REPORT NUMBER: TWG-CAL-18-03

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

Subaru Corporation
2018 Subaru Crosstrek

NHTSA NUMBER: M20185503TWG2
CALSPAN TEST NUMBER: CT2018-03

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

November 14, 2018

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-00311L, Alpha Technology PO 12GC150. 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: _____
Zachary Granby, Test Engineer

Approved By: _____
Vanessa Hansen, Program Manager

Approval Date: November 14, 2018

FINAL REPORT ACCEPTANCE BY:

Accepted By: _____

Acceptance Date: _____

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. TWG-CAL-18-03	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Final Report 2018 , TWG/Out-of-Position Tests NHTSA No.: M20185503TWG2		5. Report Date November 14, 2018
		6. Performing Organization Code CAL
7. Author(s) Vanessa Hansen, Program Manager Zachary Granby, Test Engineer		8. Performing Organization Report No. CT2018-03
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-00311L
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, November 14, 2018
		14. Sponsoring Agency Code NRM-110

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 July 19, 2018.

Injury Summary

HIC15	Maximum Chest Displacement (mm)	Maximum Chest Displacement Rate (m/s)	NIJ(NTF)	NIJ(NTE)	NIJ(NCF)	NIJ(NCE)
11.19	8.82	4.13	0.074	0.189	0.085	0.467

17. Key Words New Car Assessment Program (NCAP) Side Airbag Out-Of-Position	18. Distribution Statement Copies of this report are available from: Alpha Technology Associate, Inc. 2810 Old Lee Hwy, Suite 120 Fairfax, VA 22031 Phone: (703) 876-0010 Fax: (703) 876-0120

19. Security Classification of Report UNCLASSIFIED	20. Security Classification of Page UNCLASSIFIED	21. No. of Pages 36	22. Price

TABLE OF CONTENTS

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 side MDB impact test requested by the National Highway Traffic Safety Administration (NHTSA). This test was performed under NHTSA contract No. DTNH22-13-D-00311L 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 2018 Subaru Crosstrek on an out-of-position 3-Year-Old ATD were evaluated. The test was performed by Calspan on July 19, 2018. 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. The cameras were placed perpendicular to the right-front passenger seat centerline, Oblique, and through the passenger window to capture the deployment event from various positions.

The Hybrid III 3-year-old anthropomorphic test device (ATD) was placed in the right front (passenger) seat along the outboard edge of the seat cushion, kneeling and facing the seatback 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 3.3.3.2 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 Hybrid III 3-year-old ATD was instrumented with head x, y and z accelerometers, upper and lower neck forces and moments x, y, and z, chest acceleration x, y, z, mid sternum deflection Dx, upper and lower sternum accelerations x, and upper and lower spine accelerations x, y, and z.

27 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:	3.3.3.2	Rearward Facing Hybrid III 3YO Child Dummy
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.:	139	3 Year Old

Number of Data Channels:	27	
Number of Cameras:	0	Real Time
	3	High Speed Digital

PRE-TEST VISIBLE DUMMY CONTACT POINTS

Head Contact:	Seatback
Upper Torso Contact:	None
Lower Torso Contact:	Seatback
Knee Contact:	Seatpan
Foot Contact:	Seatpan

POST-TEST VISIBLE DUMMY CONTACT POINTS

Head Contact:	Curtain Airbag & Seatback
Upper Torso Contact:	Torso Airbag & Seatback
Lower Torso Contact:	Torso Airbag & Seatback
Knee Contact:	Seatpan
Foot Contact:	Seatpan & Door

DATA SHEET NO. 2
VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2018 Subaru Crosstrek

NHTSA No. : M20185503TWG2 ; VIN: JF2GTAAC3J9210580 Color: Light Blue

Engine Data: I4 cylinders; - CID; 2 Liters; - cc

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

Transmission Data: 6 speeds; X Manual; - Automatic; X Overdrive

Final Drive: - Rear Wheel Drive; - Front Wheel Drive; X 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: 10/3/2017 ; Odometer Reading 43.5 Km

Selling Dealer: Kenosha Subaru

& Address: 7900 120th AVE Kenosha WI 53142

DATA FROM TIRE VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: Subaru Corporation

Date of Manufacture 07/17

GVWR: 1970 kg; GAWR: 1010 kg FRONT; 1000 kg REAR

DATA FROM TIRE PLACARD:

Recommended Tire Size: P225/60R17

*Recommended Cold Tire Pressure: 230 kPa Front 220 kPa Rear

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P225/60R17 ; Manufacturer: Yokohama

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

Treadwear: 320 ; Traction: B : 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) = 408 Kg

No. of Occupants x 68.04 kg = 340.2 Kg

Rated Cargo/Luggage Weight (RCLW) = 67.8 Kg

*Tire pressure used for test

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

DATA SHEET NO. 3
Hybrid III 3YO Dummy POSITIONING IN VEHICLE

NHTSA No. M20185503TWG2

Measurement	Value
Total Fore/Aft Travel (mm)	260
Test Distance Rearward of Full-Forward (mm)	0
Total Fore/Aft Travel (Detents)	27
Placed in Position #	0

Seat Back Angle (headrest post)	SA (-8.8°)	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)	125
Head to Seat Back Centerline	HSC (mm)	160
Head to B-Pillar (cg)	HB (mm)	190
Head to Roof, Z (top of the head)	HZ (mm)	240
Head to Header	HHD (mm)	305
Chest to Dash	CD (mm)	191
Chest to Seatback	CS (mm)	40
Right Arm to Seat Back Centerline	RACL (mm)	85
Right Arm to Seat Back Centerline	RACL (deg)	0
Left Arm to Seat Back Centerline	LACL (mm)	330
Left Arm to Seat Back Centerline	LACL (deg)	0
Left Arm to Door Panel	LA (mm)	0
Knee to Knee	KK (mm)	140
Toe to Toe	TT (mm)	120
Right Knee to Seat Cushion Centerline	KSCR (mm)	135
Left Knee to Seat Cushion Centerline	KSCL (mm)	240
Right Toe to Seat Cushion Centerline	TSCR (mm)	90
Left Toe to Seat Cushion Centerline	TSCL (mm)	215
Nose to Seatback	NR (mm)	0

DATA SHEET 4
Hybrid III 3YO Dummy INJURY CRITERIA VALUES

NHTSA No.: M20185503TWG2

Channel	Units	Max	Time (ms)	Min	Time (ms)
V1P3 Head x [CFC_1000]	g's	20.78	10.10	-11.90	11.10
V1P3 Head y [CFC_1000]	g's	33.56	10.20	-4.73	261.00
V1P3 Head z [CFC_1000]	g's	48.63	10.15	-8.61	13.05
V1P3 Headform Resultant [CFC_1000]	g's	61.34	10.15	0.00	-32.30
V1P3 Upper Neck Mocy [CFC_600]	Nm	2.83	23.60	-4.69	72.05
V1P3 Upper Neck Ntf [CFC_600]	-	0.07	27.50	0.00	-50.00
V1P3 Upper Neck Nte [CFC_600]	-	0.19	72.00	0.00	-50.00
V1P3 Upper Neck Ncf [CFC_600]	-	0.09	281.10	0.00	-50.00
V1P3 Upper Neck Nce [CFC_600]	-	0.47	209.40	0.00	-22.45
V1P3 Upper Neck Nij [CFC_600]	-	0.47	209.40	0.00	-21.70
V1P3 Upper Neck Fx [CFC_1000]	N	46.18	27.30	-121.47	215.85
V1P3 Upper neck Fy [CFC_1000]	N	70.57	162.30	-125.09	223.70
V1P3 Upper neck Fz [CFC_1000]	N	104.95	27.60	-683.63	209.40
V1P3 Neck Force Resultant [CFC_1000]	N	699.69	209.40	0.65	-22.50
V1P3 Upper Neck Mx [CFC_600]	Nm	1.39	178.10	-1.27	60.50
V1P3 Upper Neck My [CFC_600]	Nm	2.83	23.60	-4.69	72.05
V1P3 Upper Neck Mz [CFC_600]	Nm	1.34	146.90	-0.79	26.10
V1P3 Neck Moment Resultant [CFC_600]	Nm	4.76	72.10	0.04	-19.65
V1P3 Lower Neck Fx F [CFC_1000]	N	55.09	4.90	-228.72	17.55
V1P3 Lower Neck Fy F [CFC_1000]	N	100.10	27.90	-333.84	15.55
V1P3 Lower Neck Fz F [CFC_1000]	N	285.20	10.05	-194.52	12.60
V1P3 Lower Neck Force Resultant [CFC_1000]	N	421.34	16.30	0.02	-8.65
V1P3 Lower Neck Mx F [CFC_600]	Nm	10.47	299.90	-20.16	16.75
V1P3 Lower Neck My F [CFC_600]	Nm	11.56	17.70	-3.20	6.25
V1P3 Lower Neck Mz F [CFC_600]	Nm	6.91	73.95	-8.07	27.35
V1P3 Lower Neck Moment Resultant [CFC_600]	Nm	24.09	16.80	0.00	-39.50
Curtain Airbag Volts	V	16.64	0.60	-10.95	0.00
Torso/Pelvis Airbag Volts	V	7.95	1.10	-13.66	0.00
Front Center Airbag Volts	V	-	-	-	-
Curtain Airbag Current	A	2.05	0.80	-1.39	6.90
Torso/Pelvis Airbag Current	A	0.93	0.40	-2.49	23.10
Front Center Airbag Current	A	-	-	-	-

DATA SHEET 4

Hybrid III 3YO DUMMY INJURY CRITERIA VALUES (CONTINUED)

VEHICLE: 2018 Subaru Crosstrek NHTSA No.: M20185503TWG2

HEAD INJURY CRITERIA (HIC)

	HIC15			
	HIC(15)	t_1 (msec)	t_2 (msec)	Average Acceleration t_1 to t_2
Position P2	11.19	7.10	15.05	18.23

THORAX CRITERIA

	Critical Values	Actual	Time(ms)
Maximum Deflection (mm)	36.0	8.82	7.95
Maximum Deflection Rate (m/s)	8.0	4.13	5.35

Position P2 - Neck Injury Summary (H3 – 3 year Old – In Position)

Nij V10	Nij	Time (ms)	Z Force (N)	X Force (N)	Y Moment (N-m)
Ntf	0.074	27.500	103.823	45.818	1.740
Nte	0.189	72.000	33.886	11.508	-4.686
Ncf	0.085	281.100	-181.242	-63.660	0.002
Nce	0.467	209.400	-683.629	-119.181	-3.904

Peak Tension (CFC1000) 104.955 **N** **Peak Compression (CFC1000)** -683.629 **N**

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	2120.00 N	Extension (mCVe)	27.00 N-m	Tension	1130.00 N
Compression (CVc)	2120.00 N	Flexion (mCVf)	68.00 N-m	Compression	1380.00 N

