rib 1 Middle Displacement (Z)	0	+	no	60
41	11TRRILUMIWSDSLB	Driver Thorax Rib 1 Middle Length Change	600	+	no	60
42	11TRRILUFRWSDSX0	Driver Thorax Rib 1 Front Displacement (X)	0	+	no	60
43	11TRRILUFRWSDSY0	Driver Thorax Rib 1 Front Displacement (Y)	0	+	no	60
44	11TRRILUFRWSDSZ0	Driver Thorax Rib 1 Front Displacement (Z)	0	+	no	60
45	11TRRILUFRWSDSLB	Driver Thorax Rib 1 Front Length Change	600	+	no	60
46	11TRRILMREWSDSX0	Driver Thorax Rib 2 Rear Displacement (X)	0	+	no	60
47	11TRRILMREWSDSY0	Driver Thorax Rib 2 Rear Displacement (Y)	0	+	no	60
48	11TRRILMREWSDSZ0	Driver Thorax Rib 2 Rear Displacement (Z)	0	+	no	60
49	11TRRILMREWSDSLB	Driver Thorax Rib 2 Rear Length Change	600	+	no	60
50	11TRRILMMIWSDSX0	Driver Thorax Rib 2 Middle Displacement (X)	0	+	no	60
51	11TRRILMMIWSDSY0	Driver Thorax Rib 2 Middle Displacement (Y)	0	+	no	60
52	11TRRILMMIWSDSZ0	Driver Thorax Rib 2 Middle Displacement (Z)	0	+	no	60
53	11TRRILMMIWSDSLB	Driver Thorax Rib 2 Middle Length Change	600	+	no	60
54	11TRRILMFRWSDSX0	Driver Thorax Rib 2 Front Displacement (X)	0	+	no	60
55	11TRRILMFRWSDSY0	Driver Thorax Rib 2 Front Displacement (Y)	0	+	no	60
56	11TRRILMFRWSDSZ0	Driver Thorax Rib 2 Front Displacement (Z)	0	+	no	60
57	11TRRILMFRWSDSLB	Driver Thorax Rib 2 Front Length Change	600	+	no	60

Channel Number	ISO mnemonic	Channel Title	Filter Class	Flip	Zero	Full Scale
58	11TRRILLREWSDSX0	Driver Thorax Rib 3 Rear Displacement (X)	0	+	no	60
59	11TRRILLREWSDSY0	Driver Thorax Rib 3 Rear Displacement (Y)	0	+	no	60
60	11TRRILLREWSDSZ0	Driver Thorax Rib 3 Rear Displacement (Z)	0	+	no	60
61	11TRRILLREWSDSLB	Driver Thorax Rib 3 Rear Length Change	600	+	no	60
62	11TRRILLMIWSDSX0	Driver Thorax Rib 3 Middle Displacement (X)	0	+	no	60
63	11TRRILLMIWSDSY0	Driver Thorax Rib 3 Middle Displacement (Y)	0	+	no	60
64	11TRRILLMIWSDSZ0	Driver Thorax Rib 3 Middle Displacement (Z)	0	+	no	60
65	11TRRILLMIWSDSLB	Driver Thorax Rib 3 Middle Length Change	600	+	no	60
66	11TRRILLFRWSDSX0	Driver Thorax Rib 3 Front Displacement (X)	0	+	no	60
67	11TRRILLFRWSDSY0	Driver Thorax Rib 3 Front Displacement (Y)	0	+	no	60
68	11TRRILLFRWSDSZ0	Driver Thorax Rib 3 Front Displacement (Z)	0	+	no	60
69	11TRRILLFRWSDSLB	Driver Thorax Rib 3 Front Length Change	600	+	no	60
70	11ABRILUREWSDSX0	Driver Abdomen Rib 1 Rear Displacement (X)	0	+	no	60
71	11ABRILUREWSDSY0	Driver Abdomen Rib 1 Rear Displacement (Y)	0	+	no	60
72	11ABRILUREWSDSZ0	Driver Abdomen Rib 1 Rear Displacement (Z)	0	+	no	60
73	11ABRILUREWSDSLB	Driver Abdomen Rib 1 Rear Length Change	600	+	no	60
74	11ABRILUMIWSDSX0	Driver Abdomen Rib 1 Middle Displacement (X)	0	+	no	60
75	11ABRILUMIWSDSY0	Driver Abdomen Rib 1 Middle Displacement (Y)	0	+	no	60
76	11ABRILUMIWSDSZ0	Driver Abdomen Rib 1 Middle Displacement (Z)	0	+	no	60
77	11ABRILUMIWSDSLB	Driver Abdomen Rib 1 Middle Length Change	600	+	no	60
78	11ABRILUFRWSDSX0	Driver Abdomen Rib 1 Front Displacement (X)	0	+	no	60
79	11ABRILUFRWSDSY0	Driver Abdomen Rib 1 Front Displacement (Y)	0	+	no	60
80	11ABRILUFRWSDSZ0	Driver Abdomen Rib 1 Front Displacement (Z)	0	+	no	60
81	11ABRILUFRWSDSLB	Driver Abdomen Rib 1 Front Length Change	600	+	no	60

