

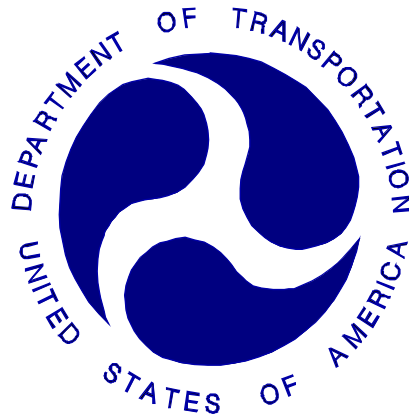
REPORT NUMBER: TWG-CAL-16-06

NEW CAR ASSESSMENT PROGRAM (NCAP)
SIDE AIRBAG OUT-OF-POSITION INJURY TESTING

Honda Mfg. of Indiana, LLC
2016 Honda Civic

NHTSA NUMBER: M20165300TWG2
CALSPAN TEST NUMBER: CT2016-06

PREPARED BY:
CALSPAN CORPORATION
4455 Genesee St.
BUFFALO, NEW YORK 14225



June 1, 2016

DRAFT 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-00311, Alpha Technology PO 12GC153. 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: Alexander Rudniski
Alexander Rudniski, Project Engineer

Approved By: Edward Dutton
Edward Dutton, Test Engineer

Approval Date: _____

FINAL REPORT ACCEPTANCE BY:

Accepted By: _____

Acceptance Date: _____

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. TWG-CAL-16-06		2. Government Accession No.		3. Recipient's Catalog No.		
4. Title and Subtitle Final Report 2016 , TWG/Out-of-Position Tests NHTSA No.: M20165300TWG2				5. Report Date June 1, 2016		
				6. Performing Organization Code CAL		
7. Author(s) Edward Dutton, Project Manager Alexander Rudniski, Project Engineer				8. Performing Organization Report No. CT2016-06		
9. Performing Organization Name and Address Calspan Corporation 4455 Genesee St. Buffalo, New York 14225				10. Work Unit No.		
				11. Contract or Grant No. DTNH22-13-D-00311		
12. Sponsoring Agency Name and Address Alpha Technology Associate, Inc. 2810 Old Lee Hwy, Suite 120 Fairfax, VA 22031				13. Type of Report and Period Covered Final Report, June 1, 2016		
				14. Sponsoring Agency Code NVS-111		
15. Supplementary Notes						
16. Abstract This side impact Out-Of-Position test was performed in conjunction with a New Car Assessment Program (NCAP). This test was conducted at the Calspan Test Facility in Buffalo, New York, on May 25, 2016.						
Injury Summary						
HIC15	Maximum Chest Displacement (mm)	Maximum Chest Displacement Rate (m/s)	NIJ(NTF)	NIJ(NTE)	NIJ(NCF)	NIJ(NCE)
20.20	N/A	N/A	0.057	0.186	0.476	0.319
17. Key Words New Car Assessment Program (NCAP) Side Airbag Out-Of-Position				18. Distribution Statement <u>Copies of this report are available from:</u> Alpha Technology Associate, Inc. 2810 Old Lee Hwy, Suite 120 Fairfax, VA 22031 Phone: (703) 876-0010 Fax: (703) 876-0120 Attn: Mai Lan Aram		
19. Security Classification of Report UNCLASSIFIED		20. Security Classification of Page UNCLASSIFIED		21. No. of Pages 37		22. Price

TABLE OF CONTENTS

<u>Section</u>		<u>Page No.</u>
1	PURPOSE AND SUMMARY OF TEST	1-1
2	DATA SHEETS	2-1
	Data Sheet 1 – Test Summary	2-1
	Data Sheet 2 – Vehicle Parameter Data	2-2
	Data Sheet 3 – Dummy Positioning in Vehicle	2-3
	Data Sheet 4 – Dummy Injury Criteria Values	2-4
A	PHOTOGRAPHS	A-1
B	DUMMY RESPONSE DATA TRACES	B-1
C	TEST EQUIPMENT LIST AND CALIBRATION INFORMATION	C-1

SECTION 1

PURPOSE AND SUMMARY OF TEST:

1.1 PURPOSE

The purpose of this test was to obtain data from a static out-of-position side impact using a vehicle that had previously undergone a New Car Assessment Program (NCAP) sponsored frontal impact test requested by the National Highway Traffic Safety Administration (NHTSA). This test was performed under NHTSA contract No. DTNH22-13-D-00311 and through Alpha Technology Associate, Inc.

1.2 SUMMARY

The effects of both a seat-mounted side airbag and a curtain airbag deployment in a 2016 Honda Civic on an out-of-position SID-IIs 5th Female ATD were evaluated. The test was performed by Calspan on May 25, 2016. Pre- and post-test photographs of the vehicle and ATD can be found in Appendix A.

Three high-speed digital cameras were used to document the side airbag deployment event. Images were recorded at rates of 1000 frames per second. One camera was placed perpendicular to the right-front seat centerline to capture the deployment event from the driver's side. The second camera was placed parallel to the right-front seat centerline to capture the deployment event from the front. A third camera was placed perpendicular to the right-front seat from the passenger side to capture the deployment event.

The SID-IIs 5th Female anthropomorphic test device (ATD) was placed in the right front (passenger) seat situated parallel to the seat centerline, facing towards the front of the test vehicle according to the ATD placement instructions specified by Alpha Technology Associate, Inc. who referenced 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). This orientation complies with section 3.3.5.2 of the TWG Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as defined by Lund, et al and the Technical Working Group First Revision dated July, 2003.

The SID-IIs 5th Female ATD was instrumented with head x, y and z accelerometers (primary and redundant). In addition, a six axis upper neck load cell sensor was utilized to record the resulting neck forces and moments during the event.

Fourteen channels of data were recorded using an on-board data acquisition system. Appendix A contains photographs. Appendix B contains ATD response data traces. Appendix C contains the Instrumentation Data Channel assignments.

SECTION 2

DATA SHEET NO. 1 TEST SUMMARY

TEST CONFIGURATION INFORMATION:

Seating Position:	P2	Right Front Seating Position
Test:	3.3.5.2	Forward Facing SID-IIs 5th Female ATD (Driver and Passenger Positions with Roof-Rail-Mounted Airbags)
Airbag: 1	Curtain	Roof Rail Mounted – Passenger Side
Airbag: 2	Seat/Torso	Passenger Seat Mounted – Outside Seam
Booster Block:	N/A	N/A
ATD Type/Serial No.:	303	SID-IIs 5th Female ATD

Number of Data Channels:

14

Number of Cameras:

0

Real Time

3

High Speed Digital

PRE-TEST VISIBLE DUMMY CONTACT POINTS

Head Contact:	None
Upper Torso Contact:	Passenger Door, Passenger Seat Back
Lower Torso Contact:	Passenger Seat Pan
Knee Contact:	None
Foot Contact:	Passenger Toe Pan

POST-TEST VISIBLE DUMMY CONTACT POINTS

Head Contact:	Curtain Airbag, Passenger Headrest
Upper Torso Contact:	Curtain Airbag, Seat/Torso Airbag, Passenger Seat Back, Passenger Door
Lower Torso Contact:	Passenger Seat Pan, Passenger Torso Airbag
Knee Contact:	None
Foot Contact:	Passenger Toe Pan

**DATA SHEET NO. 2
VEHICLE PARAMETER DATA**

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2016 Honda Civic

NHTSA No. : M20165300TWG2 ; VIN: 19XFC2F5XGE003800 Color: Charcoal Grey

Engine Data: 14 cylinders; - CID; 2.0 Liters; - cc

Placement: - Longitudinal or In-Line; X Transverse or Lateral

Transmission Data: CVT speeds; - Manual; X Automatic; X Overdrive

Final Drive: - Rear Wheel Drive; X Front Wheel Drive; - Four Wheel Drive

Safety Belt Features – Driver X Pretensioner (Shoulder); X Load Limiter; X Adj. Anchorage

Safety Belt Features - Passenger X Pretensioner (Shoulder); X Load Limiter; X Adj. Anchorage

Major Options: X A/C; X Pwr. Steering.; X Pwr. Brakes

X Pwr. Windows; X Pwr. Door Locks; X Tilt Wheel

Date Received: 12/10/2015 ; Odometer Reading 11.26 Km

Selling Dealer: Schaumburg Honda Automobi

& Address: 750 East Golf Road, Schaumburg, IL 60173

DATA FROM TIRE VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: Honda Mfg. of Indiana, LLC

Date of Manufacture 11/2015

GVWR: 1695 kg; GAWR: 900 kg FRONT; 810 kg REAR

DATA FROM TIRE PLACARD:

Recommended Tire Size: P215/55R16

*Recommended Cold Tire Pressure: 220 kPa Front 220 kPa Rear

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P215/55R16 ; Manufacturer: Hankook

Tire Pressure with Maximum Capacity Vehicle Load: Front 350 kPa Rear: 350 kPa

Treadwear: 500 ; Traction: A ; Temperature: A

VEHICLE CAPACITY DATA:

Type of Front Seats: - Bench; X Bucket; - Split Bench

Number of Occupants: 2 Front; 3 Rear; 5 Total

Vehicle Capacity Weight (VCW) = 385 Kg

No. of Occupants x 68.04 kg = 340.2 Kg

Rated Cargo/Luggage Weight (RCLW) = 44.8 Kg

*Tire pressure used for test

‡Vehicle had previously undergone a New Car Assessment Program Frontal NCAP Test.

