

REPORT NUMBER: NCAP-MGA-25-013

**NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test**

**TOYOTA MOTOR MANUFACTURING, INDIANA, INC.
2025 Toyota Grand Highlander XLE AWD 5-Door SUV
NHTSA No.: M20255110**

**MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105**



Test Date: February 17, 2025

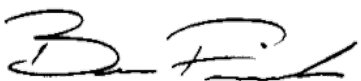
Final Report Date: April 8, 2025

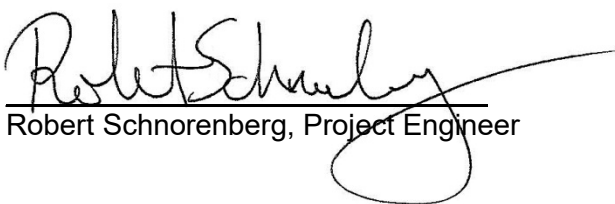
FINAL REPORT

**U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NRM-110
1200 New Jersey Ave, SE
Washington, DC 20590**

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof.

If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared by: 
Ben Fischer, Program Manager

Approved by: 
Robert Schnorenberg, Project Engineer

Approval Date: April 8, 2025

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. NCAP-MGA-25-013	2. Government Accession No.	3. Recipient's Catalog No.																																																							
4. Title and Subtitle Final Report of New Car Assessment Program Frontal Impact Testing of a 2025 Toyota Grand Highlander XLE AWD 5-Door SUV, NHTSA No.: M20255110		5. Report Date April 8, 2025																																																							
		6. Performing Organization Code MGA																																																							
7. Author(s) Ben Fischer, Program Manager		8. Performing Organization Report No. NCAP-MGA-25-013																																																							
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		10. Work Unit No.																																																							
		11. Contract or Grant No. 693JJ919D000006																																																							
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave, SE Washington, D.C. 20590		13. Type of Report and Period Covered Final Test Report February 17, 2025 to April 8, 2025																																																							
		14. Sponsoring Agency Code NRM-110																																																							
15. Supplementary Notes																																																									
16. Abstract A 56.3 km/h NCAP Full Frontal Rigid Barrier Impact Test was conducted on a 2025 Toyota Grand Highlander XLE AWD 5-Door SUV in accordance with the specifications of the Office of Crashworthiness Standards Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing. The test was conducted at MGA Research Corporation in Burlington, Wisconsin on February 17, 2025. The impact velocity of the vehicle was 56.17 km/h and the ambient temperature at the barrier face at the time of impact was 21.1°C. The target vehicle post-test maximum crush was 511 mm located to the right of the vehicle 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 colspan="2">Driver ATD</th> <th colspan="2">Passenger ATD</th> </tr> <tr> <th>Threshold</th> <th>Result</th> <th>Threshold</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₁₅)</td> <td></td> <td>700</td> <td>218.455</td> <td>700</td> <td>356.318</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>23.361</td> <td>52</td> <td>16.090</td> </tr> <tr> <td>Nij</td> <td></td> <td>1</td> <td>0.393</td> <td>1</td> <td>0.330</td> </tr> <tr> <td>Neck Tension</td> <td>N</td> <td>4170</td> <td>1578.317</td> <td>2620</td> <td>885.511</td> </tr> <tr> <td>Neck Compression</td> <td>N</td> <td>4000</td> <td>52.953</td> <td>2520</td> <td>266.871</td> </tr> <tr> <td>Left Femur Force</td> <td>N</td> <td>10008</td> <td>1471.180</td> <td>6805</td> <td>1707.249</td> </tr> <tr> <td>Right Femur Force</td> <td>N</td> <td>10008</td> <td>1406.372</td> <td>6805</td> <td>1233.209</td> </tr> </tbody> </table>						Measurement Description	Units	Driver ATD		Passenger ATD		Threshold	Result	Threshold	Result	Head Injury Criteria (HIC ₁₅)		700	218.455	700	356.318	Maximum Chest Compression	mm	63	23.361	52	16.090	Nij		1	0.393	1	0.330	Neck Tension	N	4170	1578.317	2620	885.511	Neck Compression	N	4000	52.953	2520	266.871	Left Femur Force	N	10008	1471.180	6805	1707.249	Right Femur Force	N	10008	1406.372	6805	1233.209
Measurement Description	Units	Driver ATD		Passenger ATD																																																					
		Threshold	Result	Threshold	Result																																																				
Head Injury Criteria (HIC ₁₅)		700	218.455	700	356.318																																																				
Maximum Chest Compression	mm	63	23.361	52	16.090																																																				
Nij		1	0.393	1	0.330																																																				
Neck Tension	N	4170	1578.317	2620	885.511																																																				
Neck Compression	N	4000	52.953	2520	266.871																																																				
Left Femur Force	N	10008	1471.180	6805	1707.249																																																				
Right Femur Force	N	10008	1406.372	6805	1233.209																																																				
17. Key Words 56.3 km/h (35 mph) Full Frontal Rigid Barrier Impact Test New Car Assessment Program (NCAP)			18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division 1200 New Jersey Ave, SE Washington, DC 20590																																																						
19. Security Classification of Report Unclassified	20. Security Classification of Page Unclassified	21. No. of Pages 173	22. Price																																																						

TABLE OF CONTENTS

<u>Section</u>		<u>Page No.</u>
1	Purpose and Summary of Test	1
2	Occupant and Vehicle Information / Data Sheets	3
<u>Data Sheet No.</u>		<u>Page No.</u>
1	General Test and Vehicle Parameter Data	4
2	Seat Adjustment, Fuel System, and Steering Wheel Data	8
3	Dummy Longitudinal Clearance Dimensions	10
4	Dummy Lateral Clearance Dimensions	11
5	Seat Belt Positioning Data	12
6	High-Speed Camera Locations and Data	13
7	Vehicle Accelerometer Locations	15
8	Photographic Reference Target Locations	16
9	Load Cell Locations on Fixed Barrier	17
10	Test Vehicle Summary of Results	18
11	Post-Test Observations	19
12	Vehicle Profile Measurements	20
13	Accident Investigation Division Data	22
14	Vehicle Intrusion Measurements	23
15	Summary of Indicant FMVSS No. 212 and FMVSS No. 219 (Partial) Data	25
16	FMVSS No. 301 Barrier Impact and Static Rollover Results	26
17	Dummy/Vehicle Temperature Stabilization Data	28
<u>Appendix</u>		
A	Photographs	A
B	Dummy Response Data Traces	B
C	Dummy Qualification and Performance Verification	C
D	Test Equipment and Instrumentation Calibration	D

SECTION 1 PURPOSE AND SUMMARY OF TEST

PURPOSE

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number 693JJ919D000006. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

The 56.3 km/h frontal barrier impact was conducted in accordance with the Office of Crashworthiness Standards Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing, dated May 2018.

SUMMARY

A load cell barrier consisting of 176 load cells was impacted by a 2025 Toyota Grand Highlander XLE AWD 5-Door SUV at a velocity of 56.17 km/h. The test was performed at MGA Research Corporation on February 17, 2025. Pre-test and post-test photographs of the vehicle and dummies can be found in Appendix A.

Two (2) real-time cameras and sixteen (16) high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

One Part 572E 50th percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5th percentile female test device (ATD) was placed in the right-front passenger seating position according to dummy placement instructions specified in the Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck transducers, right/left femur load cells, and lower leg instrumentation.

The driver (position 1) ATD (Serial No. 064) and the right-front passenger (position 2) ATD (Serial No. 142) were qualified previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 278 channels of data were recorded on a data acquisition system. Appendix B contains the dummy response data traces.

There was 100 percent windshield retention and no intrusion into the protected zone of the windshield during the event. 13.62 oz (by weight) of Stoddard Solvent was collected in the first 5 minutes after the event. A static rollover was not conducted.

The maximum static crush of the vehicle was 511 mm located to the right of the vehicle centerline and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's visible contact points were as follows: The driver's head contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the knee airbag.

The passenger's visible contact points were as follows: The passenger's head contacted the airbag. The passenger's head also contacted the headrest and side curtain airbag. The passenger's knees contacted the glove box.

The occupant data is summarized below:

ATD position	HIC₁₅	Nij	Neck Tension (N)	Neck Comp. (N)	3ms Chest Clip (g)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50 th)	218.455	0.393	1578.317	52.953	44.627	23.361	1471.180	1406.372
Passenger (5 th)	356.318	0.330	885.511	266.871	46.671	16.090	1707.249	1233.209

The test data can be found on the NHTSA website at www.nhtsa.gov

TEST NOTES

A post-test vehicle inspection revealed a puncture on the upper inboard side of the fuel tank as the source of the Stoddard solvent leak. The puncture appeared to be caused by interaction between a driveshaft carrier bracket and the fuel tank that occurred during the impact.

MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20255110	Traction Control System (TCS)	Yes
Model Year	2025	Power Steering	Yes
Make	Toyota	Power Window Auto-Reverse	Yes
Model	Grand Highlander XLE AWD	Driver Frontal Airbag	Yes
Body Style	5-Door SUV	Driver Curtain Airbag	Yes
VIN	5TDAAAB50SS073580	Driver Head/Torso Airbag	No
Body Color	Wind Chill Pearl	Driver Torso Airbag	No
Odometer (km/mi)	180 km / 112 mi	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	2.4	Driver Pelvis Airbag	No
Type/No. Cylinders	Inline 4	Driver Knee Airbag	Yes
Engine Placement	Lateral	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	8	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	AWD	Front Pass. Torso/Pelvis Airbag	Yes
Roof Rack	No	Front Pass. Pelvis Airbag	No
Sunroof/T-Top	No	Front Pass. Knee Airbag	No
Running Boards	No	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	Yes	Front Pass. Pretensioner	Yes
Anti-Lock Brakes (ABS)	Yes	Front Pass. Load Limiter	Yes
Automatic Door Locks (ADLs)	Yes	Front Pass. Seat Cushion Airbag	Yes

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

DATA FROM CERTIFICATION LABEL

Manufactured By	TOYOTA MOTOR MANUFACTURING, INDIANA, INC.	GVWR (kg)	2735
Date of Manufacture	01/25	GAWR Front (kg)	1345
		GAWR Rear (kg)	1615

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench	Split Bench	
Designated Seating Capacity (DSC)	2	2	3	7
Capacity Weight (VCW) (kg)				565
Cargo Weight (RCLW) (kg)				77

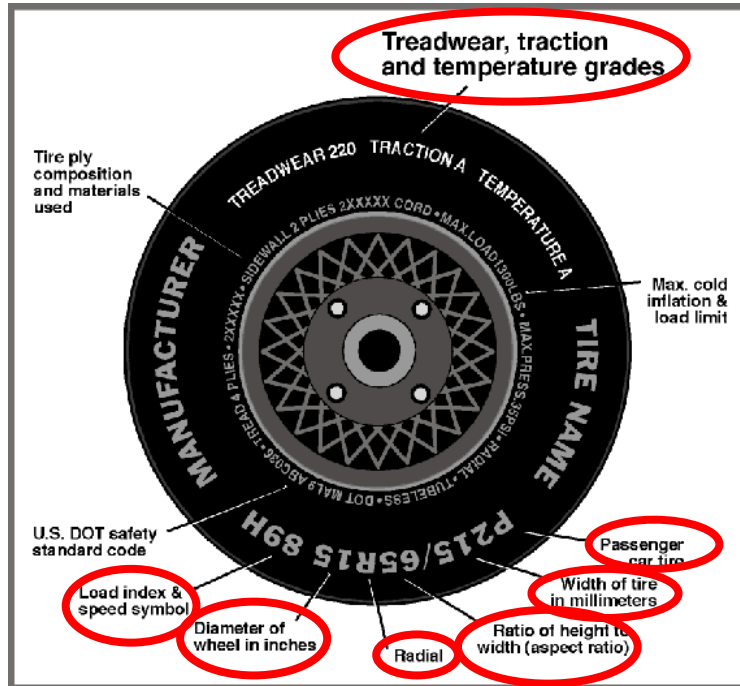
* Rated Cargo and Luggage Weight (RCLW) reduced by 12 kg to account for Load Carrying Capacity Reduction Label.

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

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	255/65R18	255/65R18
Tire Size on Vehicle	255/65R18	255/65R18
Tire Manufacturer	Michelin	Michelin
Tire Model	Primacy	Primacy
Treadwear	540	540
Traction	B	B
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Polyamide	2 Polyester, 2 Steel, 1 Polyamide
Load Index/Speed Symbol	111H	111H
Tire Material	Rubber	Rubber
DOT Safety Code Left	1M3AY 02UX 5024	1M3AY 02UX 5024
DOT Safety Code Right	1M3AY 02UX 5024	1M3AY 02UX 5024

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

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	587.0	444.0		635.5	502.0	
Right	kg	524.5	472.5		568.0	533.0	
Ratio	%	54.8%	45.2%		53.8%	46.2%	
Totals	kg	1111.5	916.5	2028.0	1203.5	1035.0	2238.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	2028.0
Weight of 1 P572E ATD & 1 P572O ATD	kg	141
Rated Cargo/Luggage Weight (RCLW)	kg	77
Calculated Test Vehicle Target Weight (TVTW)	kg	2246.0

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	854	859	863	870	1331
As Tested	mm	836	839	845	852	1362
Post Test	mm	847	851	848	844	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2946
Total Vehicle Length at Left Side	mm	4903
Total Vehicle Length at Centerline	mm	5109
Total Vehicle Length at Right Side	mm	4896
Weight of Ballast in Cargo Area	kg	0
Weight of Vehicle Components Removed	kg	14
Amount of Stoddard Solvent in Fuel Tank	L	62.1

List of components removed to meet test weight: None.

List of components removed for instrumentation, data box, and equipment installation:
Cargo area carpet/trim/dividers, jack and tools, front underbody plastic.

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

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements	Pre-Test (mm)
1	Total Length	5109
2	Total Width	1969
3	Bumper Top Height	632
4	Bumper Bottom Height	498
5	Longitudinal Member Top Height	615
6	Distance between Longitudinal Members	951
7	Longitudinal Member Width	61
8	Engine Top Height	917
9	Engine Bottom Height	269
10	Engine and Gearbox Width	864
11	Front Bumper-Engine Distance	583
12	Front Shock Absorber Fixing Height	1035
13	Bonnet Leading Edge Height	1058
14	Front Shock Absorber Fixing Width	1285
15	Front Bumper – Front Axle Distance	860
16	Front Axle – A-Pillar Distance	608
17	A-Pillar – B-Pillar Distance	947
18	B-Pillar – Rear Axle Distance	1391
19	B-Pillar – C-Pillar Distance	1277
20	Roof Sill Bottom Height	1555
21	Roof Sill Top Height	1661
22	Floor Sill Bottom Height	295
23	Floor Sill Top Height	465

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

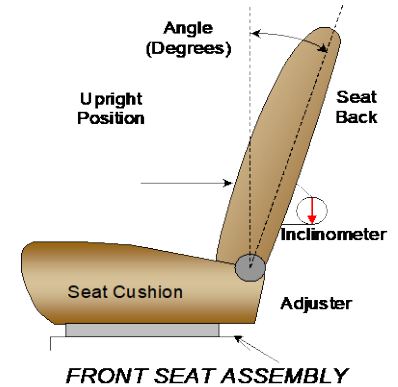
Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

NOMINAL DESIGN RIDING POSITION

The driver seat back is positioned as close as possible to the manufacturer's design angle. For the passenger seat back, seat back is adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated May 2018.

	Degrees
Driver Seat Back Angle	1.5° on outboard headrest post
Passenger Seat Back Angle	1.0° on outboard headrest post



SEAT FORE/AFT POSITIONS

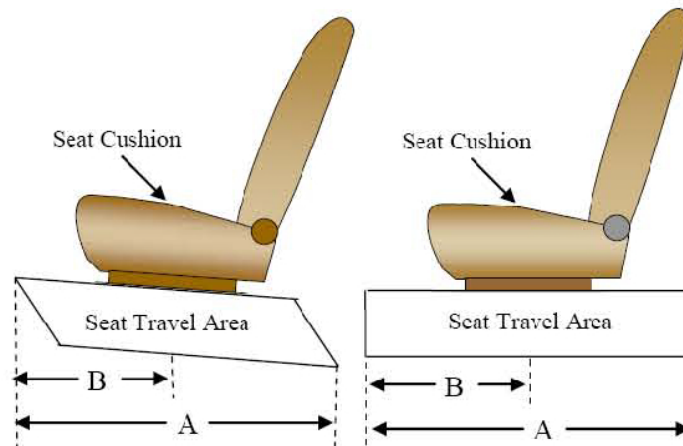
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated May 2018.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	284 mm	142 mm
Passenger Seat	240 mm	0 mm

SEAT BELT UPPER ANCHORAGES

The seat belt upper anchorages are set following the manufacturer's specified position as listed in Form 1.

	Total # of Positions	Placed in Position #
Driver Seat	4 (1st as 1)	0 (1st as 0)
Passenger Seat	4 (1st as 1)	0 (1st as 0)



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

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

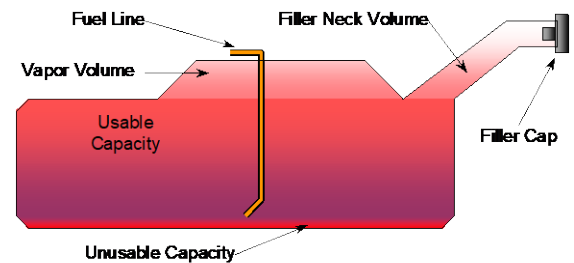
NHTSA No.: M20255110
 Test Date: 2/17/2025

FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	66.6
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	61.3 to 62.6
Actual Amount of Solvent used	62.1
1/3 of Usable Capacity	22.2

FUEL PUMP

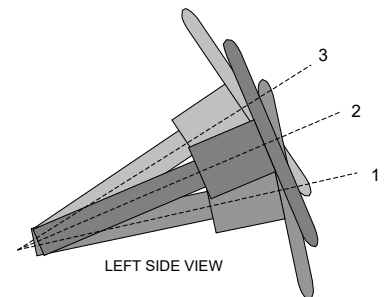
The vehicle is equipped with an electronic fuel pump. The fuel pump will run when the engine is running. The pump will also briefly run when the ignition key is turned to the "on" position. The filler neck is located on the driver's side.



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. An aluminum plate is placed across the rim of the steering wheel, an inclinometer is placed on the plate and the angle is measured.



STEERING COLUMN ASSEMBLY

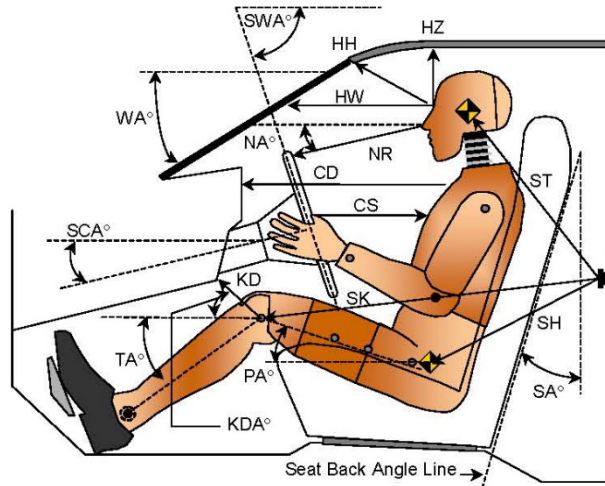
STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	66.6	
Geometric Center Position 2	64.3	
Uppermost Position 3	62.0	
Telescoping Steering Wheel Travel		57
Test Position	64.3	29

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025



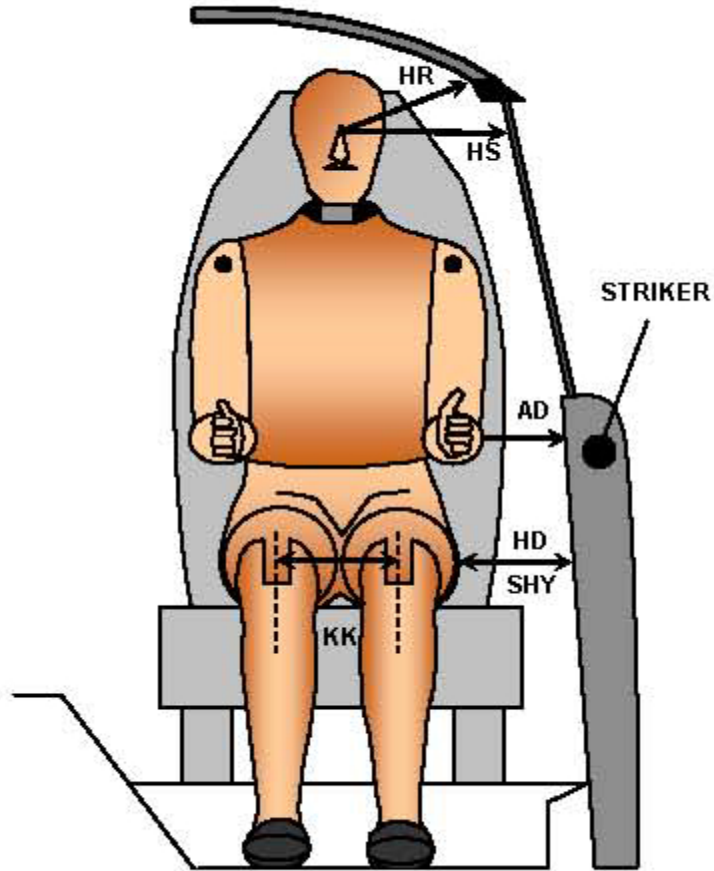
LEFT SIDE VIEW

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		30.0		
SWA°	Steering Wheel Angle		64.3		
SCA°	Steering Column Angle		25.7		
SA°	Seat Back Angle		1.5		1.0
HZ	Head to Roof (Z)	214	90	231	90
HH	Head to Header	369	28.1	298	51.8
HW	Head to Windshield	641	0	609	0
NR	Nose to Rim	419	11.8		
CD	Chest to Dash	552		368	
CS	Chest to Steering Hub	331	6.0		
RA	Rim to Abdomen	201	0		
KDL	Left Knee to Dash	158	37.9	89	59.4
KDR	Right Knee to Dash	156	36.0	99	42.9
PA°	Pelvic Angle		22.9		18.6
TA°	Tibia Angle		43.2		56.2
SK	Striker to Knee	608	99.6	707	100.2
ST	Striker to Head	460	12.1	445	31.3
SH	Striker to H-Point	305	133.3	408	117.4

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025



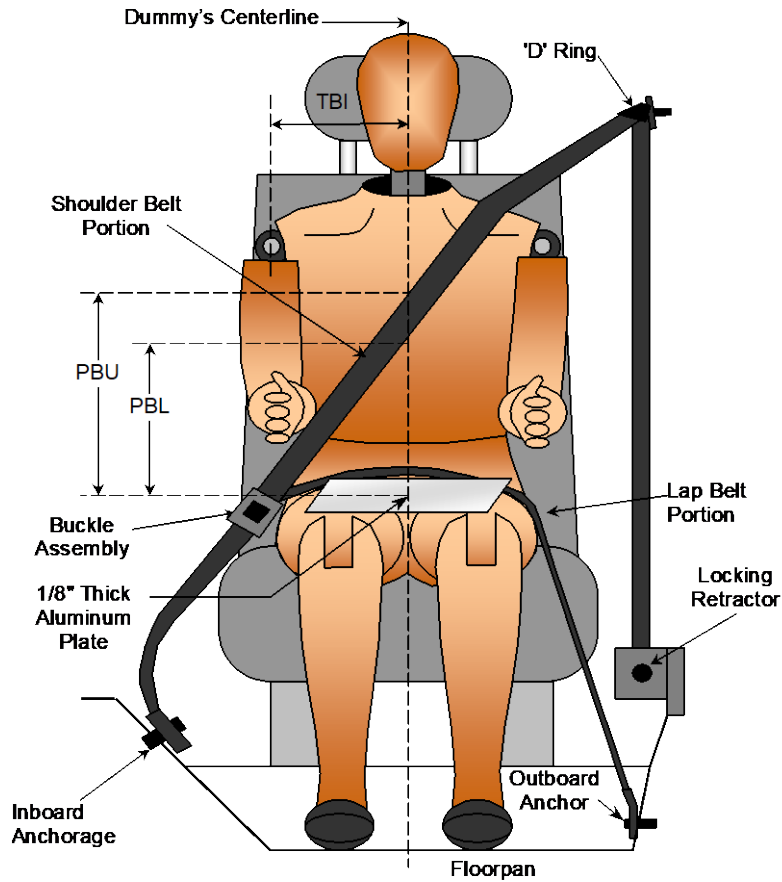
FRONT VIEW OF DUMMY

Code	Measurement Description	Units	Driver	Passenger
AD	Arm to Door	mm	131	69
HD	H-Point to Door	mm	152	181
HR	Head to Side Header	mm	245	274
HS	Head to Side Window	mm	352	374
KK	Knee to Knee	mm	348	229
SHY	Striker to H-Point (Y Direction)	mm	265	299
AA	Ankle to Ankle	mm	340	176

DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
Test Date: 2/17/2025



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	320	310
PBL - Top surface of reference to belt lower edge	mm	230	220

BELT LENGTH DATA

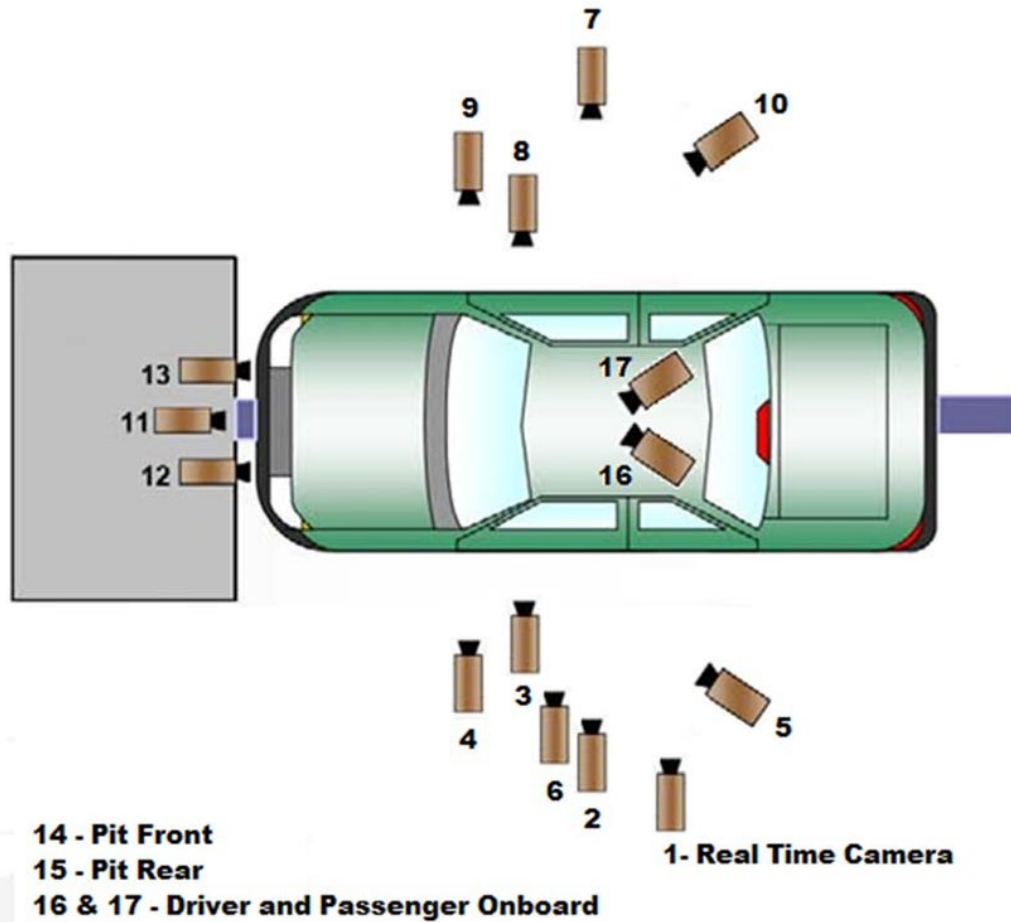
Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	869	950
Lap Belt Length as measured on ATD	mm	712	800
Remainder of belt on reel	mm	274	105
Total Belt Length for Continuous Webbing Systems	mm	2575	2575

DATA SHEET NO. 6
HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
Test Date: 2/17/2025

CAMERA POSITIONS FOR FRONTAL IMPACTS



***Camera locations are approximate and not to scale*

DATA SHEET NO. 6 (CONTINUED)
HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

CAMERA LOCATIONS

No.	Camera View	Coordinates* (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Overall					30
2	Left Overall	-2380	-5970	-1530	12	1000
3	Driver Close-Up	-1650	-6570	-2100	50	1000
4	Left Front Half	-1550	-5680	-1500	24	1000
5	Left Angle	-7160	-5870	-2250	75	1000
6	Steering Column	-1280	-5640	-1250	50	1000
7	Right Overall	-2290	5930	-1470	12	1000
8	Passenger Close-Up	-1700	6750	-2110	50	1000
9	Right Front Half	-1200	5610	-1520	24	1000
10	Right Angle	-7280	5420	-2200	75	1000
11	Windshield	-130	0	-2310	12	1000
12	Driver Windshield	-180	-370	-2230	25	1000
13	Passenger Windshield	-180	370	-2230	25	1000
14	Pit Front	-1020	0	3340	24	1000
15	Pit Rear	-2960	0	3340	24	1000
16	Driver Onboard				12	1000
17	Passenger Onboard				12	1000
18	Real-Time Pan View					30

*COORDINATES:

+X = forward of impact plane

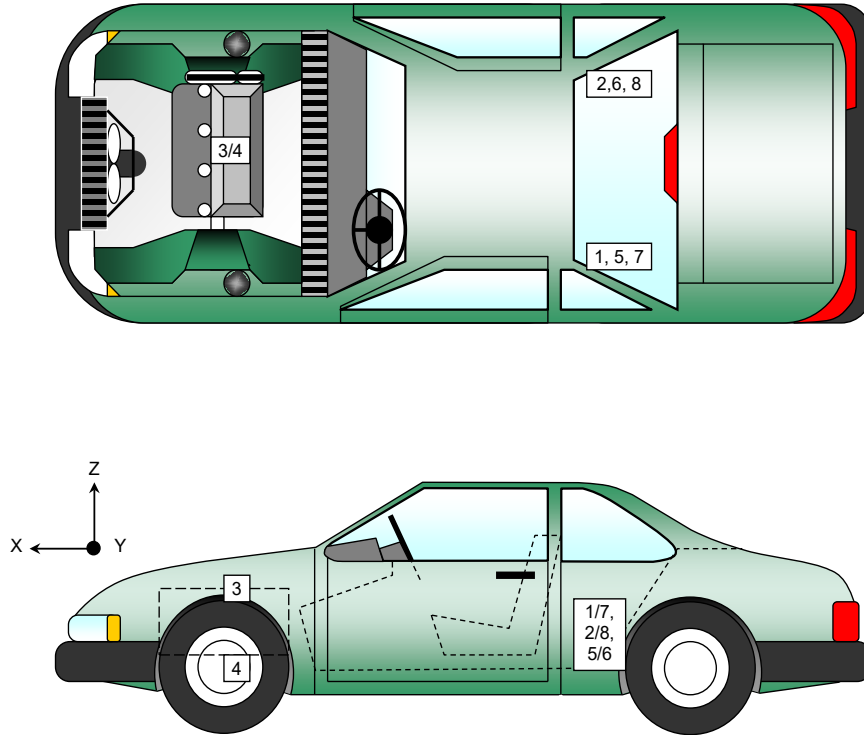
+Y = right of monorail centerline

+Z = below ground level

DATA SHEET NO. 7 **VEHICLE ACCELEROMETER LOCATIONS**

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
Test Date: 2/17/2025



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	2241	-380	-400
2	Right Rear Crossmember Accelerometer – X Direction	2245	387	-407
3	Engine Top X	4354	32	-921
4	Engine Bottom X	4316	160	-238
5	Left Rear Crossmember Accelerometer – Z Direction	2241	-380	-400
6	Right Rear Crossmember Accelerometer – Z Direction	2245	387	-407
7	Left Rear Crossmember Accelerometer Redundant – X Direction	2241	-380	-400
8	Right Rear Crossmember Accelerometer Redundant – X Direction	2245	387	-407

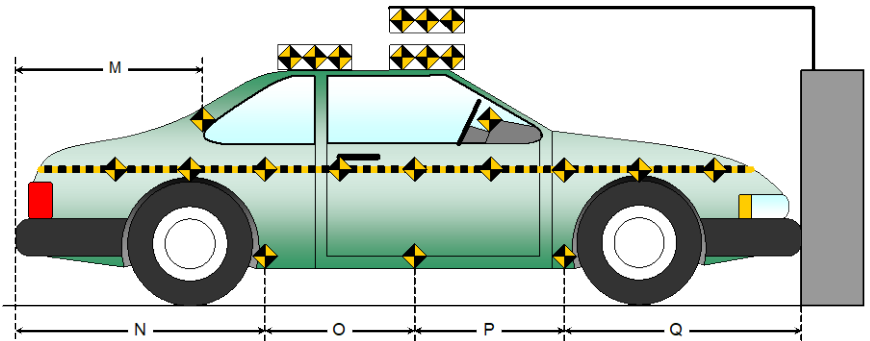
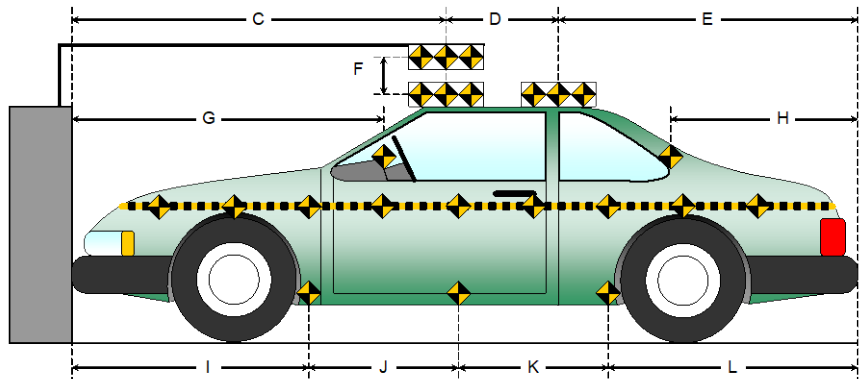
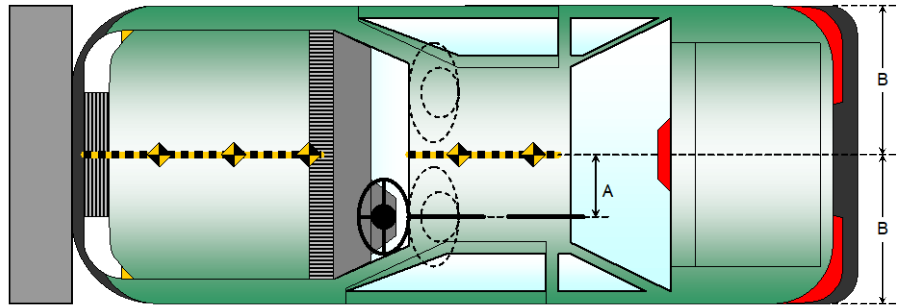
Reference Points: X - Rear Surface of Vehicle (+ forward)
Y - Vehicle Centerline (+ to right)
Z - Ground Plane (+ down)

DATA SHEET NO. 8
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

Item	Value (mm)
A	419
B	984
C	2422
D	609
E	2078
F	113
G	
H	1306
I	1546
J	938
K	942
L	1683
M	1311
N	1690
O	942
P	936
Q	1541



DATA SHEET NO. 9 **LOAD CELL LOCATIONS ON FIXED BARRIER**

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

ADVANCED RESEARCH LOAD CELL BARRIER

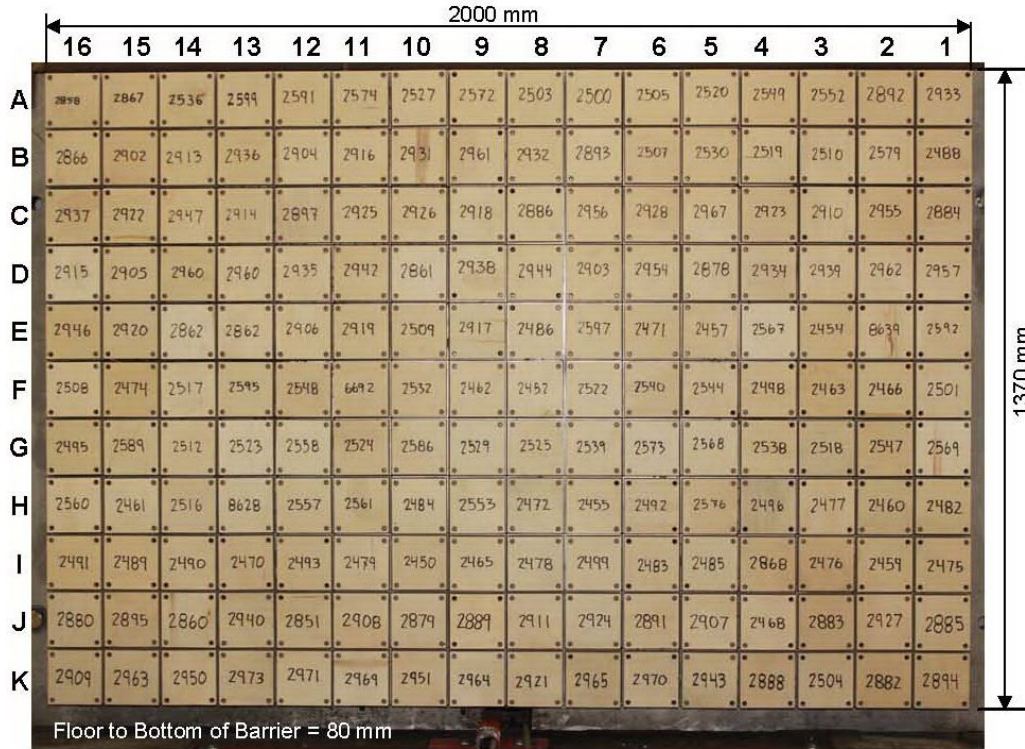


Photo for Reference Only

Centerline

A-16	A-15	A-14	A-13	A-12	A-11	A-10	A-09	A-08	A-07	A-06	A-05	A-04	A-03	A-02	A-01
B-16	B-15	B-14	B-13	B-12	B-11	B-10	B-09	B-08	B-07	B-06	B-05	B-04	B-03	B-02	B-01
C-16	C-15	C-14	C-13	C-12	C-11	C-10	C-09	C-08	C-07	C-06	C-05	C-04	C-03	C-02	C-01
D-16	D-15	D-14	D-13	D-12	D-11	D-10	D-09	D-08	D-07	D-06	D-05	D-04	D-03	D-02	D-01
E-16	E-15	E-14	E-13	E-12	E-11	E-10	E-09	E-08	E-07	E-06	E-05	E-04	E-03	E-02	E-01
F-16	F-15	F-14	F-13	F-12	F-11	F-10	F-09	F-08	F-07	F-06	F-05	F-04	F-03	F-02	F-01
G-16	G-15	G-14	G-13	G-12	G-11	G-10	G-09	G-08	G-07	G-06	G-05	G-04	G-03	G-02	G-01
H-16	H-15	H-14	H-13	H-12	H-11	H-10	H-09	H-08	H-07	H-06	H-05	H-04	H-03	H-02	H-01
I-16	I-15	I-14	I-13	I-12	I-11	I-10	I-09	I-08	I-07	I-06	I-05	I-04	I-03	I-02	I-01
J-16	J-15	J-14	J-13	J-12	J-11	J-10	J-09	J-08	J-07	J-06	J-05	J-04	J-03	J-02	J-01
K-16	K-15	K-14	K-13	K-12	K-11	K-10	K-09	K-08	K-07	K-06	K-05	K-04	K-03	K-02	K-01

Load Cells are 121 mm x 121 mm with a 7 mm gap in between each load cell.

DATA SHEET NO. 10
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy Data Channels	47
Passenger Dummy Data Channels	47
Vehicle Structure Accelerometers	8
Barrier Channels	176
Total	278

CAMERA COVERAGE

Type of Camera	Number Used in this Test
High-Speed Vehicle Onboard	2
High-Speed Offboard	14
Real-Time	2
Total	18

DATA SHEET NO. 11
POST-TEST OBSERVATIONS

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
Test Date: 2/17/2025

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 064	HIII 5% / 142
Head Contact	Frontal Airbag, Headrest	Frontal Airbag, Headrest, Curtain Airbag
Upper Torso Contact	Frontal Airbag	Frontal Airbag
Lower Torso Contact	Frontal Airbag	Frontal Airbag
Left Knee Contact	Knee Airbag	Glove Box
Right Knee Contact	Knee Airbag	Glove Box

DOOR OPENING, TRUNK OPENING, AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were unlocked pre-test	Doors were unlocked pre-test
Front Door Opening	Remained closed and unlocked; opened without tools	Remained closed and unlocked; opened without tools
Rear Door Opening	Remained closed and unlocked; opened without tools	Remained closed and unlocked; opened without tools
Trunk/Hatch/Tailgate Opening	Remained closed; opened without tools	
Seat Track Shift (mm)	0	0
Seat Back Movement	None	None

OTHER VEHICLE POST-TEST OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Windshield Damage	Cracked by hood corners
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	2880
Center	mm	2926
Right Side	mm	2975
Average	mm	2927

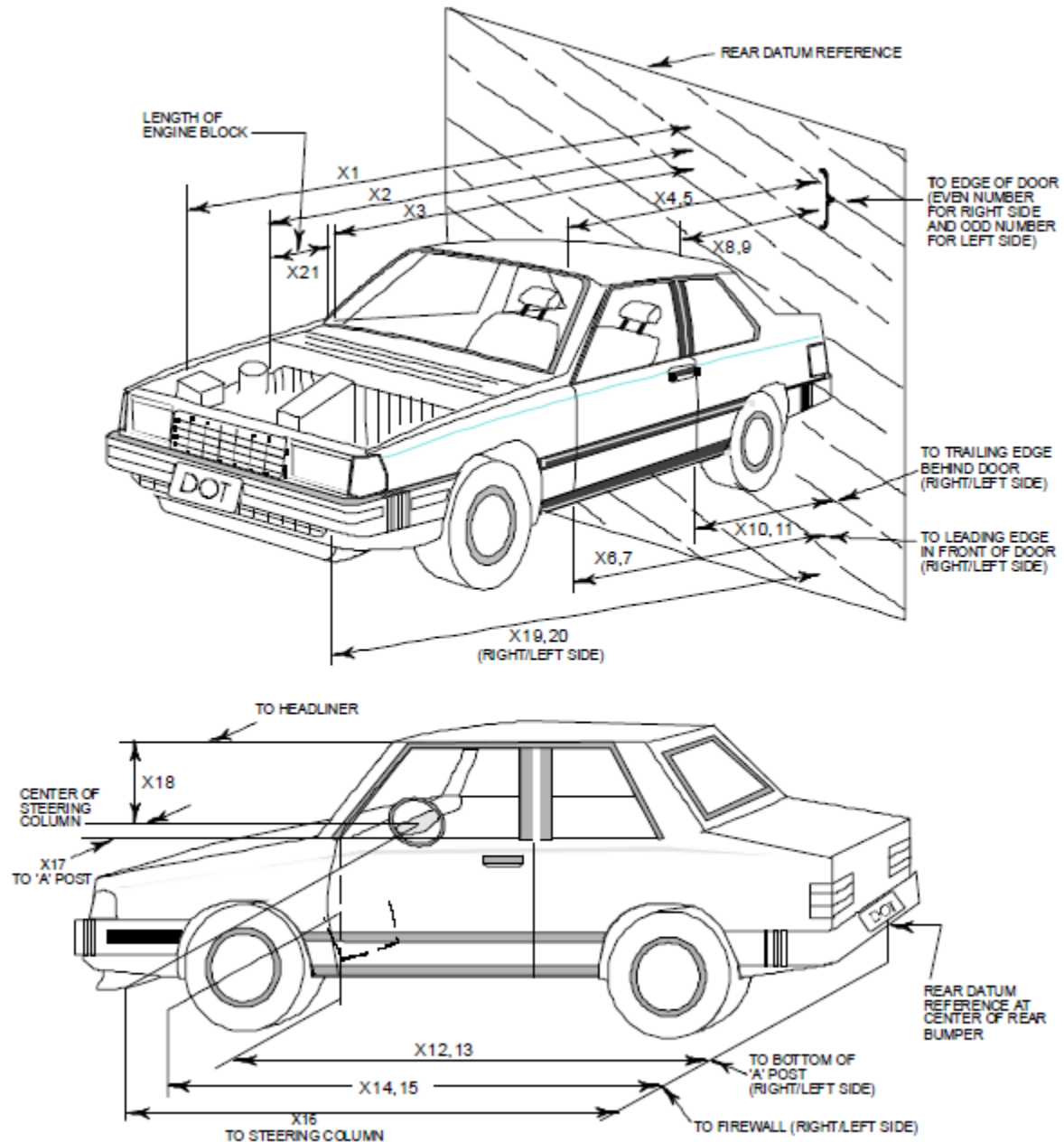
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Driver		Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Curtain Side Airbag	Yes	Yes	Yes	Yes
Torso/Pelvis Side Airbag	Yes	No	Yes	No
Knee Airbag	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes	Yes	Yes	Yes
Seat Cushion Airbag			Yes	Yes

DATA SHEET NO. 12 VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

No.	Measurement Description	Pre-Test	Post-Test	Change
1	Total Length of Vehicle at Centerline	5109	4596	-513
2	RSOV to Front of Engine	4379	4200	-179
3	RSOV to Firewall	4034	4012	-22
4	RSOV to Upper Leading Edge of Right Door	3548	3548	0
5	RSOV to Upper Leading Edge of Left Door	3544	3544	0
6	RSOV to Lower Leading Edge of Right Door	3525	3526	1
7	RSOV to Lower Leading Edge of Left Door	3519	3521	2
8	RSOV to Upper Trailing Edge of Right Door	2488	2489	1
9	RSOV to Upper Trailing Edge of Left Door	2484	2487	3
10	RSOV to Lower Trailing Edge of Right Door	2551	2554	3
11	RSOV to Lower Trailing Edge of Left Door	2545	2547	2
12	RSOV to Bottom of "A" Post of Right Side	3568	3567	-1
13	RSOV to Bottom of "A" Post of Left Side	3562	3562	0
14	RSOV to Firewall, Right Side	4089	4067	-22
15	RSOV to Firewall, Left Side	4085	4060	-25
16	RSOV to Steering Column	3126	3185	59
17	Center of Steering Column to "A" Post	286	287	1
18	Center of Steering Column to Headliner	470	461	-9
19	RSOV to Right Side of Front Bumper	4896	4573	-323
20	RSOV to Left Side of Front Bumper	4903	4655	-248
21	Length of Engine Block	202	202	0
RD	RSOV to Right Side of Dash Panel	3346	3352	6
CD	RSOV to Center of Dash Panel	3497	3505	8
LD	RSOV to Left Side of Dash Panel	3342	3347	5

All dimensions in mm

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
Test Date: 2/17/2025

VEHICLE INFORMATION

VIN: 5TDAAAB50SS073580
Vehicle Size Category: MPV

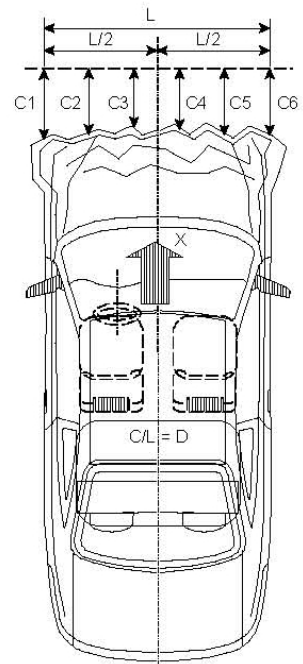
Wheelbase (mm): 2946
Test Weight (kg): 2238.5

ACCELEROMETER DATA

Accelerometer Locations: As per Data Sheet No. 7
Cal. Procedure/Interval: MGA Procedure / 6 month
Integration Algorithm: Trapezoidal
Linearity: > 99%
Impact Velocity (km/h): 56.17
Velocity Change (km/h): 66.7
Time of Separation (msec) 95

CRUSH PROFILE

Collision Deformation Classification: 12FDEW3
Midpoint of Damage: Centerline
Damage Region Length (mm): 1455
Impact Mode: Frontal



No.	Measurement Description	Units	Pre-Test	Post-Test	Exterior Crush
C1	Crush zone 1 at left side	mm	2097	2345	248
C2	Crush zone 2 at left side	mm	1927	2391	464
C3	Crush zone 3 at left side	mm	1903	2402	499
C4	Crush zone 4 at right side	mm	1903	2414	511
C5	Crush zone 5 at right side	mm	1930	2419	489
C6	Crush zone 6 at right side	mm	2104	2427	323
L	C1 TO C6	mm	1455	1536	81

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
Test Program: NCAP Frontal Barrier Impact Test

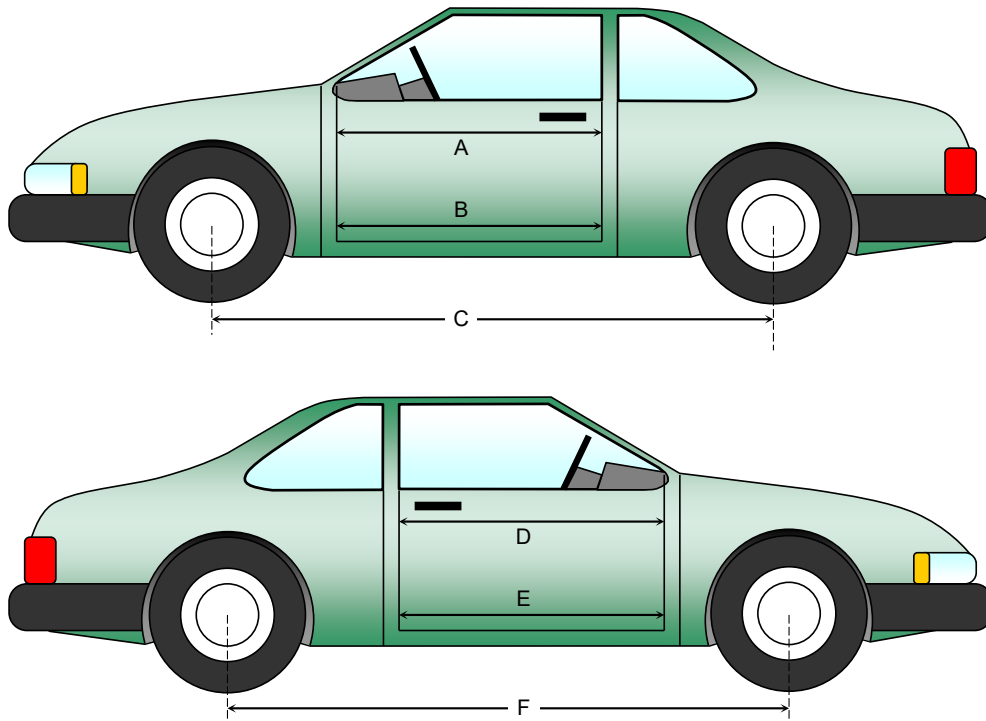
NHTSA No.: M20255110
Test Date: 2/17/2025

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Change
A	Left Side Upper	mm	972	972	0
B	Left Side Lower	mm	851	851	0
D	Right Side Upper	mm	971	970	-1
E	Right Side Lower	mm	856	856	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Change
C	Left Side Wheelbase	mm	2946	2885	-61
F	Right Side Wheelbase	mm	2943	2940	-3



DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

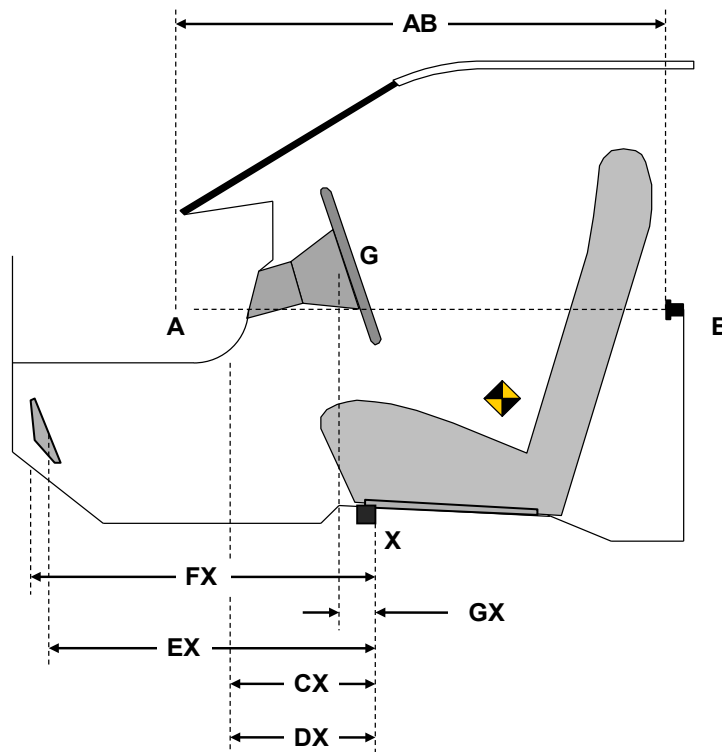
Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Change
AB	Door Opening (Inside Window Jam)	mm	788	343	-445
CX	Left Knee Bolster to X	mm	280	281	1
DX	Right Knee Bolster to X	mm	285	278	-7
EX	Brake Pedal to X	mm	520	492	-28
FX	Foot Rest to X	mm	518	508	-10
GX	Center of Steering Column Wheel Hub to X	mm	47	104	57

X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

DATA SHEET NO. 15
SUMMARY OF INDICANT FMVSS NO. 212 AND FMVSS NO. 219 (PARTIAL) DATA

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

WINDSHIELD MOUNTING DETAILS

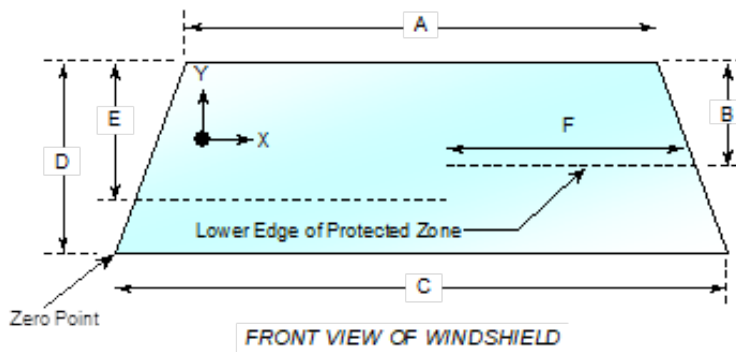
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

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

Temperature of windshield molding during test: 21.1°C.

