REPORT NUMBER: NCAPCHILD-MGA-2005-004

NEW CAR ASSESSMENT PROGRAM
FRONTAL BARRIER IMPACT TEST

Evenflo Titan 5
Graco Turbo Booster

NHTSA NUMBER: M55900

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

Test Date: October 19, 2004

Final Report Date: November 29, 2004

FINAL REPORT

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

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: Shefalika Naik Date: 11/29/04
Shefalika Naik, Project Engineer

Reviewed by: David Winkelbauer Date: 11/29/04
David Winkelbauer, Facility Director

FINAL REPORT ACCEPTED BY:

_____
Manager, New Car Assessment Program

_____
Date of Acceptance

_____
COTR, NCAP Frontal Impact Program

_____
Date of Acceptance

Technical Report Documentation Page

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15. Supplementary Notes

16. Abstract

The subjects CRS Evenflo Titan 5 and Graco Turbo Booster were tested in conjunction with a Frontal NCAP test in support of research 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 October 19, 2004, in conjunction with frontal NCAP.

Measurement Description	Units	Pos. 3 ATD	Pos. 4 ATD
Head Injury Criteria (HIC36)	N/A	685	1019
Head Injury Criteria (HIC15)	N/A	441	725
Max. Thorax Accel. (3msec Clip)	G's	48	50

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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 56.3 km/h 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, both dummies had six upper axial neck force and moment sensors. The left rear child dummy had six lumbar force and moment sensors.

The right rear (Position 3) child dummy (S/N 42) and left rear (Position 4) child dummy (S/N 009) were calibrated previous to this test. Child dummy certification information is found in Appendix C.

The right rear child dummy's HIC36 was 685.1; maximum chest deceleration over 3 msec was 48.3 g's. The left rear child dummy's HIC36 was 1019.4. The maximum chest deceleration over 3 msec was 50.4 g's. Position 3 and Position 4 were forward facing. Position 3 used the vehicle LATCH and top tether for attachments. Position 4 (booster seat) used vehicle seat belts.

TEST NOTES

The following channels did not collect any valid data:

RRP Child Seat Z after 55ms
LRP Lumbar FX after 80ms

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 10 Year Old / 009
Number of Data Channels	20	35
Restraint System	Evenflo Titan 5 (Forward Facing)	Graco Turbo Booster (Booster)

16 MM CAMERA COVERAGE

High Speed	16
Real Time	1
Total	17

POST TEST DOOR OPENING

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were unlocked	Doors were unlocked
Front Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Rear Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None
Glazing Damage	The windshield cracked	

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 009)
Head Contact	Back of head to CRS	Back of head to CRS, Vehicle roof
Upper Torso Contact	None	None
Lower Torso Contact	None	None
Left Foot Contact	Passenger seat back	Driver seat back
Right Foot Contact	Passenger seat back	Driver seat back

SECTION 2… (continued)

DATA SHEET NO. 2
CRS PARAMETER DATA

Child Restraint System (Position 3)	Evenflo Titan 5 (Forward Facing)
Child Restraint System (Position 4)	Graco Turbo Booster (Forward Facing)
NHTSA No.	M55900

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1570.8
Weight of 2 P572E ATDs	kg	156.0
Rated Cargo/Luggage Weight (RCLW)	kg	81.6
Calculated Vehicle Target Weight (TVTW)	kg	1808.4

TEST VEHICLE WEIGHTS

	Units	As Tested (ATW) (Axle)		
		Front	Rear	Total
Left	kg	500.3	417.3	
Right	kg	473.1	411.4	
Ratio	%	54.0	46.0	
Totals	kg	973.4	828.7	1802.1

As tested weight of vehicle includes two 50th percentile ATDs, one 3 year old with CRS, one 10 year old with CRS, cargo, equipment and instrumentation.