DATA SHEET NO. 3
SID-IIs 5th Female POSITIONING IN VEHICLE

NHTSA No. M20165300TWG2

Measurement	Value
Total Fore/Aft Travel (mm)	240
Test Distance Rearward of Full-Forward (mm)	120
Total Fore/Aft Travel (Detents)	N/A
Placed in Position #	120

Seat Back Angle	SA (1.7°)	Value
Airbag Module Width	AMW (mm)	-
Airbag Width	ABW (mm)	-
Airbag Module Length	AML (mm)	-
Airbag Length	ABL (mm)	-
Top of Airbag Module to Head/Neck Junction	AN (mm)	-
Head CG to Door Panel/Side Window	HD (mm)	106
Head to Seat Back Centerline	HSC (mm)	112
Head to B-Pillar (cg)	HB (mm)	203
Head to Roof, Z (top of the head)	HZ (mm)	127
Head to Header	HHD (mm)	343
Chest to Door	CD (mm)	443
Chest to Seatback	CS (mm)	0

DATA SHEET 4
SID-IIISD DUMMY INJURY CRITERIA VALUES

NHTSA No.: M20165300TWG2

Channel	Units	Max	Time (ms)	Min	Time (ms)
V1P2 Head x [CFC_1000]	g's	16.87	10.75	-9.93	13.25
V1P2 Head y [CFC_1000]	g's	14.79	10.75	-17.83	23.85
V1P2 Head z [CFC_1000]	g's	85.45	10.90	-21.62	16.30
V1P2 Headform Resultant [CFC_1000]	g's	85.98	10.90	0.00	-6.00
V1P2 Upper Neck Mocy [CFC_600]	Nm	24.30	22.25	-13.81	40.25
V1P2 Upper Neck Ntf [CFC_600]	-	0.06	187.05	0.00	-50.00
V1P2 Upper Neck Nte [CFC_600]	-	0.19	84.40	0.00	-50.00
V1P2 Upper Neck Ncf [CFC_600]	-	0.48	15.95	0.00	-50.00
V1P2 Upper Neck Nce [CFC_600]	-	0.32	37.75	0.00	-49.80
V1P2 Upper Neck Nij [CFC_600]	-	0.48	15.95	0.00	-13.35
V1P2 Upper Neck Fx [CFC_1000]	N	332.38	21.35	-127.69	10.85
V1P2 Upper neck Fy [CFC_1000]	N	122.28	219.90	-215.60	29.15
V1P2 Upper neck Fz [CFC_1000]	N	82.75	6.40	-1657.14	14.40
V1P2 Neck Force Resultant [CFC_1000]	N	1671.86	14.40	0.05	-7.85
V1P2 Upper Neck Mx [CFC_600]	Nm	6.69	232.00	-12.76	56.95
V1P2 Upper Neck My [CFC_600]	Nm	30.14	22.20	-11.97	40.25
V1P2 Upper Neck Mz [CFC_600]	Nm	6.94	172.00	-5.45	40.65
V1P2 Neck Moment Resultant [CFC_600]	Nm	30.69	22.20	0.00	-5.90
V1P2 Lower Neck Fx F [CFC_1000]	N	-	-	-	-
V1P2 Lower Neck Fy F [CFC_1000]	N	-	-	-	-
V1P2 Lower Neck Fz F [CFC_1000]	N	-	-	-	-
V1P2 Lower Neck Force Resultant [CFC_1000]	N	-	-	-	-
V1P2 Lower Neck Mx F [CFC_600]	Nm	-	-	-	-
V1P2 Lower Neck My F [CFC_600]	Nm	-	-	-	-
V1P2 Lower Neck Mz F [CFC_600]	Nm	-	-	-	-
V1P2 Lower Neck Moment Resultant [CFC_600]	Nm	-	-	-	-
Curtain Airbag Volts	V	17.63	0.40	-16.01	192.70
Torso/Pelvis Airbag Volts	V	9.79	0.40	-23.34	0.00
Front Center Airbag Volts	V	-	-	-	-
Curtain Airbag Current	A	-	-	-	-
Torso/Pelvis Airbag Current	A	-	-	-	-
Front Center Airbag Current	A	-	-	-	-

DATA SHEET 4

CHILD DUMMY INJURY CRITERIA VALUES (CONTINUED)

VEHICLE: 2016 Honda Civic

NHTSA No.: M20165300TWG2

HEAD INJURY CRITERIA (HIC)

	HIC15			
	HIC(15)	t ₁ (msec)	t ₂ (msec)	Average Acceleration t ₁ to t ₂
Position P2	20.20	10.65	11.25	66.23

THORAX CRITERIA

	Critical Values	Actual	Time(ms)
Maximum Deflection (mm)	N/A	N/A	N/A
Maximum Deflection Rate (m/s)	N/A	N/A	N/A

Position P2 - Neck Injury Summary (SID-IIs 5th Female Dummy – Out Of Position)

Nij V10	Nij	Time (ms)	Z Force (N)	X Force (N)	Y Moment (N-m)
Ntf	0.057	187.050	52.819	-58.260	5.789
Nte	0.186	84.400	42.962	85.468	-9.174
Ncf	0.476	15.950	-1511.101	294.783	18.962
Nce	0.319	37.750	-386.712	107.118	-11.508

Peak Tension (CFC1000) 82.753 N

Peak Compression (CFC1000) -1657.136 N

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	3880.00 N	Extension (mCVe)	61.00 N-m	Tension	2070.00 N
Compression (CVc)	3880.00 N	Flexion (mCVf)	155.00 N-m	Compression	2520.00 N

Appendix A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

<u>Figure</u>	<u>Photograph Title</u>	<u>Page</u>
Figure A- 1	Right $\frac{3}{4}$ Front View of Vehicle, As Received	A- 3
Figure A- 2	Vehicle Certification Placard	A- 3
Figure A- 3	Pre-Test SID-IIs 5th Female Left Side View	A- 4
Figure A- 4	Post-Test SID-IIs 5th Female Left Side View	A- 4
Figure A- 5	Pre-Test SID-IIs 5th Female Left Side Close-up View	A- 5
Figure A- 6	Post-Test SID-IIs 5th Female Left Side Close-up View	A- 5
Figure A- 7	Pre-Test SID-IIs 5th Female Left $\frac{3}{4}$ Front View	A- 6
Figure A- 8	Post-Test SID-IIs 5th Female Left $\frac{3}{4}$ Front View	A- 6
Figure A- 9	Pre-Test SID-IIs 5th Female Left $\frac{3}{4}$ Front Close-up View	A- 7
Figure A- 10	Post-Test SID-IIs 5th Female Left $\frac{3}{4}$ Front Close-up View	A- 7
Figure A- 11	Pre-Test SID-IIs 5th Female Front View	A- 8
Figure A- 12	Post-Test SID-IIs 5th Female Front View	A- 8
Figure A- 13	Pre-Test SID-IIs 5th Female Front Close-up View	A- 9
Figure A- 14	Pre-Test SID-IIs 5th Female Rear View	A- 9
Figure A- 15	Pre-Test SID-IIs 5th Female Right Side Clearance View	A- 10
Figure A- 16	Post-Test SID-IIs 5 th Female Right Side Clearance View	A- 10
Figure A- 17	Pre-Test SID-IIs 5th Female Rear Clearance View	A- 11
Figure A- 18	Post-Test Curtain Airbag Left Side View	A- 11
Figure A- 19	Post-Test Torso and Curtain Airbag(s) Right Side View	A- 12
Figure A- 20	Post NCAP Left Side View	A- 12



