REPORT NUMBER: TWG-TRC-19-01

NEW CAR ASSESSMENT PROGRAM (NCAP)
Side Airbag Out-of-Position Test

BAYERISCHE MOTOREN WERKE AG
2019 BMW X5 5-DR SUV

NHTSA NUMBER: M20194105TWG2
TRC TEST NUMBER: 190709-1

PREPARED BY:
TRANSPORTATION RESEARCH CENTER INC.
10820 State Route 347
P.O. BOX B-67
East Liberty, OH 43319

Test Date: July 9, 2019

FINAL REPORT

Alpha Technology Associate, Inc.
2810 Old Lee Highway, Suite 120
Fairfax, VA 22031

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-13-D-00311L, Alpha Technology PO 15GT153. This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

Prepared By: ILO Projects Operations Group

Approved By: 

John Shultz
Project Manager

Approval Date: June 26, 2020

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Accepted By: _____

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16. ABSTRACT

A side air bag out of position test was conducted on the subject 2019 BMW X5 5-DR SUV 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 air bag protection. The test was conducted at the by Transportation Research Center Inc. in East Liberty, Ohio, on July 9, 2019.

The curtain and torso side air bags were deployed and responses were measured on a SID-IIs. Three high speed cameras recorded the event. The ambient temperature at the time of air bag deployment was 22.1°C.

Section 3.3.5.2 – SID-IIs – Position 2

Measurement Description	Units	IARV	Result
Head Injury Criteria (HIC15)	N/A	779	1
Nij	N/A	1	0.16
Upper Neck Tension	Newton	2070	218.3
Upper Neck Compression	Newton	2520	-337.1
Maximum Chest Compression	mm	34	
Maximum Chest Compression rate	m/sec	8.2	

17. KEY WORDS New Car Assessment Program Side Air Bag Out-of-position (OOP) Technical Working Group (TWG)		18. DISTRIBUTION STATEMENT Copies of this report are available from the following: Alpha Technology Associate, Inc. 2810 Old Lee Hwy, Suite 120 Fairfax, VA 22031 Phone: (703) 876-0010 FAX: (703) 876-0120 Attn: Steven Kim	
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SECTION 1 – TEST PURPOSE AND PROCEDURE

This side air bag out-of-position test is part of the MY19 New Car Assessment Program (NCAP), sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number DTNH22-13-D-00311L. The purpose of this test is to obtain data on the performance of side air bags with an out-of-position occupant in a 2019 BMW X5 5-DR SUV. The air bag test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure, dated April 2018.

SECTION 2 – SUMMARY OF TEST RESULTS

The effects of both a seat-mounted side air bag and a curtain air bag deployment in a 2019 BMW X5 5-DR SUV on an out-of-position SID-IIs were evaluated. The test was performed by TRC on July 9, 2019. Pre and post-test photographs of the vehicle and ATD can be found in Appendix A.

The vehicle had previously undergone crash testing as part of the NCAP. After conducting the crash test and before conducting the air bag deployment test, the vehicle was inspected for damage. The vehicle was found to be in good condition to undergo the air bag deployment test.

Three high-speed cameras were used to record the air bag deployment event. High speed images were recorded at rates of 1,000 frames per second. Cameras were placed relative to the position 2 and were positioned to capture the deployment event from the side, the front, and the oblique views.

The SID-IIs was placed in the right front (passenger) seat situated forward facing. This placement followed the ATD placement instructions in the NCAP Laboratory Test Procedure as well as the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as prepared by the Side Airbag Out-of-Position Injury Technical Working Group (TWG). The specific test section was section 3.3.5.2.

The SID-IIs was instrumented with head X, Y, and Z accelerometers, a six-axis upper neck load cell, and a six-axis lower neck load cell. During the air bag deployment, a total of twenty-two channels of data were recorded using an on-board data acquisition system. Appendix B contains the ATD response data traces and Appendix C contains the instrumentation list and calibration information. Appendix D contains the dummy's pre-test qualification performance verification data.

No Injury Reference Values were exceeded during the test. The occupant data is summarized below:

Measurement Description	Units	Passenger ATD SID-IIs	
		IARV	Result
Head Injury Criteria (HIC15)	N/A	779	1
Nij	N/A	1	0.16
Upper Neck Tension	N	2070	218.3
Upper Neck Compression	N	2520	-337.1
Thorax Compression	mm	34	
Thorax Compression rate	m/sec	8.2	

SECTION 3 DATA SHEET

DATA SHEET NO. 1
TEST SUMMARY

Test Vehicle:	2019 BMW X5 5-DR SUV	NHTSA No.:	M20194105TWG2
Test Program:	Side Air Bag Out-of-Position Test	Test Date:	7/9/2019

TEST SUMMARY

TEST CONFIGURATION INFORMATION

Seating Position:	P2	Right Front Seating Position
Test Section:	3.3.5.2	Roof-Rail-Mounted, Forward Facing
Airbag 1:	Seat	Seat mounted – outside seam
Airbag 2:	Side Rail	Side curtain airbag
Booster Block:	N/A	N/A
ATD Type/Serial No.:	SID-IIs	DI8818
Vehicle	BMW	X5
Previous Crash Test	MDB	1/9/2019 & M20194105

EQUIPMENT INFORMATION

Number of Data Channels	22
Number of High Speed Video Cameras	3
Number of Real Time Video Cameras	0

VISIBLE DUMMY CONTACT POINTS

Head	None Visible
Upper Torso	None Visible
Lower Torso	None Visible
Knee	None Visible

DATA SHEET NO. 2
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 BMW X5 5-DR SUV NHTSA No.: M20194105TWG2
Test Program: Side Air Bag Out-of-Position Test Test Date: 7/9/2019

TEST CONFIGURATION INFORMATION

NHTSA No.	M20194105
Model Year	2019
Make	BMW
Model	X5
Body Style	MPV
VIN	5UXCR6C57KLK79699
Body Color	Arctic Grey Metallic
Odometer Reading (km/mi)	9 mi
Engine Displacement (L)	3.0
Type/No. Cylinders	Gas/6
Engine Placement	Front/Longitudinal
Transmission Type	Automatic
Transmission Speeds	8
Overdrive	Yes
Final Drive	AWD
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 (ADL)	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	Yes
Rear Passenger Pelvis Airbag	No
Driver Seat Belt Pretensioner	Yes
Rear Pass. Seat Belt Pretensioner	Yes
Driver Load Limiter	Yes
Rear Passenger Load Limiter	Yes
Other Safety Restraint	No

DATA FROM CERTIFICATION LABEL

Manufactured By	BAYERISCHE MOTOREN WERKE AG
Date of Manufacture	10/18
Vehicle Type	MPV

GVWR (kg)	2795
GAWR Front (kg)	1325
GAWR Rear (kg)	1640

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity DSC)	2	3	N/A	5	
Capacity Weight (VCW) (kg)				385	(A)
DSC x 68.04 (kg)				340.2	(B)
Cargo Weight (RCLW) (kg)				44.8	(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	N/A	N/A		N/A	Yes	N/A
Rear or Second Row Seat	N/A	N/A	Yes	Yes	Yes	N/A	N/A
Third Row Seat	N/A	N/A	N/A	N/A	N/A	N/A	N/A

DATA SHEET NO. 3

SEAT ADJUSTMENT DATA

Test Vehicle: 2019 BMW X5 5-DR SUV NHTSA No.: M20194105TWG2

Test Program: Side Air Bag Out-of-Position Test Test Date: 7/9/2019

VEHICLE SEAT FORE/AFT POSITION

Seat Location	Total Fore/Aft Travel		Test Position from Forwardmost Position	
	mm	# Detents	mm	# Detents
Front Right	220	N/A	0	N/A
Rear Right	Fixed	N/A	N/A	N/A

Seat Fore/Aft Position Per TWG Guidelines	Highest and full foward
Reason for Deviation from TWG Guidelines	No deviations

VEHICLE SEAT BACK ANGLE ADJUSTMENT

Seat Location	Total Seat Back Angle Range		Test Position from Most Upright (Vertical)	
	Degrees	# Detents	Degrees	# Detents
Front Right	62.4	N/A	19.0	N/A
Rear Right	0	N/A	N/A	N/A

OEM Back Angle Design Position	19.0 degrees measured across seat back
Method of Measuring Back Angle Position	Inclinometer on straight edge across seat back
Seat Back Angle Position Per TWG Guidelines	Per OEM Form 1
Reason for Deviation from TWG Guidelines	No deviations

VEHICLE SEAT HEIGHT ADJUSTMENT

Seat Location	Total Height Adjustment Range		Test Position from Lowest Position	
	mm	# Detents	mm	# Detents
Front Right	75	N/A	75	N/A
Rear Right	Fixed	N/A	N/A	N/A

