REPORT NUMBER: TWG-KAR-19-004

SIDE AIRBAG OCCUPANT RISK PROGRAM
OCCUPANT OUT-OF-POSITION TESTS

BAYERISCHE MOTOREN WERKE AG

2019 BMW X3 SDRIVE30I 5-DOOR MPV

NHTSA NUMBER: M20194102TWG2

PREPARED BY:

APPLUS+ IDIADA KARCO ENGINEERING, LLC.

9270 HOLLY ROAD

ADELANTO, CA 92301

AUGUST 23, 2019

FINAL REPORT

PREPARED FOR:

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This final test report was prepared for the U.S. Department of Transportation, Alpha Technology Associate, Inc., in response to Contract Number DTNH22-13-D-00311L.

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Date of Acceptance

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Final Report of New Car Assessment Program Side Airbag Out-of-Position Testing of 2019 BMW X3 sDrive30i 5-Door MPV NHTSA No. M20194102TWG2	August 23, 2019
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15. Supplementary Notes

16. Abstract

A side airbag out of position test was conducted on the subject 2019 BMW X3 sDrive30i 5-Door MPV in accordance with the specifications of the Office of Crashworthiness Standards SAB OOP NCAP Laboratory Test Procedure for the generation of consumer information on vehicle side airbag protection. The test was conducted at the Applus+ IDIADA KARCO Engineering, LLC. facility in Adelanto, California on August 9, 2019.

The curtain and torso/pelvis side airbags were deployed and responses were measured on a Hybrid III 6-year old child dummy. Three high speed cameras, and one real time camera recorded the event. The ambient temperature at the time of airbag deployment was 22.7°C

Section 3.3.5.1 - HIII 6-Year Old Child Dummy - P2			
Measurement Description	**Units**	**IARV**	**Result**
Head Injury Criteria (HIC_{15})	N/A	723	1.5
Nij	N/A	1	0.16
Upper Neck Tension	N	1490	344.9
Upper Neck Compression	N	1820	-266.5

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New Car Assessment Program (NCAP) Side Airbag Out-of-position Technical Working Group (TWG)	Copies of this report are available from the following: National Highway Traffic Safety Administration Technical Information Services 1200 New Jersey Ave, SE Washington, DC 20590 Email: tis@nhtsa.dot.gov FAX: 202-493-2833

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PURPOSE AND SUMMARY OF TEST

PURPOSE

This occupant out-of-position static side airbag deployment test is part of the Technical Working Group Occupant Injury Risk from Deploying Side Airbags Testing Program sponsored by Alpha Technology Associate, Inc. under Contract No. DTNH22-13-D-00311L. The purpose of this test was to obtain occupant injury data for a side airbag deployment.

The occupant out-of-position (OOP) side airbag test was conducted in accordance with the Technical Working Group Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

SUMMARY

The effects of a roof mounted curtain airbag and a seat mounted torso/pelvis airbag deployment in a 2019 BMW X3 sDrive30i 5-door MPV with an out-of-position Hybrid III 6-year old crash test dummy were evaluated. The test was performed at Applus+ IDIADA KARCO Engineering, LLC. on August 9, 2019. Pre- and post-test photographs of the vehicle and dummy can be found in Appendix A.

Three (3) high-speed digital cameras and one (1) real time camera were used to document the deployment of the airbags. Camera locations and other pertinent camera information can be found on Data Sheet No.1 and Data Sheet No.6.

A 6-year old anthropomorphic test device (ATD) was placed in the right front passenger seating position with its arms hanging at its sides on a foam block, facing inboard with its legs extended according to the dummy placement instructions (3.3.5.1) in the July 2003 Revision of the Technical Working Group's 'Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags'.

The 6-year old ATD was instrumented with head tri-axial accelerometers, upper and lower neck force, and moment transducers.

The airbags were deployed and fifteen (15) channels of data were recorded using a data acquisition system. Appendix B contains dummy response data traces. Appendix C contains the instrumentation data channel assignments. Appendix D contains ATD calibration sheets.

Orientation of the 6-year old dummy was with the dummy facing inboard. The seat was set in mid position. The seat was not tested in the rearmost position to maximize the interaction and contact between the dummy and airbag. The dummy was placed with its arms hanging at its sides on the foam block facing inboard with its legs extended. The dummy's pelvis was slid outboard until contact was made with the door panel while keeping the head in a neutral orientation. The center of gravity of the head was centered in the deployment trajectory of the airbag. The dummy's arms were bent at the elbow until the fingers just touch the booster seat. This orientation complies with section 3.3.5.1 of the Technical Working Group (TWG) recommendation in the Recommended procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

The passenger side door remained closed during the test and was operable after the airbag deployed.

The 6-year old dummy's visible contact points were as follows: The ATD's head contacted the window.

The occupant data is summarized below:

Measurement Description	Units	Passenger ATD (HIII 3YO)	
		IARV	Result
Head Injury Criteria (HIC15)	N/A	723	1.5
Upper Neck Nij	N/A	1	0.16
Upper Neck Peak Tension	N	1490	344.9
Upper Neck Peak Compression	N	1820	-266.5

SECTION 2

OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

Test Vehicle: 2019 BMW X3 sDrive30i 5-Door MPV NHTSA No.: M20194102TWG2

Test Program: TWG 3.3.5.1 Test Date: 08/09/19

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	^oF	^oC	=(Tf -32)/1.8
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf-ft	N•m	1.355

DATA SHEET NO. 1

TEST SUMMARY

Test Vehicle: 2019 BMW X3 sDrive30i 5-Door MPV NHTSA No.: M20194102TWG2

Test Program: TWG 3.3.5.1 Test Date: 08/09/19

TEST DUMMY INFORMATION

Description	Passenger Seat
Dummy Type / Serial No.	6-year old / 186
Head Contact	Curtain Airbag
Chest Contact	Curtain Airbag, Seat Airbag
Abdomen Contact	Seat Airbag
Pelvis Contact	None
Left Knee Contact	None
Right Knee Contact	None

VIDEO COVERAGE

Description	Quantity
High Speed Digital	3
Real Time	1
Total	4

DATA CHANNELS

Description	Quantity
Head Accelerometers	3
Upper Neck Transducers	6
Lower Neck Transducers	6
Total	15

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 BMW X3 sDrive30i 5-Door MPV NHTSA No.: M20194102TWG2

Test Program: TWG 3.3.5.1 Test Date: 08/09/19

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA Number	M20194102TWG2
Model Year	2019
Make	BMW
Model	X3 sDrive30i
Body Style	5-Door MPV
VIN	5UXTR7C53KLF30114
Body Color	Silver
Odometer Reading (km / mi)	71 / 44
Engine Displacement (L)	2.0
Type / No. of Cylinders	Inline 4
Engine Placement	Longitudinal
Transmission Type	Automatic
Transmission Speeds	8
Overdrive	Yes
Final Drive	RWD
Roof Rack	Yes
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	No
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	Jan-19
Vehicle Type	MPV

GVWR (kg)	2330
GAWR Front (kg)	1090
GAWR Rear (kg)	1365

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity	2	3		5	
Capacity Weight (VCW) (kg)				425.0	*A*
DSC x 68.04 (kg)				340.2	*B*
Cargo Weight (RCLW) (kg)				84.8	*A-B*

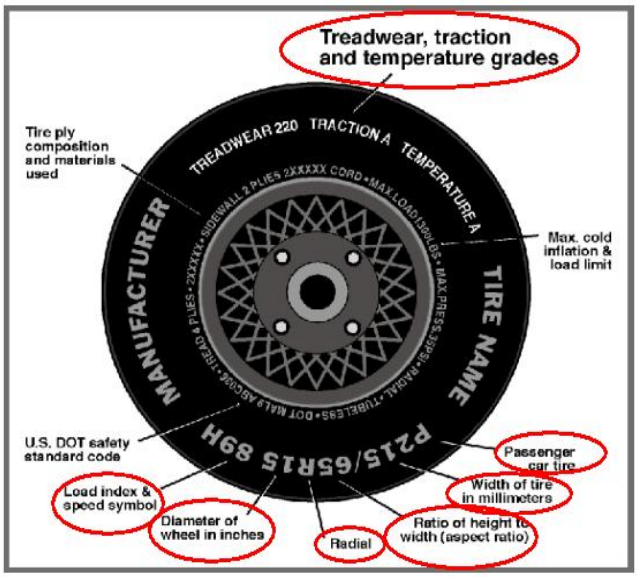
*Vehicle underwent New Car Assessment Program Side MDB Impact Testing on February 13, 2019.