Channel Number	ISO mnemonic	Channel Title	Filter Class	Flip	Zero	Full Scale
82	11ABRILLREWSDSX0	Driver Abdomen Rib 2 Rear Displacement (X)	0	+	no	60
83	11ABRILLREWSDSY0	Driver Abdomen Rib 2 Rear Displacement (Y)	0	+	no	60
84	11ABRILLREWSDSZ0	Driver Abdomen Rib 2 Rear Displacement (Z)	0	+	no	60
85	11ABRILLREWSDSLB	Driver Abdomen Rib 2 Rear Length Change	600	+	no	60
86	11ABRILLMIWSDSX0	Driver Abdomen Rib 2 Middle Displacement (X)	0	+	no	60
87	11ABRILLMIWSDSY0	Driver Abdomen Rib 2 Middle Displacement (Y)	0	+	no	60
88	11ABRILLMIWSDSZ0	Driver Abdomen Rib 2 Middle Displacement (Z)	0	+	no	60
89	11ABRILLMIWSDSLB	Driver Abdomen Rib 2 Middle Length Change	600	+	no	60
90	11ABRILLFRWSDSX0	Driver Abdomen Rib 2 Front Displacement (X)	0	+	no	60
91	11ABRILLFRWSDSY0	Driver Abdomen Rib 2 Front Displacement (Y)	0	+	no	60
92	11ABRILLFRWSDSZ0	Driver Abdomen Rib 2 Front Displacement (Z)	0	+	no	60
93	11ABRILLFRWSDSLB	Driver Abdomen Rib 2 Front Length Change	600	+	no	60
94	11THSP0100WSACXP	Driver Spine T1 Acceleration (X)	180	+	yes	2000
95	11THSP0100WSACYP	Driver Spine T1 Acceleration (Y)	180	+	yes	2000
96	11THSP0100WSACZP	Driver Spine T1 Acceleration (Z)	180	+	yes	2000
96A	11THSP0100WSACRP	Driver Spine T1 Acceleration Resultant	180			
97	11THSP0400WSACXP	Driver Spine T4 Acceleration (X)	180	+	yes	2000
98	11THSP0400WSACYP	Driver Spine T4 Acceleration (Y)	180	+	yes	2000
99	11THSP0400WSACZP	Driver Spine T4 Acceleration (Z)	180	+	yes	2000
99A	11THSP0400WSACRP	Driver Spine T4 Acceleration Resultant	180			
100	11THSP1200WSACXP	Driver Spine T12 Acceleration (X)	180	+	yes	2000
101	11THSP1200WSACYP	Driver Spine T12 Acceleration (Y)	180	+	yes	2000
102	11THSP1200WSACZP	Driver Spine T12 Acceleration (Z)	180	+	yes	2000
102A	11THSP1200WSACRP	Driver Spine T12 Acceleration Resultant	180			
103	11PUBC0000WSFOYP	Driver Pubic Symphysis Force (Y)	600	+	yes	12000
104	11SACRLE00WSFOXP	Driver Sacro-iliac Left Force (X)	600	+	yes	6000
105	11SACRLE00WSFOYP	Driver Sacro-iliac Left Force (Y)	600	+	yes	12000
106	11SACRLE00WSFOZP	Driver Sacro-iliac Left Force (Z)	600	+	yes	6000
107	11SACRLE00WSMOXP	Driver Sacro-iliac Left Moment (X)	600	+	yes	800
108	11SACRLE00WSMOYP	Driver Sacro-iliac Left Moment (Y)	600	+	yes	400
109	11SACRLE00WSMOZP	Driver Sacro-iliac Left Moment (Z)	600	+	yes	400

