REPORT NUMBER: SPNCAP-MGA-2019-046

NEW CAR ASSESSMENT PROGRAM (NCAP)
Side Impact Pole Test

NISSAN MOTOR CO., LTD.
2019 Nissan Altima S 4-Door Sedan
NHTSA No.: O20195201

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: May 30, 2019

Final Report Date: September 13, 2019

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NRM-110
1200 New Jersey Ave, SE
Room W43-410
Washington, DC 20590

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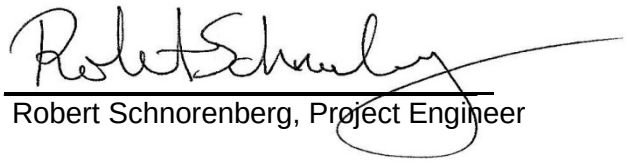
Prepared by: 
Robert Schnorenberg, Project Engineer

Approved by: 
Ben Fischer, Project Engineer

Approval Date: September 13, 2019

FINAL REPORT ACCEPTANCE BY OCWS:

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

Date: _____

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

Date: _____

Technical Report Documentation Page

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4. Title and Subtitle Final Report of New Car Assessment Program Side Impact Pole Testing of a 2019 Nissan Altima S 4-Door Sedan, NHTSA No.: O20195201		*5. Report Date* September 13, 2019 *6. Performing Organization Code* MGA
7. Author(s) Robert Schnorenberg, Project Engineer		*8. Performing Organization Report No.* SPNCAP-MGA-2019-046
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-14-D-00353
12. Sponsoring Agency Name and Address United States Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave, SE, Room W43-410 Washington, DC 20590		*13. Type of Report and Period Covered:* Final Test Report May 30, 2019 to September 13, 2019 *14. Sponsoring Agency Code* NRM-110
15. Supplementary Notes		

16. Abstract

A 32.20 km/h, 75° oblique impact Side NCAP Test was conducted on the subject 2019 Nissan Altima S 4-Door Sedan 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 MGA Research Corporation in Burlington, Wisconsin on May 30, 2019.

The impact velocity was 32.22 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21.8°C. The test vehicle post-test maximum crush was 397 mm at level 3. The test vehicle's performance was as follows:

	Driver ATD (SID-IIs)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	157
Resultant Lower Spine Acceleration	Gs	82	42
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3420
Maximum Thoracic Rib Deflection	mm	38*	21
Maximum Abdomen Rib Deflection	mm	45*	17

*Proposed IARV

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

17. Key Words New Car Assessment Program (NCAP) Side Impact Pole Part 572V SID-IIs	*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave, SE Washington, DC 20590

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SECTION 1
TEST PURPOSE AND PROCEDURE

This side impact test is part of the MY 2019 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 2019 Nissan Altima S 4-Door Sedan. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP Pole Laboratory Test Procedure, dated October 2015.

SECTION 2
SUMMARY OF TEST RESULTS

A rigid pole side impact test was conducted on a 2019 Nissan Altima S 4-Door Sedan. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 32.22 km/h. The test was conducted by MGA Research Corporation in Burlington, Wisconsin on May 30, 2019. Pre-test and post-test photographs of the test vehicle and side impact dummy (SID-IIs) are included in Appendix A of 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 October 2015. 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
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	Driver ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC_{36})	N/A	1000	157
Resultant Lower Spine Acceleration	Gs	82	42
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3420
Maximum Thoracic Rib Deflection	mm	38*	21
Maximum Abdominal Rib Deflection	mm	45*	17

*Proposed IARV

Supplemental restraint information is given below:

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	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
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	
Other	No		No	

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

GENERAL COMMENTS

Vehicle CG Z recorded no valid data after 53 ms.
Left A-Post at Sill Y recorded no valid data after 39 ms.
Left B-Post at Sill Y recorded no valid data after 78 ms.
Driver Seat Track Y recorded no valid data after 53 ms.
Load Cell Pole #8 Fy recorded no valid data.

SECTION 3
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20195201
Model Year	2019
Make	Nissan
Model	Altima S
Body Style	4-Door Sedan
VIN	1N4BL4BV4KC141323
Body Color	Gun Metallic
Odometer Reading (km/mi)	14 km / 9 mi
Engine Displacement (L)	2.5 L
Type/No. Cylinders	4
Engine Placement	Lateral
Transmission Type	Automatic
Transmission Speeds	CVT
Overdrive	Yes
Final Drive	FWD
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
Anti-Lock Brakes (ABS)	Yes

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

Does owner's manual provide instructions to turn off automatic door locks?	No

DATA FROM CERTIFICATION LABEL

Manufactured By	NISSAN MOTOR CO., LTD.
Date of Manufacture	11/18
Vehicle Type	Passenger Car

GVWR (kg)	1963
GAWR Front (kg)	1097
GAWR Rear (kg)	945

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	3	2		5	
Capacity Weight (VCW) (kg)				408	(A)
DSC x 68.04 kg				340	(B)
Rated Cargo and Luggage Weight (RCLW) (kg)				68	(A-B)

VEHICLE SEAT TYPE

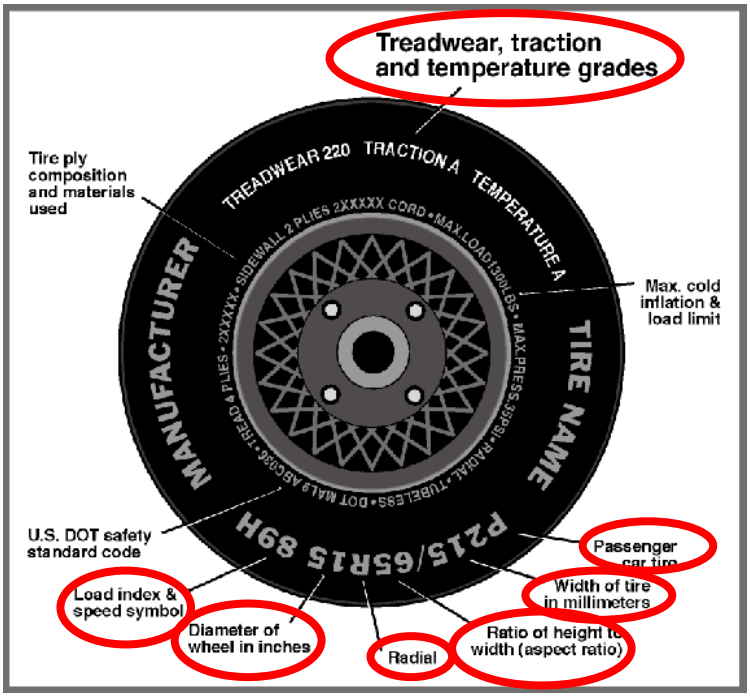
Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						Manual	Power
Front Seat	X					w/Lever	Driver Only
Rear or Second Row				X	X		
Third Row Seat							

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

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan
Test Program: NCAP Side Pole Impact Test

NHTSA No. O20195201
Test Date: 5/30/2019

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	220	220
Recommended Tire Size	215/60R16	215/60R16
Tire Size on Vehicle	215/60R16	215/60R16
Tire Manufacturer	Hankook	Hankook
Tire Model	Kinergy GT	Kinergy GT
Treadwear	500	500
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	1 Polyester, 2 Steel, 1 Polyamide	1 Polyester, 2 Steel, 1 Polyamide
Load Index/Speed Symbol	95H	95H
Tire Material	Rubber	Rubber
DOT Safety Code Left	T7V9 1BH 3918	T7V9 1BH 3918
DOT Safety Code Right	T7V9 1BH 3918	T7V9 1BH 3918

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

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019

TEST PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kpa	275	285	285	275
Tire Placard	kpa	220	220	220	220
Owner's Manual	kpa	220	220	220	220
As Tested	kpa	220	220	220	220

TEST VEHICLE WEIGHTS

		As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
	Units	Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	446.0	295.5		460.5	351.0		460.0	354.0	
Right	kg	440.5	281.0		435.0	330.5		441.5	327.5	
Ratio	%	60.6%	39.4%		56.8%	43.2%		56.9%	43.1%	
Totals	kg	886.5	576.5	1463.0	895.5	681.5	1577.0	901.5	681.5	1583.0

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1463.0	(A)
Actual Weight of 1 P572V ATD (SID-IIs) ATD Used	kg	52	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	68	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1583.0	(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-	deg	-0.1	-0.2	-0.5	Yes
Front Pass. Sill Angle (front-to-	deg	0.4	0.2	0.0	Yes
Front Bumper Angle (left-to-right)**	deg	-0.6	-0.7	0.3	Yes
Rear Bumper Angle (left-to-right)**	deg	0.3	0.3	0.3	Yes
Vehicle CG (Aft of Front Axle)	mm	1110	1217	1215	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	11	24	23	

*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	Weight (kg)
Ballast (if any)	67
None	

Test height adjustable suspension setting, if applicable:	Not Applicable

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

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019

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	25.9	17.5	21.7
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-Fore/Aft	Forward-Most
Driver Seat	21.7	24	Max	48	48	48
			Mid	24	24	24
			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

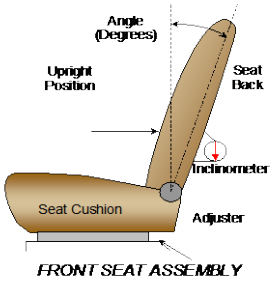
Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019

SEAT FORE/AFT POSITIONS

Seat	Total Fore/Aft Travel		Test Position from Forward-most Position	
	mm	Detents	mm	Detent
Driver Seat	238		0	
Front Passenger Seat	240	25 (1st as 1)	0	0th (1st as 0)
Front Center Seat				
Struck Side Rear Seat	Fixed		Fixed	
Non-Struck Side Rear Seat	Fixed		Fixed	
Rear Center Seat	Fixed		Fixed	

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 Form No. 1 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	Degree	Detent
Driver Seat w/Seated Dummy	88.9		-2.8	
Front Passenger Seat	74.9	41 (1st as 1)	0.4	7th (1st as 0)
Front Center Seat				
Struck Side Rear Seat	Fixed		Fixed	
Non-Struck Side Rear Seat	Fixed		Fixed	
Rear Center Seat	Fixed		Fixed	

Front seat back angle measured on outboard headrest post.

SEAT BELT ANCHORAGE ADJUSTMENT

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

	Total # of Positions	**Placed in Position #**
Driver Seat	3 detents (1st as 1)	0th (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	6 detents (1st as 1)	0th (Lowermost as 0)

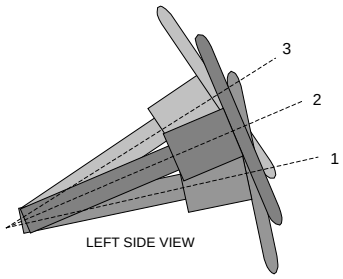
DATA SHEET NO. 2 (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019

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.

	Degrees	Fore/Aft Position (mm)
Lowermost, Position 1	70.2	211
Geometric Center, Position 2	67.5	184
Uppermost, Position 3	64.7	157
Telescoping Steering Wheel Travel		54
Test Position	67.5	184

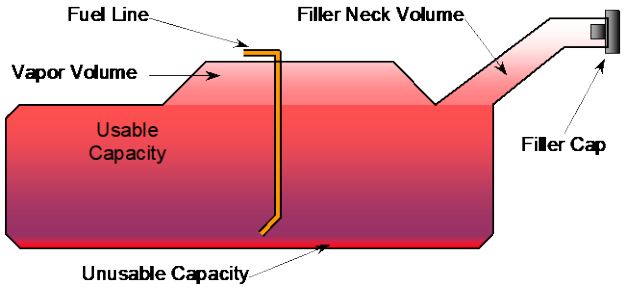


STEERING COLUMN ASSEMBLY

FUEL PUMP

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

The vehicle is equipped with an electronic fuel pump. The fuel pump is activated approximately 1 second after the ignition is turned on. It remains on while the engine is running. The filler neck is located on the driver's side.



VEHICLE FUEL TANK ASSEMBLY

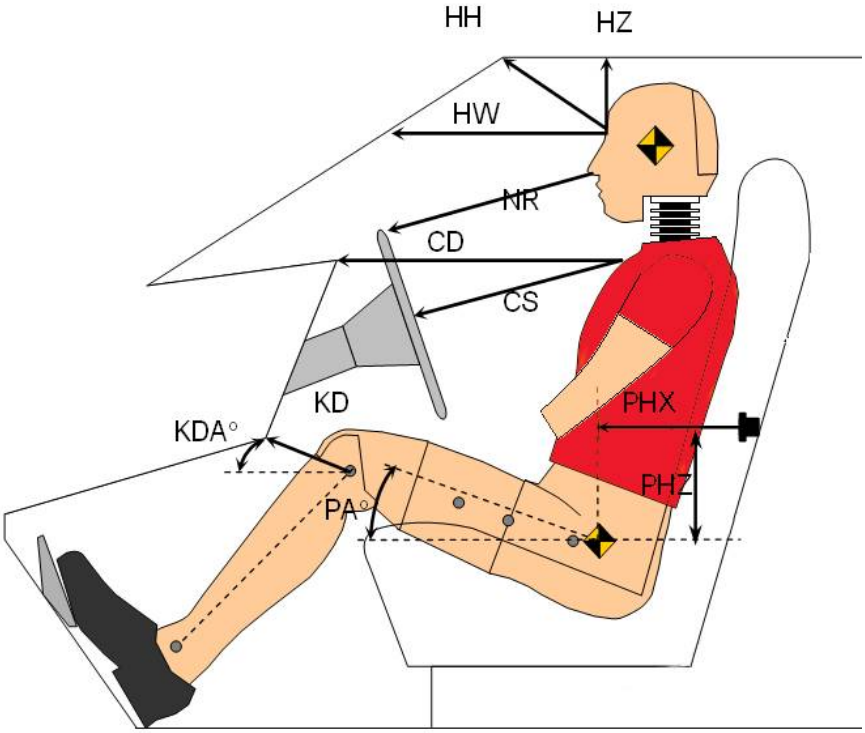
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	61.3
Usable Capacity of "Optional Tank" (see Form No. 1)	
Usable Capacity of Standard Tank as Specified in Owner's Manual	61.3
Usable Capacity of Optional Tank as Specified in Owner's Manual	
93% of Usable Capacity	57.0
Actual Amount of Solvent Used	56.8
1/3 of Usable Capacity	20.4

Is the actual amount of solvent used in the test equal to 93% ± 1%
of the Usable Capacity stated in Form No. 1? **YES**

.DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019

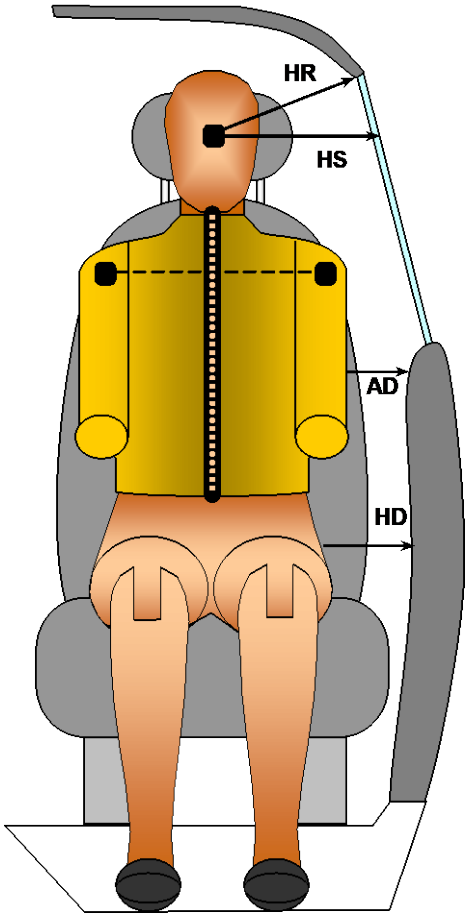


LEFT SIDE VIEW

Code	Measurement Description	Driver	
		Length (mm)	Angle (°)
HH	Head to Header	252	
HW	Head to Windshield	515	
HZ	Head to Roof Liner	171	
NR	Nose to Rim	207	
CD	Chest to Dashboard	385	
CS	Chest to Steering Wheel	162	
KDL/KDAL°	Left Knee to Dash	95	94.0
KDR/KDAR°	Right Knee to Dash	88	85.0
PAX°	Pelvic Tilt Angle (X-Axis)		21.1
PAY°	Pelvic Tilt Angle (Y-Axis)		-0.2
PHX	Hip Point to Striker (X-Axis)	373	
PHZ	Hip Point to Striker (Z-Axis)	153	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019

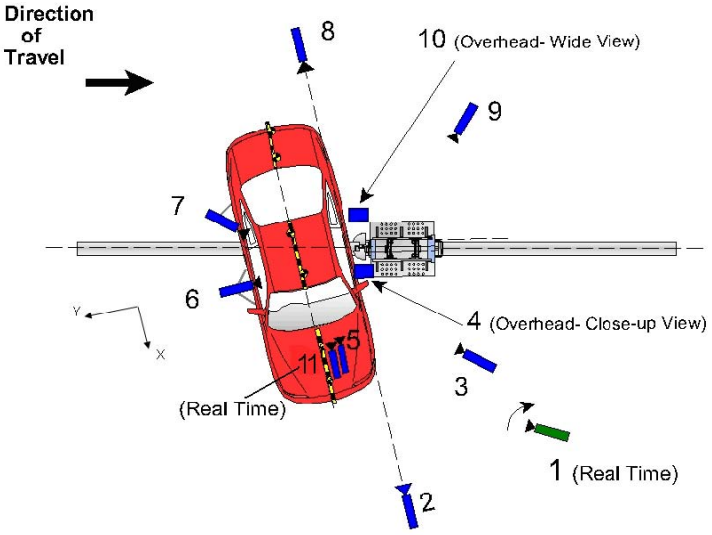


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver Length (mm)
HR	Head to Side Header	232
HS	Head to Side Window	349
AD	Arm to Door	165
HD	Hip Point to Door	156

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019



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

Camera No.	View	Coordinates (mm)			Lens (mm)	Film Speed (fps)
		X*	Y*	Z*		
1	Real-Time Pan View					30
2	Front Ground Level	6200	220	-2020	25	1000
3	Impact Side 45° Forward	4650	-1720	-1950	20	1000
4	Overhead Closeup	0	0	-6670	70	1000
5	Onboard – Driver Front				16	1000
6	Onboard – Driver Side				8	1000
7	Onboard – Driver Rear				8	1000
8	Rear Ground Level	-7100	230	-1975	25	1000
9	Impact Side 45° Rearward	-2925	-3800	-1950	20	1000
10	Overhead Wide View	-325	750	-6650	11	1000
11	Real-Time Dummy Front View					30

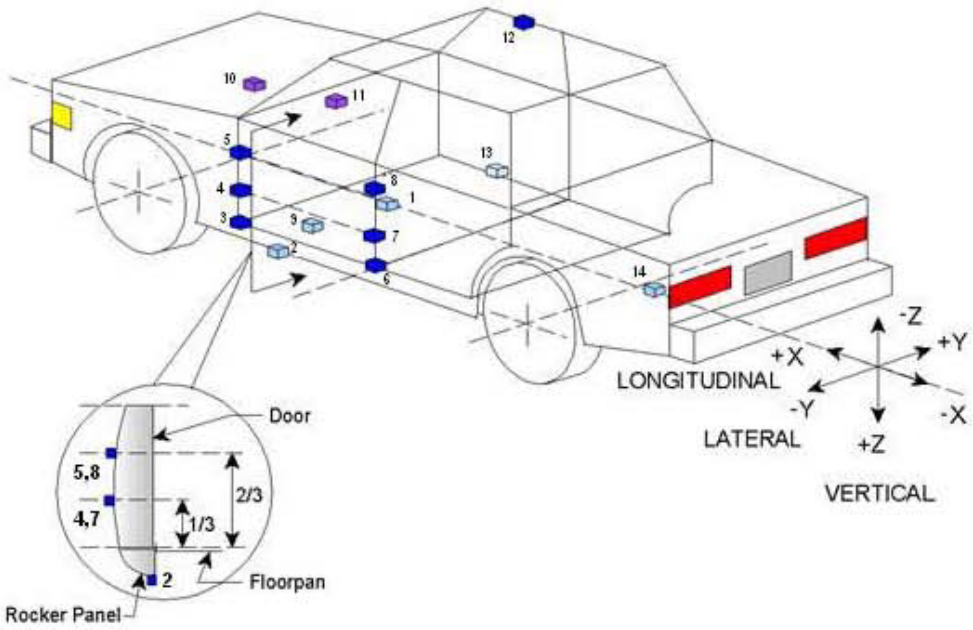
*All measurements accurate to ± 6 mm
Note: Vehicle was at a 75° angle to the rigid pole.

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

INSTRUMENTATION	Number of Channels
Driver Dummy	19
Vehicle Structure	18
Pole Load Cells	8
TOTAL	45

DATA SHEET NO. 6
VEHICLE ACCELEROMETER DATA

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019



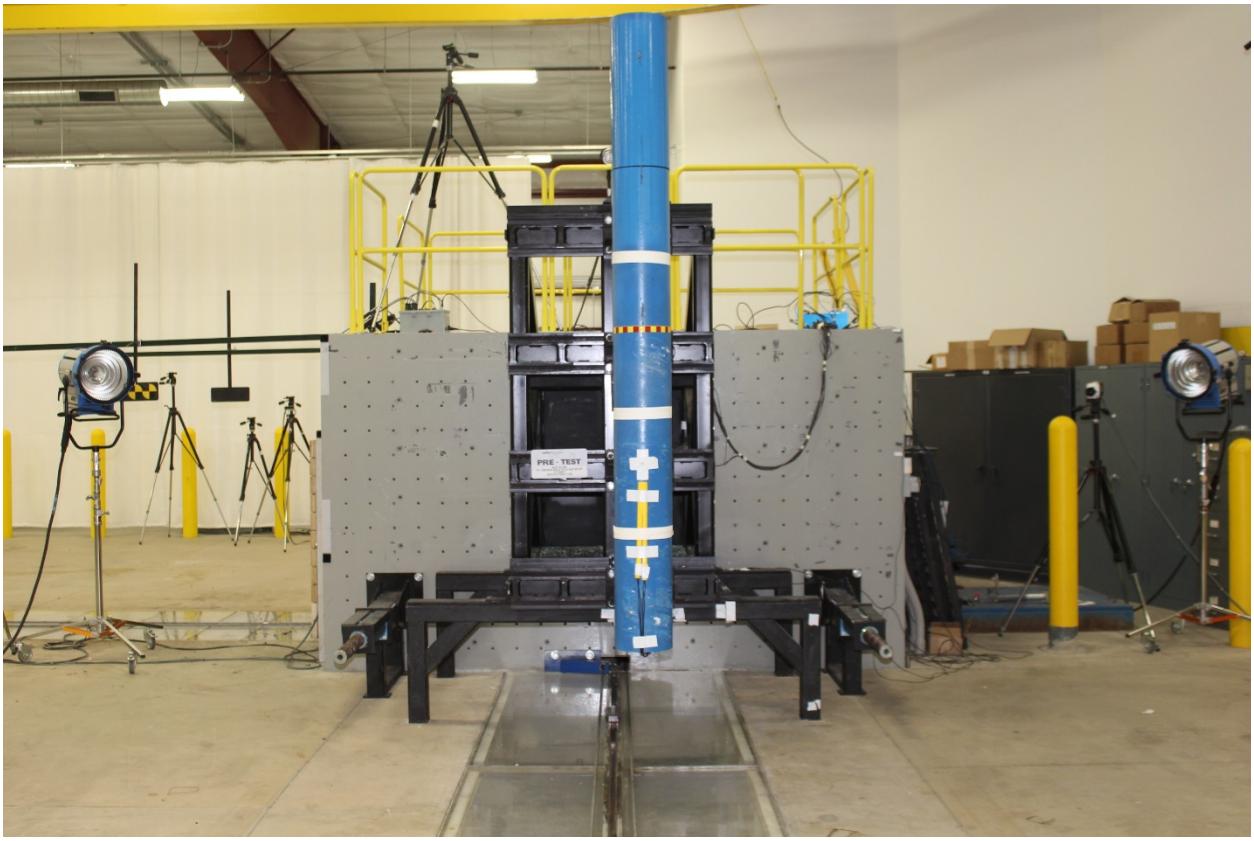
	Accelerometer Location			
	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2673	180	-185
2	Left Floor Sill	2971	-750	-177
3	A Pillar Sill	3431	-750	-180
4	A Pillar Low	3372	-839	-496
5	A Pillar Mid	3369	-827	-734
6	B Pillar Sill	2225	-750	-180
7	B Pillar Low	2271	-736	-576
8	B Pillar Mid	2268	-734	-747
9	Driver Seat Track	2373	-396	-206
10	Engine Top	4068	23	-788
11	Firewall	3798	0	-834
12	Right Roof	2343	515	-1409
13	Right Floor Sill	2963	750	-182
14	Rear Floorpan	1001	0	-511

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: 2019 Nissan Altima S 4-Door Sedan
Test Program: NCAP Side Pole Impact Test

NHTSA No. O20195201
Test Date: 5/30/2019



254 mm Diameter Rigid Pole

Load Cell Locations	
ID	Height From Impact 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: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Driver SID-IIs Dummy
Face	Curtain Airbag
Top of Head	Curtain Airbag
Left Side of Head	Curtain Airbag, Side Torso/Pelvis Airbag
Back of Head	Curtain Airbag, Headrest
Left Shoulder	Side Torso/Pelvis Airbag
Upper Torso	Side Torso/Pelvis Airbag
Lower Torso	Side Torso/Pelvis Airbag
Left Hip	Side Torso/Pelvis Airbag
Left Knee	Door Panel

POST-TEST DOOR PERFORMANCE

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

POST-TEST SEAT PERFORMANCE

	Struck Side		Non-Struck Side	
Description	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	None
Windshield Damage	Cracked
Side Window Damage	LF Window Broken
Other Notable Effects	None

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

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	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
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	
Other	No		No	

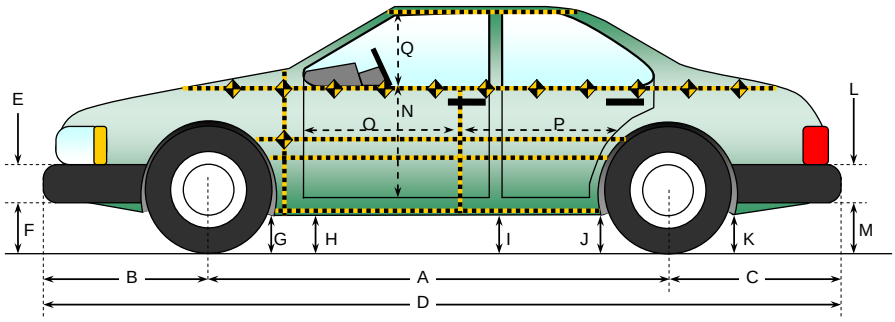
VEHICLE SPEED, VEHICLE ANGLE AT IMPACT, AND IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm		1151
Actual Impact Point (Aft of Front Axle)	mm		1150
Horizontal Offset (+forward / -rearward)	mm	+/- 38 of Intended Impact Point	1
Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion	deg	75 +/- 3	74.6
Trap No. 1 Velocity (Primary)	km/h	31.4 to 33.0	32.22
Trap No. 2 Velocity (Redundant)	km/h	31.4 to 33.0	32.24

DATA SHEET NO. 9
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan
Test Program: NCAP Side Pole Impact Test

NHTSA No. O20195201
Test Date: 5/30/2019



All measurements in (mm) with tolerance of ± 3 mm

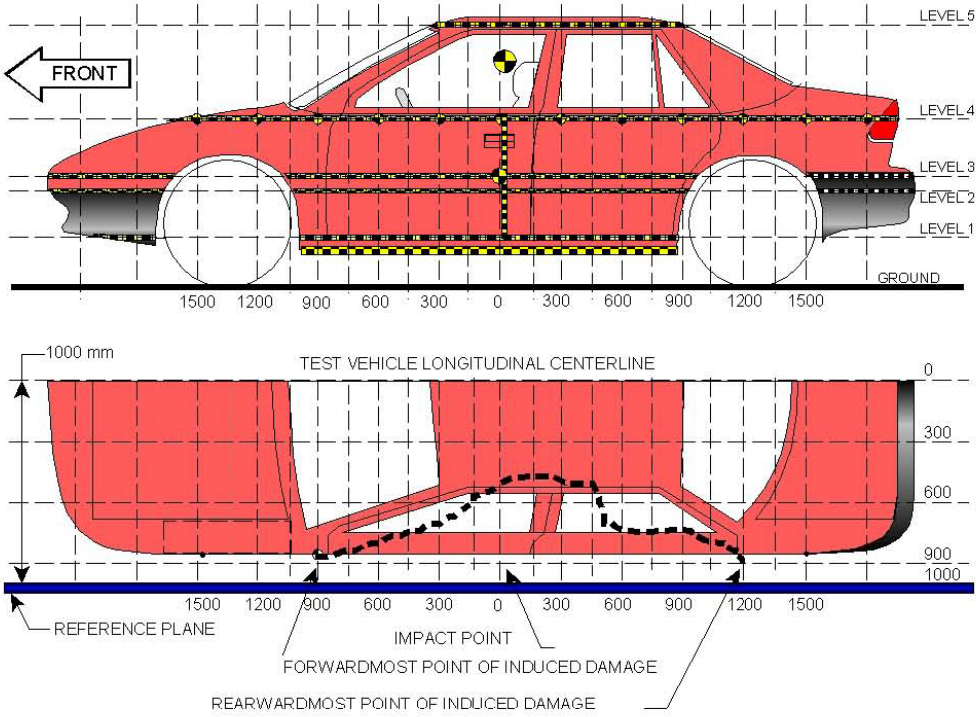
LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2818	2726	92
B	Front Axle to FSOV	968	1027	-59
C	Rear Axle to RSOV	1114	1113	1
D	Total Vehicle Length at Centerline	4900	4866	34
E	Front Bumper Thickness	120	120	0
F	Front Bumper Bottom to Ground	196	229	-33
G	Sill Height at Front Wheel Well	168	145	23
H	Sill Height at Front Door Leading Edge	168	142	26
I	Sill Height at B-Pillar	159	168	-9
J1	Sill Height at Rear Wheel Well	159	181	-22
J2	Pinch Weld Height at Rear Wheel Well	158	173	-15
K	Sill Height Aft of Rear Wheel Well	207	226	-19
L	Rear Bumper Thickness	140	140	0
M	Rear Bumper Bottom to Ground	253	253	0
N	Sill Height to Bottom of Front Window Sill	718	720	-2
O	Front Door Leading Edge to Impact CL	676	562	114
P	Rear Door Trailing Edge to Impact CL	1362	1208	154
Q	Front Window Opening	354	328	26
R	Right Side Length	3997	4011	-14
S	Left Side Length	3997	3878	119
T	Vehicle Width at B-Pillars	1836	1697	139

DATA SHEET NO. 10
VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019



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 (mm)	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	275	346	0
2	Occupant Hip Point	485	385	75
3	Mid Door	614	397	75
4	Window Sill	900	340	75
5	Window Top	1350	141	150

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

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019

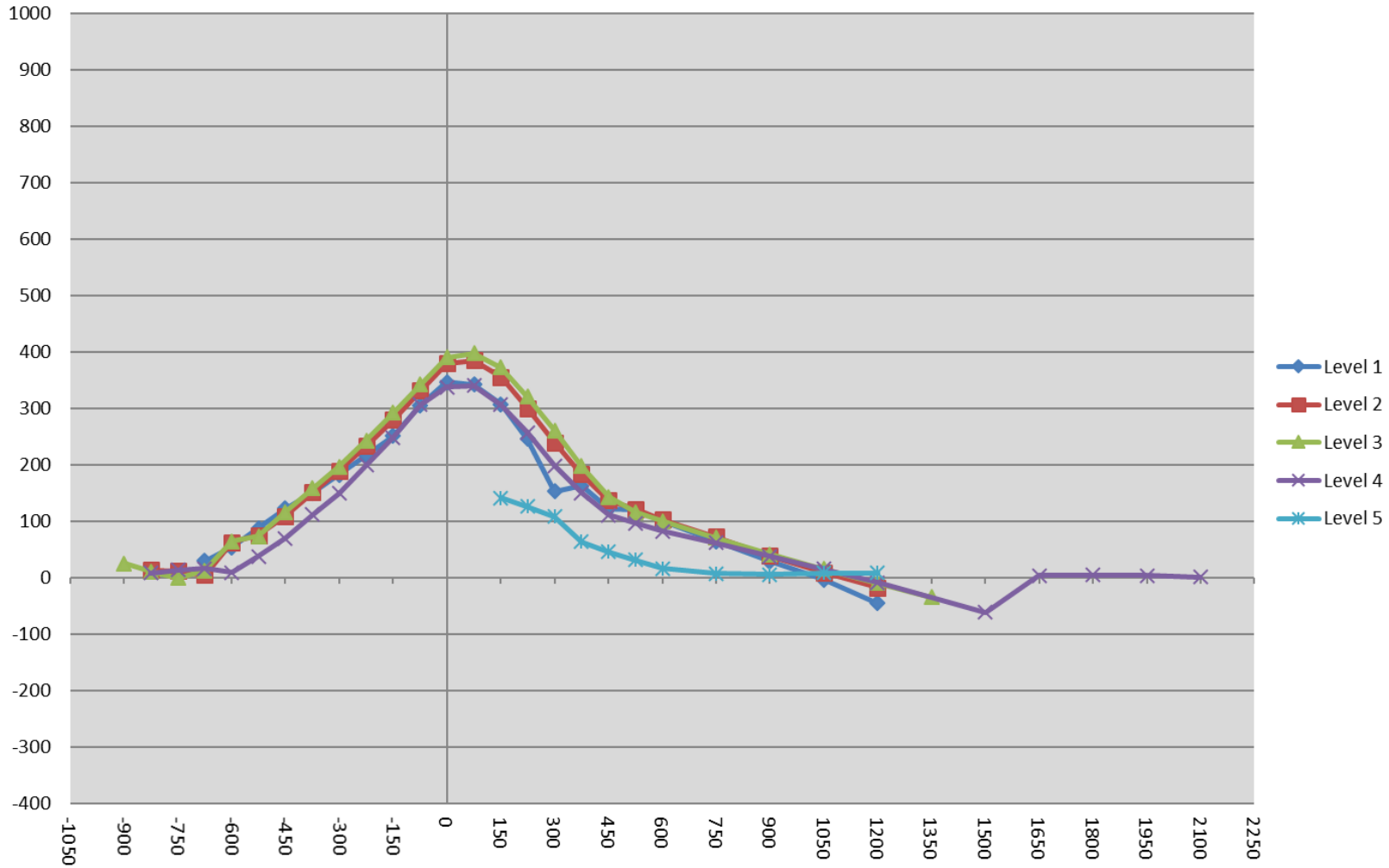
Pre-test measurements are taken when the vehicle is in the “As Tested” weight condition. Vehicle measurements forward of the vertical impact reference line are negative. The crush pile grid is established prior to the test based on an estimated impact point. The final distance from impact is determined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

	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															
-1050															
-900			174					199					25		
-825		180	180	295			193	190	303			13	10	8	
-750		184	188	289			195	187	302			11	-1	13	
-675	215	191	194	283		244	195	206	299		29	4	12	16	
-600	220	197	196	277		273	259	260	286		53	62	64	9	
-525	222	201	195	274		309	276	268	311		87	75	73	37	
-450	222	199	194	269		344	308	310	338		122	109	116	69	
-375	222	197	193	264		372	348	351	375		150	151	158	111	
-300	221	196	192	262		403	385	388	411		182	189	196	149	
-225	221	195	190	259		437	428	433	458		216	233	243	199	
-150	220	193	189	256		471	472	481	504		251	279	292	248	
-75	218	193	188	257		523	524	530	563		305	331	342	306	
0	218	191	187	257		564	570	577	594		346	379	390	337	
75	217	190	186	258		559	575	583	598		342	385	397	340	
150	217	190	185	258	507	524	545	557	564	648	307	355	372	306	141
225	217	189	184	255	503	462	489	504	512	629	245	300	320	257	126
300	216	188	184	254	499	368	427	444	452	607	152	239	260	198	108
375	216	187	183	252	497	378	370	380	402	560	162	183	197	150	63
450	215	187	182	248	497	336	323	325	358	542	121	136	143	110	45
525	214	187	182	245	496	333	308	298	341	527	119	121	116	96	31
600	214	187	182	244	497	315	289	282	326	513	101	102	100	82	16
675															
750	213	187	183	239	502	277	259	253	300	509	64	72	70	61	7
825															
900	213	188	185	233	511	241	226	226	270	516	28	38	41	37	5
1050	213	187	184	227	522	209	196	199	242	530	-4	9	15	15	8
1200	211	182	180	230	538	165	164	170	221	546	-46	-18	-10	-9	8
1350			174					139					-35		
1500				244					182					-62	
1650				254					257					3	
1800				265					269					4	
1950				278					281					3	
2100				293					294					1	
2250															
2400															
2550															
2700															

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

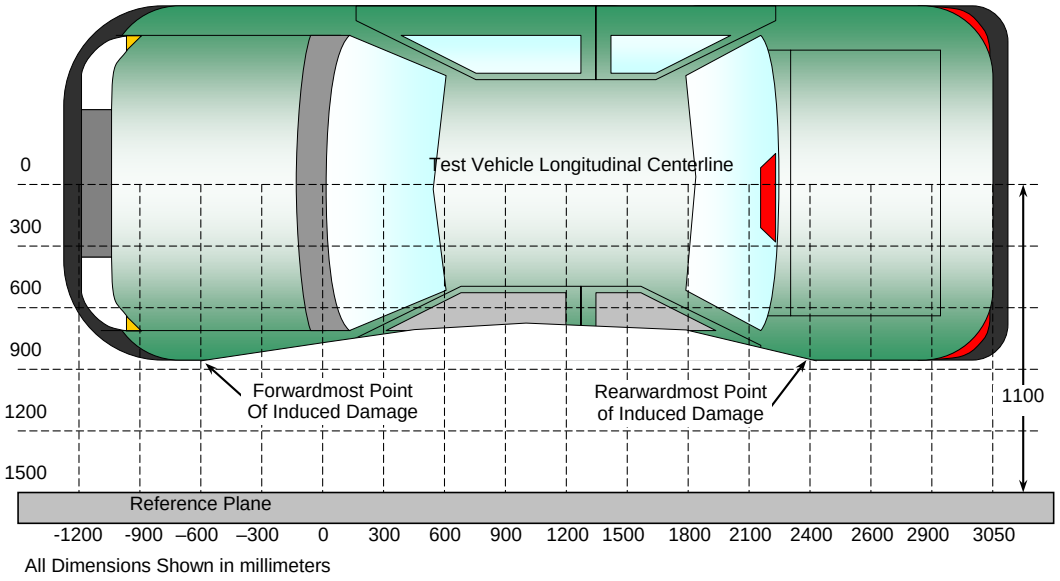
Test Vehicle: 2019 Nissan Altima S 4-Door Sedan
Test Program: NCAP Side Pole Impact Test

NHTSA No. O20195201
Test Date: 5/30/2019



DATA SHEET NO. 11
VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019



TOP VIEW

DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point (mm)	Level	Pre-Test (mm)	Post-Test (mm)	Crush (mm)
1	470	3	182	309	127
2	241	3	184	491	307
3	12	3	187	582	395
4	-217	3	190	438	248
5	-446	3	194	311	117
6	-675	3	194	206	12

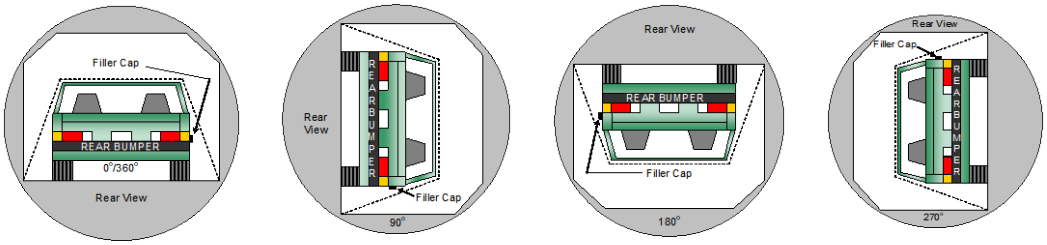
DATA SHEET NO. 12
FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019

Test Time: 3:10 p.m. Temperature: 21.8°C

A. From impact until vehicle motion ceases: 0 oz.
(Maximum Allowable = 1 ounce)
B. For the 5 minute period after motion ceases: None
(Maximum allowable = 5 ounces)
C. For the following 25 minutes: None
(Maximum allowable = 1 oz./minute)
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°	113	300	413
90° to 180°	111	300	411
180° to 270°	107	300	407
270° to 360°	112	300	412

FMVSS 301 ROLLOVER SPILLAGE TABLE (units in ounces)

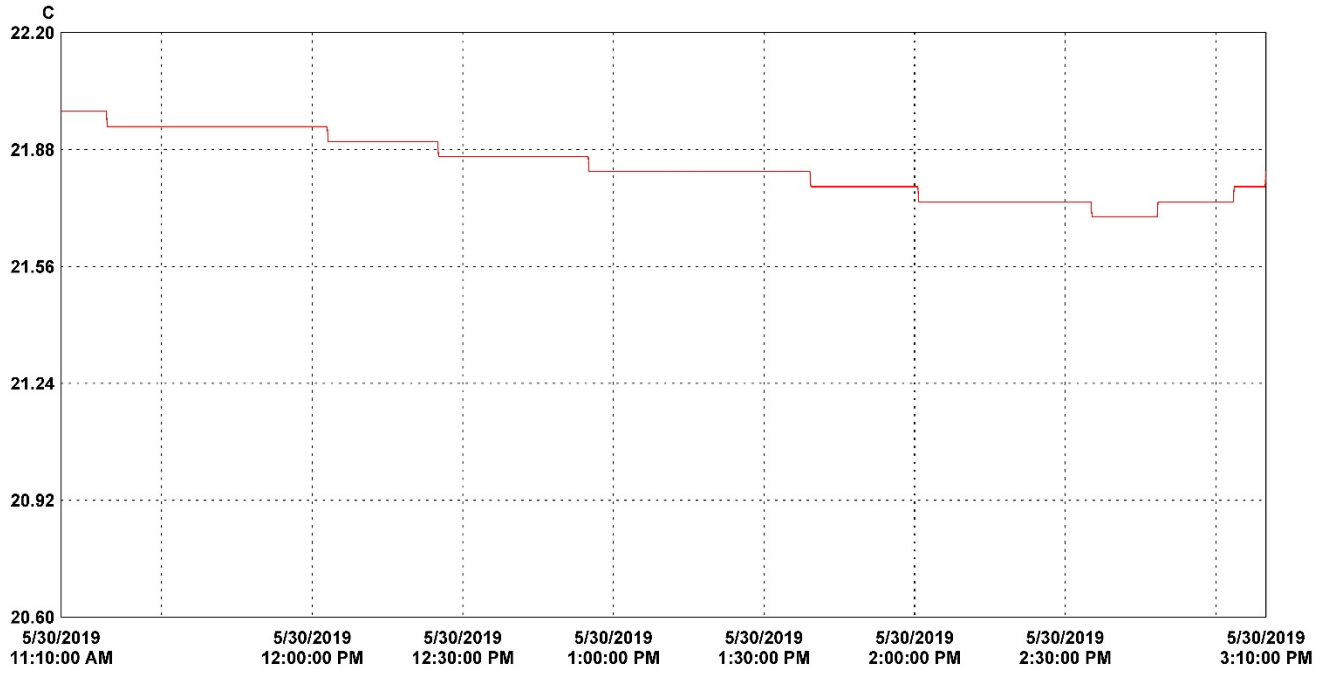
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 13
DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle: 2019 Nissan Altima S 4-Door Sedan NHTSA No. O20195201
Test Program: NCAP Side Pole Impact Test Test Date: 5/30/2019



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	12102107	VSC_South_Hall	1		21.98	21.83	21.70	C	Temperature	12102107_VSC_South_Hall.spl

APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

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

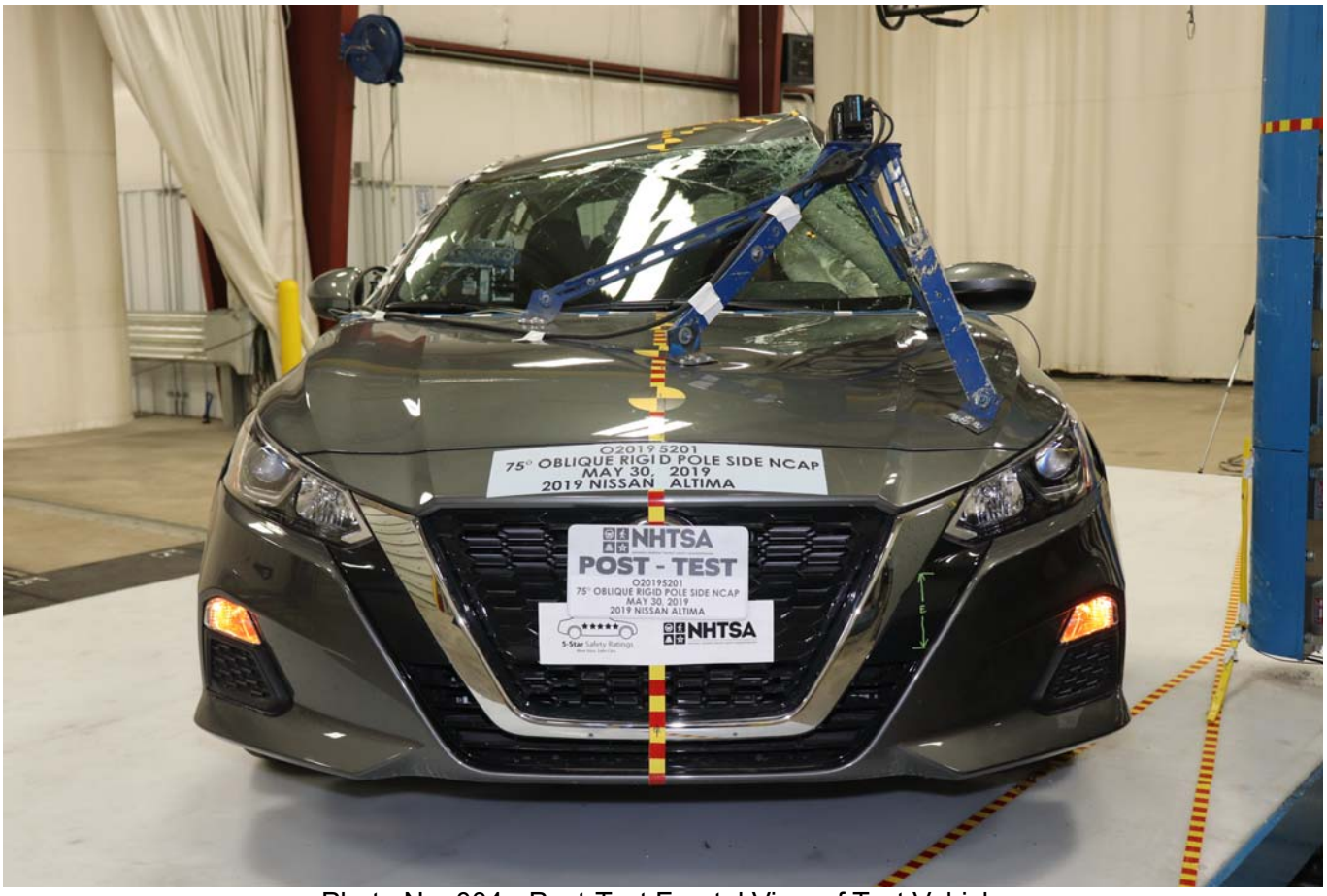


Photo No. 004 - Post-Test Frontal View of Test Vehicle

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

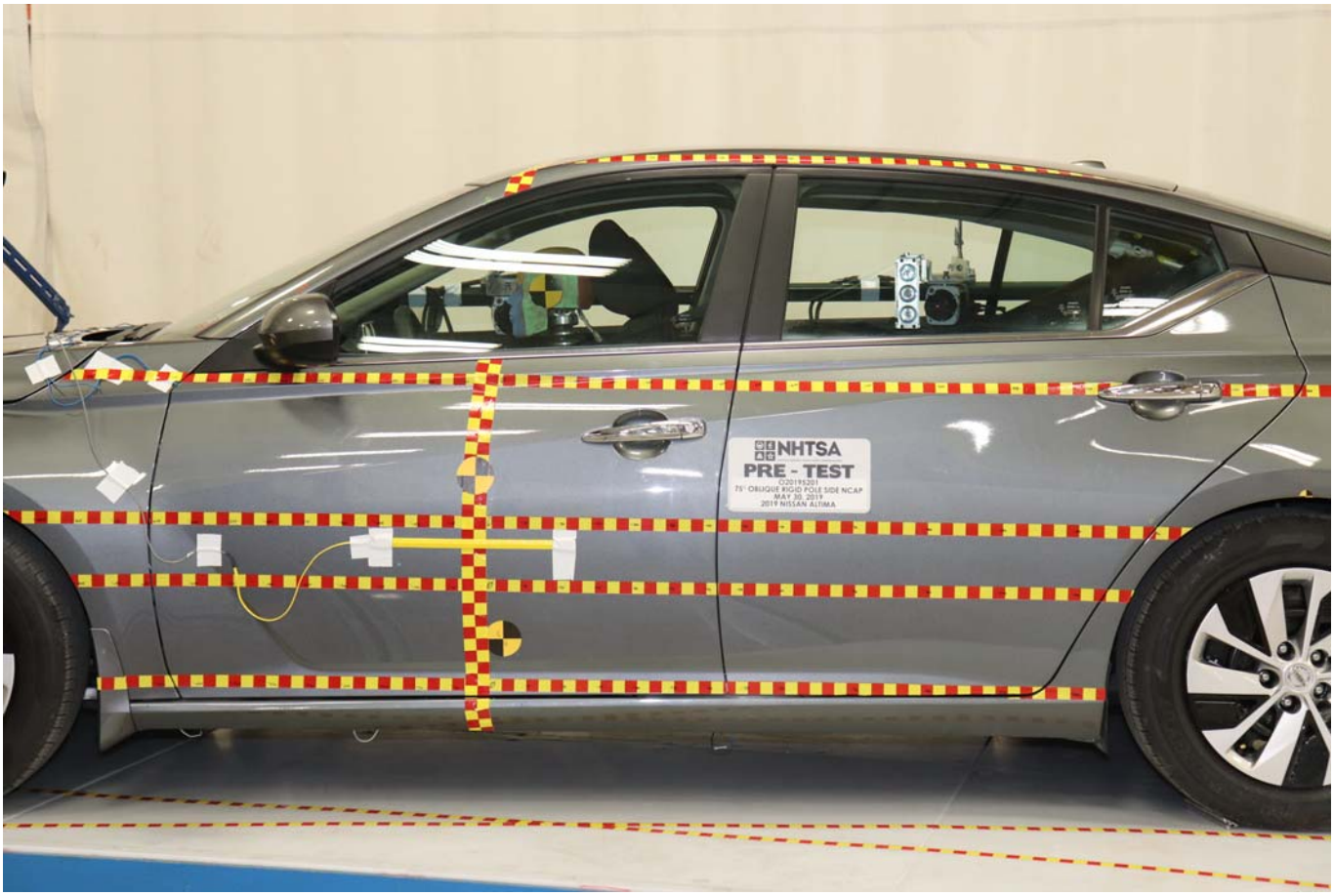


Photo No. 007 - Pre-Test Left Side View of Test Vehicle

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

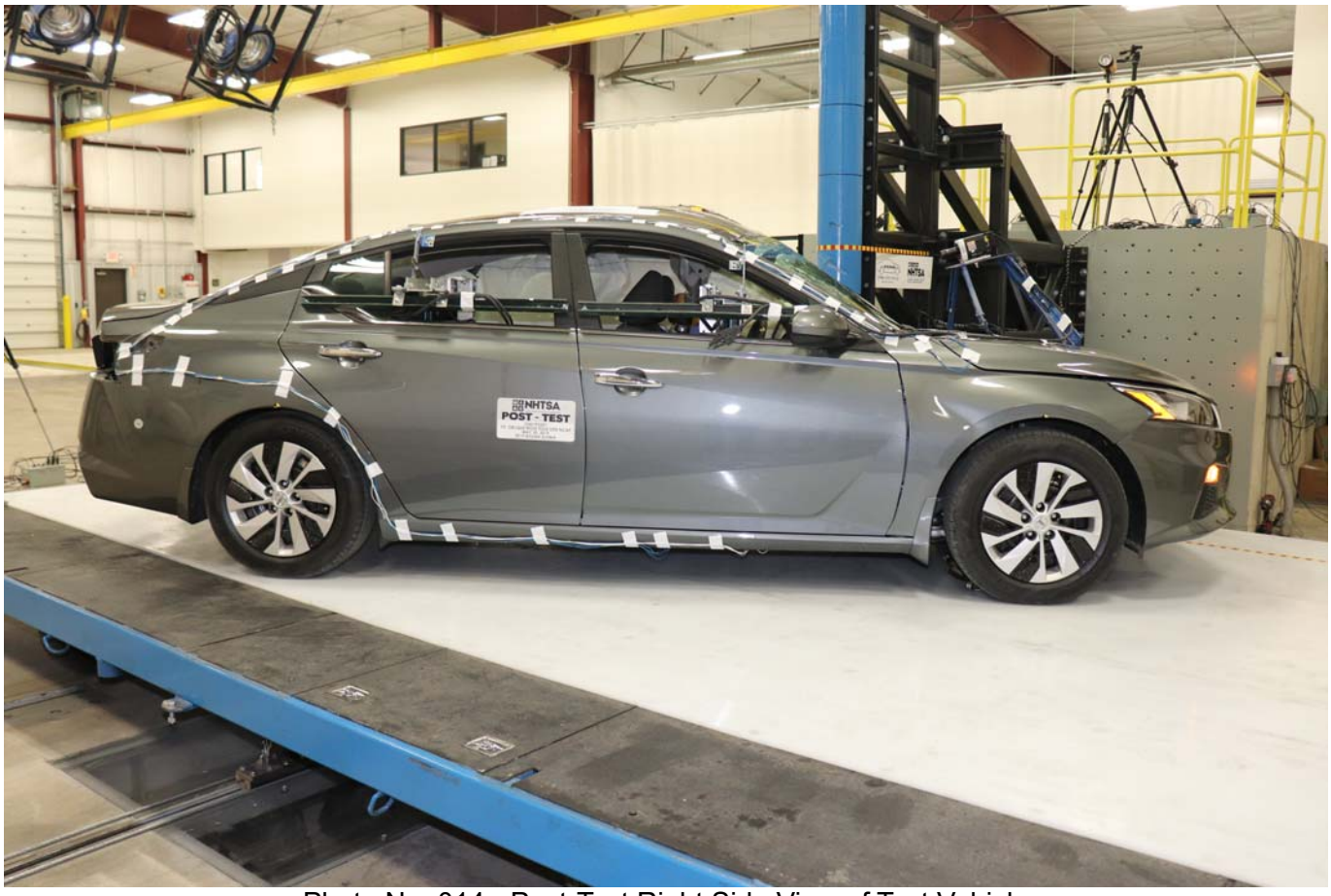


Photo No. 014 - Post-Test Right Side View of Test Vehicle

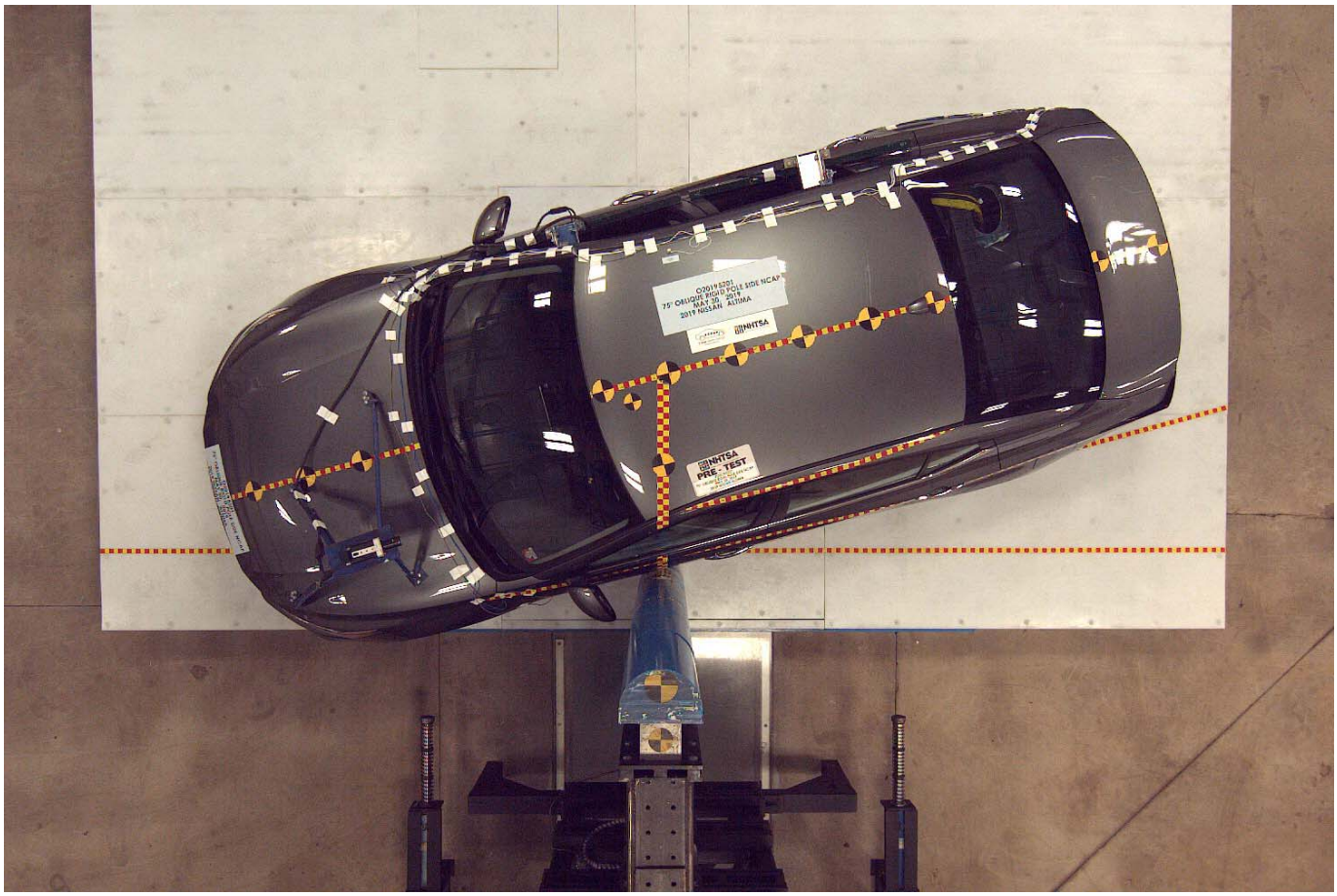


Photo No. 015 - Pre-Test Overhead View of Test Area

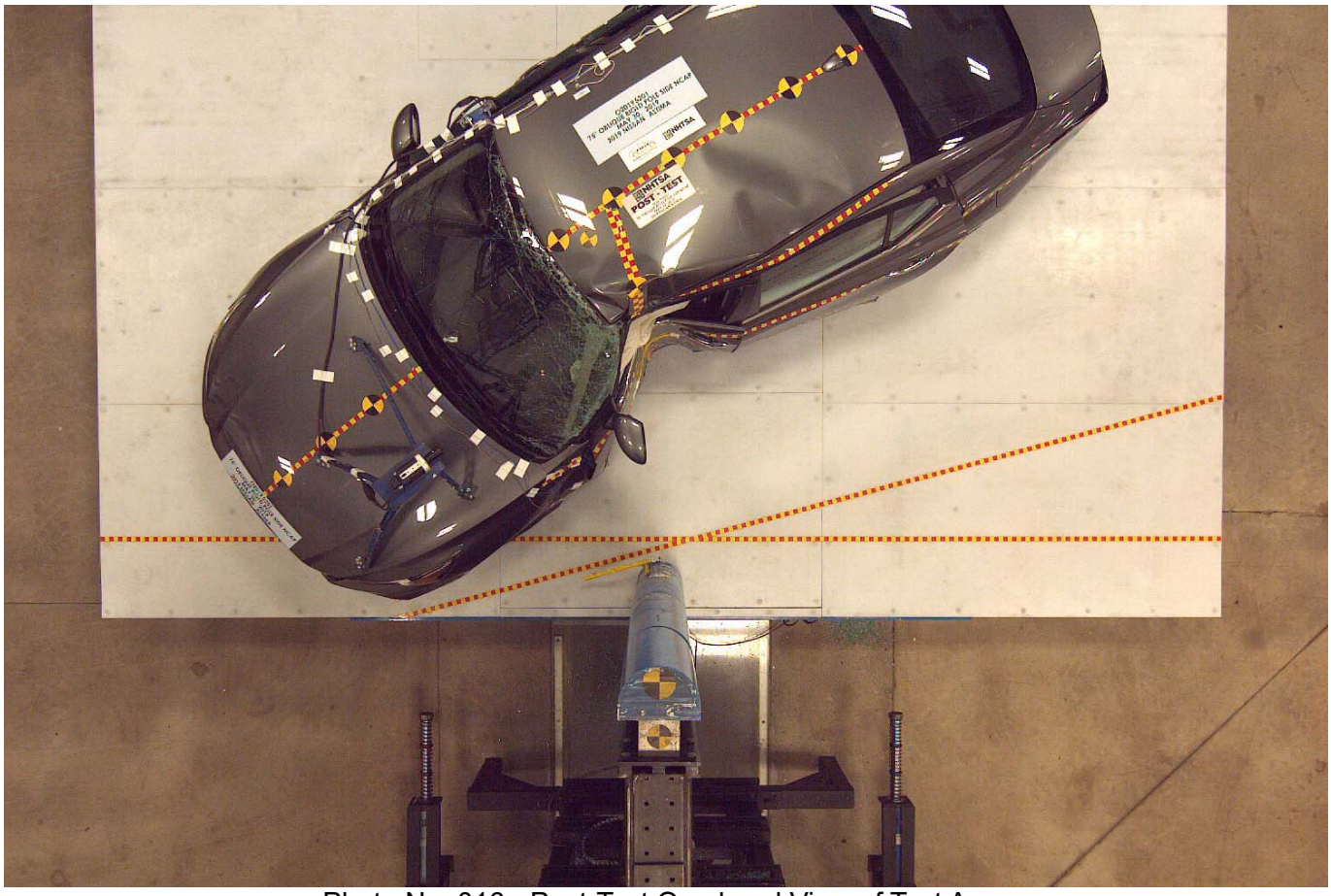


Photo No. 016 - Post-Test Overhead View of Test Area

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

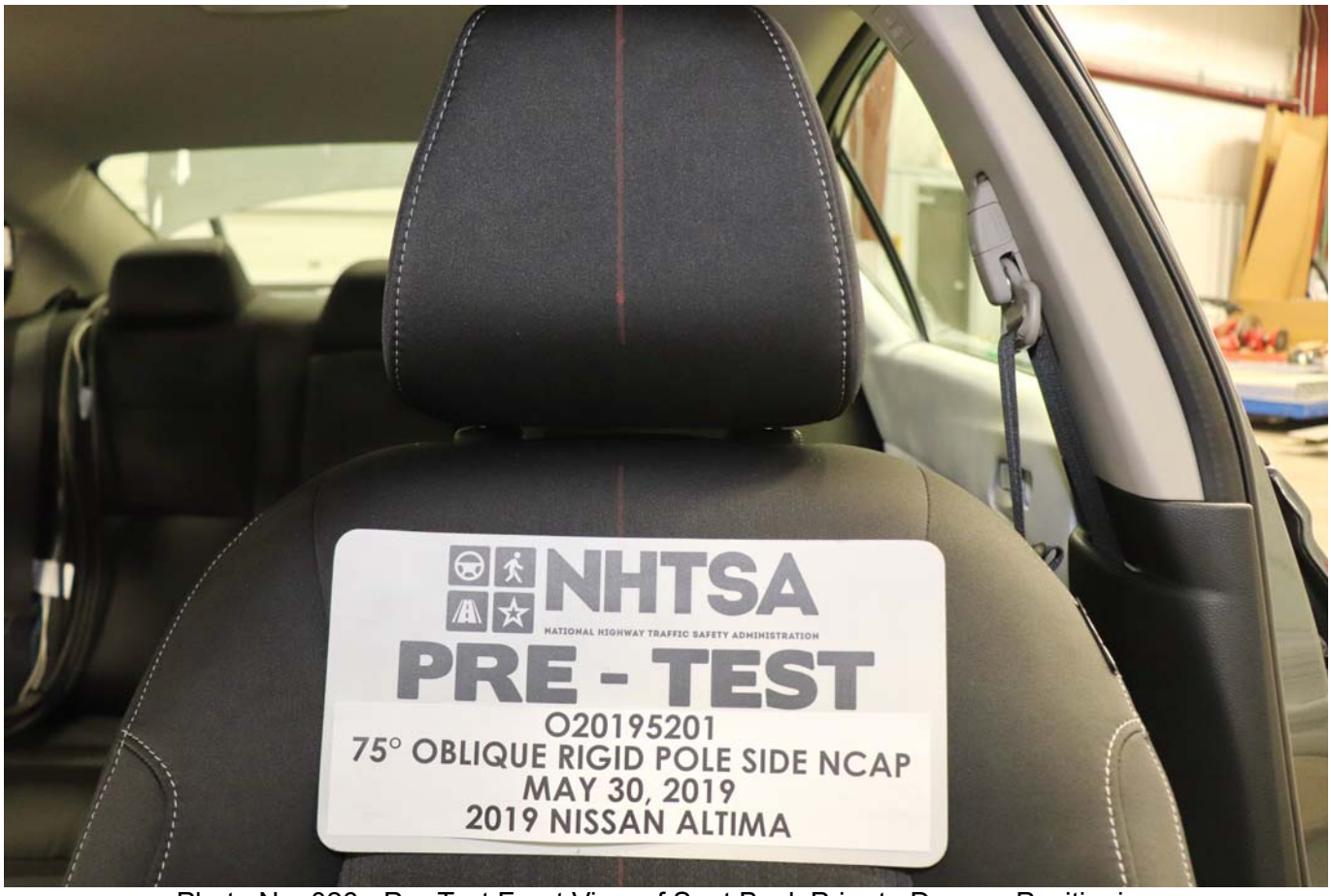


Photo No. 026 - Pre-Test Front View of Seat Back Prior to Dummy Positioning

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

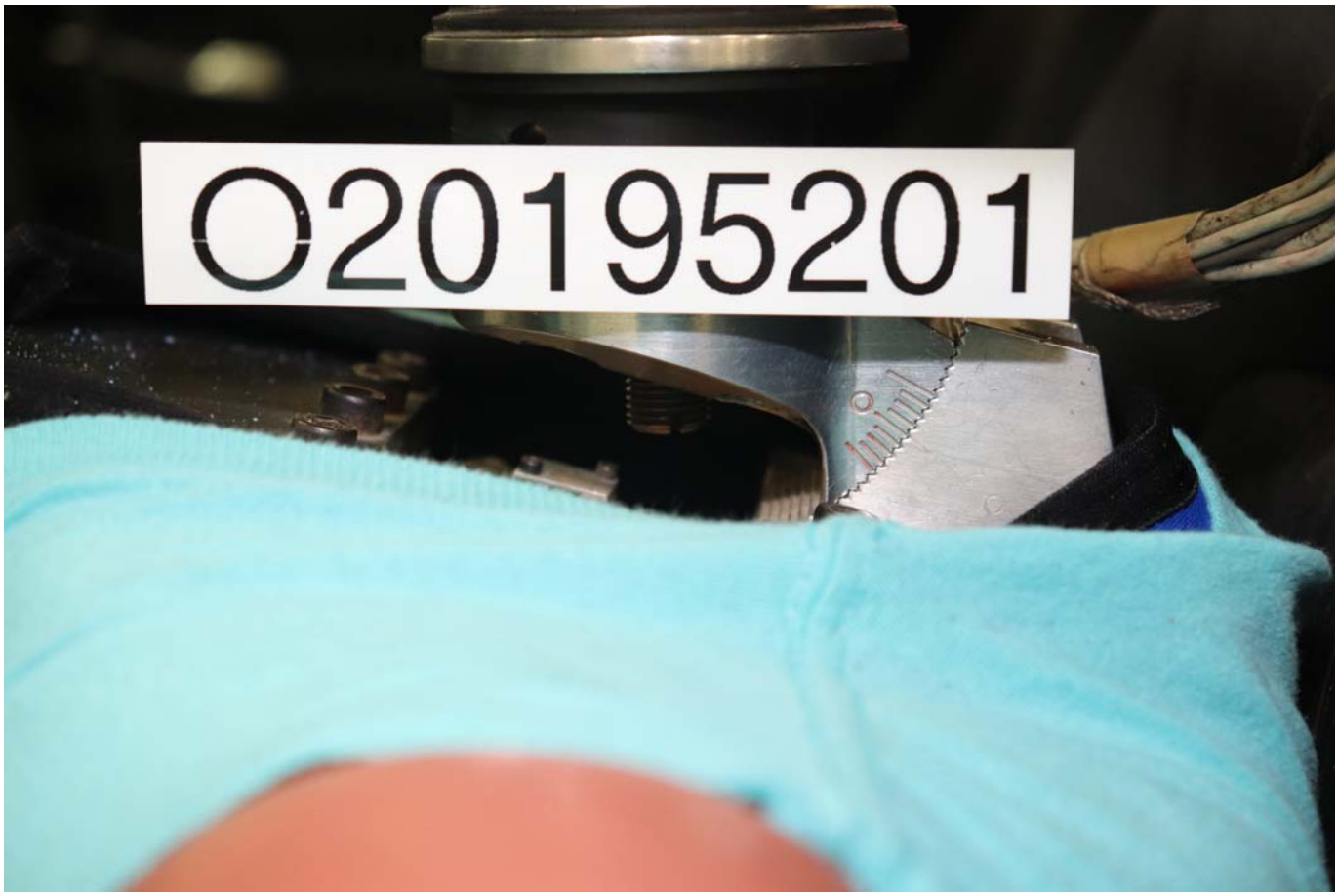


Photo No. 030 - Pre-Test Left Side View of Dummy Neck Showing Position of Adjustable Neck Bracket

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

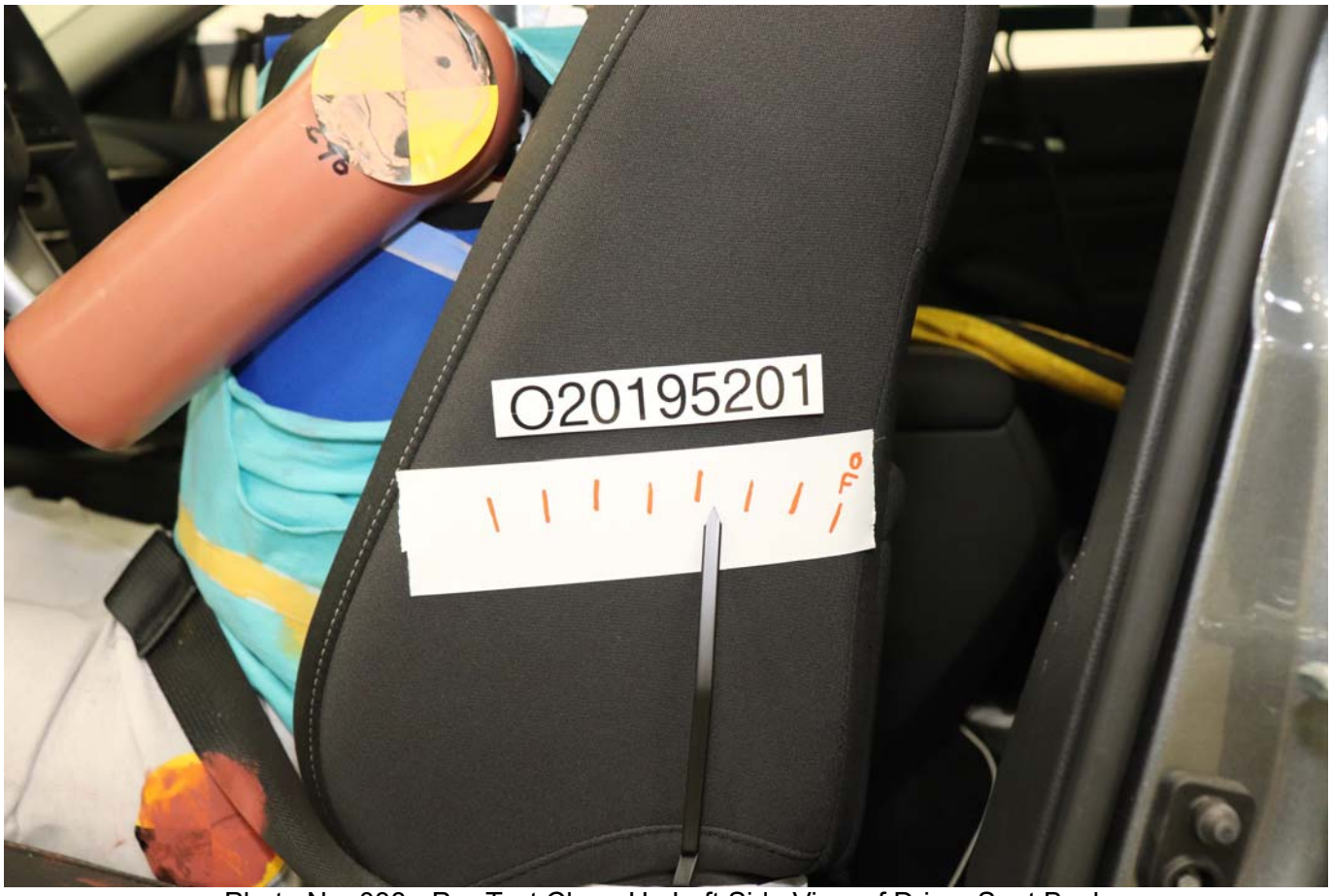


Photo No. 038 - Pre-Test Close-Up Left Side View of Driver Seat Back

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

PHOTOGRAPH NOT AVAILABLE

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

PHOTOGRAPH NOT APPLICABLE

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

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

Photo No. 053 - Pre-Test View of Fuel Filler Cap or Fuel Filler Neck

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

Photo No. 055 - Close-Up View of Vehicle Certification Label

Photo No. 056 - Close-Up View of Vehicle Tire Information Placard or Label

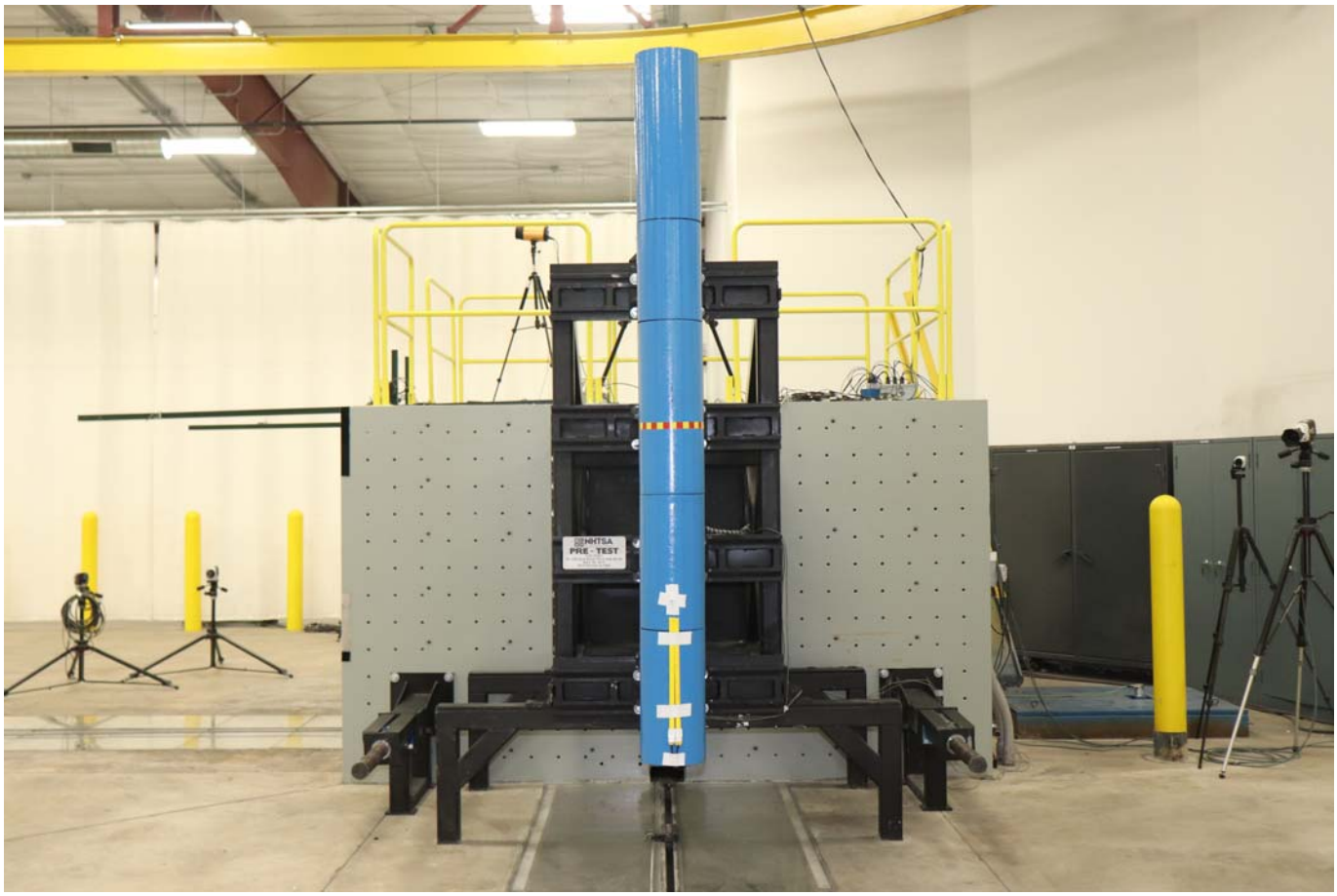


Photo No. 057 - Pre-Test Pole Barrier Front View

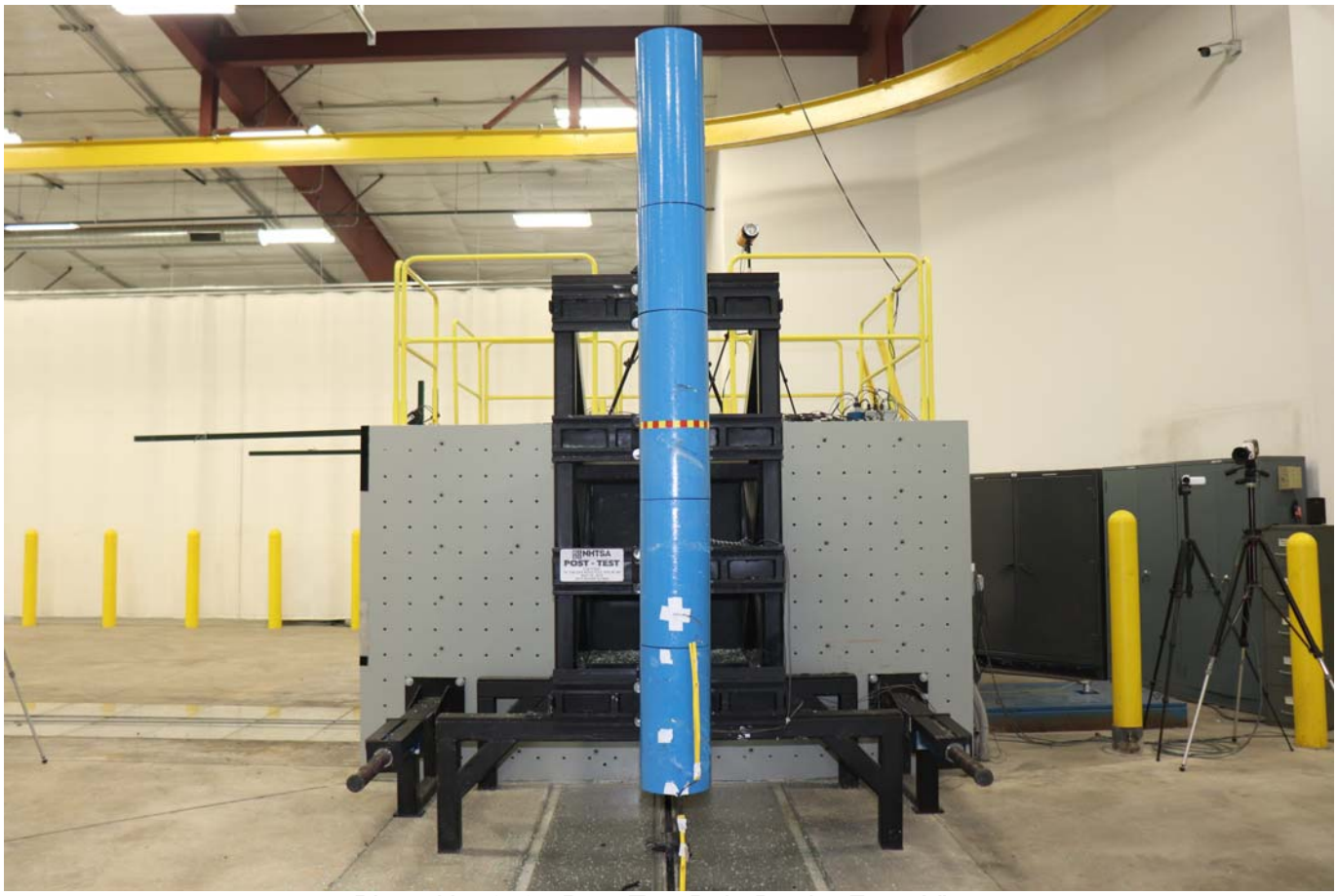


Photo No. 058 - Post-Test Pole Barrier Front View

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

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

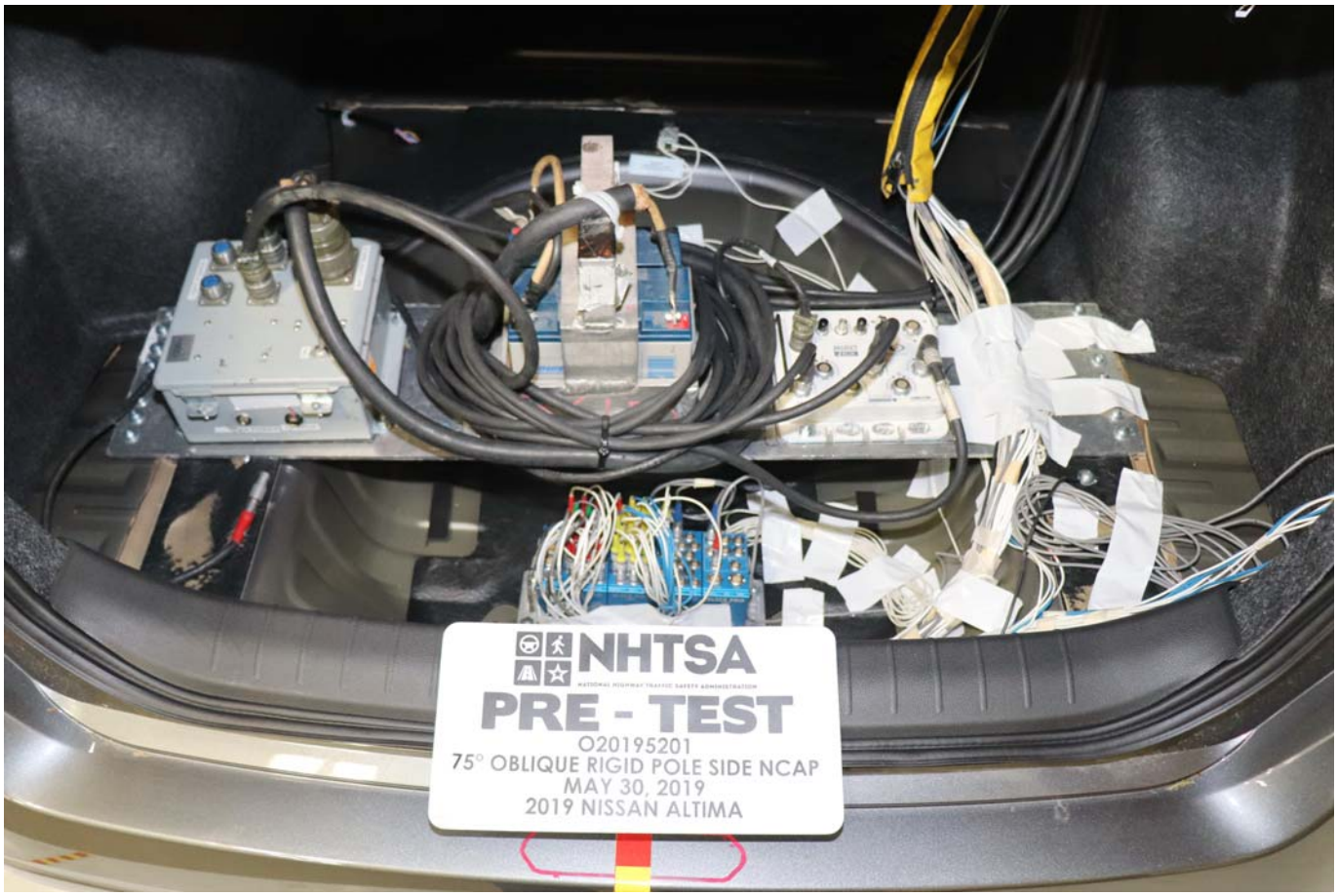


Photo No. 061 - Pre-Test Ballast View

Photo No. 062 - Post-Test Primary and Redundant Speed Trap Read-Out

Photo No. 063 - FMVSS Photo No. 301 Static Rollover 0 Degrees

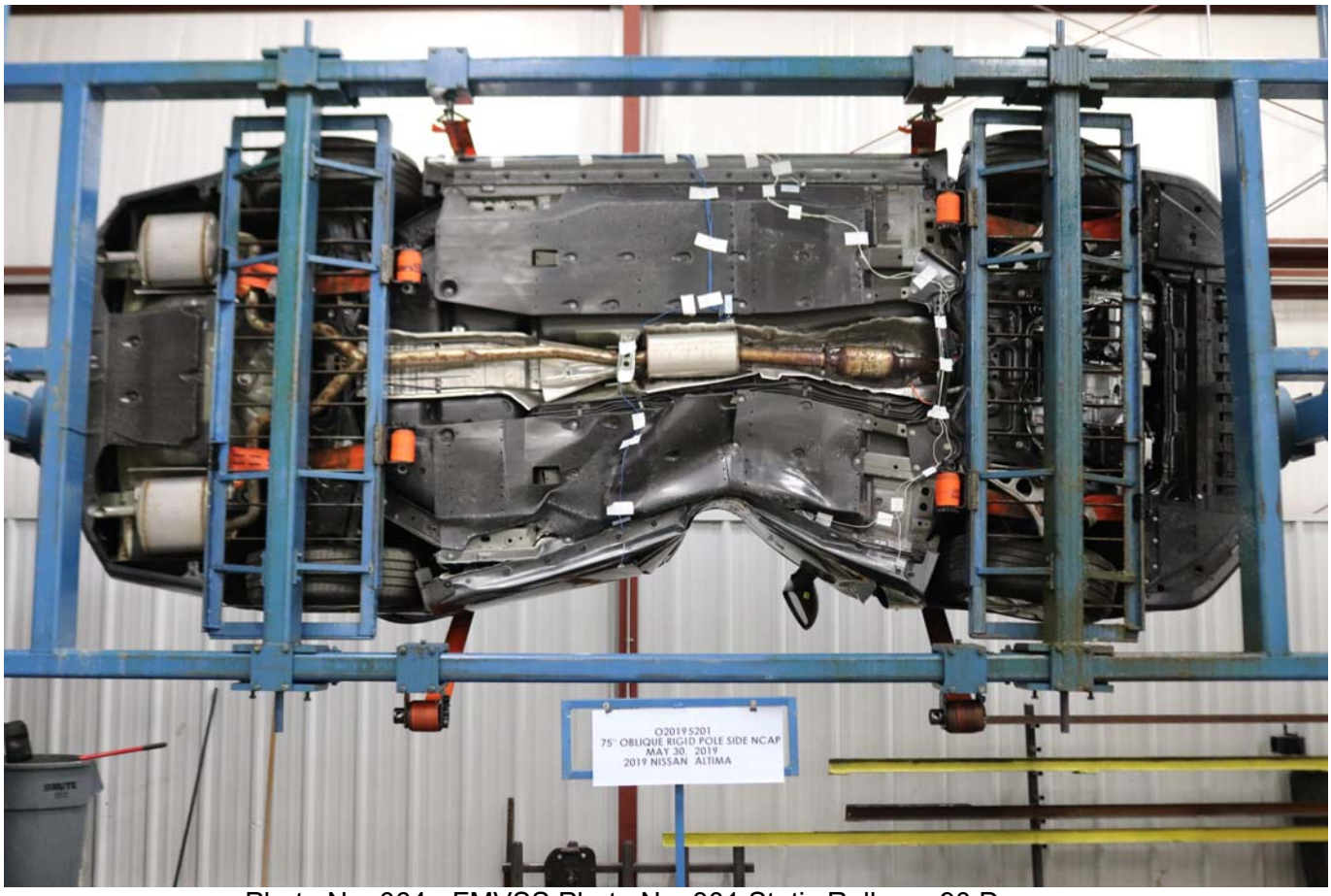


Photo No. 064 - FMVSS Photo No. 301 Static Rollover 90 Degrees

Photo No. 065 - FMVSS Photo No. 301 Static Rollover 180 Degrees

Photo No. 066 - FMVSS Photo No. 301 Static Rollover 270 Degrees

Photo No. 067 - FMVSS Photo No. 301 Static Rollover 360 Degrees

Photo No. 068 - Impact Event

2019 NISSAN ALTIMA
2.5 S FWD SEDAN

Scan QR code for general model information & options

Manufacturer's Suggested Retail Base Price: $23,750.00

Options Included by Manufacturer
SPLASH GUARDS 205.00
FLOOR MATS AND TRUNK MAT 210.00

DESTINATION CHARGES 895.00

Total* $25,060.00

Standard Equipment Included at No Extra Charge

MECHANICAL & PERFORMANCE
2.5L DOHC 16-valve I-4 Engine
188 Horsepower, 180 lb-ft Torque
Xtronic CVT®
(Continuously Variable Transmission)
Intelligent Ride Control
Intelligent Trace Control

SAFETY & SECURITY
Driver & Front Passenger, Side Impact & Curtain Airbags
Driver & Front Passenger Knee Air Bags
Rear Outboard Passenger Side-Impact Air Bags
Lower Anchors and Tethers for Children (LATCH)
Automatic Emergency Braking (AEB)
Intelligent Forward Collision Warning(I-FCW)
Intelligent Driver Alertness (I-DA)
RearView Monitor
Vehicle Dynamic Control System (VDC)
Traction Control System (TCS)
Tire Pressure Monitoring System (TPMS) w/ Easy Fill Tire Alert
Nissan Vehicle Immobilizer System
Vehicle Security System (VSS)

COMFORT & CONVENIENCE
8-way Power Driver Seat
60/40 Split Fold-Down Rear Seats
Nissan Intelligent Key® w/ Push Button Ignition
Remote Engine Start
Cruise Control w/ Steering Wheel Controls
NissanConnect® featuring Apple CarPlay™ + and Android Auto™ +
8" Color Display w/ Multi-Touch Control
SiriusXM® Radio+
Bluetooth® Hands-free Phone System+
Streaming Audio via Bluetooth®+
Hands-free Text Messaging Assistant+
Siri Eyes Free/Google Assistant™ w/ Voice Recognition+
Two Front Illuminated USB Charge Ports
Over The Air (OTA) updating for Head Unit
7" Advanced Drive Assist Display (ADAD)
6 Speakers
Two Rear Illuminated USB Charge Ports
Manual Air Conditioning
Power Front Windows w. Driver One-Touch Auto Up/Down and Auto-Reverse Feature
Manual Tilt and Telescoping Steering Column

COMFORT & CONVENIENCE CONT.
Intelligent Auto Headlight (I-AH)
Power Door Locks w/ Auto Locking
Steering Wheel Audio Switches
Rear Door Alert
Hill Start Assist

EXTERIOR
16" Steel Wheels w/ Full Wheel Covers
Projector-type Halogen Headlights
Body-colored Power Outside Mirrors

+For more information, see dealer, owner's manual, or www.NissanUSA.com/connect/important-information.
++Optional Equipment Replaces Standard Where Applicable

*Does not include dealer installed options and accessories, local taxes or license fees. This label has been applied pursuant to federal law. Do not remove prior to delivery to the ultimate purchaser.

