REPORT NUMBER: NCAPCHILD-MGA-2003-001

NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST

Century 1500 STE
Century Accel Overhead

NHTSA NUMBER: M30202

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

Test Date: November 26, 2002

Report Date: December 9, 2002

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
RULEMAKING
400 SEVENTH STREET, SW, ROOM 5311
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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FINAL REPORT ACCEPTED BY:

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Manager, New Car Assessment Program

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Date of Acceptance

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COTR, NCAP Frontal Impact Program

_____
Date of Acceptance

Technical Report Documentation Page

1. Report No. NCAPCHILD-MGA-2003-001	*2. Government Accession No.*	*3. Recipient's Catalog No.*	
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.: M30202		*5. Report Date* December 9, 2002 *6. Performing Organization Code* MGA	
7. Author(s) Shefalika Agarwal, Project Engineer		*8. Performing Organization Report No.* NCAPCHILD-MGA-2003-001	
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 400 Seventh Street, SW Washington, D.C. 20590		*13. Type of Report and Period Covered* Final Report 11/26/02 to 12/9/02 *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 November 26, 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: M30202		*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	
19. Security Classif. (of this report) Unclassified	*20. Security Classif. (of this page)* Unclassified	*21. No. of Pages* 93	22. Price

Form DOT F1700.7 (8-72)

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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 581.4; maximum chest deceleration over 3 msec was 42.7 g's. The left rear child dummy's HIC was 756.9. The maximum chest deceleration over 3 msec was 51.2 g's. The position 4 system utilized the vehicle seatbelt and top tether for attachment, the position 3 system 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	Door remained closed and latched; Door opened without tools
Right Side Doors	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
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	No
P2 (Right Front)	0	No
P3 (Right Rear)	4	No
P4 (Left Rear)	10	No

VISIBLE DUMMY CONTACT POINTS

Description	Position 3 CRS (S/N 42)	Position 4 CRS (S/N 40)
Head Contact	Right Rear Vehicle Headrest	Child Seat Overhead Shield
Upper Torso Contact	None	None
Lower Torso Contact	none	None
Left Foot Contact	Right Front Seatback	Left Front Seatback
Right Foot Contact	Right Front Seatback	Left Front Seat Frame

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.	M30202

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	2508.0
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	100.2
Calculated Vehicle Target Weight (TVTW)	kg	2764.2

TEST VEHICLE WEIGHTS

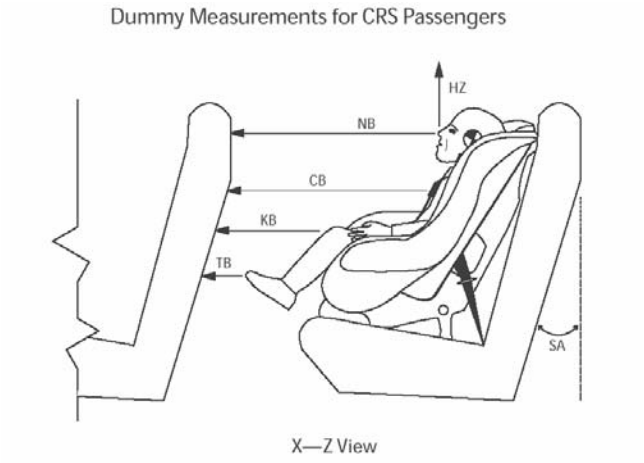
	Units	As Tested (ATW) (Axle)		
		Front	Rear	Total
Left	kg	674.0	725.3	
Right	kg	670.4	688.1	
Ratio	%	48.7	51.3	
Totals	kg	1344.4	1413.4	2757.8

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.	M30202



Measurement	Pre-Test (mm)		Post-Test (mm)	
	P3 CRS (42)	P4 CRS (40)	P3 CRS (42)	P4 CRS (40)
SA (deg)	16.6	16.6	16.6	16.6
HZ	457	365	476	396
NB	670	573	694	618
CB	673	586	646	609
KB – Left	359	380	404	385
KB – Right	354	370	416	393

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.	M30202

HEAD PEAK ACCELERATIONS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Head CG	X	G's	0.7	26	-42.8	112	10.1	200	-28.6	116
Head CG	Y	G's	22.9	112	-9.8	122	5.1	95	-5.7	73
Head CG	Z	G's	60.0	91	-22.0	50	61.9	83	-17.1	56
Resultant	N/A	G's	64.1	91			65.3	83		
Redundant	Z	G's	77.8	90	-34.8	51	87.6	87	-30.0	56

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	24	185	-597	92	32	192	-636	80
Neck Force	Y	N	36	148	-51	191	106	96	-128	75
Neck Force	Z	N	2007	91	-603	51	2095	89	-512	56
Resultant	N/A	N	2069	91			2161	89		
Neck Moment	X	N•m	3.7	152	-9.3	92	2.5	64	-7.5	81
Neck Moment	Y	N•m	4.9	150	-10.5	117	4.7	85	-10.1	66
Neck Moment	Z	N•m	2.6	165	-2.4	200	1.2	176	-1.5	95
Resultant	N/A	N•m	13.8	92			10.2	66		

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	114	200	-873	91	145	200	-1275	91
Neck Force	Y	N	588	90	-58	198	222	90	-50	198
Neck Force	Z	N	1132	90	-856	51	1353	88	-669	56
Resultant	N/A	N	1528	90			1846	90		
Neck Moment	X	N•m	5.7	148	-18.2	94	5.8	95	-16.4	78
Neck Moment	Y	N•m	109.6	91	-9.4	200	109.2	90	-9.6	200
Neck Moment	Z	N•m	4.3	153	-10.8	94	2.4	175	-3.3	81
Resultant	N/A	N•m	111.1	91			109.2	90		

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.	M30202

CHEST PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Chest CG	X	G's	3.2	199	-33.2	82	3.8	139	-41.3	87
Chest CG	Y	G's	4.7	88	-7.4	114	3.0	81	-4.6	62
Chest CG	Z	G's	19.2	90	-36.2	63	28.2	91	-36.3	61
Resultant	N/A	G's	43.2	64			52.8	58		

TETHER FORCE

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Lumbar Force	N/A	N	336.3	76	-19.7	189	192.5	80	-14.5	142

PELVIC PEAK ACCELERATIONS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Pelvis	X	G's	13.1	195	-30.8	54	8.9	141	-54.2	60
Pelvis	Y	G's	5.3	58	-7.3	66	11.9	77	-7.4	85
Pelvis	Z	G's	36.9	61	-7.7	195	14.8	92	-41.4	62
Resultant	N/A	G's	47.3	64			67.7	60		

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.	M30202

HEAD INJURY CRITERIA (HIC36)

Location	HIC	T^1 (msec)	T^2 (msec)	Average Acceleration (G's)
Position 3 - Right	581.4	71.5	107.5	48.2
Position 4 – Left	756.9	70.2	106.2	53.6

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

HEAD INJURY CRITERIA (HIC15)

Location	HIC	T^1 (msec)	T^2 (msec)	Average Acceleration (G's)
Position 3 - Right	354.3	79.3	94.3	56.1
Position 4 – Left	460.4	77.0	92.0	62.3

HIC 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	42.7	62.6	65.6
Position 4 – Left	51.2	57.2	60.2

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	0.14
Nte	1.23
Ncf	0
Nce	0.43

POSITION 4 NECK INJURY SUMMARIES

Nij V10	Nij
Ntf	1.03
Nte	0.96
Ncf	0.04
Nce	0.36

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.	M30202

POSITION 3 CRS POST-TEST INSPECTION

Location	Damage	Remarks
Upper Tether Strap	None	
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	

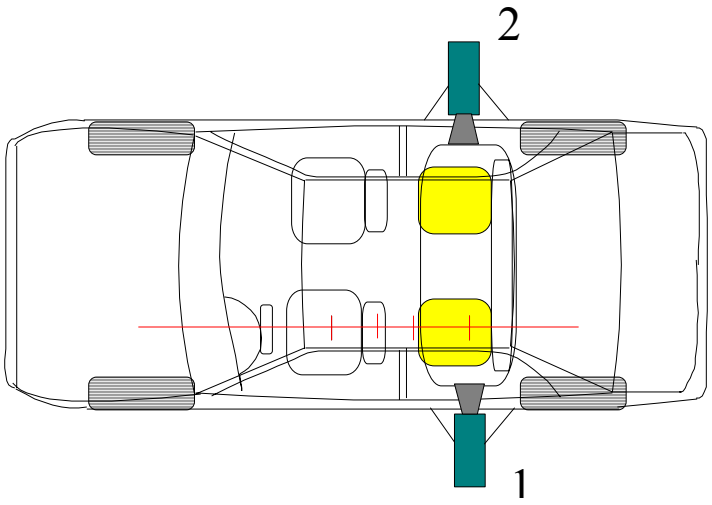
POSITION 4 CRS POST-TEST INSPECTION

Location	Damage	Remarks
Upper Tether Strap	None	
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	Yes	Some stress marks where vehicle seatbelt was routed through the CRS
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.	M30202



No.	Camera View	Location (mm) *			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Onboard Left Side CRS Lateral View				13	505
2	Onboard Right Side CRS Lateral View				13	503

*COORDINATES:

+X = film plane rearward of barrier

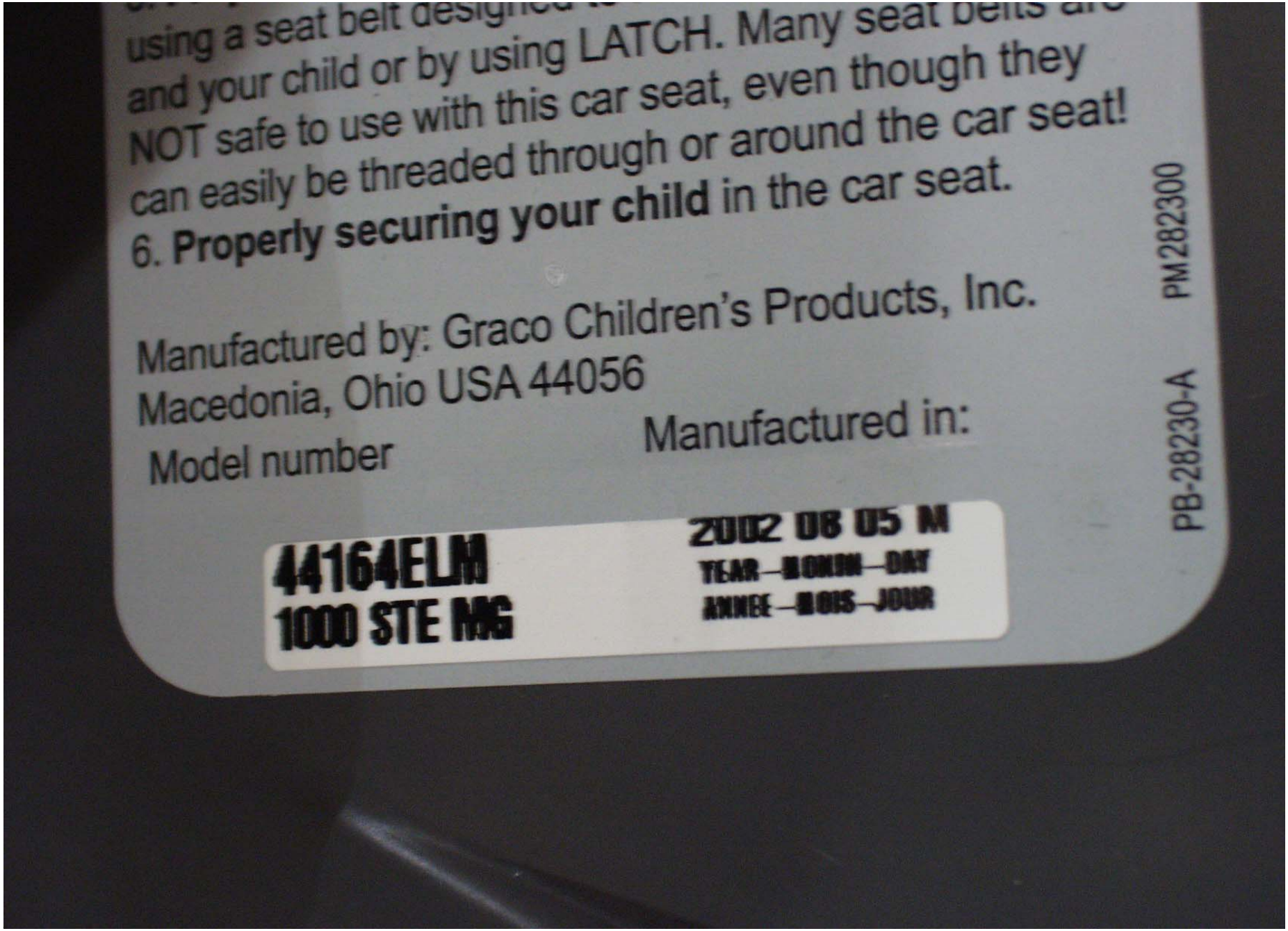
+Y = film plane to right of monorail centerline

+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

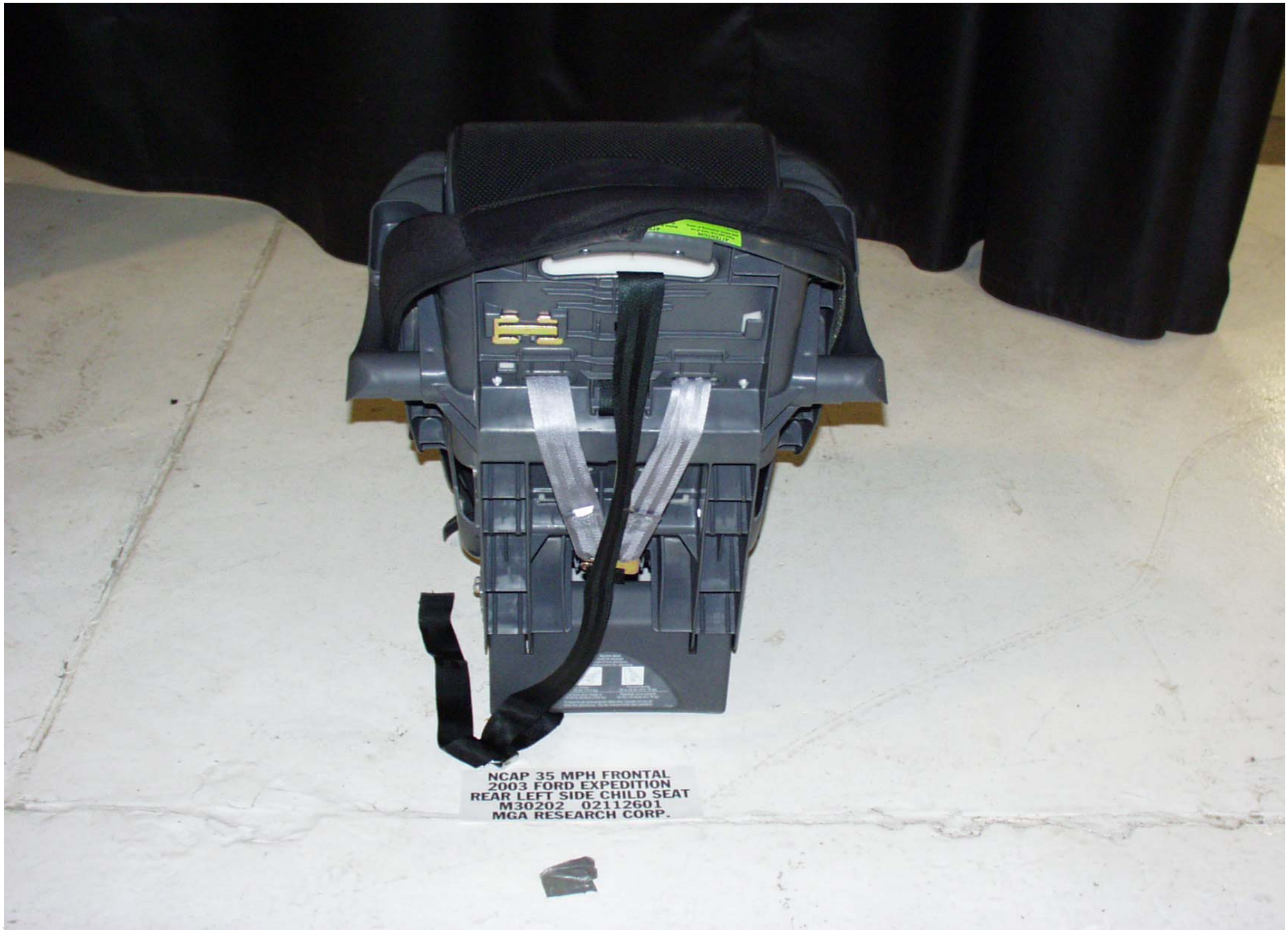
Post-Test Right Side View of Position 3 CRS

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

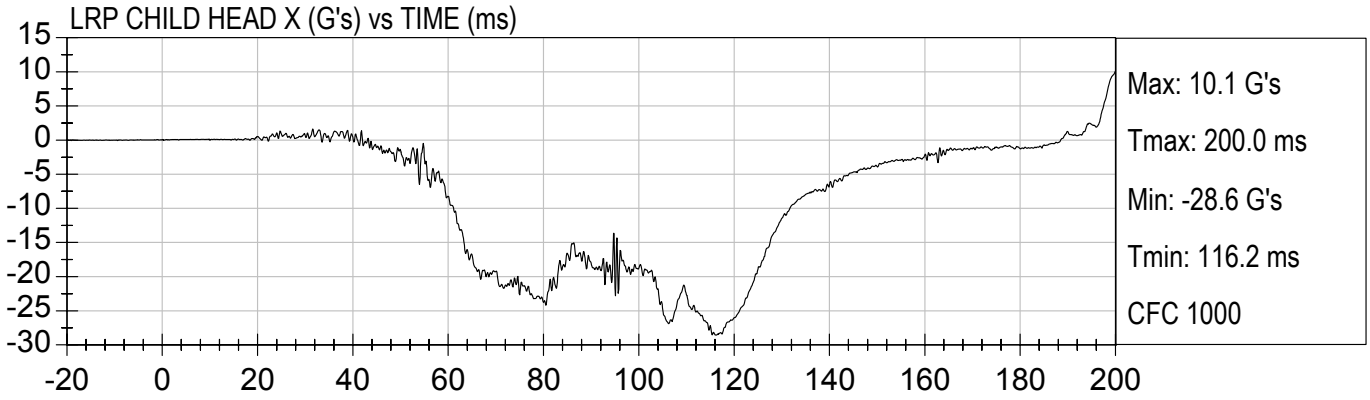
APPENDIX B

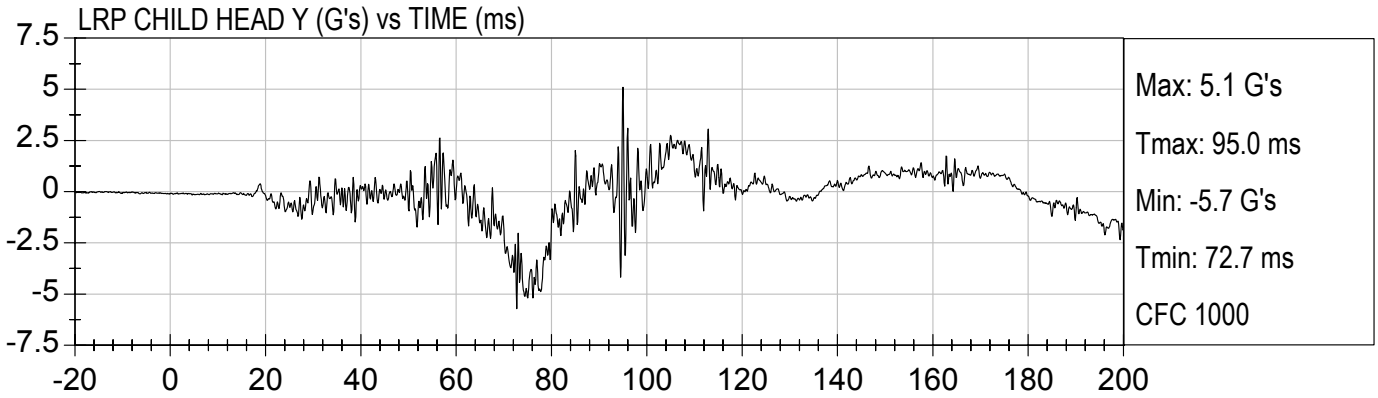
CHILD DUMMY RESPONSE DATA TRACES

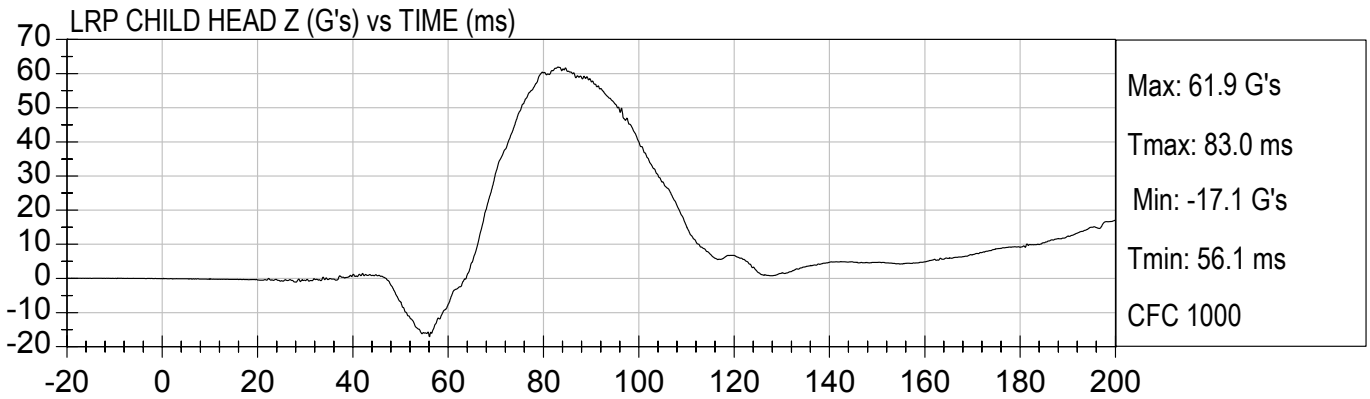
TABLE OF DATA PLOTS

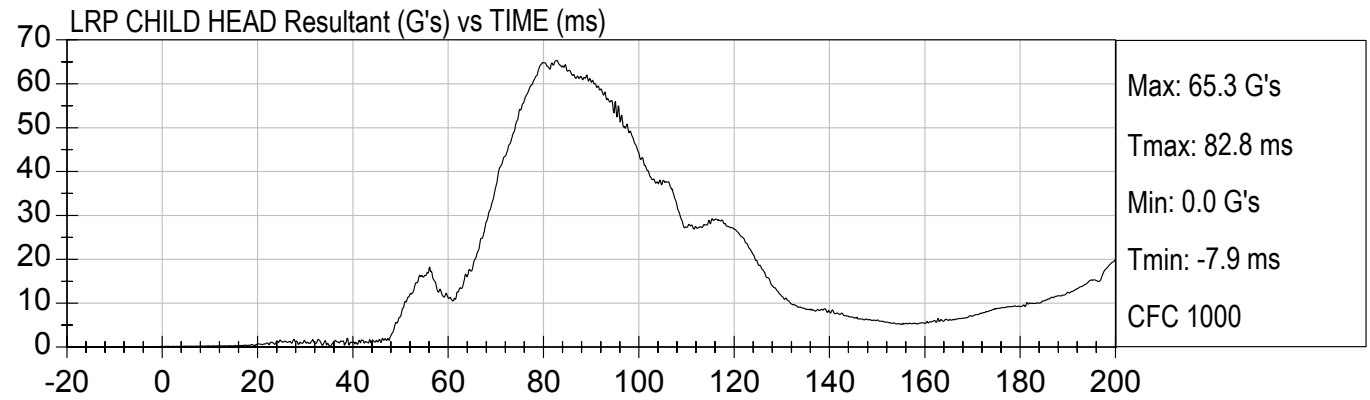
35 MPH FRONTAL IMPACT
2003 FORD EXPEDITION (M30202)

Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)









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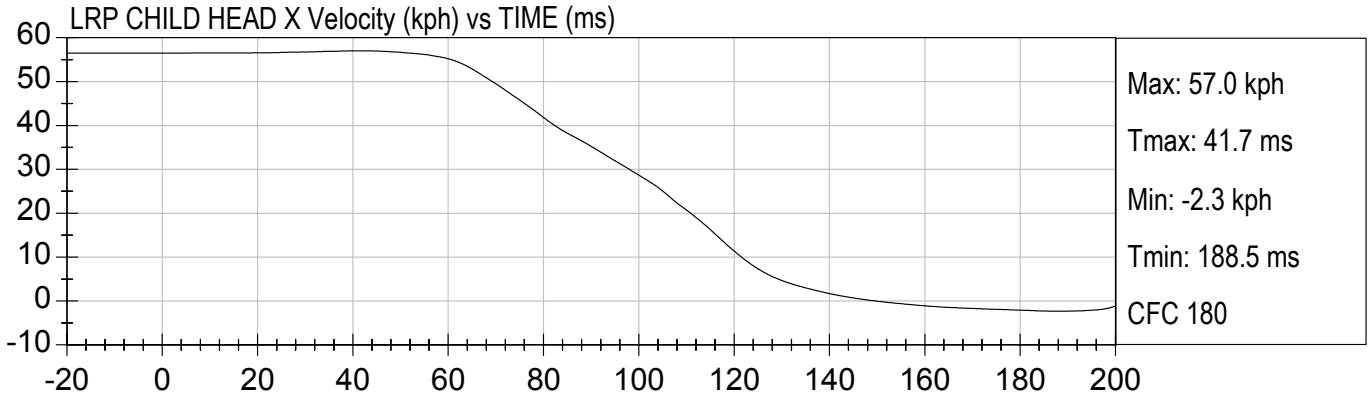

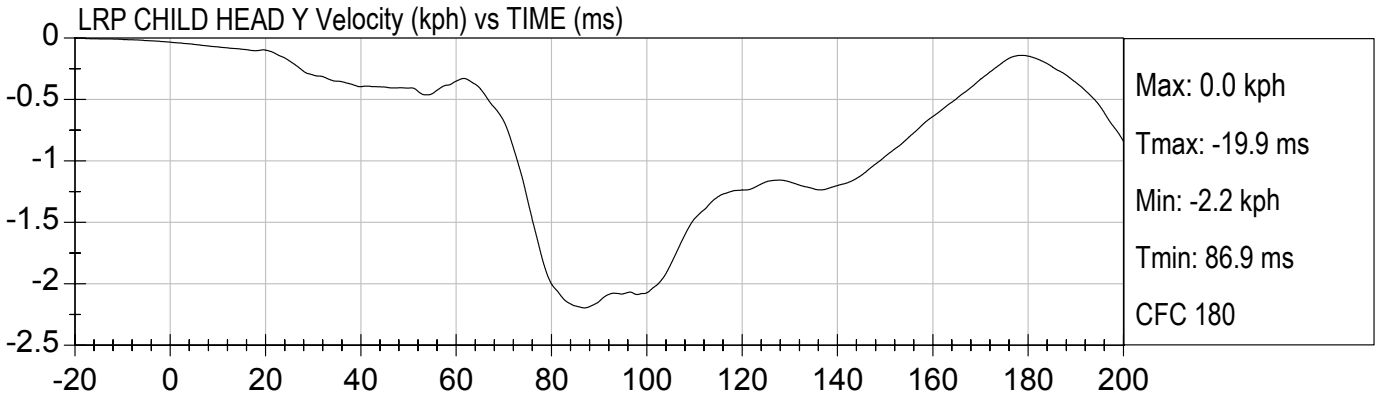

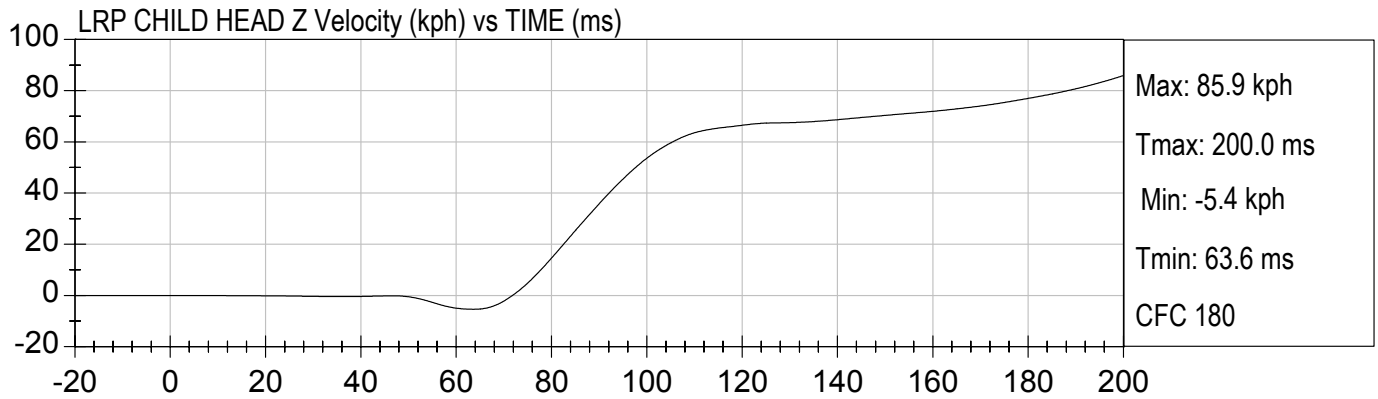

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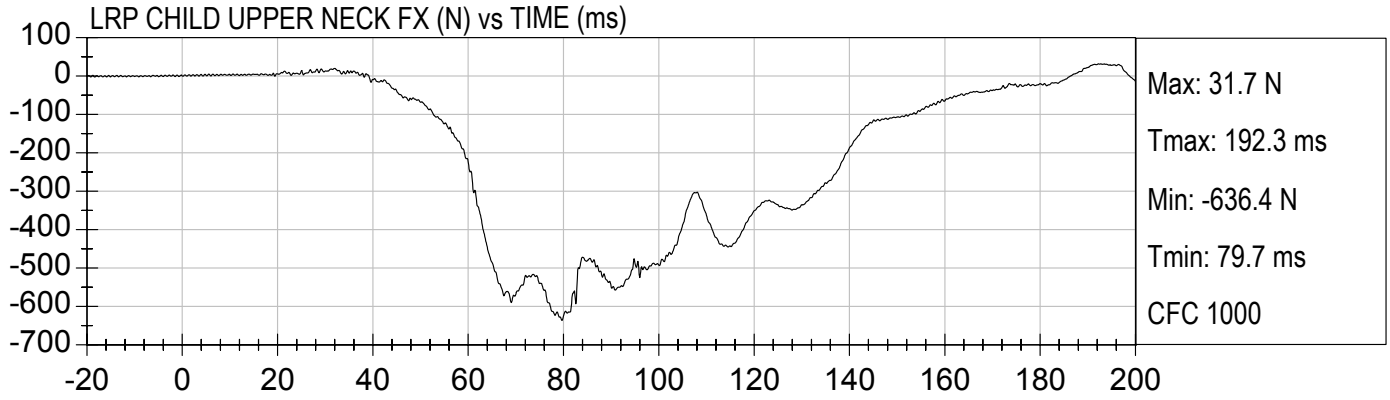

