

REPORT NUMBER: TWG-MGA-2006-001

**NEW CAR ASSESSMENT PROGRAM
SIDE AIRBAG OUT-OF-POSITION INJURY TESTING**

**GENERAL MOTORS CORPORATION
2006 CHEVROLET TRAILBLAZER EXT
NHTSA NUMBER: M60121TWG3**

**PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105**



Test Date: June 6, 2006

Final Report Date: August 16, 2006

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
RULEMAKING
OFFICE OF CRASHWORTHINESS STANDARDS
400 SEVENTH STREET, SW, ROOM 5311
WASHINGTON, D.C. 20590**

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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 MGA Research Corporation in Burlington, Wisconsin, on June 6, 2006. <table style="margin-left: auto; margin-right: auto; border: none;"> <tr> <td style="text-align: center;">HIC 15</td> <td style="text-align: center;">HIC 36</td> <td style="text-align: center;">NIJ NTF</td> <td style="text-align: center;">NIJ NTE</td> <td style="text-align: center;">NIJ NCF</td> <td style="text-align: center;">NIJ NCE</td> </tr> <tr> <td style="text-align: center;">0.6</td> <td style="text-align: center;">0.6</td> <td style="text-align: center;">0.02</td> <td style="text-align: center;">0.03</td> <td style="text-align: center;">0.08</td> <td style="text-align: center;">0.07</td> </tr> </table>				HIC 15	HIC 36	NIJ NTF	NIJ NTE	NIJ NCF	NIJ NCE	0.6	0.6	0.02	0.03	0.08	0.07
HIC 15	HIC 36	NIJ NTF	NIJ NTE	NIJ NCF	NIJ NCE										
0.6	0.6	0.02	0.03	0.08	0.07										
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

The purpose of this test was to obtain data in a static out-of-position side impact. These data constitute part of the general consumer information collected by the New Car Assessment Program (NCAP) sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-03-D-12005.

SUMMARY

The effects of a curtain airbag deployment in a 2006 Chevrolet Trailblazer Ext with an out-of-position six-year-old child were evaluated. The test was performed by MGA Research Corporation on June 6, 2006. Pre and post test photographs of the vehicle and dummy can be found in Appendix A.

One real-time camera (24 fps) and three high-speed cameras (1000 fps) were used to document the side airbag deployment event. The following camera locations were used:

- Left Side Through Passenger Window
- Front Through Windshield
- Left Side $\frac{3}{4}$ View Through Windshield

One Part 572N, 6-year-old child dummy (Serial Number 144) was placed in the right rear passenger seat situated in the inboard-facing position per Section 3.3.5.1 according to dummy placement instructions specified in 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 child dummy was instrumented with head tri-axial accelerometers. In addition, upper and lower neck force and moment load cell sensors were utilized.

The 15 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy head and neck response data traces. Appendix C contains the instrumentation calibration data.

The HIII 6-year-old child dummy's visible contact points were as follows: The curtain airbag to the top of the head and the face.

The HIII 6-year-old child dummy was placed on the foam booster block with its legs extended. With the head in its neutral orientation, the dummy's pelvis was pushed outboard until the dummy's back contacted the door trim panel. The dummy's pelvic angle was then adjusted until the head center of gravity was centered in the curtain airbag's deployment trajectory. The dummy's arms were bent at the elbow until the fingers just touched the booster seat. This orientation complies with Section 3.3.5.1 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.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
TEST SUMMARY

	Test Data	Description
Seating Position	P3	Right Rear Seating Position
Test	3.3.5.1*	Side-facing HIII 6-year-old child dummy on booster block
Airbag	Roof-Rail Mounted	Side curtain airbag
Booster Block	300 mm x 455 mm x 75 mm	Block consisted of HD36 foam with a density of 44.8 g/L
ATD Type/Serial No.	P572N / 144	HIII 6-year-old child dummy

* Procedure as defined by Lund, et al and the Technical Working Group dated July, 2003

Number of Data Channels	15
Number of Real-Time Video	1
Number of High-Speed Video	3

Visible Dummy Contact Points	
Head Contact	Curtain airbag to top of head and face
Upper Torso Contact	None
Lower Torso Contact	None
Left Knee Contact	None
Right Knee Contact	None

DATA SHEET NO. 2**TEST VEHICLE INFORMATION**

Please note that this vehicle had previously been tested in an
NCAP Frontal Impact on June 6, 2006

TEST VEHICLE INFORMATION

Manufacturer	General Motors
Model	Trailblazer EXT
Body Style	SUV
NHTSA No.	M60121TWG3
VIN	1GNET16S966102664
Color	Red
Delivery Date	12/2/05
Odometer Reading (mile)	189
Dealer	Boucher Chevrolet
Transmission	Automatic
Final Drive	Rear
Number of Cylinders	6
Engine Displacement (L)	4.2
Engine Placement	Longitudinal
Automatic Door Lock (ADL)	Yes
Owners Manual Details Instructions on Disabling ADLs	No
Bucket Seats	Yes

TEST VEHICLE OPTIONS

Front Airbag	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso Airbag	No
Rear Passenger Side Curtain Airbag	Yes
Rear Passenger Side Torso Airbag	No
Force Limiter	Yes
Pretensioner	Yes
Power Steering	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Air Conditioning	Yes
Anti-lock Brakes	Yes
Traction Control	Yes
All Wheel Drive	No
Power Seats	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	General Motors Corporation
Date of Manufacture	07/05

GVWR (kg)	2903
GAWR Front (kg)	1452
GAWR Rear (kg)	1542

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench	Split Bench	
Number of Occupants	2	3	2	7
Capacity Wt. (VCW) (kg)				631
Cargo Wt. (RCLW) (kg)				136.1

DATA SHEET NO. 3
DUMMY POSITIONING IN VEHICLE

Measurement		Value
Total Fore/Aft Travel (mm)		---
Test Distance Rearward of Full-Forward (mm)		---
Total Fore/Aft Travel (detents)		---
Placed in Position No. 3		---
Seat Back Angle	SA (°)	24
Airbag Module Width	AMW (mm)	37
Airbag Width	ABW (mm)	605
Airbag Module Length	AML (mm)	261
Airbag Length	ABL (mm)	1856
Top of Airbag Module to Head/Neck Junction	AN (mm)	---
Head CG to Door Panel/Window	HD (mm)	119
Head to Seat Back Centerline	HSC (mm)	251
Head to B-Pillar (cg)	HB (mm)	530
Head to Roof, Z (top of the head)	HZ (mm)	187
Head to Header	HHD (mm)	187
Chest to Dash	CD (mm)	---
Chest to Seatback	CS (mm)	194
Right Arm to Seat Back Centerline	RACL (mm)	---
Right Arm to Seat Back Centerline	RACL (°)	---
Left Arm to Seat Back Centerline	LACL (mm)	---
Left Arm to Seat Back Centerline	LACL (°)	---
Right Arm to Door Panel	RA (mm)	33
Left Arm to Door Panel	LA (mm)	110
Knee to Knee	KK (mm)	110
Toe to Toe	TT (mm)	106
Right Knee to Seat Cushion Centerline	KSCR (mm)	100
Left Knee to Seat Cushion Centerline	KSCL (mm)	100
Right Toe to Seat Cushion Centerline	TSCR (mm)	452
Left Toe to Seat Cushion Centerline	TSCL (mm)	435
Nose to Dash	ND (mm)	---
Nose to Seatback	NS (mm)	263
Nose to Header	HR (mm)	---
Foam Block Depth	(mm)	300
Foam Block Width	(mm)	455
Foam Block Thickness	(mm)	75