DATA SHEET NO. 2 … (CONTINUED)

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 BMW X3 sDrive30i 5-Door MPV NHTSA No.: M20194102TWG2

Test Program: TWG 3.3.5.1 Test Date: 08/09/19



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Max. Tire Pressure (kpa)	340	340
Cold Pressure (kPa)	220	220
Recommended Tire Size	P245/50R19	P245/50R19
Tire Size on Vehicle	P245/50R19	P245/50R19
Tire Manufacturer	Pirelli	Pirelli
Tire Model	Cinturato	Cinturato
Treadware	500	500
Traction Grade	A	A
Temperature Grade	A	A
Tire Plies Sidewall	1 Rayon	1 Rayon
Tire Plies Body	1 Rayon, 2 Steel, 1 Polyamide	Rayon, 2 Steel, 1 Polyamid
Load Index/Speed Symbol	105H	105H
Tire Material	Rayon, Steel, Polyamide	Rayon, Steel, Polyamide
DOT Safety Code Left	UN 0F V117 3218	1T791BHO
DOT Safety Code Right	UN 0F V117 3218	1T791BHO

DATA SHEET NO. 3

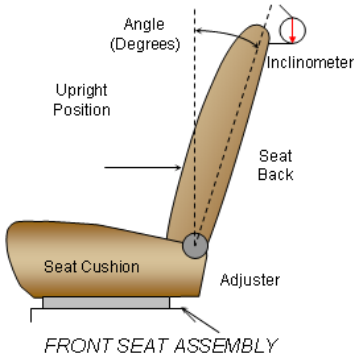
SEAT ADJUSTMENTS

Test Vehicle: 2019 BMW X3 sDrive30i 5-Door MPV NHTSA No.: M20194102TWG2

Test Program: TWG 3.3.5.1 Test Date: 08/09/19

SEAT BACK ANGLE

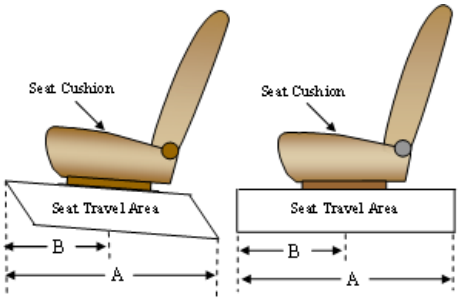
The passenger seat back is positioned per section 3.3.5.1 of the TWG recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags. Seat back angle is measured at the headrest post.



Seating Position	Degrees
Passenger Seat	5.5

SEAT FORE / AFT POSITIONING

The passenger seat track travel is set per section 3.3.5.1 of the TWG recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags. The first or forward most position is counted as zero (0)



Seating Position	Total Fore-Aft Travel		Placed in Position	
	mm	Detents	mm	Detents
Passenger Seat	233		117	

SEAT BELT UPPER ANCHORAGE

Position “H” is the uppermost position, followed by position “M1”. Position “L” is the lowermost position.

Seating Position	Total No. of Positions	Placed in Position
Passenger Seat	Fixed	Fixed

DATA SHEET NO. 4

DUMMY POSITIONING AND AIRBAG DIMENSIONS

Test Vehicle: 2019 BMW X3 sDrive30i 5-Door MPV NHTSA No.: M20194102TWG2

Test Program: TWG 3.3.5.1 Test Date: 08/09/19

DUMMY POSITIONING

Code	Measurement Description	Passenger	
		Length (mm)	Angle (°)
SA	Seat Back Angle		5.5
AN	Top of Airbag Module to Head/Neck Junction	360	90.0
HD	Head CG to Door Panel/ Window	136	0.0
HSC	Head to Seat Back Centerline	140	0.0
HB	Head to B-Pillar (measured from bridge of nose)	310	1.3
HZ	Head to Roof (Z)	257	90.0
HHD	Head to Side Header	400	31.6
ND	Nose to Dash	543	17.9
NS	Nose to Seat Back	390	0.0
NR	Nose to Header	470	29.3
CD	Chest to Dash	490	0.9
CS	Chest to Seat Back (measured to centerline)	298	0.0
RACL	Right Arm to Seat Back Centerline	250	0.0
LACL	Left Arm to Seat Back Centerline	245	0.0
RA	Right Arm to Door Panel	95	0.0
LA	Left Arm to Door Panel	82	0.0
KK	Knee to Knee	130	0.0
TT	Toe to Toe	90	0.0
KSCR	Right Knee to Seat Cushion Centerline	105	0.0
KSCL	Left Knee to Seat Cushion Centerline	105	0.0
	Head Level (X Direction)		4.8
	Head Level (Y Direction)		6.8

AIRBAG DIMENSIONS

Code	Measurement Description	Airbag
		Length (mm)
AMW	Curtain Airbag Module Diameter	30
AML	Curtain Airbag Module Length	238
ABW	Curtain Airbag Width	465
ABL	Curtain Airbag Length	1800
AMW	Torso/Pelvis Airbag Module Diameter	80
AML	Torso/Pelvis Airbag Module Length	40
ABW	Torso/Pelvis Airbag Width	260
ABL	Torso/Pelvis Airbag Length	550

DATA SHEET NO. 5

DUMMY INJURY CRITERIA AND PERFORMANCE DATA

Test Vehicle: 2019 BMW X3 sDrive30i 5-Door MPV NHTSA No.: M20194102TWG2

Test Program: TWG 3.3.5.1 Test Date: 08/09/19

HEAD PEAK ACCELERATIONS / CHEST DEFLECTIONS

Location	Axis	Units	6 Year Old			
			Max	Time	Min	Time
Head CG	X	g	9.8	94.5	-6.1	26.8
Head CG	Y	g	6.9	13.3	-5.9	18.8
Head CG	Z	g	4.1	17.1	-5.8	21.3
Head CG Resultant	N/A	g	10.1	94.4		

UPPER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	6 Year Old			
			Max	Time	Min	Time
Neck Force	X	N	155.7	53.2	-63.2	27.4
Neck Force	Y	N	188.9	20.2	-37.2	213.1
Neck Force	Z	N	344.9	27.4	-266.5	9.1
Neck Force Resultant	N/A	N	356.2	27.4		
Neck Moment	X	Nm	4.8	31.9	-11.0	21.2
Neck Moment	Y	Nm	10.0	20.1	-4.1	33.1
Neck Moment	Z	Nm	9.3	35.7	-2.4	89.8
Neck Moment Resultant	N/A	Nm	15.4	20.4		

LOWER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	6 Year Old			
			Max	Time	Min	Time
Neck Force	X	N	120.0	53.3	-55.1	100.9
Neck Force	Y	N	134.0	22.0	-24.5	32.0
Neck Force	Z	N	308.6	27.8	-146.9	14.8
Neck Force Resultant	N/A	N	311.9	27.8		
Neck Moment	X	Nm	13.2	22.0	-4.8	255.8
Neck Moment	Y	Nm	6.4	14.5	-13.3	53.3
Neck Moment	Z	Nm	9.6	38.9	-2.3	89.9
Neck Moment Resultant	N/A	Nm	16.6	22.5		

HEAD INJURY CRITERIA (HIC15)

Location	6 Year Old			
	HIC15	T^1	T^2	Avg G
Head CG	1.5	91.5	102.8	7.1

UPPER NECK NIJ VALUES

Location	6 Year Old			
	Ntf	Nte	Ncf	Nce
Upper Neck	0.13	0.16	0.15	0.09

DATA SHEET NO. 6

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2019 BMW X3 sDrive30i 5-Door MPV NHTSA No.: M20194102TWG2

Test Program: TWG 3.3.5.1 Test Date: 08/09/19

CAMERA LOCATIONS

No.	Camera View	Location (mm)			Angle (Deg.)	Lens (mm)	Speed (fps)
		X	Y	Z			
1	High Speed Side View	1001	2801	1551	4.1	24	1000
2	High Speed 3/4 View	2391	2001	3703	9.8	50	1000
3	High Speed Front View	5301	1003	5701	10.2	50	1000
4	Real Time	1001	1003	3703	10.2		24

