

REPORT NUMBER: 214P-CAL-23-004

RESEARCH SIDE IMPACT POLE TEST

**Toyota Motor Manufacturing , Texas, Inc.
2019 Toyota Tacoma
4 Door Truck**

NHTSA No: R20195150

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



July 31, 2023

FINAL REPORT

**PREPARED FOR:
U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
STRUCTURE & RESTRAINT RESEARCH DIVISION
MAIL CODE: NSR-210
1200 NEW JERSEY AVE SE, W46-451
WASHINGTON, D.C. 20590**

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number 693JJ923F000135.

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FINAL REPORT ACCEPTANCE BY OCWS:

Division Chief, New Car Assessment Program
NHTSA, Office of Structure & Restraint Research Division

Date: _____

COTR, New Car Assessment Program
NHTSA, Office of Structure & Restraint Research Division

Date: _____

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16. Abstract A 31.0 km/h (19.26 mph), 75° oblique compliance test was conducted on the subject 2019 Toyota Tacoma 4 Door Truck in accordance with the specifications of the Office of Vehicle Safety Compliance FMVSS No. 214, Dynamic Side Impact Protection Laboratory Test Procedure TP-214P-01, dated September, 2012 for the generation of consumer information on vehicle side pole crash protection. This test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on July 6, 2023. The impact velocity of the vehicle was 30.98 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle was 21°C. The target vehicle's maximum post-test static crush was 590 mm located at level 1. The test vehicle's occupant performance data is as follows: <table border="1"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th colspan="3">Driver ATD (ES-2re) (Serial No.F034)</th> </tr> <tr> <th>Units</th> <th>Threshold</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC36)</td> <td>N/A</td> <td></td> <td>228.96</td> </tr> <tr> <td>Brain Injury Criterion (BrIC)</td> <td>N/A</td> <td></td> <td>0.53</td> </tr> <tr> <td>Maximum Shoulder Force</td> <td>N</td> <td></td> <td>2440.53</td> </tr> <tr> <td>Maximum Thoracic Rib Deflection</td> <td>mm</td> <td></td> <td>31.46</td> </tr> <tr> <td>Combined Abdominal Force</td> <td>N</td> <td></td> <td>1554.15</td> </tr> <tr> <td>Pubic Symphysis Force</td> <td>N</td> <td></td> <td>-2204.99</td> </tr> </tbody> </table> The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.						Measurement Description	Driver ATD (ES-2re) (Serial No.F034)			Units	Threshold	Result	Head Injury Criteria (HIC36)	N/A		228.96	Brain Injury Criterion (BrIC)	N/A		0.53	Maximum Shoulder Force	N		2440.53	Maximum Thoracic Rib Deflection	mm		31.46	Combined Abdominal Force	N		1554.15	Pubic Symphysis Force	N		-2204.99
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17. Key Words Side Impact Pole Part 572U ES-2re				18. Distribution Statement <u>Copies of this report are available from:</u> National Highway Traffic Safety Administration Technical Information Services Division, 1200 New Jersey Ave. Washington, D.C. 20590																																
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SECTION 1

TEST PURPOSE AND PROCEDURE

This side impact test was conducted as part of the Federal Motor Vehicle Safety Standard 214 Side Impact Protection Program. It was conducted for the National Highway Traffic Safety Administration (NHTSA), under Contract No. 693JJ923F000135. The purpose of this test was to evaluate side impact protection in a 2019 Toyota Tacoma 4 Door Truck. The side impact test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure, TP-214P-01 dated September 2012.

SECTION 2

SUMMARY OF TEST RESULTS

A rigid pole side impact test was conducted on a 2019 Toyota Tacoma 4 Door Truck. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 30.98 km/h. The test was conducted by Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on July 6, 2023. Pre-test and post-test photographs of the test vehicle and side impact dummy (ES-2re) are included in Appendix A of this report.

One Part 572U (ES-2re) dummy was placed in the driver designated seating position according to instructions specified in the OCWS FMVSS No. 214, Dynamic Side Impact Protection Laboratory Test Procedure, TP-214P-01, dated September, 2012. Camera locations and other pertinent camera information are included on page 3-11 in this report.

The Part 572U (ES-2re) dummy was instrumented accordingly:

- DRIVER ATD (ES-2re)
- Head CG tri-axial accelerometer
- Head angular rate sensor
- Upper neck load cells
- Shoulder load cell
- Upper (T1) and lower spine (T12) tri-axial accelerometers
- Lower Spine (T12) load cell
- Lumbar load cell
- Pelvic tri-axial accelerometers
- Pubic load cell
- Abdomen forward, middle, and rear y-axis load cells

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

Injury readings for the ES-2re dummy were recorded as follows:

INJURY READINGS

Measurement Description	Driver ATD (ES-2re)		
	Units	IARV	Result
Head Injury Criteria (HIC36)	N/A		228.96
Brain Injury Criterion (BrIC)	N/A		0.53
Maximum Shoulder Force	N		2440.53
Maximum Thoracic Rib Deflection	mm		31.46
Combined Abdominal Force	N		1554.15
Pubic Symphysis Force	N		-2204.99

*Proposed IARV

Supplemental restraint information was recorded as follows:

SUPPLEMENTAL RESTRAINT INFORMATION

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

GENERAL COMMENTS:

1. P1 serial number - F034

Data Anomalies:

- No Questionable Channels

SECTION 3

OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

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

Data Sheet No. 2 - Seat, Seat Belt, Steering Wheel Adjustment and Fuel Systems Data

Data Sheet No. 3 - Dummy Longitudinal Clearance Dimensions

Data Sheet No. 4 - Dummy Lateral Clearance Dimensions

Data Sheet No. 5 - Camera and instrumentation Data

Data Sheet No. 6 - Vehicle Accelerometer Data

Data Sheet No. 7- Rigid Pole Load Cell Data

Data Sheet No. 8 - Post-Test Observations

Data Sheet No. 9 - Test Vehicle Profile Measurements

Data Sheet No. 10 - Test Vehicle Exterior Crush Measurements

Data Sheet No. 11 - Vehicle Damage Profile Distances

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

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

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
Test Date: 07/06/2023

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	R20195150	Traction Control System (TCS)	Yes
Model Year	2019	Auto-Leveling System	No
Make	Toyota	Automatic Door Locks (ADL)	Yes
Model	Tacoma	Power Window Auto-Reverse	Yes
Body Style	Truck	Other Optional Feature	No
VIN	5TFSZ5AN5KX206592	Driver Front Airbag	Yes
Body Color	White	Driver Curtain Airbag	Yes
Odometer Reading (km/mi)	33,006 mi	Driver Head/Torso Airbag	No
Engine Displacement (L)	3.5	Driver Torso Airbag	No
Type / No. Cylinders	V6	Driver Torso / Pelvis Airbag	Yes
Engine Placement	Inline	Driver Pelvis Airbag	No
Transmission Type	Automatic	Driver Knee Airbag	Yes
Transmission Speeds	6 speed	Rear Pass. Curtain Airbag	Yes
Overdrive	Yes	Rear Pass. Head / Torso Airbag	No
Final Drive	Four Wheel Drive	Rear Pass. Torso Airbag	No
Roof Rack	No	Rear Pass. Torso / Pelvis Airbag	No
Sunroof / T-Top	No	Rear Pass. Pelvis Airbag	No
Running Boards	No	Driver Seat Belt Pretensioner	Yes
Tilt Steering Wheel	Yes	Rear Pass. Seat Belt Pretensioner	No
Power Seats	No	Driver Load Limiter	Yes
Anti-Lock Brakes (ABS)	Yes	Rear Pass. Load Limiter	No
		Other Safety Restraint	No

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

Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Manufacturing , Texas, Inc.	GVWR	2545
Date of Manufacture	07/19	GVWR Front	1320
Vehicle Type	Truck	GVWR Rear	1490

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	2	N/A	4	
Vehicle Capacity Weight (VCW) (kg)				520	(A)
DSC x 68.04 kg				272.16	(B)
Cargo Weight (RCLW) (kg)				136	(A-B)

VEHICLE SEAT TYPE

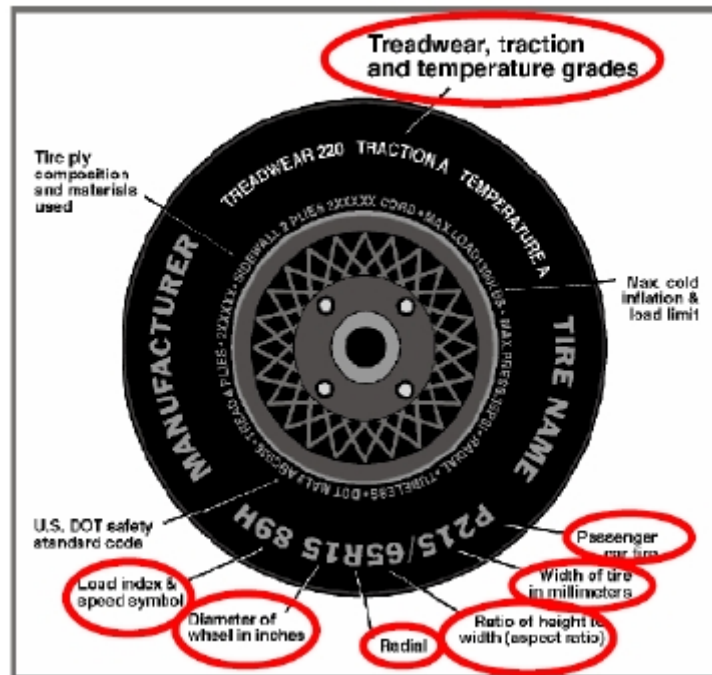
Seating Location	Type Of Seat Pan				Type Of Seat Back		
	Bucket	Bench	Split Bench	Contour	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front	X					X	
Rear or Second Row Seat		X			X		
Third Row seat	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
 Test Date: 07/06/2023

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



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	220	220
Recommended Tire Size	P245/75R16	P245/75R16
Tire Size on Vehicle	P245/75R16	P245/75R16
Tire Manufacturer	Yokohama	Yokohama
Tire Model	Geolandar H/T	Geolandar H/T
Treadwear	720	720
Traction	A	A
Temperature Grades	B	B
Load Index / Speed Symbol	109T	109T
Tire Material	Rubber	Rubber

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

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
 Test Date: 07/06/2023

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	256	260	252	254
Tire Placard	kPa	220	220	220	220
Owner's Manual	kPa	220	220	220	220
As Tested	kPa	220	220	220	220

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Rear	Total	Total	Front	Rear	Total
Left	kg	571	436		604	524		607	522	
Right	kg	552	409		557	494		567	490	
Ratio	%	57.1	42.9		53.3	46.7		53.7	46.3	
Totals	kg	1123	845	1968	1161	1018	2179	1174	1012	2186

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	1968	(A)
Actual Weight of 1 P572U (ES2-re) ATD Used	kg	82.0	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	136	(C)
Calculated Vehicle Target Weight (TVTW)	kg	2186	(A+B+C)

Does the measured As Test Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Target Weight – 4.5 kg to – 9 kg)?

☒ Yes

☐ No

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	As Delivered	As Tested	Fully Loaded	Meets Rqmt***
Driver Door Sill Angle (front-to-rear)*	Deg	+0.75	+0.40	+0.25	Yes
Front Passenger Sill Angle (front-to-rear)*	Deg	-0.50	-0.2	+0.35	Yes
Front Bumper-Line Angle (left-to-right)**	Deg	-0.30	-0.6	-0.65	Yes
Rear Bumper-Line Angle (left-to-right)**	Deg	+0.55	+0.55	+0.50	Yes
Vehicle CG (Aft of Front Axle)	mm	1396	1519	1506	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	-19	-29	-27	

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

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

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

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

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck

NHTSA No.: R20195150

Test Program: Research Side Pole Impact Test

Test Date: 07/06/2023

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Tonneau Cover	10
Ballast / Equipment Added	81.6
Test Height – Adjustable Suspension Setting, if Applicable	N/A

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

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck

NHTSA No.: R20195150

Test Program: Research Side Pole Impact Test

Test Date: 07/06/2023

SEAT POSITIONING

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

SCRL ANGLE RANGE

Seat	SCRL(°)		
	Max	Min	Mid
Driver Seat	Fixed	Fixed	Fixed
Front Passenger Seat	Fixed	Fixed	Fixed
Front Center Seat			

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rearmost	Mid-Fore / Aft	Forward-Most
Driver Seat	Fixed	Fixed	Max			
			Mid			
			Min			
Front Passenger Seat	Fixed	Fixed	Max			
			Mid			
			Min			
Front Center Seat*			Max			
			Mid			
			Min			

**If applicable*

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

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck

NHTSA No.: R20195150

Test Program: Research Side Pole Impact Test

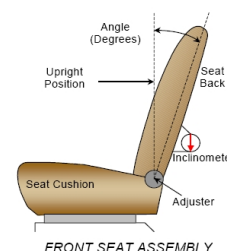
Test Date: 07/06/2023

SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forward most Position	
	mm	Detents*	mm	Detents*
Driver Seat	239	17 (0-16)	119	8
Front Passenger Seat	239	17 (0-16)	119	8
Front Center Seat				

SEAT BACK ANGLE ADJUSTMENT

The driver and passenger seat back are positioned to the manufacturer's designated angle provided in the Form1.



Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents*	Degrees	Detents*
Driver Seat w/Seated Dummy	52.2	25 (0-24)	0.2	4
Front Passenger Seat	52.1	25 (0-24)	1.9	4
Front Center Seat				

SEAT BELT ANCHORAGE ADJUSTMENT

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

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

HEAD RESTRAINT ADJUSTMENT

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

Seat	Total # of Positions	Placed in Position #
Driver Seat	3 (0-2)	Uppermost

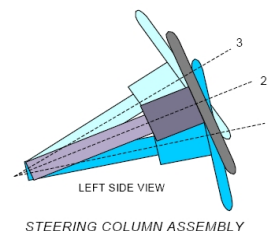
DATA SHEET NO. 2 ... (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
 Test Date: 07/06/2023

STEERING COLUMN POSITIONS

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves through its full range of motion.

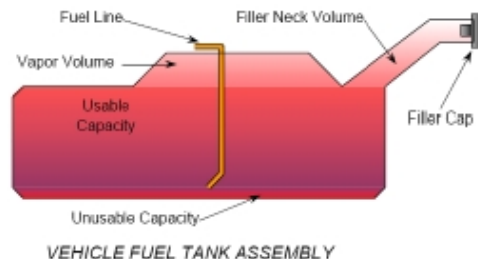


	Degrees	Fore / Aft Position (mm)
Lowermost - Position No. 1	22.9	
Geometric center - Position No. 2	24.6	
Uppermost - Position No. 3	26.2	
Telescoping Steering Wheel Travel		28
Test Position	24.6	14

FUEL PUMP

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

The vehicle is equipped with an electric fuel pump. The fuel filler neck is on the left side of the vehicle. The pump creates positive pressure in the fuel lines, pushing the gasoline to the engine. See form 1 for more information.



FUEL TANK CAPACITY

Description	Liters
Usable Capacity of "Standard Tank" - see Form No. 1	80
Usable Capacity of "Optional Tank" - see Form No. 1	N/A
Usable Capacity of "Standard Tank" - see Owner's Manual	80
Usable Capacity of "Optional Tank" - see Owner's Manual	N/A
93% of Usable Capacity	74.4
Actual Amount of Solvent Used in Test	74.4
1/3 of Usable Capacity	26.7

Is the Actual Amount of Solvent Used in the test equal to 93% $\pm$ 1% of the Usable

Capacity stated in Form No. 1?



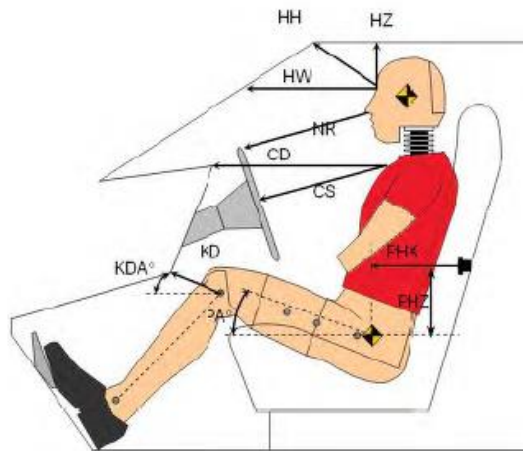
Yes



No

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle:	2019 Toyota Tacoma 4 Door Truck	NHTSA No:	R20195150
Test Program:	Research Side Pole Impact Test	Test Date:	7/06/2023



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

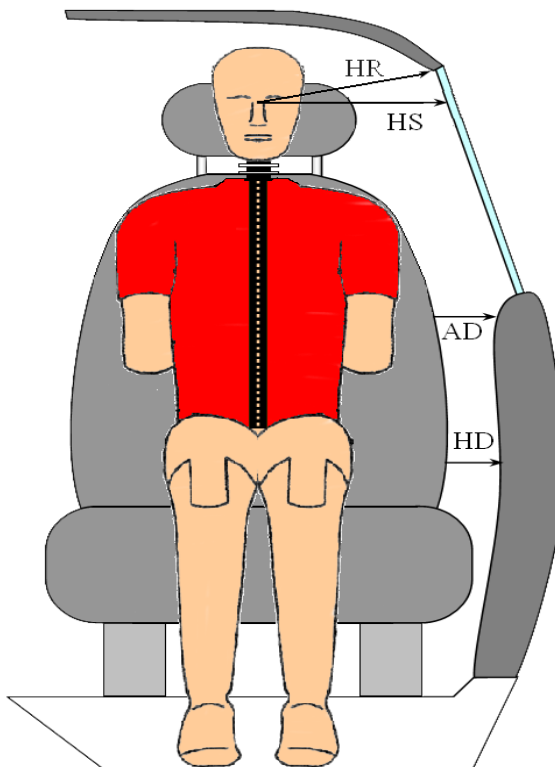
Code	Measurement Description	Driver SN # F034	
		Length (mm)	Angle
HH	Header to Header	431	
HW	Header to Windshield	606	
HZ	Head to Roof Liner	190	
NR	Nose to Rim/Seat Back	461	
CD	Chest to Dash/Seat Back	966	
CS	Chest to Steering Wheel	318	
KD(L)/KDA(L)°	Left Knee to Dash/Seat Back	223	0.14
KD(R)/KDA(R)°	Right Knee to Dash/Seat Back	119	46
PAX°	Pelvic Tilt Angle X		-19.2
PAY°	Pelvic Tilt Angle Y		0.2
PHX	Hip Point to Striker (X-Axis)	184	
PHZ	Hip Point to Striker (Z-Axis)	152	
HAX°	Head Tilt Angle X		
HAY ^{1°}	Head Tilt Angle Y		
TAX°	Thorax Tilt Angle X		
TAY°	Thorax Tilt Angle Y		
	Head Rest Angle		0.6
	H-Point Tool Angle		9.0
	Torso Angle		9.7
	Windshield Angle		52.3

See Appendix E

DATA SHEET NO. 4 **DUMMY LATERAL CLEARANCE DIMENSIONS**

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
 Test Date: 07/06/2023



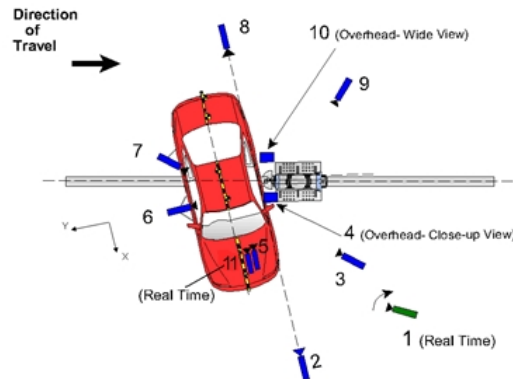
Code	Description	Units	Driver – Length (Serial No. F034)
HR	Head to Side Header	mm	230
HS	Head to Side Window	mm	354
AD	Arm to Door	mm	114
HD	H-point to Door	mm	238

See Appendix E

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
Test Date: 07/06/2023



CAMERA LOCATIONS AND DATA

No.	Camera View	Location (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-time (24 - 30 fps) pan view of impact				Zoom	30
2	Front ground level - impact view	0	8545	-1423	24	1000
3	Impact side 45° - forward pole view	770	6311	-1510	28	1000
4	Overhead Close-up view of impact	0	0	-9200	24	1000
5	Onboard - dummy front view				25	1000
6	Onboard - dummy side view				12.5	1000
7	Onboard - dummy rear oblique view				8	1000
8	Rear ground level - impact view	0	-8823	-1526	24	1000
9	Impact side 45° - rearward pole view	4277	-5286	-1580	24	1000
10	Overhead wide - view of impact	0	0	9200	12.5	1000
11	Real-time (24 - 30 fps) - dummy front view				Zoom	60

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

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

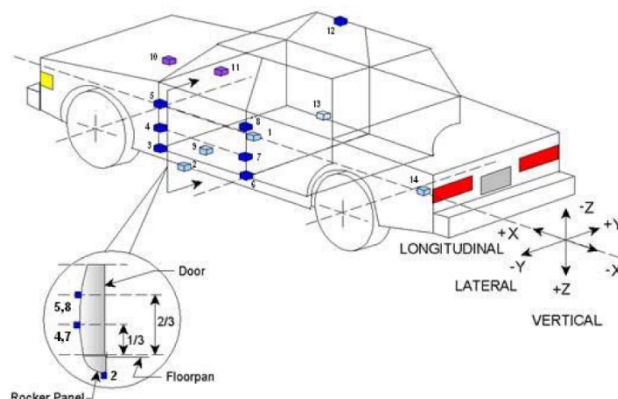
INSTRUMENTATION

Description	Number of Channels
Driver Dummy Channels	45
Vehicle Structure Accelerometers	32
Pole Load Cells	8
Total	85

DATA SHEET NO. 6 **TEST VEHICLE ACCELEROMETER LOCATIONS**

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
 Test Date: 07/06/2023



TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	3268	-70	-173
2	Left Floor Sill	3408	-713	-15
3	A-Pillar Sill	3857	-756	-18
4	A-Pillar Low	3819	-754	-284
5	A-Pillar Mid	3736	-748	-772
6	B-Pillar Sill	2819	-723	-19
7	B-Pillar Low	2839	-777	-389
8	B-Pillar Mid	2826	-736	-794
9	Driver Seat Track	2921	-572	-51
10	Engine Top	4574	-100	-577
11	Firewall	4127	43	-620
12	Right Roof	2853	595	-1207
13	Right Floor Sill	3385	706	-11
14	Rear Floor Pan	1369	-4	-265
15	Left Front Door – Mid Centerline	3371	-795	-336
16	Left Front Door – Mid Rear	3014	-803	-325
17	Left Front Door – Upper Centerline	3354	-783	-614
18	Left Rear Door – Mid Rear	2308	-778	-386
19	Left Rear Door – Upper Centerline	2592	-813	-662
20	Rear Deck	439	-6	-273
21	Rear Deck ARS	380	-3	-265

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

DATA SHEET NO. 7
RIGID POLE LOAD CELL DATA AND ES-2re INJURY SUMMARY

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
 Test Date: 07/06/2023

RIGID POLE BARRIER AND LOAD CELL LOCATION



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

Loc. No	Description	Axes	Units	Peak Values (g's)			
				Max	Time (ms)	Min	Time (ms)
N/A	Pole Load Cell 1	Y	g	416.29	3.45	-22209.55	122.05
N/A	Pole Load Cell 2	Y	g	181.10	-1.20	-105765.00	49.90
N/A	Pole Load Cell 3	Y	g	276.49	-3.55	-60750.64	68.15
N/A	Pole Load Cell 4	Y	g	319.73	266.75	-32192.76	47.25
N/A	Pole Load Cell 5	Y	g	318.96	153.50	-17544.03	38.05
N/A	Pole Load Cell 6	Y	g	1168.65	28.45	-48085.42	38.40
N/A	Pole Load Cell 7	Y	g	1443.42	57.05	-2087.56	90.10
N/A	Pole Load Cell 8	Y	g	1501.69	73.40	-2339.50	59.20

DATA SHEET NO. 7
RIGID POLE LOAD CELL DATA

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
Test Date: 07/06/2023

Driver: ES-2re Serial No. F034 Injury Summary

	Nomenclature	Units	Source	Max	Max Time	Min	Min Time
Head	Head CG X Acceleration	g	CFC1000	5.38	145.40	-16.79	46.75
	Head CG Y Acceleration	g	CFC1000	53.14	53.45	-9.01	143.40
	Head CG Z Acceleration	g	CFC1000	7.52	39.25	-4.89	33.30
	Head Resultant Acceleration	g	Compute	54.10	53.60		
	36 ms HIC		Compute	228.96			
	15 ms HIC		Compute	206.24			
	Head Resultant Acceleration, 3 ms Clip	g	CFC1000	51.85			
	Head CG X Angular Rate	deg/s	CFC60	710.01	300.00	-641.40	121.50
	Head CG Y Angular Rate	deg/s	CFC60	660.33	103.55	-644.33	50.70
	Head CG Z Angular Rate	deg/s	CFC60	1096.52	157.50	-919.04	203.20
	Head CG Resultant Angular Rate	deg/s	CFC60	1187.70			
	Brain Injury Criteria (BrIC)		Compute	0.53			
Neck	Upper Neck Tension	N	CFC1000	792.16	53.55		
	Upper Neck Compression	N	CFC1000			-177.30	33.50
	Upper Neck Resultant Force	N	CFC1000	871.51	53.05		
	Upper Neck Resultant Moment	Nm	CFC600	36.15	65.50		
Shoulder	Shoulder Y Force	N	CFC600	2440.53	41.75	-129.93	89.35
	Shoulder Resultant Force	N	CFC600	2987.05			
Chest	Thorax Rib Upper Y Deflection	mm	CFC180	28.47	50.90	-2.95	88.10
	Thorax Rib Middle Y Deflection	mm	CFC180	25.50	50.95	-1.28	86.50
	Thorax Rib Lower Y Deflection	mm	CFC180	31.46	51.20	-2.31	92.05
	Thorax Rib Max. Deflection	mm	CFC180	31.46			
	Thorax Rib Avg. Deflection	mm	CFC180	28.48			
Abdomen	Abdomen Front Y Force	N	CFC600	395.20	48.85	-29.95	22.75
	Abdomen Middle Y Force	N	CFC600	520.26	49.15	-3.69	20.55
	Abdomen Rear Y Force	N	CFC600	641.56	49.60	-6.59	225.45
	Combined Abdominal Force	N	Compute	1554.15			
Spine	Lower Spine T12 Y Force	N	CFC600	2025.03	44.00	-547.54	83.25
	Lower Spine T12 X Moment	Nm	CFC600	118.96	75.70	-133.10	42.95
	Lower Spine T12 Resultant Acceleration	g	CFC180	58.14	47.70		
Pelvis	Lumbar Y Force	N	CFC600	1500.46	45.60	-525.83	78.35
	Lumbar Z Force	N	CFC600	3120.84	60.95	-368.72	31.65
	Lumbar X Moment	Nm	CFC600	74.15	47.40	-10.67	156.90
	Pubic Symphysis Y Force	N	CFC600	32.87	241.30	-2204.99	46.75
	Pelvis Resultant Acceleration	g	CFC1000	54.64			
	Anomalies None						

**DATA SHEET NO. 8
POST-TEST OBSERVATIONS**

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
Test Date: 07/06/2023

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Driver Seat Dummy (ES-2re)
Face	Curtain Airbag
Top of Head	Side header & Curtain Airbag
Left Side of Head	Curtain Airbag & Side Header
Back of Head	Headrest & Side header
Left Shoulder	Curtain Airbag & Driver Door
Upper Torso	Torso/Pelvis Airbag and Seatback
Lower Torso	Torso/Pelvis Airbag and Seatback
Left Hip	Seat pan & Driver Door
Left Knee	Driver Door

POST-TEST DOOR PERFORMANCE

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

POST-TEST SEAT PERFORMANCE

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

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

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
Test Date: 07/06/2023

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	B-pillar buckled
Sill Separation	None
Windshield Damage	Cracked throughout
Side Window Damage	Driver window shattered during impact
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

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

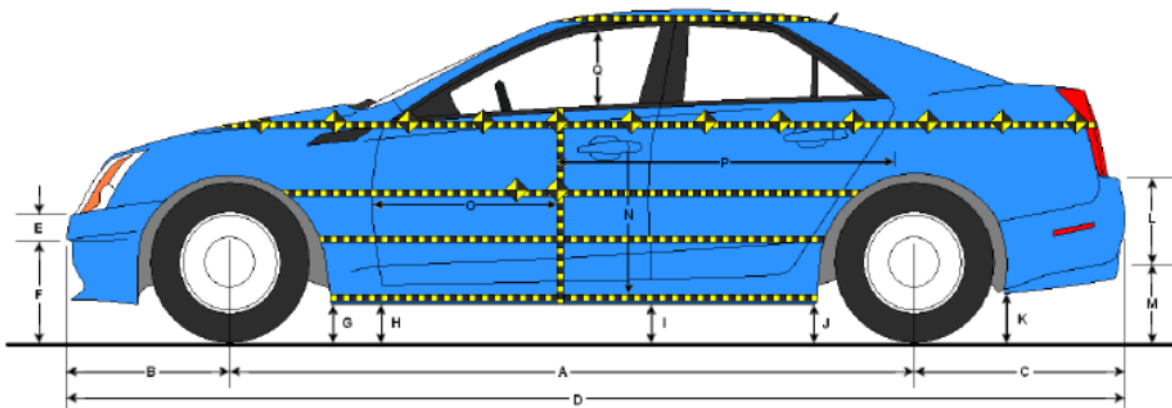
Measured Parameter	Units	Tolerance	Value
Vertical Impact Ref Line - Aft of Front Axle, Intended Impact Pt	mm		1354
Actual Impact Point - Aft of Front Axle	mm		1354
Horizontal Offset (+ forward / - rearward)	mm	+/- 38*	0
Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion	deg	75 +/- 3	75
Trap No. 1 Velocity - Primary	kph	30.2 to 31.8	30.98
Trap No. 2 Velocity - Redundant	kph	30.2 to 31.8	30.94

*Of Intended Impact Point

DATA SHEET NO. 9
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
Test Date: 07/06/2023



LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

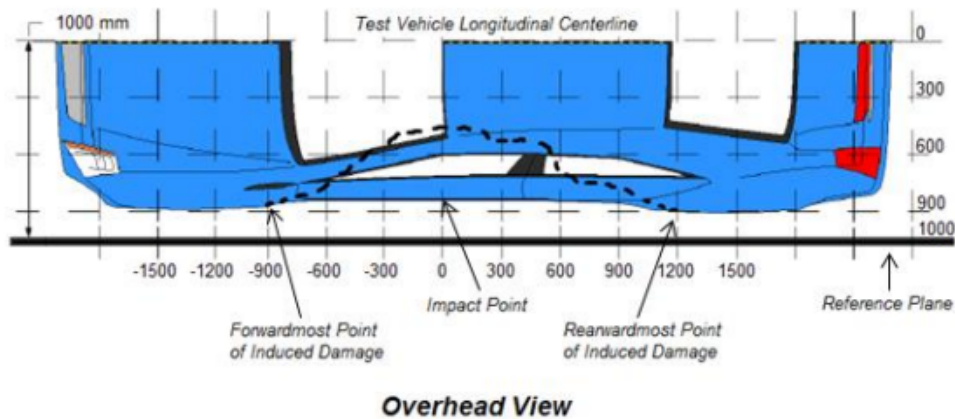
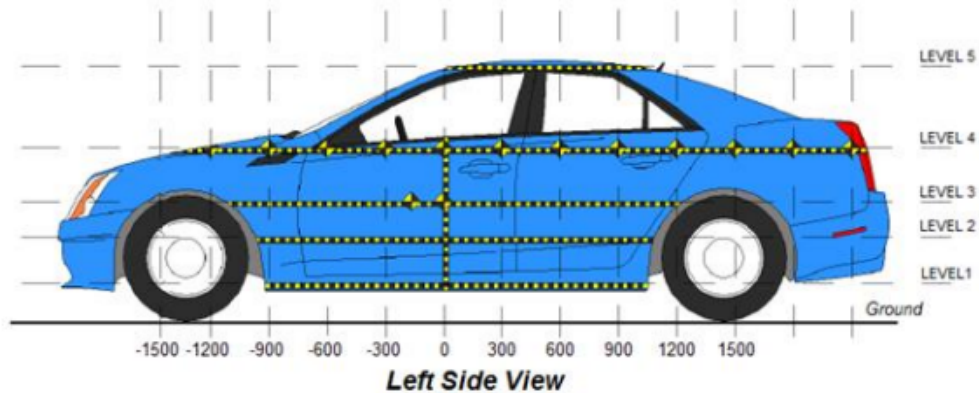
No.	Measurement Description	Pre-Test	Post-Test	Difference
A	Vehicle Wheelbase	3252	3213	-39
B	Front Axle to FSOV	923	945	22
C	Rear Axle to RSOV	1201	1165	-36
D	Total Length at Centerline	5375	5323	-52
E	Front Bumper Thickness	115	115	0
F	Front Bumper Bottom to Ground	535	548	13
G	Sill Height at Front Wheel Well	411	414	3
H	Sill Height at Front Door Leading Edge	411	413	2
I	Sill Height at B Pillar	421	394	-27
J1	Sill Height at Rear Wheel Well	441	464	23
J2	Pinch Weld Height at Rear Wheel Well	420	438	18
K	Sill Height Aft of Rear Wheel Well	460	543	83
L	Rear Bumper Thickness	141	141	0
M	Rear Bumper Bottom to Ground	503	567	64
N	Sill Height to Bottom of Front Window Sill	740	728	-12
O	Front Door Leading Edge to Impact CL	773	681	-92
P	Rear Door Trailing Edge to Impact CL	969	845	-124
Q	Front Window Opening	421	424	3
R	Right Side Length	5351	5310	-41
S	Left Side Length	5351	5269	-82
T	Vehicle Width at B-Pillars	1806	1576	-230

* All measurements in mm with tolerance of $\pm 3\text{mm}$

DATA SHEET NO.10 **TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS**

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
 Test Date: 07/06/2023



MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	584	590	0
2	Driver H-Point	mm	844	574	0
3	Mid-Door	mm	886	571	0
4	Window Sill	mm	1224	485	0
5	Window Top	mm	1734	230	0

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

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

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
 Test Date: 07/06/2023

EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

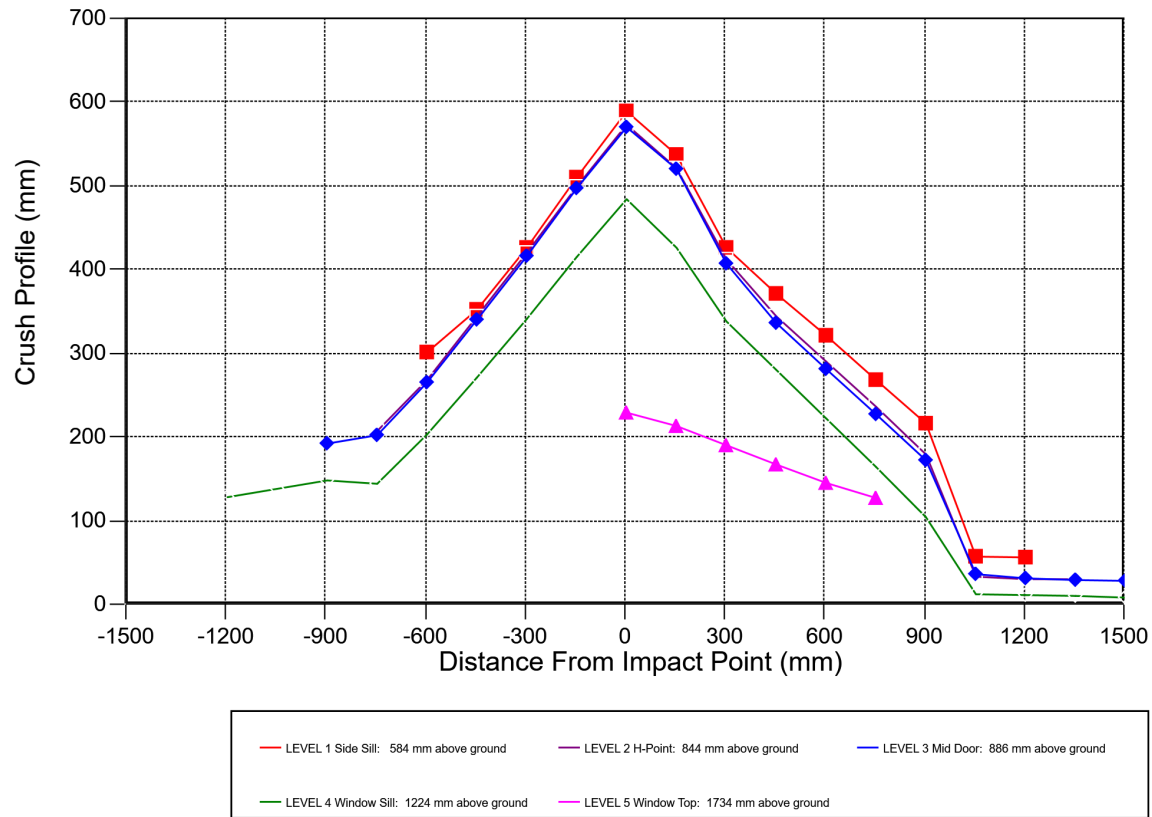
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1500															
-1350															
-1200				828					699					129	
-1050				834					695					139	
-900			940	838				747	689				193	149	
-750		919	917	842			711	714	697			208	203	145	
-600	883	900	900	845		581	631	634	641		302	269	266	204	
-450	884	898	900	847		531	553	559	575		353	345	341	272	
-300	885	898	900	850		458	477	483	508		427	421	417	342	
-150	886	899	901	853		375	399	403	437		511	500	498	416	
0	886	899	901	855	635	296	325	330	370	405	590	574	571	485	230
150	886	899	902	856	641	348	377	381	429	427	538	522	521	427	214
300	886	901	903	859	644	459	488	495	520	453	427	413	408	339	191
450	884	900	902	860	643	512	555	565	579	475	372	345	337	281	168
600	883	898	900	861	639	561	607	618	638	493	322	291	282	223	146
750	880	896	898	860	628	611	659	670	695	500	269	237	228	165	128
900	874	890	893	855		657	710	720	750		217	180	173	105	
1050	857	875	878	839		799	841	841	826		58	34	37	13	
1200	851	878	879	838		794	847	847	826		57	31	32	12	
1350		898	897	836			867	867	825			31	30	11	
1500			936	834				907	825				29	9	

NOTE: Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition. Vehicle measurements forward of the vertical impact reference line are negative. The crush profile grid is established prior to the test based on an estimated impact point. The final distance from impact is determined after the final dummy positioning and the pole is aligned with the center of gravity of the dummy's head.

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

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
Test Date: 07/06/2023



Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO.11 **VEHICLE DAMAGE PROFILE DISTANCE**

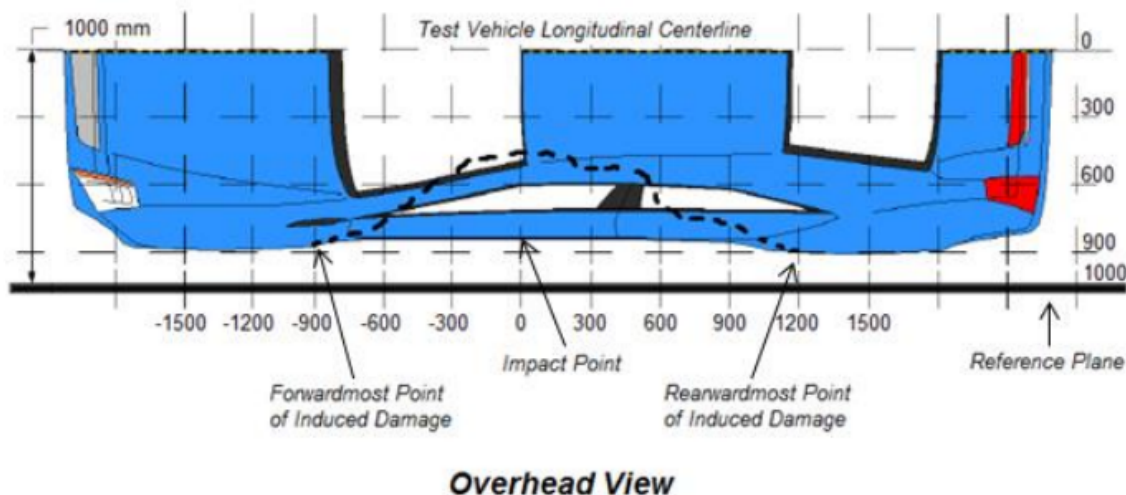
Test Vehicle: 2019 Toyota Tacoma 4 Door Truck

NHTSA No.: R20195150

Test Program: Research Side Pole Impact Test

Test Date: 07/06/2023

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



VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance From Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	-900	3	253	60	193
2	-420	3	456	100	356
3	60	3	650	99	551
4	540	3	403	99	304
5	1020	3	183	119	64
6	1500	3	93	64	29

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

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
Test Program: Research Side Pole Impact Test

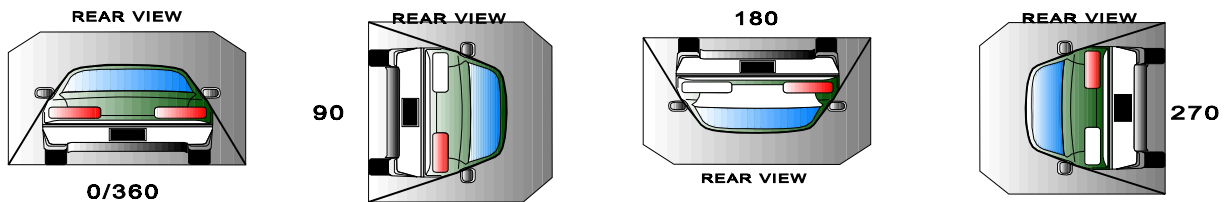
NHTSA No.: R20195150
Test Date: 07/06/2023

Test Time: 10:12 AM

Temperature: 21 °C

- A. From impact until vehicle motion ceases: 0 oz
(Maximum allowable is 1 oz.)
B. For the 5-minute period after motion ceases: 0 oz
(Maximum allowable is 5 oz.)
C. For the following 25 minutes: 0 oz
(Maximum allowable is 1 oz.)