Figure A-1: Right ¾ Front View of Vehicle, As Delivered

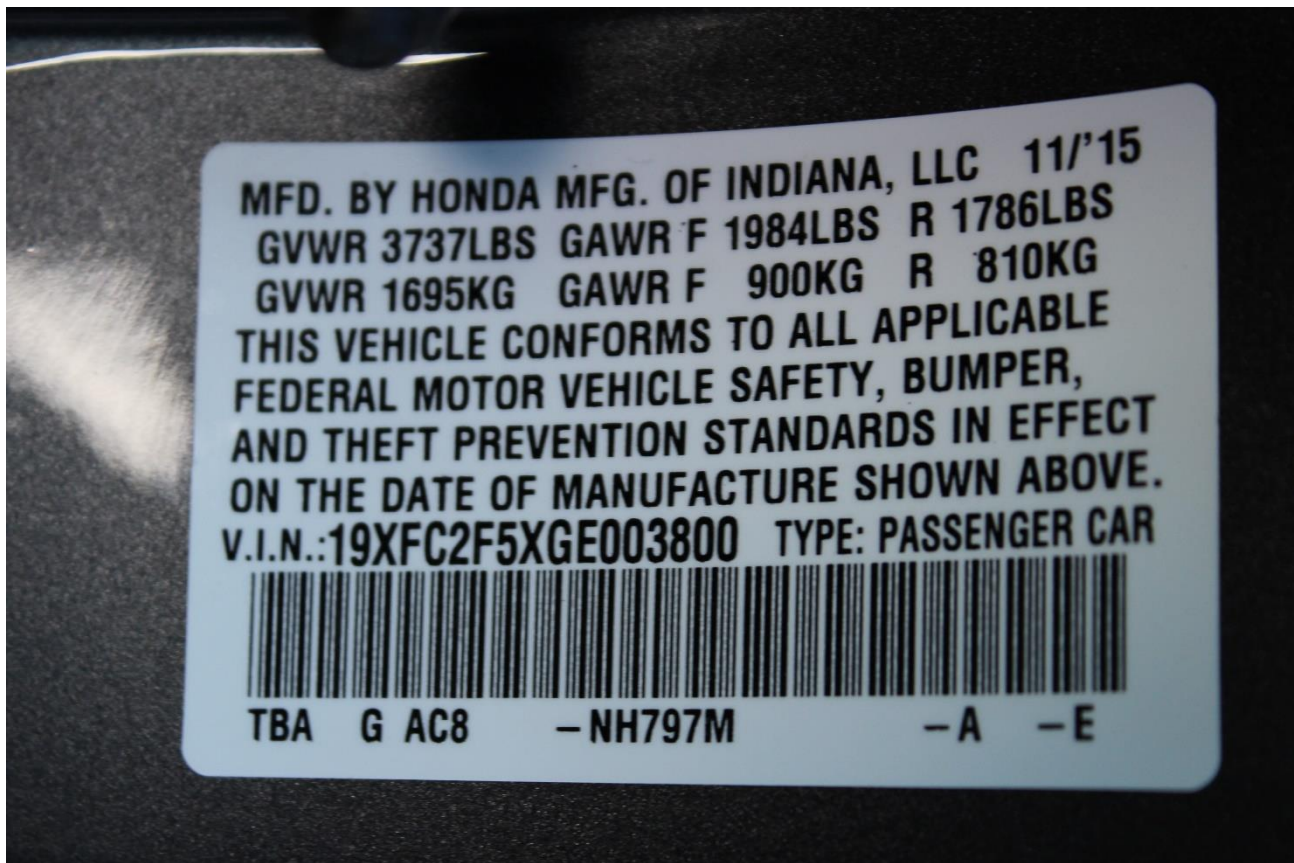


Figure A-2: Vehicle Certification Placard



Figure A-3: Pre-Test SID-IIs 5th Female Left Side View



Figure A-4: Post-Test SID-IIs 5th Female Left Side View



Figure A-5: Pre-Test SID-IIs 5th Female Left Side Close-up View



Figure A-6: Post-Test SID-IIs 5th Female Left Side Close-up View



Figure A-7: Pre-Test SID-IIs 5th Female Left $\frac{3}{4}$ Front View



Figure A-8: Post-Test SID-IIs 5th Female Left $\frac{3}{4}$ Front View



Figure A-9: Pre-Test SID-IIs 5th Female Left $\frac{3}{4}$ Front Close-up View



Figure A-10: Post-Test SID-IIs 5th Female Left $\frac{3}{4}$ Front Close-up View



Figure A-11: Pre-Test SID-IIs 5th Female Front View



Figure A-12: Post-Test SID-IIs 5th Female Front View



