REPORT NUMBER: NCAPCHILD-MGA-2003-002

NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST

Century 1500 STE
Century Accel Overhead

NHTSA NUMBER: M30206

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

Test Date: December 11, 2002

Report Date: December 20, 2002

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
RULEMAKING
OFFICE OF CRASHWORTHINESS STANDARDS
400 SEVENTH STREET, SW, ROOM 5313
WASHINGTON, D.C. 20590

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-01-D-12005.

Prepared by: _____ Date: _____
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Reviewed by: _____ Date: _____
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FINAL REPORT ACCEPTED BY:

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Manager, New Car Assessment Program

_____
Date of Acceptance

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COTR, NCAP Frontal Impact Program

_____
Date of Acceptance

Technical Report Documentation Page

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4. Title and Subtitle Final Report of New Car Assessment Program Testing of Century 1500 STE and Century Accel Overhead Child Restraint Systems NHTSA No.: M30206		*5. Report Date* December 20, 2002 *6. Performing Organization Code* MGA	
7. Author(s) Shefalika Agarwal, Project Engineer		*8. Performing Organization Report No.* NCAPCHILD-MGA-2003-002	
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-01-D-12005	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Rulemaking, Office of Crashworthiness Standards 400 Seventh Street, SW, Room 5313 Washington, D.C. 20590		*13. Type of Report and Period Covered* Final Report 12/11/02 to 12/20/02 *14. Sponsoring Agency Code* NVS-111	
15. Supplementary Notes			
16. Abstract A frontal load cell barrier test was conducted on the subject CRS Century 1500 STE and Century Accel Overhead in accordance with the specifications of the Office of Crashworthiness Standards Test Procedure for the determination of CRS crashworthiness. This test was conducted at MGA Research Corporation in Burlington, Wisconsin on December 11, 2002.			
17. Key Words 56.3 km/h NCAP Frontal Barrier Impact Test New Car Assessment Program (NCAP) Century 1500 STE Century Accel Overhead NHTSA No: M30206		*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Admin., Technical Ref. Division, Room 5108 (NAD-52) 400 Seventh Street, S.W. Washington, D.C. 20590	
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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

The purpose of this test was to obtain CRS performance data in a frontal impact NCAP condition.

This 56.5 kph frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-01-D-12005.

SUMMARY

Both child dummies were instrumented with head, chest, and pelvic triaxial accelerometers. In addition, redundant head z acceleration, and upper and lower six axial neck force and moment sensors were utilized.

The right rear (Position 3) child dummy (S/N 42) and left rear (Position 4) child dummy (S/N 40) were calibrated previous to this test. Child dummy certification information is found in Appendix C.

The right rear child dummy's HIC was 792.4; maximum chest deceleration over 3 msec was 54.4 g's. The left rear child dummy's HIC was not calculated because there was no valid data collected for the head CG Y acceleration. The maximum chest deceleration over 3 msec was 38.5 g's. Positions 3 and 4 used the vehicle LATCH and top tether for attachment.

SECTION 2
DATA SHEET NO. 1
CRASH TEST SUMMARY

TEST DUMMY INFORMATION

Description	Position 3 CRS	Position 4 CRS
Dummy Type / Serial No.	HIII 3 Year Old / 42	HIII 3 Year Old / 40
Number of Data Channels	23	23
Restraint System	Century 1500 STE	Century Accel Overhead

CAMERA COVERAGE

High Speed	17
Real Time	1
Total	18

POST TEST DOOR OPENING

Description	Front	Rear
Left Side Doors	Door remained closed and latched; Door opened without tools	Not Applicable
Right Side Doors	Door remained closed and latched; Door opened without tools	Not Applicable
Hatch/Other Door	None	Door remained closed and latched; Door opened without tools

POST TEST SEAT DATA

Location	Seat Movement (mm)	Seat Back Failure
P1 (Left Front)	0	None
P2 (Right Front)	0	None
P3 (Right Rear)	0	None
P4 (Left Rear)	0	None

VISIBLE DUMMY CONTACT POINTS

Description	Position 3 CRS (S/N 42)	Position 4 CRS (S/N 40)
Head Contact	Left Arm	Overhead Shield
Upper Torso Contact	None	None
Lower Torso Contact	None	None
Left Foot Contact	Seat back (2 levels)	Seat back (2 levels)
Right Foot Contact	Seat back (2 levels)	Seat back (2 levels)

SECTION 2… (continued)

DATA SHEET NO. 2
CRS PARAMETER DATA

Child Restraint System (Position 3)	Century 1500 STE
Child Restraint System (Position 4)	Century Accel Overhead
NHTSA No.	M30206

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1154.4
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	36.3
Calculated Vehicle Target Weight (TVTW)	kg	1346.7

TEST VEHICLE WEIGHTS

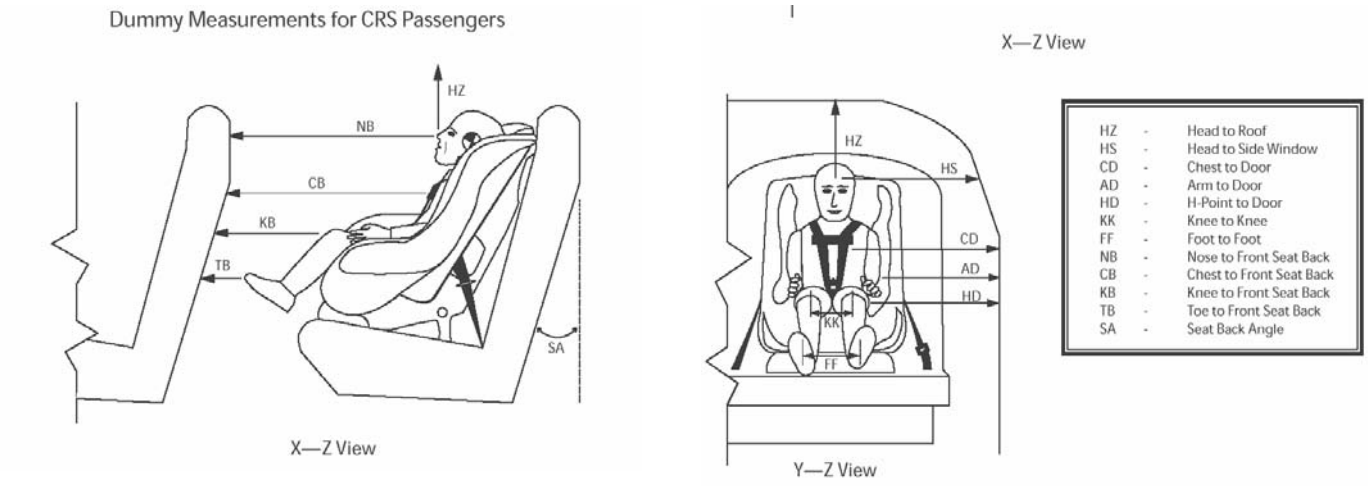
	Units	As Tested (ATW) (Axle)		
		Front	Rear	Total
Left	kg	425.5	250.8	
Right	kg	416.0	247.7	
Ratio	%	62.8	37.2	
Totals	kg	841.5	498.5	1340.0

As tested weight of vehicle includes two ATDs, two 3 year olds with CRS, cargo, equipment and instrumentation.

SECTION 2… (continued)

DATA SHEET NO. 3
CHILD DUMMY POSITIONING IN VEHICLE

Child Restraint System (Position 3)	Century 1500 STE
Child Restraint System (Position 4)	Century Accel Overhead
NHTSA No.	M30206



Measurement	Pre-Test (mm)		Post-Test (mm)	
	P3 CRS (42)	P4 CRS (40)	P3 CRS (42)	P4 CRS (40)
SA (deg)	24	27	24	26
HS	335	322	365	401
CD	277	265	304	310
AD	177	140	180	162
HD	226	185	147	212
HZ	305	291	247	241
NB	470	499	508	514
CB	468	500	490	504
KK	127	170	145	148
FF	127	220	146	150
KB - LEFT	250	285	268	307
KB – RIGHT	252	310	260	311
TB - LEFT	22	27	100	65
TB - RIGHT	24	41	108	65

All dimensions in mm (unless noted)
P3 – Right Rear Passenger
P4 – Left Rear Passenger

SECTION 2… (continued)

DATA SHEET NO. 4
CHILD DUMMY INJURY CRITERIA VALUES

Child Restraint System (Position 3)	Century 1500 STE
Child Restraint System (Position 4)	Century Accel Overhead
NHTSA No.	M30206

HEAD PEAK ACCELERATIONS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Head CG	X	G's	26.2	200	-37.8	85	62.2	200	-30.9	99
Head CG	Y	G's	14.3	107	-2.3	131	*	*	*	*
Head CG	Z	G's	59.4	82	-3.6	35	59.0	91	-7.2	33
Resultant	N/A	G's	68.7	82						
Rear	Z	G's	88.1	78	-10.7	57	74.0	84	-14.1	53

* No valid data collected

UPPER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Neck Force	X	N	8	188	-876	85	90	190	-671	83
Neck Force	Y	N	109	77	-67	133	76	119	-170	71
Neck Force	Z	N	2339	84	-79	34	2009	85	-232	35
Resultant	N/A	N	2483	84			2110	85		
Neck Moment	X	N•m	4.4	80	-6.1	136	1.7	184	-8.0	84
Neck Moment	Y	N•m	7.9	147	-16.7	86	4.3	134	-5.9	57
Neck Moment	Z	N•m	1.7	127	-1.8	151	1.4	150	-2.5	115
Resultant	N/A	N•m	16.8	86			8.2	84		

LOWER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Neck Force	X	N	227	200	-1651	84	316	195	-946	86
Neck Force	Y	N	14	41	-369	81	462	78	-237	94
Neck Force	Z	N	1038	79	-135	49	1277	91	-244	35
Resultant	N/A	N	1956	84			1597	90		
Neck Moment	X	N•m	17.6	79	-10.1	135	3.3	116	-33.8	89
Neck Moment	Y	N•m	139.7	84	-14.5	200	115.9	83	-15.1	192
Neck Moment	Z	N•m	13.3	79	-4.8	137	2.2	142	-15.4	88
Resultant	N/A	N•m	140.8	84			120.6	83		

SECTION 2… (continued)

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

Child Restraint System (Position 3)	Century 1500 STE
Child Restraint System (Position 4)	Century Accel Overhead
NHTSA No.	M30206

CHEST PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Chest CG	X	G's	3.4	183	-38.2	69	17.7	186	-37.5	79
Chest CG	Y	G's	5.5	87	-3.4	109	3.1	79	-6.9	98
Chest CG	Z	G's	17.7	83	-40.2	66	21.6	94	-25.8	70
Resultant	N/A	G's	55.1	66			39.5	76		

TETHER FORCE

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Tether Force	N/A	N	**	**	**	**	**	**	**	**

** Not recorded because the load cell would not fit between the tether anchor and the CRS

PELVIC PEAK ACCELERATIONS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Pelvis	X	G's	10.9	130	-38.5	64	13.4	169	-42.1	77
Pelvis	Y	G's	7.3	70	-7.9	83	8.3	68	-7.6	96
Pelvis	Z	G's	52.0	66.4	-6.1	197	10.4	96	-29.3	66
Resultant	N/A	G's	63.8	66			48.4	73		

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

Child Restraint System (Position 3)	Century 1500 STE
Child Restraint System (Position 4)	Century Accel Overhead
NHTSA No.	M30206

HEAD INJURY CRITERIA (HIC36)

Location	HIC	T^1 (msec)	T^2 (msec)	Average Acceleration (G's)
Position 3 - Right	792.4	63.4	98.4	55.2
Position 4 – Left				

HIC36 is as defined in FMVSS 208. The maximum time interval from t1 to t2 is 36 milliseconds.

HEAD INJURY CRITERIA (HIC15)

Location	HIC	T^1 (msec)	T^2 (msec)	Average Acceleration (G's)
Position 3 - Right	505.2	72.0	87.0	64.7
Position 4 – Left				

HIC15 is as defined in FMVSS 208. The maximum time interval from t1 to t2 is 15 milliseconds.

CLIP SUMMARY

Location	CLIP	T^1 (msec)	T^2 (msec)
Position 3 - Right	54.4	65.4	68.4
Position 4 – Left	38.5	74.5	77.5

The maximum chest resultant acceleration is defined as the maximum acceleration which exceeds 0.003 seconds in duration.

POSITION 3 NECK INJURY SUMMARIES

Nij V10	Nij
Ntf	0.15
Nte	1.5
Ncf	0.01
Nce	0.16

POSITION 4 NECK INJURY SUMMARIES

Nij V10	Nij
Ntf	0.8
Nte	0.92
Ncf	0.09
Nce	0.18

SECTION 2… (continued)

DATA SHEET NO. 5
CRS PERFORMANCE DATA

Child Restraint System (Position 3)	Century 1500 STE
Child Restraint System (Position 4)	Century Accel Overhead
NHTSA No.	M30206

POSITION 3 CRS POST-TEST INSPECTION

Location	Damage	Remarks
Upper Tether Strap	Yes	Upper strap anchor and rod inside the child seat bent.
Upper Tether Buckle	None	
Upper Tether Hook	None	
Vehicle Upper Tether Anchor	None	
Lower Anchor Strap	None	
Lower Anchor Buckle	None	
Lower Anchor Hooks	None	
Vehicle Lower CRS Anchors	None	
Five Point Harness Connections	None	
Cracks on CRS	None	
Fabric Tears on CRS	None	
Vehicle Seat Structure	None	
Vehicle Seat Fabric Tears	None	
Child Dummy	None	

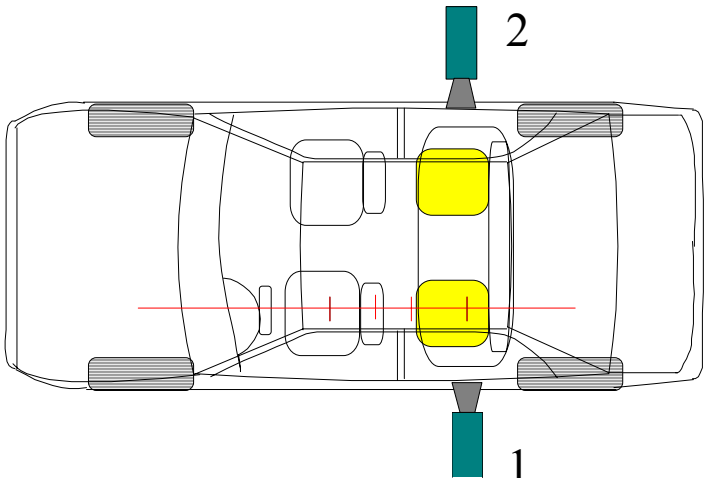
POSITION 4 CRS POST-TEST INSPECTION

Location	Damage	Remarks
Upper Tether Strap	Yes	Small crack in plastic. Plastic turns white showing stress.
Upper Tether Buckle	None	
Upper Tether Hook	None	
Vehicle Upper Tether Anchor	None	
Lower Anchor Strap	Yes	Lower straps cracked plastic and dug into plastic, pinching the strap. Cracks on left and right side 40mm long. Some stress marks where LATCH strap was routed through the CRS.
Lower Anchor Buckle	None	
Lower Anchor Hooks	None	
Vehicle Lower CRS Anchors	None	
Five Point Harness Connections	None	
Cracks on CRS	Yes	
Fabric Tears on CRS	None	
Vehicle Seat Structure	None	
Vehicle Seat Fabric Tears	None	
Child Dummy	None	

SECTION 2… (continued)

DATA SHEET NO. 6
CRS CAMERA DATA

Child Restraint System (Position 3)	Century 1500 STE
Child Restraint System (Position 4)	Century Accel Overhead
NHTSA No.	M30206



No.	Camera View	Location (mm) *			Angle (deg)	Lens (mm)	Speed (fps)
		X	Y	Z			
1	Left Side CRS Lateral View	2520	-7950	1620	90	50	Did not run
2	Right Side CRS Lateral View	2950	7200	1670	90	50	1020

*COORDINATES:

+X = film plane rearward of barrier

+Y = film plane to right of monorail centerline

+Z = film plane above ground level

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

A-1.

Close-up View of Position 3 CRS Label

Pre-Test Frontal View of Position 3 CRS

Post-Test Front View of Position 3 CRS

Pre-Test Rear View of Position 3 CRS

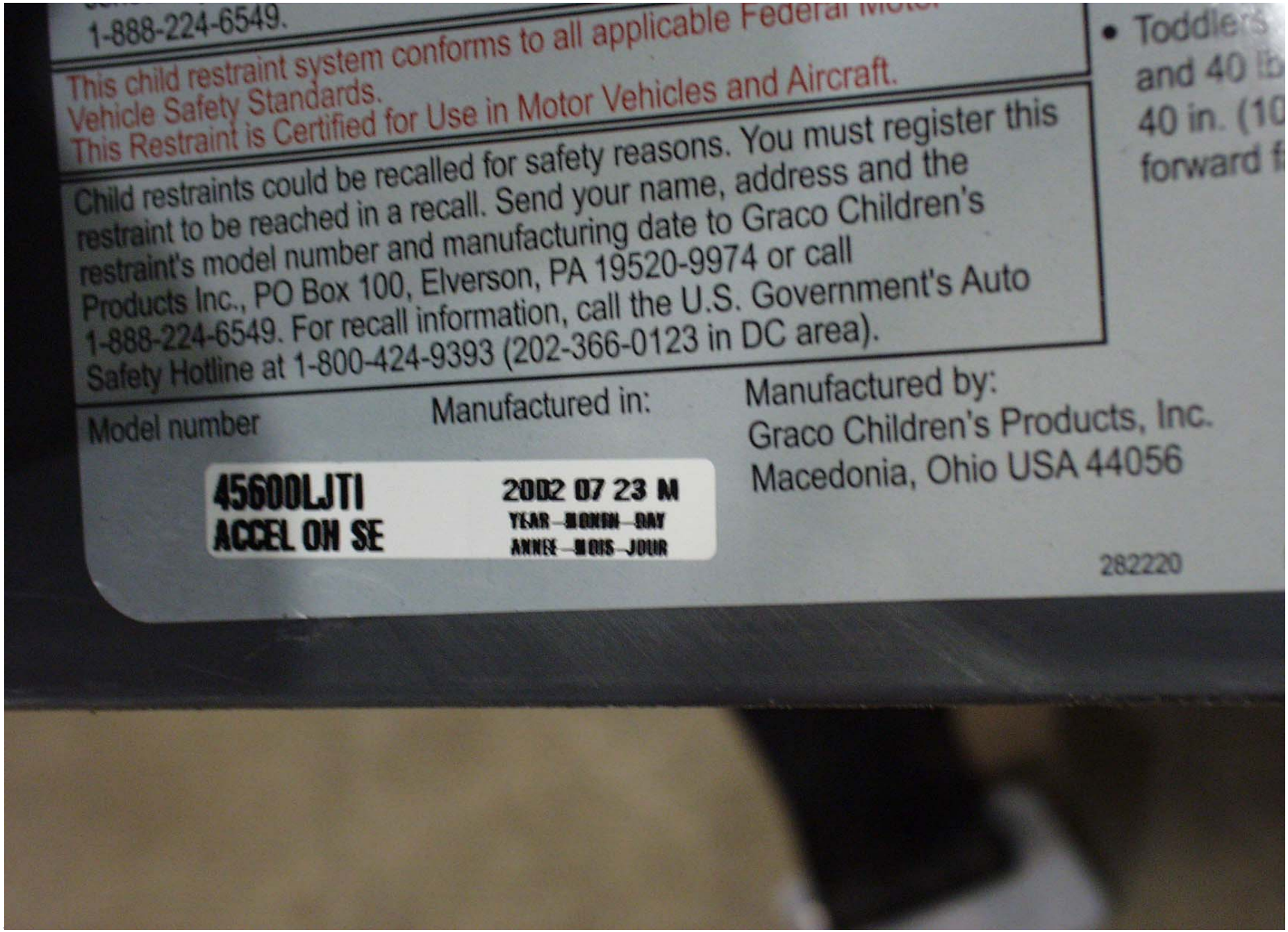
Post-Test Rear View of Position 3 CRS

Pre-Test Left Side View of Position 3 CRS

Post-Test Left Side View of Position 3 CRS

Pre-Test Right Side View of Position 3 CRS

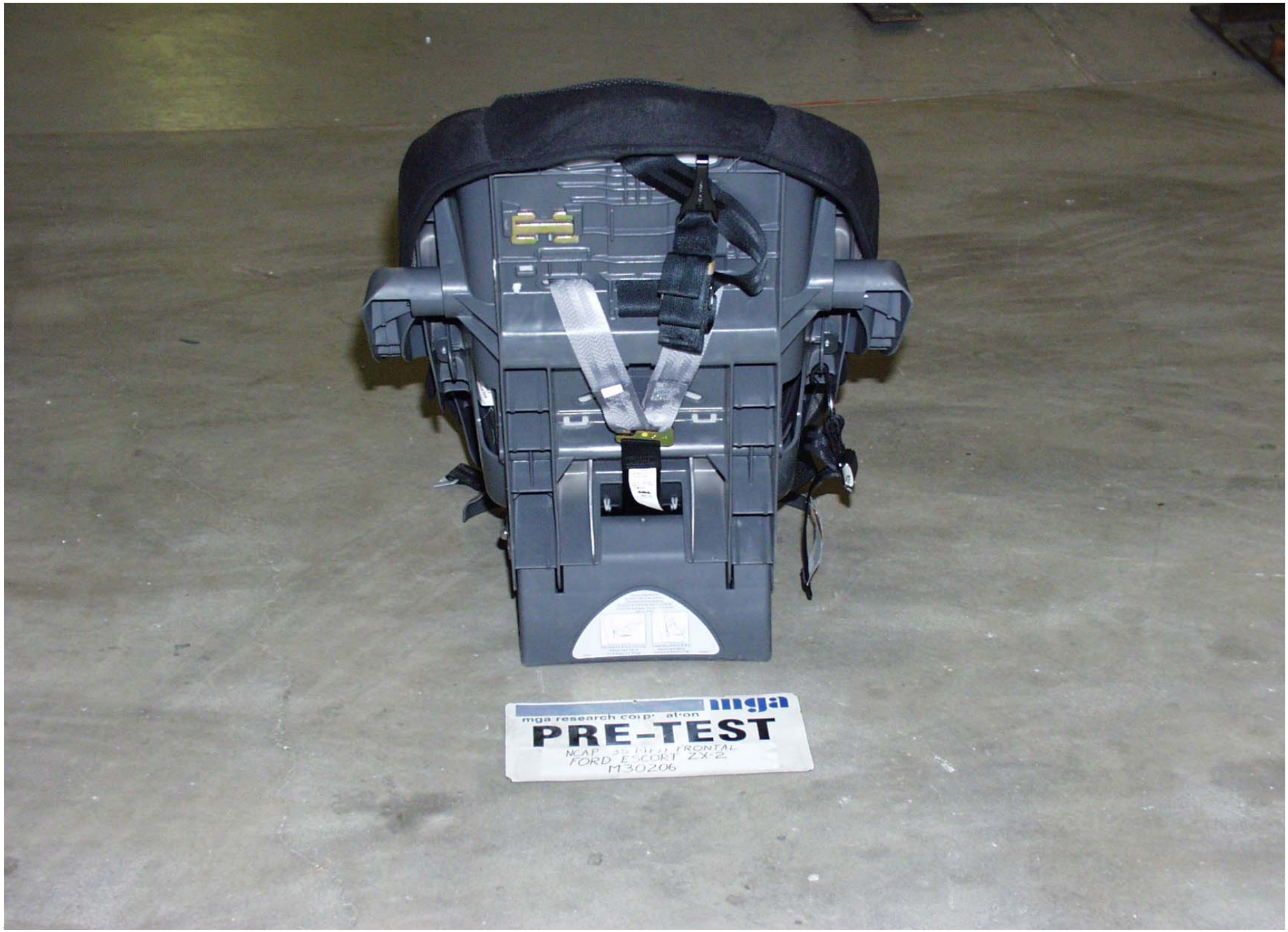
Post-Test Right Side View of Position 3 CRS



Close-up View of Position 4 CRS Label

Pre-Test Frontal View of Position 4 CRS

Post-Test Front View of Position 4 CRS



Pre-Test Rear View of Position 4 CRS

Post-Test Rear View of Position 4 CRS

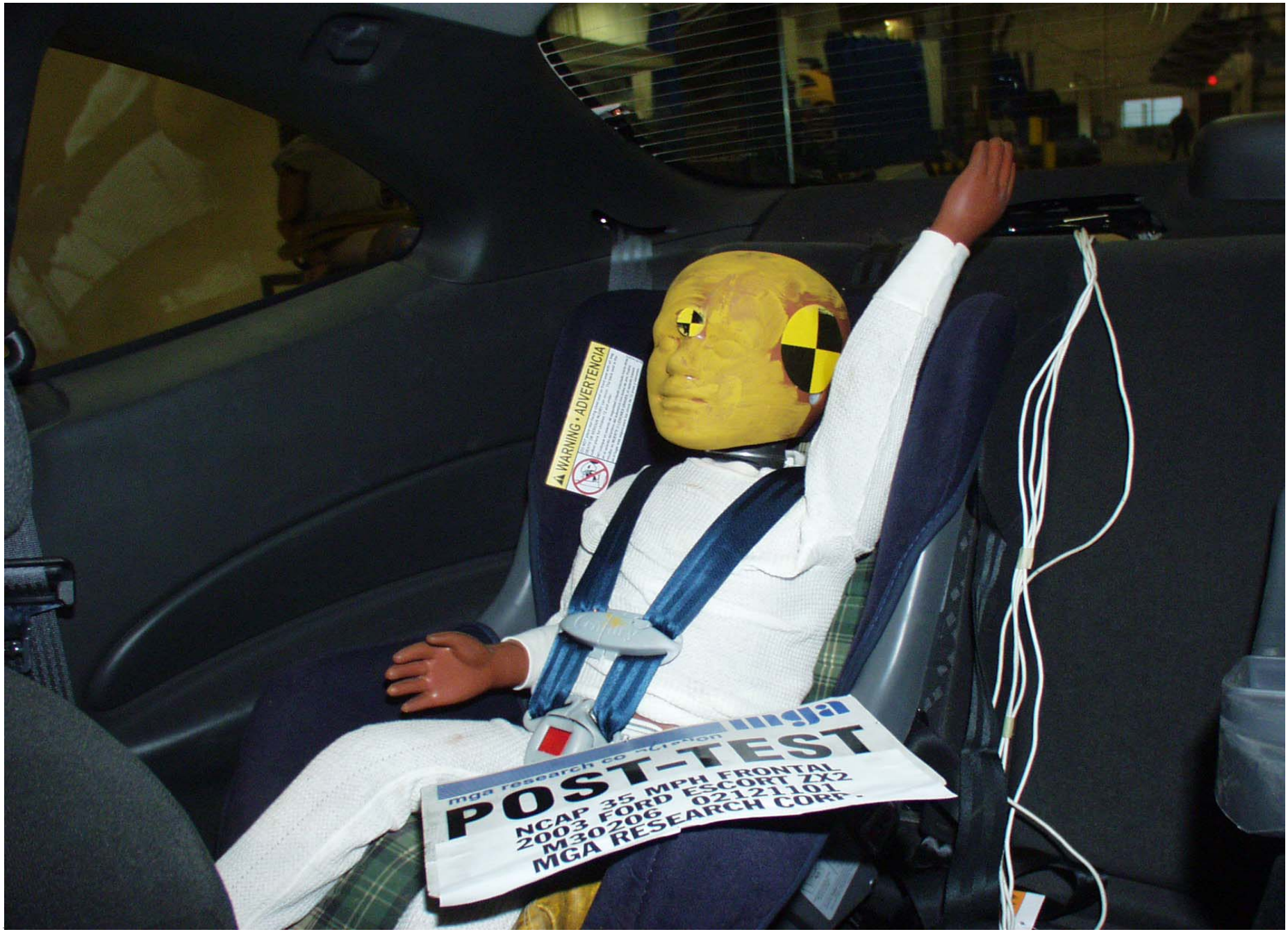
Pre-Test Left Side View of Position 4 CRS