Seat Height Adjustment Per TWG Guidelines	Full up
Reason for Deviation from TWG Guidelines	No deviations

DATA SHEET NO. 4
DUMMY SETUP AND POSITIONING DATA

Test Vehicle:	2019 BMW X5 5-DR SUV	NHTSA No.:	M20194105TWG2
Test Program:	Side Air Bag Out-of-Position Test	Test Date:	7/9/2019

DUMMY INFORMATION

ATD Type	SID-IIs
Serial Number	DI8818
Qualification Date	6/26/2019
Qualification Type	Partial
Clothing	Cotton shirt and pants
Other ATD Prep	Electrical tape at skull cap, baby power on head

DUMMY POSITIONING INFORMATION

TWG Setup Instructions	As specified in the 3.3.5.2 Test Procedure; Seat is adjusted to its highest position; ATD positioned to 3.3.5.2.1
Actual Setup	As specified in the 3.3.5.2 Test Procedure; The vehicle seat is set to the full up and full forward positions. The seat back angle is set to 19.0 degrees, as called out in Form 1. The dummy's skull cap is powdered and the seam is taped. The dummy is facing forward with the arm in the horizontal position. The seat bolster does not allow the dummy to come in contact with the door trim panel. The dummy is leaned outboard with the centerline of the top of the head as close as possible to the projected deployment trajectory of the side curtain airbag.

DATA SHEET NO. 5
DUMMY INJURY CRITERIA DATA

Test Vehicle: 2019 BMW X5 5-DR SUV NHTSA No.: M20194105TWG2
Test Program: Side Air Bag Out-of-Position Test Test Date: 7/9/2019

RECORDED DATA - MINIMUMS AND MAXIMUMS

Channel	Unit	CFC	Maximum	Time (ms)	Minimum	Time (ms)
Head X	G	1000	2.04	16.56	-5.20	10.16
Head Y	G	1000	3.64	12.88	-11.32	20.80
Head Z	G	1000	8.34	18.16	-5.77	12.88
Head Resultant	G	1000	11.62	20.16		
Head Red X	G	1000	2.28	16.48	-5.46	10.16
Head Red Y	G	1000	3.53	12.40	-11.31	22.64
Head Red Z	G	1000	8.47	18.16	-5.64	12.80
Head Red Resultant	G	1000	11.54	20.16		
Upper Neck X	N	1000	28.61	21.76	-65.03	12.08
Upper Neck Y	N	1000	83.42	9.84	-147.80	21.36
Upper Neck Z	N	1000	218.32	18.40	-337.06	12.80
Upper Neck Resultant	N	1000	342.26	12.00		
Upper Neck X	Nm	600	8.63	32.48	-8.08	18.80
Upper Neck Y	Nm	600	4.08	82.32	-5.62	12.48
Upper Neck Z	Nm	600	1.55	281.76	-4.78	42.24
Upper Neck Resultant	Nm	600	9.84	32.64		
Lower Neck X	N	1000	73.44	60.24	-74.49	59.92
Lower Neck Y	N	1000	88.10	226.24	-242.71	18.40
Lower Neck Z	N	1000	250.81	18.88	-391.15	14.32
Lower Neck Resultant	N	1000	424.17	14.40		
Lower Neck X	Nm	600	26.98	41.92	-17.76	233.60
Lower Neck Y	Nm	600	19.14	13.28	-11.17	18.80
Lower Neck Z	Nm	600	4.52	232.96	-12.05	18.48
Lower Neck Resultant	Nm	600	29.30	19.12		

HEAD INJURY SUMMARY

HIC15	T1 (ms)	T2 (ms)	HIC36	T1 (ms)	T2 (ms)
1	8.40	23.28	1	8.40	44.40

DATA SHEET NO. 5
DUMMY INJURY CRITERIA DATA (CONTINUED)

Test Vehicle: 2019 BMW X5 5-DR SUV NHTSA No.: M20194105TWG2
Test Program: Side Air Bag Out-of-Position Test Test Date: 7/9/2019

NECK INJURY SUMMARY

Injury Criteria	Value	Time (ms)
Upper Neck NTF	0.03	77.04
Upper Neck NTE	0.08	18.32
Upper Neck NCF	0.03	60.96
Upper Neck NCE	0.16	12.96
Peak Tension	218.32	18.40
Peak Compression	-337.05	12.80

CHEST INJURY SUMMARY

Injury Criteria	Value	Time (ms)
[Chest/Rib] Deflection		
Deflection Rate[1]		

[1]Deflection Rate was assessed by measuring compression from a rotary potentiometer

RESEARCH INJURY SUMMARY

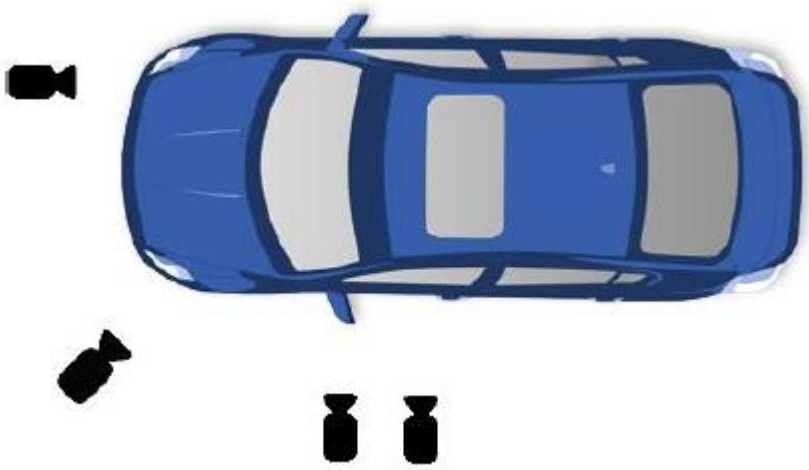
Research Injury Criteria[1]	Value	Time (ms)
Upper Neck Lateral Moment		
Upper Neck Twist Moment		
Lower Neck Flexion Moment		
Lower Neck Extension Moment		
Lower Neck Lateral Moment		
Lower Neck Twist Moment		
Lower Neck Tension		
Lower Neck Compression		
Spine Acceleration		

[1]These injury criteria are only monitored and not considered pass/fail

DATA SHEET NO. 6
CAMERA SETUP AND DESCRIPTION

Test Vehicle:	2019 BMW X5 5-DR SUV	NHTSA No.:	M20194105TWG2
Test Program:	Side Air Bag Out-of-Position Test	Test Date:	7/9/2019

CAMERA SETUP DIAGRAM FOR SAB OOP TESTS



No.	Camera View	Location (mm)[1]			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Left View	-403	-2480	-1252	20	1000
2	Oblique View	-1776	-2642	-1488	20	1000
3	Front View	2724	208	-1648	20	1000
4	Real Time[2]	---[2]	---[2]	---[2]	---[2]	---[2]

[1] +X forward of vehicle, +Y right of vehicle, +Z into ground

[2] Camera omitted

APPENDIX A

PHOTOGRAPHS

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Figure A-4 Post-Test Vehicle Left Side View

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Figure A-10 Post-Test Dummy Left Side View

Figure A-11 Pre-Test Dummy Left Side Close-up View

Figure A-12 Post-Test Dummy Left Side Close-up View

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Figure A-14 Post-Test Dummy Left ¾ Front View