EPA DOT Fuel Economy and Environment — Gasoline Vehicle

Fuel Economy: **32 MPG** combined city/hwy (28 city, 39 highway)
3.1 gallons per 100 miles

MID-SIZE CARS range from 14 to 136 MPG. The best vehicle rates 136 MPGe.

You save **$1,000** in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost **$1,200**

Fuel Economy & Greenhouse Gas Rating (tailpipe only): 7 (1–10, Best)
Smog Rating (tailpipe only): 7 (1–10, Best)
This vehicle emits 287 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

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 $7,000 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at $2.55 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™

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score Not Rated
Based on the combined ratings of frontal, side and rollover.
Should ONLY be compared to other vehicles of similar size and weight.

Frontal Crash Driver Not Rated; Passenger Not Rated
Based on the risk of injury in a frontal impact.
Should ONLY be compared to other vehicles of similar size and weight.

Side Crash Front seat Not Rated; Rear seat Not Rated
Based on the risk of injury in a side impact.

Rollover Not Rated
Based on the risk of rollover in a single-vehicle crash.

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

This Vehicle qualifies for Nissan's
Security+Plus Extended Protection Plan
The only service agreement backed by Nissan Extended Services North America!
Ask your dealer for details, or call 1-800-NISSAN-1 for more information

DELIVERY

VEHICLE COLORS:
EXT: GUN METALLIC
INT: DARK INTERIOR

FINAL ASSEMBLY POINT:
SMYRNA

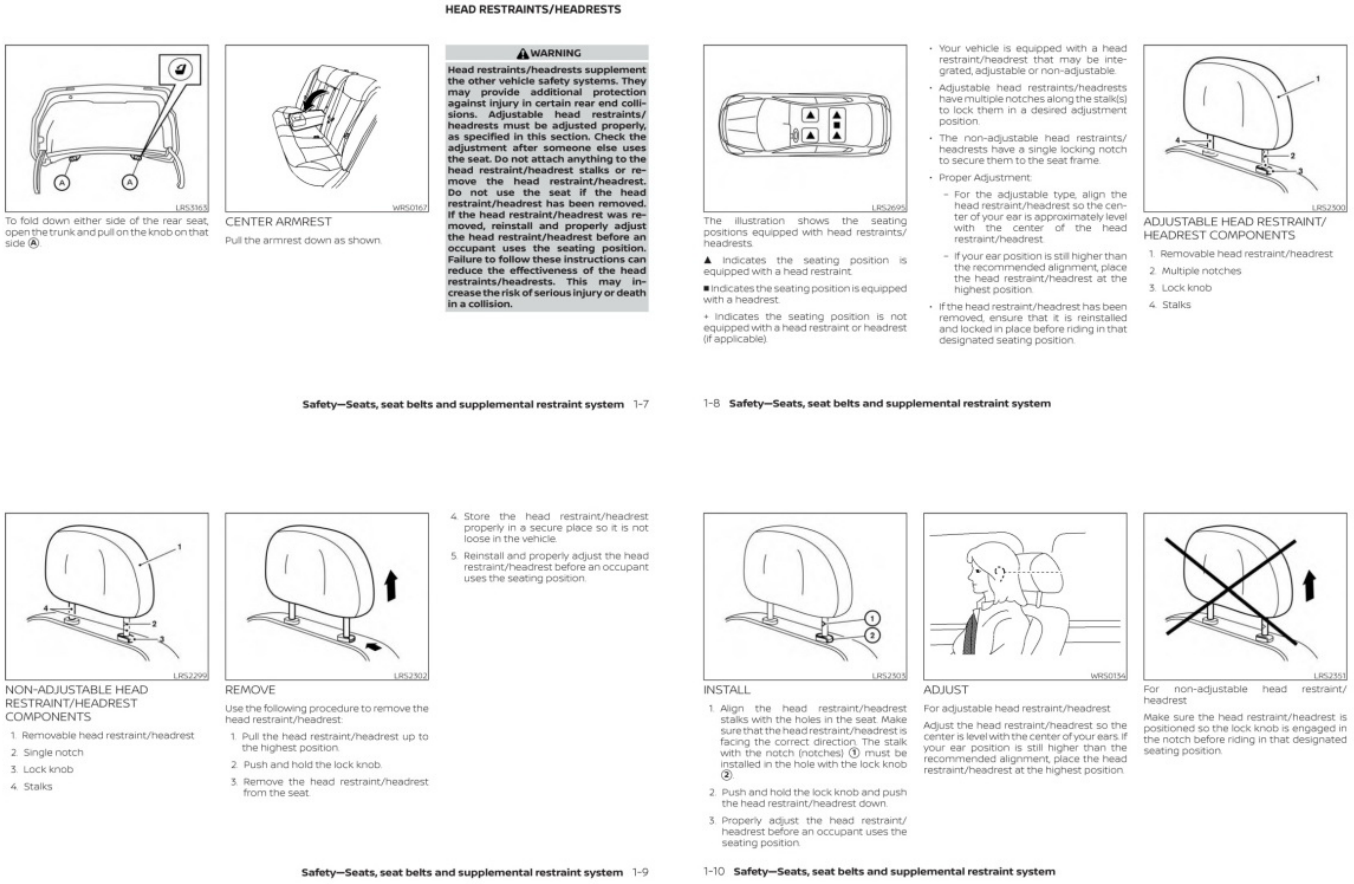
TRANSPORT METHOD:
TRUCK

DEALER:
MAGUIRE NISSAN, INC.
504 S MEADOW ST
ITHACA NY
14850

VIN: 1N4BL4BV4KC141323
EMS: 50 STATE EMISSIONS
MDL: 13119-141323 KAD-G
OPT: C-B10L92C03

20181114235415AS3719

Photo No. 069 - Monroney Label



HEAD RESTRAINTS/HEADRESTS

LRS3365
To fold down either side of the rear seat, open the trunk and pull on the knob on that side Ⓐ.

WRS0167
CENTER ARMREST
Pull the armrest down as shown.

⚠ WARNING
Head restraints/headrests supplement the other vehicle safety systems. They may provide additional protection against injury in certain rear end collisions. Adjustable head restraints/headrests must be adjusted properly, as specified in this section. Check the adjustment after someone else uses the seat. Do not attach anything to the head restraint/headrest stalks or remove the head restraint/headrest. Do not use the seat if the head restraint/headrest has been removed. If the head restraint/headrest was removed, reinstall and properly adjust the head restraint/headrest before an occupant uses the seating position. Failure to follow these instructions can reduce the effectiveness of the head restraints/headrests. This may increase the risk of serious injury or death in a collision.

LRS2695
The illustration shows the seating positions equipped with head restraints/headrests.
▲ Indicates the seating position is equipped with a head restraint.
■ Indicates the seating position is equipped with a headrest.
+ Indicates the seating position is not equipped with a head restraint or headrest (if applicable).

- Your vehicle is equipped with a head restraint/headrest that may be integrated, adjustable or non-adjustable.
- Adjustable head restraints/headrests have multiple notches along the stalk(s) to lock them in a desired adjustment position.
- The non-adjustable head restraints/headrests have a single locking notch to secure them to the seat frame.
- Proper Adjustment:
  - For the adjustable type, align the head restraint/headrest so the center of your ear is approximately level with the center of the head restraint/headrest.
  - If your ear position is still higher than the recommended alignment, place the head restraint/headrest at the highest position.
- If the head restraint/headrest has been removed, ensure that it is reinstalled and locked in place before riding in that designated seating position.

LRS2300
ADJUSTABLE HEAD RESTRAINT/HEADREST COMPONENTS
1. Removable head restraint/headrest
2. Multiple notches
3. Lock knob
4. Stalks

LRS2299
NON-ADJUSTABLE HEAD RESTRAINT/HEADREST COMPONENTS
1. Removable head restraint/headrest
2. Single notch
3. Lock knob
4. Stalks

LRS2302
REMOVE
Use the following procedure to remove the head restraint/headrest.
1. Pull the head restraint/headrest up to the highest position.
2. Push and hold the lock knob.
3. Remove the head restraint/headrest from the seat.
4. Store the head restraint/headrest properly in a secure place so it is not loose in the vehicle.
5. Reinstall and properly adjust the head restraint/headrest before an occupant uses the seating position.

LRS2303
INSTALL
1. Align the head restraint/headrest stalks with the holes in the seat. Make sure that the head restraint/headrest is facing the correct direction. The stalk with the notch (notches) ① must be installed in the hole with the lock knob ②.
2. Push and hold the lock knob and push the head restraint/headrest down.
3. Properly adjust the head restraint/headrest before an occupant uses the seating position.

WRS0134
ADJUST
For adjustable head restraint/headrest
Adjust the head restraint/headrest so the center is level with the center of your ears. If your ear position is still higher than the recommended alignment, place the head restraint/headrest at the highest position.

LRS2351
For non-adjustable head restraint/headrest
Make sure the head restraint/headrest is positioned so the lock knob is engaged in the notch before riding in that designated seating position.

Photo No. 070 - Head Restraint Use and Adjustment Information from Vehicle Owners Manual

Photo No. 071 - Post-Test View of Shattered Vehicle Inner Door Panel

APPENDIX B
DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS
Driver Dummy Instrumentation Plots

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)

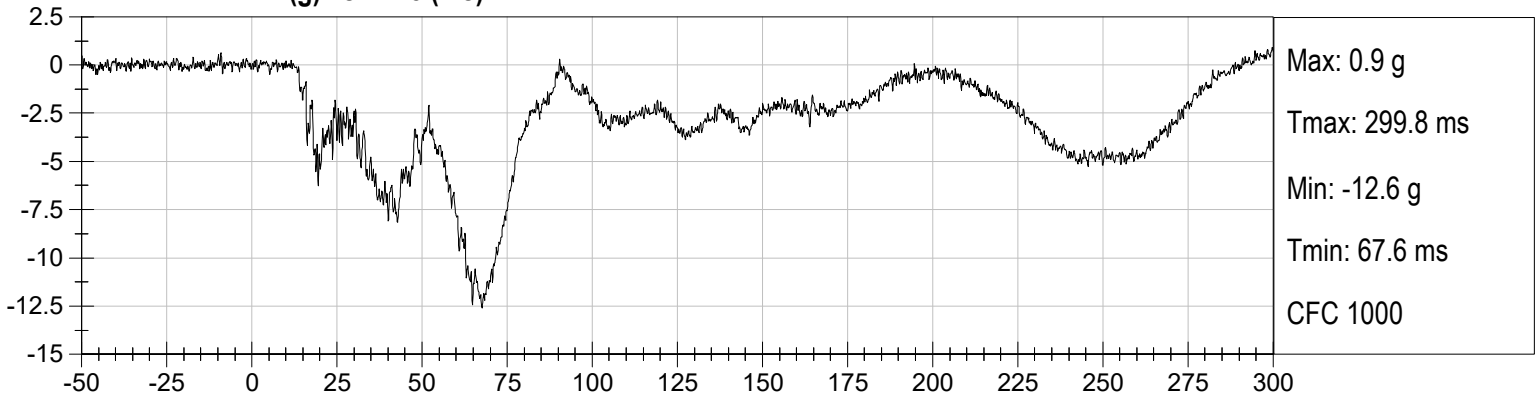
Load Cell Pole Barrier #5 Force (Y)

Load Cell Pole Barrier #6 Force (Y)

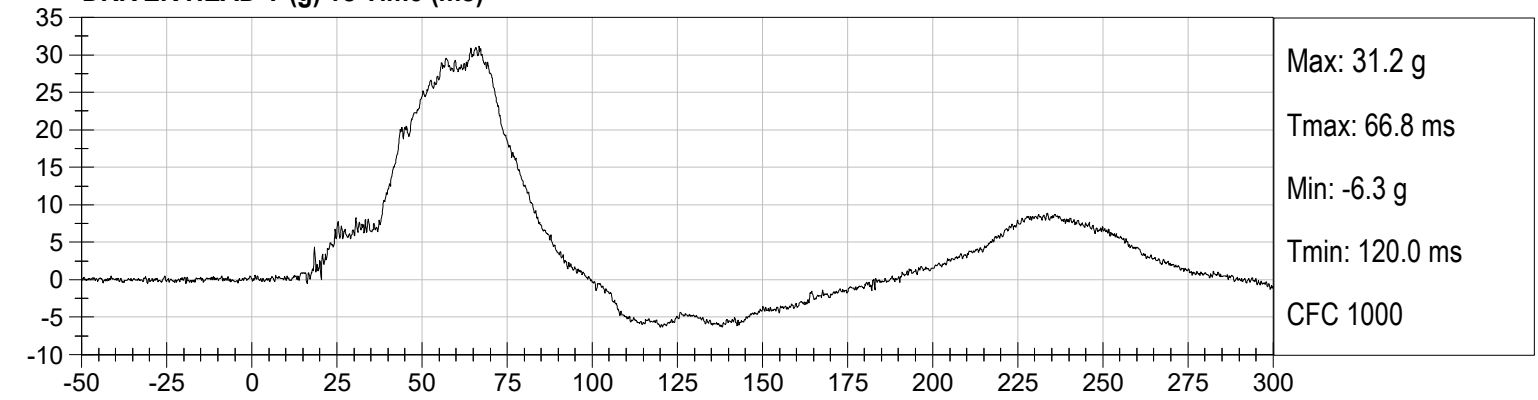
Load Cell Pole Barrier #7 Force (Y)

Load Cell Pole Barrier #8 Force (Y)

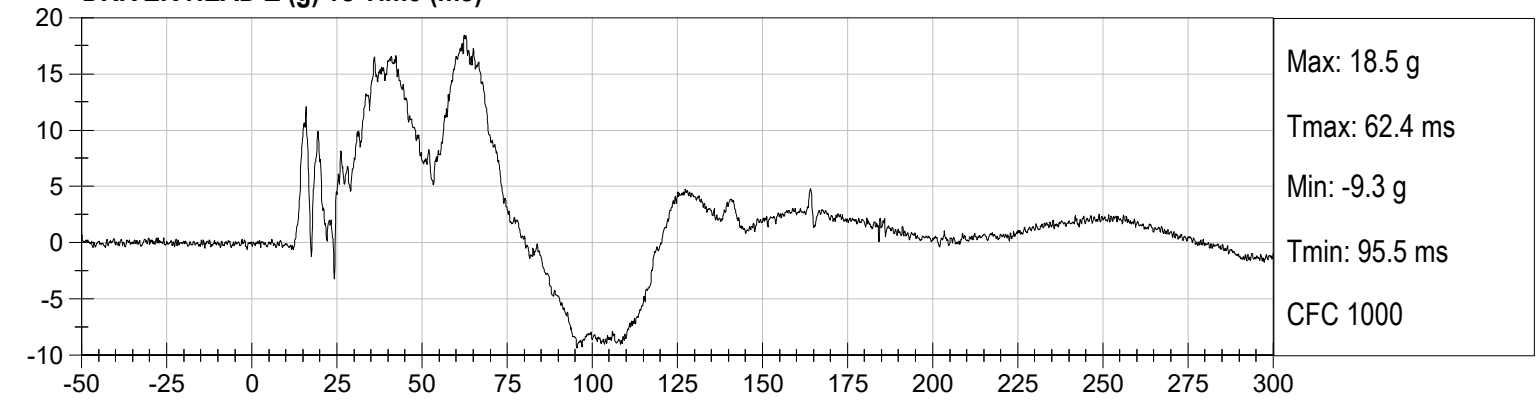
DRIVER HEAD X (g) vs Time (ms)



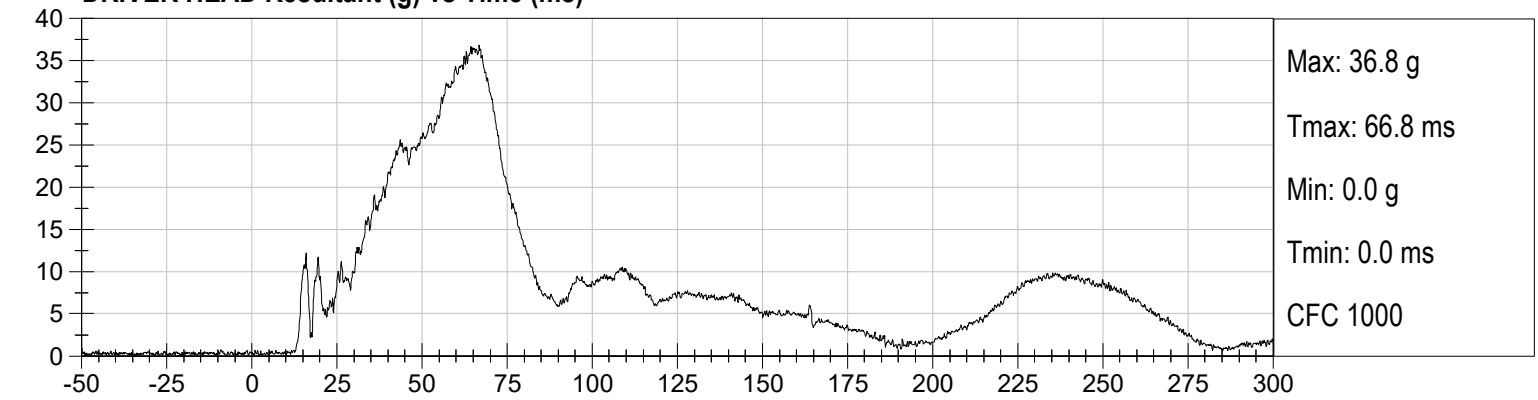
DRIVER HEAD Y (g) vs Time (ms)



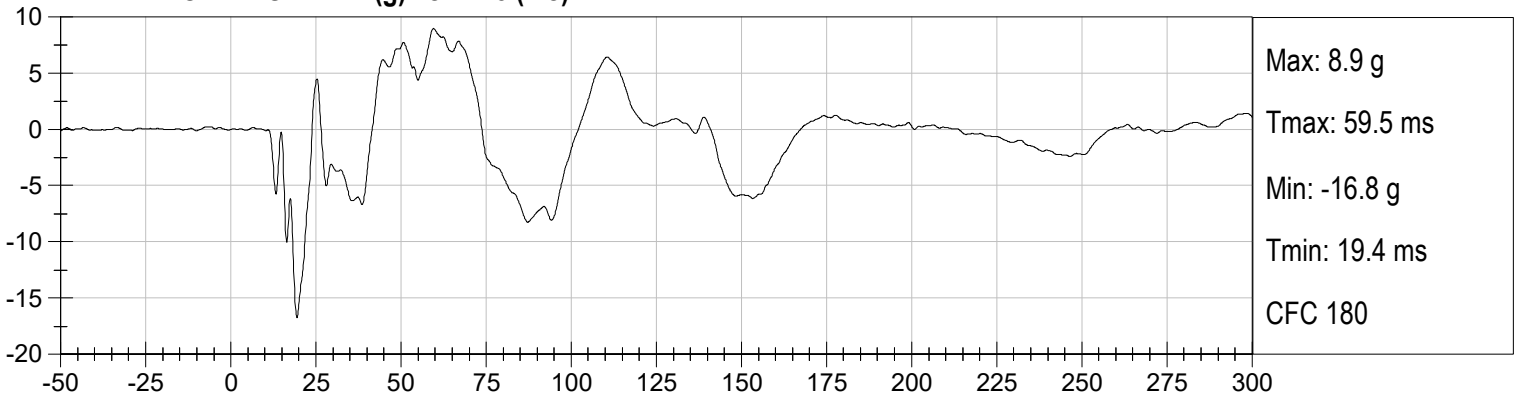
DRIVER HEAD Z (g) vs Time (ms)



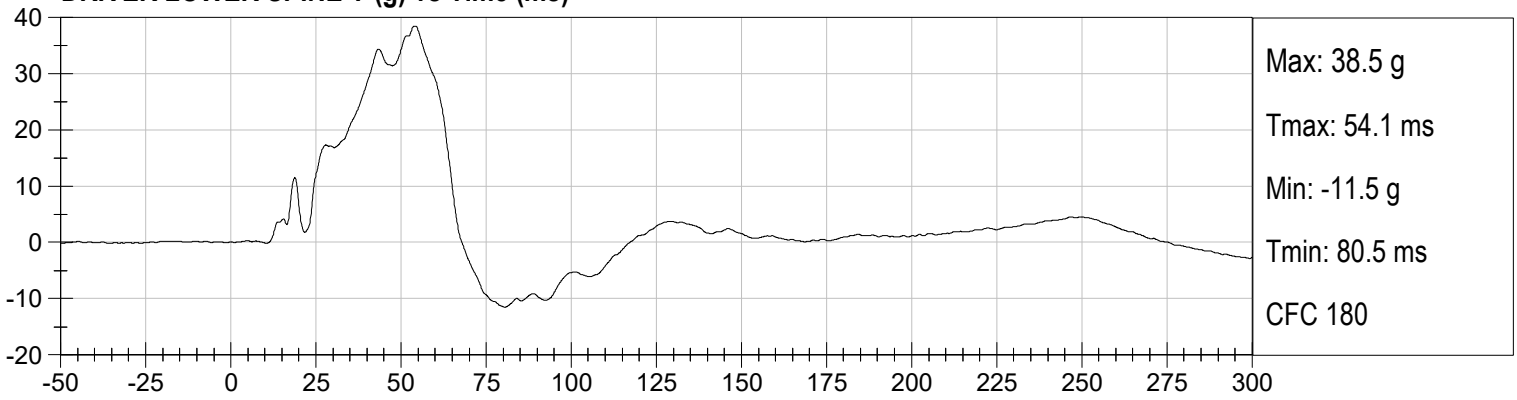
DRIVER HEAD Resultant (g) vs Time (ms)



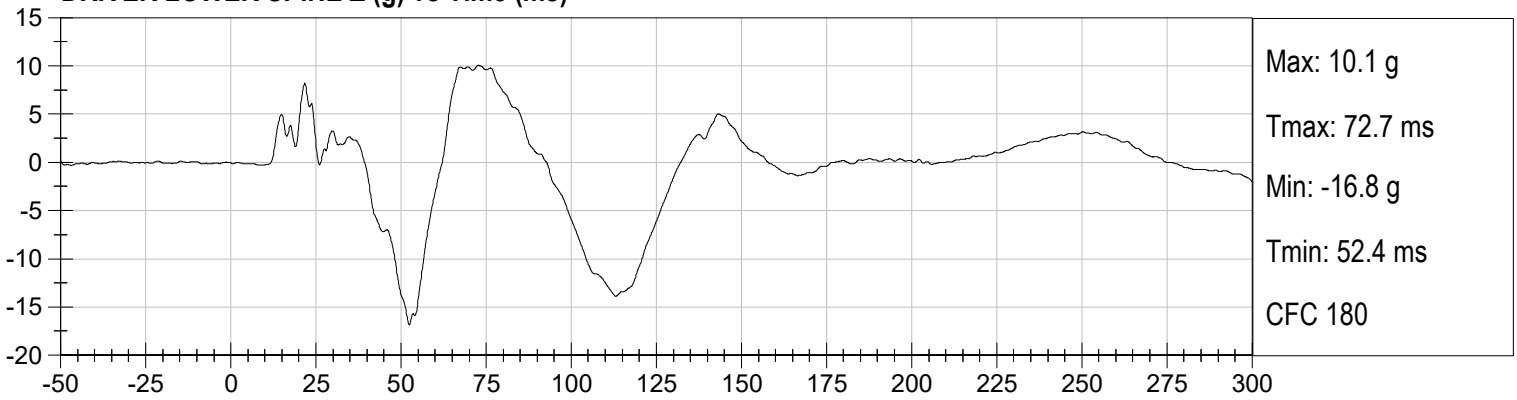
DRIVER LOWER SPINE X (g) vs Time (ms)



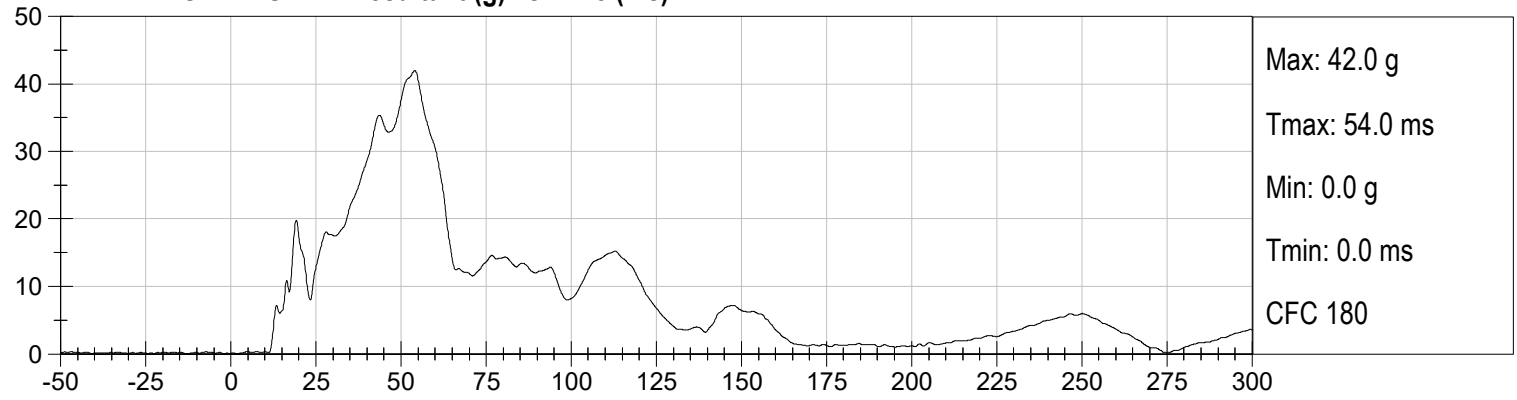
DRIVER LOWER SPINE Y (g) vs Time (ms)



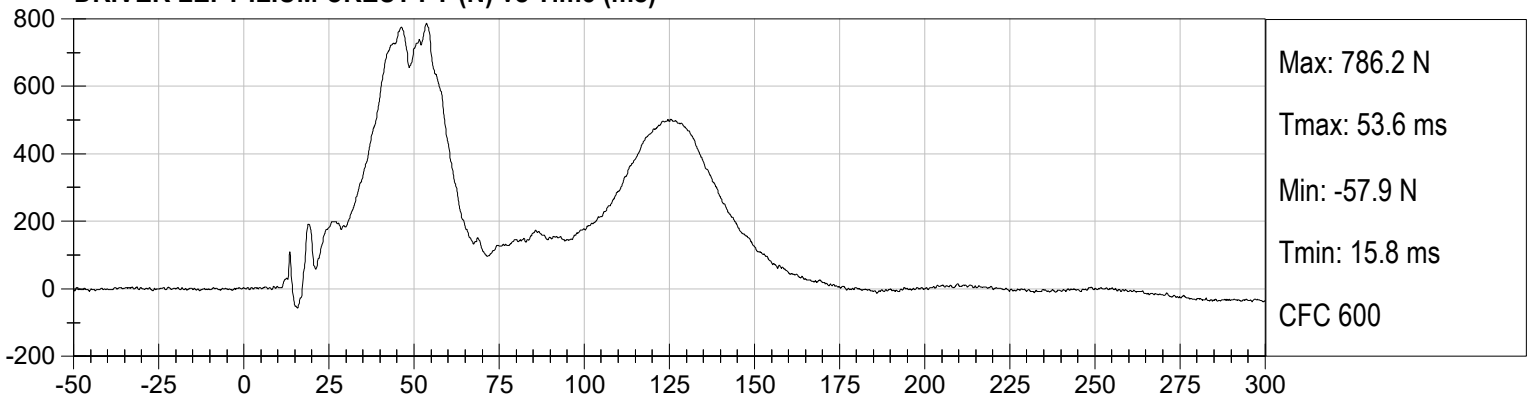
DRIVER LOWER SPINE Z (g) vs Time (ms)



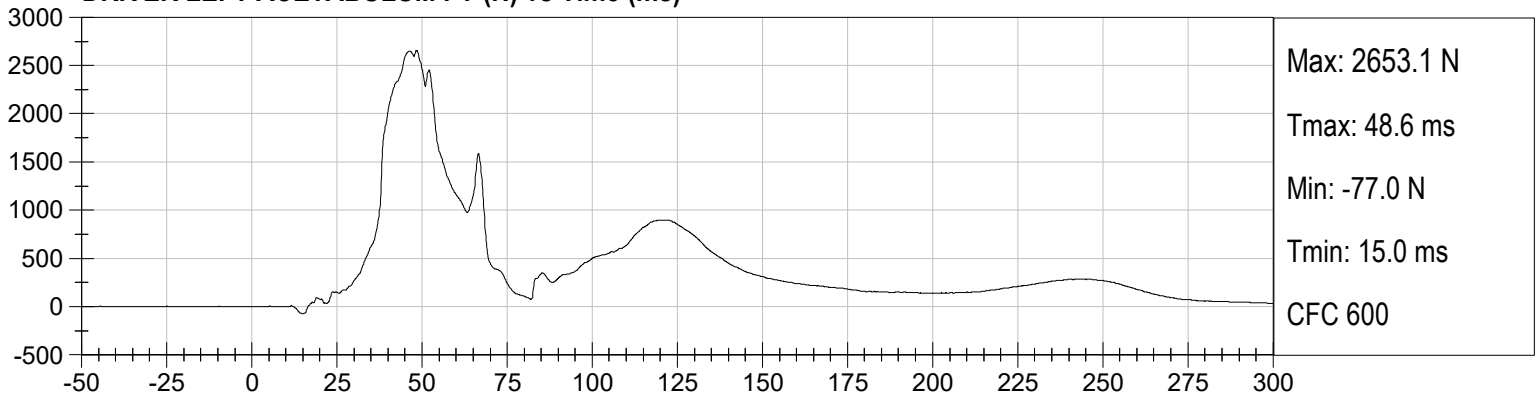
DRIVER LOWER SPINE Resultant (g) vs Time (ms)



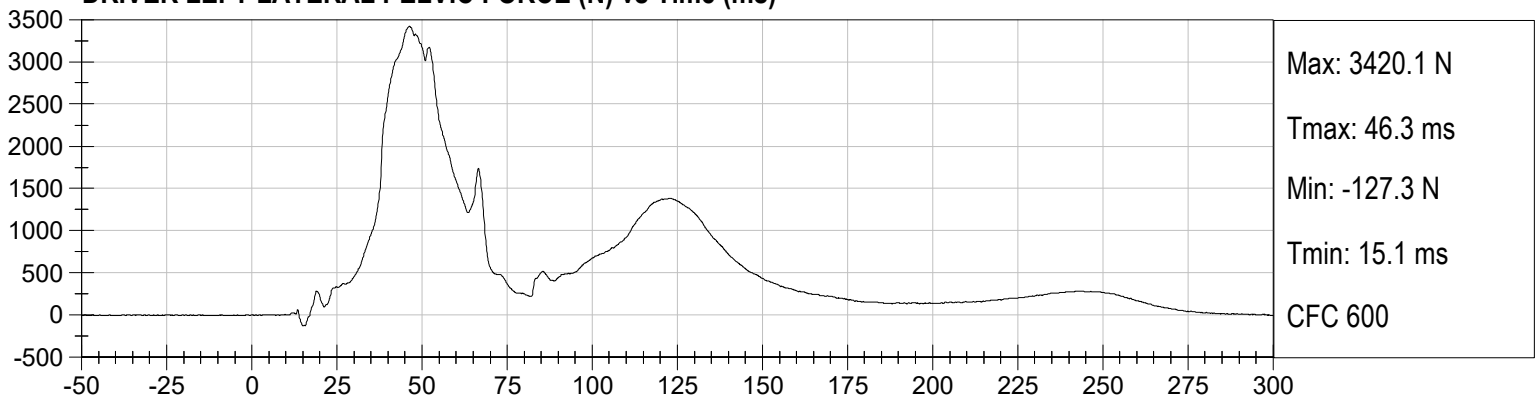
DRIVER LEFT ILIUM CREST FY (N) vs Time (ms)



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:** D191641

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	37	Pass
Peak Resultant Acceleration	G's	115 to 137	119	Pass
Peak Longitudinal Acceleration	G's	+/- 15	-3.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

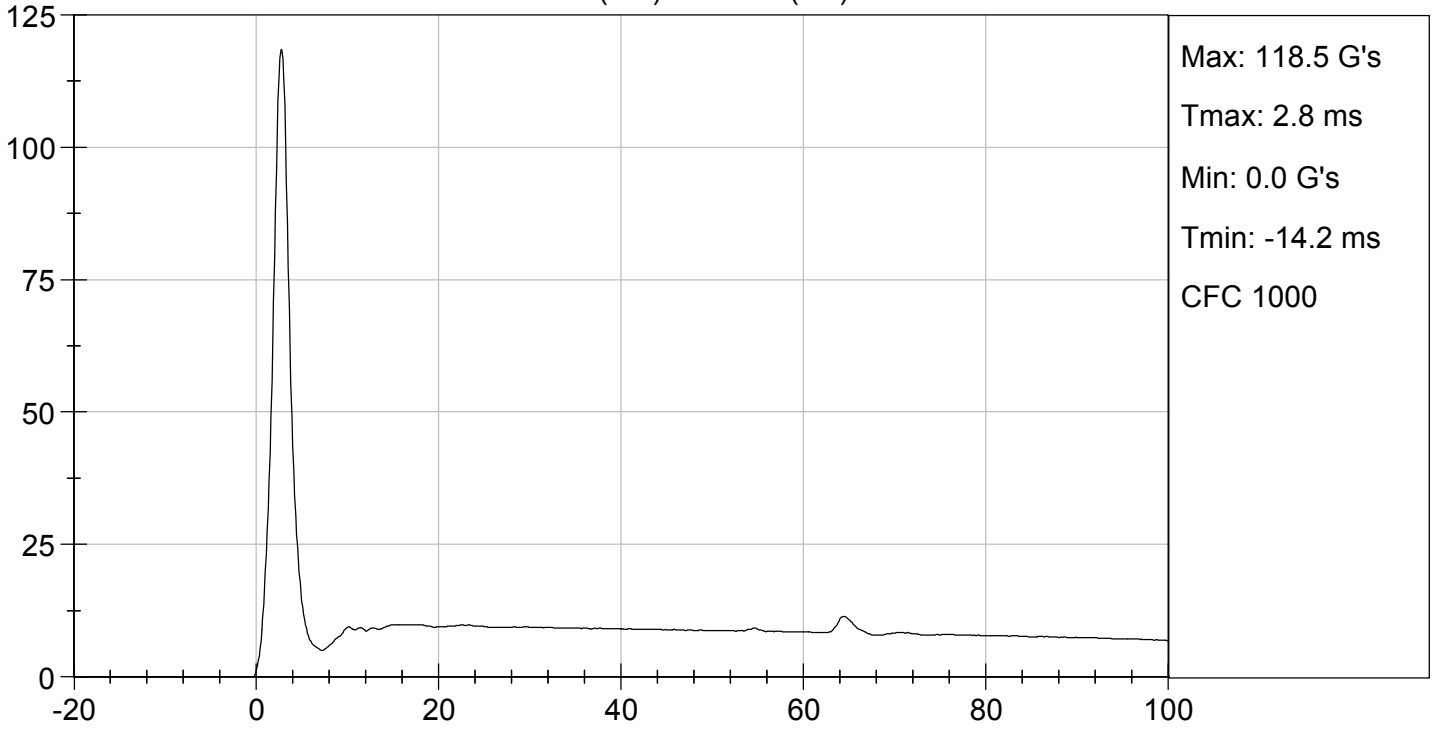
05/21/2019
Test Date

Approved By

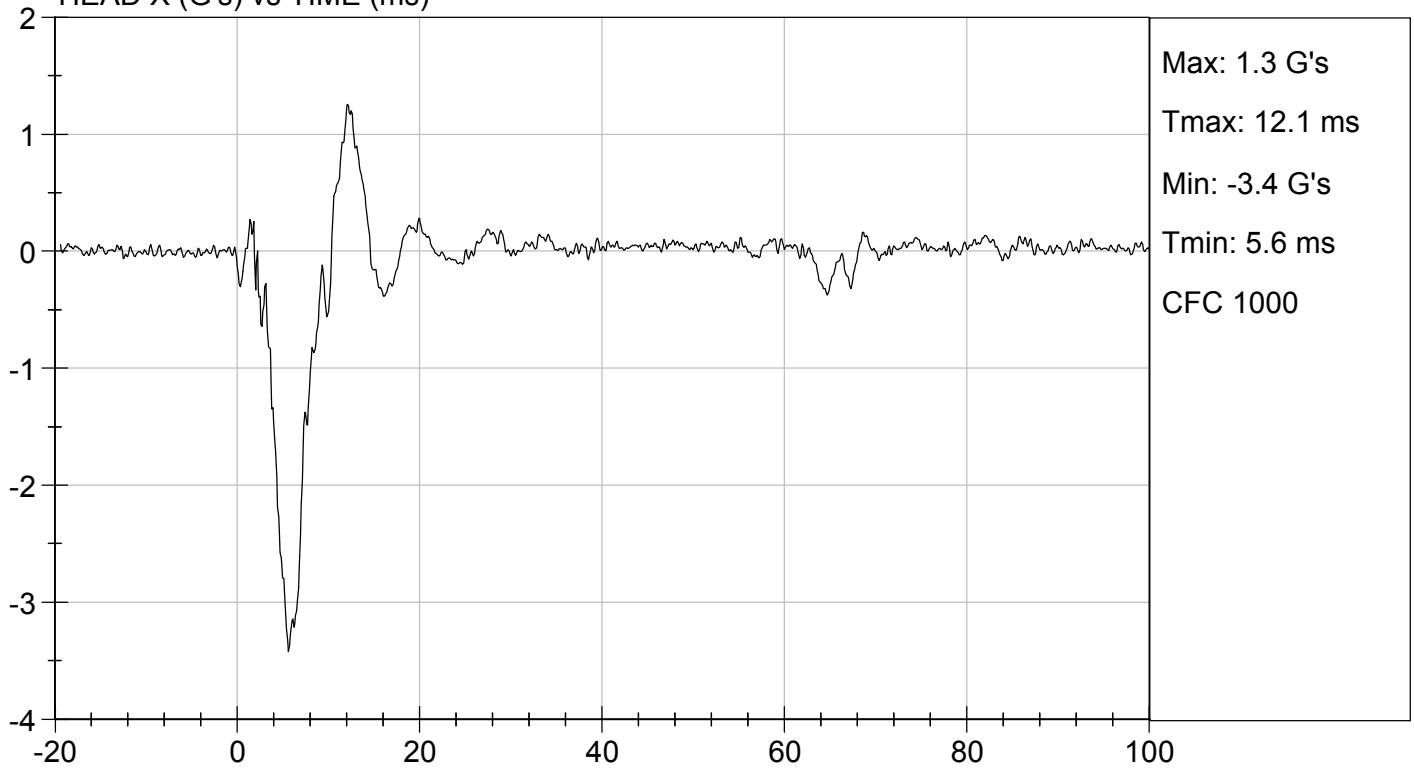
TEST DESC: HEAD DROP

TEST DATE: 05/21/2019
TEST #: D191641

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

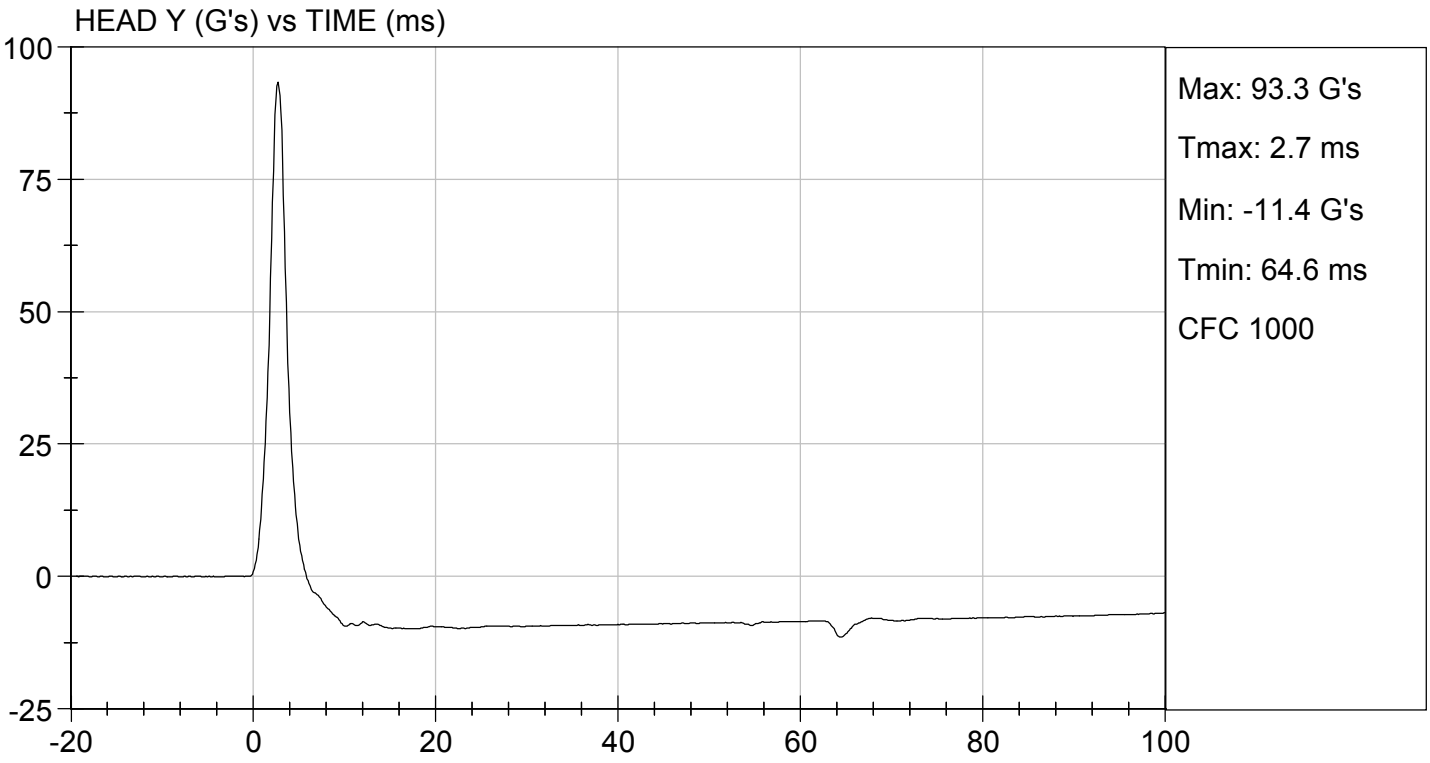


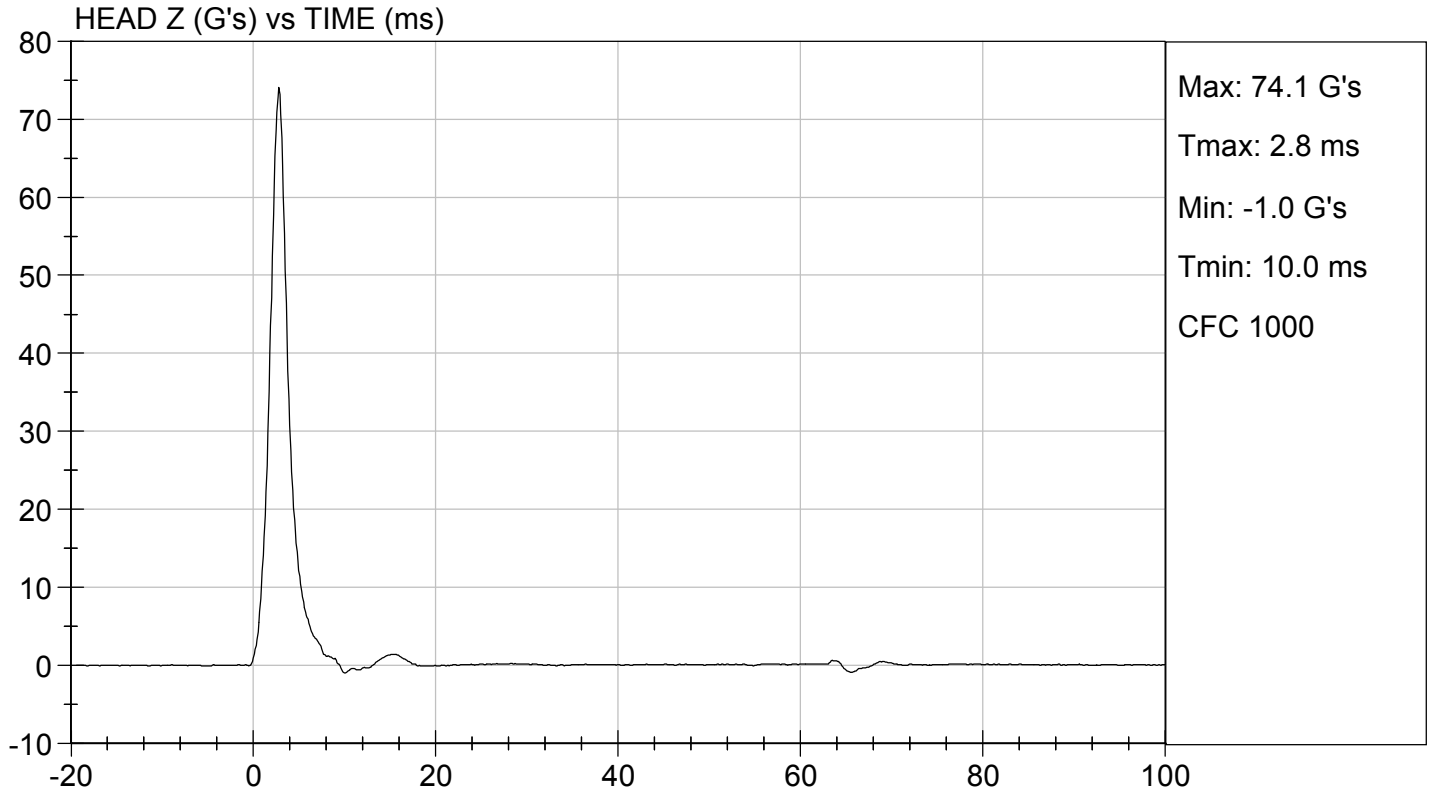
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 05/21/2019
TEST #: D191641





