REPORT NUMBER: SPNCAP-MGA-2019-030

NEW CAR ASSESSMENT PROGRAM (NCAP)
Side Impact Pole Test

NISSAN MOTOR CO., LTD.
2019 Nissan Murano S 5-Door SUV
NHTSA No.: M20195210

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: February 6, 2019

Final Report Date: May 6, 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: _____
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Approved by: _____
Ben Fischer, Project Engineer

Approval Date: May 6, 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 Murano S 5-Door SUV, NHTSA No.: M20195210		*5. Report Date* May 6, 2019 *6. Performing Organization Code* MGA
7. Author(s) Robert Schnorenberg, Project Engineer		*8. Performing Organization Report No.* SPNCAP-MGA-2019-030
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 February 6, 2019 to May 6, 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 Murano S 5-Door SUV 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 February 6, 2019.

The impact velocity was 32.17 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 418 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	439
Resultant Lower Spine Acceleration	Gs	82	41
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2631
Maximum Thoracic Rib Deflection	mm	38*	23
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 e-mail: tis@nhtsa.dot.gov FAX: 202-493-2833

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TABLE OF CONTENTS

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 Murano S 5-Door SUV. 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 Murano S 5-Door SUV. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 32.17 km/h. The test was conducted by MGA Research Corporation in Burlington, Wisconsin on February 6, 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	439
Resultant Lower Spine Acceleration	Gs	82	41
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2631
Maximum Thoracic Rib Deflection	mm	38*	23
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	Yes		
Knee Airbag	Yes	Yes		
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	Yes	Yes
Seat Belt Pretensioner	Yes	Yes	Yes	No
Seat Belt Load Limiter	Yes		No	
Other				

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

GENERAL COMMENTS

Load Cell Pole #8 Fy recorded no valid data.

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

SECTION 3
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 Nissan Murano S 5-Door SUV
Test Program: NCAP Side Pole Impact Test
NHTSA No. M20195210
Test Date: 2/6/2019

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20195210
Model Year	2019
Make	Nissan
Model	Murano S
Body Style	5-Door SUV
VIN	5N1AZ2MJ1KN106306
Body Color	Gun Metallic
Odometer Reading (km/mi)	10km / 6mi
Engine Displacement (L)	3.5 L
Type/No. Cylinders	6
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	No
Anti-Lock Brakes (ABS)	Yes

Traction Control System (TCS)	Yes
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	No
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	12/18
Vehicle Type	MPV

GVWR (kg)	2318
GAWR Front (kg)	1272
GAWR Rear (kg)	1300

VEHICLE SEATING AND WEIGHT CAPACITY DATA

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

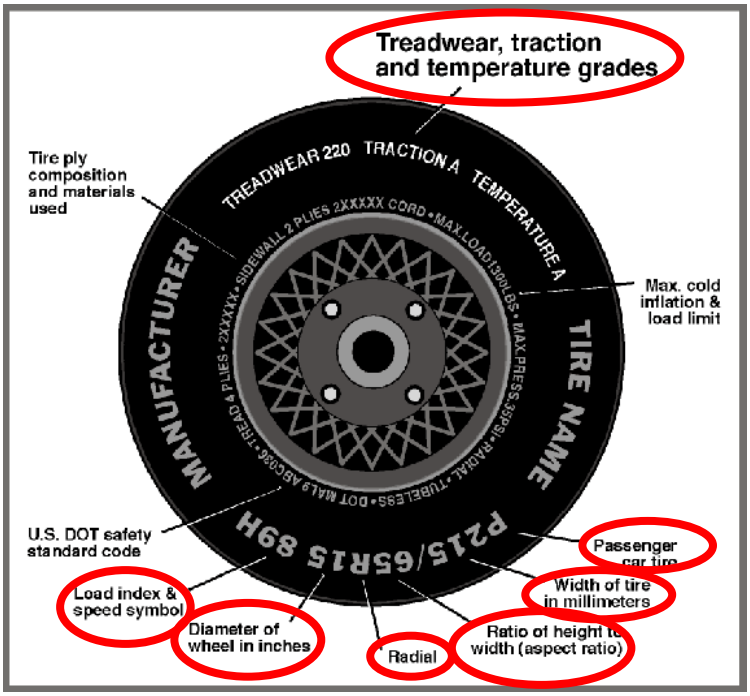
VEHICLE SEAT TYPE

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

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

Test Vehicle: 2019 Nissan Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	230	230
Recommended Tire Size	235/65R18	235/65R18
Tire Size on Vehicle	235/65R18	235/65R18
Tire Manufacturer	Continental	Continental
Tire Model	CrossContact	CrossContact
Treadwear	480	480
Traction	A	A
Temperature Grade	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 2 Steel, 1 Polyamide	2 Polyester, 2 Steel, 1 Polyamide
Load Index/Speed Symbol	106T	106T
Tire Material	Rubber	Rubber
DOT Safety Code Left	VYLM D3V4 3918	VYLM D3V4 3918
DOT Safety Code Right	VYLM D3V4 3918	VYLM D3V4 3918

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

Test Vehicle: 2019 Nissan Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019

TEST PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kpa	248	241	248	248
Tire Placard	kpa	230	230	230	230
Owner's Manual	kpa	230	230	230	230
As Tested	kpa	230	230	230	230

TEST VEHICLE WEIGHTS

		As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
	Units	Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	517.5	343.5		538.5	388.5		537.0	395.0	
Right	kg	523.0	340.5		526.5	383.5		528.5	384.0	
Ratio	%	60.3	39.7		58.0	42.0		57.8	42.2	
Totals	kg	1040.5	684.0	1724.5	1065.0	772.0	1837.0	1065.5	779.0	1844.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1724.5	(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	1844.5	(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	0.2	0.4	0.5	Yes
Front Pass. Sill Angle (front-to-	deg	-0.6	-0.4	-0.4	Yes
Front Bumper Angle (left-to-right)**	deg	-0.2	-0.3	-0.4	Yes
Rear Bumper Angle (left-to-right)**	deg	0.4	0.3	0.3	Yes
Vehicle CG (Aft of Front Axle)	mm	1124	1189	1195	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	-1	8	9	

*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)	43
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 Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019

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	16.4	12.4	14.4
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	14.4	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
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

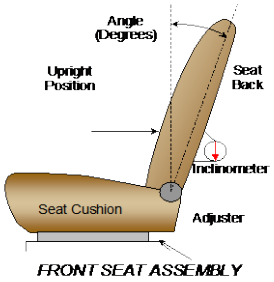
Test Vehicle: 2019 Nissan Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019

SEAT FORE/AFT POSITIONS

Seat	Total Fore/Aft Travel		Test Position from Forward-most Position	
	mm	Detents	mm	Detent
Driver Seat	240	25th (1st as 1)	0	0th (1st as 0)
Front Passenger Seat	240	25th (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	75.8	38 (1st as 1)	-7.4	4th (1st as 0)
Front Passenger Seat	74.2	38 (1st as 1)	-6.7	4th (1st as 0)
Front Center Seat				
Struck Side Rear Seat	24.5	13 (1st as 1)	-0.2	0th (1st as 0)
Non-Struck Side Rear Seat	24.5	13 (1st as 1)	-0.2	0th (1st as 0)
Rear Center Seat	24.5	13 (1st as 1)	-0.2	0th (1st as 0)

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	4 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	5 detents (1st as 1)	0th (Lowermost as 0)

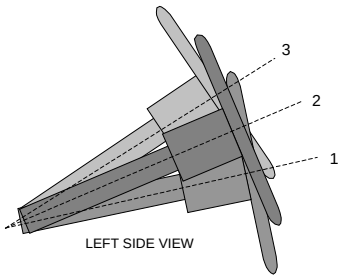
DATA SHEET NO. 2 (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2019 Nissan Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019

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	67.4	220
Geometric Center, Position 2	64.5	200
Uppermost, Position 3	61.6	180
Telescoping Steering Wheel Travel		40
Test Position	64.5	200

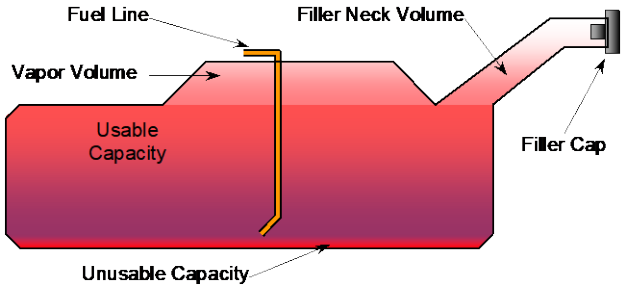


STEERING COLUMN ASSEMBLY

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 when the ignition is turned on. The filler neck is located on the driver's side.



VEHICLE FUEL TANK ASSEMBLY

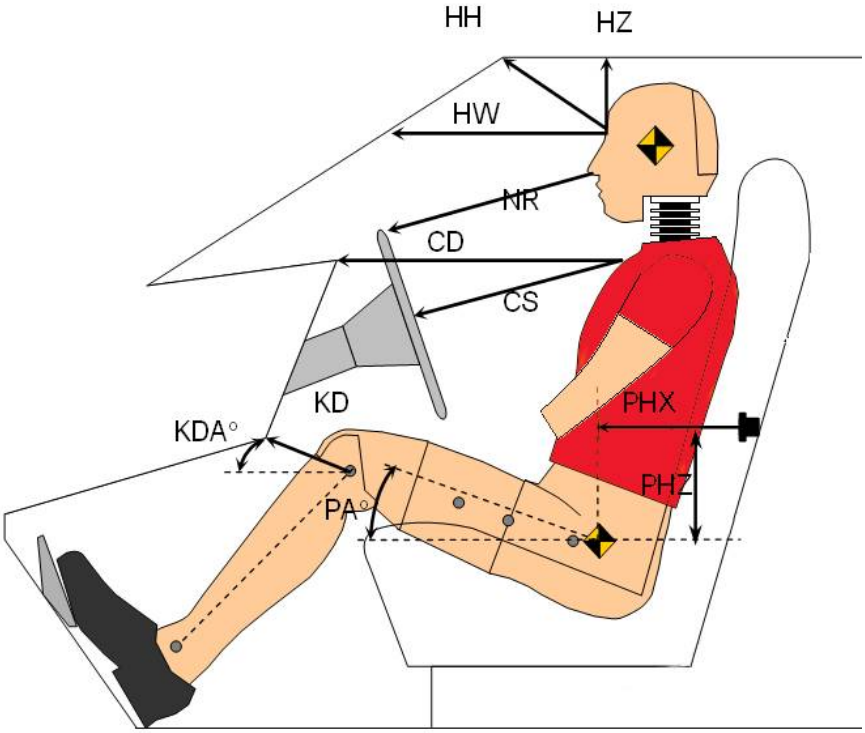
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	71.9
Usable Capacity of "Optional Tank" (see Form No. 1)	
Usable Capacity of Standard Tank as Specified in Owner's Manual	71.9
Usable Capacity of Optional Tank as Specified in Owner's Manual	
93% of Usable Capacity	66.9
Actual Amount of Solvent Used	66.6
1/3 of Usable Capacity	24.0

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 Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019

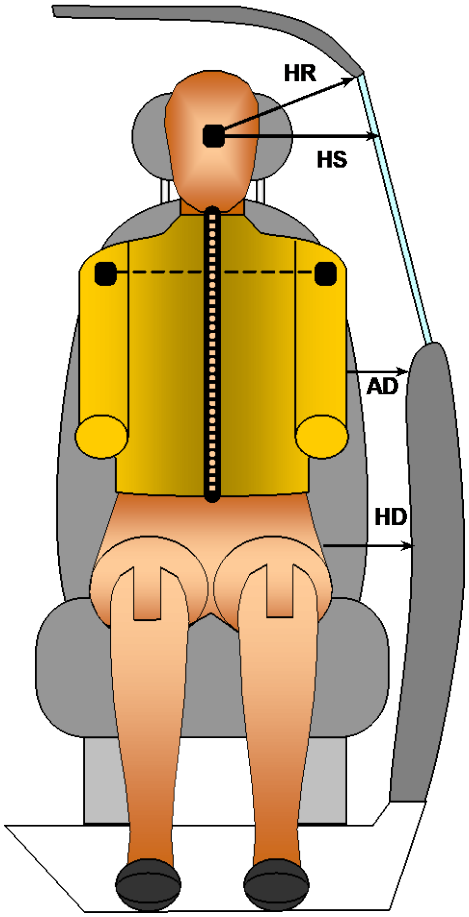


LEFT SIDE VIEW

Code	Measurement Description	Driver	
		Length (mm)	Angle (°)
HH	Head to Header	275	
HW	Head to Windshield	654	
HZ	Head to Roof Liner	190	
NR	Nose to Rim	227	
CD	Chest to Dashboard	399	
CS	Chest to Steering Wheel	159	
KDL/KDAL°	Left Knee to Dash	105	39.3
KDR/KDAR°	Right Knee to Dash	91	44.9
PAX°	Pelvic Tilt Angle (X-Axis)		21.1
PAY°	Pelvic Tilt Angle (Y-Axis)		-0.1
PHX	Hip Point to Striker (X-Axis)	385	
PHZ	Hip Point to Striker (Z-Axis)	78	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2019 Nissan Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019

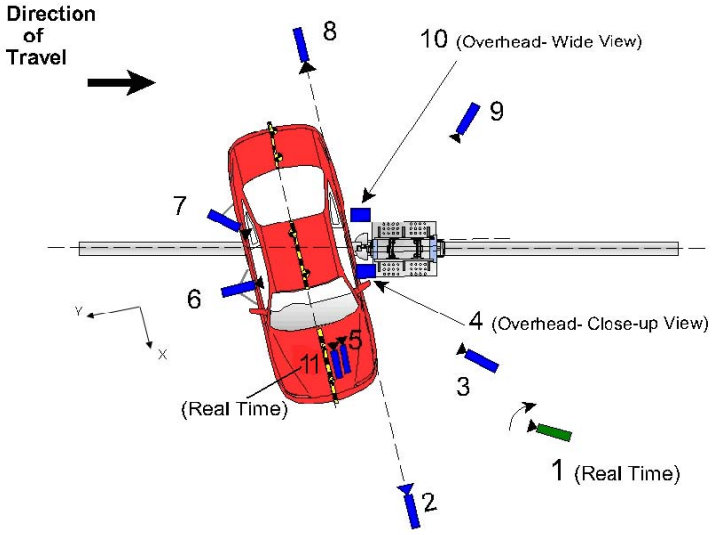


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver Length (mm)
HR	Head to Side Header	245
HS	Head to Side Window	368
AD	Arm to Door	203
HD	Hip Point to Door	163

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2019 Nissan Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019



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	6660	30	-2000	25	1000
3	Impact Side 45° Forward	4682	-1950	-1980	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	-7330	-20	-1940	25	1000
9	Impact Side 45° Rearward	-2260	3750	-2040	20	1000
10	Overhead Wide View	-80	680	-6650	14	1000
11	Real-Time Dummy Front View					30

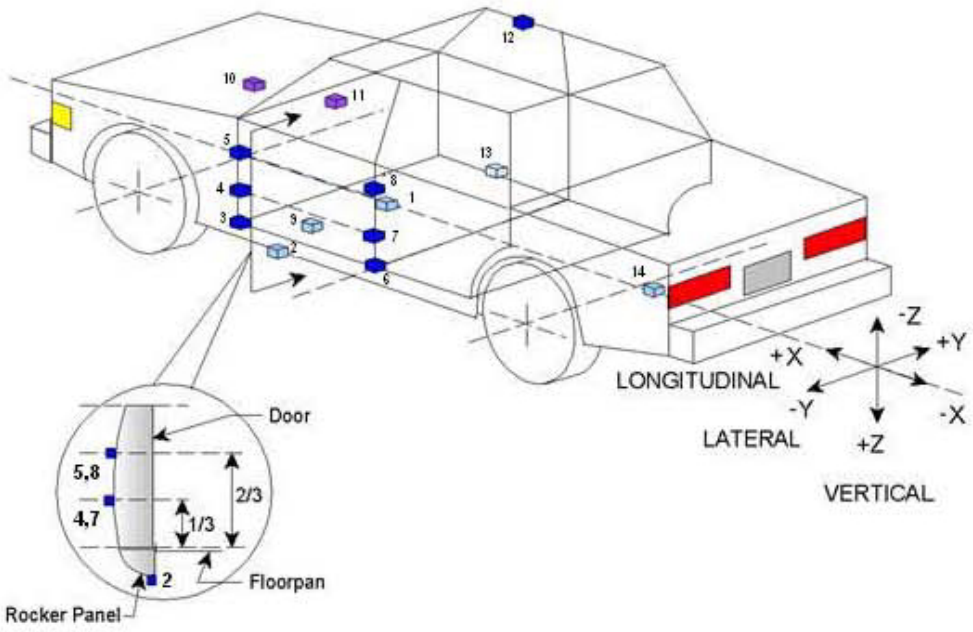
*All measurements accurate to ± 6 mm
Note: Vehicle was at a 75° angle to the rigid pole.

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 Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019



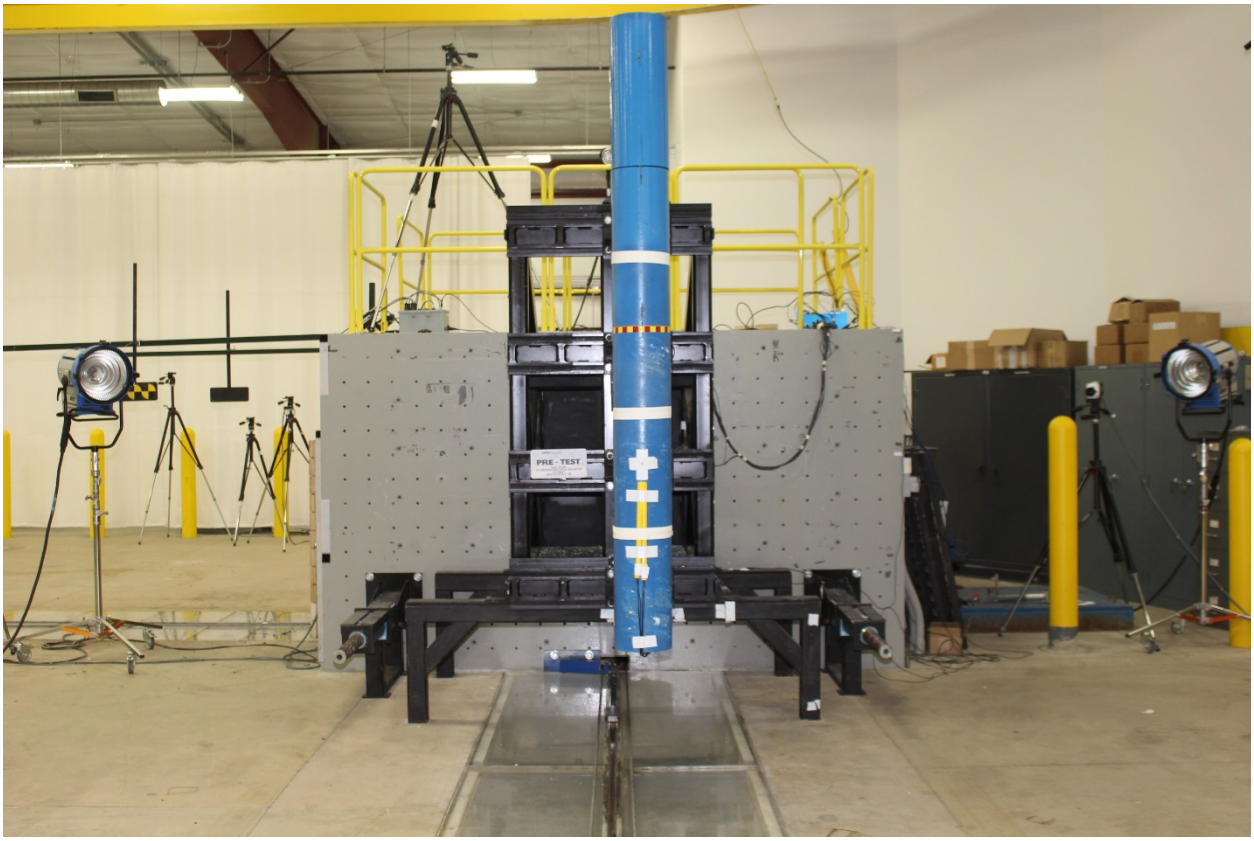
	Accelerometer Location			
	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2610	110	-320
2	Left Floor Sill	2885	-780	-307
3	A Pillar Sill	3353	-780	-306
4	A Pillar Low	3280	-879	-675
5	A Pillar Mid	3280	-880	-868
6	B Pillar Sill	2272	-780	-306
7	B Pillar Low	2200	-760	-678
8	B Pillar Mid	2190	-755	-880
9	Driver Seat Track	2270	-415	395
10	Engine Top	3996	70	-930
11	Firewall	3814	0	-1074
12	Right Roof	2420	510	-1655
13	Right Floor Sill	2887	780	-306
14	Rear Floorpan	1080	0	-575

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 Murano S 5-Door SUV
Test Program: NCAP Side Pole Impact Test

NHTSA No. M20195210
Test Date: 2/6/2019



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 Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019

TEST DUMMY INFORMATION AND CONTACT POINTS

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

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	Yes
Total Separation from Vehicle at Hinges or Latches	No	No	No	No	No
Latch or Hinge Systems Pulled Out of Their Anchorages	No	No	No	No	No
Disengaged from Latched Position	No	No	No	No	No
Latch Separated from Striker	No	No	No	No	No
Jammed Shut	Yes	Yes	No	No	No
If Door Opened at Striker, Record Width of Opening at Striker (mm)					

POST-TEST SEAT PERFORMANCE

	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	Left Front Window Cracked
Other Notable Effects	None

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

Test Vehicle: 2019 Nissan Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

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

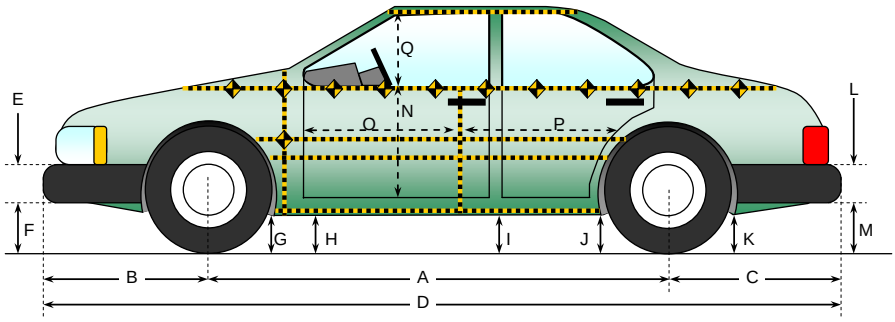
VEHICLE SPEED, VEHICLE ANGLE AT IMPACT, AND IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm		1122
Actual Impact Point (Aft of Front Axle)	mm		1122
Horizontal Offset (+forward / -rearward)	mm	+/- 38 of Intended Impact Point	0
Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion	deg	75 +/- 3	75.2
Trap No. 1 Velocity (Primary)	km/h	31.4 to 33.0	32.17
Trap No. 2 Velocity (Redundant)	km/h	31.4 to 33.0	32.21

DATA SHEET NO. 9
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2019 Nissan Murano S 5-Door SUV
Test Program: NCAP Side Pole Impact Test

NHTSA No. M20195210
Test Date: 2/6/2019



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

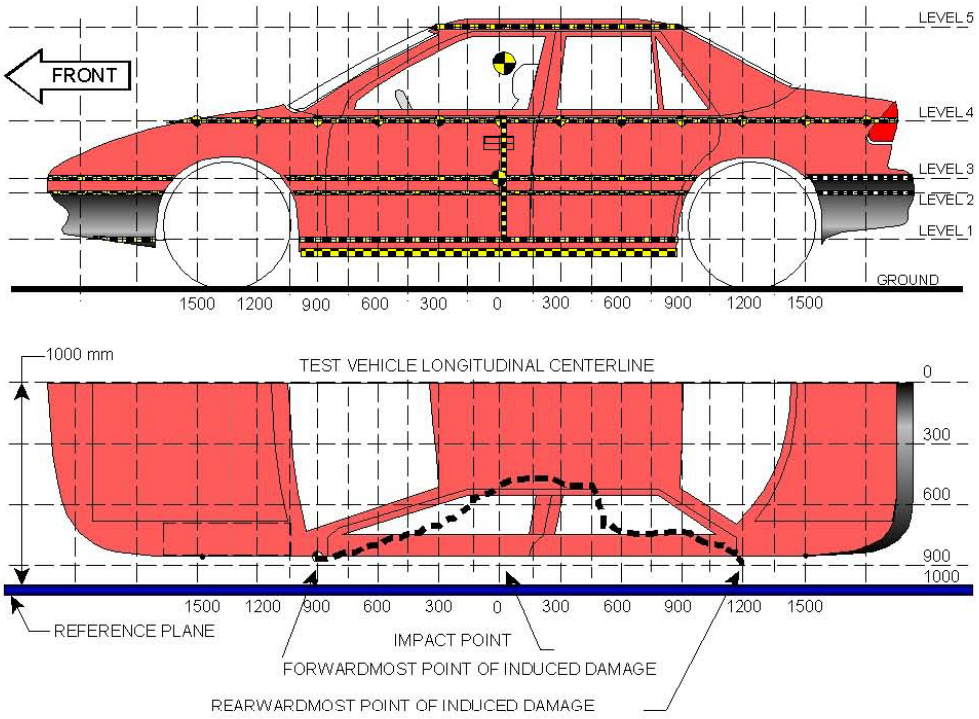
LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2832	2715	117
B	Front Axle to FSOV	1044	1101	-57
C	Rear Axle to RSOV	1015	1017	-2
D	Total Vehicle Length at Centerline	4891	4833	58
E	Front Bumper Thickness	130	130	0
F	Front Bumper Bottom to Ground	212	243	-31
G	Sill Height at Front Wheel Well	294	285	9
H	Sill Height at Front Door Leading Edge	294	287	7
I	Sill Height at B-Pillar	287	313	-26
J1	Sill Height at Rear Wheel Well	292	296	-4
J2	Pinch Weld Height at Rear Wheel Well	291	306	-15
K	Sill Height Aft of Rear Wheel Well	305	315	-10
L	Rear Bumper Thickness	100	100	0
M	Rear Bumper Bottom to Ground	332	322	10
N	Sill Height to Bottom of Front Window Sill	915	908	7
O	Front Door Leading Edge to Impact CL	670	493	177
P	Rear Door Trailing Edge to Impact CL	1319	1212	107
Q	Front Window Opening	407	352	55
R	Right Side Length	3980	4000	-20
S	Left Side Length	3980	3820	160
T	Vehicle Width at B-Pillars	1915	1795	120

DATA SHEET NO. 10
VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2019 Nissan Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019



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	487	376	0
2	Occupant Hip Point	659	414	0
3	Mid Door	713	418	0
4	Window Sill	1087	369	75
5	Window Top	1611	140	75

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

Test Vehicle: 2019 Nissan Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019

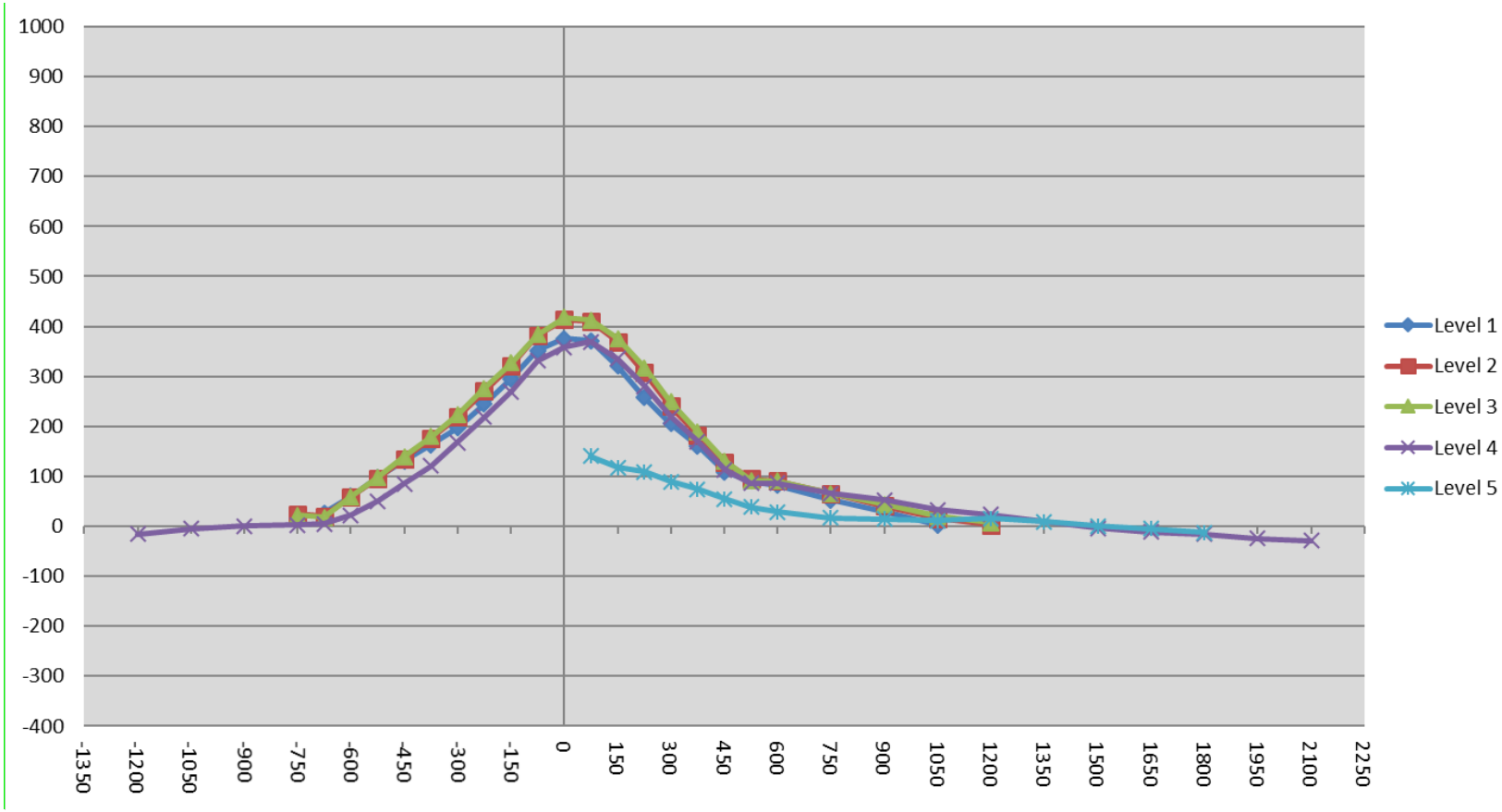
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-2700															
-2550															
-2400															
-2250															
-2100															
-1950															
-1800															
-1650															
-1500															
-1350															
-1200				263					247					-16	
-1050				234					229					-6	
-900				229					230					1	
-825															
-750		146	143	237			170	165	240			24	22	3	
-675	158	146	143	239		185	166	161	244		27	20	18	5	
-600	161	148	146	240		221	207	205	262		60	59	59	22	
-525	166	152	148	238		265	248	247	289		99	96	99	51	
-450	172	154	150	232		303	289	289	317		131	135	139	85	
-375	178	156	153	229		341	332	332	350		163	176	179	121	
-300	183	157	154	225		380	376	377	393		197	219	223	168	
-225	185	157	154	221		430	428	430	440		245	271	276	219	
-150	185	156	154	218		480	478	481	488		295	322	327	270	
-75	185	154	152	212		537	536	535	543		352	382	383	331	
0	184	153	150	208		560	567	568	566		376	414	418	358	
75	184	152	149	204	481	555	563	562	573	621	371	411	413	369	140
150	184	151	147	199	475	504	520	523	535	593	320	369	376	336	118
225	184	151	146	195	468	441	458	463	475	577	257	307	317	280	109
300	184	150	145	192	465	389	390	394	412	554	205	240	249	220	89
375	185	150	144	189	463	346	333	333	359	537	161	183	189	170	74
450	187	150	143	186	462	296	278	274	299	517	109	128	131	113	55
525	190	149	143	184	460	280	244	235	270	498	90	95	92	86	38
600	189	149	142	182	460	271	240	232	268	489	82	91	90	86	29
675															
750	194	150	143	184	460	247	215	209	250	477	53	65	66	66	17
825															
900	187	150	143	189	462	216	191	187	242	477	29	41	44	53	15
1050	172	147	142	196	466	175	163	162	229	477	3	16	20	33	11
1200		148	143	204	471		151	150	227	487		3	7	23	16
1350					479					488					9
1500				211	488				207	489				-4	1
1650				215	504				203	499				-12	-5
1800				222	529				206	516				-16	-13
1950				237					213					-24	
2100				257					228					-29	
2250															
2400															
2550															
2700															

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.

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

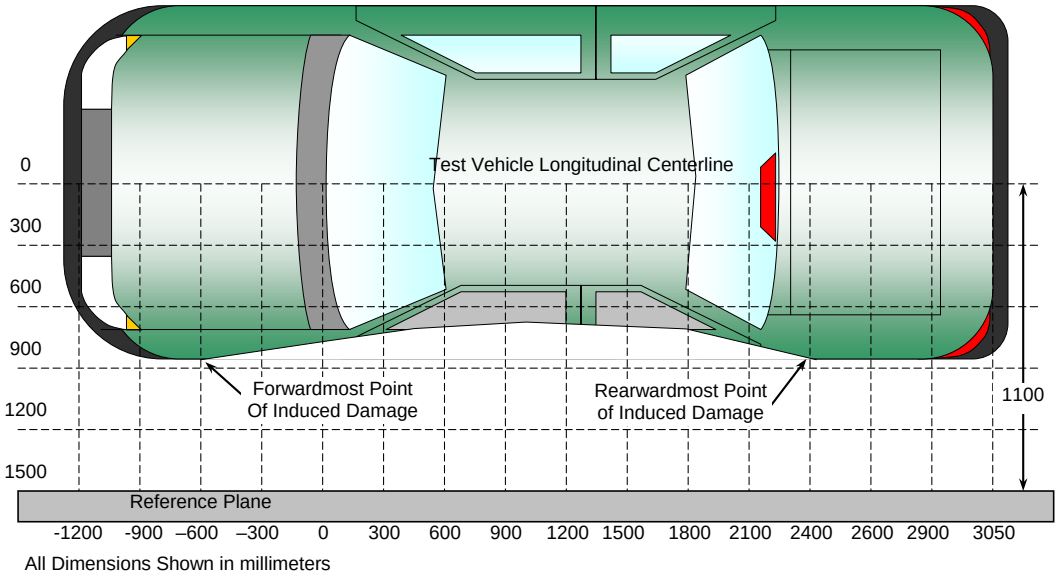
Test Vehicle: 2019 Nissan Murano S 5-Door SUV
Test Program: NCAP Side Pole Impact Test

NHTSA No. M20195210
Test Date: 2/6/2019



DATA SHEET NO. 11
VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2019 Nissan Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019



TOP VIEW

DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point (mm)	Level	Pre-Test (mm)	Post-Test (mm)	Crush (mm)
1	470	3	143	258	115
2	242	3	146	446	300
3	14	3	150	573	423
4	-214	3	154	438	284
5	-442	3	150	295	145
6	-670	3	143	164	21

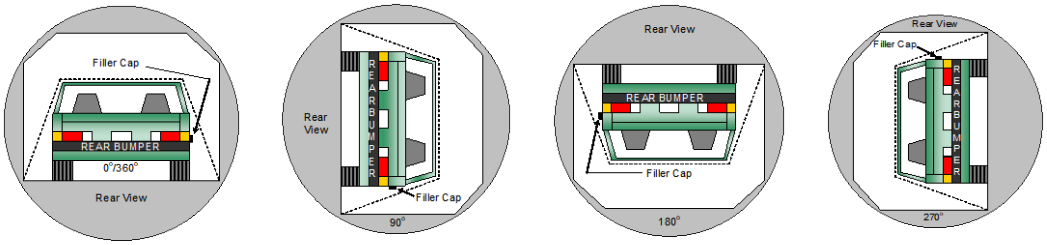
DATA SHEET NO. 12
FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2019 Nissan Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019

Test Time: 2:14 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°	111	300	411
90° to 180°	113	300	413
180° to 270°	114	300	414
270° to 360°	112	300	412

FMVSS 301 ROLLOVER SPILLAGE TABLE (units in ounces)

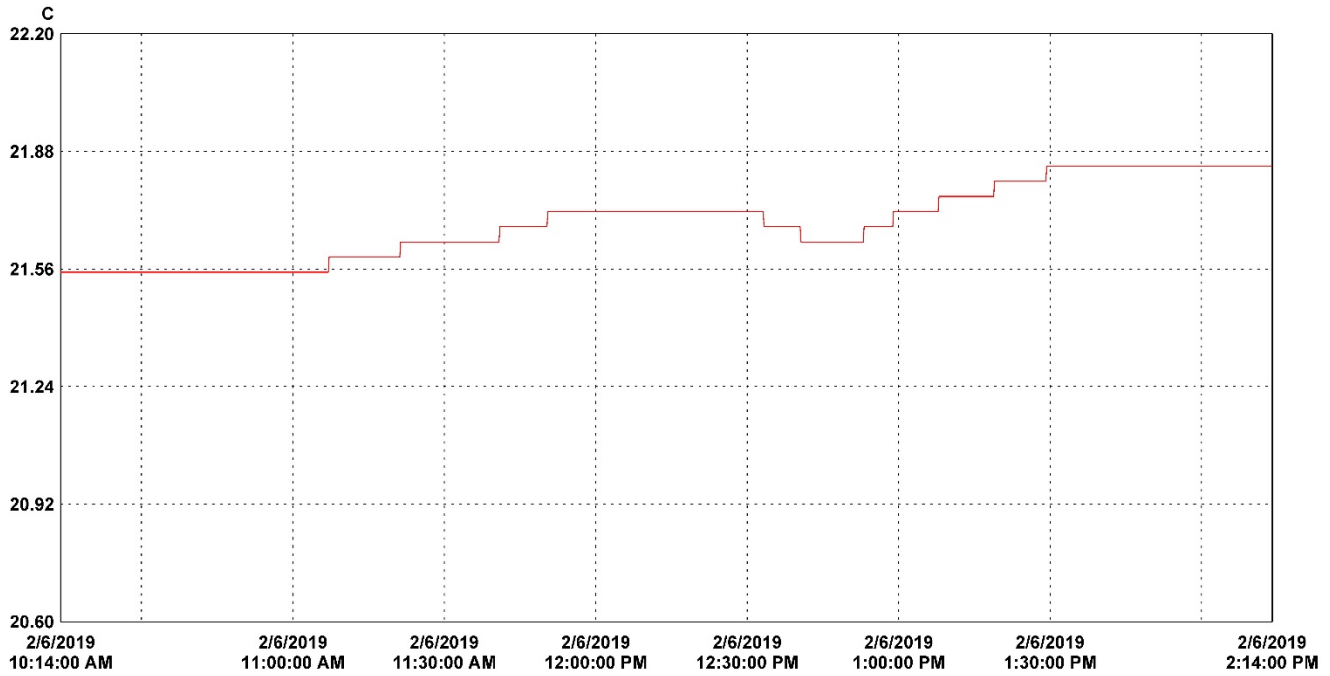
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

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 Murano S 5-Door SUV NHTSA No. M20195210
Test Program: NCAP Side Pole Impact Test Test Date: 2/6/2019



30 minutes/div 4 hours (M/d/yyyy h:mm:ss tt) Central Time Graph file (truncated): M20195210 2019 Nissan Murano S 5-Door SUV SPNCAP.spg

LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	12102107	VSC_South_Hall	1		21.84	21.69	21.55	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