DATA SHEET NO. 4
DUMMY INJURY CRITERIA VALUES

NHTSA No. M60121TWG3

		MAXIMUM VALUE			
		Position No. 3			
DESCRIPTION	UNIT	MAXIMUM	TIME (MS)	MINIMUM	TIME (MS)
Head X	g	5.3	86.6	-4.1	56.4
Head Y	g	3.6	26.3	-1.7	33.1
Head Z	g	3.1	23.8	-1.1	9.7
Head Resultant	g	5.4	86.6	0.0	274.5
Upper Neck Fx	N	42.3	75.6	-37.4	104.1
Upper Neck Fy	N	22.9	26.5	-21.9	35.8
Upper Neck Fz	N	23.5	88.1	-169.7	25.8
Upper Neck F Resultant	N	172.3	25.8	0.3	0.0
Upper Neck Mx	N-m	0.5	114.7	-3.2	29.4
Upper Neck My	N-m	3.5	30.2	-2.3	63.1
Upper Neck Mz	N-m	0.8	123.1	-0.8	36.9
Upper Neck M Resultant	N-m	4.7	29.8	0.0	0.0
Lower Neck Fx	N	34.7	28.9	-22.1	118.2
Lower Neck Fy	N	32.7	28.6	-17.5	37.4
Lower Neck Fz	N	20.6	87.1	-144.7	26.0
Lower Neck F Resultant	N	146.3	26.0	0.1	0.0
Lower Neck Mx	N-m	1.4	27.5	-3.3	37.2
Lower Neck My	N-m	5.6	117.1	-5.4	87.1
Lower Neck Mz	N-m	0.9	121.9	-1.3	37.6
Lower Neck M Resultant	N-m	5.6	117.1	0.0	0.0

DATA SHEET NO. 4 (continued)
DUMMY INJURY CRITERIA VALUES

ATD position	HEAD INJURY CRITERIA (HIC)					
	HIC15			HIC36		
	HIC	T ¹ (msec)	T ² (msec)	HIC	T ¹ (msec)	T ² (msec)
No. 3 Right Rear	0.6	81.9	95.9	0.6	81.9	95.9

Position 3 Neck Injury Summary (Hill 6-year-old – Out-of-Position)

Nij V10	Nij	Time (msec)	Z Force (N) (CFC 600)	X Force (N) (CFC 600)	Y Moment (N-m) (CFC 600)
Ntf	0.02	36.40	10.52	-10.41	1.29
Nte	0.03	85.20	8.02	26.41	-0.86
Ncf	0.08	25.80	-165.55	21.58	1.61
Nce	0.07	64.20	-16.46	7.66	-2.28
Peak Tension (CFC1000)		23.5 N	Peak Compression (CFC 1000)		-169.7 N

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	2800 N	Extension (mCVe)	37 N-m	Tension	1490 N
Compression (CVc)	2800 N	Flexion (mCVf)	93 N-m	Compression	1820 N
Condyle Offset	0.01778 m				

APPENDIX A
PHOTOGRAPHS

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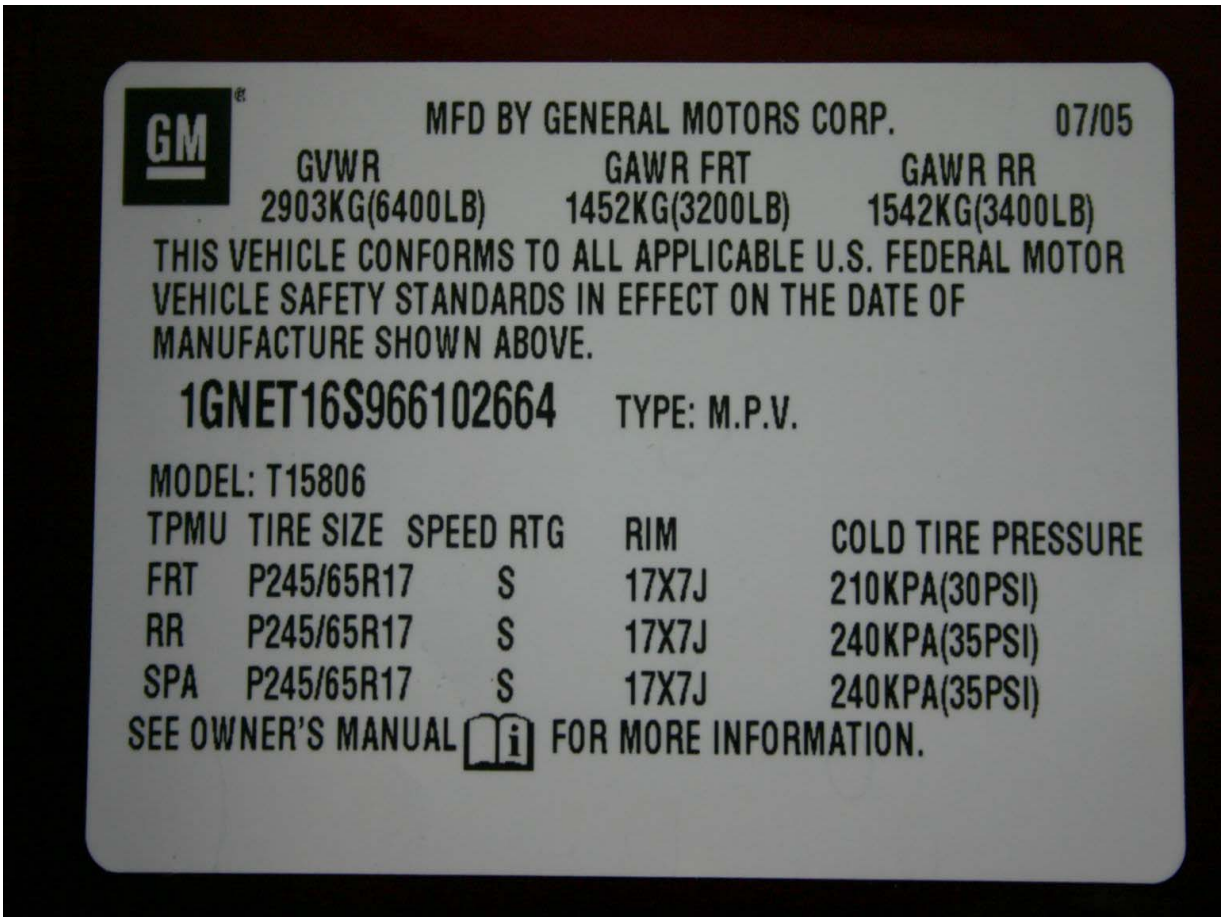
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Pre-Test Vehicle Left Side View



