

REPORT NUMBER: SideNCAPPole-KAR-21-008
NEW CAR ASSESSMENT PROGRAM (NCAP)
SIDE IMPACT POLE TEST

BAYERISCHE MOTOREN WERKE AG
2021 BMW 330i 4-DOOR SEDAN

NHTSA No: M20214101

PREPARED BY:
APPLUS IDIADA KARCO ENGINEERING, LLC.
9270 HOLLY ROAD
ADELANTO, CA 92301



JUNE 28, 2021

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
MAIL CODE: NRM-100
1200 NEW JERSEY AVE, SE, ROOM W43-410
WASHINGTON, D.C. 20590

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared By: 

Mr. Matthew J. Angeles, Project Engineer
Applus IDIADA KARCO Engineering, LLC.

Reviewed By: 

Mr. Michael L. Dunlap, Director of Operations
Applus IDIADA KARCO Engineering, LLC.

Approved By: 

Mr. Steven D. Matsusaka, Engineering Manager
Applus IDIADA KARCO Engineering, LLC.

Approval Date: June 28, 2021

FINAL REPORT ACCEPTANCE BY OCWS:


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

Date: _____


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

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. SideNCAPPole-KAR-21-008	2. Government Accession No.	3. Recipient's Catalog No.																												
4. Title and Subtitle Final Report of New Car Assessment Program Side Impact Pole Testing of a 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101		5. Report Date June 28, 2021																												
		6. Performing Organization Code KAR																												
7. Authors Mr. Matthew J. Angeles, Project Engineer, Applus IDIADA KARCO Mr. Steven D. Matsusaka, Engineering Manager, Applus IDIADA KARCO		8. Performing Organization Report No. TR-P41054-01-NC																												
9. Performing Organization Name and Address Applus IDIADA KARCO Engineering, LLC. 9270 Holly Rd. Adelanto, CA 92301		10. Work Unit No.																												
		11. Contract or Grant No. DTNH22-14-D-00355L																												
12. Sponsoring Agency Name and Address U. S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-100) 1200 New Jersey Ave., SE, Room W43-410 Washington, D.C. 20590		13. Type of Report and Period Covered Final Test Report, March 15, 2021 - June 28, 2021																												
		14. Sponsoring Agency Code NRM-100																												
15. Supplementary Notes																														
16. Abstract A 32.2 km/h 75° rigid pole side NCAP impact test was conducted on the subject 2021 BMW 330i 4-door sedan in accordance with the specifications of the Office of Crashworthiness Standards Side NCAP Pole Laboratory Test Procedure for the generation of consumer information on vehicle side pole crash protection. The test was conducted at the Applus IDIADA KARCO Engineering, LLC. facility in Adelanto, California on March 15, 2021. The impact velocity was 31.91 km/h and the outside ambient temperature at the struck (driver's) side of the vehicle was 11.7°C. The target vehicle's maximum post-test static crush was 326 mm located at level 3. The test vehicle's occupant performance data is as follows: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Measurement Description</th> <th colspan="3" style="text-align: center;">Driver ATD (SID-IIs)</th> </tr> <tr> <th style="text-align: center;">Units</th> <th style="text-align: center;">Threshold</th> <th style="text-align: center;">Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₃₆)</td> <td></td> <td style="text-align: center;">1000</td> <td style="text-align: center;">270.3</td> </tr> <tr> <td>Resultant Lower Spine Acceleration</td> <td style="text-align: center;">g</td> <td style="text-align: center;">82</td> <td style="text-align: center;">39</td> </tr> <tr> <td>Total Pelvic Force (Sum of Acetabular and Iliac Forces)</td> <td style="text-align: center;">N</td> <td style="text-align: center;">5525</td> <td style="text-align: center;">2419</td> </tr> <tr> <td>Maximum Thoracic Rib Deflection</td> <td style="text-align: center;">mm</td> <td style="text-align: center;">38</td> <td style="text-align: center;">22</td> </tr> <tr> <td>Maximum Abdominal Rib Deflection</td> <td style="text-align: center;">mm</td> <td style="text-align: center;">45</td> <td style="text-align: center;">22</td> </tr> </tbody> </table> The struck side door at the front of the vehicle was jammed shut and did not separate from the hinges. There was no separation of the latches.				Measurement Description	Driver ATD (SID-IIs)			Units	Threshold	Result	Head Injury Criteria (HIC ₃₆)		1000	270.3	Resultant Lower Spine Acceleration	g	82	39	Total Pelvic Force (Sum of Acetabular and Iliac Forces)	N	5525	2419	Maximum Thoracic Rib Deflection	mm	38	22	Maximum Abdominal Rib Deflection	mm	45	22
Measurement Description	Driver ATD (SID-IIs)																													
	Units	Threshold	Result																											
Head Injury Criteria (HIC ₃₆)		1000	270.3																											
Resultant Lower Spine Acceleration	g	82	39																											
Total Pelvic Force (Sum of Acetabular and Iliac Forces)	N	5525	2419																											
Maximum Thoracic Rib Deflection	mm	38	22																											
Maximum Abdominal Rib Deflection	mm	45	22																											
17. Key Words New Car Assessment Program (NCAP) Side Impact Pole Part 572V SID-IIs		18. Distribution Statement National Highway Traffic Safety Admin. Technical Information Services Division 1200 New Jersey Ave., SE Washington, DC 20590																												
19. Security Classification of this report UNCLASSIFIED	20. Security Classification of this page UNCLASSIFIED	21. No. of Pages 104	22. Price																											

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1	Purpose and Summary of the Test	1
2	Occupant and Vehicle Information / Data Sheets	3
<u>Data Sheet</u>		<u>Page</u>
1	General Test and Vehicle Parameter Data	4
2	Seat, Seat Belt, Steering Wheel Adjustment, and Fuel System Data	8
3	Dummy Longitudinal Clearance Dimensions	12
4	Dummy Lateral Clearance Dimensions	13
5	Camera and Instrumentation Data	14
6	Test Vehicle Accelerometer Locations	15
7	Rigid Pole Load Cell Data	16
8	Post-Test Observations	17
9	Test Vehicle Profile Measurements	19
10	Test Vehicle Exterior Crush Measurements	20
11	Vehicle Damage Profile Distances	23
12	FMVSS No. 301 Static Rollover Results	24
13	Dummy/Vehicle Temperature and Humidity Stabilization	25
<u>Appendix</u>		<u>Page</u>
A	Photographs	A
B	Vehicle and Dummy Response Data Plots	B
C	ATD Configuration and Performance Verification Data	C
D	Test Equipment and Instrumentation Calibration Data	D

SECTION 1

TEST PURPOSE AND SUMMARY OF TEST

PURPOSE

This side impact test is part of the MY 2021 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number DTNH22-14-D-00355L. The purpose of this test is to generate comparative side impact performance in a 2021 BMW 330i 4-door sedan. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure date March 2020.

SUMMARY

A rigid pole side impact test was conducted on a 2021 BMW 330i 4-door sedan. The subject vehicle was towed into the rigid pole at an angle of 74.8° and a velocity of 31.91 km/h. The test was conducted by Applus IDIADA KARCO Engineering, LLC. in Adelanto, California on March 15, 2021. 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 March 2020. Camera locations and other pertinent camera information are included in this report.

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

- Primary and Redundant Head CG tri-axial accelerometers
- Thorax upper, middle and lower rib displacement potentiometers
- Abdomen upper and lower rib displacement potentiometers
- Lower spine (12) tri-axial accelerometers
- Iliac load cell
- Acetabulum load cell

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

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

Measurement Description	Units	Driver ATD (SID-IIs)	
		IARV	Result
Head Injury Criteria (HIC ₃₆)		1000	270.3
Lower Spine (T12) Resultant Acceleration	g	82	39
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2419
Maximum Thoracic Rib Deflection	mm	38*	22
Maximum Abdominal Rib Deflection	mm	45*	22

**Proposed IARV*

Supplemental restraint information is given below:

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

SECTION 2

OCCUPANT AND VEHICLE INFORMATION/DATA SHEETS

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

CONVERSION FACTORS

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	miles/hr	km/hr	1.609344
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.574
Pressure	Tire Pressures	lbf/in ²	kPa	6.895
Temperature	General Use	°F	°C	$=(T_f - 32)/1.8$
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf-ft	N•m	1.355

DATA SHEET NO. 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	M20214101
Model Year	2021
Make	BMW
Model	330i
Body Style	4-Door Sedan
VIN	WBA5R1C04MFK51620
Body Color	Mineral Grey Metallic
Odometer Reading (km / mi)	18 / 11
Engine Displacement (L)	2.0
Type / No. of Cylinders	Inline 4-Cylinder
Engine Placement	Longitudinal
Transmission Type	Automatic
Transmission Speeds	8
Overdrive	Yes
Final Drive	RWD
Roof Rack	No
Sunroof / T-Top	Yes
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
Anti-Lock Brakes (ABS)	Yes

Traction Control System (TCS)	Yes
Auto-Leveling System	No
Automatic Door Locks	Yes
Power Window Auto-Reverse	Yes
Other Optional Feature	Yes
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	No
Rear Pass. Pelvis Airbag	No
Driver Seat Belt Pretensioner	Yes
Rear Pass. Seat Belt Pretensioner	Yes
Driver Load Limiter	Yes
Rear Pass. Load Limiter	Yes
Other Safety Restraint	No

Does Owner's Manual provide instructions to turn off automatic door locks?

Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Bayerische Motoren Werke AG
Date of Manufacture	Oct-20
Vehicle Type	Passenger car

GVWR (kg)	2080
GAWR Front (kg)	995
GAWR Rear (kg)	1160

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Designated Seating Capacity	2	3		5
Capacity Weight (VCW) (kg)				370.0
DSC x 68.04 (kg)				340.2
Cargo Weight (RCLW) (kg)				29.8

A

B

A-B

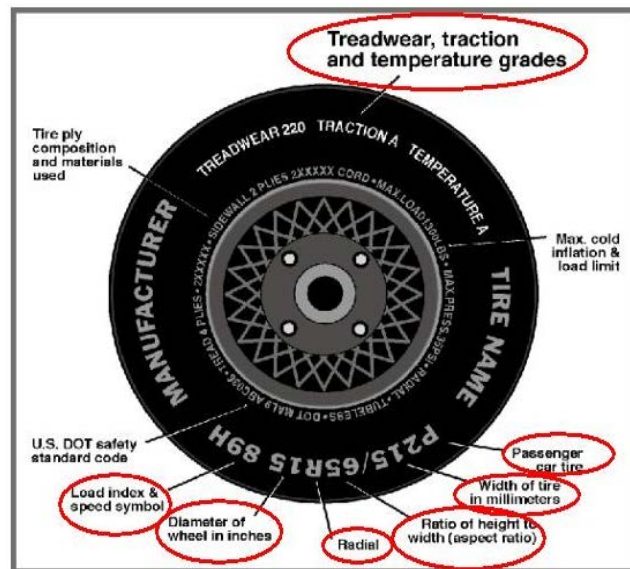
VEHICLE SEAT TYPE

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

DATA SHEET NO. 1 ... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	340	350
Cold Pressure (kPa)	220	270
Recommended Tire Size	P225/45R18	P225/45R18
Tire Size on Vehicle	P225/45R18	P225/45R18
Tire Manufacturer	Bridgestone	Bridgestone
Tire Model	Turanza	Turanza
Treadware	560	560
Traction Grade	A	A
Temperature Grade	A	A
Tire Plies Sidewall	1 Polyester	1 Polyester
Tire Plies Body	2 Polyester, 2 Steel	2 Polyester, 2 Steel
Load Index/Speed Symbol	95H	95H
Tire Material	Polyester, Steel	Polyester, Steel
DOT Safety Code Left	7GJ7 VIH 3320	7GJ7 VIH 3320
DOT Safety Code Right	7GJ7 VIH 3320	7GJ7 VIH 3320

DATA SHEET NO. 1 ... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	220	220	270	270
Tire Placard	kPa	220	220	270	270
Owner's Manual	kPa	220	220	270	270
As Tested	kPa	220	220	270	270

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	413.5	387.5		405.0	437.0		416.5	410.0	
Right	kg	402.0	395.0		415.0	411.5		419.0	428.0	
Ratio	%	51.0%	49.0%	100.0%	49.1%	50.9%	100.0%	49.9%	50.1%	100.0%
Total	kg	815.5	782.5	1598.0	820.0	848.5	1668.5	835.5	838.0	1673.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	1598.0	A
Actual Weight of 1 SID II-s ATD Used	kg	49.0	B
Rated Cargo/Luggage Wt (RCLW)	kg	29.8	C
Calculated Vehicle Target Wt (TVTW)	kg	1676.8	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 -9.0 kg)? ☒ Yes ☐ No

TEST VEHICLE ATTITUDE AND CG

Measurement Description	Units	As Delivered	As Tested	Fully Loaded	Meets Requirement***
Driver Door Sill Angle (front-to-rear)*	°	-1.8	-1.8	-1.8	Yes
Front Passenger Sill Angle (front-to-rear)*	°	-0.6	-0.5	-0.5	Yes
Front Bumper-Line Angle (left-to-right)**	°	0.4	0.4	0.4	Yes
Rear Bumper-Line Angle (left-to-right)**	°	-0.8	-0.8	-0.8	Yes
Vehicle CG (Aft of Front Axle)	mm	1396	1450	1428	
Vehicle CG (Left (+)/Right (-) from Longitudinal Centerline)	mm	2	7	-10	

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

***The "As Tested" vehicle attitude angle measurements must be within "As Delivered" and the "Fully Loaded" vehicle attitude measurements at each location. Indicate "Yes" or "No" for "Meets Requirement"

DATA SHEET NO. 1 ... (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

Test Height Adjustable Setting (If Applicable)	
--	--

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Rear Trim	3.0

TEST SURFACE MARKINGS

	Distance from 75° Impact Location Line (mm)
Fore 25 mm target	182
Aft 25 mm target	185

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

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

SEAT POSITIONING

The driver's seat, front center seat (if applicable), and 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 seat should be set to the rear most, lowest, mid-angle position.

SCRL ANGLE RANGE

Seat	SCRL (°)		
	Max	Min	Mid
Driver Seat	9.7	0.0	4.9
Front Passenger Seat	9.2	0.0	4.6
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)		
				Rearmost	Mid Fore/Aft	Forwardmost
Driver Seat	4.9	187	Max	175	190	210
			Mid	54	168	187
			Min	133	145	163
Front Passenger Seat	4.6	179	Max	190	182	200
			Mid	148	162	179
			Min	125	142	157
Front Center Seat			Max			
			Mid			
			Min			
Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed

DATA SHEET NO. 2 ... (CONTINUED)

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

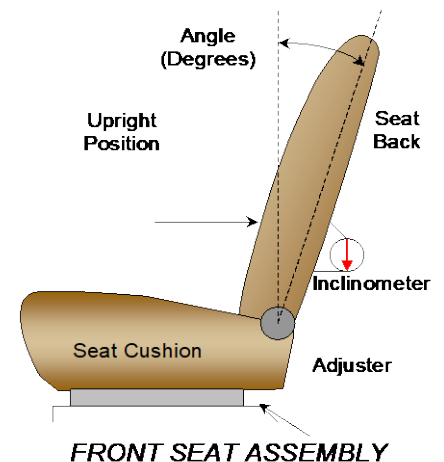
SEAT FORE/AFT POSITION

Seat	Total Fore/Aft Travel		Test Position From Forwardmost Position	
	mm	Detents*	mm	Detent*
Driver Seat	250		0	
Front Passenger Seat	250		0	
Front Center Seat				
Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Rear Center Seat				

*Detent zero (0) is the forward most detent

SEAT BACK ADJUSTMENT

The driver's seat back is positioned such that the dummy's head is level. The front passenger's seat back is positioned in a similar manner to the driver's seat. The struck side rear passenger seat back is positioned in accordance with the information provided by the manufacturer in Form 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 back angle is measured using a flat bar along the seat back.



Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents*	Degree	Detent*
Driver Seat w/Seated Dummy	63.9		14.0	
Front Passenger Seat	64.5		14.0	
Front Center Seat				
Struck Side Rear Seat w/Seated Dummy	Fixed	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed	Fixed

*Detent zero (0) is the forward most detent

DATA SHEET NO. 2 ... (CONTINUED)

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1. The positions are marked H, M2, M1, L from top to bottom.

	Total No. of Positions	Placed in Position
Driver Seat	Fixed	Fixed

HEAD RESTRAINT ADJUSTMENT

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

	Total No. of Positions	Placed in Position
Driver Seat	4	L

DATA SHEET NO. 2 ... (CONTINUED)

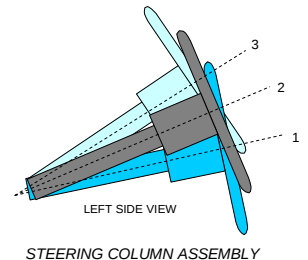
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

STEERING COLUMN ADJUSTMENT

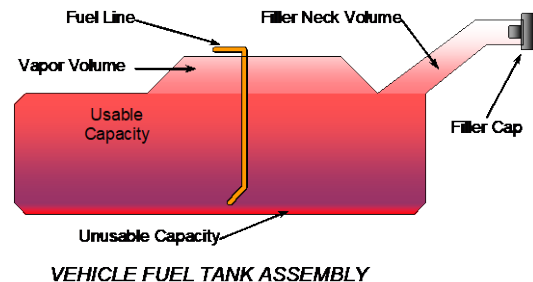
Steering wheel and column adjustments are made so that the steering wheel hub is at the center of the geometric locus it describes when it moves through its full range of motion.

	Degrees	Fore-Aft Position (mm)
Lowermost - Position 1	18.5	117
Geometric Center - Position 2	20.4	146
Uppermost - Position 3	22.2	175
Telescoping Steering Wheel Travel		58
Test Position	20.4	146



FUEL PUMP

The vehicle is equipped with an electric fuel pump. The pump will work at "ignition on" until pressure in the system has reached working pressure in the system; then it will stop pumping fuel until the engine has been started.



FUEL TANK CAPACITY

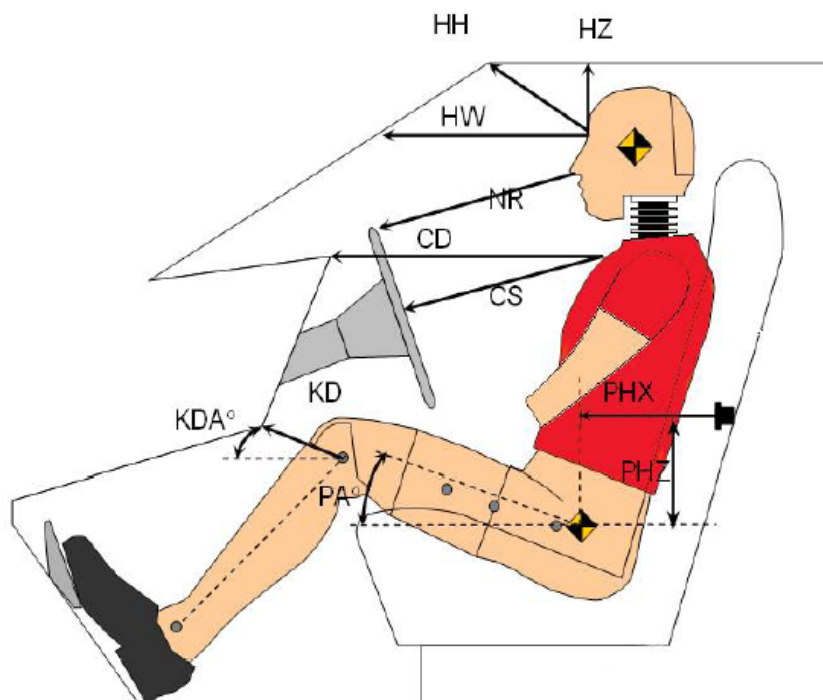
Description	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	59.01
Usable Capacity of "Optional Tank" (see Form No. 1)	
Usable Capacity of "Standard Tank" (see Owner's Manual)	59.01
Usable Capacity of "Optional Tank" (see Owner's Manual)	
93% of Usable Capacity	54.88
Actual amount of Solvent Used in Test	54.88
1/3 of Usable Capacity	19.67

Is the Actual Amount of Solvent Used in the test equal to 93% $\pm$ 1% of the Usable Capacity stated in the Form No. 1? ☒ Yes ☐ No

DATA SHEET NO. 3

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21



Driver Code	Description	Driver	
		Length (mm)	Angle (°)
HH	Head to Header	246	
HW	Head to Windshield	565	
HZ	Head to Roof	185	
NR	Nose to Rim	220	
CD	Chest to Dash	394	
CS	Chest to Steering Wheel	173	
KD(L)/KDA(L)°	Left Knee to Dash	152	37.1
KD(R)/KDA(R)°	Right Knee to Dash	120	39.2
PAX°	Pelvic Tilt Angle (x-axis)		20.8
PAY°	Pelvic Tilt Angle (y-axis)		0.3
PHX	Hip Point to Striker (x-axis)	305	
PHZ	Hip Point to Striker (z-axis)	230	

DATA SHEET NO. 4

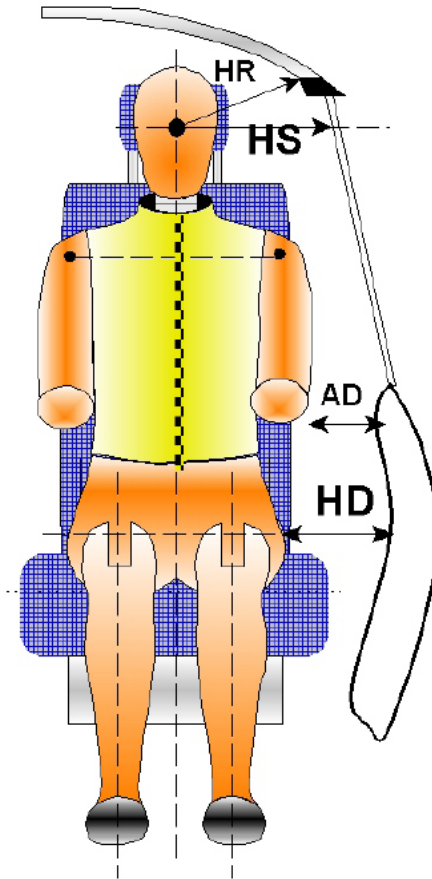
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2021 BMW 330i 4-Door Sedan

NHTSA No. M20214101

Test Program: NCAP Side Pole Impact Test

Test Date: 03/15/21

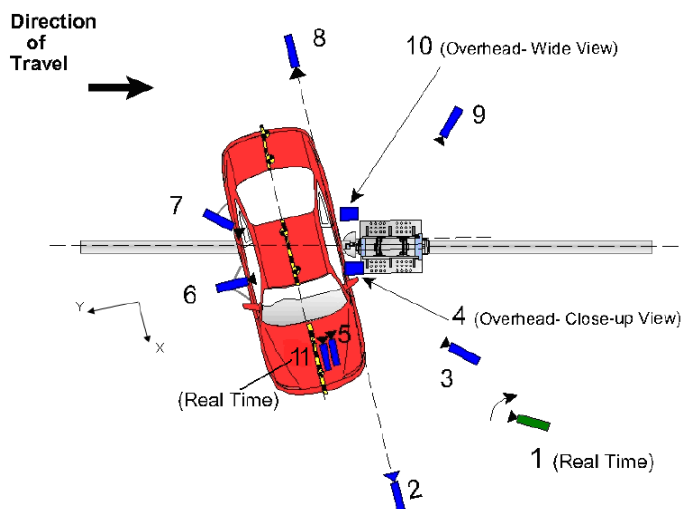


Code	Measurement Description	Units	Driver
HR	Head to Side Header	mm	222
HS	Head to Side Window	mm	371
AD	Arm to Door	mm	160
HD	Hip Point to Door	mm	156

DATA SHEET NO. 5

CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21



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

Camera No.	View	Coordinates (m)			Lens (mm)	Film Speed (fps)
		X*	Y*	Z*		
1	Real Time Pan View of Impact	8.89	46.57	-3.04		30
2	Front Ground Level - Impact View	8.34	-0.05	-0.93	24	1000
3	Impact Side 45° - Forward Pole View	4.10	-2.15	-1.15	8.5	1000
4	Overhead Close-Up View of Impact	0.00	0.00	-5.79	12.5	1000
5	On-Board - Dummy Front View	1.42	0.59	-1.29	8.5	1000
6	On-Board - Dummy Side View	0.09	1.57	-1.02	8	1000
7	On-Board - Dummy Rear Oblique View	-0.99	1.53	-1.08	8	1000
8	Rear Ground Level - Impact View	-1.30	1.68	-1.26	24	1000
9	Impact Side 45° - Rearward Pole View	-8.02	0.04	-1.01	35	1000
10	Overhead Wide View of Impact	-0.06	0.22	-5.79	14	1000
11	Real Time Dummy Front View	1.47	0.54	-1.36		30

*All measurements accurate to ± 6 mm

NOTE: Vehicle is at a 75 angle to the rigid pole.