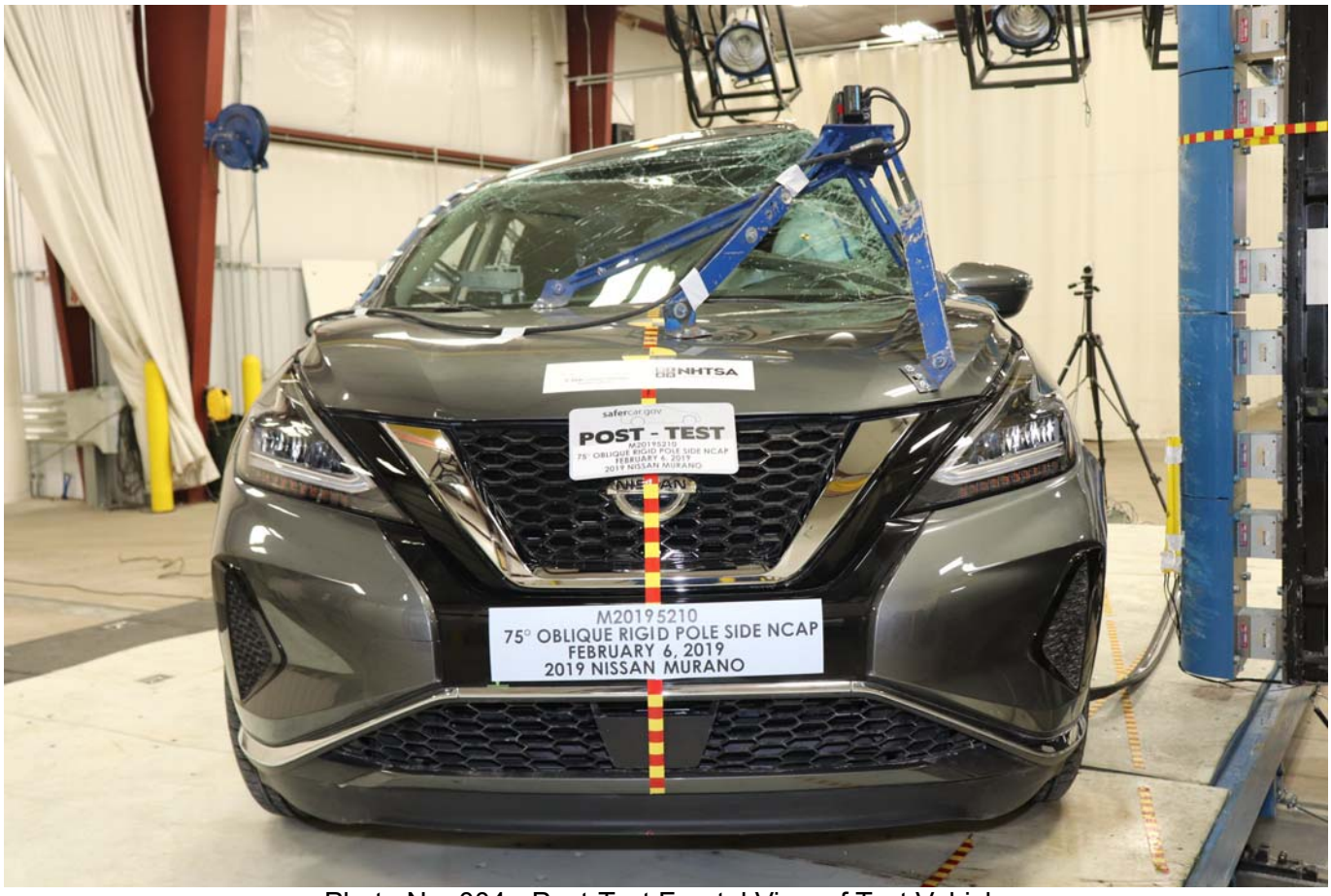


Photo No. 004 - Post-Test Frontal View of Test Vehicle

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

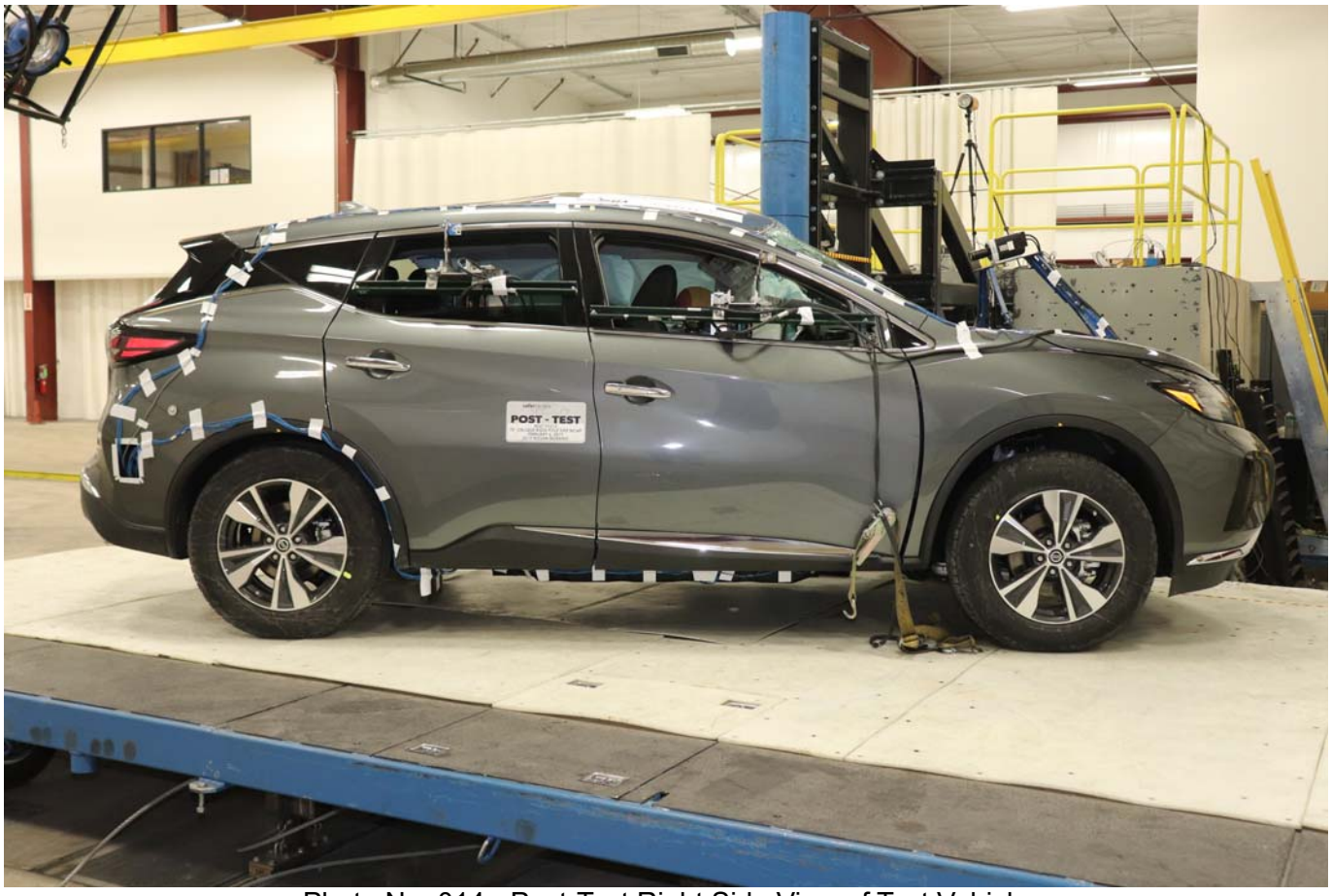


Photo No. 014 - Post-Test Right Side View of Test Vehicle

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

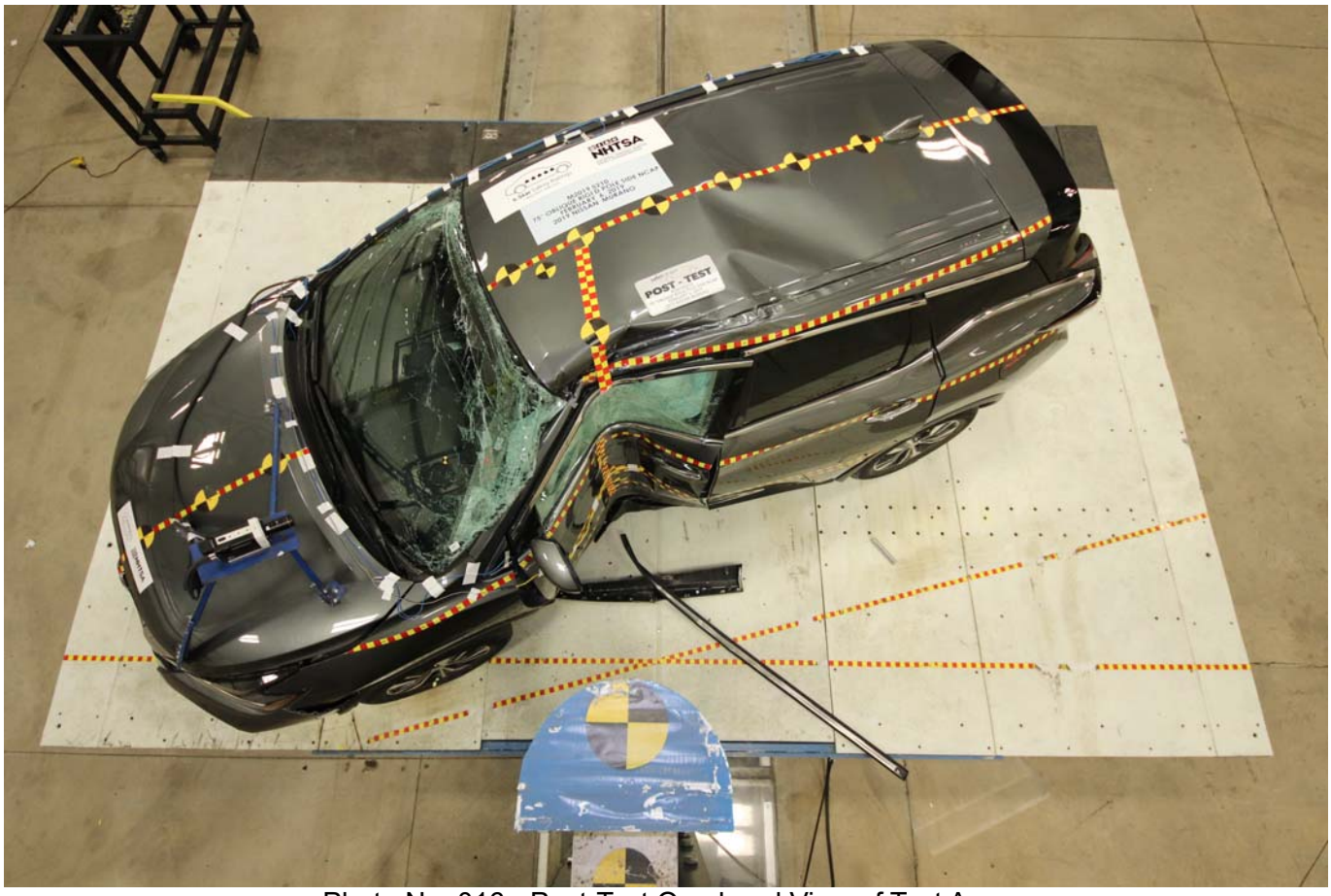


Photo No. 016 - Post-Test Overhead View of Test Area

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

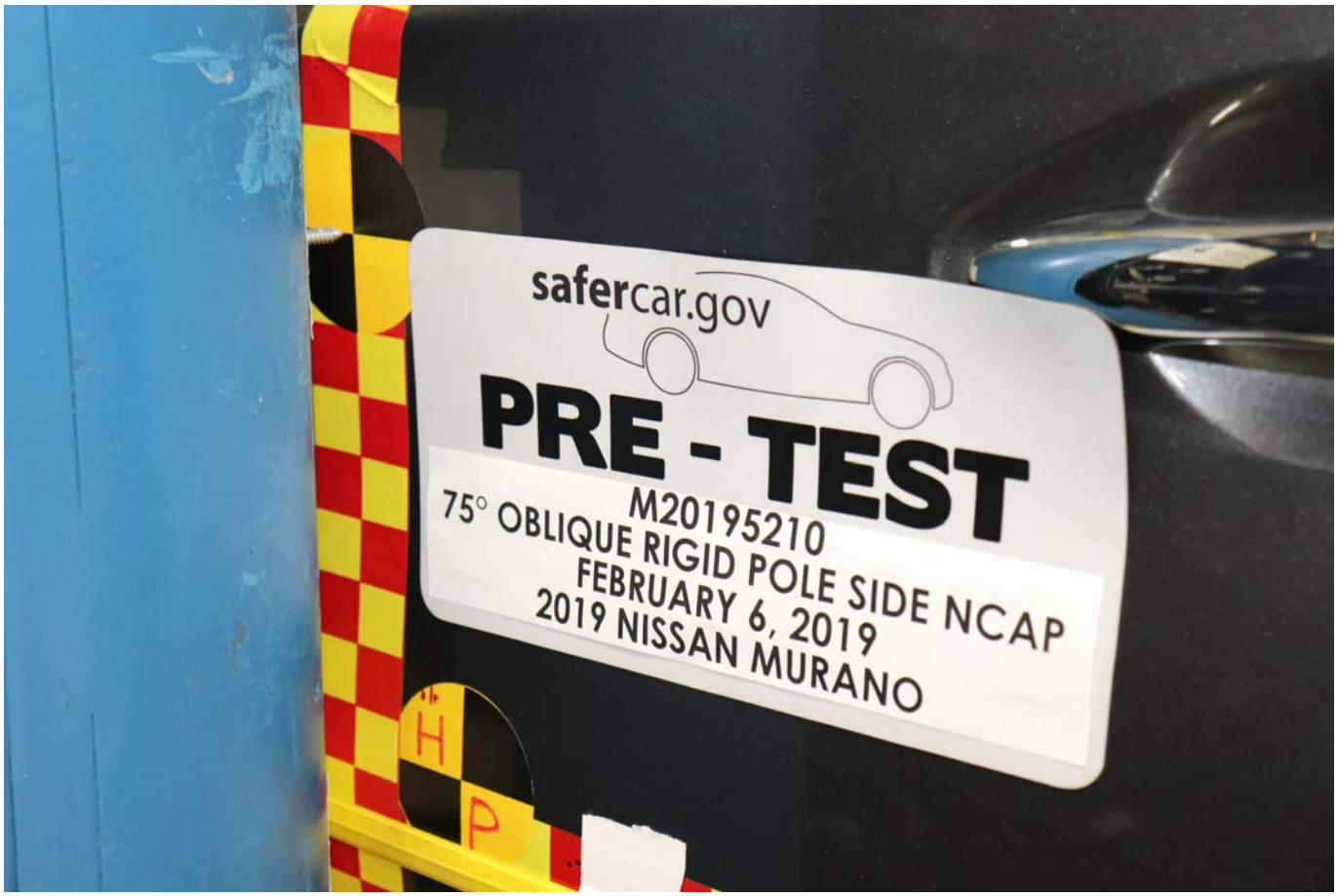


Photo No. 019 - Pre-Test Close-Up View of Impact Point Target

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

PHOTOGRAPH NOT AVAILABLE

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

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

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

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

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

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

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

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

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

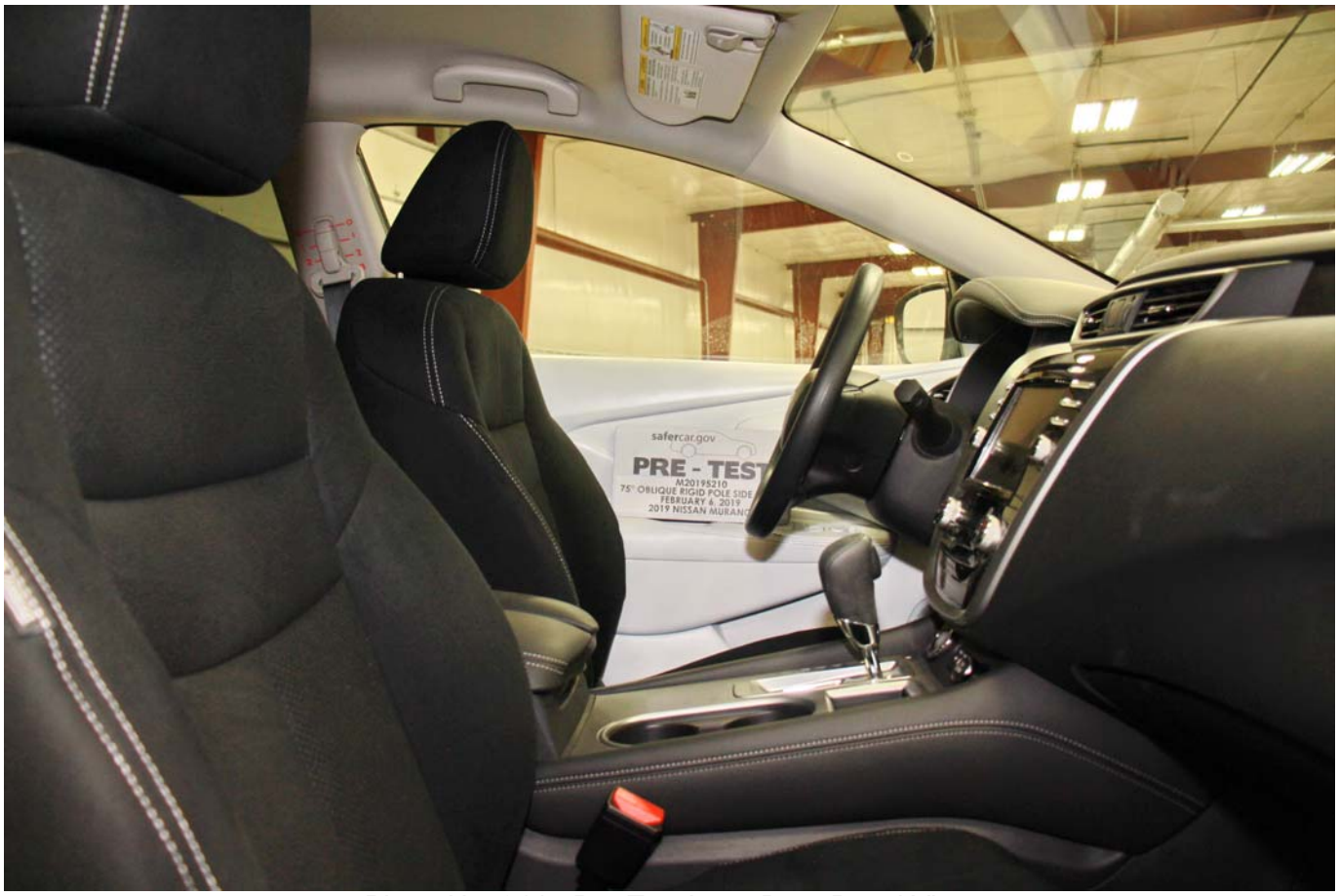


Photo No. 044 - Pre-Test Inner Door Panel View

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

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

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

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

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

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

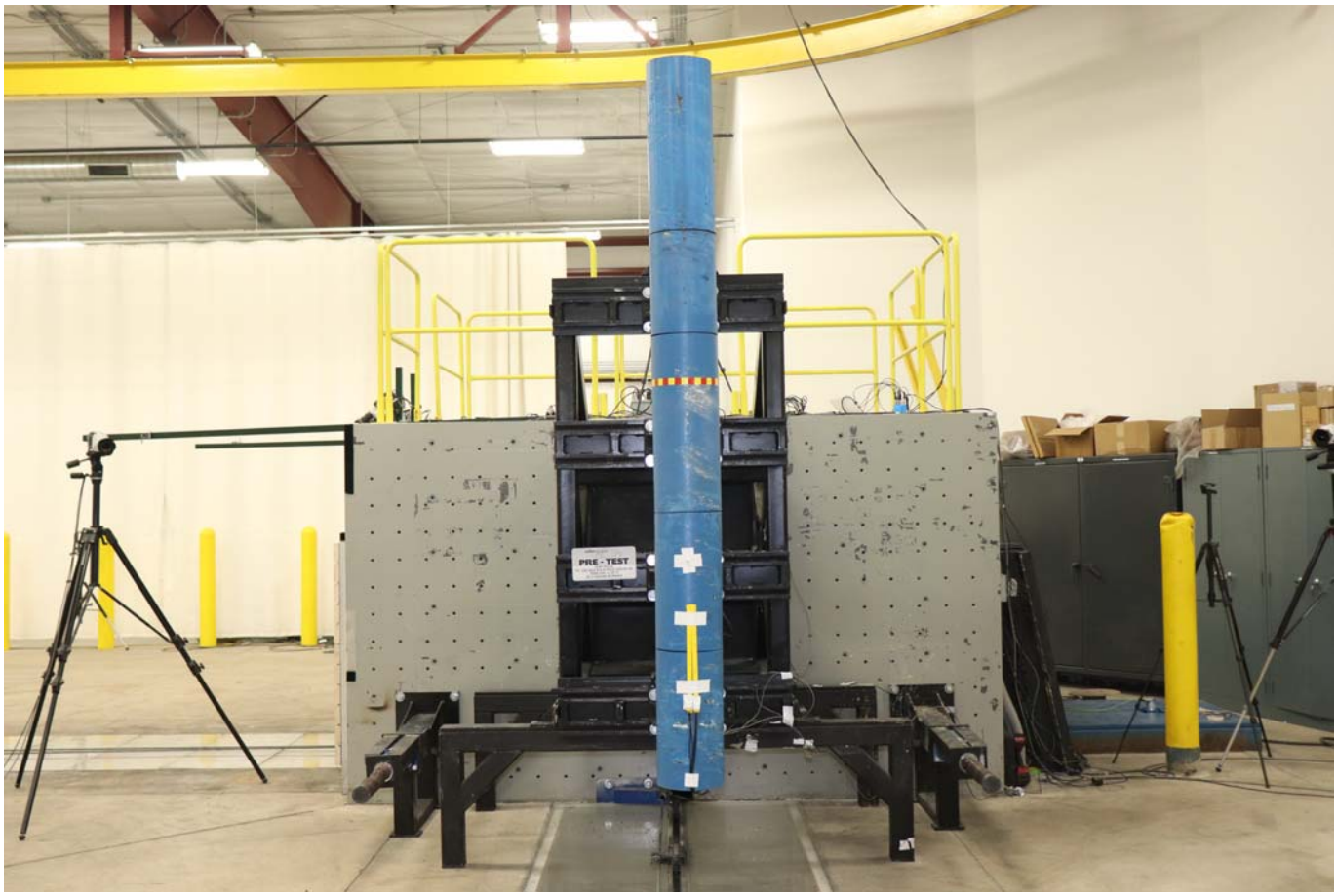


Photo No. 057 - Pre-Test Pole Barrier Front View

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

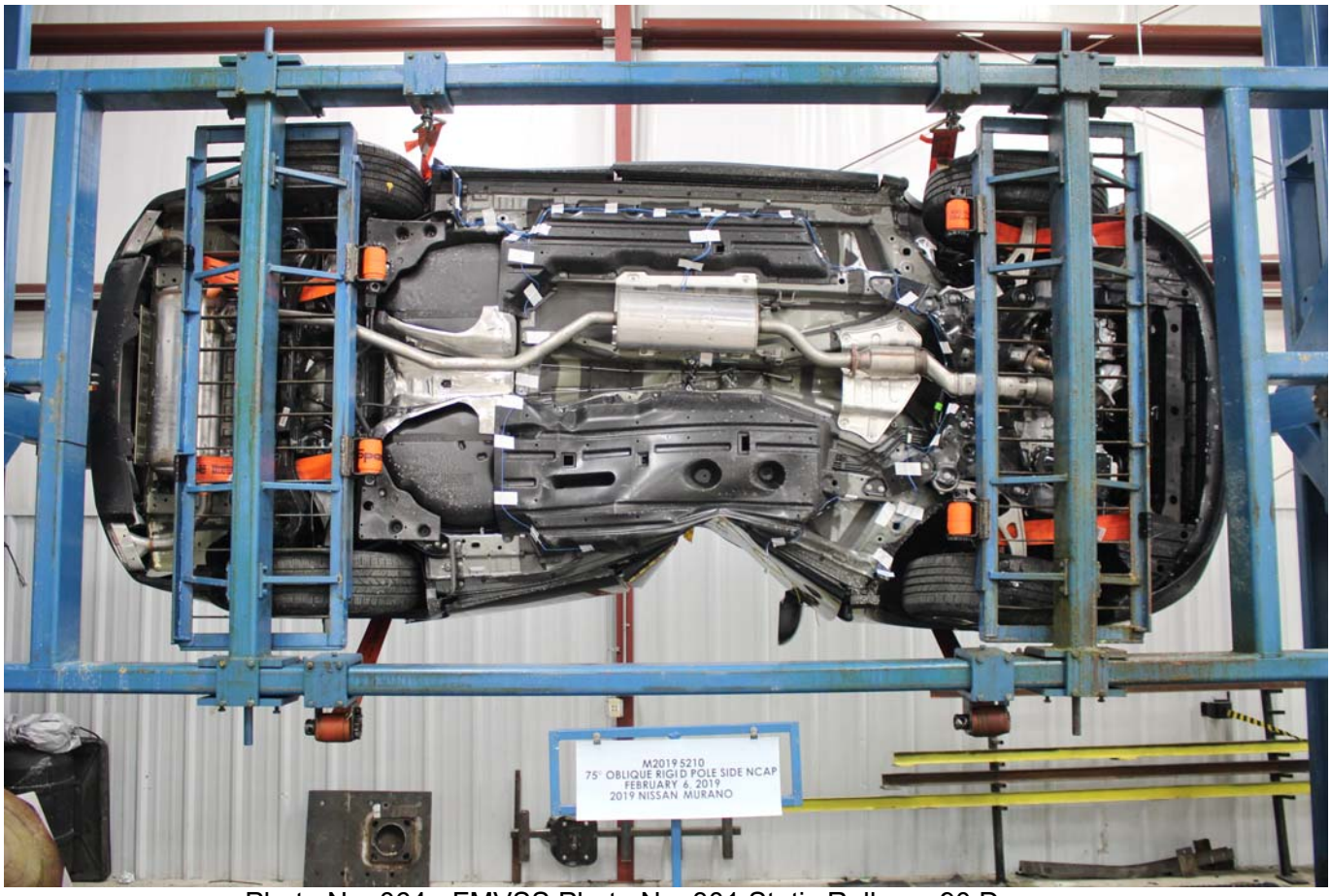


Photo No. 064 - FMVSS Photo No. 301 Static Rollover 90 Degrees

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 MURANO
S FWD

Scan QR code for general model information & options

Manufacturer's Suggested Retail Base Price: $31,270.00

Options Included by Manufacturer

DESTINATION CHARGES 1,045.00

Total* $32,315.00

Standard Equipment Included at No Extra Charge

MECHANICAL & PERFORMANCE
3.5 Liter V6 Engine
260 Horsepower, 240 lb-ft Torque
XTRONIC CVT®
(Continuously Variable Transmission)
Hill Start Assist
Front-Wheel Drive
18" Machined Aluminum-Alloy Wheels

SAFETY & SECURITY
Automatic Emergency Braking (AEB)
Intelligent Forward Collision Warning(I-FCW)
Driver & Front Passenger, Side-Impact, & Curtain Air Bags
Driver Knee Air Bag
Passenger's Seat Knee Air Bag
Second Row Side Air Bags
Lower Anchors & Tethers for CHildren (LATCH)
4-Wheel Anti-lock Braking System (ABS)
Vehicle Dynamic Control (VDC)
Electronic Brake Force Distribution (EBD) and Brake Assist (BA)
Tire Pressure Monitoring System (TPMS) w/Easy-Fill Tire Alert
Vehicle Security System (VSS)
Nissan Vehicle Immobilizer System

COMFORT & CONVENIENCE
Rear Door Alert
Intelligent Driver Alertness (I-DA)
6-Way Manual Driver's Seat
4-Way Manual Front Passenger's Seat
60/40 Split Fold-Down Rear Seats
Cloth Seats
Power Front Windows with One-Touch Auto-Up/Down with Safety Reverse Feature
Tilt and Telescoping Steering Wheel
Cruise Control
RearView Monitor
7" Advanced Drive-Assist® Display
Dual Zone Automatic Temperature Control (ATC) w/Front & Rear Vents
Nissan Intelligent Key®
Push Button Ignition

COMFORT & CONVENIENCE CONT.
AM/FM/CD Audio System with MP3/WMA Reader and 6 Speakers
NissanConnect® featuring Apple CarPlay™ and Android Auto™ +
8" Color Display w/ Multi-Touch Control
Bluetooth® Hands-Free Phone System+
Streaming Audio via Bluetooth®+
Hands-free Text Messaging Assistant+
Voice Recognition
Siri® Eyes Free+
SiriusXM® Radio with Advanced Audio Features+
2 Front Illuminated USB Connection Ports for iPod® Interface and Other Compatible Devices (1 Type-A, 1 Type-C)
2 Rear Illuminated USB Charge Port (1 Type-A, 1 Type-C)
(3) 12-Volt DC Power Outlets

EXTERIOR
LED Headlights with Signature LED Daytime Running Lights
Automatic On/Off Headlights
LED Rear Taillights
Outside Mirrors w/LED Turn Indicators
Rear Privacy Glass

+For more information, see dealer, owner's manual, or www.NissanUSA.com /connect/important-information.

*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

Fuel Economy
23 MPG combined city/hwy
20 city
28 highway
4.3 gallons per 100 miles

MID-SIZE STATION WAGON range from 18 to 27 MPG. The best vehicle rates 136 MPGe.

You spend $1,250 more in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost $1,650

Fuel Economy & Greenhouse Gas Rating (tailpipe only) 5 (1 to 10, Best)
Smog Rating (tailpipe only) 5 (1 to 10, Best)

This vehicle emits 395 grams CO_2 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: GRAPHITE

FINAL ASSEMBLY POINT:
CANTON

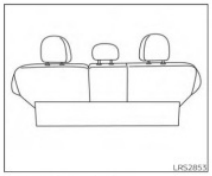
TRANSPORT METHOD:
TRUCK

DEALER:
FRANKLIN NISSAN
705 JAMESTOWN ST
COLUMBIA KY
42728

VIN: 5N1AZ2MJ1KN106306
EMS: 50 STATE EMISSIONS
MDL: 23119-106306 KAD-G
OPT: E-C03

20181215010625AS3798

Photo No. 069 - Monroney Label



To return the seatbacks:

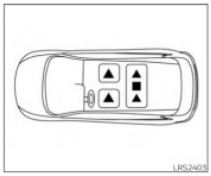
1. Lift up each seatback and push it to the upright position until it is latched.
2. Always reconnect the center seat belt when the seat is returned to the upright position.

⚠ WARNING

- **When returning the seatbacks, be sure to attach the rear center seat belt connector.**
- **Do not unfasten the rear center seat belt connector except when folding down the rear seat.**
- **When attaching the rear center seat belt connector, be certain that the seatbacks are completely secured in the latched position and the rear center seat belt connector is completely secured.**
- **If the rear center seat belt connector and the seatbacks are not secured in the correct position, serious personal injury may result in an accident or sudden stop.**

⚠ 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.



The illustration shows the seating positions equipped with head restraints/headrests.

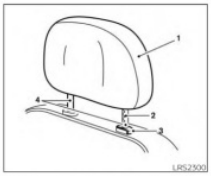
▲ Indicates the seating position is equipped with a head restraint.

■ Indicates the seating position is equipped with a headrest.

+ Indicates the seating position is not equipped with a head restraint or headrest (if applicable).

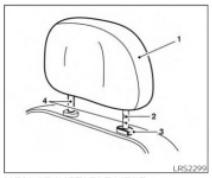
- Your vehicle is equipped with a head restraint/headrest that may be integrated, adjustable or non-adjustable.

- Adjustable head restraints/headrests have multiple notches along the stalk(s) to lock them in a desired adjustment position.
- 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.



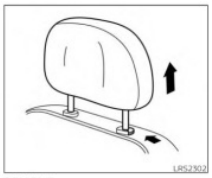
ADJUSTABLE HEAD RESTRAINT/ HEADREST COMPONENTS

1. Removable head restraint/headrest
2. Multiple notches
3. Lock knob
4. Stalks



NON-ADJUSTABLE HEAD RESTRAINT/HEADREST COMPONENTS

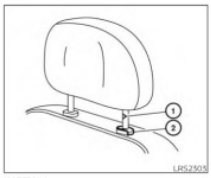
1. Removable head restraint/headrest
2. Single notch
3. Lock knob
4. Stalks



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.



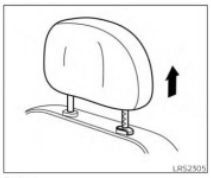
INSTALL

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.

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.



Raise

To raise the head restraint/headrest, pull it up.

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)

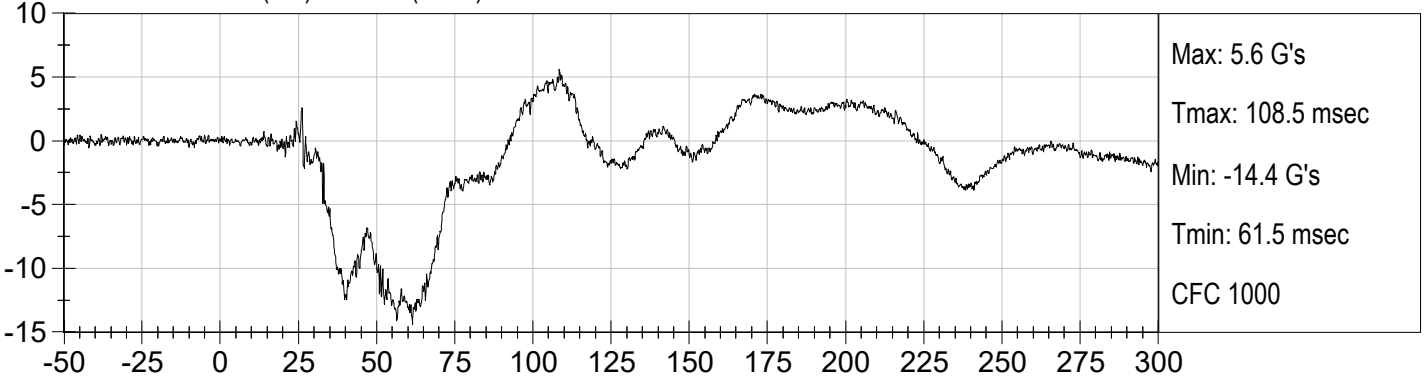
Load Cell Pole Barrier #5 Force (Y)

Load Cell Pole Barrier #6 Force (Y)

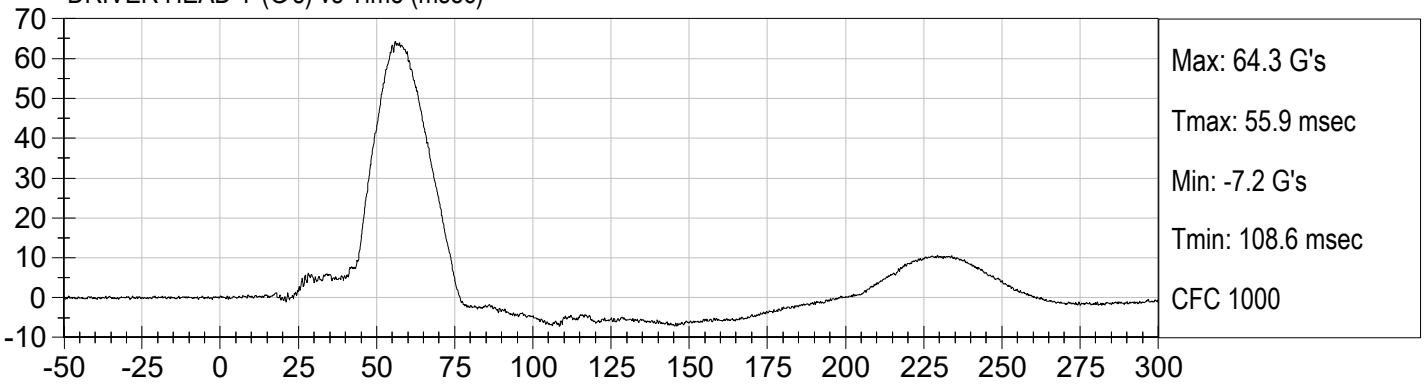
Load Cell Pole Barrier #7 Force (Y)

Load Cell Pole Barrier #8 Force (Y)

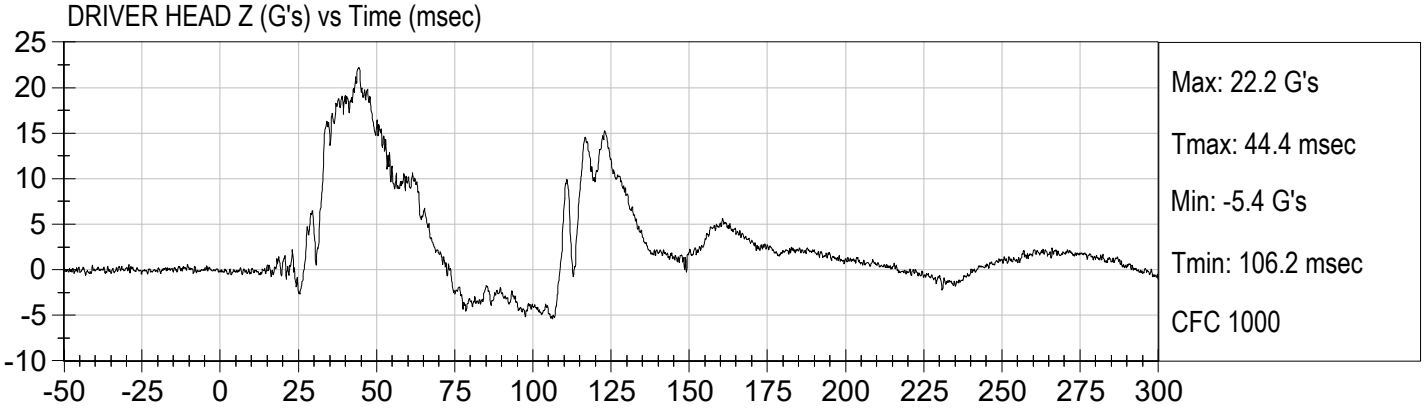
DRIVER HEAD X (G's) vs Time (msec)



DRIVER HEAD Y (G's) vs Time (msec)

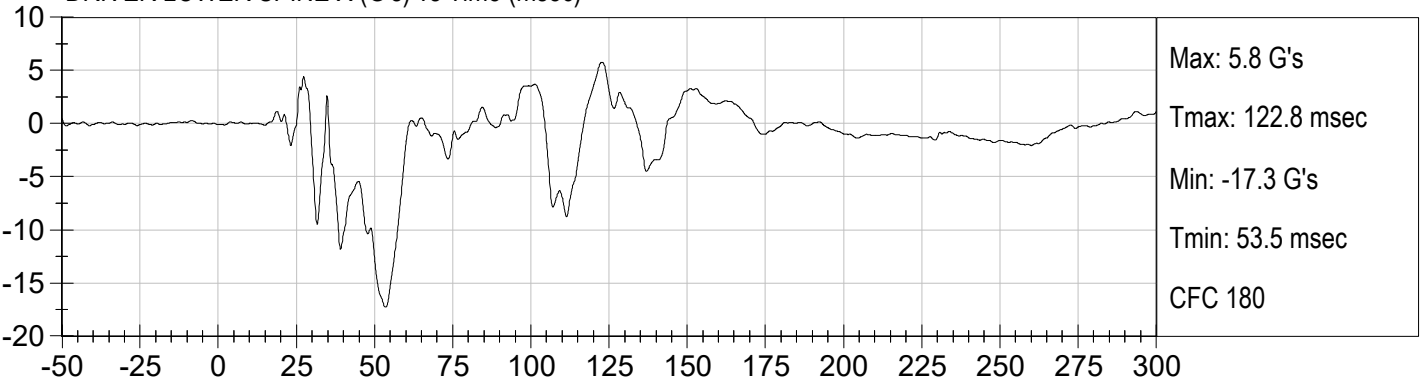


DRIVER HEAD Z (G's) vs Time (msec)

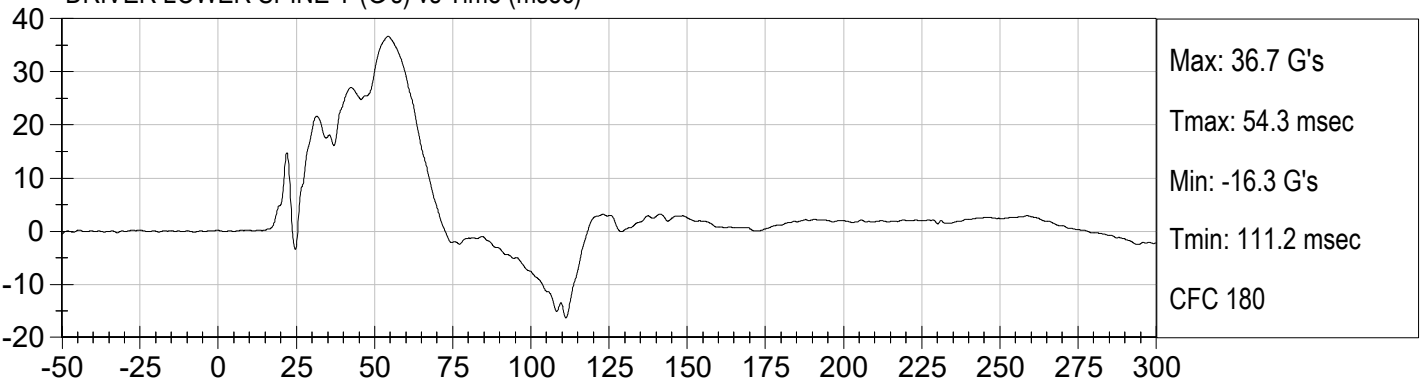


DRIVER HEAD Resultant (G's) vs Time (msec)

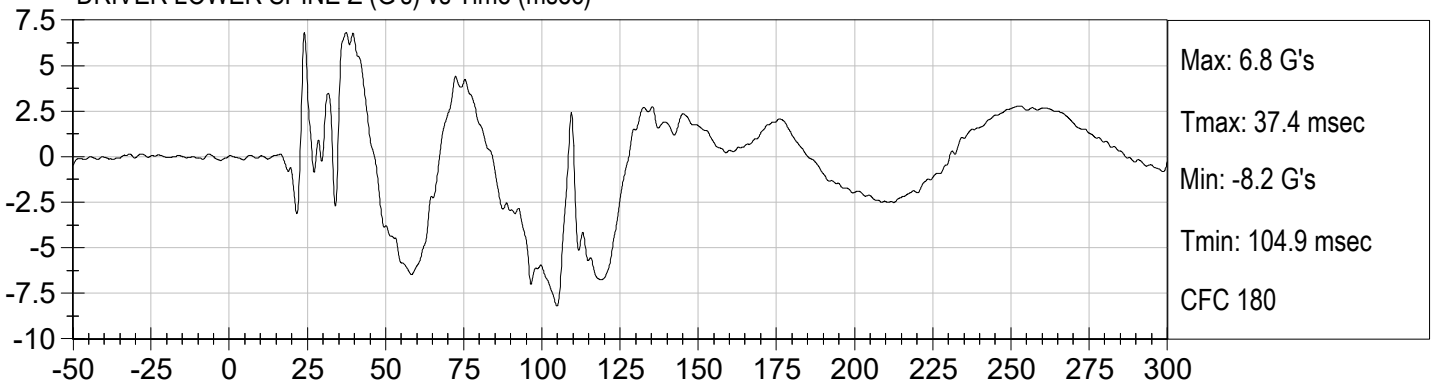
DRIVER LOWER SPINE X (G's) vs Time (msec)