Post-Test Vehicle Left Side View



Vehicle Certification Placard



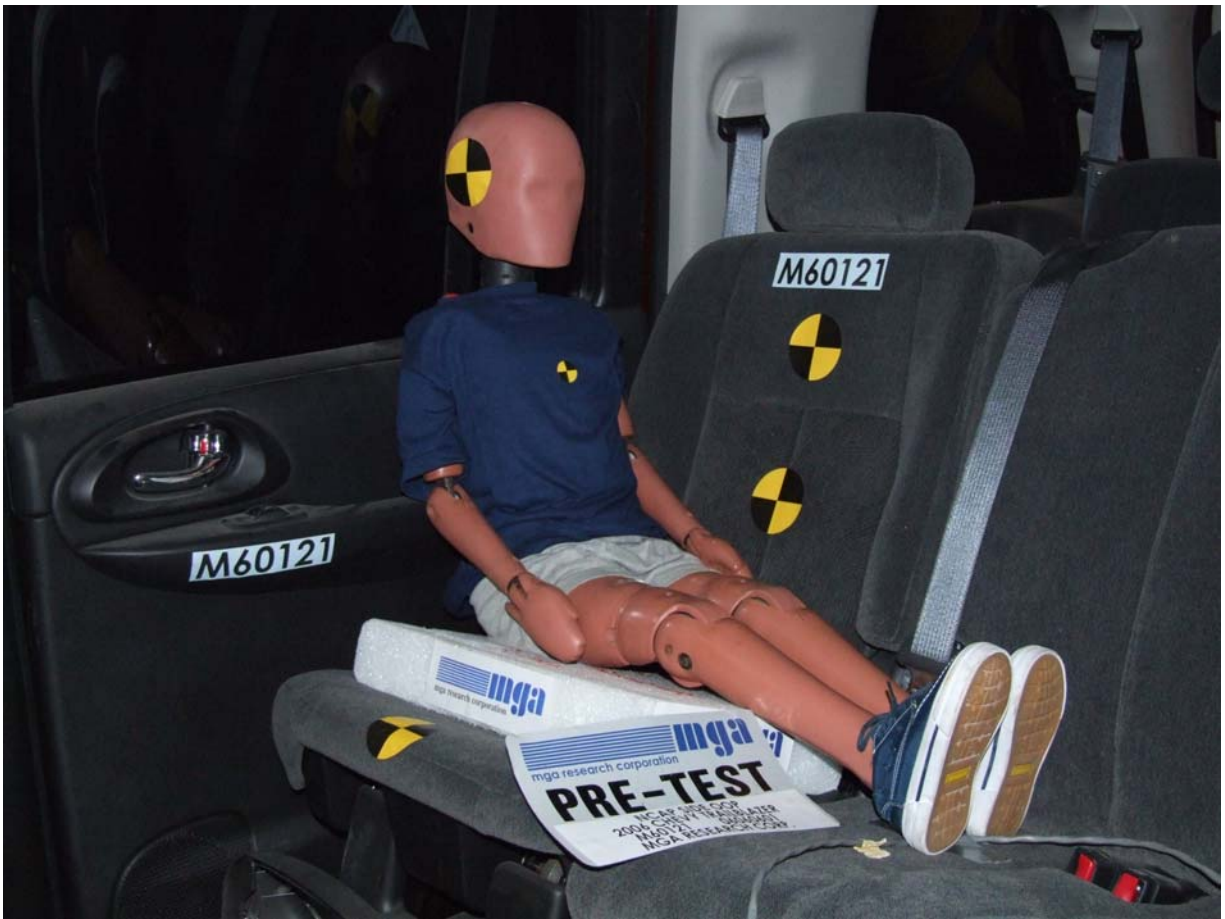
Vehicle Tire Placard



Pre-Test Child Dummy Frontal View



Post-Test Child Dummy Frontal View



Pre-Test Child Dummy Right 3/4 Side View



Post-Test Child Dummy Right 3/4 Side View



Pre-Test Child Dummy Right Side View



Post-Test Child Dummy Right Side View



Pre-Test Child Dummy Head View



Post-Test Child Dummy Head View



Pre-Test Child Dummy Head View (Through Window)



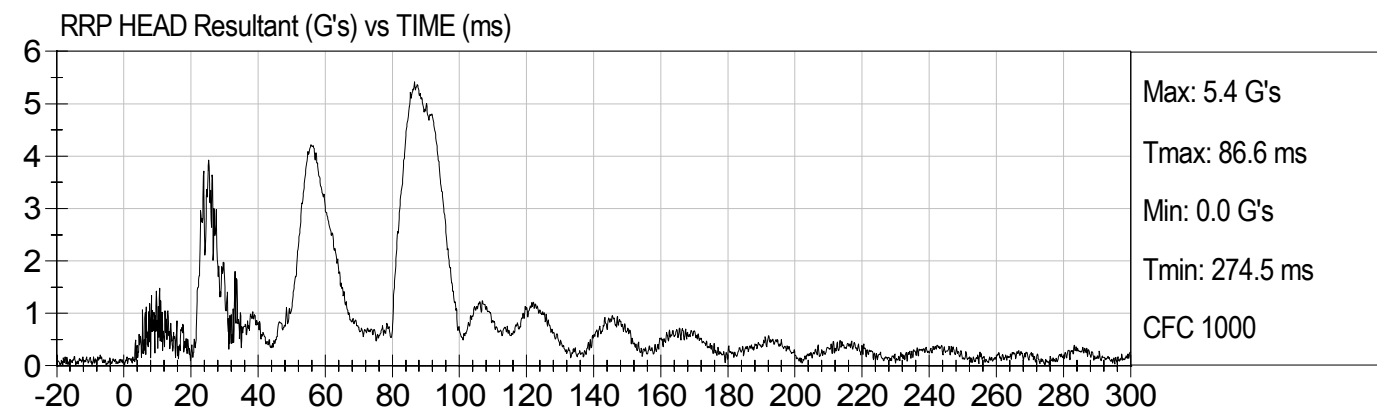
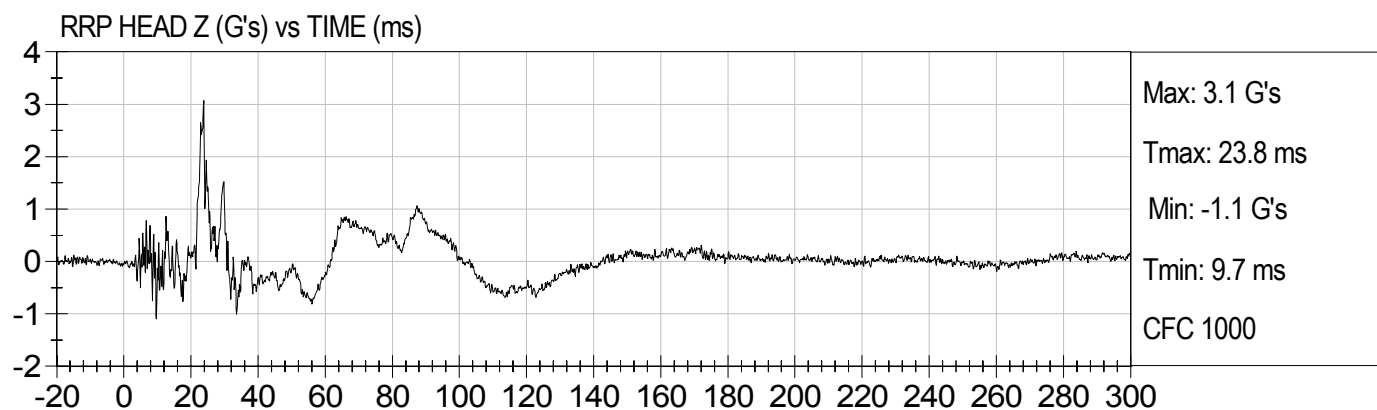
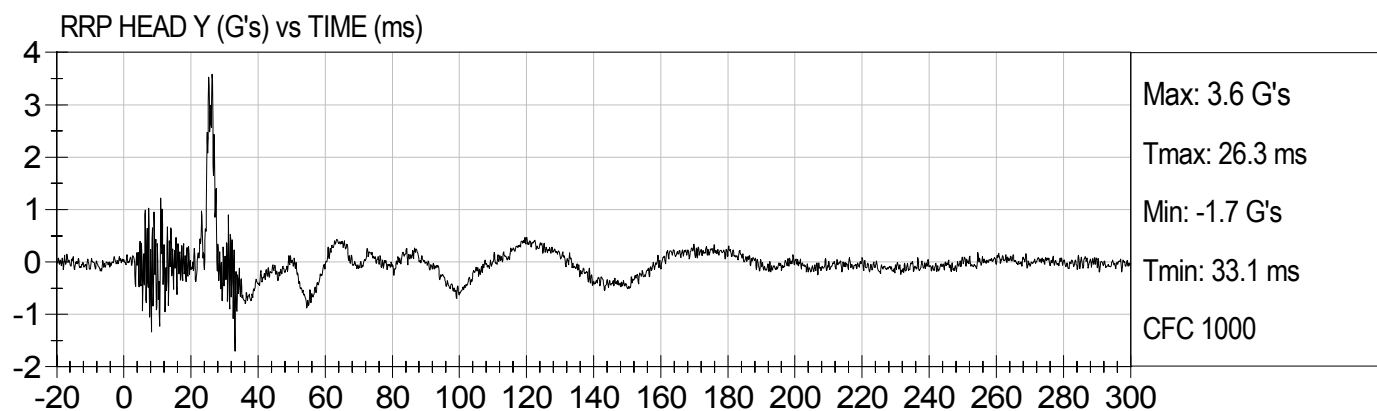
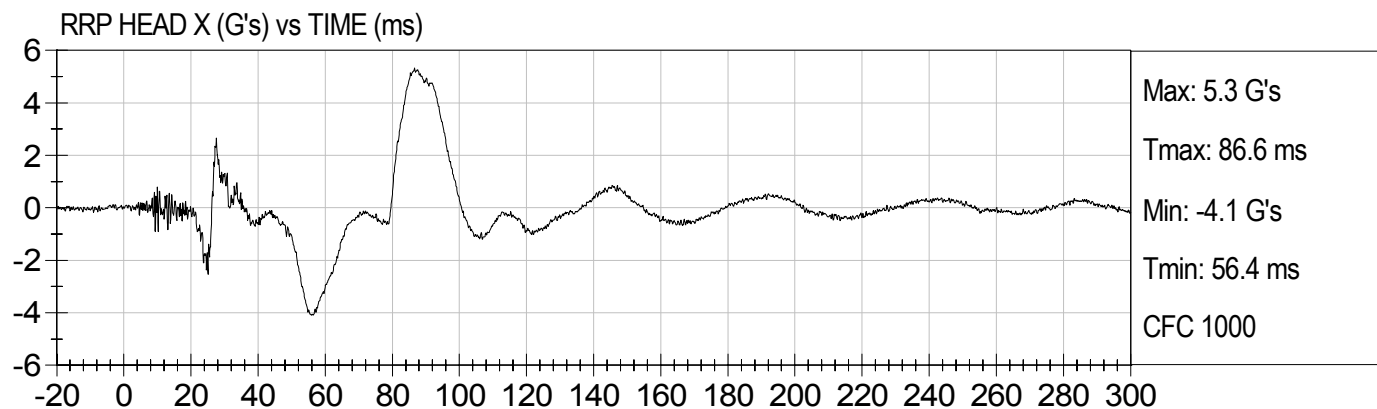
Post-Test Child Dummy Head View (Through Window)