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D191642

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	20.9	Pass
Humidity		%	10 to 70	41	Pass
Impact Velocity		m/s	5.51 to 5.63	5.63	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.30	Pass
	15 ms	m/s	3.30 to 4.10	3.51	Pass
	20 ms	m/s	4.40 to 5.40	4.90	Pass
	25 ms	m/s	5.40 to 6.10	5.72	Pass
	25-100 ms	m/s	5.50 to 6.20	5.72	Pass
Maximum D-Plane Rotation		deg	71 to 81	73	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	60	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-40	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	112	Pass
			Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

05/22/2019

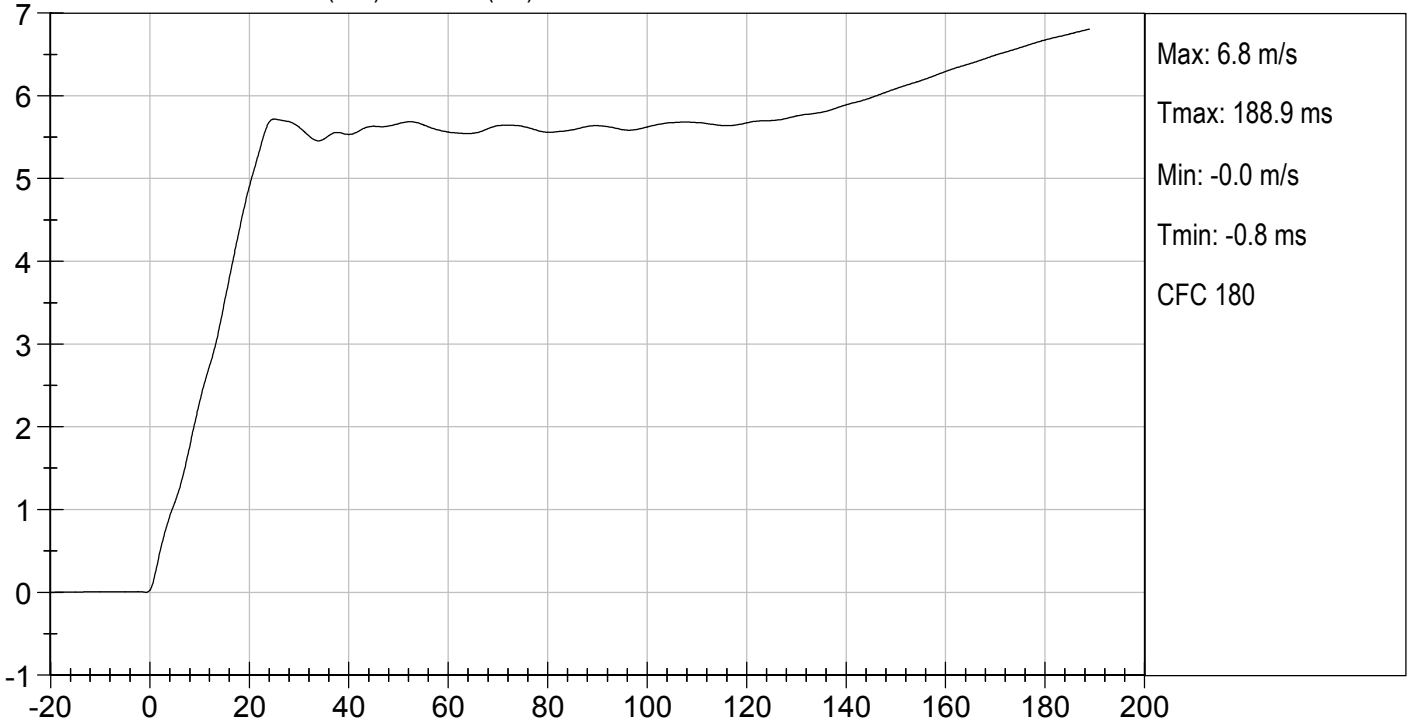
Test Date

Approved By

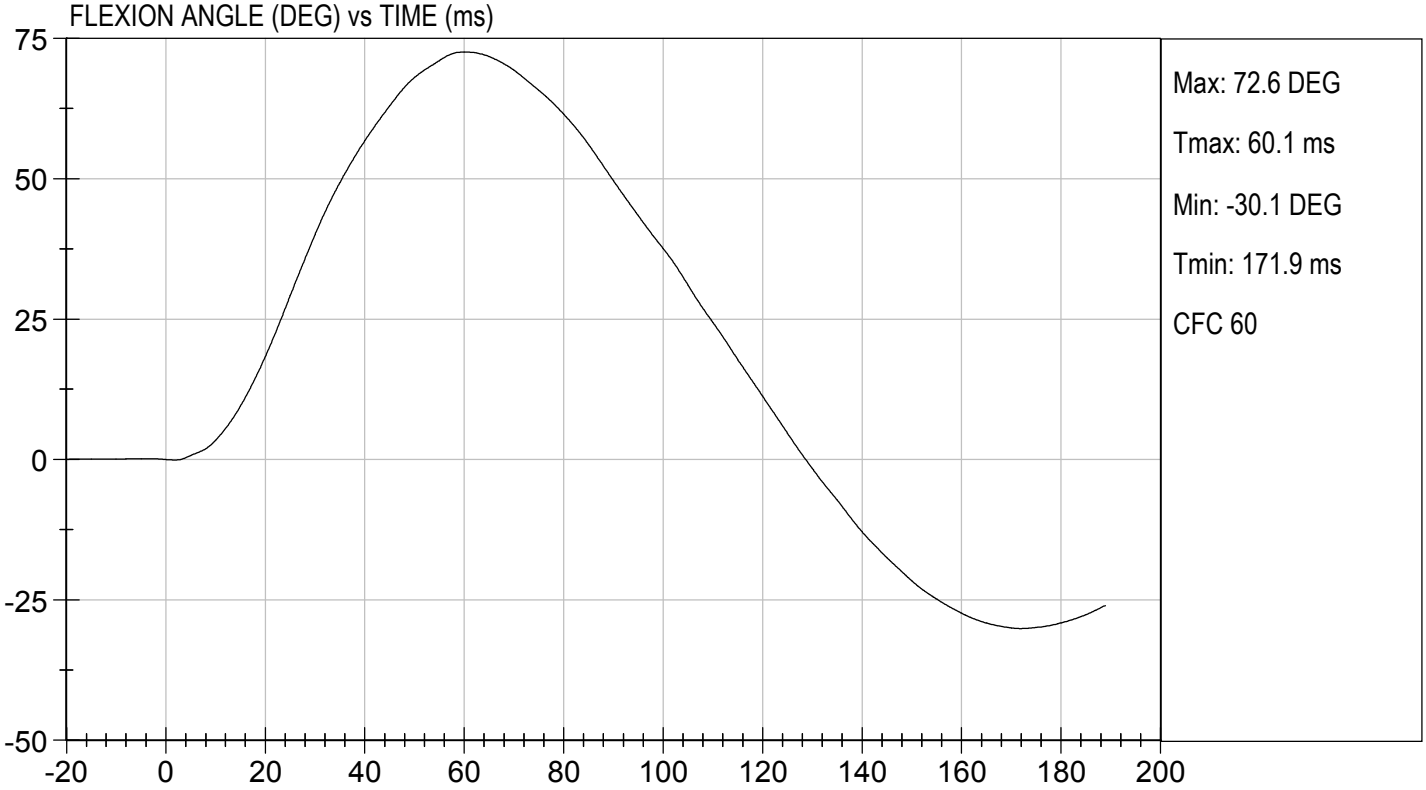
TEST DESC: NECK BENDING
VELOCITY: 18.48 ft/s, 5.63 m/s

TEST DATE: 05/22/2019
TEST #: D191642

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

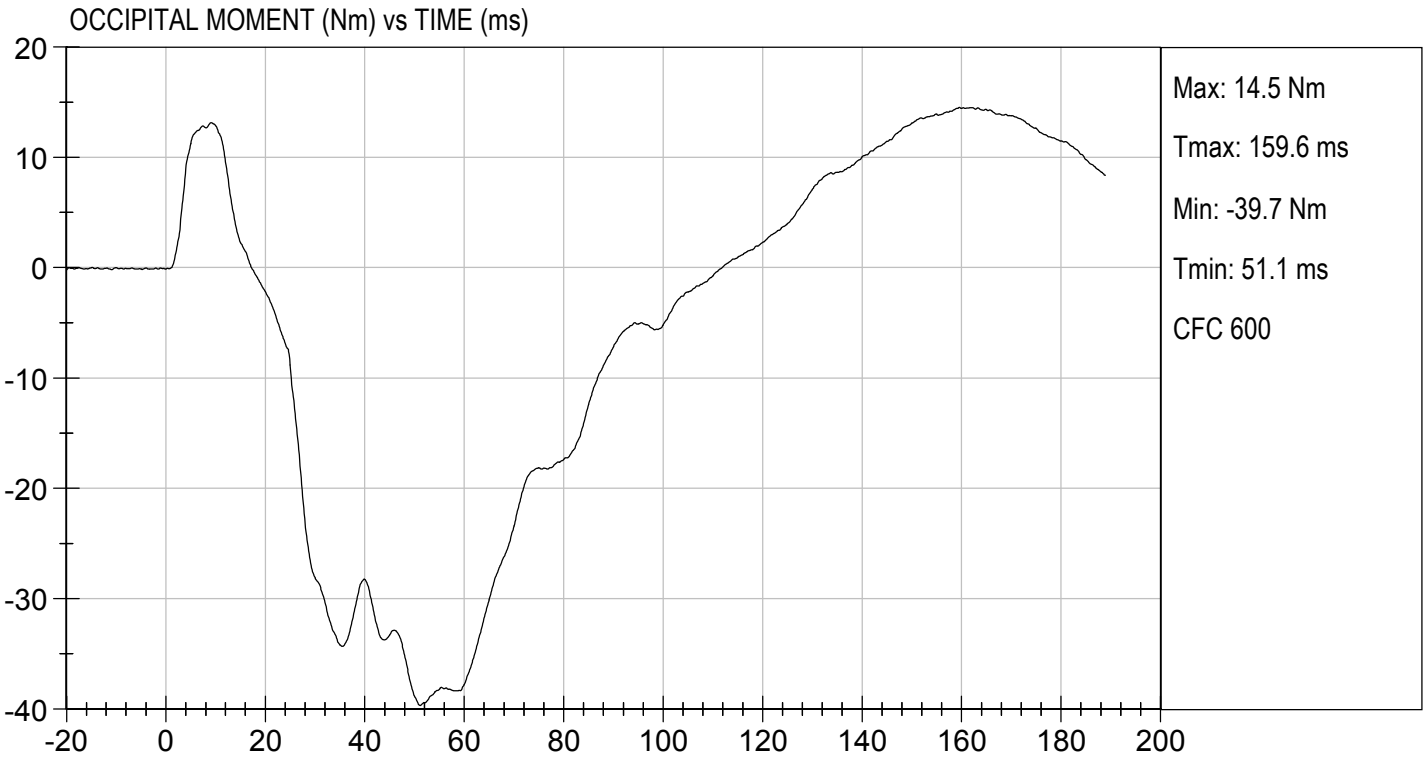


FLEXION ANGLE (DEG) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 18.48 ft/s, 5.63 m/s

TEST DATE: 05/22/2019
TEST #: D191642



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D191643

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	30	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	21	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

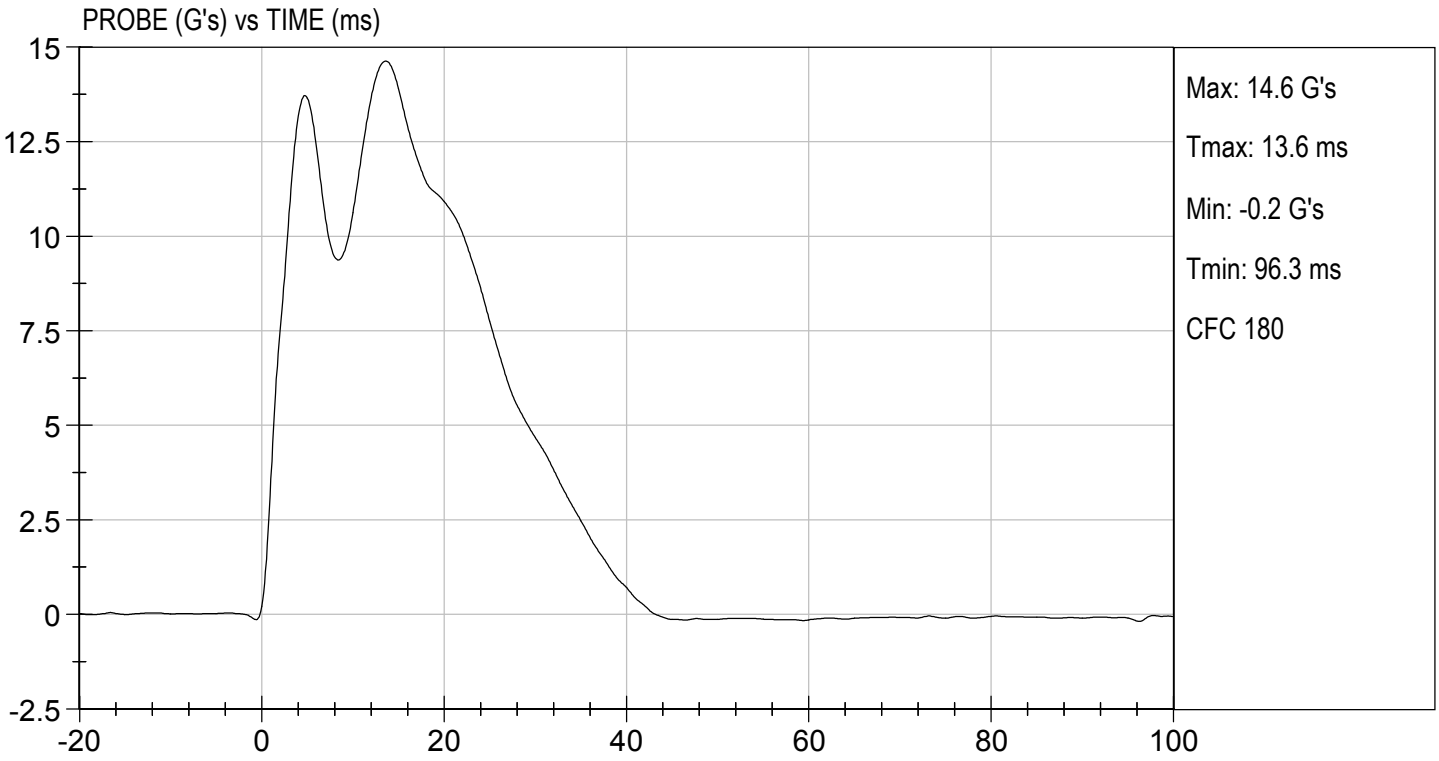
05/22/2019

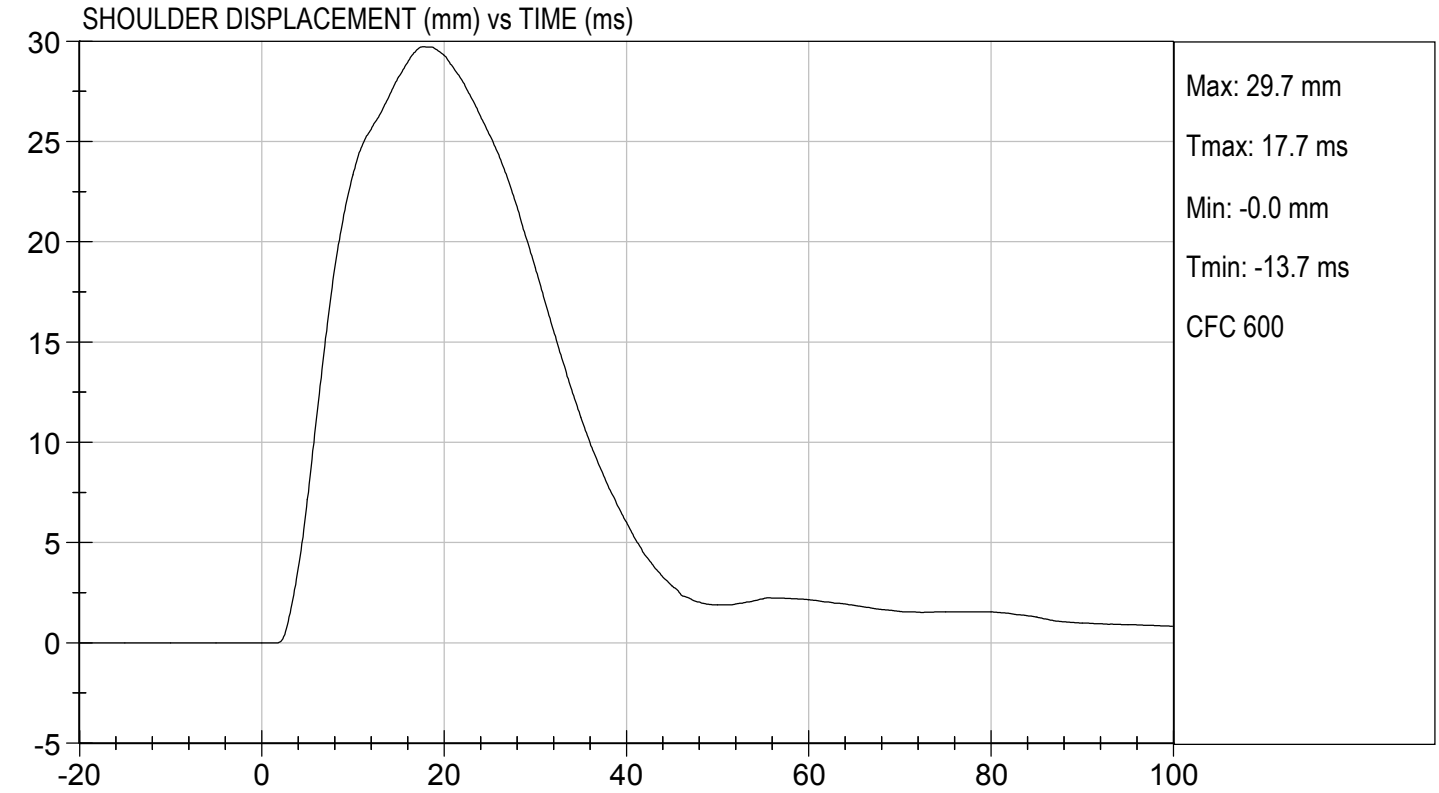
Test Date

Approved By

TEST DESC: SHOULDER IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 05/22/2019
TEST #: D191643

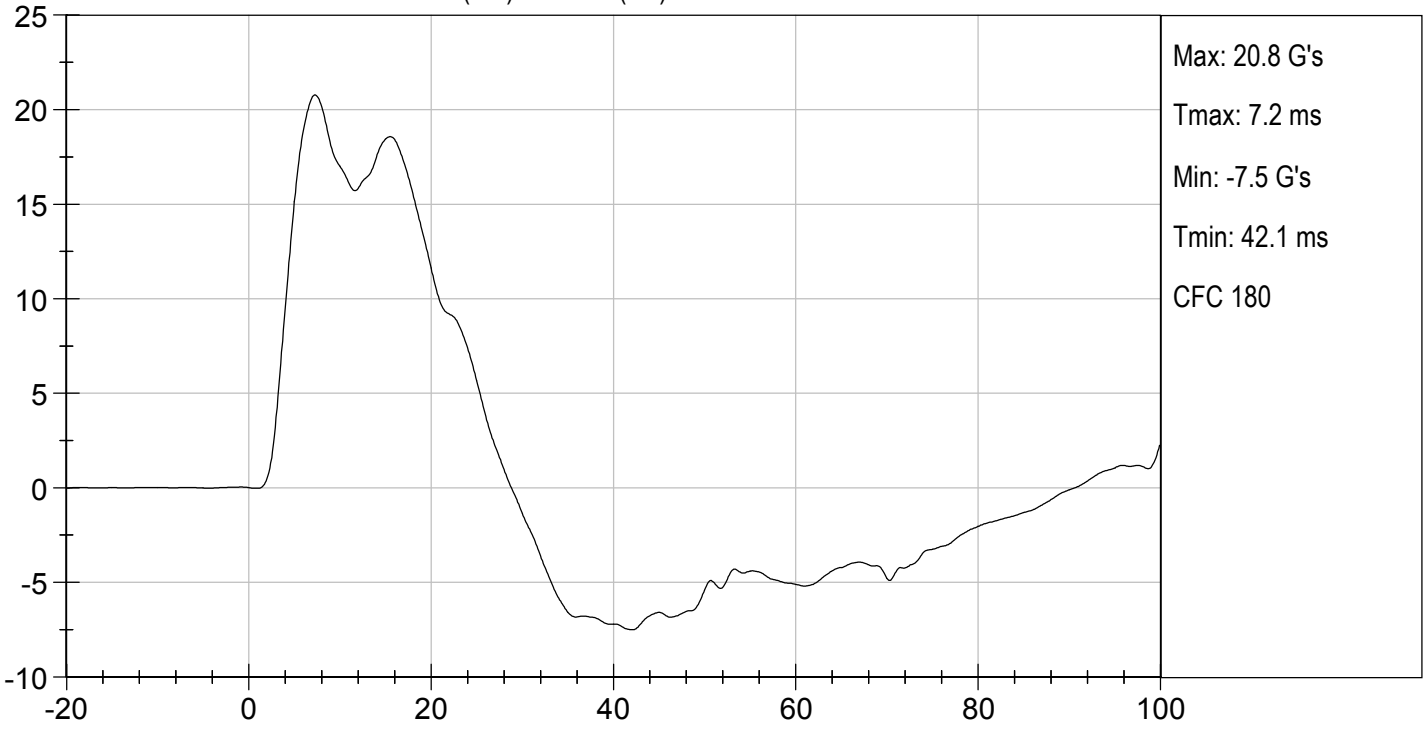




TEST DESC: SHOULDER IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 05/22/2019
TEST #: D191643

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:** D191644

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	47	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	34	Pass
Upper Rib Displacement	mm	25 to 32	26	Pass
Middle Rib Displacement	mm	30 to 36	30	Pass
Lower Rib Displacement	mm	32 to 38	33	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	38	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	34	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

05/22/2019

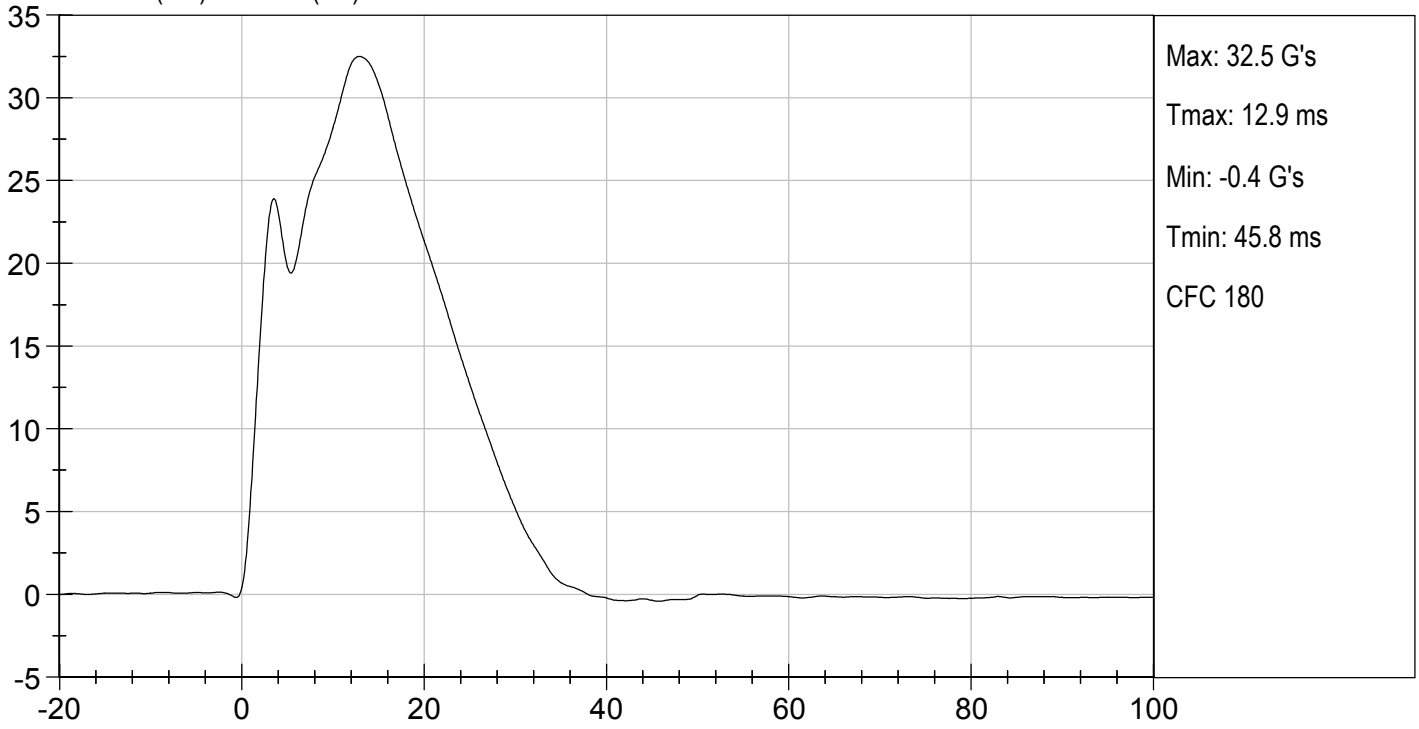
Test Date

Approved By

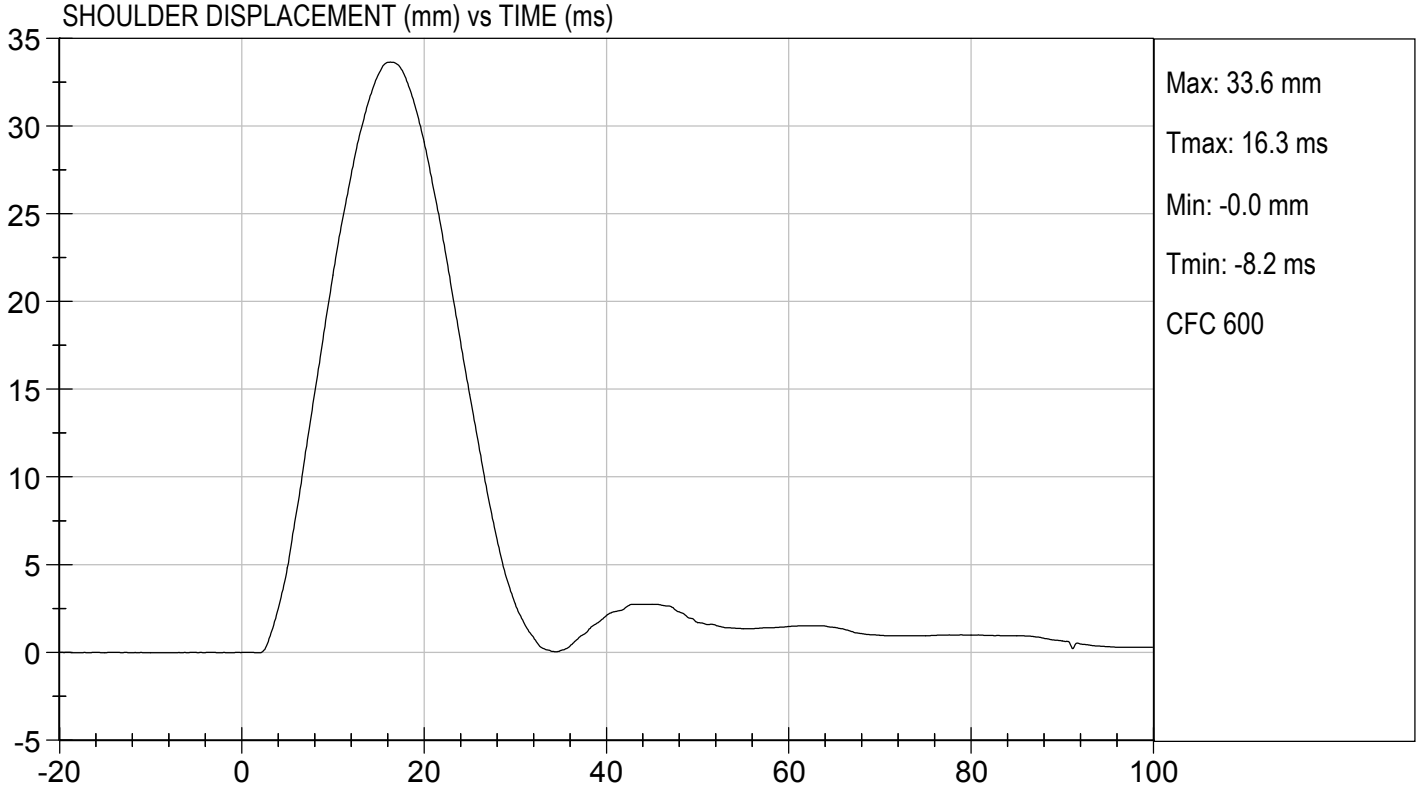
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 05/22/2019
TEST #: D191644

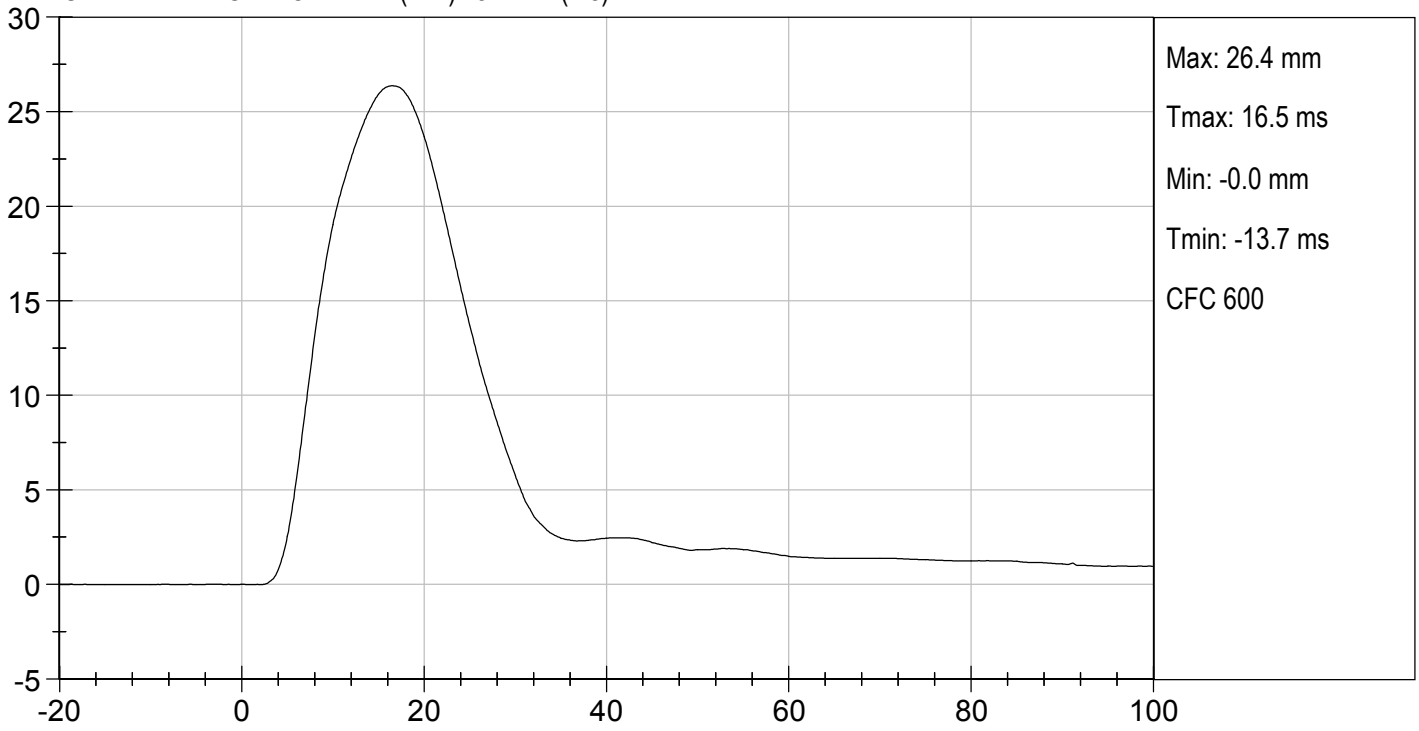
PROBE (G's) vs TIME (ms)



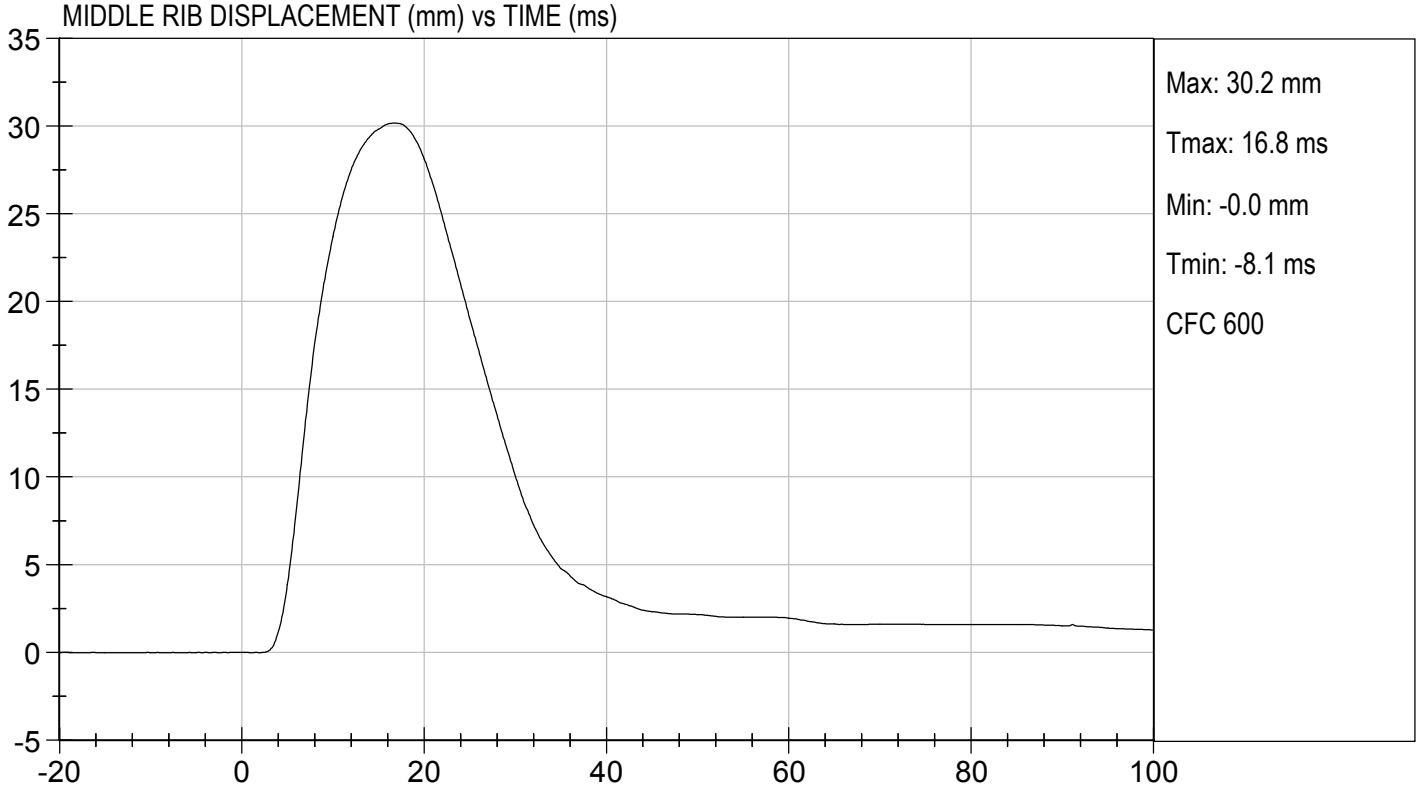
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



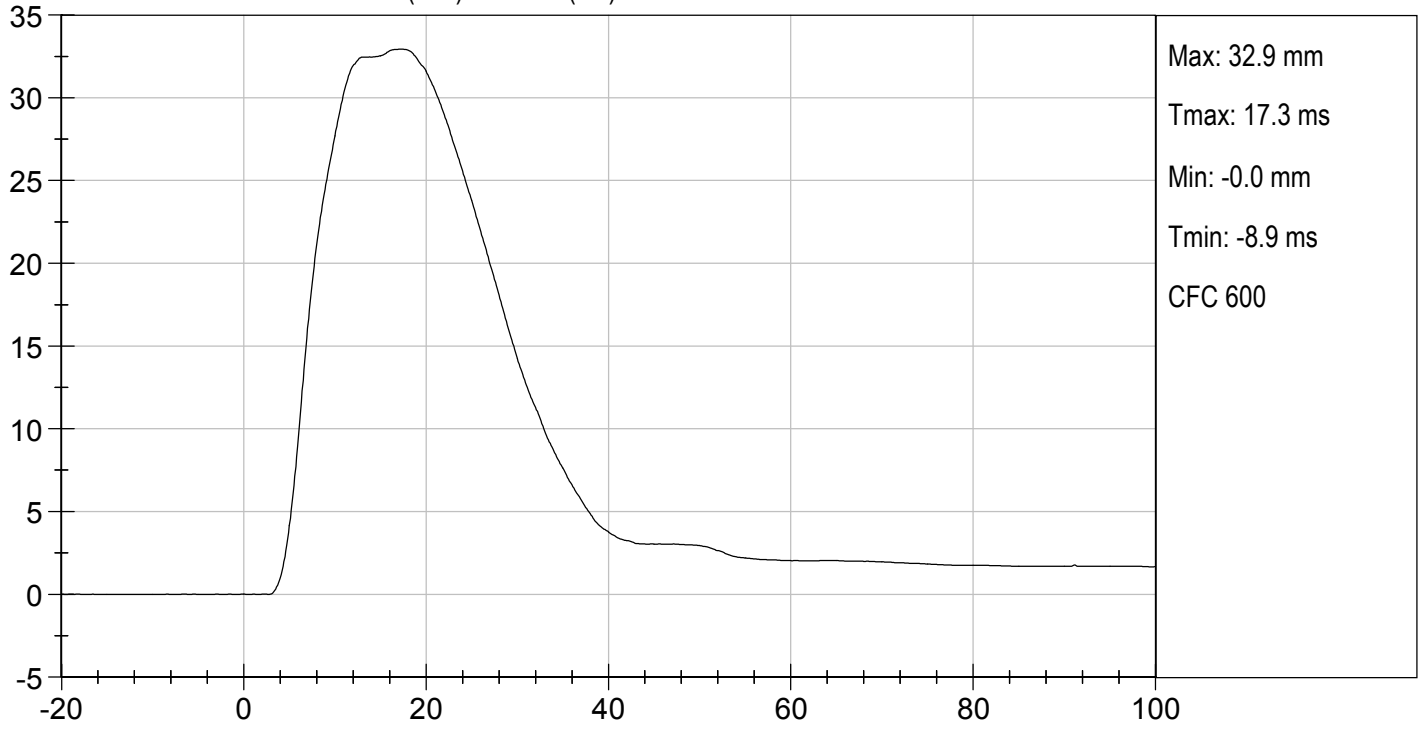
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



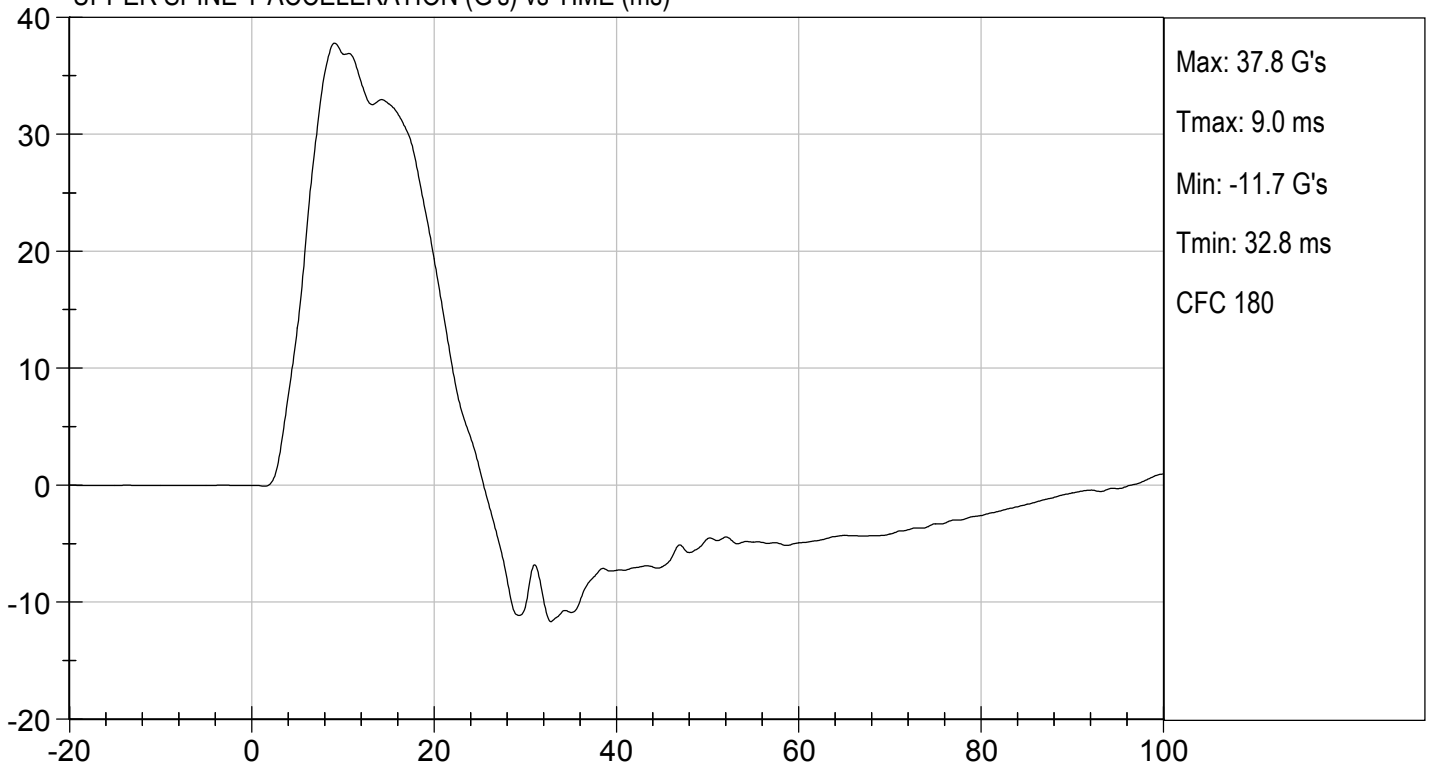
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 05/22/2019
TEST #: D191644

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



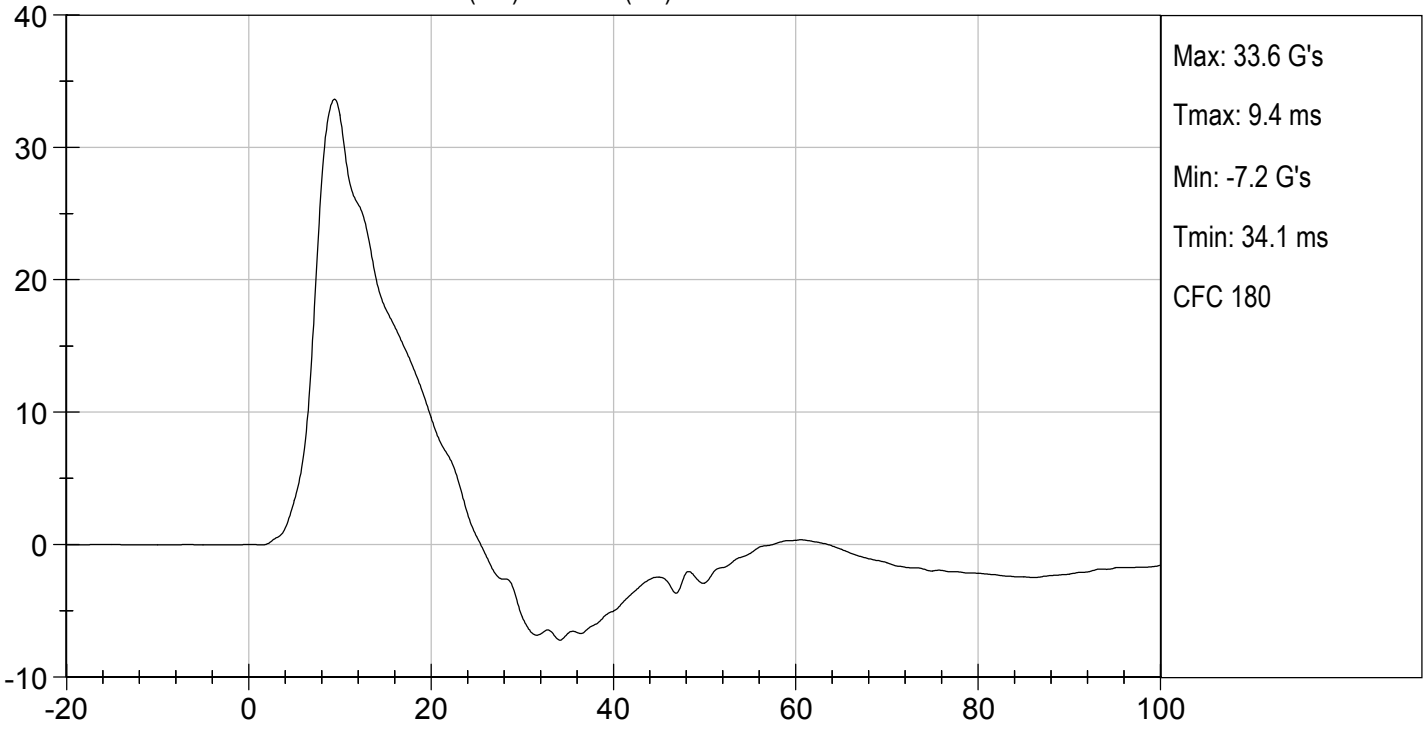
UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 05/22/2019
TEST #: D191644