Coordinates: +X = forward of vehicle relative to dummy's head CG

+Y = right of vehicle relative to dummy's head CG

+Z = into ground

APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

FIGURE 1. Right Front ¾ View, As Received

FIGURE 2. Vehicle Certification Label

FIGURE 3. Post-Test Left Front ¾ View of NCAP Side MDB Impact Test

FIGURE 4. Post-Test Left Side View of NCAP Side MDB Impact Test

FIGURE 5. Post-Test Left Rear ¾ View of NCAP Side MDB Impact Test

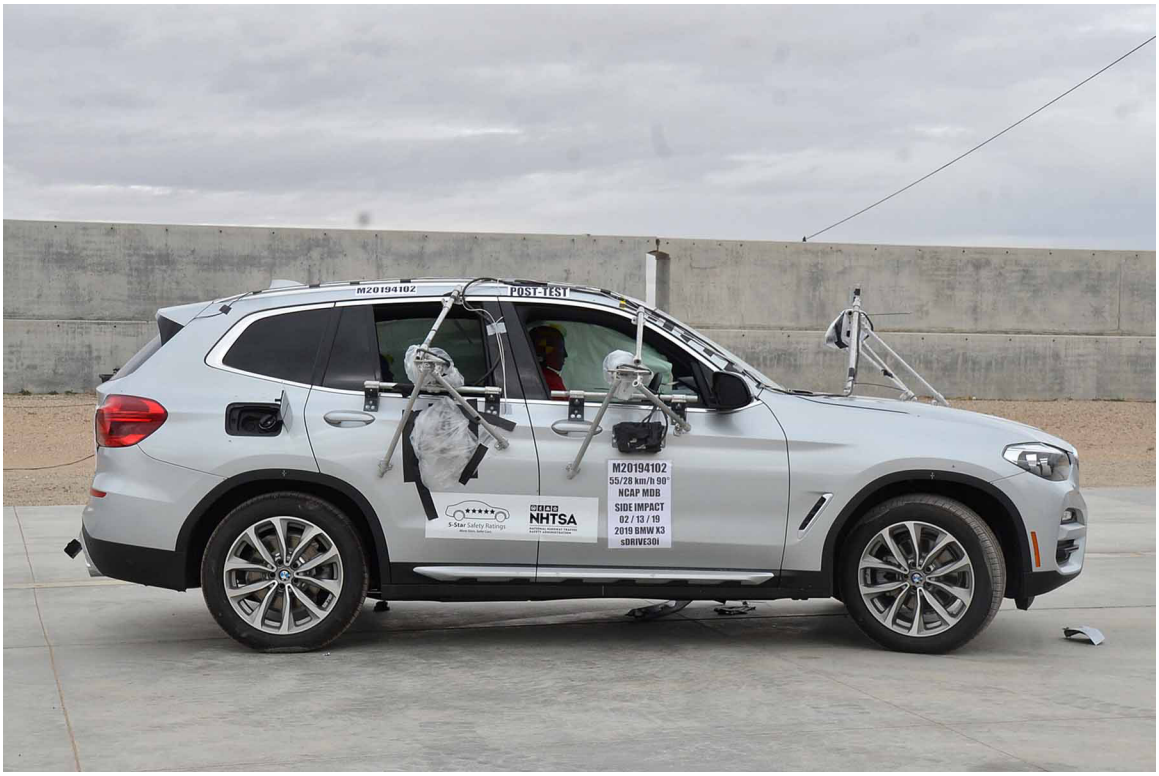


FIGURE 6. Post-Test Right Side View of NCAP Side MDB Impact Test

FIGURE 7. Pre-Test Dummy Position, Left View

FIGURE 8. Post-Test Dummy Position, Left View

FIGURE 9. Pre-Test Dummy Position, ¾ View

FIGURE 10. Post-Test Dummy Position, ¾ View

FIGURE 11. Pre-Test Dummy Position, Front View

FIGURE 12. Post-Test Dummy Position, Front View

FIGURE 13. Pre-Test Dummy Position, Close-Up Front View

FIGURE 14. Post-Test Dummy Position, Close-Up Front View

FIGURE 15. Pre-Test Dummy Position, Close-Up Rear View

FIGURE 16. Post-Test Dummy Position, Close-Up Rear View

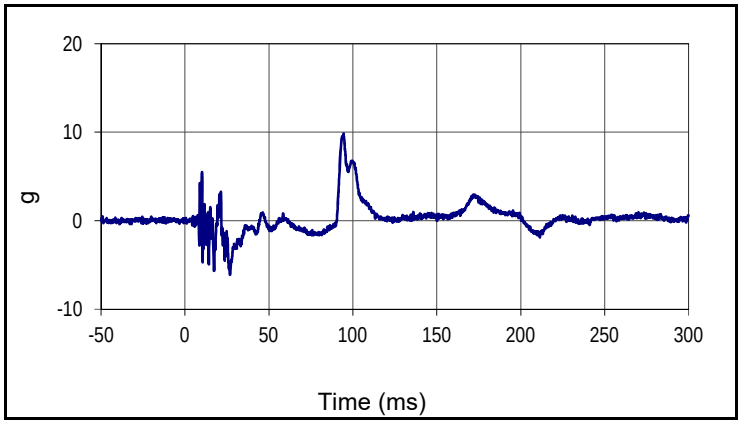
FIGURE 17. Post-Test Airbags, Left Side View

FIGURE 18. Post-Test Airbags, Left Front ¾ View

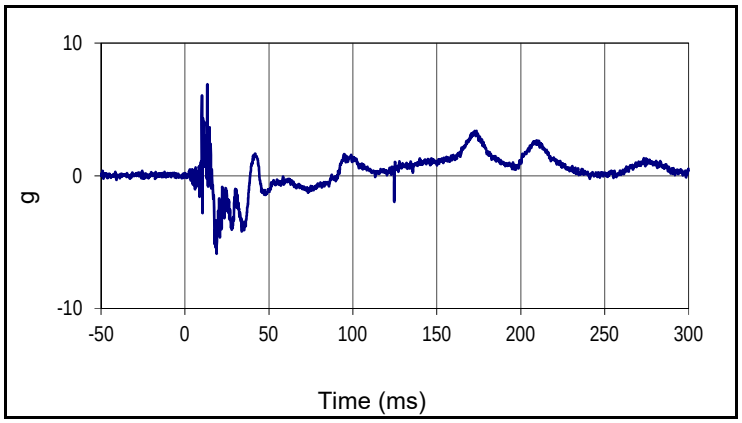
APPENDIX B
DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

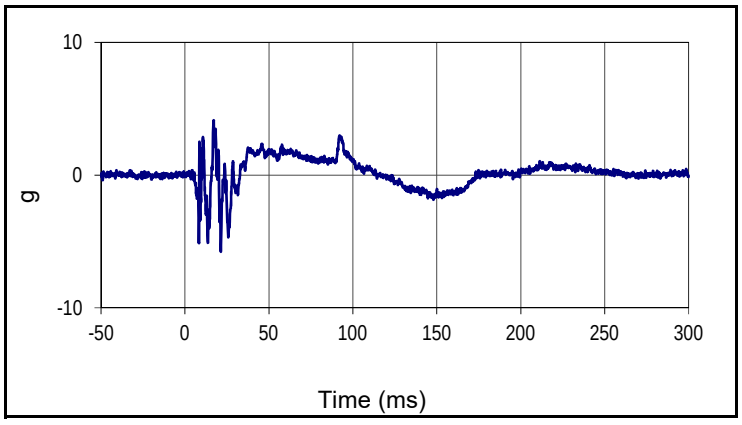
Test Vehicle:	2019 BMW X3 xDrive30i 5-Door MPV	Test Date:	08/09/19
Test Program:	TWG 3.3.5.1	NHTSA No.:	M20194102TWG2



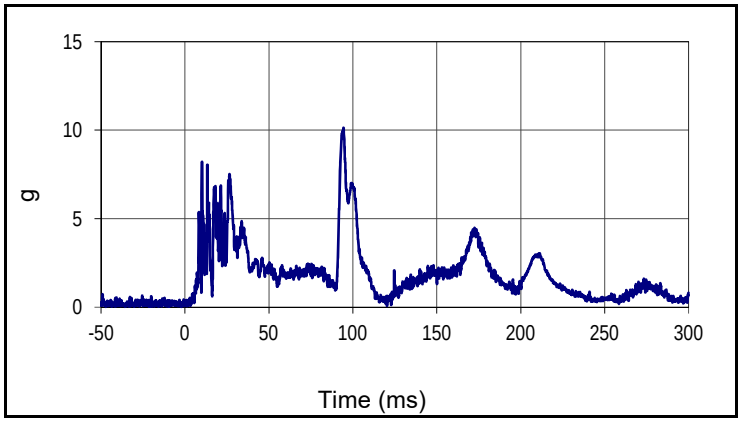
Curve Description			
6 Year Old Head Acceleration X			
Plot No.		SAE Class	Units
001		1000	g
Max	Time	Min	Time
9.8	94.5	-6.1	26.8



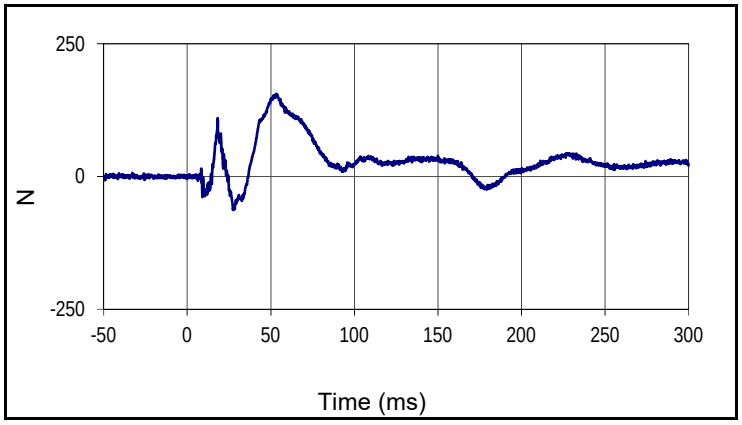
Curve Description			
6 Year Old Head Acceleration Y			
Plot No.		SAE Class	Units
002		1000	g
Max	Time	Min	Time
6.9	13.3	-5.9	18.8



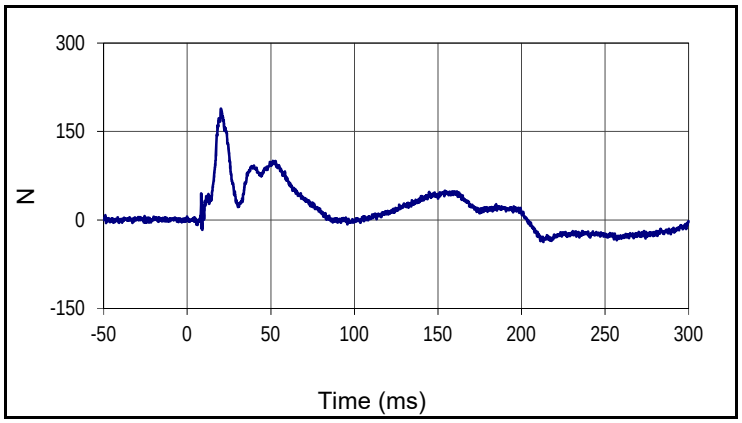
Curve Description			
6 Year Old Head Acceleration Z			
Plot No.		SAE Class	Units
003		1000	g
Max	Time	Min	Time
4.1	17.1	-5.8	21.3



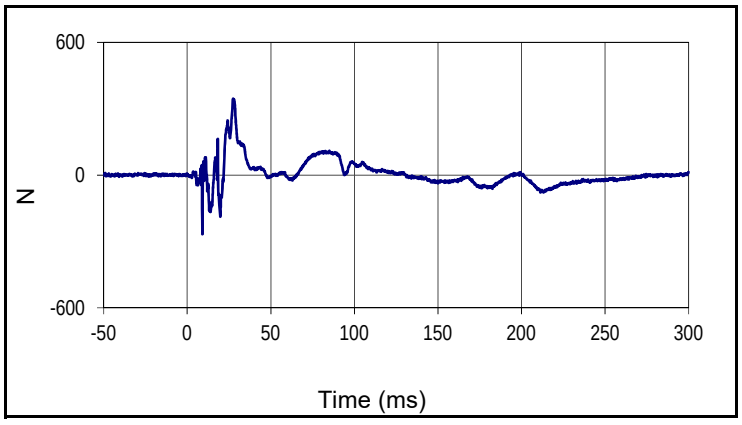
Curve Description			
6 Year Old Head Acceleration Resultant			
Plot No.		SAE Class	Units
004		1000	g
Max	Time	Min	Time
10.1	94.4	0.1	1.2