Post-Test Left Side View of Position 4 CRS

Pre-Test Right Side View of Position 4 CRS

Post-Test Right Side View of Position 4 CRS

Pre-Test Position 3 Left Side View



Post-Test Position 3 Left Side View

Pre-Test Position 4 Left Side View

Post-Test Position 4 Left Side View

Pre-Test Position 3 Right Side View

Post-Test Position 3 Right Side View

Pre-Test Position 4 Right Side View

Post-Test Position 4 Right Side View

Pre-Test Position 3 Rear View

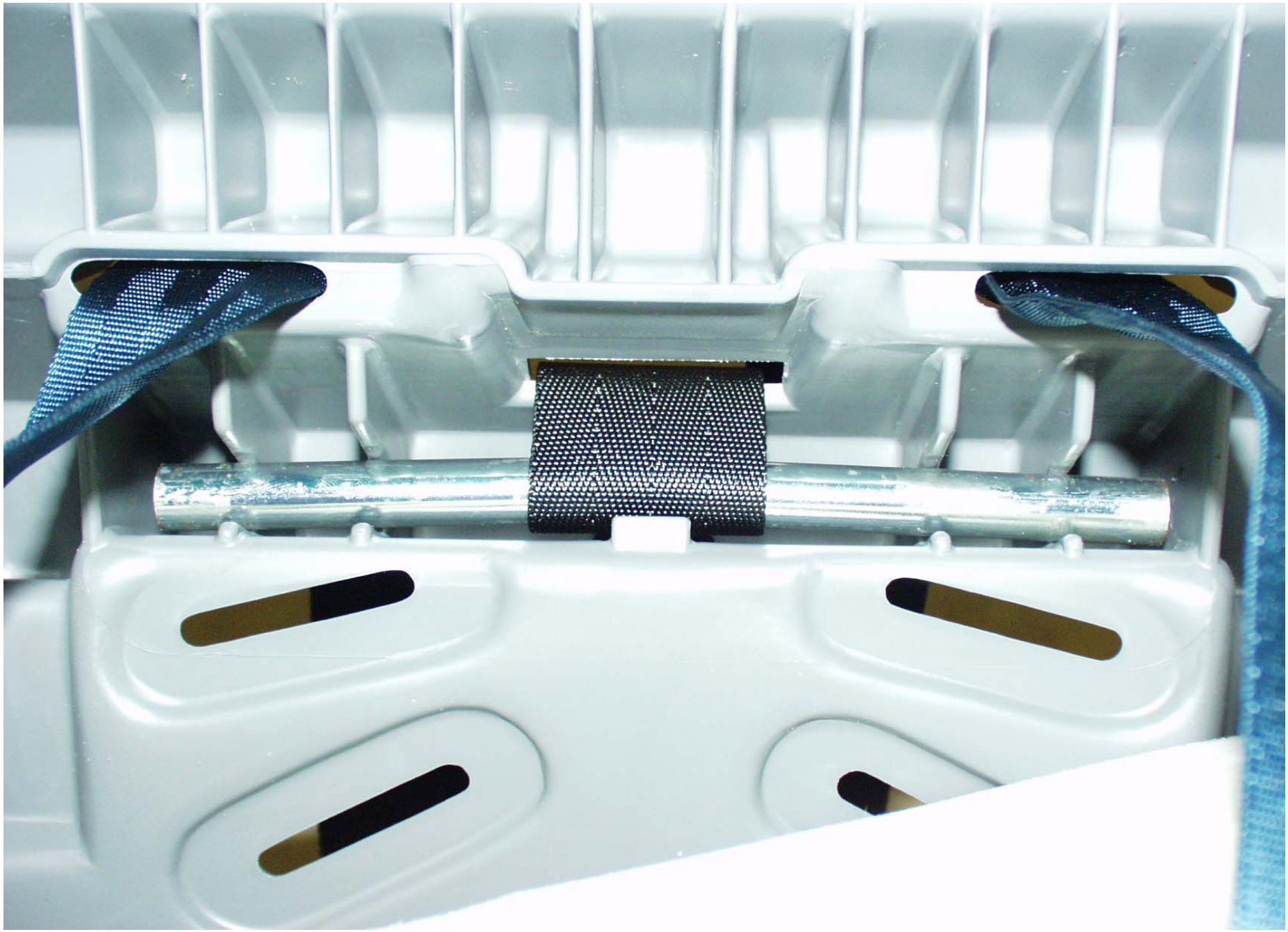
Post-Test Position 3 Rear View

Pre-Test Position 4 Rear View

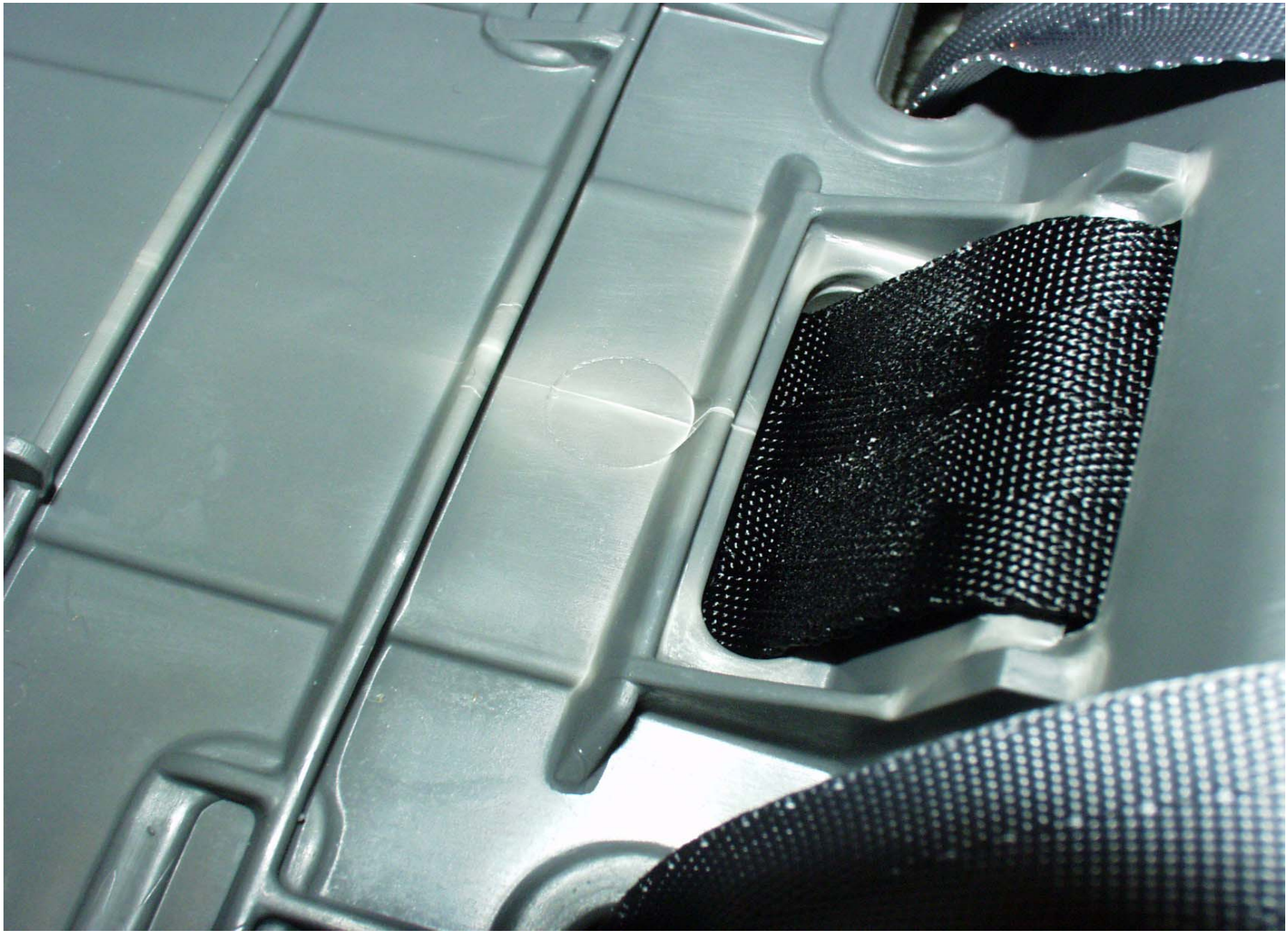
Post-Test Position 4 Rear View

Post-Test Position 3 Feet Contact

Post-Test Position 4 Head and Feet Contact



Post-Test Position 3 Tether Strap Bar



Post-Test Position 4 Upper Tether Strap Area

Post-Test Position 4 Left Lower Anchor Strap

Post-Test Position 4 Left Lower Anchor Strap

Post-Test Position 4 Right Lower Anchor Strap

Post-Test Position 4 Right Lower Anchor Strap

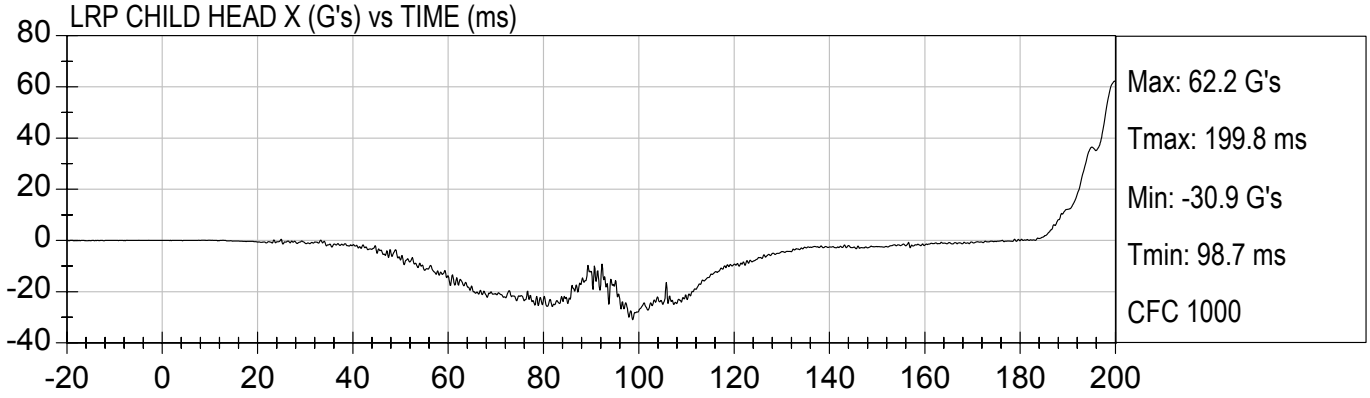
APPENDIX B

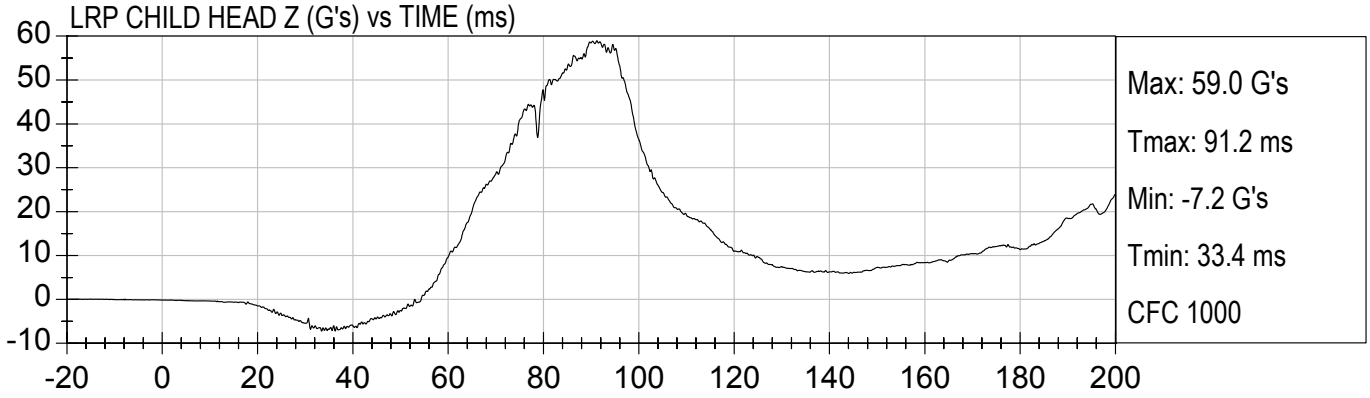
CHILD DUMMY RESPONSE DATA TRACES

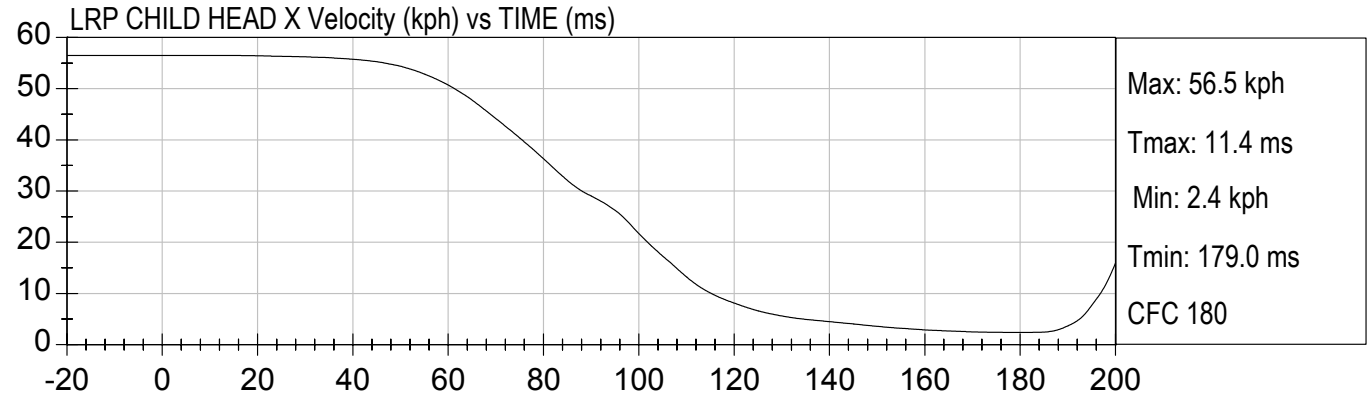
TABLE OF DATA PLOTS

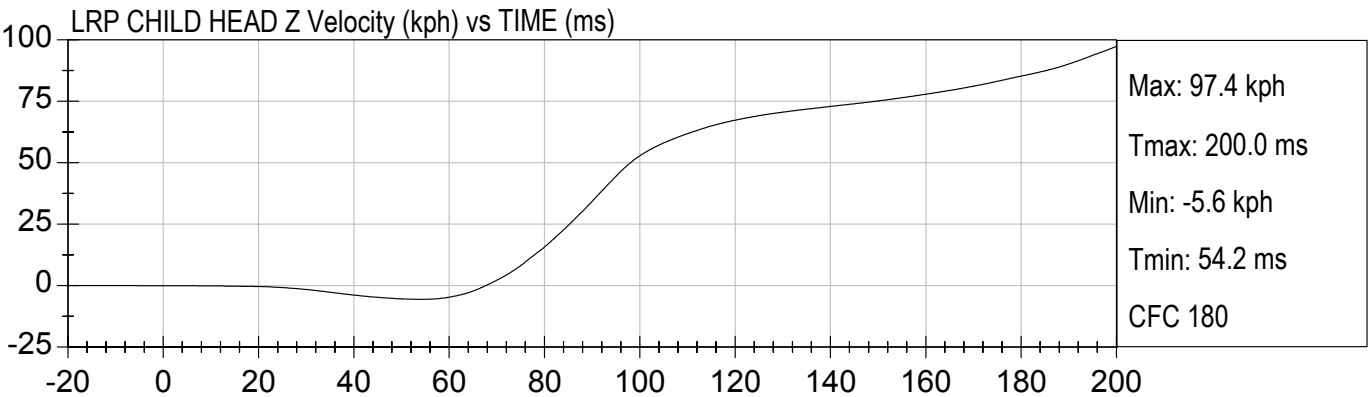
35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)









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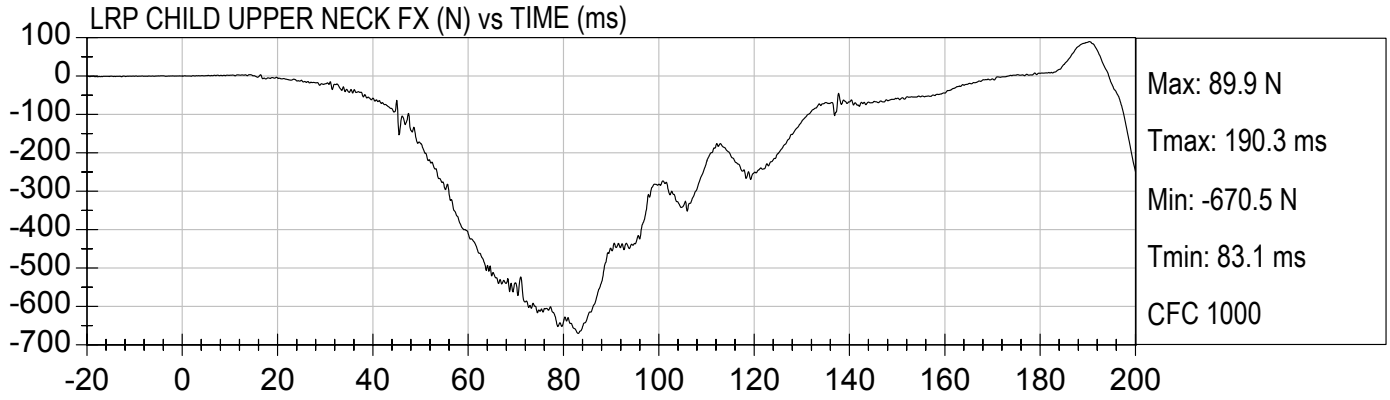

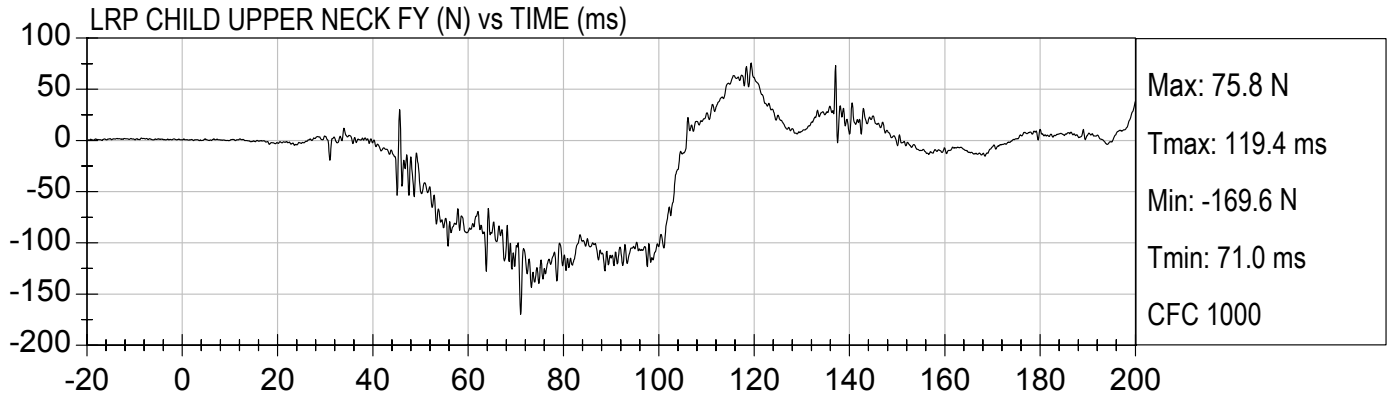

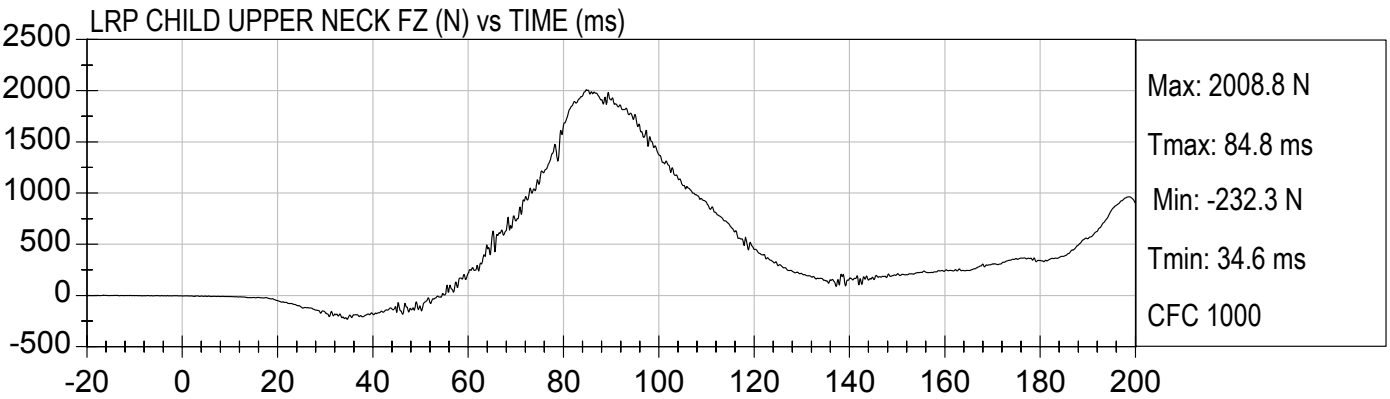

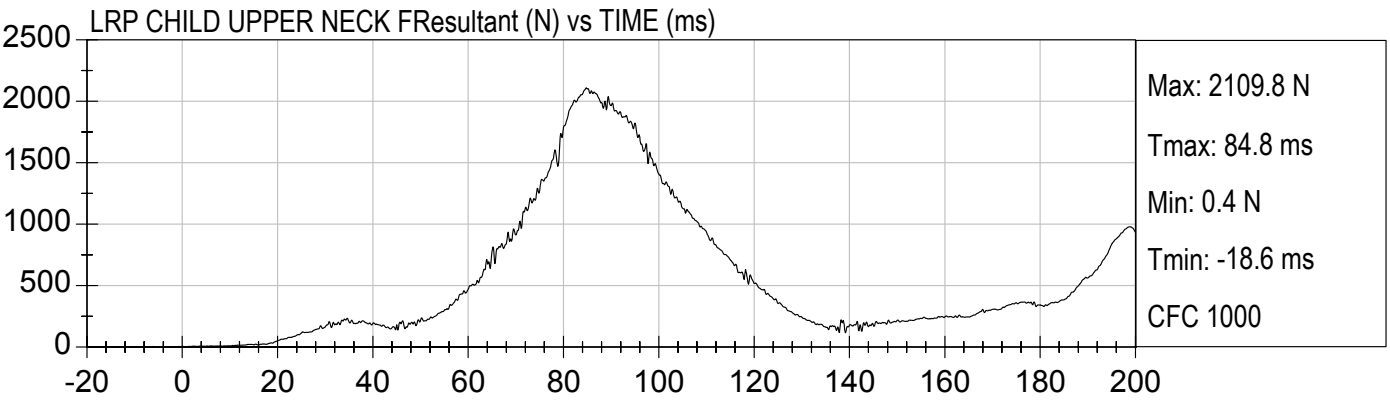

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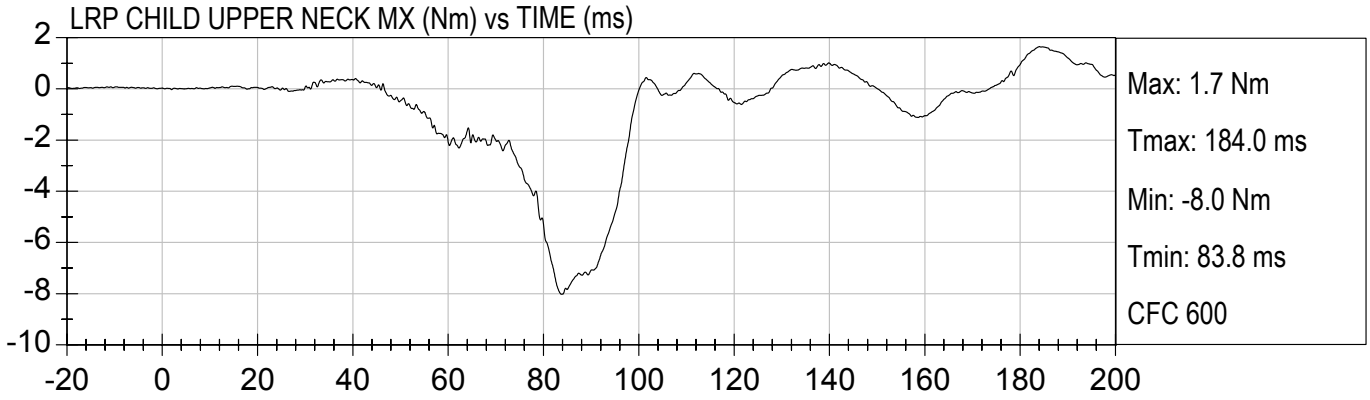

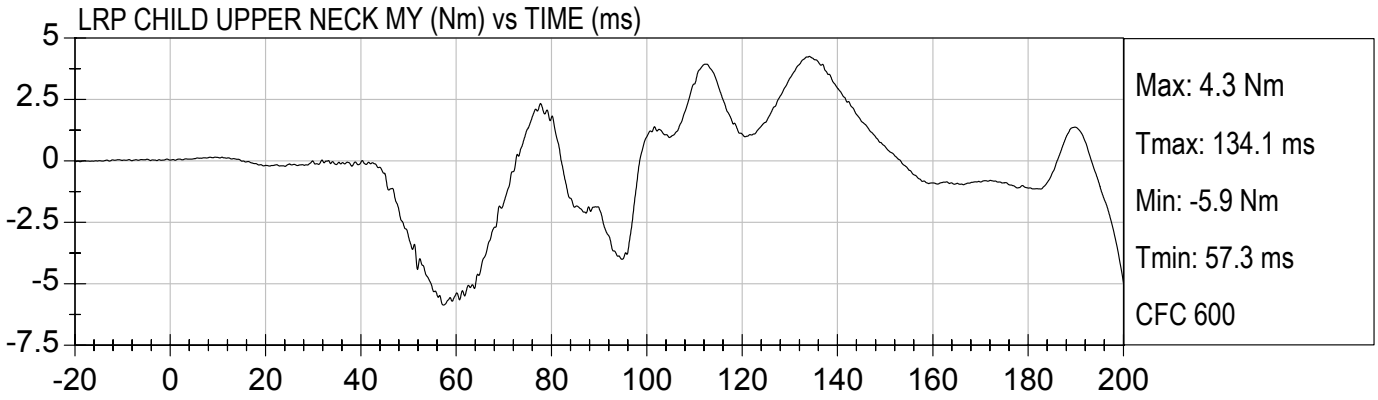

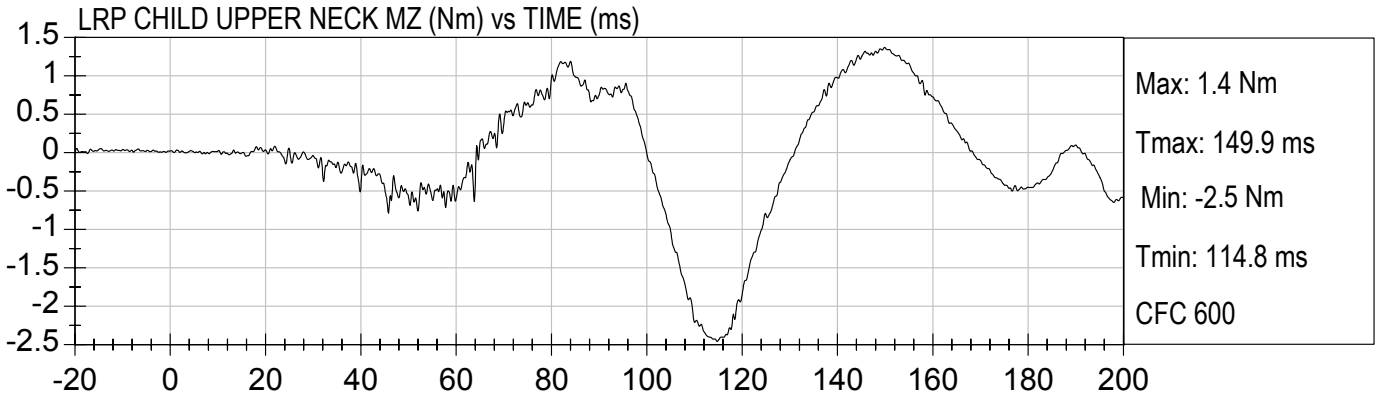

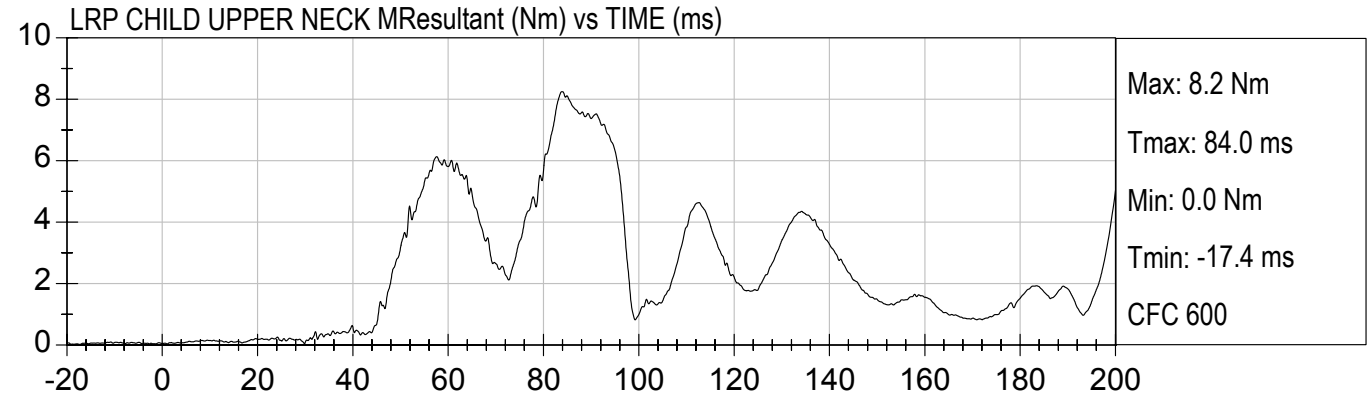

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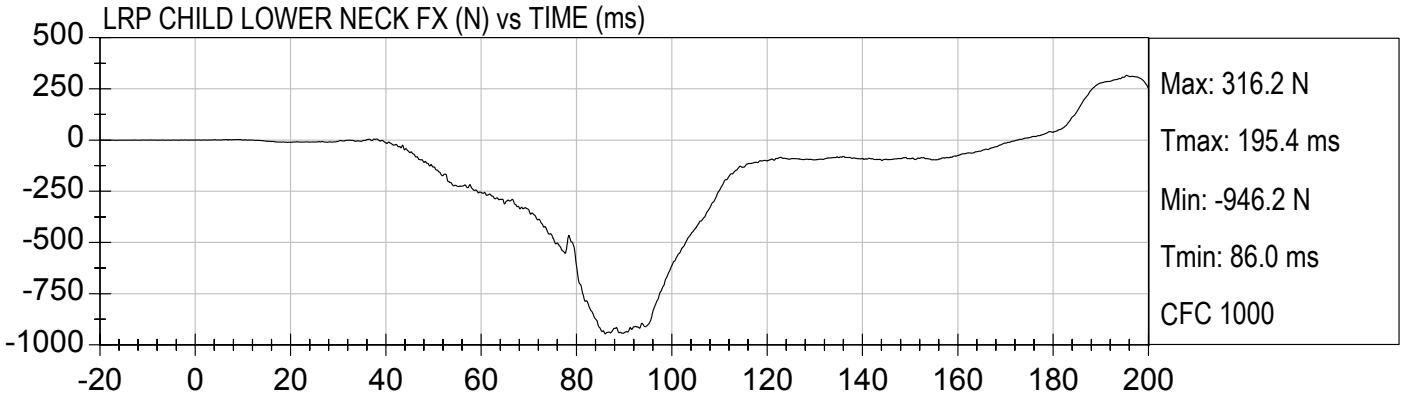
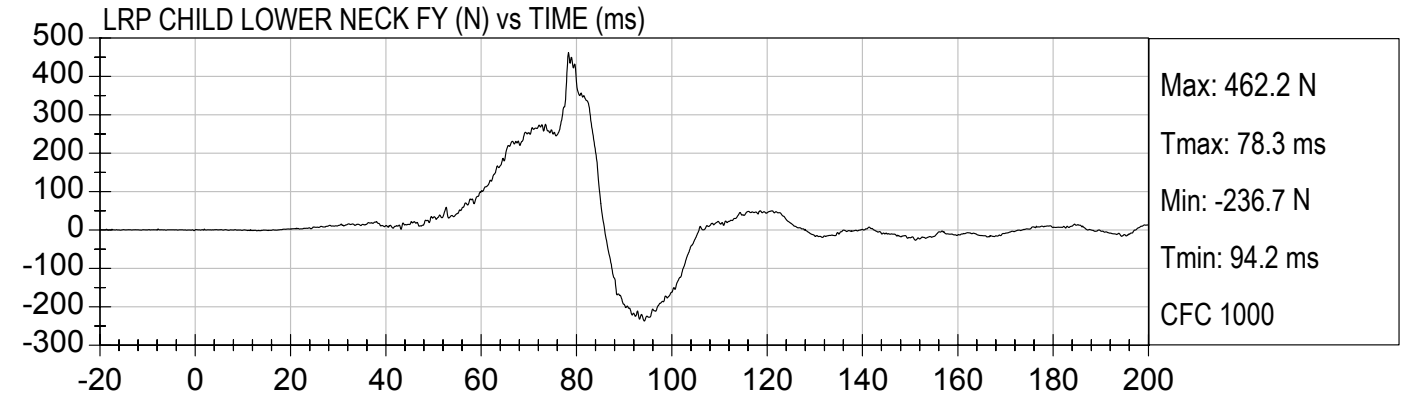
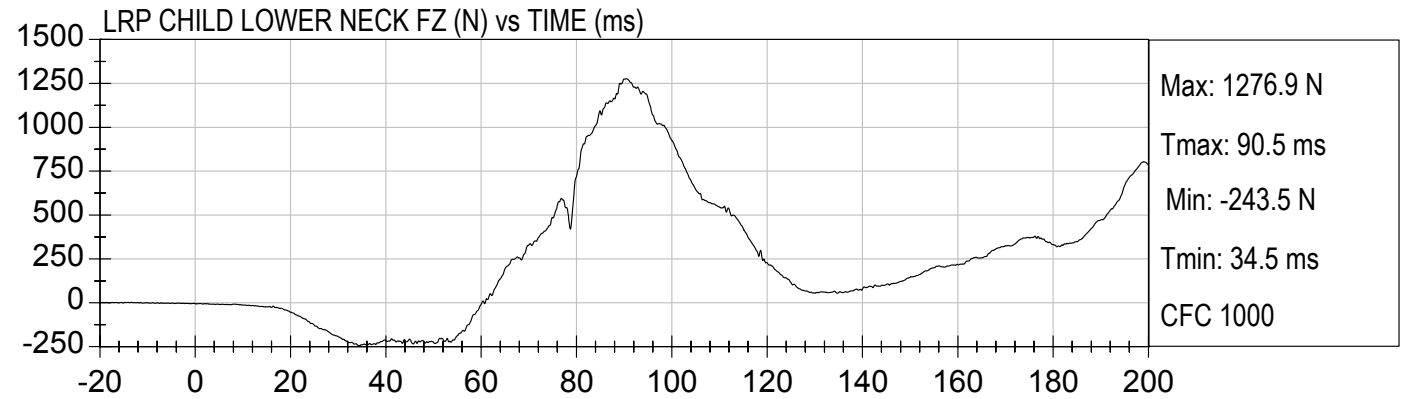
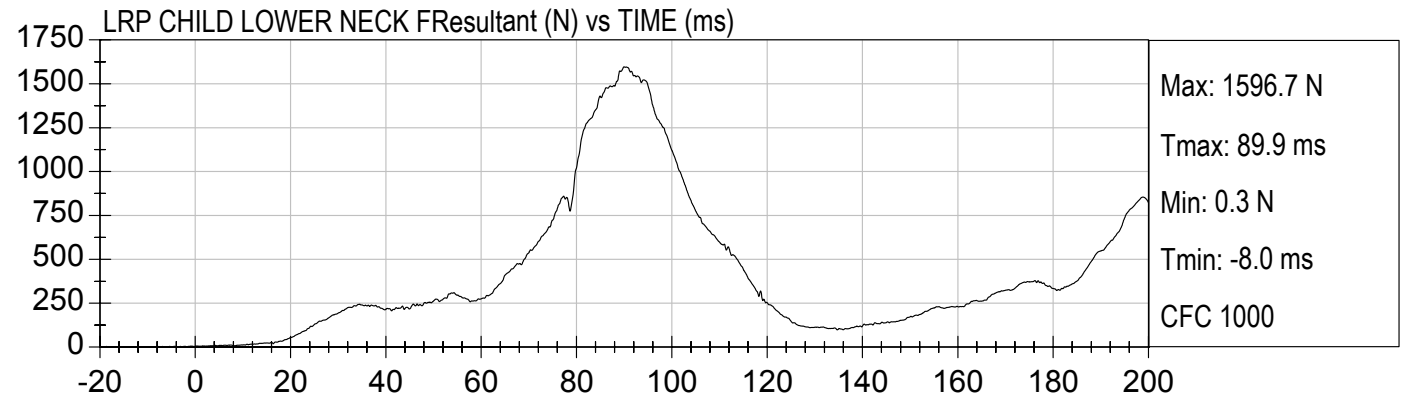


