REPORT NUMBER: SideNCAPPole-MGA-21-026

NEW CAR ASSESSMENT PROGRAM (NCAP)
Side Impact Pole Test

TOYOTA MOTOR MANUFACTURING, INDIANA, INC.
2021 Toyota Sienna Hybrid XLE Minivan
NHTSA No.: O20215109

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: March 5, 2021

Final Report Date: June 22, 2021

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NRM-100
1200 New Jersey Ave, SE
Room W43-410
Washington, DC 20590

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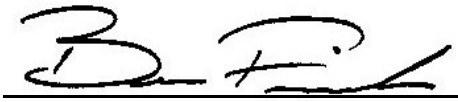
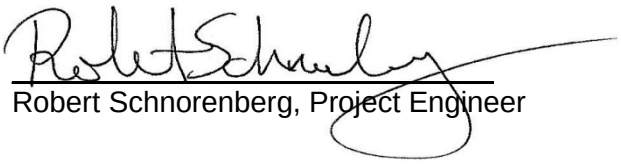
Prepared by: 
Ben Fischer, Project Manager

Approved by: 
Robert Schnorenberg, Project Engineer

Approval Date: June 22, 2021

FINAL REPORT ACCEPTANCE BY OCWS:

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

_____
COR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

TECHNICAL REPORT DOCUMENTATION PAGE

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7. Author(s) Ben Fischer, Project Manager	**8. Performing Organization Report No.** SideNCAPPole-MGA-21-026
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105	**10. Work Unit No.**
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15. Supplementary Notes

16. Abstract

A 32.20 km/h, 75° oblique impact Side NCAP Test was conducted on the subject 2021 Toyota Sienna Hybrid XLE Minivan in accordance with the specifications of the Office of Crashworthiness Standards Side NCAP Pole Laboratory Test Procedure for the generation of consumer information on vehicle side pole crash protection. The test was conducted at the MGA Research Corporation facility in Burlington, Wisconsin on March 5, 2021.

The impact velocity was 32.31 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21.1°C. The test vehicle post-test maximum crush was 297 mm at level 3. The test vehicle's performance was as follows:

Measurement Description	Units	Driver ATD (SID-IIs)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	371
Resultant Lower Spine Acceleration	g	82	31
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2220
Maximum Thoracic Rib Deflection	mm	38*	18
Maximum Abdomen Rib Deflection	mm	45*	19

*Proposed IARV

The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite door(s) did not open during the side impact event.

17. Key Words	18. Distribution Statement
New Car Assessment Program (NCAP) Side Impact Pole Part 572V SID-IIs	Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division 1200 New Jersey Ave, SE Washington, DC 20590

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SECTION 1
PURPOSE AND SUMMARY OF TEST

PURPOSE

This side pole impact test is part of the MY 2021 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-14-D-00353. The purpose of this test is to generate comparative side impact performance in a 2021 Toyota Sienna Hybrid XLE Minivan. The side impact test was conducted in accordance with the Office of Crashworthiness
Standard's Side NCAP Pole Laboratory Test Procedure, dated March 2020.

SUMMARY

A rigid pole side impact test was conducted on a 2021 Toyota Sienna Hybrid XLE Minivan. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 32.31 km/h. The test was conducted by MGA Research Corporation in Burlington, Wisconsin on March 5, 2021. Pre-test and post-test photographs of the test vehicle and side impact dummy (SID-IIs) are included in this report.

One Part 572V (SID-IIs) dummy was placed in the driver designated seating position according to instructions specified in the OCWS Side NCAP Pole Laboratory Test Procedure dated March 2020. Camera locations and other pertinent camera information are included in this report.

The Part 572V (SID-IIs) dummy was instrumented accordingly:

Primary and Redundant Head CG Triaxial Accelerometers
Head Triaxial Angular Rate Sensors
Thorax Upper, Middle, and Lower Rib Displacement Potentiometers
Abdomen Upper Rib and Lower Rib Displacement Potentiometers
Lower Spine (T12) Triaxial Accelerometers
Iliac Load Cell
Acetabulum Load Cell

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

Injury readings for the SID-IIs dummy were recorded as follows:

Measurement Description	Units	Driver ATD (SID-IIs)	
		Threshold	Result
Head Injury Criteria (HIC_{36})		1000	371
Resultant Lower Spine Acceleration	g	82	31
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2220
Maximum Thoracic Rib Deflection	mm	38*	18
Maximum Abdomen Rib Deflection	mm	45*	19

*Proposed IARV

Supplemental restraint information is given below:

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

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

GENERAL COMMENTS

Left Lower B-Post Y was not installed.
Left Mid B-Post Y was not installed.
Load Cell Pole #8 Fy recorded no valid data.

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: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20215109	Traction Control System (TCS)	Yes
Model Year	2021	Auto-Leveling System	No
Make	Toyota	Automatic Door Locks (ADL)	Yes
Model	Sienna XLE	Power Window Auto-Reverse	Yes
Body Style	Minivan	Other Optional Feature	No
VIN	5TDYRKEC9MS004252	Driver Front Airbag	Yes
Body Color	Predawn Gray Mica	Driver Curtain Airbag	Yes
Odometer Reading (km/mi)	18 km / 11 mi	Driver Head/Torso Airbag	No
Engine Displacement (L)	2.5 L	Driver Torso Airbag	No
Type/No. Cylinders	Inline 4	Driver Torso/Pelvis Airbag	Yes
Engine Placement	Lateral	Driver Pelvis Airbag	No
Transmission Type	Automatic	Driver Knee Airbag	Yes
Transmission Speeds	CVT	Rear Pass. Curtain Airbag	Yes
Overdrive	Yes	Rear Pass. Head/Torso Airbag	No
Final Drive	FWD	Rear Pass. Torso Airbag	No
Roof Rack	No	Rear Pass. Torso/Pelvis Airbag	Yes
Sunroof/T-Top	Yes	Rear Pass. Pelvis Airbag	No
Running Boards	No	Driver Seat Belt Pretensioner	Yes
Tilt Steering Wheel	Yes	Rear Pass. Seat Belt Pretensioner	No
Power Seats	Yes	Driver Load Limiter	Yes
Anti-Lock Brakes (ABS)	Yes	Rear Pass. Load Limiter	No
		Other Safety Restraint	N/A

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

DATA FROM CERTIFICATION LABEL

Manufactured By	TOYOTA MOTOR MANUFACTURING, INDIANA, INC.
Date of Manufacture	11/20
Vehicle Type	MPV

GVWR (kg)	2800
GAWR Front (kg)	1590
GAWR Rear (kg)	1590

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	2	3	7	
Capacity Weight (VCW) (kg)				570	(A)
DSC x 68.04 kg				476	(B)
Rated Cargo and Luggage Weight (RCLW) (kg)				88	(A-B)

* Rated Cargo and Luggage Weight (RCLW) reduced by 6 kg to account for Load Carrying Capacity Reduction Label.

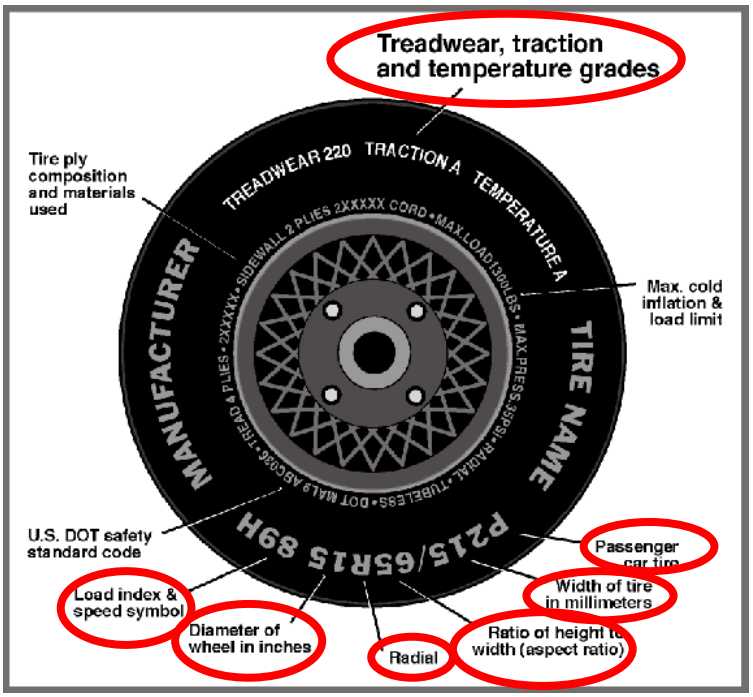
VEHICLE SEAT TYPE

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

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

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	235/65R17	235/65R17
Tire Size on Vehicle	235/65R17	235/65R17
Tire Manufacturer	Falken	Falken
Tire Model	ZIEX ZE001A A/S	ZIEX ZE001A A/S
Treadwear	380	380
Traction	B	B
Temperature Grade	B	B
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	103T	103T
Tire Material	Rubber	Rubber
DOT Safety Code Left	1DAL8 3M2R 1920	1DAL8 3M2R 1920
DOT Safety Code Right	1DAL8 3M2R 1920	1DAL8 3M2R 1920

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

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

TEST PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	285	285	290	285
Tire Placard	kPa	240	240	240	240
Owner's Manual	kPa	240	240	240	240
As Tested	kPa	240	240	240	240

TEST AXLE VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	586.0	451.0		616.5	502.5		601.5	520.0	
Right	kg	553.5	472.5		579.0	497.5		556.5	525.0	
Ratio	%	55.2%	44.8%		54.5%	45.5%		52.6%	47.4%	
Totals	kg	1139.5	923.5	2063.0	1195.5	1000.0	2195.5	1158.0	1045.0	2203.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	2063.0	(A)
Actual Weight of 1 P572 ATD (SID-IIs) Used	kg	52	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	88	(C)
Calculated Test Vehicle Target Weight (TVTW)	kg	2203.0	(A+B+C)

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

TEST VEHICLE ATTITUDES AND CG

	Units	As Delivered	As Tested	Fully Loaded	Meets Requirement
Driver Door Sill Angle (front-to-back)*	deg	0.1	0.4	0.4	Yes
Front Pass. Door Sill Angle (front-to-back)*	deg	0.1	0.4	0.4	Yes
Front Bumper Angle (left-to-right)**	deg	-0.2	-0.2	-0.2	Yes
Rear Bumper Angle (left-to-right)**	deg	-0.2	-0.2	-0.3	Yes
Vehicle CG (Aft of Front Axle)	mm	1374	1398	1456	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	5	17	16	

* ND=Nose Down (-), NU=Nose Up (+) ** LD=Left Down (-), LU=Left Up (+)
*** The "As Tested" vehicle attitude measurements must be equal to or between the "As Delivered" and "Fully Loaded" vehicle attitude measurements.

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Units	Weight
Weight of Ballast Added	kg	8
Components Removed: none	kg	

Test height adjustable suspension setting, if applicable:	Not Applicable

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

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

TEST SURFACE MARKINGS

	Distance from 75° Impact Location Line (mm)
Fore 25 mm Target	995
Aft 25 mm Target	975

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

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

SEAT POSITIONING

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

SCRL ANGLE RANGE

Seat	SCRL (°)		
	Max	Min	Mid
Driver Seat	17.1	6.7	11.9
Front Passenger Seat	Fixed	Fixed	Fixed
Front Center Seat			
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed

SEAT HEIGHT AND ANGLE

Seat	As-Tested SCRL Angle (Mid) (°)	As-Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rear-Most	Mid	Forward-Most
Driver Seat	11.9	28	Max	55	55	55
			Mid	28	28	28
			Min	0	0	0
Front Passenger Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Front Center Seat			Max			
			Mid			
			Min			
Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed

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

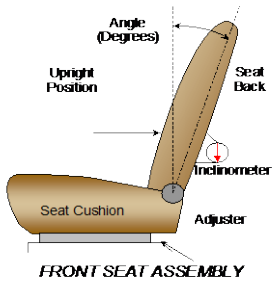
Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

SEAT FORE/AFT POSITIONS

Seat	Total Fore/Aft Travel		Test Position from Forward-Most Position	
	mm	Detents (1st as 1)	mm	Detent (1st as 0)
Driver Seat	240		0	
Front Passenger Seat	240		0	
Front Center Seat				
Struck Side Rear Seat	510	33	510	32
Non-Struck Side Rear Seat	510	33	510	32
Rear Center Seat				

SEAT BACK ANGLE ADJUSTMENT

The driver's seat back is positioned such that the dummy's head is level. The front center and front passenger's seat backs are positioned in a similar manner as the driver's seat back. The struck-side rear passenger seat back is positioned in accordance with the information provided by the manufacturer on S1 – Vehicle Setup Information for the 5th percentile female dummy in a Side NCAP MDB test. The rear center and non-struck side rear passenger's seat back is set to match the struck-side rear seat back.



Seat	Total Seat Back Angle Range		Test Position from Vertical	
	Degrees	Detents (1st as 1)	Degrees	Detent (1st as 0)
Driver Seat	51.4		-4.2	
Front Passenger Seat	51.6		-4.2	
Front Center Seat				
Struck Side Rear Seat	22.2	12	-1.1	0
Non-Struck Side Rear Seat	22.2	12	-1.1	0
Rear Center Seat	N/A	N/A	N/A	N/A

All seat back angles measured on outboard headrest post.

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on S1 – Vehicle Setup Information.

	Total # of Positions	Placed in Position #
Driver Seat	4	0 (Uppermost as 0)

HEAD RESTRAINT ADJUSTMENT

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

	Total # of Positions	Placed in Position #
Driver Seat	3	0 (Lowest as 0) / Fixed Fore-Aft

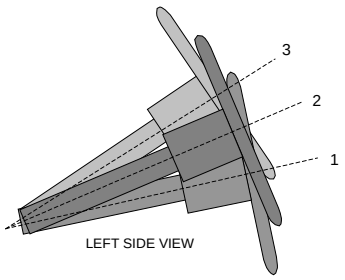
DATA SHEET NO. 2 (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

STEERING COLUMN ADJUSTMENT

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

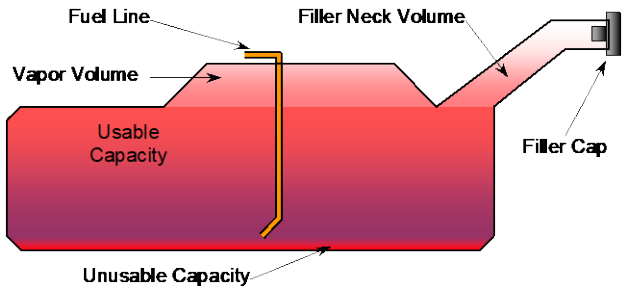
	Wheel Angle (°)	Fore/Aft Position (mm)
Lowermost, Position 1	65.6	
Geometric Center, Position 2	63.3	
Uppermost, Position 3	61.0	
Telescoping Steering Wheel Travel		50
Test Position	63.3	25



STEERING COLUMN ASSEMBLY

FUEL PUMP

The vehicle is equipped with an electronic fuel pump. The filler neck is located on the driver's side.



VEHICLE FUEL TANK ASSEMBLY

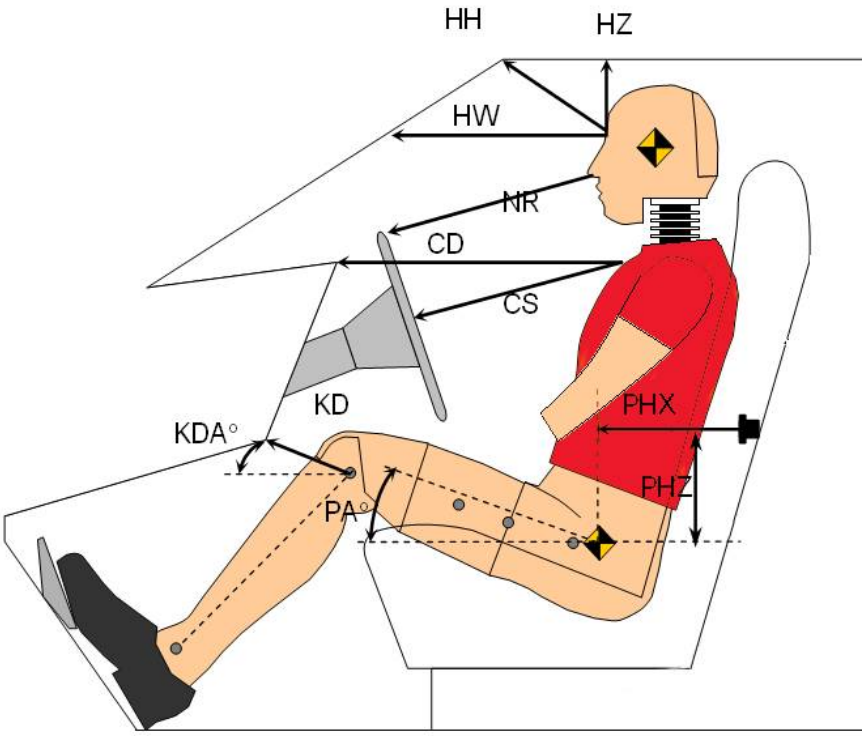
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of Standard Tank (see S1 – Vehicle Setup Information)	67.4
Usable Capacity of Optional Tank (see S1 – Vehicle Setup Information)	
Usable Capacity of Standard Tank as Specified in Owner's Manual	67.4
Usable Capacity of Optional Tank as Specified in Owner's Manual	
93% of Usable Capacity	62.7
Actual Amount of Solvent Used	62.8
1/3 of Usable Capacity	22.5

Is the actual amount of solvent used in the test equal to 93% ± 1%
of the Usable Capacity stated in S1 – Vehicle Setup Information? **YES**

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20215109
Test Date: 3/5/2021

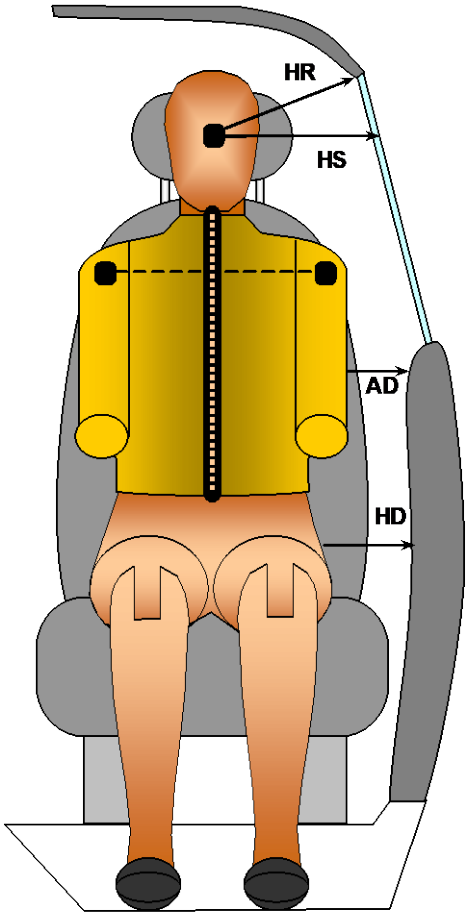


LEFT SIDE VIEW

Code	Measurement Description	Driver	
		Length (mm)	Angle (°)
HH	Head to Header	300	
HW	Head to Windshield	666	
HZ	Head to Roof Liner	201	
NR	Nose to Rim/Seat Back	256	
CD	Chest to Dashboard/Seat Back	418	
CS	Chest to Steering Wheel	186	
KDL / KDAL	Left Knee to Dash/Seat Back	124	40.3
KDR / KDAL	Right Knee to Dash/Seat Back	121	34.9
PAX	Pelvic Tilt Angle X		21.0
PAY	Pelvic Tilt Angle Y		0.0
PHX	Hip Point to Striker (X-Axis)	348	
PHZ	Hip Point to Striker (Z-Axis)	173	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20215109
Test Date: 3/5/2021

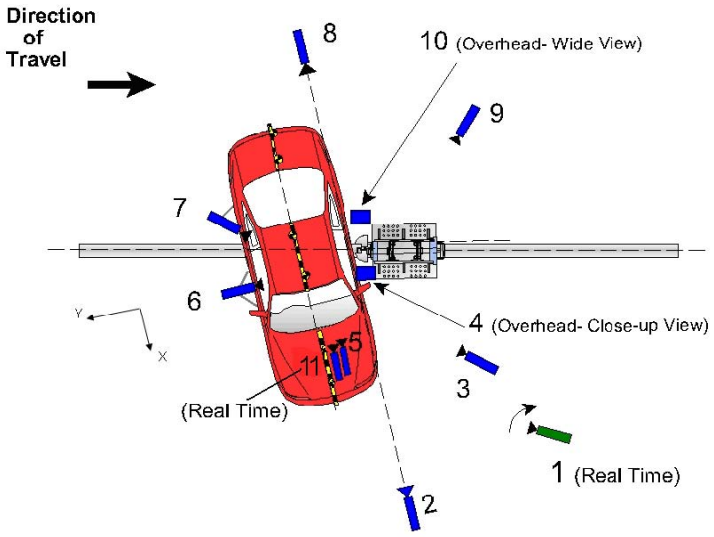


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver
		Length (mm)
HR	Head to Side Header	246
HS	Head to Side Window	394
AD	Arm to Door	186
HD	Hip Point to Door	170

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021



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

No.	Camera View	Coordinates* (mm)			Lens (mm)	Frame Rate (fps)
		X	Y	Z		
1	Real-Time Pan View					30
2	Front Ground Level	6500	-185	-1920	24	1000
3	Impact Side 45° Forward	3685	-1380	-1930	12	1000
4	Overhead Closeup	0	0	-6700	85	1000
5	Onboard – Driver Front				16	1000
6	Onboard – Driver Side				8	1000
7	Onboard – Driver Rear				8	1000
8	Rear Ground Level	-6590	-45	-1950	24	1000
9	Impact Side 45° Rearward	-3100	-3005	-1935	12	1000
10	Overhead Wide View	0	950	-6540	12	1000
11	Real-Time Dummy Front View					30

*All measurements accurate to ±6 mm
Note: Vehicle was positioned at a 75° angle to the rigid pole.

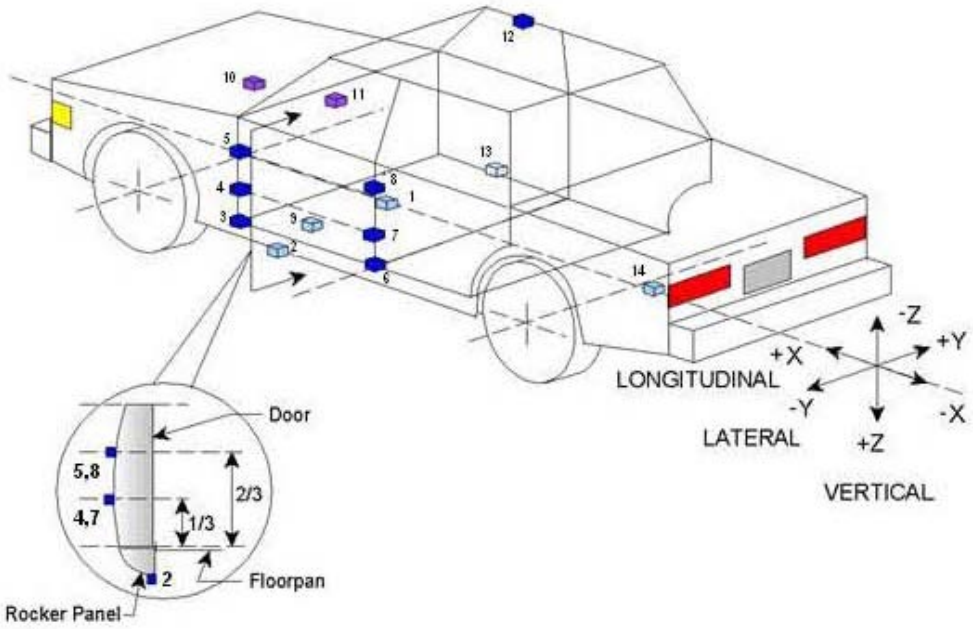
Explain why camera(s) did not operate as intended: None

INSTRUMENTATION

	Number of Channels
Driver Dummy	19
Vehicle Structure	16
Pole Load Cells	8
Total	43

DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021



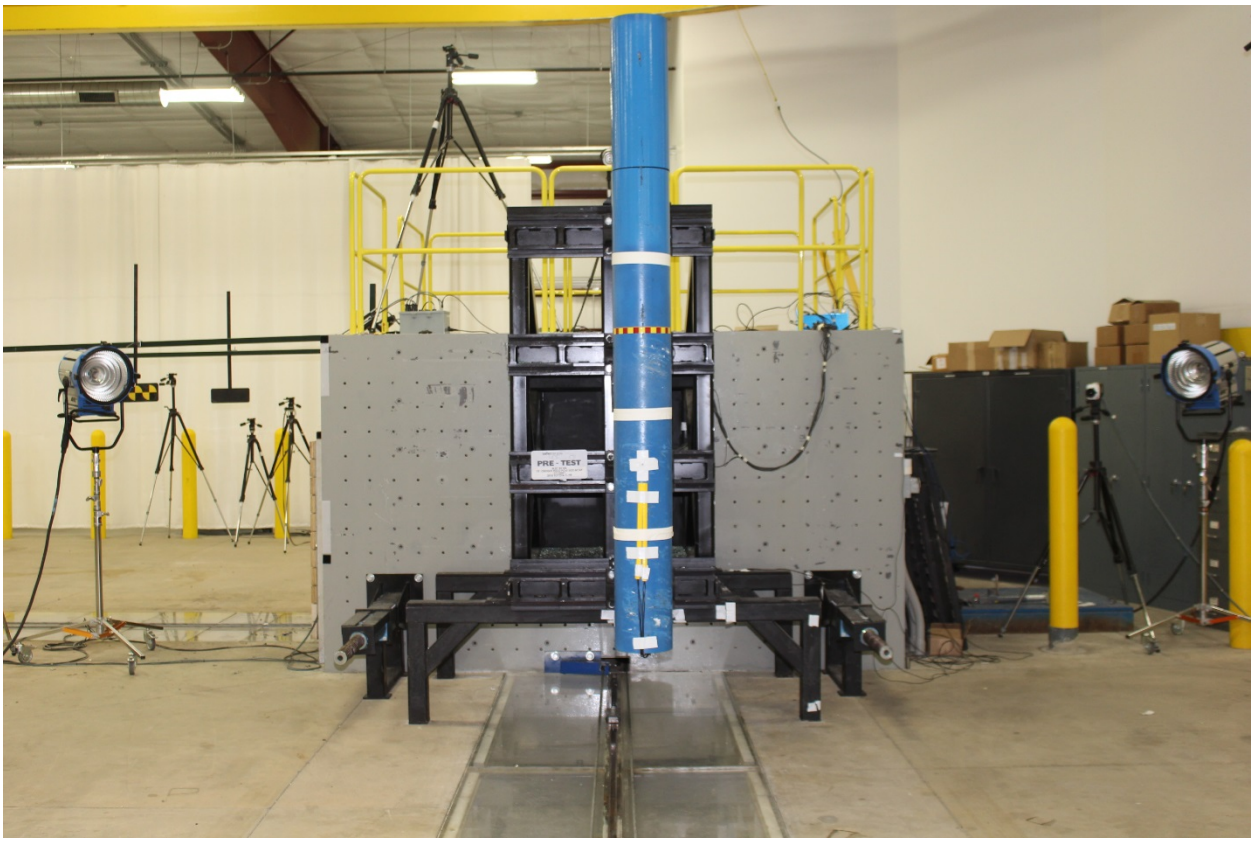
TEST VEHICLE ACCELEROMETER LOCATIONS

No.	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2755	0	-338
2	Left Floor Sill	3465	-827	-237
3	A Pillar Sill	3701	-827	-232
4	A Pillar Low	3691	-940	-668
5	A Pillar Mid	3724	-932	-903
6	B Pillar Sill	2651	-827	-248
7	B Pillar Low			
8	B Pillar Mid			
9	Driver Seat Track	2739	-411	-447
10	Engine Top	4413	63	-856
11	Firewall	4293	-46	-1024
12	Right Roof	2707	502	-1719
13	Right Floor Sill	3465	827	-242
14	Rear Floorpan	1205	107	-540

Reference: X – Test Vehicle Rear Bumper (+forward)
Y – Test Vehicle Centerline (+ to right)
Z – Ground Plane (+ down)

DATA SHEET NO. 7
RIGID POLE LOAD CELL DATA

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20215109
Test Date: 3/5/2021



254 mm Diameter Rigid Pole

Load Cell Locations	
ID	**Height from Test Surface (mm)**
1	182
2	470
3	698
4	986
5	1212
6	1641
7	1854
8	2053

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Driver Dummy (SID-IIs)
Face	Curtain Airbag
Top of Head	Curtain Airbag
Left Side of Head	Curtain Airbag
Back of Head	Curtain Airbag, Headrest
Left Shoulder	Seatback
Upper Torso	Seatback
Lower Torso	Seatback
Left Hip	Side Torso/Pelvis Airbag, Seatback, Seat Cushion
Left Knee	None

POST-TEST DOOR PERFORMANCE

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

POST-TEST SEAT PERFORMANCE

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

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	No Separation
Sill Separation	No Separation
Windshield Damage	Cracked
Side Window Damage	LF window broken
Other Notable Effects	None

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

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

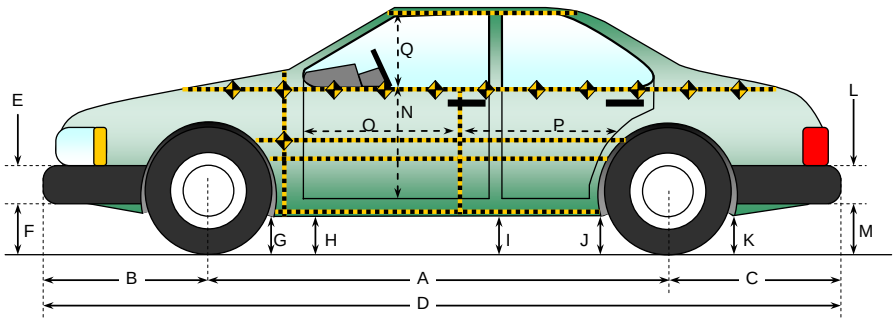
Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	Yes	No		
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	Yes	Yes
Side Airbag (Other)				
Seat Belt Pretensioner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

SPEED, ANGLE AT IMPACT, AND IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm		1058
Actual Impact Point (Aft of Front Axle)	mm		1062
Horizontal Offset (+forward / -rearward)	mm	+/- 38 of Intended Impact Point	-4
Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion	degrees	75 +/- 3	75.3
Trap No. 1 Velocity (Primary)	km/h	31.4 to 33.0	32.31
Trap No. 2 Velocity (Redundant)	km/h	31.4 to 33.0	32.34

DATA SHEET NO. 9
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20215109
Test Date: 3/5/2021



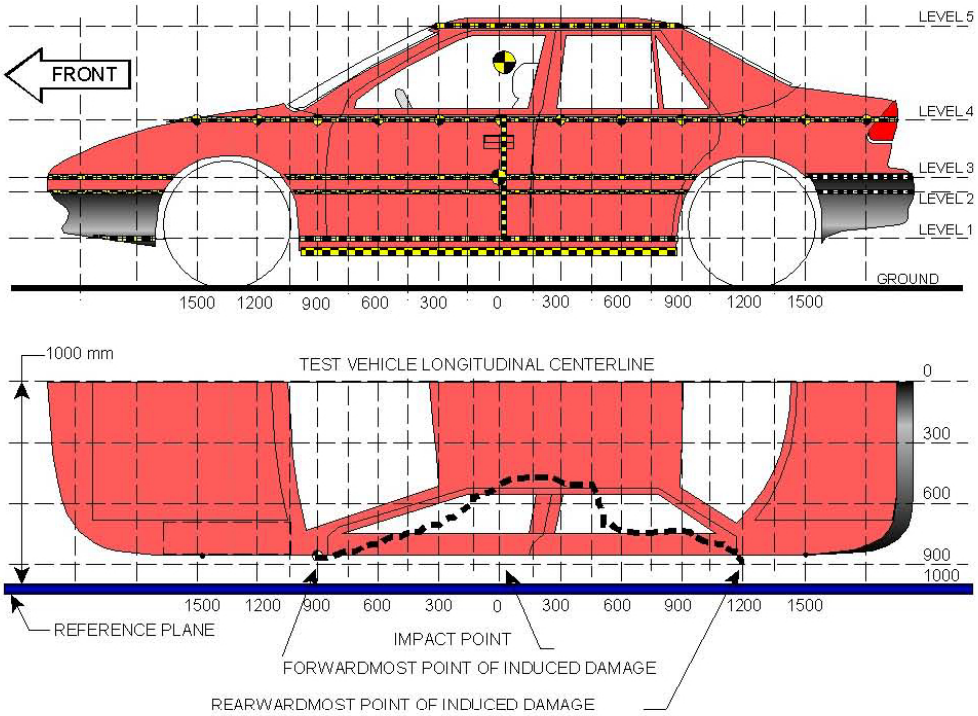
All measurements in (mm) with tolerance of ± 3 mm
LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	3070	3031	39
B	Front Axle to FSOV	952	992	-40
C	Rear Axle to RSOV	1152	1147	5
D	Total Vehicle Length at Centerline	5174	5170	4
E	Front Bumper Thickness	134	134	0
F	Front Bumper Bottom to Ground	225	243	-18
G	Sill Height at Front Wheel Well	219	210	9
H	Sill Height at Front Door Leading Edge	219	211	8
I	Sill Height at B-Pillar	214	190	24
J1	Sill Height at Rear Wheel Well	239	230	9
J2	Pinch Weld Height at Rear Wheel Well	238	228	10
K	Sill Height Aft of Rear Wheel Well	289	267	22
L	Rear Bumper Thickness	108	108	0
M	Rear Bumper Bottom to Ground	357	311	46
N	Sill Height to Bottom of Front Window Sill	889	890	-1
O	Front Door Leading Edge to Impact CL	643	540	103
P	Rear Door Trailing Edge to Impact CL	1594	1528	66
Q	Front Window Opening	502	454	48
R	Right Side Length	4360	4376	-16
S	Left Side Length	4360	4297	63
T	Vehicle Width at B-Pillars	2004	1993	11
U	Front Wheel Track Width	1722		
V	Rear Wheel Track Width	1726		

DATA SHEET NO. 10
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021



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

MAXIMUM EXTERIOR CRUSH MEAUREMENTS

Level	Measurement Description	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	280	240	0
2	Mid Door	694	293	0
3	Occupant H-Point	748	297	0
4	Window Sill	1064	259	0
5	Window Top	1655	59	0

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

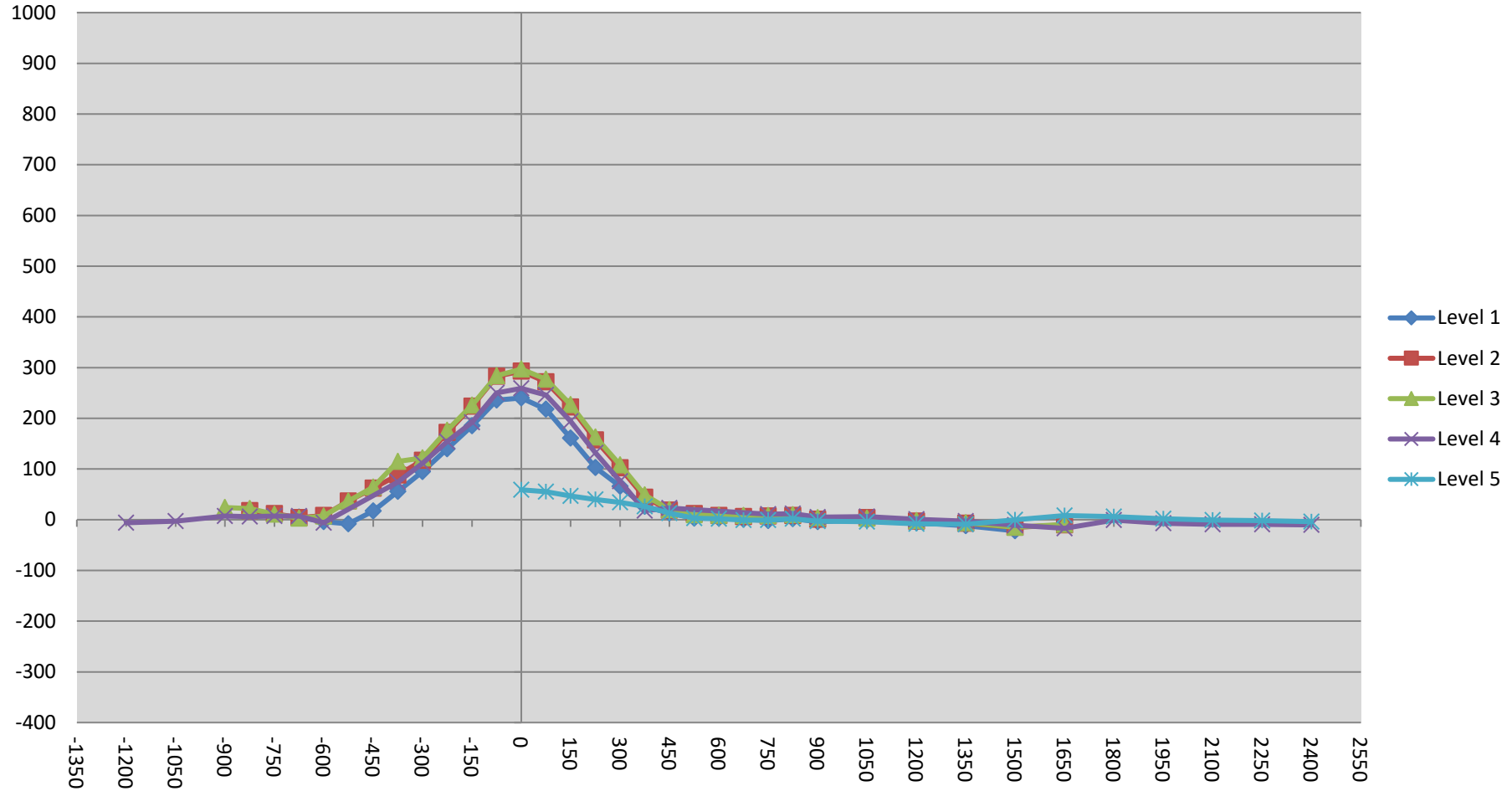
Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

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

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-2700															
-2550															
-2400															
-2250															
-2100															
-1950															
-1800															
-1650															
-1500															
-1350															
-1200				211					205					-6	
-1050				199					196					-3	
-900			102	190				126	197				24	7	
-825		104	102	188			122	124	194			18	22	6	
-750		103	105	185			115	116	192			12	11	7	
-675	141	105	106	183		146	109	109	190		5	4	3	7	
-600	142	106	106	183		138	114	113	177		-4	8	7	-6	
-525	142	107	106			134	144	143			-8	37	37		
-450	142	107	105			159	169	169			17	62	64		
-375	142	107	105	170		198	195	220	244		56	88	115	74	
-300	144	106	105	165		239	223	227	276		95	117	122	111	
-225	144	107	105	160		284	279	281	314		140	172	176	154	
-150	145	107	105	156		330	331	331	348		185	224	226	192	
-75	144	107	105	151		380	390	389	401		236	283	284	250	
0	144	108	106	147	426	384	401	403	406	485	240	293	297	259	59
75	145	109	106	143	414	363	381	383	389	469	218	272	277	246	55
150	145	109	106	141	408	306	331	333	335	455	161	222	227	194	47
225	145	111	107	147	404	248	268	270	279	444	103	157	163	132	40
300	147	111	108	147	400	213	213	216	223	434	66	102	108	76	34
375	148	113	109	140	398	174	157	158	158	424	26	44	49	18	26
450	148	114	111	131	395	161	133	131	154	408	13	19	20	23	13
525	149	116	112		394	152	128	122		397	3	12	10		3
600	150	120	114		392	153	128	123		394	3	8	9		2
675	152	123	116		391	153	129	124		390	1	6	8		-1
750	153	126	118	132	391	151	133	126	143	390	-2	7	8	11	-1
825	154	129	121	124	391	156	137	131	136	393	2	8	10	12	2
900	154	134	125	124	391	150	135	129	129	388	-4	1	4	5	-3
1050	157	141	134	126	393	156	145	137	132	389	-1	4	3	6	-4
1200	161	147	144	127	396	155	144	142	128	388	-6	-3	-2	1	-8
1350	147	130	136	130	398	135	123	130	127	389	-12	-7	-6	-3	-9
1500	147	118	120	134	403	125	103	105	123	403	-22	-15	-15	-11	0
1650		107	107	140	410		97	98	123	418		-10	-9	-17	8
1800				149	418				148	424				-1	6
1950				159	429				152	431				-7	2
2100				172	444				163	443				-9	-1
2250				186	462				177	460				-9	-2
2400				202	493				192	489				-10	-4
2550															
2700															

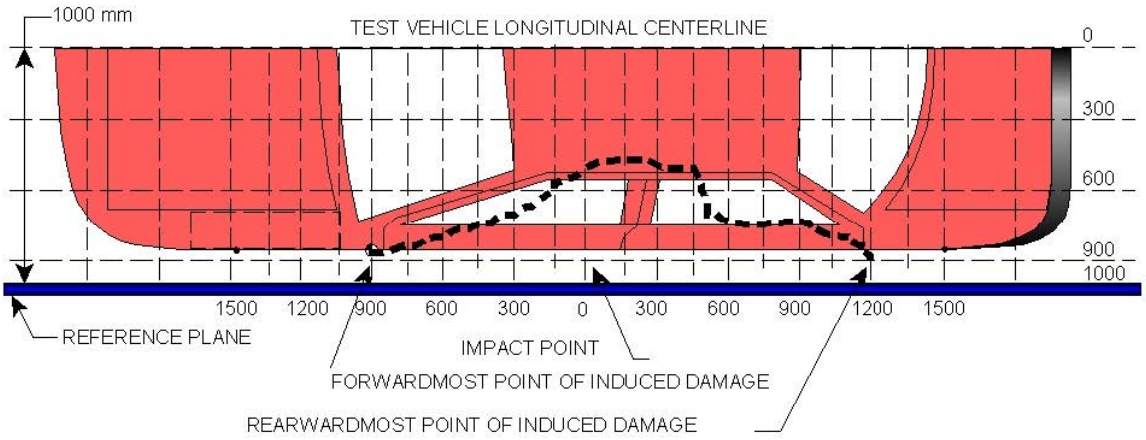
DATA SHEET NO. 10 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20215109
Test Date: 3/5/2021



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

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021



VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point (mm)	Level	Pre-Test (mm)	Post-Test (mm)	Max. Static Crush (mm)
1	430	3	110	113	3
2	216	3	107	272	165
3	2	3	106	403	297
4	-212	3	105	291	186
5	-426	3	105	182	77
6	-640	3	106	76	-30

DATA SHEET NO. 11
FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20215109
Test Date: 3/5/2021

Test Time: 2:15 pm
Temperature: 21.1°C

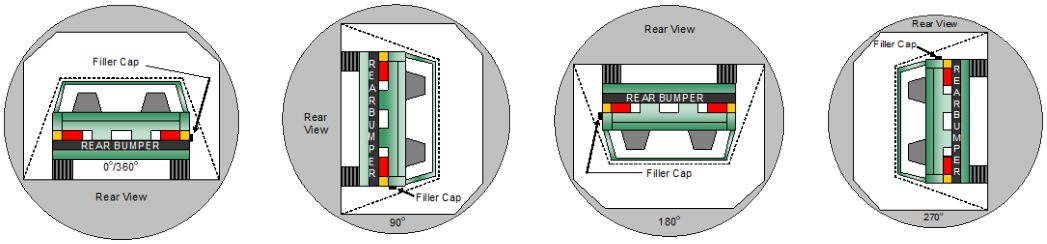
A. From impact until vehicle motion ceases: (Maximum Allowable = 1 ounce) 0.0 oz.

B. For the 5 minute period after motion ceases: (Maximum Allowable = 5 ounces) 0.0 oz.

C. For the following 25 minutes: (Maximum Allowable = 1 ounce / minute) None

D. Spillage Details: None

FMVSS 301 STATIC ROLLOVER DATA



0°/360° 90° 180° 270°

ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	111	300	411
90° to 180°	111	300	411
180° to 270°	107	300	407
270° to 360°	111	300	411

FMVSS 301 ROLLOVER SPILLAGE TABLE (UNITS IN OUNCES)

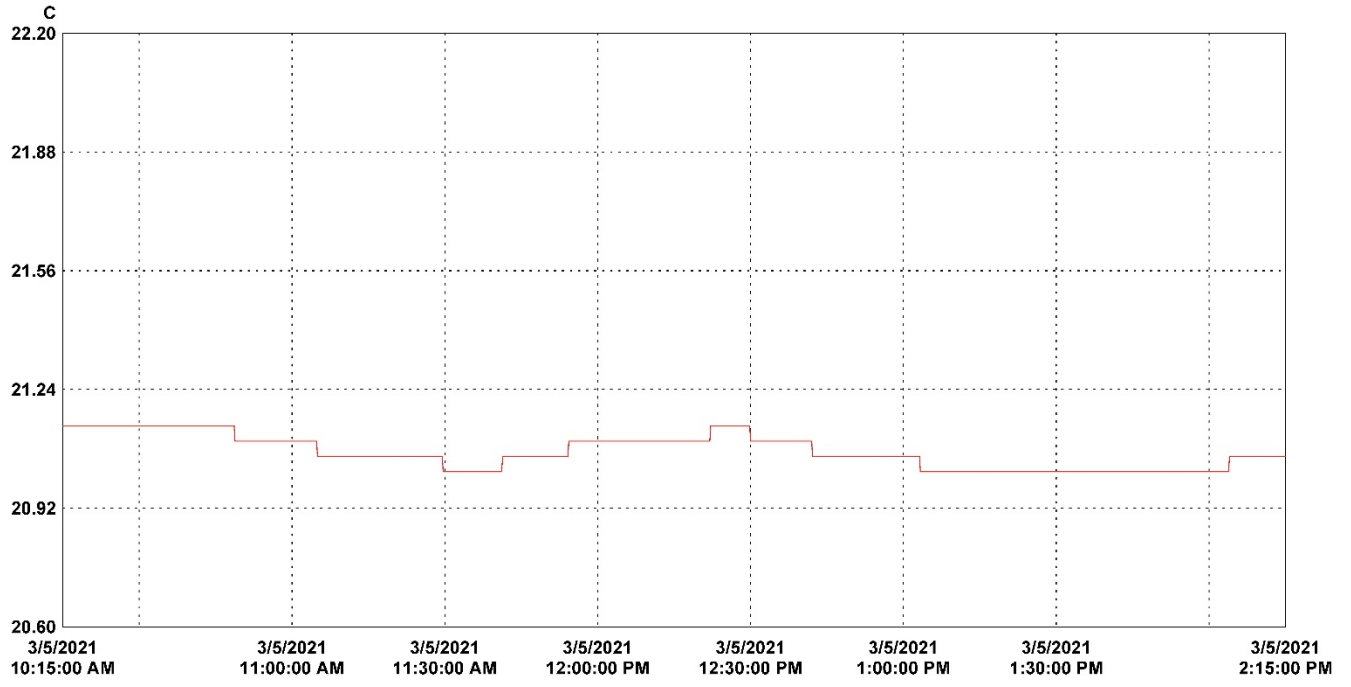
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0.0	0.0	0.0	
90° to 180°	0.0	0.0	0.0	
180° to 270°	0.0	0.0	0.0	
270° to 360°	0.0	0.0	0.0	

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

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

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	12032257	VSC_South_Hall	1		21.14	21.07	21.02	C	Temperature	12032257_VSC_South_Hall.spl

DATA SHEET NO. 305-1
GENERAL TEST AND VEHICLE PARAMETER DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

ELECTRIC VEHICLE PROPULSION SYSTEM

	Units	Observations and Conclusions
Type of Electric Vehicle		Gas-Electric Hybrid
Propulsion Battery Type		Ni-MH
Nominal Voltage	V	288
Physical Location of Automatic Propulsion Battery Disconnect		Physically located within the Hybrid Battery system
Auxiliary Battery Type		Lead-Acid

PROPULSION BATTERY SYSTEM DATA

	Units		Observations and Conclusions
Electrolyte Fluid Type			KOH (Potassium Hydroxide)
Electrolyte Fluid Specific Gravity	g/L		1.3
Electrolyte Fluid Kinematic Viscosity	cSt		2.3
Electrolyte Fluid Color			Clear
Propulsion Battery Coolant Type, Color, Specific Gravity (if applicable)			Air-Cooled
Location of Battery Modules		X	Inside Passenger Compartment
			Outside Passenger Compartment
			The high-voltage battery is located below the driver and front passenger seats.

PROPULSION BATTERY STATE OF CHARGE

For all battery types:	
Voltage range corresponding to **useable energy** of the battery:	
Minimum State of Charge	
Maximum State of Charge	
95% of Maximum State of Charge	
Test Voltage - No less than 95% of maximum State of Charge	
For batteries that are rechargeable ONLY by an energy source on the vehicle:	
Voltage range corresponding to **useable energy** of the battery:	
Minimum State of Charge	240 V
Maximum State of Charge	330 V
Test Voltage – Maximum practicable State of Charge within Normal Operating Range	323.8 V

DATA SHEET NO. 305-2
PRE-IMPACT DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2021 Toyota Sienna Hybrid XLE Minivan	NHTSA No.:	O20215109
Test Program:	NCAP Side Pole Impact Test	Test Date:	3/5/2021

VEHICLE CHASSIS GROUND POINT(S) LOCATION(S)

Details of Vehicle Chassis Ground Point(s) & Location(s)	Chassis grounding bolt near high-voltage battery pack

PROPULSION BATTERY SYSTEM

Details of Electric Energy Storage/Conversion System Test Points	Connected at + and – terminal ends of propulsion system
Additional Comments	None

DATA SHEET NO. 305-3
PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENTS AND CALCULATIONS
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

VOLTMETER INFORMATION

	Units	Observations and Conclusions
Make		Fluke
Model		289
Serial Number		32910090
Internal Impedance Value	MΩ	> 10 MΩ < 100 pF
Resolution	V	0.001
Last Calibration Date		11/19/2020

PROPULSION BATTERY VOLTAGE

Measurement shall be made with Energy Storage/Conversion System connected to the vehicle propulsion system, and the vehicle in the "ready-to-drive" (propulsion system energized) position.

NOTE: If voltage measurement is not at the voltage or within the normal operating voltage range specified by the manufacturer, the battery must be charged.

Vb	V	323.8

ELECTRIC ISOLATION MEASUREMENTS
PROPULSION BATTERY TO VEHICLE CHASSIS

Vehicle chassis point(s) determined and supplied to contractor by COR.

V1	V	157.0
V2	V	157.9

PROPULSION BATTERY TO VEHICLE CHASSIS ACROSS RESISTOR

The known resistance Ro (in ohms) should be approximately 500 times the normal operating voltage of the vehicle (in volts) per SAE J1766.

Ro	Ω	158,200

V1' Pre-Impact	V	28.4
V2' Pre-Impact	V	22.5

DATA SHEET NO. 305-3 (CONTINUED)
PRE-IMPACT ELECTRICAL ISOLATION MEASUREMENTS AND CALCULATIONS
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle:	2021 Toyota Sienna Hybrid XLE Minivan	NHTSA No.:	O20215109
Test Program:	NCAP Side Pole Impact Test	Test Date:	3/5/2021

ELECTRICAL ISOLATION CALCULATIONS

NOTE: If measured voltage is zero and results in a division by zero, record “Zero Volts”.
This “zero voltage” condition is considered as being compliant.

Ri1 = Ro (1 + V2/V1) [(V1-V1’)/V1’]		
Ri1 Pre-Impact	Ω	1,436,819
Ri2 = Ro (1 + V1/V2) [(V2-V2’)/V2’]		
Ri2 Pre-Impact	Ω	1,898,599
Ri = The lesser of Ri1 and Ri2		
Ri Pre-Impact	Ω	1,436,819
Ri / Vb = Electrical Isolation Value / Nominal Battery Voltage		
Ri / Vb Pre-Impact	Ω	4,437

NOTE: The minimum Electrical Isolation Value is 500 Ω/V.

	Yes	No (Fail)
Is the measured Electrical Isolation Value ≥ 500 Ω/V?	X	
Additional Comments	None	

DATA SHEET NO. 305-4
POST-IMPACT DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

VOLTMETER INFORMATION

	Units	Observations and Conclusions
Make		Fluke
Model		289
Serial Number		32910090
Internal Impedance Value	MΩ	> 10 MΩ < 100 pF
Resolution	V	0.001
Last Calibration Date		11/19/2020

ELECTRICAL ISOLATION MEASUREMENTS

Vb Post-Impact	V	0.7

V1 Post-Impact	V	3.0	Impact Time	1	Minutes	55	Seconds
V2 Post-Impact	V	2.4		1	Minutes	59	Seconds
V1' Post-Impact	V	0.2		2	Minutes	8	Seconds
V2' Post-Impact	V	0.2		2	Minutes	3	Seconds

DATA SHEET NO. 305-4 (CONTINUED)
POST-IMPACT DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

ELECTRICAL ISOLATION CALCULATIONS

NOTE: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']							
Ri1 Post-Impact	Ω	3,986,640	Impact Time	2	Minutes	8	Seconds
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']							
Ri2 Post-Impact	Ω	3,915,450	Impact Time	2	Minutes	3	Seconds
Ri = The lesser of Ri1 and Ri2							
Ri Post-Impact	Ω	3,915,450	Impact Time	2	Minutes	3	Seconds
Ri / Vb = Electrical Isolation Value / Nominal Battery Voltage							
Ri / Vb Post-Impact	Ω	5,593,500	Impact Time	2	Minutes	8	Seconds

NOTE: The minimum Electrical Isolation Value is 500 Ω/V.