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2319	2319	100
Right Side	2319	2319	100
Total	4638	4638	100



Item	Units	Value
A	mm	1320
B	mm	478
C	mm	1642
D	mm	838
E	mm	506
F	mm	631

AREA 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. **None**

X	Y

B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component. **None**

X	Y

DATA SHEET NO. 16
FMVSS NO. 301 BARRIER IMPACT AND STATIC ROLLOVER RESULTS

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025

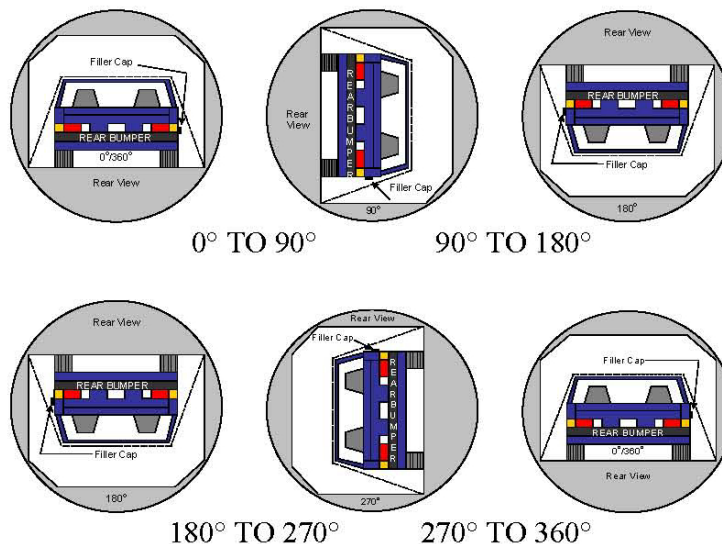
FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21.1°C

Test Time: 11:41 a.m.

- A. From impact until vehicle motion ceases: (Maximum Allowable = 1 ounce) 0.0 oz.
 B. For the 5 minute period after motion ceases: (Maximum Allowable = 5 ounces) 13.62 oz.
 C. For the following 25 minutes: (Maximum Allowable = 1 ounce / minute) N/A
 D. Spillage Details: Stoddard collected from vehicle underbody (near fuel tank)

FMVSS 301 STATIC ROLLOVER RESULTS



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: **N/A**

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°			

DATA SHEET NO. 16 (CONTINUED)
FMVSS 301 BARRIER IMPACT AND STATIC ROLLOVER

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV NHTSA No.: M20255110
 Test Program: NCAP Frontal Barrier Impact Test Test Date: 2/17/2025

FMVSS 301 SPILLAGE TABLE (UNITS IN OUNCES)

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

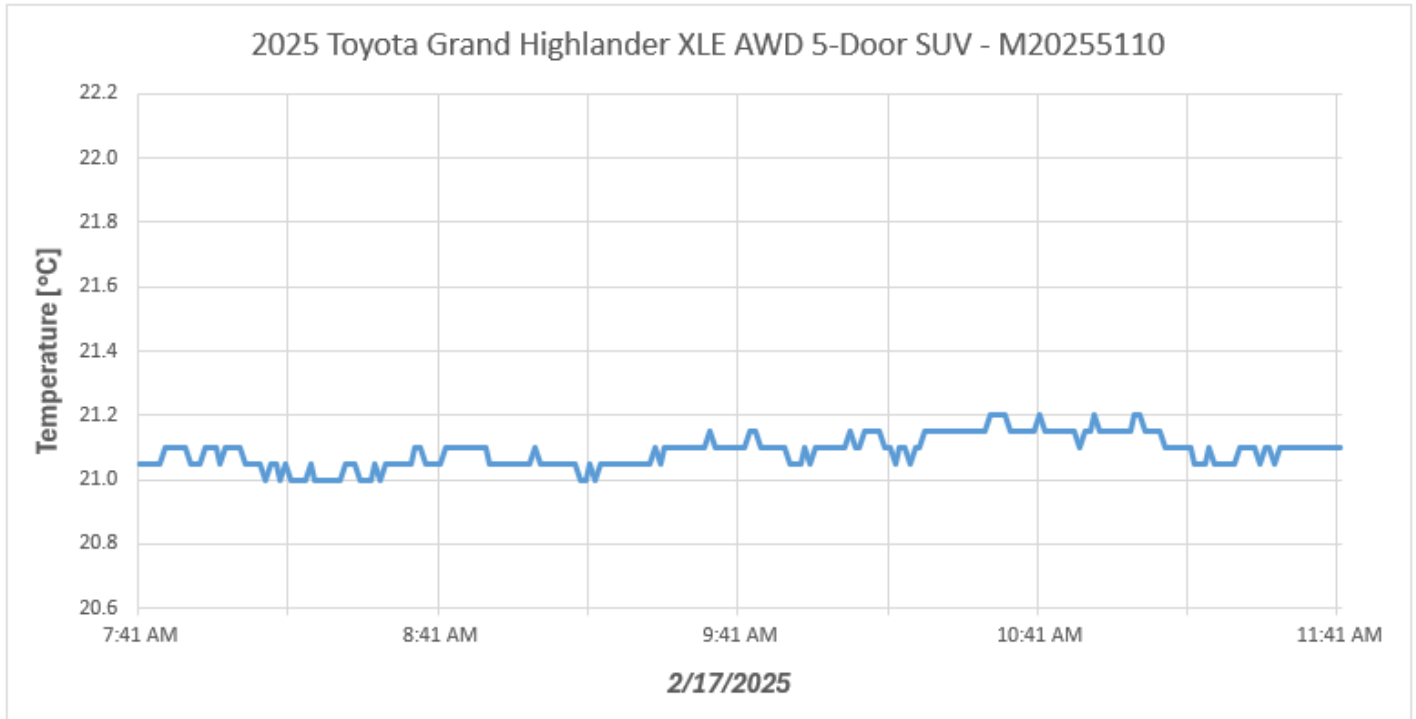
SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 17
DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle: 2025 Toyota Grand Highlander XLE AWD 5-Door SUV
 Test Program: NCAP Frontal Barrier Impact Test

NHTSA No.: M20255110
 Test Date: 2/17/2025



Serial #	Description	Maximum	Average	Minimum	Units
W1443497	VSC Start Room A - Temp (1038)	21.20	21.09	21.00	°C

**APPENDIX A
PHOTOGRAPHS**

TABLE OF PHOTOGRAPHS

		<u>Page No.</u>
Photo No. 001	Load Cell Location	A-1
Photo No. 002	Pre-Test Load Cell Wall	A-1
Photo No. 003	Post-Test Load Cell Wall	A-2
Photo No. 004	Manufacturer's Label	A-2
Photo No. 005	Tire Placard	A-3
Photo No. 005a	Vehicle Load Carrying Capacity Reduction Label	A-3
Photo No. 006	2025 Toyota Grand Highlander XLE AWD 5-Door SUV Frontal As Delivered	A-4
Photo No. 007	Left Rear 3-4 View, As Received	A-4
Photo No. 008	Pre-Test Front View of Test Vehicle	A-5
Photo No. 009	Post-Test Front View of Test Vehicle	A-5
Photo No. 010	Pre-Test Left View of Test Vehicle	A-6
Photo No. 011	Post-Test Left View of Test Vehicle	A-6
Photo No. 012	Pre-Test Right View of Test Vehicle	A-7
Photo No. 013	Post-Test Right View of Test Vehicle	A-7
Photo No. 014	Pre-Test Right Front 3-4 View	A-8
Photo No. 015	Post-Test Right Front 3-4 View	A-8
Photo No. 016	Pre-Test Left Rear 3-4 View	A-9
Photo No. 017	Post-Test Left Rear 3-4 View	A-9
Photo No. 018	Pre-Test Windshield View	A-10
Photo No. 019	Post-Test Windshield View	A-10
Photo No. 020	Pre-Test Engine Compartment View	A-11
Photo No. 021	Post-Test Engine Compartment View	A-11
Photo No. 022	Pre-Test Fuel Filler Cap View	A-12
Photo No. 023	Post-Test Fuel Filler Cap View	A-12
Photo No. 024	Pre-Test Front Underbody View	A-13
Photo No. 025	Post-Test Front Underbody View	A-13
Photo No. 026	Pre-Test Rear Underbody View	A-14
Photo No. 027	Post-Test Rear Underbody View	A-14
Photo No. 028	Pre-Test Dummy Cable Routing	A-15

		<u>Page No.</u>
Photo No. 029	Post-Test Dummy Cable Routing	A-15
Photo No. 030	Pre-Test Driver Dummy Front View	A-16
Photo No. 031	Post-Test Driver Dummy Front View	A-16
Photo No. 032	Pre-Test Driver Dummy Window View	A-17
Photo No. 033	Post-Test Driver Dummy Window View	A-17
Photo No. 034	Pre-Test Driver Dummy and Vehicle Interior View	A-18
Photo No. 035	Post-Test Driver Dummy and Vehicle Interior View	A-18
Photo No. 036	Pre-Test Driver's Seat Fore-Aft Markings	A-19
Photo No. 037	Post-Test Driver's Seat Fore-Aft Markings	A-19
Photo No. 038	Pre-Test View of Belt Anchorage for Driver Dummy	A-20
Photo No. 039	Post-Test View of Belt Anchorage for Driver Dummy	A-20
Photo No. 040	Pre-Test View of Belt Buckle and Latch Plate for Driver Dummy	A-21
Photo No. 041	Post-Test View of Belt Buckle and Latch Plate for Driver Dummy	A-21
Photo No. 042	Pre-Test Driver Dummy Feet	A-22
Photo No. 043	Post-Test Driver Dummy Feet	A-22
Photo No. 044	Pre-Test Driver's Side Knee Bolster	A-23
Photo No. 045	Post-Test Driver's Side Knee Bolster	A-23
Photo No. 046	Pre-Test Driver's Side Floorpan	A-24
Photo No. 047	Post-Test Driver's Side Floorpan	A-24
Photo No. 048	Post-Test Driver Dummy Face	A-25
Photo No. 049	Post-Test Driver Dummy Contact with Airbag	A-25
Photo No. 050	Post-Test Driver Dummy Contact with Headrest	A-26
Photo No. 051	Pre-Test View of the Steering Wheel	A-26
Photo No. 052	Post-Test View of the Steering Wheel	A-27
Photo No. 053	Pre-Test Passenger Dummy Front View	A-27
Photo No. 054	Post-Test Passenger Dummy Front View	A-28
Photo No. 055	Pre-Test Passenger Dummy Window View	A-28
Photo No. 056	Post-Test Passenger Dummy Window View	A-29
Photo No. 057	Pre-Test Passenger Dummy and Vehicle Interior	A-29
Photo No. 058	Post-Test Passenger Dummy and Vehicle Interior	A-30

		<u>Page No.</u>
Photo No. 059	Pre-Test Passenger's Seat Fore-Aft Markings	A-30
Photo No. 060	Post-Test Passenger's Seat Fore-Aft Markings	A-31
Photo No. 061	Pre-Test View of Belt Anchorage for Passenger Dummy	A-31
Photo No. 062	Post-Test View of Belt Anchorage for Passenger Dummy	A-32
Photo No. 063	Pre-Test View of Belt Buckle and Latch Plate for Passenger Dummy	A-32
Photo No. 064	Post-Test View of Belt Buckle and Latch Plate for Passenger Dummy	A-33
Photo No. 065	Pre-Test Passenger Dummy Feet	A-33
Photo No. 066	Post-Test Passenger Dummy Feet	A-34
Photo No. 067	Pre-Test Passenger's Side Knee Bolster	A-34
Photo No. 068	Post-Test Passenger's Side Knee Bolster	A-35
Photo No. 069	Pre-Test Passenger's Side Floorpan	A-35
Photo No. 070	Post-Test Passenger's Side Floorpan	A-36
Photo No. 071	Post-Test Passenger Dummy Face	A-36
Photo No. 072	Post-Test Passenger Dummy Contact with Airbag	A-37
Photo No. 073	Post-Test Passenger Dummy Contact with Headrest	A-37
Photo No. 074	Photograph of Ballast Installed in Vehicle	A-38
Photo No. 075	Post-Test Stoddard Solvent Spillage Location View	A-38
Photo No. 076	Post-Test Speed Trap Read-Out	A-39
Photo No. 077	Vehicle at 0 Degree on Static Rollover Device	A-39
Photo No. 078	Vehicle at 90 Degrees on Static Rollover Device	A-40
Photo No. 079	Vehicle at 180 Degrees on Static Rollover Device	A-40
Photo No. 080	Vehicle at 270 Degrees on Static Rollover Device	A-41
Photo No. 081	Vehicle at 360 Degrees on Static Rollover Device	A-41
Photo No. 082	2025 Toyota Grand Highlander XLE AWD 5-Door SUV Frontal Impact Event	A-42
Photo No. 083	Monroney Label Photograph	A-42

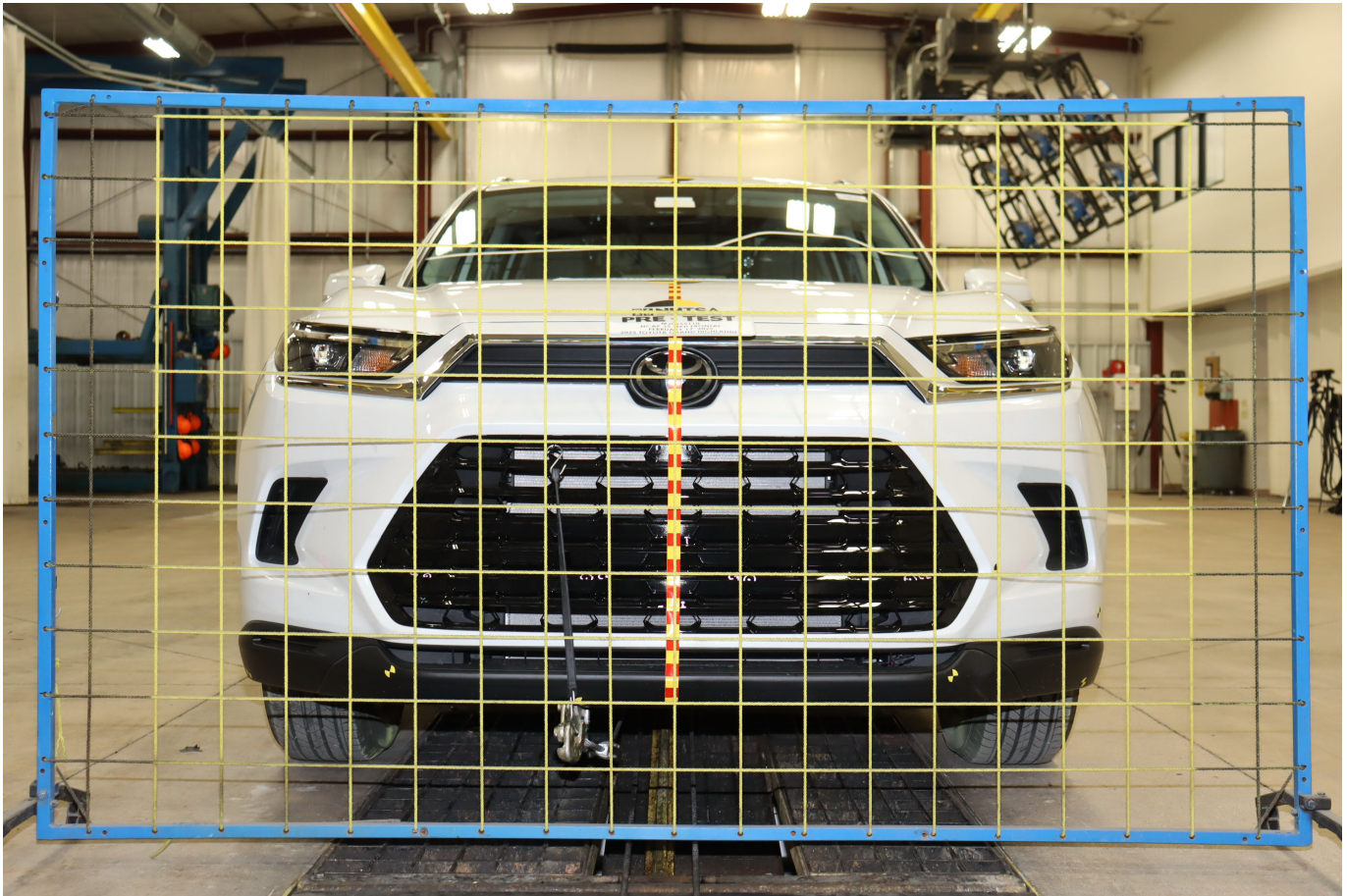


Photo No. 001 - Load Cell Location



Photo No. 002 - Pre-Test Load Cell Wall



Photo No. 003 - Post-Test Load Cell Wall



Photo No. 004 - Manufacturer's Label



Photo No. 005 - Tire Placard



Photo No. 005a - Vehicle Load Carrying Capacity Reduction Label



Photo No. 006 - 2025 Toyota Grand Highlander XLE AWD 5-Door SUV Frontal As Delivered