Channel Number	ISO mnemonic	Channel Title	Filter Class	Flip	Zero	Full Scale
110	11SACRRI00WSFOXP	Driver Sacro-iliac Right Force (X)	600	+	yes	6000
111	11SACRRI00WSFOYP	Driver Sacro-iliac Right Force (Y)	600	+	yes	12000
112	11SACRRI00WSFOZP	Driver Sacro-iliac Right Force (Z)	600	+	yes	6000
113	11SACRRI00WSMOXP	Driver Sacro-iliac Right Moment (X)	600	+	yes	800
114	11SACRRI00WSMOYP	Driver Sacro-iliac Right Moment (Y)	600	+	yes	400
115	11SACRRI00WSMOZP	Driver Sacro-iliac Right Moment (Z)	600	+	yes	400
116	11LUSP0000WSFOXP	Driver Lumbar Force (X)	600	+	yes	10000
117	11LUSP0000WSFOYP	Driver Lumbar Force (Y)	600	+	yes	10000
118	11LUSP0000WSFOZP	Driver Lumbar Force (Z)	600	+	yes	12000
119	11LUSP0000WSMOXP	Driver Lumbar Moment (X)	600	+	yes	300
120	11LUSP0000WSMOYP	Driver Lumbar Moment (Y)	600	+	yes	300
121	11LUSP0000WSMOZP	Driver Lumbar Moment (Z)	600	+	yes	200
122	11PELV0000WSACXP	Driver Pelvic Acceleration (X)	1000	+	yes	2000
123	11PELV0000WSACYP	Driver Pelvic Acceleration (Y)	1000	+	yes	2000
124	11PELV0000WSACZP	Driver Pelvic Acceleration (Z)	1000	+	yes	2000
124A	11PELV0000WSACRP	Driver Pelvic Acceleration Resultant	1000			
125	11FEMRLE00WSFOXP	Driver Left Femur Force (X)	600	+	yes	15000
126	11FEMRLE00WSFOYP	Driver Left Femur Force (Y)	600	+	yes	15000
127	11FEMRLE00WSFOZP	Driver Left Femur Force (Z)	600	+	yes	15000
128	11FEMRLE00WSMOXP	Driver Left Femur Moment (X)	600	+	yes	350
129	11FEMRLE00WSMOYP	Driver Left Femur Moment (Y)	600	+	yes	200
130	11FEMRLE00WSMOZP	Driver Left Femur Moment (Z)	600	+	yes	350
131	11FEACLE00WSFOXP	Driver Femoral Neck Force (X)	600	+	yes	10000
132	11FEACLE00WSFOYP	Driver Femoral Neck Force (Y)	600	+	yes	25000
133	11FEACLE00WSFOZP	Driver Femoral Neck Force (Z)	600	+	yes	10000
134	11KNEELE0UWSFOYP	Driver Left Outer Knee Force (Y)	600	+	yes	20000
135	11KNEELEINWSFOYP	Driver Left Inner Knee Force (Y)	600	+	yes	20000
136	11VEHCCG0000ACXA	Vehicle Center of Gravity Acceleration (X)	60	+	yes	2000
137	11VEHCCG0000ACYA	Vehicle Center of Gravity Acceleration (Y)	60	+	yes	2000
138	11VEHCCG0000ACZA	Vehicle Center of Gravity Acceleration (Z)	60	+	yes	2000
138A	11VEHCCG0000ACRA	Vehicle Center of Gravity Acceleration Resultant	60			
139	11VEHCCG0000AVXA	Vehicle Center of Gravity Angular Rate (X)	60	+	yes	8000
140	11VEHCCG0000AVYA	Vehicle Center of Gravity Angular Rate (Y)	60	+	yes	1500
141	11VEHCCG0000AVZA	Vehicle Center of Gravity Angular Rate (Z)	60	+	yes	8000
142	11VEHC00LO00ACYA	Left Floor Sill Acceleration (Y)	60	+	yes	2000
143	11APIL000000ACYA	Left A-Pillar Sill Acceleration (Y)	60	+	yes	2000
144	11APILLO0000ACYA	Left Lower A-Pillar Acceleration (Y)	60	+	yes	2000
145	11APILMI0000ACYA	Left Mid A-Pillar Acceleration (Y)	60	+	yes	2000