Figure A-13: Pre-Test SID-IIs 5th Female Front Close-up View



Figure A-14: Pre-Test SID-IIs 5th Female Rear View



Figure A-15: Pre-Test SID-IIs 5th Female Right Side Clearance View



Figure A-16: Post-Test SID-IIs 5th Female Right Side Clearance View



Figure A-17: Pre-Test SID-IIs 5th Female Rear Clearance View



Figure A-18: Post-Test Curtain Airbag Left Side View



Figure A-19: Post-Test Torso and Curtain Airbag(s) Right Side View

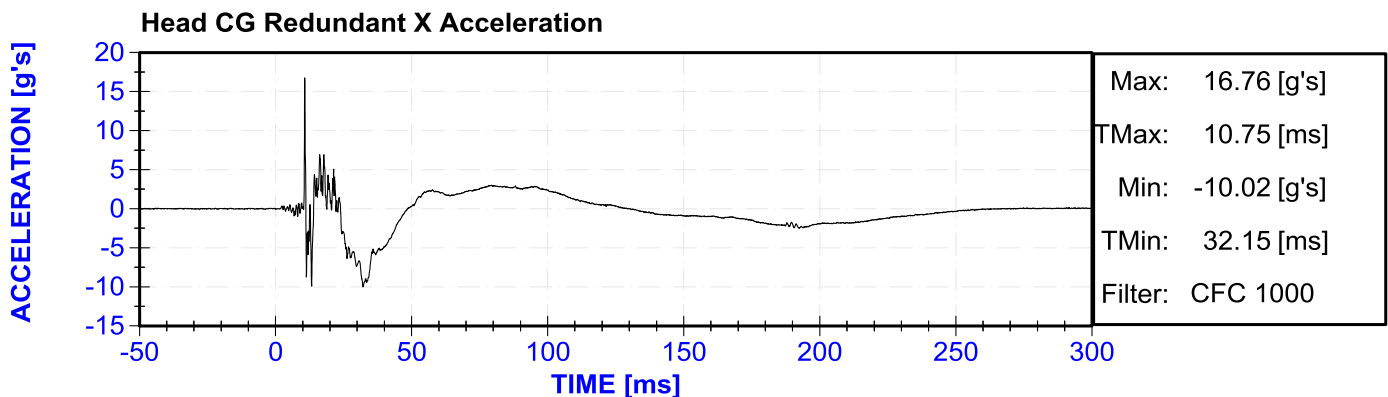
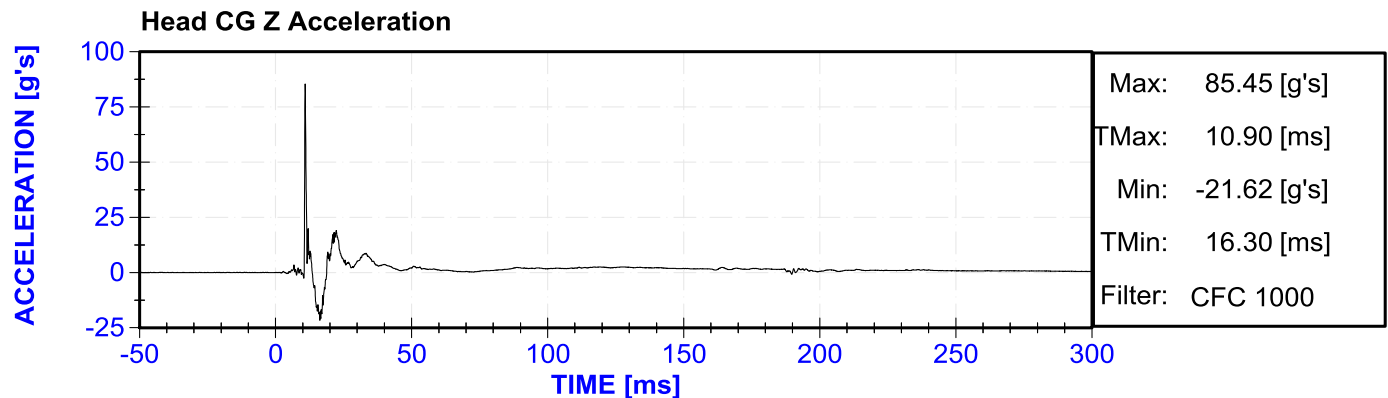
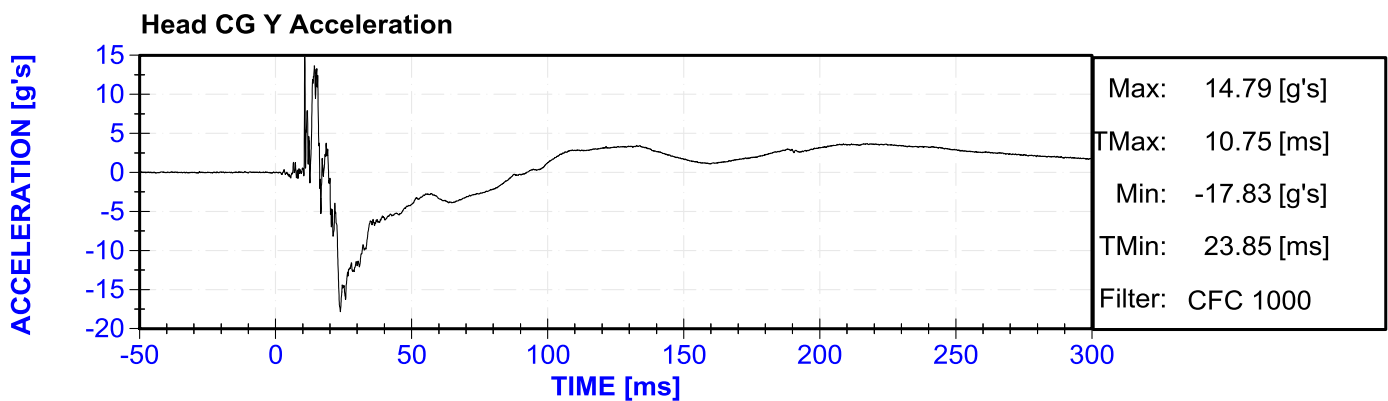
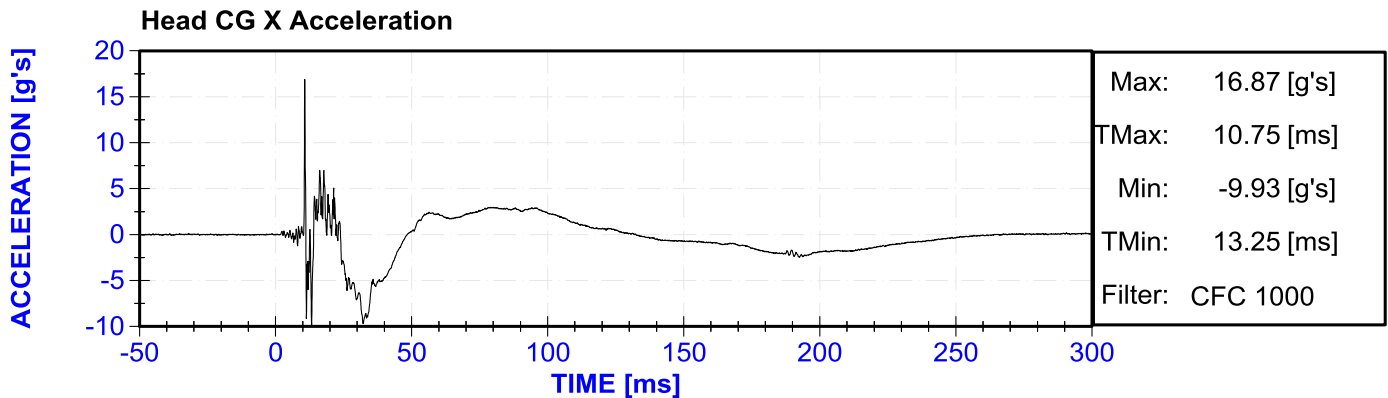


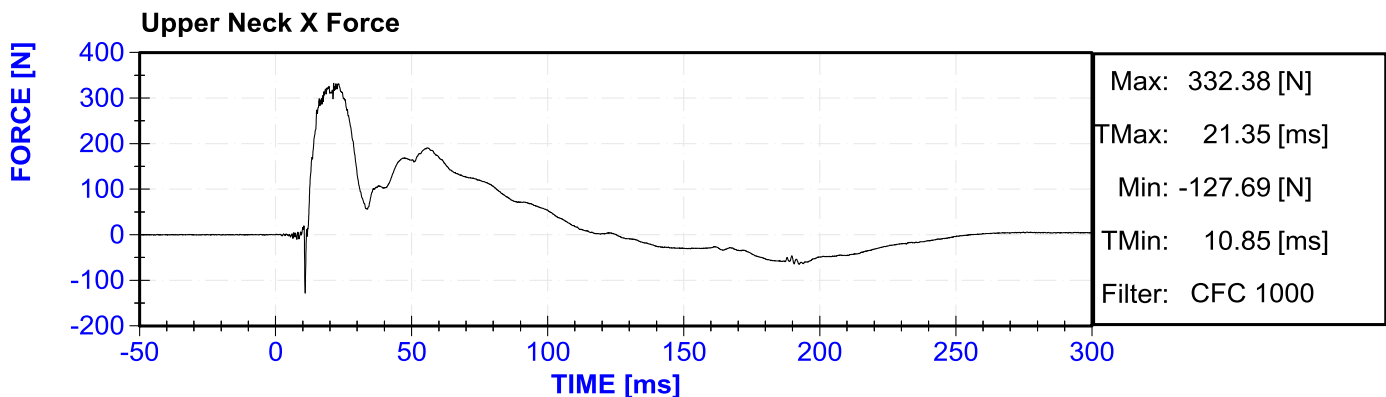
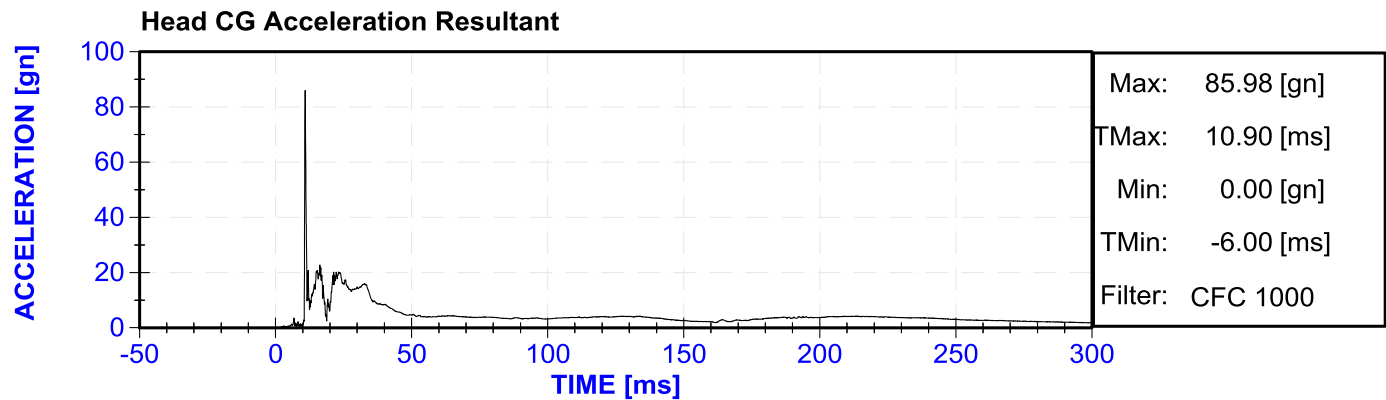
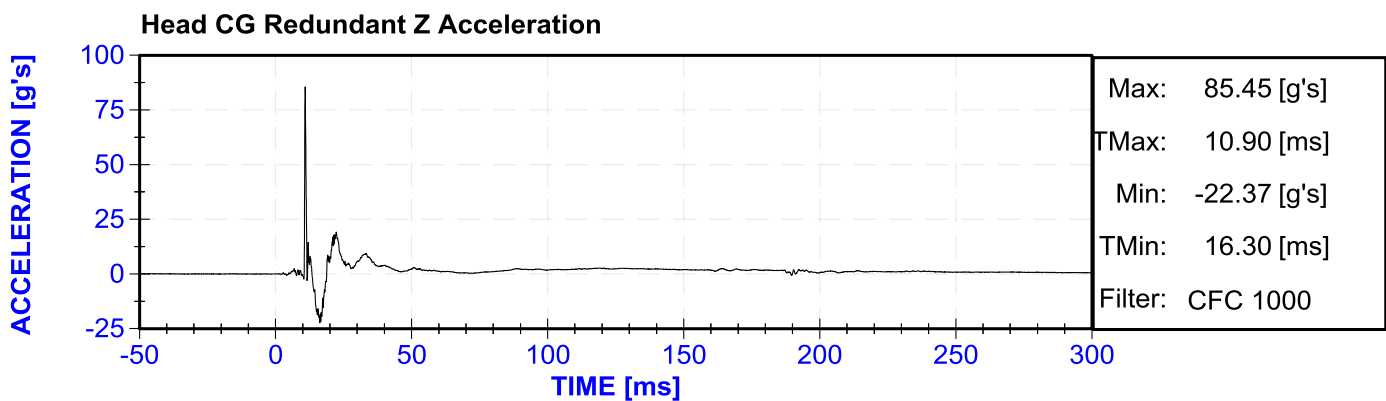
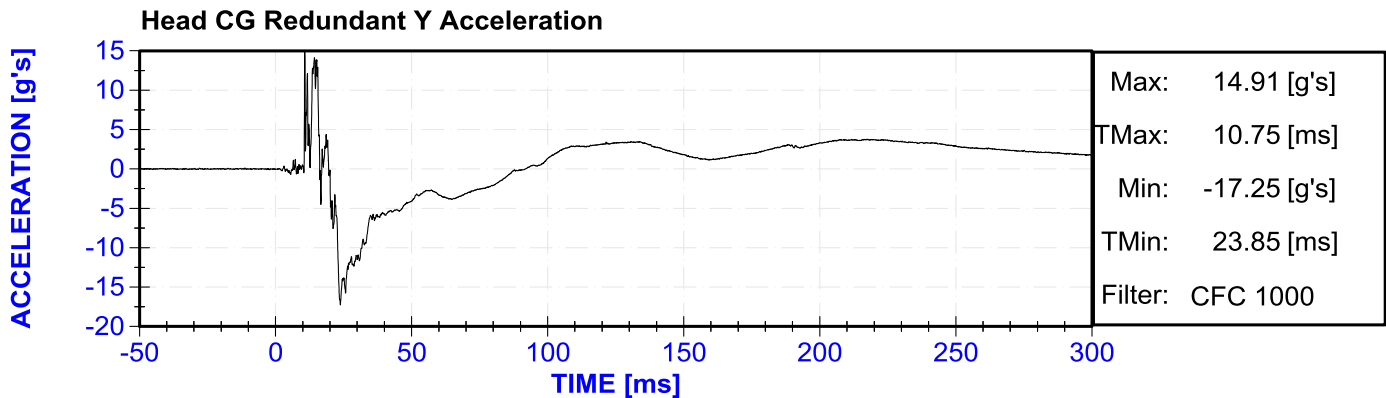
Figure A-20: Post NCAP Left Side View