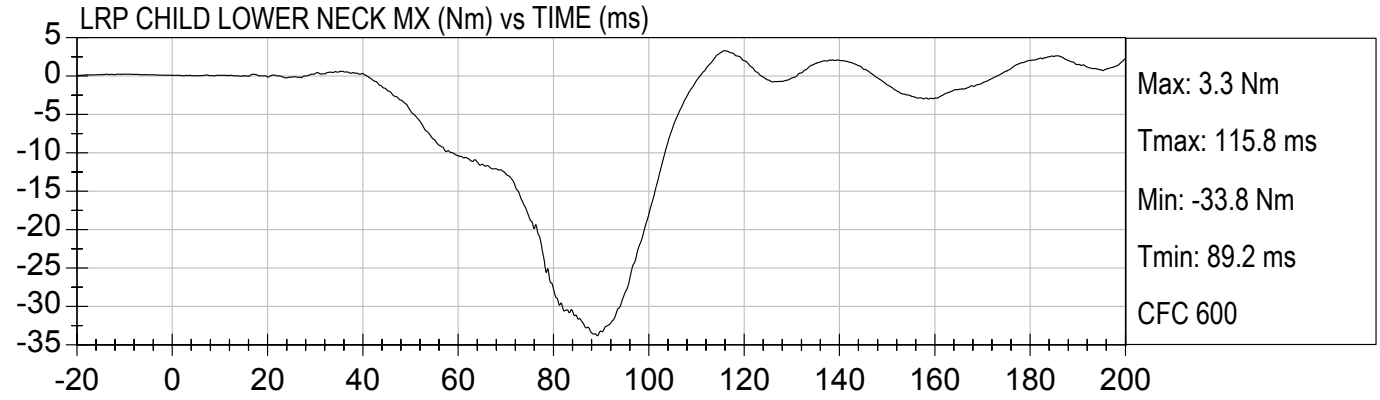


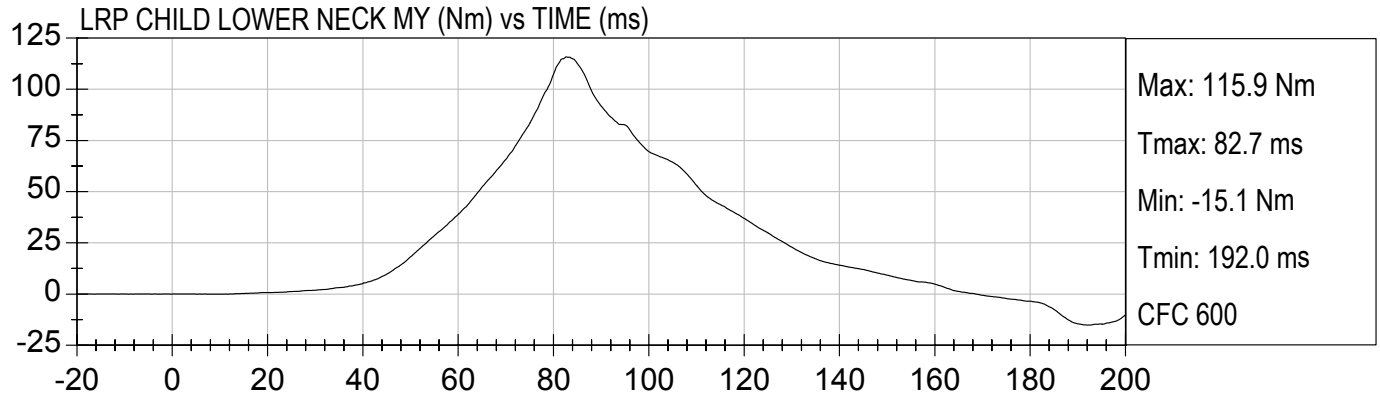


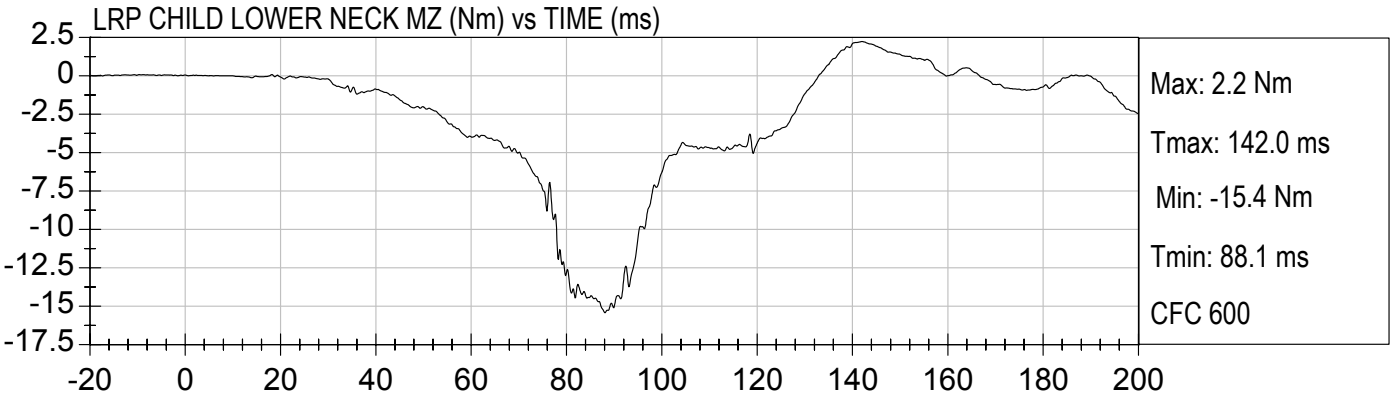


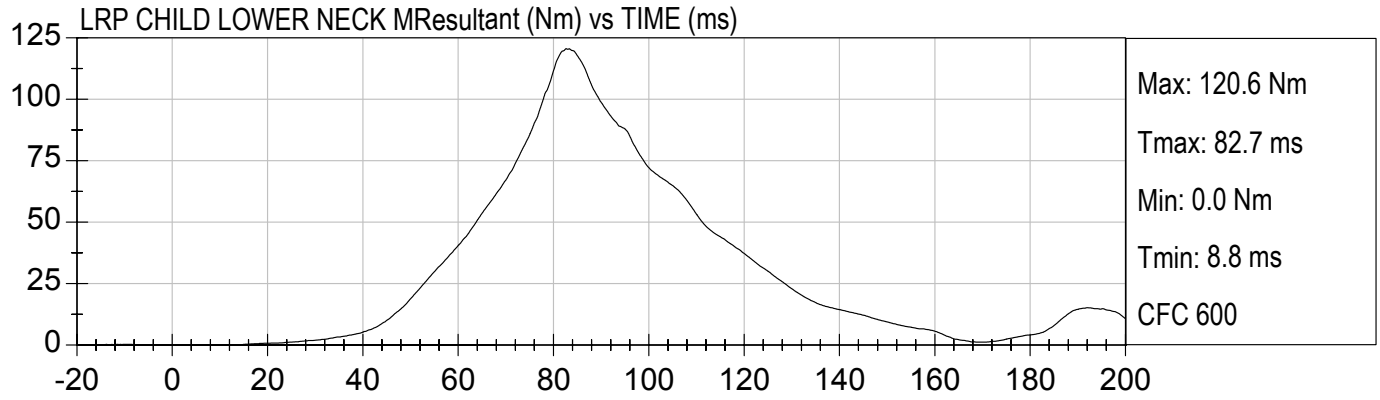
35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)



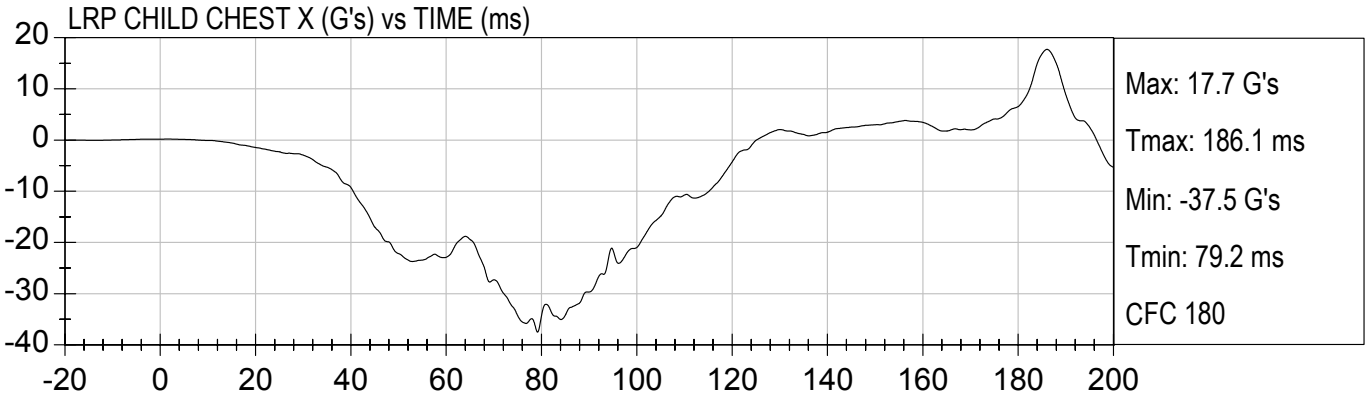


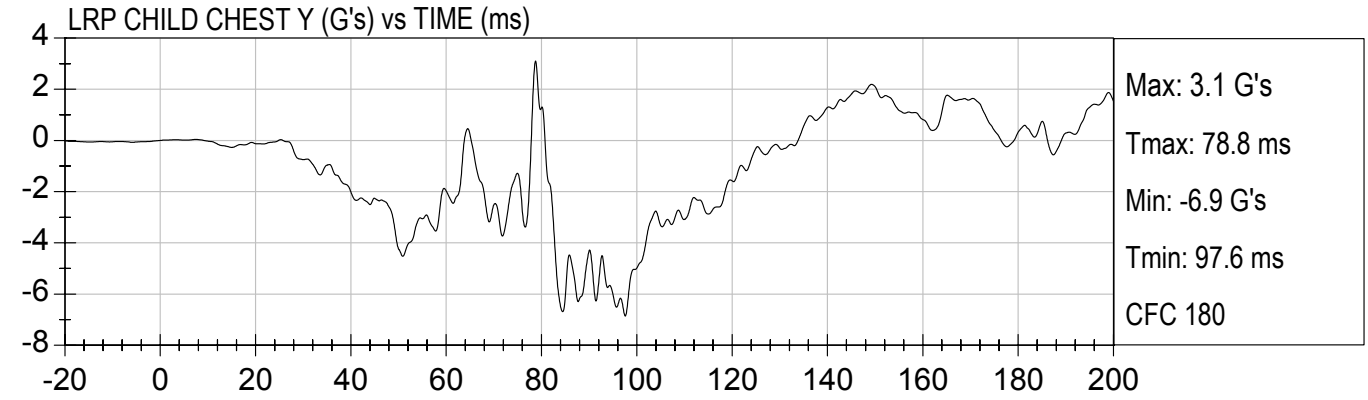


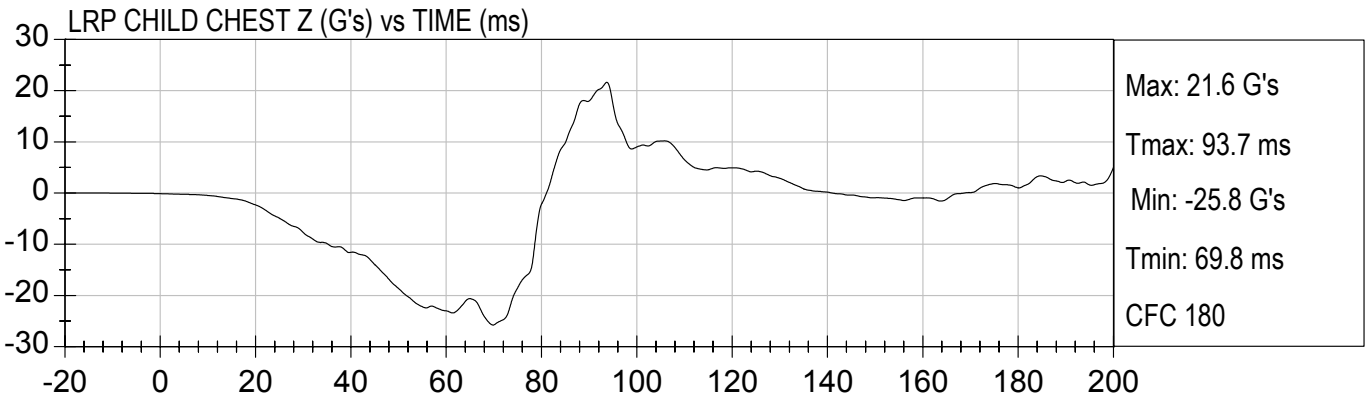


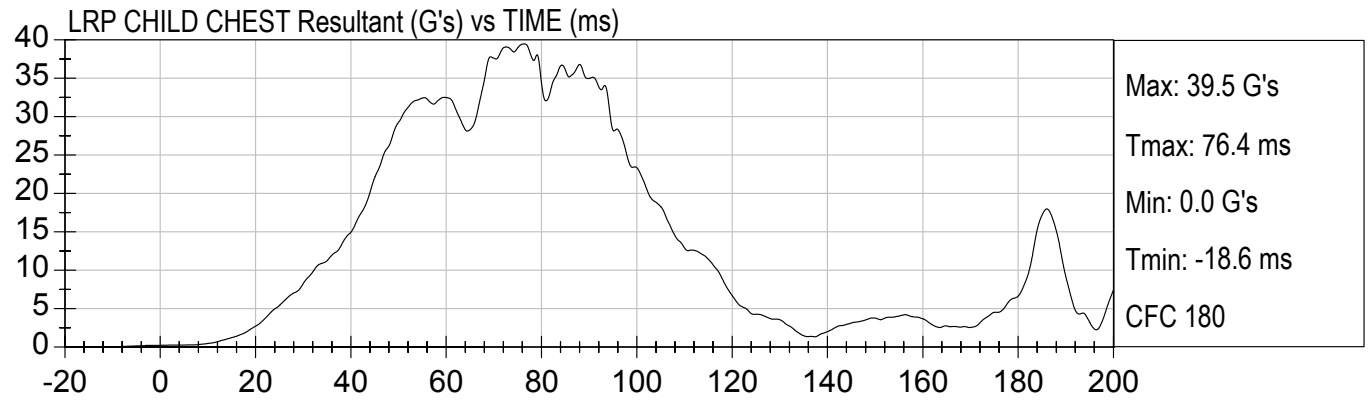
35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)



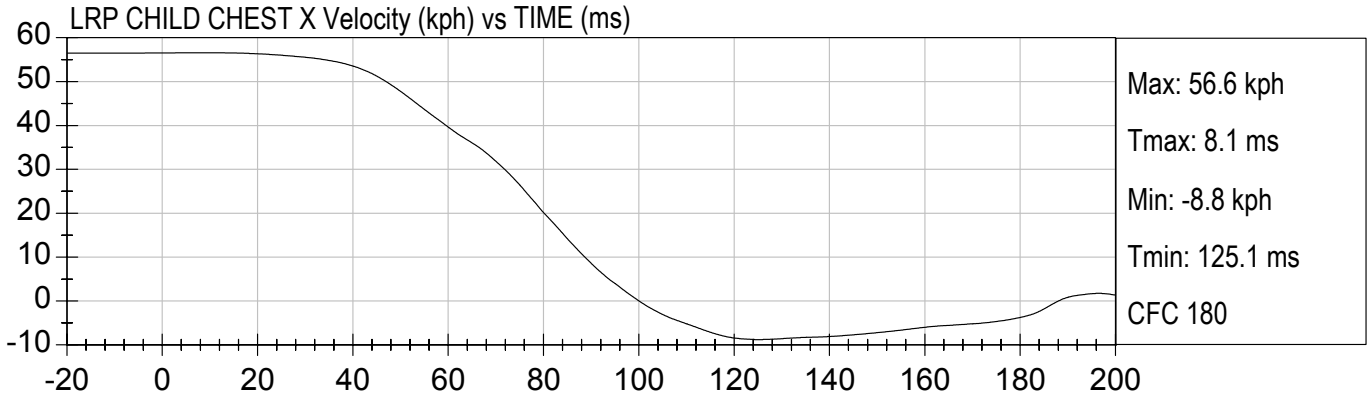


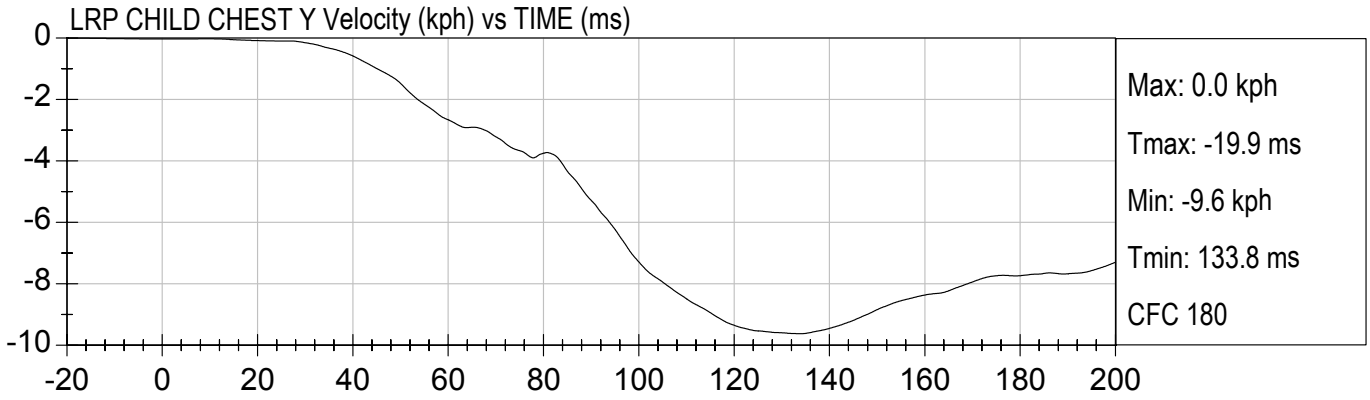


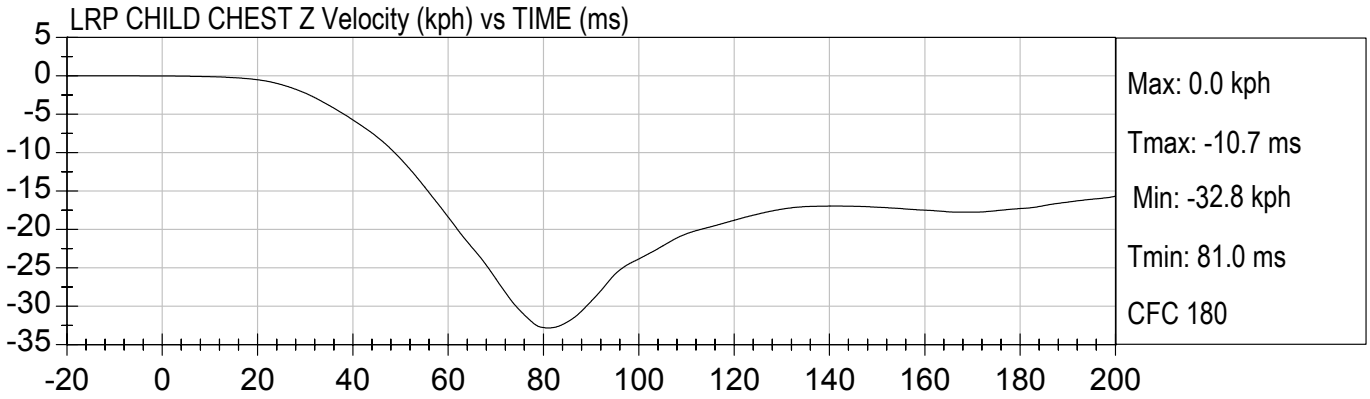


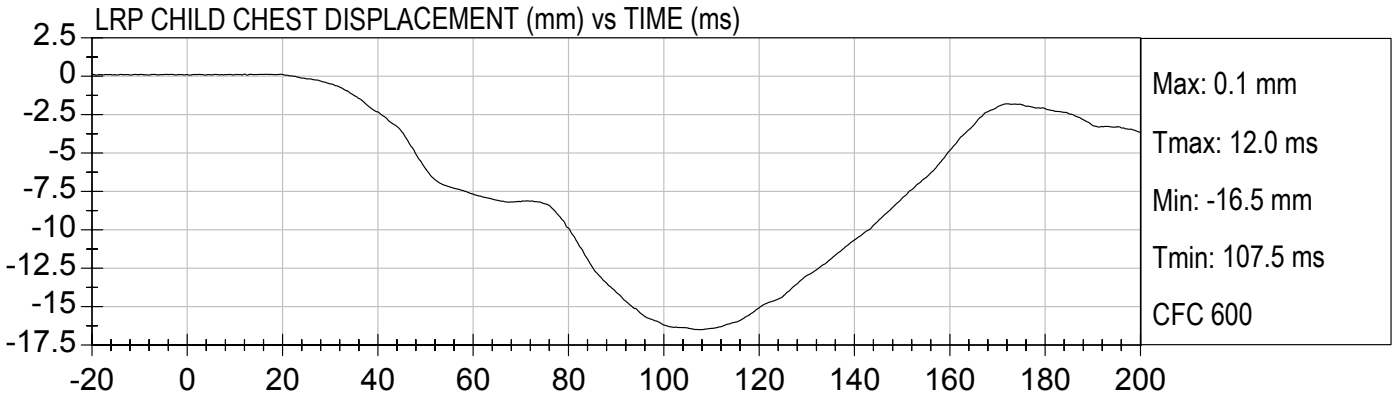
35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)



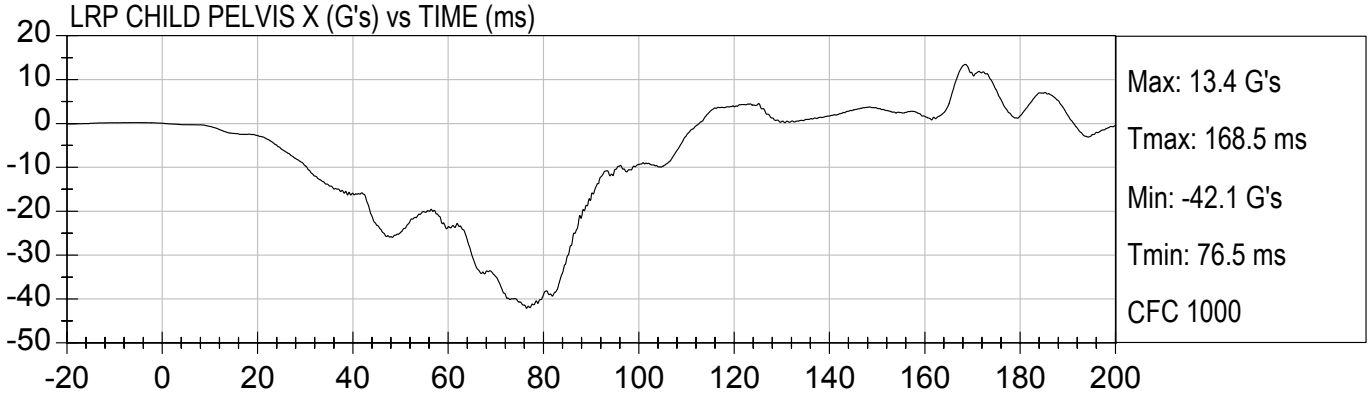


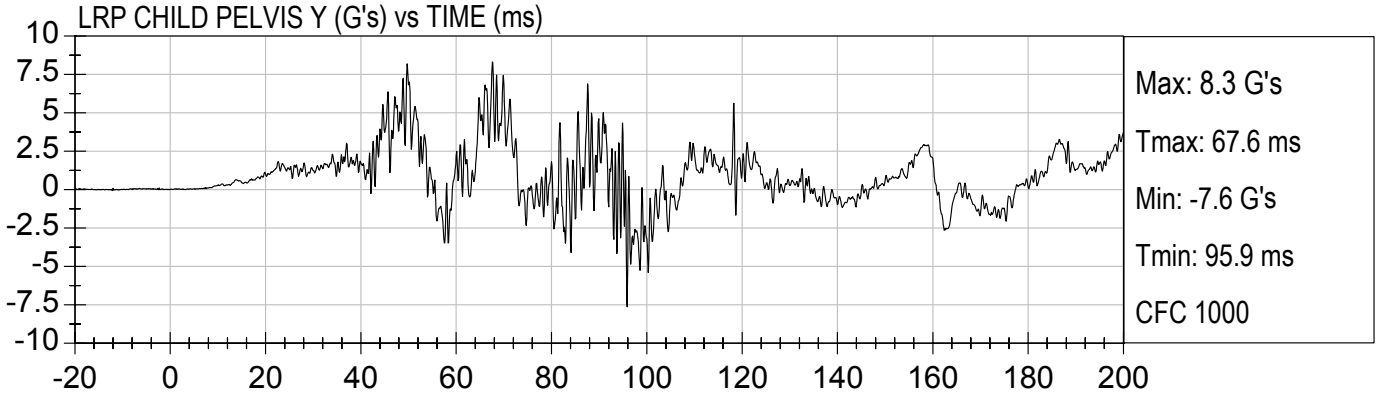


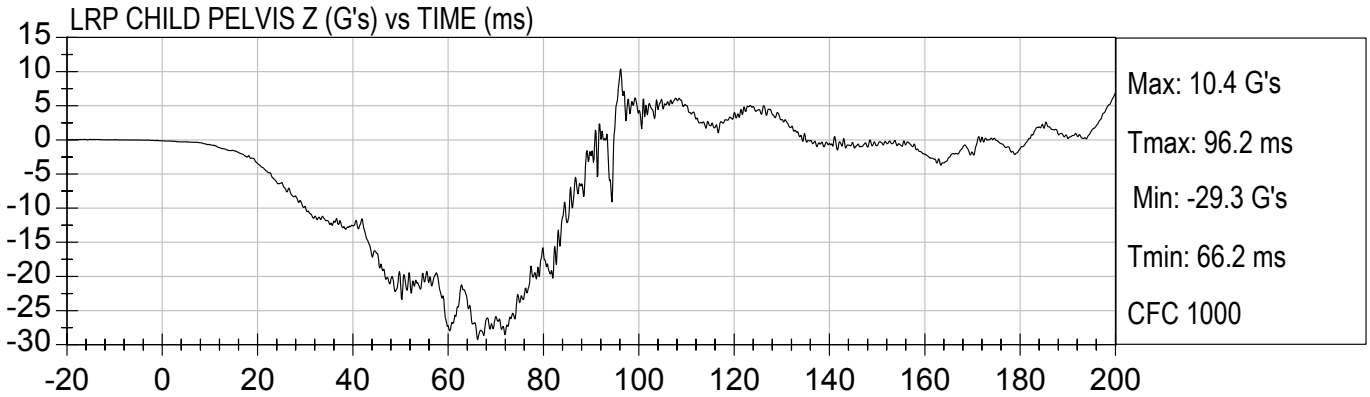


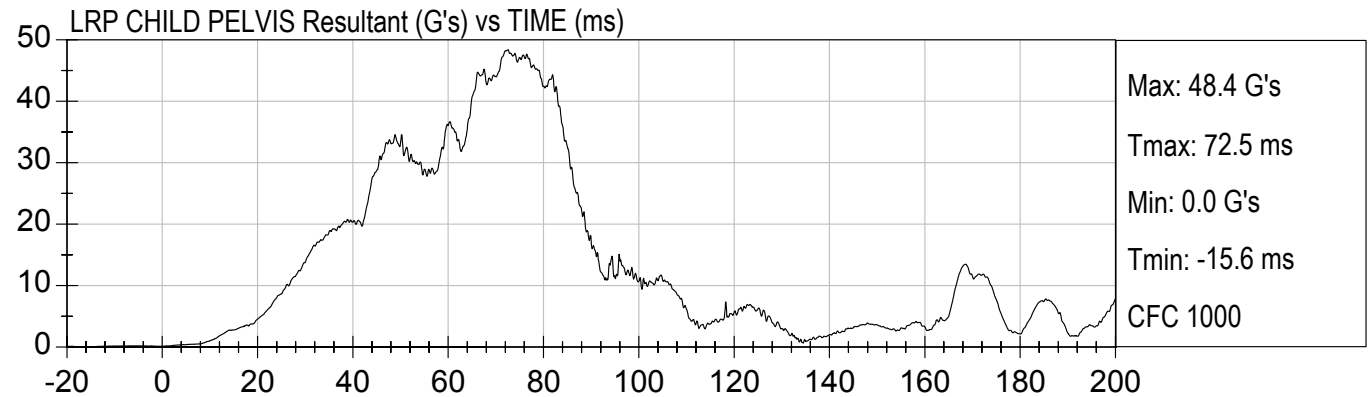
35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)



