

REPORT NUMBER: R&D-KAR-20-009

**VEHICLE TO RIGID BARRIER CRASH TEST IN SUPPORT OF
NHTSA'S FRONTAL RESEARCH CRASH TEST PROGRAM
RIGHT SIDE 30° FRONTAL RIGID BARRIER IMPACT**

**MAZDA MOTOR CORPORATION
2020 MAZDA CX-5 5-DOOR MPV**

NHTSA No: R20205414

**PREPARED BY:
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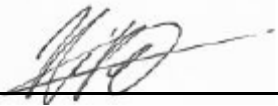
FEBRUARY 3, 2021

FINAL REPORT

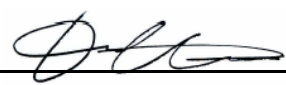
**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
VEHICLE SAFETY RESEARCH
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WASHINGTON, D.C. 20590**

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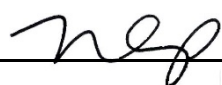
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FINAL REPORT ACCEPTANCE BY VEHICLE SAFETY RESEARCH,
OFFICE OF STRUCTURAL AND RESTRAINTS RESEARCH DIVISION:

TOM, Vehicle Crash Testing
NHTSA, Office of Structures and Restraints Research

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. R&D-KAR-20-009	2. Government Accession No.	3. Recipient's Catalog No.																																															
4. Title and Subtitle Final Report of Frontal Research Crash Testing of a 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414		5. Report Date February 3, 2021																																															
		6. Performing Organization Code KAR																																															
7. Authors Mr. Neeraj N. Patel, Project Engineer, Applus IDIADA KARCO Mr. Steven D. Matsusaka, Engineering Manager, Applus IDIADA KARCO		8. Performing Organization Report No. TR-P40212-01-NC																																															
		10. Work Unit No.																																															
9. Performing Organization Name and Address Applus IDIADA KARCO Engineering, LLC. 9270 Holly Rd. Adelanto, CA 92301		11. Contract or Grant No. DTNH22-14-D-00360L																																															
		13. Type of Report and Period Covered Final Test Report, December 18, 2020 - February 3, 2021																																															
12. Sponsoring Agency Name and Address U. S. Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Research 1200 New Jersey Ave., SE, Room W46-446 Washington, D.C. 20590		14. Sponsoring Agency Code NVS-321																																															
		15. Supplementary Notes																																															
16. Abstract A 40.0 km/h Right Side 30° Frontal Rigid Barrier Impact Test was conducted on a 2020 Mazda CX-5 5-door MPV in accordance with Contract DTNH22-14-D-00360L, Task Order #693JJ918F000199. The test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at the Applus IDIADA KARCO Engineering, LLC. facility in Adelanto, California on December 18, 2020. The impact velocity of the vehicle was 40.11 km/h and the ambient temperature at the barrier at the time of impact was 13.3°C. The vehicle's post-test maximum crush was 209 mm measured to the right of the vehicle's centerline. The test vehicle's performance was as follows: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th rowspan="2">Units</th> <th>Driver Hybrid III</th> <th>Passenger THOR</th> </tr> <tr> <th>Result</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₁₅)</td> <td></td> <td>72.04</td> <td>120.10</td> </tr> <tr> <td>Brain Injury Criteria (BrIC)</td> <td></td> <td></td> <td>0.73</td> </tr> <tr> <td>Nij</td> <td></td> <td>0.30</td> <td></td> </tr> <tr> <td>Peak Neck Tension</td> <td>N</td> <td>1281.98</td> <td>169.10</td> </tr> <tr> <td>Peak Neck Compression</td> <td>N</td> <td>-129.80</td> <td>-2286.30</td> </tr> <tr> <td>Peak Chest Deflection</td> <td>mm</td> <td>-24.29</td> <td>39.00</td> </tr> <tr> <td>Peak Abdomen Deflection</td> <td>mm</td> <td></td> <td>-32.40</td> </tr> <tr> <td>Peak Resultant Acetabulum Force</td> <td>N</td> <td></td> <td>1991.20</td> </tr> <tr> <td>Peak Femur Force</td> <td>N</td> <td>-5713.42</td> <td>-4110.00</td> </tr> <tr> <td>Peak Tibia Index</td> <td></td> <td></td> <td>0.33</td> </tr> </tbody> </table>				Measurement Description	Units	Driver Hybrid III	Passenger THOR	Result	Result	Head Injury Criteria (HIC ₁₅)		72.04	120.10	Brain Injury Criteria (BrIC)			0.73	Nij		0.30		Peak Neck Tension	N	1281.98	169.10	Peak Neck Compression	N	-129.80	-2286.30	Peak Chest Deflection	mm	-24.29	39.00	Peak Abdomen Deflection	mm		-32.40	Peak Resultant Acetabulum Force	N		1991.20	Peak Femur Force	N	-5713.42	-4110.00	Peak Tibia Index			0.33
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		19. Security Classification of this report UNCLASSIFIED																																															
20. Security Classification of this page UNCLASSIFIED		21. No. of Pages 209	22. Price																																														

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SECTION 1

TEST PURPOSE AND PROCEDURE

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

This 40.0 km/h (24.9 mph) Right Side 30° Frontal Rigid Barrier Impact Test is part of the Frontal Research Crash Test Program outlined in Contract No. DTNH22-14-D-00360L, Task Order #693JJ918F000199. The purpose of this test is to obtain vehicle crashworthiness and occupant restraint system performance data for research purposes.

This test was conducted in accordance with the instructions set forth for a 40.0 km/h Right Side 30° Frontal Rigid Barrier Impact, outlined in Contract No. DTNH22-14-D-00360L, Task Order #693JJ918F000199. Data indicant of Federal Motor Vehicle Safety Standard FMVSS 208 - Occupant Crash Protection, FMVSS 212 – Windshield Mounting, FMVSS 219 (partial) – Windshield Zone Intrusion, and FMVSS 301 – Fuel System Integrity was obtained, in addition to the data required by Contract No. DTNH22-14-D-00360L, Task Order #693JJ918F000199.

SECTION 2

SUMMARY OF TEST RESULTS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

A 40.0 km/h Right Side 30° Frontal Rigid Barrier Impact Test was conducted on a 2020 Mazda CX-5 5-door MPV. The test was performed at Applus IDIADA KARCO Engineering, LLC. on December 18, 2020.

The test was documented by one (1) real-time and eighteen (18) high-speed video cameras. Pre- and post-test photographs of the test vehicle and test setup were taken using a digital still camera. Photographic documentation of the test is presented in Appendix A of this report.

One (1) 50th percentile adult male THOR anthropomorphic test device (ATD) (Serial No. EG2595) was seated in the right front seating position (P2 – Passenger) and one (1) 50th percentile adult male Hybrid III ATD (Serial No. 168) was seated in the left front seating position (P1 - Driver). The passenger was positioned according to instructions specified in the THOR 50th Percentile Male Dummy Seating & Positioning Procedures: Driver Position. The driver was positioned according to instructions specified in FMVSS 208 Appendix F, Dummy Positioning Procedures for Driver and Passenger Test Dummy Conforming to Subpart E of Part 572.

The driver was restrained with a frontal airbag. The passenger was restrained with frontal, curtain, and torso-pelvis airbags. Both ATDs were unbelted for this test.

SECTION 2 ... (CONTINUED)
SUMMARY OF TEST RESULTS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

One hundred seventy-two (172) channels of data from the two (2) ATD's and the test vehicle were collected using Diversified Technical Systems, Inc. data acquisition systems. Appendix B contains dummy data plots, as well as vehicle response data plots.

There was 100% total windshield retention. There was no intrusion into the protected zone of the windshield during any portion of the impact event. The maximum static crush of the vehicle was 208.8 mm measured on the right of the vehicle's centerline.

All four vehicle doors remained closed and latched during the test. All doors remained operational after the impact event.

Structural observations include the following:

- The front end including the bumper, grill, and hood were crushed, with the damage concentrated on the right side of the vehicle
- The windshield was broken due to the impact with the passenger ATD's head

The driver ATD's visible contact points were:

- Head contacted the front airbag, center mirror, and dashboard
- Upper torso contacted the front airbag
- Lower torso contacted the front airbag
- Left leg contacted the knee bolster
- Right leg contacted the knee bolster

The right front passenger ATD's visible contact points were:

- Head contacted the front airbag, A-pillar trim, headliner, windshield, and curtain airbag
- Upper torso contacted the front airbag
- Lower torso contacted the front airbag
- Left leg contacted the knee bolster
- Right leg contacted the knee bolster

SECTION 2 ... (CONTINUED)
SUMMARY OF TEST RESULTS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

PRIMARY IMPACT DATA

Measured Parameter	Units	Value
Impact Velocity	km/h	40.11
Test Vehicle Weight	kg	1756
Maximum Static Crush	mm	208.8
Number of Data Channels		172
Number of Real-Time Cameras		1
Number of High-Speed Cameras		18

DUMMY CONTACTS

Description	Driver	Picture Ref.	Passenger	Picture Ref.
Dummy Type	Hybrid III, S/N: 168		THOR, S/N: EG 2595	
Head Contact	Front Airbag, Dashboard, Center Mirror	A-89	Front Airbag, A-Pillar Trim, Headliner, Curtain Airbag, Windshield	A-134, A-135, A-136a, A-136b, A-136c
Upper Torso Contact	Front Airbag	A-89	Front Airbag	A-134
Lower Torso Contact	Front Airbag	A-89	Front Airbag	A-134
Left Leg Contact	Knee Bolster	A-60, A-80	Knee Bolster	A-107, A-109
Right Leg Contact	Knee Bolster	A-60, A-80	Knee Bolster	A-107, A-109

SECTION 2 ... (CONTINUED)
SUMMARY OF TEST RESULTS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

DATA ANOMALIES

Channel Description	Explanation
Right Acetabulum Fx	Right acetabulum force X was received with bad channel. It was investigated why it was not working and was determined it was not fixable without replacing the loadcell. NHTSA approved running the test without recording this channel.
Occipital Condyle Potentiometer	Not wired when received and was not required to be recorded. NHTSA approved running the test without recording this channel.

SECTION 2 ... (CONTINUED)
SUMMARY OF TEST RESULTS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

Passenger, THOR S/N EG2595					
LOCATION	DESCRIPTION	UNIT	SOURCE	MAX	MIN
Head	HIC 15ms		Compute	120.1	
	Brain Injury Criteria (BrIC)		Compute	0.726	
	Head Rotational Velocity X	Deg/s	60	770.6	-1080.8
	Head Rotational Velocity Y	Deg/s	60	313.9	-1121.5
	Head Rotational Velocity Z	Deg/s	60	437.4	-1401.2
Neck	Upper Neck Z-axis Force	N	1000	169.1	-2286.3
	Upper Neck Y-axis Moment	Nm	600	1.2	-19.2
Chest	Upper Left Resultant Chest Deflection	mm	Compute	24.4	
	Upper Right Resultant Chest Deflection	mm	Compute	20.6	
	Lower Left Resultant Chest Deflection	mm	Compute	39.0	
	Lower Right Resultant Chest Deflection	mm	Compute	37.7	
Abdomen	Lower Left X-axis Deflection	mm	Compute	5.6	-8.6
	Lower Right X-axis Deflection	mm	Compute	5.4	-32.4
Acetabulum	Left Acetabulum Resultant Force	N	Compute	1991.2	
	Right Acetabulum Resultant Force	N	Compute	1745.7	
Femur	Left Femur Force, FZ	N	600	234.6	-2927.3
	Right Femur Force, FZ	N	600	22.7	-4110.0
Tibia	Left Upper Tibia, FZ	N	600	52.9	-1639.3
	Left Upper Tibia Index		Compute	0.233	
	Right Upper Tibia, FZ	N	600	0.0	-1532.0
	Right Upper Tibia Index		Compute	0.327	
	Left Lower Tibia, FZ	N	600	39.0	-2008.2
	Left Lower Tibia Index		Compute	0.192	
	Right Lower Tibia, FZ	N	600	0.0	-1846.3
	Right Lower Tibia Index		Compute	0.175	
Ankle	Left Ankle Rotation, RX	Deg	180	25.4	-13.8
	Left Ankle Rotation, RY	Deg	180	1.0	-9.8
	Left Ankle Dorsiflexion Moment, MY	Nm	Compute	18.1	-64.0
	Left Ankle In/Eversion Moment, MX	Nm	Compute	40.8	-8.8
	Right Ankle Rotation, RX	Deg	180	26.5	-14.3
	Right Ankle Rotation, RY	Deg	180	0.0	-19.1
	Right Ankle Dorsiflexion Moment, MY	Nm	Compute	28.0	-54.4
	Right Ankle In/Eversion Moment, MX	Nm	Compute	32.7	-14.6

Anomalies:

Right Acetabulum Fx is not functioning

SECTION 2 ... (CONTINUED)
SUMMARY OF TEST RESULTS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

Driver, Hybrid III 50th Percentile Male S/N 168					
Injury Reading	Units	Limit	Value	t ¹	t ²
HIC 15		700	72.035	126.1	141.1
Nij		1	0.300	130.0	NTE
Upper Neck Force Z (Tension)	N	4170	1281.980	140.0	
Upper Neck Force Z (Compression)	N	4000	-129.804	77.5	
Upper Neck Moment Y (Flexion)	Nm	310	29.637	91.0	
Upper Neck Moment Y (Extension)	Nm	135	-21.052	130.1	
Chest Deflection	mm	63	-24.288	129.8	
3 ms Chest Clip	g	60	30.691	120.8	123.8
Femur Force, Left	N	10000	-3524.653	91.0	
Femur Force, Right	N	10000	-5713.416	79.8	

SECTION 3

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

CONVERSION FACTORS

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	miles/hr	km/hr	1.609344
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.574
Pressure	Tire Pressures	lbf/in ²	kPa	6.895
Temperature	General Use	°F	°C	$=(T_f - 32)/1.8$
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf-ft	N•m	1.355

D17ATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	R20205414
Model Year	2020
Make	Mazda
Model	CX-5
Body Style	5-door MPV
VIN	JM3KFABM1L0801898
Body Color	Eternal Blue MC
Odometer Reading (km / mi)	11 / 7
Engine Displacement (L)	2.5
Type / No. of Cylinders	Inline 4-Cylinder
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	6
Overdrive	Yes
Final Drive	FWD
Roof Rack	No
Sunroof / T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADLs)	Yes

Traction Control System	Yes
Power Steering	Yes
Power Window Auto-Reverse	Yes
Driver Frontal 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
Front Pass. Frontal Airbag	Yes
Front Pass. Curtain Airbag	Yes
Front Pass. Head/Torso Airbag	No
Front Pass. Torso Airbag	No
Front Pass. Torso/Pelvis Airbag	Yes
Front Pass. Pelvis Airbag	No
Front Pass. Knee Airbag	No
Driver Seat Belt Pretensioner	Yes
Driver Load Limiter	Yes
Front Pass. Seat Belt Pretensioner	Yes
Front Pass. Load Limiter	Yes
Other Safety Restraint	Yes

Does Owner's Manual provide instructions to turn off automatic door locks?

Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Mazda Motor Corporation
Date of Manufacture	Feb-20

GVWR (kg)	2075
GAWR Front (kg)	1075
GAWR Rear (kg)	1000

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

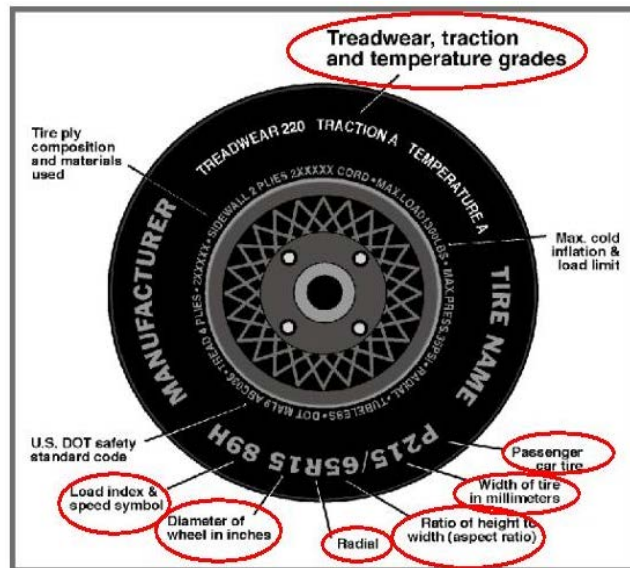
Measured Parameter	Front	Rear	Third	Total	
Type of Seats	Bucket	Split-Bench			
Designated Seating Capacity	2	3		5	
Capacity Weight (VCW) (kg)				385.0	A
DSC x 68.04 (kg)				340.2	B
Cargo Weight (RCLW) (kg)				44.8	A-B

*A maximum RCLW of 136.0 kg is used for a truck, MPV, or bus

DATA SHEET NO. 1 ... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20



Measured Parameter	Front	Rear
Max. Tire Pressure (kpa)	300	300
Cold Pressure (kPa)	230	230
Recommended Tire Size	225/65R17	225/65R17
Tire Size on Vehicle	225/65R17	225/65R17
Tire Manufacturer	Yokohama	Yokohama
Tire Model	Geolander	Geolander
Treadware	280	280
Traction Grade	B	B
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Steel, 2 Polyester, 1 Nylon	2 Steel, 2 Polyester, 1 Nylon
Load Index/Speed Symbol	100H	100H
Tire Material	Polyester, Nylon, Steel	Polyester, Nylon, Steel
DOT Safety Code Left	FDF5 PC50520	FDF5 PC50520
DOT Safety Code Right	FDF5 PC50520	FDF5 PC50520

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

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

TEST VEHICLE WEIGHTS

	Units	As Delivered Weights (UVW)			As Tested Weights (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	468.0	329.0		509.0	379.0	
Right	kg	450.0	309.0		505.0	363.0	
Ratio	%	59.0%	41.0%	100.0%	57.7%	42.3%	100.0%
Total	kg	918.0	638.0	1556.0	1014.0	742.0	1756.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1556.0	A
Weight of THOR-50M and AM50	kg	164.0	B
Rated Cargo/Luggage Weight (RCLW)	kg	44.8	C
Calculated Vehicle Target Weight (TVTW)	kg	1764.8	A+B+C

TEST VEHICLE ATTITUDES

Condition	Units	LF	RF	LR	RR	CG Aft of Front Axle
As Delivered	mm	803	805	822	830	1107
As Tested	mm	787	790	799	812	1141
Post-Test	mm	784	805	816	796	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2700
Total Vehicle Length at Left Side	mm	4304
Total Vehicle Length at Centerline	mm	4557
Total Vehicle Length at Right Side	mm	4313
Weight of Ballast/Equipment in Cargo Area	kg	77.7
Weight of Vehicle Components Removed	kg	24.5
Amount of Stoddard Solvent in Fuel Tank	L	52.10

VEHICLE COMPONENTS REMOVED TO MEET TEST WEIGHT:

Taillights, rear trim, spare tire and tools, underbody covers.

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

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

TARGET VEHICLE STRUCTURAL MEASUREMENTS

No.	Description	Units	Pre-Test
1	Total Length	mm	4557
2	Total Width	mm	1847
3*	Bumper Top Height	mm	599
4*	Bumper Bottom Height	mm	434
5*	Longitudinal Member Top Height	mm	599
6	Distance Between Longitudinal Members	mm	923
7	Longitudinal Member Width	mm	32
8*	Engine Top Height	mm	930
9*	Engine Bottom Height	mm	219
10	Engine and Gearbox Width	mm	603
11	Front Bumper to Engine Distance	mm	467
12*	Front Shock Absorber Fixing Height	mm	1020
13*	Bonnet Leading Edge Height	mm	900
14	Front Shock Absorber Fixing Width	mm	603
15	Front Bumper to Front Axle Distance	mm	950
16	Front Axle to A-Pillar Distance	mm	587
17	A-Pillar to B-Pillar Distance	mm	991
18	B-Pillar to Rear Axle Distance	mm	1111
19	B-Pillar to C-Pillar Distance	mm	987
20*	Roof Sill Bottom Height	mm	1555
21*	Roof Sill Top Height	mm	1665
22*	Floor Sill Bottom Height	mm	330
23*	Floor Sill Top Height	mm	420

*Note: Height measurements are in reference to the ground.

DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL

Test Vehicle: 2020 Mazda CX-5 5-Door MPV

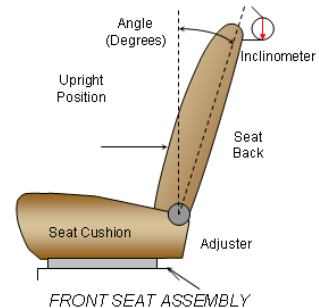
NHTSA No. R20205414

Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact

Test Date: 12/18/20

NOMINAL DESIGN RIDING POSITION

The passenger seat back was initially set to the manufacturer's designated angle listed in FORM 208 but was moved rearward per THOR seating procedure to level the head. The driver seat back was set to the manufacturer's designated angle listed in FORM 208.

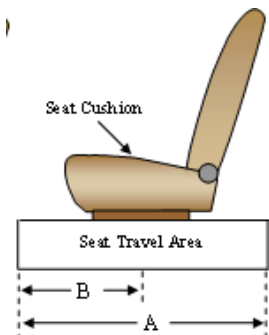


SEAT BACK ANGLE

Seating Position	Unit	FORM 208 Position	After ATD Positioning
Driver Seat Back Angle	Degrees	6.2	5.4
Passenger Seat Back Angle	Degrees	6.2	8.4

SEAT FORE / AFT POSITIONING

The driver seat travel is measured from the forward most position to the rear most position with the seat cushion set at mid angle. The driver seat was initially positioned 25 mm rearward of mid-track before being moved as far forward as possible where the ATD did not contact any interior panels, up to mid-track. The passenger seat travel is measured from the forward most possible position to the rear most possible position. The passenger seat is set to the middle of the fore-aft travel.



SEAT FORE/AFT POSITIONS

Seating Position	Total Fore/Aft Travel (mm)	Placed in Position (mm)
Driver Seat	325	162
Passenger Seat	259	130

SEAT BELT UPPER ANCHORAGE

The seat belt upper anchorage is positioned to the manufacturer's design position for a 50th percentile adult male ATD for the driver and passenger. Position "H" is the uppermost position, followed by position "M1" and "M2." Position "L" is the lowermost position.

SEAT BELT UPPER ANCHORAGES

Seating Position	Total No. of Positions	Placed in Position
Driver Seat	4	H
Passenger Seat	4	H

DATA SHEET NO. 2 ... (CONTINUED)

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL

Test Vehicle: 2020 Mazda CX-5 5-Door MPV

NHTSA No. R20205414

Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact

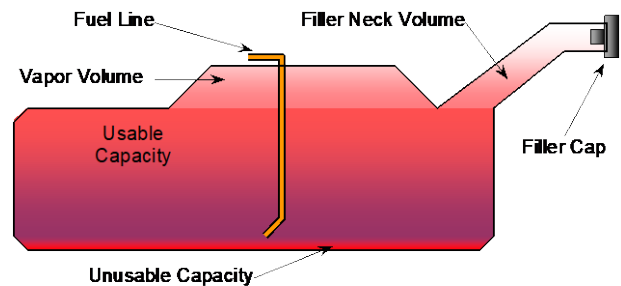
Test Date: 12/18/20

FUEL TANK CAPACITY

Description	Liters
Usable Capacity of "Standard Tank"	56.02
Usable Capacity of "Optional Tank"	
93% of Usable Capacity	52.10
Actual Amount of Stoddard Solvent Used	52.10
1/3 of Usable Capacity	18.67

FUEL PUMP

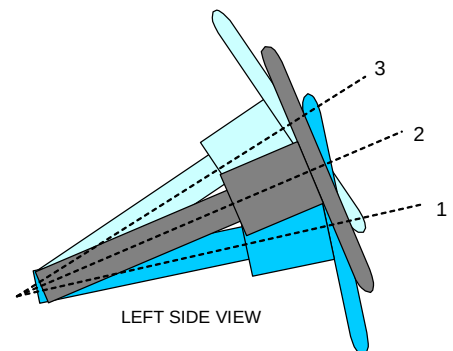
Fuel was evacuated according to the specifications provided by the manufacturer in Form 208. The electric fuel pump operates when the electrical system is activated.



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. A digital inclinometer is used to measure a plate which is placed across the rim of the steering wheel for angular measurements. A tape measure is used to measure telescoping steering wheel travel.



STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITIONING

	Degrees	Fore-Aft Position (mm)
Lowermost Position, No. 1	23.5	100
Geometric Center Position, No. 2	26.0	125
Uppermost Position, No. 3	28.4	150
Telescoping Steering Wheel Travel		50
Test Position	28.4	125

DATA SHEET NO. 3

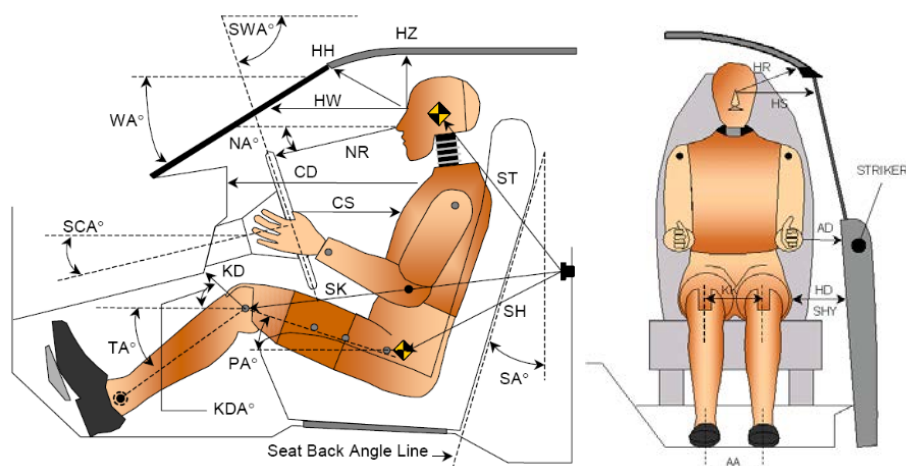
DUMMY CLEARANCE DIMENSIONS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV

NHTSA No. R20205414

Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact

Test Date: 12/18/20



LEFT SIDE VIEW

Code	Measurement Description	Driver S/N# 168		Passenger S/N# EG2595	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
HZ	Nasion to Roof (Z Distance)	233		201	
HH	Nasion to Header (3D Distance)	344		394	
HW	Nasion to Windshield Point 1 Inside (X Distance)	738		720	
NR	Tip of Nose to Top of Steering Wheel (3D Distance)	401			
CD	Chest Point 1 to Dash Point 1 (3D Distance)	528		568	
CS	Chest Point 2 to Center of Steering Wheel (X Distance)	297			
CBS	Chest Point 3 to Bottom of Steering Wheel (X Distance)	178			
IKD	Inboard Knee to Dash Point 3 (3D Distance)			79	
OKD	Outboard Knee to Dash Point 2 (3D Distance)	150		91	
HR	Nasion to Side Header (3D Distance)	245		218	
HS	Nasion to Side Window Distance (Y Distance)	366		346	
AD	Elbow to Door (Y Distance)	155		50	
HD	H-Point to Door (Y Distance)	222		195	
HLHL	Inboard Heel to Outboard Heel (Y Distance)	322		205	
KK	Inboard Knee to Outboard Knee (Y Distance)			234	
SH	Striker to H-Point (3D Distance)	329		336	
HRA	Head Restraint Post Angle		5.4		8.4
	H-Point Tool Angle		24.7		32.9
	Torso Angle		13.8		20.5
	Windshield Angle		60.4		60.9
	Head Angle (X)		1.6		0.3
	Head Angle (Y)				-0.6
	T1 Angle (X)				
	T1 Angle (Y)				
	T6 Angle (X)				-1.6
	T6 Angle (Y)				20.0
	T12 Angle (X)				
	T12 Angle (Y)				
	Pelvis Angle (X)				34.0
	Pelvis Angle (Y)				-0.8

DATA SHEET NO. 4

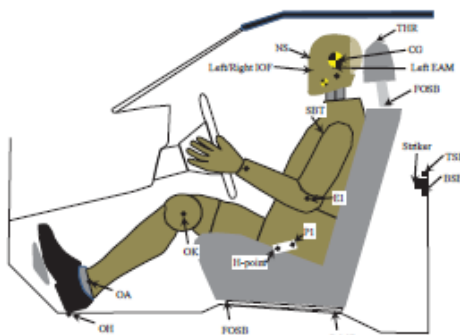
DUMMY CMM MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV

NHTSA No. R20205414

Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact

Test Date: 12/18/20



Description	Units	Driver S/N# 168			Passenger S/N# EG2595		
		X	Y	Z	X	Y	Z
Center of Upper Striker Bolt	mm	2035	-790	-326	2030	801	-324
Center of Lower Striker Bolt	mm	2041	-791	-290	2036	803	-289
Center of Striker Bar	mm	2069	-792	-313	2063	801	-311
Front Outboard Seat Bolt	mm	2557	-603	82	2556	616	82
Rear Outboard Seat Bolt	mm	2117	-604	128	2115	612	128
Center of Steering Wheel Hub	mm	2563	-364	-530			
Outer Head Restraint Post	mm	1890	-442	-643	1852	461	-666
Right Head CG	mm	2136	-282	-772	2070	452	-808
Left Head CG	mm	2139	-434	-773	2068	297	-809
Right EAM	mm				2067	444	-780
Left EAM	mm				2067	300	-779
Nasion	mm	2229	-364	-769	2155	373	-826
Right IOF	mm				2154	406	-786
Left IOF	mm				2154	343	-786
Tip of Nose	mm	2251	-362	-731	2160	372	-757
Tip of Chin	mm	2230	-365	-660	2161	369	-693
Chest Point 1	mm	2261	-365	-521	2200	373	-568
Chest Point 2	mm	2251	-364	-536			
Chest Point 3	mm	2314	-364	-379			
Shoulder Point 1	mm	2121	-553	-522	2062	575	-581
Shoulder Point 2	mm				2062	575	-581
Elbow	mm	2329	-583	-365	2062	575	-581
Center of H-Point Tool	mm				2062	575	-581
H-Point on H-Point Tool	mm	2295	-647	-126	2062	575	-581
H-Point on ATD Skin	mm	2294	-549	-126	2062	575	-581
Outboard Knee	mm	2685	-547	-279	2728	538	-292
Inboard Knee	mm				2722	304	-293
Outboard Ankle	mm	2964	-582	59	3003	539	12
Inboard Ankle	mm	2971	-255	48	2990	327	14
Outboard Heel	mm	2986	-548	162	2987	480	146
Inboard Heel	mm	2975	-225	161	2967	276	148

Reference Point:

+X – From the rear of the vehicle to the front of the vehicle

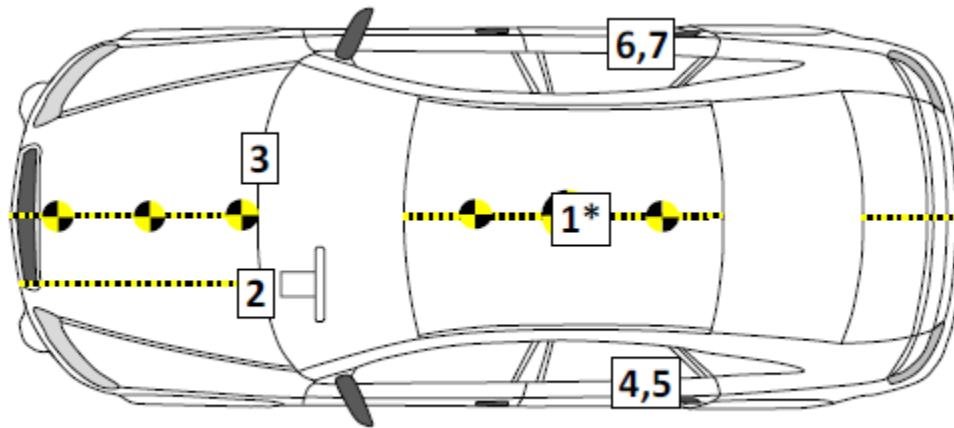
+Y – From the left side of the vehicle to the right side of the vehicle

+Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO. 5

VEHICLE INSTRUMENTATION DATA

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20



* Use Mounting Plate

VEHICLE ACCELEROMETER PRE-TEST LOCATIONS RELATIVE TO VCS

No.	Instrumentation Location	Axes	Units	Coordinates (mm)		
				X	Y	Z
1	Vehicle CG (Acceleration and Angular Rate)	x, y, z	g, °/s	1805	4	62
2	Driver Floor Pan	x, y, z	°/s	3298	-403	33
3	Passenger Floor Pan	x, y, z	g	3217	398	76
4	Door Sill LR	x, y	g	1607	-720	155
5	Door Sill LR Redundant	x, y	g	1585	-720	156
6	Door Sill RR	x, y	g	1608	707	156
7	Door Sill RR Redundant	x, y	g	1582	709	157

Reference Point:

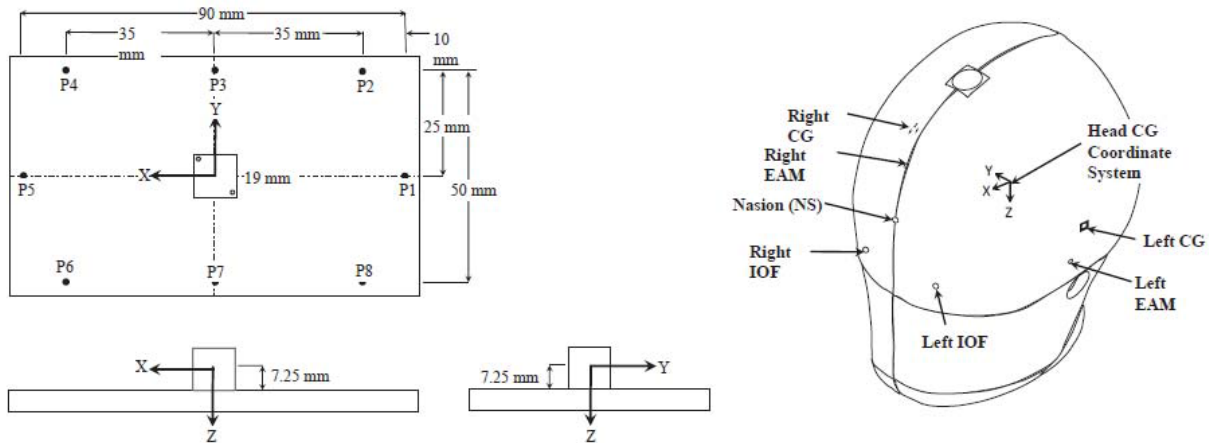
- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO. 5 ... (CONTINUED)

VEHICLE INSTRUMENTATION DATA

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

ANGULAR RATE SENSOR MOUNTING PLATE & THOR HEAD POINT DEFINITIONS



CG ARS MOUNTING PLATE - VEHICLE COORDINATE SYSTEM

No.	Description	Units	X	Y	Z
P1	Plate Point 1	mm	1860	-2	73
P2	Plate Point 2	mm	1851	-28	73
P3	Plate Point 3	mm	1817	-26	73
P4	Plate Point 4	mm	1781	-25	72
P5	Plate Point 5	mm	1770	2	72
P6	Plate Point 6	mm	1781	25	73
P7	Plate Point 7	mm	1851	27	73
P8	Plate Point 8	mm	1817	26	73

DRIVER HEAD POINTS IN RELATION TO HEAD CG COORDINATE SYSTEM

Description	Units	x	y	z
Left CG	mm	65	-42	45
Left EAM	mm	71	-36	72
Left IOF	mm	154	2	73
Right IOF	mm	153	66	72
Nasion	mm	157	36	35
Right EAM	mm	73	107	73
Right CG	mm	64	111	44

DATA SHEET NO. 5 ... (CONTINUED)

VEHICLE INSTRUMENTATION DATA

Test Vehicle: 2020 Mazda CX-5 5-Door MPV

NHTSA No. R20205414

Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact

Test Date: 12/18/20

Location No.	Description	Axes	Units	Positive Direction		Negative Direction	
				Max	Time (ms)	Min	Time (ms)
1	Vehicle CG	x	g	12.1	26.8	-29.5	34.6
		y	g	2.7	30.0	-15.9	48.8
		z	g	19.9	32.3	-16.9	24.0
	Vehicle CG Rotation	x	°/s	97.9	79.6	-84.9	53.3
		y	°/s	119.5	33.4	-98.9	30.6
		z	°/s	60.7	297.4	-62.2	63.3
2	Driver Floor Pan	x	g	1.9	28.4	-17.5	58.7
		y	g	7.0	79.5	-19.0	47.3
		z	g	18.3	56.4	-7.4	28.8
3	Passenger Floor Pan	x	g	7.9	64.1	-18.3	77.1
		y	g	9.0	80.5	-20.6	59.5
		z	g	24.1	61.0	-10.2	27.8
4	Door Sill LR	x	g	1.4	28.9	-23.7	61.3
		y	g	3.4	119.3	-14.2	49.4
5	Door Sill LR Redundant	x	g	1.7	168.7	-24.3	61.4
		y	g	2.7	55.5	-14.4	49.4
6	Door Sill RR	x	g	3.3	28.9	-22.7	82.1
		y	g	4.5	19.8	-14.4	48.9
7	Door Sill RR Redundant	x	g	3.5	28.8	-22.3	82.1
		y	g	3.1	19.6	-13.1	49.0

Note: See Appendix B for all vehicle data plots

DATA SHEET NO. 6

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

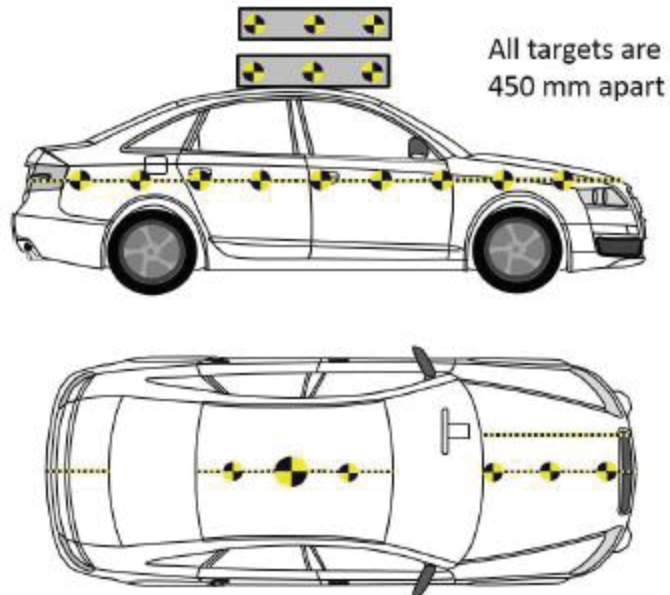
Test Vehicle: 2020 Mazda CX-5 5-Door MPV

NHTSA No. R20205414

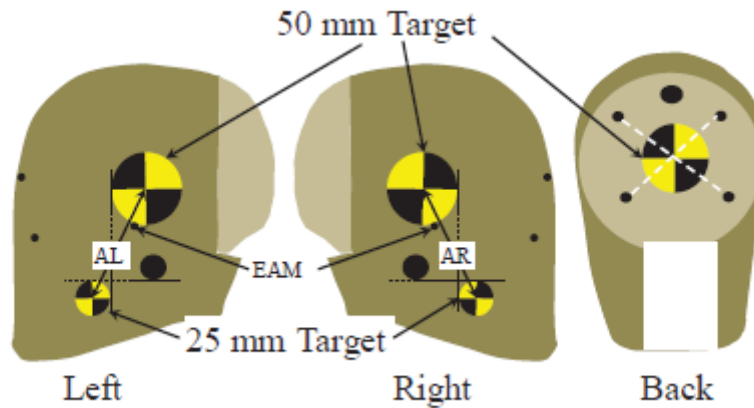
Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact

Test Date: 12/18/20

VEHICLE TARGETS



ATD HEAD TARGETS



Driver

Target	Units	Measurement
AL	mm	97
AR	mm	98

DATA SHEET NO. 7**TEST VEHICLE SUMMARY OF RESULTS**

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy Sensors	43
Passenger Dummy Sensors	99
Airbag Timing Sensors	10
Vehicle Structure Sensors	20
Total	172

CAMERA COVERAGE

Type of Camera	Number of Cameras Collected
High-Speed Vehicle Onboard	4
High-Speed Off-Board	14
Real-Time Panning	1
Total	19

DATA SHEET NO. 8
POST TEST OBSERVATIONS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

TEST DUMMY INFORMATION AND CONTACT

Description	Driver	Passenger
Dummy Type/Serial No.	AM-50 / 168	THOR-50M / EG2595
Lower Leg Type		LX
Lower Leg Serial No.		
Head Contact	Front Airbag, Center Mirror, Dashboard	Front Airbag, A-Pillar Trim, Headliner, Windshield, Curtain Airbag
Upper Torso Contact	Front Airbag	Front Airbag
Lower Torso Contact	Front Airbag	Front Airbag
Left Knee Contact	Knee Bolster	Knee Bolster
Right Knee Contact	Knee Bolster	Knee Bolster

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked / Unlocked Doors	Unlocked	Unlocked
Front Door Opening	Remained closed and latched, operational	Remained closed and latched, operational
Rear Door Opening	Remained closed and latched, operational	Remained closed and latched, operational
Seat Track Shift (mm)		
Seat Back Failure	None	None
Glazing Damage	Broken	

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	Good
Windshield Damage	Broken
Window Damage	None
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Driver		Passenger	
	Installed	Operated	Installed	Operated
Front Airbag	Yes	Yes	Yes	Yes
Side Airbag 1 (Curtain)	Yes	No	Yes	Yes
Side Airbag 2 (Torso/Pelvis)	Yes	No	Yes	Yes
Knee Airbag	No		No	
Seat Belt Pretensioner	Yes	N/A	Yes	N/A
Seat Belt Load Limiter	Yes	N/A	Yes	N/A

DATA SHEET NO. 9

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

No.	Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	4557	4510	-48
2	Rear Surface of Vehicle to Front of Engine	4091	3933	-158
3	RSOV to Firewall	3549	3546	-3
4	RSOV to Upper Leading Edge of Right Door	3052	3047	-4
5	RSOV to Upper Leading Edge of Left Door	3059	3057	-2
6	RSOV to Lower Leading Edge of Right Door	3081	3067	-14
7	RSOV to Lower Leading Edge of Left Door	3085	3084	-2
8	RSOV to Upper Trailing Edge of Right Door	1945	1942	-3
9	RSOV to Upper Trailing Edge of Left Door	1945	1947	2
10	RSOV to Lower Trailing Edge of Right Door	2075	2069	-6
11	RSOV to Lower Trailing Edge of Left Door	2072	2072	1
12	RSOV to Bottom of A-Pillar, Right Side	3013	3012	-2
13	RSOV to Bottom of A-Pillar, Left Side	3021	3020	-2
14	RSOV to Firewall, Right Side	3627	3592	-35
15	RSOV to Firewall, Left Side	3637	3639	2
16	RSOV to Steering Column	2566	2560	-6
17	Center of Steering Column to A-Pillar	455	460	4
18	Center of Steering Column to Headliner	472	487	15
19	RSOV to Right Side of Front Bumper	4313	4104	-209
20	RSOV to Left Side of Front Bumper	4304	4322	18
21	Length of Engine Block	517	457	-61
RD	RSOV to Right Side of Dash Panel	2780	2784	3
CD	RSOV to Center of Dash Panel	2749	2759	10
LD	RSOV to Left Side of Dash Panel	2787	2788	1

All measurements in millimeters.

DATA SHEET NO. 10**ACCIDENT INVESTIGATION DIVISION DATA**

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

VEHICLE INFORMATION

VIN: JM3KFABM1L0801898
Vehicle Size Category: MPV

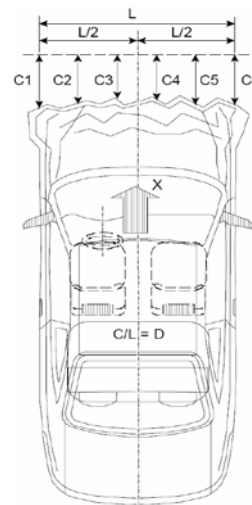
Wheelbase (mm): 2700
Test Weight (kg): 1756.0

ACCELEROMETER DATA

Accelerometer Locations: Vehicle CG_x
Cal. Procedure/Interval: Vibration test / 6 months
Integration Algorithm: NHTSA Standard
Linearity: Good
Impact Velocity (km/h): 40.11

CRUSH PROFILE

Collision Deformation Classification: 12FDEW1
Midpoint of Damage: 754.2
Damage Region Length (mm): 1508.5
Impact Mode: Right Side 30° Frontal

**Crush Measurements**

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush Zone 1 at Left Side	mm	4301	4320	19
C2	Crush Zone 2 at Left Side	mm	4446	4463	18
C3	Crush Zone 3 at Left Side	mm	4509	4466	-43
C4	Crush Zone 4 at Right Side	mm	4510	4393	-117
C5	Crush Zone 5 at Right Side	mm	4451	4306	-145
C6	Crush Zone 6 at Right Side	mm	4310	4102	-208
L	C1 to C6	mm	1508		

DATA SHEET NO. 11

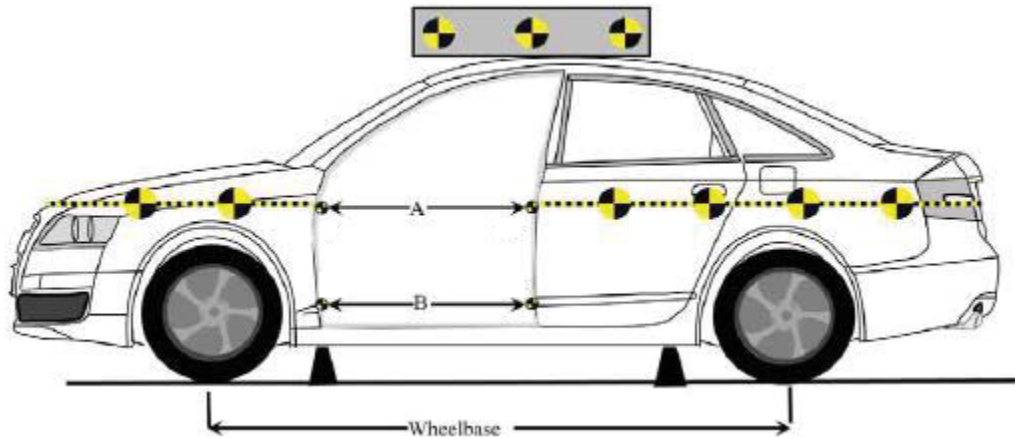
VEHICLE INTRUSION MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414

Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Driver Side Upper	mm	873	872	1
B	Driver Side Lower	mm	733	733	0
D	Passenger Side Upper	mm	875	876	-1
E	Passenger Side Lower	mm	743	743	0



DATA SHEET NO. 11 ... (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV

NHTSA No. R20205414

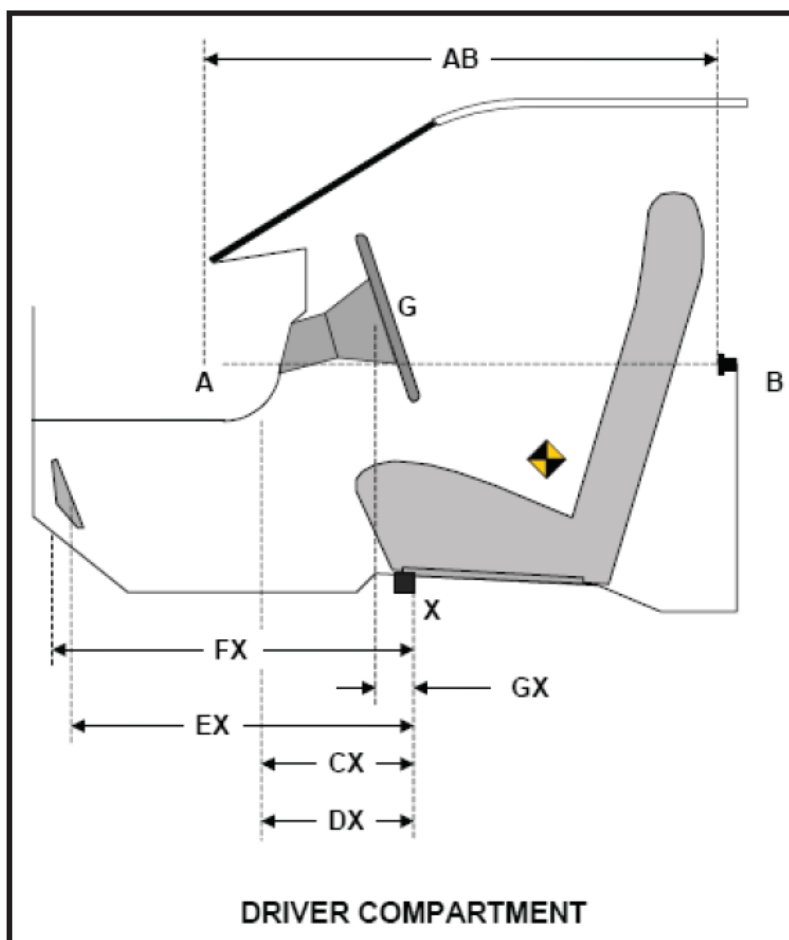
Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact

Test Date: 12/18/20

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	861	860	1
CX	Left Knee Bolster to X	mm	288	249	38
DX	Right Knee Bolster to X	mm	268	280	-12
EX	Brake Pedal to X	mm	529	524	5
FX	Footrest to X	mm	662	659	3
GX	Center of Steering Column Wheel Hub to X	mm	-7	0	-7

X = Front of Seat Bolt

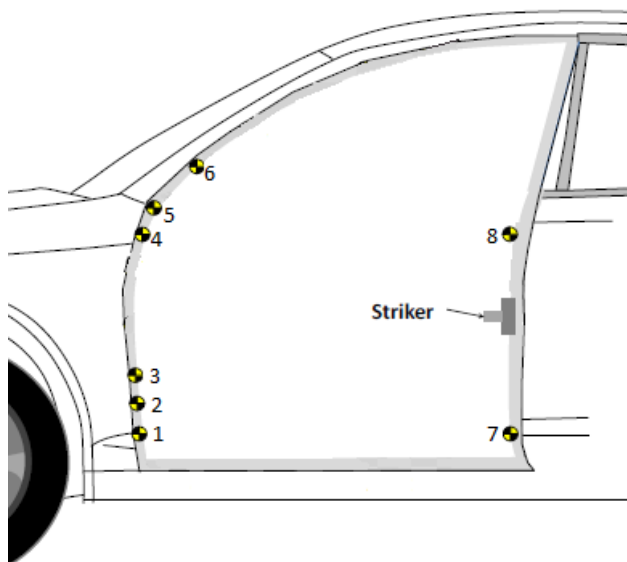


DATA SHEET NO. 11 ... (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

DRIVER SIDE DOOR SILL INTRUSIONS



+X – From the rear of the vehicle to the front of the vehicle
 +Y – From the left side of the vehicle to the right side of the vehicle
 +Z – From the top of the vehicle to the bottom of the vehicle

Point	Pre-Test			Post-Test			Difference		
	x	y	z	x	y	z	x	y	z
1	2957	-746	-15	2957	-746	-16	0	0	-1
2	2969	-741	-88	2971	-742	-87	1	0	1
3	2958	-738	-164	2956	-738	-163	-2	0	0
4	2920	-739	-465	2920	-739	-462	0	0	2
5	2908	-743	-540	2908	-743	-538	0	0	2
6	2881	-744	-616	2881	-745	-615	0	-1	1
7	2224	-754	-14	2224	-754	-14	0	0	0
8	2047	-737	-464	2047	-737	-463	0	0	1

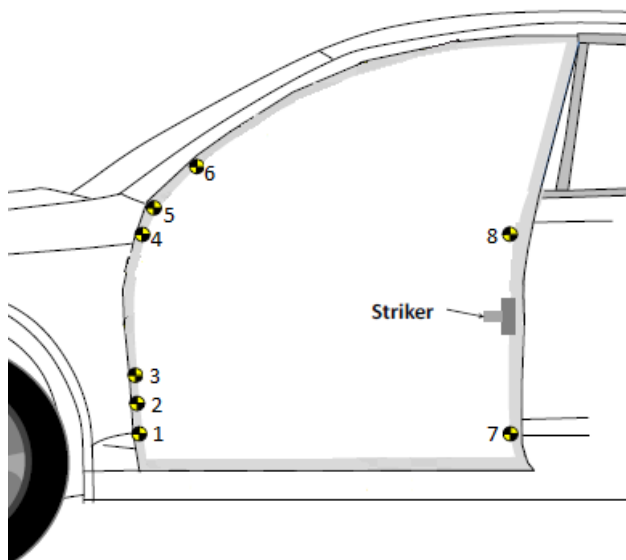
All measurements in millimeters.

DATA SHEET NO. 11 ... (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

PASSENGER SIDE DOOR SILL INTRUSIONS



+X – From the rear of the vehicle to the front of the vehicle
 +Y – From the left side of the vehicle to the right side of the vehicle
 +Z – From the top of the vehicle to the bottom of the vehicle

Point	Pre-Test			Post-Test			Difference		
	x	y	z	x	y	z	x	y	z
1	2958	762	-15	2958	762	-18	0	-1	-3
2	2966	758	-90	2966	759	-92	0	0	-3
3	2958	754	-164	2959	755	-165	0	1	-1
4	2921	757	-472	2922	760	-475	1	3	-3
5	2906	761	-539	2905	763	-539	-1	3	0
6	2878	761	-616	2876	764	-618	-2	3	-2
7	2215	764	-15	2215	765	-16	0	0	-1
8	2047	747	-465	2046	748	-464	0	1	1

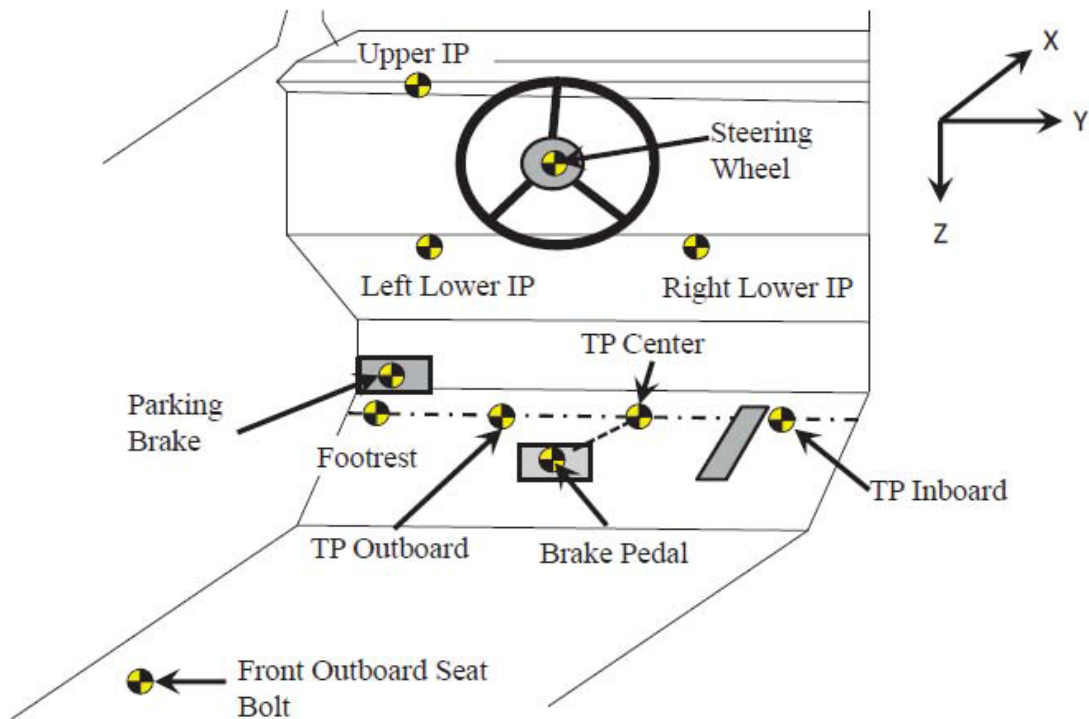
All measurements in millimeters.

DATA SHEET NO. 11 ... (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

DRIVER FLOOR PAN MEASUREMENTS



Intrusion Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	x	y	z	x	y	z	x	y	z
TP Inboard	3367	-180	-28	3362	-172	-29	-5	8	-1
TP Center	3355	-330	-13	3352	-330	-13	-3	0	0
TP Outboard	3275	-484	-15	3268	-487	-16	-6	-3	-2
TP Footrest	3217	-584	-15	3217	-584	-14	0	0	1
Brake Pedal	3085	-331	-15	3082	-335	-17	-3	-5	-3
Left Lower IP	2844	-523	-298	2855	-518	-299	11	4	-1
Right Lower IP	2824	-222	-298	2843	-221	-304	19	1	-5
Upper IP	2756	-520	-435	2765	-521	-436	8	-1	-1
Steering Wheel	2563	-364	-530	2558	-358	-513	-5	6	16
Front Outboard Bolt	2557	-604	82	2558	-602	82	1	2	-1
Emergency Brake									

Reference point:

+X – From the rear of the vehicle to the front of the vehicle

+Y – From the left side of the vehicle to the right side of the vehicle

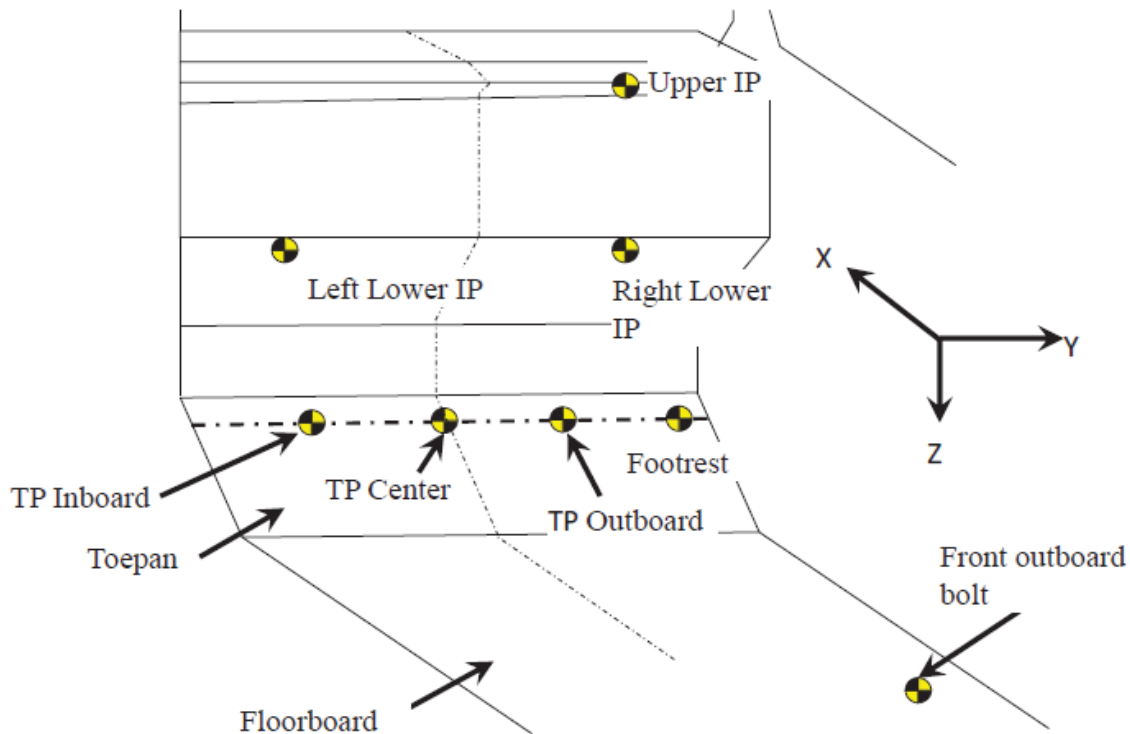
+Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO. 11 ... (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS RELATIVE TO VCS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

PASSENGER FLOOR PAN MEASUREMENTS



Intrusion Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	x	y	z	x	y	z	x	y	z
TP Inboard	3299	210	-19	3296	209	-27	-2	-2	-8
TP Center	3350	361	-19	3343	356	-13	-7	-5	6
TP Outboard	3258	512	-15	3252	512	-22	-7	0	-7
TP Footrest	3208	613	-17	3206	612	-20	-3	-1	-3
Left Lower IP	2800	214	-302	2808	216	-309	8	2	-6
Right Lower IP	2835	514	-300	2838	515	-305	3	1	-5
Upper IP	2744	513	-451	2750	515	-455	6	2	-5
Front Outboard Seat Bolt	2556	616	82	2556	615	81	0	0	-1

Reference point:

+X – From the rear of the vehicle to the front of the vehicle

+Y – From the left side of the vehicle to the right side of the vehicle

+Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO. 12

SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

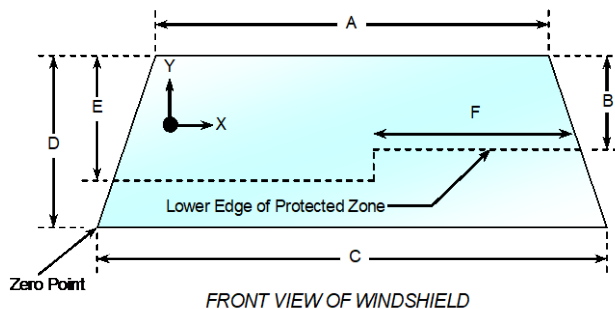
Windshield Mounting Details: Windshield glass is secured to the vehicle frame with plastic molding and rubber cement.

The standard requires that the post-test retention measurement be a minimum of 75% of the pre-test total periphery measurement for vehicles not equipped with occupant passive restraints and 50% for each side of the windshield for vehicles which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 13.3° C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2315	2315	100.0%
Right Side	2315	2315	100.0%
Total	4630	4630	100.0%



Item	Units	Value
A	mm	1250
B	mm	383
C	mm	1540
D	mm	920
E	mm	510
F	mm	557

AREAS OF PROTECTED ZONE FAILURES

- A. Provide Coordinates of the area that the protected zone was penetrated more than 0.25 inches by a vehicle component other than one that is normally in contact with the windshield.
- B. Provide Coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component.

X	Y

X	Y

DATA SHEET NO. 12 ... (CONTINUED)

SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 13.3° C Test Time: 6:18 PM

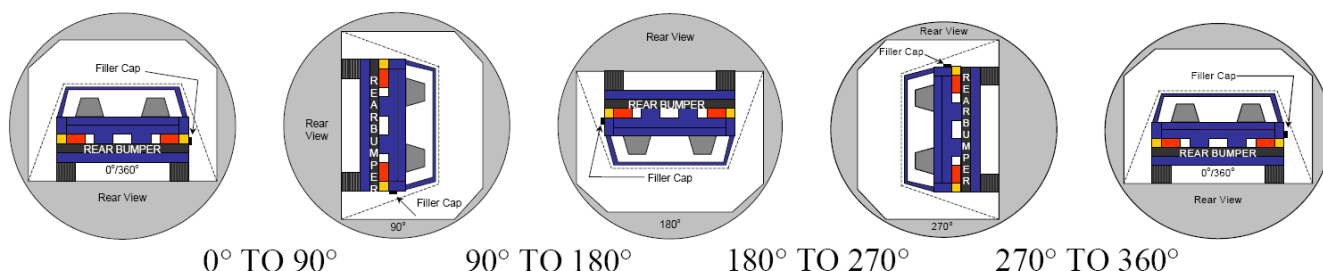
Stoddard Solvent Spillage Measurements

- A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable = 1 oz.)
- B. For the 5 minute period after motion ceases: 0 oz.
(Maximum allowable = 5 oz.)
- C. For the following 25 minutes: 0 oz.
(Maximum allowable = 1 oz./minute)
- D. Spillage: There was no Stoddard solvent spillage.

DATA SHEET NO. 13

FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2020 Mazda CX-5 5-Door MPV NHTSA No. R20205414
 Test Program: R&D Right Side 30° Frontal Rigid Barrier Impact Test Date: 12/18/20



1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard solvent spillage: There was no Stoddard solvent spillage.

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° To 90°	78	300	378
90° To 180°	80	300	380
180° To 270°	79	300	379
270° To 360°	78	300	378

FMVSS 301 SPILLAGE TABLE

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

SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° To 90°	
90° To 180°	
180° To 270°	
270° To 360°	

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PHOTOGRAPHS

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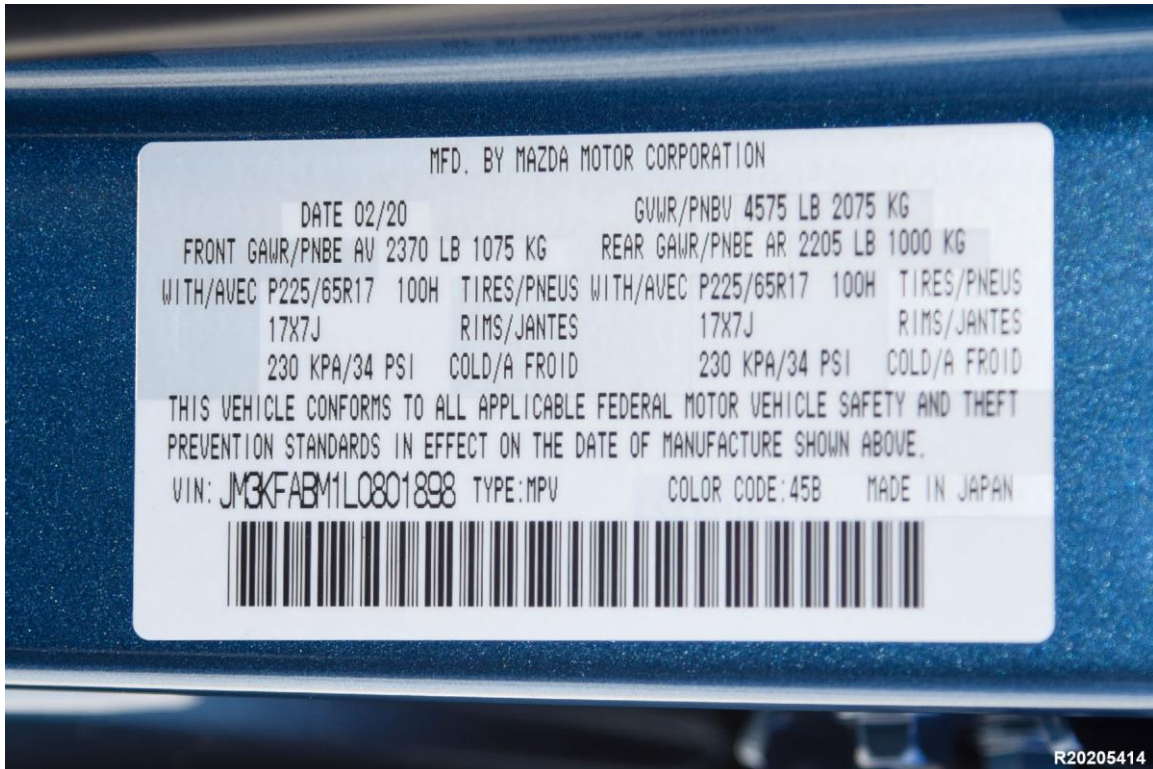


FIGURE 1. Test Vehicle Certification Label



FIGURE 2. Test Vehicle Tire Placard



FIGURE 3. Right Front $\frac{3}{4}$ View, As Received



FIGURE 4. Left Rear $\frac{3}{4}$ View, As Received



FIGURE 5. Pre-Test Front View of Test Vehicle

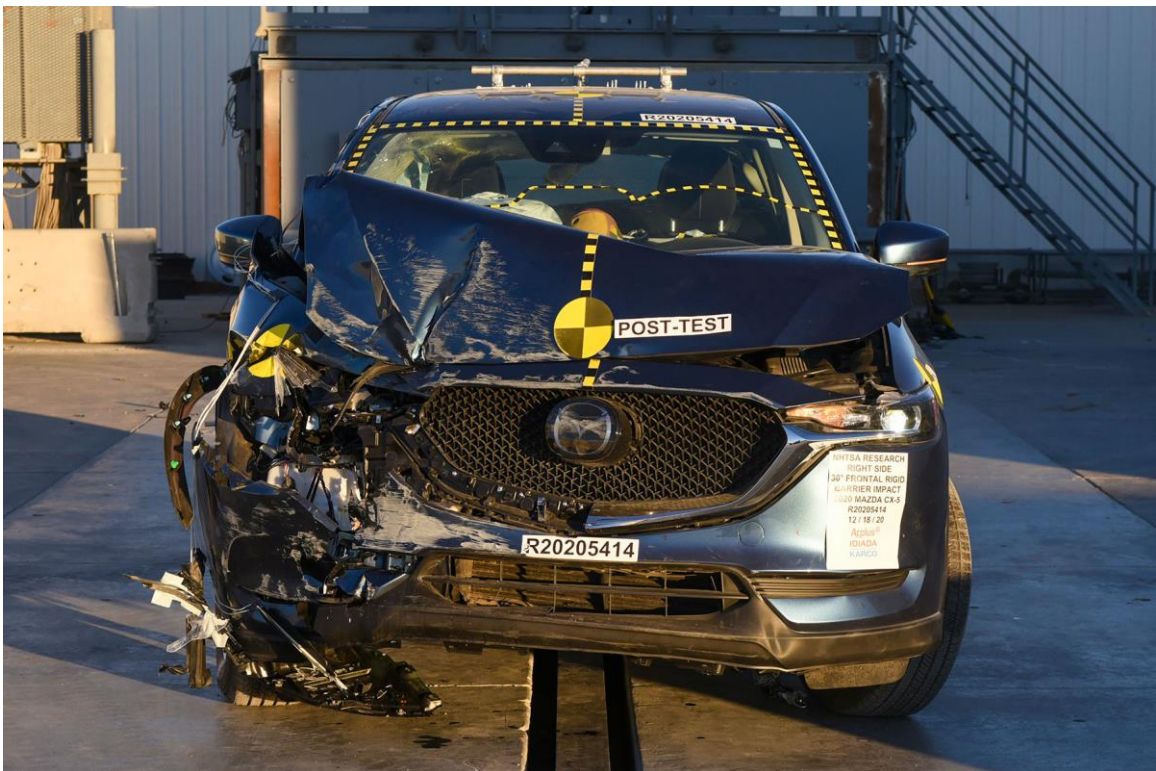


FIGURE 6. Post-Test Front View of Test Vehicle



FIGURE 7. Pre-Test Left View of Test Vehicle



FIGURE 8. Post-Test Left View of Test Vehicle



FIGURE 9. Pre-Test Right View of Test Vehicle



FIGURE 10. Post-Test Right View of Test Vehicle



FIGURE 11. Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle

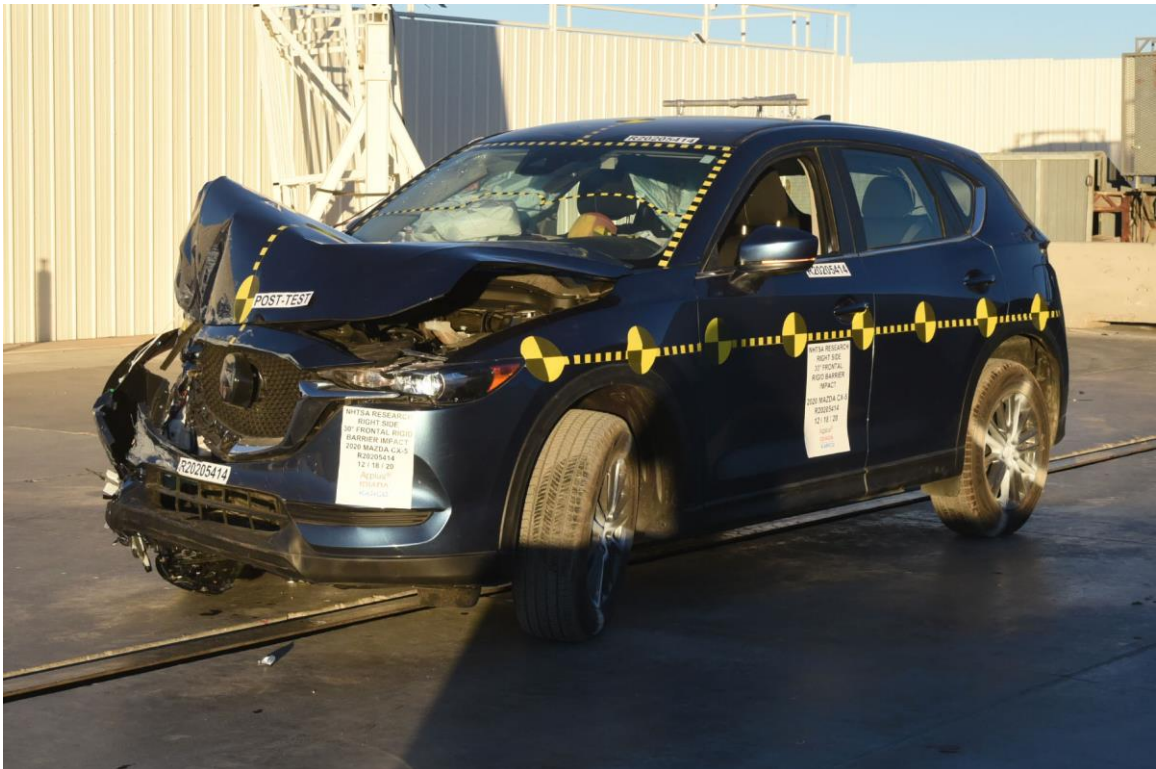


FIGURE 12. Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 13. Pre-Test Right Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 14. Post-Test Right Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 15. Pre-Test Right Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 16. Post-Test Right Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 17. Pre-Test Rear View of Test Vehicle

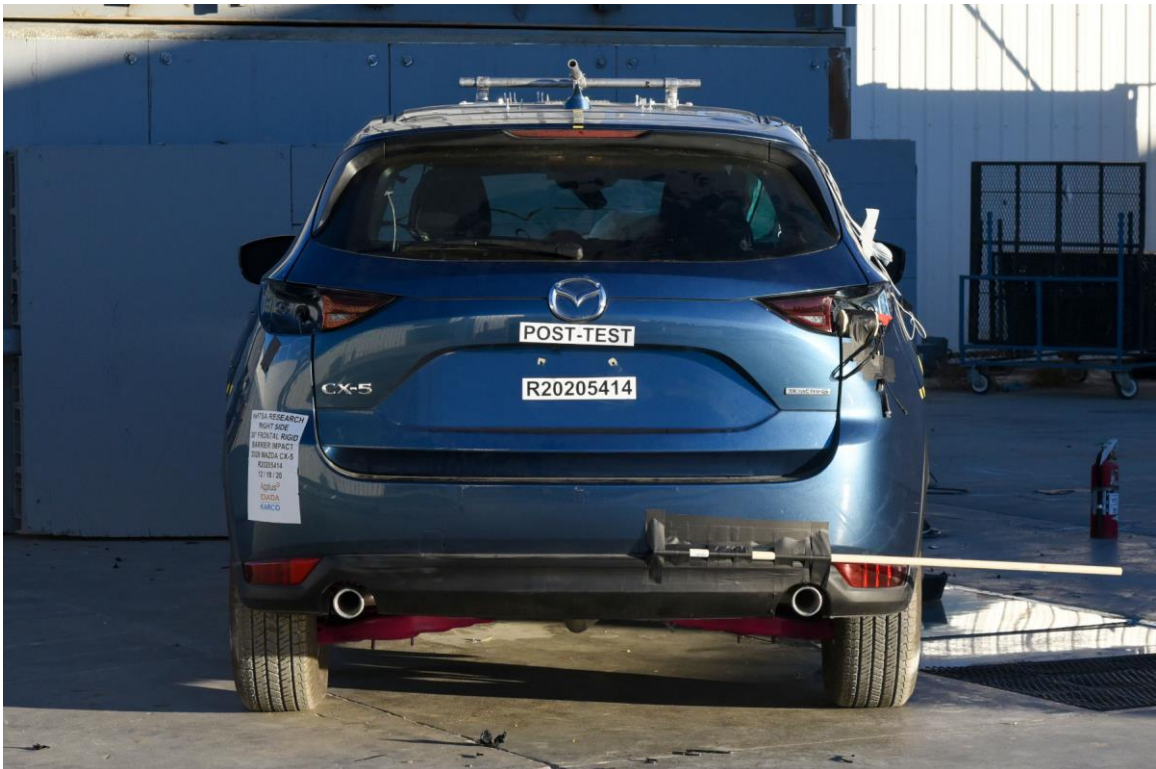


FIGURE 18. Post-Test Rear View of Test Vehicle



FIGURE 19. Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 20. Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 21. Pre-Test Windshield View