D. Spillage Detail: No Spillage Occurred



ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°			
90° to 180°			
180° to 270°			
270° to 360°			

FMVSS 301 SPILLAGE TABLE

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

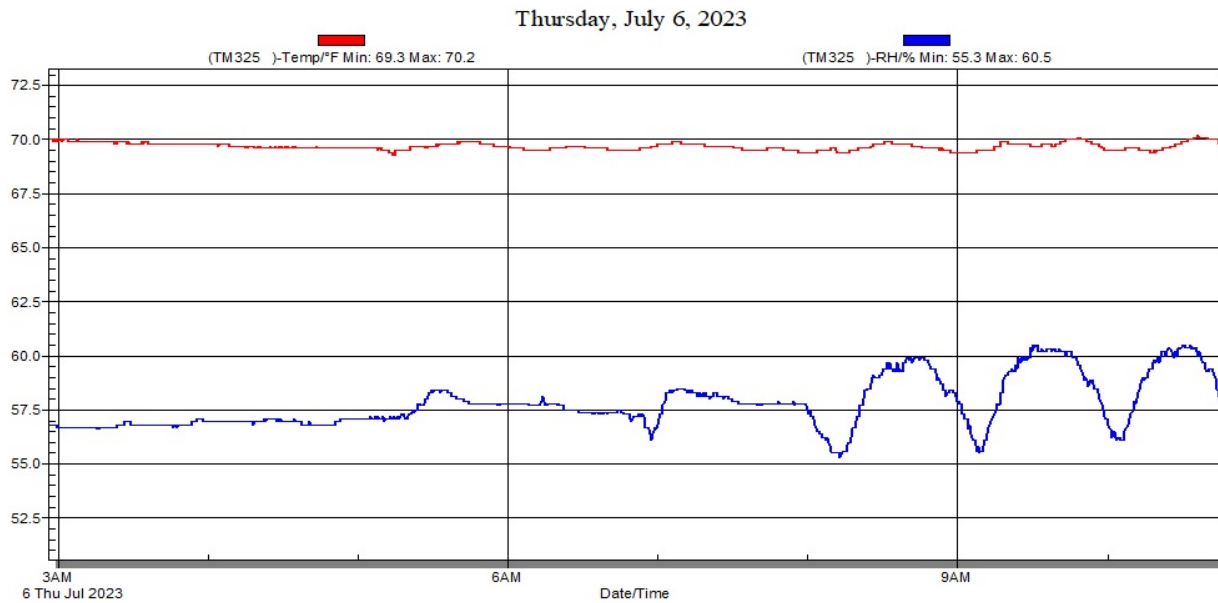
SOLVENT SPILLAGE LOCATION TABLE

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

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

Test Vehicle: 2019 Toyota Tacoma 4 Door Truck
Test Program: Research Side Pole Impact Test

NHTSA No.: R20195150
Test Date: 07/06/2023



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

APPENDIX A
PHOTOGRAPHS

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Figure A-1: As Delivered Right Front $\frac{3}{4}$ View of Test Vehicle



Figure A-2: As Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle



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

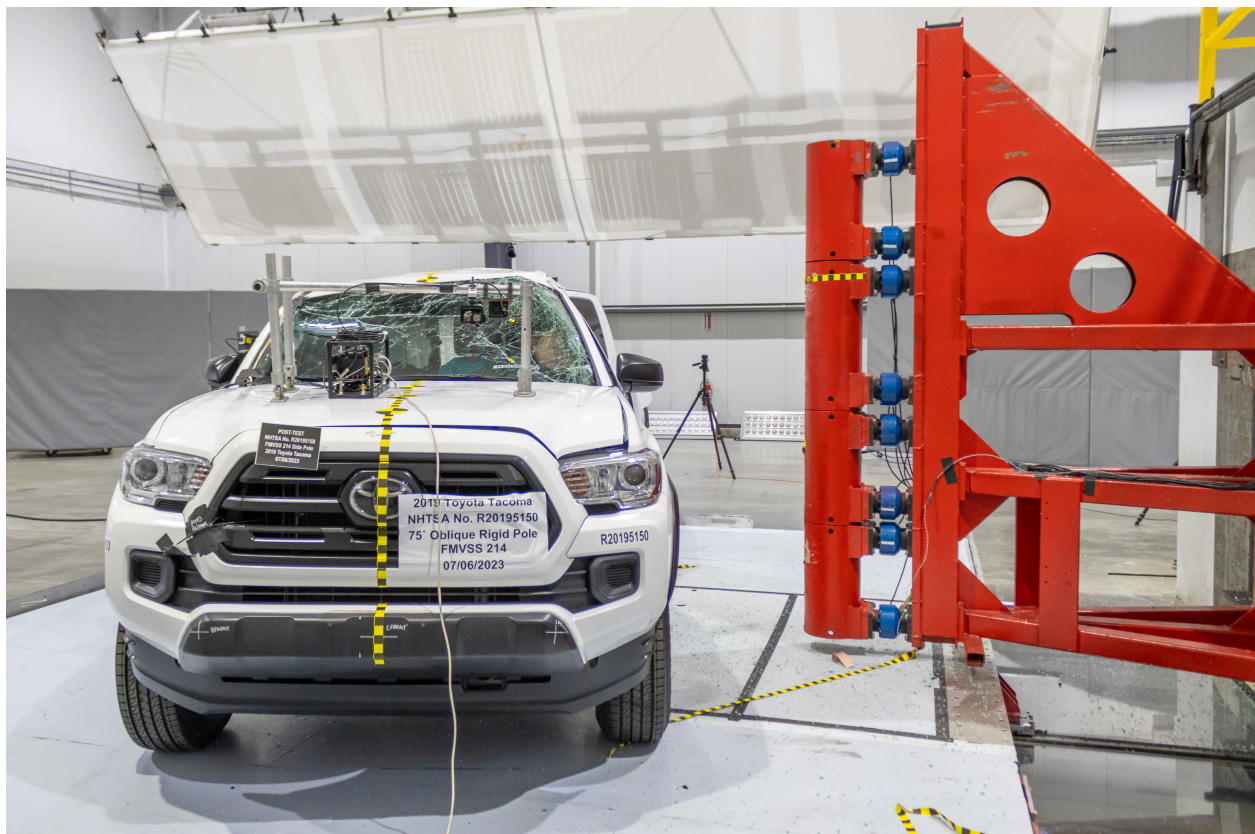


Figure A-4: Post-Test Frontal View of Test Vehicle



Figure A-5: Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle



Figure A-6: Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle



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



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



Figure A-9: Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



Figure A-10: Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



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



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



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



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



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

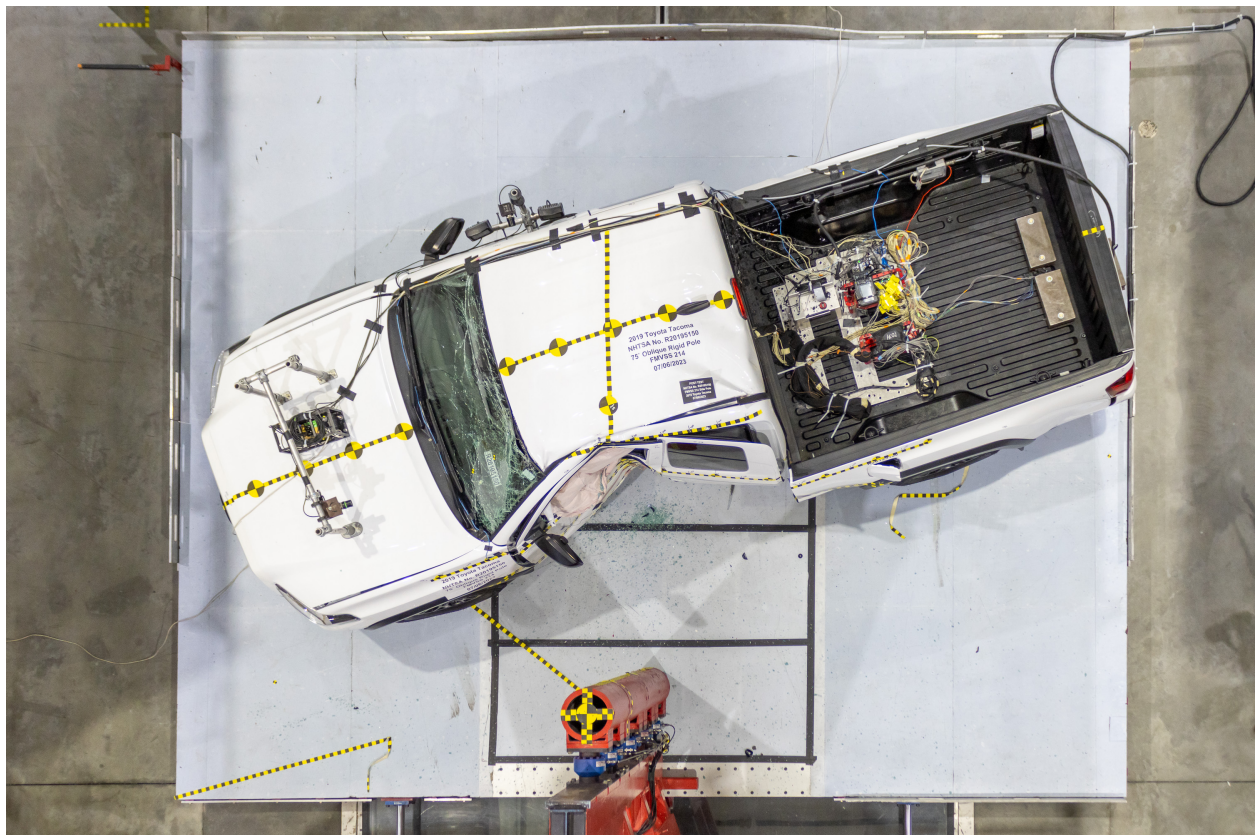


Figure A-16: Post-Test Overhead View of Test Area



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



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



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



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



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



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



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



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



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



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



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



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



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

Photo Not Applicable

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

Photo Not Applicable

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



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



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



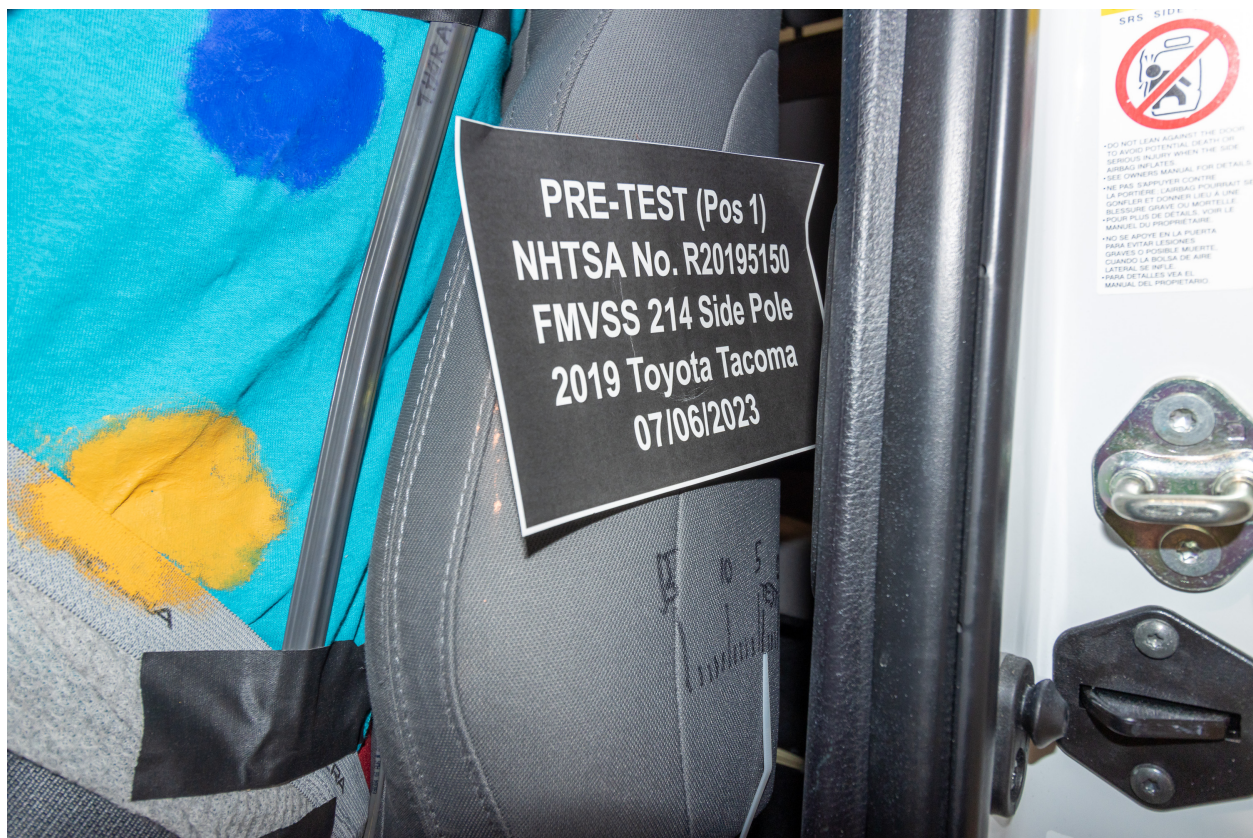
Figure A-34: Pre-Test Left Side View of Steering Wheel



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



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



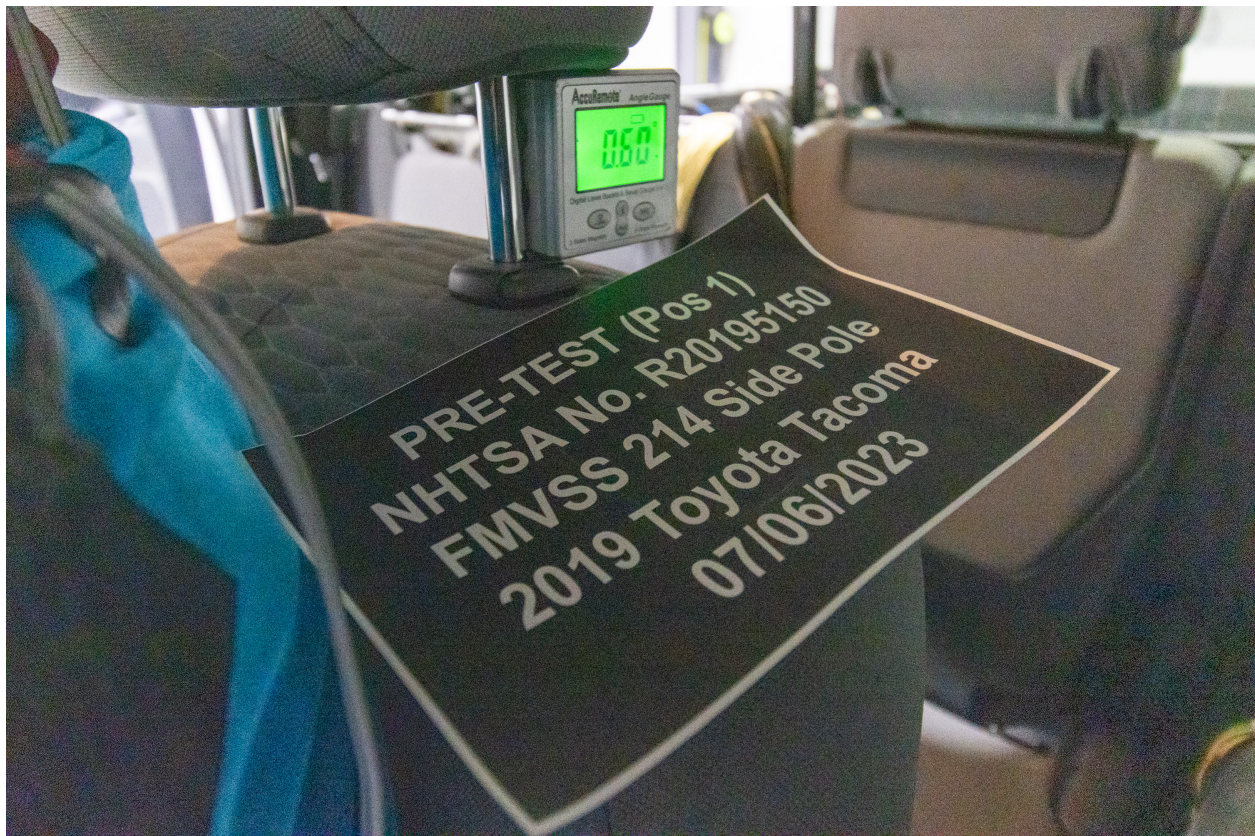


Figure A-39: Pre-Test Close-Up View of Driver Seat Back or Head Restraint



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



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



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



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



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



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



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



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



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



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



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



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



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



Figure A-53: Pre-Test Right Side View of Dummy and Rear Seat of Occupant Compartment



Figure A-54: Post-Test Inner Rear Passenger Torso Air Bag Deployment View



Figure A-55: Pre-Test View of Fuel Filler Cap or Fuel Filler Neck



Figure A-56: Post-Test View of Fuel Filler Cap or Fuel Filler Neck



Figure A-57: Close-Up View of Vehicle's Certification Label

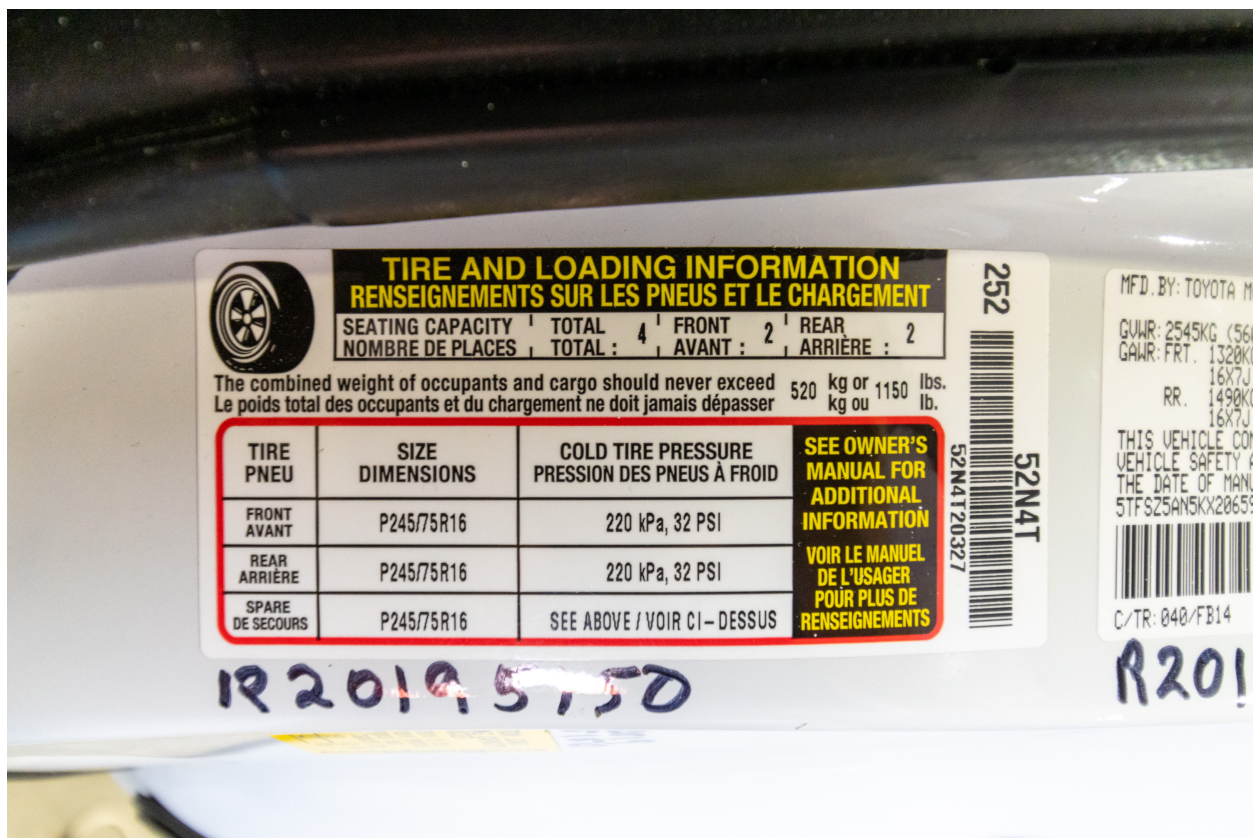


Figure A-58: Close-Up View of Vehicle's Tire Information Placard or Label

Photo Not Available

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



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

Photo Not Available

Figure A-61: Pre-Test Pole Barrier Side View

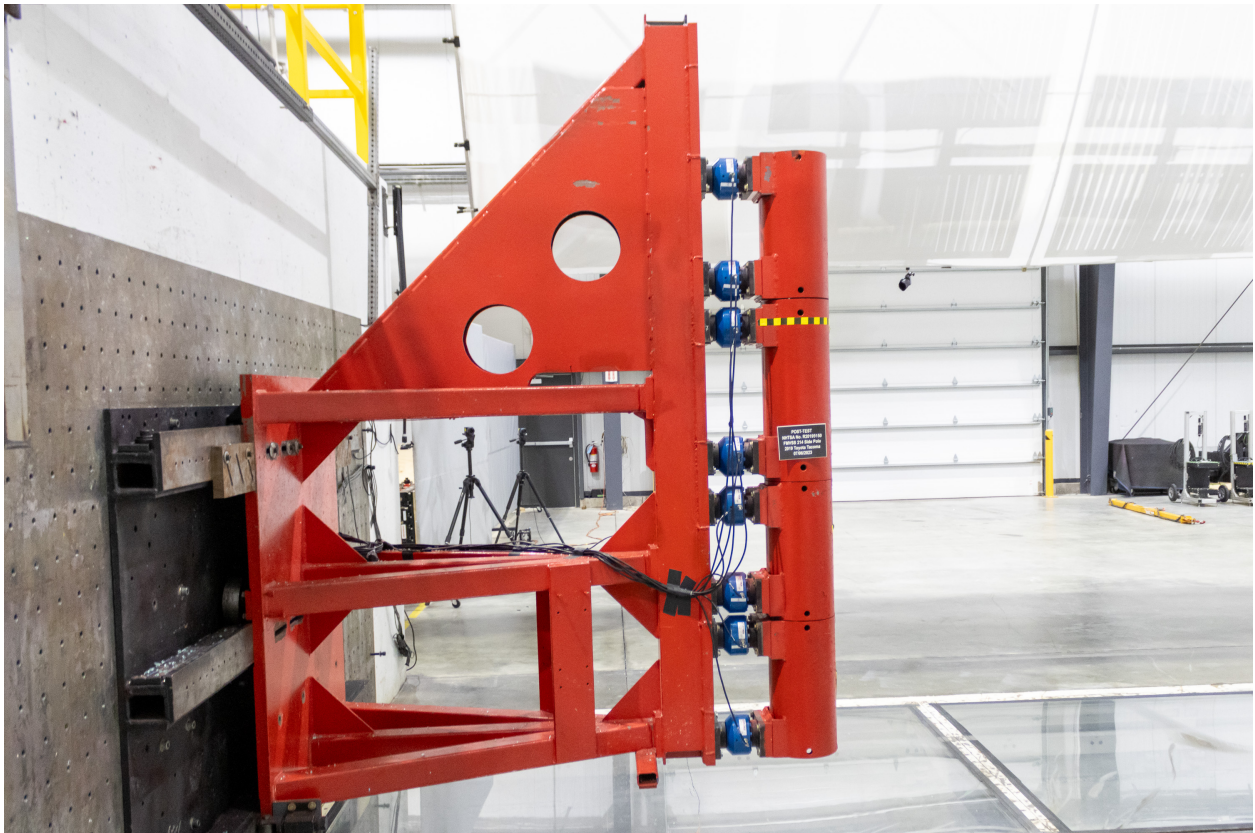


Figure A-62: Post-Test Pole Barrier Side View



Figure A-63: Pre-Test Ballast View



Figure A-64: Post-Test Primary and Redundant Speed Trap Read-Out

Photo Not Applicable

Figure A-65: FMVSS No. 301 Static Rollover 0 Degrees

Photo Not Applicable

Figure A-66: FMVSS No. 301 Static Rollover 90 Degrees

Photo Not Applicable

Figure A-67: FMVSS No. 301 Static Rollover 180 Degrees

Photo Not Applicable

Figure A-68: FMVSS No. 301 Static Rollover 270 Degrees



Figure A-69: FMVSS No. 301 Static Rollover 360 Degrees



Figure A-70: Impact Event

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Horsepower: 278 @ 6000

Torque: 265 @ 4600

Fuel: 18 City 22 Hwy

Front/Side Crash Ratings: /

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Automatic Highbeams	Front Side Air Bag	Sliding Rear Window
Auxiliary Audio Input	Gasoline Fuel	Stability Control
Back-Up Camera	Immobilizer	Steering Wheel Audio Controls
Bluetooth Connection	Intermittent Wipers	Tire Pressure Monitor
Brake Actuated Limited Slip	Knee Air Bag	Tires - Front All-Season
Brake Assist	Lane Departure Warning	Tires - Rear All-Season
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Figure A-71: Monroney Label

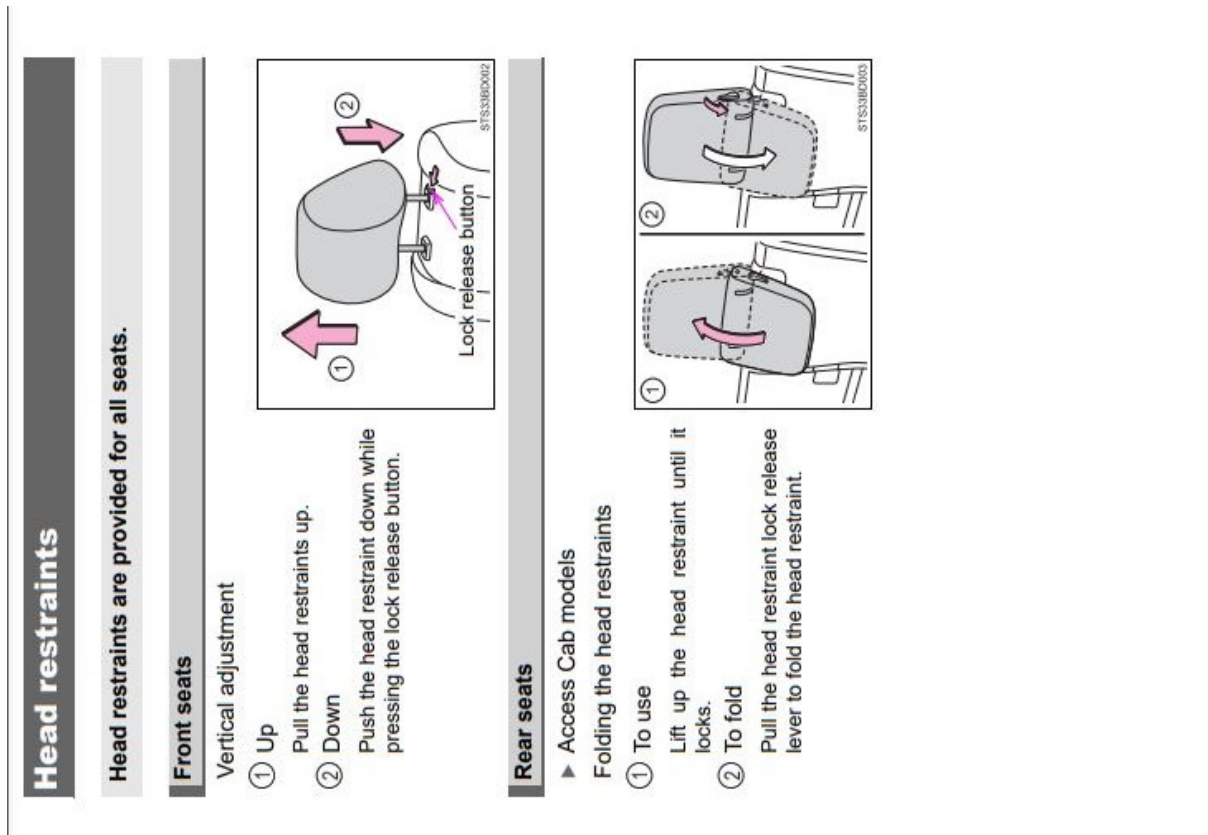


Figure A-72: Head Restraint Use and Adjustment Information from Vehicle Owner's Manual



Figure A-73: Post-Test View of Shattered Vehicle Inner Door Panel

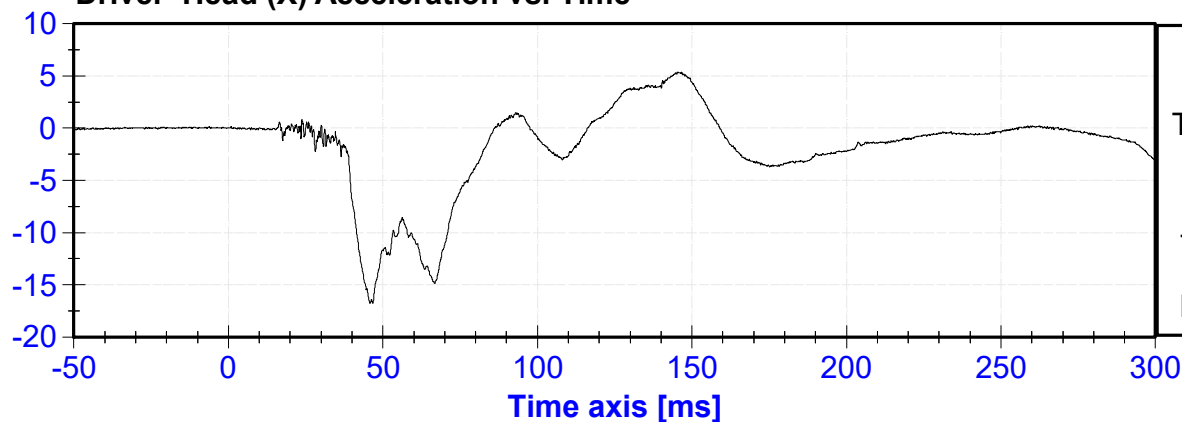
Data Traces
VEHICLE & DUMMY RESPONSE DATA TRACES

Table of Data Plots

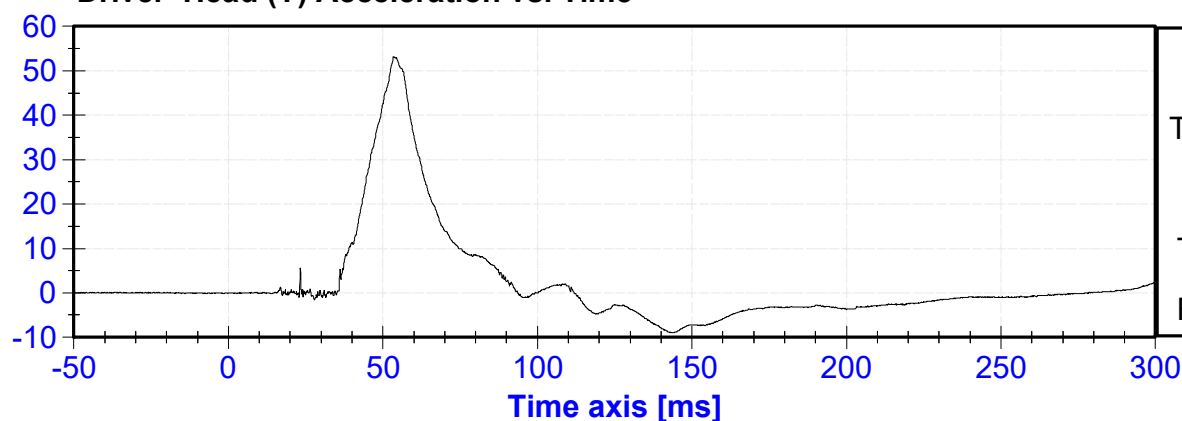
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3	Driver Head (Z) Acceleration vs. Time	B-4
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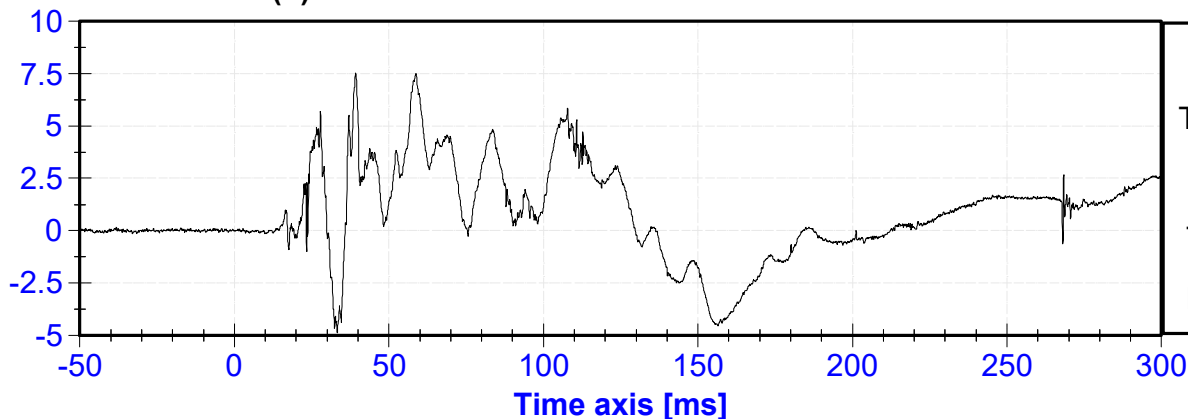
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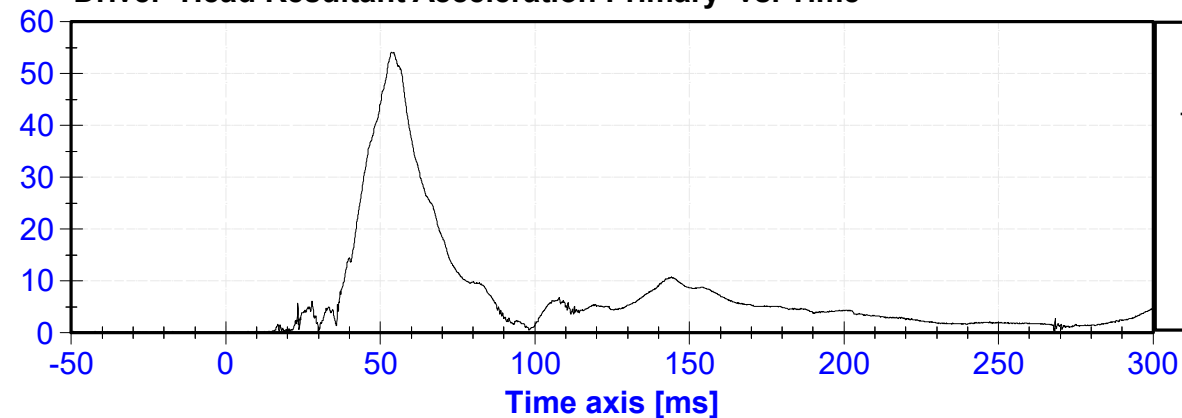
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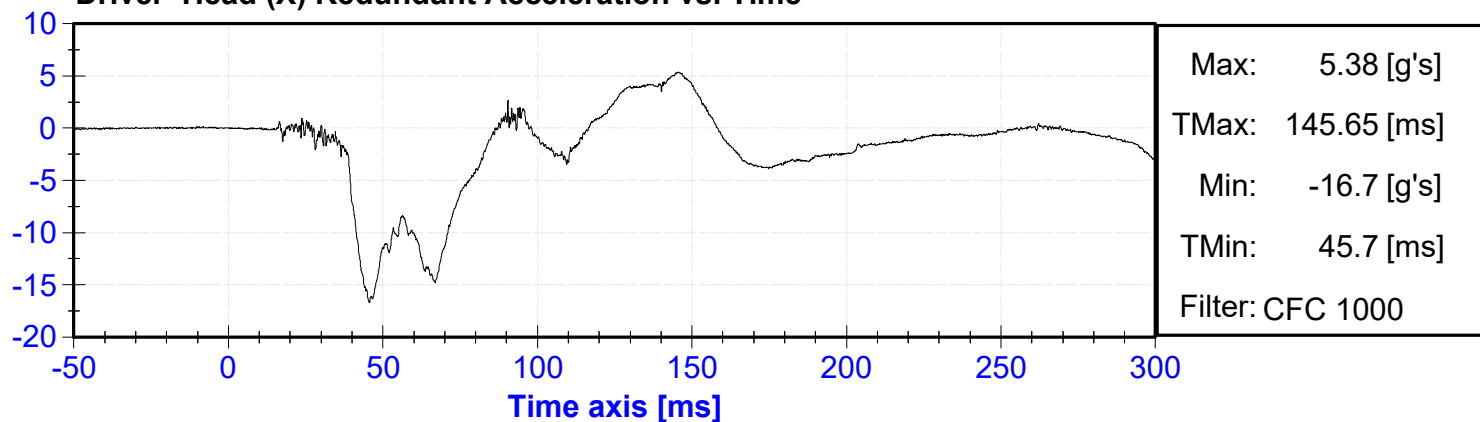
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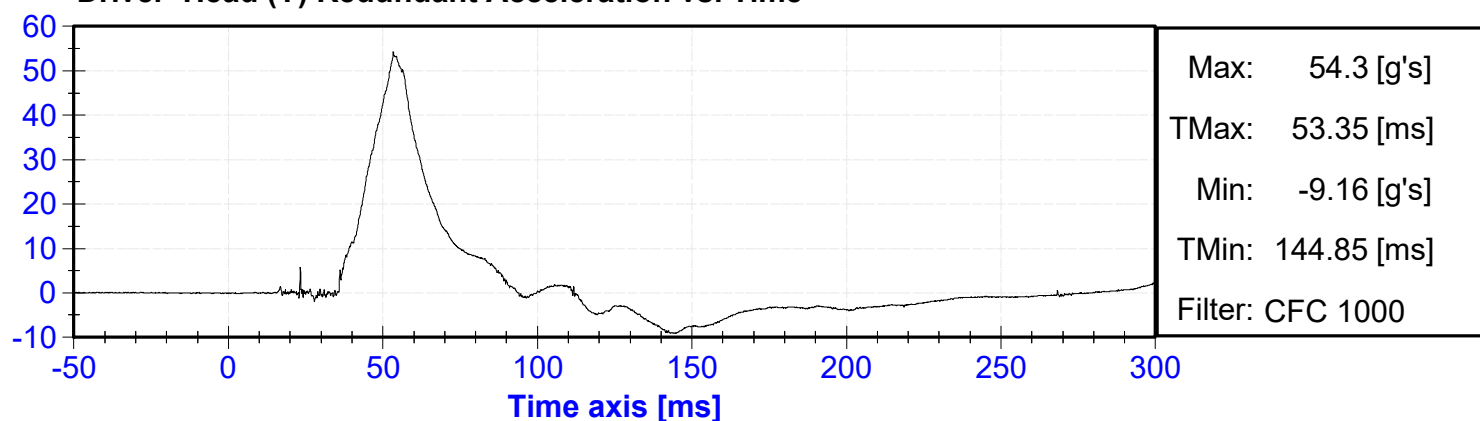
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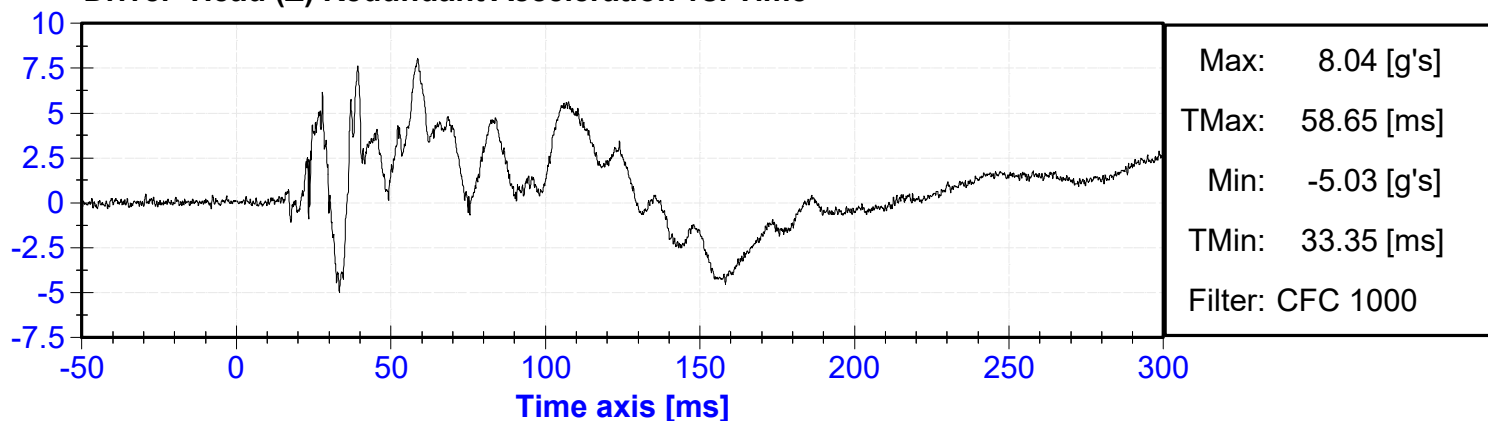
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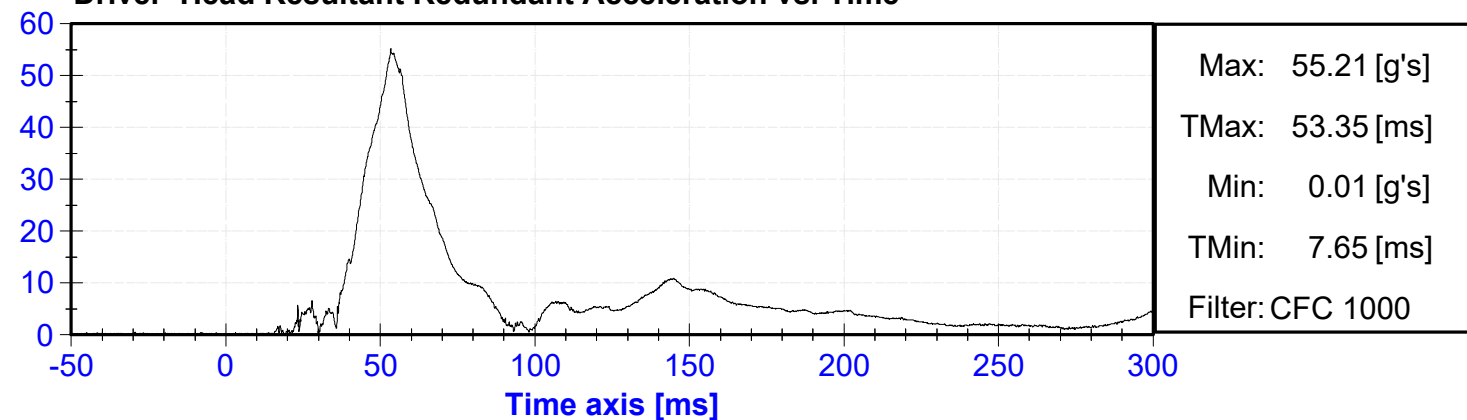
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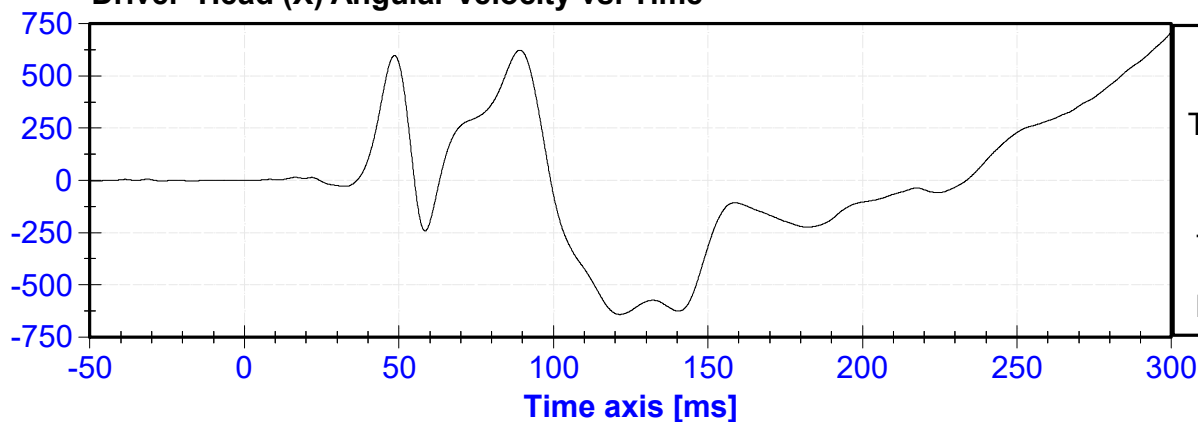
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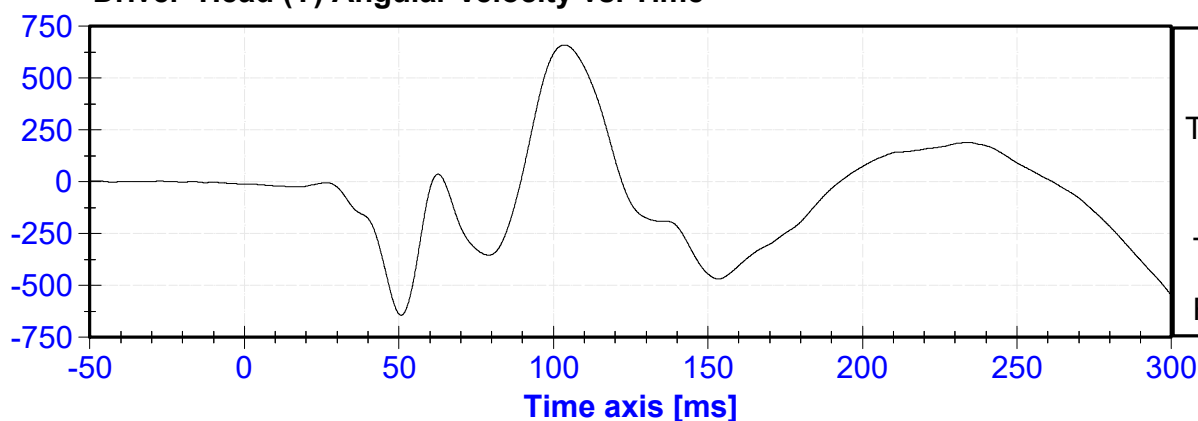
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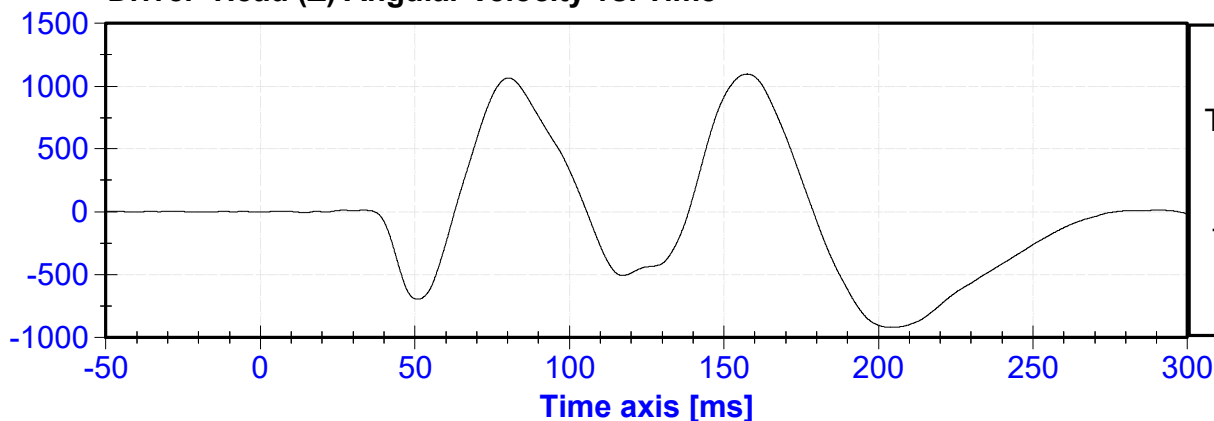
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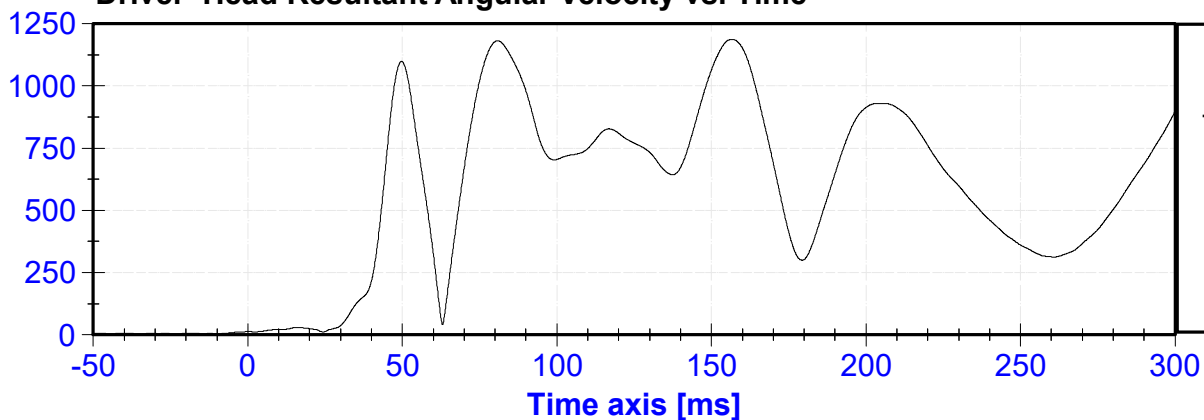
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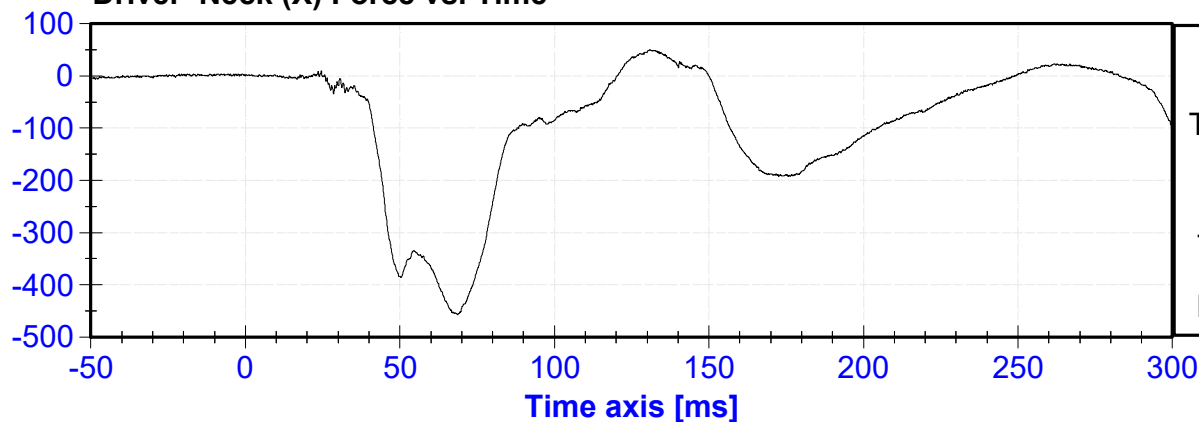
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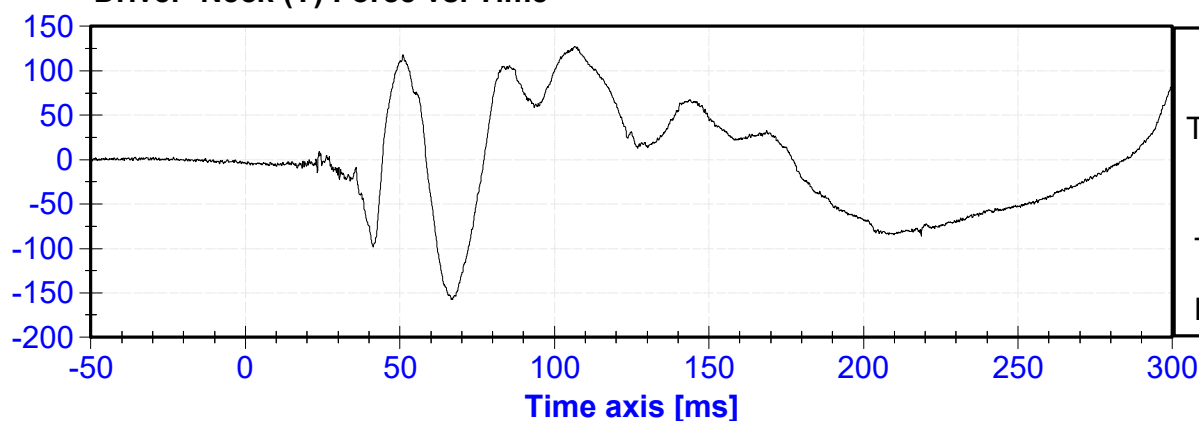
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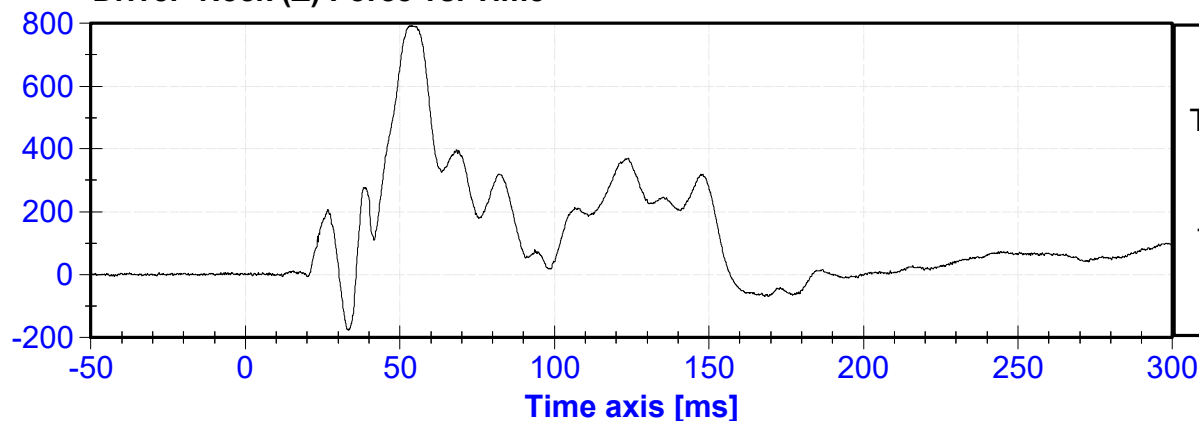
Driver Neck (X) Force vs. Time