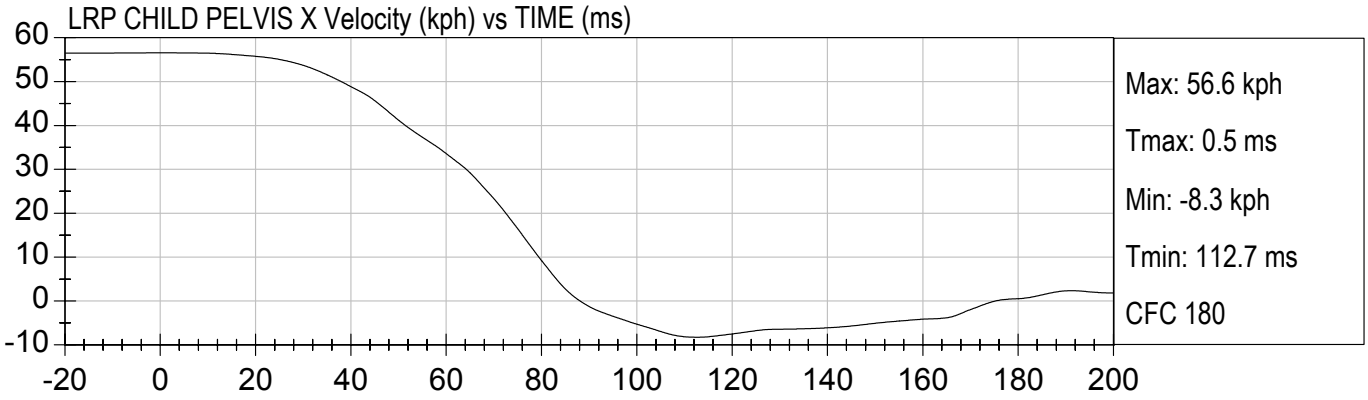


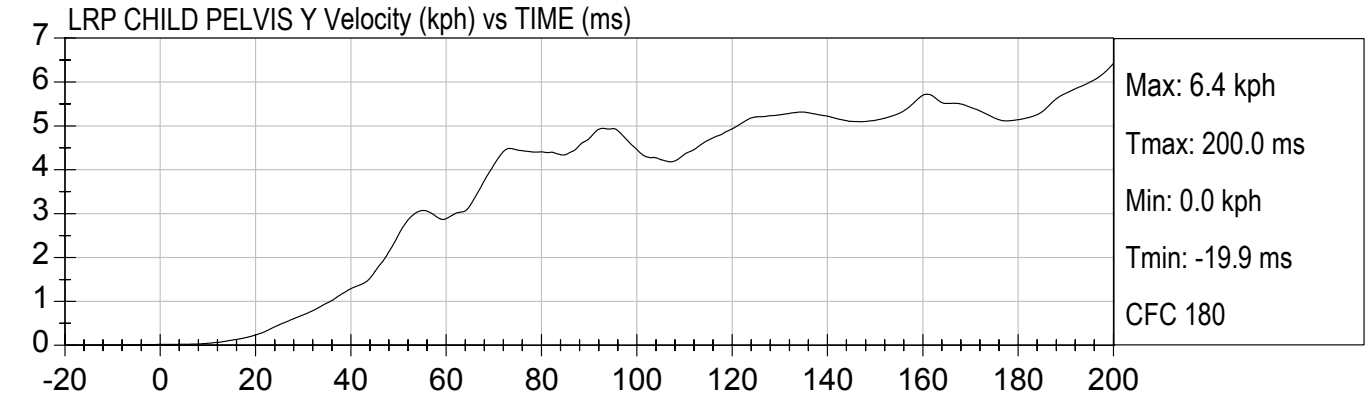


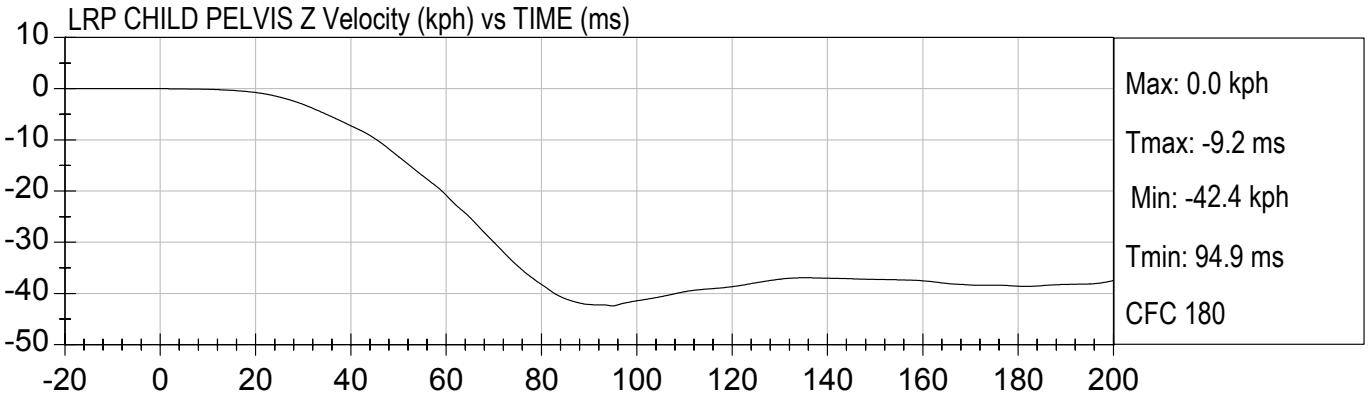


35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)

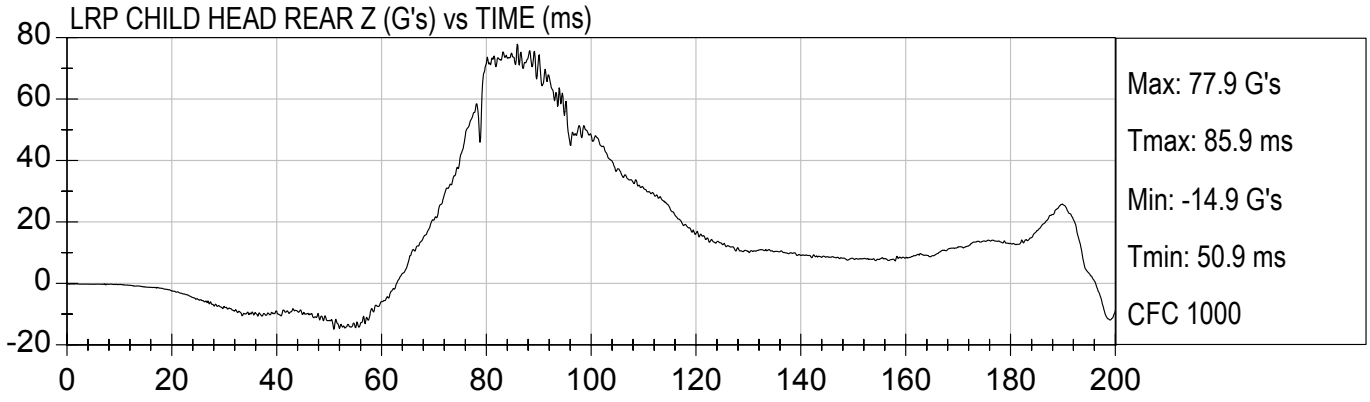


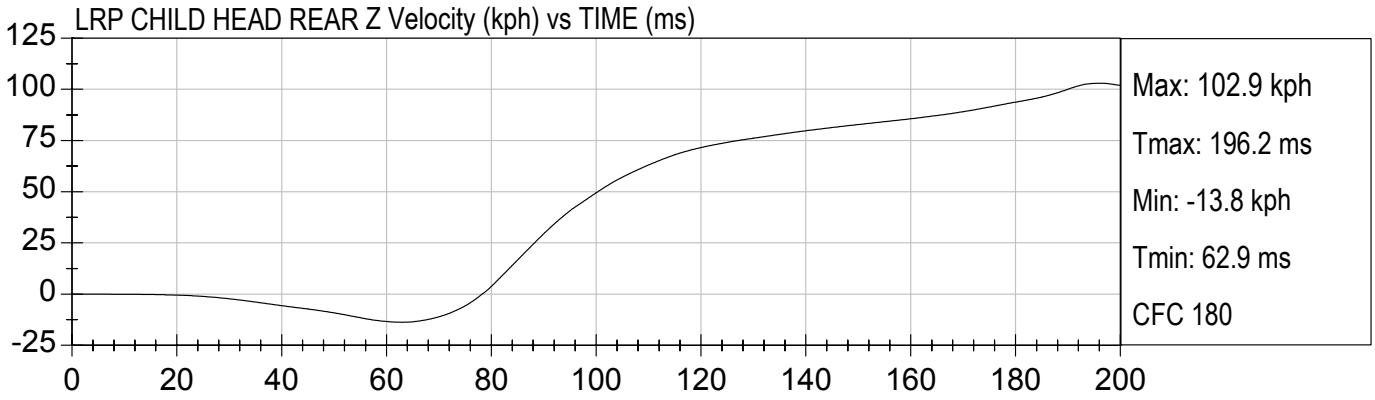




35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

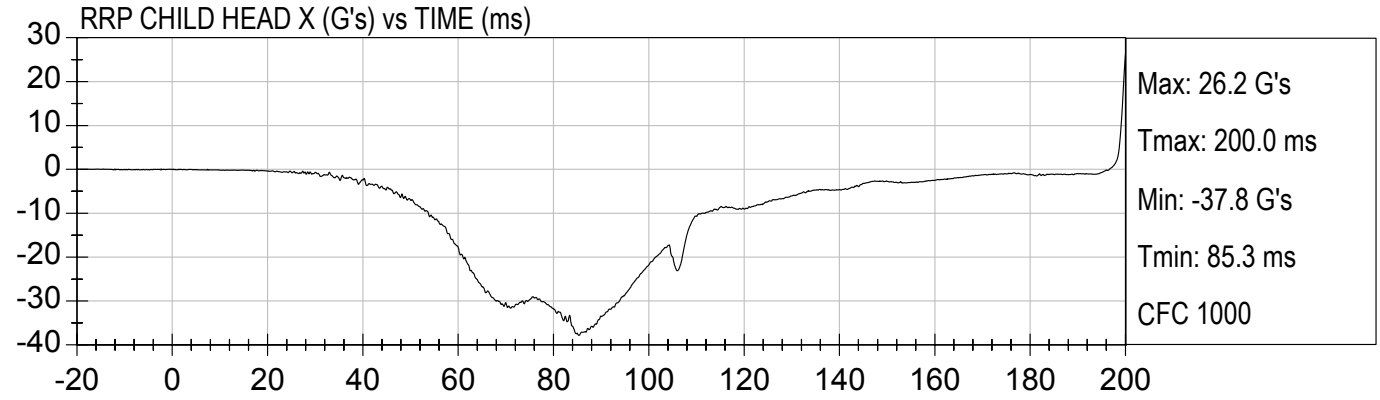
Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)

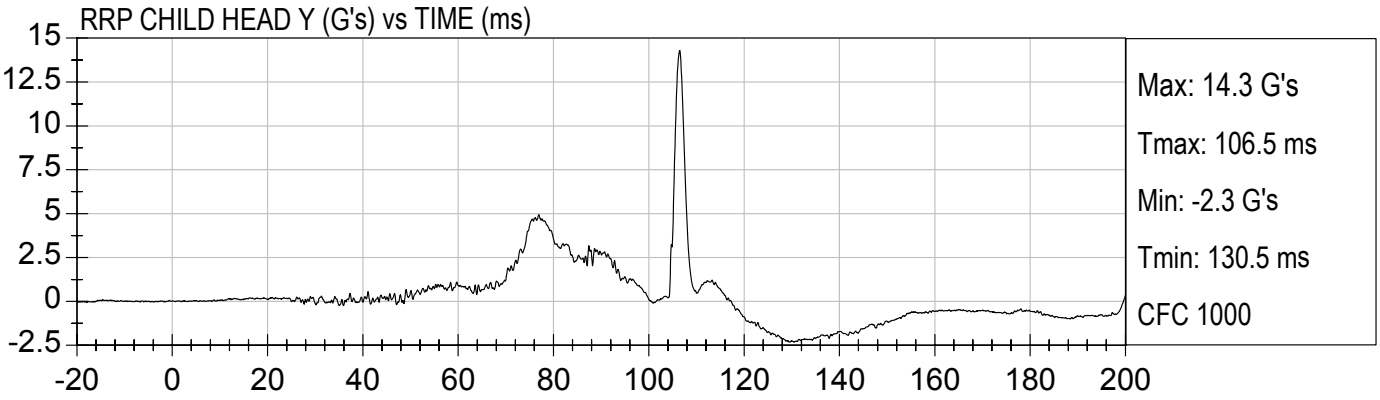


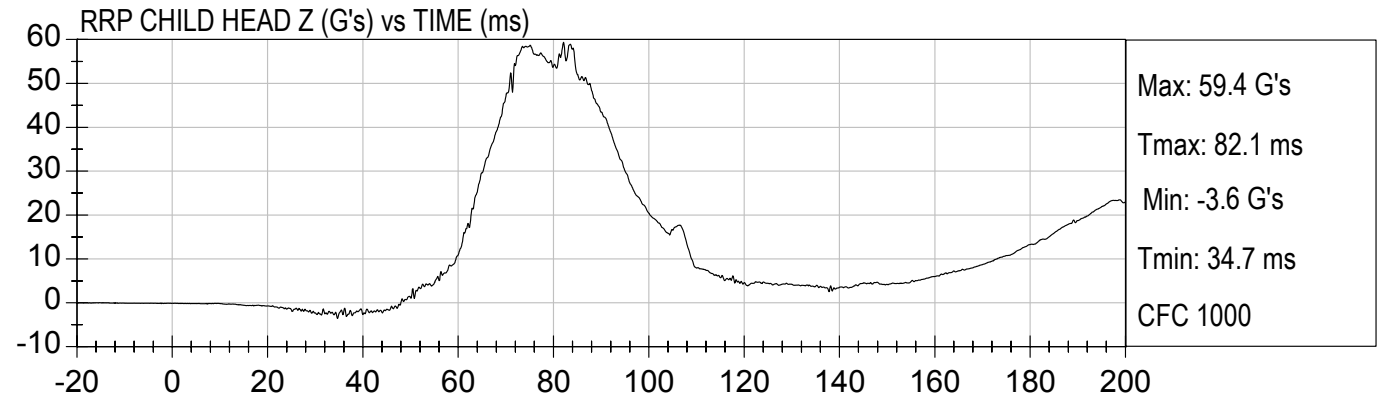


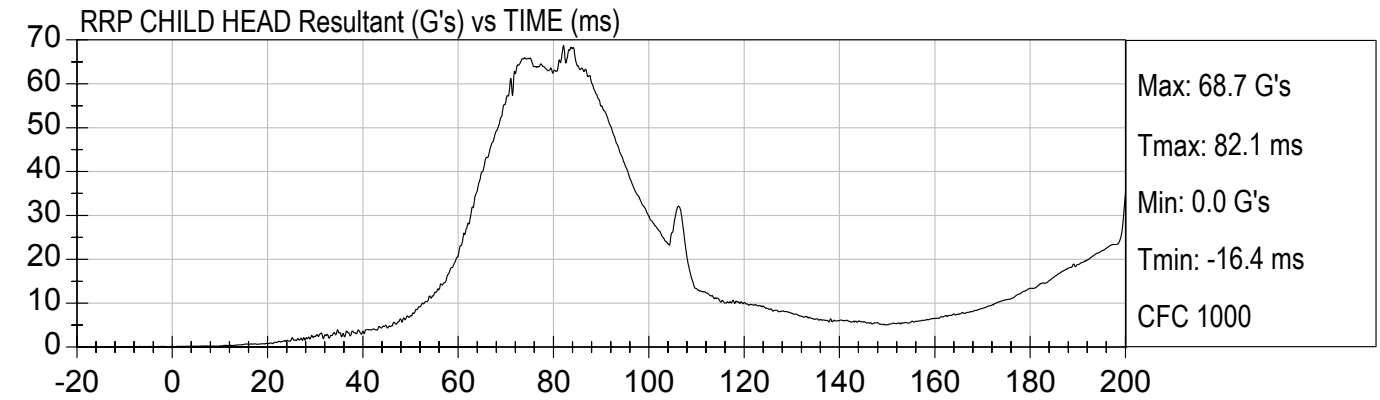
35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)



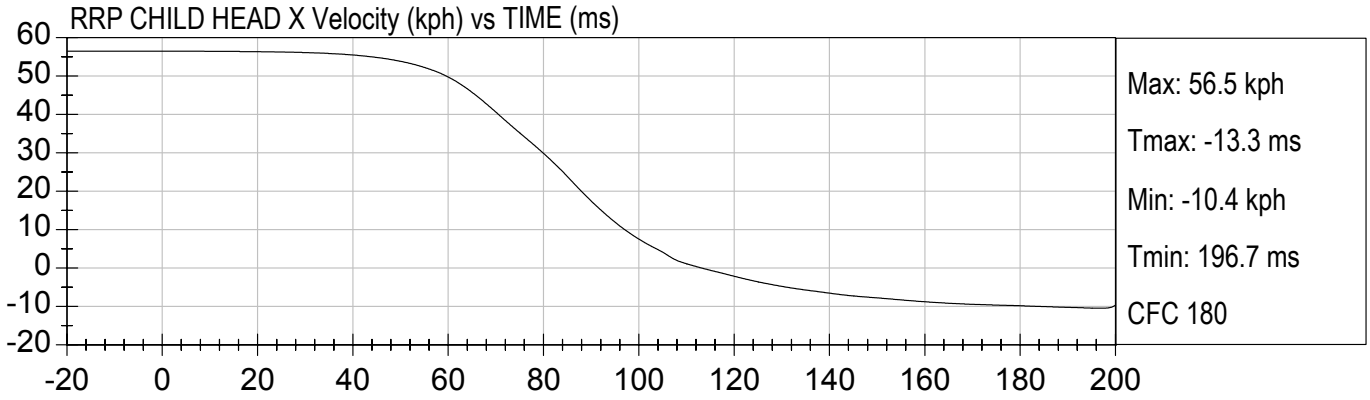


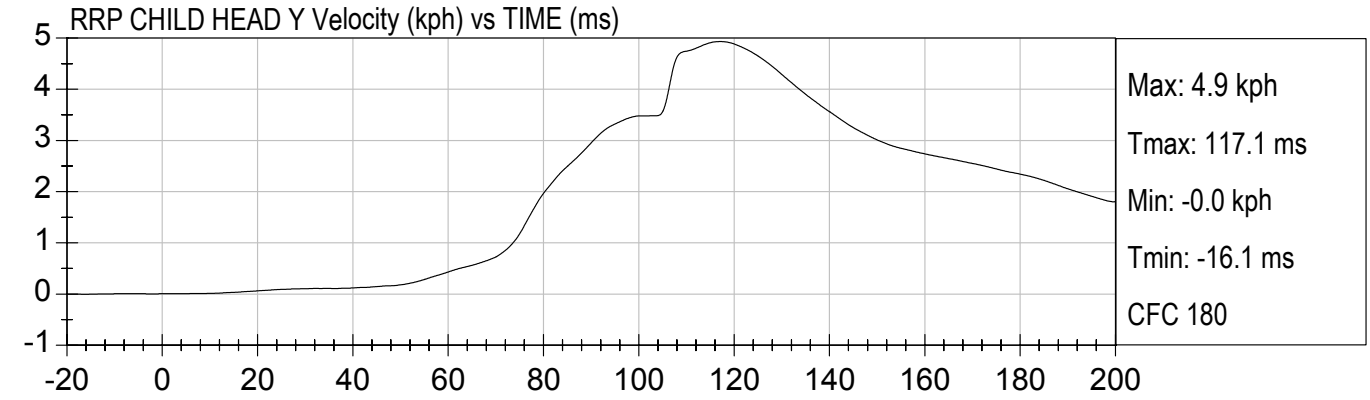


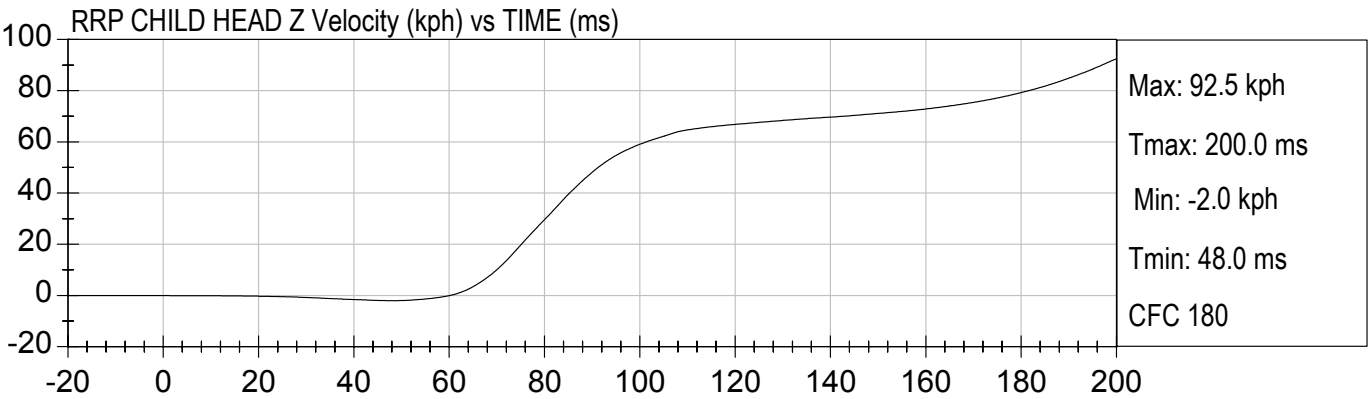


35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)

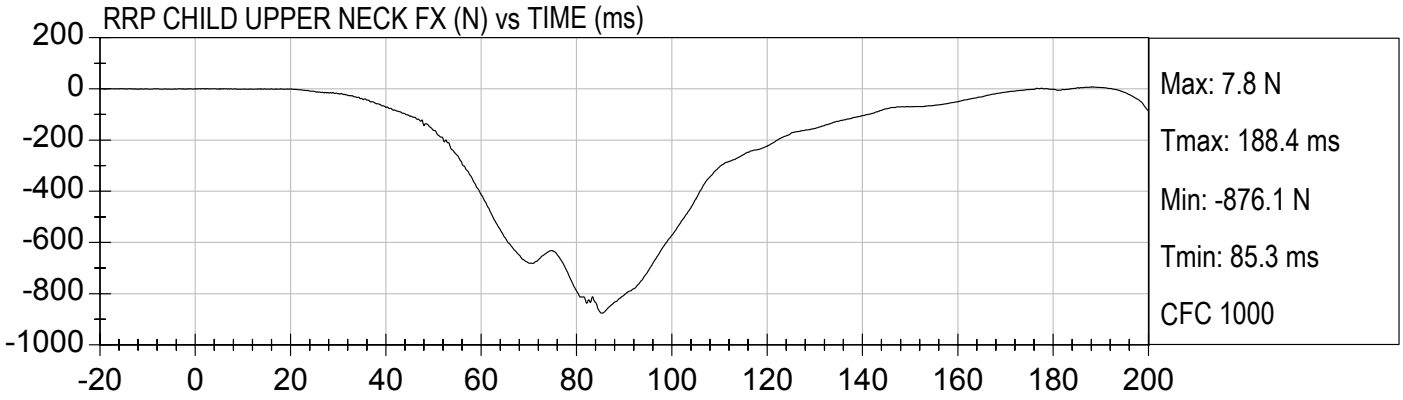


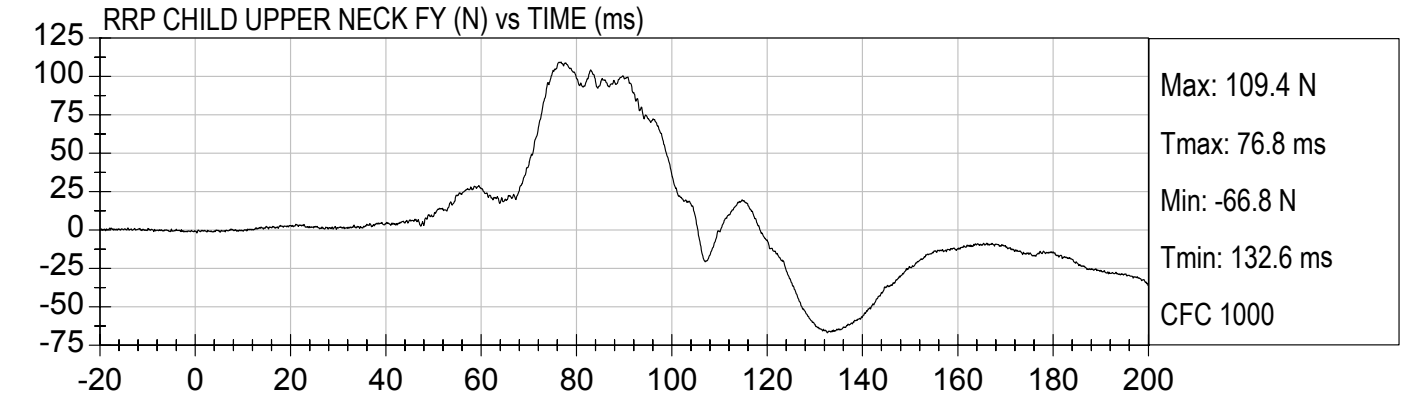


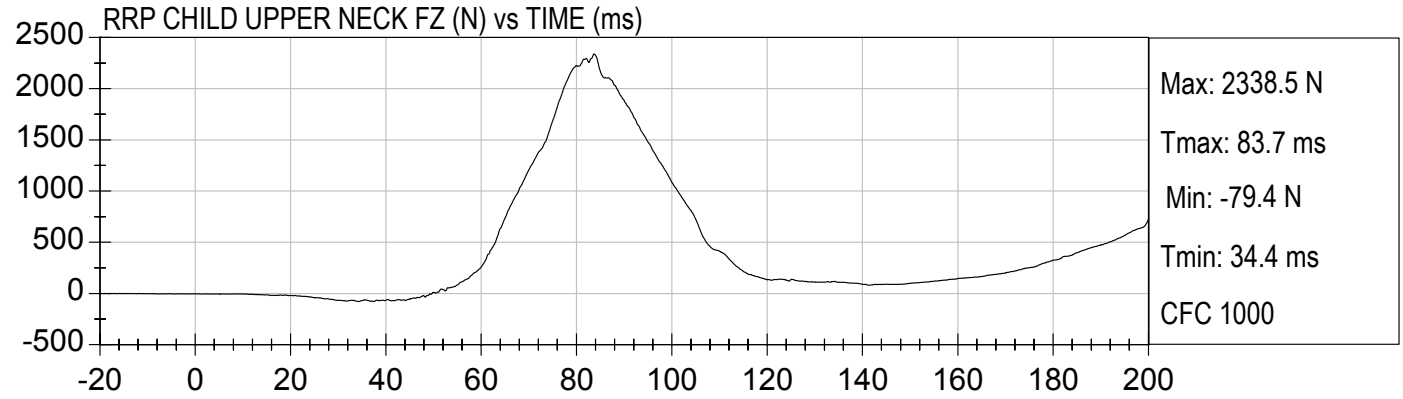


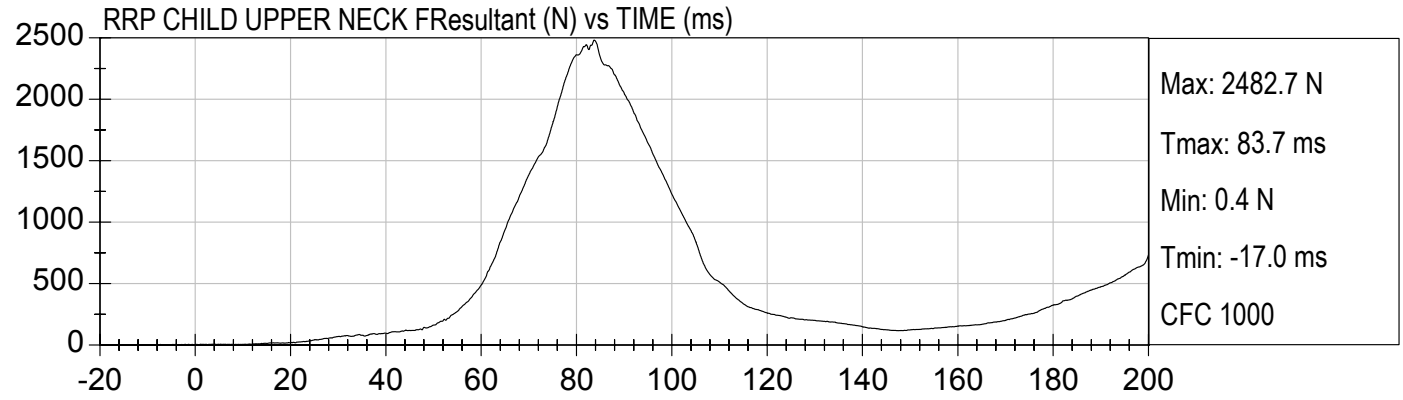
35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)