Channel Number	ISO mnemonic	Channel Title	Filter Class	Flip	Zero	Full Scale
146	11BPIL000000ACYA	Left B-Pillar Sill Acceleration (Y)	60	+	yes	2000
147	11BPILLO0000ACYA	Left Lower B-Pillar Acceleration (Y)	60	+	yes	2000
148	11BPILMI0000ACYA	Left Mid B-Pillar Acceleration (Y)	60	+	yes	2000
149	11SETR000000ACYA	Driver Seat Track at Dummy H-Point Acceleration (Y)	60	+	yes	2000
150	11ENGNTTP0000ACXA	Engine Top Acceleration (X)	60	+	yes	2000
151	11ENGNTTP0000ACYA	Engine Top Acceleration (Y)	60	+	yes	2000
152	12FIRCX000000ACYA	Firewall Center Acceleration (Y)	60	+	yes	2000
153	13ROFR000000ACYA	Right Roof at Vertical Impact Reference Line Acceleration (Y)	60	+	yes	2000
154	13SILB000000ACXA	Right Sill at Vertical Impact Reference Line Acceleration (X)	60	+	yes	2000
155	13SILB000000ACYA	Right Sill at Vertical Impact Reference Line Acceleration (Y)	60	+	yes	2000
156	13SILB000000ACZA	Right Sill at Vertical Impact Reference Line Acceleration (Z)	60	+	yes	2000
156A	13SILB000000ACRA	Right Sill at Vertical Impact Reference Line Acceleration Resultant	60			
157	16SILB000000ACXA	Right Sill at Rear Seat Acceleration (X)	60	+	yes	2000
158	16SILB000000ACYA	Right Sill at Rear Seat Acceleration (Y)	60	+	yes	2000
159	16SILB000000ACZA	Right Sill at Rear Seat Acceleration (Z)	60	+	yes	2000
159A	16SILB000000ACRA	Right Sill at Rear Seat Acceleration Resultant	60			
160	11FORA000000ACXA	Rear Floorpan Behind Rear Axle at Centerline Acceleration (X)	60	+	yes	2000
161	11FORA000000ACYA	Rear Floorpan Behind Rear Axle at Centerline Acceleration (Y)	60	+	yes	2000
162	11DOORMIMI71ACYA	Left Front Door Mid Centerline Acceleration (Y)	60	+	yes	2000
163	11DOORMIRE71ACYA	Left Front Door Mid Rear Acceleration (Y)	60	+	yes	2000
164	11DOORMIUP71ACYA	Left Front Door Upper Centerline Acceleration (Y)	60	+	yes	2000
165	14DOORMIRE71ACYA	Left Rear Door Mid Rear Acceleration (Y)	60	+	yes	2000
166	14DOORMIUP71ACYA	Left Rear Door Upper Centerline Acceleration (Y)	60	+	yes	2000
167	10FORARD0000ACXA	Rear Deck Acceleration (X)	60	+	yes	2000
168	10FORARD0000ACYA	Rear Deck Acceleration (Y)	60	+	yes	2000
169	10FORARD0000ACZA	Rear Deck Acceleration (Z)	60	+	yes	2000
169A	10FORARD0000ACRA	Rear Deck Acceleration Resultant	60			
170	10FORARD0000AVXA	Rear Deck Angular Rate (X)	60	+	yes	8000
171	10FORARD0000AVYA	Rear Deck Angular Rate (Y)	60	+	yes	8000
172	10FORARD0000AVZA	Rear Deck Angular Rate (Z)	60	+	yes	8000

Channel Number	ISO mnemonic	Channel Title	Filter Class	Flip	Zero	Full Scale
173	11HEADCONT00VO00	Driver Head Contact	0	+	no	1
174	11SHOUCONT00VO00	Driver Shoulder Contact	0	+	no	1
175	11THORCONT00VO00	Driver Thorax Contact	0	+	no	1
176	11PELVCONT00VO00	Driver Pelvis Contact	0	+	no	1
177	K0FBAR010000FOXA	POLE LOAD CELL 1	60	+	yes	400000
178	K0FBAR020000FOXA	POLE LOAD CELL 2	60	+	yes	400000
179	K0FBAR030000FOXA	POLE LOAD CELL 3	60	+	yes	400000
180	K0FBAR040000FOXA	POLE LOAD CELL 4	60	+	yes	400000
181	K0FBAR050000FOXA	POLE LOAD CELL 5	60	+	yes	400000
182	K0FBAR060000FOXA	POLE LOAD CELL 6	60	+	yes	400000
183	K0FBAR070000FOXA	POLE LOAD CELL 7	60	+	yes	400000
184	K0FBAR080000FOXA	POLE LOAD CELL 8	60	+	yes	400000

APPENDIX E
SEATING PROCEDURE WORKSHEETS AND PLOTS

Driver WSID 50th Seating Worksheet

Vehicle	2020 Hyundai Santa Fe	Technician	Postle, Ramadan & Xu
VIN #	5MNS23AD8LH262066	Position	Driver
ATD	WorldSID EB8888	Date	12/15/2020
Test #	201215		