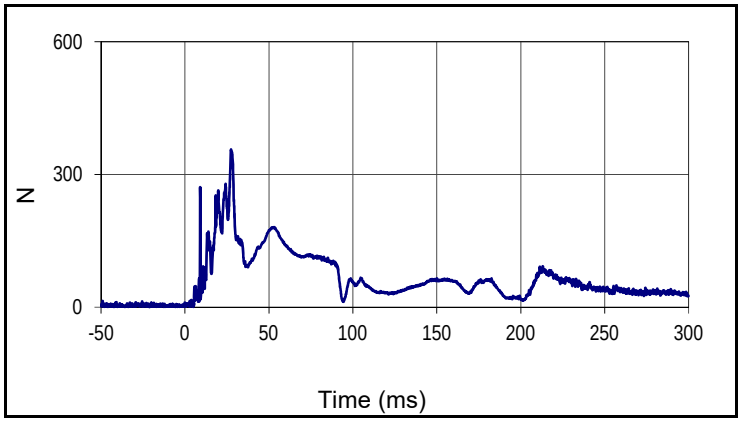
Curve Description			
6 Year Old Upper Neck Force X			
Plot No.		SAE Class	Units
005		1000	N
Max	Time	Min	Time
155.7	53.2	-63.2	27.4



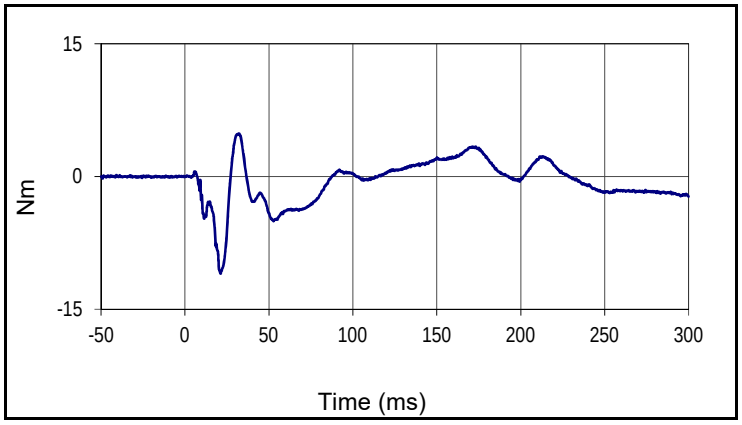
Curve Description			
6 Year Old Upper Neck Force Y			
Plot No.		SAE Class	Units
006		1000	N
Max	Time	Min	Time
188.9	20.2	-37.2	213.1



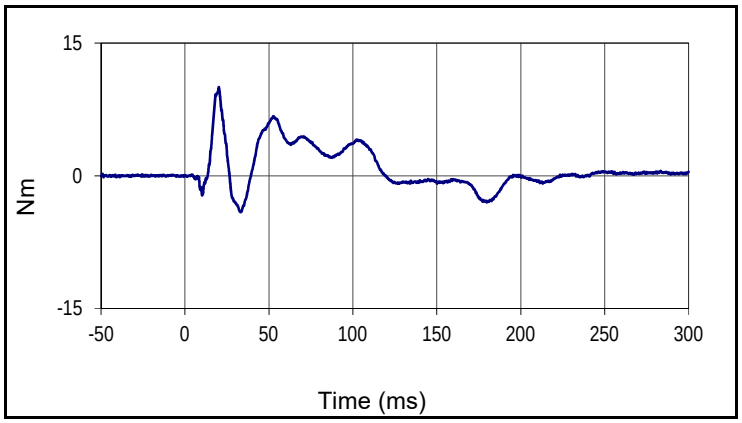
Curve Description			
6 Year Old Upper Neck Force Z			
Plot No.		SAE Class	Units
007		1000	N
Max	Time	Min	Time
344.9	27.4	-266.5	9.1



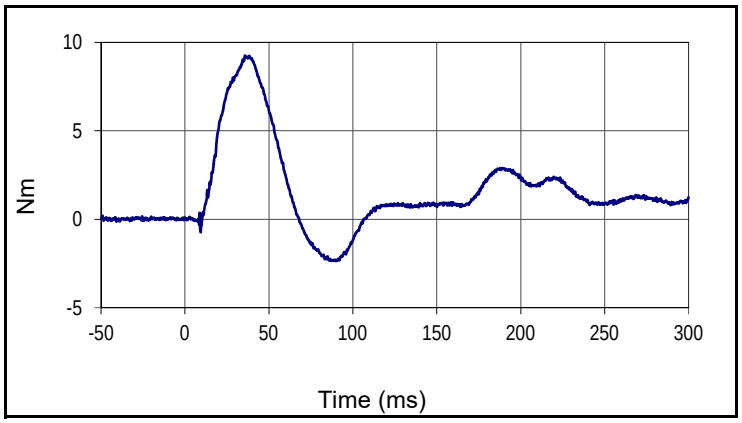
Curve Description			
6 Year Old Upper Neck Force Resultant			
Plot No.		SAE Class	Units
008		1000	N
Max	Time	Min	Time
356.2	27.4	0.5	5.0



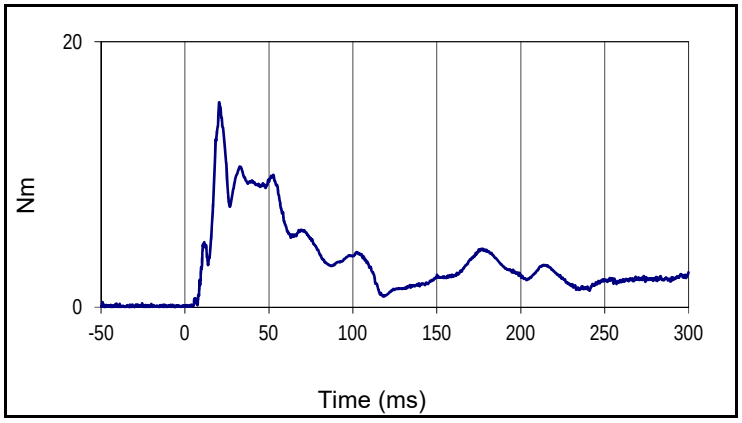
Curve Description			
6 Year Old Upper Neck Moment X			
Plot No.		SAE Class	Units
009		600	Nm
Max	Time	Min	Time
4.8	31.9	-11.0	21.2



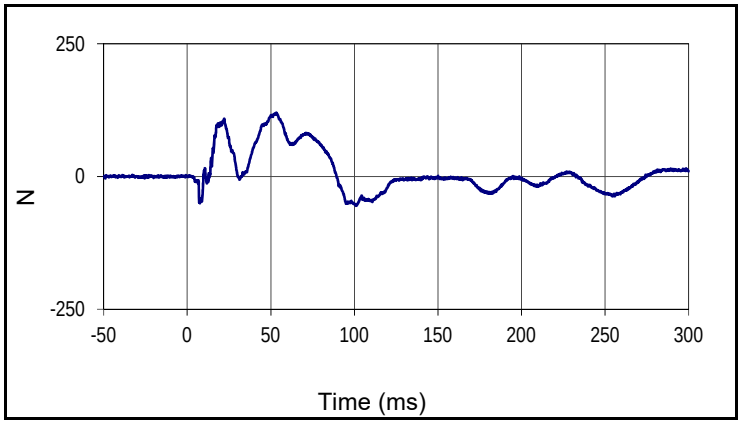
Curve Description			
6 Year Old Upper Neck Moment Y			
Plot No.		SAE Class	Units
010		600	Nm
Max	Time	Min	Time
10.0	20.1	-4.1	33.1



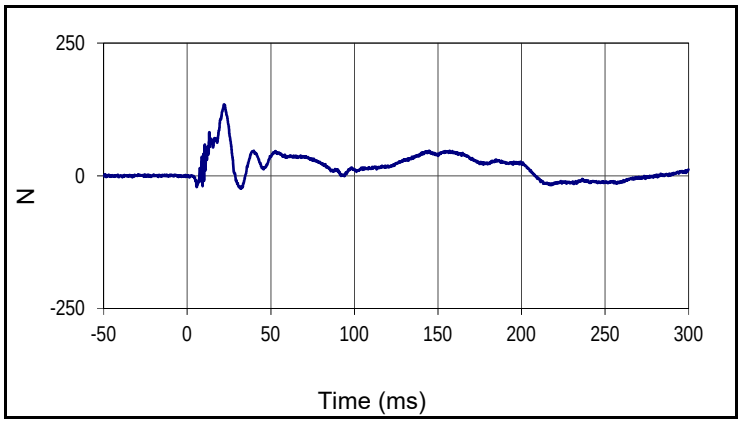
Curve Description			
6 Year Old Upper Neck Moment Z			
Plot No.		SAE Class	Units
011		600	Nm
Max	Time	Min	Time
9.3	35.7	-2.4	89.8