Photo No. 007 - Left Rear 3-4 View, As Received

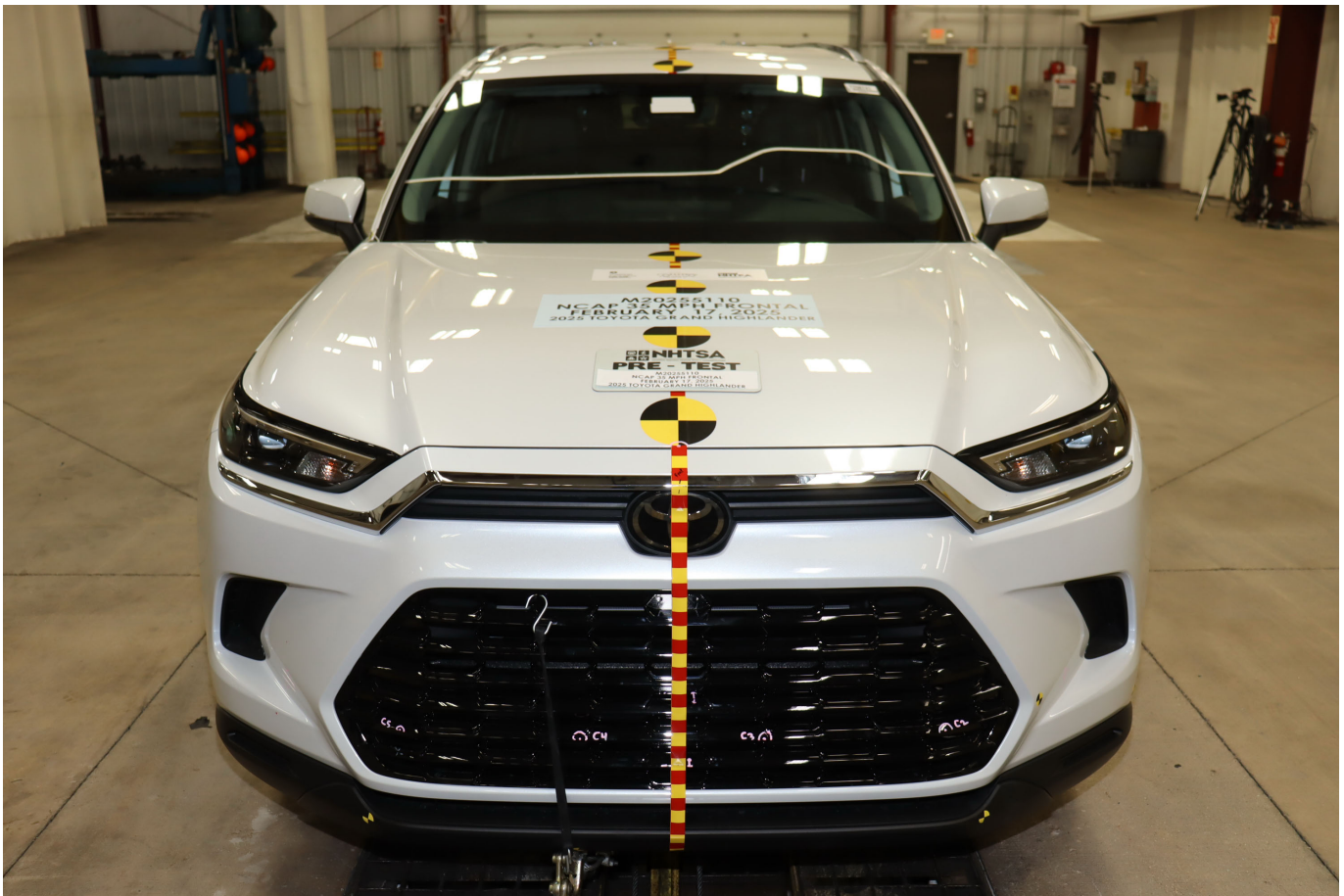


Photo No. 008 - Pre-Test Front View of Test Vehicle

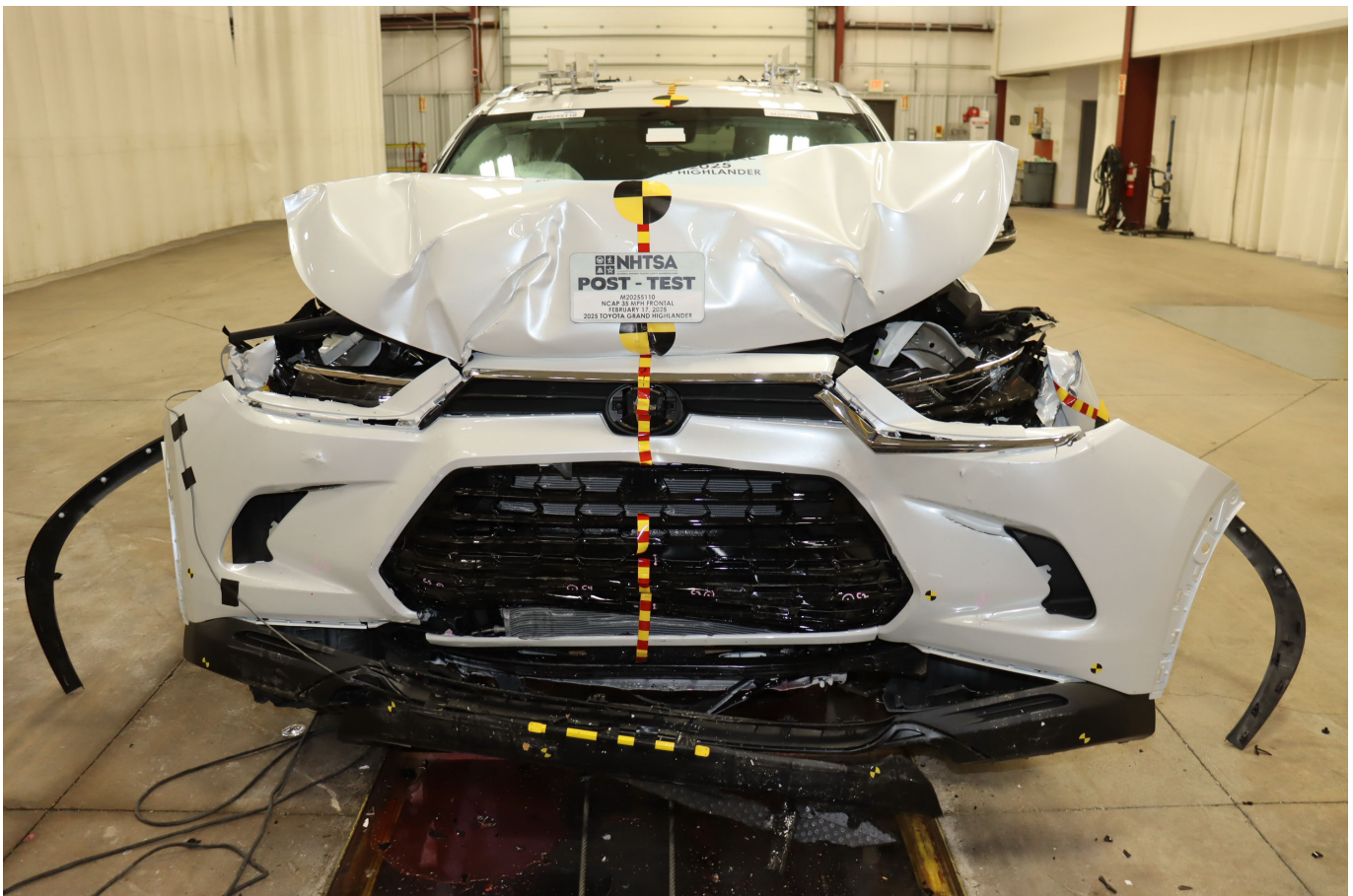


Photo No. 009 - Post-Test Front View of Test Vehicle



Photo No. 010 - Pre-Test Left View of Test Vehicle



Photo No. 011 - Post-Test Left View of Test Vehicle



Photo No. 012 - Pre-Test Right View of Test Vehicle



Photo No. 013 - Post-Test Right View of Test Vehicle



Photo No. 014 - Pre-Test Right Front 3-4 View



Photo No. 015 - Post-Test Right Front 3-4 View



Photo No. 016 - Pre-Test Left Rear 3-4 View



Photo No. 017 - Post-Test Left Rear 3-4 View



Photo No. 018 - Pre-Test Windshield View



Photo No. 019 - Post-Test Windshield View

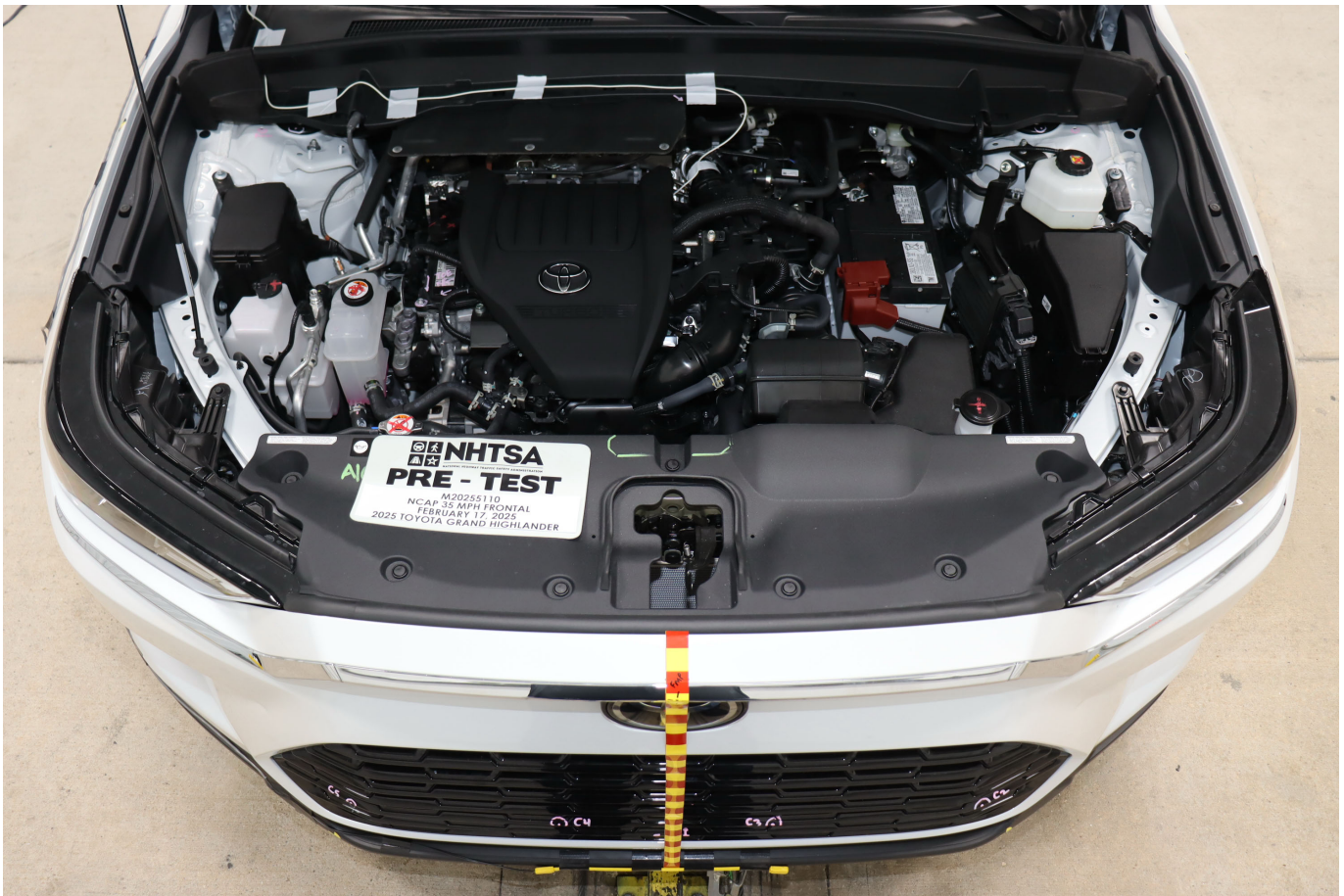


Photo No. 020 - Pre-Test Engine Compartment View

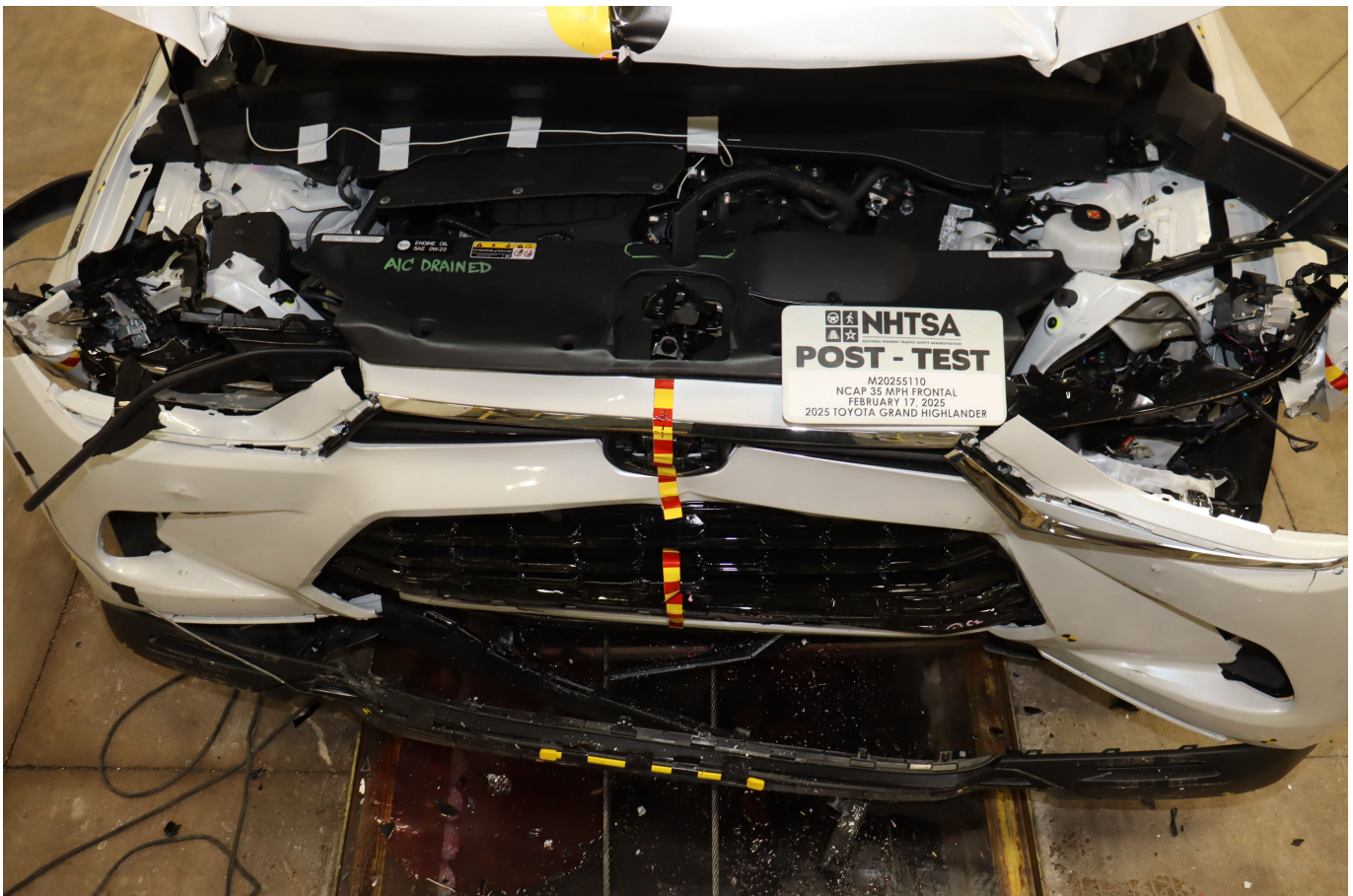


Photo No. 021 - Post-Test Engine Compartment View



Photo No. 022 - Pre-Test Fuel Filler Cap View



Photo No. 023 - Post-Test Fuel Filler Cap View

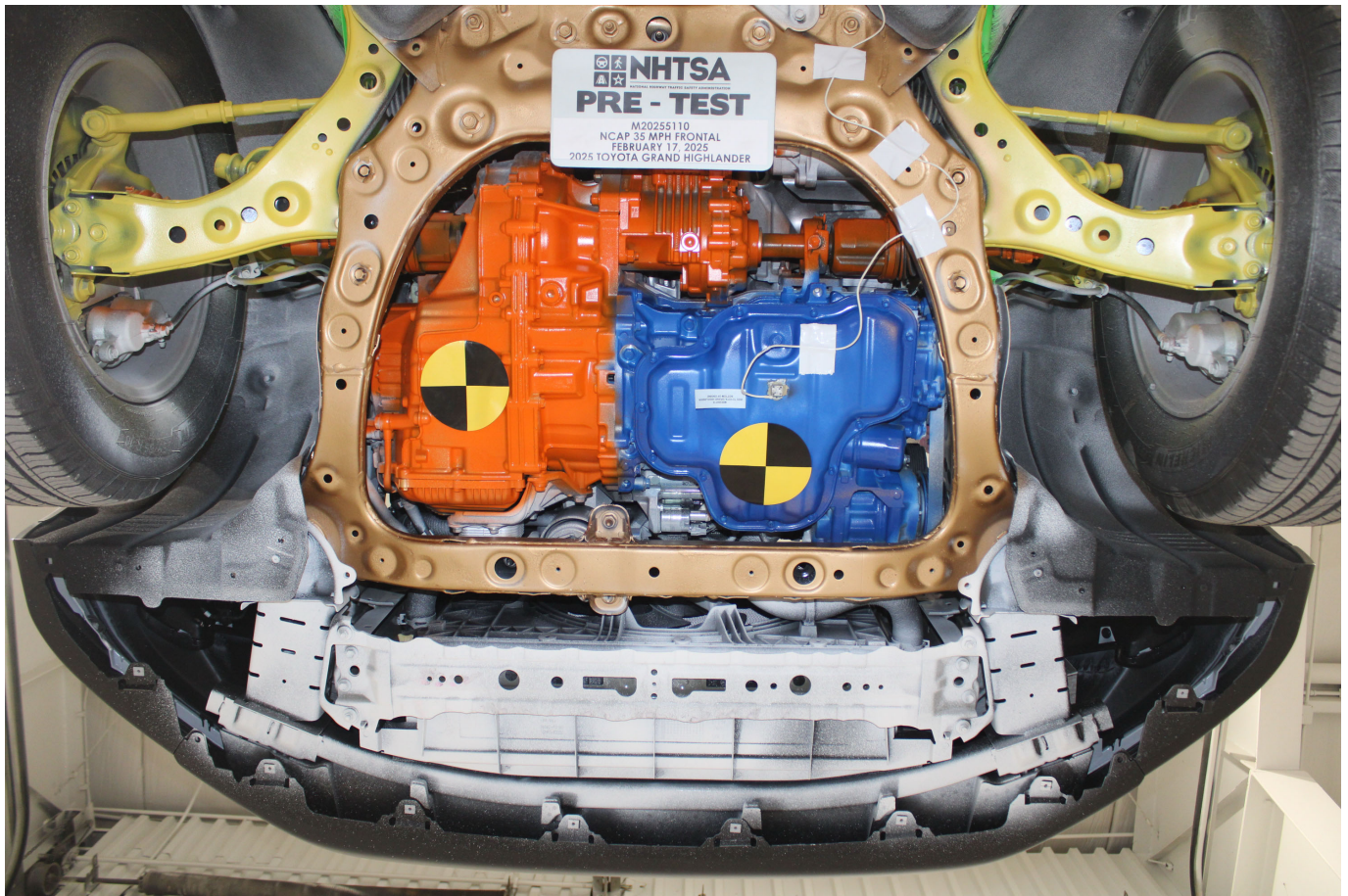


Photo No. 024 - Pre-Test Front Underbody View

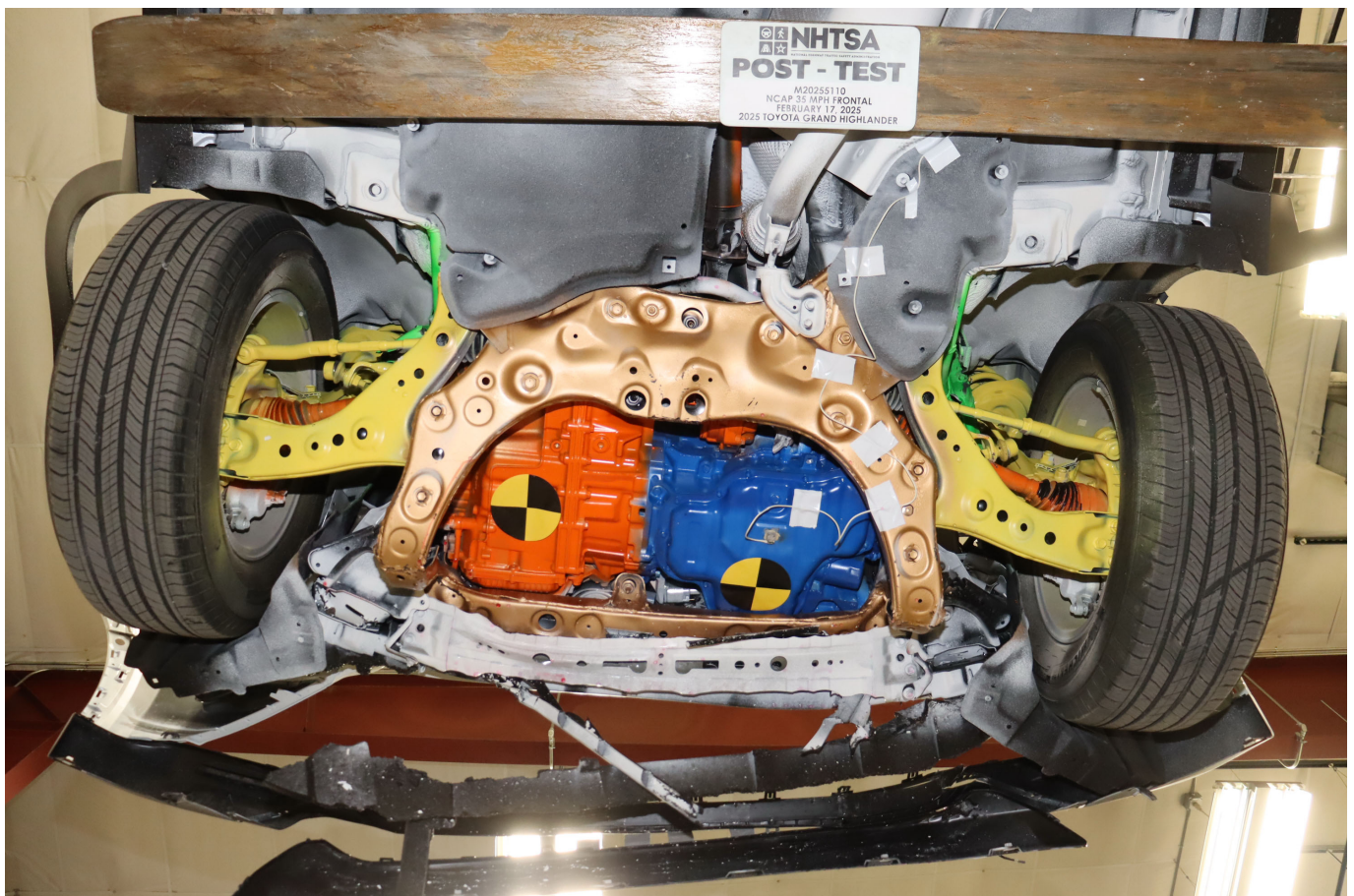


Photo No. 025 - Post-Test Front Underbody View

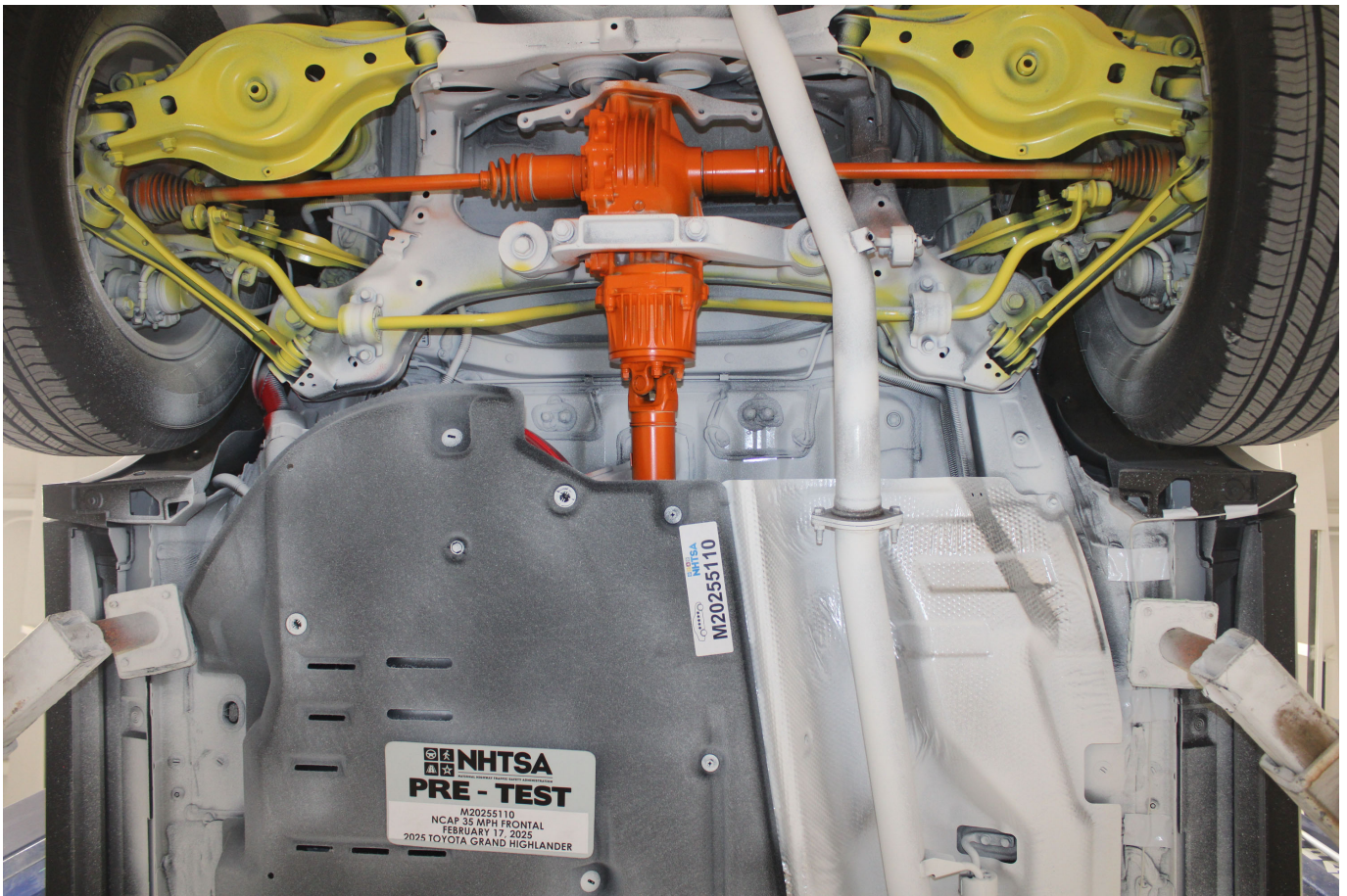


Photo No. 026 - Pre-Test Rear Underbody View

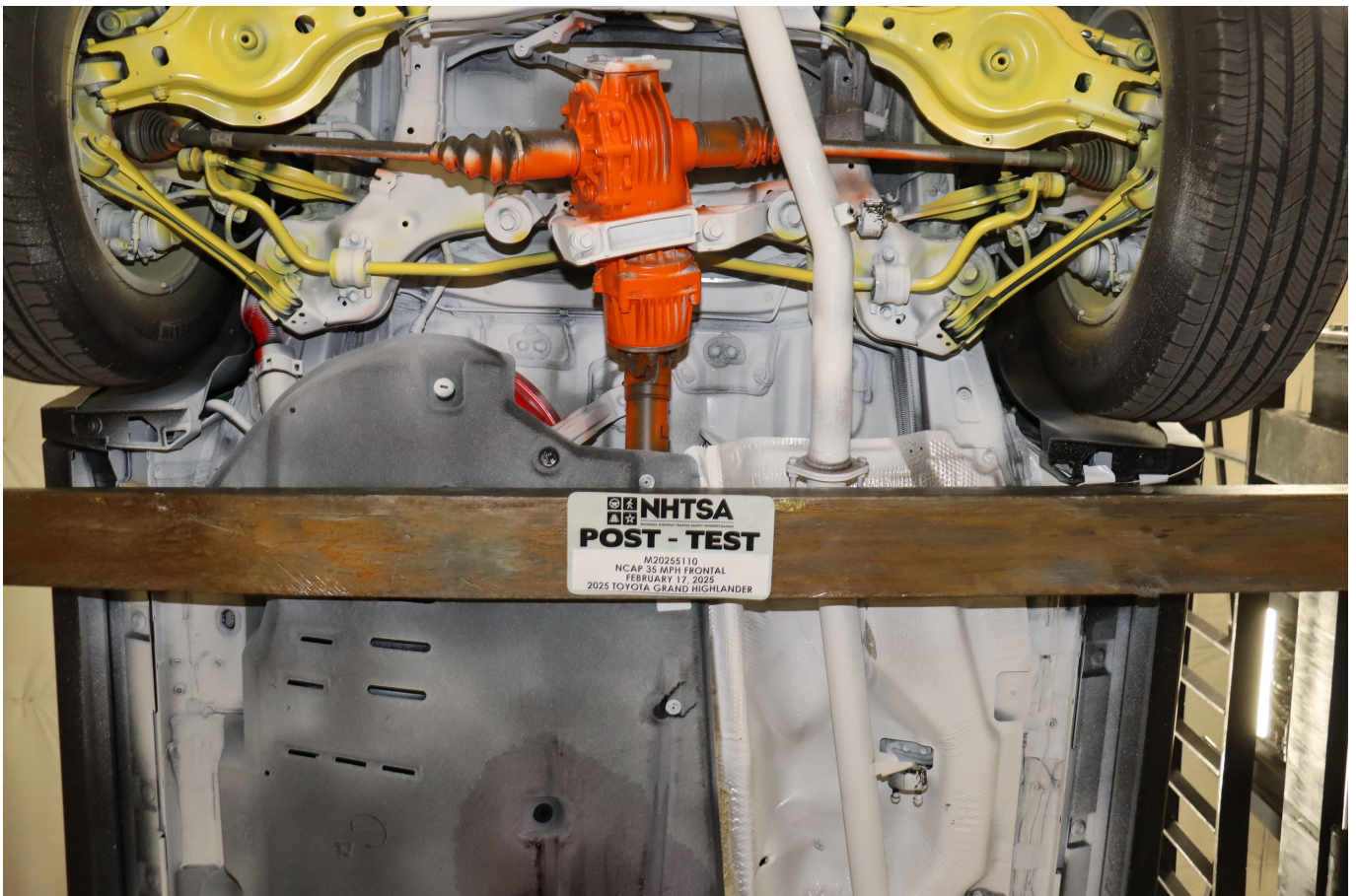


Photo No. 027 - Post-Test Rear Underbody View



Photo No. 028 - Pre-Test Dummy Cable Routing



Photo No. 029 - Post-Test Dummy Cable Routing



Photo No. 030 - Pre-Test Driver Dummy Front View



Photo No. 031 - Post-Test Driver Dummy Front View



Photo No. 032 - Pre-Test Driver Dummy Window View



Photo No. 033 - Post-Test Driver Dummy Window View



Photo No. 034 - Pre-Test Driver Dummy and Vehicle Interior View



Photo No. 035 - Post-Test Driver Dummy and Vehicle Interior View



Photo No. 036 - Pre-Test Driver's Seat Fore-Aft Markings



Photo No. 037 - Post-Test Driver's Seat Fore-Aft Markings



Photo No. 038 - Pre-Test View of Belt Anchorage for Driver Dummy



Photo No. 039 - Post-Test View of Belt Anchorage for Driver Dummy



Photo No. 040 - Pre-Test View of Belt Buckle and Latch Plate for Driver Dummy



Photo No. 041 - Post-Test View of Belt Buckle and Latch Plate for Driver Dummy



Photo No. 042 - Pre-Test Driver Dummy Feet



Photo No. 043 - Post-Test Driver Dummy Feet



Photo No. 044 - Pre-Test Driver's Side Knee Bolster



Photo No. 045 - Post-Test Driver's Side Knee Bolster



Photo No. 046 - Pre-Test Driver's Side Floorpan



Photo No. 047 - Post-Test Driver's Side Floorpan



Photo No. 048 - Post-Test Driver Dummy Face



Photo No. 049 - Post-Test Driver Dummy Contact with Airbag



Photo No. 050 - Post-Test Driver Dummy Contact with Headrest



Photo No. 051 - Pre-Test View of the Steering Wheel



Photo No. 052 - Post-Test View of the Steering Wheel



Photo No. 053 - Pre-Test Passenger Dummy Front View



Photo No. 054 - Post-Test Passenger Dummy Front View



Photo No. 055 - Pre-Test Passenger Dummy Window View



Photo No. 056 - Post-Test Passenger Dummy Window View



Photo No. 057 - Pre-Test Passenger Dummy and Vehicle Interior View



Photo No. 058 - Post-Test Passenger Dummy and Vehicle Interior View

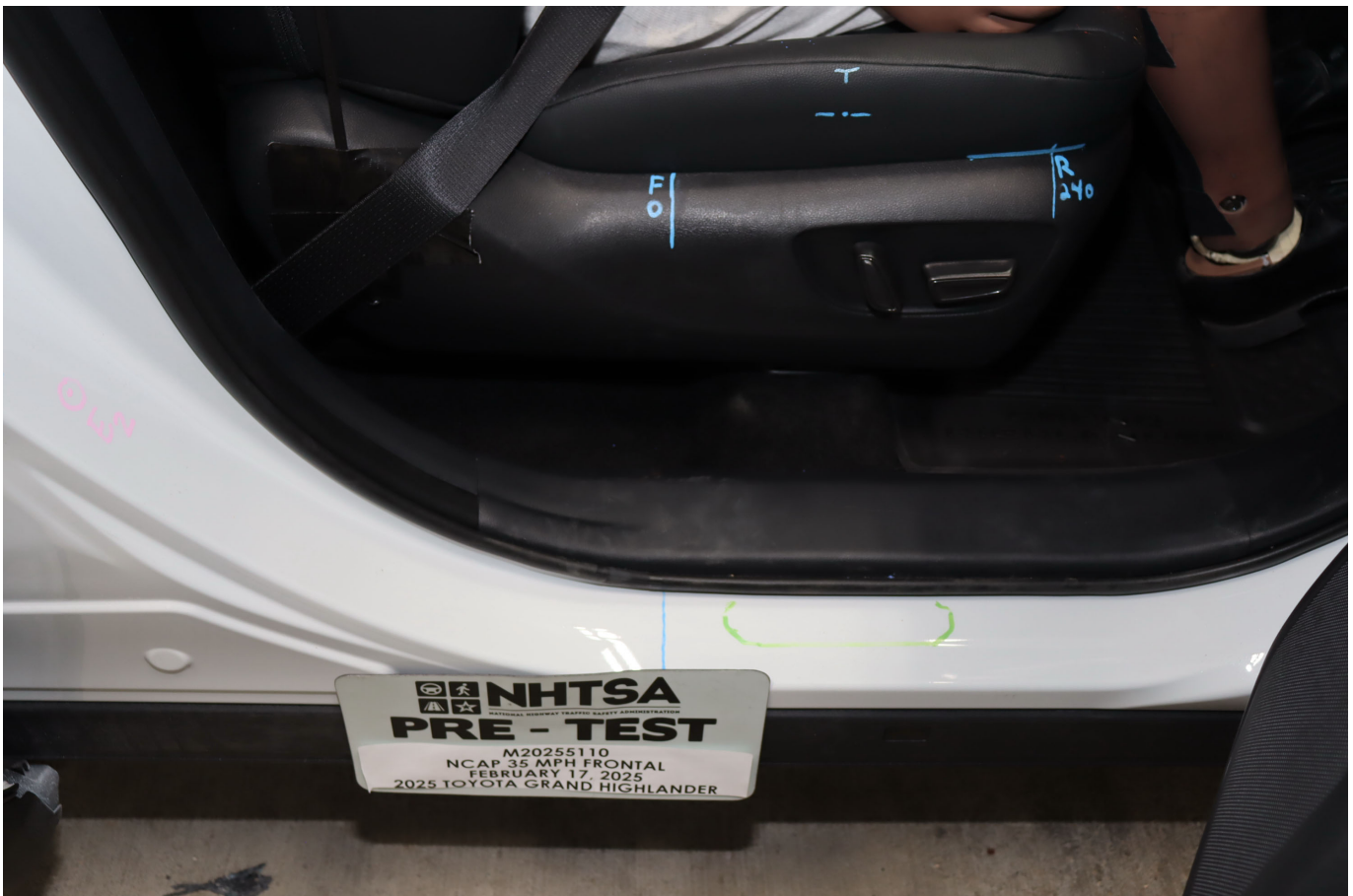


Photo No. 059 - Pre-Test Passenger's Seat Fore-Aft Markings



Photo No. 060 - Post-Test Passenger's Seat Fore-Aft Markings



Photo No. 061 - Pre-Test View of Belt Anchorage for Passenger Dummy



Photo No. 062 - Post-Test View of Belt Anchorage for Passenger Dummy



Photo No. 063 - Pre-Test View of Belt Buckle and Latch Plate for Passenger Dummy



Photo No. 064 - Post-Test View of Belt Buckle and Latch Plate for Passenger Dummy



Photo No. 065 - Pre-Test Passenger Dummy Feet



Photo No. 066 - Post-Test Passenger Dummy Feet



Photo No. 067 - Pre-Test Passenger's Side Knee Bolster



Photo No. 068 - Post-Test Passenger's Side Knee Bolster



Photo No. 069 - Pre-Test Passenger's Side Floorpan



Photo No. 070 - Post-Test Passenger's Side Floorpan

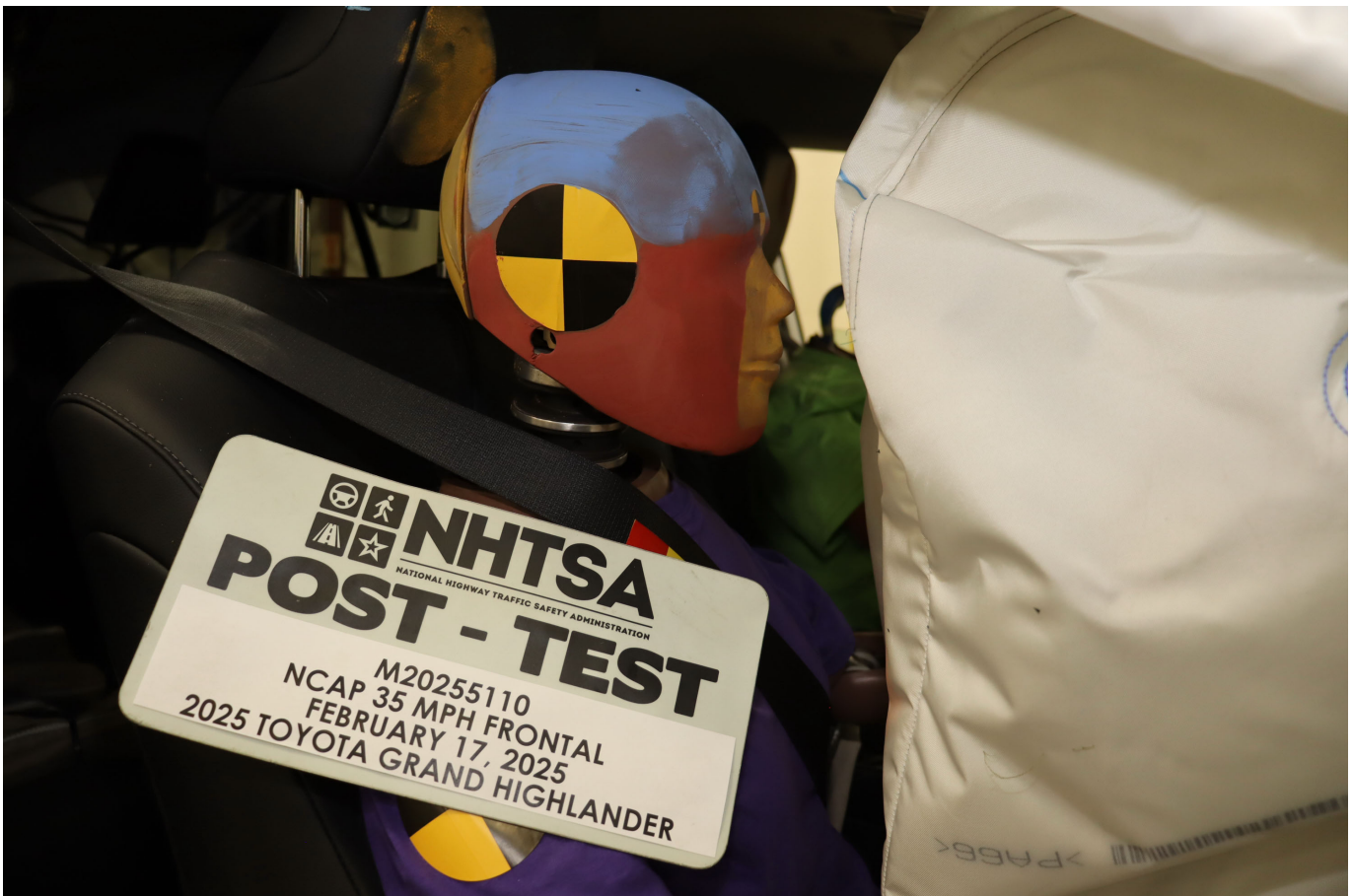


Photo No. 071 - Post-Test Passenger Dummy Face



Photo No. 072 - Post-Test Passenger Dummy Contact with Airbag



Photo No. 073 - Post-Test Passenger Dummy Contact with Headrest



Photo No. 074 - Photograph of Ballast Installed in Vehicle

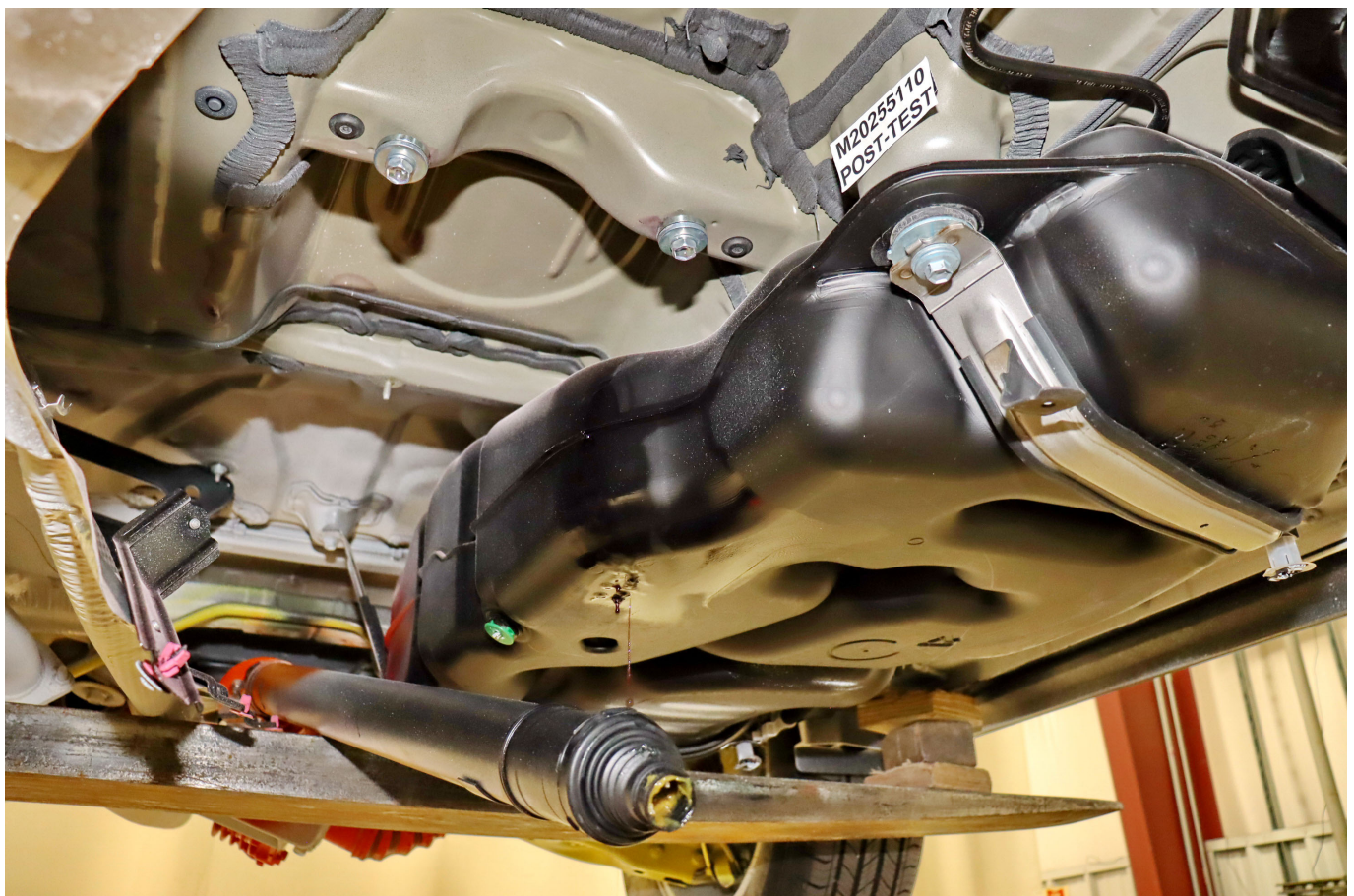


Photo No. 075 - Post-Test Stoddard Solvent Spillage Location View



Photo No. 076 - Post-Test Speed Trap Read-Out

PHOTOGRAPH NOT APPLICABLE

Photo No. 077 - Vehicle at 0 Degrees on Static Rollover Device

PHOTOGRAPH NOT APPLICABLE

Photo No. 078 - Vehicle at 90 Degrees on Static Rollover Device

PHOTOGRAPH NOT APPLICABLE

Photo No. 079 - Vehicle at 180 Degrees on Static Rollover Device

PHOTOGRAPH NOT APPLICABLE

Photo No. 080 - Vehicle at 270 Degrees on Static Rollover Device

PHOTOGRAPH NOT APPLICABLE

Photo No. 081 - Vehicle at 360 Degrees on Static Rollover Device



Photo No. 082 - 2025 Toyota Grand Highlander XLE AWD 5-Door SUV Frontal Impact Event



TOYOTA

DESC.: **GRAND HIGHLANDER XLE AWD**
VIN: **5TDAAB50SS073580**
YR/MDL: 2025/6708A
CLR: WIND CHILL PEARL/EA20 (0089/20)
FINAL ASSEMBLY POINT: PRINCETON, INDIANA, U.S.A.

STANDARD EQUIPMENT
UNLESS REPLACED BY OPTIONAL EQUIPMENT

MECHANICAL & PERFORMANCE

- 2.4L 4-cyl Turbo Engine; 8 Speed Auto
- 5,000-lb Tow Capacity
- AWD w/Multi-Terrain Select

SAFETY & CONVENIENCE

- Toyota Safety Sense 3.0 w/Pre-Collision
- Blind Spot Monitor w/Rear Cross-Traffic Alert
- Star Safety System
- LATCH-Lower Anchor & Tether for Children
- Connected Services Capable, 4G Network Dependent. See Toyota.com for Details.

EXTERIOR

- 18-in. Alloy Wheels
- LED Headlights and Taillights
- 5-Door Smart Key w/ Push Button Start
- Heated Outside Mirrors
- Power Liftgate

INTERIOR

- 12.3-in. Toyota Audio Multimedia w/ 6-Speakers, Wireless Apple CarPlay & Android Auto Compatibility
- SiriusXM w/3-Month Trial
- Seating for 7; Softex-Trimmed Seats
- Heated & Power Front Seats
- 3rd Row 60/40 Split-Fold-Flat Seats
- Integrated 2nd Row Window Sunshades
- 3-Zone Auto Climate Control
- Qi Wireless Smartphone Charger
- Auto-Dimming Mirror w/Garage Door Opener
- 13 Cup/Bottle Holders
- 7 USB-C Ports
- 7-in. Color Multi-Info Display
- For Full Product Details, Please Visit Toyota.com/GrandHighlander
- **Full Tank of Gas**

BASE MANUFACTURER'S SUGGESTED RETAIL PRICE \$45,230.00

OPTIONAL EQUIPMENT

FE	50 STATE EMISSION	
PC	PREMIUM PAINT	475.00
ZT	All Weather Floor Liners / Cargo Tray	378.00
DS	Door Edge Guards	160.00

GOVERNMENT 5-STAR SAFETY RATINGS

This vehicle has not been rated by the government for overall vehicle score, frontal crash, side crash or rollover risk.

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

EPA DOT Fuel Economy and Environment

Fuel Economy

23 MPG
combined city/hwy

21 city 27 highway

4.3 gallons per 100 miles

Standard SUVs range from 11 to 100 MPG. The best vehicle rates 140 MPG.

You spend \$2,000 more in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost \$2,300

Fuel Economy & Greenhouse Gas Rating (tailpipe only) **Smog Rating** (tailpipe only)

1 **5** **10** **1** **6** **10**
Best Best

This vehicle emits 379 grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions. Learn more at fuel economy.gov.

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 28 MPG and costs \$9,500 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$3.50 per gallon. MPG is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fuel economy.gov
Calculate personalized estimates and compare vehicles

Smartphone QR Code

MANUFACTURER'S SUGGESTED RETAIL PRICE \$46,243.00

DELIVERY, PROCESSING AND HANDLING FEE 1,450.00

TOTAL SUGGESTED RETAIL PRICE \$47,693.00

*Manufacturer's suggested retail price excludes delivery processing and handling fees, license and title fees, applicable federal, state and local taxes, and dealer and distributor options and accessories.

Delivered by Truck for 48065
TOYOTA OF BROOKFIELD
20655 WEST CAPITOL DR
BROOKFIELD WI53045

TMLZEINISOFW00

Photo No. 083 - Monroney Label Photograph

APPENDIX B
DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

Page No.

List of Data Plots Provided in the Test Report

Figure No. 1.	Driver Head X Acceleration vs. Time	B-1
Figure No. 2.	Driver Head Y Acceleration vs. Time	B-1
Figure No. 3.	Driver Head Z Acceleration vs. Time	B-1
Figure No. 4.	Driver Head Resultant Acceleration vs. Time	B-1
Figure No. 5.	Driver Chest Displacement vs. Time	B-2
Figure No. 6.	Driver Chest X Acceleration vs. Time	B-3
Figure No. 7.	Driver Chest Y Acceleration vs. Time	B-3
Figure No. 8.	Driver Chest Z Acceleration vs. Time	B-3
Figure No. 9.	Driver Chest Resultant Acceleration vs. Time	B-3
Figure No. 10.	Driver Neck Force X vs. Time	B-4
Figure No. 11.	Driver Neck Force Z vs. Time	B-4
Figure No. 12.	Driver Neck Moment Y vs. Time	B-4
Figure No. 13.	Driver Nij (NTF) vs. Time	B-5
Figure No. 14.	Driver Nij (NTE) vs. Time	B-5
Figure No. 15.	Driver Nij (NCF) vs. Time	B-5
Figure No. 16.	Driver Nij (NCE) vs. Time	B-5
Figure No. 17.	Driver Left Femur Force vs. Time	B-6
Figure No. 18.	Driver Right Femur Force vs. Time	B-6
Figure No. 19.	Passenger Head X Acceleration vs. Time	B-7
Figure No. 20.	Passenger Head Y Acceleration vs. Time	B-7
Figure No. 21.	Passenger Head Z Acceleration vs. Time	B-7
Figure No. 22.	Passenger Head Resultant Acceleration vs. Time	B-7
Figure No. 23.	Passenger Chest Displacement vs. Time	B-8
Figure No. 24.	Passenger Chest X Acceleration vs. Time	B-9
Figure No. 25.	Passenger Chest Y Acceleration vs. Time	B-9
Figure No. 26.	Passenger Chest Z Acceleration vs. Time	B-9
Figure No. 27.	Passenger Chest Resultant Z Acceleration vs. Time	B-9

	<u>Page No.</u>
Figure No. 28. Passenger Neck Force X vs. Time	B-10
Figure No. 29. Passenger Neck Force Z vs. Time	B-10
Figure No. 30. Passenger Neck Moment Y vs. Time	B-10
Figure No. 31. Passenger Nij (NTF) vs. Time	B-11
Figure No. 32. Passenger Nij (NTE) vs. Time	B-11
Figure No. 33. Passenger Nij (NCF) vs. Time	B-11
Figure No. 34. Passenger Nij (NCE) vs. Time	B-11
Figure No. 35. Passenger Left Femur Force vs. Time	B-12
Figure No. 36. Passenger Right Femur Force vs. Time	B-12

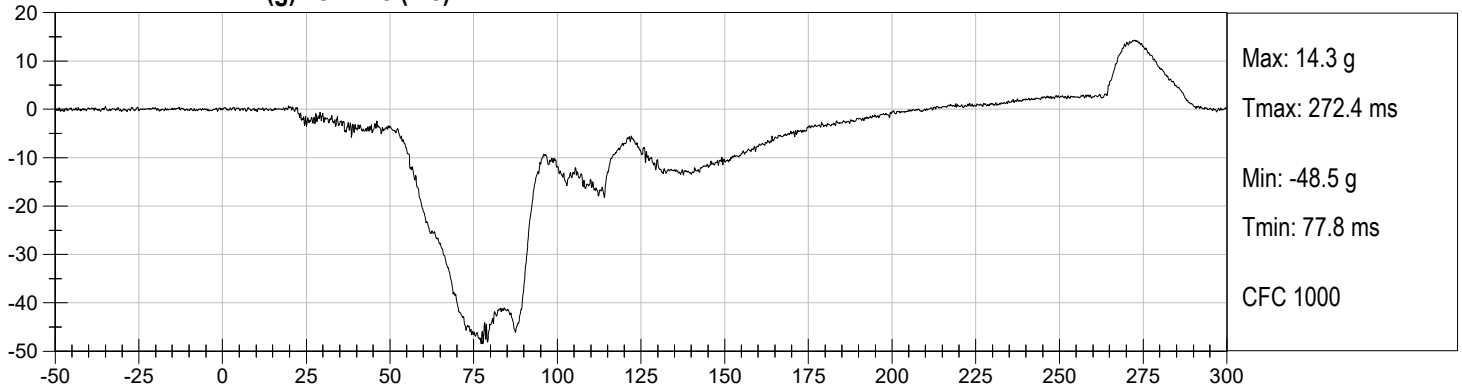
The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.gov

Driver Head X Redundant
 Driver Head Y Redundant
 Driver Head Z Redundant
 Driver Head Angular Velocity X
 Driver Head Angular Velocity Y
 Driver Head Angular Velocity Z
 Driver Upper Neck Force Y
 Driver Upper Neck Moment X
 Driver Upper Neck Moment Z
 Driver Chest X Redundant
 Driver Chest Y Redundant
 Driver Chest Z Redundant
 Driver Pelvis X
 Driver Pelvis Y
 Driver Pelvis Z
 Driver Left Femur Redundant
 Driver Right Femur Redundant
 Driver Left Upper Tibia Moment X
 Driver Left Upper Tibia Moment Y

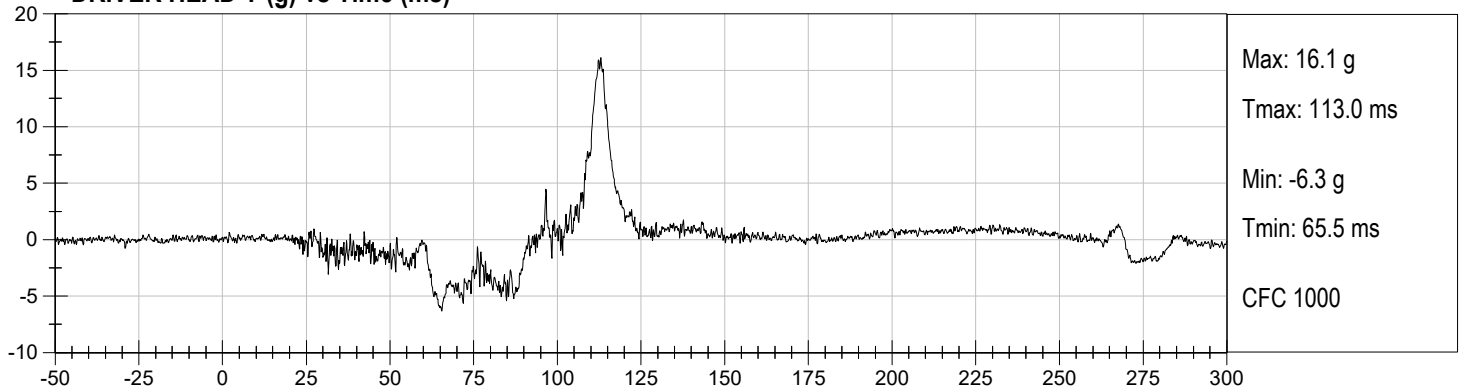
Driver Left Upper Tibia Force Z
Driver Left Lower Tibia Moment X
Driver Left Lower Tibia Moment Y
Driver Left Lower Tibia Force Z
Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left Foot Aft X
Driver Left Foot Aft Z
Driver Right Foot Fore Z
Driver Right Foot Aft X
Driver Right Foot Aft Z
Driver Lap Belt Force
Driver Shoulder Belt Force
Passenger Head X Redundant
Passenger Head Y Redundant
Passenger Head Z Redundant
Passenger Head Angular Velocity X
Passenger Head Angular Velocity Y
Passenger Head Angular Velocity Z
Passenger Upper Neck Force Y
Passenger Upper Neck Moment X
Passenger Upper Neck Moment Z
Passenger Chest X Redundant
Passenger Chest Y Redundant
Passenger Chest Z Redundant
Passenger Pelvis X
Passenger Pelvis Y

Passenger Pelvis Z
Passenger Left Femur Redundant
Passenger Right Femur Redundant
Passenger Left Upper Tibia Moment X
Passenger Left Upper Tibia Moment Y
Passenger Left Upper Tibia Force Z
Passenger Left Lower Tibia Moment X
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right Lower Tibia Moment X
Passenger Right Lower Tibia Moment Y
Passenger Right Lower Tibia Force Z
Passenger Left Foot Fore Z
Passenger Left Foot Aft X
Passenger Left Foot Aft Z
Passenger Right Foot Fore Z
Passenger Right Foot Aft X
Passenger Right Foot Aft Z
Passenger Lap Belt Force
Passenger Shoulder Belt Force
Left Rear Seat Crossmember X
Right Rear Seat Crossmember X
Vehicle Engine Top X
Vehicle Engine Bottom X
Left Rear Seat Crossmember Z
Right Rear Seat Crossmember Z
Left Rear Seat Crossmember Xr
Right Rear Seat Crossmember Xr
Advanced Research Load Cell Barrier – 528 channels

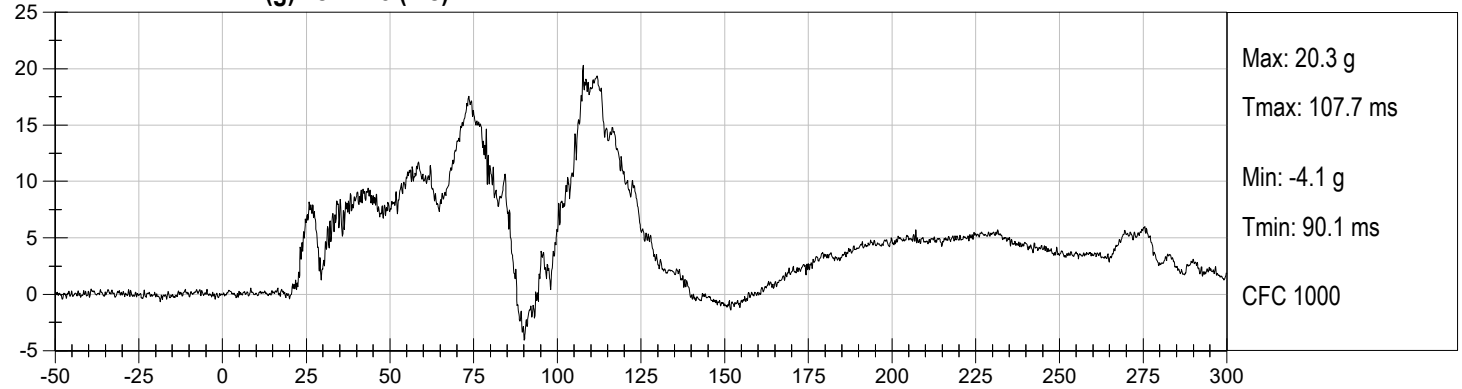
DRIVER HEAD X (g) vs Time (ms)



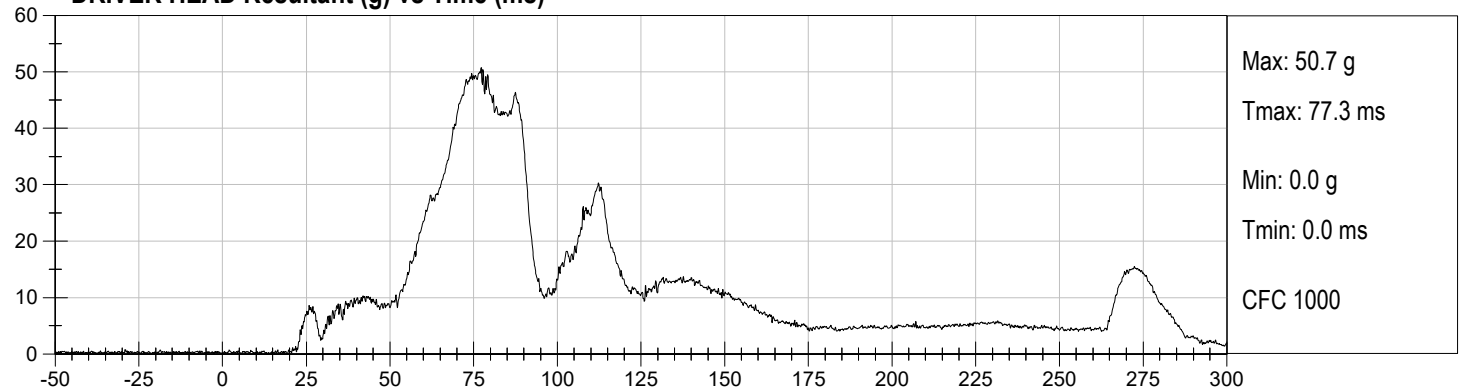
DRIVER HEAD Y (g) vs Time (ms)

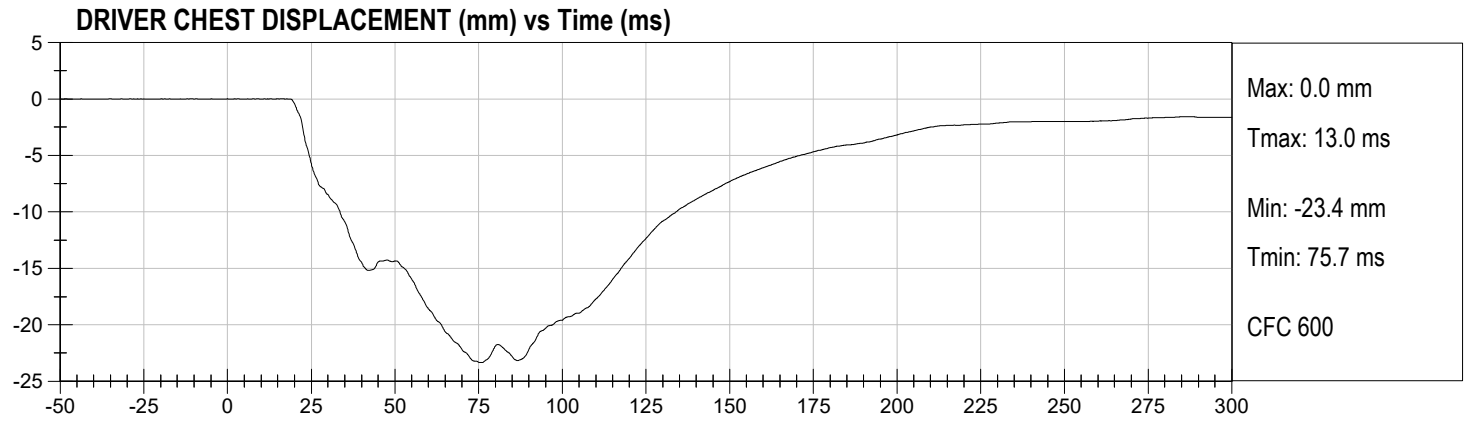


DRIVER HEAD Z (g) vs Time (ms)

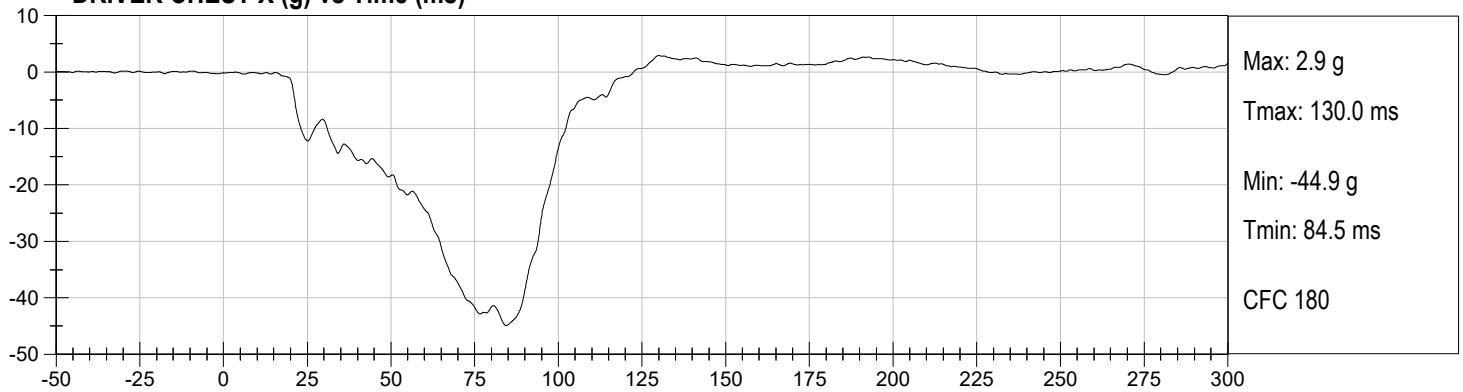


DRIVER HEAD Resultant (g) vs Time (ms)





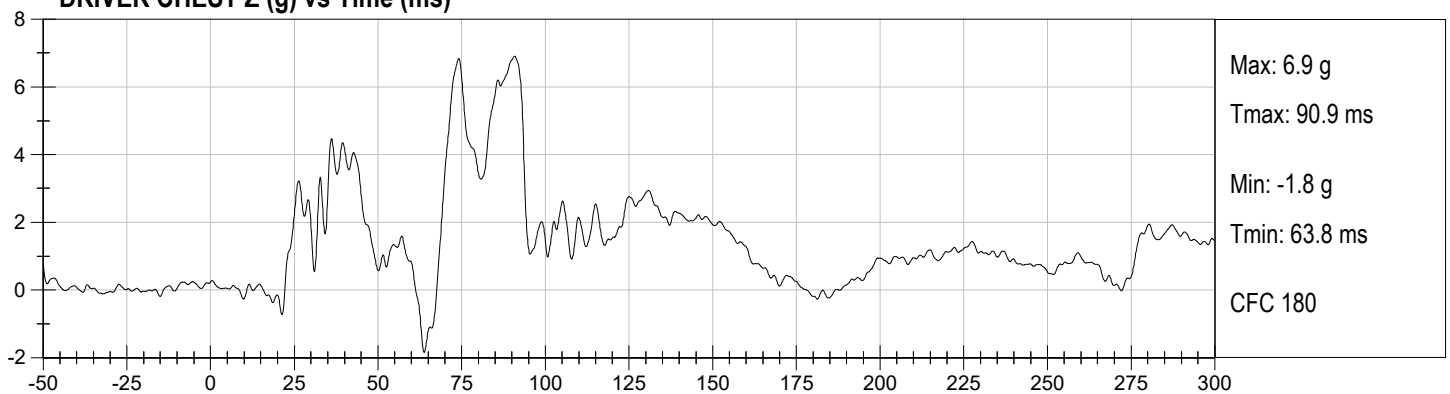
DRIVER CHEST X (g) vs Time (ms)



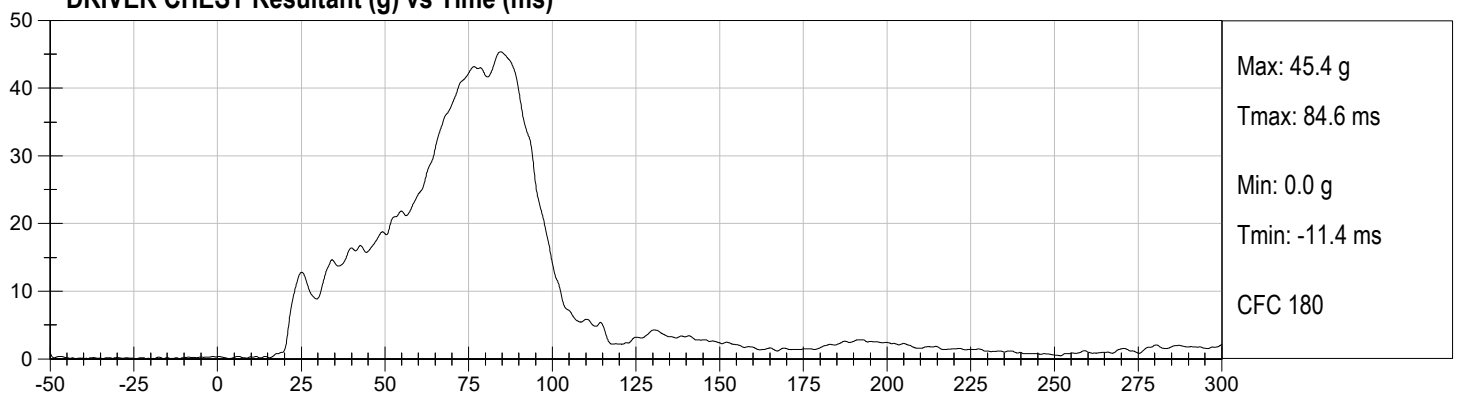
DRIVER CHEST Y (g) vs Time (ms)



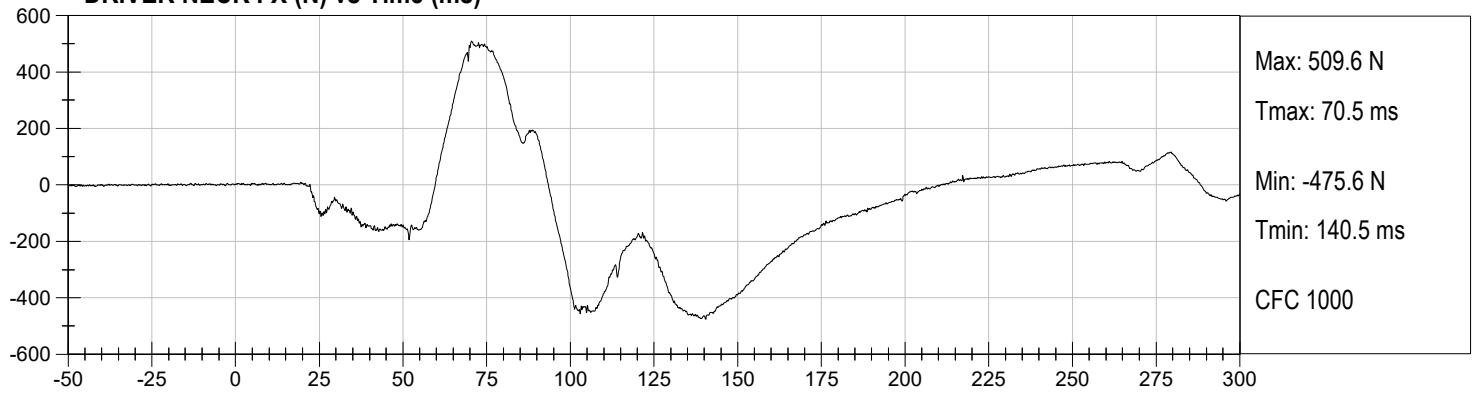
DRIVER CHEST Z (g) vs Time (ms)



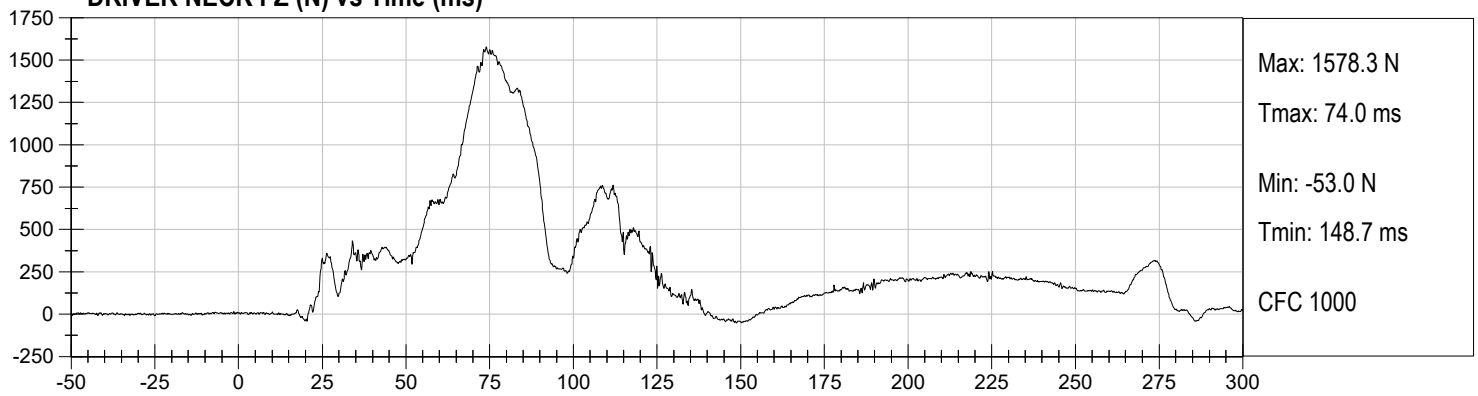
DRIVER CHEST Resultant (g) vs Time (ms)



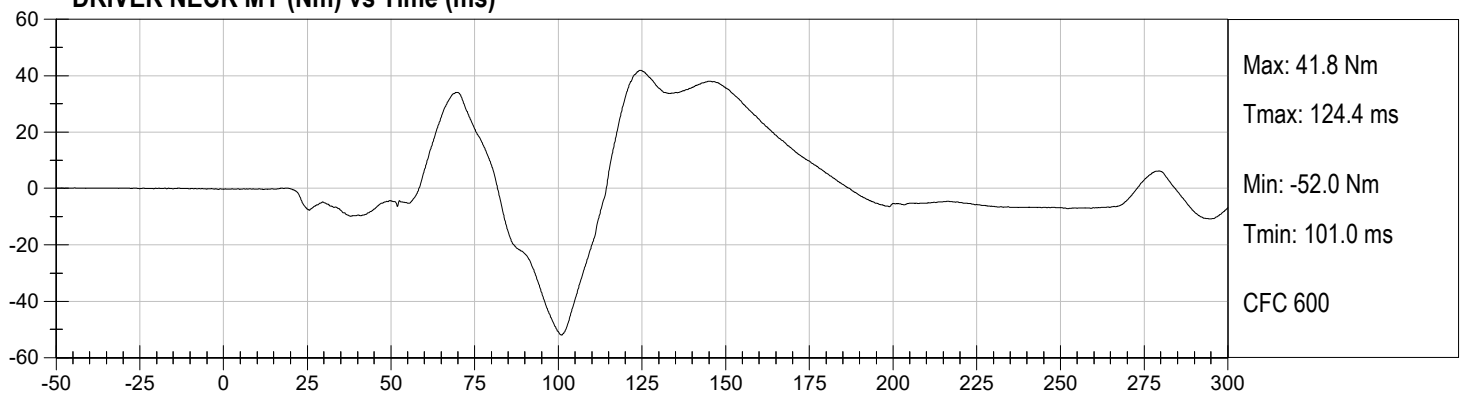
DRIVER NECK FX (N) vs Time (ms)



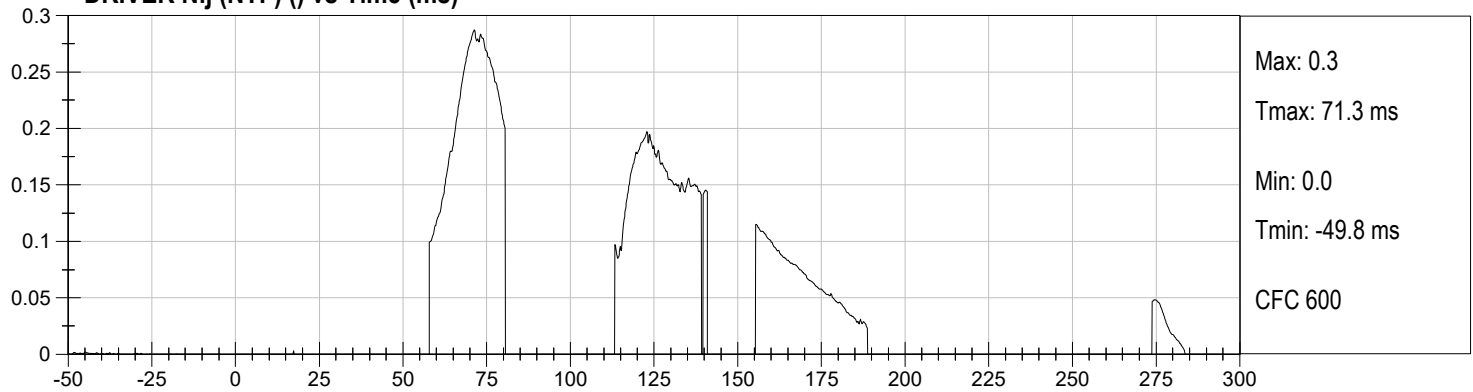
DRIVER NECK FZ (N) vs Time (ms)