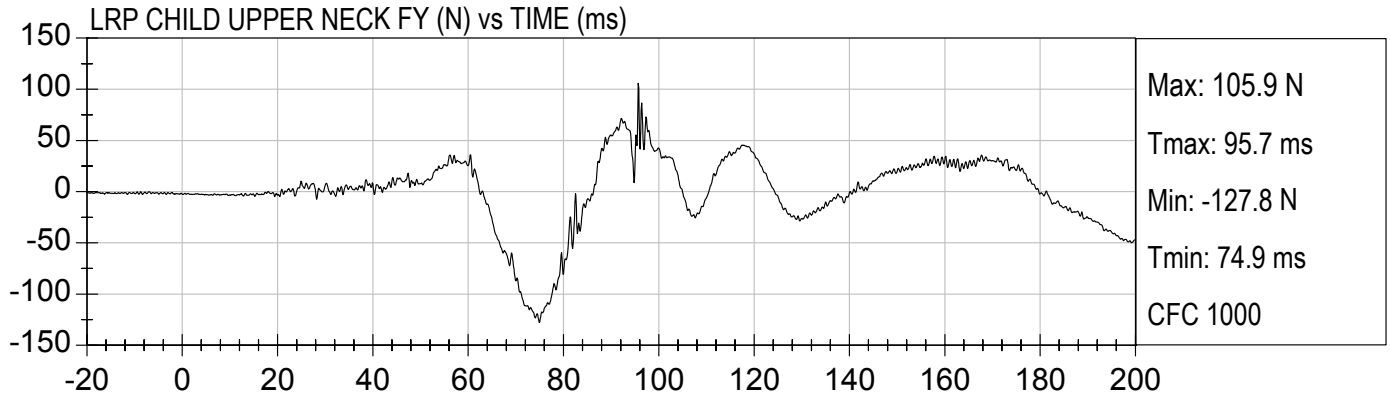

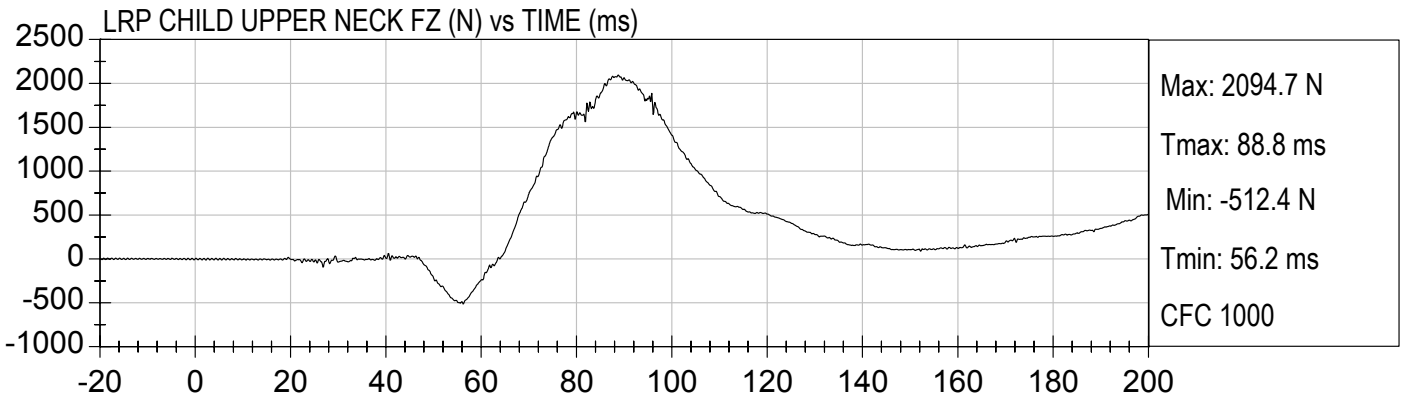

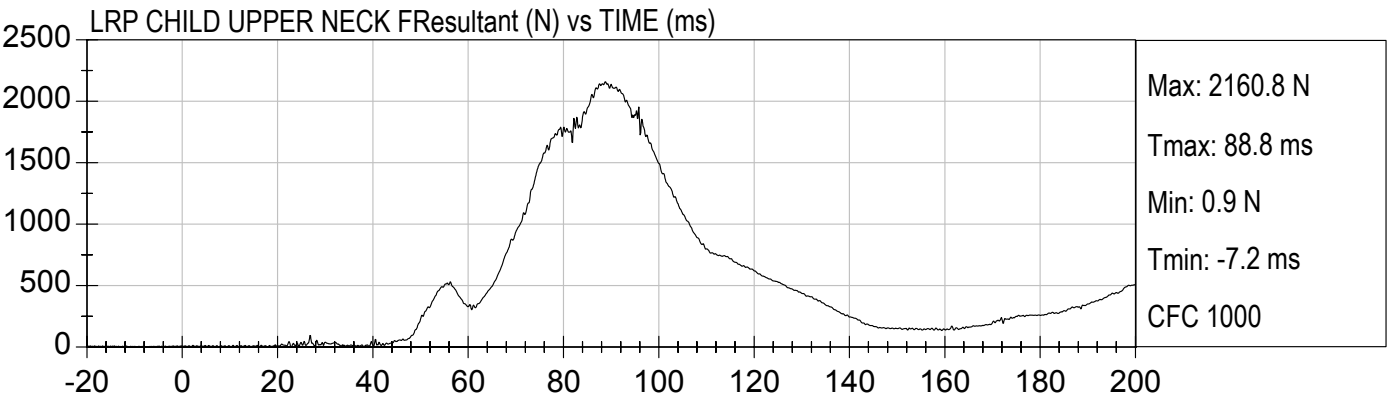

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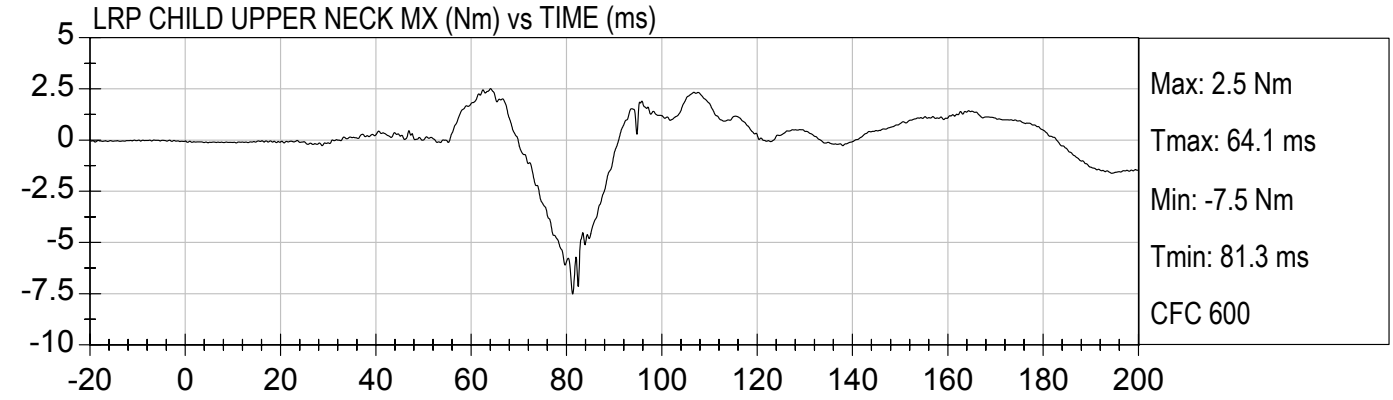

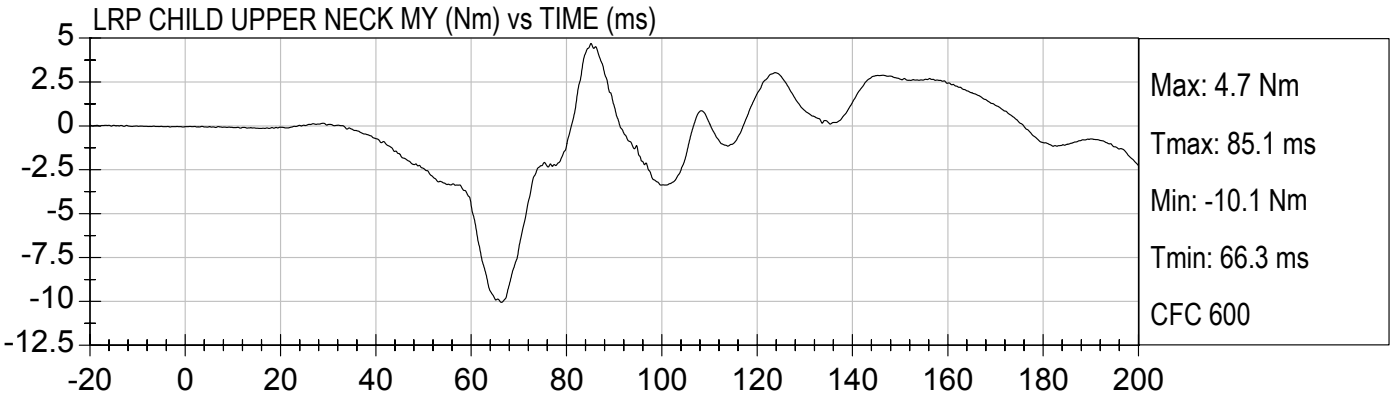

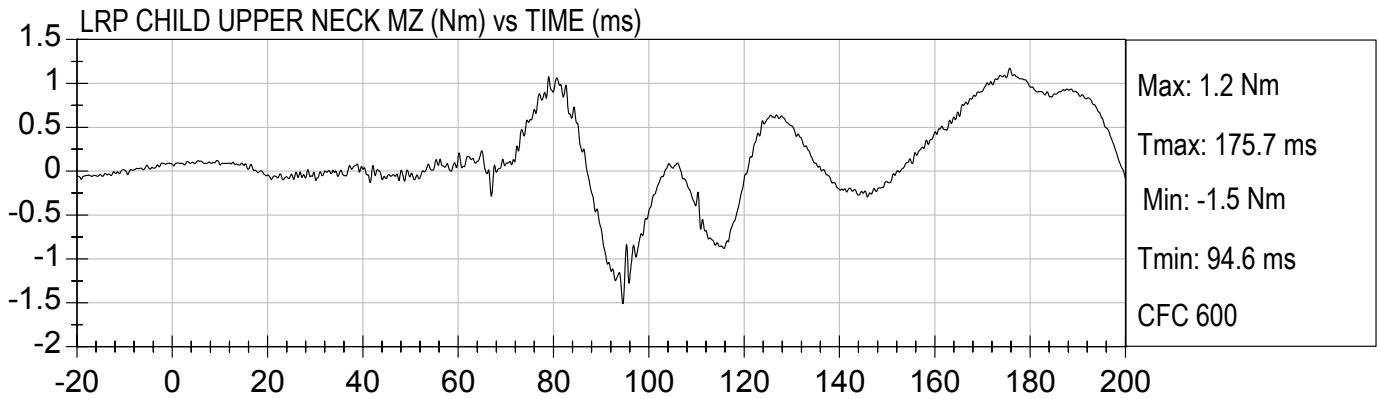

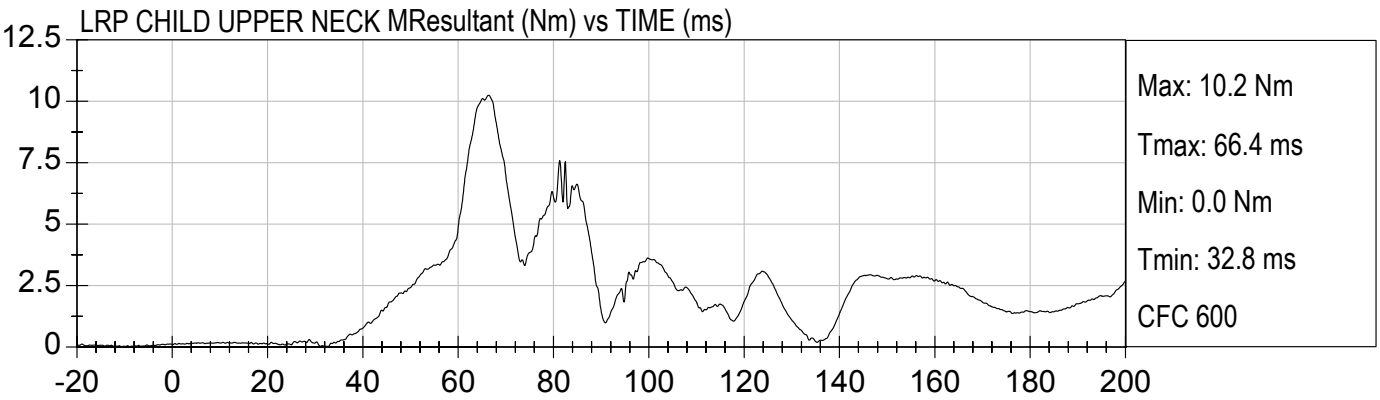

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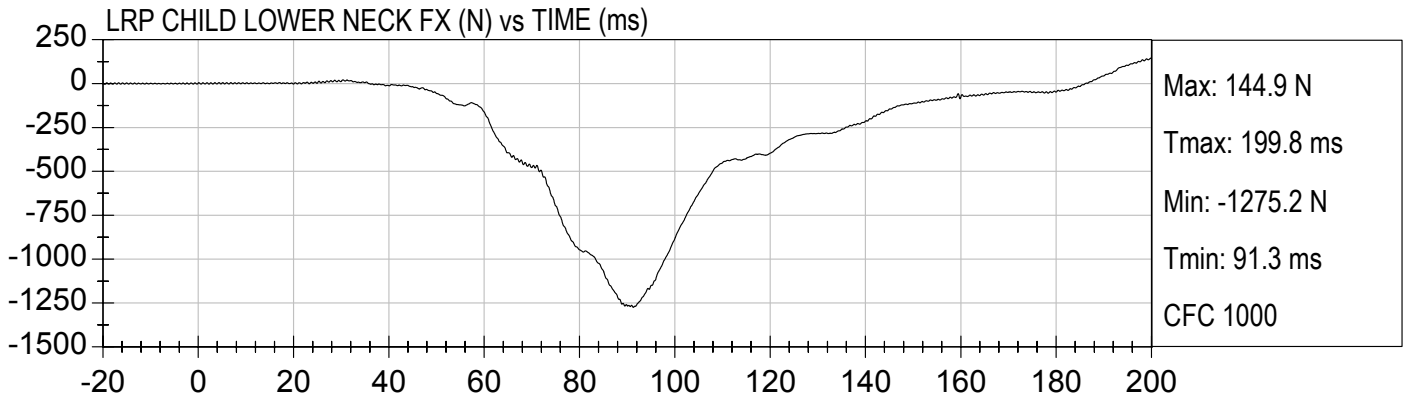

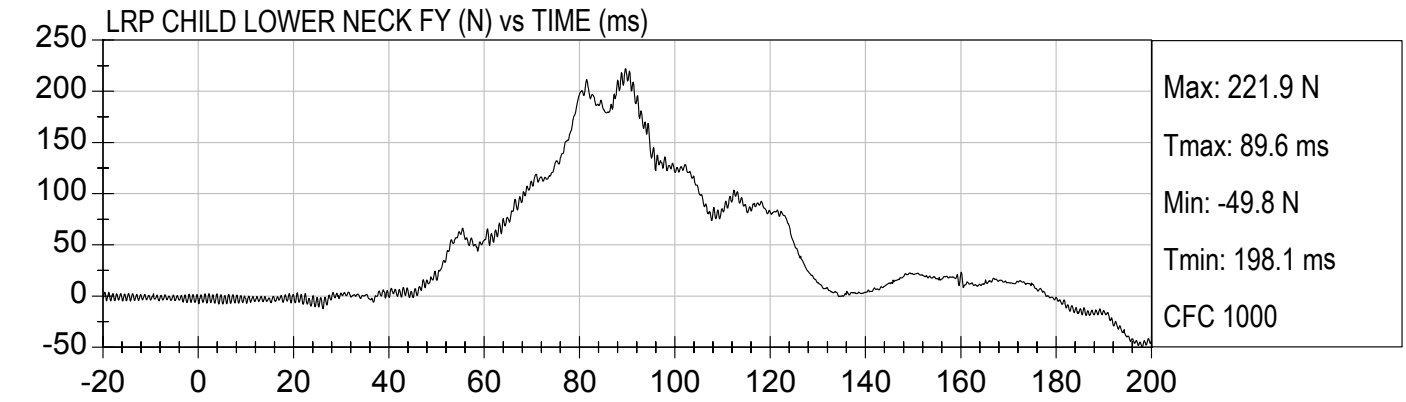

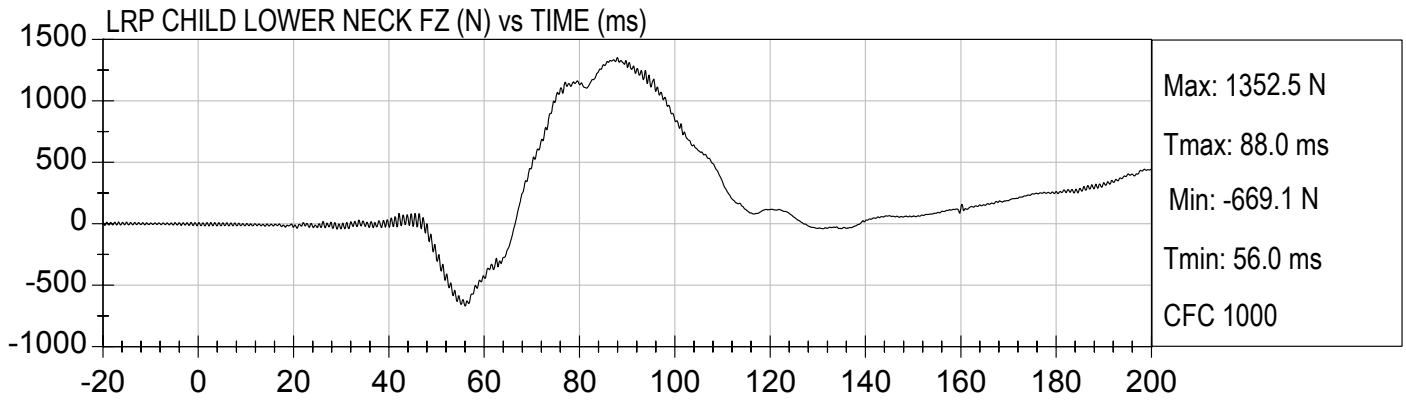

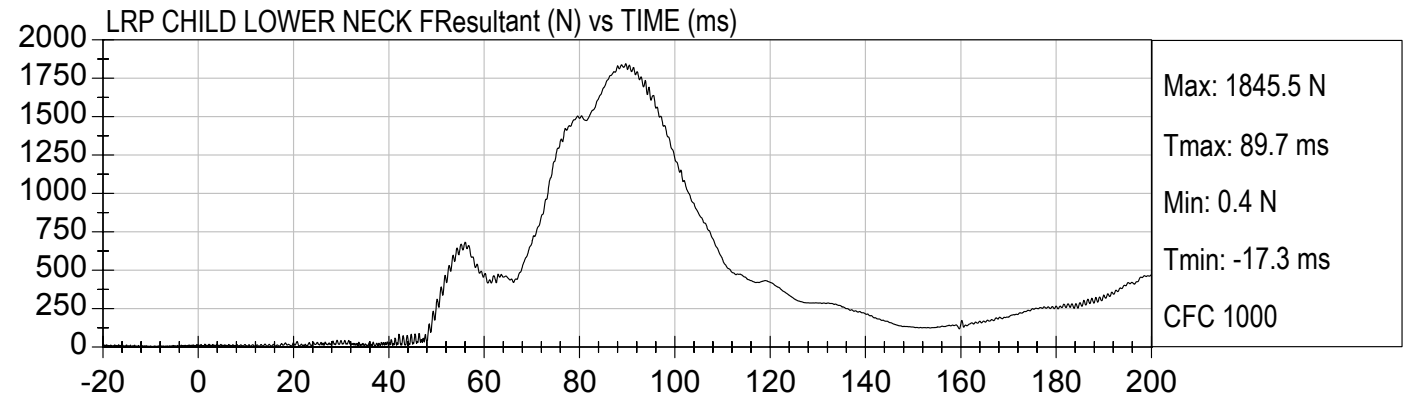

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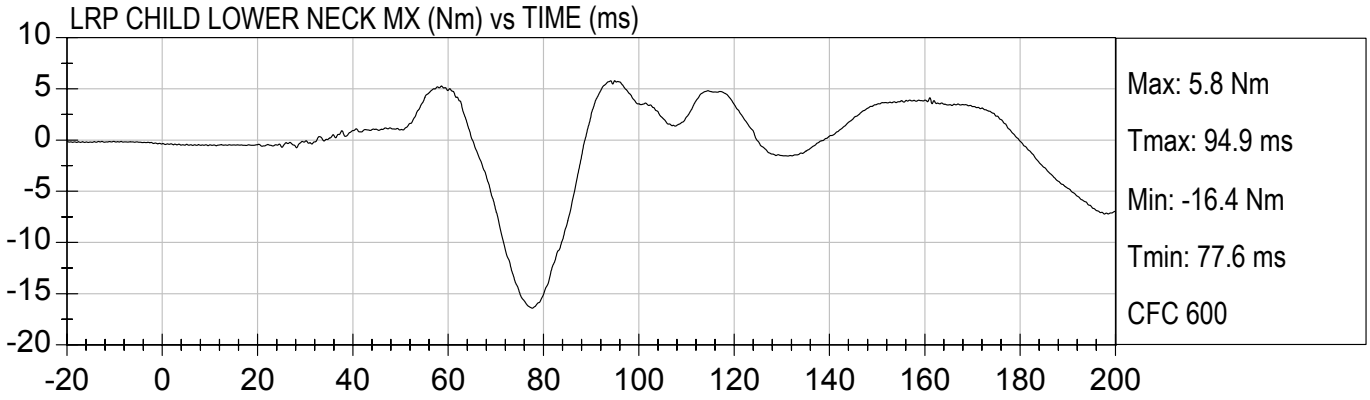
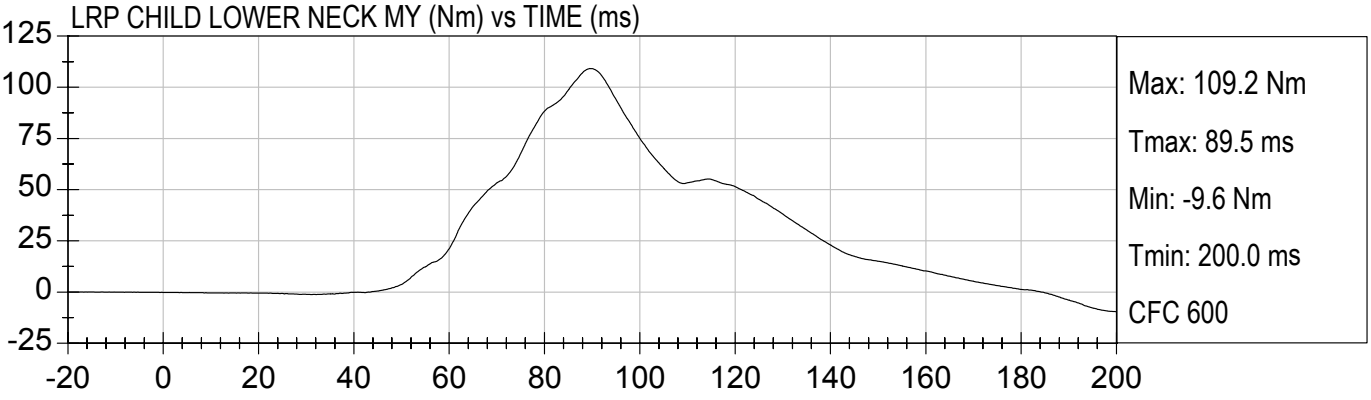
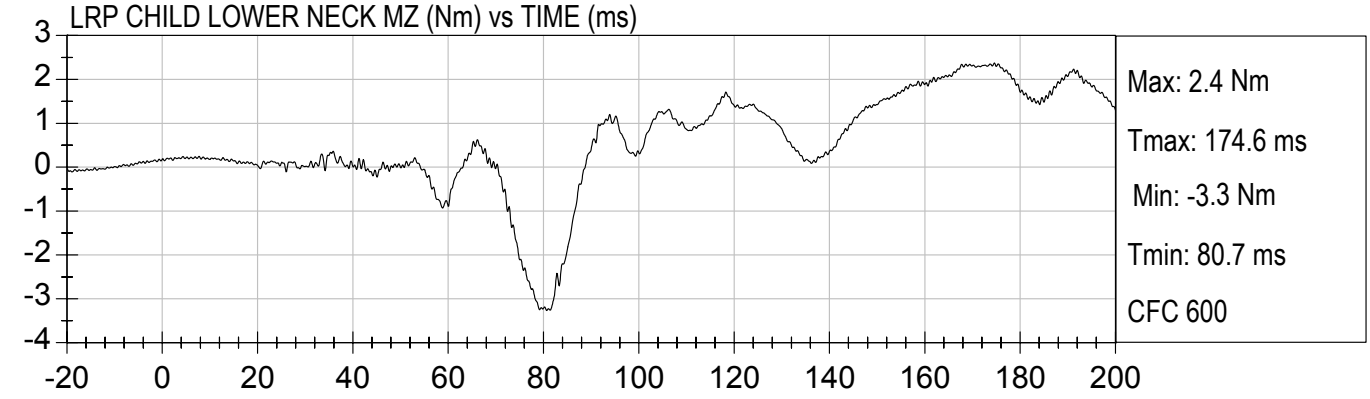
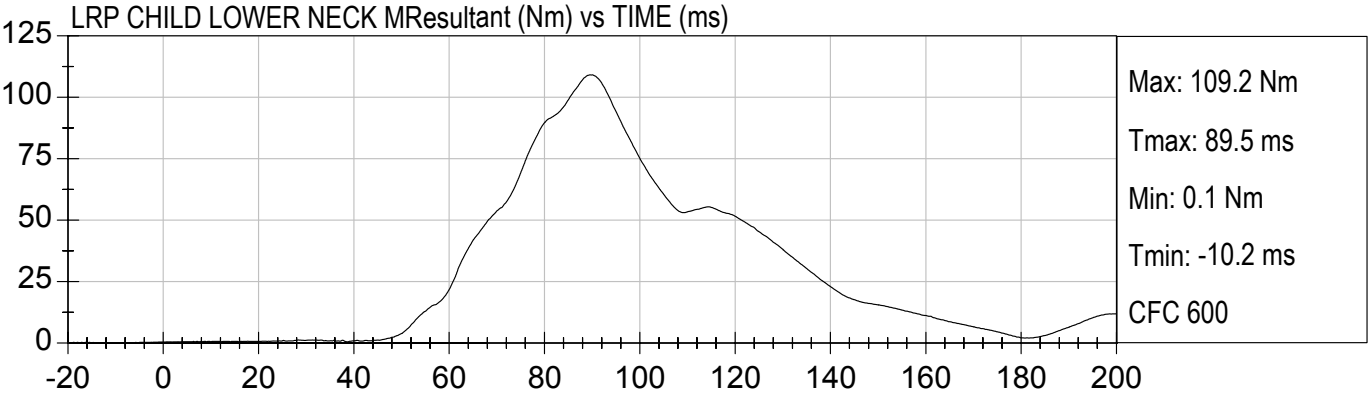
2003 FORD EXPEDITION (M30202)

Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)