FIGURE 22. Post-Test Windshield View



FIGURE 23. Pre-Test Engine Compartment View

Photograph Not Available

FIGURE 24. Post-Test Engine Compartment View



FIGURE 25. Pre-Test Fuel Filler Cap View



FIGURE 26. Post-Test Fuel Filler Cap View

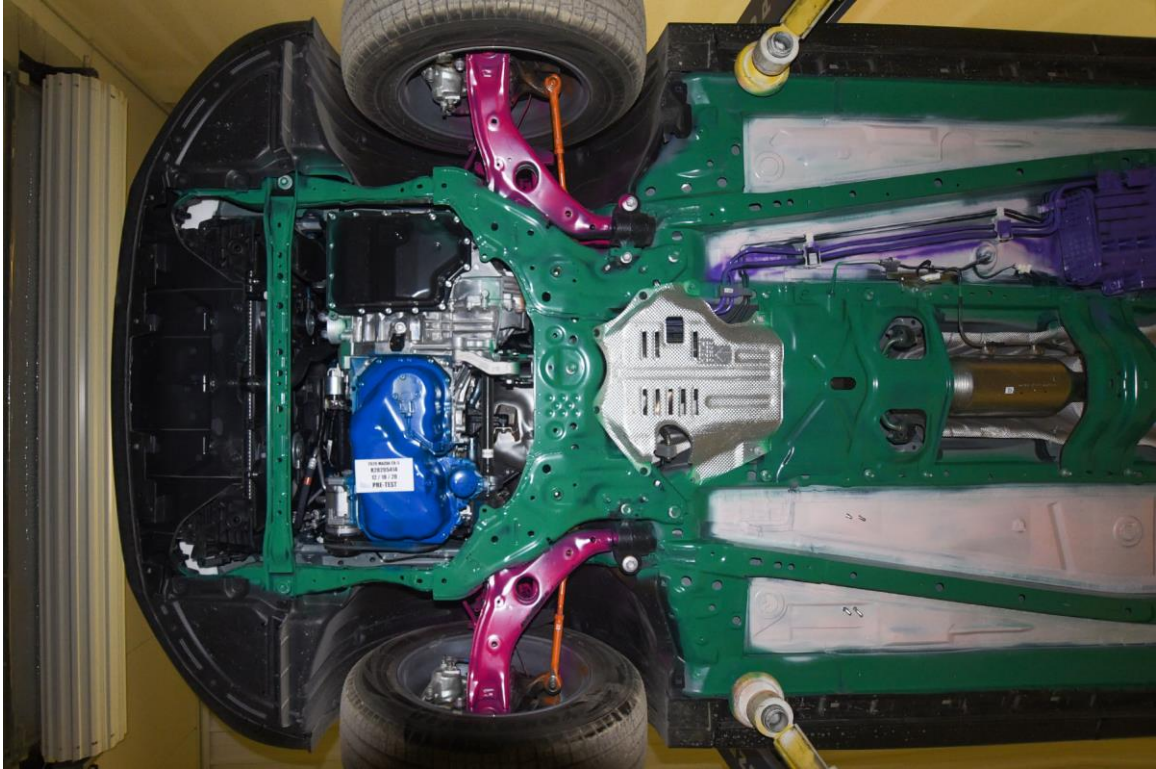


FIGURE 27. Pre-Test Front Underbody View

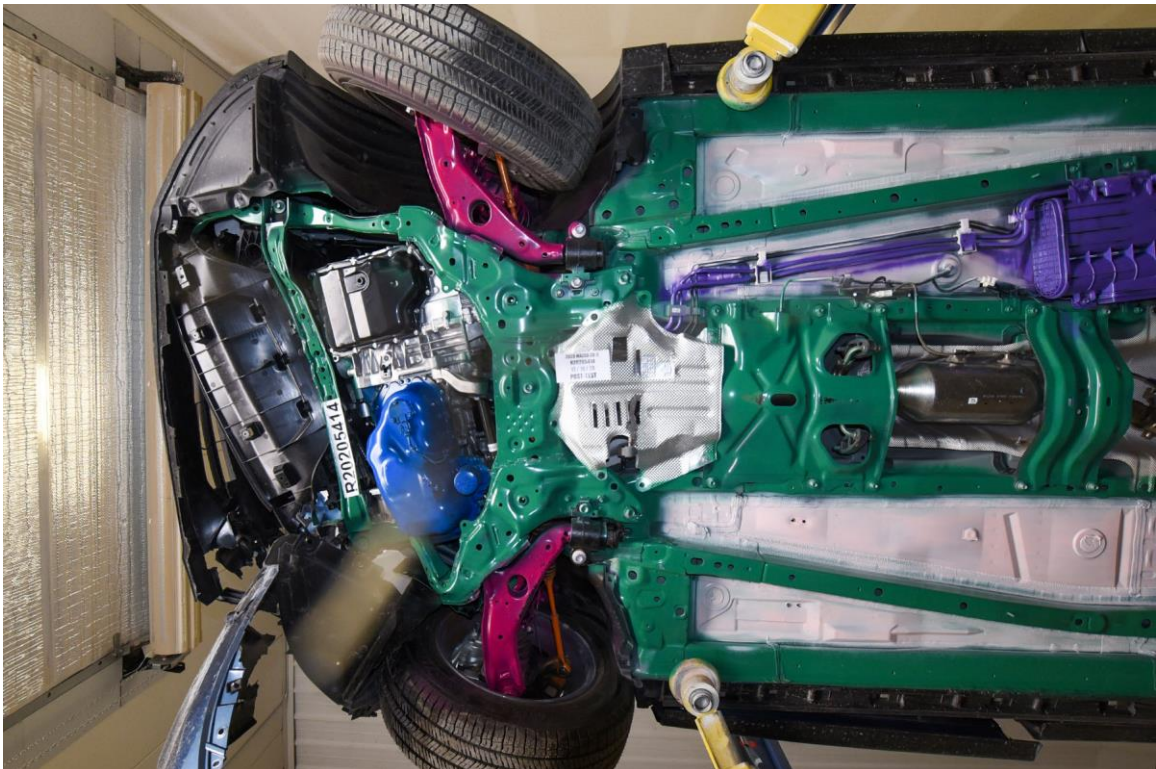


FIGURE 28. Post-Test Front Underbody View

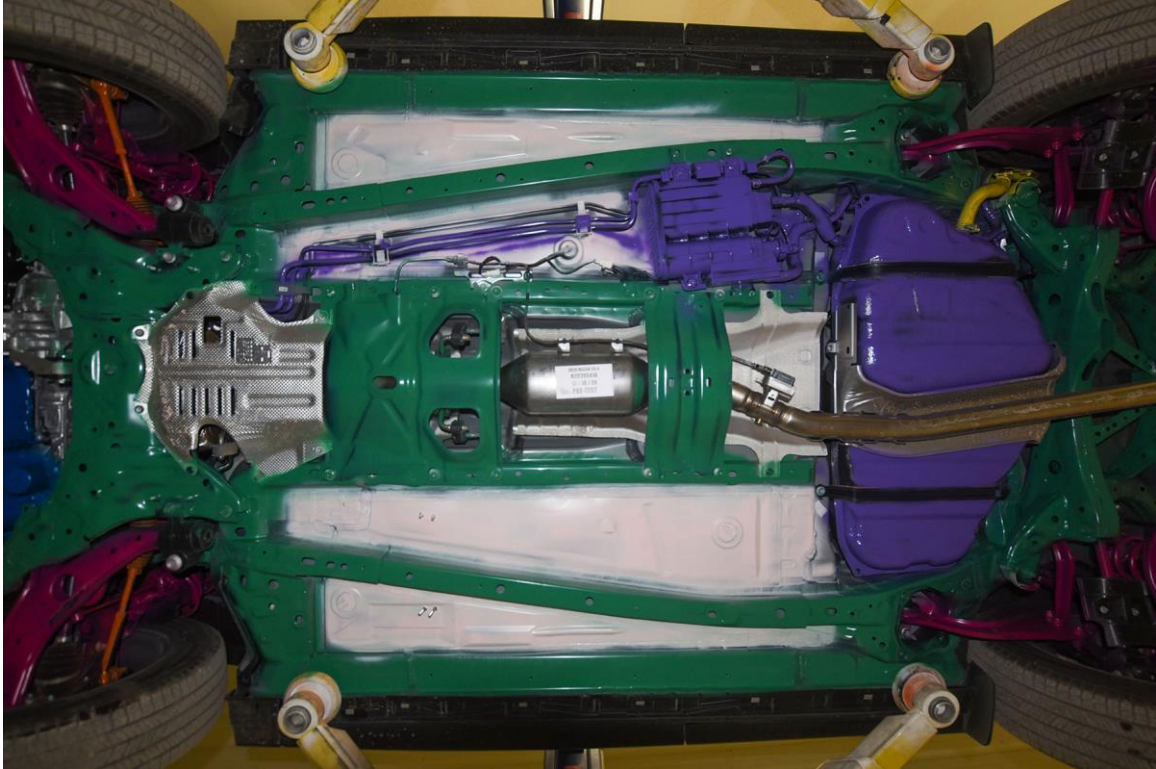


FIGURE 29. Pre-Test Mid Underbody View

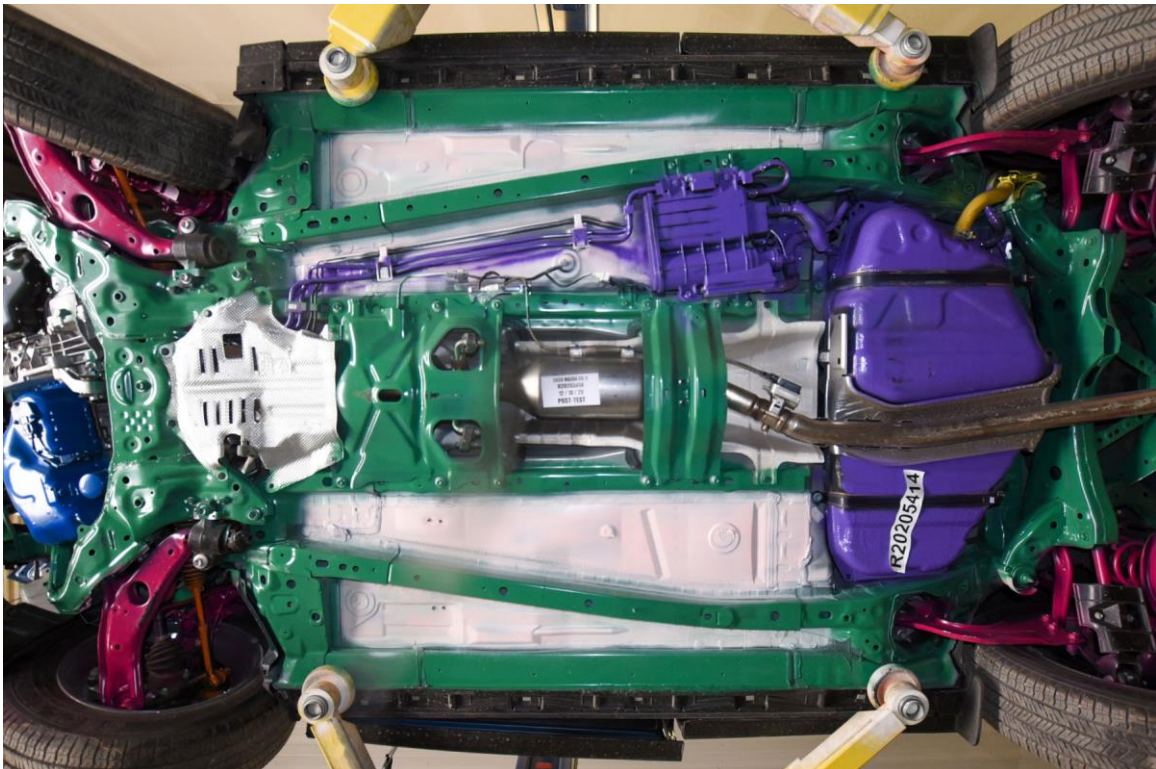


FIGURE 30. Post-Test Mid Underbody View

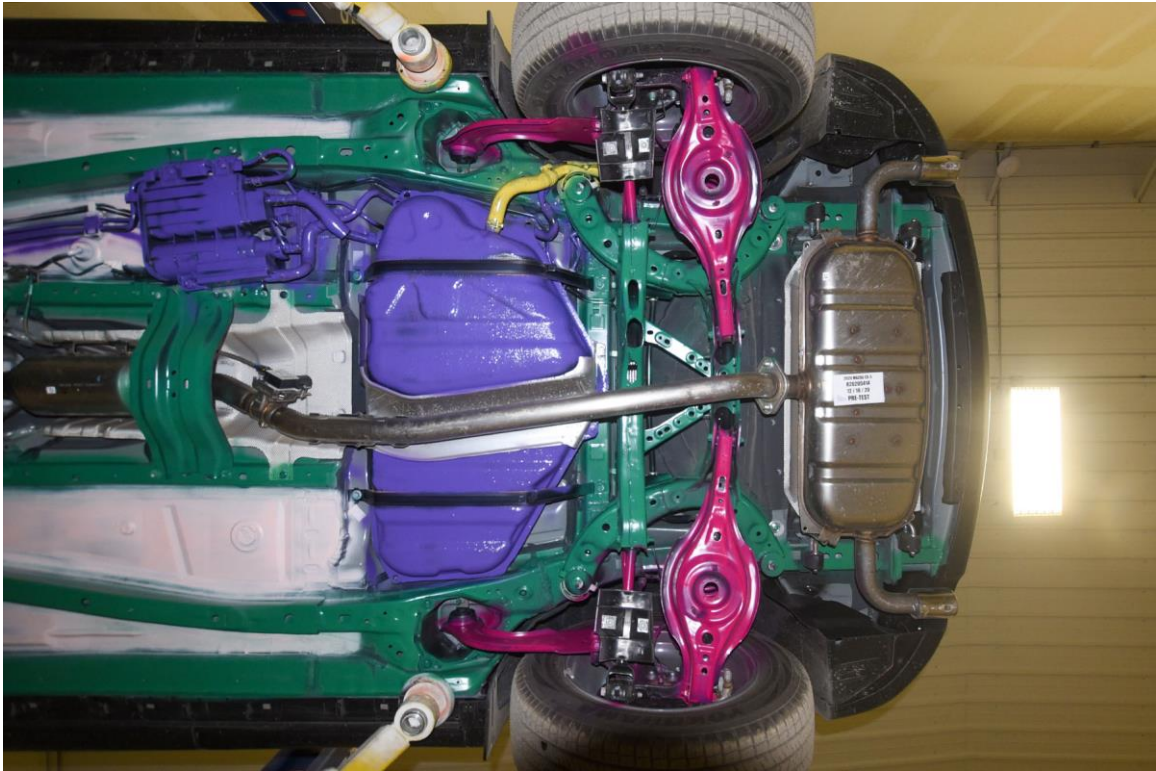


FIGURE 31. Pre-Test Rear Underbody View

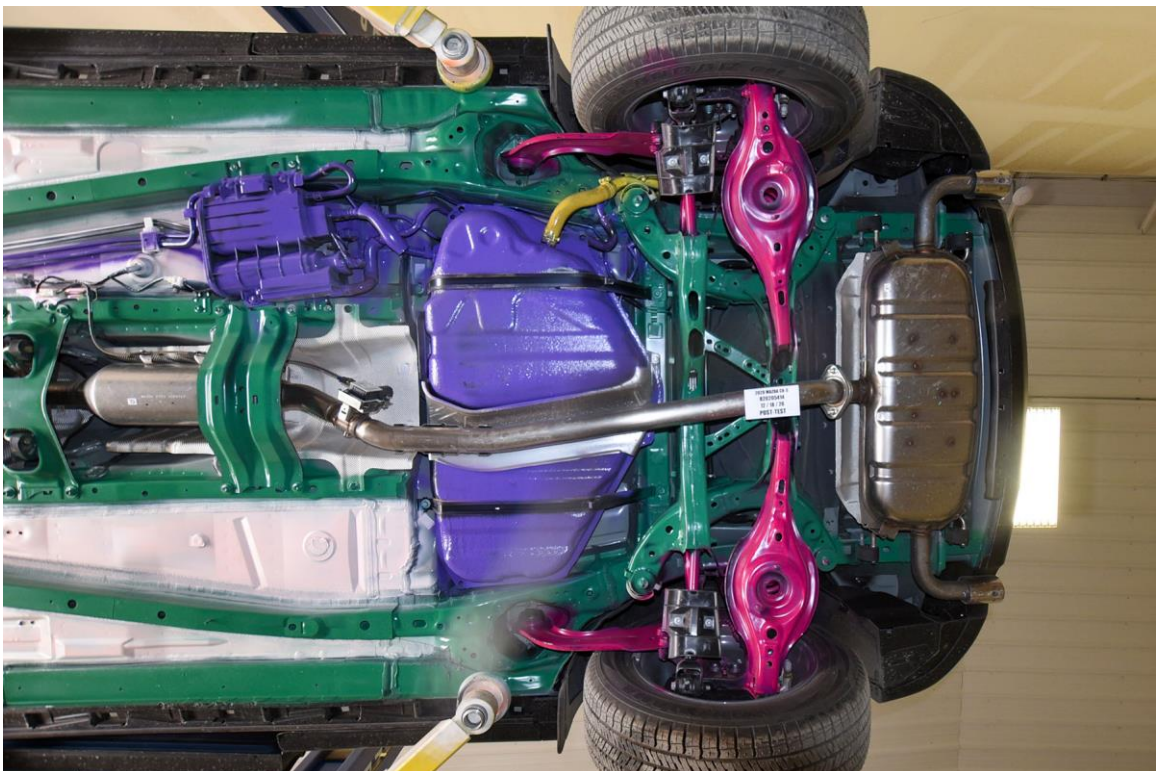


FIGURE 32. Post-Test Rear Underbody View



FIGURE 33. Pre-Test Bumper to Rail Attachments and Crush Initiators

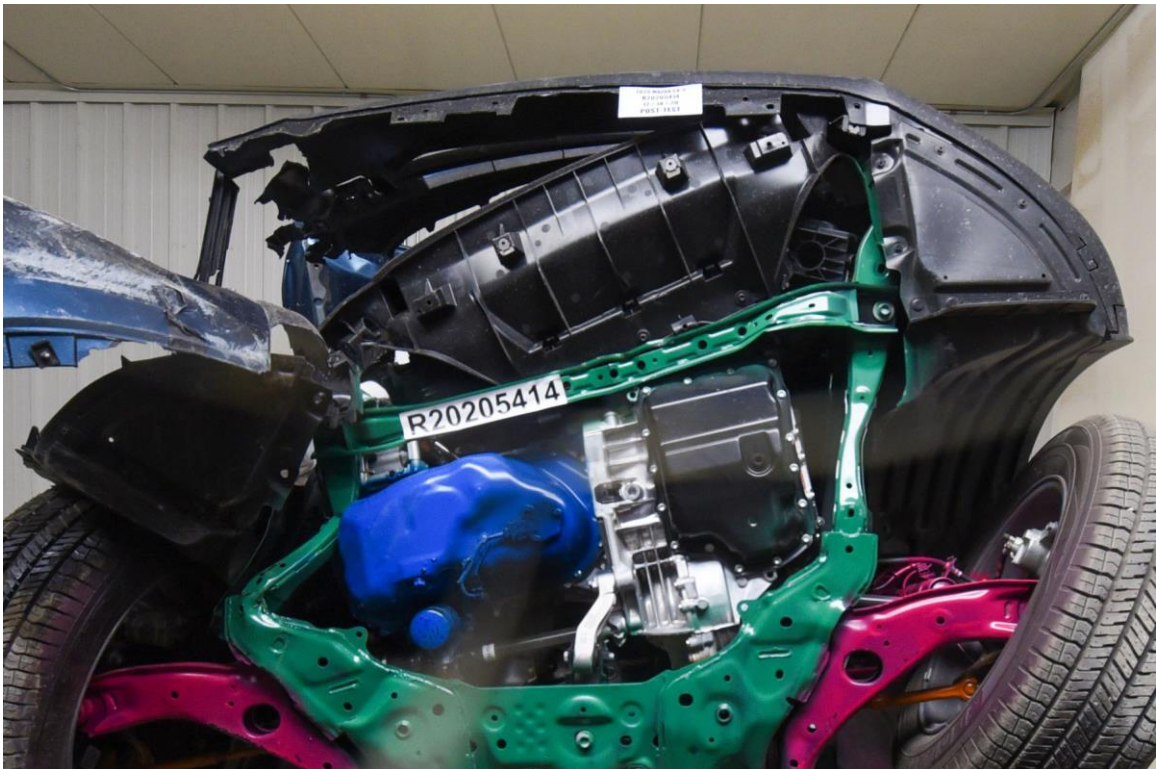


FIGURE 34. Post-Test Bumper to Rail Attachments and Crush Initiators

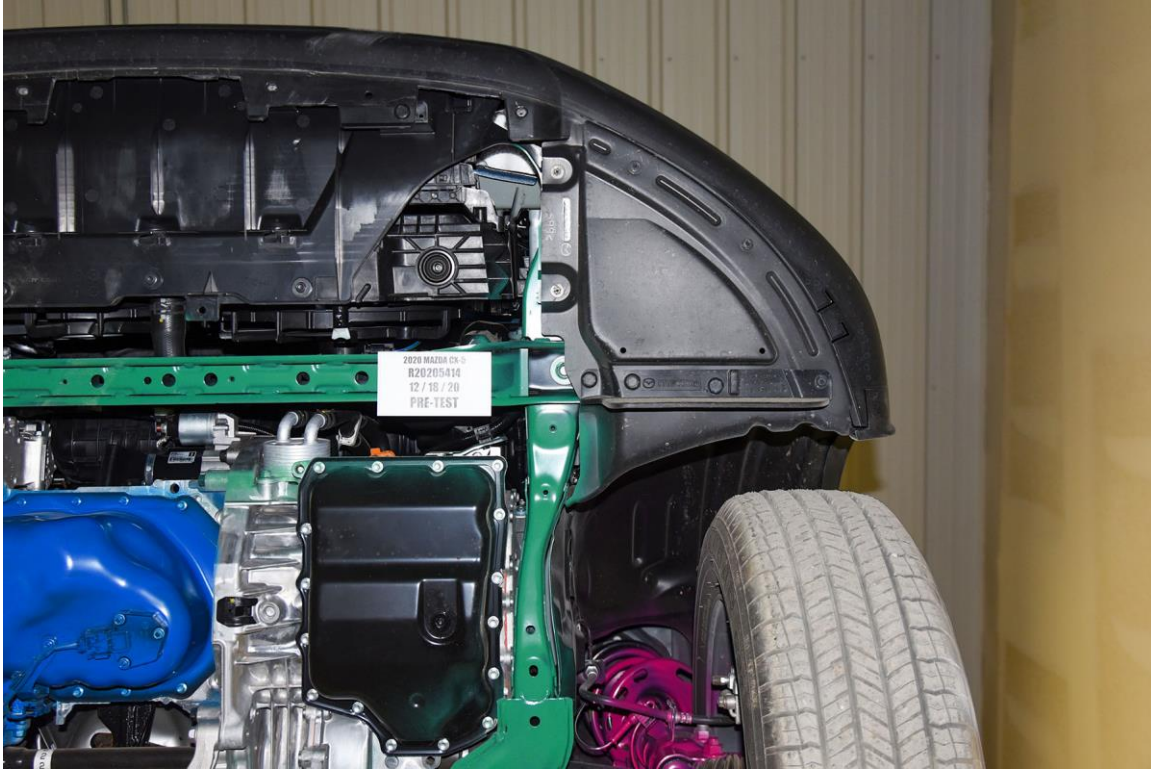


FIGURE 35. Pre-Test Driver Side Bumper to Rail Attachments and Crush Initiators



FIGURE 36. Post-Test Driver Side Bumper to Rail Attachments and Crush Initiators



FIGURE 37. Pre-Test Passenger Side Bumper to Rail Attachments
and Crush Initiators

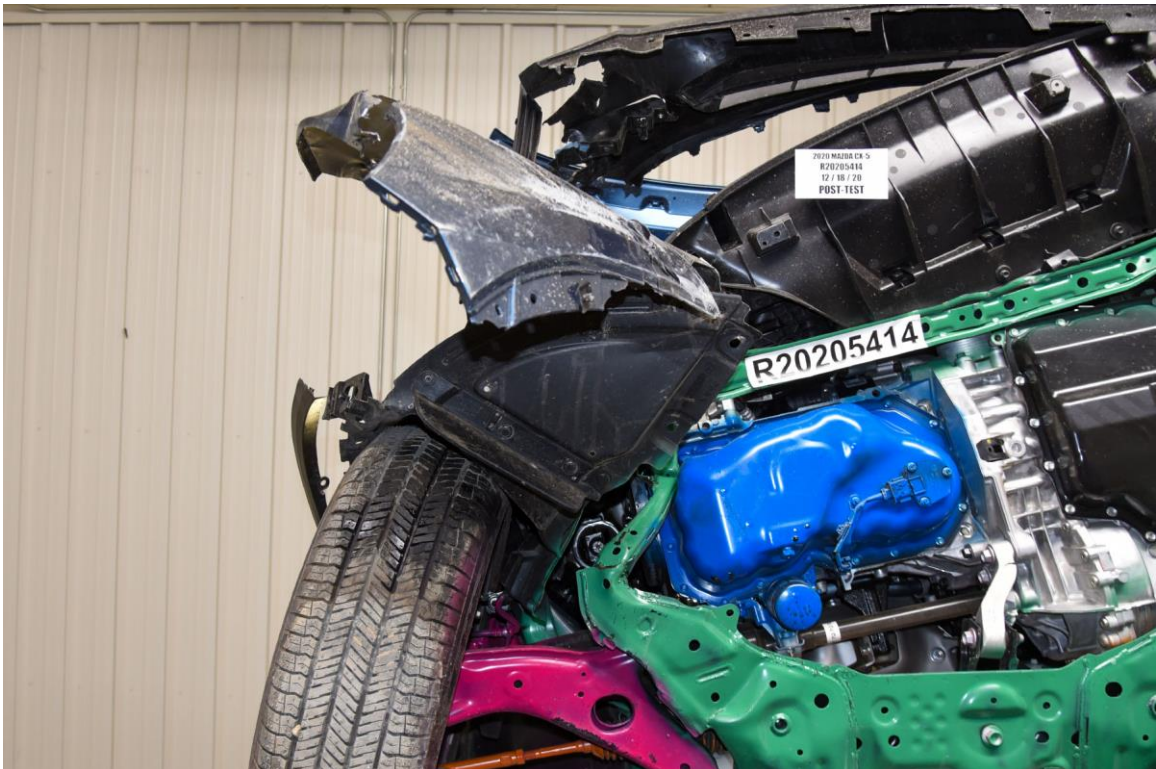


FIGURE 38. Post-Test Passenger Side Bumper to Rail Attachments
and Crush Initiators

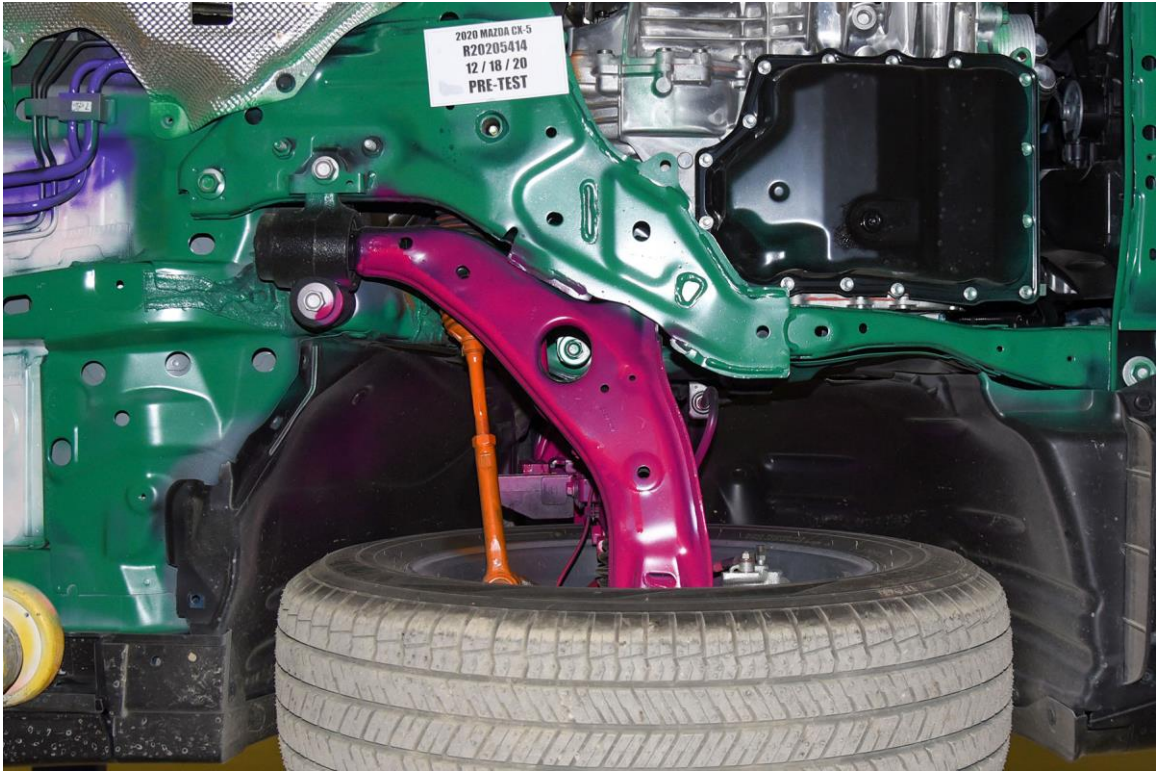


FIGURE 39. Pre-Test Driver Side Rocker



FIGURE 40. Post-Test Driver Side Rocker



FIGURE 41. Pre-Test Passenger Side Rocker



FIGURE 42. Post-Test Passenger Side Rocker



FIGURE 43. Pre-Test Driver Front Windshield View



FIGURE 44. Post-Test Driver Front Windshield View

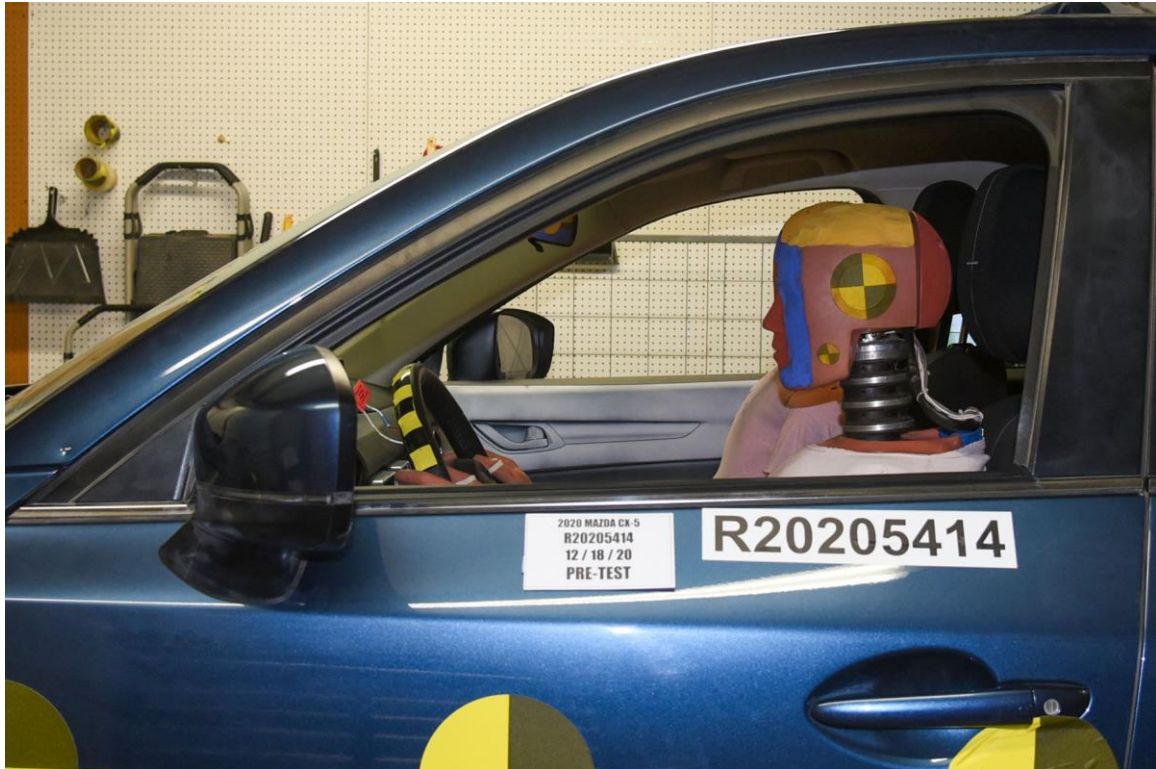


FIGURE 45. Pre-Test Driver Side Front Window View



FIGURE 46. Post-Test Driver Side Front Window View



FIGURE 47. Pre-Test View of Driver Door Clearance

Photograph Not Available

FIGURE 48. Post-Test View of Driver Door Clearance



FIGURE 49. Pre-Test Left Side View of Driver and Interior



FIGURE 50. Post-Test Left Side View of Driver and Interior



FIGURE 51. Pre-Test Left Side View of Steering Wheel Position



FIGURE 52. Post-Test Left Side View of Steering Wheel Position



FIGURE 53. Pre-Test Overhead View of Driver Thighs on Seat



FIGURE 54. Post-Test Overhead View of Driver Thighs on Seat



FIGURE 55. Pre-Test View of Driver Abdomen



FIGURE 56. Post-Test View of Driver Abdomen

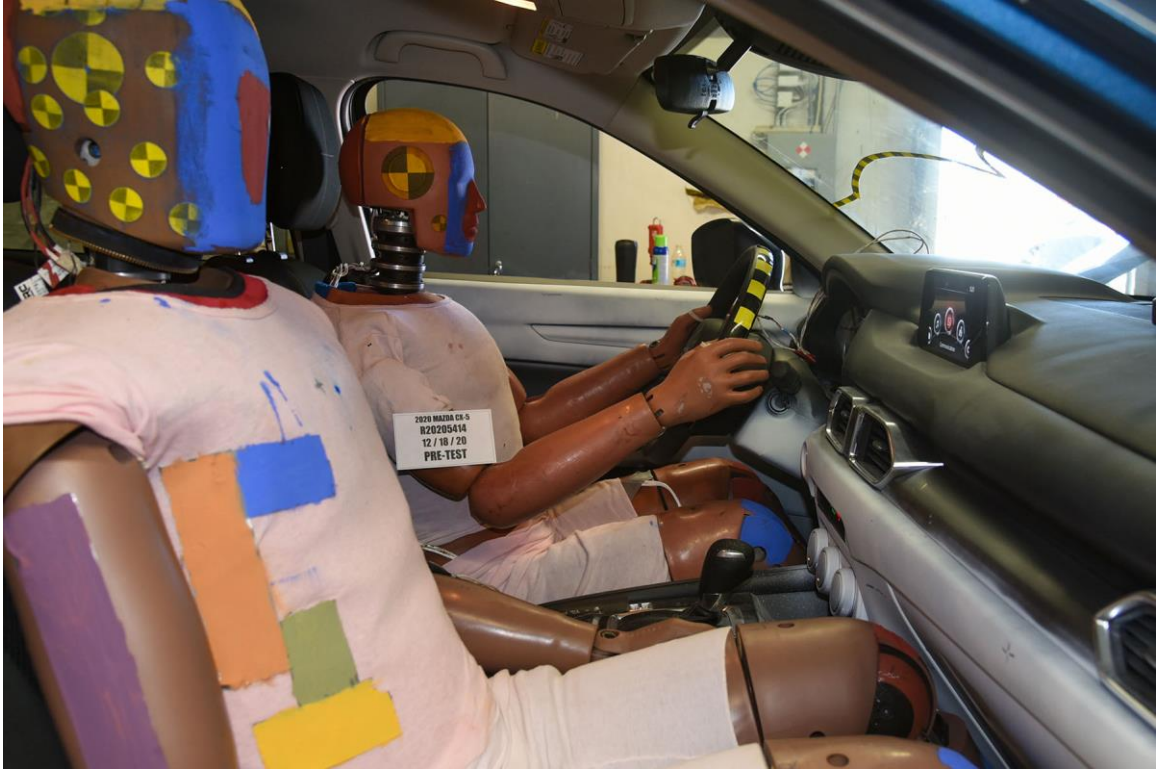


FIGURE 57. Pre-Test Right Side View of Driver and Interior



FIGURE 58. Post-Test Right Side View of Driver and Interior

Photograph Not Available

FIGURE 59. Pre-Test View of Driver Left Knee and Bolster



FIGURE 60. Post-Test View of Driver Left Knee and Bolster



FIGURE 61. Pre-Test View of Driver Right Knee and Bolster

Photograph Not Available

FIGURE 62. Post-Test View of Driver Right Knee and Bolster



FIGURE 63. Pre-Test View of the Driver Left Leg



FIGURE 64. Post-Test View of the Driver Left Leg



FIGURE 65. Pre-Test View of the Driver Feet



FIGURE 66. Post-Test View of the Driver Feet



FIGURE 67. Pre-Test Driver Adjustable D-Ring



FIGURE 68. Post-Test Driver Adjustable D-Ring



FIGURE 69. Pre-Test Driver Seat Fore-Aft Markings



FIGURE 70. Post-Test Driver Seat Fore-Aft Markings

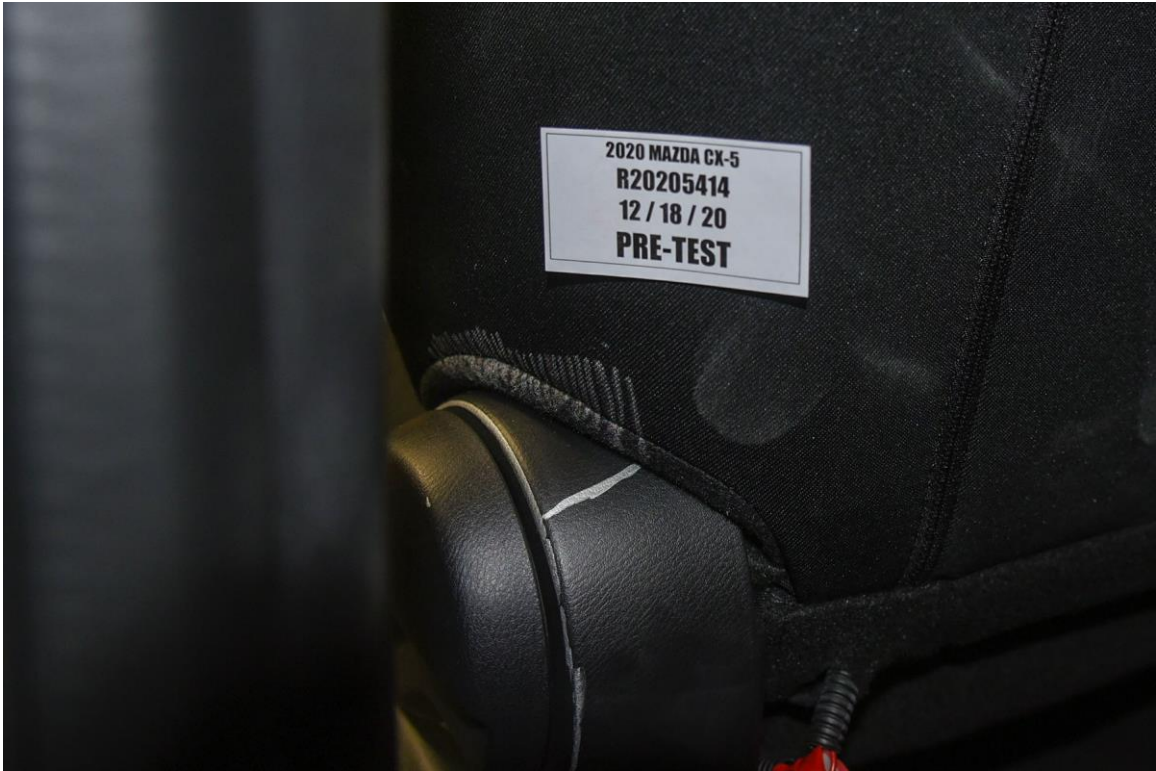


FIGURE 71. Pre-Test Driver Seat Back Markings



FIGURE 72. Post-Test Driver Seat Back Markings

Photograph Not Available

FIGURE 73. Pre-Test Close-Up View of Driver Door Latch



FIGURE 74. Post-Test Close-Up View of Driver Door Latch

Photograph Not Available

FIGURE 75. Pre-Test Driver Inner Door Panel



FIGURE 76. Post-Test Driver Inner Door Panel



FIGURE 77. Pre-Test Left Side View of Driver Knee Bolster



FIGURE 78. Post-Test Left Side View of Driver Knee Bolster



FIGURE 79. Pre-Test Overall View of Driver Knee Bolster



FIGURE 80. Post-Test Overall View of Driver Knee Bolster



FIGURE 81. Pre-Test Right Side View of Driver Knee Bolster



FIGURE 82. Post-Test Right Side View of Driver Knee Bolster



FIGURE 83. Pre-Test View of Driver Floor Pan from Outside of Vehicle



FIGURE 84. Post-Test View of Driver Floor Pan from Outside of Vehicle



FIGURE 85. Pre-Test View of Driver Floor Pan from Top of Seat



FIGURE 86. Post-Test View of Driver Floor Pan from Top of Seat



FIGURE 87. Pre-Test View of Driver Floor Pan from Center of Vehicle



FIGURE 88. Post-Test View of Driver Floor Pan from Center of Vehicle



FIGURE 89. Post-Test Driver Dummy Contact with Front Airbag

Photograph Not Applicable

FIGURE 90. Post-Test Driver Dummy Contact with Side Airbag

Photograph Not Applicable

FIGURE 91. Post-Test Driver Dummy Contact with Knee Airbag



FIGURE 91a. Post-Test Driver Dummy Contact with Knee Bolster



FIGURE 92. Pre-Test Passenger Front Windshield View



FIGURE 93. Post-Test Passenger Front Windshield View



FIGURE 94. Pre-Test Passenger Side Front Window View



FIGURE 95. Post-Test Passenger Side Front Window View



FIGURE 96. Pre-Test View of Passenger Door Clearance

Photograph Not Available

FIGURE 97. Post-Test View of Passenger Door Clearance



FIGURE 98. Pre-Test Right Side View of Passenger and Interior



FIGURE 99. Post-Test Right Side View of Passenger and Interior



FIGURE 100. Pre-Test Overhead View of Passenger Thighs on Seat



FIGURE 101. Post-Test Overhead View of Passenger Thighs on Seat

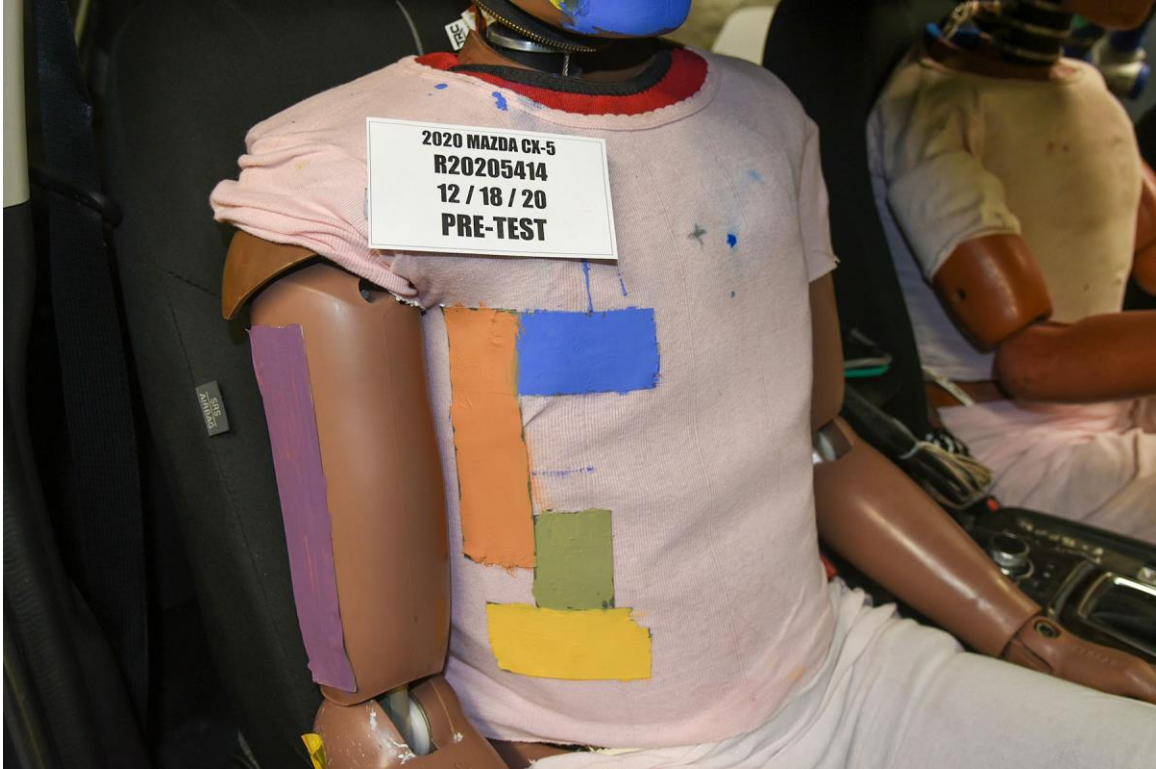


FIGURE 102. Pre-Test View of Passenger Abdomen



FIGURE 103. Post-Test View of Passenger Abdomen



FIGURE 104. Pre-Test Left Side Passenger and Interior View



FIGURE 105. Post-Test Left Side Passenger and Interior View

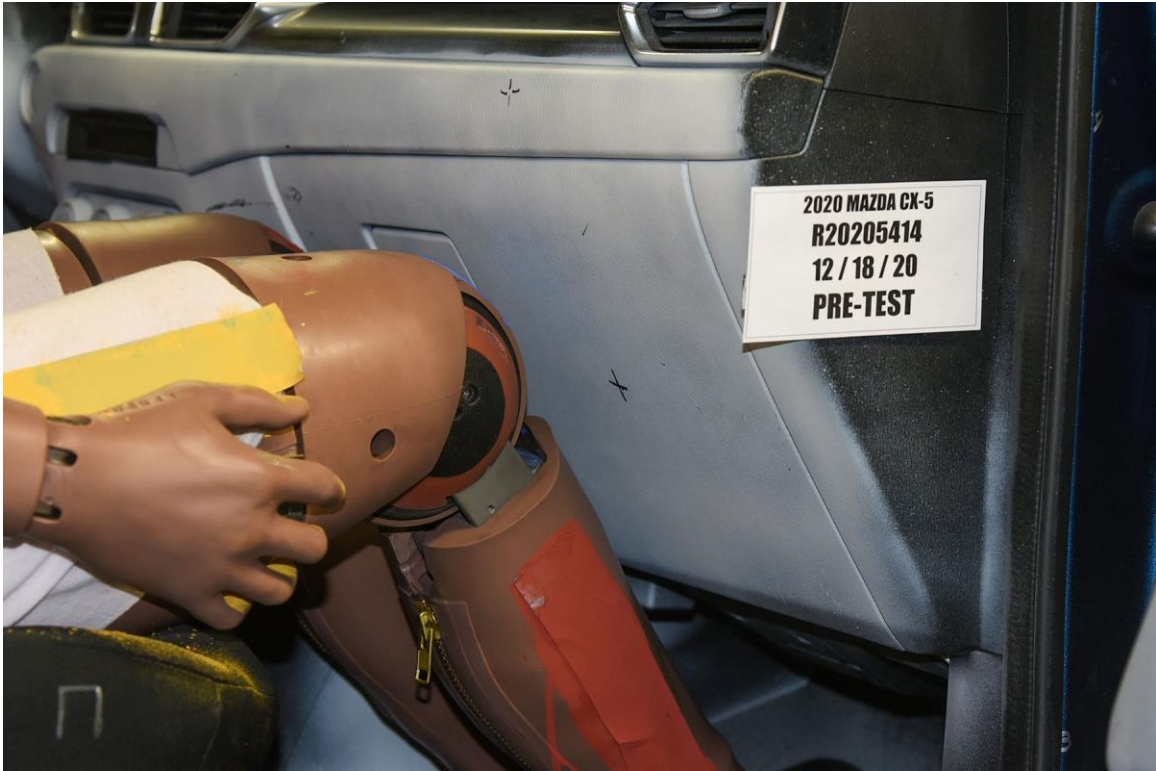


FIGURE 106. Pre-Test View of Passenger Right Knee and Bolster



FIGURE 107. Post-Test View of Passenger Right Knee and Bolster



FIGURE 108. Pre-Test View of Passenger Left Knee and Bolster



FIGURE 109. Post-Test View of Passenger Left Knee and Bolster



FIGURE 110. Pre-Test View of the Passenger Feet



FIGURE 111. Post-Test View of the Passenger Feet



FIGURE 112. Pre-Test Passenger Adjustable D-Ring



FIGURE 113. Post-Test Passenger Adjustable D-Ring

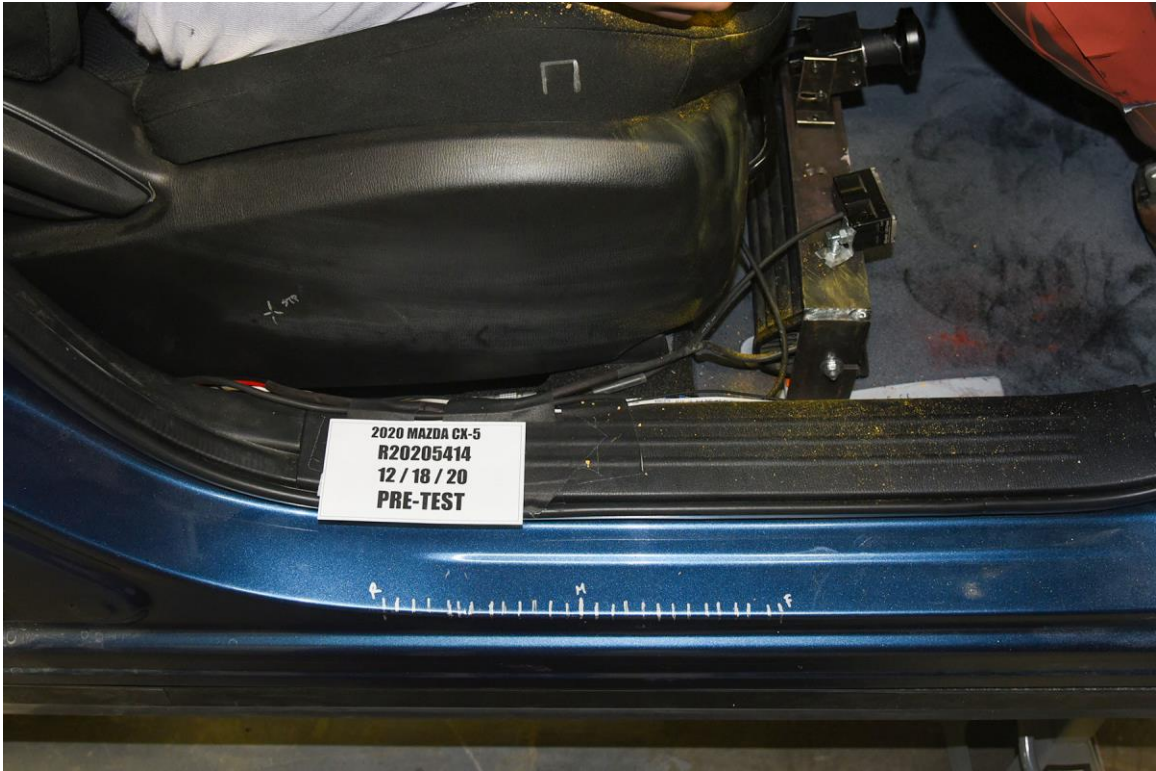


FIGURE 114. Pre-Test Right Front Passenger Seat Fore-Aft Markings



FIGURE 115. Post-Test Right Front Passenger Seat Fore-Aft Markings

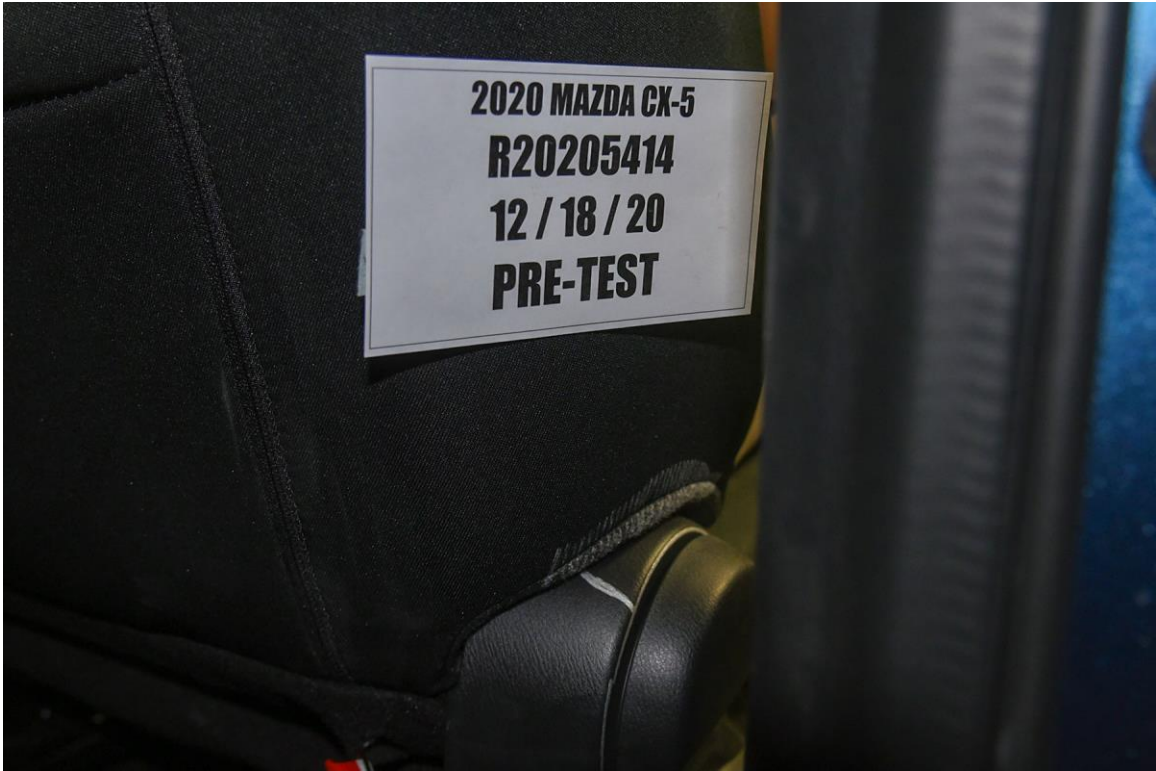


FIGURE 116. Pre-Test Passenger Seat Back Markings



FIGURE 117. Post-Test Passenger Seat Back Markings



FIGURE 118. Pre-Test Close-up View of Passenger Door Latch



FIGURE 119. Post-Test Close-up View of Passenger Door Latch



FIGURE 120. Pre-Test Passenger Inner Door Panel



FIGURE 121. Post-Test Passenger Inner Door Panel



FIGURE 122. Pre-Test Right Side View of Passenger Knee Bolster



FIGURE 123. Post-Test Right Side View of Passenger Knee Bolster



FIGURE 124. Pre-Test Center View of Passenger Knee Bolster



FIGURE 125. Post-Test Center View of Passenger Knee Bolster



FIGURE 126. Pre-Test Left Side View of Passenger Knee Bolster



FIGURE 127. Post-Test Left Side View of Passenger Knee Bolster



FIGURE 128. Pre-Test View of Passenger Floor Pan from Outside of Vehicle



FIGURE 129. Post-Test View of Passenger Floor Pan from Outside of Vehicle



FIGURE 130. Pre-Test View of Passenger Floor Pan from Top of Front Seat



FIGURE 131. Post-Test View of Passenger Floor Pan from Top of Front Seat



FIGURE 133. Post-Test View of Passenger Floor Pan from Center of Vehicle



FIGURE 133. Post-Test View of Passenger Floor Pan from Center of Vehicle



FIGURE 134. Post-Test Passenger Dummy Contact with Front Airbag

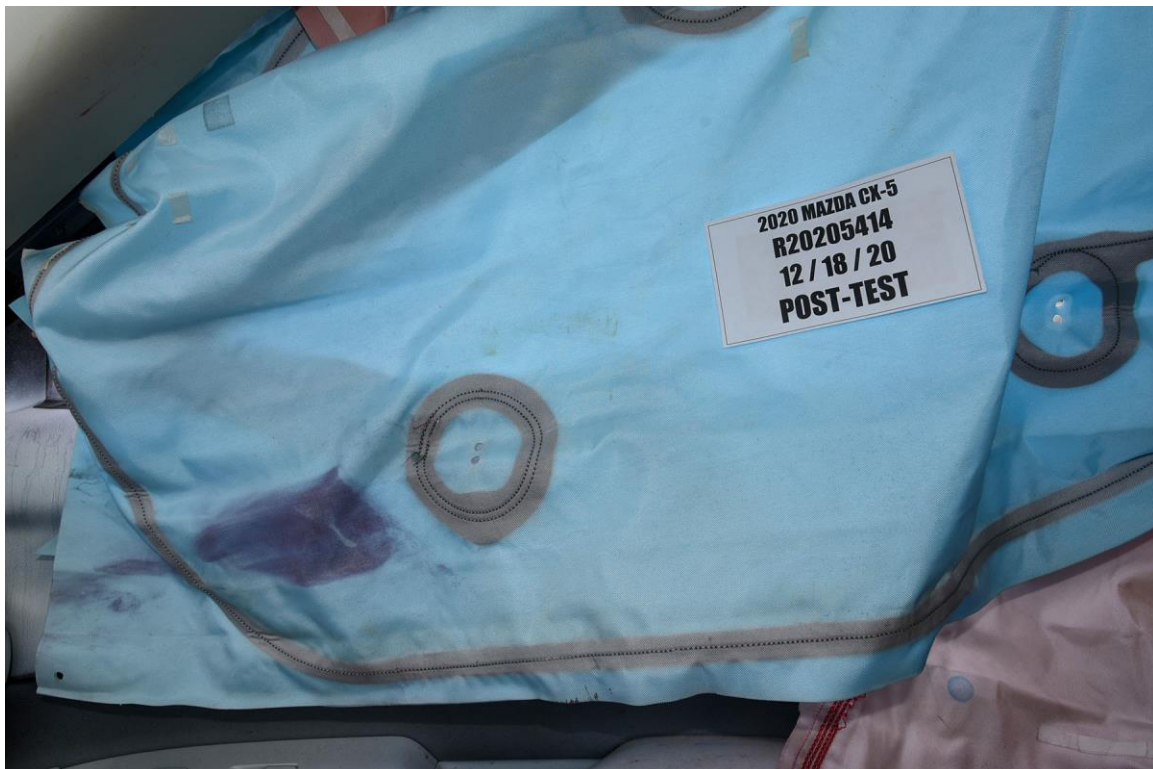


FIGURE 135. Post-Test Passenger Dummy Contact with Side Airbag

Photograph Not Applicable

FIGURE 136. Post-Test Passenger Dummy Contact with Knee Airbag



FIGURE 136a. Post-Test Passenger Dummy Contact with Headliner



FIGURE 136b. Post-Test Passenger Dummy Contact with A-Pillar



FIGURE 136c. Post-Test Passenger Dummy Contact with Windshield



FIGURE 136d. Post-Test Passenger Dummy Contact with Pelvis/Torso Airbag

Photograph Not Available

FIGURE 137. Photograph of Ballast Installed in Vehicle

Photograph Not Applicable

No Stoddard Solvent Spillage

FIGURE 138. Post-Test Stoddard Solvent Spillage Location View

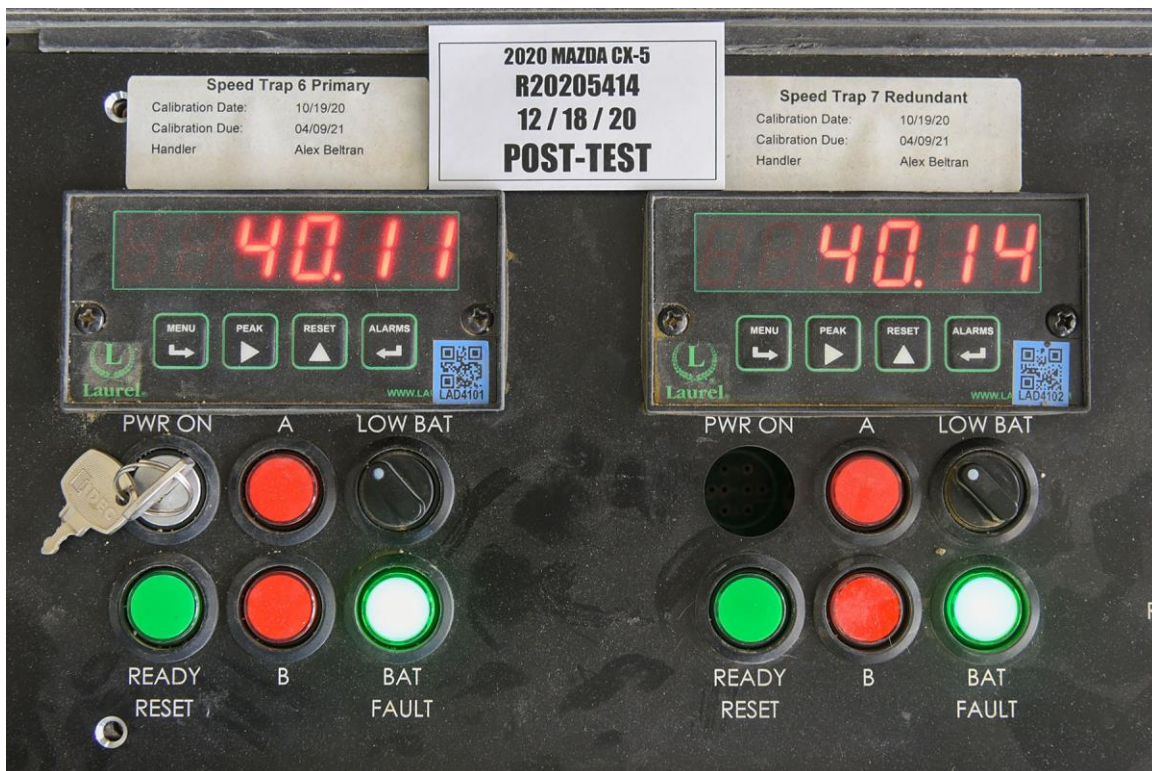


FIGURE 139. Post-Test Speed Trap Read-Out



FIGURE 140. Vehicle at 0° on Static Rollover Device



FIGURE 141. Vehicle at 90° on Static Rollover Device

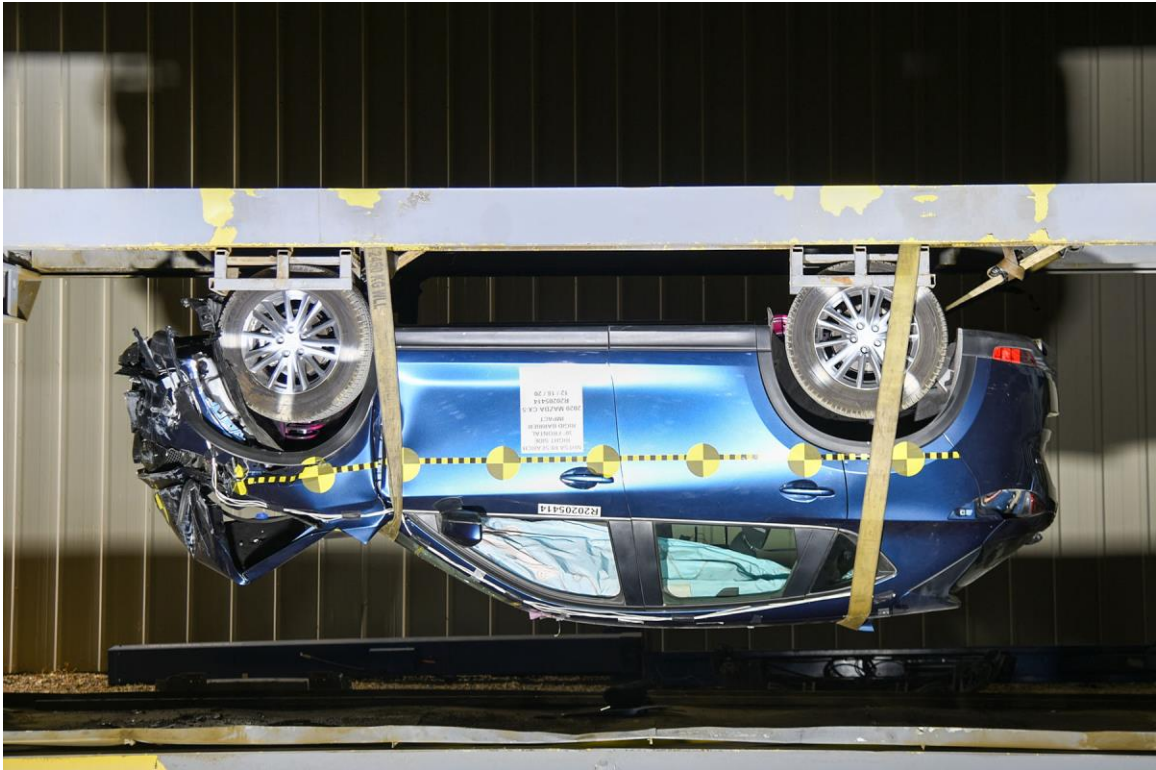


FIGURE 142. Vehicle at 180° on Static Rollover Device

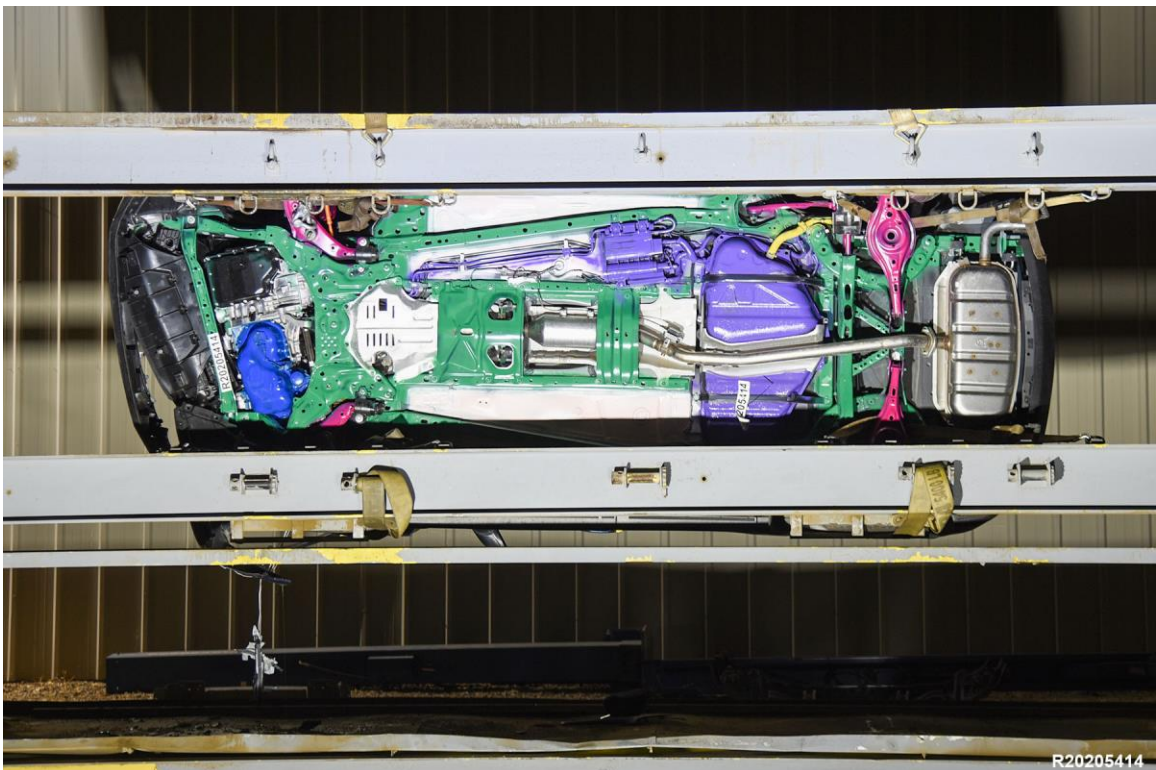


FIGURE 143. Vehicle at 270° on Static Rollover Device

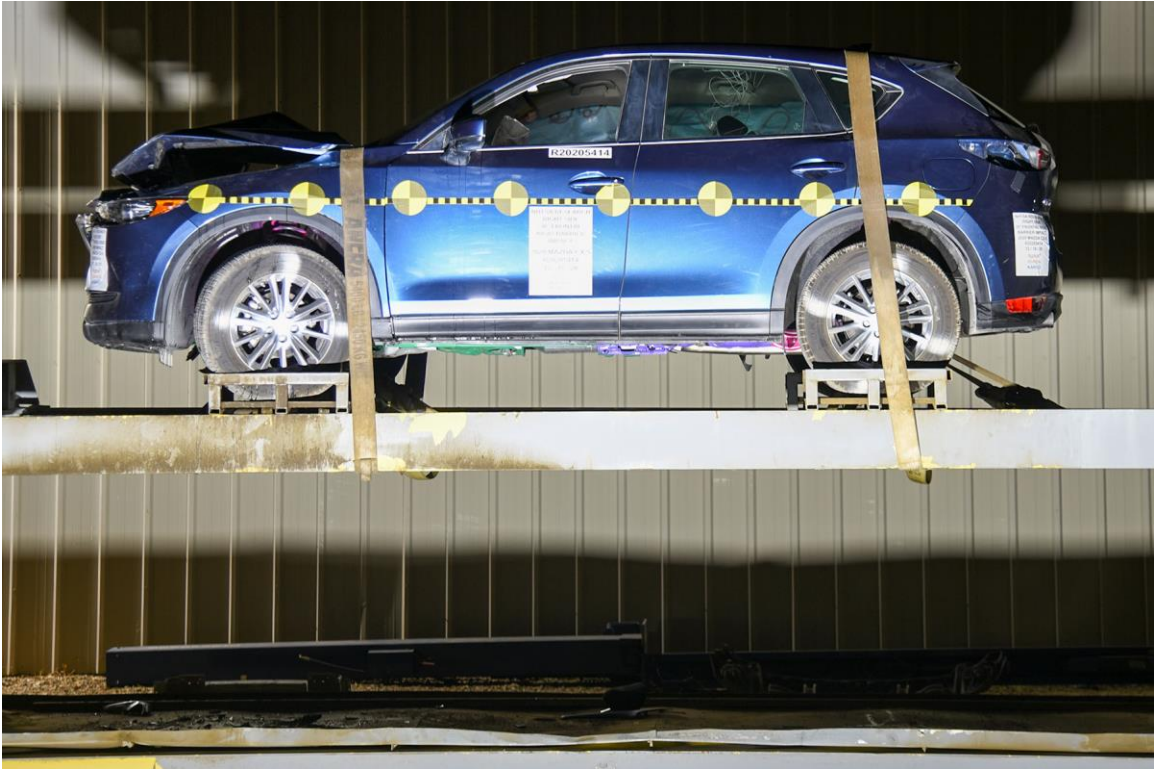


FIGURE 144. Vehicle at 360° on Static Rollover Device



FIGURE 145. Frontal Impact Event



2020 Mazda CX-5

Model: 2020 CX-5 SPORT FRONT WHEEL DRIVE
 Exterior Color: ETHERAL BLUE MC
 Interior Color: BLACK

Fuel Economy and Environment

Fuel Economy

28 MPG combined city/hwy
 25 city
 31 highway
 3.6 gallons per 100 miles

You Save \$250 in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost \$1,450

Fuel Economy & Greenhouse Gas Rating (passenger only) **6** (Best)

Smog Rating (passenger only) **7** (Best)

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score ★★★★★

Based on the combined ratings of frontal, side and rollover.

Should ONLY be compared to other vehicles of similar size and weight.

Frontal Crash	Driver	★★★★★
Frontal Crash	Passenger	★★★★★
Side Crash	Front seat	★★★★★
Side Crash	Rear seat	★★★★★
Rollover		★★★★

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.
 Source: National Highway Traffic Safety Administration (NHTSA)
www.safercar.gov or 1-888-327-4236

PARTS CONTENT INFORMATION:

FOR VEHICLES IN THIS CARLINE:
 U.S./CANADIAN PARTS CONTENT: 0%
 MAJOR SOURCES OF FOREIGN PARTS CONTENT: JAPAN 90%

NOTE: PARTS CONTENT DOES NOT INCLUDE FINAL ASSEMBLY, DISTRIBUTION, OR OTHER NON-PARTS COSTS.