	Yes	No (Fail)
Is the measured Electrical Isolation Value ≥ 500 Ω/V?	X	
Additional Comments	None	

DATA SHEET NO. 305-4 (CONTINUED)
POST-IMPACT DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

PROPULSION BATTERY SYSTEM COMPONENTS

Describe any Propulsion Battery Module movement within the passenger compartment [Supply photographs as appropriate]:
Not Applicable

	Yes (Fail)	No
Has the Propulsion Battery Module moved within the passenger compartment?		X

Describe intrusion of an outside Propulsion Battery Component into the passenger compartment [Supply photographs as appropriate]:
No Intrusion

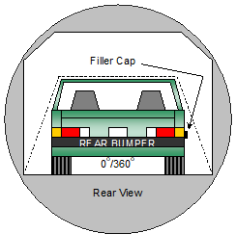
	Yes (Fail)	No
Has an outside Propulsion Battery Component intruded into the passenger compartment?		X

	Yes (Fail)	No
Is the Propulsion Battery Electrolyte Spillage visible in the passenger compartment?		X

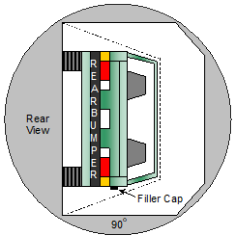
DATA SHEET NO. 305-5
STATIC ROLLOVER TEST DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan
Test Program: NCAP Side Pole Impact Test
NHTSA No.: O20215109
Test Date: 3/5/2021

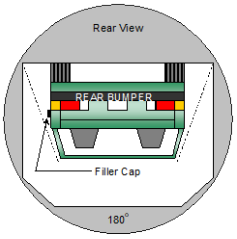
PROPULSION BATTERY SYSTEM COMPONENTS



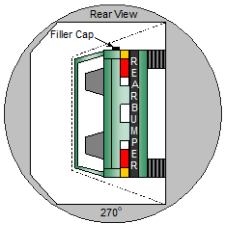
0°/360°



90°



180°



270°

PROPULSION BATTERY ELECTROLYTE COLLECTION TIME PERIOD

Test Phase	Rotation Time (spec. 1-3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0° - 90°	1	min	51	sec	5	min	6	min	51	sec	7	min
90° - 180°	1	min	51	sec	5	min	6	min	51	sec	7	min
180° - 270°	1	min	47	sec	5	min	6	min	47	sec	7	min
270° - 360°	1	min	51	sec	5	min	6	min	51	sec	7	min

TEST VEHICLE PROPULSION BATTERY ELECTROLYTE SPILLAGE

NOTE: The maximum allowable Propulsion Battery Electrolyte Spillage is 5.0 Liters.

Test Phase	Propulsion Battery Electrolyte Spillage (L)	Spillage Location
0° to 90°	0	Not Applicable
90° to 180°	0	Not Applicable
180° to 270°	0	Not Applicable
270° to 360°	0	Not Applicable
Total Spillage	0	

	Yes (Fail)	No
Is the total Propulsion Battery Electrolyte Spillage greater than 5.0 Liters?		X
Is the Propulsion Battery Electrolyte Spillage visible in the passenger compartment?		X

DATA SHEET NO. 305-5 (CONTINUED)
STATIC ROLLOVER TEST DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

VOLTMETER INFORMATION

	Units	Observations and Conclusions
Make		Fluke
Model		289
Serial Number		32910090
Internal Impedance Value	MΩ	> 10 MΩ < 100 pF
Resolution	V	0.001
Last Calibration Date		11/19/2020

ELECTRICAL ISOLATION MEASUREMENTS

Vb Post-Impact	V	0.7

Record V1, V2, V1', V2' voltage measurements at the start of each successive increment of 90°, 180°, 270°, and 360° of the static rollover test.

	Voltage	Units	Test Phase	Time			
V1	0.1	V	0°		min		sec
	0.1		90°	3		40	
	0.1		180°	3		31	
	0.1		270°	2		14	
	0.1		360°	2		10	
V2	0.1	V	0°		min		sec
	0.1		90°	3		43	
	0.1		180°	3		34	
	0.1		270°	2		17	
	0.1		360°	2		13	
V1'	0.0	V	0°		min		sec
	0.0		90°	3		50	
	0.0		180°	3		40	
	0.0		270°	2		24	
	0.0		360°	2		19	
V2'	0.0	V	0°		min		sec
	0.0		90°	3		46	
	0.0		180°	3		37	
	0.0		270°	2		21	
	0.0		360°	2		16	

DATA SHEET NO. 305-5 (CONTINUED)
STATIC ROLLOVER TEST DATA
FOR INDICANT FMVSS NO. 305 TESTING

Test Vehicle: 2021 Toyota Sienna Hybrid XLE Minivan NHTSA No.: O20215109
Test Program: NCAP Side Pole Impact Test Test Date: 3/5/2021

ELECTRICAL ISOLATION CALCULATIONS

NOTE: If measured voltage is zero and results in a division by zero, record "Zero Volts". This "zero voltage" condition is considered as being compliant.

	Voltage	Units	Test Phase	Time			
Ri1 = Ro (1 + V2/V1) [(V1-V1')/V1']							
Ri1	Zero Volts	Ω	0°		min		sec
	Zero Volts		90°	3		46	
	Zero Volts		180°	3		37	
	Zero Volts		270°	2		21	
	Zero Volts		360°	2		16	
Ri2 = Ro (1 + V1/V2) [(V2-V2')/V2']							
Ri2	Zero Volts	Ω	0°		min		sec
	Zero Volts		90°	3		50	
	Zero Volts		180°	3		40	
	Zero Volts		270°	2		24	
	Zero Volts		360°	2		19	
Ri = The lesser of Ri1 and Ri2							
Ri	Zero Volts	Ω	0°		min		sec
	Zero Volts		90°	3		46	
	Zero Volts		180°	3		37	
	Zero Volts		270°	2		21	
	Zero Volts		360°	2		16	
Ri / Vb = Electrical Isolation Value / Nominal Battery Voltage							
Ri / Vb	Zero Volts	Ω/V	0°		min		sec
	Zero Volts		90°	3		50	
	Zero Volts		180°	3		40	
	Zero Volts		270°	2		24	
	Zero Volts		360°	2		19	

NOTE: The minimum Electrical Isolation Value is 500 Ω/V.

	Yes	No (Fail)
Is the measured Electrical Isolation Value ≥ 500 Ω/V?	X	
Additional Comments	None	

APPENDIX A
PHOTOGRAPHS

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Photo No. 001 - As Delivered Right Front Three-Quarter View of Test Vehicle

Photo No. 002 - As Delivered Left Rear Three-Quarter View of Test Vehicle

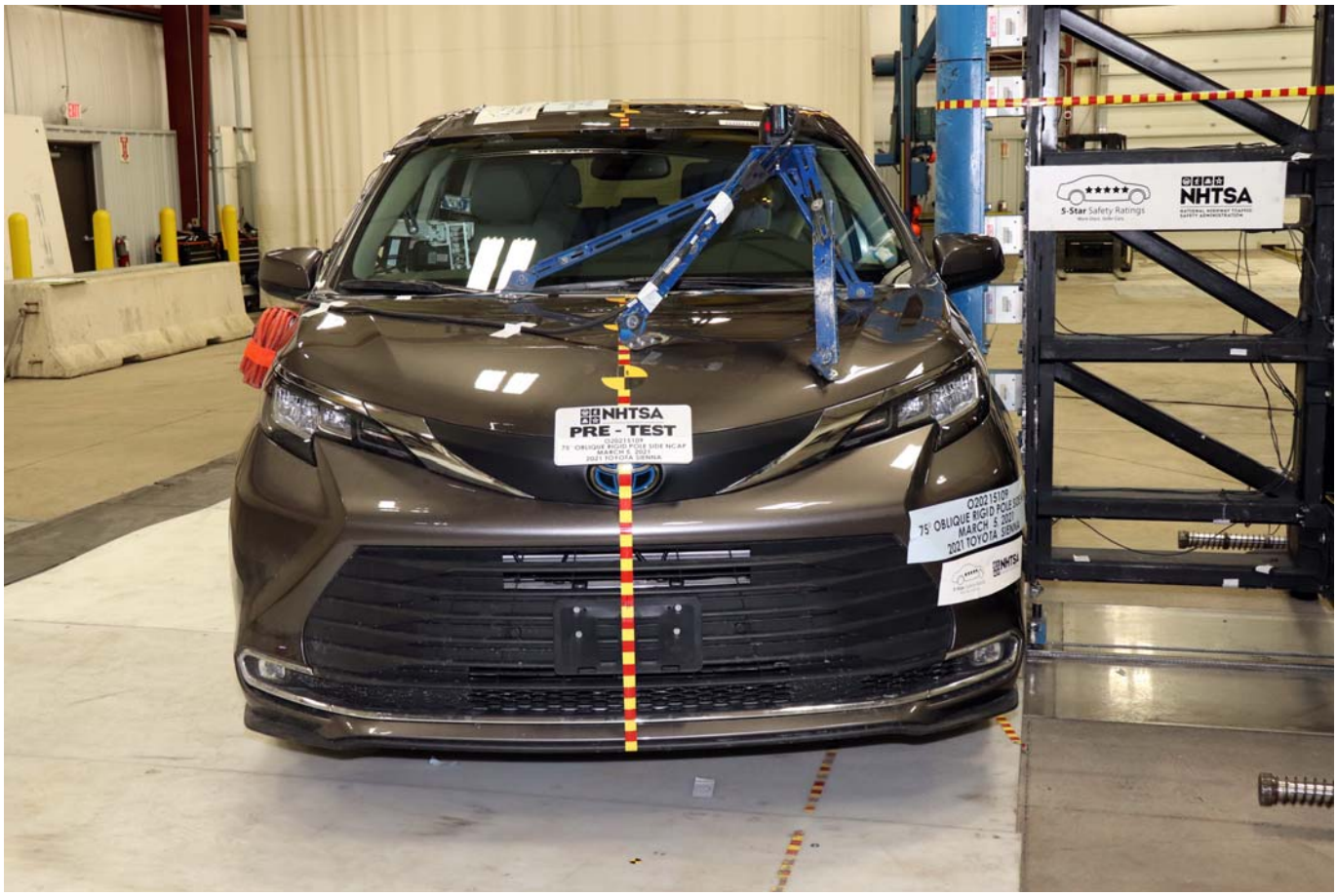


Photo No. 003 - Pre-Test Frontal View of Test Vehicle

Photo No. 004 - Post-Test Frontal View of Test Vehicle

Photo No. 005 - Pre-Test Left Front Three-Quarter View of Test Vehicle

Photo No. 006 - Post-Test Left Front Three-Quarter View of Test Vehicle

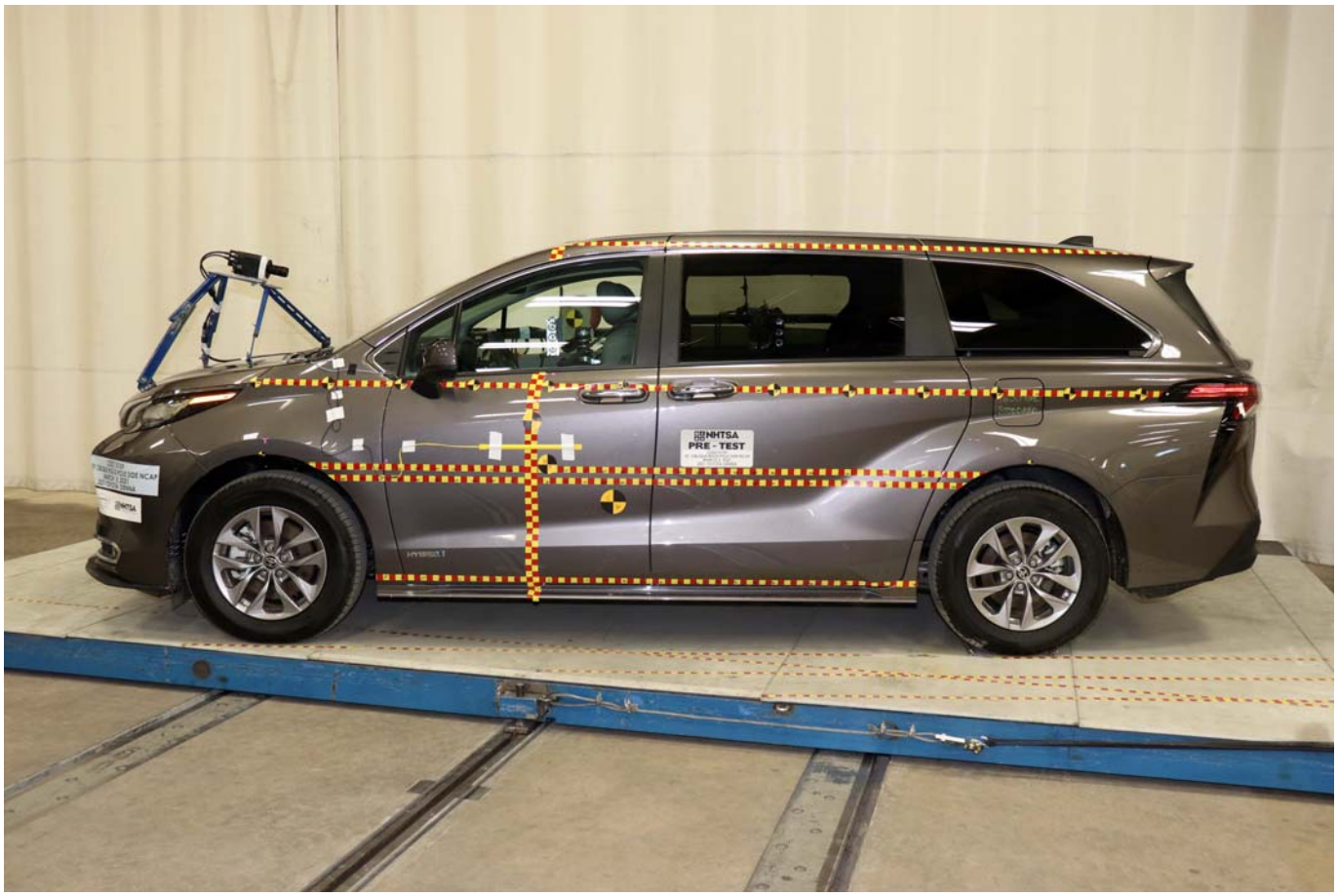


Photo No. 007 - Pre-Test Left Side View of Test Vehicle

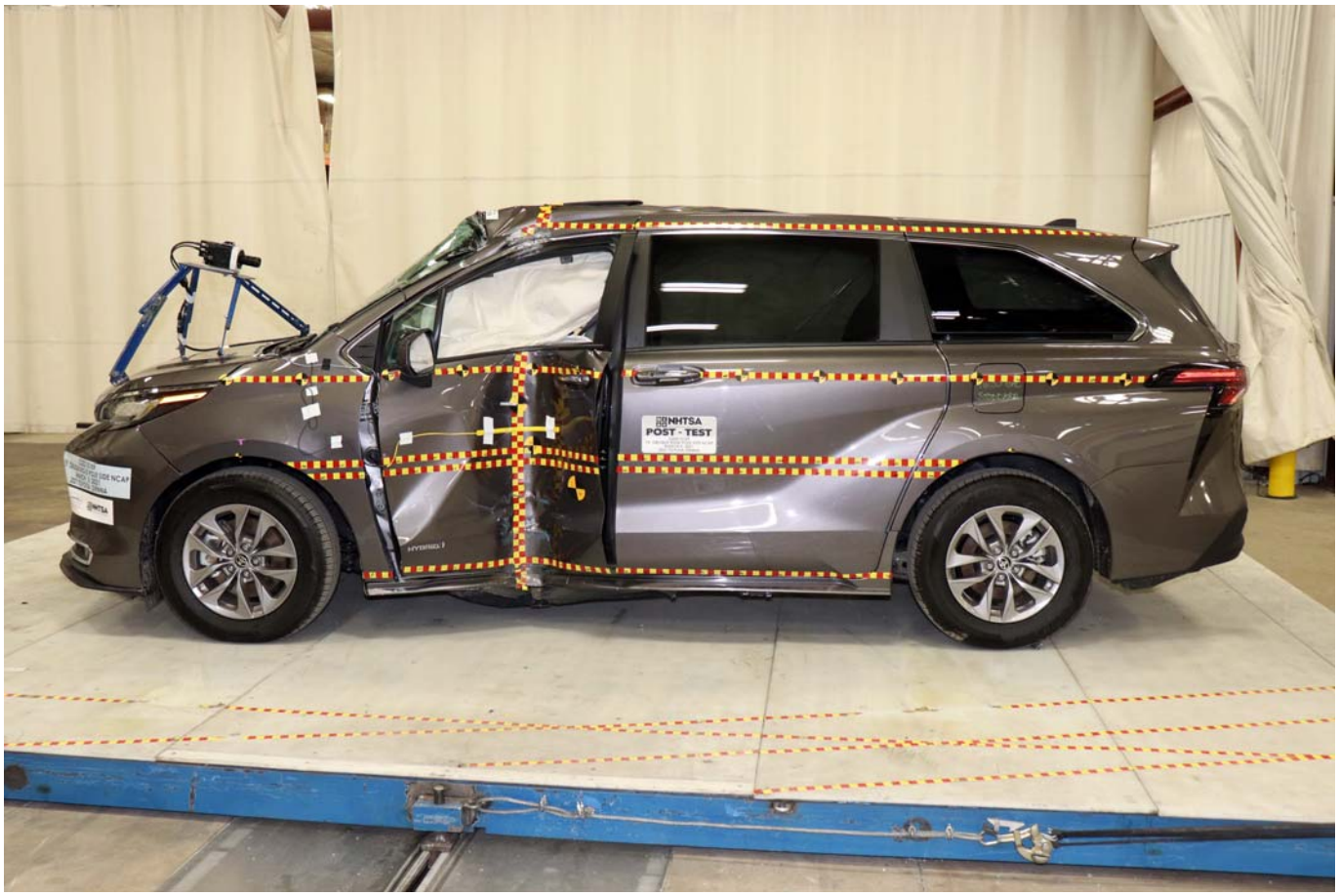


Photo No. 008 - Post-Test Left Side View of Test Vehicle

Photo No. 009 - Pre-Test Left Rear Three-Quarter View of Test Vehicle

Photo No. 010 - Post-Test Left Rear Three-Quarter View of Test Vehicle

Photo No. 011 - Pre-Test Rear View of Test Vehicle

Photo No. 012 - Post-Test Rear View of Test Vehicle

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

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

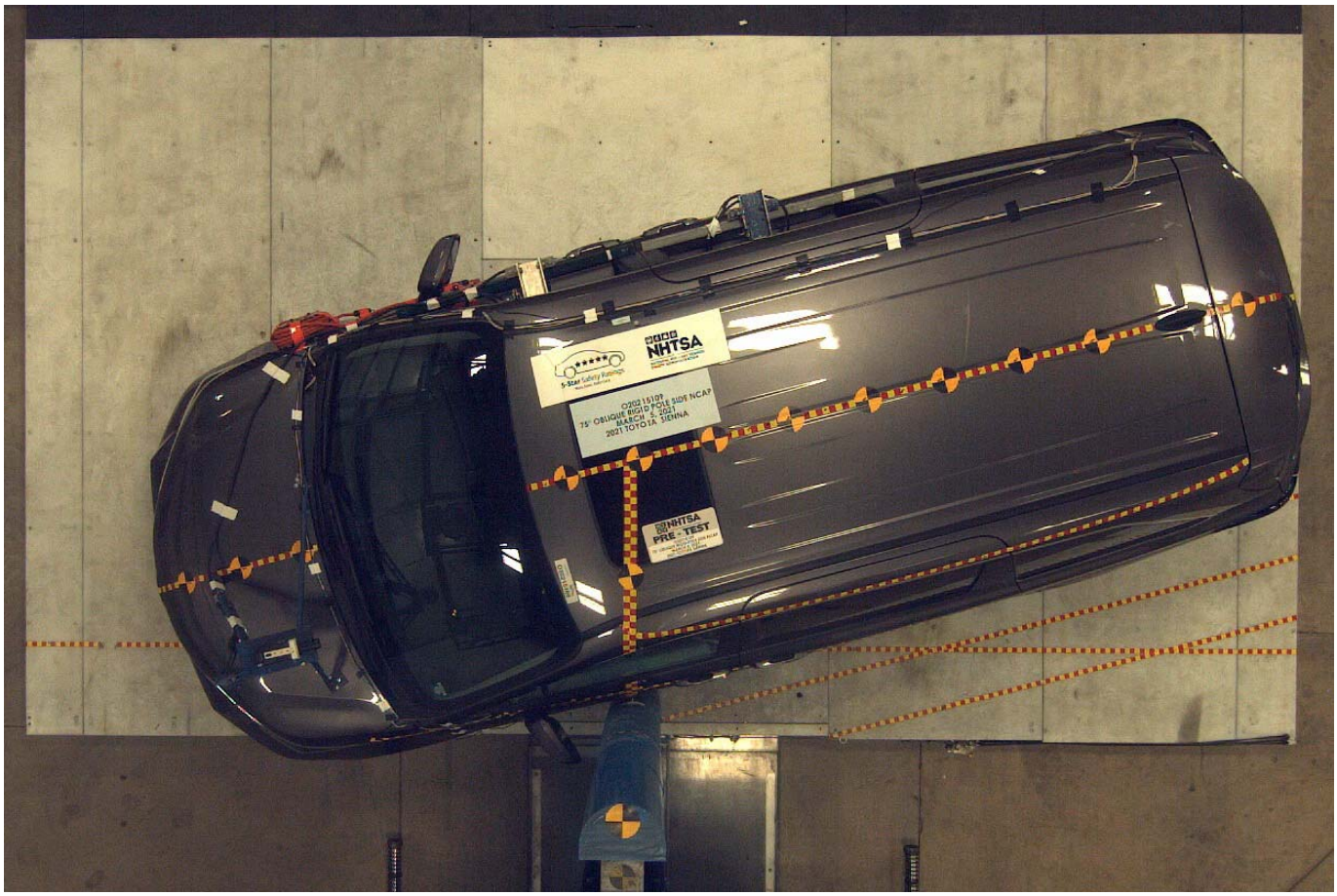


Photo No. 015 - Pre-Test Overhead View of Test Area

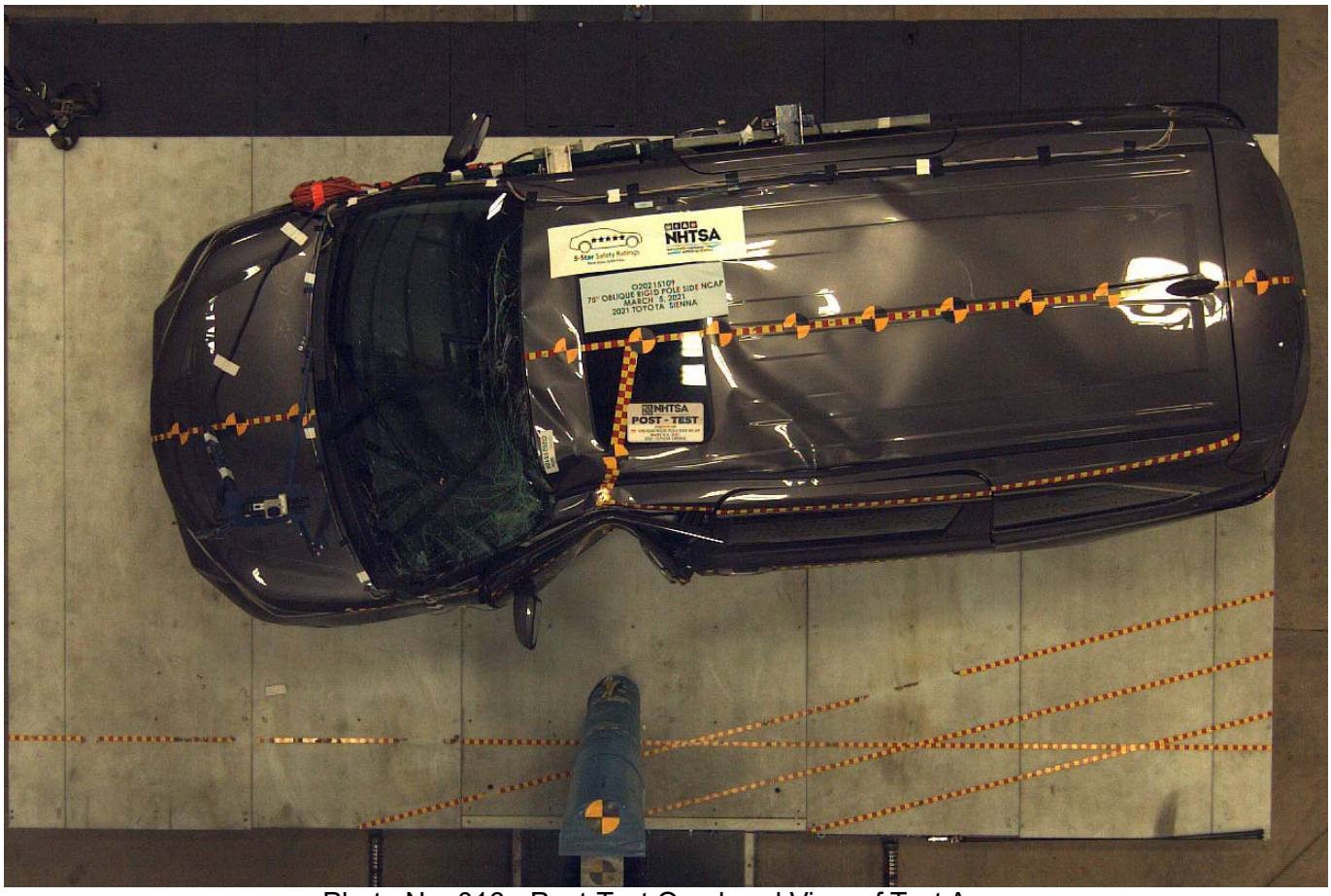


Photo No. 016 - Post-Test Overhead View of Test Area

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

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

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

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

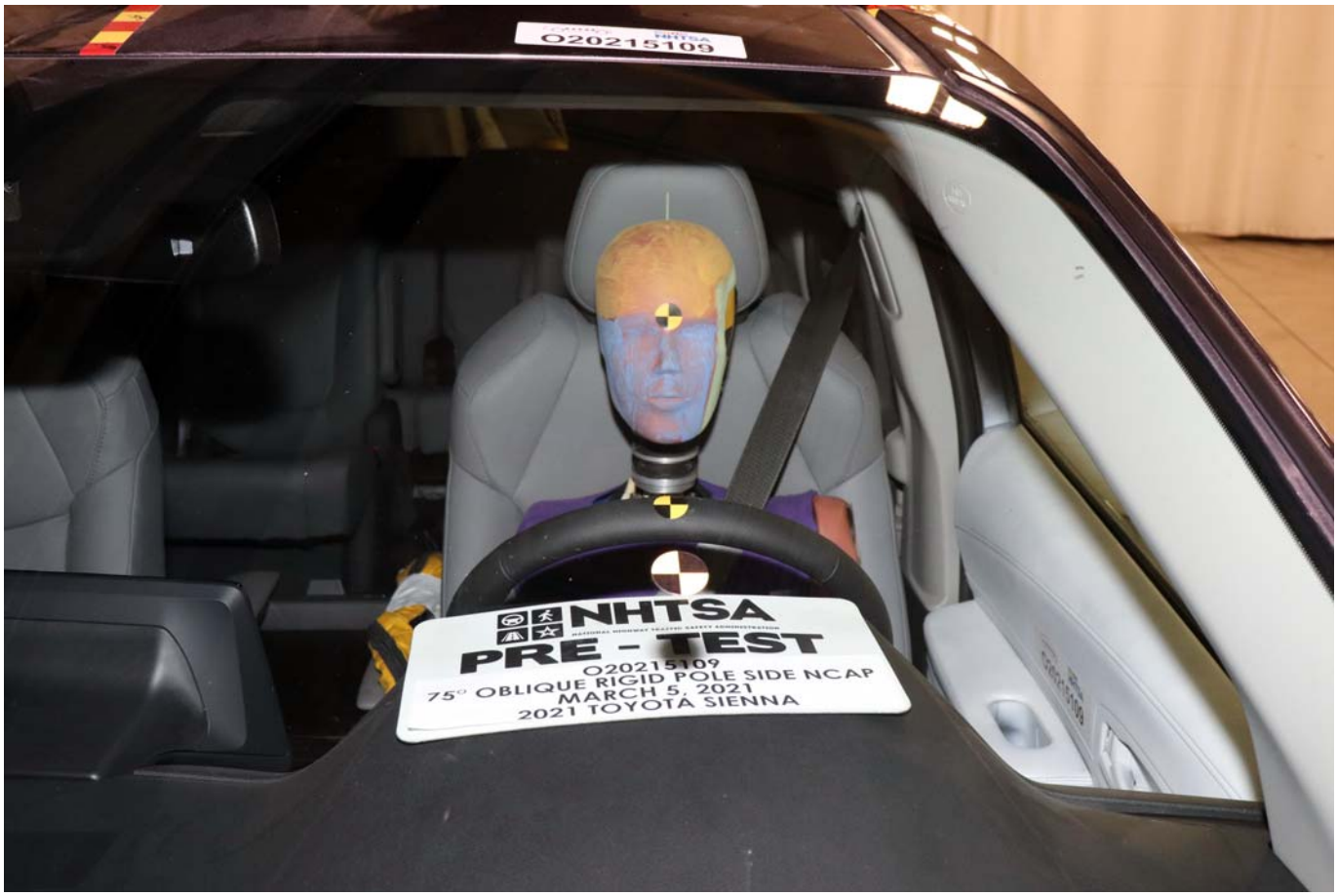


Photo No. 021 - Pre-Test Front Close-Up View of Dummy Head and Chest

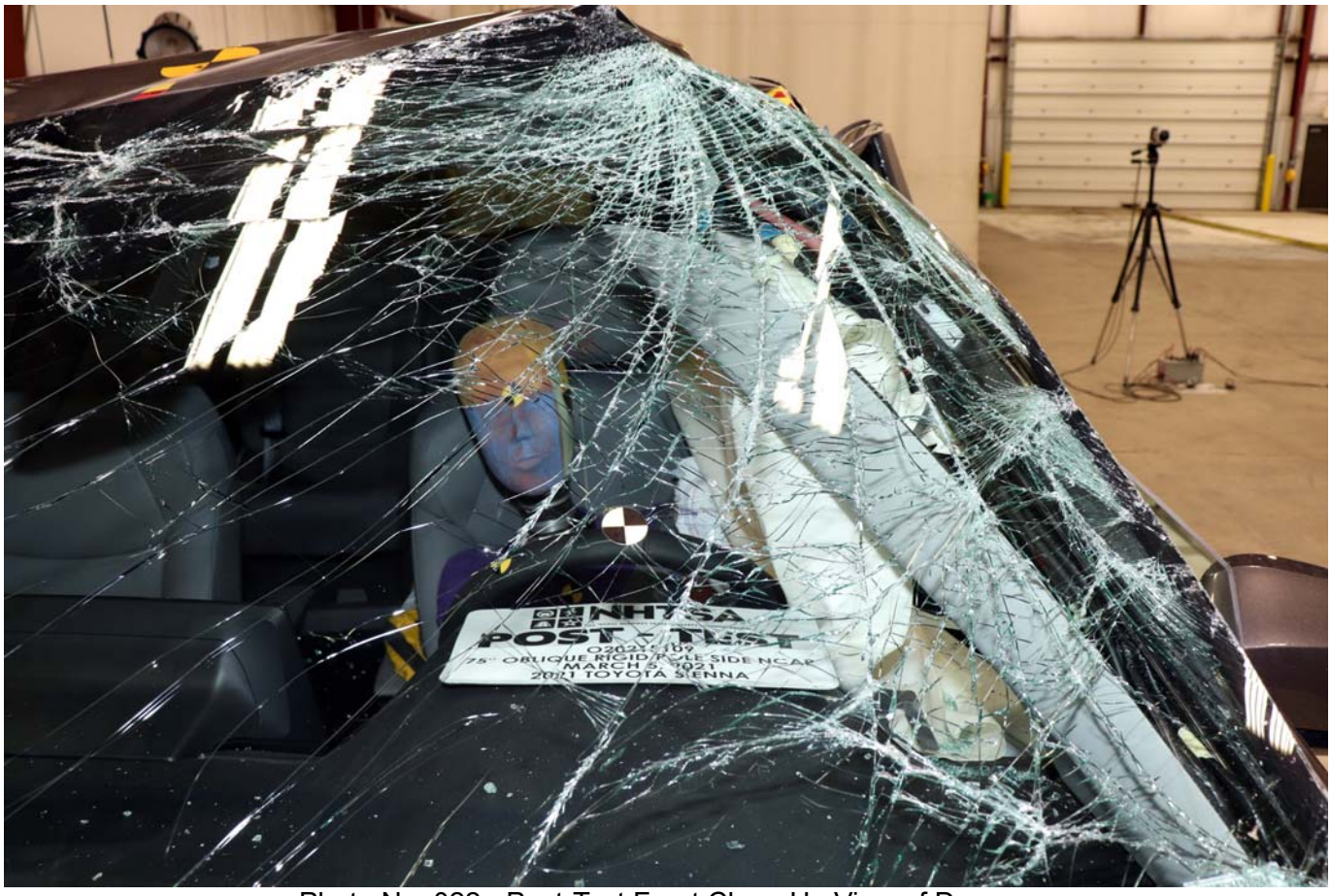


Photo No. 022 - Post-Test Front Close-Up View of Dummy

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

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

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

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

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

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

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

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

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

Photo No. 032 - Pre-Test Placement of Dummy Feet

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

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

Photo No. 035 - Pre-Test View of Disengaged Parking Brake

Photo No. 036 - Pre-Test View of Parking Brake

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

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

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

Photo No. 040 - Pre-Test Dummy and Door Clearance View

Photo No. 041 - Post-Test Dummy and Door Clearance View

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

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

Photo No. 044 - Pre-Test Inner Door Panel View

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

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

Photo No. 047 - Post-Test Dummy Close-Up Head Contact with Side Air Bag View

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

Photo No. 049 - Post-Test Dummy Close-Up Torso Contact with Side Air Bag View

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

Photo No. 051 - Post-Test Dummy Close-Up Pelvis Contact with Side Air Bag View

PHOTOGRAPH NOT APPLICABLE

Photo No. 052 - Post-Test Dummy Close-Up Knee Contact with Vehicle Interior View

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

Photo No. 054 - Post-Test Inner Rear Passenger Torso Air Bag Deployment View

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

Photo No. 056 - Post-Test View of Fuel Filler Cap or Fuel Filler Neck

Photo No. 057 - Close-Up View of Vehicle Certification Label

Photo No. 058 - Close-Up View of Vehicle Tire Information Placard or Label

Photo No. 058a - Close-Up View of Vehicle Load Carrying Capacity Reduction Label


Photo No. 059 - Pre-Test Pole Barrier Front View

Photo No. 060 - Post-Test Pole Barrier Front View

Photo No. 061 - Pre-Test Pole Barrier Side View

Photo No. 062 - Post-Test Pole Barrier Side View

Photo No. 063 - Pre-Test Ballast View

Photo No. 064 - Post-Test Primary and Redundant Speed Trap Read-Out

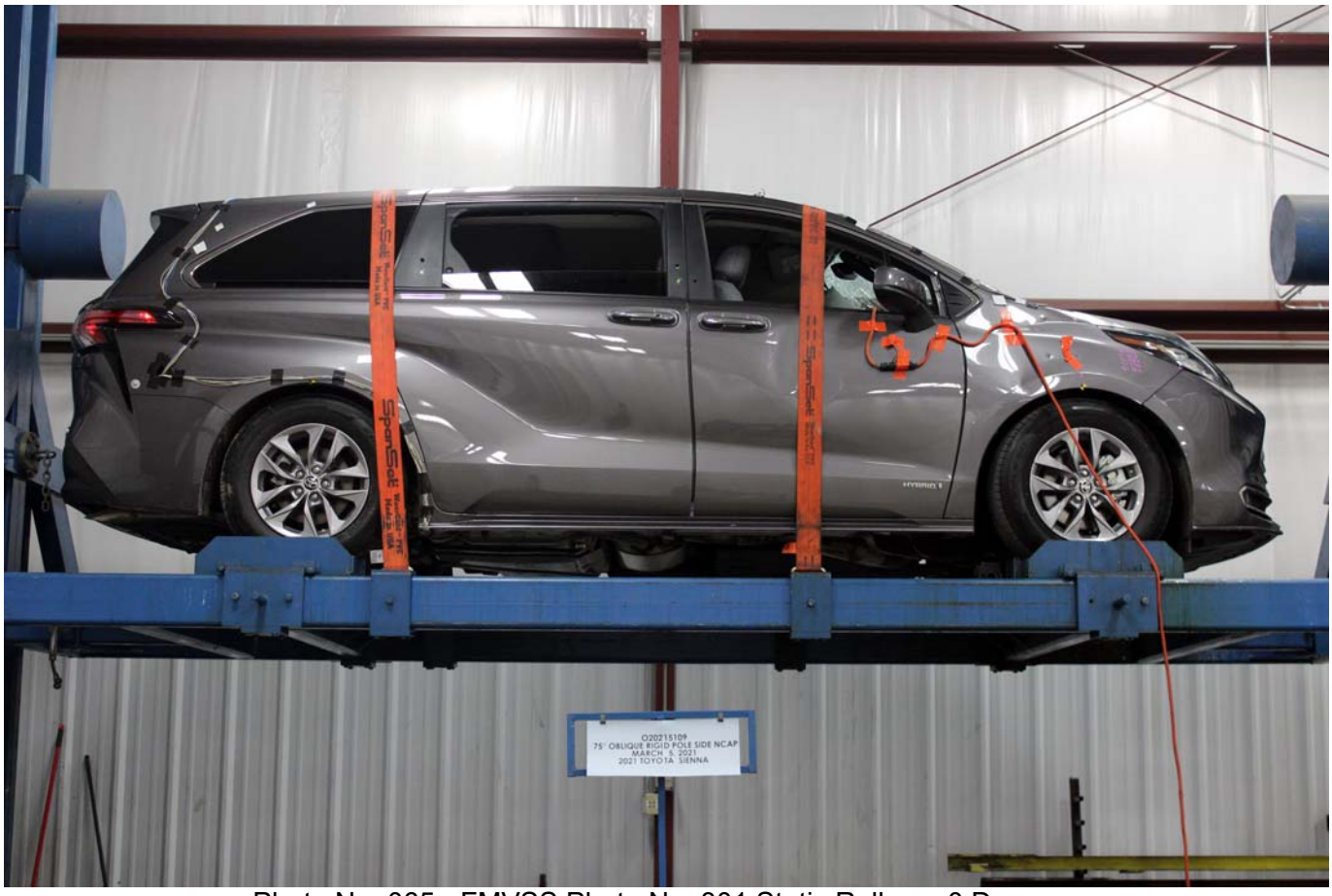


Photo No. 065 - FMVSS Photo No. 301 Static Rollover 0 Degrees

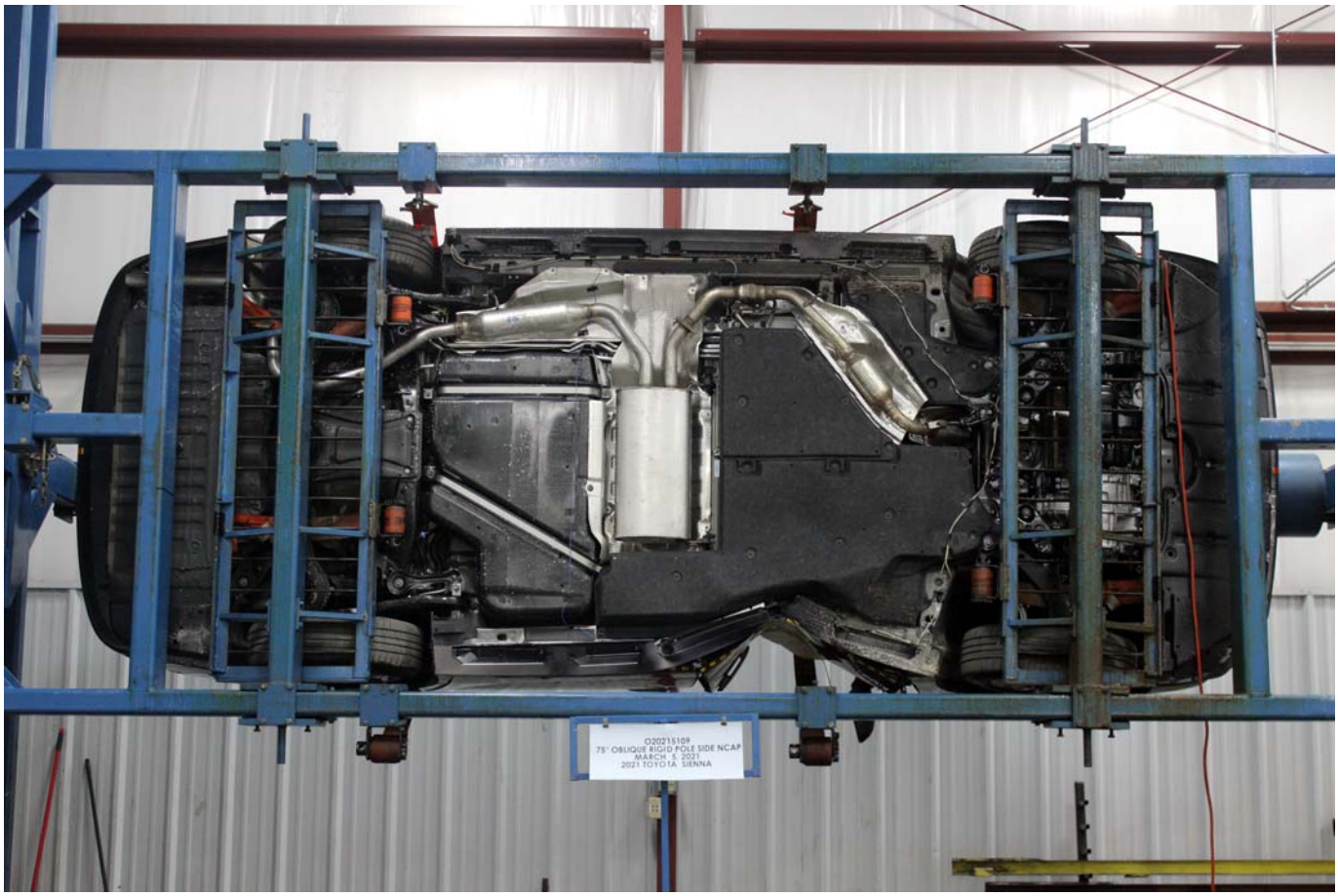


Photo No. 066 - FMVSS Photo No. 301 Static Rollover 90 Degrees

Photo No. 067 - FMVSS Photo No. 301 Static Rollover 180 Degrees

Photo No. 068 - FMVSS Photo No. 301 Static Rollover 270 Degrees

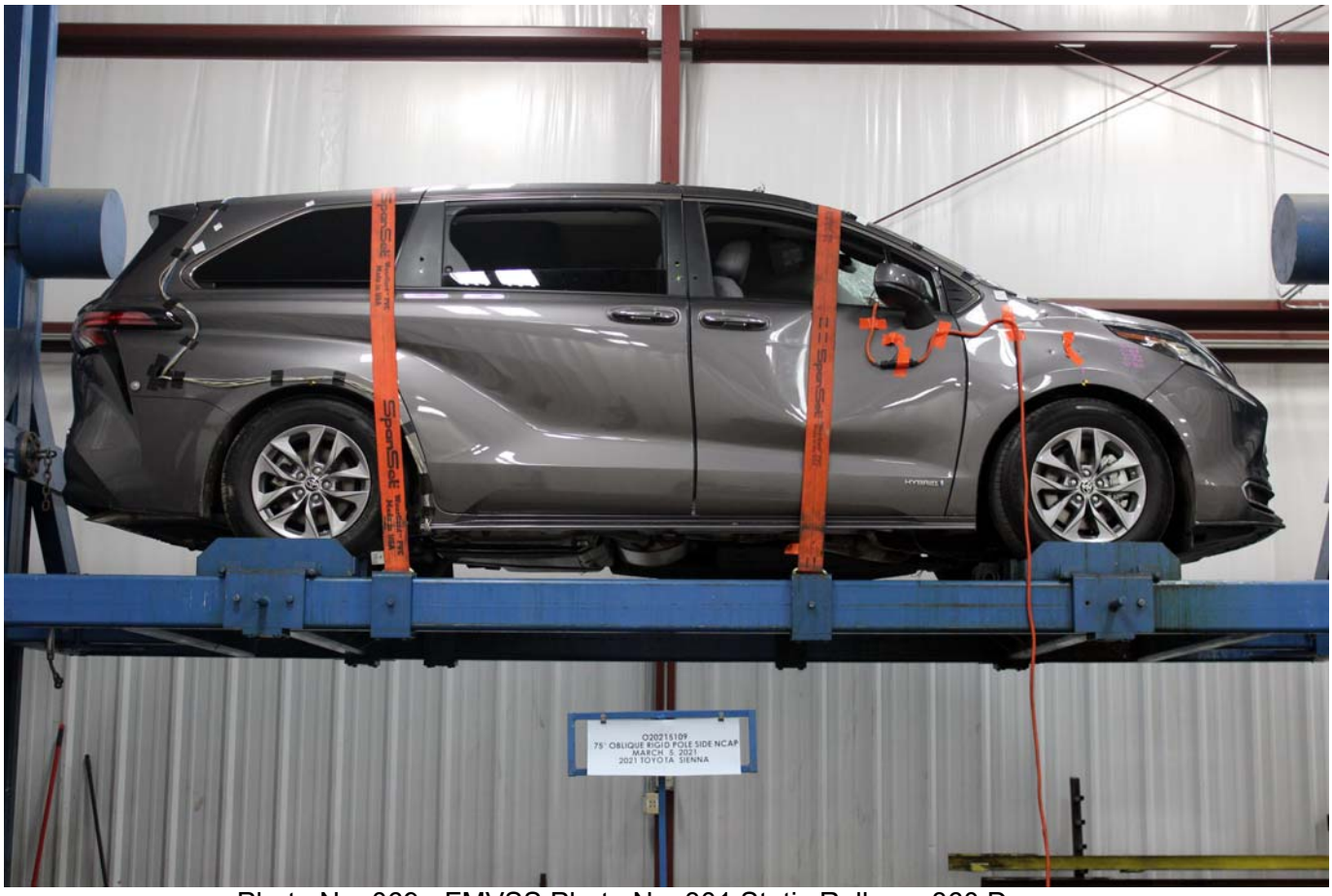


Photo No. 069 - FMVSS Photo No. 301 Static Rollover 360 Degrees

Photo No. 070 - Impact Event

TOYOTA
Let's Go Places

DESC.: SIENNA XLE 7 PASSENGER
VIN: 5TDYRKEC9MS004252
YR/MDL: 2021/5408A
CLR: PREDAWN GRAY MICA/EA10 (01H1/10)
FINAL ASSEMBLY POINT: PRINCETON, INDIANA, U.S.A.

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

STANDARD EQUIPMENT

MECHANICAL & PERFORMANCE
- 2.5L 4-Cylinder Engine
- 245 Combined Net Horsepower
- Electronic Continuous Var. Tran. (ECVT)
- 17-in Alloy Wheels

SAFETY & CONVENIENCE
- Toyota Safety Sense 2.0: Pre-Collision Sys w/ Pedestrian Detection, Full-Speed Range Dynamic Radar Cruise Control, Lane Departure Alert w/ Steering Assist, Lane Tracing Assist, Automatic High Beams, Road Sign Assist
- STAR Safety System
- LATCH-Lower Anchor & Tether for Children
- Blind Spot Monitor w/ RCTA
- 5-Door Smart Key w/ Push Button Start
- Safety & Remote Connect w/ 1-Year Trial

EXTERIOR
- LED Headlights with Auto on/off feature
- Hands-Free Dual Power Sliding SideDoors
- Power Liftgate
- Frt & Rear Parking Assist w/ Auto Brake
- Power Tilt / Slide Moonroof

INTERIOR
- Audio Plus - 9-in Touchscreen, 8 Spkrs, HandsFree Bluetooth Phone/Music, USB Media Port, 6 USB Charge Ports, SiriusXM w/ 3-Month All Access Trial, Android Auto & Apple CarPlay Compatible
- Four Zone Auto Climate Control
- SofTex-Trimmed Seats, Heated & Power Front Seats, 2nd-Row Captain's Chairs w/ Super Long-Slide Feature, 60/40 One-Motion-Stow w/ Split & Stow 3rd Row Seat
- Rear Seat Reminder
- For Full Product Details, Please Visit Toyota.com/Sienna
Full Tank of Gas

MANUFACTURER'S SUGGESTED RETAIL PRICE		$39,750.00
OPTIONAL EQUIPMENT		
FE	50 State Emissions	
2T	All Weather Floor Liners	220.00
DELIVERY PROCESSING AND HANDLING FEE		1,175.00
TOTAL		$41,145.00

The New Vehicle Limited Warranty provides 3-year/36,000 mile basic coverage, 5-year/60,000 mile powertrain coverage, plus 5-year/unlimited mile corrosion perforation coverage. See Warranty and Maintenance Guide for details. An extended service contract may be available for the vehicle.
Ask dealer for details.
Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service. Gasoline, license and title fees, applicable federal, state and local taxes and dealer and distributor installed options and accessories are not included in the manufacturer's suggested retail price.

ToyotaCare, which covers normal factory scheduled maintenance for two years or 25,000 miles, whichever occurs first, is included as part of the sales price of the vehicle for qualifying buyers. See participating dealer for eligibility and coverage details.

Delivered by Truck to: 31068
NORTHTOWN TOYOTA
1135 MILLERSPORT HIGHWAY
AMHERST NY14226

EPA DOT **Fuel Economy and Environment** — Gasoline Vehicle

Fuel Economy
36 MPG
36 city / 36 highway
combined city/hwy
2.8 gallons per 100 miles
Minivans range from 20 to 48 MPG. The best vehicle rates 141 MPGe.

You save **$ 2,000** in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost **$ 1,100**

Fuel Economy & Greenhouse Gas Rating (tailpipe only): 8 (1 Worst – 10 Best)
This vehicle emits 246 grams CO2 per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions. Learn more at fueleconomy.gov.

Smog Rating (tailpipe only): 7 (1 Worst – 10 Best)

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 27 MPG and costs $7,500 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at $2.70 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fueleconomy.gov
Calculate personalized estimates and compare vehicles

Smartphone QR Code™

Photo No. 071 - Monroney Label

Head restraints

Head restraints are provided for all seats.

WARNING

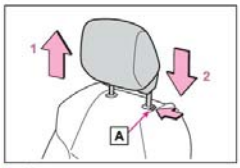
■Head restraint precautions

Observe the following precautions regarding the head restraints. Failure to do so may result in death or serious injury.

- Use the head restraints designed for each respective seat.
- Adjust the head restraints to the correct position at all times.
- After adjusting the head restraints, push down on them and make sure they are locked in position.
- Do not drive with the head restraints removed.

Vertical adjustment

■ Front and second outside seats



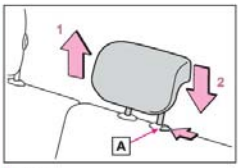
1 Up

Pull the head restraints up.

2 Down

Push the head restraint down while pressing the lock release button A.

■ Second center* and third center seats



1 Up

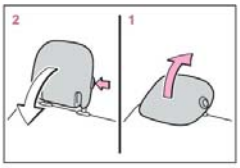
Pull the head restraints up.

2 Down

Push the head restraint down while pressing the lock release button A.

*: 8-passenger models only

■ Third outside seats



1 To use

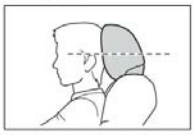
Pull the head restraints up.

2 To fold

Press the button.

■Adjusting the height of the head restraints (Front and second outside seats)

Make sure that the head restraints are adjusted so that the center of the head restraint is closest to the top of your ears.



■Adjusting the center seat head restraint

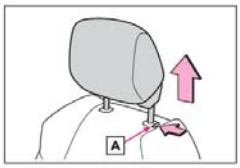
Always raise the head restraint one level from the stowed position when using.

Removing the head restraints

■ Front and second outside seats

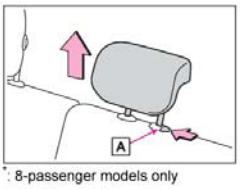
Pull the head restraint up while pressing the lock release button A.

If the head restraint touches the ceiling, making the removal difficult, change the seat height or angle. (→P.169)



■ Second center* and third center seats

Pull the head restraint up while pressing the lock release button A.



*: 8-passenger models only

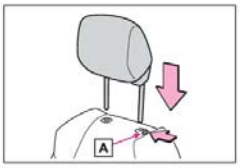
■ Third outside seats

The head restraint cannot be removed.

Installing the head restraints

■ Front and second outside seats

Align the head restraint with the installation holes and push it down to the lock position. Press and hold the lock release button A when lowering the head restraint.



■ Second center* and third center seats

Align the head restraint with the installation holes and push it down to the lowest lock position.