If applicable, explain why camera(s) did not operate as intended: N/A

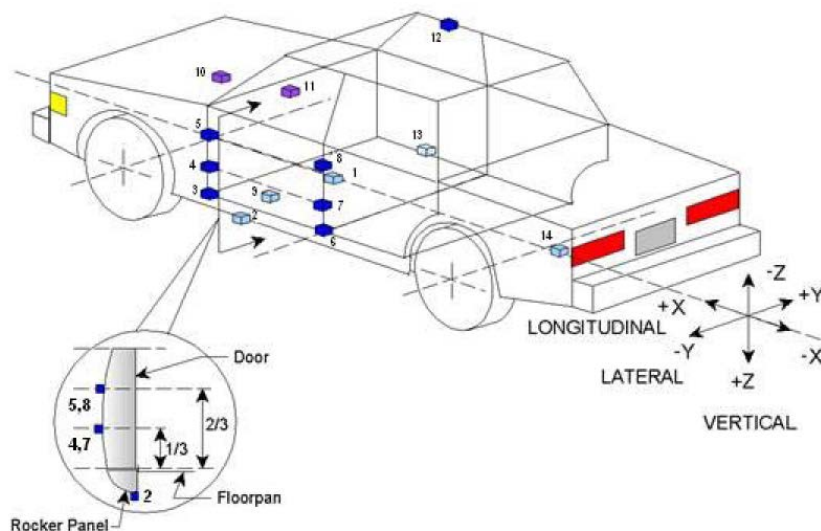
INSTRUMENTATION

Driver Dummy Channels	19
Vehicle Structure Accelerometers	18
Pole Load Cells	8
Total	45

DATA SHEET NO. 6

TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

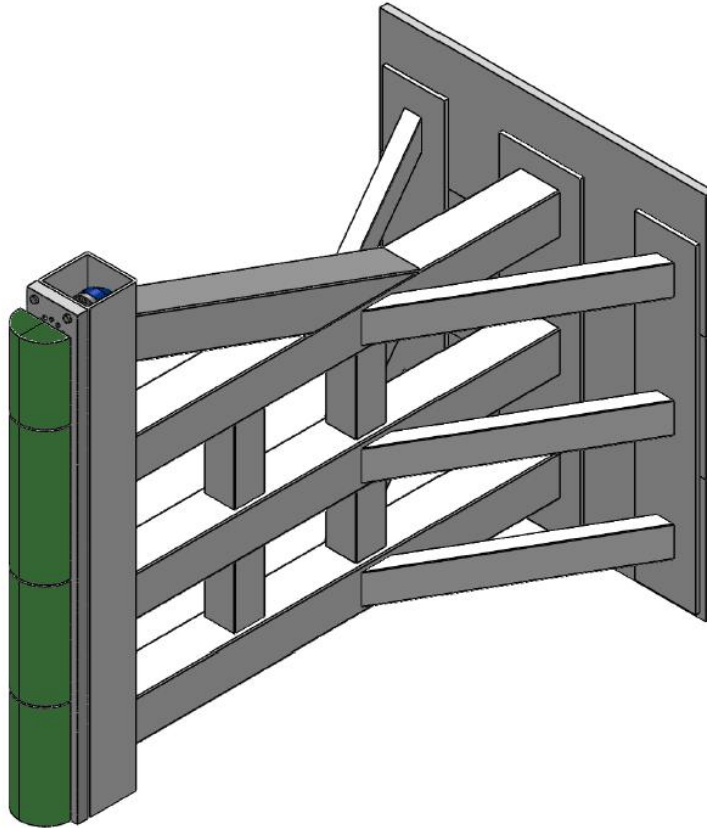


Loc. No.	Sensor Description	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2042	0	351
2	Left Floor Sill	2741	-791	193
3	A-Pillar Sill	3249	-830	360
4	A-Pillar Low	3249	-830	525
5	A-Pillar Mid	3249	-830	805
6	B-Pillar Sill	2106	-727	342
7	B-Pillar Low	2106	-727	748
8	B-Pillar Mid	2106	-727	1075
9	Driver Seat Track	2311	-205	256
10	Engine Top	3922	-55	774
11	Firewall	3534	-249	748
12	Right Roof	2470	486	1403
13	Right Floor Sill	2732	722	347
14	Rear Floorpan	1097	0	193

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

DATA SHEET NO. 7
RIGID POLE LOAD CELL DATA

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21



ID	Units	Height From Ground
1	mm	87
2	mm	468
3	mm	648
4	mm	978
5	mm	1168
6	mm	1651
7	mm	1816
8	mm	2057

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

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Driver SID-IIs Dummy
Face	Curtain Airbag
Top of Head	Curtain Airbag
Left Side of Head	Curtain Airbag
Back of Head	Curtain Airbag, Headrest
Left Shoulder	Torso-Pelvis Airbag
Upper Torso	Torso-Pelvis Airbag
Lower Torso	Torso-Pelvis Airbag
Left Hip	Door Panel
Left Knee	None

POST-TEST DOOR PERFORMANCE

Description	Struck Side		Non-Struck Side		Rear Hatch/Other Door
	Front	Rear	Front	Rear	
Remained Closed and Operational	No	Yes	Yes	Yes	Yes
Total Separation from Vehicle at Hinges or Latches	No	No	No	No	No
Latch or Hinge System 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	No	No	No	No
If Door Opened at Striker, Record Width of Opening at Striker (mm)	N/A	N/A	N/A	N/A	N/A

POST-TEST SEAT PERFORMANCE

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

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

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	No separation occurred
Sill Separation	No separation occurred
Windshield Damage	Broken
Side Window Damage	Broken
Other Notable Effects	Windshield Separation / Sunroof open / Door Handle snapped off

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	Yes	No		
Side Airbag 1 (Curtain)	Yes	Yes	Yes	Yes
Side Airbag 2 (Torso/Pelvis)	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes	Yes	Yes	Yes

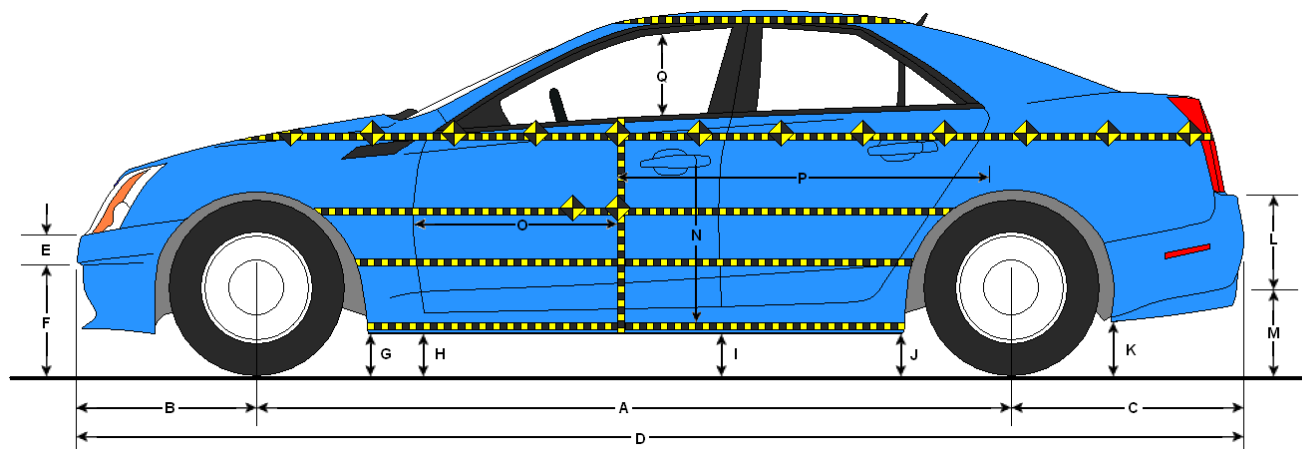
IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vertical Impact Reference Line (Aft of Front Axle)(Intended Impact Point)	mm		1336
Actual Impact Point (Aft of Front Axle)	mm		1340
Horizontal Offset (+ forward / - rearward)	mm	± 38 of Intended Impact Point	-4
Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion	°	75 ± 3	74.8
Trap No. 1 Velocity (Primary)	km/h	31.4 to 33.0	31.91
Trap No. 2 Velocity (Redundant)	km/h	31.4 to 33.0	31.94

DATA SHEET NO. 9

TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21



LEFT SIDE VIEW

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

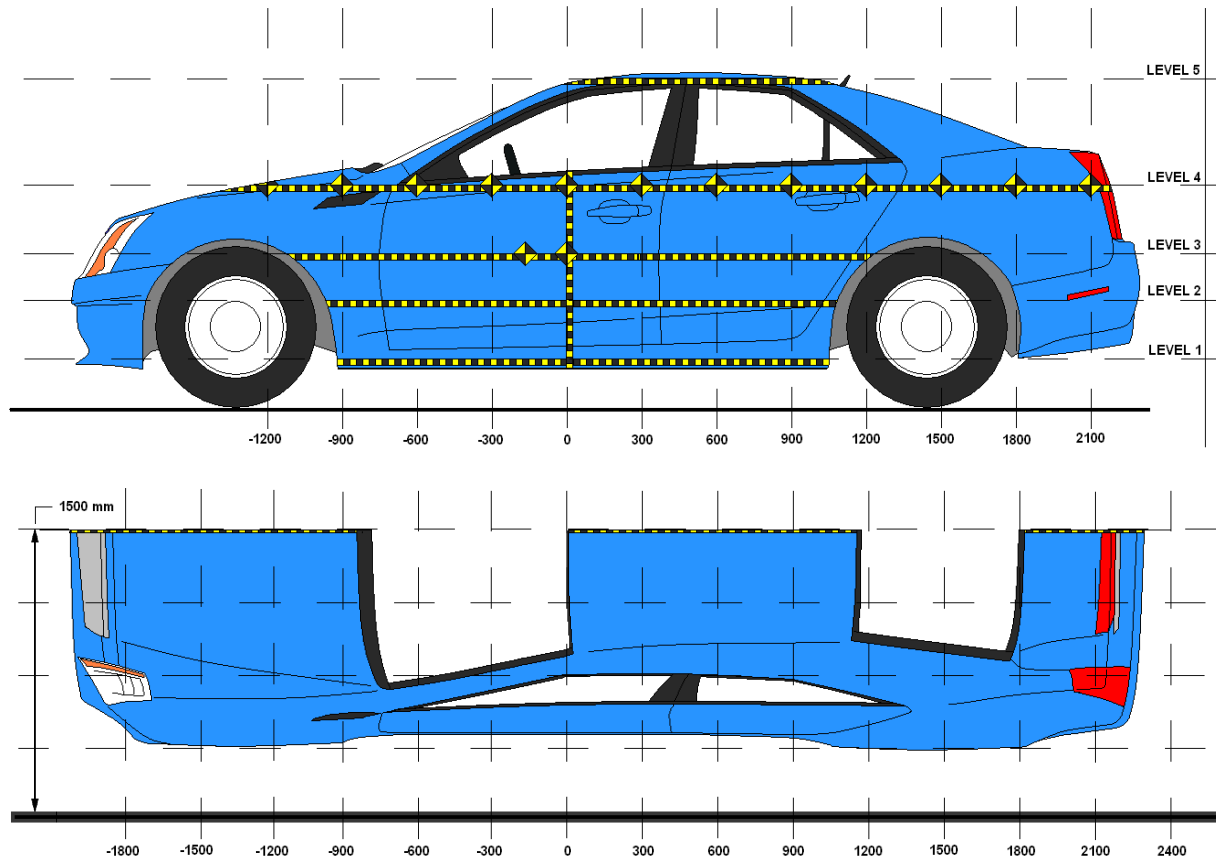
VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2851	2791	-60
B	Front Axle to FSOV	790	783	-7
C	Rear Axle to RSOV	1058	1090	32
D	Total Length at Centerline	4705	4664	-41
E	Front Bumper Thickness	132	132	0
F	Front Bumper Bottom to Ground	385	372	-13
G	Sill Height at Front Wheel Well	259	206	-53
H	Sill Height at Front Door Leading Edge	226	173	-53
I	Sill Height at B-Pillar	282	261	-21
J1	Sill Height at Rear Wheel Well	190	184	-6
J2	Pinch Weld Height at Rear Wheel Well	163	153	-10
K	Sill Height Aft of Rear Wheel Well	295	267	-28
L	Rear Bumper Thickness	225	224	-1
M	Rear Bumper Bottom to Ground	417	404	-13
N	Sill Height to Bottom of Front Window Sill	657	669	12
O	Front Door Leading Edge to Impact CL	656	586	-70
P	Rear Door Trailing Edge to Impact CL	1459	1385	-74
Q	Front Window Opening	381	391	10
R	Right Side Length	3262	3270	8
S	Left Side Length	3263	3190	-73
T	Vehicle Width at B-Pillar	1830	1733	-97

DATA SHEET NO. 10

TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21



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

MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Description	Height Above Ground (mm)	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	227	265	0
2	Occupant H-Point	524	308	0
3	Mid-Door	638	326	0
4	Window Sill	908	278	150
5	Window Top	1387	62	0

DATA SHEET NO. 10 ... (CONTINUED)

TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

	Pre-Test (mm)					Post-Test (mm)					Difference (mm)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900	628	597	594	707		641	619	609	707		13	22	15	0	
-750	632	604	592	699		668	633	613	702		36	29	21	3	
-600	635	604	590	692		698	642	616	692		63	38	26	0	
-450	636	603	589	681		735	686	675	737		99	83	86	56	
-300	637	602	588	669		775	768	751	775		138	166	163	106	
-150	637	601	587	658		828	826	833	841		191	225	246	183	
0	636	600	586	646	924	901	908	912	915	986	265	308	326	269	62
150	636	600	586	636	919	878	894	906	914	974	242	294	320	278	55
300	635	600	586	634	920	776	776	780	804	960	141	176	194	170	40
450	635	600	587	635	922	720	694	675	712	946	85	94	88	77	24
600	633	599	588	637	925	681	662	647	687	930	48	63	59	50	5
750	632	598	588	639	924	646	629	619	663	913	14	31	31	24	-11
900	630	596	588	642	923	611	596	590	640	898	-19	0	2	-2	-25
1050	626	595	589	647	923	571	571	564	618	886	-55	-24	-25	-29	-37
1200			590	628	924			537	572	879			-53	-56	-45
1350				659	930				575	878				-84	-52
1500				667					615					-52	
1650				678					621					-57	
1800				690					628					-62	
1950															
2100															
2250															
2400															
2550															
2700															
2850															

DATA SHEET NO. 10 ... (CONTINUED)

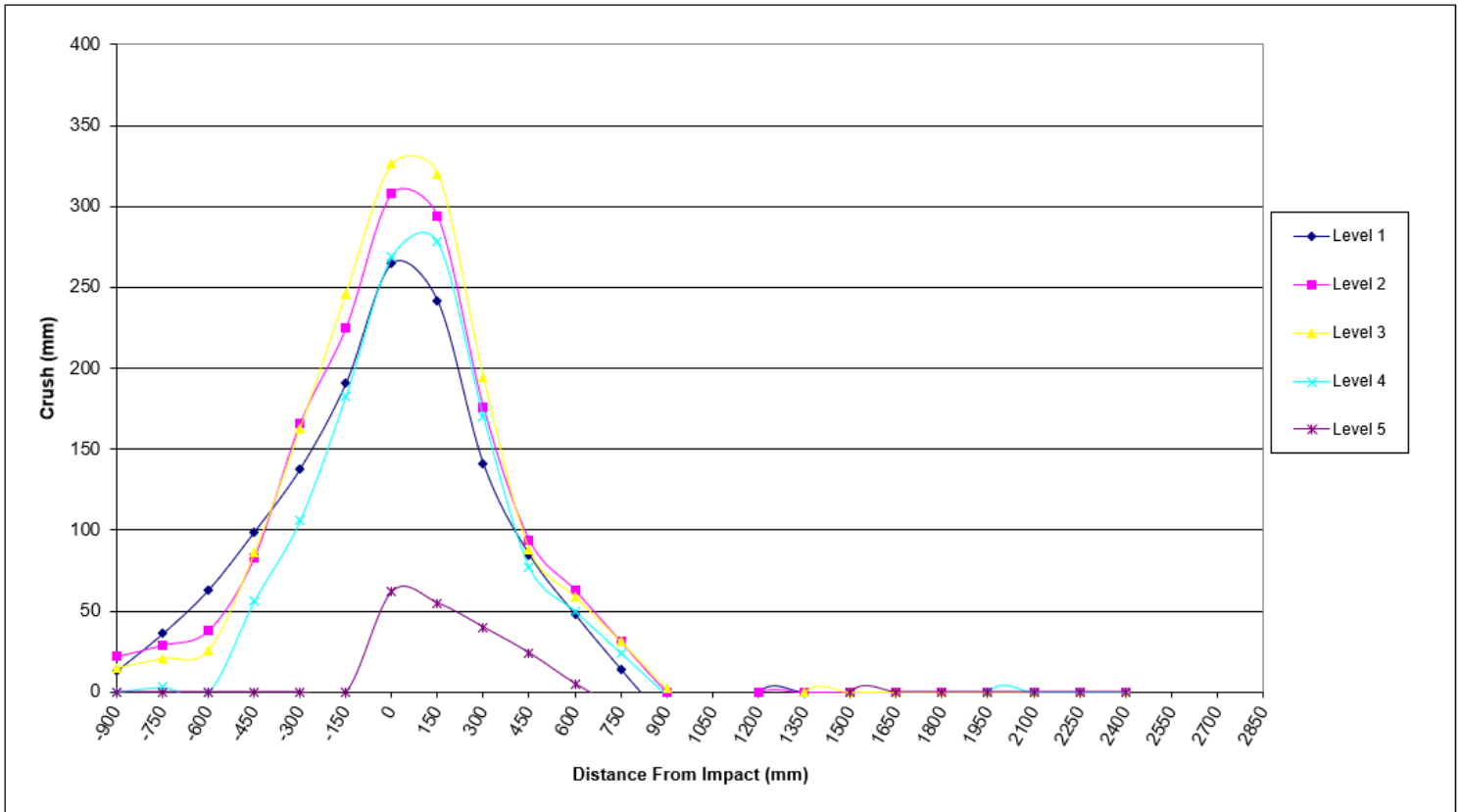
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2021 BMW 330i 4-Door Sedan

NHTSA No. M20214101

Test Program: NCAP Side Pole Impact Test

Test Date: 03/15/21

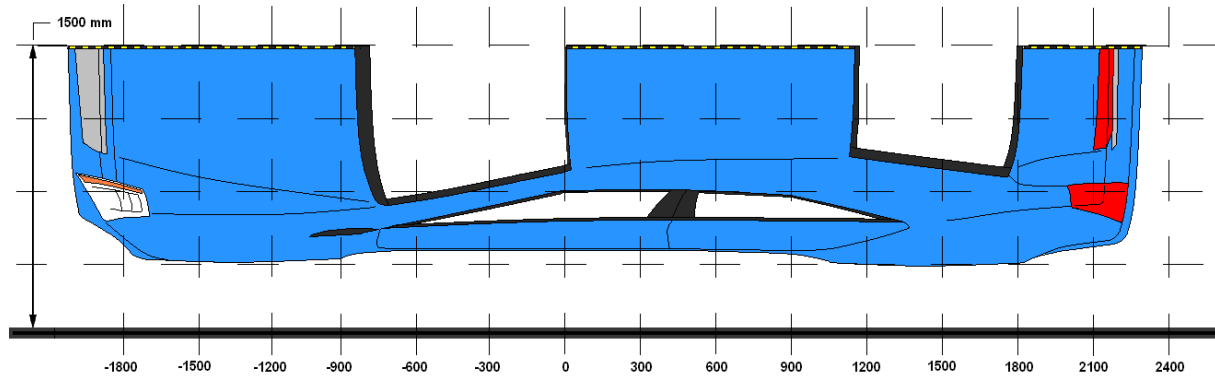


DATA SHEET NO. 11

VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101

Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21



DPD	Distance From Impact Point (mm)	Level	Pre-Test (mm)	Post-Test (mm)	Crush (mm)
1	1800	4	690	628	-62
2	1350	4	667	615	-52
3	750	3	588	619	31
4	150	3	586	906	320
5	-450	1	636	735	99
6	-750	2	597	619	22

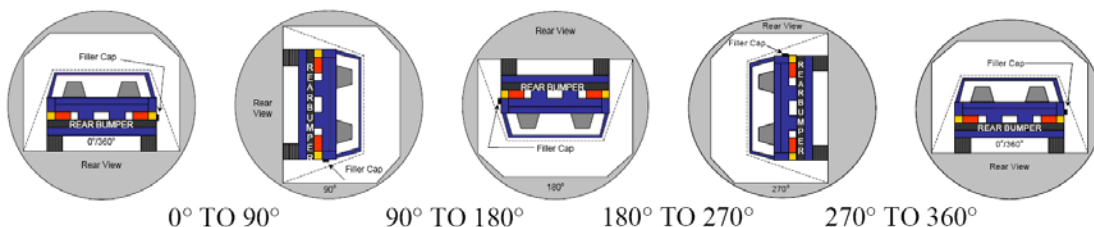
DATA SHEET NO. 12

FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101
 Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21

Temperature at Time of Impact: 11.7° C Test Time: 11:36 AM

- A. From impact until vehicle motion ceases: 0 oz.
 (Maximum allowable = 1 oz.)
- B. For the 5 minute period after motion ceases: 0 oz.
 (Maximum allowable = 5 oz.)
- C. For the following 25 minutes: 0 oz.
 (Maximum allowable = 1 oz./minute)
- D. Spillage Details: There was no Stoddard solvent spillage.



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° To 90°	81	300	381
90° To 180°	88	300	388
180° To 270°	87	300	387
270° To 360°	80	300	380

FMVSS 301 SPILLAGE TABLE

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

SOLVENT SPILLAGE LOCATION TABLE

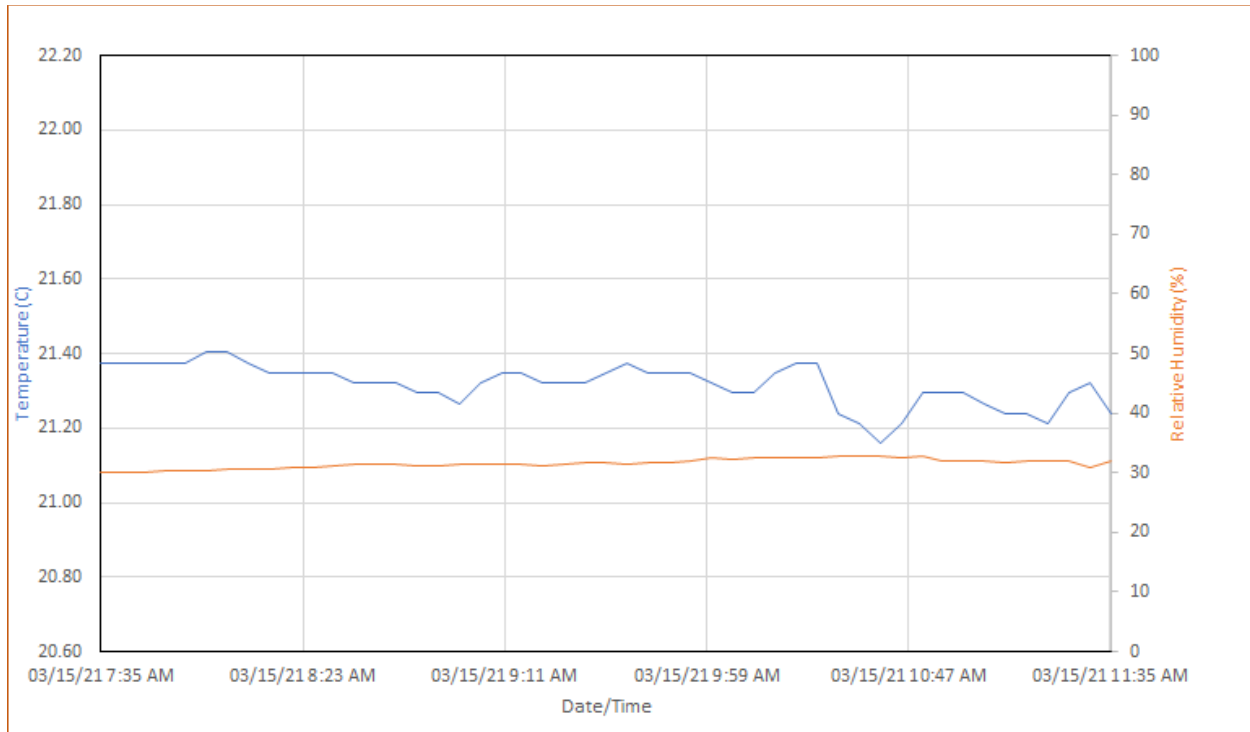
Test Phase	Spillage Location
0° To 90°	
90° To 180°	
180° To 270°	
270° To 360°	

DATA SHEET NO. 13

DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION

Test Vehicle: 2021 BMW 330i 4-Door Sedan NHTSA No. M20214101

Test Program: NCAP Side Pole Impact Test Test Date: 03/15/21



APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Figure		Page
1	As Delivered Right Front $\frac{3}{4}$ View of Test Vehicle	A-1
2	As Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle	A-1
3	Pre-Test Frontal View of Test Vehicle	A-2
4	Post-Test Frontal View of Test Vehicle	A-2
5	Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle	A-3
6	Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle	A-3
7	Pre-Test Left Side View of Test Vehicle	A-4
8	Post-Test Left Side View of Test Vehicle	A-4
9	Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle	A-5
10	Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle	A-5
11	Pre-Test Rear View of Test Vehicle	A-6
12	Post-Test Rear View of Test Vehicle	A-6
13	Pre-Test Right Side View of Test Vehicle	A-7
14	Post-Test Right Side View of Test Vehicle	A-7
15	Pre-Test Overhead View of Test Area	A-8
16	Post-Test Overhead View of Test Area	A-8
17	Pre-Test Left Side View of Pole Positioned Against Side of Vehicle	A-9
18	Pre-Test Right Side View of Pole Positioned Against Side of Vehicle	A-9
19	Pre-Test Close-Up View of Impact Point Target	A-10
20	Post-Test Close-Up View of Impact Point Target Showing Impact Location	A-10
21	Pre-Test Front Close-Up View of Dummy Head and Chest	A-11
22	Post-Test Front Close-Up View of Dummy	A-11
23	Pre-Test Left Side View of Dummy Showing Belt and Chalking	A-12
24	Pre-Test Left Side View of Dummy Shoulder and Door Top View	A-12
25	Post-Test Left Side View of Dummy Shoulder and Door Top View	A-13
26	Pre-Test Frontal View of Seat Back Prior to Dummy Positioning	A-13
27	Pre-Test Frontal Close-Up View of Dummy Head and Shoulders in Relation to Head Restraint	A-14
28	Pre-Test Overhead View of Seat Pan Prior to Dummy Positioning	A-14
29	Pre-Test Overhead View of Dummy Thighs on Seat Pan	A-15
30	Pre-Test Left Side View of Dummy's Neck Showing Position of Adjustable Neck Bracket	A-15