FOR THIS VEHICLE:
 FINAL ASSEMBLY POINT: HIROSHIMA, JAPAN
 COUNTRY OF ORIGIN: JAPAN
 TRANSMISSION: JAPAN

STANDARD EQUIPMENT

ENGINE/MECHANICAL FEATURES

- SKYACTIV-G 2.5L ENGINE
- 187 HORSEPOWER, 186 LB-FT TORQUE
- SKYACTIV-DRIVE i650 SPORT MODE AT
- FRONT VENTILATED DISC BRAKES
- REAR SOLID DISC BRAKES

EXTERIOR FEATURES

- 17" X 7" ALLOY WHEELS
- P225/65R17 ALL-SEASON TIRES
- RAIN-SENSING WINDSHIELD WIPERS
- FIXED-INTERMITTENT REAR WIPER
- BODY-COLORED REAR ROOF SPOILER
- POWER SIDE MIRRORS WITH TURN LAMPS

INTERIOR FEATURES

- 8-PASSENGER SEATING
- CLOTH-TRIMMED SEATS
- LEATHER-WRAPPED STEERING WHEEL
- LEATHER-WRAPPED SHIFT KNOB
- POWER AUTOMATIC DOOR LOCKS
- POWER WINDOWS W/ONE-TOUCH UP/DOWN
- ELECTRONIC PARKING BRAKE
- REMOTE KEYLESS ENTRY
- PUSH BUTTON ENGINE START
- REARVIEW CAMERA

SAFETY AND SECURITY FEATURES

- 5-STAR SAFETY RATING
- 30K MI BUMPER-TO-BUMPER WARRANTY
- 24-HOUR ROADSIDE ASSISTANCE
- 5-PASSENGER 3-POINT SAFETY BELTS
- LATCH CHILD SAFETY SEAT ANCHORS
- ANTI-THEFT ENGINE IMMOBILIZER
- TIRE PRESSURE MONITORING SYSTEM
- BLIND SPOT MONITORING
- LANE DEPARTURE WARNING SYSTEM
- LANE KEEP ASSIST
- REAR CROSS TRAFFIC ALERT

MSRP \$25,190

Total Vehicle and Options \$25,190
 Delivery, Processing and Handling Fee \$1,100
Total MSRP \$26,290

SOLD TO: 23658
 TOM BUSH MAZDA
 8676 ATLANTIC BOULEVARD
 JACKSONVILLE, FL 32225

SHIP TO: 23658
 TOM BUSH MAZDA
 8676 ATLANTIC BOULEVARD
 JACKSONVILLE, FL 32225

JM3KFABM1L0801898



CX5-SP-3A-KB-1764B-JS-00-30000021

MazdaUSA.com

FIGURE 146. Monroney Label Photograph

APPENDIX B
VEHICLE AND DUMMY RESPONSE DATA TRACES

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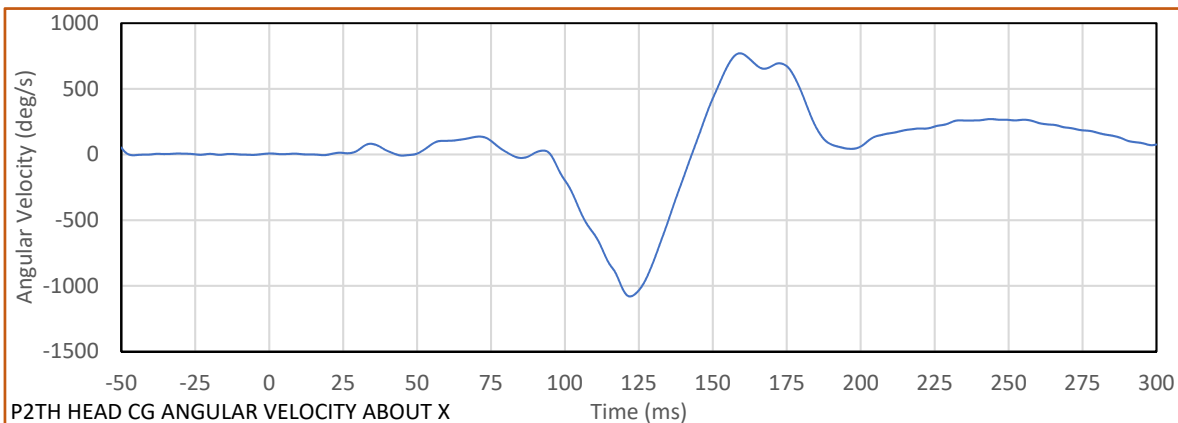
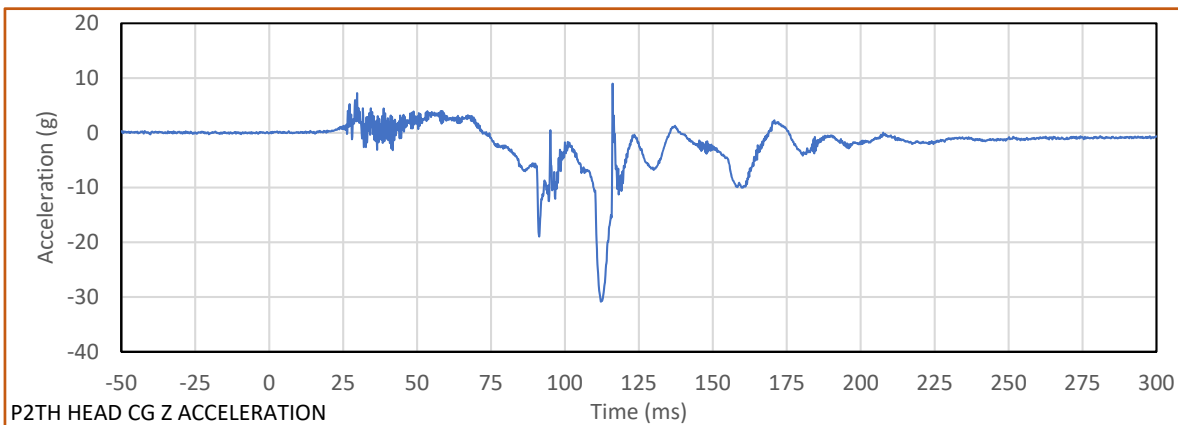
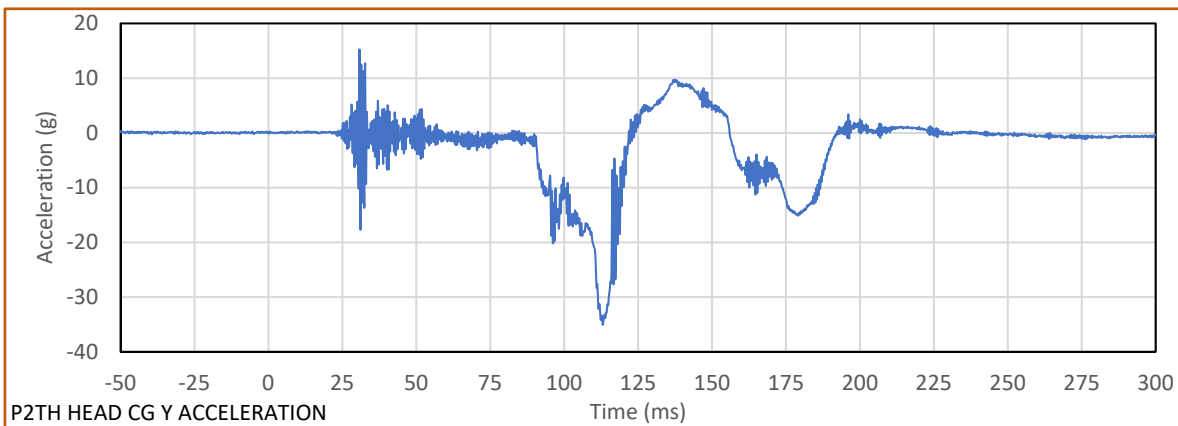
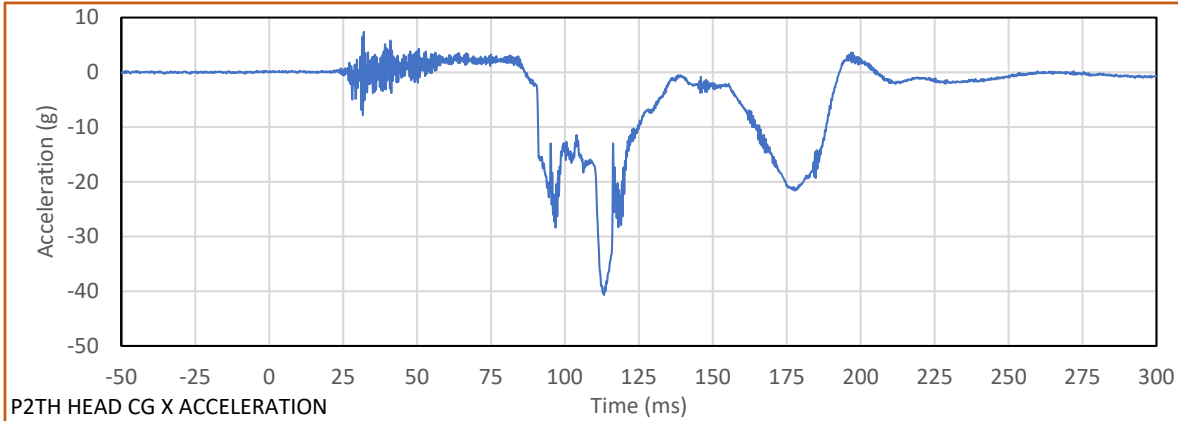
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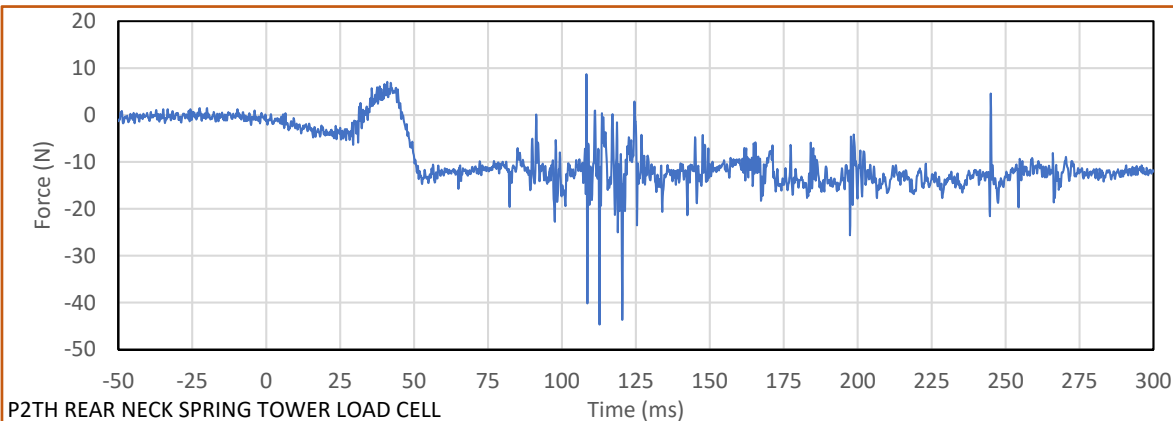
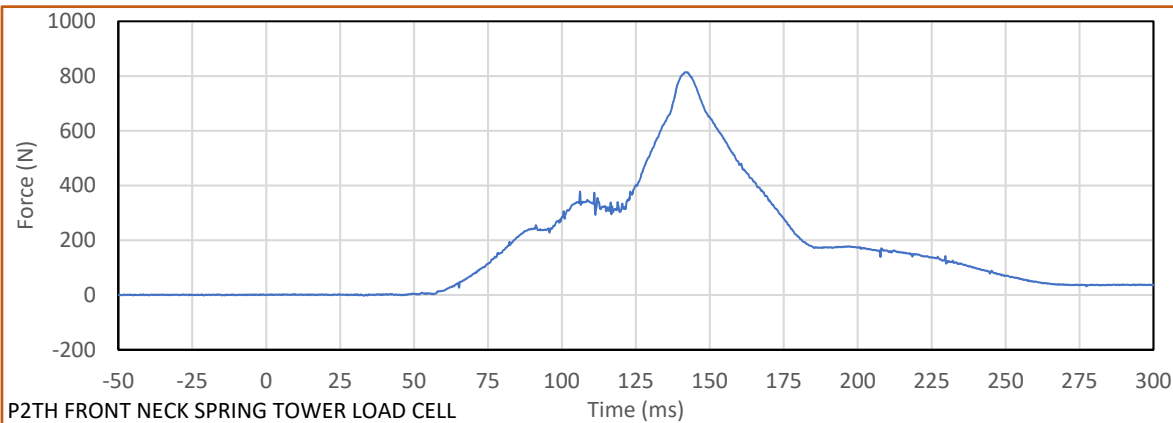
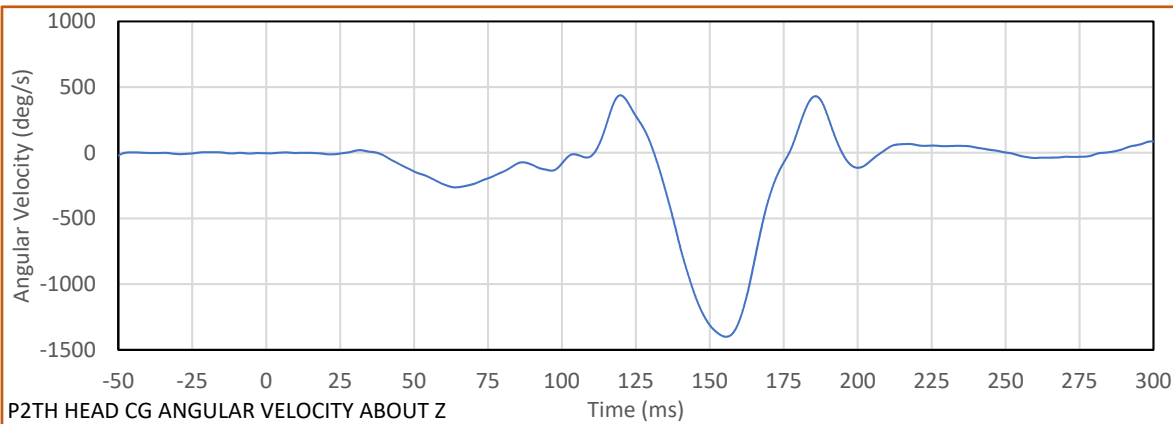
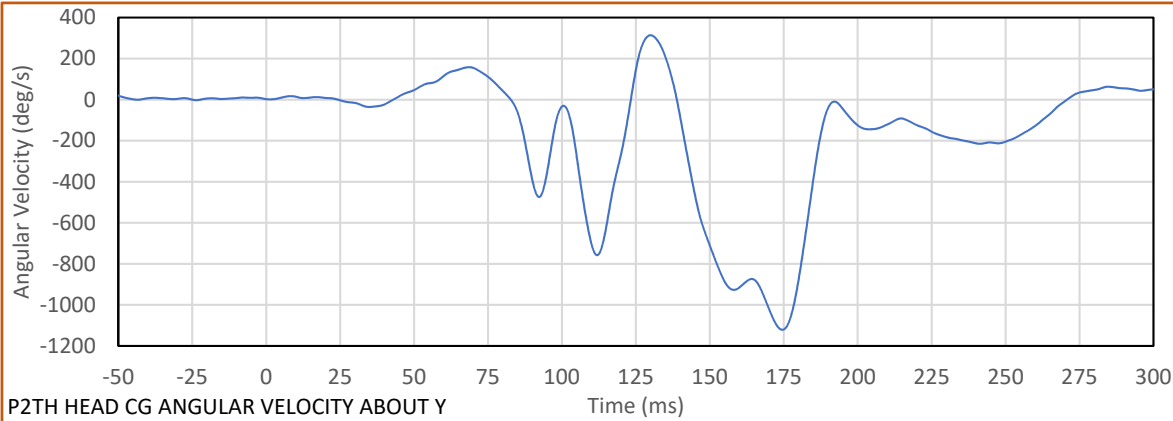
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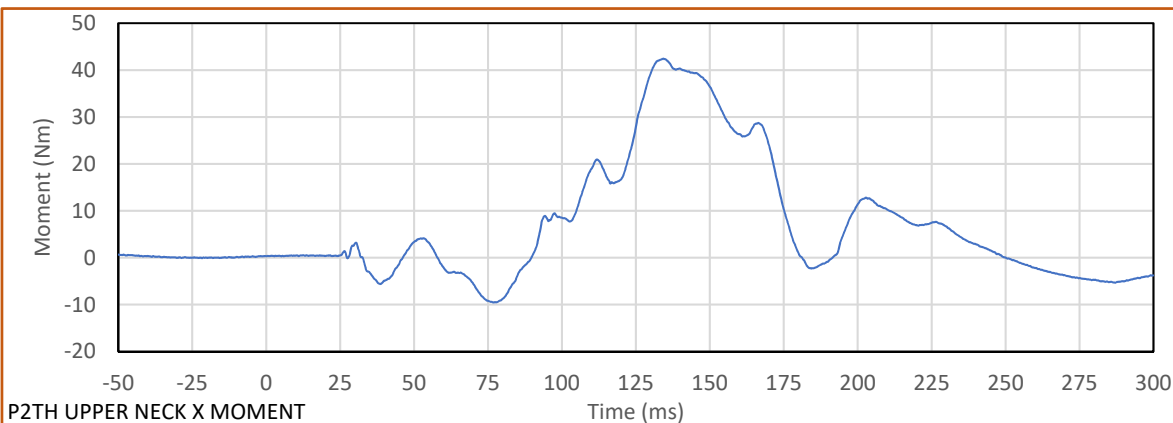
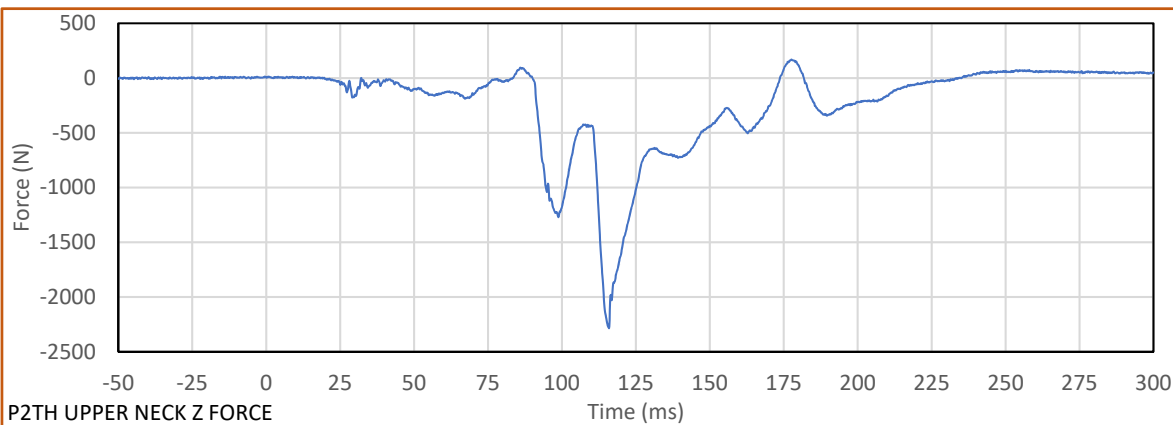
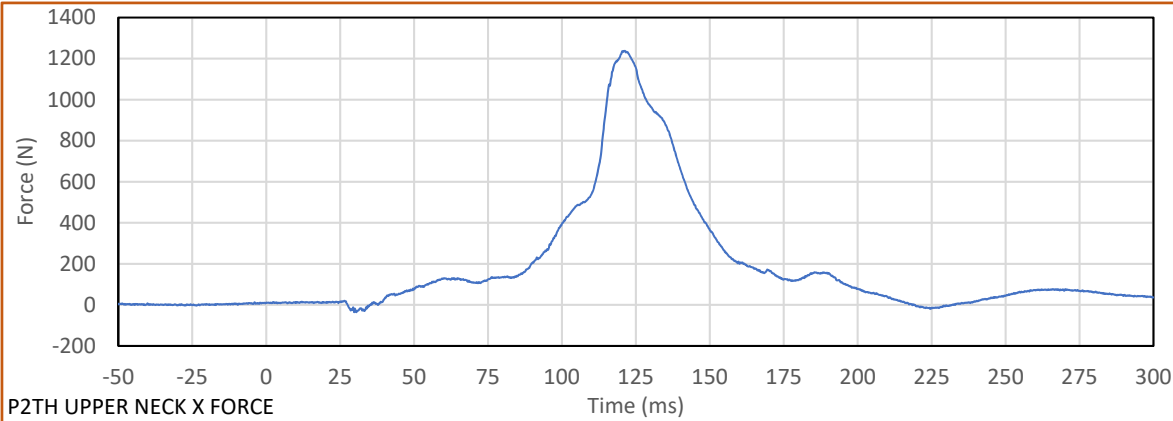
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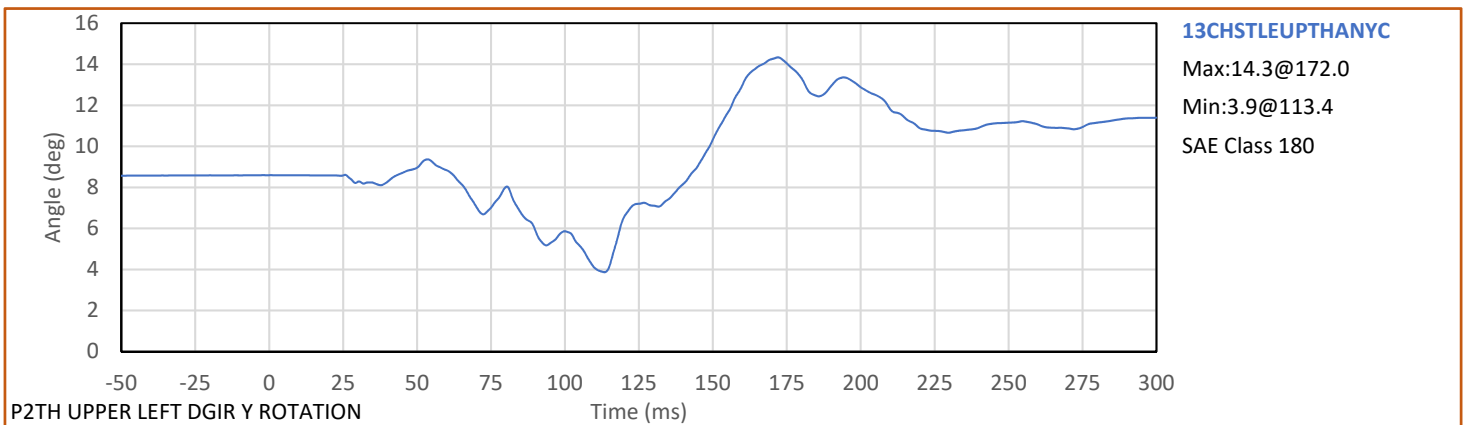
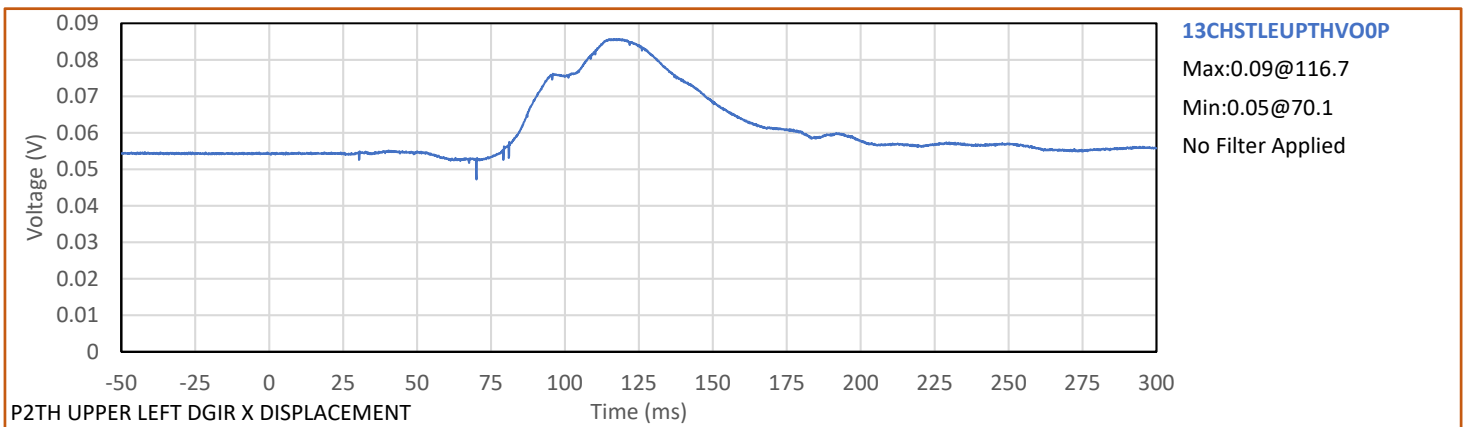
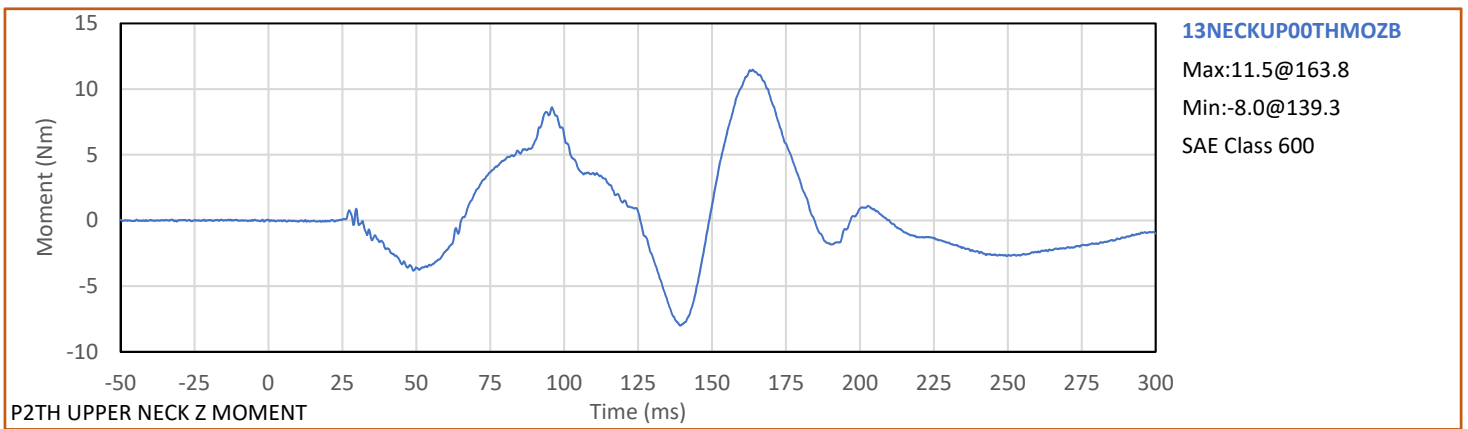
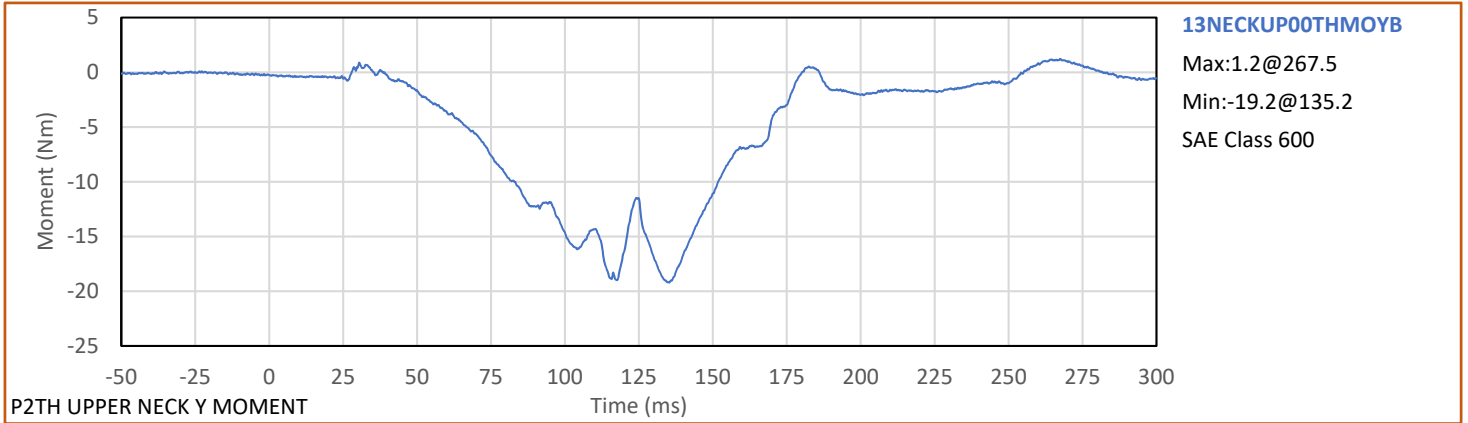
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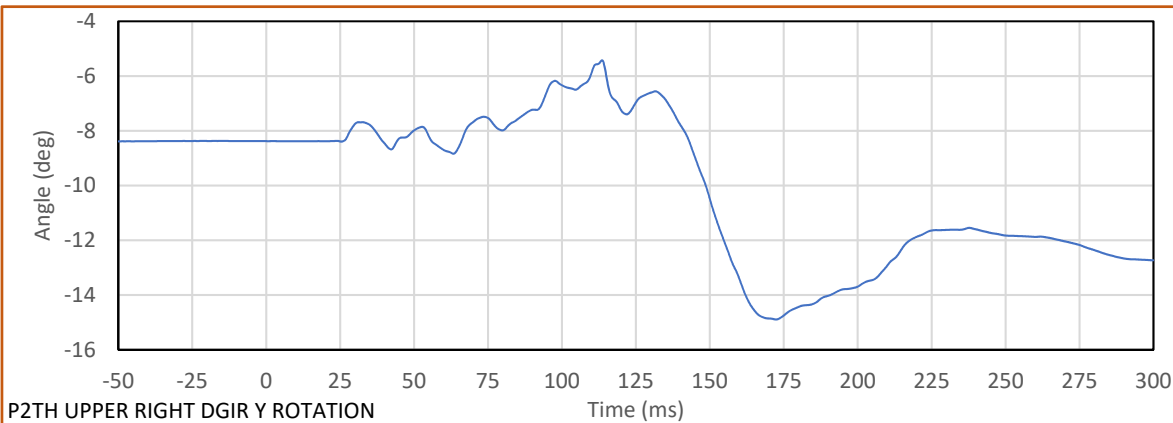
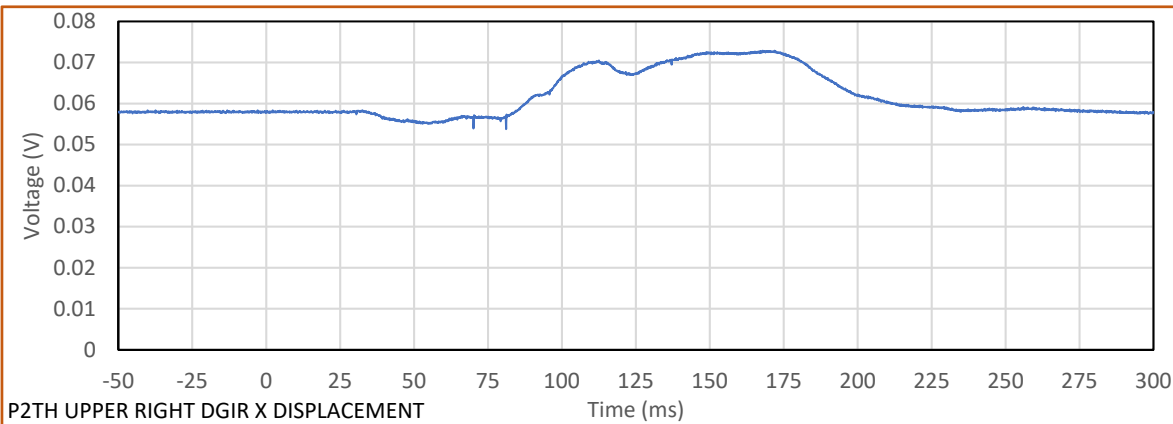
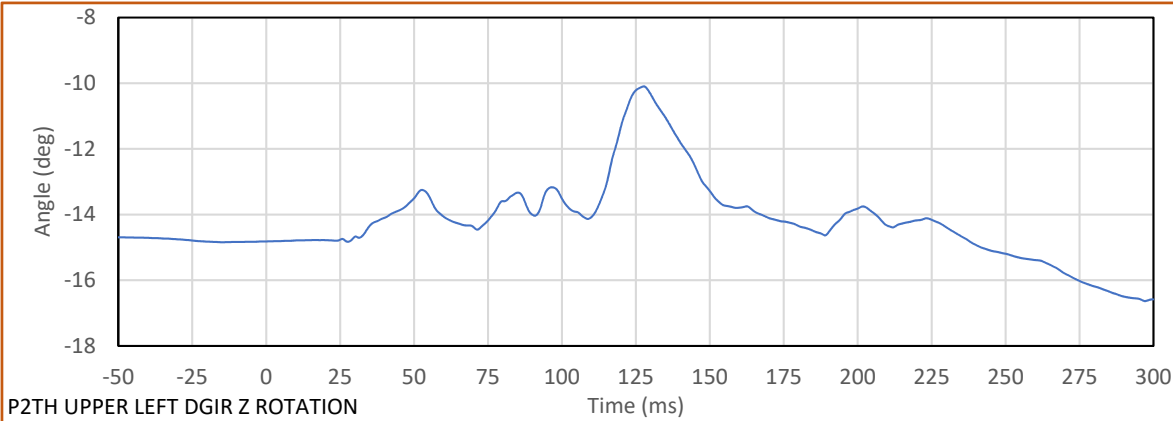
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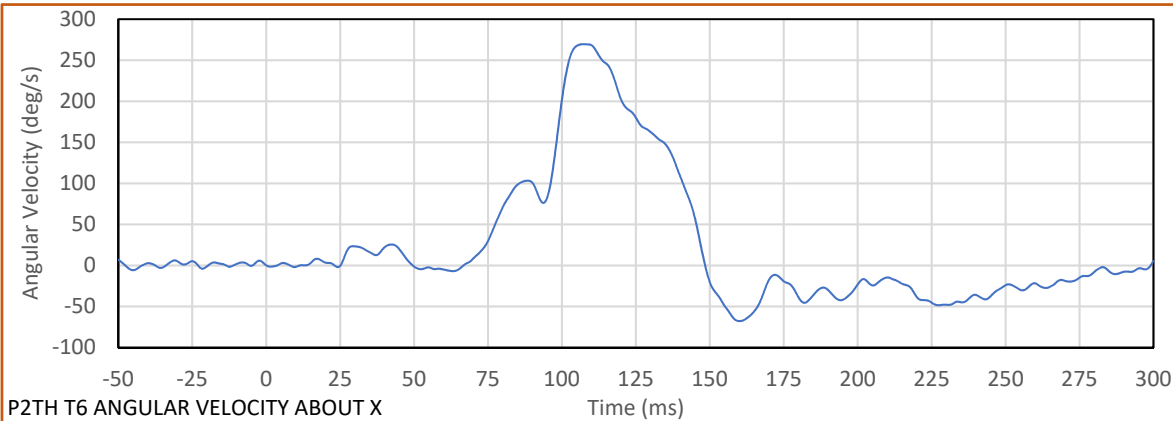
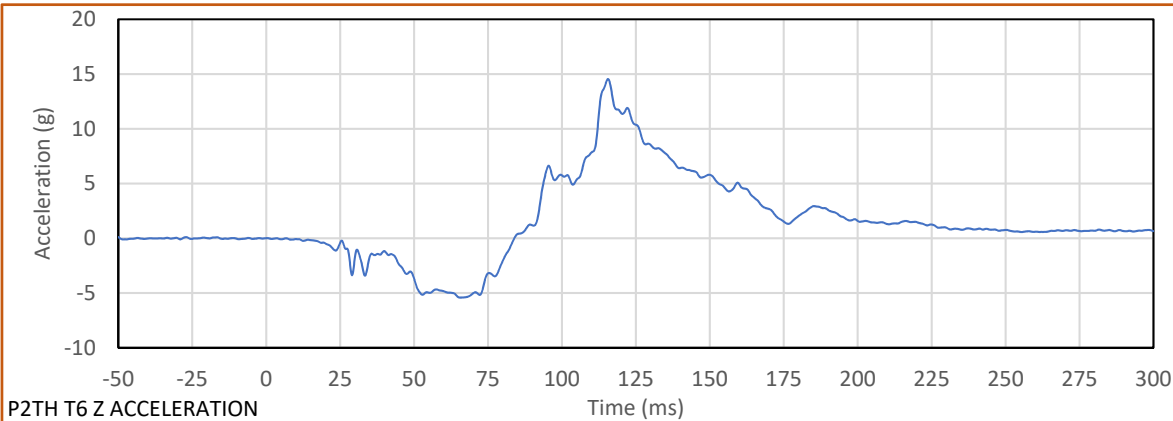
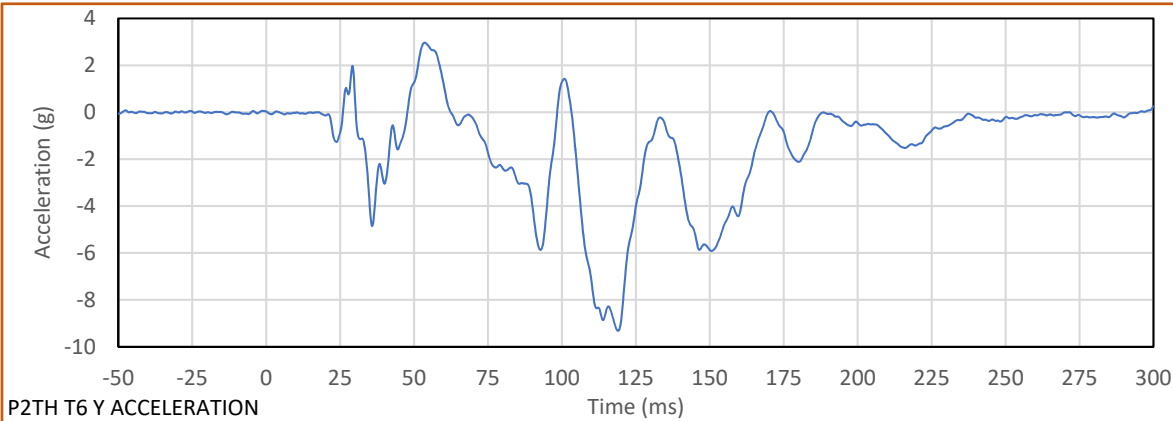
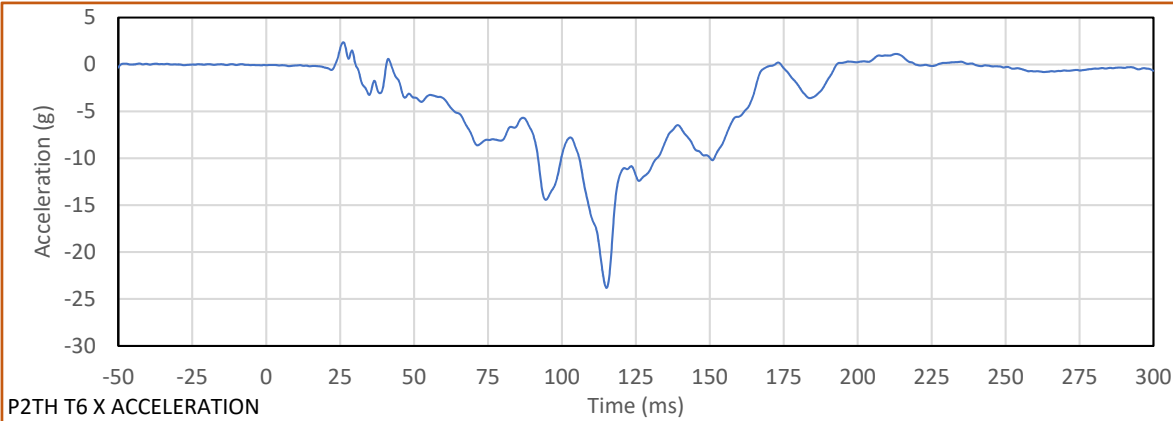


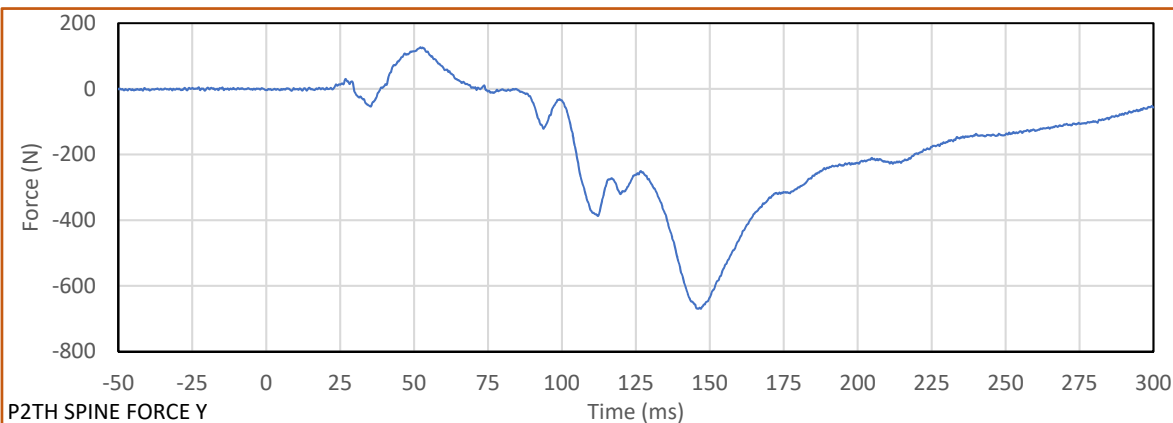
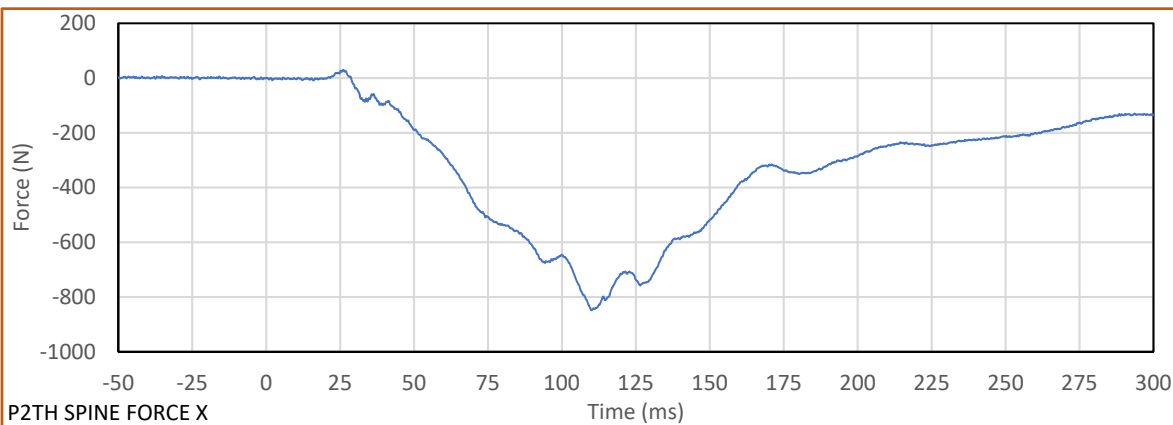
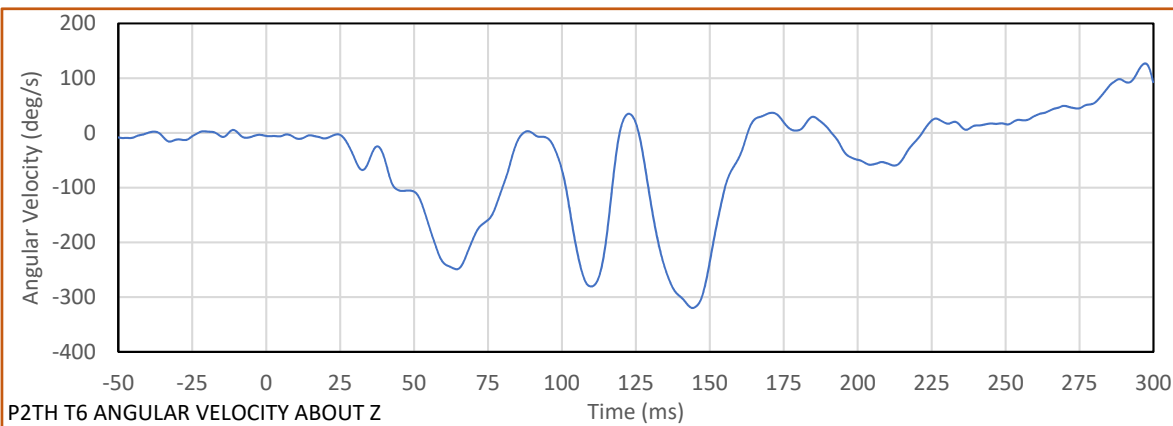
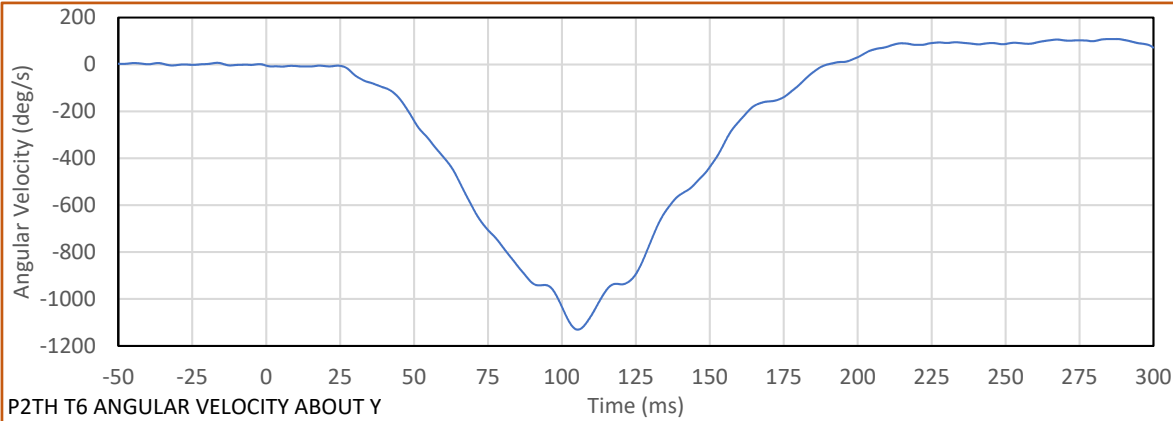


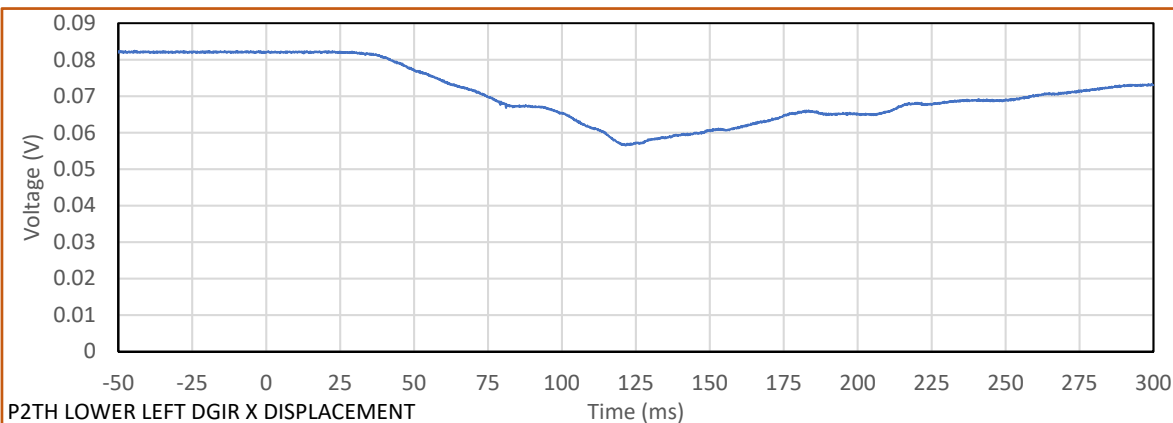
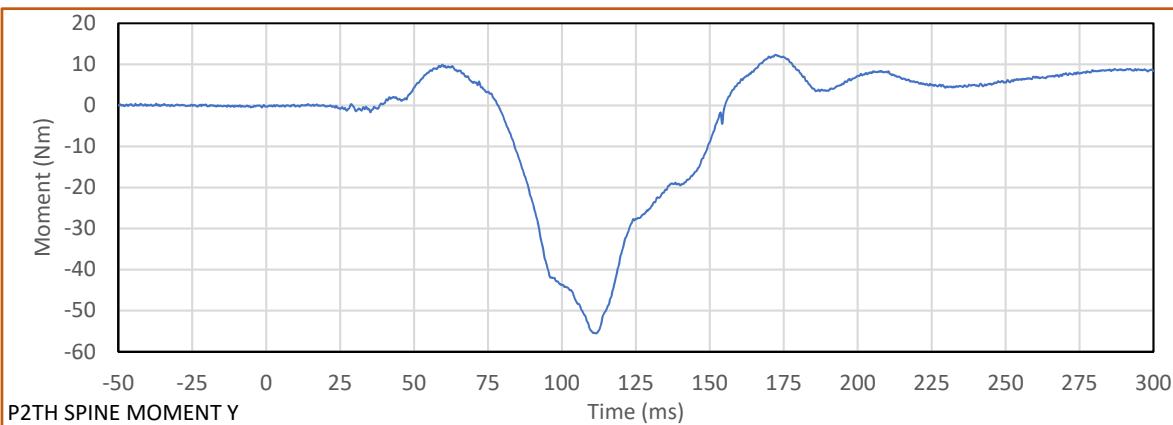
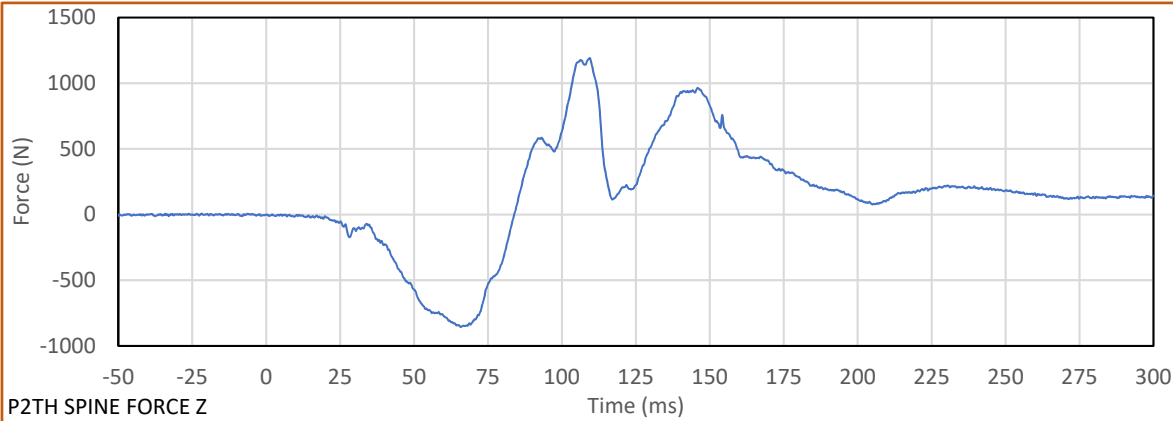


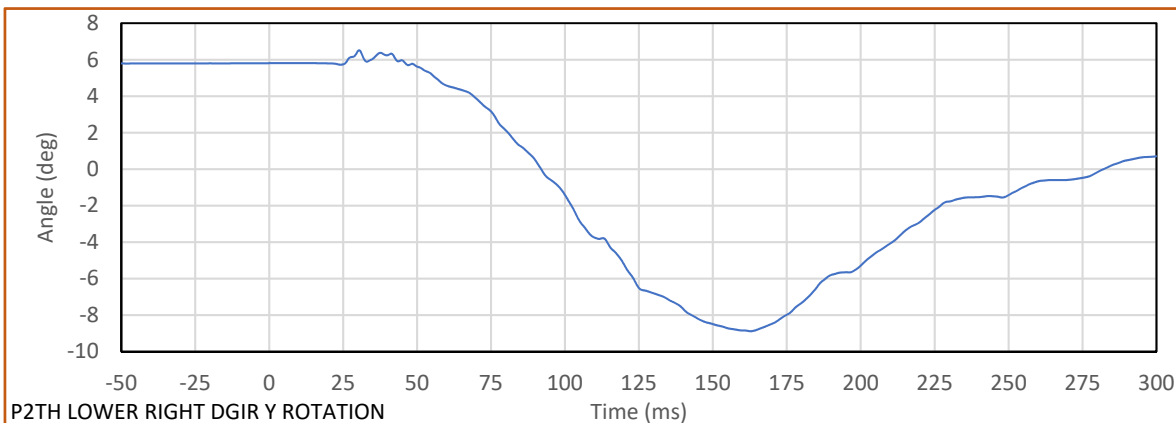
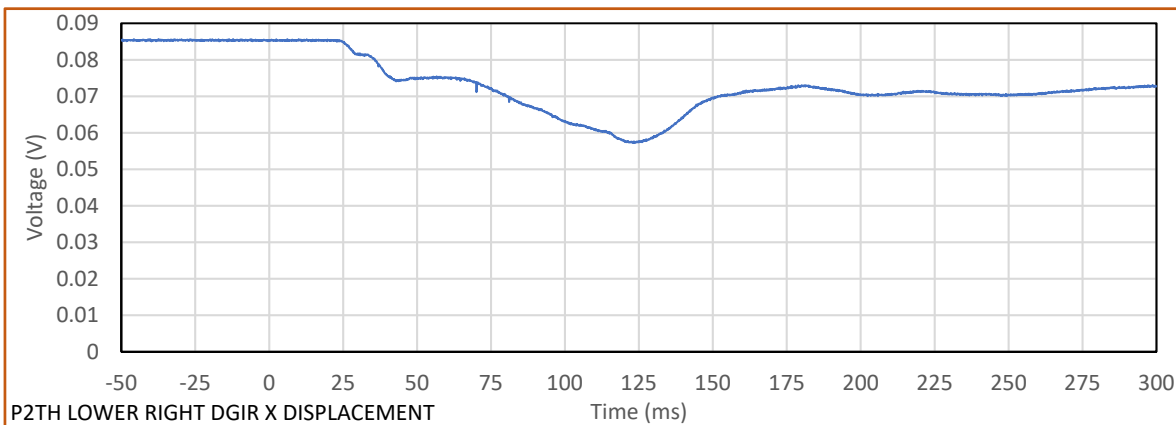
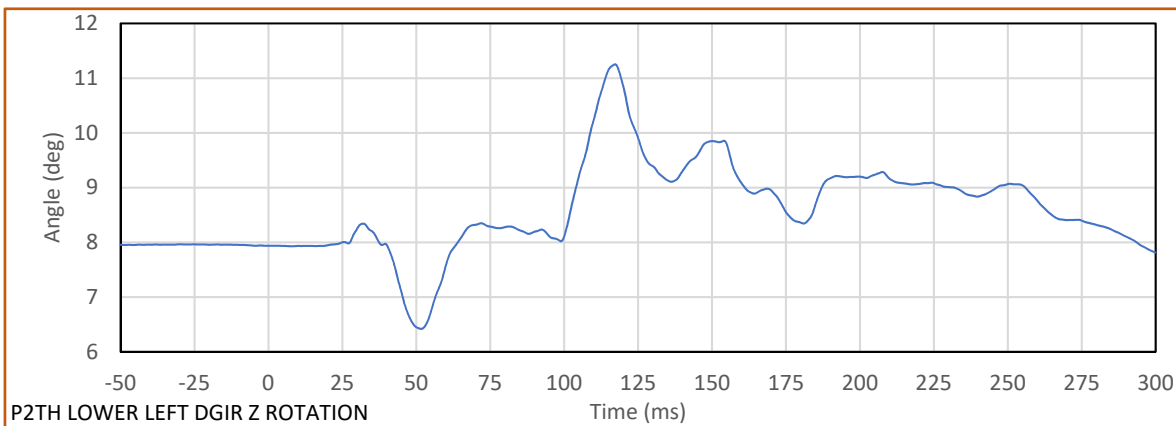
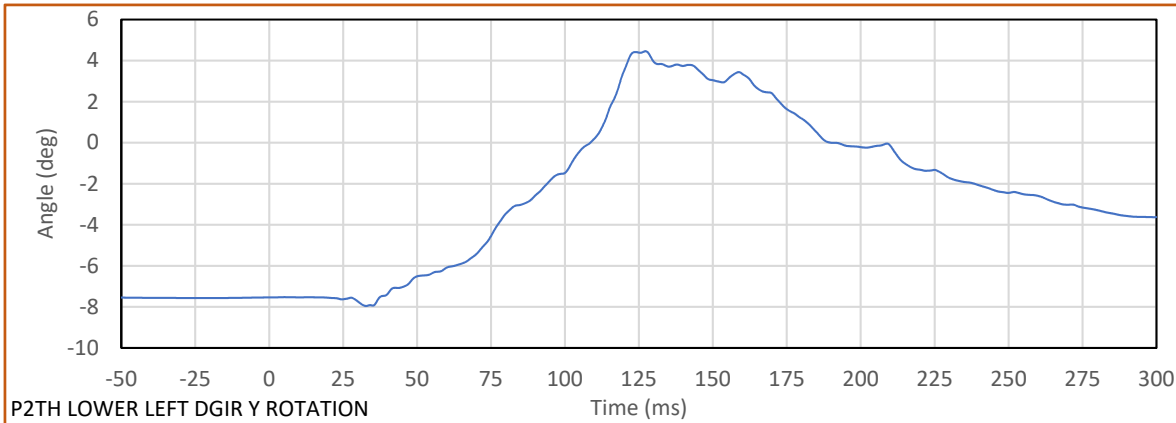


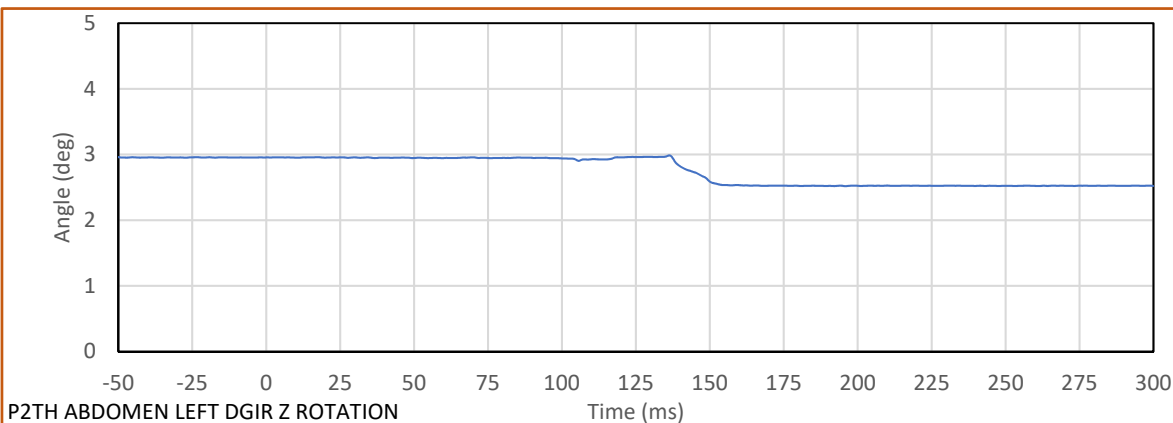
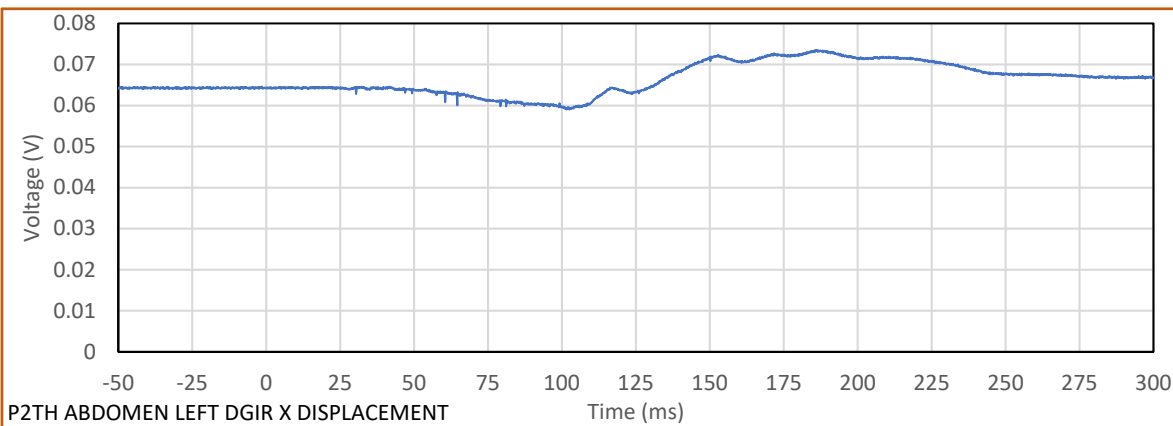
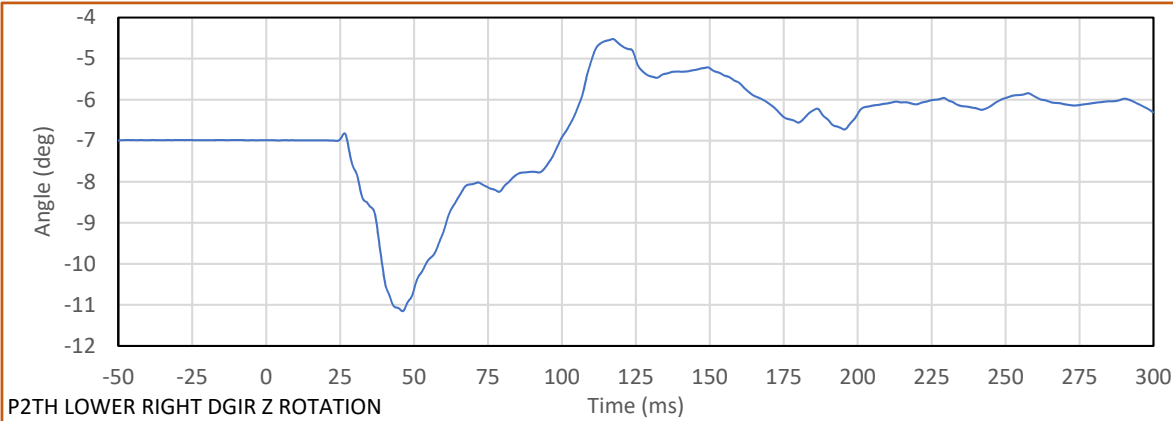


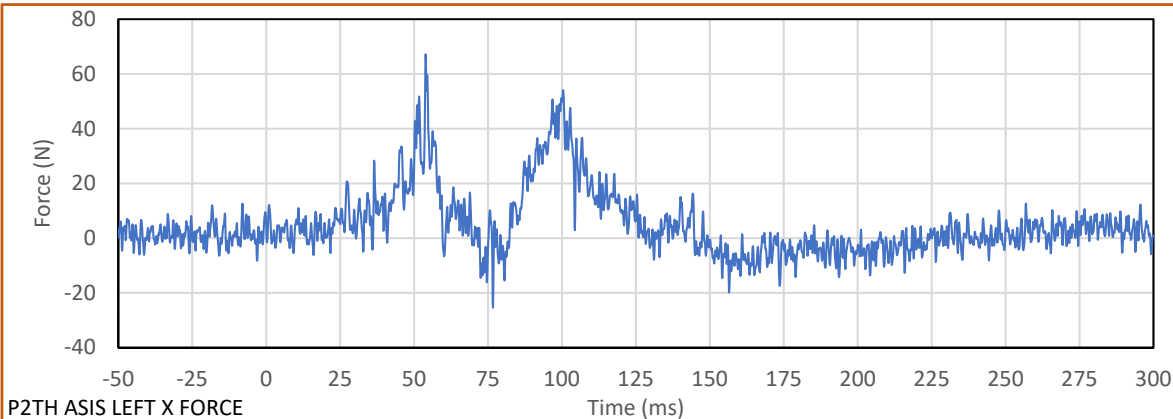
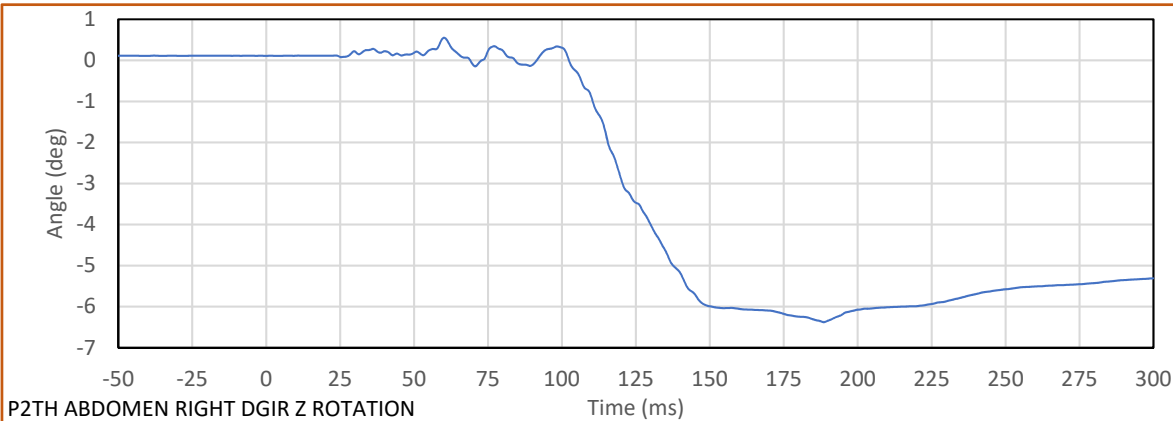
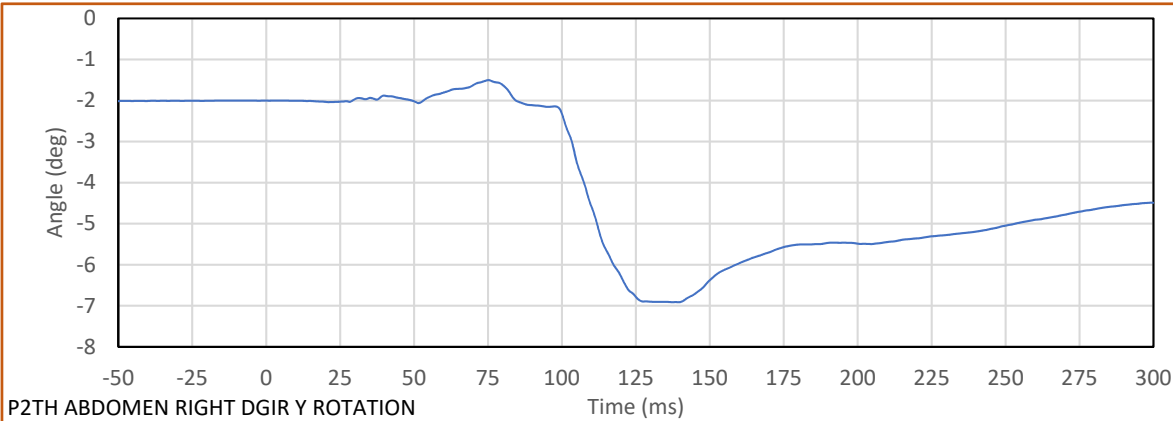
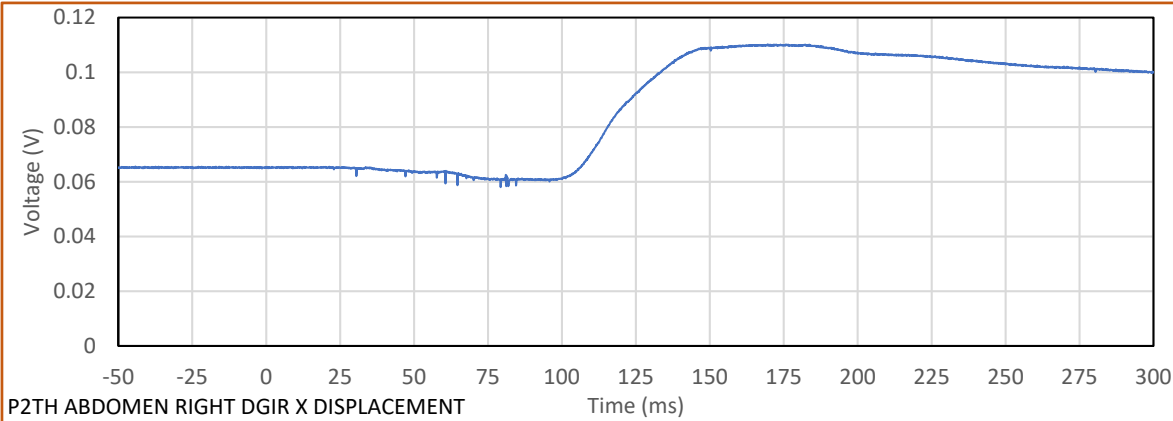


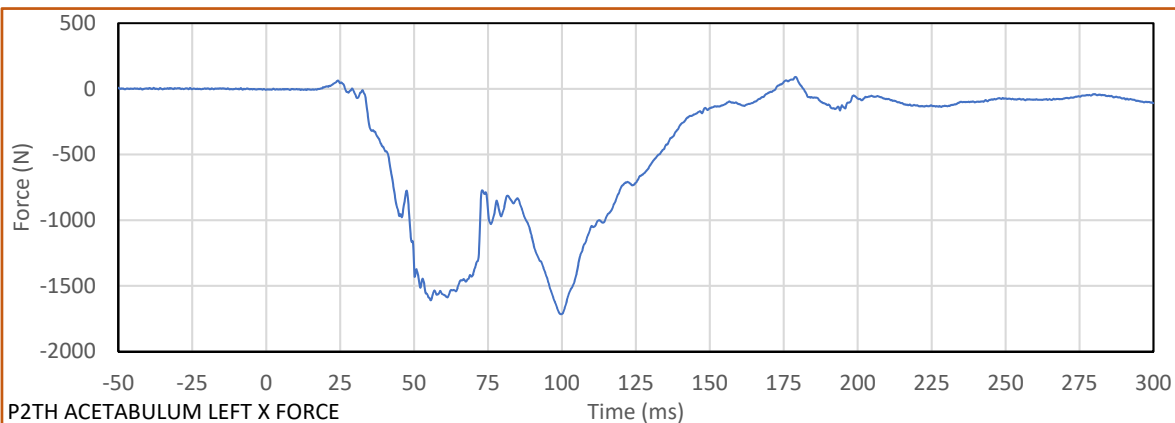
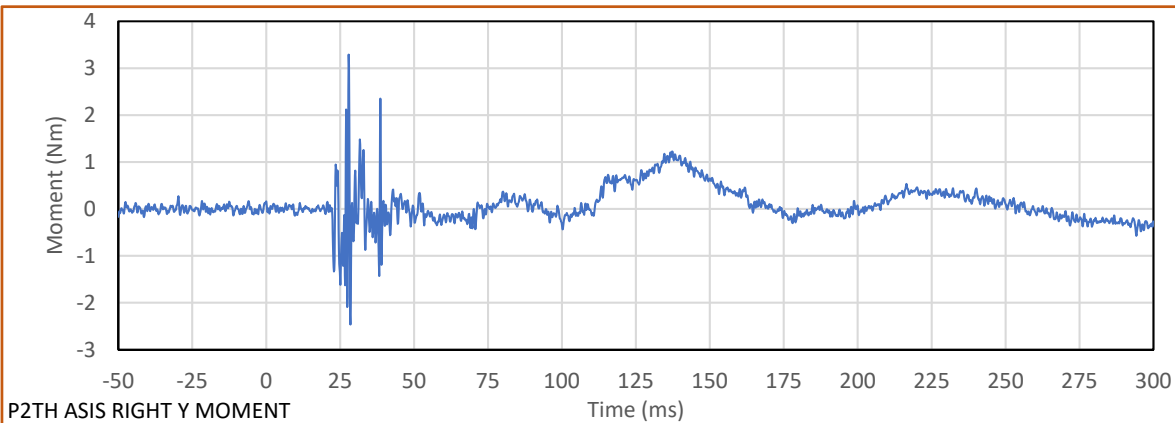
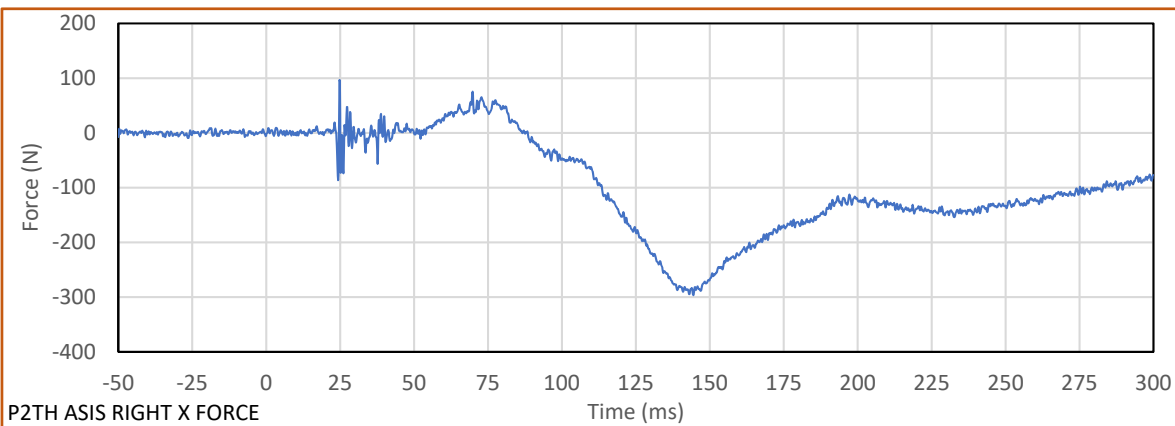
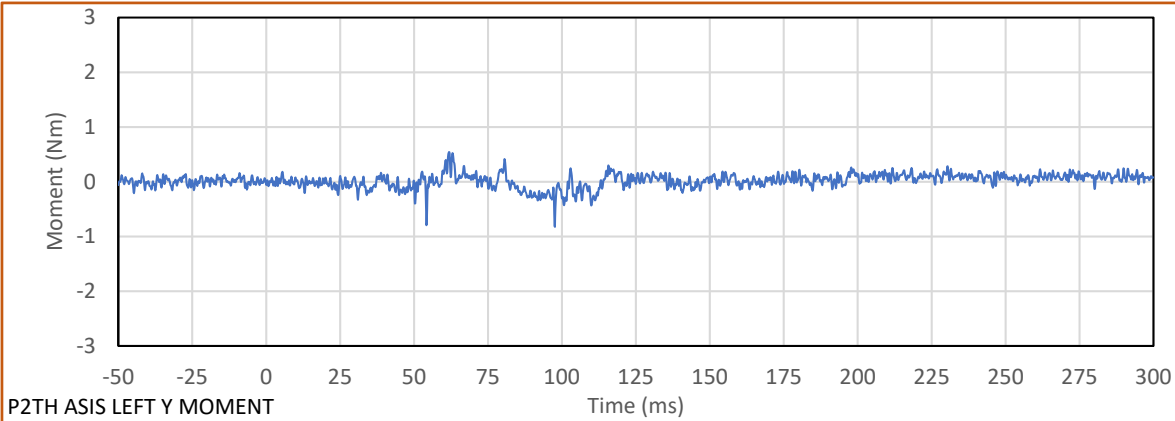