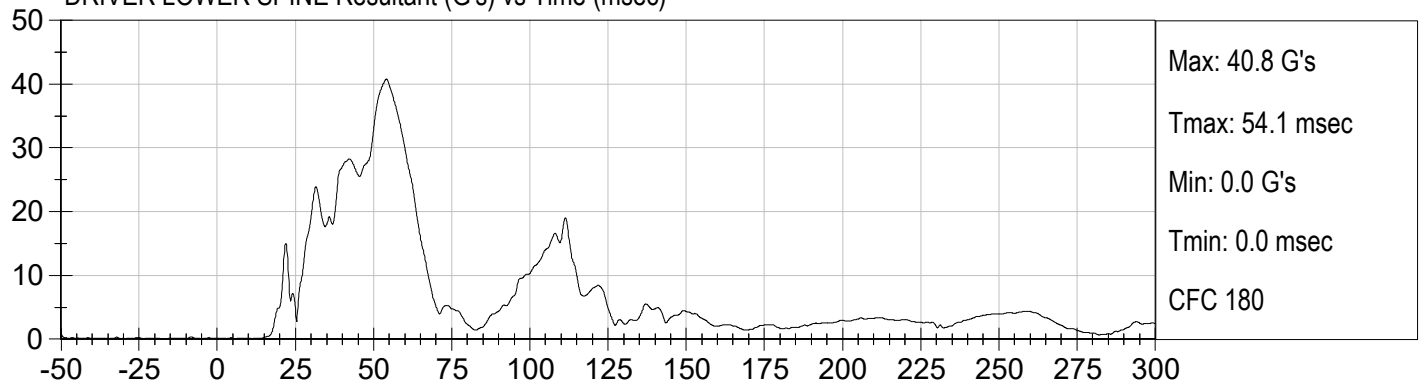
DRIVER LOWER SPINE Y (G's) vs Time (msec)



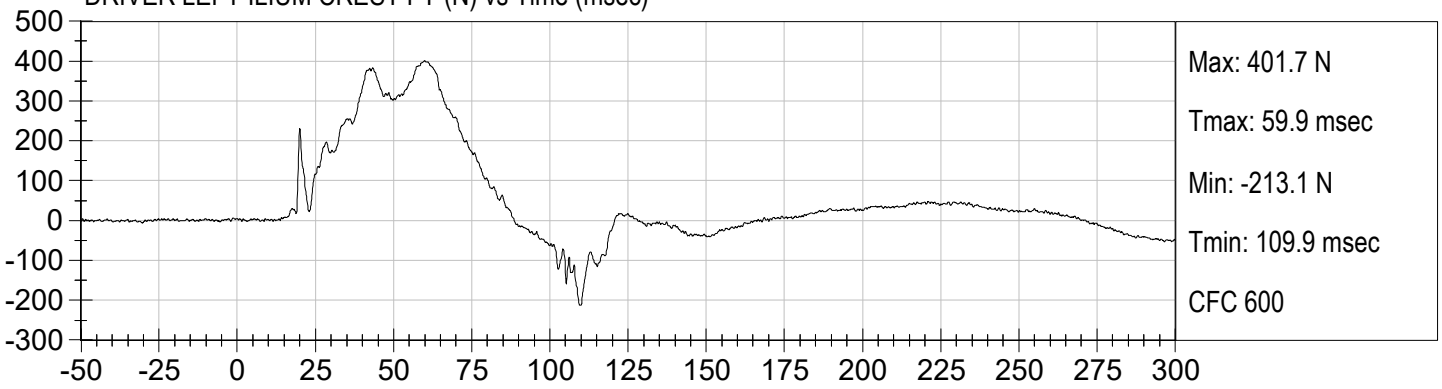
DRIVER LOWER SPINE Z (G's) vs Time (msec)



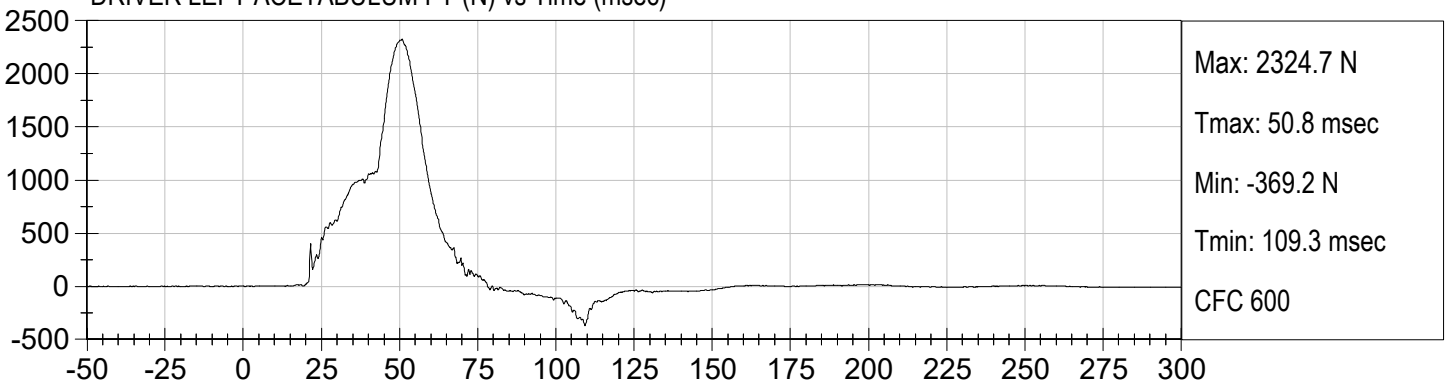
DRIVER LOWER SPINE Resultant (G's) vs Time (msec)



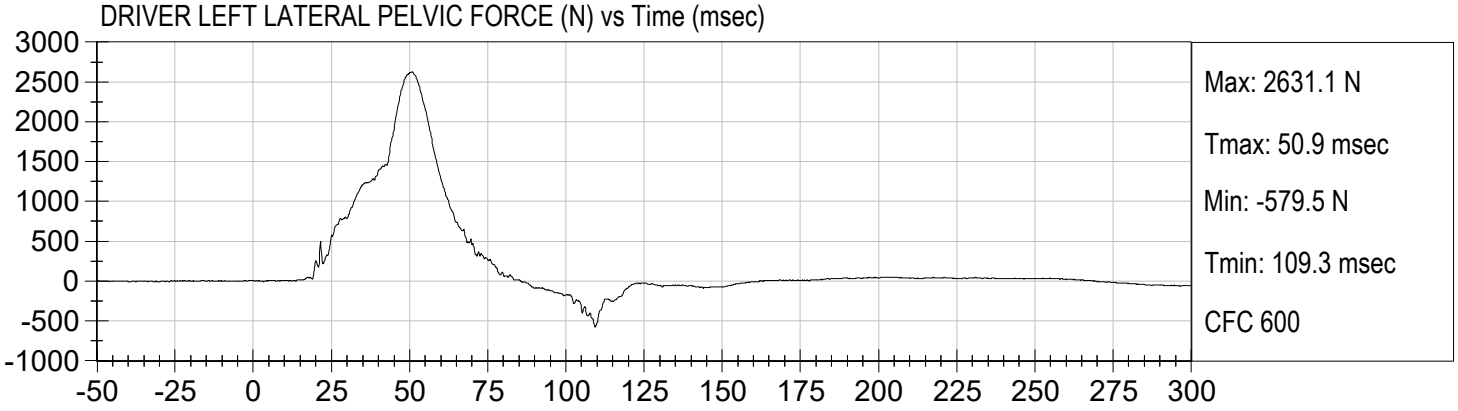
DRIVER LEFT ILIUM CREST FY (N) vs Time (msec)



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



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



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:** D190401

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	13	Pass
Peak Resultant Acceleration	G's	115 to 137	137	Pass
Peak Longitudinal Acceleration	G's	+/- 15	3.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Danielle Redinbaugh
Laboratory Technician

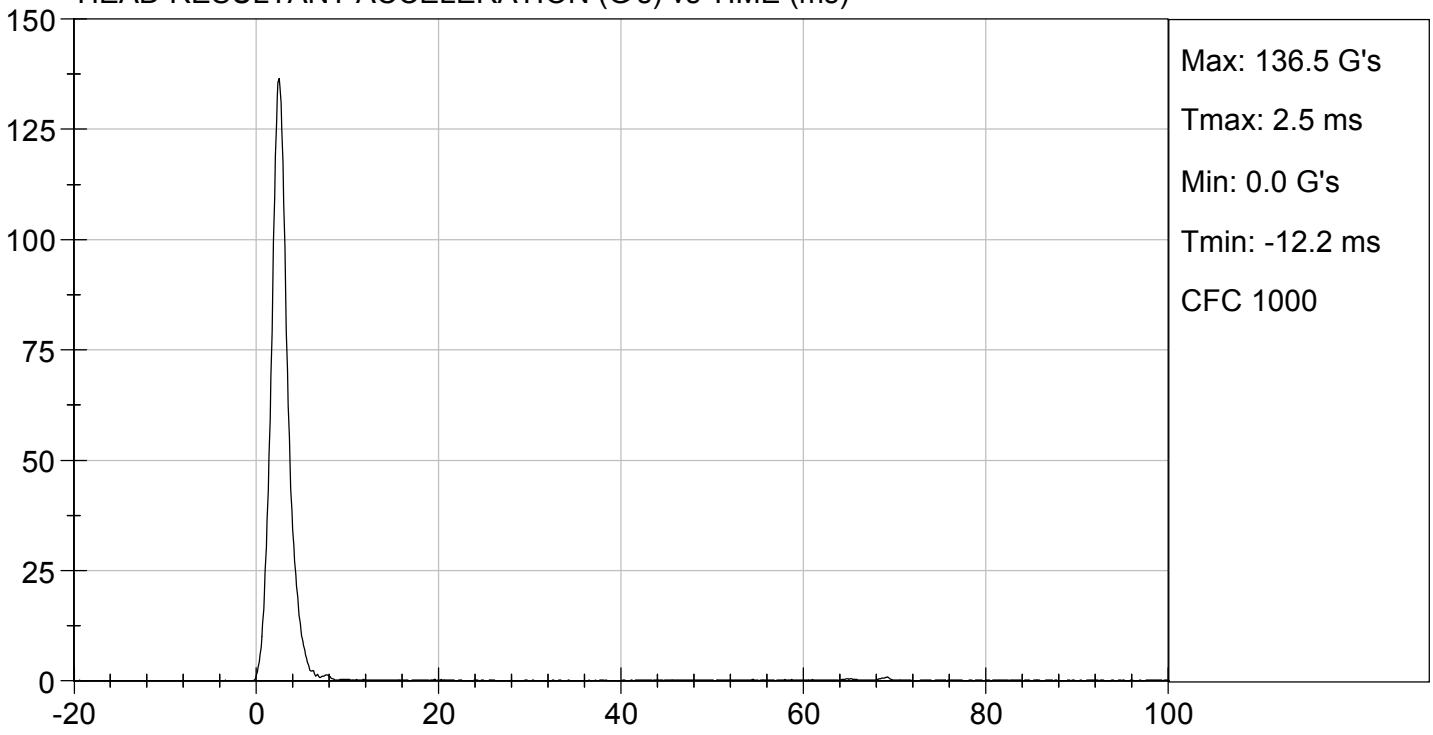
01/31/2019
Test Date

Robert Schmidt
Approved By

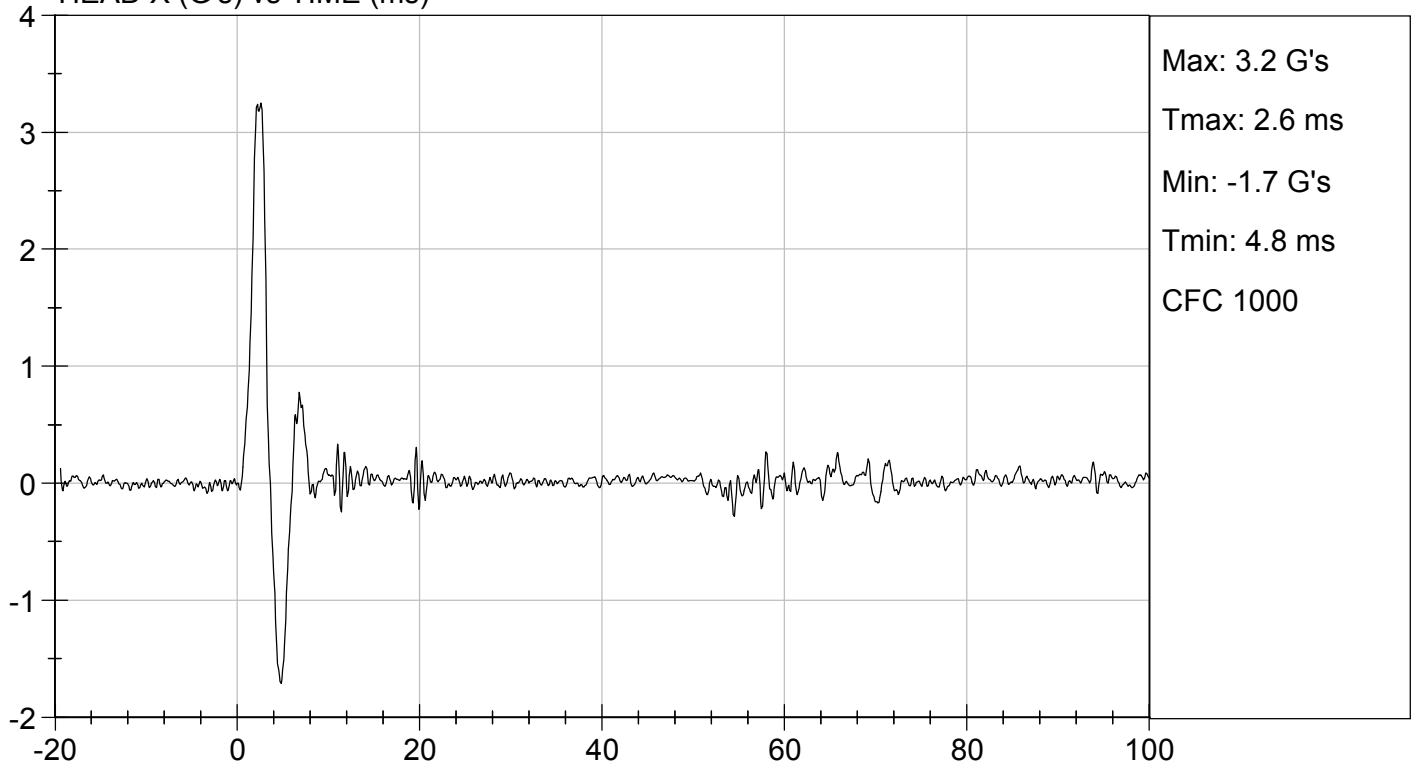
TEST DESC: HEAD DROP

TEST DATE: 01/31/2019
TEST #: D190401

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

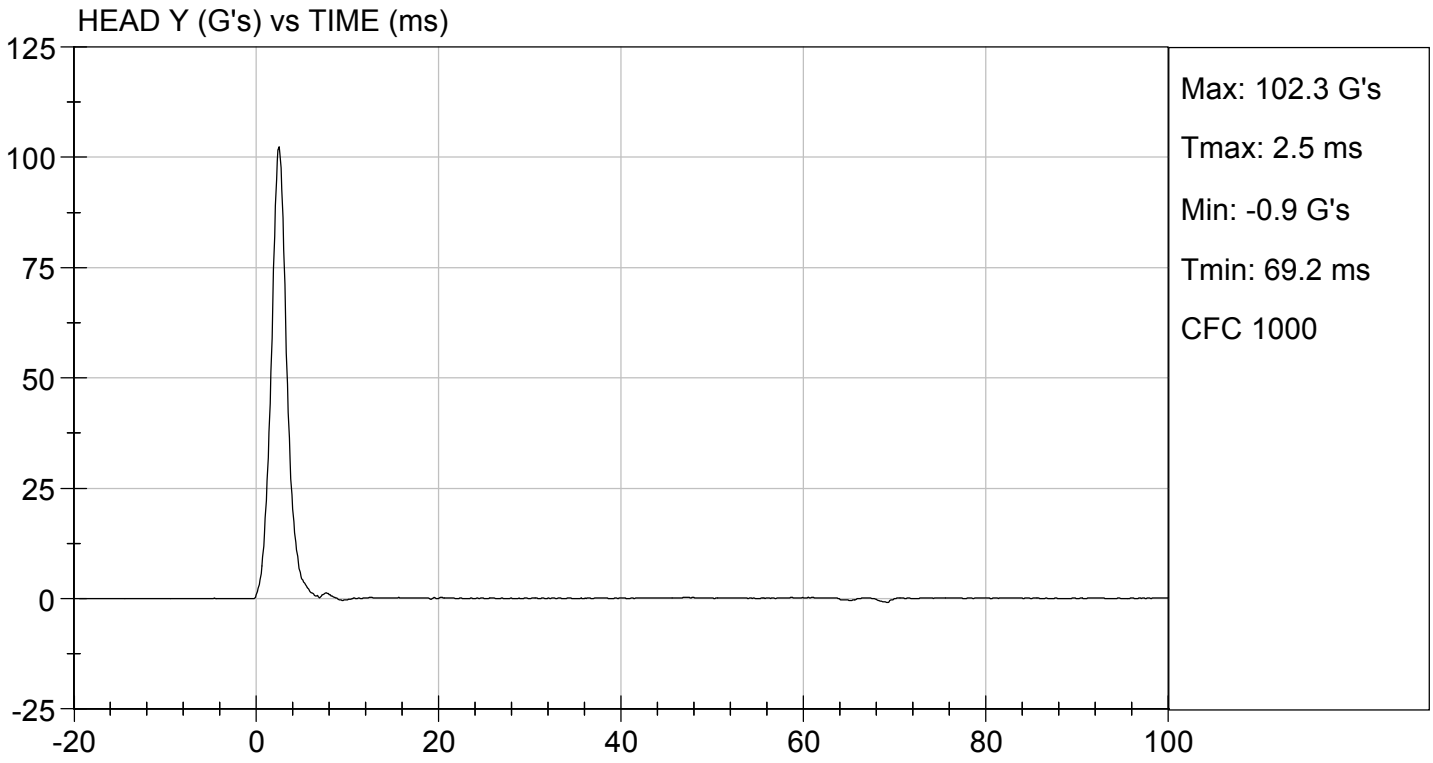


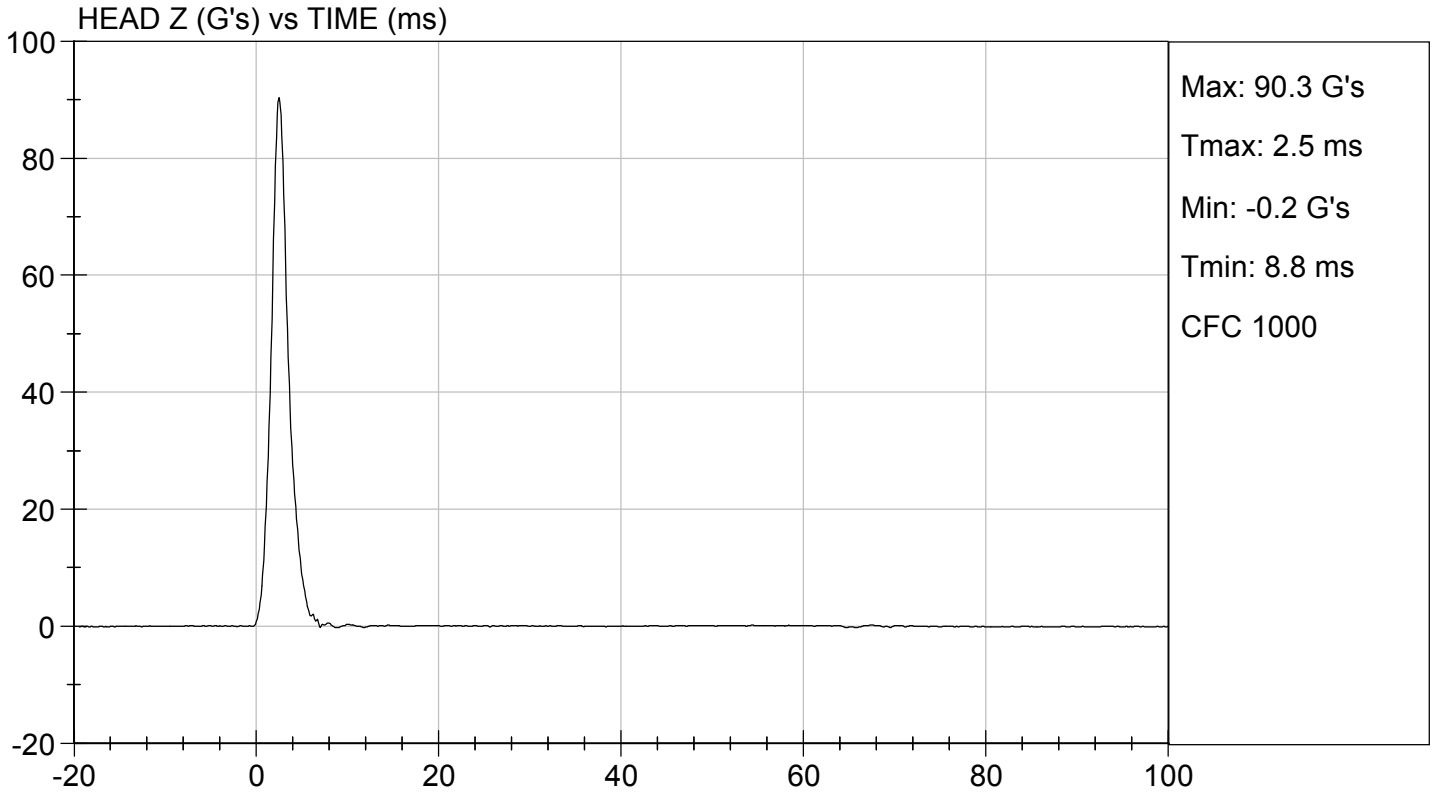
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 01/31/2019
TEST #: D190401





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D190402

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	20.7	Pass
Humidity		%	10 to 70	13	Pass
Impact Velocity		m/s	5.51 to 5.63	5.61	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.54	Pass
	15 ms	m/s	3.30 to 4.10	3.72	Pass
	20 ms	m/s	4.40 to 5.40	5.22	Pass
	25 ms	m/s	5.40 to 6.10	5.68	Pass
	25-100 ms	m/s	5.50 to 6.20	5.70	Pass
Maximum D-Plane Rotation		deg	71 to 81	73	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	58	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-41	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	109	Pass
			Overall Test Results		Pass

Danielle Redinbaugh
Laboratory Technician

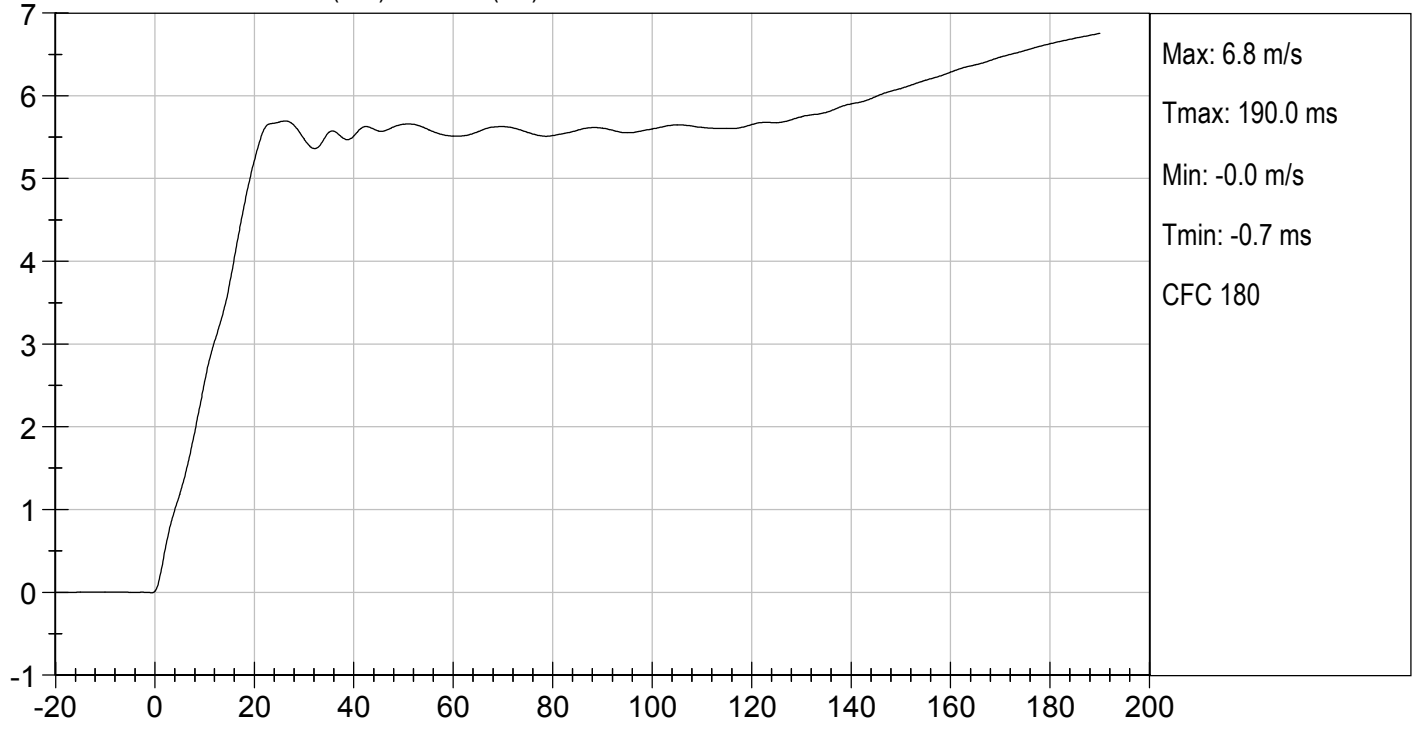
01/31/2019
Test Date

Robert Schmalz
Approved By

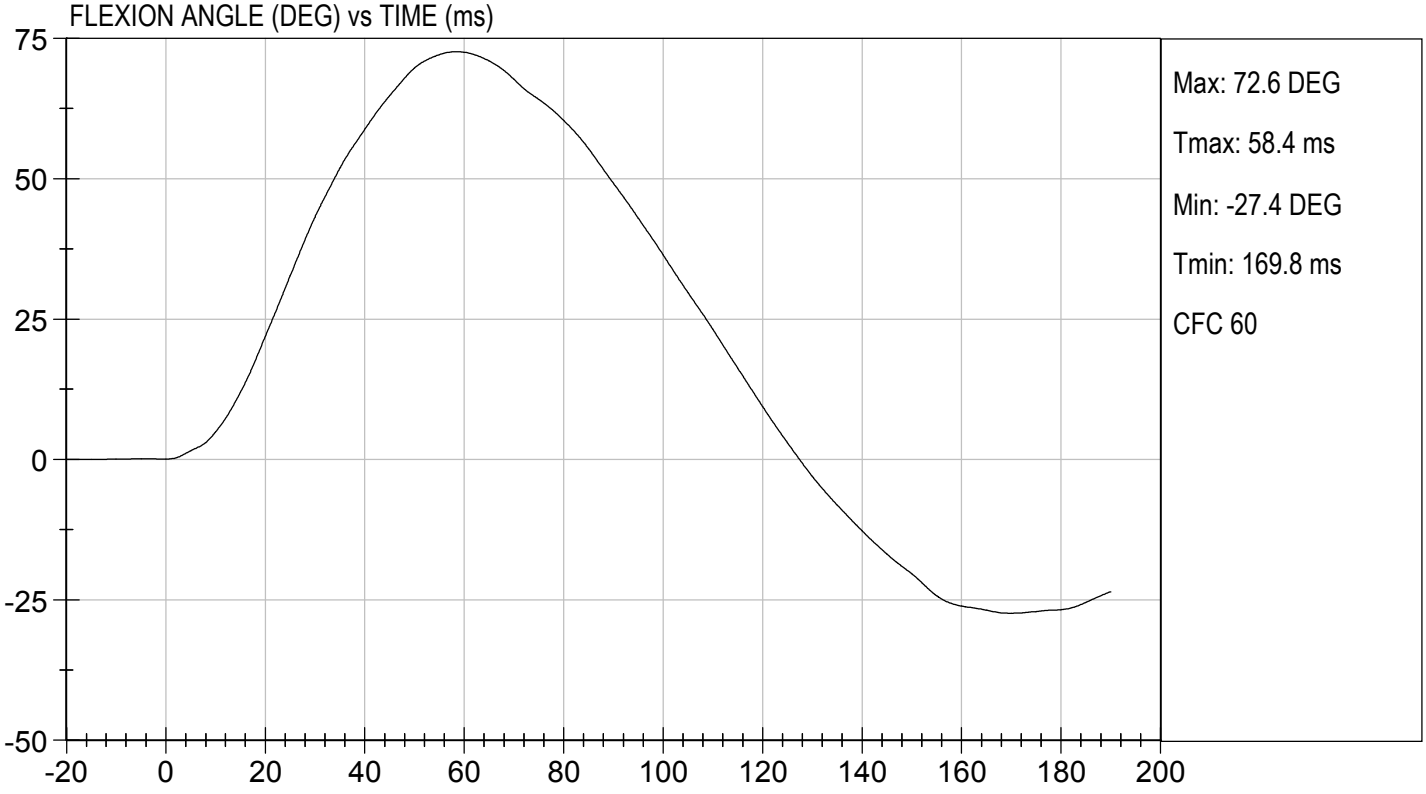
TEST DESC: NECK BENDING
VELOCITY: 18.40 ft/s, 5.61 m/s

TEST DATE: 01/31/2019
TEST #: D190402

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

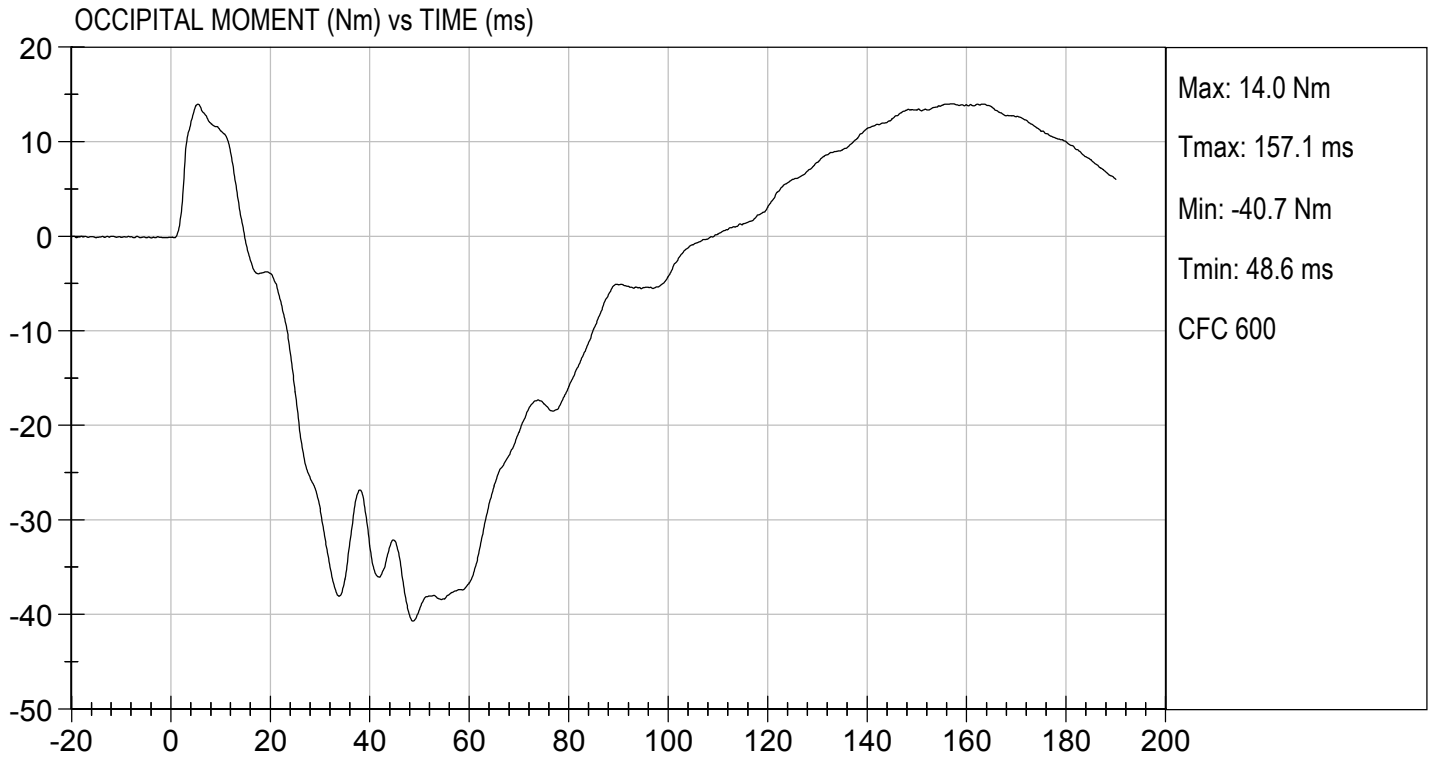


FLEXION ANGLE (DEG) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 18.40 ft/s, 5.61 m/s

TEST DATE: 01/31/2019
TEST #: D190402



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D190403

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	13	Pass
Impact Velocity	m/s	4.20 to 4.40	4.39	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	29	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	21	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

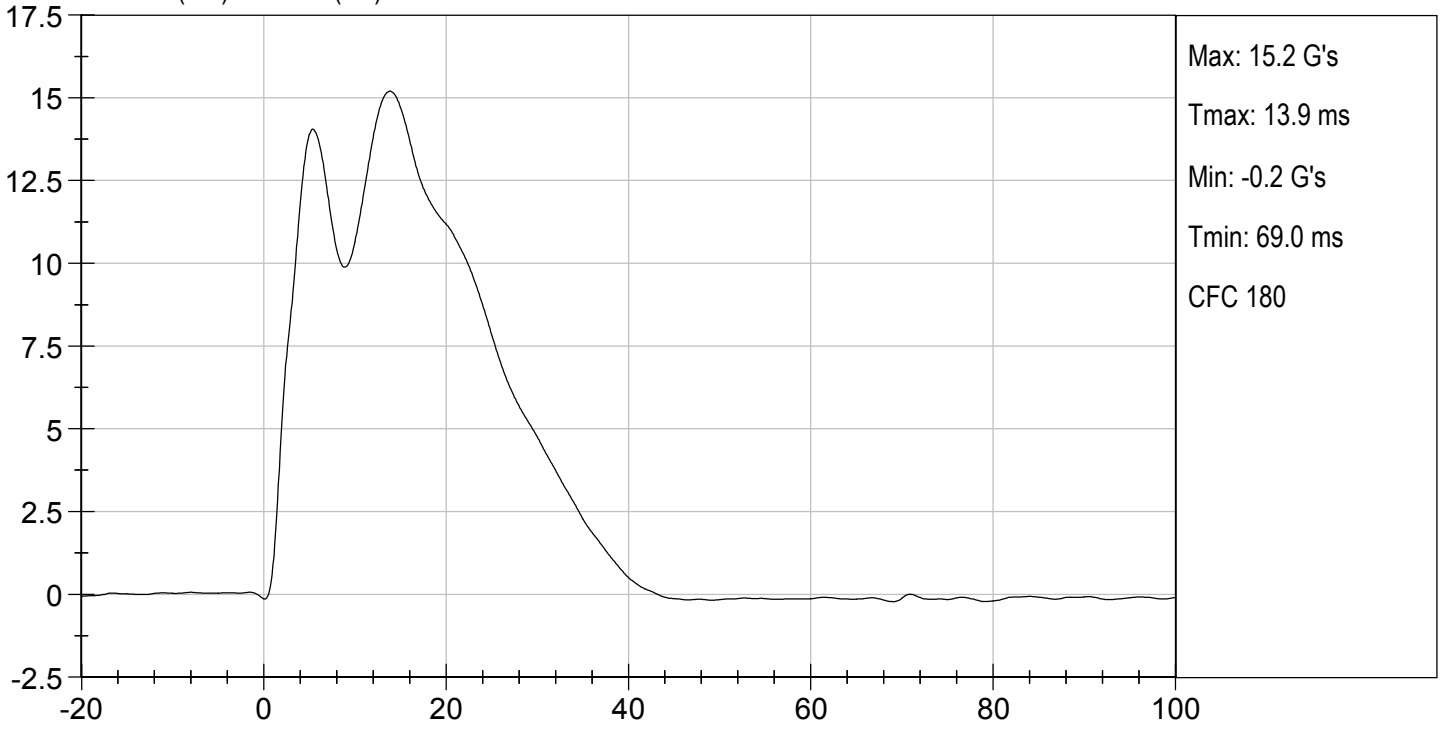
01/31/2019
Test Date

Robert Schmidt
Approved By

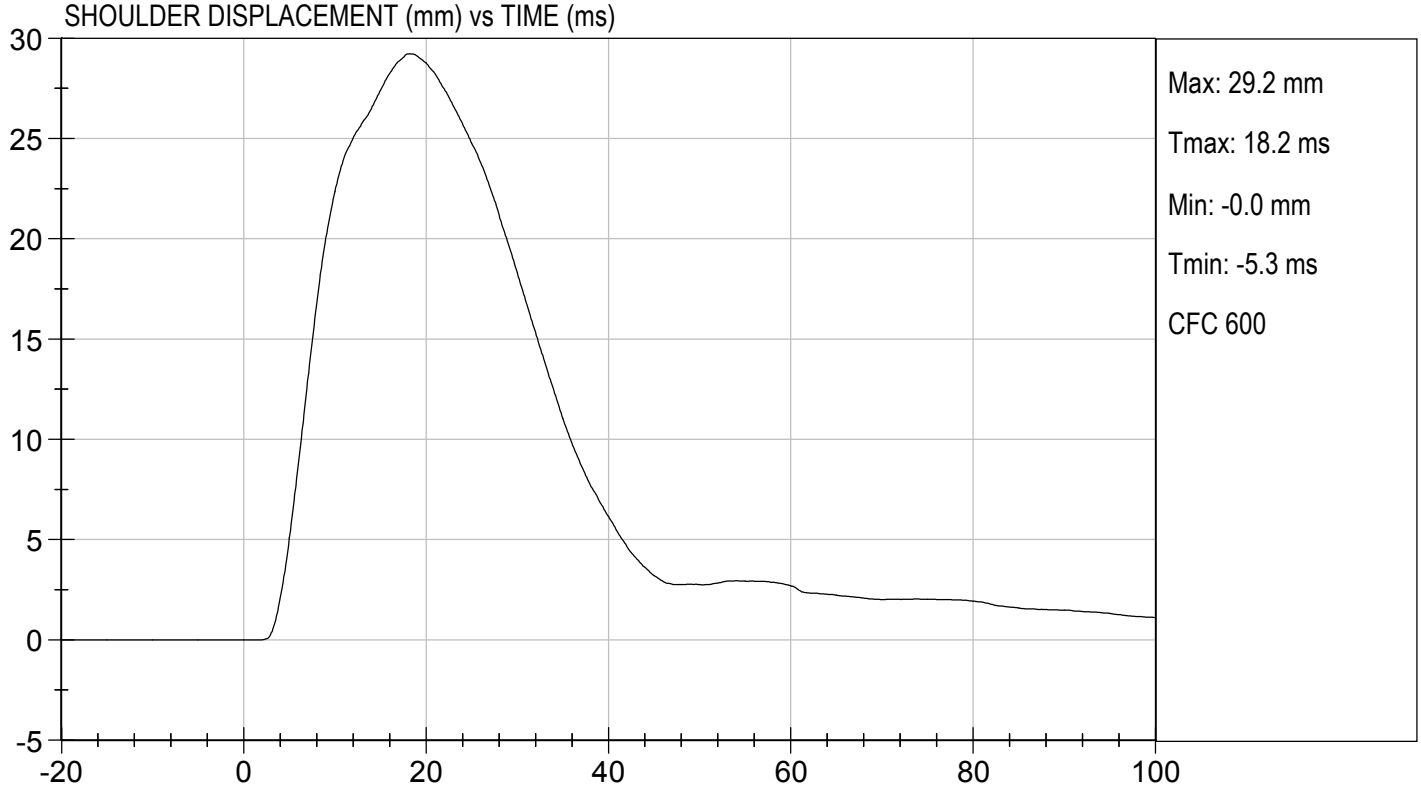
TEST DESC: SHOULDER IMPACT
VELOCITY: 14.40 ft/s, 4.39 m/s

TEST DATE: 01/31/2019
TEST #: D190403

PROBE (G's) vs TIME (ms)