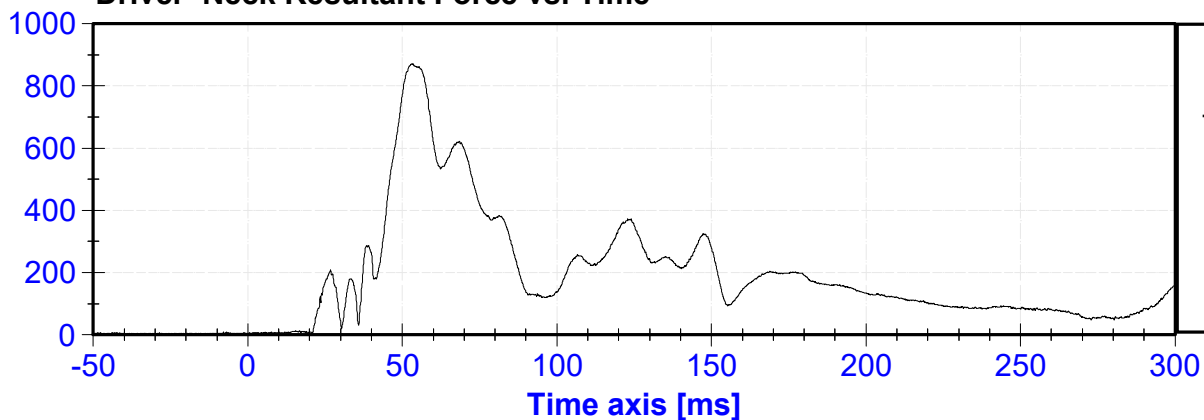
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Driver Neck (Z) Force vs. Time

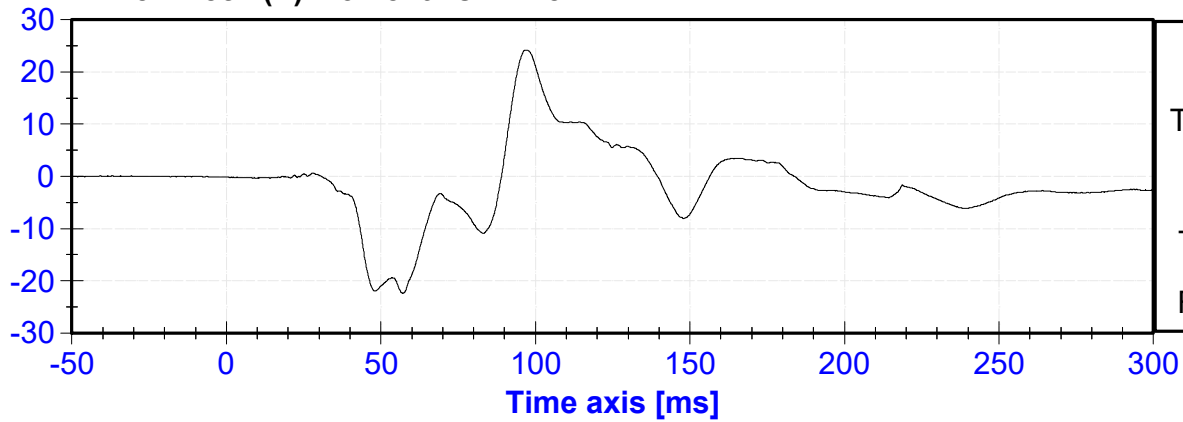


Driver Neck Resultant Force vs. Time



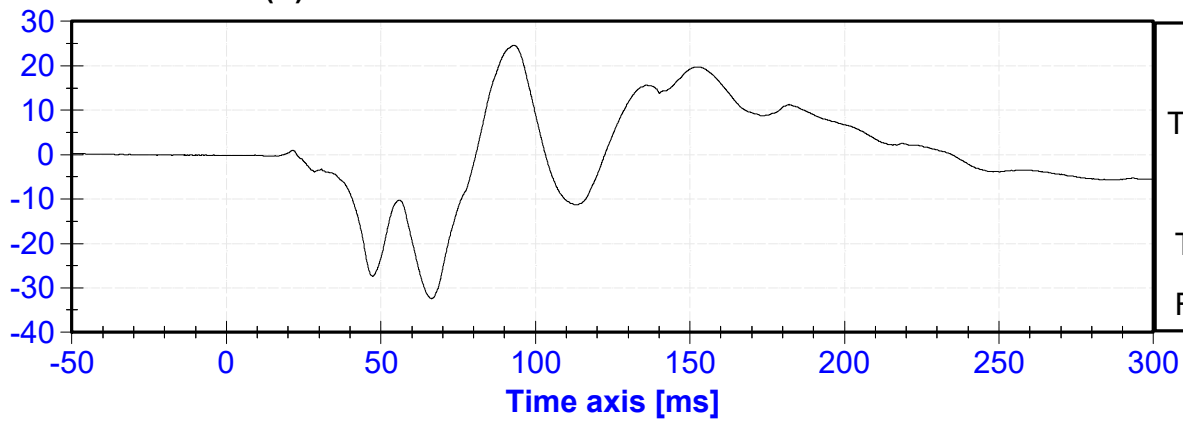
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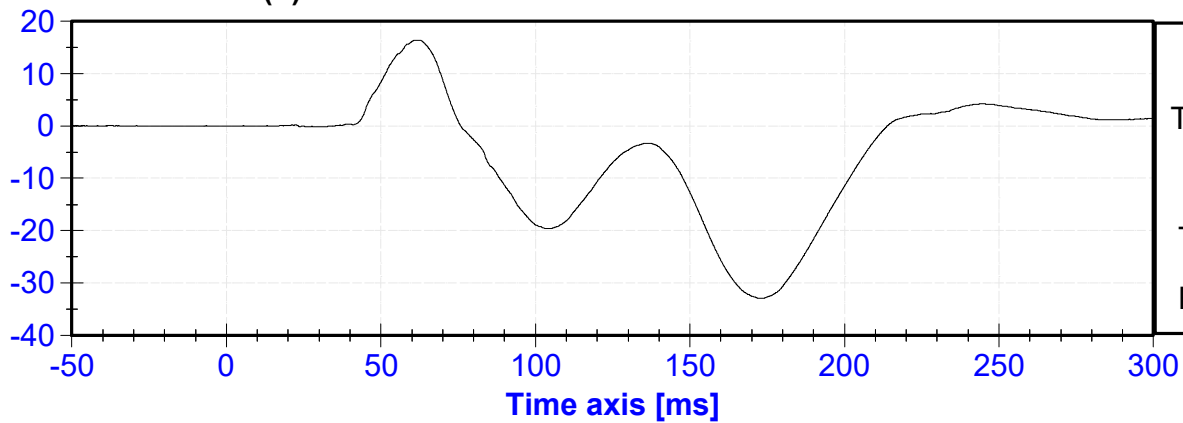
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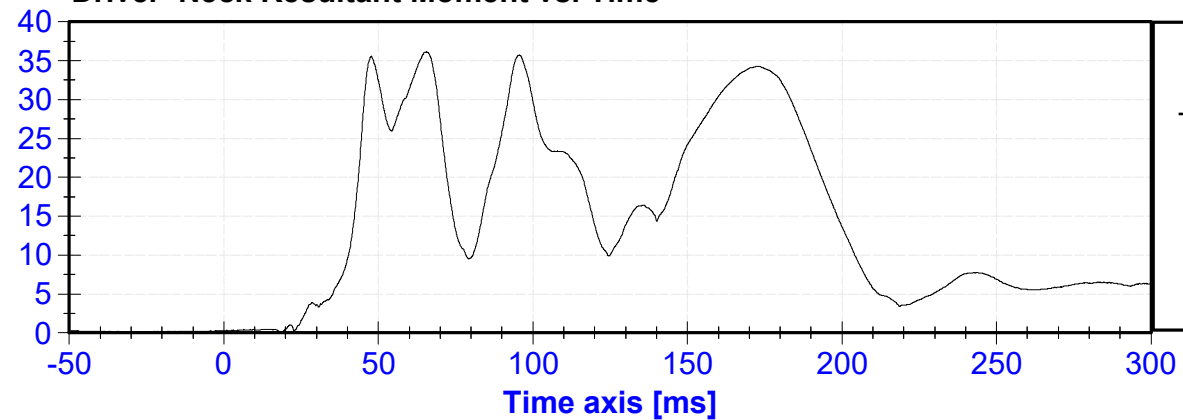
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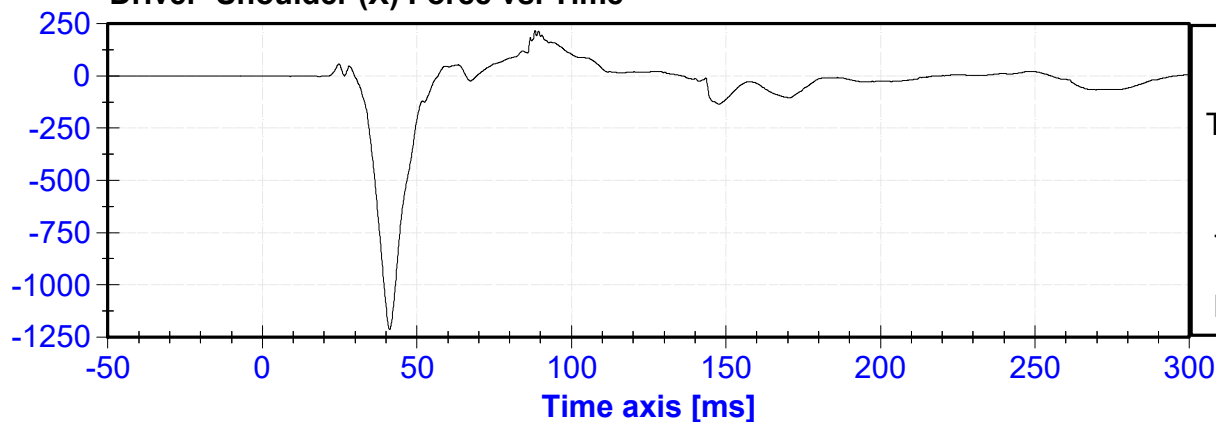


Driver Neck Resultant Moment vs. Time

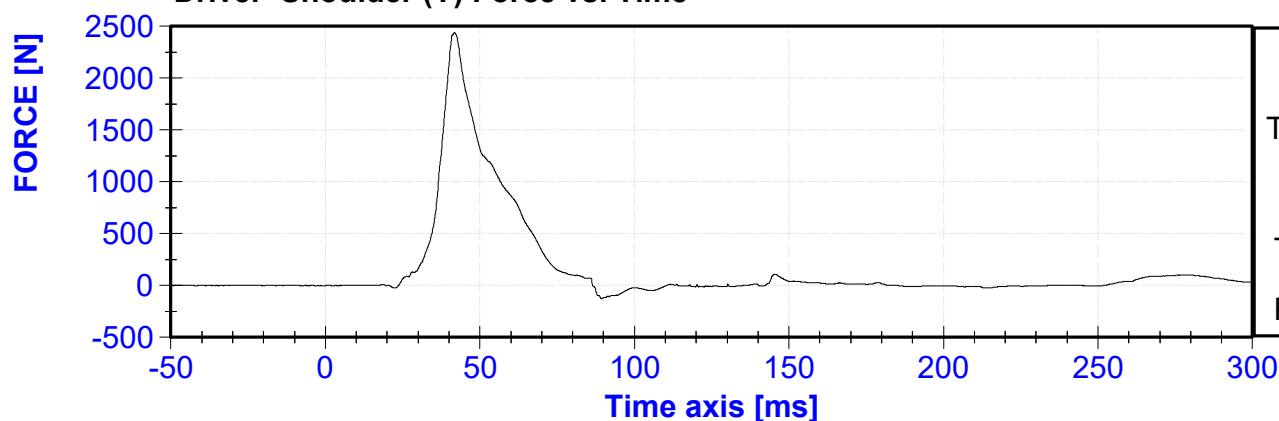
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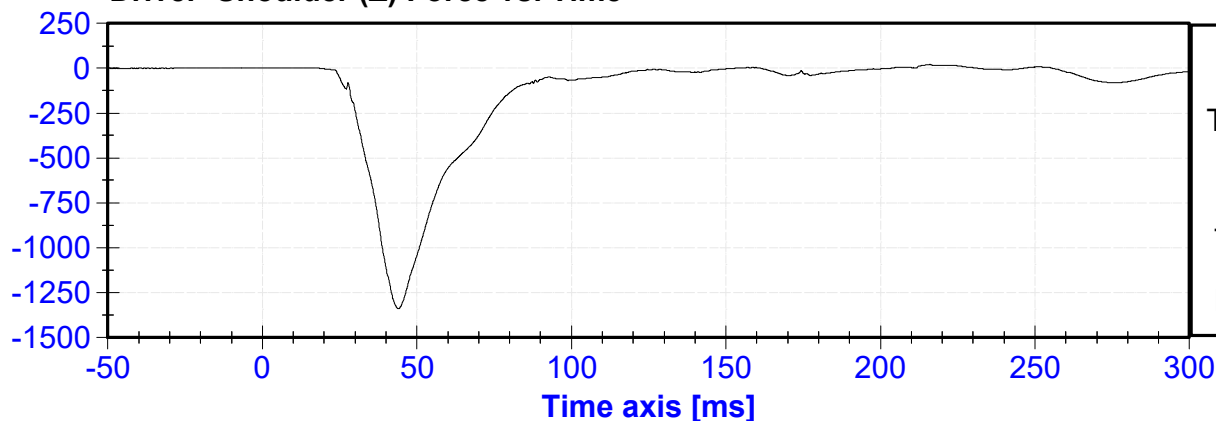
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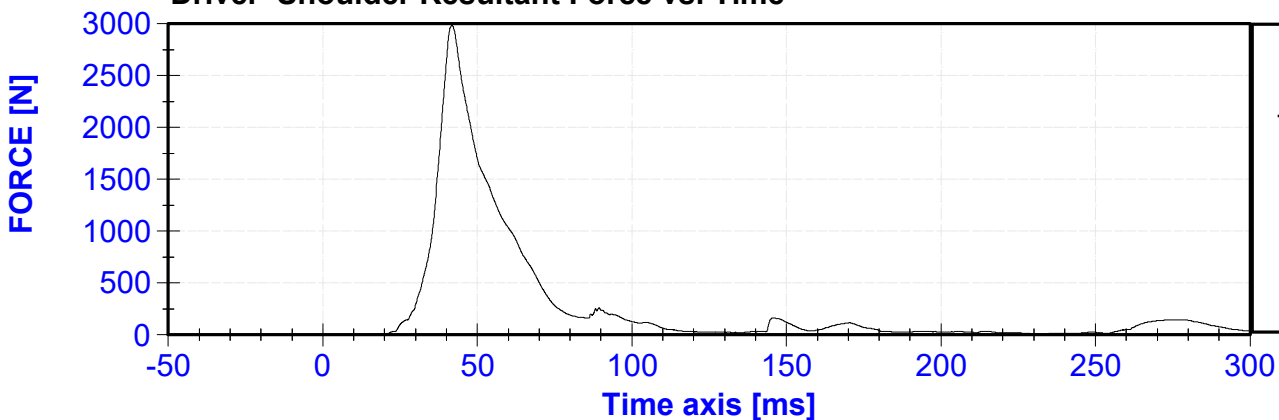
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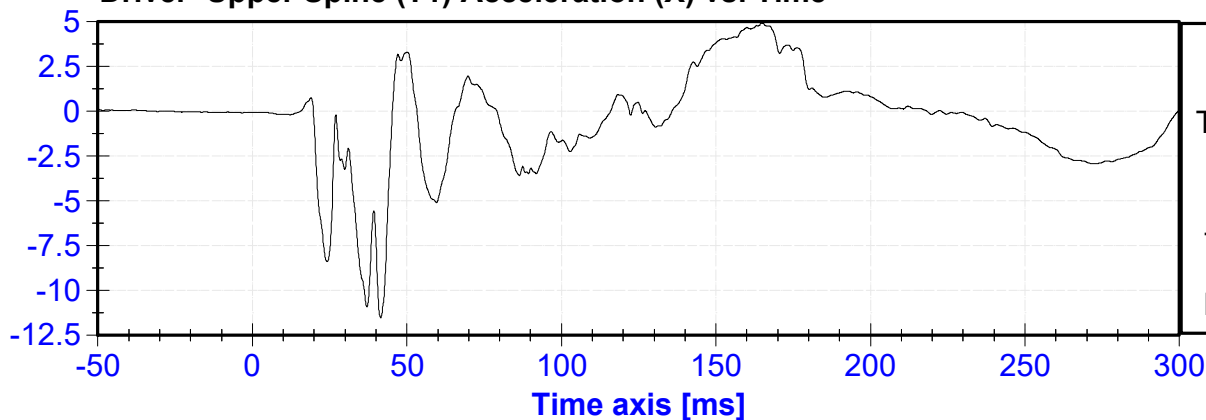
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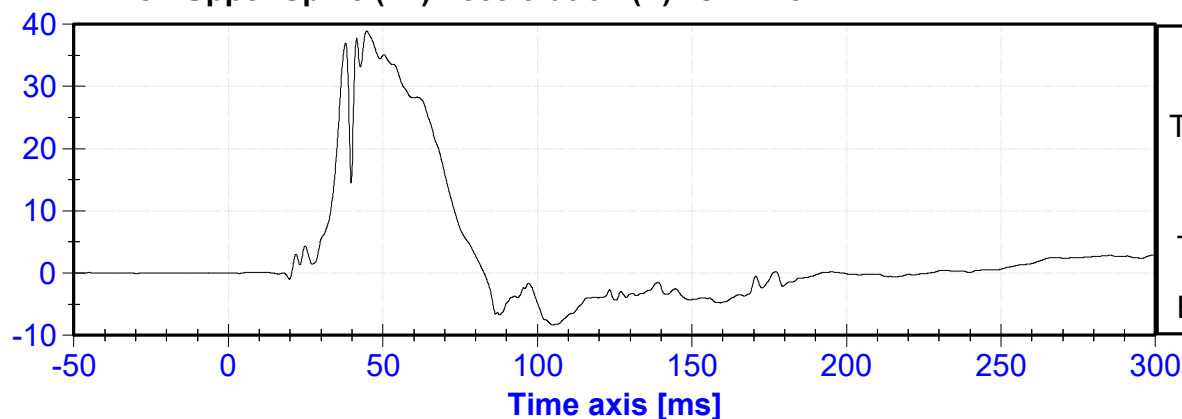
Driver Shoulder Resultant Force vs. Time



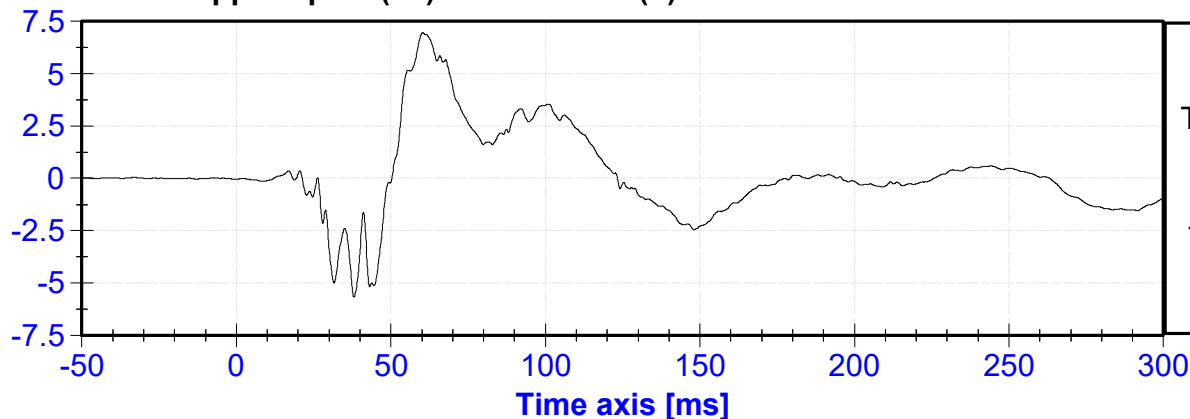
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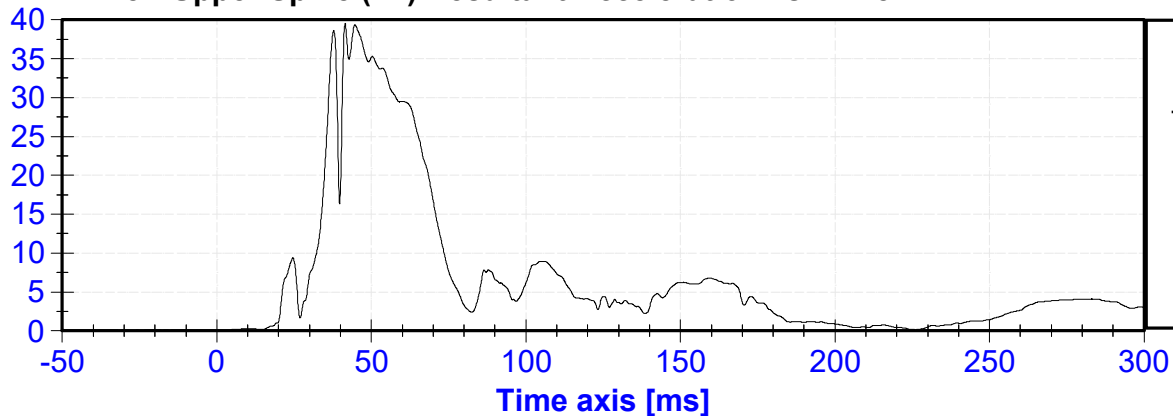
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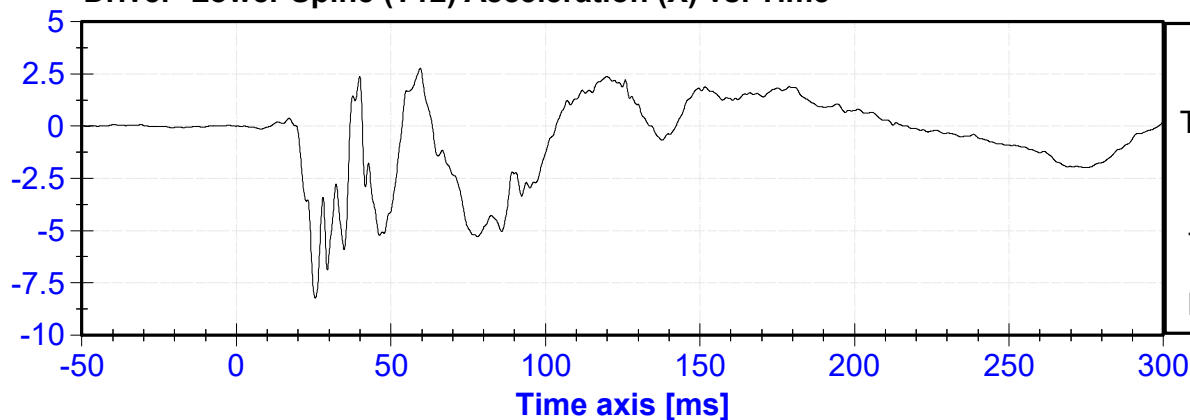
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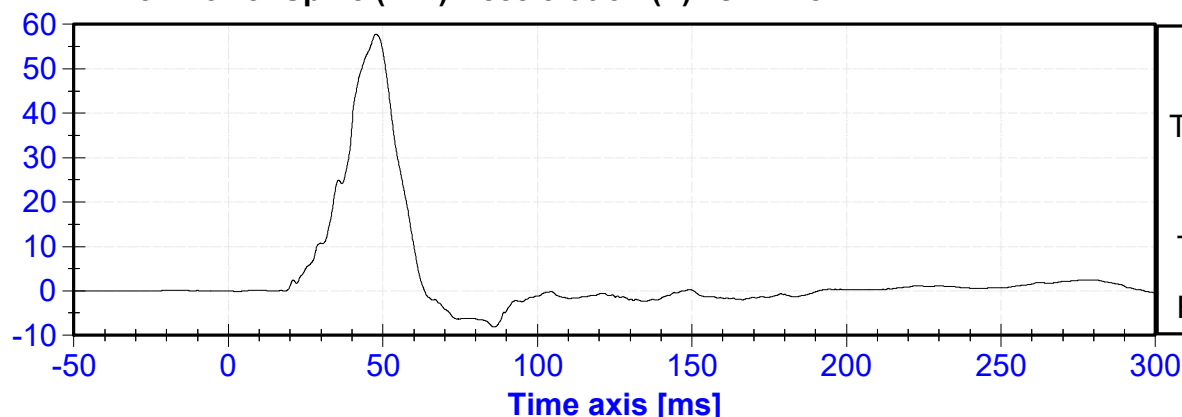
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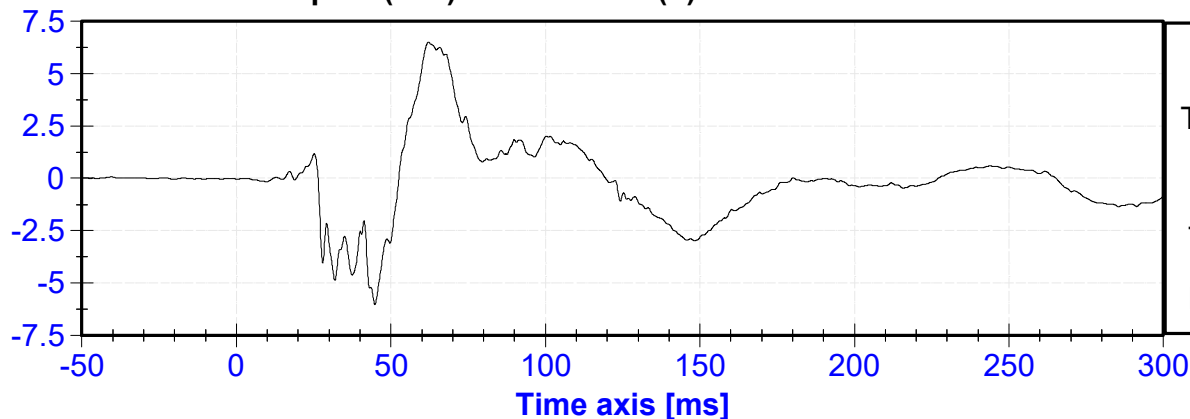
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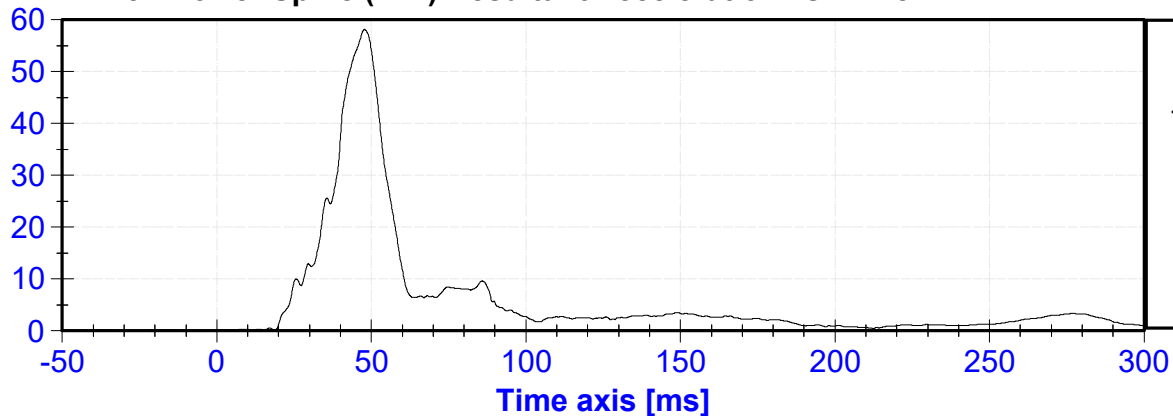
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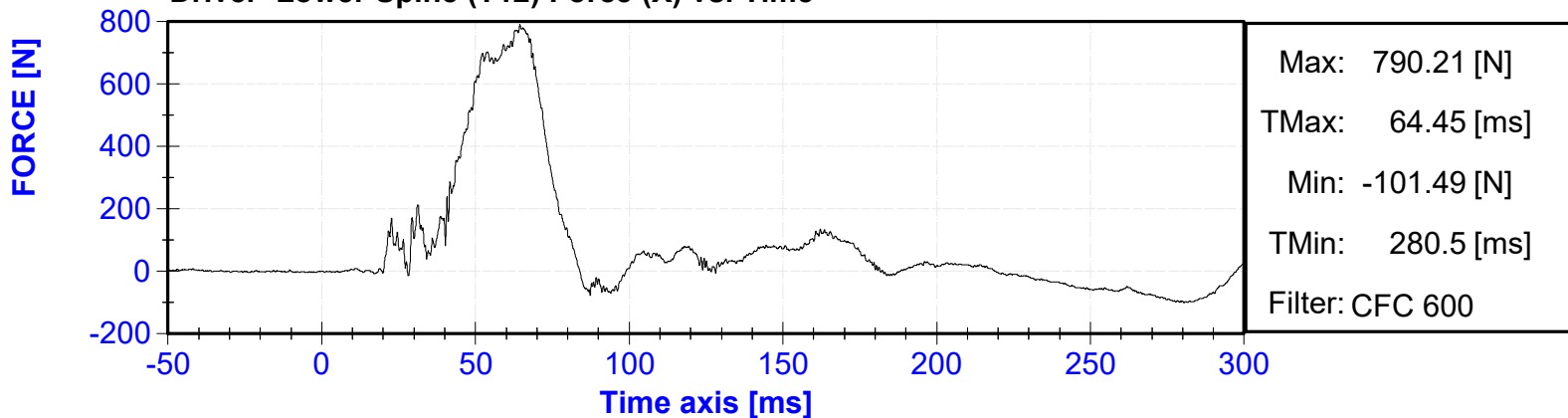
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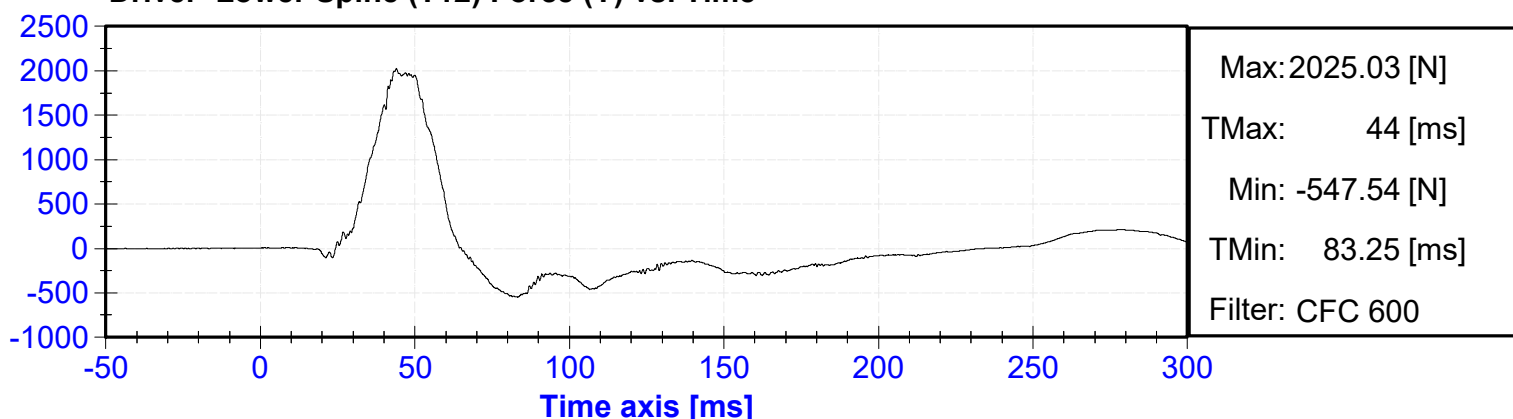
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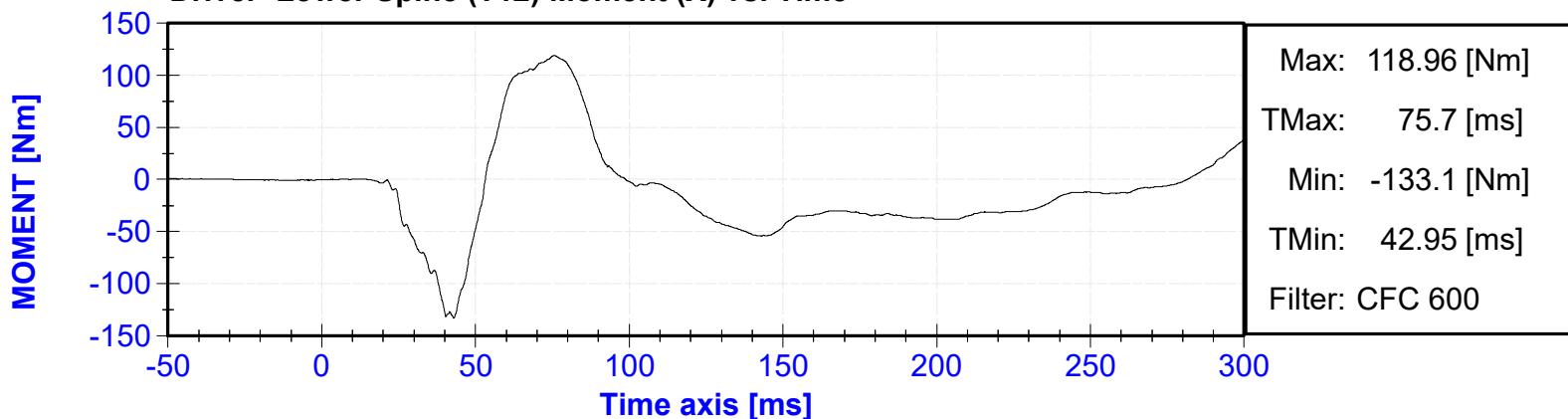
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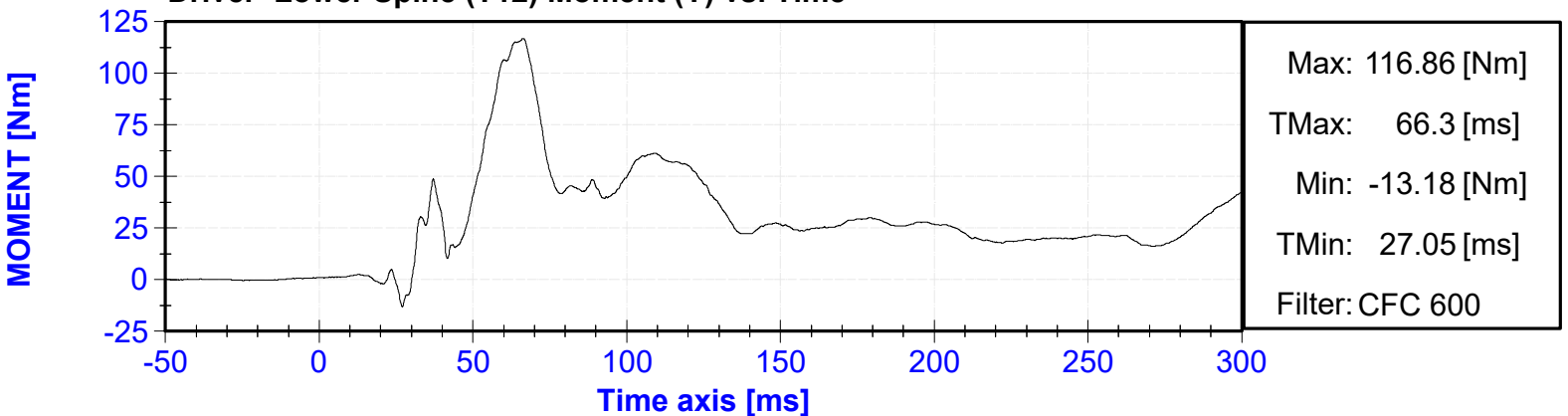
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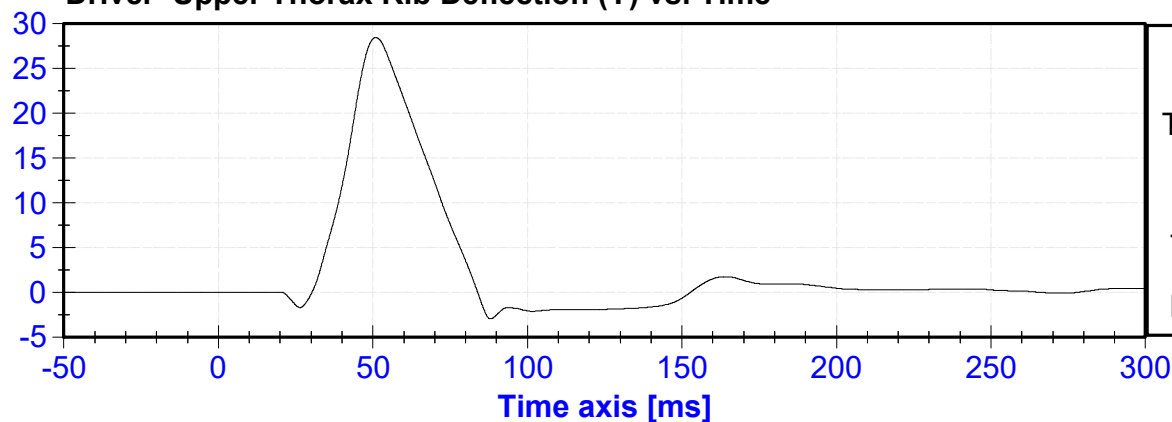
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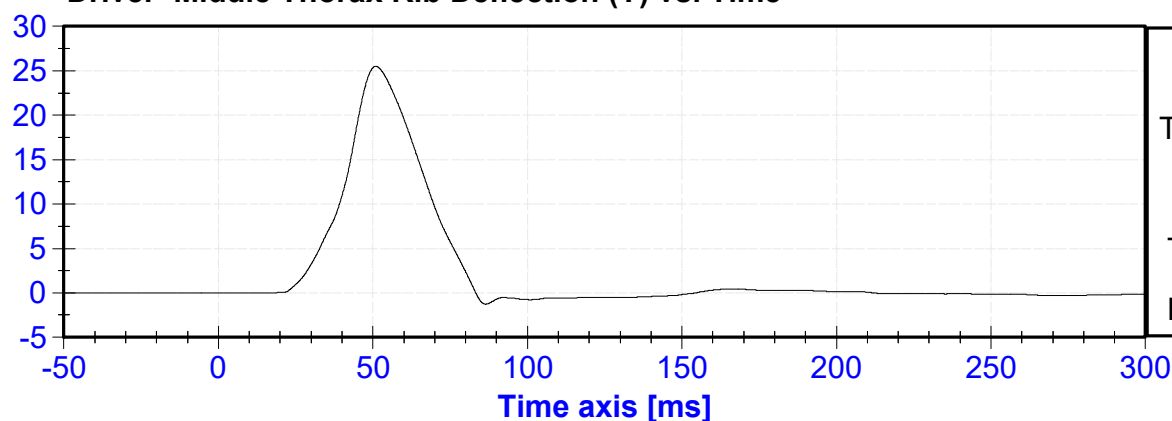
Driver Lower Spine (T12) Moment (Y) vs. Time