Figure A-15 Pre-Test Dummy Left ¾ Front Close-up View

Figure A-16 Post-Test Dummy Left ¾ Front Close-up View

Figure A-17 Pre-Test Dummy Front View

Figure A-18 Post-Test Dummy Front View

Figure A-19 Pre-Test Dummy Front Close-up View

Figure A-20 Post-Test Dummy Front Close-up View

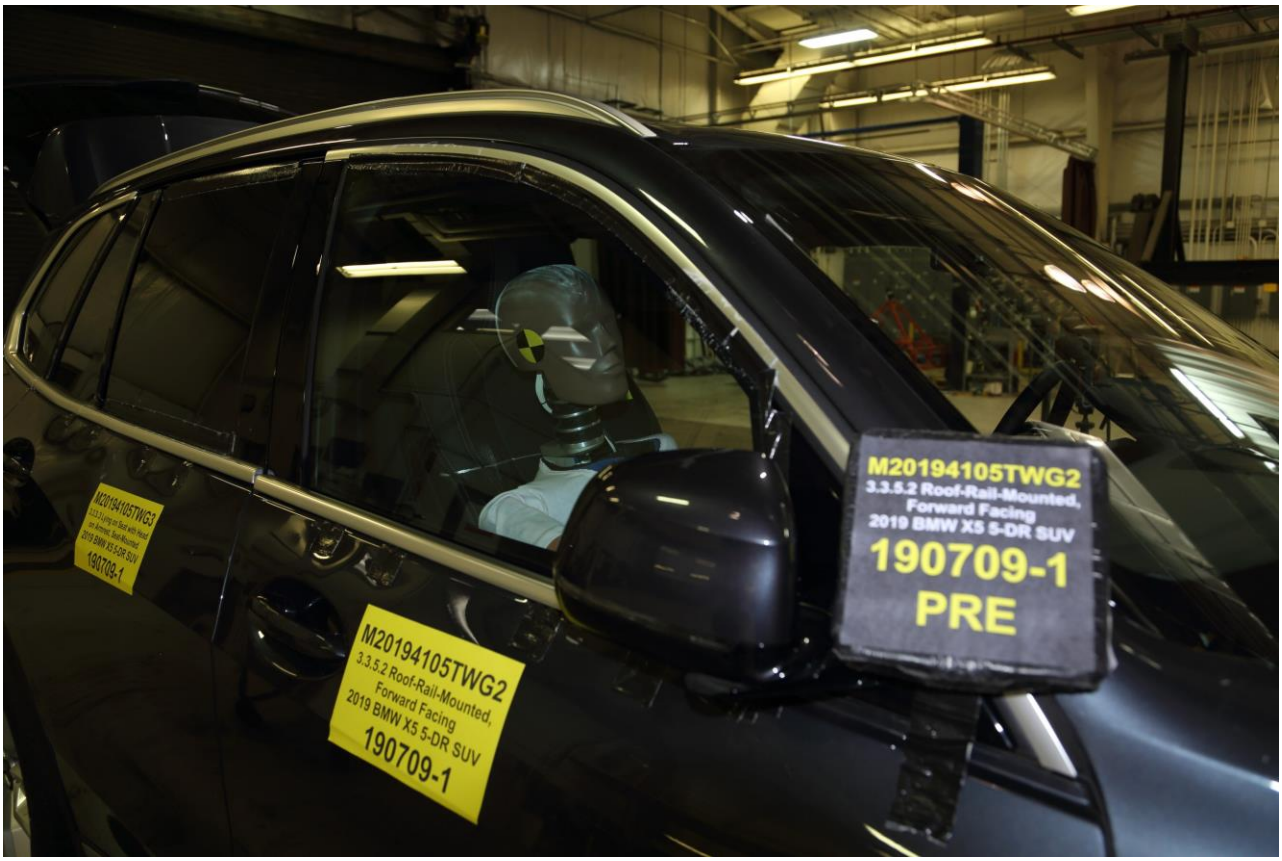


Figure A-21 Pre-Test Dummy Right ¾ Front View

Figure A-22 Post-Test Dummy Right ¾ Front View

Figure A-23 Pre-Test Dummy Right Side Front View

Figure A-24 Post-Test Dummy Right Side Front View

Figure A-25 Post-Test Dummy Right Side Front View

Figure A-26 Post-Test Curtain Air Bag Left Side View

Figure A-27 Post-Test Curtain Air Bag Left ¾ Front View

Figure A-28 Post-Test Curtain Air Bag Front View

Figure A-29 Post-Test Curtain Air Bag Right Side View

APPENDIX B

DUMMY RESPONSE DATA PLOTS

Alpha Technology

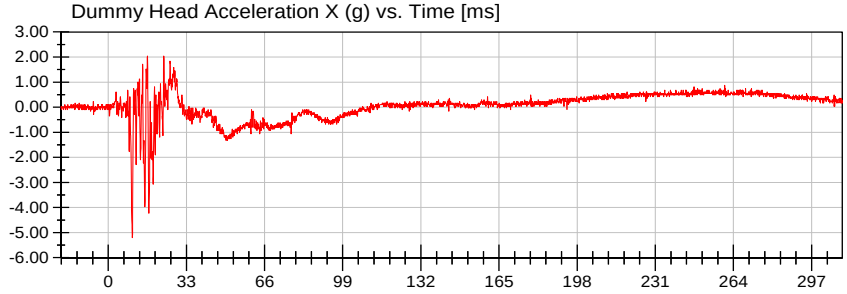
Test Date: 07/09/2019

Position #2 SID IIs Dummy (13S2)

Test Lab: CTF

Test Number: 190709-1 (M20194105TWG2)

Dummy Head Acceleration X (g) vs. Time [ms]



<Max>

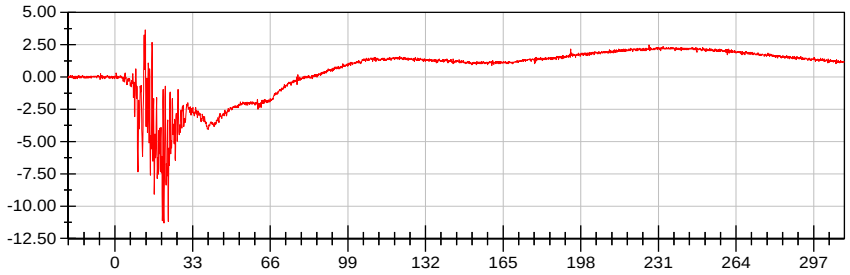
2.04 g at 16.56 ms

<Min>

-5.20 g at 10.16 ms

CFC_1000

Dummy Head Acceleration Y (g) vs. Time [ms]



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3.64 g at 12.88 ms

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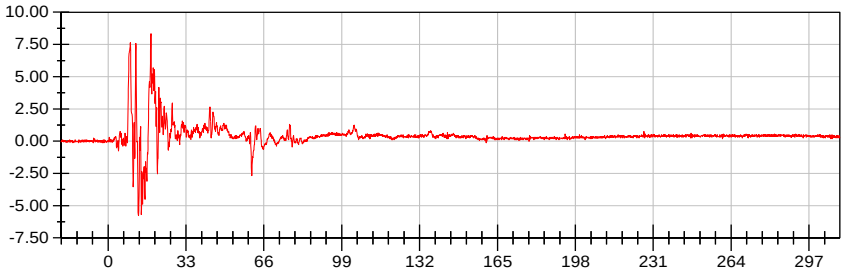
-11.32 g at 20.80 ms

CFC_1000

Dummy Head Acceleration Z (g) vs. Time [ms]



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8.34 g at 18.16 ms

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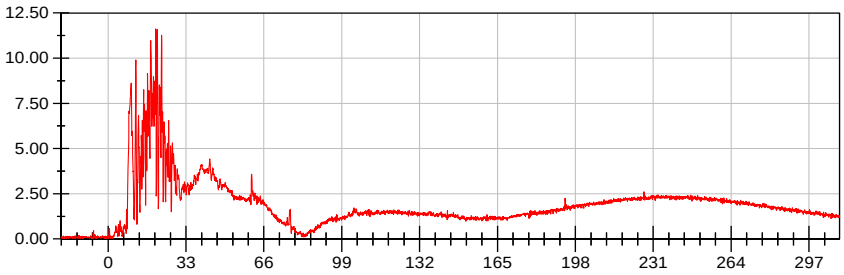
-5.77 g at 12.88 ms

CFC_1000

Dummy Head Acceleration Resultant (g) vs. Time [ms]



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11.62 g at 20.16 ms

<Min>

0.03 g at -19.92 ms

CFC_1000

Alpha Technology

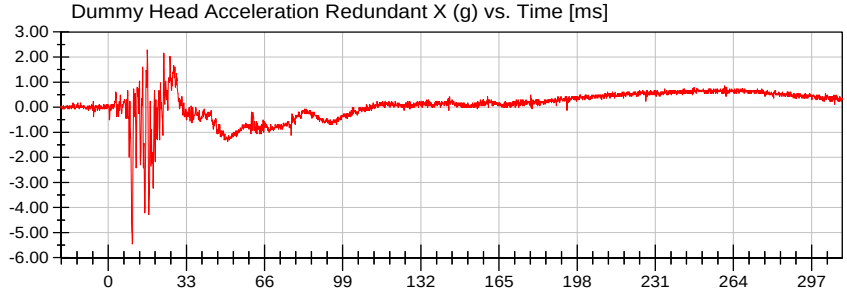
Test Date: 07/09/2019

Position #2 SID IIs Dummy (13S2)

Test Lab: CTF

Test Number: 190709-1 (M20194105TWG2)

Dummy Head Acceleration Redundant X (g) vs. Time [ms]



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2.28 g at 16.48 ms

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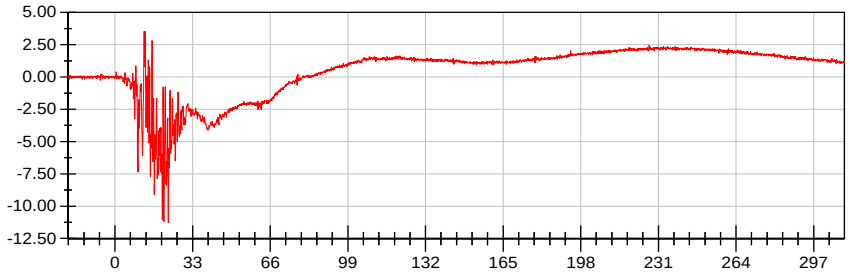
-5.46 g at 10.16 ms