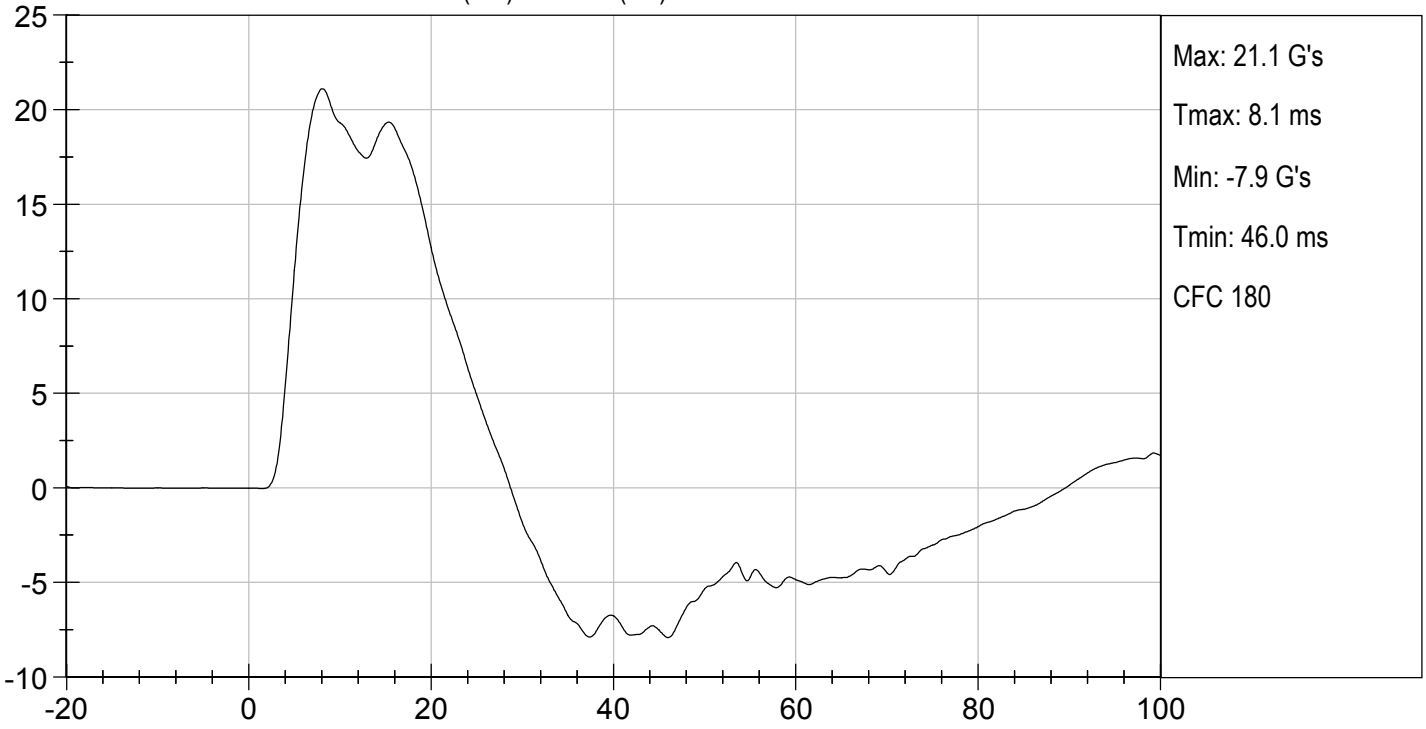
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



TEST DESC: SHOULDER IMPACT
VELOCITY: 14.40 ft/s, 4.39 m/s

TEST DATE: 01/31/2019
TEST #: D190403

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:** D190404

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	13	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	36	Pass
Upper Rib Displacement	mm	25 to 32	28	Pass
Middle Rib Displacement	mm	30 to 36	31	Pass
Lower Rib Displacement	mm	32 to 38	33	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	40	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	36	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

01/31/2019

Test Date

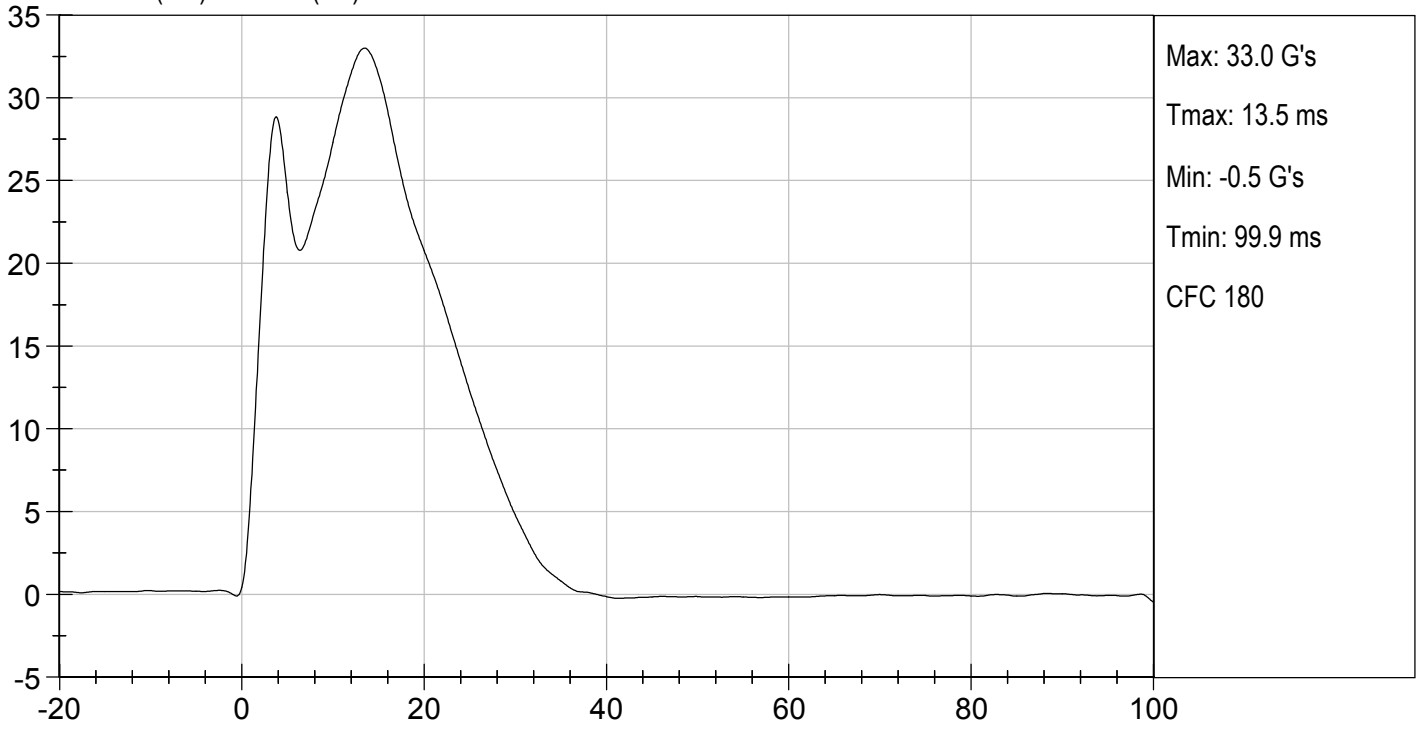
Robert Schmidt

Approved By

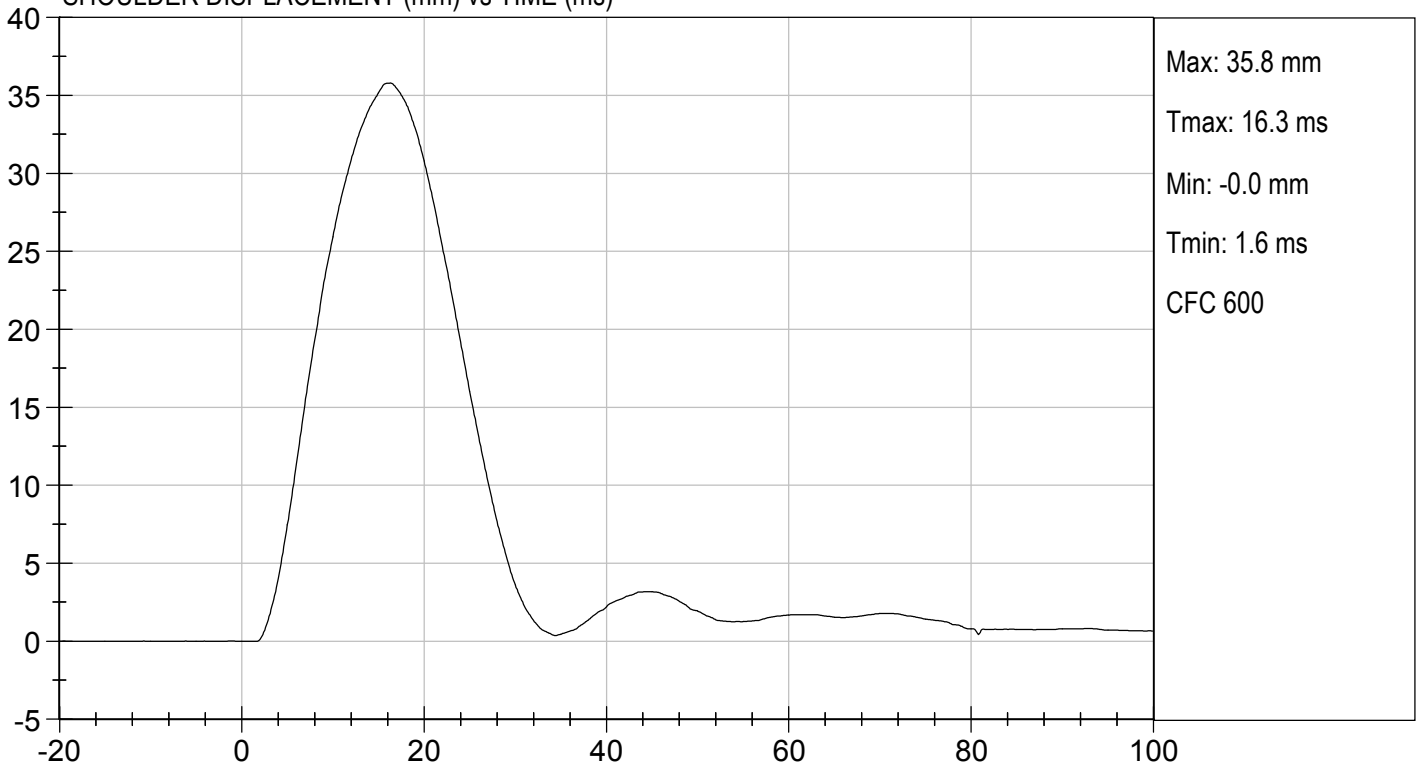
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 01/31/2019
TEST #: D190404

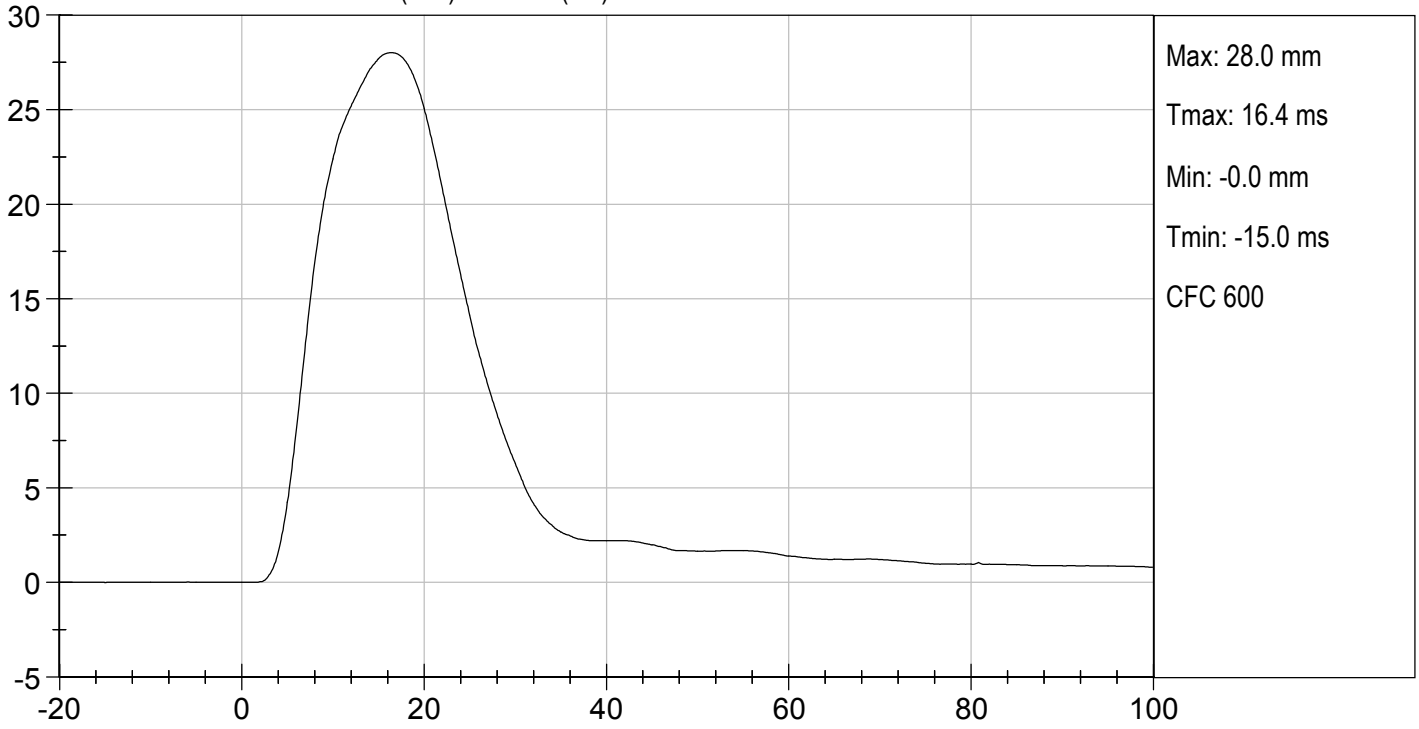
PROBE (G's) vs TIME (ms)



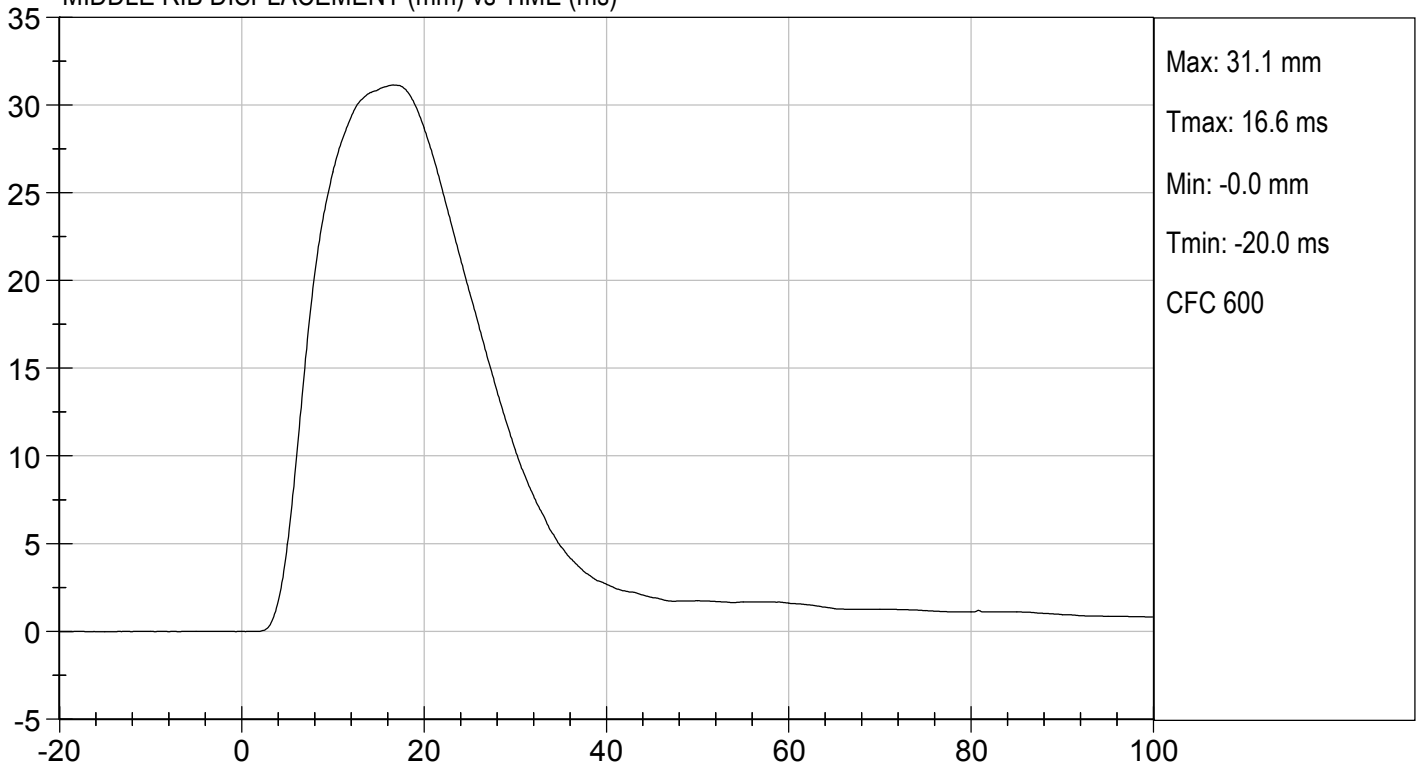
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



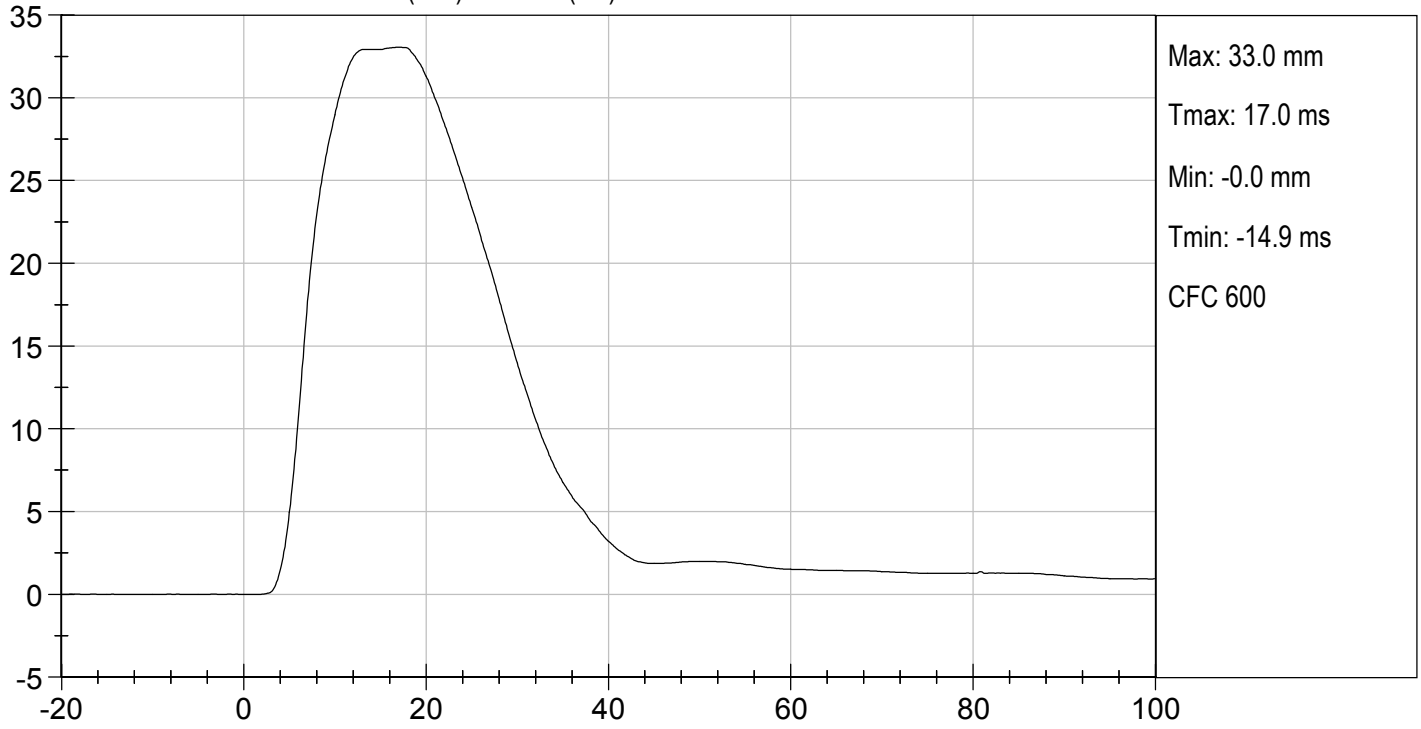
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



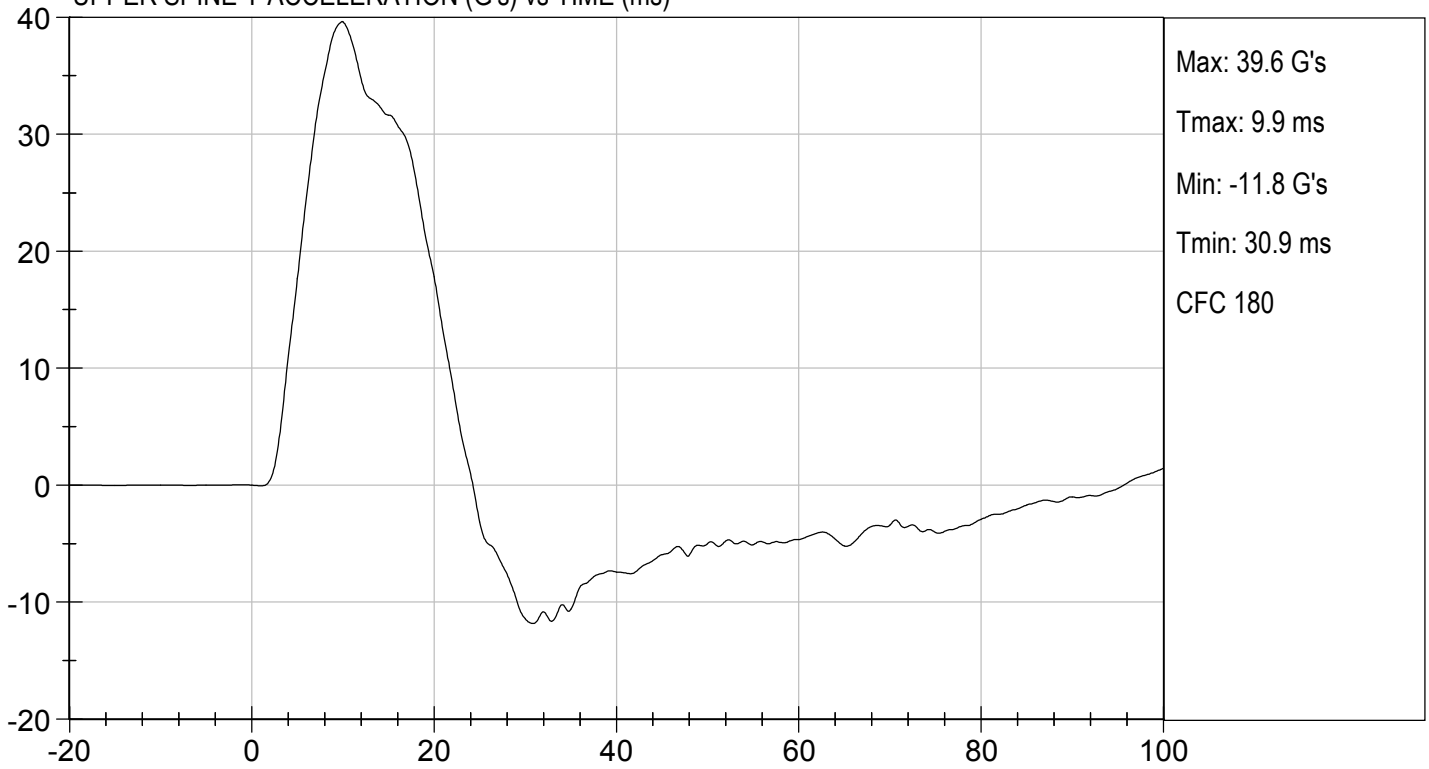
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 01/31/2019
TEST #: D190404

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)

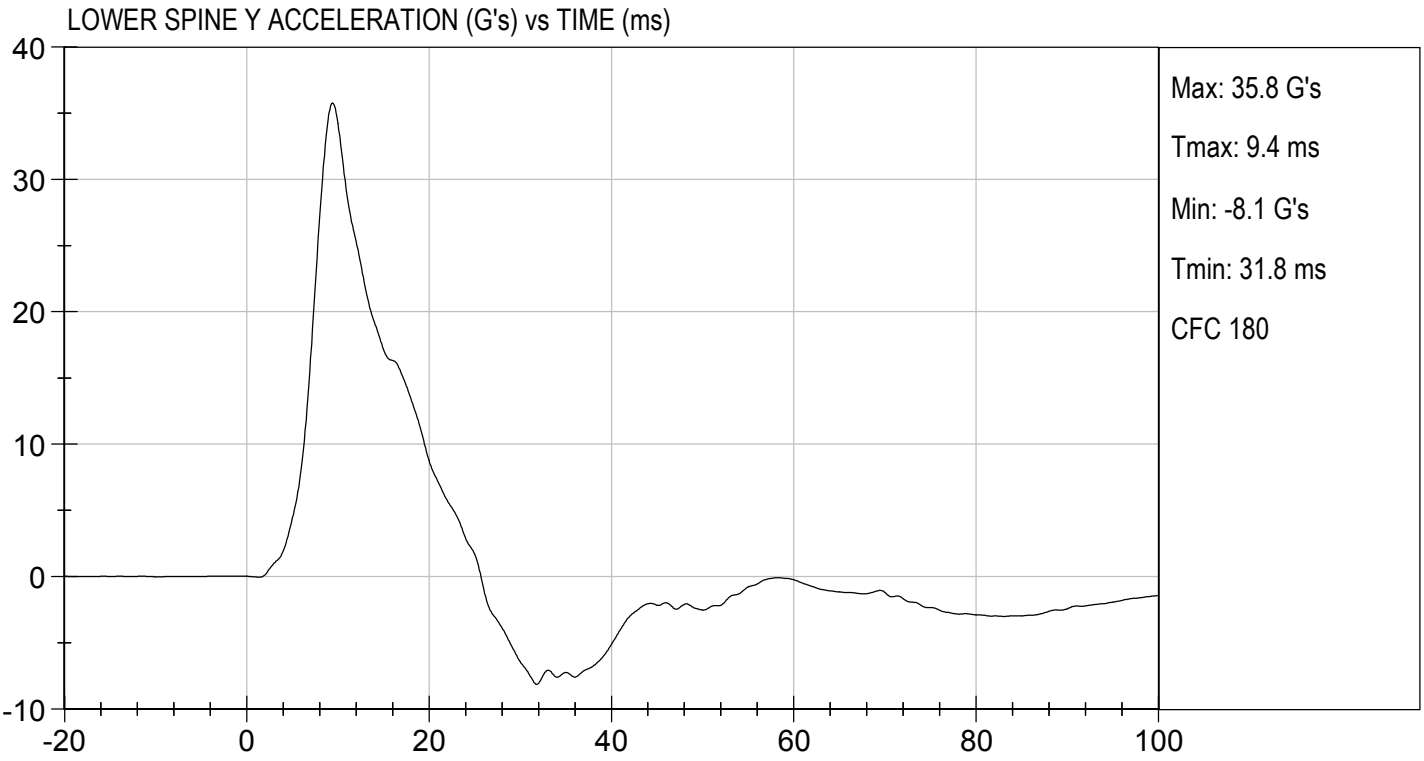


UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 01/31/2019
TEST #: D190404



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D190405

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	13	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	39	Pass
Middle Rib Displacement	mm	39 to 45	42	Pass
Lower Rib Displacement	mm	35 to 43	39	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	15	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

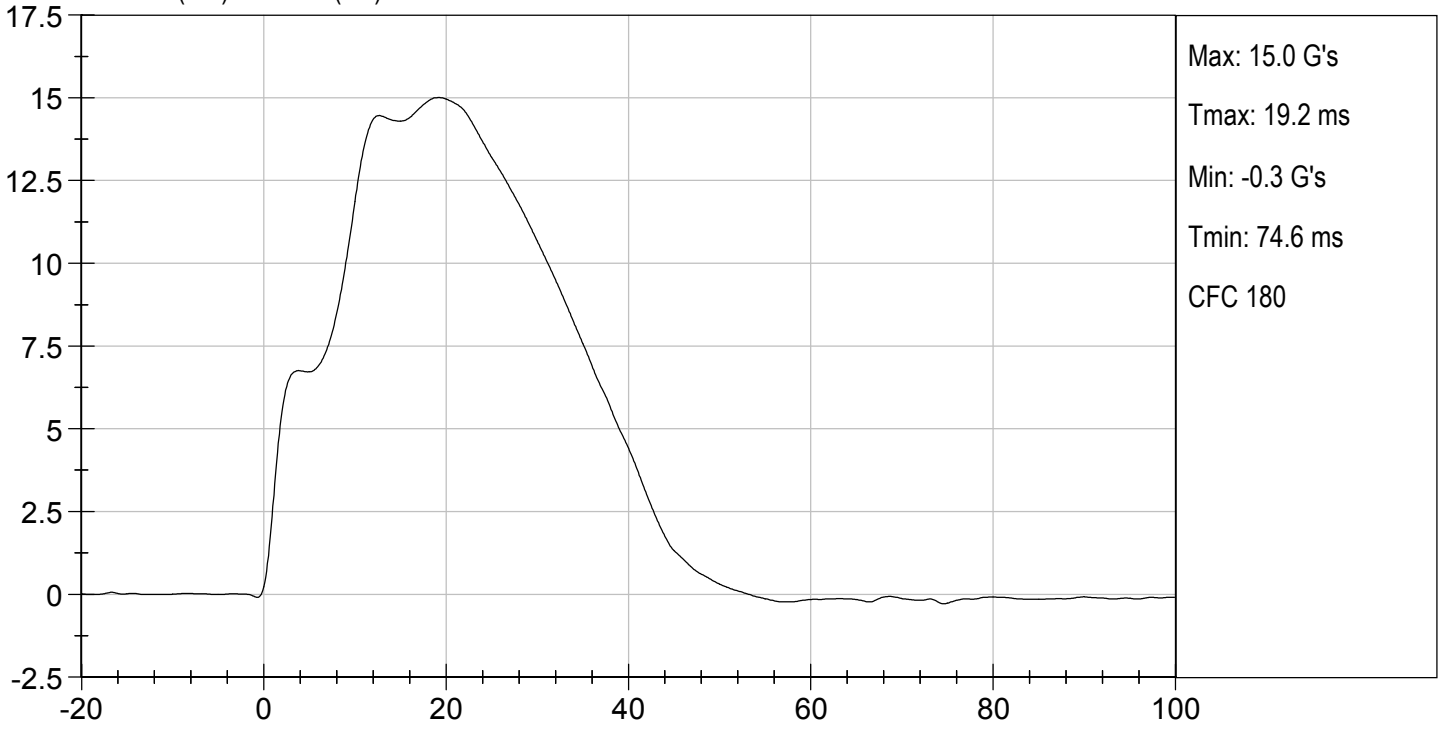
01/31/2019
Test Date

Robert Schmidt
Approved By

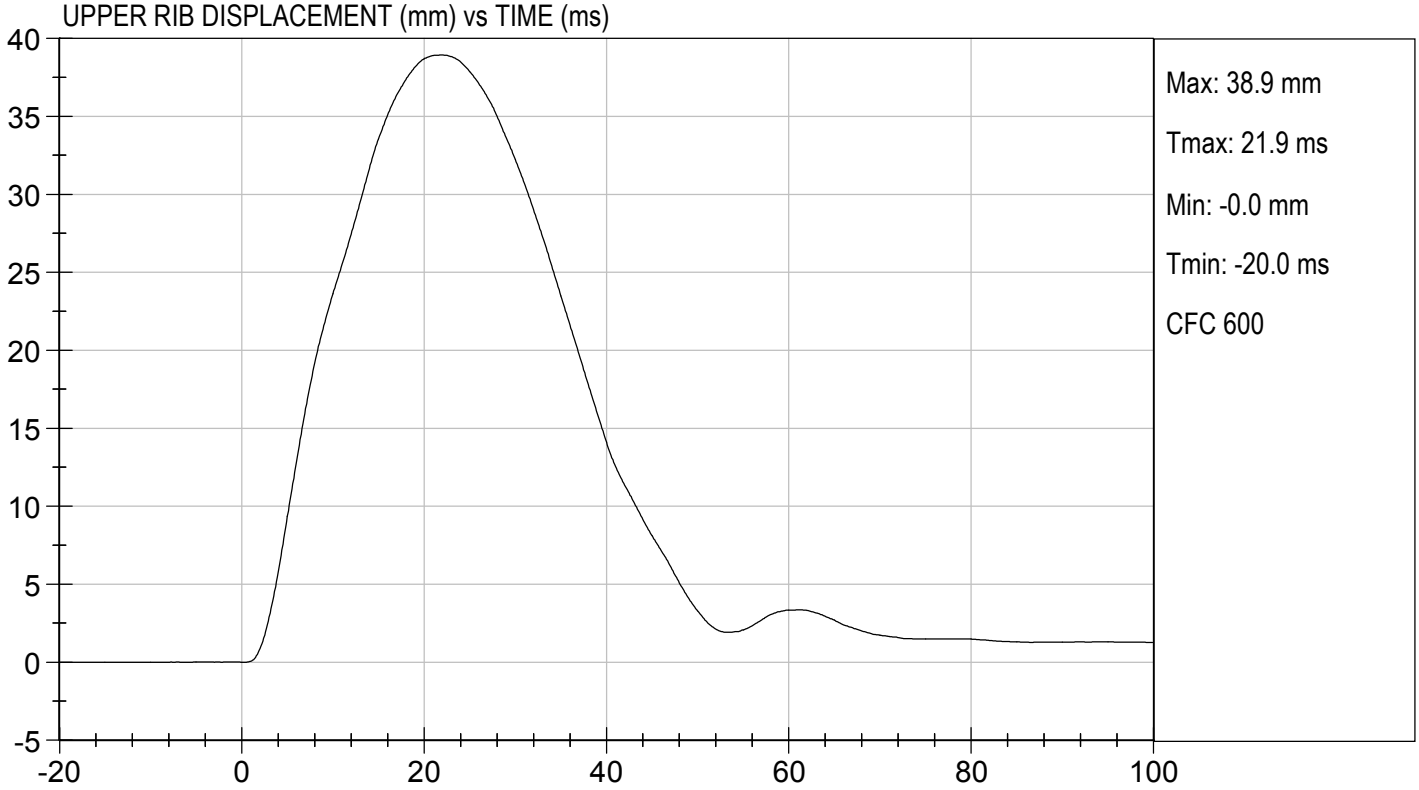
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 01/31/2019
TEST #: D190405

PROBE (G's) vs TIME (ms)



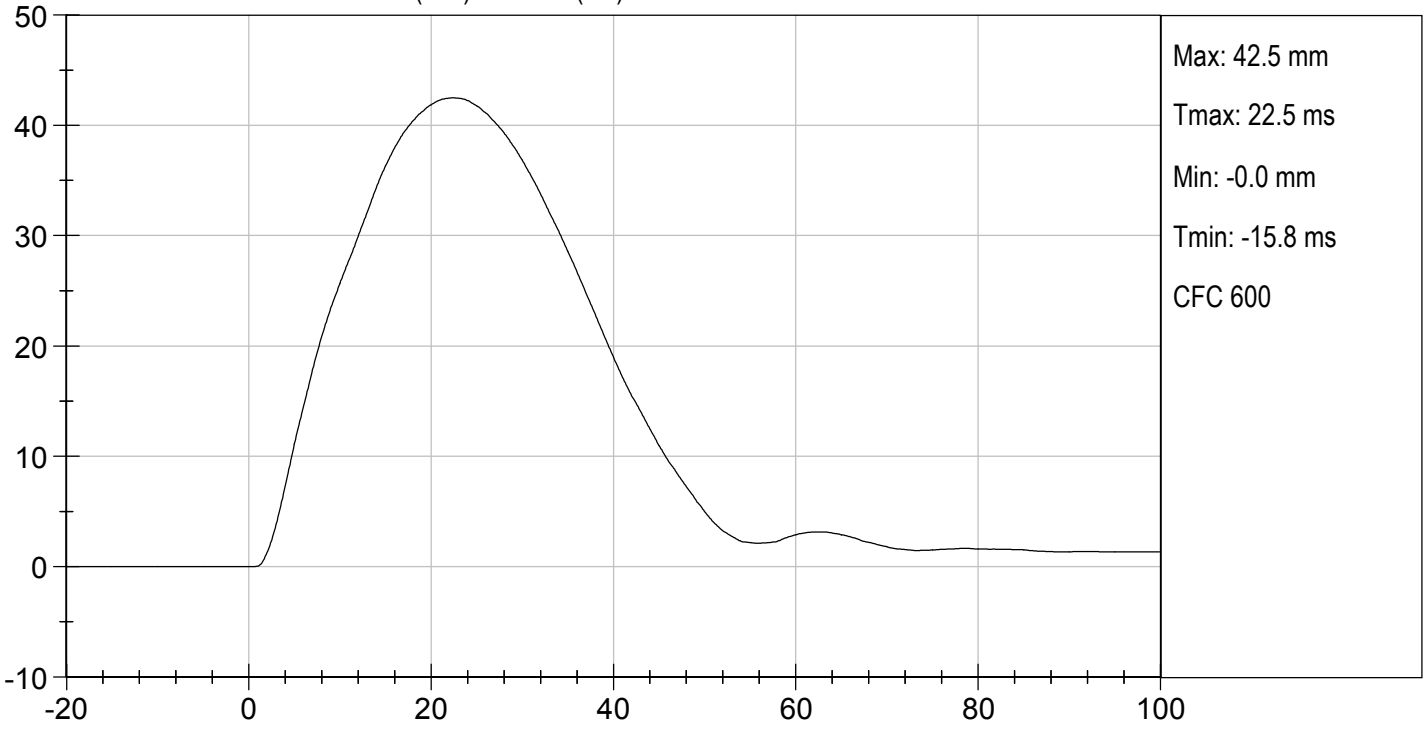
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



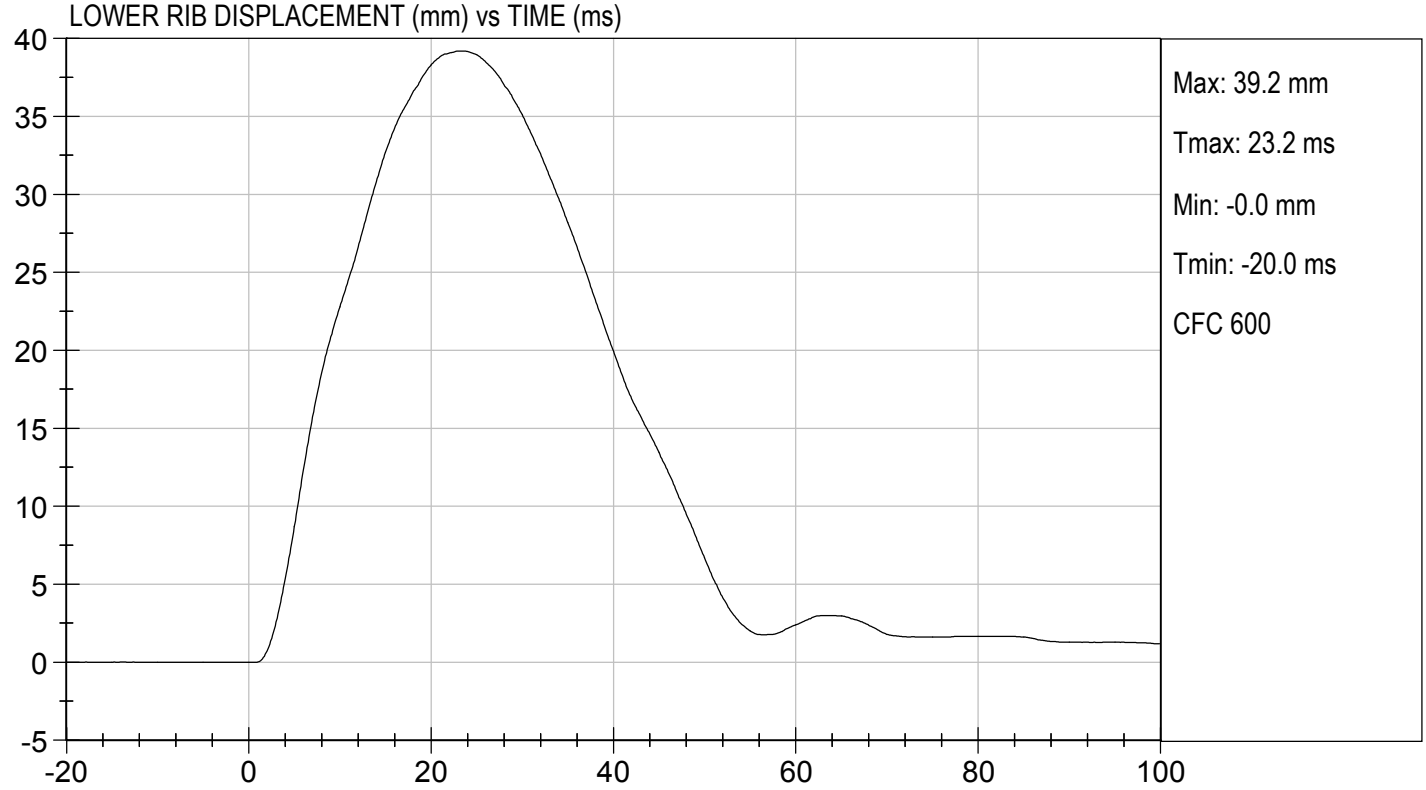
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 01/31/2019
TEST #: D190405