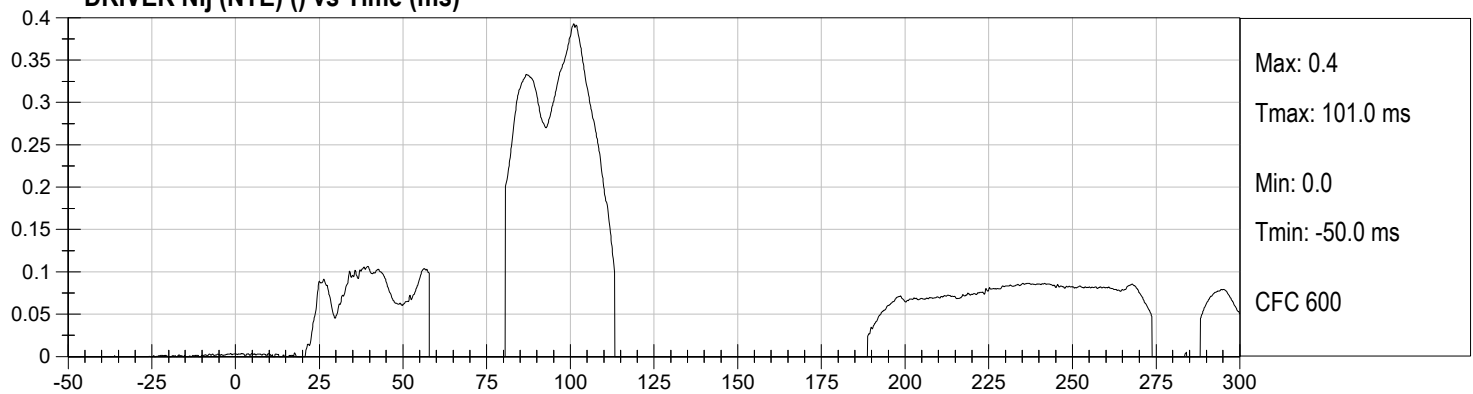
DRIVER NECK MY (Nm) vs Time (ms)



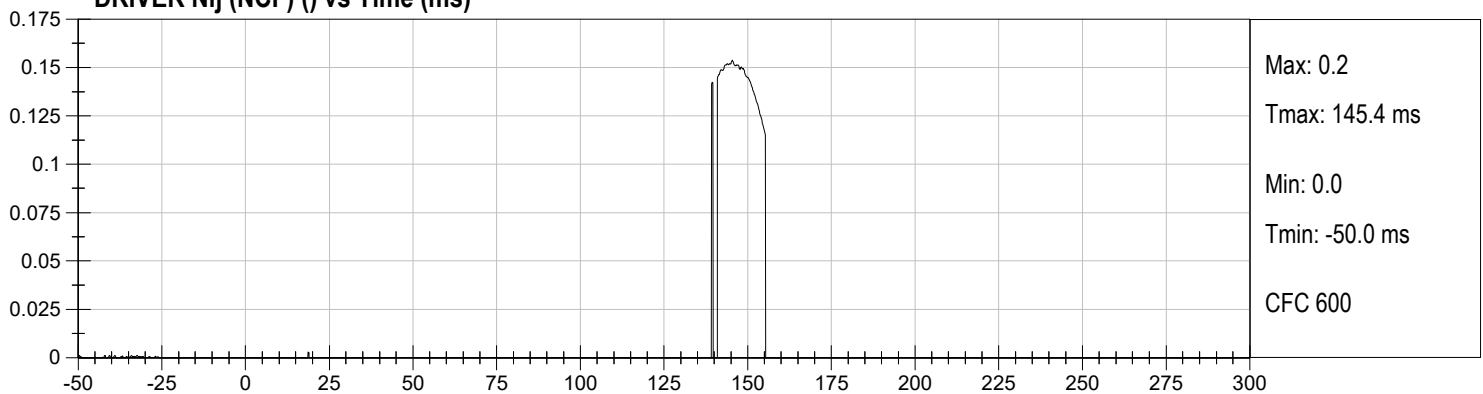
DRIVER Nij (NTF) () vs Time (ms)



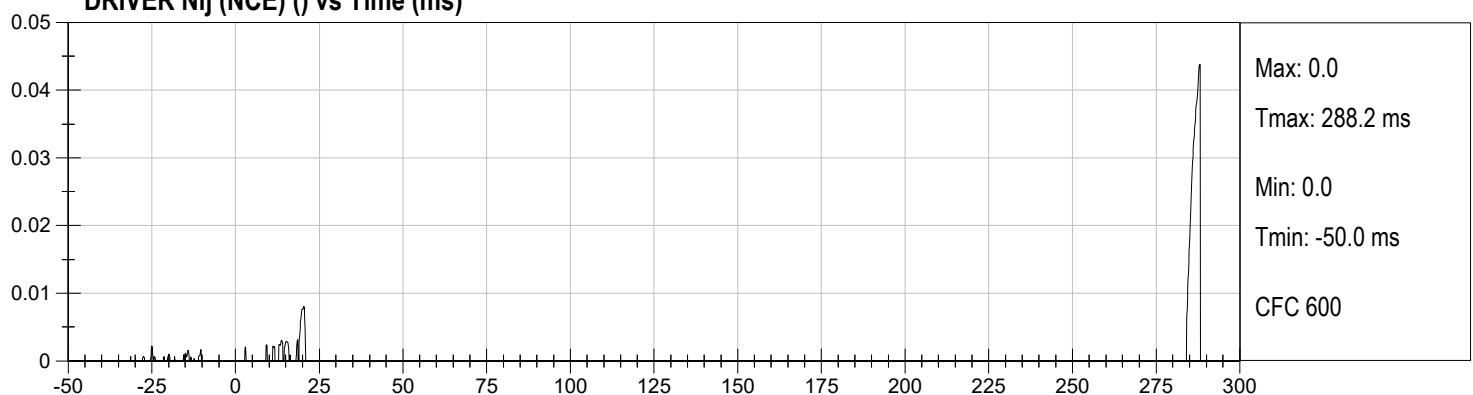
DRIVER Nij (NTE) () vs Time (ms)



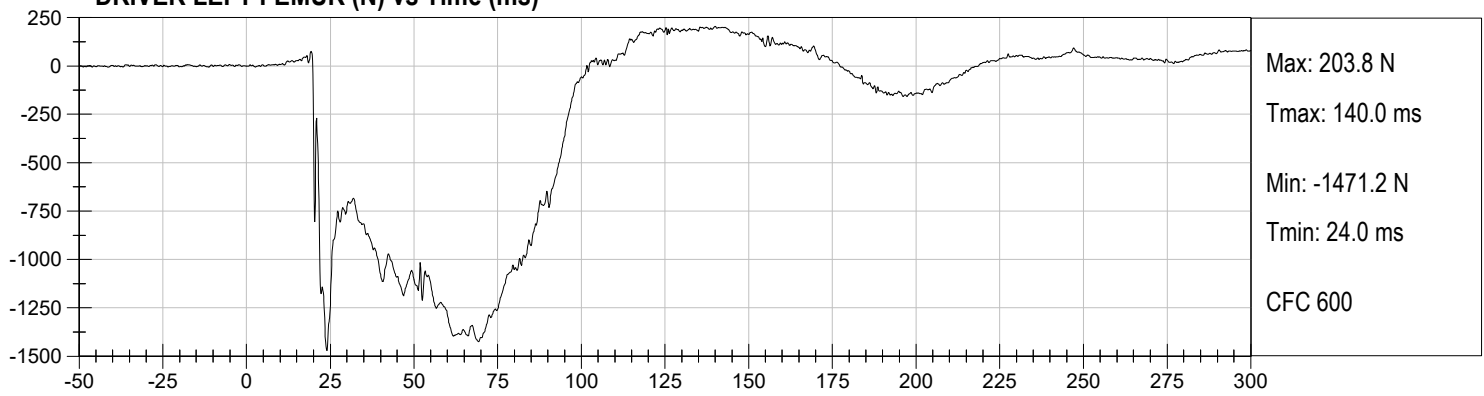
DRIVER Nij (NCF) () vs Time (ms)



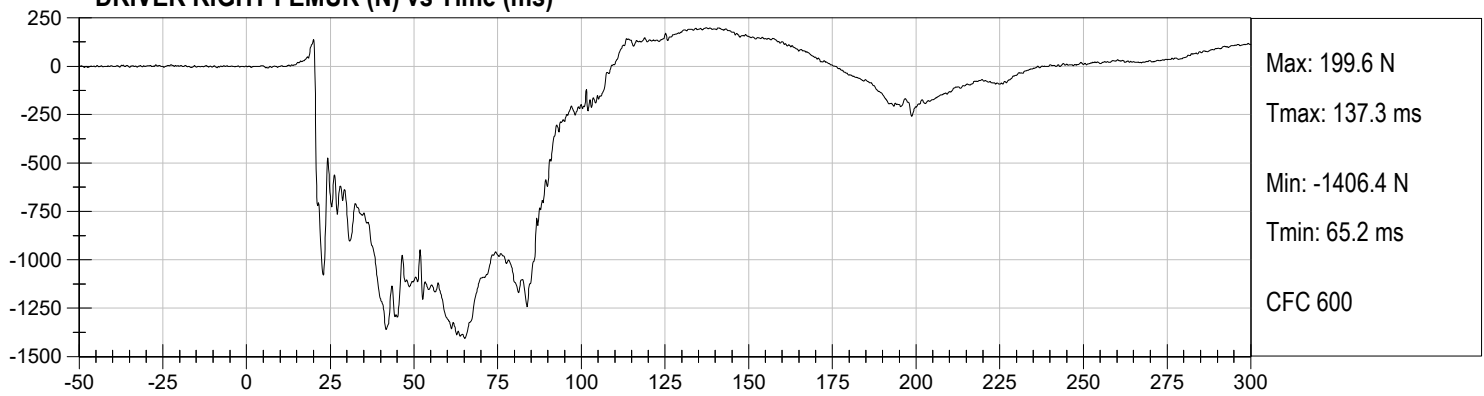
DRIVER Nij (NCE) () vs Time (ms)



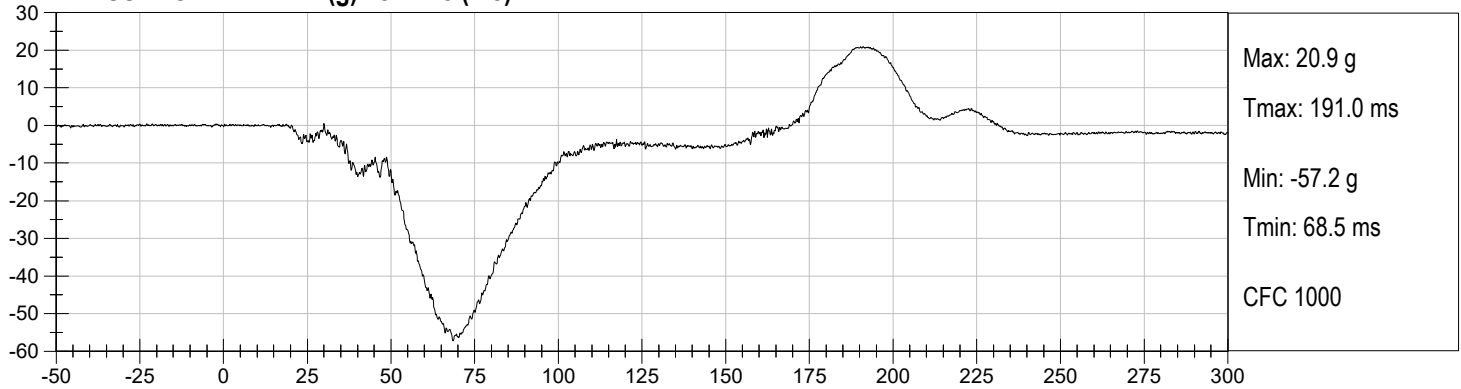
DRIVER LEFT FEMUR (N) vs Time (ms)



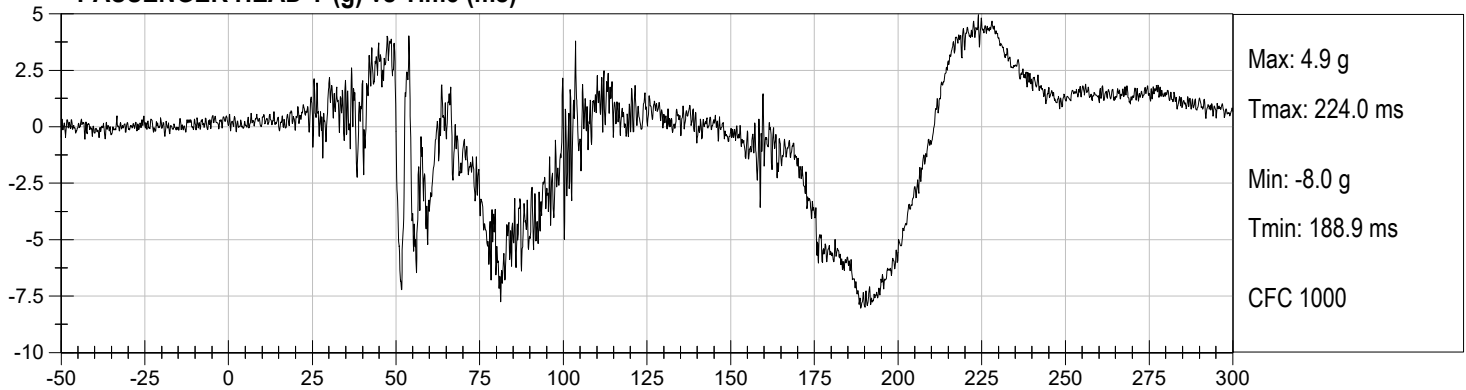
DRIVER RIGHT FEMUR (N) vs Time (ms)



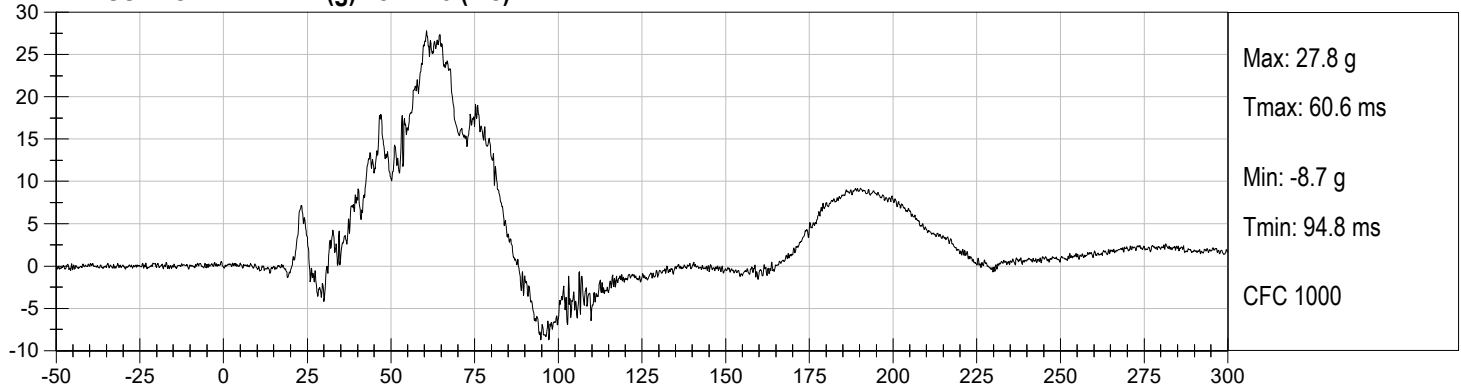
PASSENGER HEAD X (g) vs Time (ms)



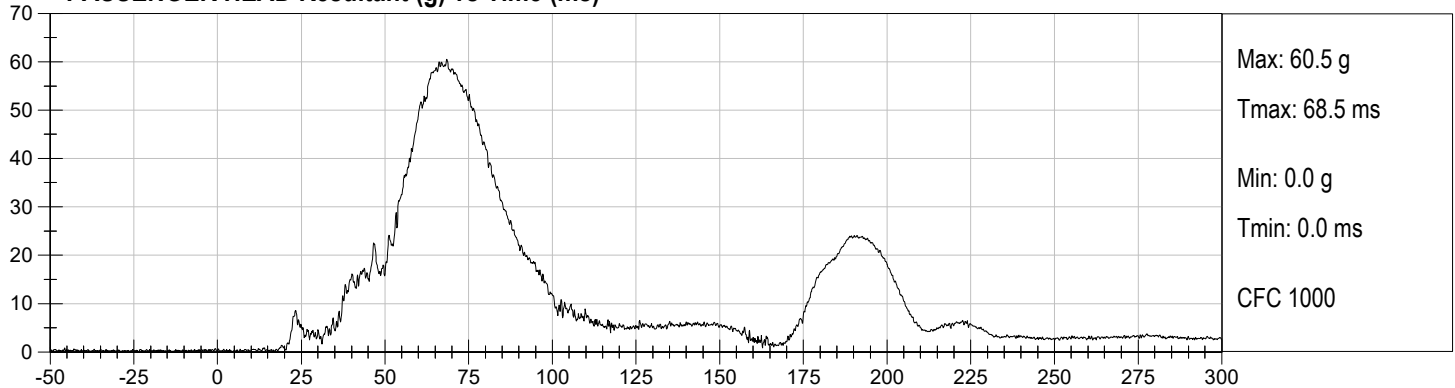
PASSENGER HEAD Y (g) vs Time (ms)

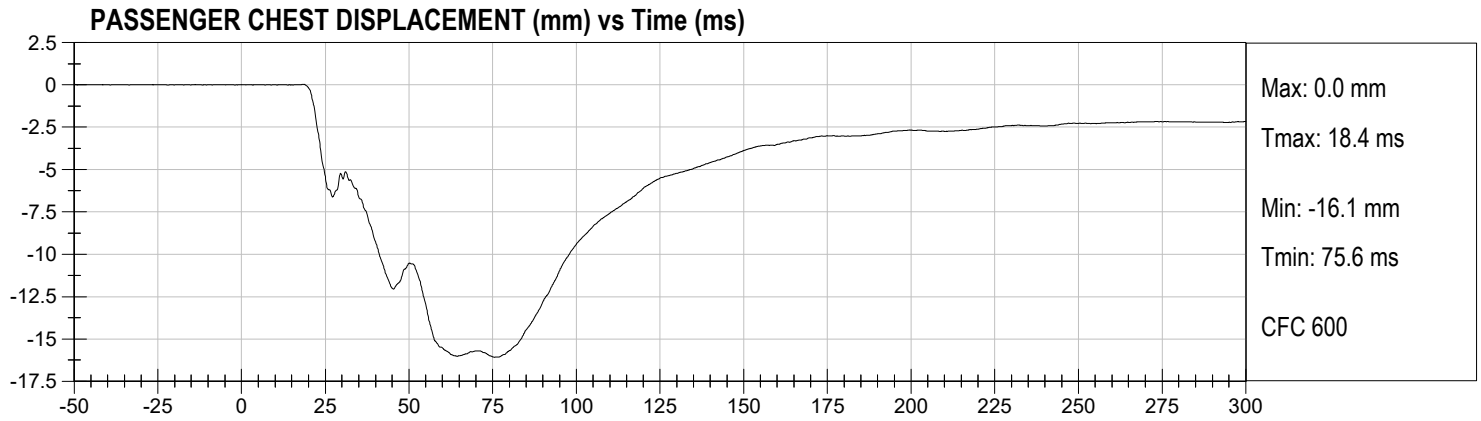


PASSENGER HEAD Z (g) vs Time (ms)

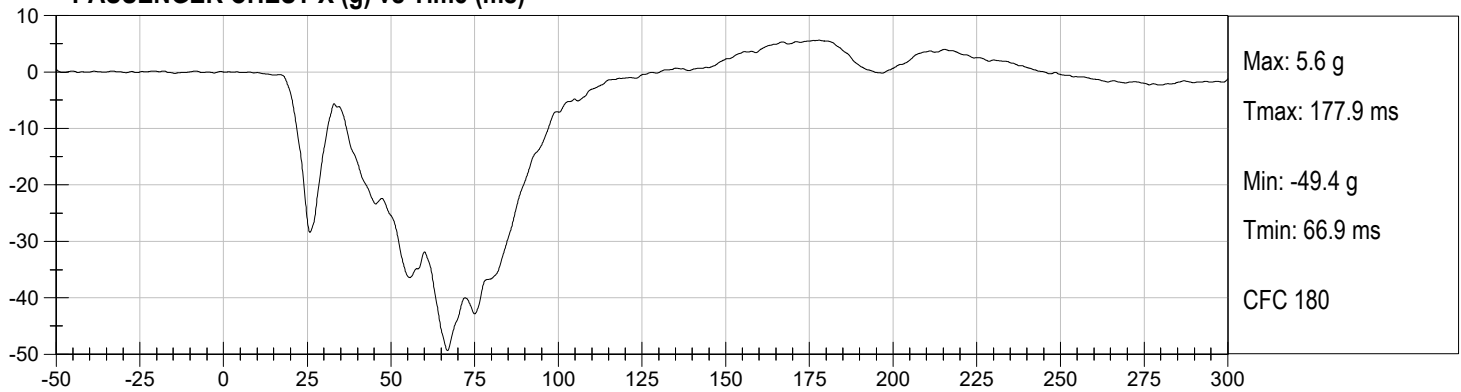


PASSENGER HEAD Resultant (g) vs Time (ms)

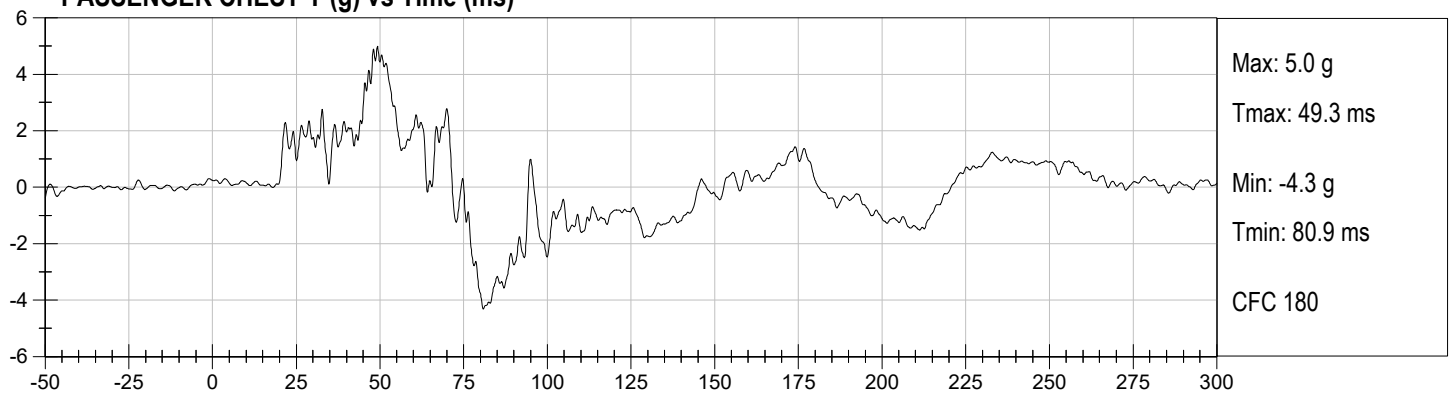




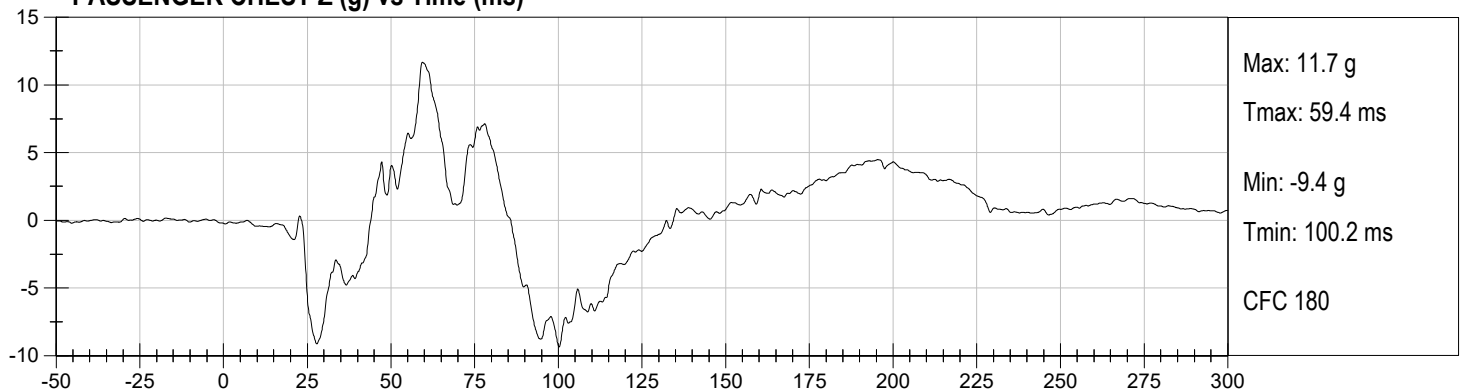
PASSENGER CHEST X (g) vs Time (ms)



PASSENGER CHEST Y (g) vs Time (ms)



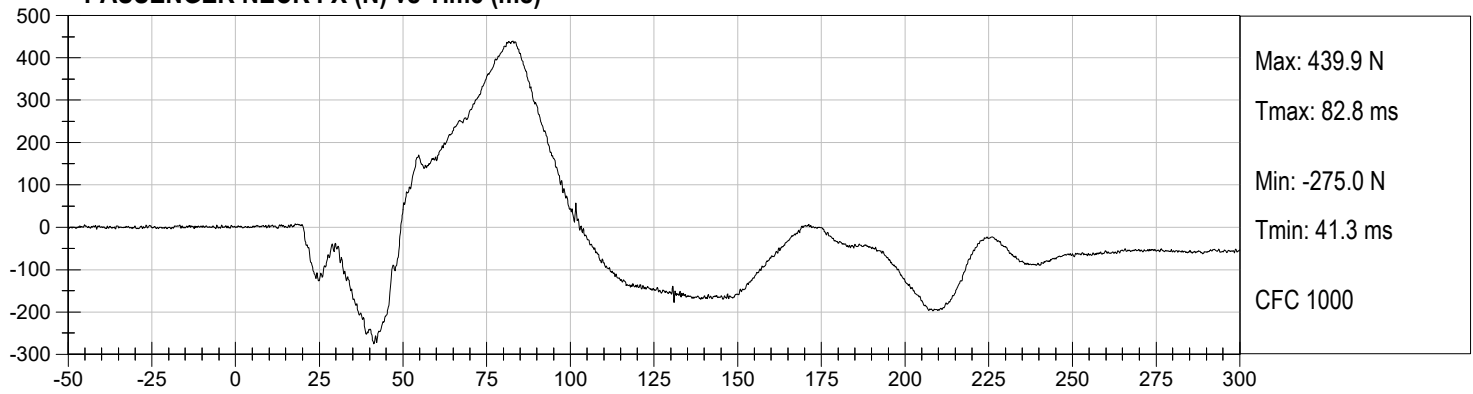
PASSENGER CHEST Z (g) vs Time (ms)



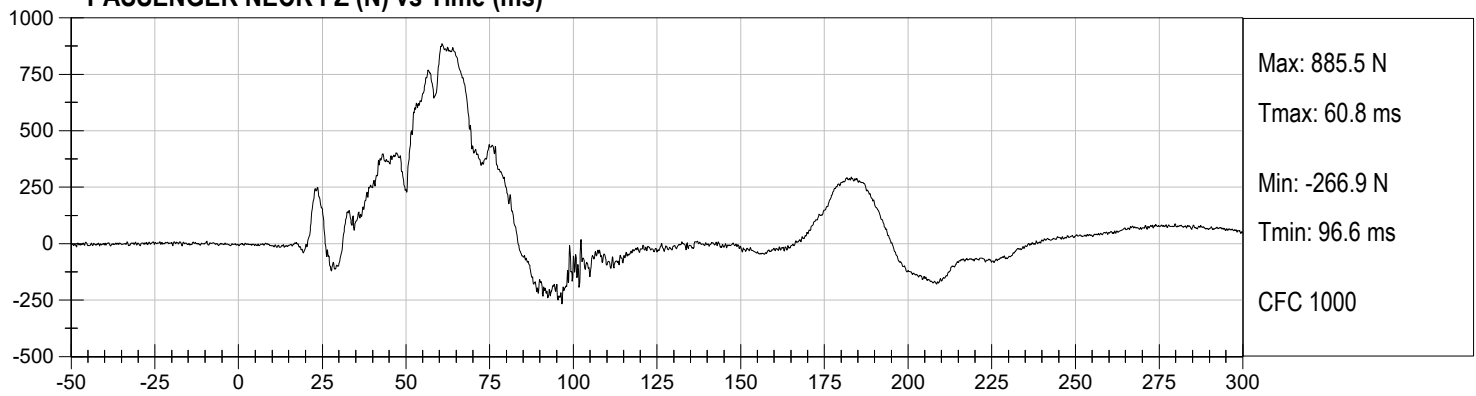
PASSENGER CHEST Resultant (g) vs Time (ms)



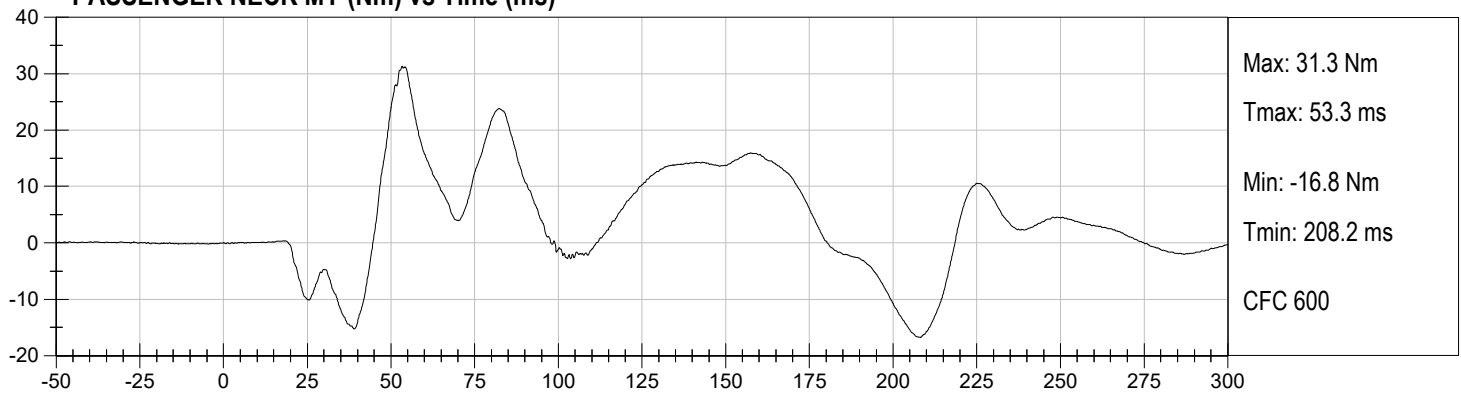
PASSENGER NECK FX (N) vs Time (ms)



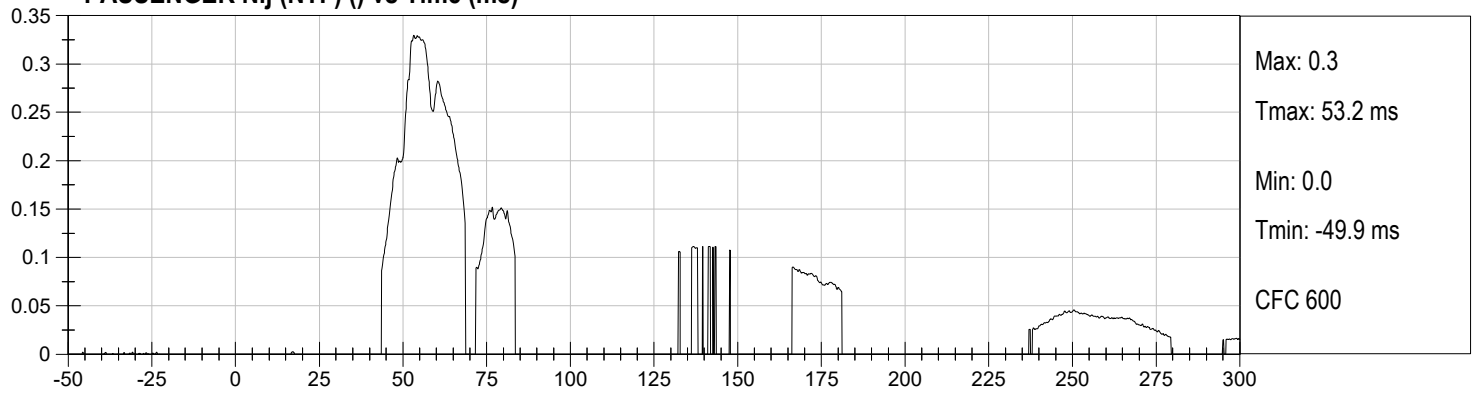
PASSENGER NECK FZ (N) vs Time (ms)



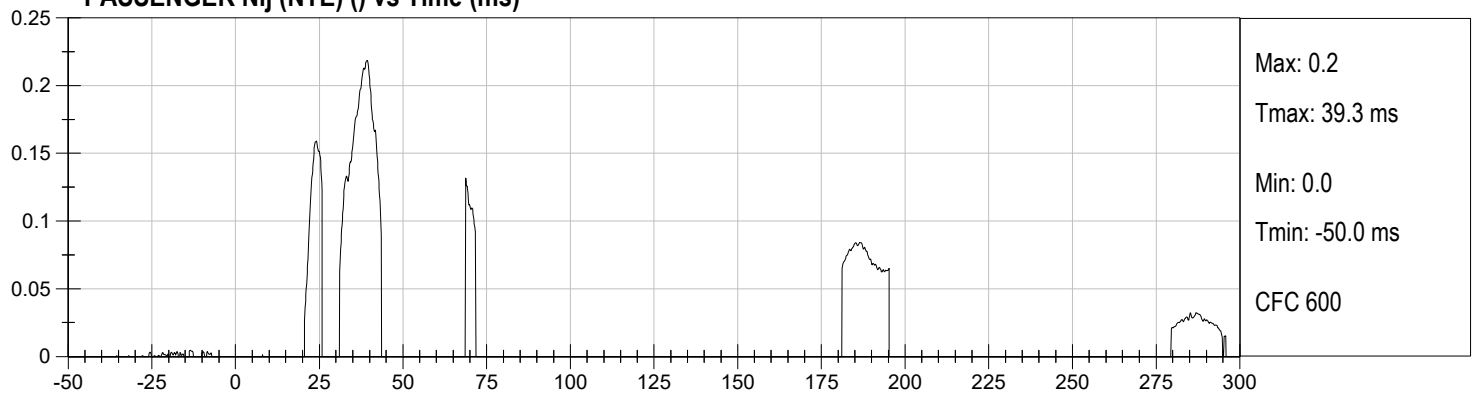
PASSENGER NECK MY (Nm) vs Time (ms)



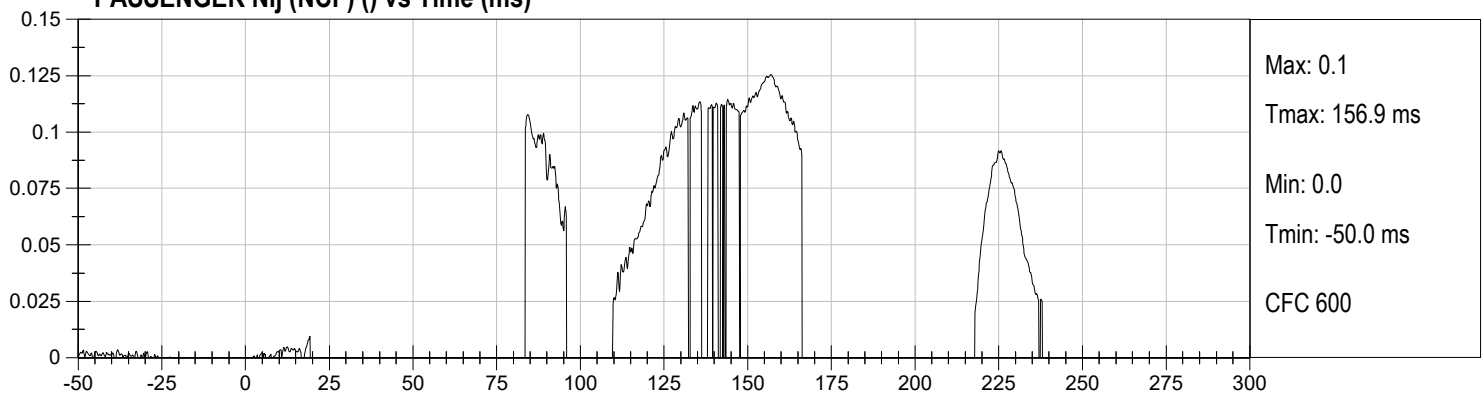
PASSENGER Nij (NTF) () vs Time (ms)



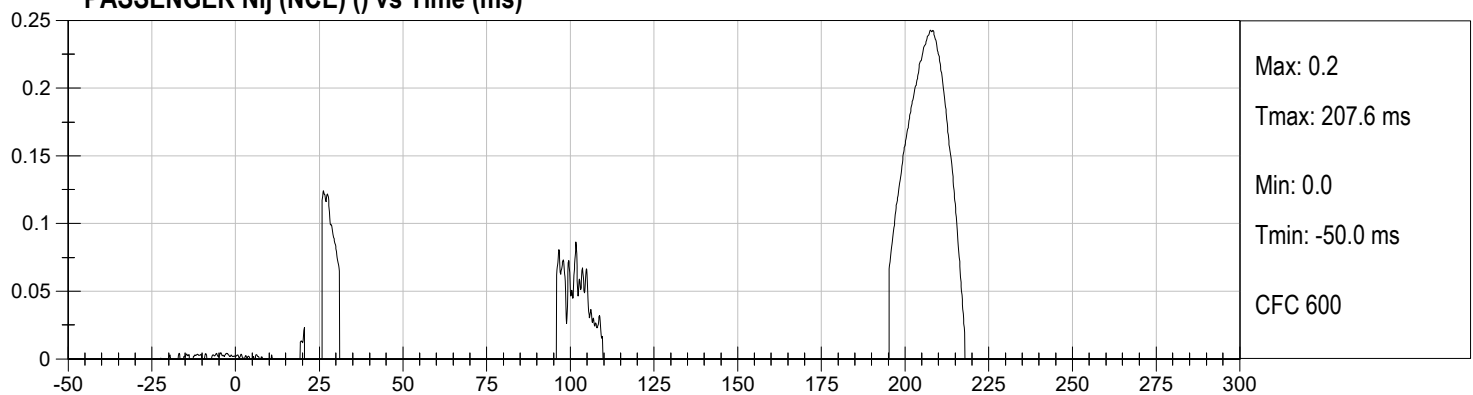
PASSENGER Nij (NTE) () vs Time (ms)



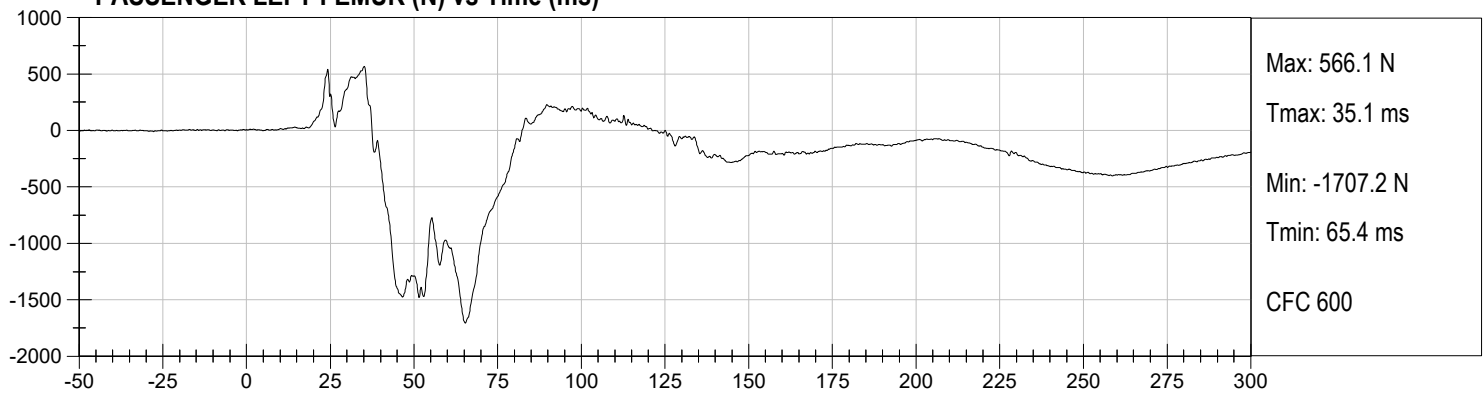
PASSENGER Nij (NCF) () vs Time (ms)



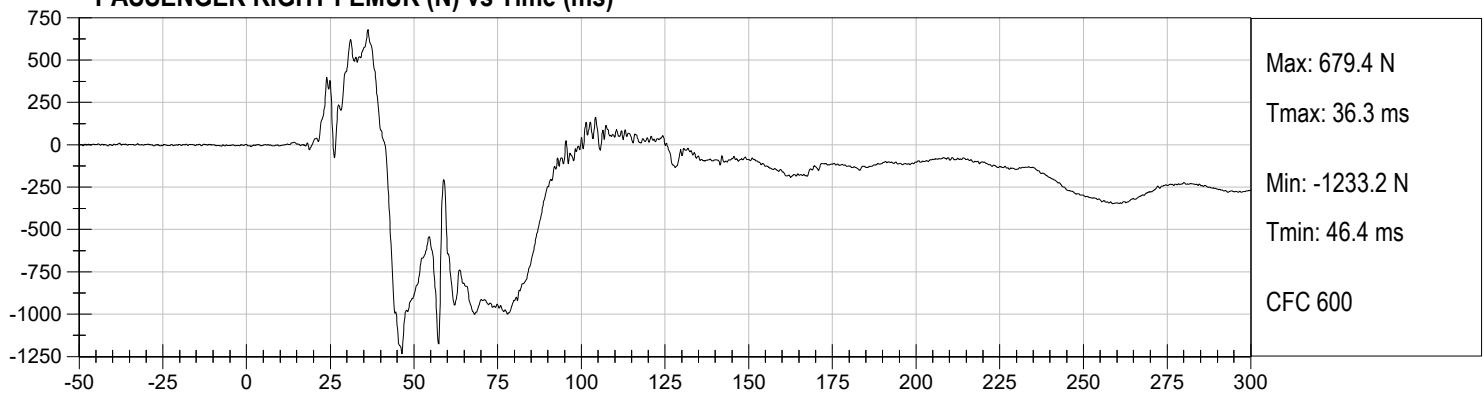
PASSENGER Nij (NCE) () vs Time (ms)



PASSENGER LEFT FEMUR (N) vs Time (ms)



PASSENGER RIGHT FEMUR (N) vs Time (ms)



APPENDIX C
DUMMY QUALIFICATION AND PERFORMANCE VERIFICATION

QUALIFICATION TEST RESULTS

PRE-TEST

HYBRID III 50TH PERCENTILE MALE - DRIVER ATD

**Hybrid III 50th, External Measurements
SN: 064**

HYBRID III, PART 572, SUBPART E EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (inches)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	34.6–35.0	34.71
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	19.9-20.5	20.31
C	H-POINT HEIGHT	Reference	3.3-3.5	3.38
D	H-POINT LOCATION FROM BACKLINE	Reference	5.3-5.5	5.40
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	3.3-3.7	3.46
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	5.5-6.1	6.09
G	BACK OF ELBOW TO WRIST PIVOT	back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	11.4-12.0	11.48
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	1.6-1.8	1.75
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	13.0-13.6	13.08
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	7.5-8.3	8.13
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	22.8-23.8	23.49
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	16.9-17.9	17.01
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	19.1-19.7	19.22
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	17.8-18.8	18.20

HYBRID III, SUBPART E EXTERIOR DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS		ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 16.9-17.1 in. above seat surface	8.4-9.0	8.43
P	FOOT LENGTH	Tip of toe to rear of heel	9.9-10.5	10.33
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	16.3-17.2	16.65
W	FOOT BREADTH	The widest part of the foot	3.6-4.2	3.94
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 16.9-17.1 in. above seat surface	38.2-39.4	39.25
Z	WAIST CIRCUMFERENCE	Measured 8.9-9.1 in. above seat surface	32.9-34.1	33.89
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	16.9-17.1	17.00
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	8.9-9.1	9.00

NOTE: THE H-POINT IS LOCATED 1.83 INCHES FORWARD AND 2.57 INCHES DOWN FROM THE CENTER OF THE PELVIS ANGLE REFERENCE HOLE.