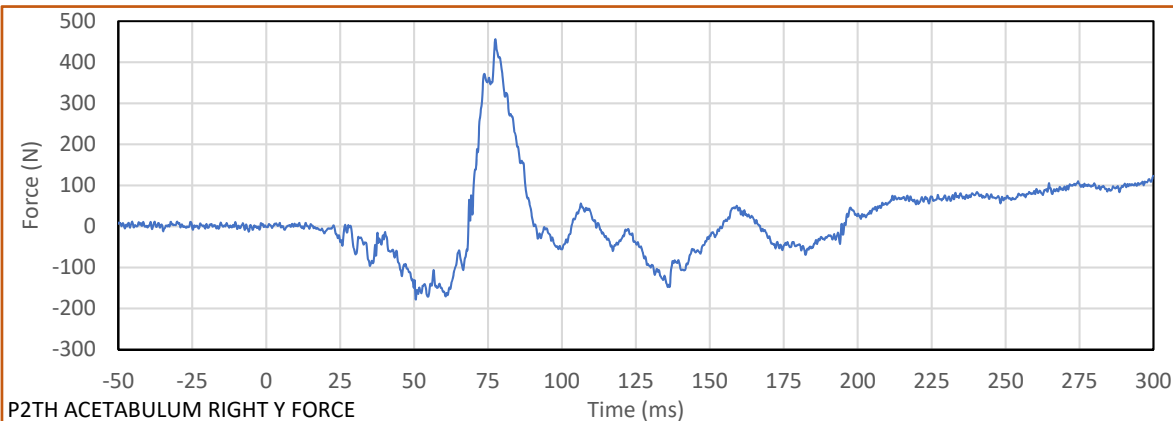
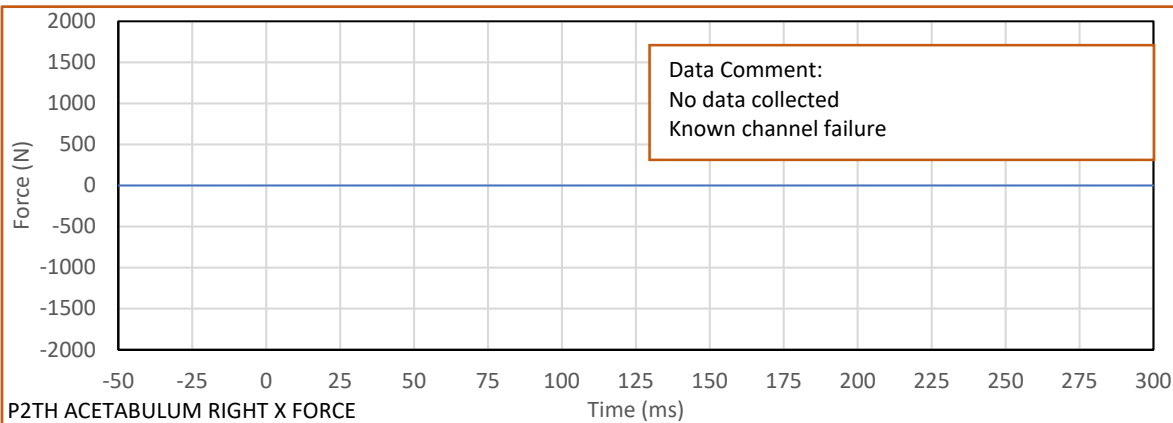
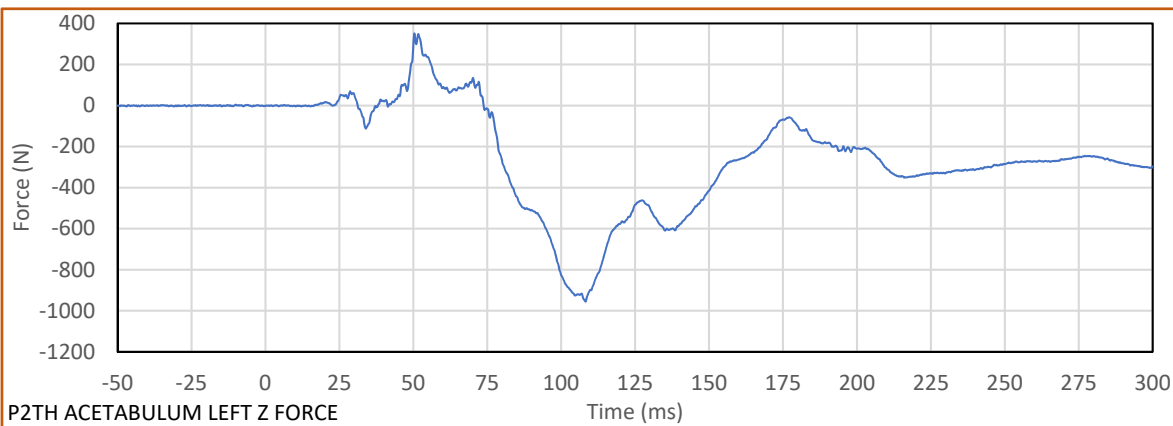
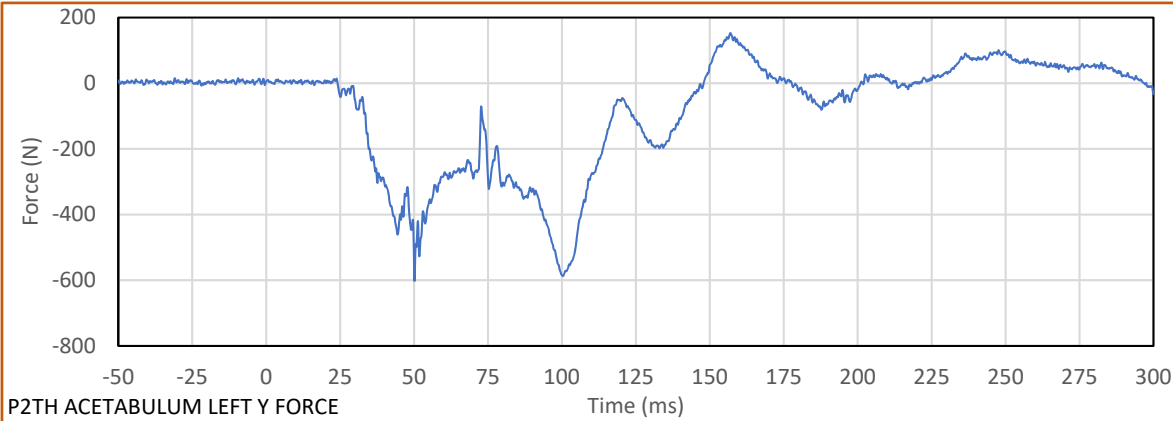


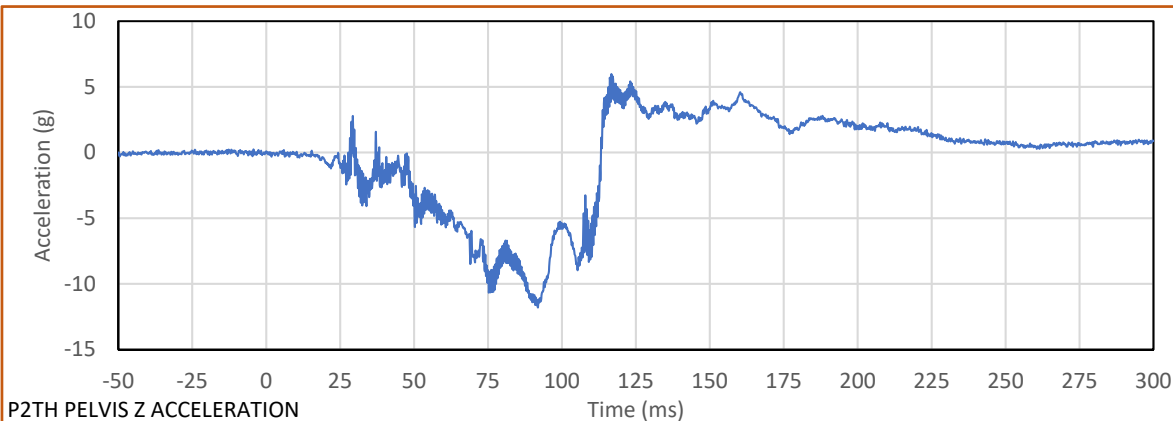
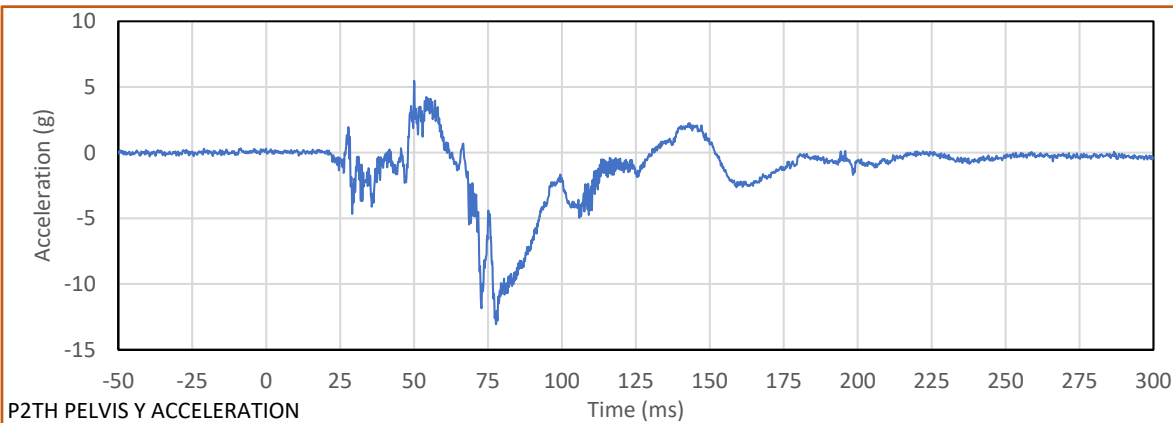
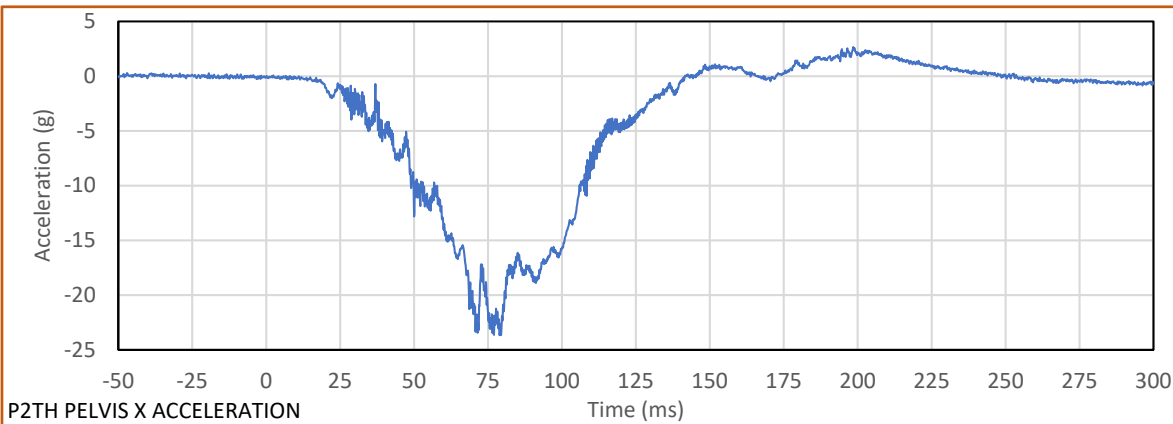
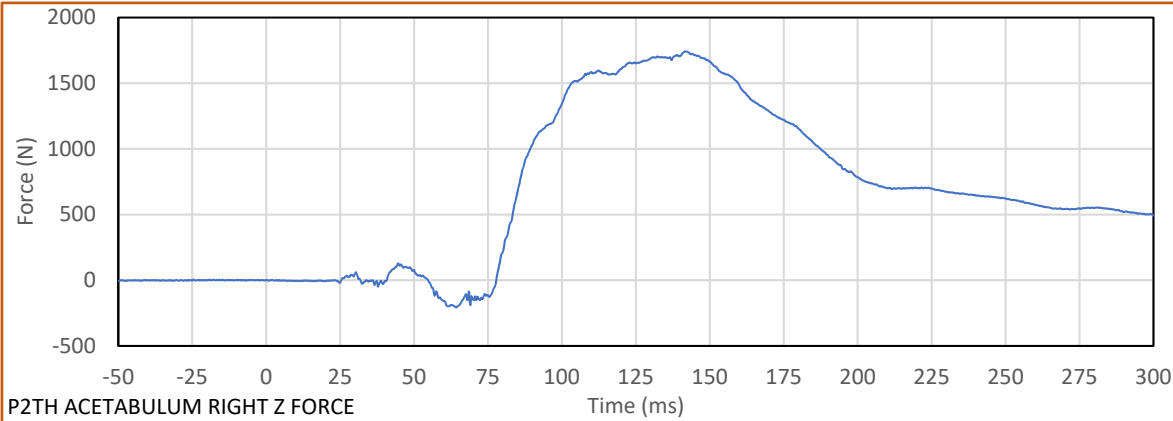


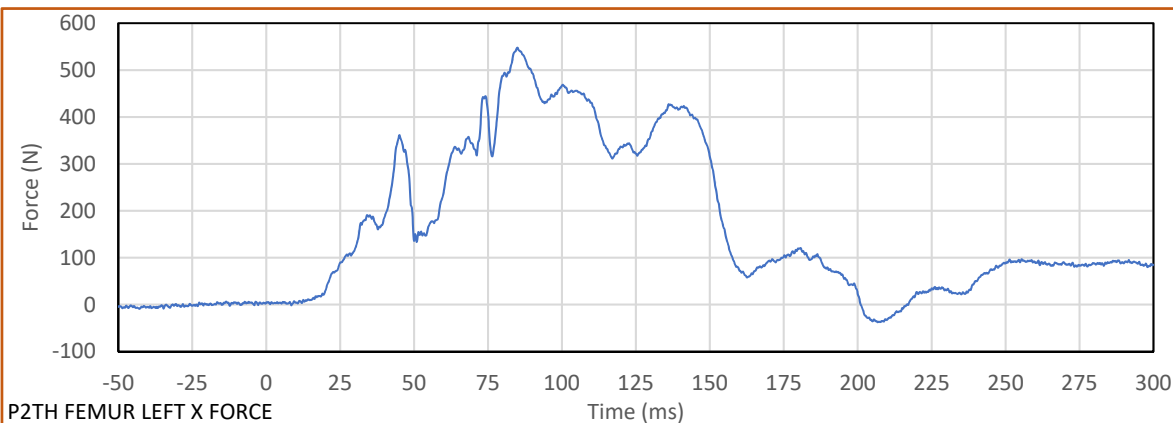
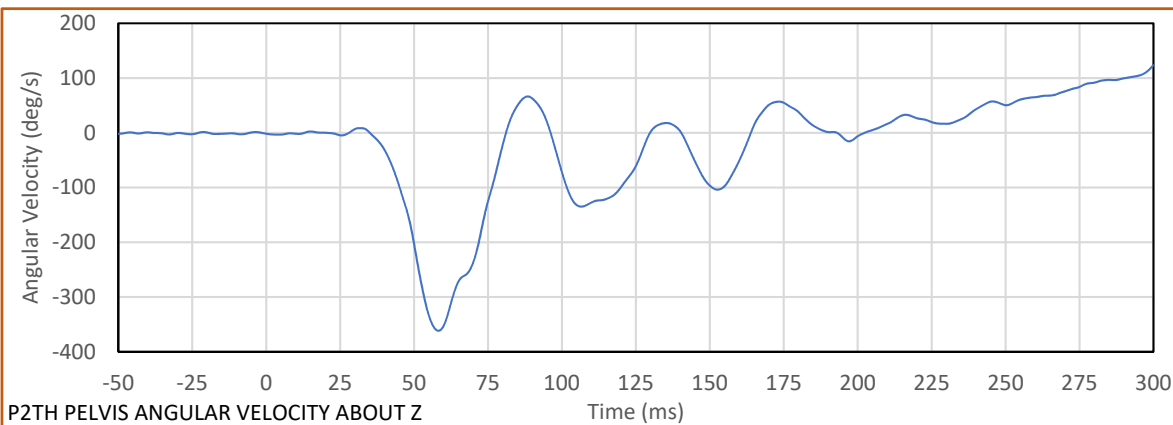
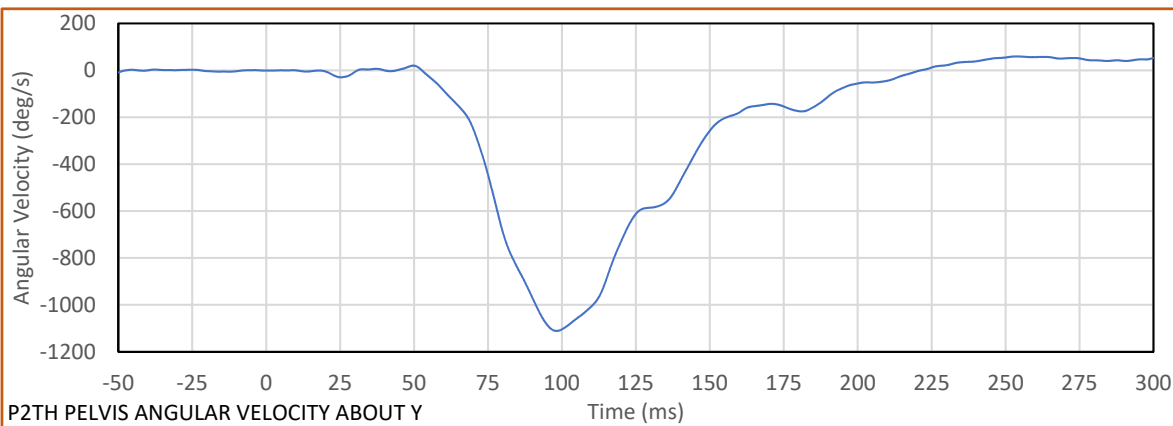
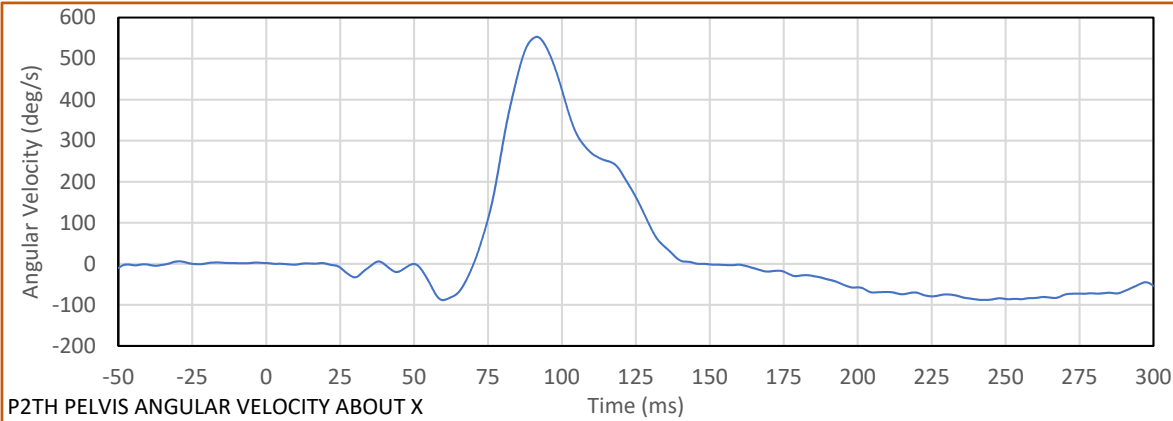


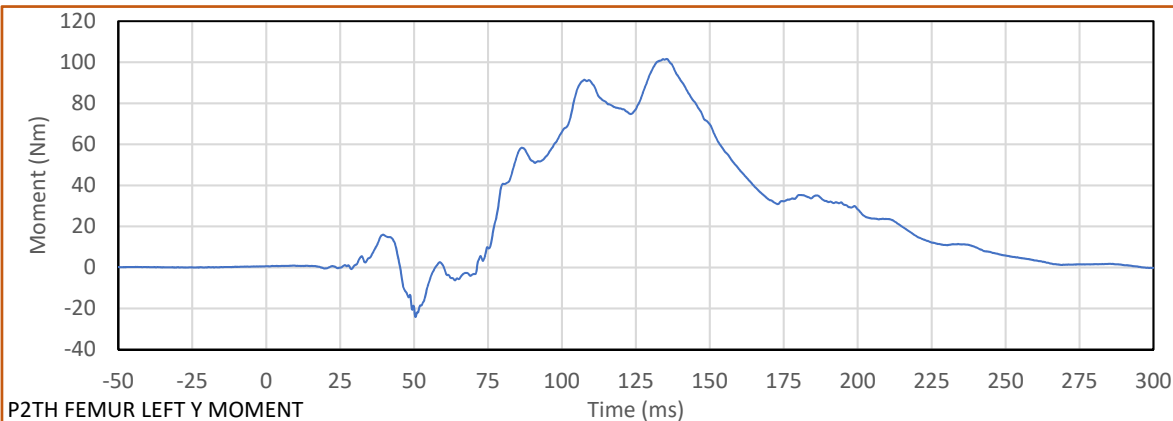
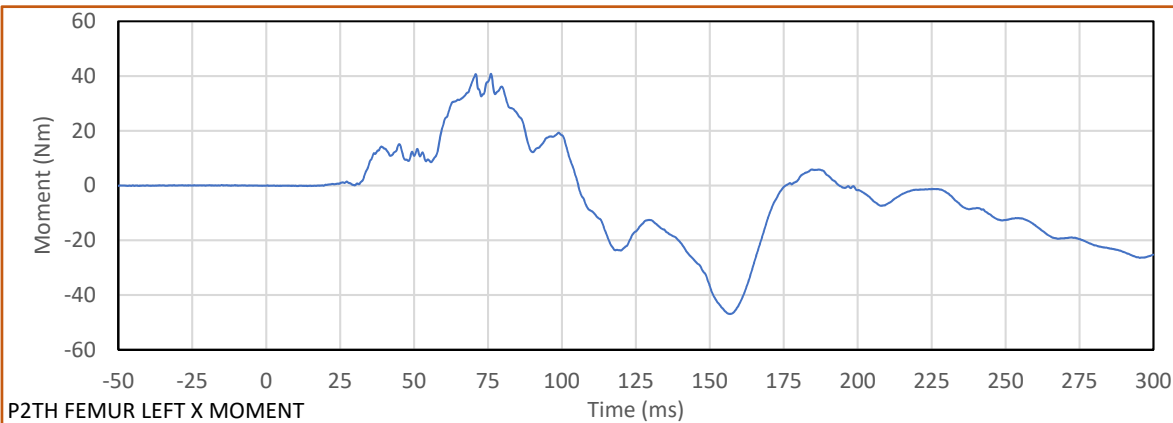
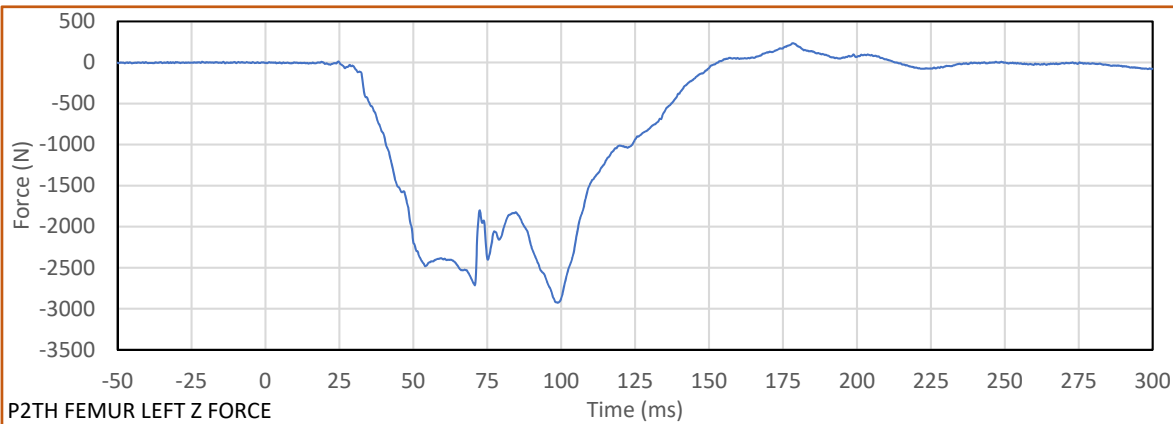
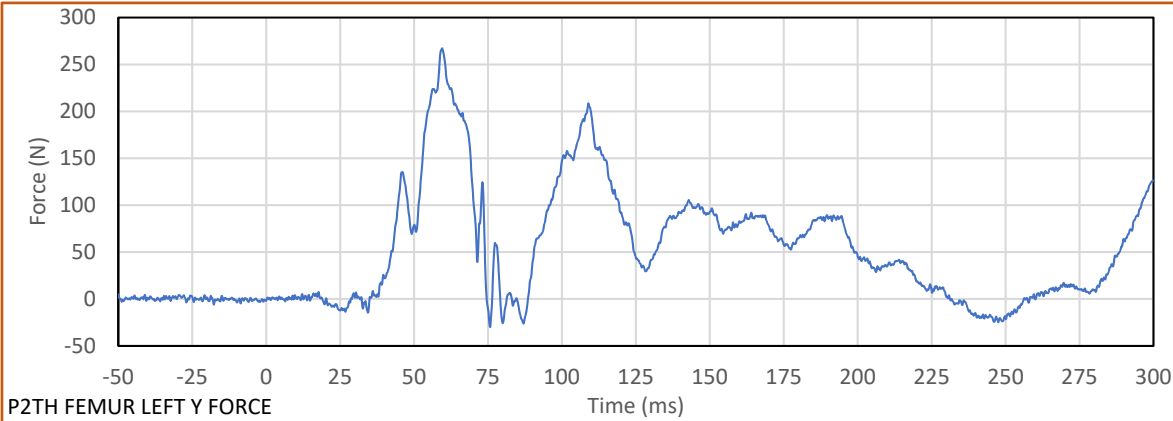


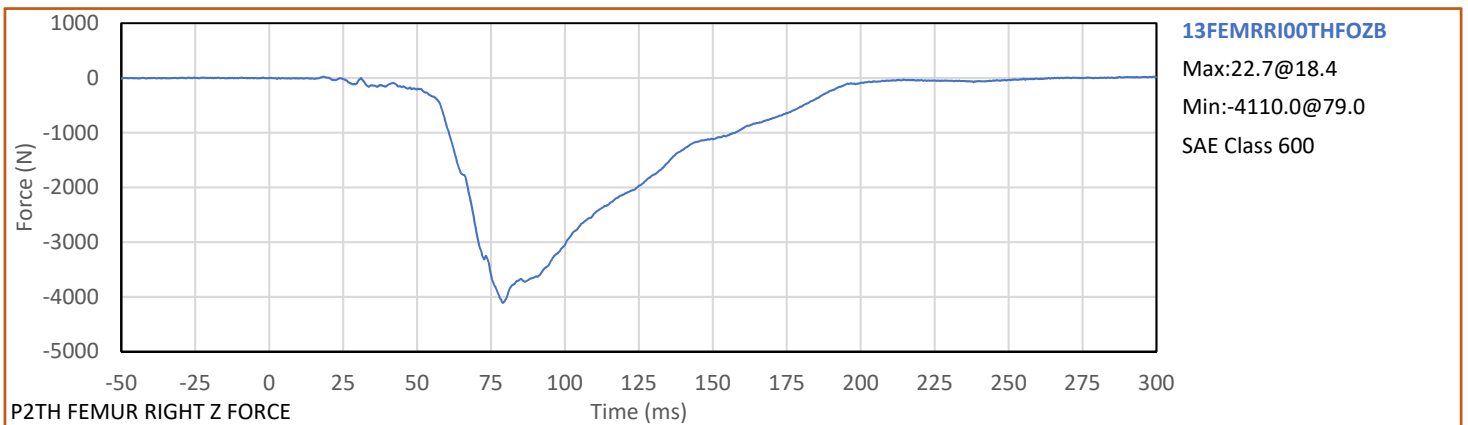
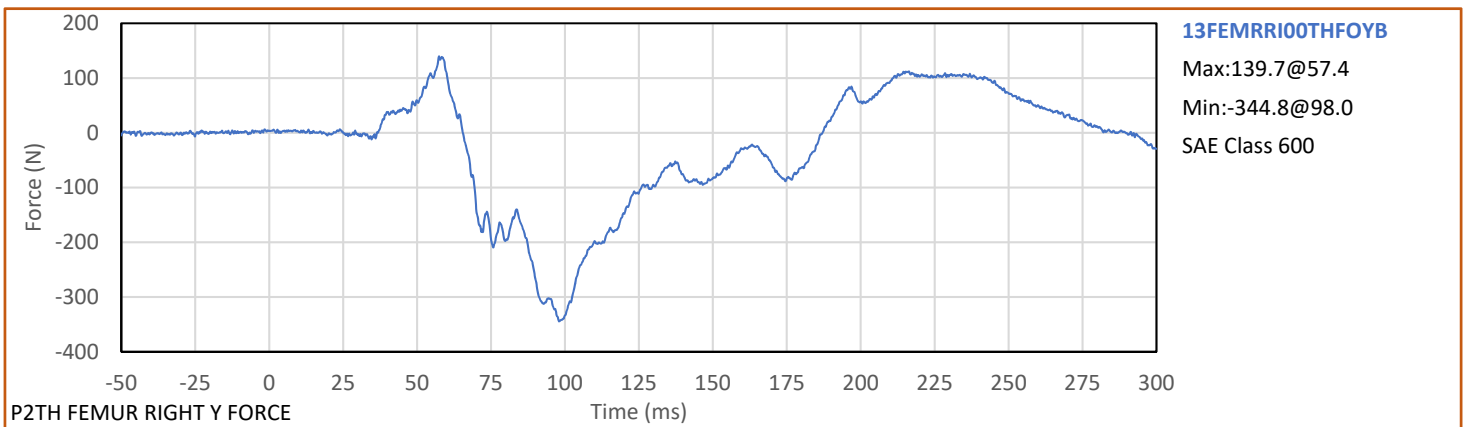
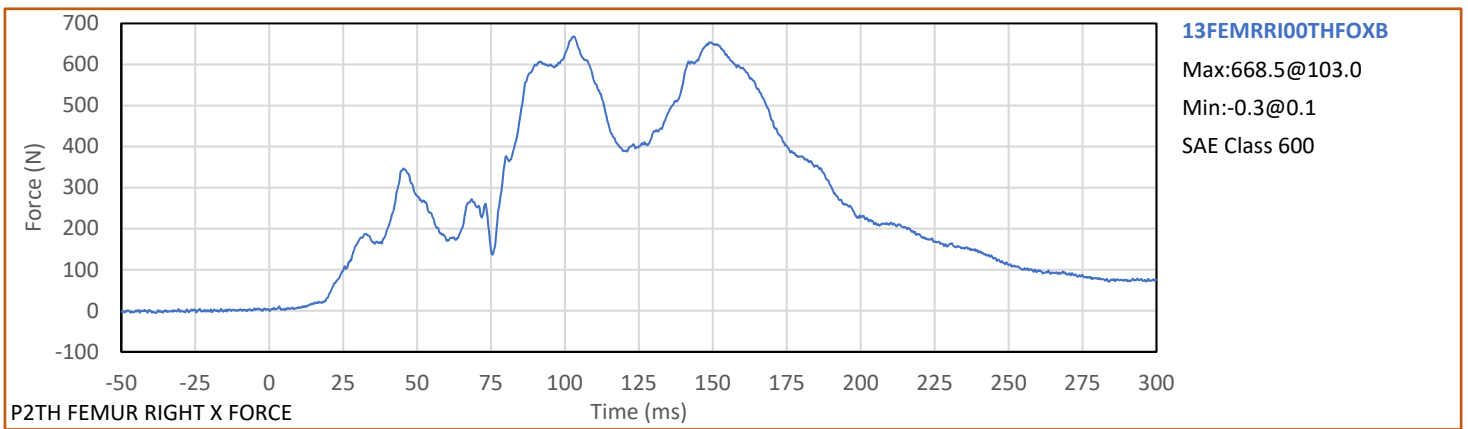
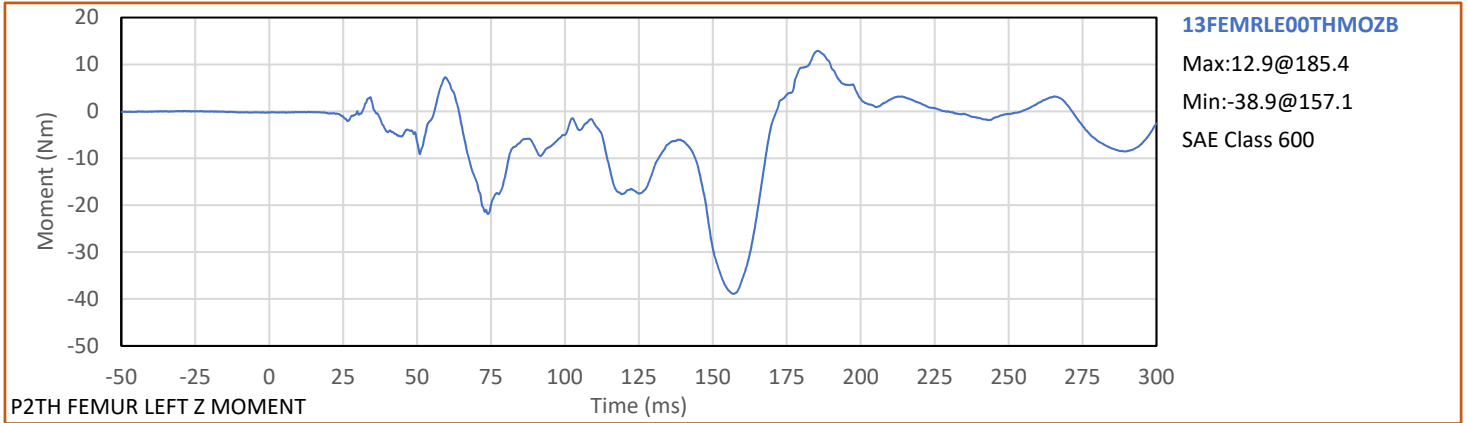


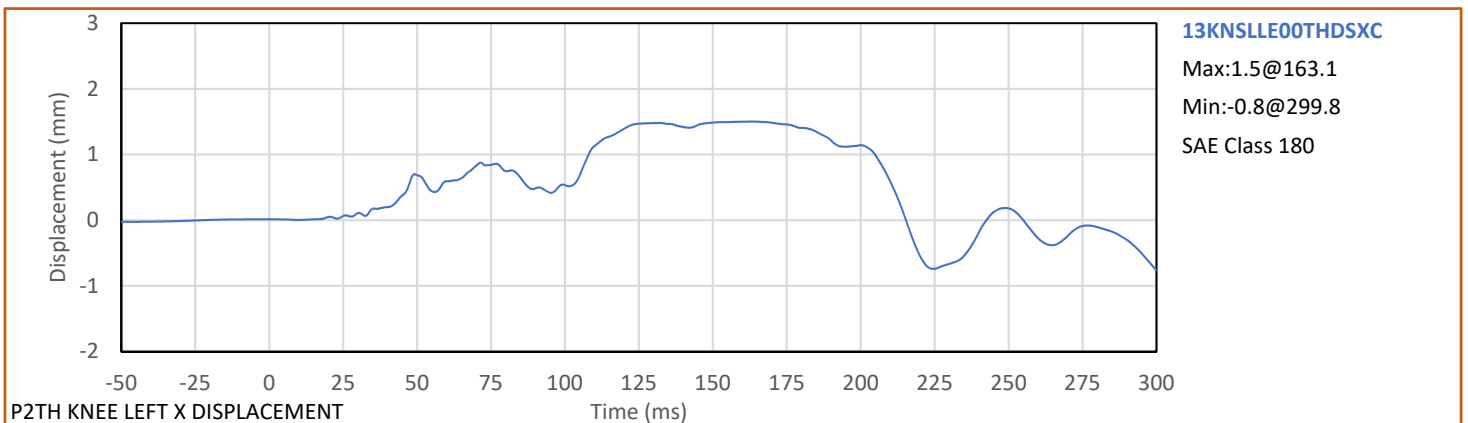
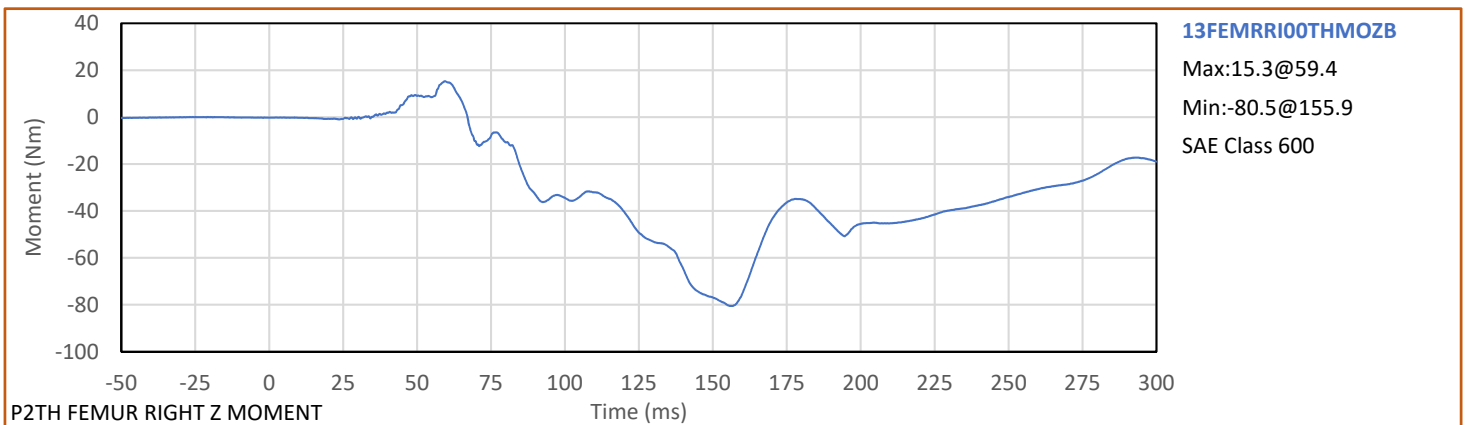
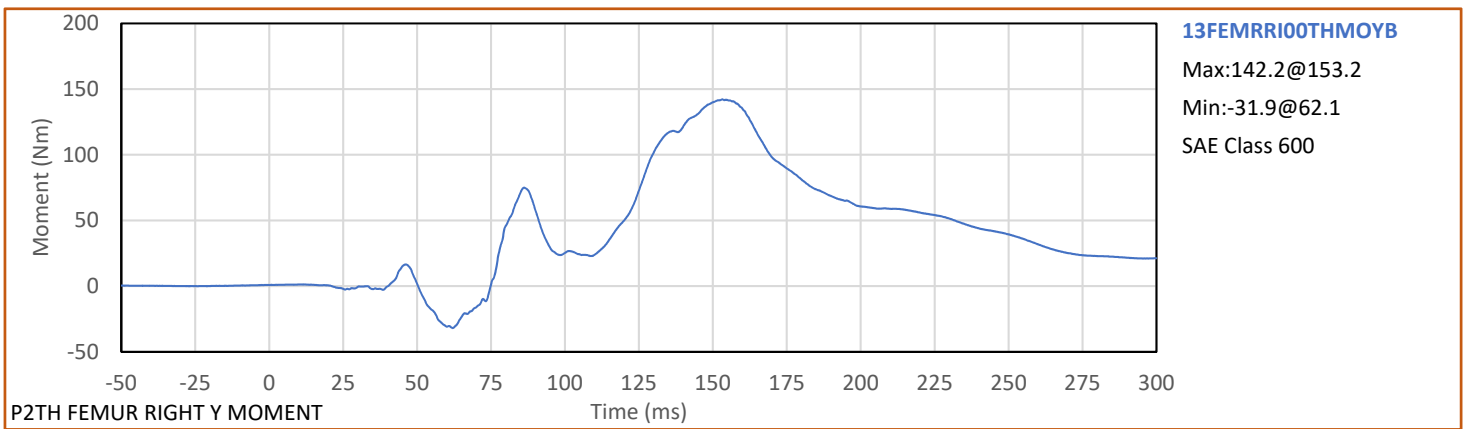
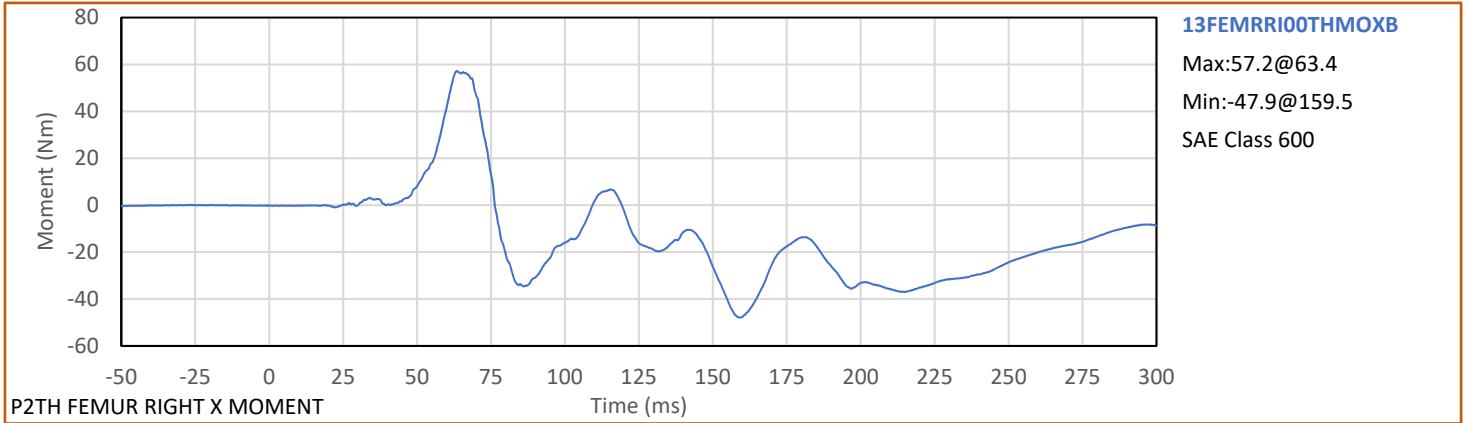


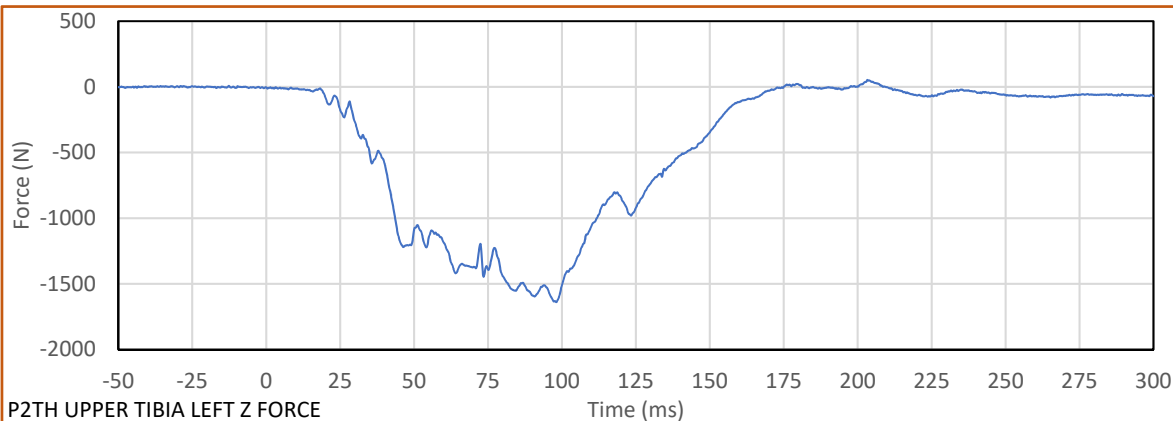
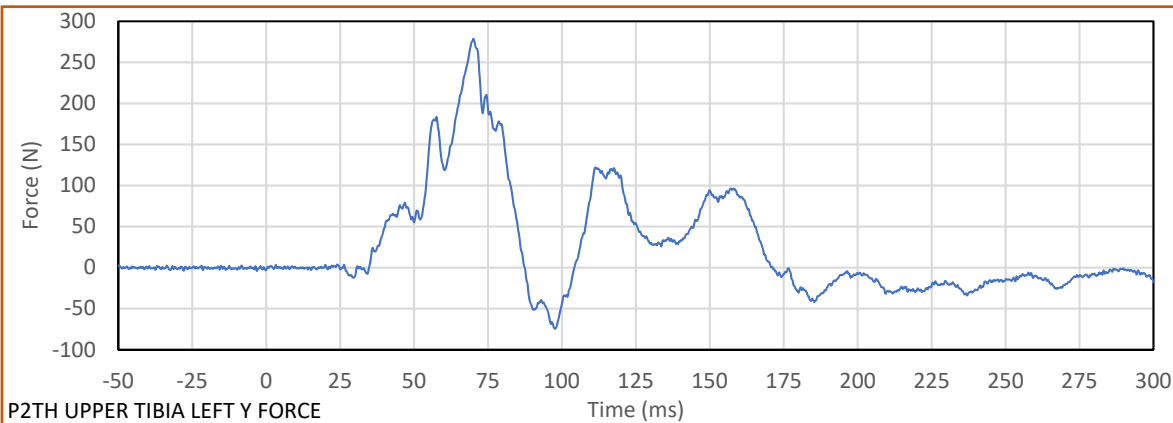
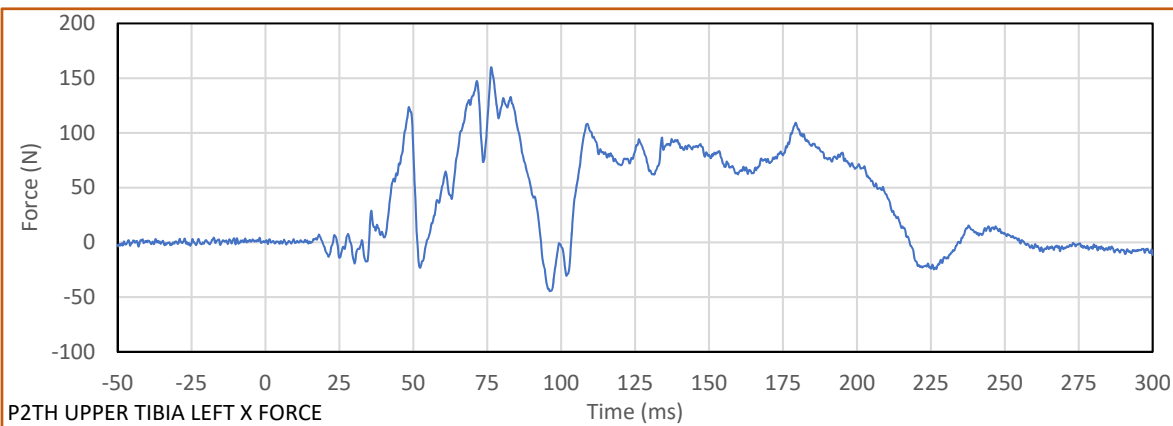
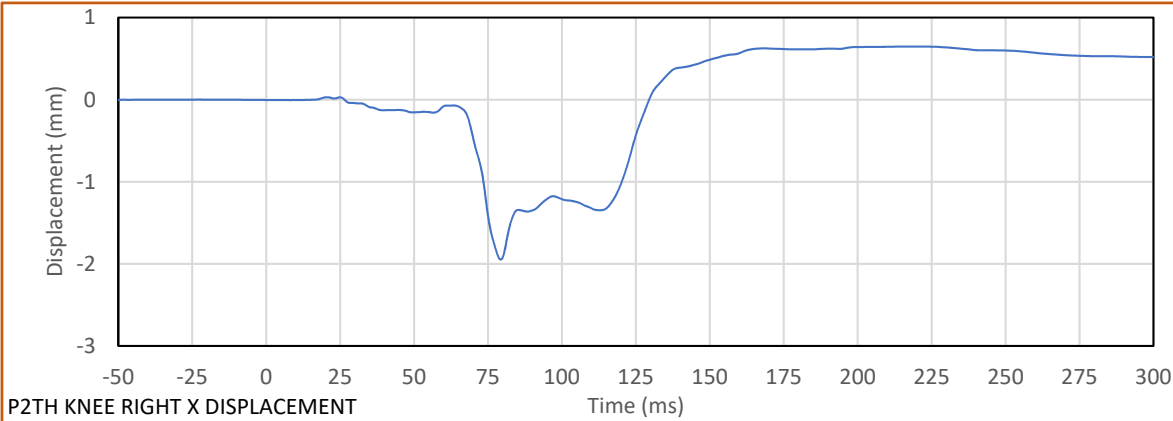


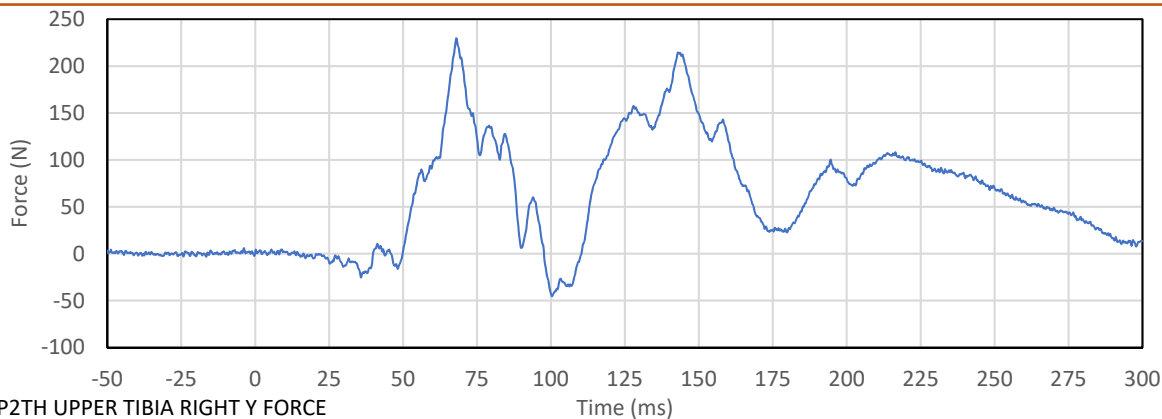
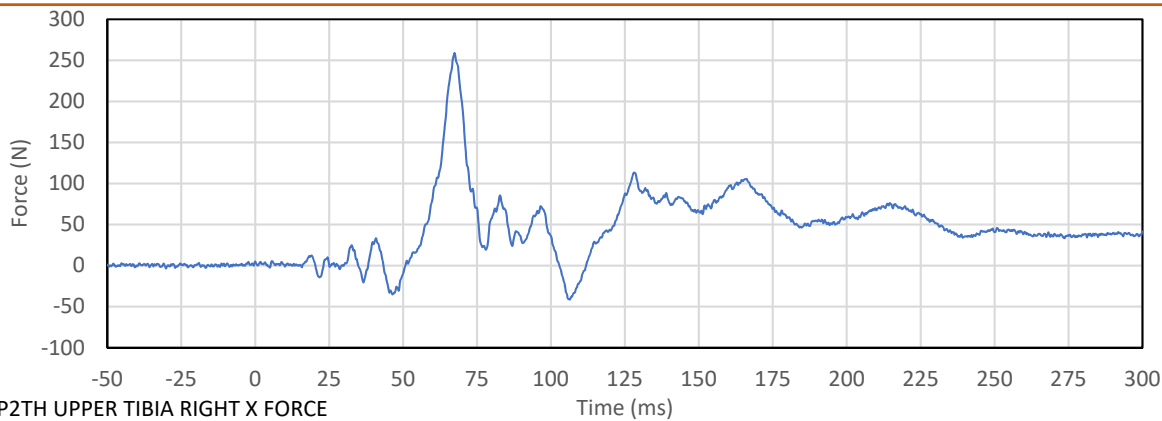
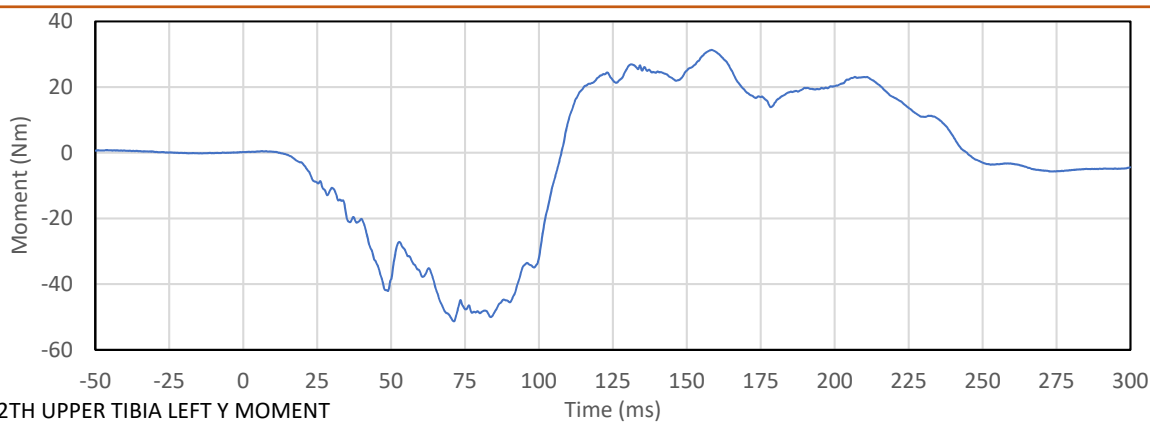
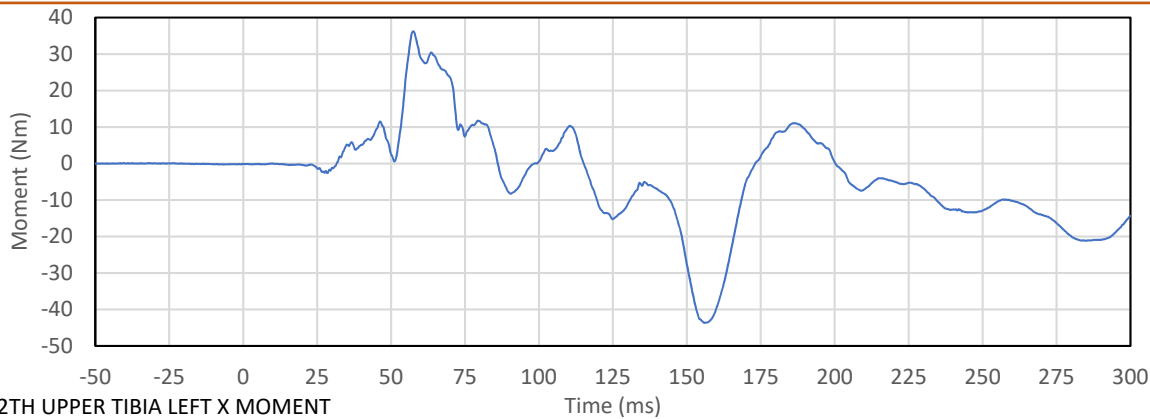


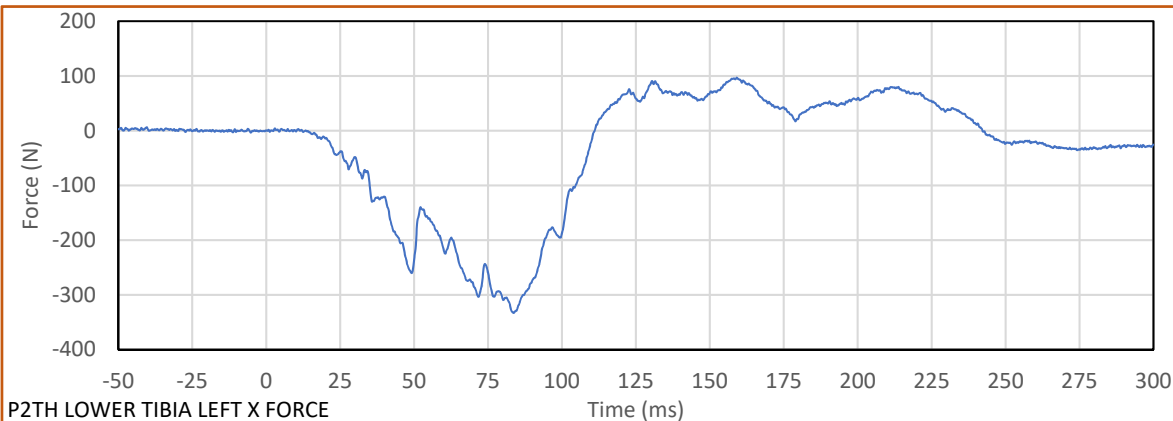
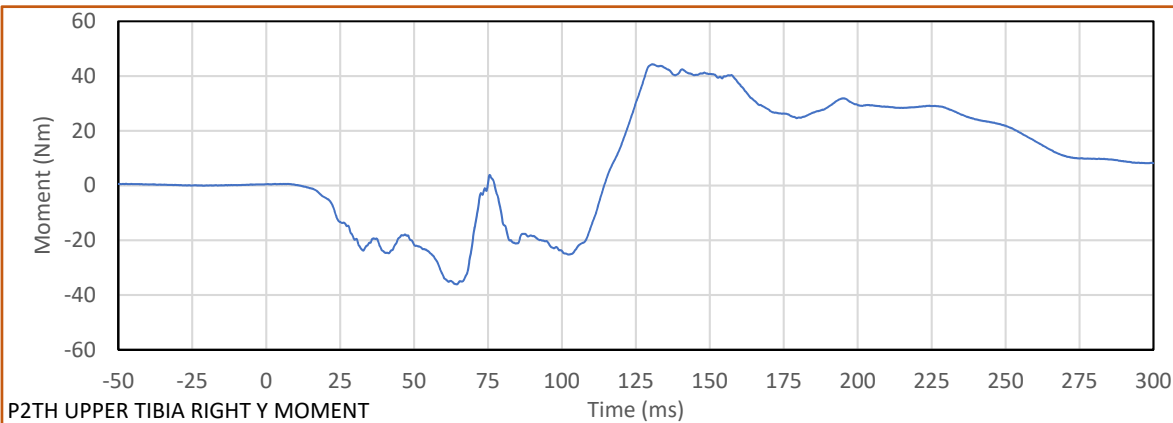
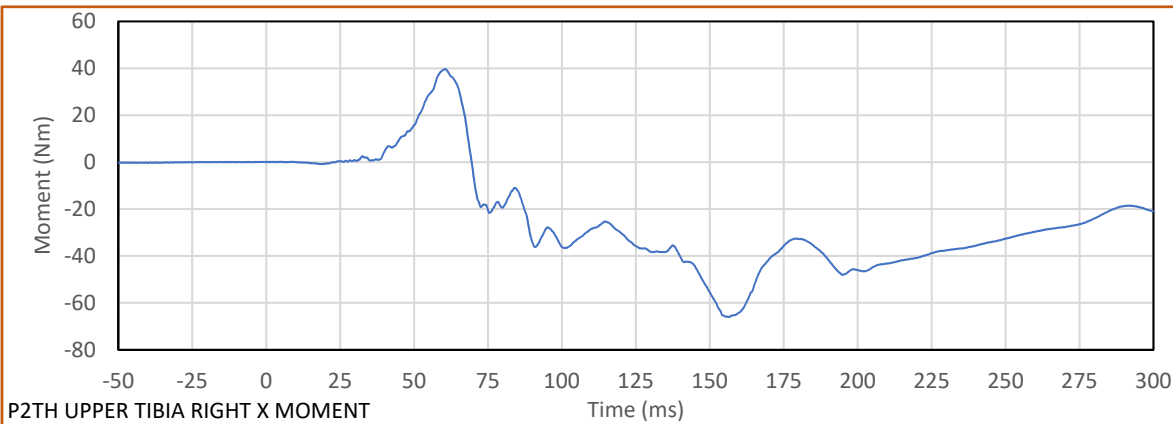
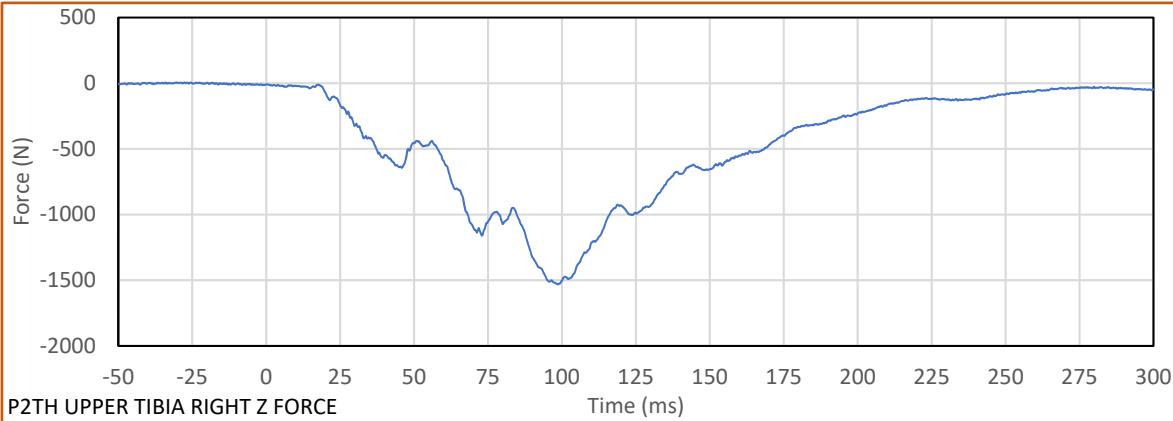


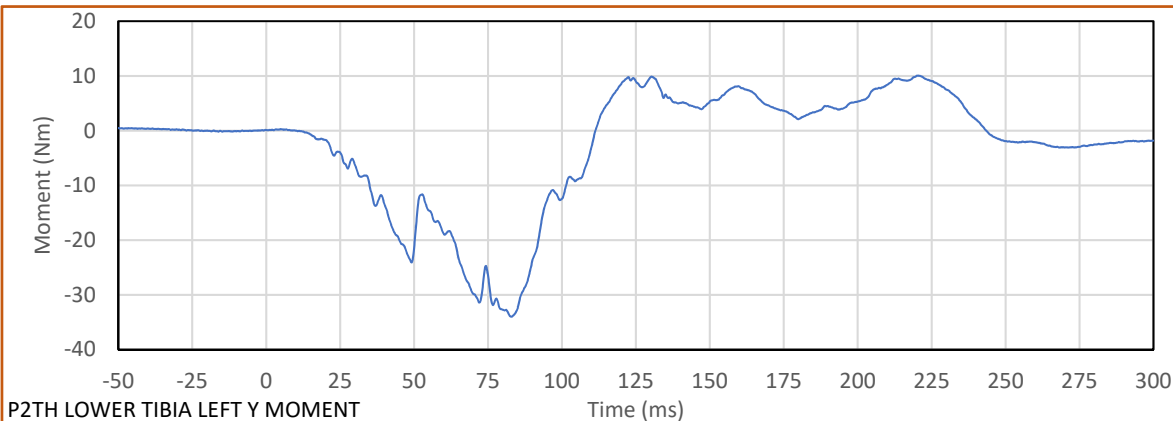
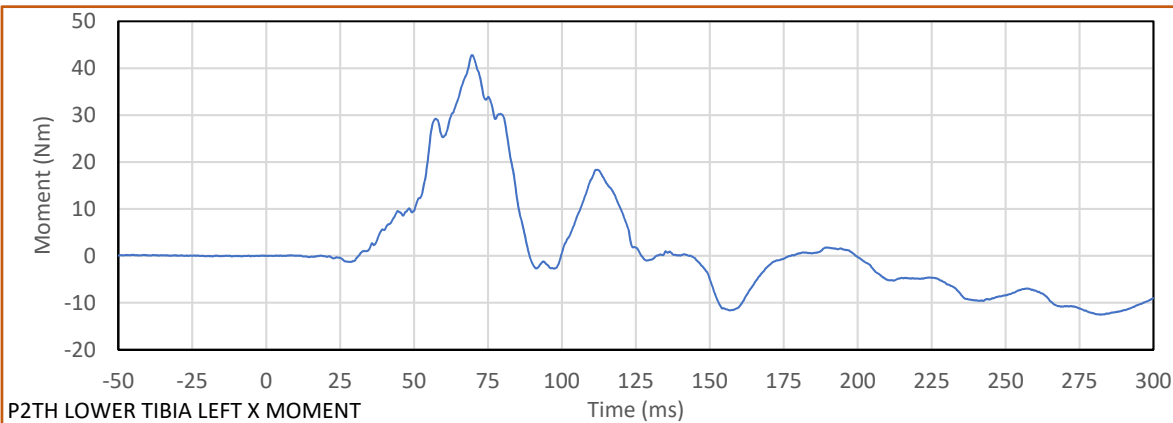
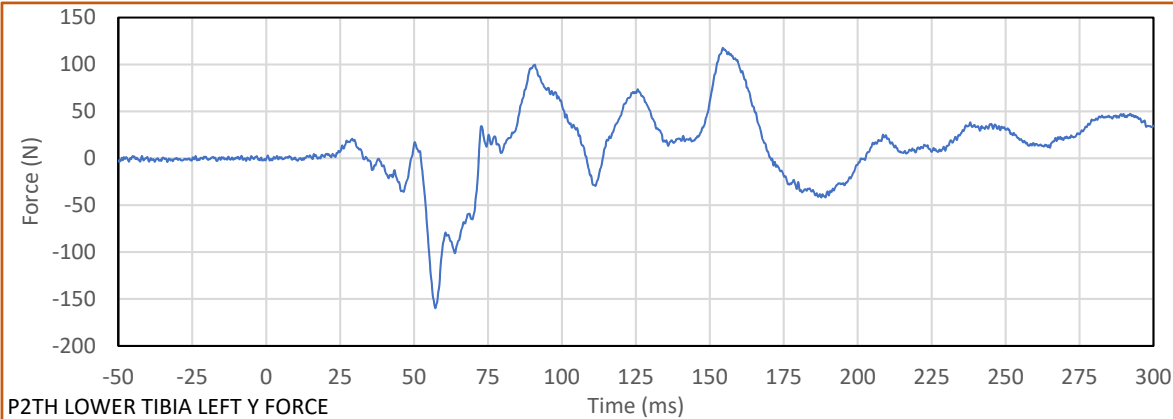


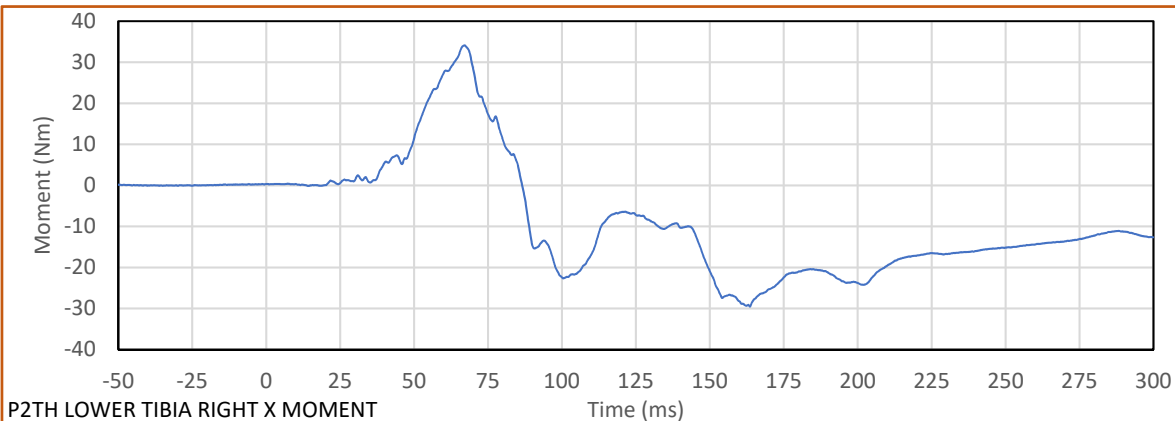
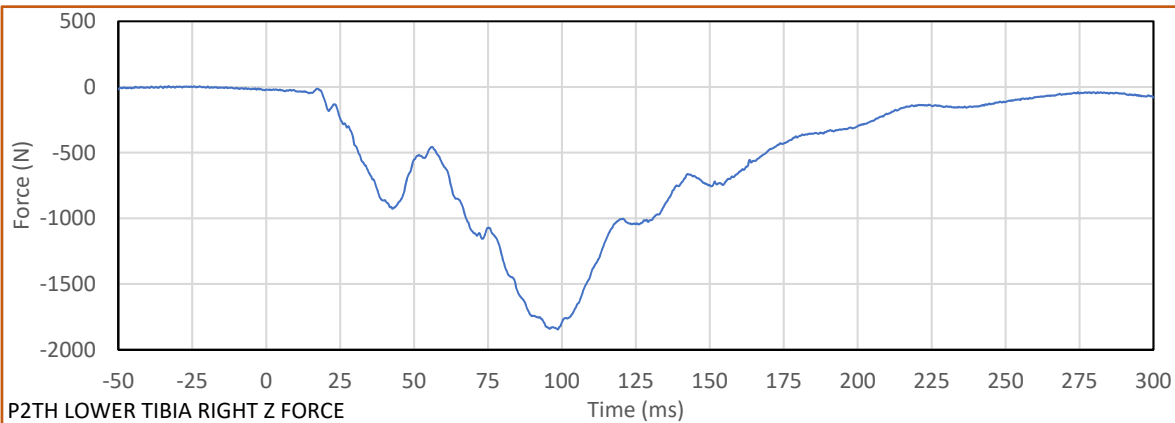
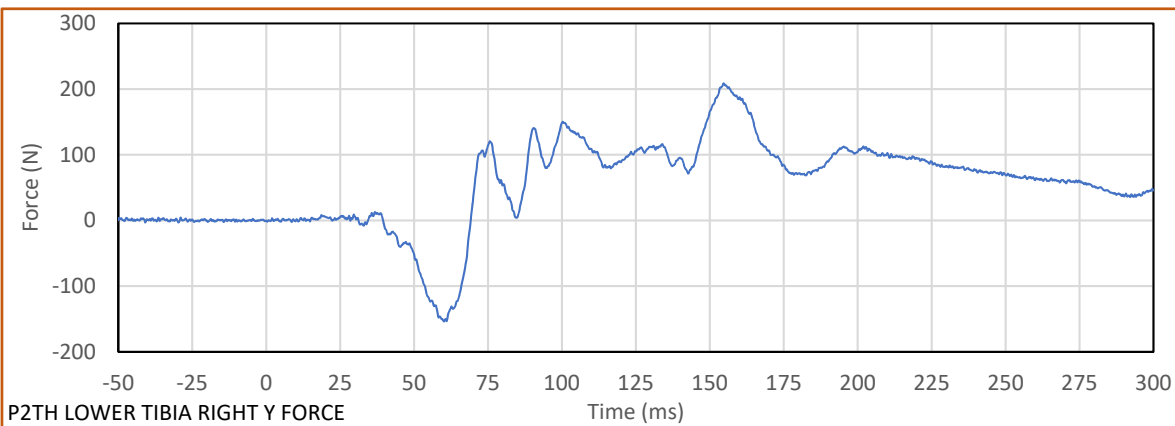
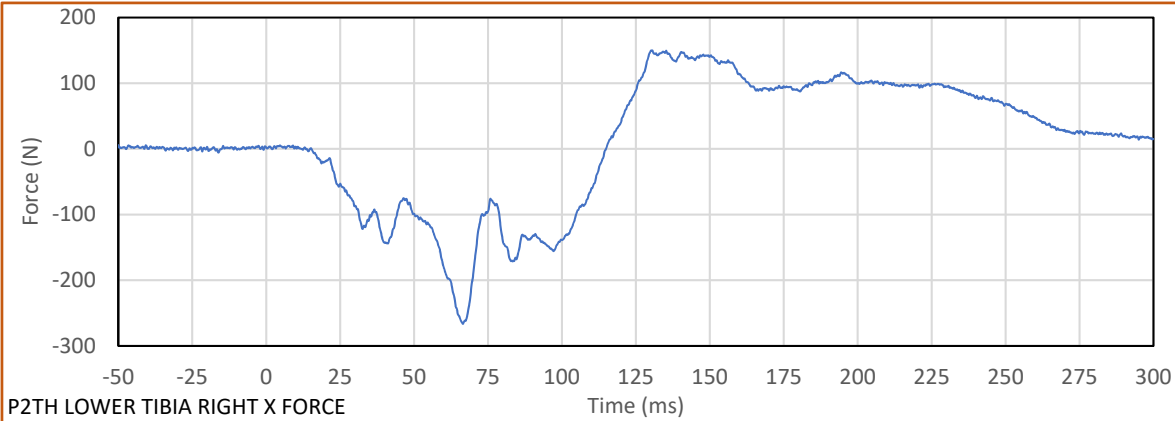


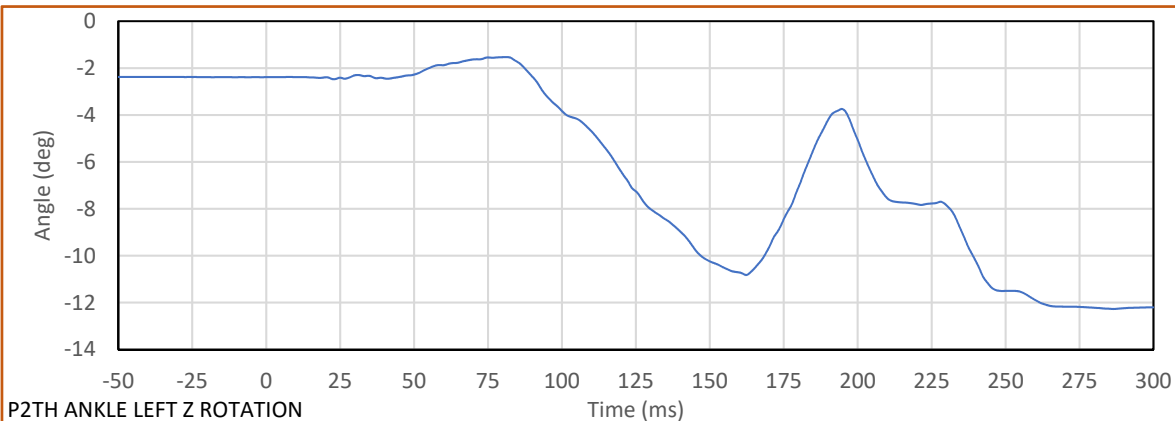
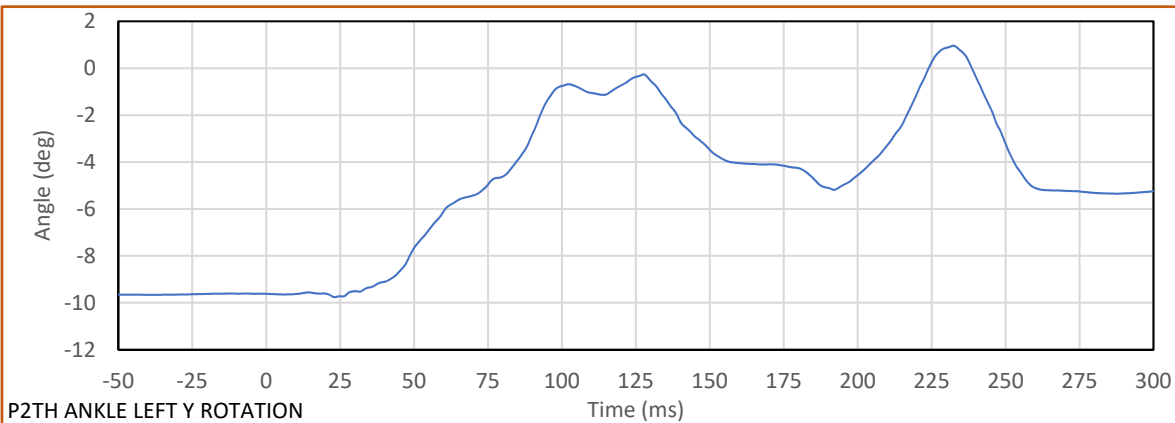
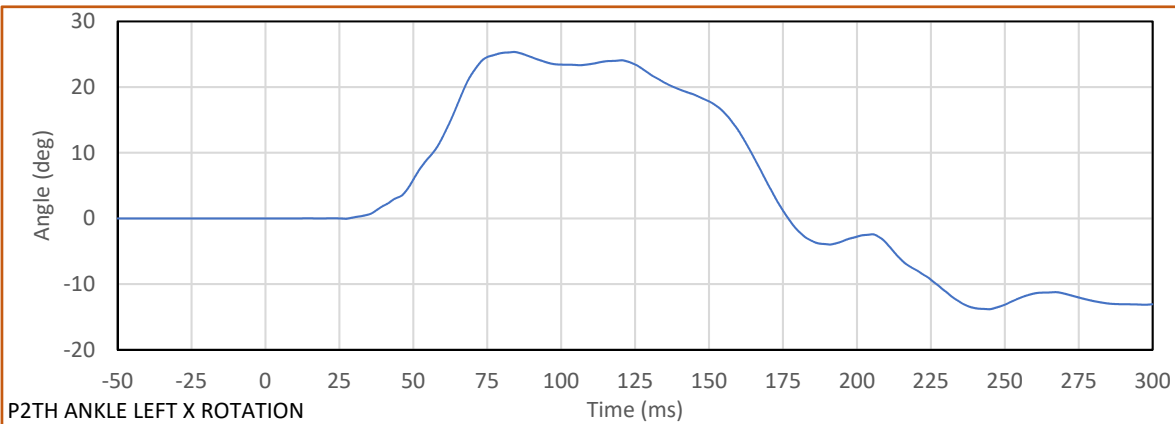
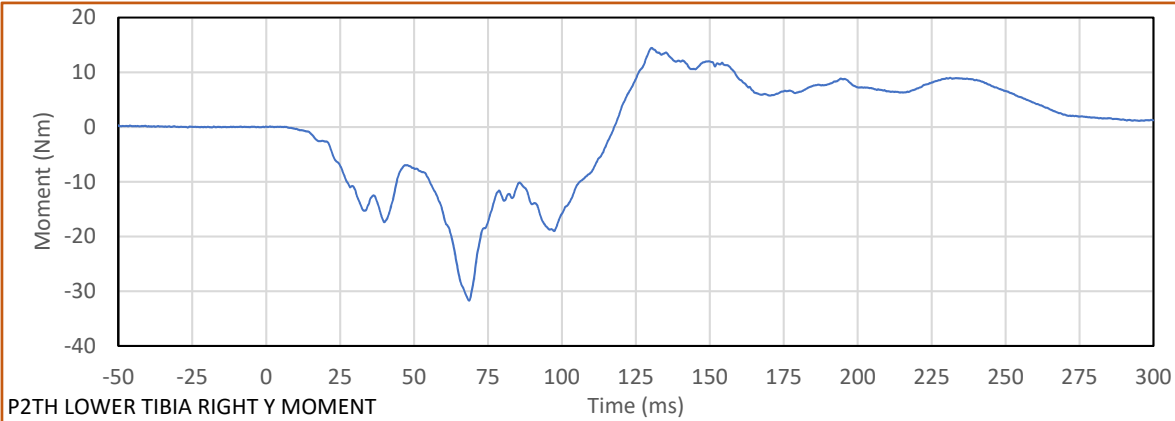