Appendix A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

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

Figure A-2: Vehicle Certification Placard

Figure A-3: Pre-Test HIII 3-Year Old Left Side View

Figure A-4: Post-Test HIII 3-Year Old Left Side View

Figure A-5: Pre-Test HIII 3-Year Old Left Side Close-up View

Figure A-6: Post-Test HIII 3-Year Old Left Side Close-up View

Figure A-7: Pre-Test HIII 3-Year Old Front View

Figure A-8: Post-Test HIII 3-Year Old Front View

Figure A-9: Pre-Test HIII 3-Year Old Left ¾ Front View

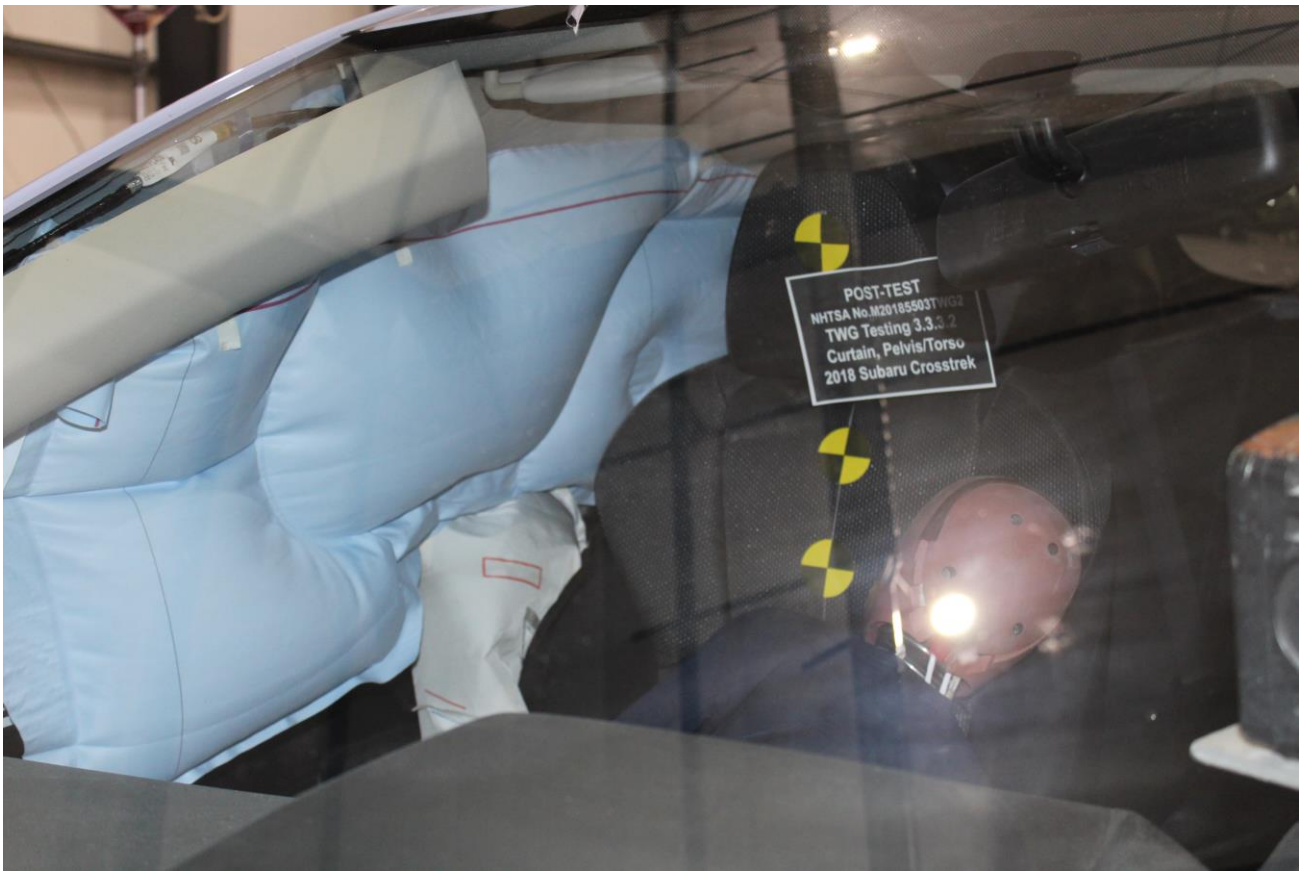


Figure A-10: Post-Test HIII 3-Year Old Left ¾ Front View

Figure A-11: Pre-Test HIII 3-Year Old Right Side View

Figure A-12: Post-Test HIII 3-Year Old Right Side View

Figure A-13: Post-Test Curtain Airbag View

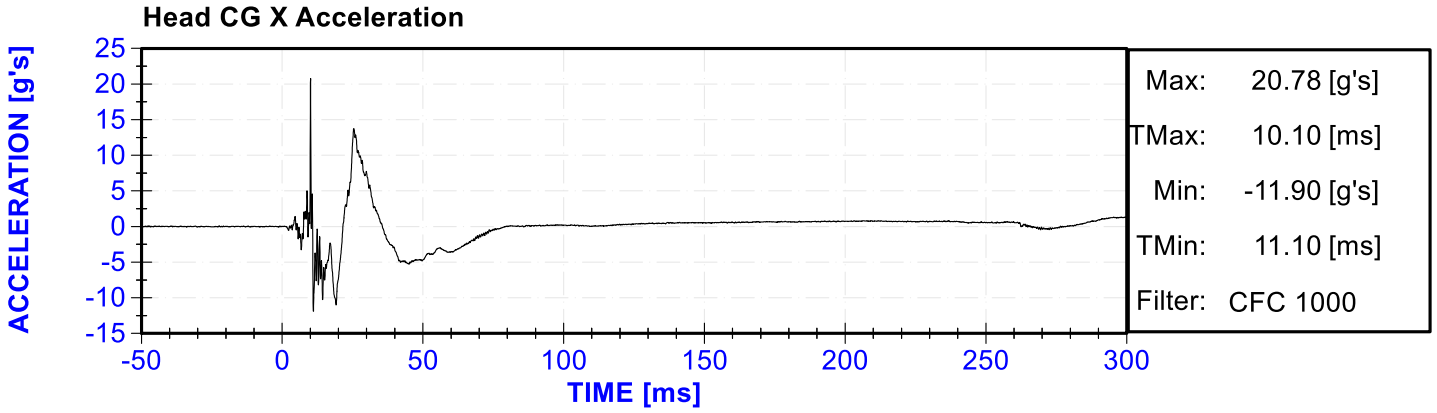
Figure A-14: Post-Test Seat Airbag View

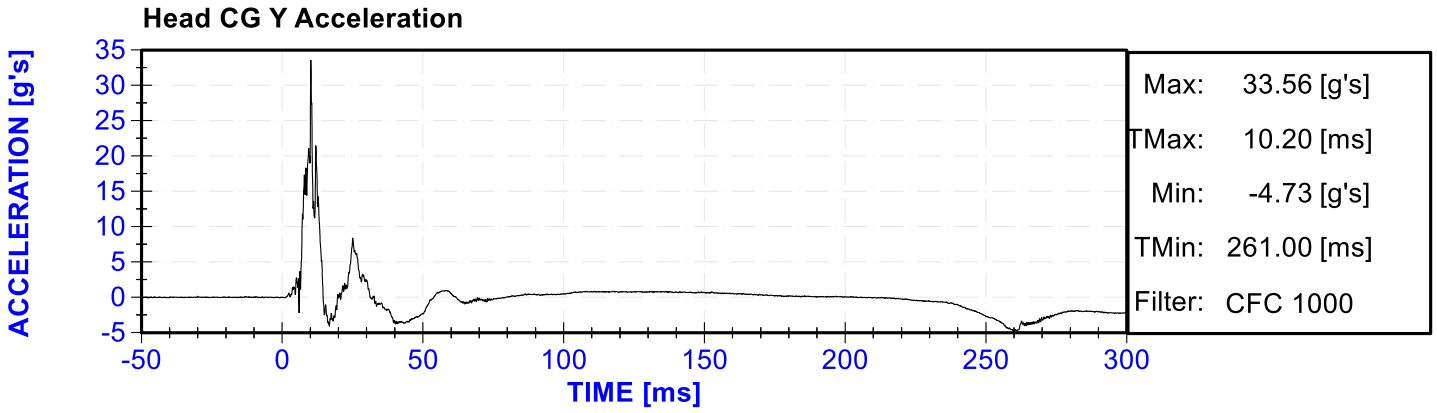
Figure A-15: Impact Event

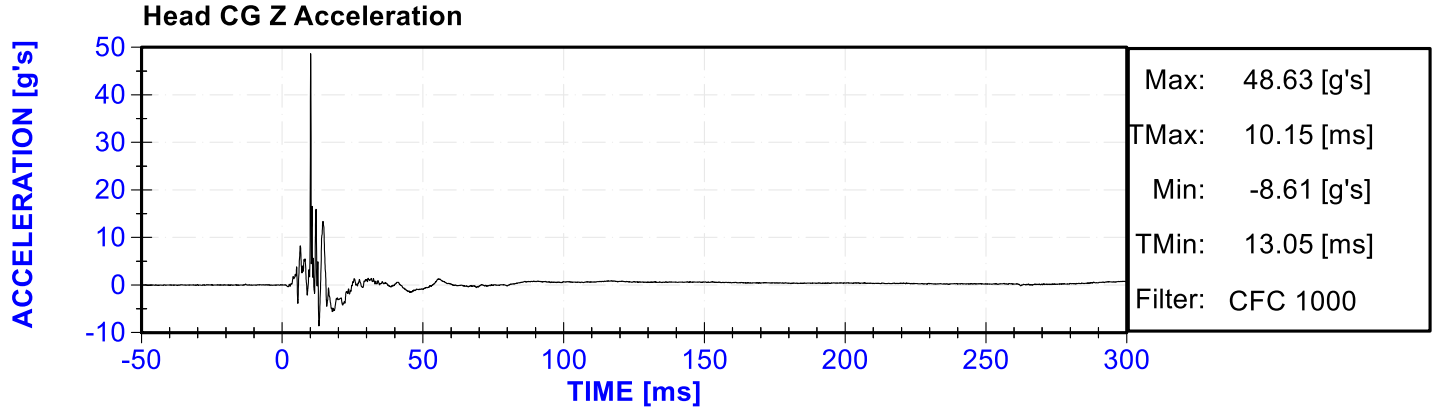
APPENDIX B

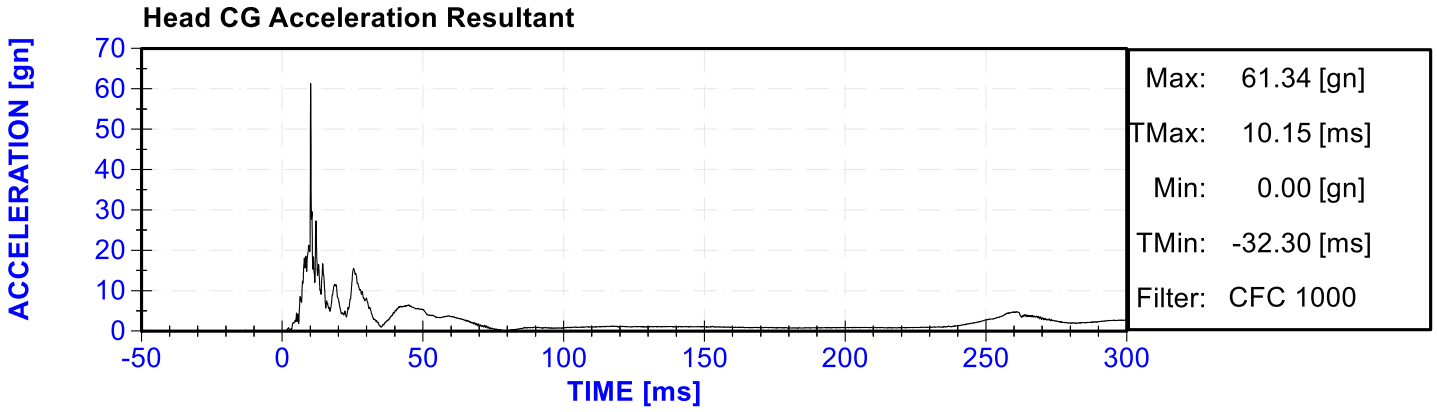
VEHICLE & DUMMY RESPONSE DATA TRACES

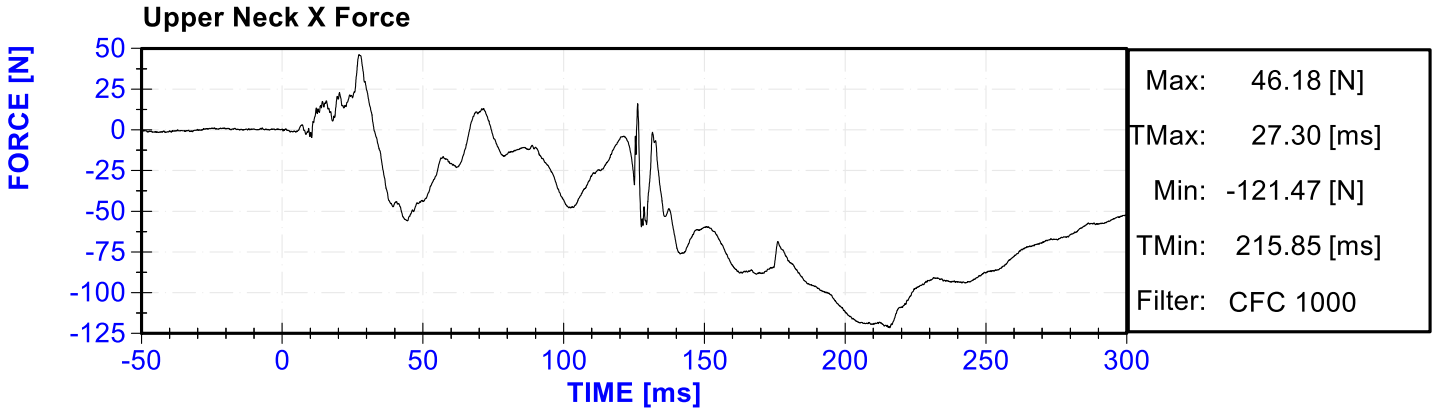
Table of Data Plots

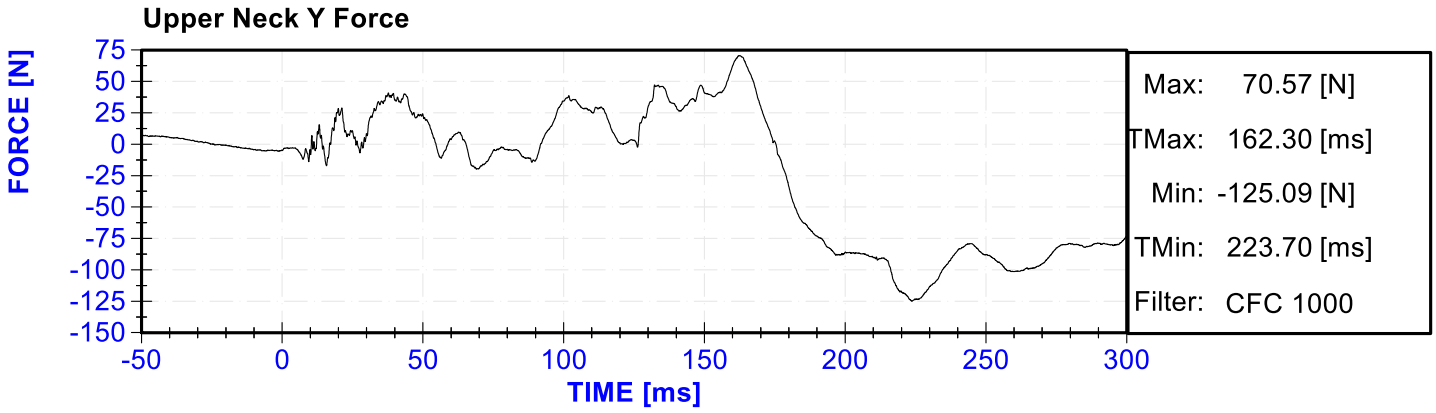

Head CG X Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 20.78 [g's]
TMax: 10.10 [ms]
Min: -11.90 [g's]
TMin: 11.10 [ms]
Filter: CFC 1000

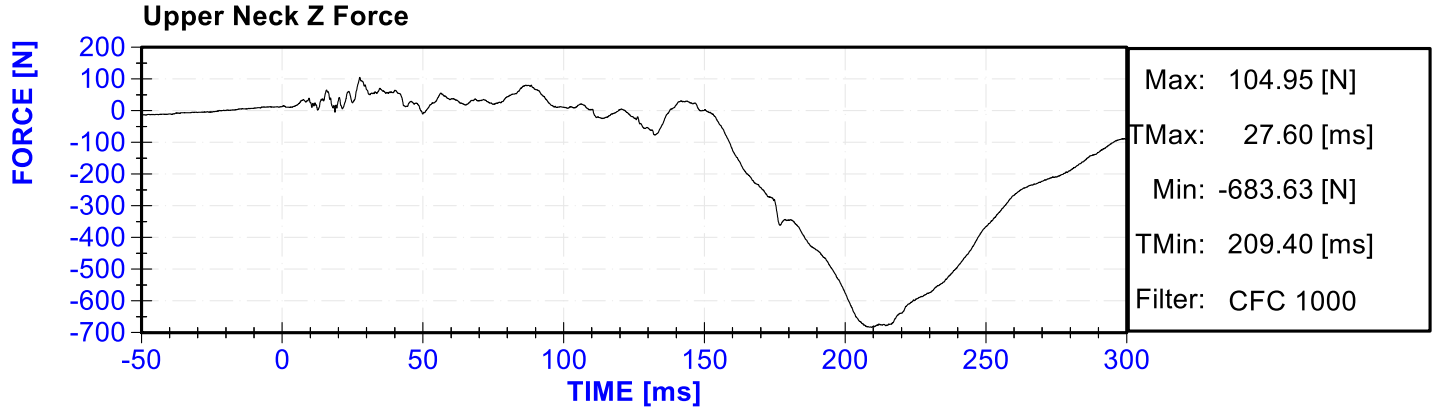

Head CG Y Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 33.56 [g's]
TMax: 10.20 [ms]
Min: -4.73 [g's]
TMin: 261.00 [ms]
Filter: CFC 1000