TABLE OF PHOTOGRAPHS ... (CONTINUED)

Figure		Page
31	Pre-Test Left Side View of Dummy's Head Showing Dummy's Head is Level	A-16
32	Pre-Test Placement of Dummy's Feet	A-16
33	Pre-Test View of Belt Anchorage for Dummy	A-17
34	Pre-Test Left Side View of Steering Wheel	A-17
35	View of Disengaged Parking Brake	A-18
36	Pre-Test View of Parking Brake	A-18
37	Pre-Test Close-Up Left Side View of Driver Seat Track	A-19
38	Pre-Test Close-Up Left Side View of Driver Seat Back	A-19
39	Pre-Test Close-Up View of Driver Seat Back or Head Restraint	A-20
40	Pre-Test Dummy and Door Clearance View	A-20
41	Post-Test Dummy and Door Clearance View	A-21
42	Pre-Test Right Side View of Dummy and Front Seat of Occupant Compartment	A-21
43	Post-Test Right Side View of Dummy and Front Seat of Occupant Compartment	A-22
44	Pre-Test Inner Door Panel View	A-22
45	Post-Test Inner Door Panel View Showing Dummy Contact Locations	A-23
46	Post-Test Dummy Close-Up Head Contact with Vehicle Interior View	A-23
47	Post-Test Dummy Close-Up Head Contact with Side Airbag View	A-24
48	Post-Test Dummy Close-Up Torso Contact with Vehicle Interior View	A-24
49	Post-Test Dummy Close-Up Torso Contact with Side Airbag View	A-25
50	Post-Test Dummy Close-Up Pelvis Contact with Vehicle Interior View	A-25
51	Post-Test Dummy Close-Up Pelvis Contact with Side Airbag View	A-26
52	Post-Test Dummy Close-Up Knee Contact with Vehicle Interior View	A-26
53	Post-Test Right Side View of Dummy and Rear Seat of Occupant Compartment	A-27
54	Pre-Test Inner Rear Passenger Torso Airbag Deployment View	A-27
55	Pre-Test View of Fuel Filler Cap or Fuel Filler Neck	A-28
56	Post-Test View of Fuel Filler Cap or Fuel Filler Neck	A-28
57	Close-Up View of Vehicle's Certification Label	A-29
58	Close-Up View of Vehicle's Tire Information Placard or Label	A-29
59	Pre-Test Pole Barrier Front View	A-30
60	Post-Test Pole Barrier Front View	A-30

TABLE OF PHOTOGRAPHS ... (CONTINUED)

Figure		Page
61	Pre-Test Pole Barrier Side View	A-31
62	Post-Test Pole Barrier Side View	A-31
63	Pre-Test Ballast View	A-32
64	Post-Test Primary and Redundant Speed Trap Read-Out	A-32
65	FMVSS No. 301 Static Rollover 0 Degrees	A-33
66	FMVSS No. 301 Static Rollover 90 Degrees	A-33
67	FMVSS No. 301 Static Rollover 180 Degrees	A-34
68	FMVSS No. 301 Static Rollover 270 Degrees	A-34
69	FMVSS No. 301 Static Rollover 360 Degrees	A-35
70	Impact Event	A-35
71	Monroney Label	A-36
72	Head Restraint Use and Adjustment Information from Vehicle Owner's Manual	A-36
73	Post-Test View of Shattered Vehicle Inner Door Panel	A-37



FIGURE 1. As-Delivered Right Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 2. As-Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 3. Pre-Test Frontal View of Test Vehicle



FIGURE 4. Post-Test Frontal View of Test Vehicle



FIGURE 5. Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 6. Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle



FIGURE 7. Pre-Test Left Side View of Test Vehicle



FIGURE 8. Post-Test Left Side View of Test Vehicle



FIGURE 9. Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 10. Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



FIGURE 11. Pre-Test Rear View of Test Vehicle



FIGURE 12. Post-Test Rear View of Test Vehicle



FIGURE 13. Pre-Test Right Side View of Test Vehicle

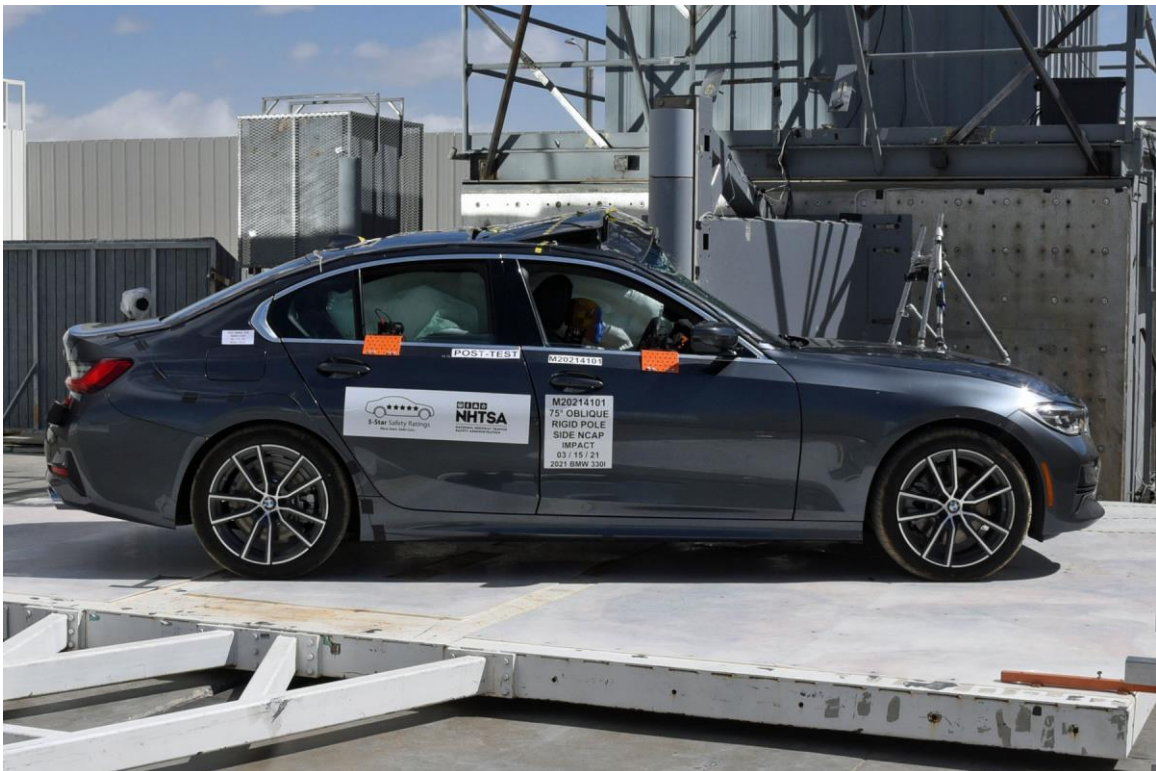


FIGURE 14. Post-Test Right Side View of Test Vehicle



FIGURE 15. Pre-Test Overhead View of Test Area

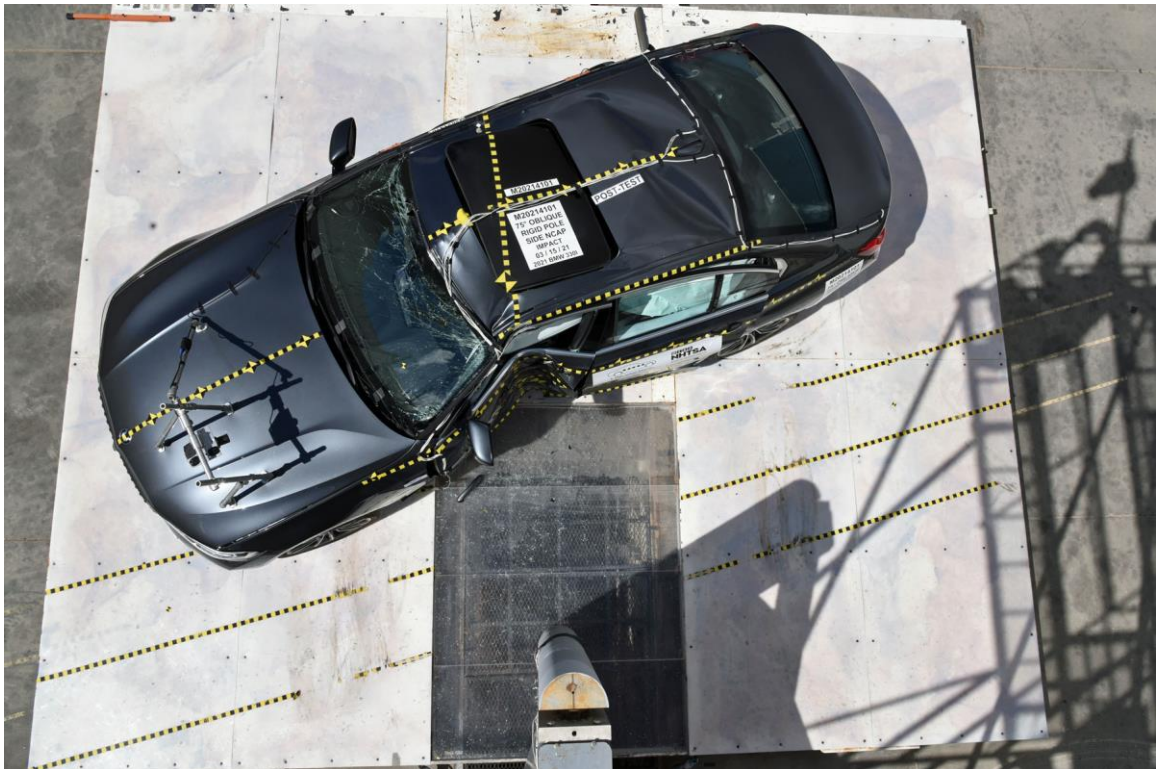


FIGURE 16. Post-Test Overhead View of Test Area



FIGURE 17. Pre-Test Left Side View of Pole Positioned Against Side of Vehicle

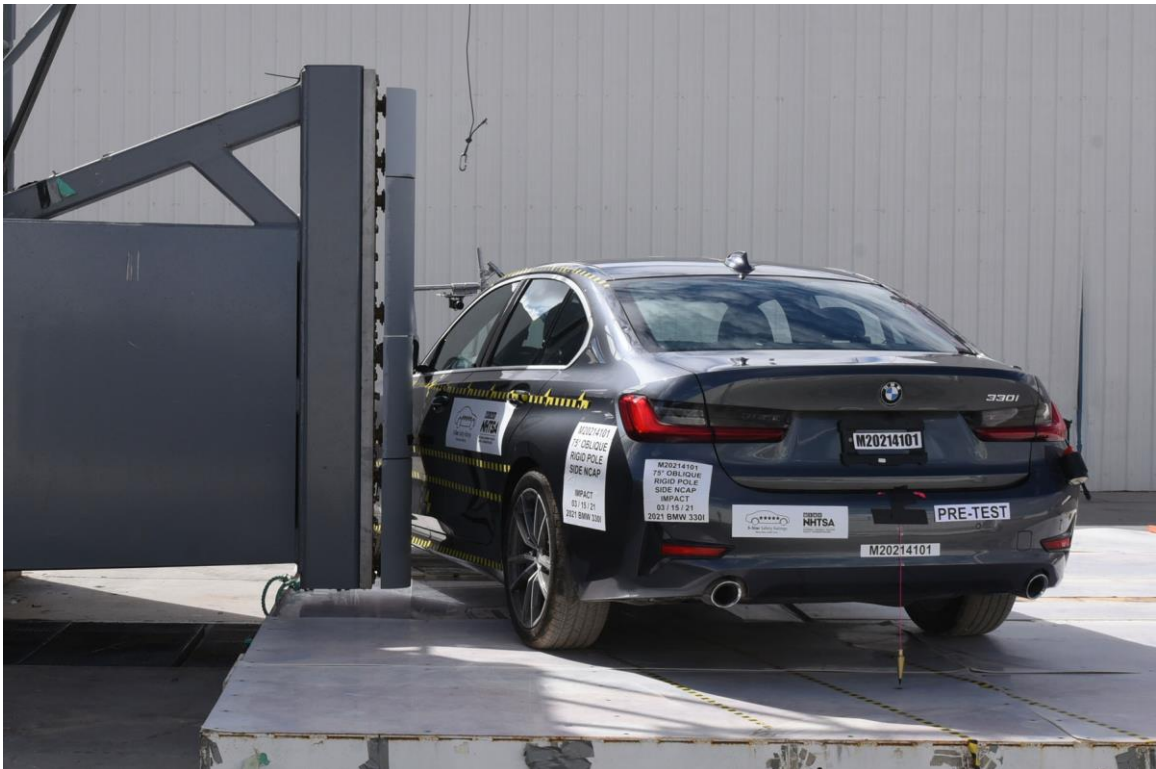


FIGURE 18. Pre-Test Right Side View of Pole Positioned Against Side of Vehicle

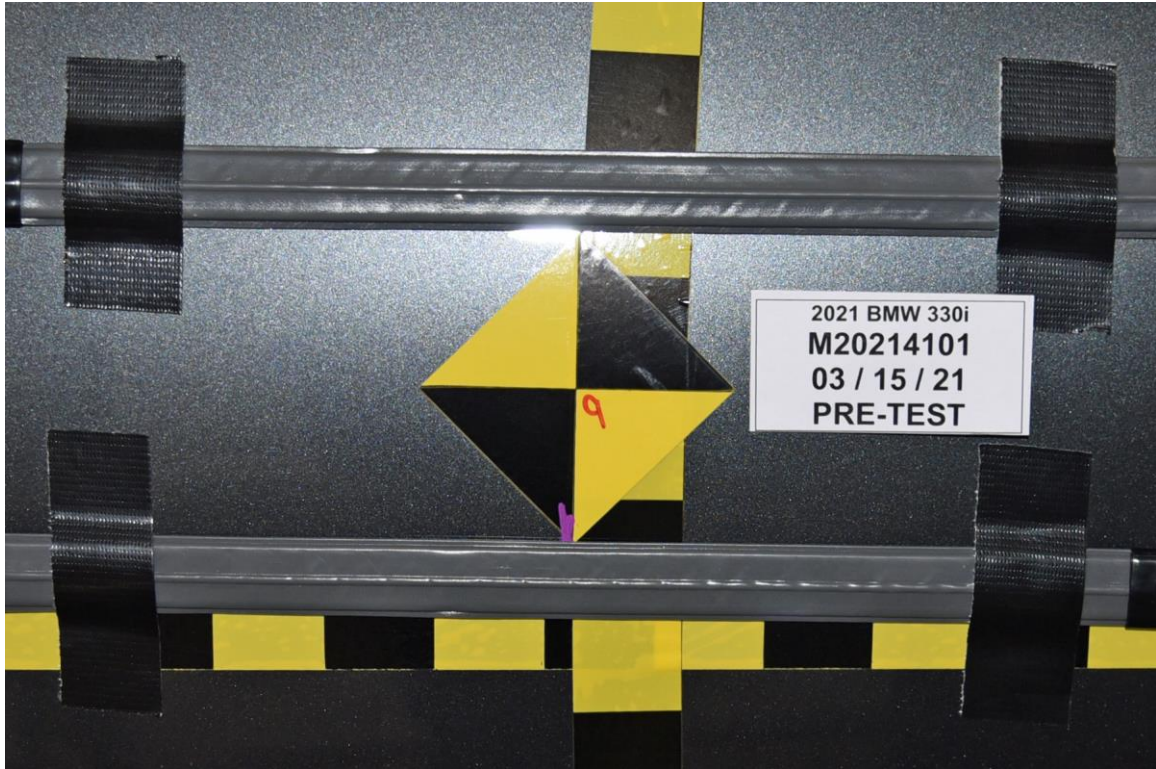


FIGURE 19. Pre-Test Close-Up View of Impact Point Target



FIGURE 20. Post-Test Close-Up View of Impact Point Target Showing Impact Location



FIGURE 21. Pre-Test Front Close-Up View of Dummy Head and Chest



FIGURE 22. Post-Test Front Close-Up View of Dummy



FIGURE 23. Pre-Test Left Side View of Dummy Showing Belt and Chalking

Photograph Not Available

FIGURE 24. Pre-Test Left Side View of Dummy Shoulder and Door Top View



FIGURE 25. Post-Test Left Side View of Dummy Shoulder and Door Top View



FIGURE 26. Pre-Test Frontal View of Seat Back Prior to Dummy Positioning



FIGURE 27. Pre-Test Frontal Close-Up View of
Dummy Head and Shoulders in Relation to Head Restraint



FIGURE 28. Pre-Test Overhead View of Seat Pan Prior to Dummy Positioning



FIGURE 29. Pre-Test Overhead View of Dummy Thighs on Seat Pan



FIGURE 30. Pre-Test Left Side View of Dummy's Neck
Showing Position of Adjustable Neck Bracket



FIGURE 31. Pre-Test Left Side View of Dummy's Head
Showing Dummy's Head is Level



FIGURE 32. Pre-Test Placement of Dummy's Feet



FIGURE 33. Pre-Test View of Belt Anchorage for Dummy



FIGURE 34. Pre-Test Left Side View of Steering Wheel



FIGURE 35. View of Disengaged Parking Brake



FIGURE 36. Pre-Test View of Parking Brake



FIGURE 37. Pre-Test Close-Up Left Side View of Driver Seat Track



FIGURE 38. Pre-Test Close-Up Left Side View of Driver Seat Back



FIGURE 39. Pre-Test Close-Up View of Driver Seat Back or Head Restraint



FIGURE 40. Pre-Test Dummy and Door Clearance View

Photograph Not Available

FIGURE 41. Post-Test Dummy and Door Clearance View



FIGURE 42. Pre-Test Right Side View of Dummy and Front Seat of Occupant Compartment



FIGURE 43. Post-Test Right Side View of Dummy and Front Seat of Occupant Compartment



FIGURE 44. Pre-Test Inner Door Panel View



FIGURE 45. Post-Test Inner Door Panel View Showing Dummy Contact Locations



FIGURE 46. Post-Test Dummy Close-Up Head Contact with Vehicle Interior View



FIGURE 47. Post-Test Dummy Close-Up Head Contact With Side Airbag View

Photograph Not Applicable

FIGURE 48. Post-Test Dummy Close-Up Torso Contact With Vehicle Interior View



FIGURE 49. Post-Test Dummy Close-Up Torso Contact With Side Airbag View



FIGURE 50. Post-Test Dummy Close-Up Pelvis Contact With Vehicle Interior View

Photograph Not Applicable

FIGURE 51. Post-Test Dummy Close-Up Pelvis Contact With Side Airbag View

Photograph Not Applicable

FIGURE 52. Post-Test Dummy Close-Up Knee Contact with Vehicle Interior View



FIGURE 53. Post-Test Right Side View of Dummy and Rear Seat of Occupant Compartment



FIGURE 54. Pre-Test Inner Rear Passenger Torso Airbag Deployment View

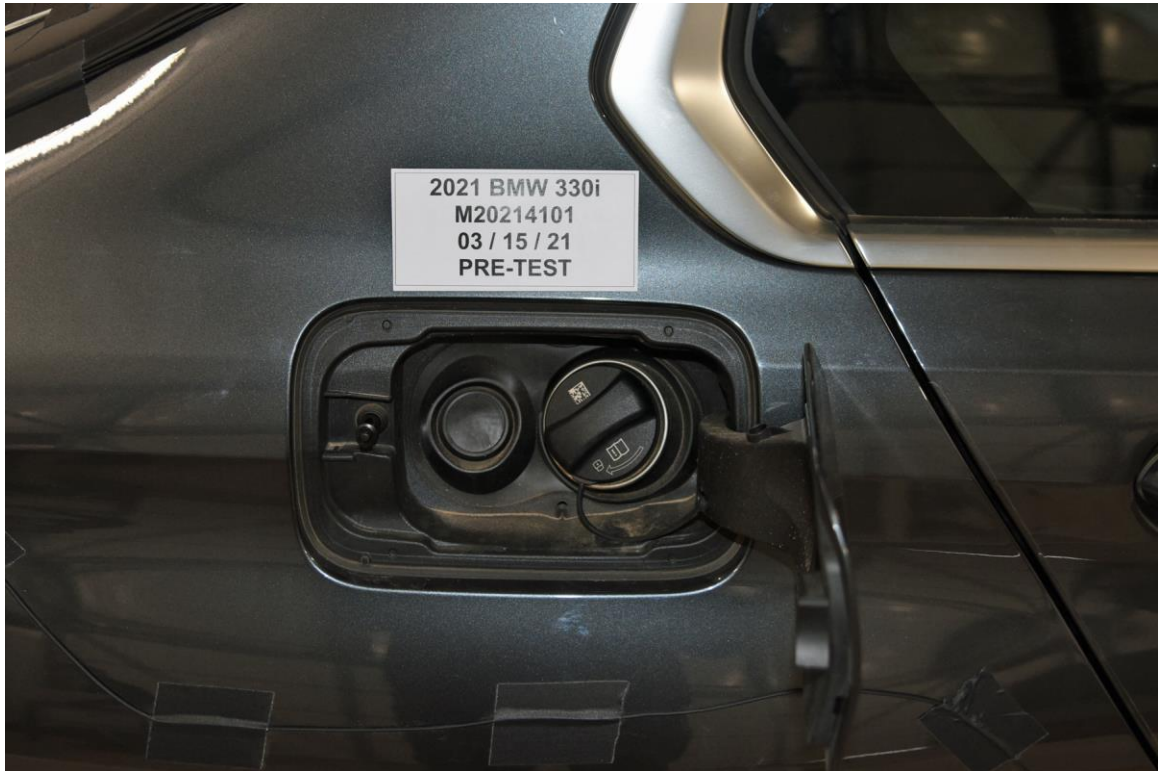


FIGURE 55. Pre-Test View of Fuel Filler Cap or Fuel Filler Neck



FIGURE 56. Post-Test View of Fuel Filler Cap or Fuel Filler Neck



FIGURE 57. Close-Up View of Vehicle's Certification Label



FIGURE 58. Close-Up View of Vehicle's Tire Information Placard or Label



FIGURE 59. Pre-Test Pole Barrier Front View



FIGURE 60. Post-Test Pole Barrier Front View



FIGURE 61. Pre-Test Pole Barrier Side View



FIGURE 62. Post-Test Pole Barrier Side View



FIGURE 63. Pre-Test Ballast View



FIGURE 64. Post-Test Primary and Redundant Speed Trap Read-Out



FIGURE 65. FMVSS No. 301 Static Rollover 0 Degrees



FIGURE 66. FMVSS No. 301 Static Rollover 90 Degrees



FIGURE 67. FMVSS No. 301 Static Rollover 180 Degrees



FIGURE 68. FMVSS No. 301 Static Rollover 270 Degrees



FIGURE 69. FMVSS No. 301 Static Rollover 360 Degrees



FIGURE 70. Impact Event

The Ultimate Driving Machine®
2021 BMW 330i Sedan

Manufacturer's Suggested Retail Price \$ 41,290.00
Options and Additional Charges: (Optional equipment may require standard equipment; check with your authorized BMW center.)

Mineral Grey Metallic \$ 550.00
Black SensaTec Included
Convenience Package \$ 900.00
- Comfort Access wireless entry
- Lumbar support
- Ambient lighting

CarPlay / Android Auto Compat. Included
Enhanced USB & Bluetooth Included
18" wheel 750 w/ as ft. Included
8-Spd Sport Auto Transmission Included
Rear view camera Included
Satin aluminum exterior trim Included
Alarm System Included
Ash grey wood trim Included
Auto-dimming mirrors Included
Auto-dimming rearview mirror Included
Power Front Seats Included
40/20/40 Split Rear Seat Included
Sport seats Included
Storage package Included
Heated front seats \$ 500.00
Active Guard Included
LED Headlights w/ Cornering Included
Park Distance Control \$ 200.00
Automatic climate control Included
BMW Assist Call Included
BMW TeleServices Included
ConnectedDrive Services Included
Connected Package Pro \$ 500.00
Wireless Charging Included
Navigation Included
WiFi Hotspot with comp 3 M Included
SiriusXM with 360L Included
Anthracite headliner Included
Control body Included
Refrigerant Included
Destination Charge \$ 995.00
Total Suggested Retail Price \$ 44,895.00

Standard Features
Performance and efficiency
- 2.0-liter BMW TwinPower Turbo inline 4-cylinder, 16-valve engine with variable valve control (Double VANOS) and Valvetronic and high-precision direct injection
- Driving Dynamics Control with selectable drive modes
- 8-speed Sport Automatic transmission
Handling, ride and braking
- Dynamic Stability Control (DSC) with Dynamic Traction Control (DTC)
- 4-wheel ventilated disc brakes with Anti-lock Braking System (ABS)
- Dynamic Brake Control (DBC) and Cornering Brake Control (CBC)
Exterior
- Power-folding, heated side mirrors
- Satin Aluminum exterior trim
Audio system
- HiFi Sound System and HD Radio
- SiriusXM with 360L - 1-year All Access subscription
Instrumentation and controls
- 3-spoke leather-wrapped sport steering wheel with paddle shifters
- USB audio connection and Bluetooth
- Live Cockpit Plus features Navigation, Drive 7.0, 8.0" touchscreens, 8.8" digital instrument cluster, Drive Controller, and natural voice operation

Connectivity
- Connected Package Pro featuring Real-Time Traffic, On-Street Parking Info (select cities), and BMW Remote Services
- Apple CarPlay and Android Auto Compatibility
- Remote Software Upgrade capable
Comfort and convenience
- 10-way power front sport seats with driver's seat memory
- 40/20/40 split-fold-over through-load rear seats
- Automatic 3-zone Climate Control
- 3-way power glass moonroof
Safety and security
- Front and rear head Protection System (HPS)
- Seat-mounted front side-impact airbags
- Knee airbags for driver and front passenger
- Automatic high beams
- Active Guard
- Rear view camera
- LED headlights with Cornering Lights
Warranty
- 4-year/50,000-mile New Vehicle Limited Warranty for Passenger Cars and Light Trucks 2021 Models
- 12-year Unlimited Mileage Rust Perforation Limited Warranty
- 4-year Unlimited Mileage Roadside Assistance Program

PARTS CONTENT INFORMATION
For Vehicles in this Car Line:
US/Canadian Parts Content: 5%
Major Source of Foreign Parts Content: GERMANY: 55%
Note: Parts content does not include final assembly, distribution, or other non-parts costs.
For this Vehicle:
Final Assembly Point: MUNICH, GERMANY
Country of Origin: GERMANY
Engine: GERMANY
Transmission: GERMANY

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 is equipped with bumpers that can withstand an impact of 2.5 miles per hour with no damage to the vehicle's body and safety systems, although the bumper and related components may sustain damage. The bumper system on this vehicle conforms to the current federal bumper standard of 2.5 miles per hour.