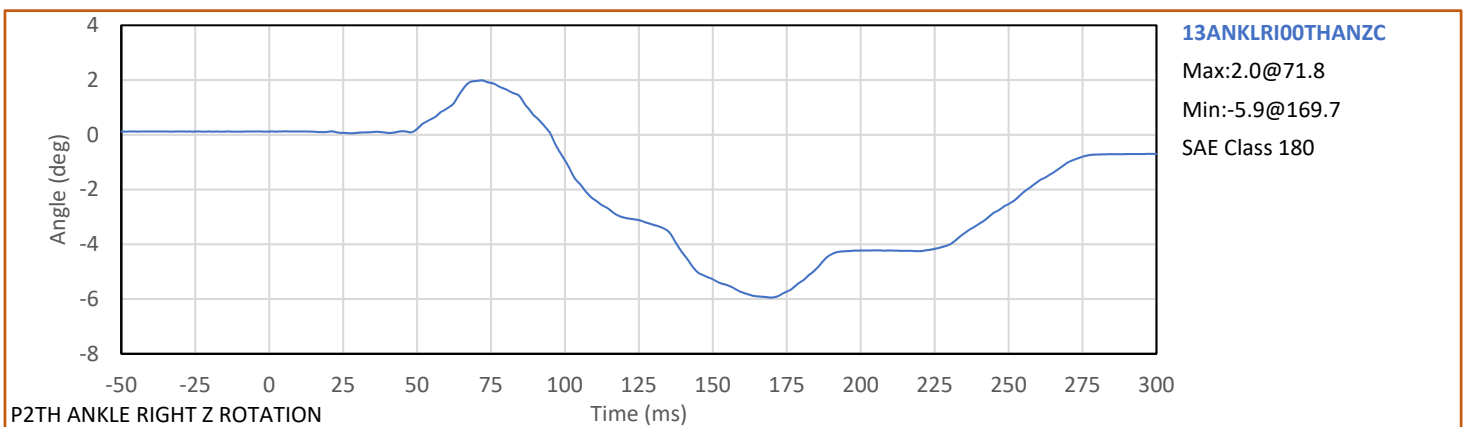
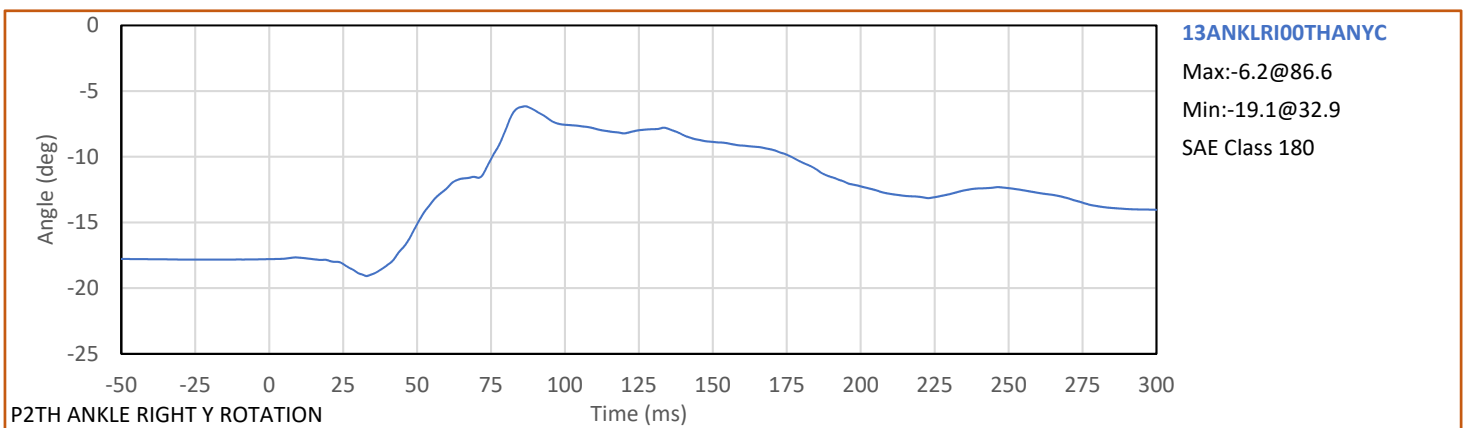
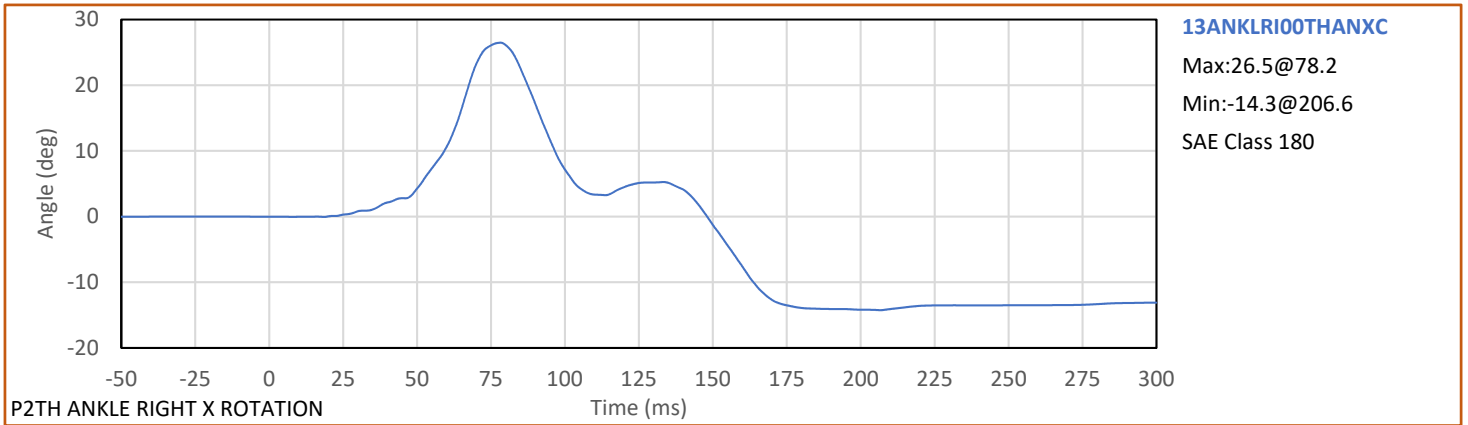


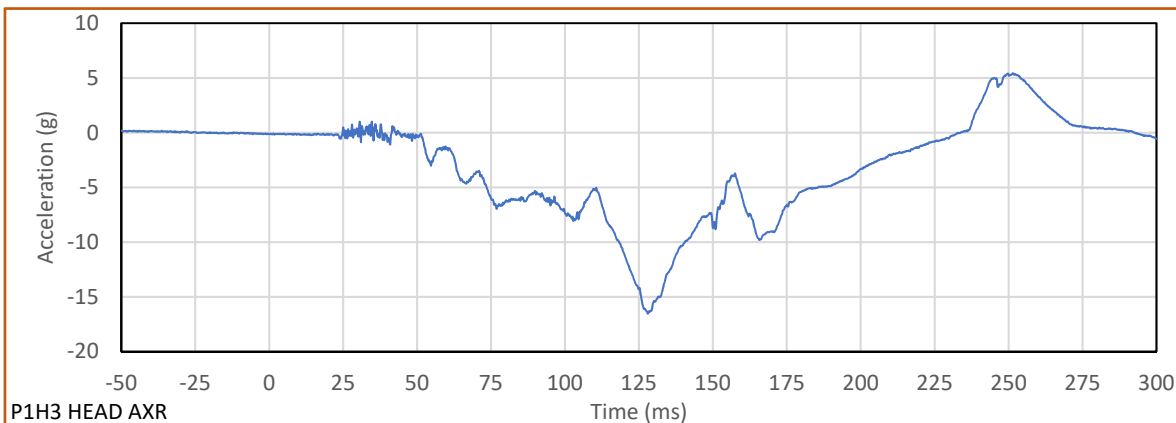
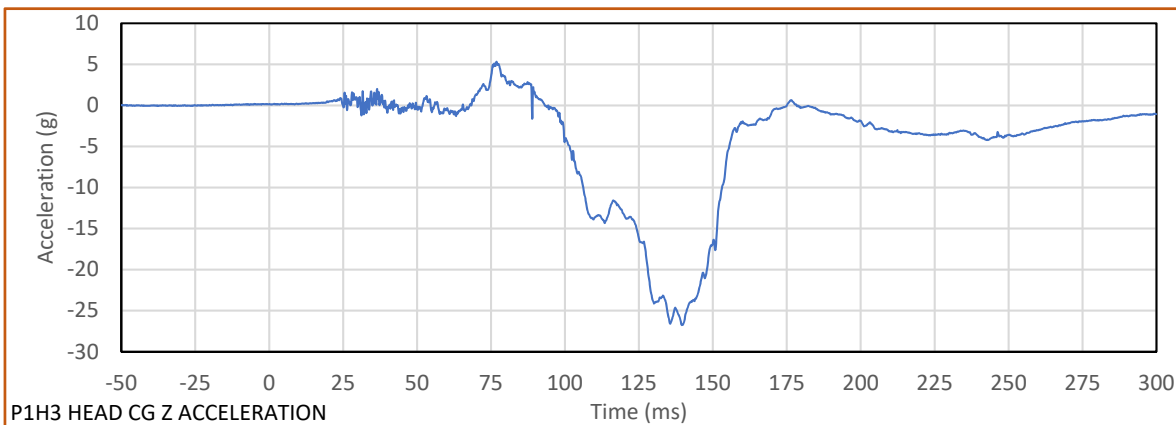
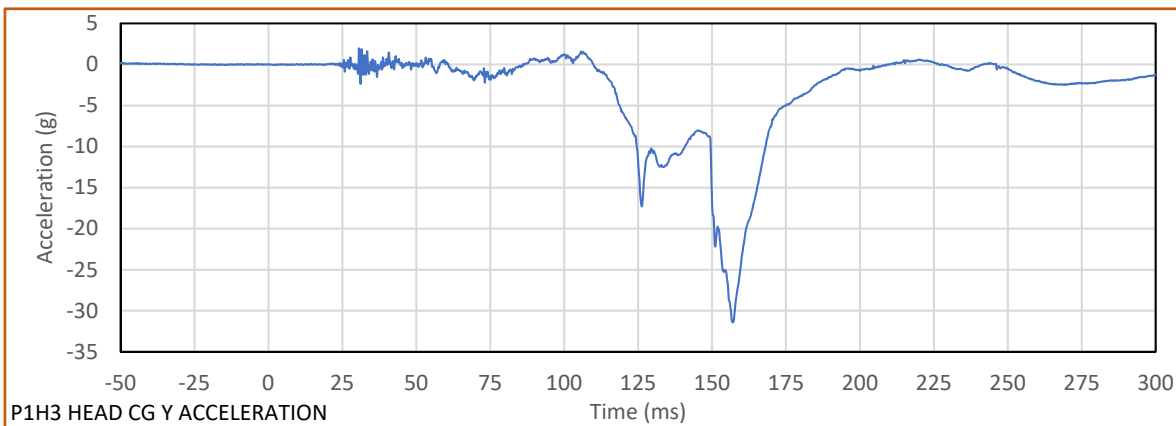
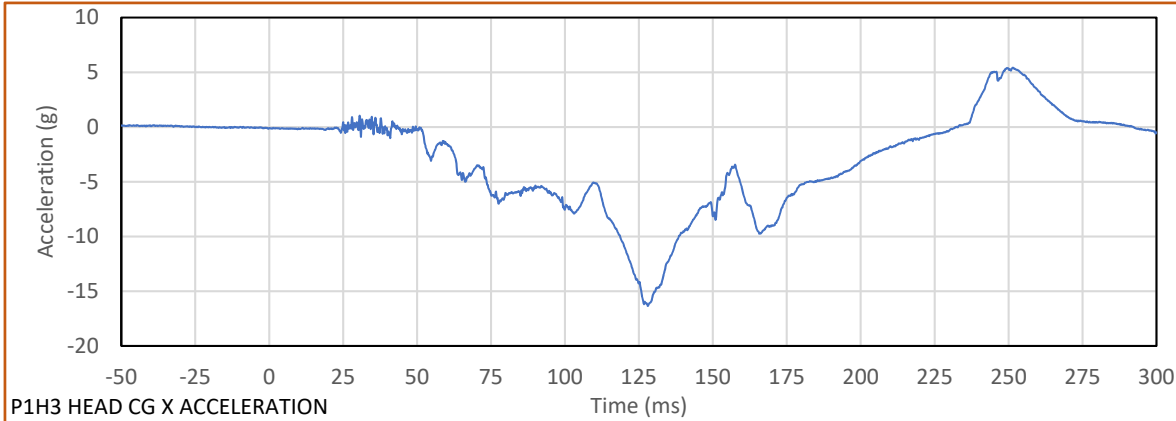


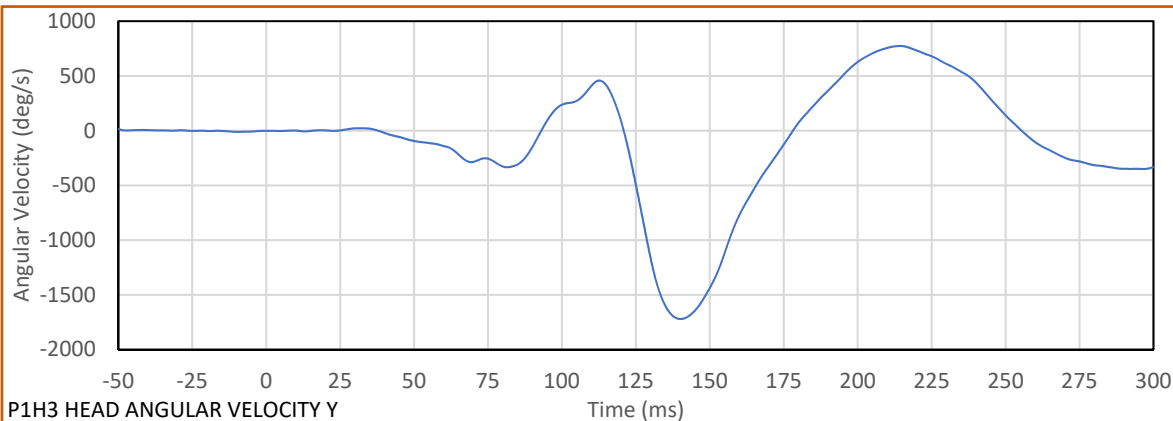
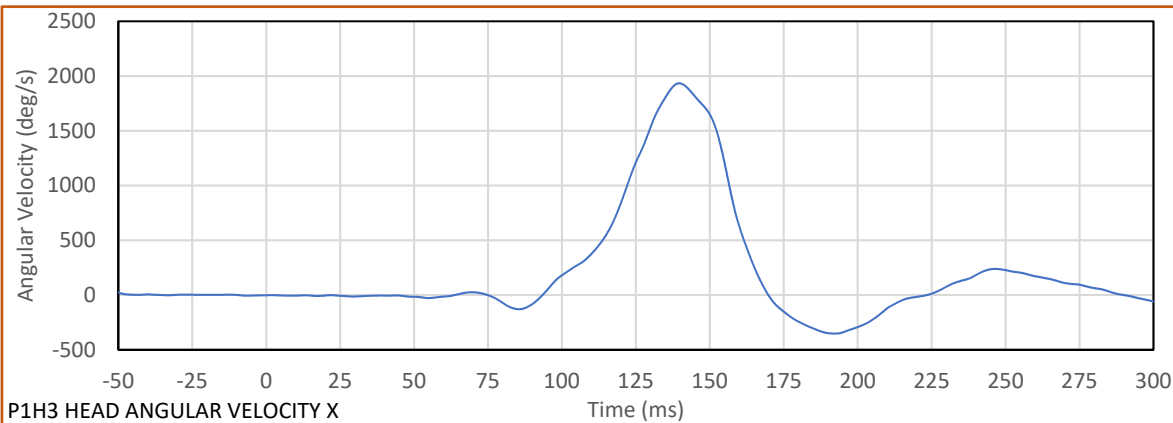
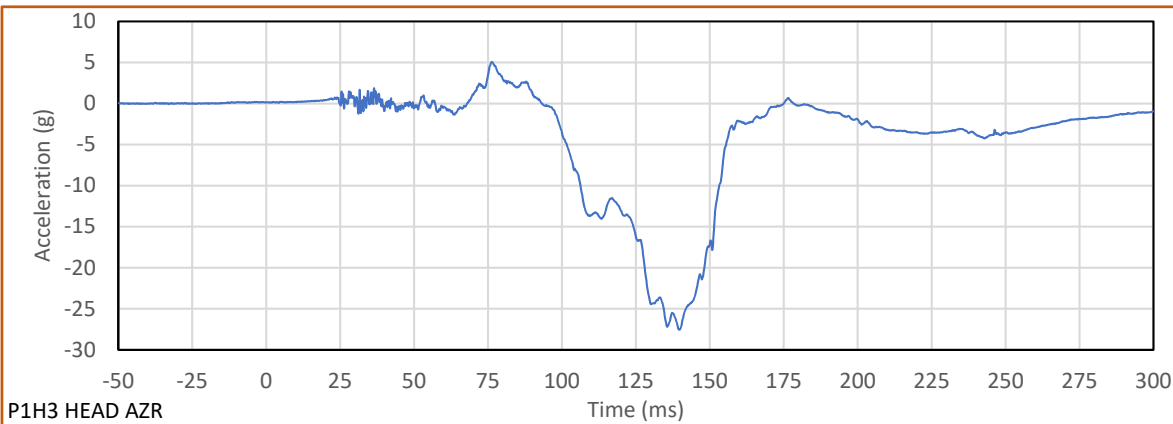
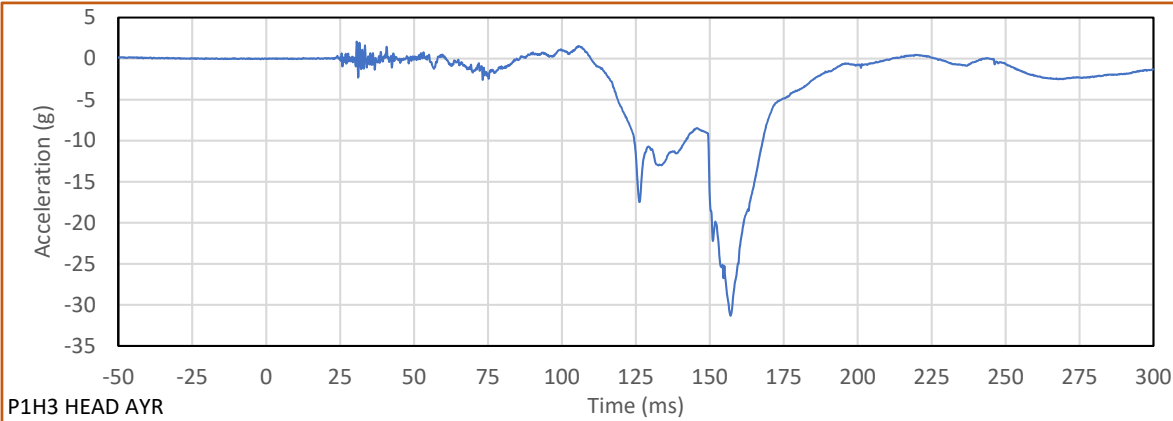


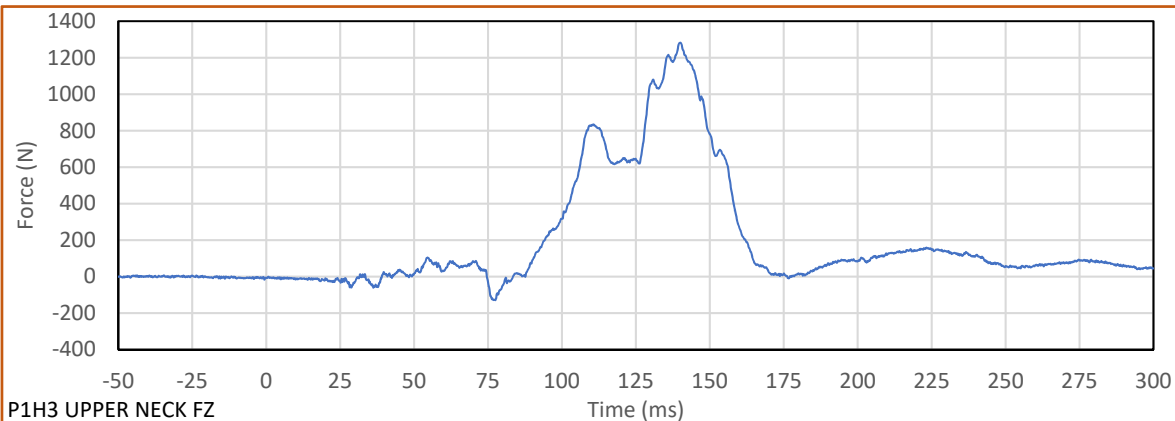
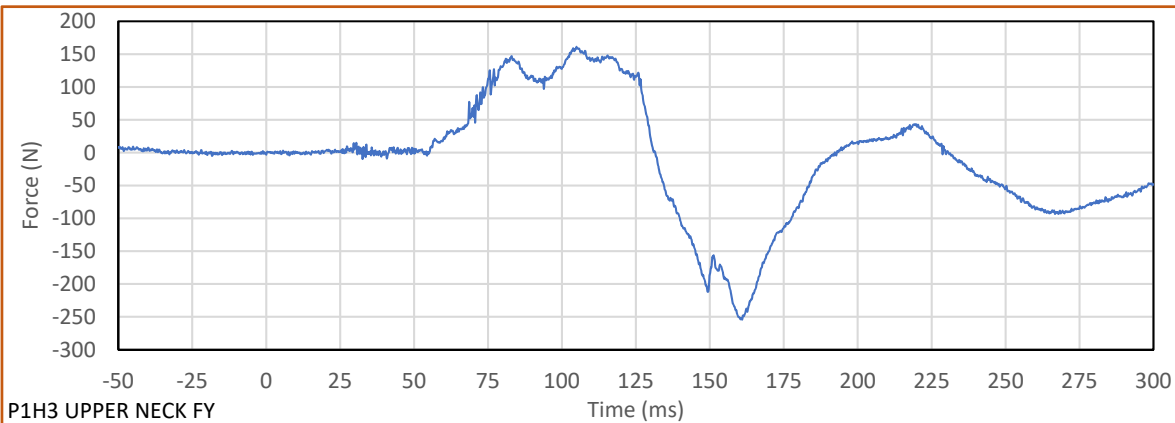
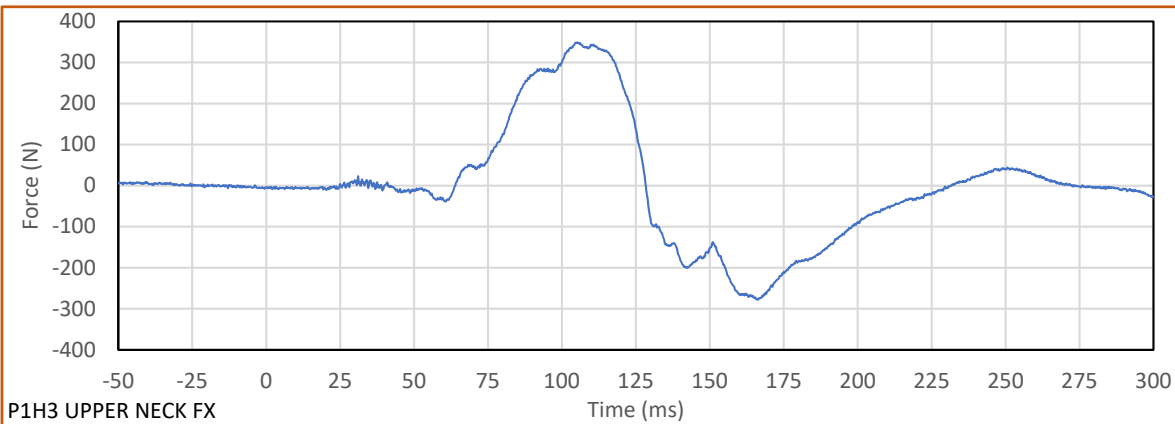
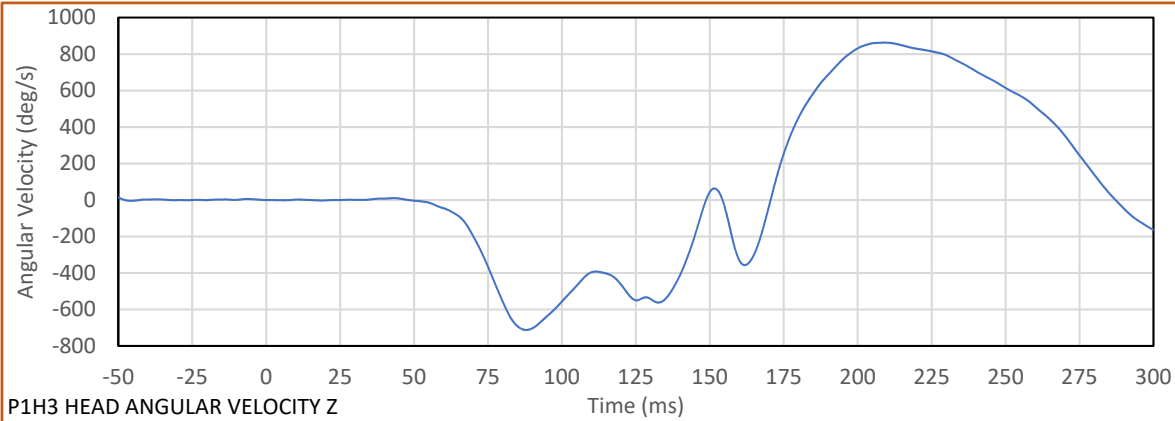


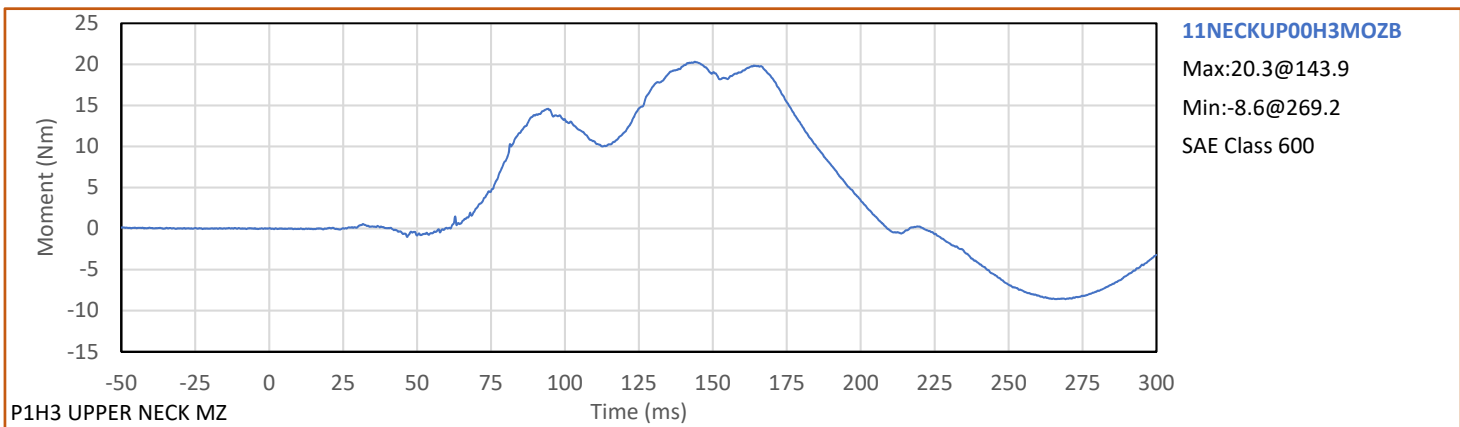
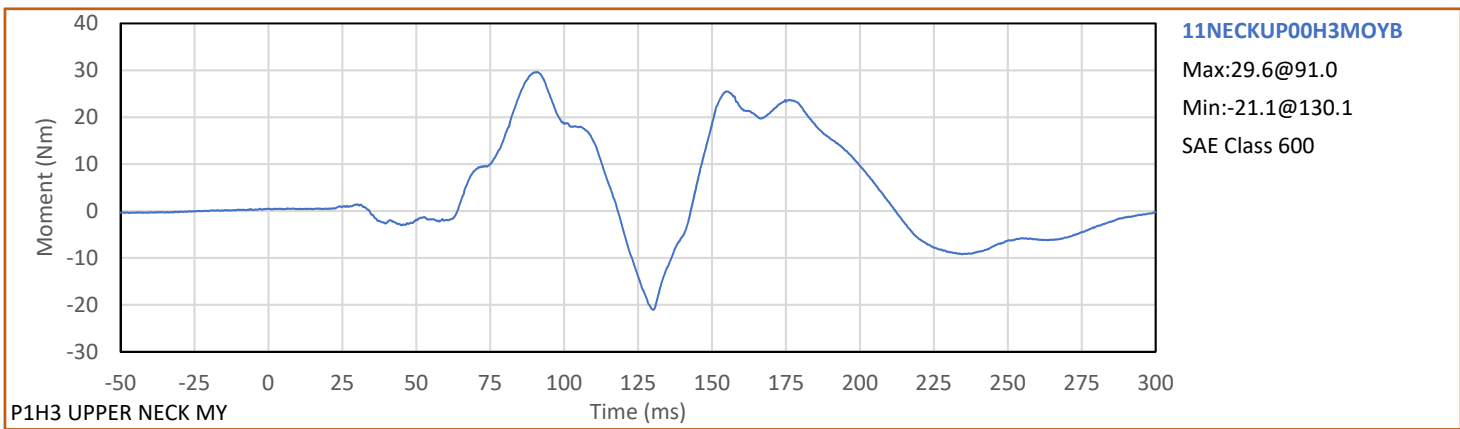
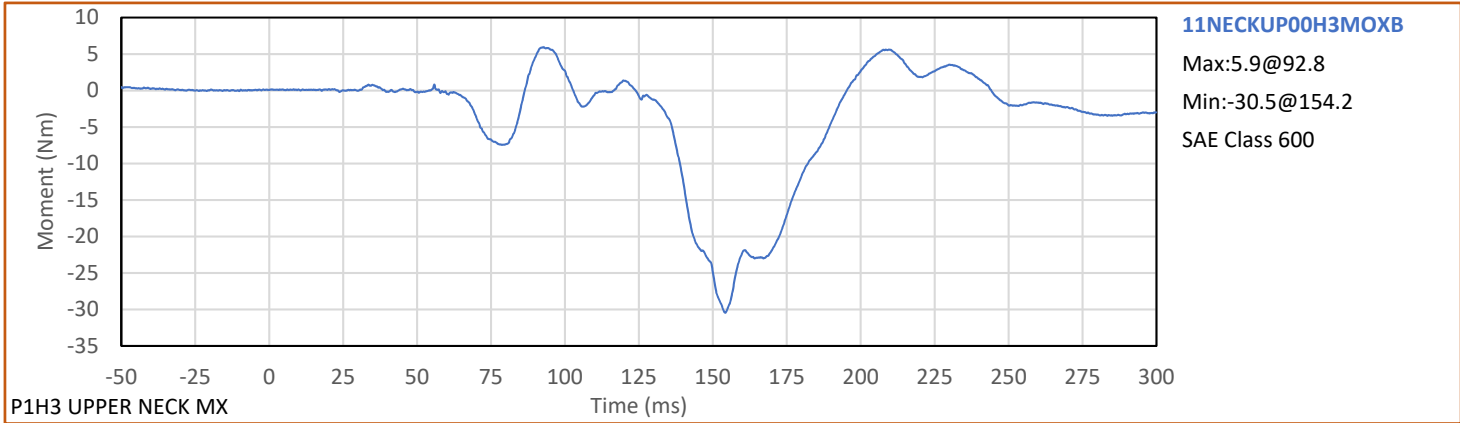


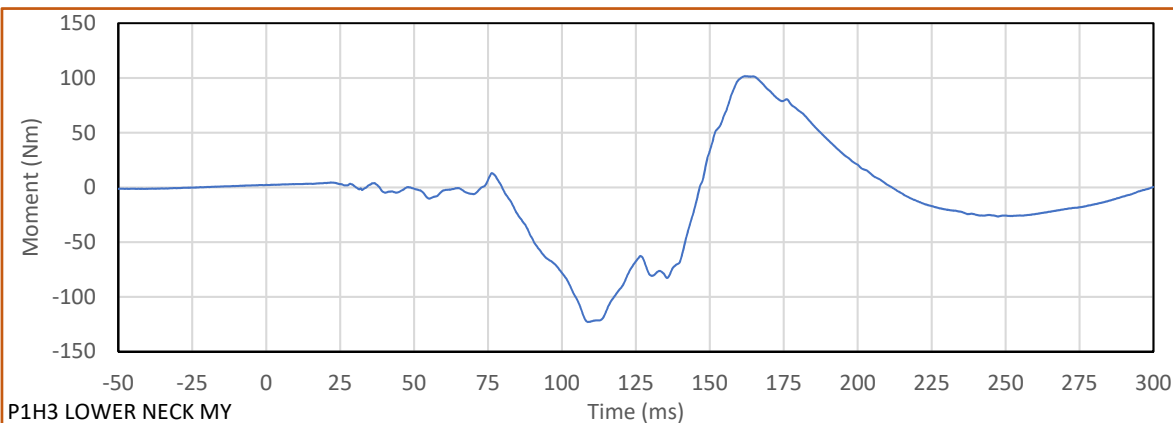
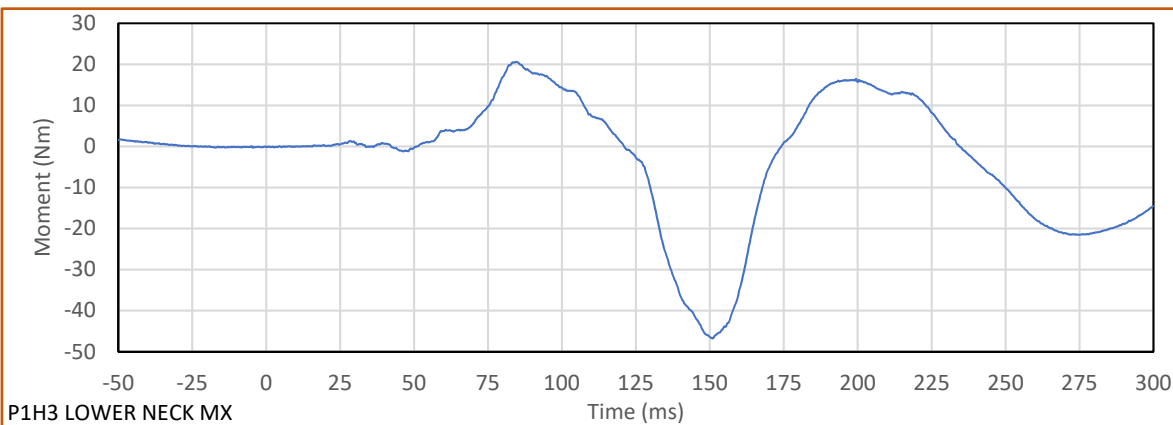
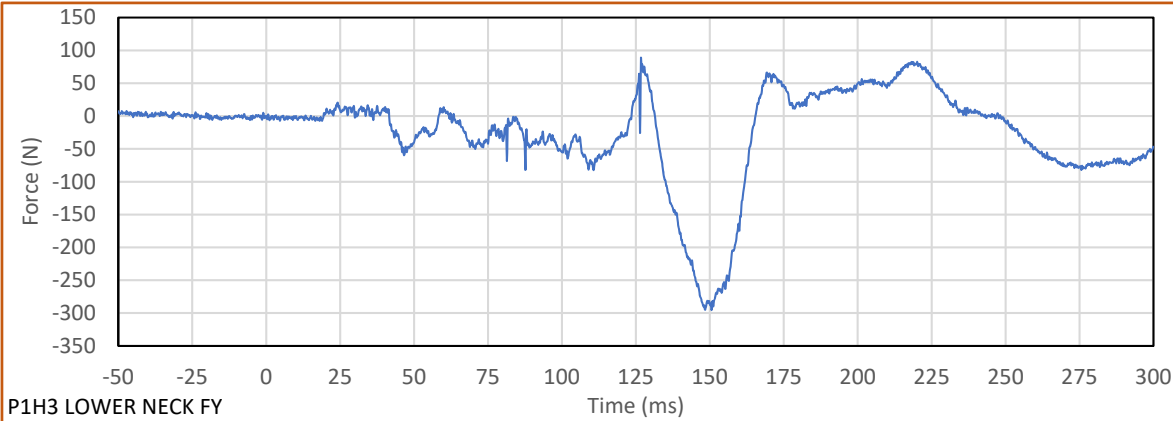


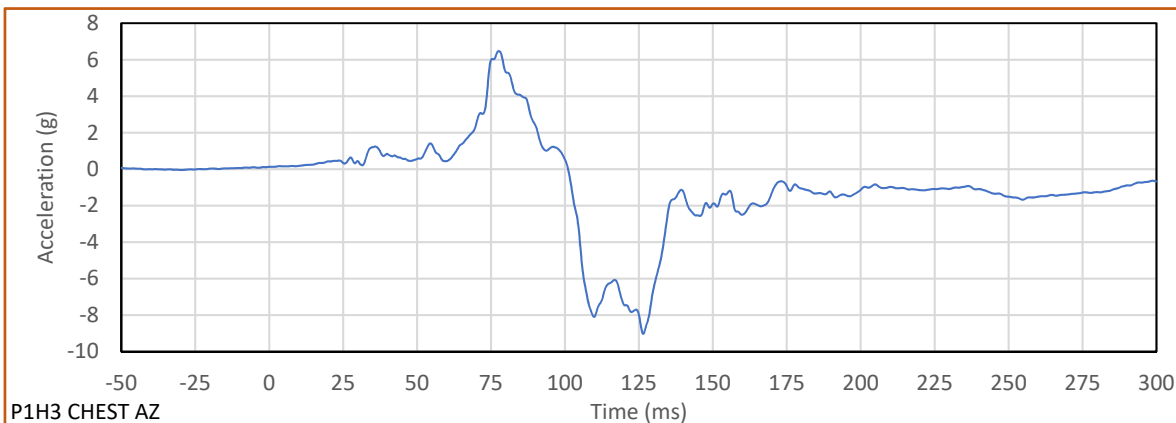
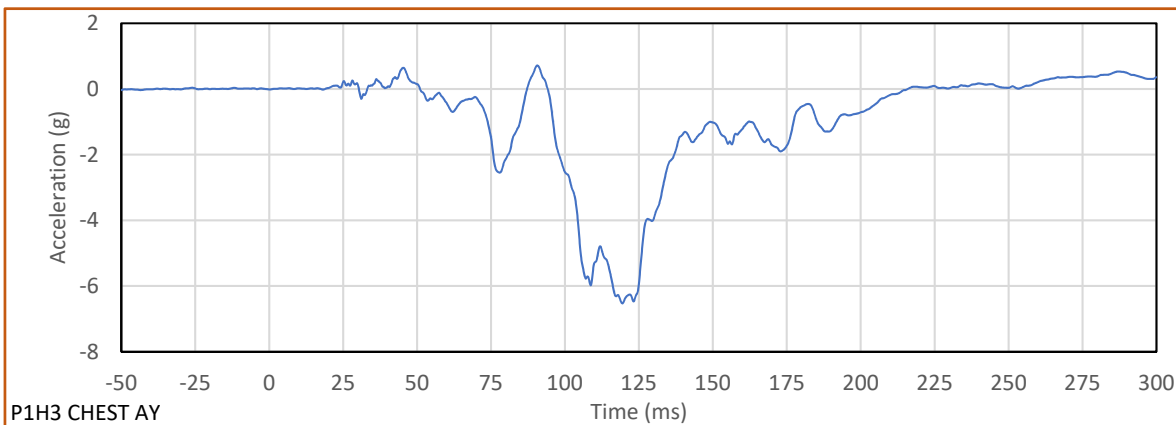
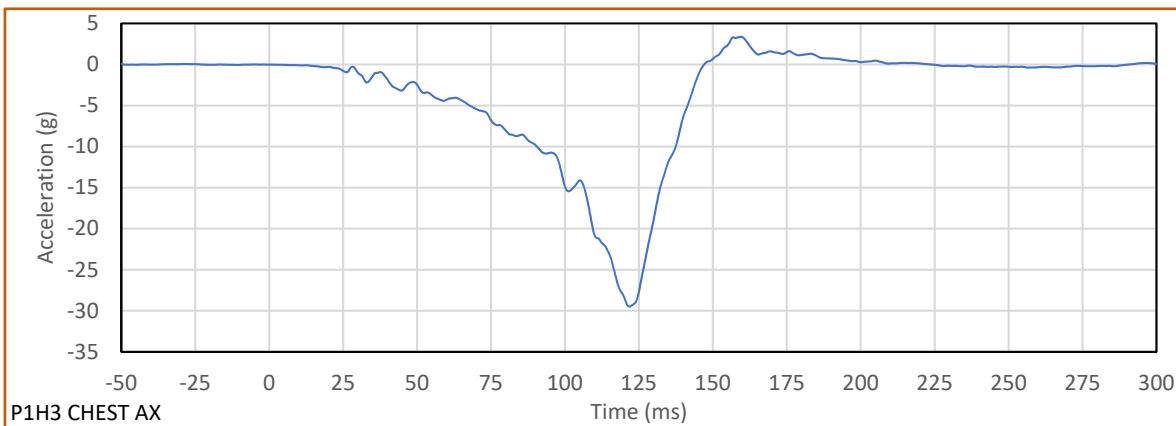
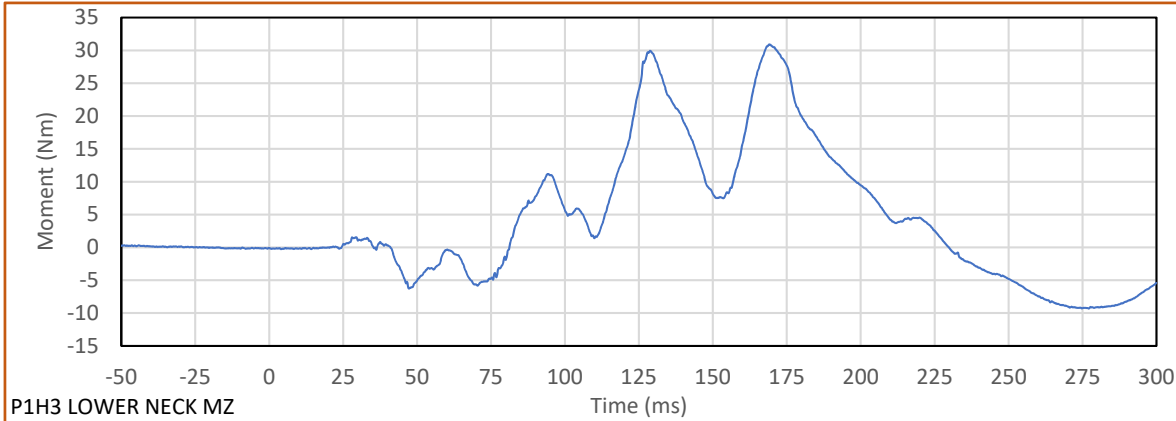


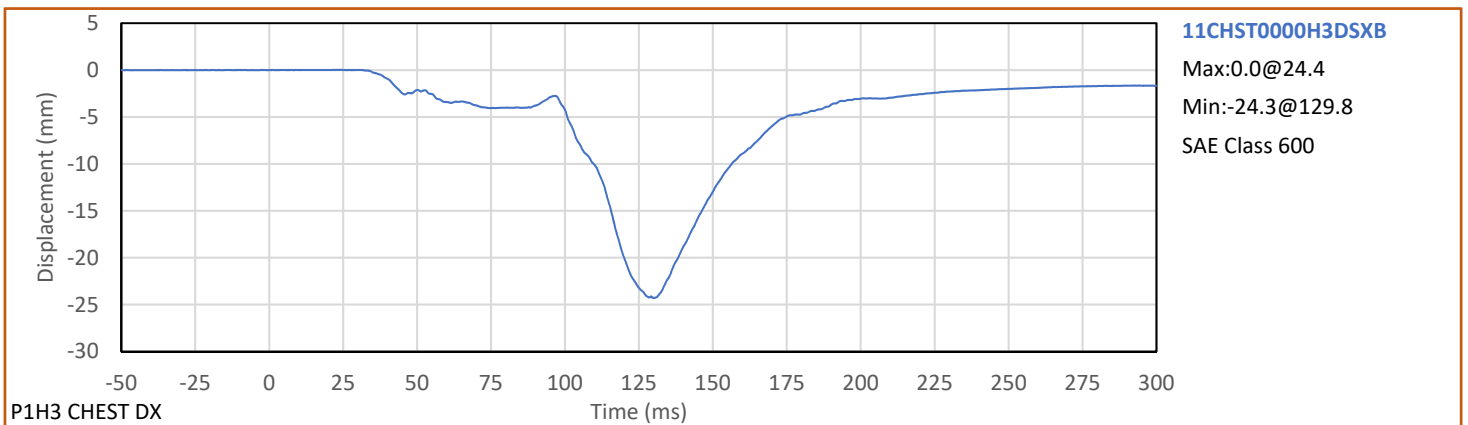
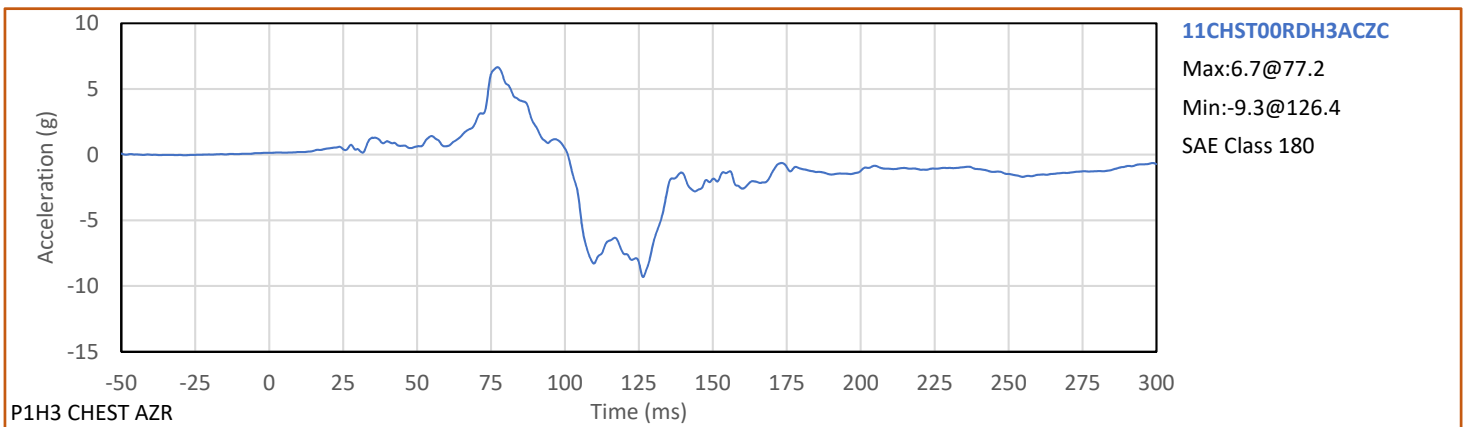
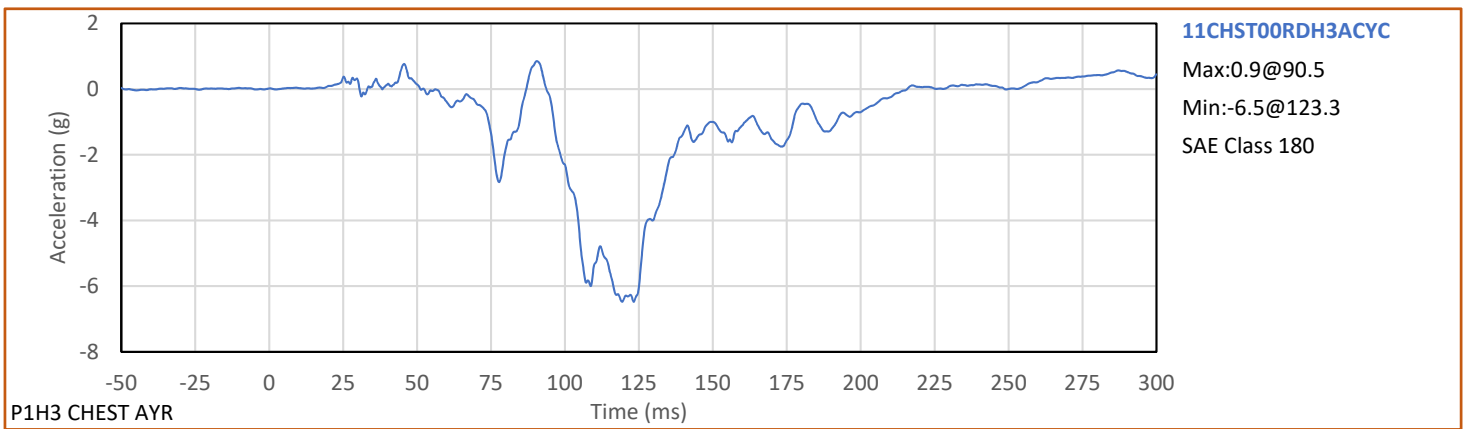
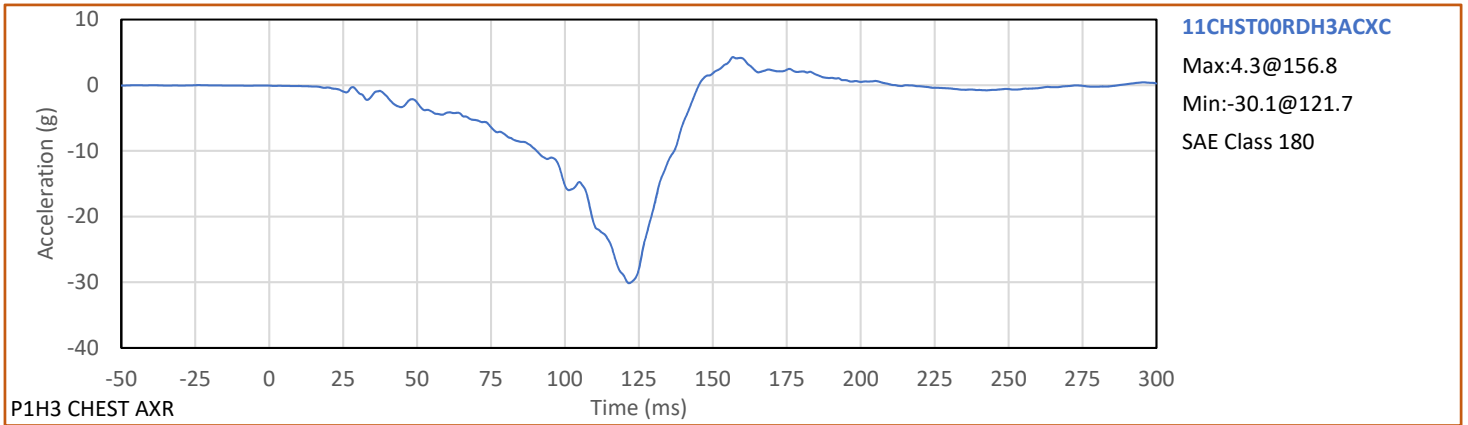


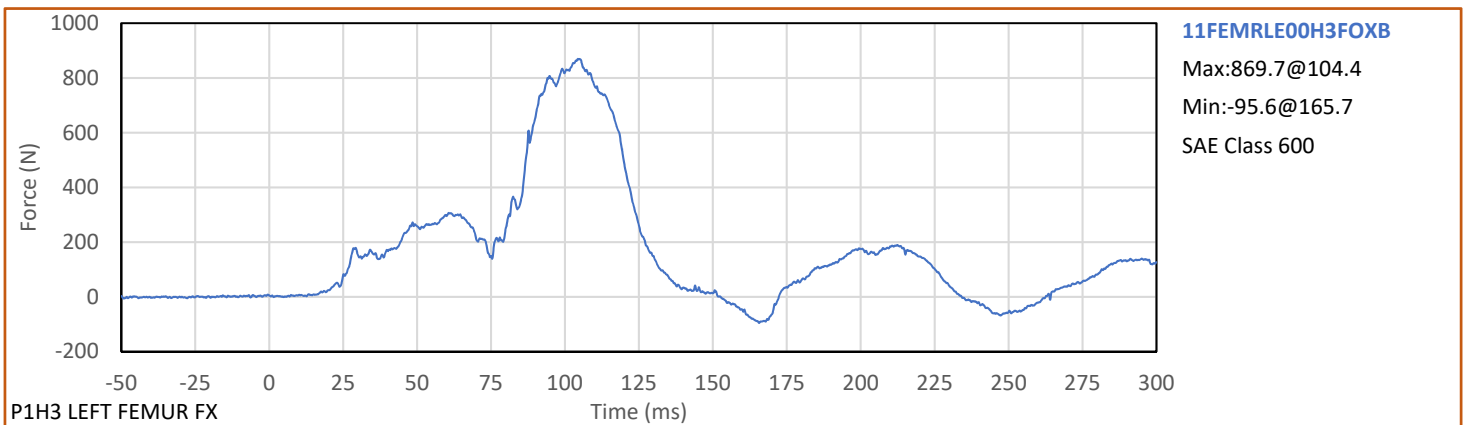
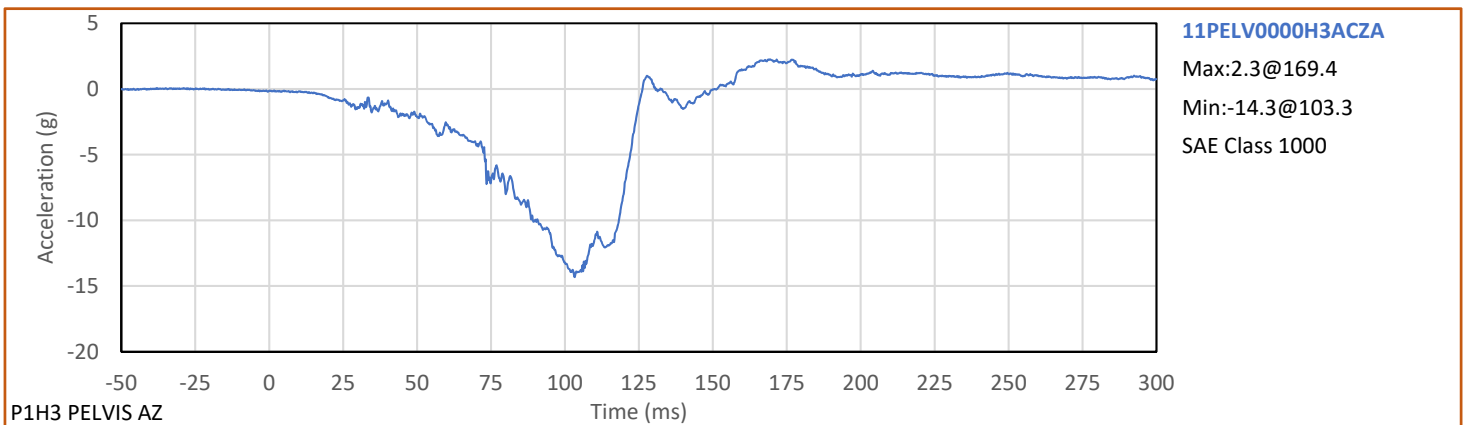
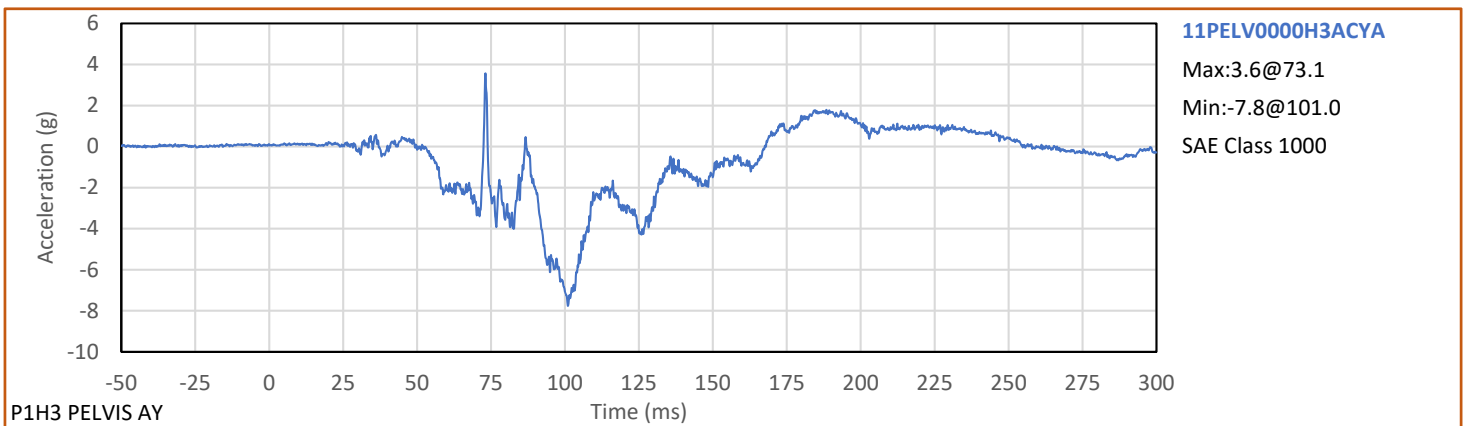
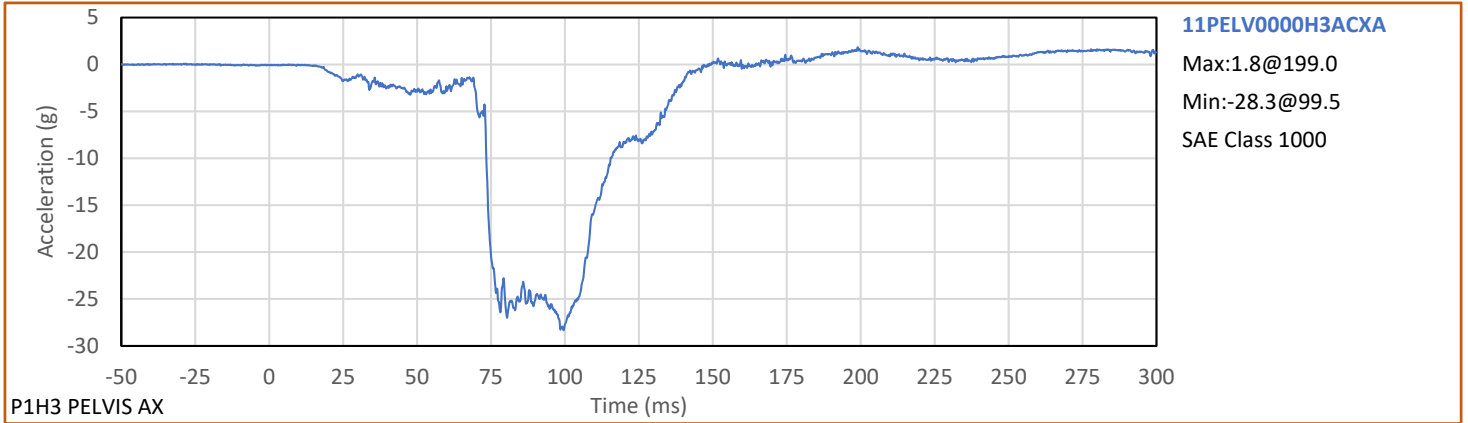


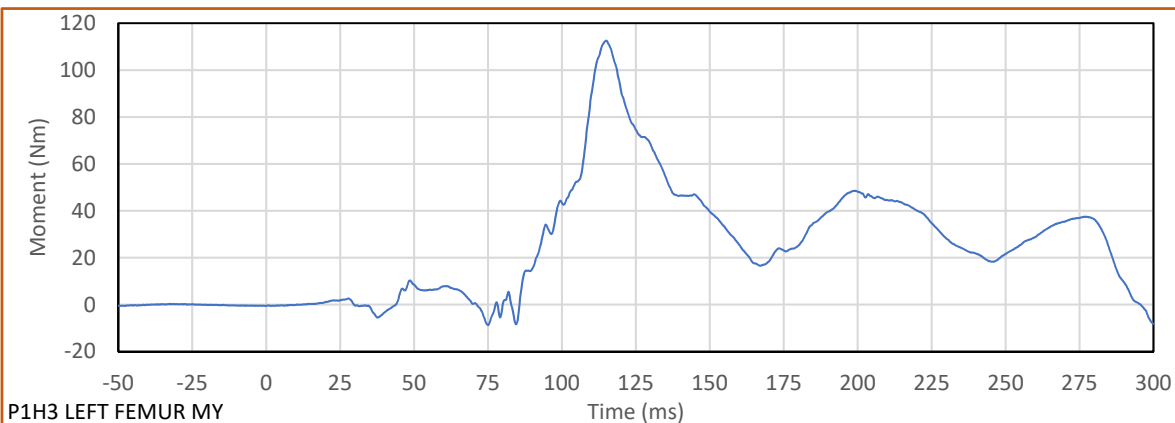
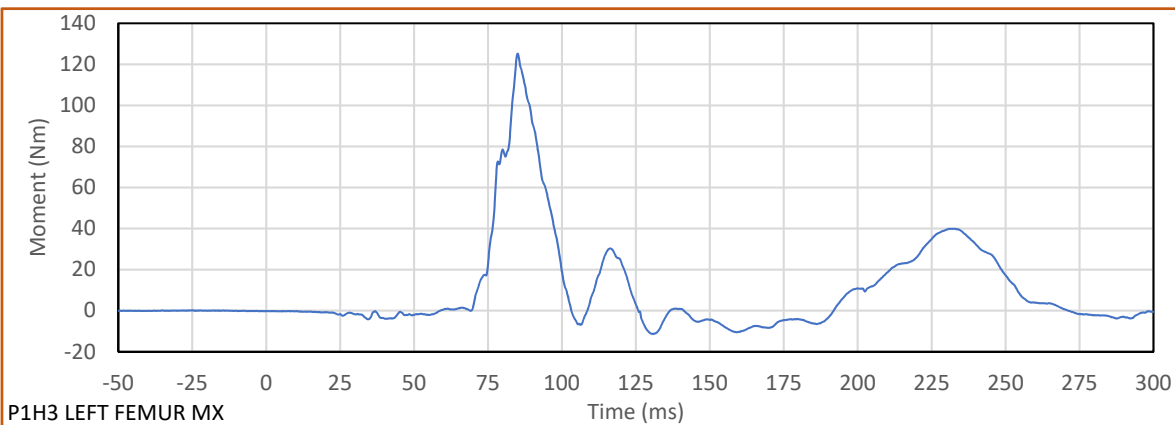
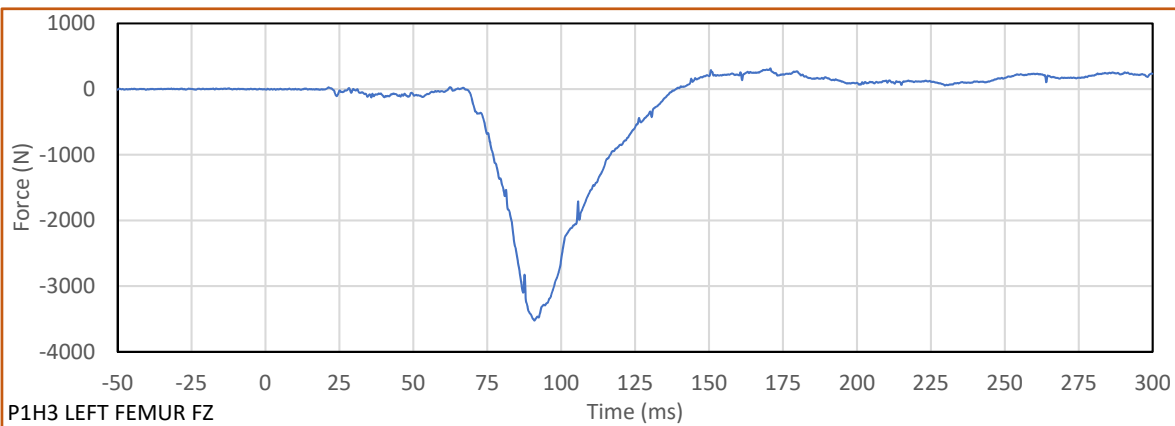
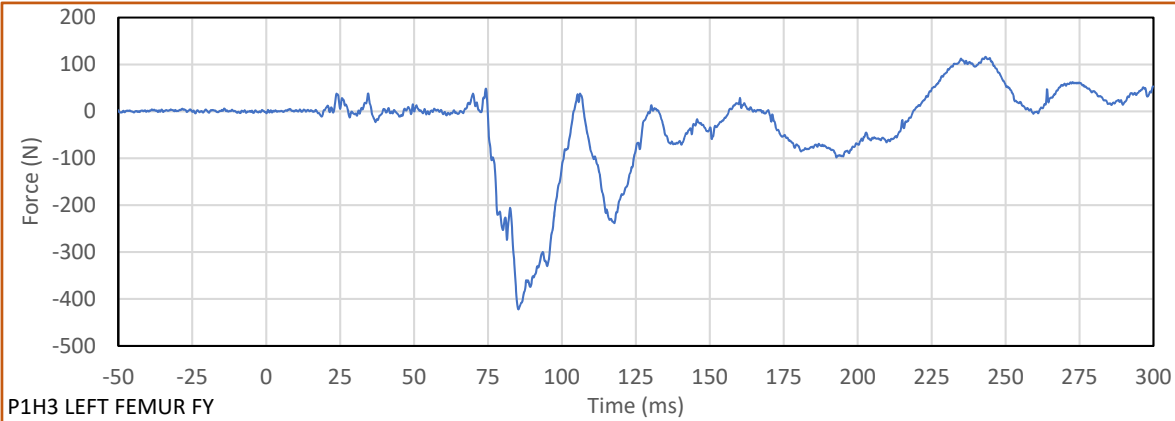


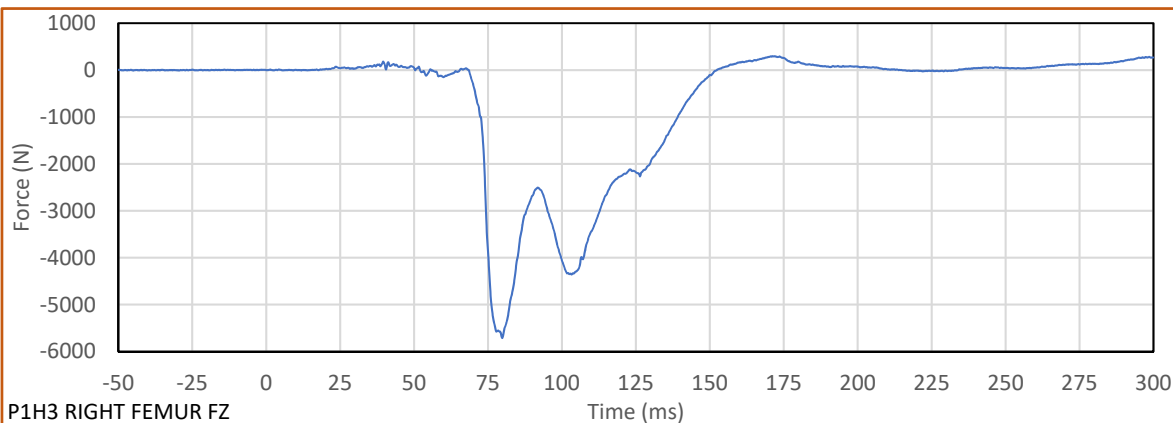
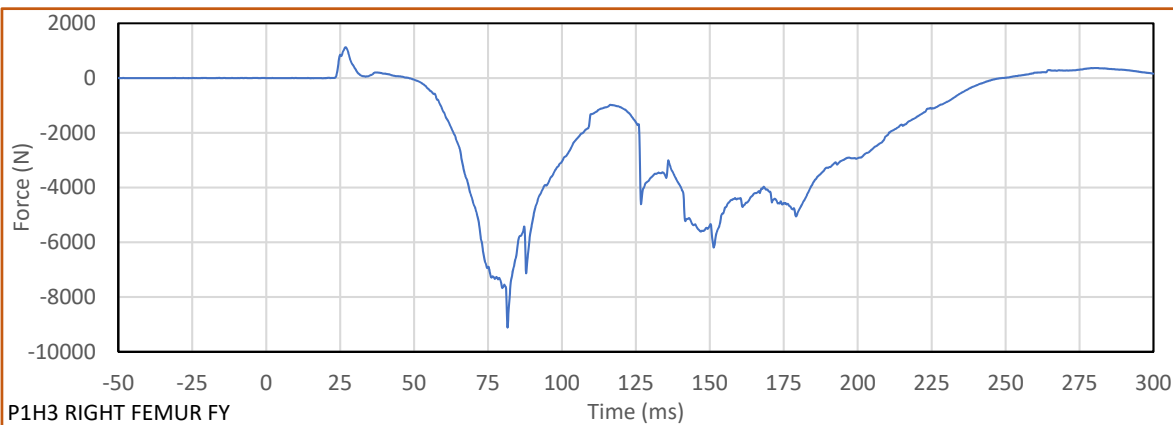
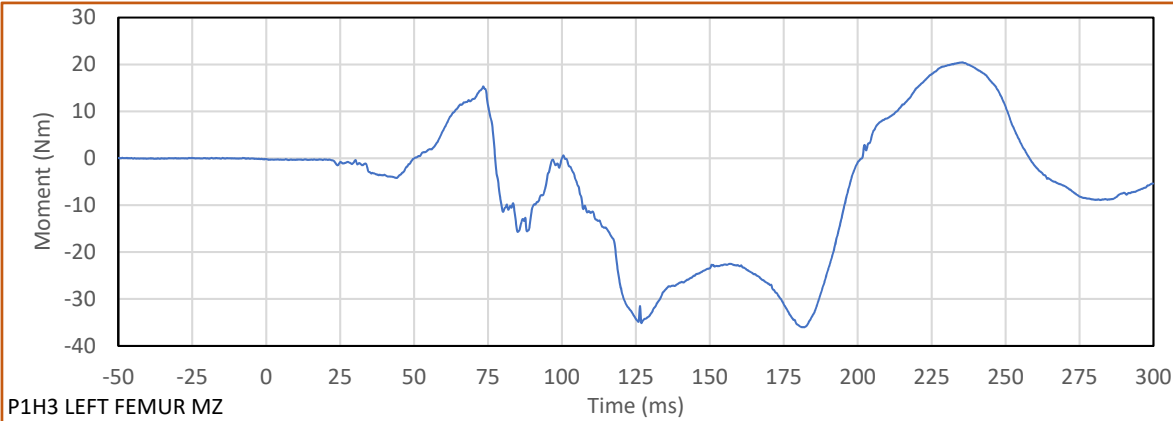


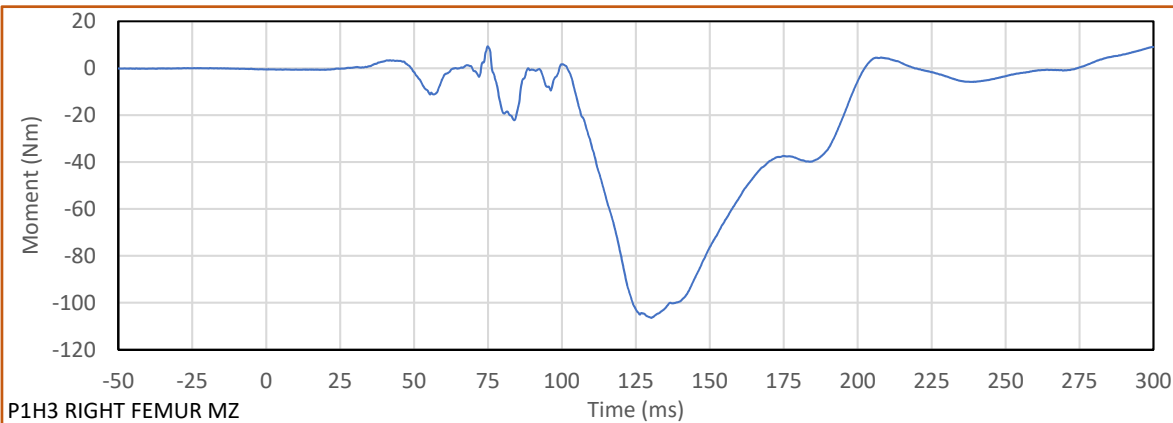
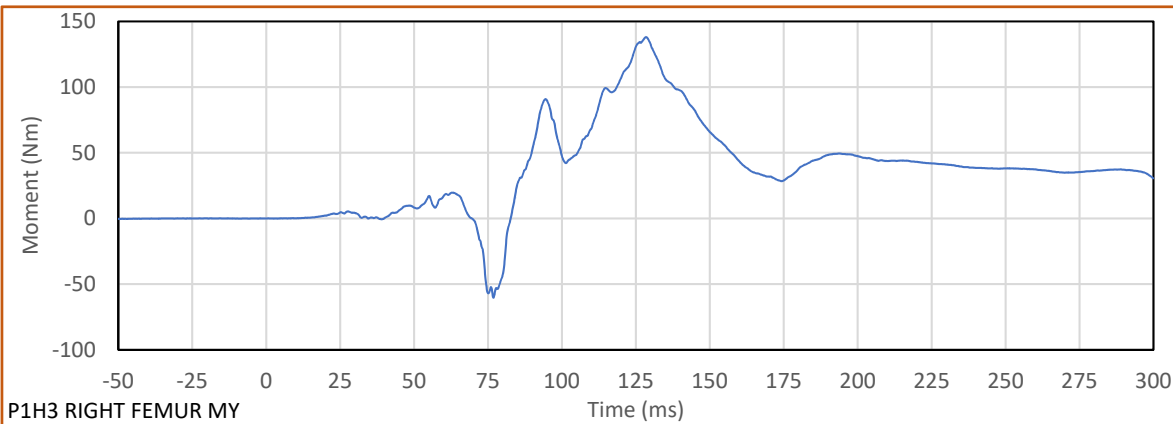
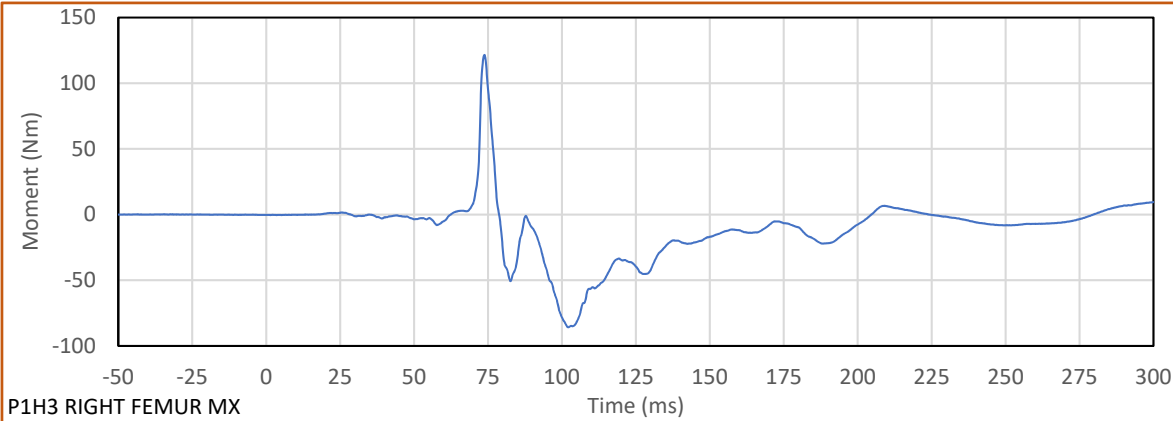