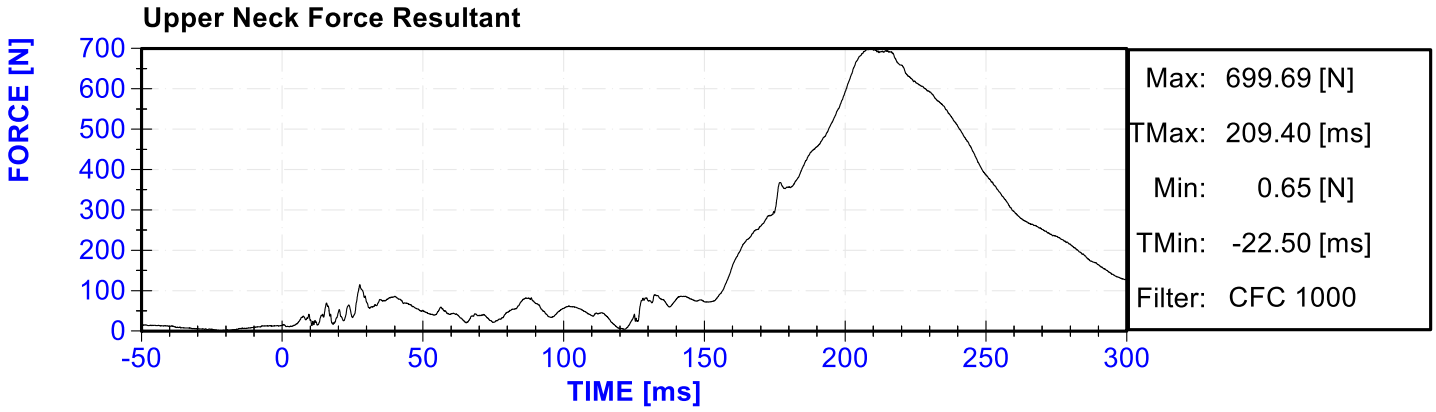

Head CG Z Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 48.63 [g's]
TMax: 10.15 [ms]
Min: -8.61 [g's]
TMin: 13.05 [ms]
Filter: CFC 1000


Head CG Acceleration Resultant
ACCELERATION [gn]
TIME [ms]
Max: 61.34 [gn]
TMax: 10.15 [ms]
Min: 0.00 [gn]
TMin: -32.30 [ms]
Filter: CFC 1000

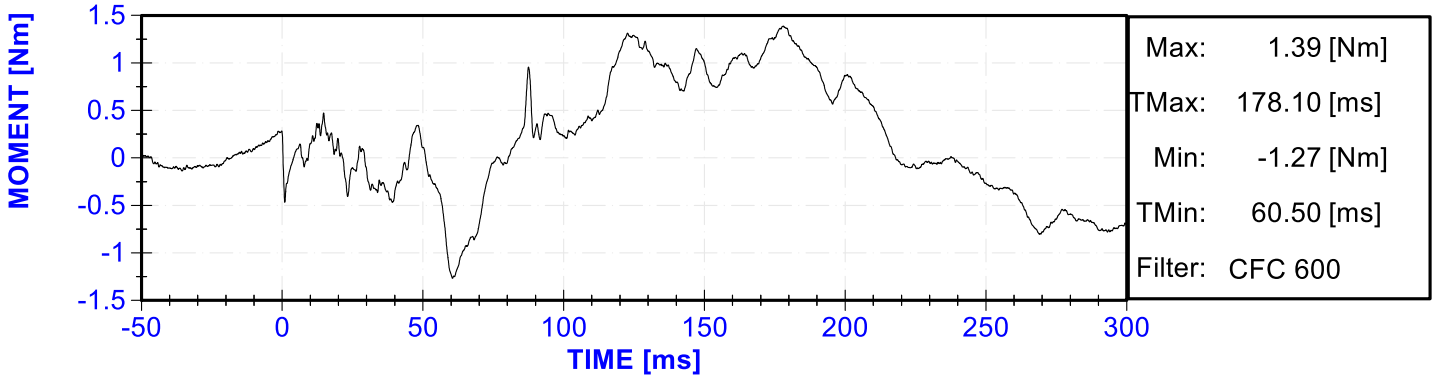

Upper Neck X Force
FORCE [N]
50
25
0
-25
-50
-75
-100
-125
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 46.18 [N]
TMax: 27.30 [ms]
Min: -121.47 [N]
TMin: 215.85 [ms]
Filter: CFC 1000


Upper Neck Y Force
FORCE [N]
75
50
25
0
-25
-50
-75
-100
-125
-150
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 70.57 [N]
TMax: 162.30 [ms]
Min: -125.09 [N]
TMin: 223.70 [ms]
Filter: CFC 1000

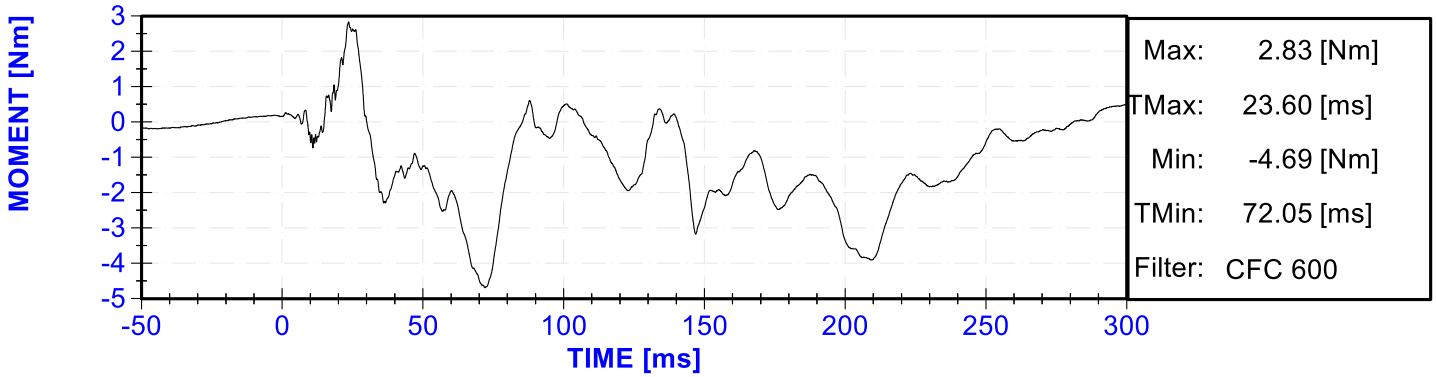

Upper Neck Z Force
FORCE [N]
200
100
0
-100
-200
-300
-400
-500
-600
-700
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 104.95 [N]
TMax: 27.60 [ms]
Min: -683.63 [N]
TMin: 209.40 [ms]
Filter: CFC 1000


Upper Neck Force Resultant
FORCE [N]
700
600
500
400
300
200
100
0
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 699.69 [N]
TMax: 209.40 [ms]
Min: 0.65 [N]
TMin: -22.50 [ms]
Filter: CFC 1000