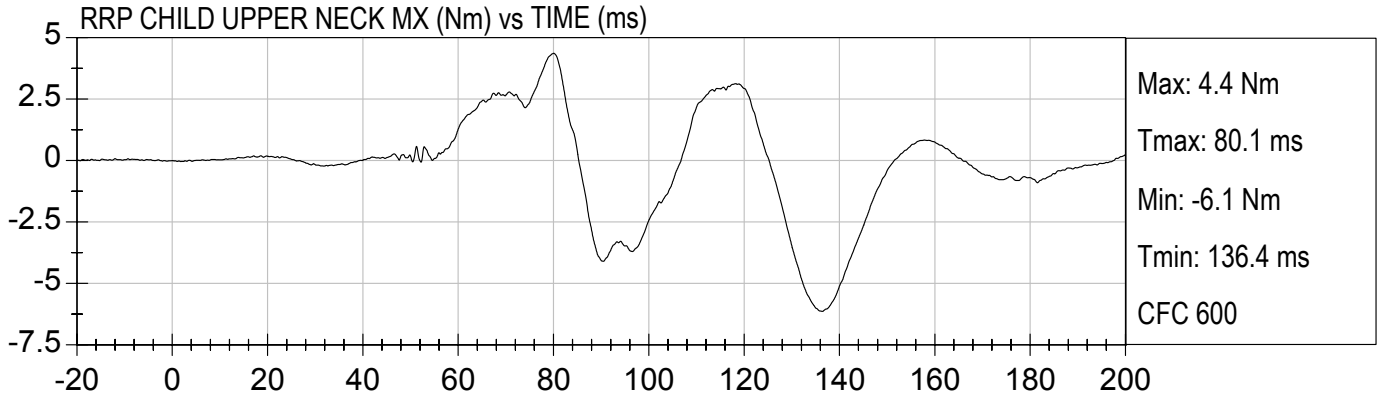


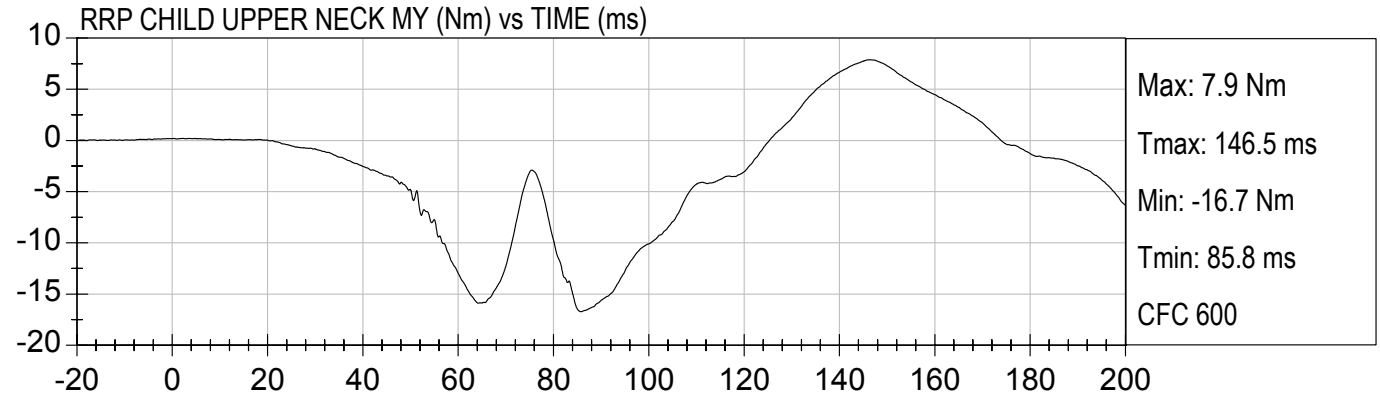


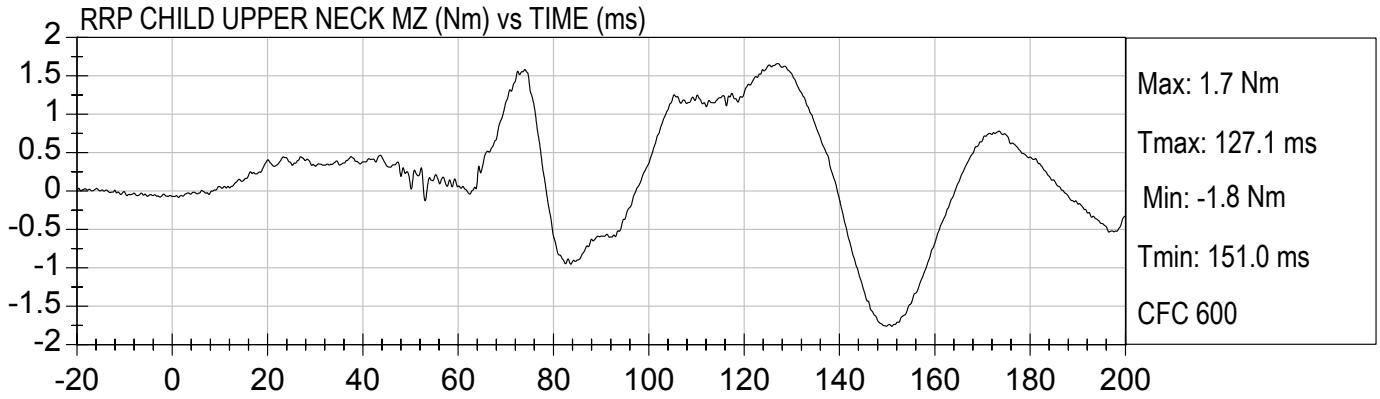


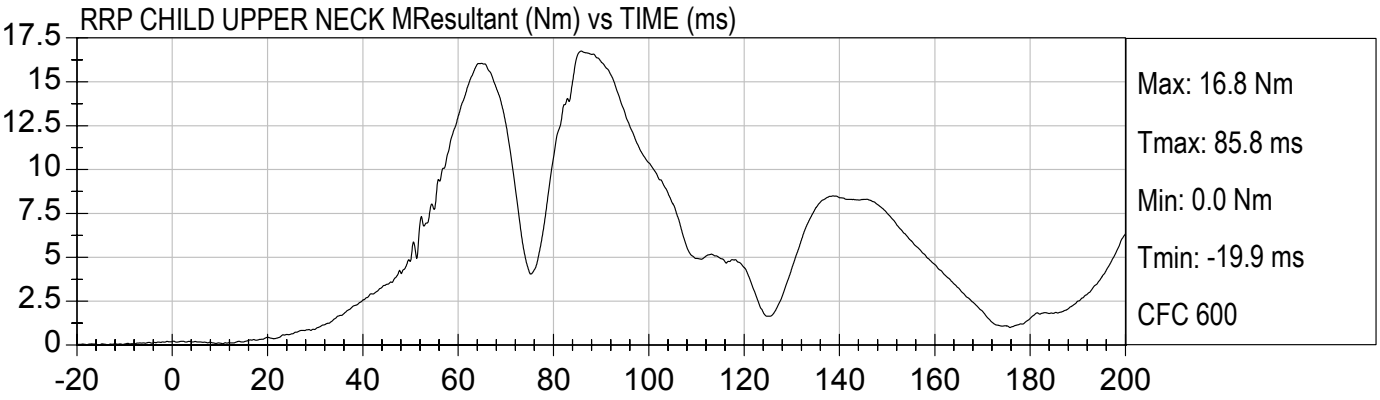
35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)



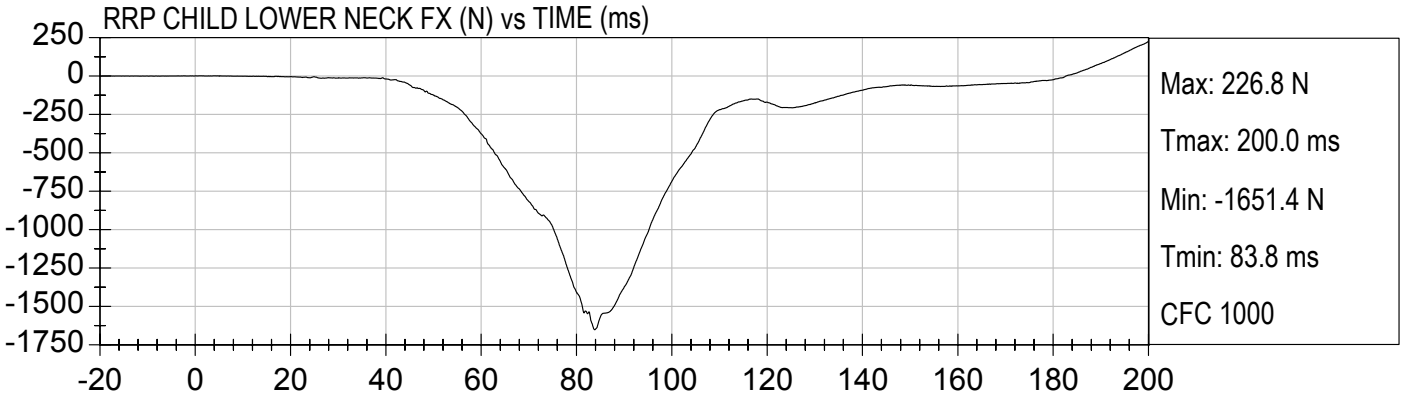


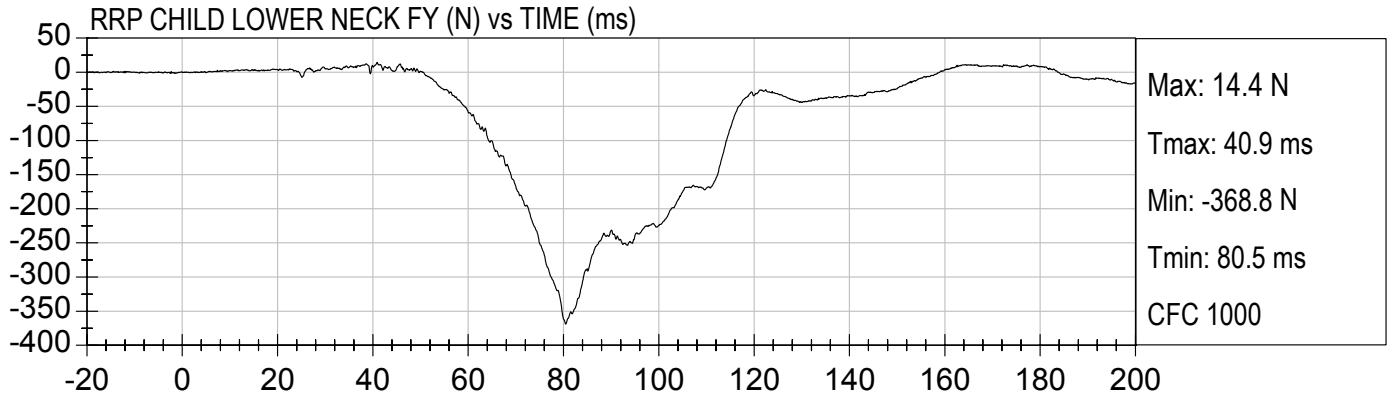


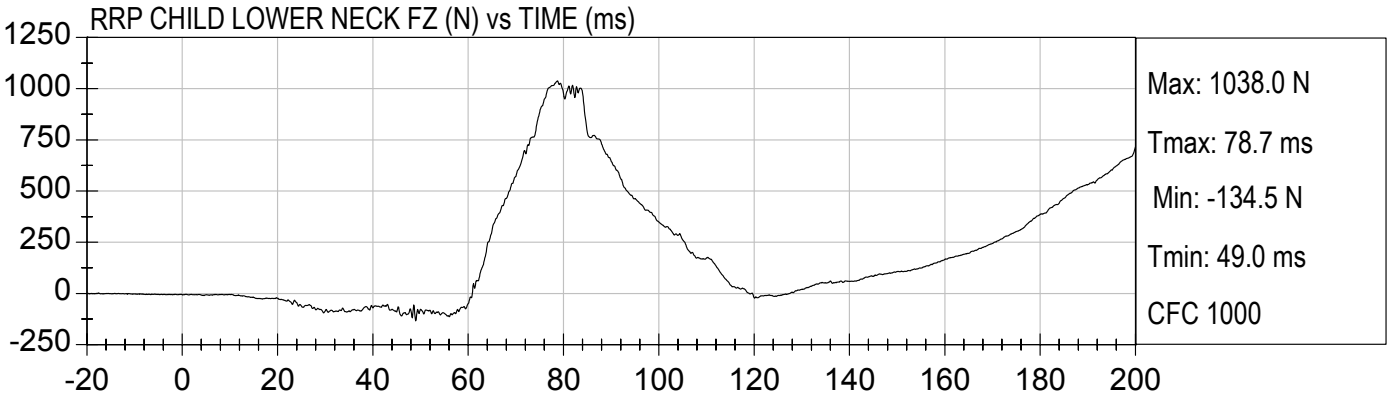


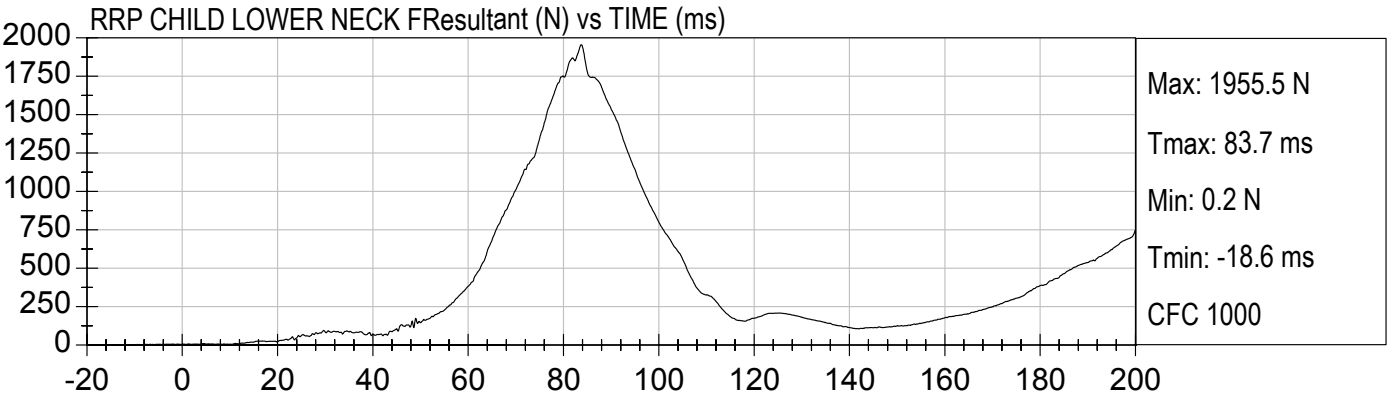
35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)





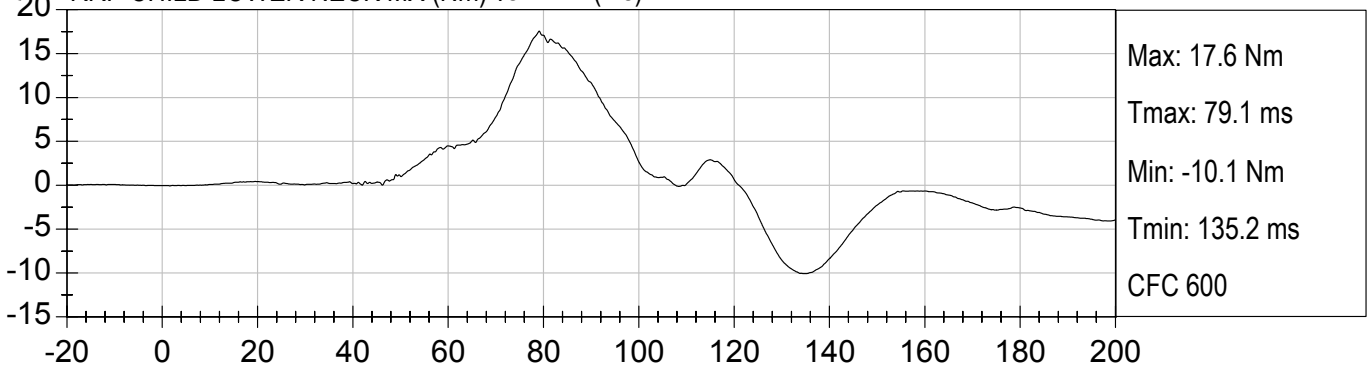




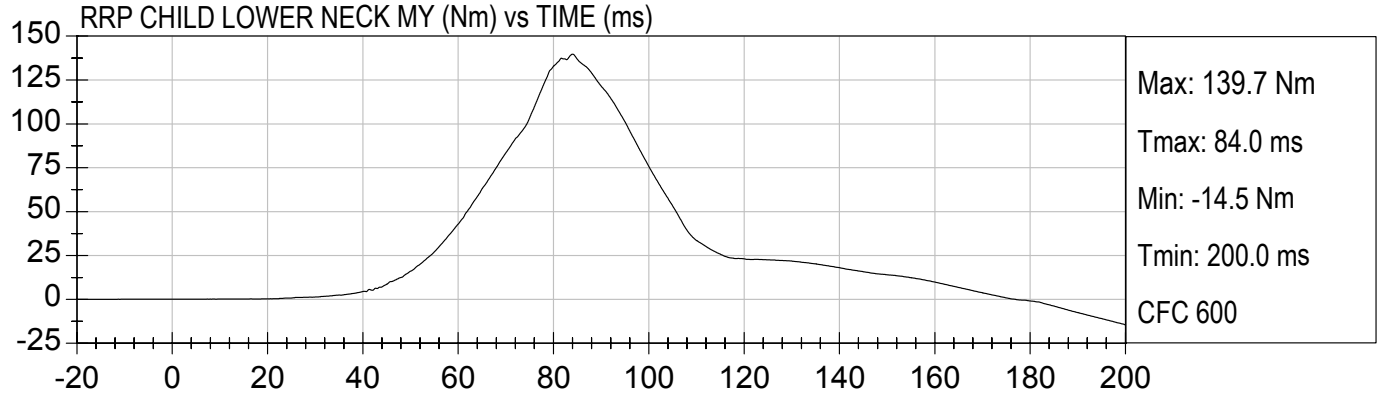
35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)

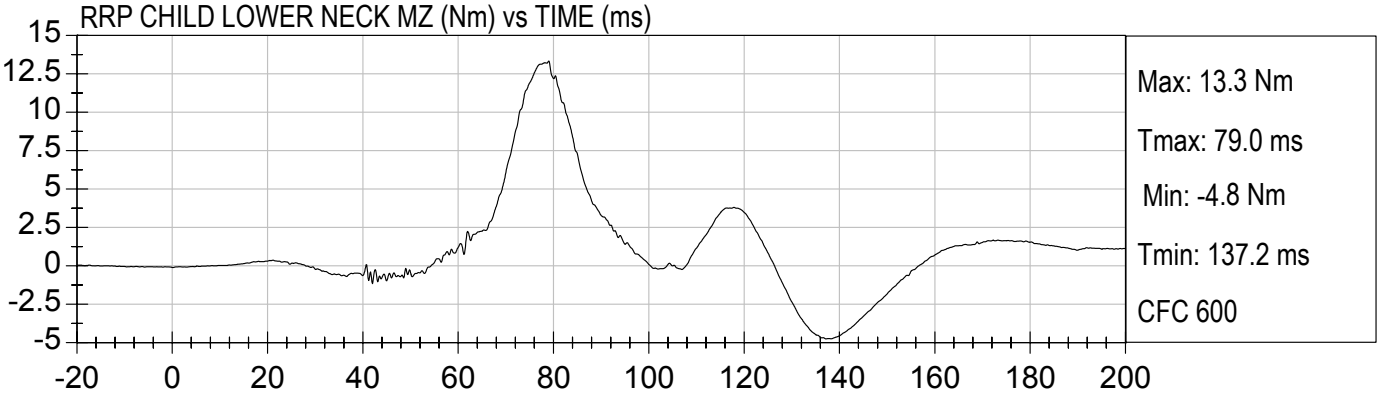
RRP CHILD LOWER NECK MX (Nm) vs TIME (ms)



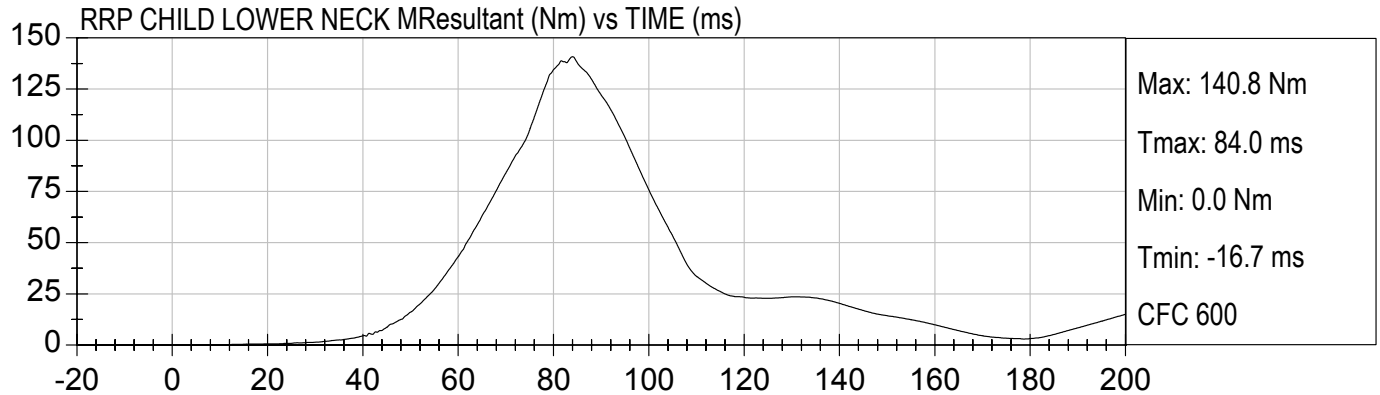
RRP CHILD LOWER NECK MY (Nm) vs TIME (ms)



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

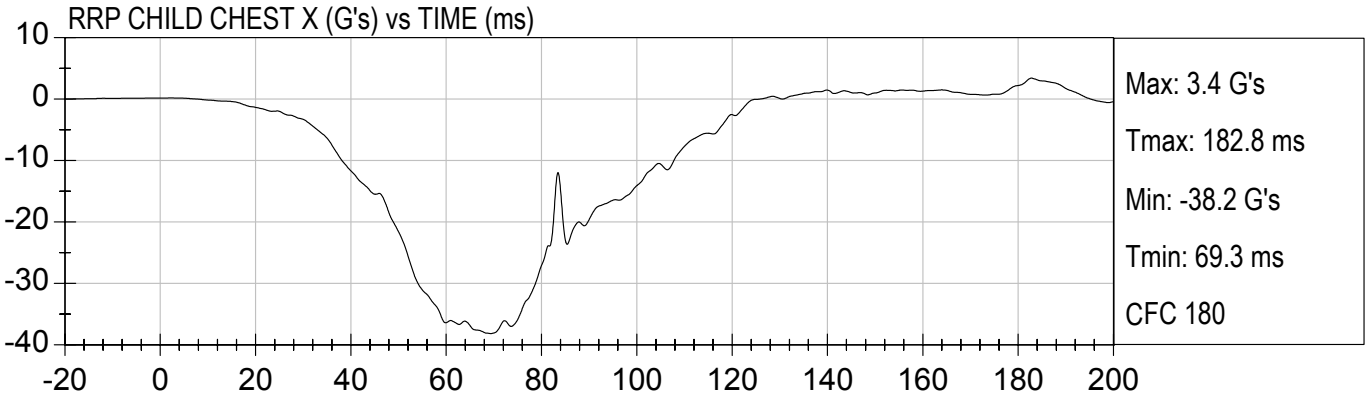


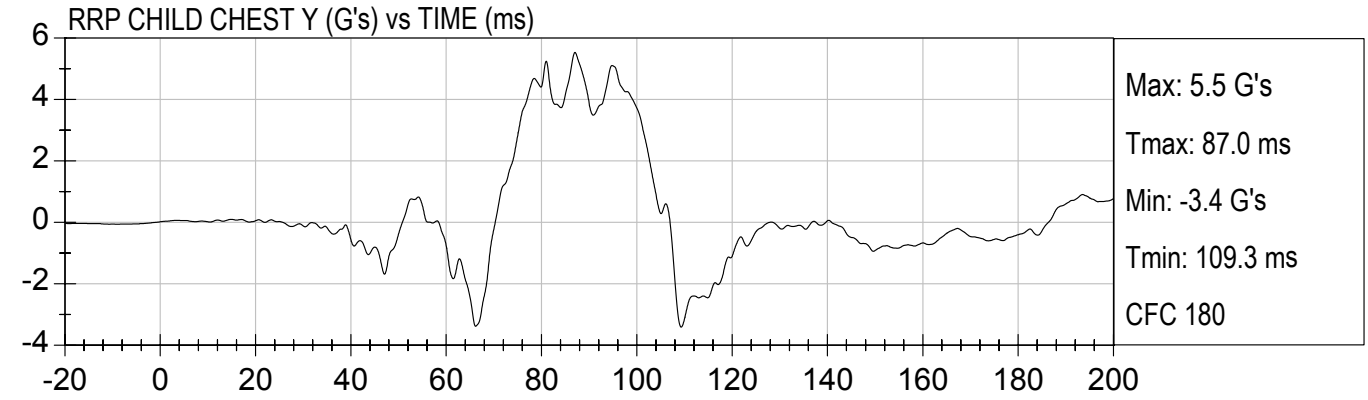
RRP CHILD LOWER NECK MResultant (Nm) vs TIME (ms)

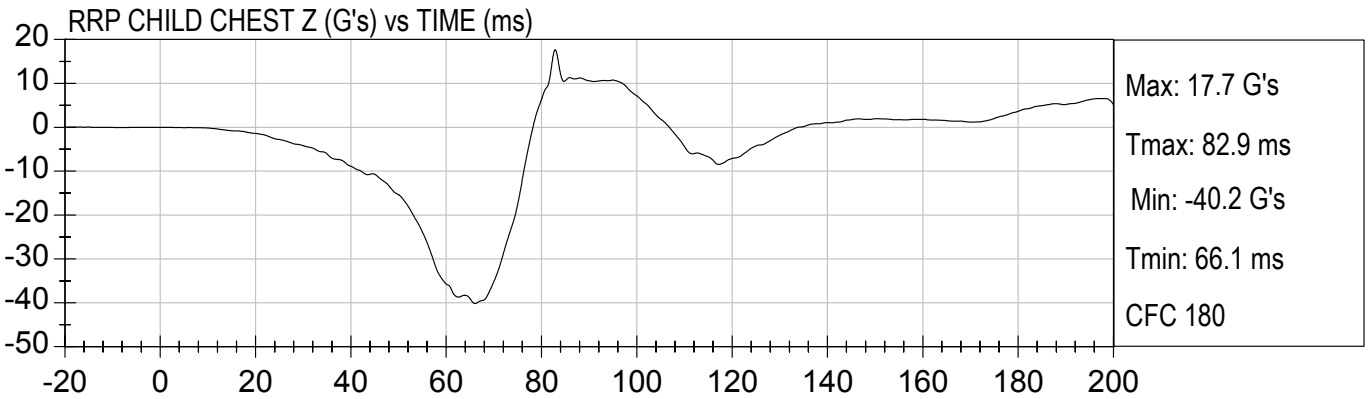


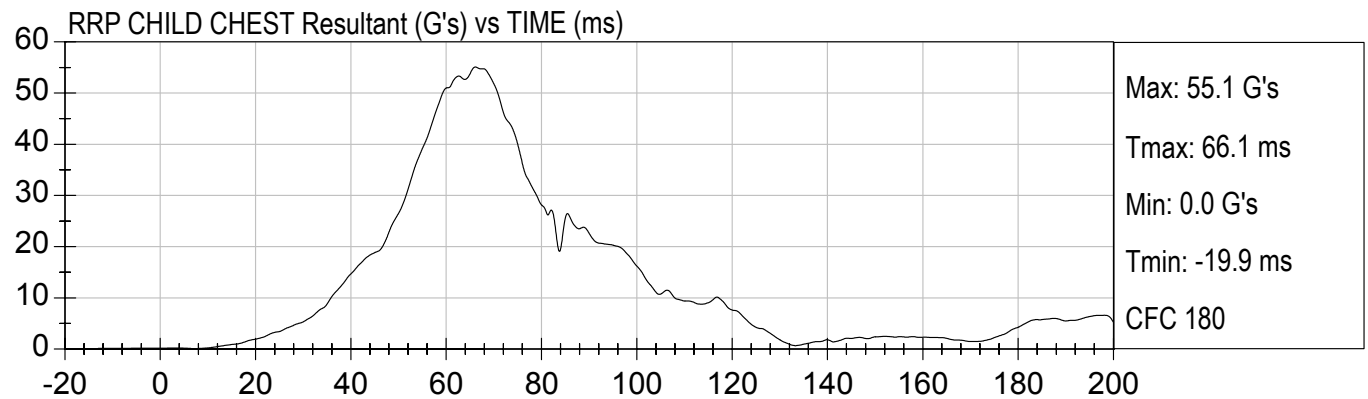
35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
Speed: 35.1 mph (56.5 km/h)









35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

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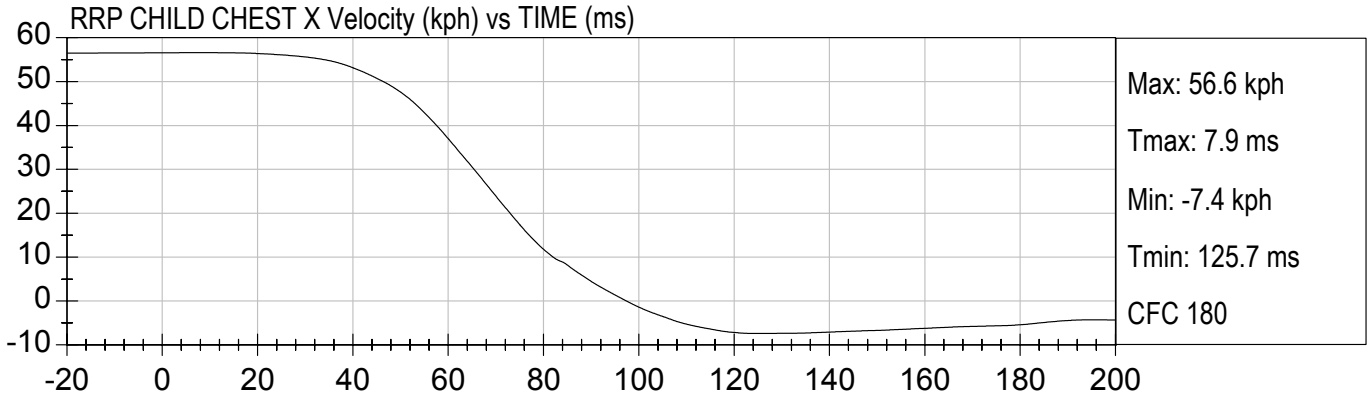