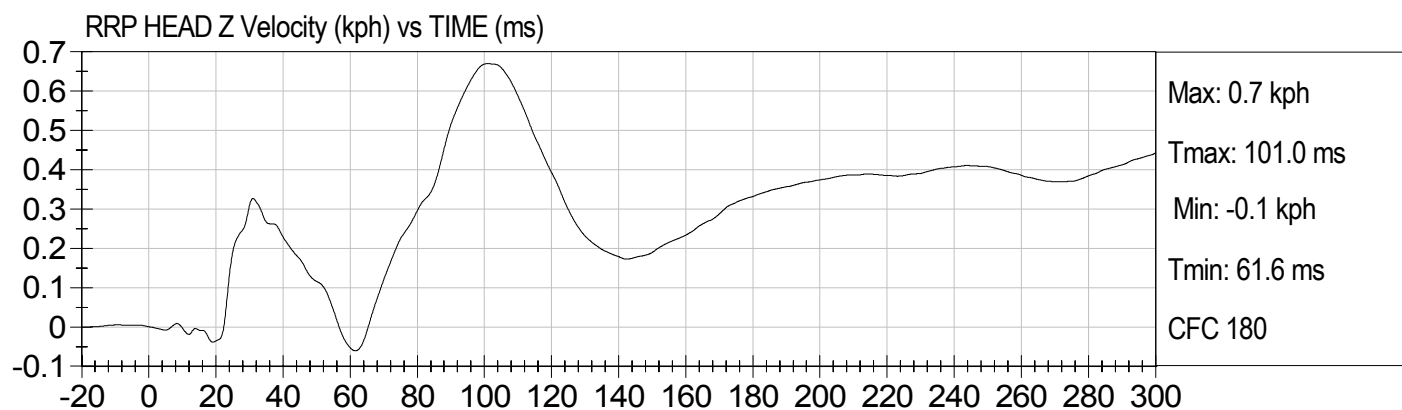
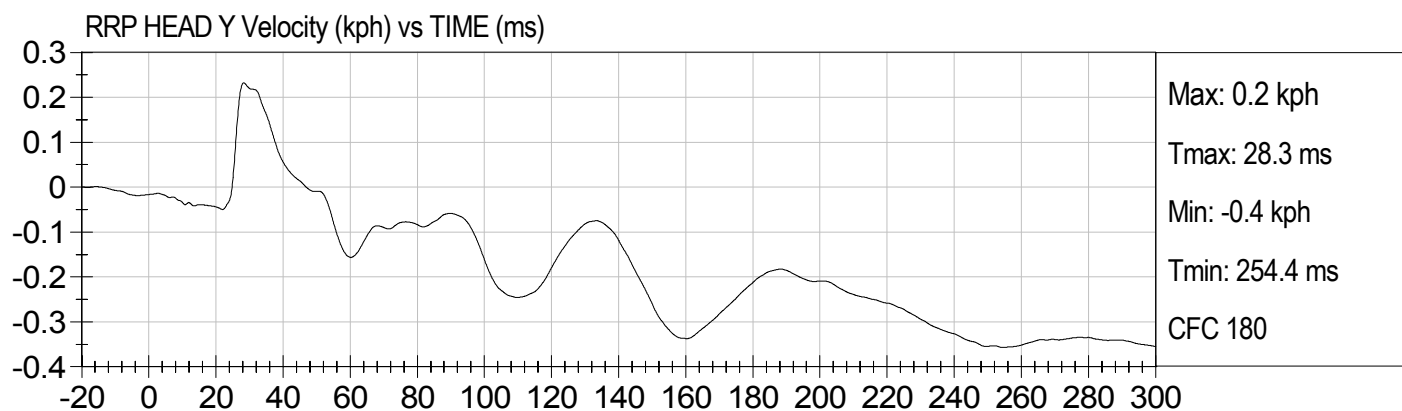
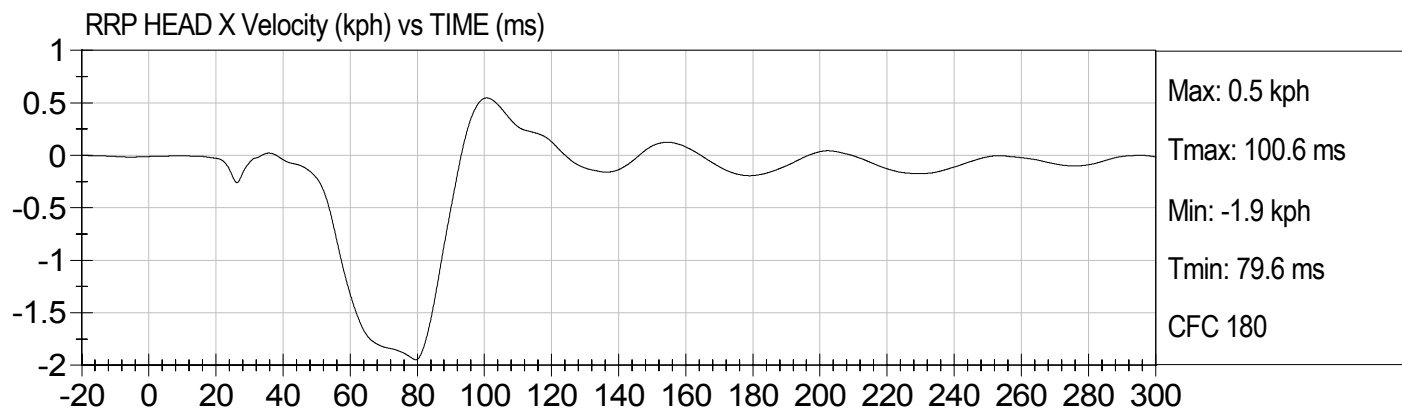
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DUMMY RESPONSE DATA TRACES