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:** D191645

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	47	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	37	Pass
Middle Rib Displacement	mm	39 to 45	42	Pass
Lower Rib Displacement	mm	35 to 43	40	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	15	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	8	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

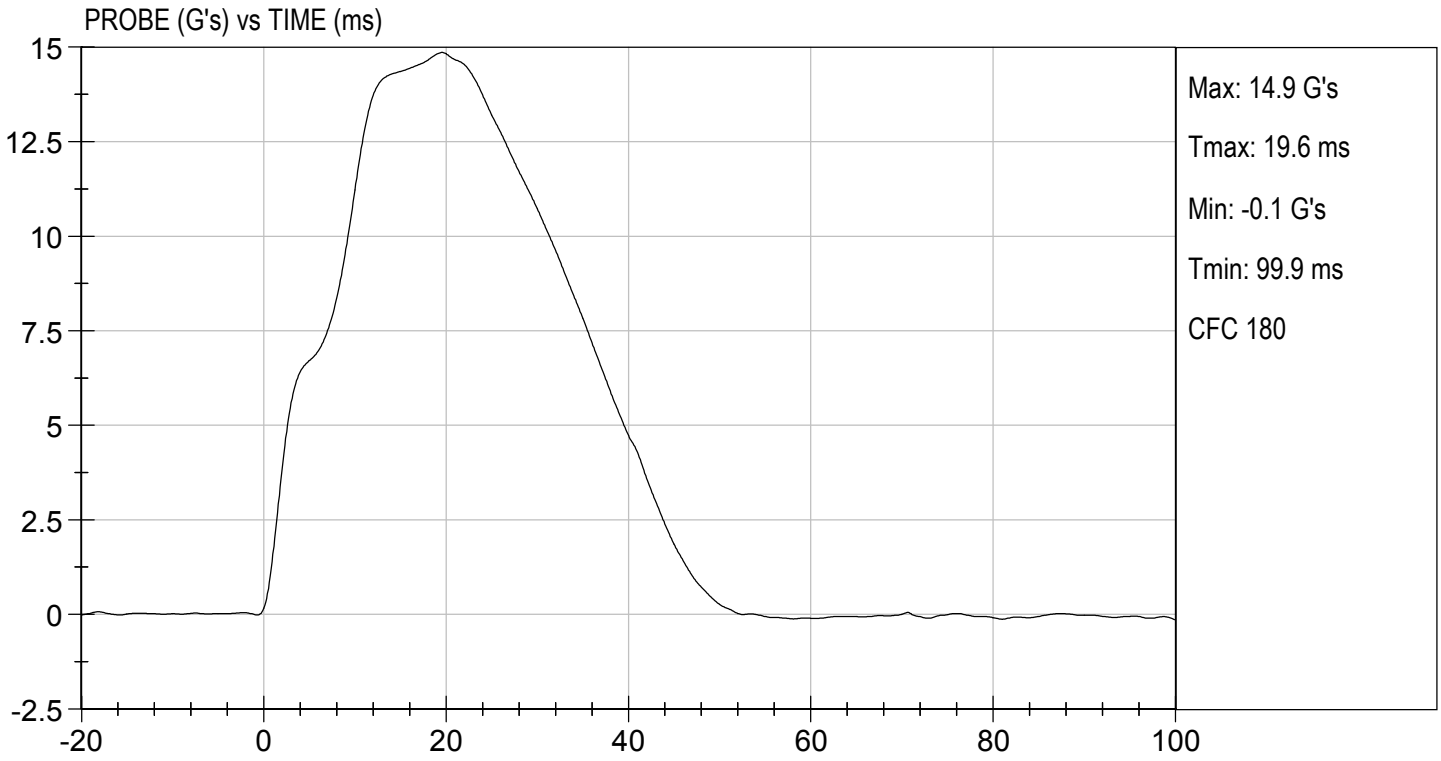
05/22/2019

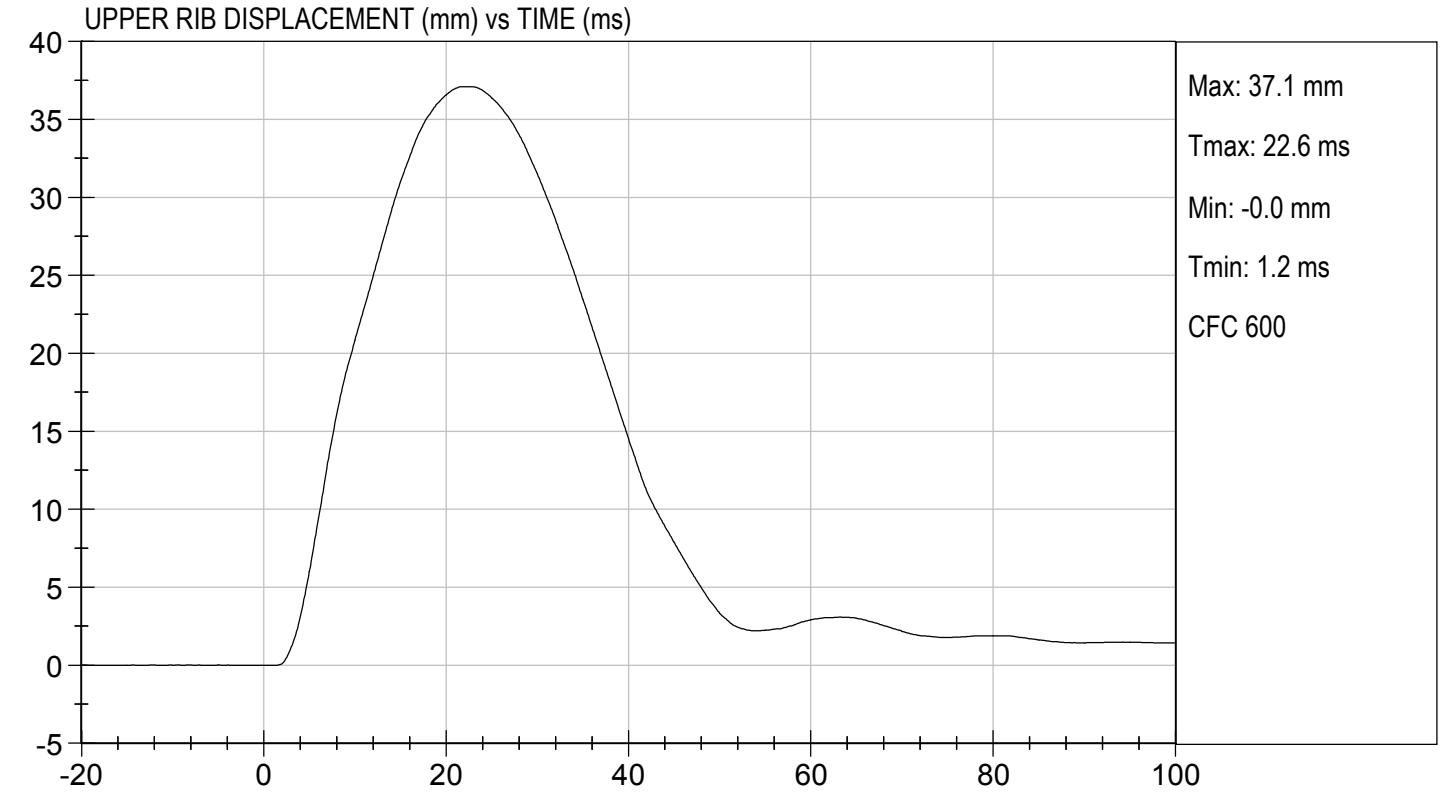
Test Date

Approved By

TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 05/22/2019
TEST #: D191645

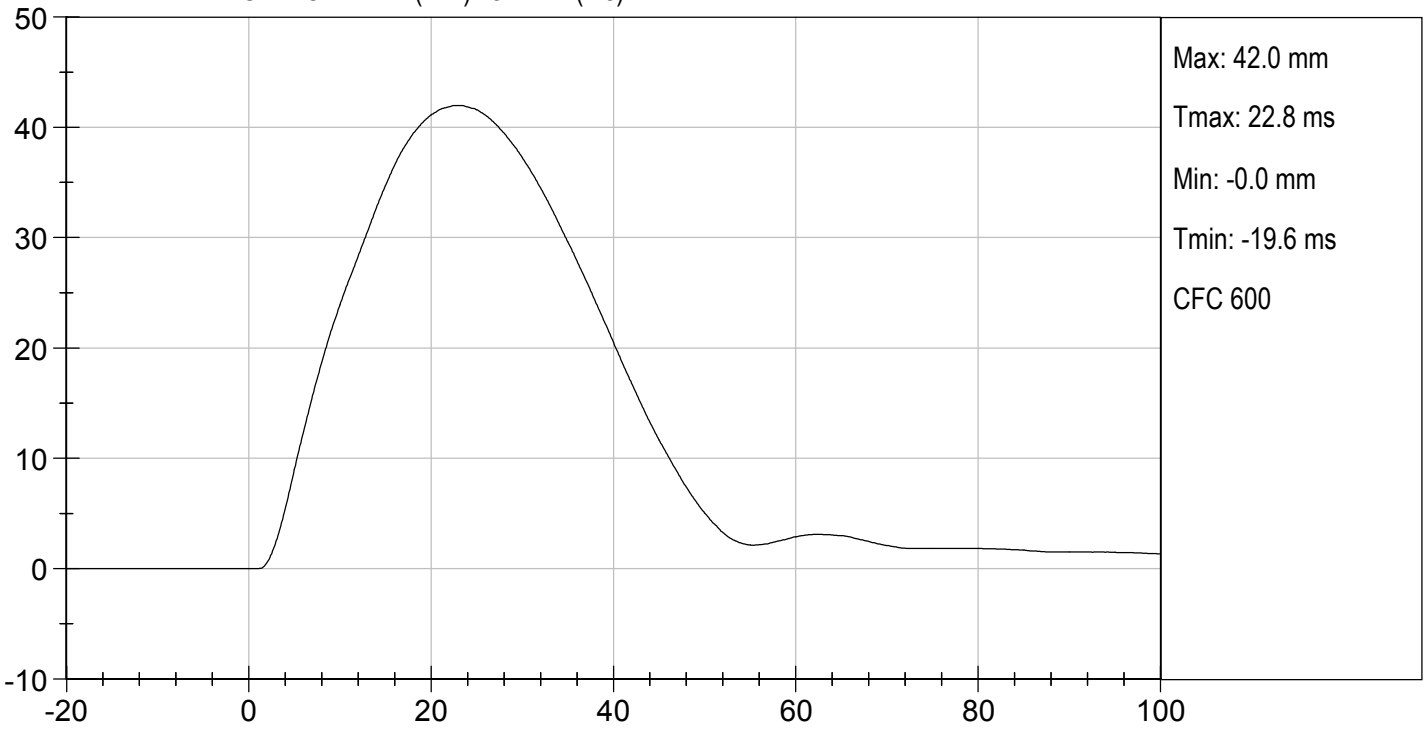




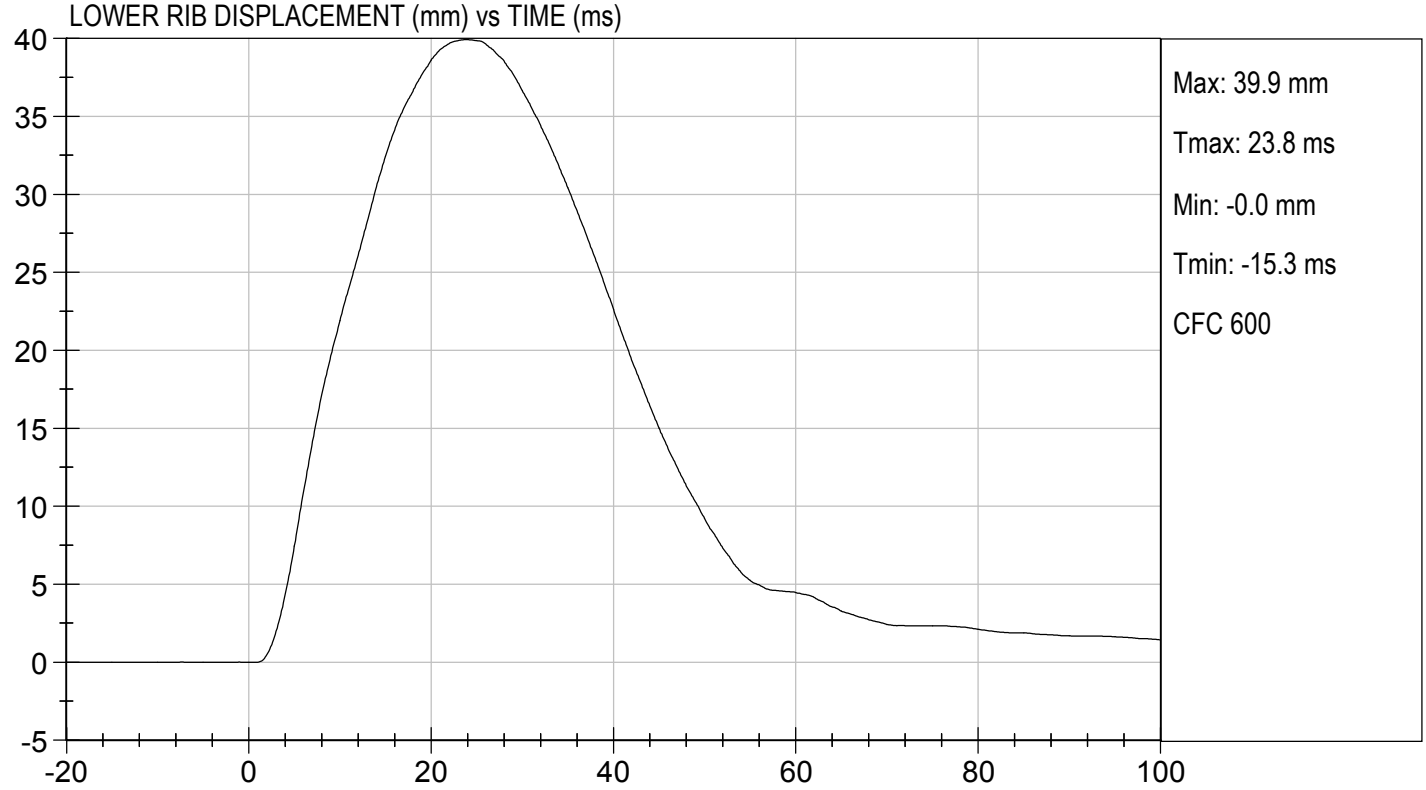
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 05/22/2019
TEST #: D191645

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



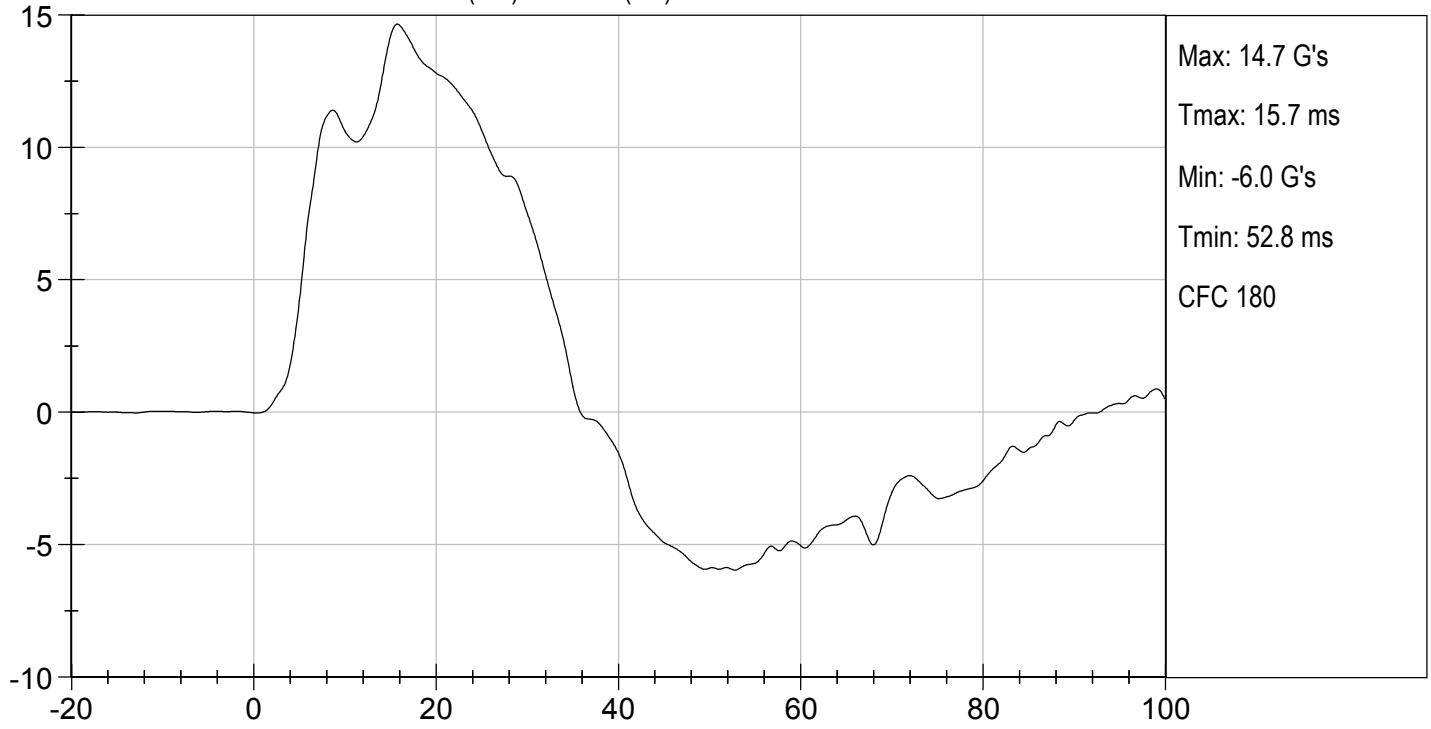
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



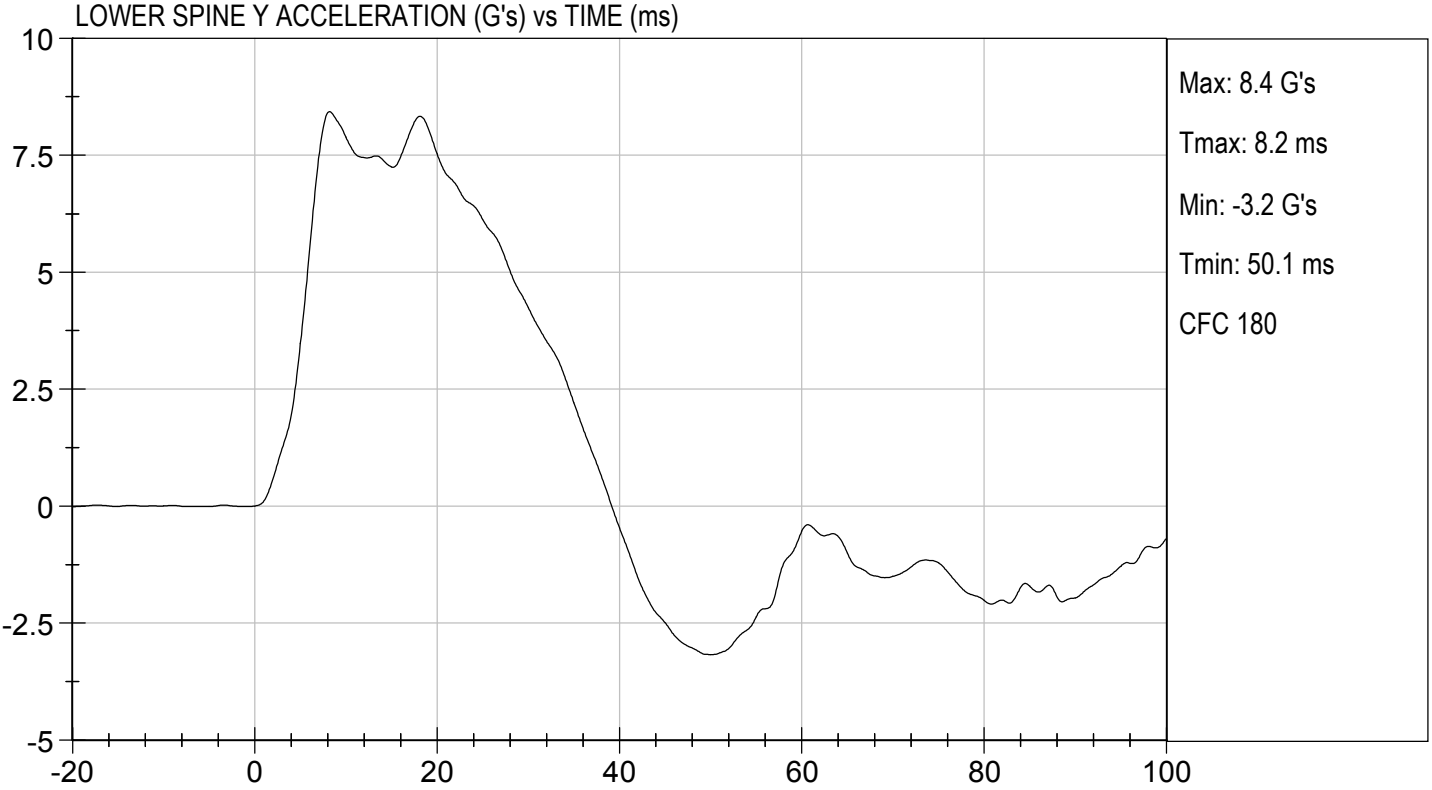
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 05/22/2019
TEST #: D191645

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:** D191646

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	47	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	12 to 16	15	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	40	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	36	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	12	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

05/22/2019

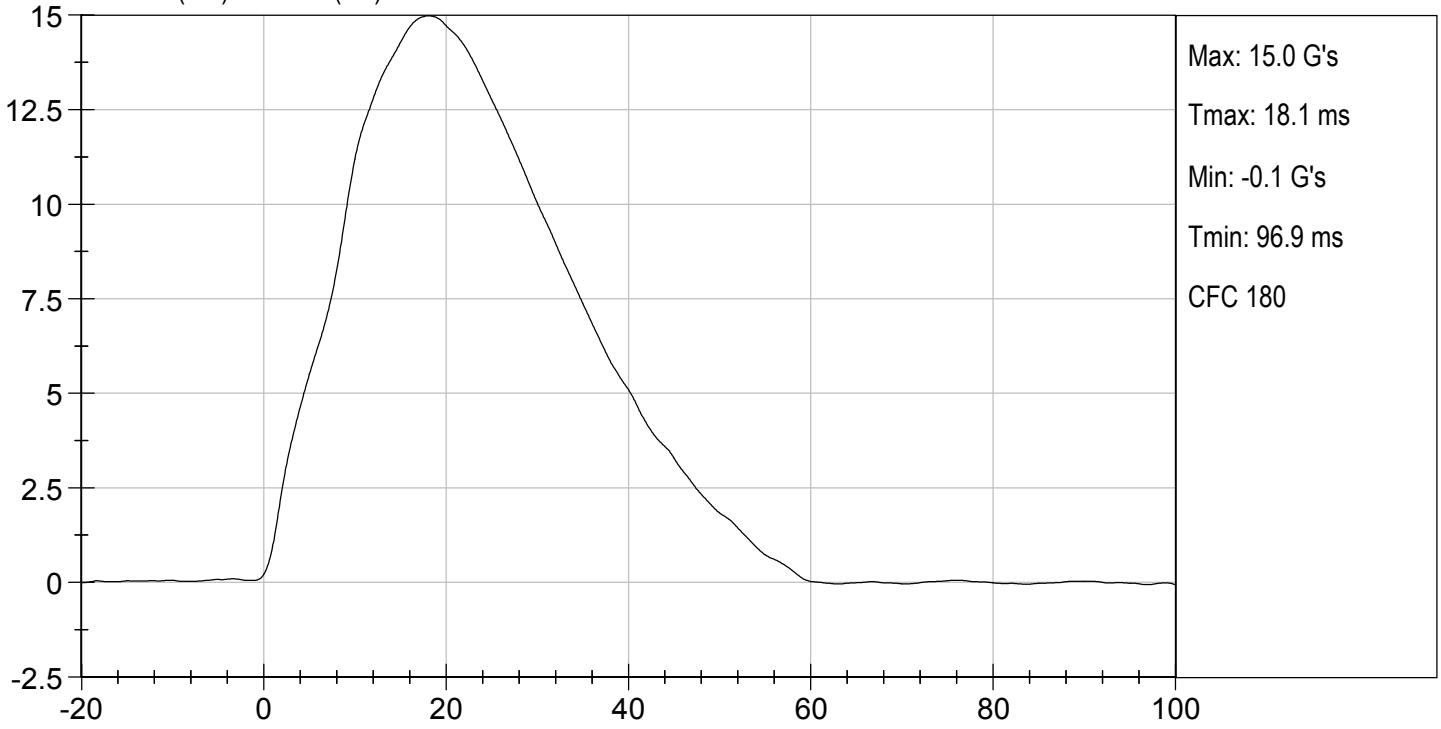
Test Date

Approved By

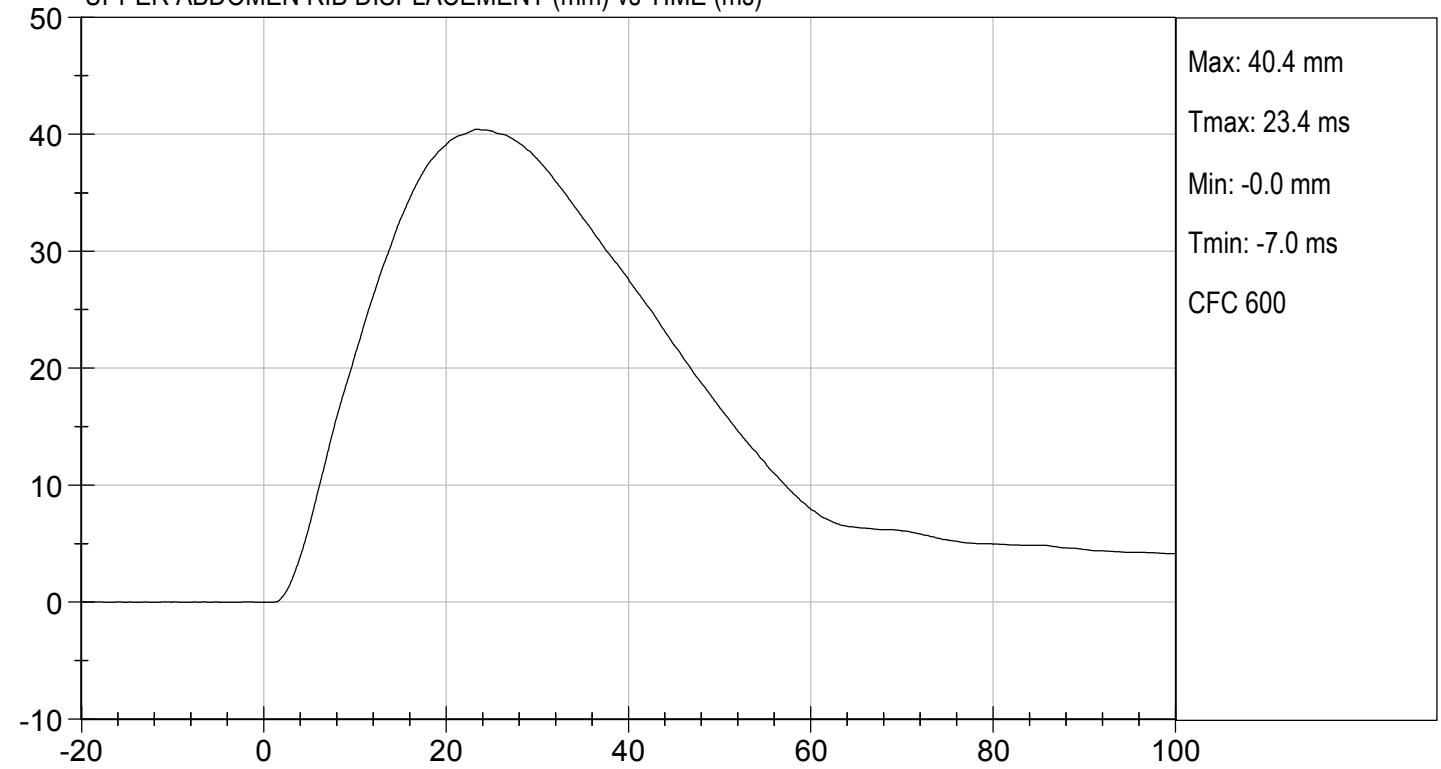
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 05/22/2019
TEST #: D191646

PROBE (G's) vs TIME (ms)



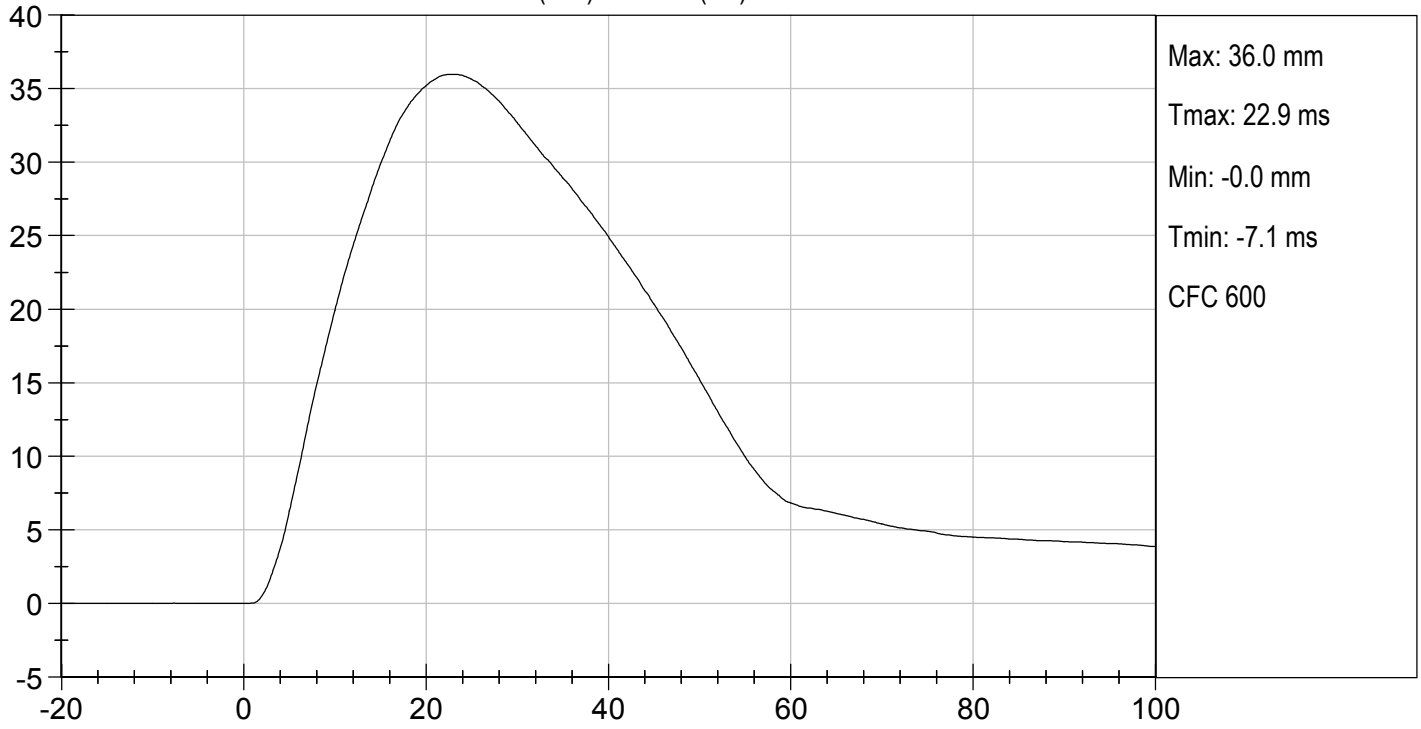
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



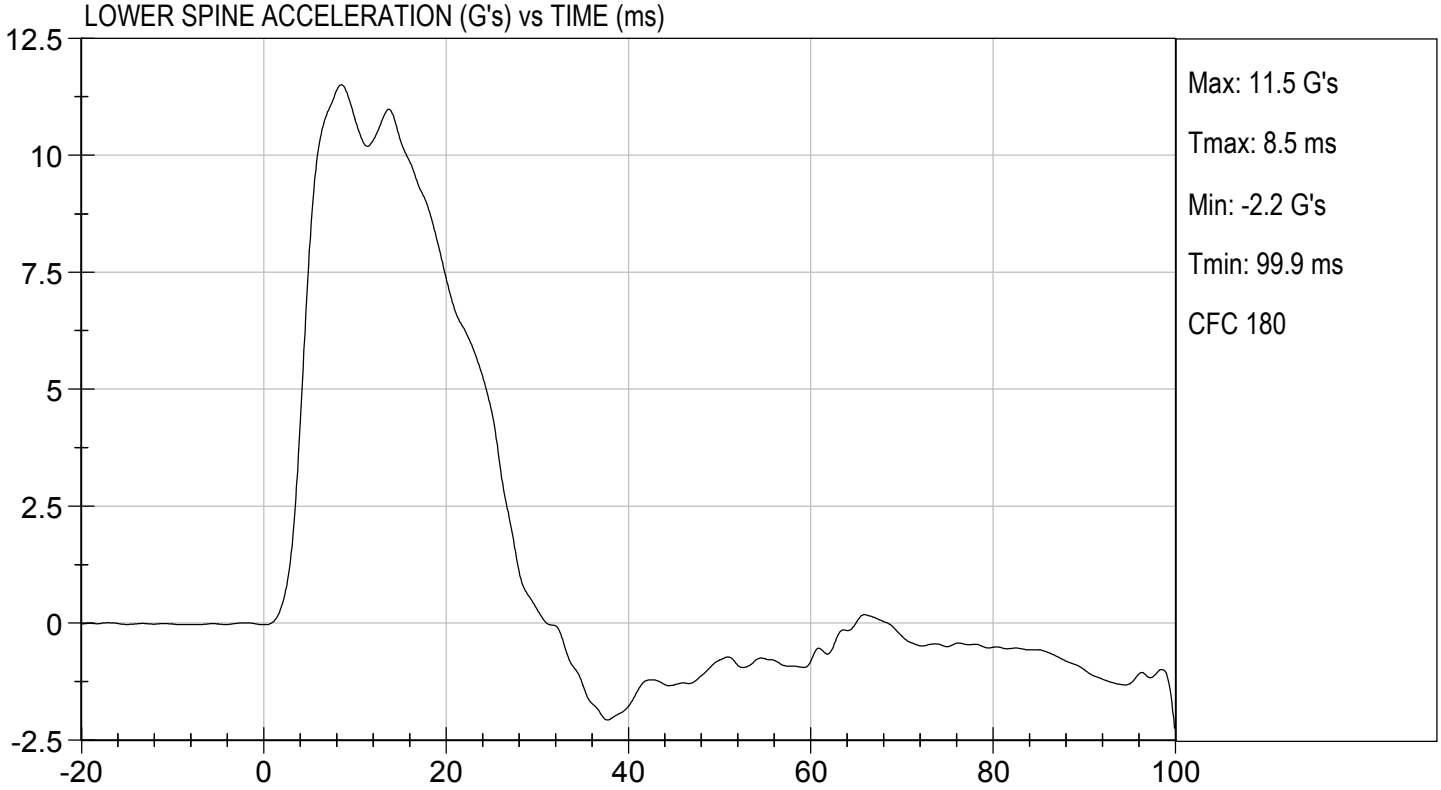
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 05/22/2019
TEST #: D191646

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:** D191647

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.9	Pass
Humidity	%	10 to 70	47	Pass
Impact Velocity	m/s	6.60 to 6.80	6.60	Pass
Maximum Probe Acceleration	G's	38 to 47	43	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	37	Pass
Peak Acetabulum Force	N	3600 to 4300	3,801	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

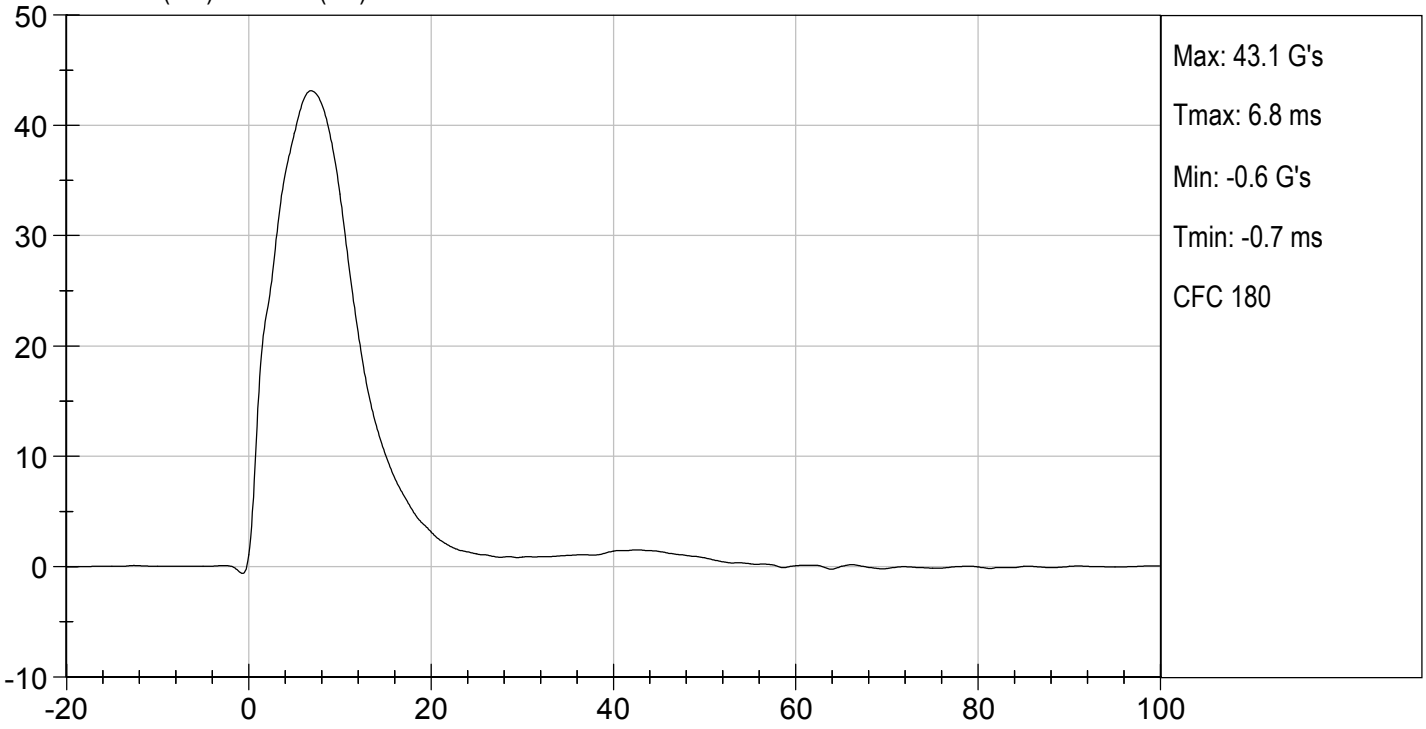
05/22/2019
Test Date

Approved By

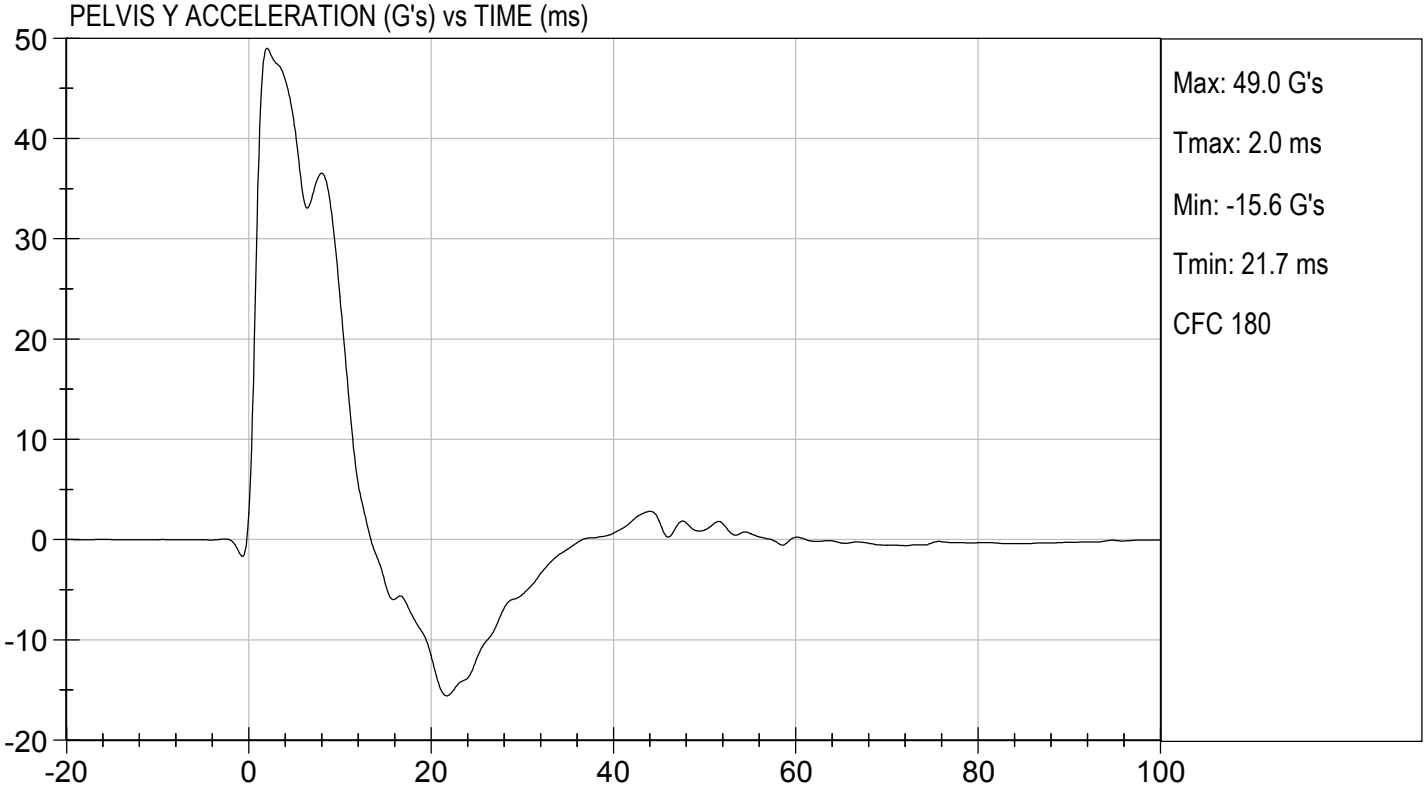
TEST DESC: PELVIS IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 05/22/2019
TEST #: D191647

PROBE (G's) vs TIME (ms)



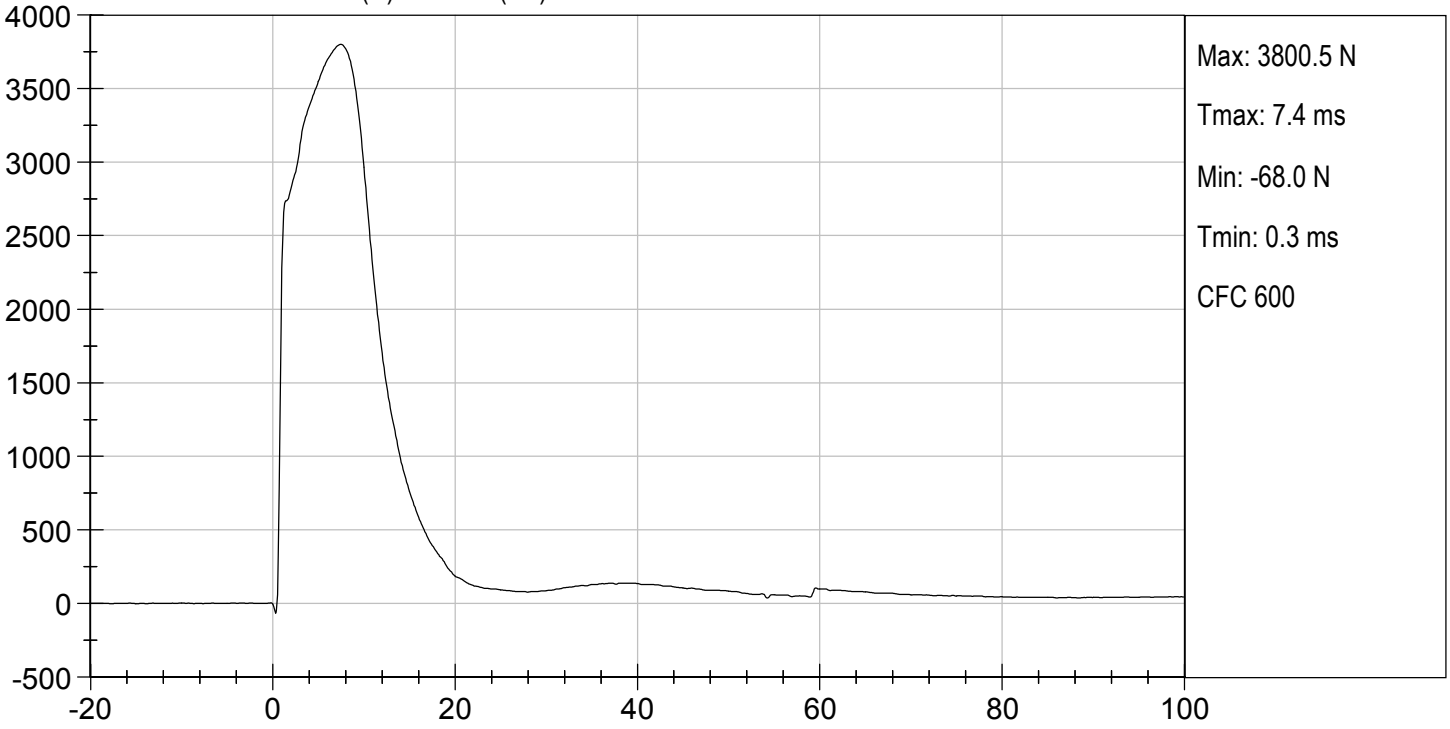
PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 05/22/2019
TEST #: D191647