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 50TH PERCENTILE MALE

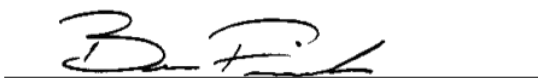
ATD Serial No: 064

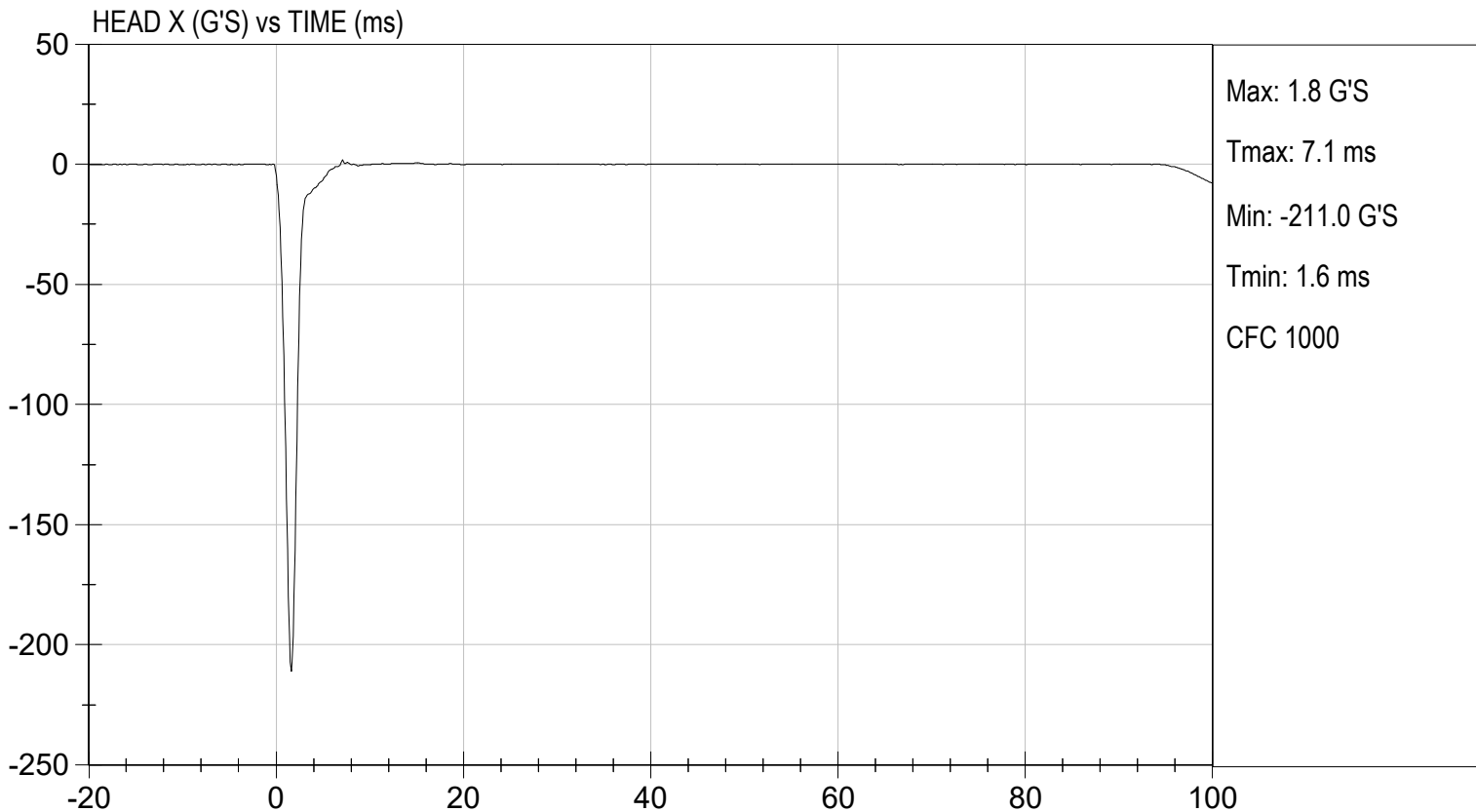
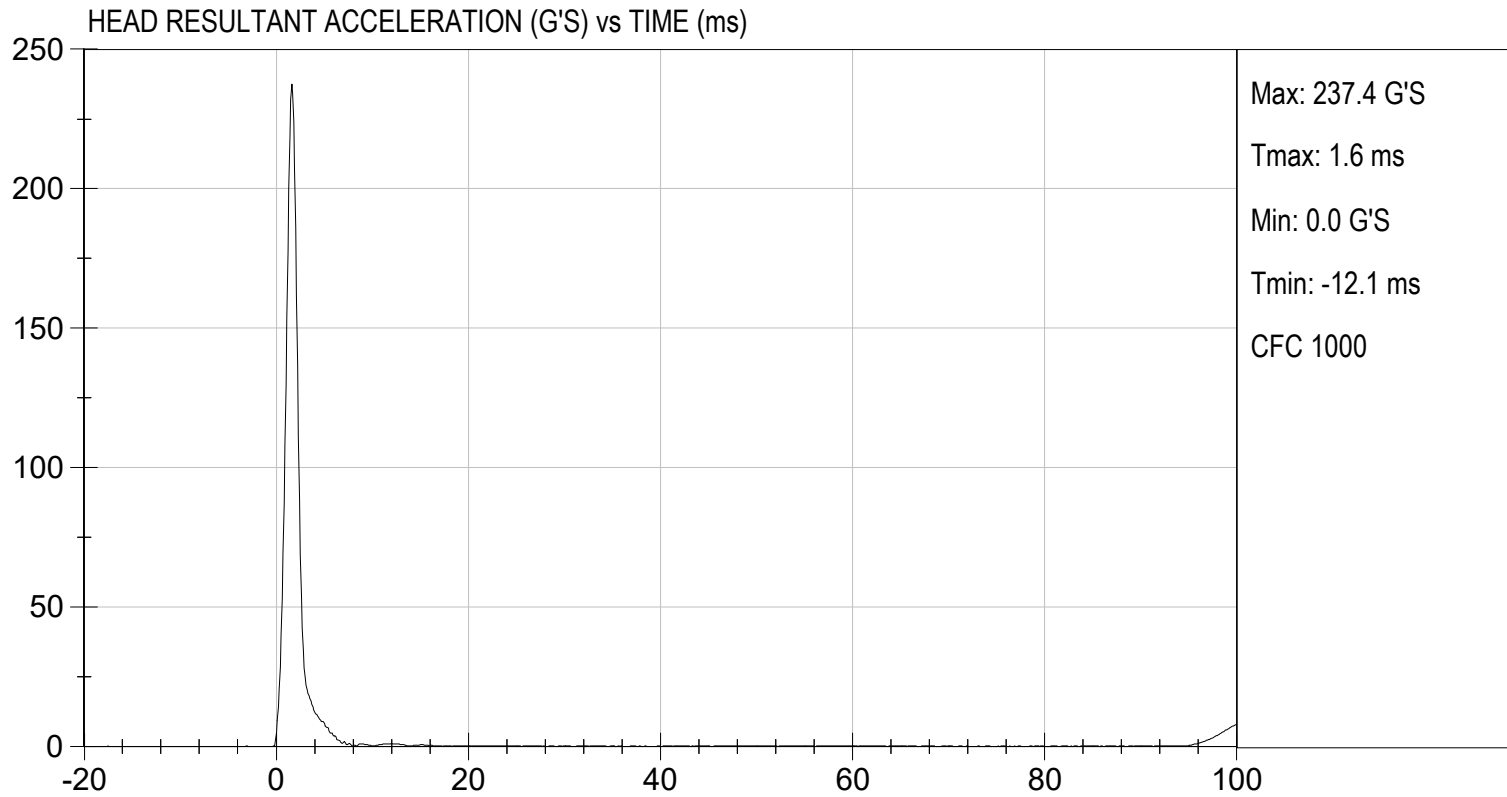
Test ID: D250131

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Peak Resultant Acceleration	G's	225 to 275	237	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-6.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

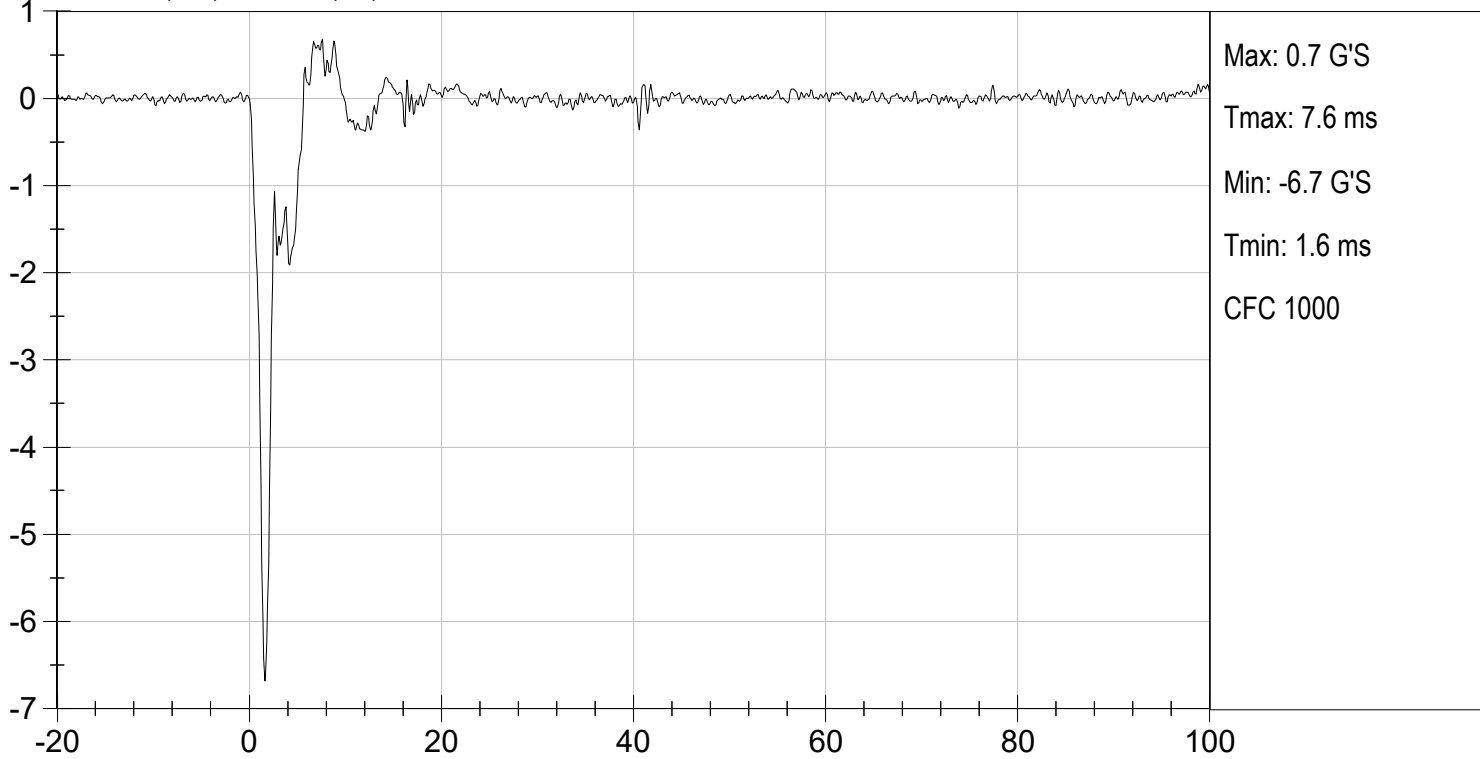

Laboratory Technician

01/14/2025
Test Date

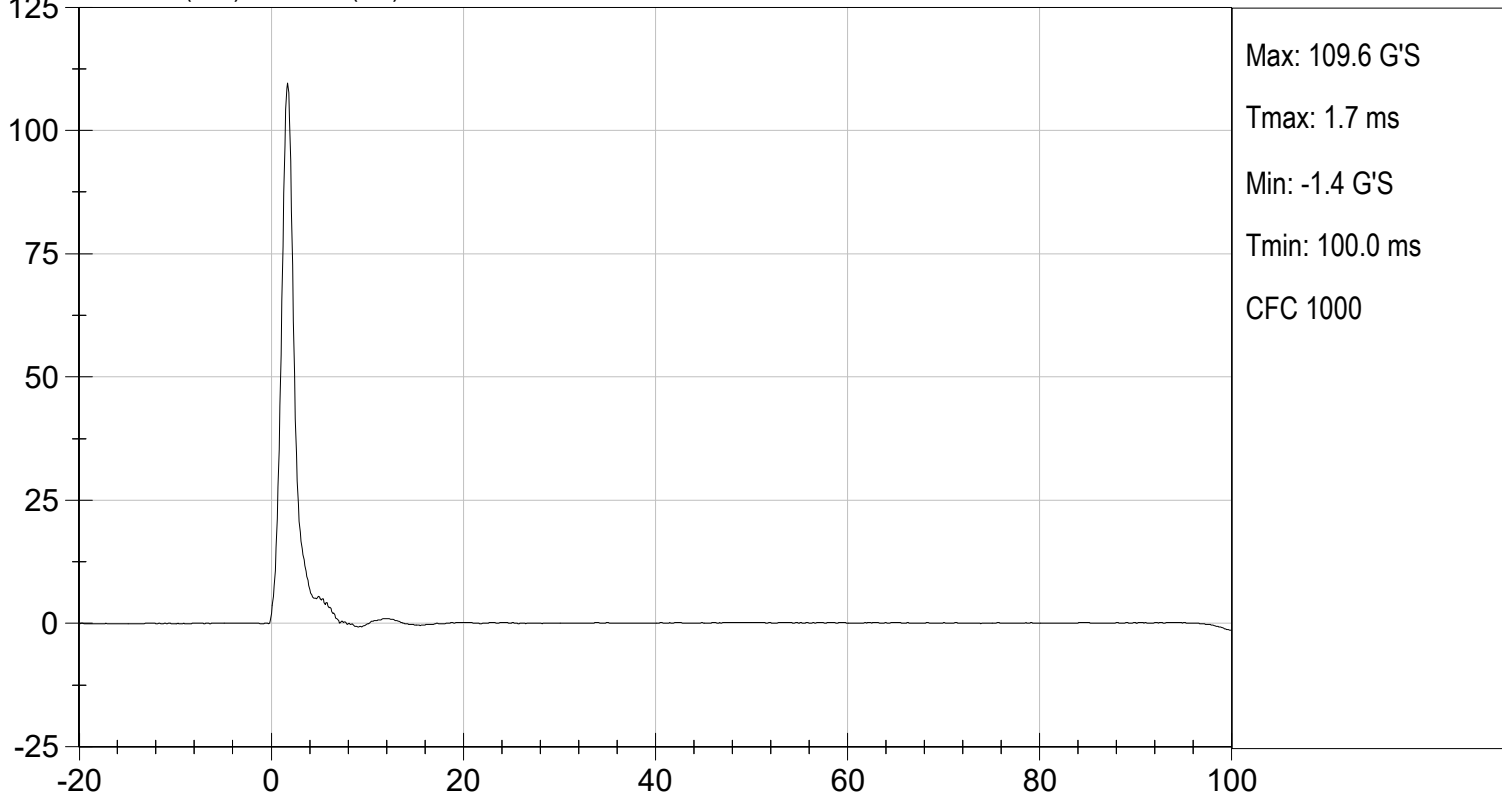

Approved By



HEAD Y (G'S) vs TIME (ms)



HEAD Z (G'S) vs TIME (ms)



MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

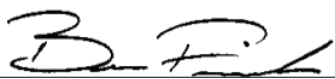
ATD Serial No: 064

Test I.D: D250132

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	24	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.82	Pass
	20 ms	G's	17.60 to 22.60	22.49	Pass
	30 ms	G's	12.50 to 18.50	18.22	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	18.1	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.4	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	74.2	Pass
	Time	ms	57.0 to 64.0	58.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	114.5	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	102.2	Pass
	Time	ms	47.0 to 58.0	49.2	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.1	Pass
Overall Test Results					Pass


Laboratory Technician

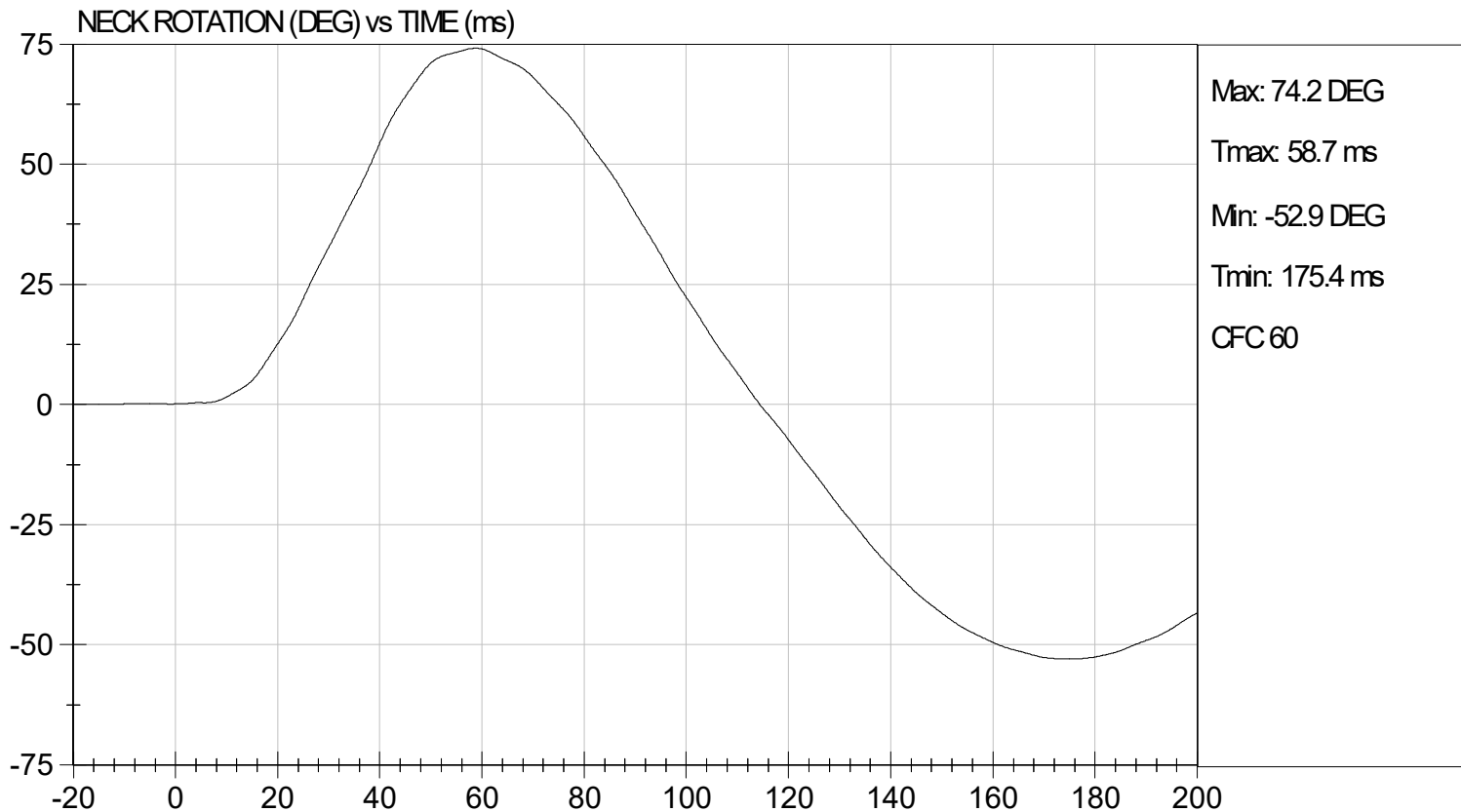
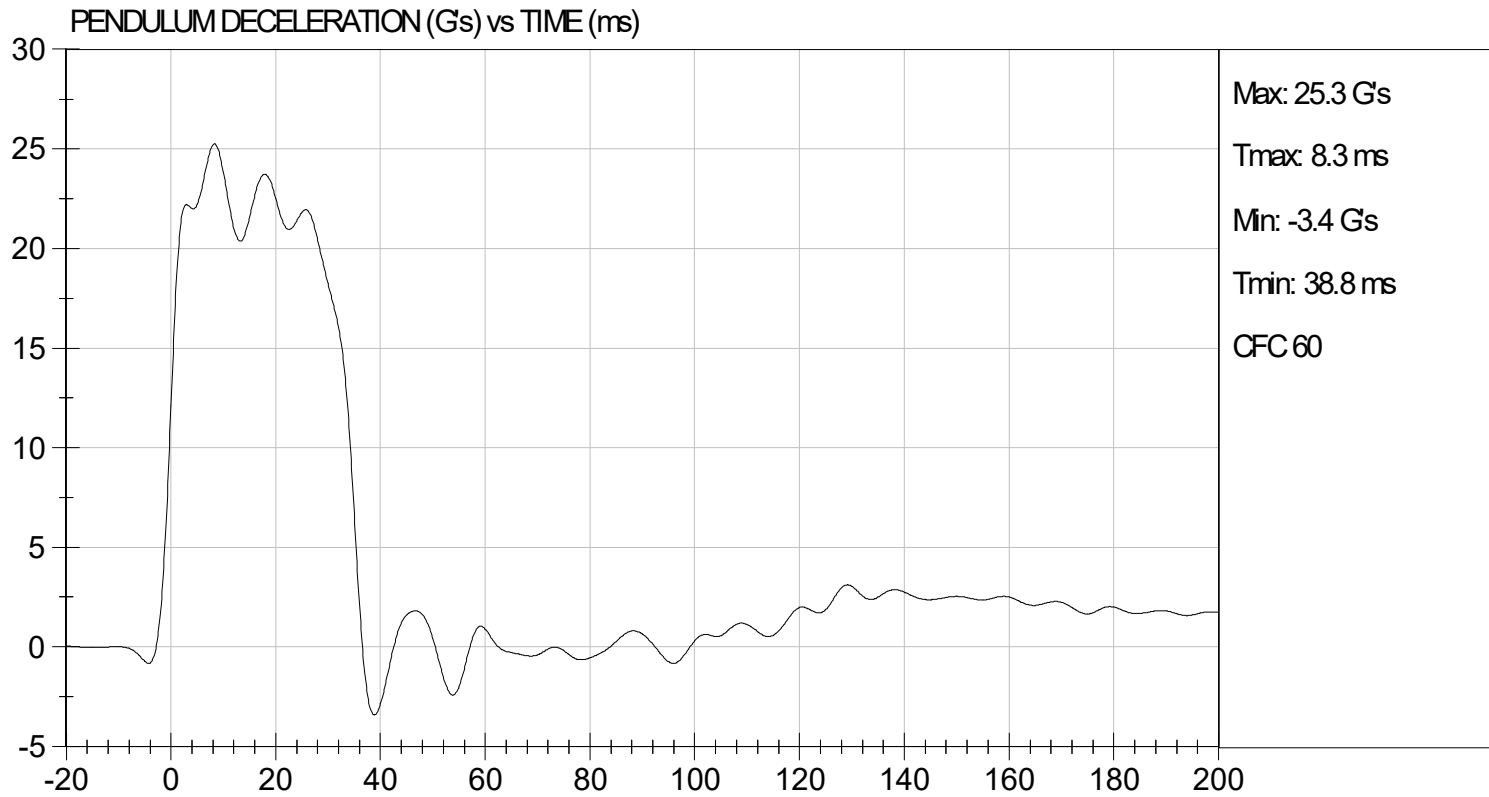
01/14/2025
Test Date


Approved By



TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

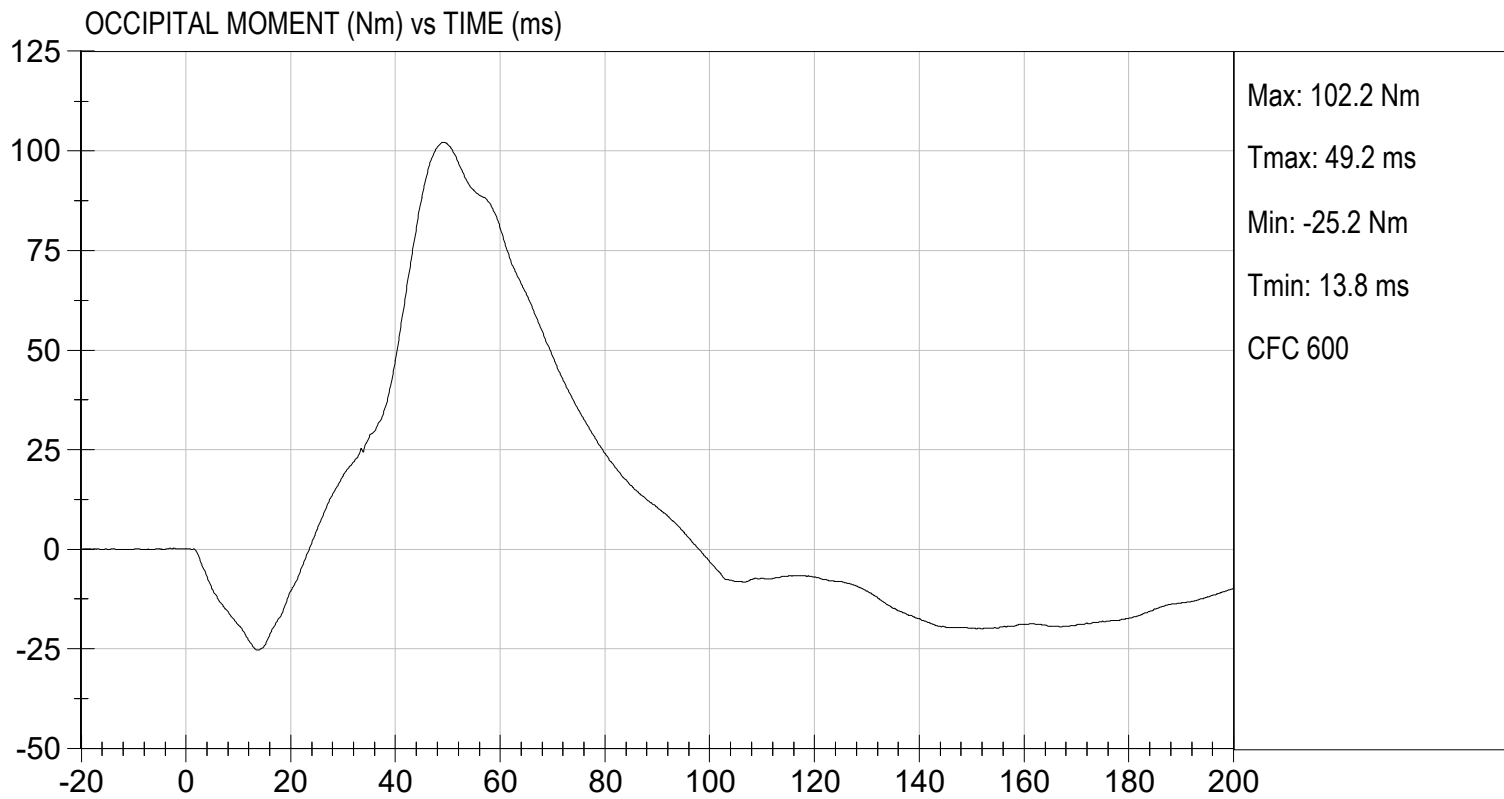
TEST DATE: 01/14/2025
TEST #: D250132





TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 01/14/2025
TEST #: D250132

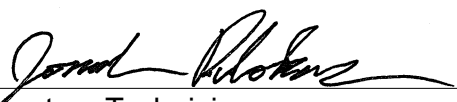


MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 064

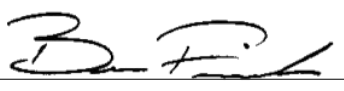
Test I.D: D250133

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	24	Pass
Pendulum Velocity		m/s	5.95 to 6.19	5.97	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	20.09	Pass
	20 ms	G's	14.00 to 19.00	17.50	Pass
	30 ms	G's	11.00 to 16.00	13.43	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.4	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	39.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	99.6	Pass
	Time	ms	72.0 to 82.0	79.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	158.6	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-61.5	Pass
	Time	ms	65.0 to 79.0	72.7	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	145.2	Pass
Overall Test Results					Pass


Laboratory Technician

01/14/2025

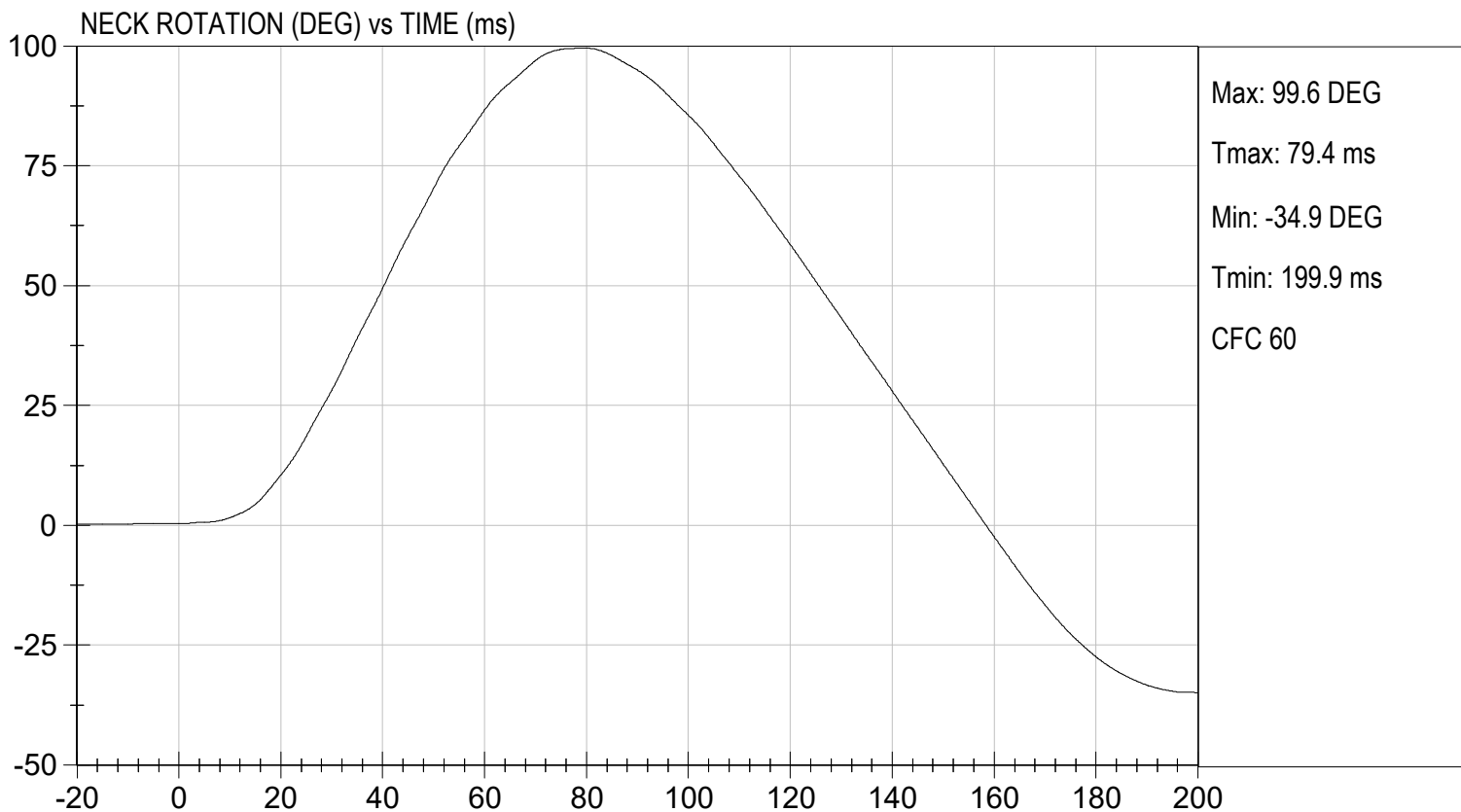
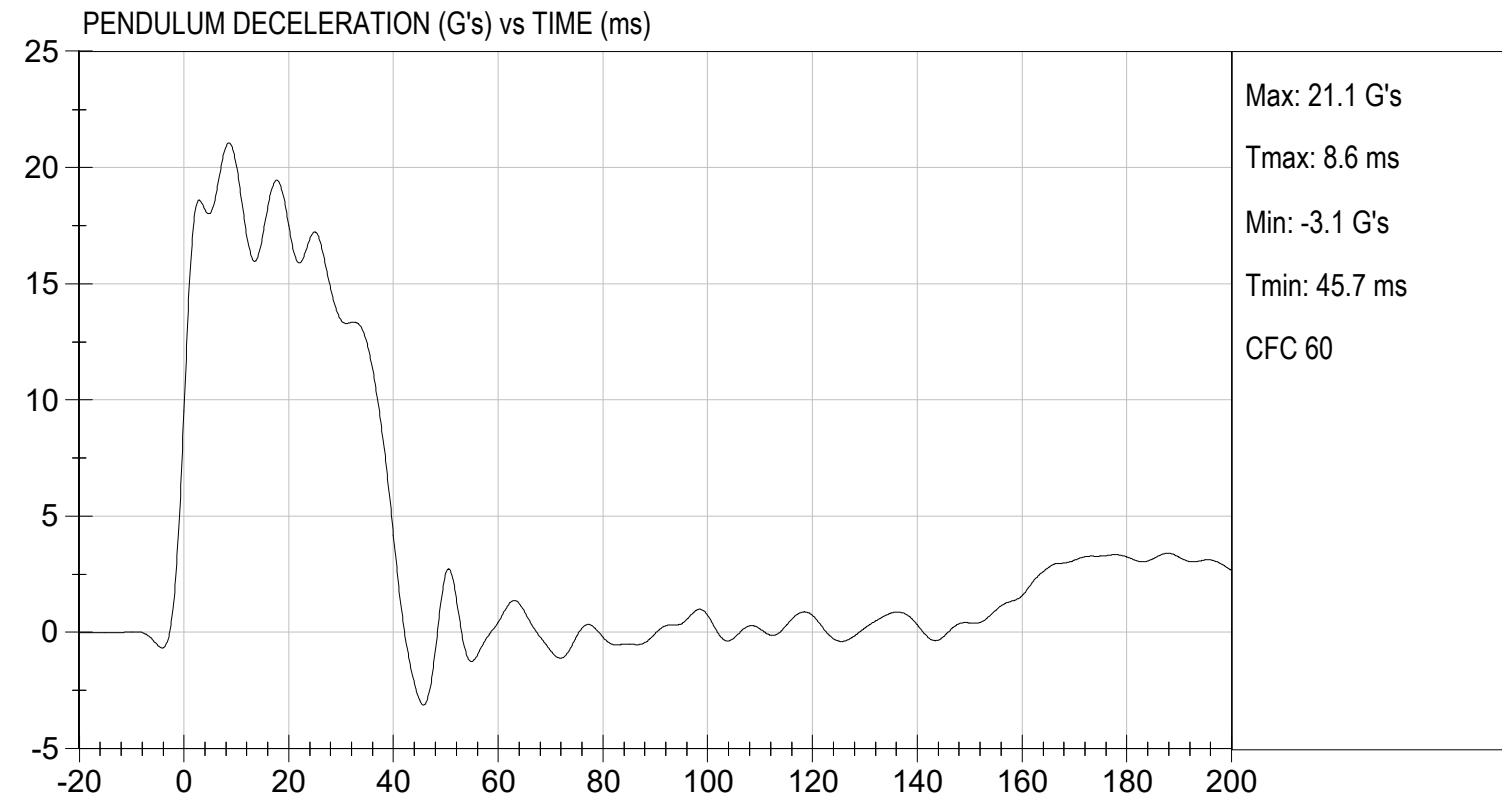
Test Date


Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 19.60 ft/s, 5.97 m/s

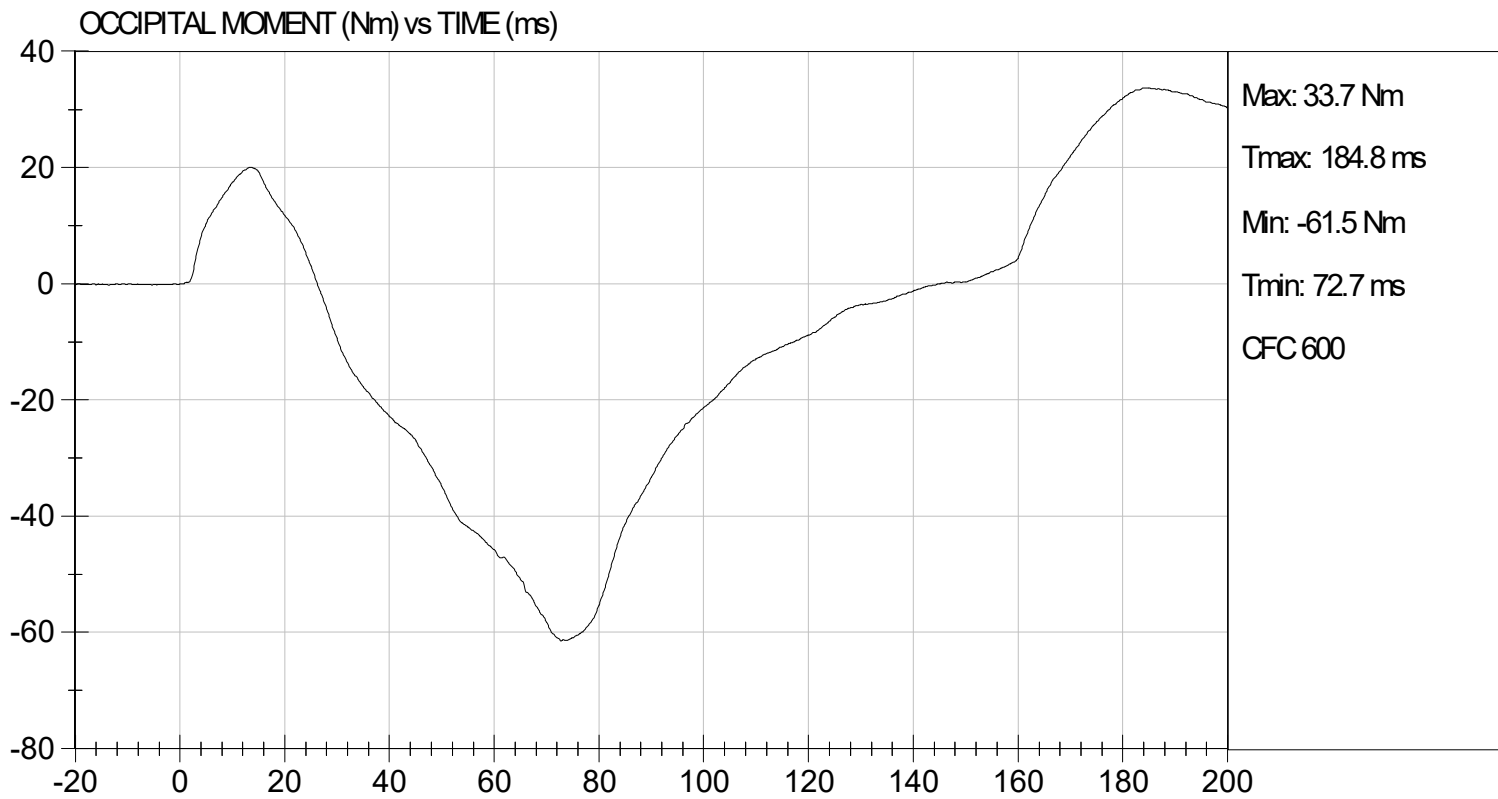
TEST DATE: 01/14/2025
TEST #: D250133





TEST DESC: NECK EXTENSION
VELOCITY: 19.60 ft/s, 5.97 m/s

TEST DATE: 01/14/2025
TEST #: D250133



MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 064

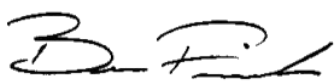
Test I.D: D250134

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,351	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.85	Pass
Internal Hysteresis	%	69 to 85	72	Pass
			Overall Test Results	Pass


Laboratory Technician

01/14/2025

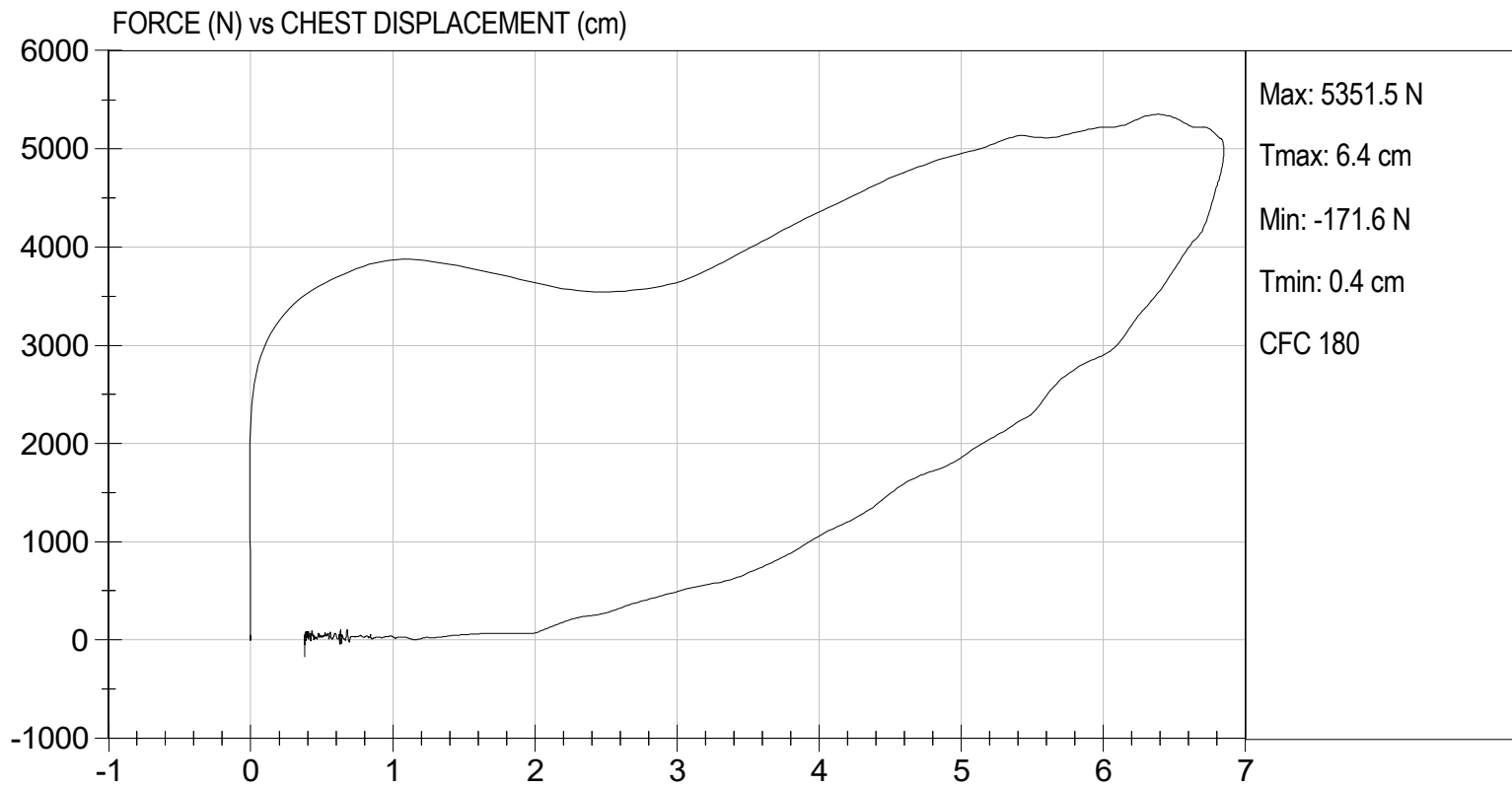
Test Date


Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 01/14/2025
TEST #: D250134



MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 064

Test I.D: D250135

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	5,062	Pass
			Overall Test Results	Pass


Laboratory Technician

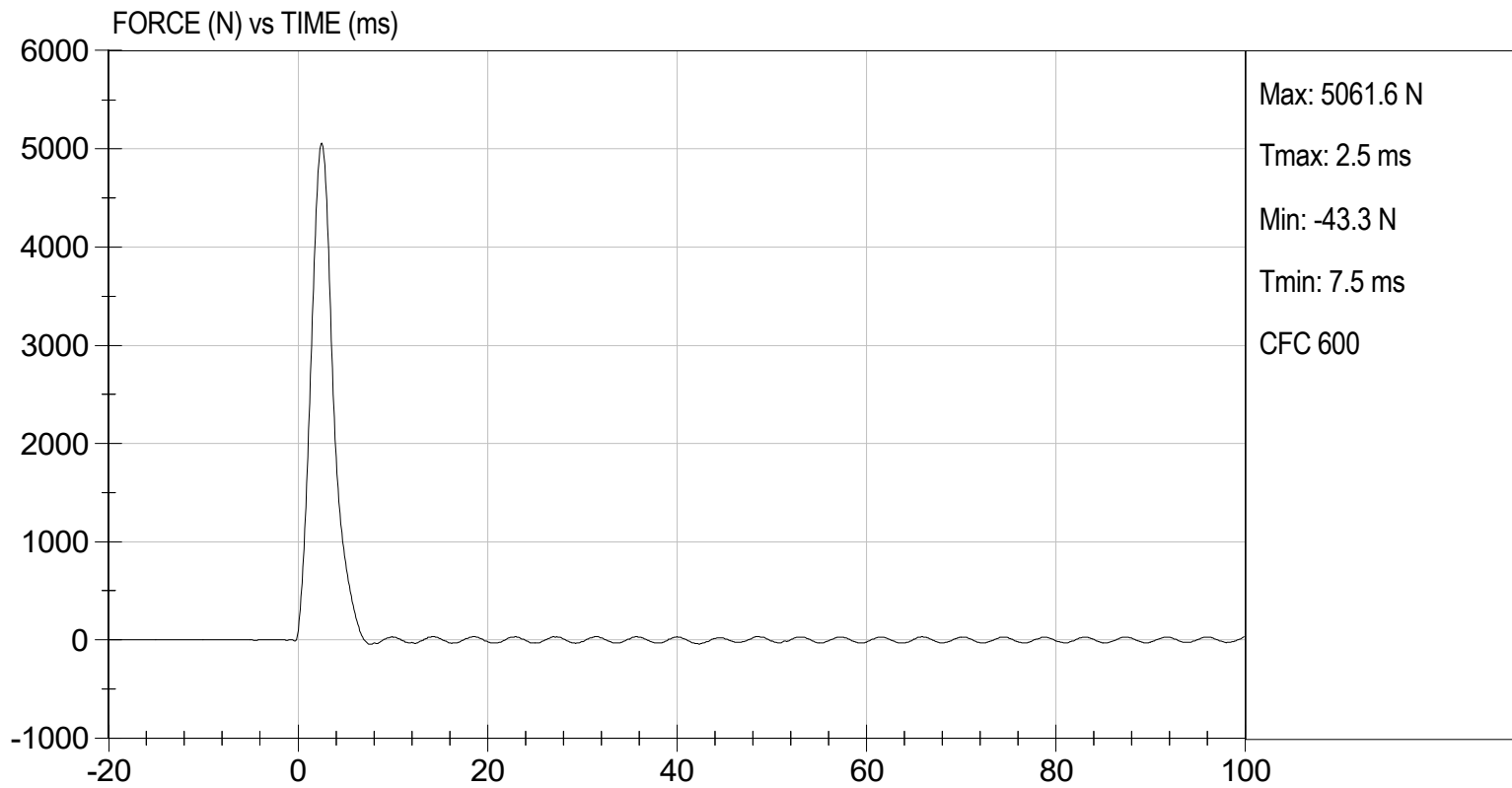
01/14/2025
Test Date


Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 6.89 ft/s, 2.10 m/s

TEST DATE: 01/14/2025
TEST #: D250135



MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 064

Test I.D: D250136

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	4,943	Pass
Overall Test Results				Pass


Laboratory Technician

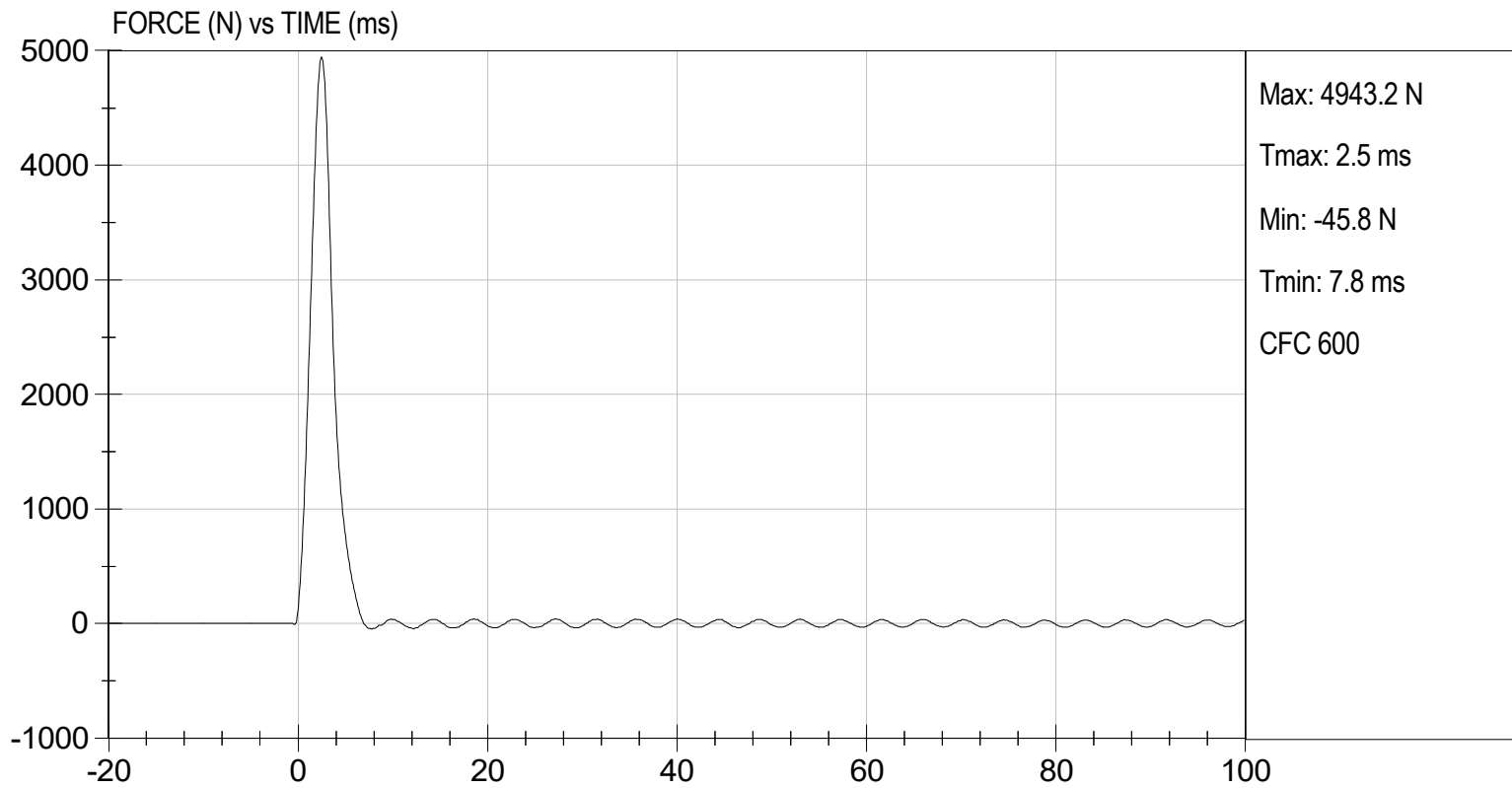
01/14/2025
Test Date


Approved By



TEST DESC: LEFT KNEE
VELOCITY: 6.89 ft/s, 2.10 m/s

TEST DATE: 01/14/2025
TEST #: D250136



MGA RESEARCH CORPORATION
HIP-FEMUR FLEXION TEST
HYBRID III 50TH PERCENTILE MALE

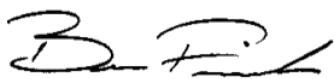
ATD Serial No: 064

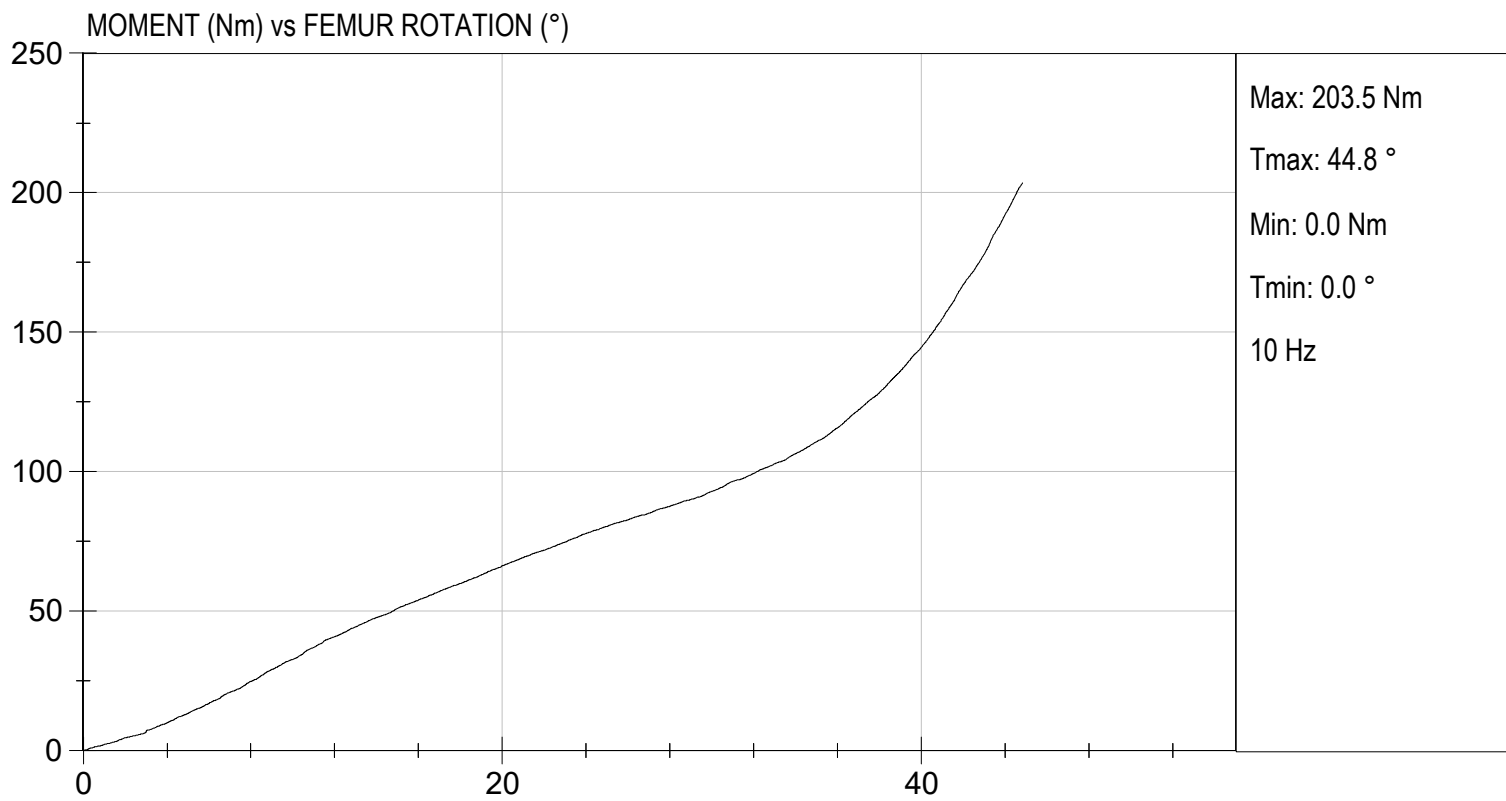
Test I.D: D250130

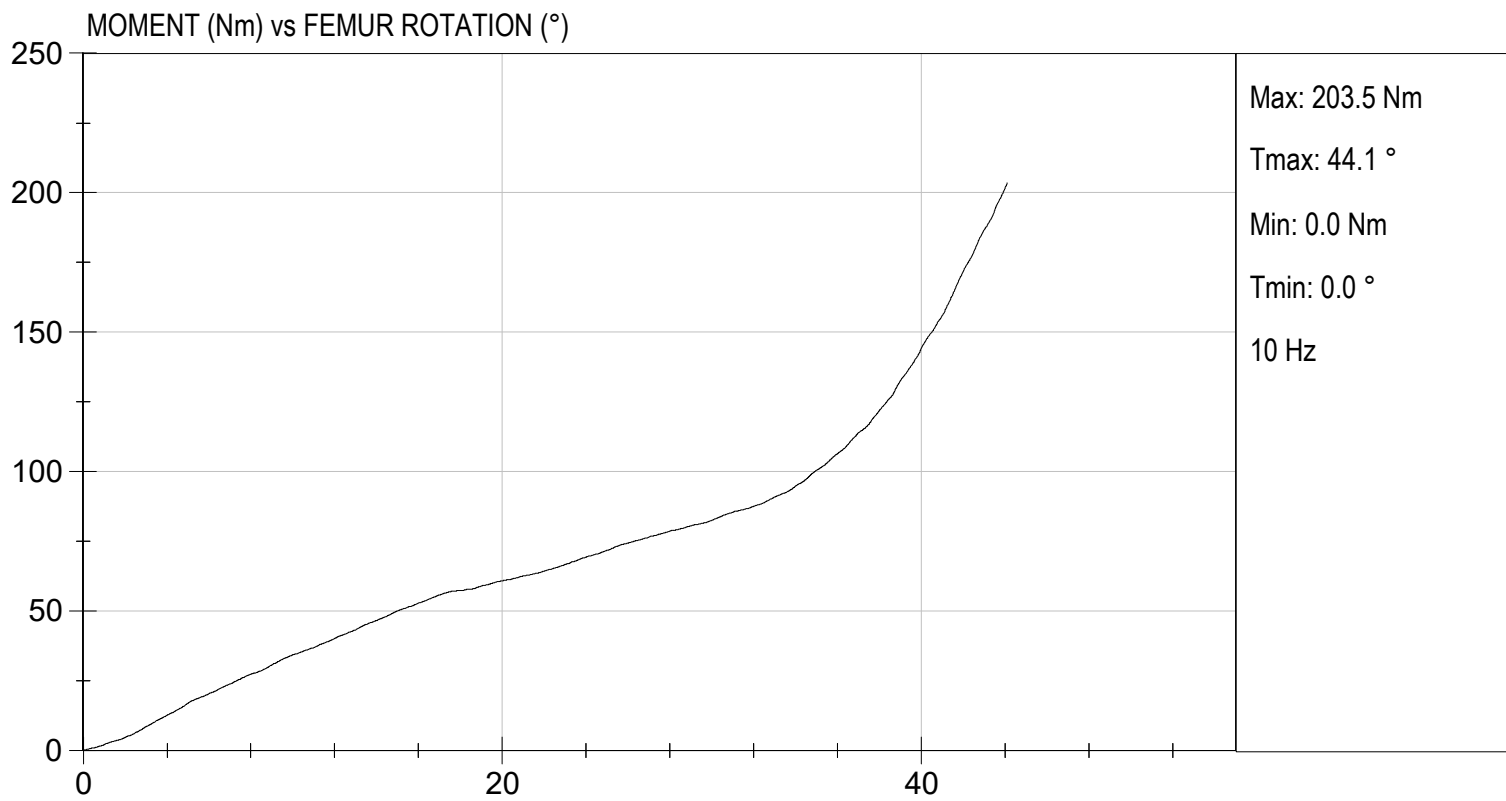
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	24	24	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.4	6.5	Pass
30 Degrees	Nm	94.9 Nm Max	82.5	93.0	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	44.1	44.8	Pass
Overall Test Results					Pass