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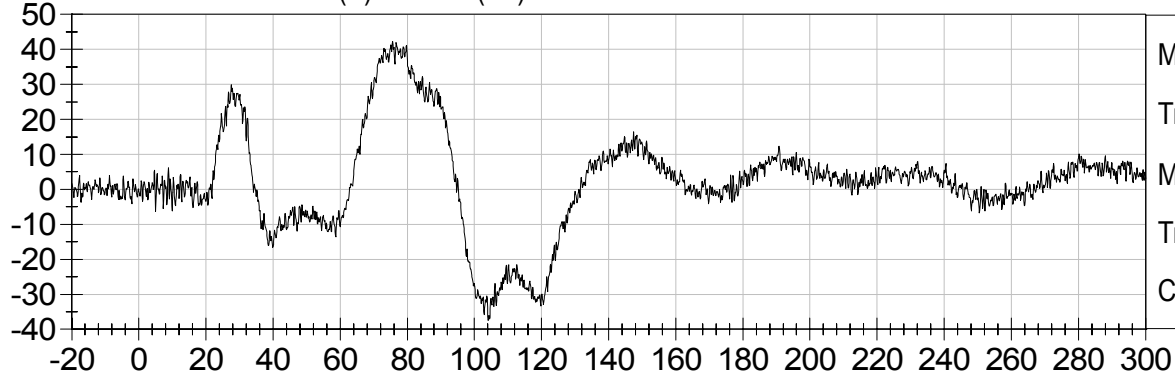
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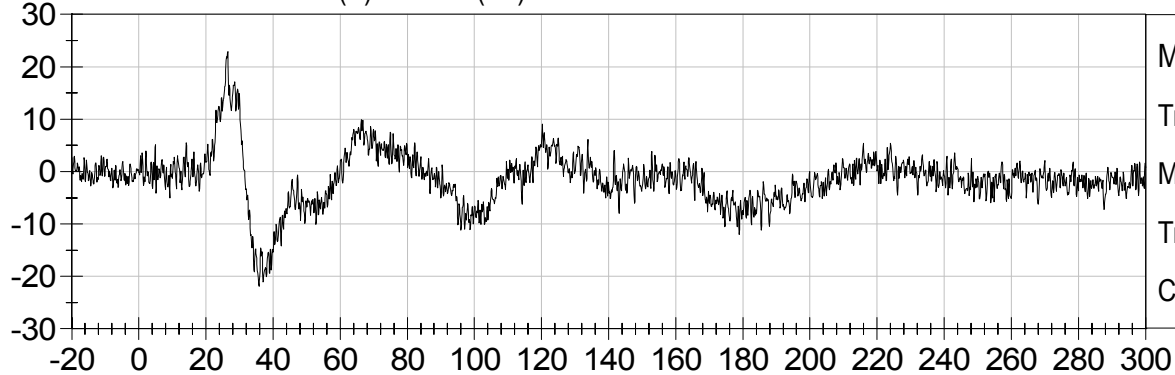




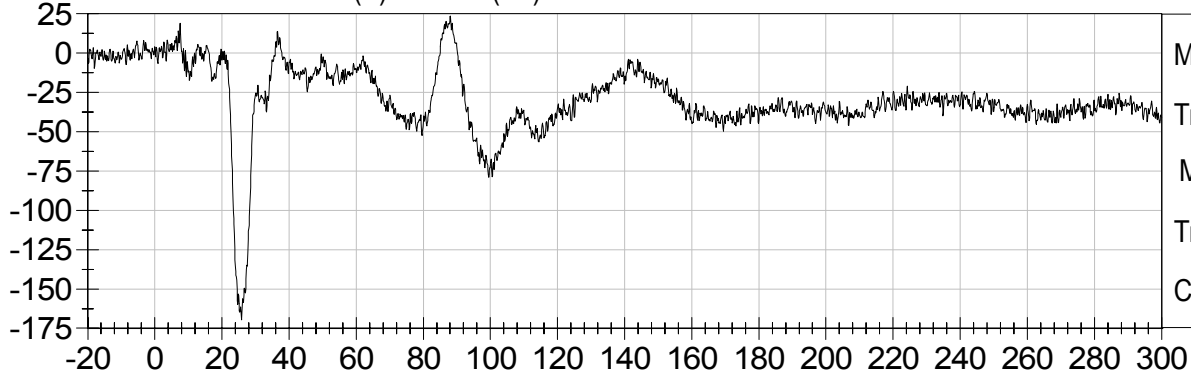
RRP UPPER NECK FX (N) vs TIME (ms)