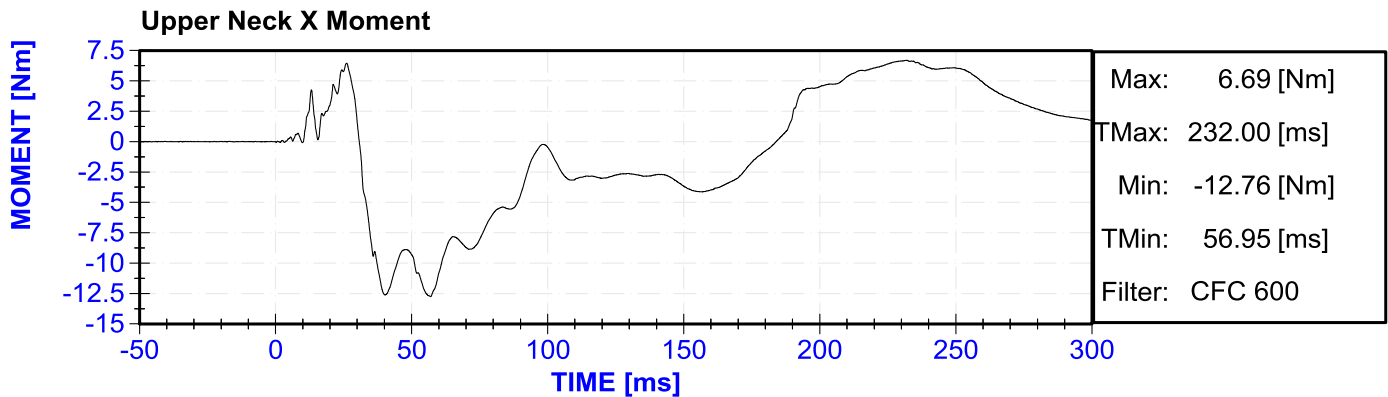
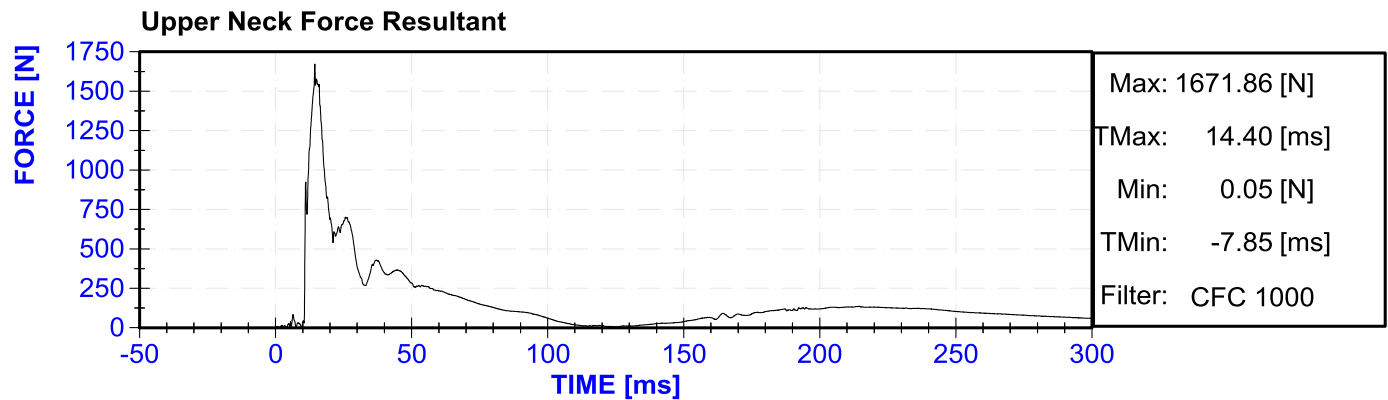
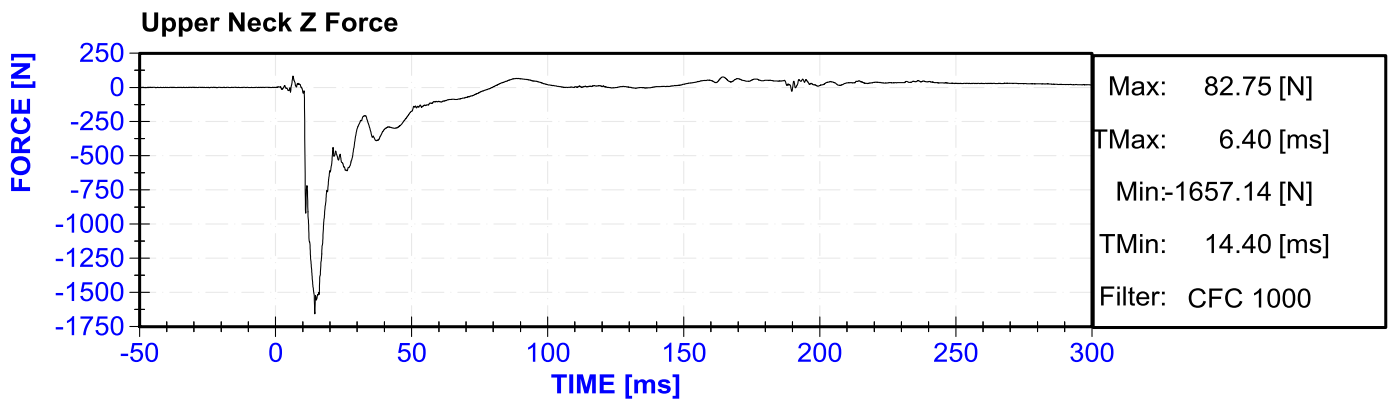
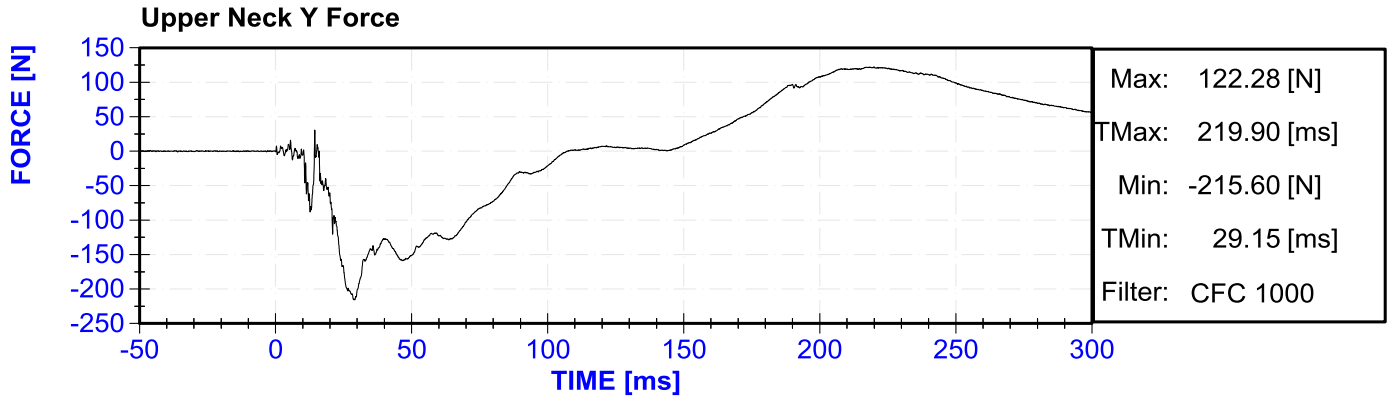
APPENDIX B
VEHICLE & DUMMY RESPONSE DATA TRACES