Photo No. 072 - Head Restraint Use and Adjustment Information from Vehicle Owners Manual

Photo No. 073 - Post-Test View of Shattered Vehicle Inner Door Panel

Photo No. 074 - Post-Test Left Front Door Latch Close-Up

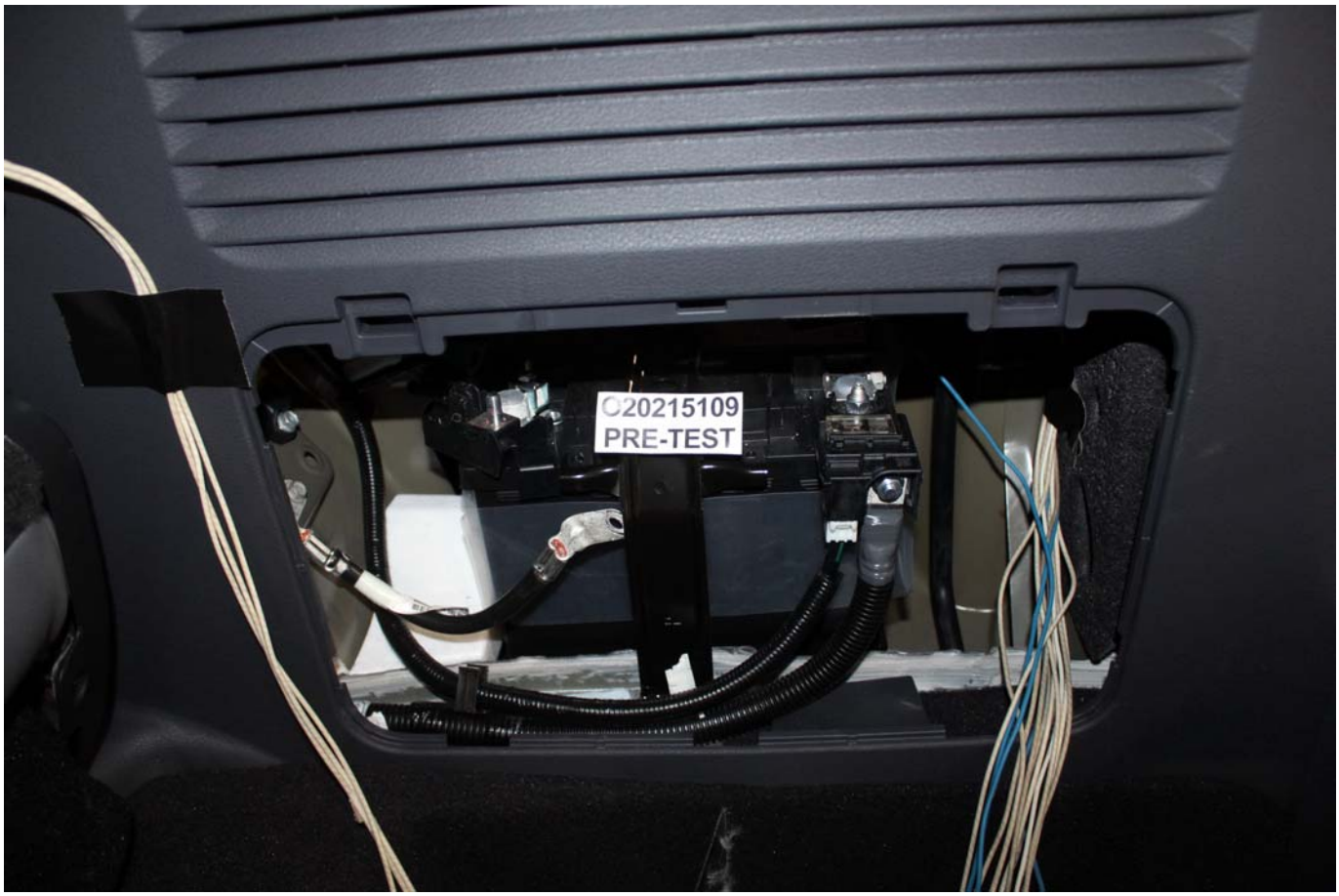


Photo No. 305-01 - Auxiliary Power Module Warning Label

Photo No. 305-02 - Power Inverter Warning Label

Photo No. 305-03 - First Responder Warning Label

PHOTOGRAPH NOT AVAILABLE

Photo No. 305-04 - First Responder Warning Location

Photo No. 305-05 - Other Vehicle Label(s) Related to Electrical Propulsion System

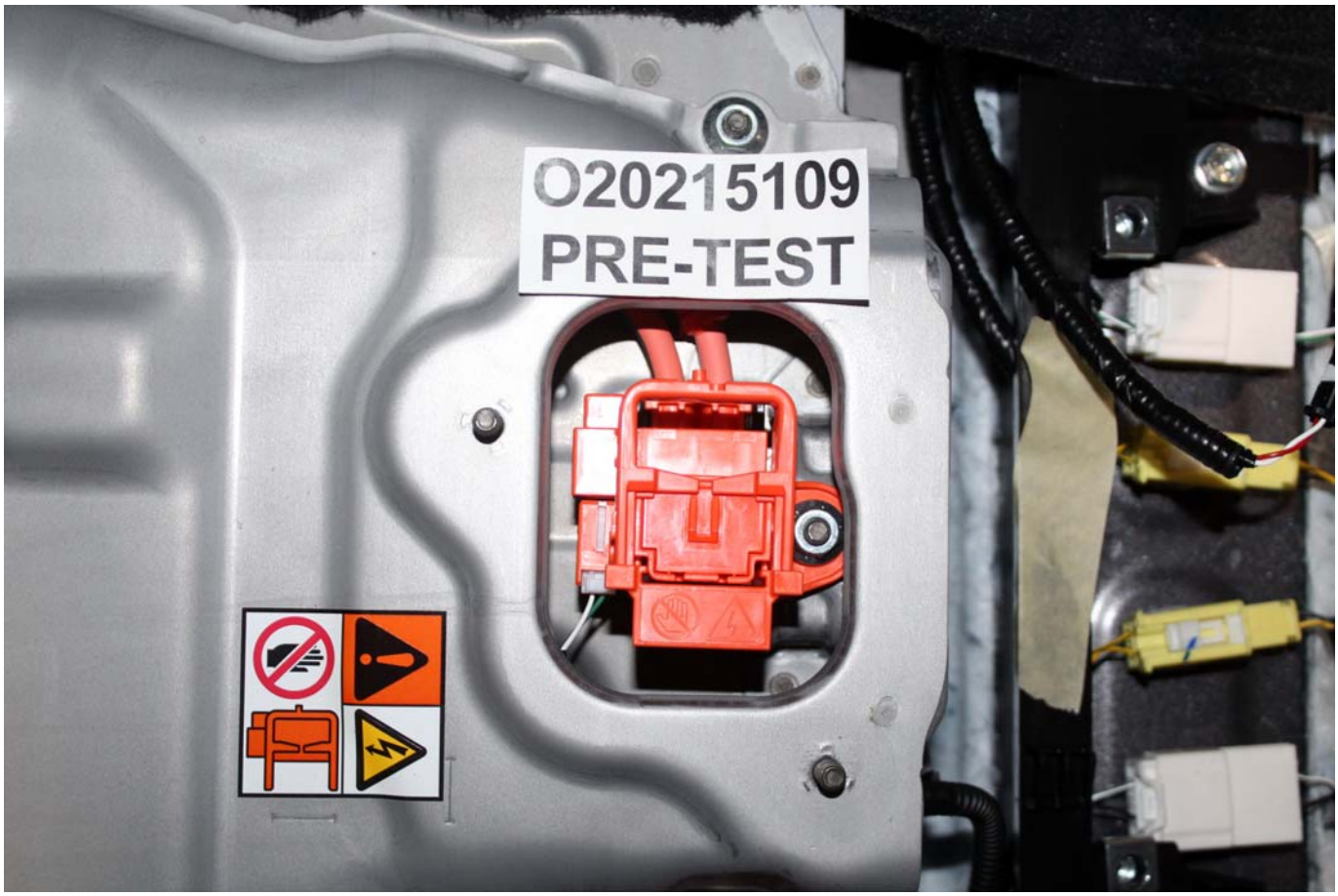


Photo No. 305-06 - Manual High Voltage Service Disconnect in Place

Photo No. 305-07 - Manual High Voltage Service Disconnect Removed

Photo No. 305-08 - Manual High Voltage Service Disconnect Removed

Photo No. 305-09 - Pre-Impact View of Propulsion Battery

Photo No. 305-10 - Post-Impact Front View of Propulsion Battery

Photo No. 305-11 - Post-Impact Rear View of Propulsion Battery

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-12 - Pre-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-13 - Post-Impact View of Battery Box(s) or Container(s) Which Holds Individual Battery Modules

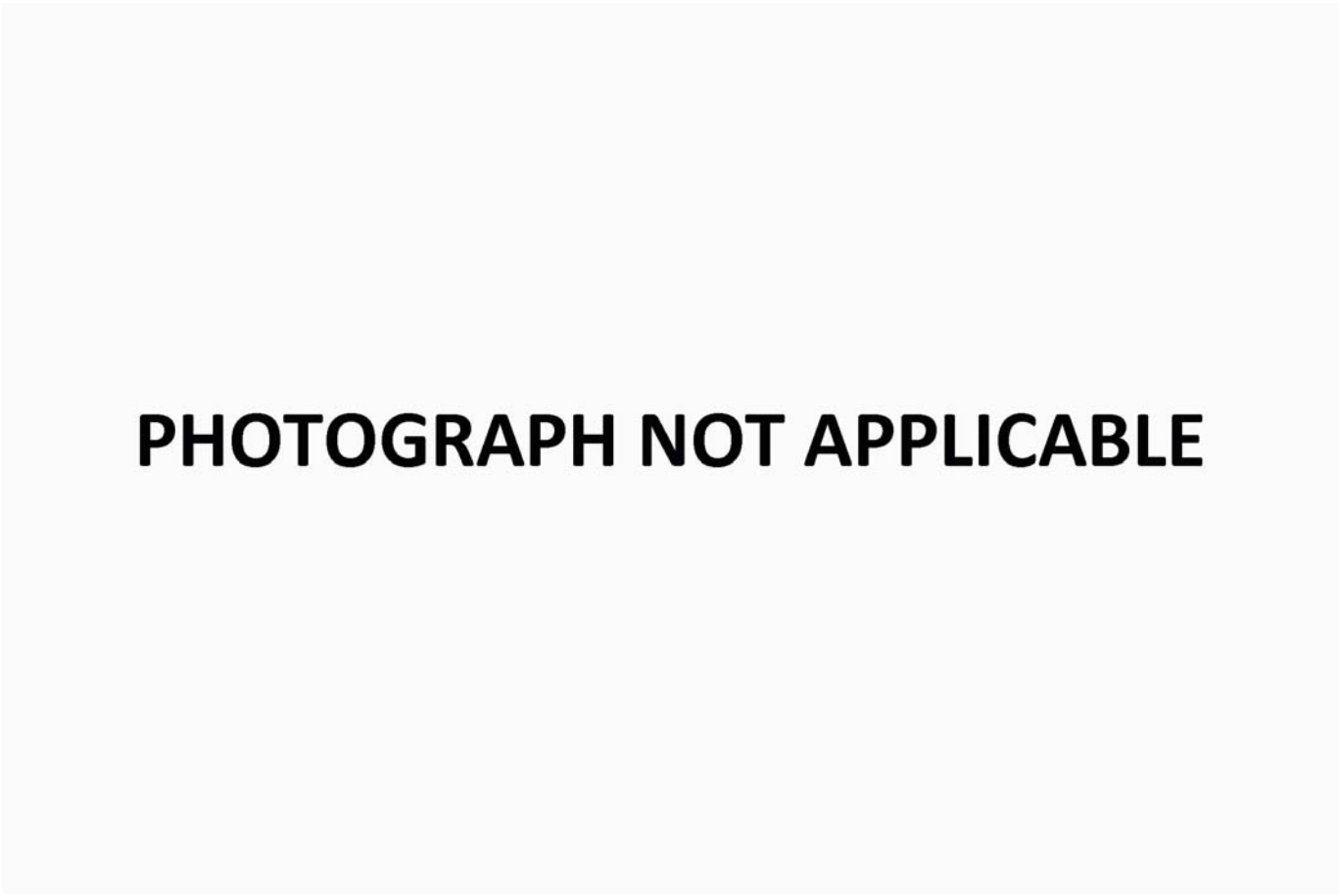


Photo No. 305-14 - Pre-Impact View of Propulsion Battery Module(s)

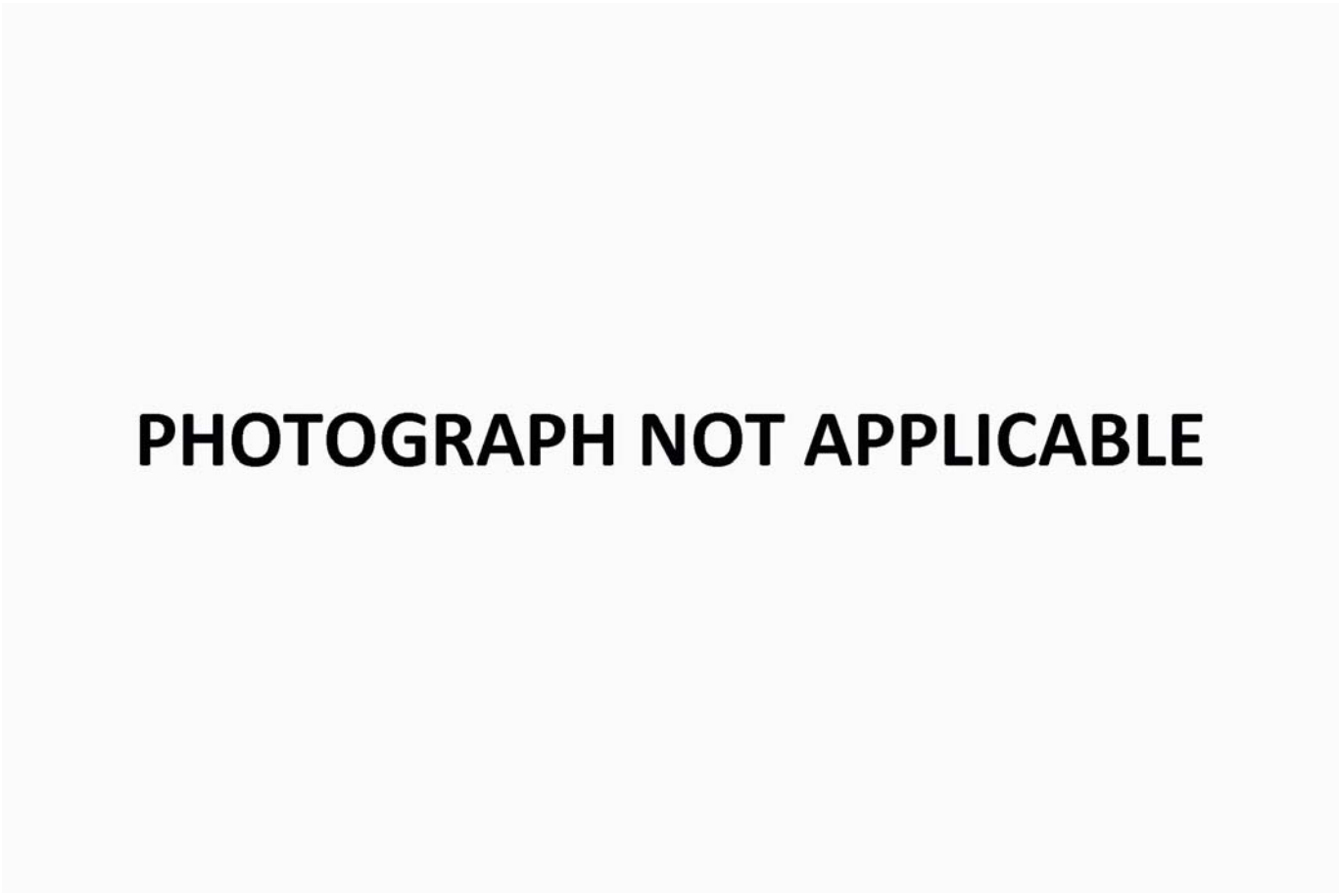


Photo No. 305-15 - Post-Impact View of Propulsion Battery Module(s)

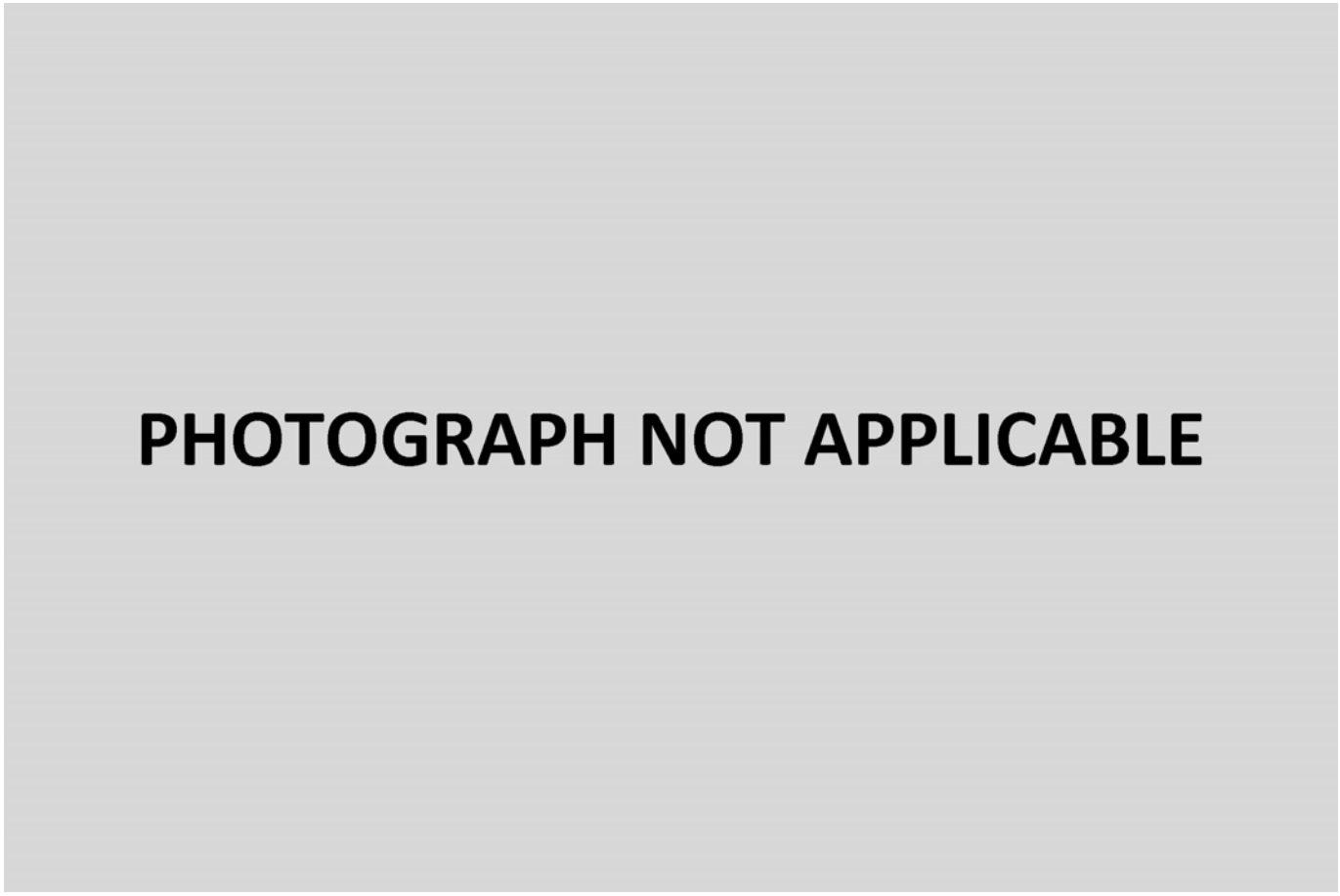


Photo No. 305-16 - Pre-Impact View of Electric Propulsion Drive

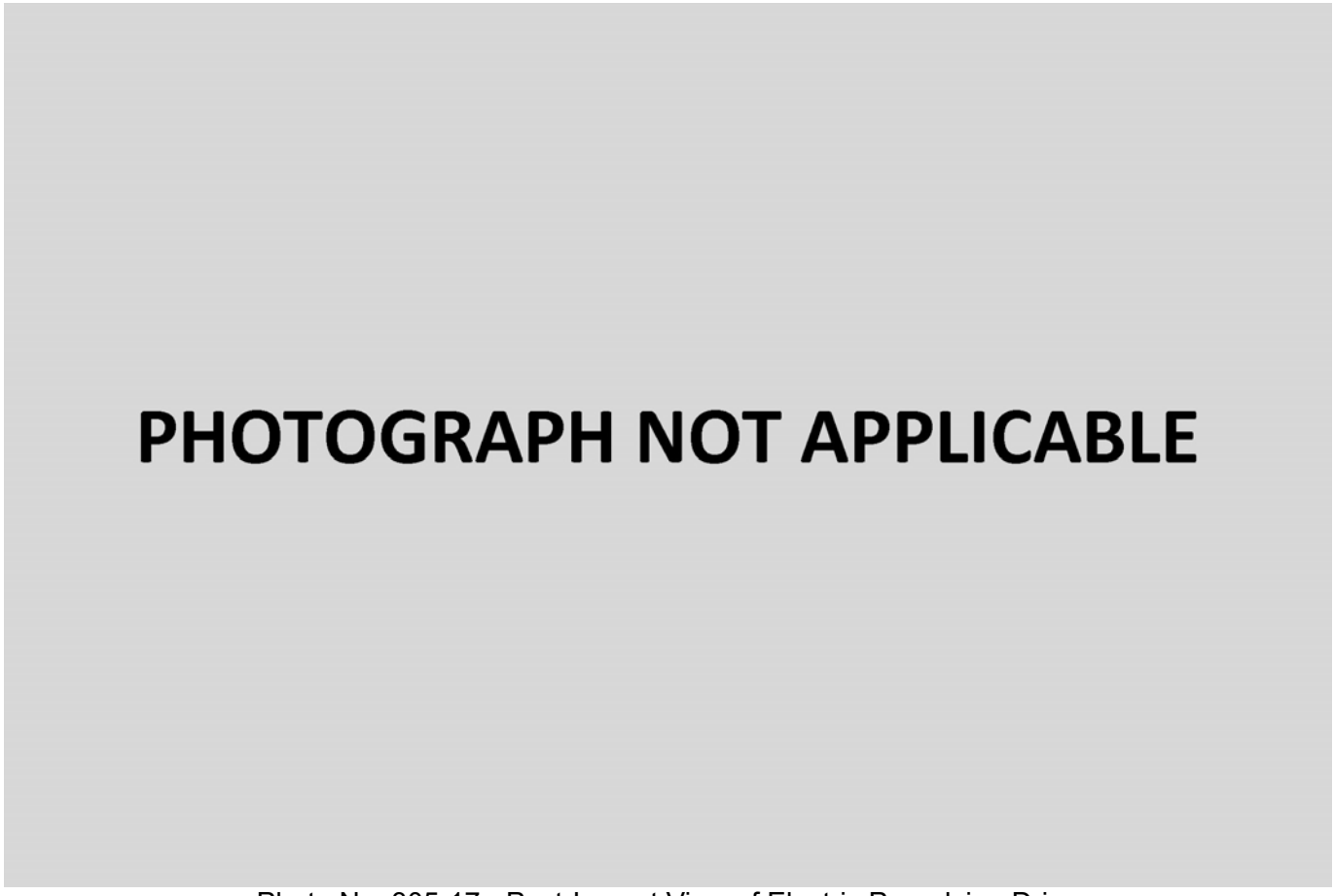


Photo No. 305-17 - Post-Impact View of Electric Propulsion Drive

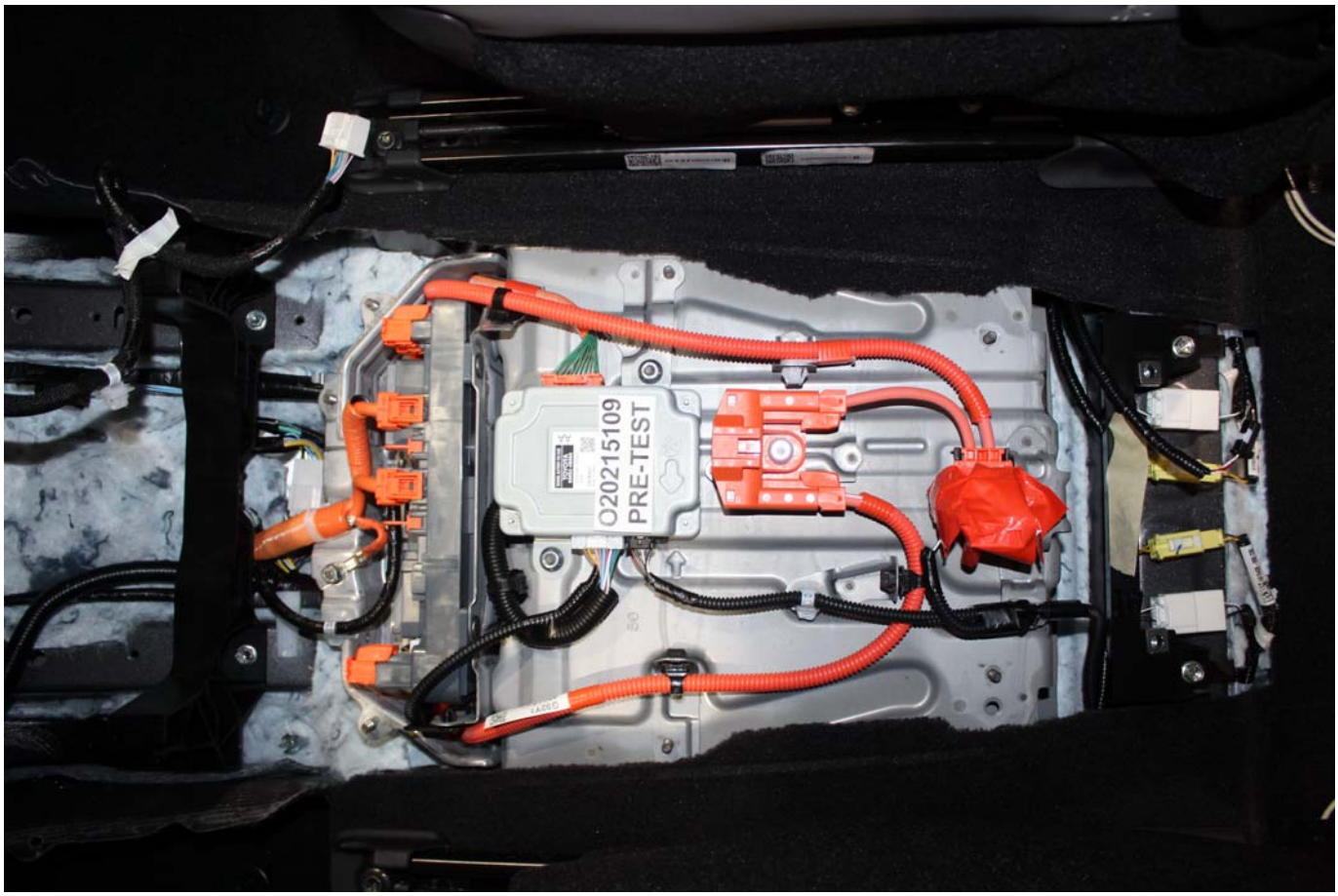


Photo No. 305-18 - Pre-Impact View of High Voltage Interconnect(s)

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-19 - Pre-Impact View Propulsion Battery Venting System(s)

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-20 - Pre-Impact View of Other Visible Electric Propulsion Components

Photo No. 305-21 - Pre-Impact View of Ground Lead Attached

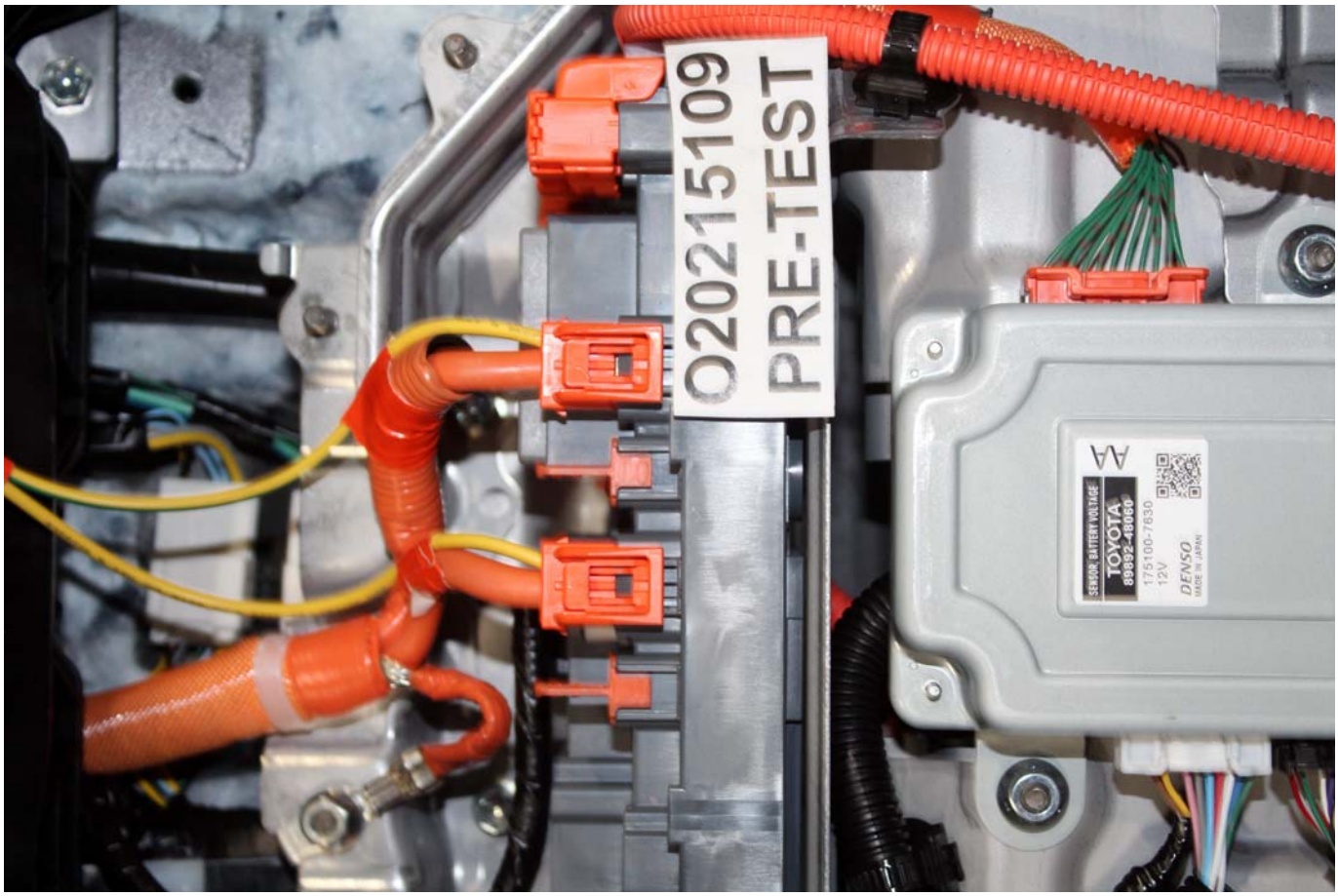


Photo No. 305-22 - Pre-Impact View of High Voltage Leads Attached

Photo No. 305-23 - Pre-Impact Close-Up View of High Voltage Leads Attached

Photo No. 305-24 - Pre-Impact View of Installed Test Interface Port

Photo No. 305-25 - Post-Impact View of Installed Test Interface Port

Photo No. 305-26 - Pre-Impact View of Other Test Devices

Photo No. 305-27 - Post-Impact View of Other Test Devices

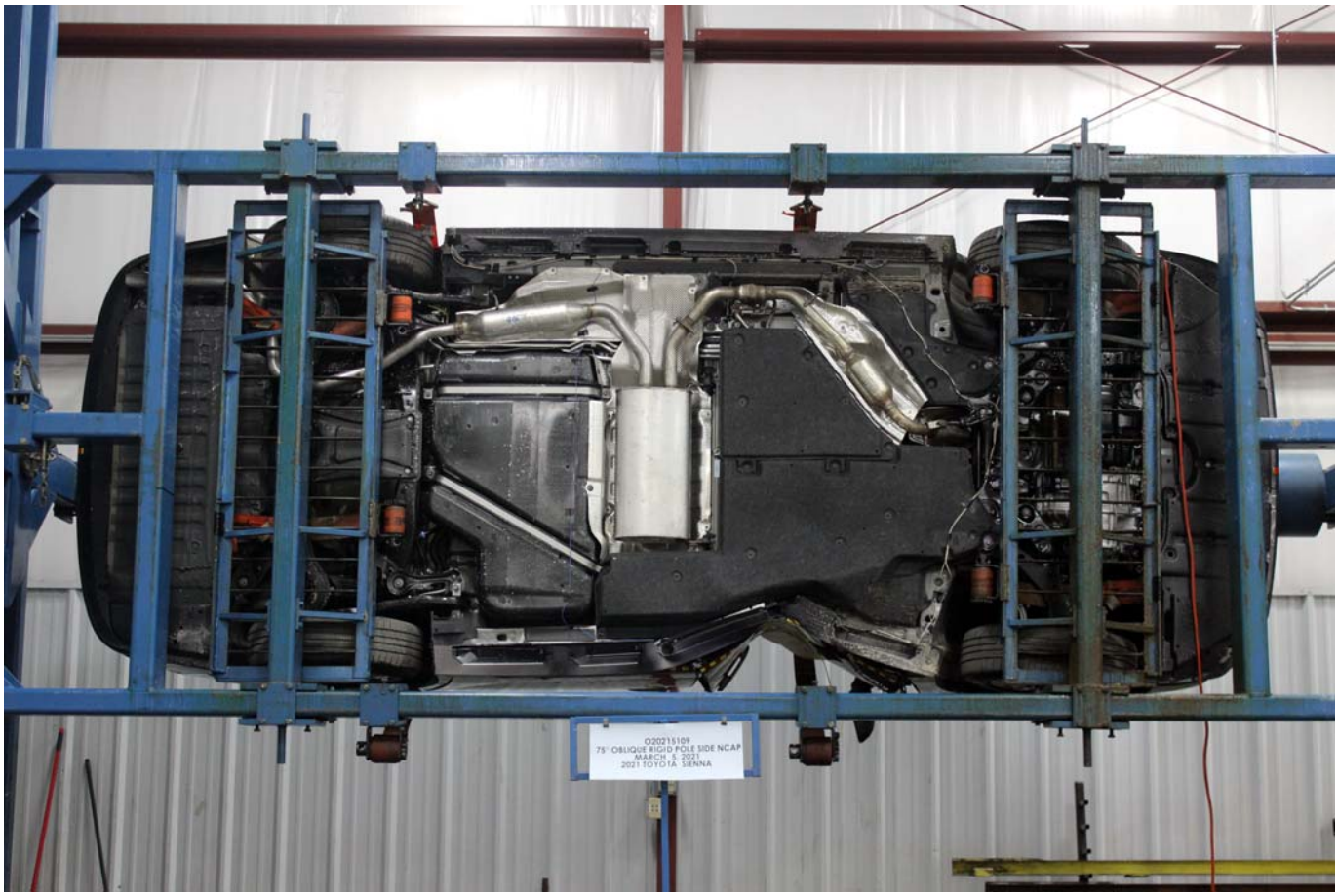


Photo No. 305-28 - FMVSS No. 305 Static Rollover at 90 Degrees

Photo No. 305-29 - FMVSS No. 305 Static Rollover at 180 Degrees

Photo No. 305-30 - FMVSS No. 305 Static Rollover at 270 Degrees

Photo No. 305-31 - FMVSS No. 305 Static Rollover at 360 Degrees

Photo No. 305-32 - Pre-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

Photo No. 305-33 - Post-Impact View of the Vehicle Passenger Compartment Adjacent to Propulsion Battery

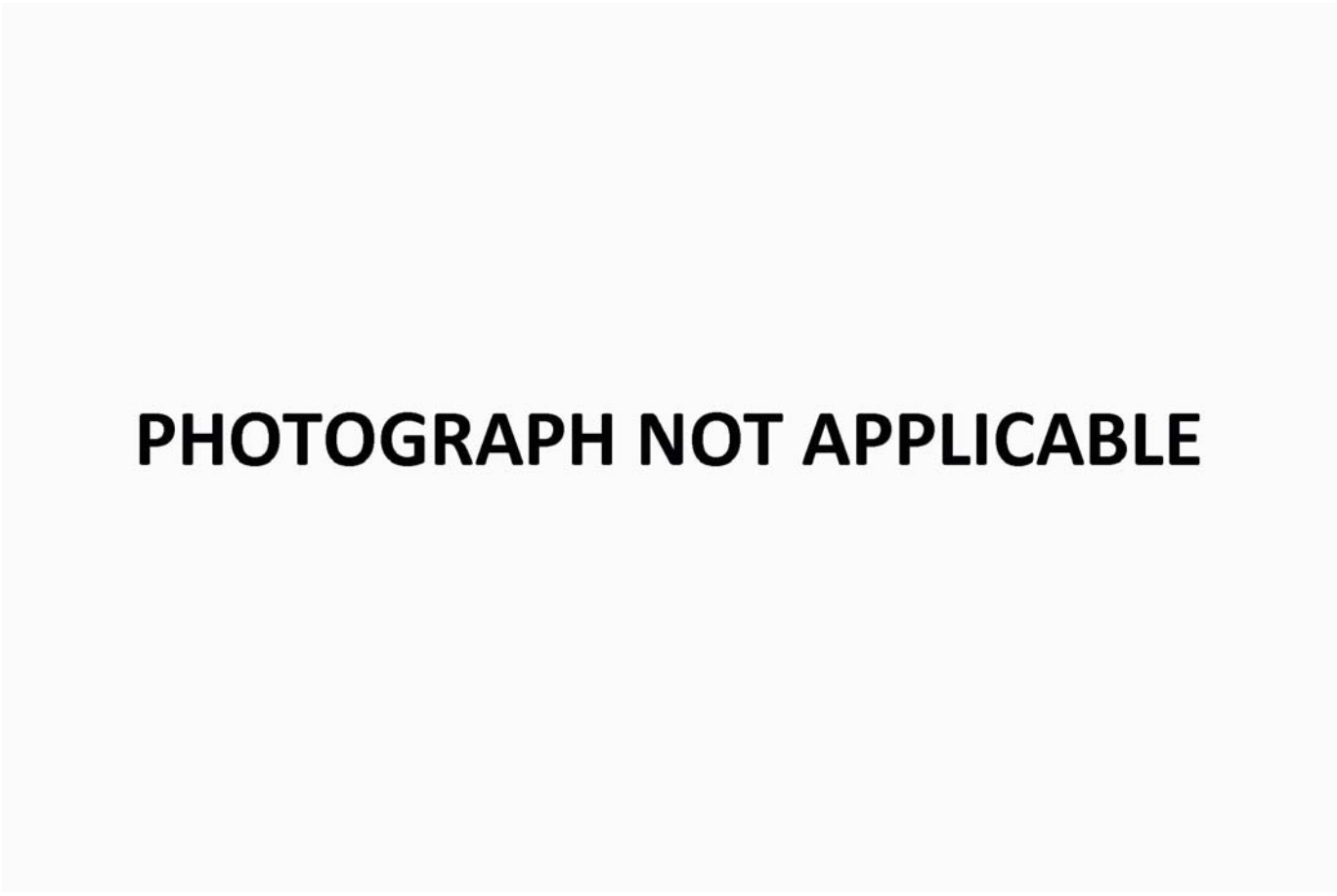


Photo No. 305-34 - Post-Impact Propulsion Battery System Mounting and-or Intrusion Failure(s)

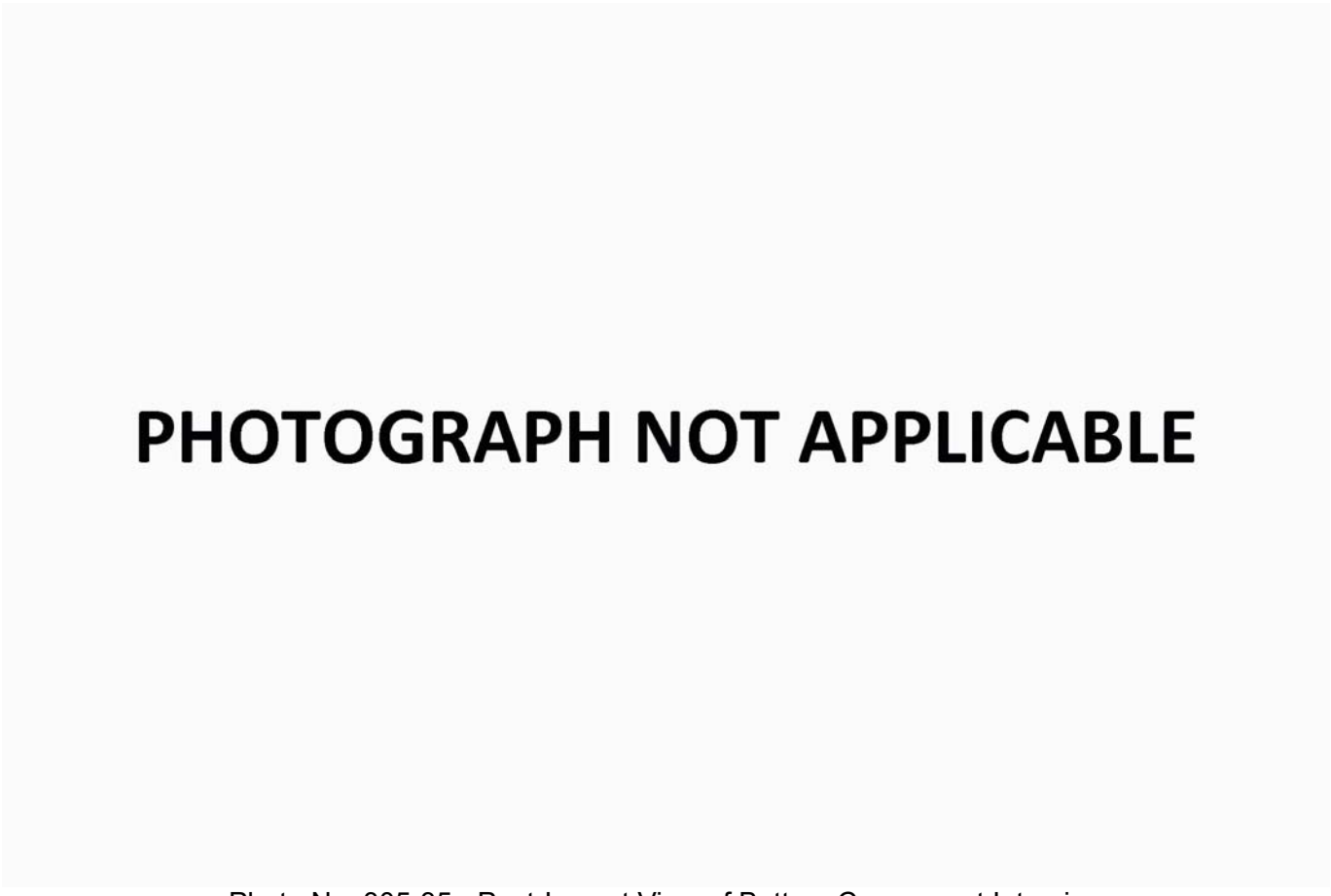


Photo No. 305-35 - Post-Impact View of Battery Component Intrusion

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-36 - Post-Impact View of Battery Module Movement or Retention Loss

PHOTOGRAPH NOT APPLICABLE

Photo No. 305-37 - Post-Impact View of Propulsion Battery Electrolyte Spillage Location

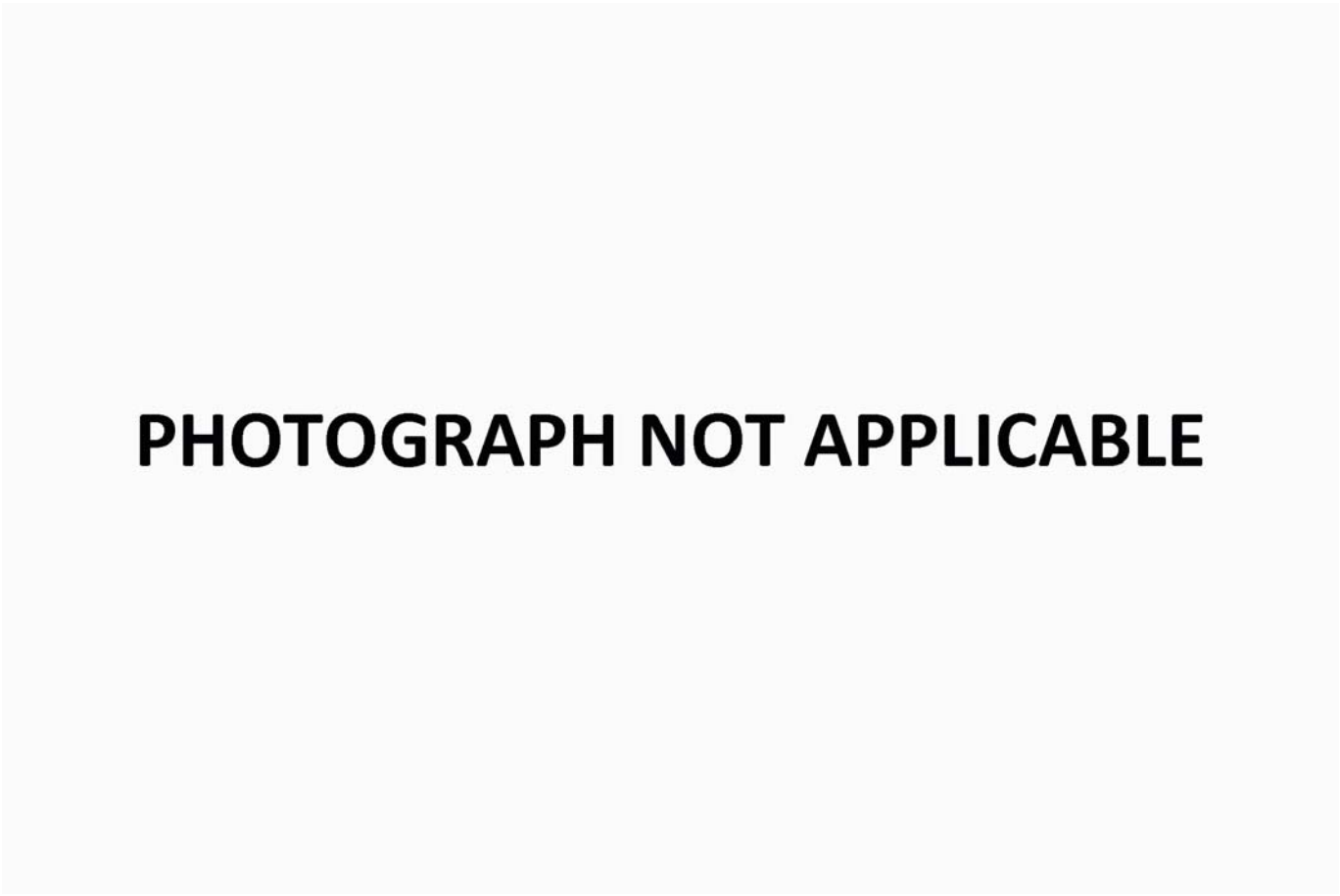


Photo No. 305-38 - Post-Test View of Propulsion Battery Electrolyte Spillage Location

APPENDIX B
DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS
Driver Dummy Instrumentation Plots

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Figure No. 1.	Driver Head CG Acceleration (X) vs. Time	B-1
Figure No. 2.	Driver Head CG Acceleration (Y) vs. Time	B-1
Figure No. 3.	Driver Head CG Acceleration (Z) vs. Time	B-1
Figure No. 4.	Driver Head CG Resultant Acceleration (X) vs. Time	B-1
Figure No. 5.	Driver Lower Spine T12 Acceleration (X) vs. Time	B-2
Figure No. 6.	Driver Lower Spine T12 Acceleration (Y) vs. Time	B-2
Figure No. 7.	Driver Lower Spine T12 Acceleration (Z) vs. Time	B-2
Figure No. 8.	Driver Lower Spine T12 Resultant Acceleration vs. Time	B-2
Figure No. 9.	Driver Iliac Wing Force on Impact Side (Y) vs. Time	B-3
Figure No. 10.	Driver Acetabulum Force on Impact Side (Y) vs. Time	B-3
Figure No. 11.	Driver Total Pelvis Force on Impact Side (Y) vs. Time	B-3

The following additional data for this test can be obtained from the Research and Development section of the NHTSA website. The website can be found at www.nhtsa.gov

Additional Driver Dummy Instrumentation Data

Driver Head CG Redundant Acceleration (X) vs. Time

Driver Head CG Redundant Acceleration (Y) vs. Time

Driver Head CG Redundant Acceleration (Z) vs. Time

Driver Head Angular Velocity X (Deg/Sec) vs. Time

Driver Head Angular Velocity Y (Deg/Sec) vs. Time

Driver Head Angular Velocity Z (Deg/Sec) vs. Time

Driver Upper Thorax Rib Deflection (Y)

Driver Middle Thorax Rib Deflection (Y)

Driver Lower Thorax Rib Deflection (Y)

Driver Upper Abdomen Rib Deflection (Y)

Driver Lower Abdomen Rib Deflection (Y)

Vehicle Instrumentation Data

Vehicle Center of Gravity Acceleration (X)

Vehicle Center of Gravity Acceleration (Y)

Vehicle Center of Gravity Acceleration (Z)

Left Floor Sill Acceleration (Y)

Left A-Pillar Sill Acceleration (Y)

Left Lower A-Pillar Acceleration (Y)

Left Mid A-Pillar Acceleration (Y)

Left B-Pillar Sill Acceleration (Y)

Left Lower B-Pillar Acceleration (Y)

Left Mid B-Pillar Acceleration (Y)

Driver Seat Track at Dummy Hip Point Acceleration (Y)

Engine Top Acceleration (X)

Engine Top Acceleration (Y)

Firewall Center Acceleration (Y)

Right Roof at Vertical Impact Reference Line Acceleration (Y)

Right Sill at Vertical Impact Reference Line Acceleration (Y)

Rear Floorpan Behind Rear Axle at Centerline Acceleration (X)

Rear Floorpan Behind Rear Axle at Centerline Acceleration (Y)

Pole Instrumentation Data

Load Cell Pole Barrier #1 Force (Y)

Load Cell Pole Barrier #2 Force (Y)

Load Cell Pole Barrier #3 Force (Y)

Load Cell Pole Barrier #4 Force (Y)

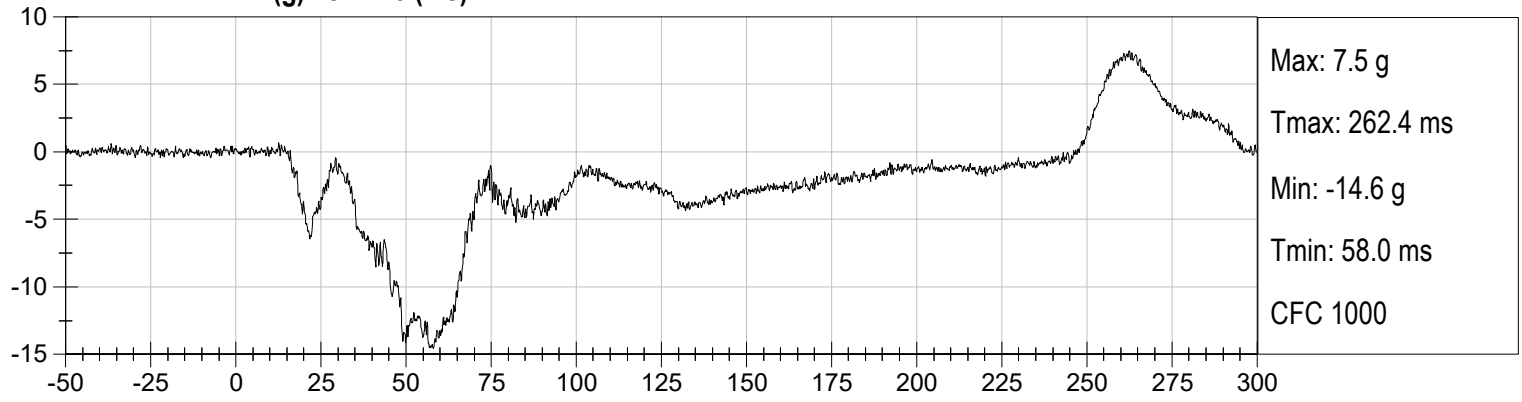
Load Cell Pole Barrier #5 Force (Y)

Load Cell Pole Barrier #6 Force (Y)

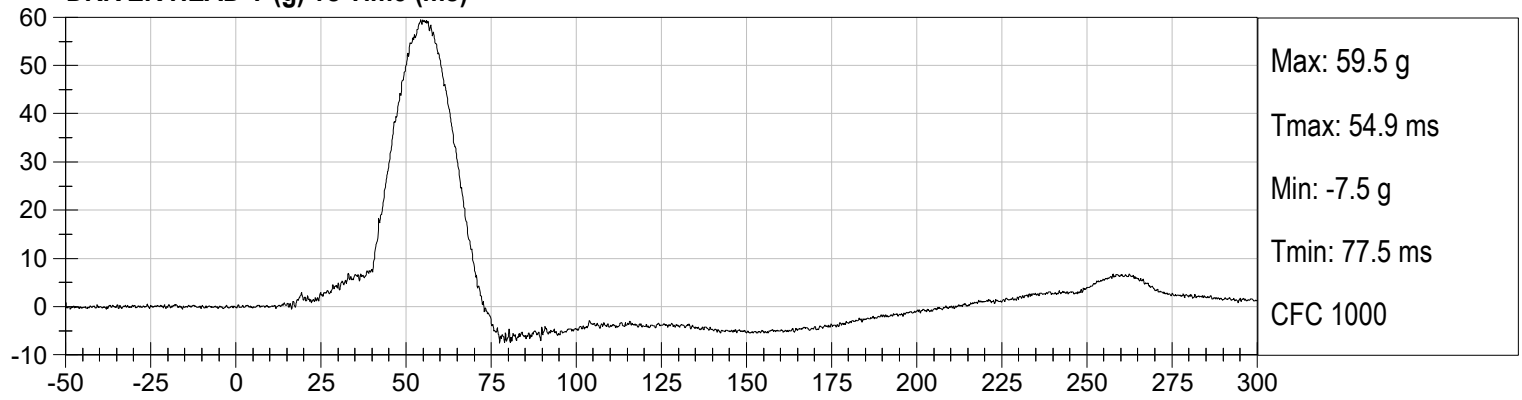
Load Cell Pole Barrier #7 Force (Y)