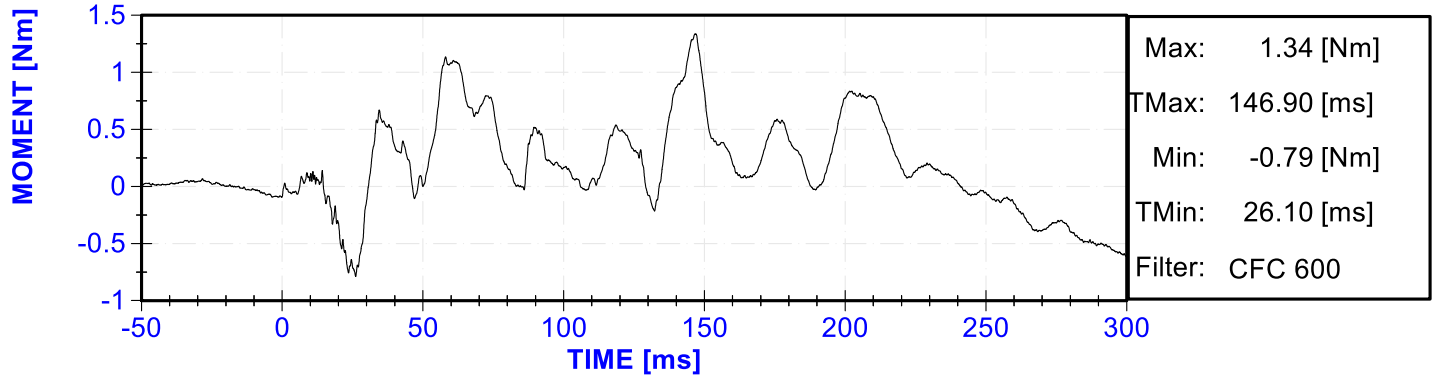
Upper Neck X Moment



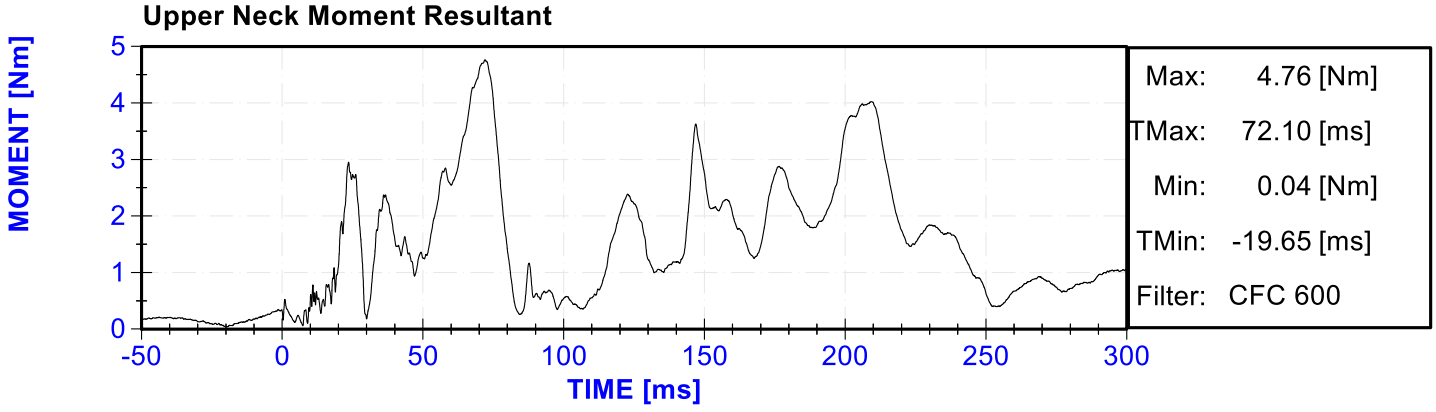
Upper Neck Y Moment

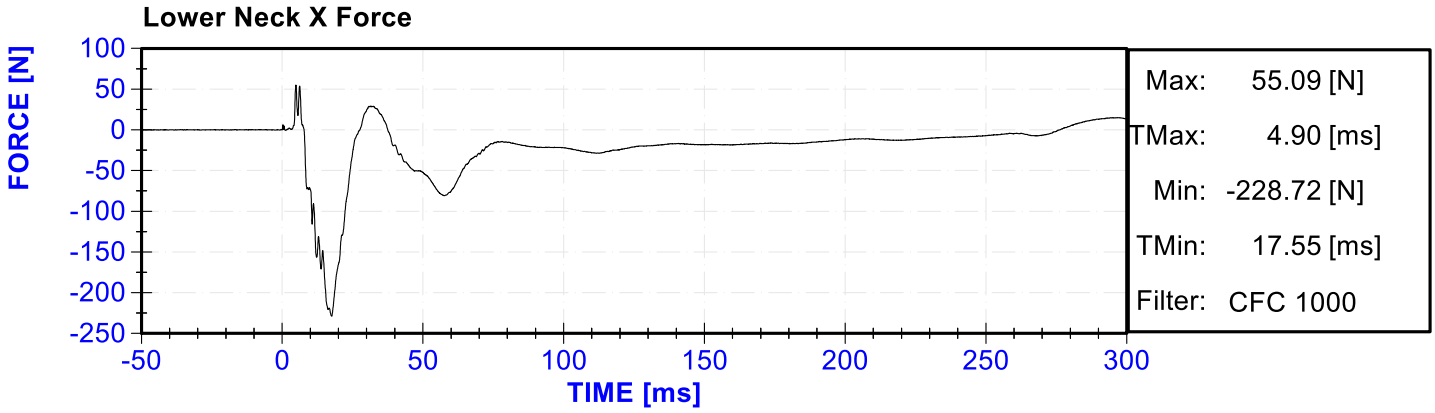


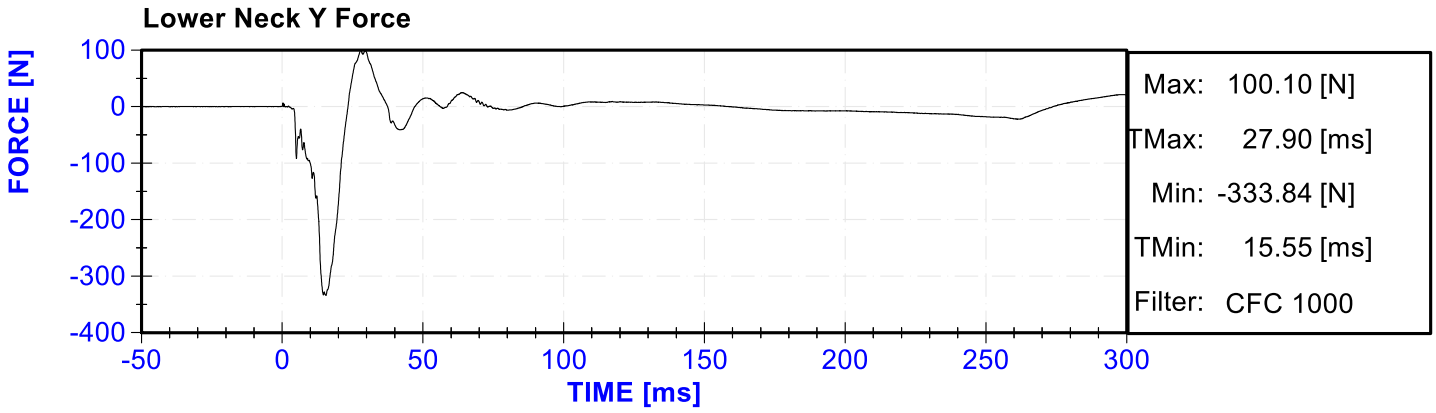
Upper Neck Z Moment

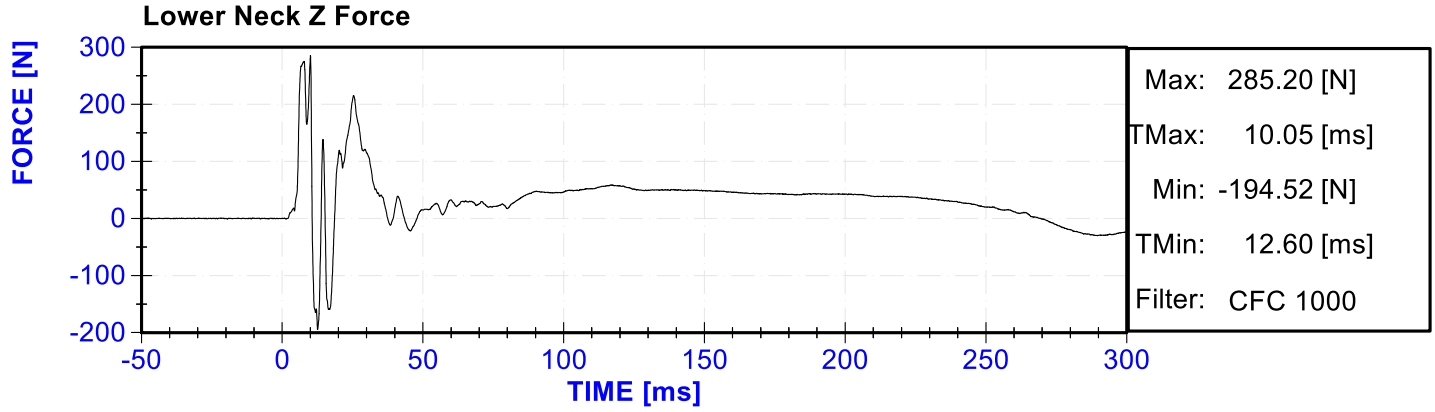


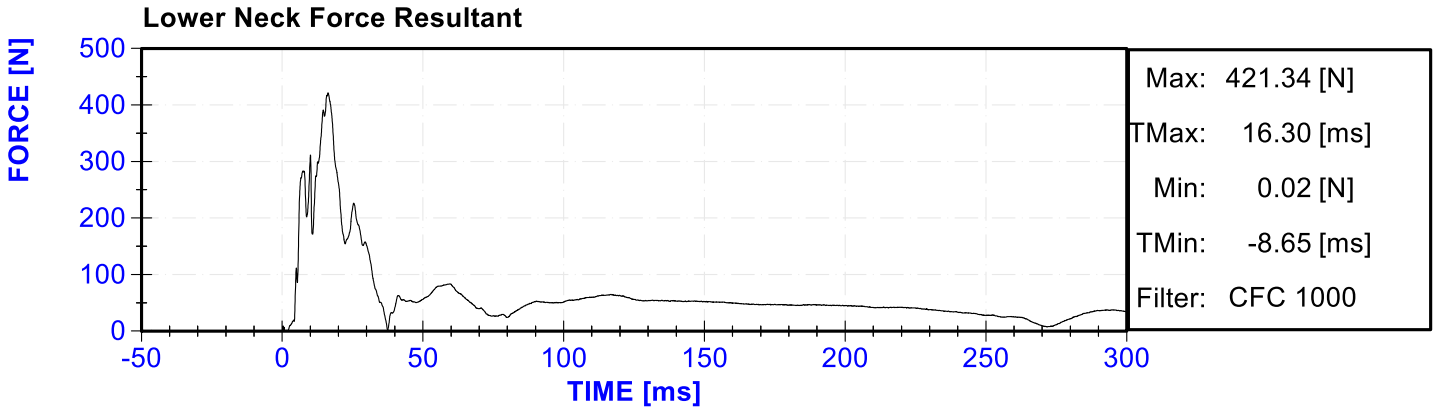
Upper Neck Moment Resultant

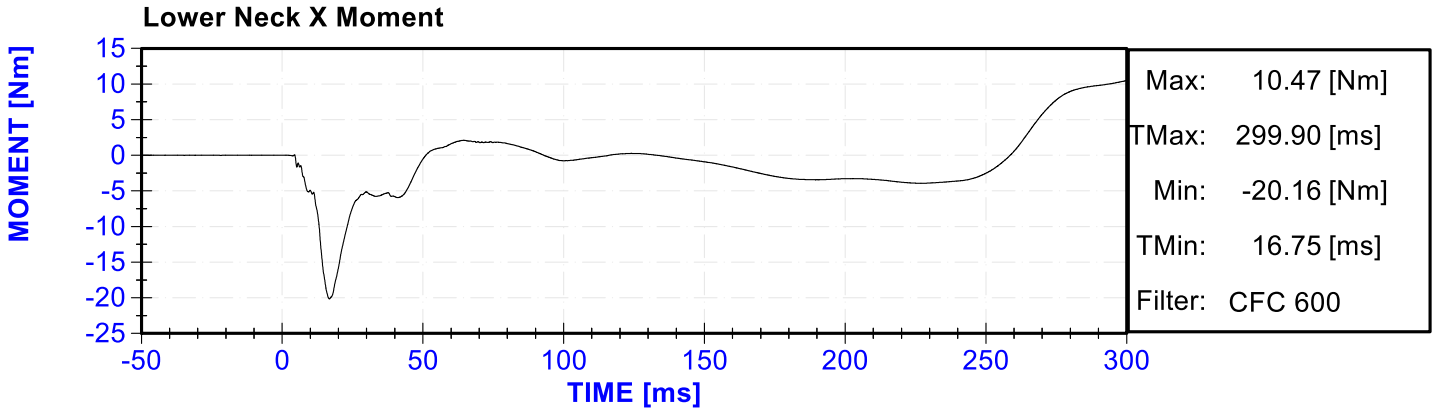


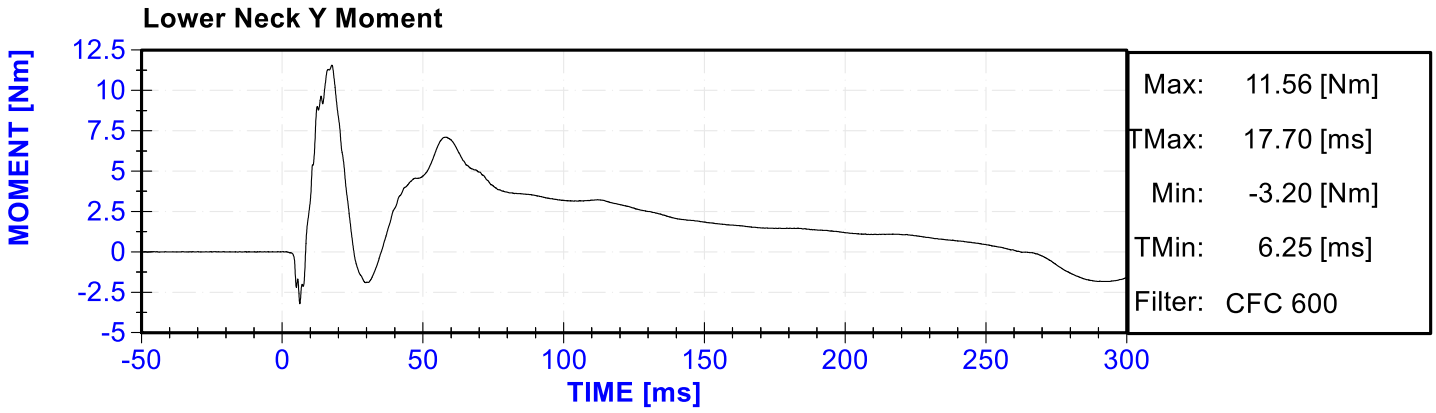

Lower Neck X Force
FORCE [N]
100
50
0
-50
-100
-150
-200
-250
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 55.09 [N]
TMax: 4.90 [ms]
Min: -228.72 [N]
TMin: 17.55 [ms]
Filter: CFC 1000

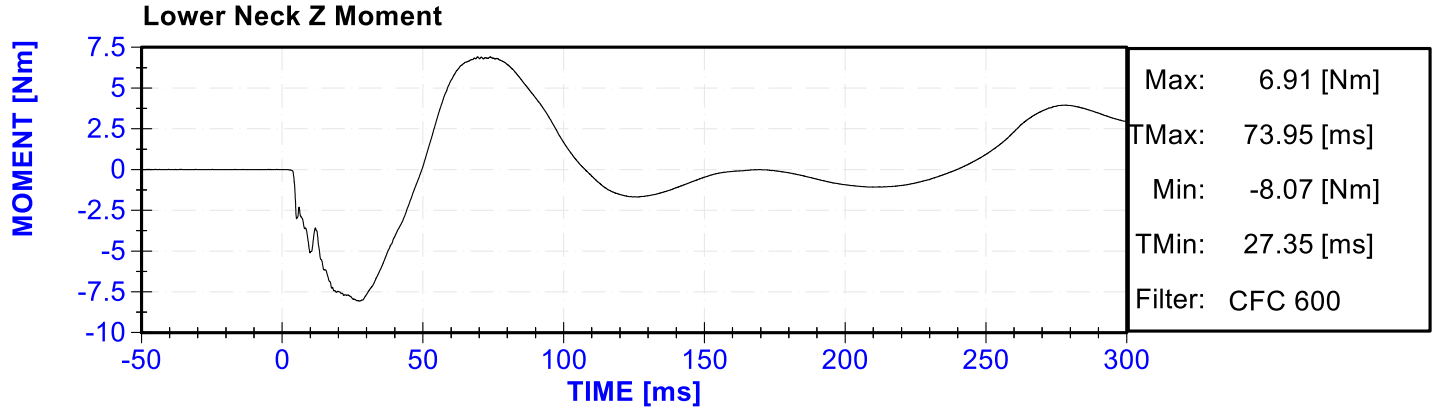

Lower Neck Y Force
FORCE [N]
100
0
-100
-200
-300
-400
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 100.10 [N]
TMax: 27.90 [ms]
Min: -333.84 [N]
TMin: 15.55 [ms]
Filter: CFC 1000

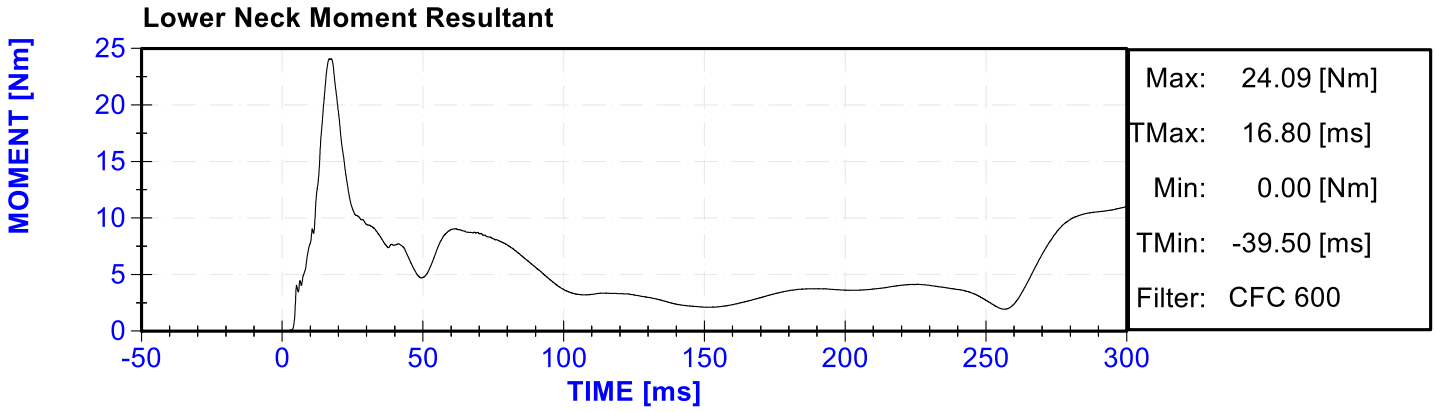

Lower Neck Z Force
FORCE [N]
300
200
100
0
-100
-200
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 285.20 [N]
TMax: 10.05 [ms]
Min: -194.52 [N]
TMin: 12.60 [ms]
Filter: CFC 1000