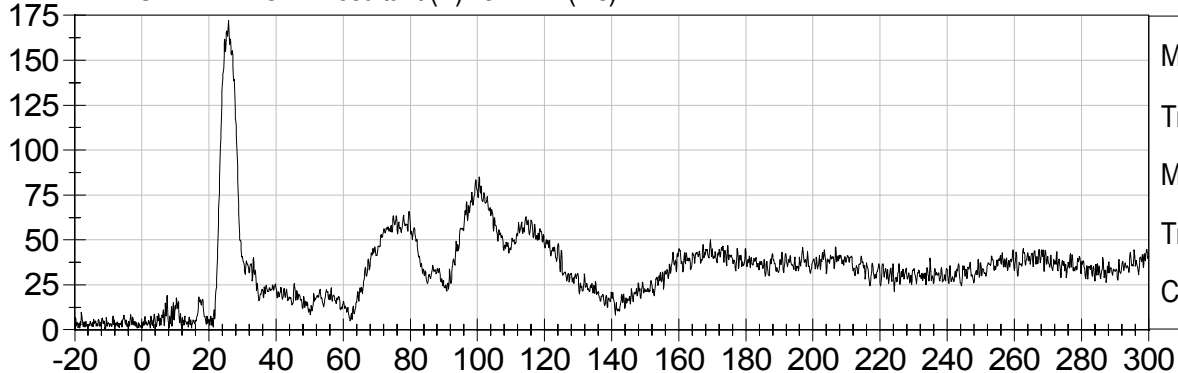
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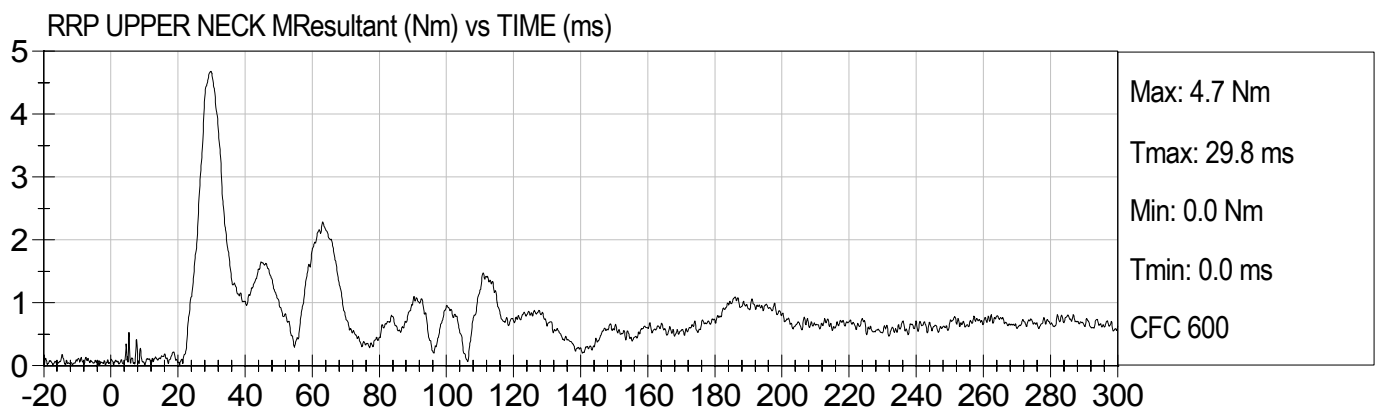
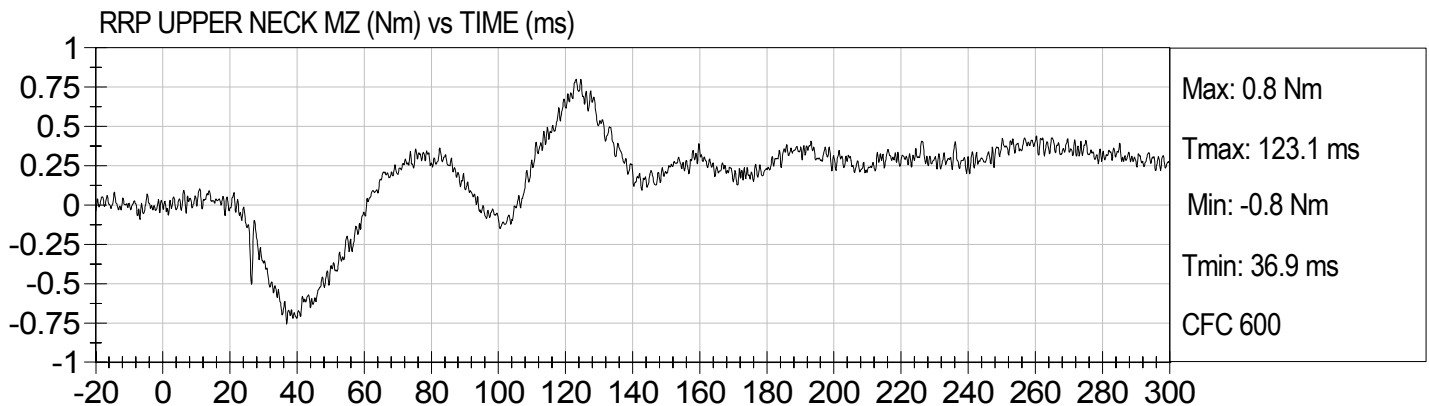
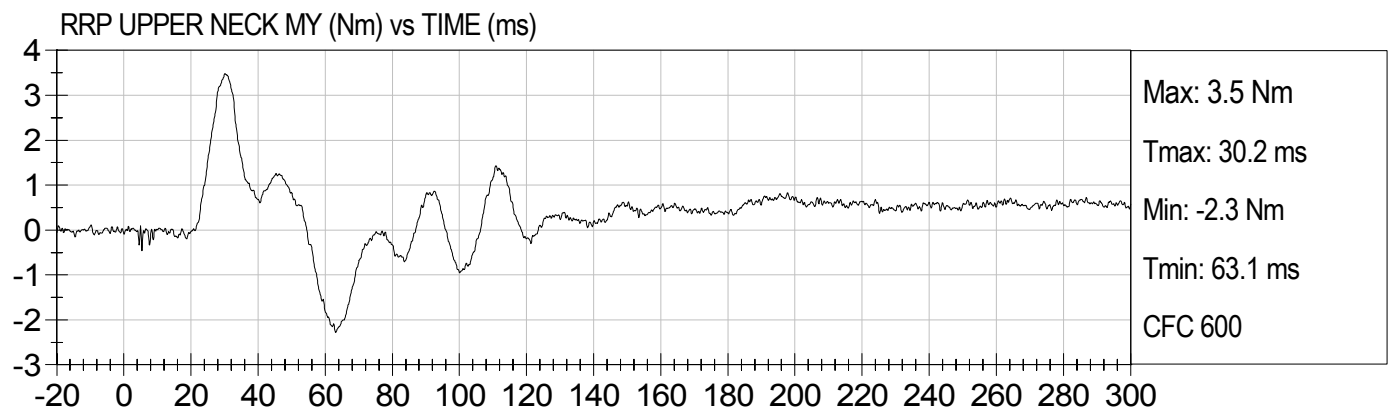
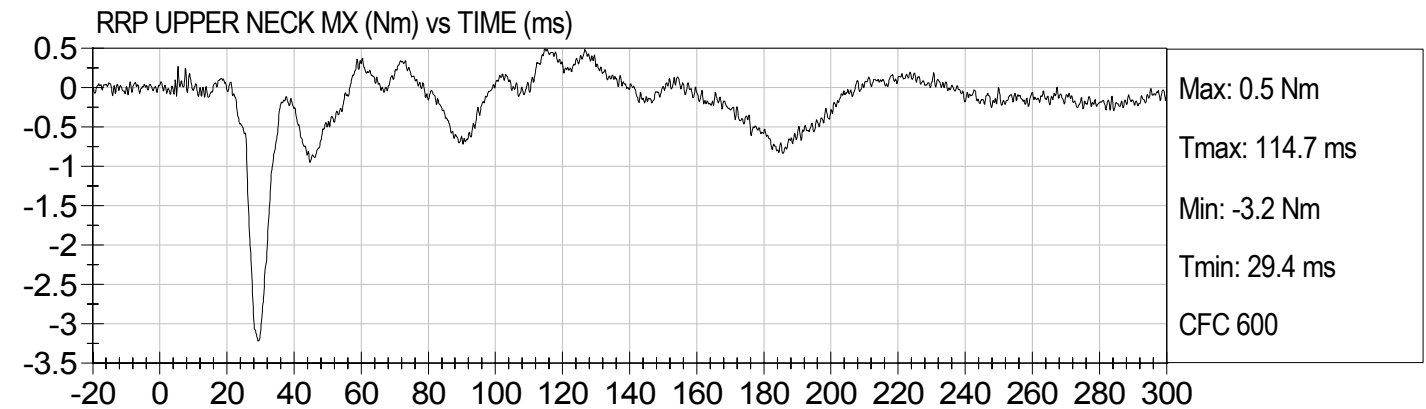