SCRL Angle	Max	14.4	WSID 50th Tilt Sensors		X	Y
	Min -	11.7	Head	0°±2	-0.8	-1.5
	Difference	2.7				
	/2	1.35	T6	0°±2	0.0	-0.2
	Min +	1.35				
	Mid Angle	13.05	Pelvis	0°±2	-0.5	1.4

Seat Back Angle	W/Level °	17.3	HEAD REST POST		FINAL HEAD REST	
Seat Pan Angle	W/Level °	11.1	ANGLE	1.0	POST ANGLE	1.2

Pelvis Angle	WSID 50th 0° +/-2.5°	Manual Inclinometer	40.3	Tilt Sensor	
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Collected Points			
Name	Meas X	Meas Y	Meas Z
SBU -	-32.917	2.455	-11.736
SBL -	-29.902	1.116	19.381
STRIKER -	0.000	0.000	0.000
FOSB -	458.852	185.974	504.409
FISB -	458.512	648.996	503.095
ROSB -	-28.656	185.821	541.541
RISB -	-28.777	650.277	540.430
PCP - (Pedal Center Point)	1030.754	605.306	406.052
RHP - (Right Heel Point)	910.174	605.028	564.696
LHP - (Left Heel Point)	912.364	266.781	567.535
S0 -	498.230	428.538	-120.454
TS -	584.582	428.796	-276.662
BS -	426.372	428.153	37.950
SC1 -	421.549	-2.952	12.840
OSCAR H-POINT -	179.153	235.105	254.053
DR PROJECTED WSID H-POINT AT MID-POSITION -	199.000		234.000
DRIVER STP 15.27 MID-POSITION -	201.000		319.000
DRIVER STP STEP 18.6 TRIAL 1 -	173.288	171.622	321.281
DR PROJECTED WSID H-POINT STEP 18.6.2 TRIAL 1 -	171.000		236.000
DRIVER STP STEP 18.6 TRIAL 2 -	199.693	171.127	320.232
DR PROJECTED WSID H-POINT STEP 18.6.2 TRIAL 2 -	198.000		235.000
DRIVER STP STEP 18.6 TRIAL 3 -			
DR PROJECTED WSID H-POINT STEP 18.6.2 TRIAL 3 -			
RHDCG -	43.824	511.121	-420.738
3DLHCG -	60.809	353.832	-421.751
LHDCG -	36.913	351.093	-424.231
BON -	135.485	429.249	-424.275
TN -	130.726	431.539	-367.312
TC -	116.621	430.225	-298.655
SHLD R1 -	87.330	432.999	-193.646
THX R1 -	125.441	433.125	-118.890
THX R2 -	159.729	433.079	-52.840
THX R3 -	176.529	433.725	-8.000
ABD R1 -	194.485	437.455	47.699
ABD R2 -	215.140	438.590	94.141
TPS -	245.029	426.458	114.727
C1 -	108.165	431.062	-173.903
C2 -	135.019	426.856	-119.467
C3 -	197.243	428.116	40.435
SHT -	12.349	214.152	-158.550
E1 -	209.822	190.966	-20.082
P1 -	147.727	208.740	191.651
H-POINT -	202.704	207.069	240.358
H-POINT 2 -	202.476	214.017	240.275

OK -	587.925	175.531	132.815
IK -	598.804	662.575	139.965
OA -	854.600	216.903	449.276
IA -	876.849	564.028	440.475
OH -	873.101	214.896	565.199
IH -	915.042	602.604	563.946
OP -	-177.242	346.730	-276.246
R -	136.178	428.482	-618.907
H -	507.926	429.261	-572.042
W1 -	787.202	429.575	-424.950
W1 - Outside	804.510	430.140	-424.770
W2 - Outside	1078.609	430.119	-264.425
D1 -	709.229	429.920	-253.013
D2 -	686.418	165.244	49.641
D3 -	663.072	660.357	114.383
HRP -	135.259	235.002	-542.838
HSP -	134.646	86.550	-424.341
ADP -	210.677	46.630	-20.793
HDP -	202.072	80.951	240.641

Calculated Measurements					
Name	Cal X	Cal Y	Cal Z	Cal 3D Distance	Deg
HZ -			195		
HH -				401	
HW -	652				
NR -				463	
CD -				606	
CS -	363				
CBS -	229				
IKD -				69	
OKD -				129	
HR -				228	
HS -		343			
AD -		144			
HD -		126			
HLHL -				390	
KK -				487	
SH -				376	
HRA -					1.2
H-POINT TOOL ANGLE -					41.5
TORSO ANGLE -					14.0
WINDSHIELD ANGLE -					59.7