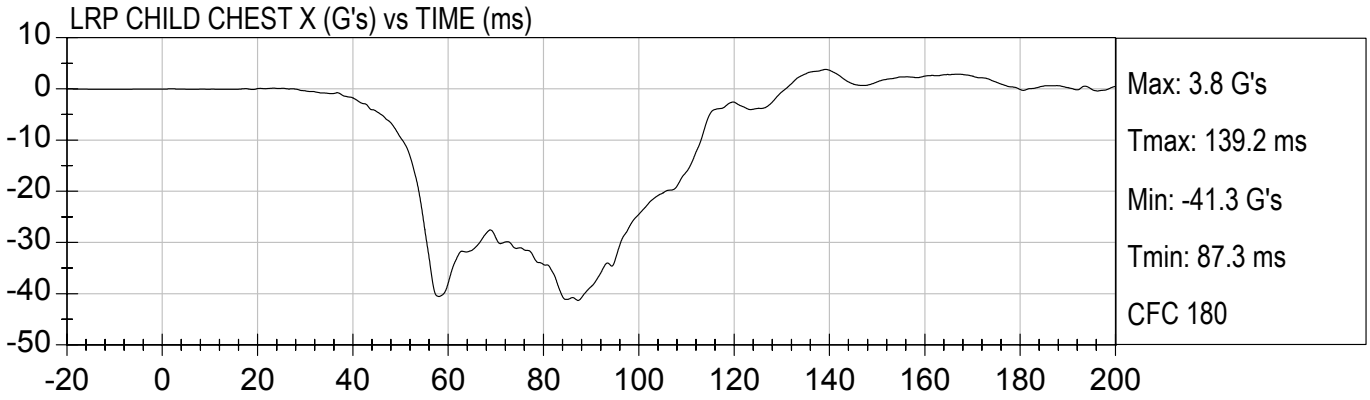


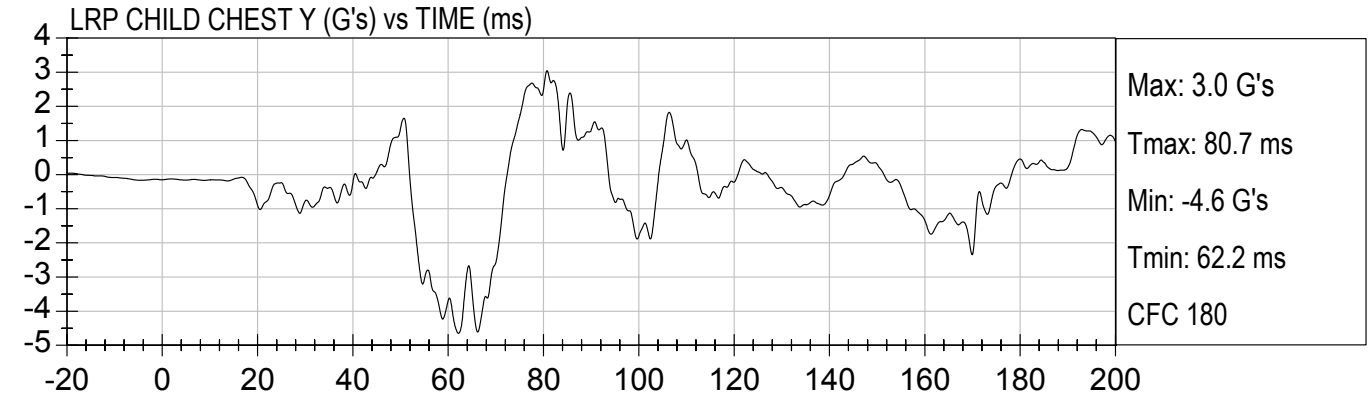


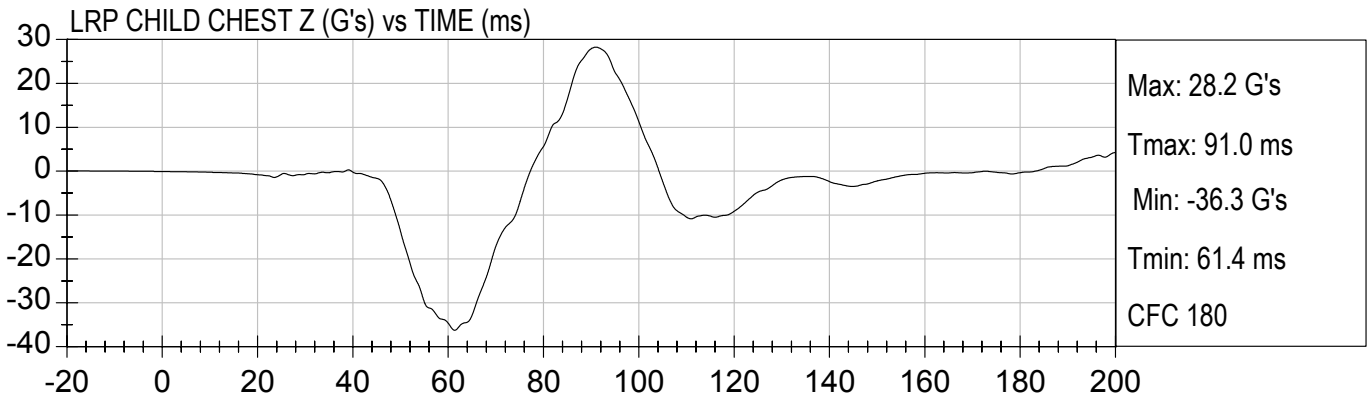


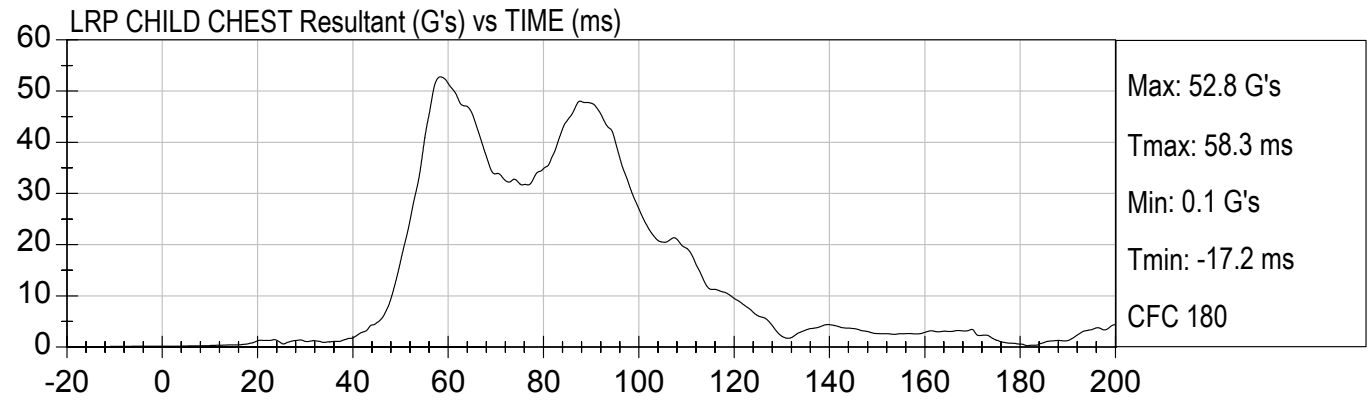
35 MPH FRONTAL IMPACT
2003 FORD EXPEDITION (M30202)

Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)



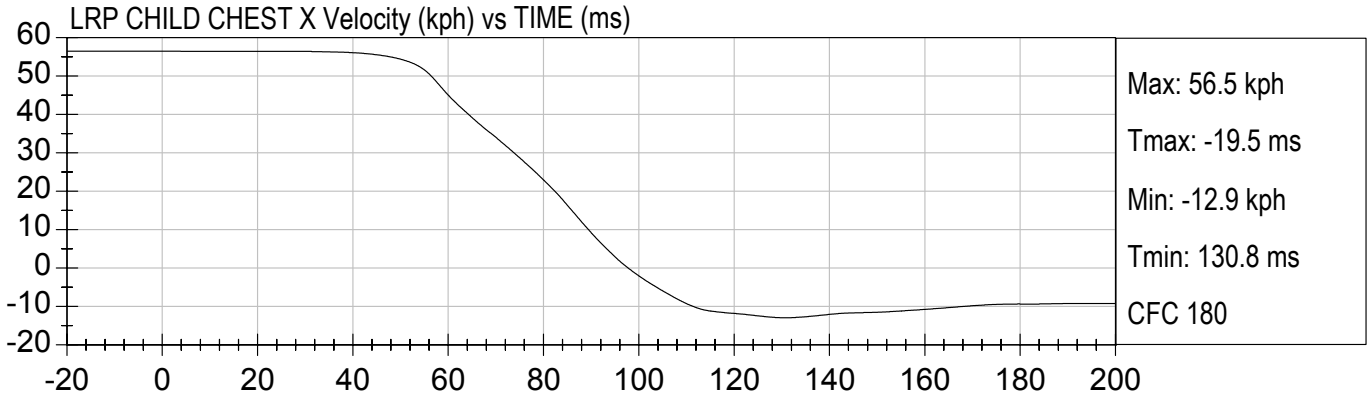


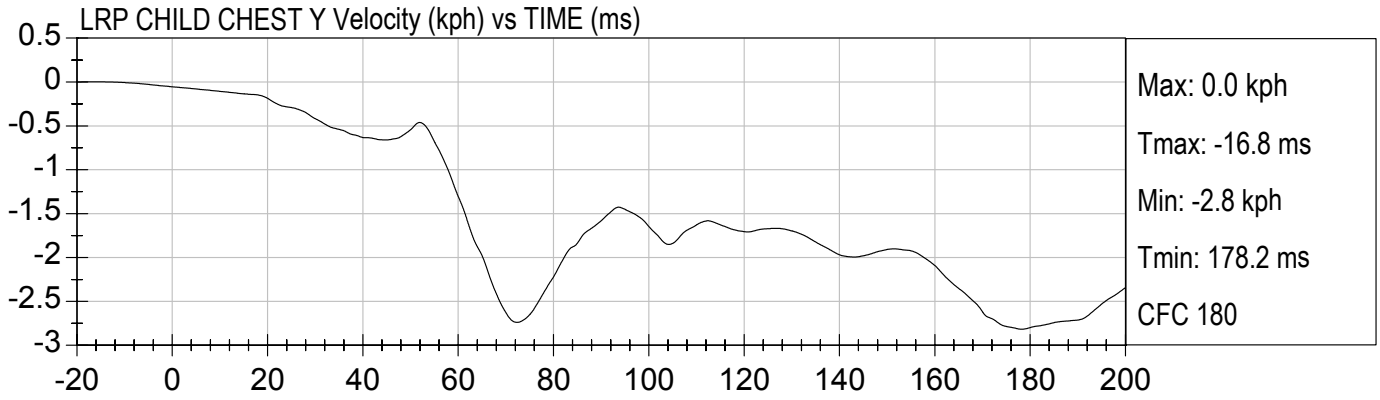


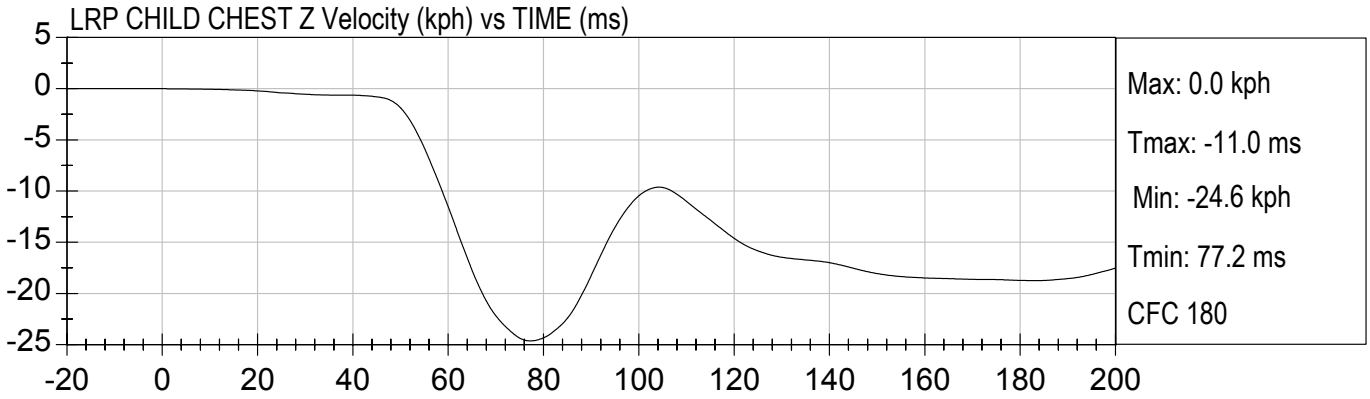


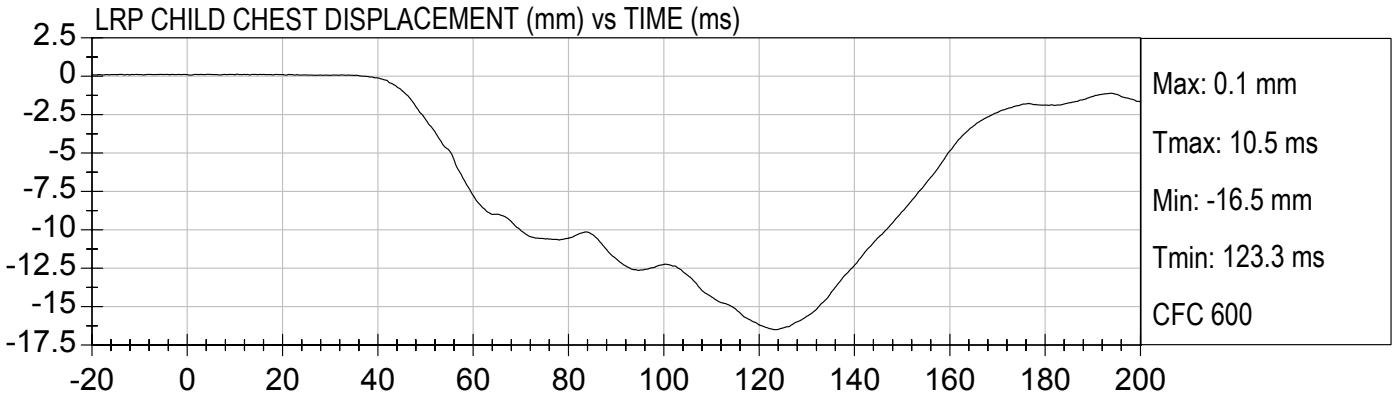
35 MPH FRONTAL IMPACT
2003 FORD EXPEDITION (M30202)

Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)



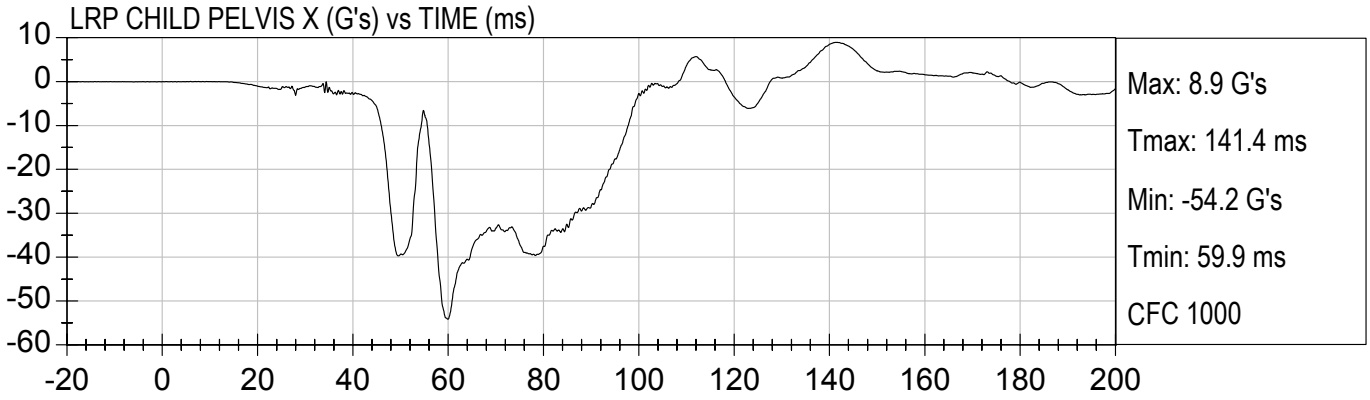


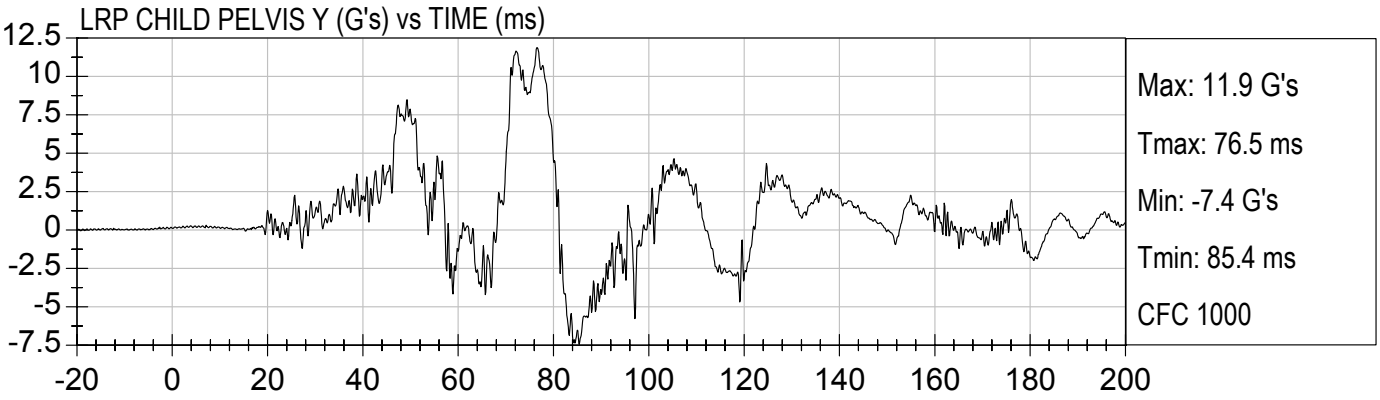


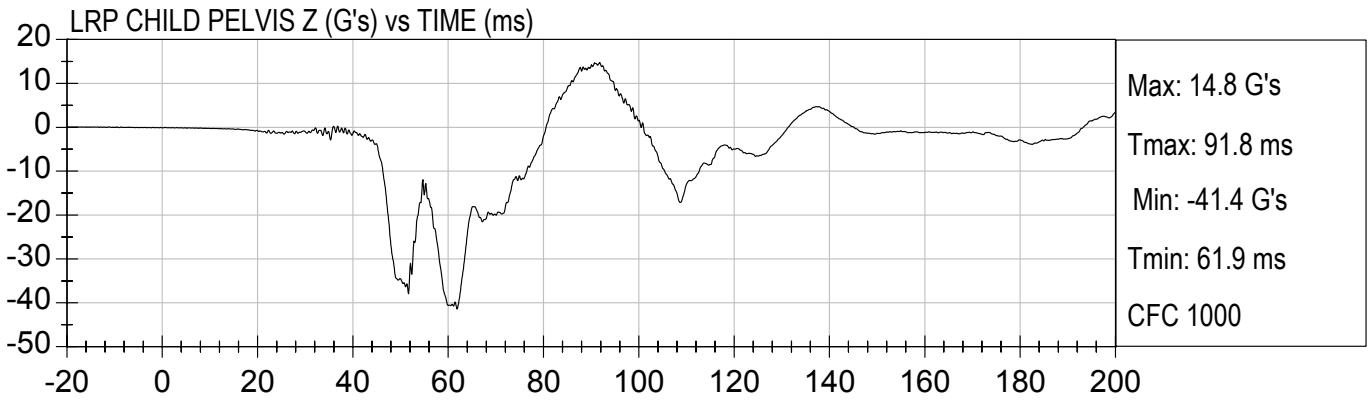


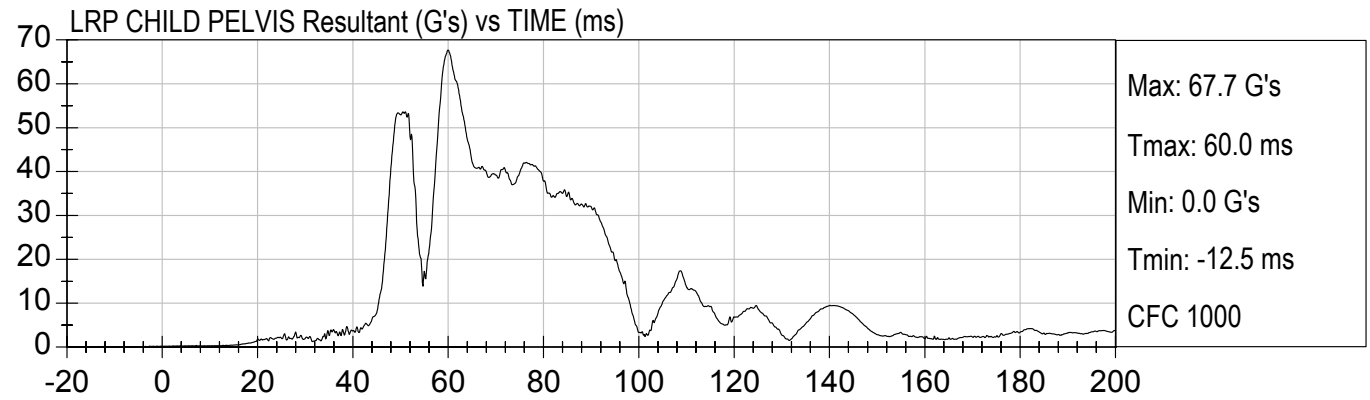
35 MPH FRONTAL IMPACT
2003 FORD EXPEDITION (M30202)

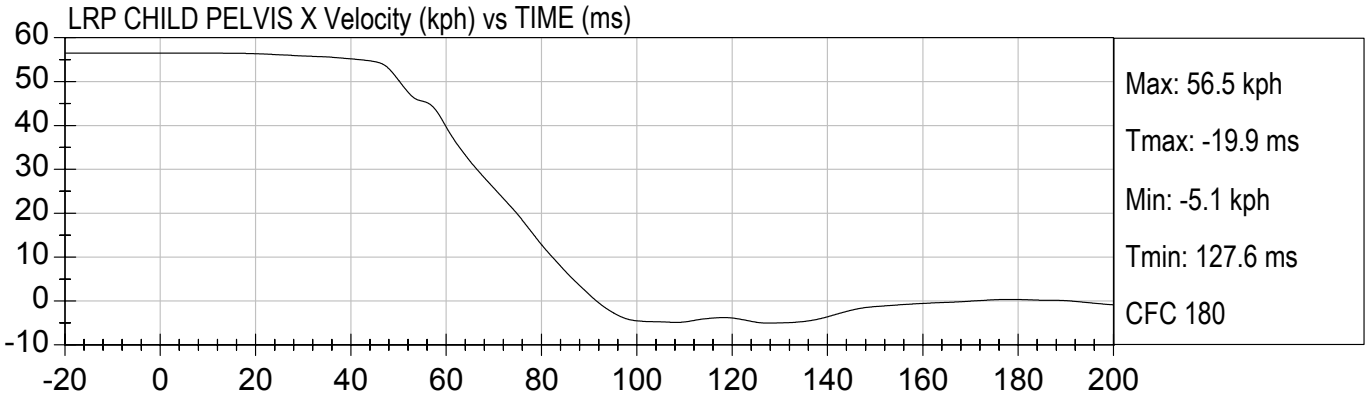
Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)

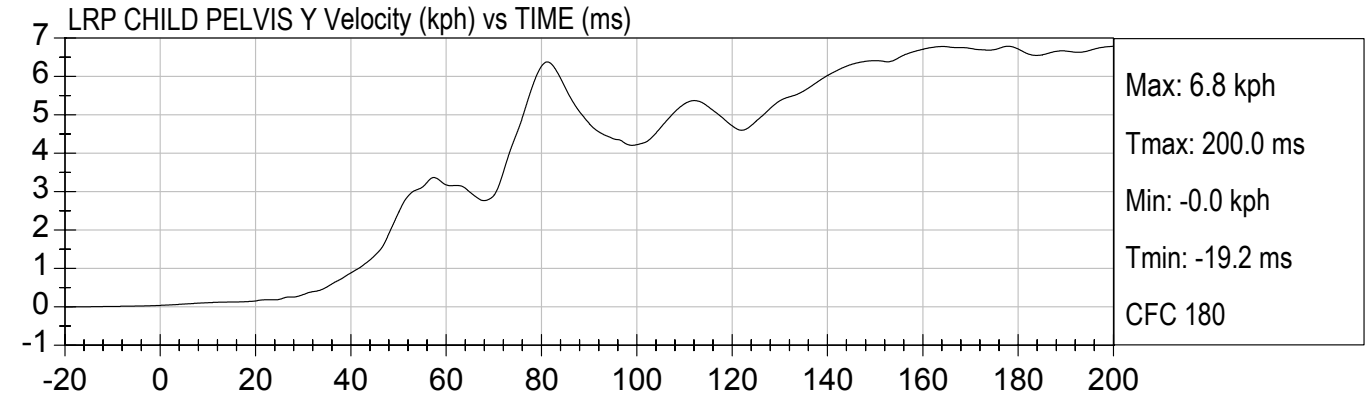


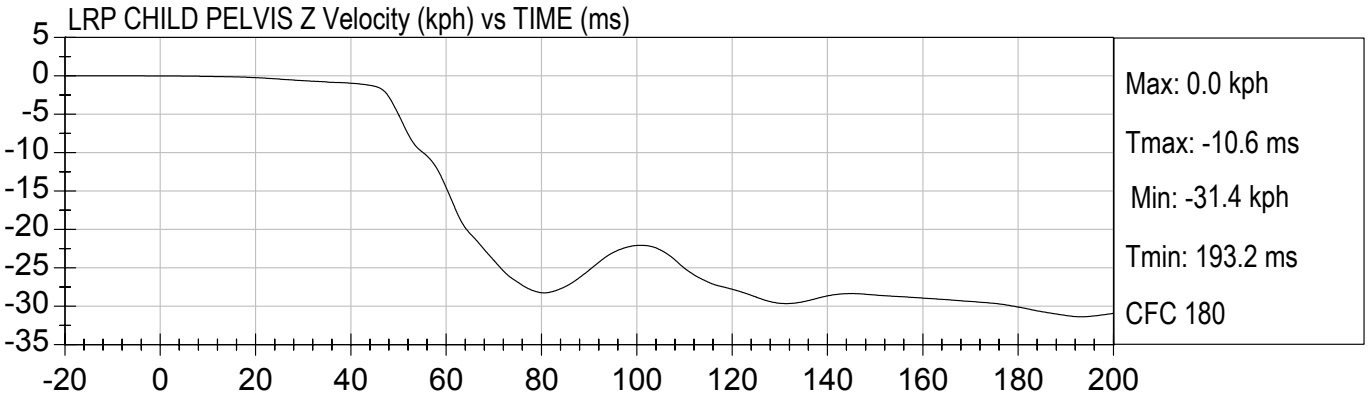






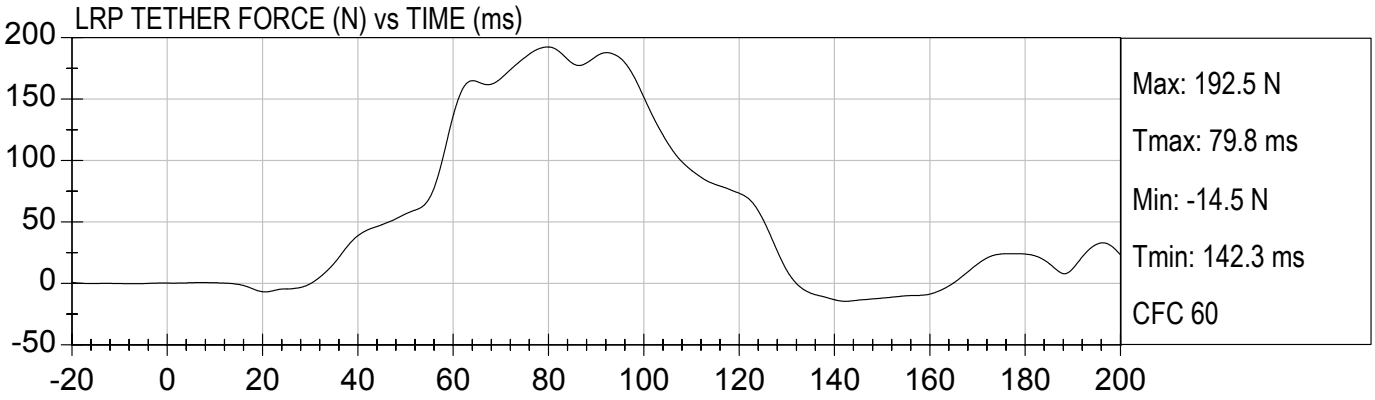

LRP CHILD PELVIS X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20 0 20 40 60 80 100 120 140 160 180 200
Max: 56.5 kph
Tmax: -19.9 ms
Min: -5.1 kph
Tmin: 127.6 ms
CFC 180

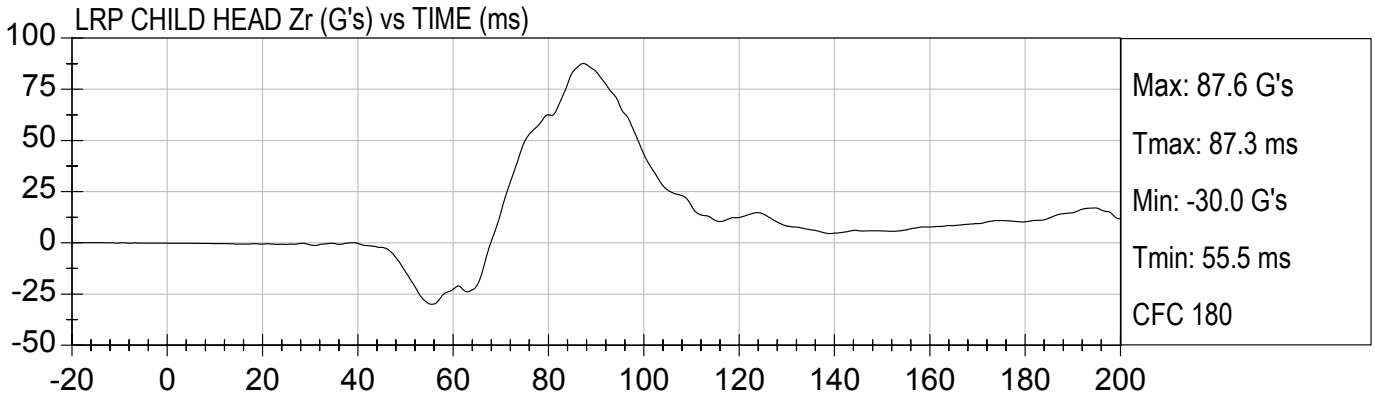

LRP CHILD PELVIS Y Velocity (kph) vs TIME (ms)
7
6
5
4
3
2
1
0
-1
-20 0 20 40 60 80 100 120 140 160 180 200
Max: 6.8 kph
Tmax: 200.0 ms
Min: -0.0 kph
Tmin: -19.2 ms
CFC 180