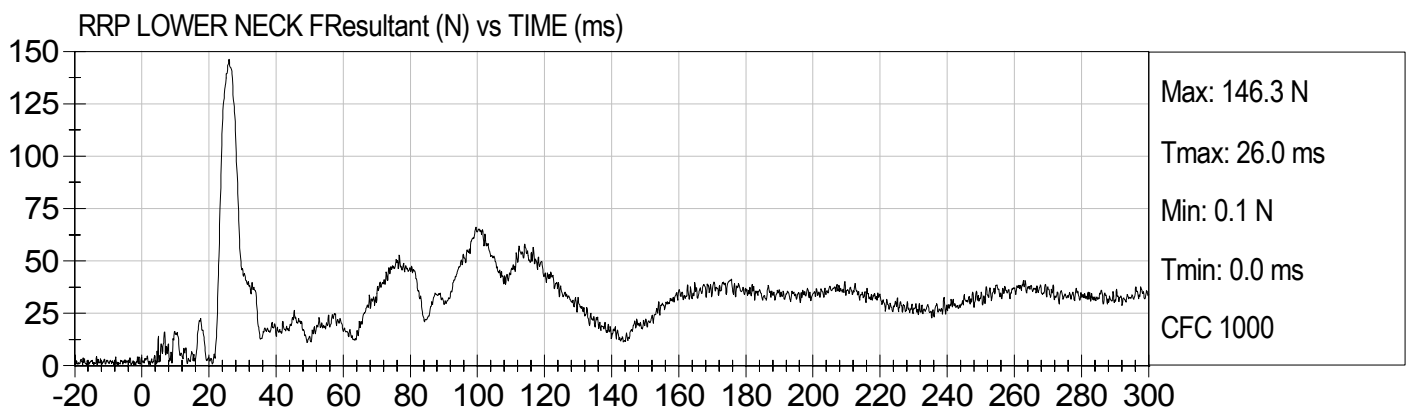
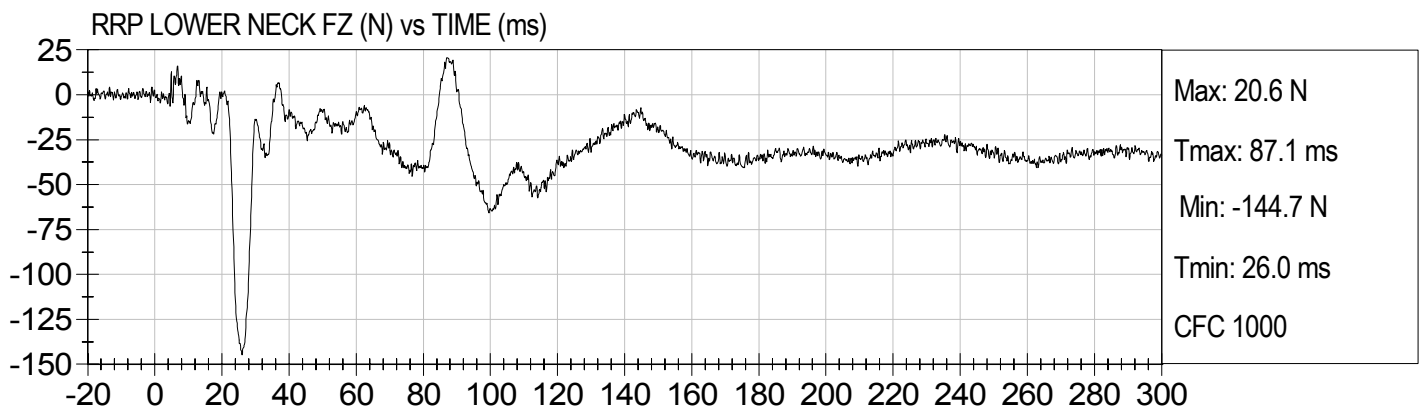
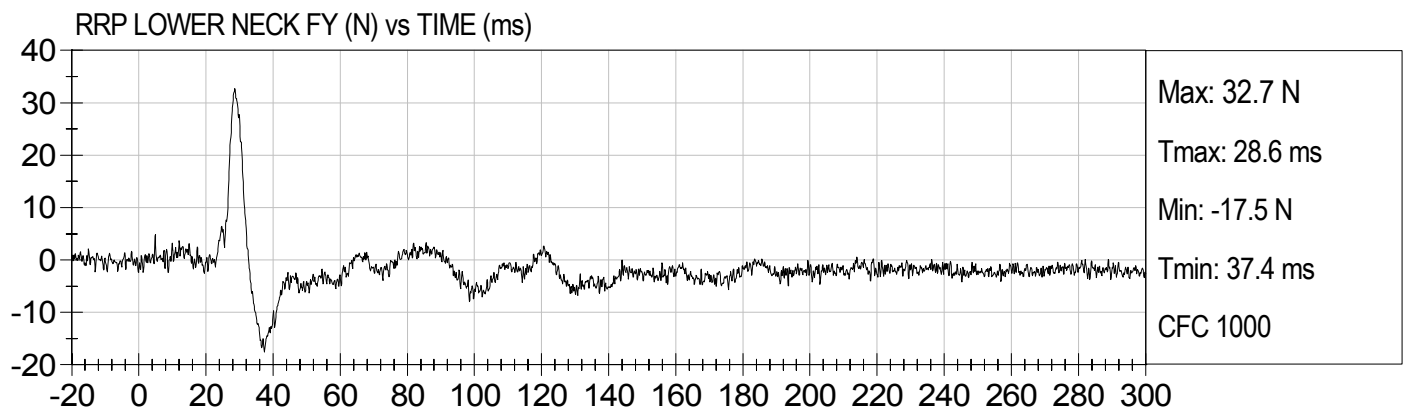
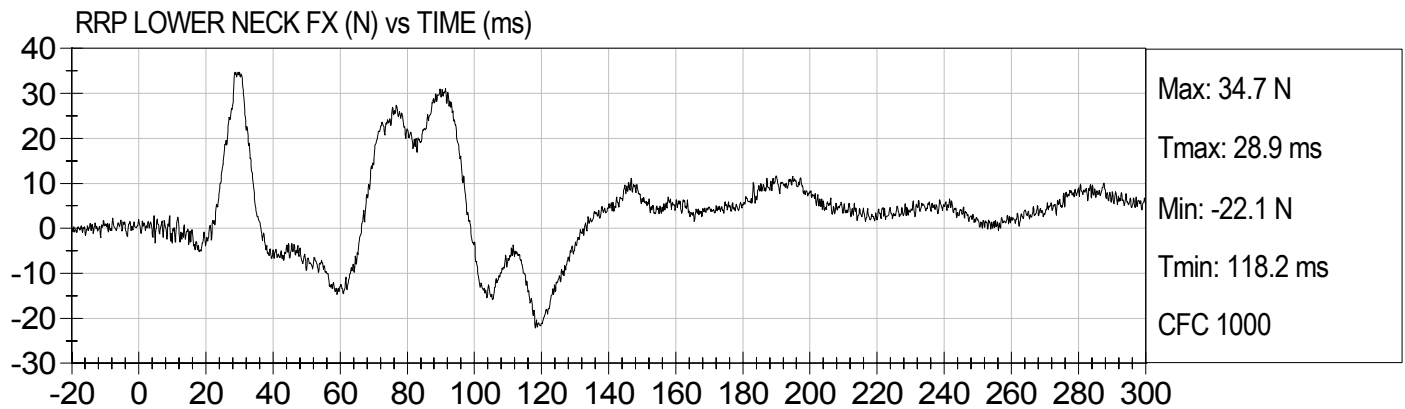
RRP UPPER NECK FZ (N) vs TIME (ms)