BMW of North America, LLC
Woodcliff Lake, NJ 07877
VPC Location: OXNARD, CALIFORNIA
Port of Entry: HUENEME, CALIFORNIA
Carrier: DELUXE AUTO CARRIERS
Sold To: BMW of Ontario
1350 Auto Center Dr
Ontario CA
(909) 390-7888 91761-2211
Ship To: BMW of Ontario
1350 Auto Center Dr
Ontario CA
(909) 390-7888 91761-2211

BMW Ultimate Care™
Maintenance Program
For the first 3 years or 36,000 miles, whichever comes first on scheduled maintenance.*
\$0
EPA DOT Fuel Economy and Environment
Fuel Economy
Compact cars range from 14 to 113 MPG. The best vehicle ran 141 MPG.
30 MPG combined city/hwy
26 city
36 highway
3.3 gallons per 100 miles
You spend \$750 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) Smog Rating (tailpipe only)
This vehicle emits 268 grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also causes pollution. Learn more at fuel-economy.gov
Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 27 MPG and cost \$7,600 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$3.25 per gallon. MPG is miles per gallon. Vehicle emissions are a significant cause of climate change and smog.
fuel-economy.gov
Calculate personalized estimates and compare vehicles

VIN: WBA5R1C04MFK51620

FIGURE 71. Monroney Label

Front head restraints

Safety information

Warning
A missing protective effect due to removed or not correctly adjusted head restraints can cause injuries in the head and neck area. There is a risk of injury.
Before driving, install the removed head restraints on the occupied seats.
Adjust the head restraint so its center supports the back of the head at as close to eye level as possible.
Adjust the distance so that the head restraint is as close as possible to the back of the head. Adjust the distance via the lockrest tilt as needed.

Adjusting the height

Do not use any accessories, for instance pillows, while driving.

1. To lower: press the button, arrow 1, and push the head restraint down.
2. To raise: push the head restraint up.
After setting the height, make sure that the head restraint engages correctly.

CONTROLS Seats, mirrors and steering wheel

Adjusting the height: M Sport seat

Push switch up or down.

Adjusting distance

Back: press the button and push the head restraint toward the rear.
Forward: pull the head restraint toward the front.
After setting the distance, make sure that the head restraint engages correctly.

Adjusting the distance: M Sport seat

The distance to the back of the head is adjusted via the lockrest tilt.
Adjust the distance so that the head restraint is as close as possible to the back of the head.

Removing
Only remove the head restraint if no one will be sitting in the seat in question.

Removing: M Sport seat
The head restraints cannot be removed.
Installing
Proceed in the reverse order to install the head restraint.

Rear head restraints

Safety information

Warning
A missing protective effect due to removed or not correctly adjusted head restraints can cause injuries in the head and neck area. There is a risk of injury.
Before driving, install the removed head restraints on the occupied seats.
Adjust the head restraint so its center supports the back of the head at as close to eye level as possible.
Adjust the distance so that the head restraint is as close as possible to the back of the head. Adjust the distance via the lockrest tilt as needed.

FIGURE 72. Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

Photograph Not Applicable

FIGURE 73. Post-Test View of Shattered Vehicle Inner Door Panel

APPENDIX B
DUMMY RESPONSE DATA

TABLE OF DATA PLOTS

Plot		Page
1	Driver Head Acceleration (X) Primary	B-1
2	Driver Head Acceleration (Y) Primary	B-1
3	Driver Head Acceleration (Z) Primary	B-1
4	Driver Head Acceleration Primary Resultant	B-1
5	Driver Lower Spine T12 Acceleration (X)	B-2
6	Driver Lower Spine T12 Acceleration (Y)	B-2
7	Driver Lower Spine T12 Acceleration (Z)	B-2
8	Driver Lower Spine T12 Acceleration Resultant	B-2
9	Driver Acetabulum Force on Impact Side (Y)	B-3
10	Driver Iliac Wing Force on Impact Side (Y)	B-3
11	Driver Total Pelvis Force on Impact Side (Y)	B-3

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

Additional Driver Dummy Instrumentation Data

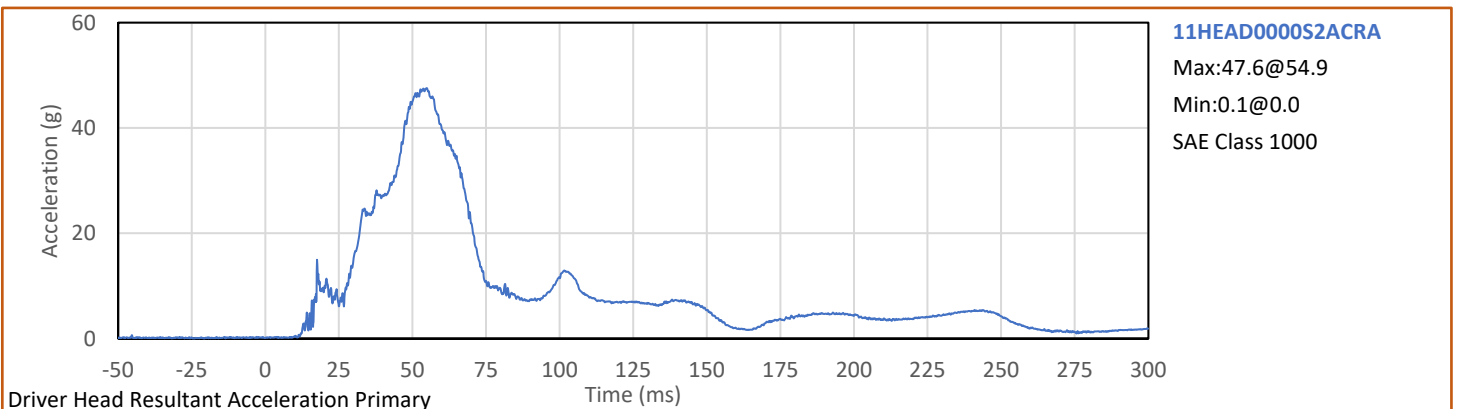
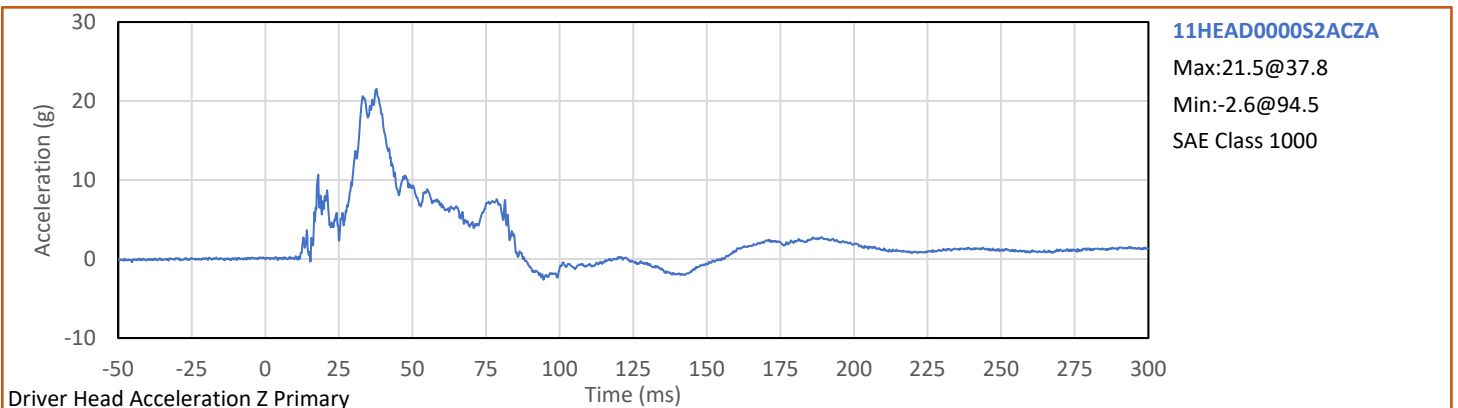
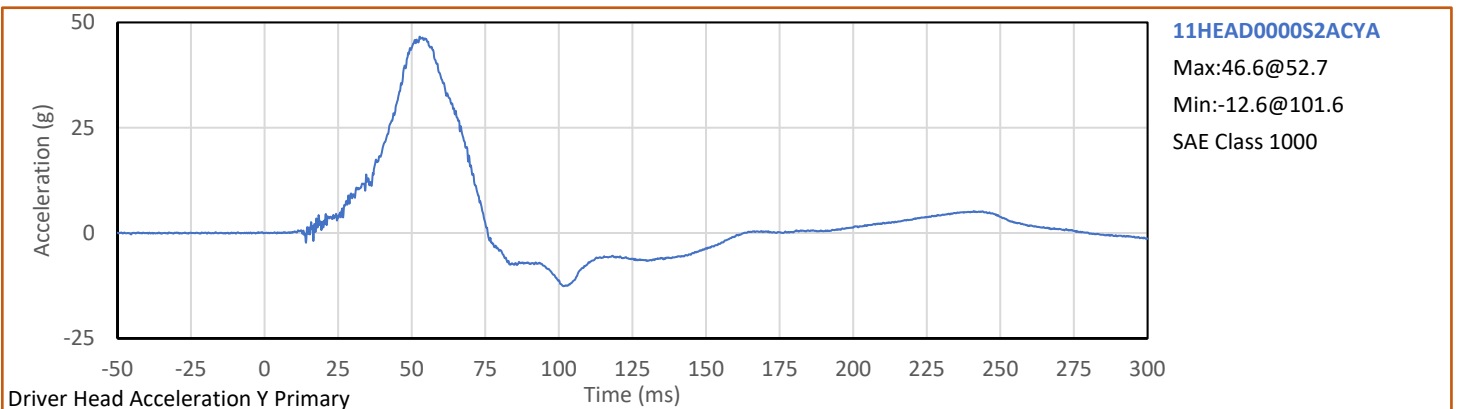
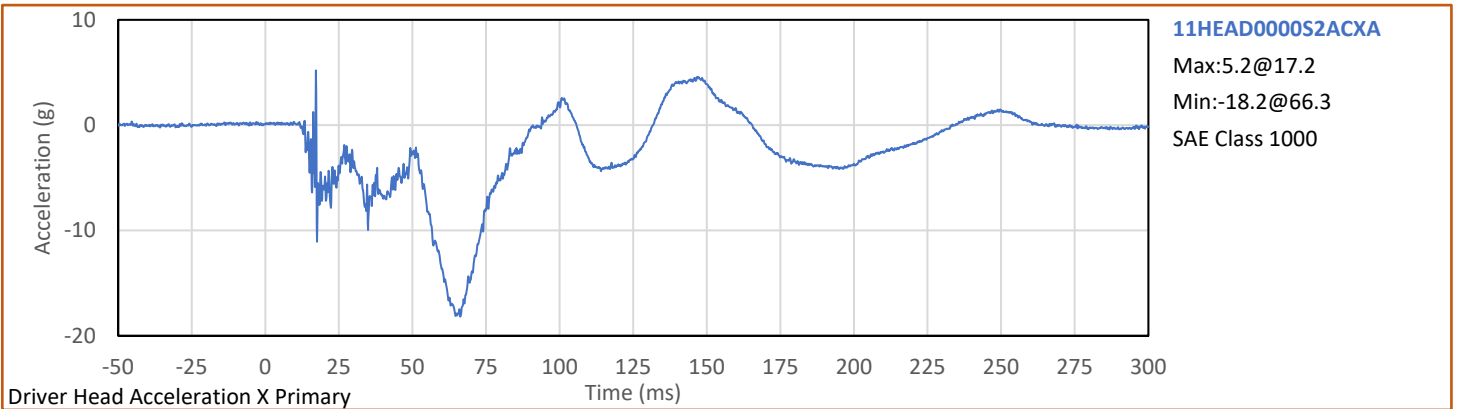
Driver Head Acceleration Redundant (X)
Driver Head Acceleration Redundant (Y)
Driver Head Acceleration Redundant (Z)

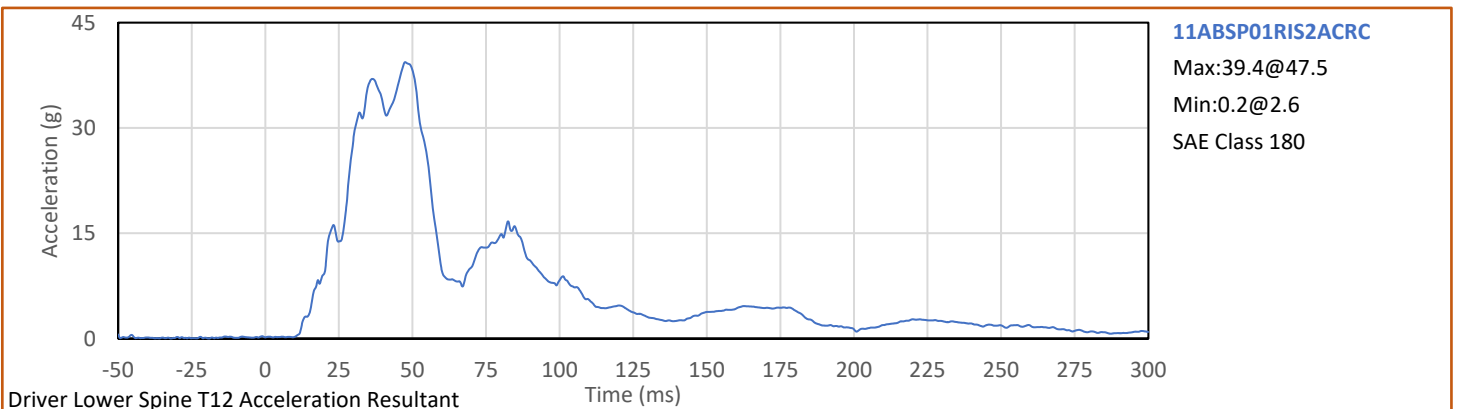
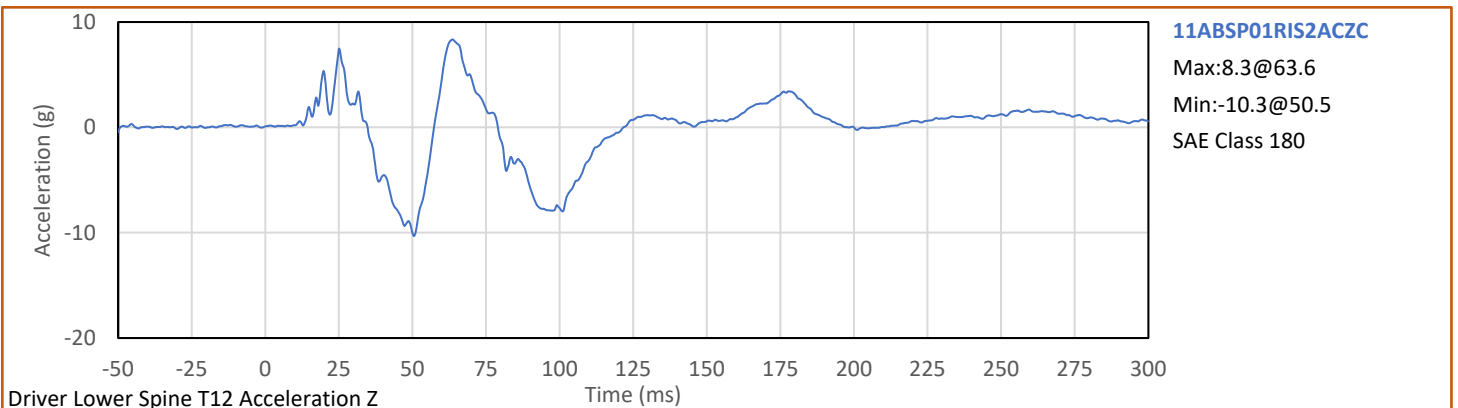
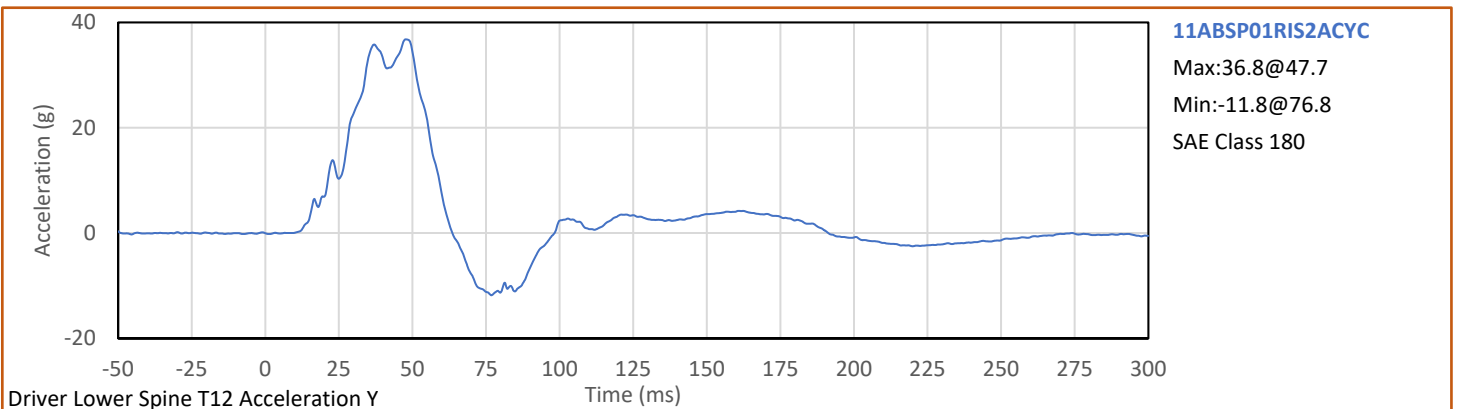
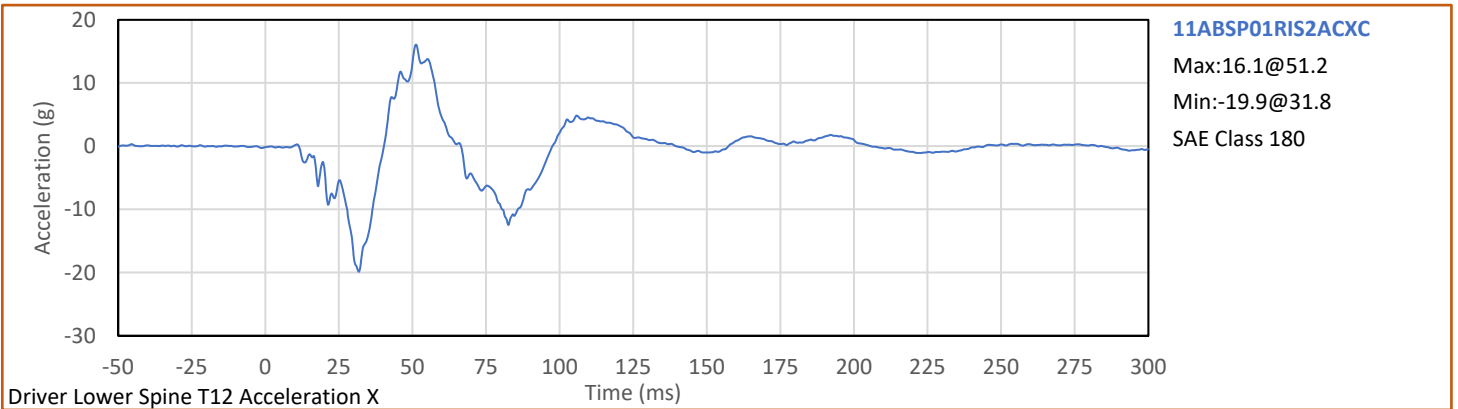
Vehicle Instrumentation Data

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
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

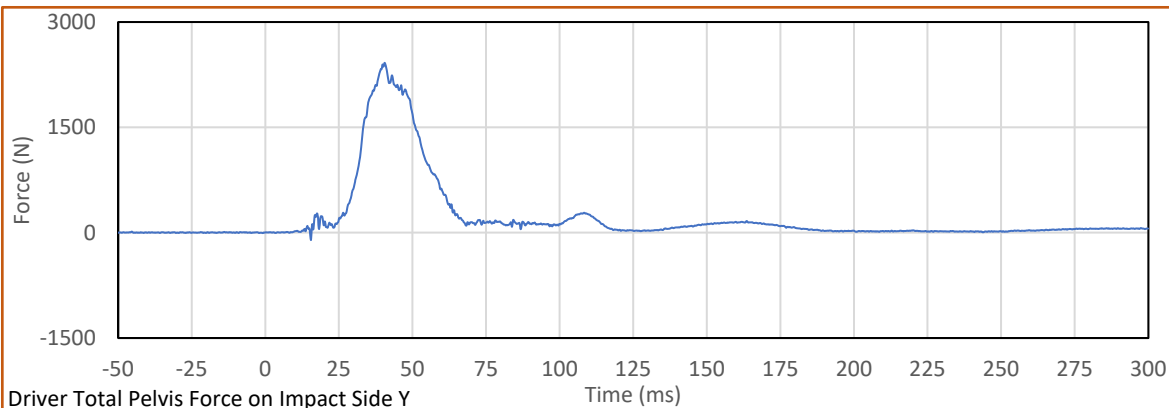
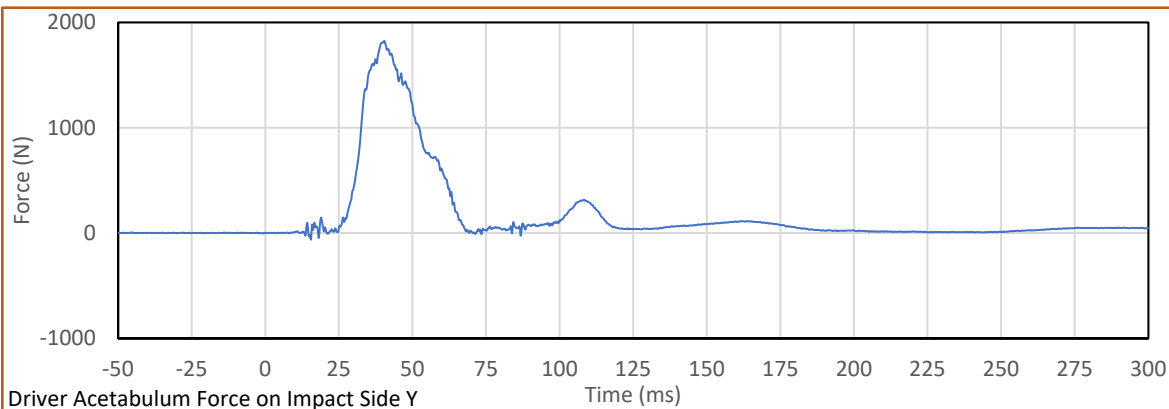
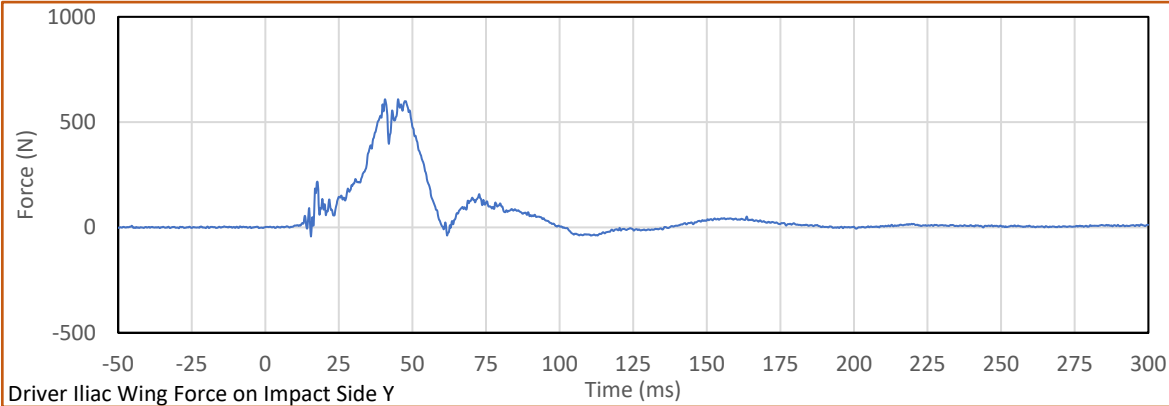
Load Cell Pole Barrier #1 Force (Y)
Load Cell Pole Barrier #2 Force (Y)
Load Cell Pole Barrier #3 Force (Y)
Load Cell Pole Barrier #4 Force (Y)
Load Cell Pole Barrier #5 Force (Y)
Load Cell Pole Barrier #6 Force (Y)
Load Cell Pole Barrier #7 Force (Y)
Load Cell Pole Barrier #8 Force (Y)