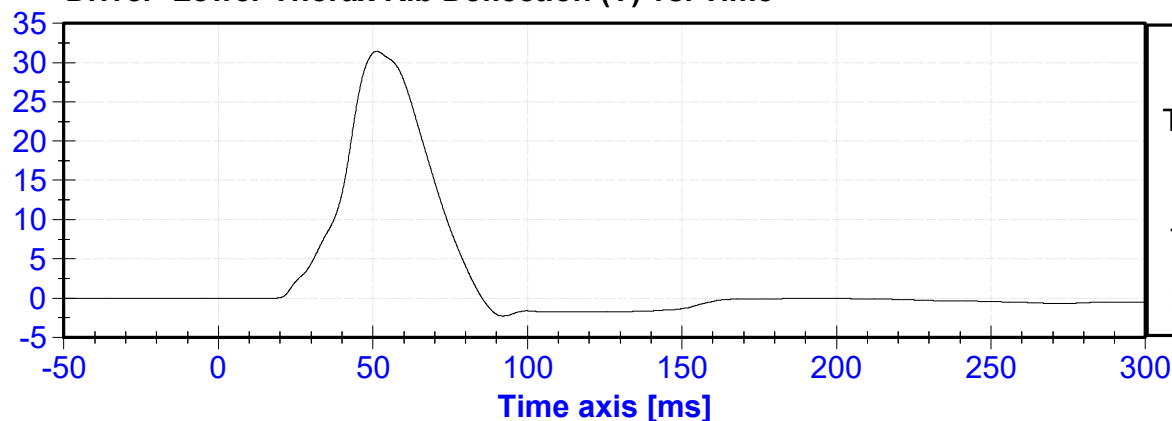
Driver Upper Thorax Rib Deflection (Y) vs. Time



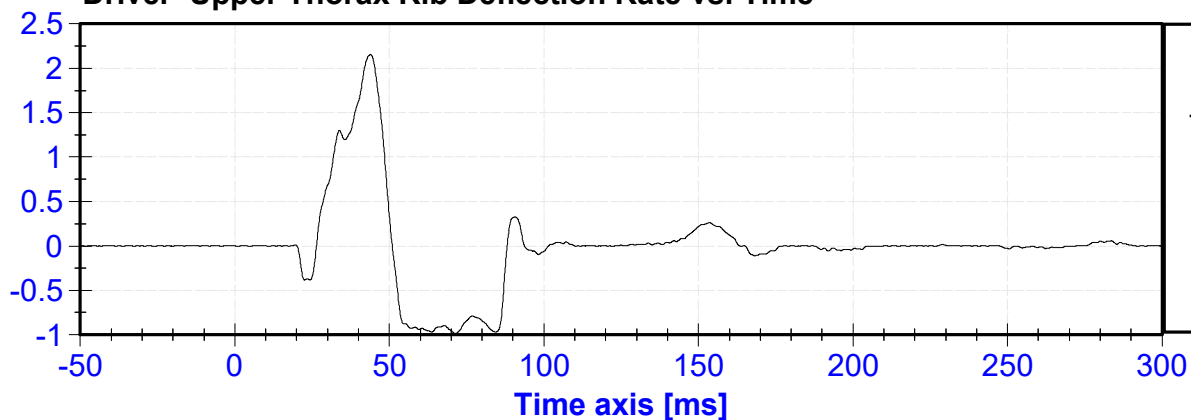
Driver Middle Thorax Rib Deflection (Y) vs. Time



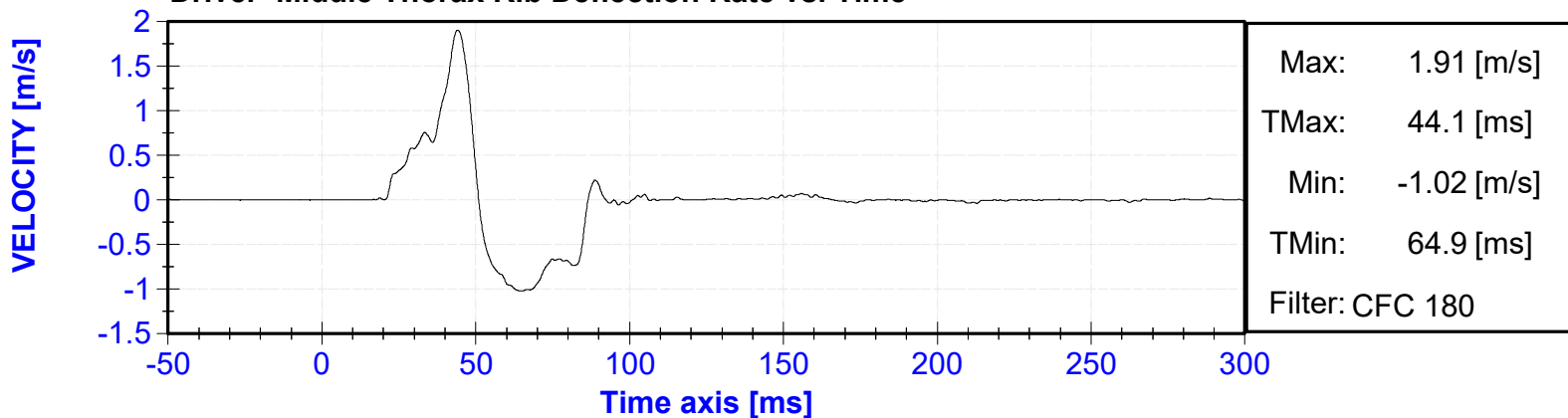
Driver Lower Thorax Rib Deflection (Y) vs. Time



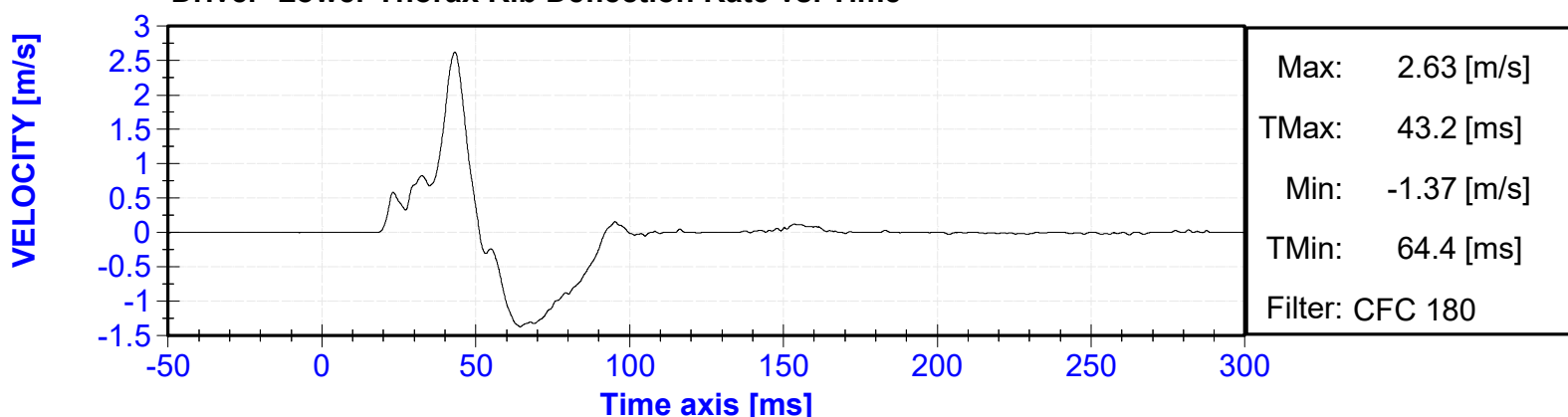
Driver Upper Thorax Rib Deflection Rate vs. Time



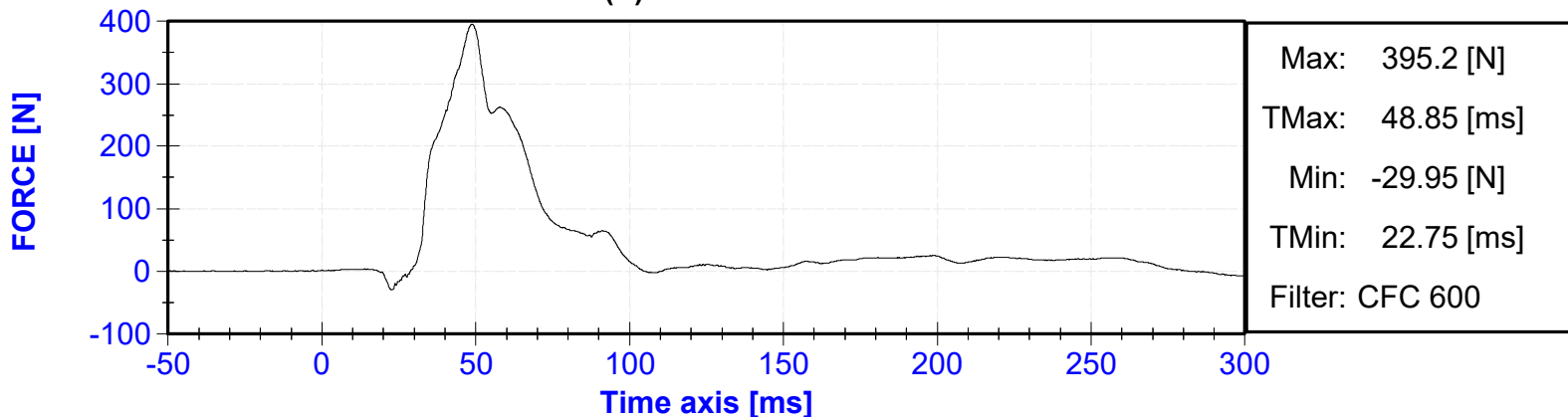
Driver Middle Thorax Rib Deflection Rate vs. Time



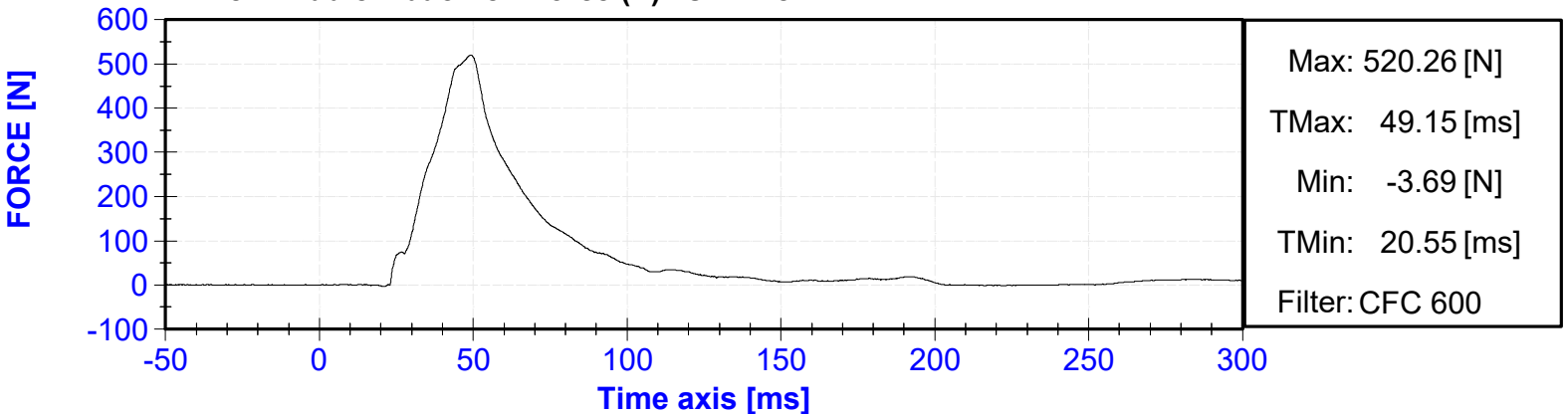
Driver Lower Thorax Rib Deflection Rate vs. Time



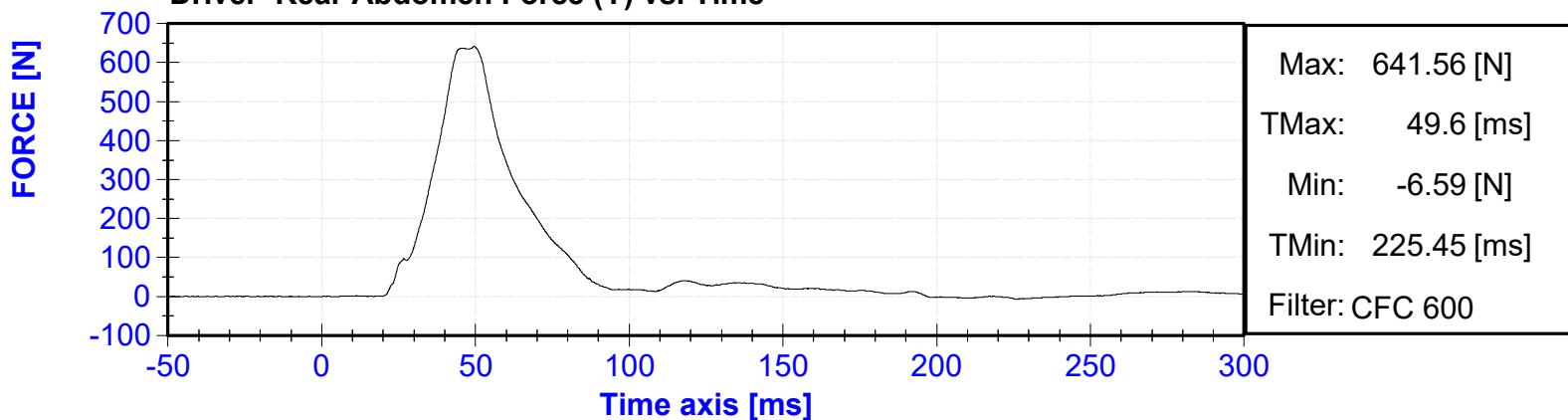
Driver Front Abdomen Force (Y) vs. Time



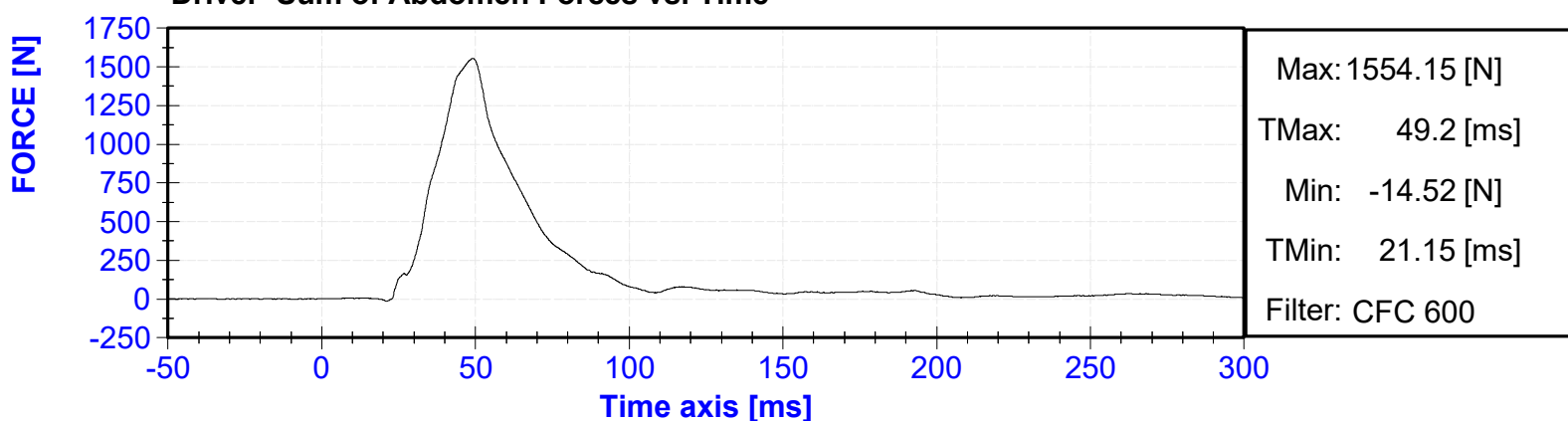
Driver Middle Abdomen Force (Y) vs. Time



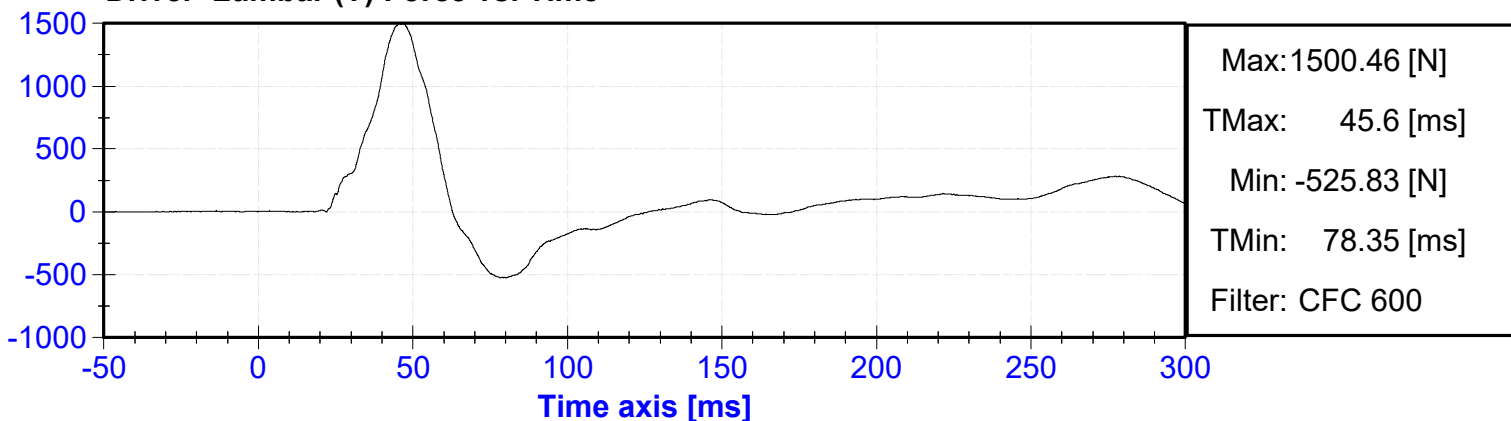
Driver Rear Abdomen Force (Y) vs. Time



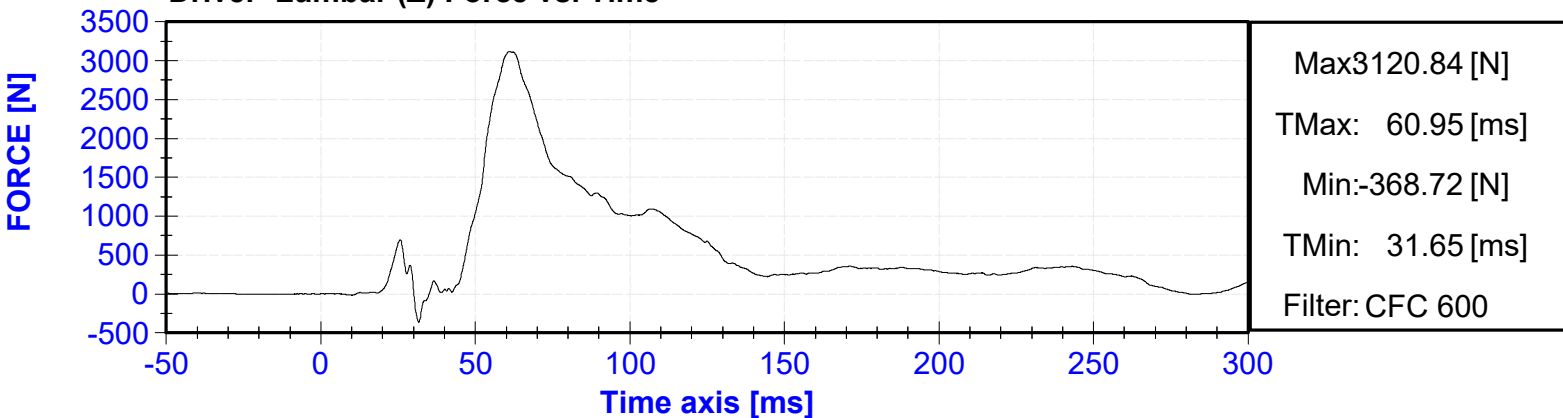
Driver Sum of Abdomen Forces vs. Time



Driver Lumbar (Y) Force vs. Time

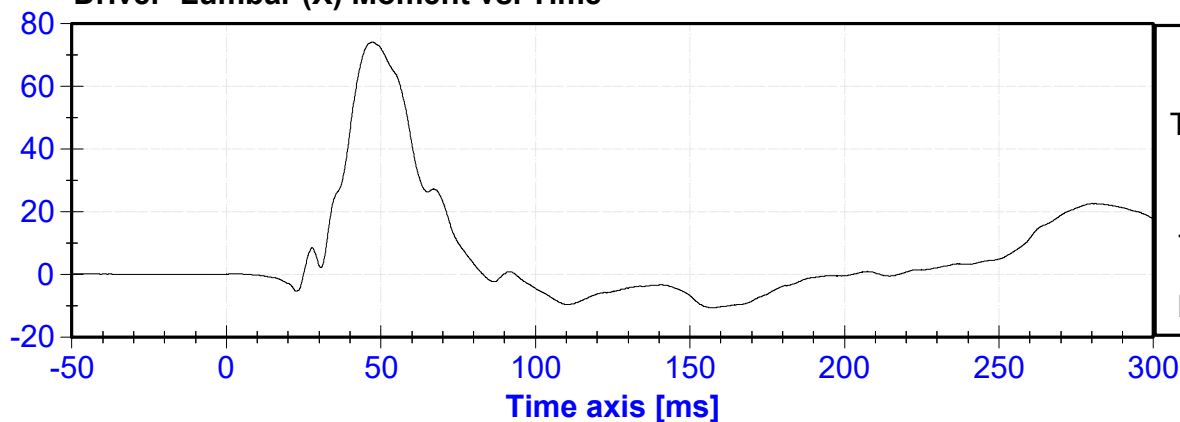


Driver Lumbar (Z) Force vs. Time



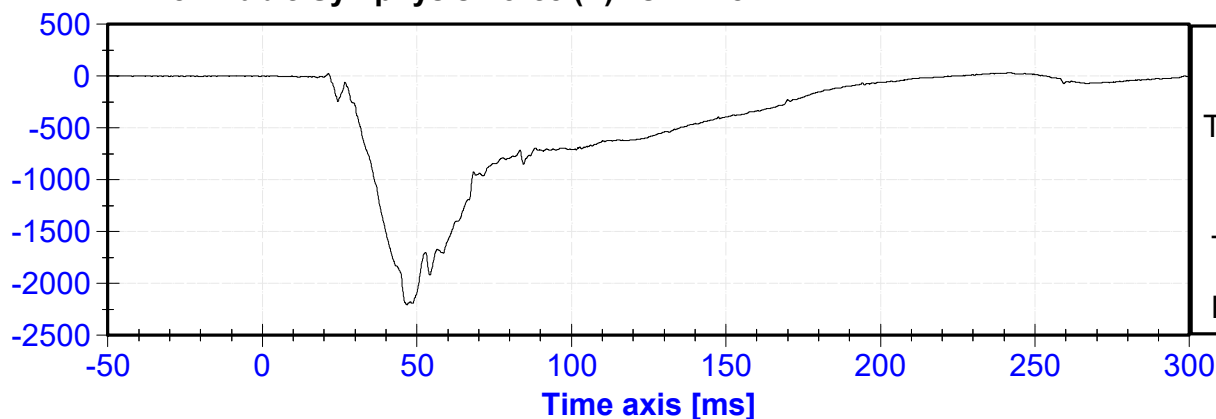
Driver Lumbar (X) Moment vs. Time

MOMENT [Nm]



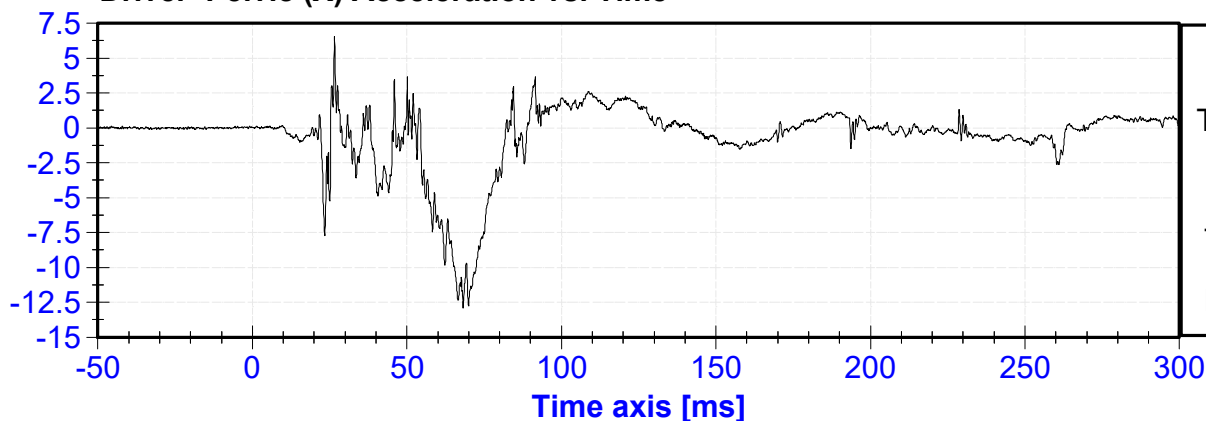
Driver Pubic Symphysis Force (Y) vs. Time

FORCE [N]



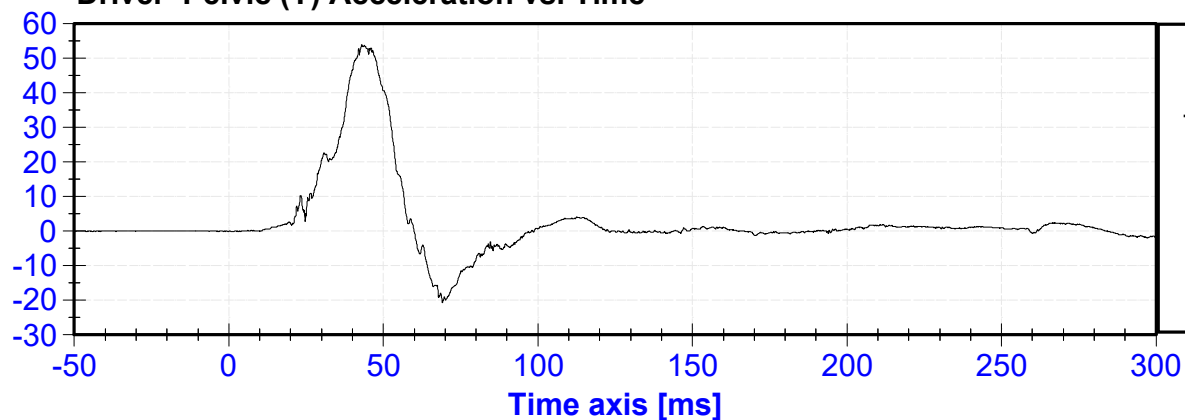
Driver Pelvic (X) Acceleration vs. Time

ACCELERATION [g's]

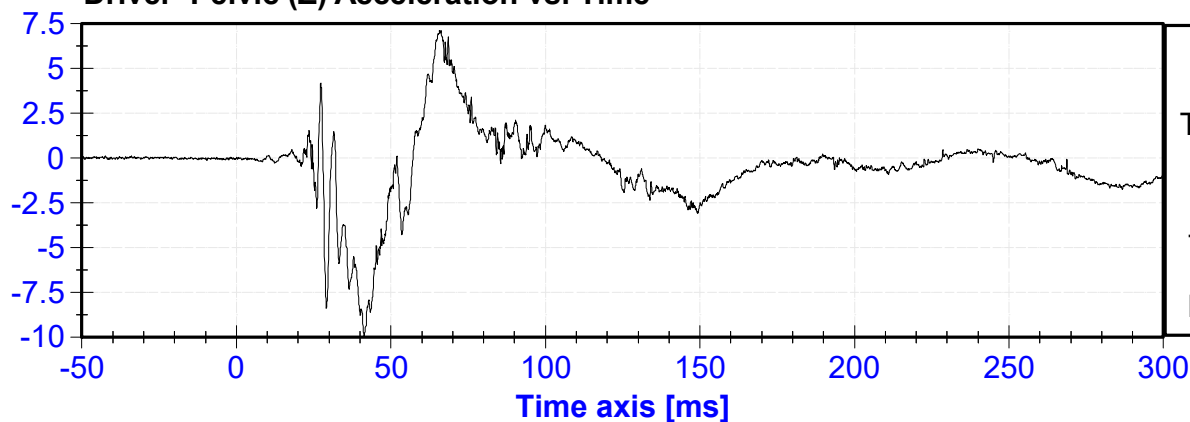


Driver Pelvic (Y) Acceleration vs. Time

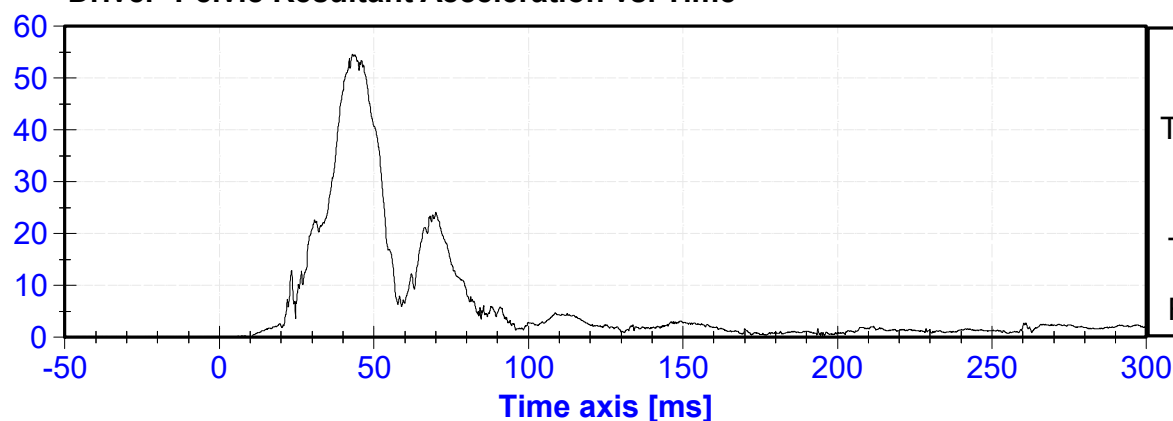
ACCELERATION [g's]



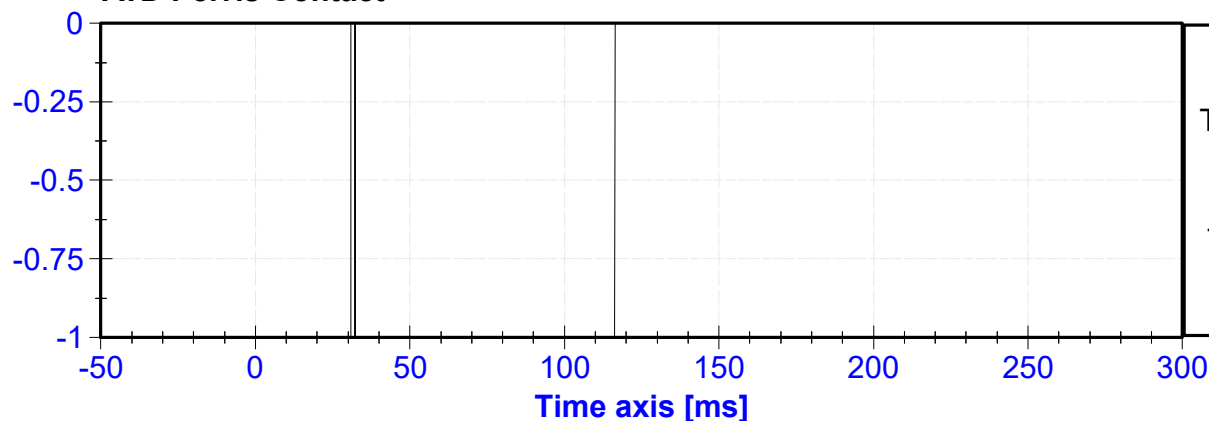
Driver Pelvic (Z) Acceleration vs. Time



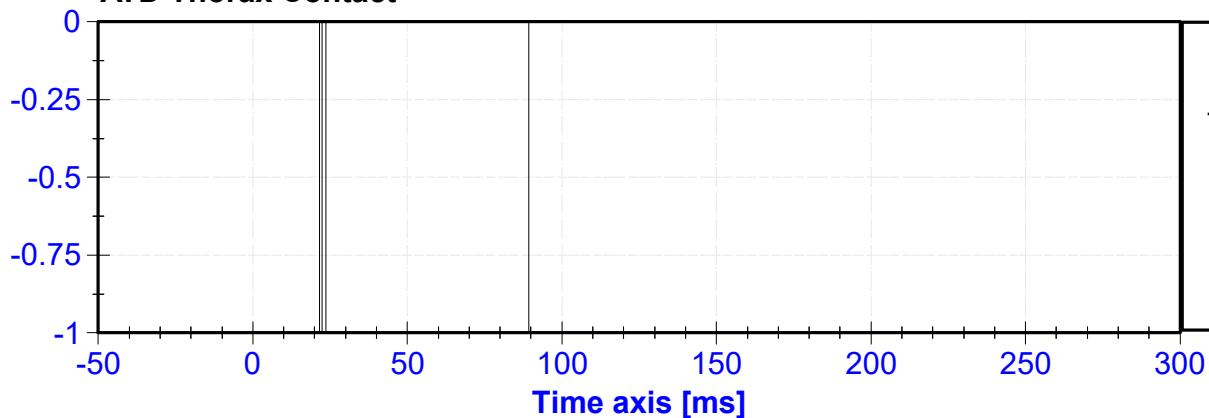
Driver Pelvic Resultant Acceleration vs. Time



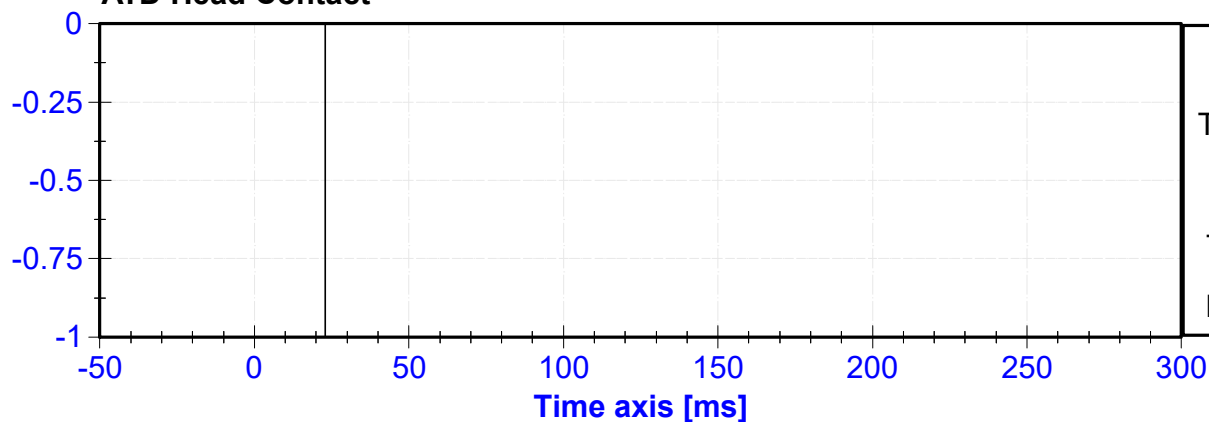
ATD Pelvis Contact



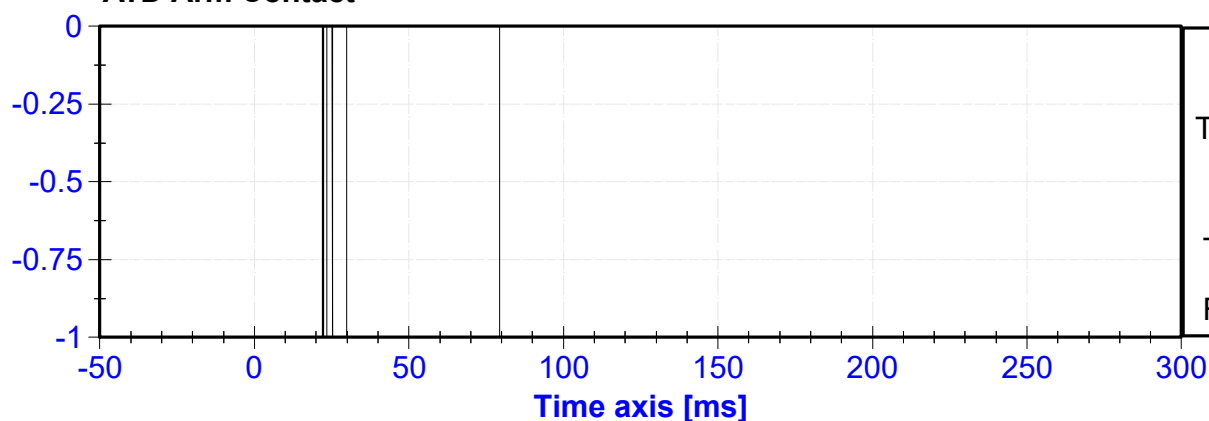
ATD Thorax Contact



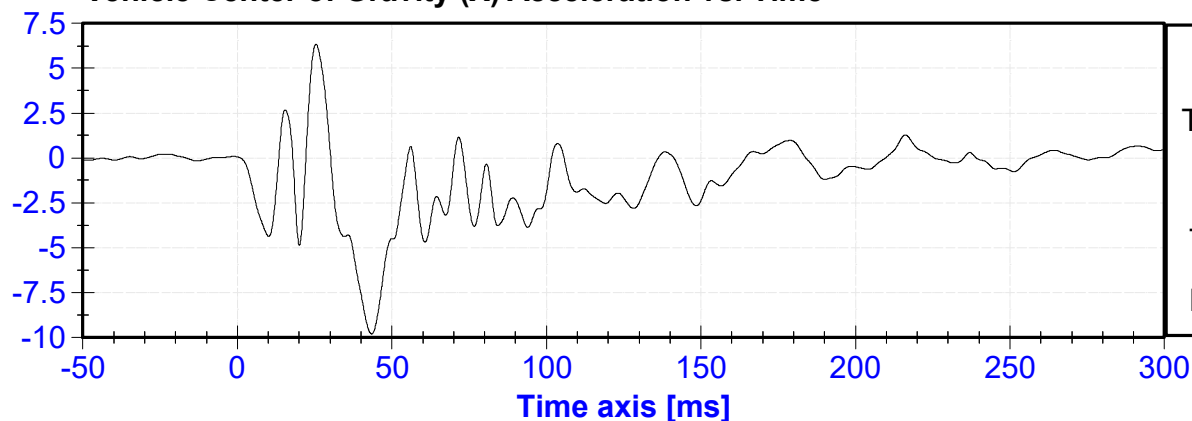
ATD Head Contact



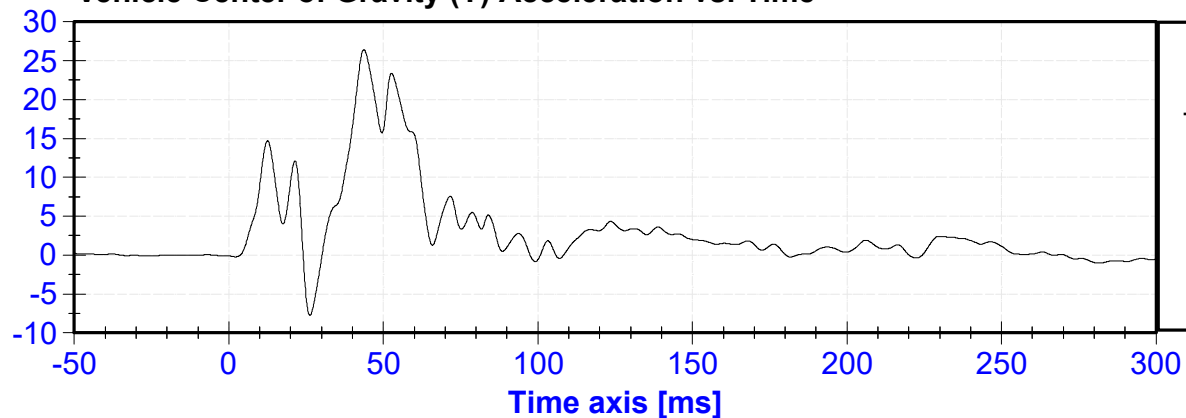
ATD Arm Contact



Vehicle Center of Gravity (X) Acceleration vs. Time

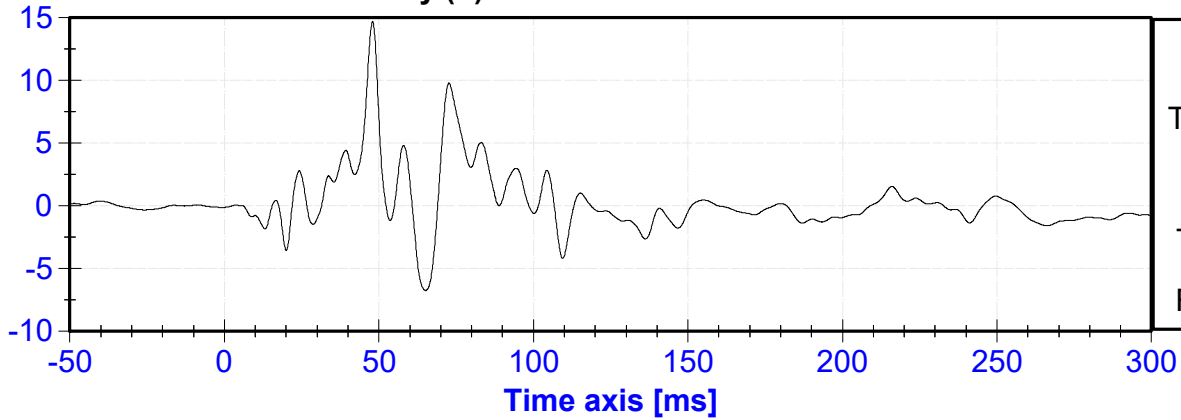


Vehicle Center of Gravity (Y) Acceleration vs. Time



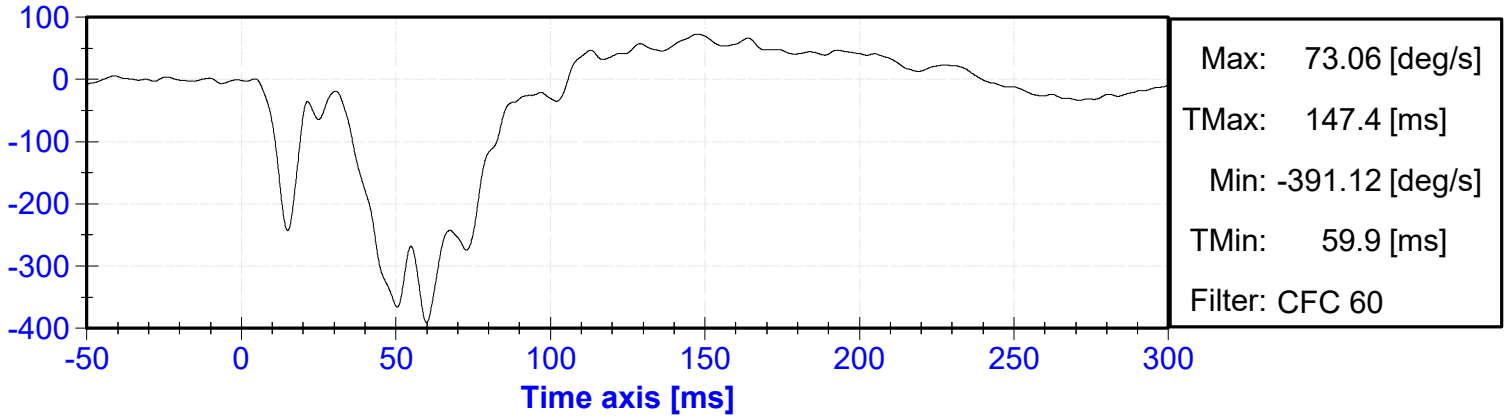
Vehicle Center of Gravity (Z) Acceleration vs. Time

ACCELERATION [g's]



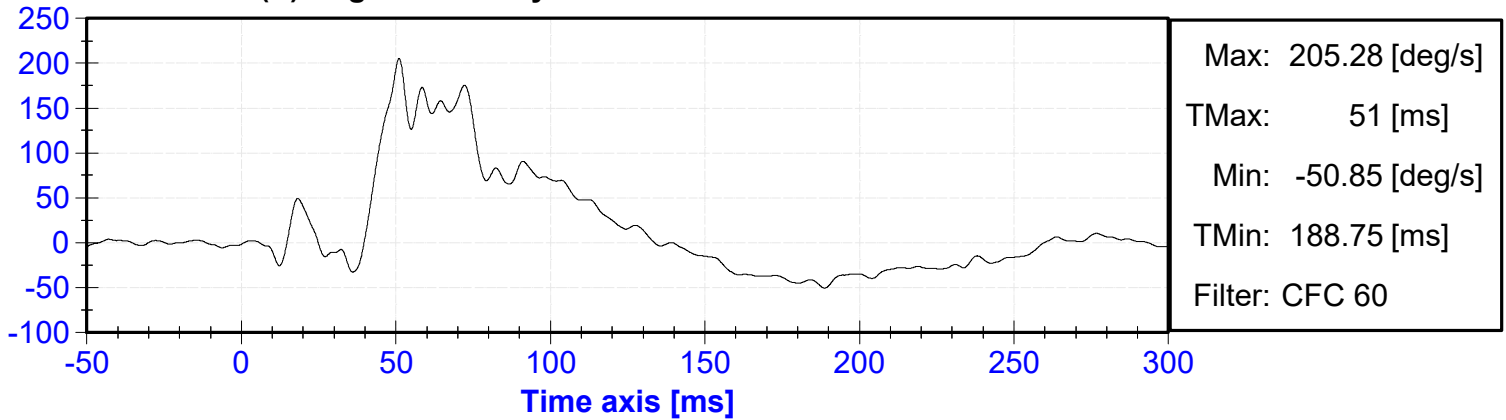
Vehicle CG (X) Angular Velocity vs. Time