Load Cell Pole Barrier #8 Force (Y)

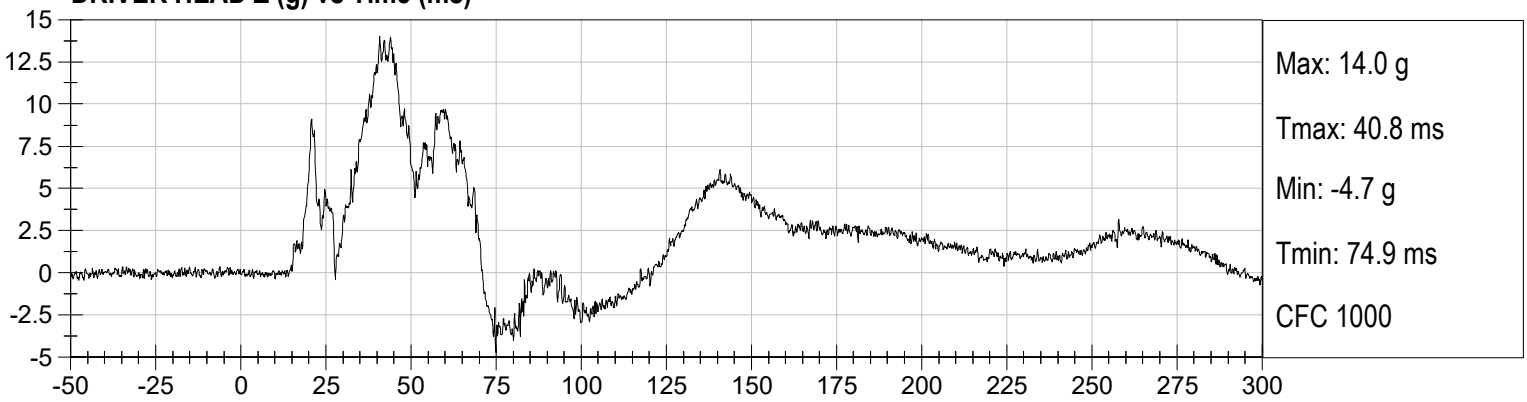
DRIVER HEAD X (g) vs Time (ms)



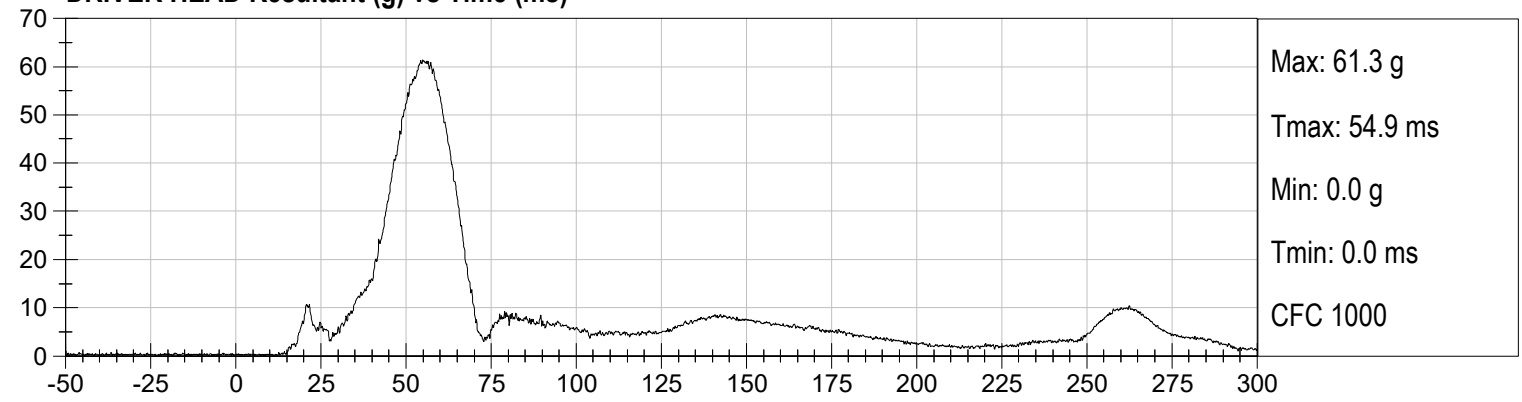
DRIVER HEAD Y (g) vs Time (ms)



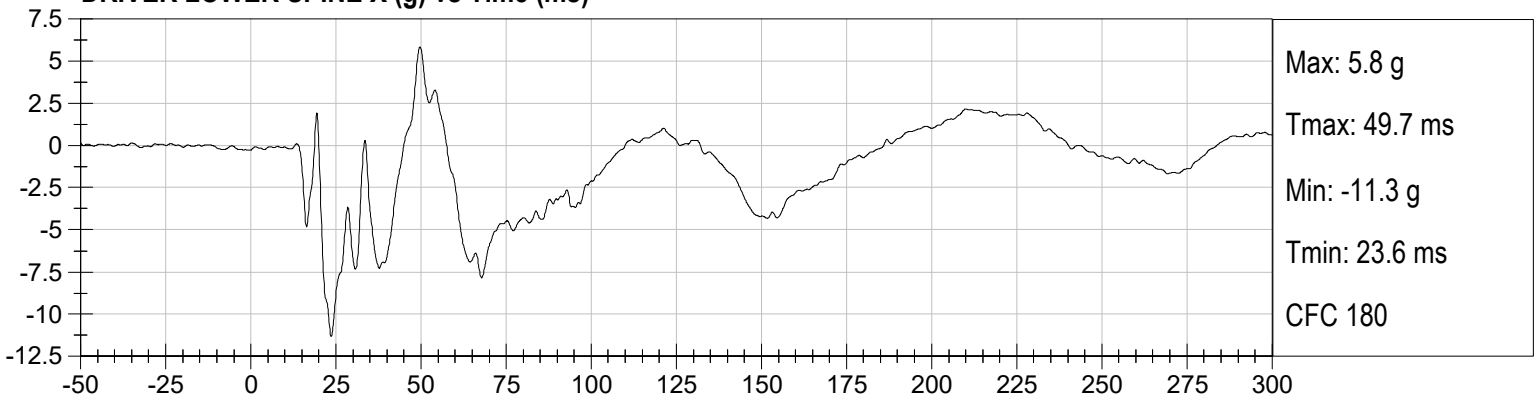
DRIVER HEAD Z (g) vs Time (ms)



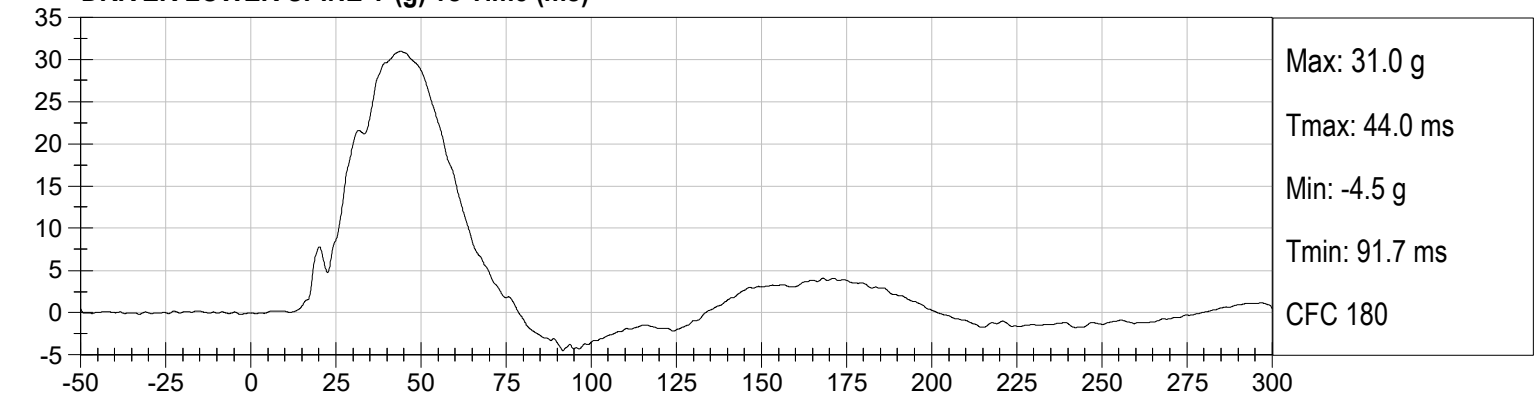
DRIVER HEAD Resultant (g) vs Time (ms)



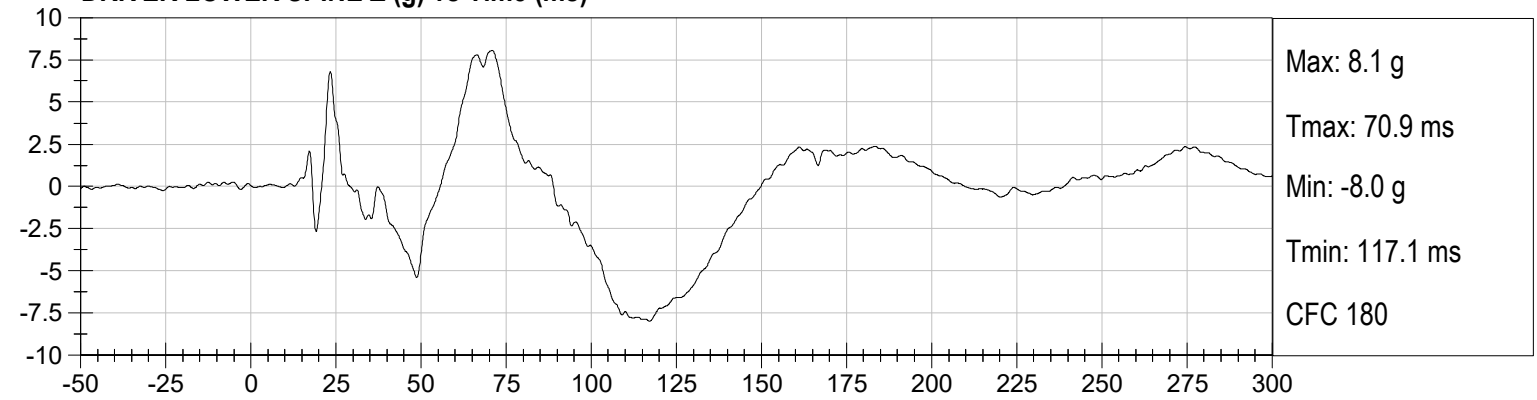
DRIVER LOWER SPINE X (g) vs Time (ms)



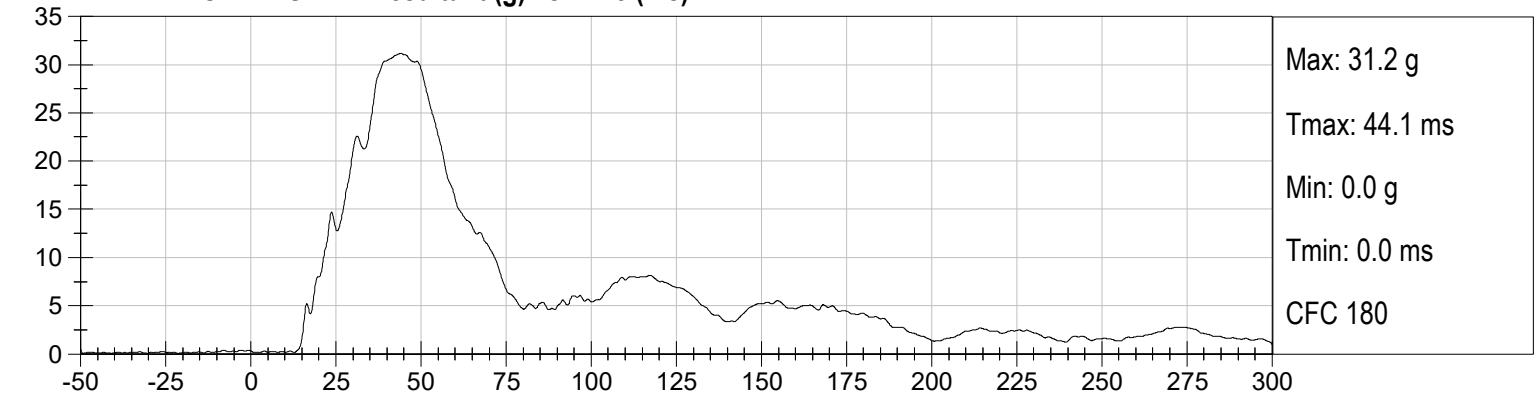
DRIVER LOWER SPINE Y (g) vs Time (ms)



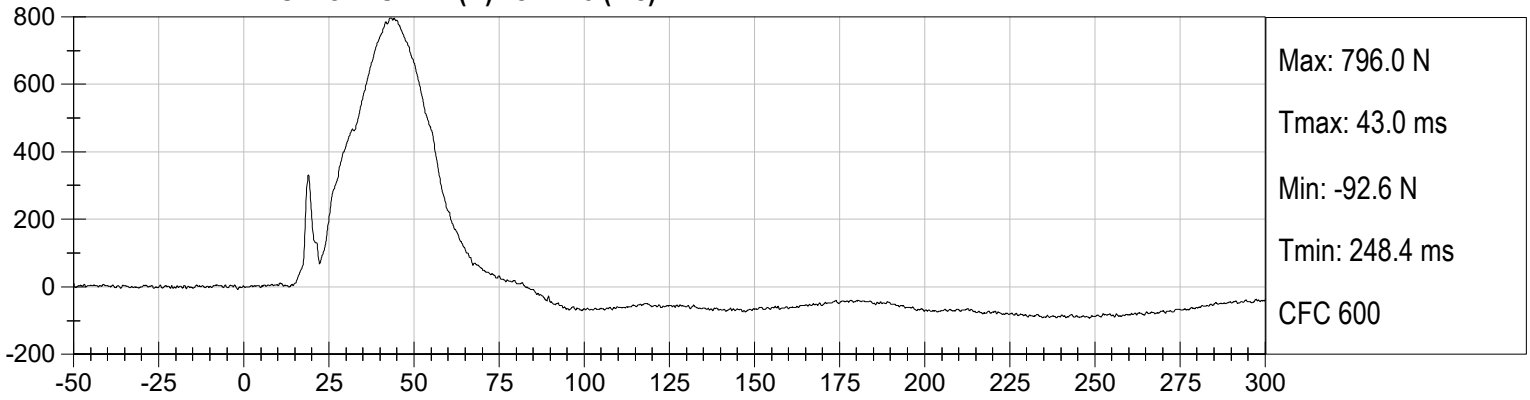
DRIVER LOWER SPINE Z (g) vs Time (ms)



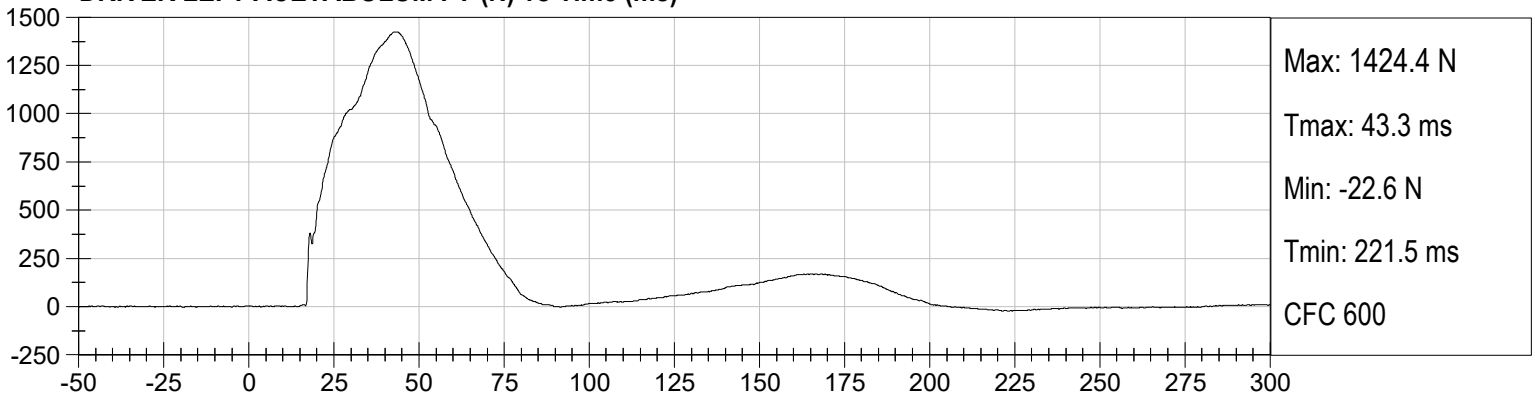
DRIVER LOWER SPINE Resultant (g) vs Time (ms)



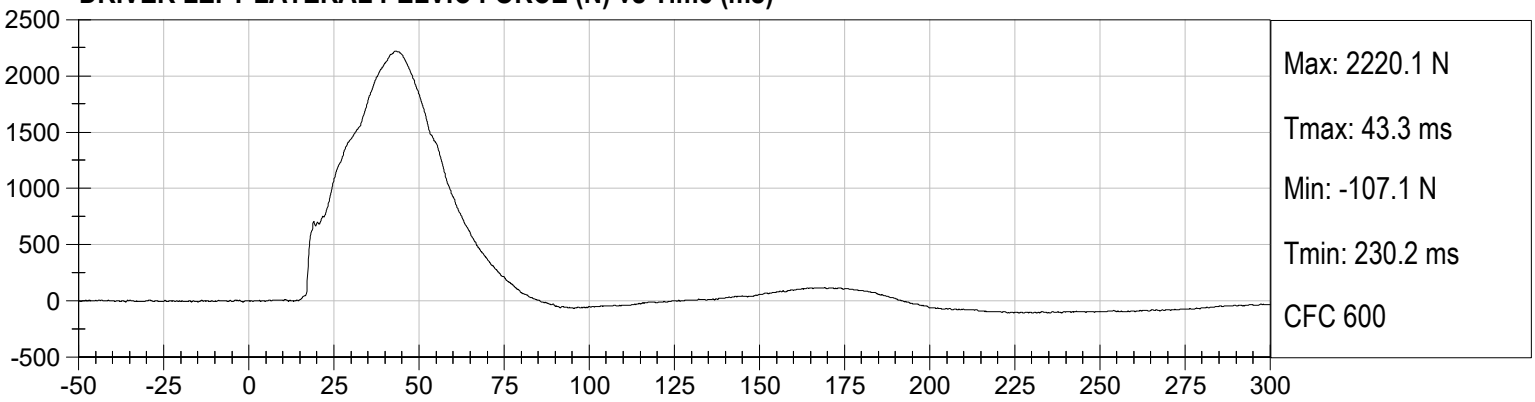
DRIVER LEFT ILIUM CREST FY (N) vs Time (ms)



DRIVER LEFT ACETABULUM FY (N) vs Time (ms)



DRIVER LEFT LATERAL PELVIC FORCE (N) vs Time (ms)



APPENDIX C
DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - DRIVER ATD

SID-IIsD External Measurements
SN: 296

No.	Name	Spec. (mm)	Result	Pass/Fail
A	Sitting Height	772 - 788	784	Pass
B	Shoulder Pivot Height	437 - 453	442	Pass
C	H-point Height	79 - 89	83	Pass
D	H-point from Seatback	141 - 151	145	Pass
E	Shoulder Pivot from Backline	97 - 107	99	Pass
F	Thigh Clearance	119 -135	121	Pass
G	Head Breadth	140 - 148	142	Pass
H	Head Back from Backline	40 - 46	45	Pass
I	Head Depth	178 - 188	180	Pass
J	Head Circumference	541 - 551	548	Pass
K	Buttock to Knee Length	514 - 540	535	Pass
L	Popliteal Height	343 - 369	358	Pass
M	Knee Pivot to Floor Height	392 - 409	404	Pass
N	Buttock Popliteal Length	416 - 442	435	Pass
O	Chest Depth w/o Jacket	195 - 211	206	Pass
P	Foot Length	216 - 232	219	Pass
Q	Hip Breadth (w/ pelvic plugs)	313 - 323	316	Pass
R	Arm Length	249 - 259	250	Pass
S	Knee Joint to Seatback	477 - 493	481	Pass
V	Shoulder Width	341 - 357	346	Pass
W	Foot Width	78 - 94	85	Pass
Y	Chest Circumference w/ jacket	851 - 881	870	Pass
Z	Waist Circumference	761 - 791	772	Pass

MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

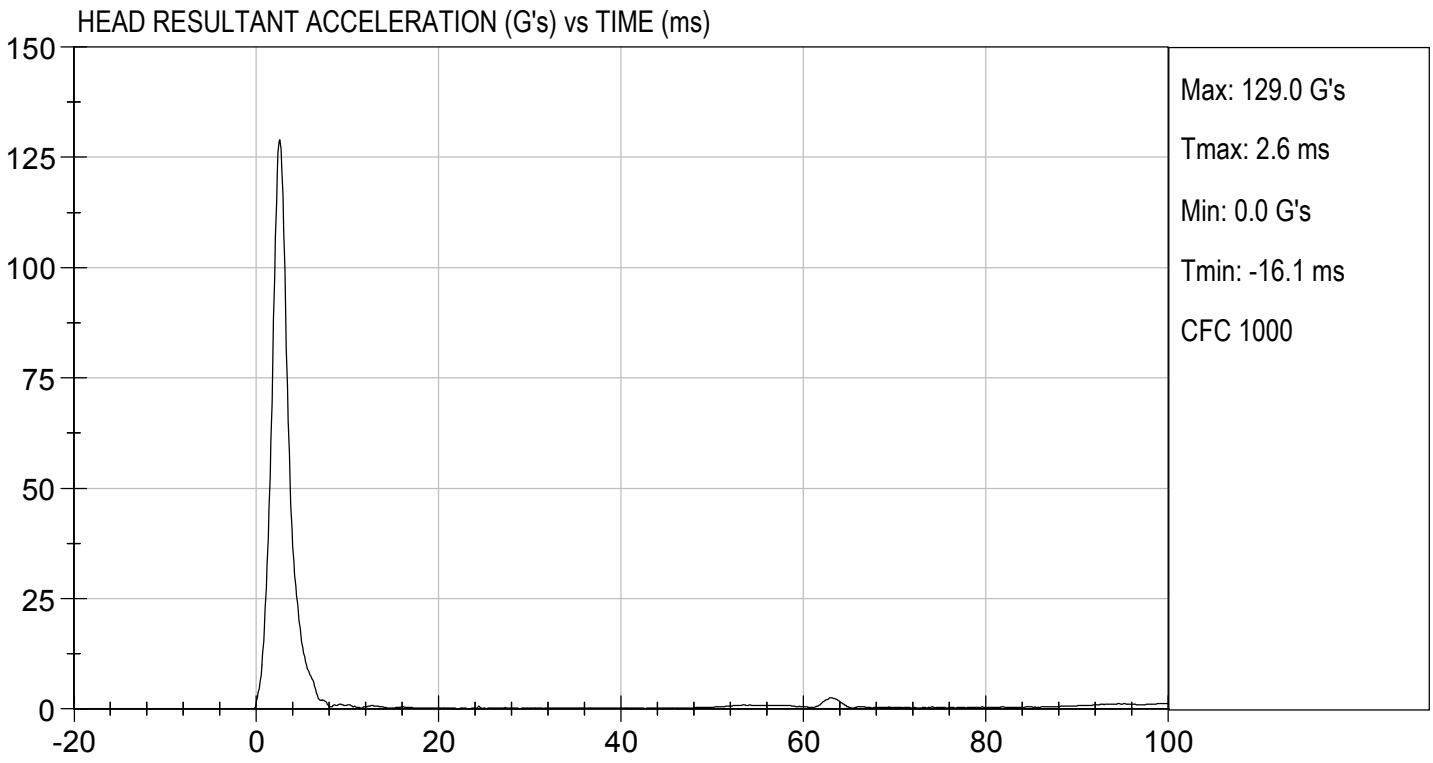
ATD Serial No: 296 **Test ID:** D210491

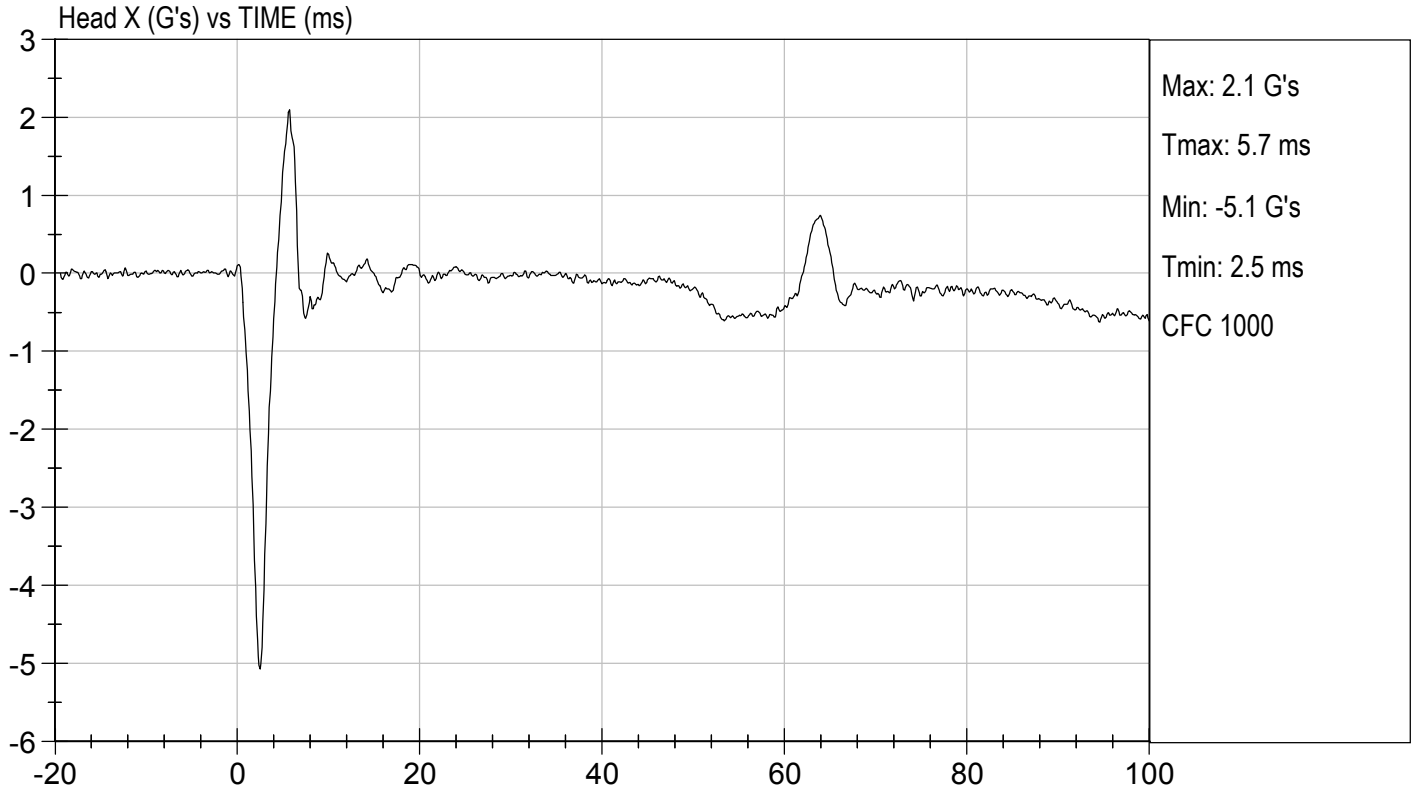
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Peak Resultant Acceleration	G's	115 to 137	129	Pass
Peak Longitudinal Acceleration	G's	+/- 15	-5.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Alex Thomas
Laboratory Technician

02/19/2021
Test Date

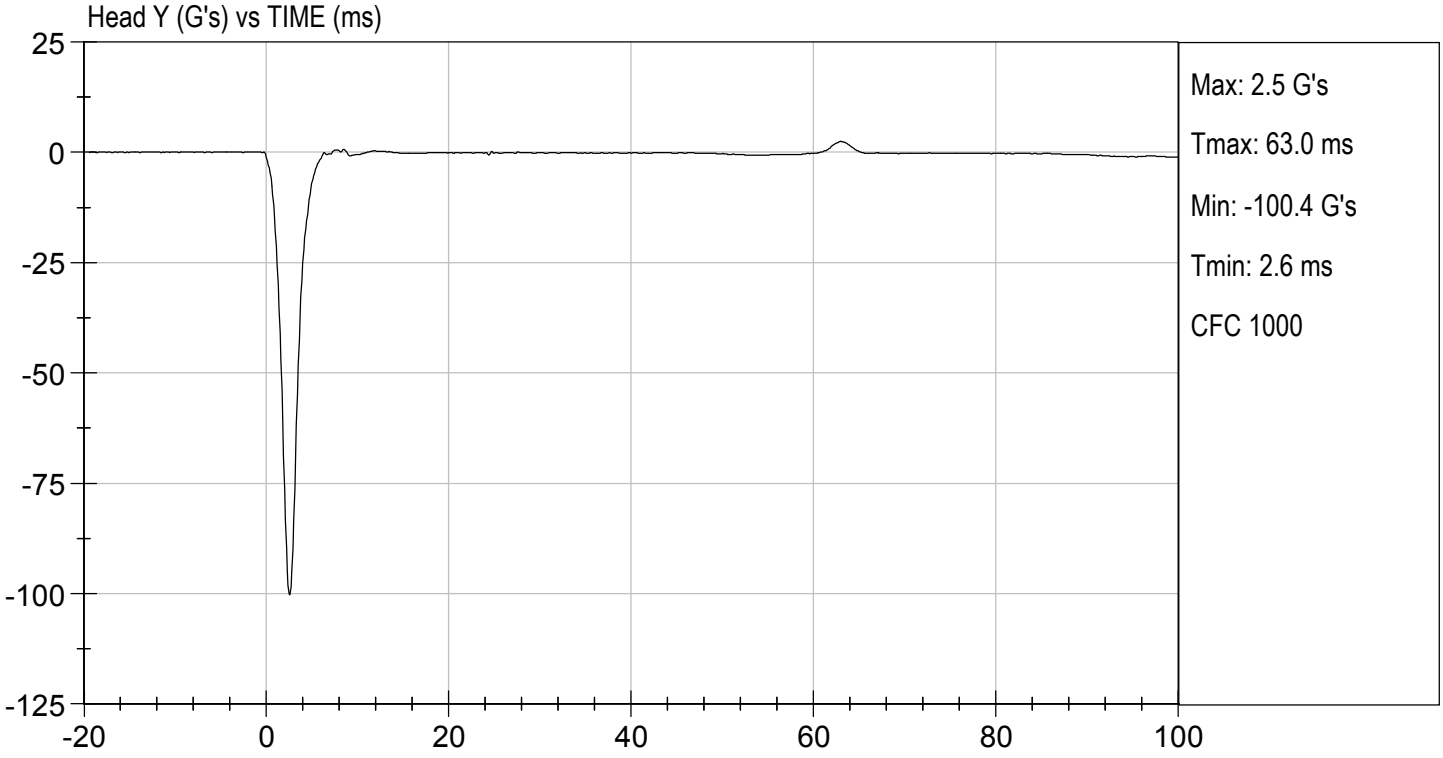
Approved By

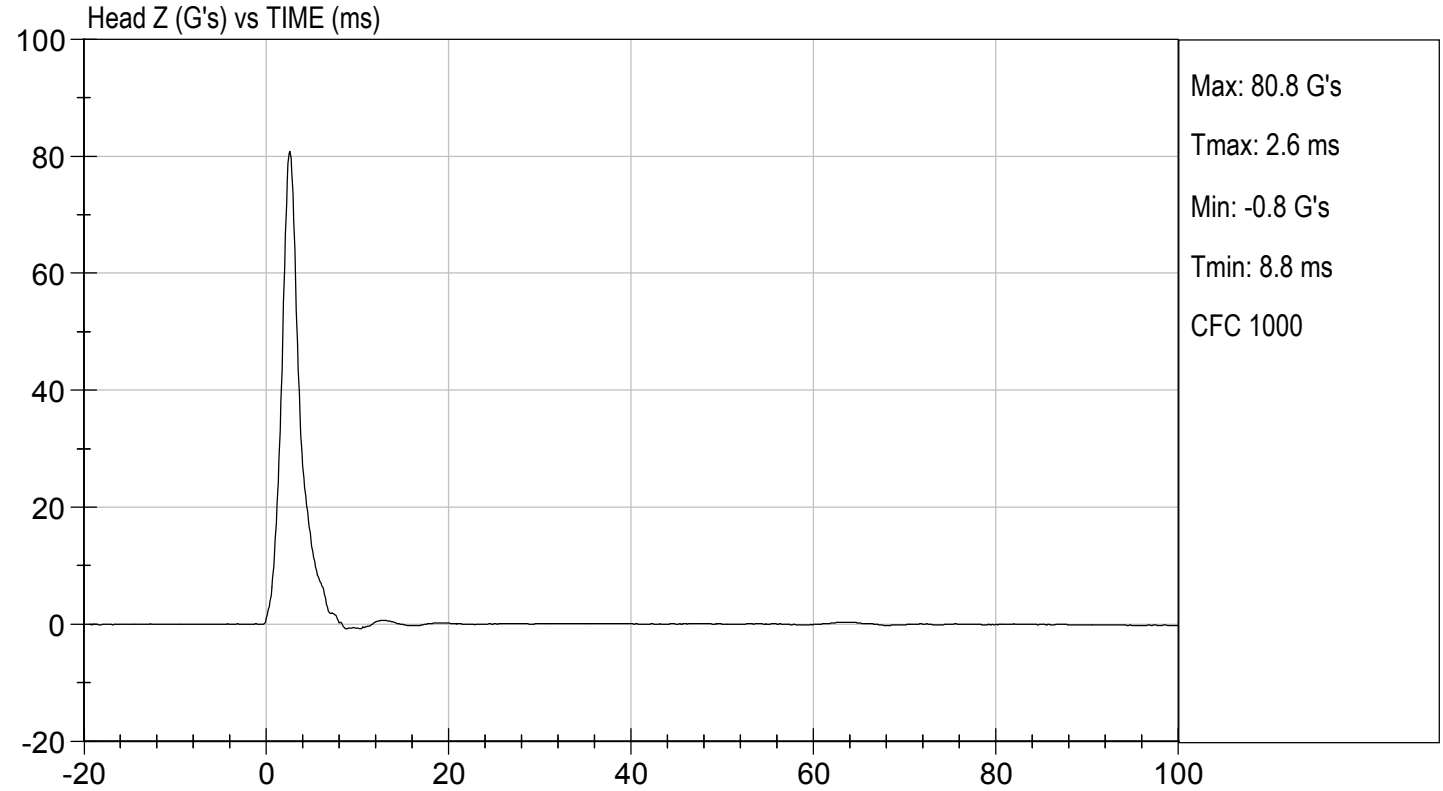

HEAD RESULTANT ACCELERATION (G's) vs TIME (ms)
150
125
100
75
50
25
0
-20
0
20
40
60
80
100
Max: 129.0 G's
Tmax: 2.6 ms
Min: 0.0 G's
Tmin: -16.1 ms
CFC 1000


Head X (G's) vs TIME (ms)
3
2
1
0
-1
-2
-3
-4
-5
-6
-20
0
20
40
60
80
100
Max: 2.1 G's
Tmax: 5.7 ms
Min: -5.1 G's
Tmin: 2.5 ms
CFC 1000

TEST DESC: HEAD DROP

TEST DATE: 02/19/2021
TEST #: D210491





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D210492

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.3	Pass
Humidity		%	10 to 70	17	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.77	Pass
	15 ms	m/s	3.30 to 4.10	3.96	Pass
	20 ms	m/s	4.40 to 5.40	5.38	Pass
	25 ms	m/s	5.40 to 6.10	5.64	Pass
	25-100 ms	m/s	5.50 to 6.20	5.66	Pass
Maximum D-Plane Rotation		deg	71 to 81	71	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	59	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-37	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	111	Pass
			Overall Test Results		Pass

Alex Thomas

Laboratory Technician

02/19/2021

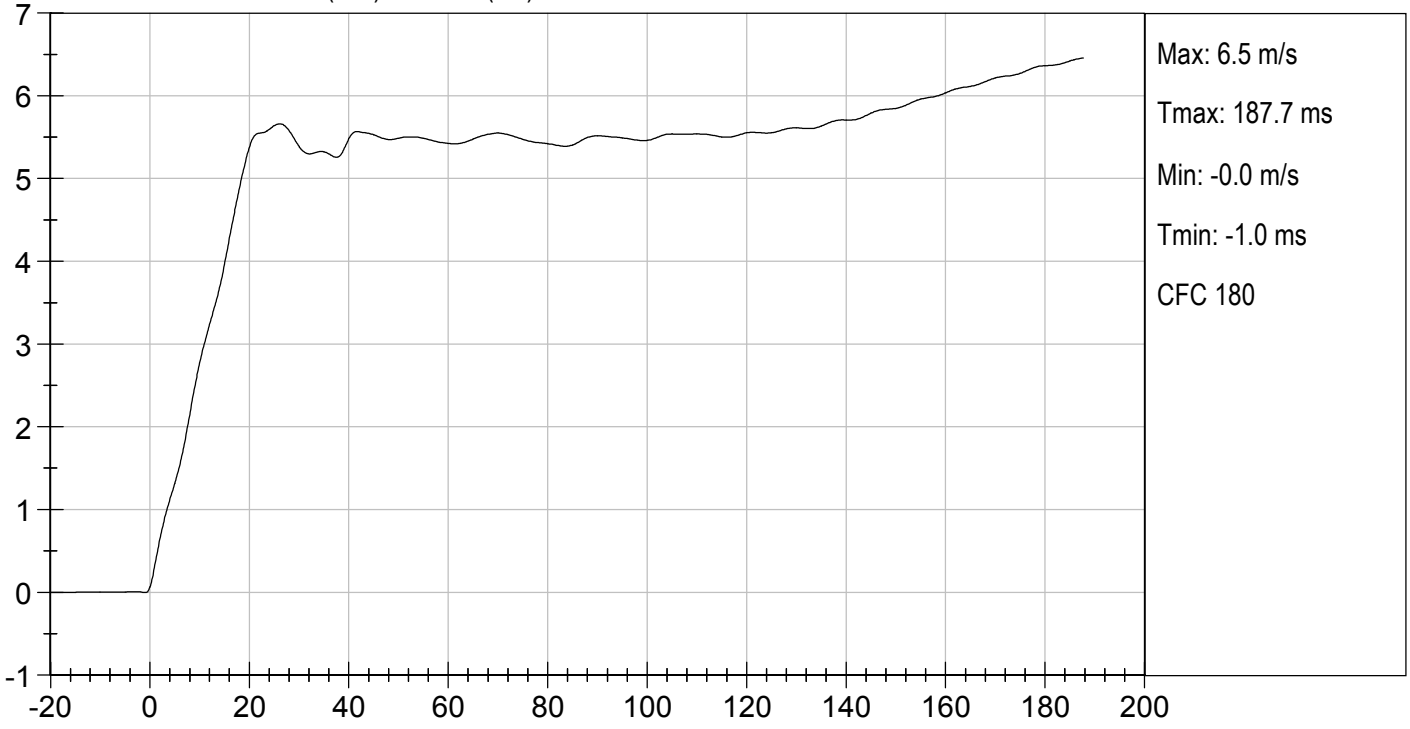
Test Date

Approved By

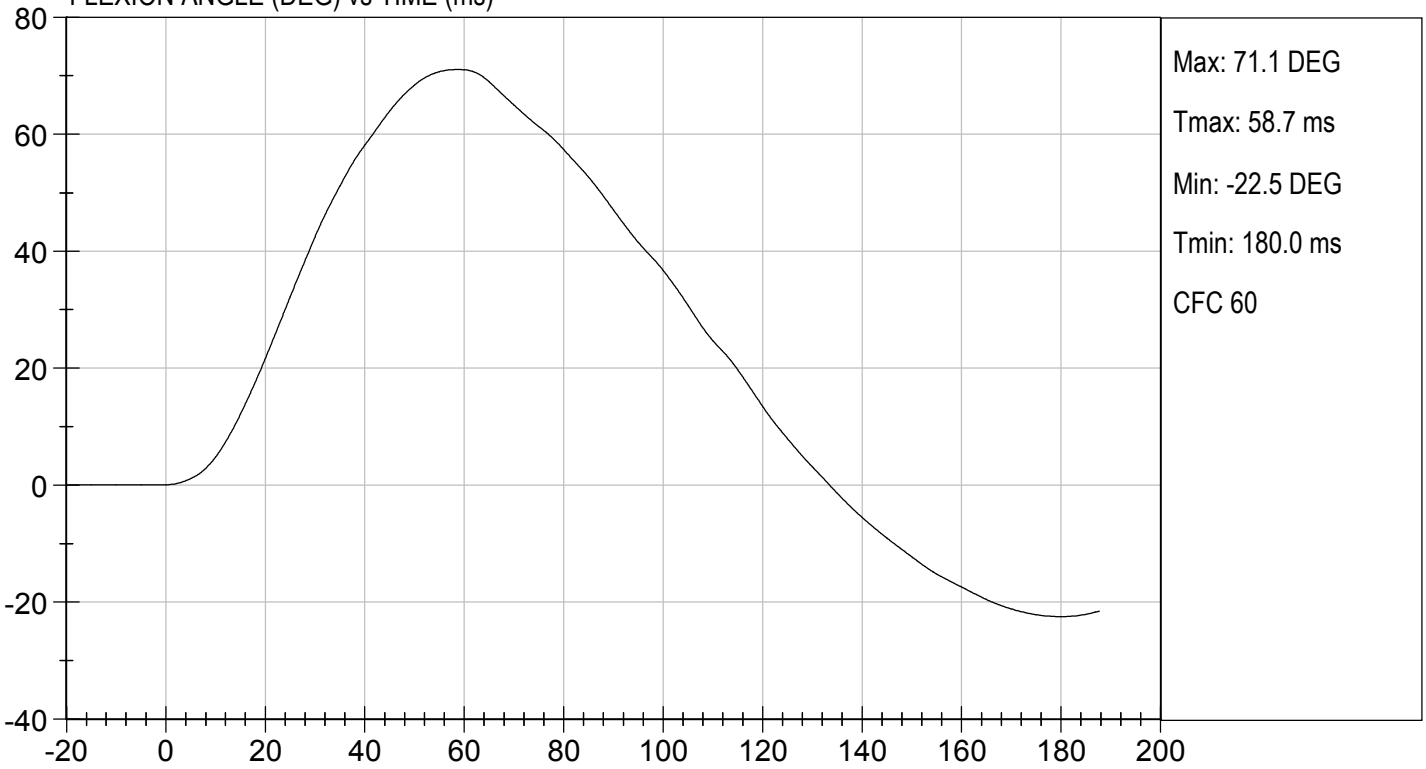
TEST DESC: NECK BENDING
VELOCITY: 18.32 ft/s, 5.58 m/s

TEST DATE: 02/19/2021
TEST #: D210492

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

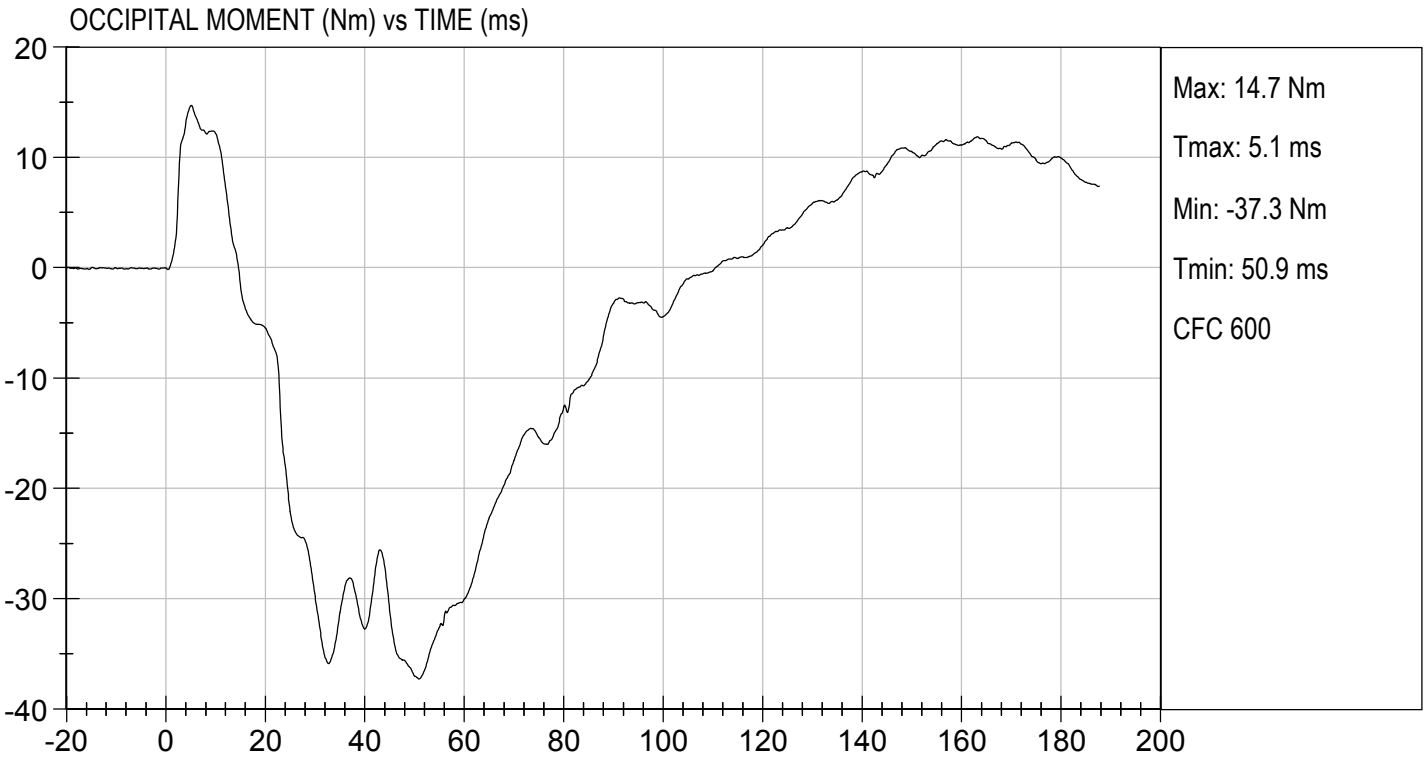


FLEXION ANGLE (DEG) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 18.32 ft/s, 5.58 m/s

TEST DATE: 02/19/2021
TEST #: D210492



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D210493

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	32	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	18	Pass
		Overall Test Results		Pass

Alex Thomas

Laboratory Technician

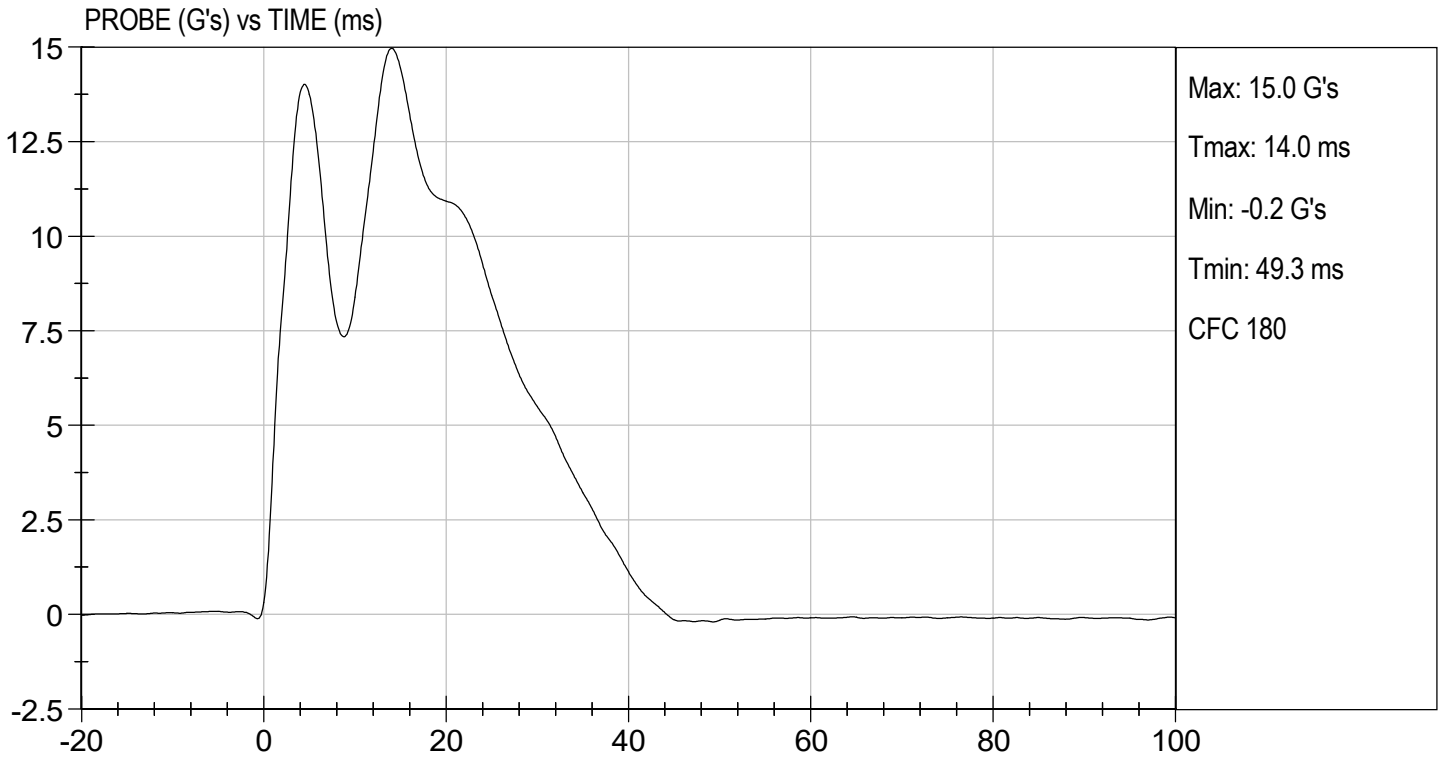
02/19/2021

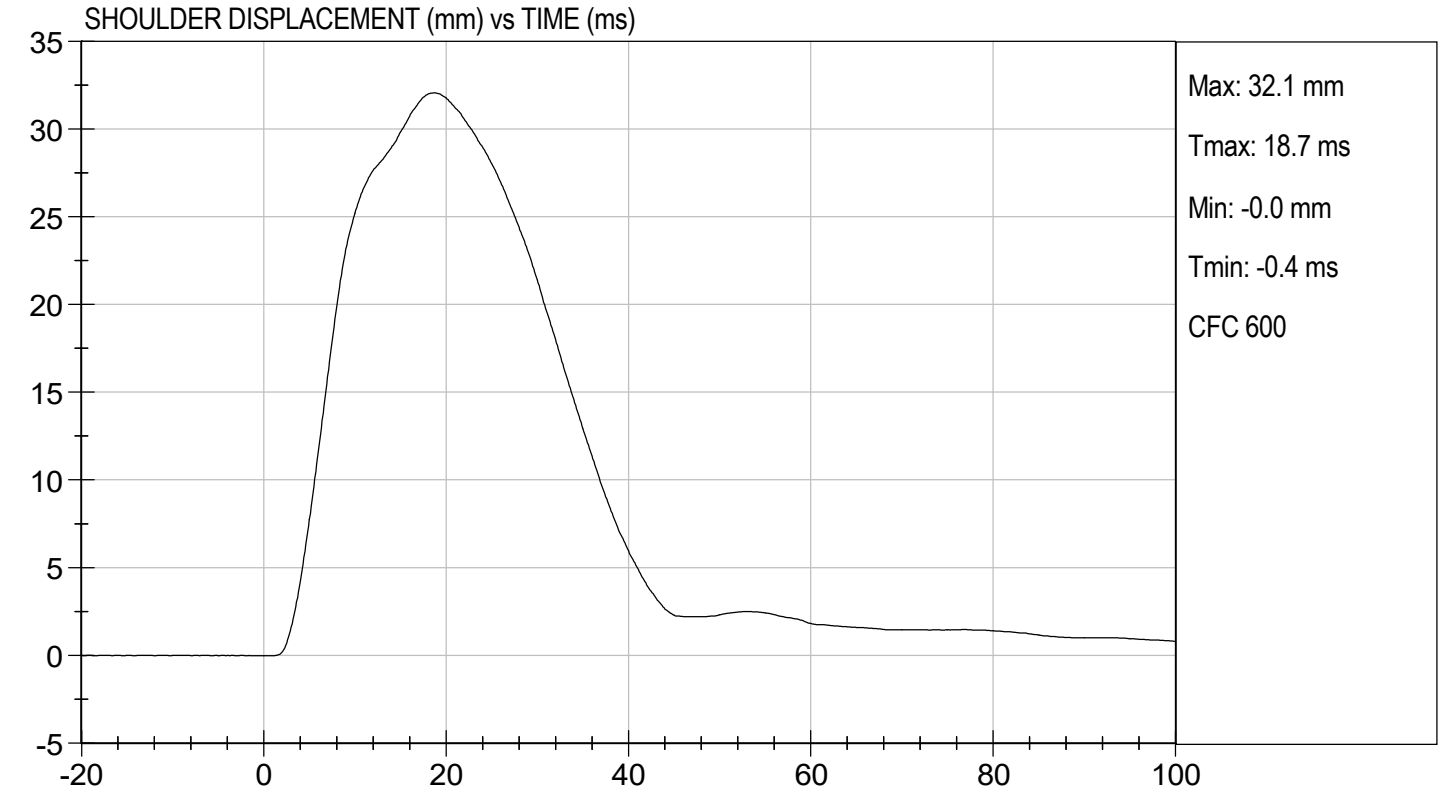
Test Date

Approved By

TEST DESC: SHOULDER IMPACT
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 02/19/2021
TEST #: D210493