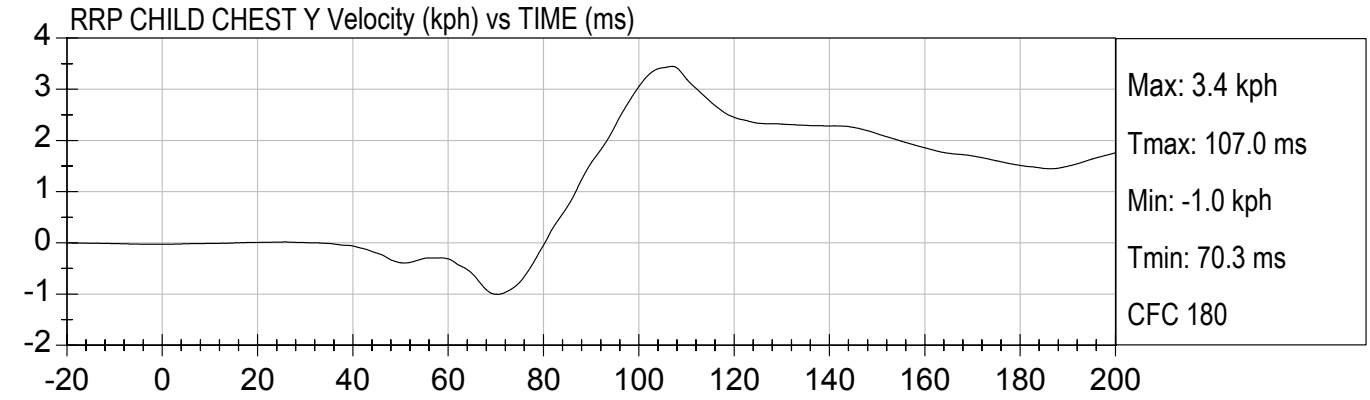

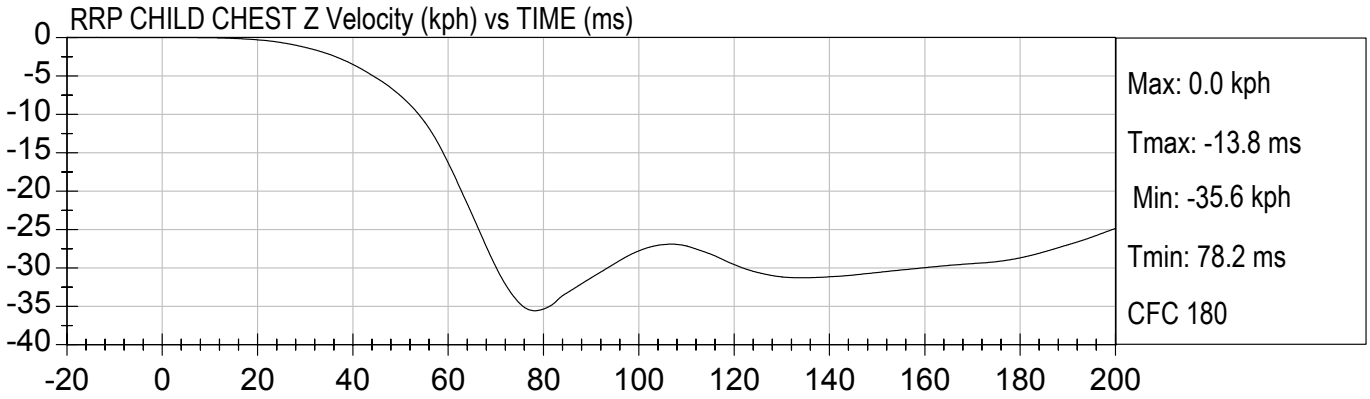

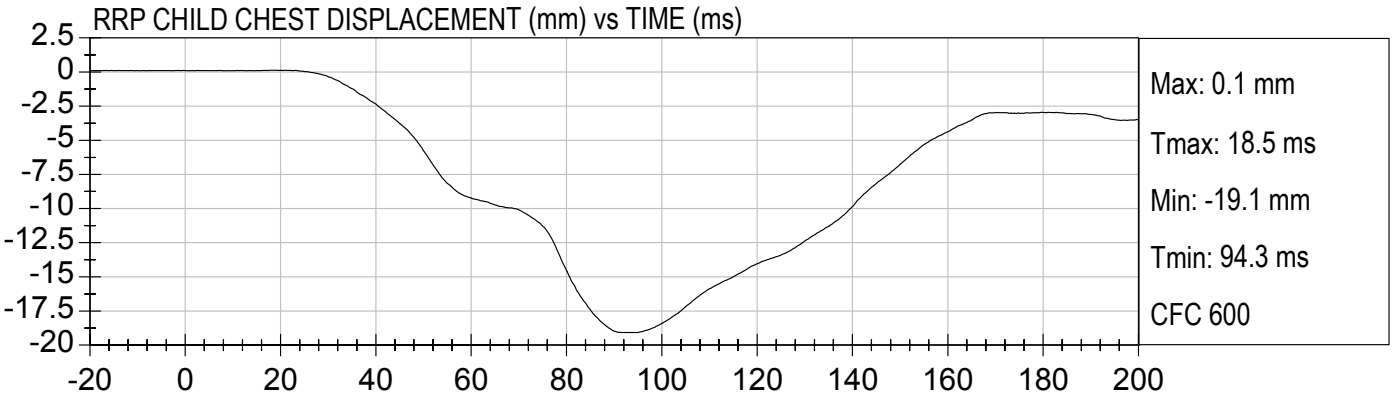

35 MPH FRONTAL IMPACT
2003 ZX2 2 DOOR

Test Date: 12/11/2002
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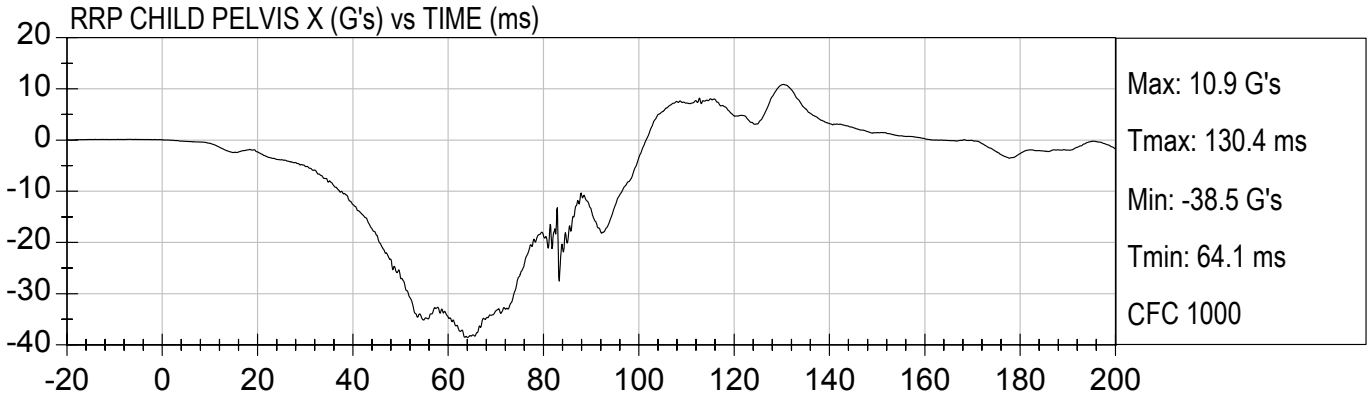
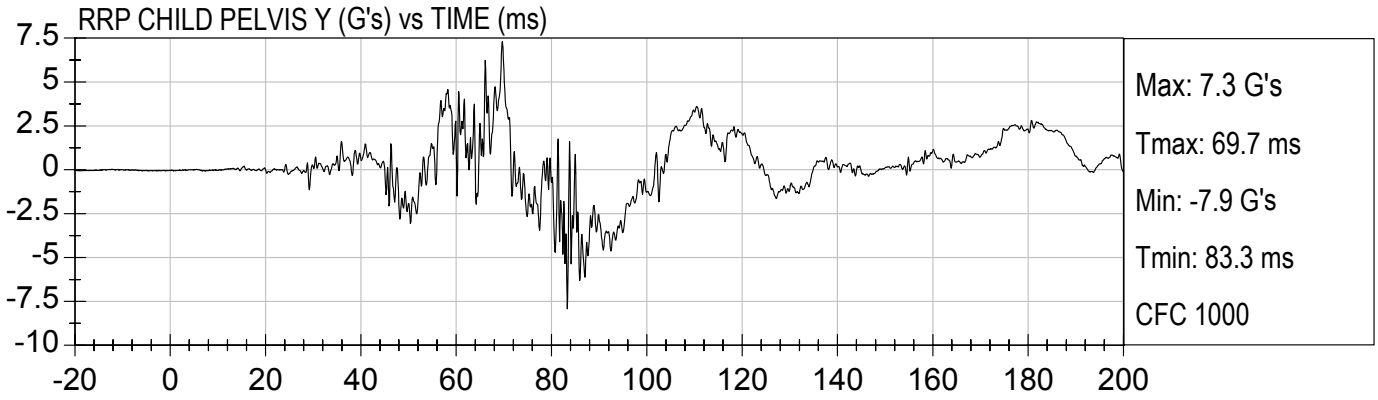
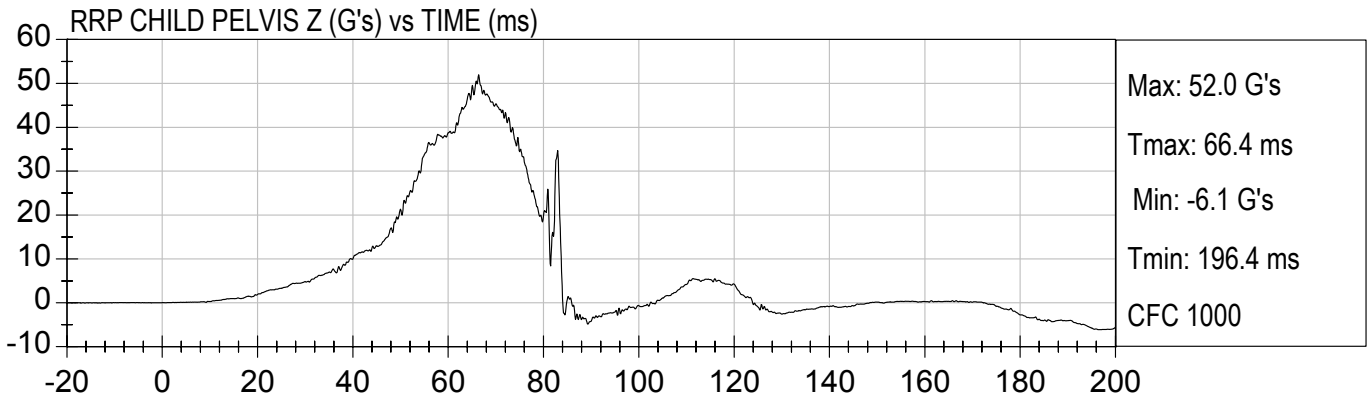
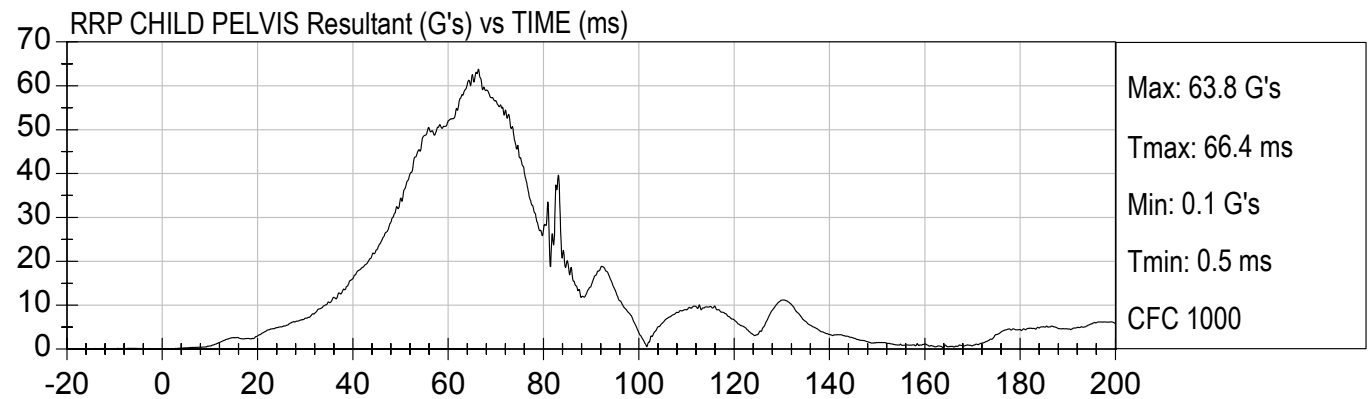
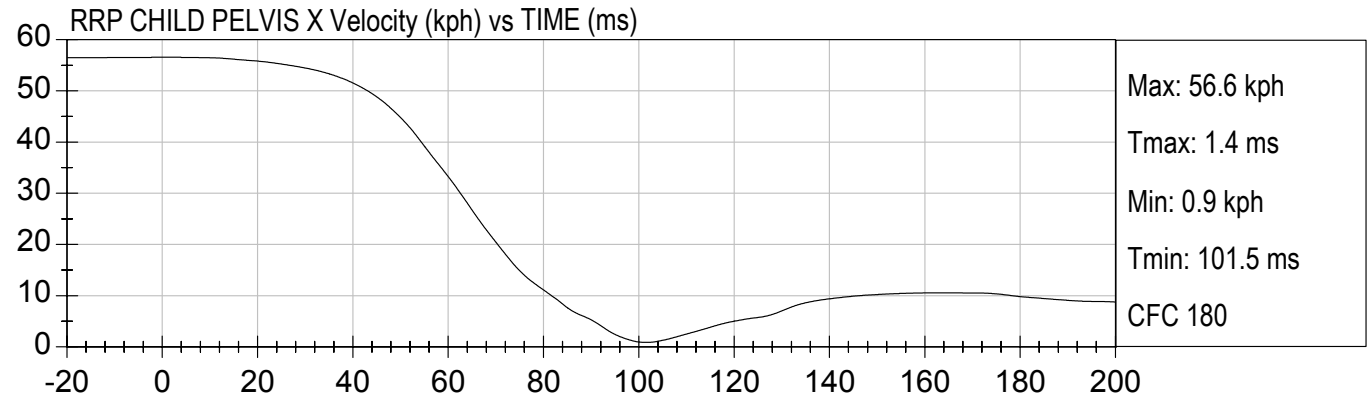
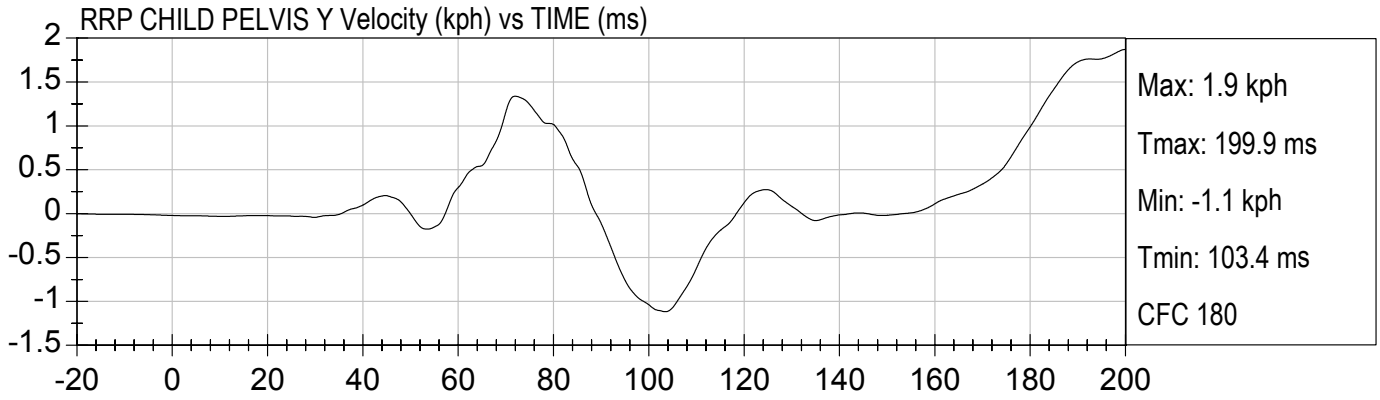


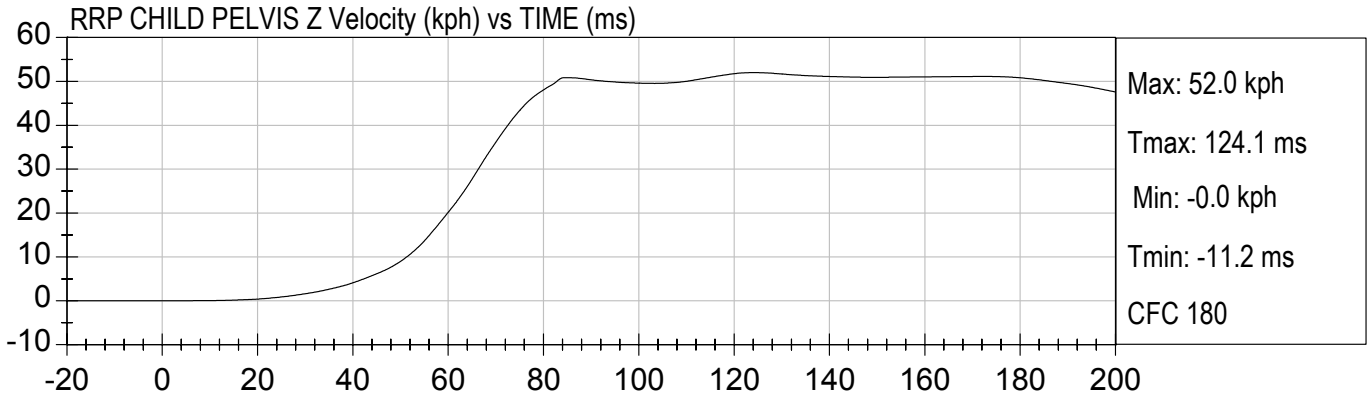


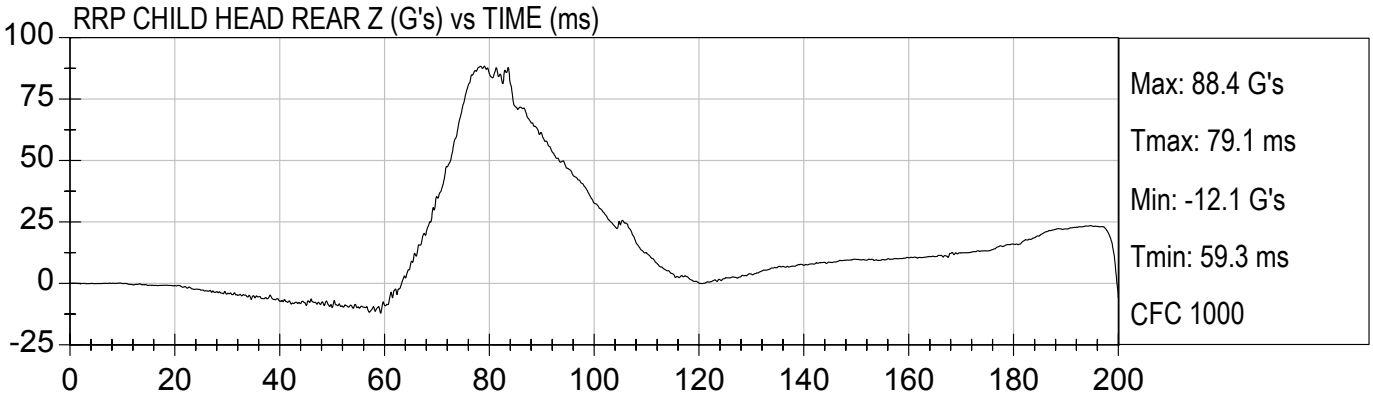


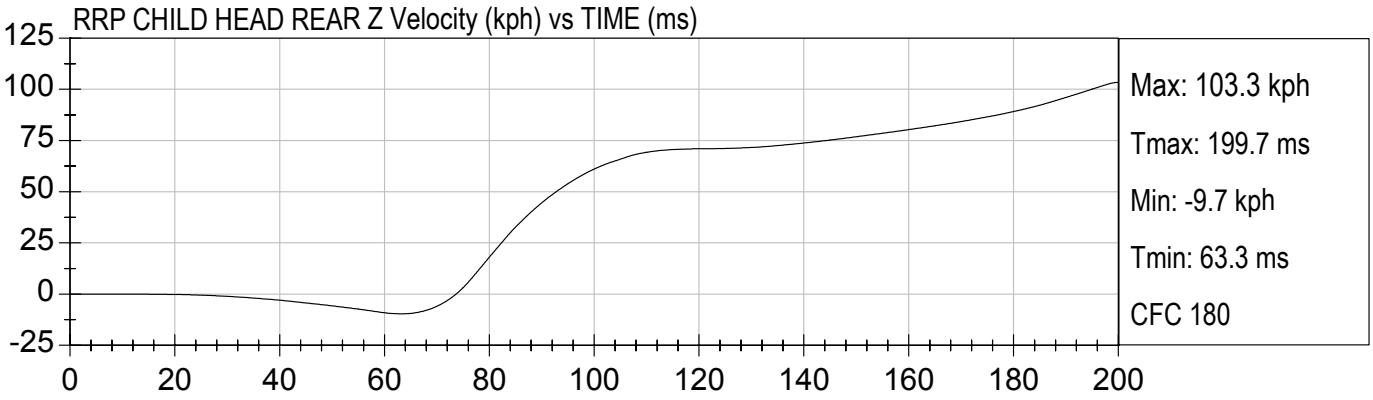



RRP CHILD PELVIS X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 56.6 kph
Tmax: 1.4 ms
Min: 0.9 kph
Tmin: 101.5 ms
CFC 180


RRP CHILD PELVIS Y Velocity (kph) vs TIME (ms)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 1.9 kph
Tmax: 199.9 ms
Min: -1.1 kph
Tmin: 103.4 ms
CFC 180


RRP CHILD PELVIS Z Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 52.0 kph
Tmax: 124.1 ms
Min: -0.0 kph
Tmin: -11.2 ms
CFC 180


RRP CHILD HEAD REAR Z (G's) vs TIME (ms)
100
75
50
25
0
-25
0
20
40
60
80
100
120
140
160
180
200
Max: 88.4 G's
Tmax: 79.1 ms
Min: -12.1 G's
Tmin: 59.3 ms
CFC 1000


RRP CHILD HEAD REAR Z Velocity (kph) vs TIME (ms)
125
100
75
50
25
0
-25
0
20
40
60
80
100
120
140
160
180
200
Max: 103.3 kph
Tmax: 199.7 ms
Min: -9.7 kph
Tmin: 63.3 ms
CFC 180

APPENDIX C

CHILD DUMMY CALIBRATION INFORMATION

Hybrid III Calibration Data Sheet

3 Year Old

Head Drop Calibration

ATD Serial No: 040 **Test I.D:** D021451

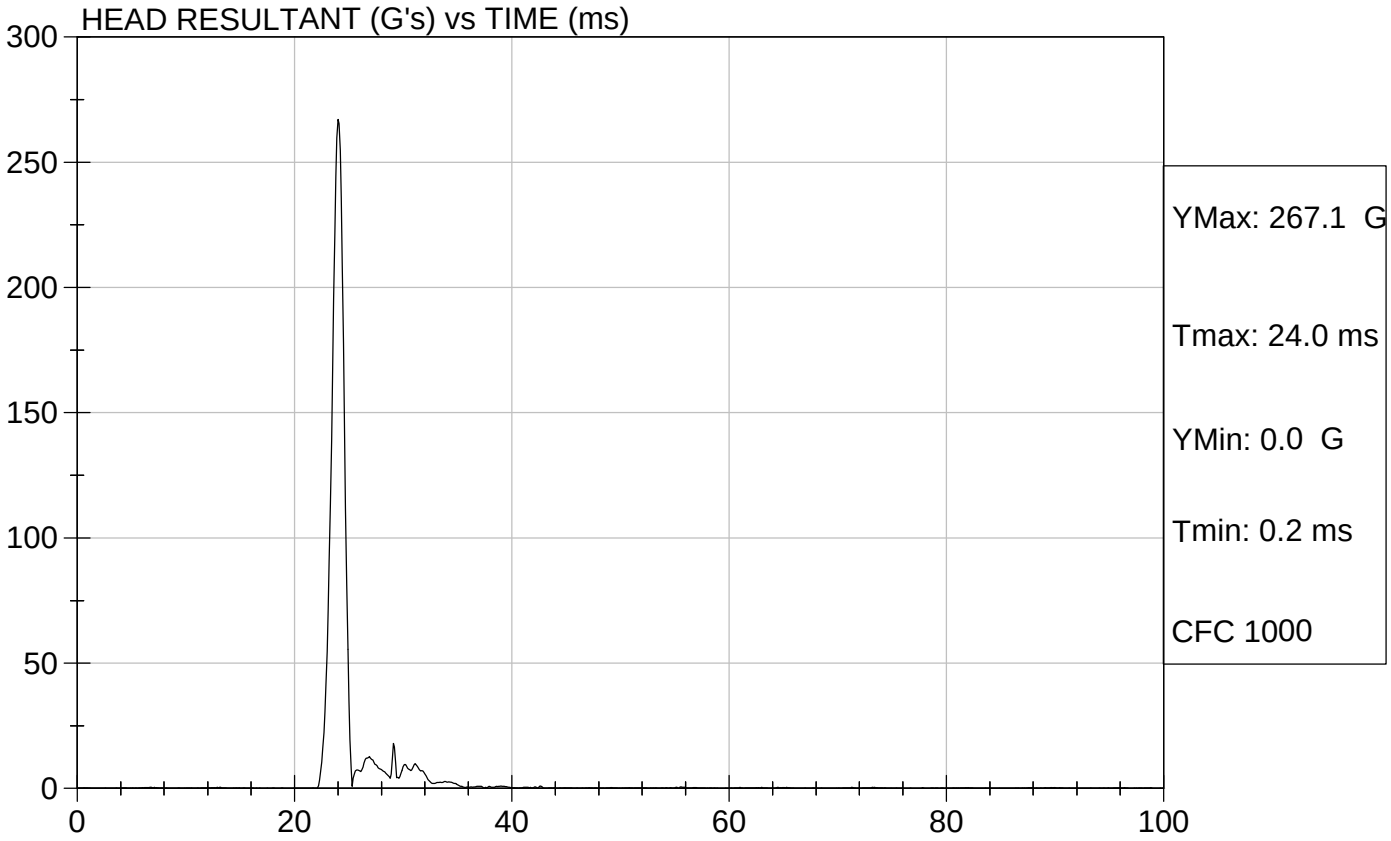
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Peak Resultant Acceleration	G's	225.0 to 275.0	267.1	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-5.2	Pass
Is Acceleration Unimodal?	Yes/No	< 10% Peak	Yes	Pass
		Overall Test Results		Pass

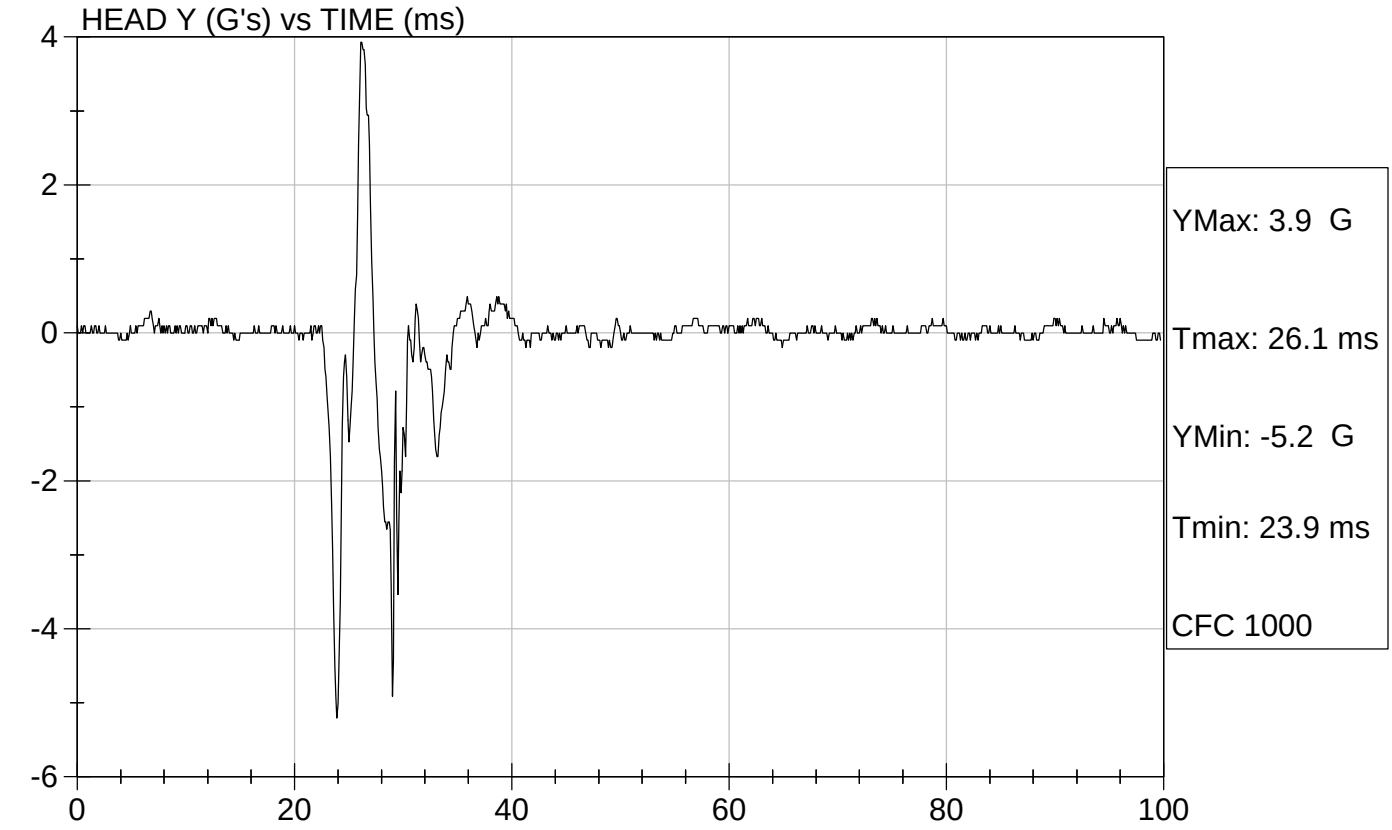
Laboratory Technician

11/13/2002
Test Date

Approved By

	Test Description: Head Drop	Test Date: 11/13/2002
	Component: D021451	Speed: 0 ft/s, 0.00 m/s





Hybrid III Calibration Data Sheet

3 Year Old

Neck Flexion Test

ATD Serial No: 040 **Test I.D:** D021452

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	29	Pass
Pendulum Speed		m/s	5.4 to 5.6	5.49	Pass
Pendulum Deceleration	10 msec	m/s	2.0 - 2.7	2.2	Pass
	15 msec	m/s	3.0 - 4.0	3.2	Pass
	20 msec	m/s	4.0 - 5.1	4.4	Pass
D Plane Rotation		deg	70 - 82	78.0	Pass
Peak Moment within Deflection Corridor		deg	42.0 - 53.0	46.1	Pass
Positive Moment - Time Curve Decay to 10 Nm		msec	60.0 - 80.0	71.9	Pass
			Overall Test Results		Pass