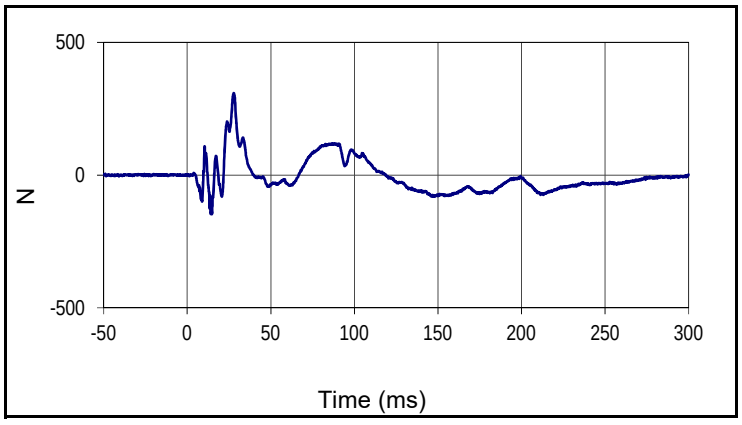
Curve Description			
6 Year Old Upper Neck Moment Resultant			
Plot No.		SAE Class	Units
012		1000	Nm
Max	Time	Min	Time
15.4	20.4	0.0	0.7



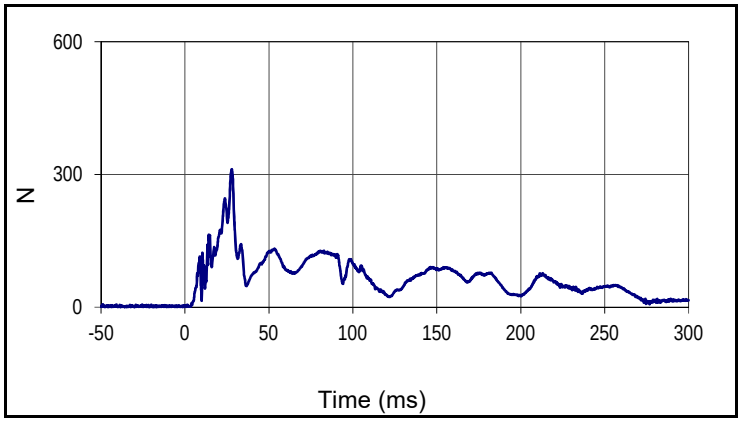
Curve Description			
6 Year Old Lower Neck Force X			
Plot No.		SAE Class	Units
013		1000	N
Max	Time	Min	Time
120.0	53.3	-55.1	100.9



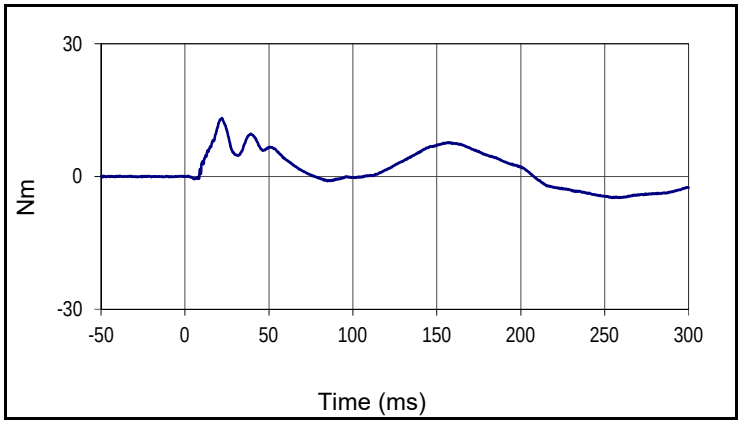
Curve Description			
6 Year Old Lower Neck Force Y			
Plot No.		SAE Class	Units
014		1000	N
Max	Time	Min	Time
134.0	22.0	-24.5	32.0



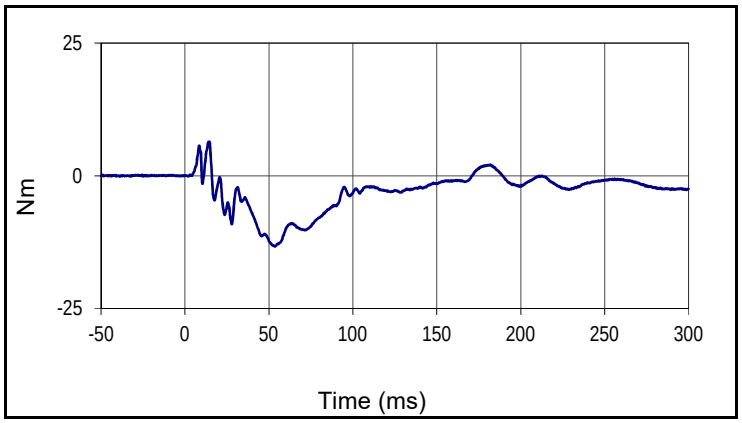
Curve Description			
6 Year Old Lower Neck Force Z			
Plot No.		SAE Class	Units
015		1000	N
Max	Time	Min	Time
308.6	27.8	-146.9	14.8



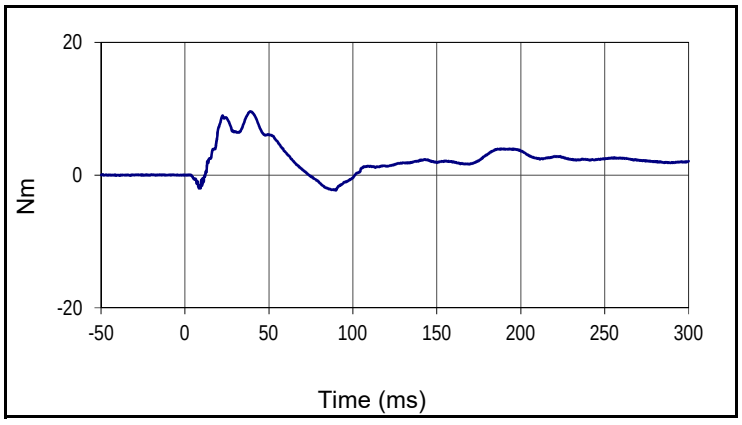
Curve Description			
6 Year Old Lower Neck Force Resultant			
Plot No.		SAE Class	Units
016		1000	N
Max	Time	Min	Time
311.9	27.8	0.8	0.4



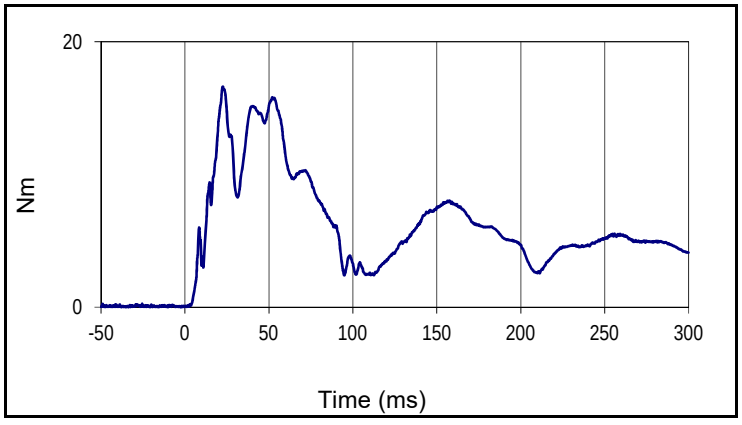
Curve Description			
6 Year Old Lower Neck Moment X			
Plot No.		SAE Class	Units
017		600	Nm
Max	Time	Min	Time
13.2	22.0	-4.8	255.8



Curve Description			
6 Year Old Lower Neck Moment Y			
Plot No.		SAE Class	Units
018		600	Nm
Max	Time	Min	Time
6.4	14.5	-13.3	53.3



Curve Description			
6 Year Old Lower Neck Moment Z			
Plot No.		SAE Class	Units
019		600	Nm
Max	Time	Min	Time
9.6	38.9	-2.3	89.9



Curve Description			
6 Year Old Lower Neck Moment Resultant			
Plot No.		SAE Class	Units
020		600	Nm
Max	Time	Min	Time
16.6	22.5	0.0	1.1