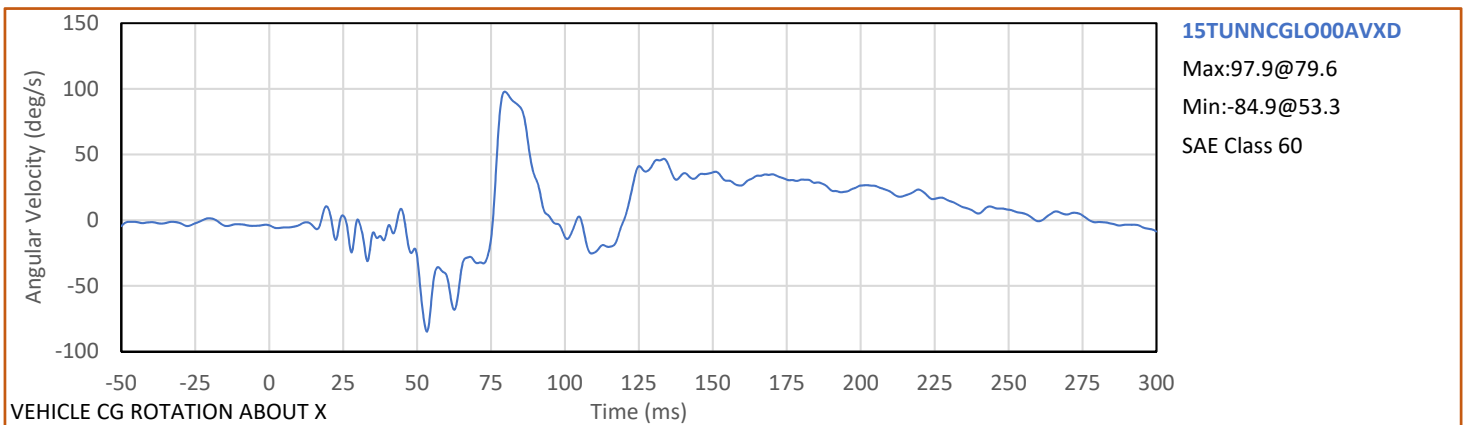
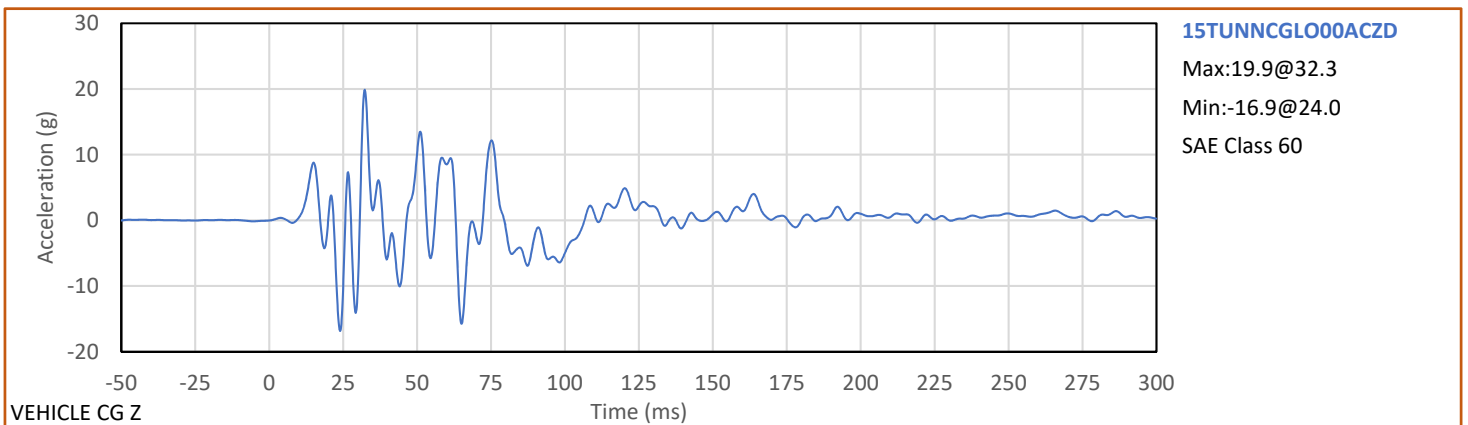
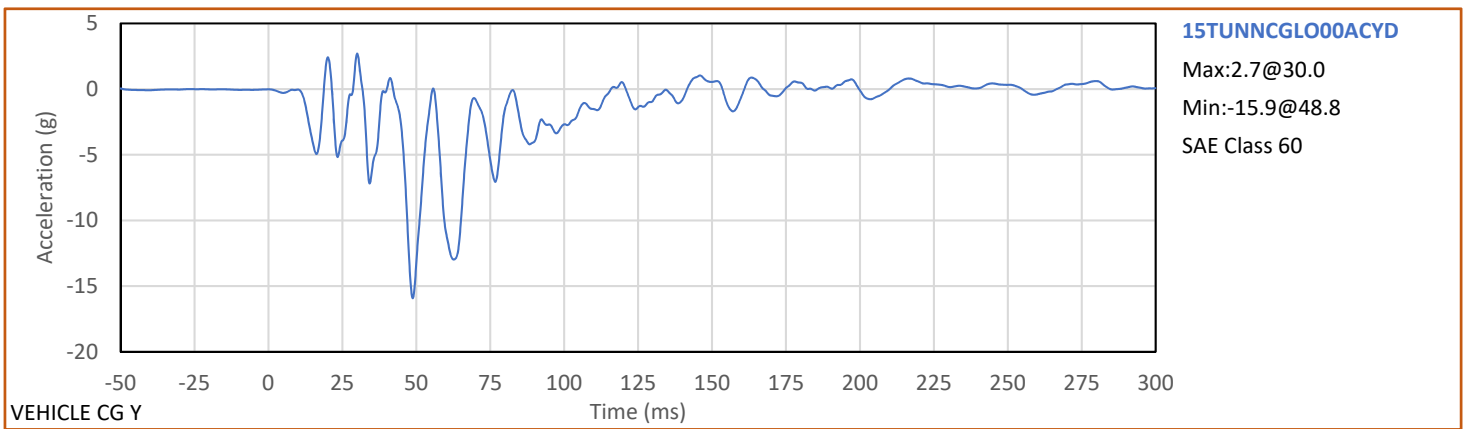
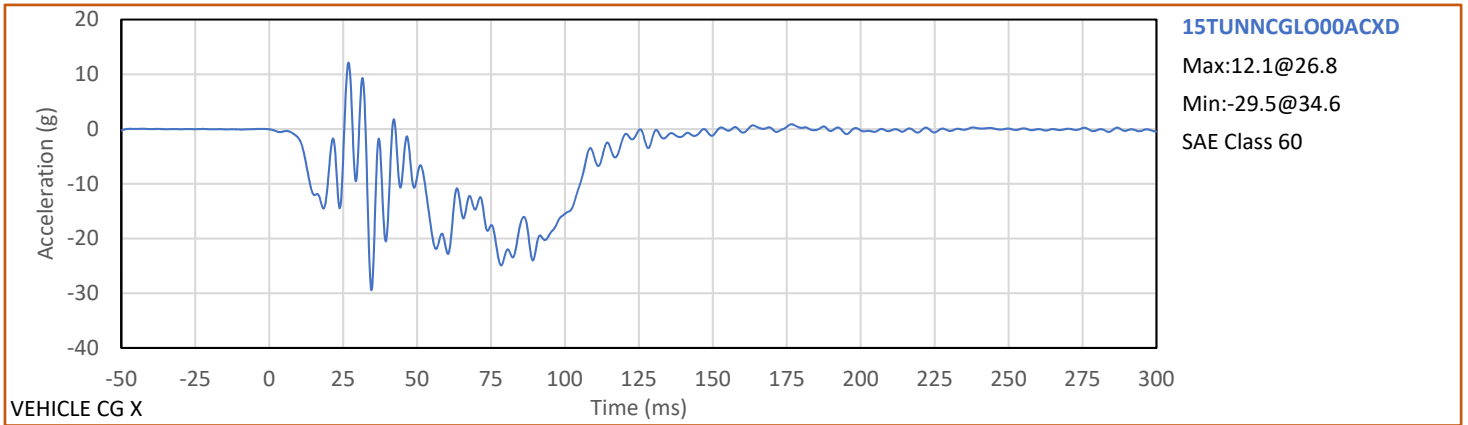


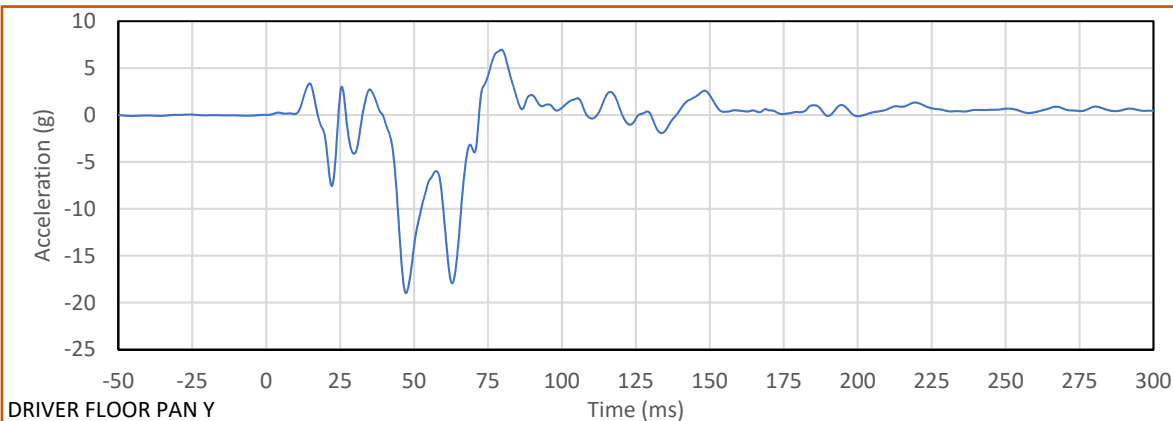
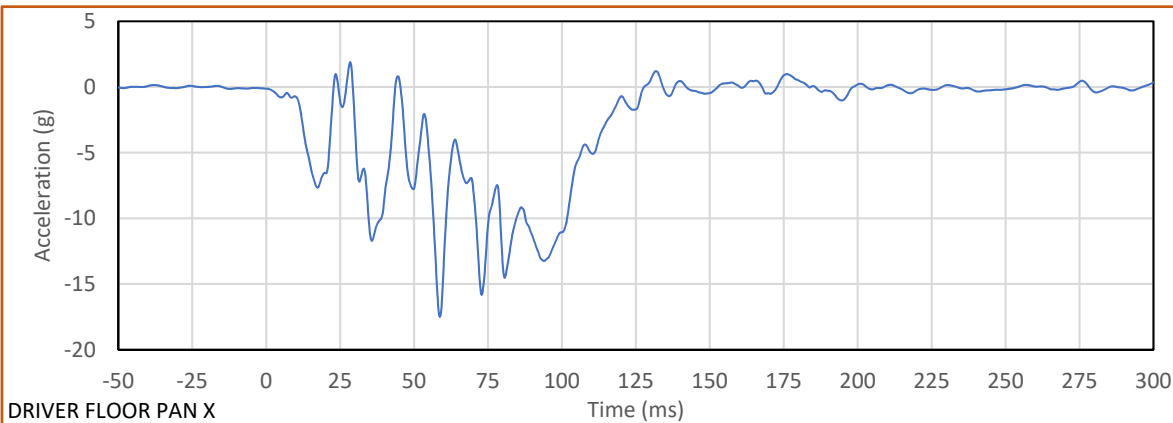
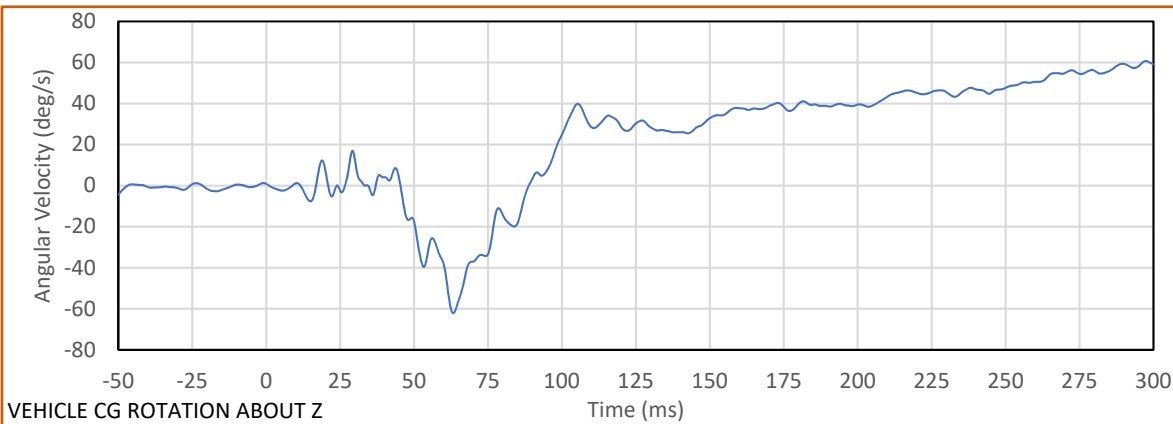
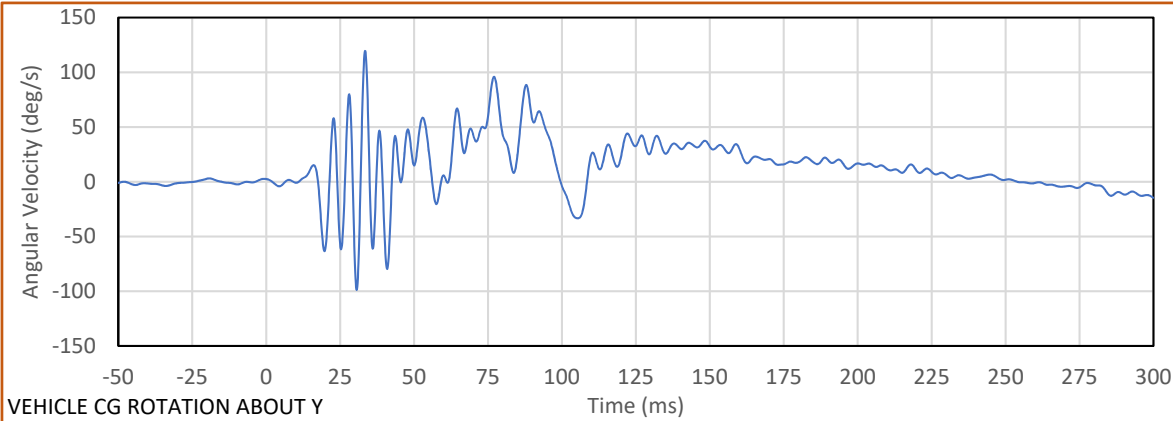


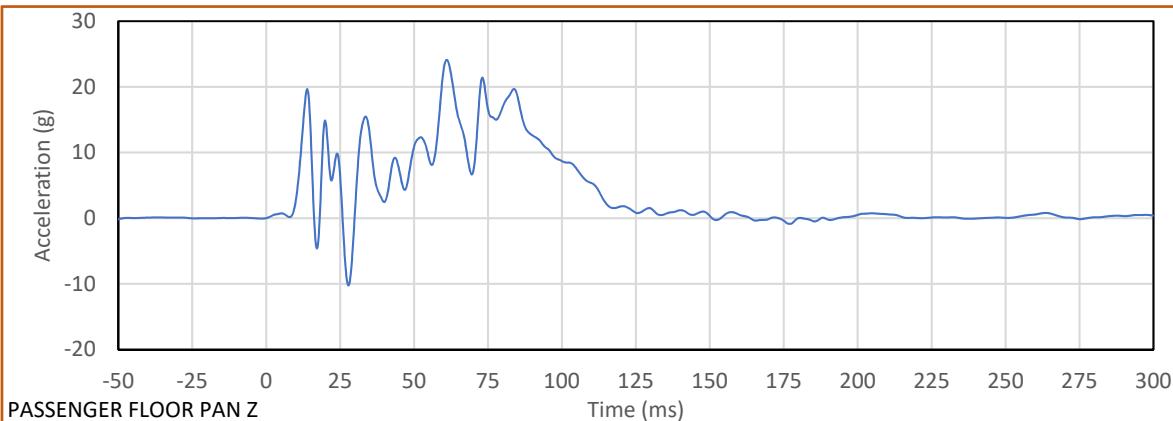
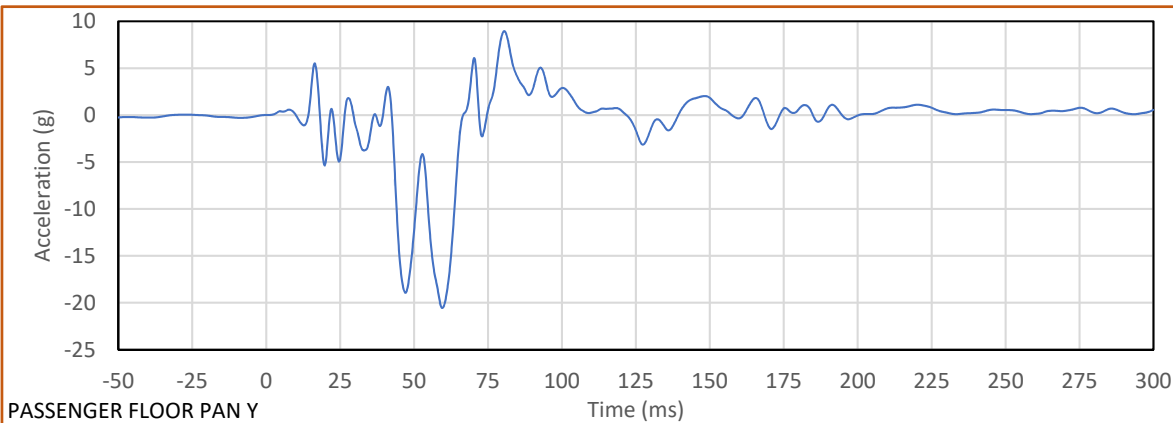
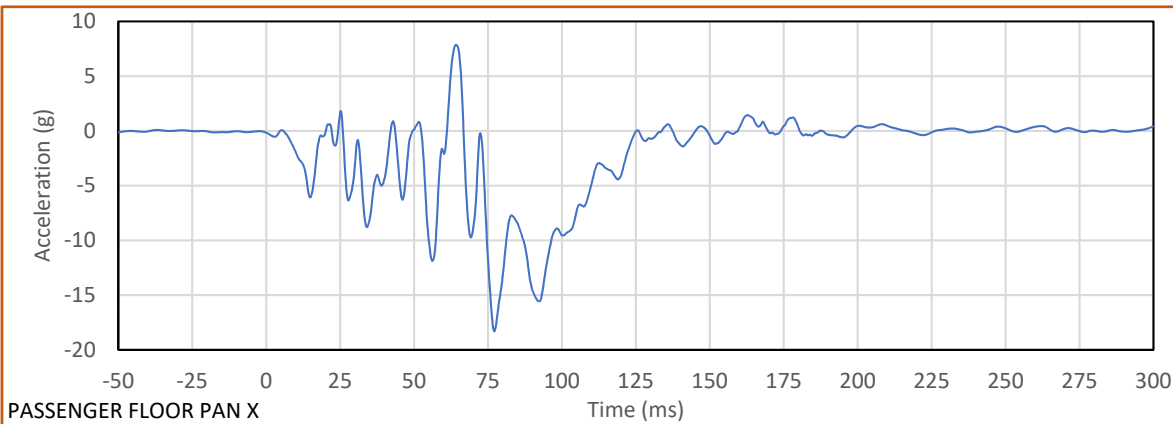
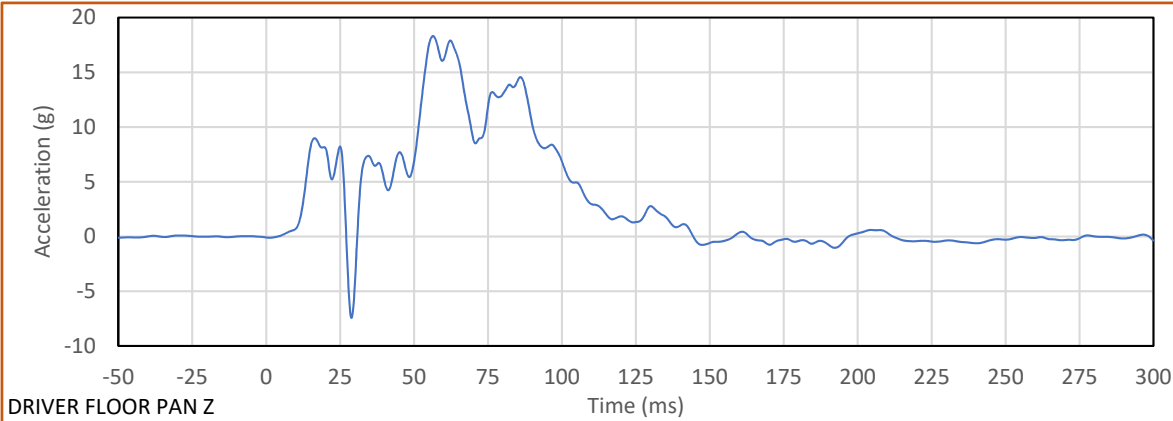


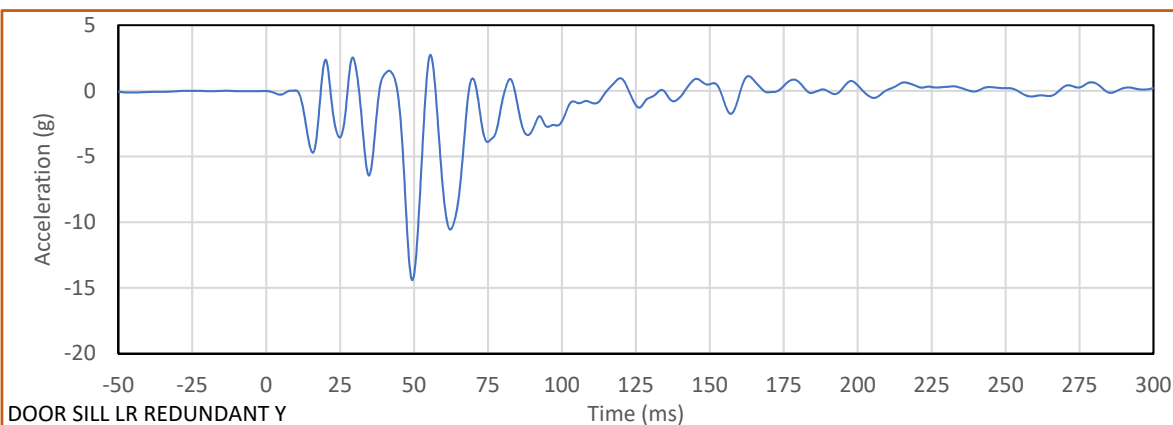
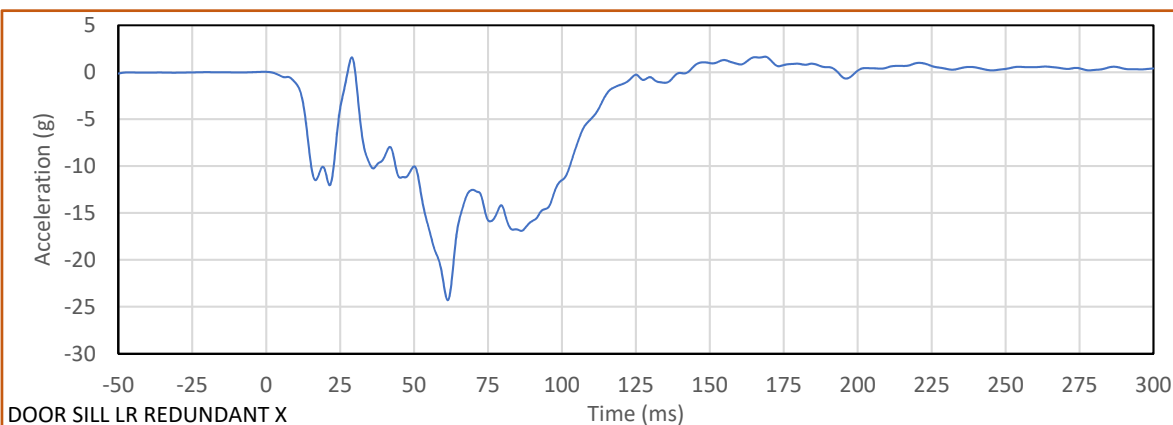
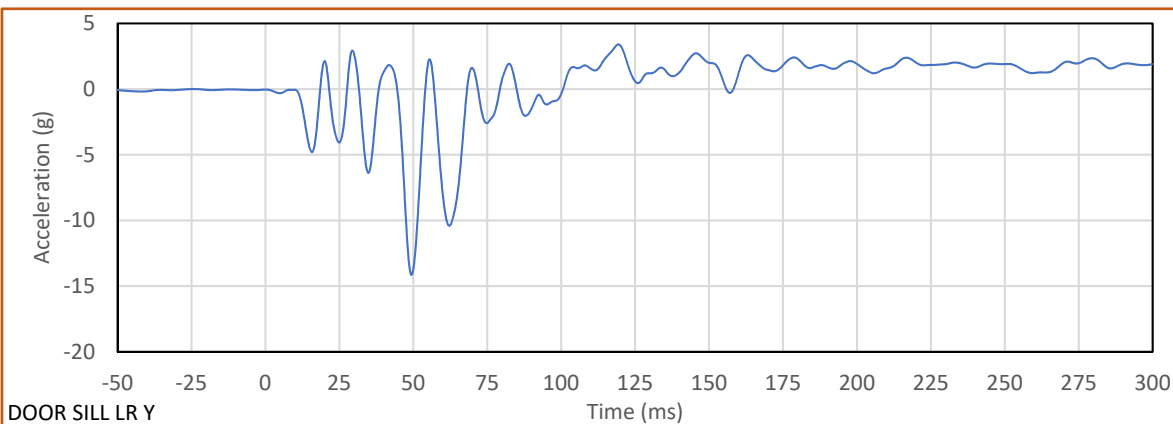
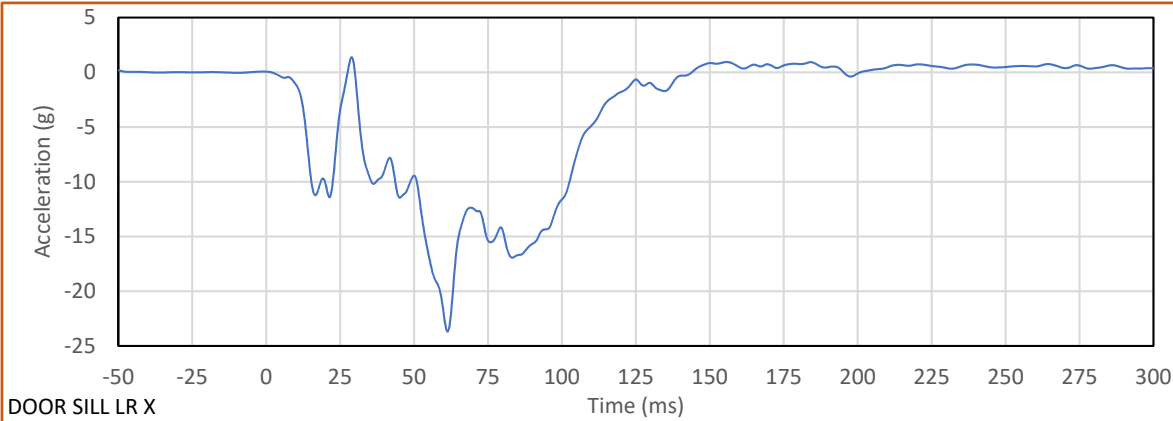












Test Vehicle:

2020 Mazda CX-5 5-Door MPV

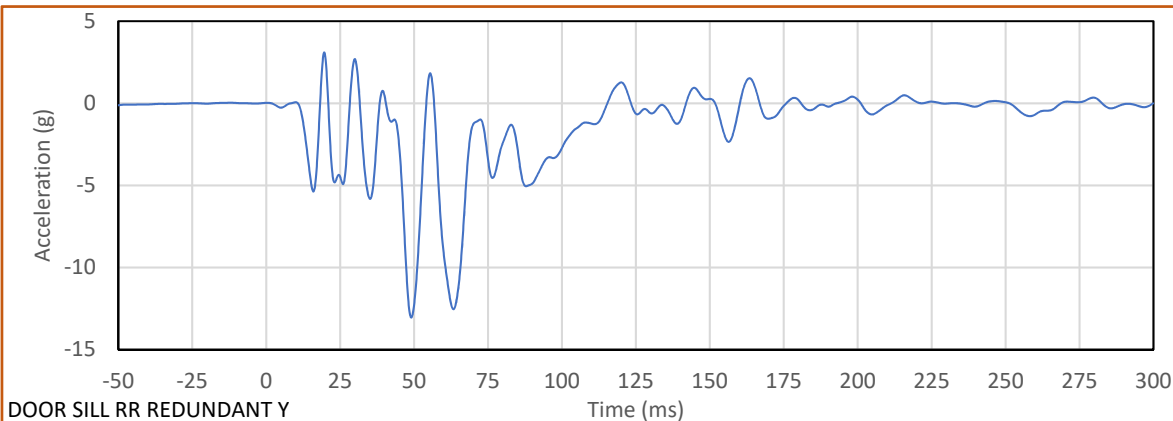
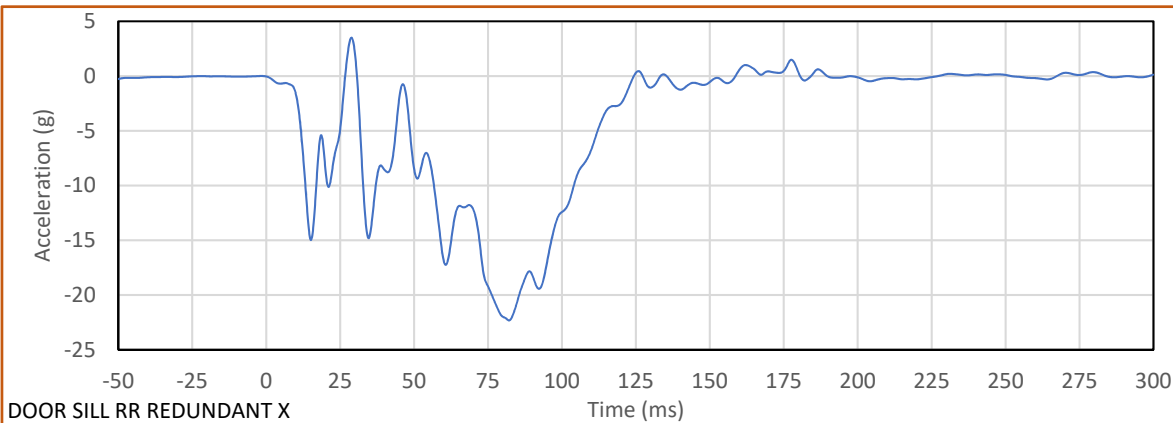
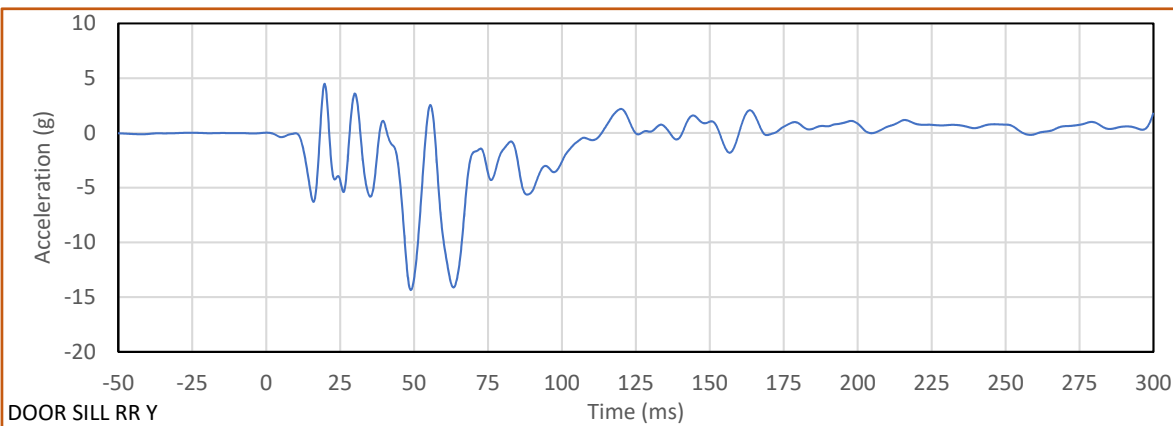
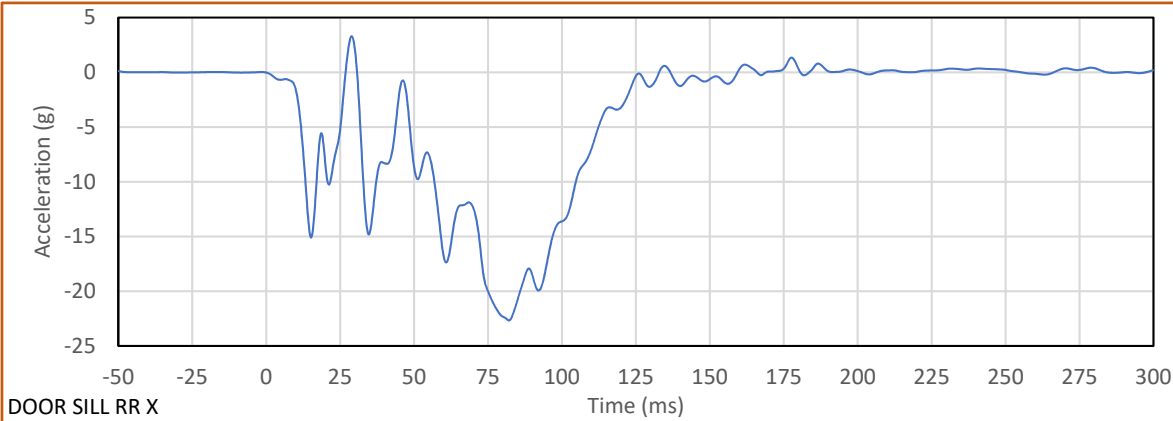
NHTSA No.: R20205414

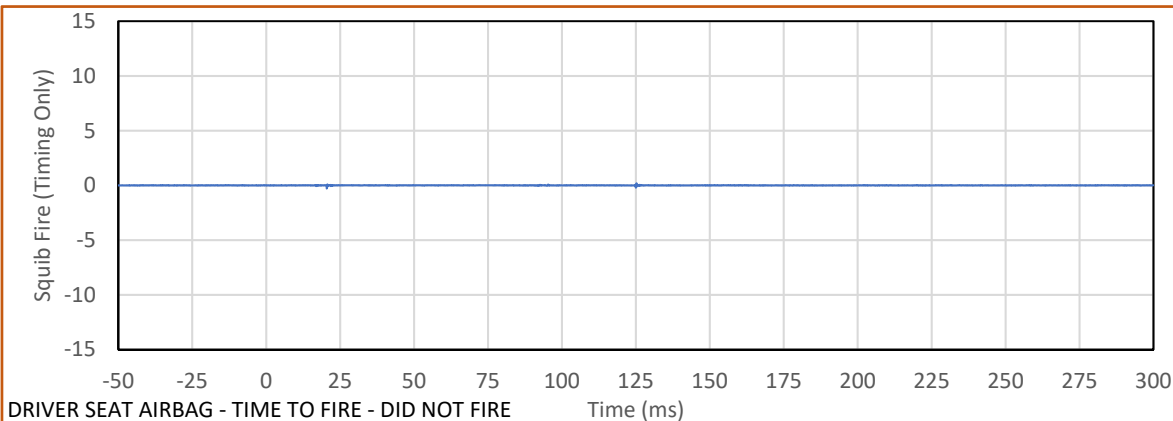
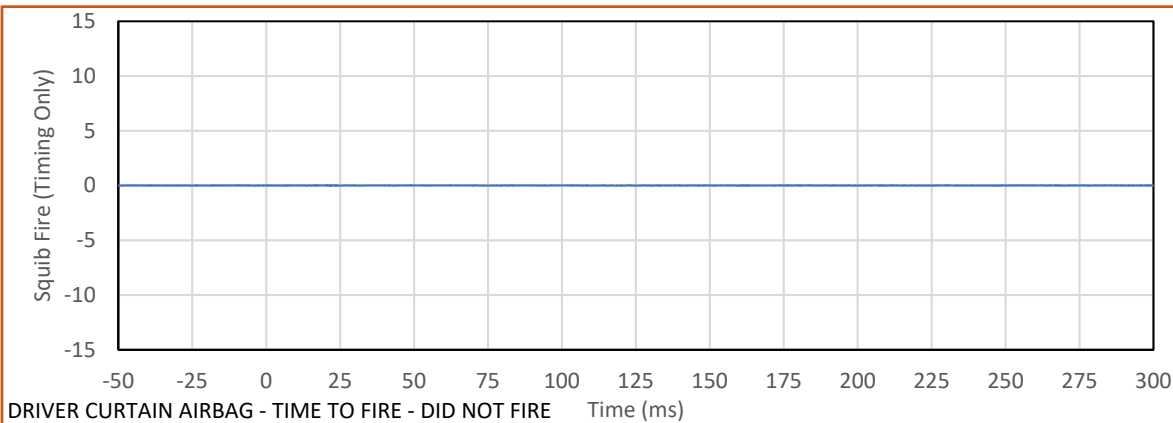
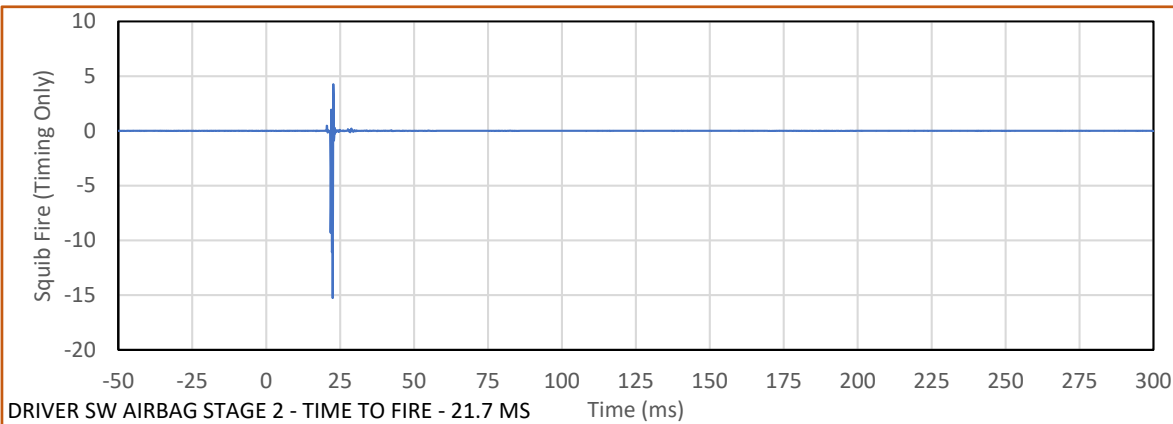
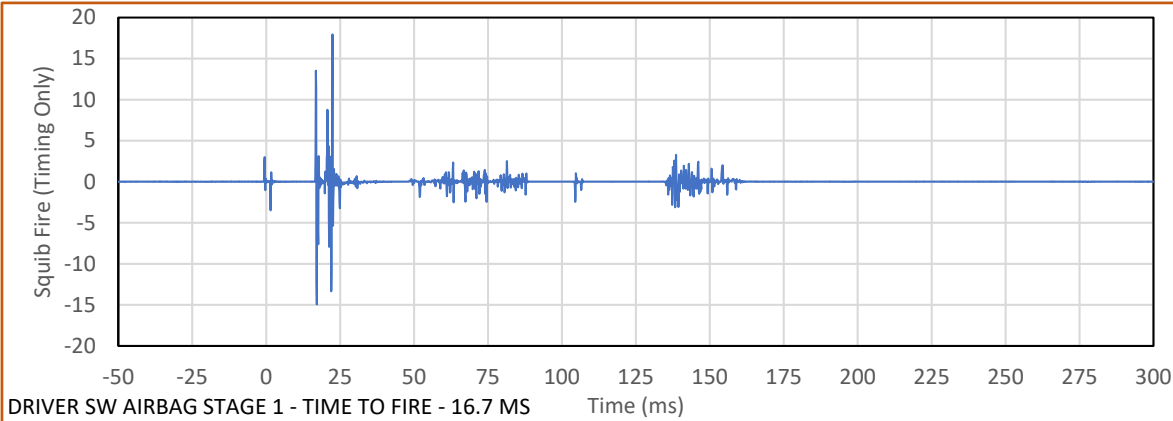


Test Program:

Right Side 30° Frontal Rigid Barrier Impact

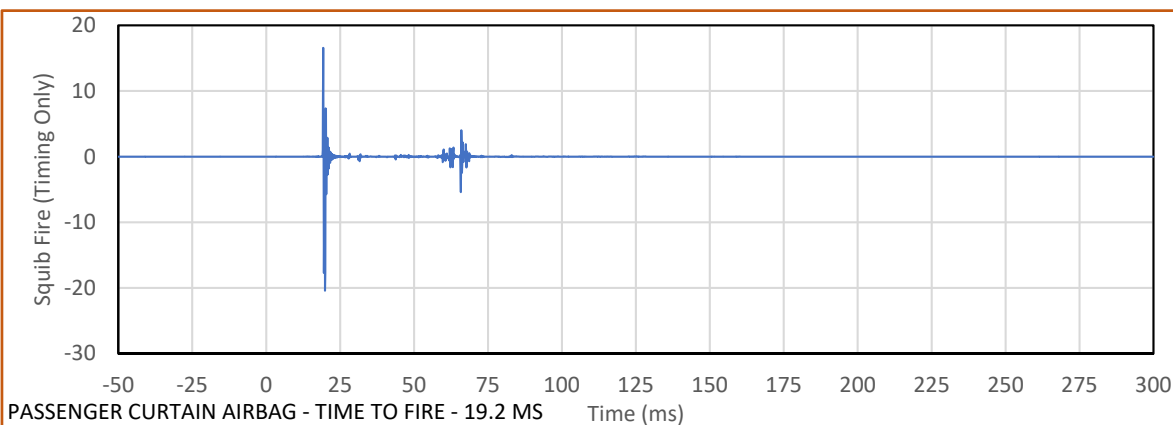
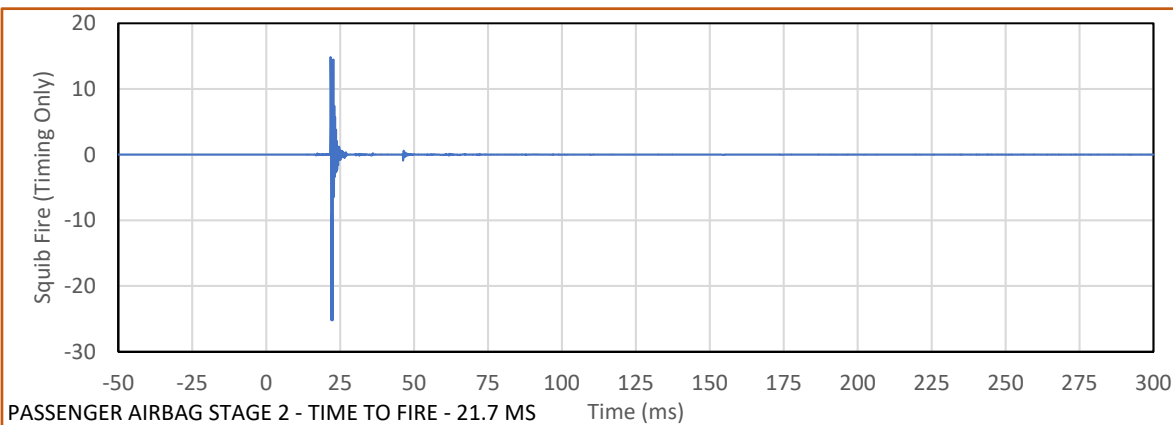
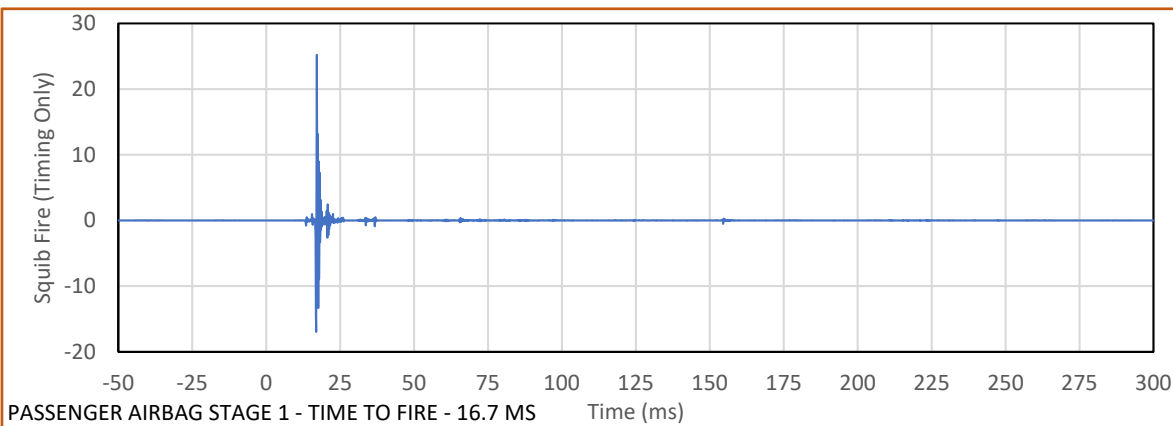
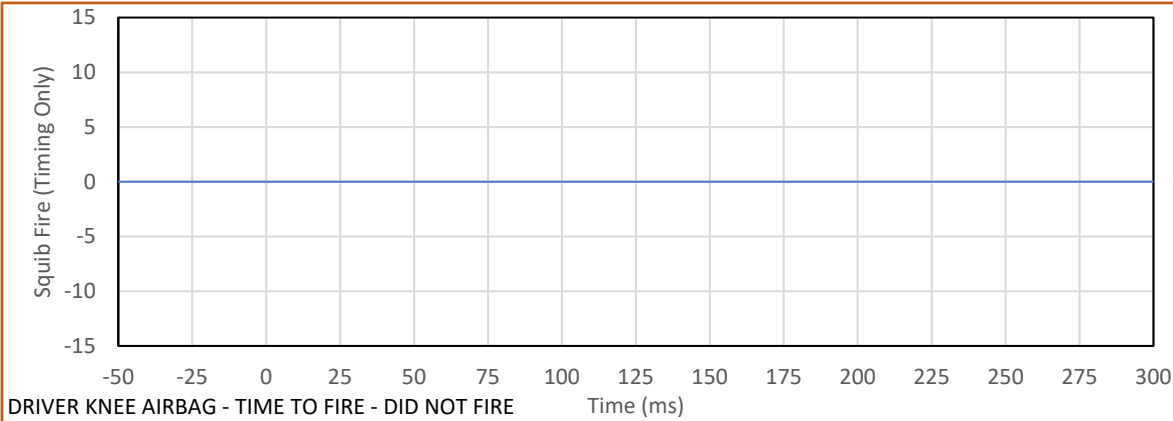
Test Date: 12/18/2020





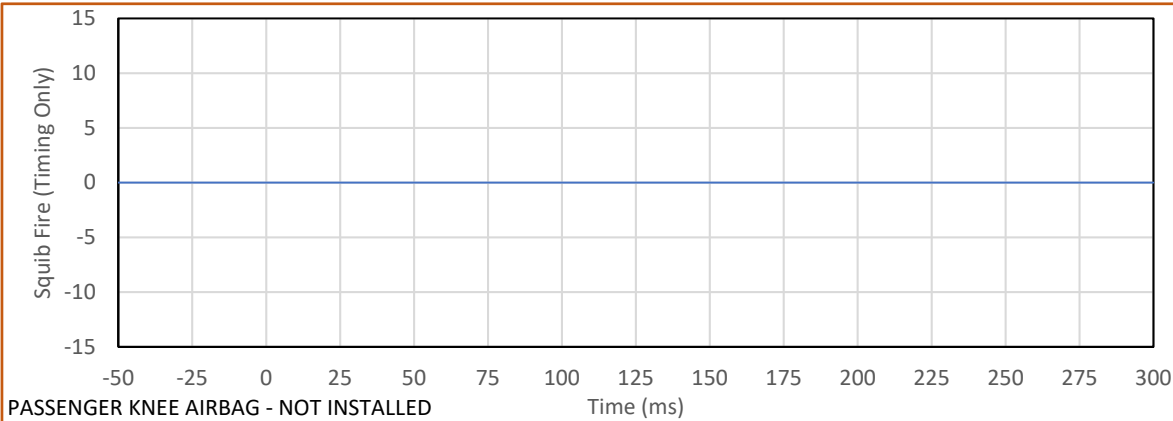
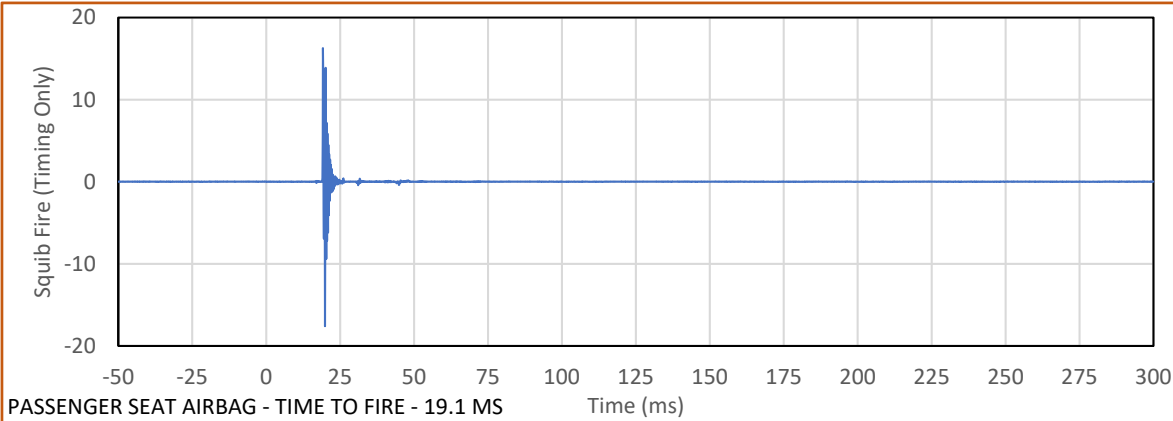
Test Vehicle: 2020 Mazda CX-5 5-Door MPV
Test Program: Right Side 30° Frontal Rigid Barrier Impact

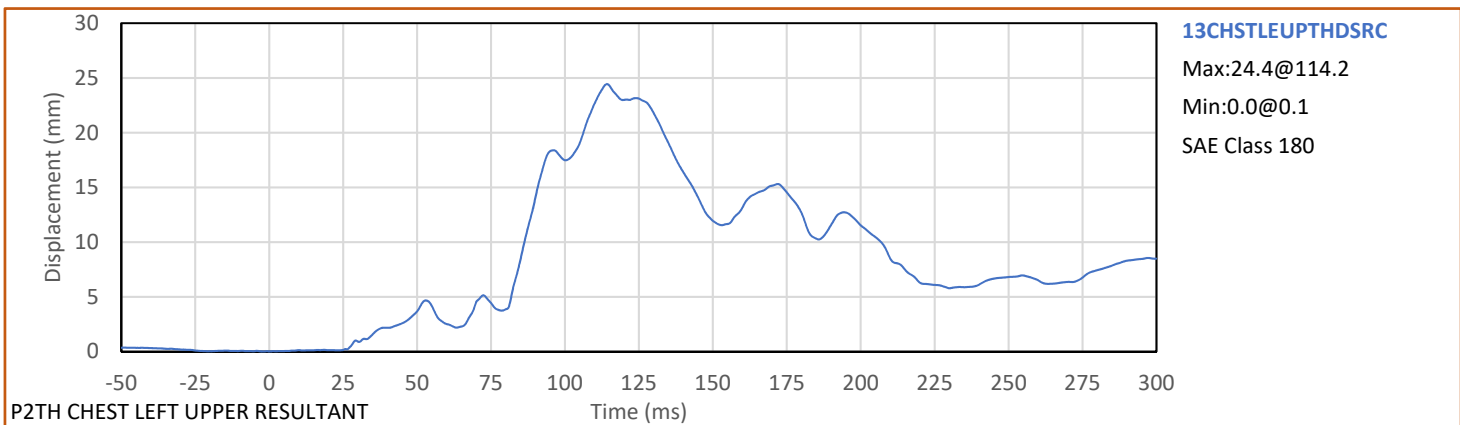
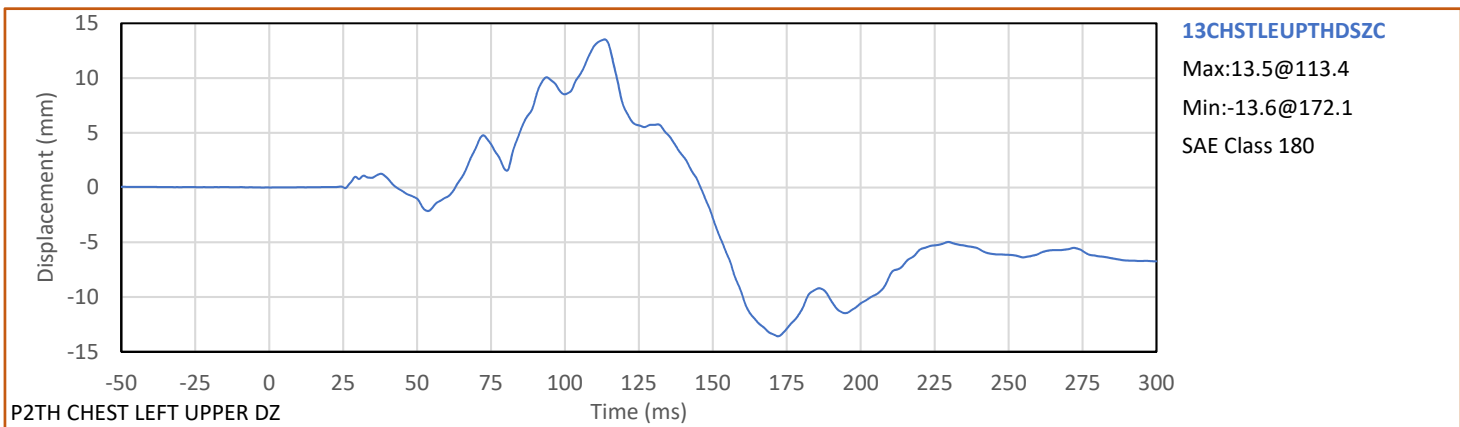
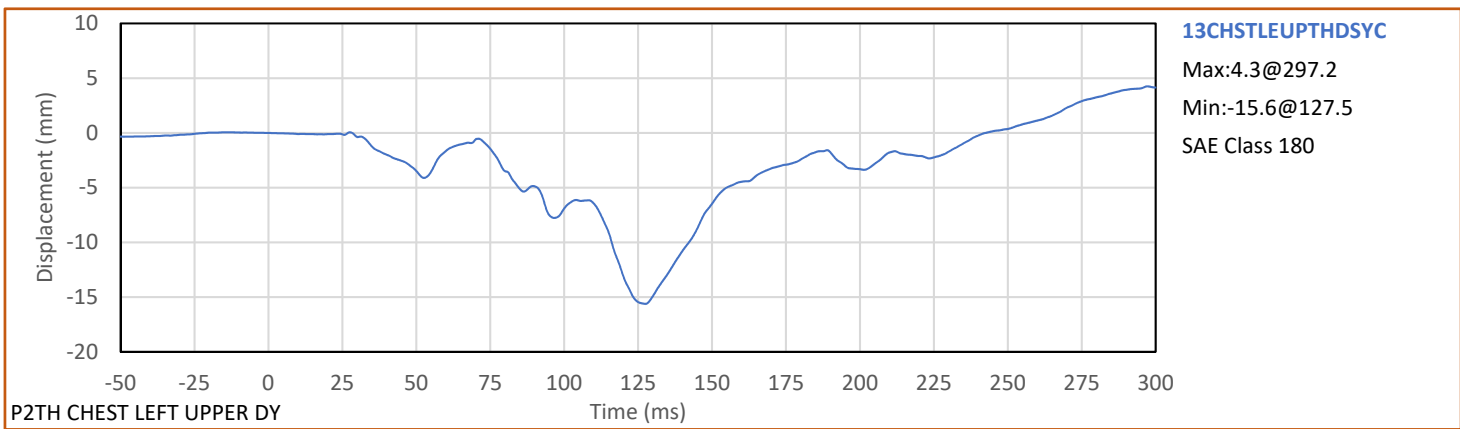
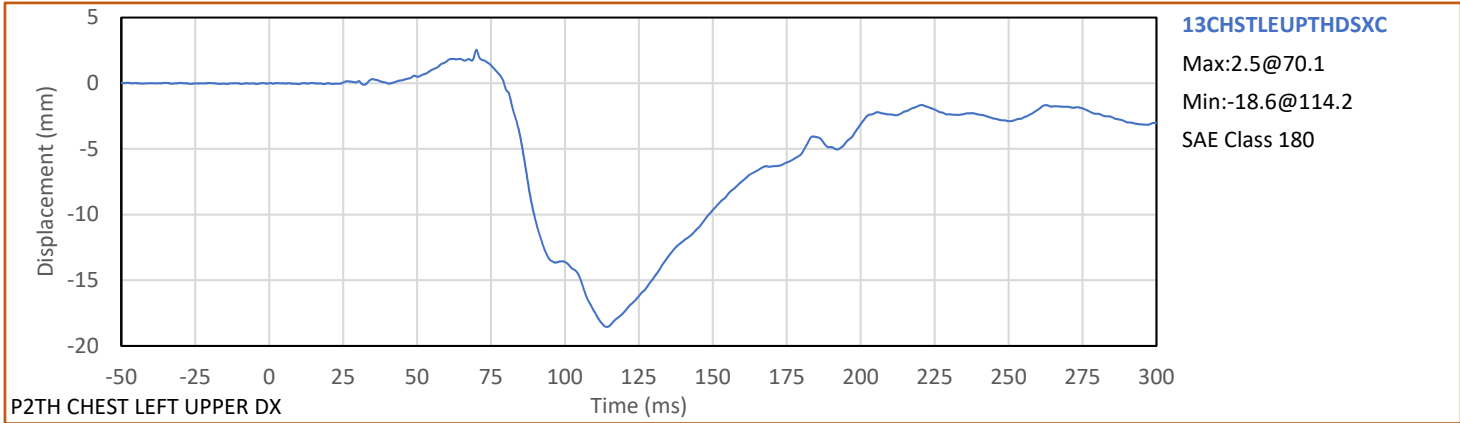
NHTSA No.: R20205414
Test Date: 12/18/2020

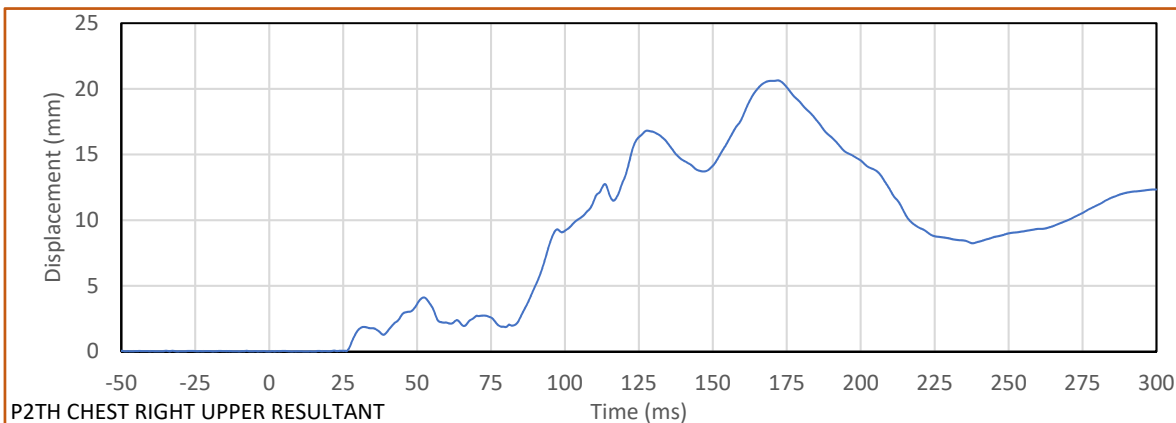
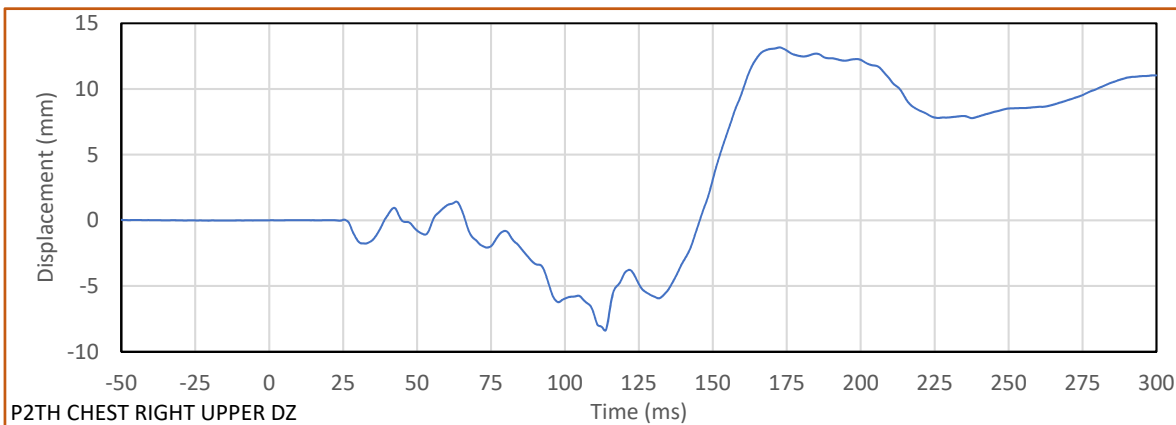
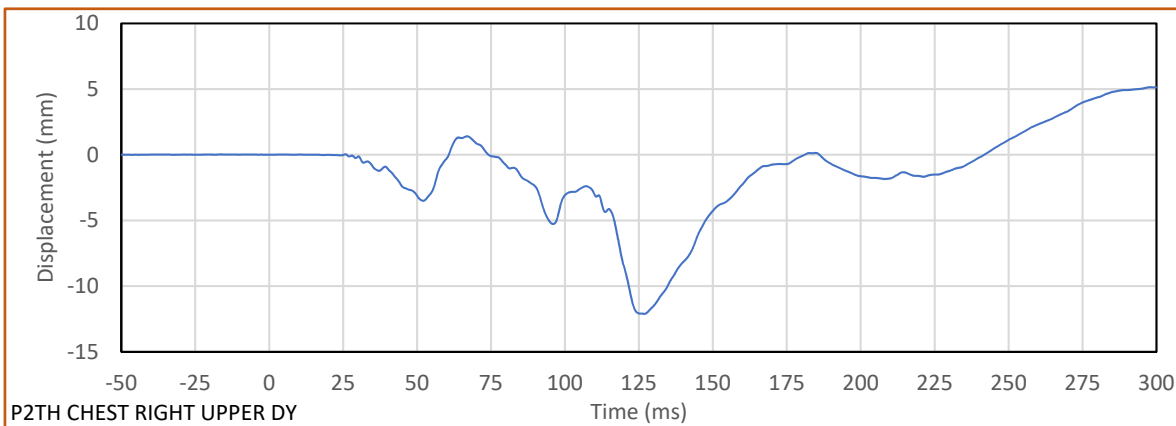
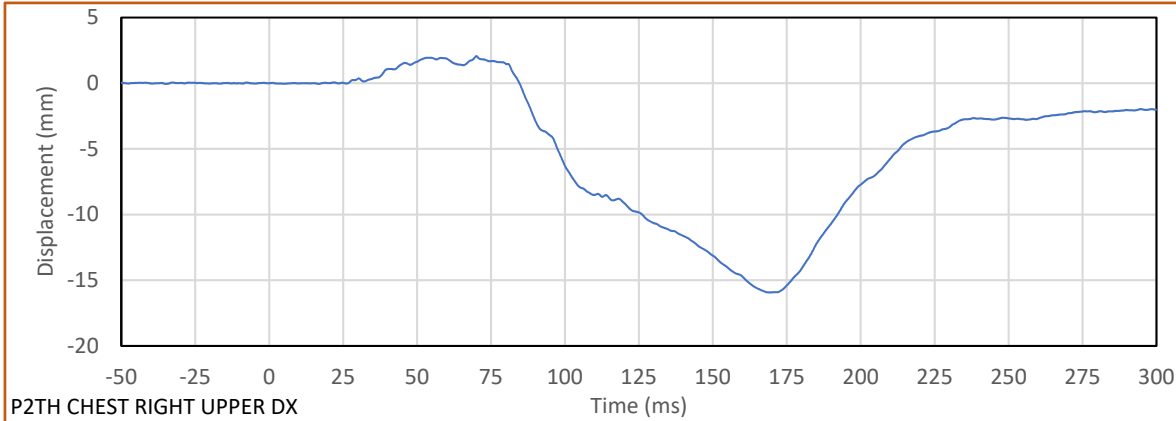


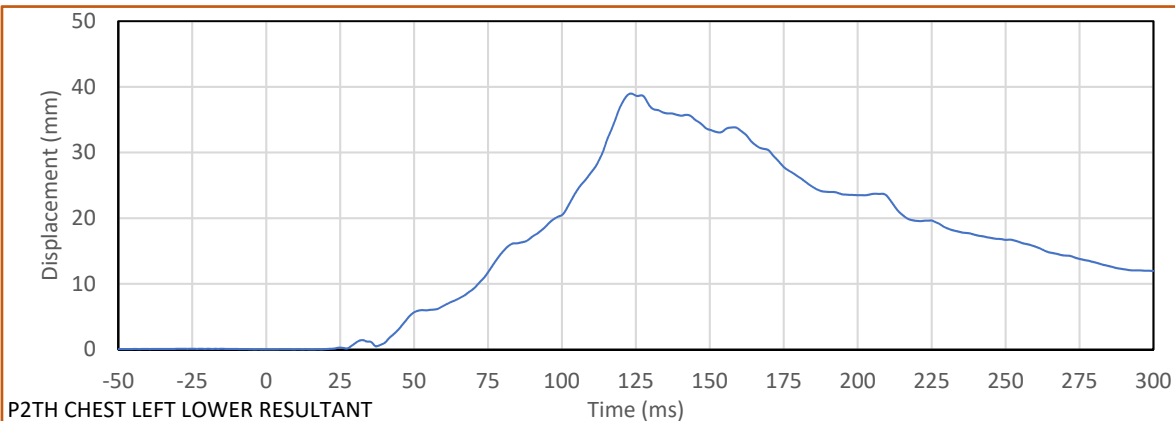
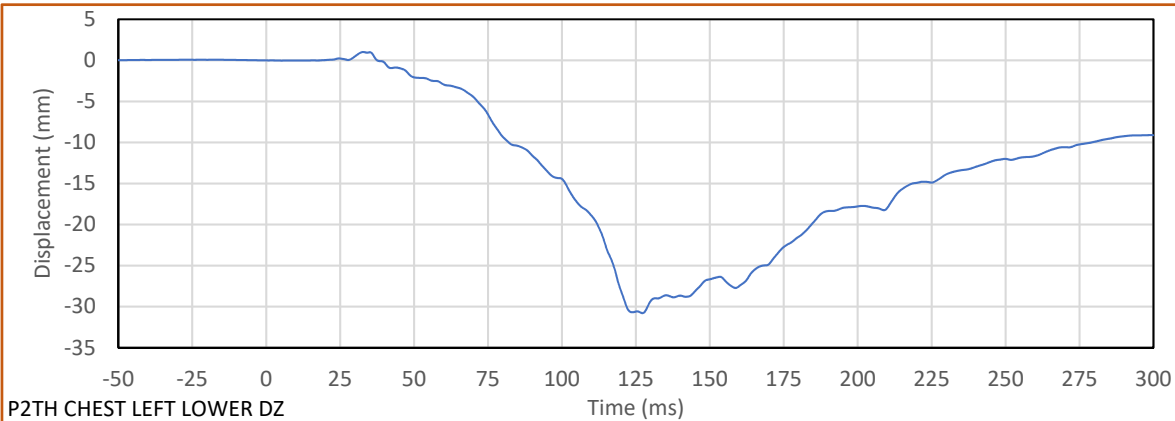
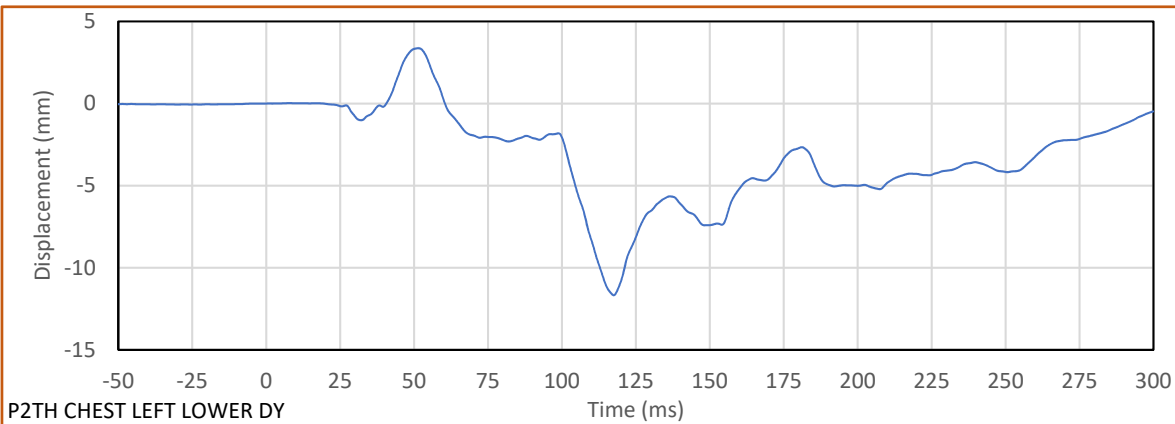
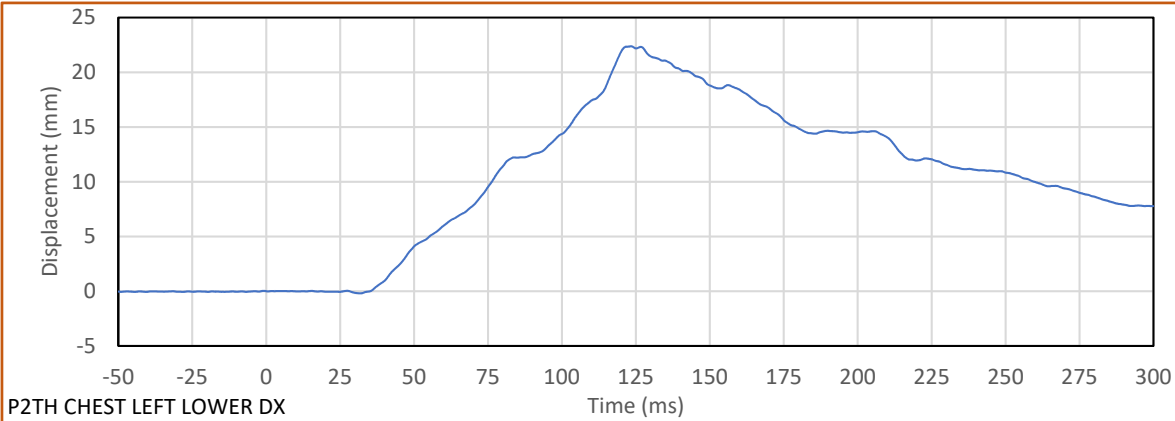
Test Vehicle: 2020 Mazda CX-5 5-Door MPV
Test Program: Right Side 30° Frontal Rigid Barrier Impact