CFC_1000

Dummy Head Acceleration Redundant Y (g) vs. Time [ms]



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3.53 g at 12.40 ms

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-11.31 g at 22.64 ms

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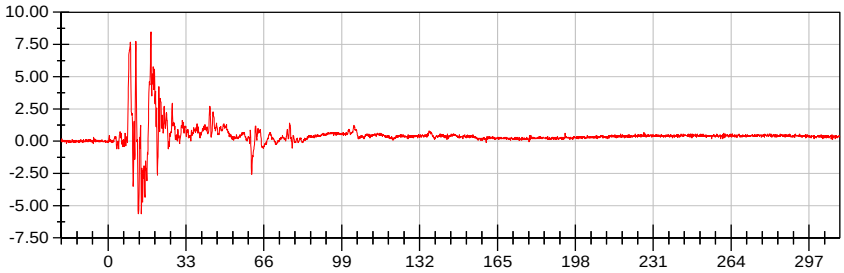
Dummy Head Acceleration Redundant Z (g) vs. Time [ms]



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8.47 g at 18.16 ms

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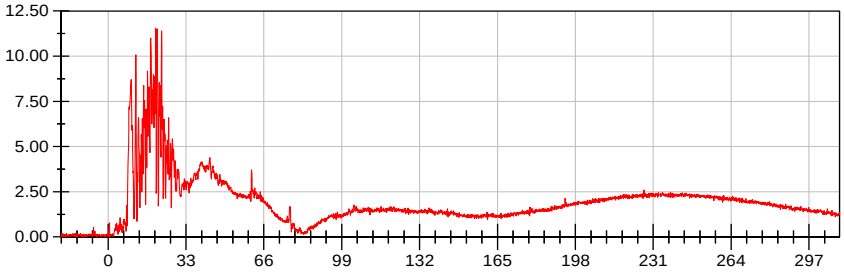
-5.64 g at 12.80 ms

CFC_1000

Dummy Head Acceleration Redundant Resultant (g) vs. Time [ms]



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11.54 g at 20.16 ms

<Min>

0.02 g at -19.84 ms

CFC_1000

Alpha Technology

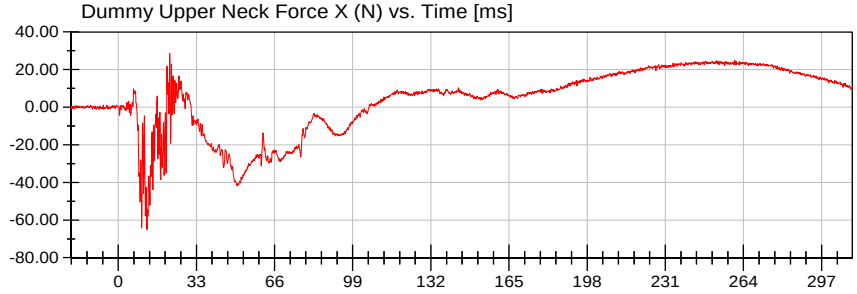
Test Date: 07/09/2019

Position #2 SID IIs Dummy (13S2)

Test Lab: CTF

Test Number: 190709-1 (M20194105TWG2)

Dummy Upper Neck Force X (N) vs. Time [ms]



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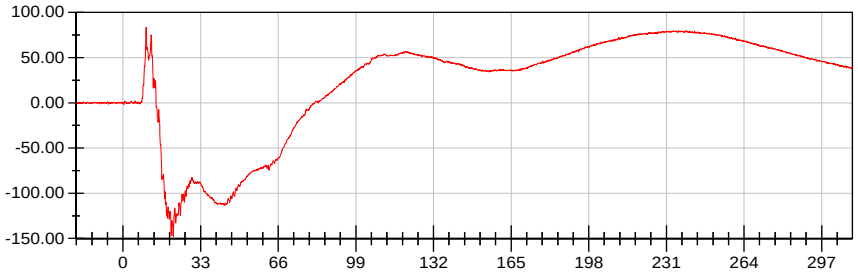
28.61 N at 21.76 ms

<Min>

-65.03 N at 12.08 ms

CFC_1000

Dummy Upper Neck Force Y (N) vs. Time [ms]



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83.42 N at 9.84 ms

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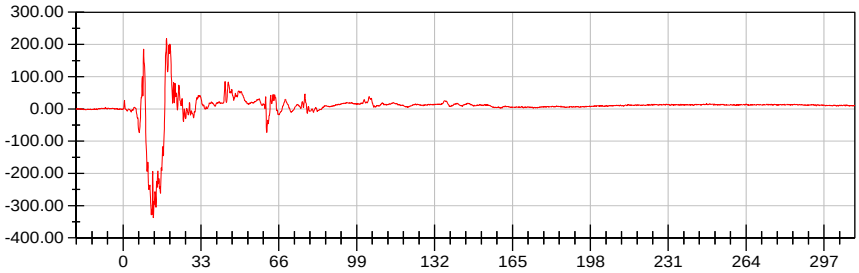
-147.80 N at 21.36 ms

CFC_1000

Dummy Upper Neck Force Z (N) vs. Time [ms]



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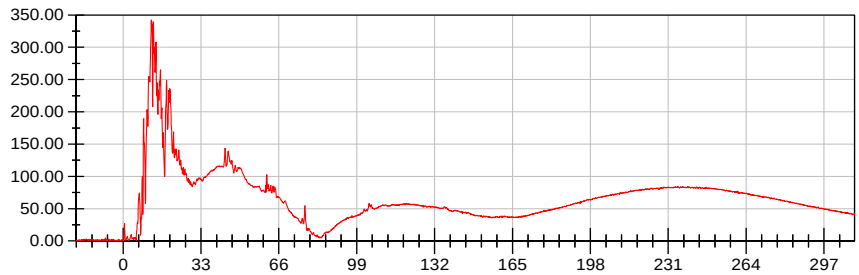
218.32 N at 18.40 ms

<Min>

-337.05 N at 12.80 ms

CFC_1000

Dummy Upper Neck Force Resultant (N) vs. Time [ms]



<Max>

342.26 N at 12.00 ms

<Min>

0.10 N at -19.36 ms

CFC_1000

Alpha Technology

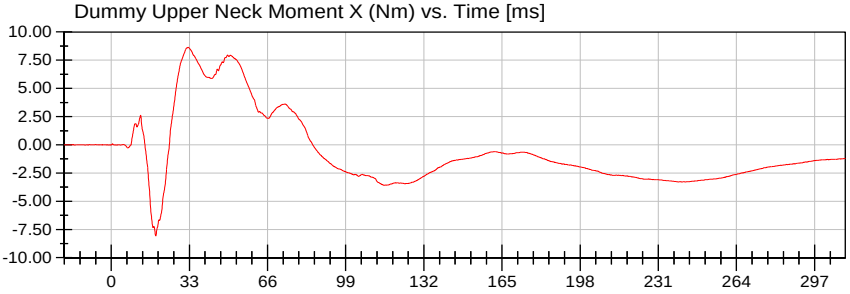
Test Date: 07/09/2019

Position #2 SID IIs Dummy (13S2)

Test Lab: CTF

Test Number: 190709-1 (M20194105TWG2)

Dummy Upper Neck Moment X (Nm) vs. Time [ms]



<Max>

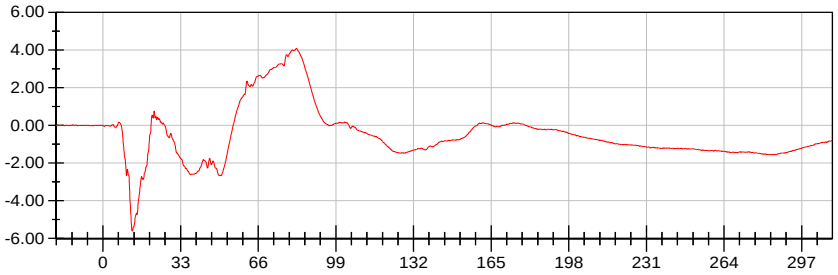
8.63 Nm at 32.48 ms

<Min>

-8.08 Nm at 18.80 ms

CFC_600

Dummy Upper Neck Moment Y (Nm) vs. Time [ms]