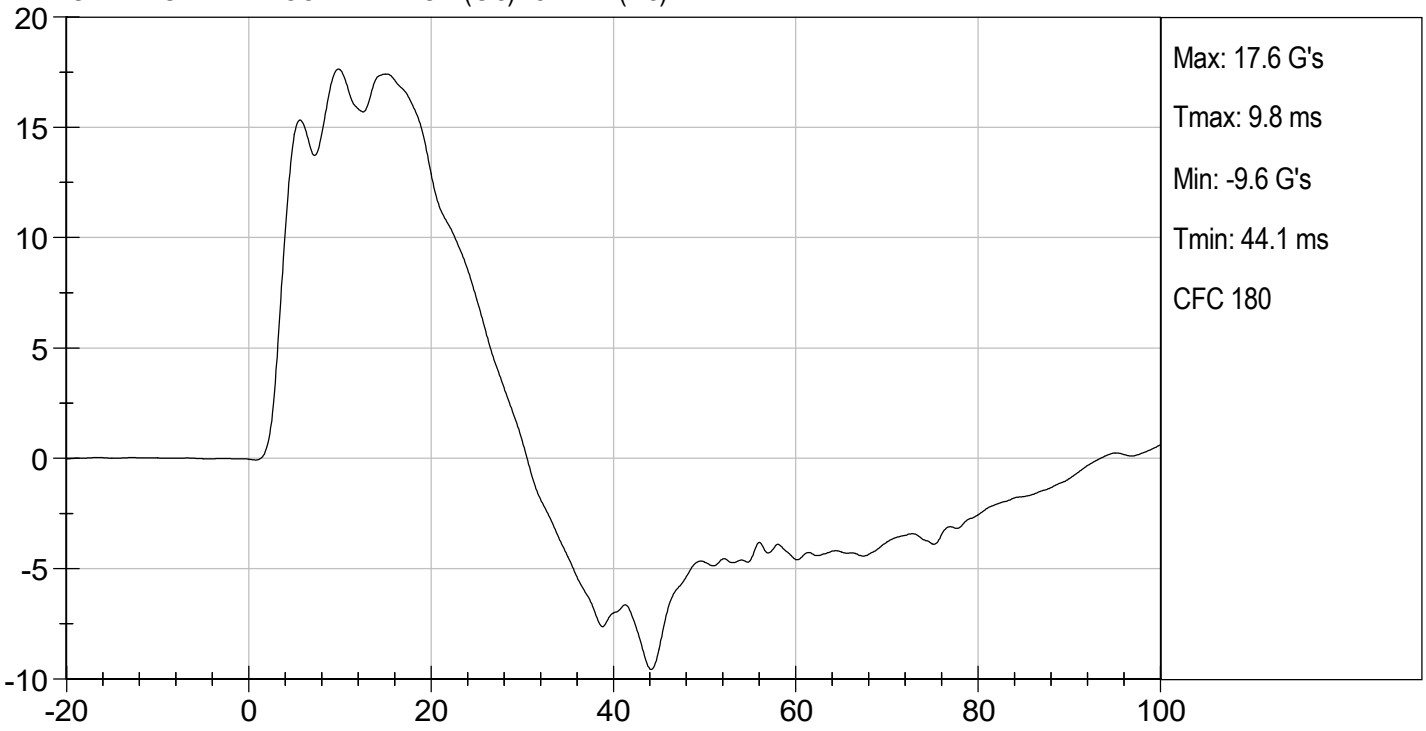




TEST DESC: SHOULDER IMPACT
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 02/19/2021
TEST #: D210493

UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D210494

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	32	Pass
Shoulder Displacement	mm	31 to 40	38	Pass
Upper Rib Displacement	mm	25 to 32	29	Pass
Middle Rib Displacement	mm	30 to 36	32	Pass
Lower Rib Displacement	mm	32 to 38	34	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	37	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	32	Pass
		Overall Test Results		Pass

Alex Thomas
Laboratory Technician

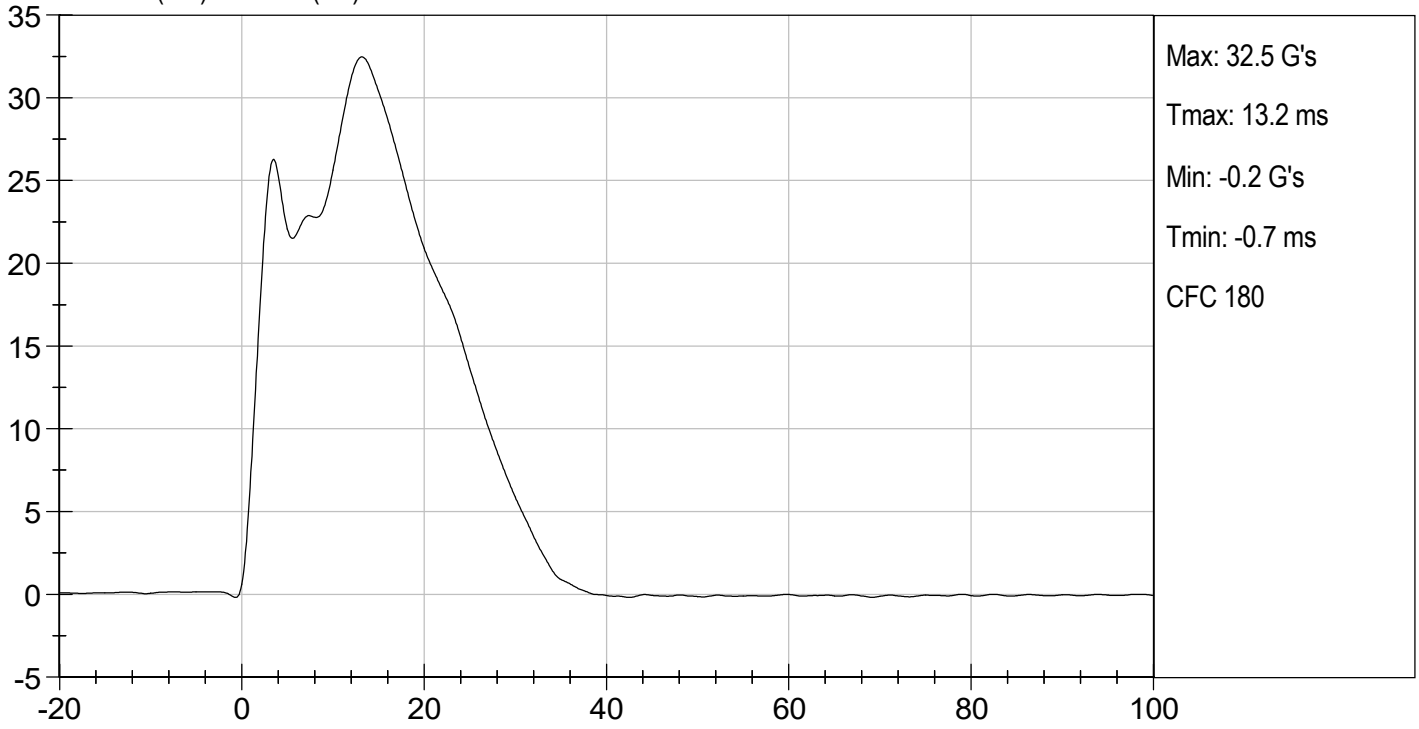
02/19/2021
Test Date

Approved By

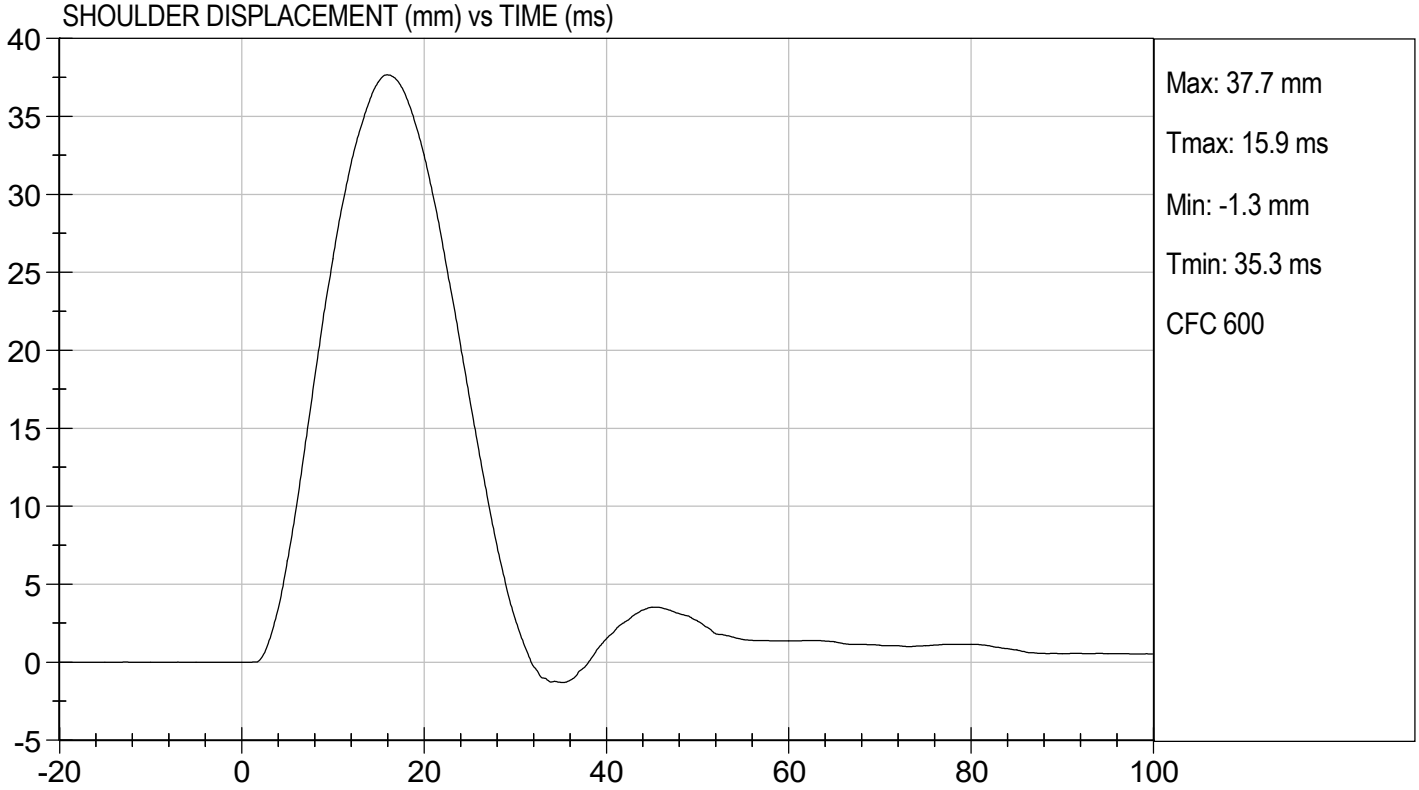
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 02/19/2021
TEST #: D210494

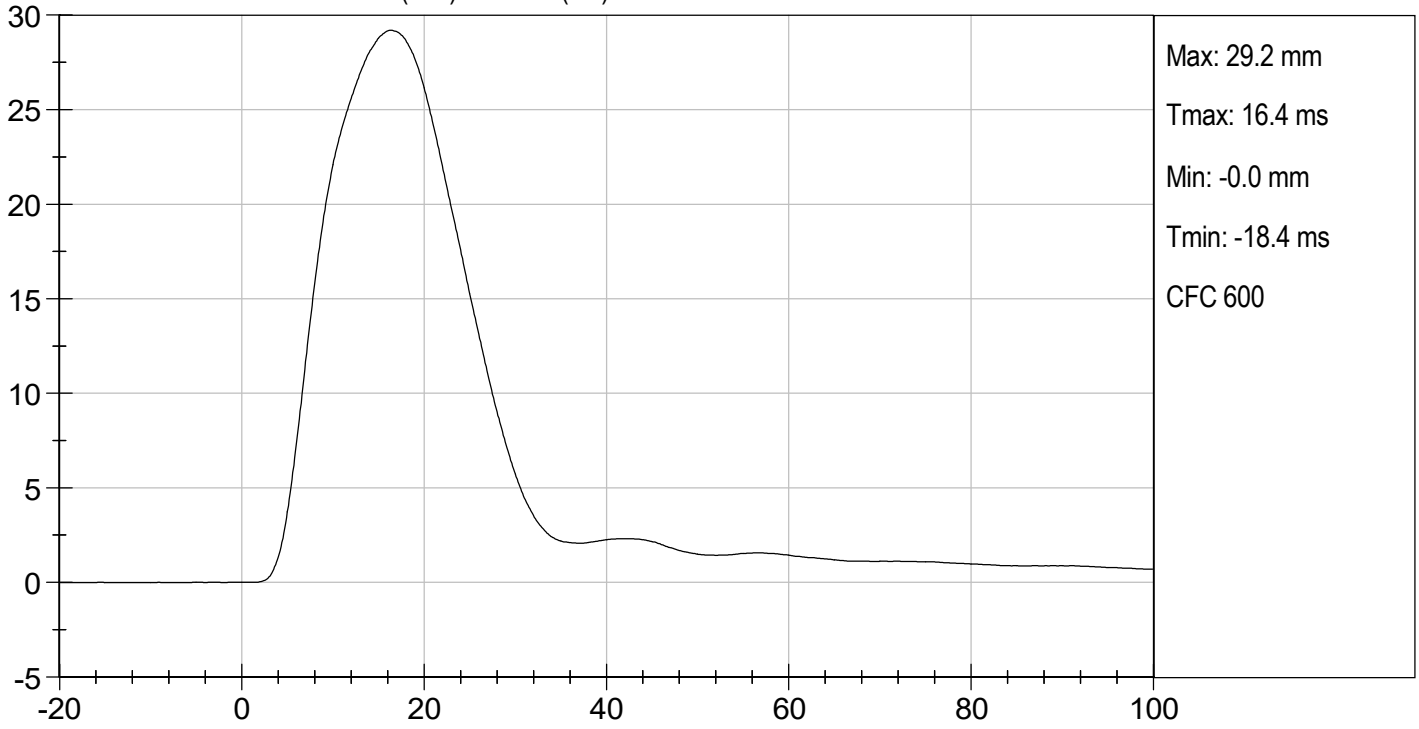
PROBE (G's) vs TIME (ms)



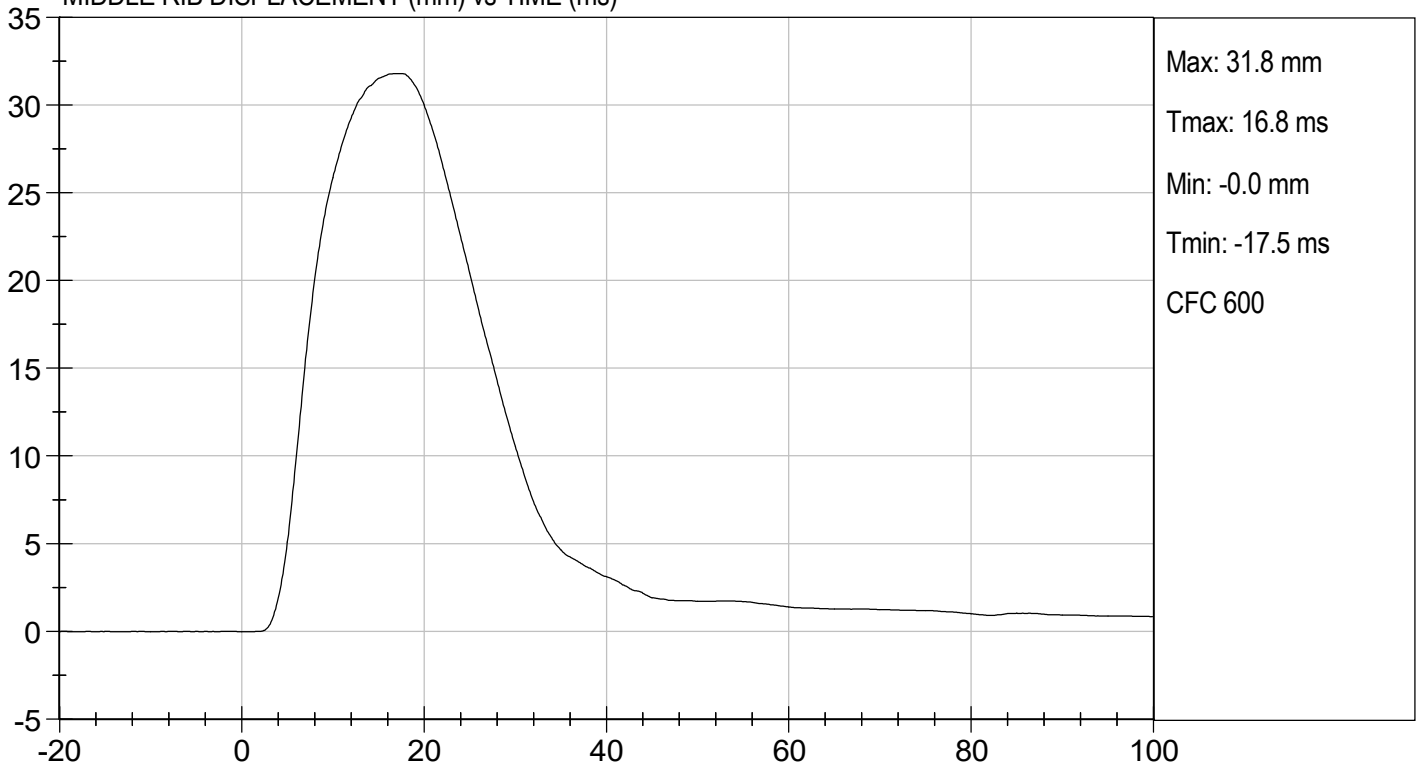
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



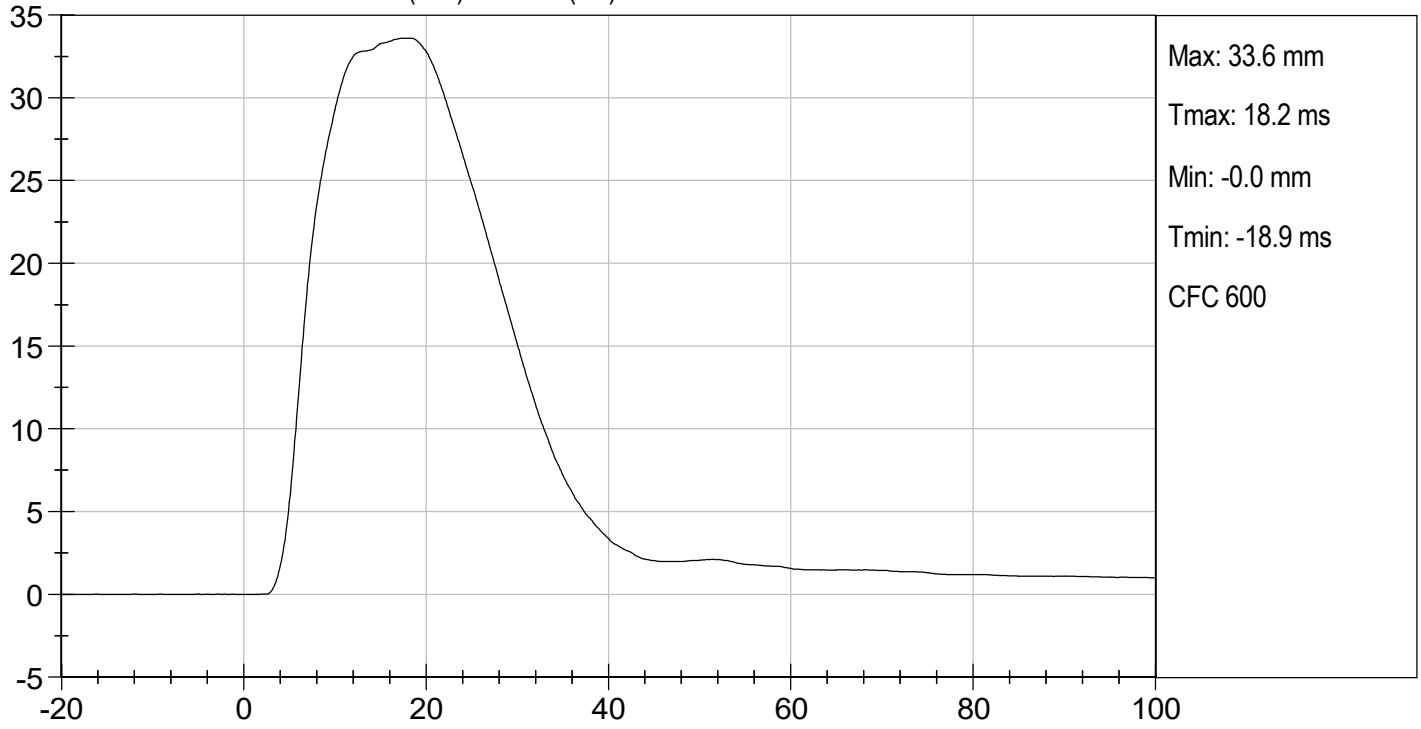
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



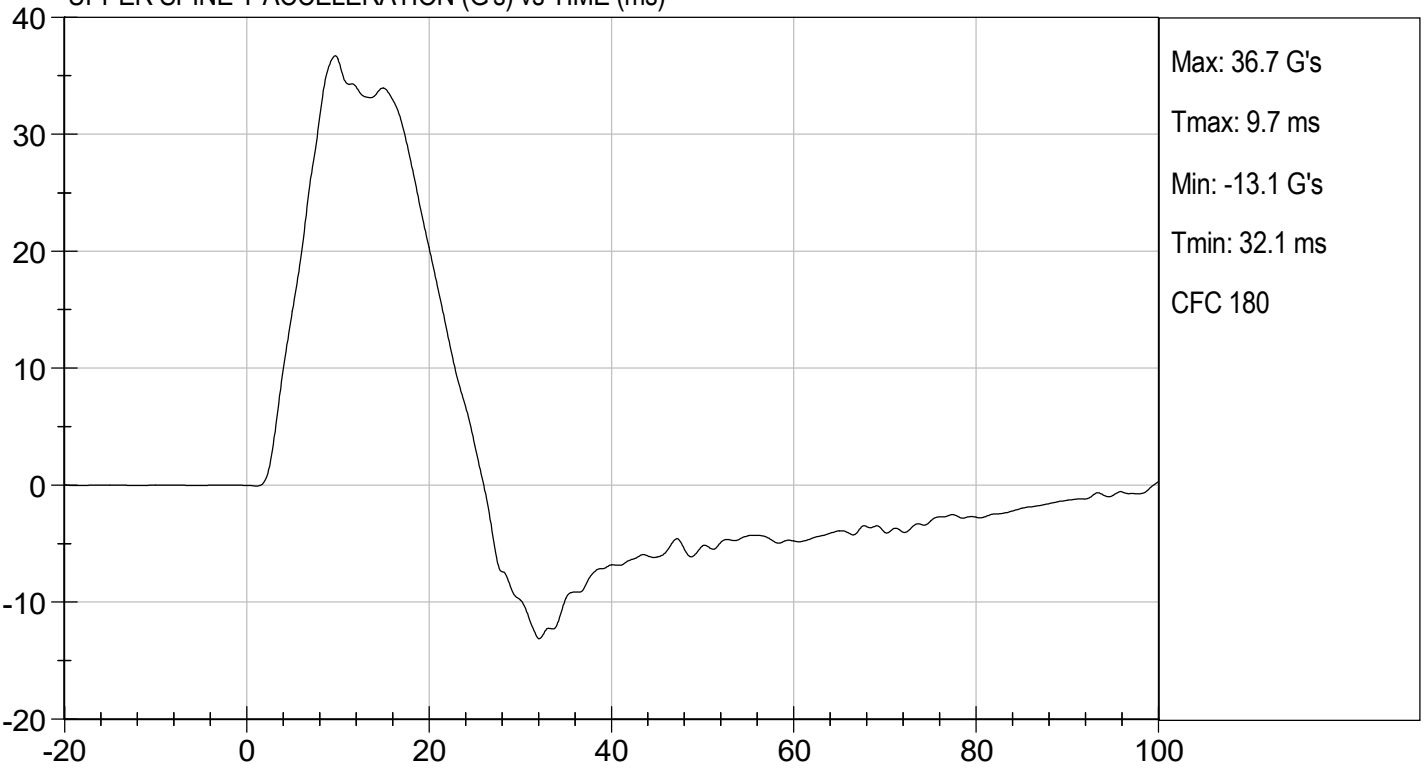
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 02/19/2021
TEST #: D210494

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



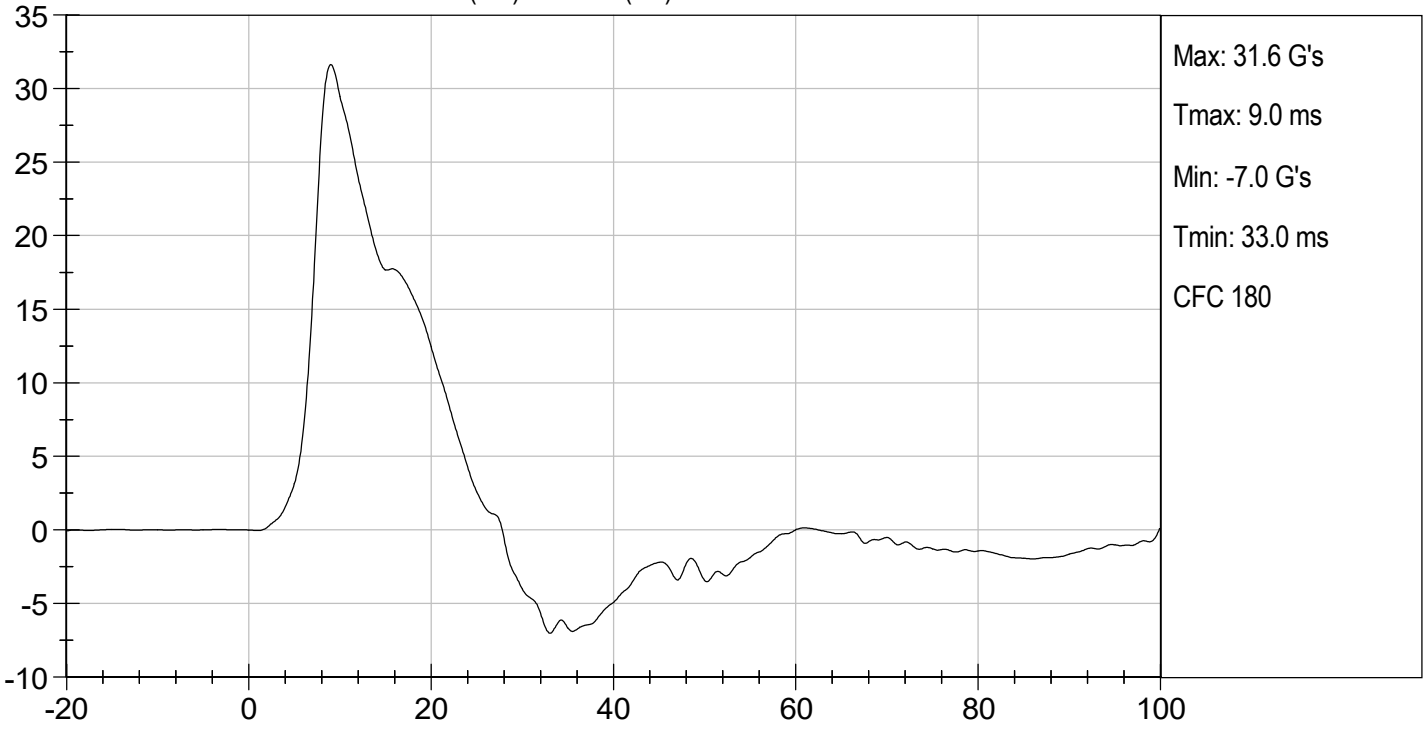
UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 02/19/2021
TEST #: D210494

LOWER SPINE Y ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D210495

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	4.20 to 4.40	4.23	Pass
Maximum Probe Acceleration	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	40	Pass
Middle Rib Displacement	mm	39 to 45	43	Pass
Lower Rib Displacement	mm	35 to 43	39	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	15	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
		Overall Test Results		Pass

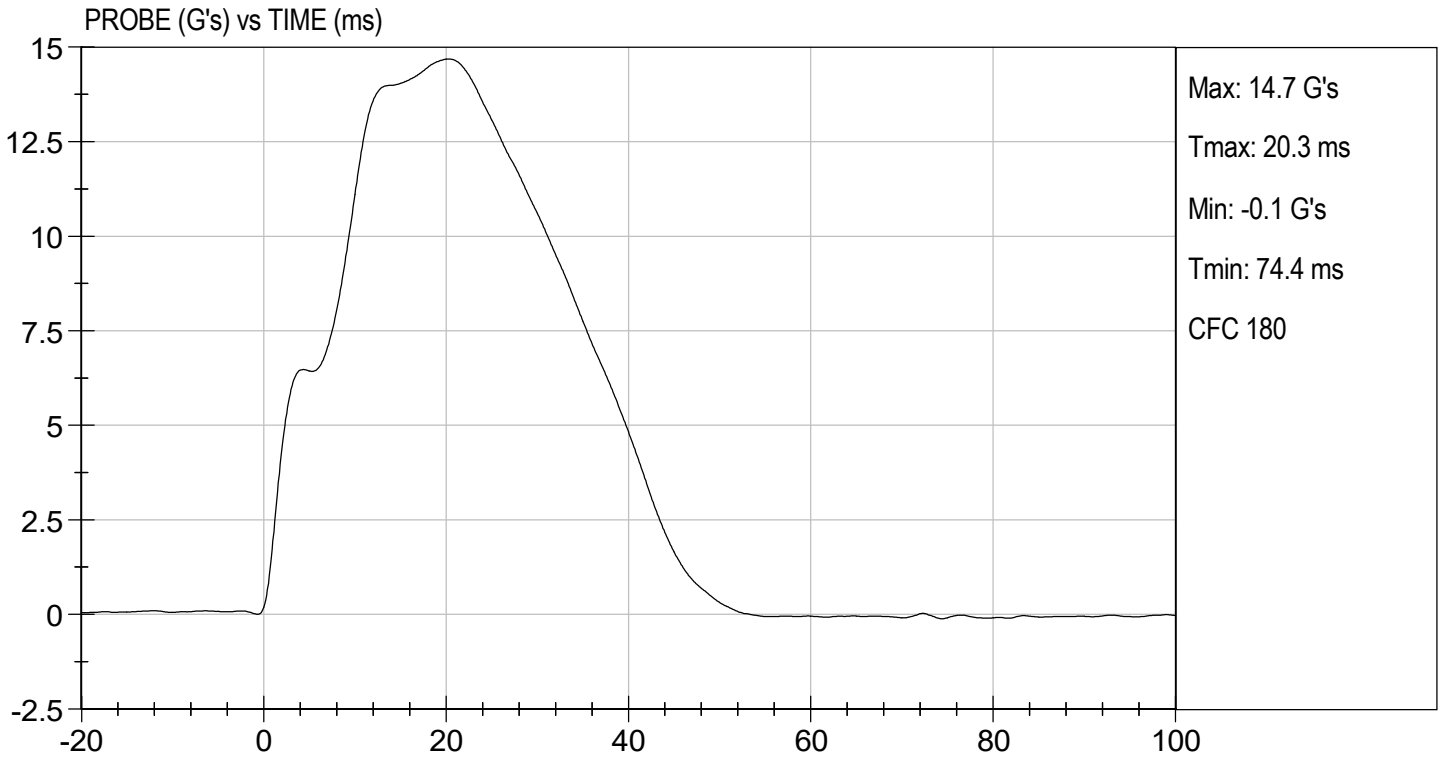
Alex Thomas
Laboratory Technician

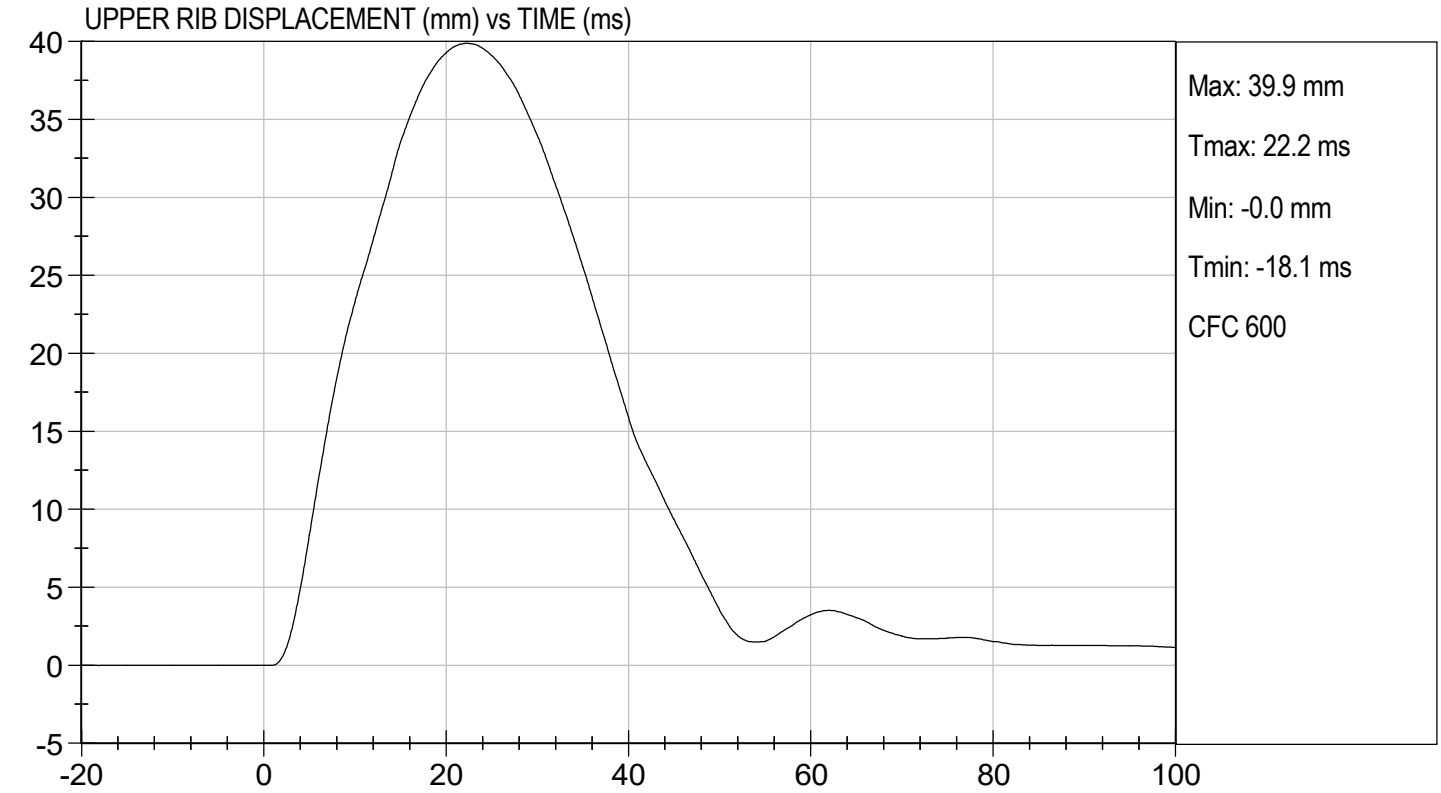
02/19/2021
Test Date

Approved By

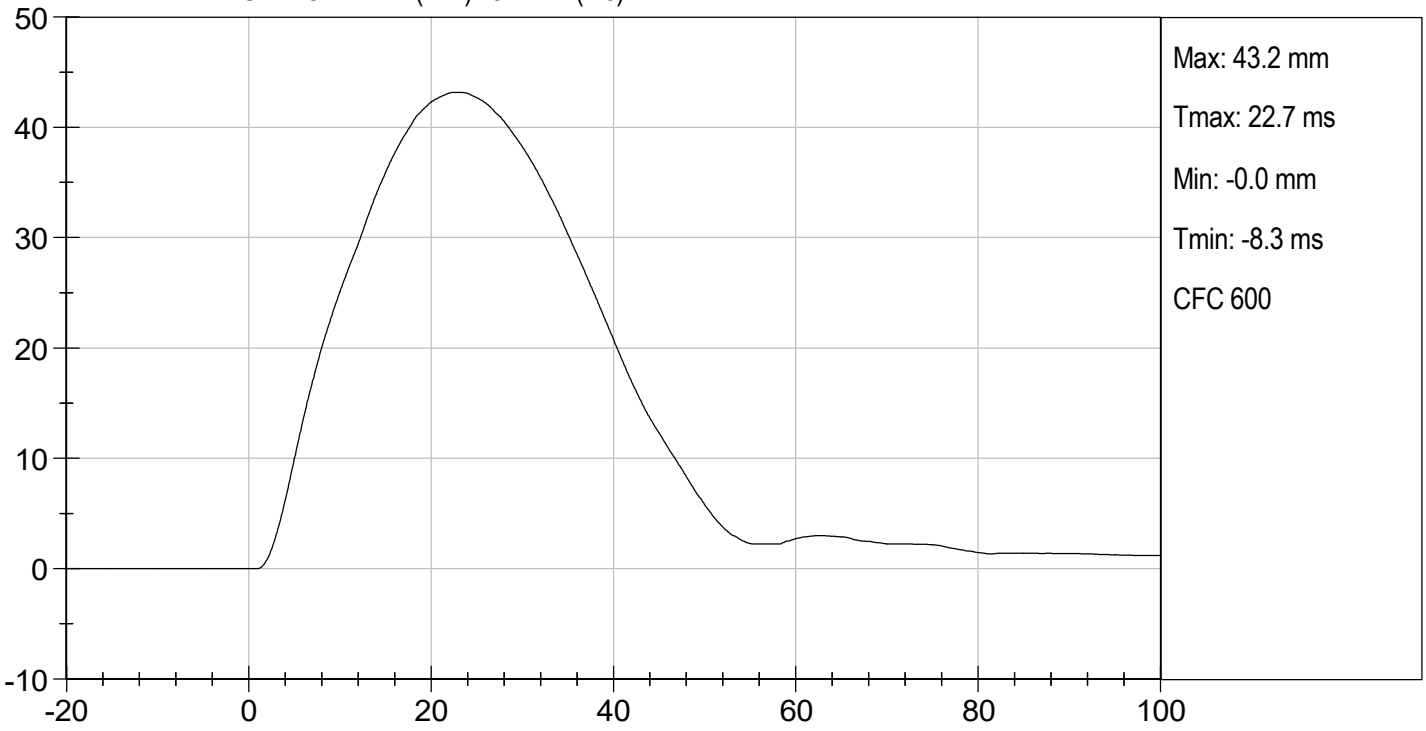
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 02/19/2021
TEST #: D210495

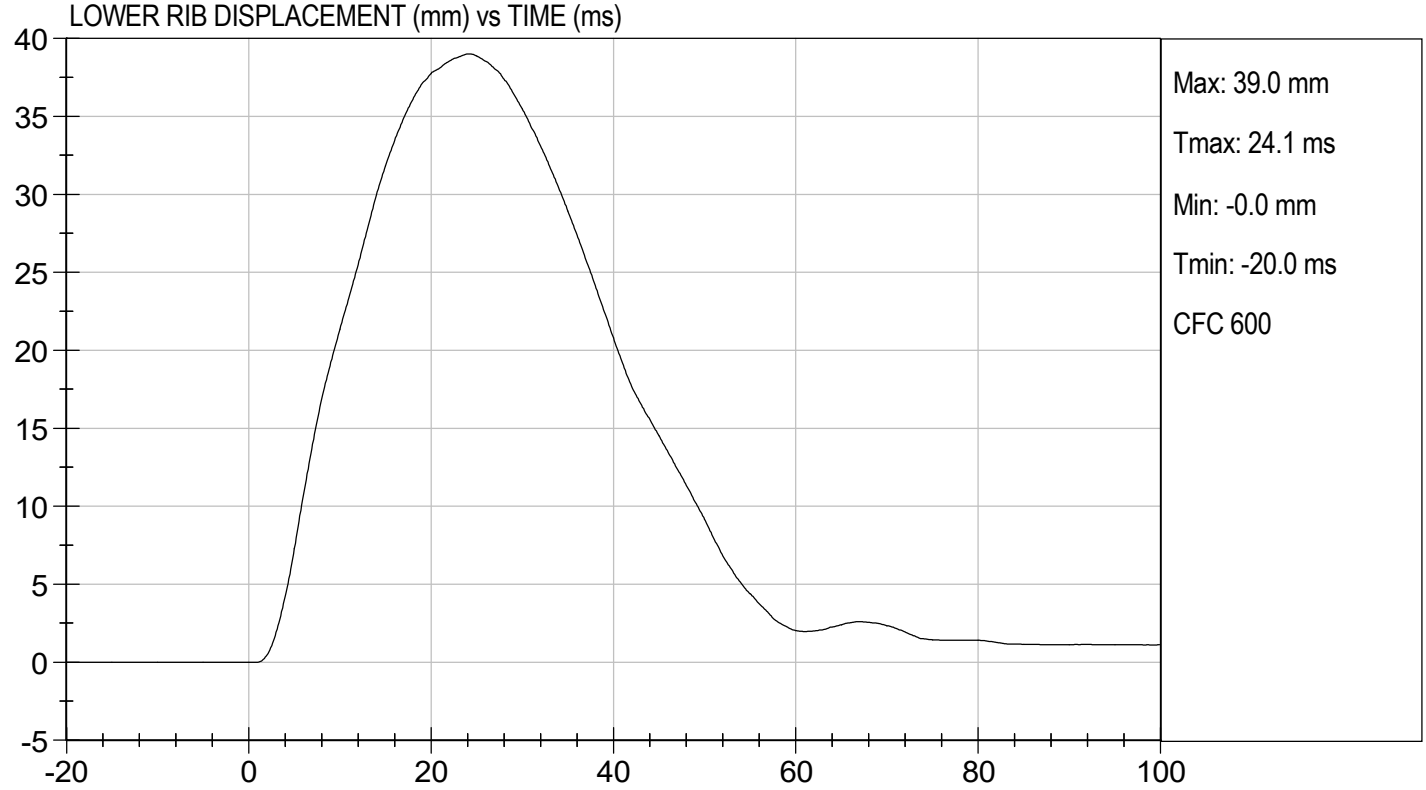




MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



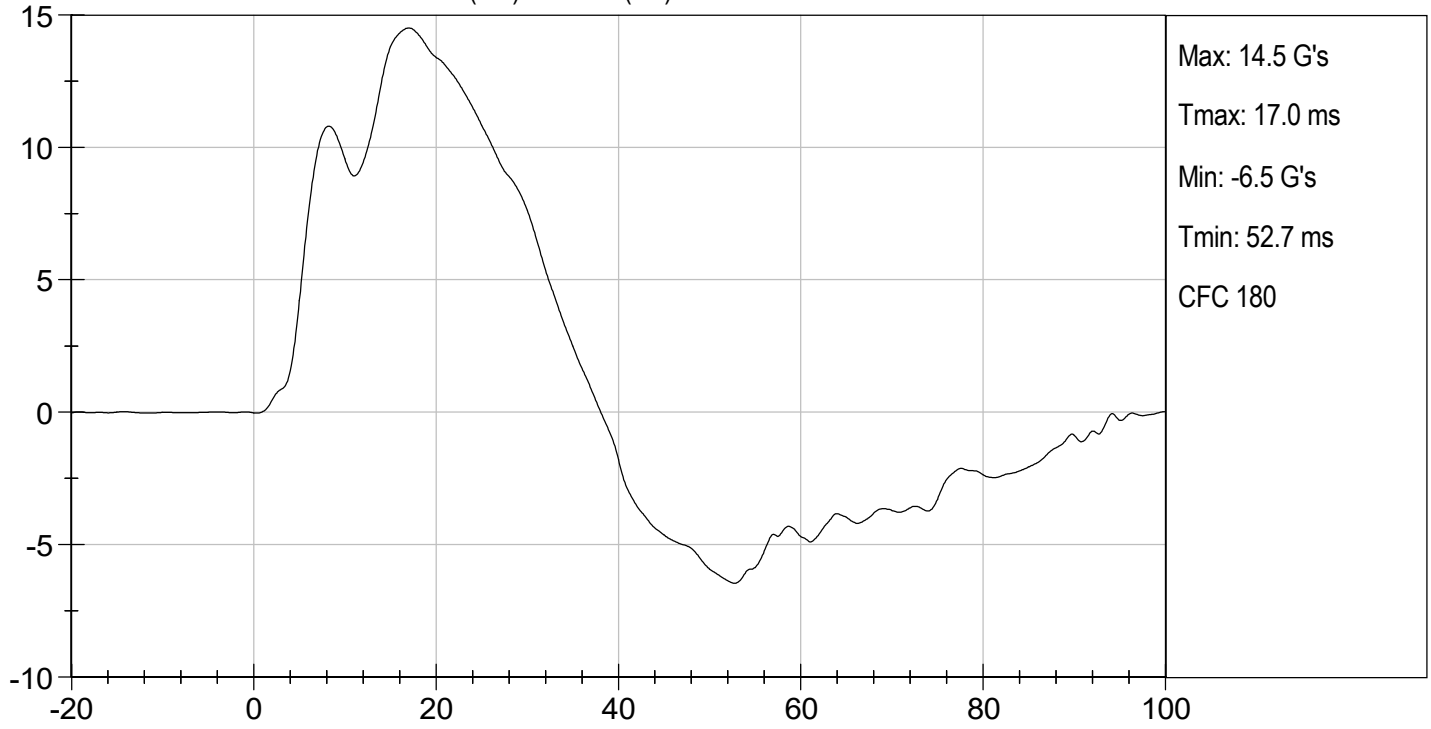
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



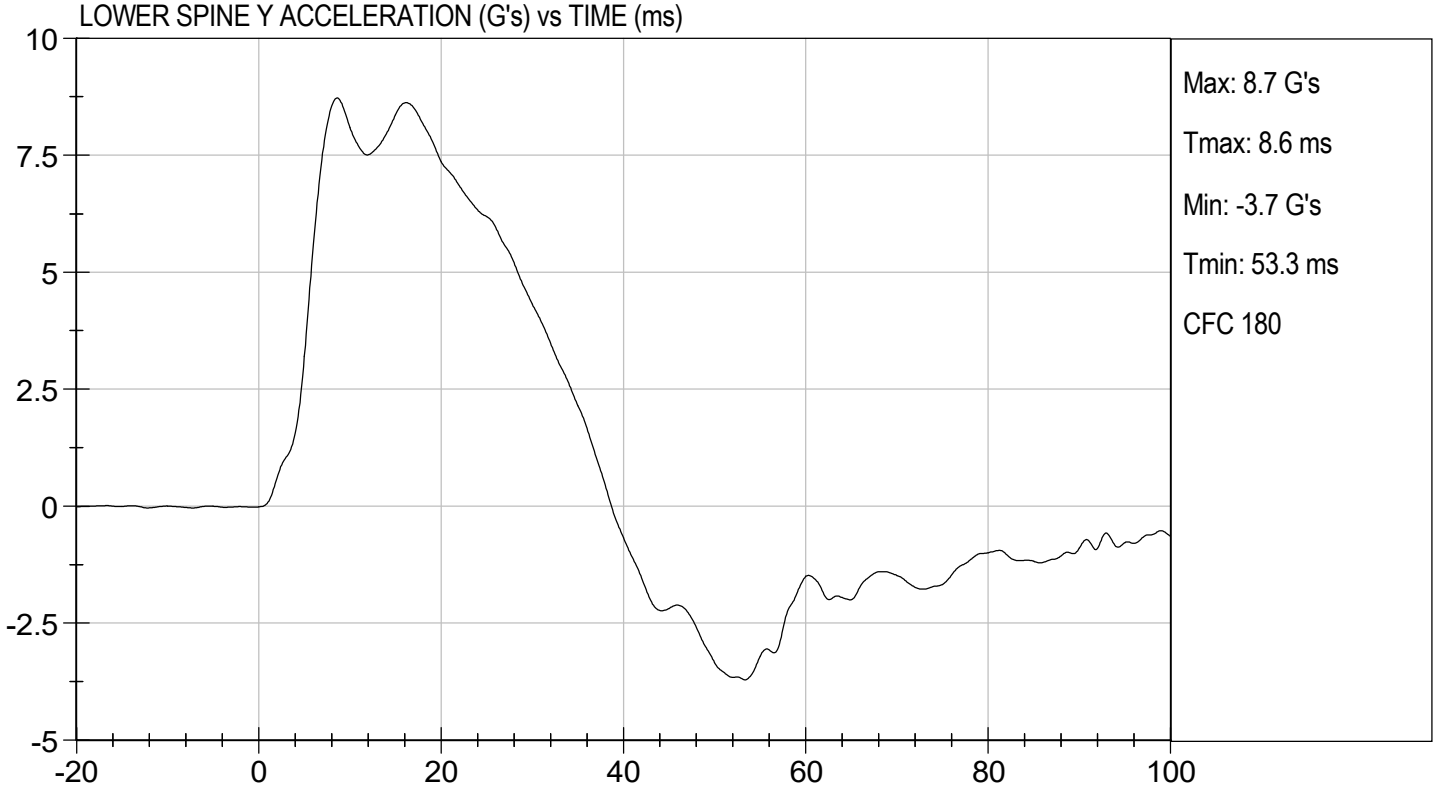
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.89 ft/s, 4.23 m/s

TEST DATE: 02/19/2021
TEST #: D210495

UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



LOWER SPINE Y ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D210496

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	12 to 16	13	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	41	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	39	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

Alex Thomas

Laboratory Technician

02/19/2021

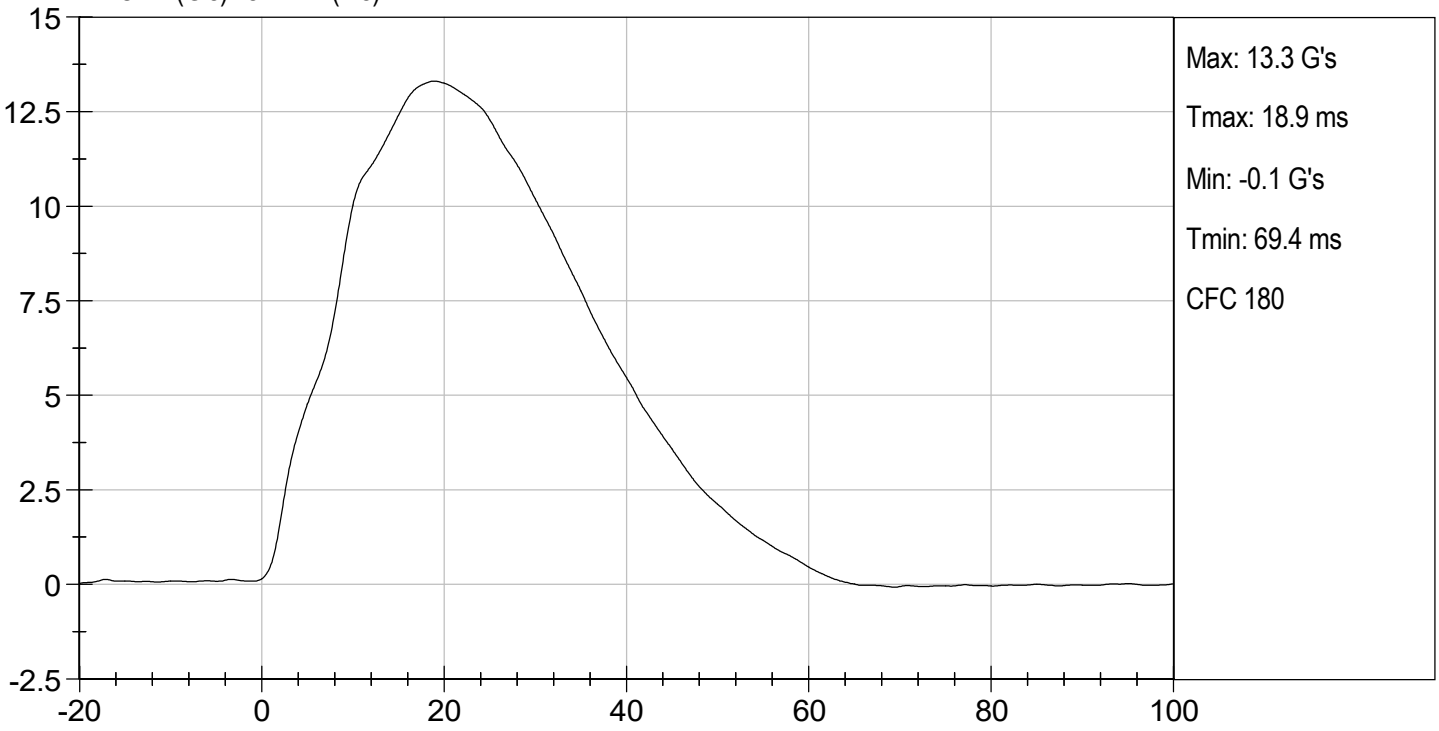
Test Date

Approved By

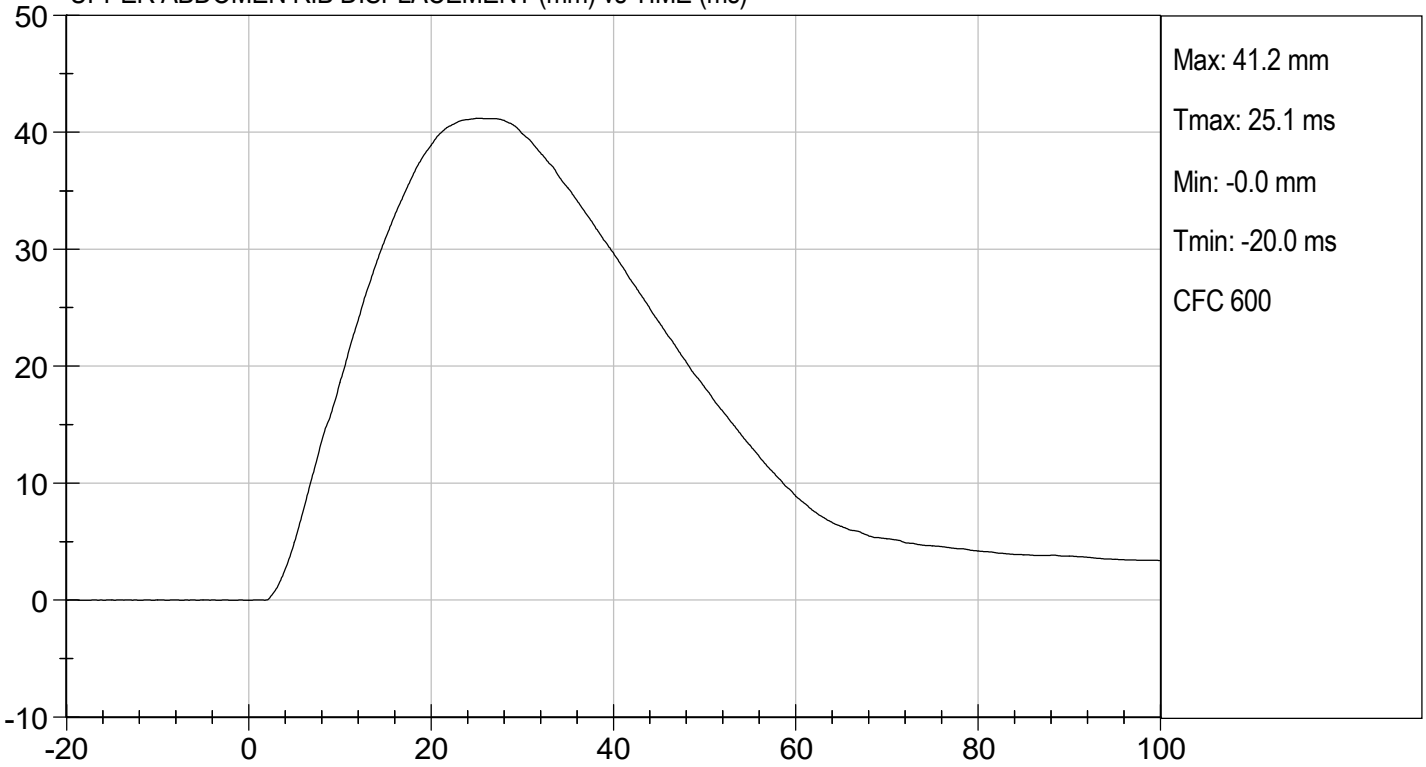
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 02/19/2021
TEST #: D210496