Test Vehicle: 2021 BMW 330i 4-Door Sedan
Test Program: NCAP Side Pole Impact Test

NHTSA No.: M20214101
Test Date: 3/15/2021



APPENDIX C
ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

APPENDIX C
Pre-Test ATD Qualification and Performance Verification
SID-IIs Small Side Impact ATD, Left Side Configuration
S/N: 308

ATD Serial No.: 308

Test Date: 2021-02-07

Tested Parameter	Units	Spec Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Relative Humidity	%	10	70	20	Pass
A - Sitting Height	mm	772	788	785	Pass
B - Shoulder Pivot Height	mm	437	453	450	Pass
C - Hpoint Height	mm	79	89	84	Pass
D - H Point From Seatback	mm	141	151	146	Pass
E - Shoulder Pivot From Backline	mm	97	107	106	Pass
F - Thigh Clearance	mm	119	135	130	Pass
G - Head Breadth	mm	140	148	143	Pass
H - Head Back From Backline	mm	40	46	42	Pass
I - Head Depth	mm	178	188	188	Pass
J - Head Circumference	mm	541	551	547	Pass
K - Buttock To Knee Length	mm	514	540	526	Pass
L - Popliteal Height	mm	343	369	352	Pass
K - Knee Pivot To Floor Height	mm	392	409	404	Pass
N - Buttock Popliteal Length	mm	416	442	438	Pass
O - Chest Depth W/O Jacket	mm	195	211	202	Pass
P - Foot Length	mm	216	232	223	Pass
Q - Hip Breadth (W/Pelvic Plugs)	mm	313	323	321	Pass
R - Arm Length	mm	249	259	255	Pass
S - Knee Joint To Seatback	mm	477	493	480	Pass
V - Shoulder Width	mm	341	357	350	Pass
W - Foot Width	mm	78	94	89	Pass
Y - Chest Circumference W/Jacket	mm	851	881	862	Pass
Z - Waist Circumference	mm	761	791	775	Pass
			Overall Test Results		Pass

Technician:



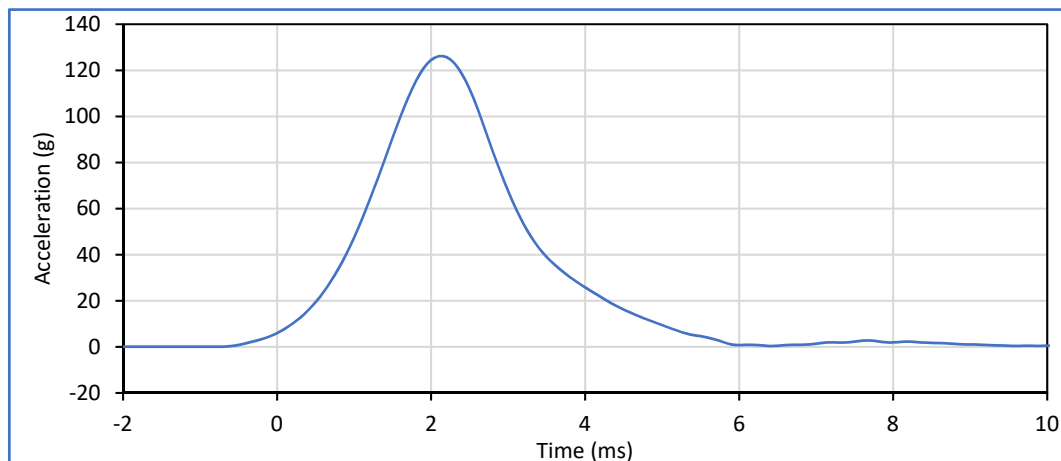
J. Hernandez

Approved By:



P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.2	Pass
Laboratory Humidity	%	10	70	40	Pass
Peak Resultant Acceleration	g	115.0	137.0	126.2	Pass
Peak Head Ax	g	-15.0	15.0	-1.8	Pass
Oscillations After Main Pulse	%	0.0	15.0	2.2	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass

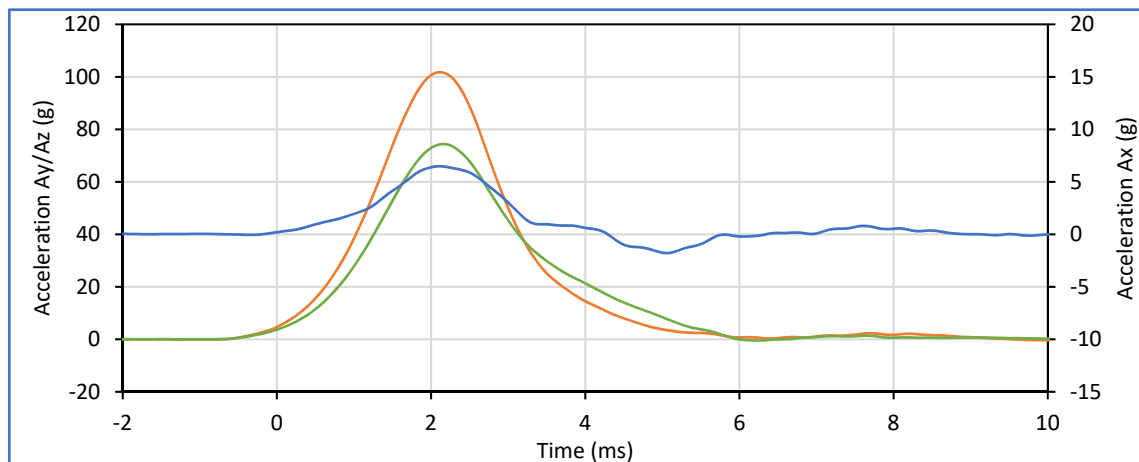


Head Resultant

Max:126.2@2.2

Min:0.4@6.4

SAE Class 1000



Head Ax

Max:6.5@2.1

Min:-1.8@5.1

SAE Class 1000

Head Ay

Max:101.8@2.1

Min:-0.4@10.0

SAE Class 1000

Head Az

Max:74.4@2.2

Min:-0.5@6.3

SAE Class 1000

Technician:

J. Hernandez

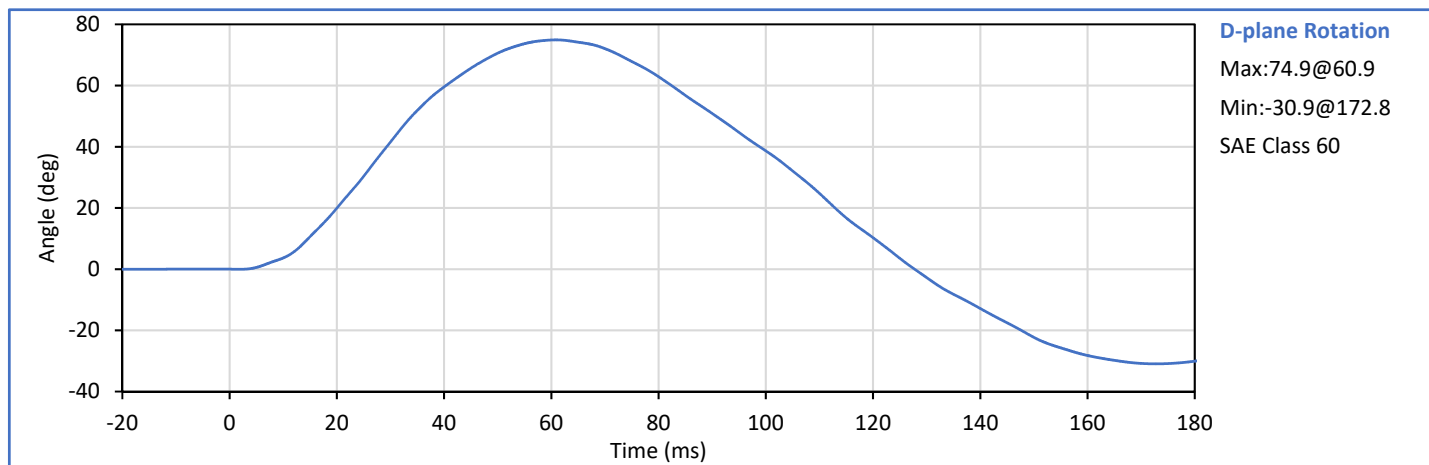
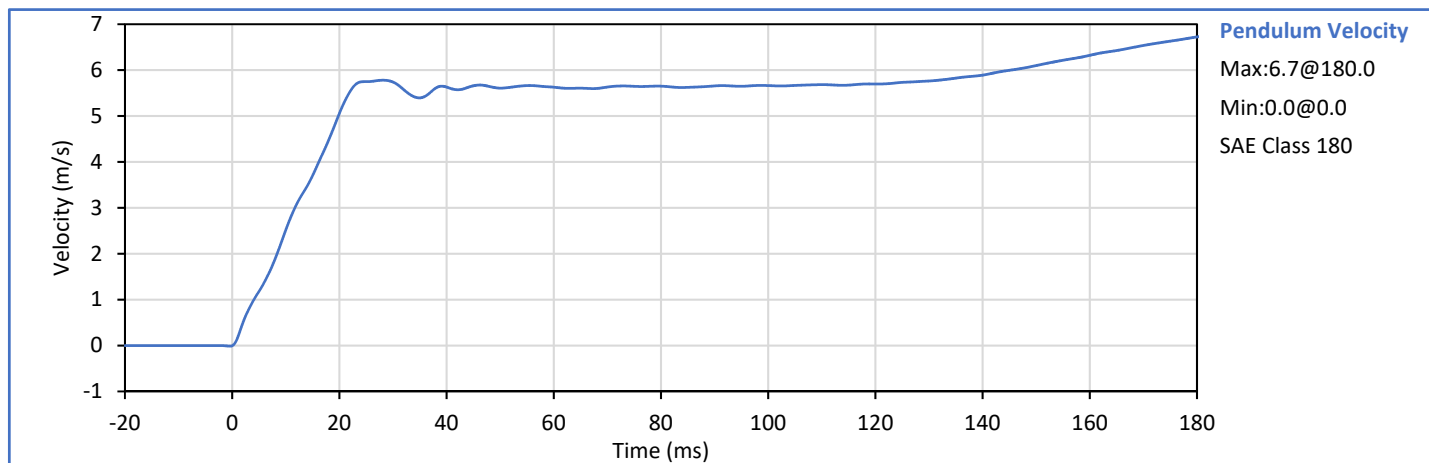
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Humidity	%	10	70	23	Pass
Pendulum Velocity	m/s	5.51	5.63	5.58	Pass
Pendulum Decel at 10 ms	m/s	2.20	2.80	2.52	Pass
Pendulum Decel at 15 ms	m/s	3.30	4.10	3.70	Pass
Pendulum Decel at 20 ms	m/s	4.40	5.40	5.05	Pass
Pendulum Decel at 25 ms	m/s	5.40	6.10	5.75	Pass
Pendulum Decel from 25-100 ms	m/s	5.50	6.20	5.78	Pass
Peak "D" Plane Rotation	deg	71.0	81.0	74.9	Pass
Time of Peak "D" Plane Rotation	ms	50.0	70.0	60.9	Pass
Peak Occ. Condyle Moment	Nm	-44.0	-36.0	-43.6	Pass
Time of Moment Decay to 0 Nm	ms	102.0	126.0	110.3	Pass
Overall Test Results				Pass	



Technician:

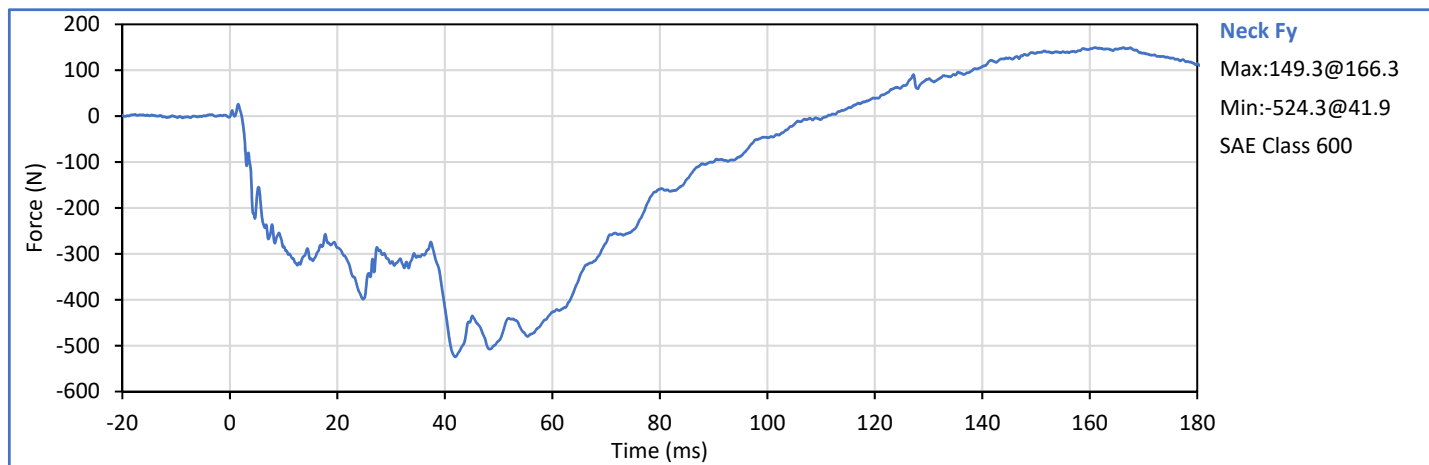
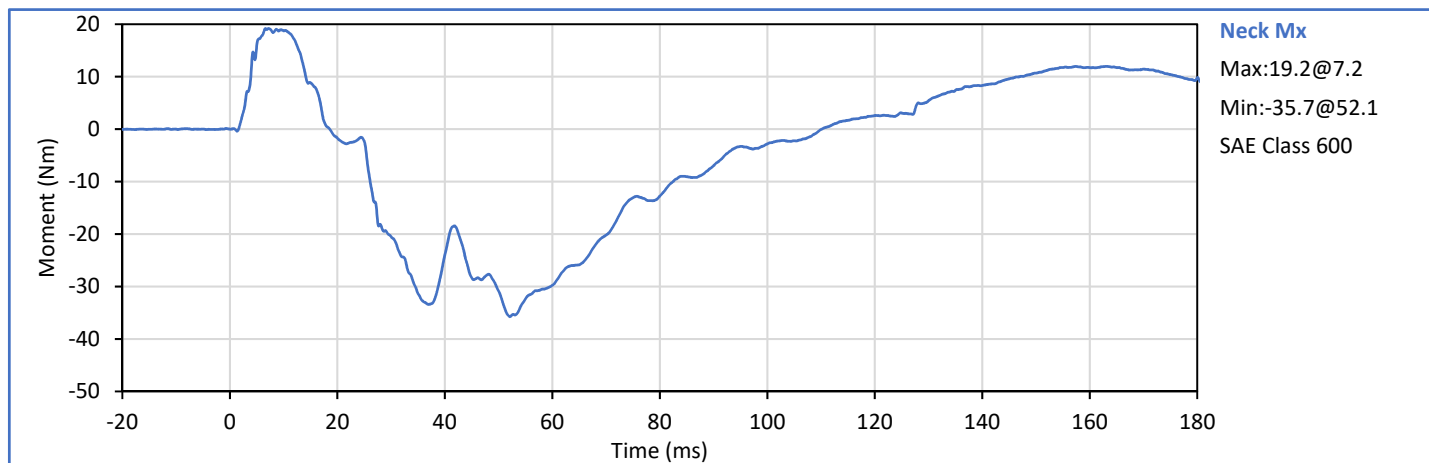
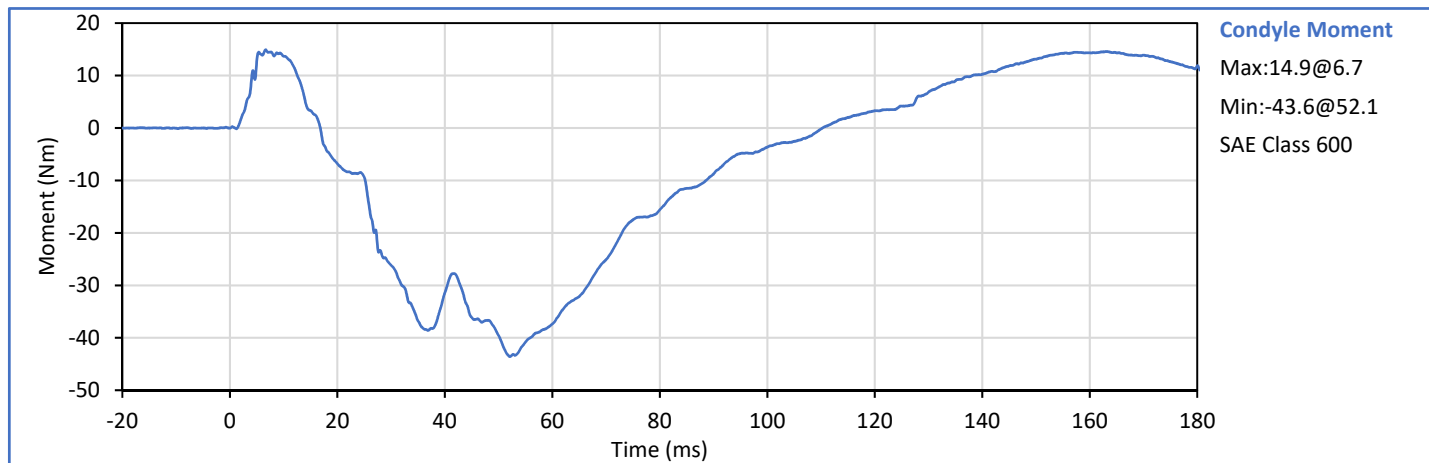
J. Hernandez

J. Hernandez

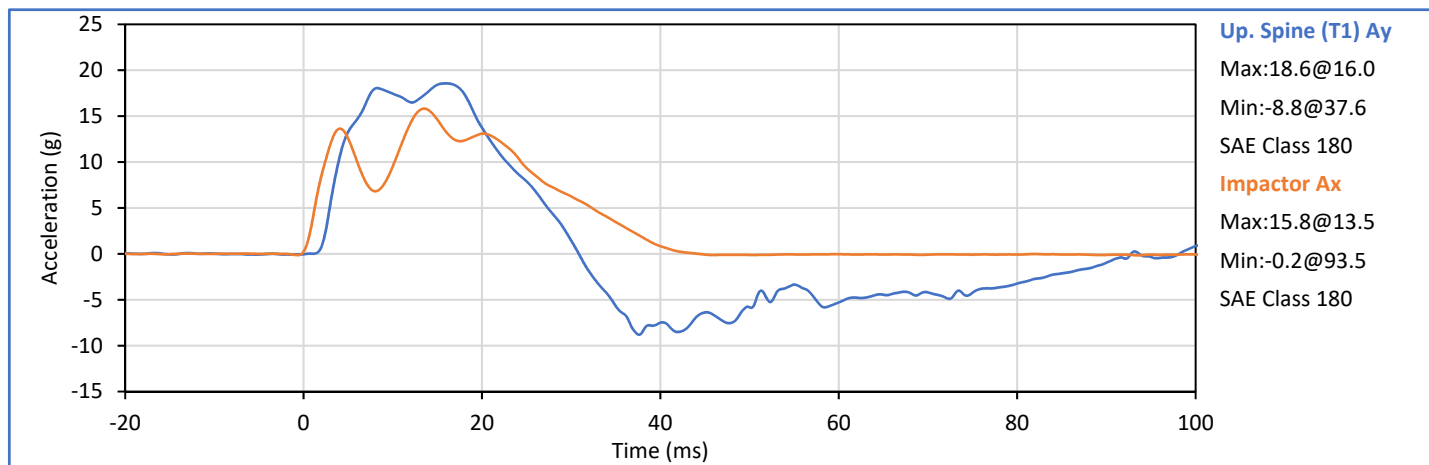
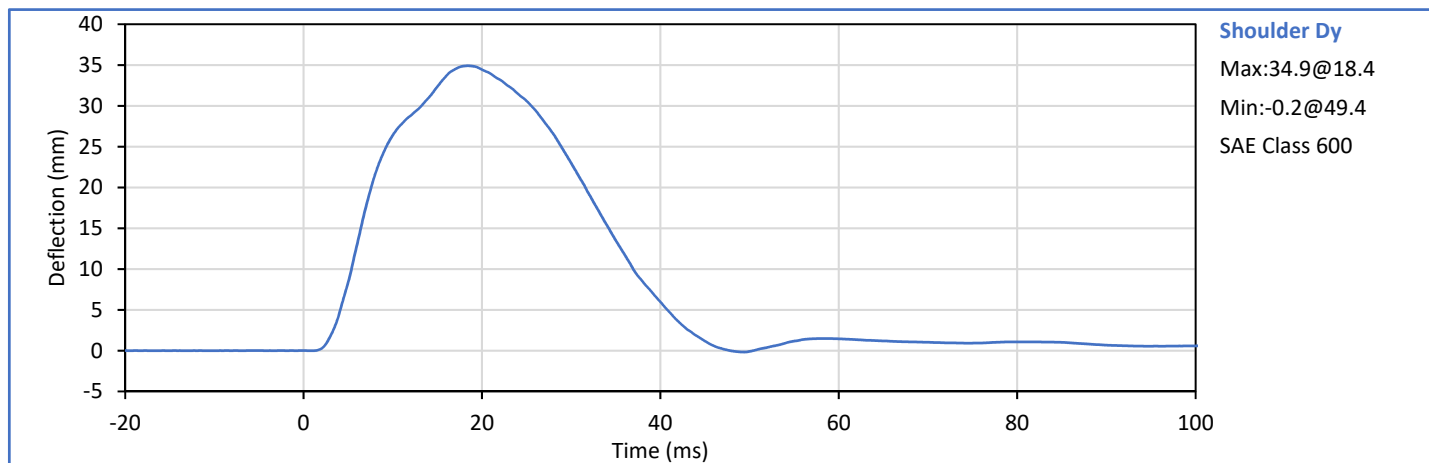
Approved By:

P. Puzzuto

P. Puzzuto



Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Humidity	%	10	70	20	Pass
Impactor Velocity	m/s	4.20	4.40	4.31	Pass
Peak Shoulder Dy	mm	28.0	37.0	34.9	Pass
Peak Upper Spine (T1) Ay	g	17.0	22.0	18.6	Pass
Peak Impactor Ax	g	13.0	18.0	15.8	Pass
Overall Test Results					Pass



Technician:

J. Hernandez

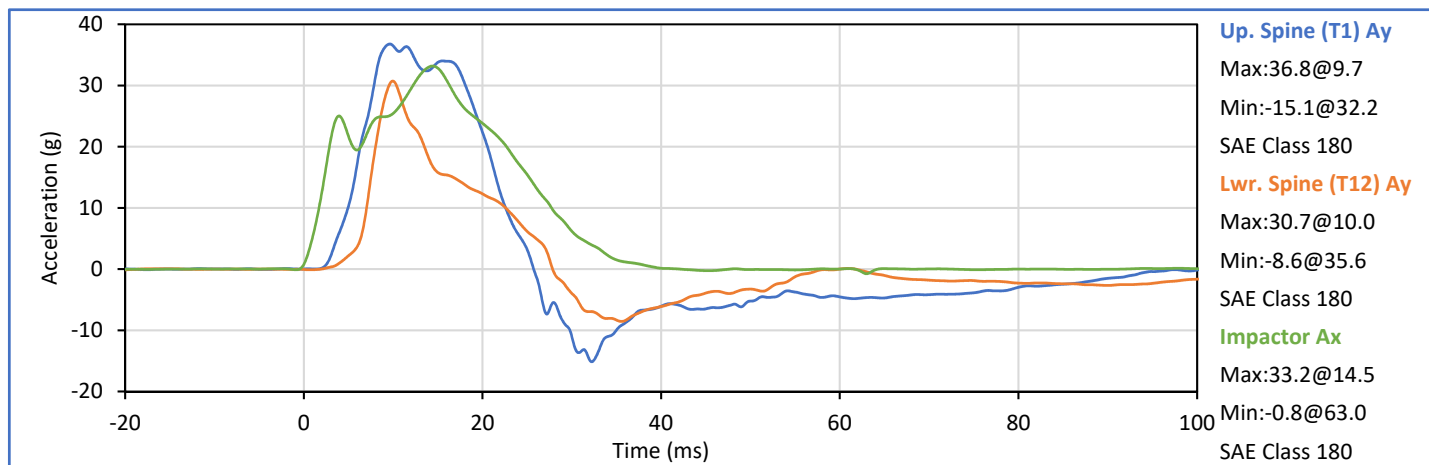
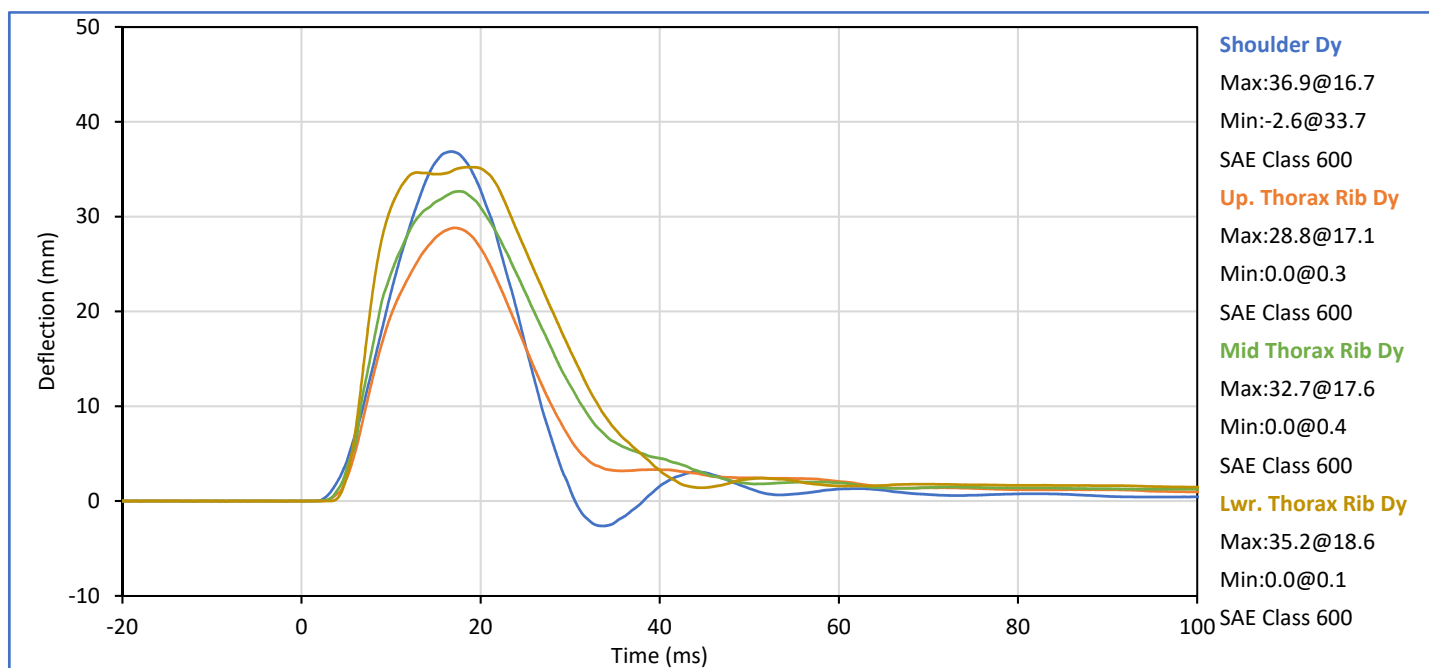
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Humidity	%	10	70	20	Pass
Impactor Velocity	m/s	6.60	6.80	6.66	Pass
Peak Shoulder Dy	mm	31.0	40.0	36.9	Pass
Peak Upper Rib Dy	mm	25.0	32.0	28.8	Pass
Peak Middle Rib Dy	mm	30.0	36.0	32.7	Pass
Peak Lower Rib Dy	mm	32.0	38.0	35.2	Pass
Peak Upper Spine (T1) Ay	g	34.0	43.0	36.8	Pass
Peak Lower Spine (T12) Ay	g	29.0	37.0	30.7	Pass
Peak Impactor Ax	g	30.0	36.0	33.2	Pass
Overall Test Results					Pass



Technician:

J. Hernandez

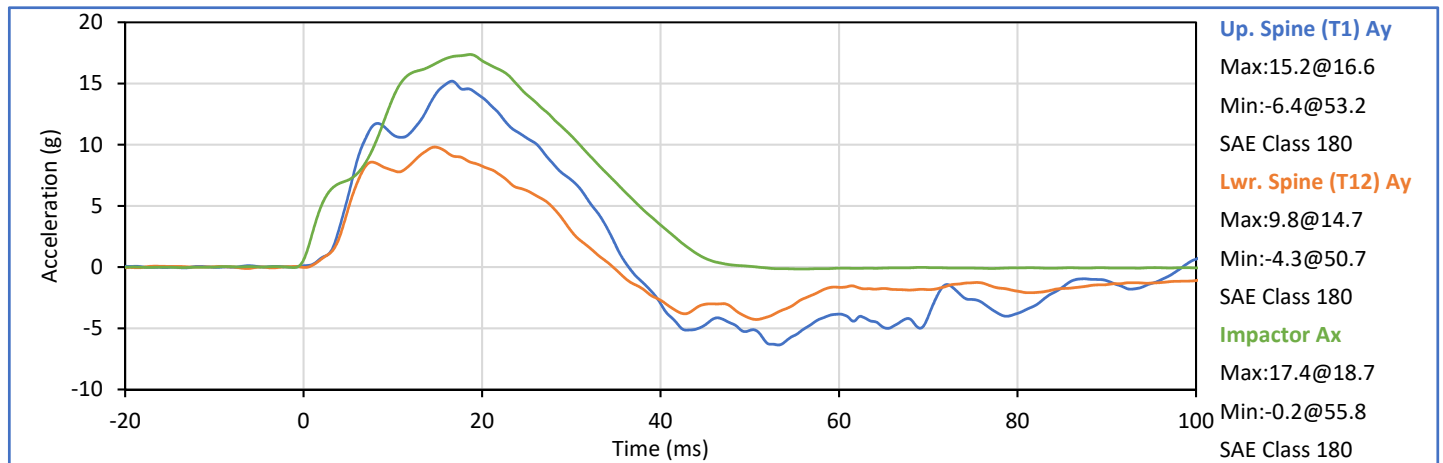
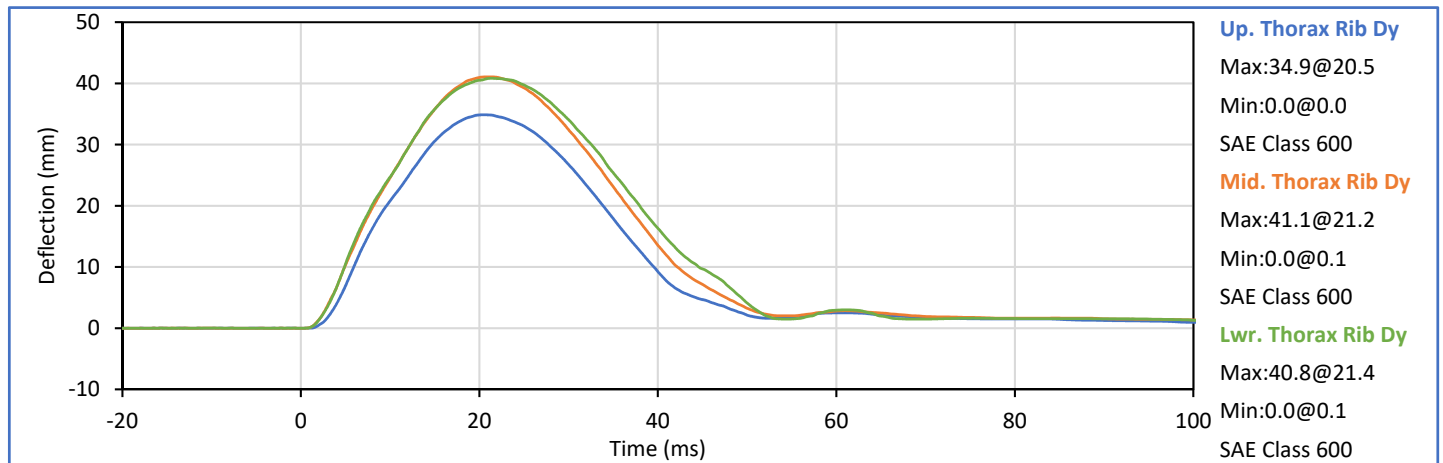
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Humidity	%	10	70	20	Pass
Impactor Velocity	m/s	4.20	4.40	4.32	Pass
Peak Upper Rib Dy	mm	32.0	40.0	34.9	Pass
Peak Middle Rib Dy	mm	39.0	45.0	41.1	Pass
Peak Lower Rib Dy	mm	35.0	43.0	40.8	Pass
Peak Upper Spine (T1) Ay	g	13.0	17.0	15.2	Pass
Peak Lower Spine (T12) Ay	g	7.0	11.0	9.8	Pass
Peak Impactor Ax	g	14.0	18.0	17.4	Pass
Overall Test Results				Pass	Pass



Technician:

J. Hernandez

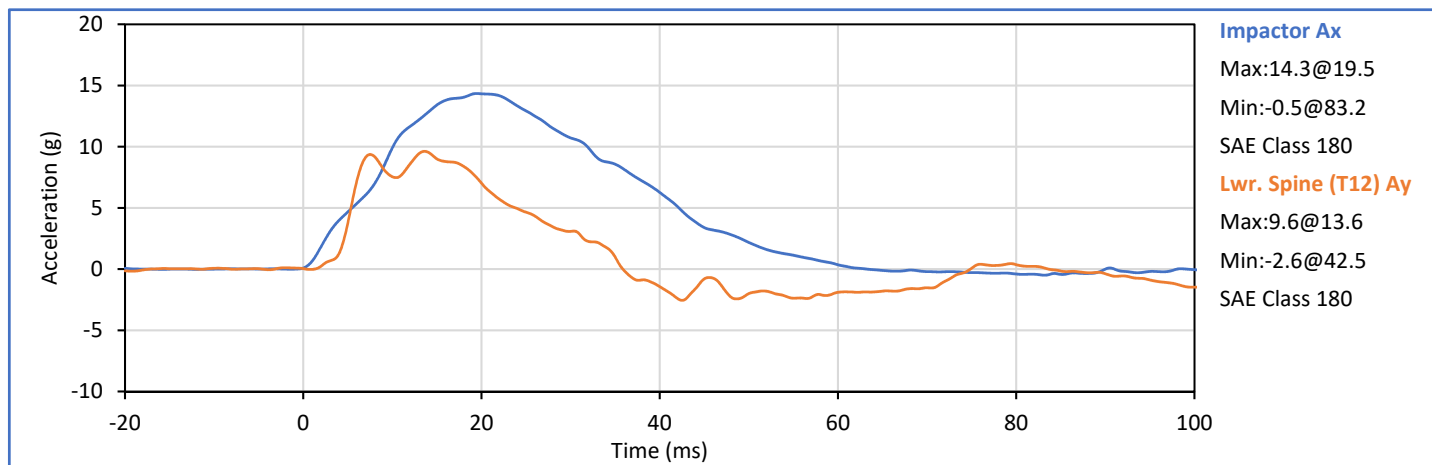
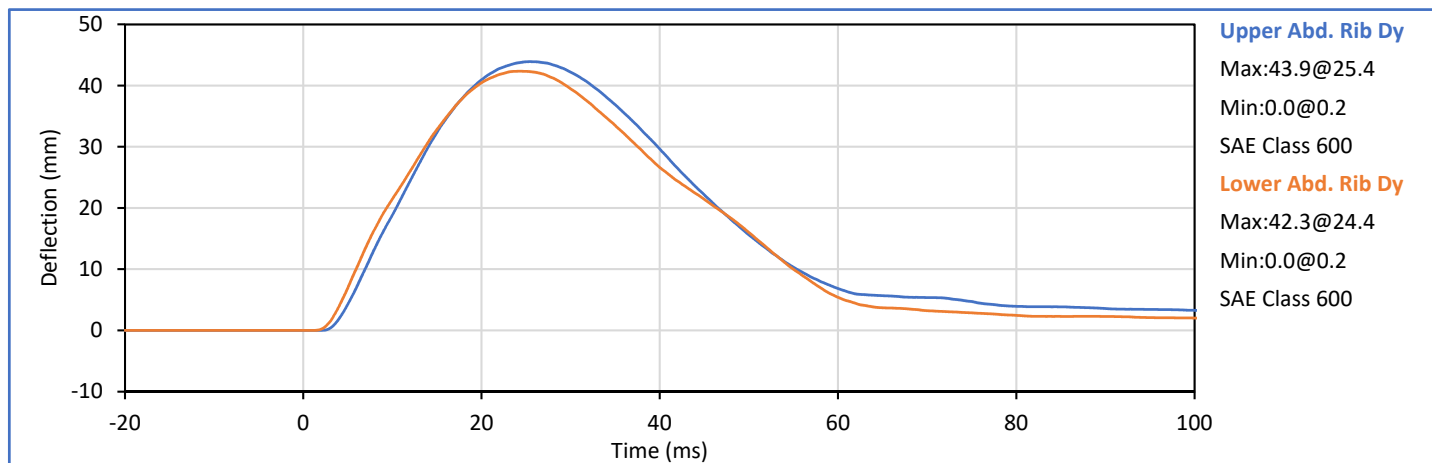
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Humidity	%	10	70	40	Pass
Impactor Velocity	m/s	4.20	4.40	4.33	Pass
Peak Upper Abdomen Rib Dy	mm	36.0	47.0	43.9	Pass
Peak Lower Abdomen Rib Dy	mm	33.0	44.0	42.3	Pass
Peak Lower Spine T12 Ay	mm	9.0	14.0	9.6	Pass
Peak Impactor Ax	g	12.0	16.0	14.3	Pass
Overall Test Results					Pass



Technician:

J. Hernandez

J. Hernandez

Approved By:

P. Puzzuto

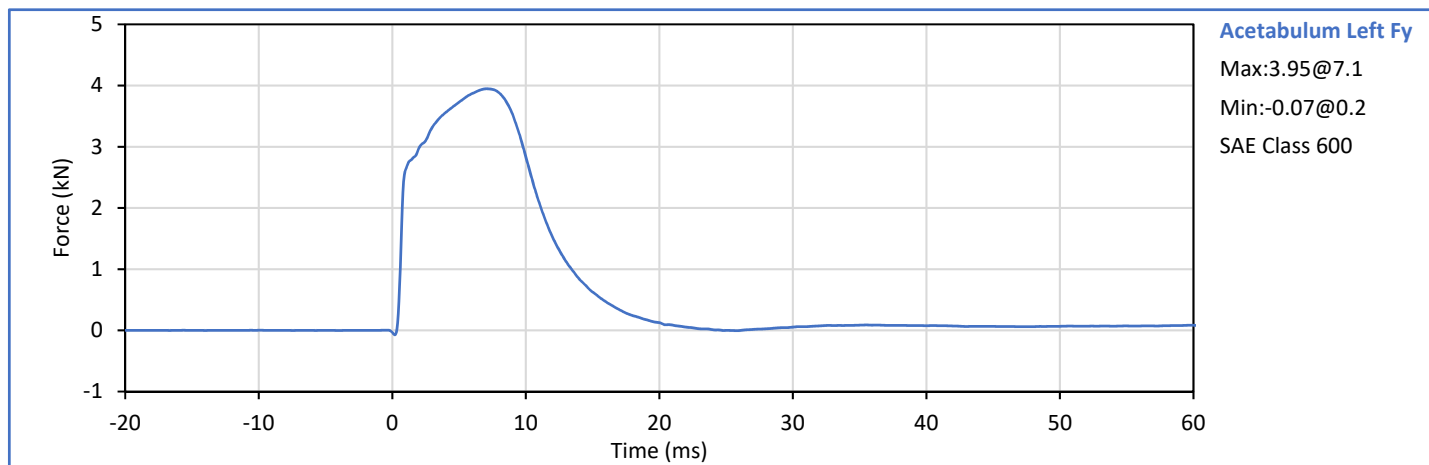
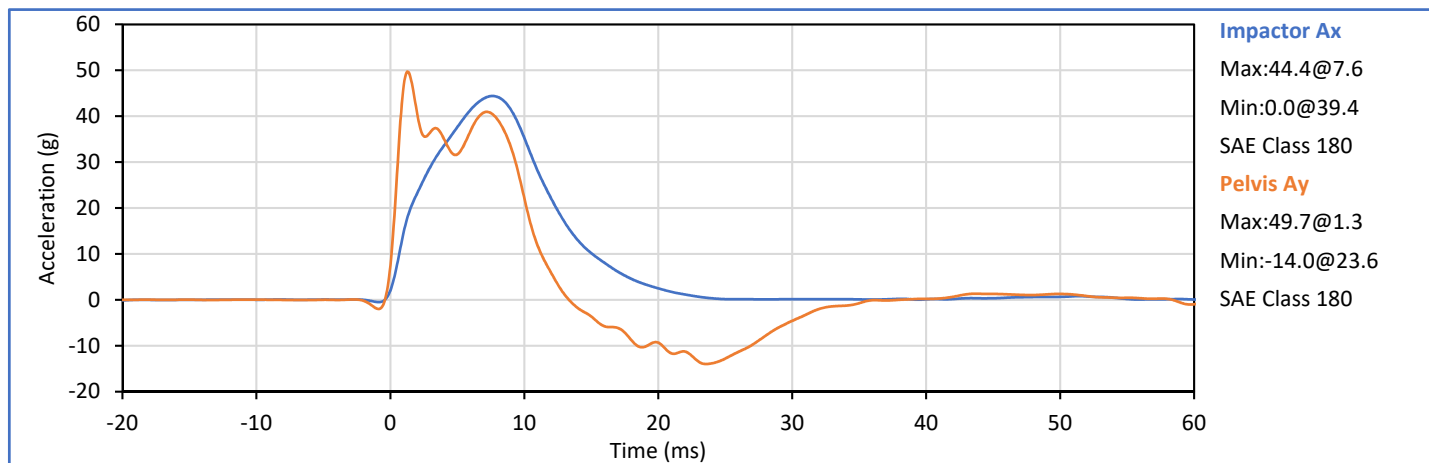
P. Puzzuto

ATD Serial No.: 308

Test Date: 2021-02-10

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Humidity	%	10	70	27	Pass
Impactor Velocity	m/s	6.60	6.80	6.71	Pass
Peak Acetabulum Fy	kN	3.60	4.30	3.95	Pass
Pelvis Ay after 6ms	g	34.0	42.0	41.0	Pass
Peak Impactor Ax	g	38.0	47.0	44.4	Pass
Overall Test Results				Pass	Pass

Pelvis Plug S/N: 13906



Technician: J. Hernandez

Approved By: P. Puzzuto

ATD Serial No.: 308

SID-IIs Small Side Impact ATD
Pelvis Acetabulum Impact

Test Date: 2021-02-10

Pelvis Plug S/N: 13906



SID-IIs Pelvis Plug Certification Test

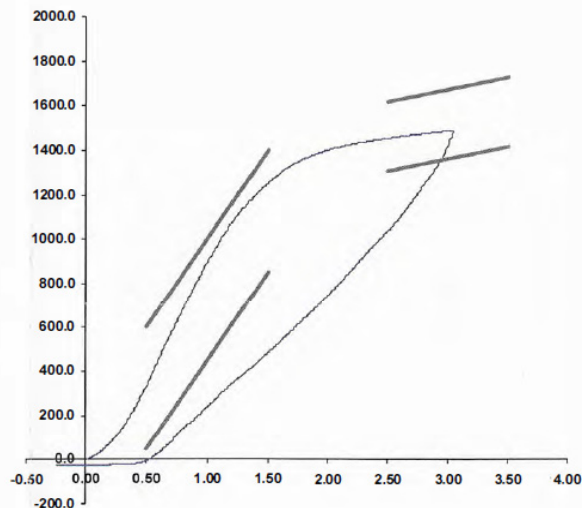
Plug S/N 13906
Test Number 13380
Report Number 13425
Test Date 5/20/2020 8:36:51 PM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	342.95	50.00	600.00
Force @ 1.5 mm (N)	1,255.61	850.00	1,400.00
Force @ 2.5 mm (N)	1,453.61	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,487.53	1,361.00	1,673.00

Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000
Preload Value (-N) 22.24
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 20-May-20
SACO Research

By: DC Date: 5/20/2020

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

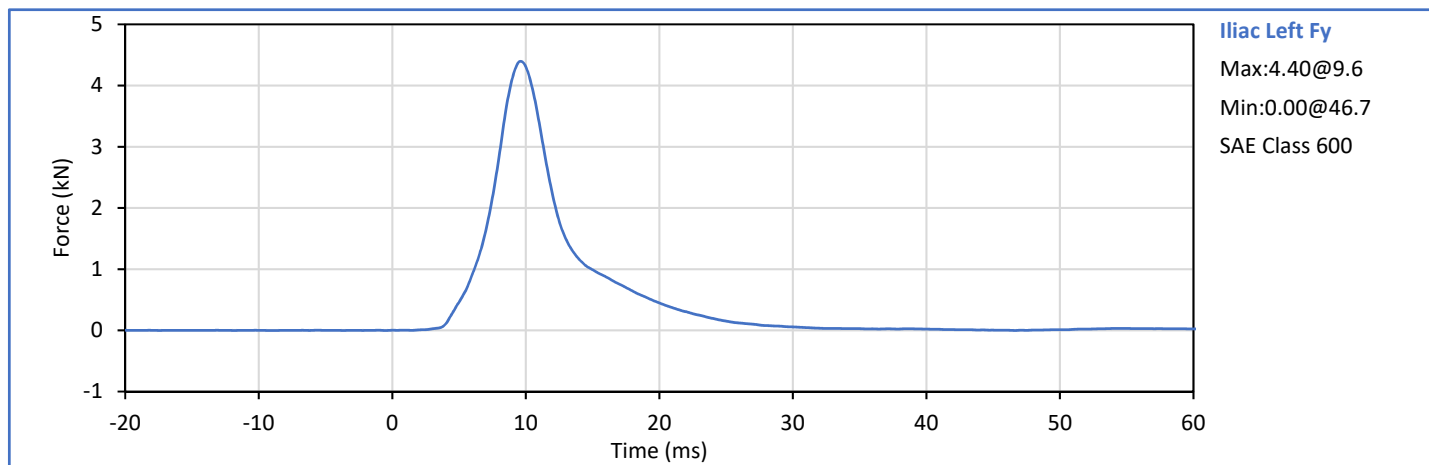
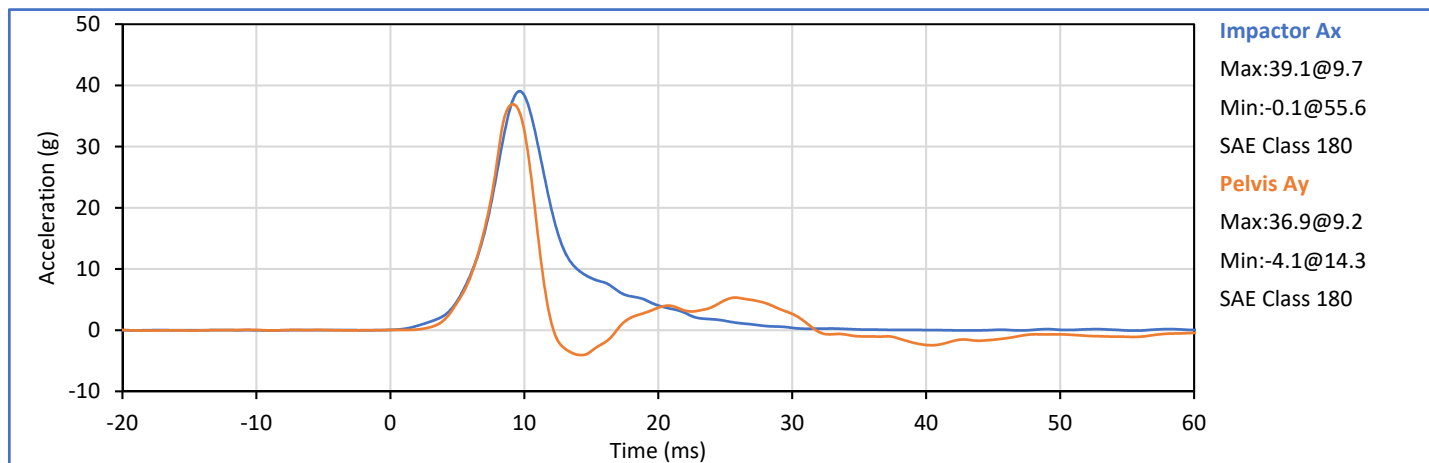
ATD Serial No.: 308

Test Date: 2021-02-09

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Humidity	%	10	70	44	Pass
Impactor Velocity	m/s	4.20	4.40	4.28	Pass
Peak Iliac Fy	kN	4.10	5.10	4.40	Pass
Pelvis Ay after 6ms	g	28.0	39.0	36.9	Pass
Peak Impactor Ax	g	36.0	45.0	39.1	Pass
Overall Test Results				Pass	Pass

Pelvis Plug S/N: 12228 *

* Plug is not impacted and remains certified



Technician:

J. Hernandez

J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

APPENDIX C
Post-Test ATD Qualification and Performance Verification
SID-IIs Small Side Impact ATD, Left Side Configuration
S/N: 308

ATD Serial No.: 308

Test Date: 2021-03-18

Tested Parameter	Units	Spec Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.2	Pass
Laboratory Relative Humidity	%	10	70	44	Pass
A - Sitting Height	mm	772	788	782	Pass
B - Shoulder Pivot Height	mm	437	453	450	Pass
C - Hpoint Height	mm	79	89	83	Pass
D - H Point From Seatback	mm	141	151	149	Pass
E - Shoulder Pivot From Backline	mm	97	107	105	Pass
F - Thigh Clearance	mm	119	135	126	Pass
G - Head Breadth	mm	140	148	143	Pass
H - Head Back From Backline	mm	40	46	42	Pass
I - Head Depth	mm	178	188	186	Pass
J - Head Circumference	mm	541	551	547	Pass
K - Buttock To Knee Length	mm	514	540	524	Pass
L - Popliteal Height	mm	343	369	350	Pass
K - Knee Pivot To Floor Height	mm	392	409	398	Pass
N - Buttock Popliteal Length	mm	416	442	437	Pass
O - Chest Depth W/O Jacket	mm	195	211	207	Pass
P - Foot Length	mm	216	232	221	Pass
Q - Hip Breadth (W/Pelvic Plugs)	mm	313	323	318	Pass
R - Arm Length	mm	249	259	256	Pass
S - Knee Joint To Seatback	mm	477	493	486	Pass
V - Shoulder Width	mm	341	357	345	Pass
W - Foot Width	mm	78	94	84	Pass
Y - Chest Circumference W/Jacket	mm	851	881	862	Pass
Z - Waist Circumference	mm	761	791	779	Pass
			Overall Test Results		Pass