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



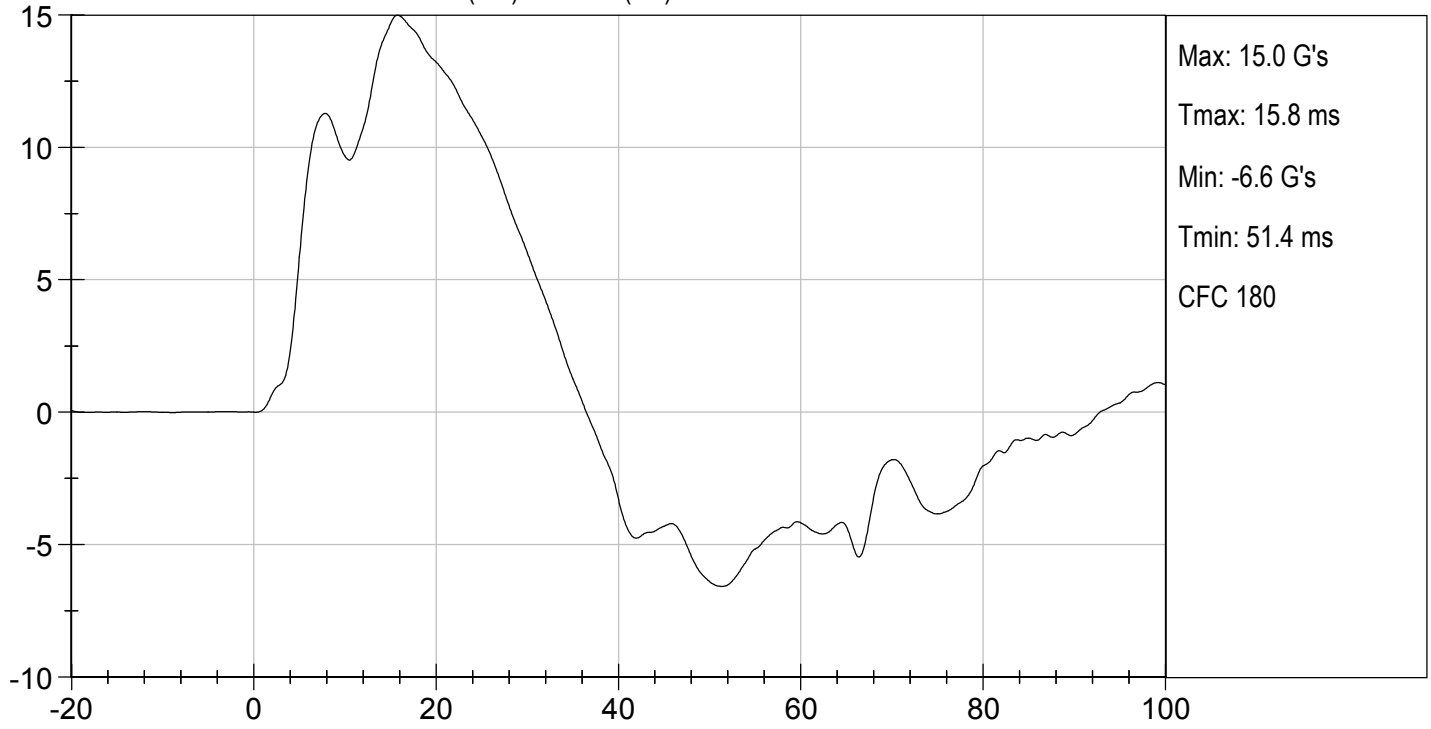
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



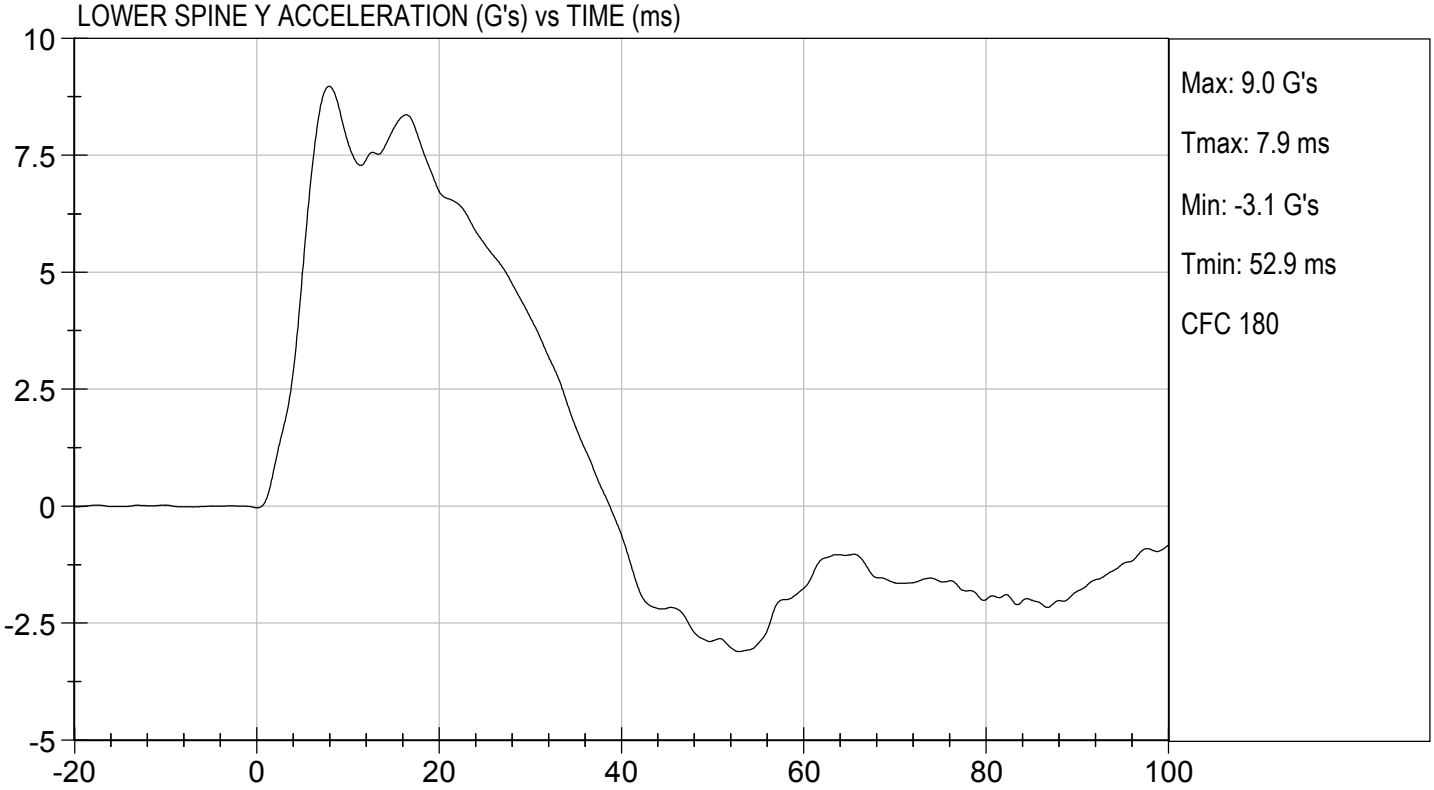
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 01/31/2019
TEST #: D190405

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:** D190406

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	13	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Maximum Probe Acceleration	G's	12 to 16	14	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	43	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	39	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

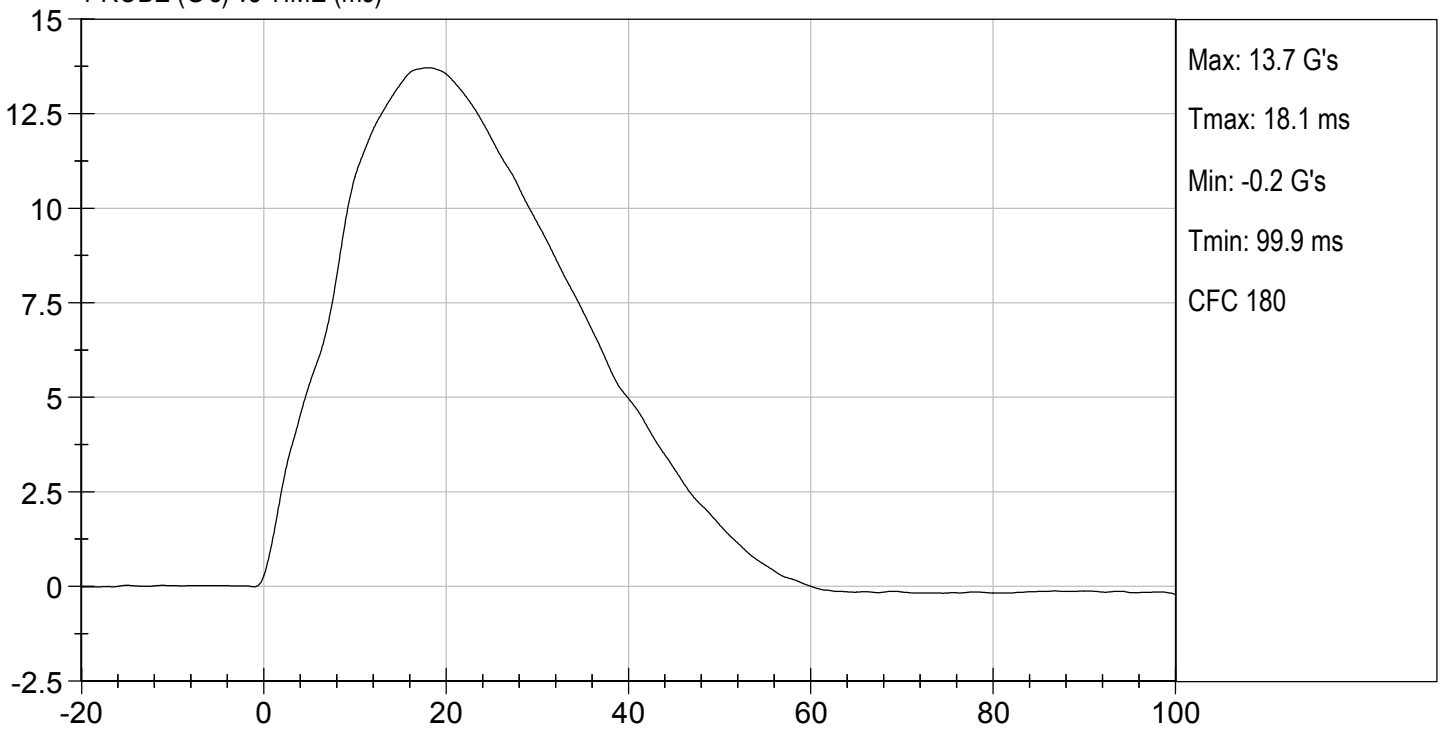
01/31/2019
Test Date

Robert Schmulsky
Approved By

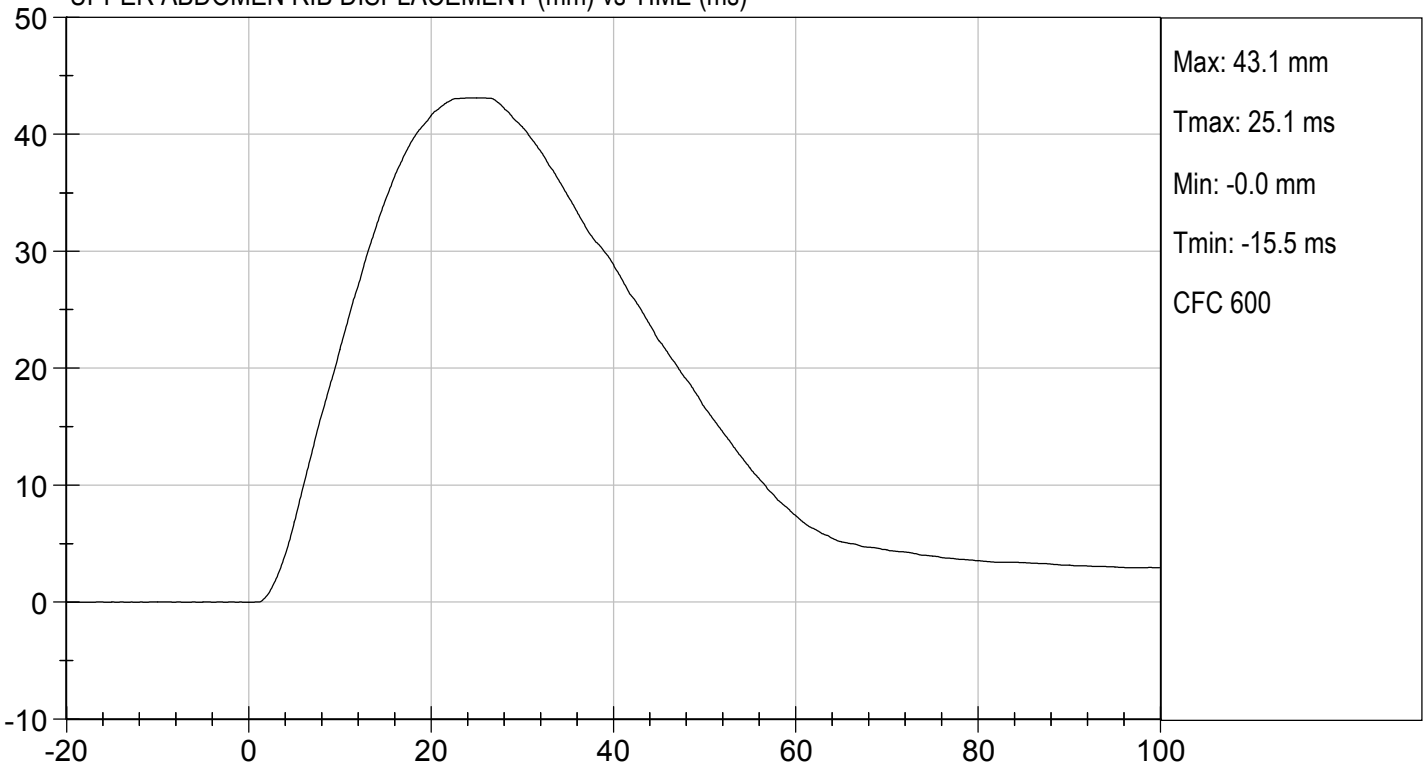
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.37 ft/s, 4.38 m/s

TEST DATE: 01/31/2019
TEST #: D190406

PROBE (G's) vs TIME (ms)



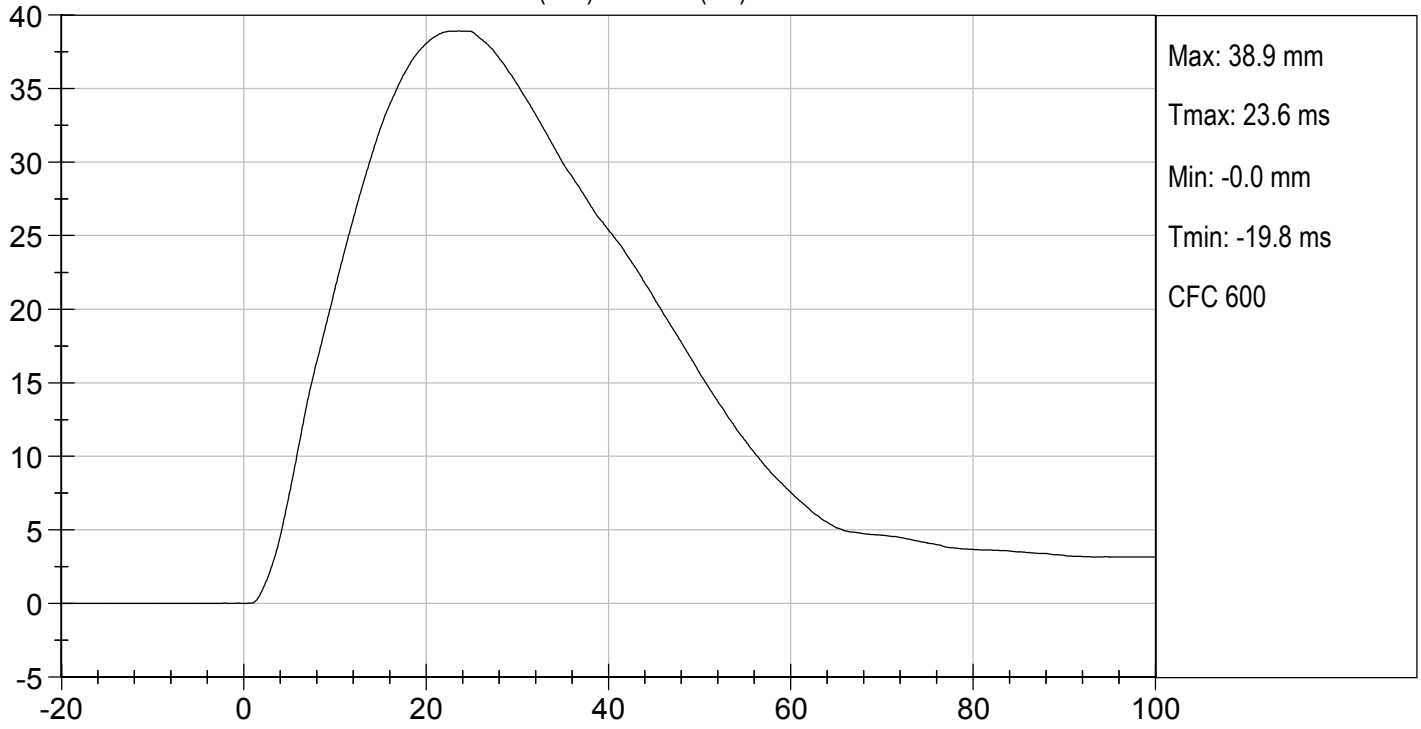
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



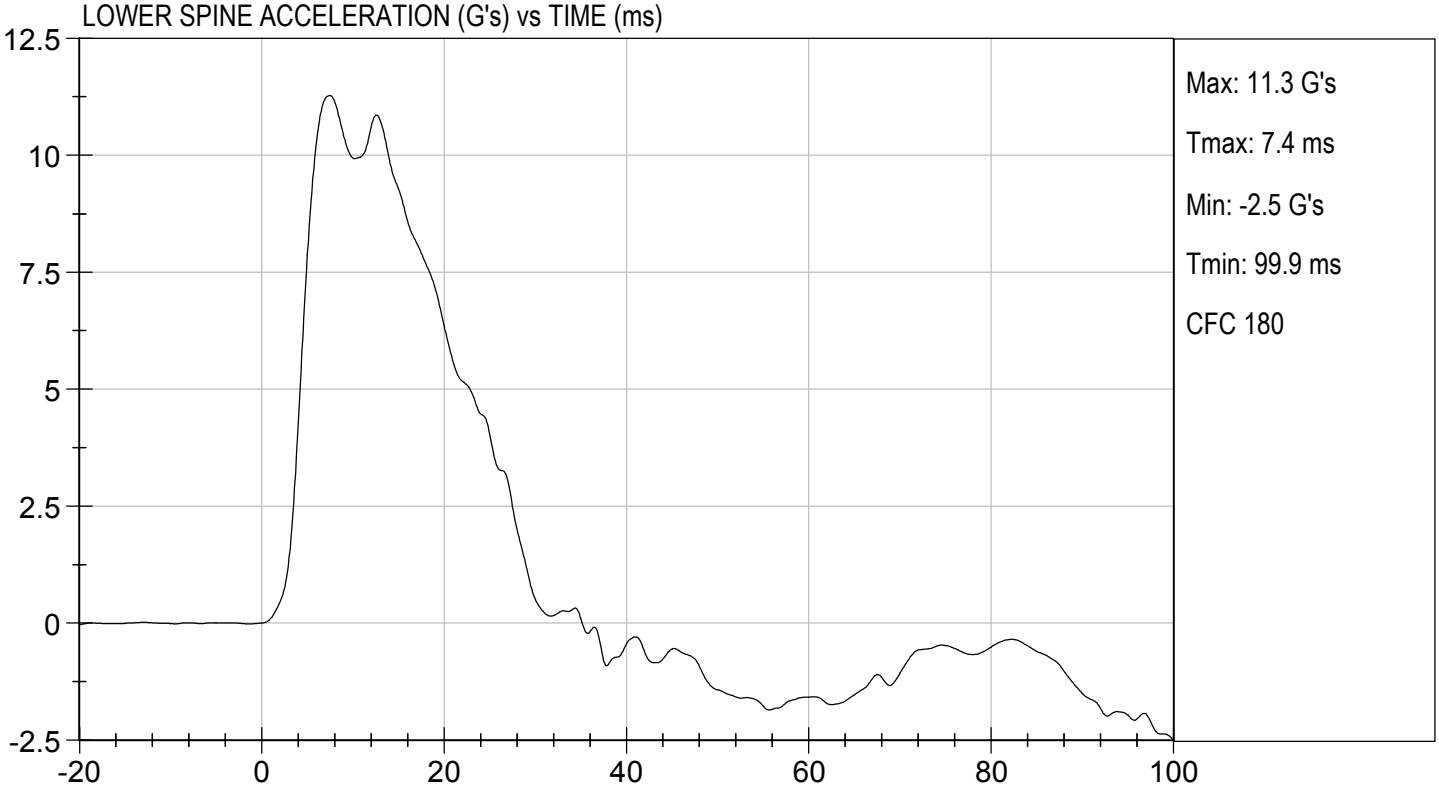
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.37 ft/s, 4.38 m/s

TEST DATE: 01/31/2019
TEST #: D190406

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:** D190407

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	13	Pass
Impact Velocity	m/s	6.60 to 6.80	6.60	Pass
Maximum Probe Acceleration	G's	38 to 47	46	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	42	Pass
Peak Acetabulum Force	N	3600 to 4300	4,097	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

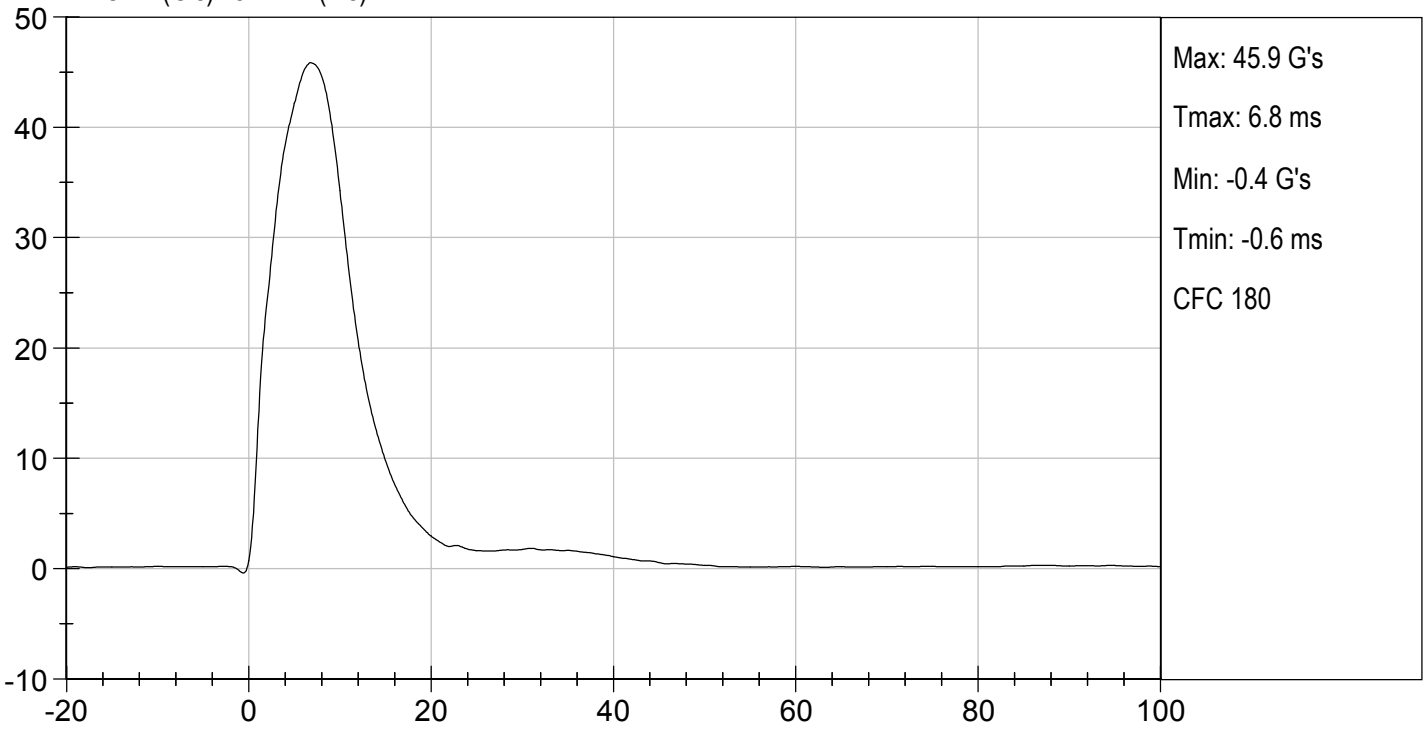
01/31/2019
Test Date

Robert Schmidt
Approved By

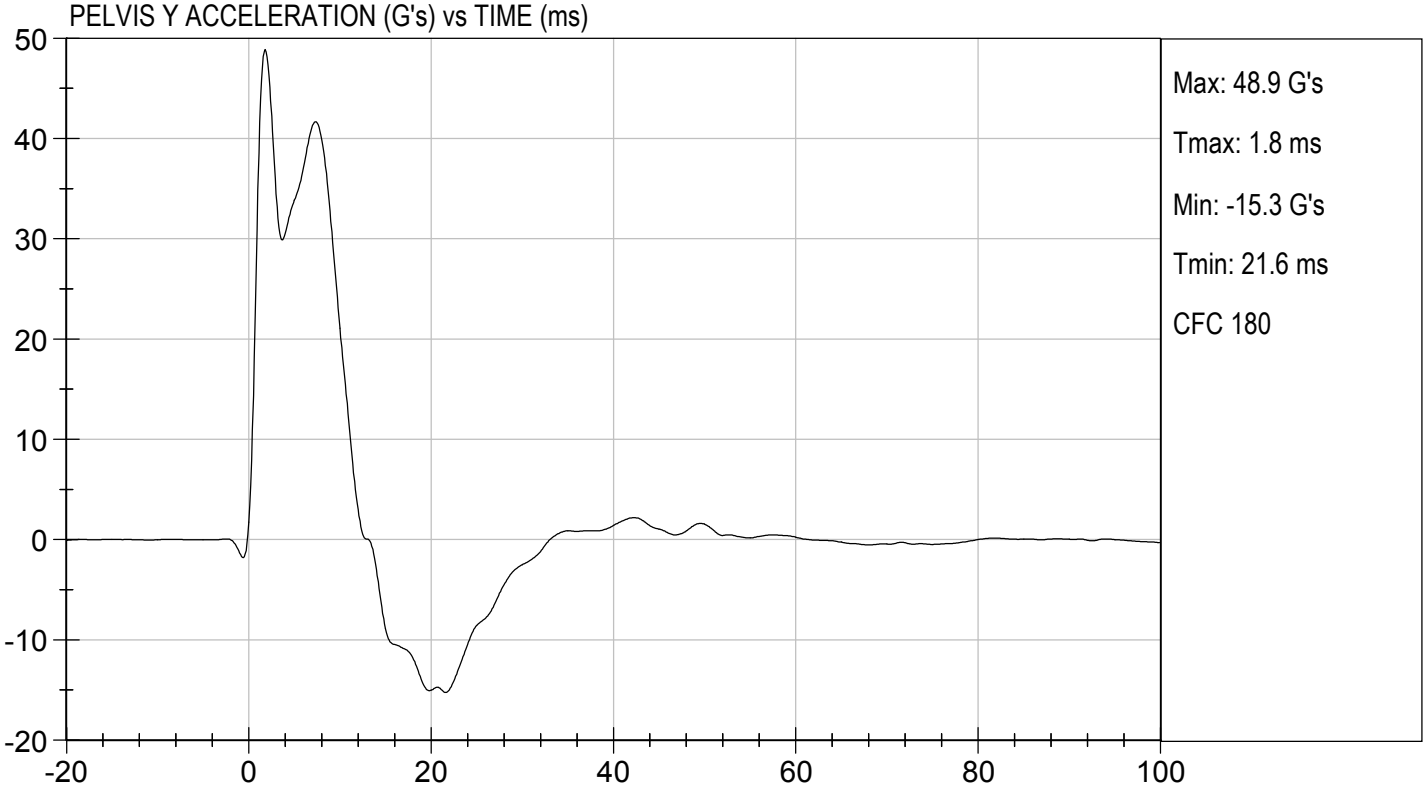
TEST DESC: PELVIS IMPACT
VELOCITY: 21.64 ft/s, 6.60 m/s

TEST DATE: 01/31/2019
TEST #: D190407

PROBE (G's) vs TIME (ms)

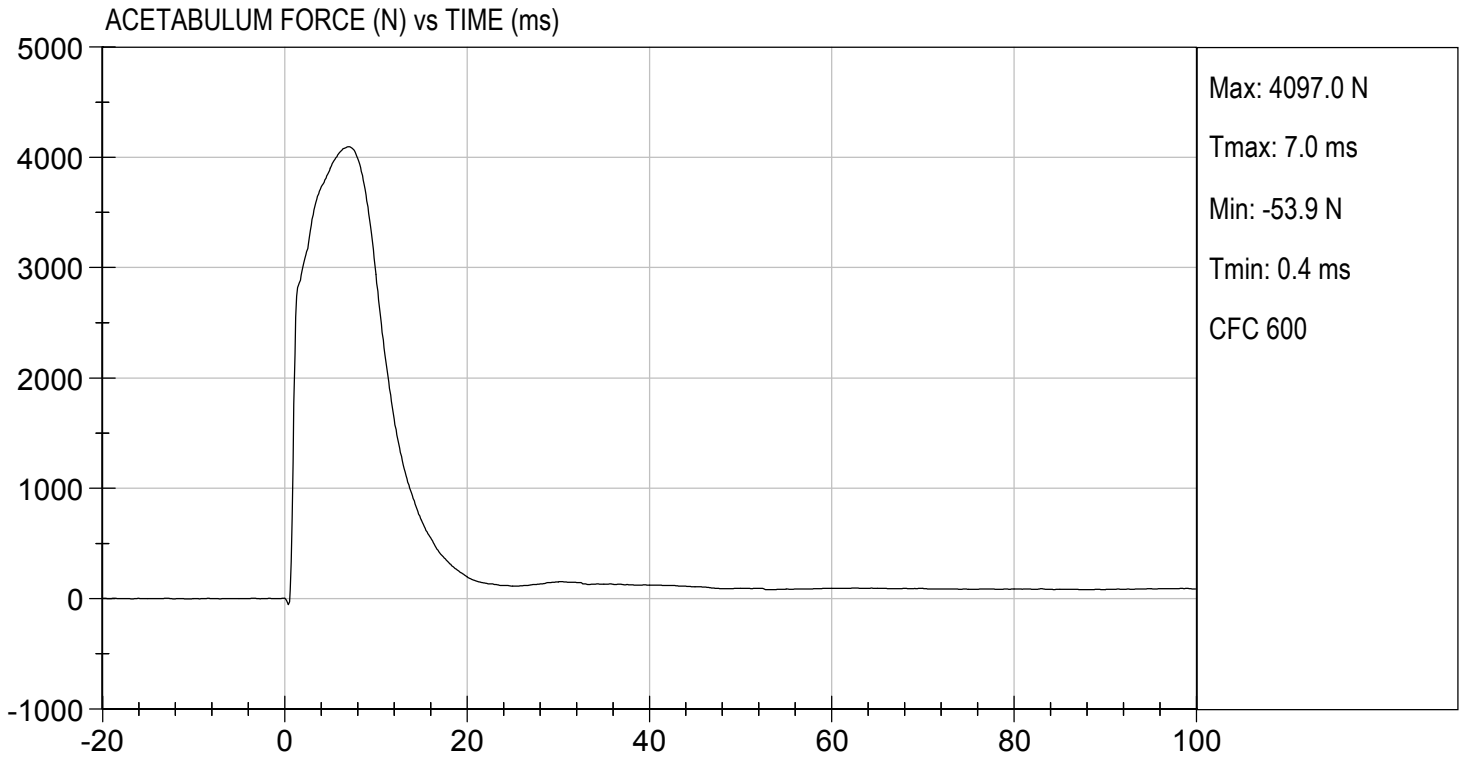


PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 01/31/2019
TEST #: D190407



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D190408

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Humidity	%	10 to 70	13	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	30	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,363	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

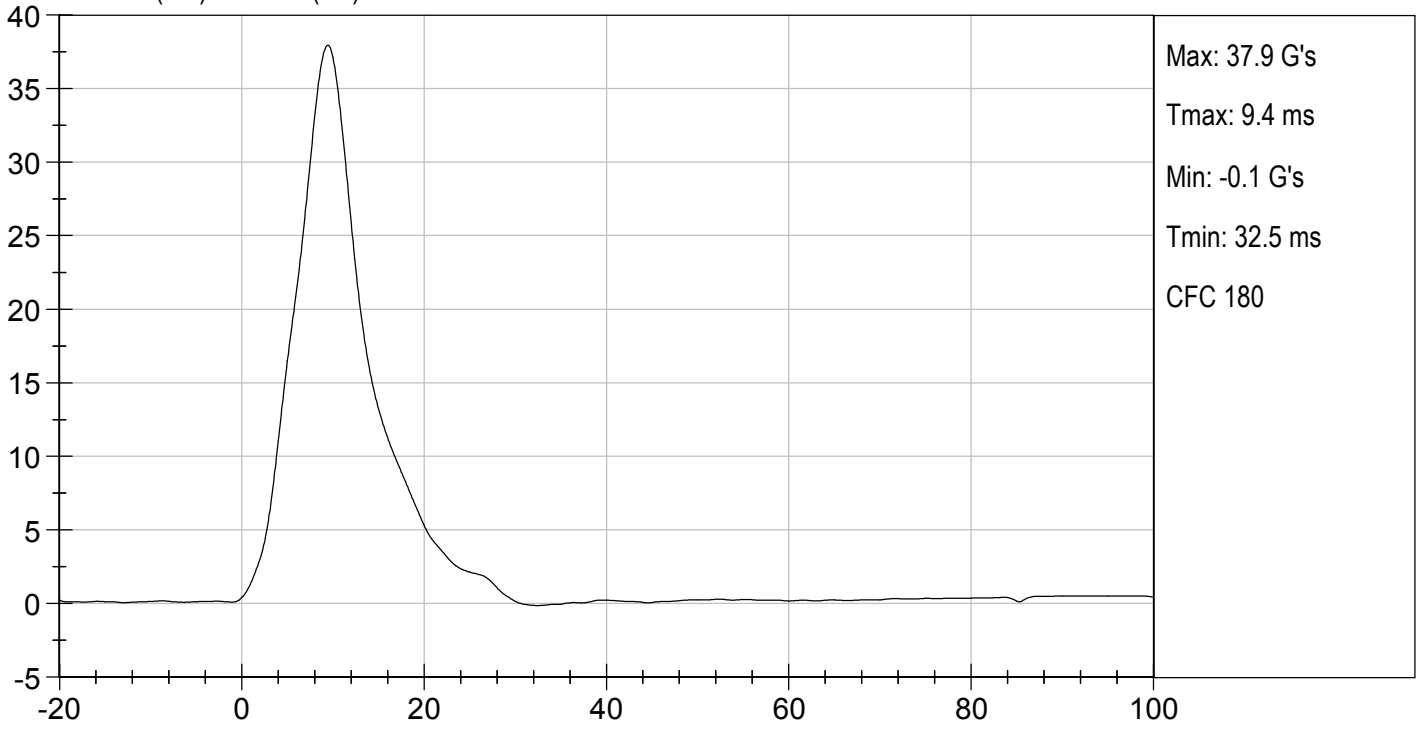
01/31/2019
Test Date

Robert Schmidt
Approved By

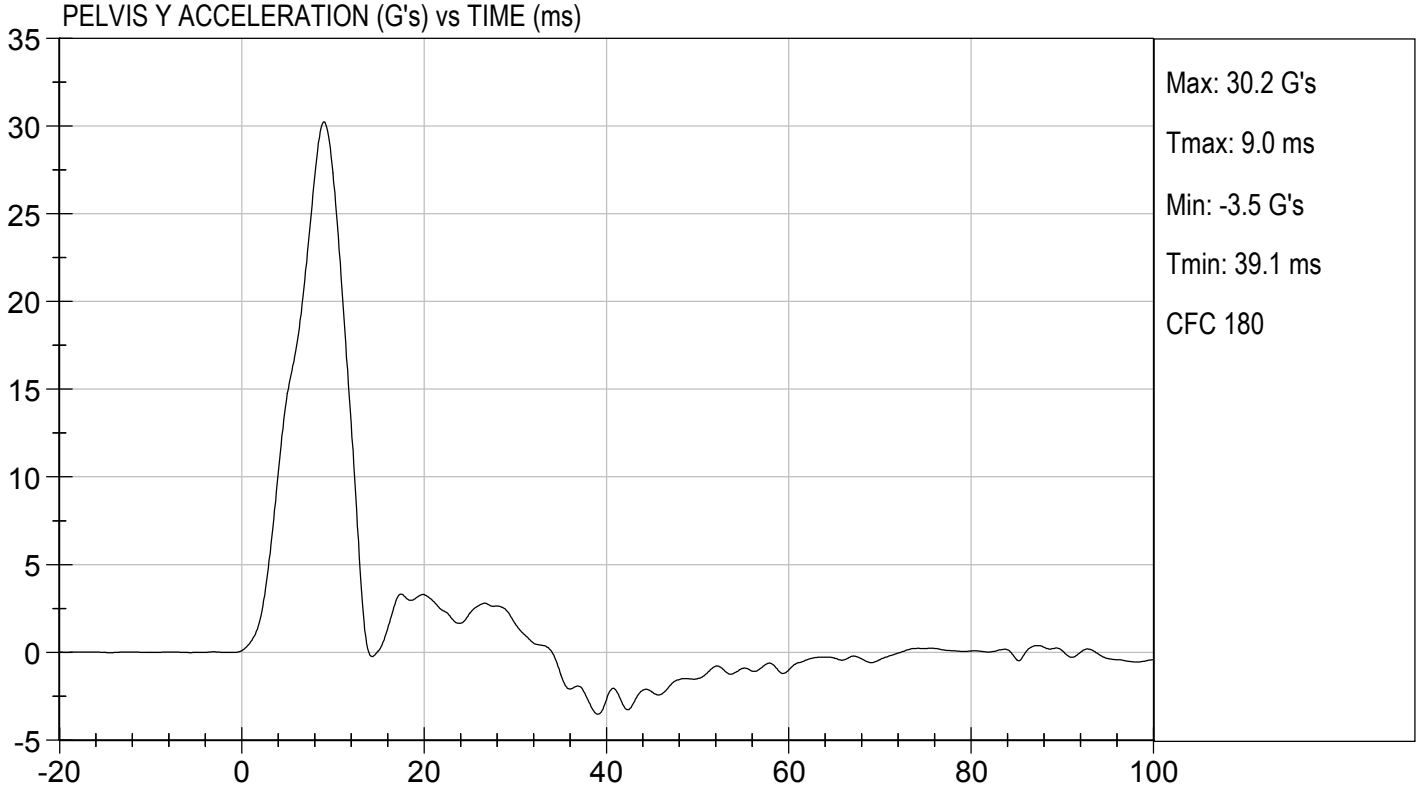
TEST DESC: ILLIAC
VELOCITY: 14.40 ft/s, 4.39 m/s

TEST DATE: 01/31/2019
TEST #: D190408

PROBE (G's) vs TIME (ms)

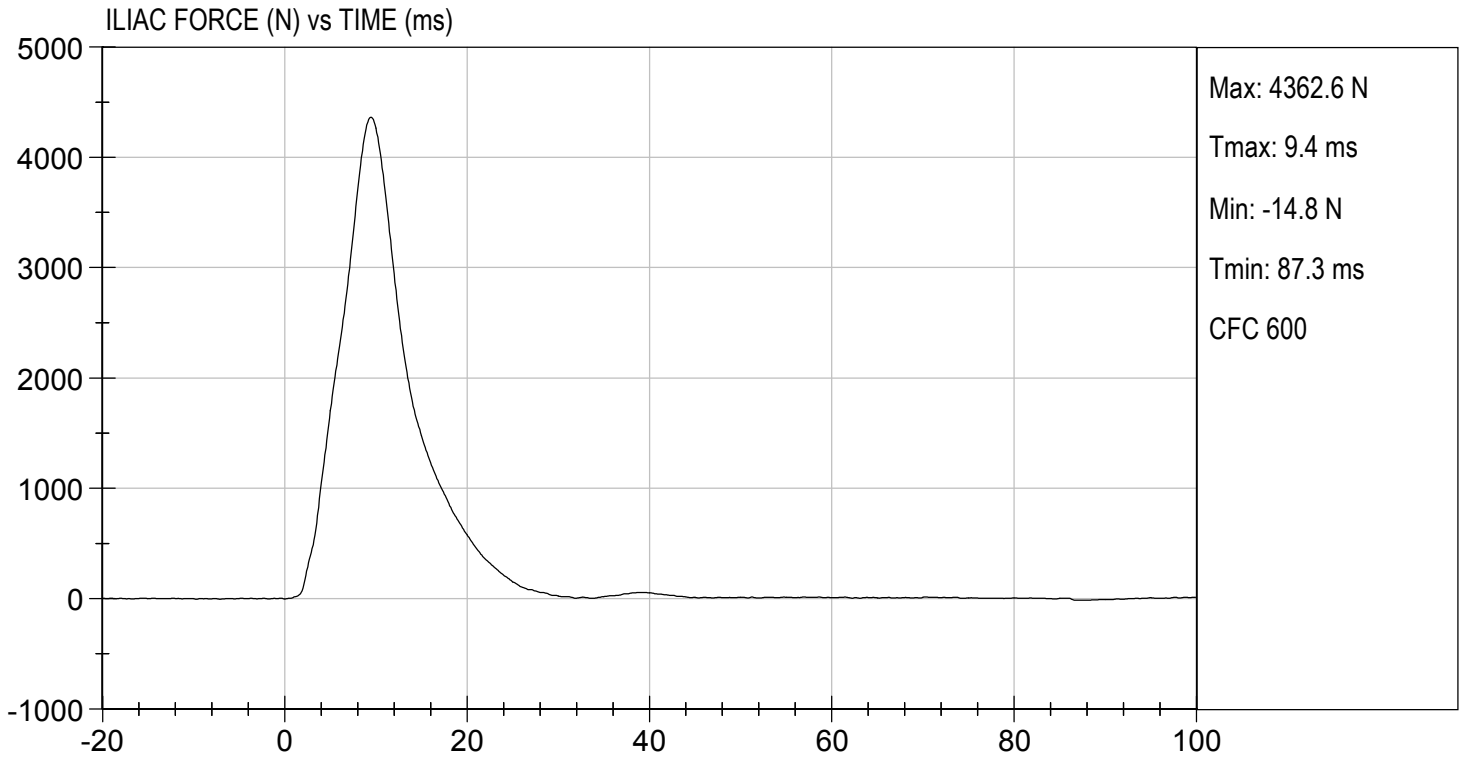


PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 01/31/2019
TEST #: D190408



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:** D190561

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	20	Pass
Peak Resultant Acceleration	G's	115 to 137	129	Pass
Peak Longitudinal Acceleration	G's	+/- 15	5.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