PROBE (G's) vs TIME (ms)



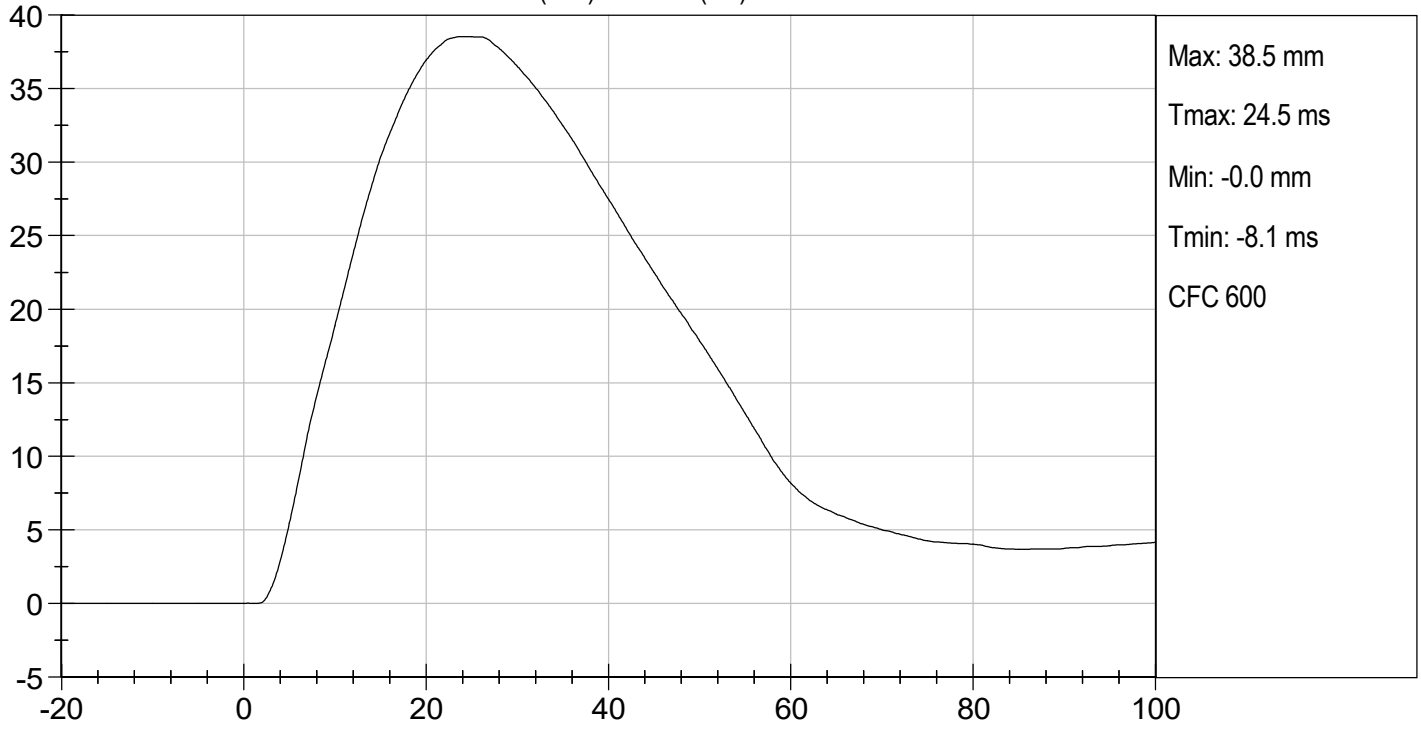
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



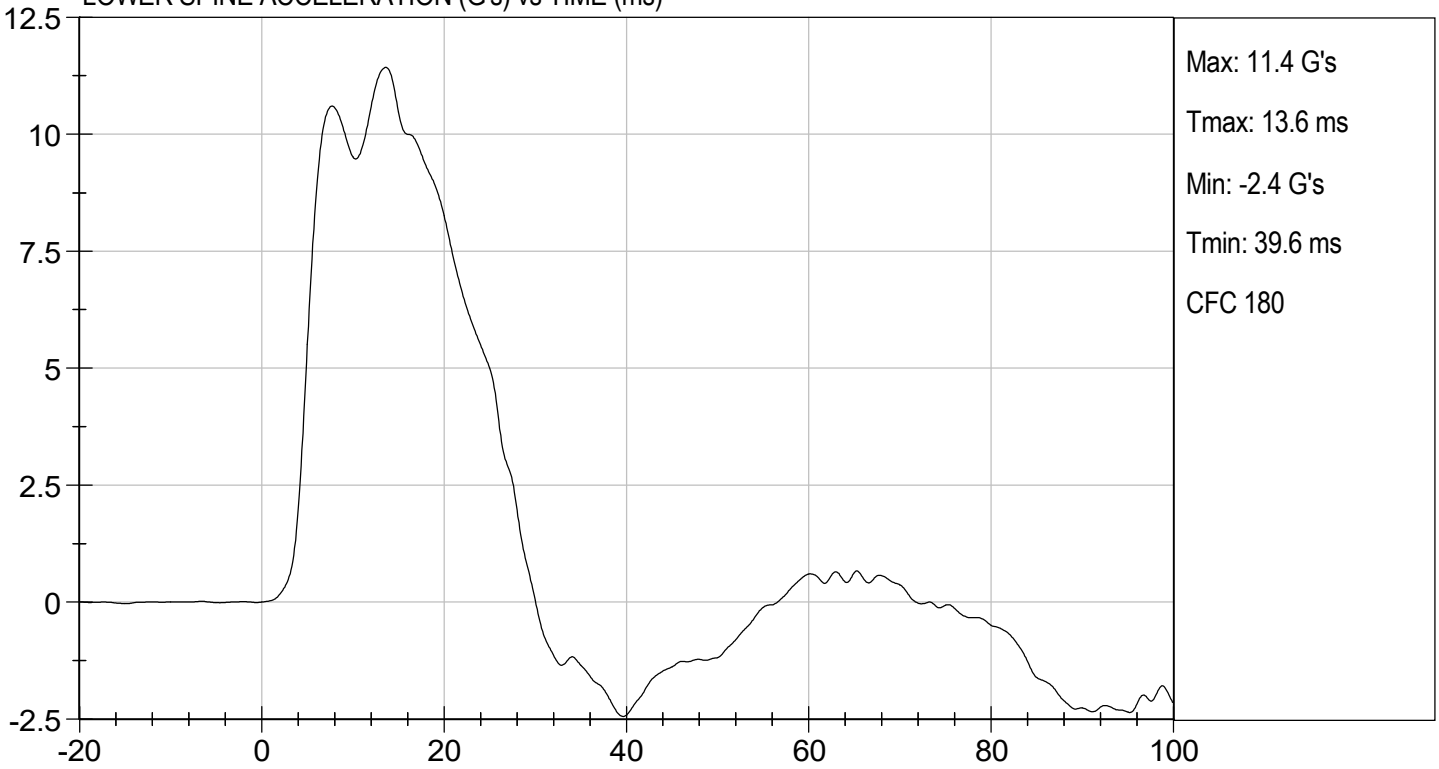
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 02/19/2021
TEST #: D210496

LOWER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER SPINE ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D210497

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	6.60 to 6.80	6.60	Pass
Maximum Probe Acceleration	G's	38 to 47	40	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	38	Pass
Peak Acetabulum Force	N	3600 to 4300	3,766	Pass
		Overall Test Results		Pass

Alex Thomas

Laboratory Technician

02/19/2021

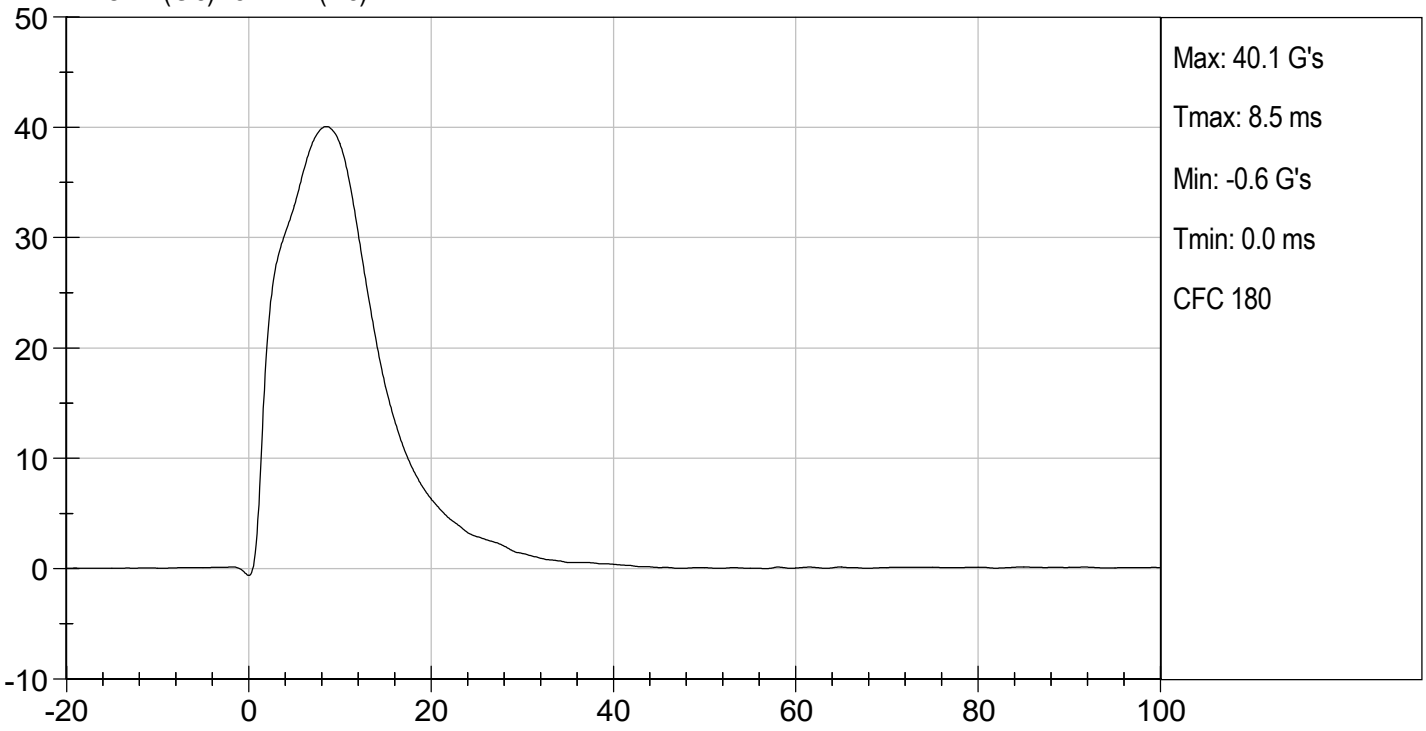
Test Date

Approved By

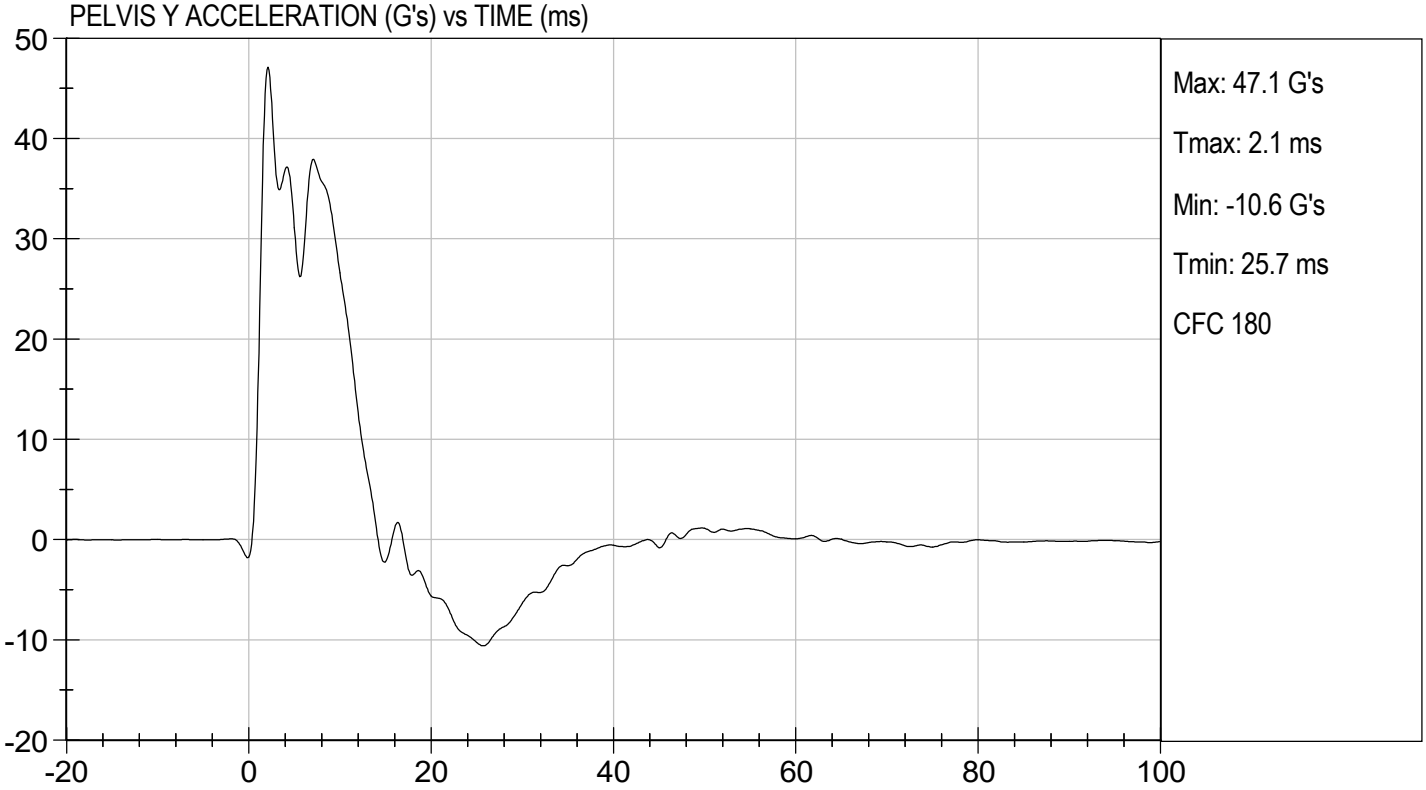
TEST DESC: PELVIS IMPACT
VELOCITY: 21.64 ft/s, 6.60 m/s

TEST DATE: 02/19/2021
TEST #: D210497

PROBE (G's) vs TIME (ms)

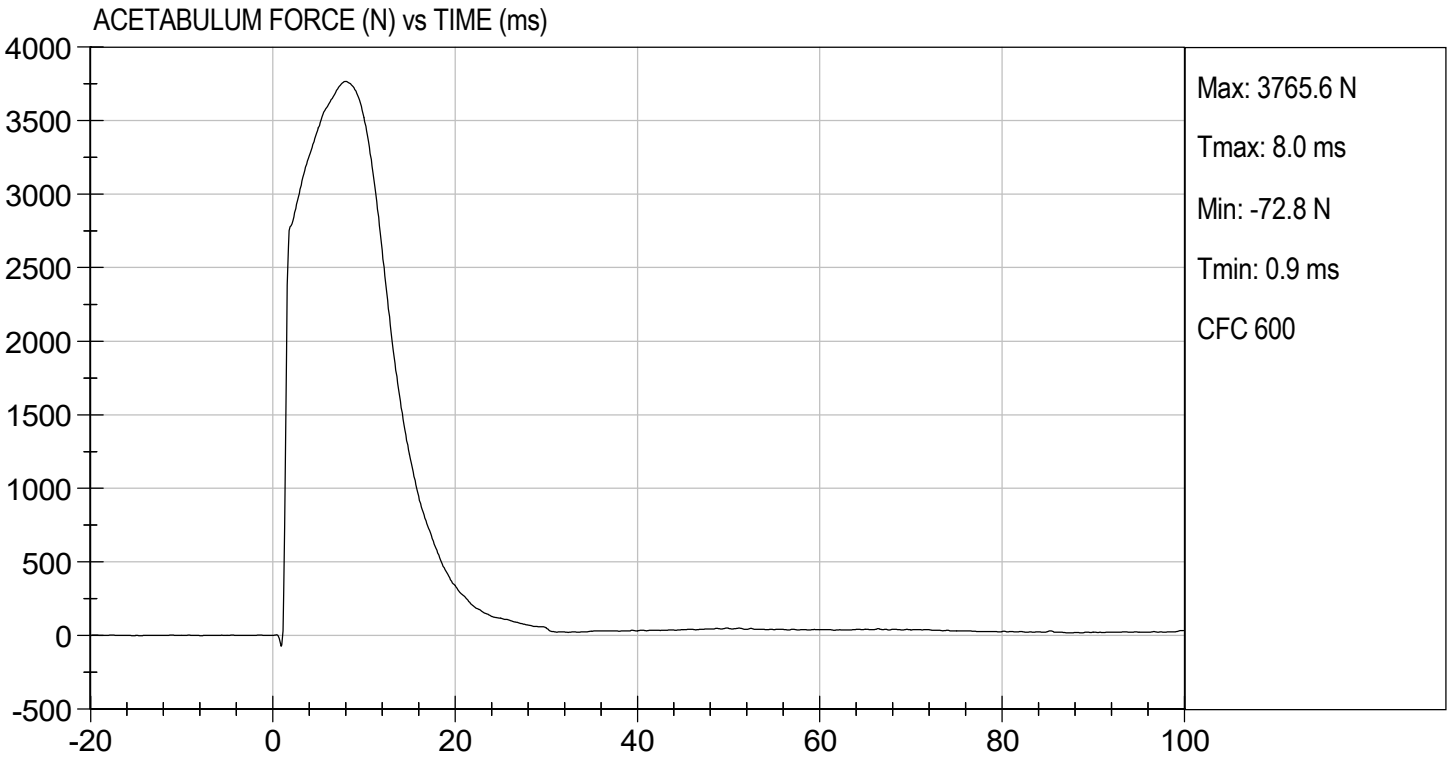


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: PELVIS IMPACT
VELOCITY: 21.64 ft/s, 6.60 m/s

TEST DATE: 02/19/2021
TEST #: D210497



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D210498

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	4.20 to 4.40	4.20	Pass
Maximum Probe Acceleration	G's	36 to 45	40	Pass
Pelvis Y Acceleration	G's	28 to 39	32	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,620	Pass
		Overall Test Results		Pass

Alex Thomas

Laboratory Technician

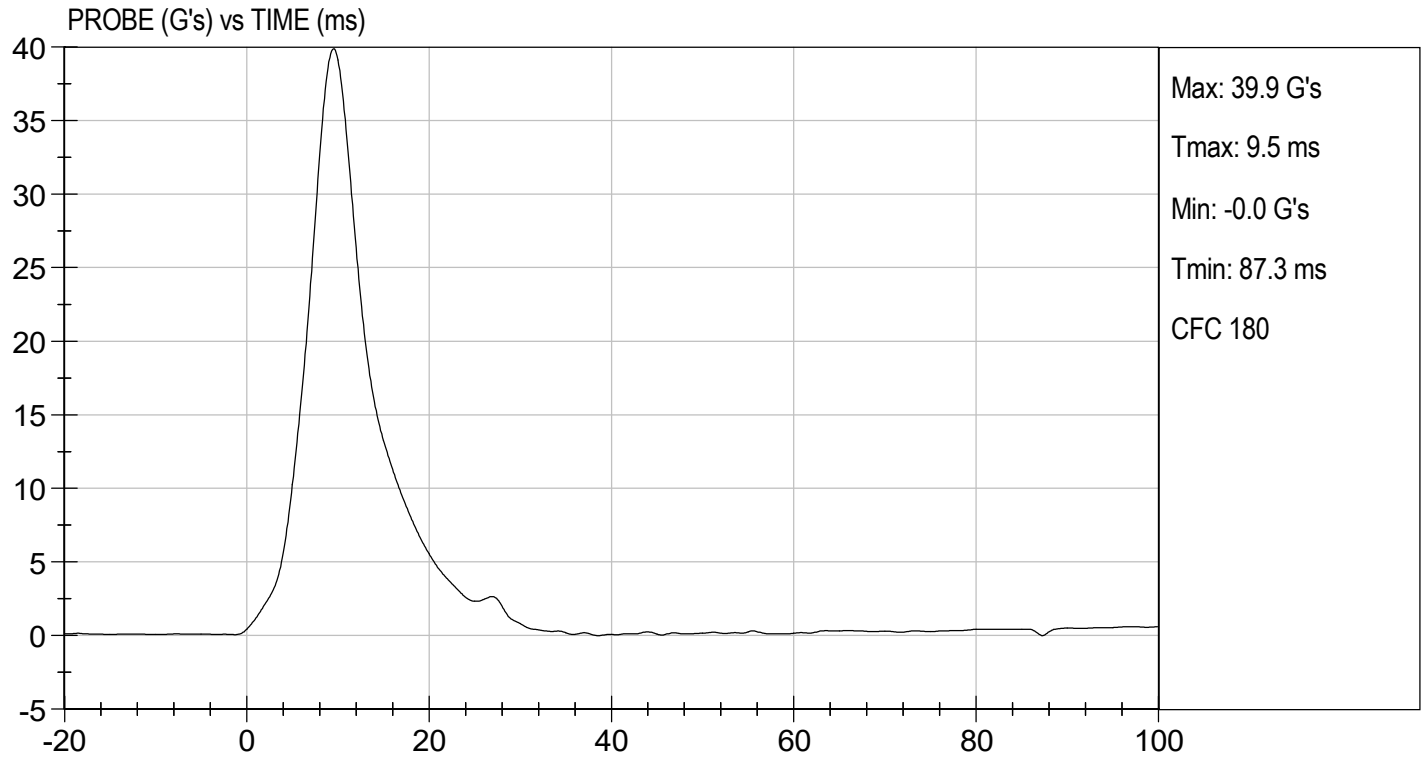
02/19/2021

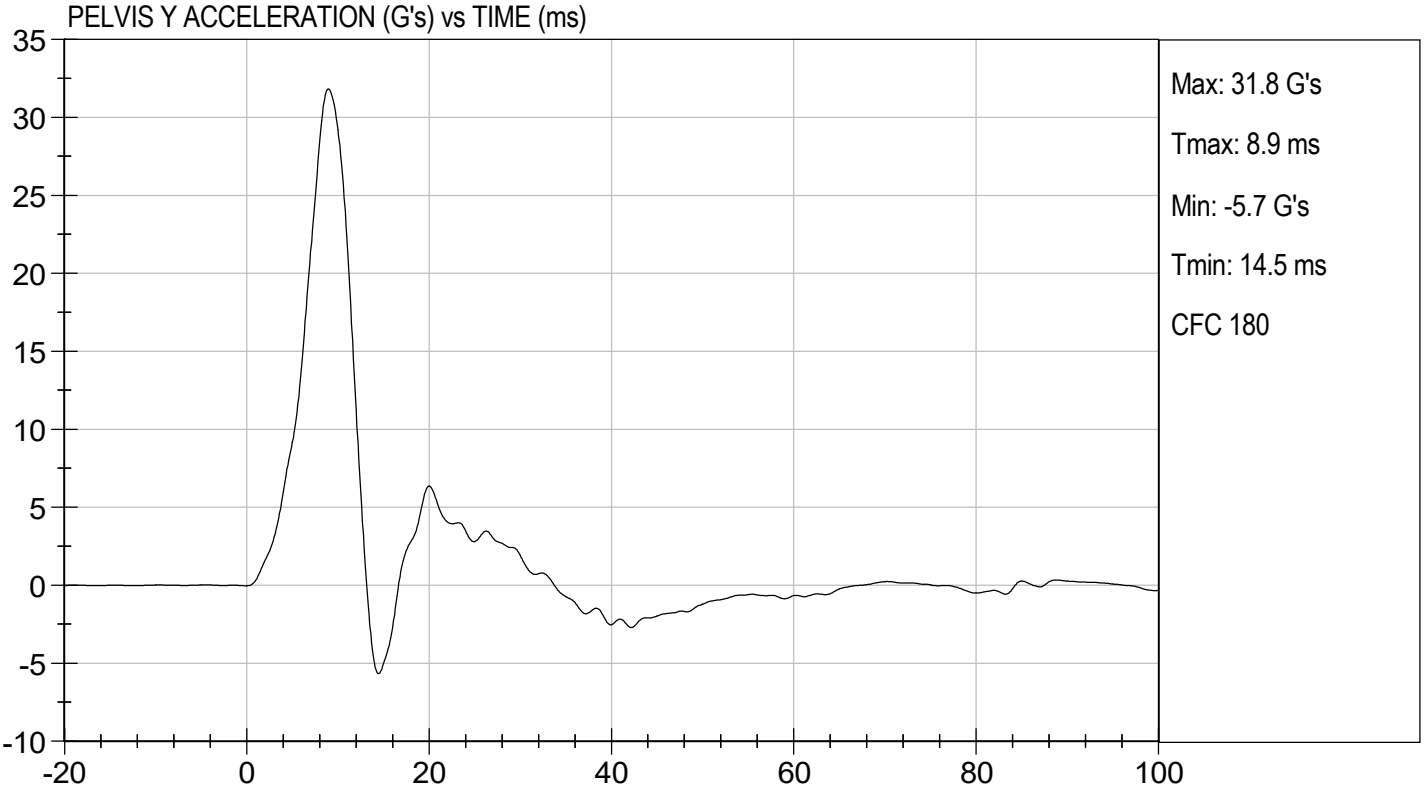
Test Date

Approved By

TEST DESC: ILLIAC
VELOCITY: 13.77 ft/s, 4.20 m/s

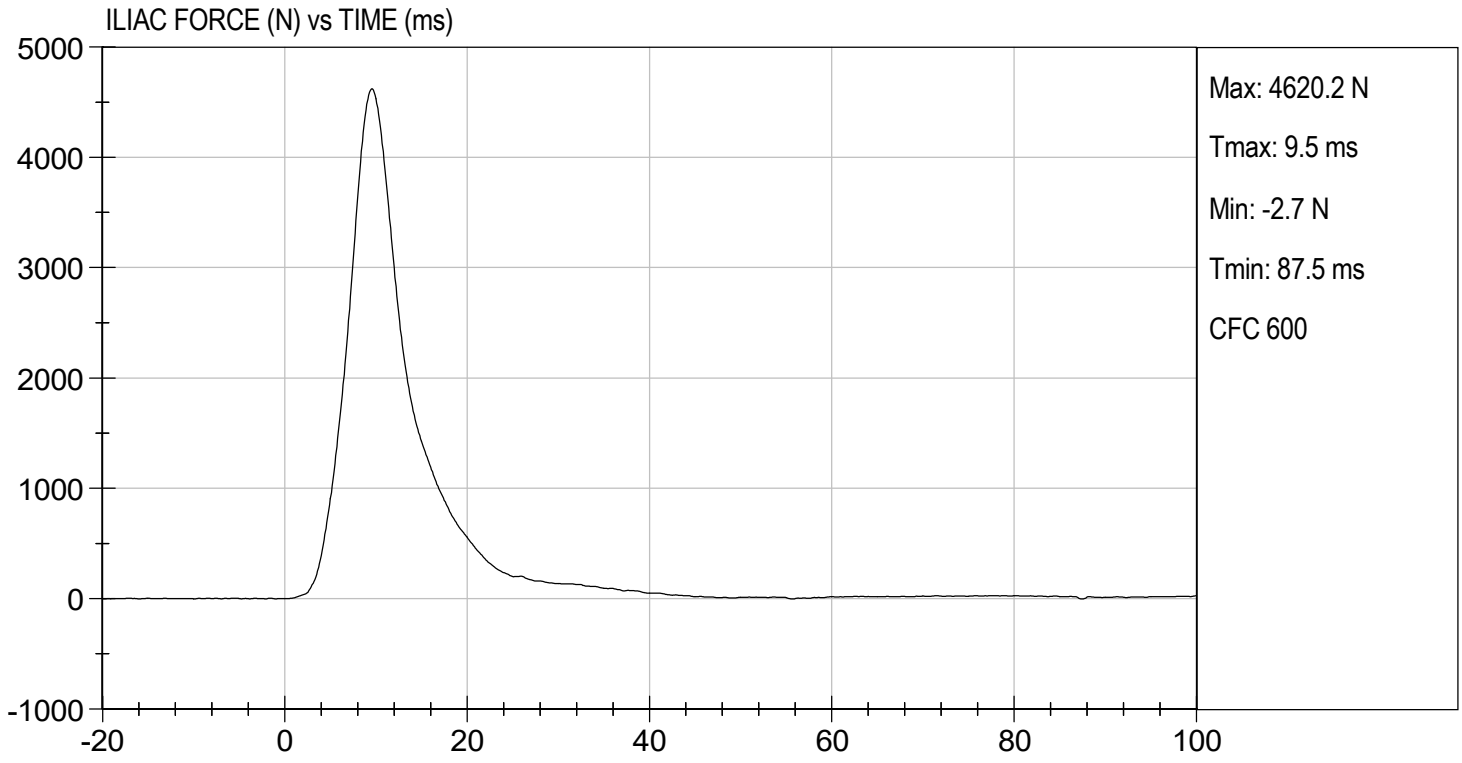
TEST DATE: 02/19/2021
TEST #: D210498





TEST DESC: ILLIAC
VELOCITY: 13.77 ft/s, 4.20 m/s

TEST DATE: 02/19/2021
TEST #: D210498



CALIBRATION TEST RESULTS

POST-TEST

SID-IIS 5TH PERCENTILE FEMALE - DRIVER ATD

SID-IIsD External Measurements
SN: 296

No.	Name	Spec. (mm)	Result	Pass/Fail
A	Sitting Height	772 - 788	784	Pass
B	Shoulder Pivot Height	437 - 453	442	Pass
C	H-point Height	79 - 89	83	Pass
D	H-point from Seatback	141 - 151	145	Pass
E	Shoulder Pivot from Backline	97 - 107	99	Pass
F	Thigh Clearance	119 -135	121	Pass
G	Head Breadth	140 - 148	142	Pass
H	Head Back from Backline	40 - 46	45	Pass
I	Head Depth	178 - 188	180	Pass
J	Head Circumference	541 - 551	548	Pass
K	Buttock to Knee Length	514 - 540	535	Pass
L	Popliteal Height	343 - 369	358	Pass
M	Knee Pivot to Floor Height	392 - 409	404	Pass
N	Buttock Popliteal Length	416 - 442	435	Pass
O	Chest Depth w/o Jacket	195 - 211	206	Pass
P	Foot Length	216 - 232	219	Pass
Q	Hip Breadth (w/ pelvic plugs)	313 - 323	316	Pass
R	Arm Length	249 - 259	250	Pass
S	Knee Joint to Seatback	477 - 493	481	Pass
V	Shoulder Width	341 - 357	346	Pass
W	Foot Width	78 - 94	85	Pass
Y	Chest Circumference w/ jacket	851 - 881	870	Pass
Z	Waist Circumference	761 - 791	772	Pass

MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D210721

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Peak Resultant Acceleration	G's	115 to 137	131	Pass
Peak Longitudinal Acceleration	G's	+/- 15	-4.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Gerald A Guerrero
Laboratory Technician

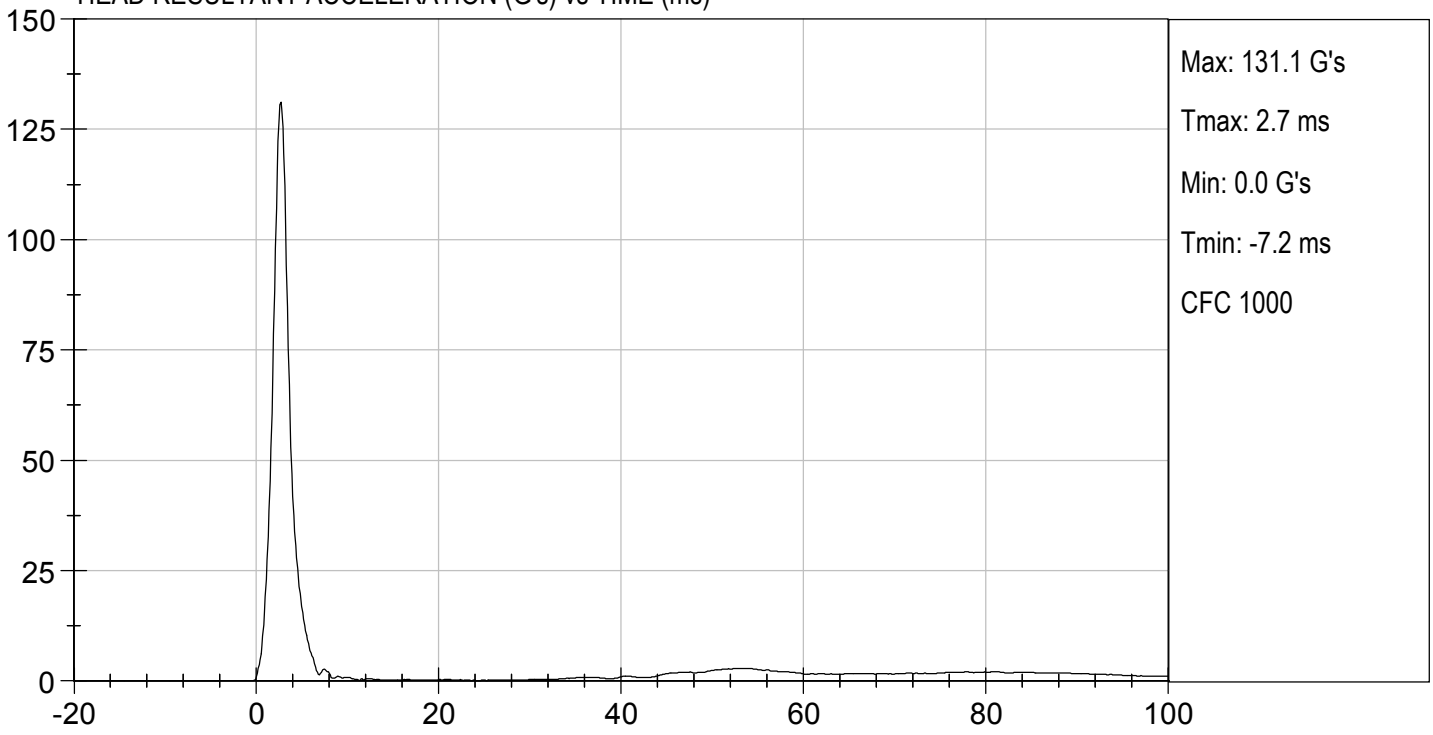
03/05/2021
Test Date

Approved By

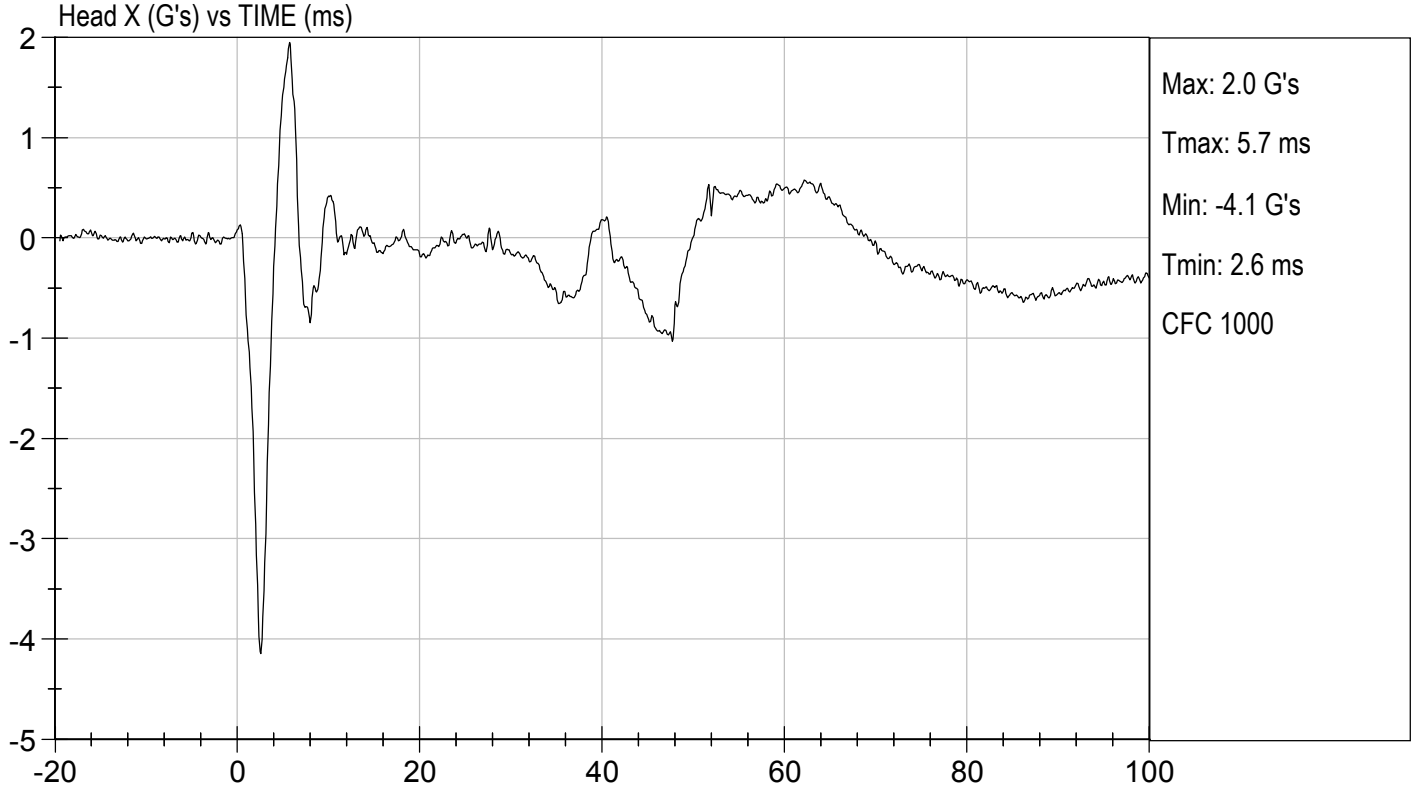
TEST DESC: HEAD DROP

TEST DATE: 03/05/2021
TEST #: D210721

HEAD RESULTANT ACCELERATION (G's) vs TIME (ms)

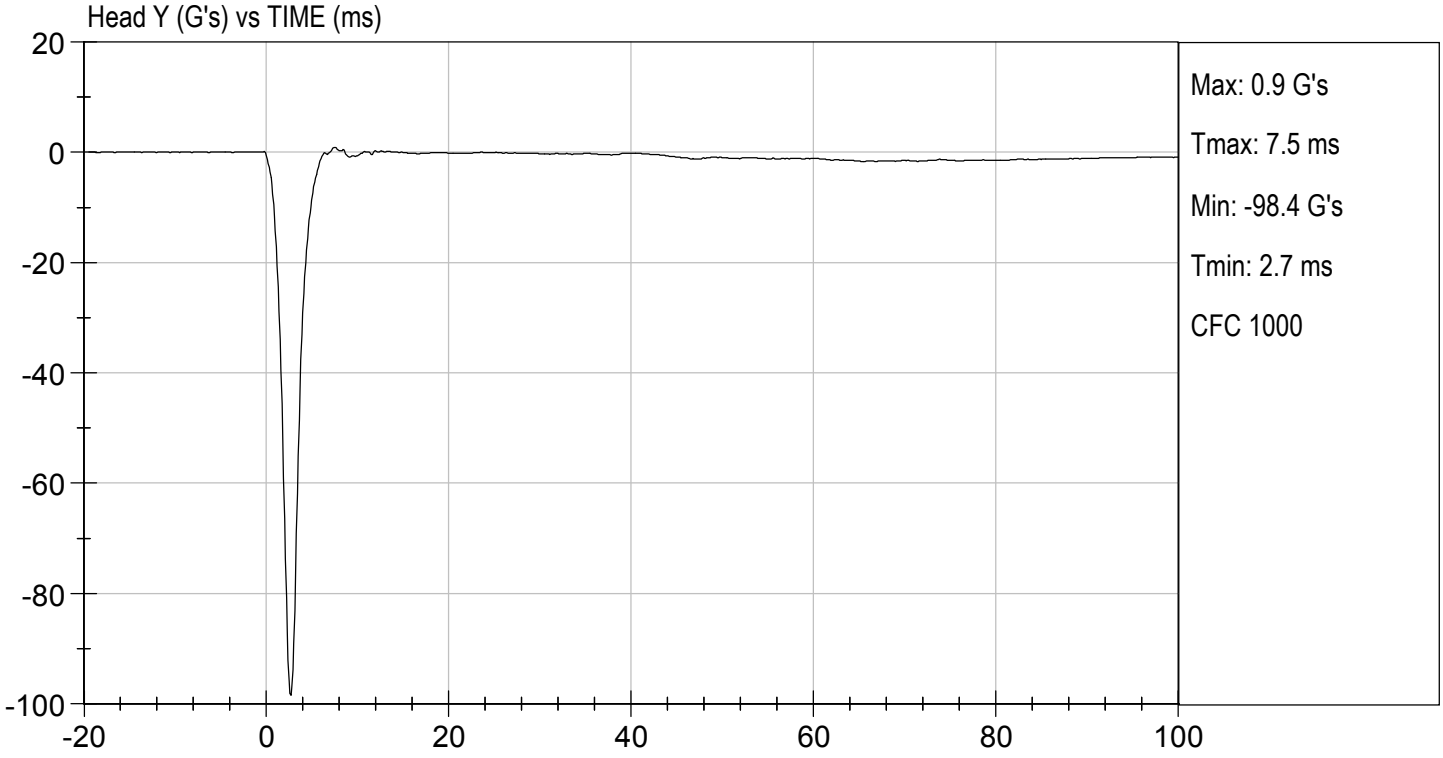


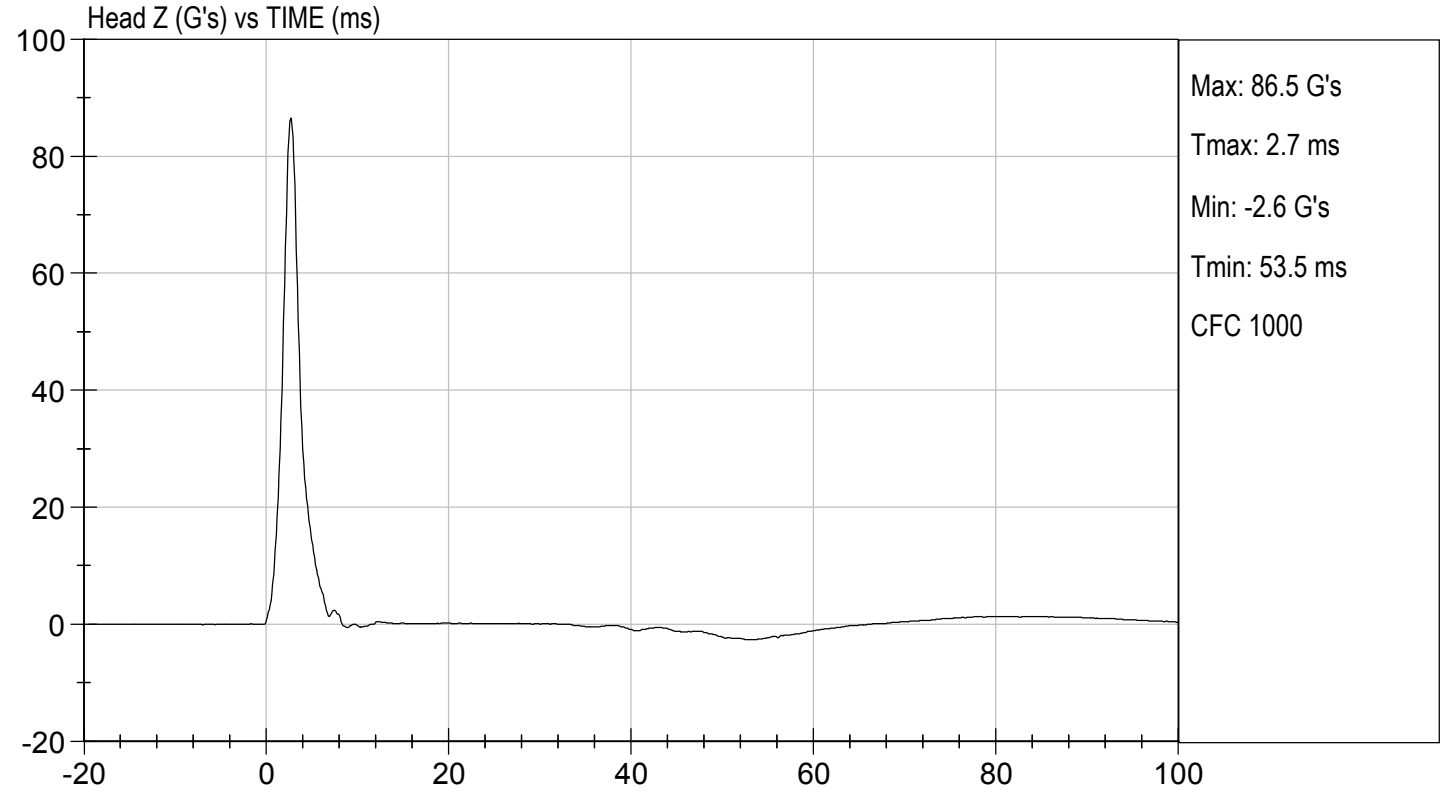
Head X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 03/05/2021
TEST #: D210721





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D210722

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.5	Pass
Humidity		%	10 to 70	23	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.75	Pass
	15 ms	m/s	3.30 to 4.10	3.92	Pass
	20 ms	m/s	4.40 to 5.40	5.34	Pass
	25 ms	m/s	5.40 to 6.10	5.65	Pass
	25-100 ms	m/s	5.50 to 6.20	5.67	Pass
Maximum D-Plane Rotation		deg	71 to 81	75	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	60	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-38	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	119	Pass
			Overall Test Results		Pass

Gerald Guerrero

Laboratory Technician

03/08/2021

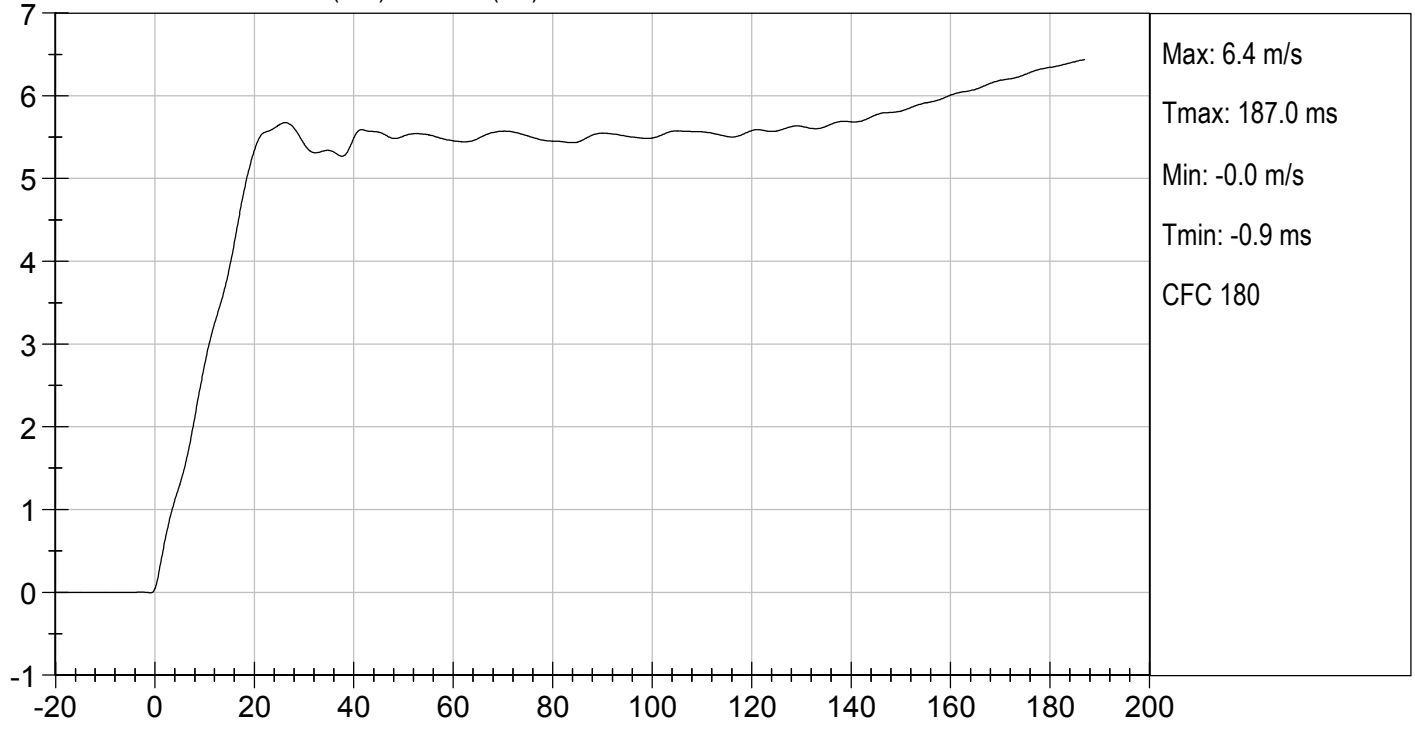
Test Date

Approved By

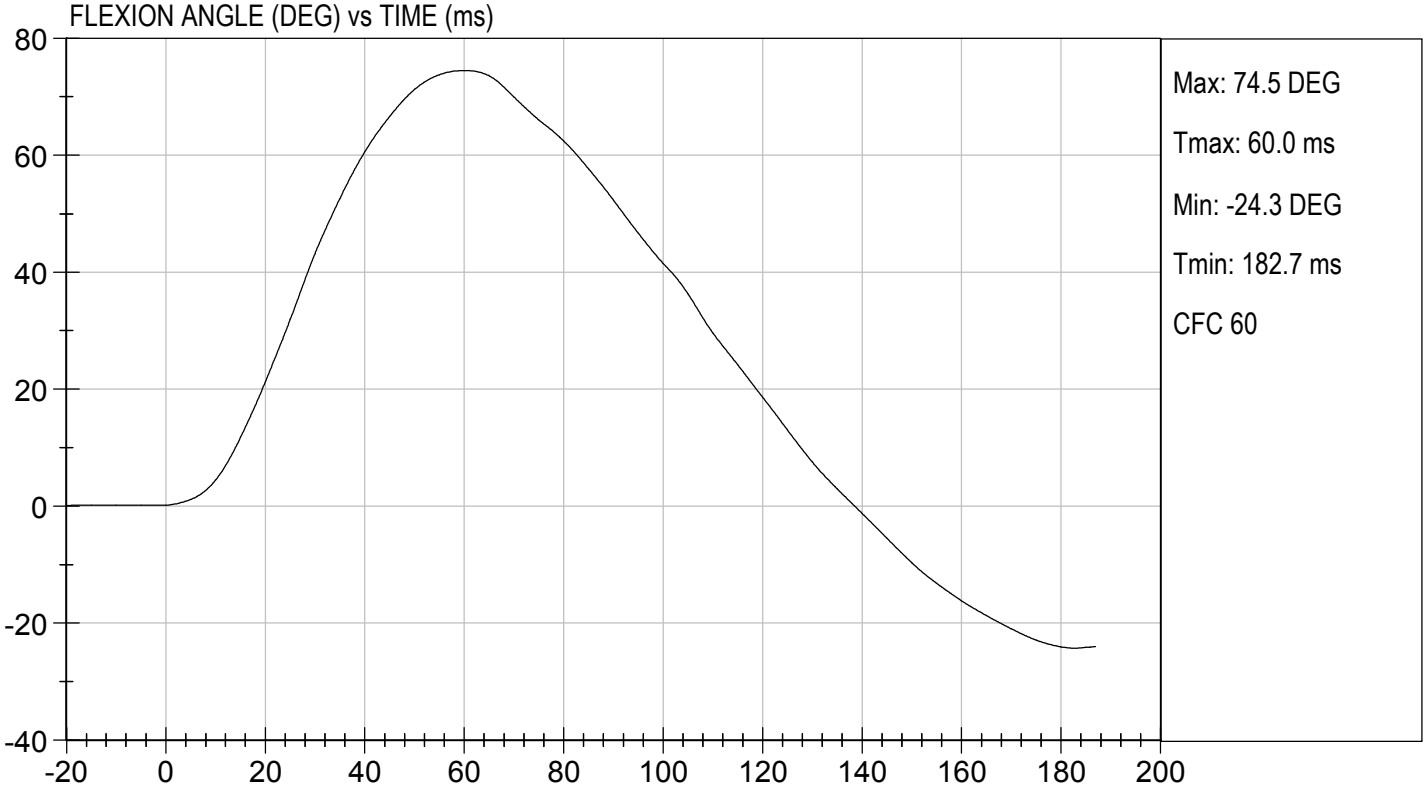
TEST DESC: NECK BENDING
VELOCITY: 18.32 ft/s, 5.58 m/s