Technician:



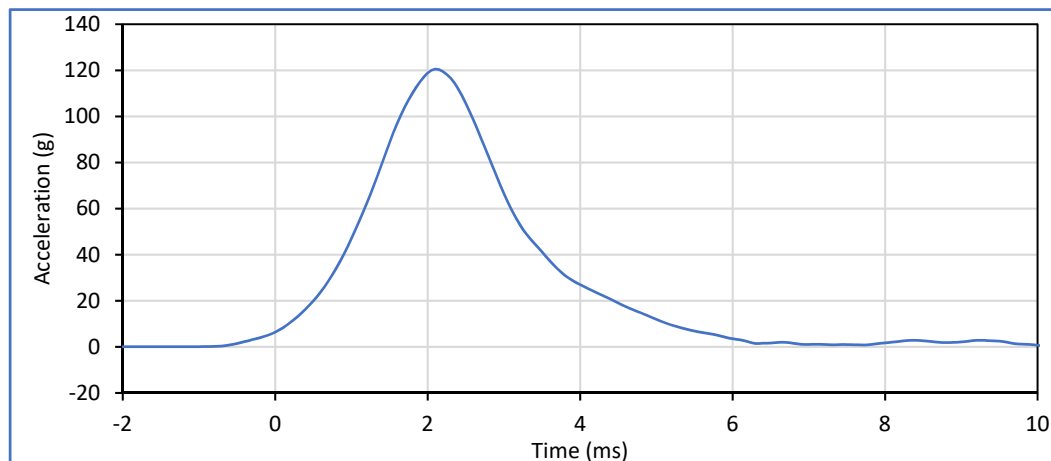
J. Hernandez

Approved By:



P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.7	Pass
Laboratory Humidity	%	10	70	26	Pass
Peak Resultant Acceleration	g	115.0	137.0	120.5	Pass
Peak Head Ax	g	-15.0	15.0	-2.8	Pass
Oscillations After Main Pulse	%	0.0	15.0	2.5	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass

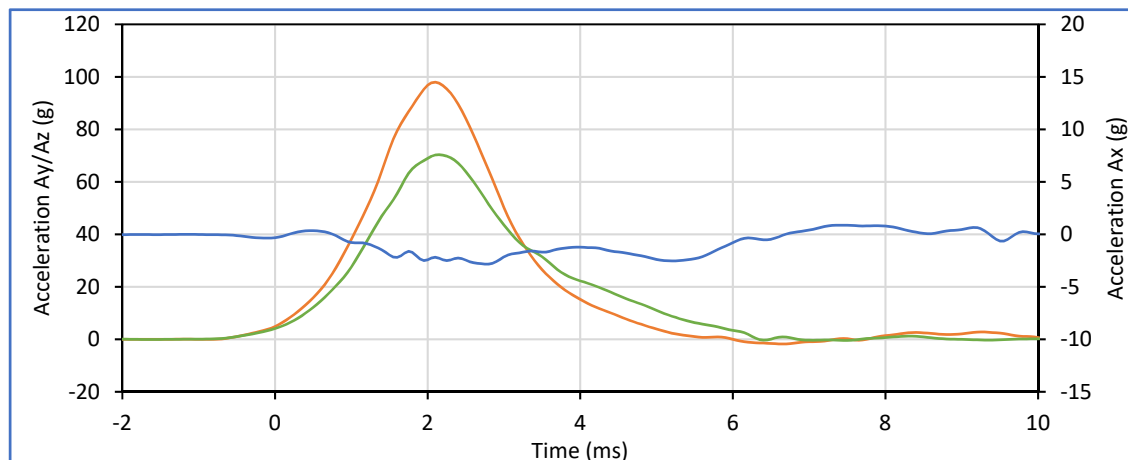


Head Resultant

Max:120.5@2.1

Min:0.7@10.0

SAE Class 1000



Head Ax

Max:0.9@7.4

Min:-2.8@2.8

SAE Class 1000

Head Ay

Max:98.0@2.1

Min:-1.8@6.7

SAE Class 1000

Head Az

Max:70.4@2.2

Min:-0.4@7.5

SAE Class 1000

Technician:

J. Hernandez

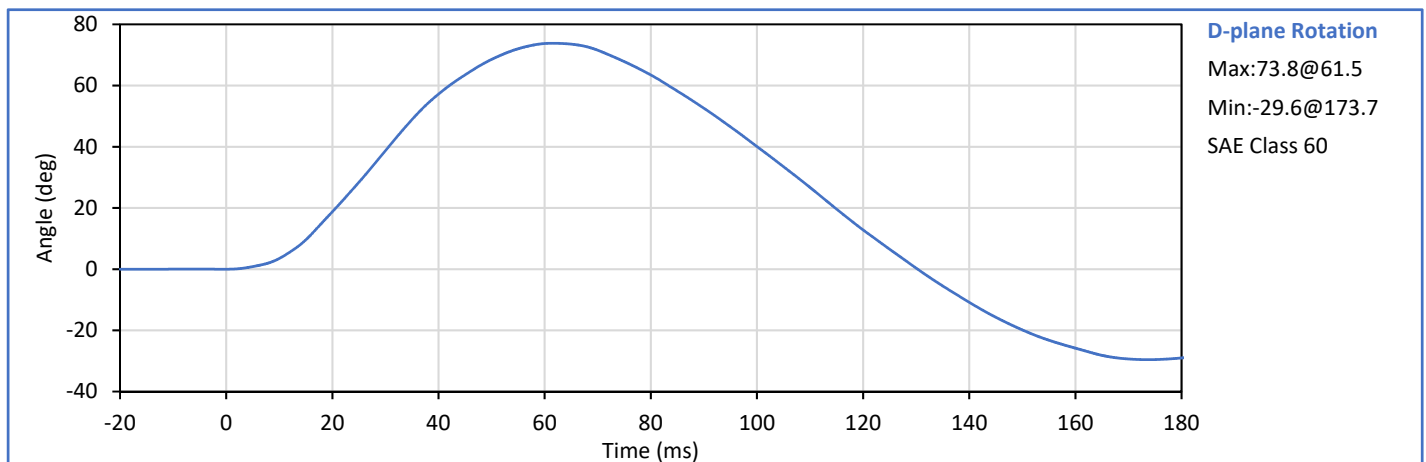
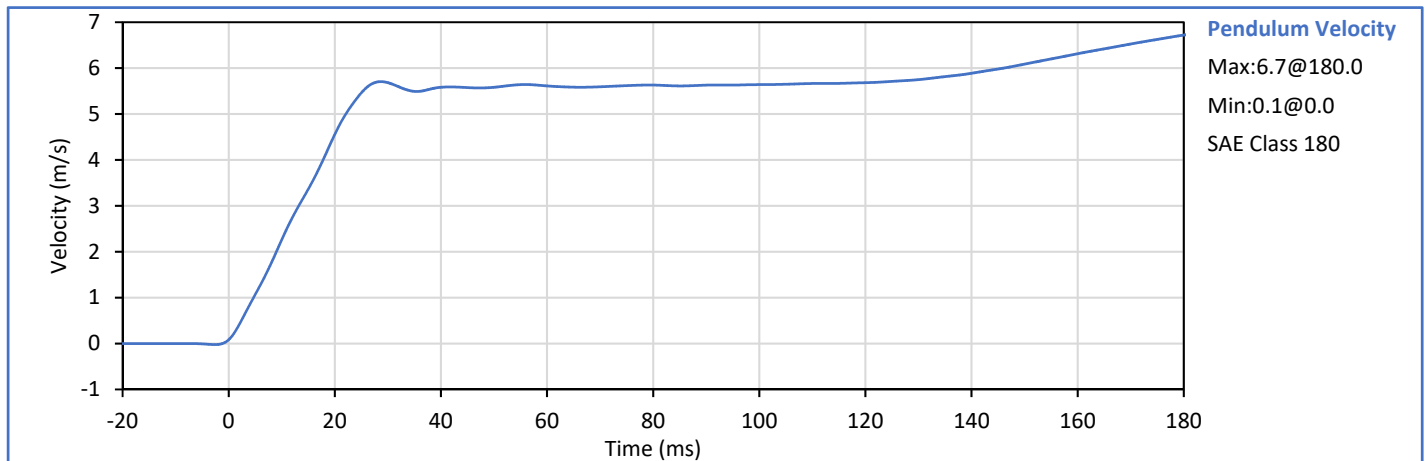
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Humidity	%	10	70	23	Pass
Pendulum Velocity	m/s	5.51	5.63	5.57	Pass
Pendulum Decel at 10 ms	m/s	2.20	2.80	2.26	Pass
Pendulum Decel at 15 ms	m/s	3.30	4.10	3.36	Pass
Pendulum Decel at 20 ms	m/s	4.40	5.40	4.56	Pass
Pendulum Decel at 25 ms	m/s	5.40	6.10	5.46	Pass
Pendulum Decel from 25-100 ms	m/s	5.50	6.20	5.71	Pass
Peak "D" Plane Rotation	deg	71.0	81.0	73.8	Pass
Time of Peak "D" Plane Rotation	ms	50.0	70.0	61.5	Pass
Peak Occ. Condyle Moment	Nm	-44.0	-36.0	-40.0	Pass
Time of Moment Decay to 0 Nm	ms	102.0	126.0	112.3	Pass
Overall Test Results				Pass	Pass



Technician:

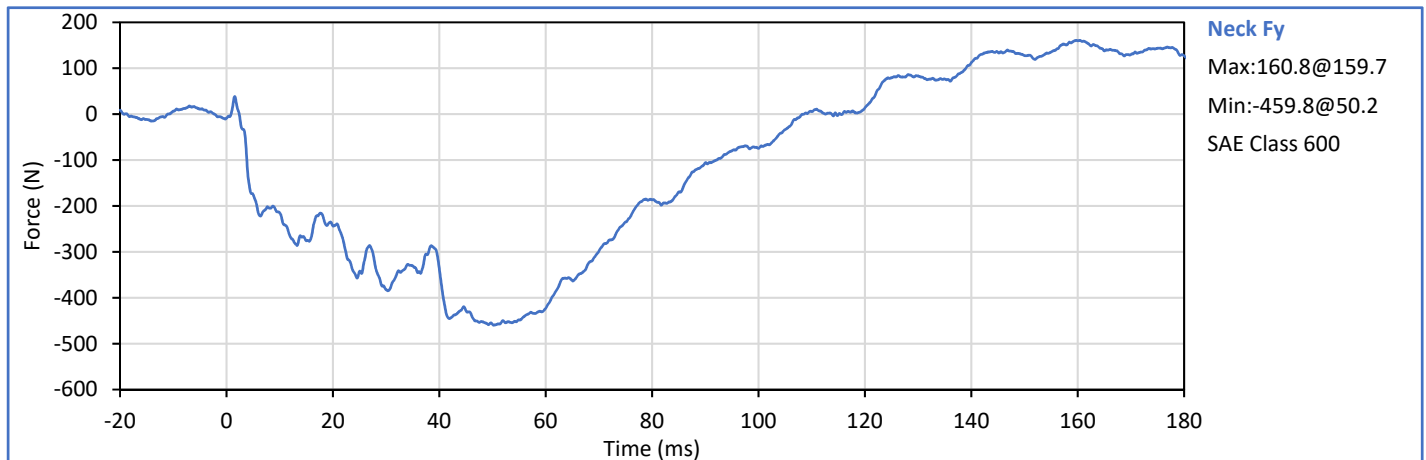
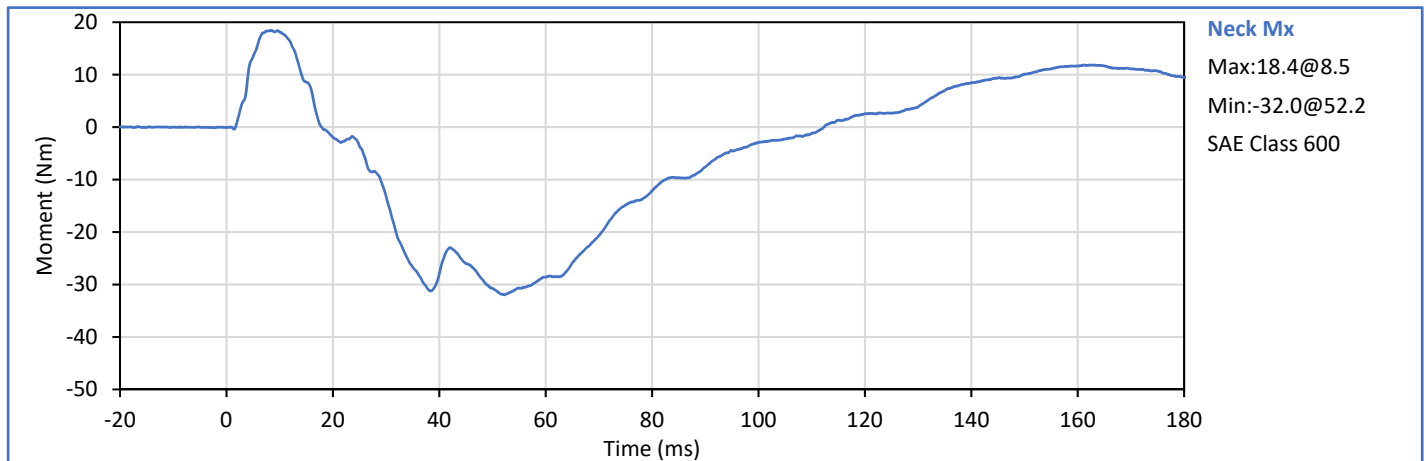
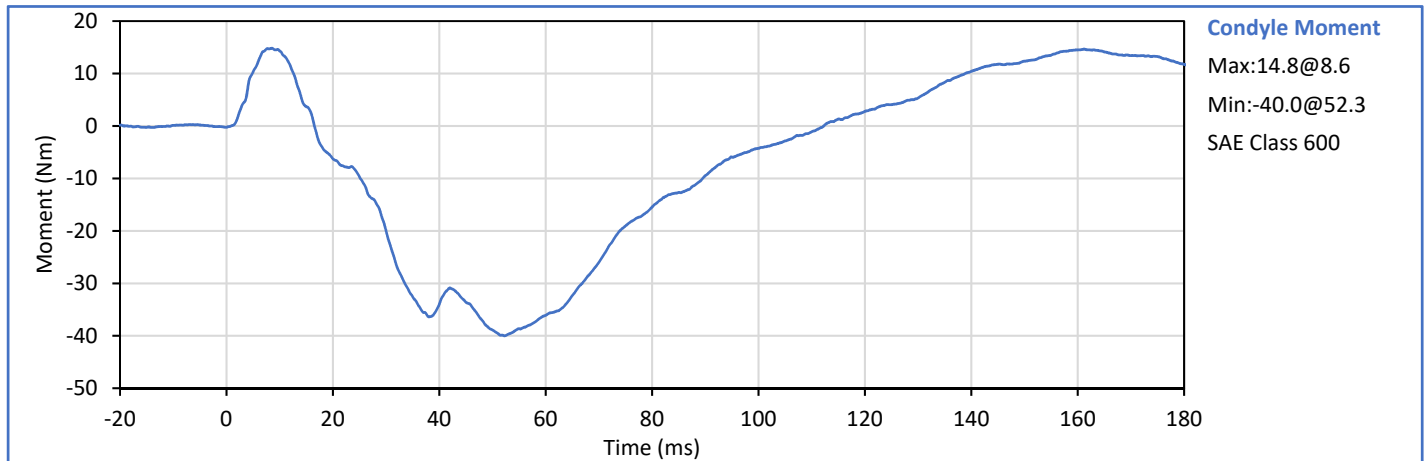
J. Hernandez

J. Hernandez

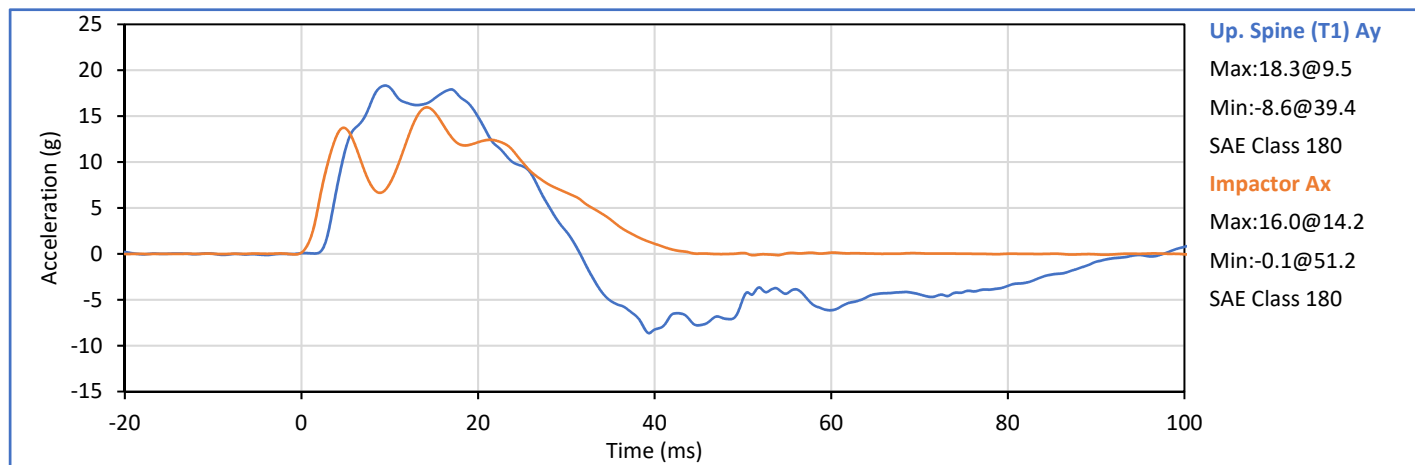
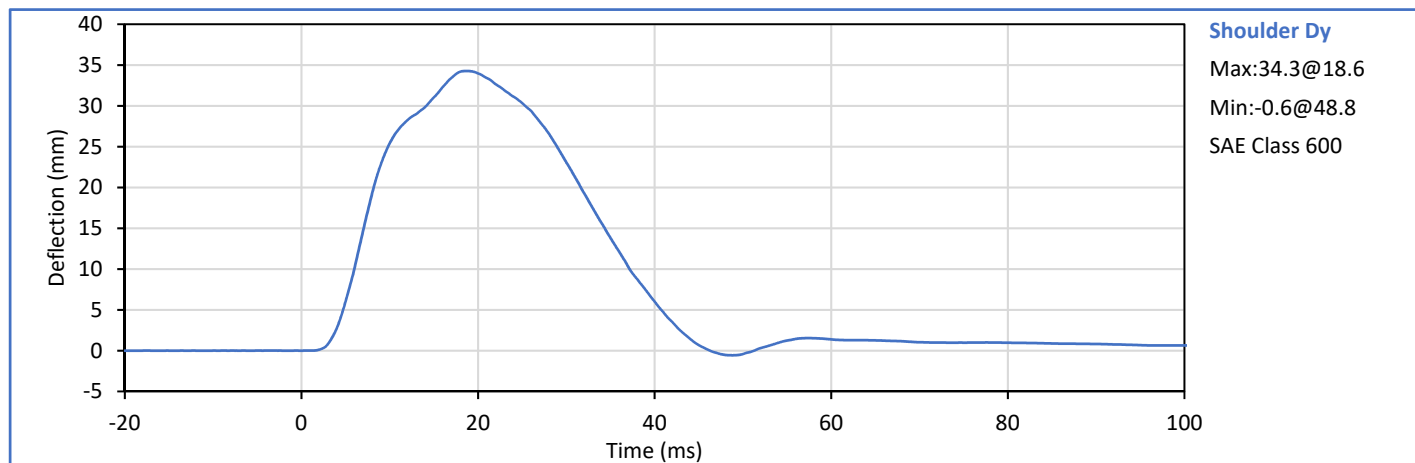
Approved By:

P. Puzzuto

P. Puzzuto



Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Humidity	%	10	70	25	Pass
Impactor Velocity	m/s	4.20	4.40	4.29	Pass
Peak Shoulder Dy	mm	28.0	37.0	34.3	Pass
Peak Upper Spine (T1) Ay	g	17.0	22.0	18.3	Pass
Peak Impactor Ax	g	13.0	18.0	16.0	Pass
Overall Test Results					Pass



Technician:

J. Hernandez

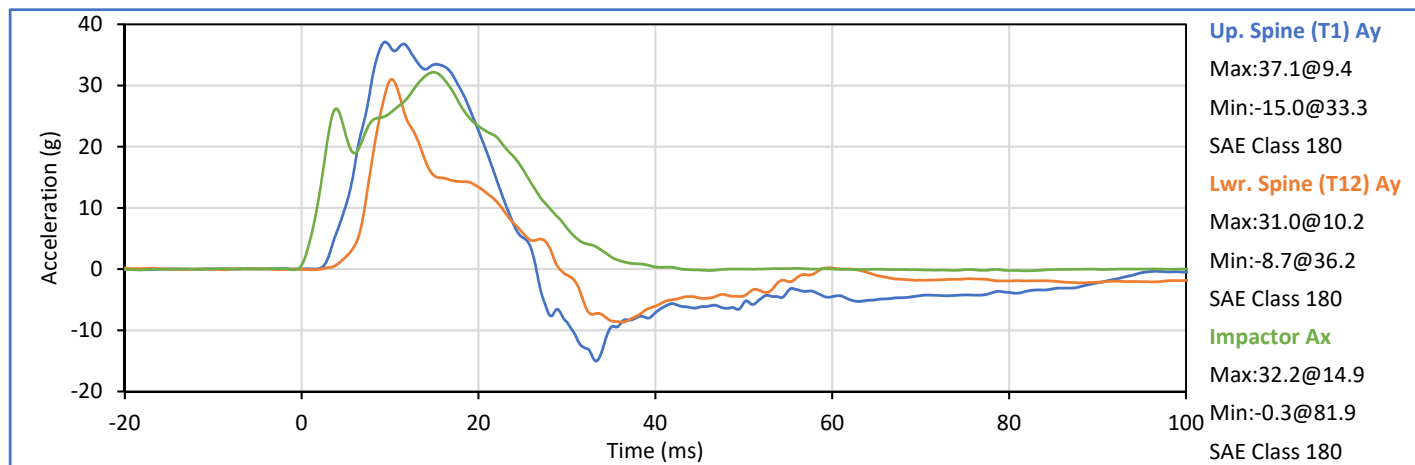
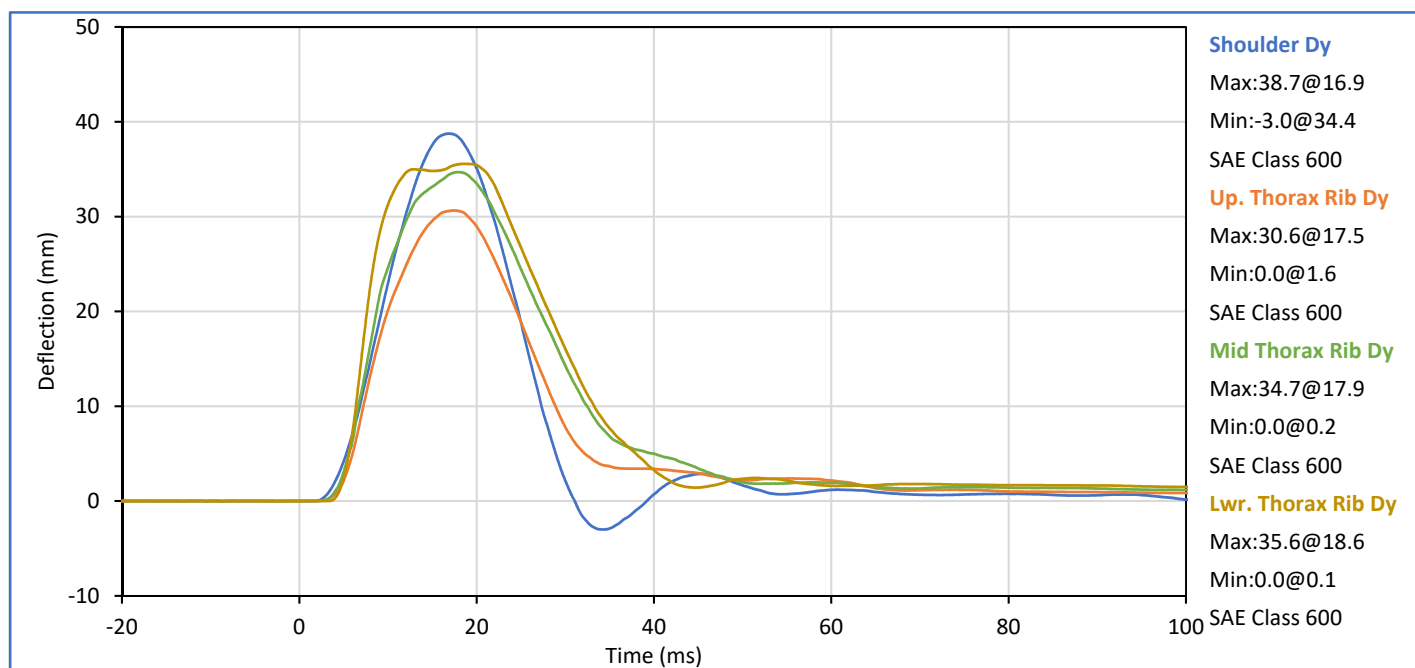
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Humidity	%	10	70	25	Pass
Impactor Velocity	m/s	6.60	6.80	6.67	Pass
Peak Shoulder Dy	mm	31.0	40.0	38.7	Pass
Peak Upper Rib Dy	mm	25.0	32.0	30.6	Pass
Peak Middle Rib Dy	mm	30.0	36.0	34.7	Pass
Peak Lower Rib Dy	mm	32.0	38.0	35.6	Pass
Peak Upper Spine (T1) Ay	g	34.0	43.0	37.1	Pass
Peak Lower Spine (T12) Ay	g	29.0	37.0	31.0	Pass
Peak Impactor Ax	g	30.0	36.0	32.2	Pass
Overall Test Results				Pass	