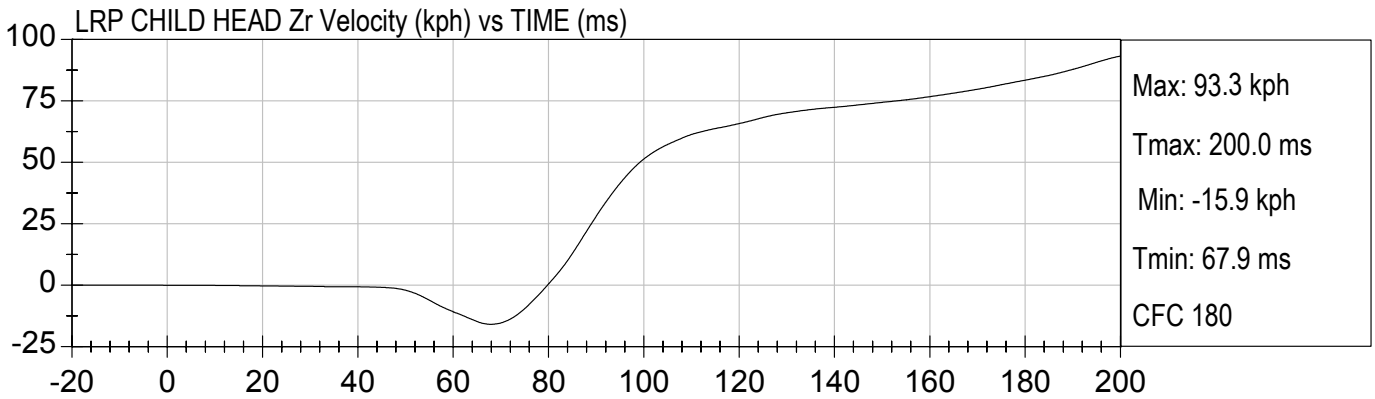

LRP CHILD PELVIS Z Velocity (kph) vs TIME (ms)
5
0
-5
-10
-15
-20
-25
-30
-35
-20 0 20 40 60 80 100 120 140 160 180 200
Max: 0.0 kph
Tmax: -10.6 ms
Min: -31.4 kph
Tmin: 193.2 ms
CFC 180

35 MPH FRONTAL IMPACT
2003 FORD EXPEDITION (M30202)

Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)

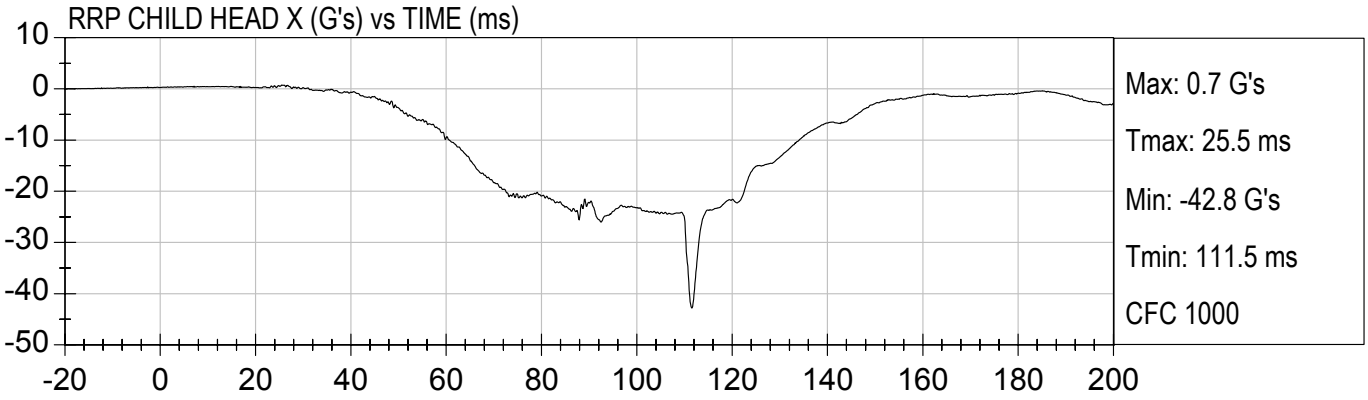


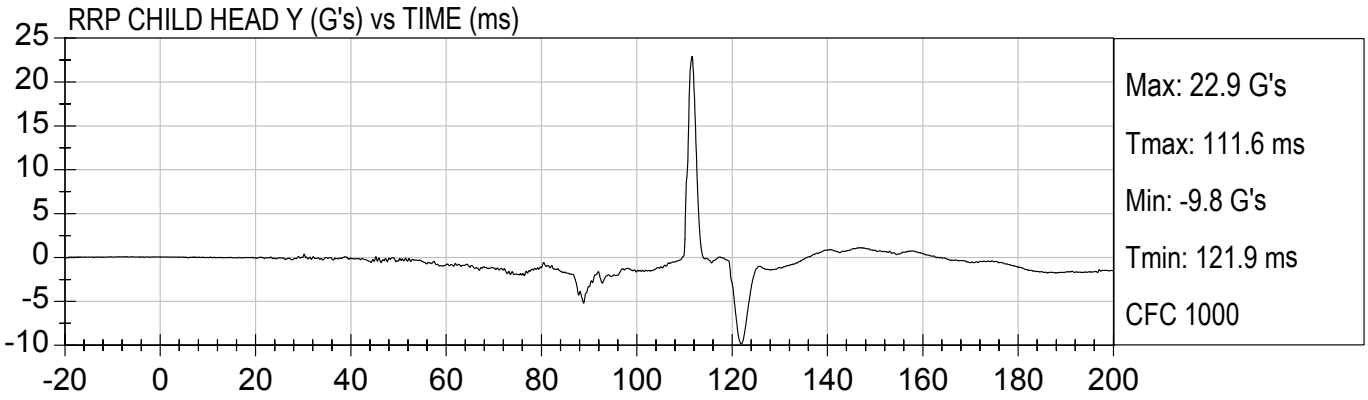


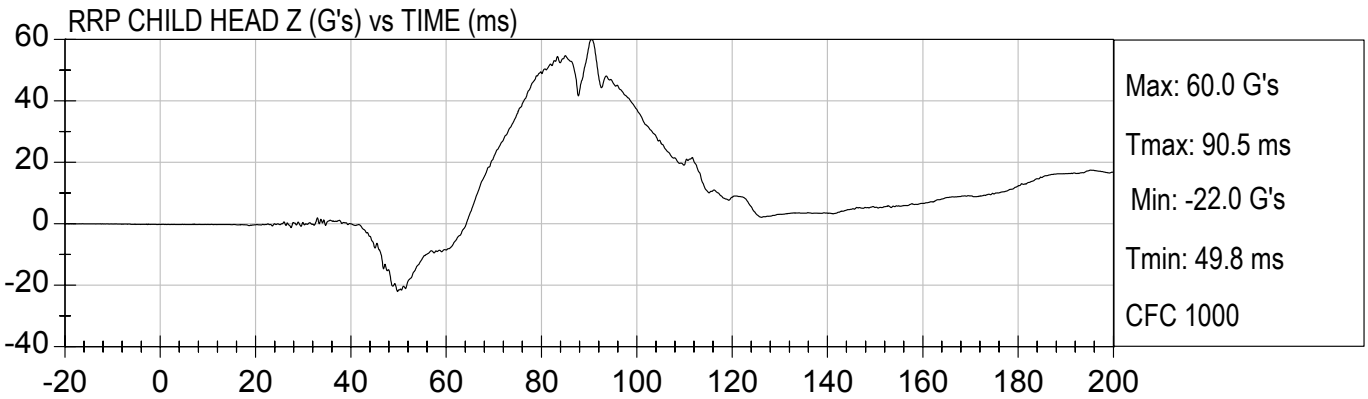


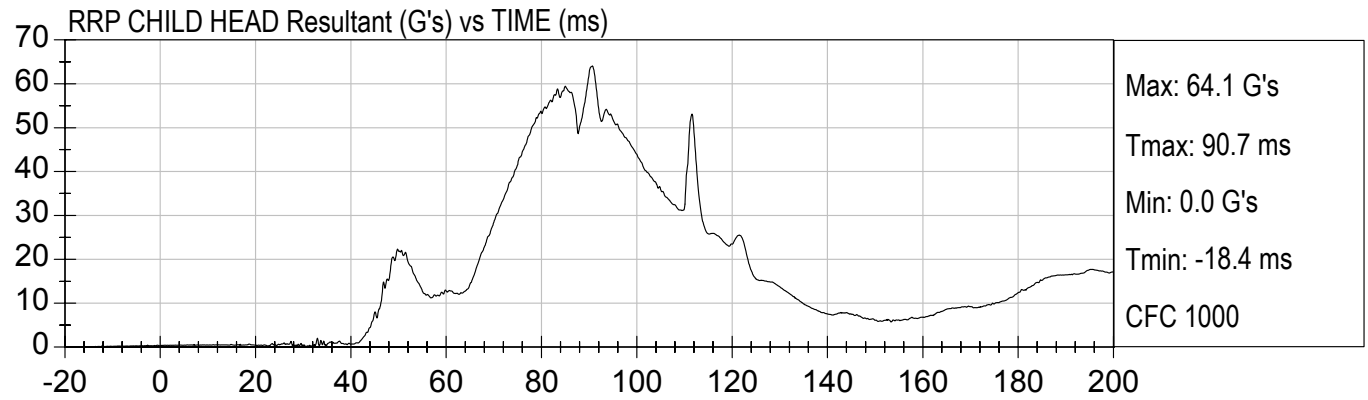
35 MPH FRONTAL IMPACT
2003 FORD EXPEDITION (M30202)

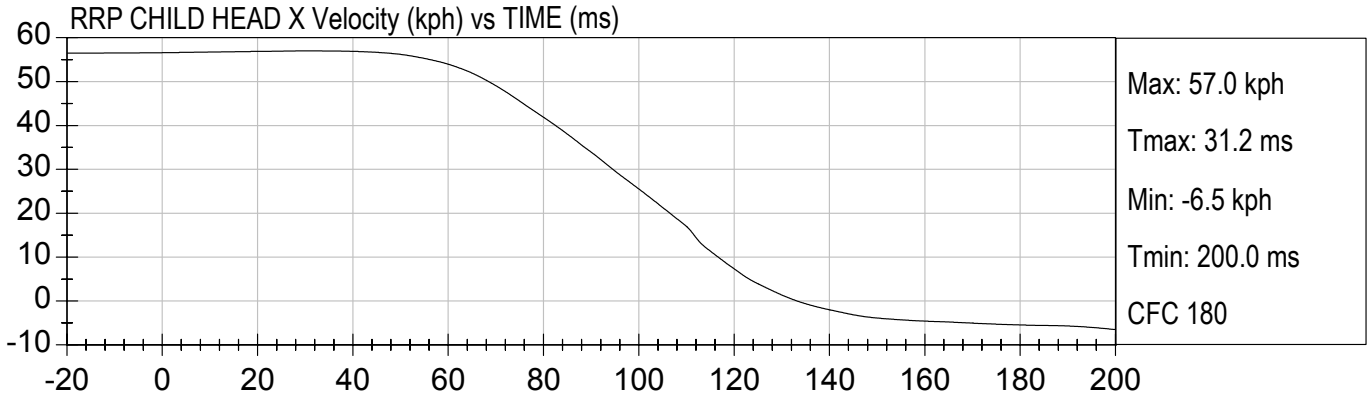
Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)

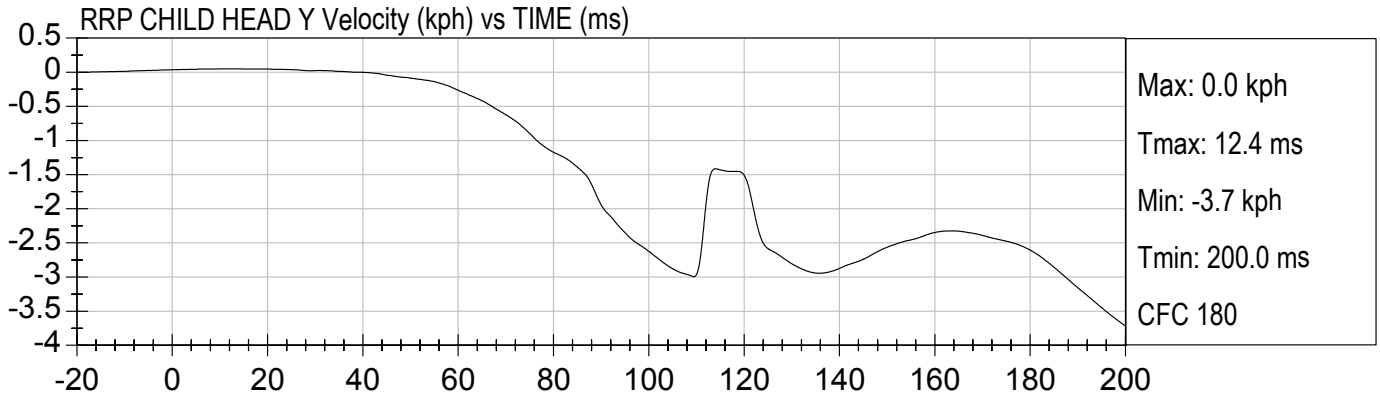


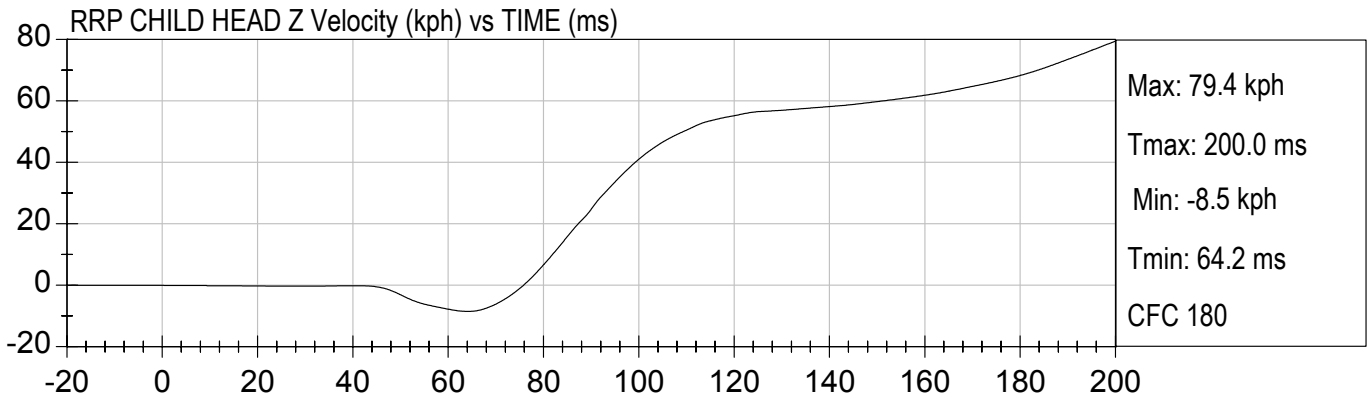






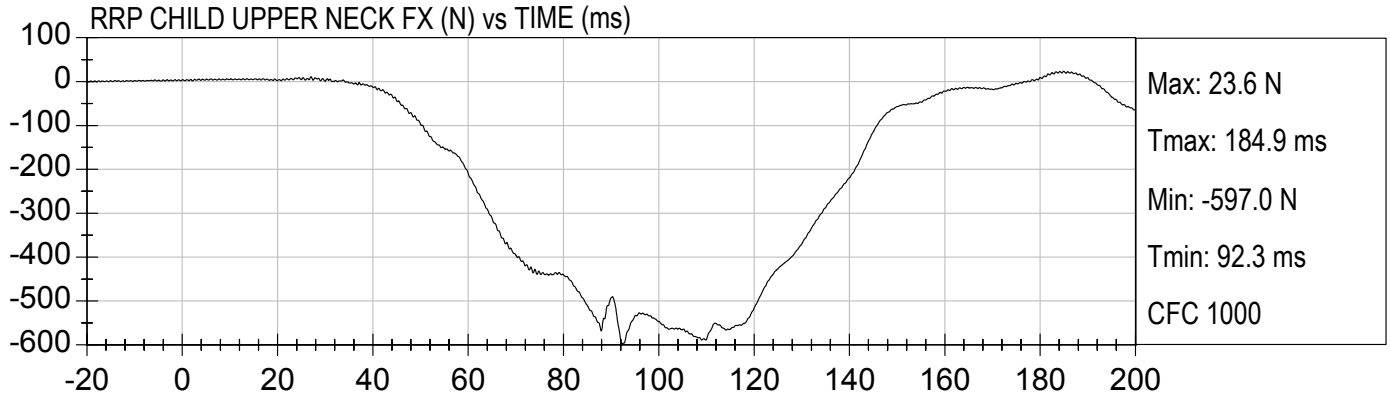

RRP CHILD HEAD X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20 0 20 40 60 80 100 120 140 160 180 200
Max: 57.0 kph
Tmax: 31.2 ms
Min: -6.5 kph
Tmin: 200.0 ms
CFC 180

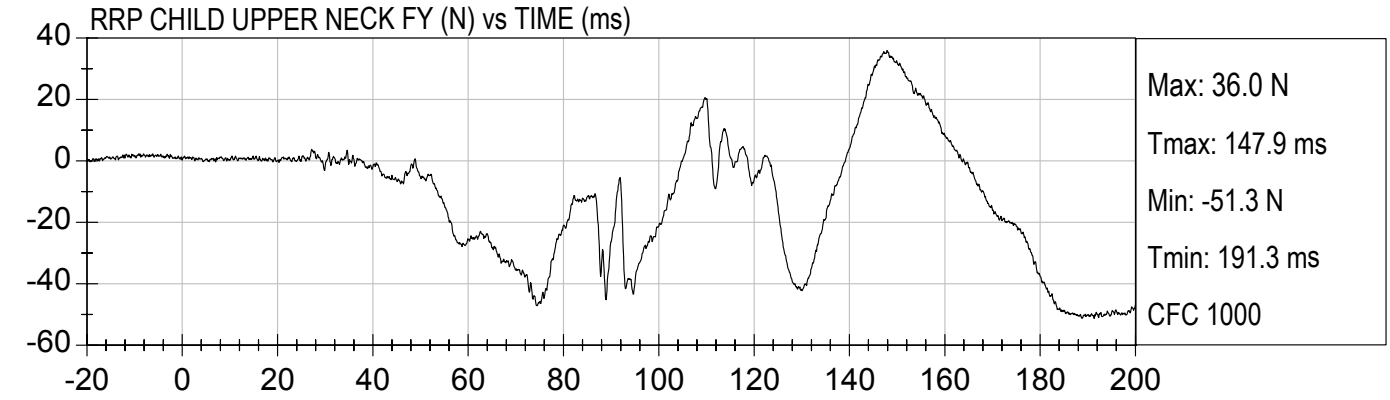

RRP CHILD HEAD Y Velocity (kph) vs TIME (ms)
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-20 0 20 40 60 80 100 120 140 160 180 200
Max: 0.0 kph
Tmax: 12.4 ms
Min: -3.7 kph
Tmin: 200.0 ms
CFC 180

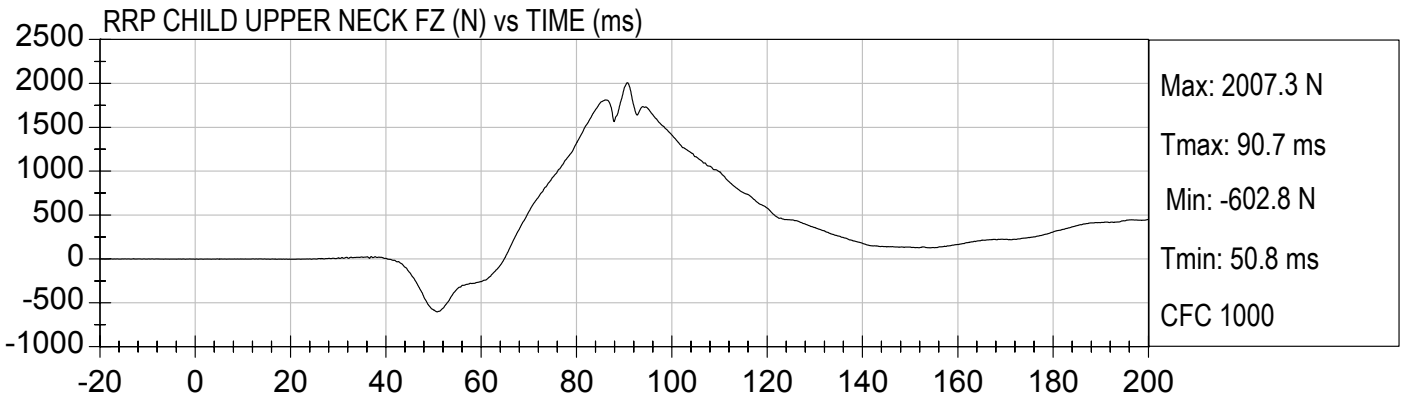

RRP CHILD HEAD Z Velocity (kph) vs TIME (ms)
80
60
40
20
0
-20
-20 0 20 40 60 80 100 120 140 160 180 200
Max: 79.4 kph
Tmax: 200.0 ms
Min: -8.5 kph
Tmin: 64.2 ms
CFC 180

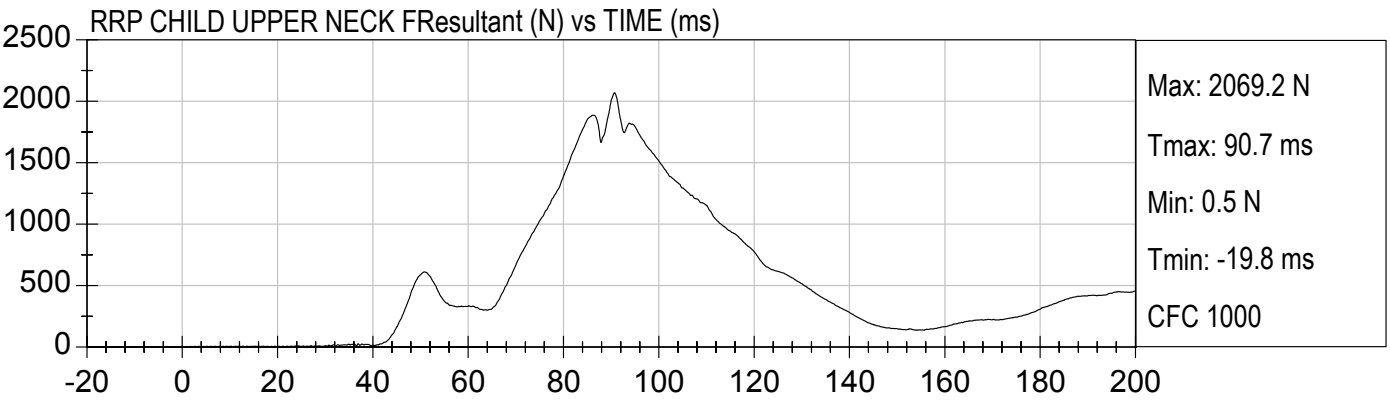
35 MPH FRONTAL IMPACT
2003 FORD EXPEDITION (M30202)

Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)



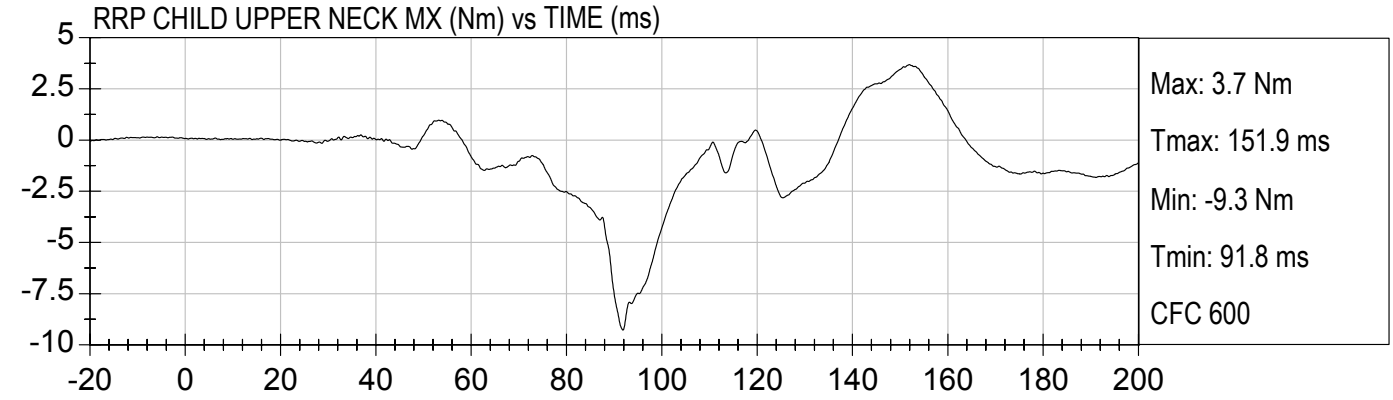


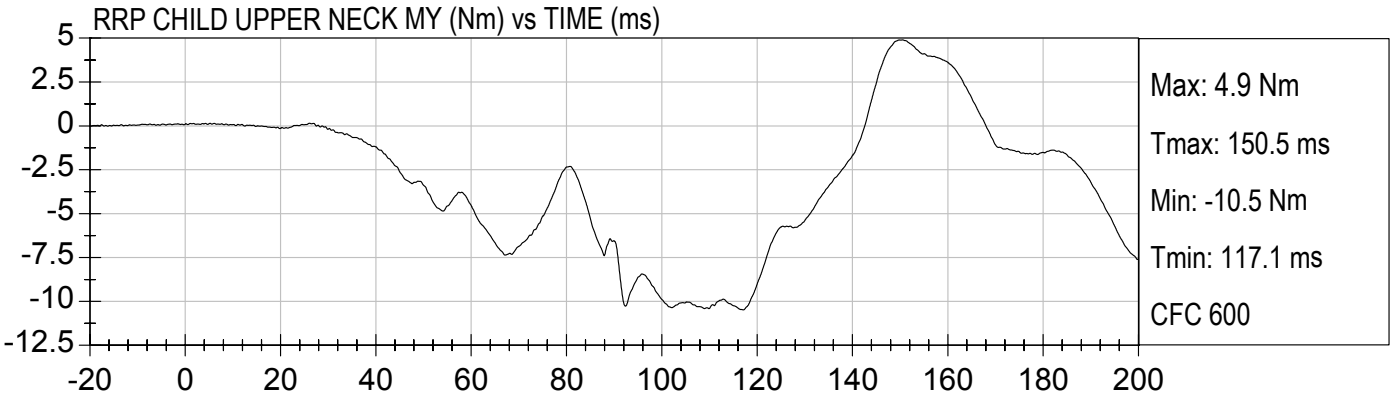


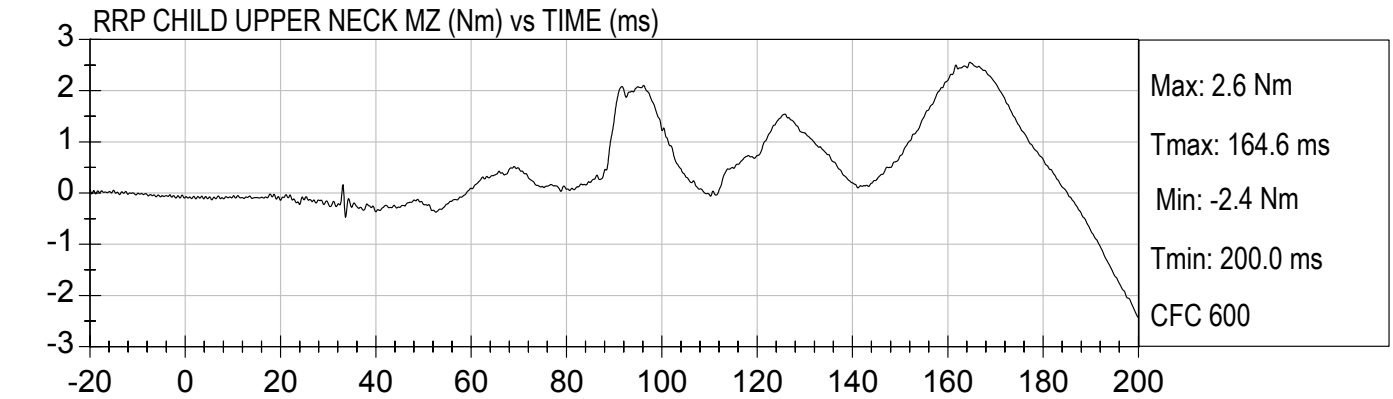


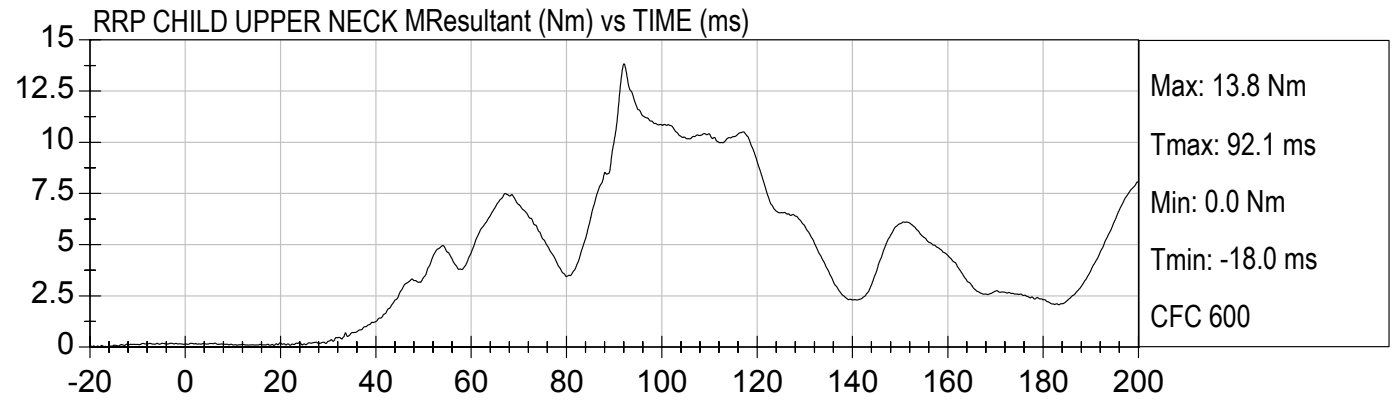
35 MPH FRONTAL IMPACT
2003 FORD EXPEDITION (M30202)

Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)



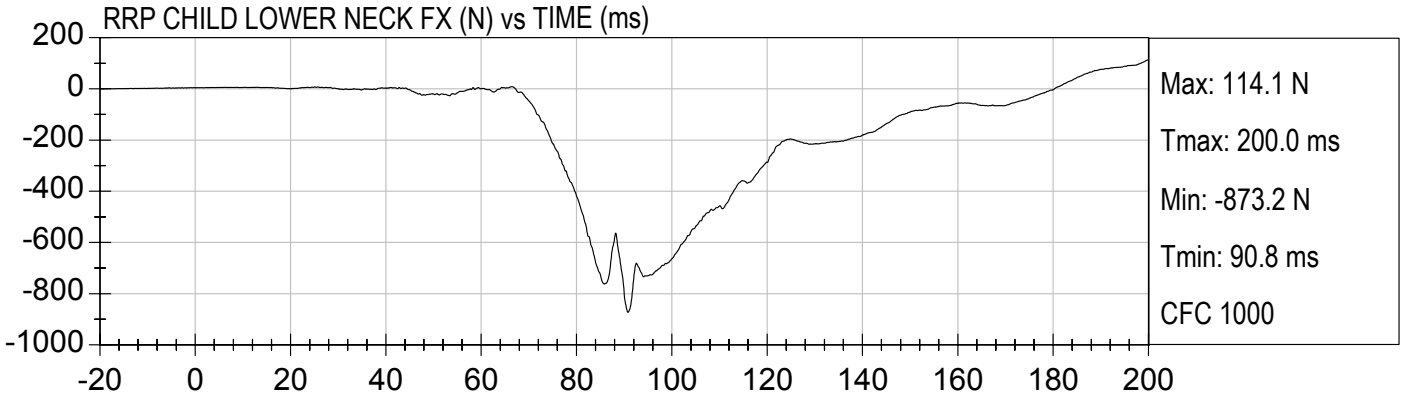


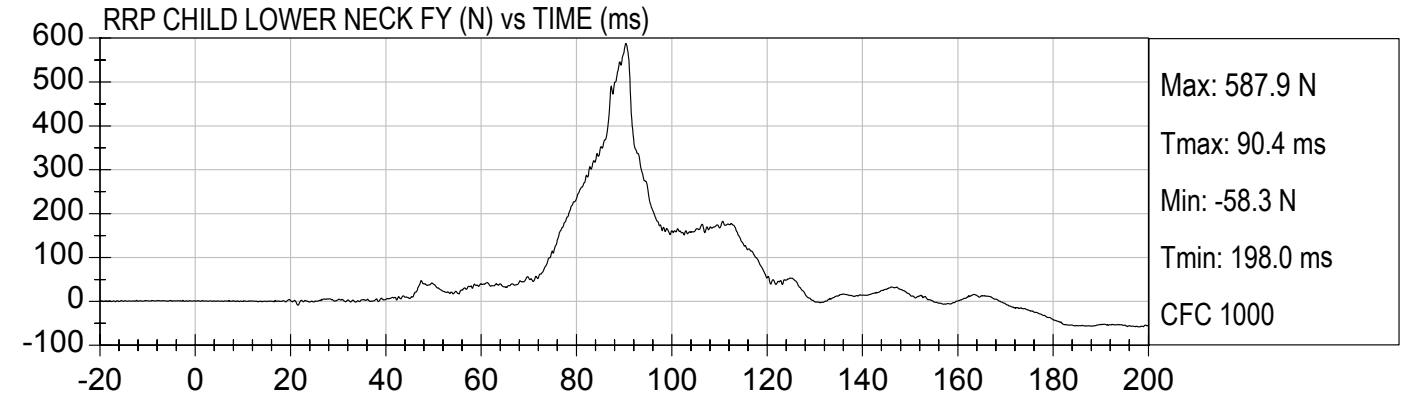


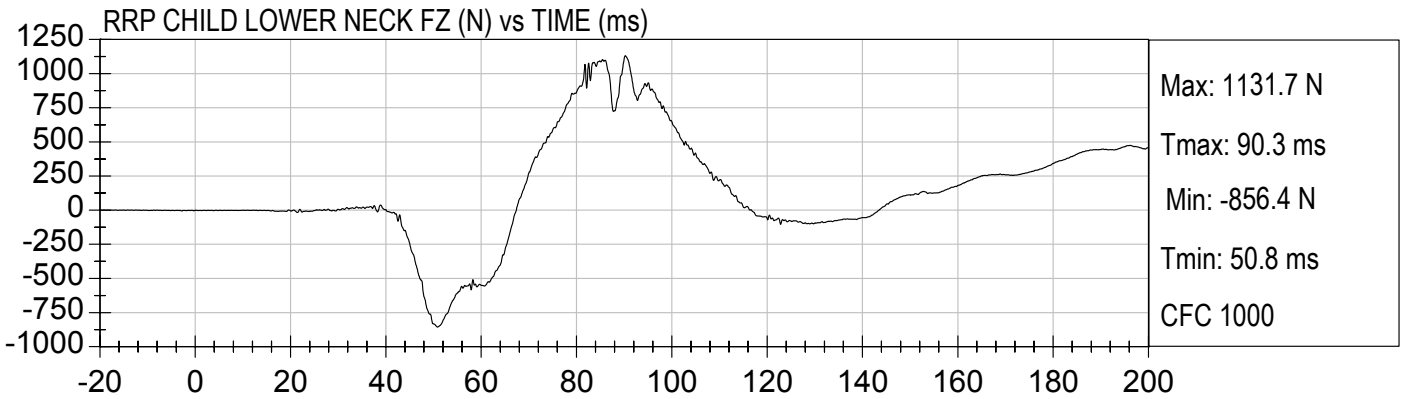


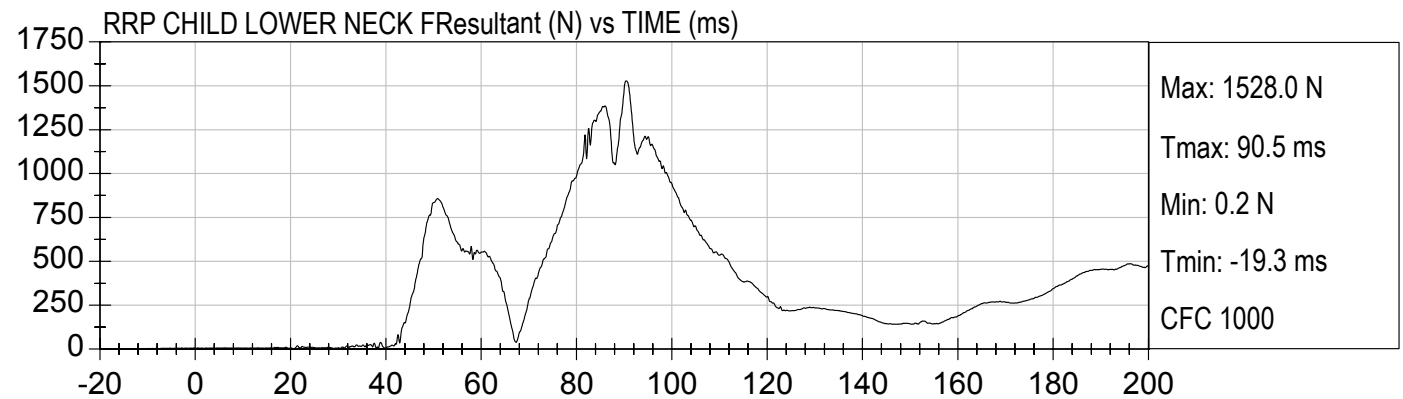
35 MPH FRONTAL IMPACT
2003 FORD EXPEDITION (M30202)

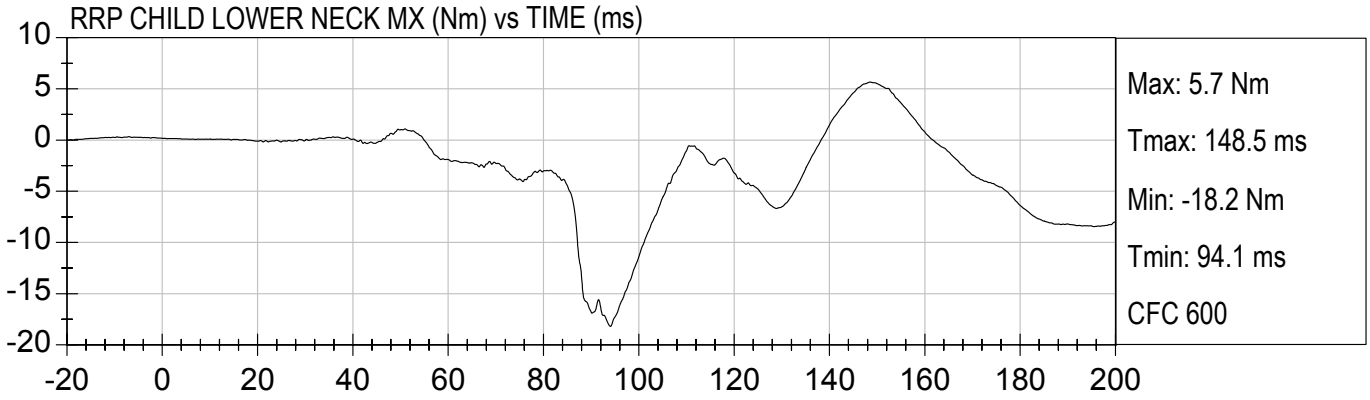
Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)

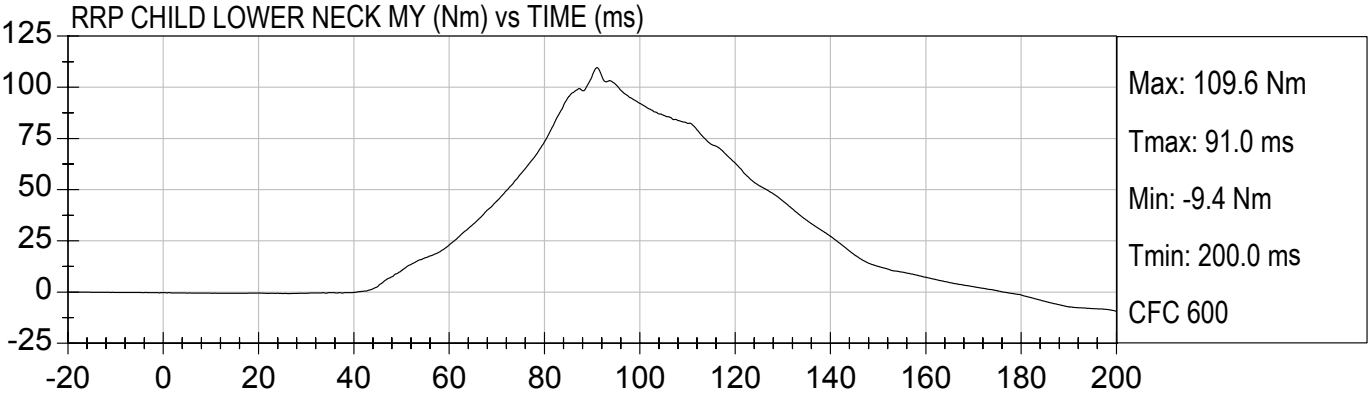


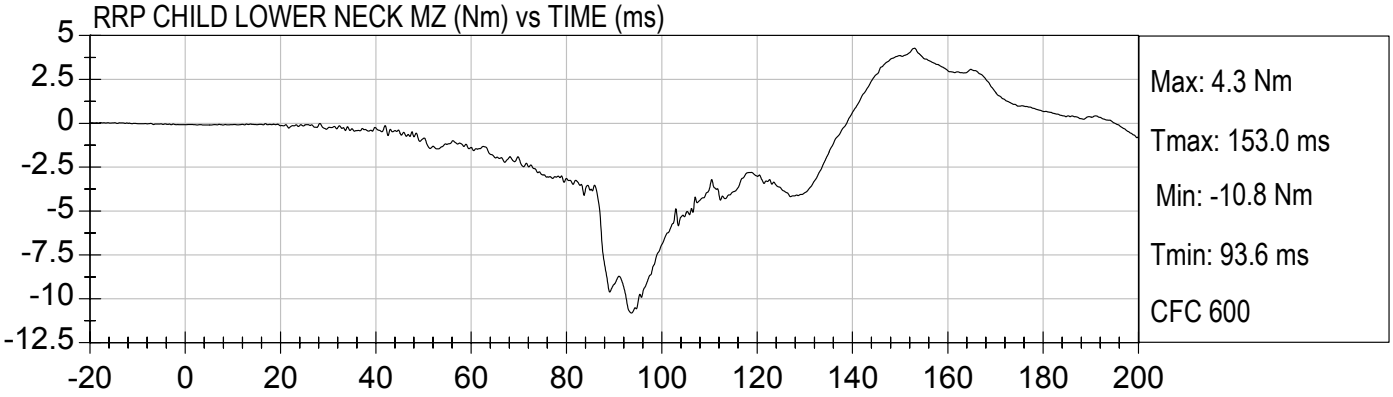


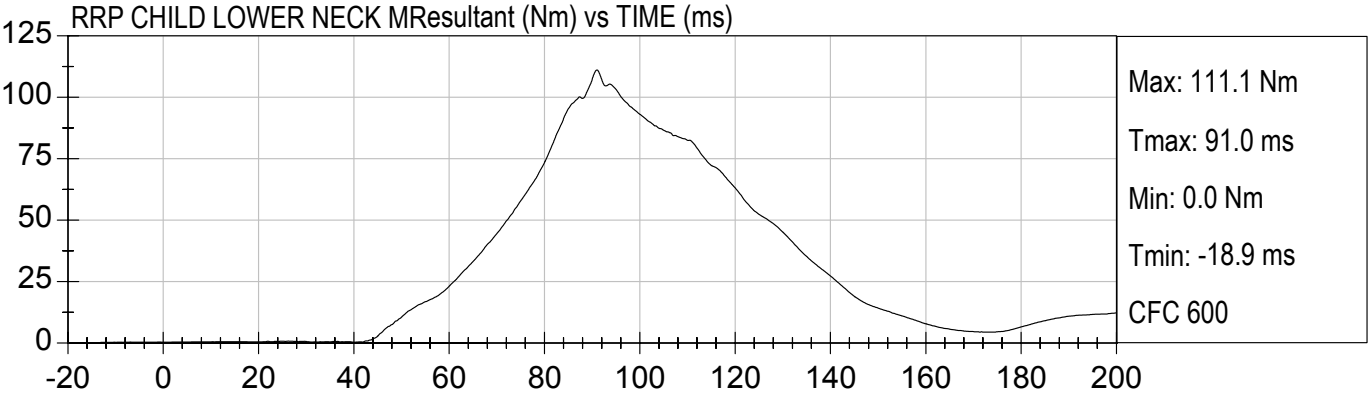





RRP CHILD LOWER NECK MX (Nm) vs TIME (ms)
10
5
0
-5
-10
-15
-20
-20 0 20 40 60 80 100 120 140 160 180 200
Max: 5.7 Nm
Tmax: 148.5 ms
Min: -18.2 Nm
Tmin: 94.1 ms
CFC 600

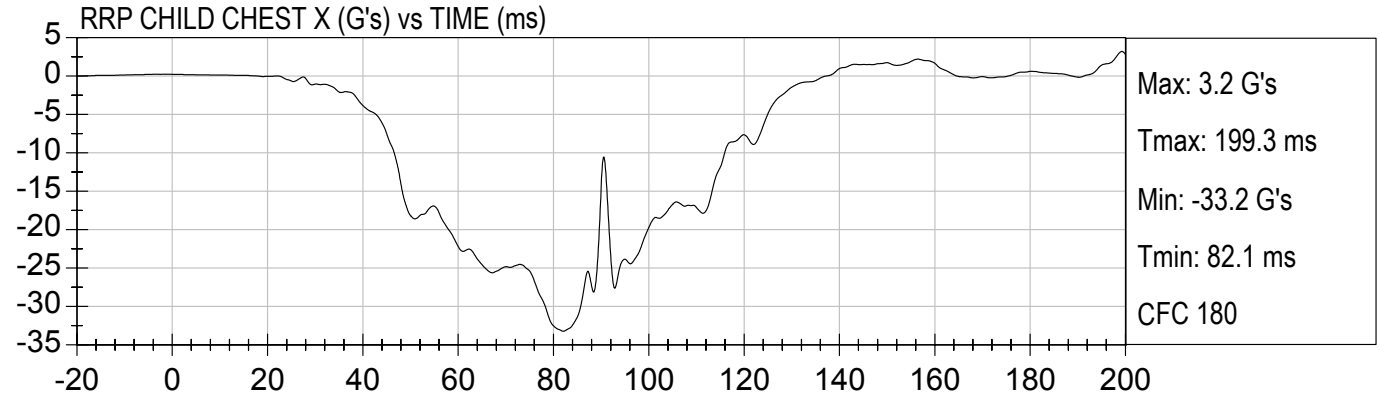

RRP CHILD LOWER NECK MY (Nm) vs TIME (ms)
125
100
75
50
25
0
-25
-20 0 20 40 60 80 100 120 140 160 180 200
Max: 109.6 Nm
Tmax: 91.0 ms
Min: -9.4 Nm
Tmin: 200.0 ms
CFC 600

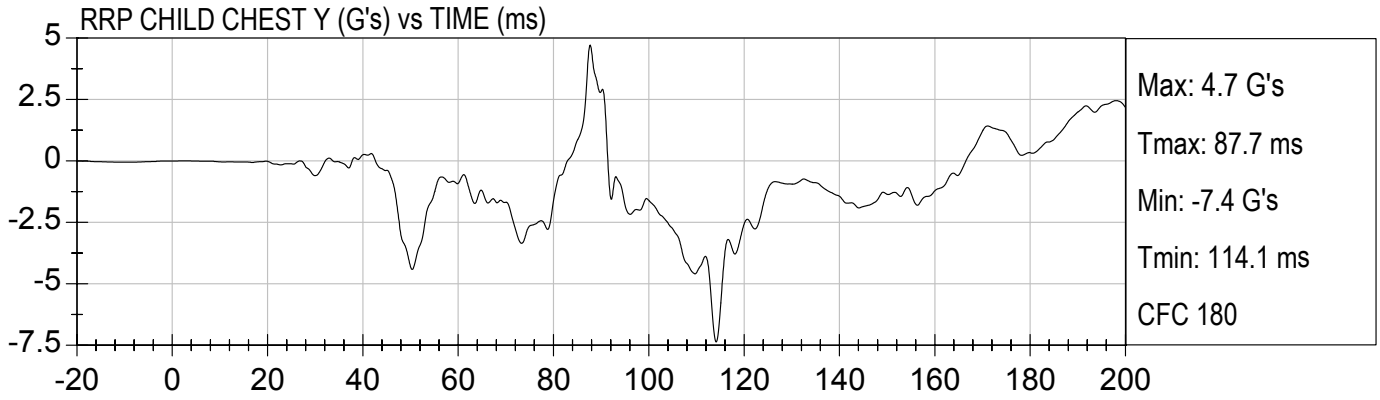

RRP CHILD LOWER NECK MZ (Nm) vs TIME (ms)
5
2.5
0
-2.5
-5
-7.5
-10
-12.5
-20 0 20 40 60 80 100 120 140 160 180 200
Max: 4.3 Nm
Tmax: 153.0 ms
Min: -10.8 Nm
Tmin: 93.6 ms
CFC 600

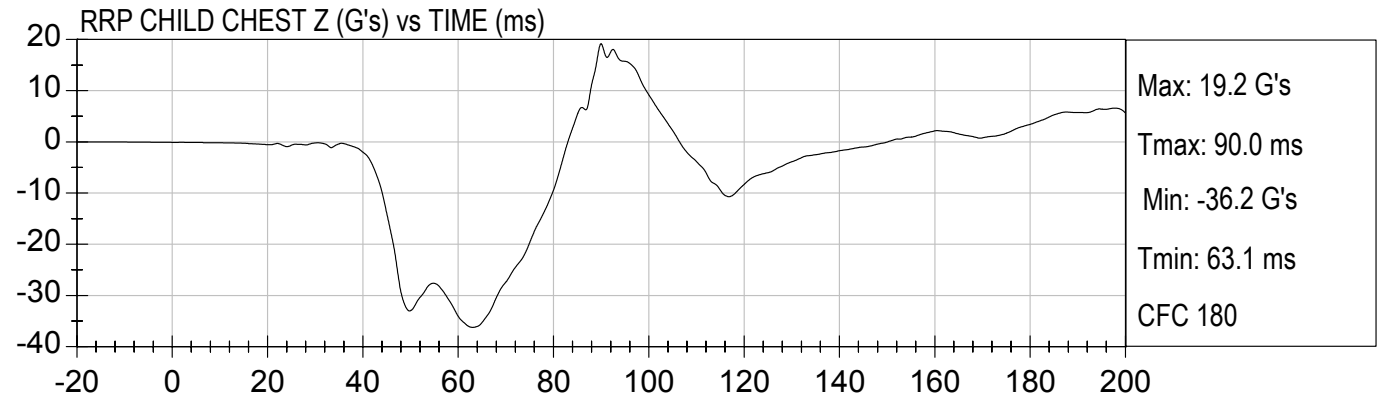

RRP CHILD LOWER NECK MResultant (Nm) vs TIME (ms)
125
100
75
50
25
0
-20 0 20 40 60 80 100 120 140 160 180 200
Max: 111.1 Nm
Tmax: 91.0 ms
Min: 0.0 Nm
Tmin: -18.9 ms
CFC 600

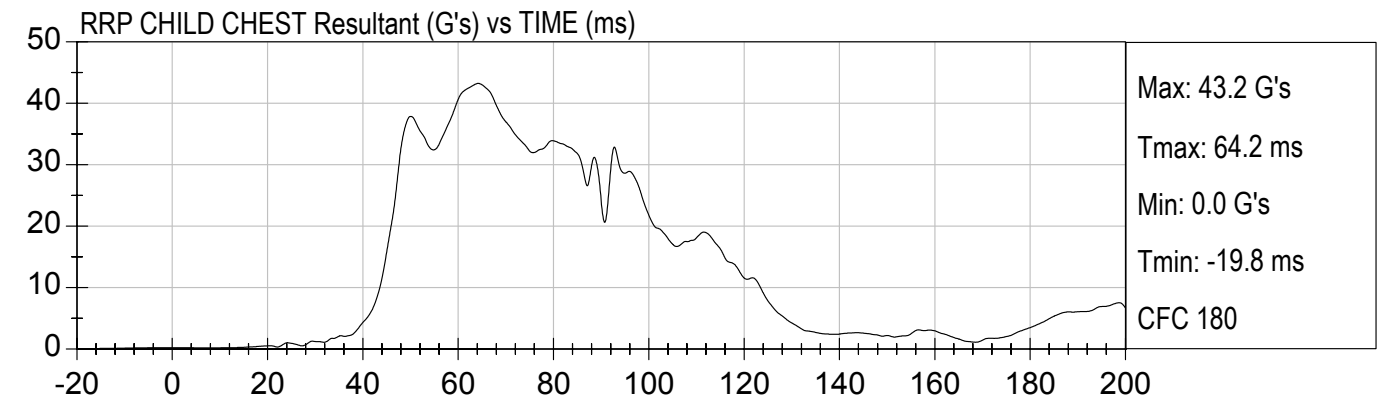
35 MPH FRONTAL IMPACT
2003 FORD EXPEDITION (M30202)

Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)



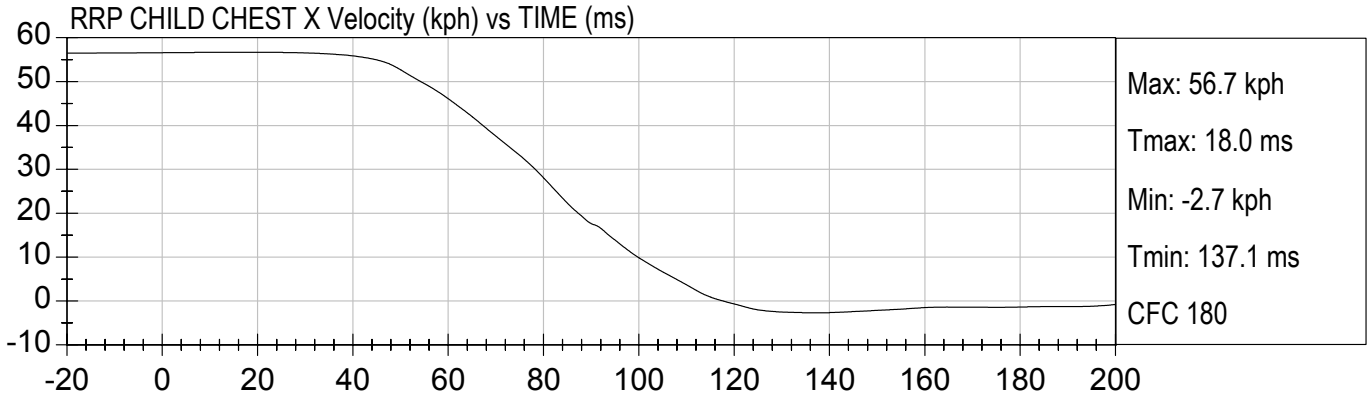


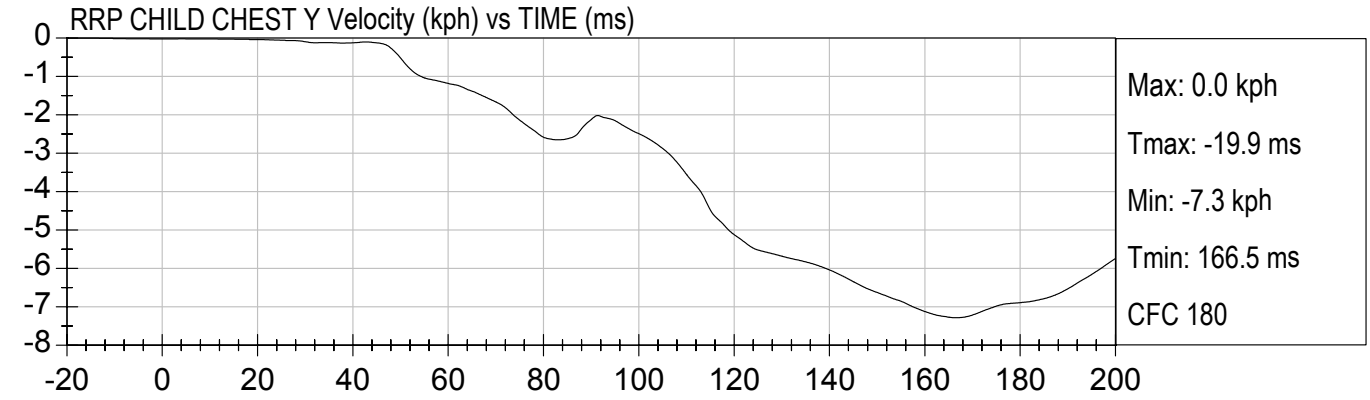


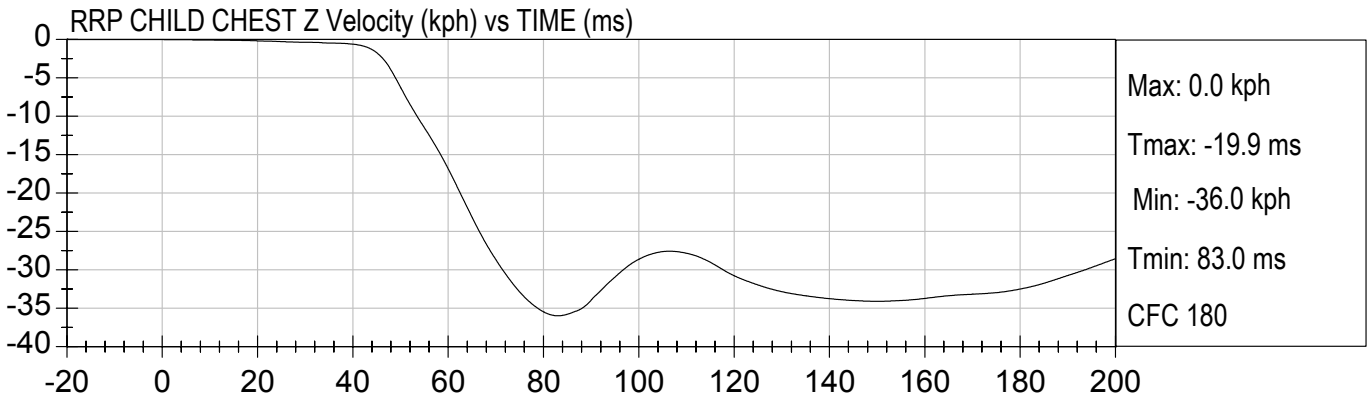


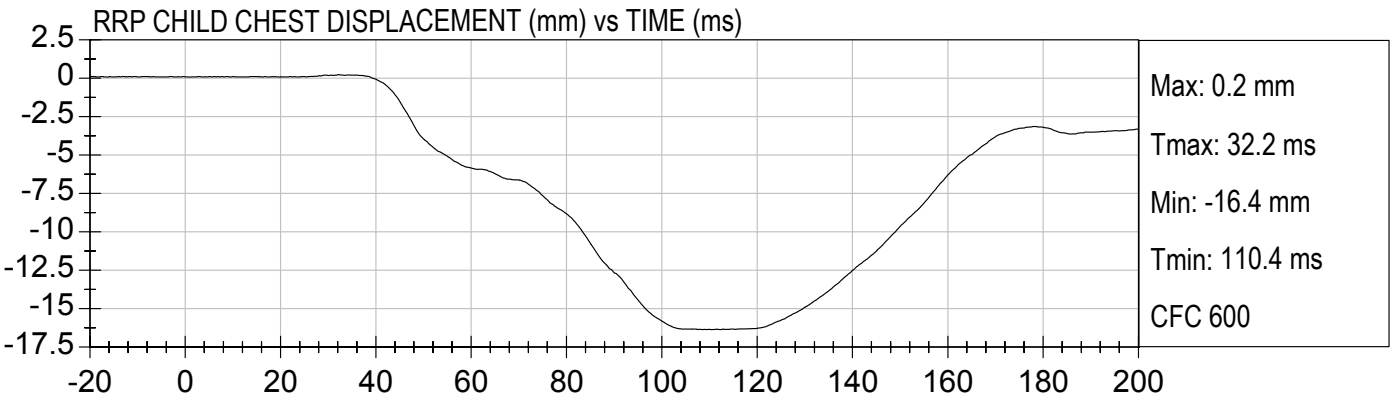
35 MPH FRONTAL IMPACT
2003 FORD EXPEDITION (M30202)

Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)



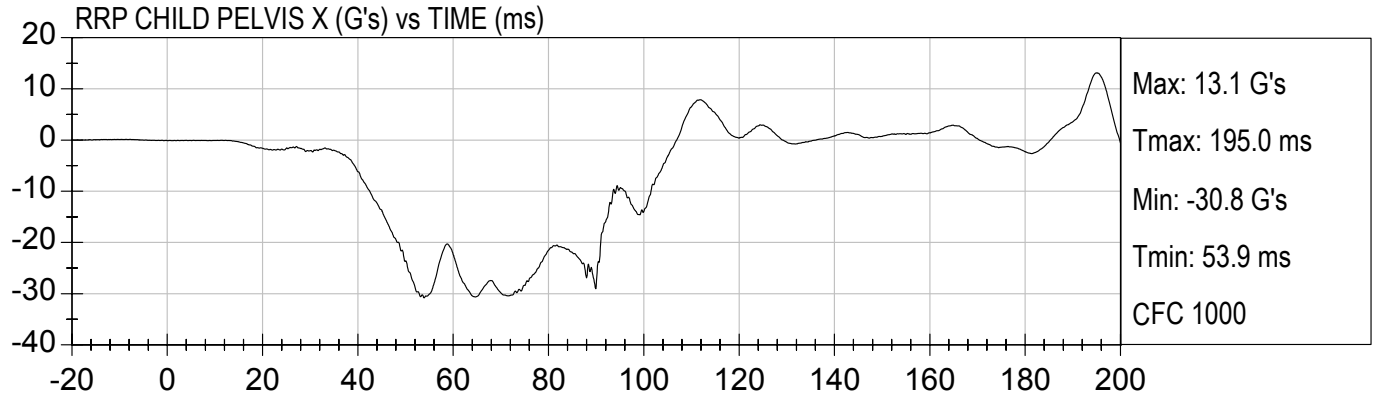


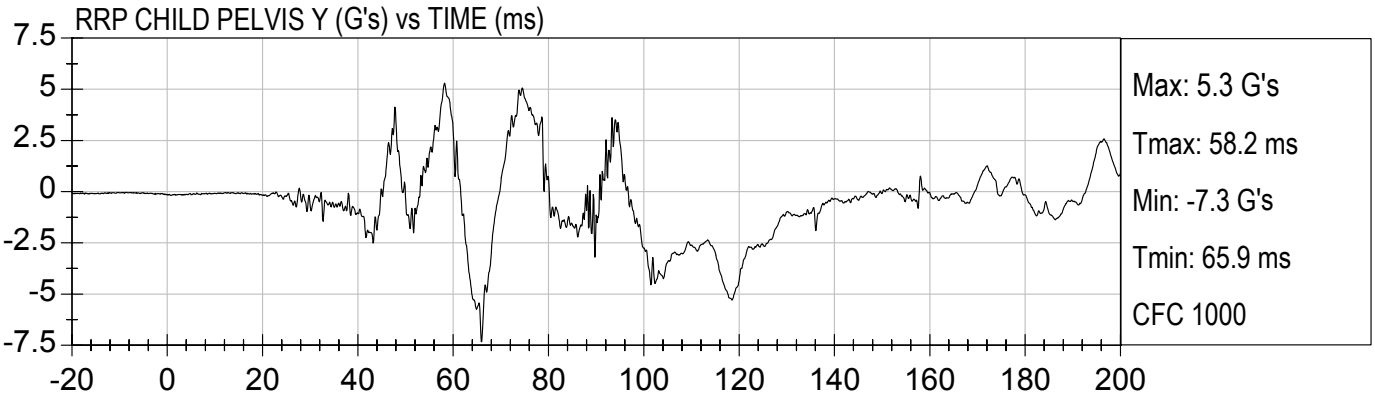


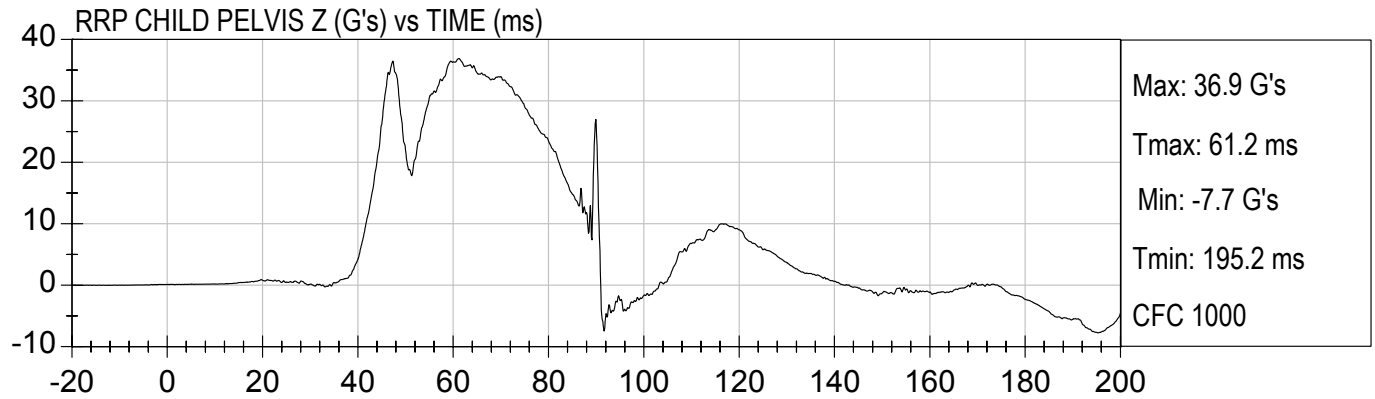


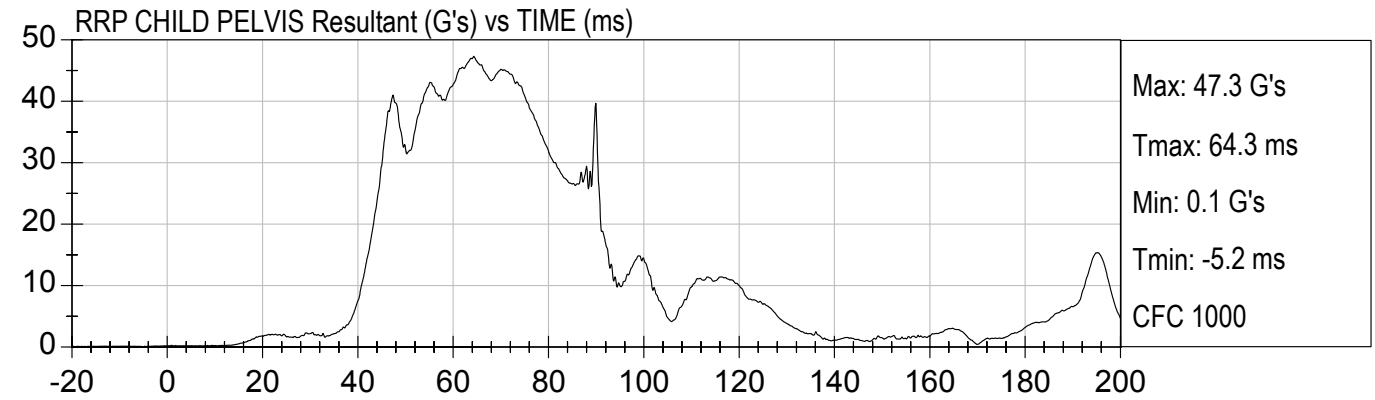
35 MPH FRONTAL IMPACT
2003 FORD EXPEDITION (M30202)

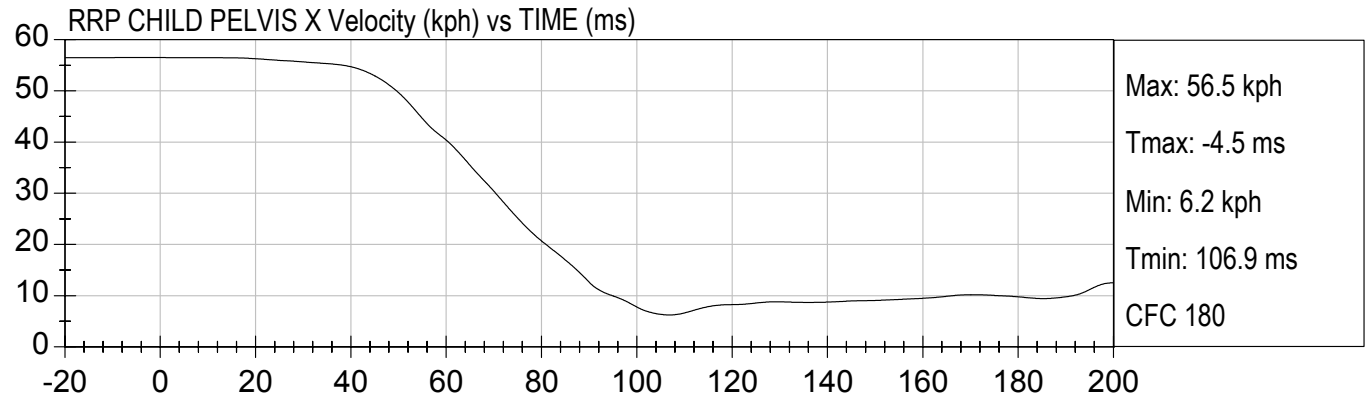
Test Date: 11/26/2002
Speed: 35.1 mph (56.5 km/h)

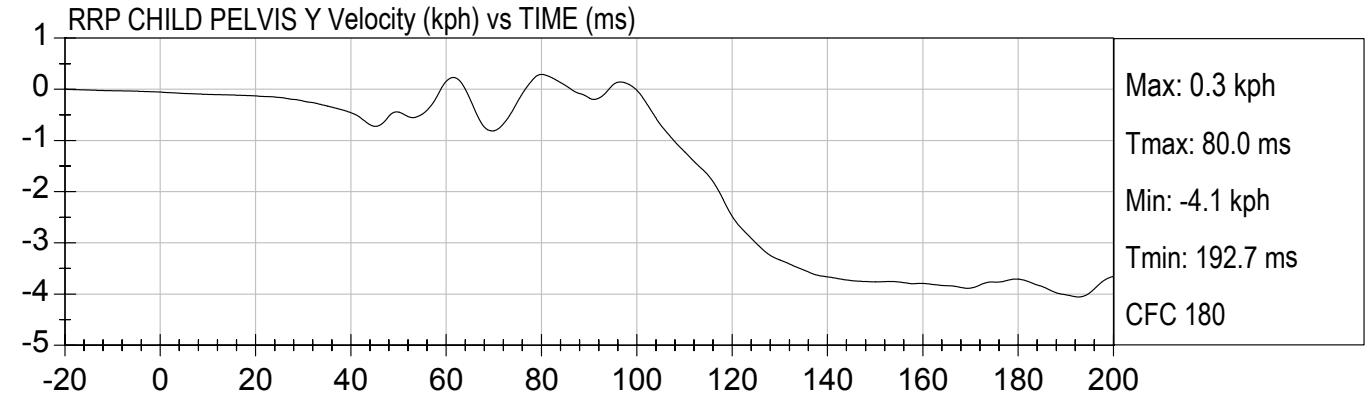


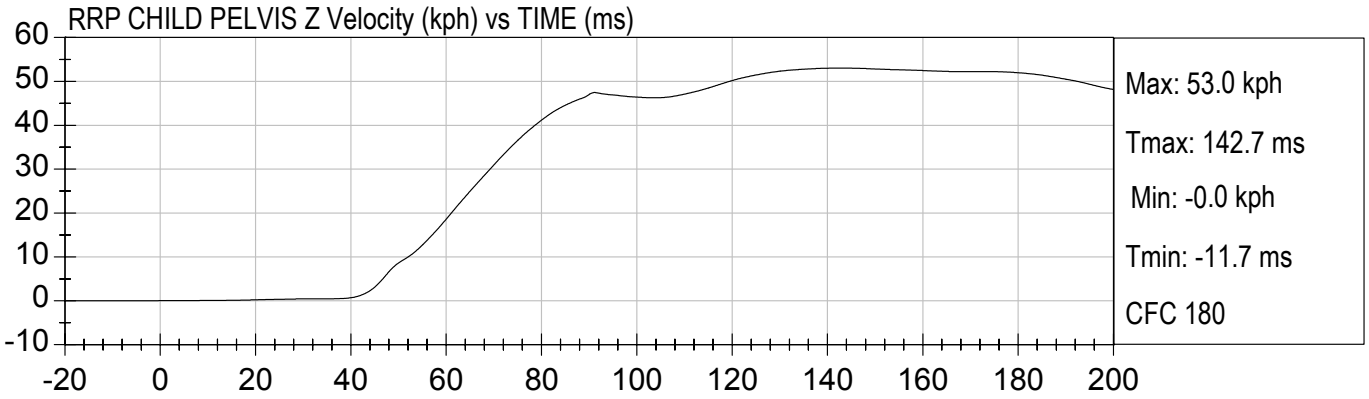


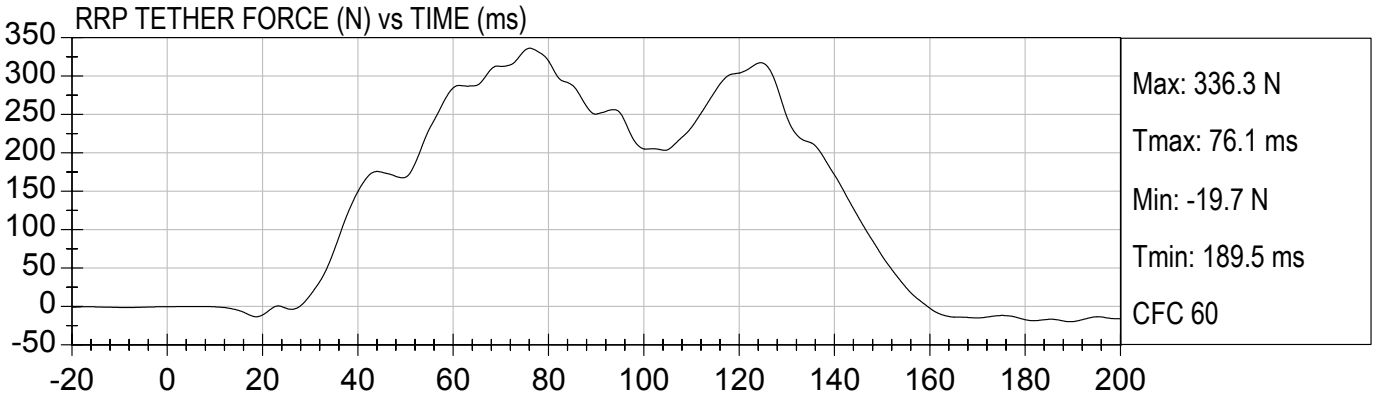


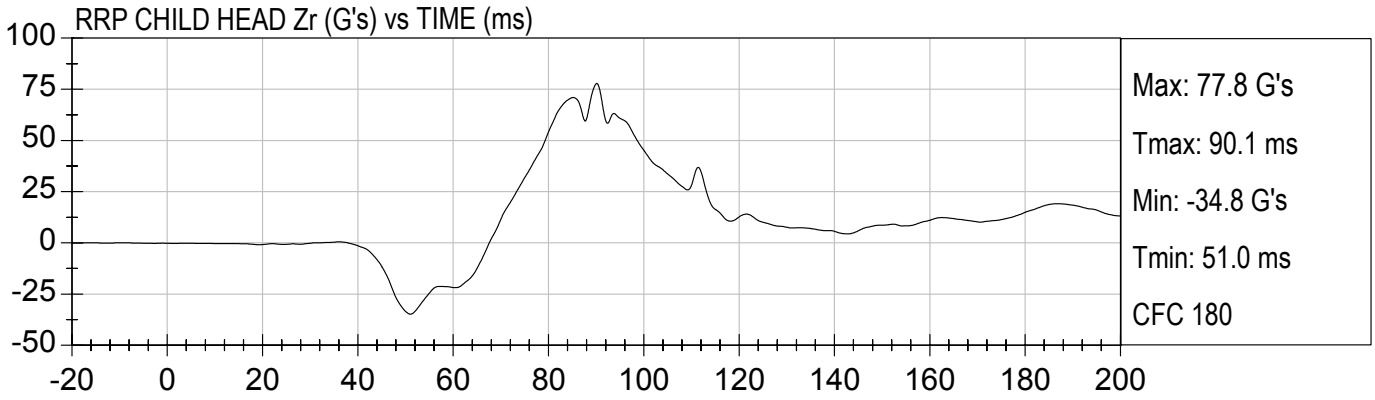


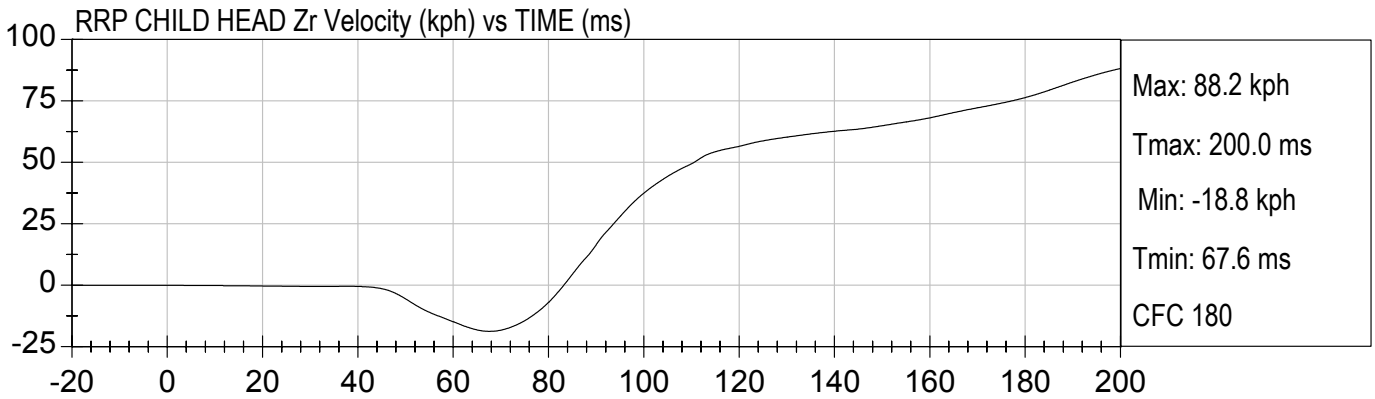

RRP CHILD PELVIS X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 56.5 kph
Tmax: -4.5 ms
Min: 6.2 kph
Tmin: 106.9 ms
CFC 180


RRP CHILD PELVIS Y Velocity (kph) vs TIME (ms)
1
0
-1
-2
-3
-4
-5
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 0.3 kph
Tmax: 80.0 ms
Min: -4.1 kph
Tmin: 192.7 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: 53.0 kph
Tmax: 142.7 ms
Min: -0.0 kph
Tmin: -11.7 ms
CFC 180


RRP TETHER FORCE (N) vs TIME (ms)
350
300
250
200
150
100
50
0
-50
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 336.3 N
Tmax: 76.1 ms
Min: -19.7 N
Tmin: 189.5 ms
CFC 60


RRP CHILD HEAD Zr (G's) vs TIME (ms)
100
75
50
25
0
-25
-50
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 77.8 G's
Tmax: 90.1 ms
Min: -34.8 G's
Tmin: 51.0 ms
CFC 180


RRP CHILD HEAD Zr Velocity (kph) vs TIME (ms)
100
75
50
25
0
-25
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 88.2 kph
Tmax: 200.0 ms
Min: -18.8 kph
Tmin: 67.6 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

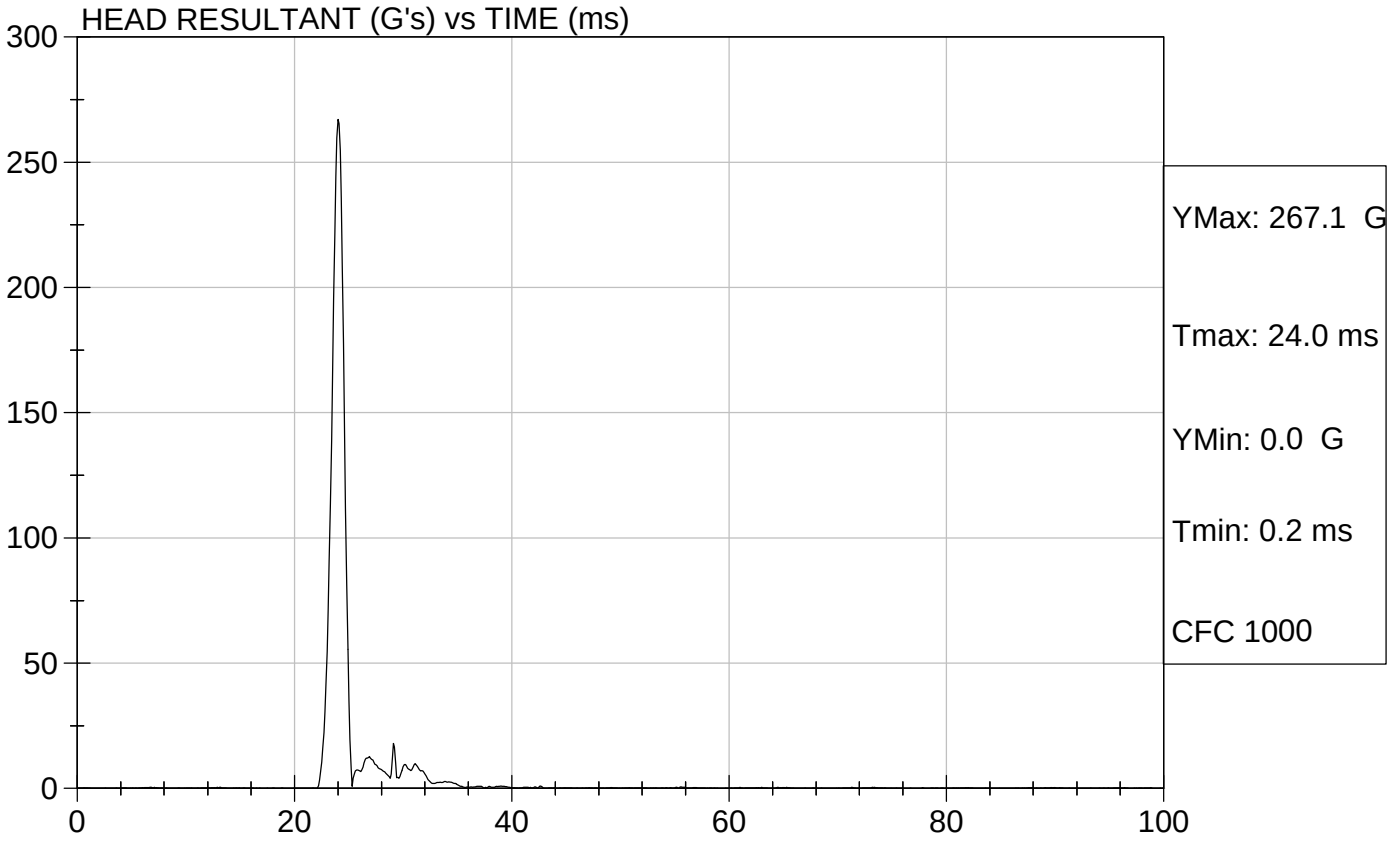
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Peak Resultant Acceleration	G's	225.0 to 275.0	267.1	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-5.2	Pass
Is Acceleration Unimodal?	Yes/No	< 10%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