ACETABULUM FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D191648

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Humidity	%	10 to 70	41	Pass
Impact Velocity	m/s	4.20 to 4.40	4.39	Pass
Maximum Probe Acceleration	G's	36 to 45	38	Pass
Pelvis Y Acceleration	G's	28 to 39	31	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,450	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

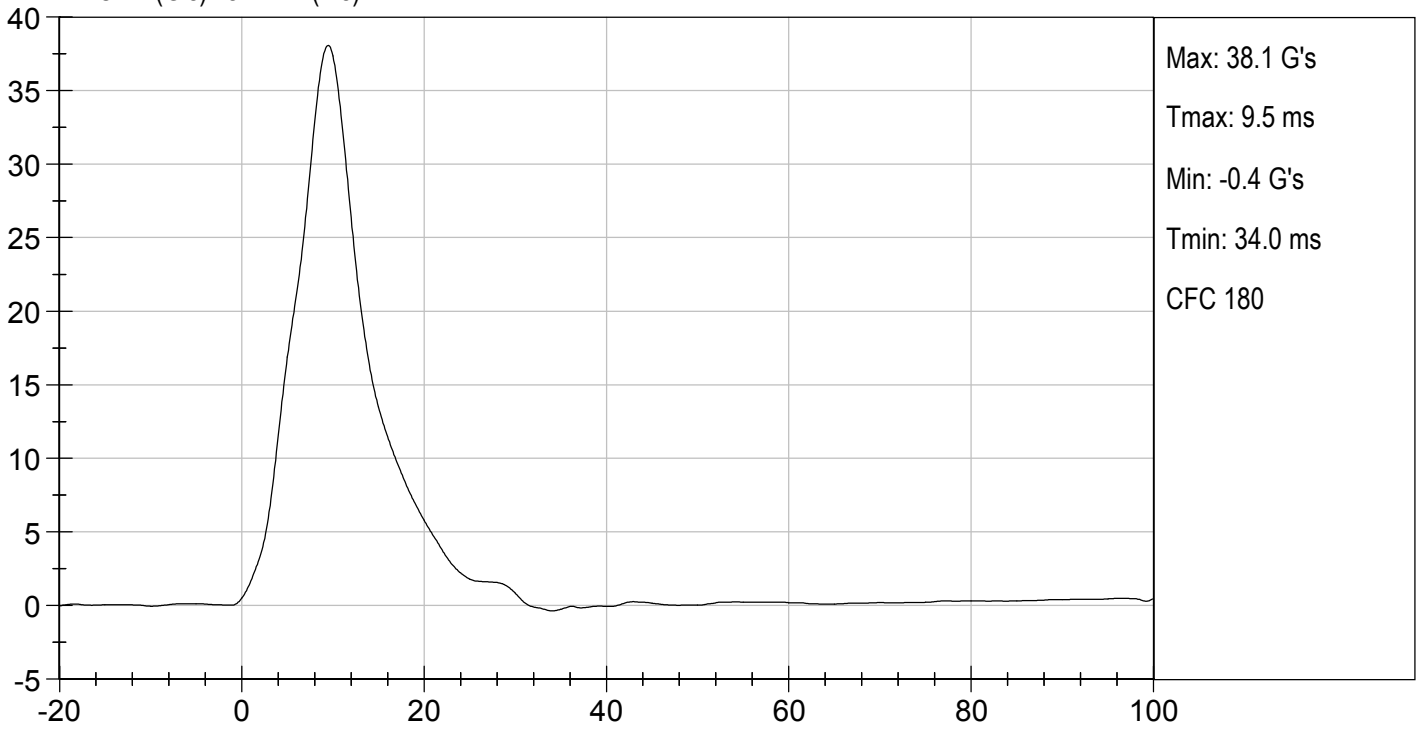
05/22/2019
Test Date

Approved By

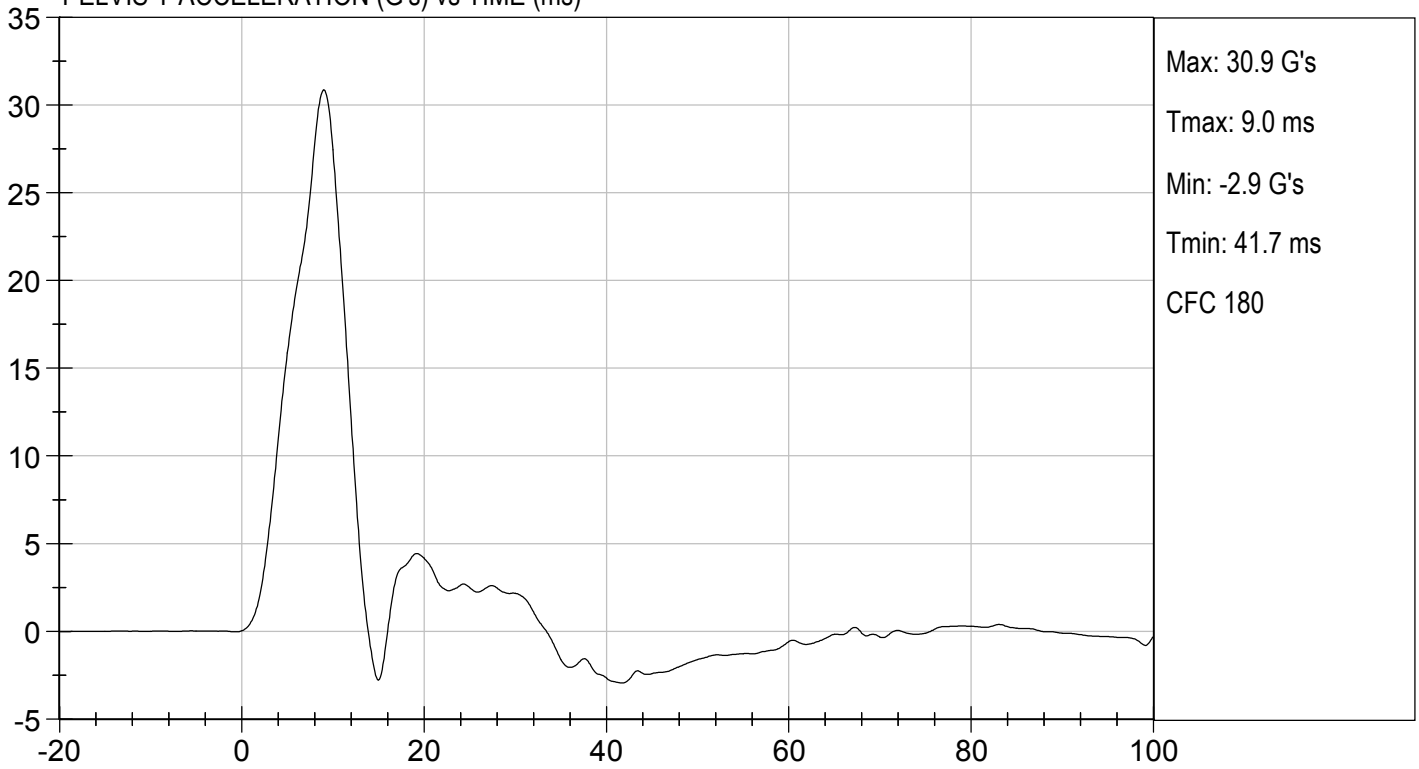
TEST DESC: ILLIAC
VELOCITY: 14.40 ft/s, 4.39 m/s

TEST DATE: 05/22/2019
TEST #: D191648

PROBE (G's) vs TIME (ms)

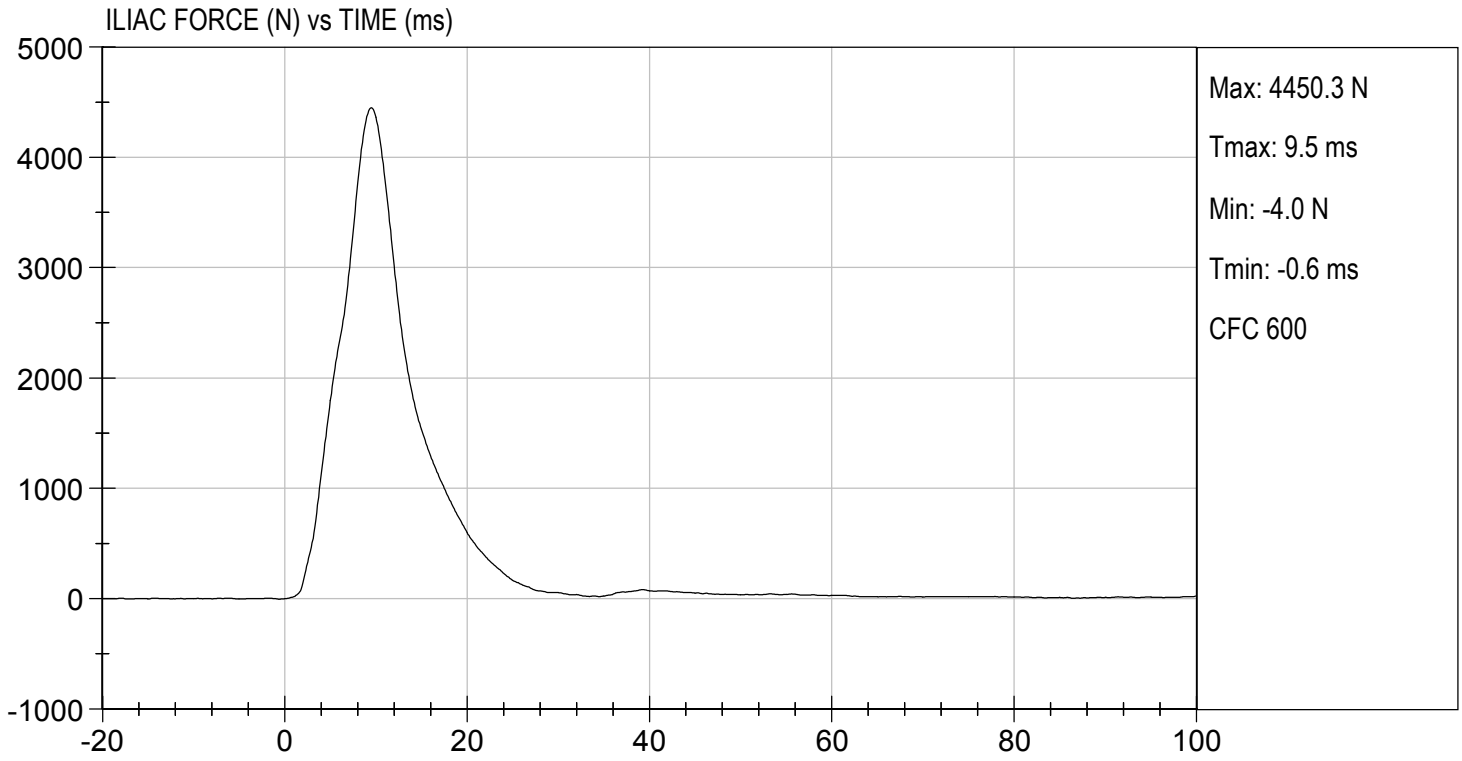


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: ILLIAC
VELOCITY: 14.40 ft/s, 4.39 m/s

TEST DATE: 05/22/2019
TEST #: D191648



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:** D191701

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	52	Pass
Peak Resultant Acceleration	G's	115 to 137	119	Pass
Peak Longitudinal Acceleration	G's	+/- 15	3.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Danielle Redenbaugh
Laboratory Technician

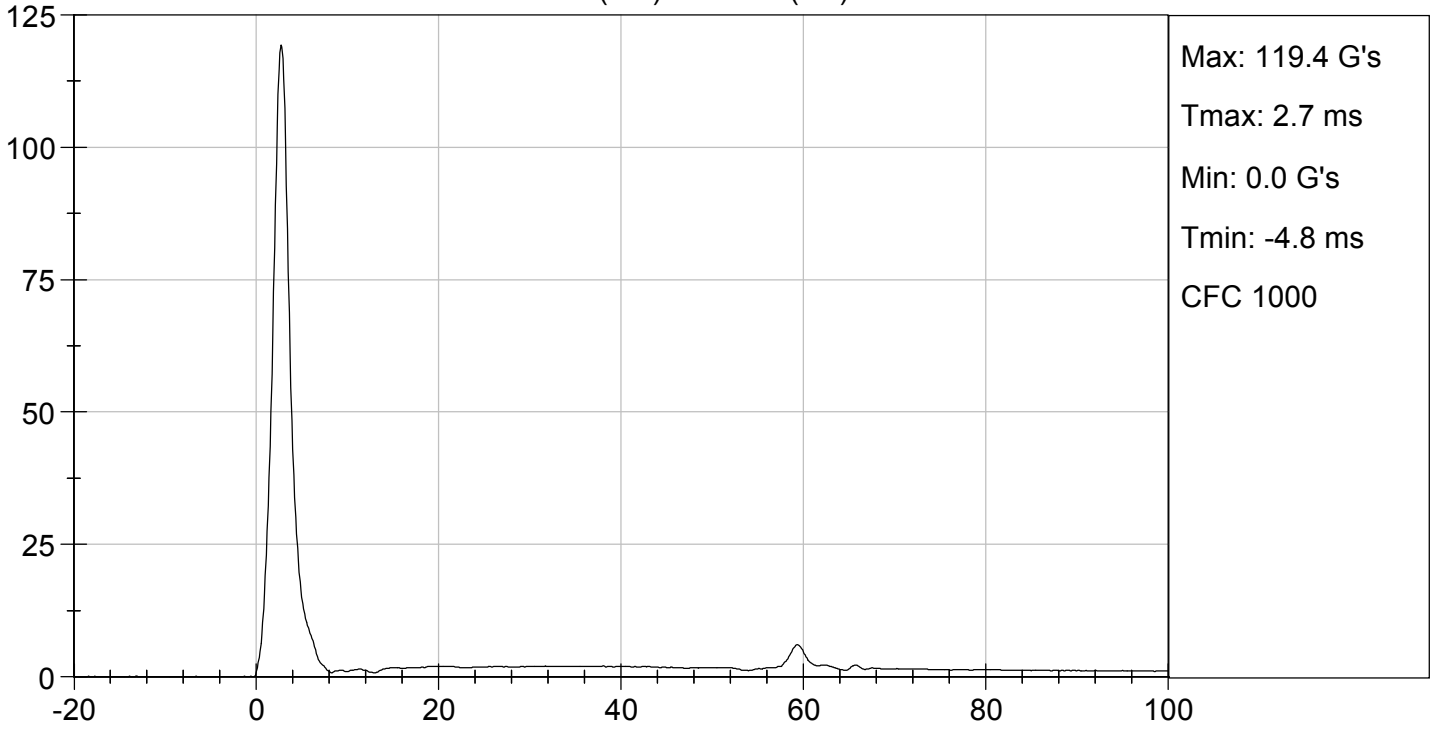
05/31/2019
Test Date

Approved By

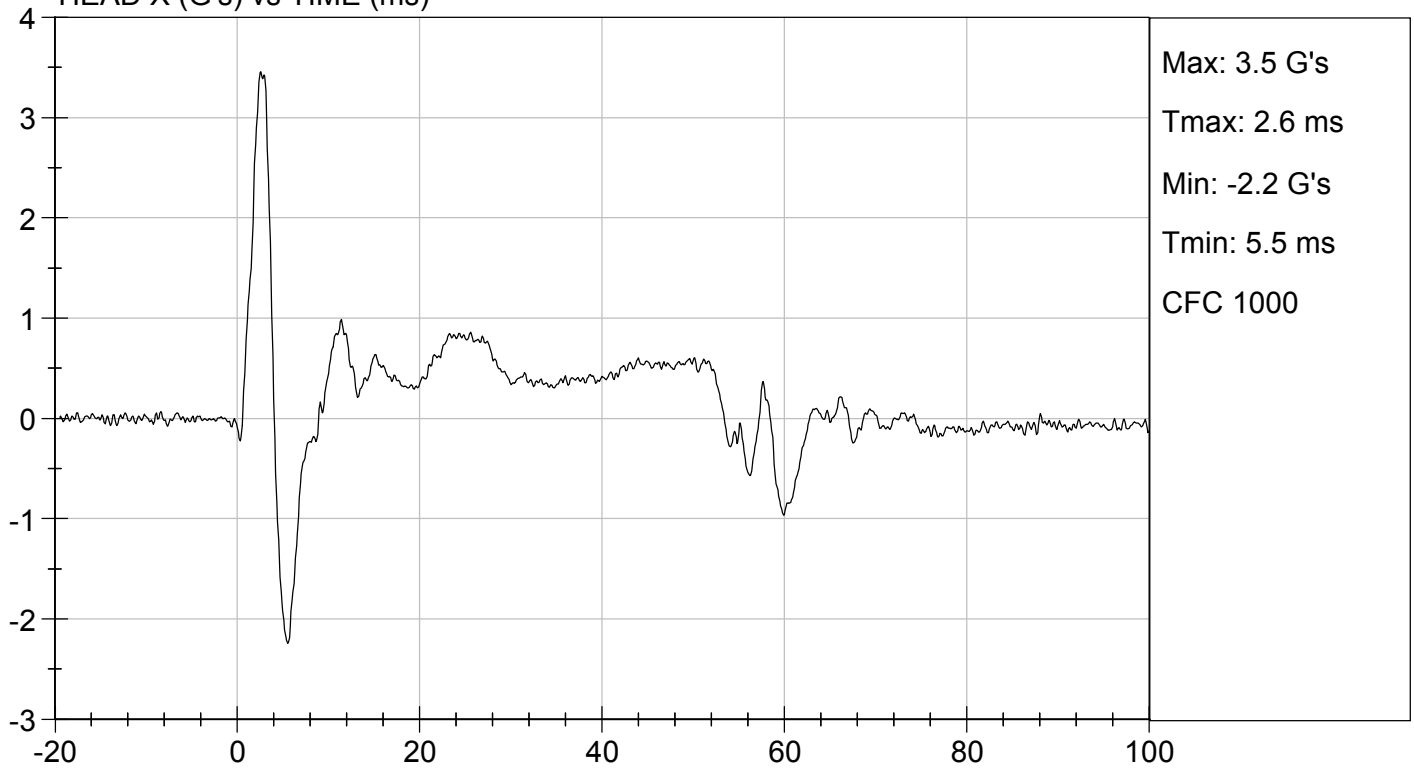
TEST DESC: HEAD DROP

TEST DATE: 05/31/2019
TEST #: D191701

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

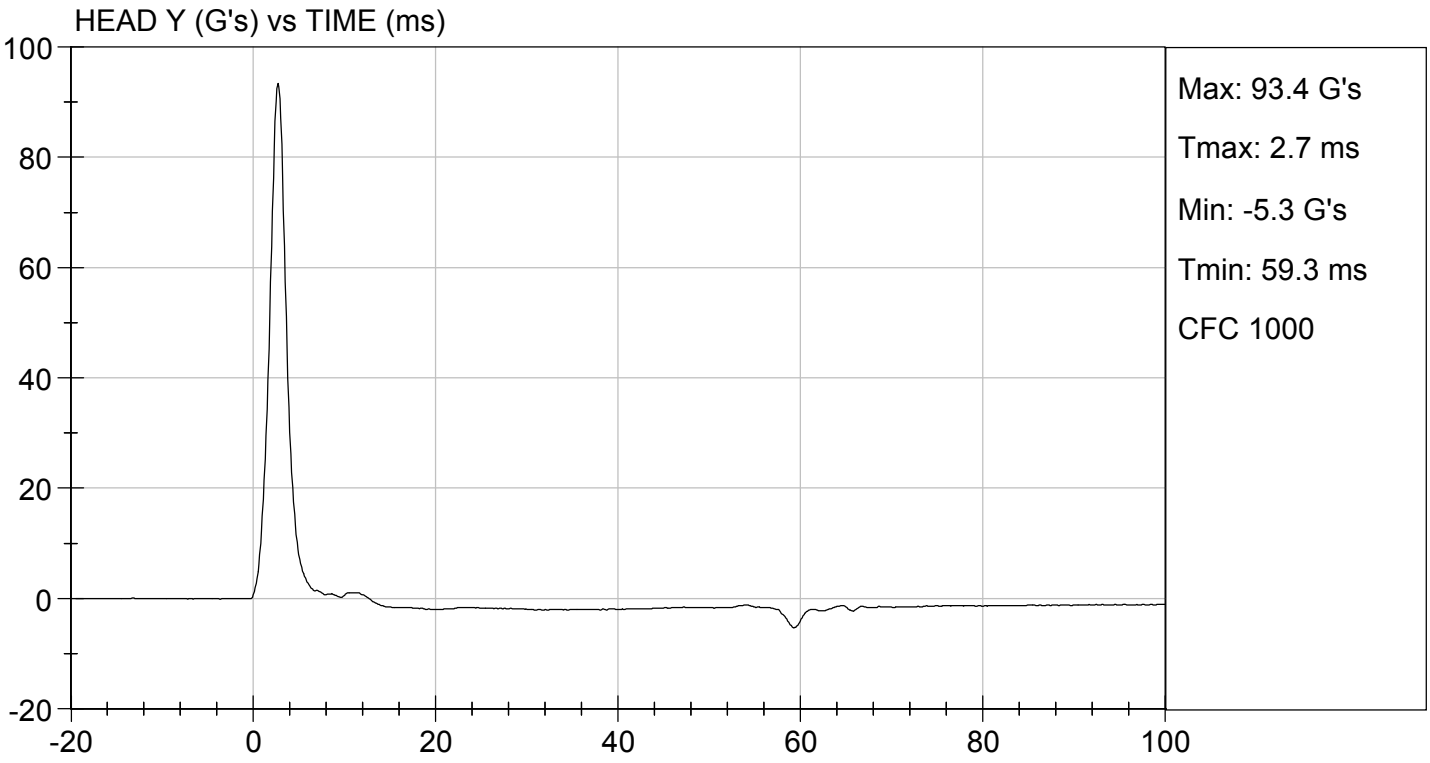


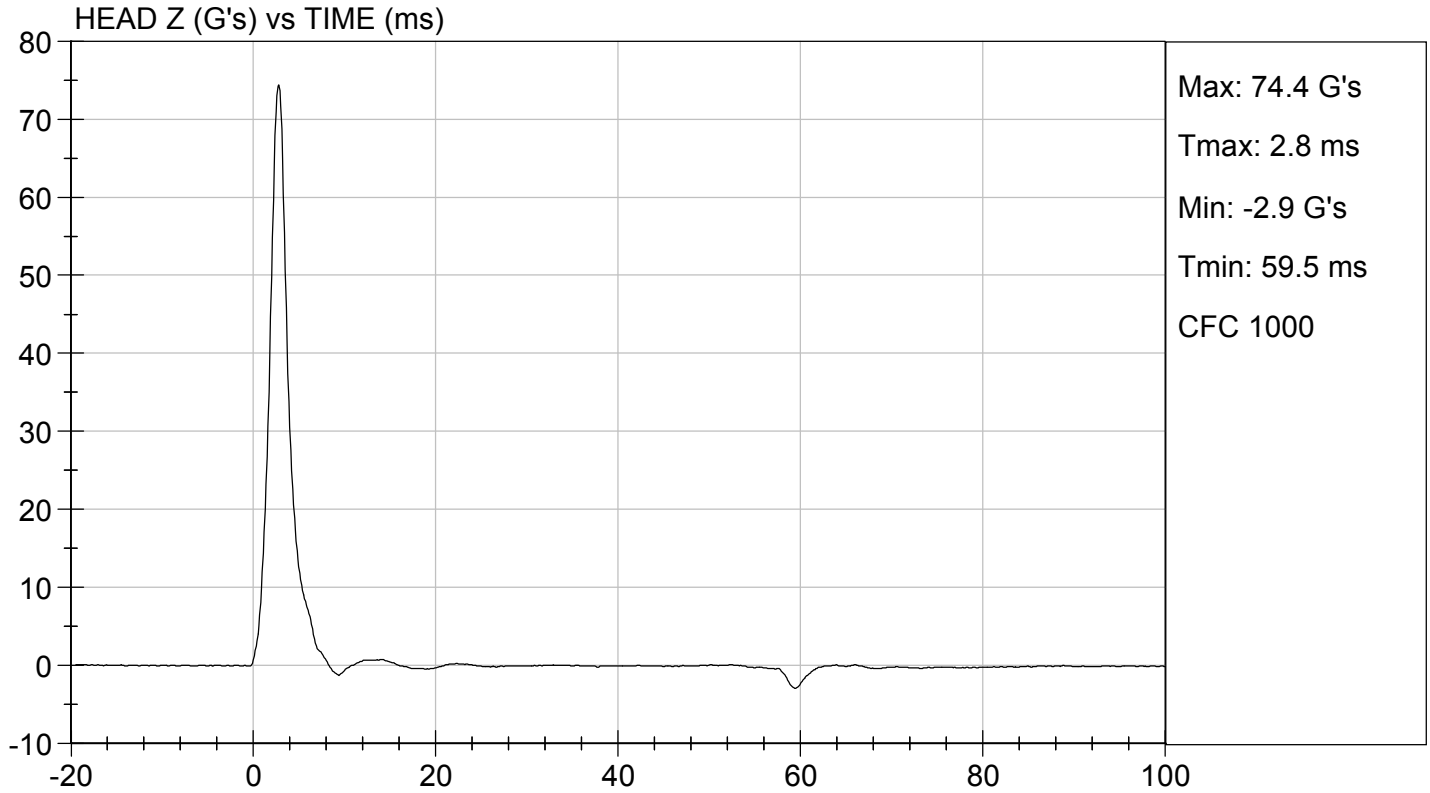
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 05/31/2019
TEST #: D191701





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D191702

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.7	Pass
Humidity		%	10 to 70	52	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.29	Pass
	15 ms	m/s	3.30 to 4.10	3.44	Pass
	20 ms	m/s	4.40 to 5.40	4.83	Pass
	25 ms	m/s	5.40 to 6.10	5.71	Pass
	25-100 ms	m/s	5.50 to 6.20	5.72	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	61	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-39	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	113	Pass
			Overall Test Results		Pass

Danielle Redinbaugh

Laboratory Technician

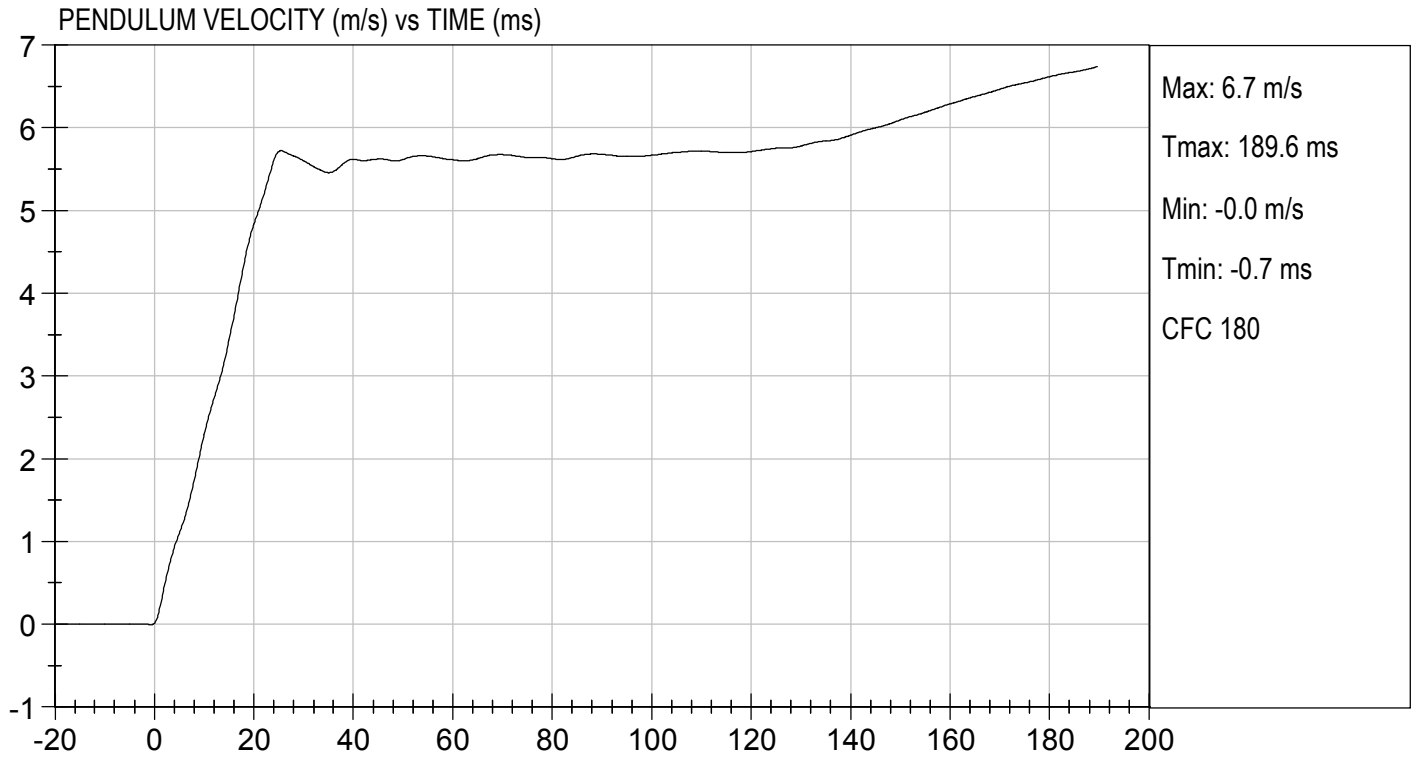
05/31/2019

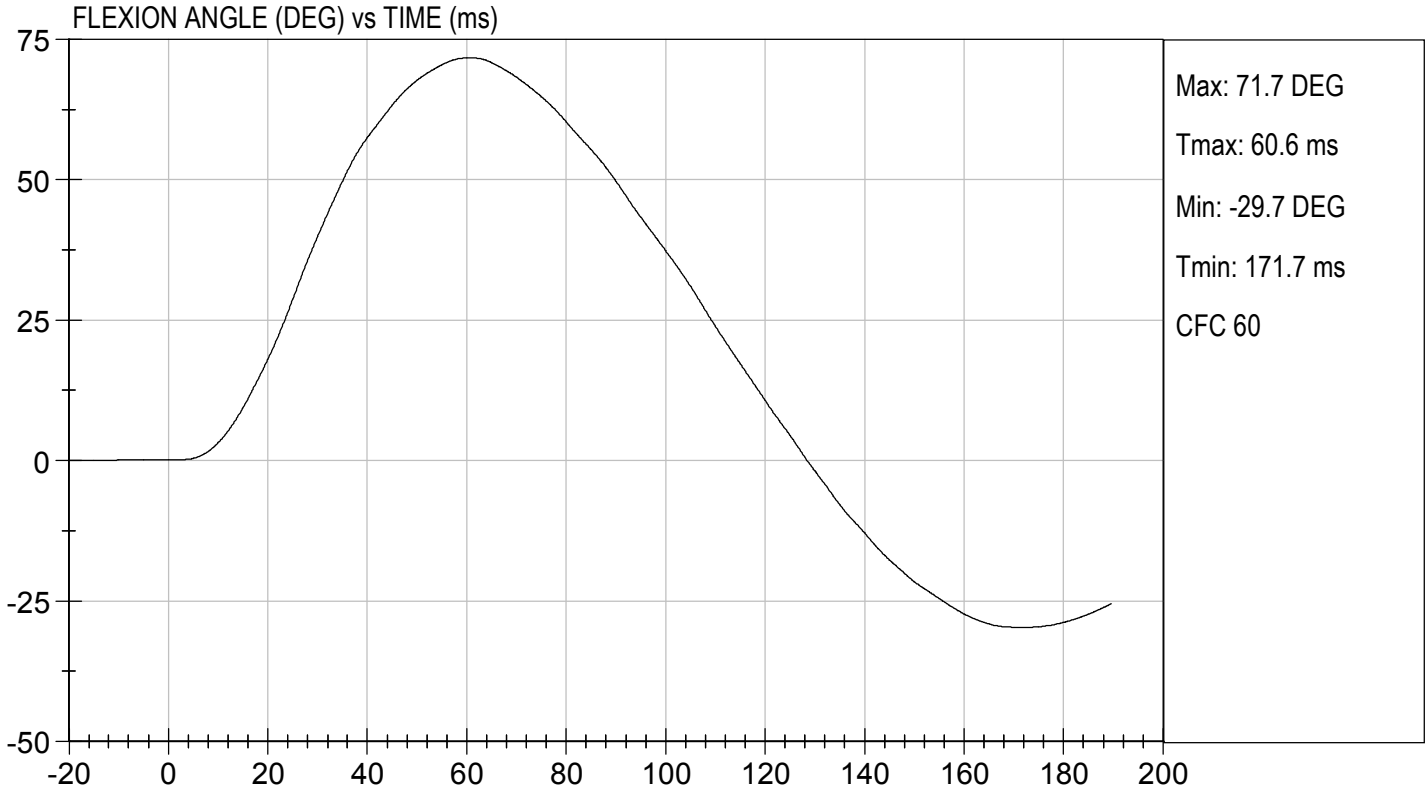
Test Date

Approved By

TEST DESC: NECK BENDING
VELOCITY: 18.30 ft/s, 5.58 m/s

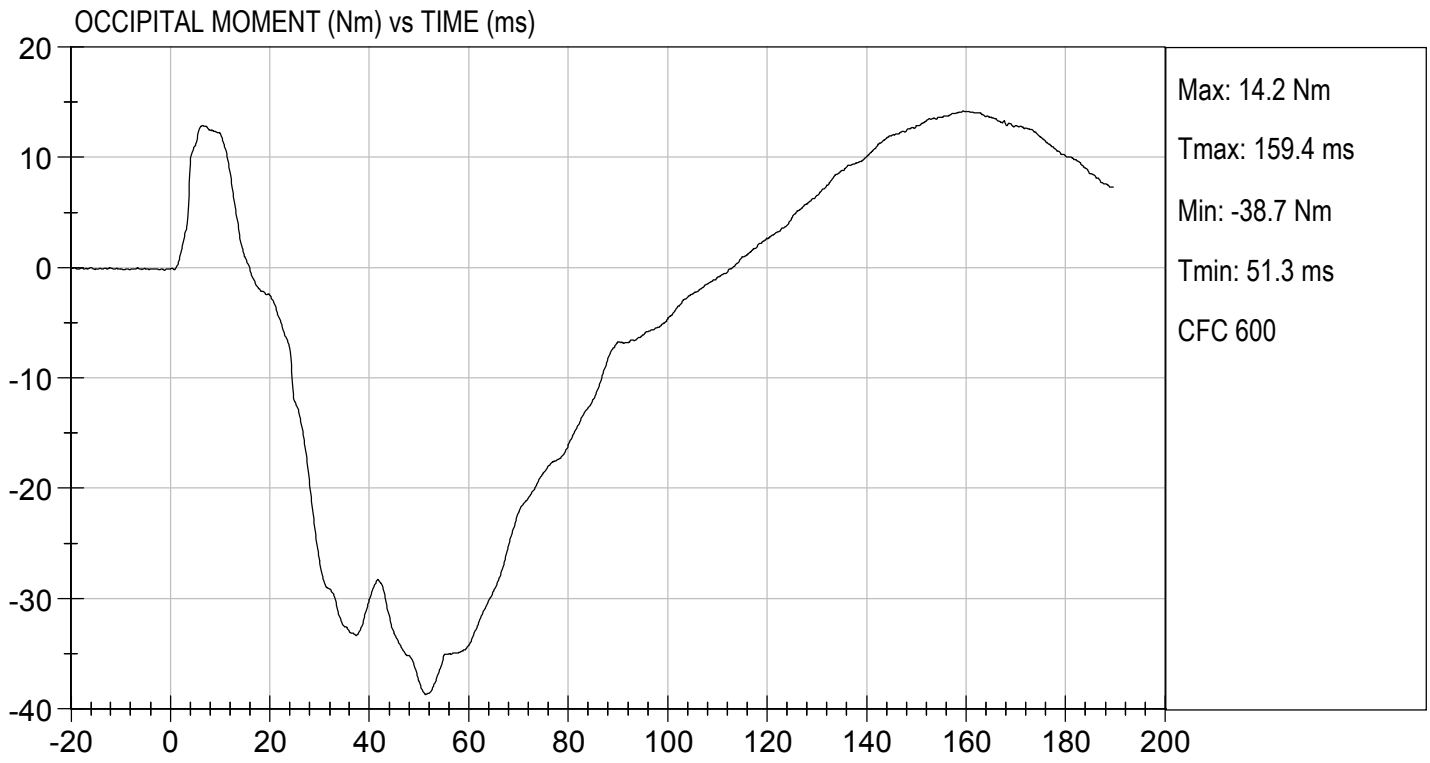
TEST DATE: 05/31/2019
TEST #: D191702





TEST DESC: NECK BENDING
VELOCITY: 18.30 ft/s, 5.58 m/s

TEST DATE: 05/31/2019
TEST #: D191702



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D191703

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	13 to 18	14	Pass
Shoulder Displacement	mm	28 to 37	31	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	20	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

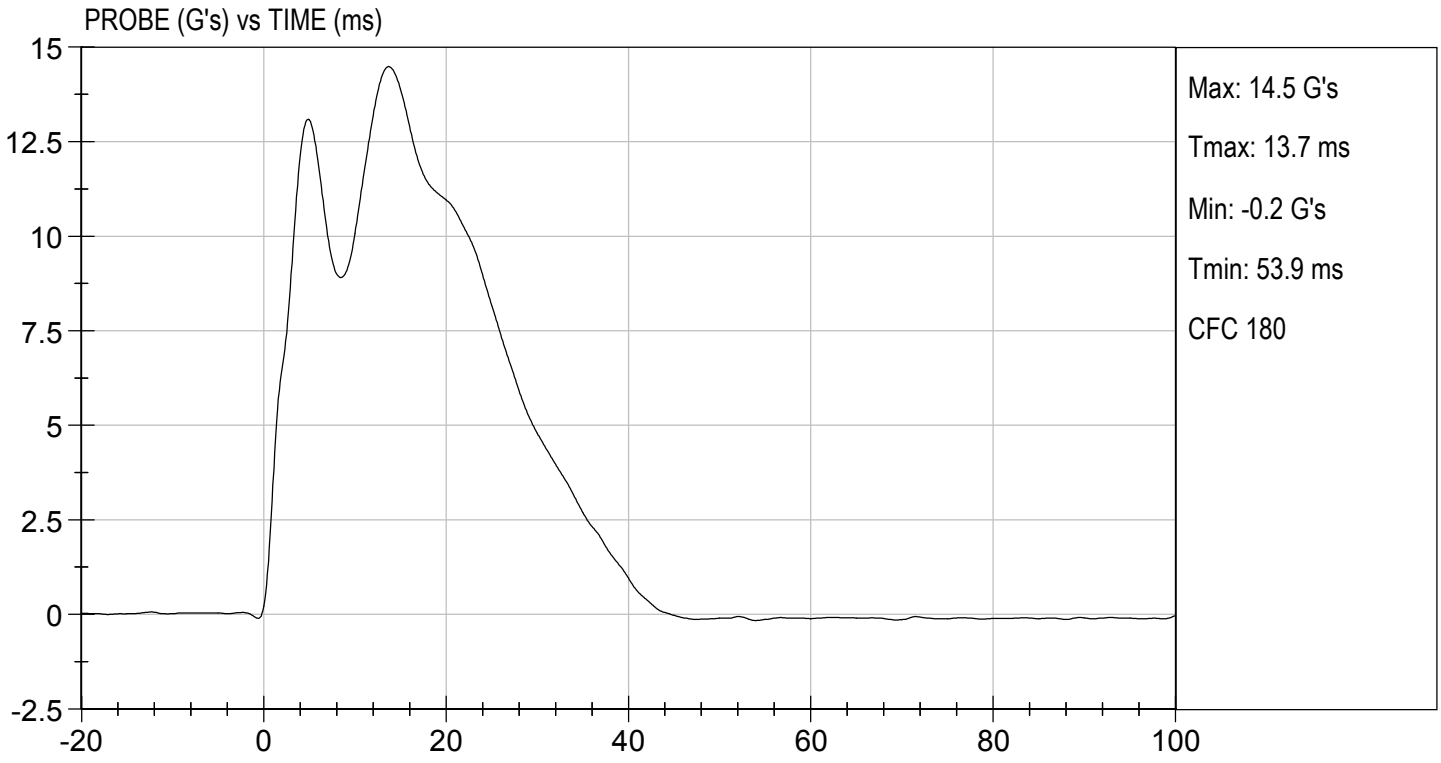
05/31/2019

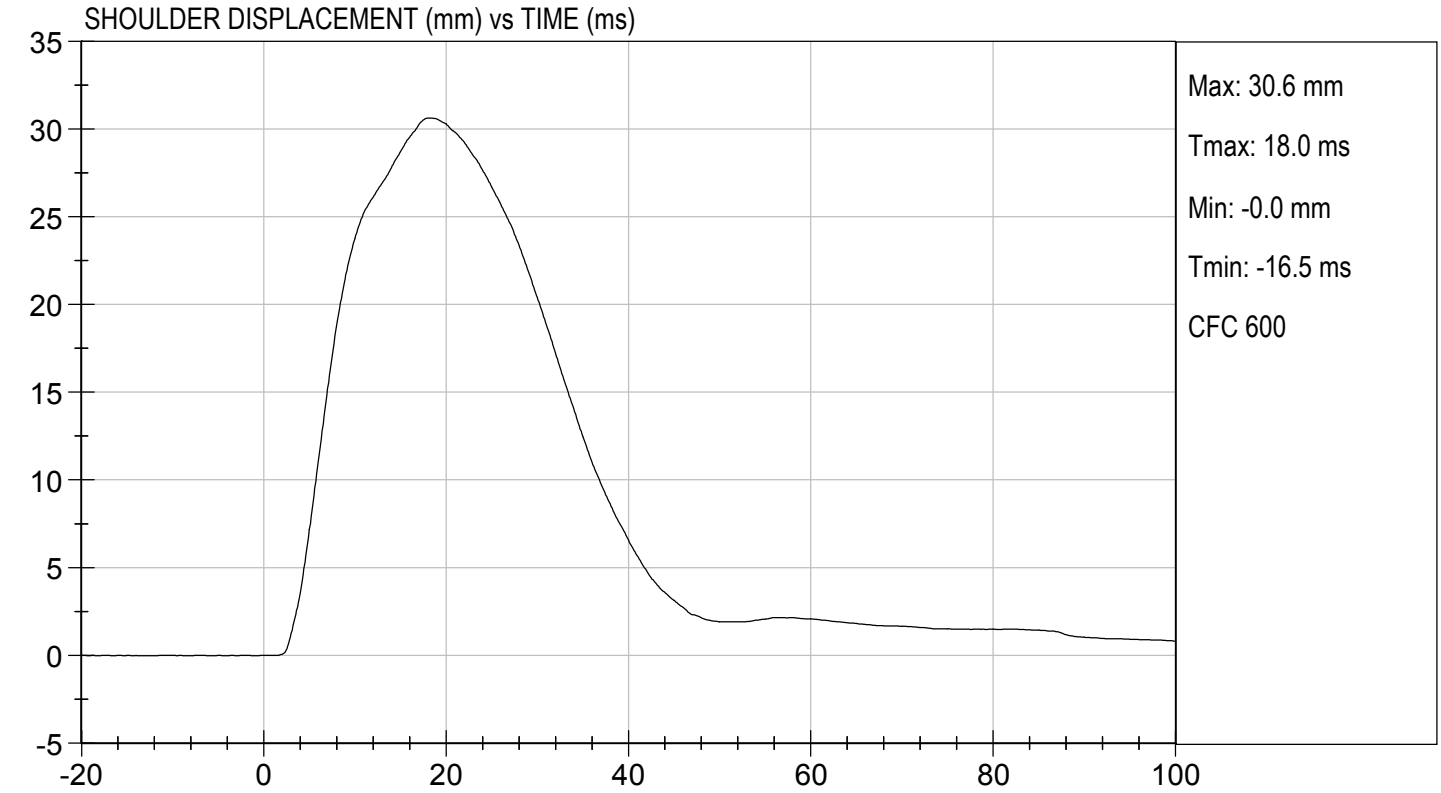
Test Date

Approved By

TEST DESC: SHOULDER IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

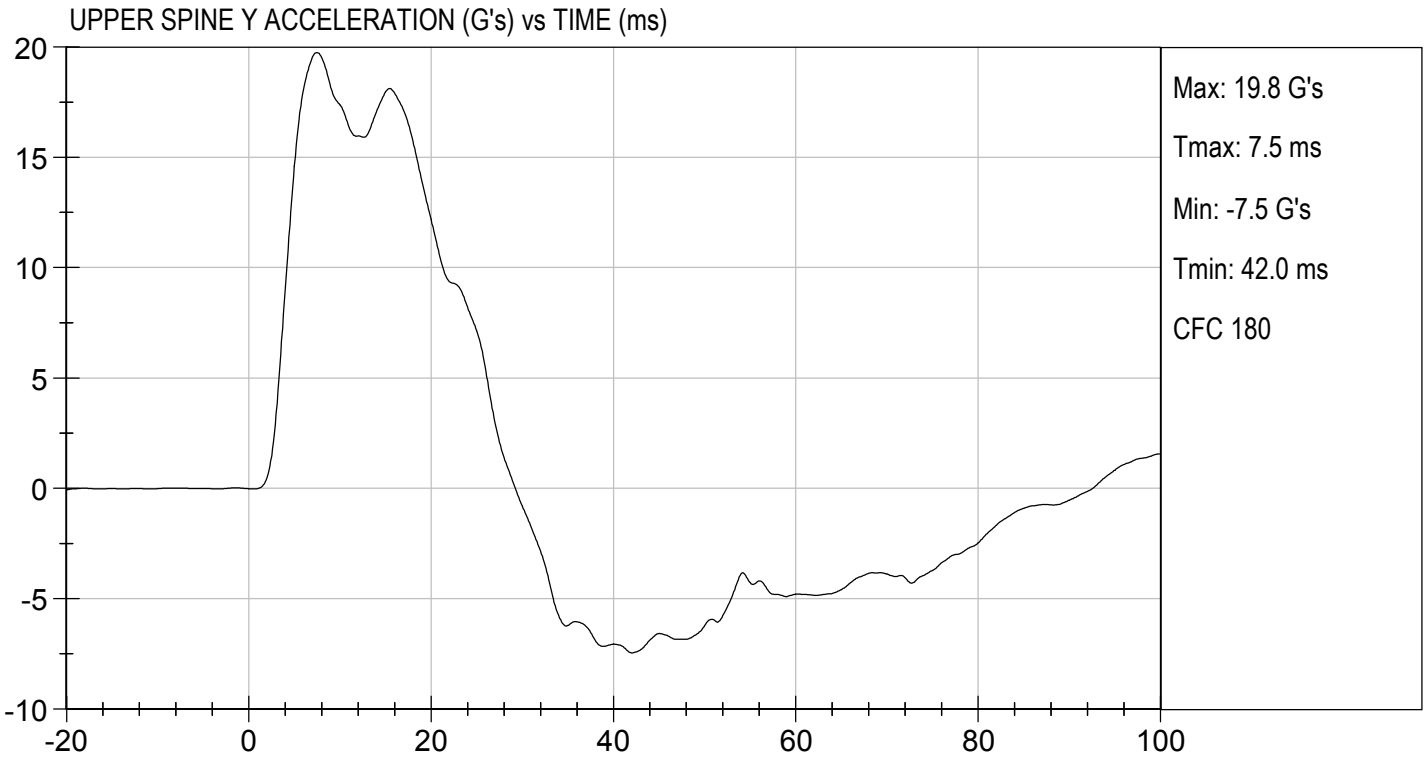
TEST DATE: 05/31/2019
TEST #: D191703





TEST DESC: SHOULDER IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 05/31/2019
TEST #: D191703