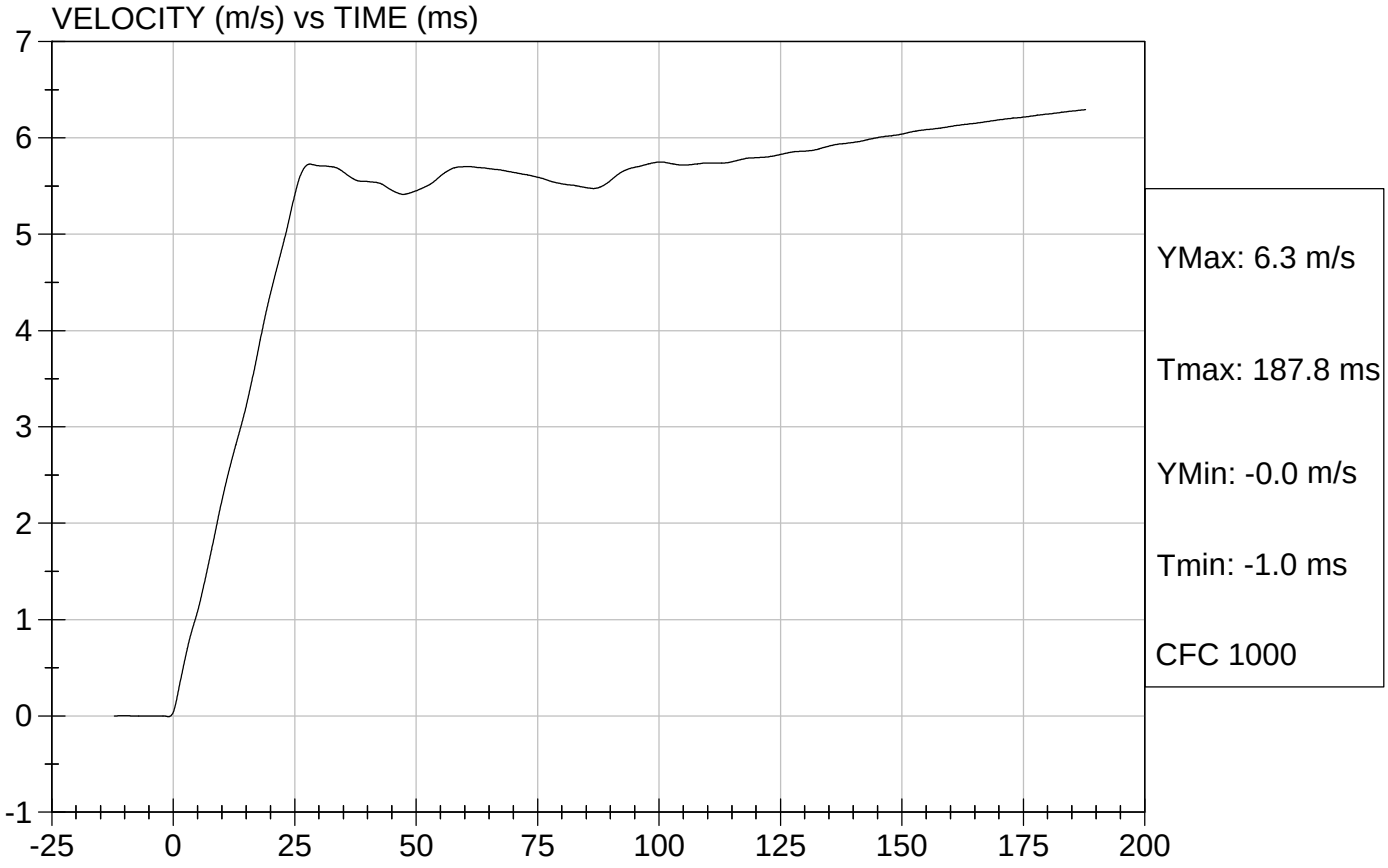
Laboratory Technician

11/13/2002
Test Date

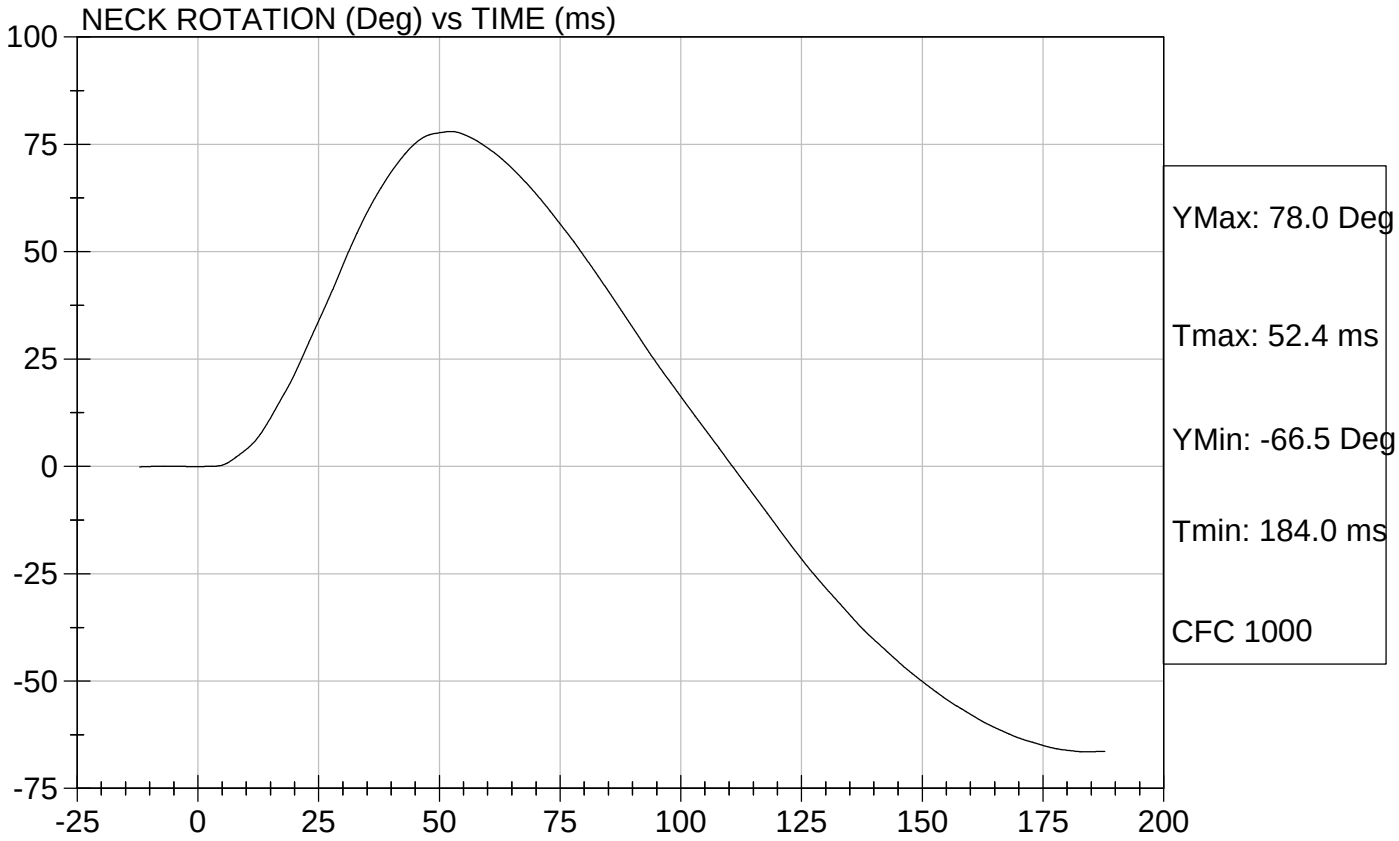
Approved By

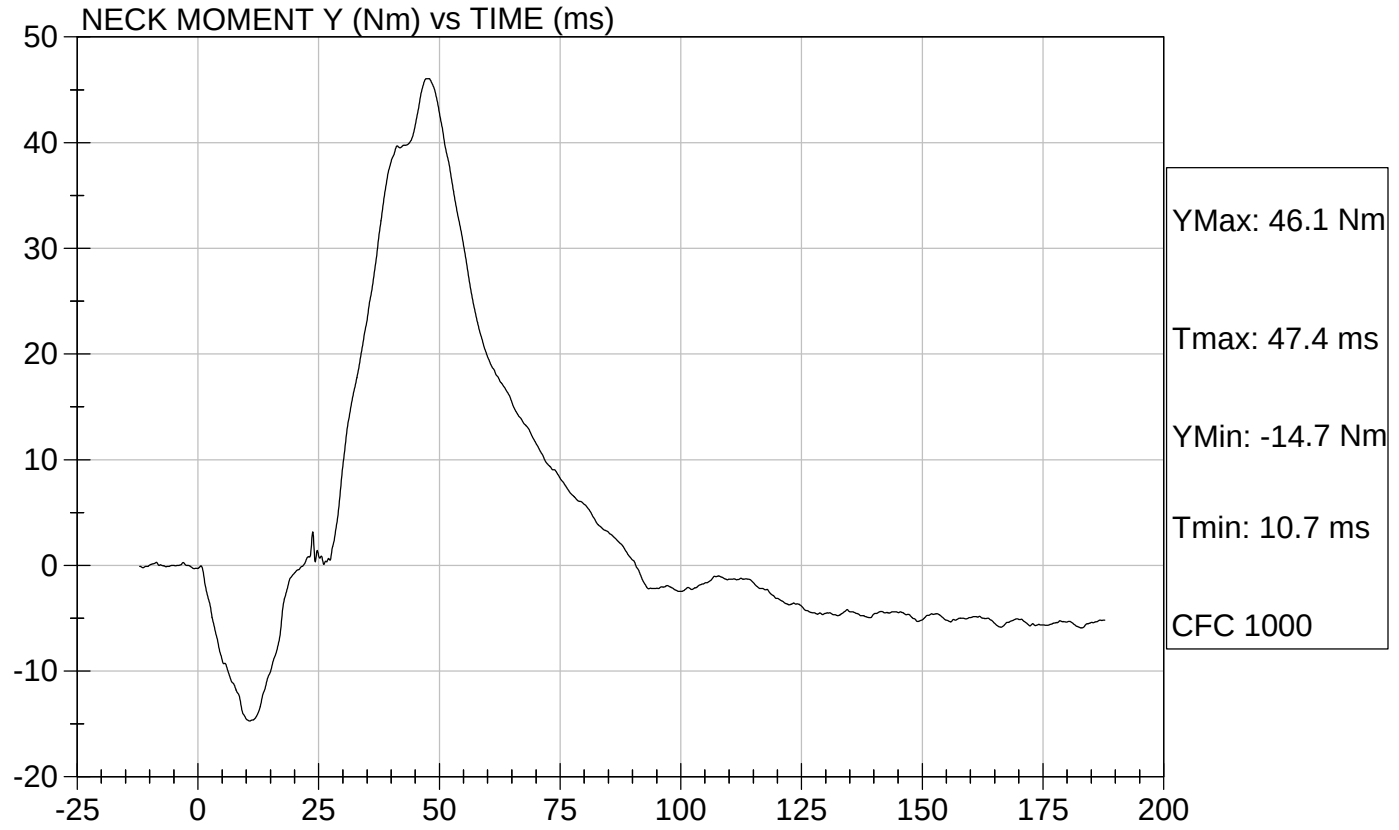
Test Description: Neck Flexion | Test Date: 11/13/2002

Component: D021452 | Speed: 18.02 ft/sec, 5.49 m/sec



	Test Description: Neck Flexion	Test Date: 11/13/2002
	Component: D021452	Speed: 18.02 ft/s, 5.49 m/s





Hybrid III Calibration Data Sheet

3 Year Old

Neck Extension Test

ATD Serial No: 040 **Test I.D:** D021453

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	31	Pass
Pendulum Speed		m/s	3.55 to 3.75	3.67	Pass
Pendulum Deceleration	6 msec	m/s	1.0 - 1.4	1.3	Pass
	10 msec	m/s	1.9 - 2.5	2.2	Pass
	14 msec	m/s	2.8 - 3.5	3.0	Pass
D Plane Rotation		deg	83 - 93	90.2	Pass
Peak Moment within Deflection Corridor		deg	-53.3 - -43.7	-48.0	Pass
Negative Moment - Time Curve Decay to -10 Nm		msec	60.0 - 80.0	67.1	Pass
			Overall Test Results		Pass

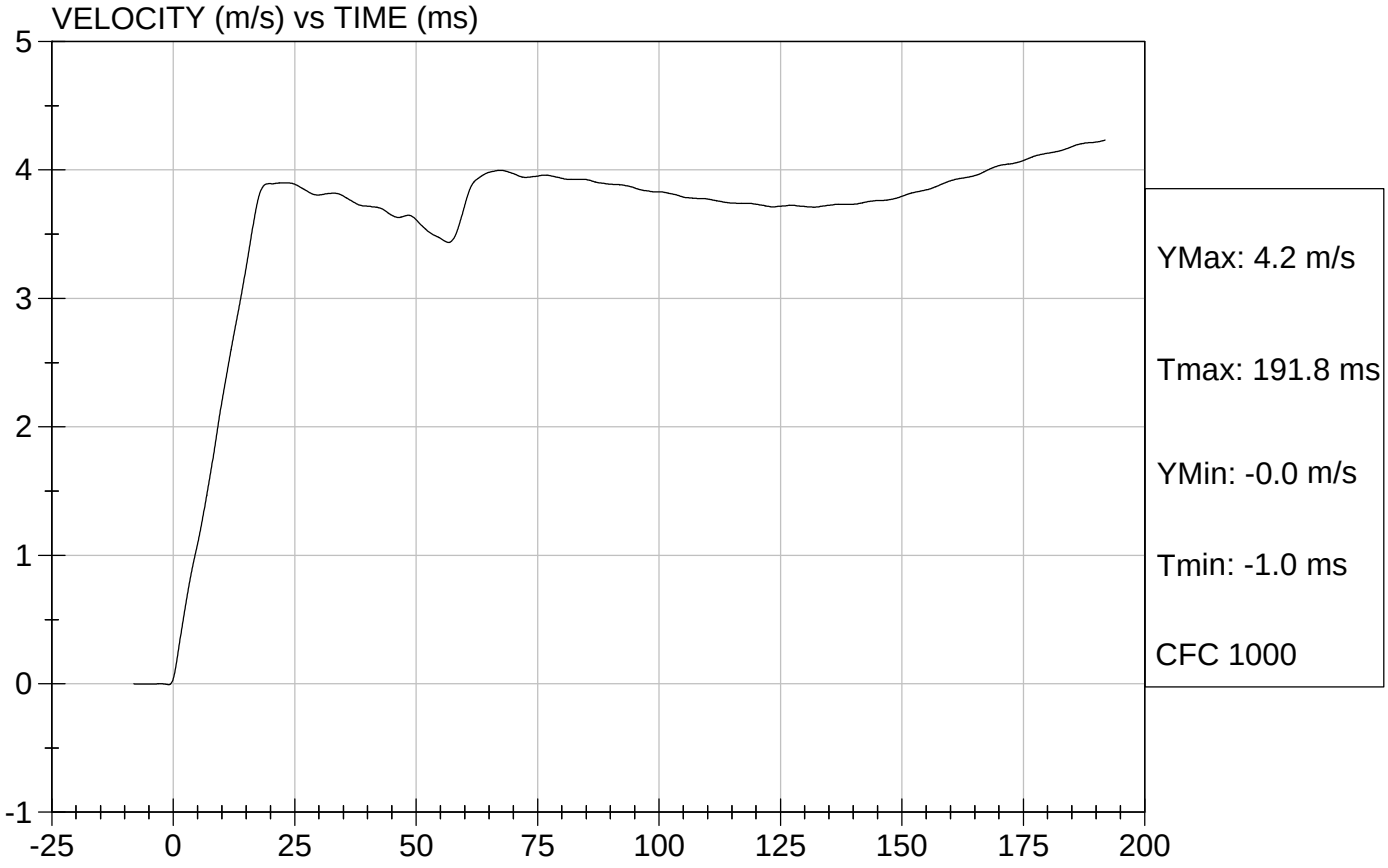
Laboratory Technician

11/14/2002
Test Date

Approved By

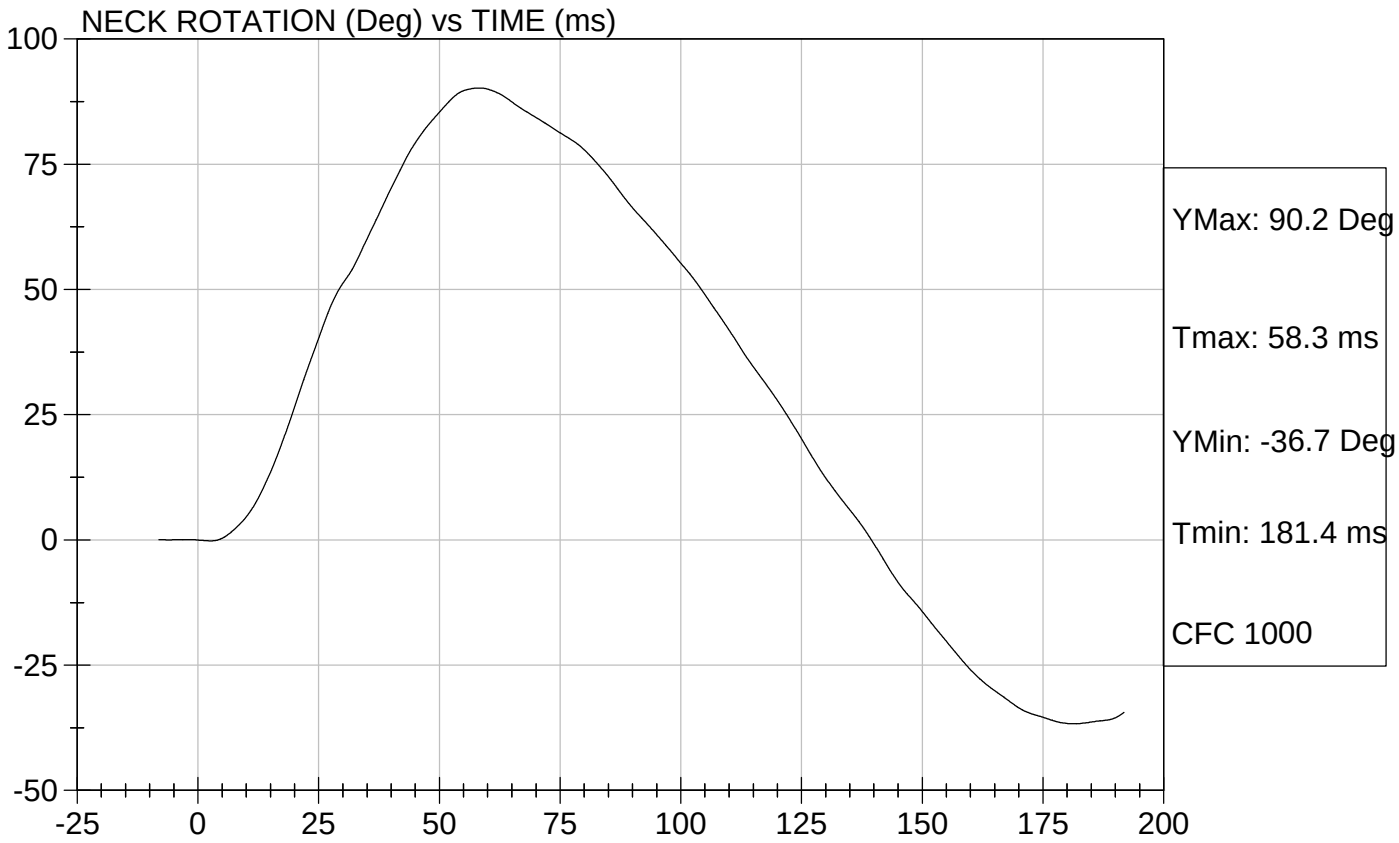
Test Description: Neck Extension Test Date: 11/14/2002

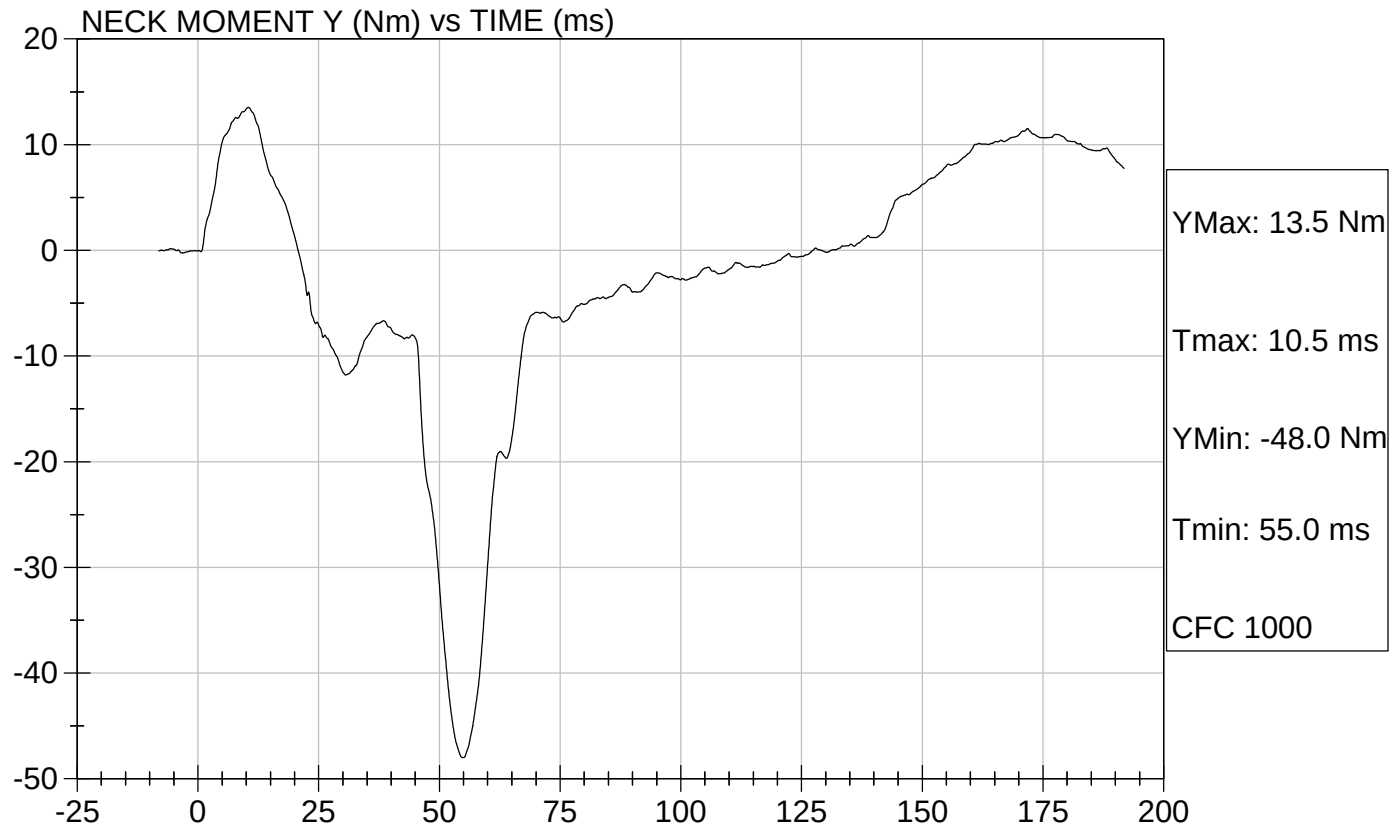
Component: D021453 Speed: 12.03 ft/sec, 3.67 m/sec



Test Description: Neck Extension | Test Date: 11/14/2002

Component: D021453 | Speed: 12.03 ft/s, 3.67 m/s





Hybrid III Calibration Data Sheet

3 Year Old

Thorax Impact Test

ATD Serial No: 040 **Test I.D:** D021454

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Probe Velocity	m/s	5.9 to 6.1	5.96	Pass
Peak Deflection	mm	32 - 38	33	Pass
Peak Resistive Force w/in Deflection Corridor	kN	0.68 - 0.81	0.69	Pass
Internal Hysteresis	%	65 to 85	71	Pass
Max Force 12.5 mm - 32 mm Deflection	kN	Max 0.86	0.84	Pass
		Overall Test Results		Pass

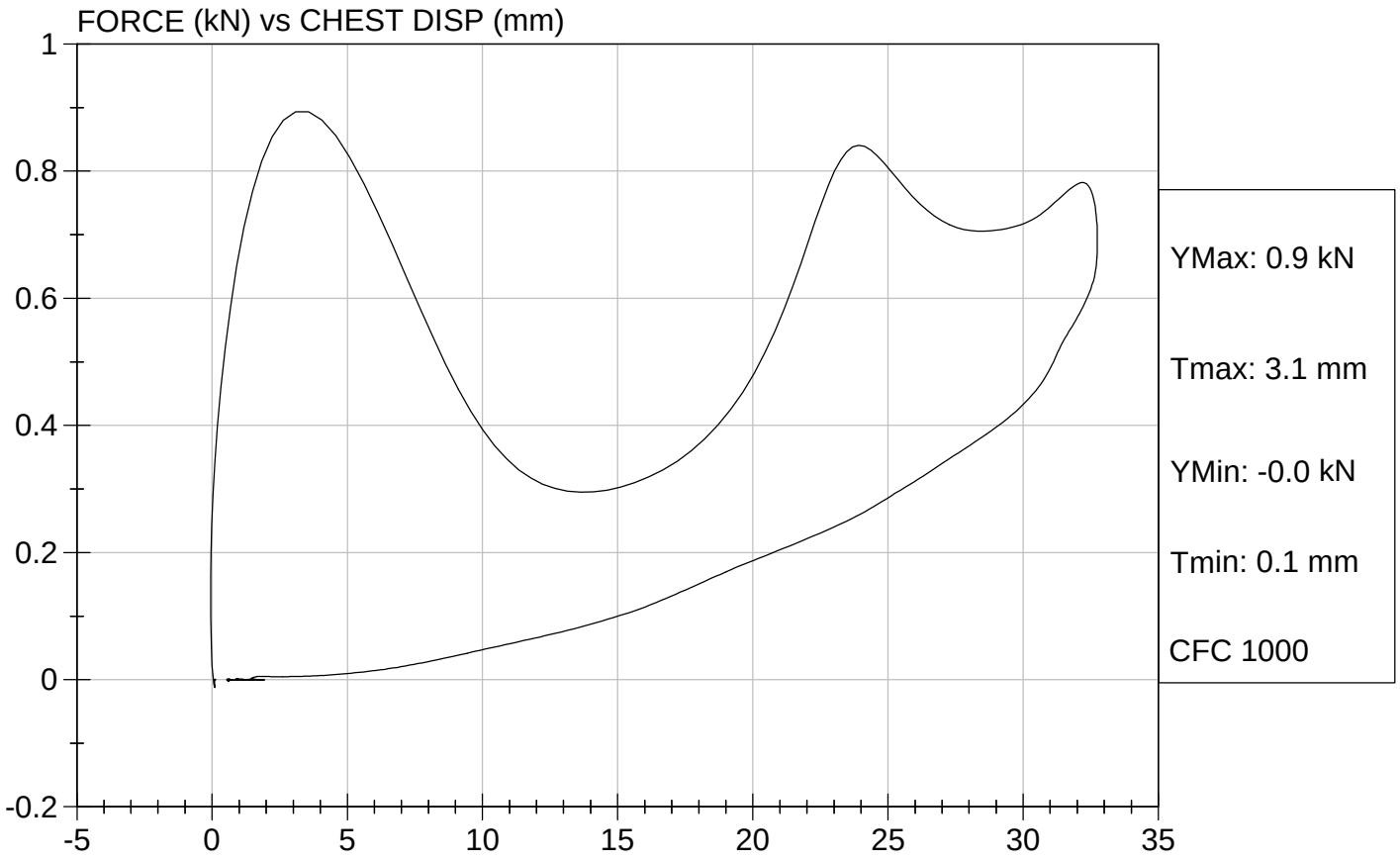
Laboratory Technician

11/19/2002
Test Date

Approved By

Test Description: Thorax Impact Test Date: 11/19/2002

Component: D021454 Speed: 19.55 ft/sec, 5.96 m/sec



Hybrid III Calibration Data Sheet

3 Year Old

Torso Lumbar Flexion

ATD Serial No: 040 **Test I.D:** D021455

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	28	Pass
Force At 45 deg.	N	130 - 180	142	Pass
Initial Angle	deg	0 - 15	7	Pass
Return Angle	deg	0 - 10	5	Pass
		Overall Test Results		Pass

Laboratory Technician

11/19/02
Test Date

Approved By

Hybrid III Calibration Data Sheet

3 Year Old

Head Drop Calibration

ATD Serial No: 042 **Test I.D:** D021461

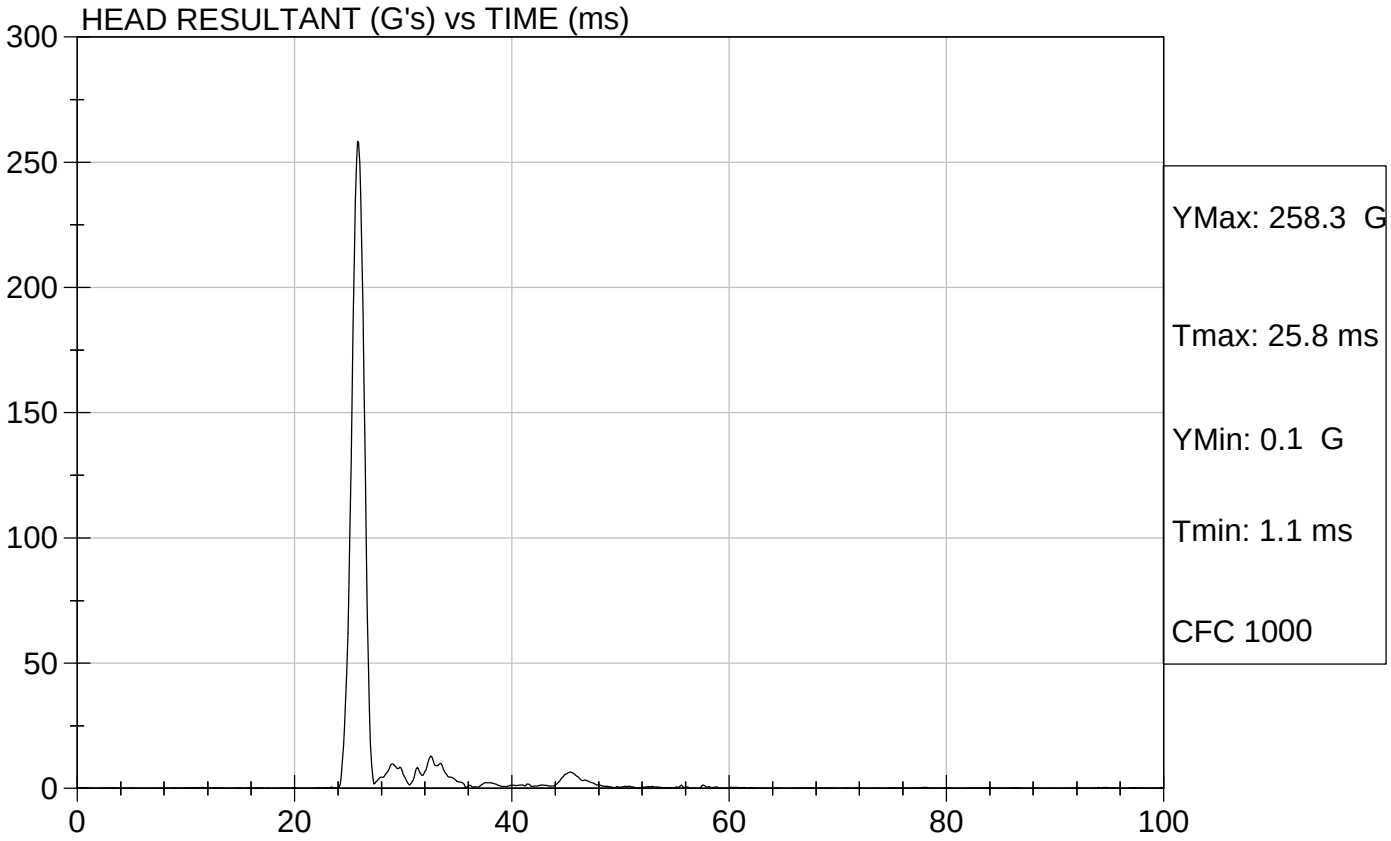
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Peak Resultant Acceleration	G's	225.0 to 275.0	258.3	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	9.9	Pass
Is Acceleration Unimodal?	Yes/No	< 10% Peak	Yes	Pass
		Overall Test Results		Pass

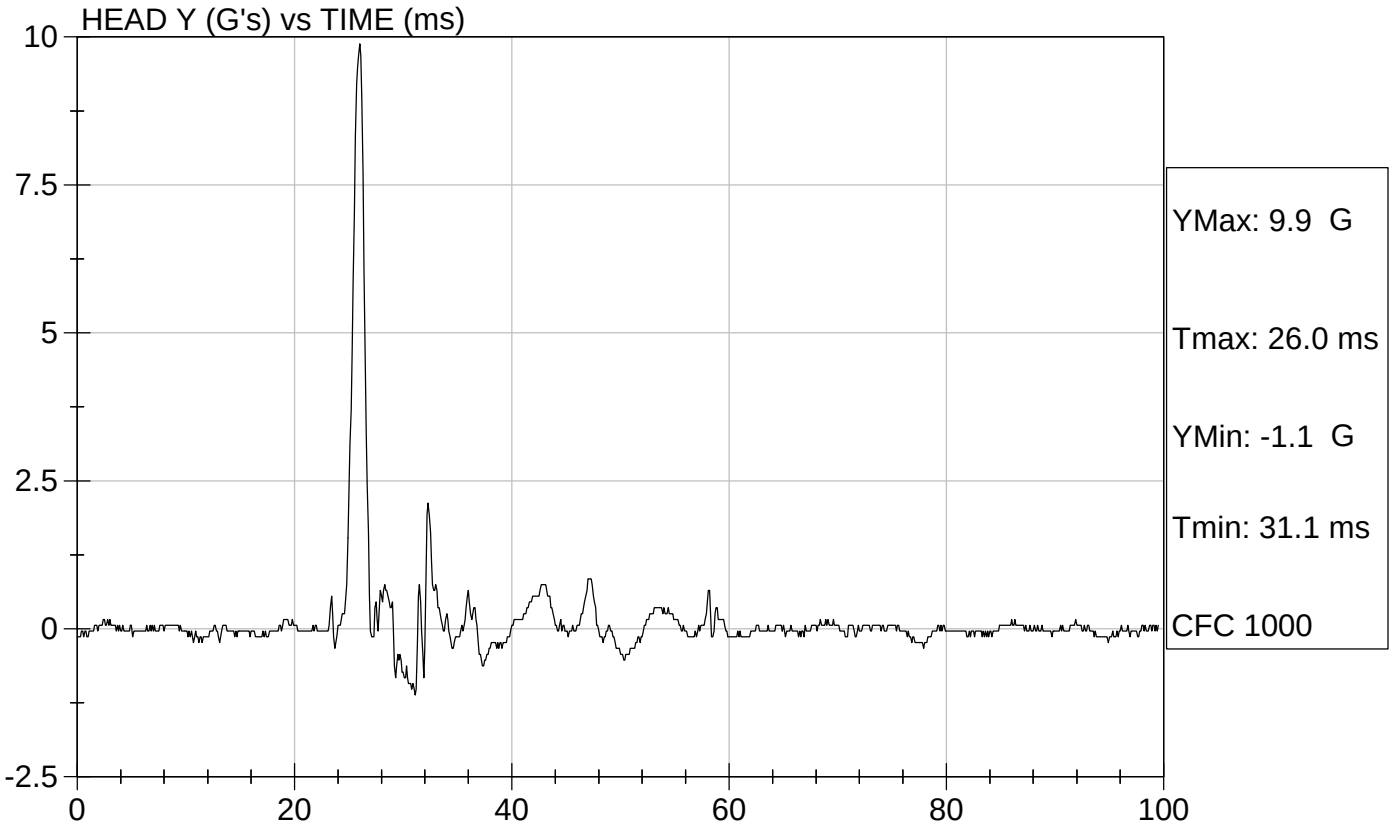
Laboratory Technician

11/13/2002
Test Date

Approved By

	Test Description: Head Drop	Test Date: 11/13/2002
	Component: D021461	Speed: 0 ft/s, 0.00 m/s