ANGULAR VEL [deg/s]



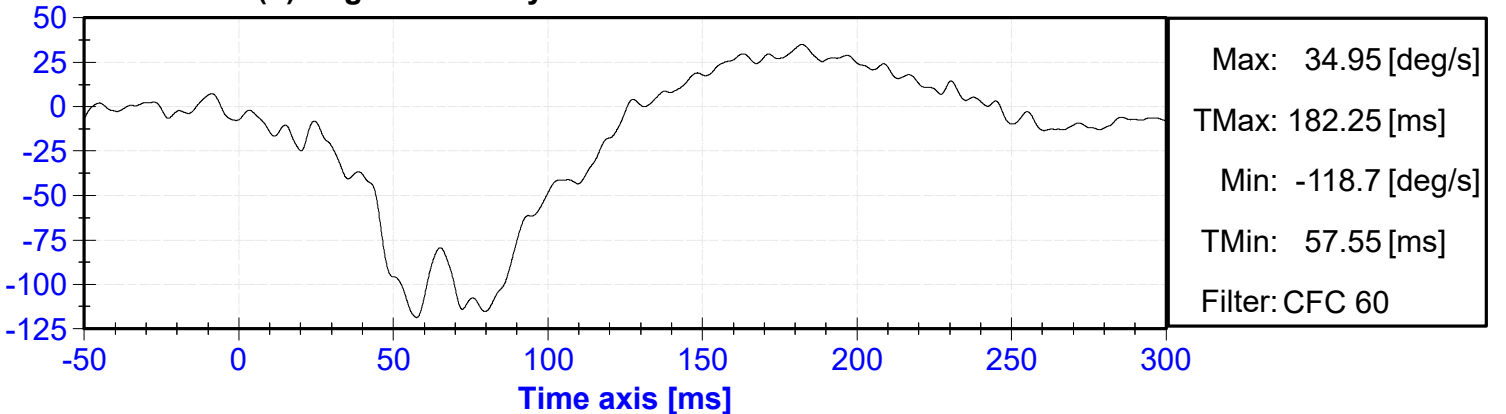
Vehicle CG (Y) Angular Velocity vs. Time

ANGULAR VEL [deg/s]

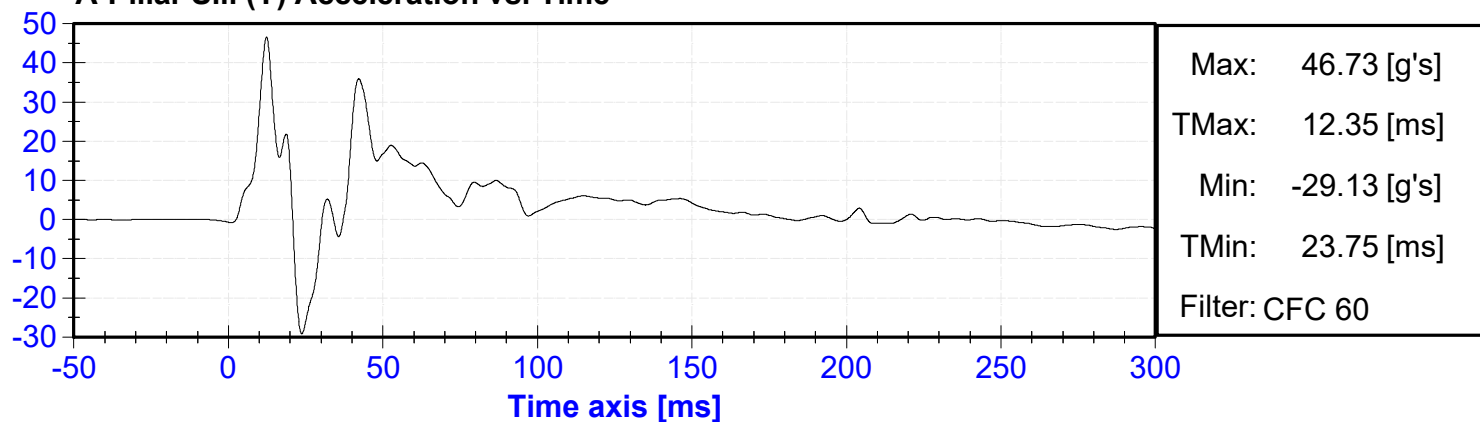


Vehicle CG (Z) Angular Velocity vs. Time

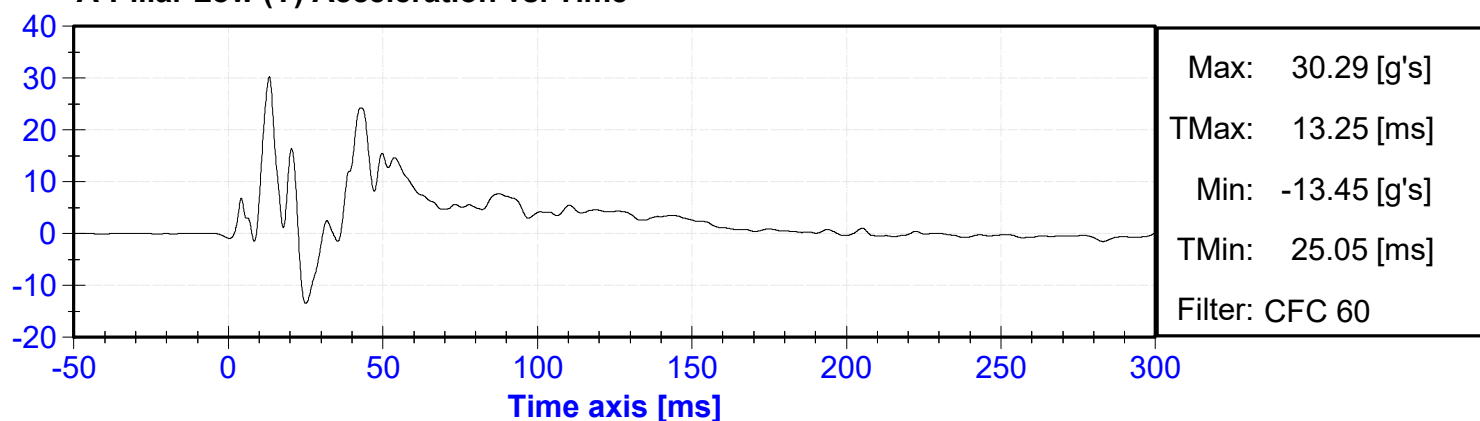
ANGULAR VEL [deg/s]



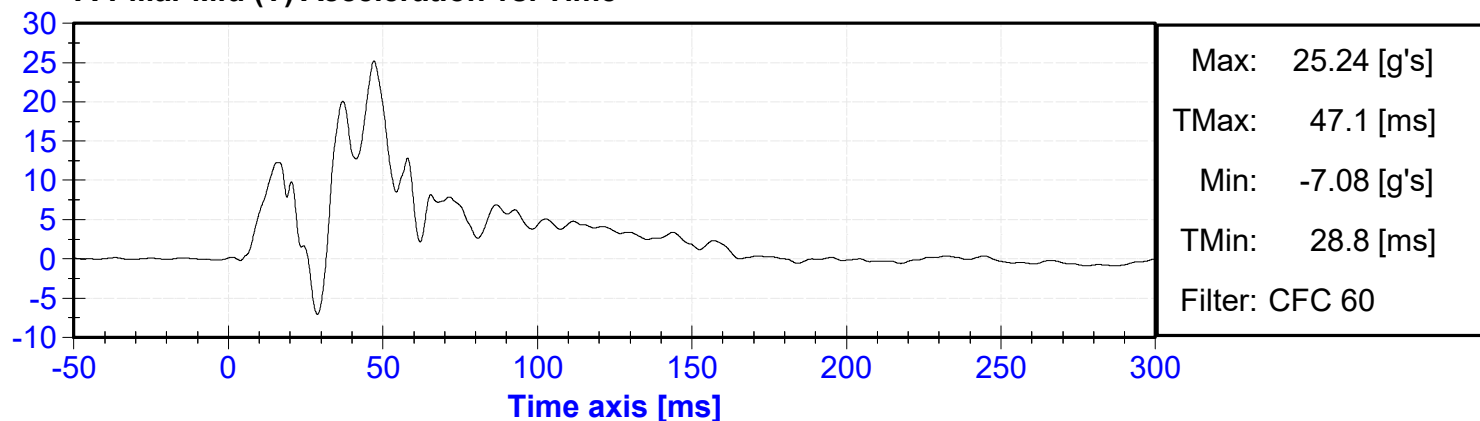
A-Pillar Sill (Y) Acceleration vs. Time



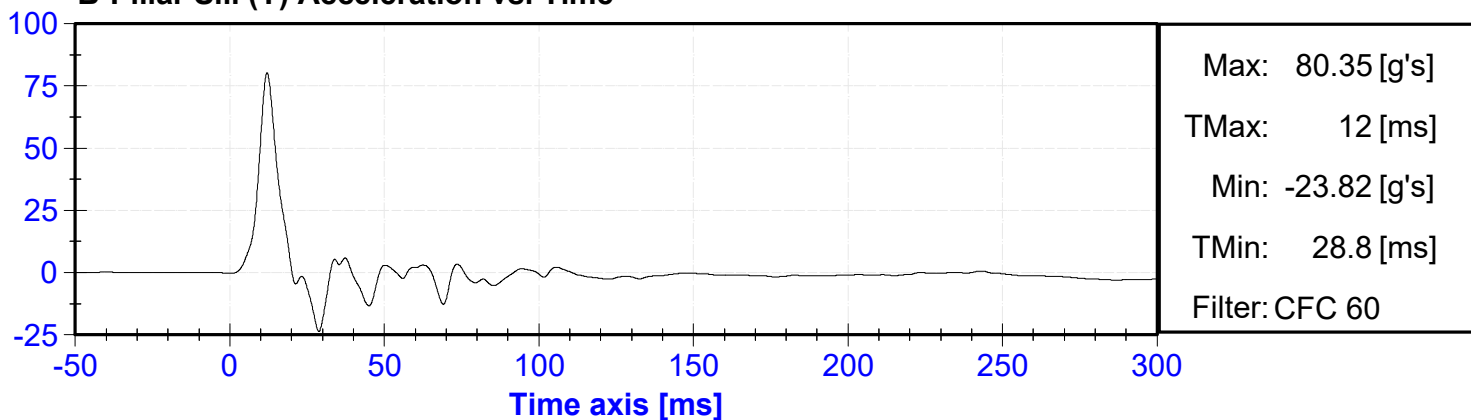
A-Pillar Low (Y) Acceleration vs. Time



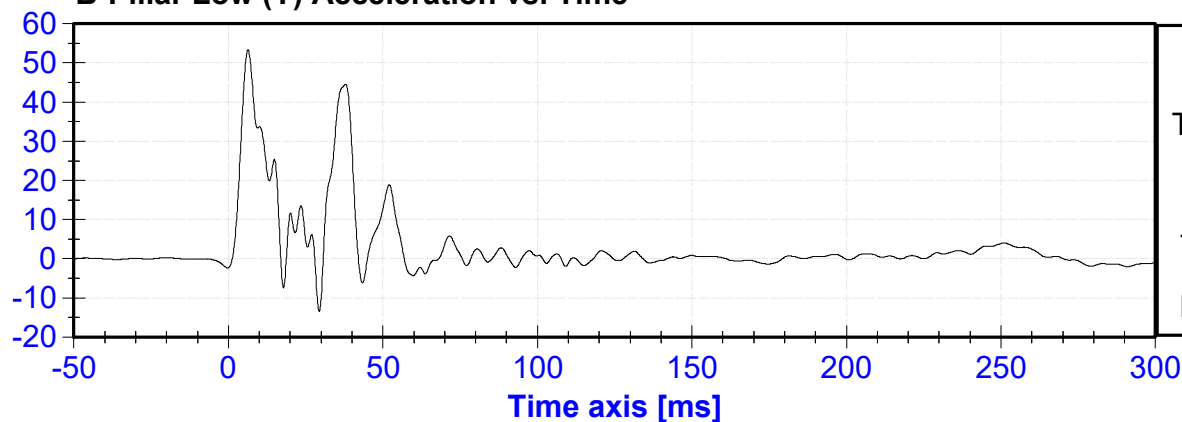
A-Pillar Mid (Y) Acceleration vs. Time



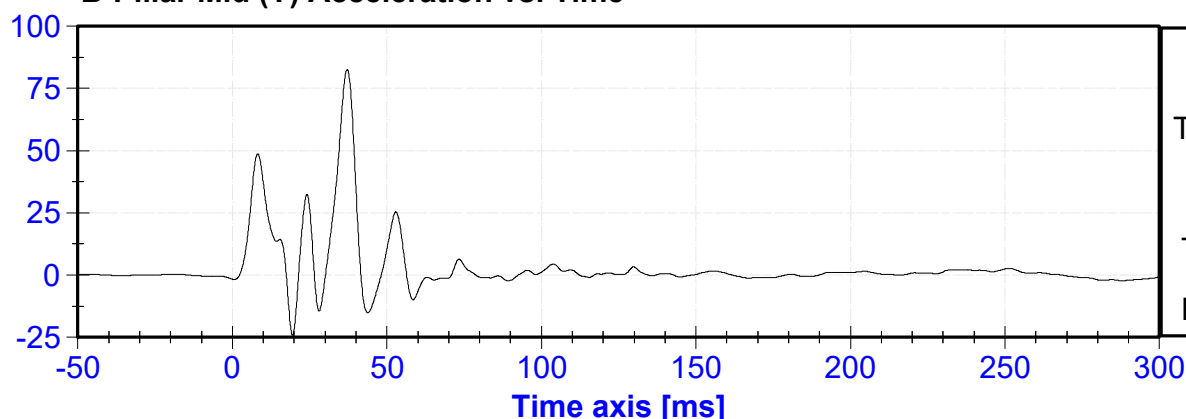
B-Pillar Sill (Y) Acceleration vs. Time



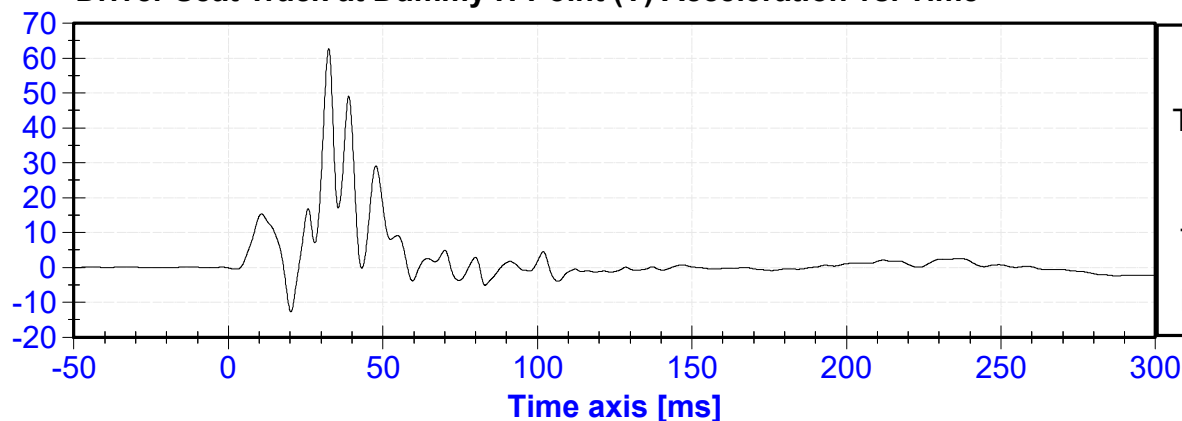
B-Pillar Low (Y) Acceleration vs. Time



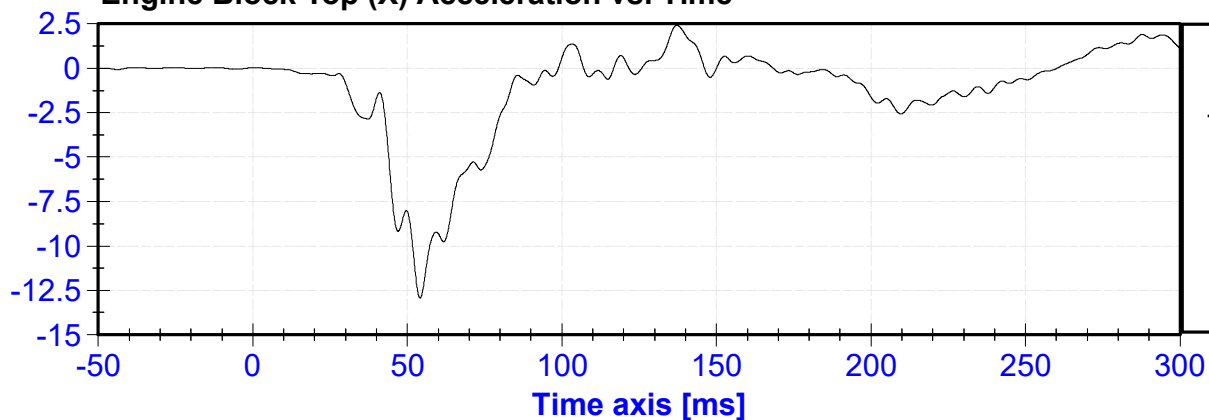
B-Pillar Mid (Y) Acceleration vs. Time



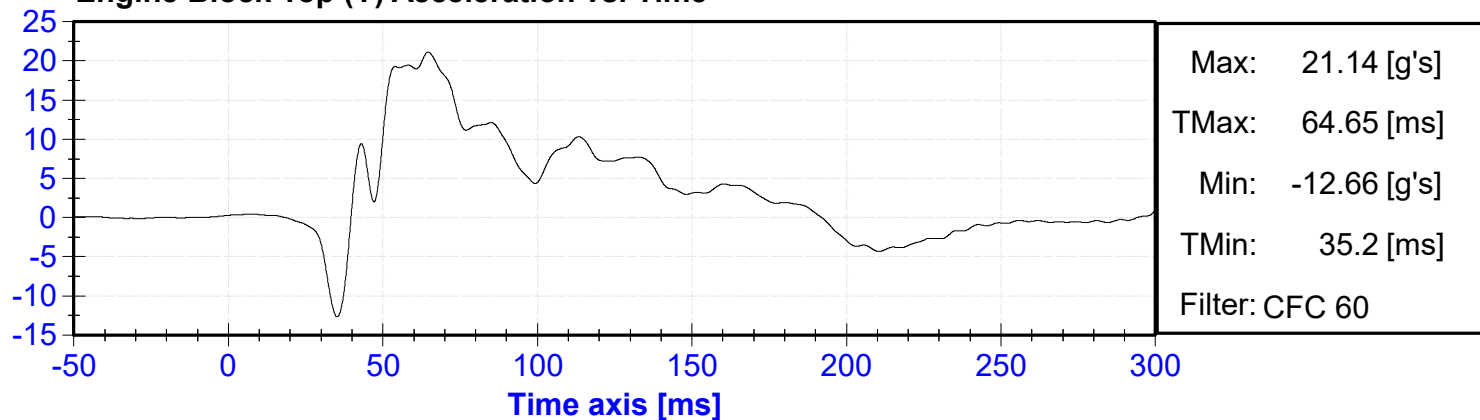
Driver Seat Track at Dummy H-Point (Y) Acceleration vs. Time



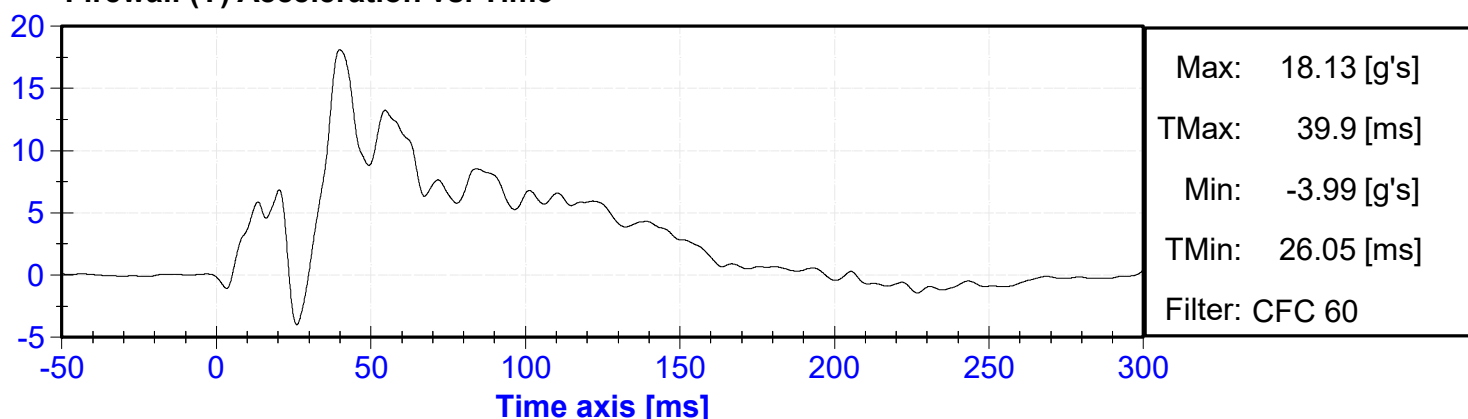
Engine Block Top (X) Acceleration vs. Time



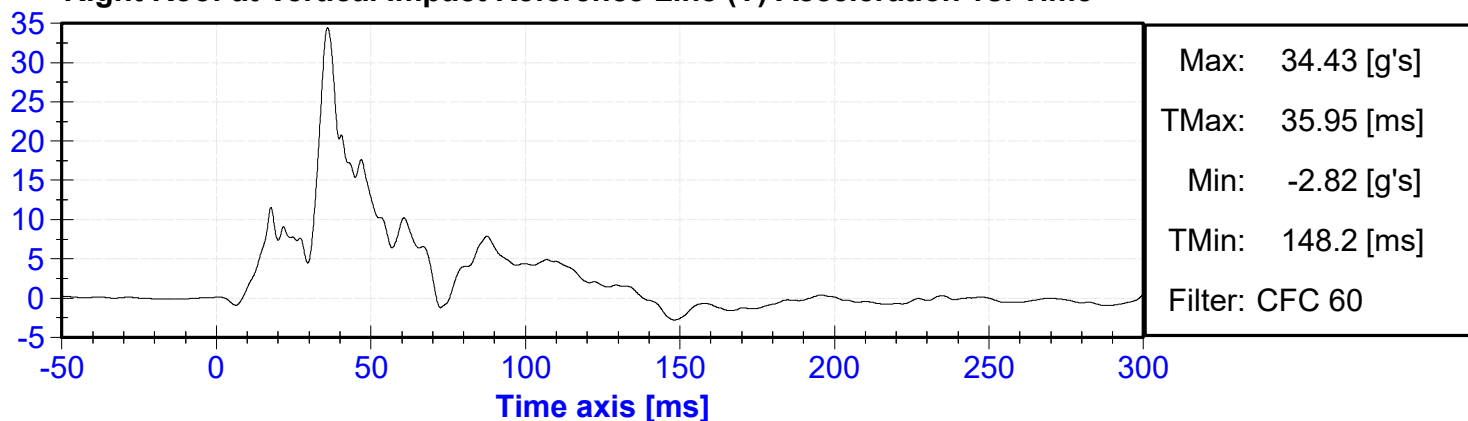
Engine Block Top (Y) Acceleration vs. Time



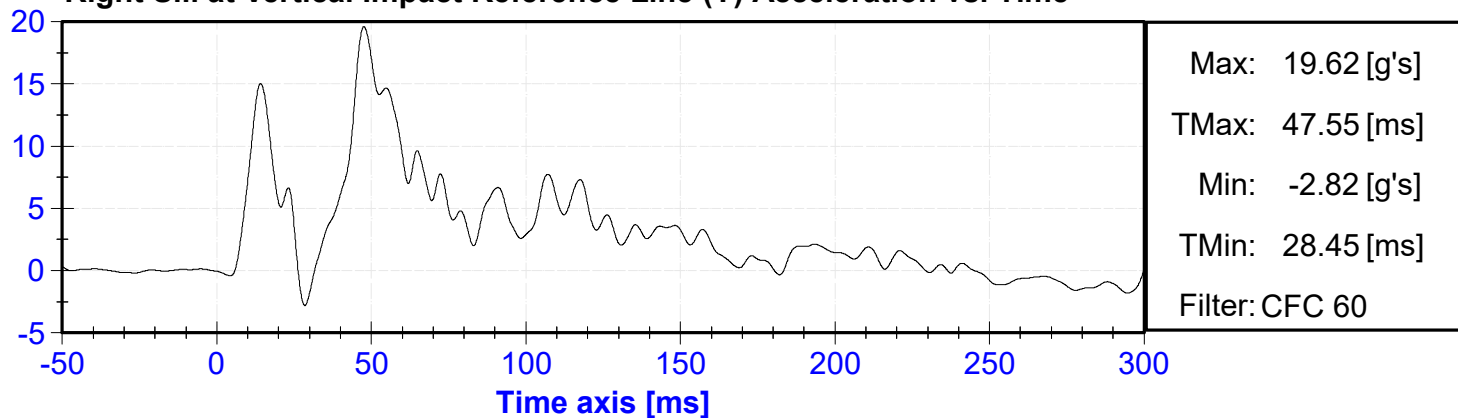
Firewall (Y) Acceleration vs. Time



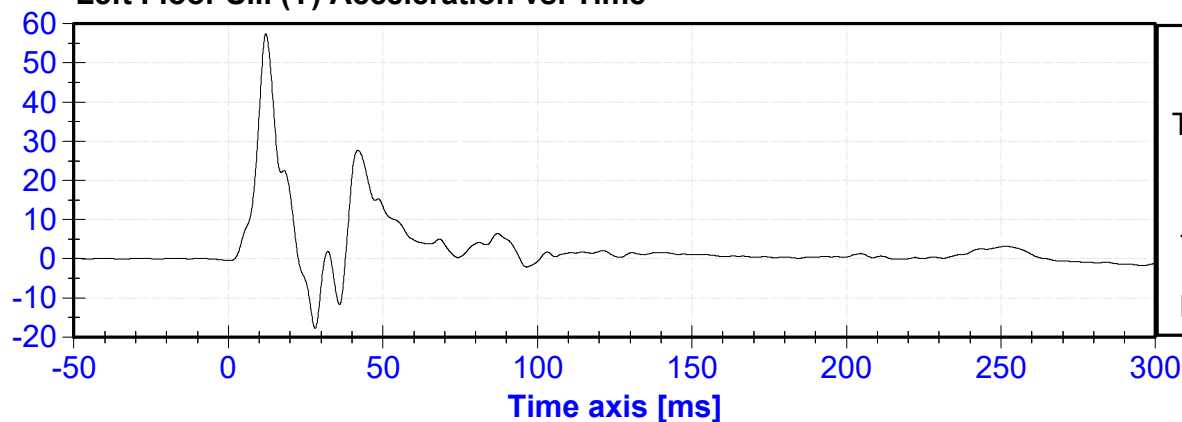
Right Roof at Vertical Impact Reference Line (Y) Acceleration vs. Time



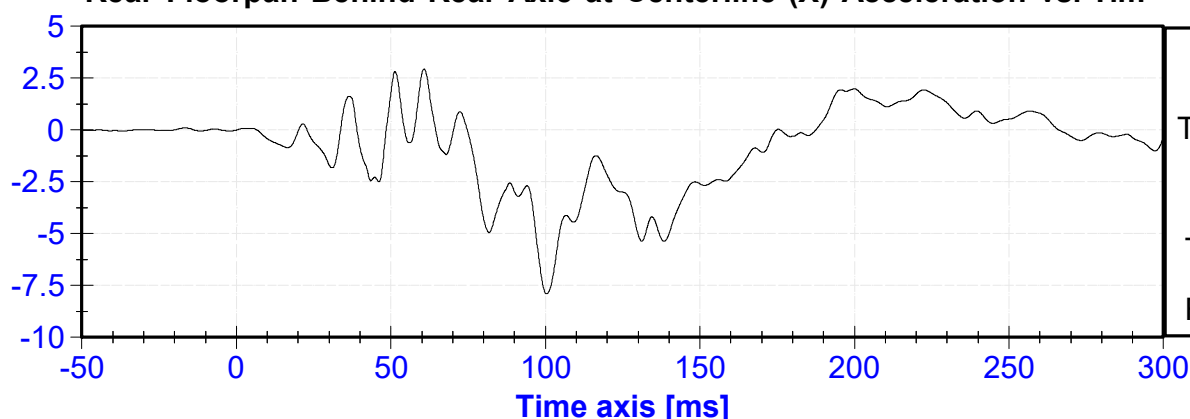
Right Sill at Vertical Impact Reference Line (Y) Acceleration vs. Time



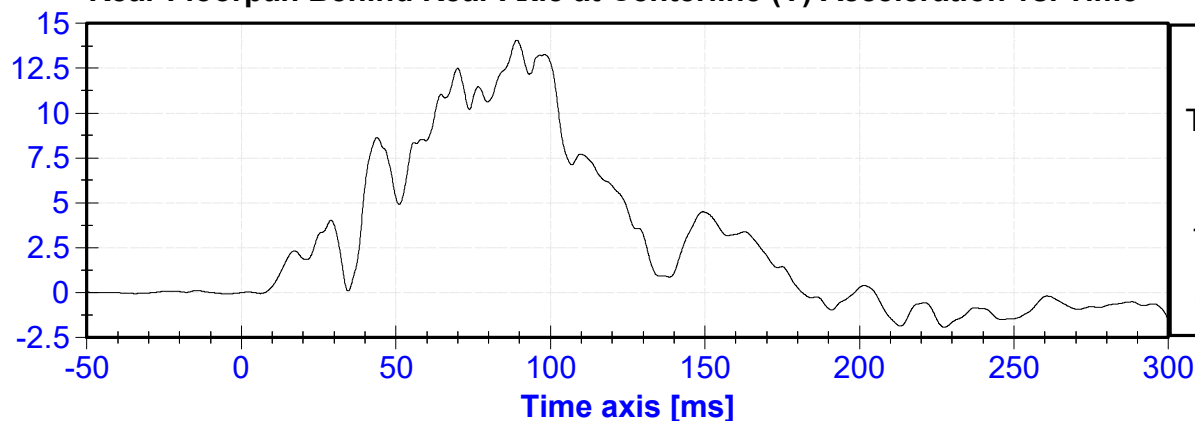
Left Floor Sill (Y) Acceleration vs. Time



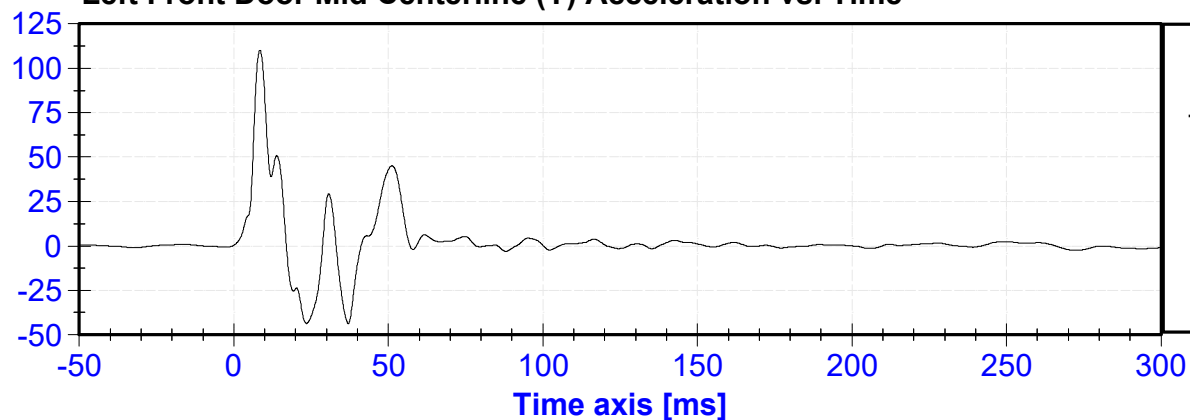
Rear Floorpan Behind Rear Axle at Centerline (X) Acceleration vs. Time



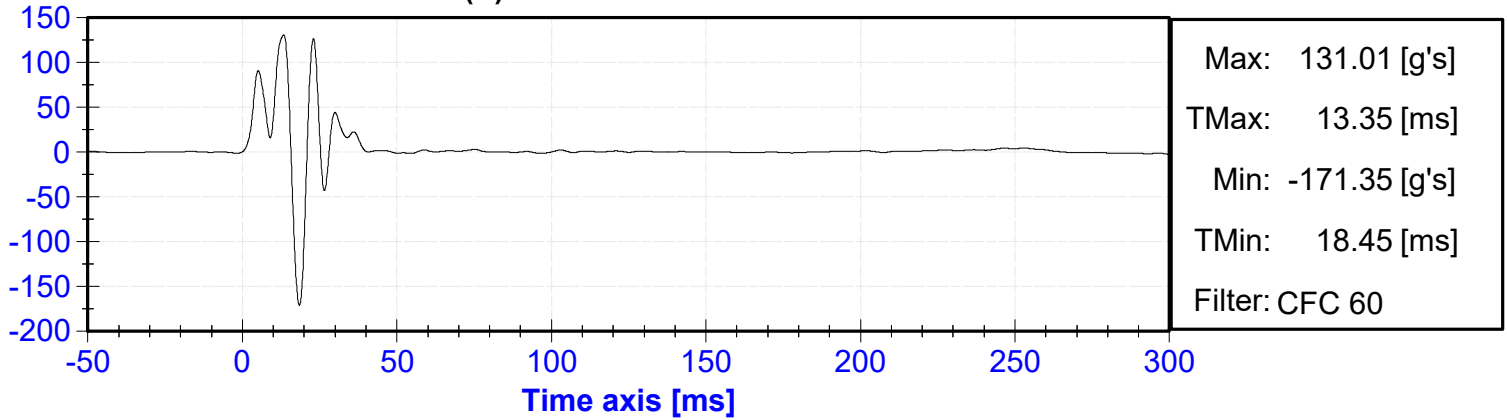
Rear Floorpan Behind Rear Axle at Centerline (Y) Acceleration vs. Time



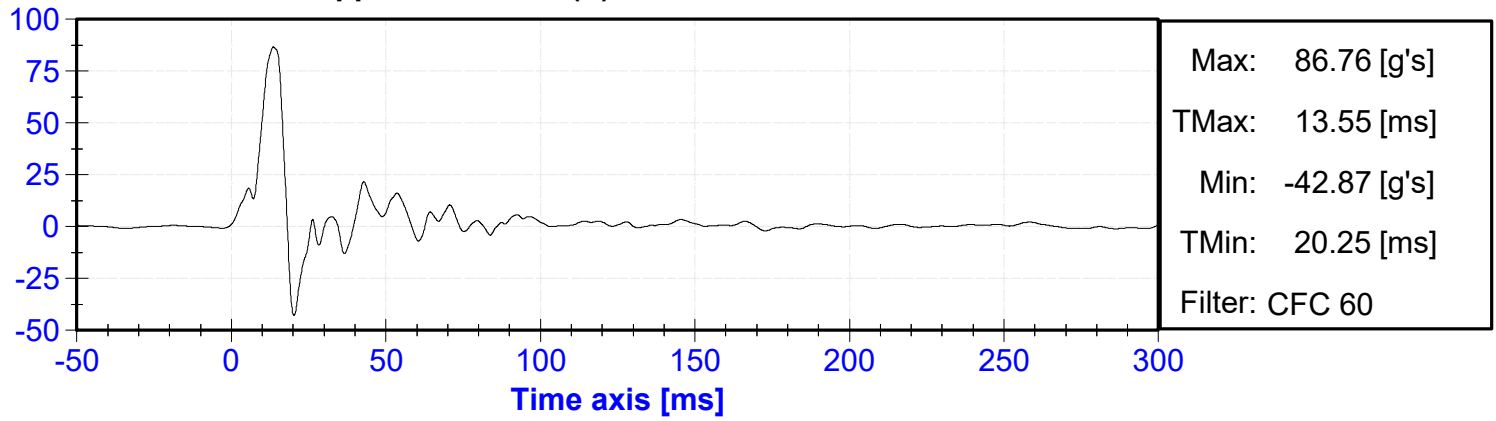
Left Front Door Mid Centerline (Y) Acceleration vs. Time



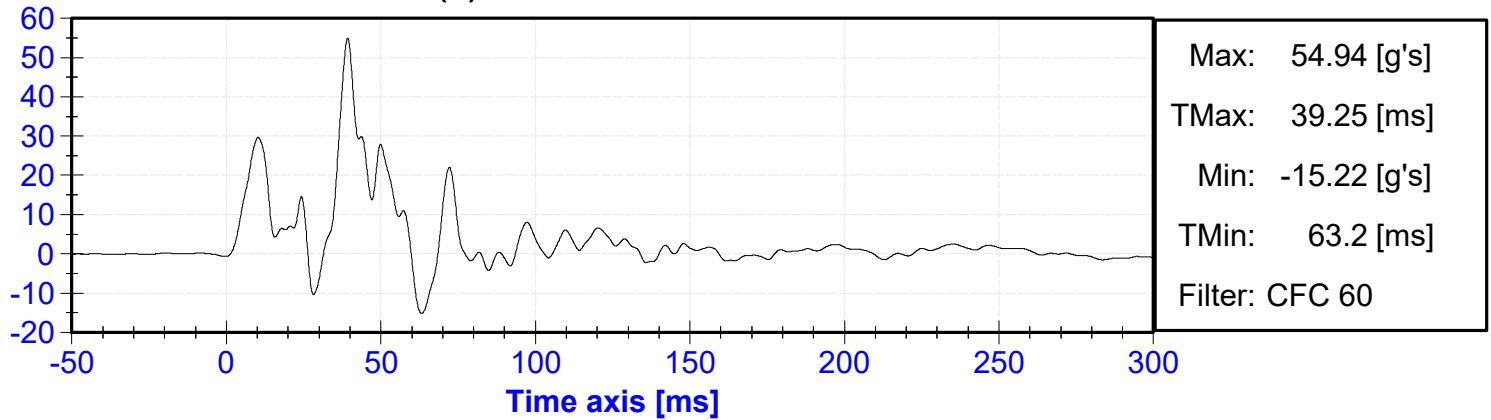
Left Front Door Mid Rear (Y) Acceleration vs. Time



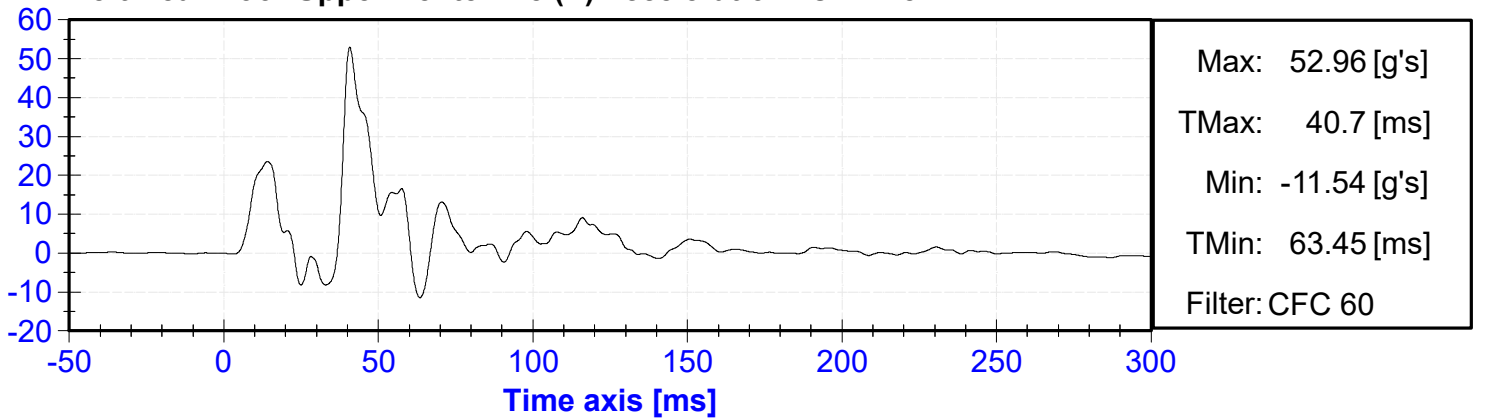
Left Front Door Upper Centerline (Y) Acceleration vs. Time



Left Rear Door Mid Rear (Y) Acceleration vs. Time

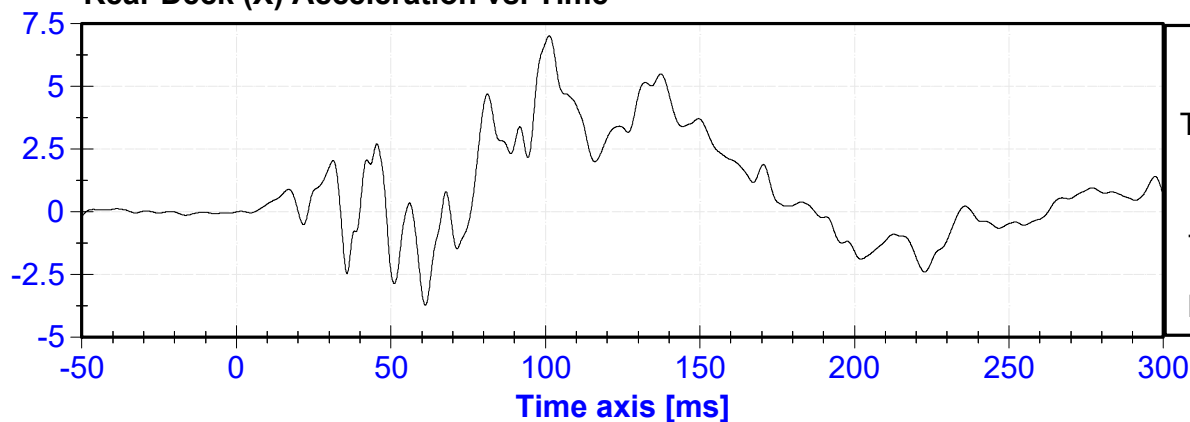


Left Rear Door Upper Centerline (Y) Acceleration vs. Time



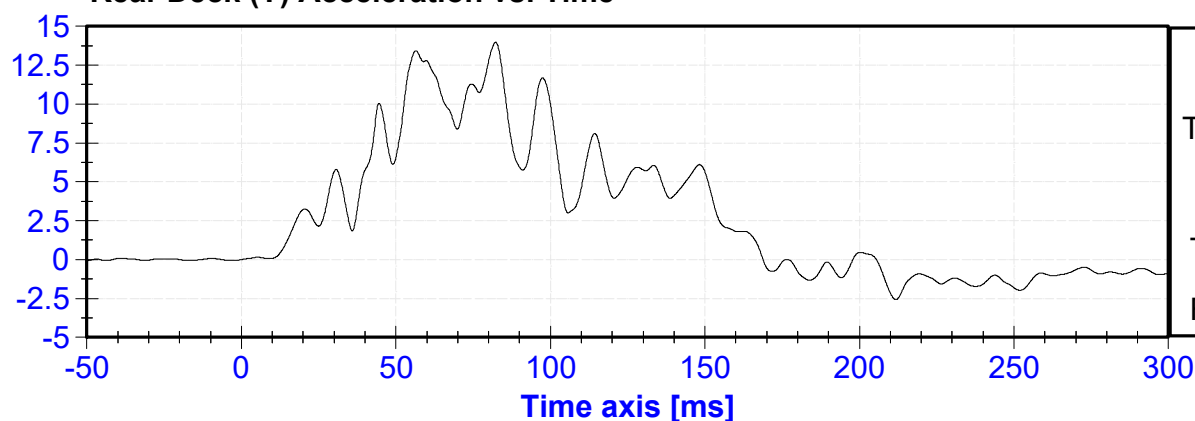
Rear Deck (X) Acceleration vs. Time

ACCELERATION [g's]



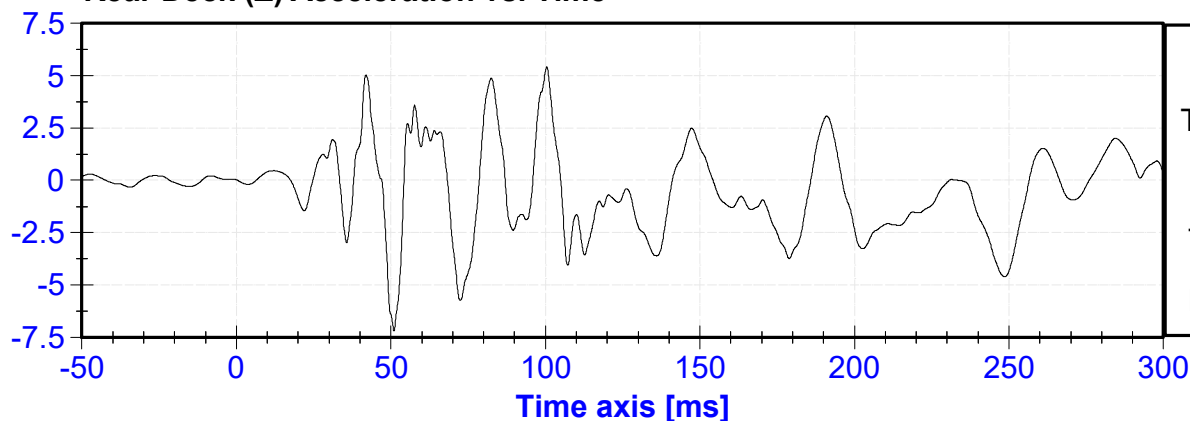
Rear Deck (Y) Acceleration vs. Time

ACCELERATION [g's]