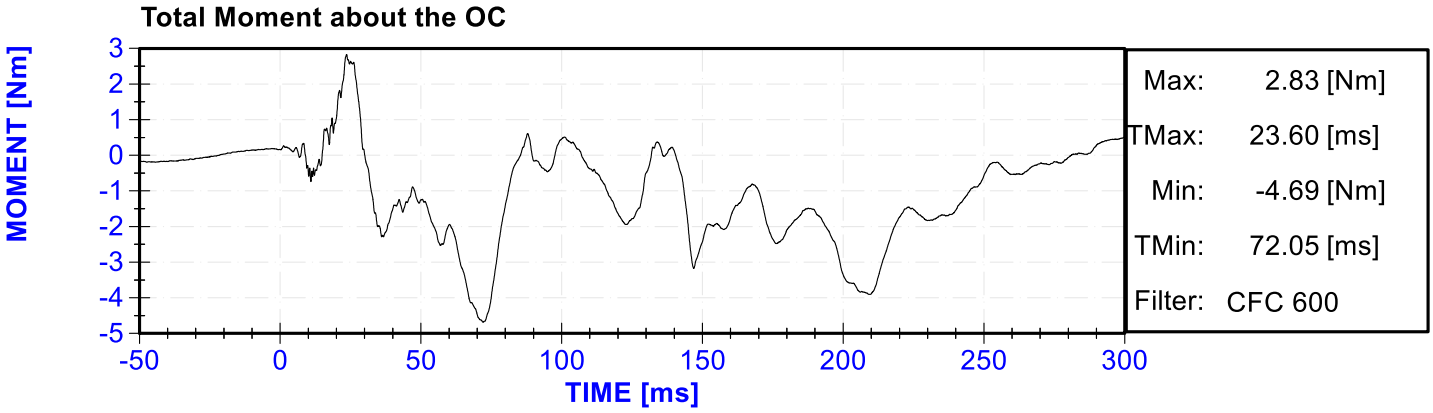

Lower Neck Force Resultant
FORCE [N]
500
400
300
200
100
0
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 421.34 [N]
TMax: 16.30 [ms]
Min: 0.02 [N]
TMin: -8.65 [ms]
Filter: CFC 1000

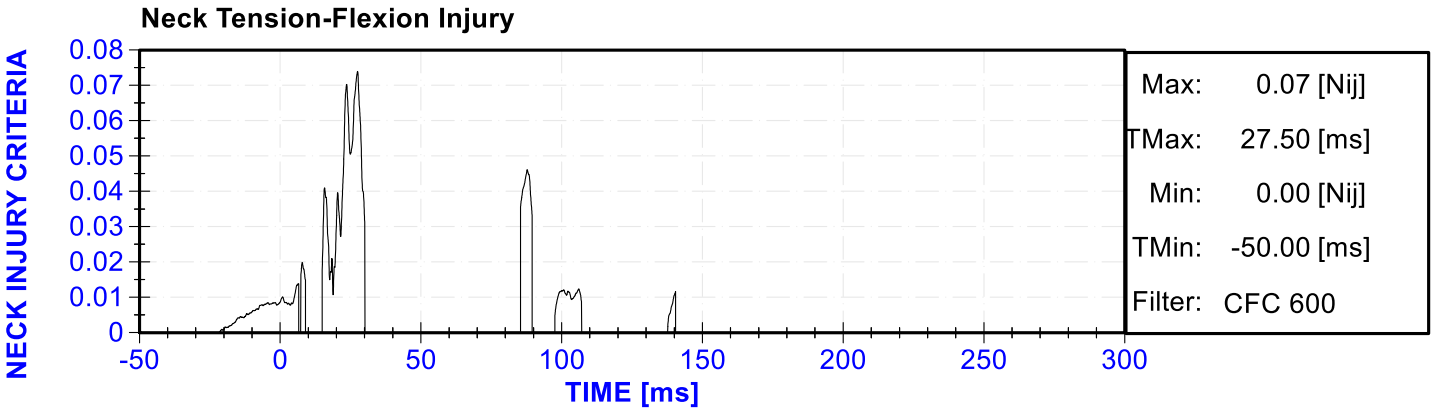

Lower Neck X Moment
MOMENT [Nm]
TIME [ms]
Max: 10.47 [Nm]
TMax: 299.90 [ms]
Min: -20.16 [Nm]
TMin: 16.75 [ms]
Filter: CFC 600

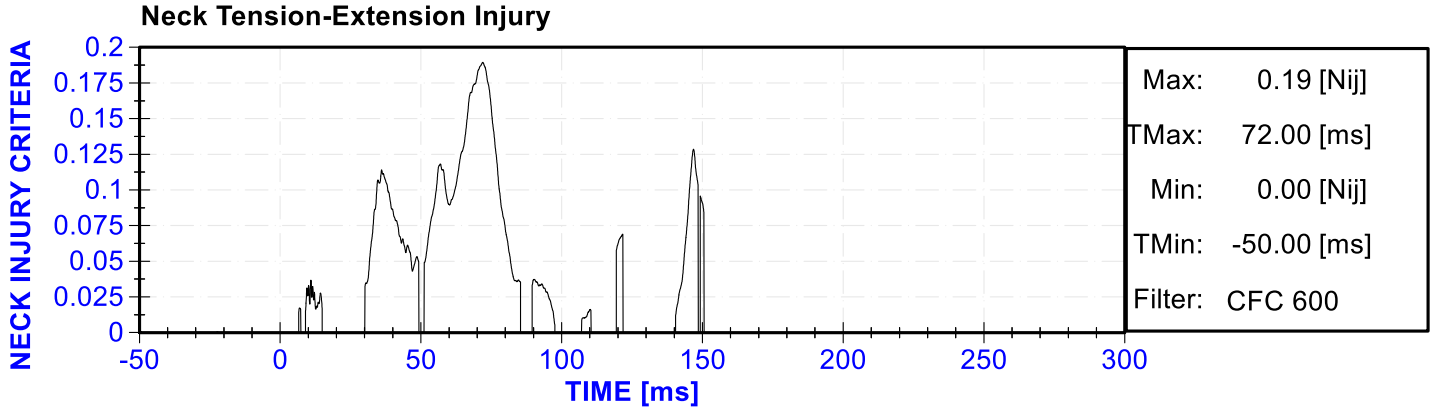

Lower Neck Y Moment
MOMENT [Nm]
TIME [ms]
Max: 11.56 [Nm]
TMax: 17.70 [ms]
Min: -3.20 [Nm]
TMin: 6.25 [ms]
Filter: CFC 600

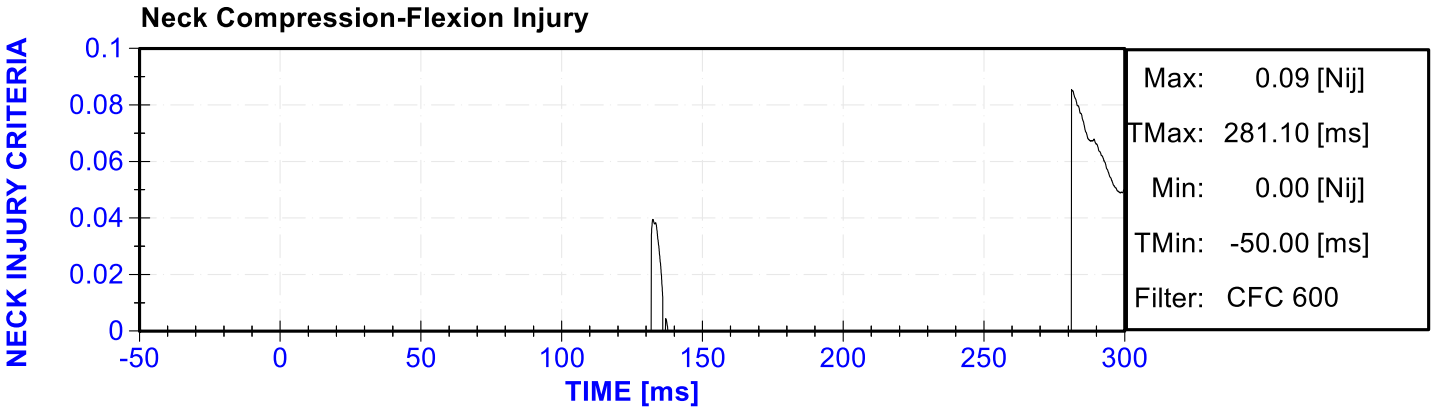

Lower Neck Z Moment
MOMENT [Nm]
TIME [ms]
Max: 6.91 [Nm]
TMax: 73.95 [ms]
Min: -8.07 [Nm]
TMin: 27.35 [ms]
Filter: CFC 600


Lower Neck Moment Resultant
MOMENT [Nm]
TIME [ms]
Max: 24.09 [Nm]
TMax: 16.80 [ms]
Min: 0.00 [Nm]
TMin: -39.50 [ms]
Filter: CFC 600

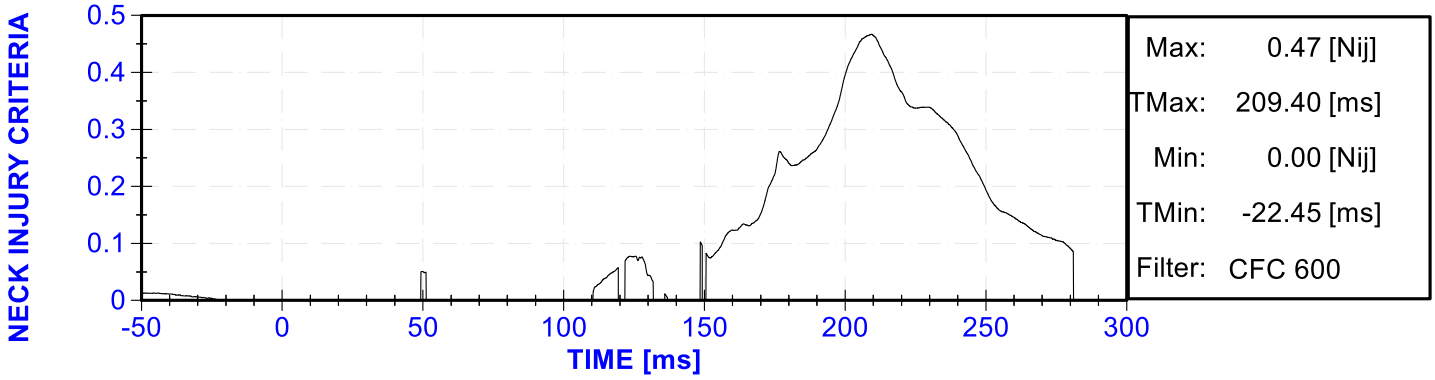

Total Moment about the OC
MOMENT [Nm]
TIME [ms]
Max: 2.83 [Nm]
TMax: 23.60 [ms]
Min: -4.69 [Nm]
TMin: 72.05 [ms]
Filter: CFC 600


Neck Tension-Flexion Injury
NECK INJURY CRITERIA
TIME [ms]
Max: 0.07 [Nij]
TMax: 27.50 [ms]
Min: 0.00 [Nij]
TMin: -50.00 [ms]
Filter: CFC 600

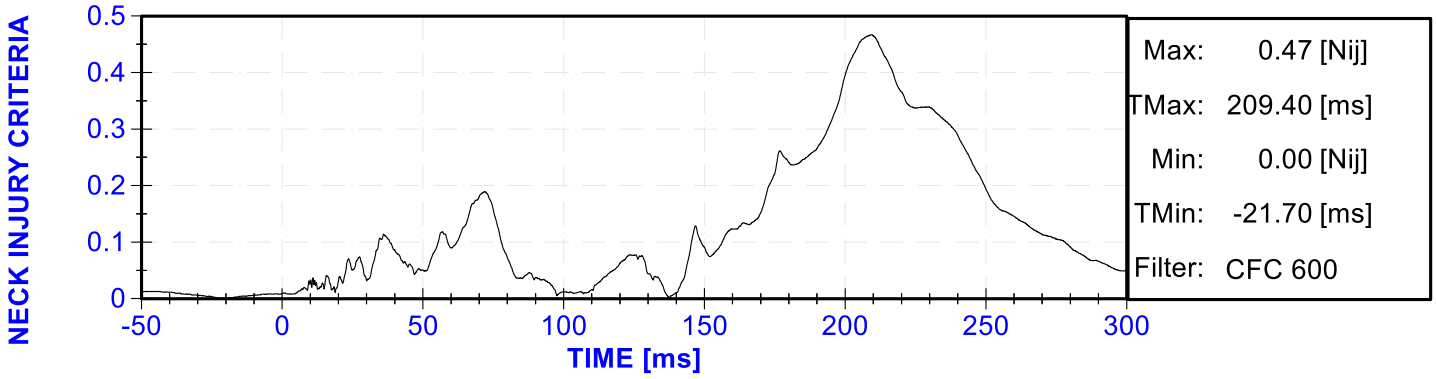

Neck Tension-Extension Injury
NECK INJURY CRITERIA
TIME [ms]
Max: 0.19 [Nij]
TMax: 72.00 [ms]
Min: 0.00 [Nij]
TMin: -50.00 [ms]
Filter: CFC 600


Neck Compression-Flexion Injury
NECK INJURY CRITERIA
TIME [ms]
Max: 0.09 [Nij]
TMax: 281.10 [ms]
Min: 0.00 [Nij]
TMin: -50.00 [ms]
Filter: CFC 600