Hybrid III Calibration Data Sheet

3 Year Old

Neck Flexion Test

ATD Serial No: 042 **Test I.D:** D021462

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	31	Pass
Pendulum Speed		m/s	5.4 to 5.6	5.53	Pass
Pendulum Deceleration	10 msec	m/s	2.0 - 2.7	2.3	Pass
	15 msec	m/s	3.0 - 4.0	3.4	Pass
	20 msec	m/s	4.0 - 5.1	4.5	Pass
D Plane Rotation		deg	70 - 82	81.0	Pass
Peak Moment within Deflection Corridor		deg	42.0 - 53.0	45.1	Pass
Positive Moment - Time Curve Decay to 10 Nm		msec	60.0 - 80.0	72.0	Pass
			Overall Test Results		Pass

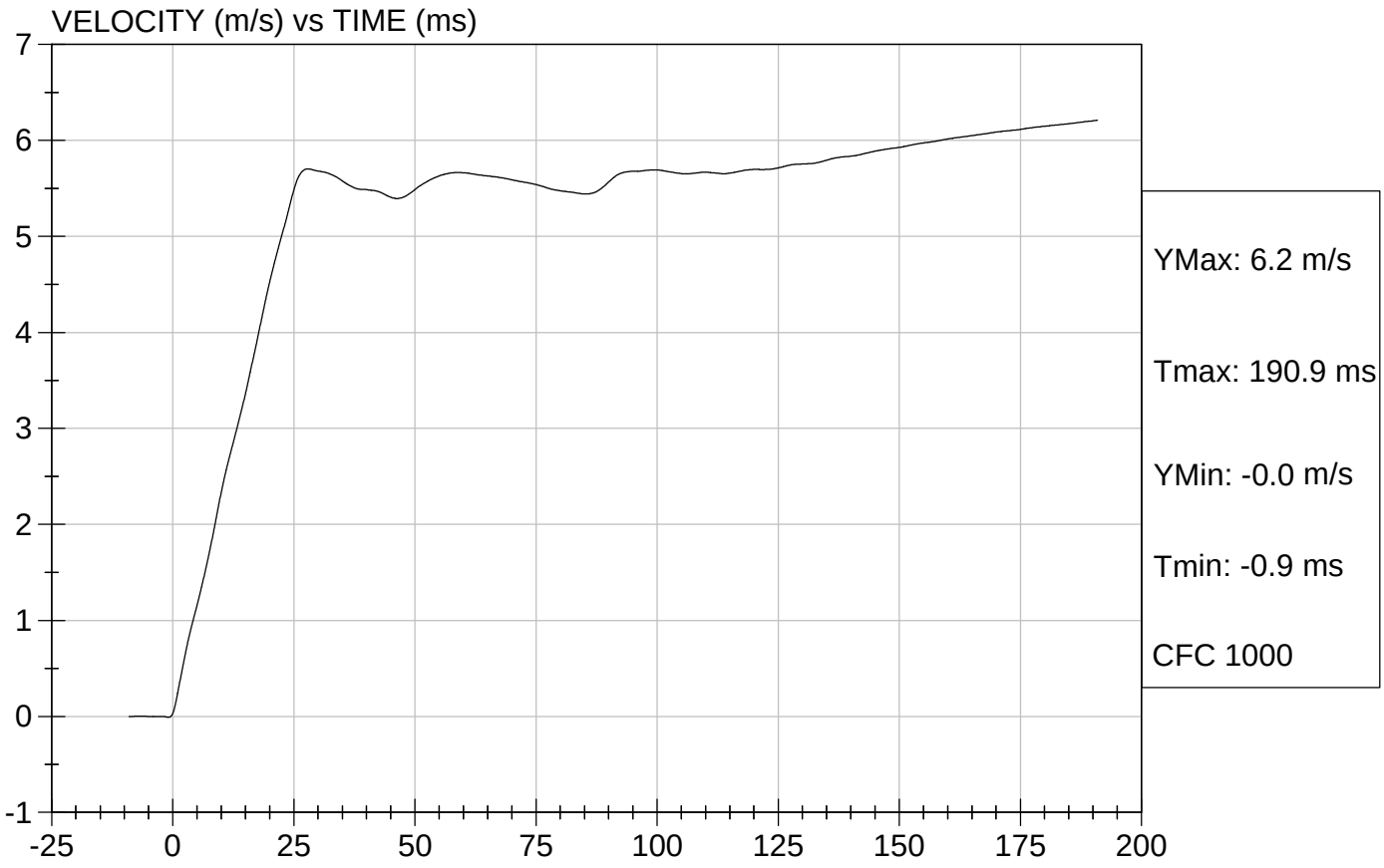
Laboratory Technician

11/14/2002
Test Date

Approved By

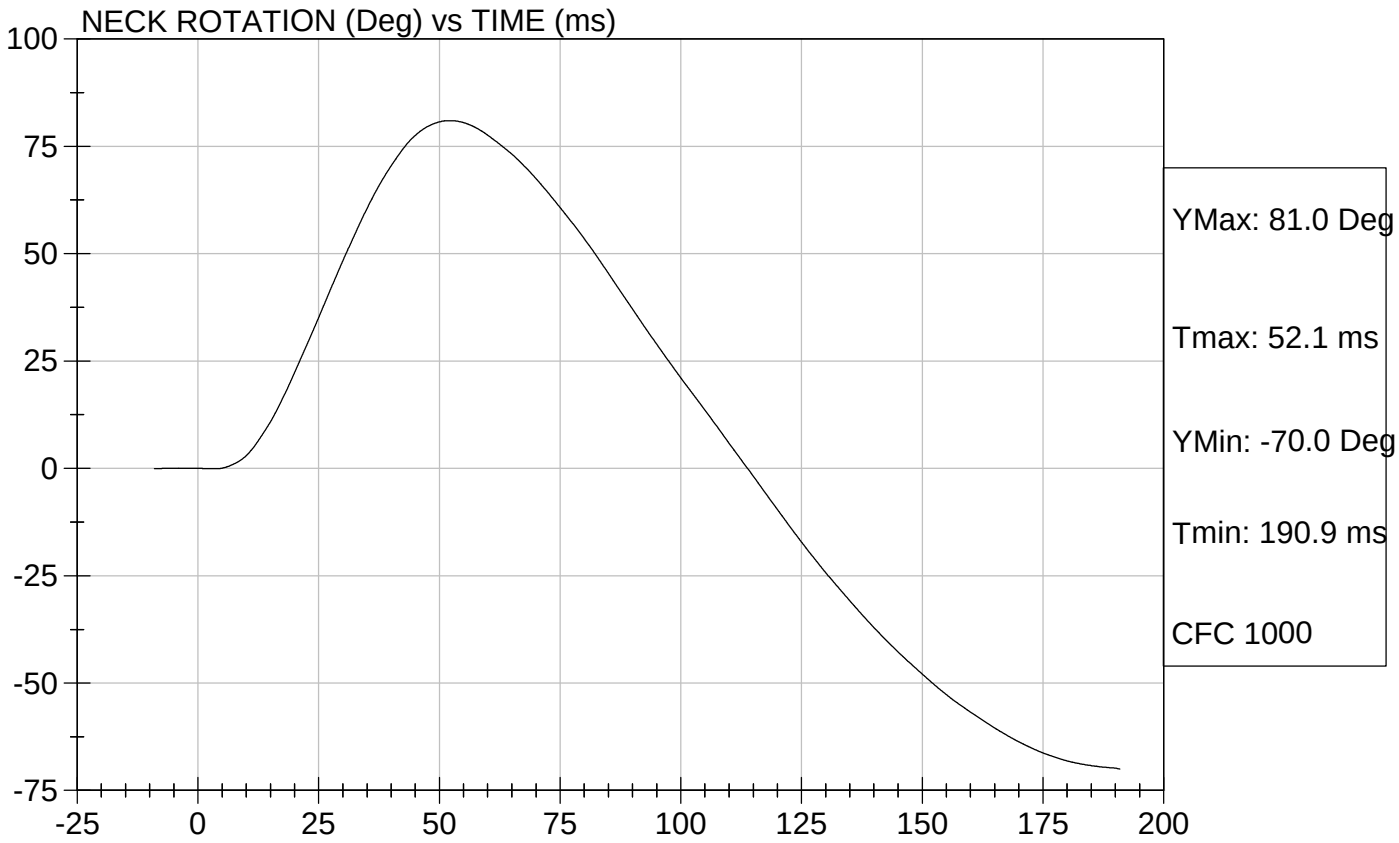
Test Description: Neck Flexion | Test Date: 11/14/2002

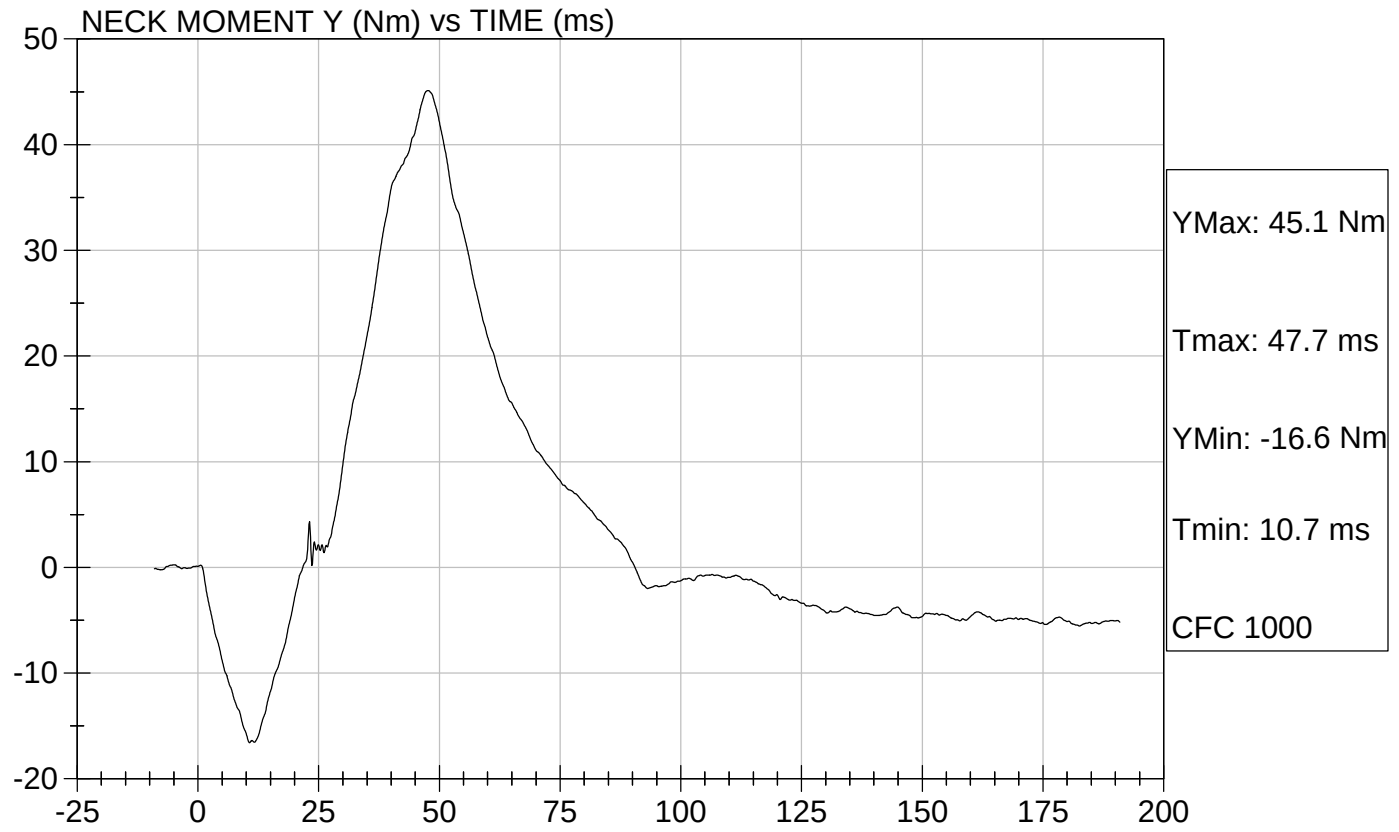
Component: D021462 | Speed: 18.15 ft/sec, 5.53 m/sec



Test Description: Neck Flexion | Test Date: 11/14/2002

Component: D021462 | Speed: 18.15 ft/s, 5.53 m/s





Hybrid III Calibration Data Sheet

3 Year Old

Neck Extension Test

ATD Serial No: 042 **Test I.D:** D021463

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	31	Pass
Pendulum Speed		m/s	3.55 to 3.75	3.73	Pass
Pendulum Deceleration	6 msec	m/s	1.0 - 1.4	1.3	Pass
	10 msec	m/s	1.9 - 2.5	2.2	Pass
	14 msec	m/s	2.8 - 3.5	3.0	Pass
D Plane Rotation		deg	83 - 93	85.8	Pass
Peak Moment within Deflection Corridor		deg	-53.3 - -43.7	-44.5	Pass
Negative Moment - Time Curve Decay to -10 Nm		msec	60.0 - 80.0	69.9	Pass
			Overall Test Results		Pass

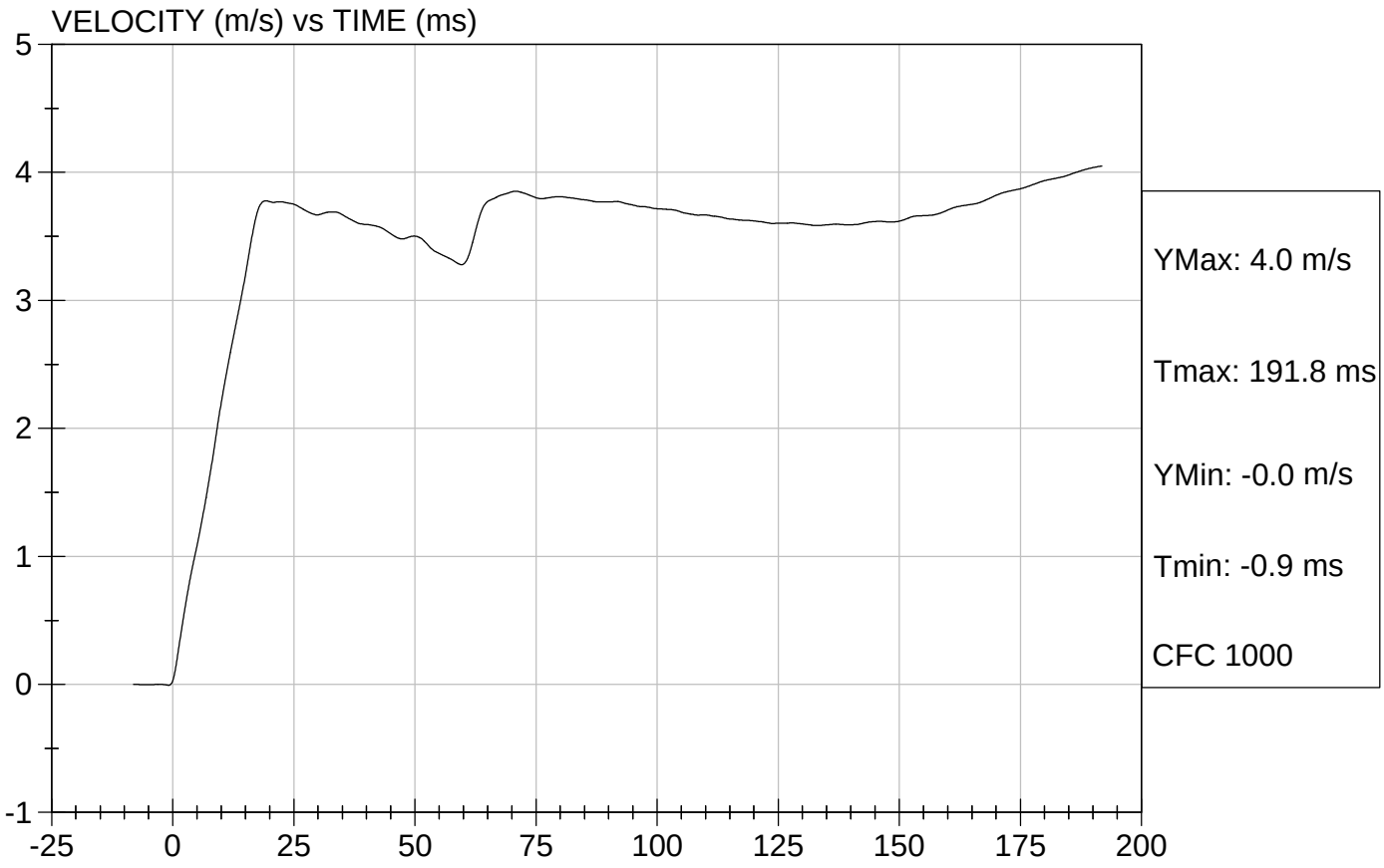
Laboratory Technician

11/14/2002
Test Date

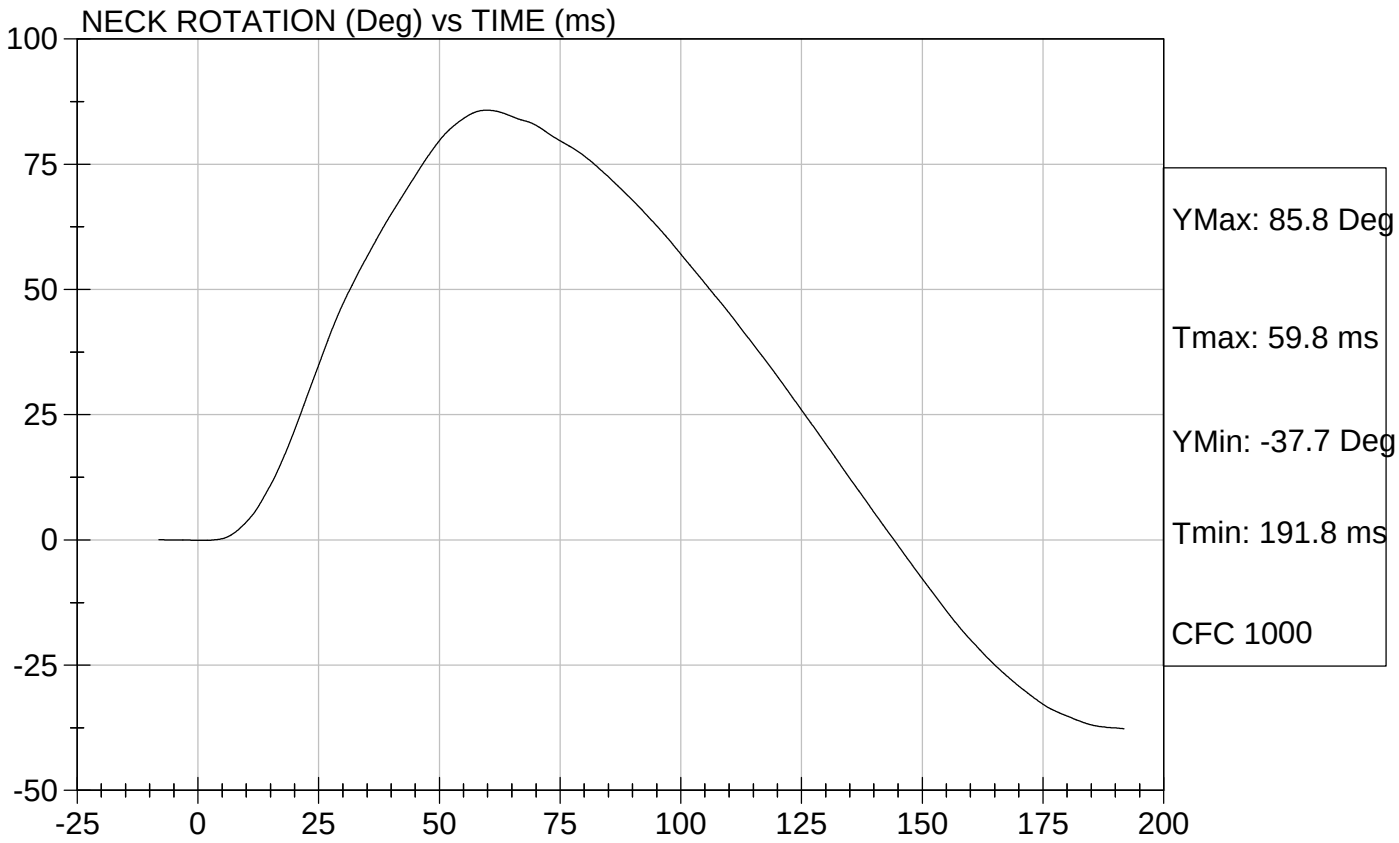
Approved By

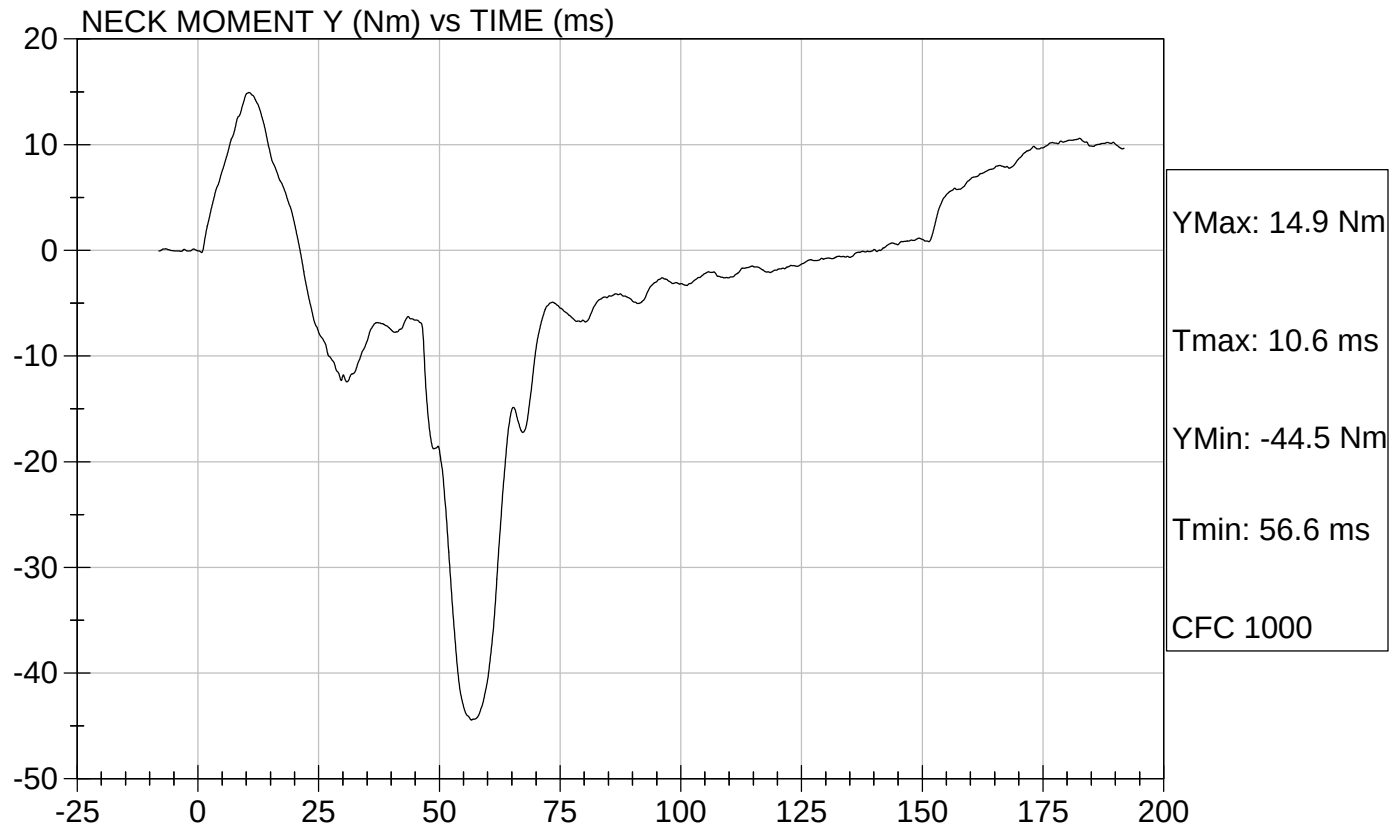
Test Description: Neck Extension Test Date: 11/14/2002

Component: D021463 Speed: 12.23 ft/sec, 3.73 m/sec



	Test Description: Neck Extension	Test Date: 11/14/2002
	Component: D021463	Speed: 12.23 ft/s, 3.73 m/s





Hybrid III Calibration Data Sheet

3 Year Old

Thorax Impact Test

ATD Serial No: 042 **Test I.D:** D021464

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Velocity	m/s	5.9 to 6.1	6.00	Pass
Peak Deflection	mm	32 - 38	33	Pass
Peak Resistive Force w/in Deflection Corridor	kN	0.68 - 0.81	0.72	Pass
Internal Hysteresis	%	65 to 85	72	Pass
Max Force 12.5 mm - 32 mm Deflection	kN	Max 0.86	0.80	Pass
		Overall Test Results		Pass

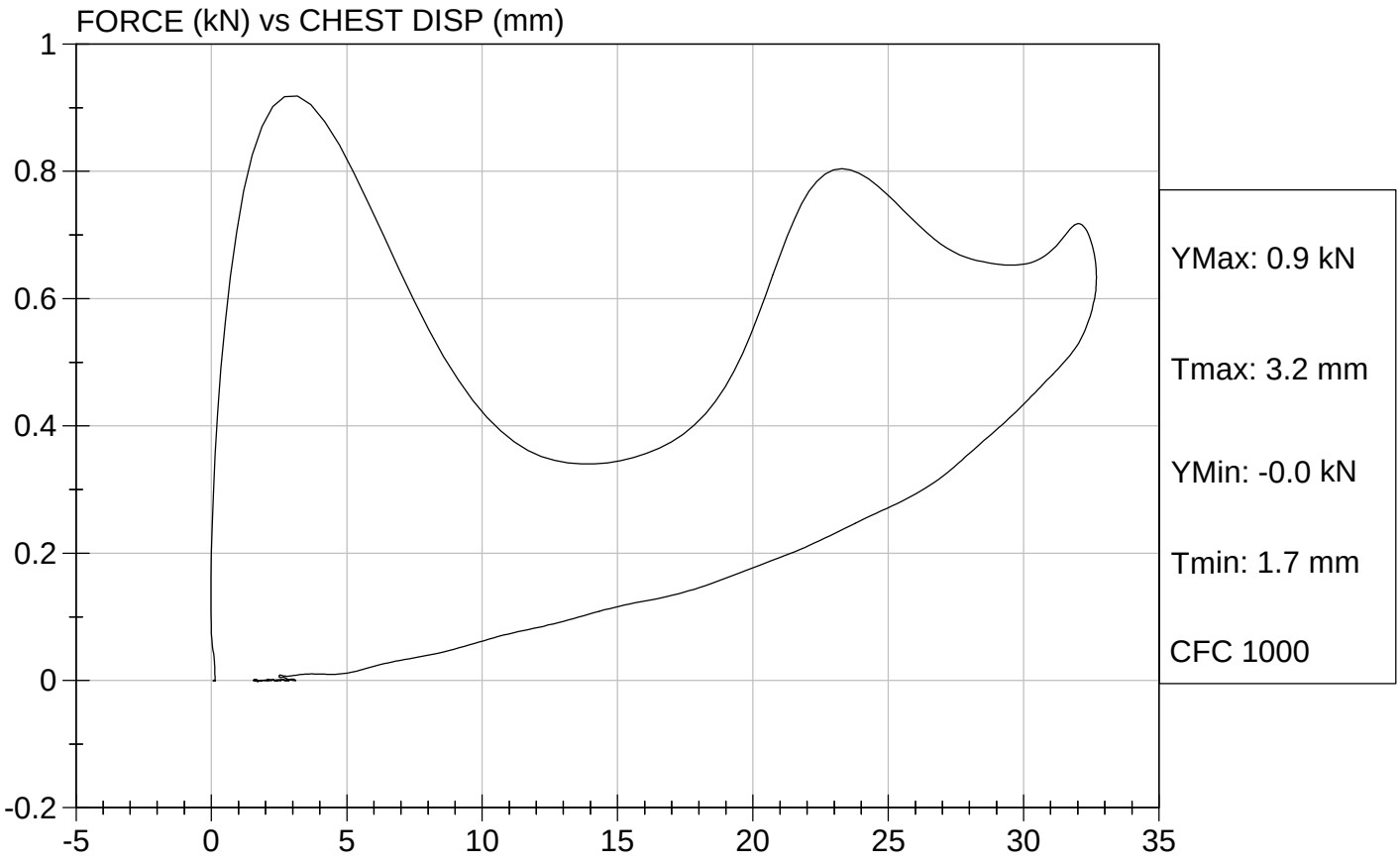
Laboratory Technician

11/15/2002
Test Date

Approved By

Test Description: Thorax Impact Test Date: 11/15/2002

Component: D021464 Speed: 19.67 ft/sec, 6.00 m/sec



Hybrid III Calibration Data Sheet

3 Year Old

Torso Lumbar Flexion

ATD Serial No: 042 **Test I.D:** D021465

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	28	Pass
Force At 45 deg.	N	130 - 180	157	Pass
Initial Angle	deg	0 - 15	8	Pass
Return Angle	deg	0 - 10	6	Pass
		Overall Test Results		Pass

Laboratory Technician

11/19/02
Test Date

Approved By

APPENDIX D

TEST EQUIPMENT LIST AND CALIBRATION INSTRUMENTATION

INSTRUMENTS FOR LRP CHILD DUMMY S/N: 40

	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	AAMD5	Endevco	11/16/02
Head Y	J27509	Endevco	11/13/02
Head Z	J20014	Endevco	11/16/02
Head Z Redundant	AC9F9	Endevco	11/16/02
Upper Neck Load Cell	86	Denton	10/4/02
Lower Neck Load Cell	210	Denton	10/4/02
Chest X	AC9P8	Endevco	11/13/02
Chest Y	J23996	Endevco	11/16/02
Chest Z	H12-F08	Entran	11/16/02
Chest Deflection Gauge	40	Servo	11/15/02
Pelvis X	BG37J	Endevco	11/16/02
Pelvis Y	J35560	Endevco	11/16/02
Pelvis Z	DE15J	Endevco	11/16/02

INSTRUMENTS FOR RRP CHILD DUMMY S/N: 42

	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	H10-F10	Entran	11/13/02
Head Y	H10-F12	Entran	11/13/02
Head Z	AJ4L1	Endevco	11/13/02
Head Z Redundant	ADAT0	Endevco	11/13/02
Upper Neck Load Cell	121	FTSS	10/4/02
Lower Neck Load Cell	120	FTSS	10/4/02
Chest X	J19547	Endevco	11/13/02
Chest Y	CC92H	Endevco	11/13/02
Chest Z	J26976	Endevco	11/13/02
Chest Deflection Gauge	42	Servo	11/15/02
Pelvis X	BE95J	Endevco	11/13/02
Pelvis Y	DE54J	Endevco	11/13/02
Pelvis Z	H12-F30	Entran	11/13/02