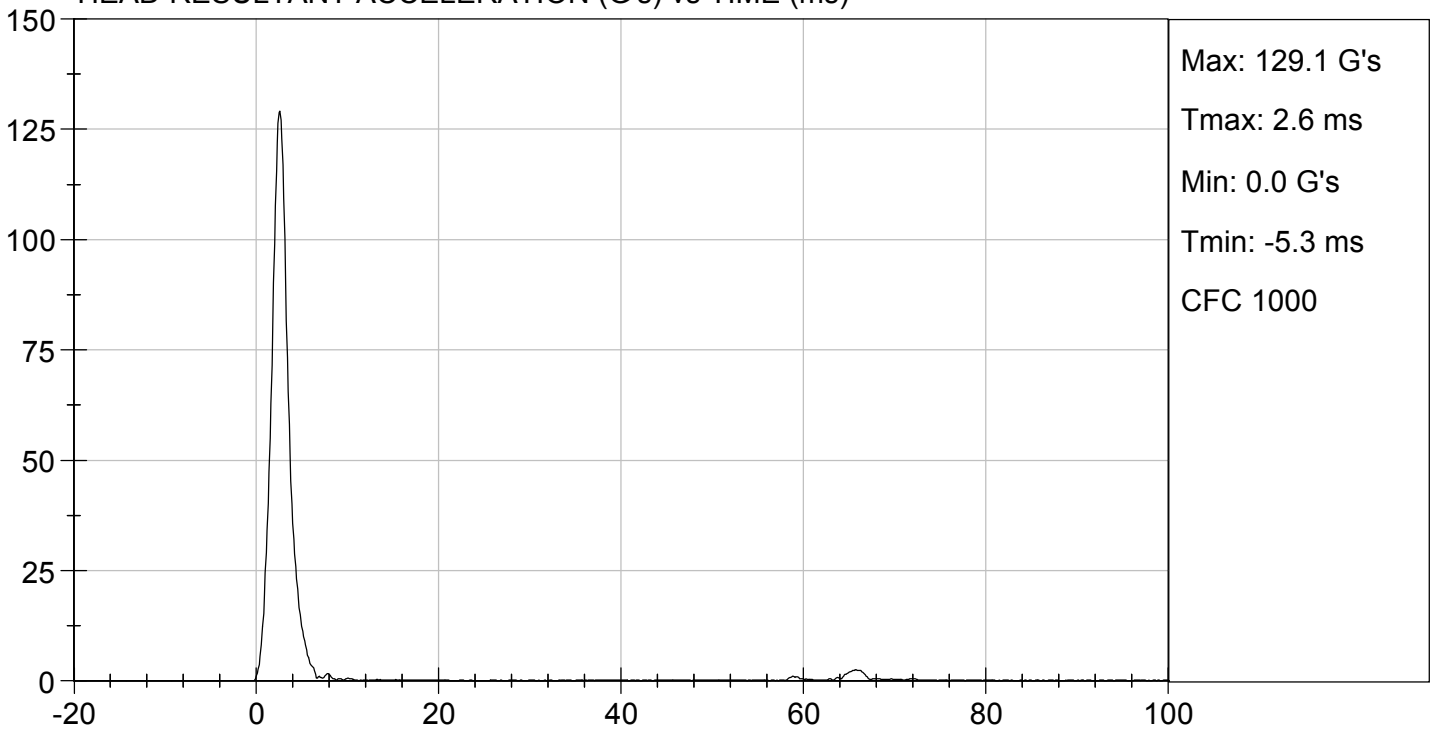
02/11/2019
Test Date

Robert Schmidt
Approved By

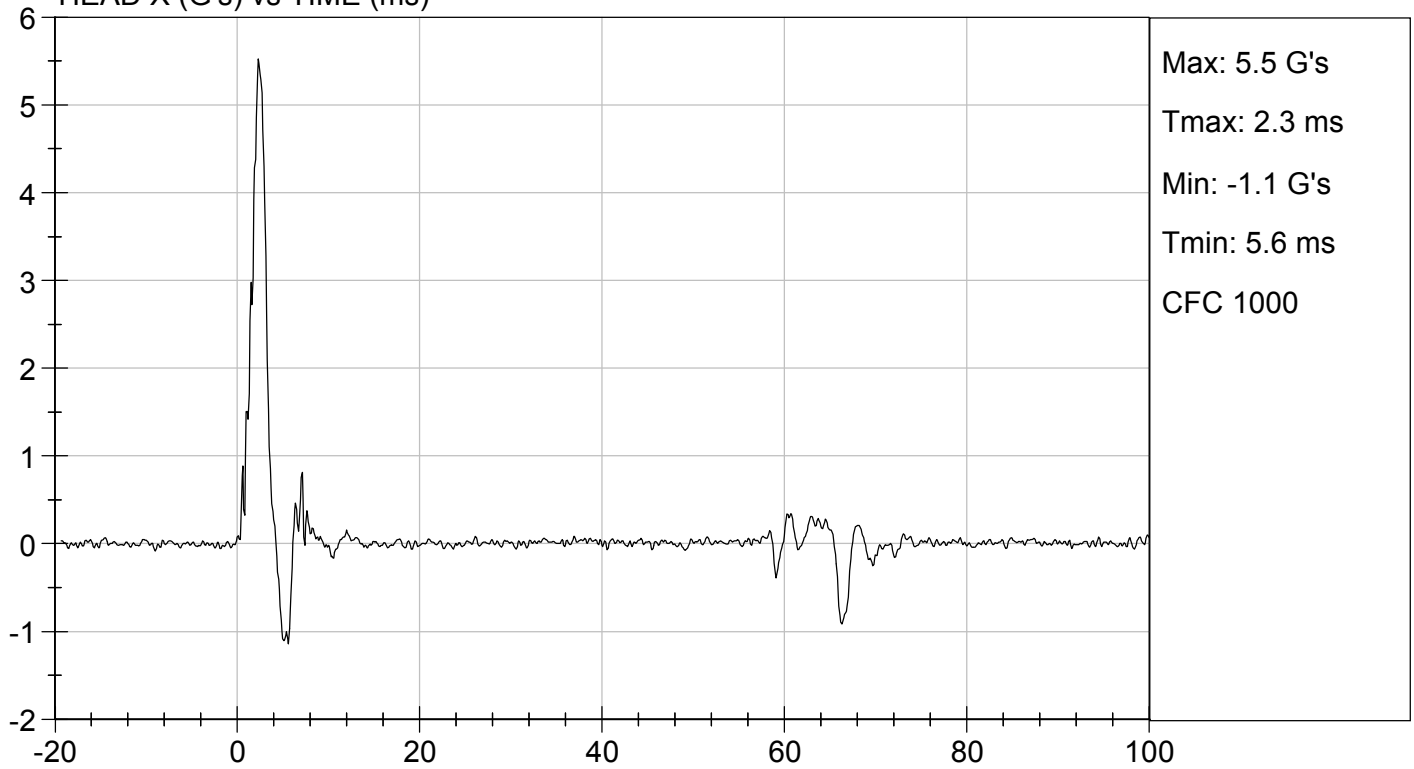
TEST DESC: HEAD DROP

TEST DATE: 02/11/2019
TEST #: D190561

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

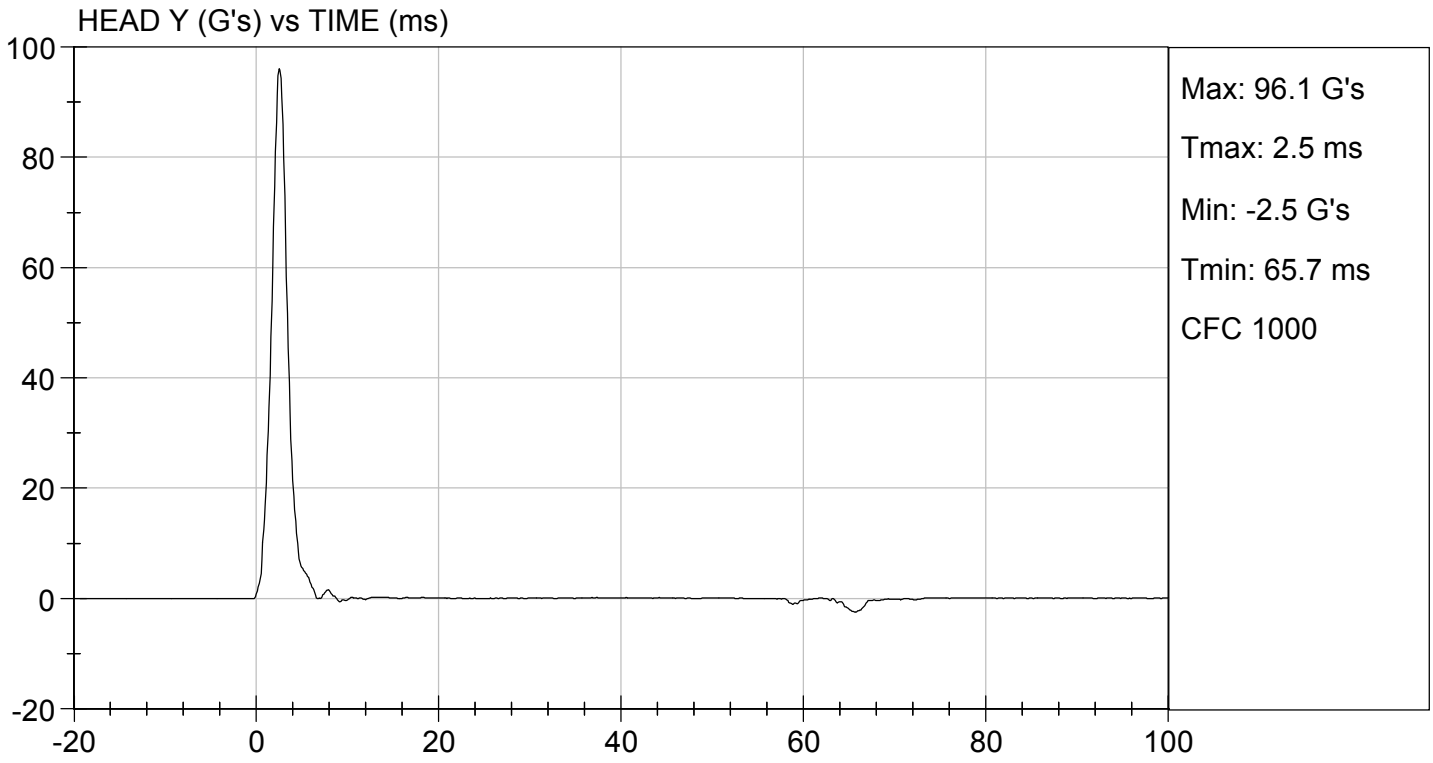


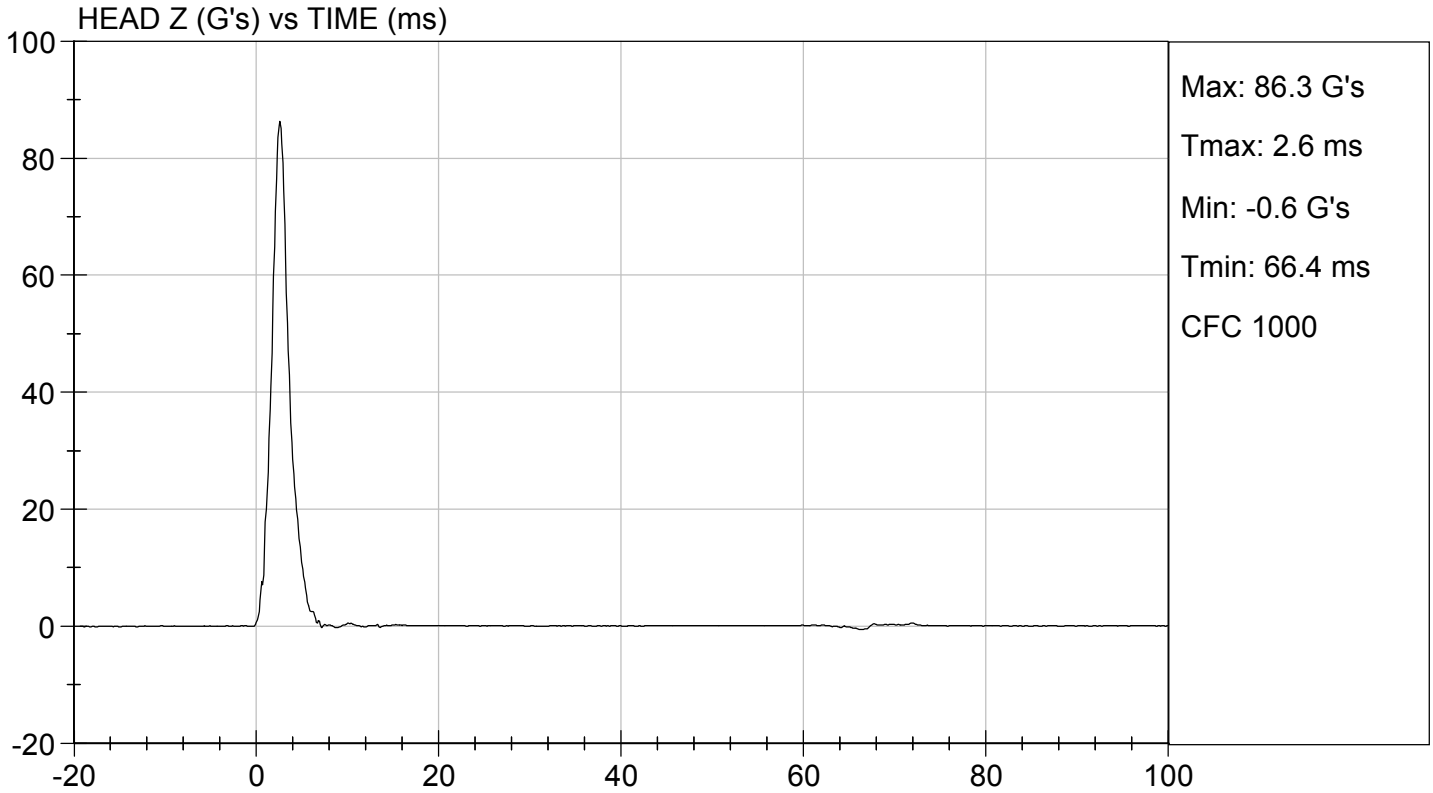
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 02/11/2019
TEST #: D190561





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D190562

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.6	Pass
Humidity		%	10 to 70	20	Pass
Impact Velocity		m/s	5.51 to 5.63	5.61	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.54	Pass
	15 ms	m/s	3.30 to 4.10	3.71	Pass
	20 ms	m/s	4.40 to 5.40	5.25	Pass
	25 ms	m/s	5.40 to 6.10	5.74	Pass
	25-100 ms	m/s	5.50 to 6.20	5.76	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	60	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-43	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	110	Pass
			Overall Test Results		Pass

Danielle Redenbaugh

Laboratory Technician

02/11/2019

Test Date

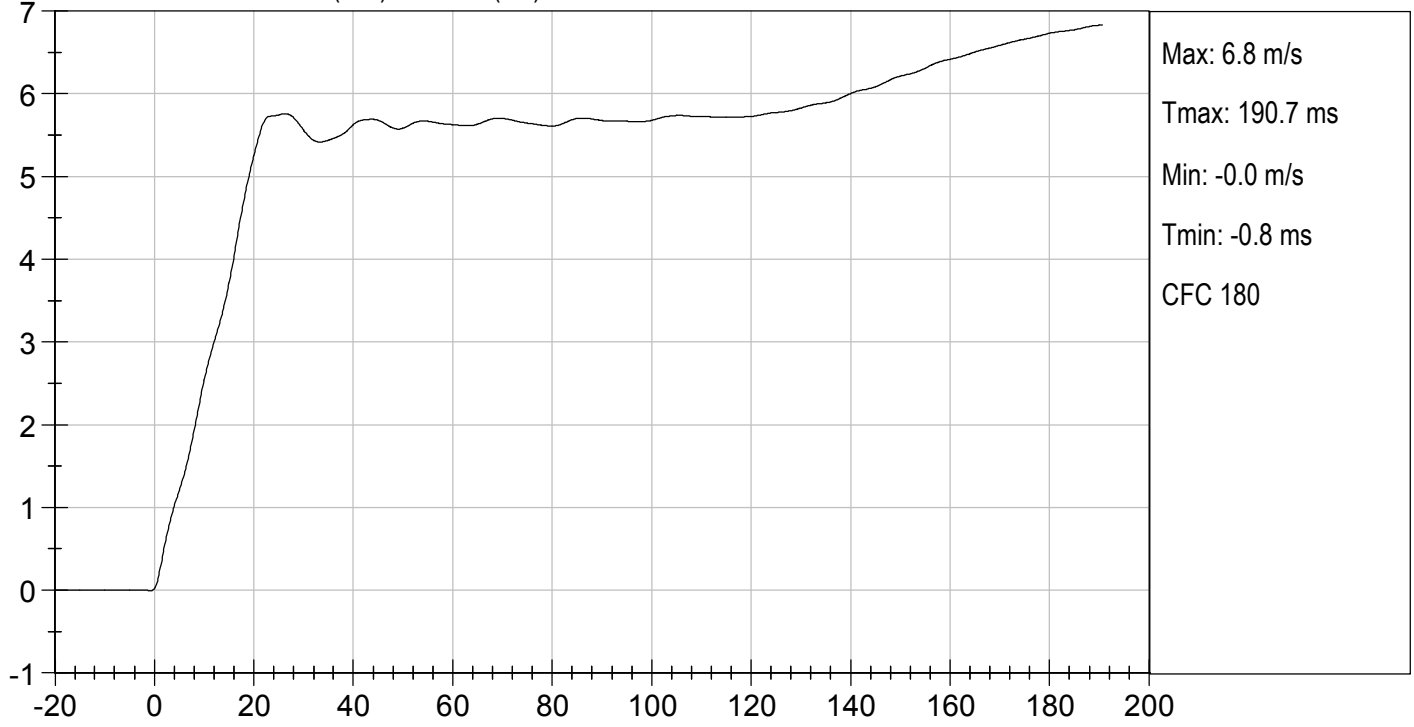
Robert Schmidt

Approved By

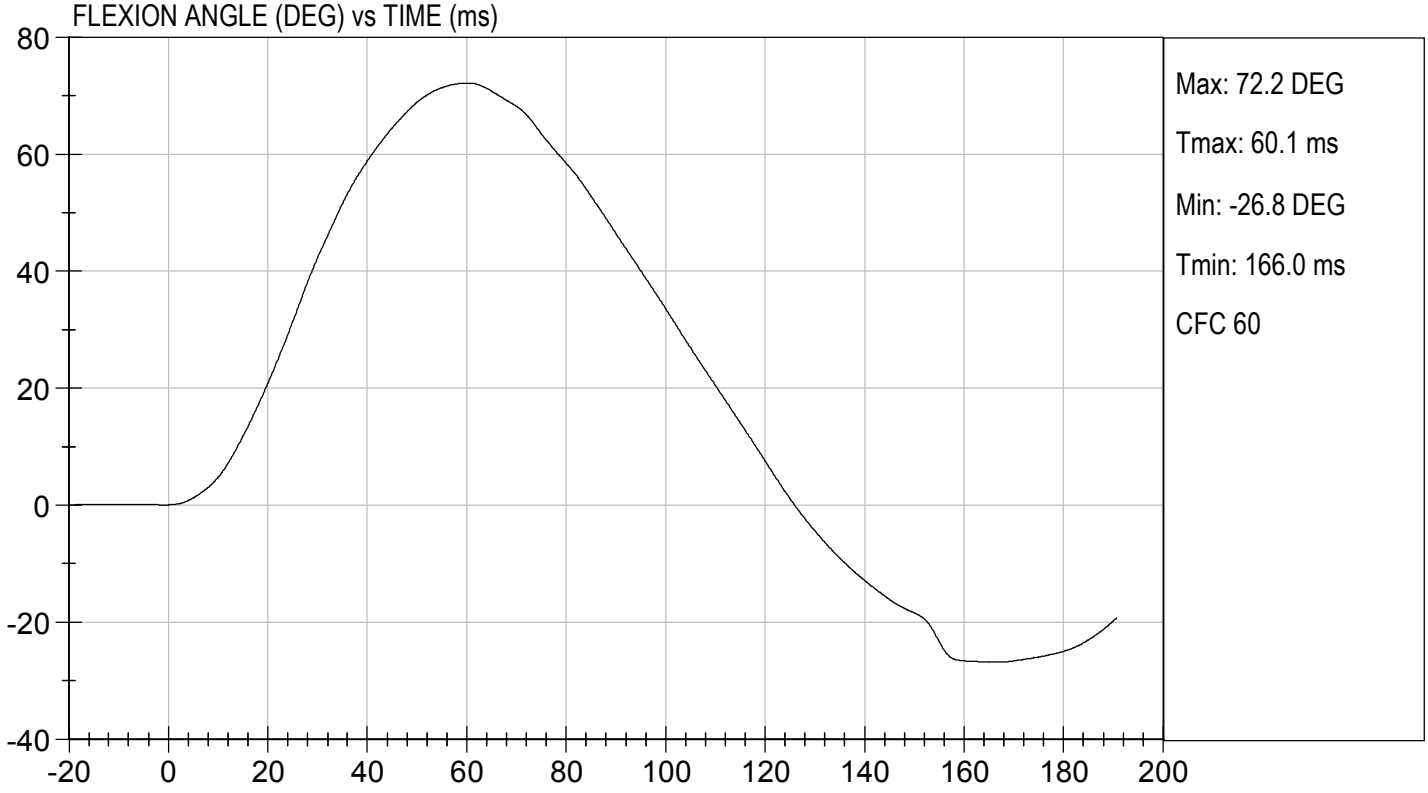
TEST DESC: NECK BENDING
VELOCITY: 18.40 ft/s, 5.61 m/s

TEST DATE: 02/11/2019
TEST #: D190562

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

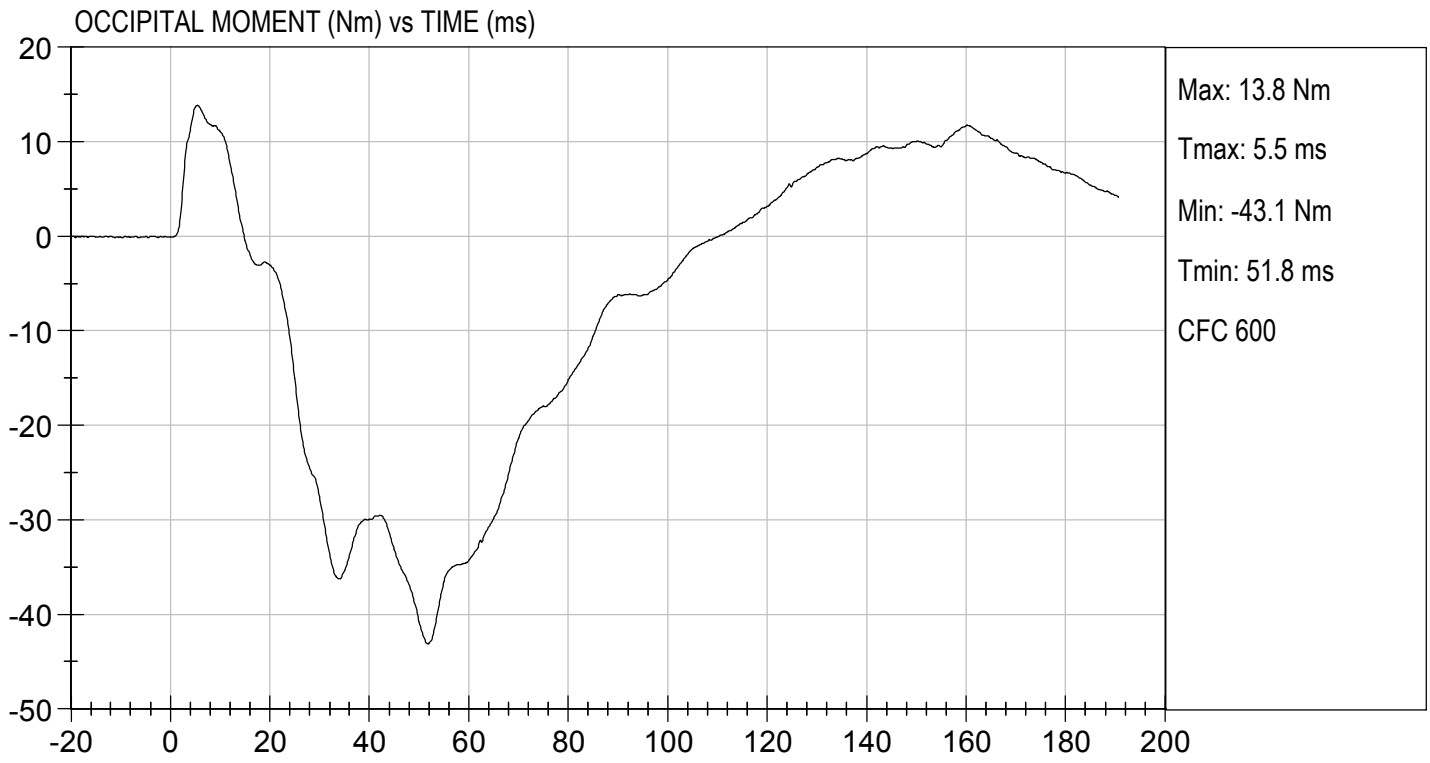


FLEXION ANGLE (DEG) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 18.40 ft/s, 5.61 m/s

TEST DATE: 02/11/2019
TEST #: D190562



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D190563

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	32	Pass
Impact Velocity	m/s	4.20 to 4.40	4.39	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

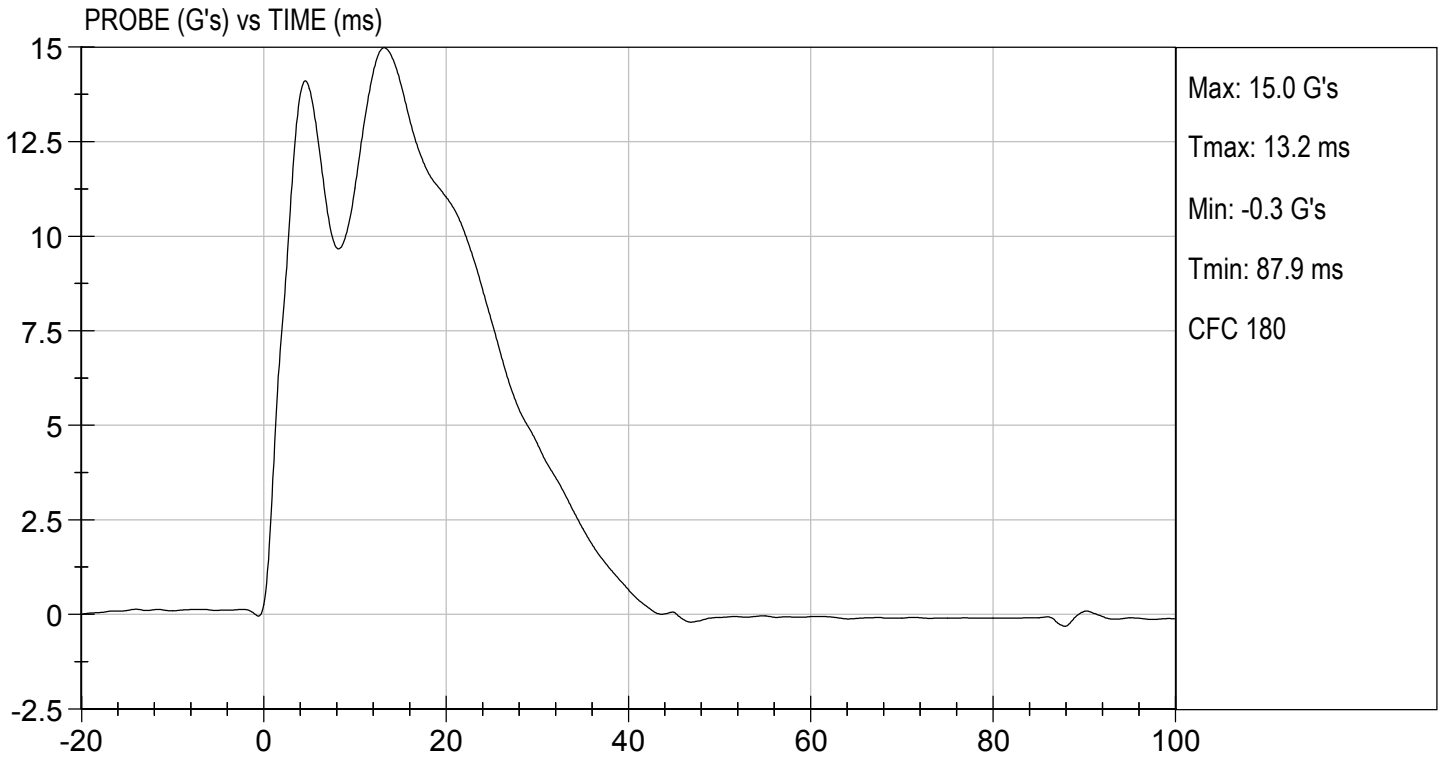
Jacob D Taylor
Laboratory Technician

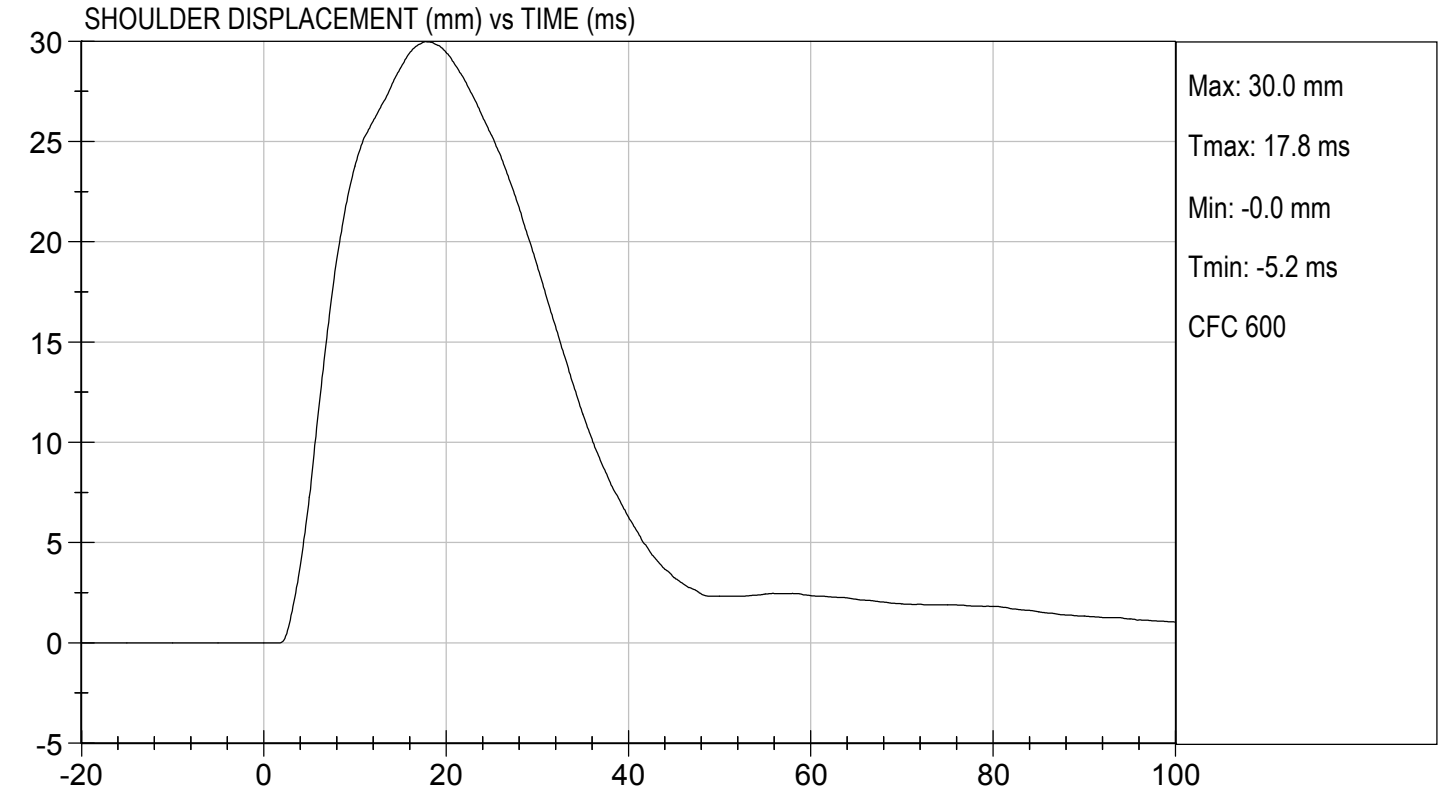
02/08/2019
Test Date

Robert Schmidt
Approved By

TEST DESC: SHOULDER IMPACT
VELOCITY: 14.40 ft/s, 4.39 m/s

TEST DATE: 02/08/2019
TEST #: D190563

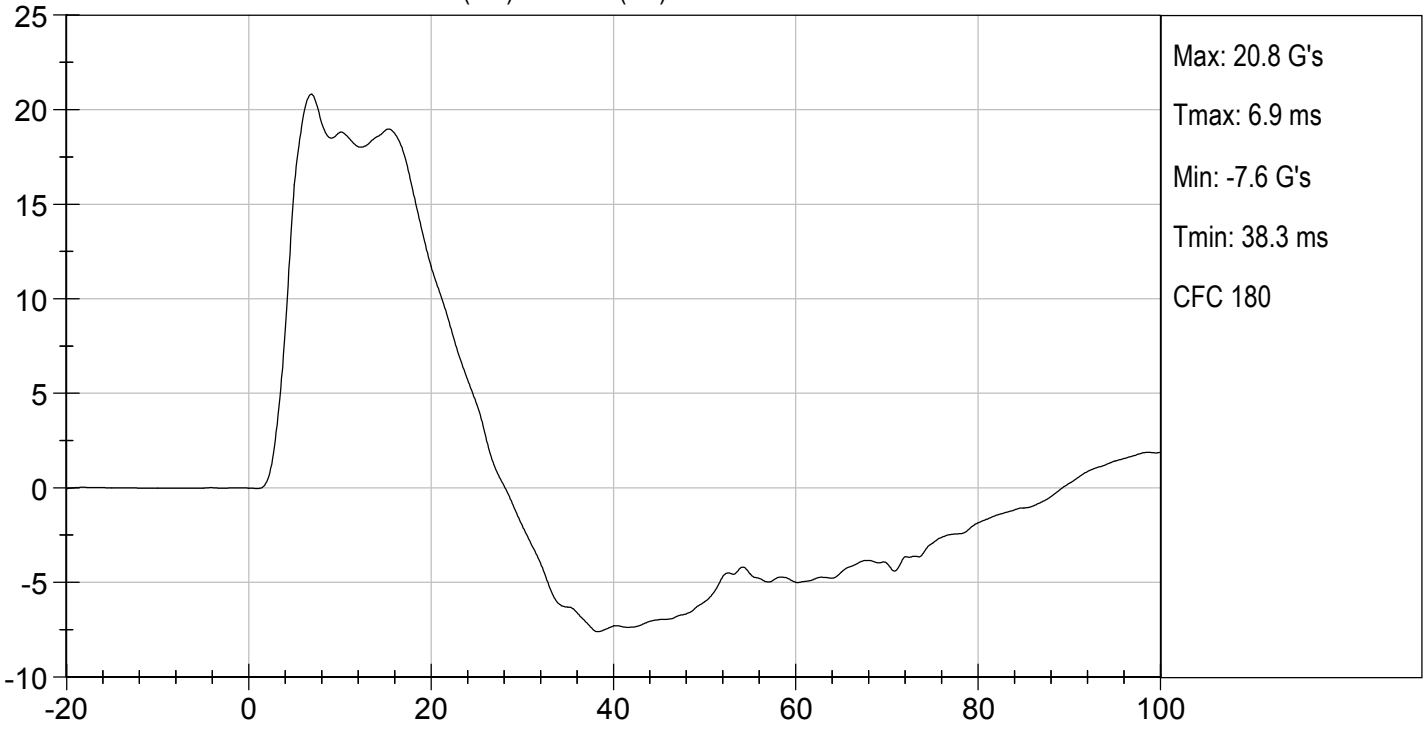




TEST DESC: SHOULDER IMPACT
VELOCITY: 14.40 ft/s, 4.39 m/s

TEST DATE: 02/08/2019
TEST #: D190563

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:** D190564

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	32	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	32	Pass
Upper Rib Displacement	mm	25 to 32	27	Pass
Middle Rib Displacement	mm	30 to 36	32	Pass
Lower Rib Displacement	mm	32 to 38	36	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	41	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	33	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

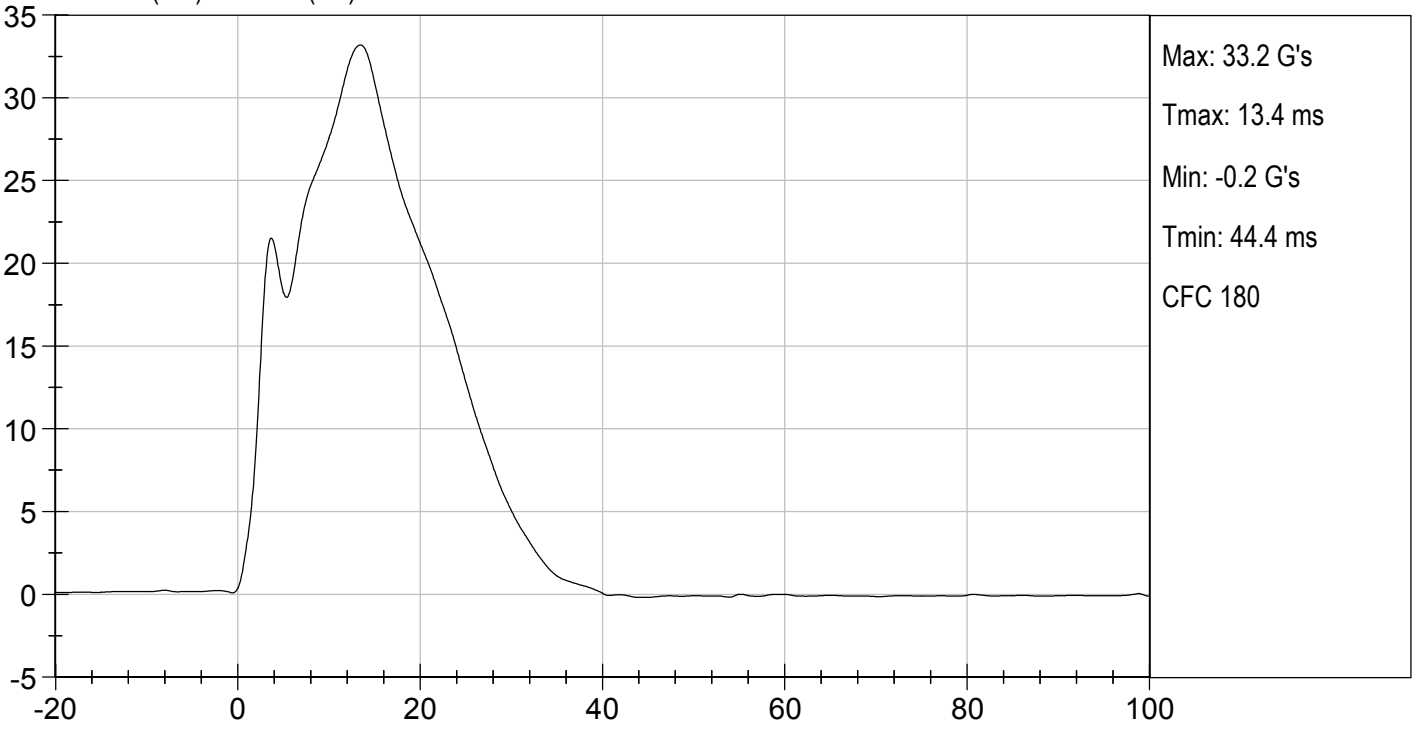
02/08/2019
Test Date

Robert Schmalz
Approved By

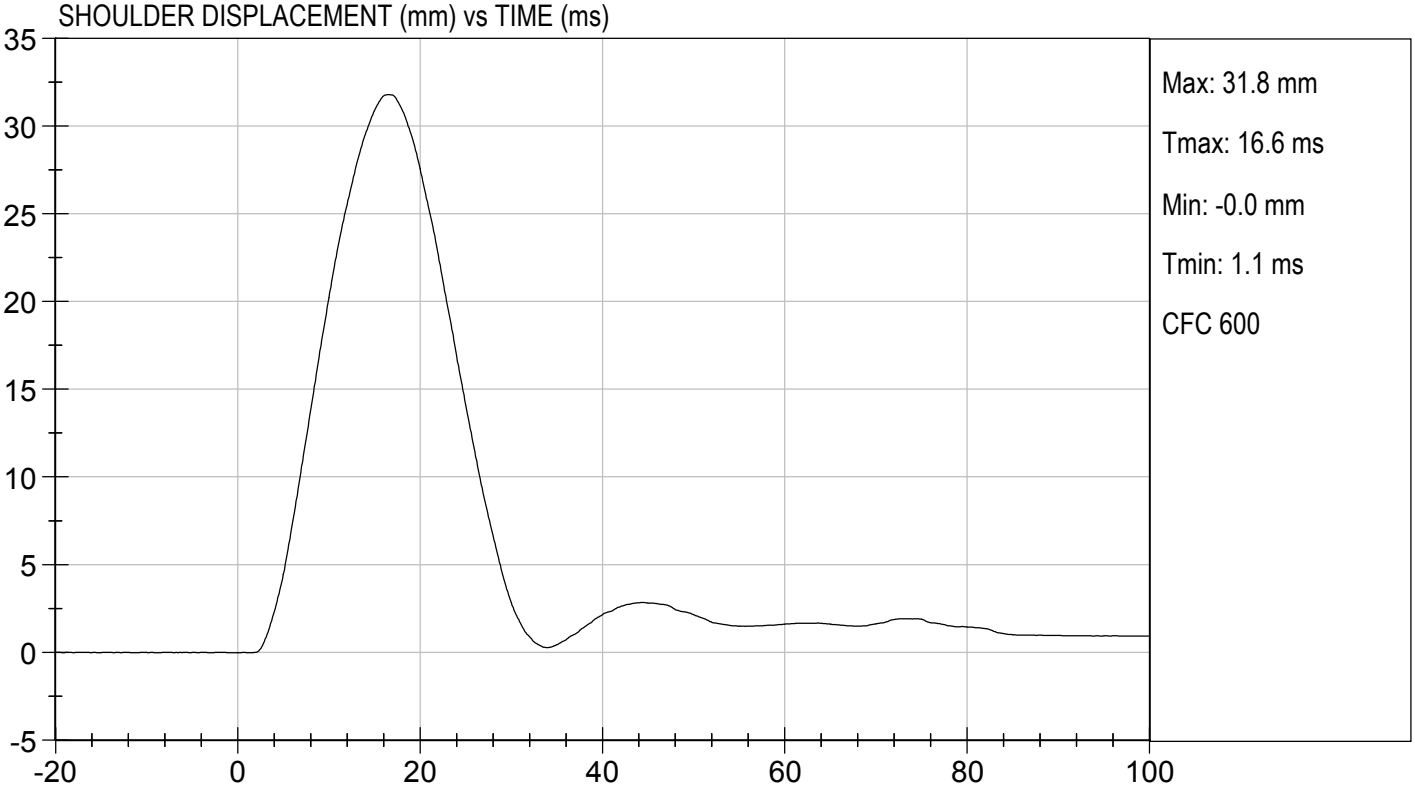
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 02/08/2019
TEST #: D190564