 Laboratory Technician

01/14/2025
 Test Date


 Approved By





QUALIFICATION TEST RESULTS

POST-TEST

HYBRID III 50TH PERCENTILE MALE - DRIVER ATD

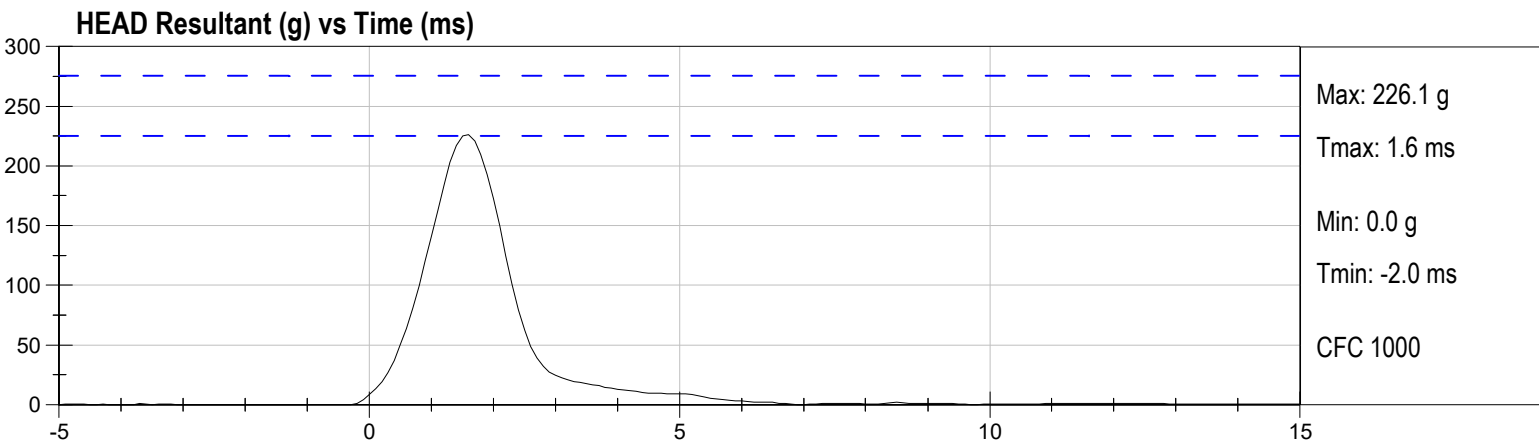
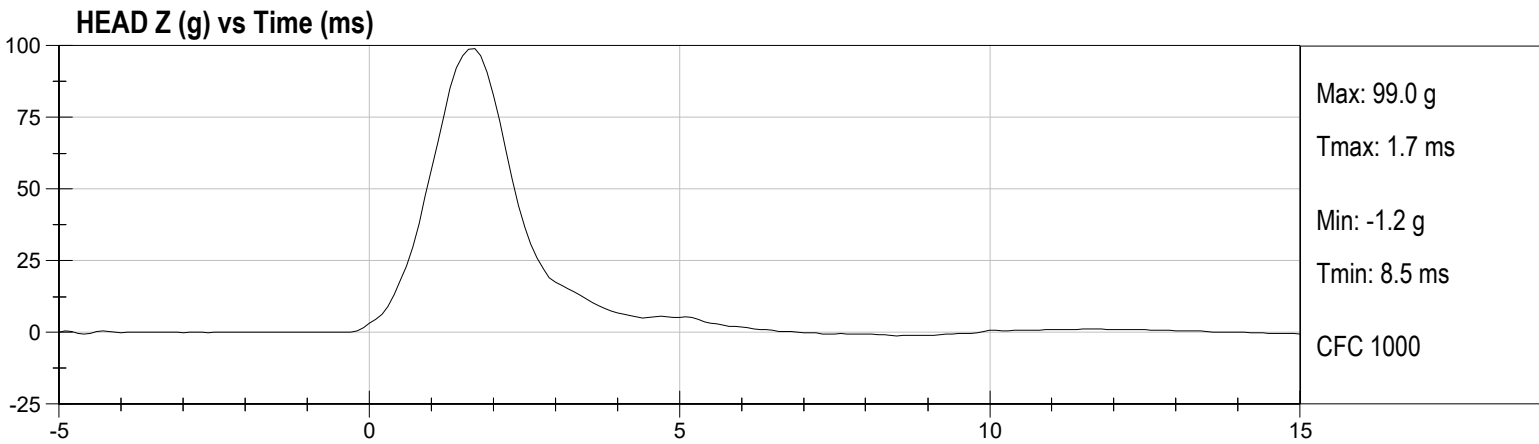
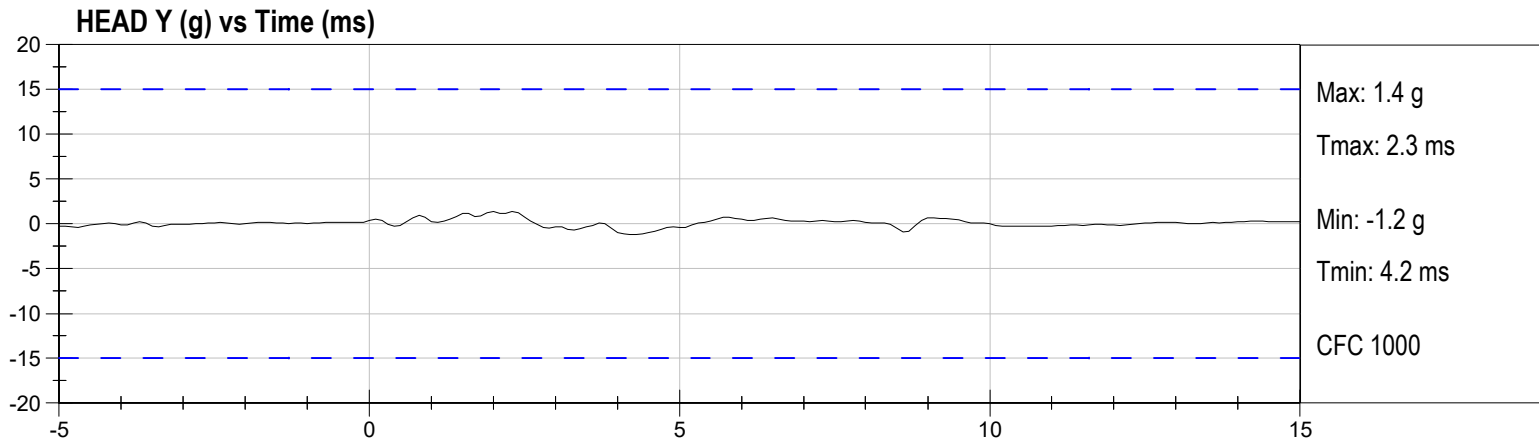
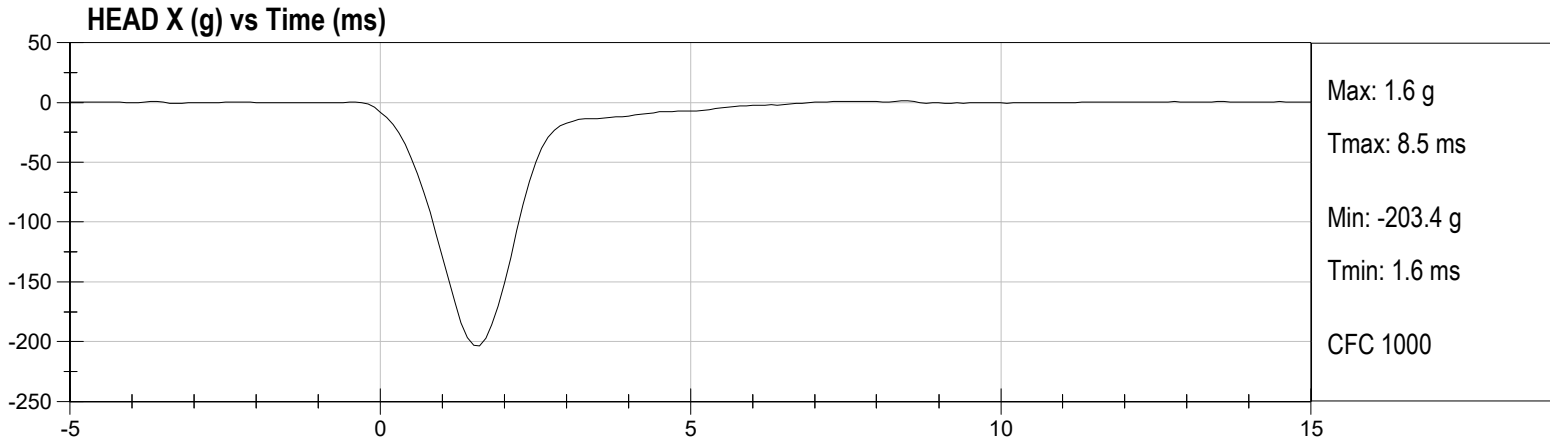


Head Drop Test
Hybrid III 50th Percentile Male
ATD Serial No: 064

Test Date: 02/18/2025
Test ID: D250511
Test Technician: Jonah Pulokas

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	21	Pass
Peak Resultant Acceleration	g	225 to 275	226	Pass
Peak Lateral Acceleration	g	-15.0 to 15.0	1.4	Pass
Unimodal	%	within 10% of peak	4	Pass

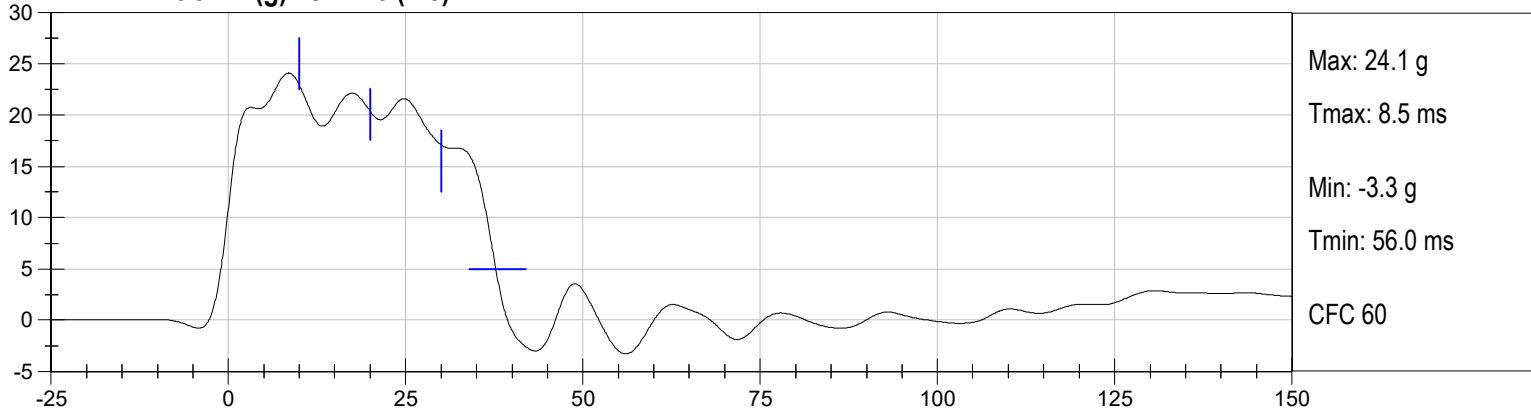
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
HEAD X	Endevco	T30974	11/25/2024	5/27/2025
HEAD Y	Endevco	T30975	11/25/2024	5/27/2025
HEAD Z	Endevco	T30976	11/25/2024	5/27/2025



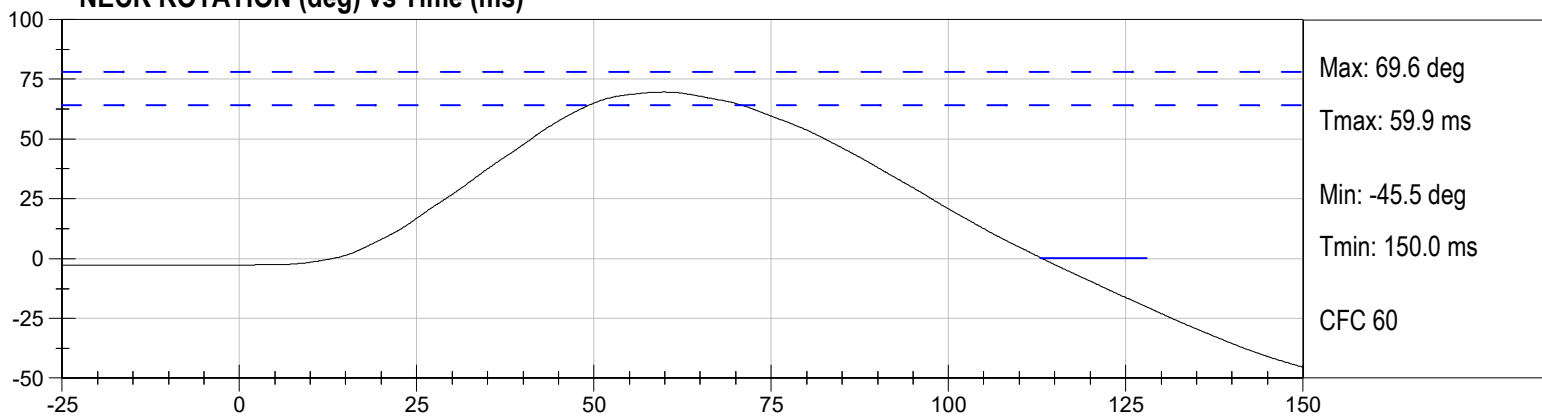
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Pendulum Velocity	m/s	6.89 to 7.13	7.10	Pass
Pendulum Deceleration At 10 ms After T0	g	22.50 to 27.50	23.07	Pass
Pendulum Deceleration At 20 ms After T0	g	17.60 to 22.60	20.45	Pass
Pendulum Deceleration At 30 ms After T0	g	12.50 to 18.50	17.14	Pass
Peak Pendulum Deceleration After 30 ms	g	<= 29.0	17.1	Pass
Deceleration Decay Time to Cross 5 g	ms	34.0 to 42.0	37.9	Pass
Maximum "D" Plane Rotation	deg	64.0 to 78.0	69.6	Pass
Time of Maximum "D" Plane Rotation	ms	57.0 to 64.0	59.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing	ms	113.0 to 128.0	113.4	Pass
Maximum Moment About Occipital Condyle	Nm	88.1 to 108.5	97.9	Pass
Time of Maximum Moment About Occipital Condyle	ms	47.0 to 58.0	50.2	Pass
Positive Moment Decay Time To Zero Crossing	ms	97.0 to 107.0	97.1	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
PEND. ACCEL.	Endevco	AH5P1	01/13/2025	7/15/2025
NECK FORCE X	Denton	NG2022FX	05/24/2024	5/24/2025
NECK MOMENT Y	Denton	NG2022MY	05/24/2024	5/24/2025
PEND. POT	Servo	4707	08/21/2024	2/20/2025
HEAD POT	Servo	7297	08/21/2024	2/20/2025

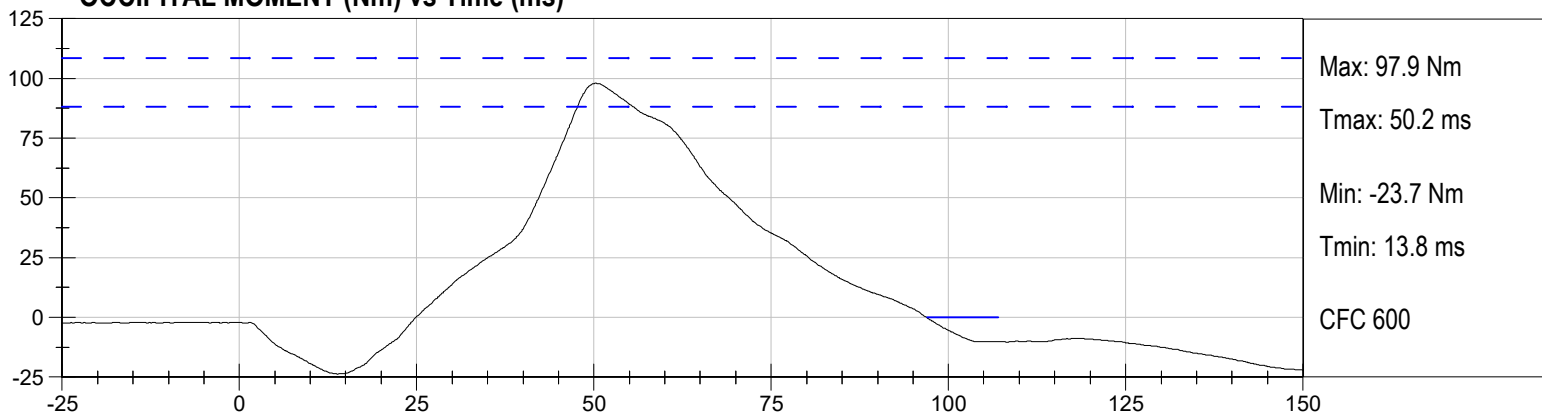
PEND. ACCEL. (g) vs Time (ms)



NECK ROTATION (deg) vs Time (ms)



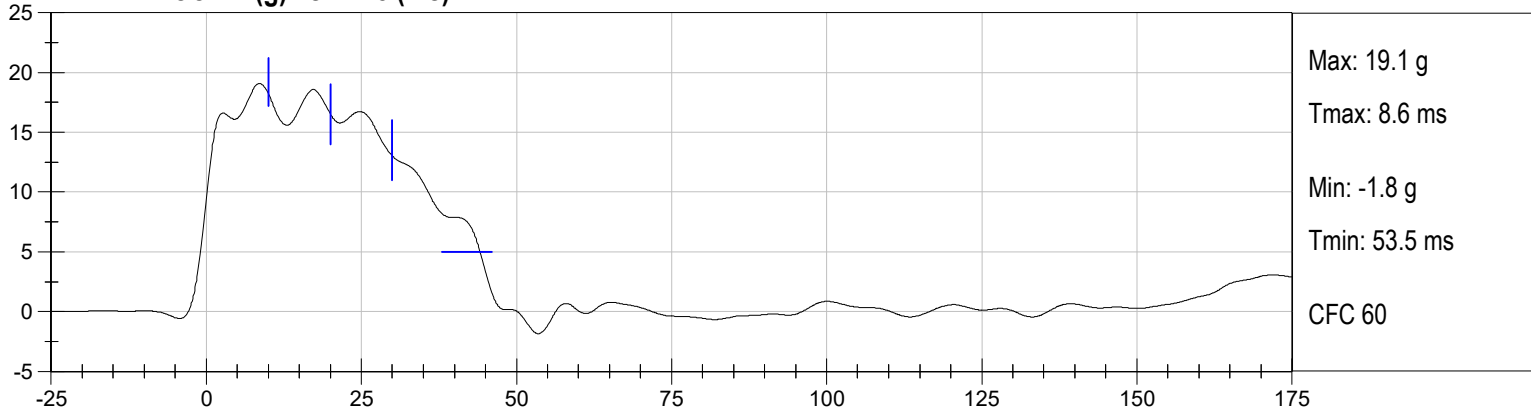
OCCIPITAL MOMENT (Nm) vs Time (ms)



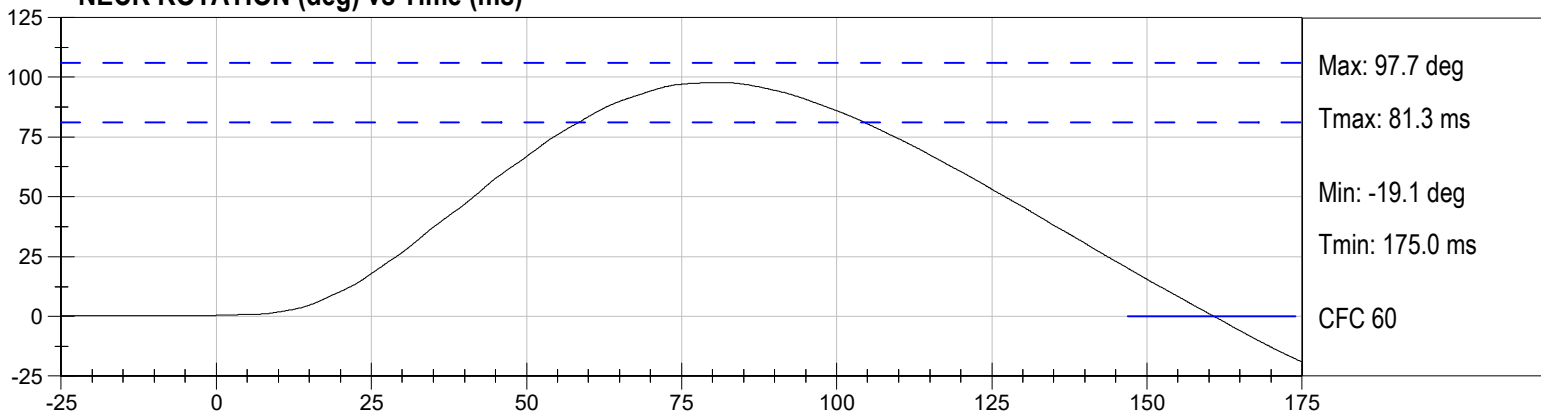
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Pendulum Velocity	m/s	5.95 to 6.19	5.98	Pass
Pendulum Deceleration At 10 ms After T0	g	17.20 to 21.20	18.31	Pass
Pendulum Deceleration At 20 ms After T0	g	14.00 to 19.00	16.61	Pass
Pendulum Deceleration At 30 ms After T0	g	11.00 to 16.00	13.06	Pass
Peak Pendulum Deceleration After 30 ms	g	<= 22.0	13.0	Pass
Deceleration Decay Time to Cross 5 G's	ms	38.0 to 46.0	44.3	Pass
Maximum "D" Plane Rotation	deg	81.0 to 106.0	97.7	Pass
Time of Maximum "D" Plane Rotation	ms	72.0 to 82.0	81.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing	ms	147.0 to 174.0	161.0	Pass
Minimum Moment About Occipital Condyle	Nm	-79.9 to -52.9	-57.0	Pass
Time of Minimum Moment About Occipital Condyle	ms	65.0 to 79.0	75.3	Pass
Negative Moment Decay Time To Zero Crossing	ms	120.0 to 148.0	145.0	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
PEND. ACCEL.	Endevco	AH5P1	01/13/2025	7/15/2025
NECK FORCE X	Denton	NG2022FX	05/24/2024	5/24/2025
NECK MOMENT Y	Denton	NG2022MY	05/24/2024	5/24/2025
PEND. POT	Servo	4707	08/21/2024	2/20/2025
HEAD POT	Servo	7297	08/21/2024	2/20/2025

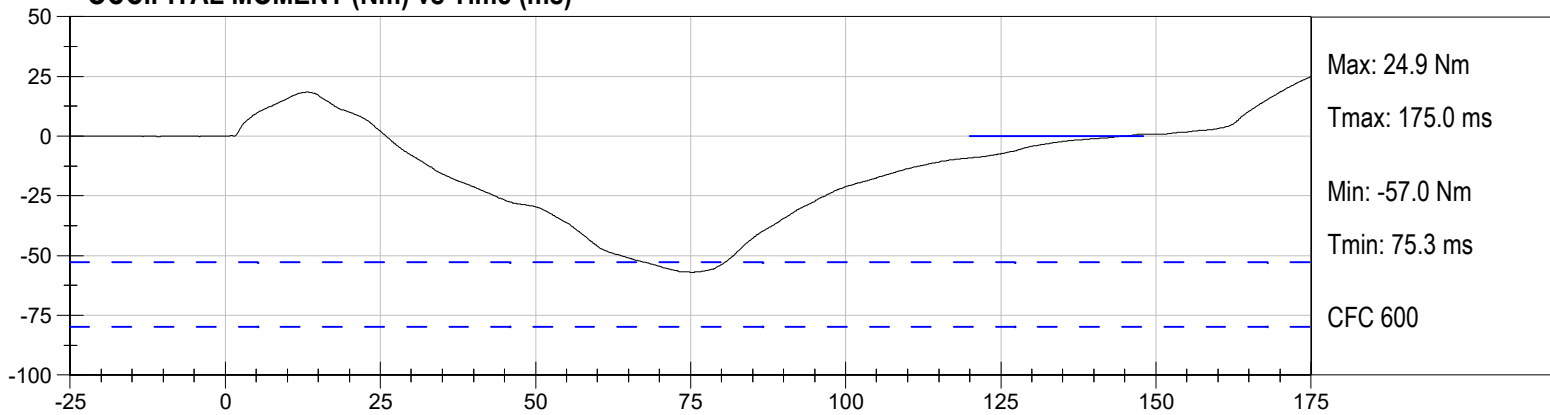
PEND. ACCEL. (g) vs Time (ms)



NECK ROTATION (deg) vs Time (ms)



OCCIPITAL MOMENT (Nm) vs Time (ms)





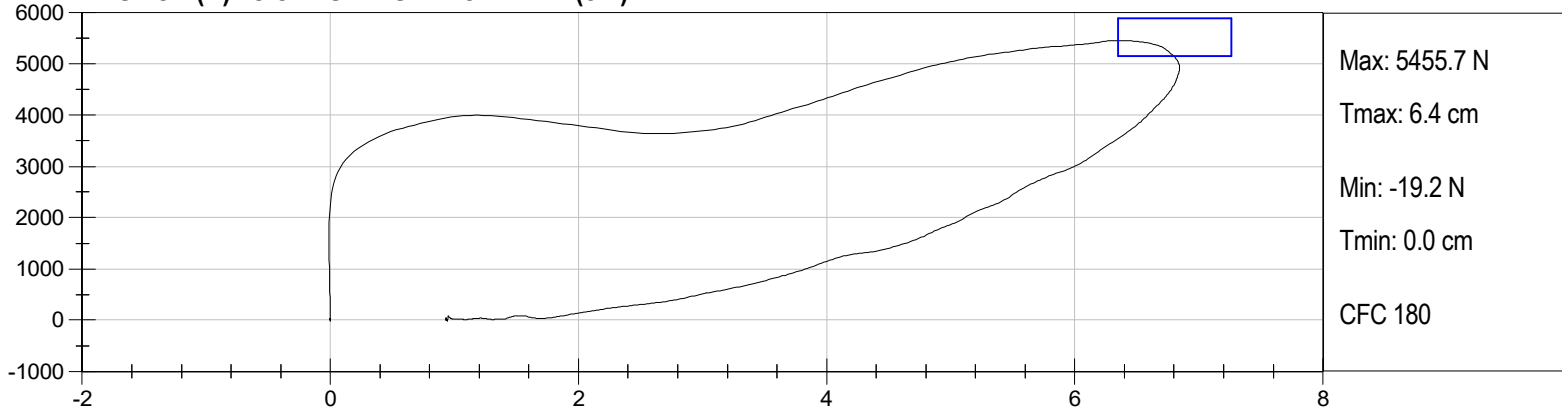
Thorax Impact Test
Hybrid III 50th Percentile Male
ATD Serial No: 064

Test Date: 02/18/2025
Test ID: D250514
Test Technician: Jonah Pulokas

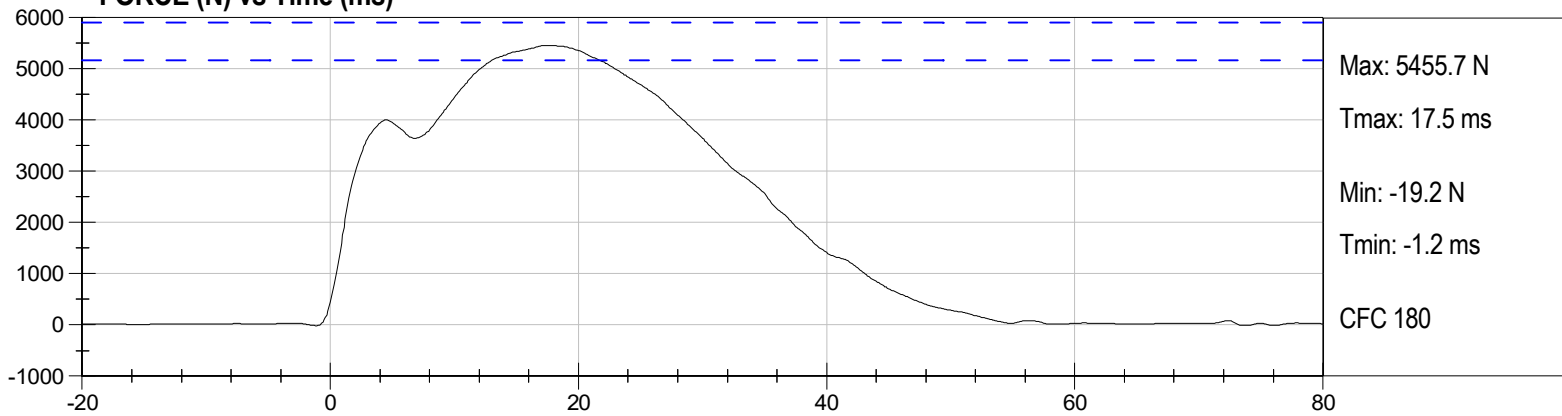
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5456	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.84	Pass
Internal Hysteresis	%	69 to 85	72	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
PROBE	Endevco	P79577	09/18/2024	3/20/2025
CHEST DISPLACEMENT	Humanetics	064	11/19/2024	5/21/2025

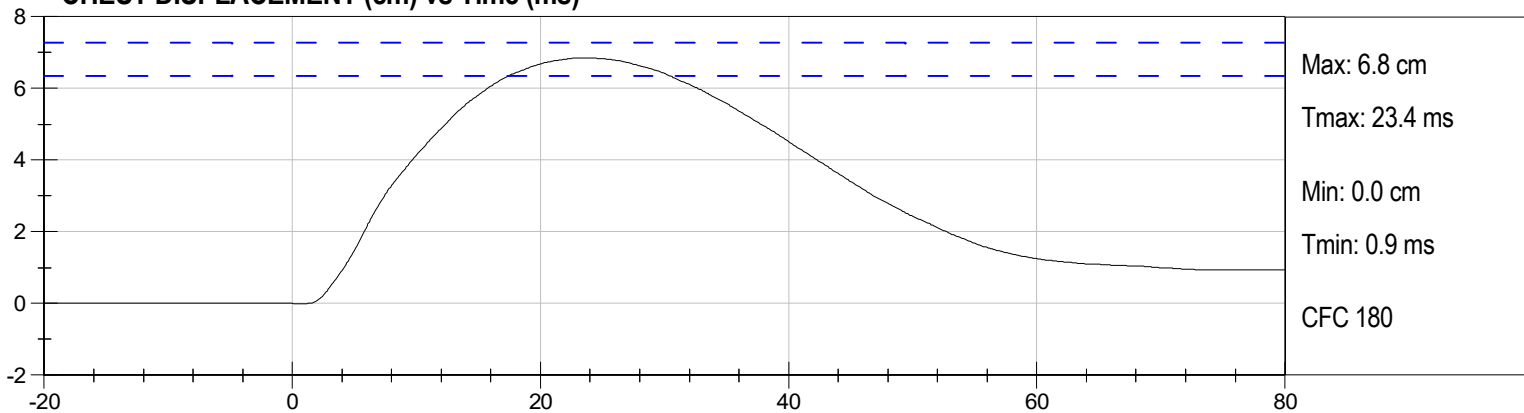
FORCE (N) vs CHEST DISPLACEMENT (cm)



FORCE (N) vs Time (ms)



CHEST DISPLACEMENT (cm) vs Time (ms)



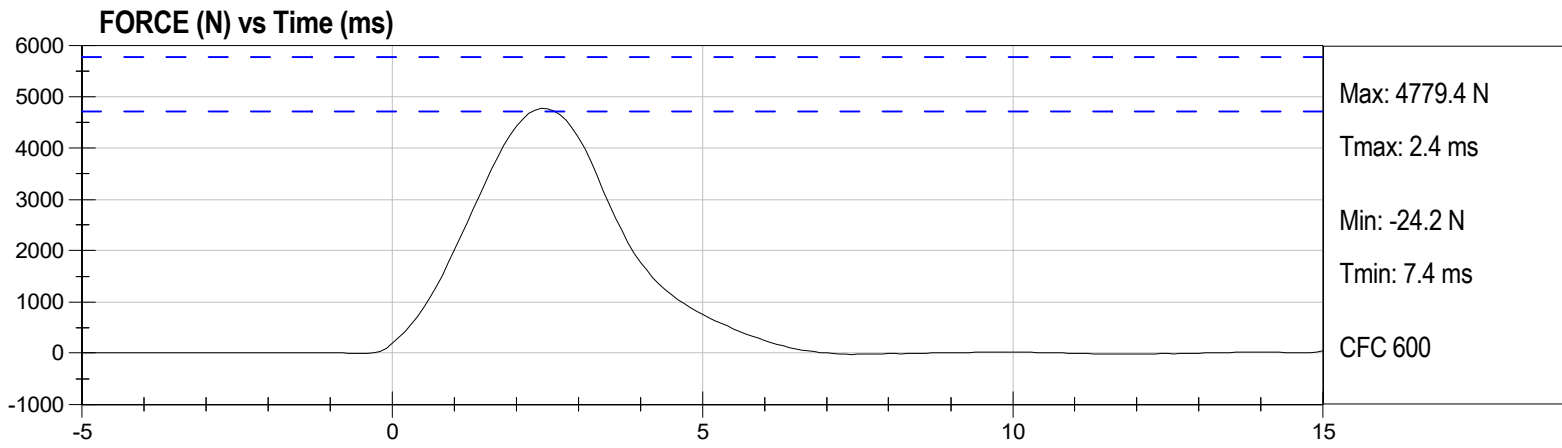


Right Knee Impact Test
Hybrid III 50th Percentile Male
ATD Serial No: 064

Test Date: 02/18/2025
Test ID: D250515
Test Technician: Jonah Pulokas

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	4779	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
KNEE PROBE	Endevco	P82128	12/03/2024	6/4/2025



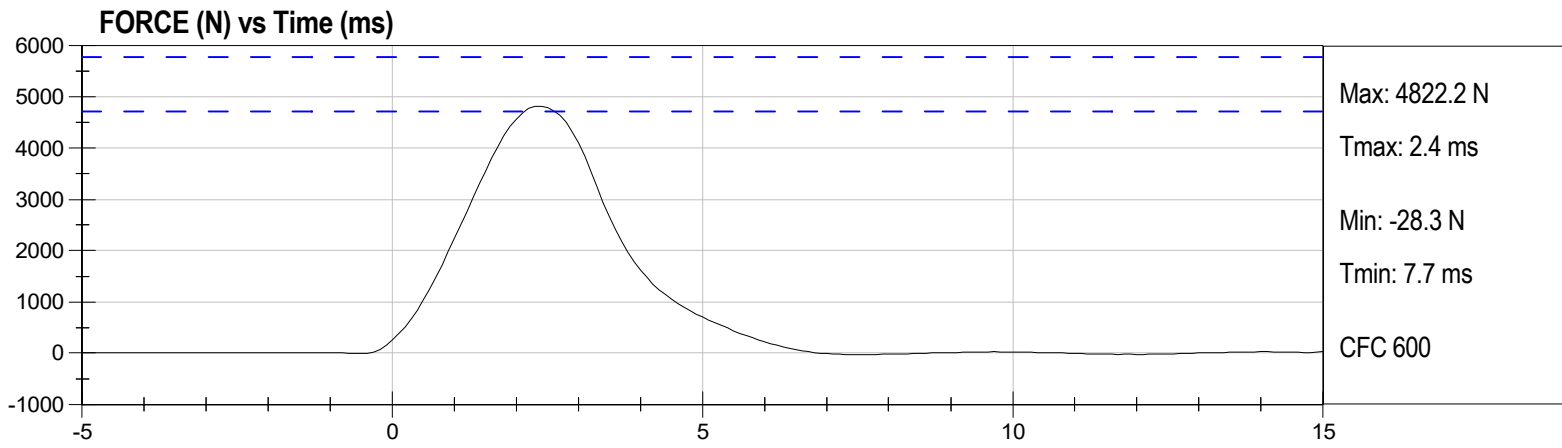


Left Knee Impact Test
Hybrid III 50th Percentile Male
ATD Serial No: 064

Test Date: 02/18/2025
Test ID: D250516
Test Technician: Jonah Pulokas

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	4822	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
KNEE PROBE	Endevco	P82128	12/03/2024	6/4/2025



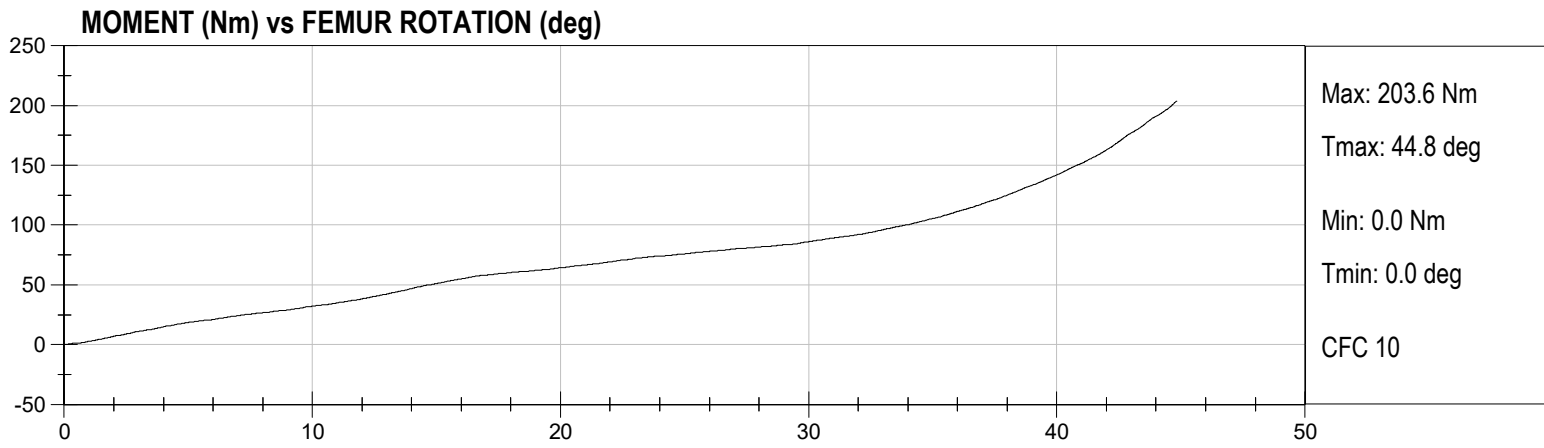


Right Hip-Femur Flexion Test
Hybrid III 50th Percentile Male
ATD Serial No: 064

Test Date: 02/18/2025
Test ID: D250519
Test Technician: Jonah Pulokas

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.5	Pass
Moment at 30 Degrees	Nm	<= 94.9	86.0	Pass
Rotation Angle at 203.4 Nm	deg	40.0 to 50.0	44.8	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
LOAD CELL	FTSS	DN7673MY	03/22/2024	3/22/2025
FRAME ANGLE	Servo	3966	09/20/2024	3/22/2025
FEMUR ANGLE	Servo	4714	09/20/2024	3/22/2025



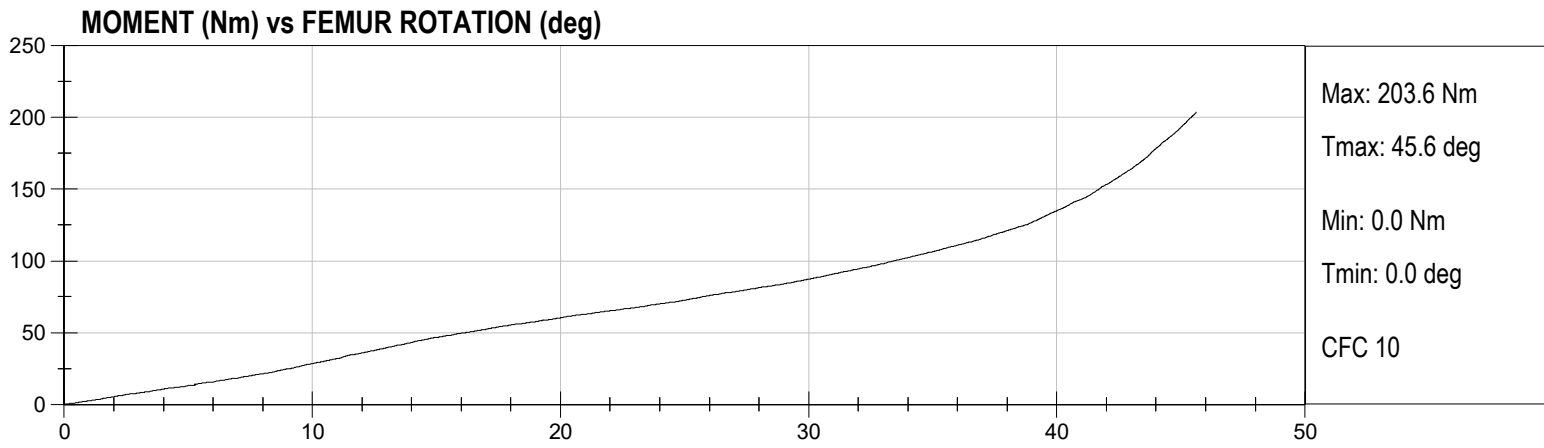


Left Hip-Femur Flexion Test
Hybrid III 50th Percentile Male
ATD Serial No: 064

Test Date: 02/18/2025
Test ID: D250510
Test Technician: Jonah Pulokas

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.6	Pass
Moment at 30 Degrees	Nm	<= 94.9	87.2	Pass
Rotation Angle at 203.4 Nm	deg	40.0 to 50.0	45.6	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
LOAD CELL	FTSS	DN7673MY	03/22/2024	3/22/2025
FRAME ANGLE	Servo	3966	09/20/2024	3/22/2025
FEMUR ANGLE	Servo	4714	09/20/2024	3/22/2025



QUALIFICATION TEST RESULTS

PRE-TEST

HYBRID III 5TH PERCENTILE FEMALE - PASSENGER ATD

Hybrid III, 5th External Measurements
SN: 142

HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	775.0
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	438.2
C	H-POINT HEIGHT	Reference	81.3-86.3	81.8
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	148.3
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	83.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	124.4
G	BACK OF ELBOW TO WRIST PIVOT	back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	245.2
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	43.4
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	281.1
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	197.2
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	537.2
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376	358.8
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	403.1
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414-439.4	435.2

HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	181.2
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	227.3
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	475.0
S	HEAD BREADTH	The widest part of the head	137.1-147.3	138.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188	181.0
U	HIP BREADTH	The widest part of the hip	299.7-314.9	308.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	362.1
W	FOOT BREADTH	The widest part of the foot	78.8-94	82.8
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	545.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	870.7
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	779.9
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	350.1
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	170.0

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142

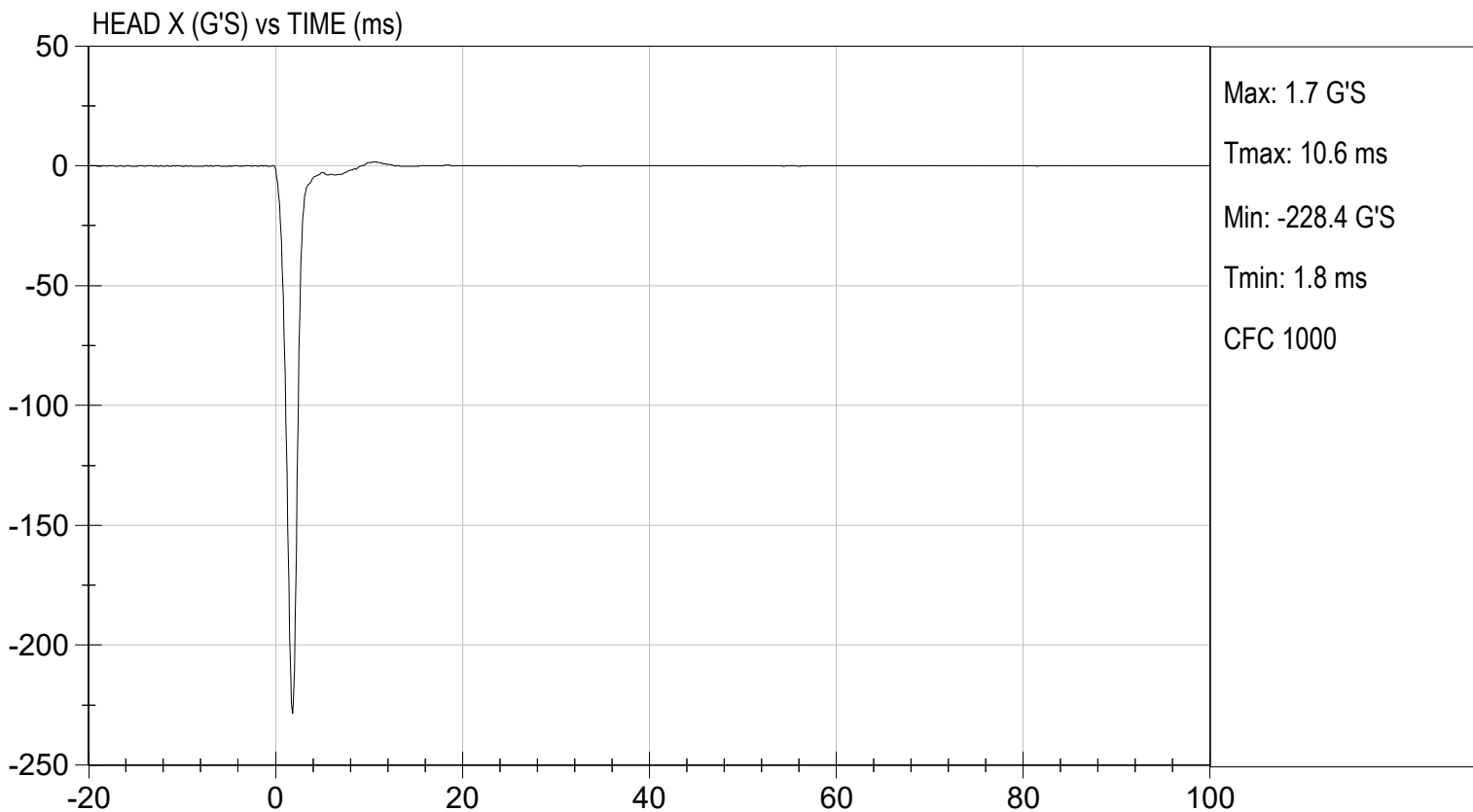
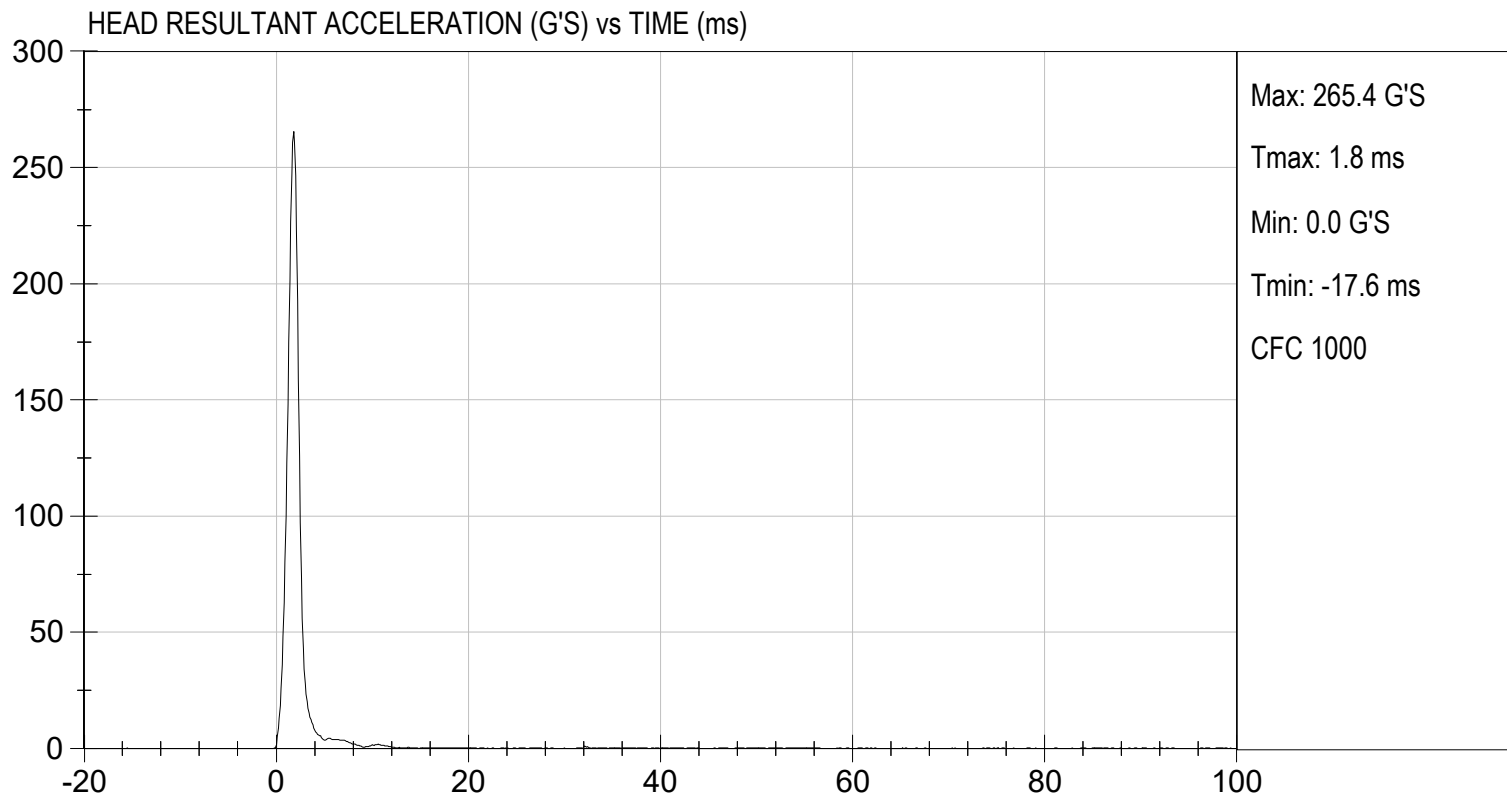
Test ID: D250121