APPENDIX C
ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

APPENDIX C
PRE-TEST ATD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

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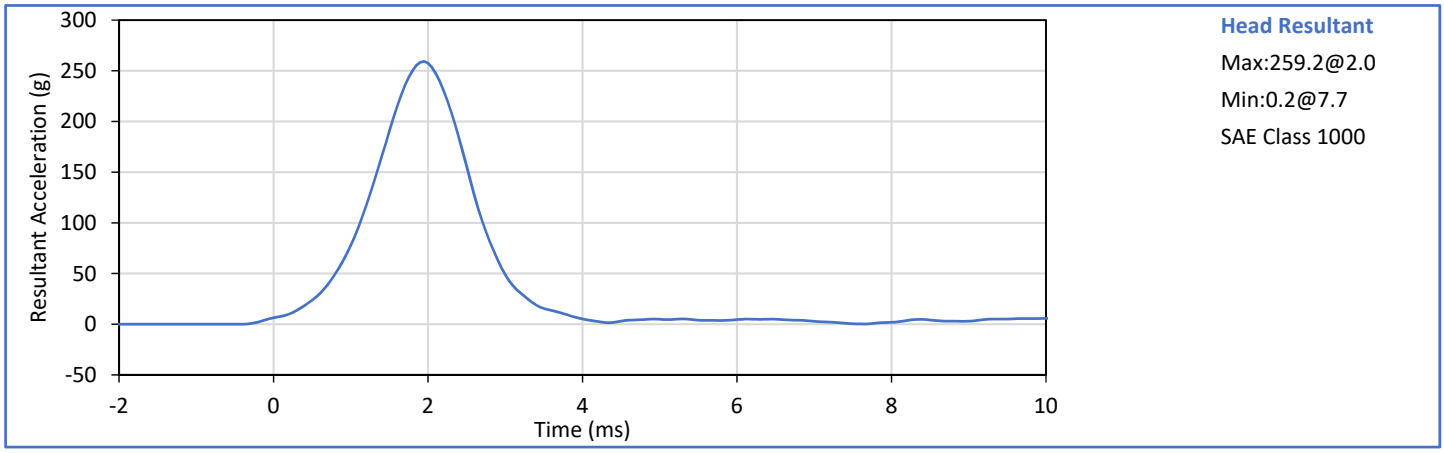
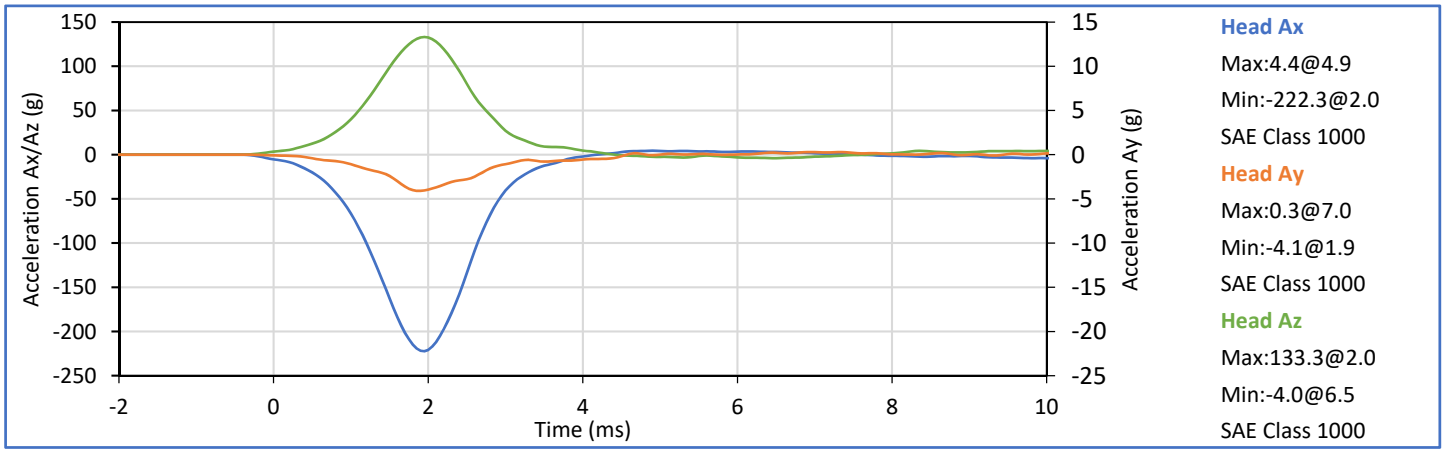
Info@karco.com www.karco.com

Hybrid III 6 Year-Old Child Dummy
Head Drop

ATD Serial No.: 186 Test Date: 2019-07-19

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	18.9	25.6	21.1	Pass
Laboratory Humidity	%	10	70	30	Pass
Peak Resultant Acceleration	g	250.0	280.0	259.2	Pass
Peak Lateral Acceleration	g	-15.0	15.0	-4.1	Pass
Oscillations After Main Pulse	%	0.0	10.0	2.2	Pass
Is Acceleration Unimodal?	Yes/No	Yes		Yes	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

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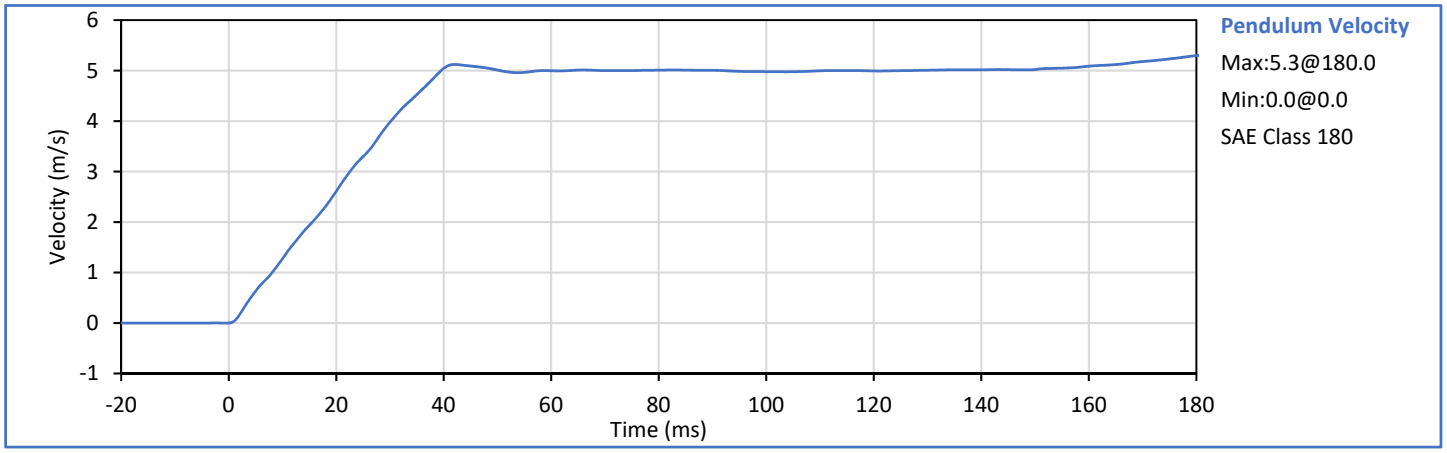
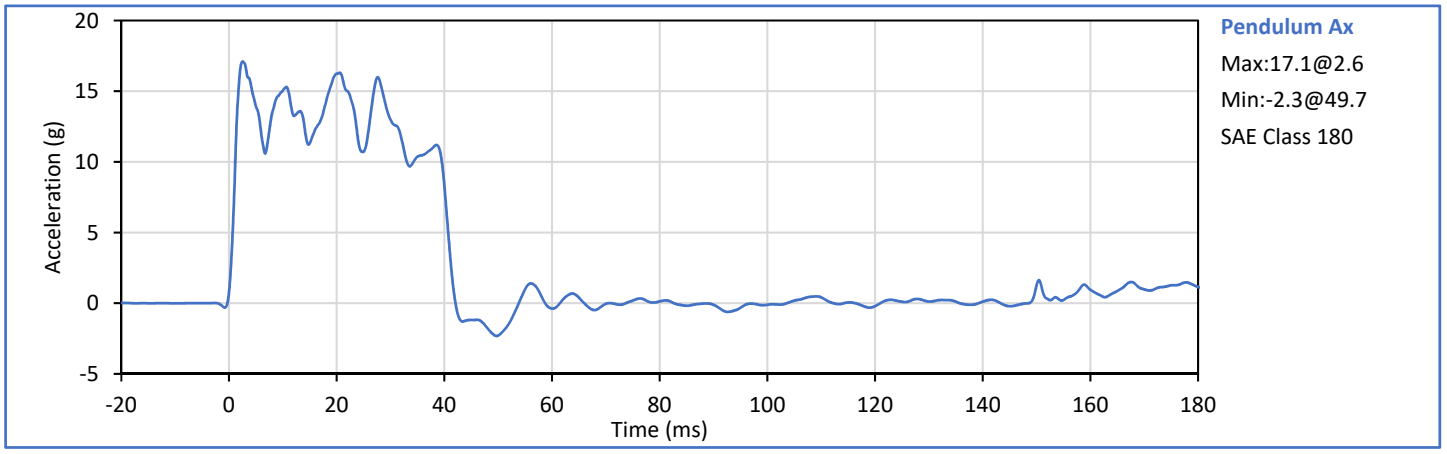
Info@karco.com www.karco.com

Hybrid III 6 Year-Old Child Dummy
Neck Flexion Test

ATD Serial No.: 186 Test Date: 2019-07-26

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.2	Pass
Laboratory Humidity	%	10	70	39	Pass
Pendulum Velocity	m/s	4.83	5.07	5.00	Pass
Pendulum Velocity at 10 ms	m/s	1.20	1.60	1.27	Pass
Pendulum Velocity at 20 ms	m/s	2.40	3.40	2.61	Pass
Pendulum Velocity at 30 ms	m/s	3.80	5.00	3.98	Pass
Peak Moment in Rotation	Nm	27.0	33.0	29.9	Pass
	deg	74.0	92.0	74.2	Pass
Positive Moment Decay to 5 Nm	ms	103.0	123.0	117.5	Pass
			Overall Test Results		Pass