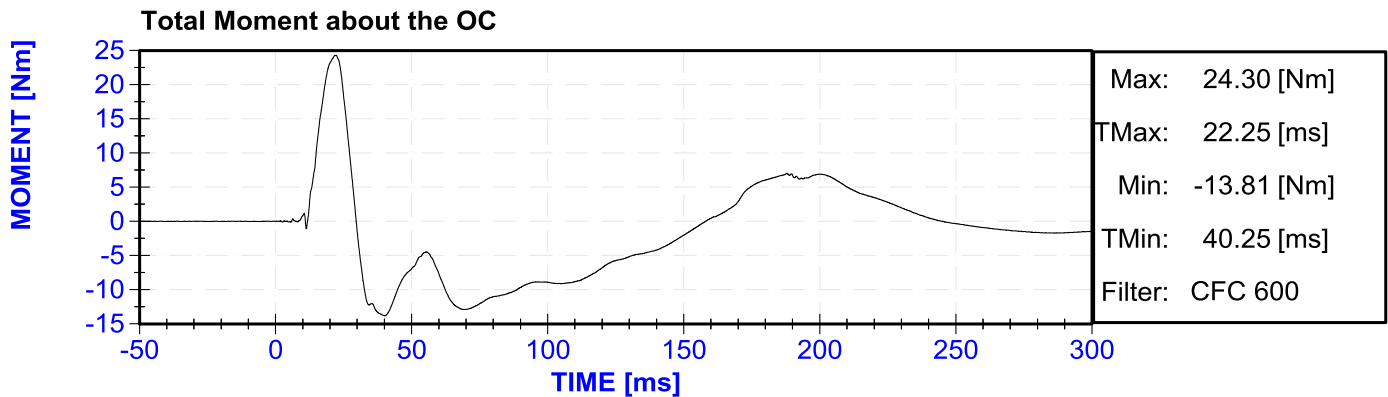
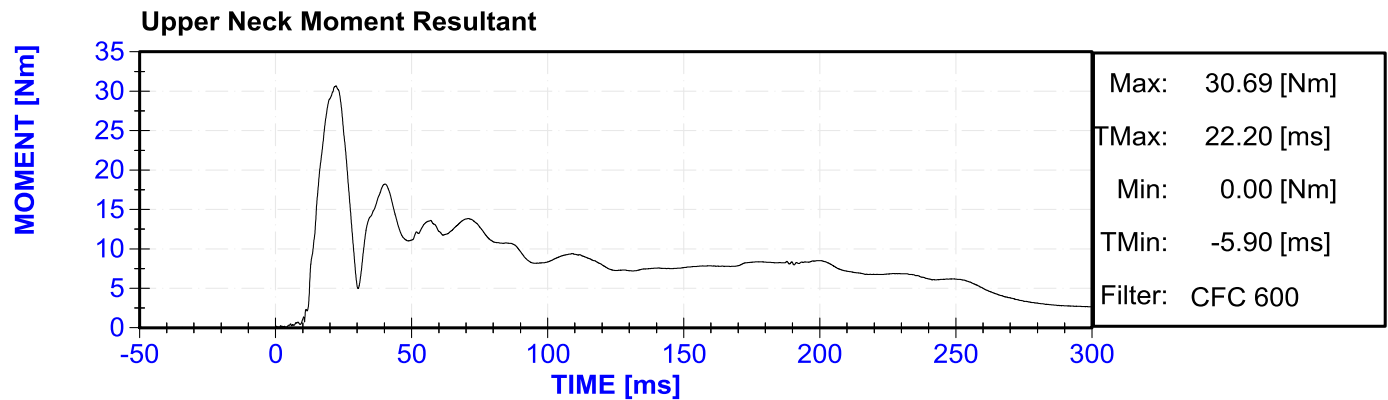
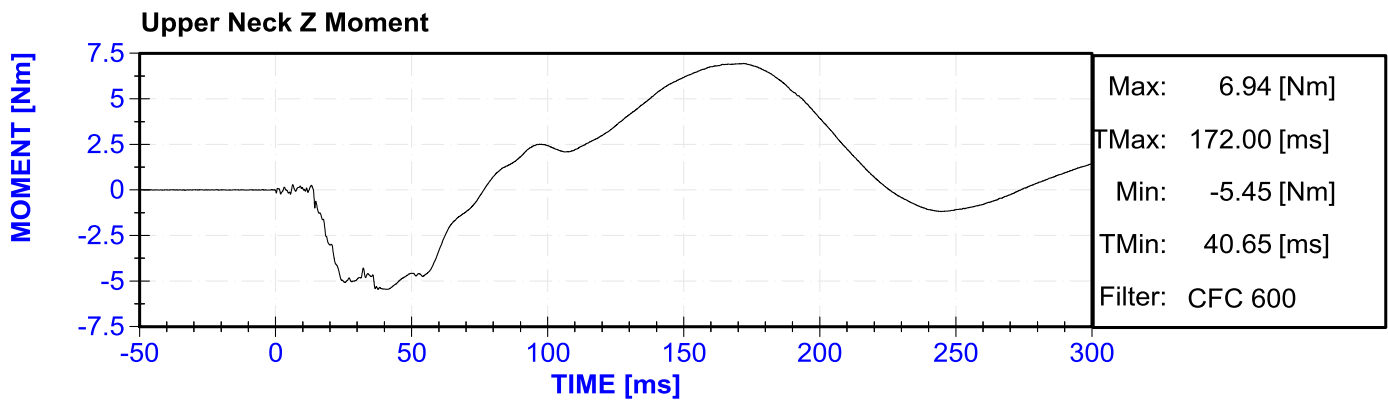
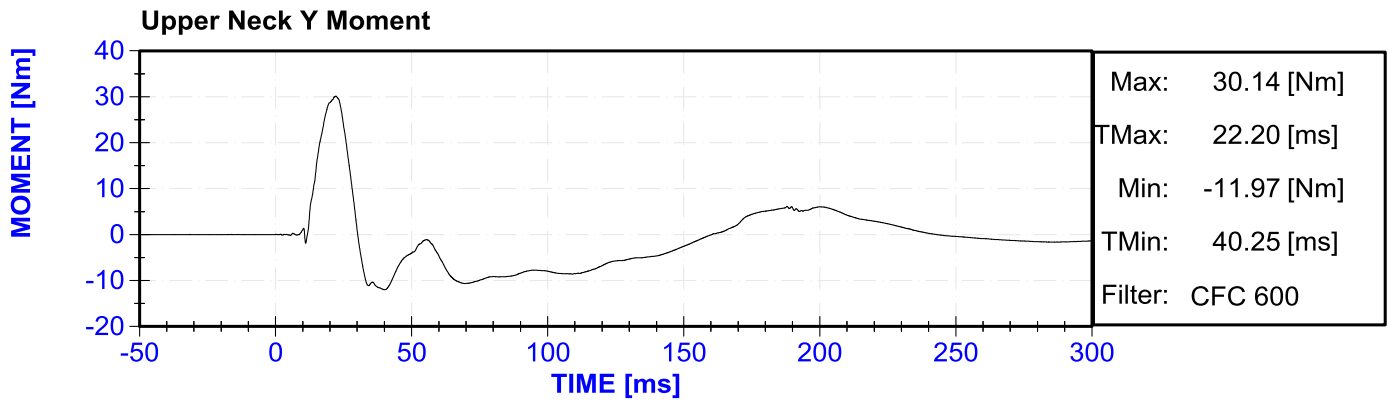
Table of Data Plots