<Max>

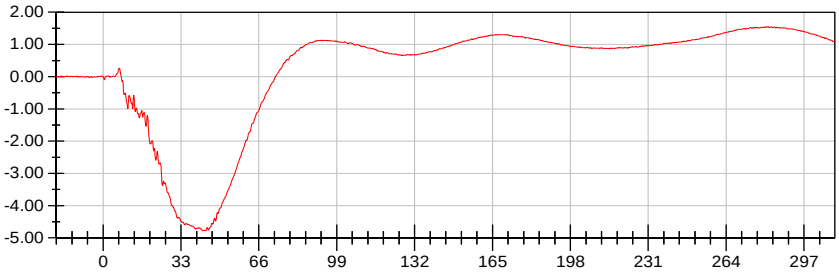
4.08 Nm at 82.32 ms

<Min>

-5.62 Nm at 12.48 ms

CFC_600

Dummy Upper Neck Moment Z (Nm) vs. Time [ms]



<Max>

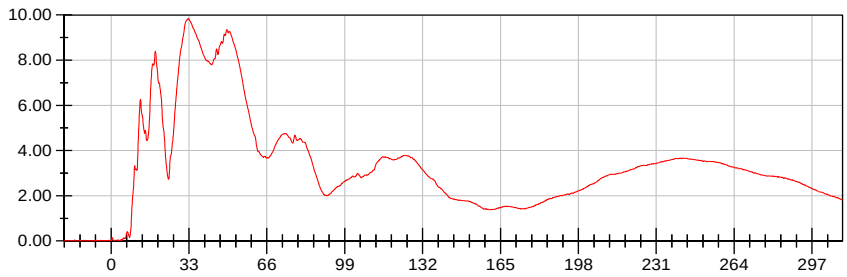
1.55 Nm at 281.76 ms

<Min>

-4.78 Nm at 42.24 ms

CFC_600

Dummy Upper Neck Moment Resultant (Nm) vs. Time [ms]



<Max>

9.84 Nm at 32.64 ms

<Min>

0.00 Nm at -18.32 ms

CFC_600

Alpha Technology

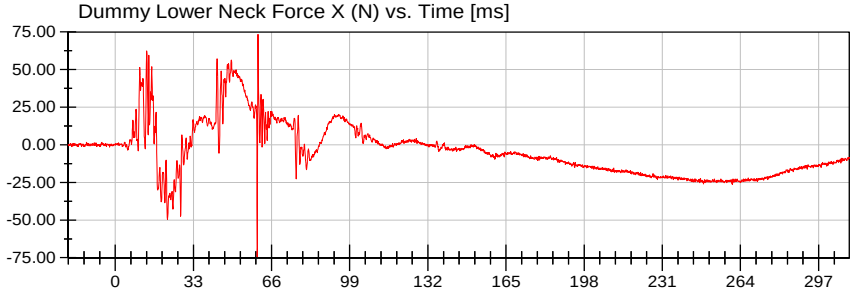
Test Date: 07/09/2019

Position #2 SID IIs Dummy (13S2)

Test Lab: CTF

Test Number: 190709-1 (M20194105TWG2)

Dummy Lower Neck Force X (N) vs. Time [ms]



<Max>

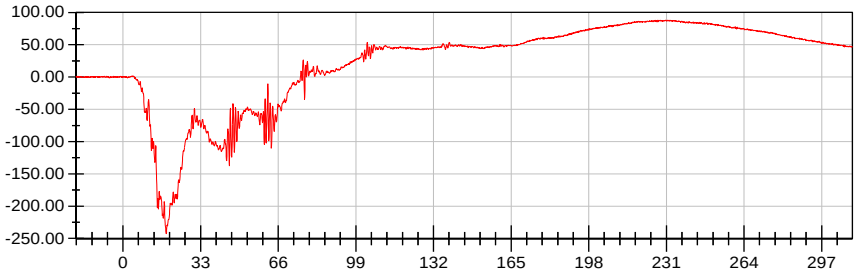
73.44 N at 60.24 ms

<Min>

-74.49 N at 59.92 ms

CFC_1000

Dummy Lower Neck Force Y (N) vs. Time [ms]



<Max>

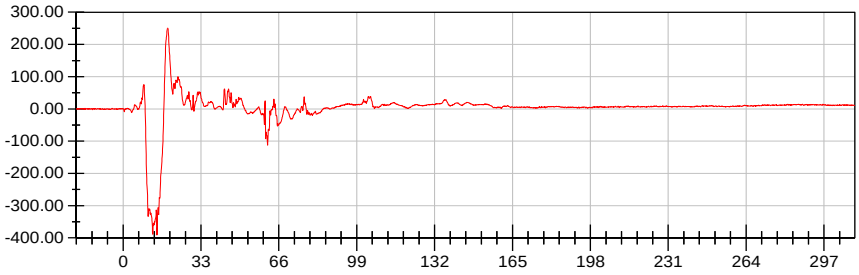
88.10 N at 226.24 ms

<Min>

-242.71 N at 18.40 ms

CFC_1000

Dummy Lower Neck Force Z (N) vs. Time [ms]



<Max>

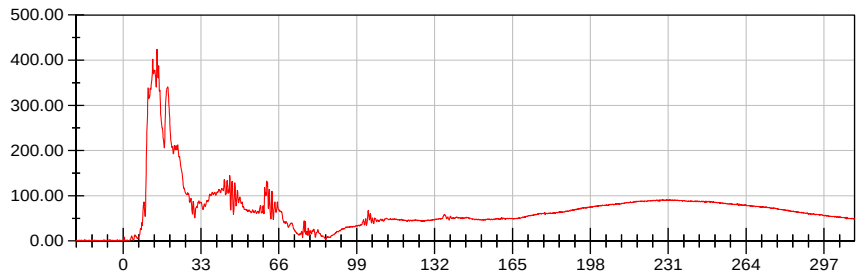
250.81 N at 18.88 ms

<Min>

-391.15 N at 14.32 ms

CFC_1000

Dummy Lower Neck Force Resultant (N) vs. Time [ms]



<Max>

424.17 N at 14.40 ms

<Min>

0.09 N at -19.92 ms

CFC_1000

Alpha Technology

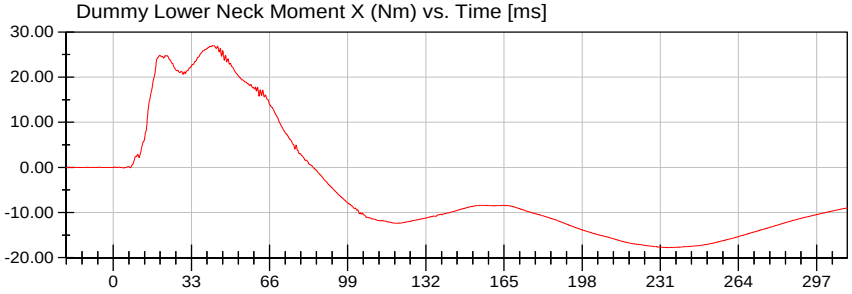
Test Date: 07/09/2019

Position #2 SID IIs Dummy (13S2)

Test Lab: CTF

Test Number: 190709-1 (M20194105TWG2)

Dummy Lower Neck Moment X (Nm) vs. Time [ms]



<Max>

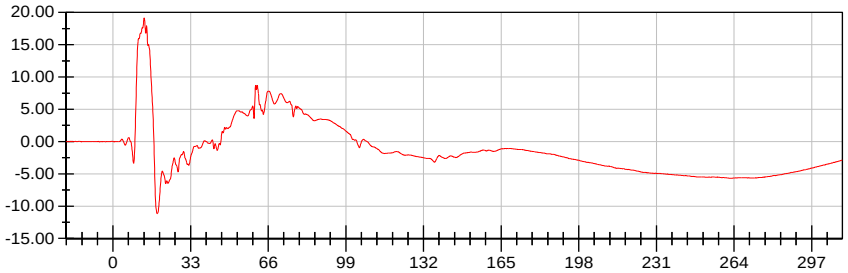
26.98 Nm at 41.92 ms

<Min>

-17.76 Nm at 233.60 ms

CFC_600

Dummy Lower Neck Moment Y (Nm) vs. Time [ms]



<Max>

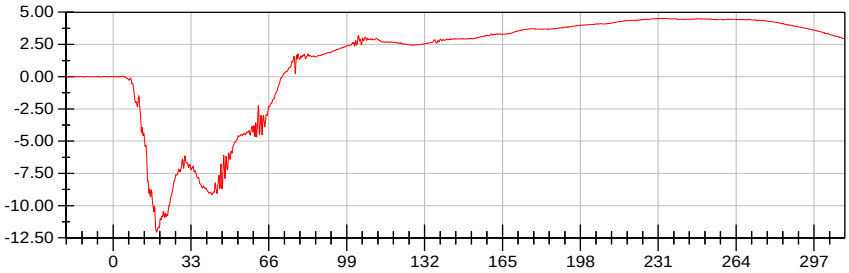
19.14 Nm at 13.28 ms

<Min>

-11.17 Nm at 18.80 ms

CFC_600

Dummy Lower Neck Moment Z (Nm) vs. Time [ms]