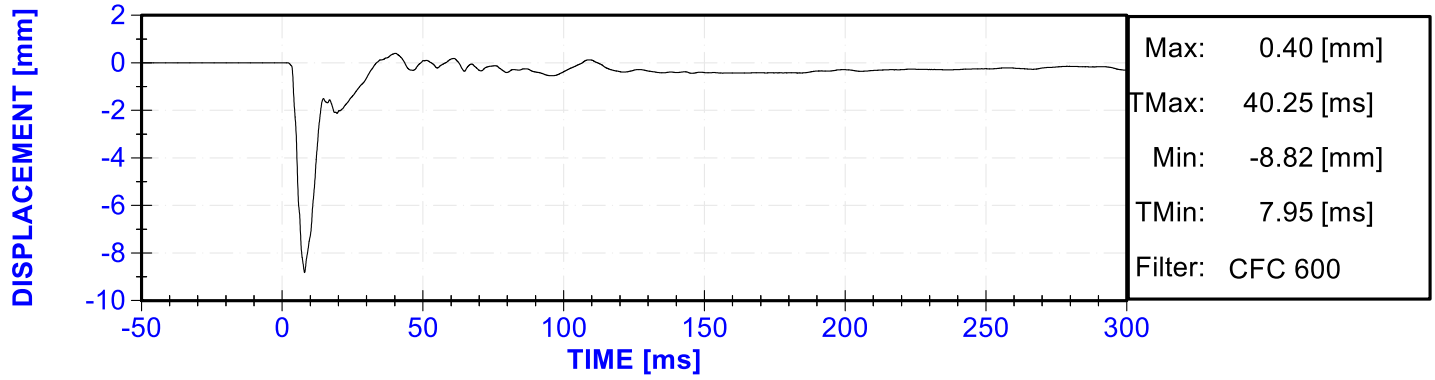
Neck Compression-Extension Injury



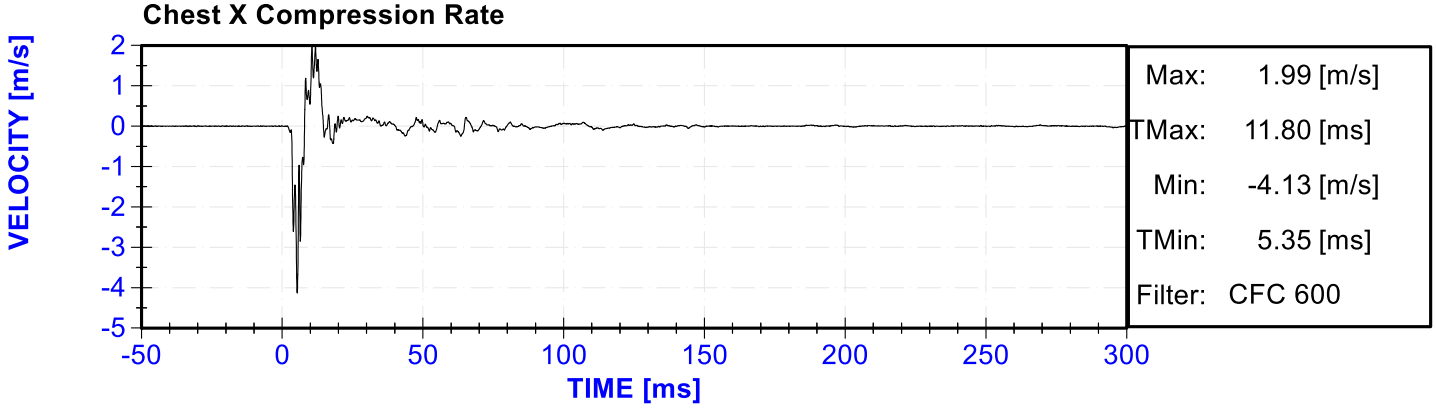
Total Neck Injury

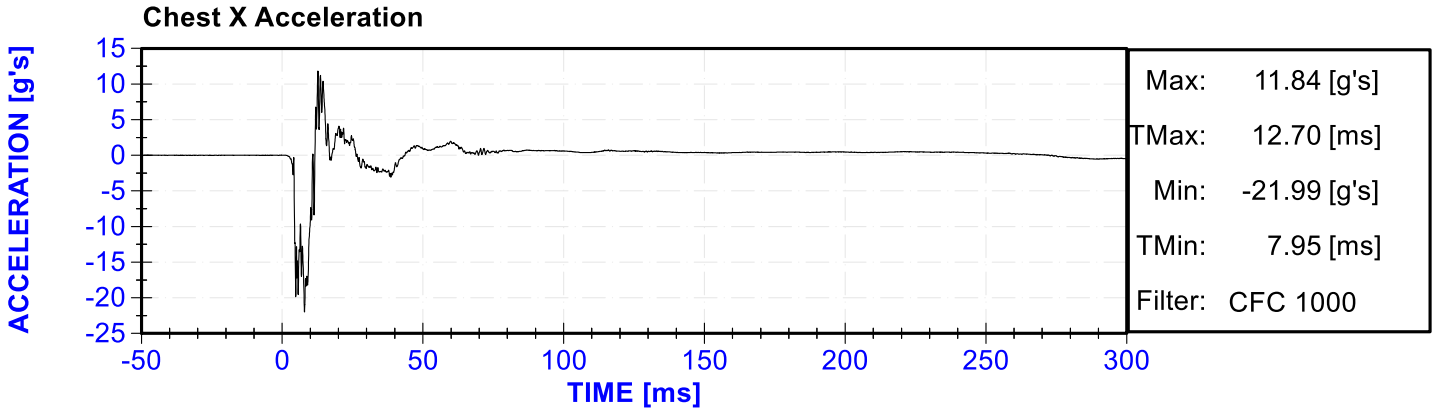


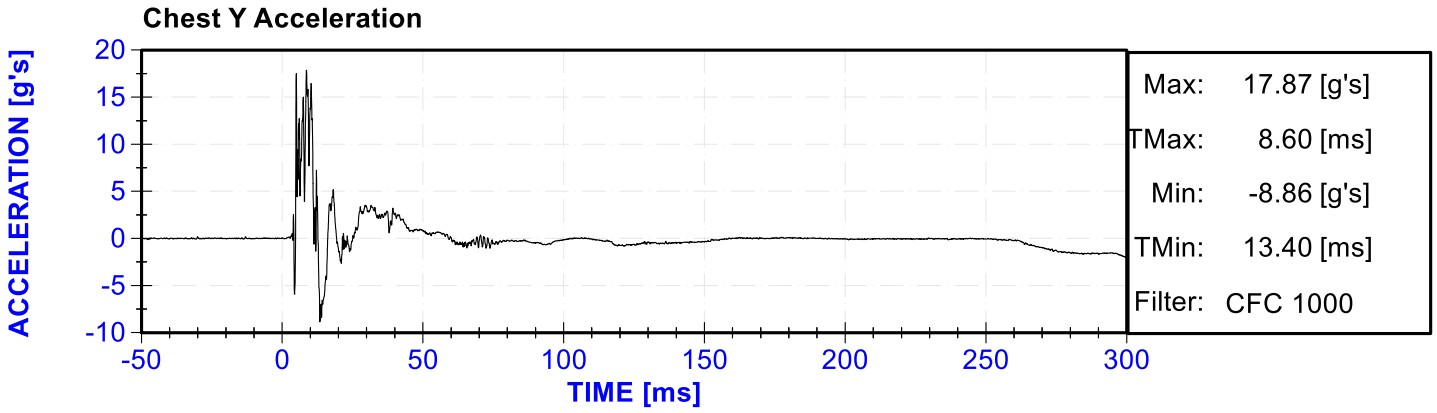
Chest Displacement X

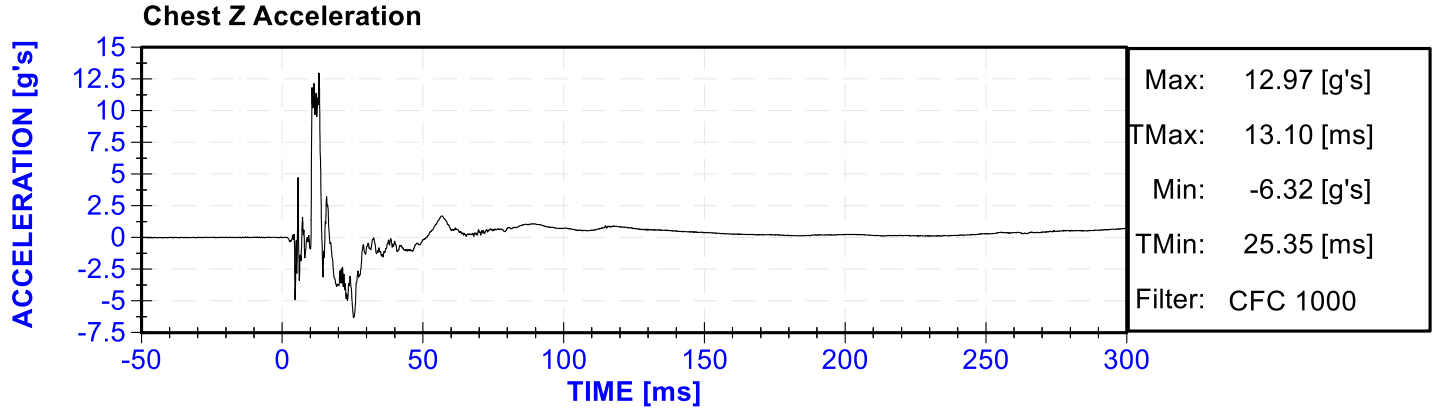


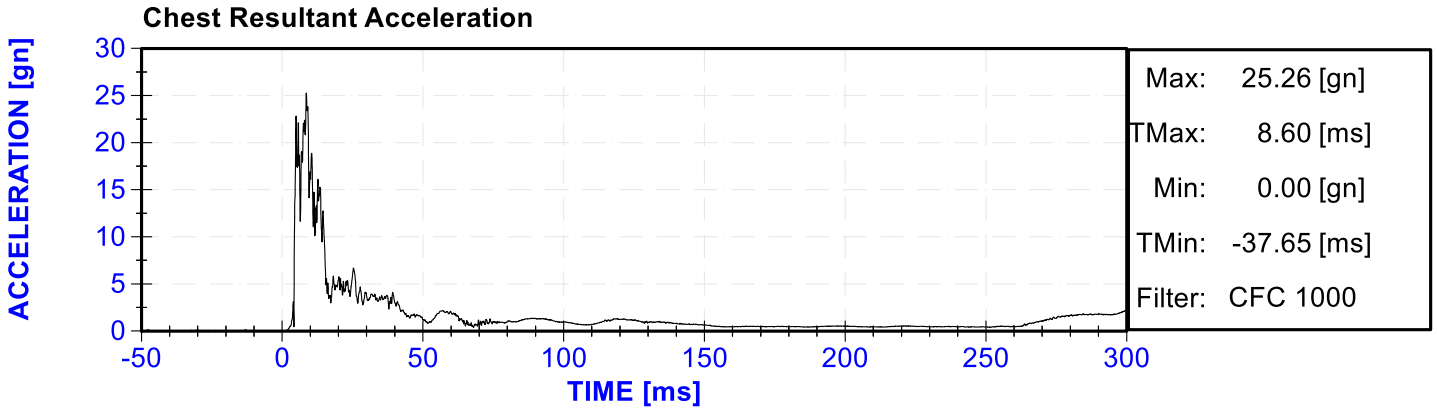
Chest X Compression Rate

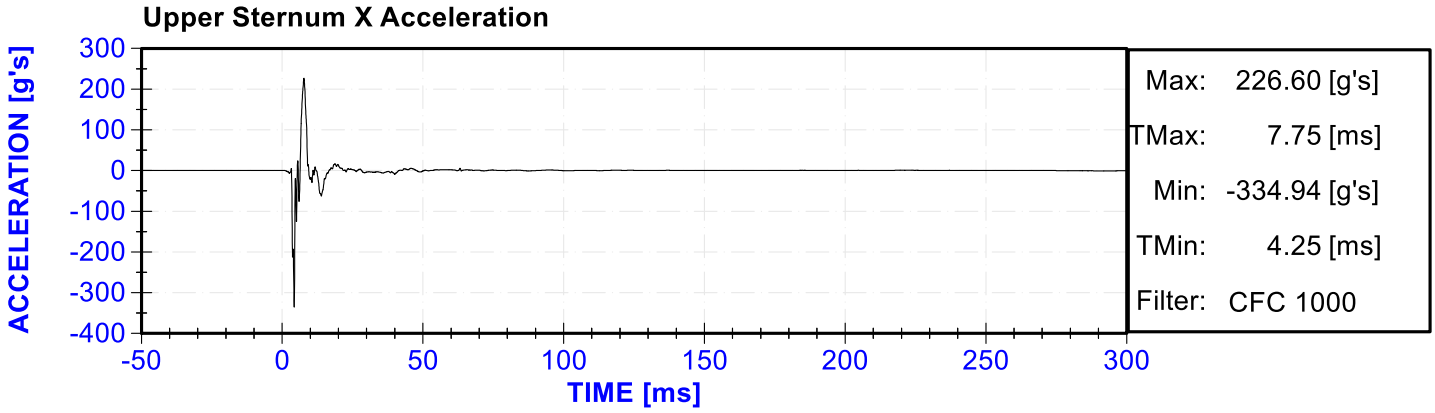


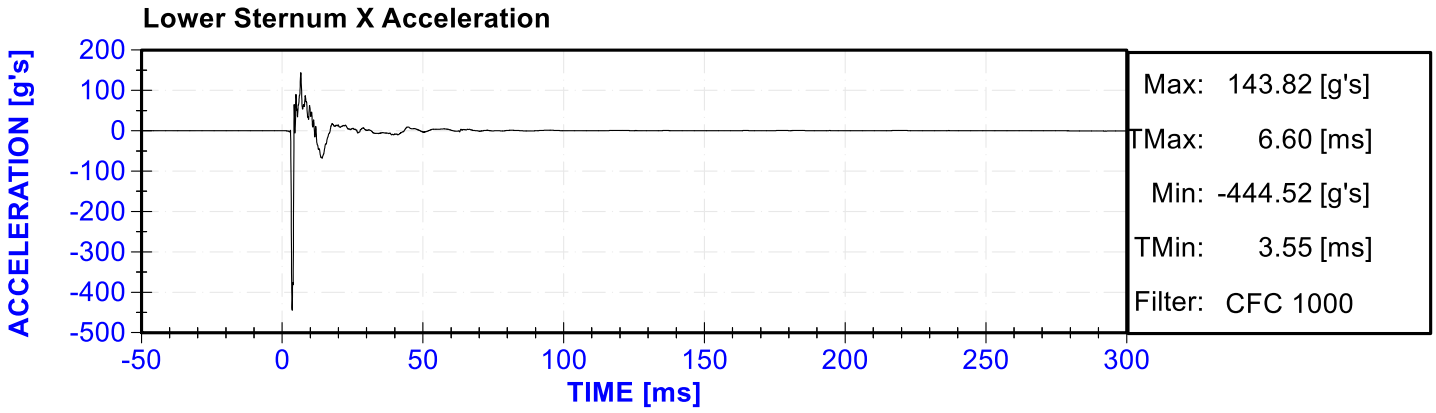

Chest X Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 11.84 [g's]
TMax: 12.70 [ms]
Min: -21.99 [g's]
TMin: 7.95 [ms]
Filter: CFC 1000