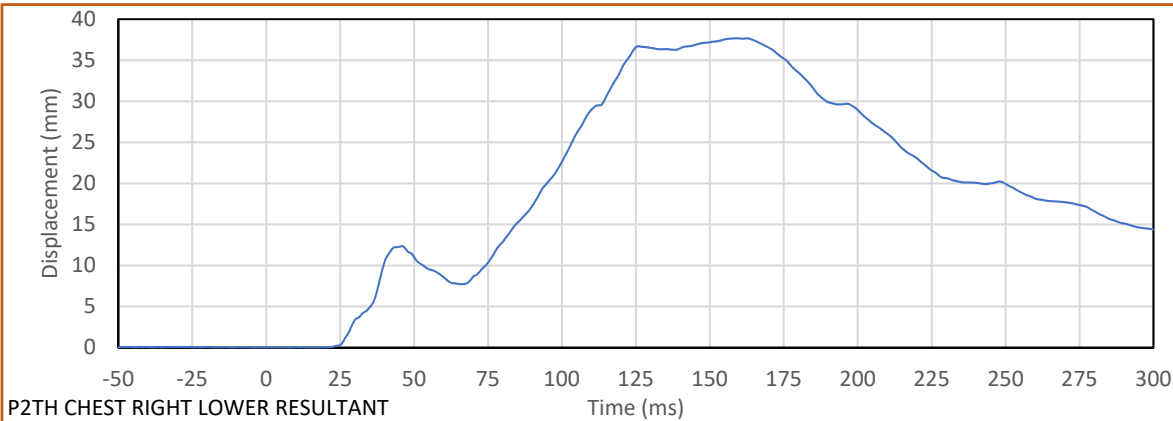
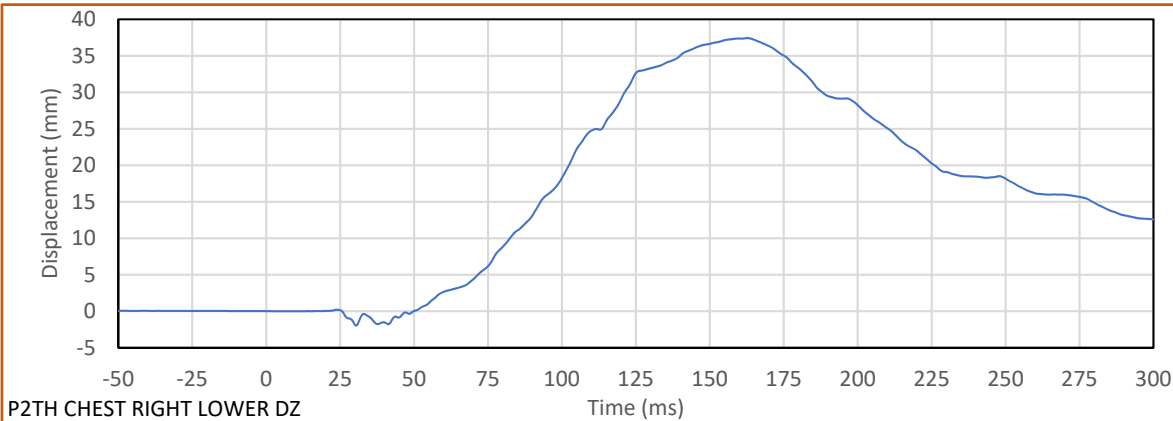
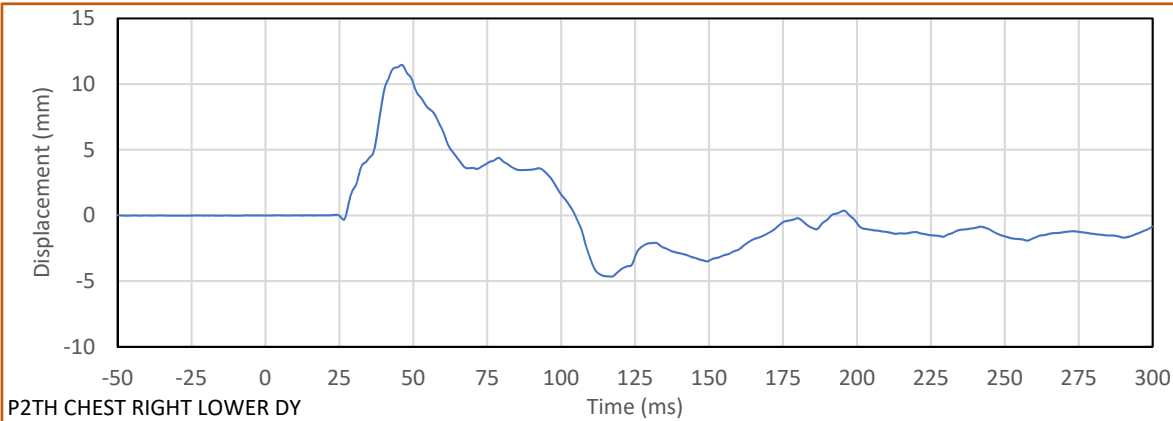
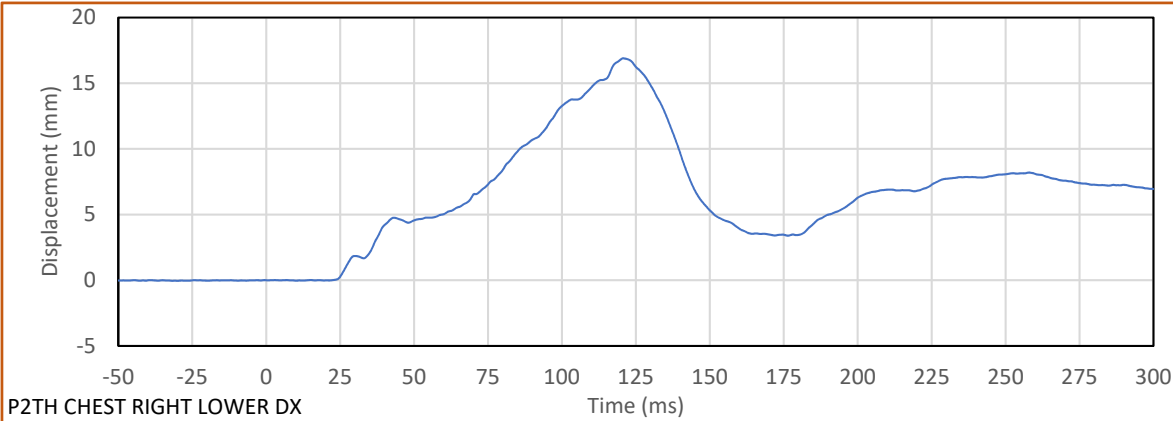
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Test Date: 12/18/2020

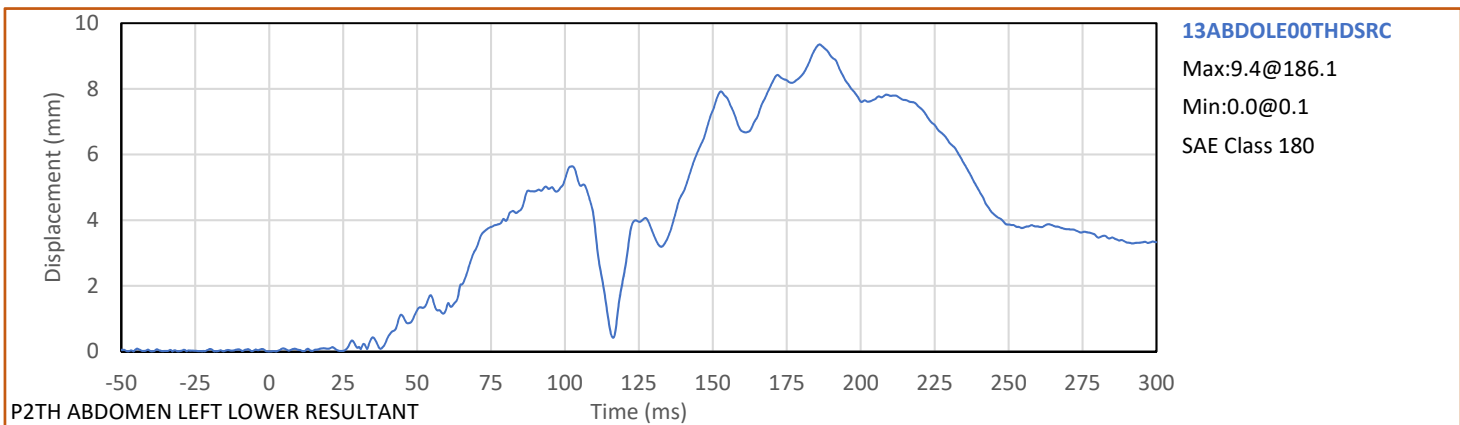
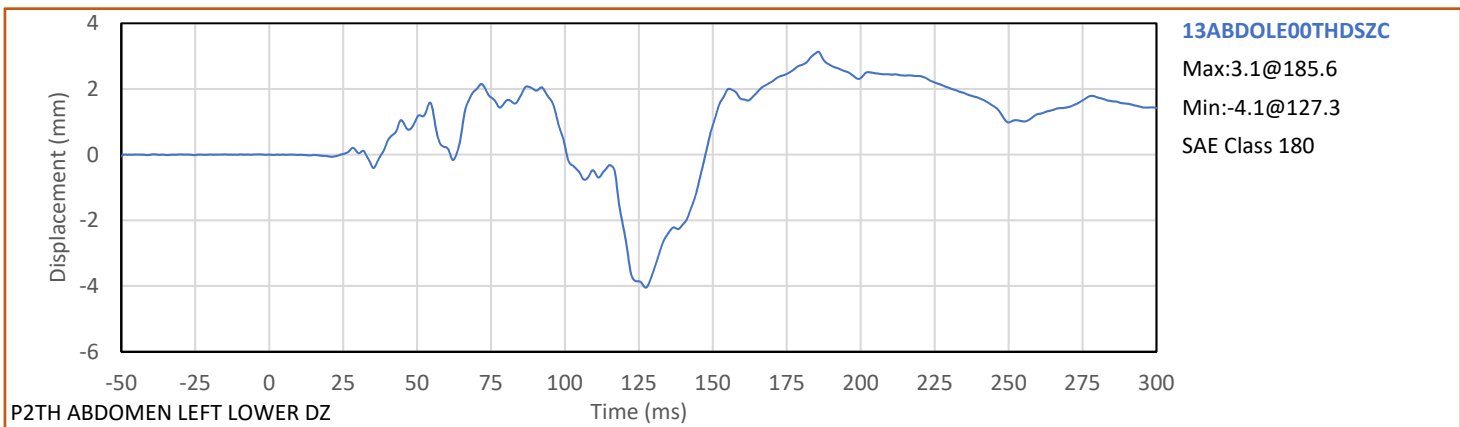
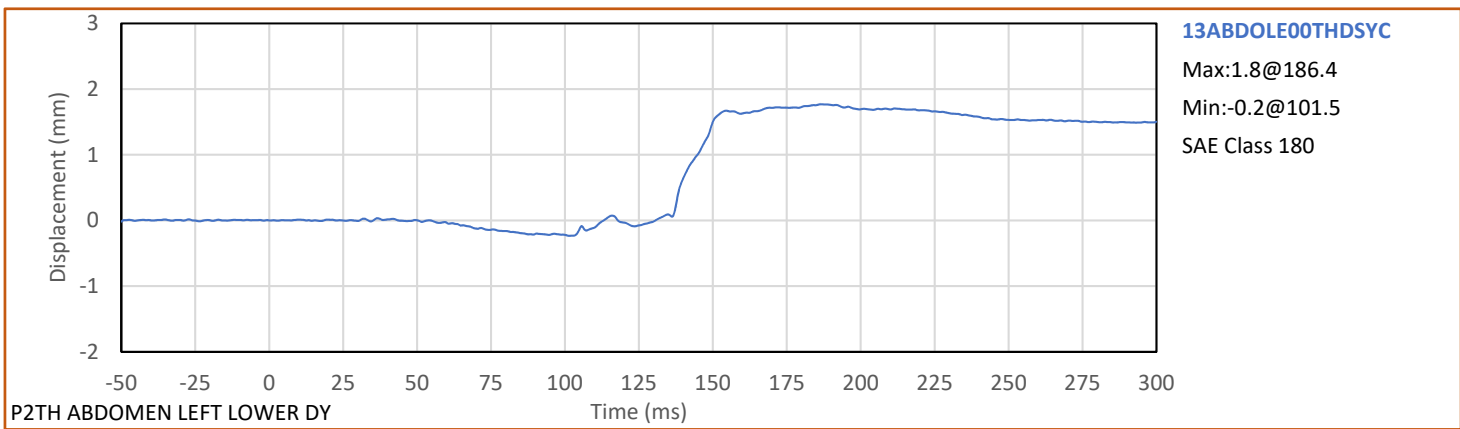
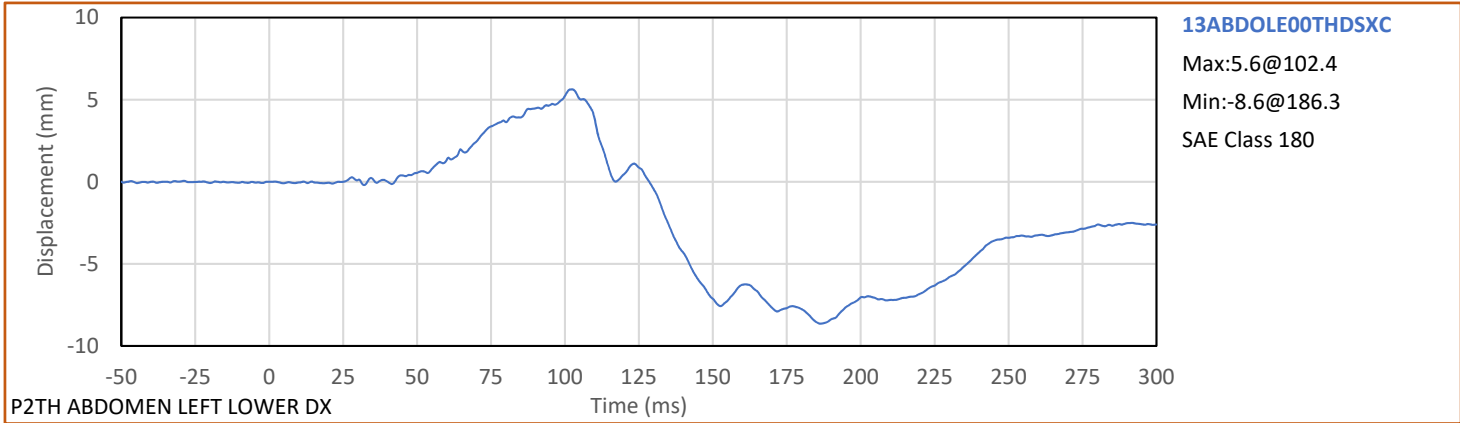


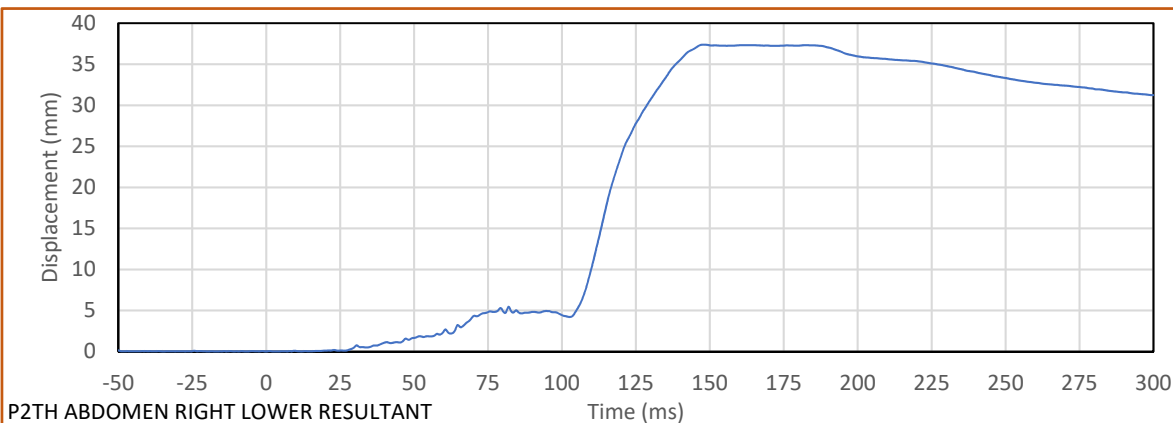
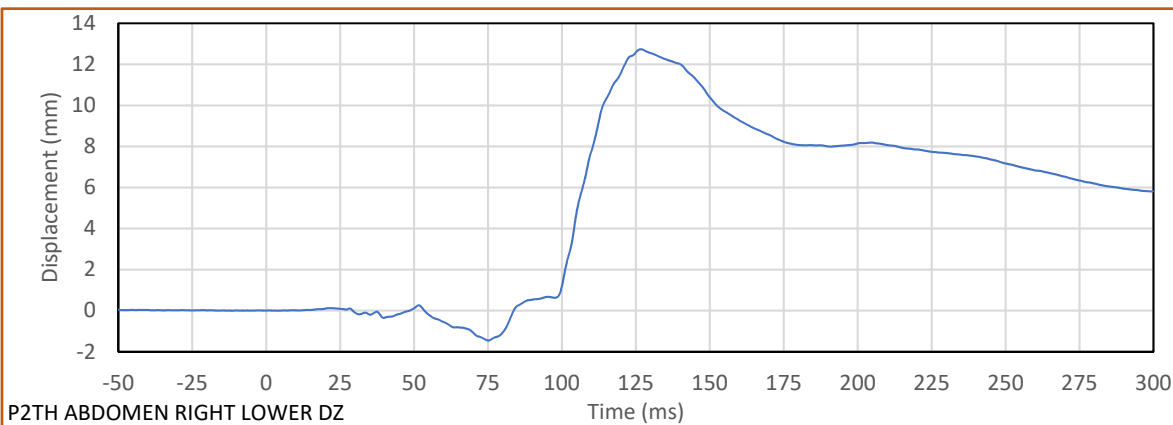
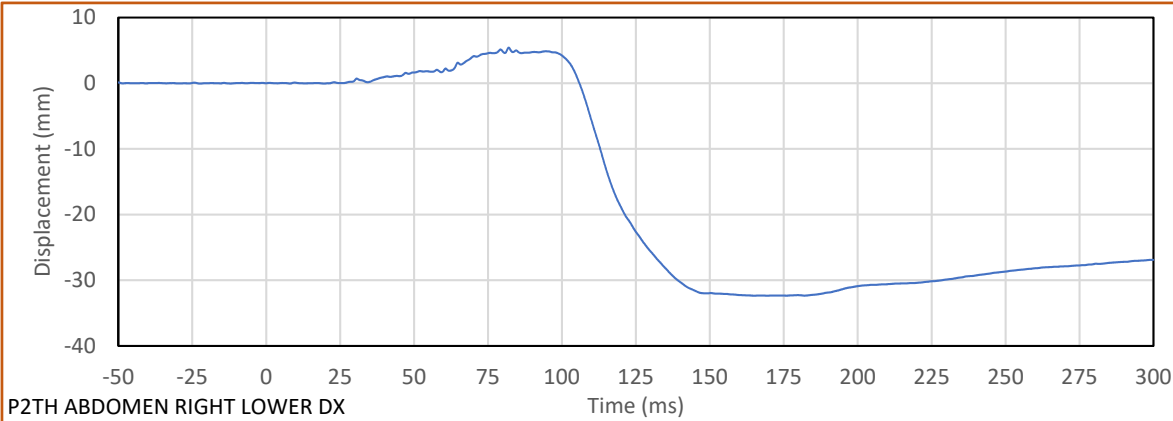








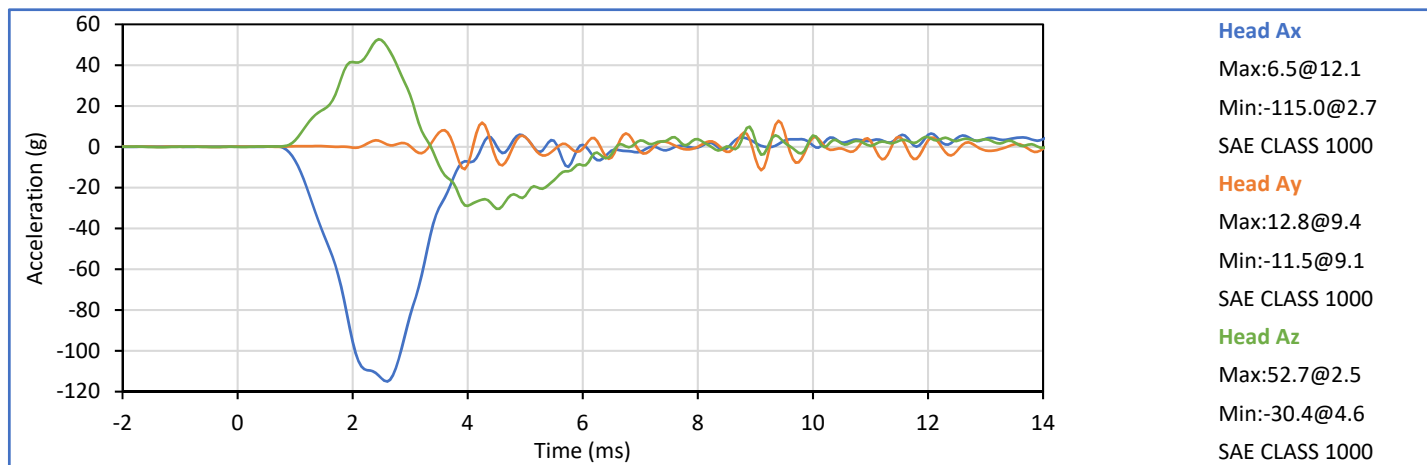
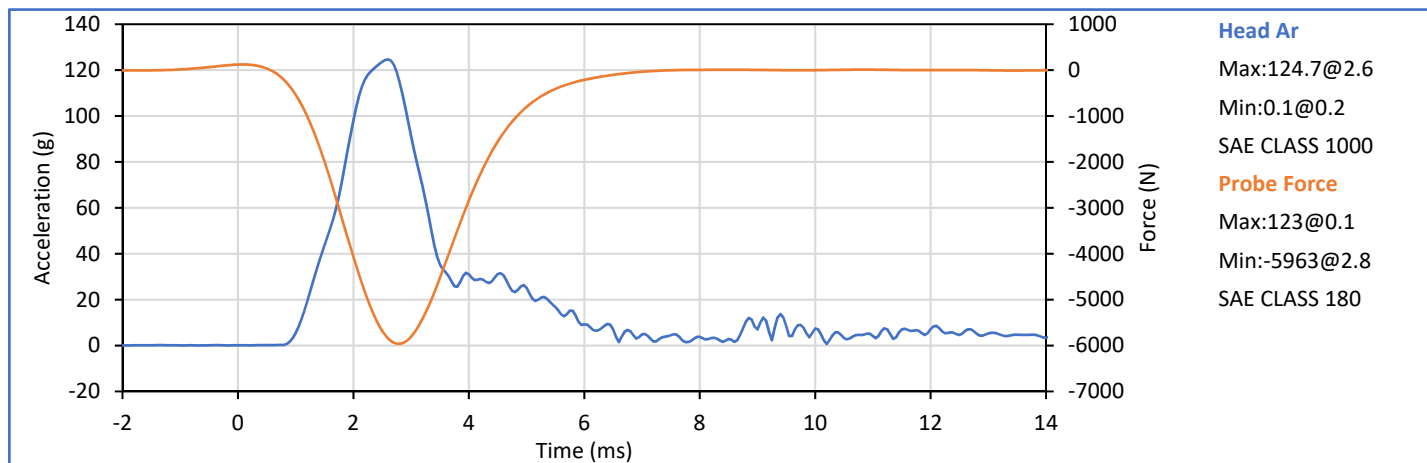




APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA SHEETS

APPENDIX C
Pre-Test ATD Qualification and Performance Verification
THOR-50M 50th Percentile Male ATD, (Reduced Certification)
S/N: EG2595

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	19	Pass
Probe Velocity	m/s	1.95	2.05	2.00	Pass
Peak Probe Force	kN	-6138	-5022	-5963	Pass
Peak Head Resultant Acceleration	g	105.3	128.7	124.7	Pass
NHTSA Corridor 2019-05				Overall Test Results	Pass



Technician:

J. Hernandez

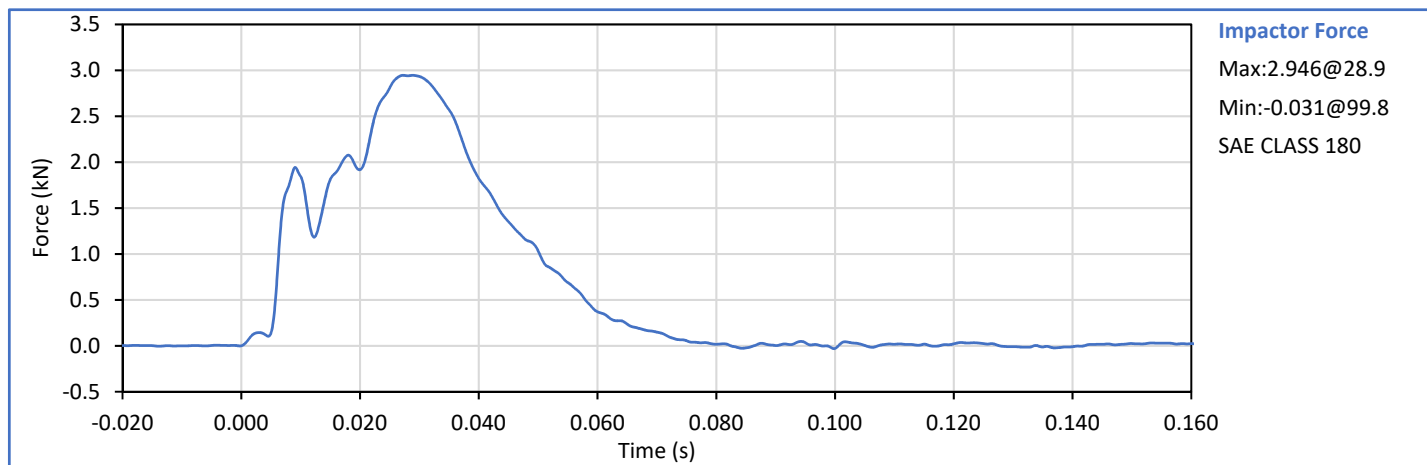
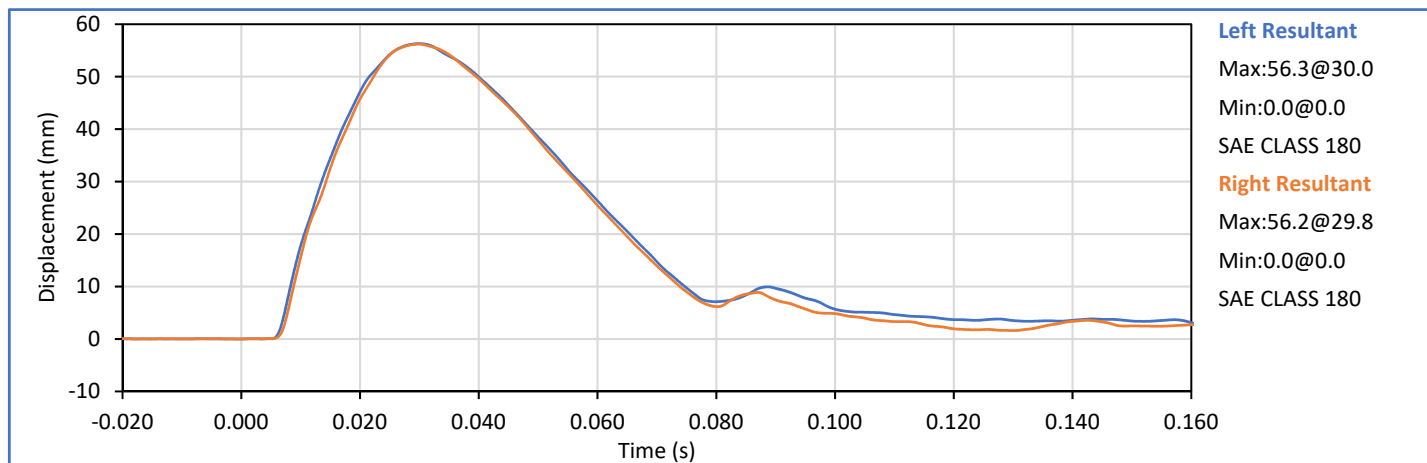
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Relative Humidity	%	10	70	21	Pass
Probe Velocity	m/sec	4.25	4.35	4.28	Pass
Peak Probe Force	kN		3.039	2.946	Pass
Peak Upper Left Deflection Resultant	mm	48.3	59.0	56.3	Pass
Peak Upper Right Deflection Resultant	mm			56.2	Pass
Absolute Difference L/R Dx Resultant	mm	0.0	5.0	0.1	Pass
Force at Peak Upper Left Resultant	mm	2.409	2.944	2.933	Pass
Force at Peak Upper Right Resultant	mm			2.937	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass



Technician:

J. Hernandez

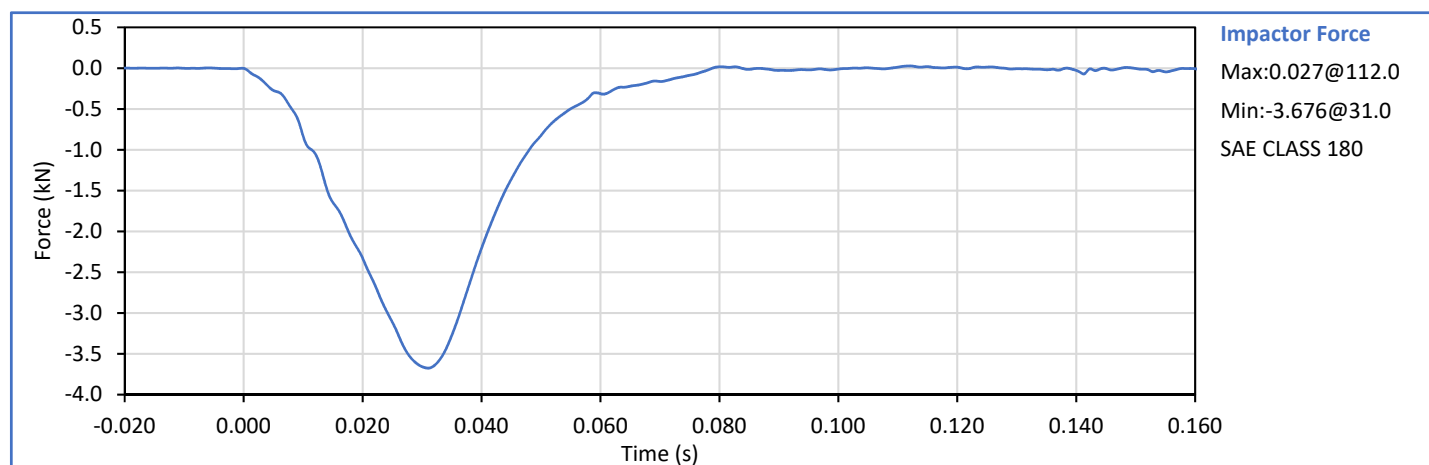
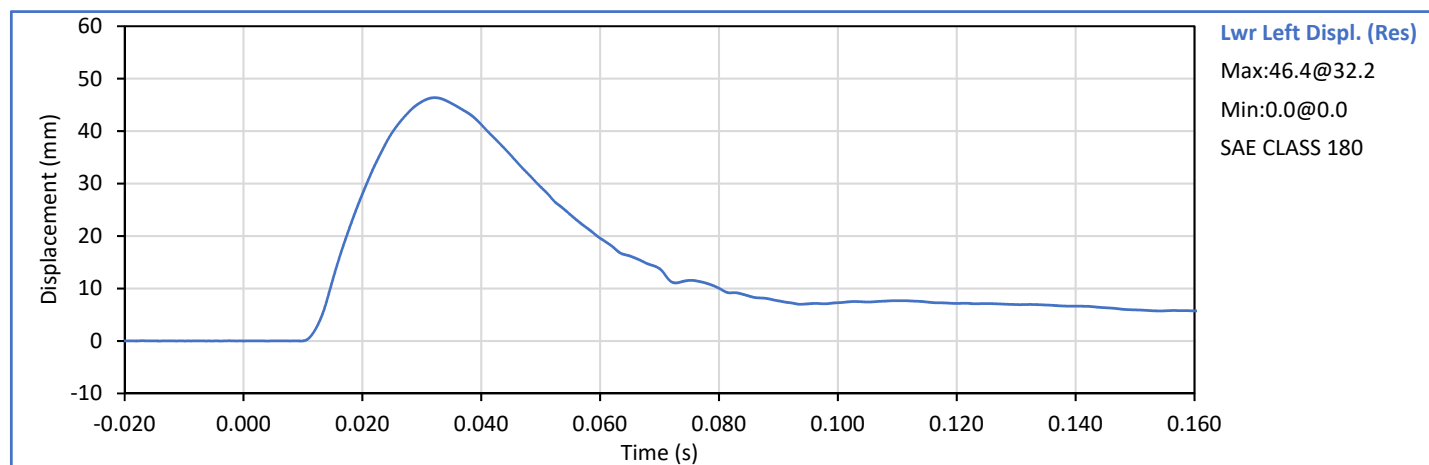
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.6	Pass
Laboratory Relative Humidity	%	10	70	36	Pass
Probe Velocity	m/sec	4.25	4.35	4.31	Pass
Peak Probe Force	kN	-3.832	-3.136	-3.676	Pass
Lower Left Resultant Dx at Peak Fx	mm	45.8	56.0	46.2	Pass
NHTSA Corridor 2019-05				Overall Test Results	Pass



Technician:

J. Hernandez

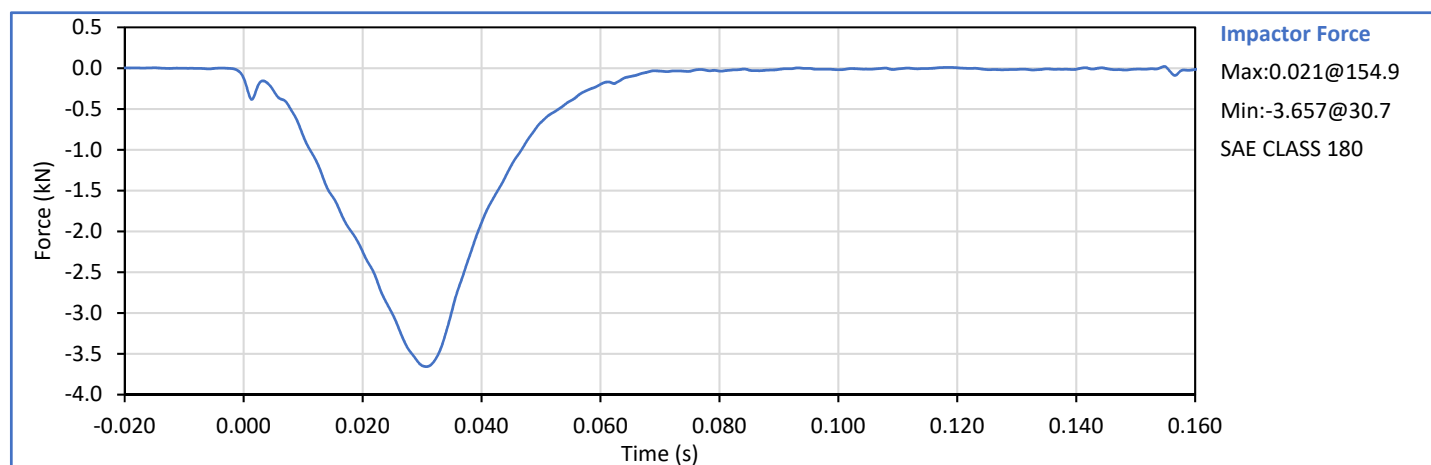
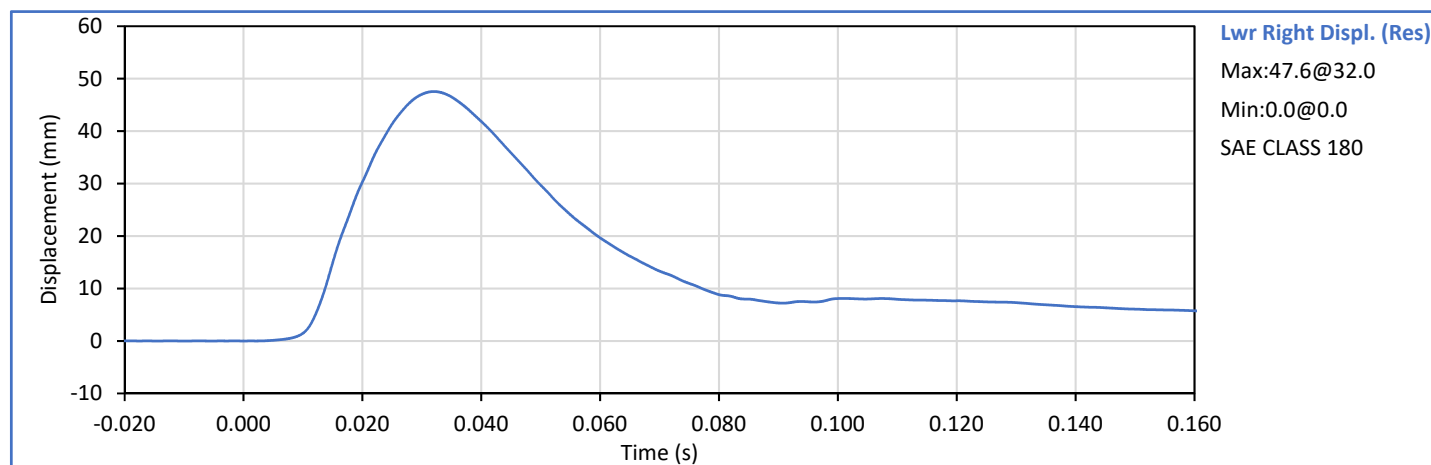
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.6	Pass
Laboratory Relative Humidity	%	10	70	26	Pass
Probe Velocity	m/sec	4.25	4.35	4.33	Pass
Peak Probe Force	kN	-3.832	-3.136	-3.657	Pass
Lower Right Resultant Dx at Peak Fx	mm	45.8	56.0	47.3	Pass
NHTSA Corridor 2019-05				Overall Test Results	Pass



Technician:

J. Hernandez

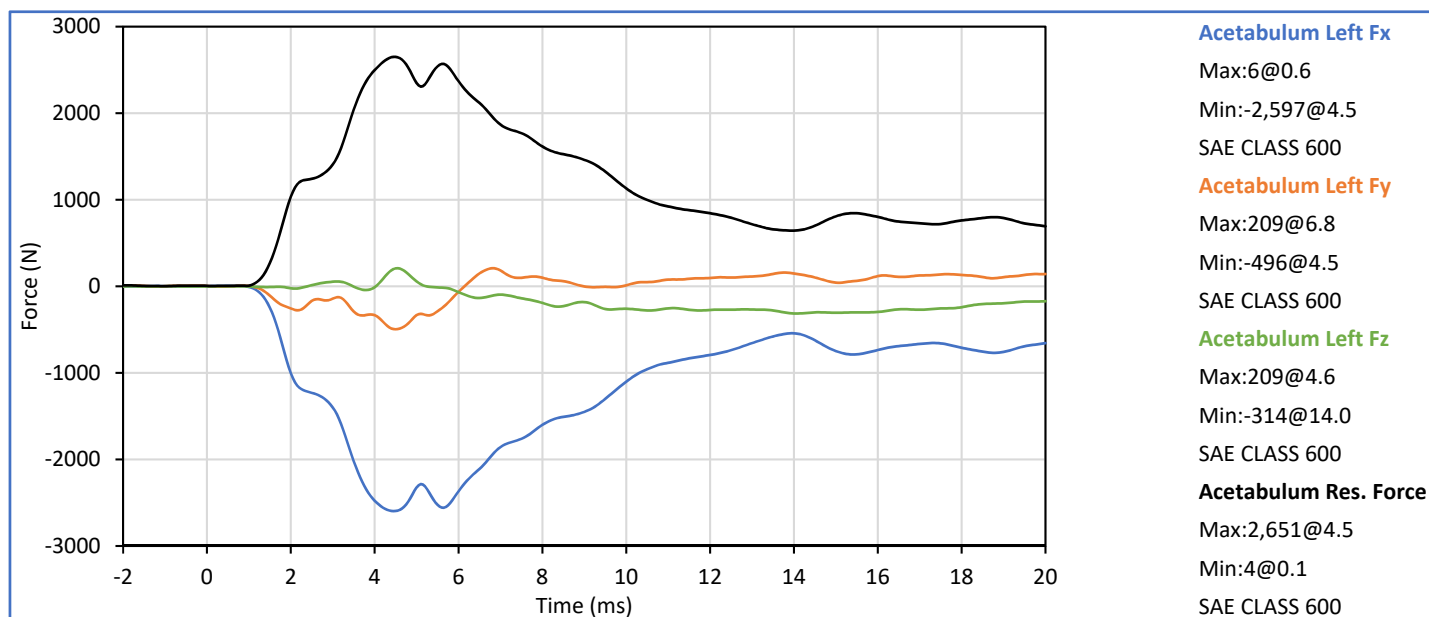
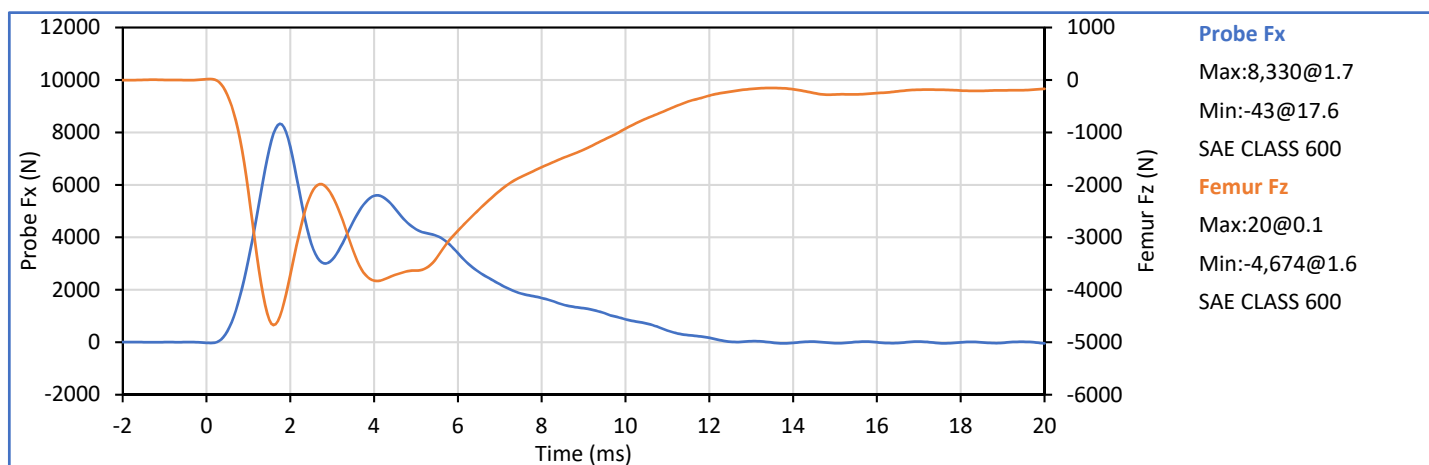
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.9	Pass
Laboratory Relative Humidity	%	10	70	19	Pass
Pendulum Velocity	m/s	3.25	3.35	3.30	Pass
Peak Probe Force	N	*	*	8330	*
Peak Femur Fz	N	*	*	-4674	*
Acetabulum Force Resultant	N	*	*	2651	*
* Research data. No defined P/F corridor				Overall Test Results	Pass



Technician:

J. Hernandez

J. Hernandez

Approved By:

P. Puzzuto

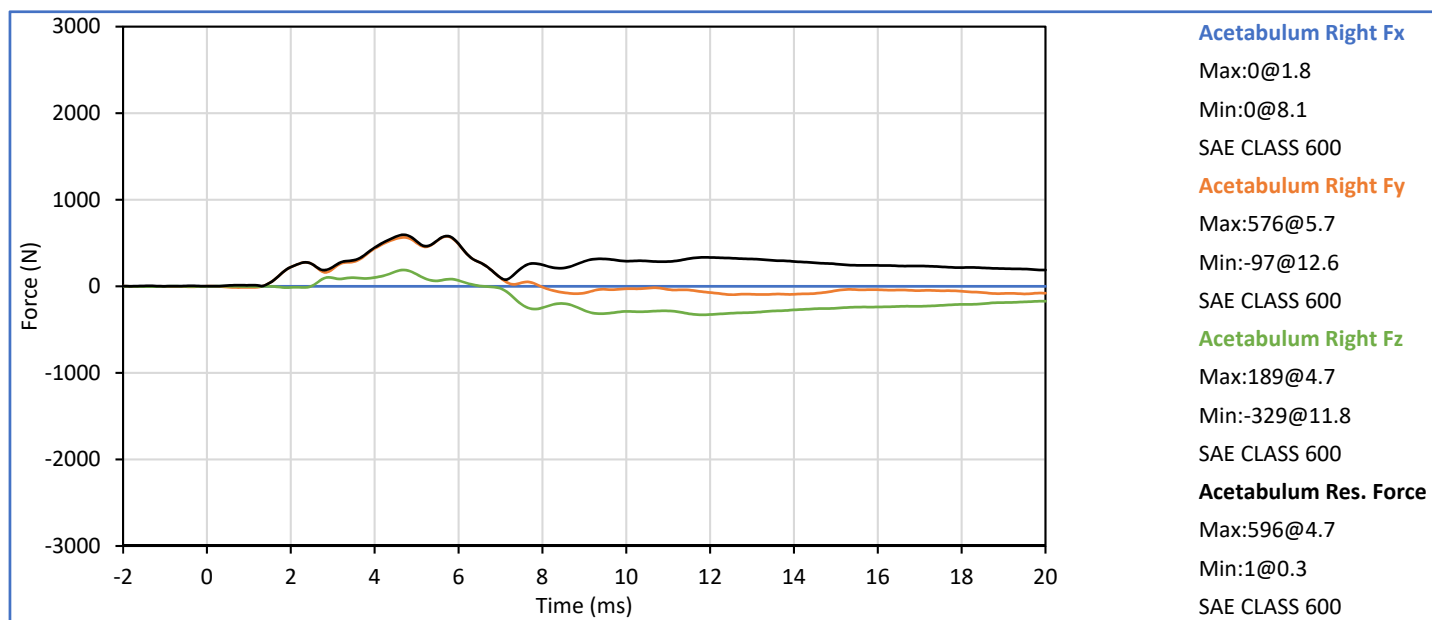
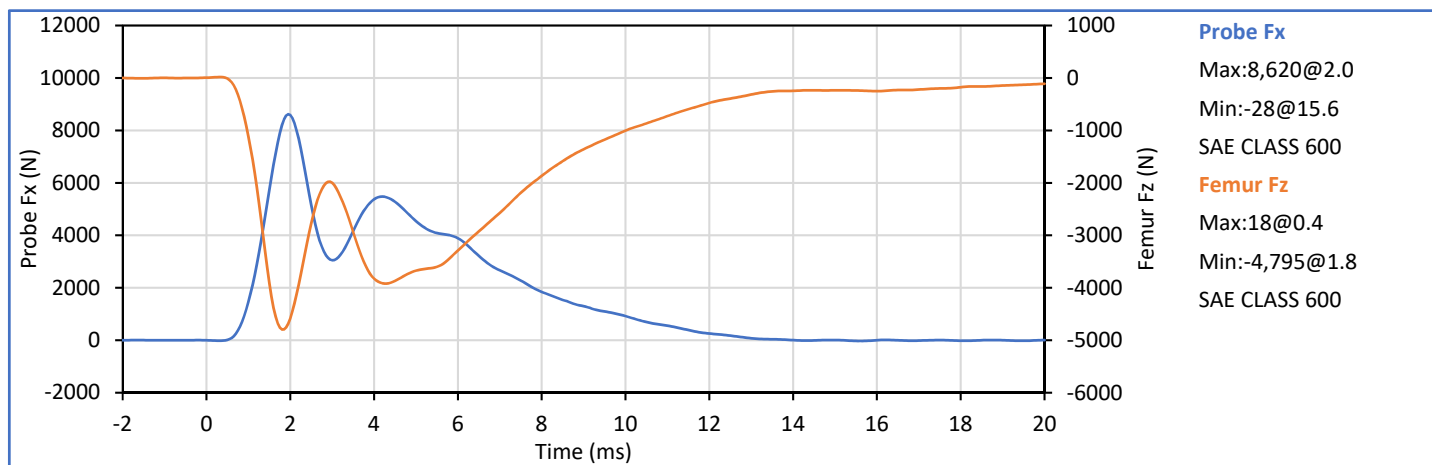
P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.9	Pass
Laboratory Relative Humidity	%	10	70	19	Pass
Pendulum Velocity	m/s	3.25	3.35	3.33	Pass
Peak Probe Force	N	*	*	8620	*
Peak Femur Fz	N	*	*	-4795	*
Acetabulum Force Resultant	N	*	*	596	*
Overall Test Results					Pass

* Research data. No defined P/F corridor

** Acetabulum Fx is not functioning

**



Technician:

J. Hernandez

J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

APPENDIX C

**Pre-Test ATD Qualification and Performance Verification Hybrid
III 50th Percentile Male ATD, (Compressed Certification) S/N:**

168

ATD Serial No.: 168

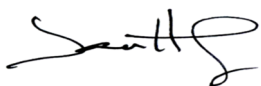
Test Date: 2020-12-10

Dummy Item	Inspect for	Comments	Damage	OK
Entire ATD	Perform general cleaning			✓
Outer Skin	Gashes, rips, cracks			✓
Head	Ballast secure			✓
	General appearance			✓
Neck bracket	Upper neck firmly attached to lower bracket			✓
Neck	Broken or cracked rubber			✓
	Looseness at the condyle joint			✓
Nodding block	Cracked or out of position			✓
Lumbar Spine	Broken or cracked rubber			✓
Ribs	Broken or bent ribs			✓
	Broken or bent rib supports			✓
	Damping material separated or cracked			✓
	Rubber bumpers in place			✓
Chest Displ. Assembly	Bent shaft			✓
	Slider arm riding in track			✓
Sensors	Check cables for cuts, tears			✓
	Check for damaged insulation			✓
Accelerometer Mounting	Head mounting secure			✓
	Chest mounting secure			✓
Knees	Skin condition			✓
	Insert (do not remove)			✓
	Casting			✓
Limbs	Normal movement and adjustment			✓
Knee Sliders	Wires intact			✓
	Rubber returned to "resting" position			✓
Pelvis	Broken			✓
Other	Describe below as needed			✓

Describe any repairs or replacement of parts or other findings:

No Problems Found

Technician:



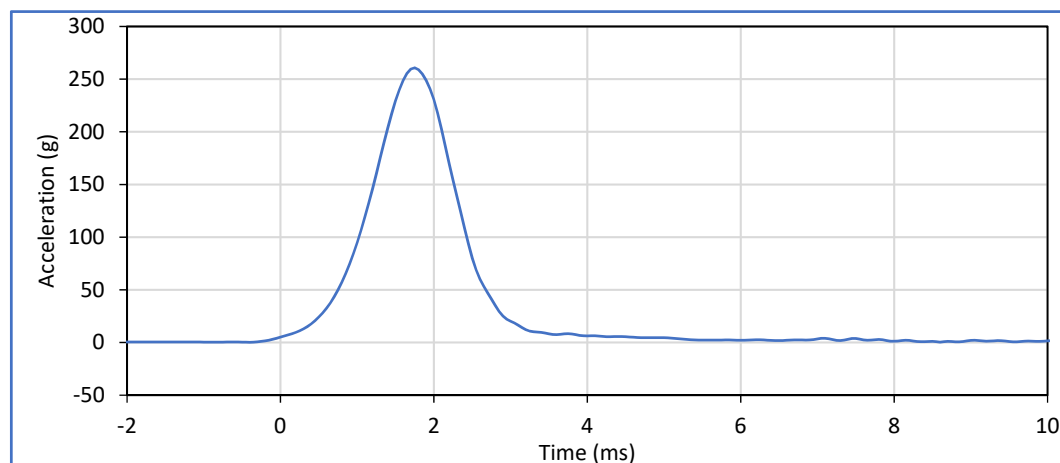
J. Hernandez

Approved By:



P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.4	Pass
Laboratory Relative Humidity	%	10	70	15	Pass
Peak Resultant Acceleration	g	225.0	275.0	260.8	Pass
Peak Lateral Acceleration	g	-15.0	15.0	-8.0	Pass
Oscillations After Main Pulse	%	0.0	10.0	1.5	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass

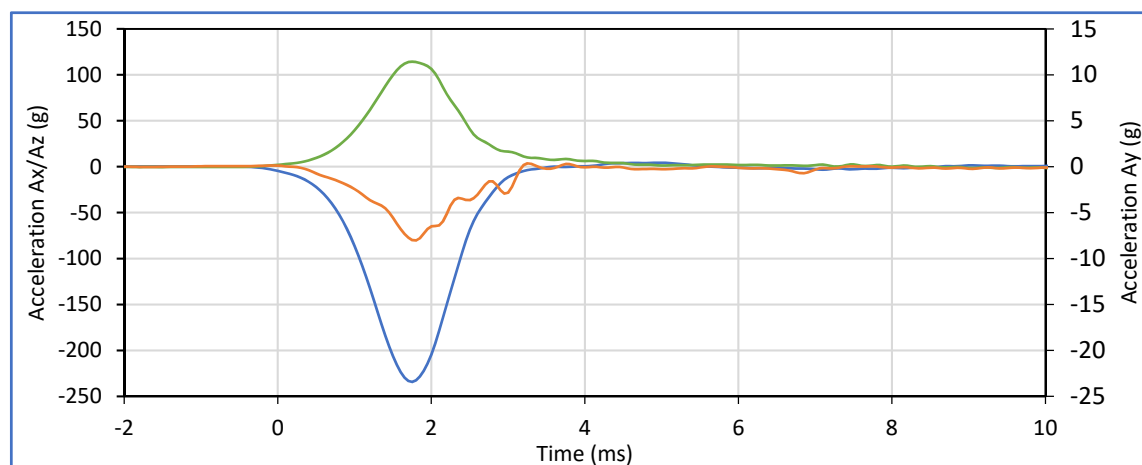


Head Resultant

Max:260.8@1.8

Min:0.3@8.6

SAE Class 1000



Head Ax

Max:4.3@5.0

Min:-234.2@1.8

SAE Class 1000

Head Ay

Max:0.4@3.3

Min:-8.0@1.8

SAE Class 1000

Head Az

Max:114.4@1.8

Min:-1.4@9.1

SAE Class 1000

Technician:

J. Hernandez

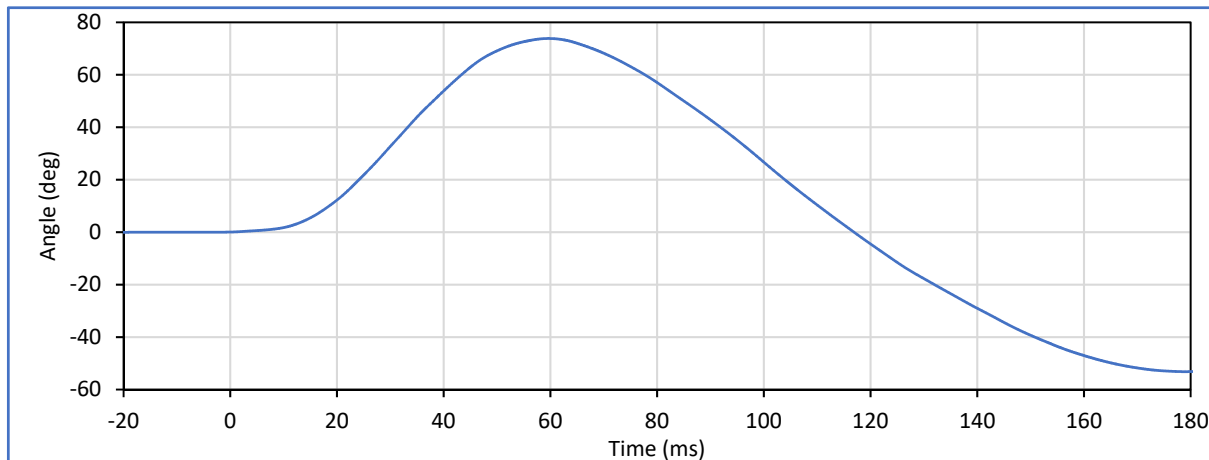
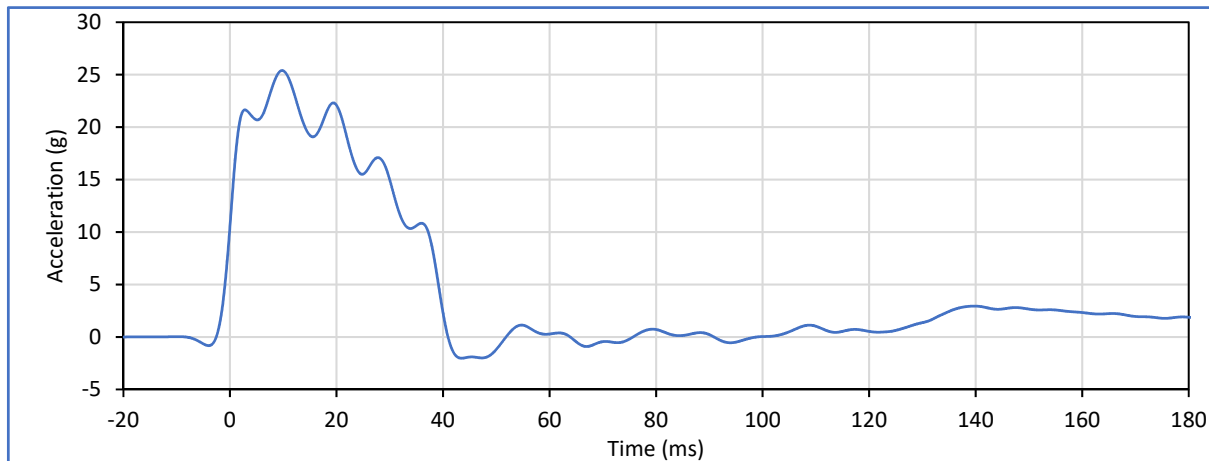
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	17	Pass
Pendulum Velocity	m/s	6.89	7.13	6.96	Pass
Pendulum Deceleration at 10 ms	g	22.5	27.5	25.4	Pass
Pendulum Deceleration at 20 ms	g	17.6	22.6	22.1	Pass
Pendulum Deceleration at 30 ms	g	12.5	18.5	15.0	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	29.0	15.0	Pass
Deceleration Decay to Cross 5 g	ms	34.0	42.0	39.1	Pass
"D" Plane Rotation peak	deg	64.0	78.0	73.8	Pass
	ms	57.0	64.0	59.7	Pass
"D" Plane Rotation Decay To Zero	ms	113.0	128.0	117.0	Pass
Moment About Occipital Condyle	Nm	88.1	108.5	95.9	Pass
	ms	47.0	58.0	52.8	Pass
Moment Decay, Peak to Zero	ms	97.0	107.0	102.5	Pass
Overall Test Results					Pass



Technician:

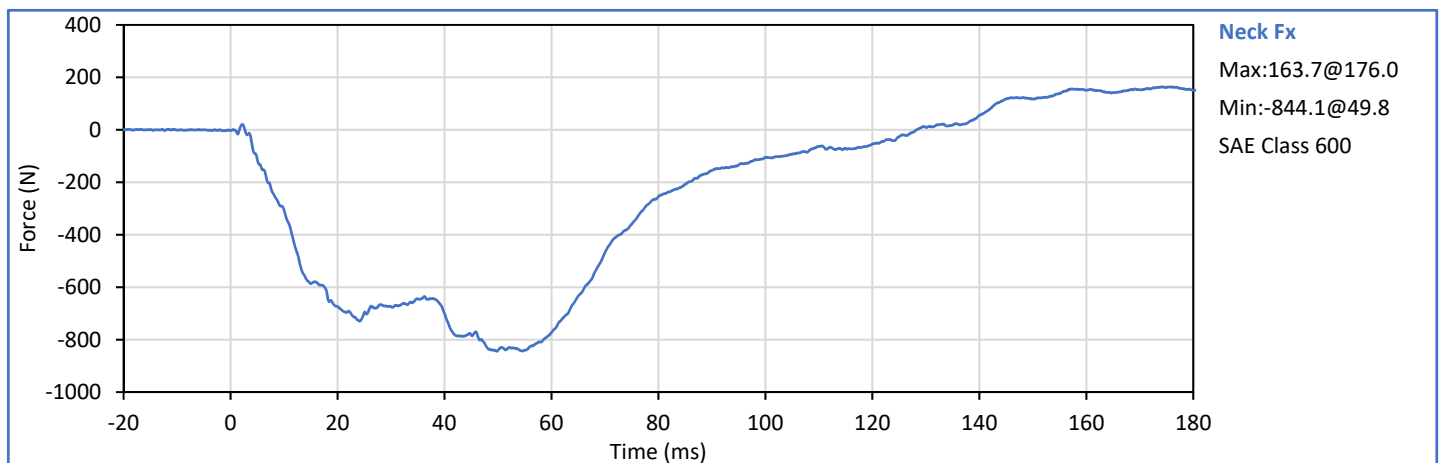
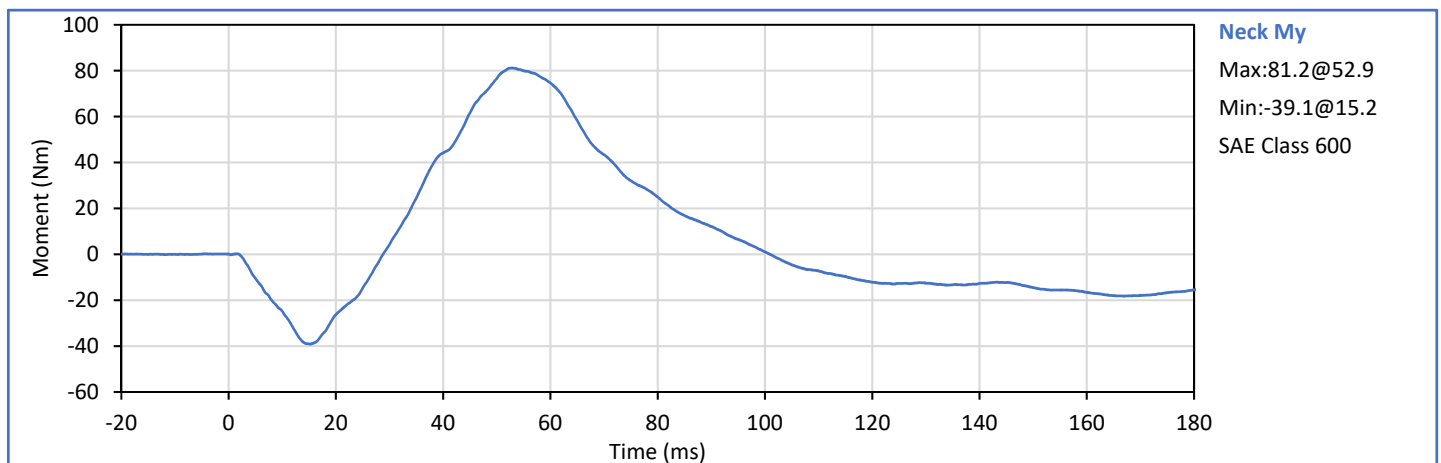
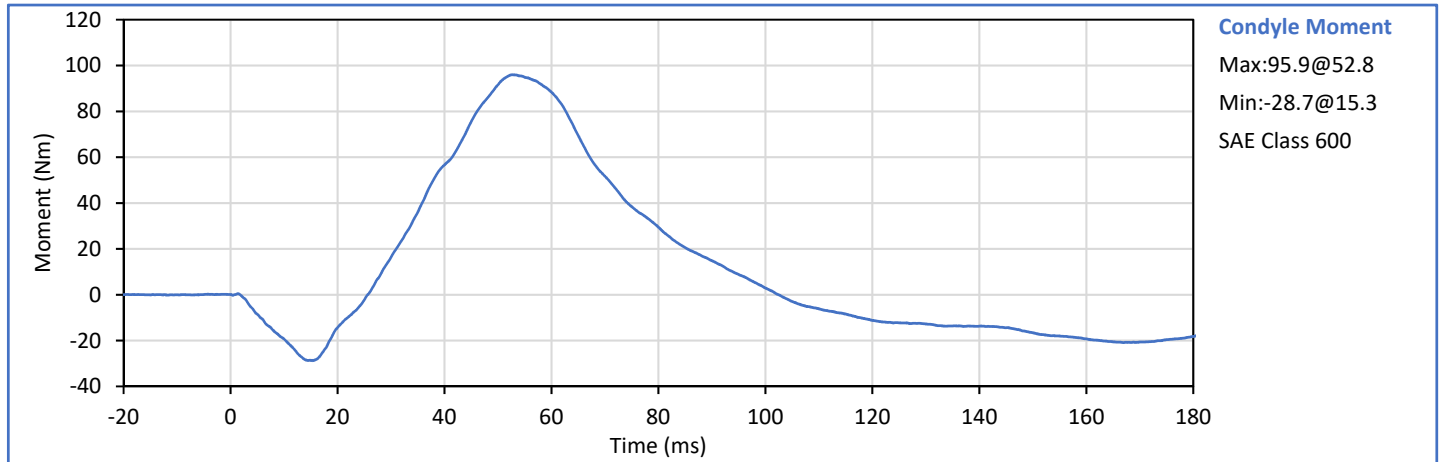
J. Hernandez

J. Hernandez

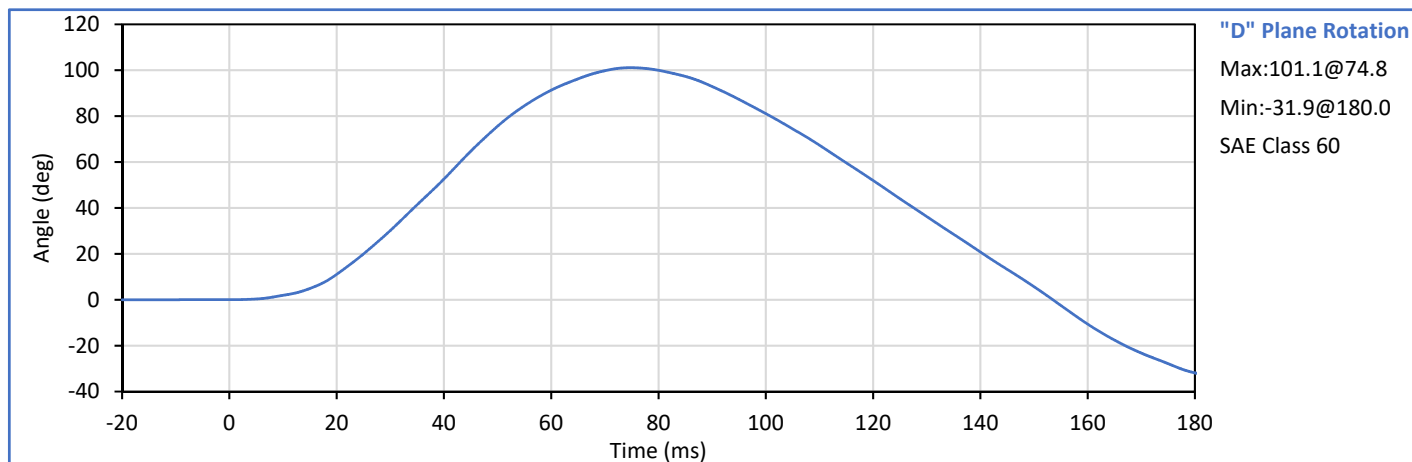
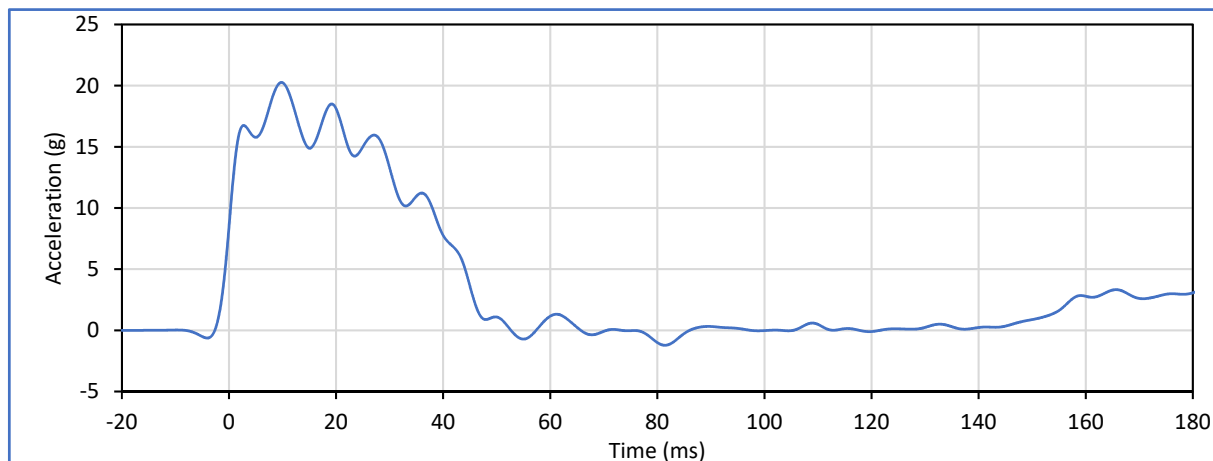
Approved By:

P. Puzzuto

P. Puzzuto



Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	17	Pass
Pendulum Velocity	m/s	5.94	6.19	6.08	Pass
Pendulum Deceleration at 10 ms	g	17.2	21.2	20.2	Pass
Pendulum Deceleration at 20 ms	g	14.0	19.0	18.1	Pass
Pendulum Deceleration at 30 ms	g	11.0	16.0	13.3	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	22.0	13.3	Pass
Deceleration Decay to Cross 5 g	ms	38.0	46.0	44.1	Pass
"D" Plane Rotation peak	deg	81.0	106.0	101.1	Pass
	ms	72.0	82.0	74.8	Pass
"D" Plane Rotation Decay To Zero	ms	147.0	174.0	153.6	Pass
Moment About Occipital Condyle	Nm	-79.9	-52.9	-76.0	Pass
	ms	65.0	79.0	69.6	Pass
Moment Decay, Peak to Zero	ms	120.0	148.0	140.2	Pass
Overall Test Results					Pass



Technician:

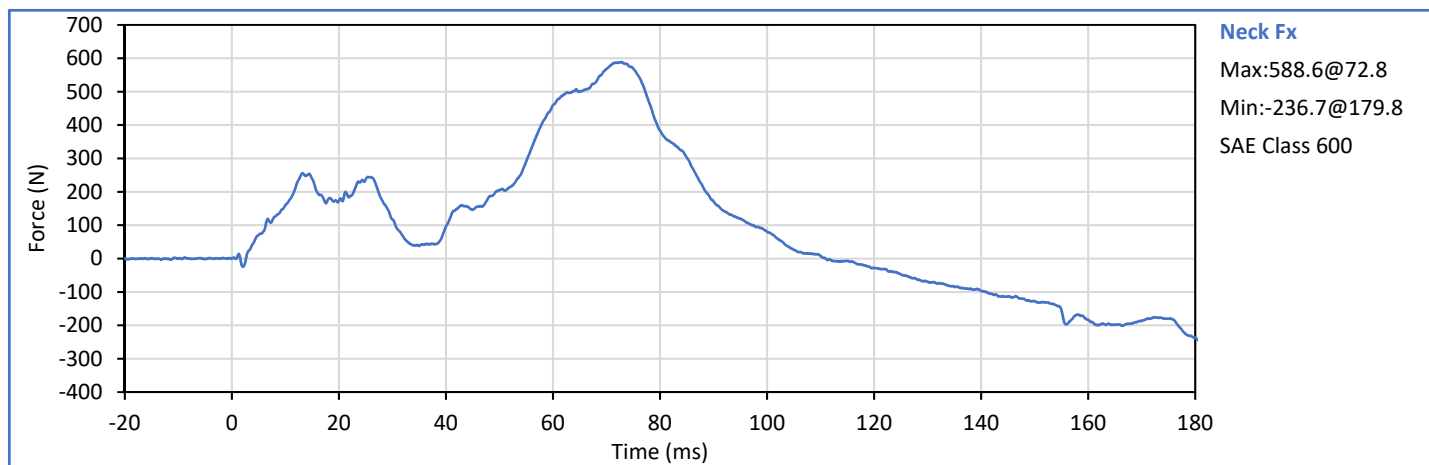
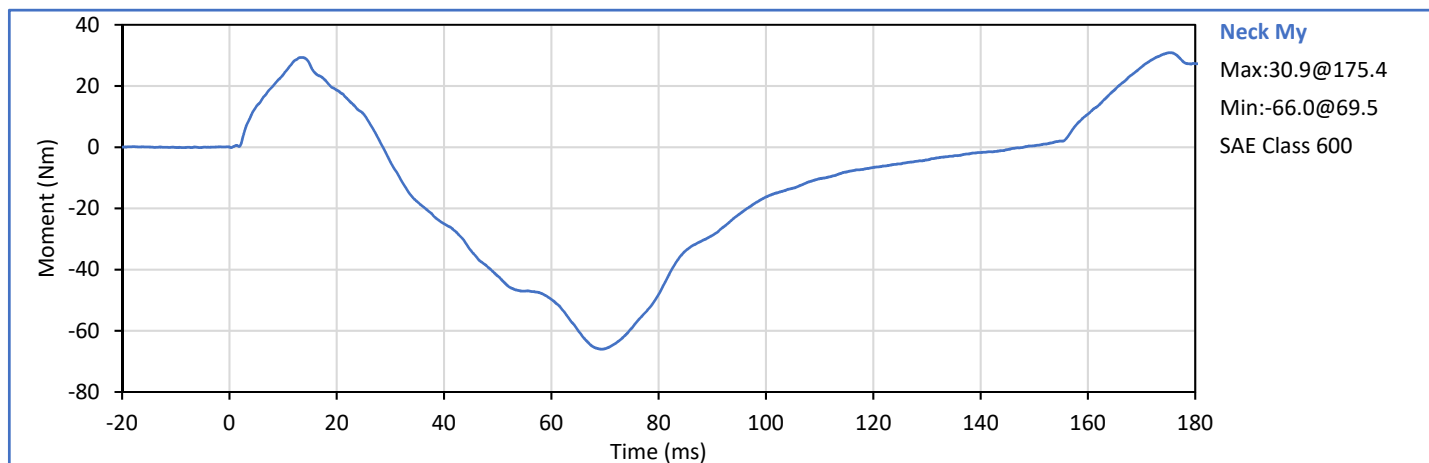
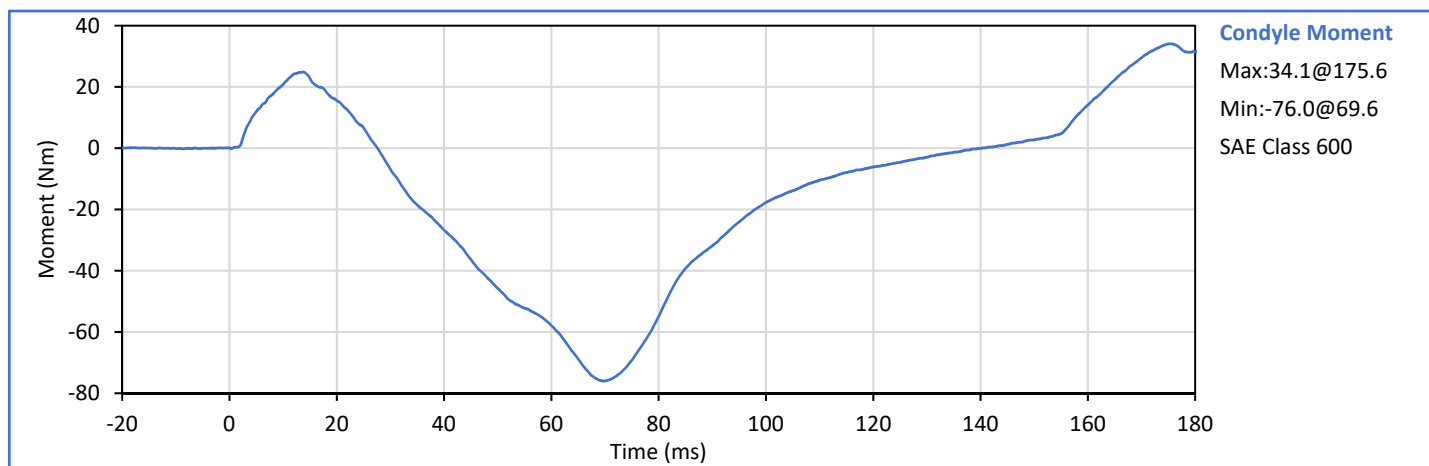
J. Hernandez