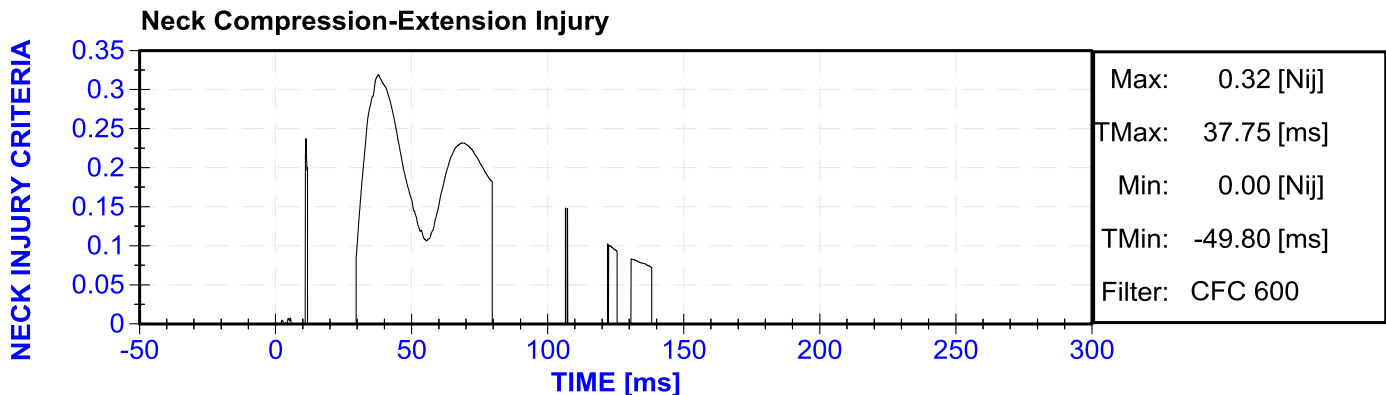
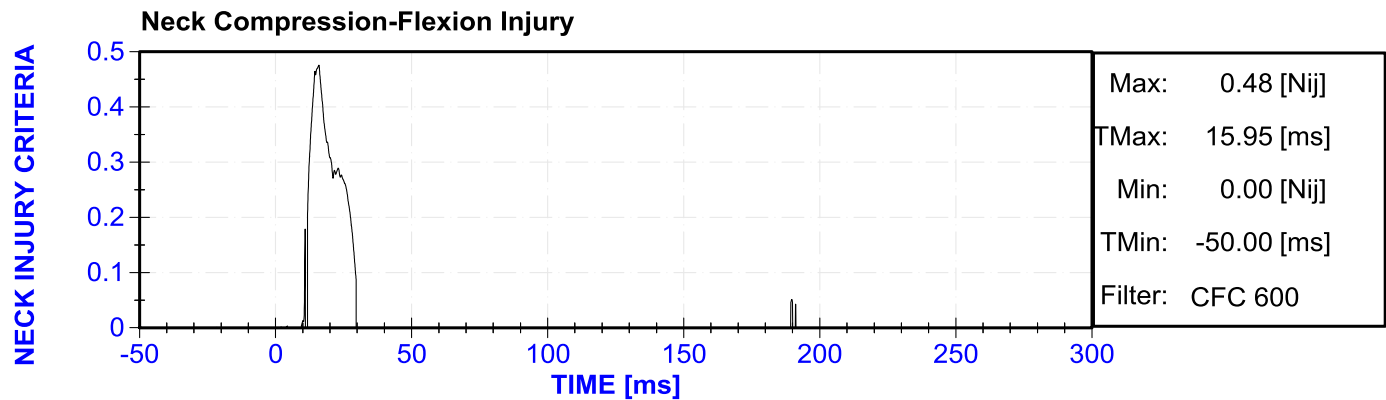
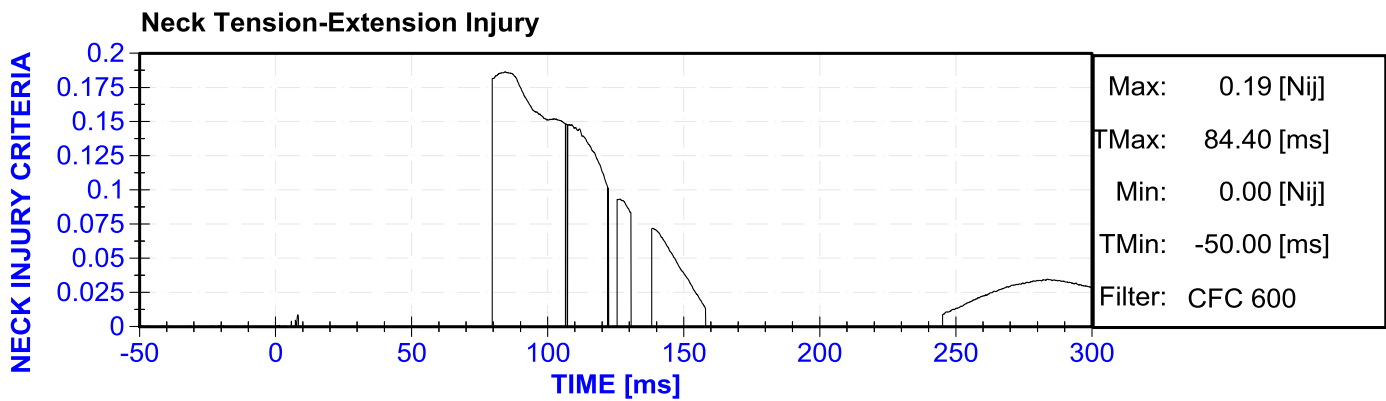
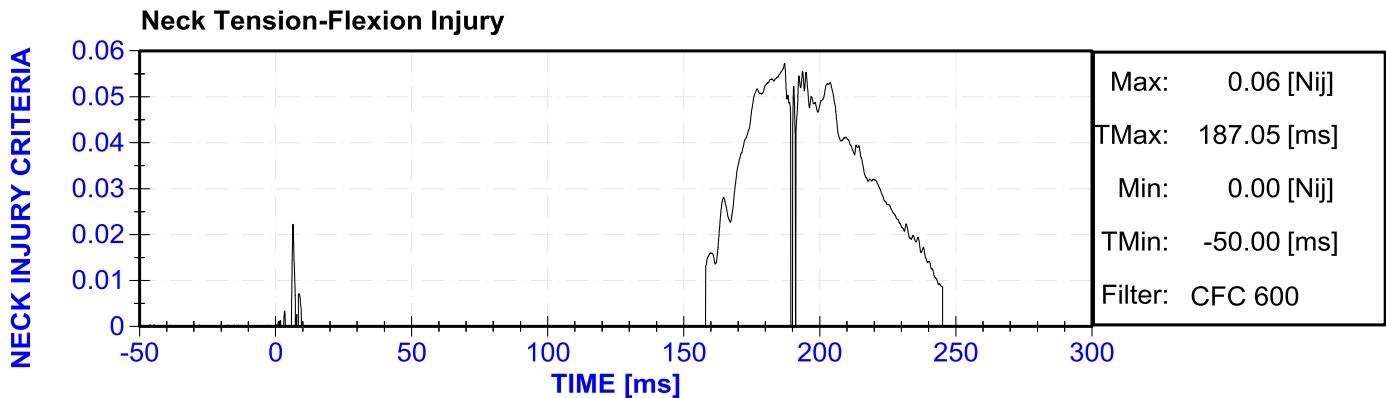
No.	Description	Page
Plot 1	Head CG X Acceleration	B-3
Plot 2	Head CG Y Acceleration	B-3
Plot 3	Head CG Z Acceleration	B-3
Plot 4	Head CG Redundant X Acceleration	B-3
Plot 5	Head CG Redundant Y Acceleration	B-4
Plot 6	Head CG Redundant Z Acceleration	B-4
Plot 7	Head CG Acceleration Resultant	B-4
Plot 8	Upper Neck X Force	B-4
Plot 9	Upper Neck Y Force	B-5
Plot 10	Upper Neck Z Force	B-5
Plot 11	Upper Neck Force Resultant	B-5
Plot 12	Upper Neck X Moment	B-5
Plot 13	Upper Neck Y Moment	B-6
Plot 14	Upper Neck Z Moment	B-6
Plot 15	Upper Neck Moment Resultant	B-6
Plot 16	Total Moment about the OC	B-6
Plot 17	Neck Tension-Flexion Injury	B-7
Plot 18	Neck Tension-Extension Injury	B-7
Plot 19	Neck Compression-Flexion Injury	B-7
Plot 20	Neck Compression-Extension Injury	B-7
Plot 21	Total Neck Injury	B-8
Plot 22	Passenger Curtain Squib Voltage	B-8
Plot 23	Passenger Seat Squib Voltage	B-8