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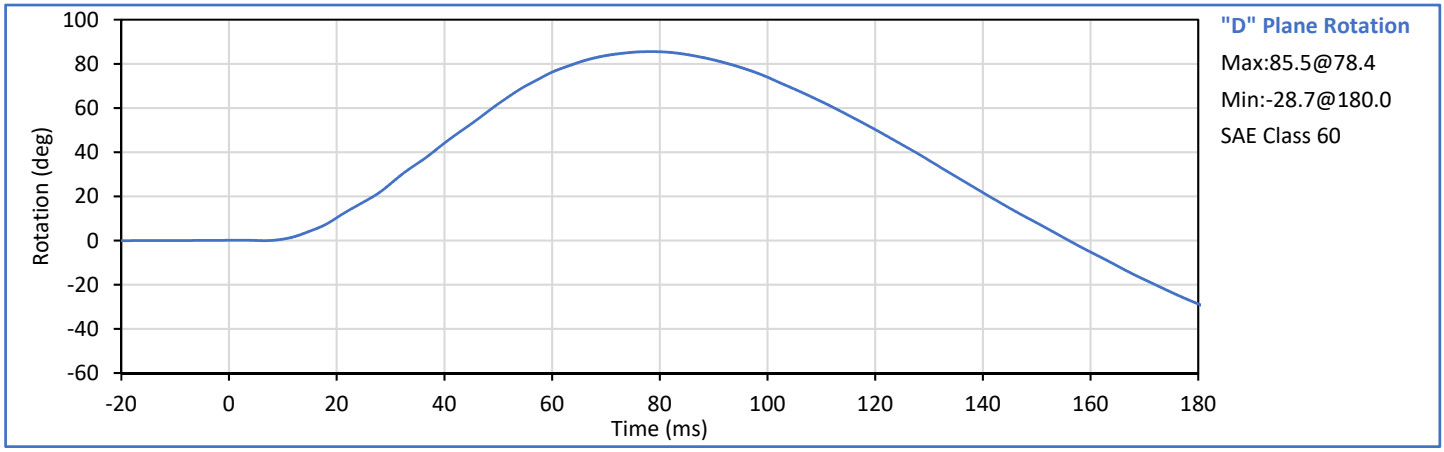
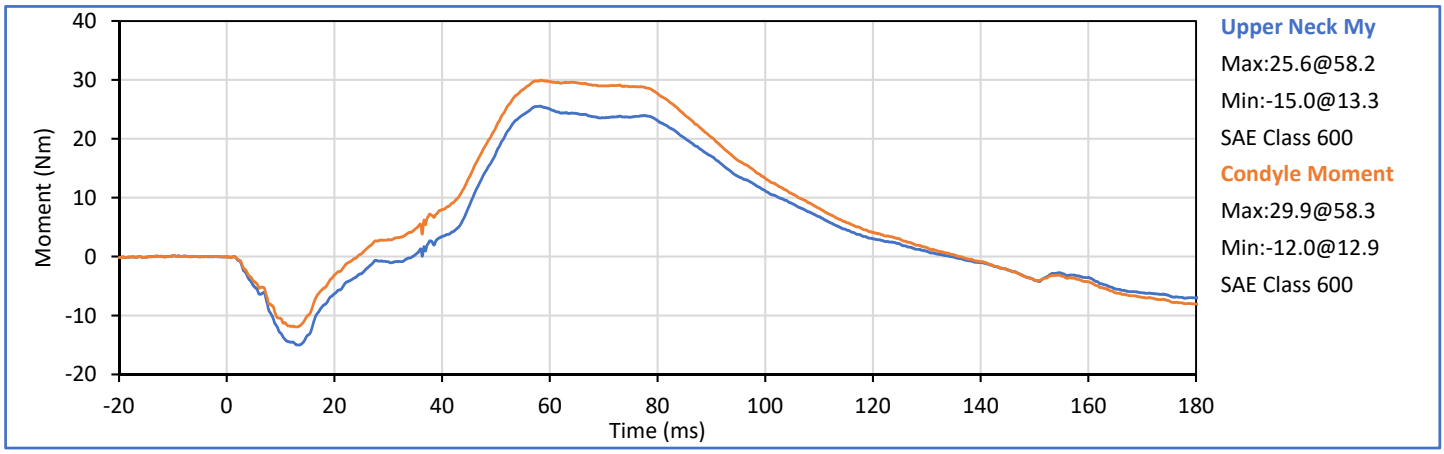
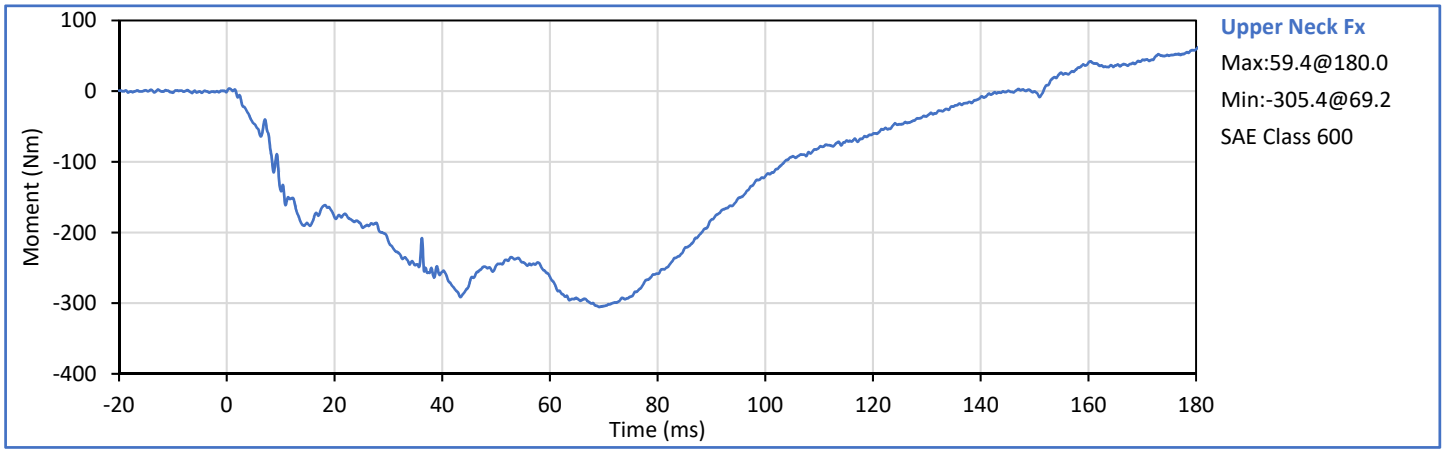
Hybrid III 6 Year-Old Child Dummy
Neck Flexion Test

ATD Serial No.: 186 Test Date: 2019-07-26







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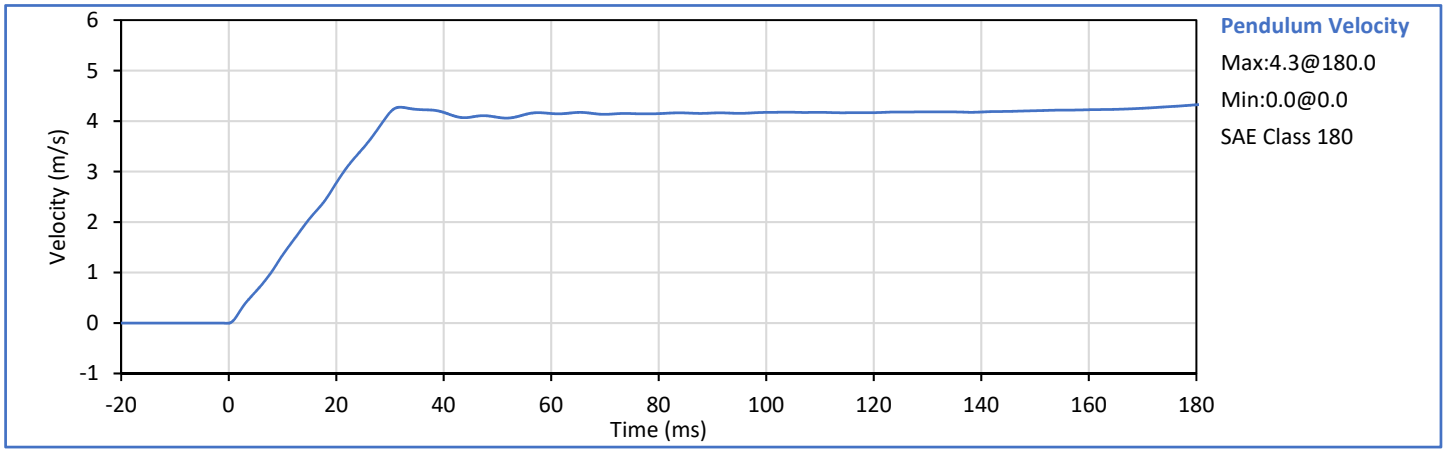
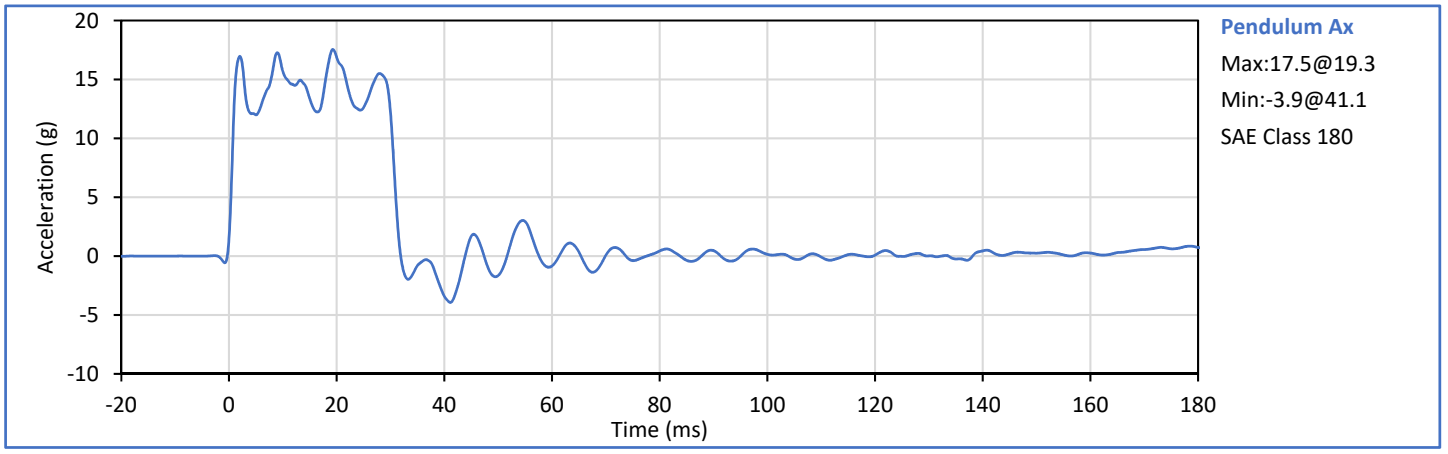
Hybrid III 6 Year-Old Child Dummy
Neck Flexion Test