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D191704

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	51	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	37	Pass
Upper Rib Displacement	mm	25 to 32	28	Pass
Middle Rib Displacement	mm	30 to 36	30	Pass
Lower Rib Displacement	mm	32 to 38	32	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	38	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	34	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

05/31/2019

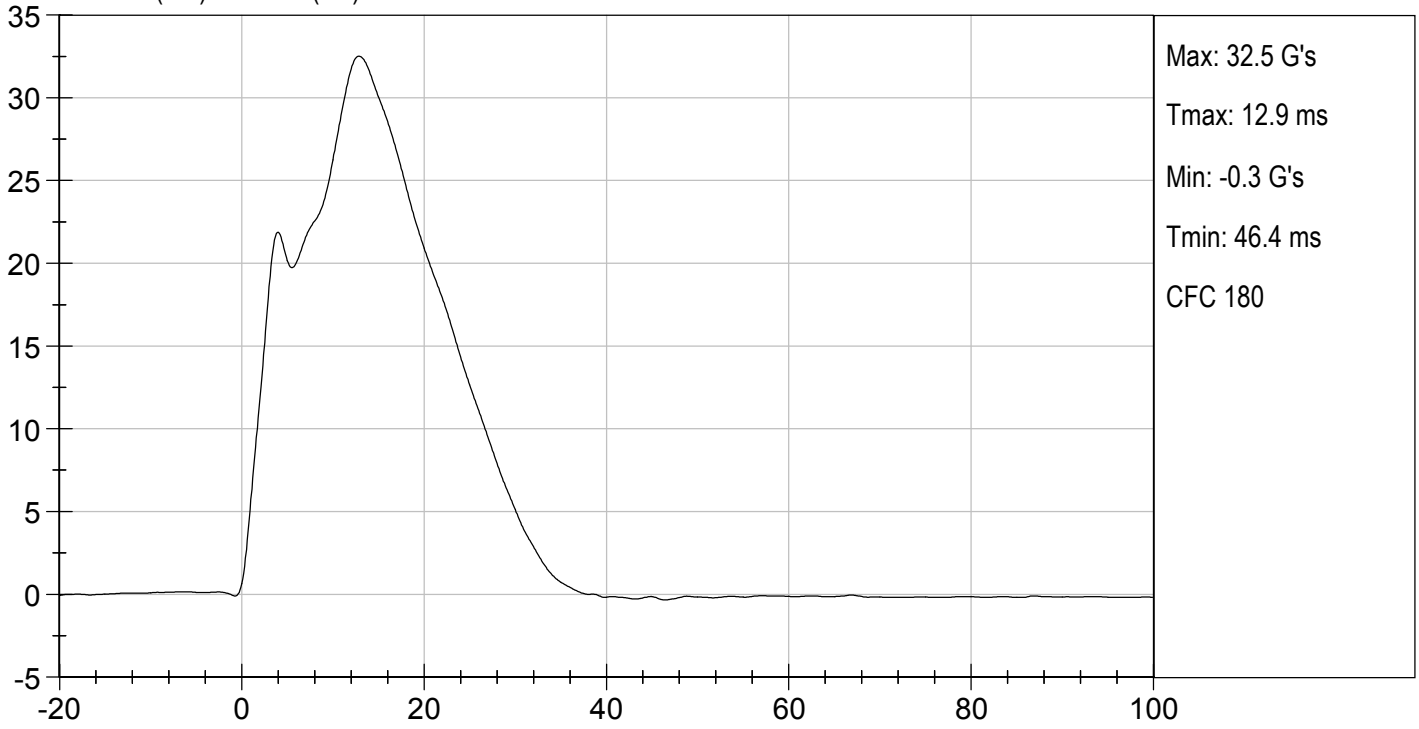
Test Date

Approved By

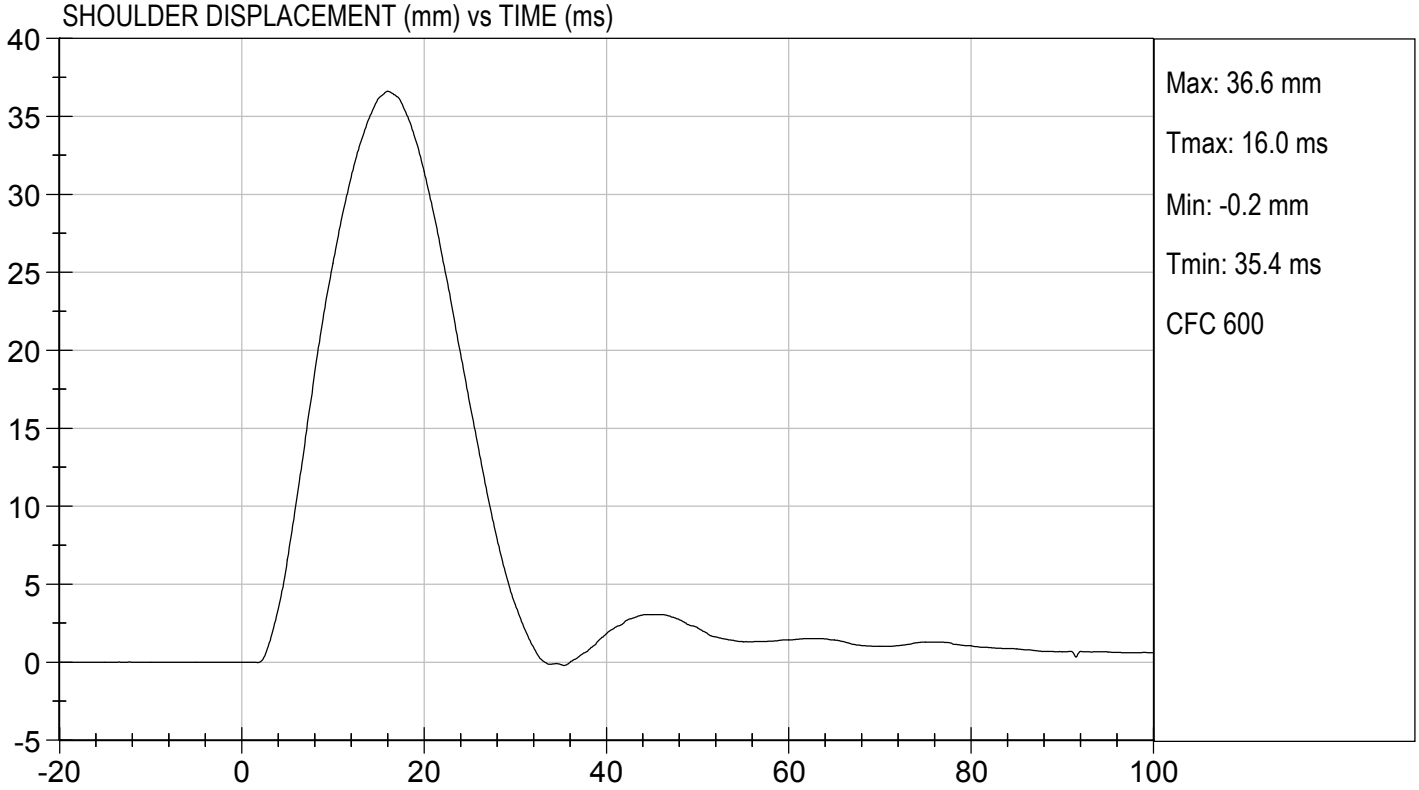
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 05/31/2019
TEST #: D191704

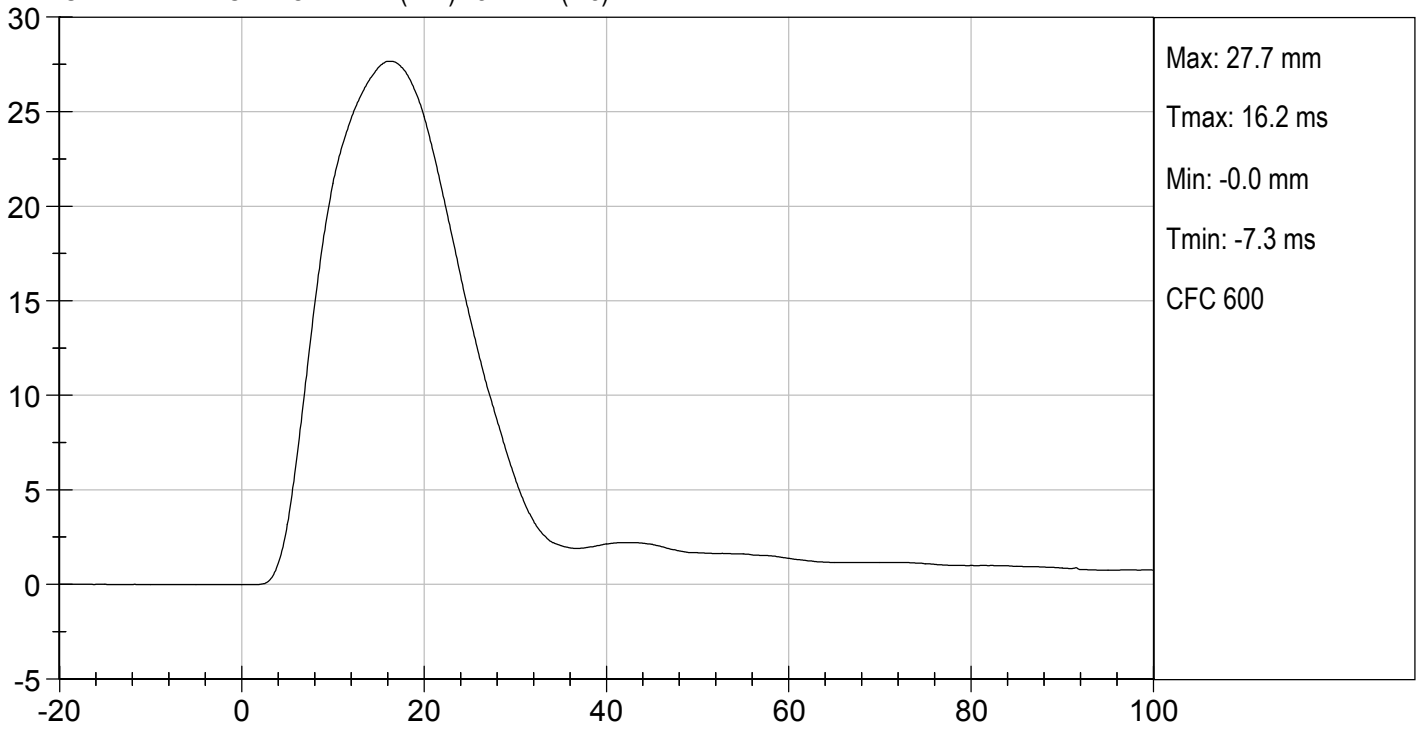
PROBE (G's) vs TIME (ms)



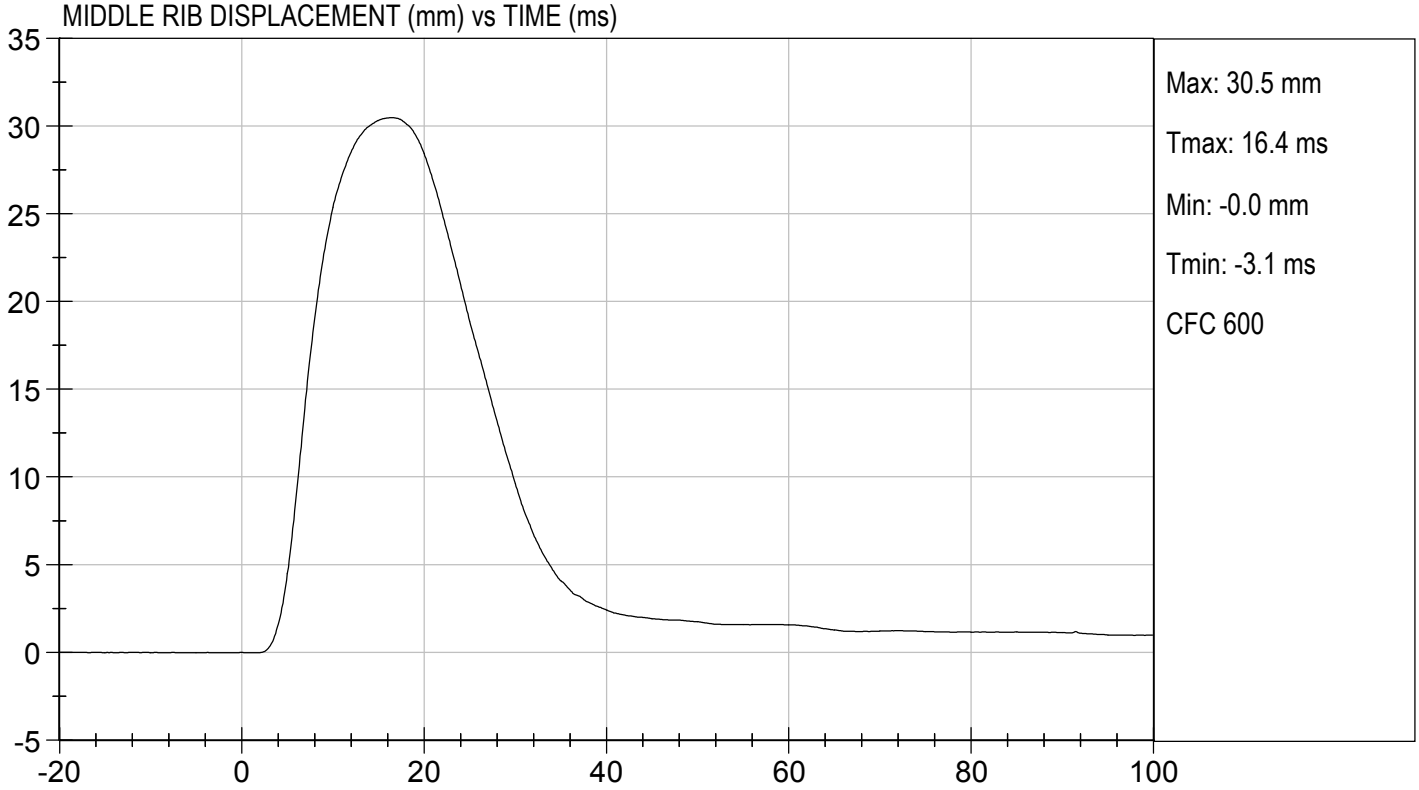
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



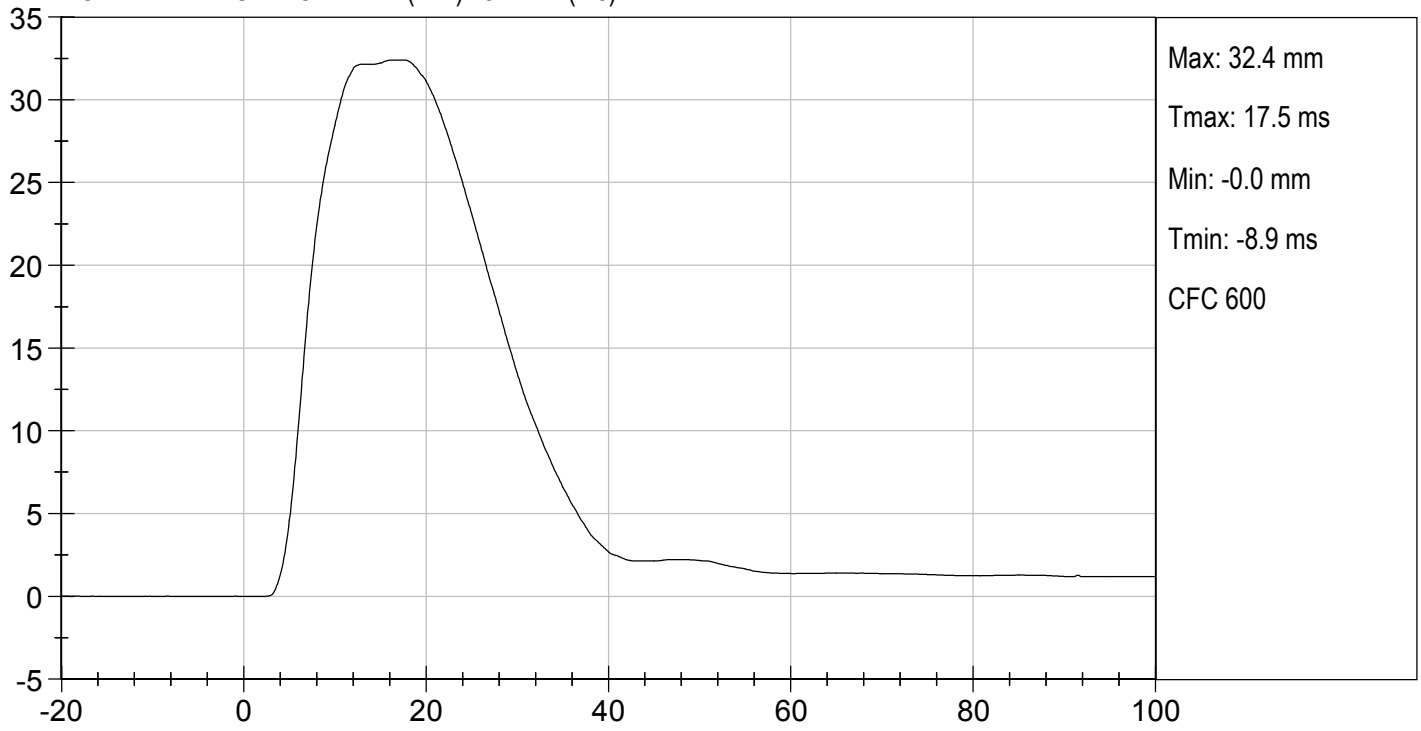
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



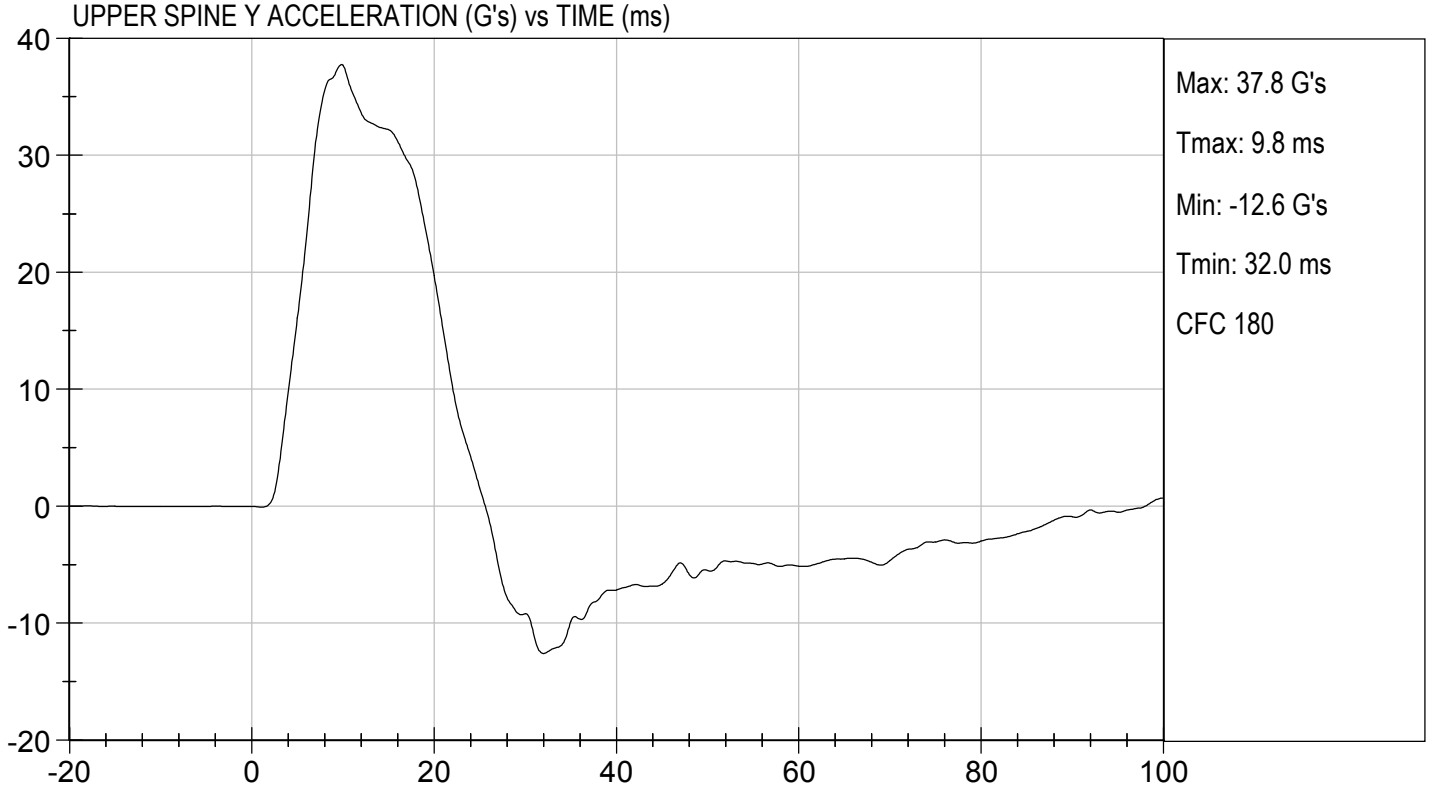
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 05/31/2019
TEST #: D191704

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



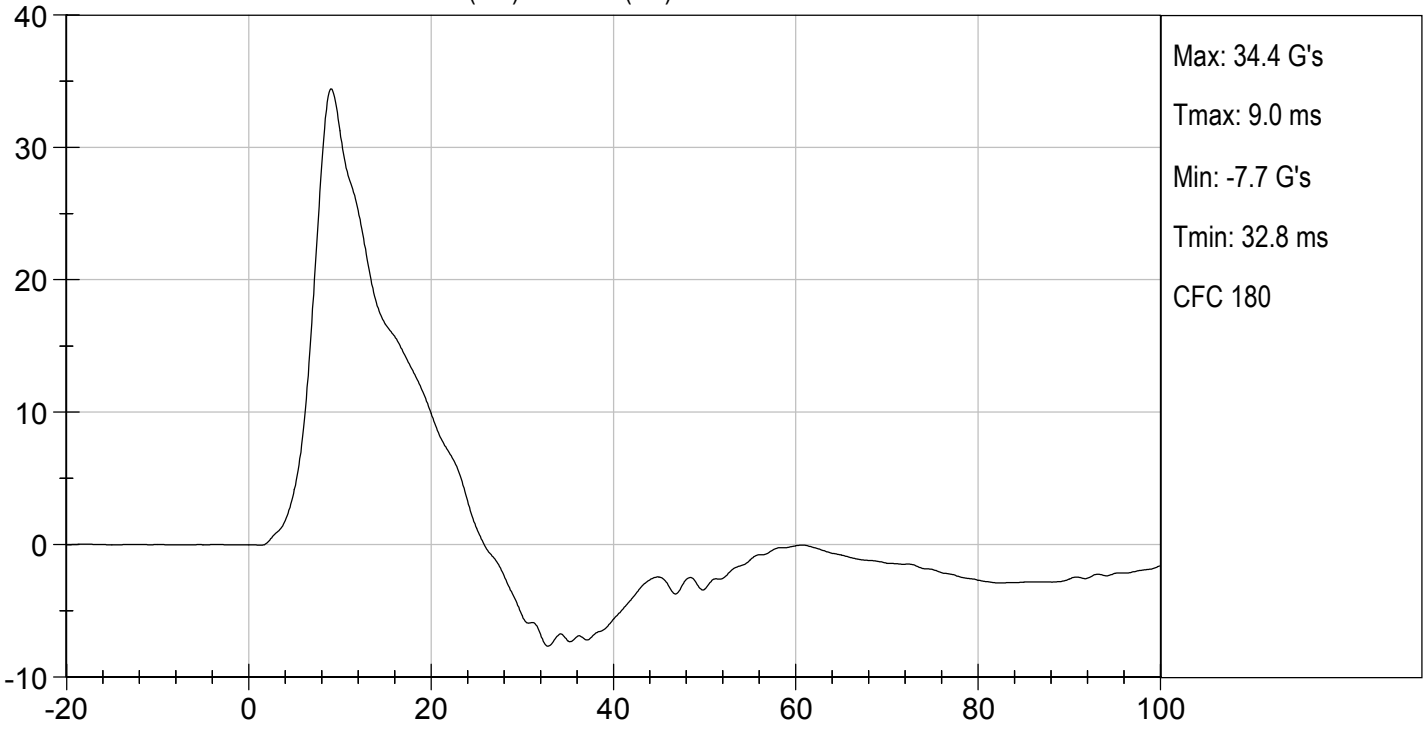
UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 05/31/2019
TEST #: D191704

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:** D191705

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	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

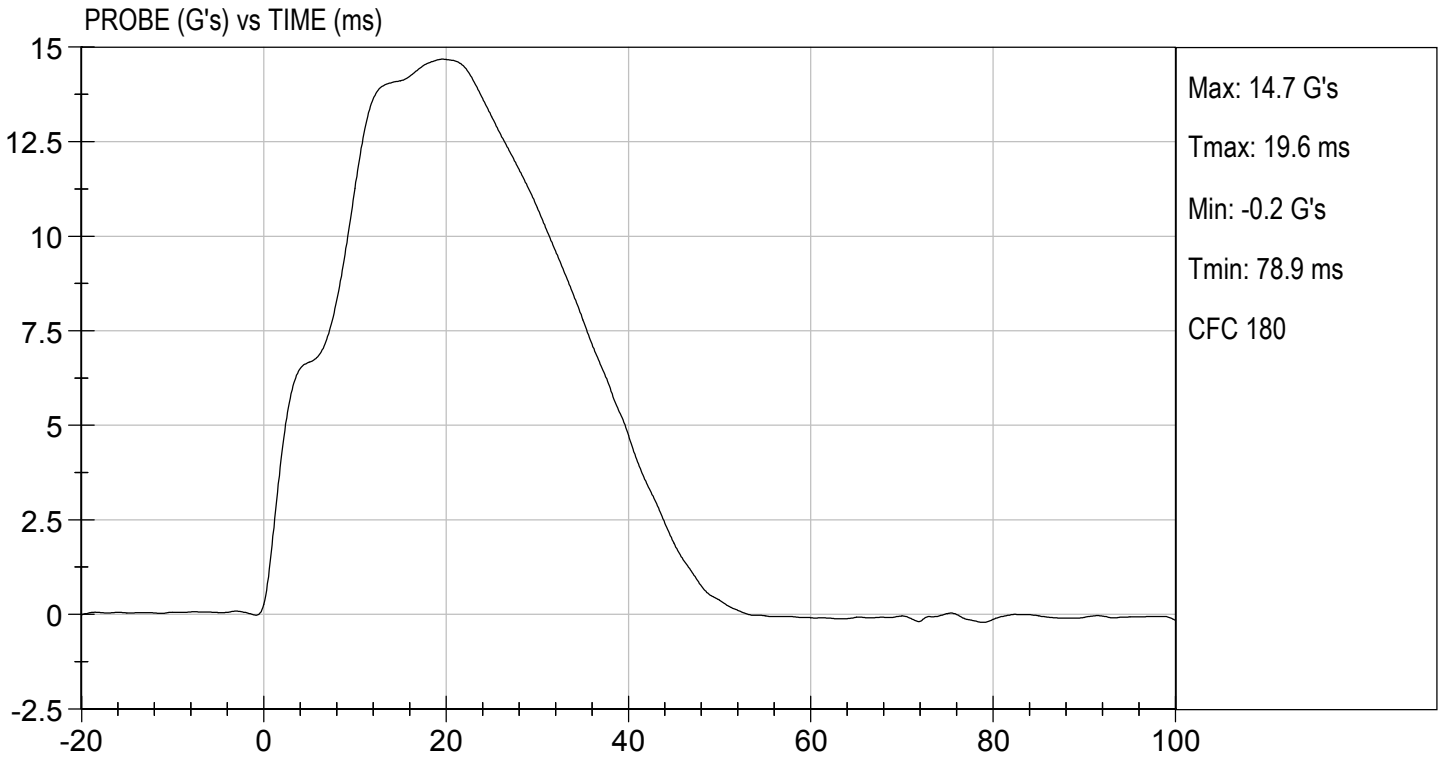
Jacob D Taylor
Laboratory Technician

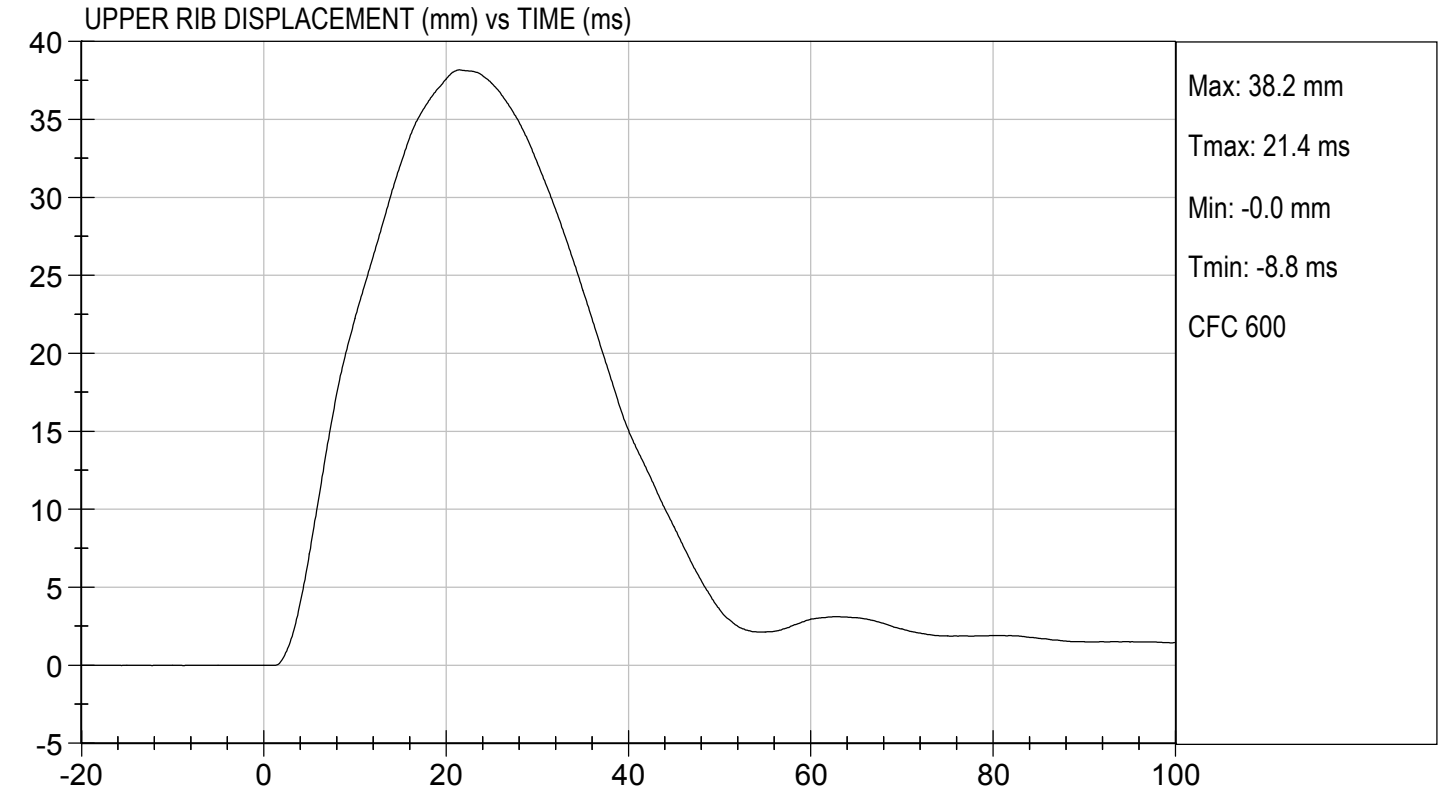
05/31/2019
Test Date

Approved By

TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 05/31/2019
TEST #: D191705

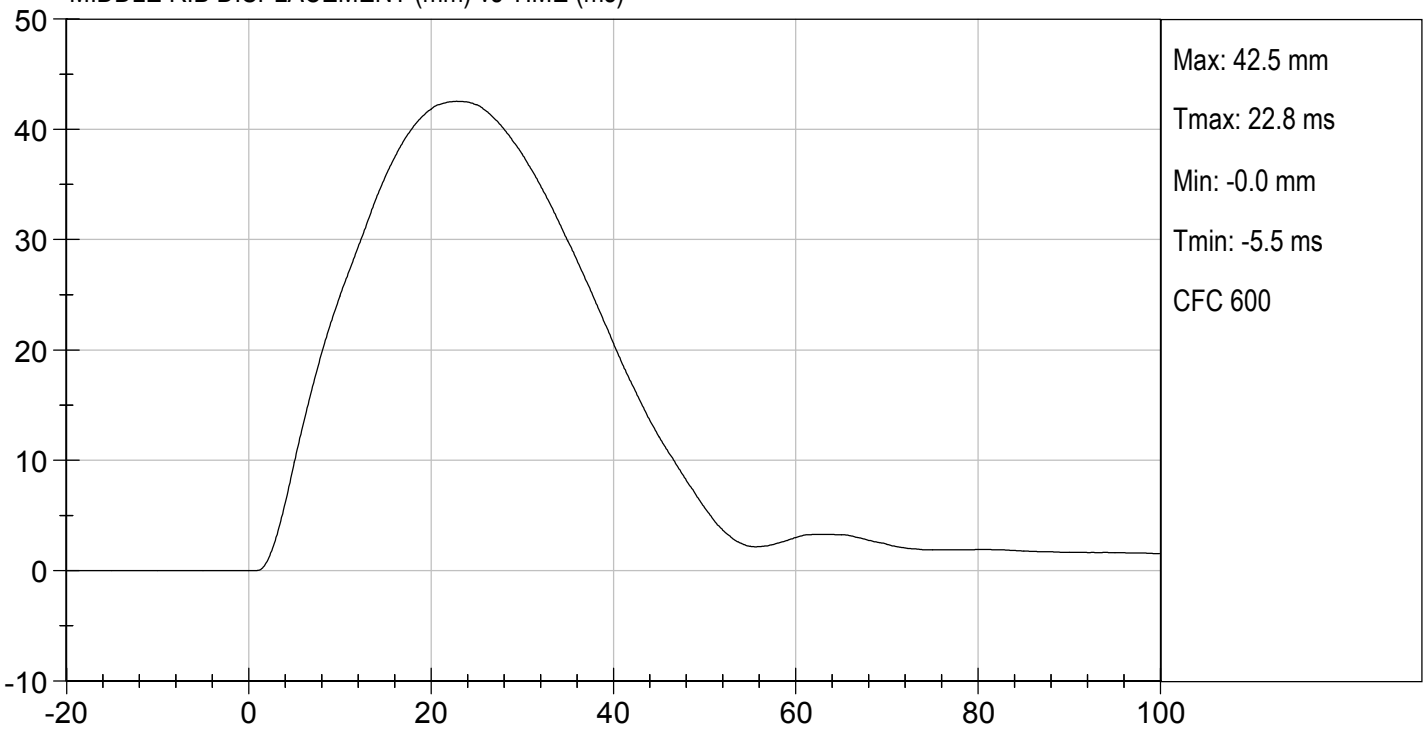




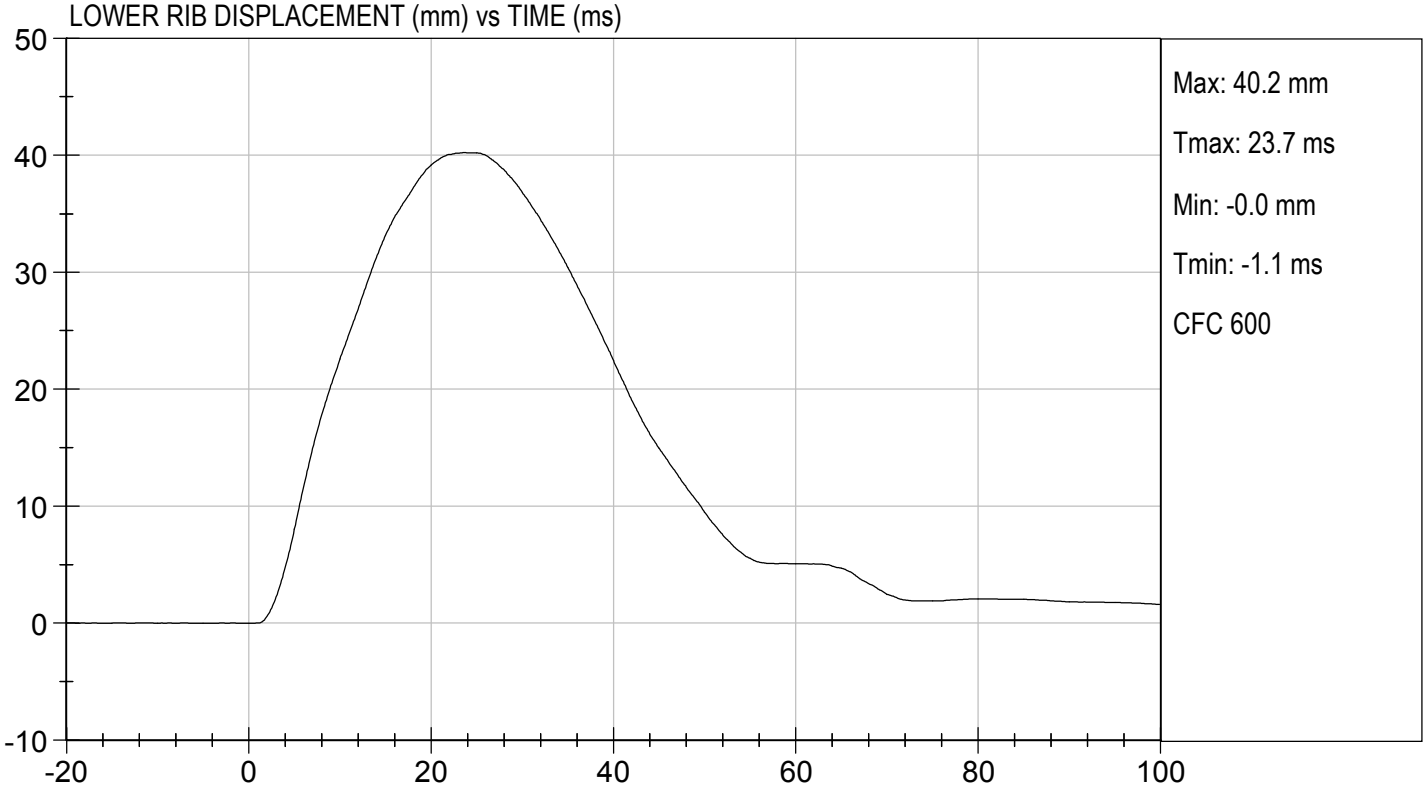
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 05/31/2019
TEST #: D191705

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



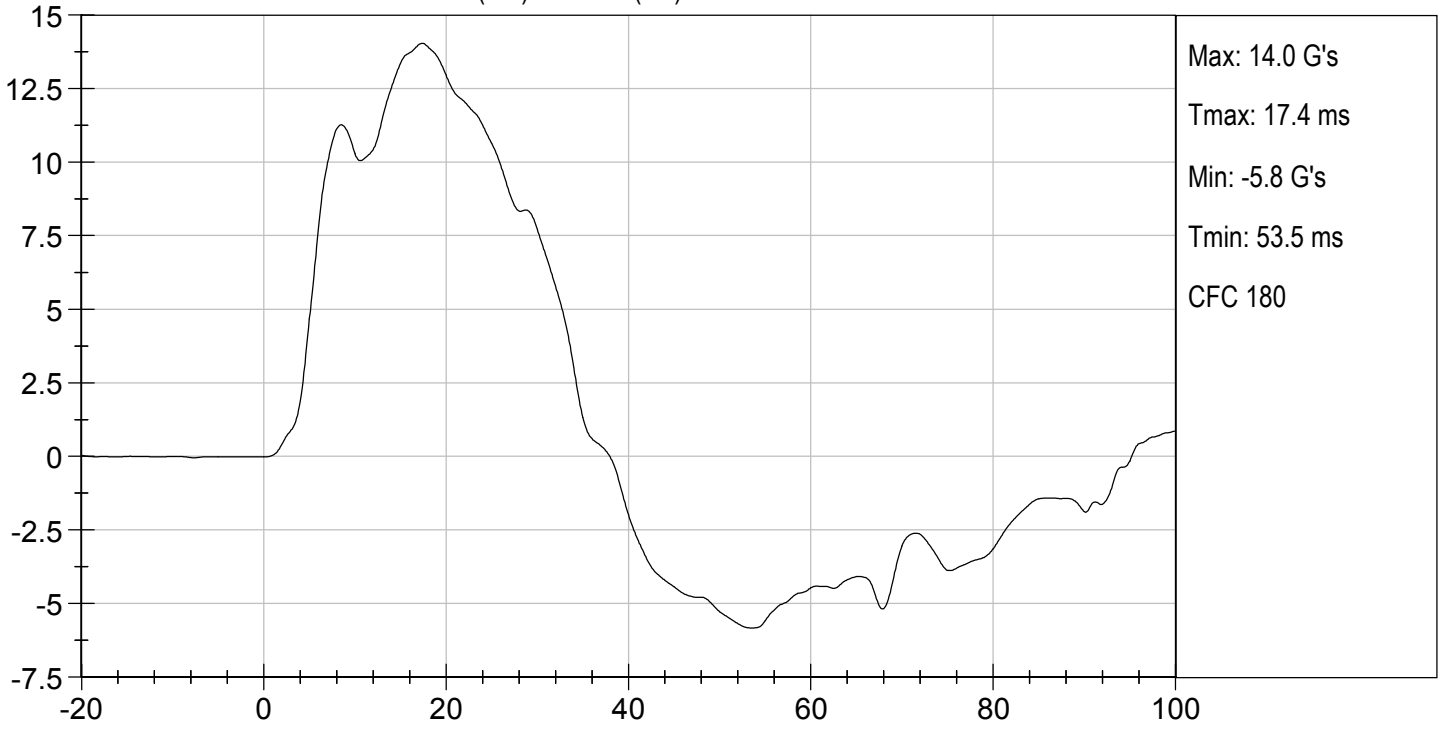
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