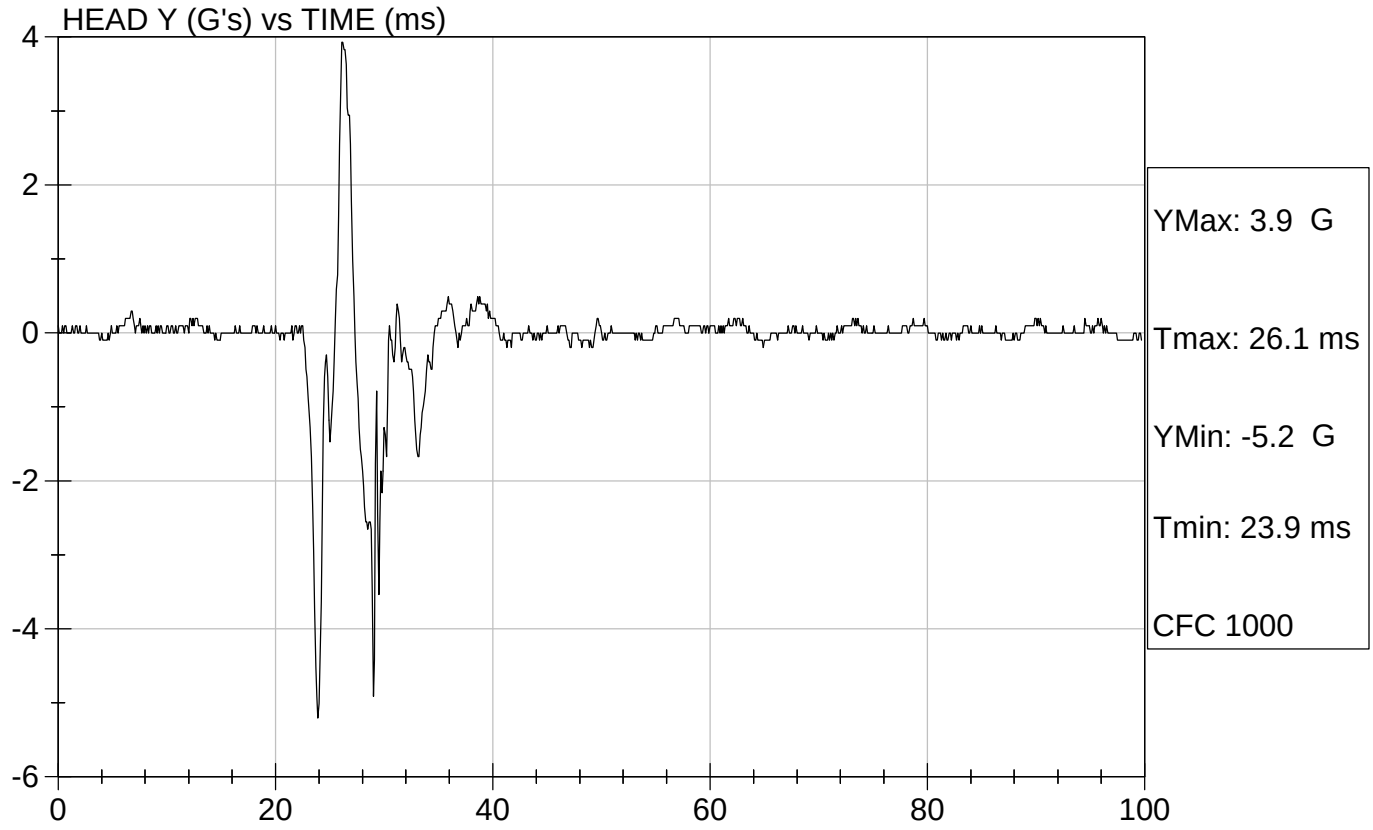
Laboratory Technician

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

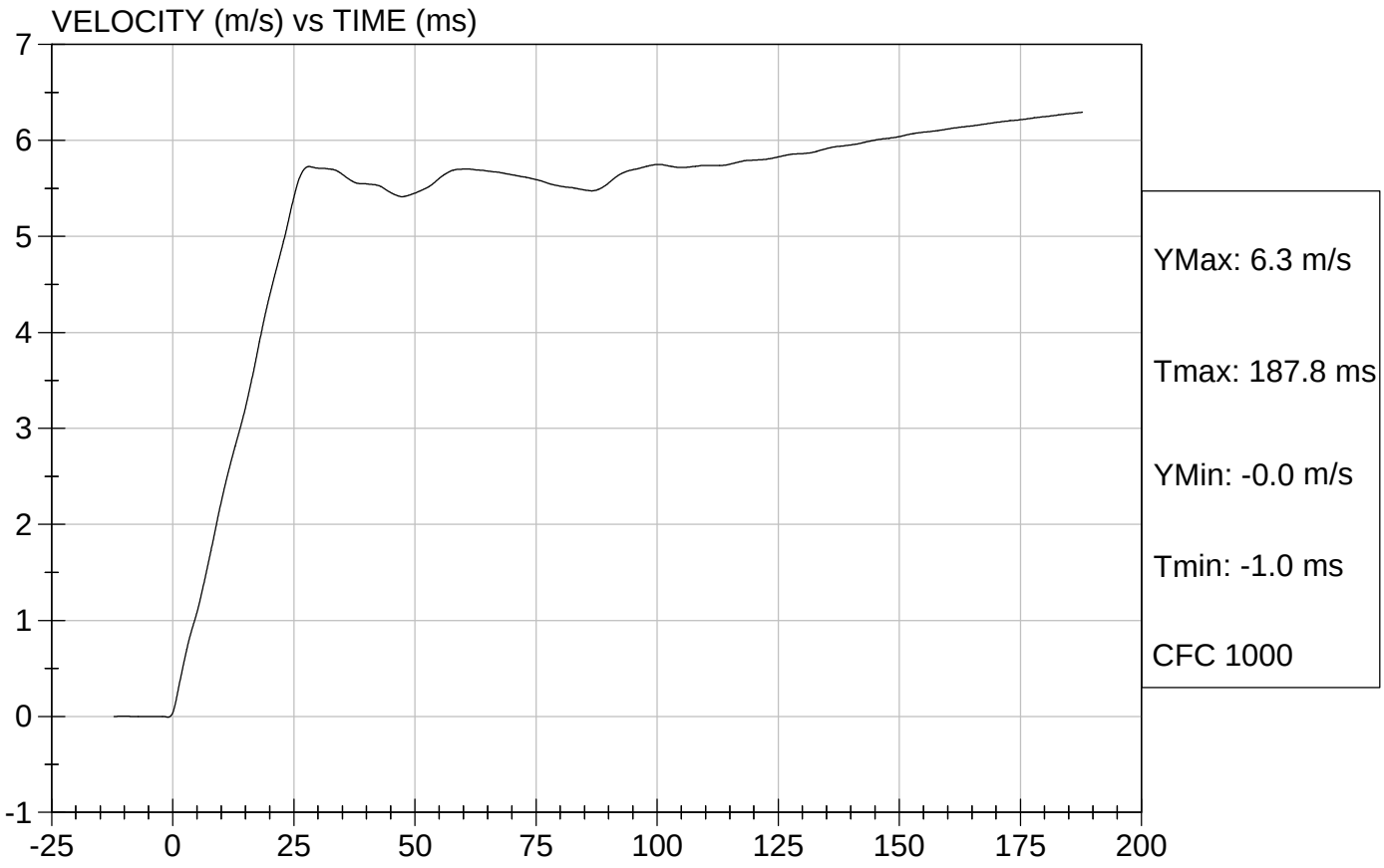
Laboratory Technician

11/13/2002
Test Date

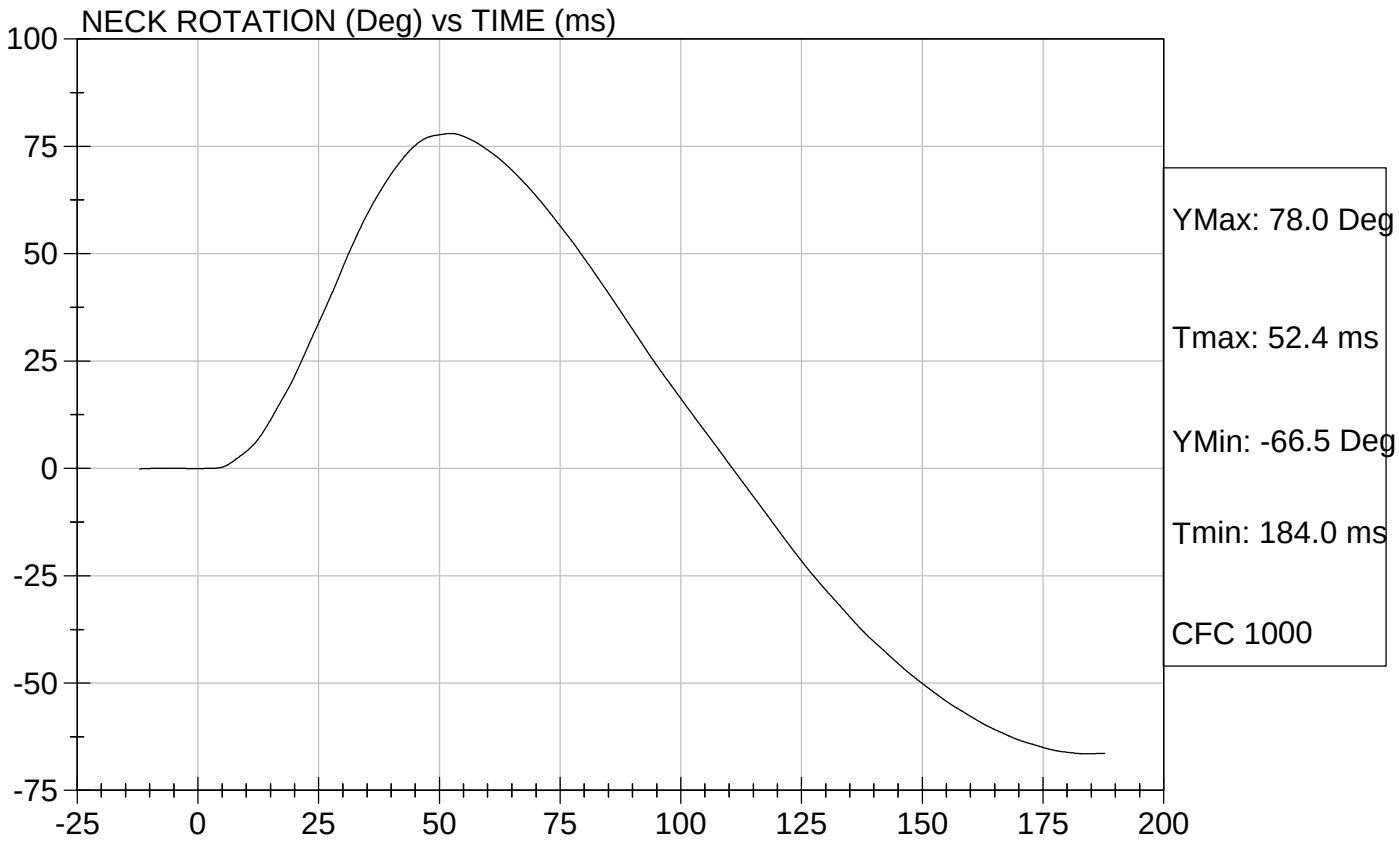
Approved By

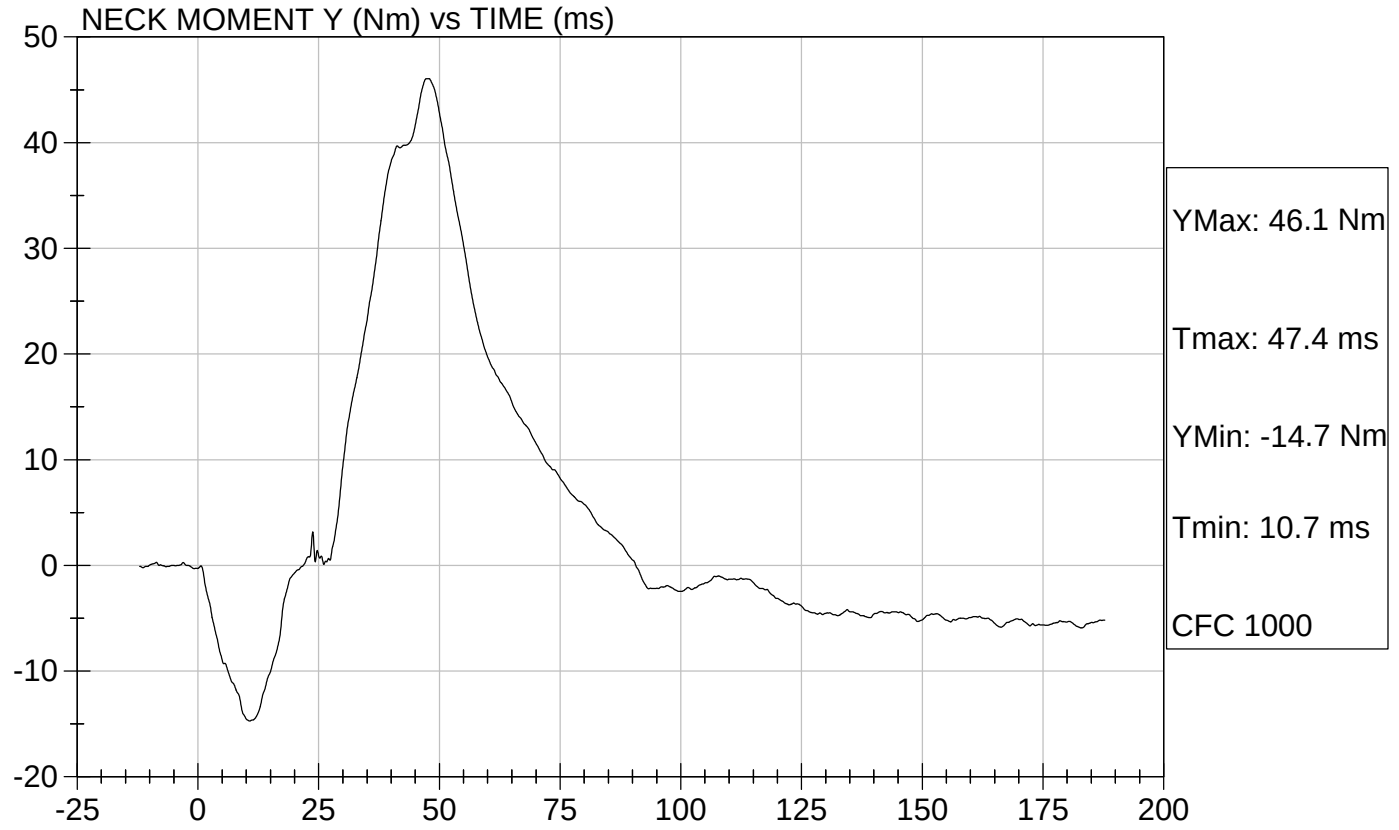
Test Description: Neck Flexion | Test Date: 11/13/2002

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

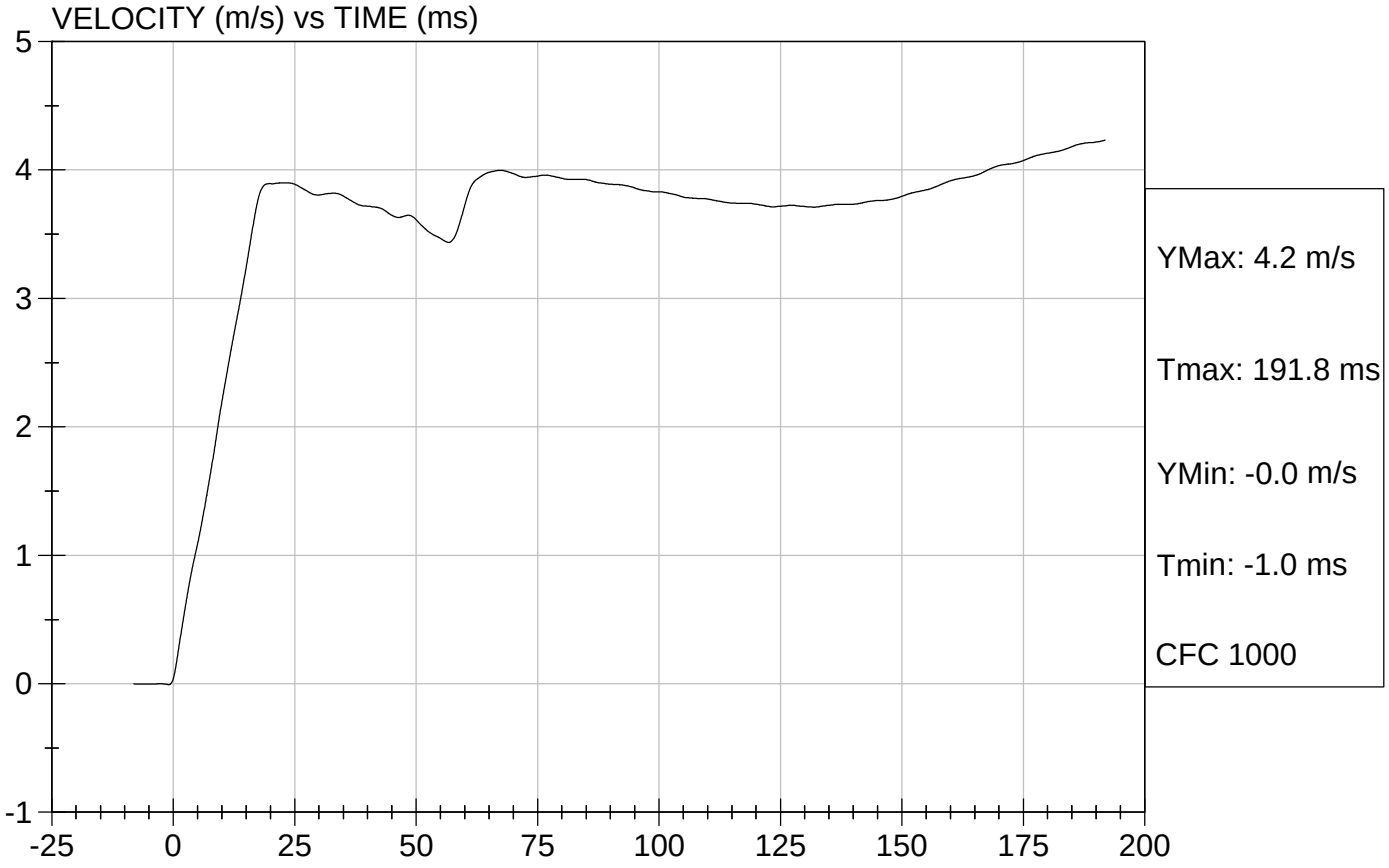
Laboratory Technician

11/14/2002
Test Date

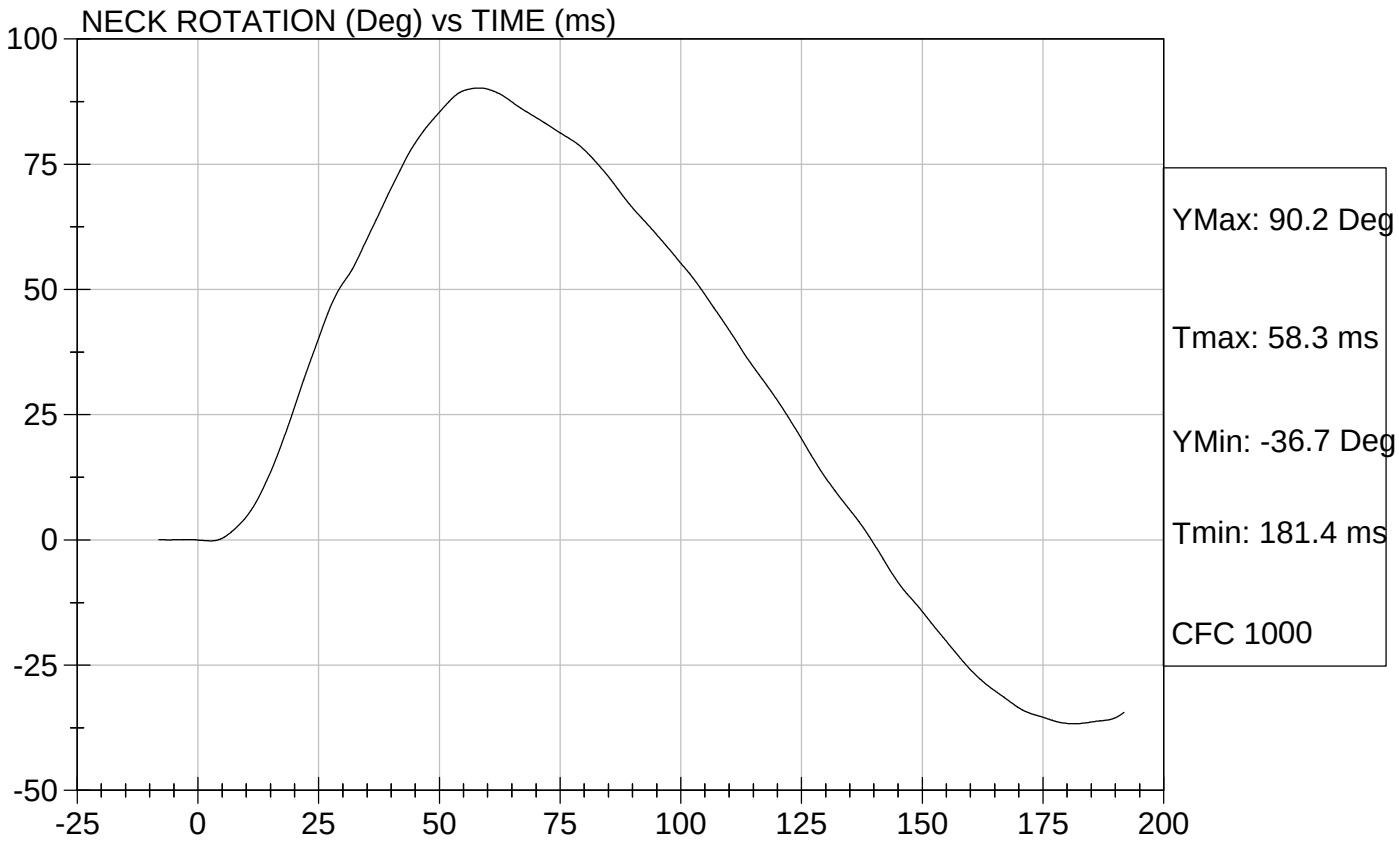
Approved By

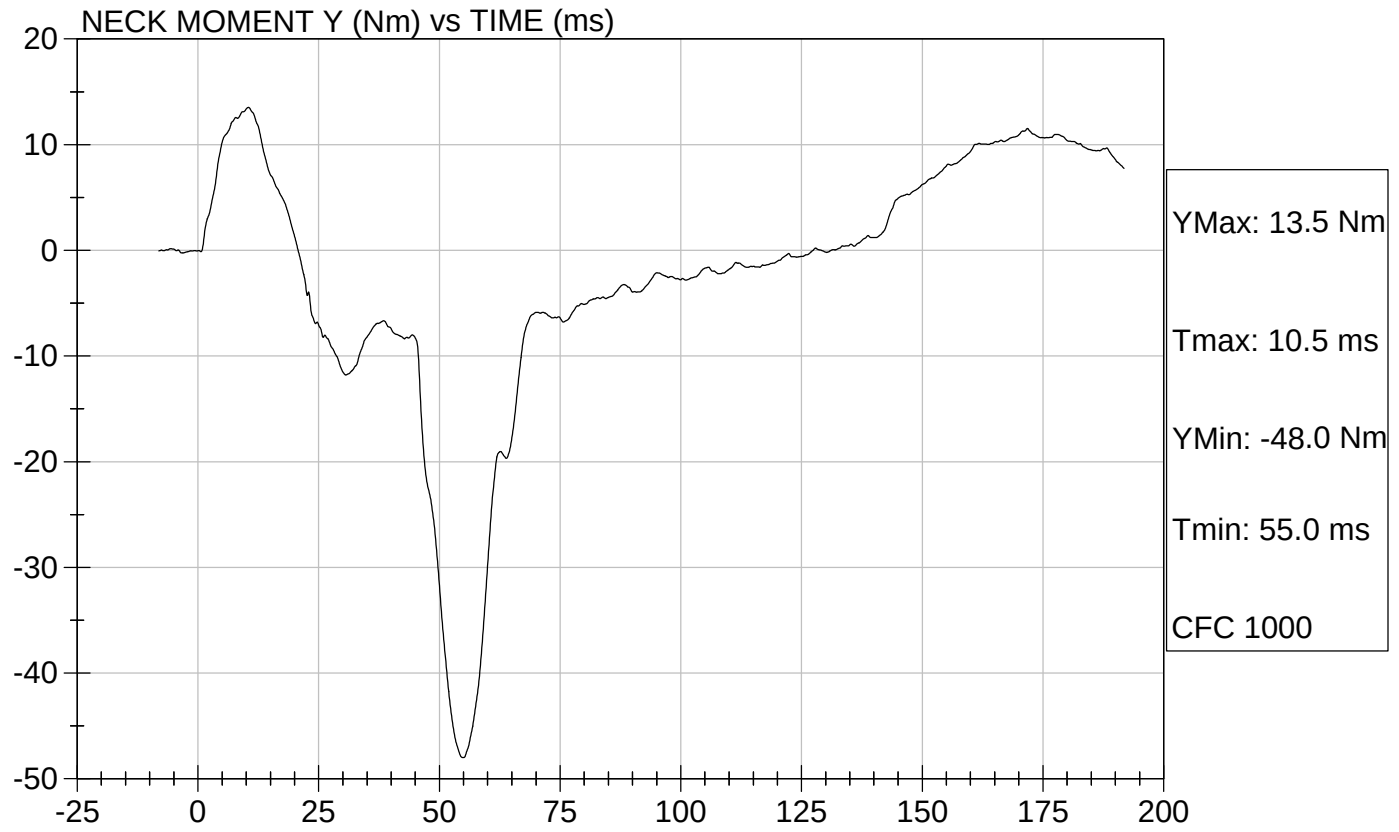
Test Description: Neck Extension Test Date: 11/14/2002