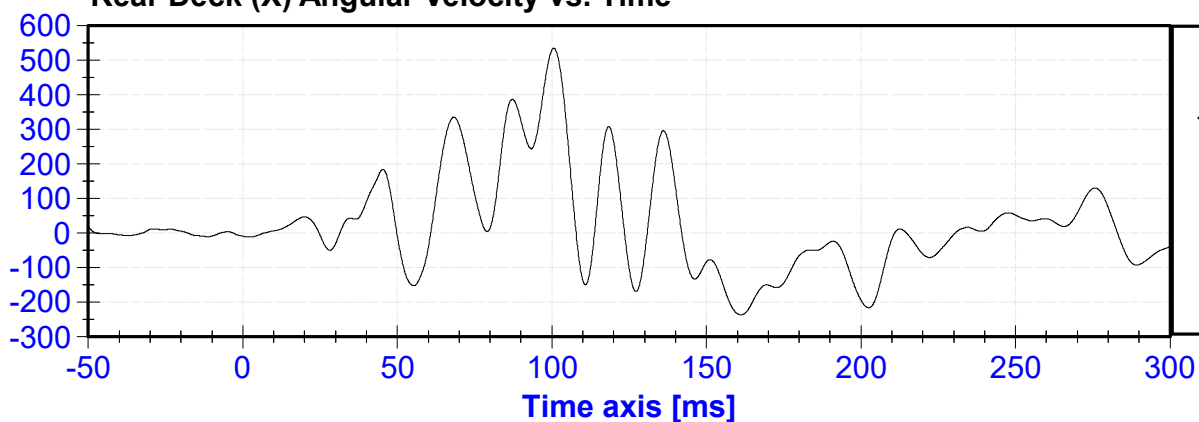
Rear Deck (Z) Acceleration vs. Time

ACCELERATION [g's]



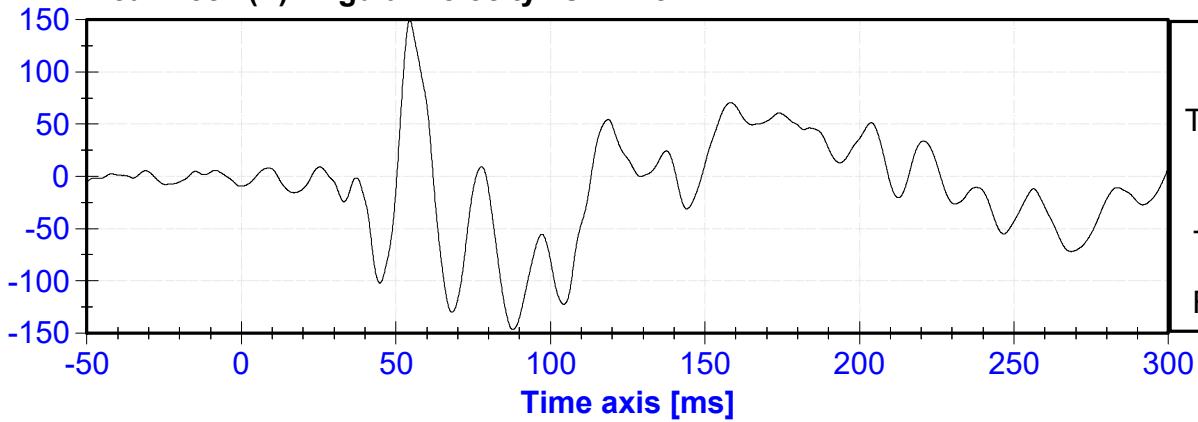
Rear Deck (X) Angular Velocity vs. Time

ANGULAR VEL [deg/s]



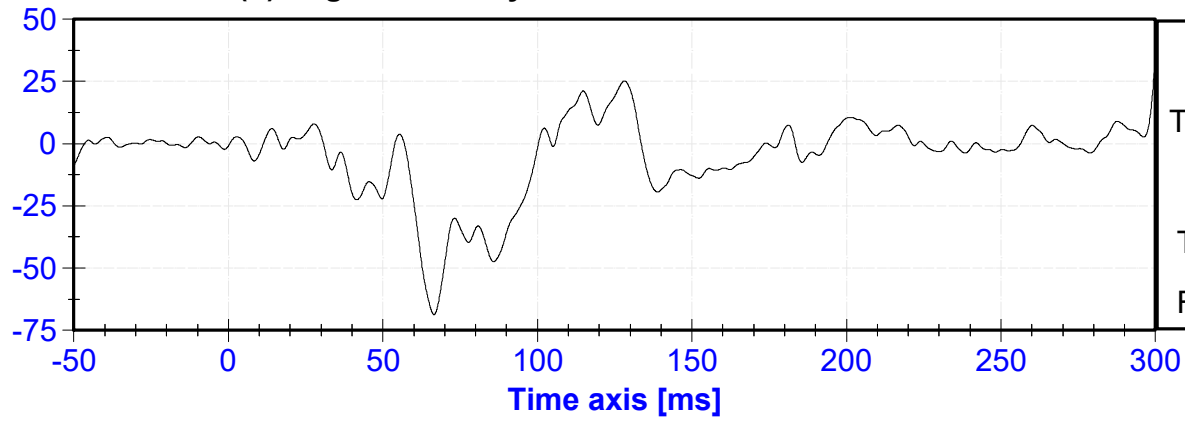
Rear Deck (Y) Angular Velocity vs. Time

ANGULAR VEL [deg/s]



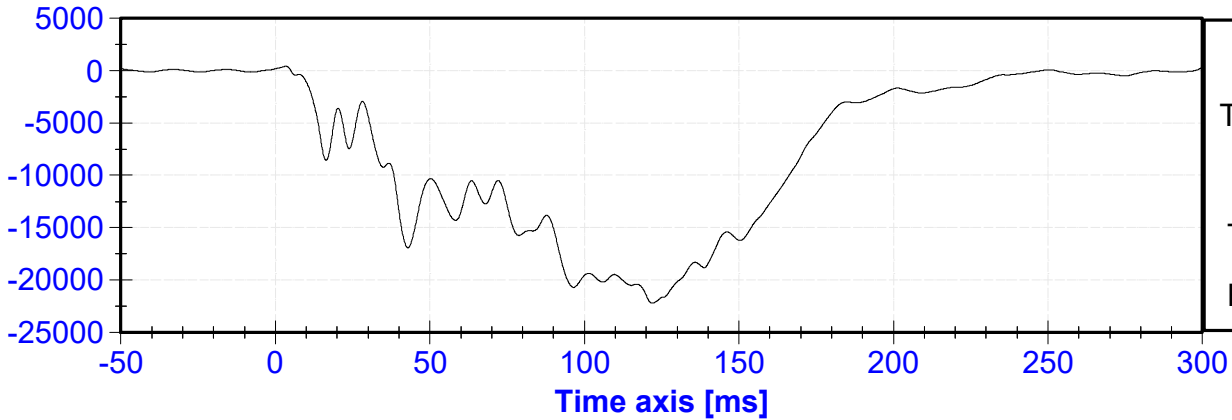
Rear Deck (Z) Angular Velocity vs. Time

ANGULAR VEL [deg/s]



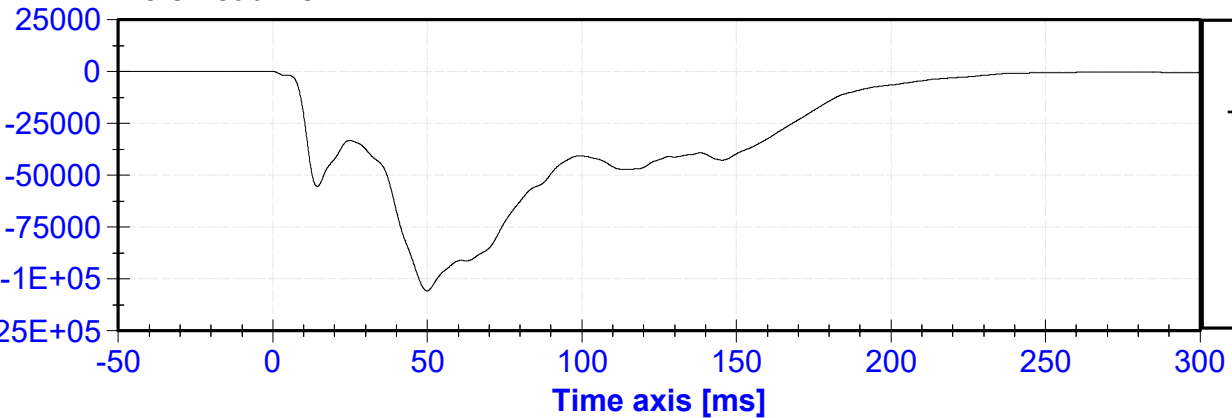
Pole Load Cell 1

FORCE [N]

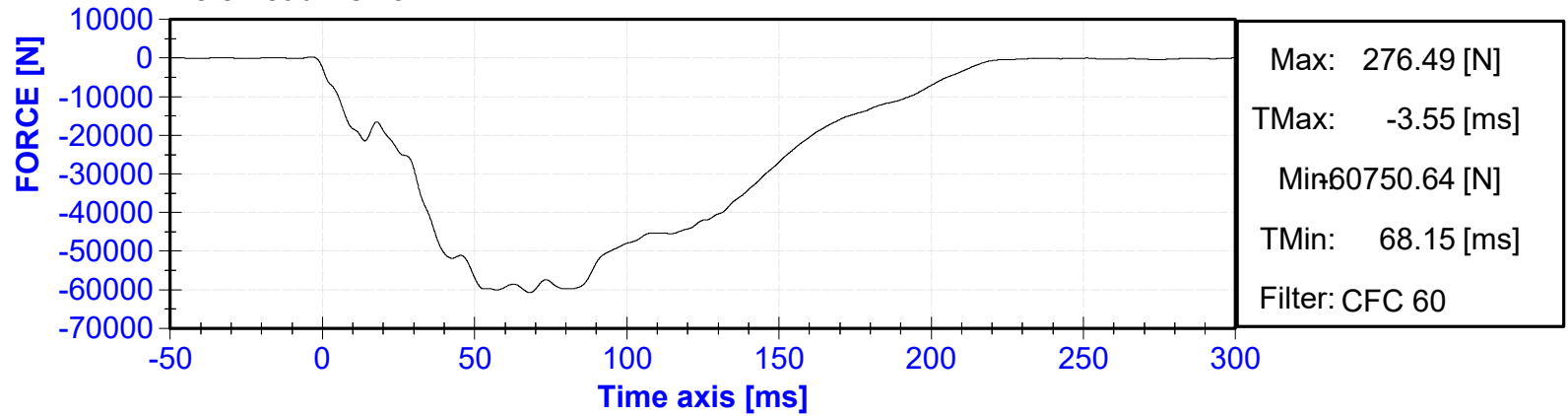


Pole Load Cell 2

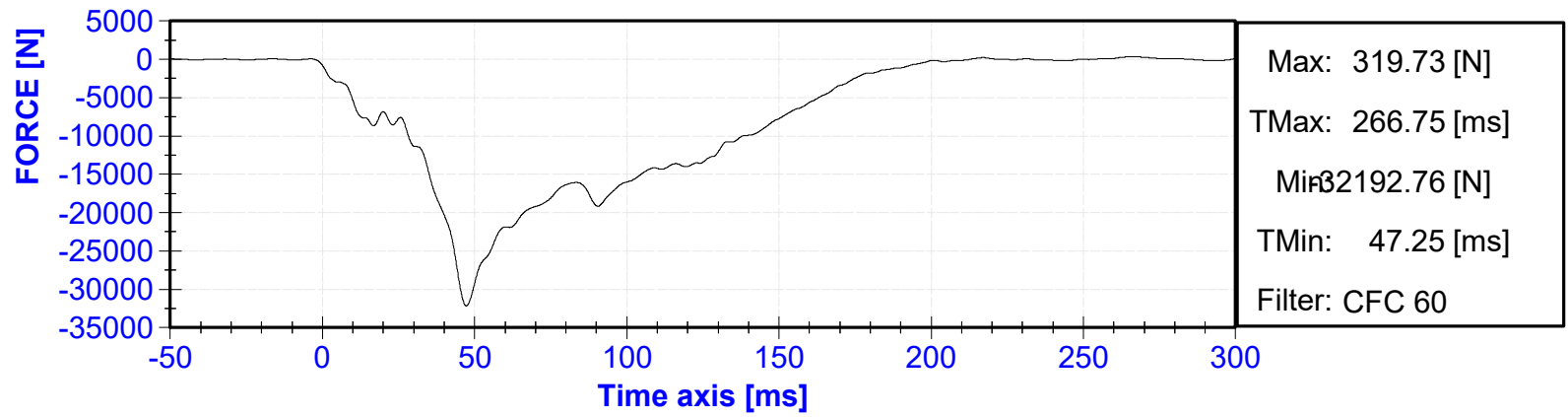
FORCE [N]



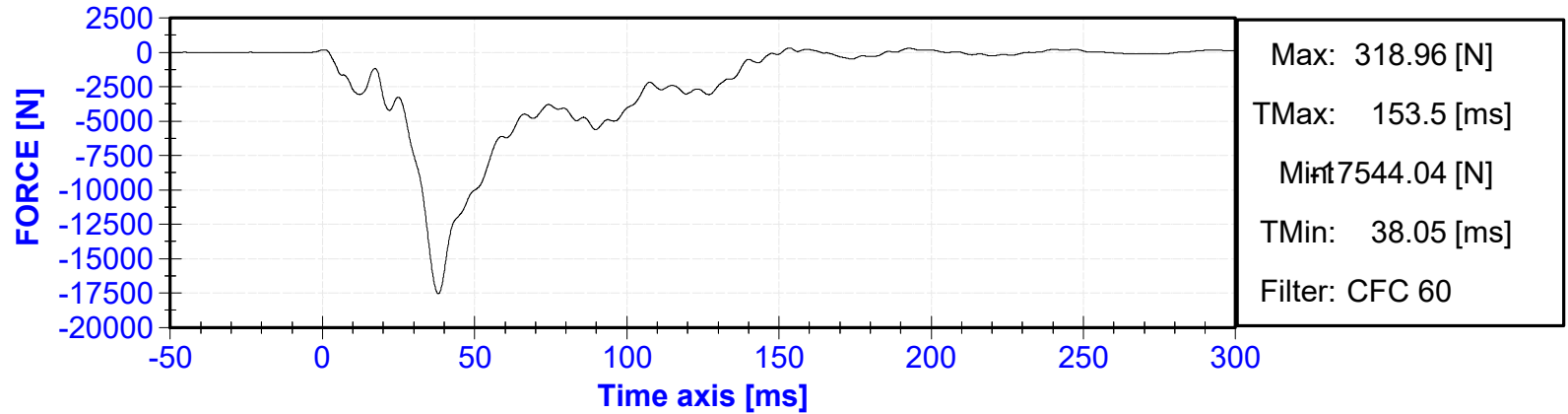
Pole Load Cell 3



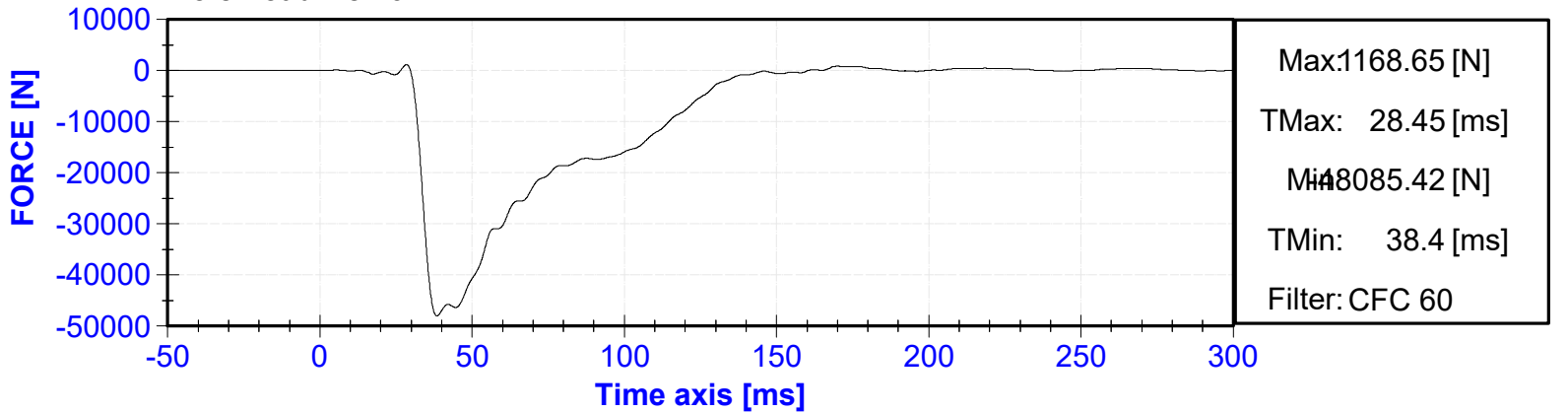
Pole Load Cell 4



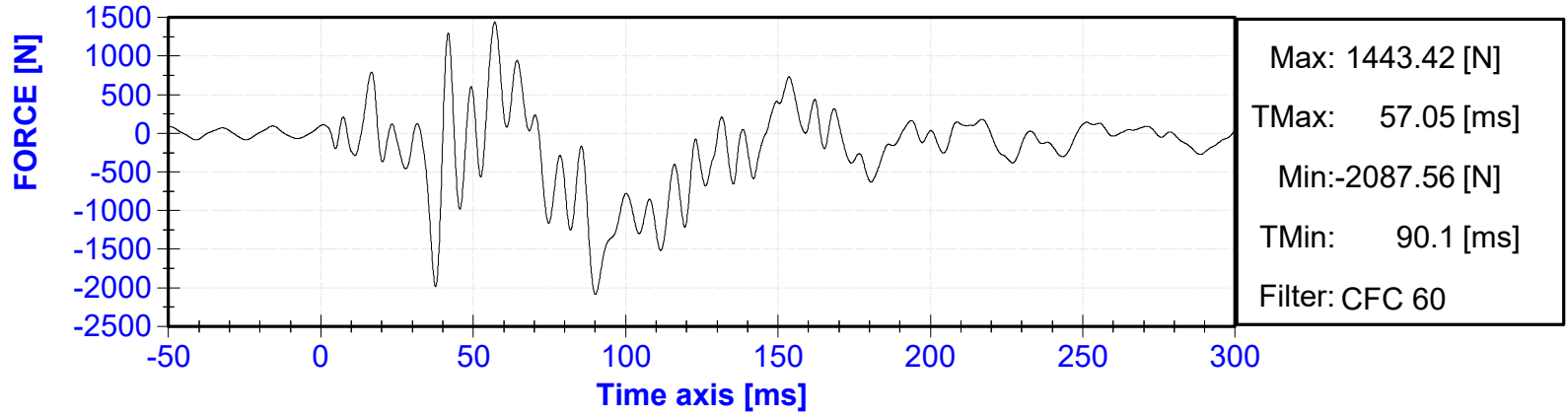
Pole Load Cell 5



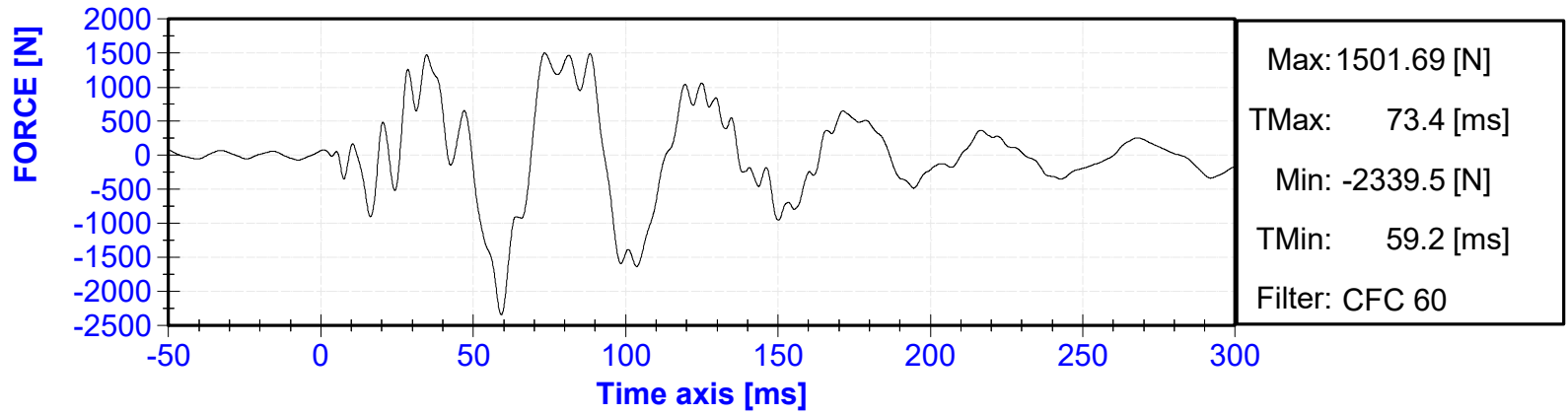
Pole Load Cell 6



Pole Load Cell 7



Pole Load Cell 8



APPENDIX C

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

ES-2RE 5TH PERCENTILE MALE - DRIVER ATD

SERIAL NO:F034

(CONFIGURED FOR LEFT SIDE IMPACT)

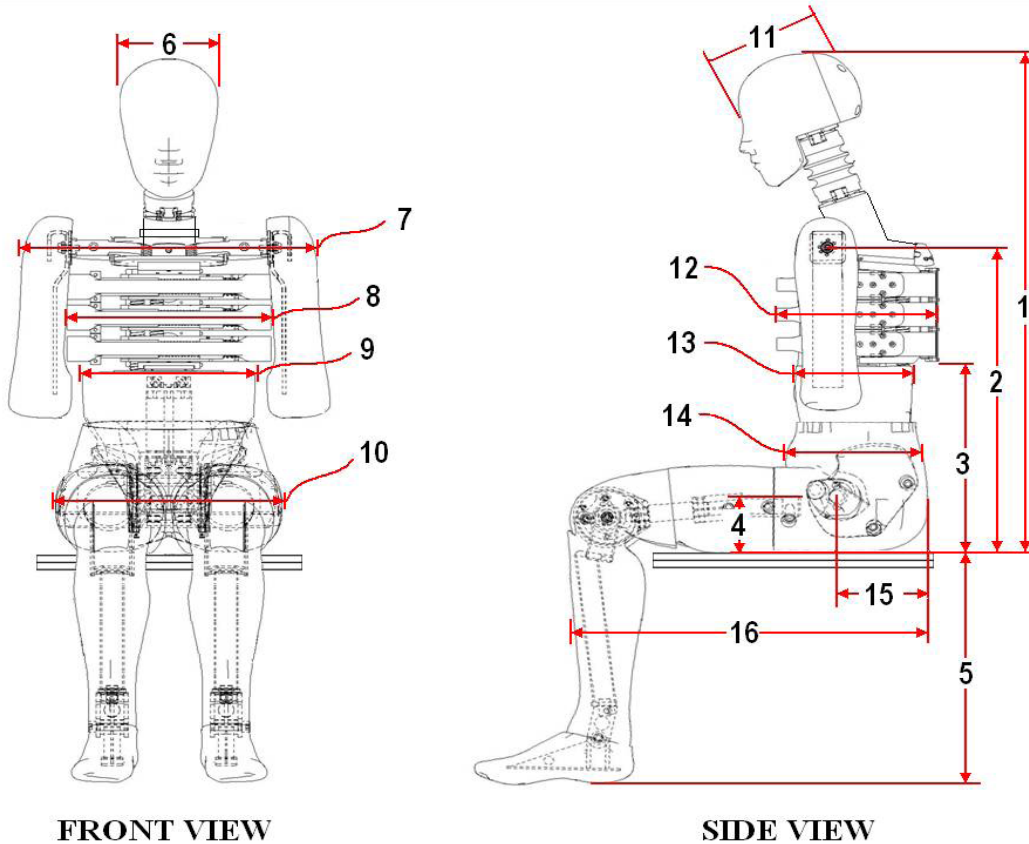


External Measurements - EuroSID-2re

Technician: K. Brogan

Date: 06/07/2023

Dummy Serial Number: F034



FRONT VIEW

SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	913	Pass
2	Seat to Shoulder Joint	558	572	569	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	351	Pass
4	Seat to Hip Joint (center of bolt)	97	103	101	Pass
5	Sole to Seat, Sitting	333	451	425	Pass
6	Head Width	152	158	155	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	328	Pass
9	Abdomen Width	273	287	284	Pass
10	Pelvis Lap Width	359	373	368	Pass
11	Head Depth	196	206	202	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	201	Pass
14	Pelvis Depth	235	245	240	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	156	Pass
16	Back of Buttocks to Front Knee	597	615	608	Pass

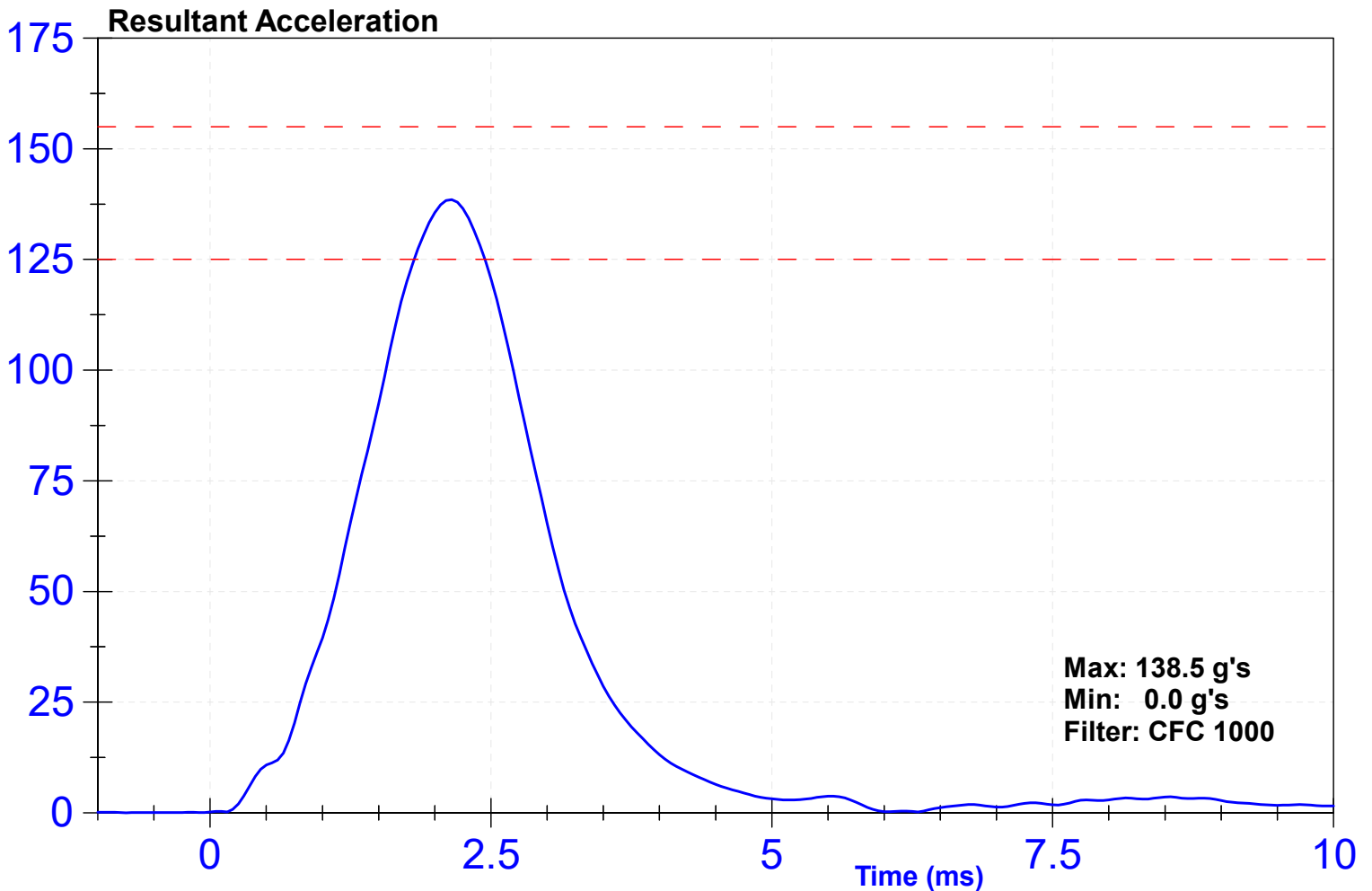
ATD Manufacturer	FTSS	Test Technician	Z.Schneider
ATD Serial Number	F034	Laboratory Supervisor	C.Mantell

Results

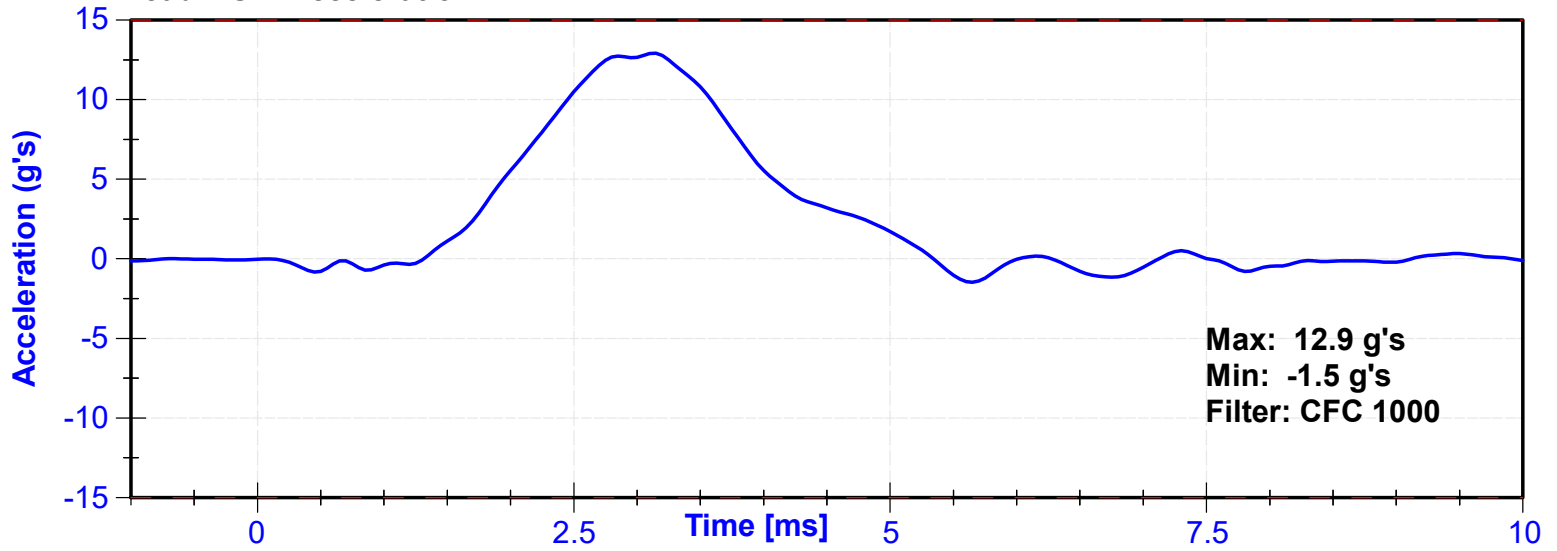
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	34	Pass
Resultant Acceleration	125	155	g's	138.5	Pass
Oscillation	0	15	%	2.71	Pass
Fore-Aft Acceleration	-15	15	g's	12.9	Pass

Transducer Calibrations

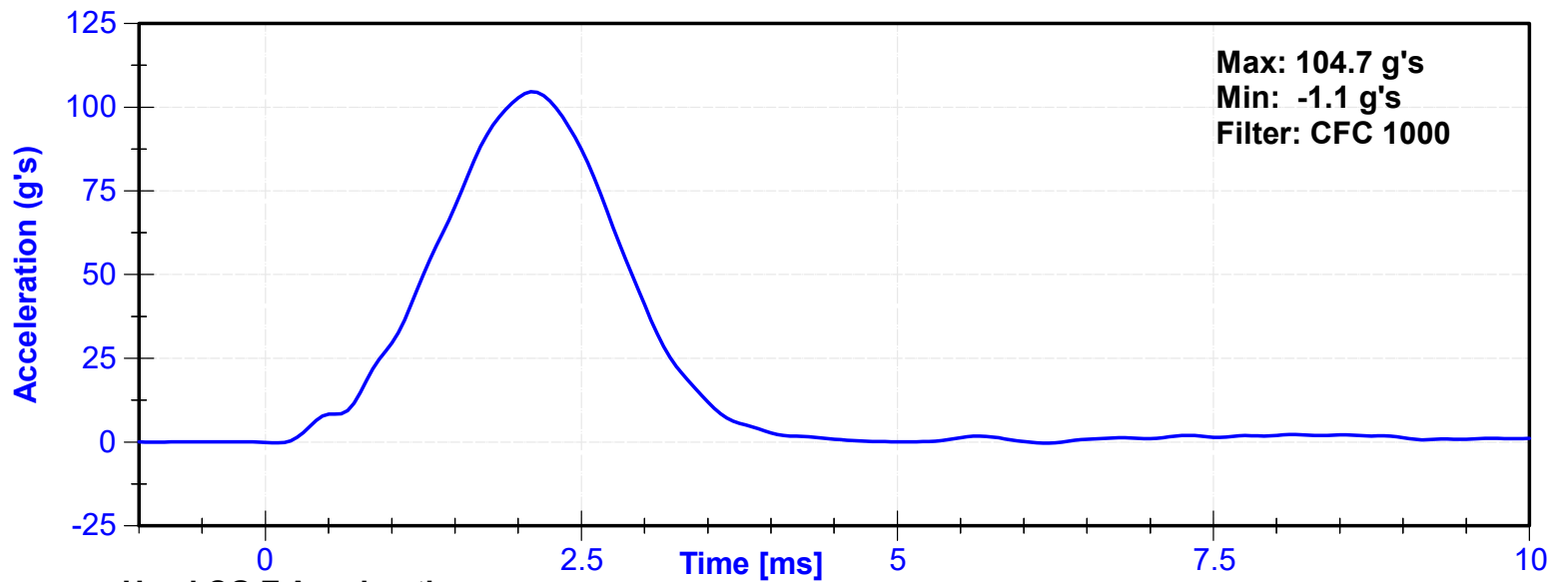
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	P51945	4/26/2023	10/23/2023
Y Accelerometer	Endevco	P51974	4/26/2023	10/23/2023
Z Accelerometer	Endevco	P51946	4/26/2023	10/23/2023



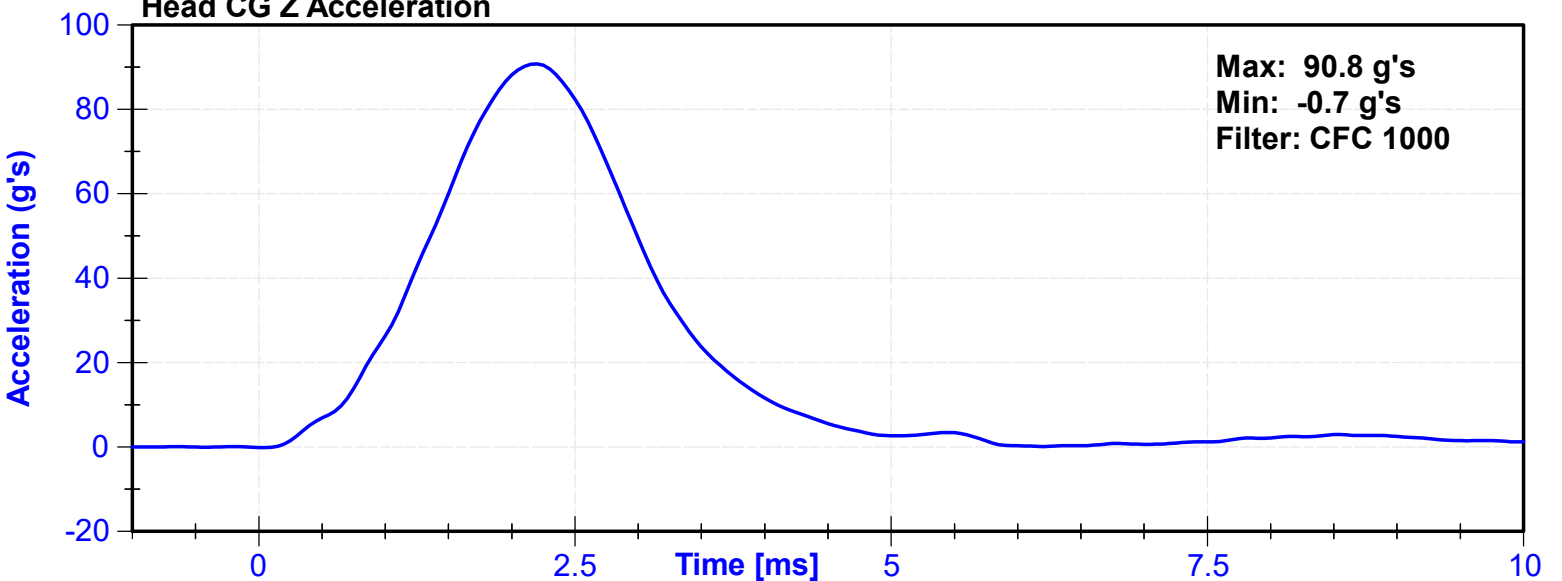
Head CG X Acceleration



Head CG Y Acceleration



Head CG Z Acceleration



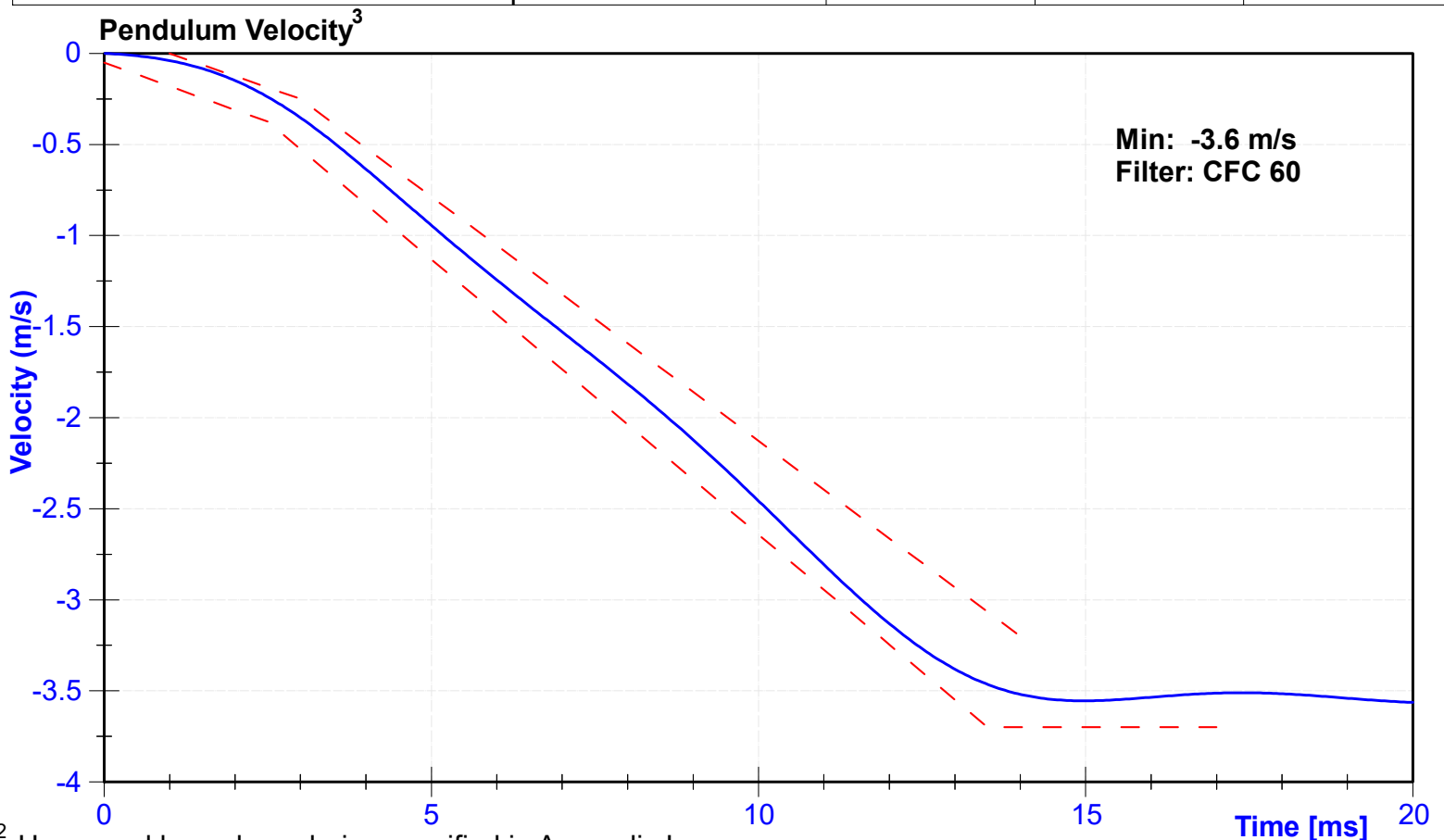
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	34.5	Pass
Velocity	3.3	3.5	m/s	3.30	Pass
Lateral Neck Rotation	49	59	deg	52.0	Pass
Time at Maximum Rotation	54	66	ms	58.0	Pass
Time of Rotation Decay from Maximum	53	88	ms	56.0	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

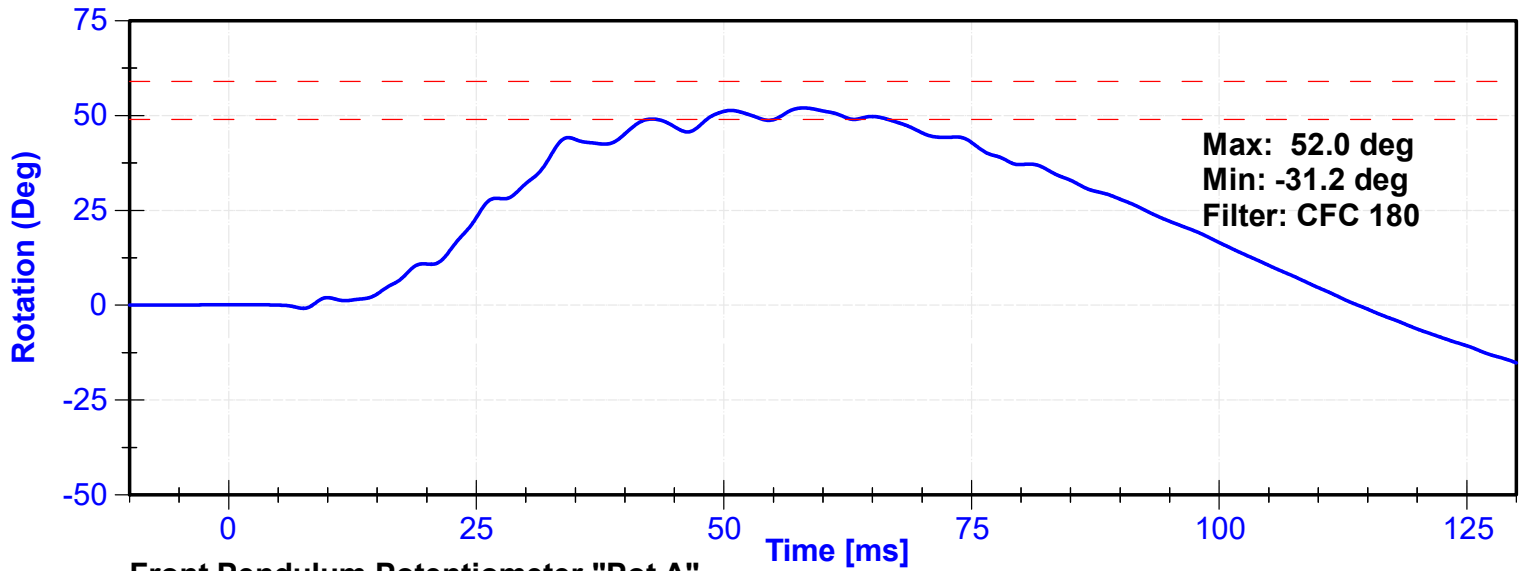
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16650	10/31/2022	10/31/2023
Front Pendulum Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Headform Potentiometer	Sfernice	095	10/5/2022	10/5/2023