ATD Serial No.: 186 Test Date: 2019-07-26

Tested Parameter	Units	Spec. Low	Spec. High	Result	Pass/Fail
Laboratory Temperature	°C	20.6	22.2	21.2	Pass
Laboratory Humidity	%	10	70	39	Pass
Pendulum Velocity	m/s	4.18	4.42	4.21	Pass
Pendulum Velocity at 10 ms	m/s	1.00	1.40	1.34	Pass
Pendulum Velocity at 20 ms	m/s	2.20	3.00	2.77	Pass
Pendulum Velocity at 30 ms	m/s	3.20	4.20	4.17	Pass
Peak Moment in Rotation	Nm	-24.0	-19.0	-22.9	Pass
	deg	85.0	103.0	86.6	Pass
Negative Moment Decay to -5 Nm	ms	123.0	147.0	126.2	Pass
			Overall Test Results		Pass





Technician: J. Hernandez

Approved By: P. Puzzuto

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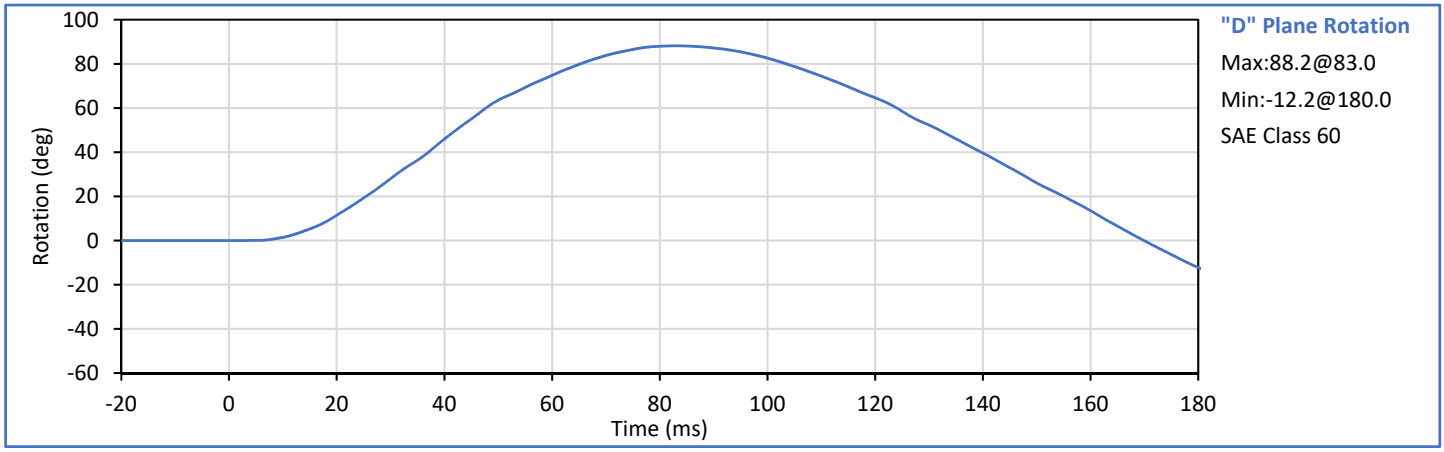
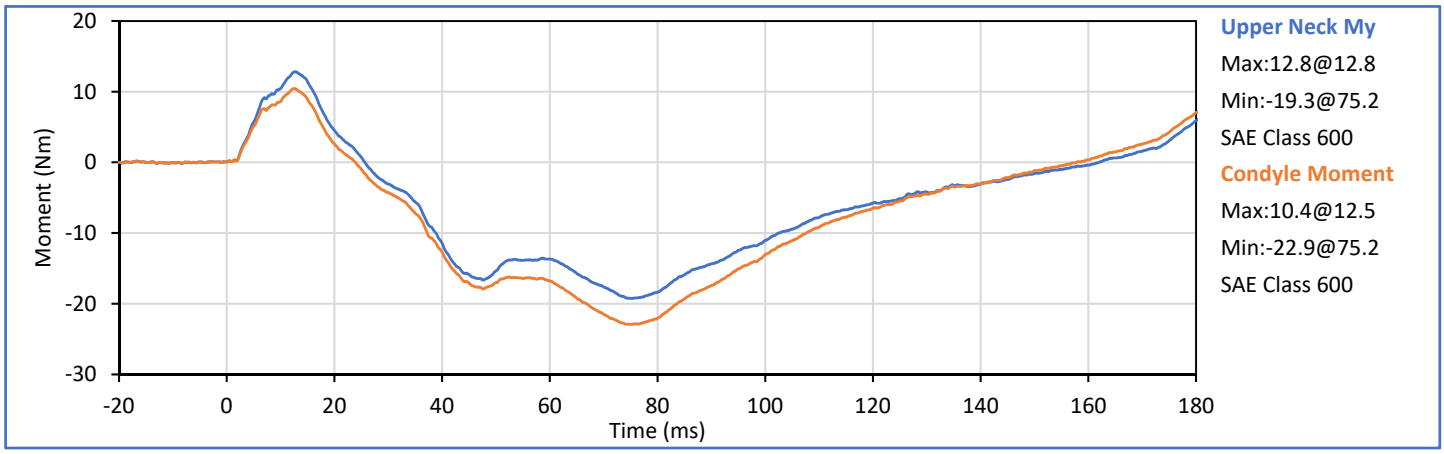
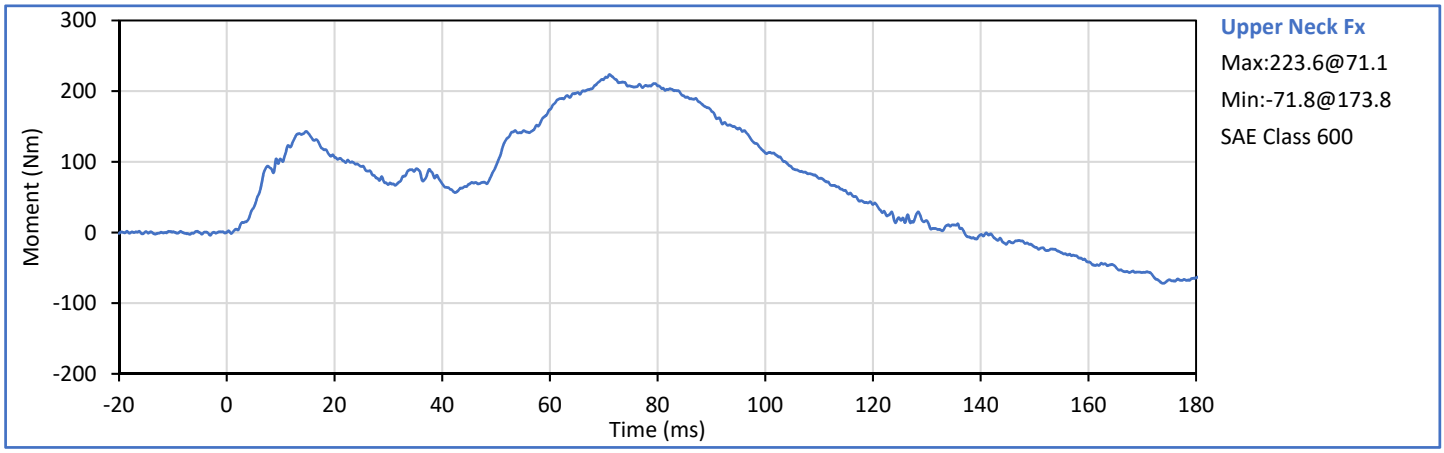
Hybrid III 6 Year-Old Child Dummy
Neck Flexion Test

ATD Serial No.: 186 Test Date: 2019-07-26







APPENDIX D
INSTRUMENTATION DATA CHANNEL ASSIGNMENTS

TWG 3.3.5.1

Test Equipment and Instrumentation Calibration Data

A.T.D. Serial Number 186

08/09/19

2019 BMW X3 xDrive30i 5-Door MPV

Channel	Location	Axis	Sensor S/N	MFR	Model	Units	Calibration Date
1	Head Acceleration	X	A301106	MSI	64C-2000	g	06/14/19
2	Head Acceleration	Y	A301096	MSI	64C-2000	g	06/14/19
3	Head Acceleration	Z	A301124	MSI	64C-2000	g	06/14/19
4	Upper Neck Force	X	3303 Fx	R.A. Denton	1633	N	04/10/19
5	Upper Neck Force	Y	3303 Fy	R.A. Denton	1633	N	04/10/19
6	Upper Neck Force	Z	3303 Fz	R.A. Denton	1633	N	04/10/19
7	Upper Neck Moment	X	3303 Mx	R.A. Denton	1633	Nm	04/10/19
8	Upper Neck Moment	Y	3303 My	R.A. Denton	1633	Nm	04/10/19
9	Upper Neck Moment	Z	3303 Mz	R.A. Denton	1633	Nm	04/10/19
10	Lower Neck Force	X	180 Fx	R.A. Denton	2430-D	N	12/06/18
11	Lower Neck Force	Y	180 Fy	R.A. Denton	2430-D	N	12/06/18
12	Lower Neck Force	Z	180 Fz	R.A. Denton	2430-D	N	12/06/18
13	Lower Neck Moment	X	180 Mx	R.A. Denton	2430-D	Nm	12/06/18
14	Lower Neck Moment	Y	180 My	R.A. Denton	2430-D	Nm	12/06/18
15	Lower Neck Moment	Z	180 Mx	R.A. Denton	2430-D	Nm	12/06/18