J. Hernandez

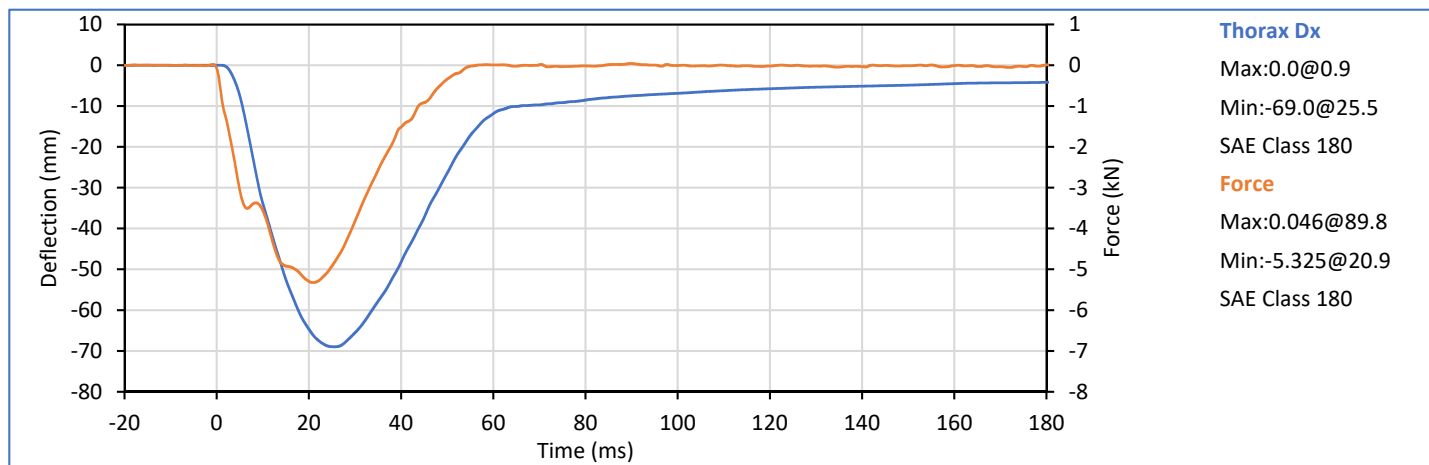
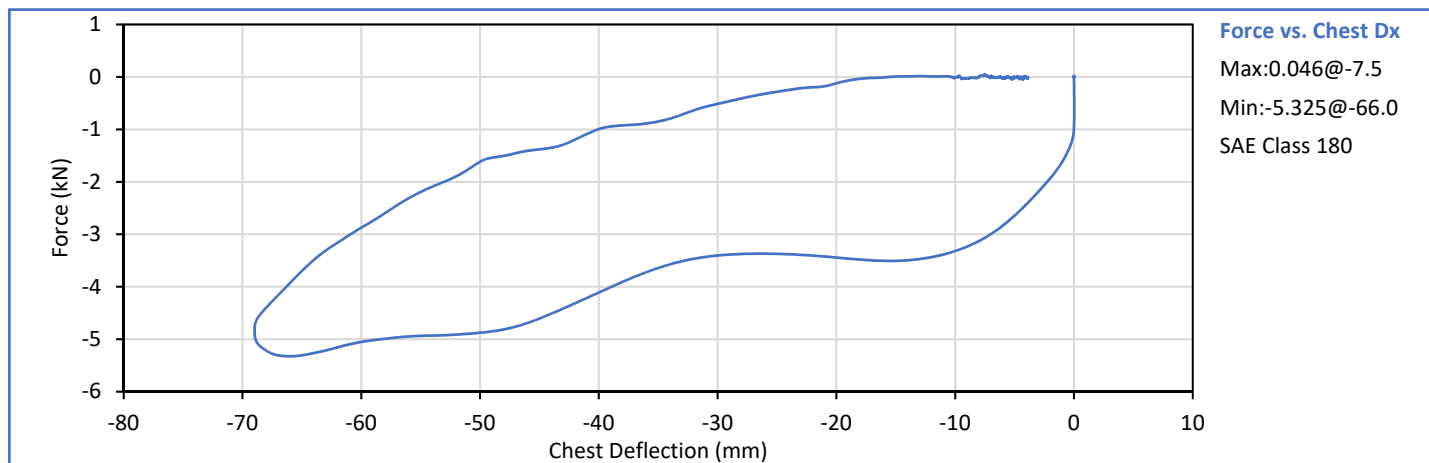
Approved By:

P. Puzzuto

P. Puzzuto



Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	14	Pass
Probe Velocity	m/s	6.58	6.82	6.73	Pass
Peak Chest Deflection	mm	-72.6	-63.5	-69.0	Pass
Peak Probe Force	kN	-5.893	-5.159	-5.325	Pass
Internal Hysteresis	%	69.0	85.0	70.7	Pass
Overall Test Results				Pass	Pass



Technician:

J. Hernandez

J. Hernandez

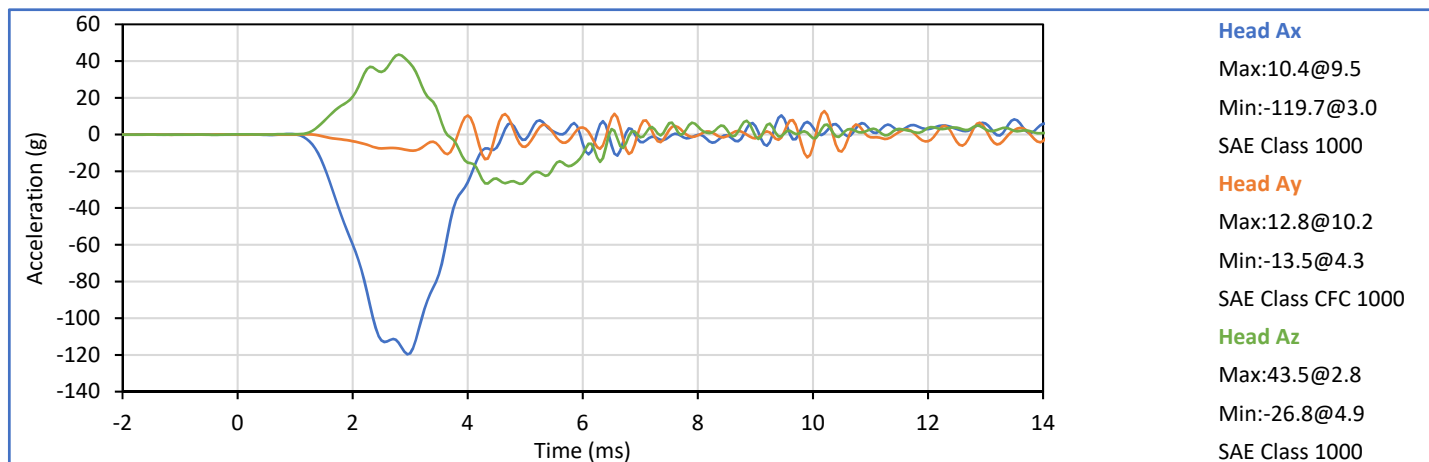
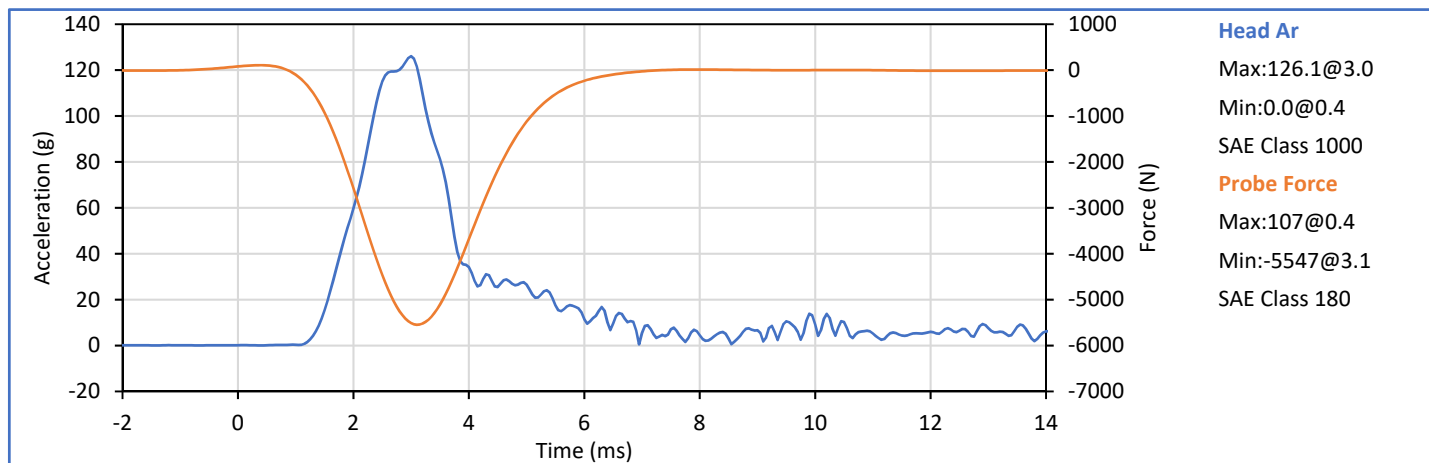
Approved By:

P. Puzzuto

P. Puzzuto

APPENDIX C
Post-Test ATD Qualification and Performance Verification
THOR-50M 50th Percentile Male ATD, (Reduced Certification)
S/N: EG2595

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.9	Pass
Laboratory Relative Humidity	%	10	70	25	Pass
Probe Velocity	m/s	1.95	2.05	1.97	Pass
Peak Probe Force	kN	-6138	-5022	-5547	Pass
Peak Head Resultant Acceleration	g	105.3	128.7	126.1	Pass
NHTSA Corridor 2019-05				Overall Test Results	Pass



Technician:

J. Hernandez

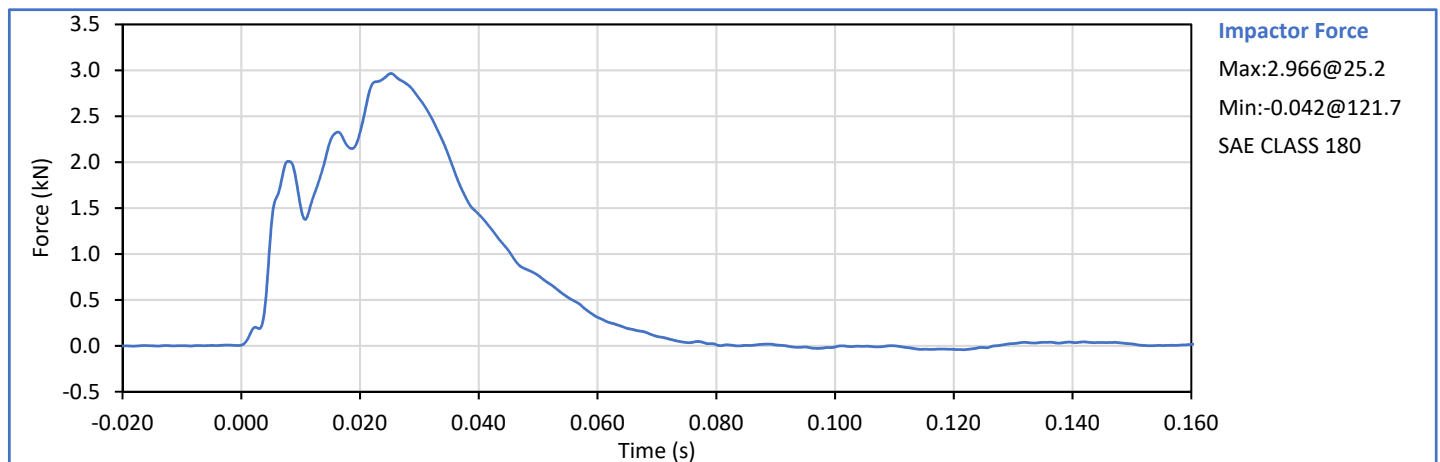
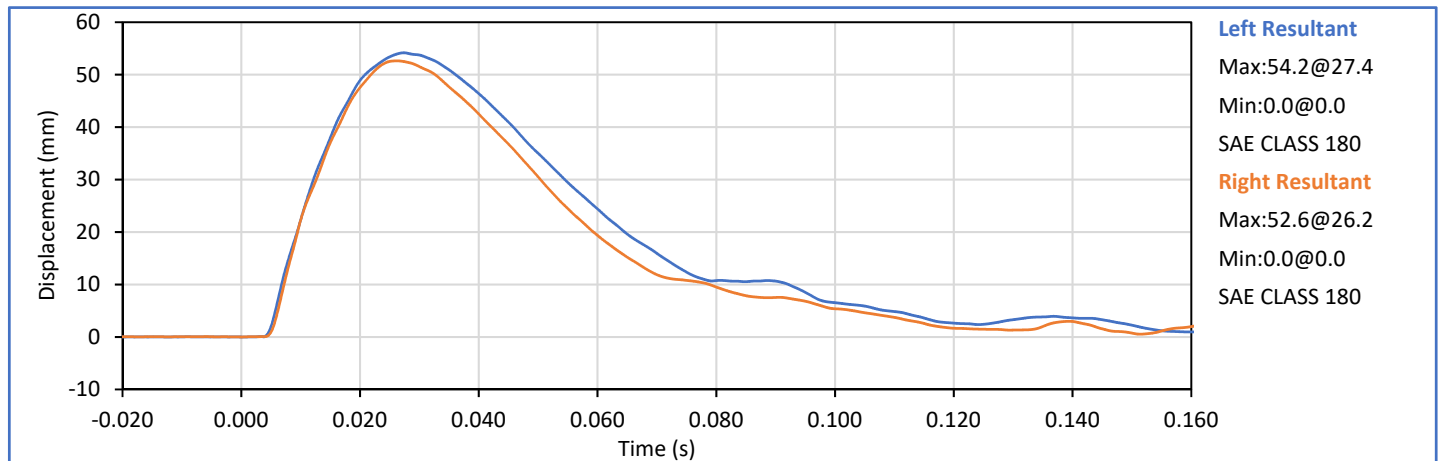
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.4	Pass
Laboratory Relative Humidity	%	10	70	23	Pass
Probe Velocity	m/sec	4.25	4.35	4.32	Pass
Peak Probe Force	kN		3.039	2.966	Pass
Peak Upper Left Deflection Resultant	mm	48.3	59.0	54.2	Pass
Peak Upper Right Deflection Resultant	mm			52.6	Pass
Absolute Difference L/R Dx Resultant	mm	0.0	5.0	1.5	Pass
Force at Peak Upper Left Resultant	mm	2.409	2.944	2.874	Pass
Force at Peak Upper Right Resultant	mm			2.921	Pass
NHTSA Corridor 2019-05			Overall Test Results		Pass



Technician:

J. Hernandez

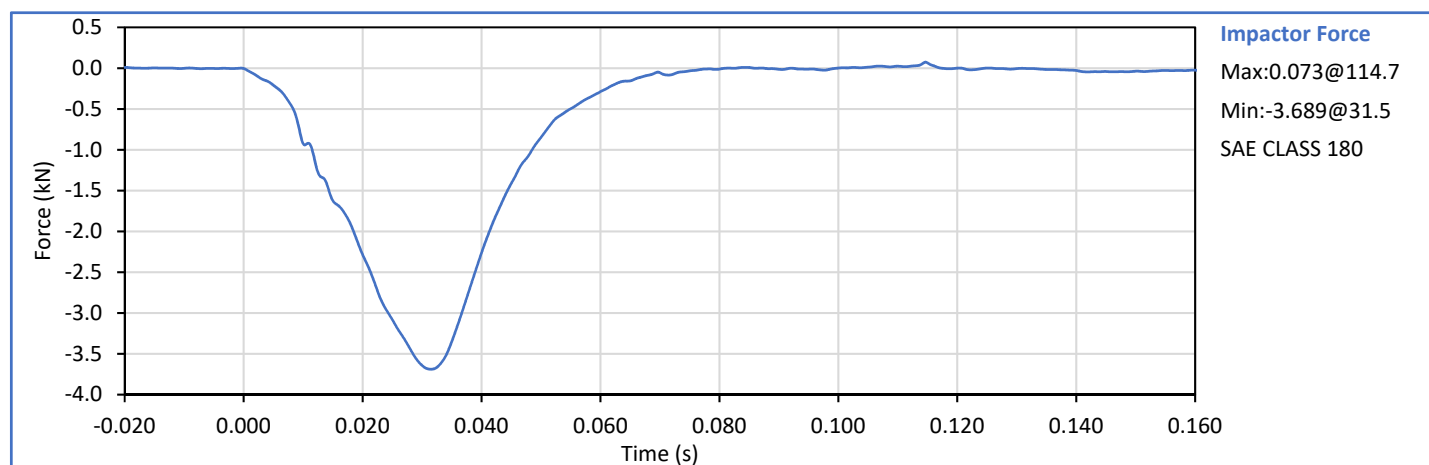
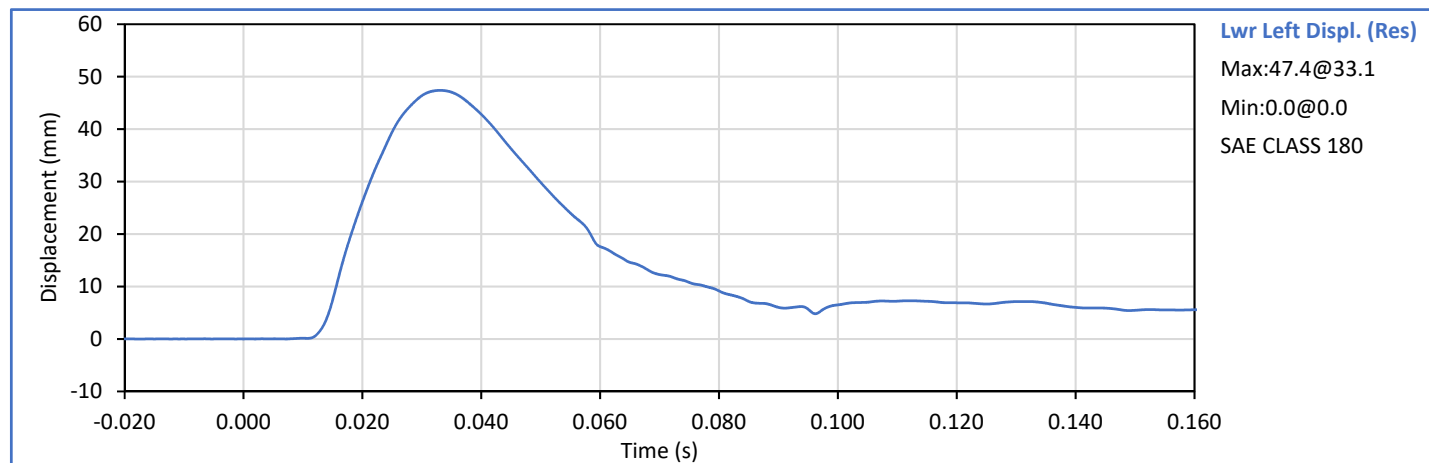
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.9	Pass
Laboratory Relative Humidity	%	10	70	23	Pass
Probe Velocity	m/sec	4.25	4.35	4.32	Pass
Peak Probe Force	kN	-3.832	-3.136	-3.689	Pass
Lower Left Resultant Dx at Peak Fx	mm	45.8	56.0	47.2	Pass
NHTSA Corridor 2019-05				Overall Test Results	Pass



Technician:

J. Hernandez

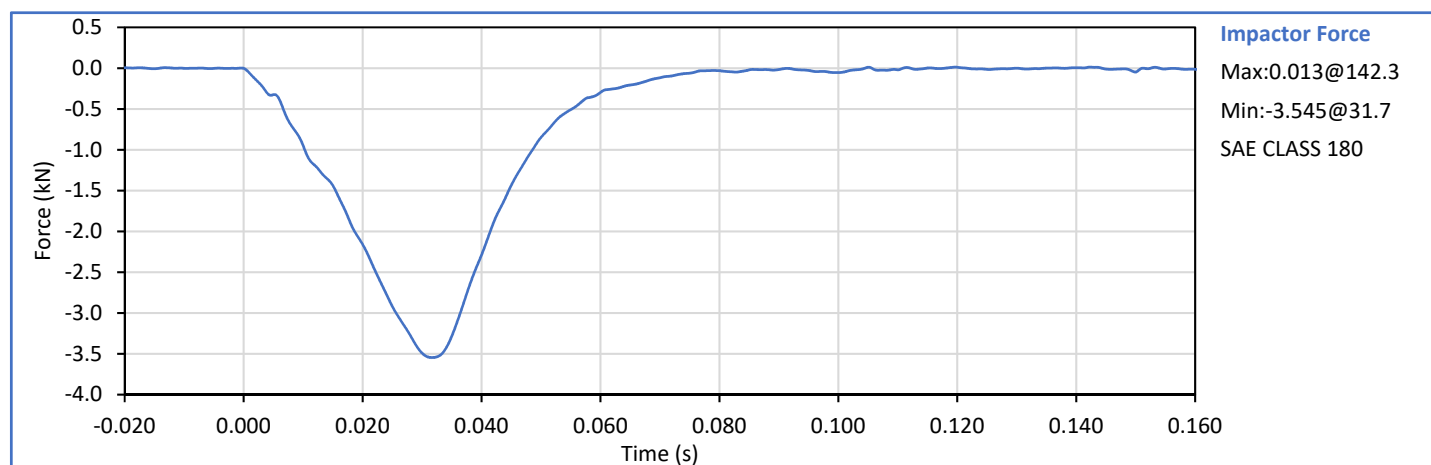
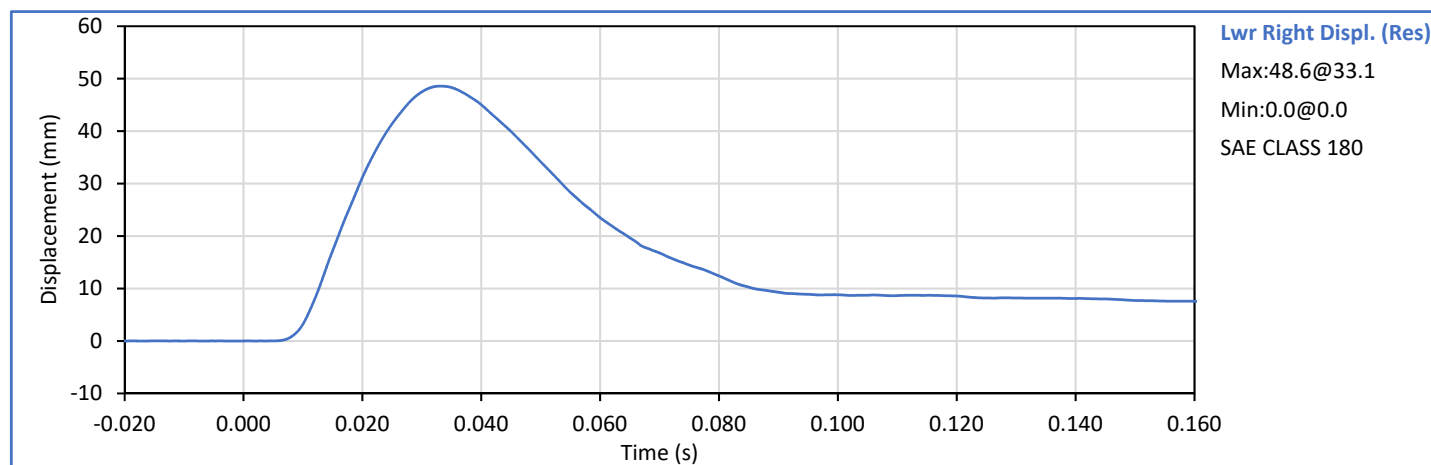
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.9	Pass
Laboratory Relative Humidity	%	10	70	24	Pass
Probe Velocity	m/sec	4.25	4.35	4.30	Pass
Peak Probe Force	kN	-3.832	-3.136	-3.545	Pass
Lower Right Resultant Dx at Peak Fx	mm	45.8	56.0	48.4	Pass
NHTSA Corridor 2019-05				Overall Test Results	Pass



Technician:

J. Hernandez

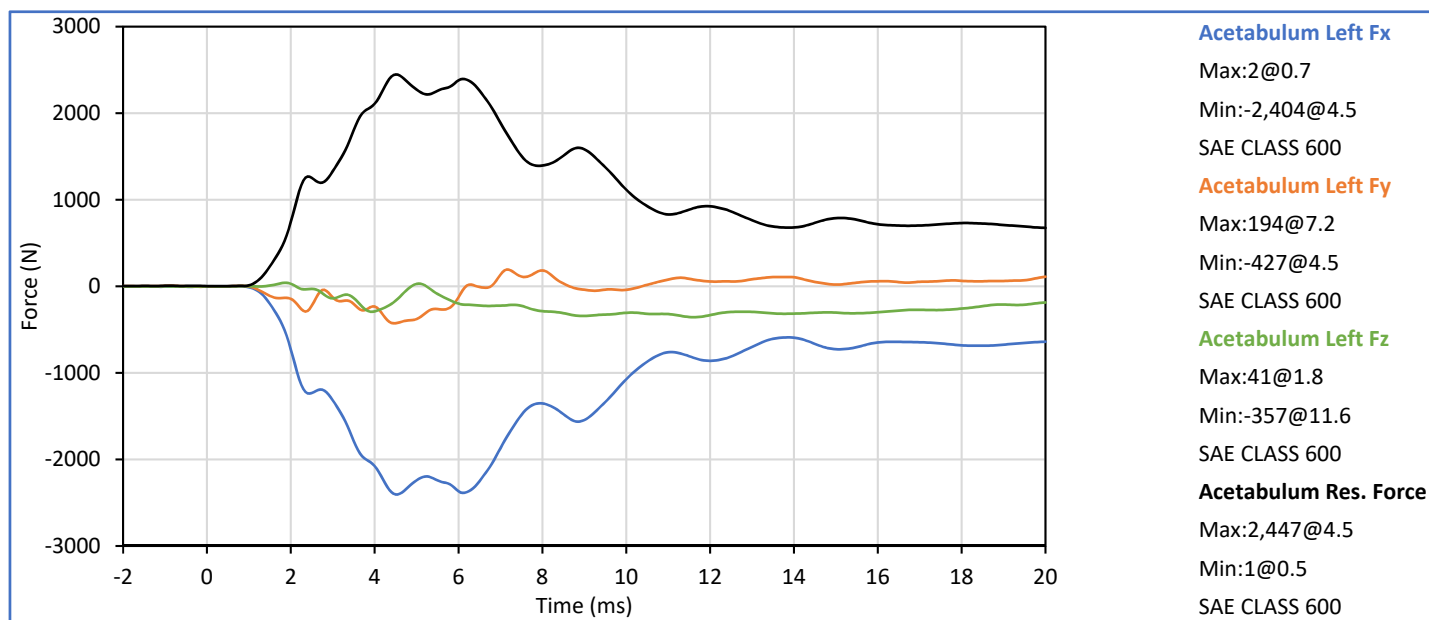
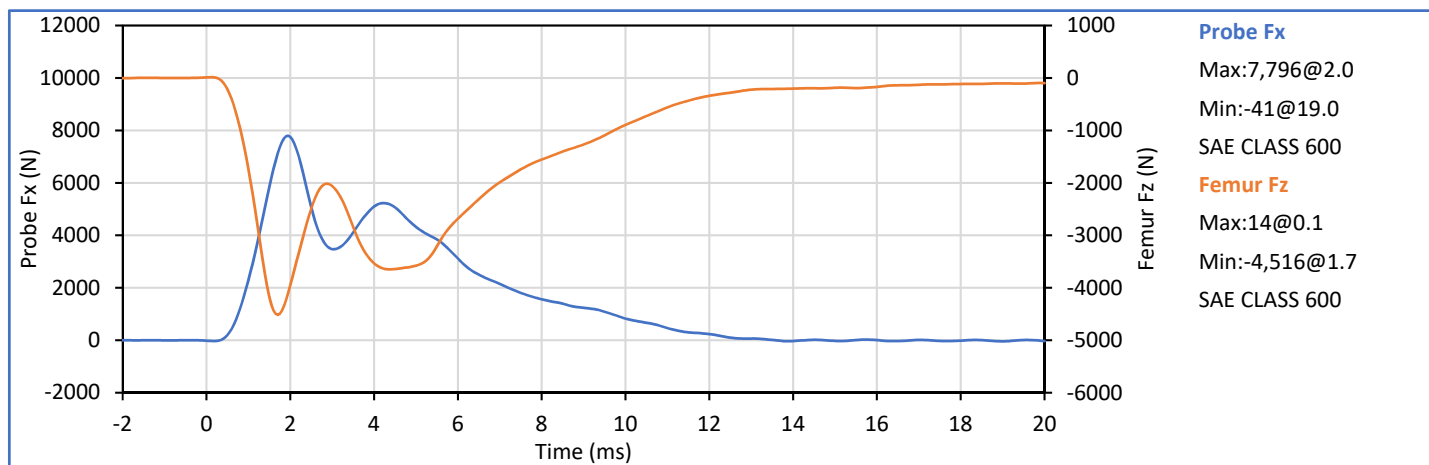
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	31	Pass
Pendulum Velocity	m/s	3.25	3.35	3.30	Pass
Peak Probe Force	N	*	*	7796	*
Peak Femur Fz	N	*	*	-4516	*
Acetabulum Force Resultant	N	*	*	2447	*
* Research data. No defined P/F corridor				Overall Test Results	Pass



Technician:

J. Hernandez

J. Hernandez

Approved By:

P. Puzzuto

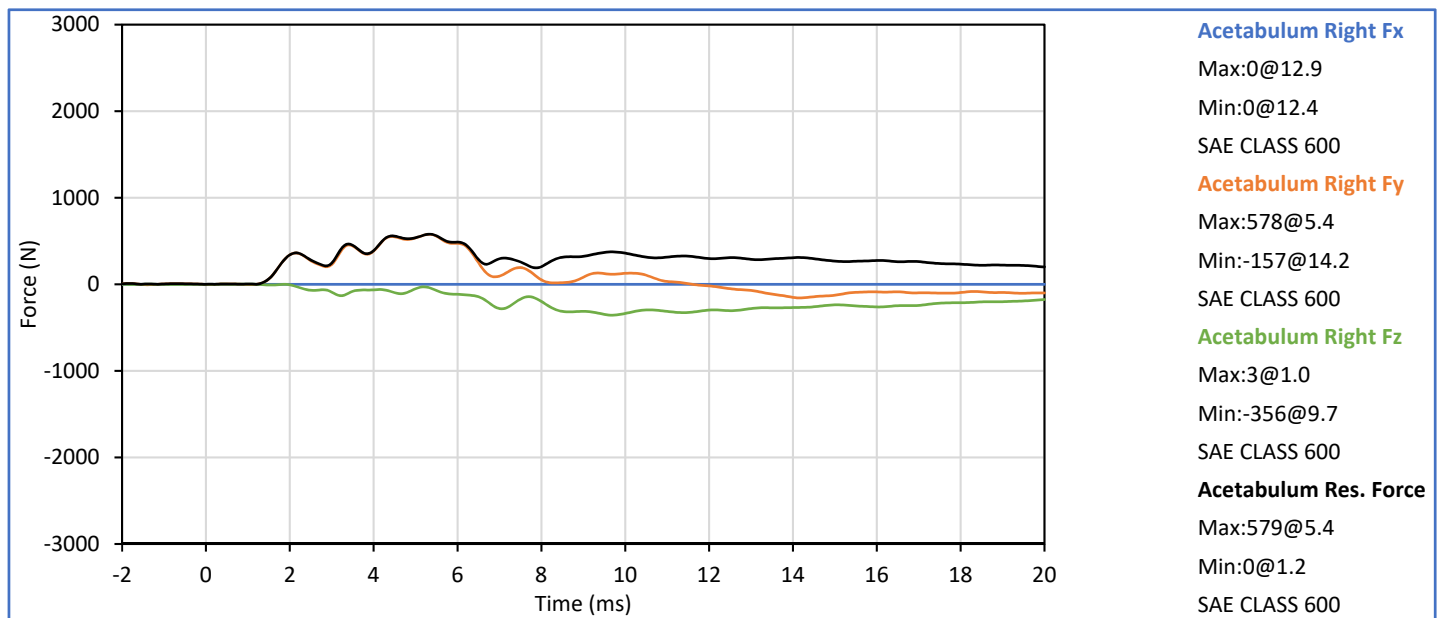
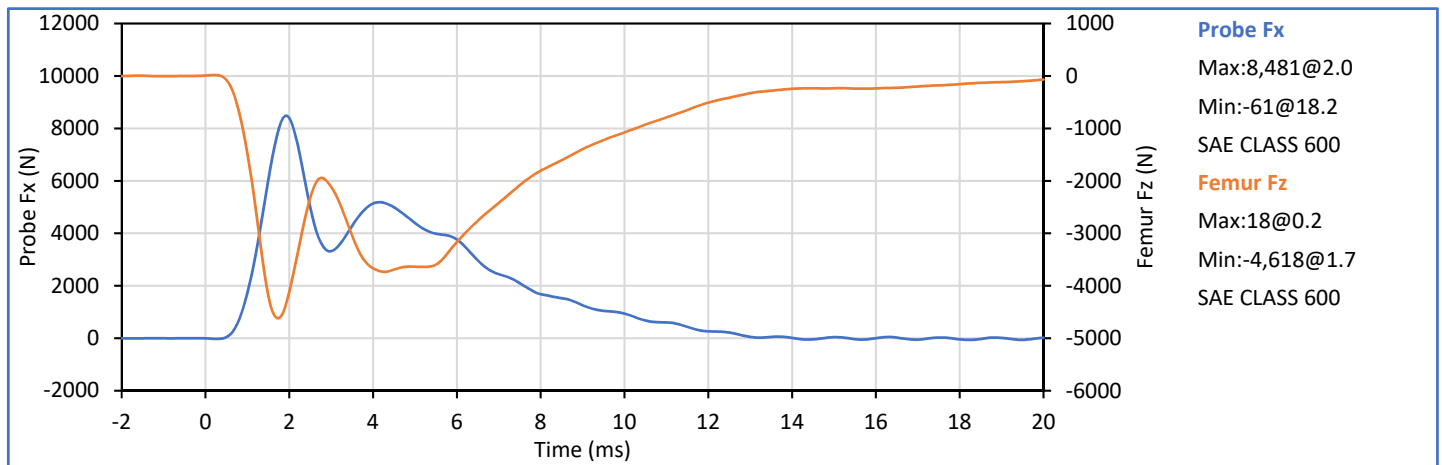
P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	31	Pass
Pendulum Velocity	m/s	3.25	3.35	3.32	Pass
Peak Probe Force	N	*	*	8481	*
Peak Femur Fz	N	*	*	-4618	*
Acetabulum Force Resultant	N	*	*	579	*
Overall Test Results					Pass

* Research data. No defined P/F corridor

** Acetabulum Fx is not functioning

**



Technician:

J. Hernandez

J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

APPENDIX C
Post-Test ATD Qualification and Performance Verification
Hybrid III 50th Percentile Male ATD
S/N: 168

ATD Serial No.: 168

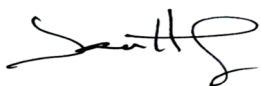
Test Date: 2020-12-29

Dummy Item	Inspect for	Comments	Damage	OK
Entire ATD	Perform general cleaning			✓
Outer Skin	Gashes, rips, cracks			✓
Head	Ballast secure			✓
	General appearance			✓
Neck bracket	Upper neck firmly attached to lower bracket			✓
Neck	Broken or cracked rubber			✓
	Looseness at the condyle joint			✓
Nodding block	Cracked or out of position			✓
Lumbar Spine	Broken or cracked rubber			✓
Ribs	Broken or bent ribs			✓
	Broken or bent rib supports			✓
	Damping material separated or cracked			✓
	Rubber bumpers in place			✓
Chest Displ. Assembly	Bent shaft			✓
	Slider arm riding in track			✓
Sensors	Check cables for cuts, tears			✓
	Check for damaged insulation			✓
Accelerometer Mounting	Head mounting secure			✓
	Chest mounting secure			✓
Knees	Skin condition			✓
	Insert (do not remove)			✓
	Casting			✓
Limbs	Normal movement and adjustment			✓
Knee Sliders	Wires intact			✓
	Rubber returned to "resting" position			✓
Pelvis	Broken			✓
Other	Describe below as needed			✓

Describe any repairs or replacement of parts or other findings:

No Problems Found

Technician:



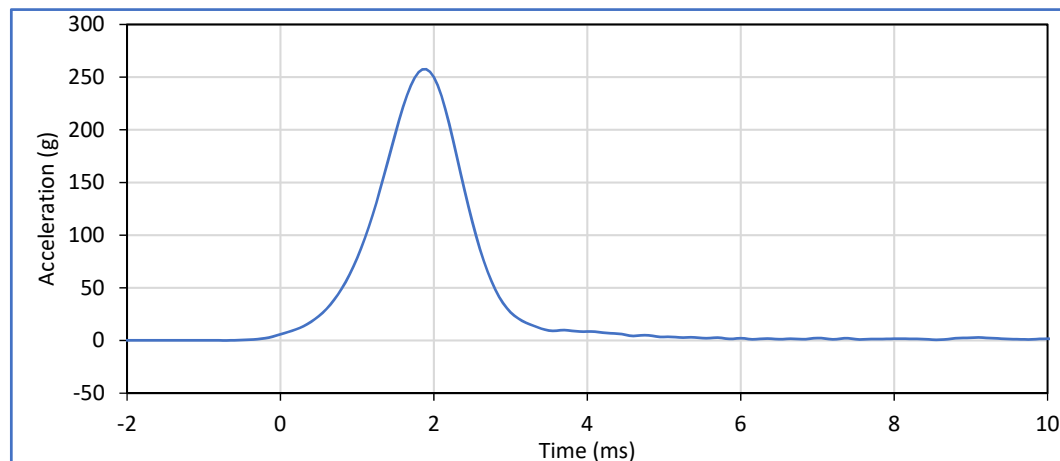
J. Hernandez

Approved By:



P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	22.2	Pass
Laboratory Relative Humidity	%	10	70	23	Pass
Peak Resultant Acceleration	g	225.0	275.0	257.5	Pass
Peak Lateral Acceleration	g	-15.0	15.0	-1.6	Pass
Oscillations After Main Pulse	%	0.0	10.0	1.1	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass

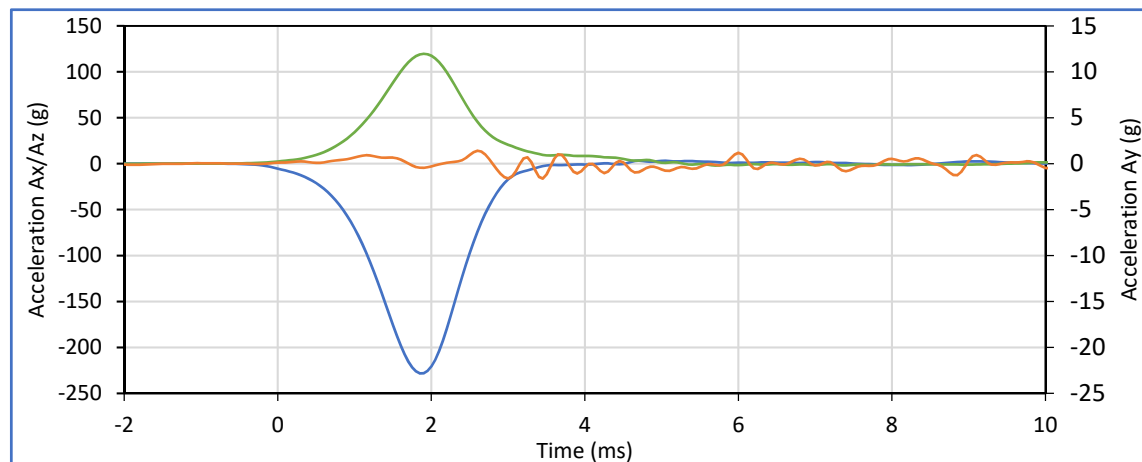


Head Resultant

Max:257.5@1.9

Min:0.7@8.6

SAE Class 1000



Head Ax

Max:3.4@4.7

Min:-228.2@1.9

SAE Class 1000

Head Ay

Max:1.4@2.6

Min:-1.6@3.5

SAE Class 1000

Head Az

Max:119.7@1.9

Min:-2.0@5.7

SAE Class 1000

Technician:

J. Hernandez

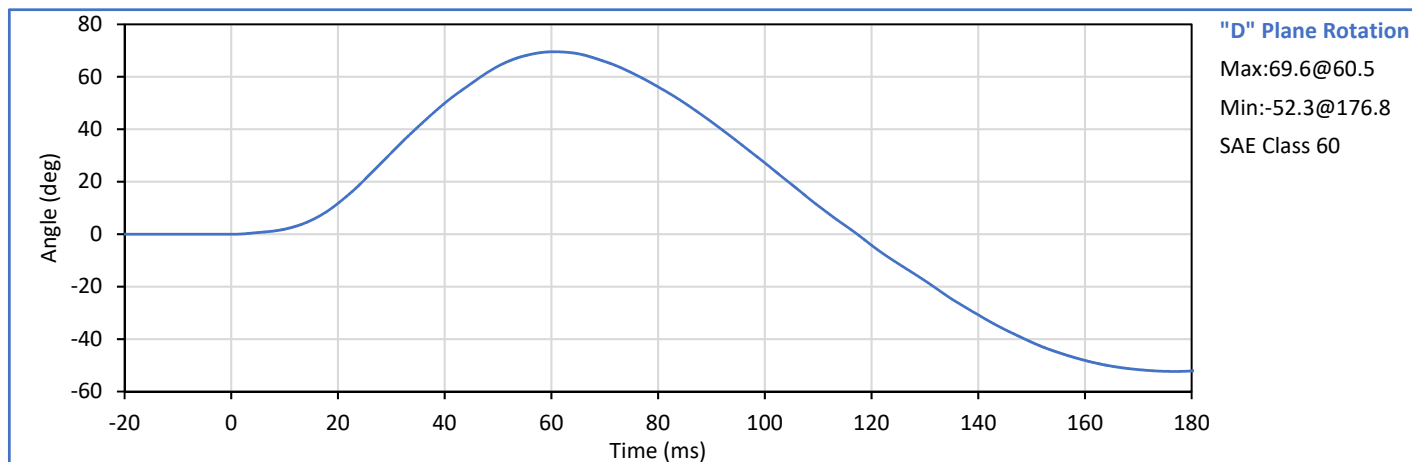
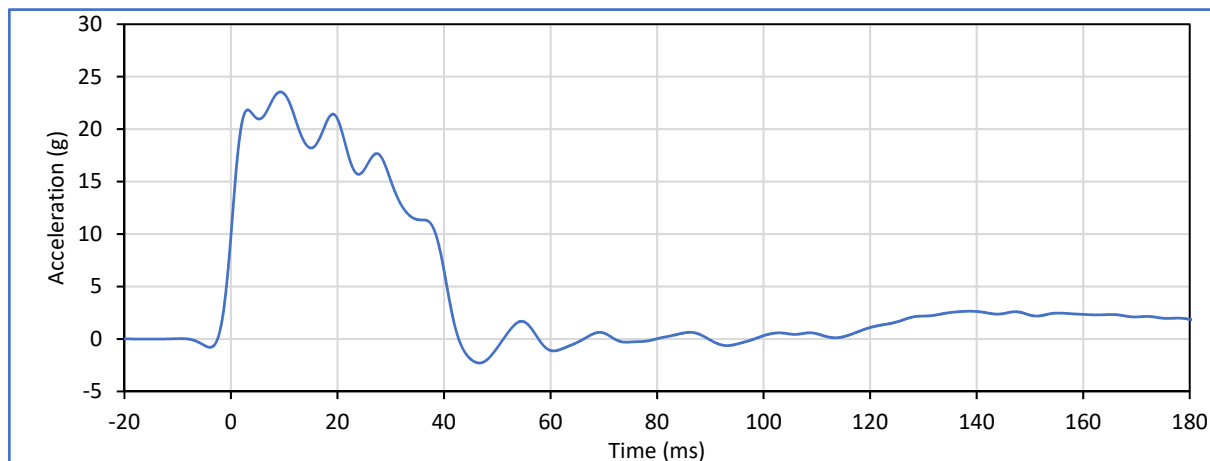
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Relative Humidity	%	10	70	15	Pass
Pendulum Velocity	m/s	6.89	7.13	6.98	Pass
Pendulum Deceleration at 10 ms	g	22.5	27.5	23.4	Pass
Pendulum Deceleration at 20 ms	g	17.6	22.6	21.0	Pass
Pendulum Deceleration at 30 ms	g	12.5	18.5	15.1	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	29.0	15.1	Pass
Deceleration Decay to Cross 5 g	ms	34.0	42.0	40.5	Pass
"D" Plane Rotation peak	deg	64.0	78.0	69.6	Pass
	ms	57.0	64.0	60.5	Pass
"D" Plane Rotation Decay To Zero	ms	113.0	128.0	117.4	Pass
Moment About Occipital Condyle	Nm	88.1	108.5	93.5	Pass
	ms	47.0	58.0	54.8	Pass
Moment Decay, Peak to Zero	ms	97.0	107.0	102.3	Pass
Overall Test Results					Pass



Technician:

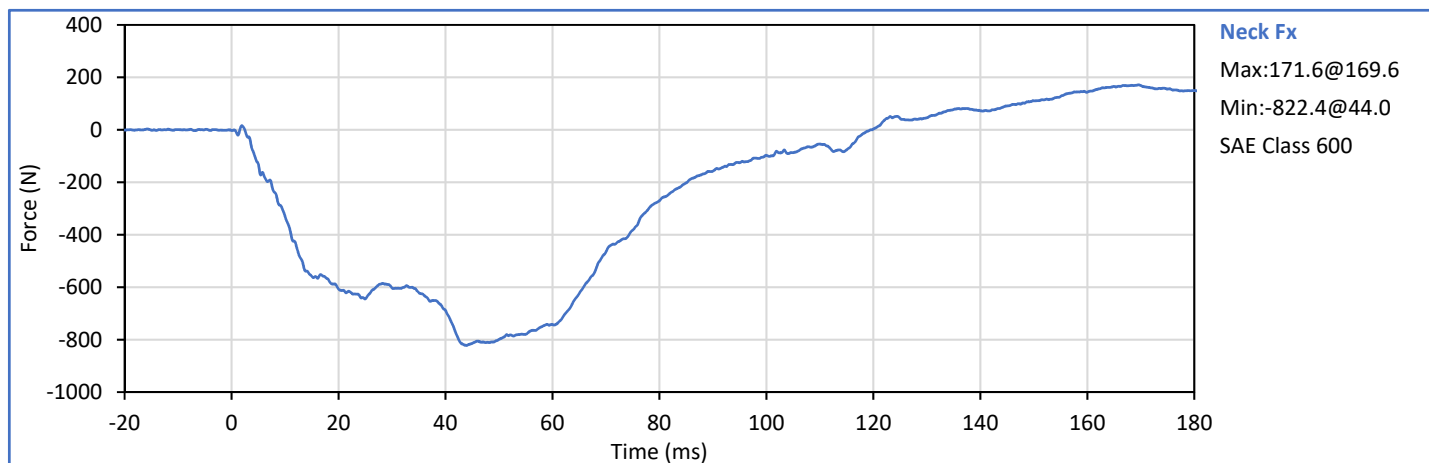
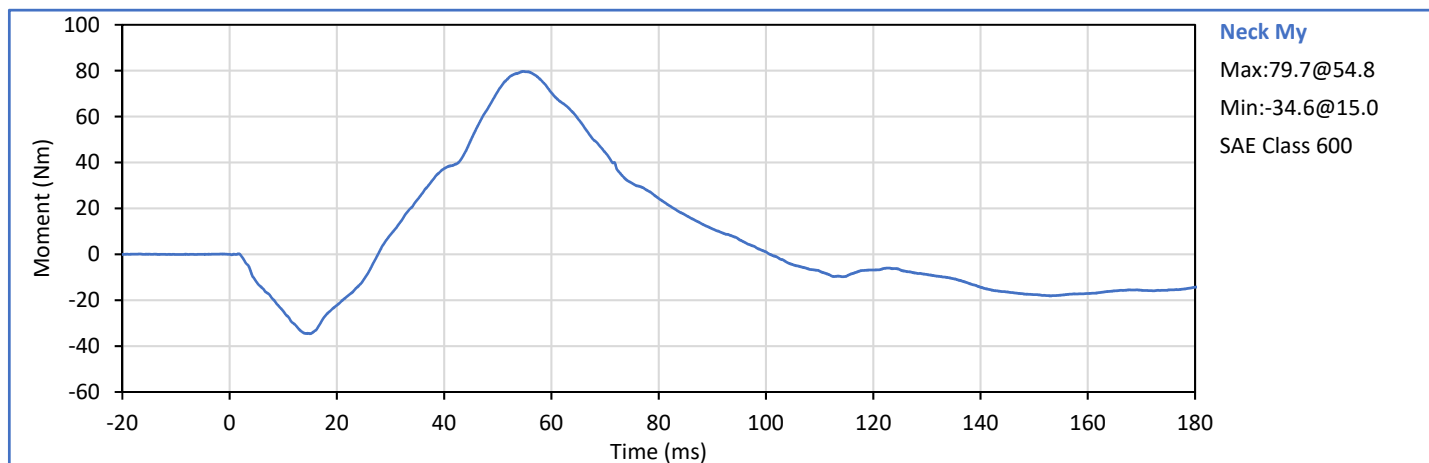
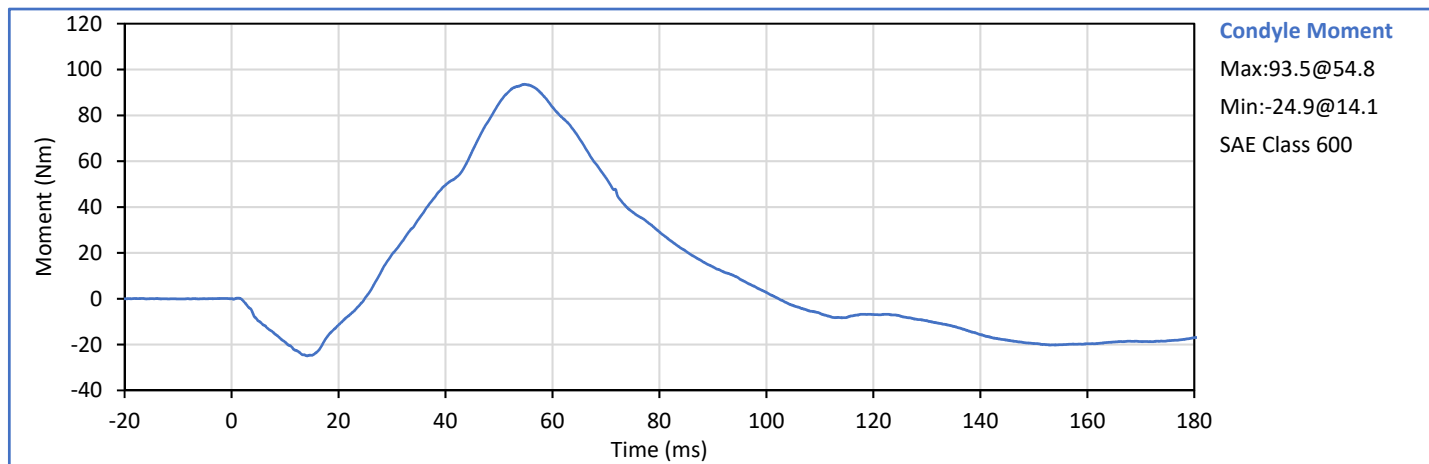
J. Hernandez

J. Hernandez

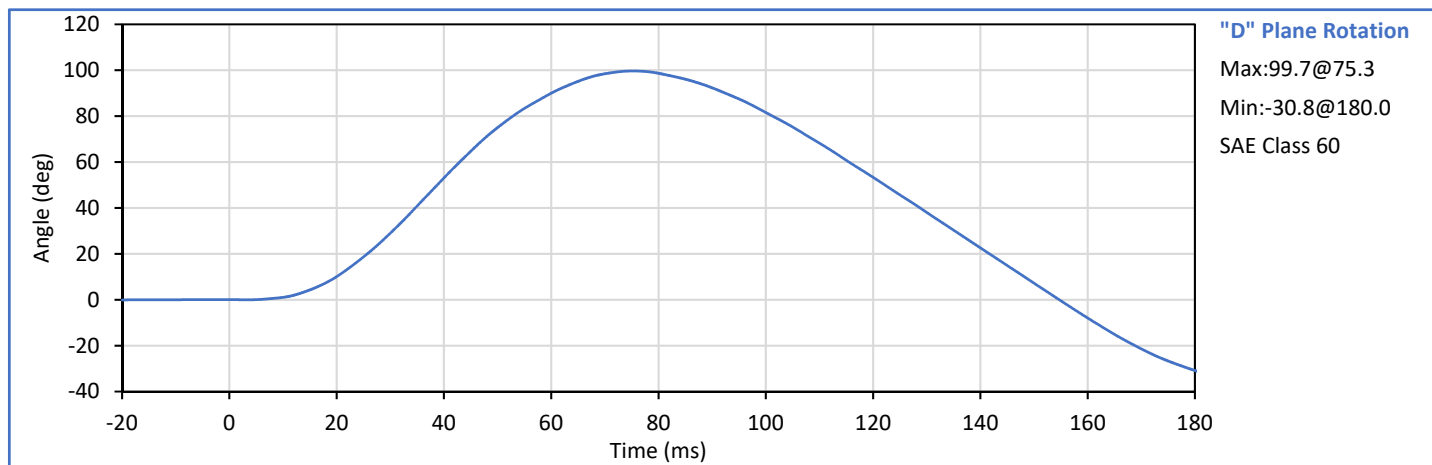
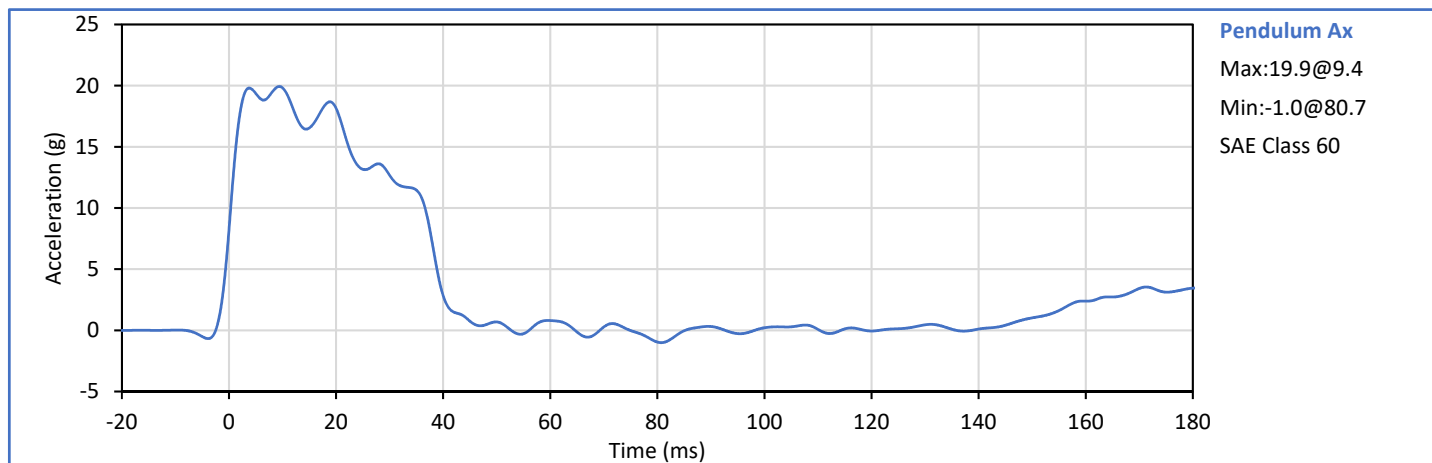
Approved By:

P. Puzzuto

P. Puzzuto



Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.8	Pass
Laboratory Relative Humidity	%	10	70	29	Pass
Pendulum Velocity	m/s	5.94	6.19	6.07	Pass
Pendulum Deceleration at 10 ms	g	17.2	21.2	19.8	Pass
Pendulum Deceleration at 20 ms	g	14.0	19.0	18.2	Pass
Pendulum Deceleration at 30 ms	g	11.0	16.0	12.7	Pass
Peak Pendulum Decel. after 30 ms	g	0.0	22.0	12.7	Pass
Deceleration Decay to Cross 5 g	ms	38.0	46.0	38.8	Pass
"D" Plane Rotation peak	deg	81.0	106.0	99.7	Pass
	ms	72.0	82.0	75.3	Pass
"D" Plane Rotation Decay To Zero	ms	147.0	174.0	154.8	Pass
Moment About Occipital Condyle	Nm	-79.9	-52.9	-71.1	Pass
	ms	65.0	79.0	70.2	Pass
Moment Decay, Peak to Zero	ms	120.0	148.0	141.1	Pass
Overall Test Results					Pass



Technician:

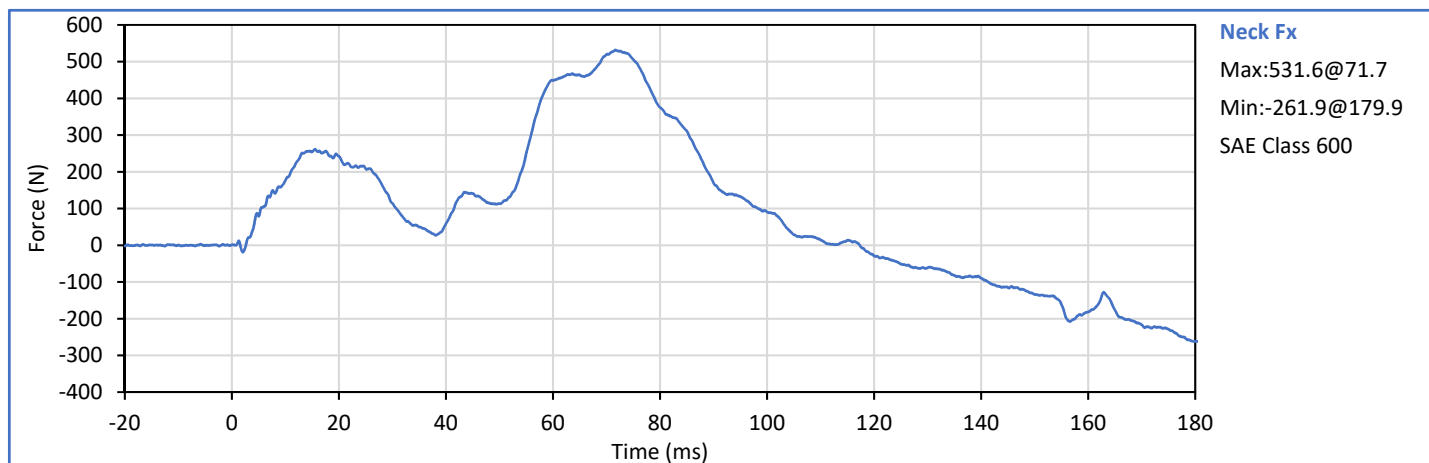
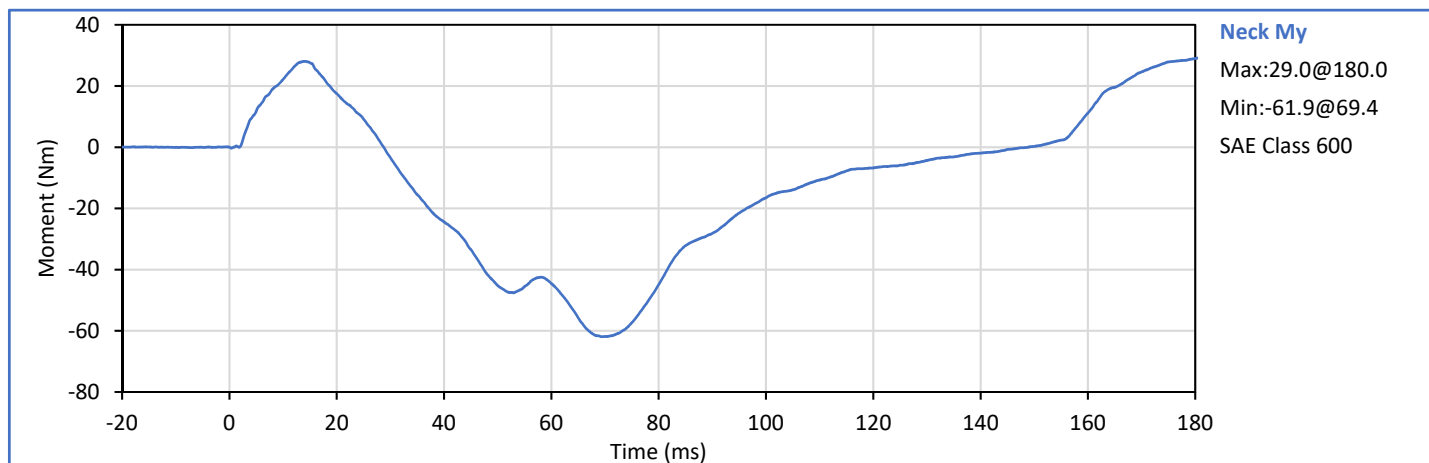
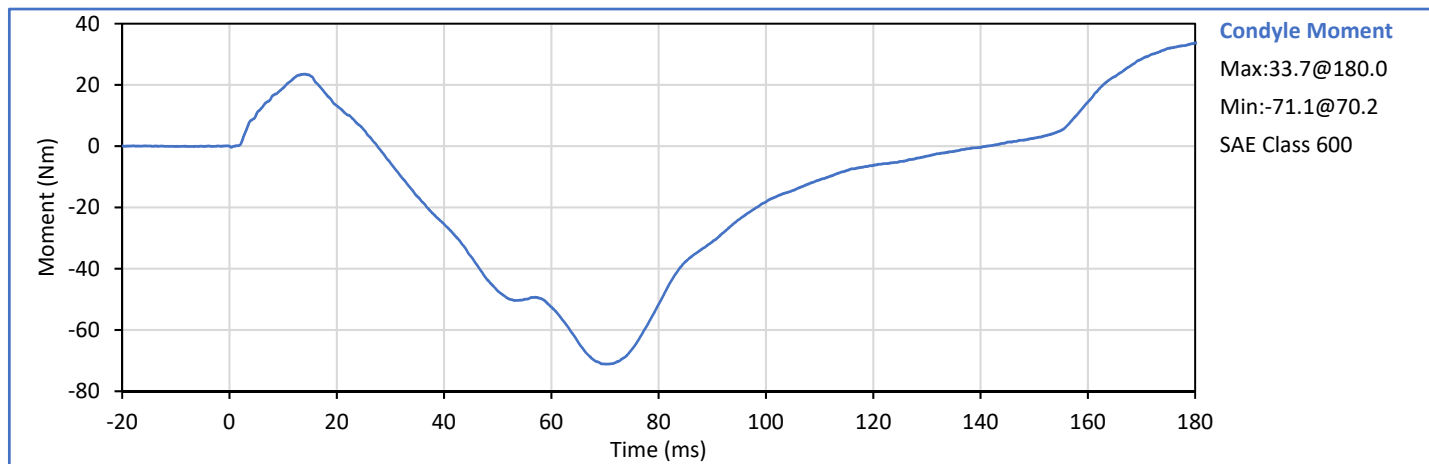
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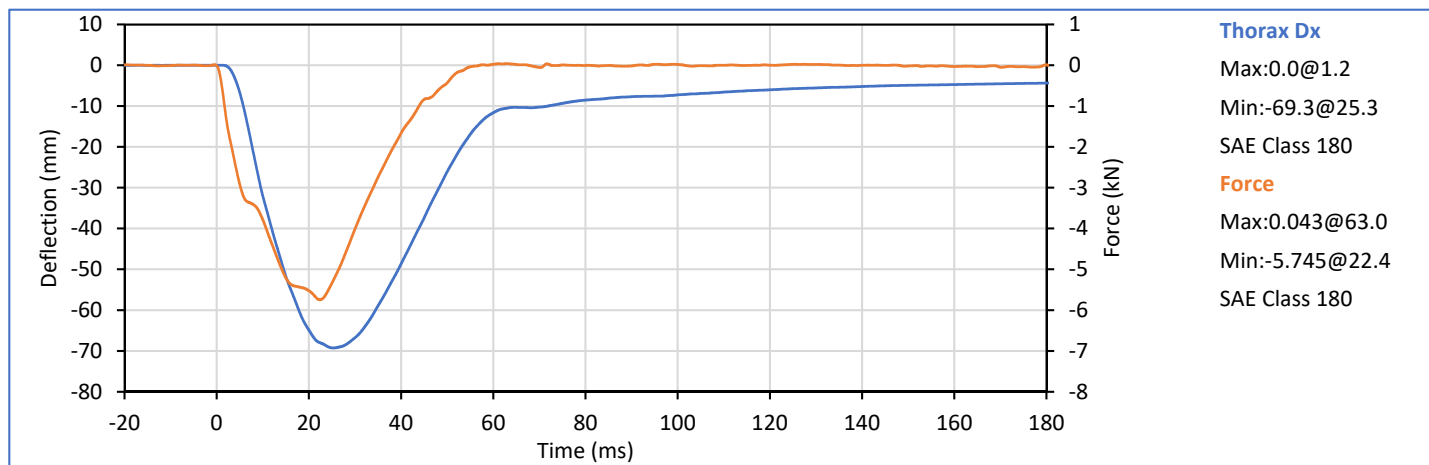
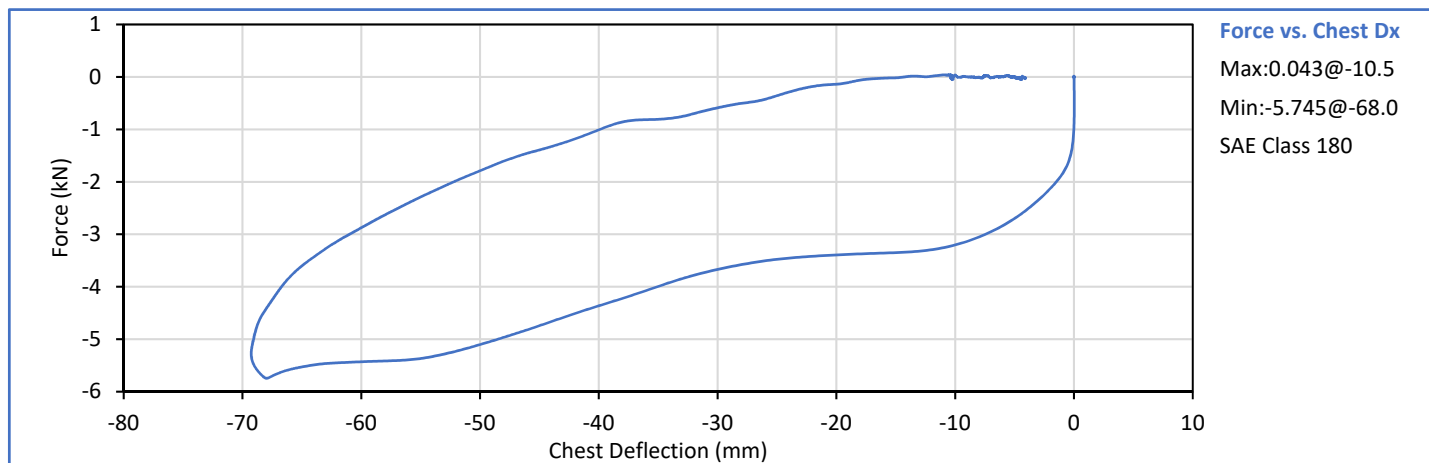
Approved By:

P. Puzzuto

P. Puzzuto



Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.9	Pass
Laboratory Relative Humidity	%	10	70	17	Pass
Probe Velocity	m/s	6.58	6.82	6.71	Pass
Peak Chest Deflection	mm	-72.6	-63.5	-69.3	Pass
Peak Probe Force	kN	-5.893	-5.159	-5.745	Pass
Internal Hysteresis	%	69.0	85.0	71.1	Pass
Overall Test Results				Pass	Pass



Technician:

J. Hernandez

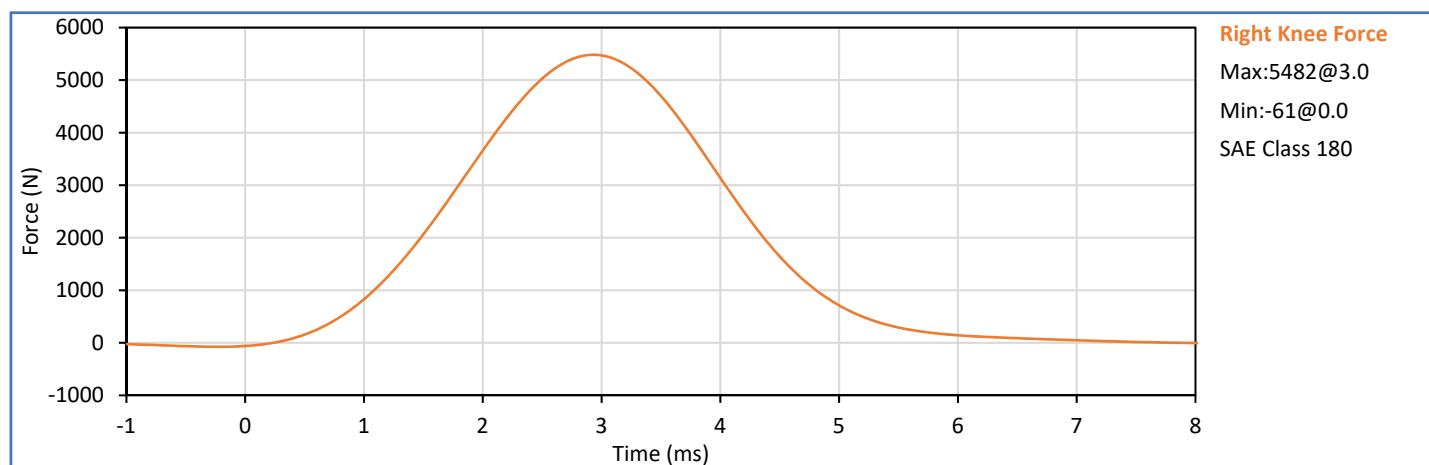
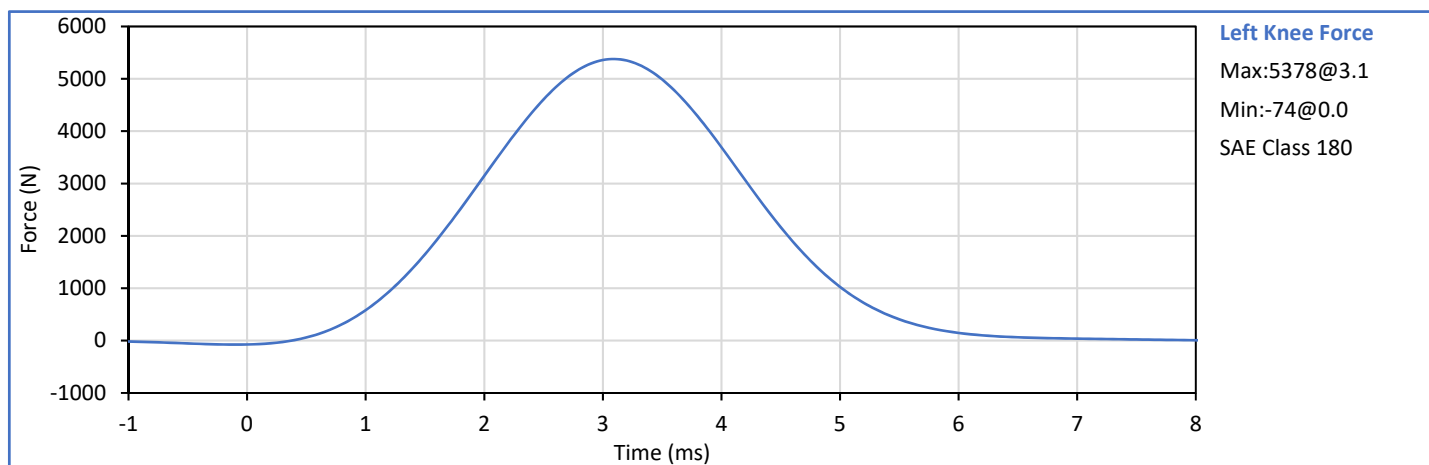
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

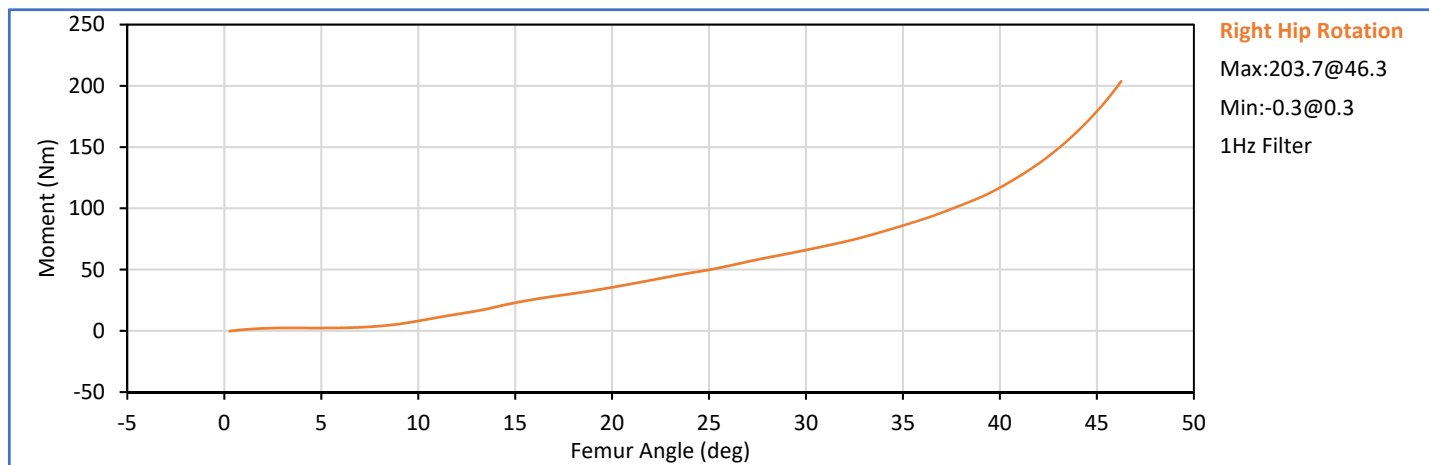
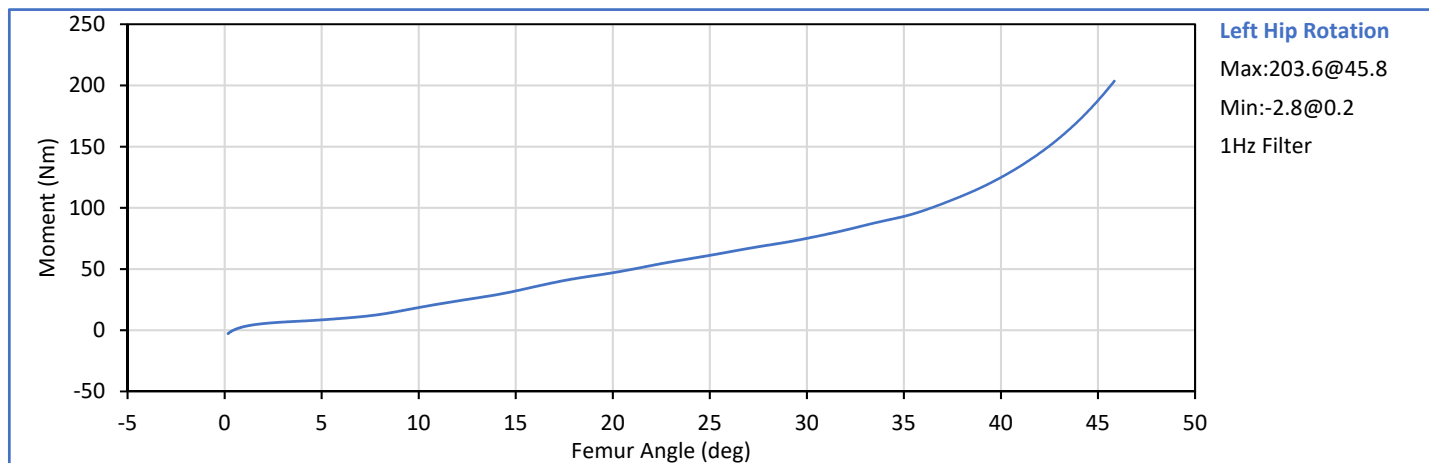
	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.7	Pass
	Laboratory Relative Humidity	%	10	70	22	Pass
Left	Probe Velocity	m/s	2.070	2.130	2.097	Pass
Knee	Peak Resistive Force	N	4715	5782	5378	Pass
Right	Probe Velocity	m/s	2.070	2.130	2.089	Pass
Knee	Peak Resistive Force	N	4715	5782	5482	Pass
Overall Test Results						Pass



Technician: J. Hernandez

Approved By: P. Puzzuto

	Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
	Laboratory Temperature	°C	18.9	25.6	21.1	Pass
	Laboratory Relative Humidity	%	10	70	27	Pass
Left Hip	Left Hip Rotation Rate	deg/s	5.0	10.0	5.8	Pass
	Left Femur Torque at 30°	Nm	0.0	95.0	75.1	Pass
	Left Hip Rotation at 203 Nm	deg	40.0	50.0	45.8	Pass
Right Hip	Right Hip Rotation Rate	deg/s	5.0	10.0	5.7	Pass
	Right Femur Torque at 30°	Nm	0.0	95.0	66.0	Pass
	Right Hip Rotation at 203 Nm	deg	40.0	50.0	46.2	Pass
Overall Test Results						Pass



Technician: J. Hernandez

Approved By: P. Puzzuto