Technician:

J. Hernandez

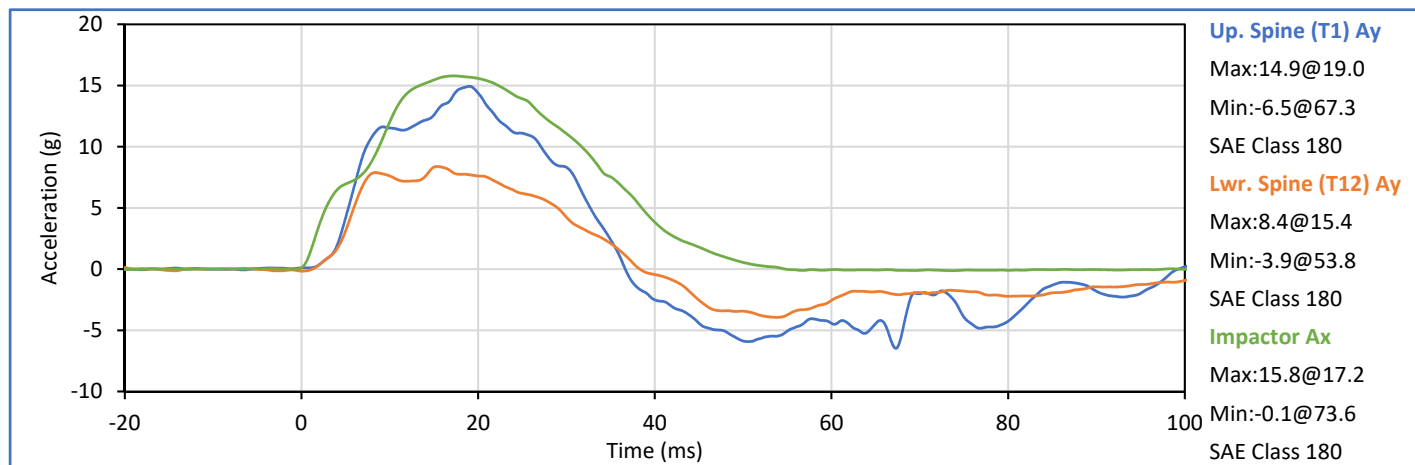
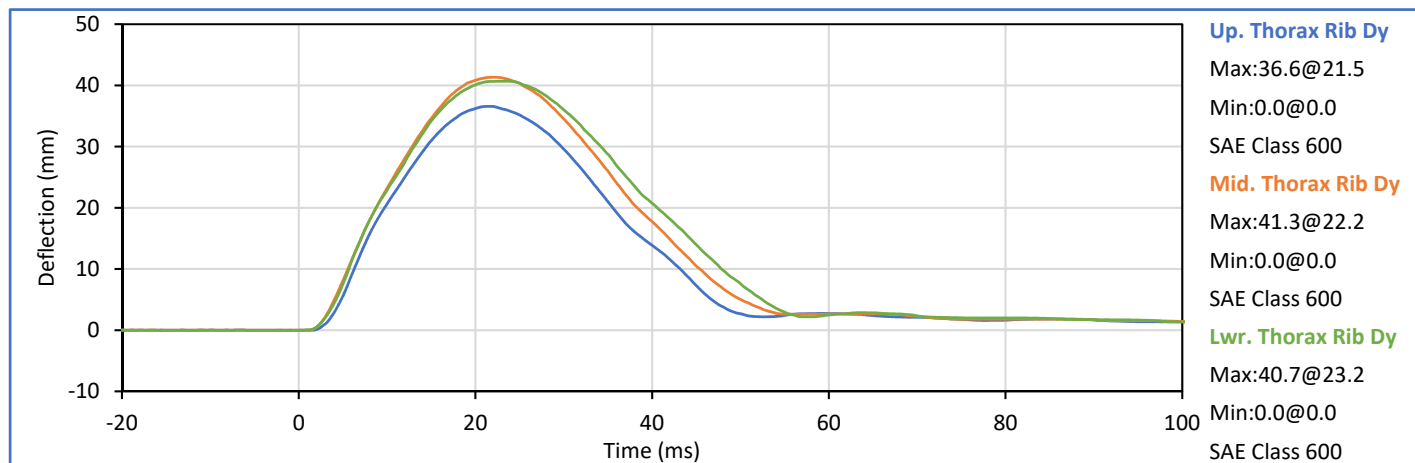
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Humidity	%	10	70	25	Pass
Impactor Velocity	m/s	4.20	4.40	4.31	Pass
Peak Upper Rib Dy	mm	32.0	40.0	36.6	Pass
Peak Middle Rib Dy	mm	39.0	45.0	41.3	Pass
Peak Lower Rib Dy	mm	35.0	43.0	40.7	Pass
Peak Upper Spine (T1) Ay	g	13.0	17.0	14.9	Pass
Peak Lower Spine (T12) Ay	g	7.0	11.0	8.4	Pass
Peak Impactor Ax	g	14.0	18.0	15.8	Pass
Overall Test Results				Pass	Pass



Technician:

J. Hernandez

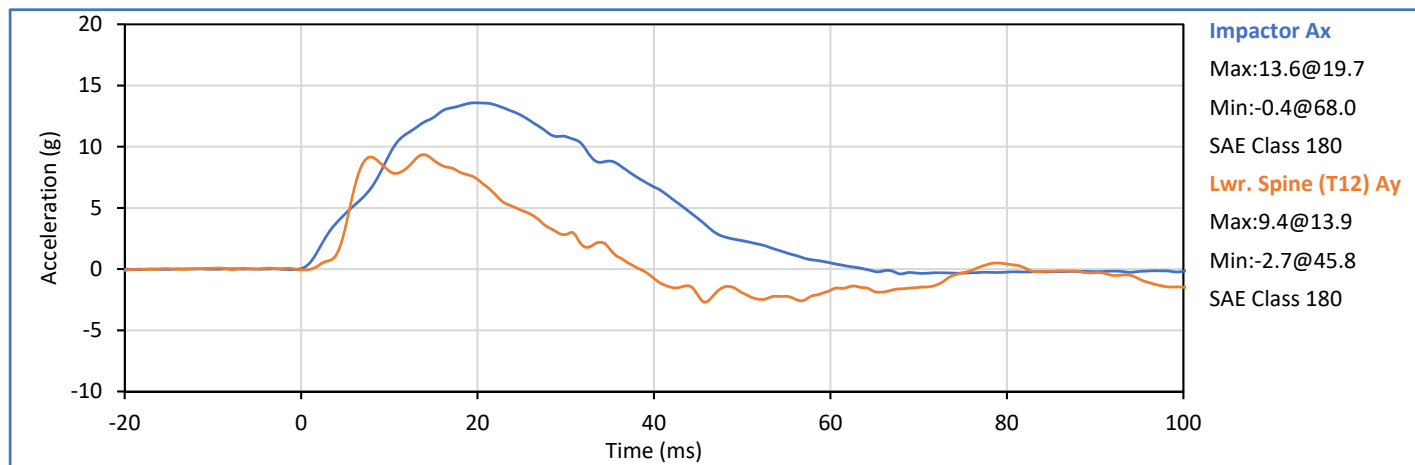
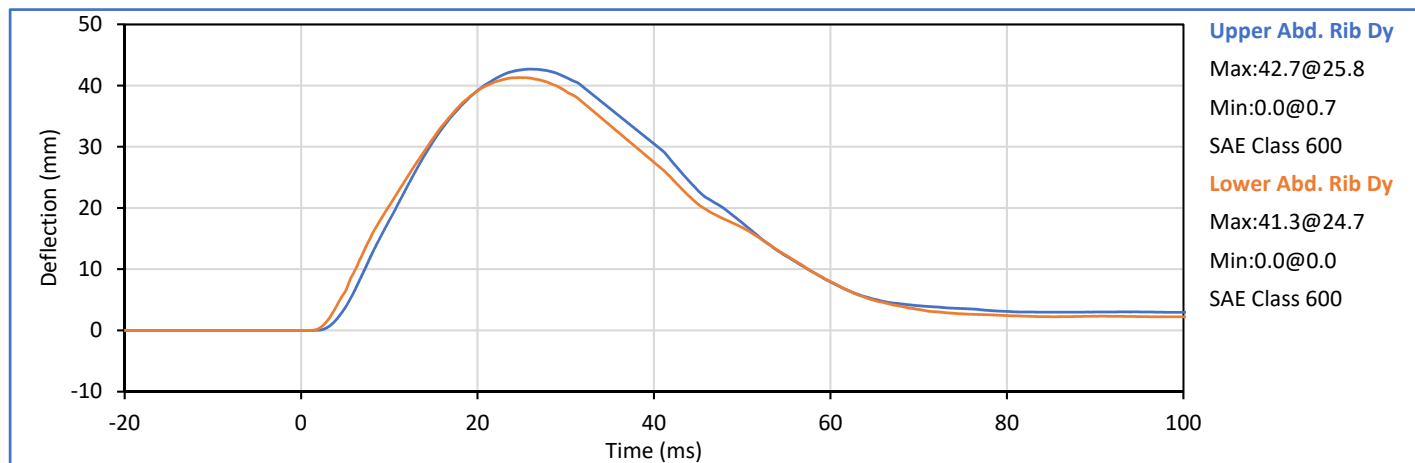
J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.7	Pass
Laboratory Humidity	%	10	70	25	Pass
Impactor Velocity	m/s	4.20	4.40	4.32	Pass
Peak Upper Abdomen Rib Dy	mm	36.0	47.0	42.7	Pass
Peak Lower Abdomen Rib Dy	mm	33.0	44.0	41.3	Pass
Peak Lower Spine T12 Ay	mm	9.0	14.0	9.4	Pass
Peak Impactor Ax	g	12.0	16.0	13.6	Pass
Overall Test Results					Pass



Technician:

J. Hernandez

J. Hernandez

Approved By:

P. Puzzuto

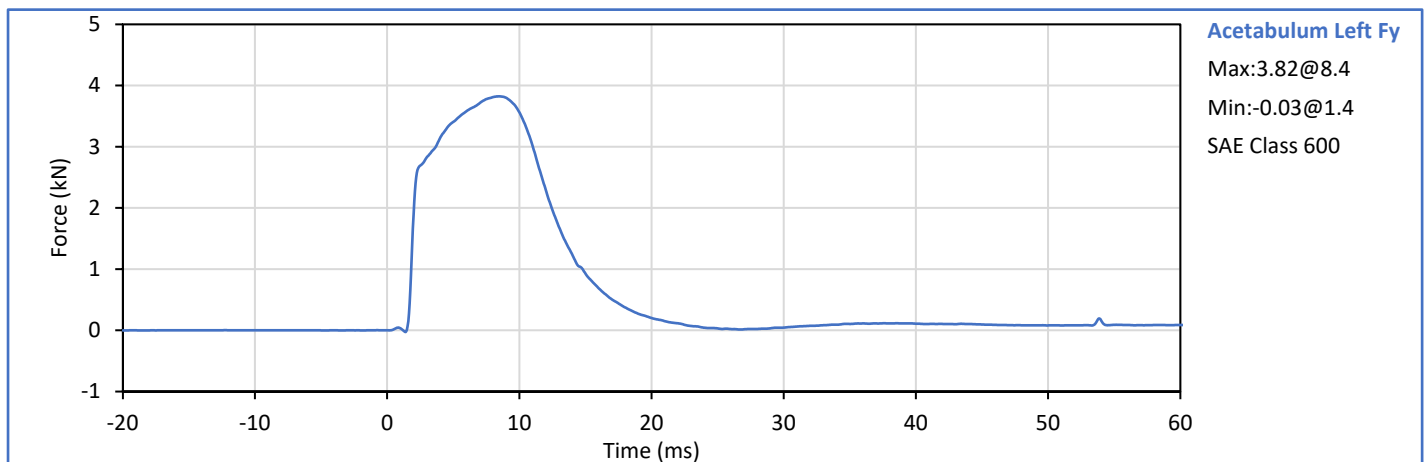
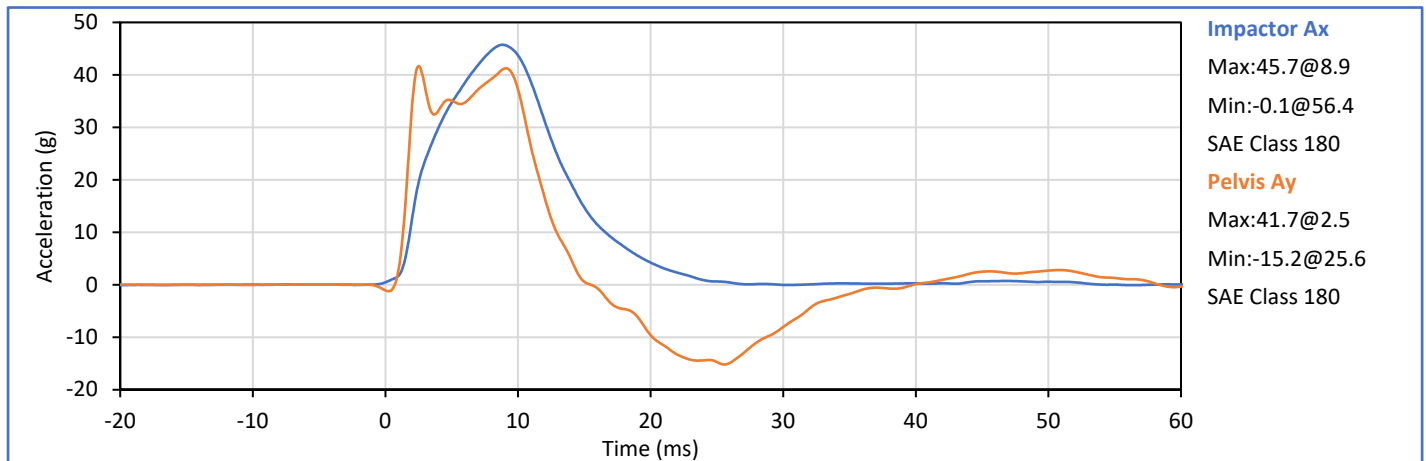
P. Puzzuto

ATD Serial No.: 308

Test Date: 2021-03-23

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.8	Pass
Laboratory Humidity	%	10	70	28	Pass
Impactor Velocity	m/s	6.60	6.80	6.72	Pass
Peak Acetabulum Fy	kN	3.60	4.30	3.82	Pass
Pelvis Ay after 6ms	g	34.0	42.0	41.3	Pass
Peak Impactor Ax	g	38.0	47.0	45.7	Pass
Overall Test Results				Pass	Pass

Pelvis Plug S/N: 14043



Technician:

J. Hernandez

J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

ATD Serial No.: 308

Test Date: 2021-03-23

Pelvis Plug S/N: 14043



SID-IIs Pelvis Plug Certification Test

Plug S/N 14043

Test Number 13517

Report Number 13562

Test Date 5/22/2020 1:14:48 PM

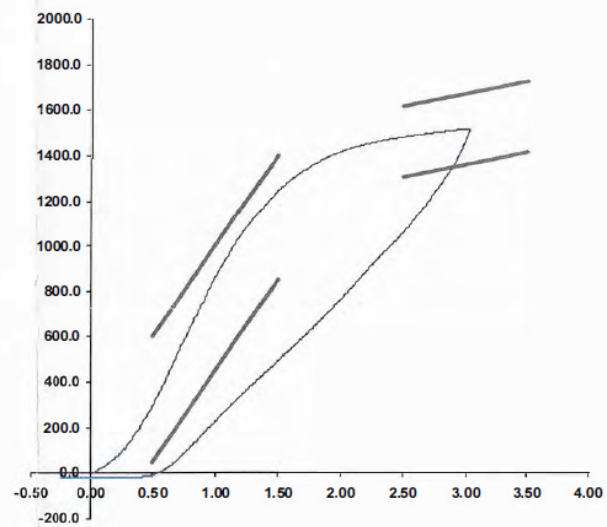
	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	306.68	50.00	600.00
Force @ 1.5 mm (N)	1,246.63	850.00	1,400.00
Force @ 2.5 mm (N)	1,483.15	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,516.15	1,361.00	1,673.00

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 22-May-20
SACO Research

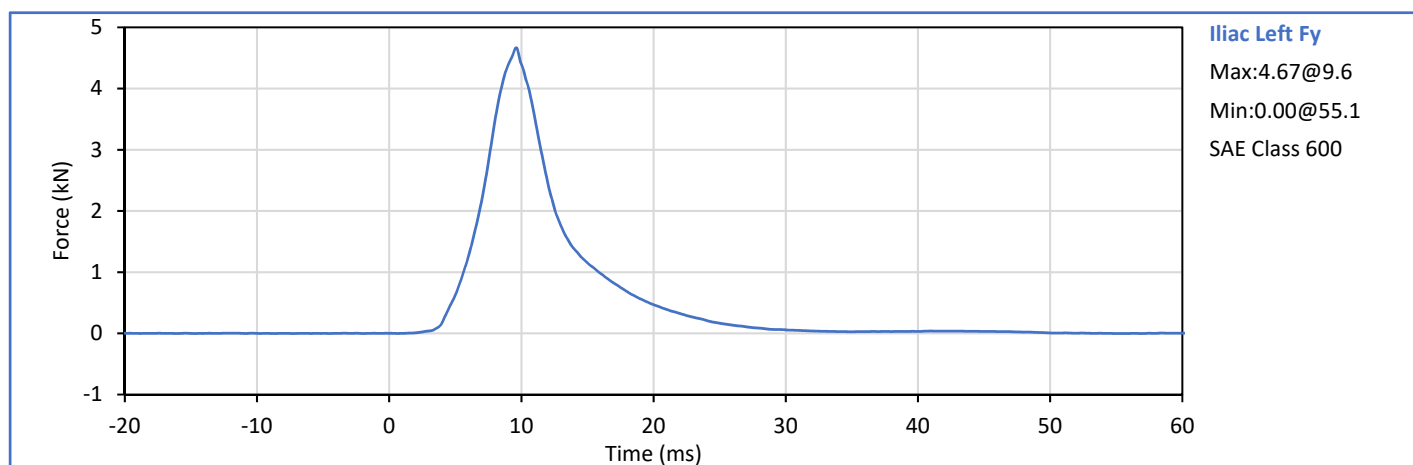
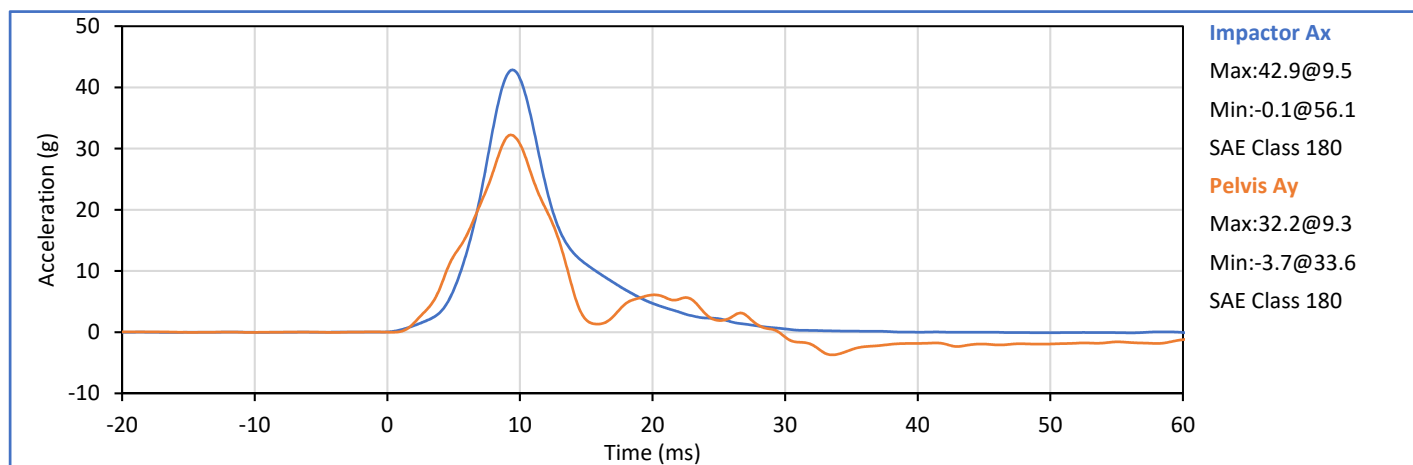
By: DC Date: 5-22-2020

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

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.1	Pass
Laboratory Humidity	%	10	70	30	Pass
Impactor Velocity	m/s	4.20	4.40	4.33	Pass
Peak Iliac Fy	kN	4.10	5.10	4.67	Pass
Pelvis Ay after 6ms	g	28.0	39.0	32.2	Pass
Peak Impactor Ax	g	36.0	45.0	42.9	Pass
Overall Test Results				Pass	Pass

Pelvis Plug S/N: 12228 *

* Plug is not impacted and remains certified



Technician:

J. Hernandez

J. Hernandez

Approved By:

P. Puzzuto

P. Puzzuto

APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 - Driver ATD Instrumentation

Sensor Location	Sensor S\N	Mfr	Model	Cal Date
Head Acceleration X Primary	P63980	Endevco	7264C-2k	2021-01-06
Head Acceleration Y Primary	P58861	Endevco	7264C-2k	2021-01-06
Head Acceleration Z Primary	P51261	Endevco	7264C-2k	2021-01-06
Head Acceleration X Redundant	P58808	Endevco	7264C-2k	2021-01-06
Head Acceleration Y Redundant	P63310	Endevco	7264C-2k	2021-01-06
Head Acceleration Z Redundant	P49189	Endevco	7264C-2k	2021-01-06
Head Rotation Rate X	ARS11393	DTS	ARS PRO-18k (2kHz)	2020-08-04
Head Rotation Rate Y	ARS13119	DTS	ARS PRO-18k (2kHz)	2020-08-04
Head Rotation Rate Z	ARS13586	DTS	ARS PRO-18k (2kHz)	2020-08-04
Upper Thorax Rib Deflection Y	1249	Servo	08TCI-3725	2021-01-05
Middle Thorax Rib Deflection Y	1219	Servo	08TCI-3725	2021-01-05
Lower Thorax Rib Deflection Y	1221	Servo	08TCI-3725	2021-01-05
Upper Abdomen Rib Deflection Y	1252	Servo	08TCI-3725	2021-01-05
Lower Abdomen Rib Deflection Y	1283	Servo	08TCI-3725	2021-01-05
Lower Spine T12 Acceleration X	P52108	Endevco	7264C-2k	2021-01-06
Lower Spine T12 Acceleration Y	P63970	Endevco	7264C-2k	2021-01-06
Lower Spine T12 Acceleration Z	P51712	Endevco	7264C-2k	2021-01-06
Iliac Wing Impact Side Force Y	272 Fy (Iliac)	R.A. Denton	3228J	2020-07-17
Acetabulum Impact Side Force Y	260 Fy (Acetabulum)	R.A. Denton	3249J	2020-07-17

Table 2 - Vehicle Instrumentation

Sensor Location	Sensor S\N	Mfr	Model	Cal Date
Vehicle CG Ax	A361340	MSI	52F-2k	2020-10-21
Vehicle CG Ay	A361475	MSI	52F-2k	2020-10-21
Vehicle CG Az	A361467	MSI	52F-2k	2020-10-21
Left Floor Sill Ay	A361307	MSI	52F-2k	2020-10-21
A-Pillar Sill Ay	A361315	MSI	52F-2k	2020-10-21
A-Pillar Low Ay	A361351	MSI	52F-2k	2020-10-21
A-Pillar Mid Ay	A361479	MSI	52F-2k	2020-10-21
B-Pillar Sill Ay	A361498	MSI	52F-2k	2020-10-19
B-Pillar Low Ay	A361322	MSI	52F-2k	2020-10-21
B-Pillar Mid Ay	A361471	MSI	52F-2k	2020-10-21
Driver Seat Track at H-Point Ay	A361486	MSI	52F-2k	2020-10-19
Engine Top Ax	A361489	MSI	52F-2k	2020-10-19
Engine Top Ay	A361491	MSI	52F-2k	2020-10-19
Firewall Ay	A361502	MSI	52F-2k	2020-10-19
Right Roof Ay	A361492	MSI	52F-2k	2020-10-19
Right Floor Sill Ay	A361490	MSI	52F-2k	2020-10-19
Rear Floorpan Ax	A361470	MSI	52F-2k	2020-10-21
Rear Floorpan Ay	A361468	MSI	52F-2k	2020-10-21

Table 3 - Barrier Pole Instrumentation

Sensor Location	Sensor S\N	Mfr	Model	Cal Date
Barrier Pole 01 Fx	19461A	Interface	1220FS-50k	2020-03-18
Barrier Pole 02 Fx	131822A	Interface	1220AF-50k	2020-03-18
Barrier Pole 03 Fx	131816A	Interface	1220AF-50k	2020-03-18
Barrier Pole 04 Fx	19325	Interface	1220FS-50k	2020-03-18
Barrier Pole 05 Fx	131827A	Interface	1220AF-50k	2020-03-18
Barrier Pole 06 Fx	19340	Interface	1220FS-50k	2020-03-18
Barrier Pole 07 Fx	19267	Interface	1220FS-50k	2020-03-18
Barrier Pole 08 Fx	19466A	Interface	1220FS-50k	2020-03-18