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Peak Resultant Acceleration	G's	250 to 300	265	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-5.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

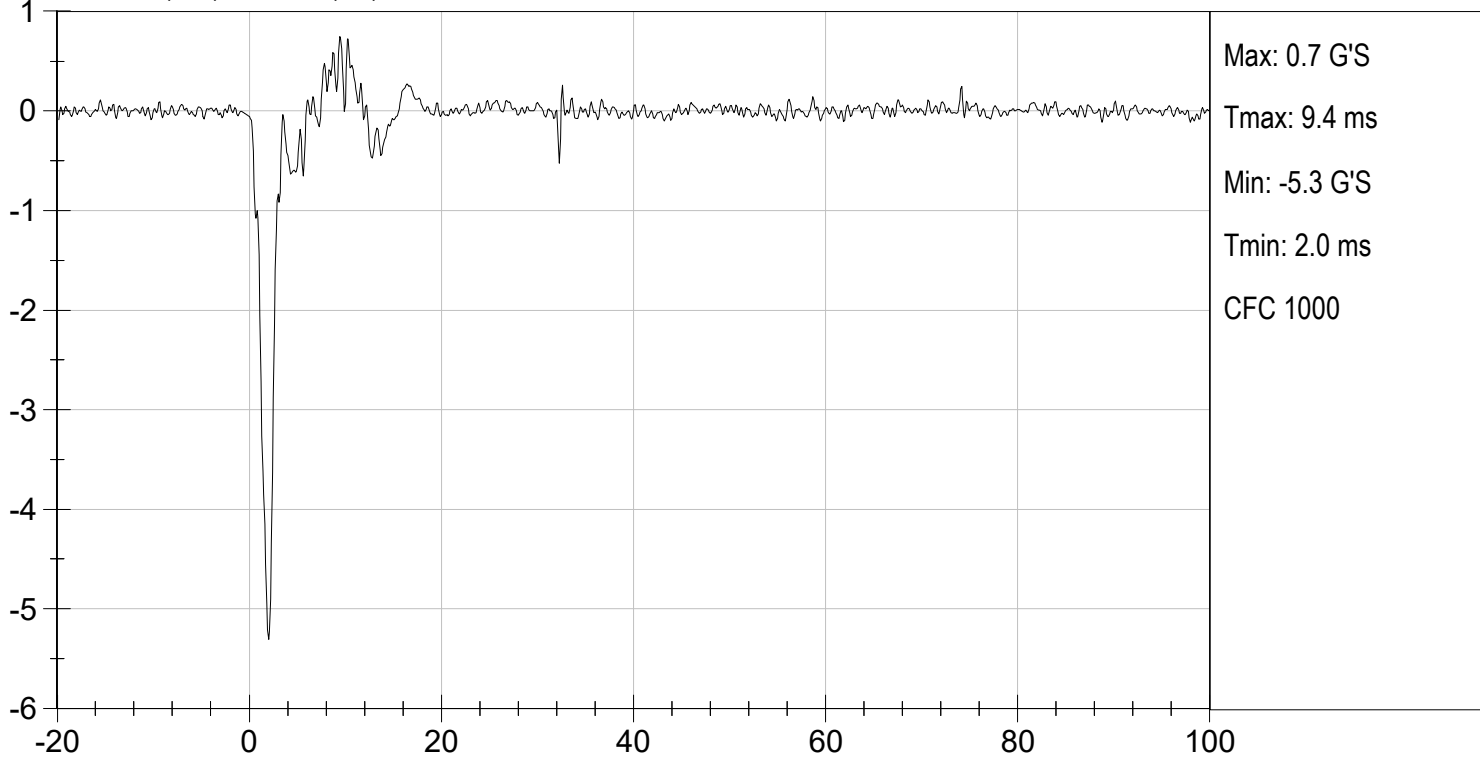

Laboratory Technician

01/14/2025
Test Date

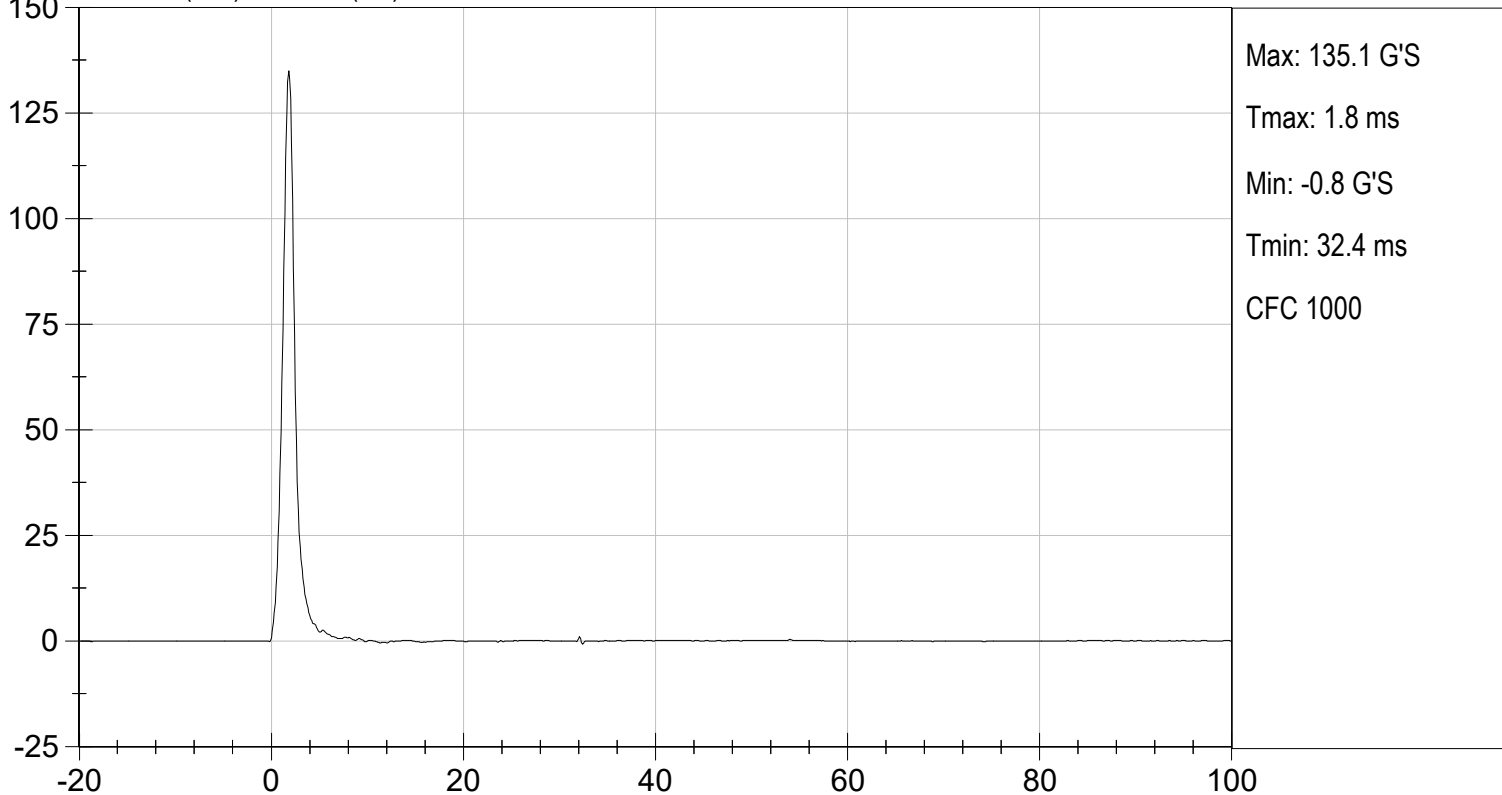

Approved By



HEAD Y (G'S) vs TIME (ms)



HEAD Z (G'S) vs TIME (ms)



MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142

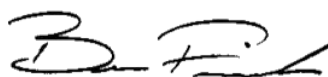
Test I.D: D250122

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	23	Pass
Pendulum Speed		m/s	6.89 to 7.13	6.96	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.7	Pass
	30 ms	m/s	5.8 to 7.0	6.8	Pass
D Plane Rotation	Max	deg	77 to 91	80	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	73	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	87	Pass
Overall Results					Pass


Laboratory Technician

01/14/2025

Test Date

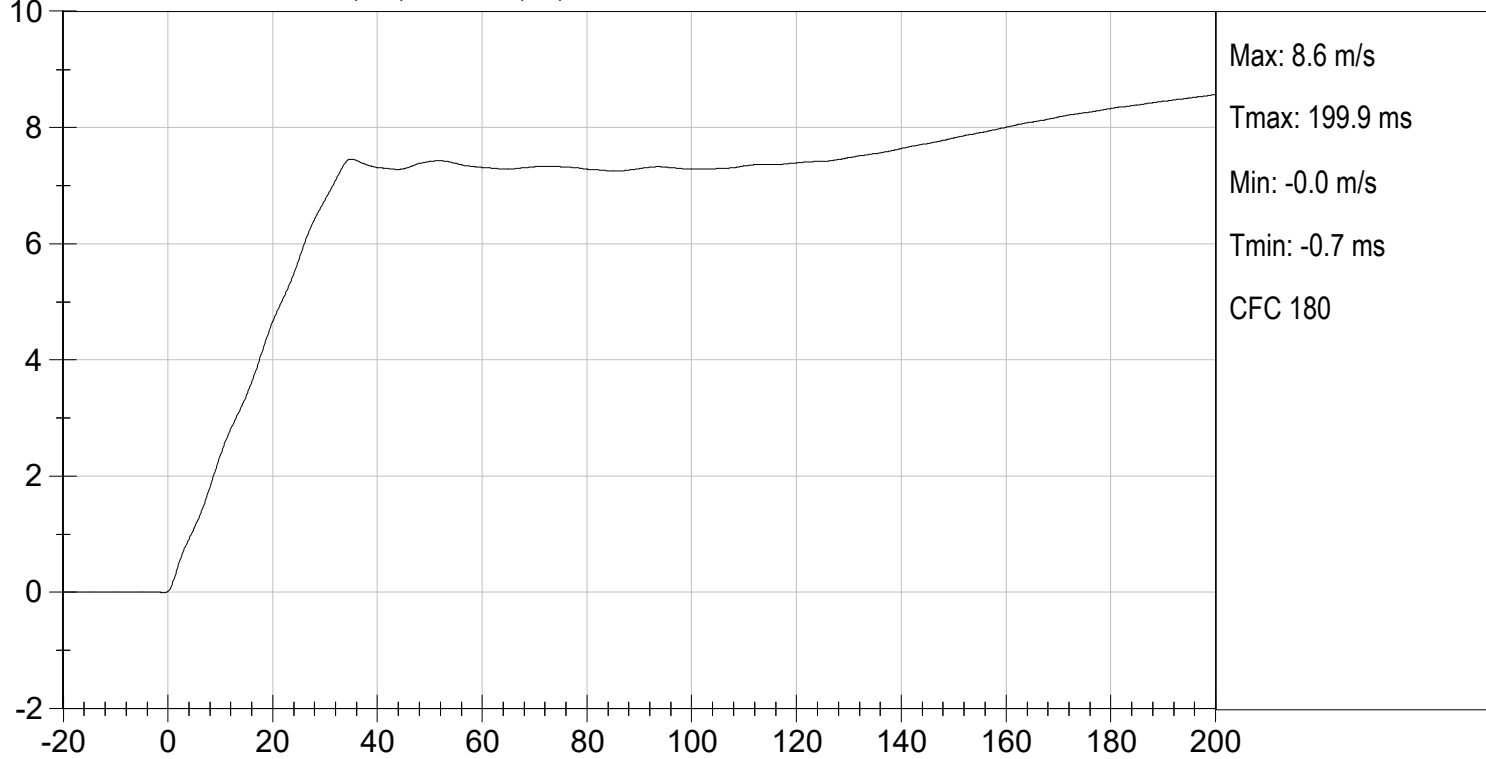

Approved By



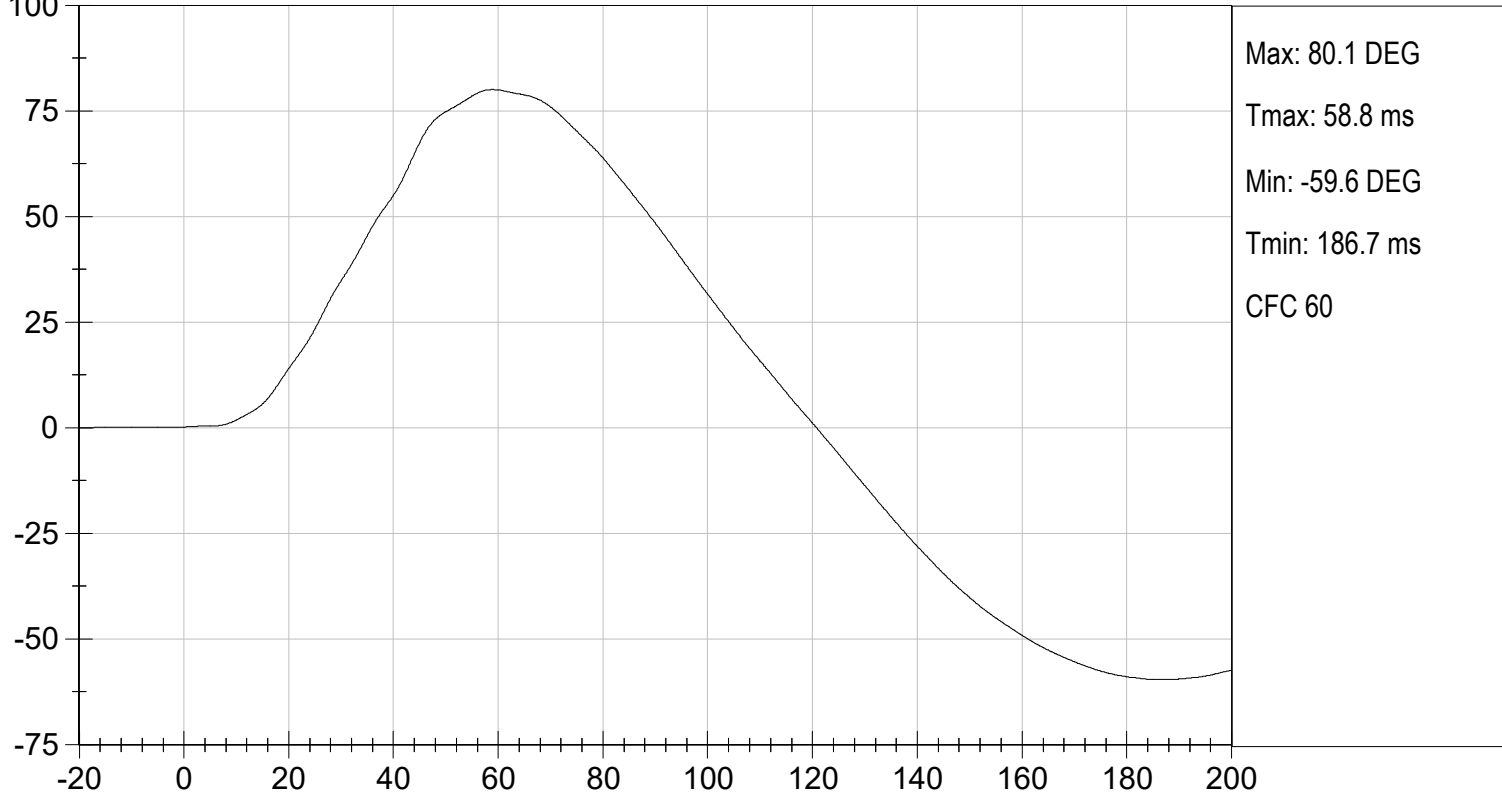
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 01/14/2025
TEST #: D250122

PENDULUM VELOCITY (m/s) vs TIME (ms)



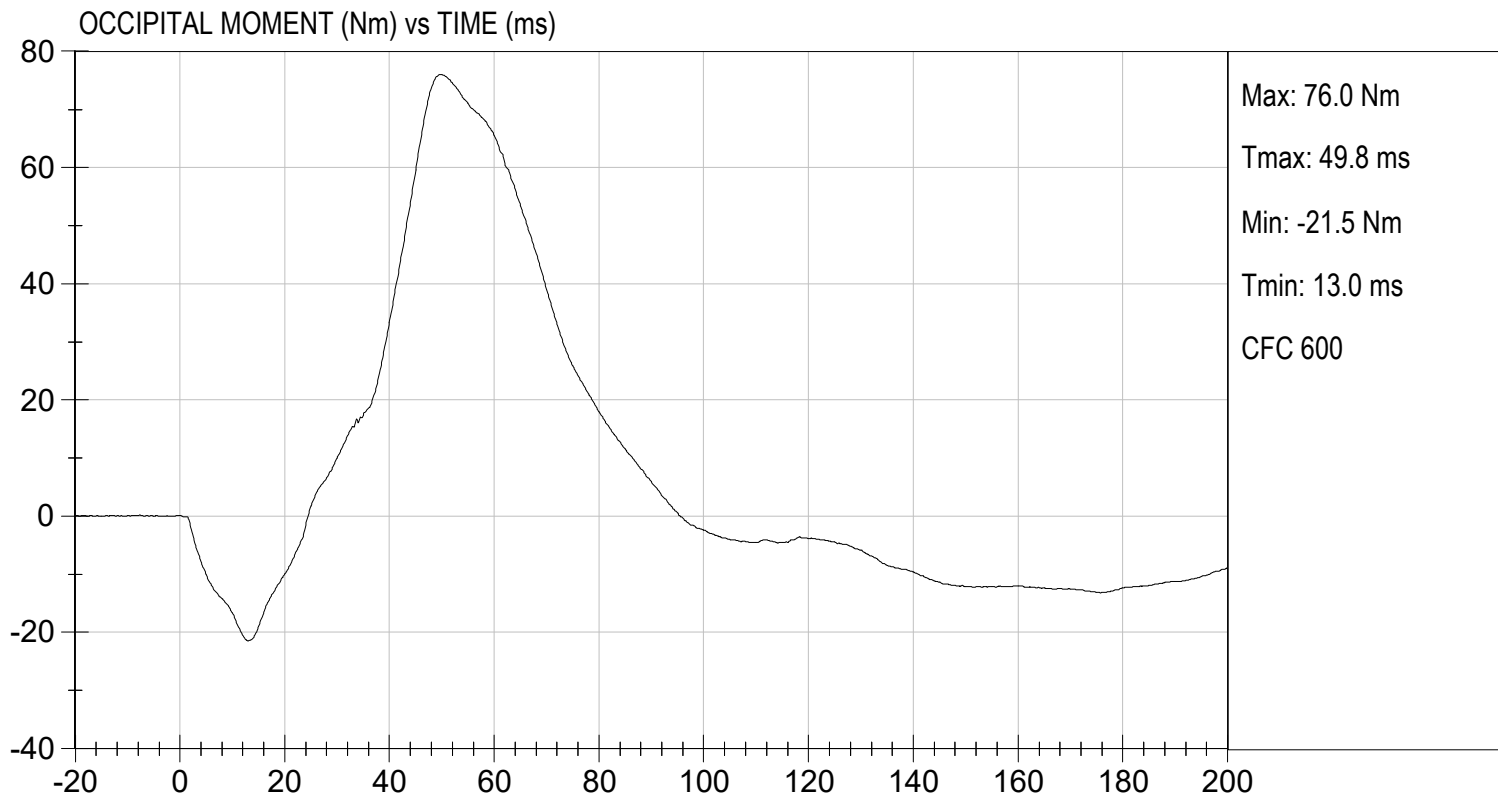
NECK ROTATION (DEG) vs TIME (ms)





TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 01/14/2025
TEST #: D250122



MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

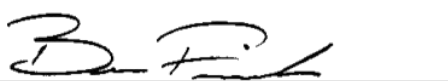
ATD Serial No: 142

Test I.D: D250123

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	23	Pass
Pendulum Speed		m/s	5.95 to 6.19	5.98	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.5	Pass
	30 ms	m/s	4.6 to 5.6	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	110	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	106	Pass
Overall Results					Pass


 Laboratory Technician

01/14/2025
 Test Date

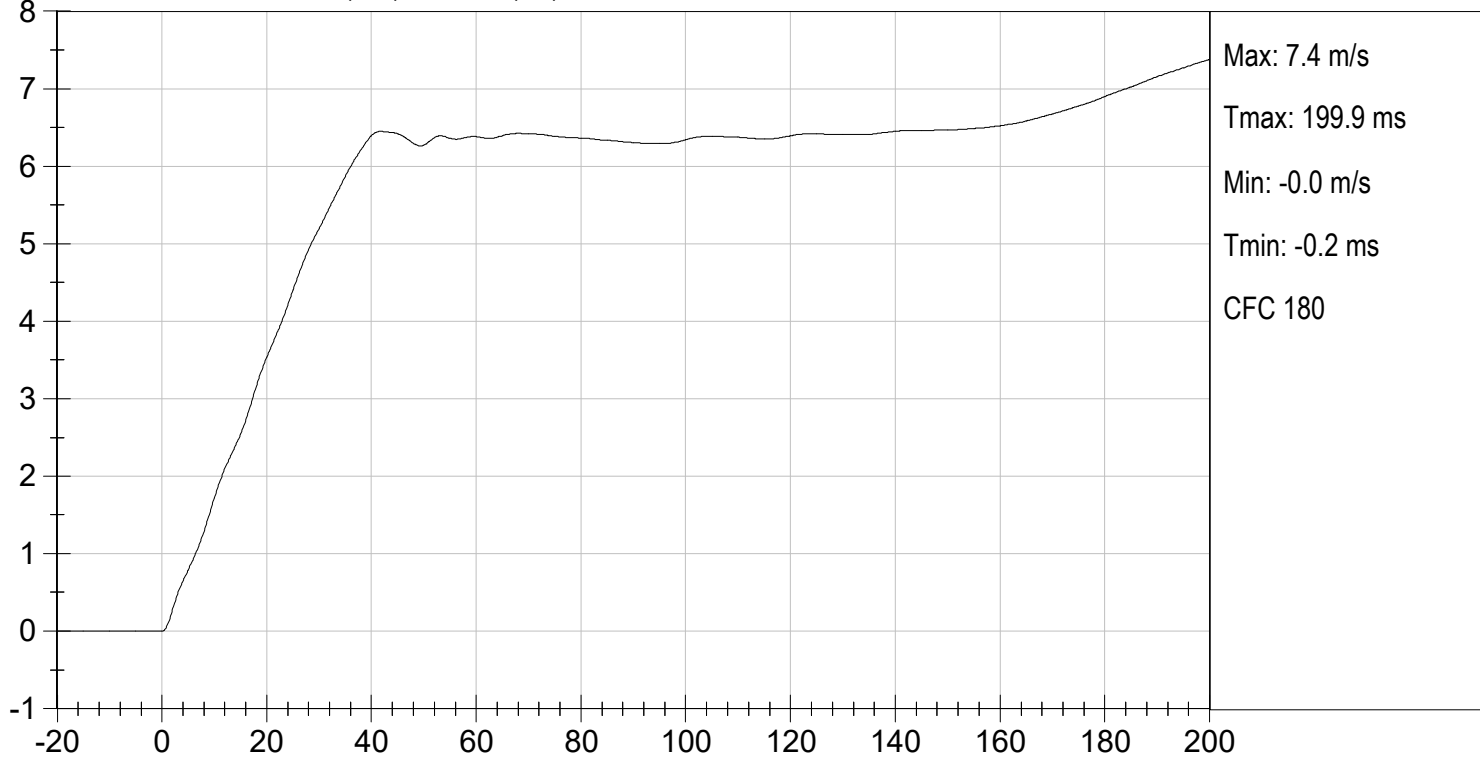

 Approved By



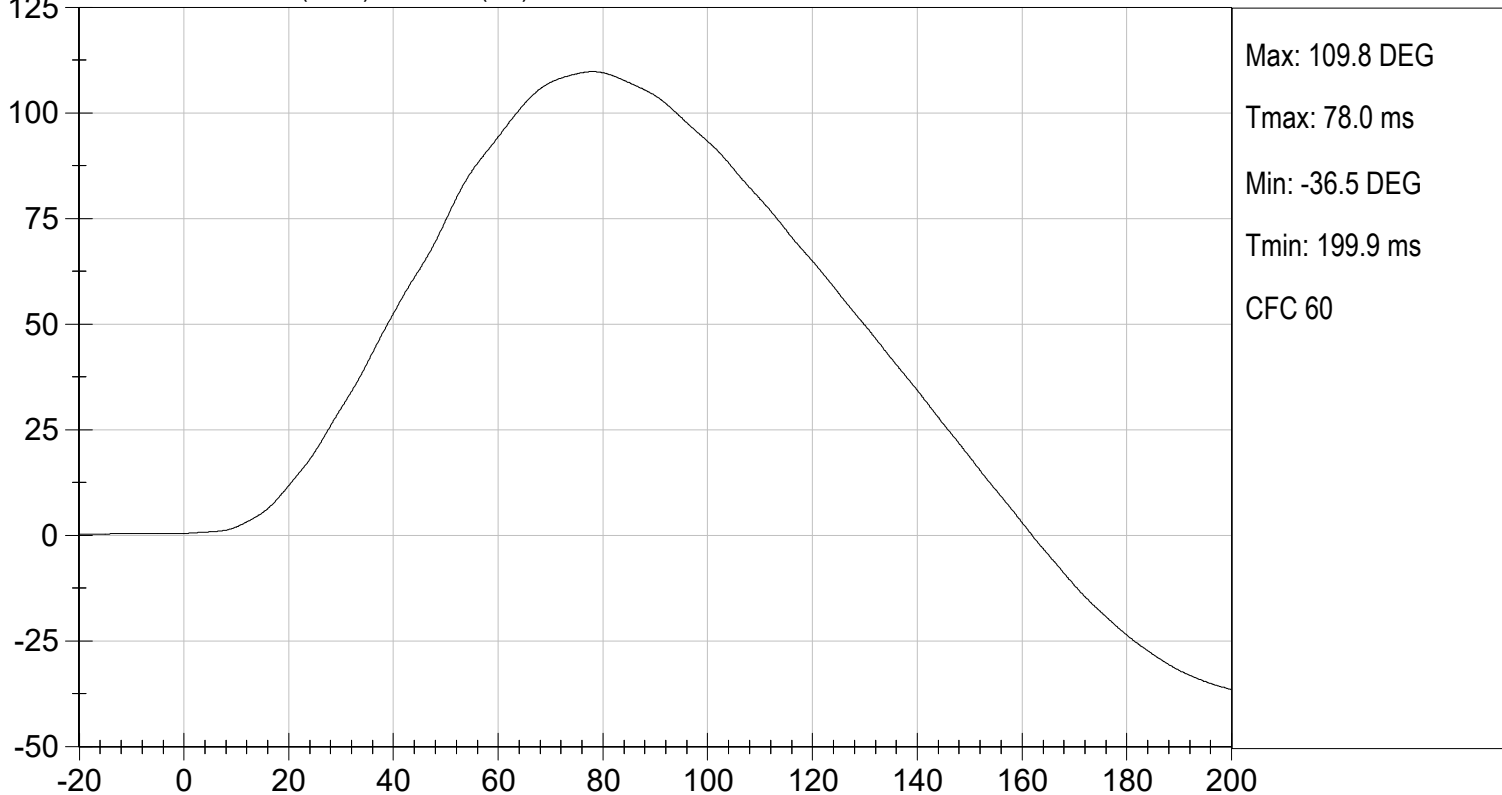
TEST DESC: NECK EXTENSION
VELOCITY: 19.61 ft/s, 5.98 m/s

TEST DATE: 01/14/2025
TEST #: D250123

PENDULUM VELOCITY (m/s) vs TIME (ms)



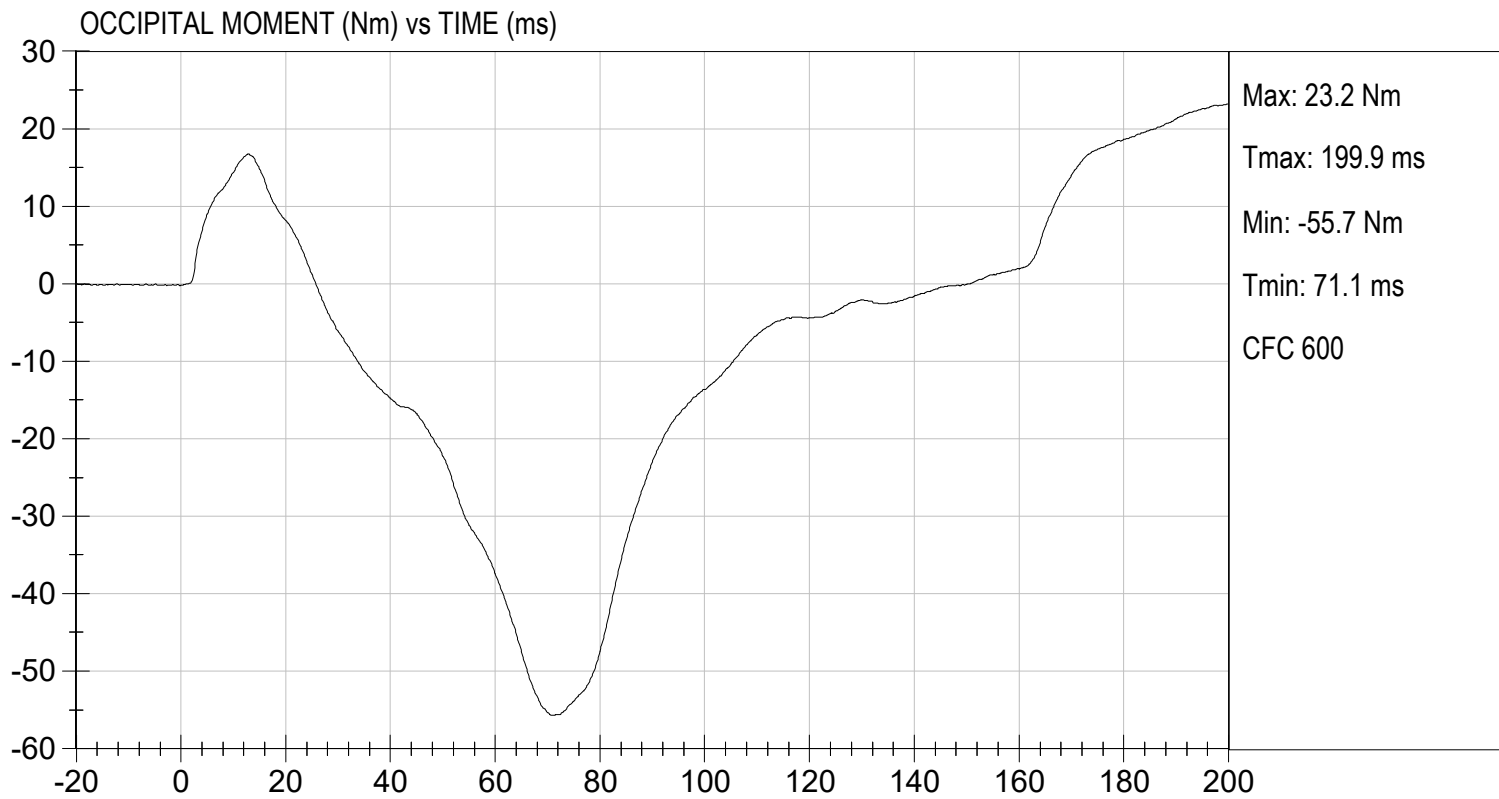
NECK ROTATION (DEG) vs TIME (ms)





TEST DESC: NECK EXTENSION
VELOCITY: 19.61 ft/s, 5.98 m/s

TEST DATE: 01/14/2025
TEST #: D250123



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 142

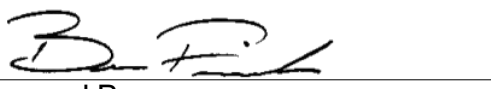
Test I.D: D250124

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Relative Humidity	%	10 to 70	24	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	53	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4305	Pass
Internal Hysteresis	%	69 to 85	75	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4314	Pass
			Overall Test Results	Pass


Laboratory Technician

01/14/2025

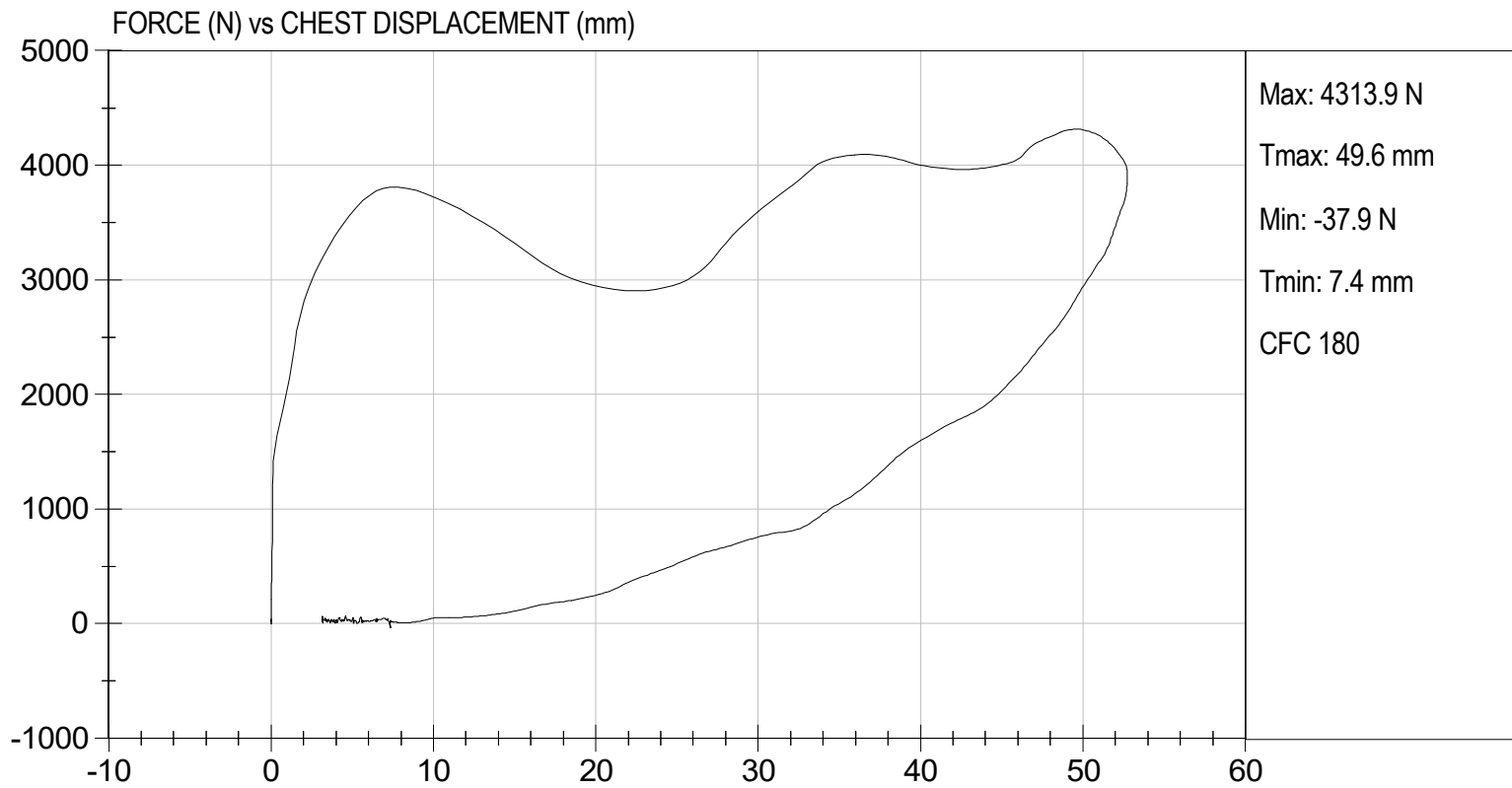
Test Date


Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 01/14/2025
TEST #: D250124



MGA RESEARCH CORPORATION

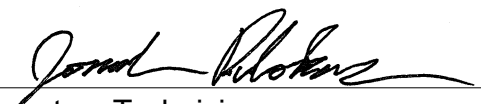
RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

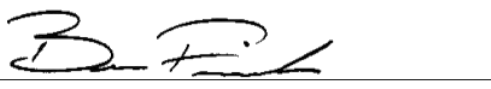
ATD Serial No: 142

Test I.D: D250125

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	N	3450 to 4060	3746	Pass
Overall Test Results				Pass


Laboratory Technician

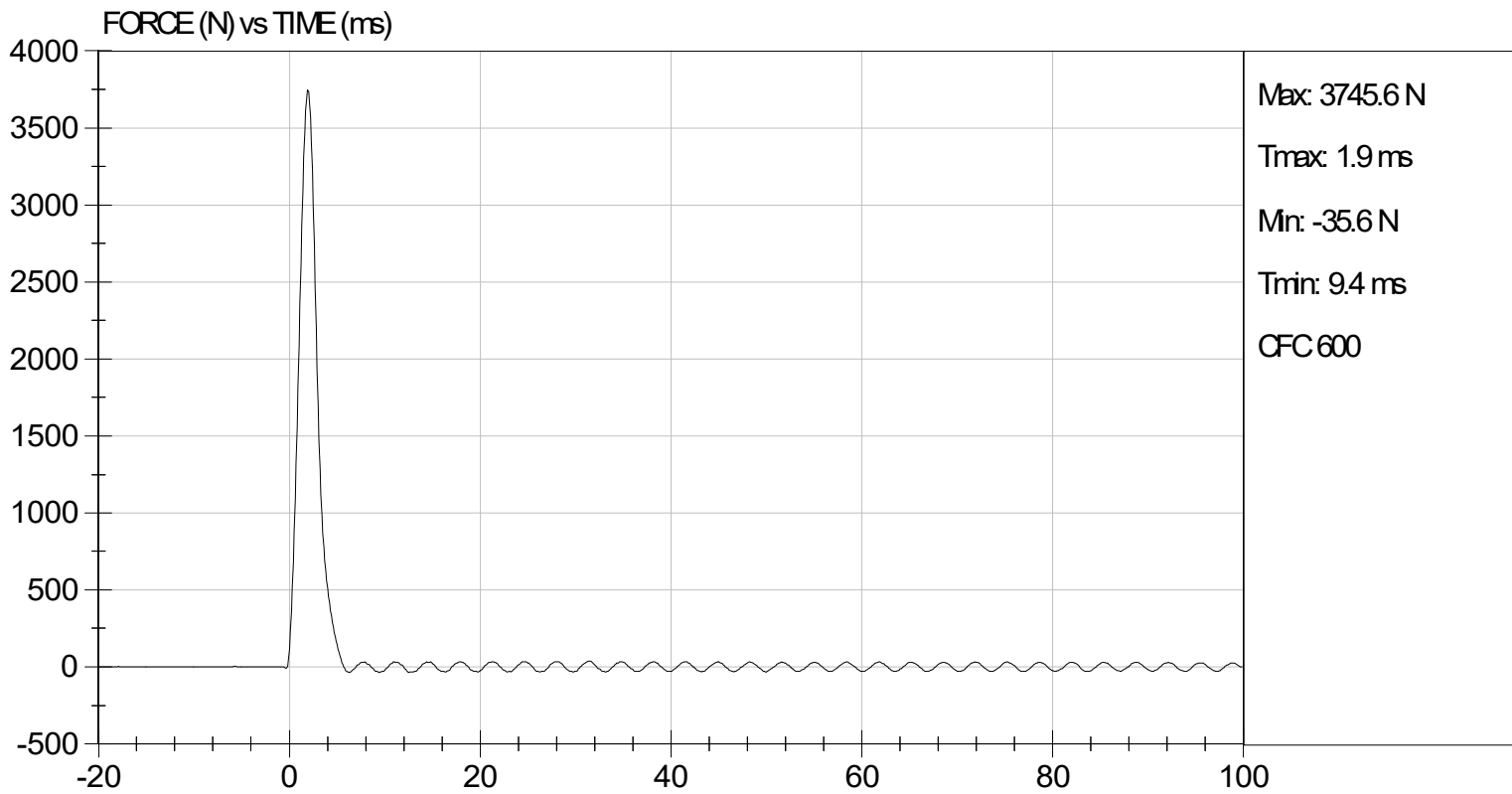
01/14/2025
Test Date


Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 6.89 ft/s, 2.10 m/s

TEST DATE: 01/14/2025
TEST #: D250125



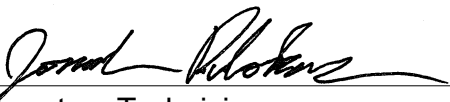
MGA RESEARCH CORPORATION

**LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE**

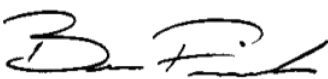
ATD Serial No: 142

Test I.D: D250126

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	N	3450 to 4060	3810	Pass
Overall Test Results			Pass	


Laboratory Technician

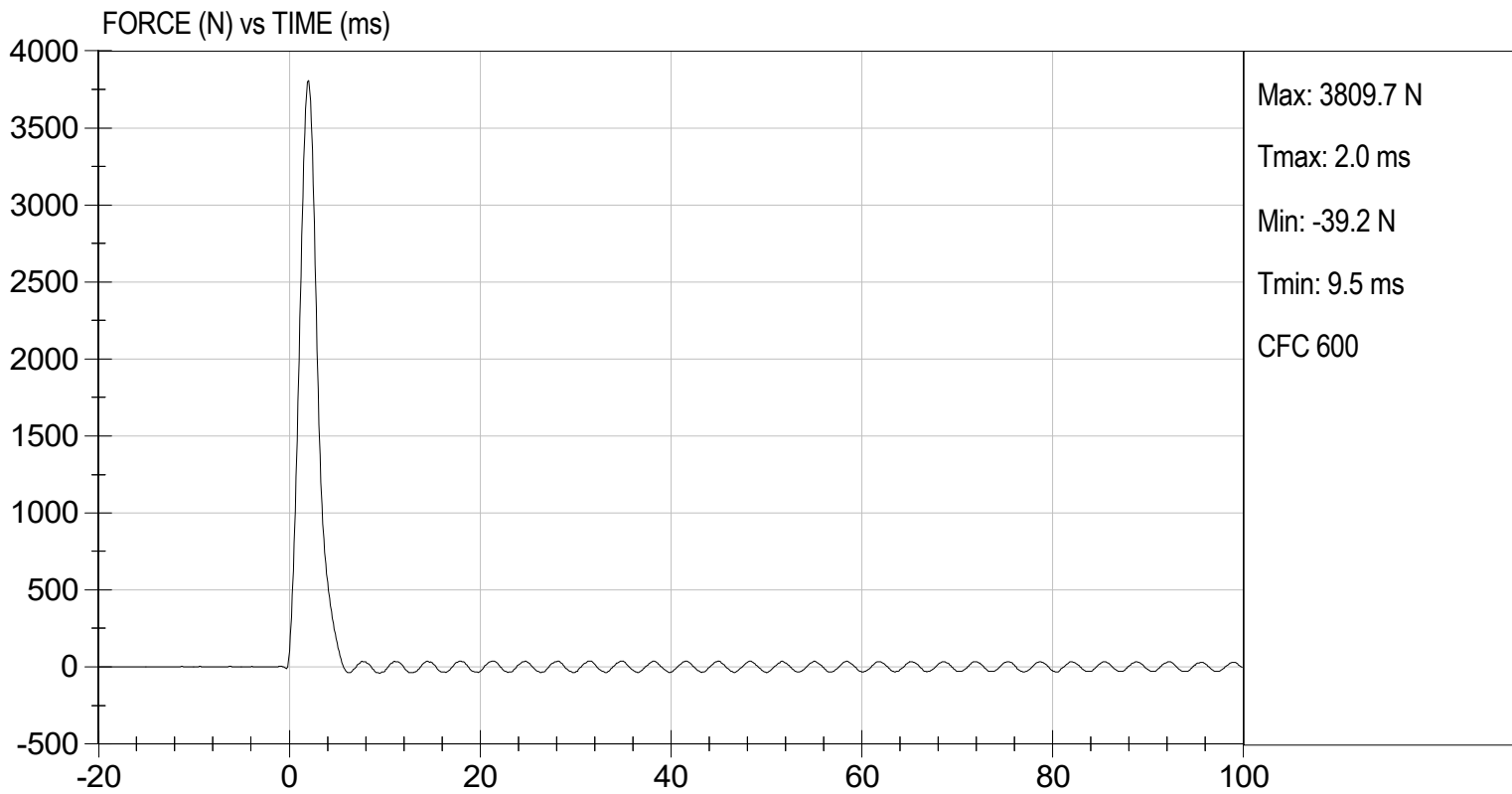
01/14/2025
Test Date


Approved By



TEST DESC: LEFT KNEE
VELOCITY: 6.89 ft/s, 2.10 m/s

TEST DATE: 01/14/2025
TEST #: D250126



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 142

Test I.D: D250127

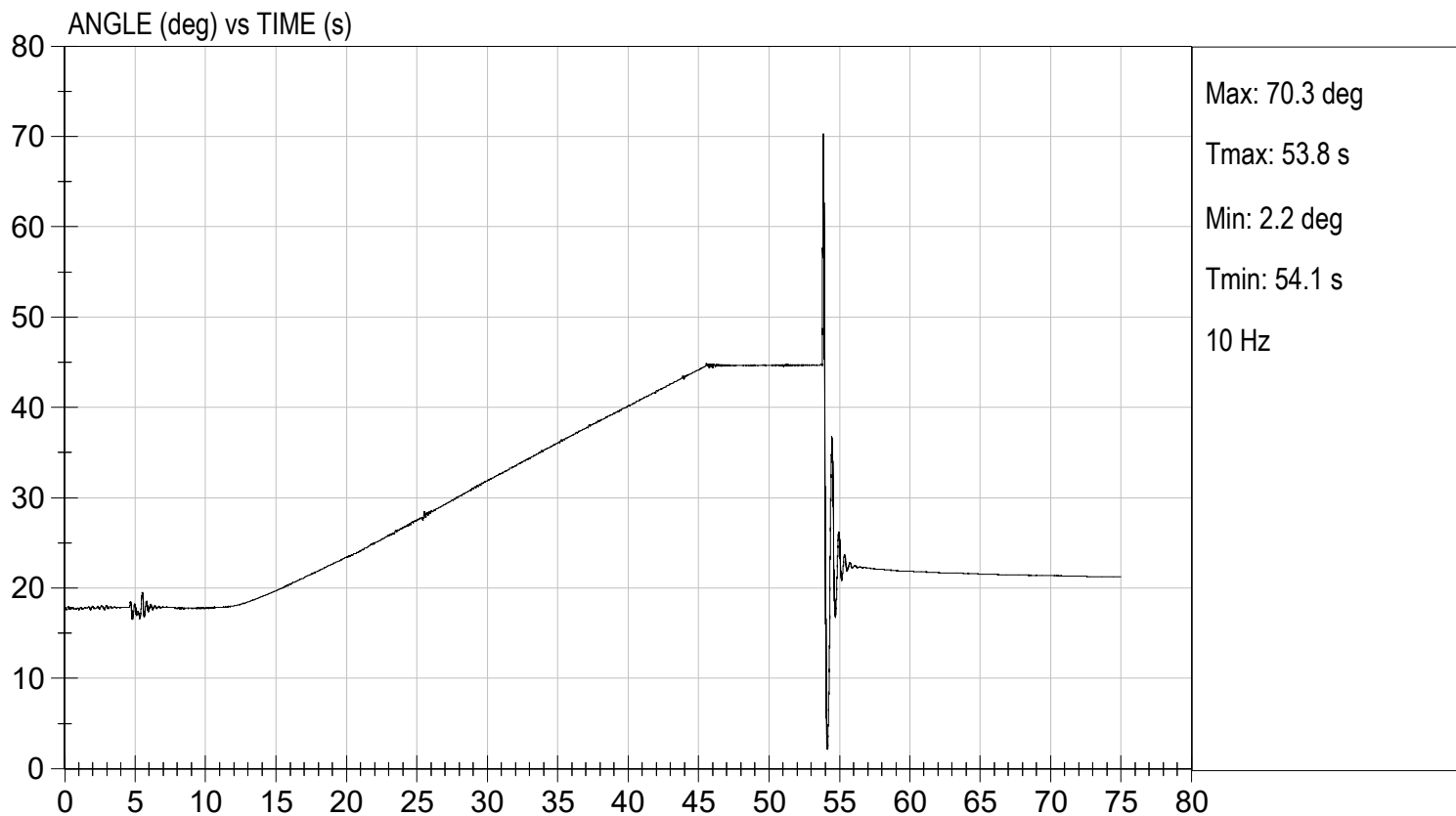
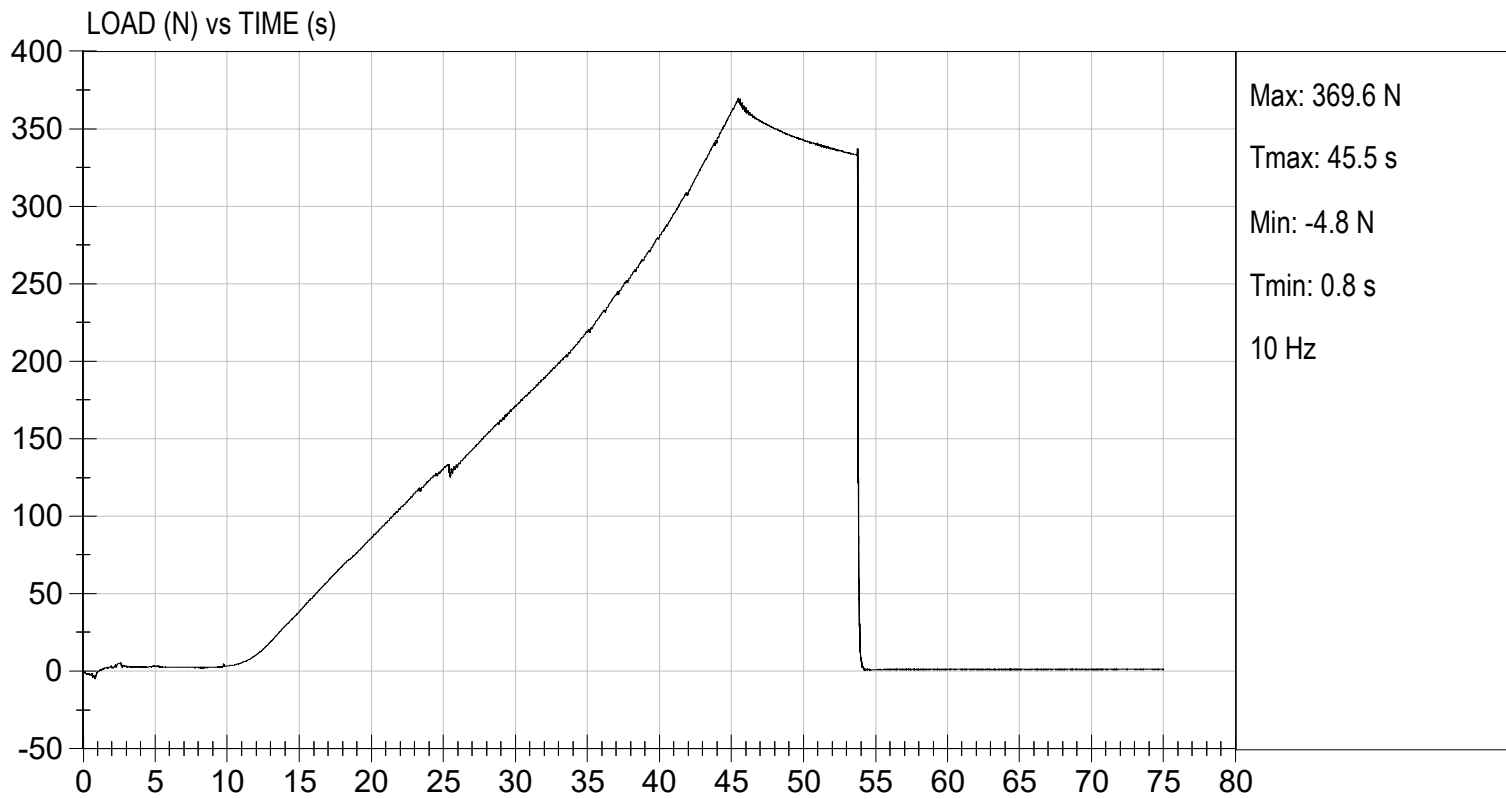
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	3	Pass
Force at 45 deg	N	320 to 390	370	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
Overall Result			Pass	