RRP UPPER NECK FResultant (N) vs TIME (ms)

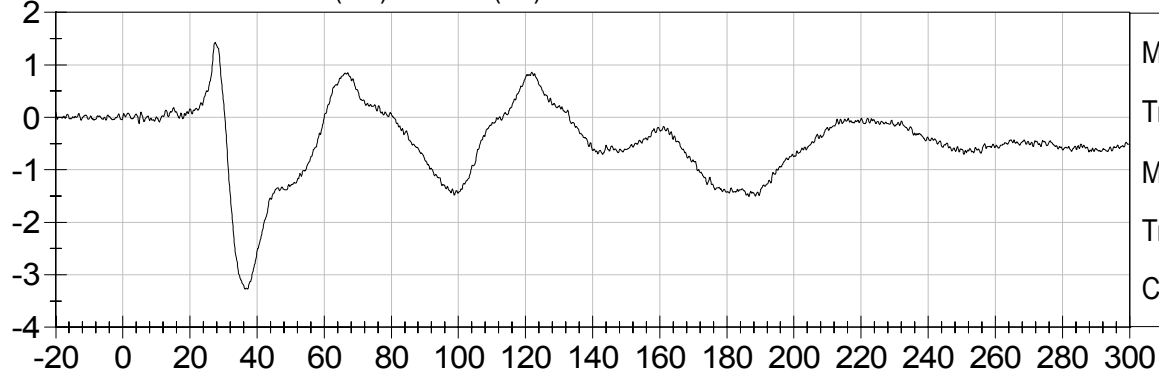






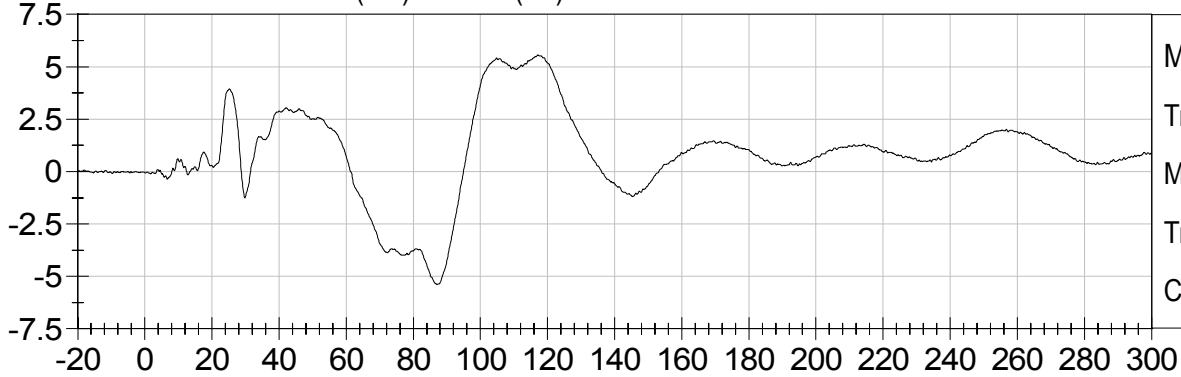


RRP LOWER NECK MX (Nm) vs TIME (ms)



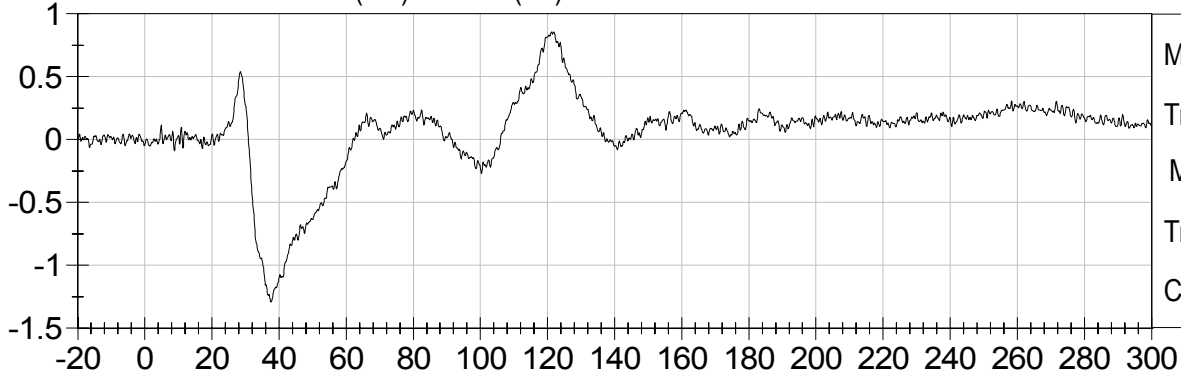
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Min: -3.3 Nm
Tmin: 37.2 ms
CFC 600

RRP LOWER NECK MY (Nm) vs TIME (ms)



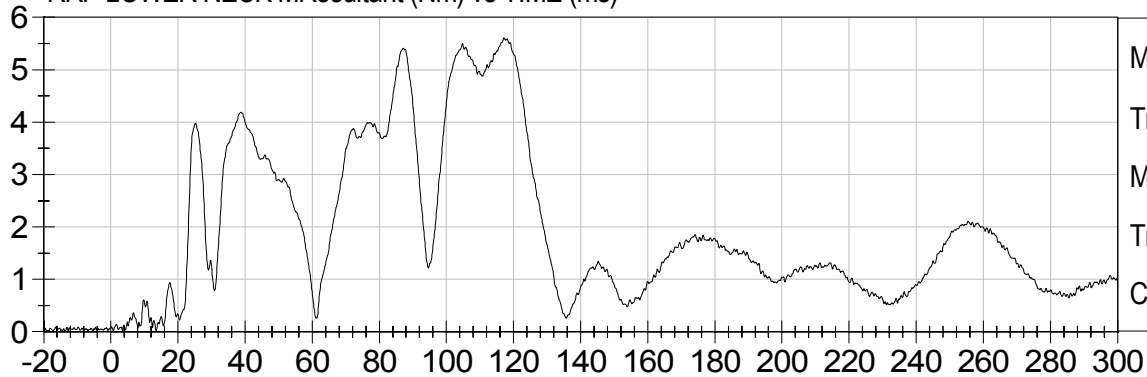
Max: 5.6 Nm
Tmax: 117.1 ms
Min: -5.4 Nm
Tmin: 87.1 ms
CFC 600

RRP LOWER NECK MZ (Nm) vs TIME (ms)



Max: 0.9 Nm
Tmax: 121.9 ms
Min: -1.3 Nm
Tmin: 37.6 ms
CFC 600

RRP LOWER NECK MResultant (Nm) vs TIME (ms)



Max: 5.6 Nm
Tmax: 117.1 ms
Min: 0.0 Nm
Tmin: 0.0 ms
CFC 600

APPENDIX C

INSTRUMENTATION CALIBRATION DATA

SIX YEAR OLD – SERIAL NUMBER 144

	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	G29-X17	Entran	5/24/06
Head Y	G29-X47	Entran	5/24/06
Head Z	G29-X06	Entran	5/24/06
Upper Neck Load Cell	N197	FTSS	5/03/06
Lower Neck Load Cell	LNG147	Denton	5/18/06