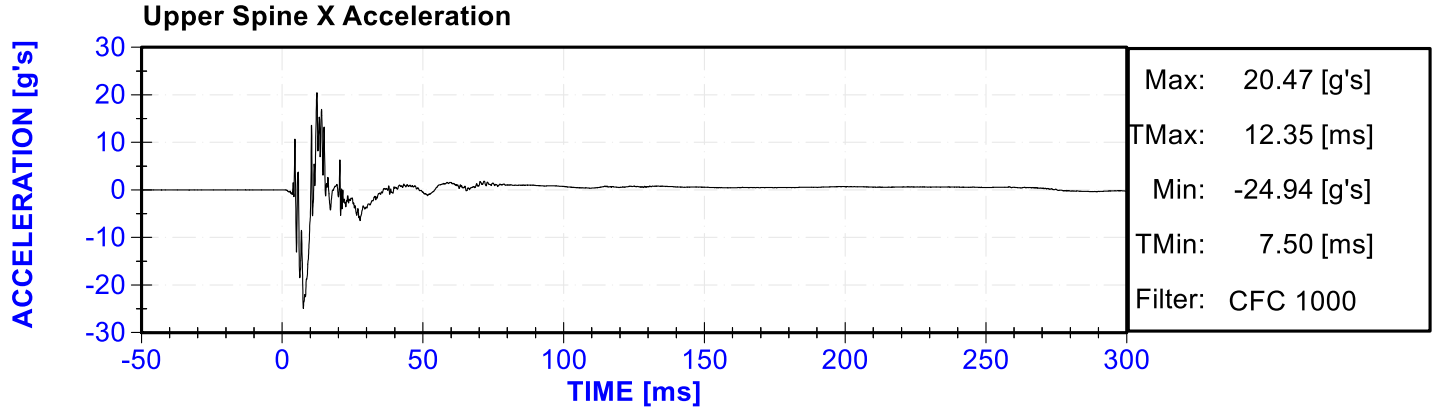

Chest Y Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 17.87 [g's]
TMax: 8.60 [ms]
Min: -8.86 [g's]
TMin: 13.40 [ms]
Filter: CFC 1000

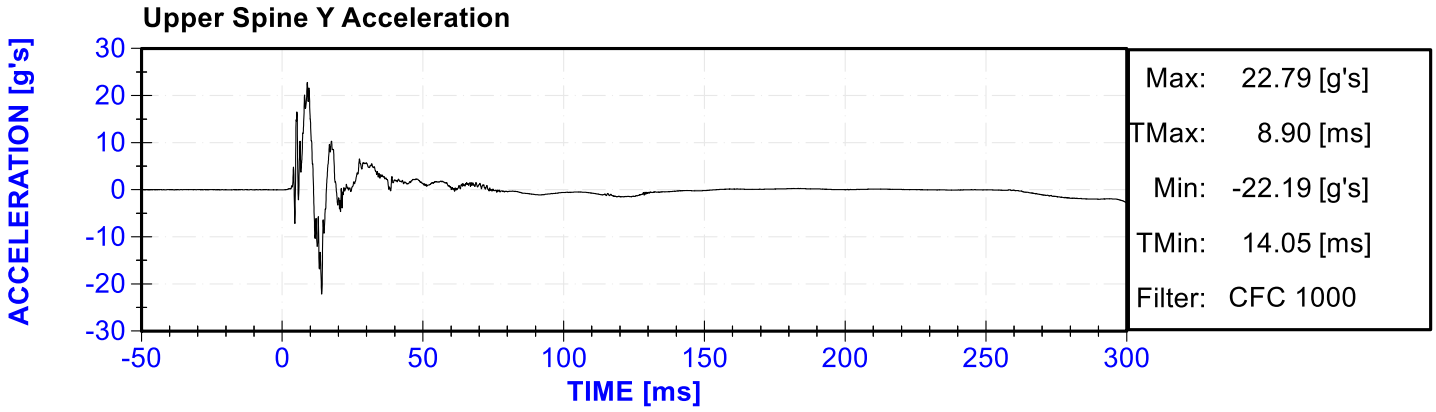

Chest Z Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 12.97 [g's]
TMax: 13.10 [ms]
Min: -6.32 [g's]
TMin: 25.35 [ms]
Filter: CFC 1000

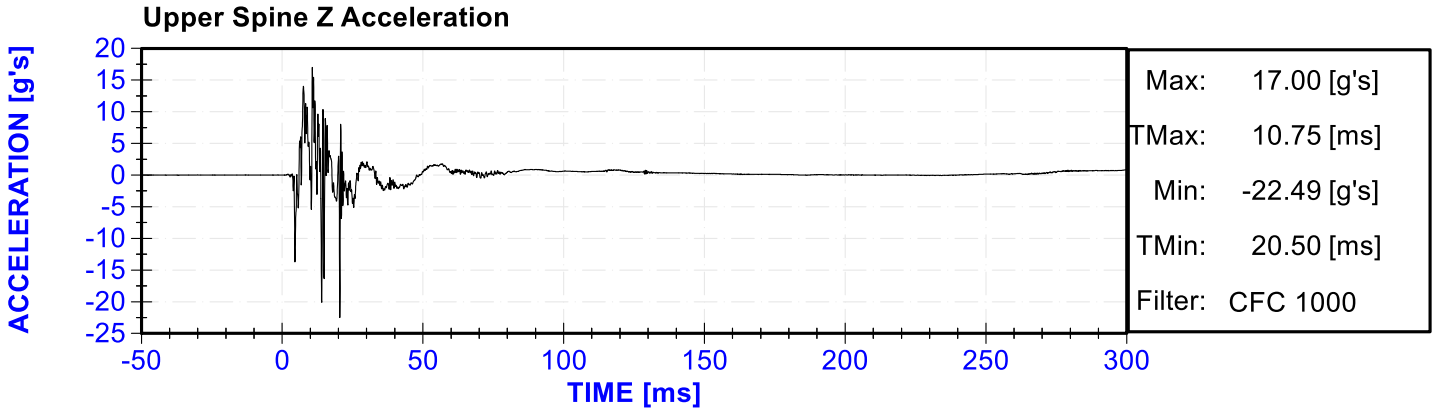

Chest Resultant Acceleration
ACCELERATION [gn]
TIME [ms]
Max: 25.26 [gn]
TMax: 8.60 [ms]
Min: 0.00 [gn]
TMin: -37.65 [ms]
Filter: CFC 1000

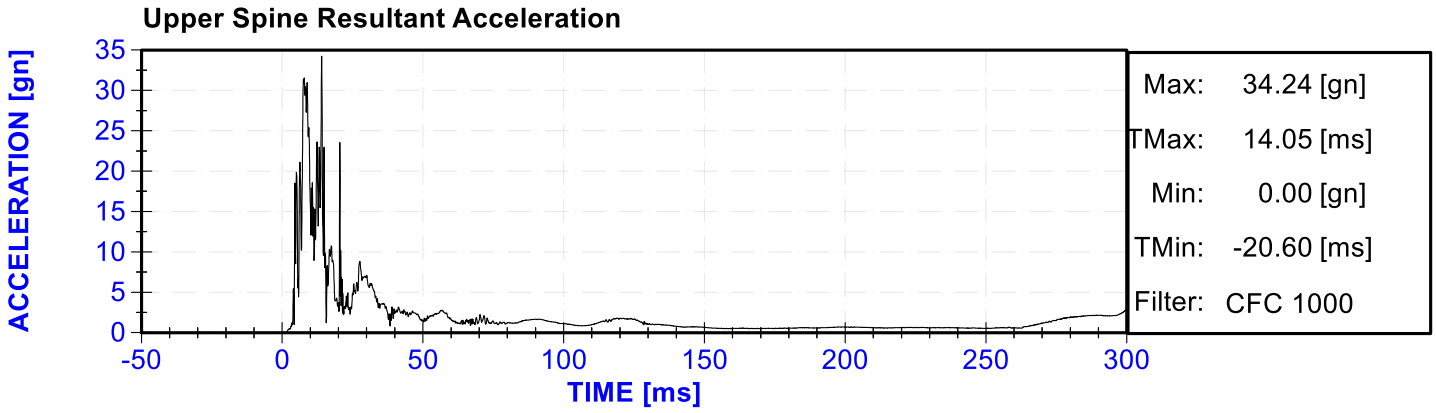

Upper Sternum X Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 226.60 [g's]
TMax: 7.75 [ms]
Min: -334.94 [g's]
TMin: 4.25 [ms]
Filter: CFC 1000

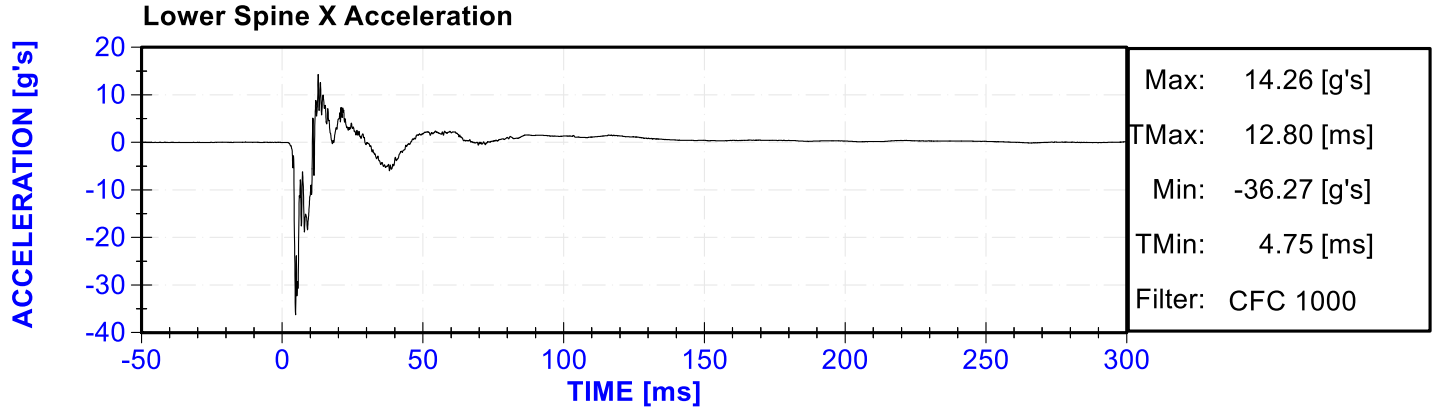

Lower Sternum X Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 143.82 [g's]
TMax: 6.60 [ms]
Min: -444.52 [g's]
TMin: 3.55 [ms]
Filter: CFC 1000

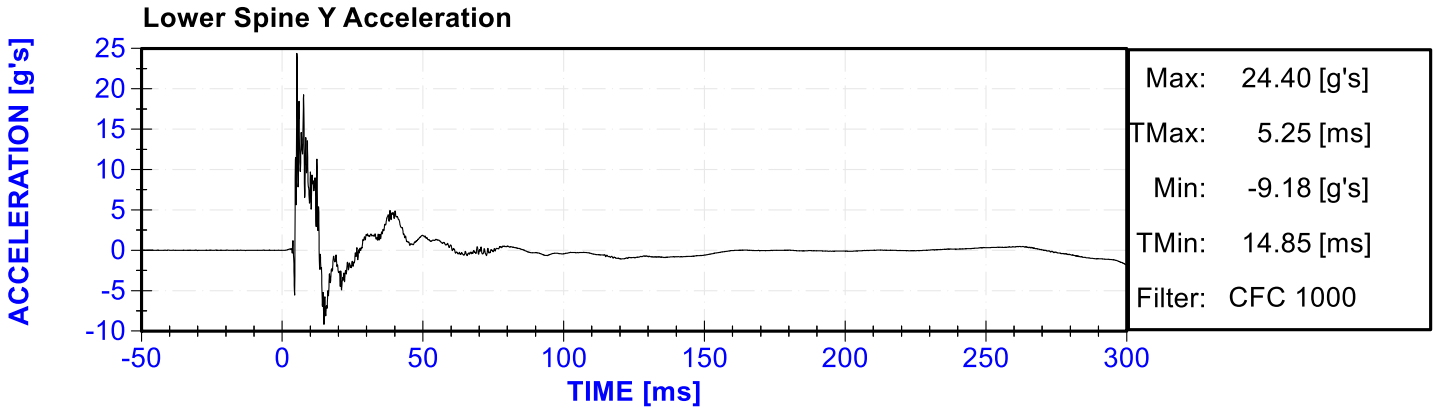

Upper Spine X Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 20.47 [g's]
TMax: 12.35 [ms]
Min: -24.94 [g's]
TMin: 7.50 [ms]
Filter: CFC 1000

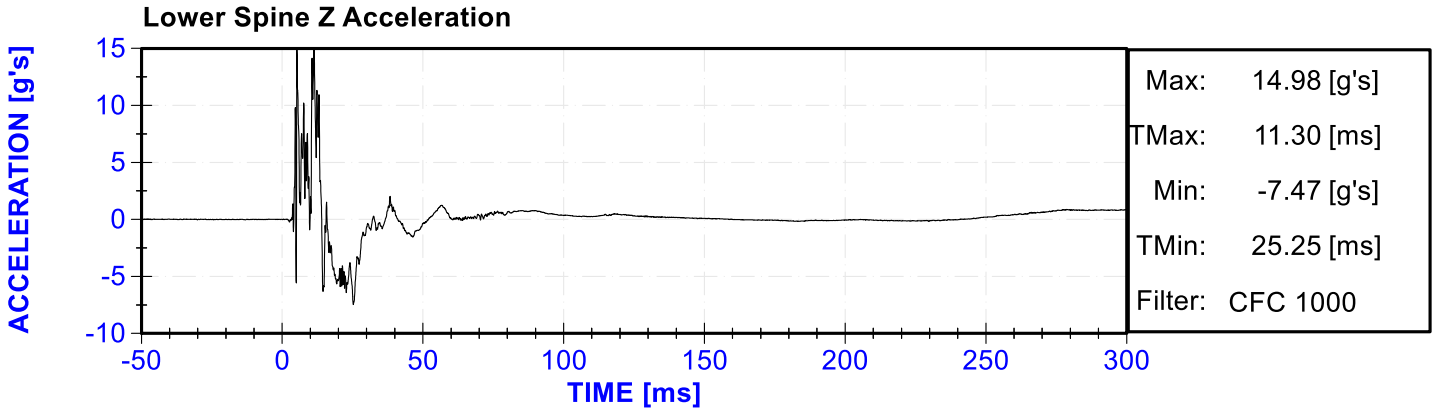

Upper Spine Y Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 22.79 [g's]
TMax: 8.90 [ms]
Min: -22.19 [g's]
TMin: 14.05 [ms]
Filter: CFC 1000