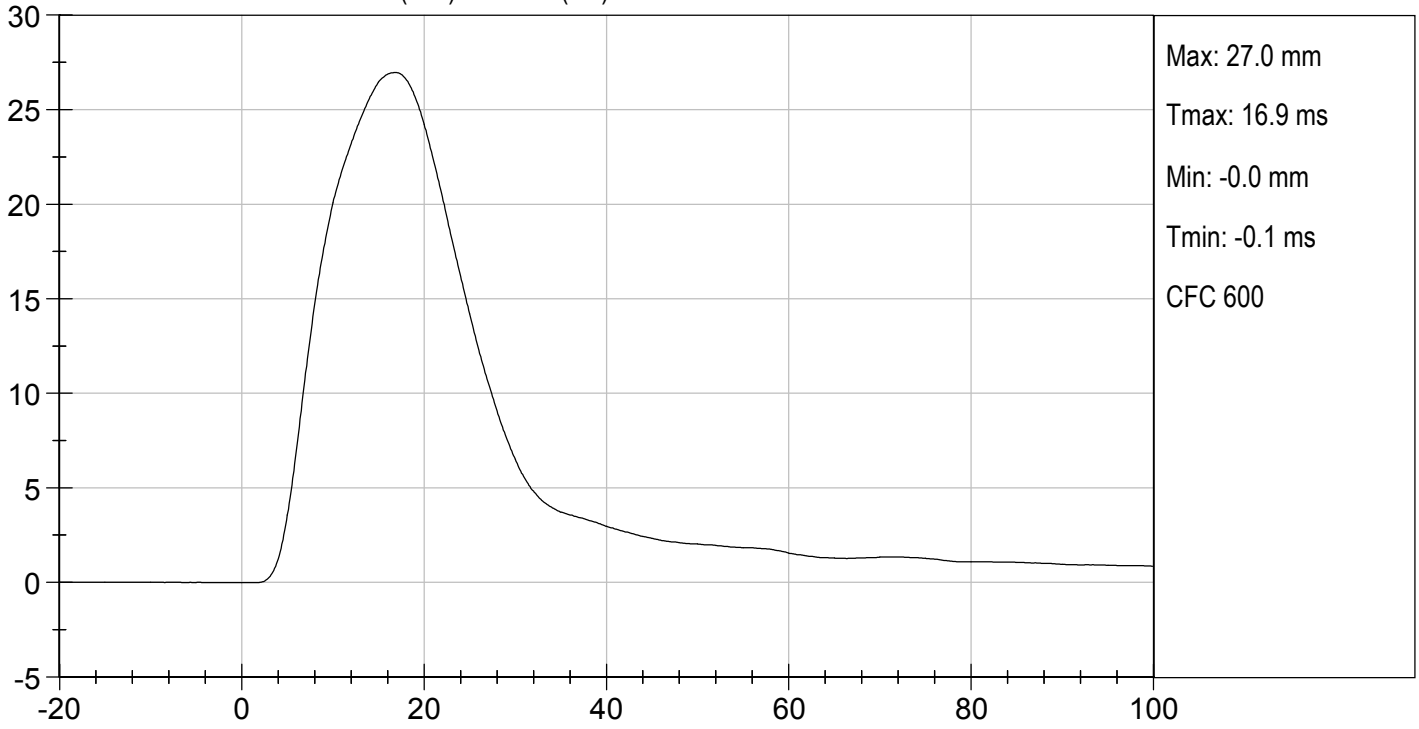
PROBE (G's) vs TIME (ms)



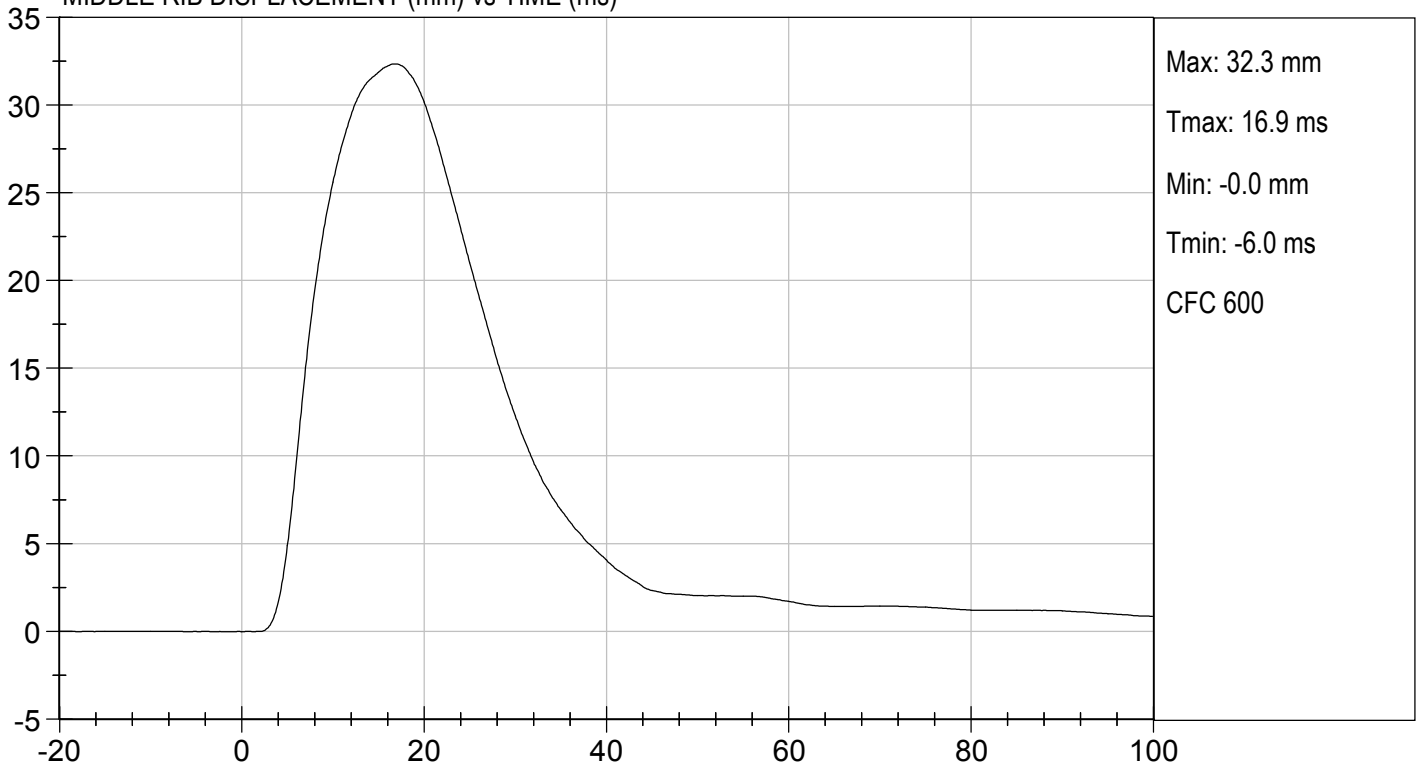
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



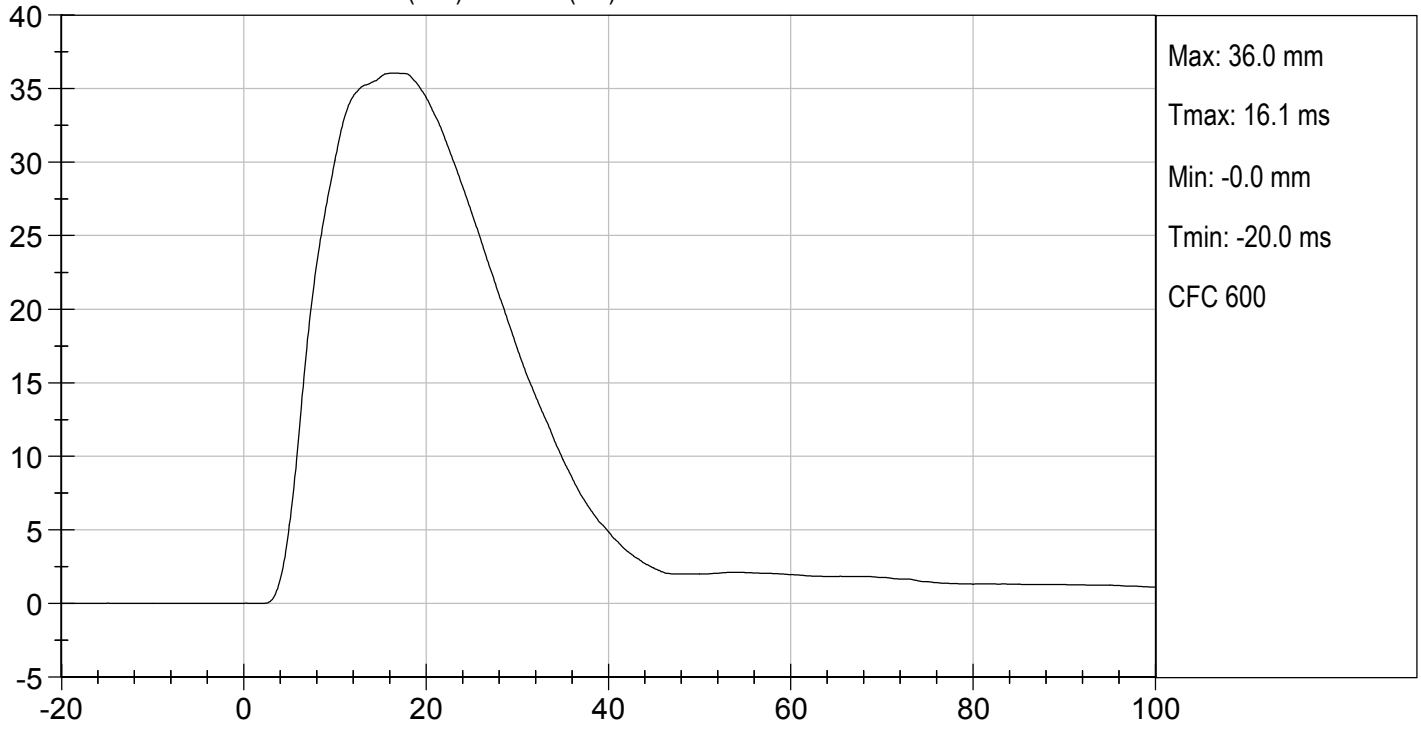
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



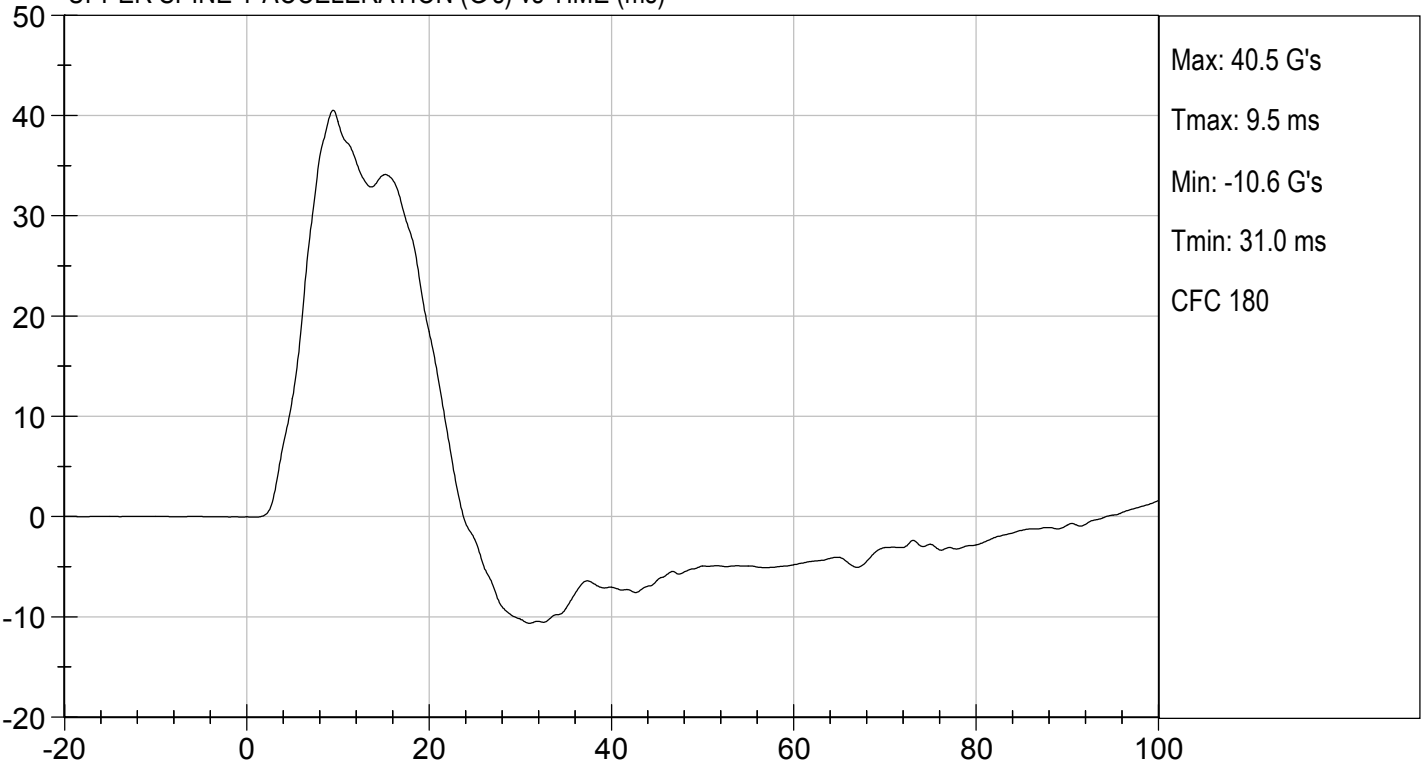
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 02/08/2019
TEST #: D190564

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



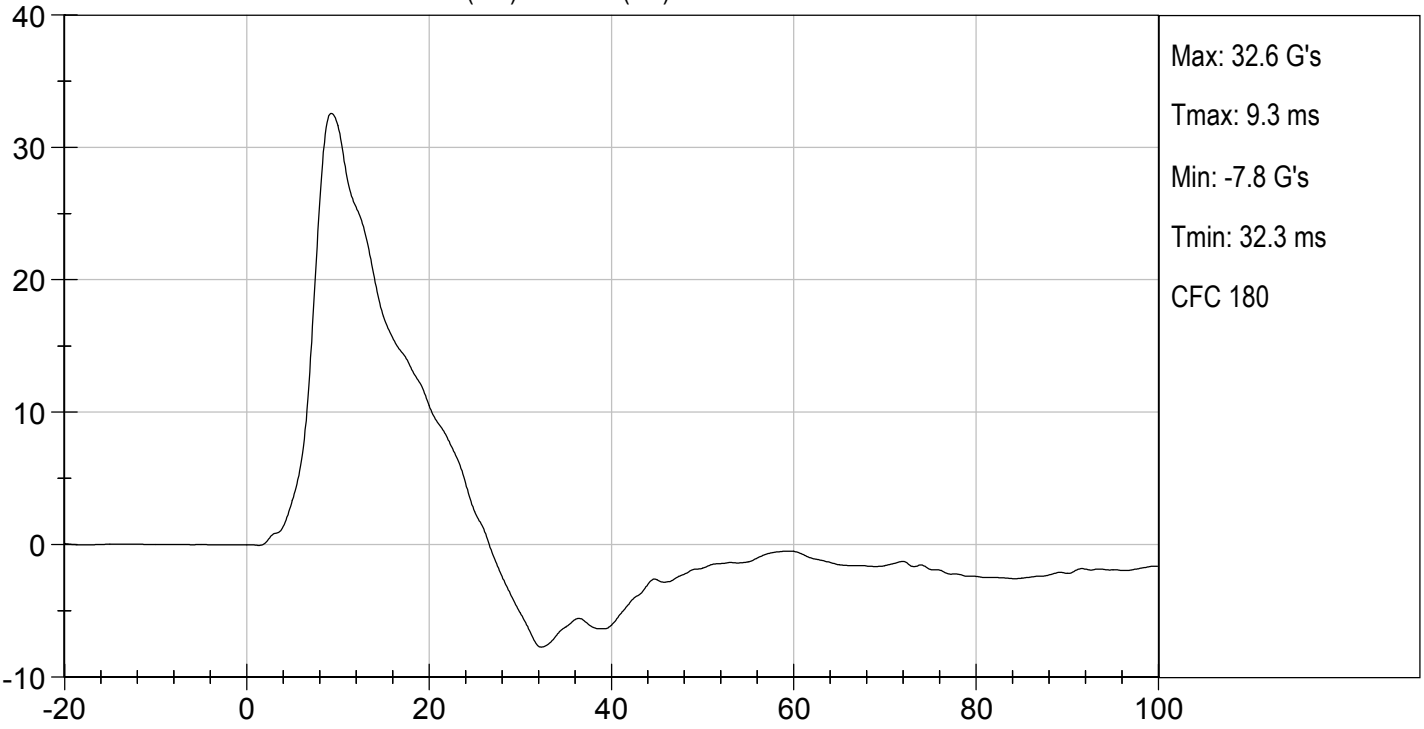
UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 02/08/2019
TEST #: D190564

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:** D190565

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	32	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	36	Pass
Middle Rib Displacement	mm	39 to 45	42	Pass
Lower Rib Displacement	mm	35 to 43	42	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	15	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	9	Pass
		Overall Test Results		Pass

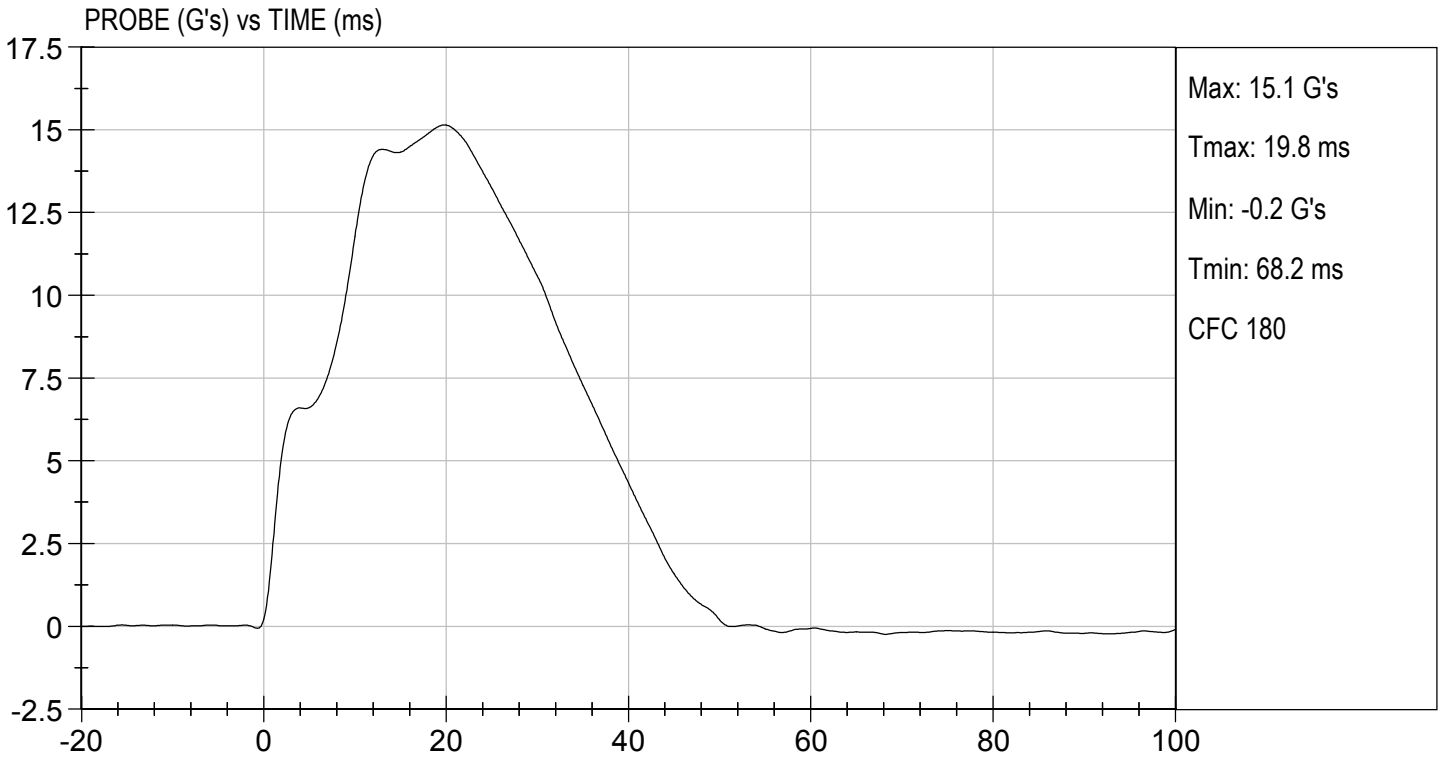
Jacob D Taylor
Laboratory Technician

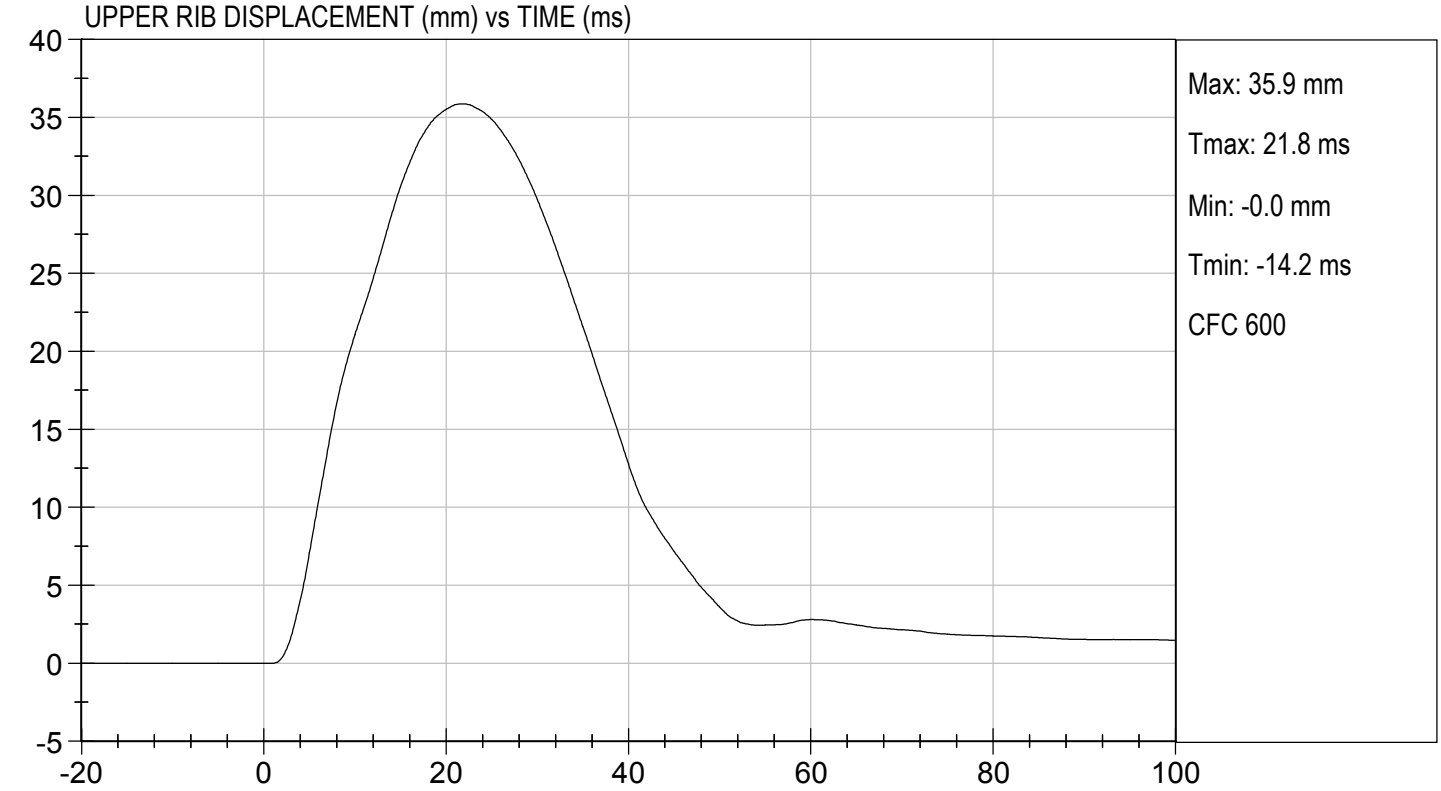
02/08/2019
Test Date

Robert Schmidt
Approved By

TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 02/08/2019
TEST #: D190565

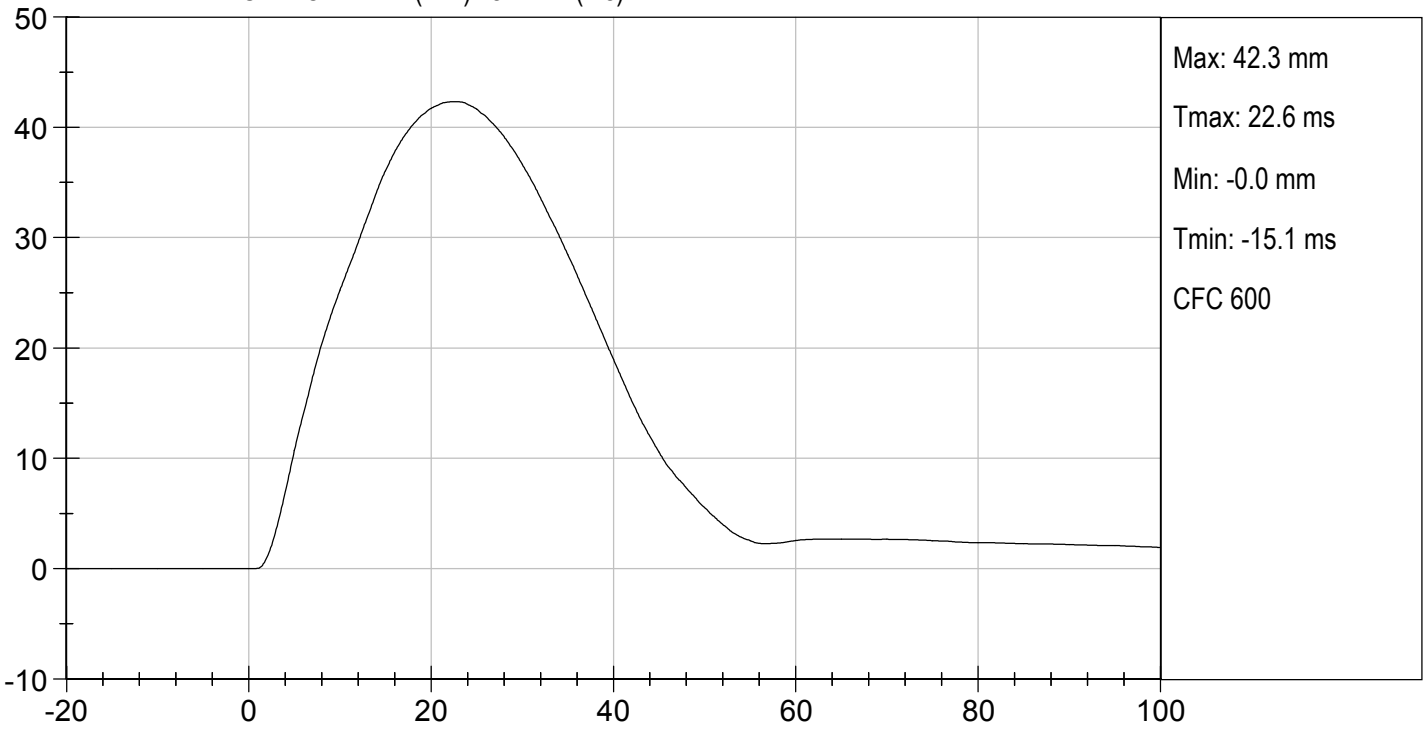




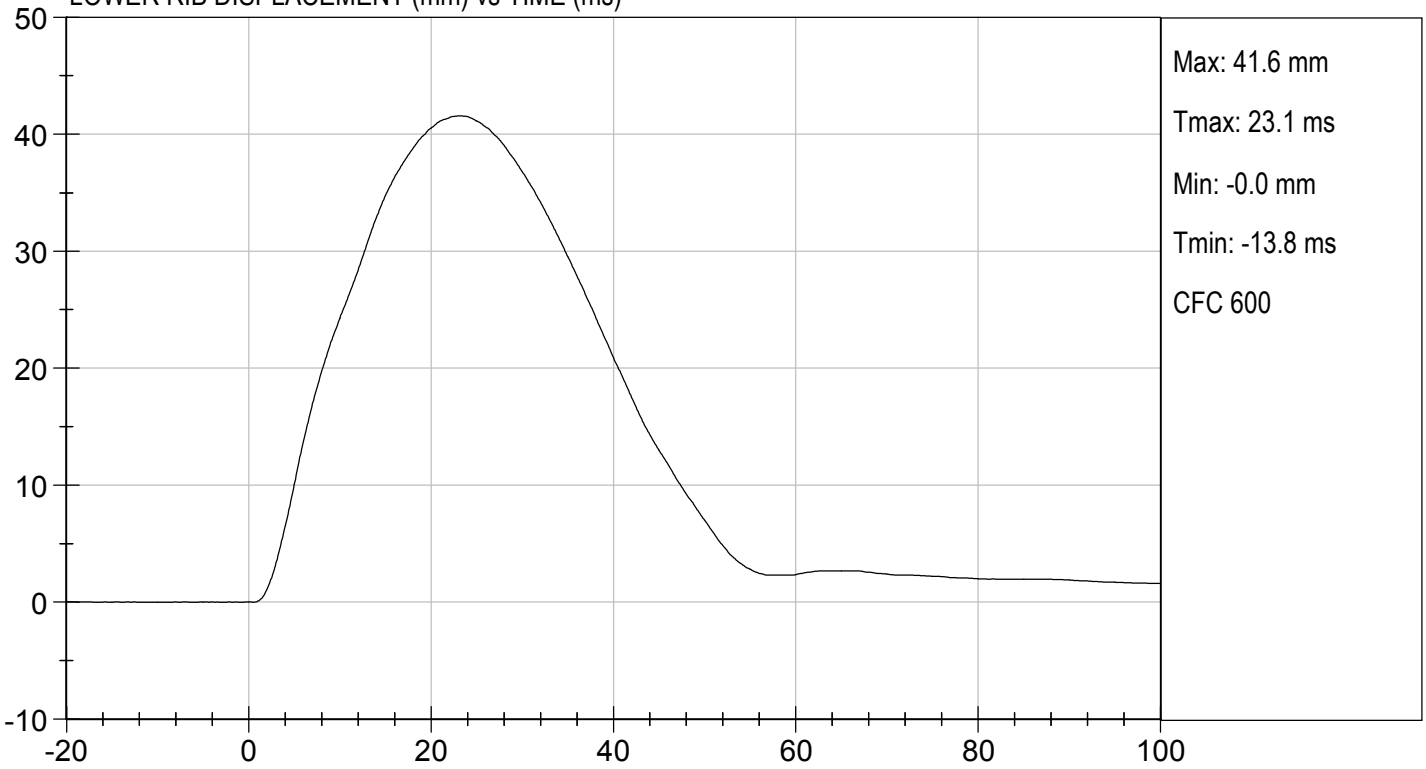
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 02/08/2019
TEST #: D190565

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



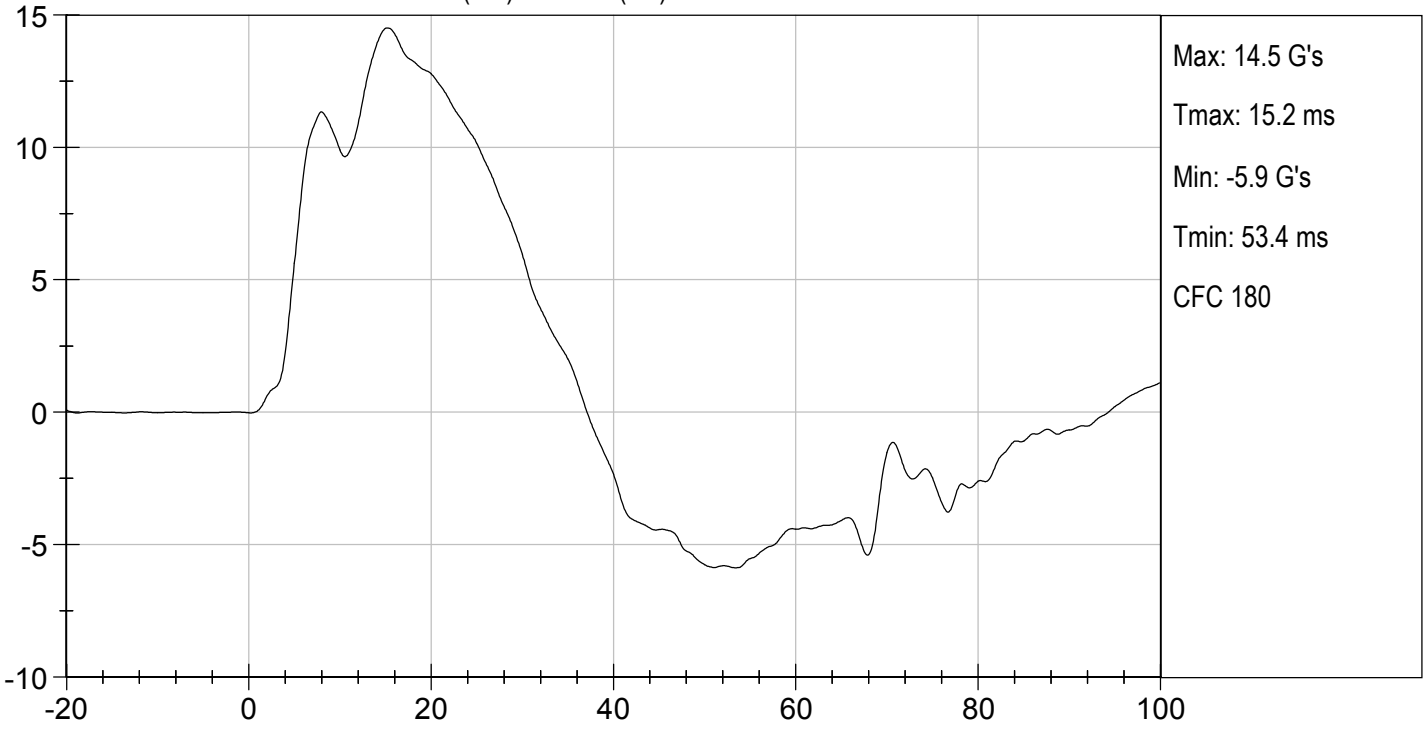
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



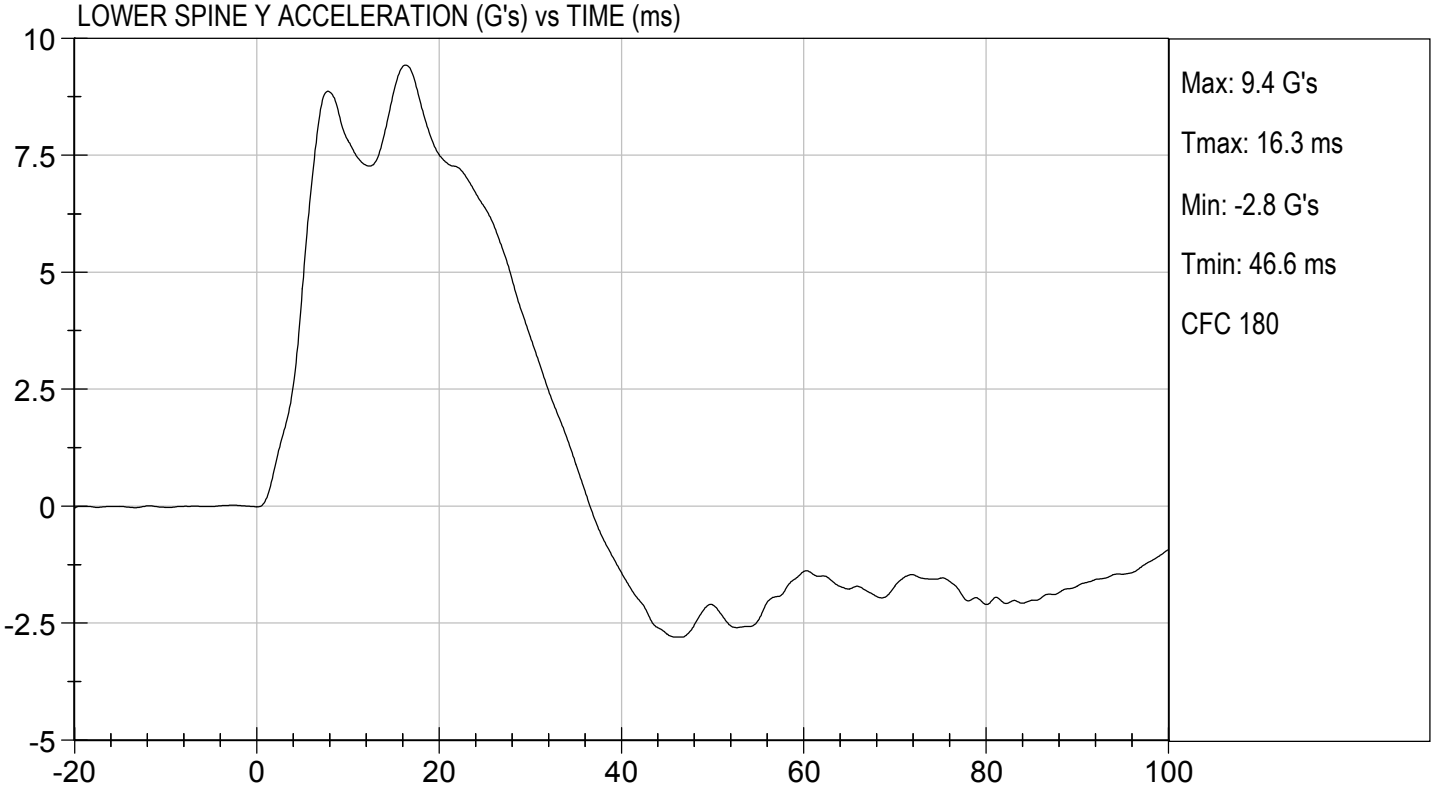
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 02/08/2019
TEST #: D190565

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:** D190566

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	32	Pass
Impact Velocity	m/s	4.20 to 4.40	4.30	Pass
Maximum Probe Acceleration	G's	12 to 16	13	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	41	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	42	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