<Max>

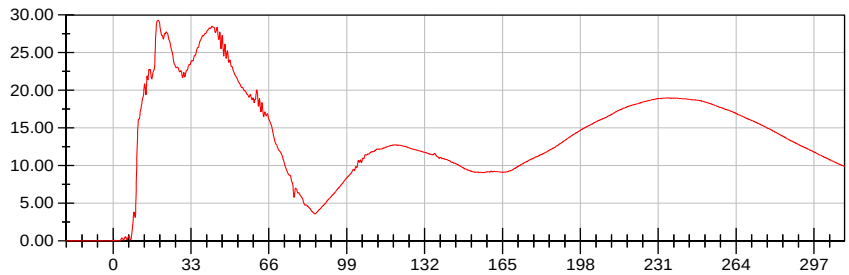
4.52 Nm at 232.96 ms

<Min>

-12.05 Nm at 18.48 ms

CFC_600

Dummy Lower Neck Moment Resultant (Nm) vs. Time [ms]



<Max>

29.30 Nm at 19.12 ms

<Min>

0.00 Nm at -9.44 ms

CFC_600

2019 BMW X5 5-DR SUV TWG OOP Test 3.3.5.2

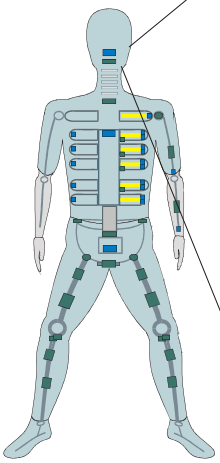
Neck Injury Predictor (NIJ)

Date: 07/09/2019
Time: 13:25

Customer: Alpha Technology
Test Number: M20194105TWG2

TRC Inc. Test Lab: CTF
Test Number: 190709-1

Test Orientation = Frontal
Fzc(Tension) = 3880
Fzc(Compression) = 3880
Myc(Extension) = 61
Myc(Flexion) = 155



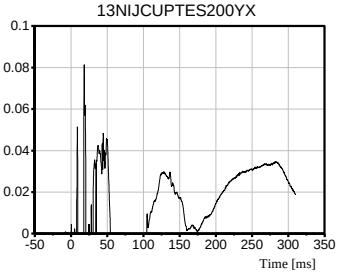
Dummy:SID IIs
Seating Position:
Right Front Passenger

NIJ Source Code: (Fz/Fzc)+(My/Myc)

13TMONUP00S2MOYX

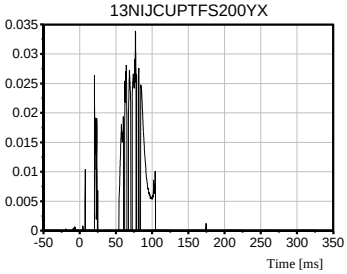
13NECKUP00S2FOZA

13NIJCUPTES200YX



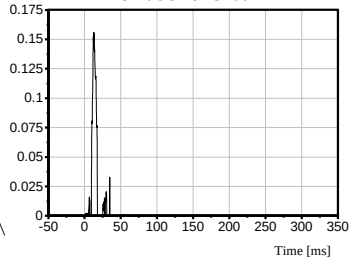
Max [NTE] 0.0813 at 18.32 ms

13NIJCUPTFS200YX



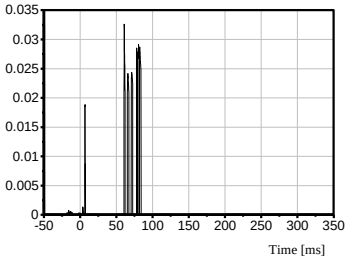
Max [NTF] 0.0339 at 77.04 ms

13NIJCUPCES200YX



Max [NCE] 0.1558 at 12.96 ms

13NIJCUPCFS200YX



Max [NCF] 0.0326 at 60.96 ms

Alpha Technology

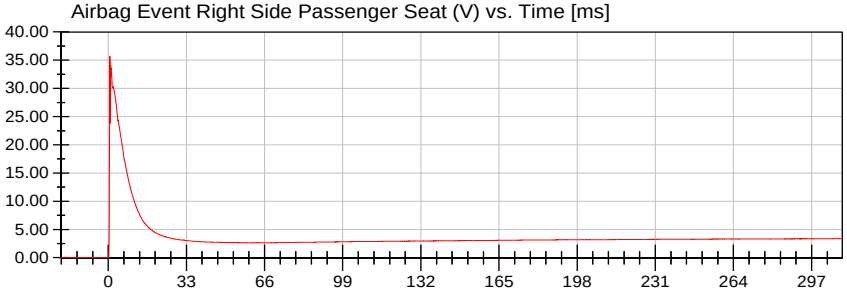
Test Date: 07/09/2019

Position #2 SID IIs Dummy (13S2)

Test Lab: CTF

Test Number: 190709-1 (M20194105TWG2)

Airbag Event Right Side Passenger Seat (V) vs. Time [ms]



<Max>

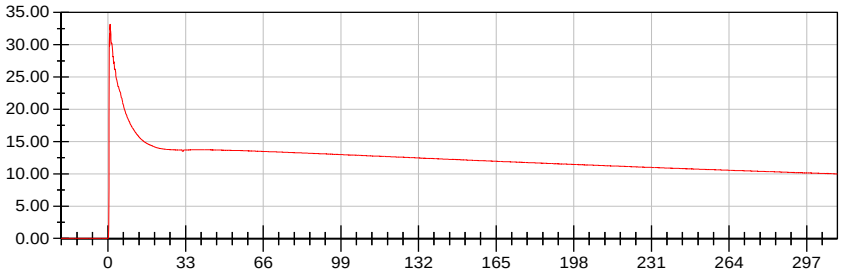
35.63 V at 0.64 ms

<Min>

0.00 V at -20.00 ms

Unfiltered

Airbag Event Right Side Passenger Curtain (V) vs. Time [ms]



<Max>

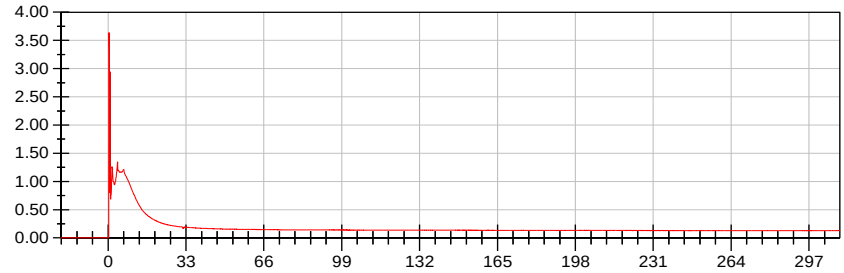
33.18 V at 0.88 ms

<Min>

0.00 V at -20.00 ms

Unfiltered

Airbag Event Right Side Passenger Seat (A) vs. Time [ms]



<Max>

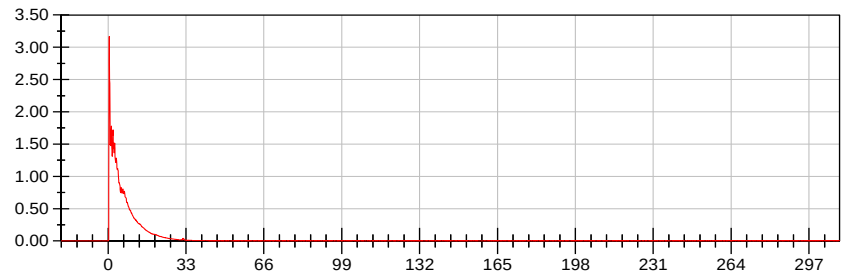
3.64 A at 0.40 ms

<Min>

0.00 A at -20.00 ms

Unfiltered

Airbag Event Right Side Passenger Curtain (A) vs. Time [ms]



<Max>

3.17 A at 0.48 ms

<Min>

0.00 A at -20.00 ms

Unfiltered

APPENDIX C

DUMMY QUALIFICATION DATA

Pre-Test Calibration Sheets
Passenger S/N DI8818

Transportation Research Center Inc.

Right Lateral Head Drop
SID IIs Serial No. DI8818 Certification No. 27-1
Test Date: 6/26/2019

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	58 %	Yes
Peak Head Resultant Acceleration	115 - 137 g	129.5 g	Yes
Peak Head Longitudinal Acceleration	(-15) - 15 g	-5.0 g	Yes
Is Head Resultant Acceleration Curve Unimodal within 15% of Peak?	< 15 %	1.40 %	Yes

Test meets specifications.