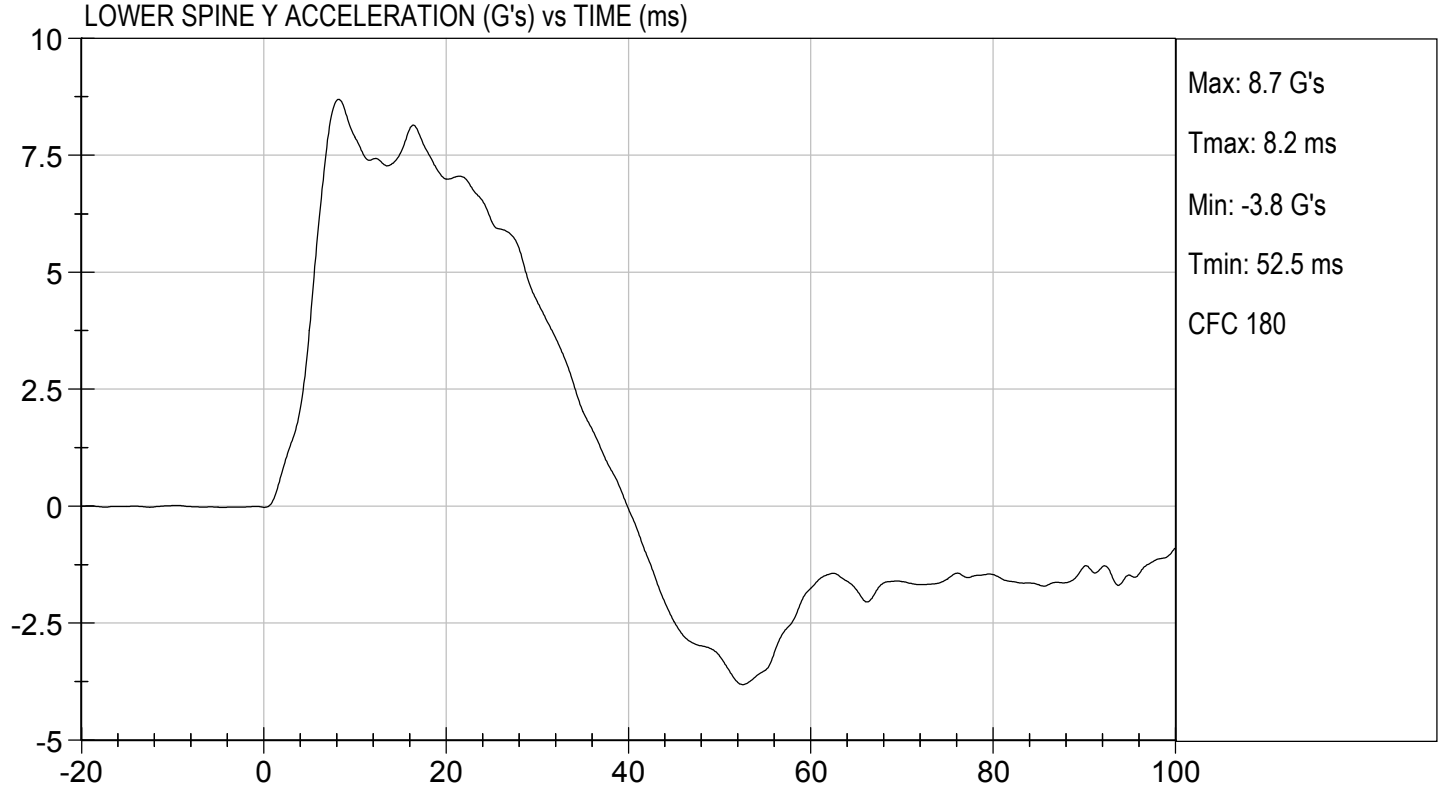
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 05/31/2019
TEST #: D191705

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:** D191706

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	12 to 16	15	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	42	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	38	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	12	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

05/31/2019

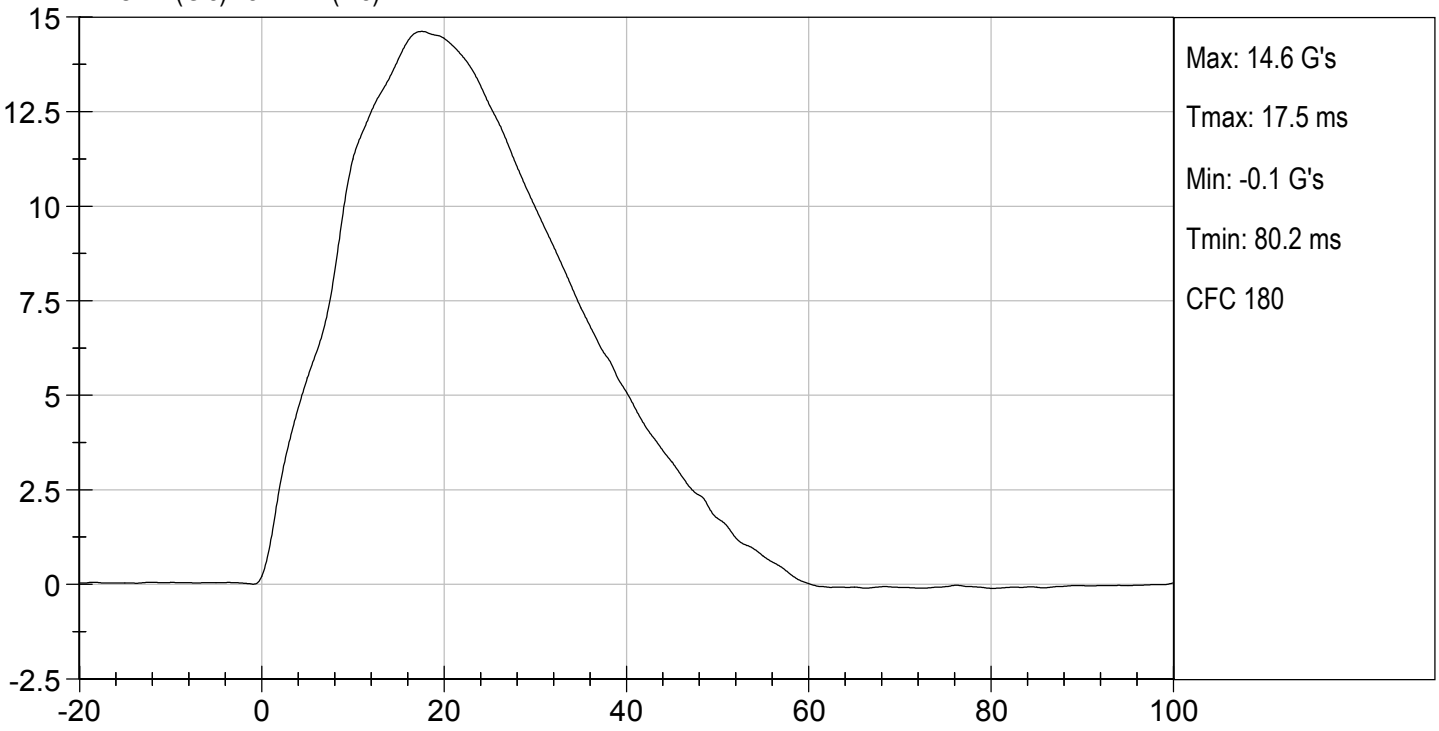
Test Date

Approved By

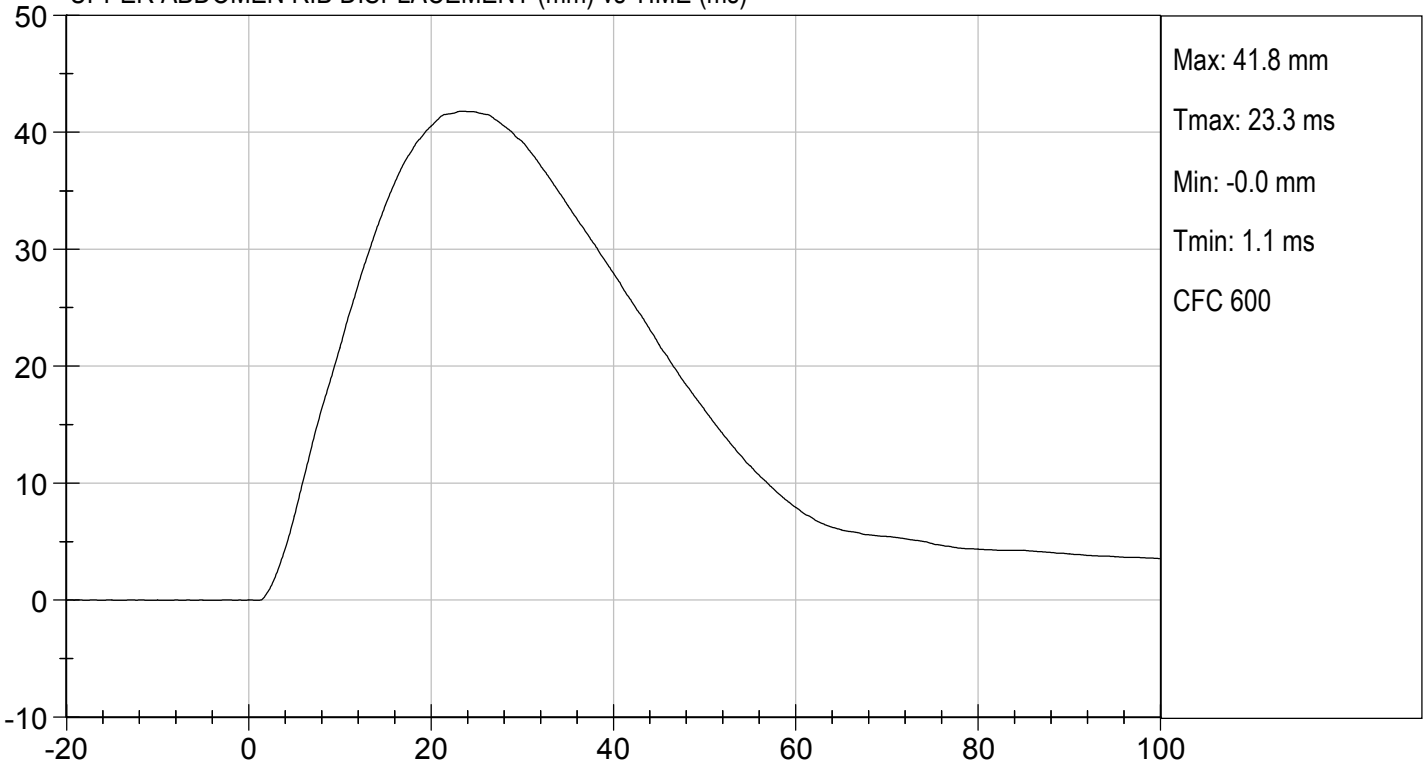
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 05/31/2019
TEST #: D191706

PROBE (G's) vs TIME (ms)



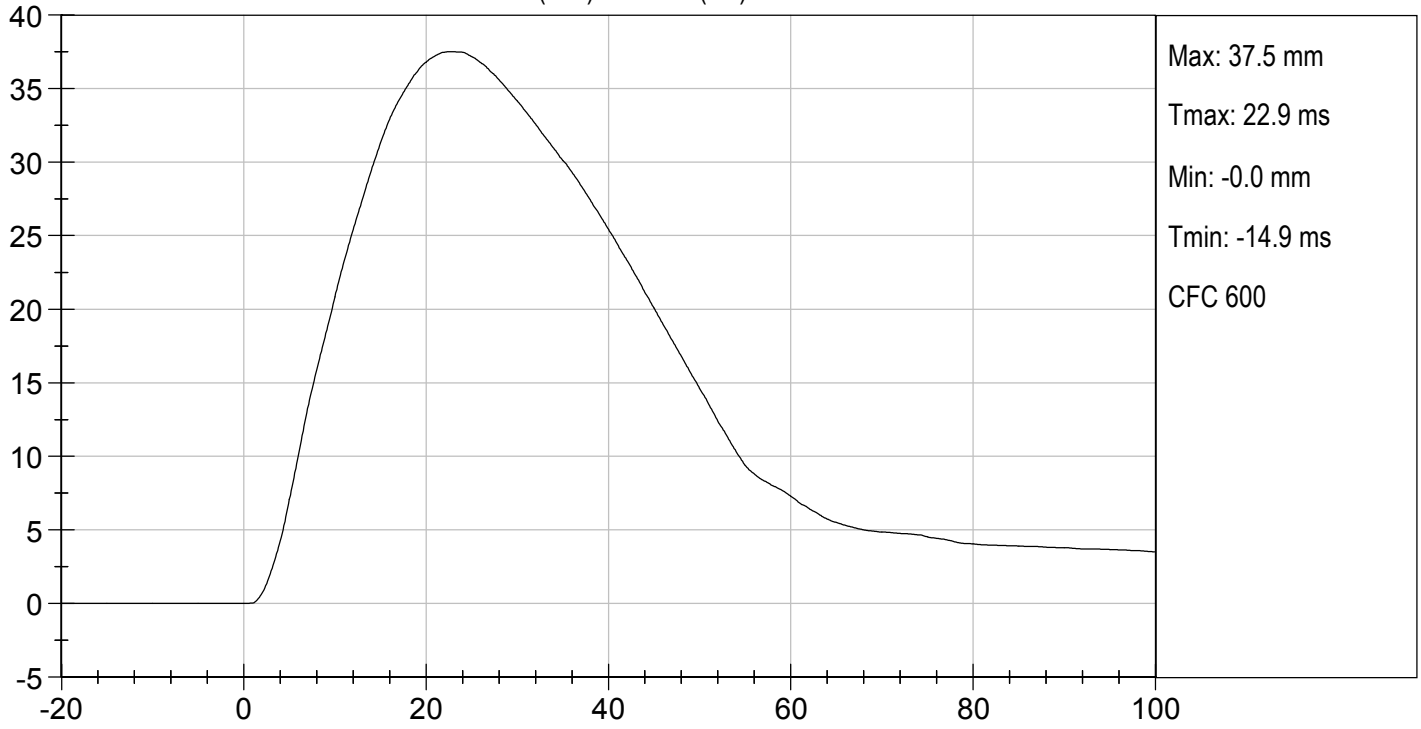
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



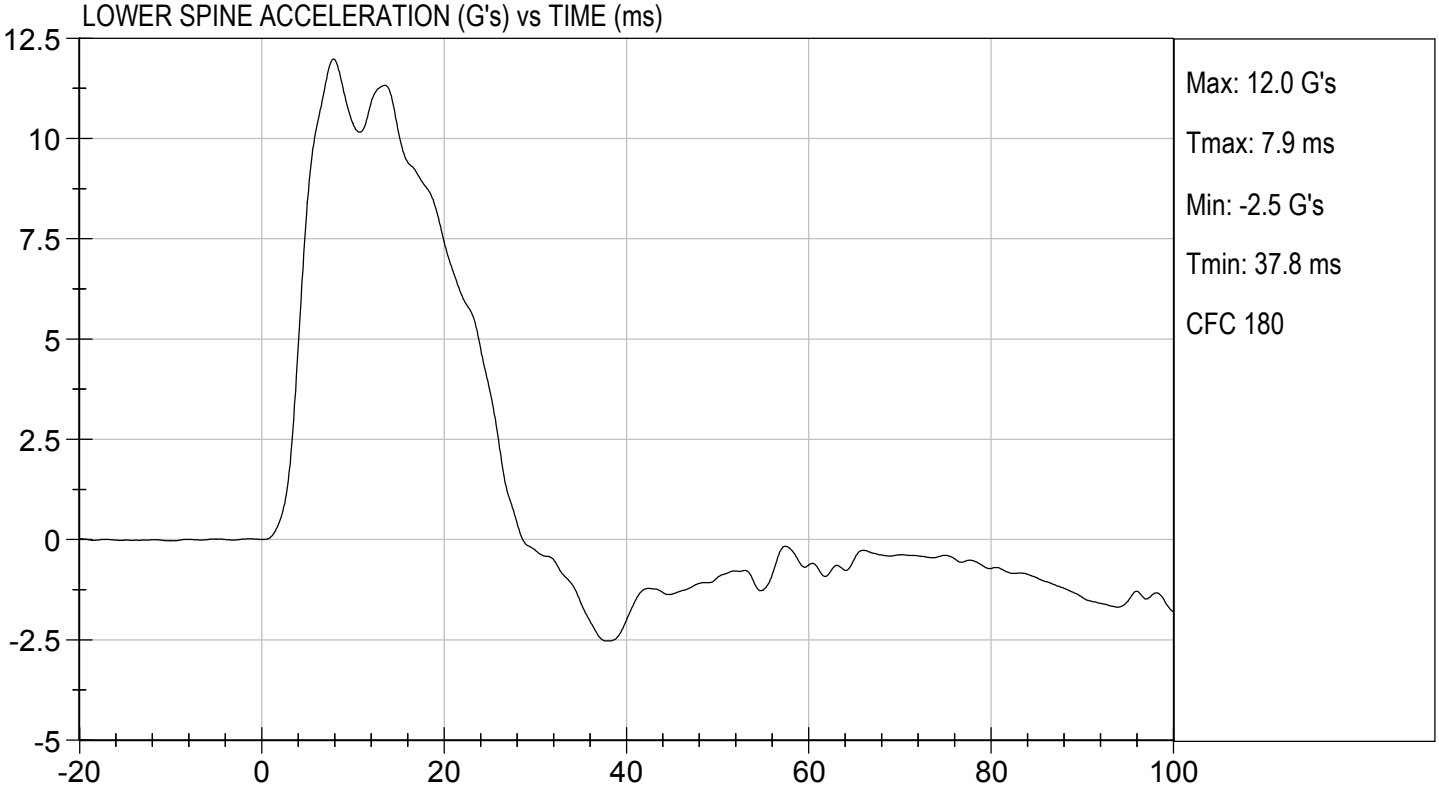
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 05/31/2019
TEST #: D191706

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:** D191707

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	6.60 to 6.80	6.60	Pass
Maximum Probe Acceleration	G's	38 to 47	45	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	39	Pass
Peak Acetabulum Force	N	3600 to 4300	4,139	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

05/31/2019

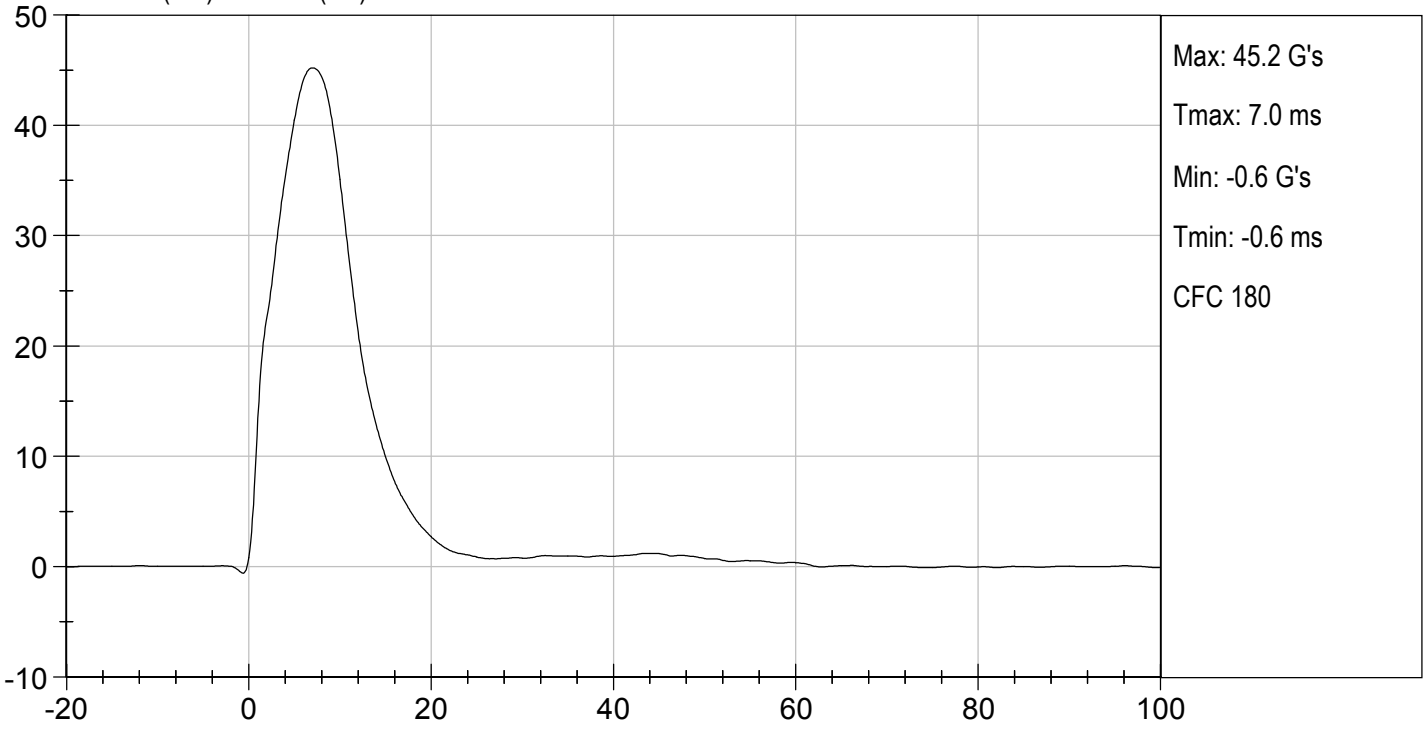
Test Date

Approved By

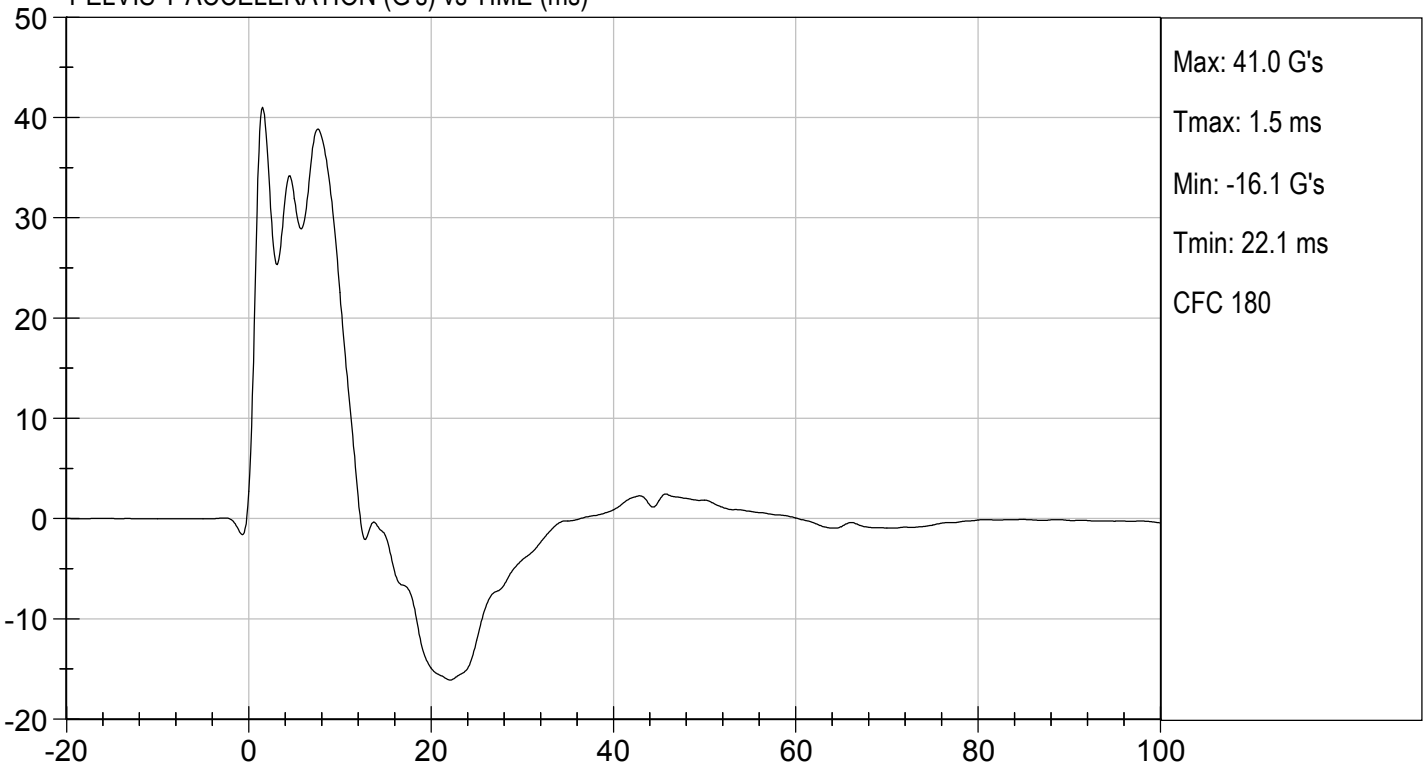
TEST DESC: PELVIS IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 05/31/2019
TEST #: D191707

PROBE (G's) vs TIME (ms)

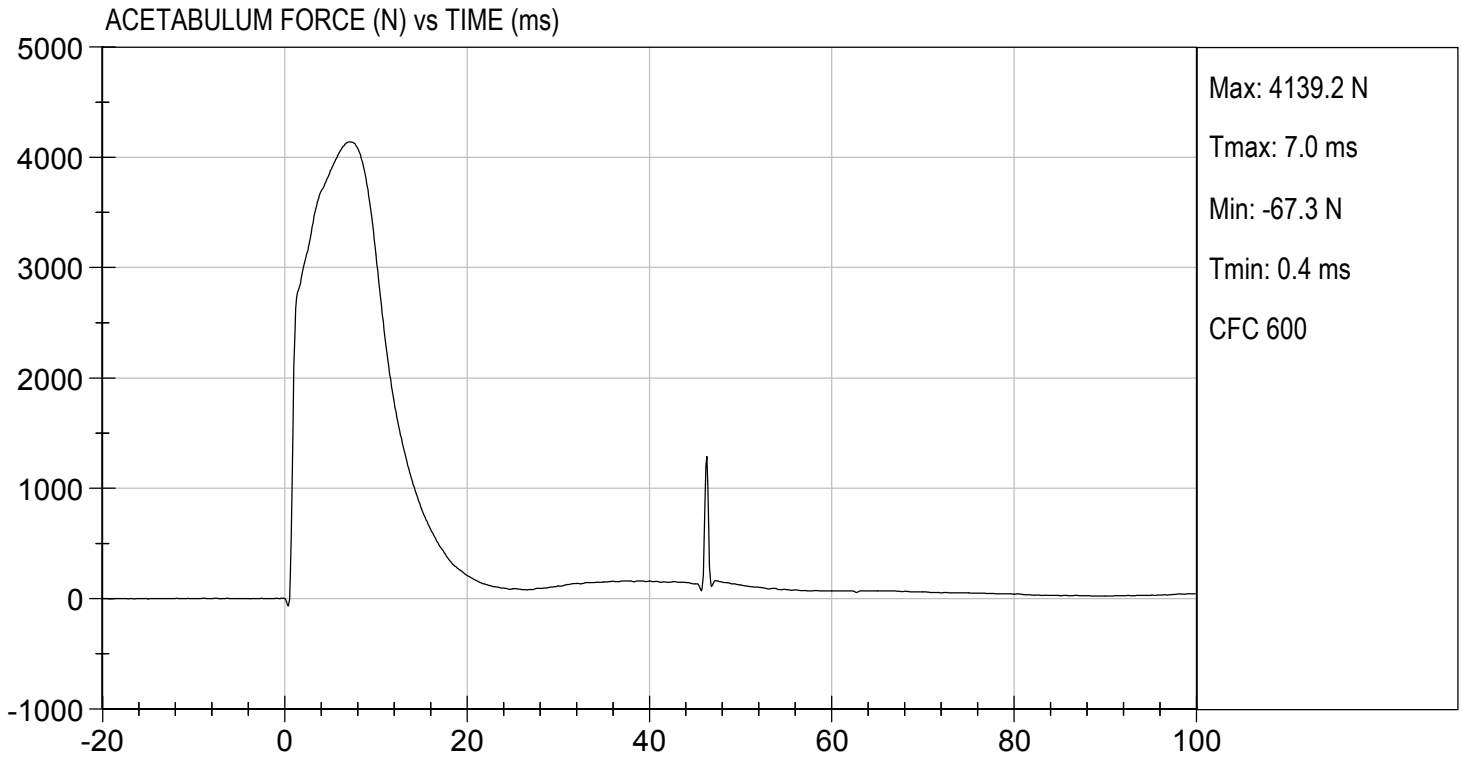


PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 05/31/2019
TEST #: D191707



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D191708

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	4.20 to 4.40	4.39	Pass
Maximum Probe Acceleration	G's	36 to 45	37	Pass
Pelvis Y Acceleration	G's	28 to 39	30	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,308	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

05/31/2019

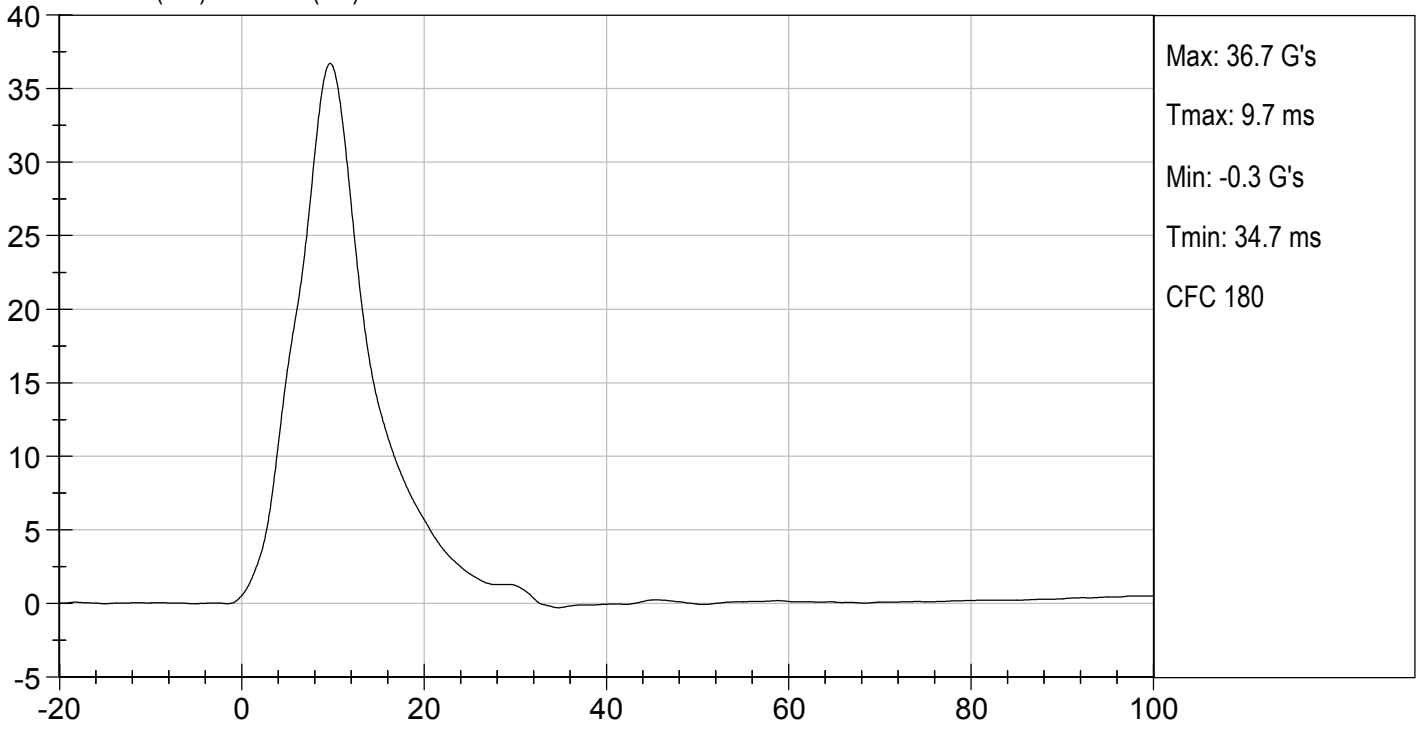
Test Date

Approved By

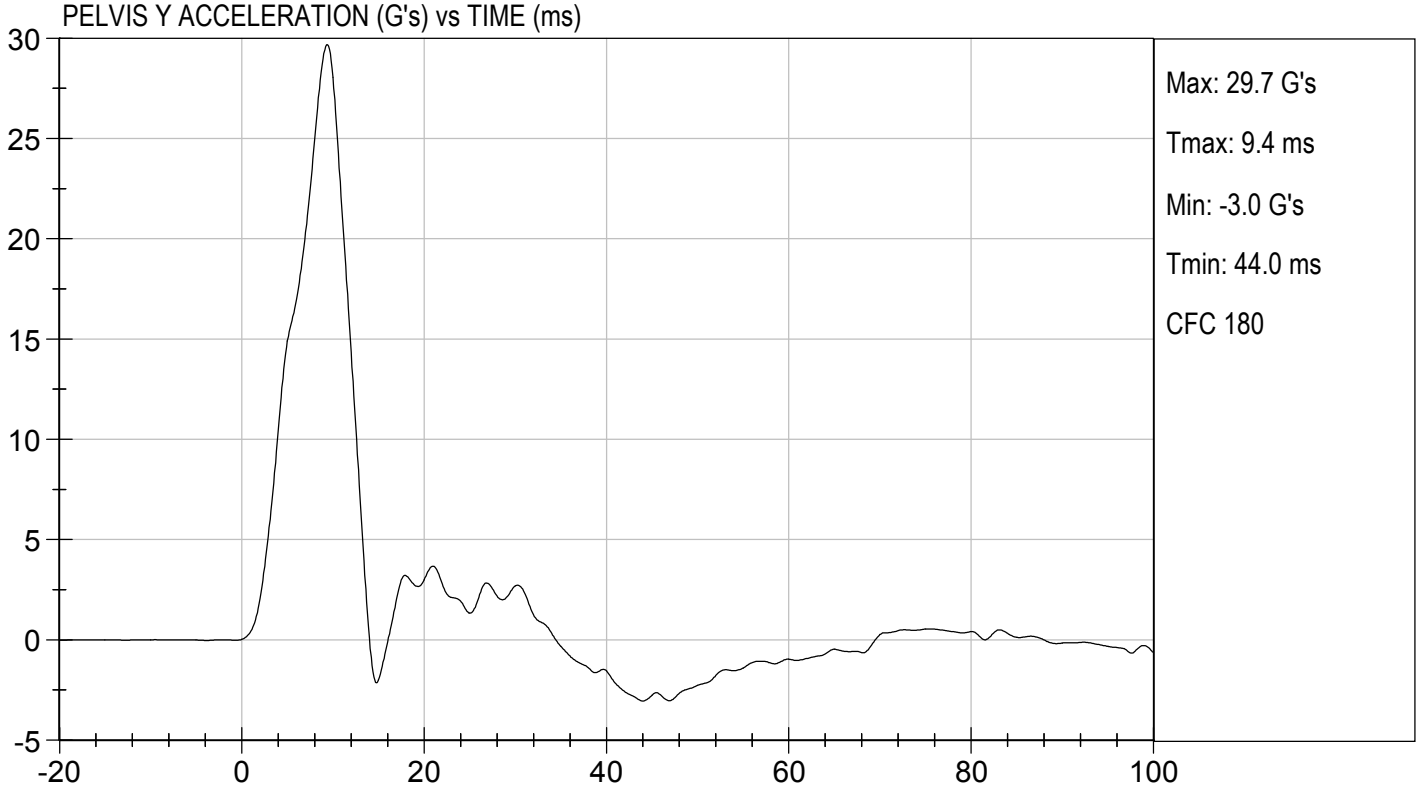
TEST DESC: ILLIAC
VELOCITY: 14.40 ft/s, 4.39 m/s

TEST DATE: 05/31/2019
TEST #: D191708

PROBE (G's) vs TIME (ms)

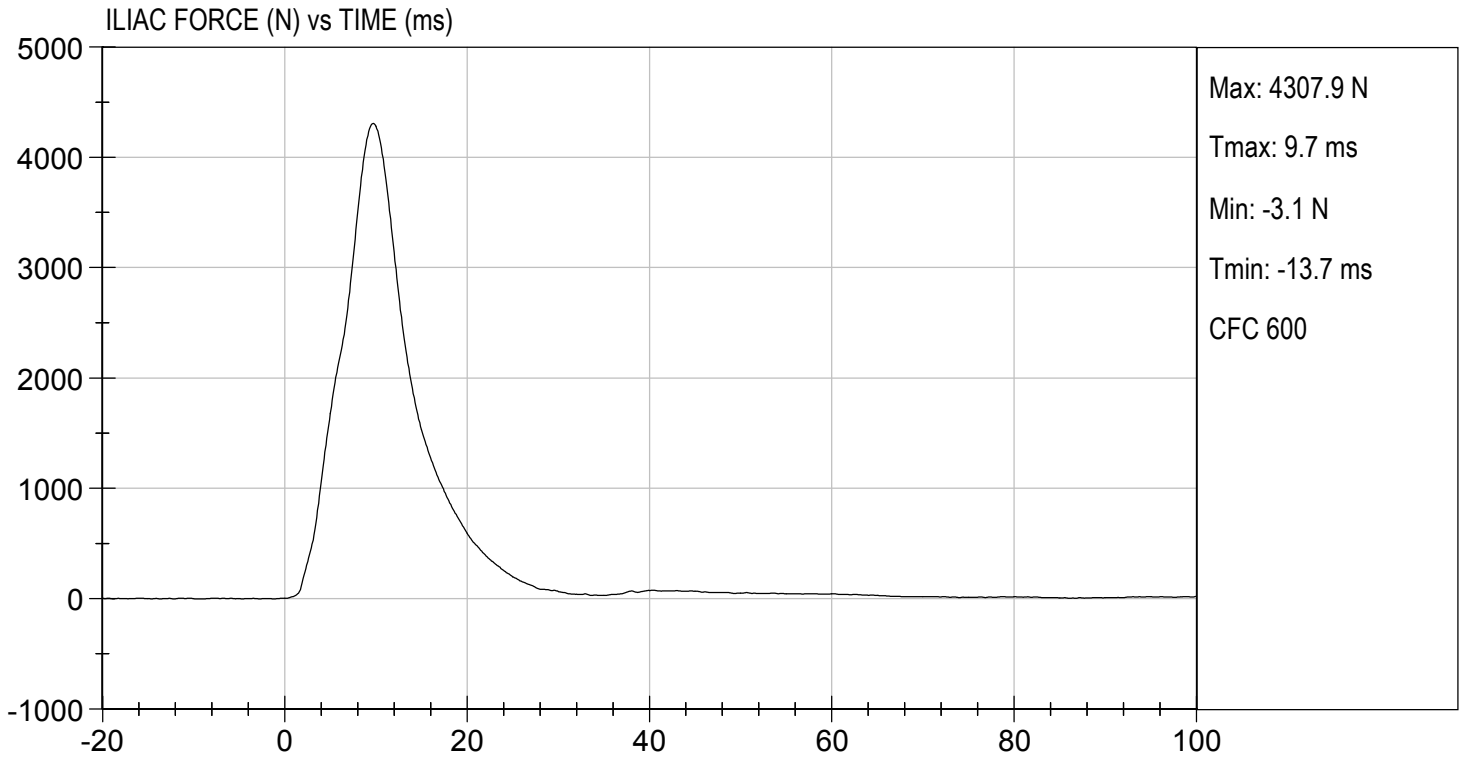


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: ILLIAC
VELOCITY: 14.40 ft/s, 4.39 m/s

TEST DATE: 05/31/2019
TEST #: D191708



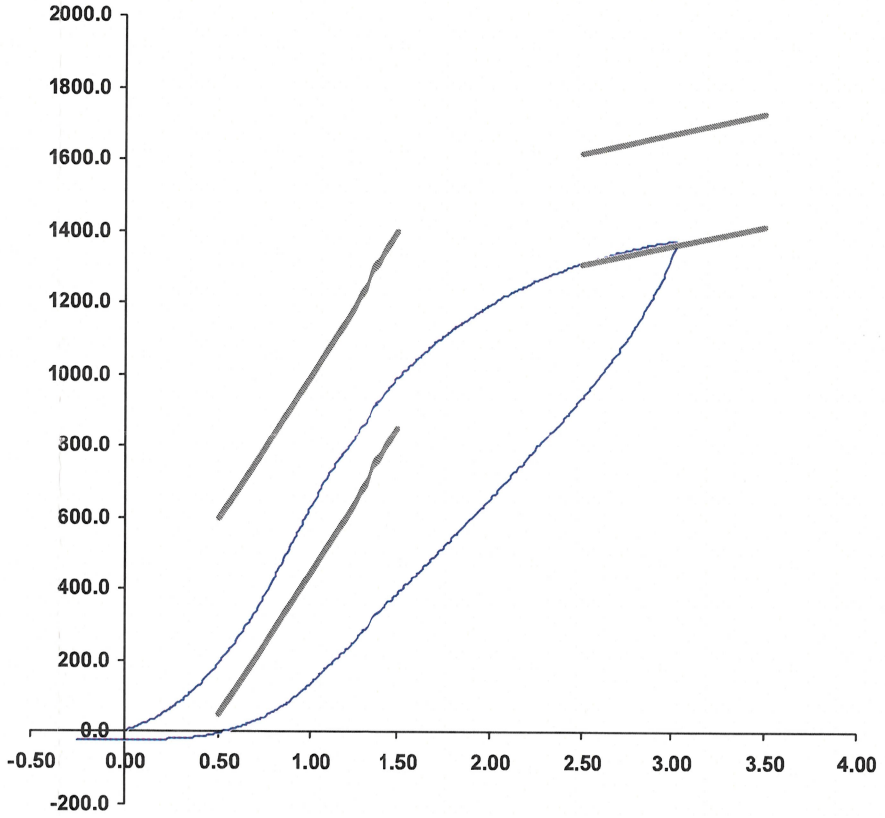
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 11719
Test Number 3461
Report Number 3454
Test Date 3/27/2017 12:58:40 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	187.81	50.00	600.00
Force @ 1.5 mm (N)	985.67	850.00	1,400.00
Force @ 2.5 mm (N)	1,309.21	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,371.99	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (TI240813), Units (LBS) 1000

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

Notes:

Operator DC

Part Number 180-4450

Template No 107 27-Mar-17
SACO Research

By : DC Date : 3/27/17

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 11340
Test Number 2742
Report Number 2739
Test Date 5/3/2016 7:49:52 AM

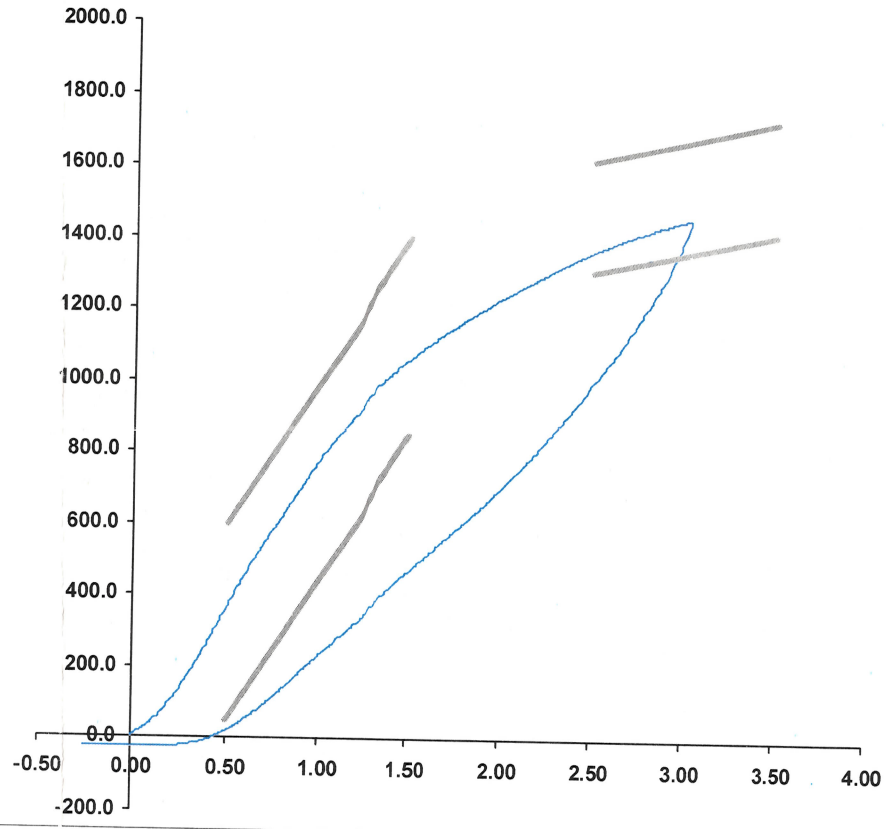
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	362.29	50.00	600.00
Force @ 1.5 mm (N)	1,061.93	850.00	1,400.00
Force @ 2.5 mm (N)	1,366.09	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,455.65	1,361.00	1,673.00

Testing Machine STM-20 5965542
Load Cell S/N (TI240813), Units (LBS) 1000

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

Notes:

Force (-N) vs Extension (-mm)



Operator DC

Part Number 180-4450

Template No 107 03-May-16
SACO Research

By : DC Date : 5/3/16

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

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	01/07/19
			Y	P94783	Endevco	01/07/19
			Z	P94786	Endevco	01/07/19
			Xr	P94938	Endevco	01/07/19
			Yr	P96854	Endevco	01/07/19
			Zr	P97386	Endevco	01/07/19
Head Angular Rate Sensors			X	ARS7413	DTS	07/15/14
			Y	ARS7421	DTS	07/15/14
			Z	ARS7423	DTS	07/15/14
Displacement Potentiometers	Thoracic Rib	Upper	Y	G012	Servo	01/07/19
		Middle	Y	G1163	FTSS	01/07/19
		Lower	Y	G1158	FTSS	01/07/19
	Abdominal Rib	Upper	Y	G1146	FTSS	01/07/19
		Lower	Y	G1126	FTSS	01/07/19
Lower Spine Accelerometers (T12)			X	P79418	Endevco	01/07/19
			Y	P79439	Endevco	01/07/19
			Z	P79614	Endevco	01/07/19
Acetabulum Load Cell			Y	ACG269	Denton	03/15/19
Iliac Wing Load Cell			Y	IWG282	Denton	03/15/19
Pelvis Plug (struck side)				11719	SACO	03/27/17
Pelvis Plug (non-struck side)				11340	SACO	05/03/16

Table 2 – Vehicle Instrumentation

		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	PCB1143	PCB	12/21/18
Vehicle Center of Gravity	Y	PCB1368	PCB	03/01/19
Vehicle Center of Gravity	Z	PCB759	PCB	12/21/18
Left Floor Sill	Y	T19035	Endevco	01/23/19
A-Pillar Sill	Y	T19535	Endevco	04/12/19
A-Pillar Low	Y	PCB1257	PCB	12/28/18
A-Pillar Mid	Y	PCB1134	PCB	12/21/18
B-Pillar Sill	Y	PCB1188	PCB	04/08/19
B-Pillar Low	Y	T19547	Endevco	05/02/19
B-Pillar Mid	Y	PCB1109	PCB	04/08/19
Driver Seat	Y	T19358	Endevco	05/02/19
Engine Top	X	T19507	Endevco	05/03/19
Engine Top	Y	T19523	Endevco	05/03/19
Firewall	Y	T19330	Endevco	04/30/19
Right Roof	Y	T19524	Endevco	05/02/19
Right Floor Sill	Y	T19377	Endevco	04/12/19
Rear Floorpan	X	T19546	Endevco	04/12/19
Rear Floorpan	Y	T19488	Endevco	04/30/19

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