Laboratory Technician

01/14/2025

Test Date


Approved By



QUALIFICATION TEST RESULTS

POST-TEST

HYBRID III 5TH PERCENTILE FEMALE - PASSENGER ATD

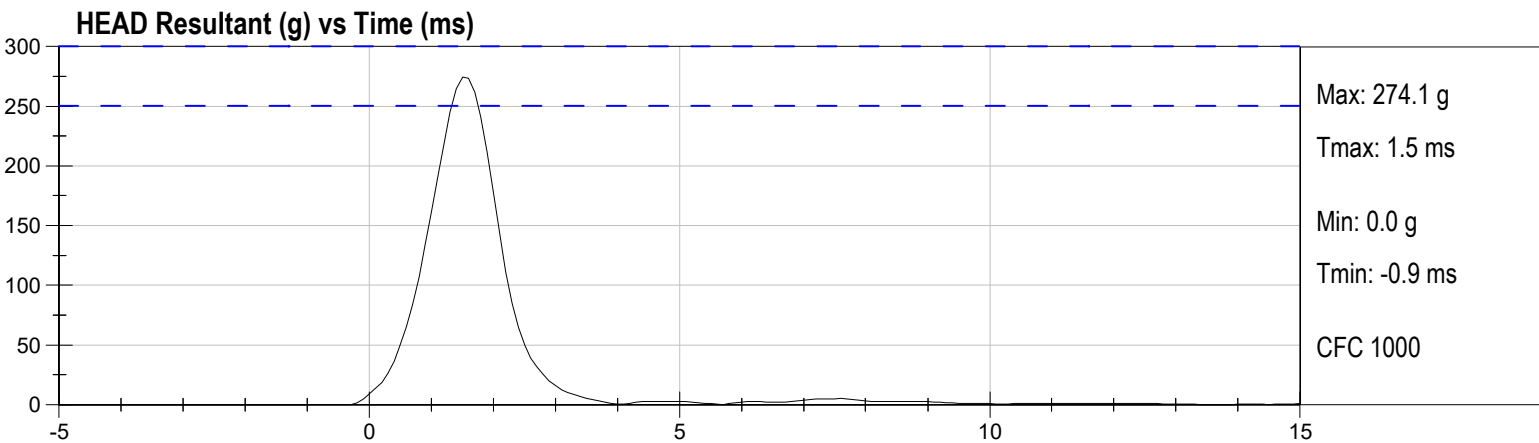
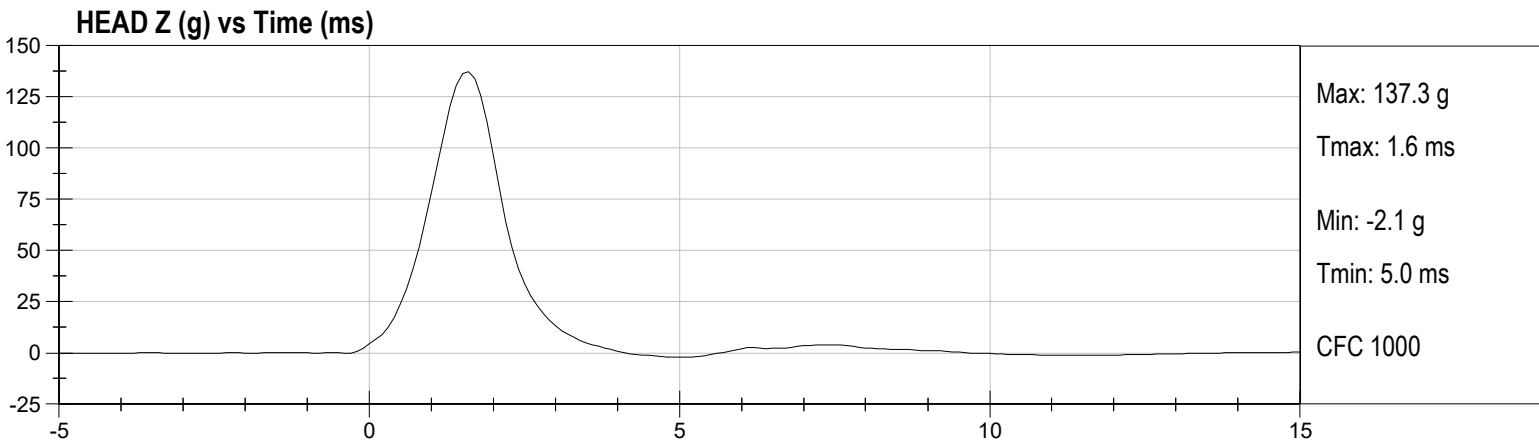
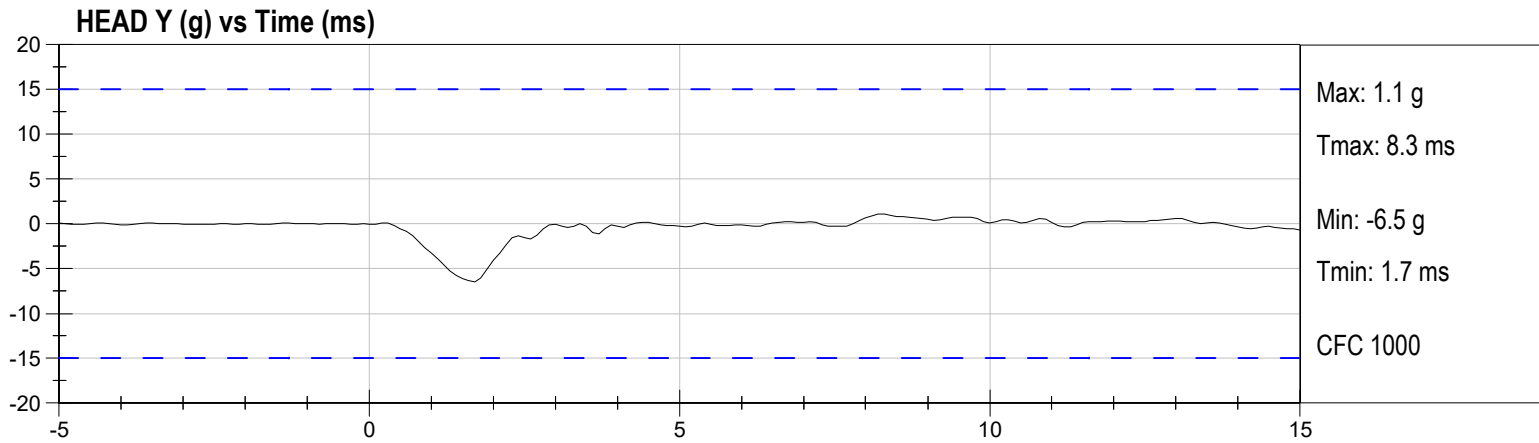
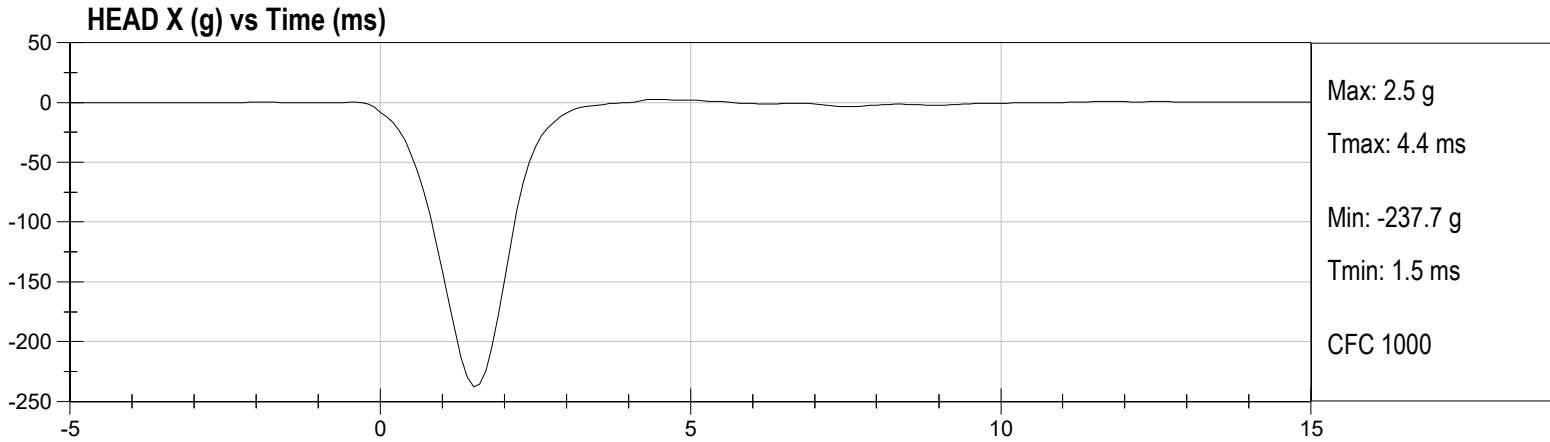


Head Drop Test
Hybrid III 5th Percentile Female
ATD Serial No: 142

Test Date: 02/18/2025
Test ID: D250501
Test Technician: Jonah Pulokas

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Peak Resultant Acceleration	g	250 to 300	274	Pass
Peak Lateral Acceleration	g	-15.0 to 15.0	-6.5	Pass
Unimodal	%	within 10% of peak	2	Pass

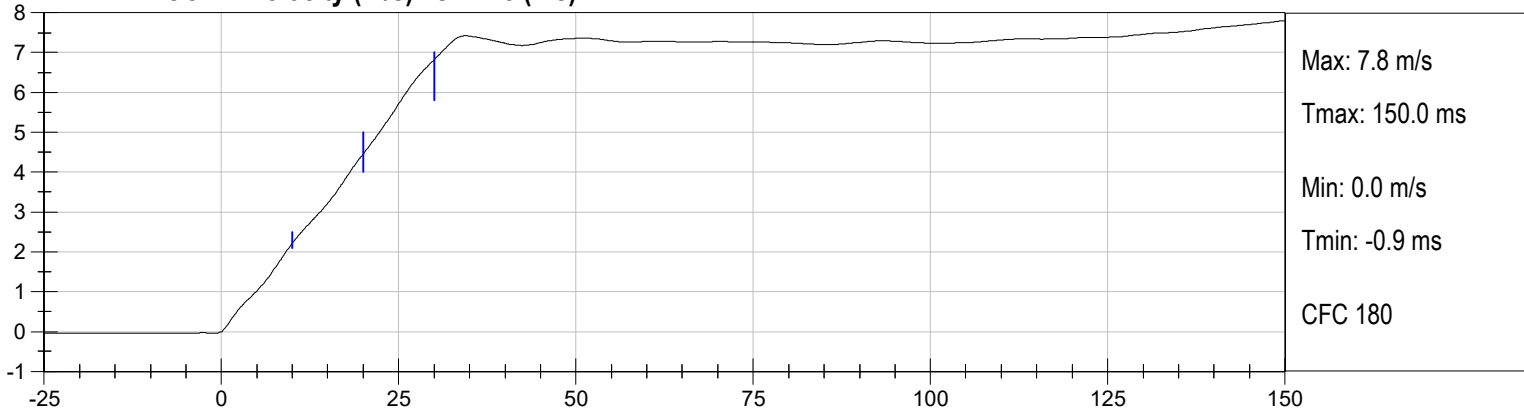
Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
HEAD X	Endevco	T30974	11/25/2024	5/27/2025
HEAD Y	Endevco	T30975	11/25/2024	5/27/2025
HEAD Z	Endevco	T30976	11/25/2024	5/27/2025



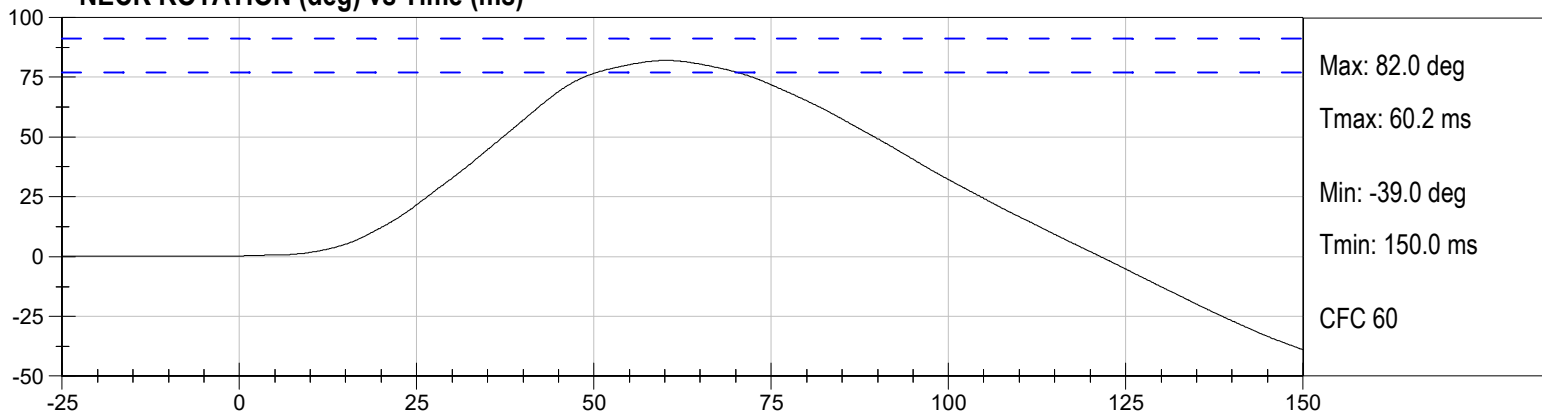
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Pendulum Velocity	m/s	6.89 to 7.13	6.96	Pass
Pendulum Velocity At 10 ms After T0	m/s	2.1 to 2.5	2.2	Pass
Pendulum Velocity At 20 ms After T0	m/s	4.0 to 5.0	4.4	Pass
Pendulum Velocity At 30 ms After T0	m/s	5.8 to 7.0	6.8	Pass
Maximum "D" Plane Rotation	Deg	77 to 91	82	Pass
Occipital Condyle Moment within Rotation Corridor	Nm	69 to 83	72	Pass
Positive Moment Time Curve Decay to 10 Nm	ms	80 to 100	87	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
PEND. ACCEL.	Endevco	AH5P1	01/13/2025	7/15/2025
NECK FORCE X	Denton	Ng2203FX	01/20/2025	1/20/2026
NECK MOMENT Y	Denton	NG2203MY	01/20/2025	1/20/2026
PEND. POT	Servo	4707	08/21/2024	2/20/2025
HEAD POT	Servo	7297	08/21/2024	2/20/2025

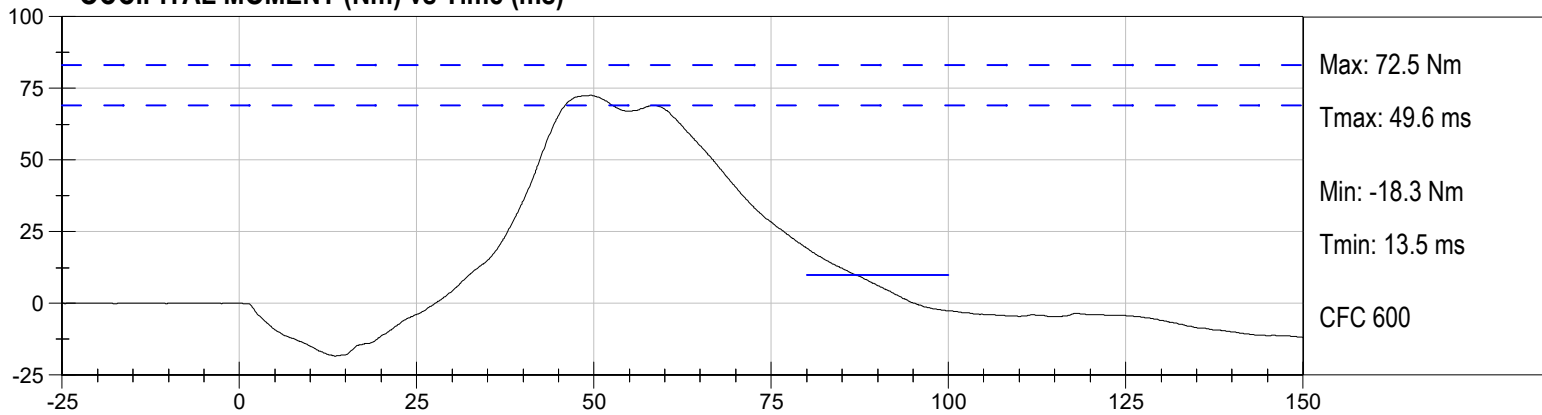
PEND. ACCEL. Velocity (m/s) vs Time (ms)



NECK ROTATION (deg) vs Time (ms)



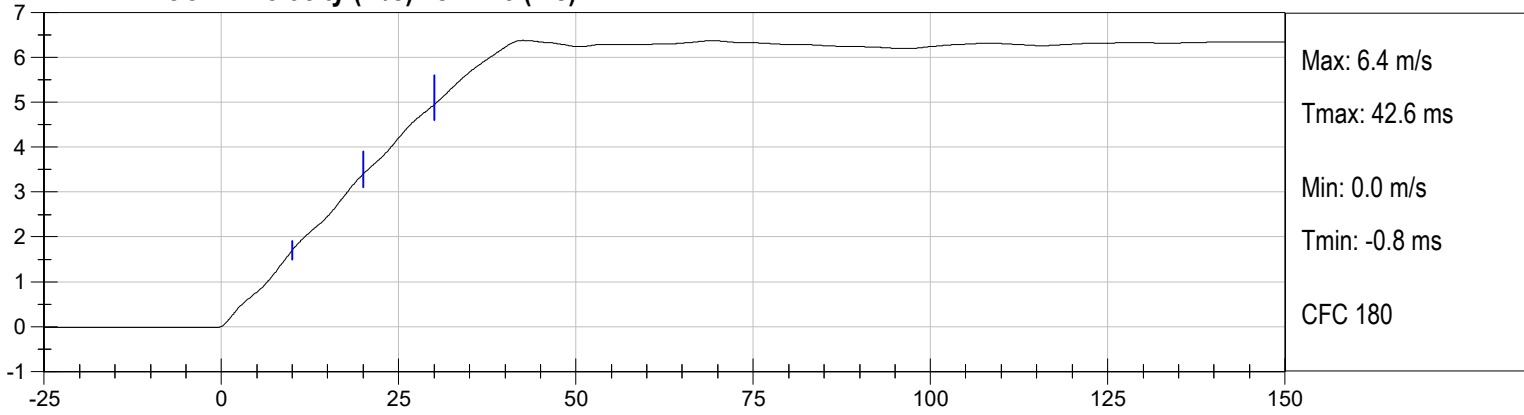
OCCIPITAL MOMENT (Nm) vs Time (ms)



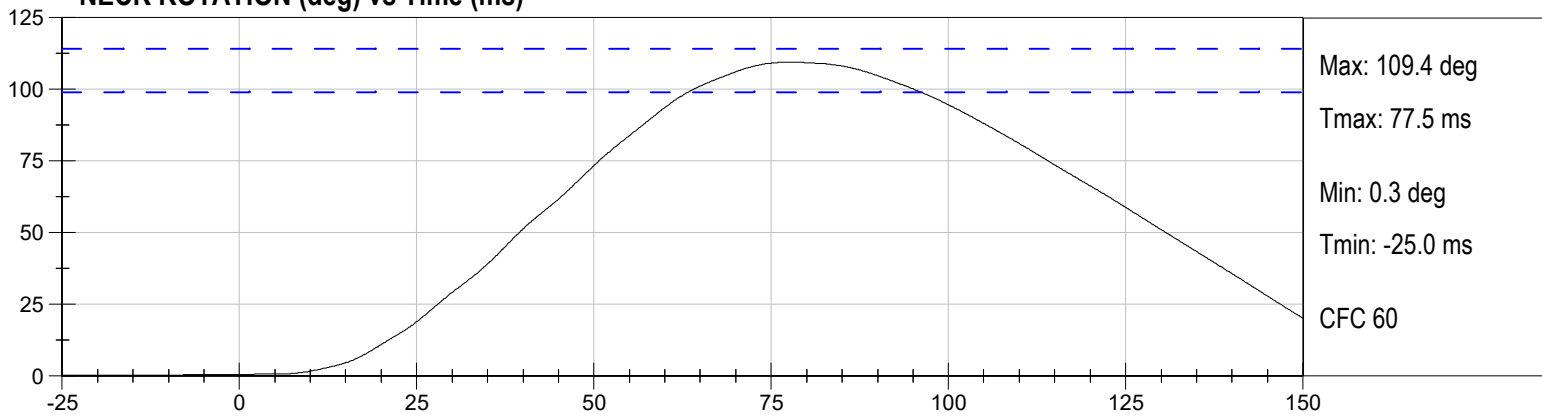
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Pendulum Velocity	m/s	5.95 to 6.19	6.05	Pass
Pendulum Velocity At 10 ms After T0	m/s	1.5 to 1.9	1.68	Pass
Pendulum Velocity At 20 ms After T0	m/s	3.1 to 3.9	3.39	Pass
Pendulum Velocity At 30 ms After T0	m/s	4.6 to 5.6	4.94	Pass
Maximum "D" Plane Rotation	Deg	99 to 114	109.4	Pass
Occipital Condyle Moment within Rotation Corridor	Nm	-53 to -65	-55	Pass
Negative Moment Time Curve Decay to -10 Nm	ms	94 to 114	107	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
PEND. ACCEL.	Endevco	AH5P1	01/13/2025	7/15/2025
NECK FORCE X	Denton	Ng2203FX	01/20/2025	1/20/2026
NECK MOMENT Y	Denton	NG2203MY	01/20/2025	1/20/2026
PEND. POT	Servo	4707	08/21/2024	2/20/2025
HEAD POT	Servo	7297	08/21/2024	2/20/2025

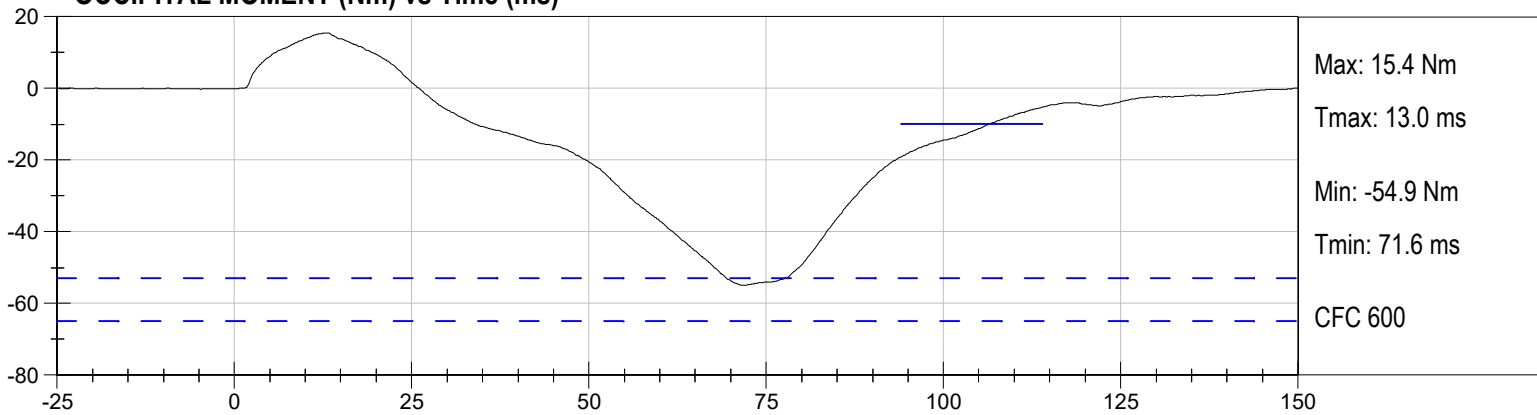
PEND. ACCEL. Velocity (m/s) vs Time (ms)



NECK ROTATION (deg) vs Time (ms)



OCCIPITAL MOMENT (Nm) vs Time (ms)





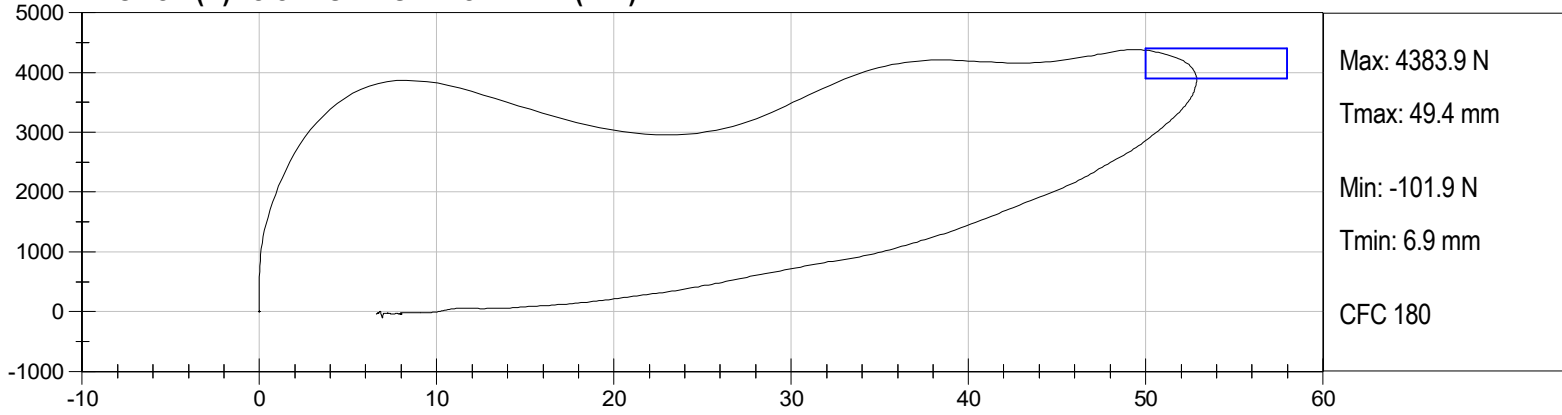
Thorax Impact Test
Hybrid III 5th Percentile Female
ATD Serial No: 142

Test Date: 02/18/2025
Test ID: D250504
Test Technician: Jonah Pulokas

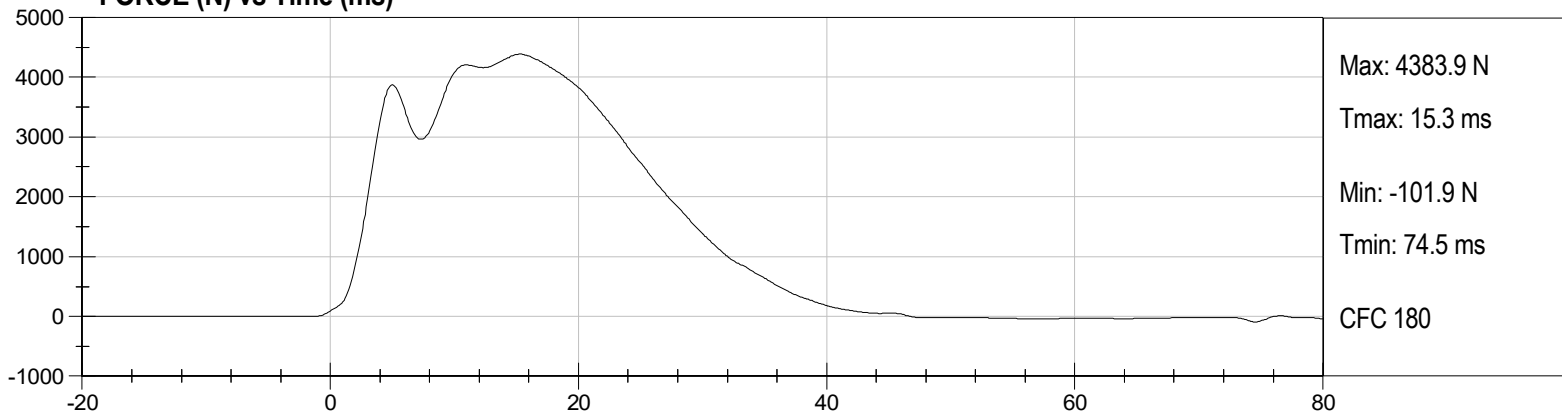
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Probe Velocity	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	53	Pass
Peak Resistive Force w/in Corridor	N	3900 to 4400	4371	Pass
Internal Hysteresis	%	69 to 85	76	Pass
Peak Force 18 mm - 50 mm	N	0 to 4600	4384	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
PROBE	Endevco	P79577	09/18/2024	3/20/2025
CHEST DISPLACEMENT	Humanetics	142	10/29/2024	4/30/2025

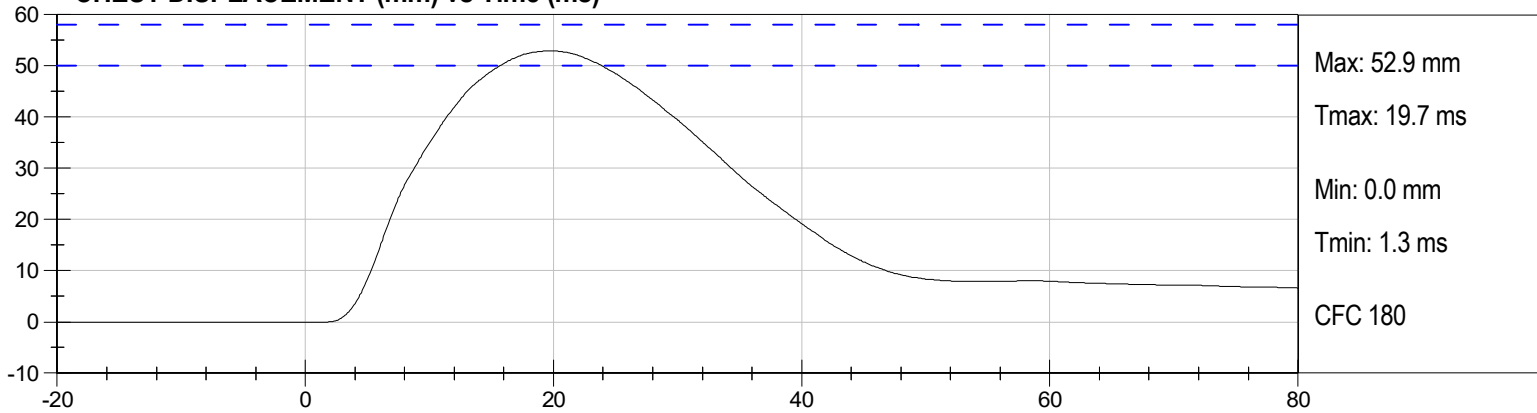
FORCE (N) vs CHEST DISPLACEMENT (mm)



FORCE (N) vs Time (ms)



CHEST DISPLACEMENT (mm) vs Time (ms)



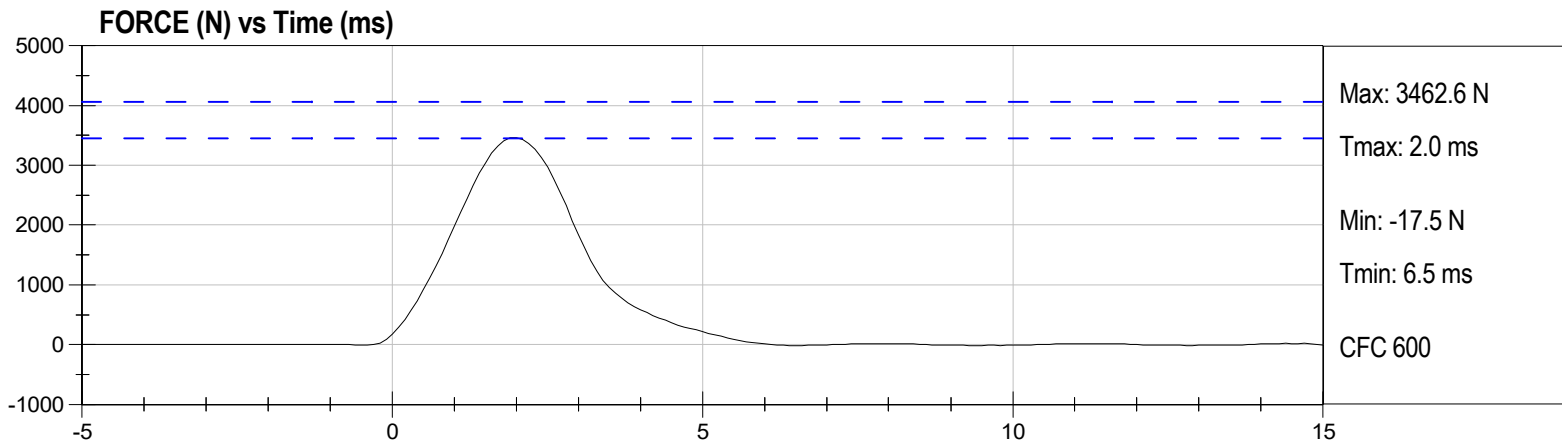


Right Knee Impact Test
Hybrid III 5th Percentile Female
ATD Serial No: 142

Test Date: 02/18/2025
Test ID: D250505
Test Technician: Jonah Pulokas

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	3450 to 4060	3463	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
KNEE PROBE	Endevco	P82128	12/03/2024	6/4/2025



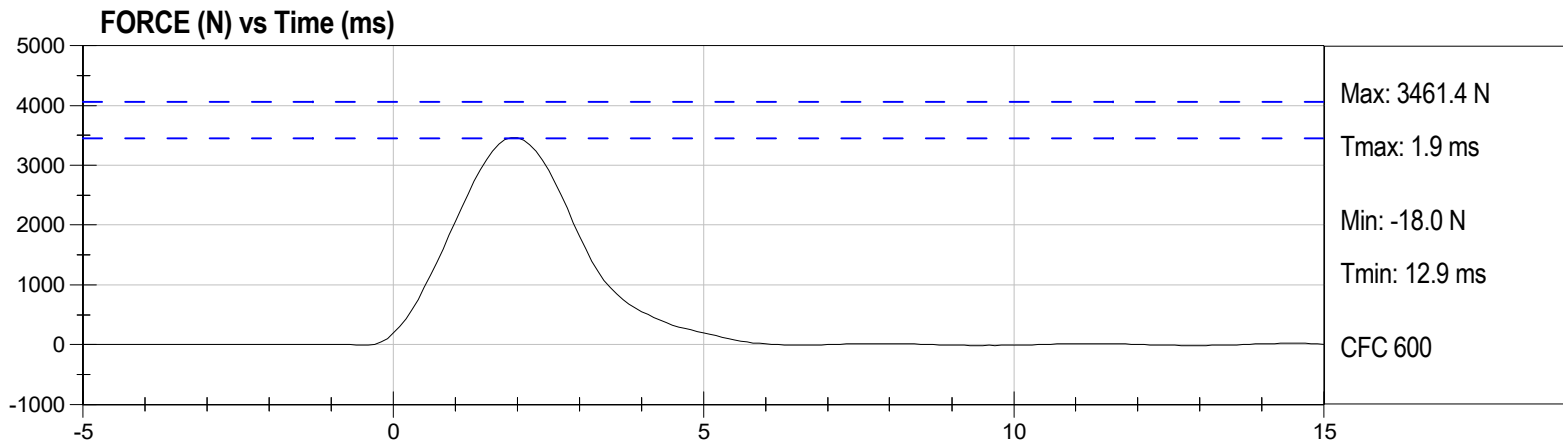


Left Knee Impact Test
Hybrid III 5th Percentile Female
ATD Serial No: 142

Test Date: 02/18/2025
Test ID: D250506
Test Technician: Jonah Pulokas

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	3450 to 4060	3461	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
KNEE PROBE	Endevco	P82128	12/03/2024	6/4/2025



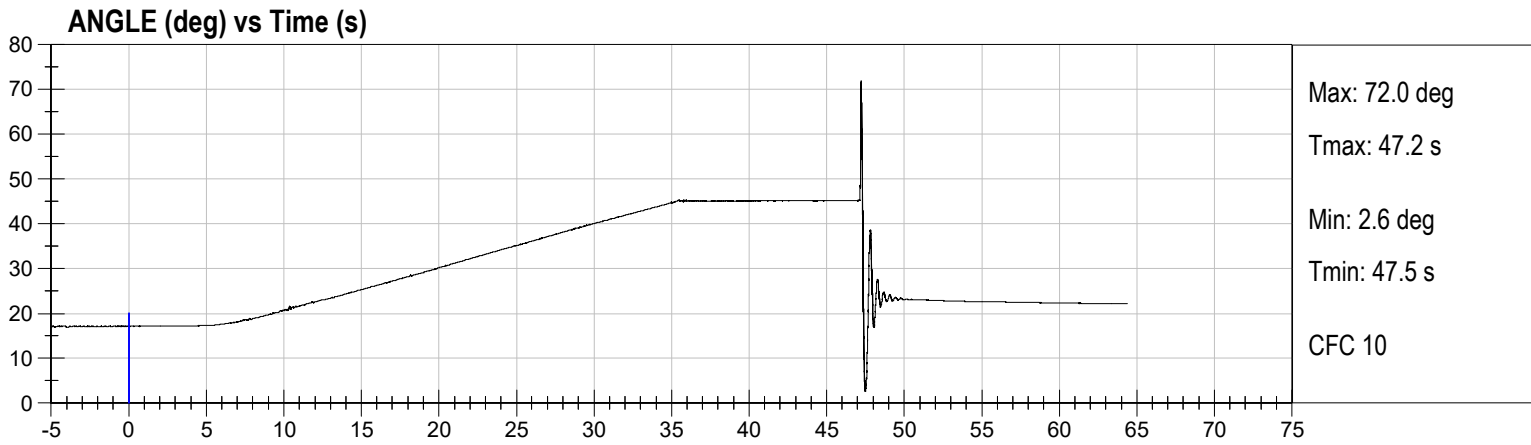
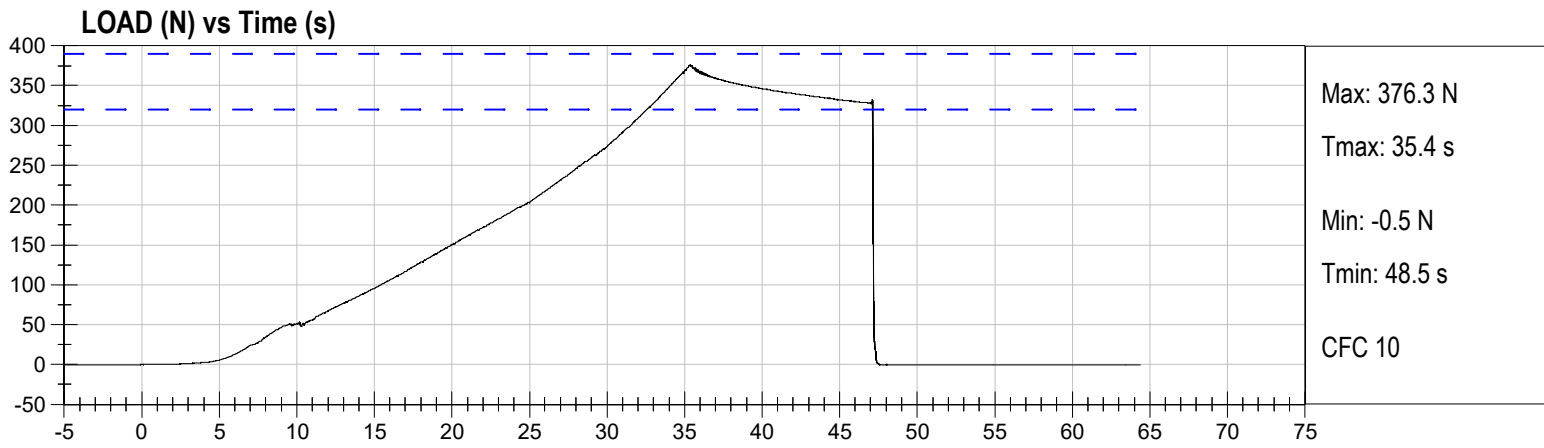


Torso Flexion Test
Hybrid III 5th Percentile Female
ATD Serial No: 142

Test Date: 02/18/2025
Test ID: D250507
Test Technician: Jonah Pulokas

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Initial Angle	deg	0 to 20	17	Pass
Return Angle Relative to Initial	deg	-8 to 8	4	Pass
Force at 45 deg	N	320 to 390	376	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	1.0	Pass

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
LOAD	Interface	479661	01/29/2025	7/31/2025
ANGLE	Seika	494819	05/21/2024	5/21/2025



APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

TABLE 1 – DRIVER DUMMY INSTRUMENTATION

Instrument Location			Axis	Hybrid III 50 th S/N 064		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary		X	T30960	Endevco	11/19/2024
			Y	P79743	Endevco	11/19/2024
			Z	P79741	Endevco	11/19/2024
	Redundant		X	P79744	Endevco	11/19/2024
			Y	P94834	Endevco	11/19/2024
			Z	P94856	Endevco	11/19/2024
Head Angular Rate Sensors			X	ARS7502	DTS	7/31/2024
			Y	ARS7524	DTS	7/31/2024
			Z	ARS7547	DTS	7/31/2024
Upper Neck Load Cell			Fx, Fy, Fz Mx, My, Mz	NG2022	Denton	5/24/2024
Chest Accelerometers	Primary		X	P86793	Endevco	11/19/2024
			Y	P88348	Endevco	11/19/2024
			Z	P86792	Endevco	11/19/2024
	Redundant		X	P88667	Endevco	11/19/2024
			Y	P94109	Endevco	11/19/2024
			Z	P88666	Endevco	11/19/2024
Chest Potentiometer			X	064	Humanetics	11/19/2024
Pelvis Accelerometers			X	P97742	Endevco	11/19/2024
			Y	P96038	Endevco	11/19/2024
			Z	P95526	Endevco	11/19/2024
Femur Load Cells	Right	Primary	Z	FG121P	Denton	11/19/2024
		Redundant	Z	FG121R	Denton	11/19/2024
	Left	Primary	Z	FG122P	Denton	11/19/2024
		Redundant	Z	FG122R	Denton	11/19/2024
Tibia Load Cells	Right	Upper	Mx, My, Fz	TG405	Denton	11/12/2024
		Lower	Mx, My, Fz	AG368	Denton	11/11/2024
	Left	Upper	Mx, My, Fz	TG475	Denton	11/12/2024
		Lower	Mx, My, Fz	AG504	Denton	11/12/2024
Foot Accelerometers	Right	Rear	X	T22486	Endevco	11/19/2024
			Z	P97382	Endevco	11/19/2024
		Front	Z	P82120	Endevco	11/19/2024
	Left	Rear	X	T16468	Endevco	11/19/2024
			Z	T32154	Endevco	11/19/2024
		Front	Z	T32190	Endevco	11/19/2024
Seat Belt Load Cells		Lap				
		Shoulder				

TABLE 2 – FRONT PASSENGER DUMMY INSTRUMENTATION

Instrument Location			Axis	Hybrid III 5 th S/N 142		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers	Primary		X	P94799	Endevco	10/29/2024
			Y	P94800	Endevco	10/29/2024
			Z	P94801	Endevco	10/29/2024
	Redundant		X	P94802	Endevco	10/29/2024
			Y	P94803	Endevco	10/29/2024
			Z	P97377	Endevco	10/29/2024
Head Angular Rate Sensors			X	ARS7413	DTS	7/31/2024
			Y	ARS7421	DTS	7/31/2024
			Z	ARS7423	DTS	7/31/2024
Upper Neck Load Cell		Fx, Fy, Fz Mx, My, Mz	NG2203	Denton	1/20/2025	
Chest Accelerometers	Primary		X	P88719	Endevco	10/29/2024
			Y	P94785	Endevco	10/29/2024
			Z	P94793	Endevco	10/29/2024
	Redundant		X	P95322	Endevco	10/29/2024
			Y	P95370	Endevco	10/29/2024
			Z	T30901	Endevco	10/29/2024
Chest Potentiometer		X	142	Humanetics	10/29/2024	
Pelvis Accelerometers			X	P94798	Endevco	10/29/2024
			Y	P82646	Endevco	10/29/2024
			Z	P97705	Endevco	10/29/2024
Femur Load Cells	Right	Primary	Z	FG126P	Denton	10/29/2024
		Redundant	Z	FG126R	Denton	10/29/2024
	Left	Primary	Z	FG127P	Denton	10/29/2024
		Redundant	Z	FG127R	Denton	10/29/2024
Tibia Load Cells	Right	Upper	Mx, My, Fz	TG408	Denton	1/17/2025
		Lower	Mx, My, Fz	AG116	Denton	1/17/2025
	Left	Upper	Mx, My, Fz	TG480	Denton	1/17/2025
		Lower	Mx, My, Fz	AG502	Denton	1/17/2025
Foot Accelerometers	Right	Rear	X	P94795	Endevco	10/29/2024
			Z	P94796	Endevco	10/29/2024
		Front	Z	P94797	Endevco	10/29/2024
	Left	Rear	X	P83167	Endevco	10/29/2024
			Z	P83168	Endevco	10/29/2024
		Front	Z	P83169	Endevco	10/29/2024
Seat Belt Load Cells		Lap				
		Shoulder				

TABLE 3 – VEHICLE INSTRUMENTATION

Instrument Location			Axis	Serial Number	Manufacturer	Calibration Date
Crossmember / Rear Seat Accelerometers	Left	Primary	X	T45278	Endevco	2/9/2025
			Z	T43930	Endevco	2/9/2025
		Redundant	X	T43929	Endevco	2/9/2025
	Right	Primary	X	T43947	Endevco	2/7/2025
			Z	T44023	Endevco	2/2/2025
		Redundant	X	T44012	Endevco	2/6/2025
Engine Accelerometers		Top	X	T43949	Endevco	2/2/2025
		Bottom	X	T45284	Endevco	2/2/2025