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

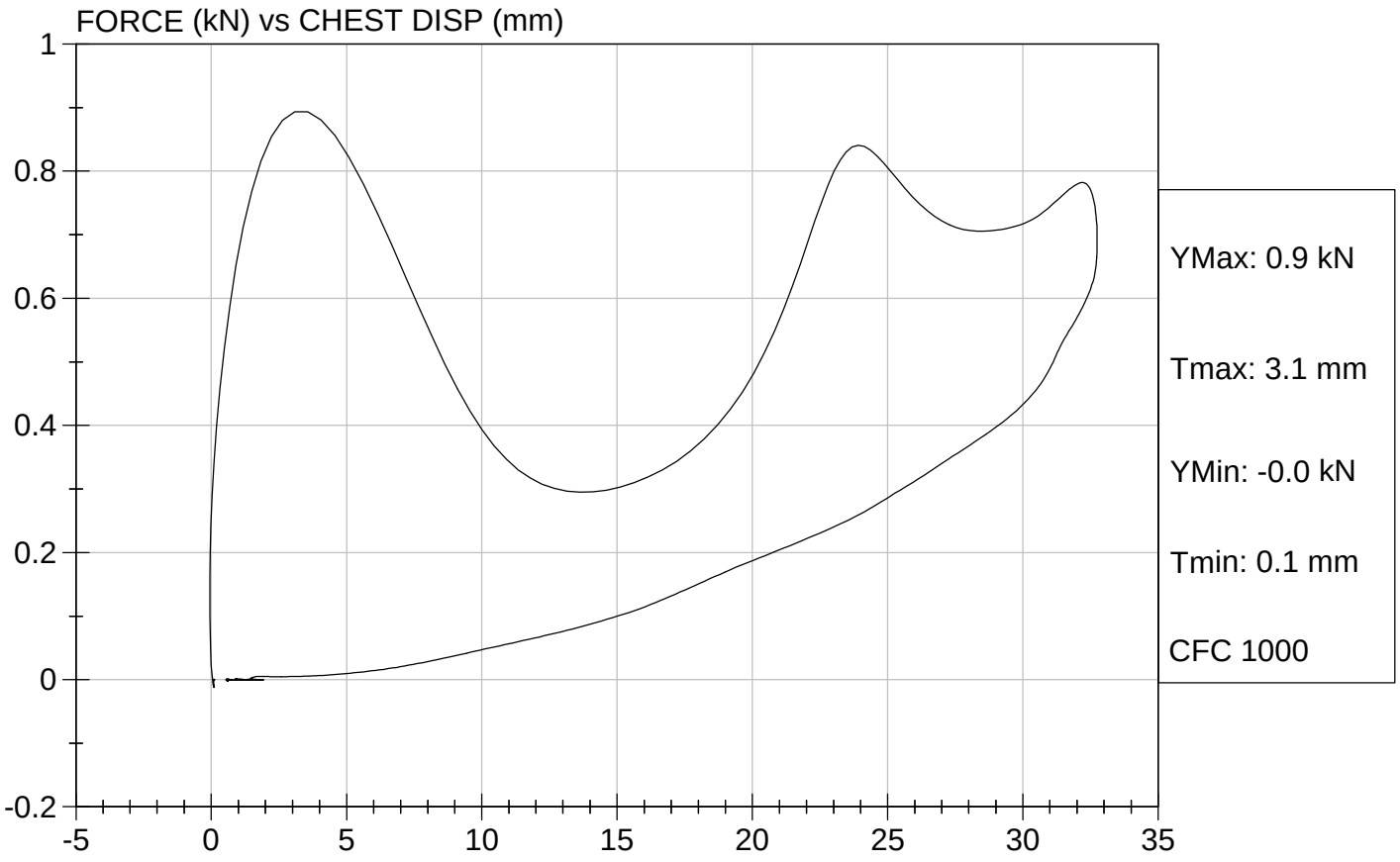
Laboratory Technician

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

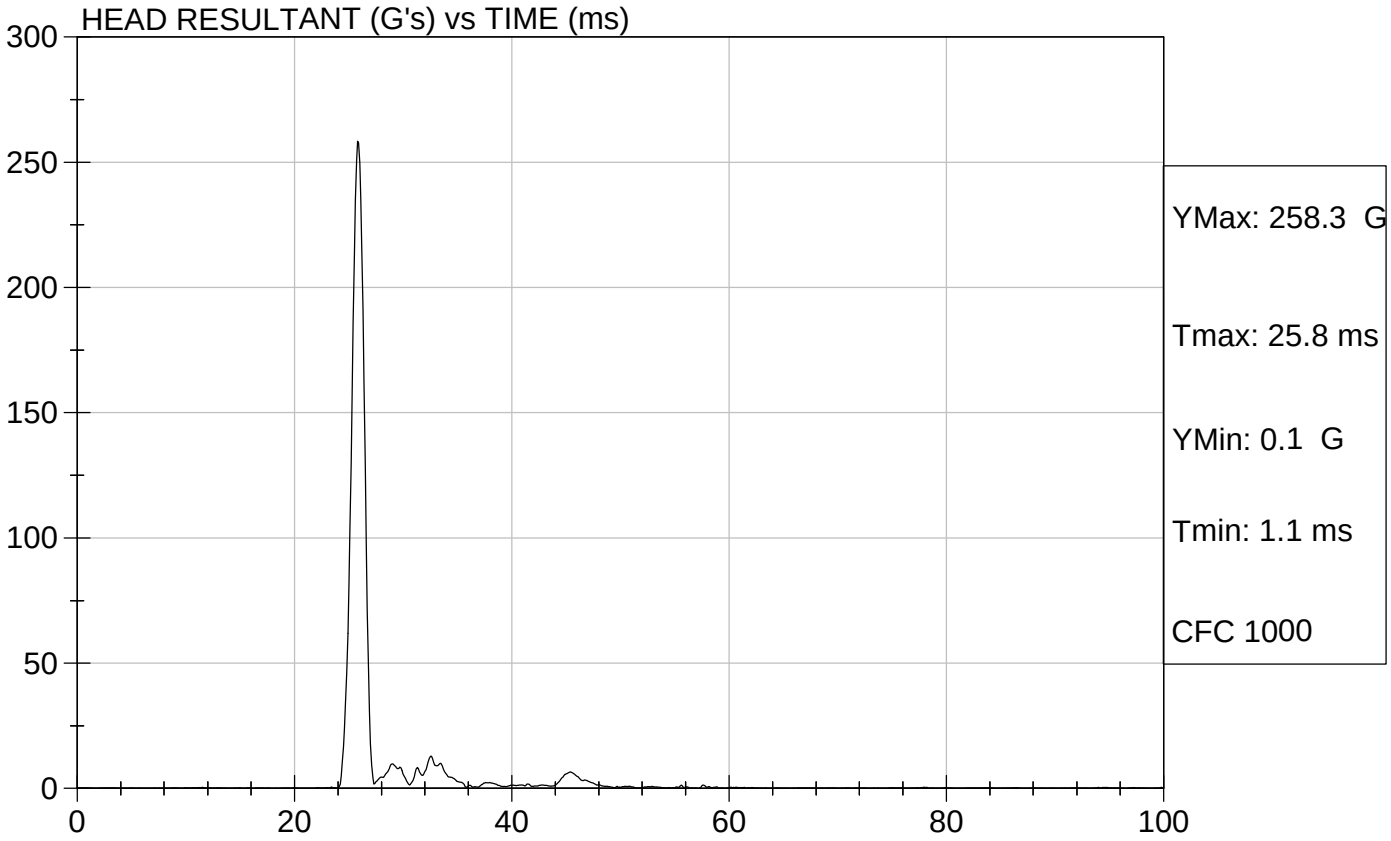
Laboratory Technician

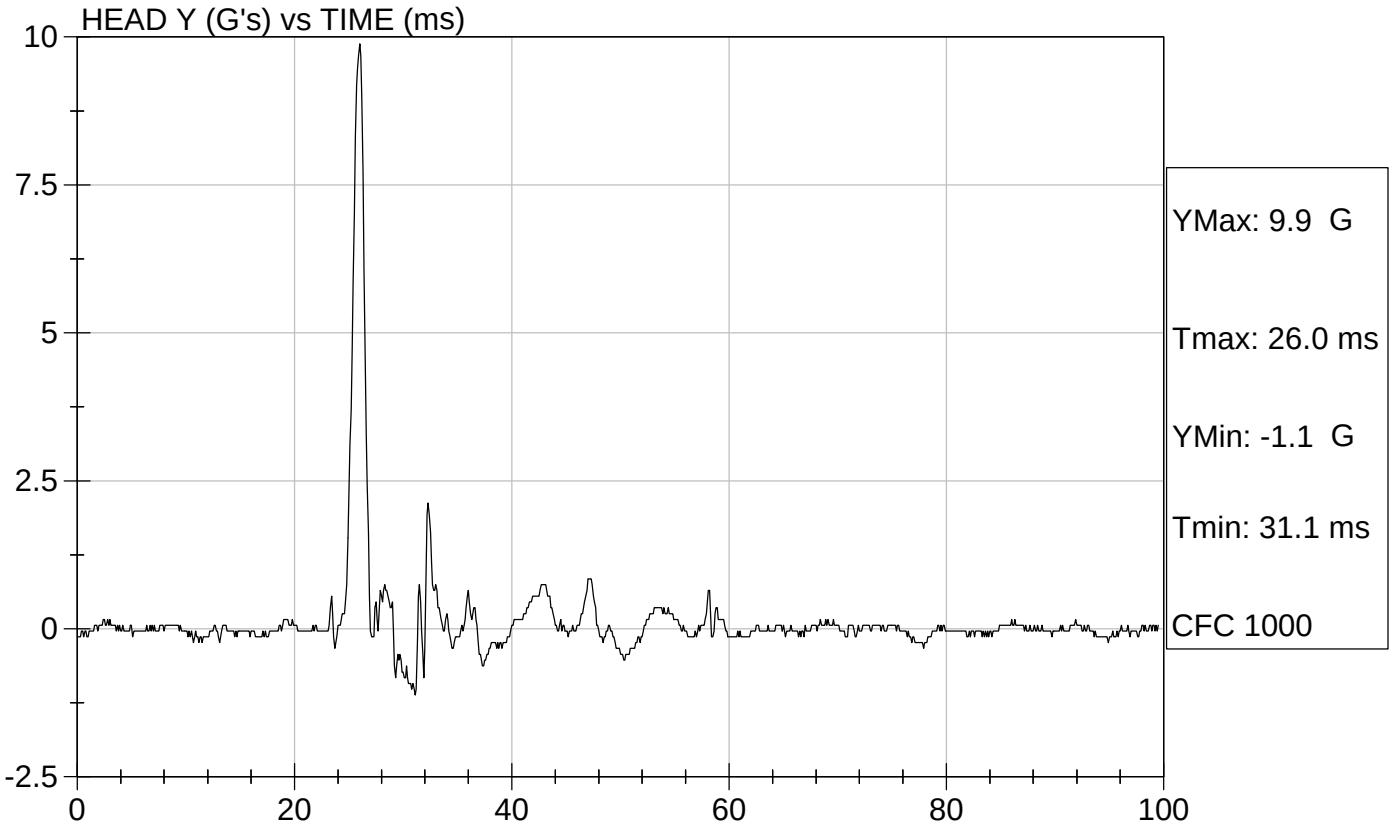
11/13/2002
Test Date

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

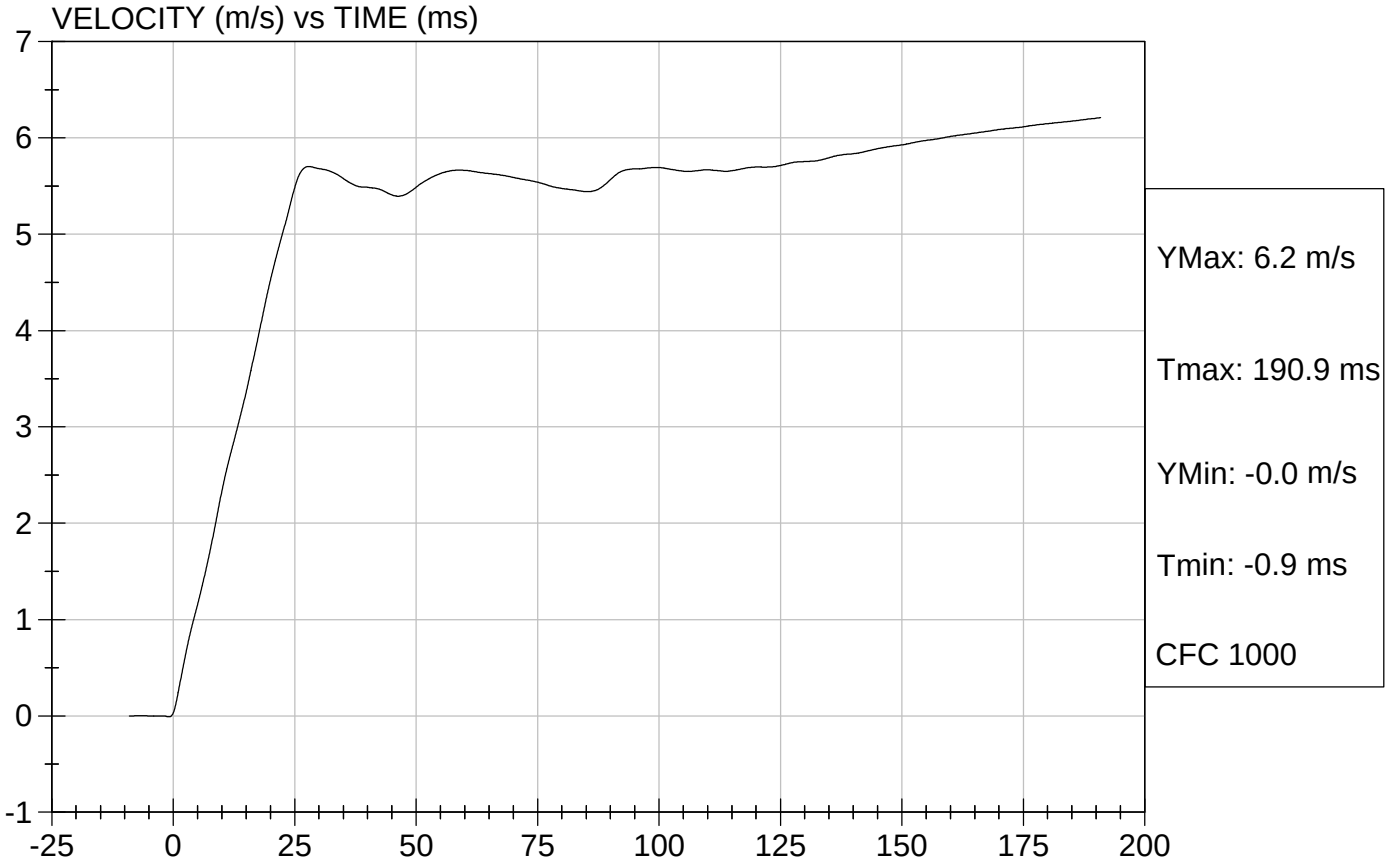
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	31	Pass
Pendulum Speed		m/s	5.4 to 5.6	5.53	Pass
Pendulum Deceleration	10 msec	m/s	2.0 - 2.7	2.3	Pass
	15 msec	m/s	3.0 - 4.0	3.4	Pass
	20 msec	m/s	4.0 - 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

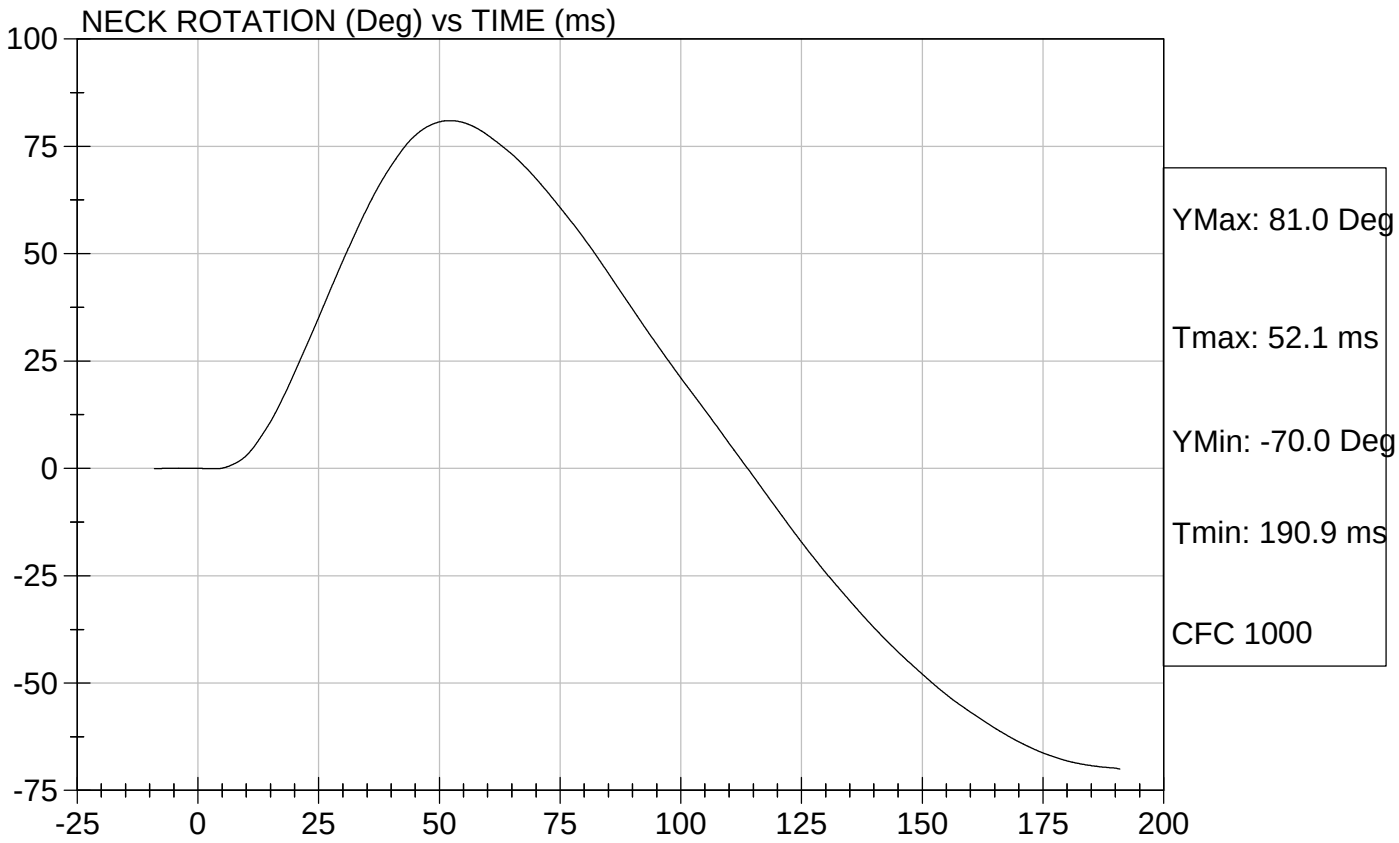
Approved By

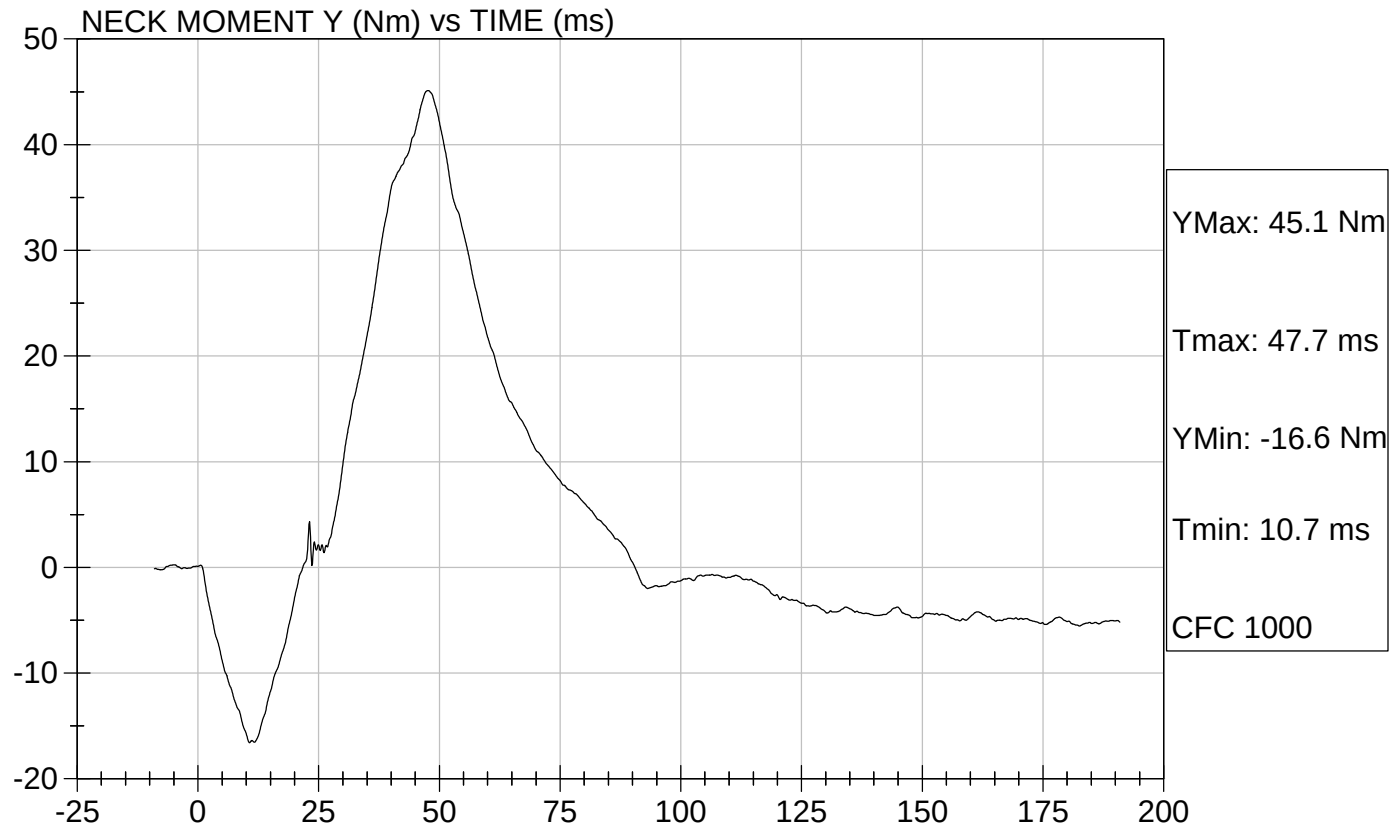
	Test Description: Neck Flexion	Test Date: 11/14/2002
	Component: D021462	Speed: 18.15 ft/sec, 5.53 m/sec



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

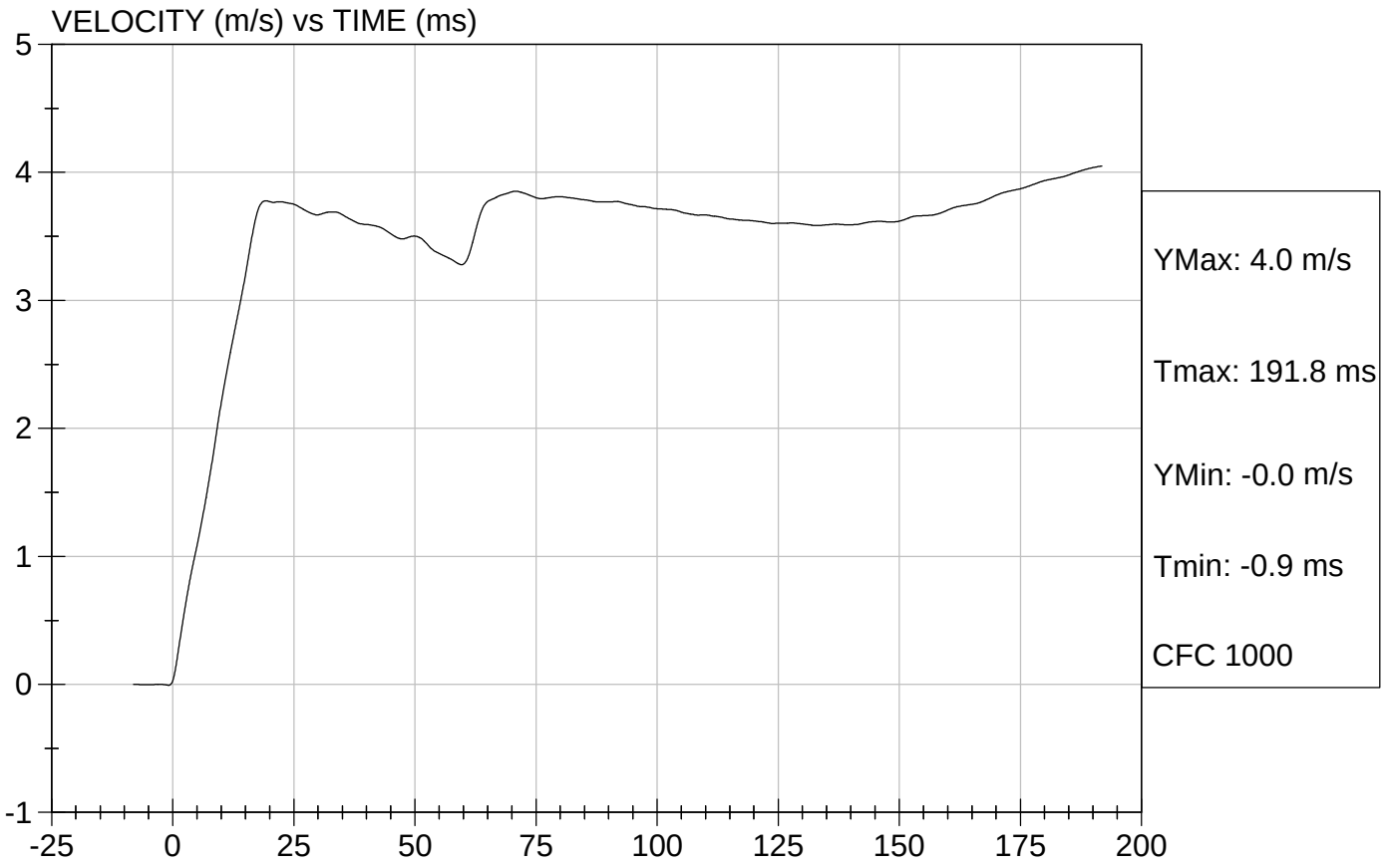
Laboratory Technician

11/14/2002
Test Date

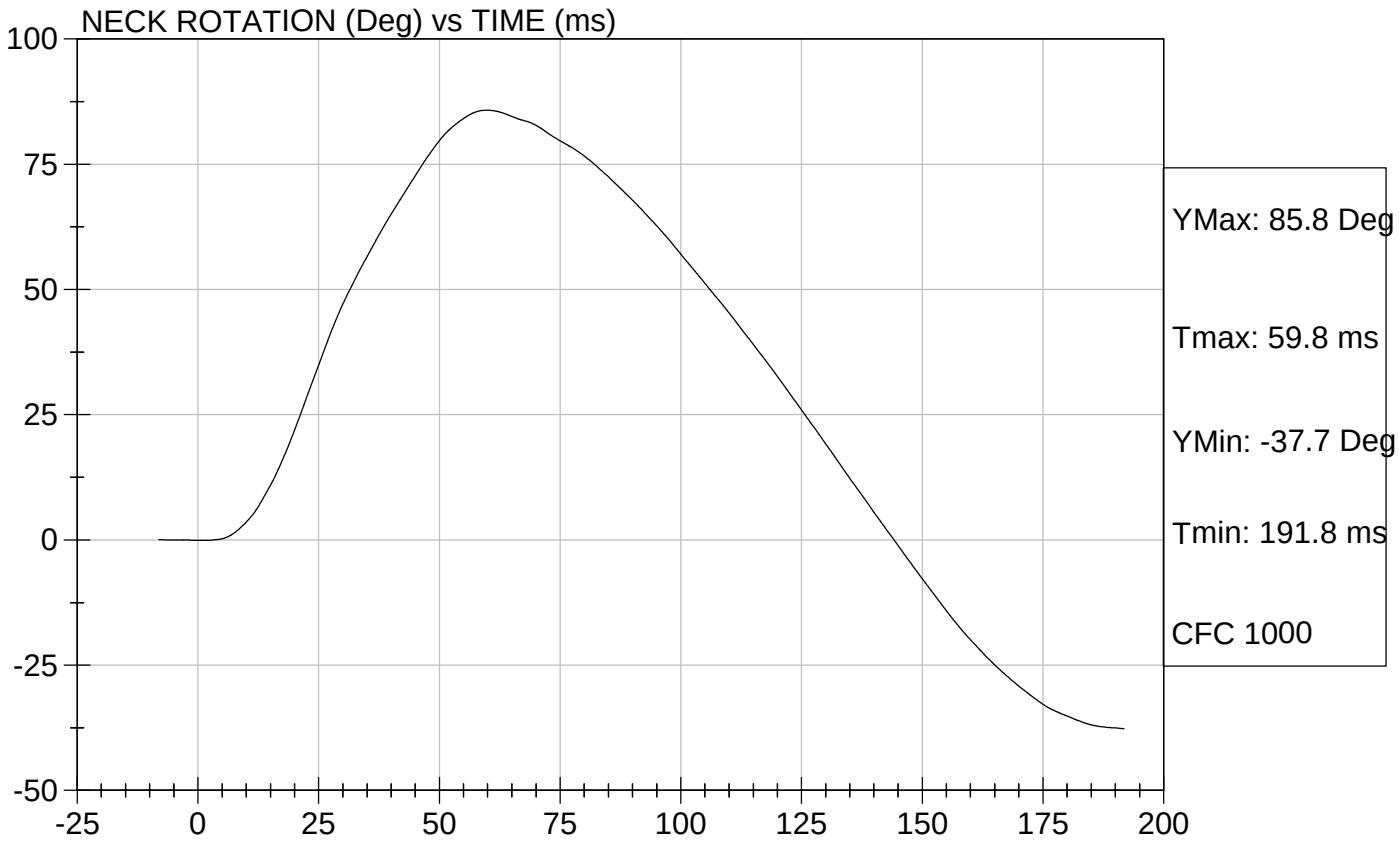
Approved By

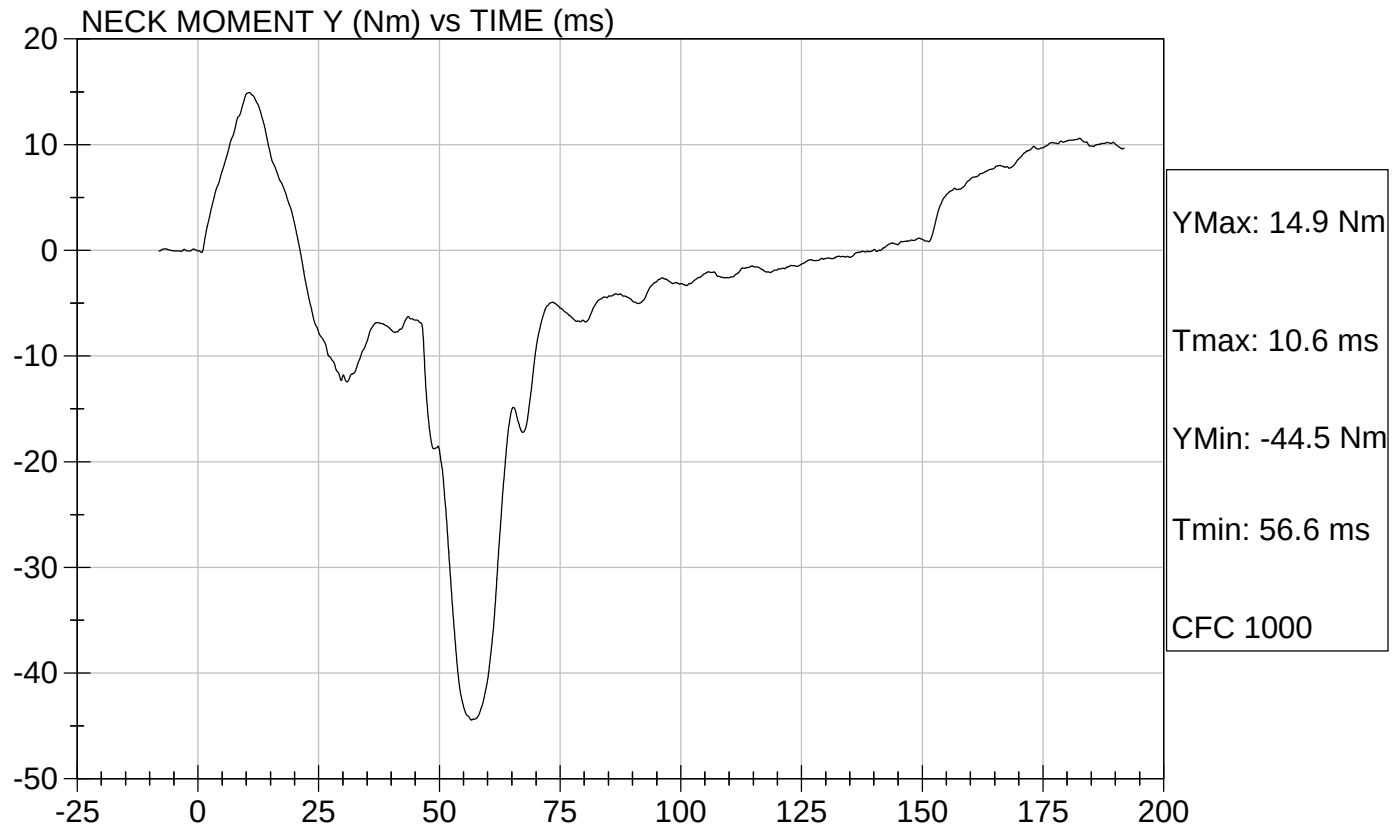
Test Description: Neck Extension Test Date: 11/14/2002

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

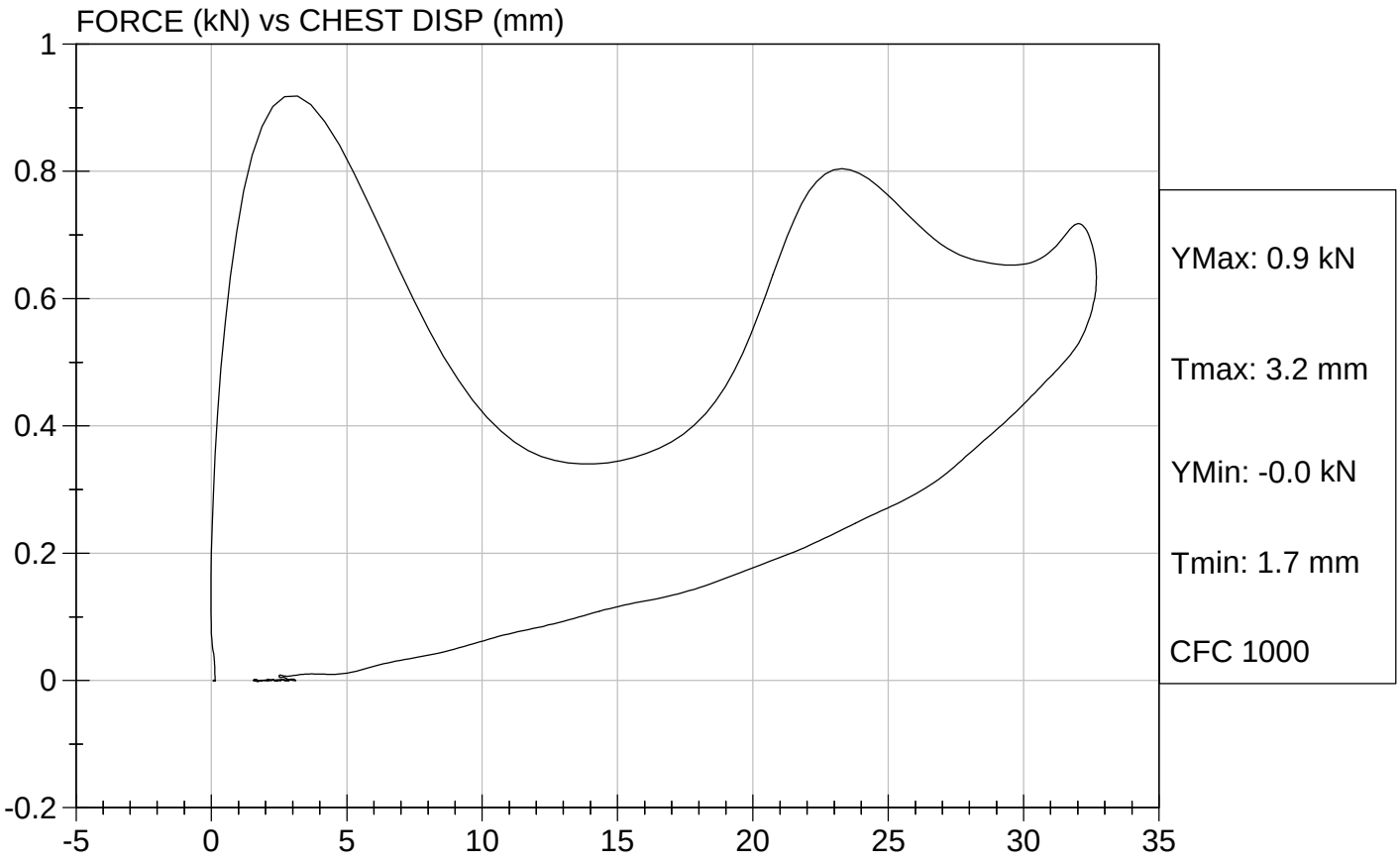
Laboratory Technician

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 RRP CHILD DUMMY S/N: 42

	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	H10-F10	Entran	11/16/02
Head Y	H10-F12	Entran	11/16/02
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	11/16/02

INSTRUMENTS FOR LRP CHILD DUMMY S/N: 40

	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	AAMD5	Endevco	11/16/02
Head Y	AALG2	Endevco	11/16/02
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	J23918	Endevco	11/16/02
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