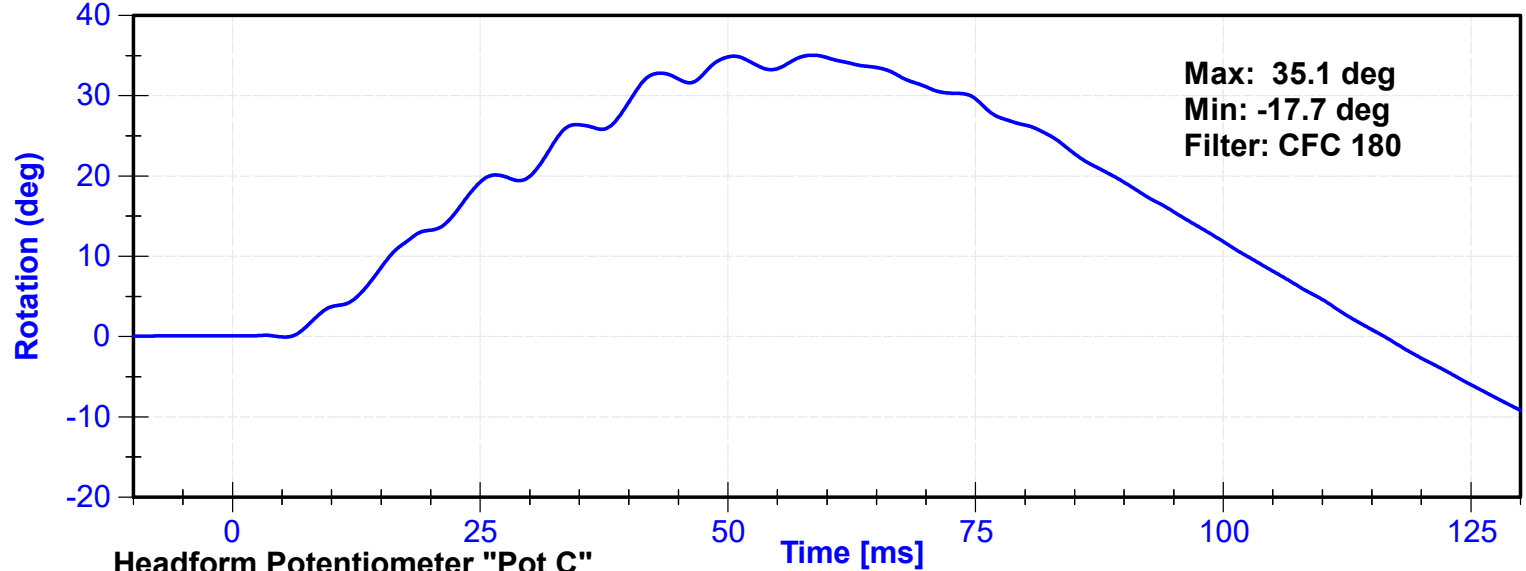


^{1,2} Upper and lower boundaries specified in Appendix I

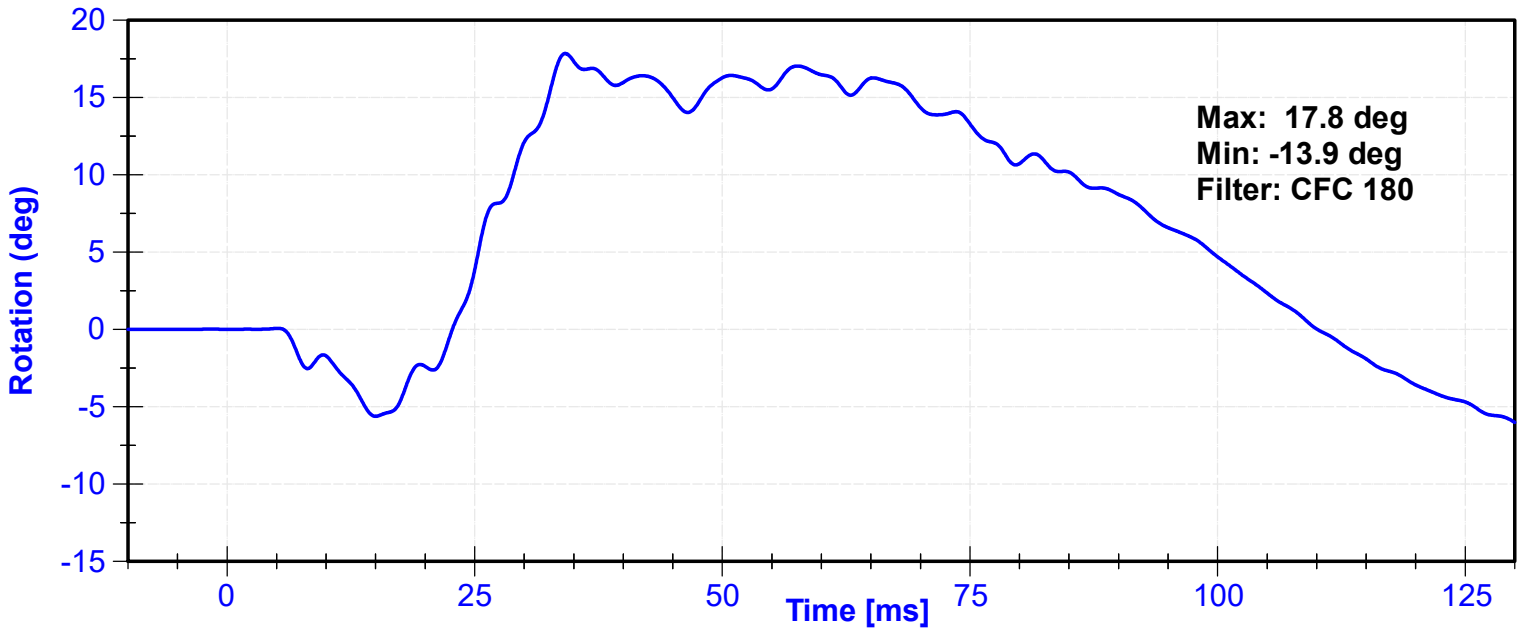
Neck Rotation



Front Pendulum Potentiometer "Pot A"



Headform Potentiometer "Pot C"



Appendix I

² Upper Boundary Corridor		¹ Lower Boundary Corridor	
Time (ms)	Velocity (m/s)	Time (ms)	Velocity (m/s)
1.0	0.00	0.0	-0.05
3.0	-0.25	2.5	-0.375
14.0	-3.20	13.5	-3.7
		17.0	-3.7

ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

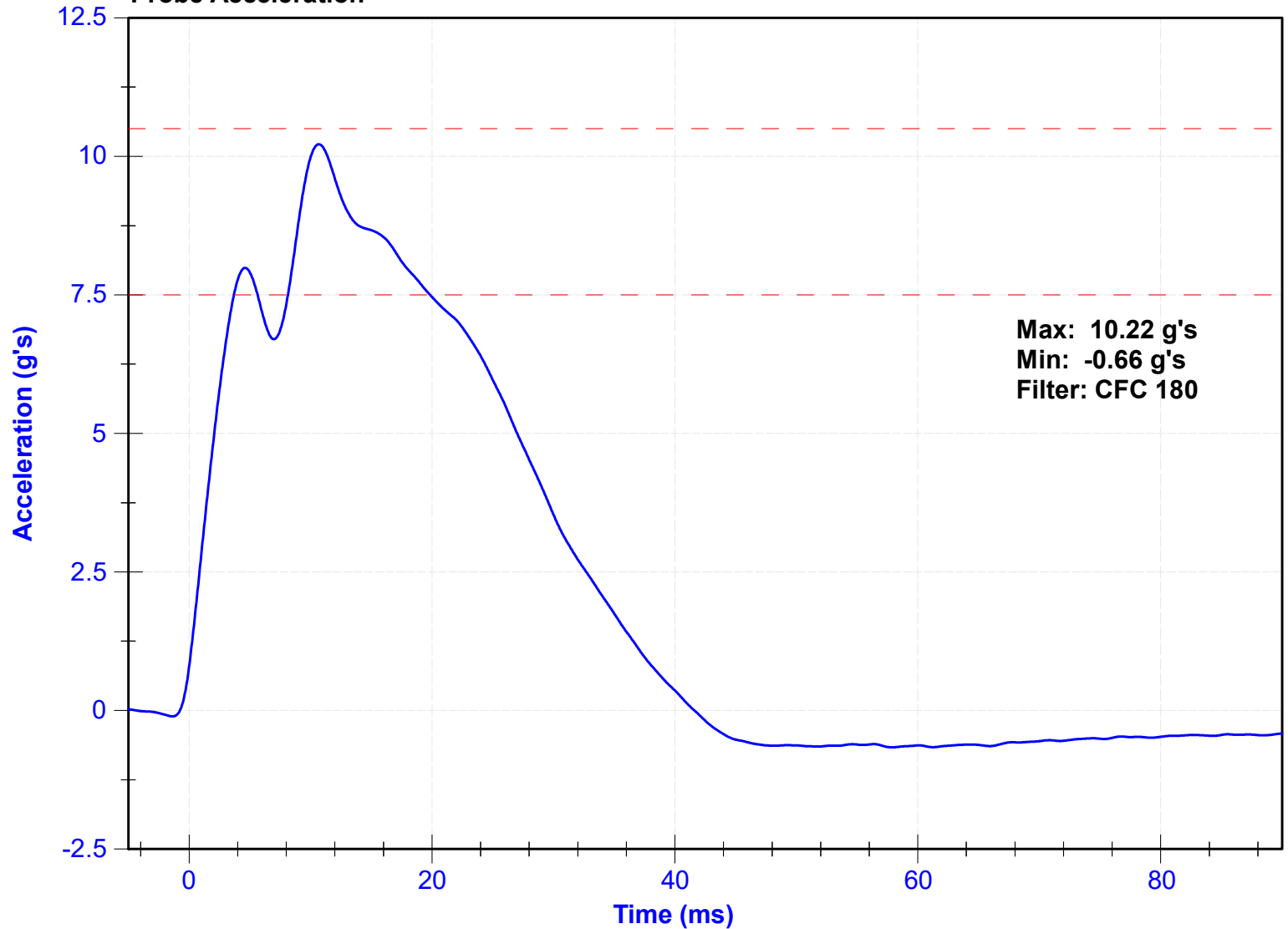
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	41.5	Pass
Velocity	4.2	4.4	m/s	4.34	Pass
Probe Acceleration	7.5	10.5	g's	10.22	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	P51736	10/25/2022	10/25/2023

Probe Acceleration



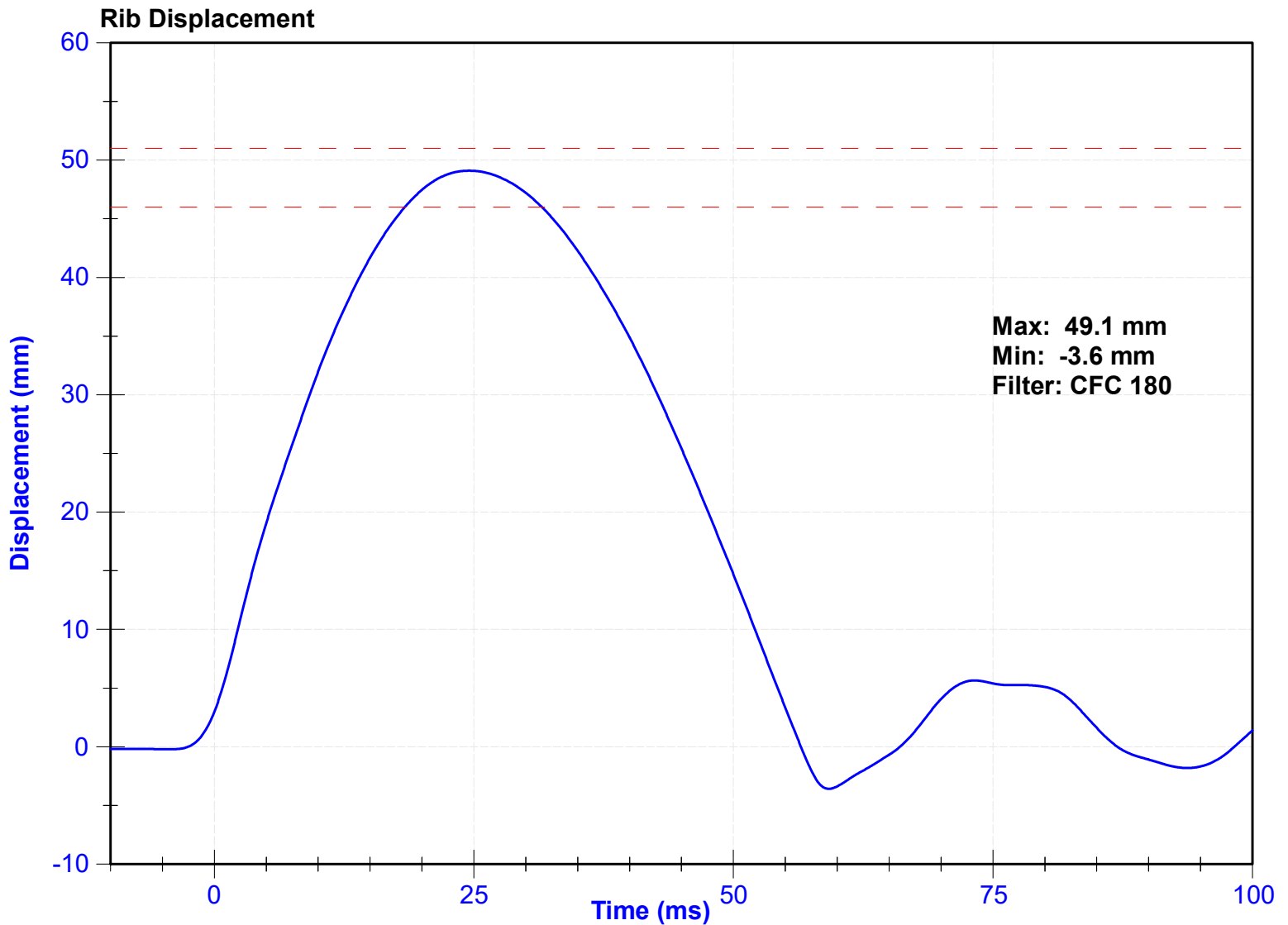
ATD Manufacturer	FTSS	Test Technician	Z.Schneider
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	34	Pass
Rib Displacement	46	51	mm	49.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	182GFE	4/27/2023	10/26/2023



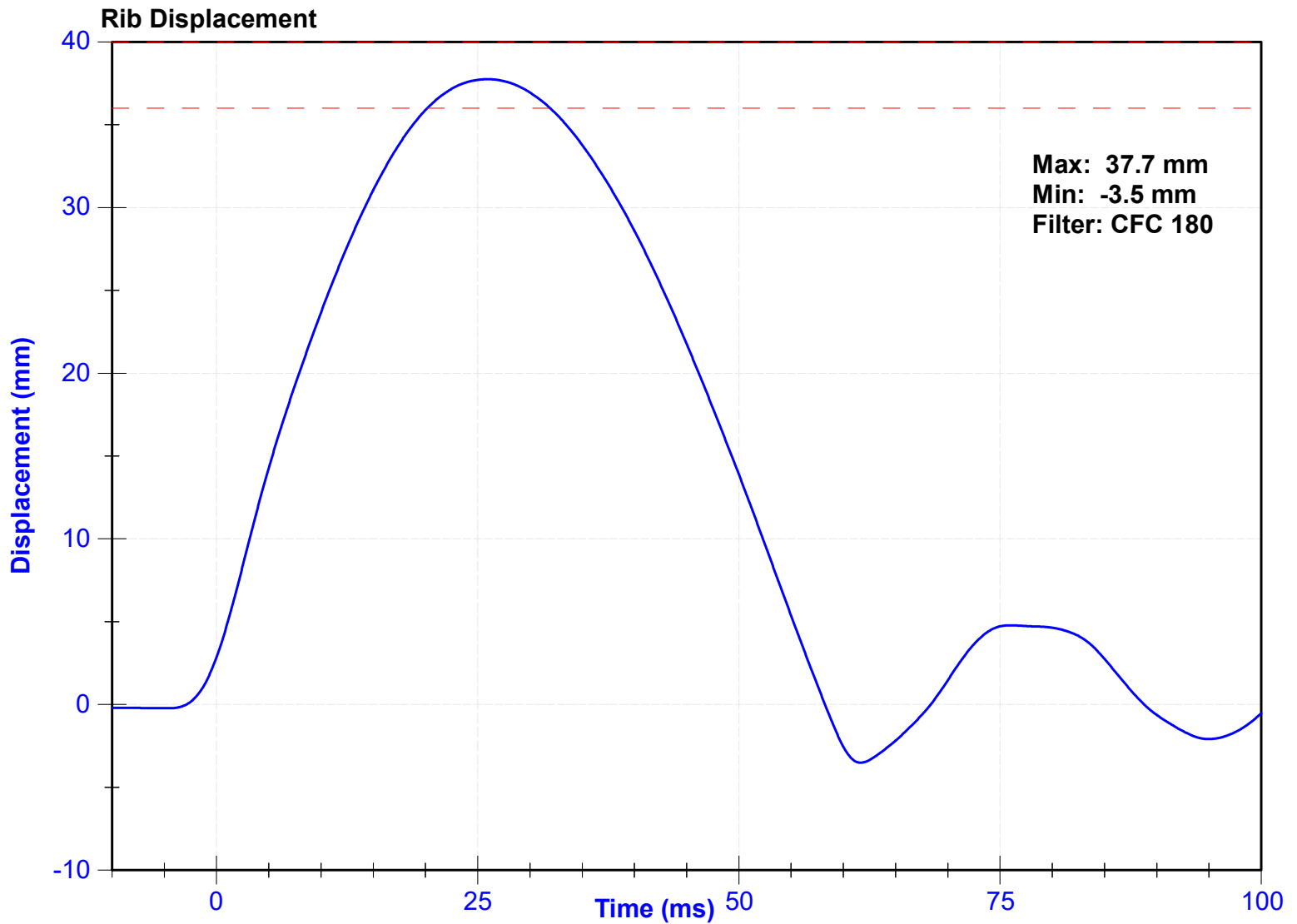
ATD Manufacturer	FTSS	Test Technician	Z.Schneider
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	34	Pass
Rib Displacement	36	40	mm	37.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	182GFE	4/27/2023	10/26/2023



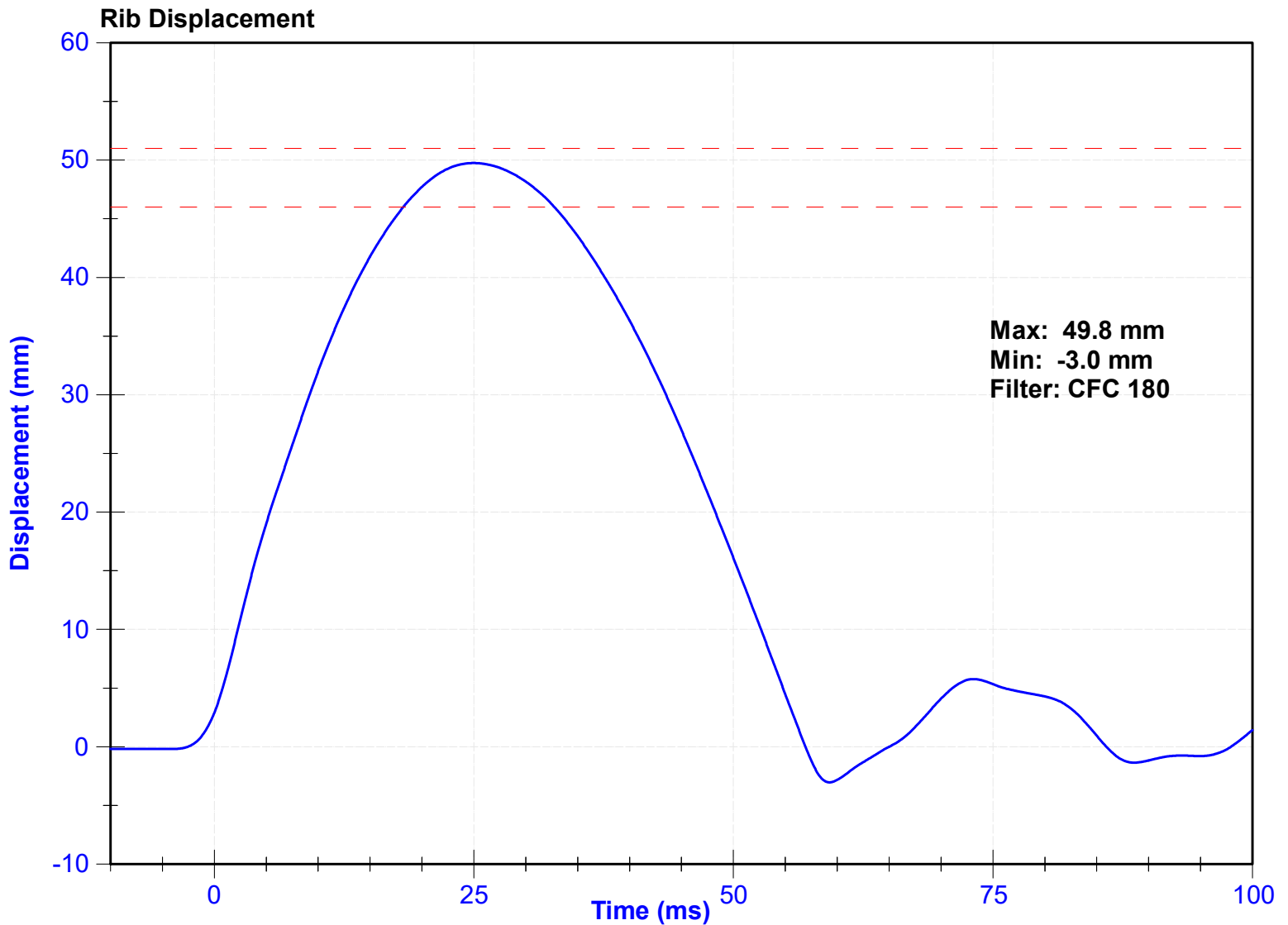
ATD Manufacturer	FTSS	Test Technician	Z.Schneider
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	34	Pass
Rib Displacement	46	51	mm	49.8	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	183GFE	4/27/2023	10/26/2023



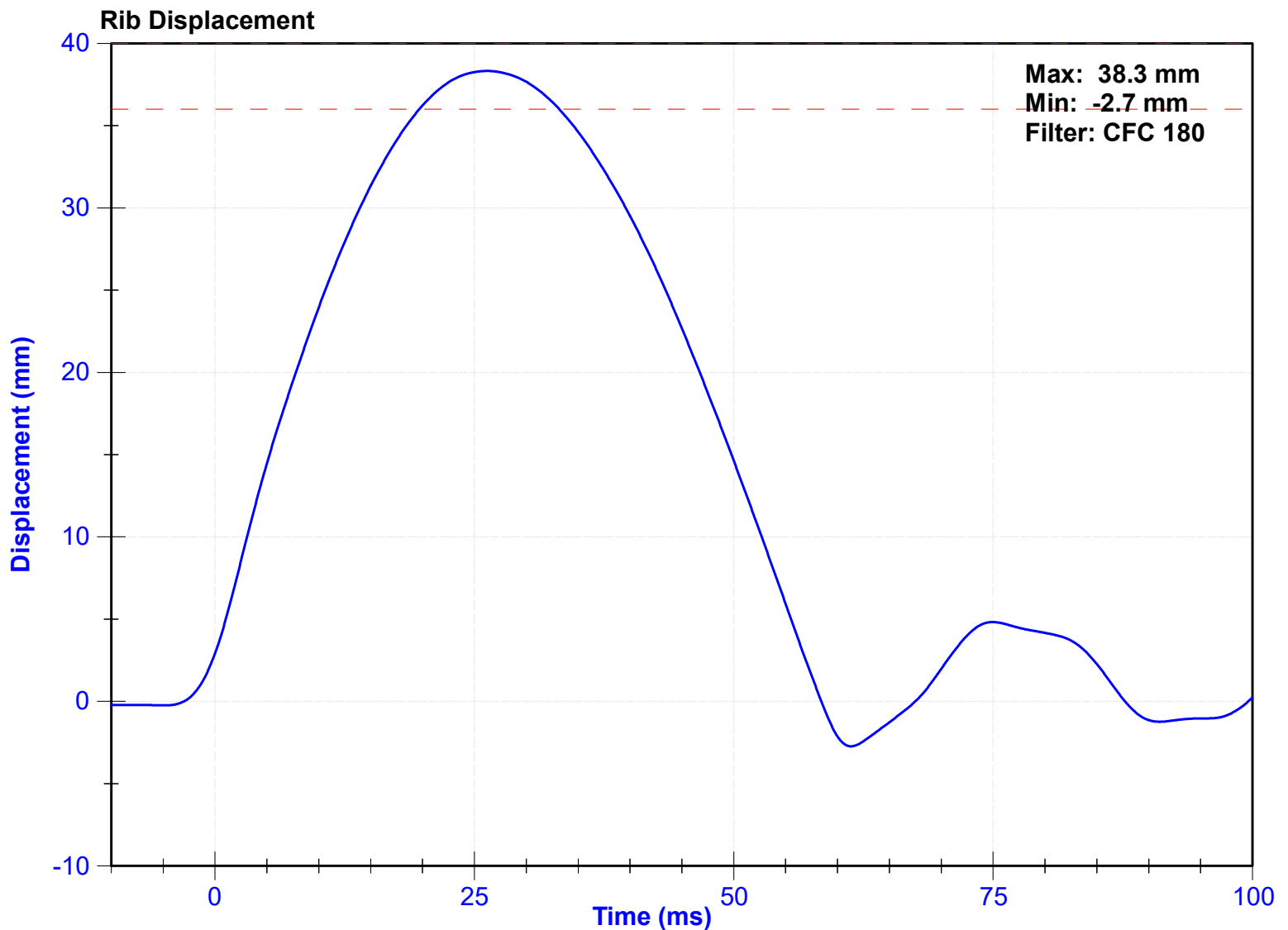
ATD Manufacturer	FTSS	Test Technician	Z.Schneider
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	34	Pass
Rib Displacement	36	40	mm	38.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	183GFE	4/27/2023	10/26/2023



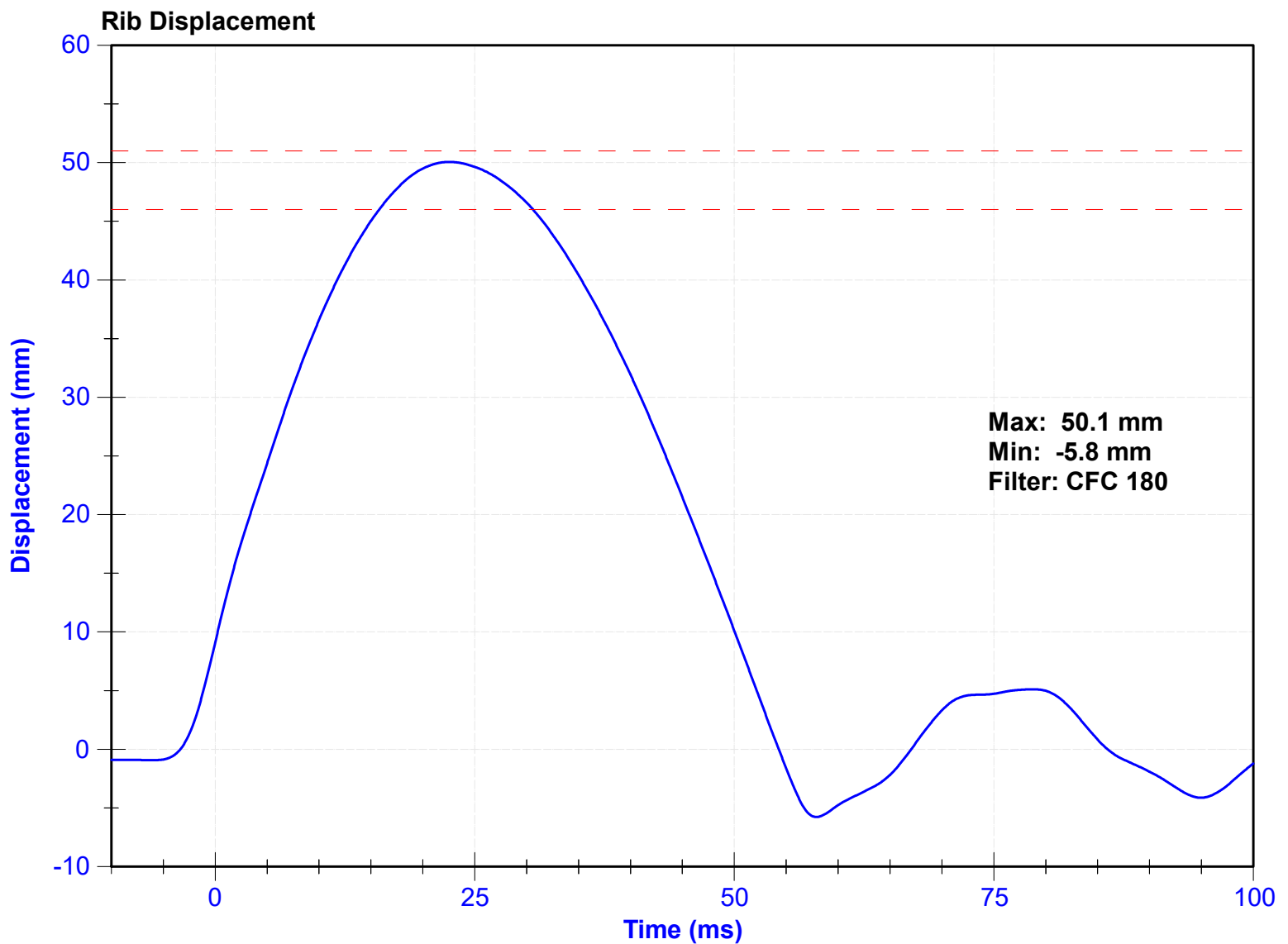
ATD Manufacturer	FTSS	Test Technician	Z.Schneider
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	34	Pass
Rib Displacement	46	51	mm	50.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	184GFE	4/27/2023	10/26/2023



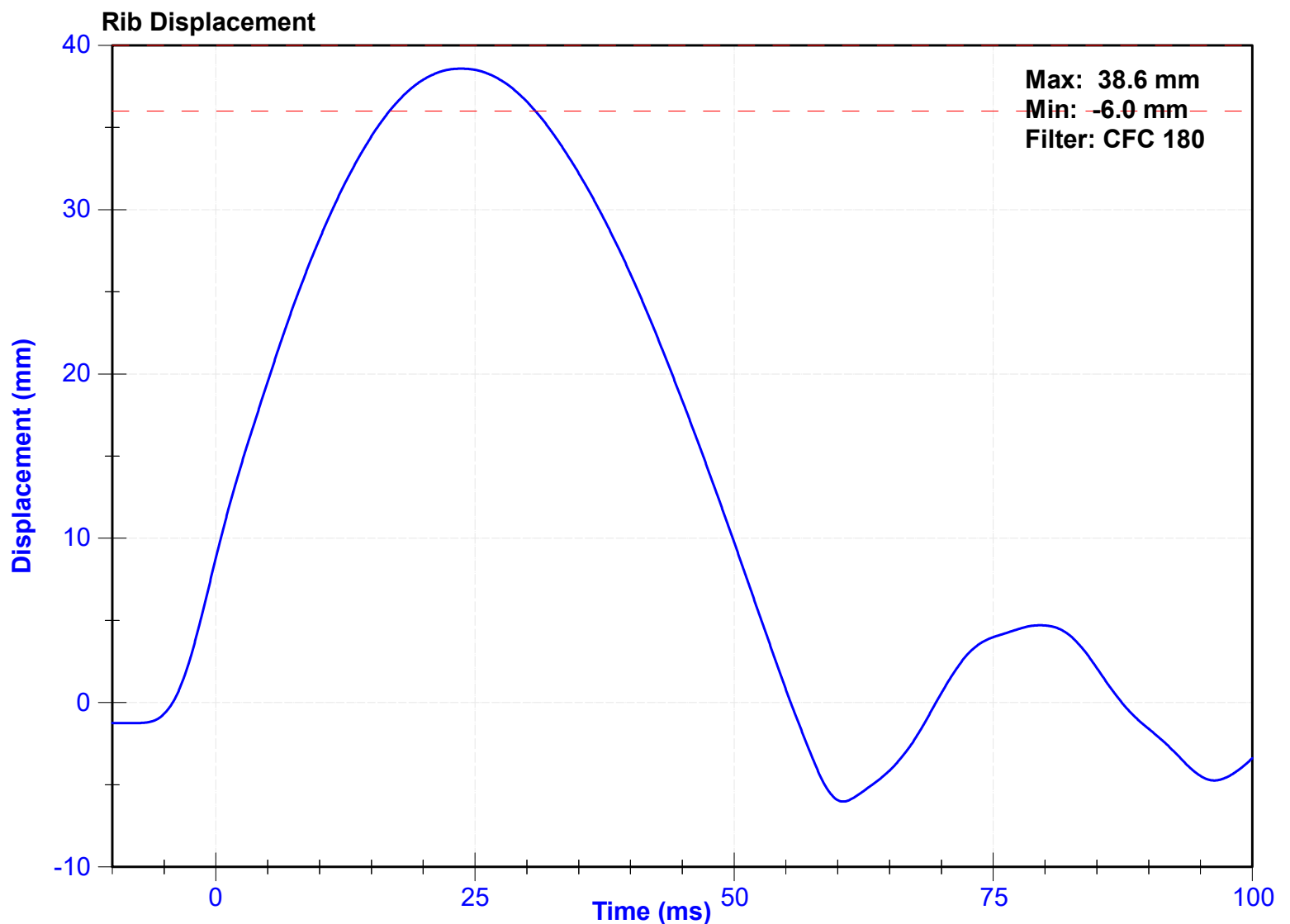
ATD Manufacturer	FTSS	Test Technician	Z.Schneider
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21	Pass
Humidity	10	70	%	34	Pass
Rib Displacement	36	40	mm	38.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	184GFE	4/27/2023	10/26/2023



ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

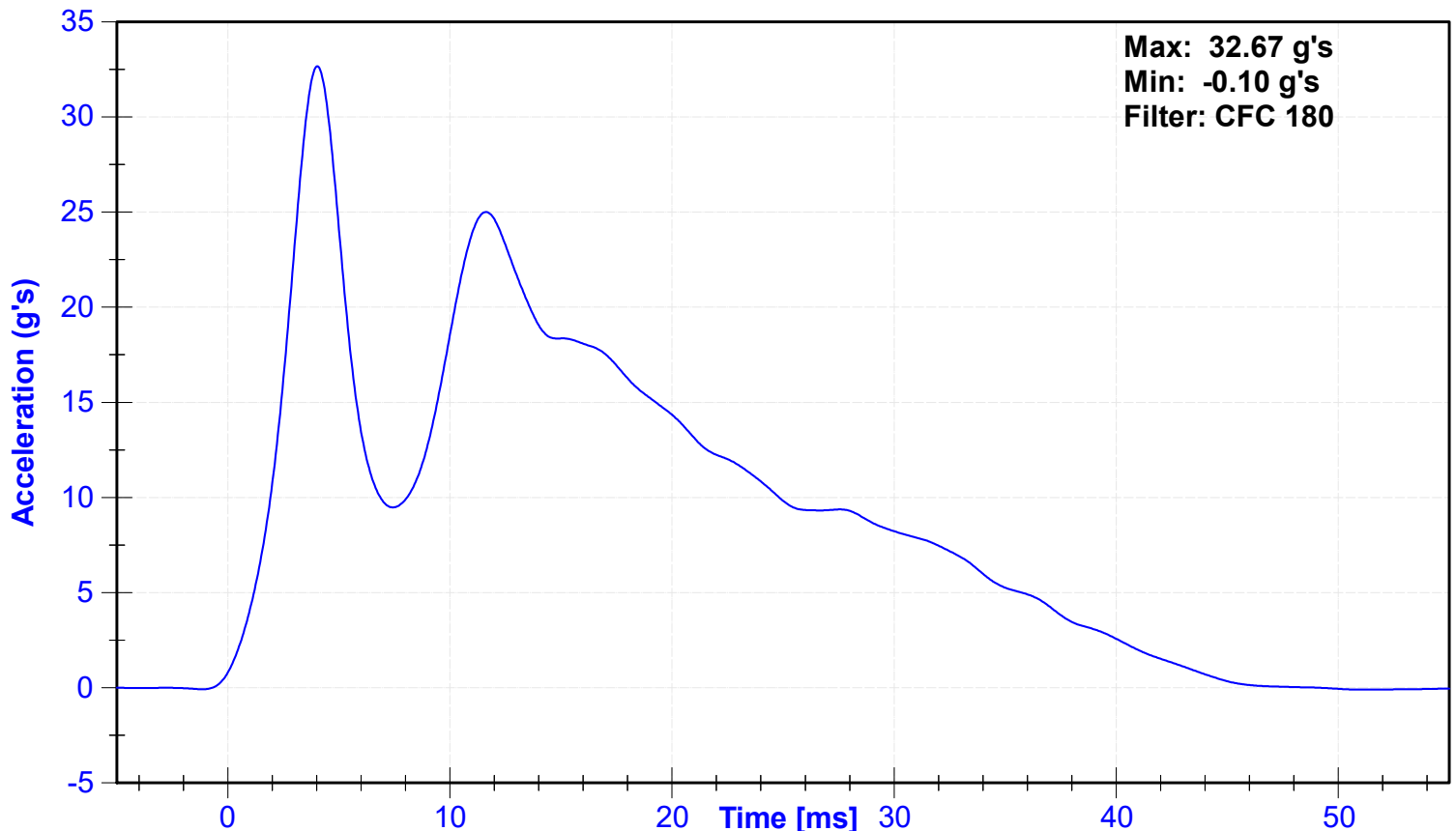
Results

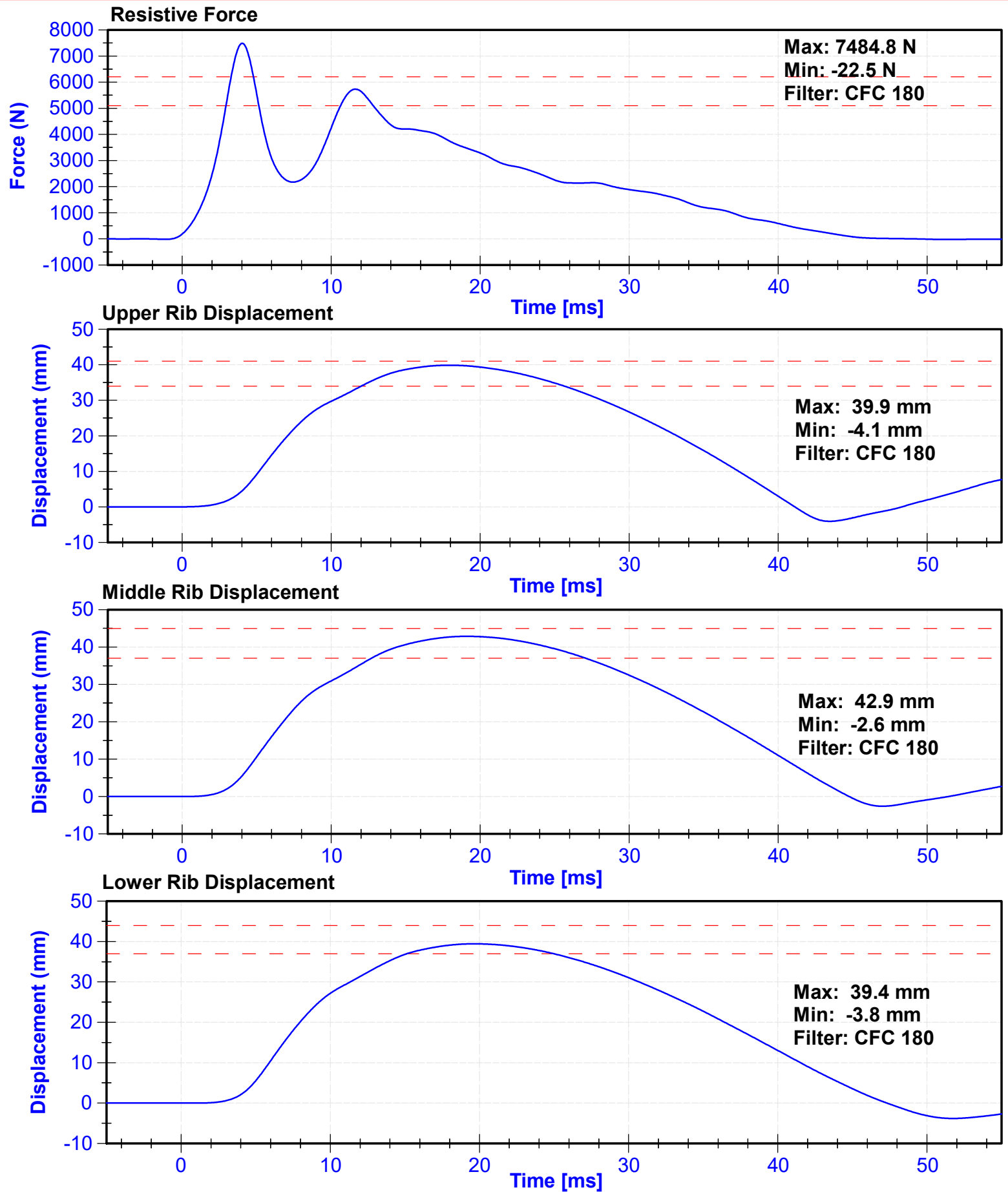
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	41.5	Pass
Velocity	5.4	5.6	m/s	5.52	Pass
Resistive Force after 6ms	5100	6200	N	5729.5	Pass
Upper Thorax Rib Deflection	34	41	mm	39.9	Pass
Mid Thorax Rib Deflection	37	45	mm	42.9	Pass
Lower Thorax Rib Deflection	37	44	mm	39.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Upper Thorax Rib Potentiometer	Honeywell	182GFE	4/27/2023	10/26/2023
Middle Thorax Rib Potentiometer	Honeywell	183GFE	4/27/2023	10/26/2023
Lower Thorax Rib Potentiometer	Honeywell	184GFE	4/27/2023	10/26/2023

Probe Acceleration





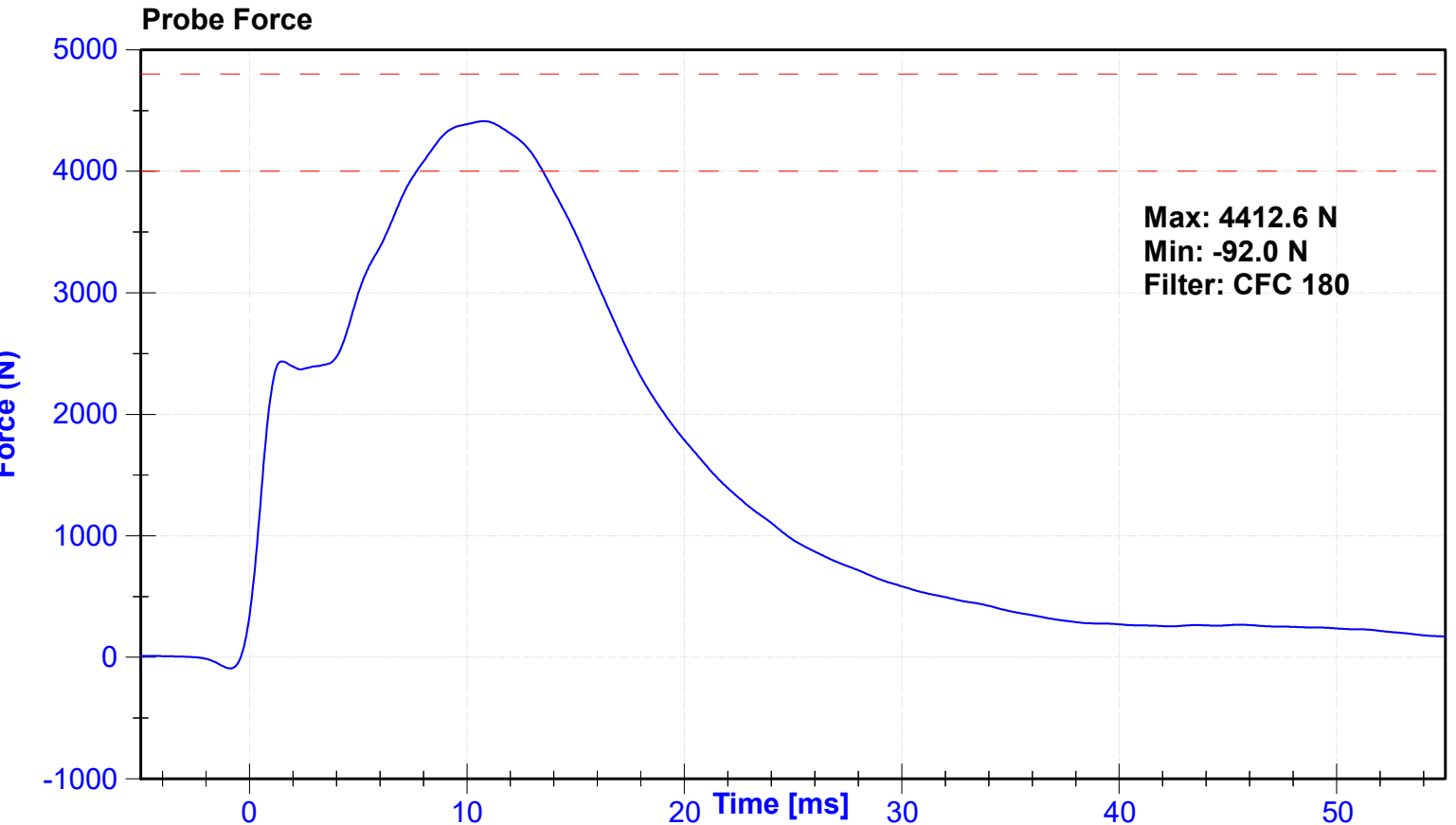
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