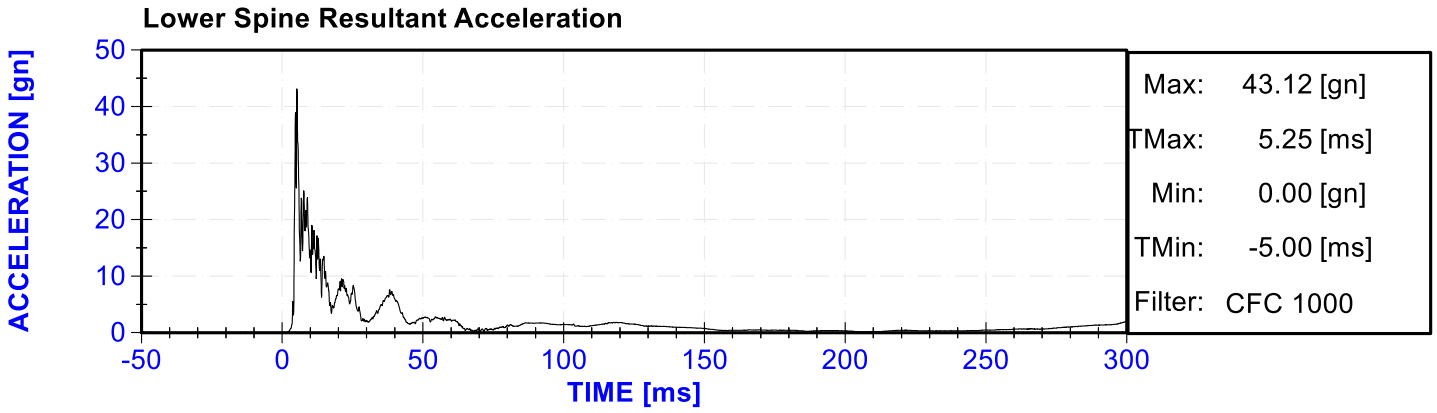

Upper Spine Z Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 17.00 [g's]
TMax: 10.75 [ms]
Min: -22.49 [g's]
TMin: 20.50 [ms]
Filter: CFC 1000

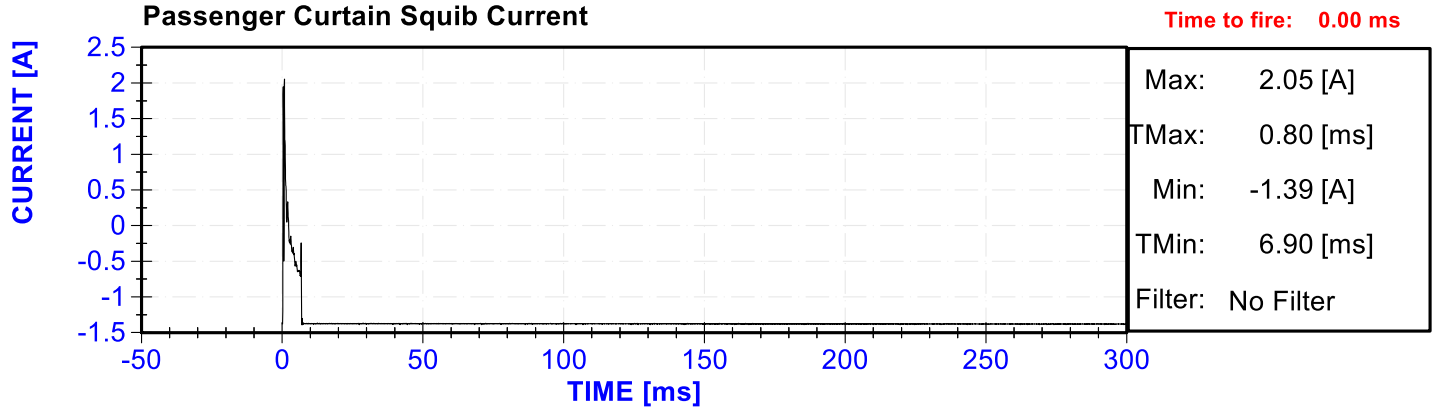

Upper Spine Resultant Acceleration
ACCELERATION [gn]
TIME [ms]
Max: 34.24 [gn]
TMax: 14.05 [ms]
Min: 0.00 [gn]
TMin: -20.60 [ms]
Filter: CFC 1000

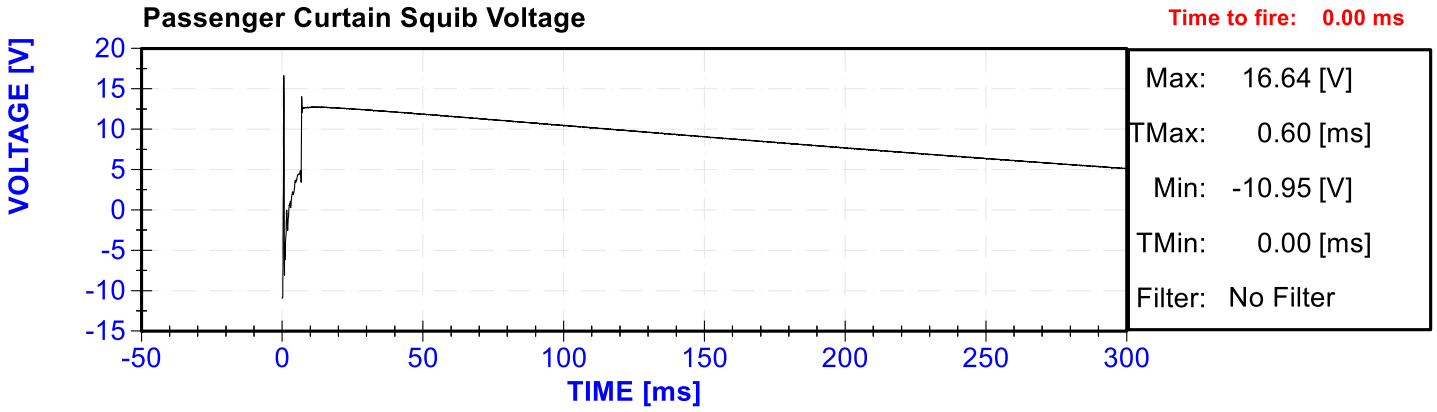

Lower Spine X Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 14.26 [g's]
TMax: 12.80 [ms]
Min: -36.27 [g's]
TMin: 4.75 [ms]
Filter: CFC 1000

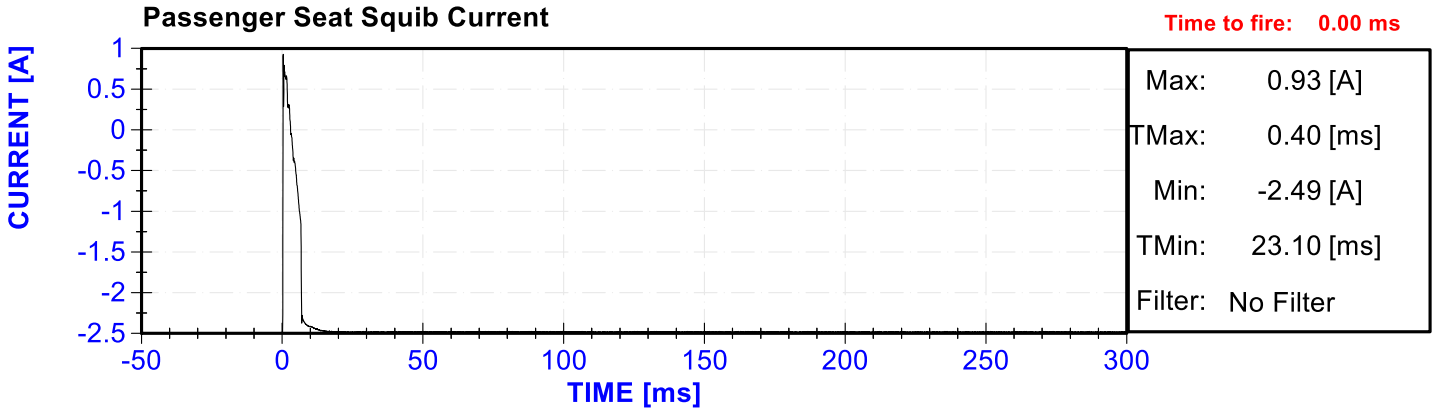

Lower Spine Y Acceleration
ACCELERATION [g's]
TIME [ms]
Max: 24.40 [g's]
TMax: 5.25 [ms]
Min: -9.18 [g's]
TMin: 14.85 [ms]
Filter: CFC 1000

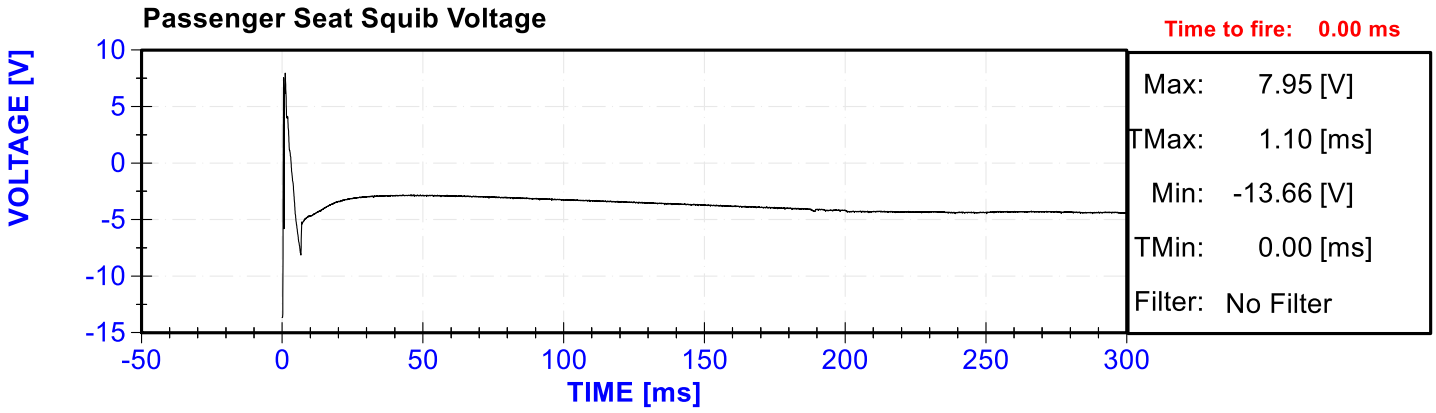

Lower Spine Z Acceleration
ACCELERATION [g's]
15
10
5
0
-5
-10
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 14.98 [g's]
TMax: 11.30 [ms]
Min: -7.47 [g's]
TMin: 25.25 [ms]
Filter: CFC 1000


Lower Spine Resultant Acceleration
ACCELERATION [gn]
50
40
30
20
10
0
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 43.12 [gn]
TMax: 5.25 [ms]
Min: 0.00 [gn]
TMin: -5.00 [ms]
Filter: CFC 1000


Passenger Curtain Squib Current
Time to fire: 0.00 ms
CURRENT [A]
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 2.05 [A]
TMax: 0.80 [ms]
Min: -1.39 [A]
TMin: 6.90 [ms]
Filter: No Filter


Passenger Curtain Squib Voltage
Time to fire: 0.00 ms
VOLTAGE [V]
20
15
10
5
0
-5
-10
-15
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 16.64 [V]
TMax: 0.60 [ms]
Min: -10.95 [V]
TMin: 0.00 [ms]
Filter: No Filter


Passenger Seat Squib Current
Time to fire: 0.00 ms
CURRENT [A]
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 0.93 [A]
TMax: 0.40 [ms]
Min: -2.49 [A]
TMin: 23.10 [ms]
Filter: No Filter


Passenger Seat Squib Voltage
Time to fire: 0.00 ms
VOLTAGE [V]
10
5
0
-5
-10
-15
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 7.95 [V]
TMax: 1.10 [ms]
Min: -13.66 [V]
TMin: 0.00 [ms]
Filter: No Filter

APPENDIX C

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

	POSITION 2 (Front Right Passenger) SERIAL NO.: 139 M20185503TWG2		
	SERIAL NUMBER	**MANUFACTURER**	**CALIBRATION DATE**
Head X Acceleration	AC-P64001	ENDEVCO 7264CT	7/3/2018
Head Y Acceleration	AC-P51687	ENDEVCO 7264CT	7/3/2018
Head Z Acceleration	AC-P15321	ENDEVCO 7264	7/3/2018
Head Redundant X Acceleration	-	-	-
Head Redundant Y Acceleration	-	-	-
Head Redundant Z Acceleration	-	-	-
Upper Neck X Force	LC-125Fx	FTSS IF-234	7/12/2018
Upper Neck Y Force	LC-125Fy	FTSS IF-234	7/12/2018
Upper Neck Z Force	LC-125Fz	FTSS IF-234	7/12/2018
Upper Neck X Moment	LC-125Mx	FTSS IF-234	7/12/2018
Upper Neck Y Moment	LC-125My	FTSS IF-234	7/12/2018
Upper Neck Z Moment	LC-125Mz	FTSS IF-234	7/12/2018
Lower Neck X Force	LC-208 Fx	Humanetics 3303	7/12/2018
Lower Neck Y Force	LC-208 Fy	Humanetics 3303	7/12/2018
Lower Neck Z Force	LC-208 Fz	Humanetics 3303	7/12/2018
Lower Neck X Moment	LC-208 Mx	Humanetics 3303	7/12/2018
Lower Neck Y Moment	LC-208 My	Humanetics 3303	7/12/2018
Lower Neck Z Moment	LC-208 Mz	Humanetics 3303	7/12/2018
Curtain Bag Voltage	ABT squib volts	AutoLab System	-
Curtain Bag Current	ABT squib amps	AutoLab System	-
Seat/Torso Bag Voltage	ABT squib volts	AutoLab System	-
Seat/Torso Bag Current	ABT squib amps	AutoLab System	-