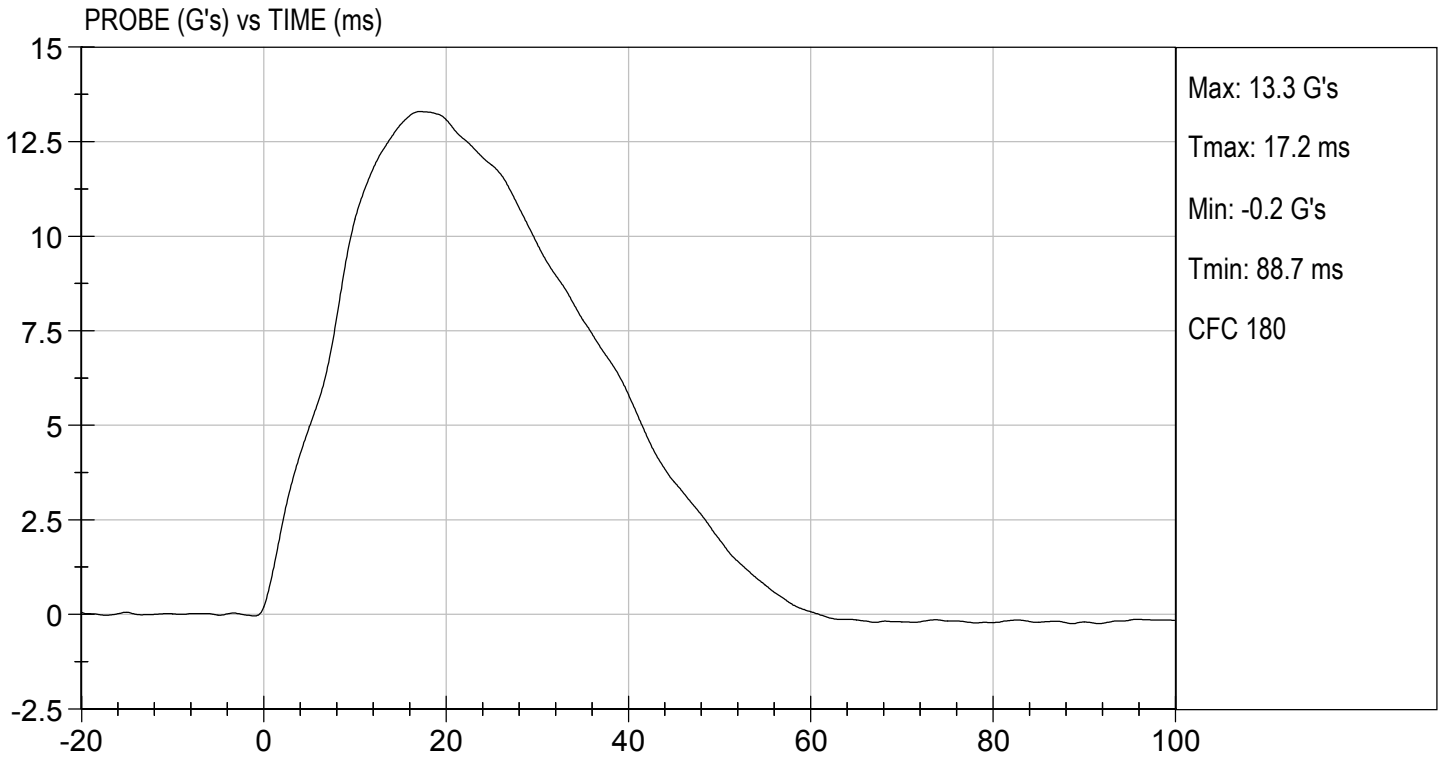
Jacob D Taylor
Laboratory Technician

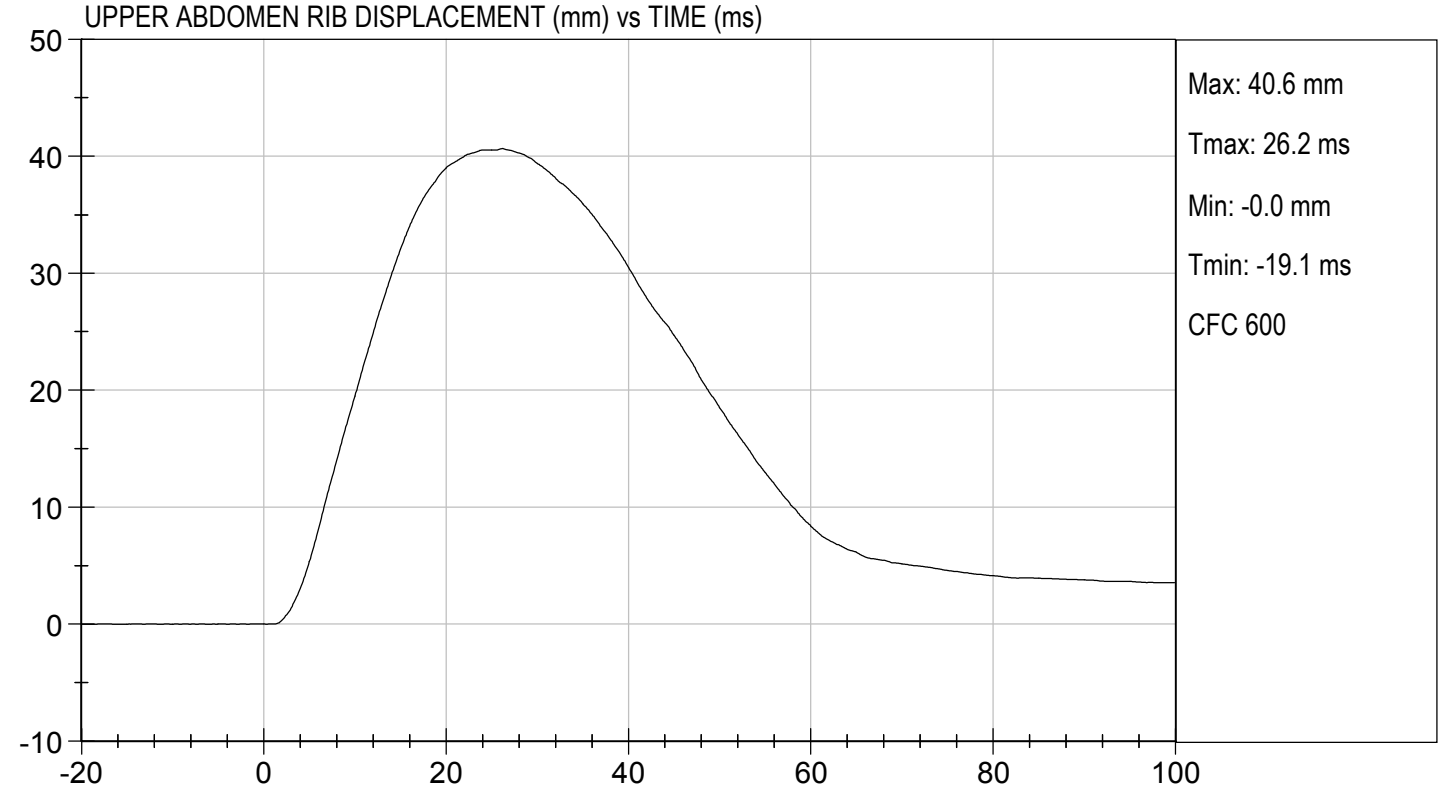
02/08/2019
Test Date

Robert Schmidt
Approved By

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

TEST DATE: 02/08/2019
TEST #: D190566

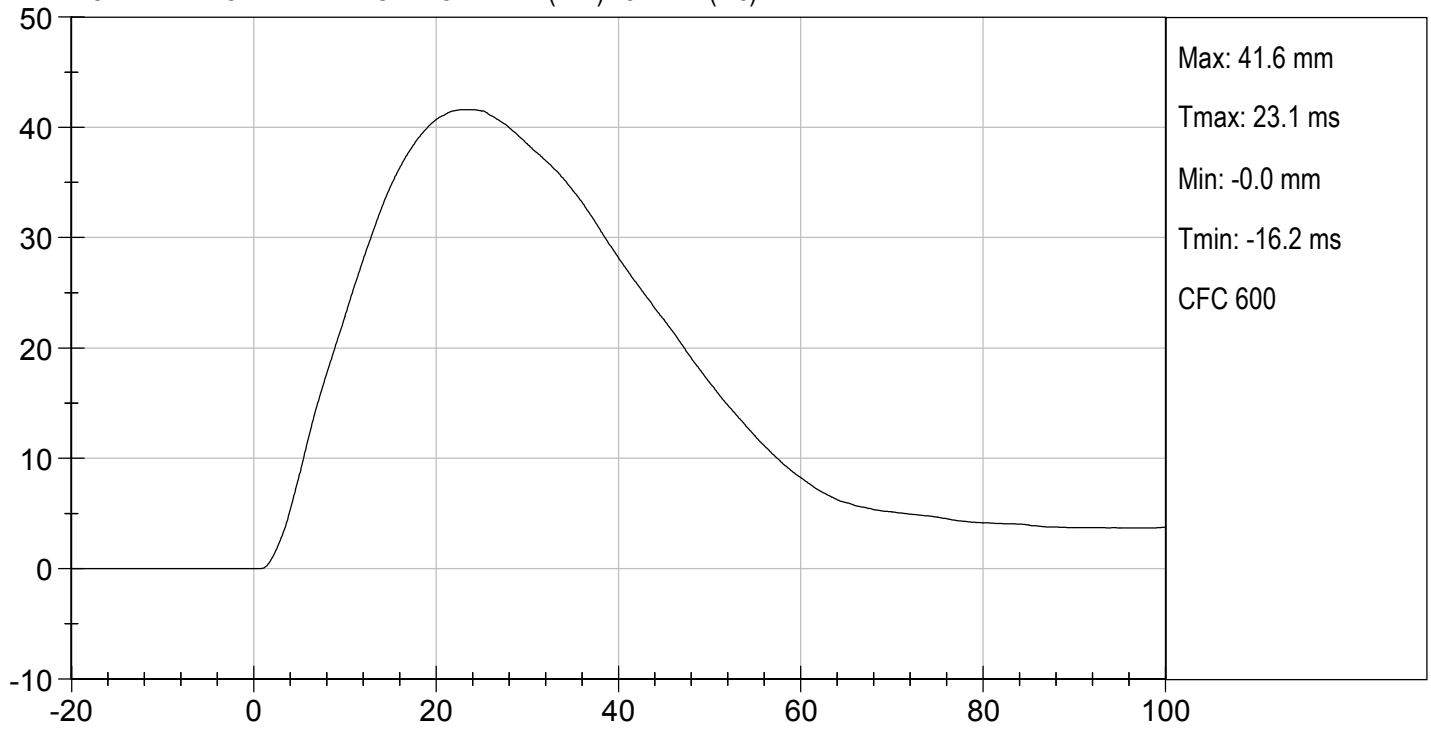




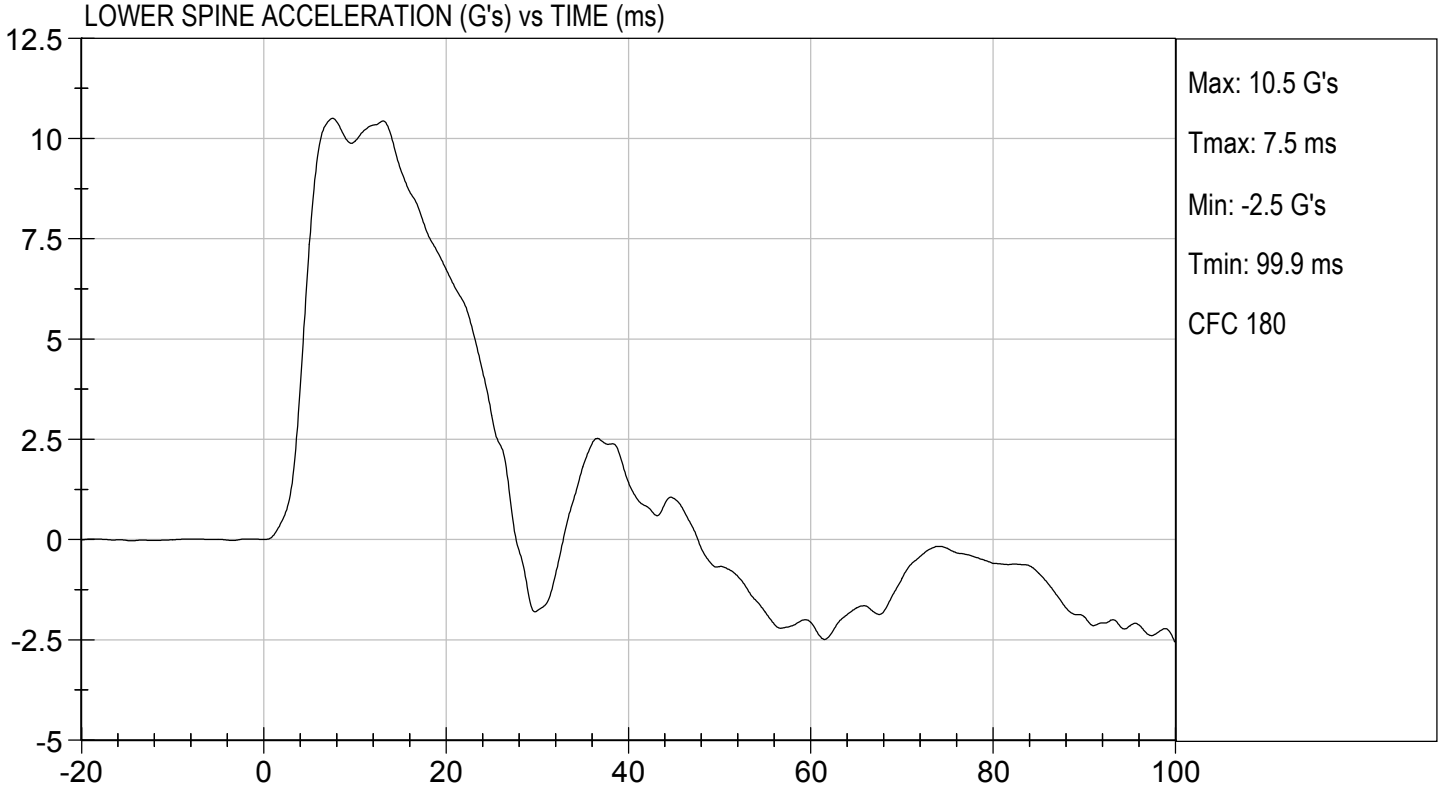
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 02/08/2019
TEST #: D190566

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:** D190567

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	32	Pass
Impact Velocity	m/s	6.60 to 6.80	6.60	Pass
Maximum Probe Acceleration	G's	38 to 47	47	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	39	Pass
Peak Acetabulum Force	N	3600 to 4300	4,240	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

02/08/2019

Test Date

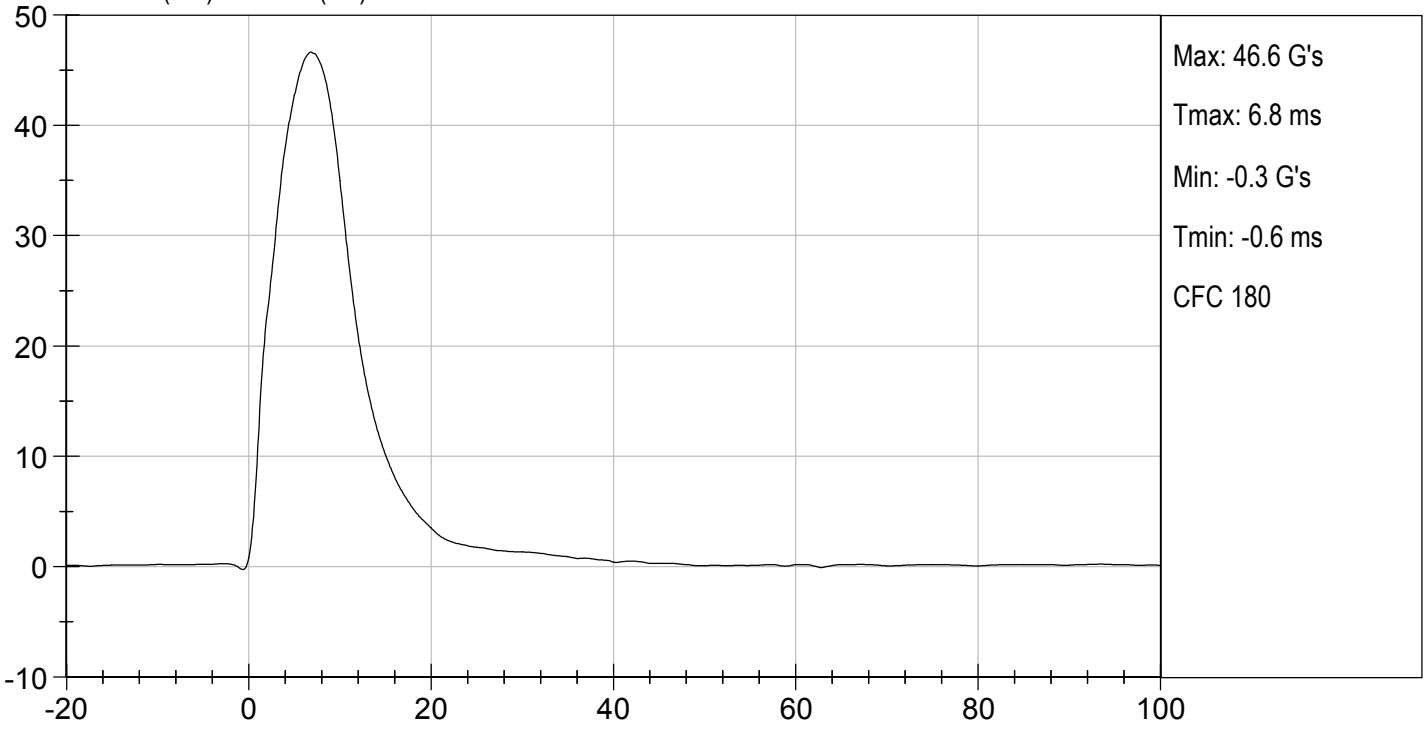
Robert Schmidt

Approved By

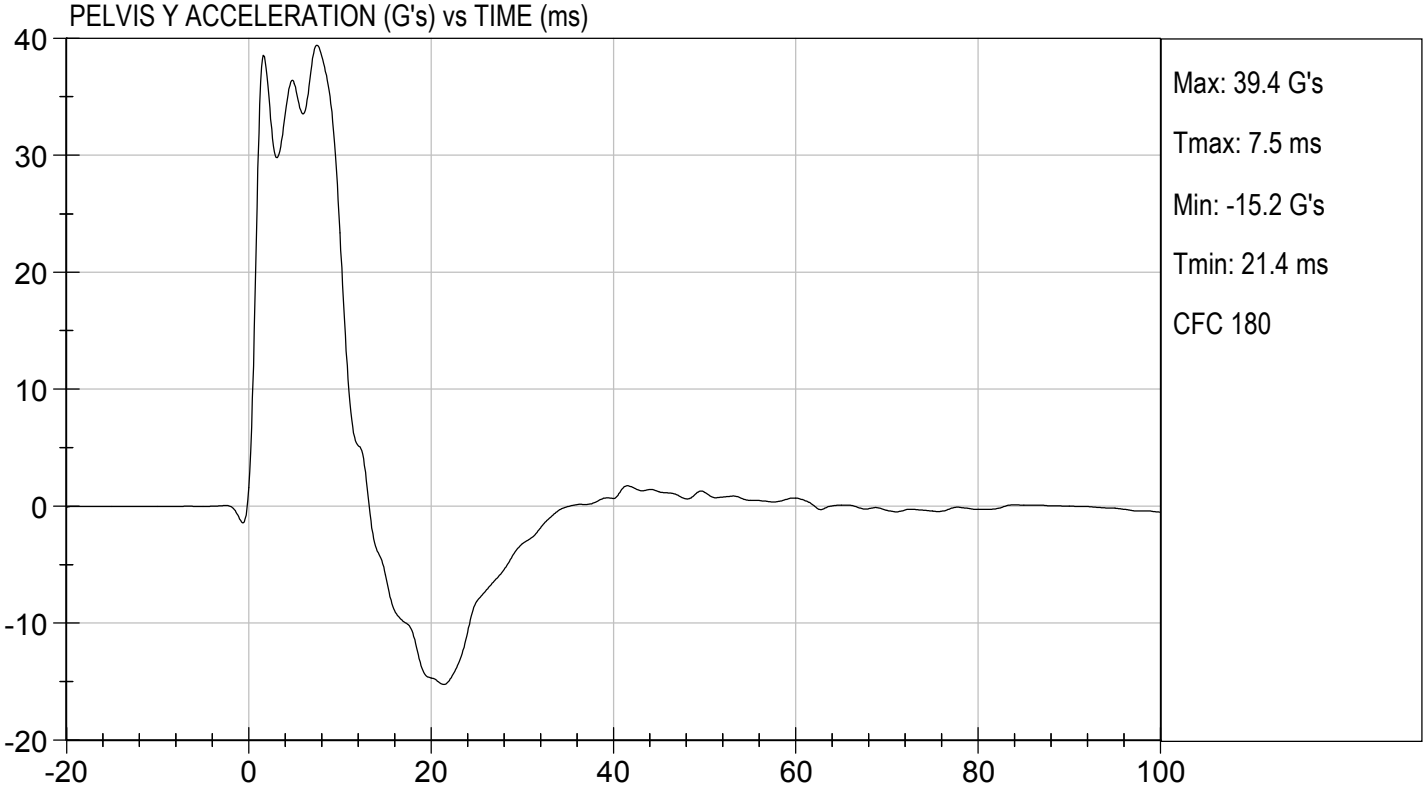
TEST DESC: PELVIS IMPACT
VELOCITY: 21.64 ft/s, 6.60 m/s

TEST DATE: 02/08/2019
TEST #: D190567

PROBE (G's) vs TIME (ms)

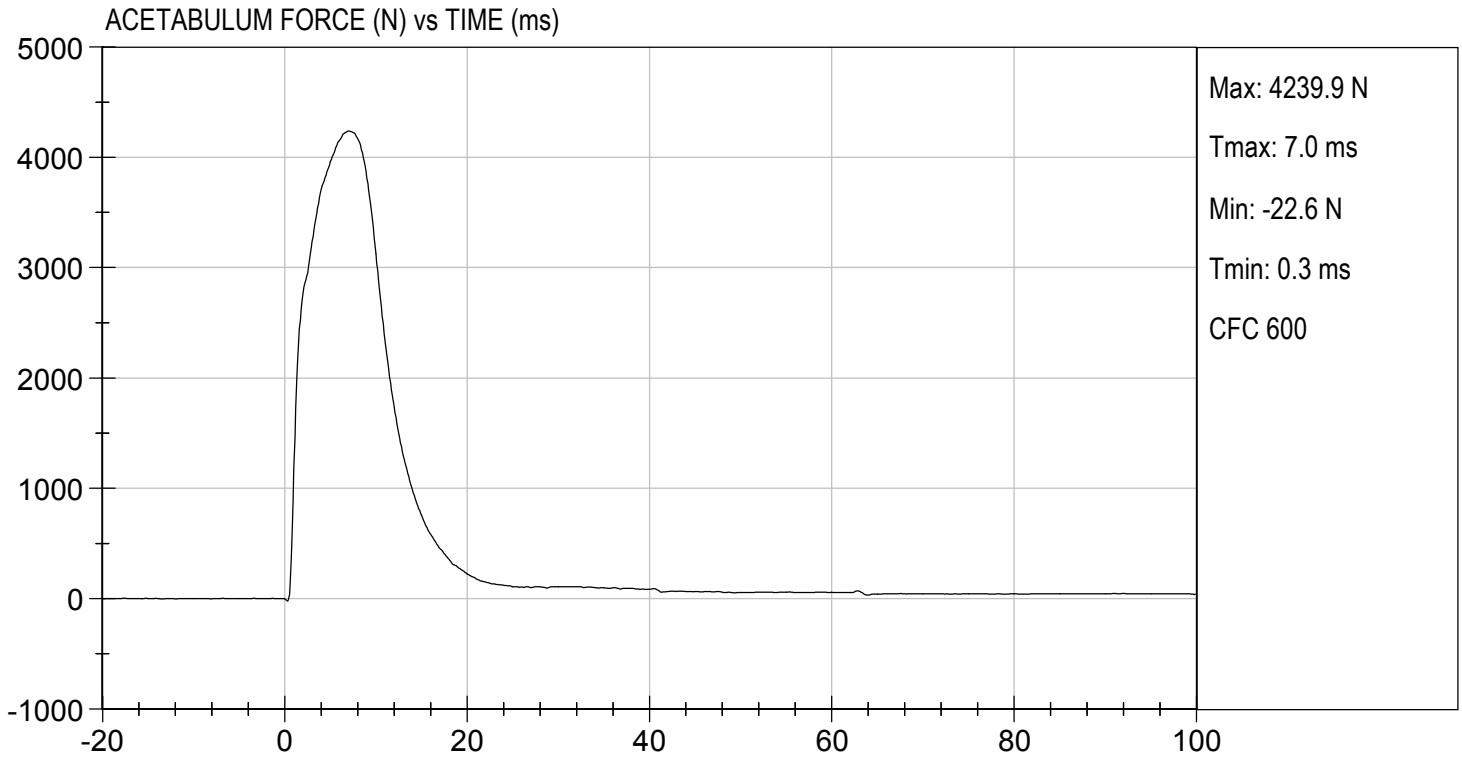


PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 02/08/2019
TEST #: D190567



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D190568

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Humidity	%	10 to 70	32	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	28	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,227	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

02/08/2019

Test Date

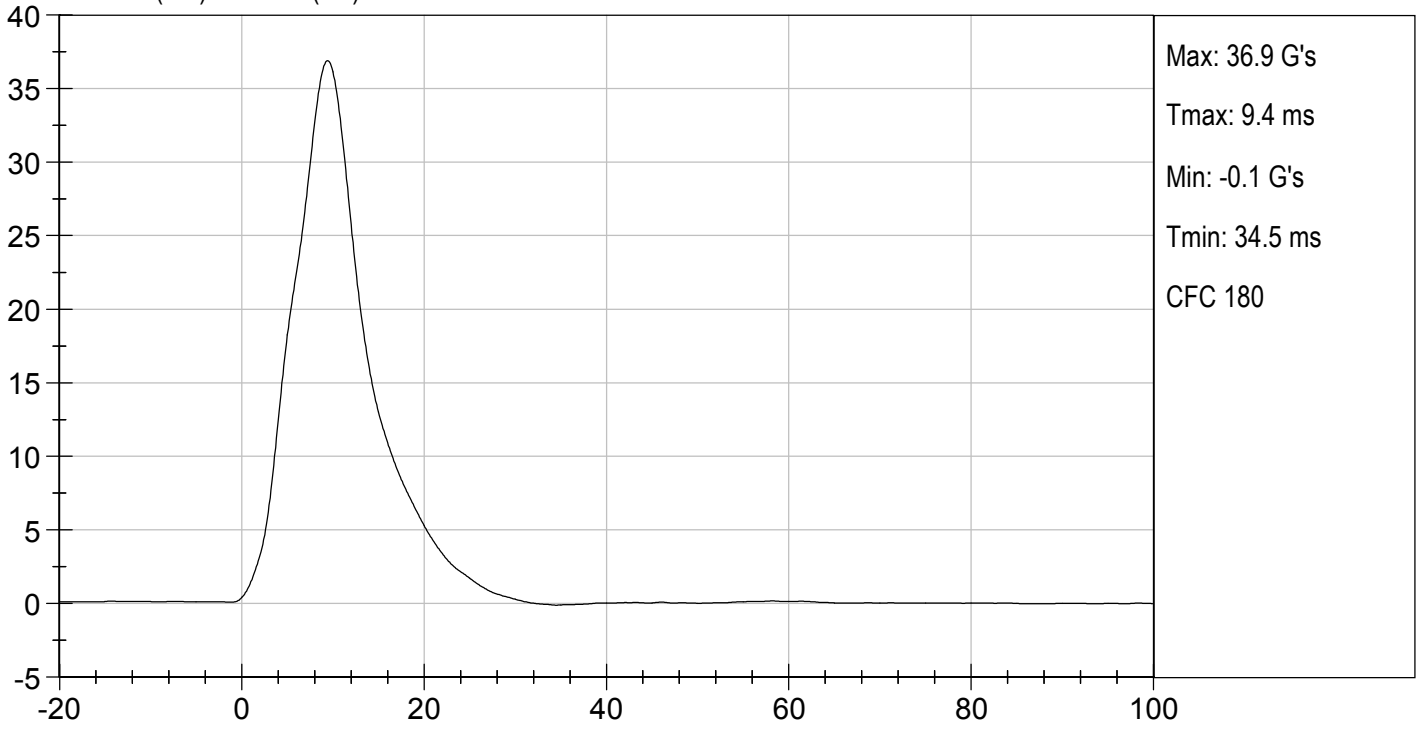
Robert Schmidt

Approved By

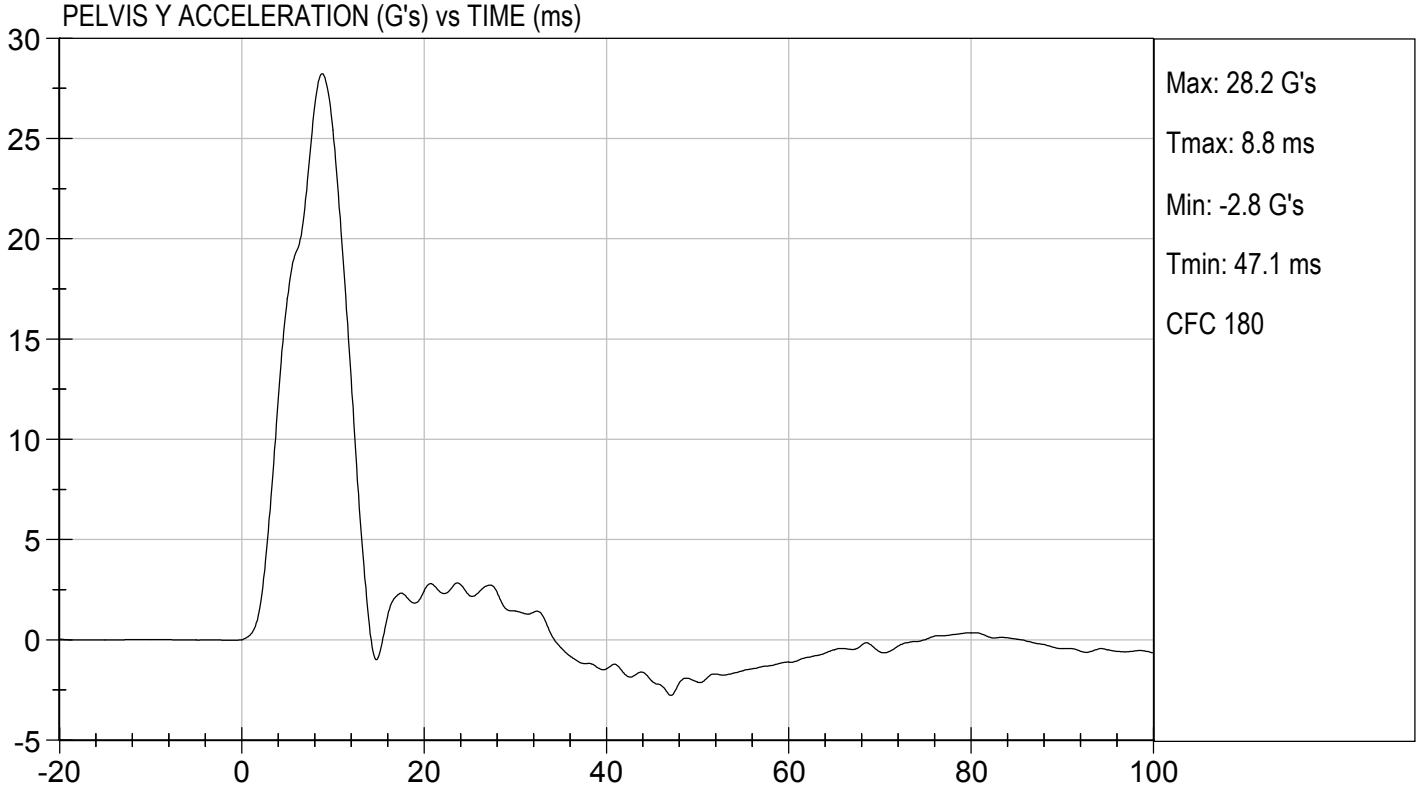
TEST DESC: ILLIAC
VELOCITY: 14.40 ft/s, 4.39 m/s

TEST DATE: 02/08/2019
TEST #: D190568

PROBE (G's) vs TIME (ms)

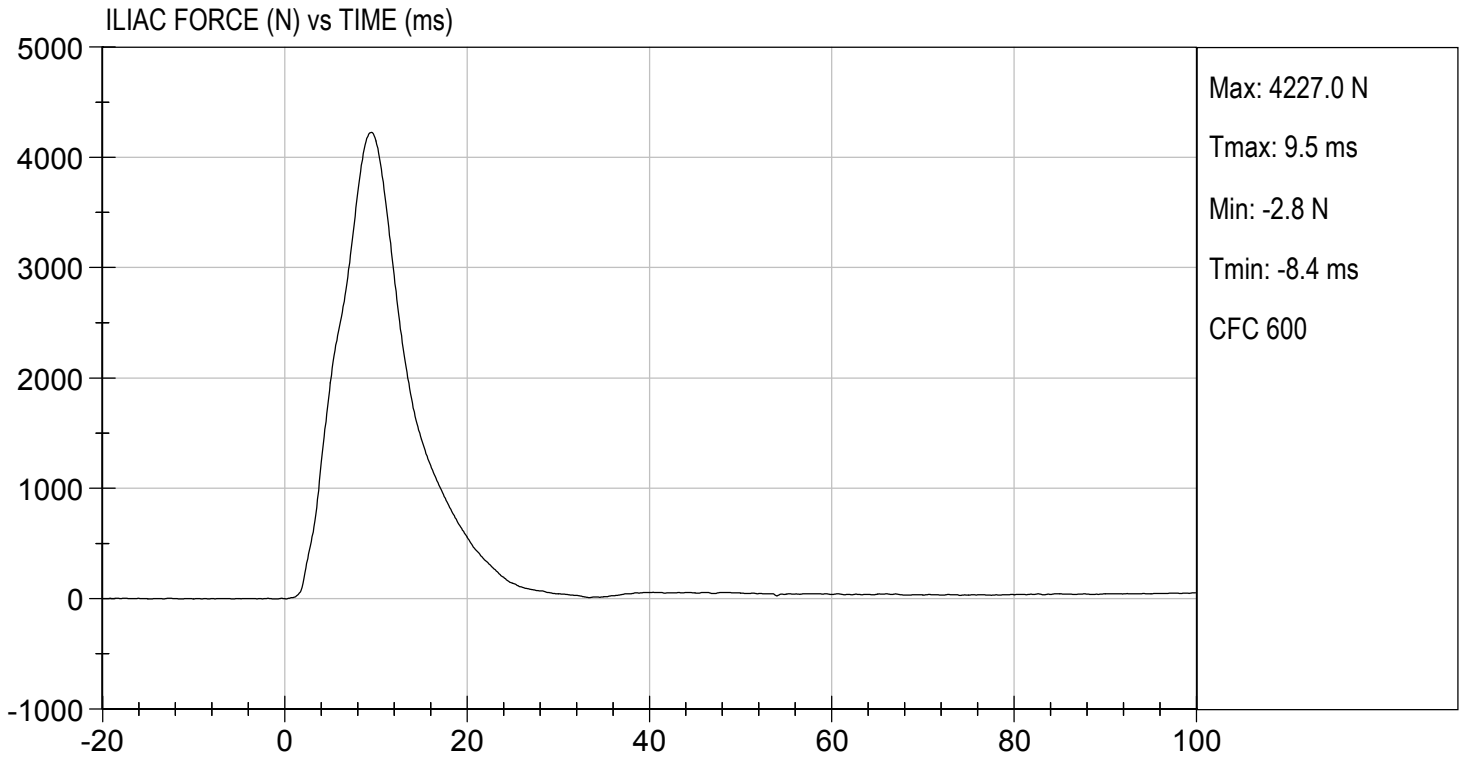


PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 02/08/2019
TEST #: D190568



SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 12201
Test Number 6561
Report Number 6576
Test Date 3/1/2018 9:33:08 AM

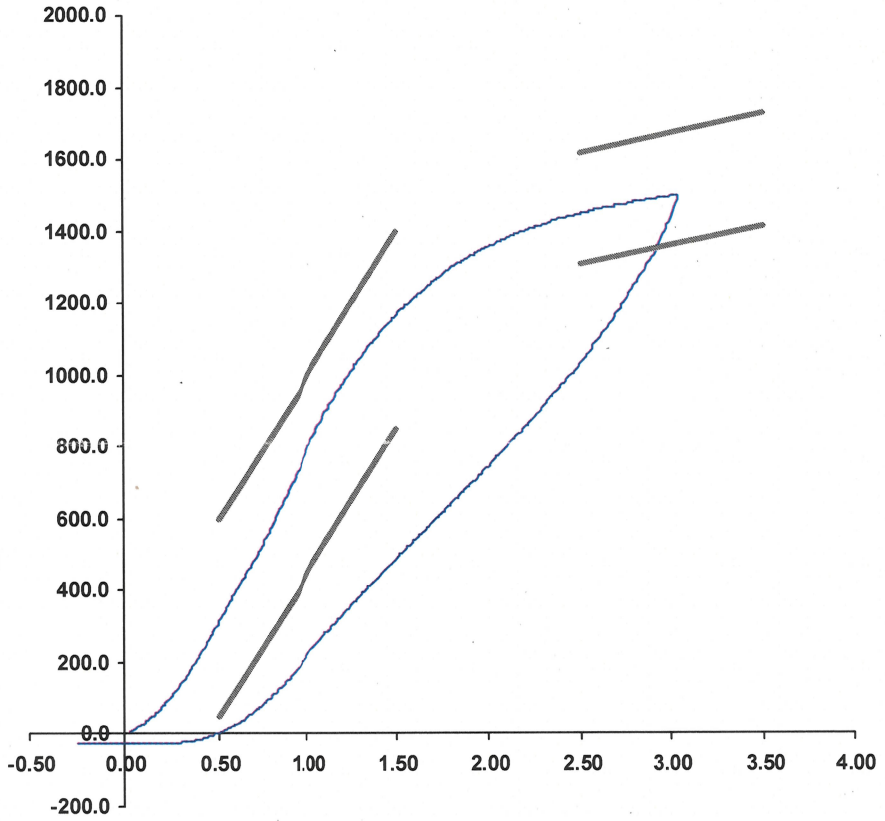
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	314.58	50.00	600.00
Force @ 1.5 mm (N)	1,169.14	850.00	1,400.00
Force @ 2.5 mm (N)	1,449.02	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,498.19	1,361.00	1,673.00

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

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

Notes:

Force (-N) vs Extension (-mm)



Operator

Part Number 180-4450

Template No 107 **01-Mar-18**
SACO Research

By : DC Date : 3/1/18

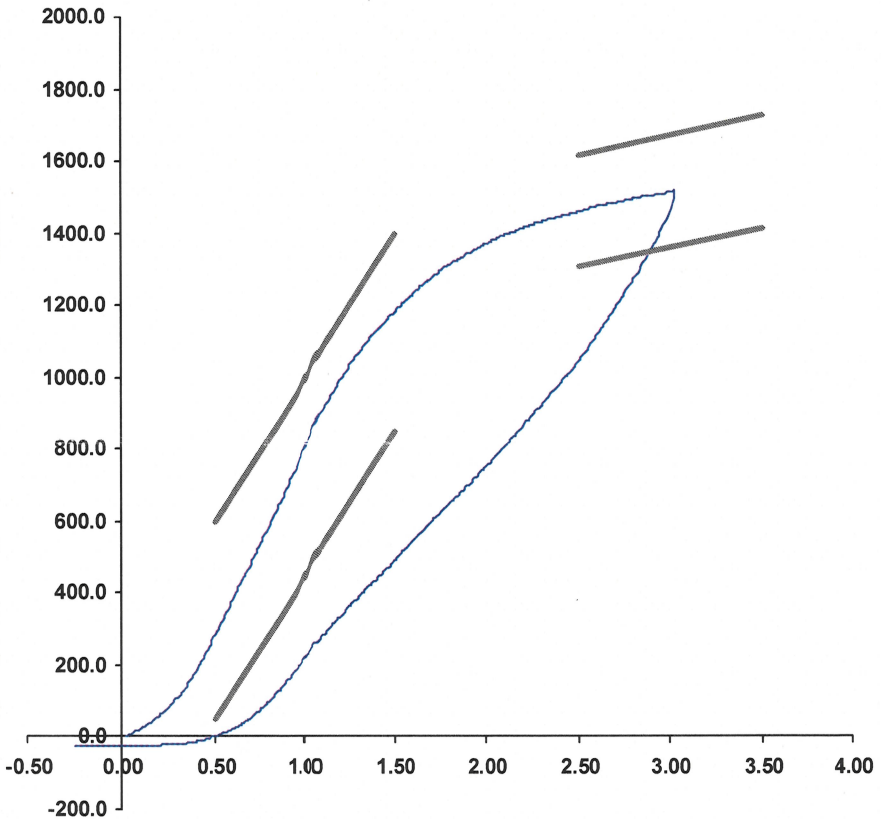
SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

SID-IIs Pelvis Plug Certification Test

Plug S/N 12127
Test Number 6486
Report Number 6501
Test Date 2/28/2018 9:46:23 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	284.91	50.00	600.00
Force @ 1.5 mm (N)	1,186.11	850.00	1,400.00
Force @ 2.5 mm (N)	1,461.21	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,515.54	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



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

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

Notes:

Operator 12123

Part Number 180-4450

Template No 107 **28-Feb-18**
SACO Research

By : DC Date : 2/28/18

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	ACG111FY	FTSS	04/04/18
Iliac Wing Load Cell			Y	IWG226FY	FTSS	04/04/18
Pelvis Plug (struck side)				12201	SACO	03/01/18
Pelvis Plug (non-struck side)				12127	SACO	02/28/18

Table 2 – Vehicle Instrumentation

		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	PCB1278	PCB	01/16/19
Vehicle Center of Gravity	Y	PCB1294	PCB	01/16/19
Vehicle Center of Gravity	Z	PCB1247	PCB	01/16/19
Left Floor Sill	Y	PCB595	PCB	10/03/18
A-Pillar Sill	Y	PCB1077	PCB	09/24/18
A-Pillar Low	Y	PCB1240	PCB	01/09/19
A-Pillar Mid	Y	PCB896	PCB	01/09/19
B-Pillar Sill	Y	PCB1119	PCB	10/01/18
B-Pillar Low	Y	PCB1348	PCB	08/14/18
B-Pillar Mid	Y	PCB1374	PCB	08/14/18
Driver Seat	Y	PCB1140	PCB	01/16/19
Engine Top	X	PCB1159	PCB	12/28/18
Engine Top	Y	PCB1239	PCB	12/28/18
Firewall	Y	PCB1176	PCB	12/05/18
Right Roof	Y	PCB1100	PCB	10/01/18
Right Floor Sill	Y	PCB1191	PCB	12/05/18
Rear Floorpan	X	T17965	Endevco	01/04/19
Rear Floorpan	Y	T18396	Endevco	01/03/19

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