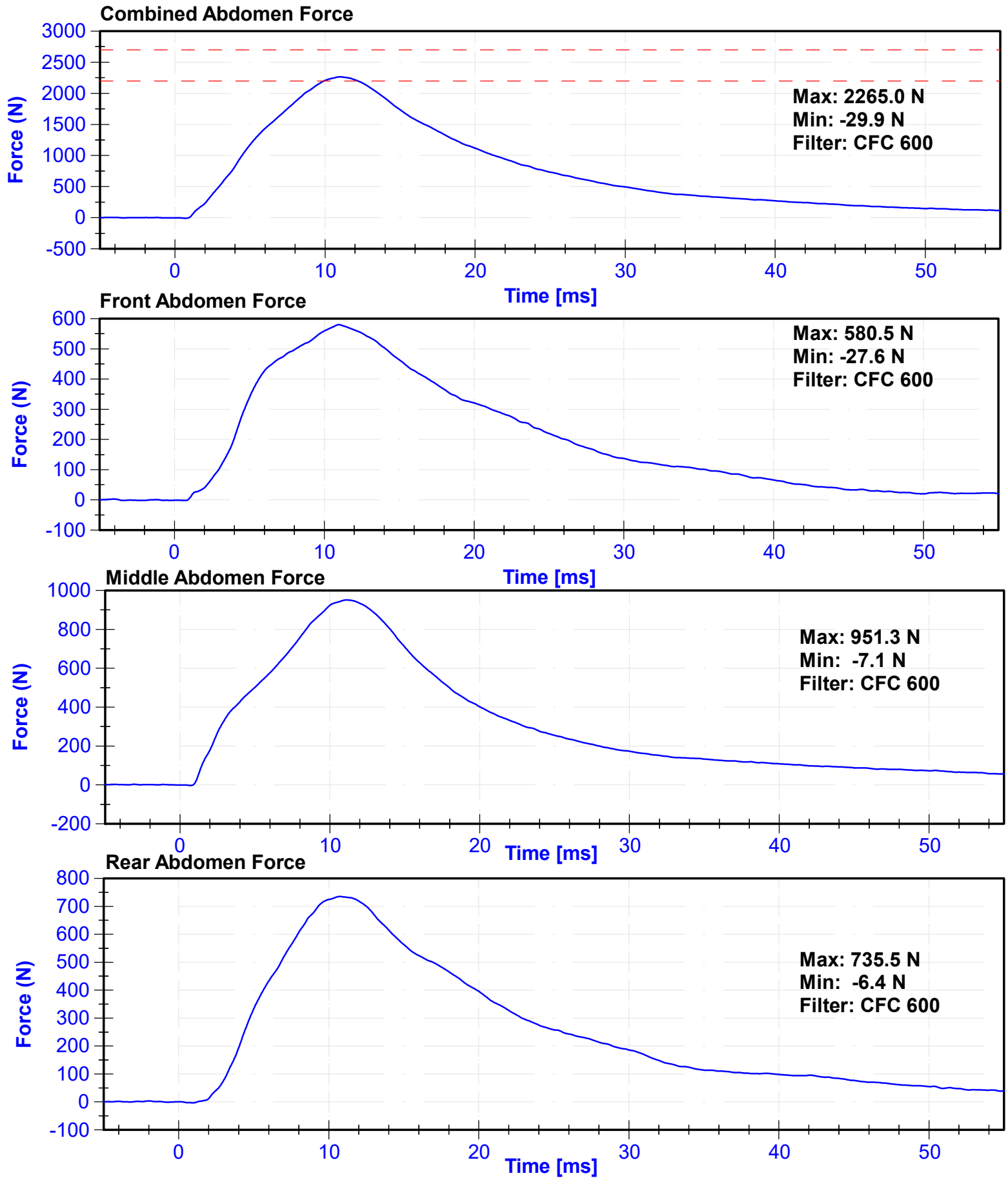
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	41.5	Pass
Velocity	3.9	4.1	m/s	4.03	Pass
Combined Abdomen Force	2200	2700	N	2265.0	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.00	Pass
Resistive Probe Force	4000	4800	N	4412.6	Pass
Time at Peak Resistive Force	10.6	13.0	ms	10.75	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Front Abdomen Load Cell	Denton	1523	8/12/2022	8/12/2023
Middle Abdomen Load Cell	Denton	1524	8/12/2022	8/12/2023
Rear Abdomen Load Cell	Denton	1530	8/12/2022	8/12/2023





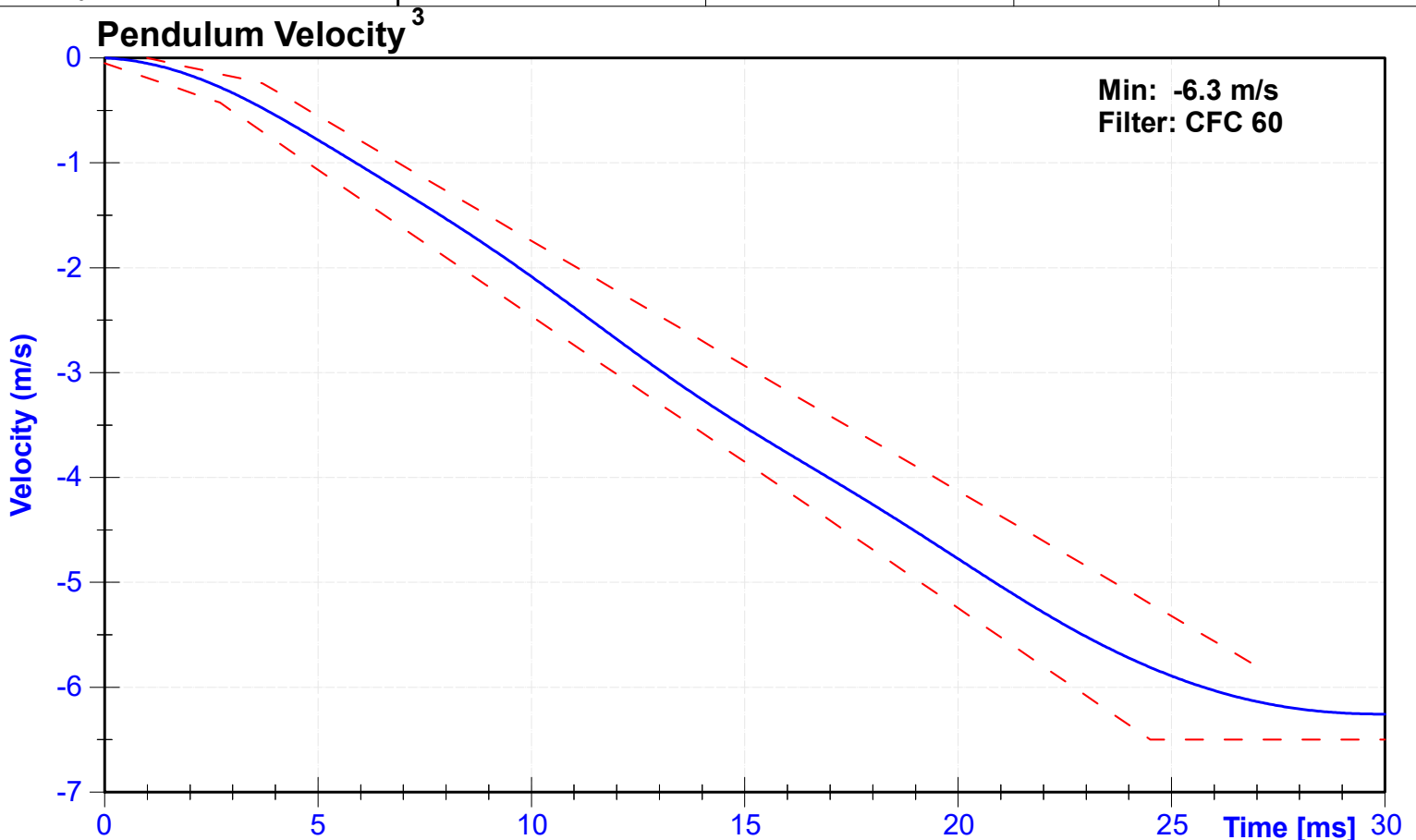
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

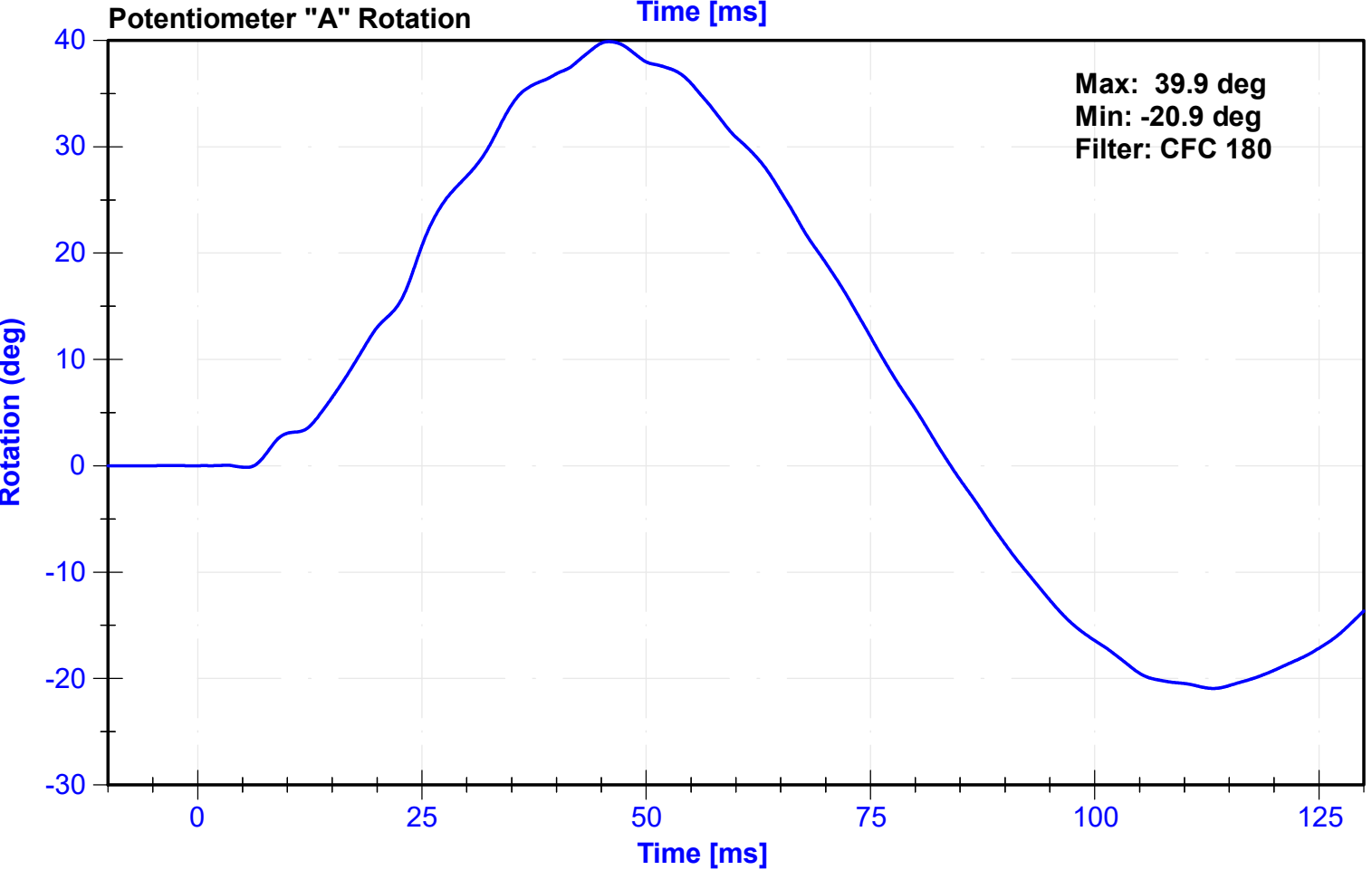
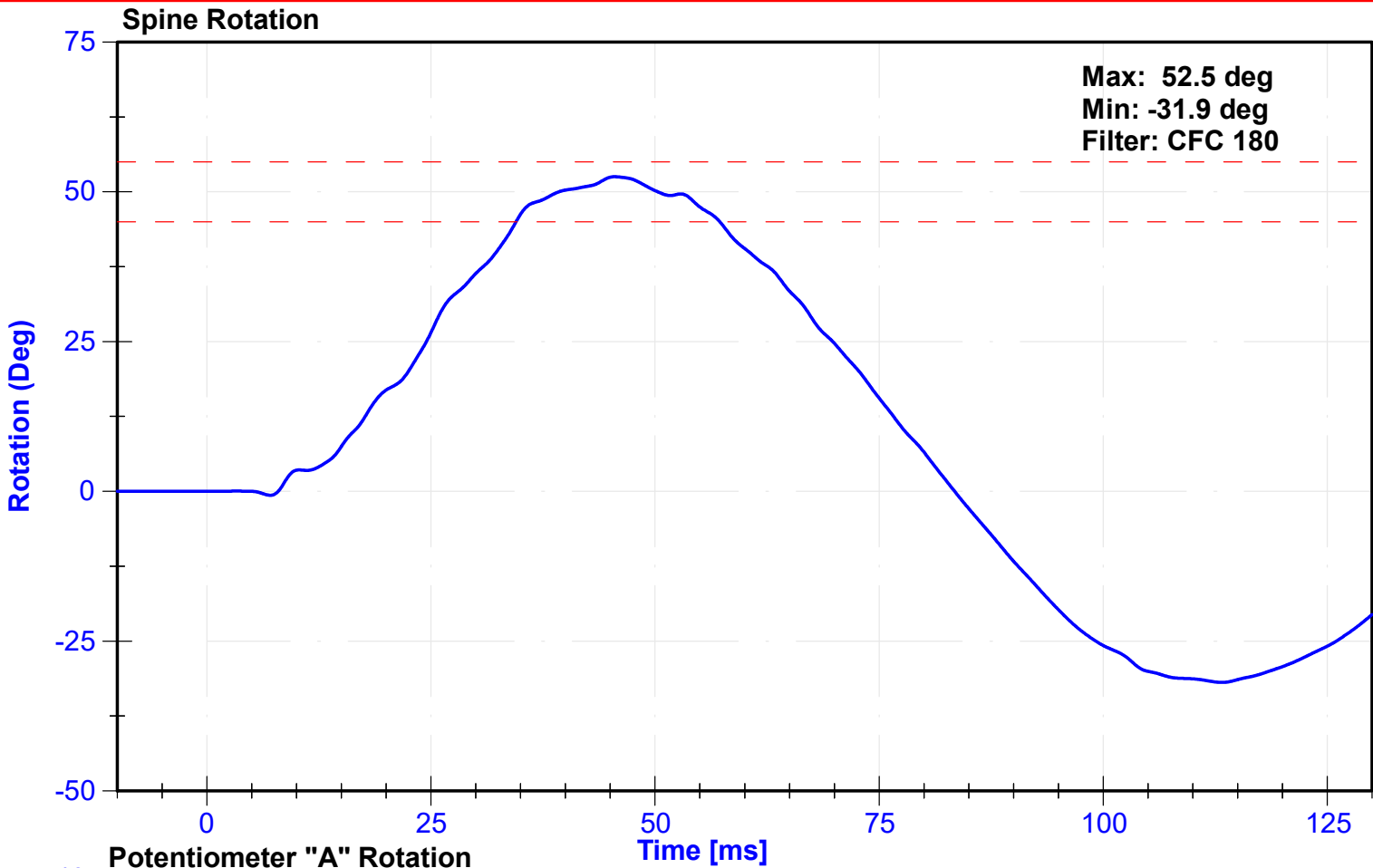
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.9	Pass
Humidity	10	70	%	44.5	Pass
Velocity	5.95	6.15	m/s	6.076	Pass
Lateral Spine Rotation	45	55	deg	52.5	Pass
Time at Maximum Rotation	39	53	ms	45.5	Pass
Time of Decay to Zero Degrees	37	57	ms	38.0	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

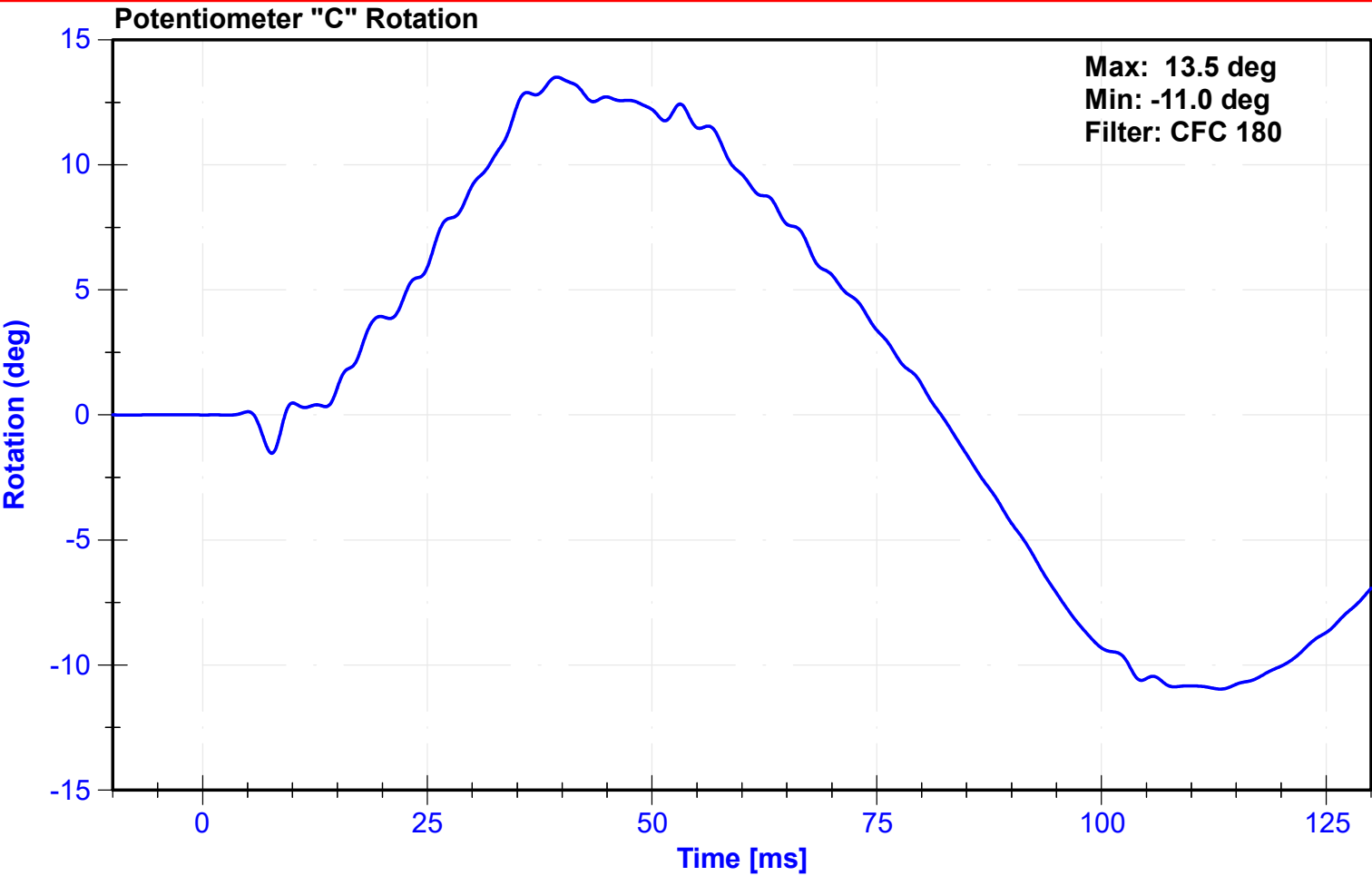
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Pendulum "A" Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Condyle "B" Potentiometer	Sfernice	095	10/5/2022	10/5/2023



^{1,2} Upper and lower boundaries specified in Appendix I





Appendix I

² Upper Boundary Corridor		¹ Lower Boundary Corridor	
Time (ms)	Velocity (m/s)	Time (ms)	Velocity (m/s)
1.0	0.00	0.0	-0.05
3.7	-0.24	2.7	-0.425
27.0	-5.80	24.5	-6.5
		30.0	-6.5

ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

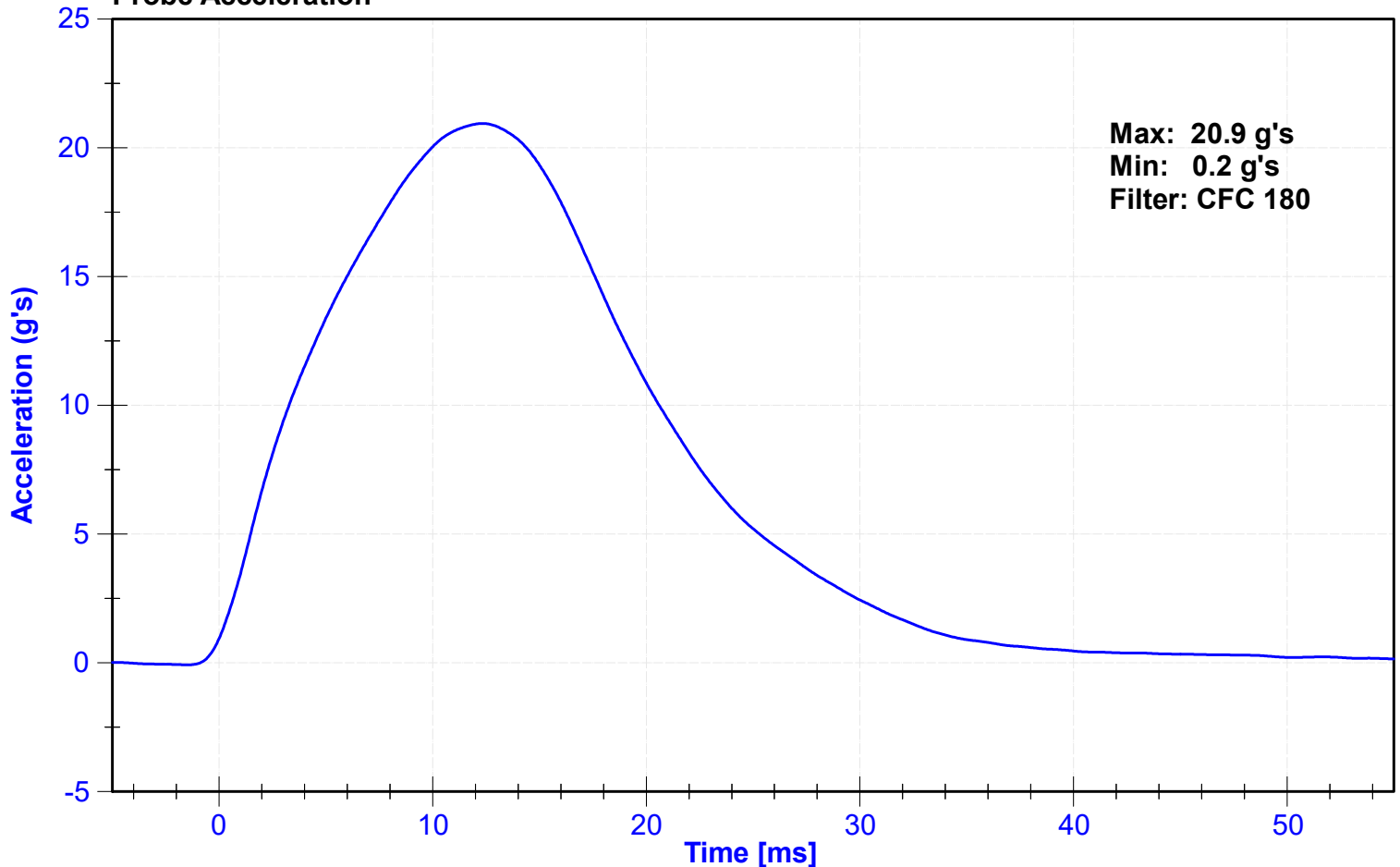
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.6	Pass
Humidity	10	70	%	41.5	Pass
Velocity	4.2	4.4	m/s	4.36	Pass
Resistive Force	4700	5400	N	4797.7	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.35	Pass
Pubic Force	-1590	-1230	N	-1436.0	Pass
Time at Peak Pubic Force	12.2	17.0	ms	12.75	Pass

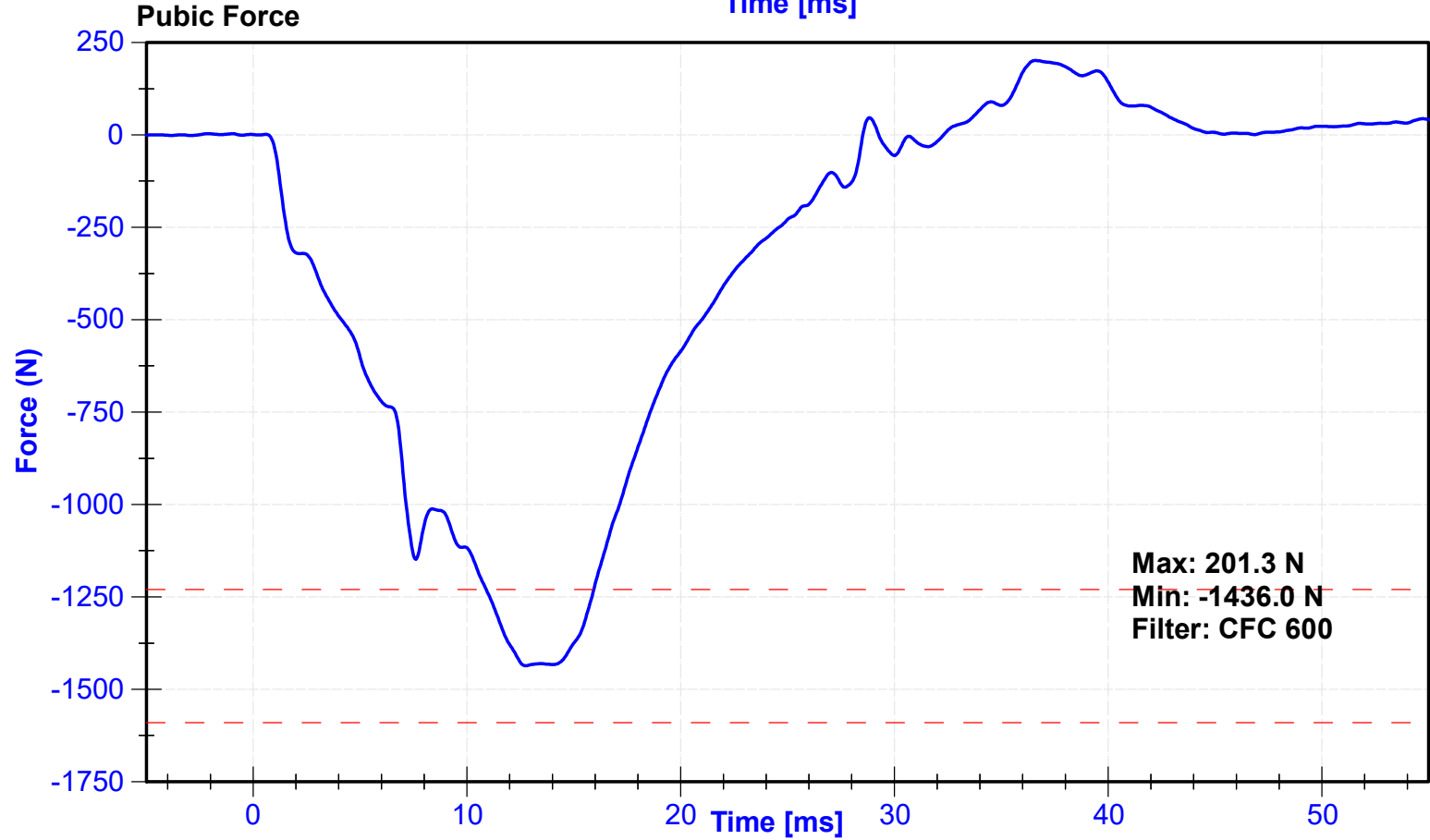
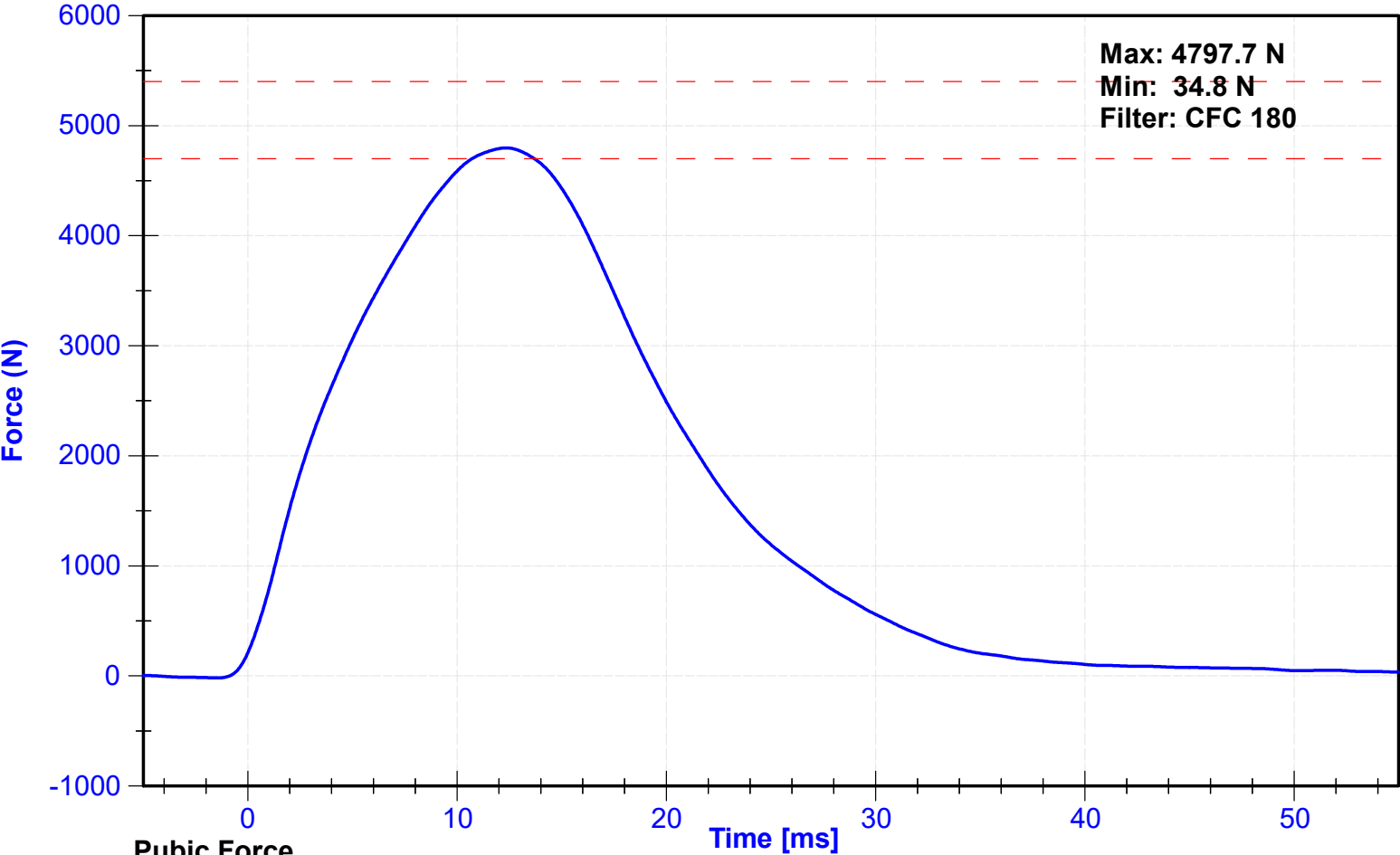
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Pubic Load Cell	Denton	458-FY	8/12/2022	8/12/2023

Probe Acceleration



Resistive Force



APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

TABLE 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N F034		
			Serial Number	Manufacturer	Calibration Date
Head	Primary Accelerometers	X	P51945	Endevco	4/26/2023
		Y	P51974	Endevco	4/26/2023
		Z	P51946	Endevco	4/26/2023
	Redundant Accelerometers	X	P51950	Endevco	4/26/2023
		Y	P49440	Endevco	4/26/2023
		Z	P49211	Endevco	4/26/2023
	Angular Rate Sensors	X	21126	DTS ARS	8/3/2022
		Y	21115	DTS	8/22/2022
		Z	20842	DTS ARS	9/16/2022
Upper Neck Load Cell	Forces	X	131-FX	FTSS	3/29/2023
		Y	131-FY	FTSS	3/29/2023
		Z	131-FZ	FTSS	3/29/2023
	Moments	X	131-MX	FTSS	3/29/2023
		Y	131-MY	FTSS	3/29/2023
		Z	131-MZ	FTSS	3/29/2023
Shoulder Load Cell	Forces	X	119-FX	FTSS	3/30/2023
		Y	119-FY	FTSS	3/30/2023
		Z	119-FZ	FTSS	3/30/2023
Thorax Rib Displacement Potentiometers	Upper	Y	182GFE	Honeywell	4/27/2023
	Middle	Y	183GFE	Honeywell	4/27/2023
	Lower	Y	184GFE	Honeywell	4/27/2023
Abdomen Load Cells	Forward	Y	1523	Denton	8/12/2022
	Middle	Y	1524	Denton	8/12/2022
	Rear	Y	1530	Denton	8/12/2022
Spine	Upper (T1) Accelerometers	X	T34792	Endevco	4/26/2023
		Y	T28864	Endevco	4/27/2023
		Z	T34366	Endevco	4/26/2023
	Lower (T12) Accelerometers	X	P51962	Endevco	4/26/2023
		Y	P64007	Endevco	4/26/2023
		Z	P71281	Endevco	4/26/2023
	Forces	X	103-FX	FTSS	2/20/2008
		Y	103-FY	FTSS	2/20/2008
	Moments	X	103-MX	FTSS	2/20/2008
		Y	103-MY	FTSS	2/20/2008
Lumbar Spine	Forces	Y	105-FY	FTSS	7/14/2020
		Z	105-FZ	FTSS	7/14/2020
	Moment	X	105-MX	FTSS	7/14/2020
Pelvis	Pubic Symphysis Load Cell	Y	458-FY	Denton	8/12/2022
	Accelerometers	X	P58871	Endevco	4/26/2023
		Y	P58776	Endevco	4/26/2023
		Z	P51734	Endevco	4/26/2023

TABLE 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	A274227	Measurement Specialties	6/17/2023
		Y	A274252	Measurement Specialties	6/17/2023
		Z	A293488	Measurement Specialties	6/17/2023
2	Vehicle Center of Gravity Angular Rate	X	18627	DTS ARS	1/20/2023
		Y	20279	DTS ARS	1/20/2023
		Z	20292	DTS ARS	1/20/2023
3	Right Sill at Vertical Impact Reference Line	Y	A280968	Measurement Specialties	3/23/2023
4	Left Floor Sill	Y	G22834	Endevco	2/4/2023
5	Left Front Door Mid Centerline	Y	G22924	Endevco	2/25/2023
6	Left Front Door Mid Rear	Y	A281032	Measurement Specialties	5/26/2023
7	Left Front Door Upper Centerline	Y	A290932	Measurement Specialties	5/26/2023
8	Left Rear Door Mid Rear	Y	A280936	Measurement Specialties	6/17/2023
9	Left Rear Door Upper Centerline	Y	A398325	Measurement Specialties	2/27/2023
10	Left Lower A-Pillar	Y	A431368	Measurement Specialties	6/17/2023
11	Left Mid A-Pillar	Y	A374342	Measurement Specialties	6/17/2023
12	Left A-Pillar Sill	Y	G22597	Endevco	3/22/2023
13	Left Lower B-Pillar	Y	A315707	Measurement Specialties	6/6/2023
14	Left Mid B-Pillar	Y	A370963	Measurement Specialties	6/1/2023
15	Left B-Pillar Sill	Y	G22836	Endevco	2/4/2023
16	Driver Seat Track at Dummy H-Point	Y	G22427	Endevco	3/23/2023
17	Engine Block Top	X	G22115	Endevco	3/23/2023
		Y	G23420	Endevco	4/24/2023
18	Firewall Center	Y	G23419	Endevco	4/24/2023
19	Right Roof at Vertical Impact Reference Line	Y	G22445	Endevco	3/22/2023
20	Rear Floorpan Behind Rear Axle at Centerline	X	G21404	Endevco	3/23/2023
		Y	G22396	Endevco	3/9/2023
21	Rear Deck	X	A280890	Measurement Specialties	5/23/2023
		Y	A284229	Measurement Specialties	5/23/2023
		Z	A284293	Measurement Specialties	5/23/2023
22	Rear Deck Angular Velocity	X	20278	DTS ARS	12/22/2022
		Y	17027	DTS ARS	1/20/2023
		Z	18195	DTS ARS	1/20/2023

Table 4 – Pole Instrumentation

Pole Instrumentation	Serial Number	Manufacturer	Calibration Date
Load Cell 1	1220AF-1117006-F0	Interface	7/19/2022
Load Cell 2	1220AF-1277329-F0	Interface	3/2/2023
Load Cell 3	1220AF-1117025-F0	Interface	7/19/2022
Load Cell 4	1220AF-1130989-F0	Interface	7/19/2022
Load Cell 5	1220AF-1281288-F0	Interface	3/17/2023
Load Cell 6	1220AF-1281285-F0	Interface	3/17/2023
Load Cell 7	1220AF-1117035-F0	Interface	7/19/2022
Load Cell 8	1220AF-1117011-F0	Interface	7/19/2022

APPENDIX E

SEATING PROCEDURE WORKSHEETS AND PLOTS

Driver ES2re Seating Worksheet									
Vehicle	2019 Toyota Tacoma			Technician	Quinn Porzio				
VIN #	5TFSZ5AN5KX206592			Position	Associate Test Engineer				
ATD	ES2re (Left Side Hit)			Date	7/6/2023				
Test #	R20195150								
SCRL Angle	Max	Fixed			ES2re Tilt Sensors	X		Y	
	Min -				Head	0°±2			
	Difference								
	/2				T6	0°±2	N/A	N/A	
	Min +								
	Mid Angle				Pelvis	0°±2	-19.4	0.2	
Seat Back Angle	W/Level *	22.0							
Seat Pan Angle	W/Level *		HEAD REST POST ANGLE	0.6	FINAL HEAD REST POST ANGLE		0.6		
Pelvis Angle	ES2re 0° +/- 2.5°		Manual Indinometer		Tilt Sensor				
FARO Measurements On Vehicle Before Seating and Instrumentation									
	TAKE WITH ES2 RE TESTs								
Name		Meas X	Meas Y	Meas Z	X-DISTANCE	Y-DISTANCE	Z-DISTANCE	3D Distance	Deg
SBU -	X	2855.574	-809.349	-475.742					
SBL -	X	2855.324	-813.274	-435.728					
STRIKER (Center) -	X	2887.631	-813.522	-455.734					
FO5B	X	3382.784	-607.140	-81.281					
FISB	X	3384.360	-202.871	-80.537					
RO5B	X	2856.026	-606.667	-35.514					
RISB	X	2857.205	-201.023	-33.642					
S0	X	3409.313	-386.202	-633.308					
TS -	X	3506.271	-385.415	-829.236					
BS -	X	3352.113	-386.150	-502.063					
SC1-	X	3507.509	-386.798	-619.830					
CLAP (Bottom center of accel pedal)	X	3944.542	-214.700	-177.627					
Floor Pan Point	X	3944.090	-215.391	-90.687					
PEDAL REFERENCE POINT (PRP)	X	3972.914	-214.820	-214.388					
RHP - (Right Heel Point)	X	3856.036	-215.844	-57.558					
LHP - (Left Heel Point)	X	3856.864	-521.307	-46.983					
Gas Pedal Right Upper	X	4000.548	-204.084	-240.178					
Gas Pedal Right Lower	X	3947.716	-204.811	-183.407					
Gas Pedal Left Upper	X	4001.803	-231.599	-240.743					
Gas Pedal Left Lower	X	3946.301	-231.542	-180.640					
Brake Pedal Right Upper	X	3931.457	-316.575	-227.089					
Brake Pedal Right Lower	X	3910.751	-326.965	-196.035					
Brake Pedal Left Upper	X	3931.404	-406.256	-228.960					
Brake Pedal Left Lower	X	3909.595	-393.514	-194.362					
Seat Centerline Point	X	2718.534	-368.656	-938.849					
SCR- Full Forward (Per Seating Procedure)	X	3352.406	-643.472	-277.857					
SCR- Full Rearward (Per Seating Procedure)	X	3128.027	643.324	-256.973					
SCR- Mid Track (Per Seating Procedure)	X	3247.068	638.955	-267.148					
SAE J826 Manikin H-POINT - (Seating Procedure)	X	3077.133	-581.005	-295.855					
DR PROJECTED WSID H-POINT AT MID-POSITION - (Seating Procedure)									
DRIVER STP 15.27 MID-POSITION - (Seating Procedure)									
NOTES:									

FARO Measurements Taken Once Seating is Complete									
Name		Measurements From Striker							
		Meas X	Meas Y	Meas Z	X-DISTANCE	Y-DISTANCE	Z-DISTANCE	3D Distance	Deg
DRIVER STP STEP 18.6 TRIAL 1 -									
DR PROJECTED THOR H-POINT STEP 18.6.2 TRIAL 1 -									
DRIVER STP STEP 18.6 TRIAL 2 -									
DR PROJECTED THOR H-POINT STEP 18.6.2 TRIAL 2 -									
DRIVER STP STEP 18.6 TRIAL 3 -									
DR PROJECTED THOR H-POINT STEP 18.6.2 TRIAL 3 -									
RHDCG	X	2,959.223	-299.768	-992.548					
3DLHDCG									
LHDCG	X	2,952.582	-451.719	-1,000.647					
BON	X	3,048.489	-376.285	-987.415					
TN	X	3,060.710	-375.999	-945.233					
TC -	X	3,025.801	-375.694	-874.375					
SHLD R1 -	c/l of AT	3,010.749	-376.662	-782.285					
THX R1 -	c/l of AT	3,051.876	-375.751	-729.513					
THX R2 -	c/l of AT	3,068.374	-376.090	-681.109					
THX R3 -	c/l of ATD								
ABD R1 -	top center	3,086.565	-367.675	-623.720					
ABD R2 -	bottom center								
TPS -	X	3,119.834	-375.874	-465.825					
C1 -	X	3,019.312	-376.290	-749.183					
C2 -	X	3,091.370	-385.355	-633.310					
C3 -	X	3,139.626	-385.998	-502.869					
SHT -	X	2,963.305	-556.784	-747.850					
E1 -	X	3,157.168	-634.176	-626.685					
P1 -	X	3,094.450	-502.558	-300.587					
H-POINT -	X	3,071.653	-502.088	-304.200					
H-POINT 2 -	X	3,071.588	-552.285	-304.061					
OK -	X	3,464.245	-579.772	-385.283					
IK -	X	3,477.038	-324.819	-401.232					
OA -	X	3,803.792	-623.344	-153.308					
IA -	X	3,806.114	-300.405	-163.528					
OH -	X	3,832.556	-597.802	-33.054					
IH -	X	3,835.938	-266.244	-37.577					
OUTBOARD TOE	X	3,993.739	-561.031	-289.945					
INBOARD TOE	X	3,964.777	-244.539	-307.781					
OP -	X	2,725.318	-457.964	-801.454					
TOP CENTER SHOULDER BELT	X	3,065.343	-375.542	-730.506					
BOTTOM CENTER SHOULDER BELT	X	3,094.801	-375.729	-647.667					
TOP CENTER LAP BELT	X	3,135.318	-375.611	-445.937					
BOTTOM CENTER LAP BELT	X	3,172.656	-376.015	-419.614					
CENTER OF BELT AT D-RING	X	2,810.262	-648.591	-951.734					
DRIVER SCRP - FINAL TEST POSITION	X	3,232.572	-639.720	-268.399					
Measurements to be taken once Dummy is seated and measured									
Name		Meas X	Meas Y	Meas Z	X-DISTANCE	Y-DISTANCE	Z-DISTANCE	3D Distance	Deg
R	X	3,048.323	-376.534	-1,177.121					
H	X	3,464.062	-376.167	-1,103.020					
W1	X	3,654.639	-376.571	-987.703					
W1 OUTSIDE	X	3,667.988	-376.635	-987.208					
W2 OUTSIDE	X	3,861.529	-378.357	-837.864					
D1	X	3,629.238	-376.314	-797.190					
D2	X	3,699.812	-579.504	-384.706					
D3	X	3,560.127	-315.080	-486.503					
HRP	X	3,048.316	-585.767	-1,082.774					
HSP	X	3,048.453	-730.143	-987.305					
ADP	X	3,157.176	-748.021	-626.557					
HDP	X	3,150.080	-740.120	-635.478					
Measurements calculated using points collected from the FARO arm									
Name		Meas X	Meas Y	Meas Z	X-DISTANCE	Y-DISTANCE	Z-DISTANCE	3D Distance	Deg
HZ	X						190		
HH	X							431	
HW	X				606				
NR	X							461	
CD	X							966	
CS	X				318				
CBS	X				212				
IKD	X							119	
OKD	X							223	
HR	X							230	
HS	X					354			
AD	X					114			
HD	X					238			
HLHL	X							332	
KK	X							255	
SH	X							392	
HRA - (Inclinometer measurement deg)	X								0.6
H-POINT TOOL ANGLE	X								9.0
TORSO ANGLE	X								9.7
WINDSHIELD ANGLE	X								52.3
NOTES:									