TEST DATE: 03/08/2021
TEST #: D210722

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

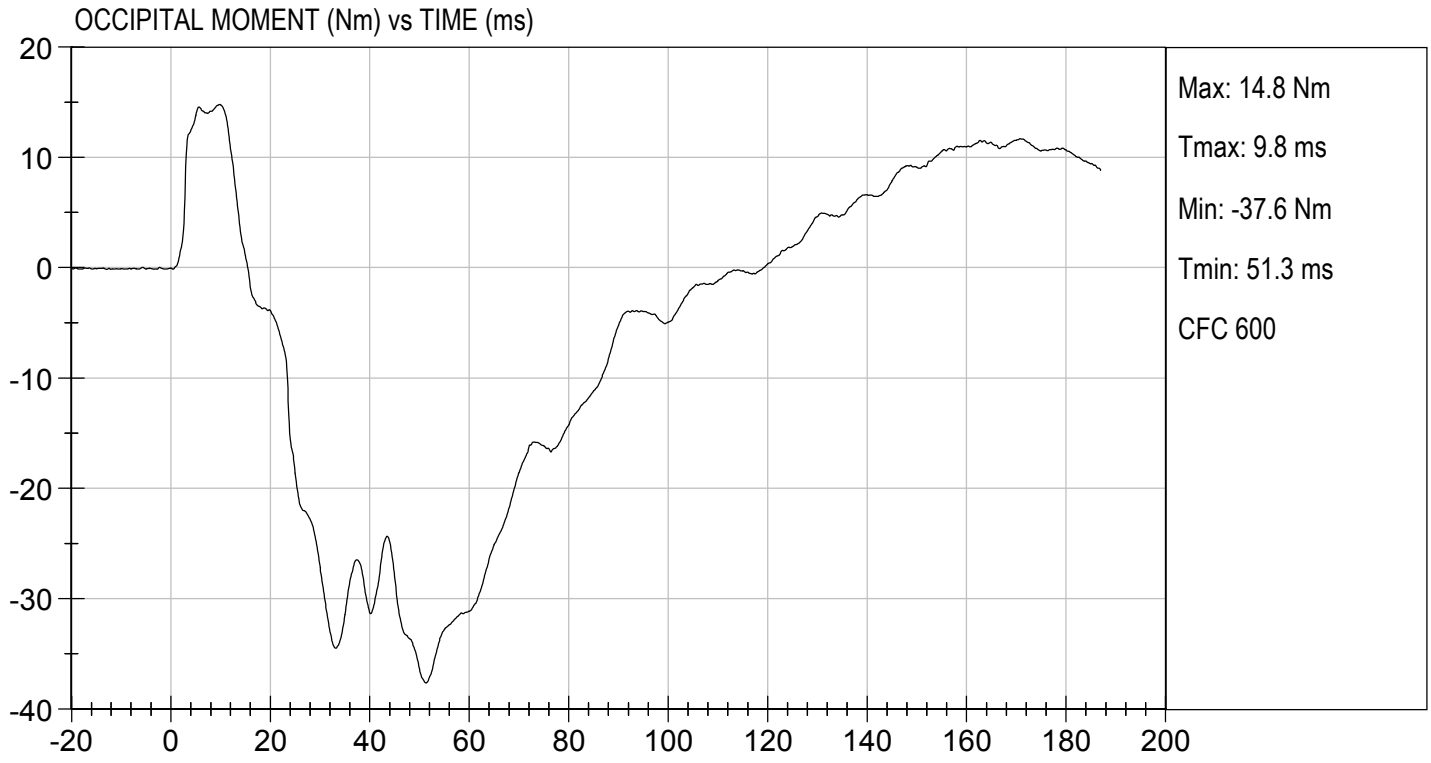


FLEXION ANGLE (DEG) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 18.32 ft/s, 5.58 m/s

TEST DATE: 03/08/2021
TEST #: D210722



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D210723

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	28	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	32	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	18	Pass
		Overall Test Results		Pass

Gerald Guerrero
Laboratory Technician

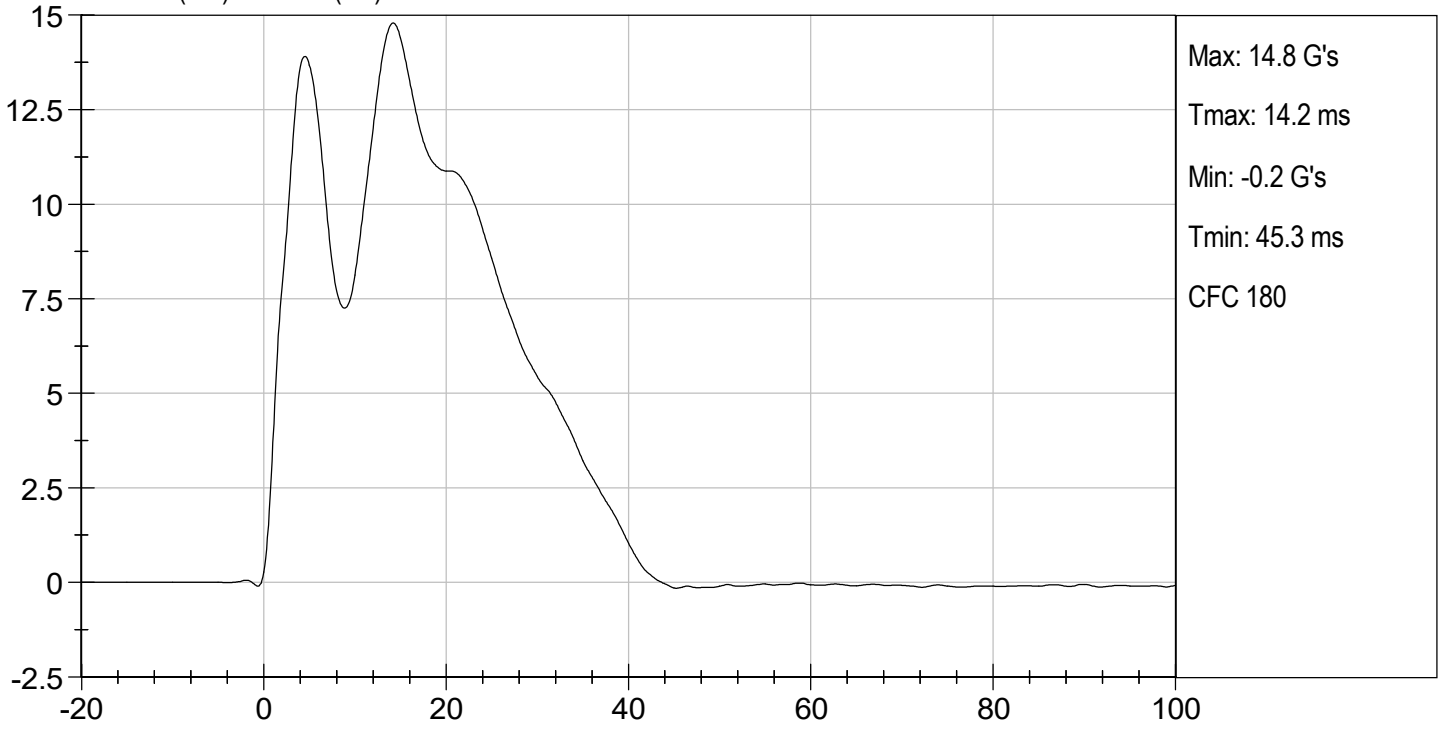
03/08/2021
Test Date

Approved By

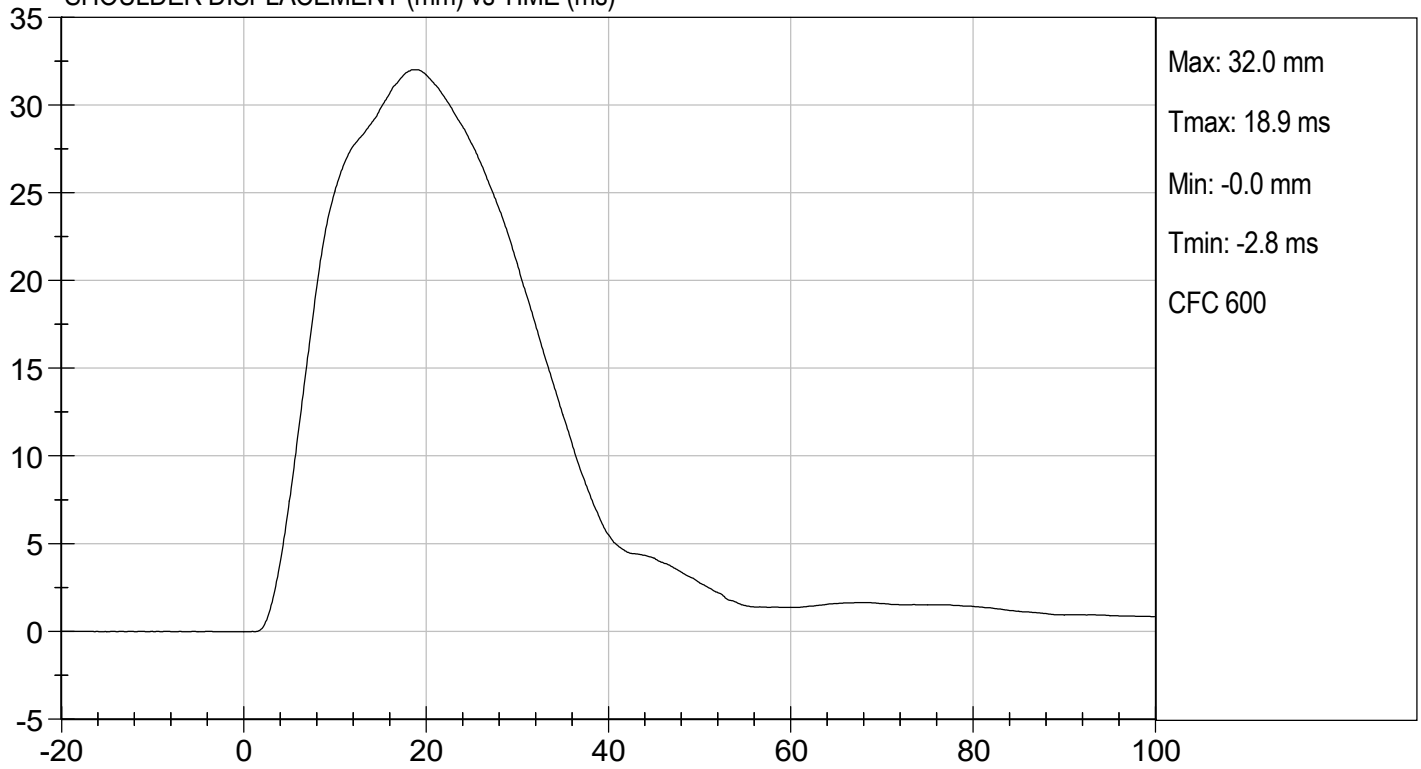
TEST DESC: SHOULDER IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 03/08/2021
TEST #: D210723

PROBE (G's) vs TIME (ms)

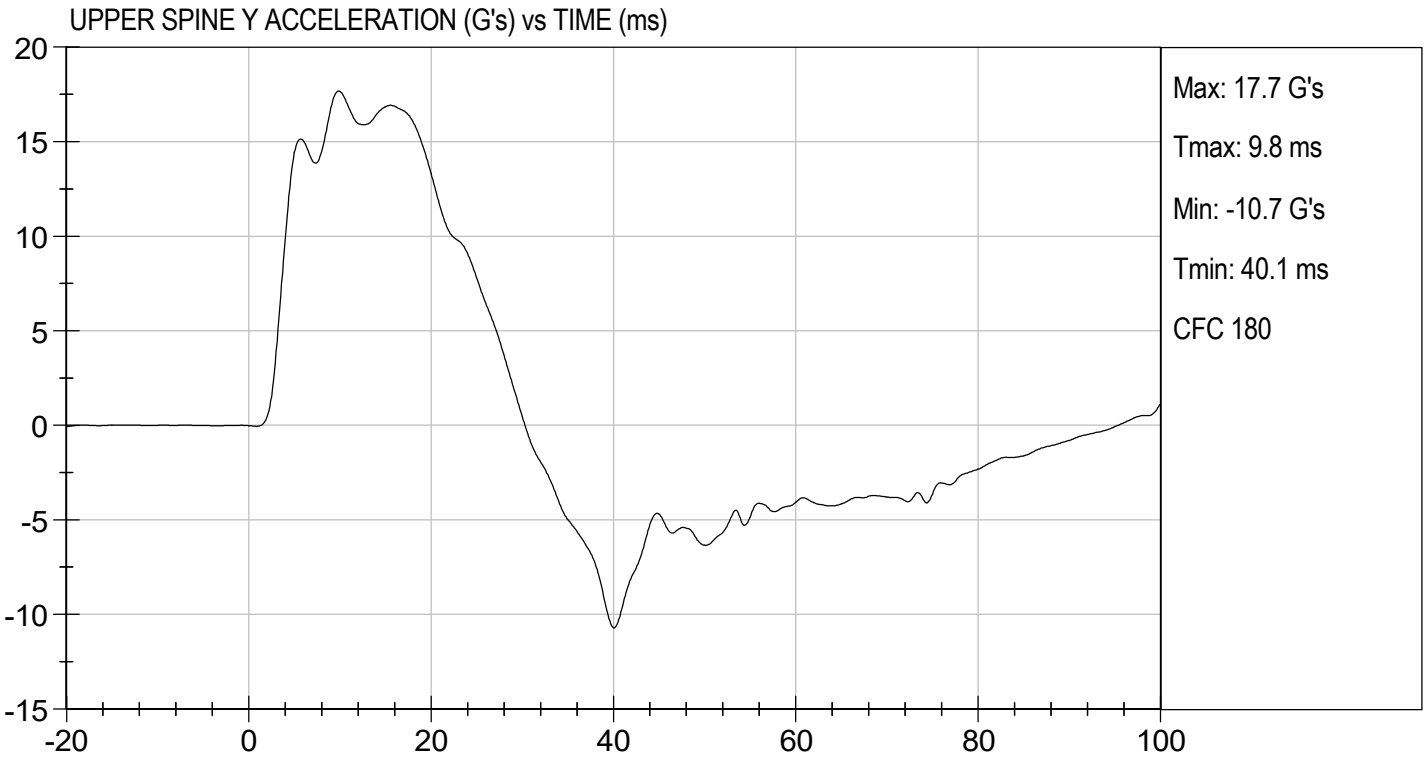


SHOULDER DISPLACEMENT (mm) vs TIME (ms)



TEST DESC: SHOULDER IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 03/08/2021
TEST #: D210723



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D210724

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	28	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	33	Pass
Shoulder Displacement	mm	31 to 40	38	Pass
Upper Rib Displacement	mm	25 to 32	30	Pass
Middle Rib Displacement	mm	30 to 36	32	Pass
Lower Rib Displacement	mm	32 to 38	34	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	37	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	33	Pass
		Overall Test Results		Pass

Gerald Guerrero

Laboratory Technician

03/08/2021

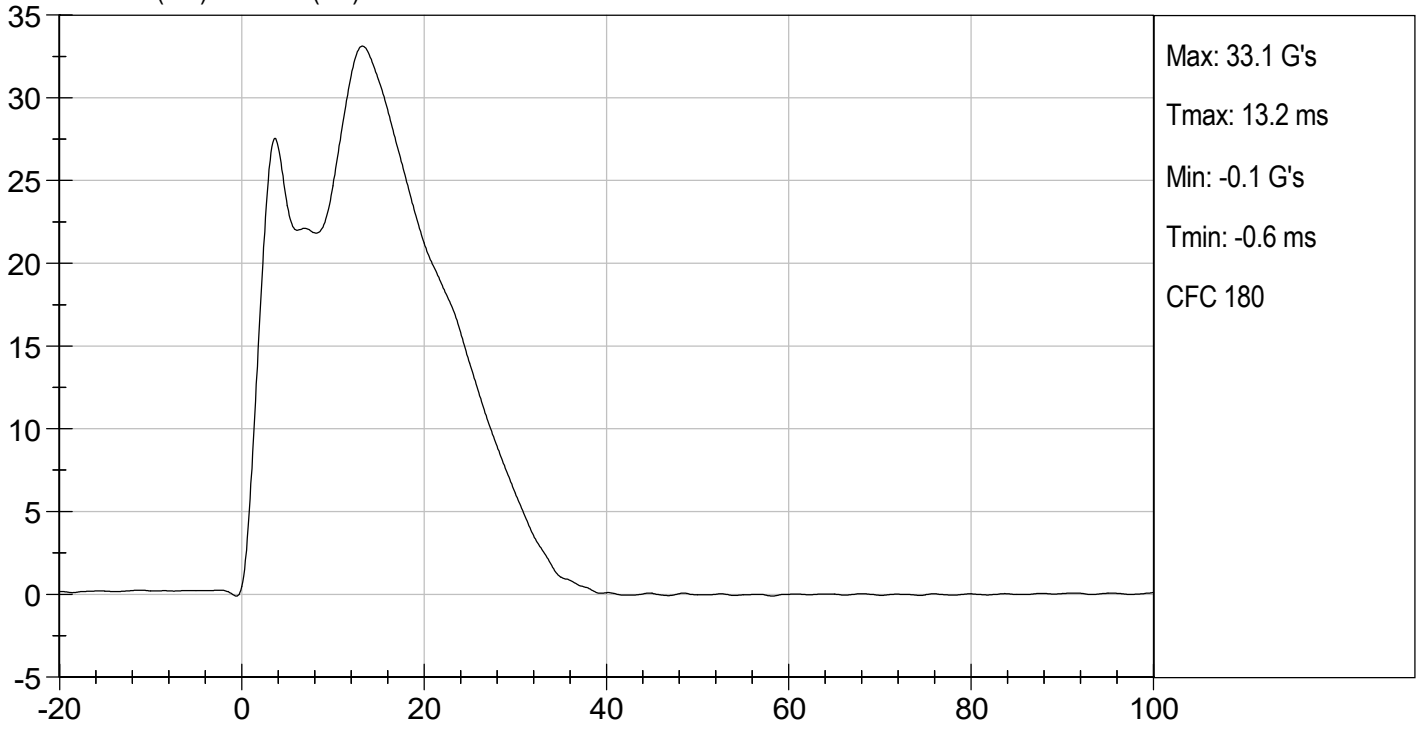
Test Date

Approved By

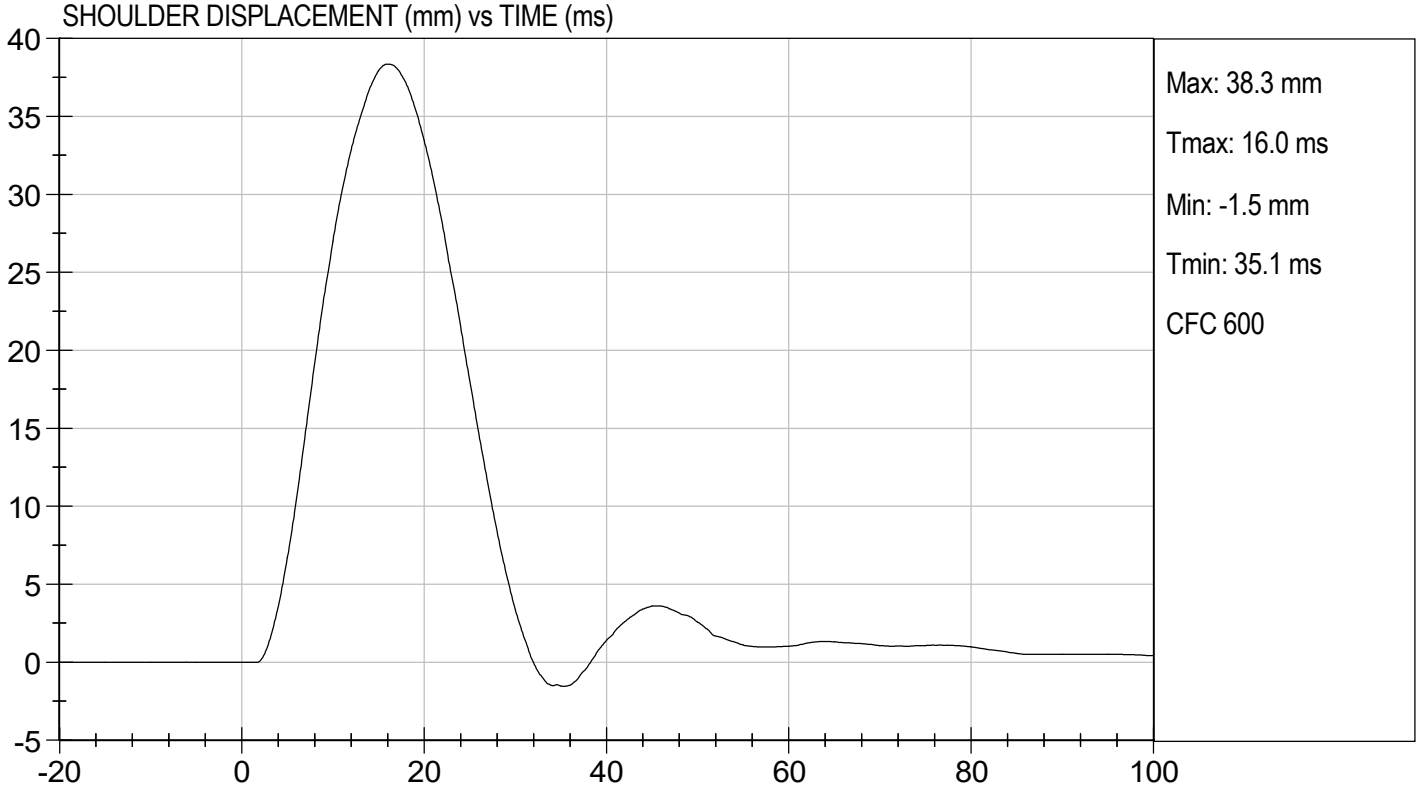
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 03/08/2021
TEST #: D210724

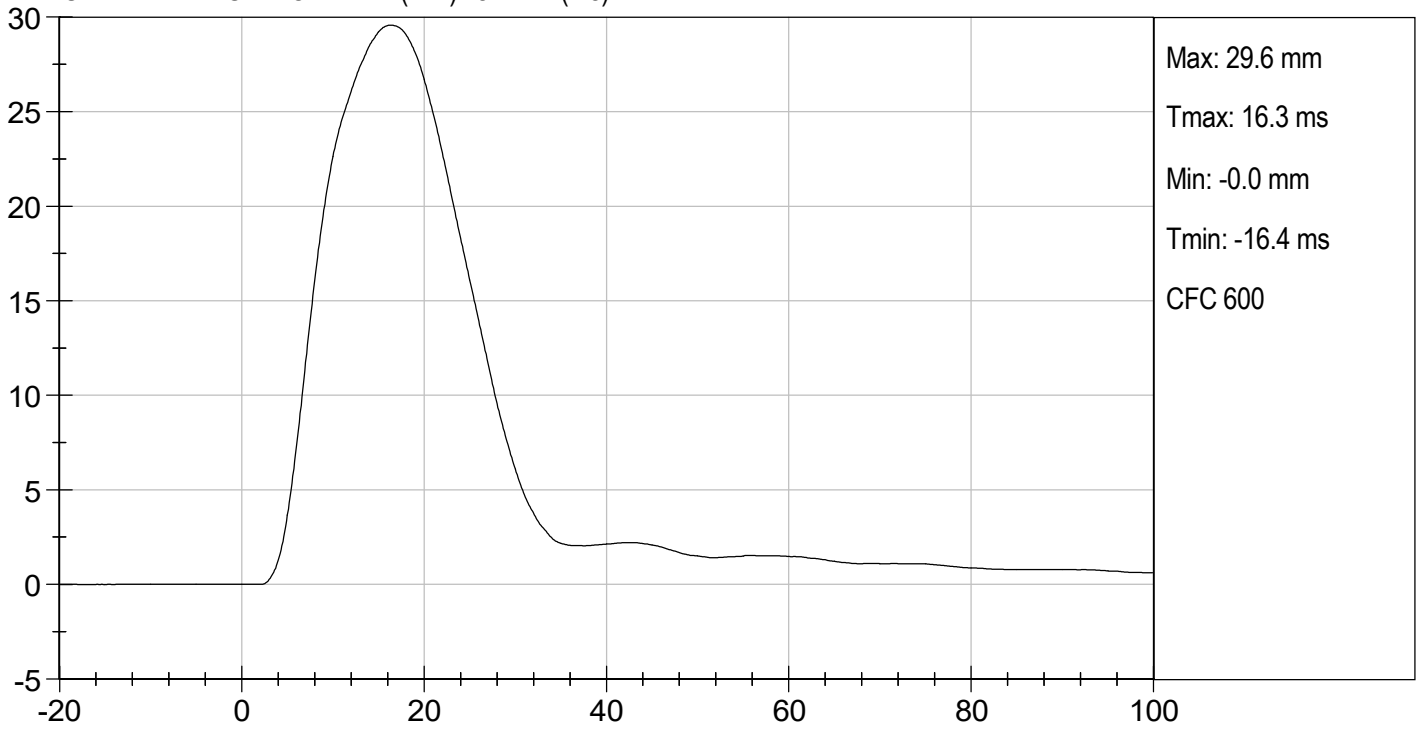
PROBE (G's) vs TIME (ms)



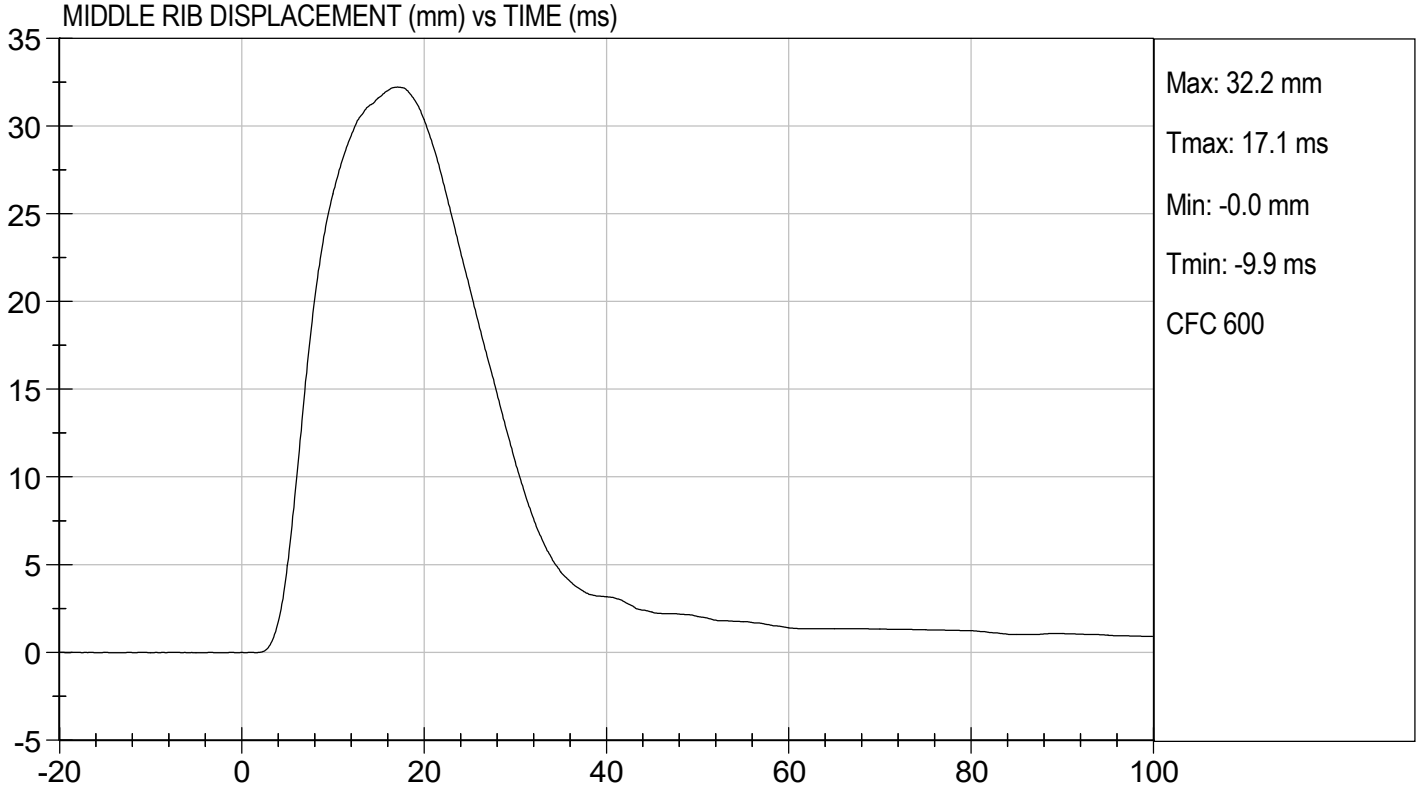
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



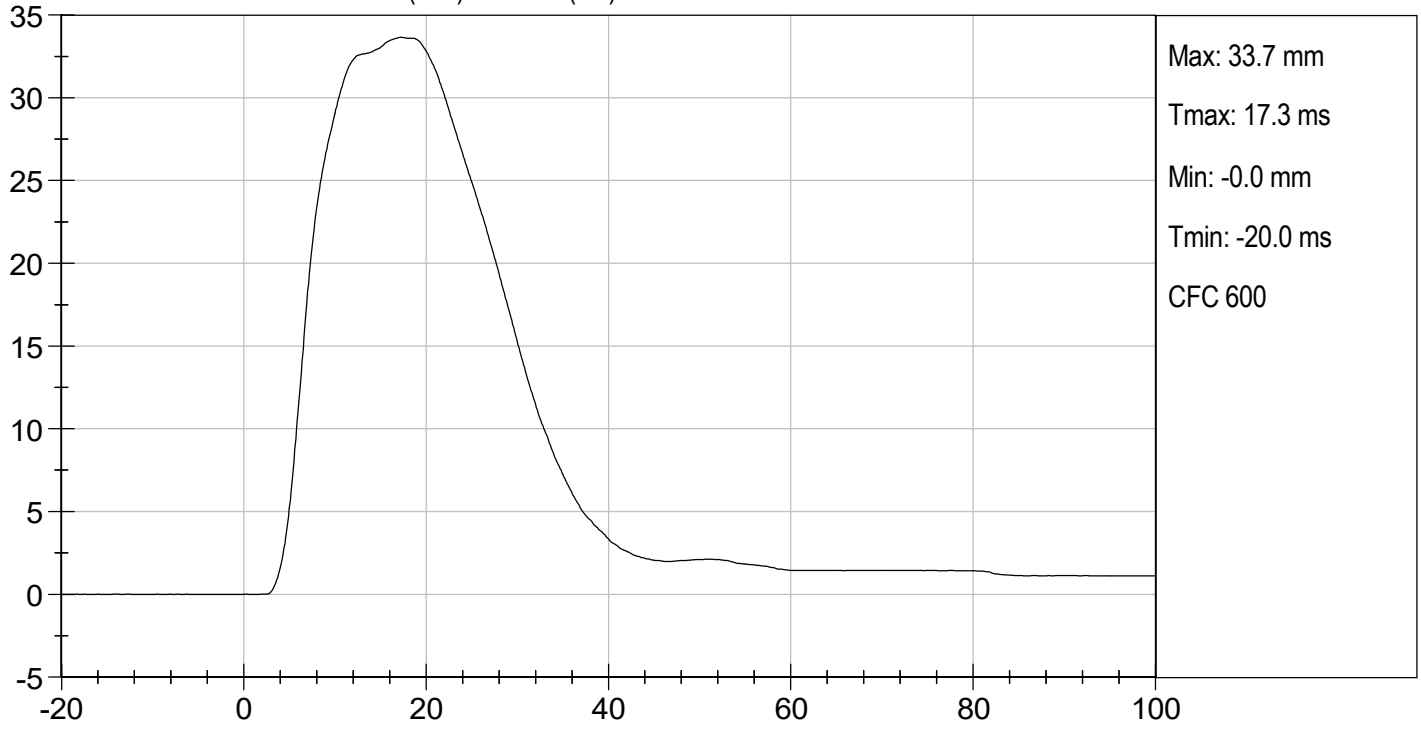
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



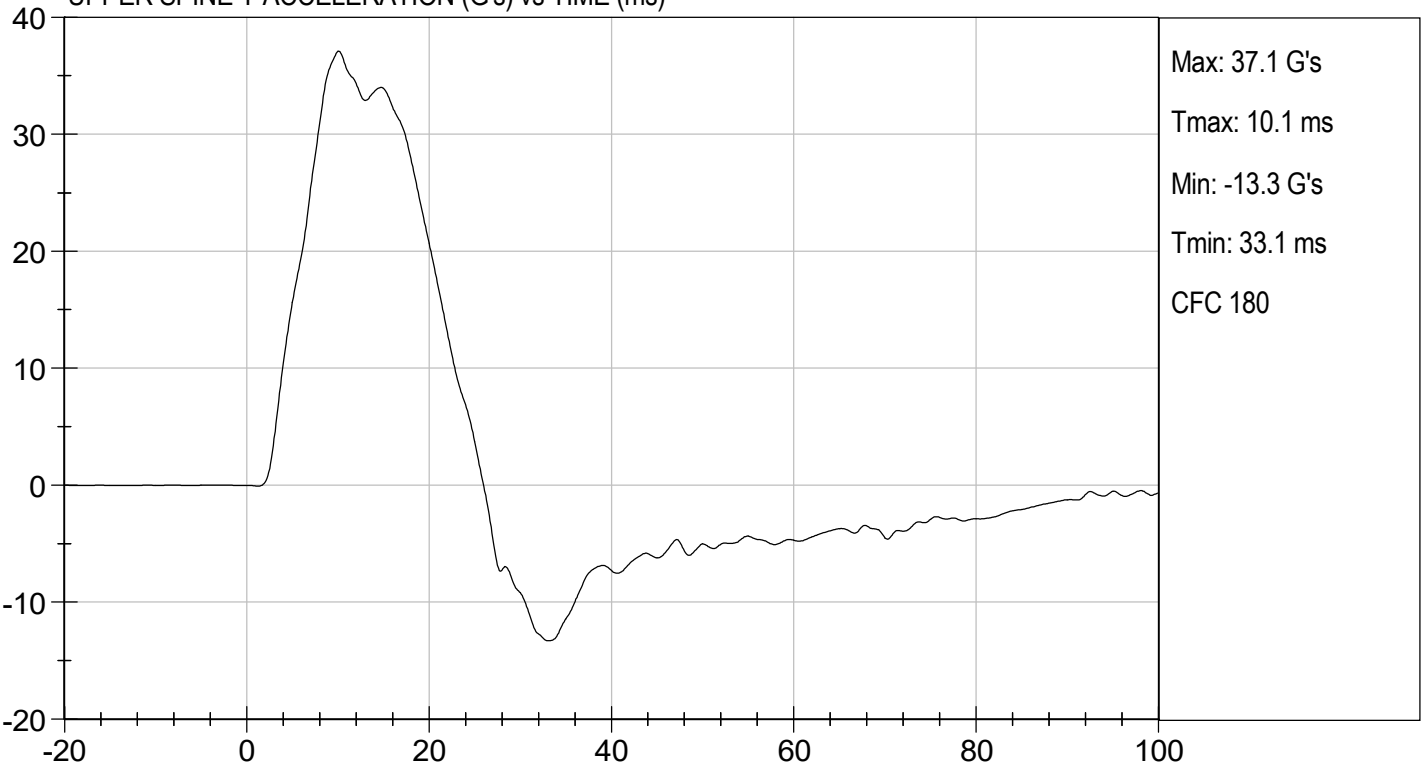
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 03/08/2021
TEST #: D210724

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)

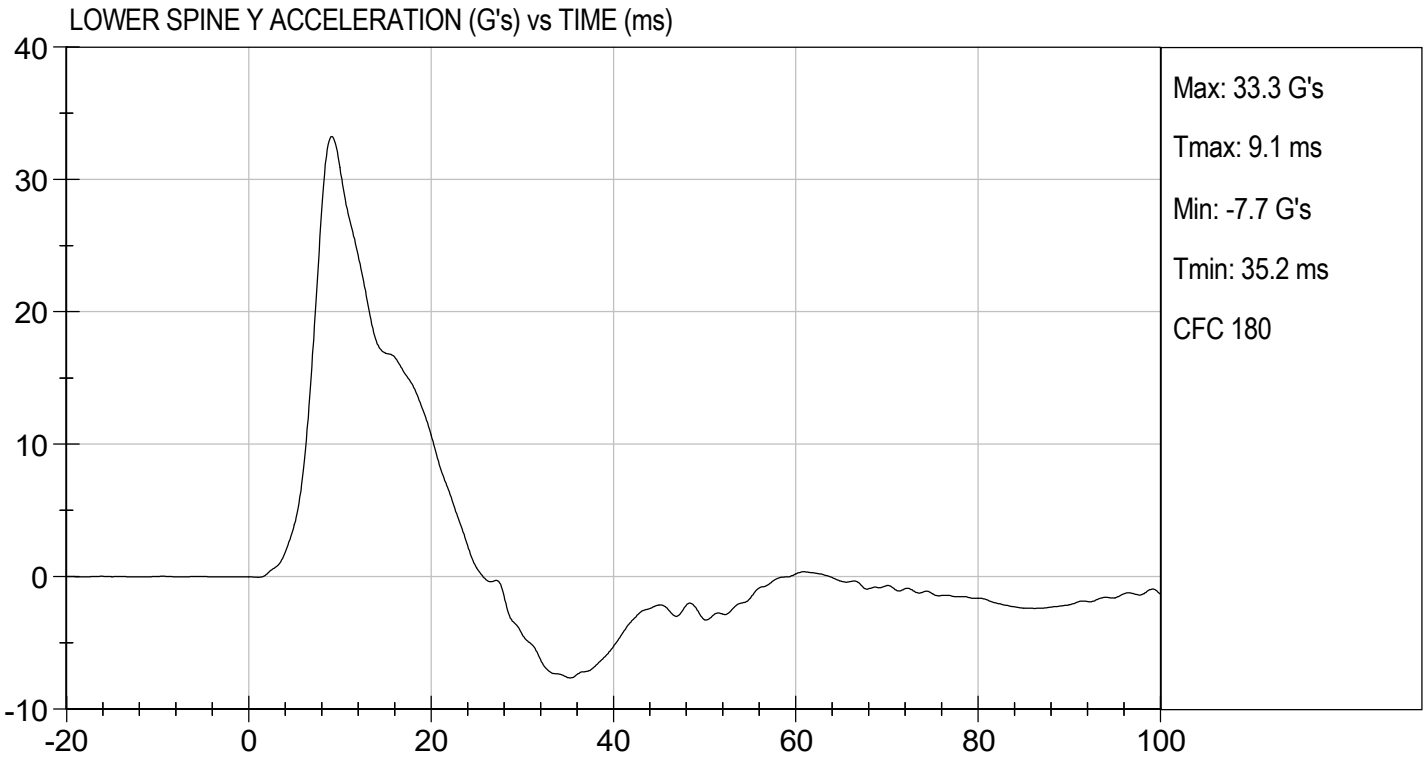


UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 03/08/2021
TEST #: D210724



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D210725

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	28	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	38	Pass
Middle Rib Displacement	mm	39 to 45	43	Pass
Lower Rib Displacement	mm	35 to 43	40	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	14	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
		Overall Test Results		Pass

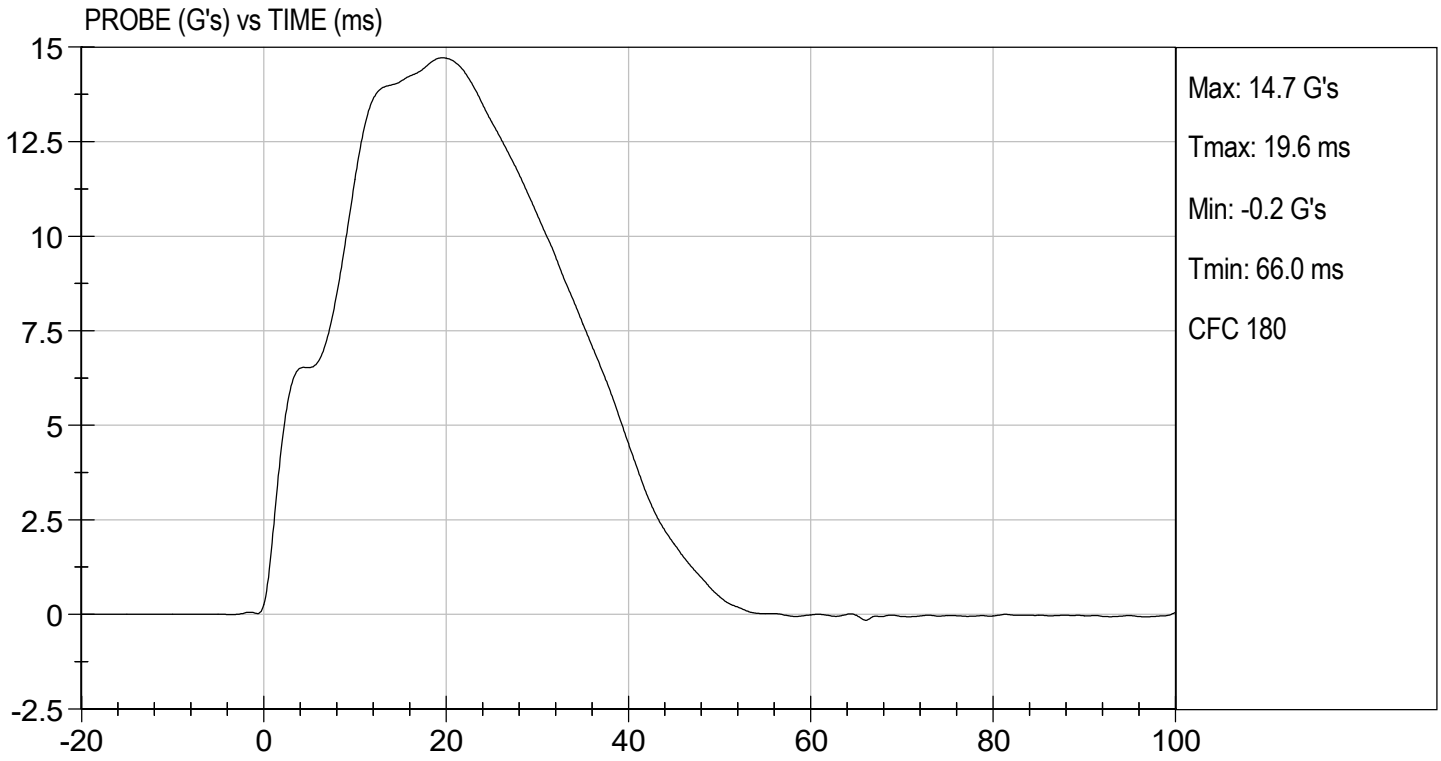
Gerald Guerrero
Laboratory Technician

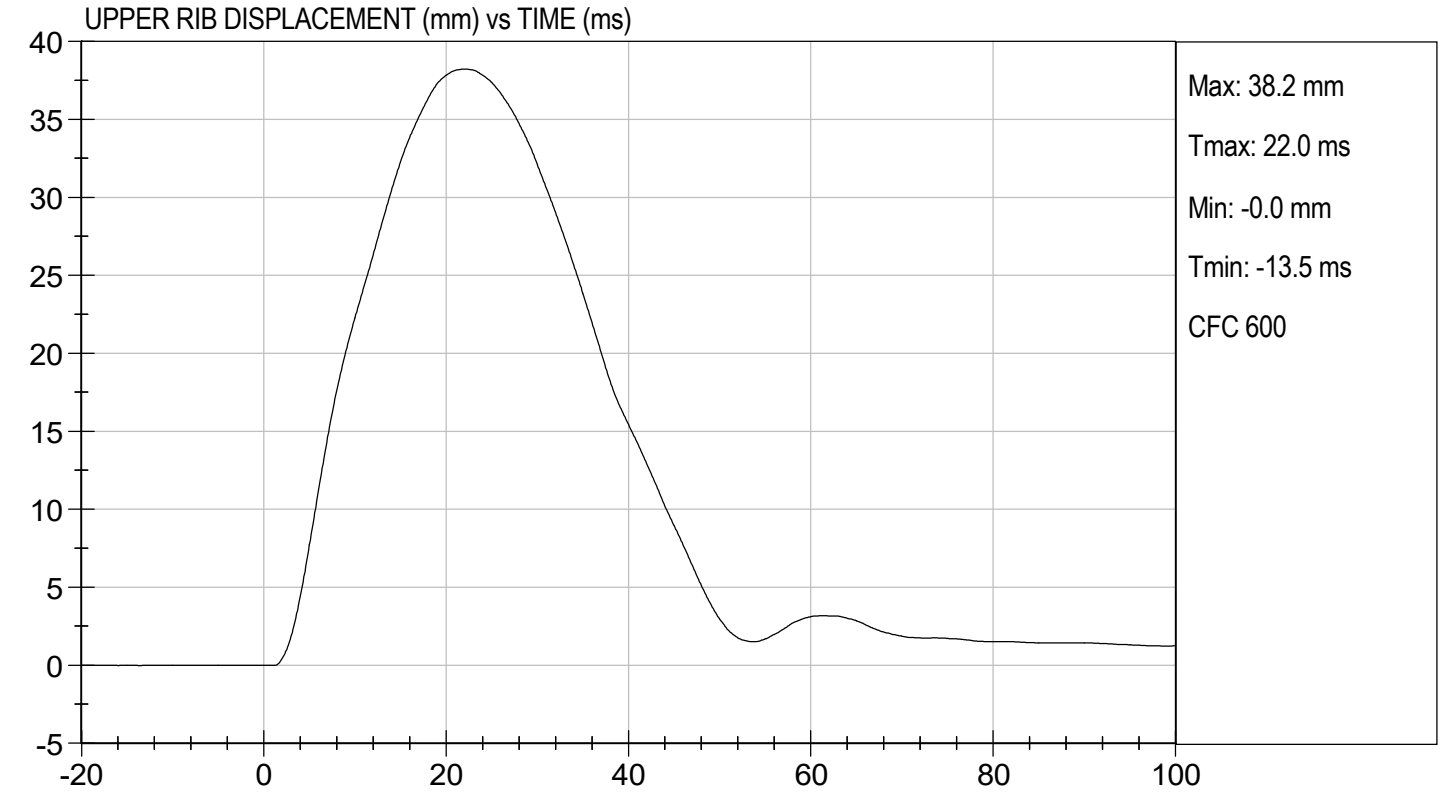
03/08/2021
Test Date

Approved By

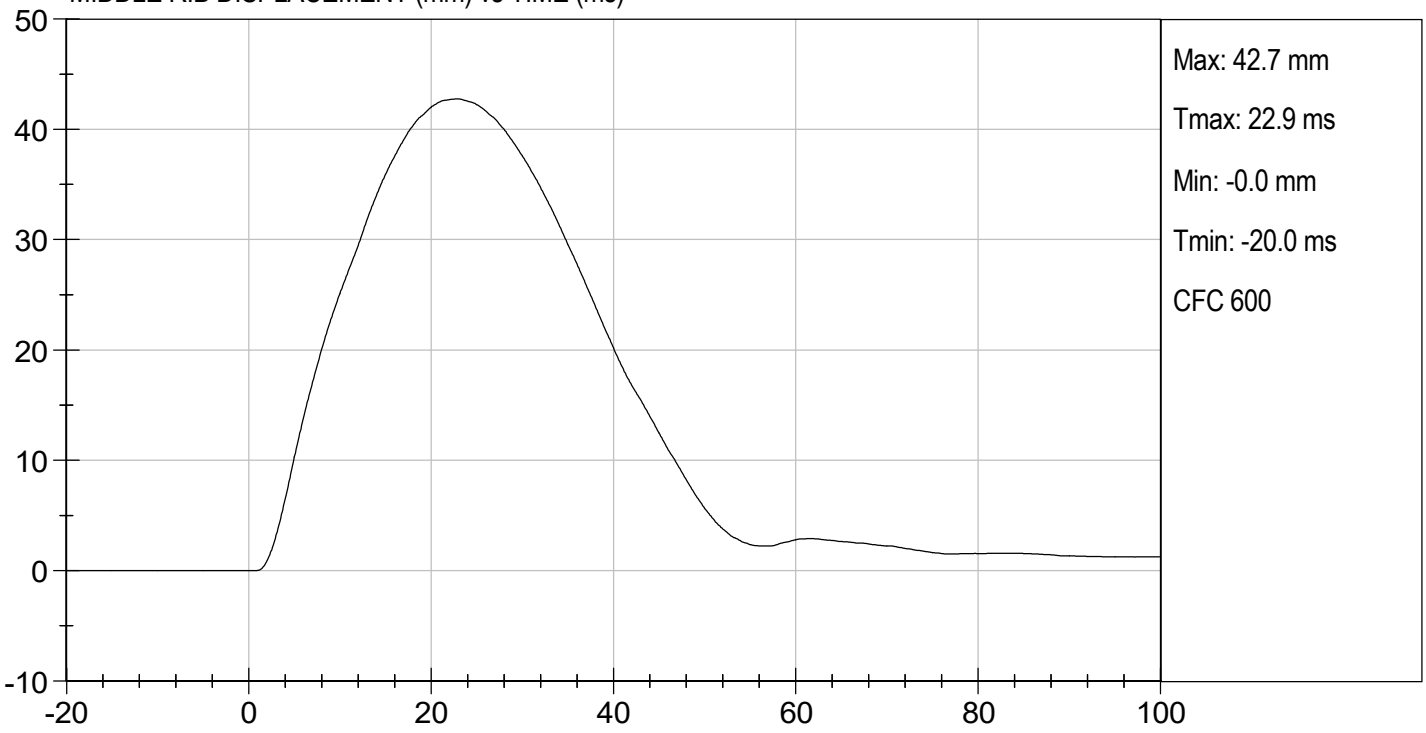
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 03/08/2021
TEST #: D210725