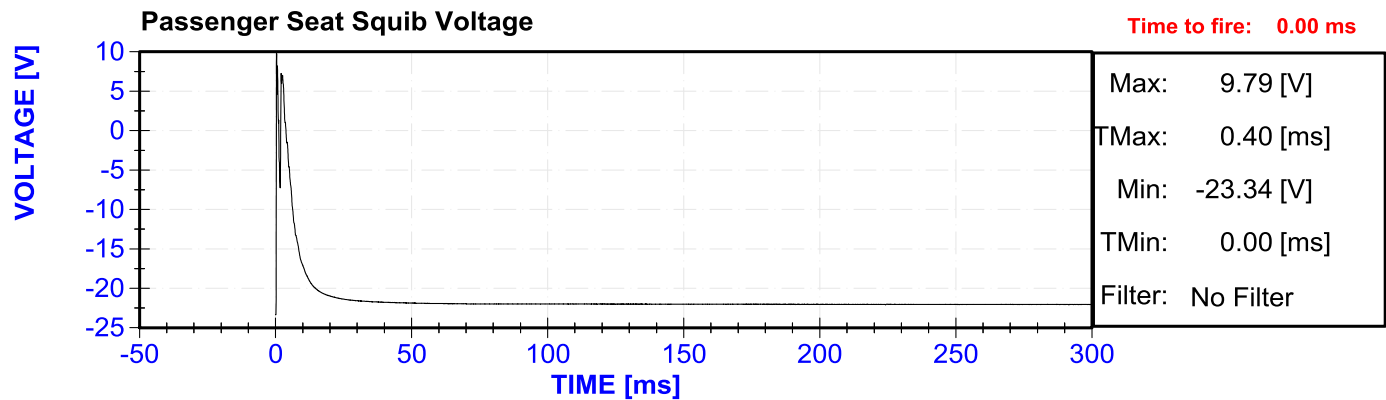
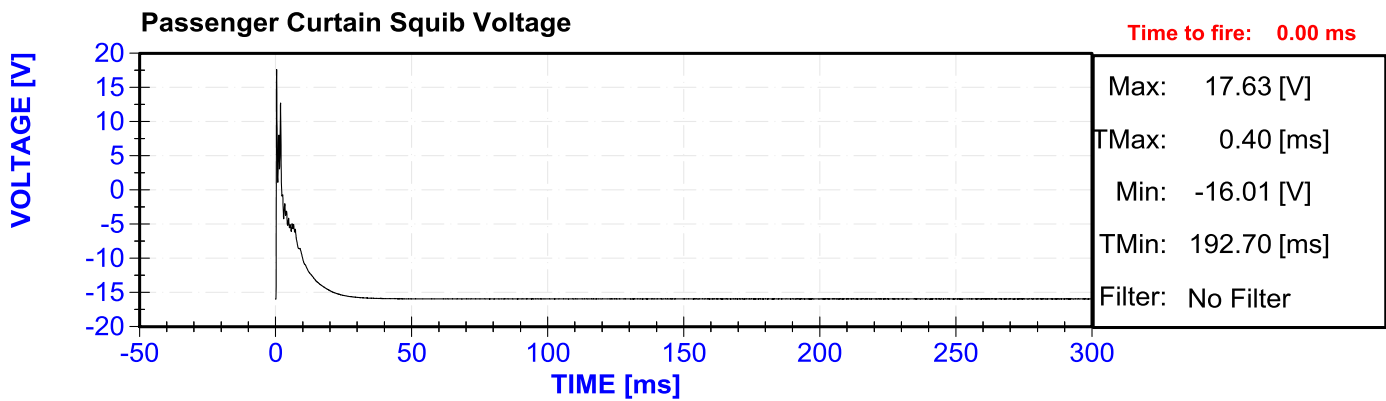
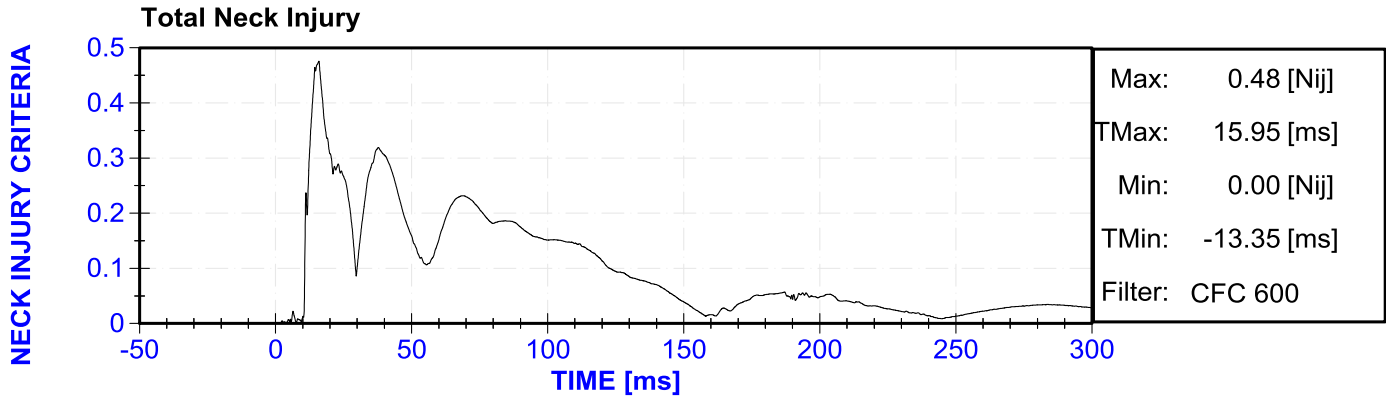












APPENDIX C

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

	POSITION #2 (Right Front Passenger) SERIAL NO.: 303 M20165300TWG2		
	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
Head X Acceleration	AC-P83420	ENDEVCO 7264	5/18/2016
Head Y Acceleration	AC-P52040	ENDEVCO 7264	5/18/2016
Head Z Acceleration	AC-P58737	ENDEVCO 7264CT	5/18/2016
Head Redundant X Acceleration	AC-P51668	ENDEVCO 7264CT	5/18/2016
Head Redundant Y Acceleration	AC-P51327	ENDEVCO 7264CT	5/18/2016
Head Redundant Z Acceleration	AC-P51695	ENDEVCO 7264	5/18/2016
Upper Neck X Force	LC-2019Fx	Denton 1716A	6/29/2015
Upper Neck Y Force	LC-2019Fy	Denton 1716A	6/29/2015
Upper Neck Z Force	LC-2019Fz	Denton 1716A	6/29/2015
Upper Neck X Moment	LC-2019Mx	Denton 1716A	6/29/2015
Upper Neck Y Moment	LC-2019My	Denton 1716A	6/29/2015
Upper Neck Z Moment	LC-2019Mz	Denton 1716A	6/29/2015
Lower Neck X Force	-	-	-
Lower Neck Y Force	-	-	-
Lower Neck Z Force	-	-	-
Lower Neck X Moment	-	-	-
Lower Neck Y Moment	-	-	-
Lower Neck Z Moment	-	-	-
Curtain Bag Voltage	ABT squib volts	AutoLab System	-
Curtain Bag Current	-	-	-
Seat/Torso Bag Voltage	ABT squib volts	AutoLab System	-
Seat/Torso Bag Current	-	-	-