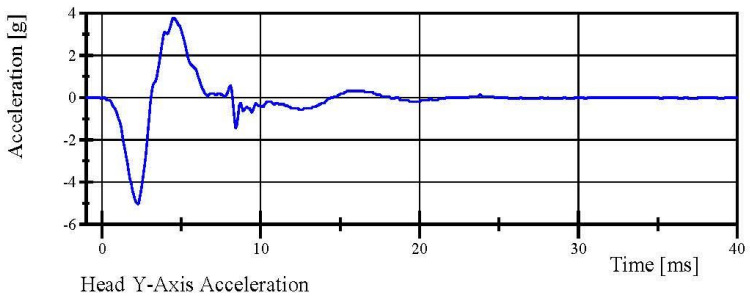
Condition: Used

Comments:
Head Skin S/N: DI6457

Transportation Research Center Inc.

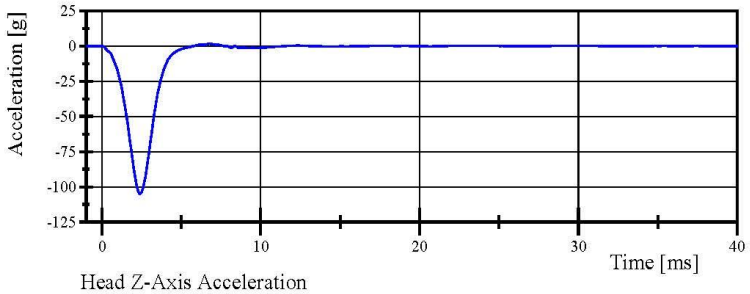
Right Lateral Head Drop
SID IIs Serial No. DI8818 Certification No. 27-1
Test Date: 6/26/2019

Head X-Axis Acceleration



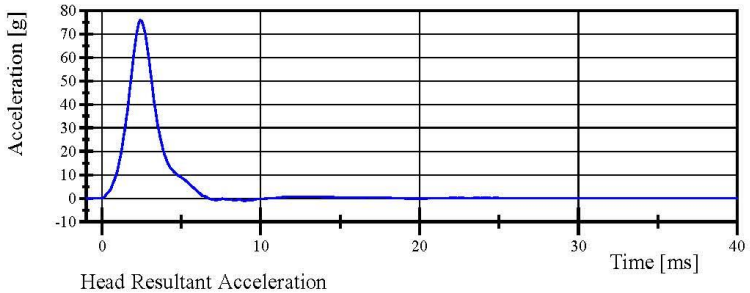
Filter Class: CFC_1000
Max: 3.8 g at 4.5 ms
Min: -5.0 g at 2.2 ms

Head Y-Axis Acceleration



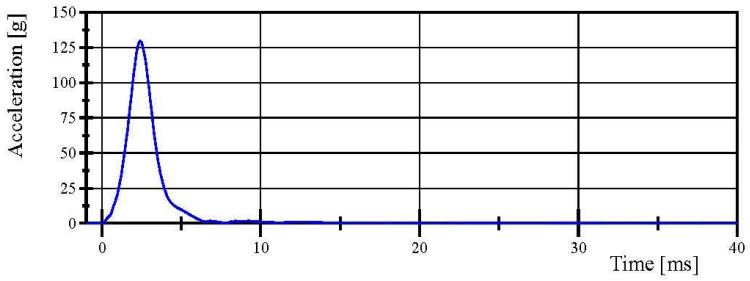
Filter Class: CFC_1000
Max: 1.7 g at 6.8 ms
Min: -104.9 g at 2.4 ms

Head Z-Axis Acceleration



Filter Class: CFC_1000
Max: 75.9 g at 2.4 ms
Min: -1.1 g at 9.0 ms

Head Resultant Acceleration



Filter Class: CFC_1000
Max: 129.5 g at 2.4 ms
Min: 0.0 g at -1.0 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

06.26.2019 09:23:06 199

Transportation Research Center Inc.

Right Lateral Neck
SID IIs Serial No. DI8818 Certification No. 27-1
Test Date: 6/26/2019

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	59 %	Yes
Pendulum Velocity	5.51 - 5.63 m/s	5.581 m/s	Yes
Pendulum Integrated Velocity Change at 10 ms	(-2.20) - (-2.80) m/s	-2.447 m/s	Yes
Change at 15 ms	(-3.30) - (-4.10) m/s	-3.626 m/s	Yes
Change at 20 ms	(-4.40) - (-5.40) m/s	-4.902 m/s	Yes
Change at 25 ms	(-5.40) - (-6.10) m/s	-5.905 m/s	Yes
Change at 25 to 100 ms	(-5.50) - (-6.20) m/s	-6.078 m/s	Yes
Maximum Headform Flexion occurring between 50ms and 70ms.			
Peak	71 - 81 deg	71.3 deg	Yes
Time of Peak	50 - 70 ms	62.2 ms	Yes
Total Neck Occipital Condyles Moment	(-36) - (-44) N·m	-39.0 N·m	Yes
Total Neck Occipital Condyles Moment Decay Time to 0 N·m	102 - 126 ms	121.6 ms	Yes

Test meets specifications.

Condition: Used

Comments:
Neck S/N: DJ1259

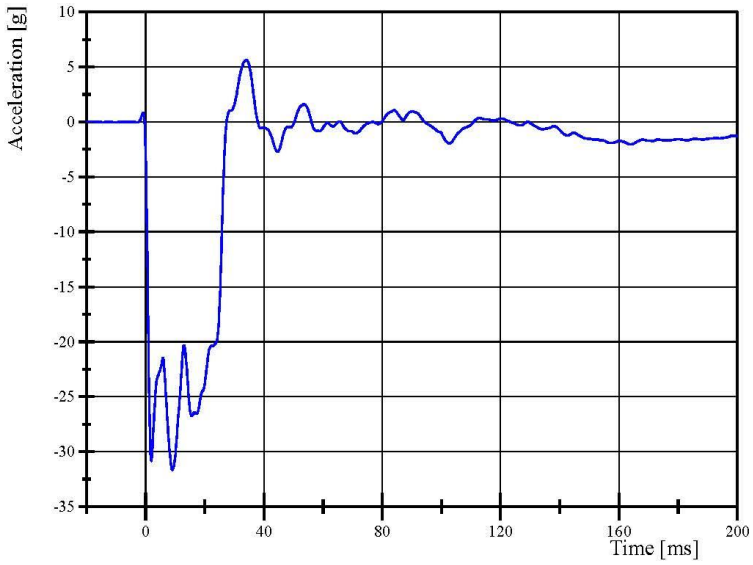
Specification Source: CFR49 Part 572 Subpart V with Polarity in accordance with J211

06.26.2019 10:28:59 719

Transportation Research Center Inc.

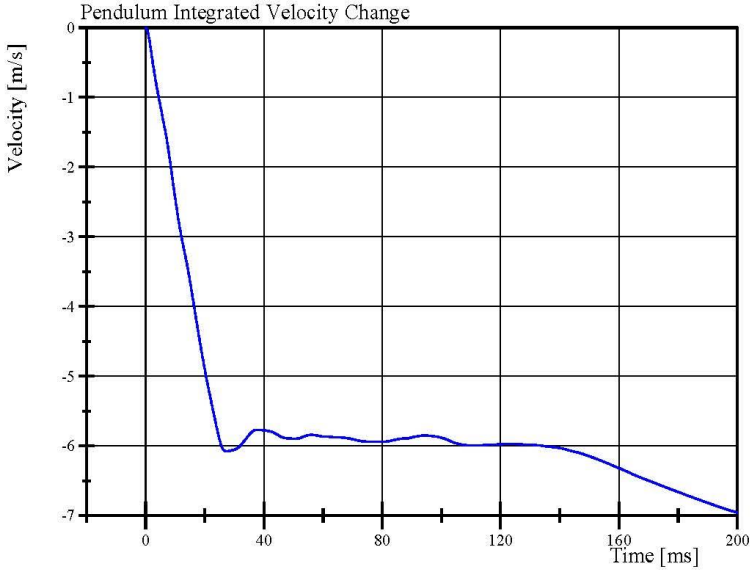
Right Lateral Neck
SID IIs Serial No. DI8818 Certification No. 27-1
Test Date: 6/26/2019

Pendulum Acceleration



Filter Class: CFC_180
Max: 5.6 g at 34.0 ms
Min: -31.6 g at 9.0 ms

Pendulum Integrated Velocity Change



Filter Class: CFC_180
Max: 0.0 m/s at 0.0 ms
Min: -7.0 m/s at 200.0 ms

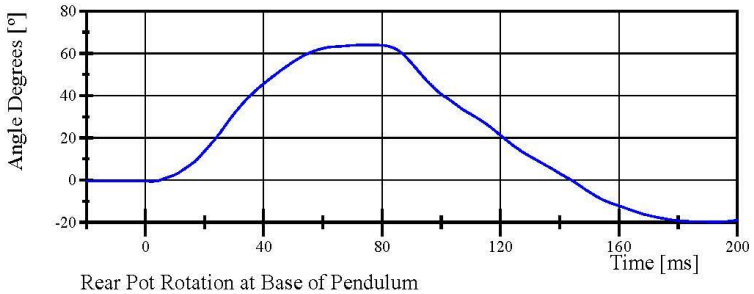
Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

06.26.2019 10:30:42 719

Transportation Research Center Inc.