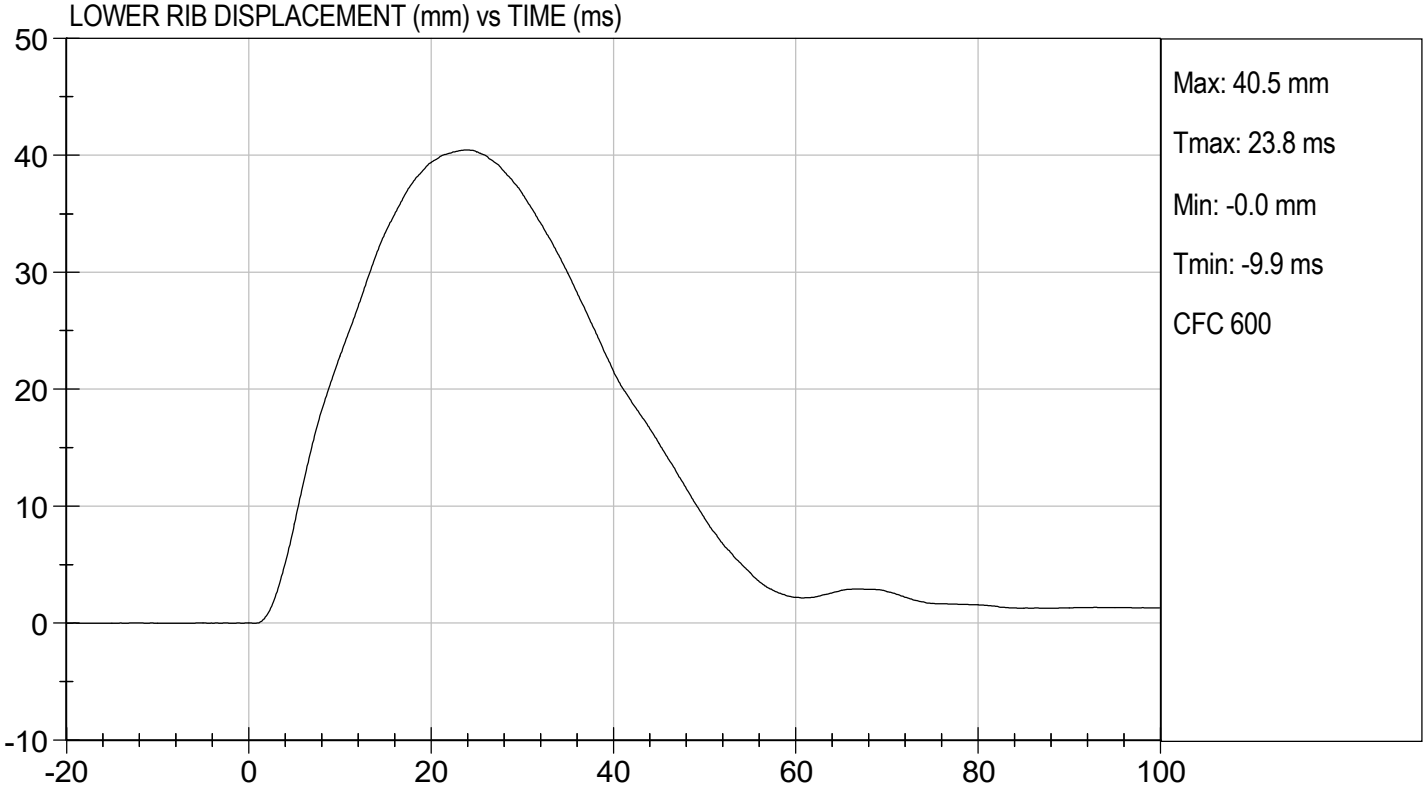




MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



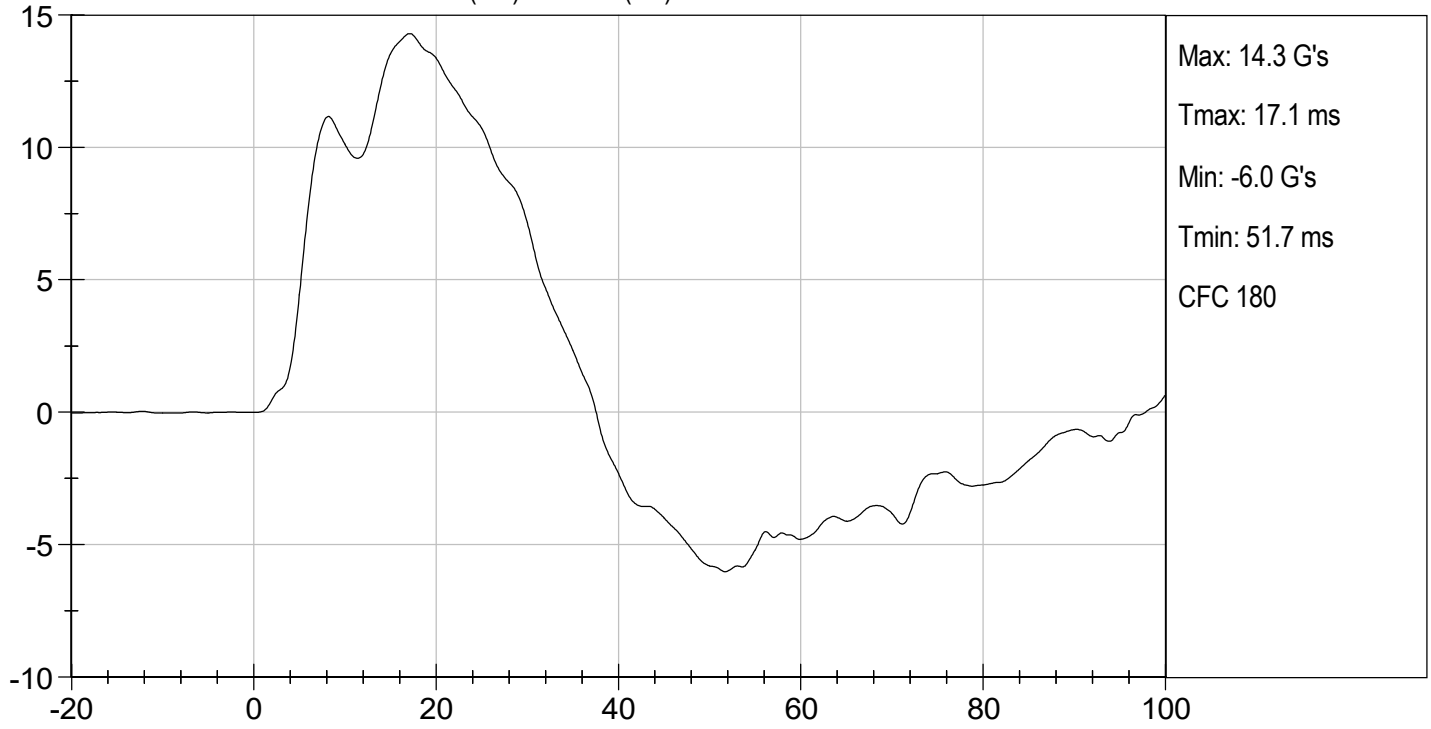
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



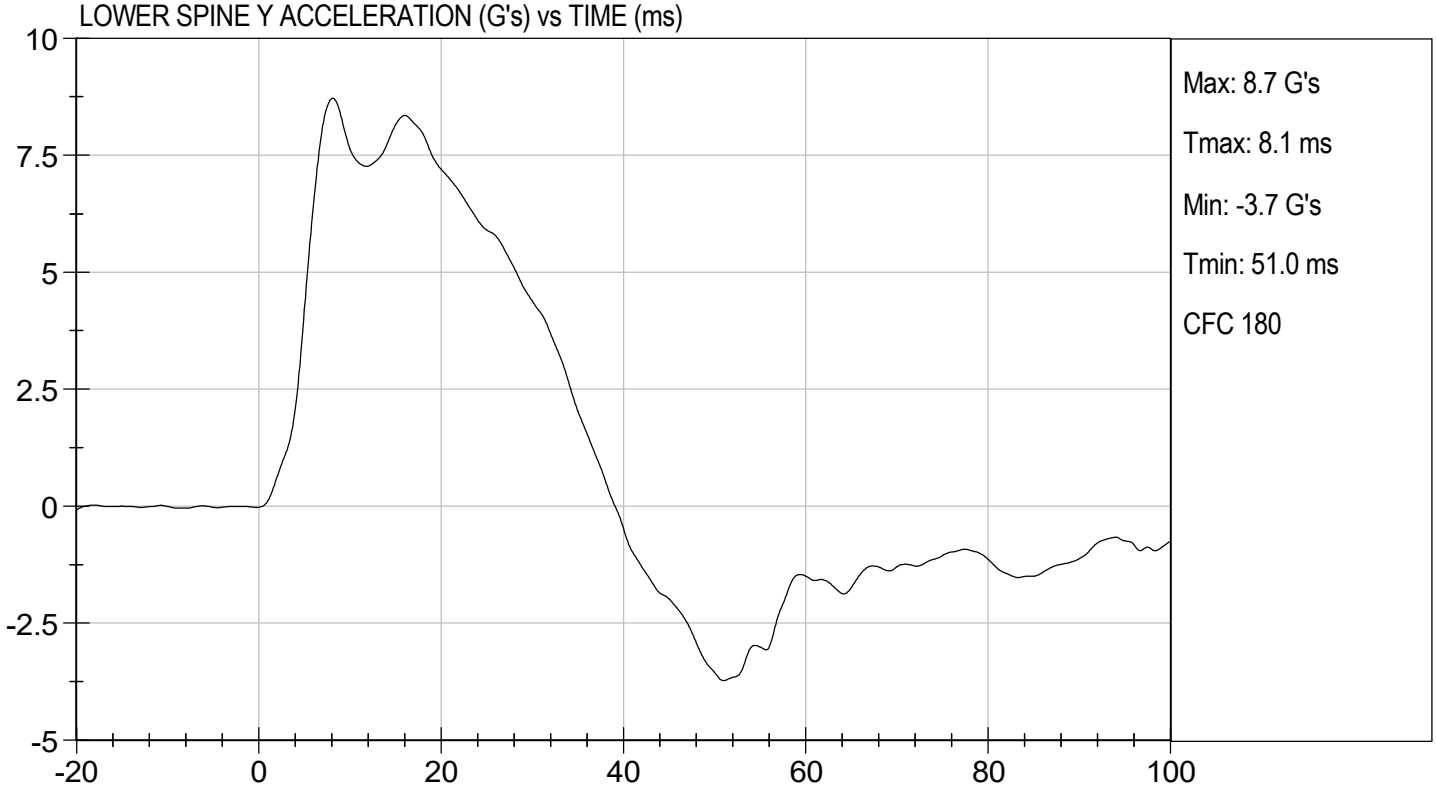
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 03/08/2021
TEST #: D210725

UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



LOWER SPINE Y ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D210726

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21	Pass
Humidity	%	10 to 70	27	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	12 to 16	14	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	40	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	39	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	12	Pass
		Overall Test Results		Pass

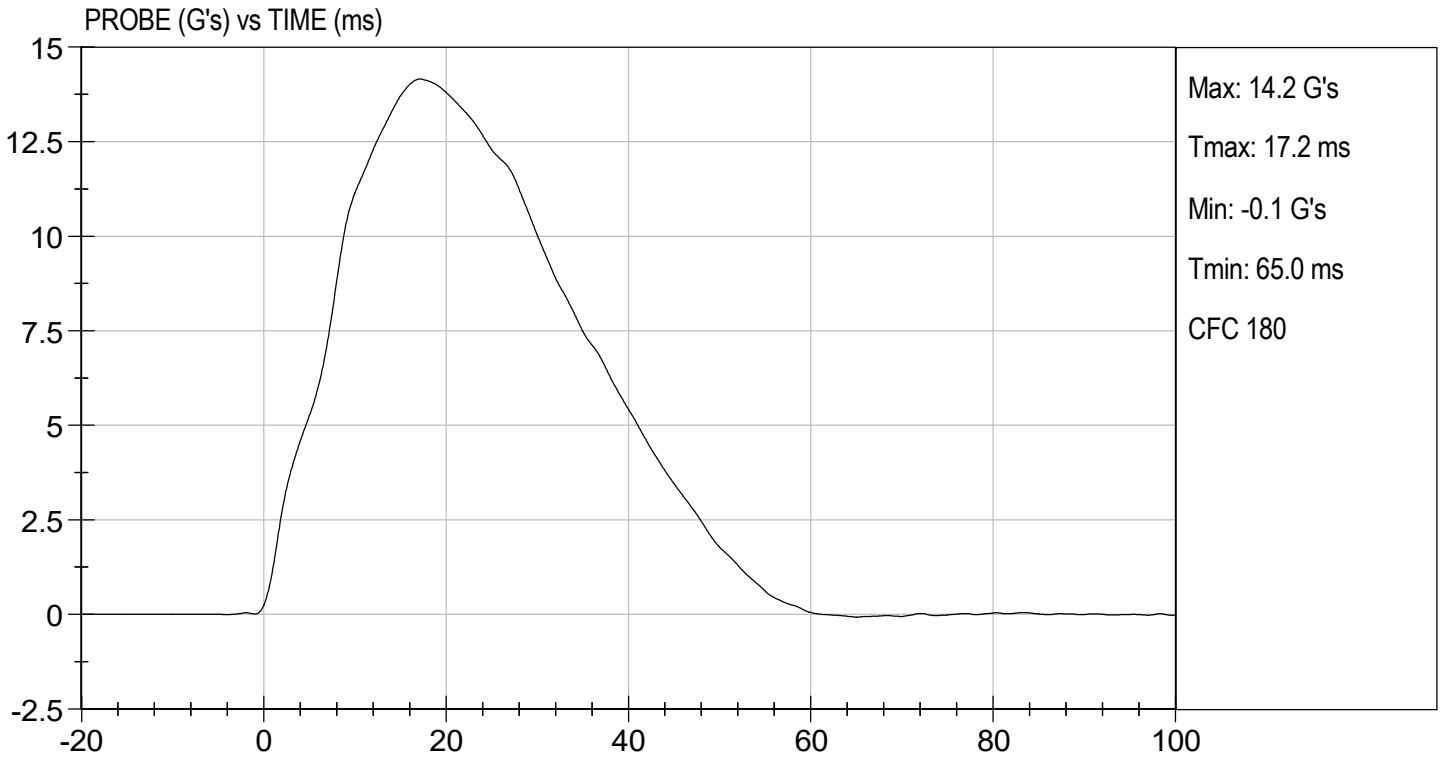
Gerald Guerrero
Laboratory Technician

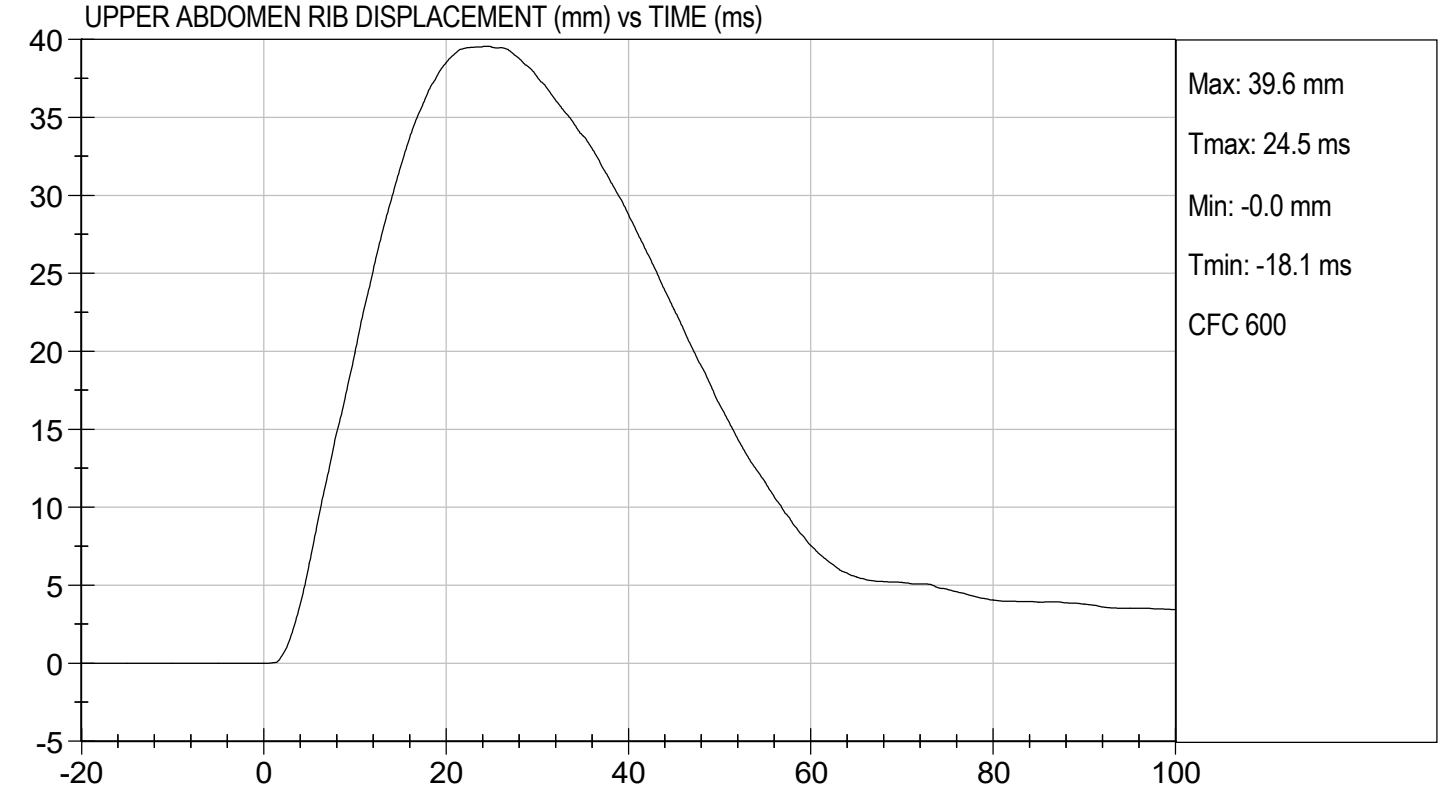
03/09/2021
Test Date

Approved By

TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.24 ft/s, 4.34 m/s

TEST DATE: 03/09/2021
TEST #: D210726

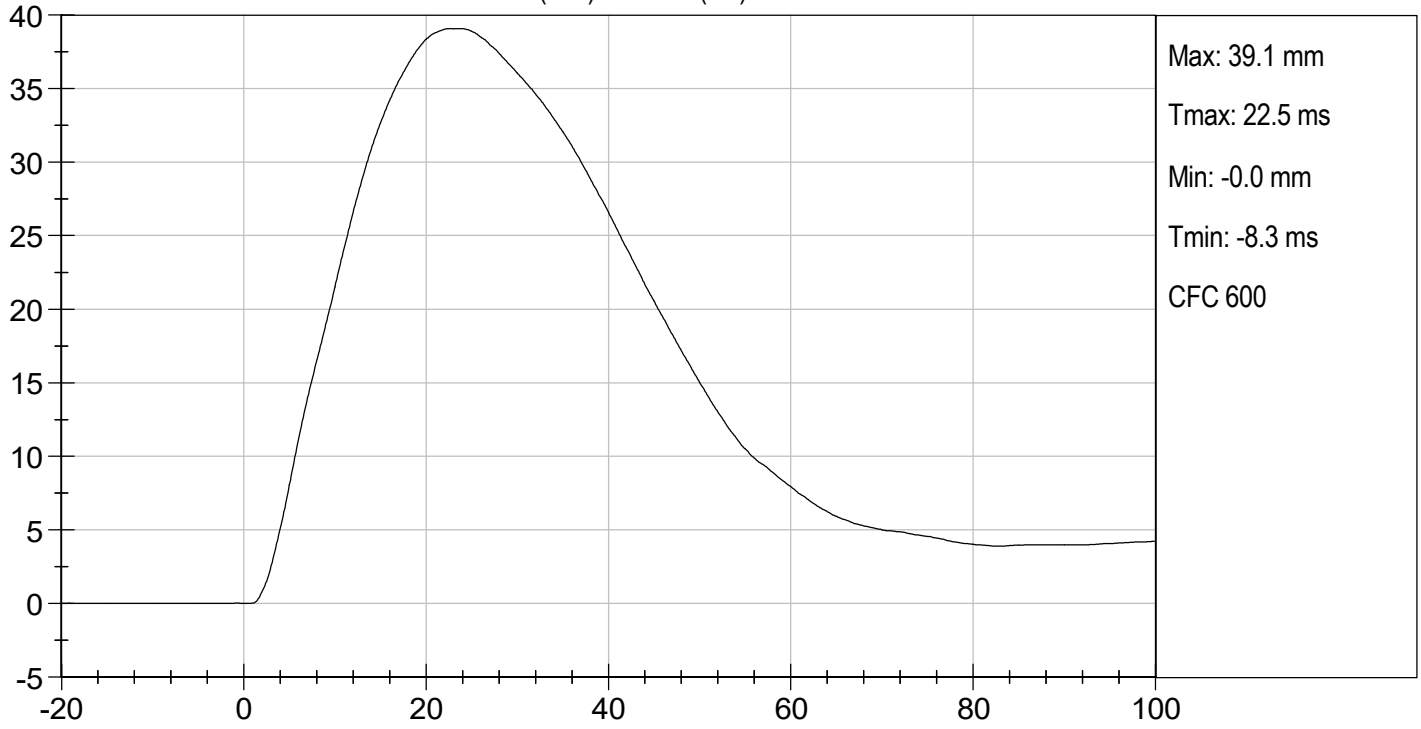




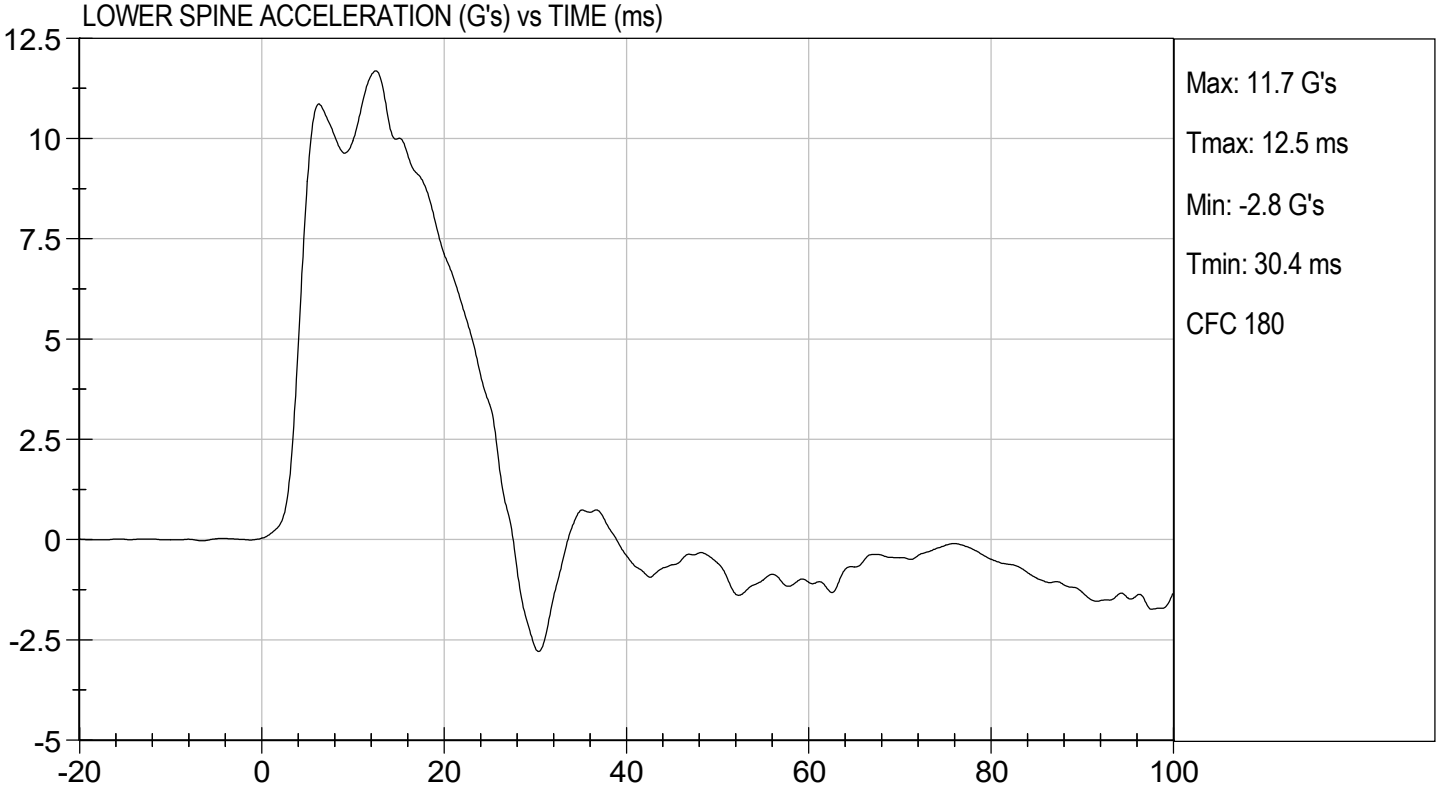
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.24 ft/s, 4.34 m/s

TEST DATE: 03/09/2021
TEST #: D210726

LOWER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER SPINE ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D210727

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21	Pass
Humidity	%	10 to 70	27	Pass
Impact Velocity	m/s	6.60 to 6.80	6.60	Pass
Maximum Probe Acceleration	G's	38 to 47	41	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	38	Pass
Peak Acetabulum Force	N	3600 to 4300	3,949	Pass
		Overall Test Results		Pass

Gerald Guerrero

Laboratory Technician

03/09/2021

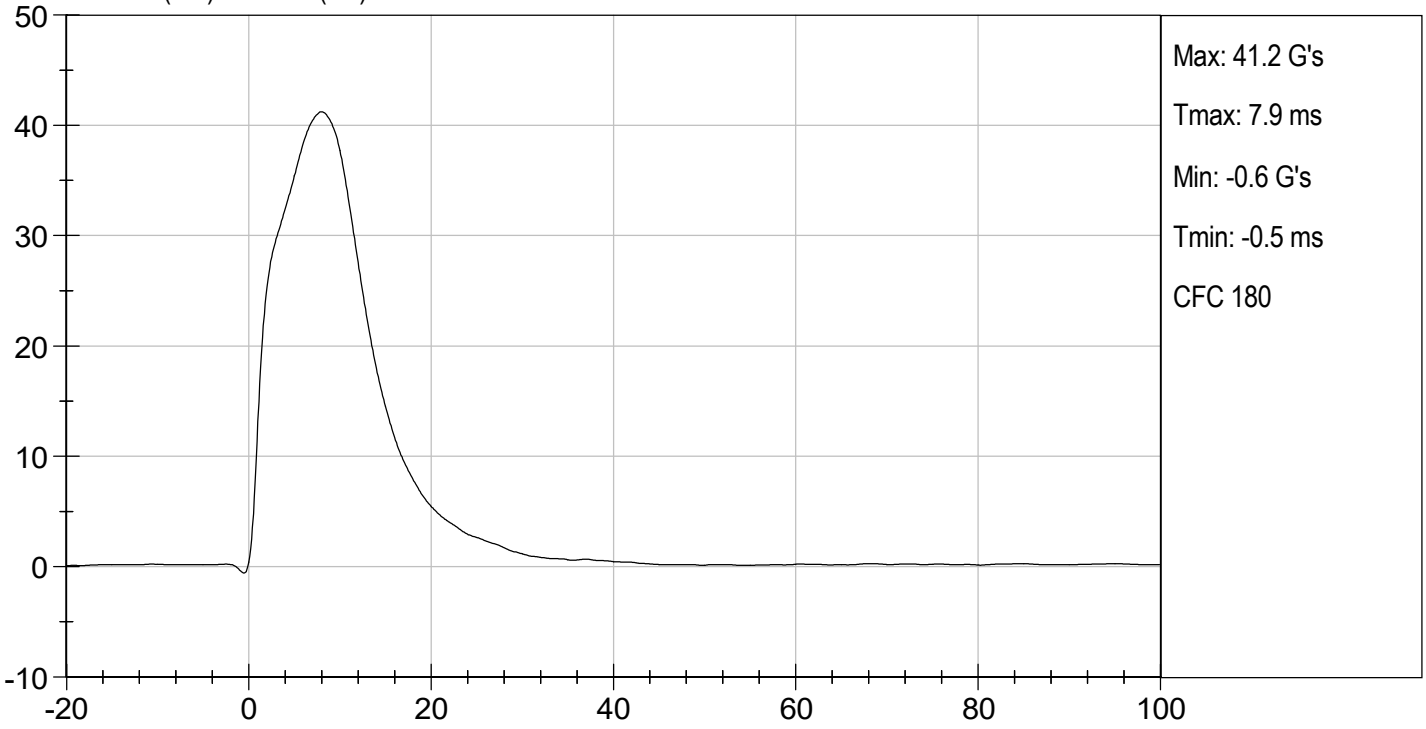
Test Date

Approved By

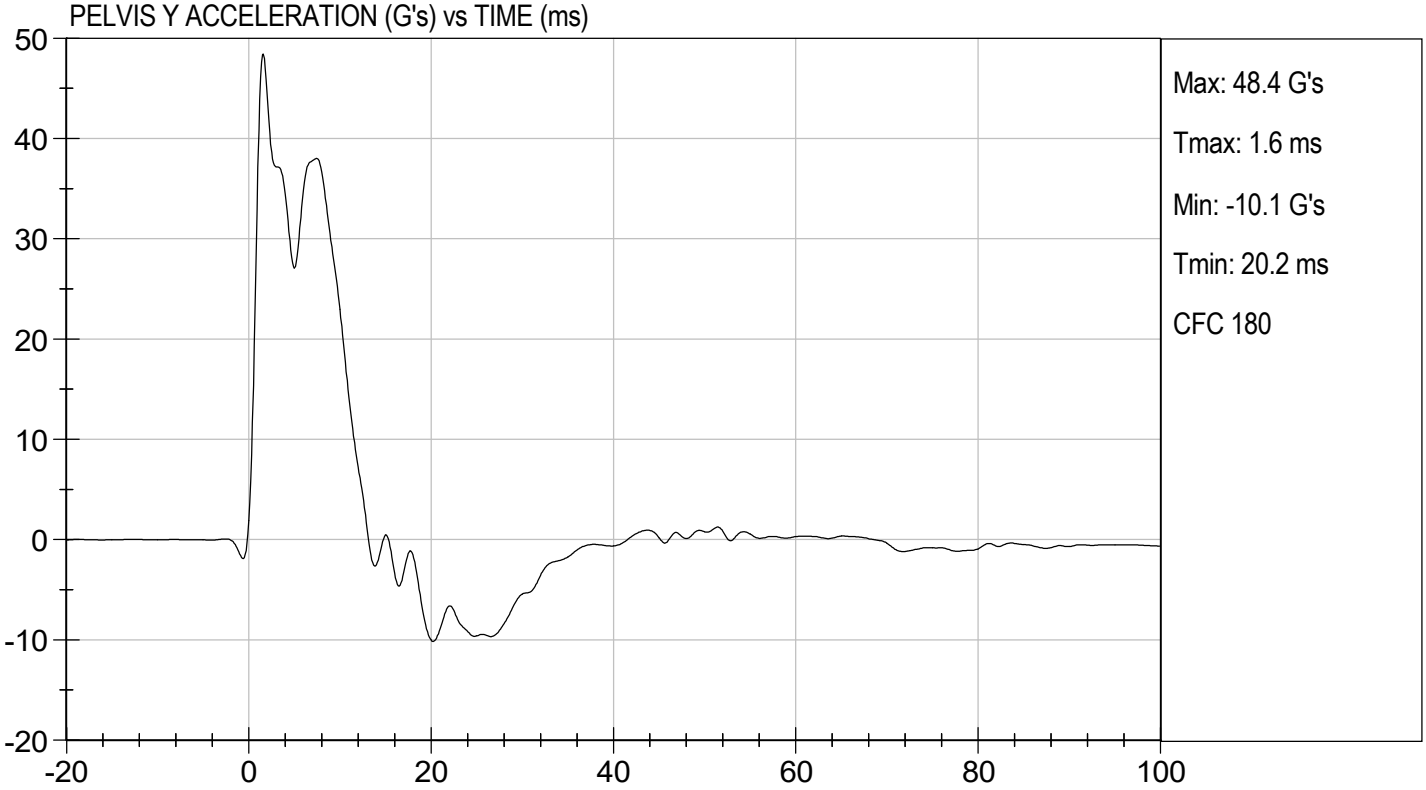
TEST DESC: PELVIS IMPACT
VELOCITY: 21.64 ft/s, 6.60 m/s

TEST DATE: 03/09/2021
TEST #: D210727

PROBE (G's) vs TIME (ms)

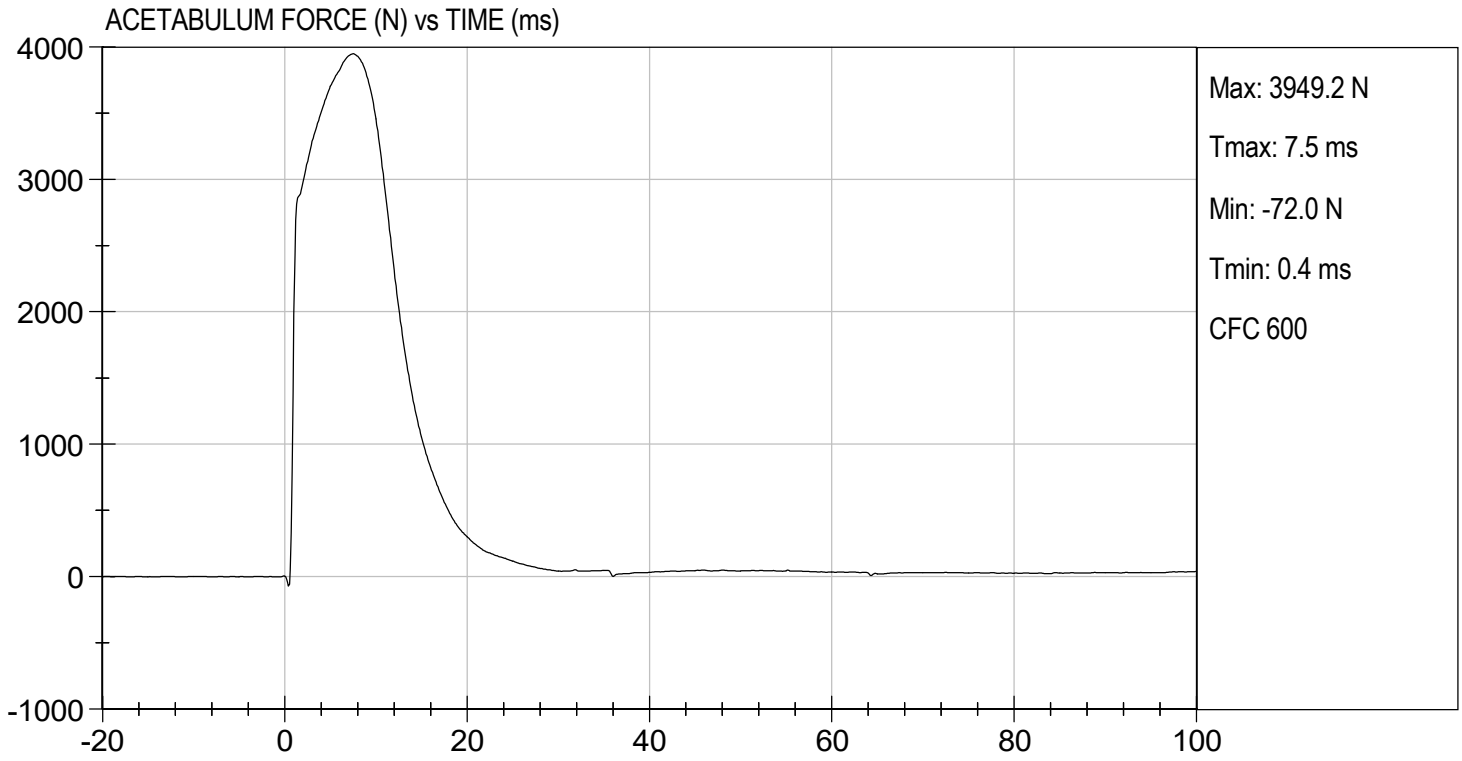


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: PELVIS IMPACT
VELOCITY: 21.64 ft/s, 6.60 m/s

TEST DATE: 03/09/2021
TEST #: D210727



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D210728

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Humidity	%	10 to 70	23	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	36 to 45	42	Pass
Pelvis Y Acceleration	G's	28 to 39	34	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,851	Pass
		Overall Test Results		Pass

Gerald Guerrero

Laboratory Technician

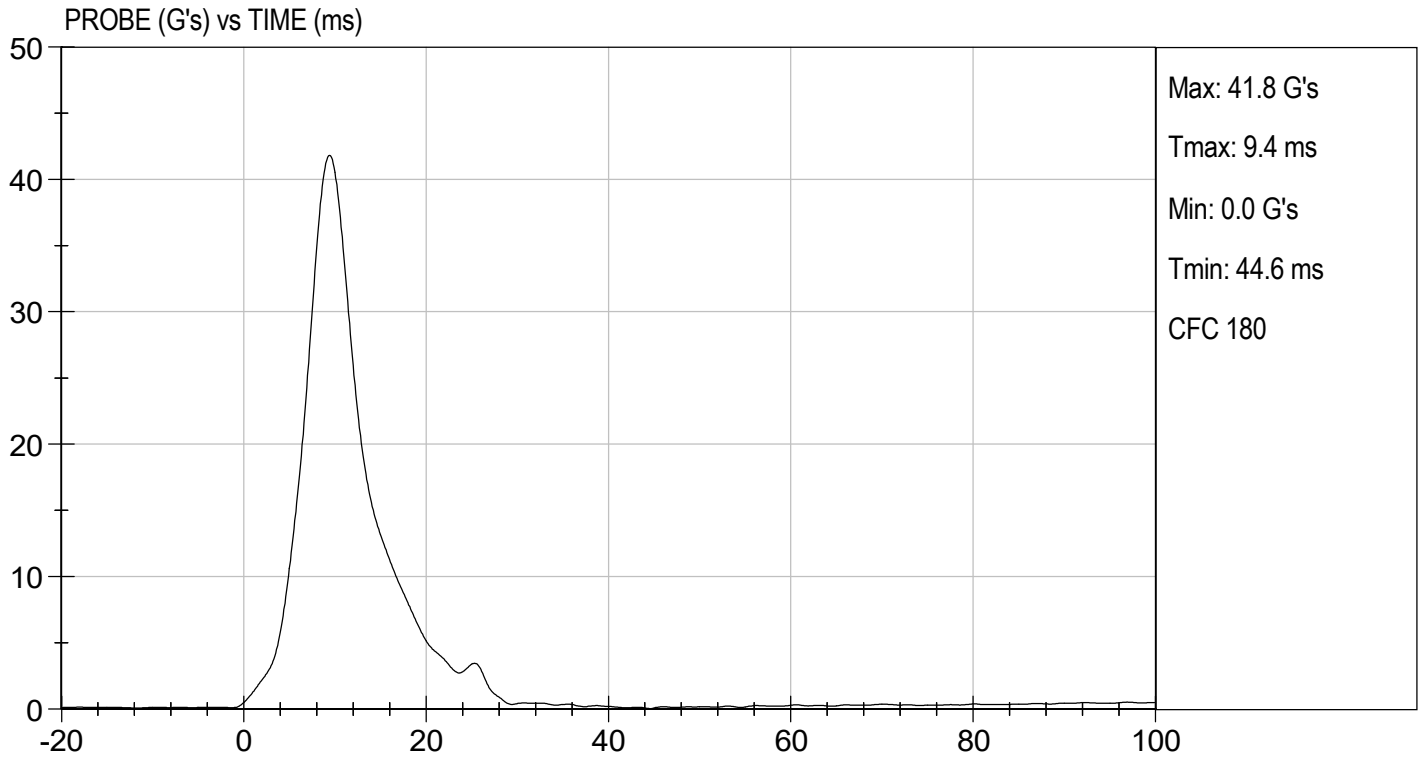
03/08/2021

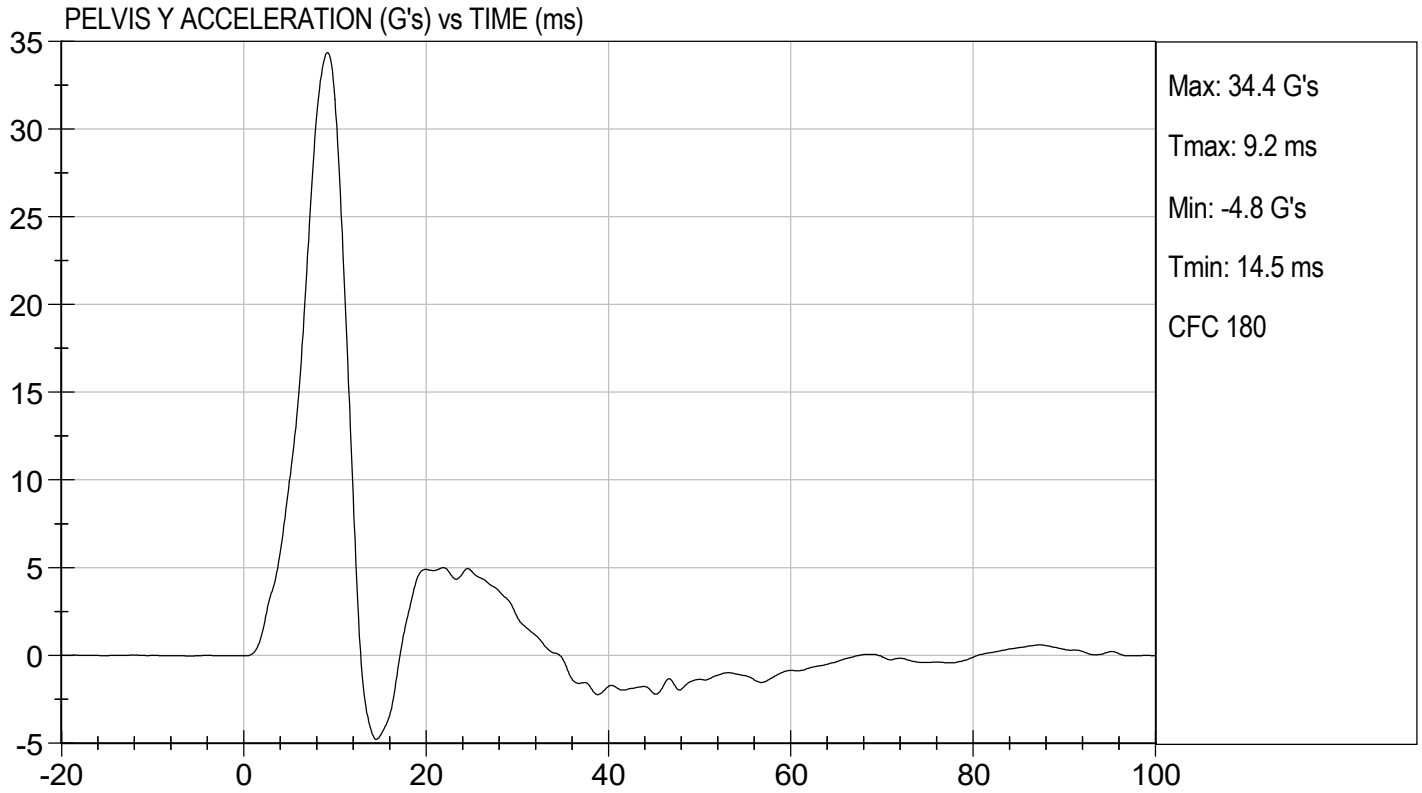
Test Date

Approved By

TEST DESC: ILLIAC
VELOCITY: 14.24 ft/s, 4.34 m/s

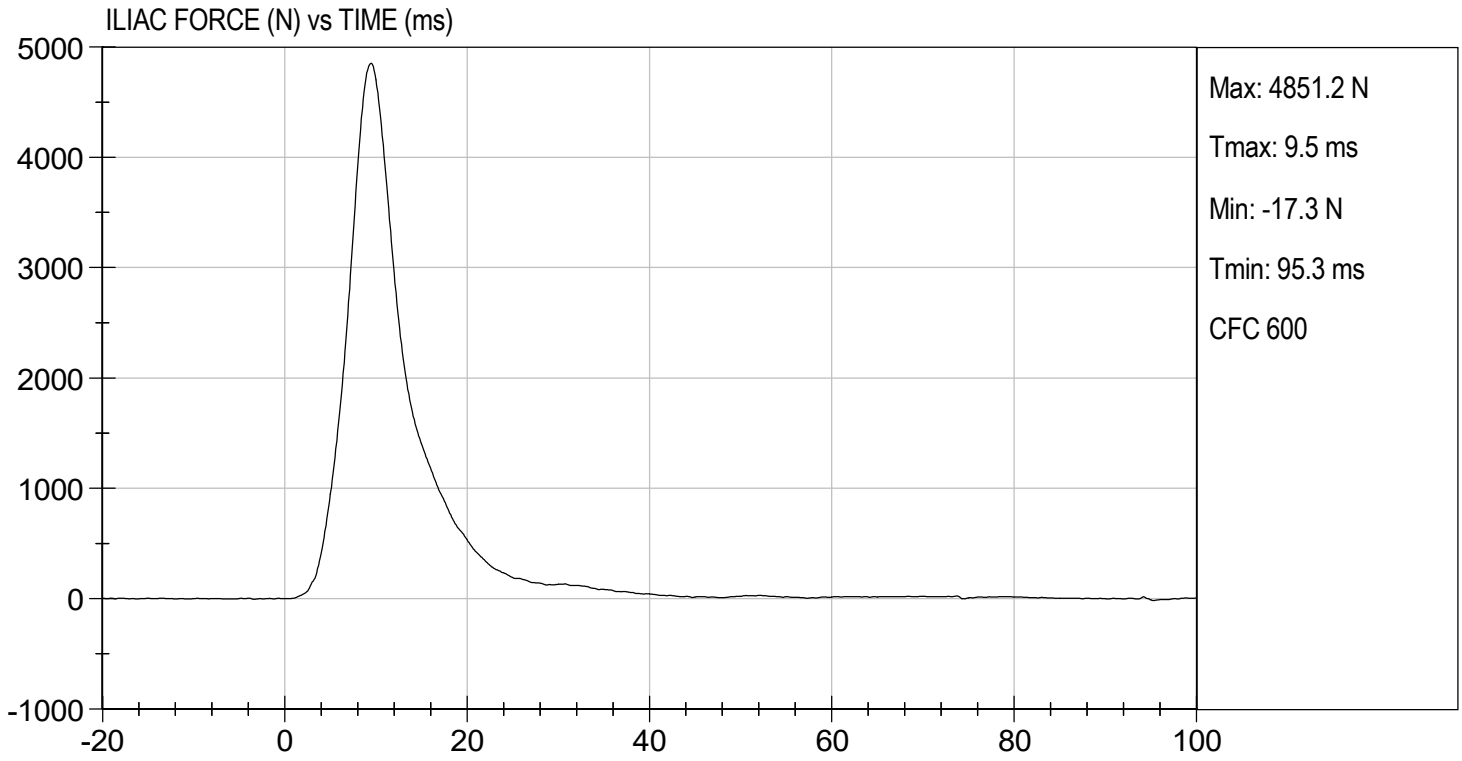
TEST DATE: 03/08/2021
TEST #: D210728





TEST DESC: ILLIAC
VELOCITY: 14.24 ft/s, 4.34 m/s

TEST DATE: 03/08/2021
TEST #: D210728



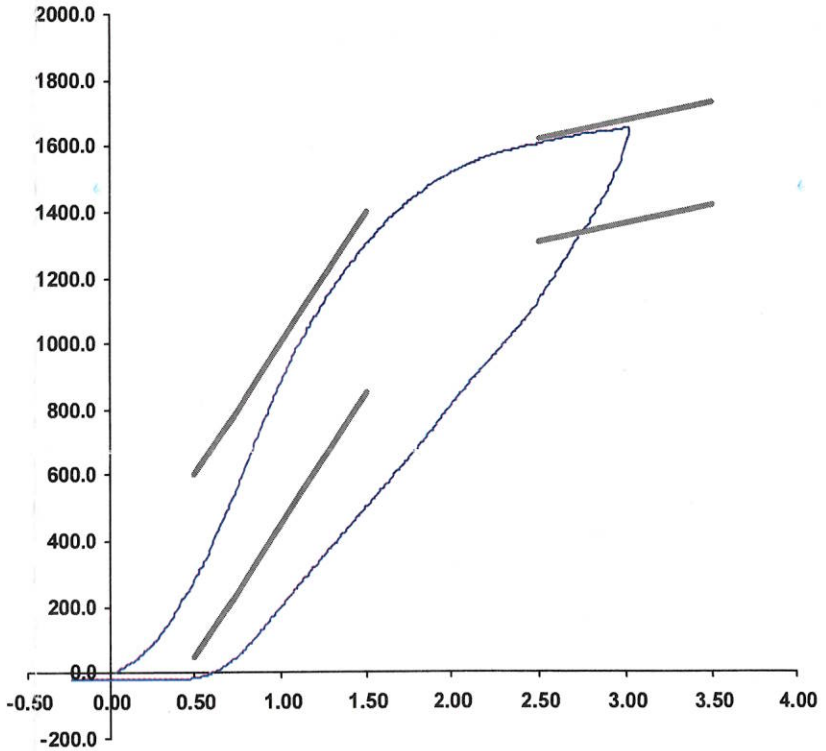
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 13047
Test Number 10367
Report Number 10402
Test Date 7/30/2019 2:23:12 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	297.02	50.00	600.00
Force @ 1.5 mm (N)	1,305.24	850.00	1,400.00
Force @ 2.5 mm (N)	1,607.09	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,651.39	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator

Part Number 180-4450

Template No 107 **30-Jul-19**
SACO Research

By : DC Date : 7/30/2019

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

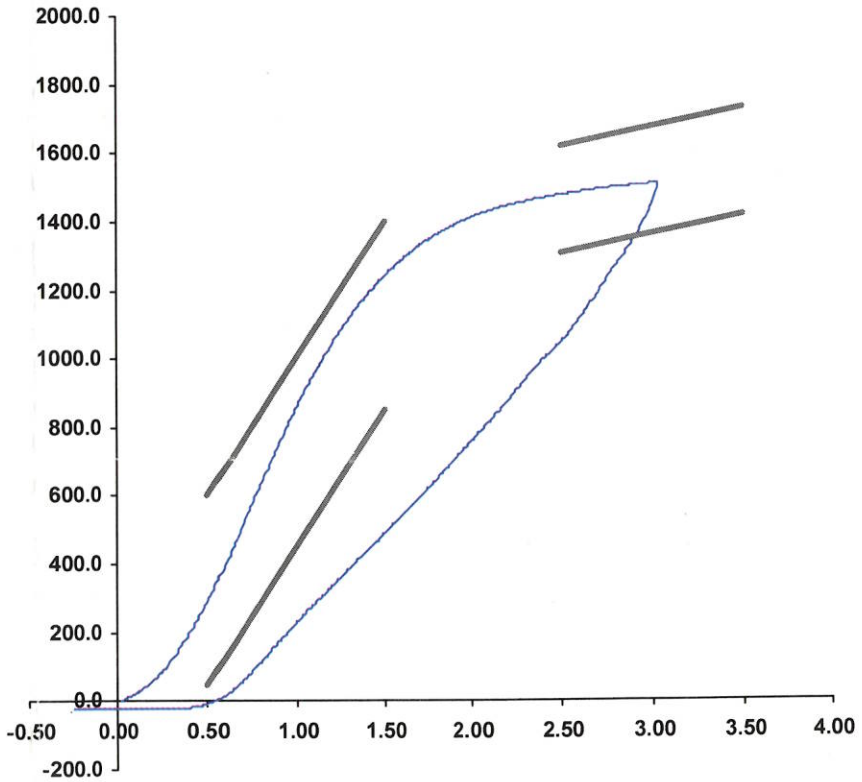
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 13940
Test Number 13414
Report Number 13459
Test Date 5/20/2020 10:17:10 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	294.42	50.00	600.00
Force @ 1.5 mm (N)	1,240.61	850.00	1,400.00
Force @ 2.5 mm (N)	1,474.96	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,508.13	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator

Part Number 180-4450

Template No 107 20-May-20
SACO Research

By : DC Date : 5/20/2020

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APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation

				SID-IIs S/N 296		
				Serial Number	Manufacturer	Calibration Date
Head CG Accelerometers			X	P85003	Endevco	01/18/2021
			Y	P94783	Endevco	01/18/2021
			Z	P94786	Endevco	01/18/2021
			Xr	P94938	Endevco	01/18/2021
			Yr	P96854	Endevco	01/18/2021
			Zr	P97386	Endevco	01/18/2021
Head Angular Rate Sensors			X	ARS7325	DTS	09/14/2020
			Y	ARS7354	DTS	08/04/2020
			Z	ARS7371	DTS	09/14/2020
Displacement Potentiometers	Thoracic Rib	Upper	Y	G012	FTSS	12/23/2020
		Middle	Y	G1163	FTSS	12/23/2020
		Lower	Y	G1158	FTSS	12/23/2020
	Abdominal Rib	Upper	Y	G1146	FTSS	12/23/2020
		Lower	Y	G1126	FTSS	12/23/2020
Lower Spine Accelerometers (T12)			X	P79418	Endevco	01/18/2021
			Y	P79439	Endevco	01/18/2021
			Z	P79614	Endevco	01/18/2021
Acetabulum Load Cell			Y	ACG4285	FTSS	02/10/2021
Iliac Wing Load Cell			Y	IWG3023	FTSS	02/10/2021
Pelvis Plug (struck side)				13047	SACO	07/30/2019
Pelvis Plug (non-struck side)				13940	SACO	05/20/2020

Table 2 – Vehicle Instrumentation

		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	A340708	MSI	10/09/2020
Vehicle Center of Gravity	Y	A340704	MSI	10/09/2020
Vehicle Center of Gravity	Z	A340718	MSI	10/09/2020
Left Floor Sill	Y	A356214	MSI	12/14/2020
A-Pillar Sill	Y	T22745	Endevco	11/02/2020
A-Pillar Low	Y	A340789	MSI	12/05/2020
A-Pillar Mid	Y	PCB1263	PCB	12/31/2020
B-Pillar Sill	Y	PCB1138	PCB	11/02/2020
B-Pillar Low	Y			
B-Pillar Mid	Y			
Driver Seat	Y	A360966	MSI	12/14/2020
Engine Top	X	A337200	MSI	12/03/2020
Engine Top	Y	A305692	MSI	10/22/2020
Firewall	Y	A356215	MSI	12/12/2020
Right Roof	Y	PCB1269	PCB	02/19/2021
Right Floor Sill	Y	A356243	MSI	12/05/2020
Rear Floorpan	X	A340683	MSI	11/03/2020
Rear Floorpan	Y	A356239	MSI	12/08/2020

Table 3 – Pole Instrumentation

	Serial Number	Manufacturer	Calibration Date
Load Cell 1	DG6277	FTSS	07/30/18
Load Cell 2	DG6278	FTSS	07/30/18
Load Cell 3	DG6279	FTSS	07/30/18
Load Cell 4	DG6280	FTSS	07/30/18
Load Cell 5	DG6281	FTSS	07/30/18
Load Cell 6	DG6283	FTSS	07/30/18
Load Cell 7	DG6284	FTSS	07/30/18
Load Cell 8	DG6582	FTSS	07/30/18