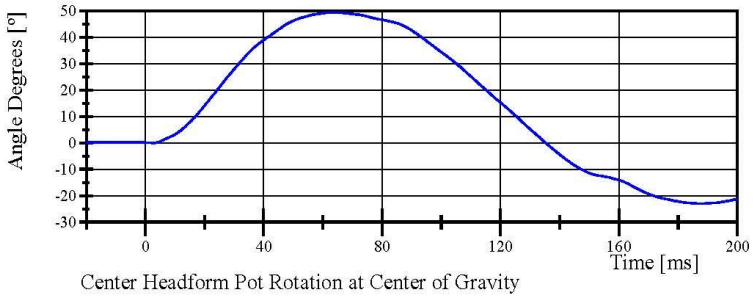
Right Lateral Neck
SID IIs Serial No. DI8818 Certification No. 27-1
Test Date: 6/26/2019

Forward Pot Rotation at Base of Pendulum



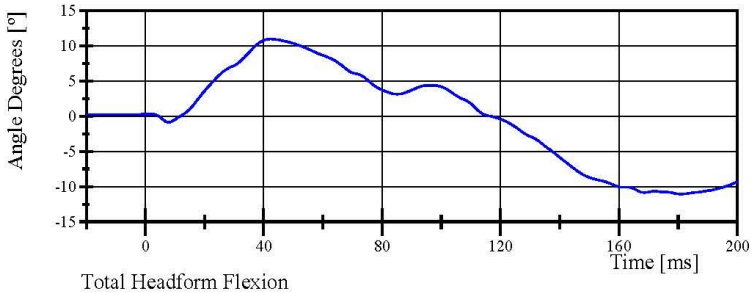
Filter Class: CFC_60
Max: 64.1 ° at 73.4 ms
Min: -19.8 ° at 192.3 ms

Rear Pot Rotation at Base of Pendulum



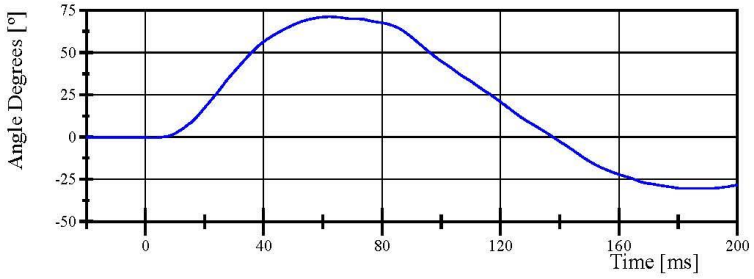
Filter Class: CFC_60
Max: 49.3 ° at 63.6 ms
Min: -23.0 ° at 187.6 ms

Center Headform Pot Rotation at Center of Gravity



Filter Class: CFC_60
Max: 11.0 ° at 42.4 ms
Min: -11.1 ° at 180.9 ms

Total Headform Flexion



Filter Class: CFC_60
Max: 71.3 ° at 62.2 ms
Min: -30.4 ° at 182.2 ms

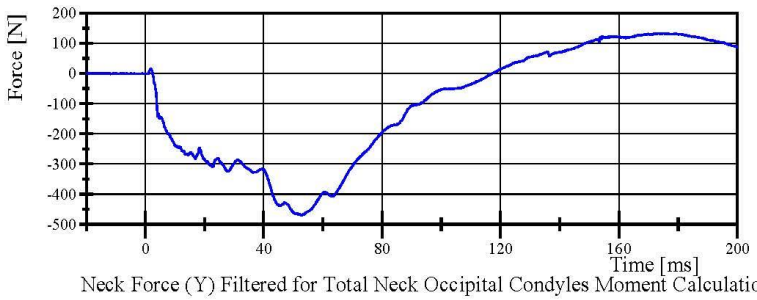
Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

06.26.2019 10:30:43 719

Transportation Research Center Inc.

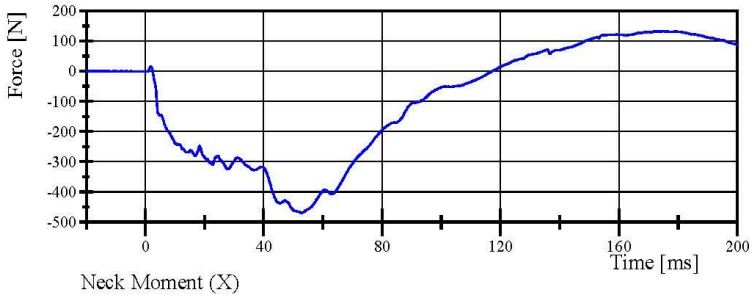
Right Lateral Neck
SID IIs Serial No. DI8818 Certification No. 27-1
Test Date: 6/26/2019

Neck Force (Y)



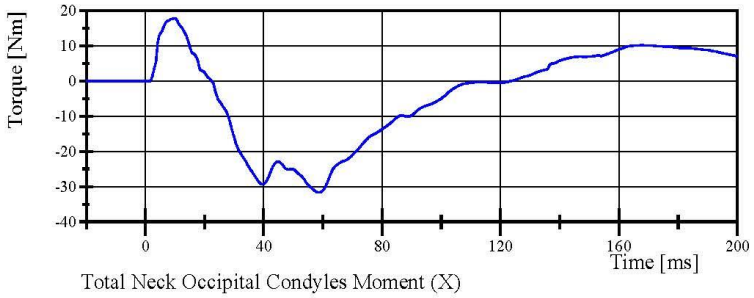
Filter Class: CFC_1000
Max: 134.4 N at 175.0 ms
Min: -469.4 N at 52.9 ms

Neck Force (Y) Filtered for Total Neck Occipital Condyles Moment Calculation



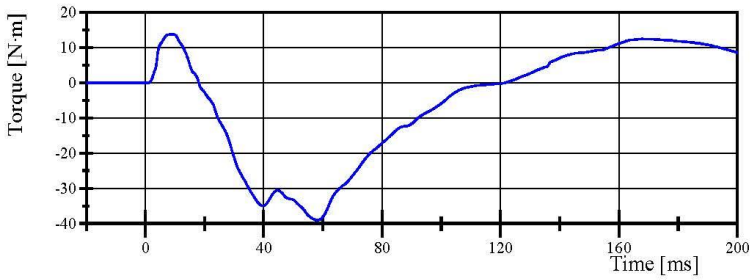
Filter Class: CFC_600
Max: 133.9 N at 175.0 ms
Min: -468.8 N at 52.9 ms

Neck Moment (X)



Filter Class: CFC_600
Max: 17.9 Nm at 10.0 ms
Min: -31.6 Nm at 58.6 ms

Total Neck Occipital Condyles Moment (X)



Filter Class: Without_(Constar
Max: 13.8 N·m at 8.6 ms
Min: -39.0 N·m at 58.1 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

06.26.2019 10:30:44 719

APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

			Serial Number	Manufacturer and Model #	Calibration Date	Date Due
ATD		N/A	DI8818	FTSS	26-Jun-2019	
Head Accelerometers	Primary	X	P97682	Endevco	26-Jun-2019	26-Dec-2019
		Y	P97834	Endevco	27-Jun-2019	27-Dec-2019
		Z	P97883	Endevco	27-Jun-2019	27-Dec-2019
	Redundant	X	P97692	Endevco	27-Jun-2019	28-Dec-2019
		Y	P97543	Endevco	27-Jun-2019	27-Dec-2019
		Z	P97848	Endevco	27-Jun-2019	27-Dec-2019
Upper Neck Load Cell		Fx, Fy, Fz, Mx, My, Mz	DK7373S	FTSS	27-Jun-2019	26-Jun-2020
Lower Neck Load Cell		Fx, Fy, Fz, Mx, My, Mz	151	Denton	2-Apr-2019	1-Apr-2020
Chest Potentiometer		Dx				
Sternum Accelerometer		X				
Spine Accelerometer		X				
Data System		N/A	223	Kayser-Threde	9-Jul-2019	
Inclinometer		N/A	DP-7	Mitutoyo Pro 360	19-Oct-2018	19-Oct-2019