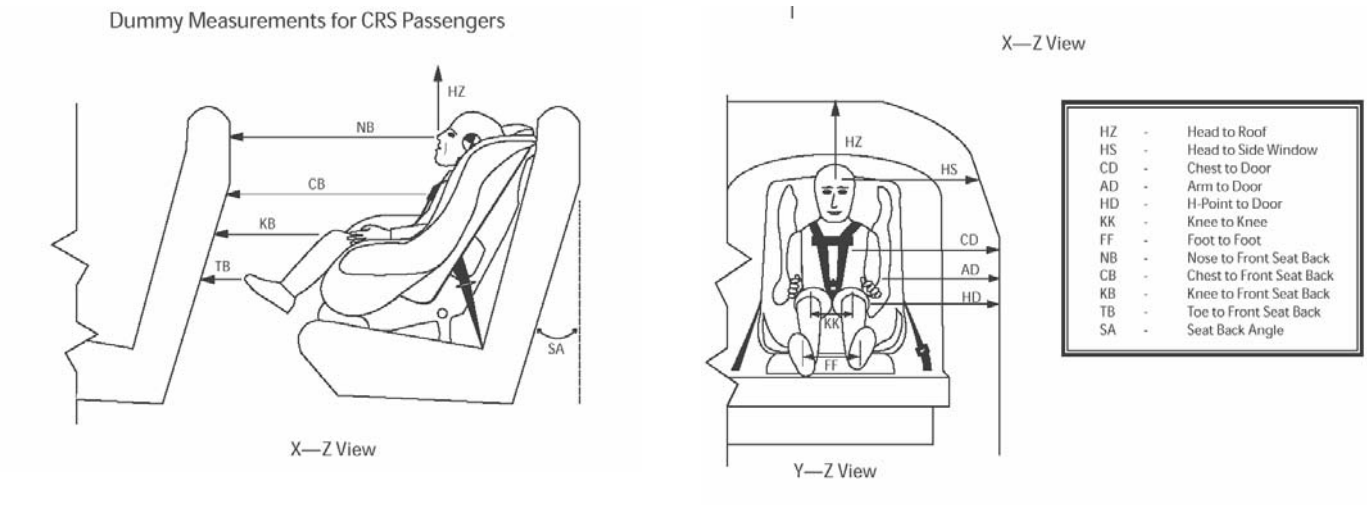
CHEST CLIP DISPLACEMENT

	Units	Left	Right
Right Child Dummy	mm	55	58
Left Child Dummy	mm		

SECTION 2… (continued)

DATA SHEET NO. 3
CHILD DUMMY POSITIONING IN VEHICLE

Child Restraint System (Position 3)	Evenflo Titan 5 (Forward Facing)
NHTSA No.	M55900



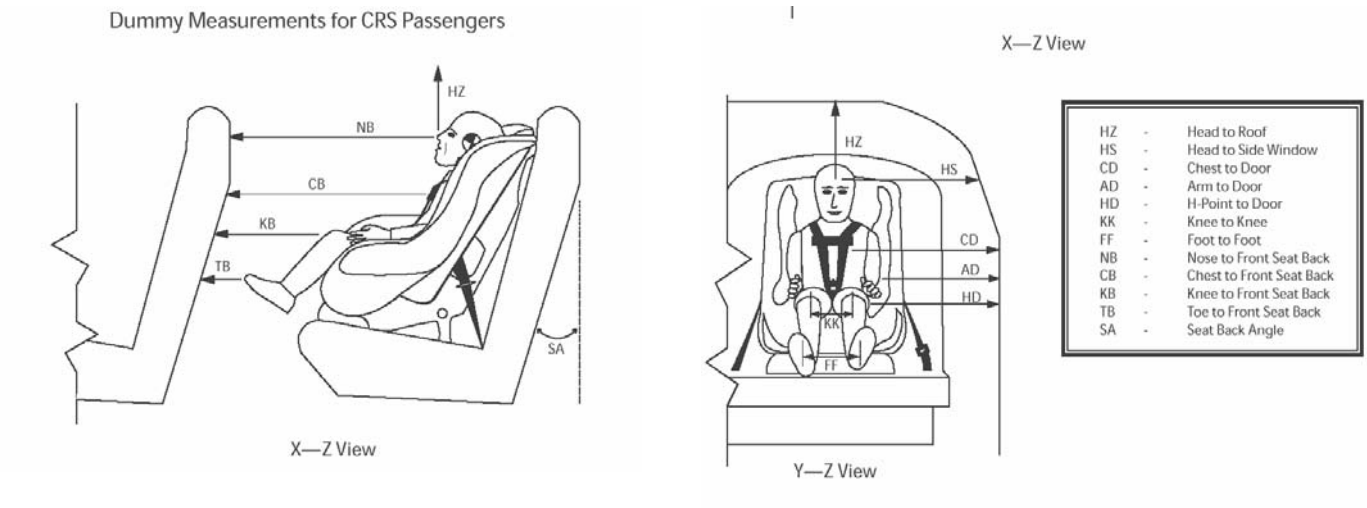
Measurement	Pre-Test (mm)	Post-Test (mm)
	P3 CRS (42)	P3 CRS (42)
SA (deg)	7.0	10.3
HS	381	352
CD	321	292
AD	201	189
HD	259	252
HZ	355	350
NB	662	631
CB	596	587
KK	142	184
FF	91	380
KB - LEFT	360	335
KB – RIGHT	360	366
TB - LEFT	114	118
TB - RIGHT	116	186

All dimensions in mm (unless noted)
P3 – Right Rear Passenger (Forward Facing)

SECTION 2… (continued)

DATA SHEET NO. 3
CHILD DUMMY POSITIONING IN VEHICLE

Child Restraint System (Position 4)	Graco Turbo Booster(Forward Facing)
NHTSA No.	M55900



Measurement	Pre-Test (mm)	Post-Test (mm)
	P4 CRS (009)	P4 CRS (119)
SA (deg)	8.8	11.3
HS	340	176
CD	300	255
AD	145	0
HD	253	270
HZ	170	91
NB	659	640
CB	570	572
KK	167	154
FF	155	97
KB - LEFT	240	297
KB – RIGHT	230	271
TB - LEFT	20	95
TB - RIGHT	15	52

All dimensions in mm (unless noted)
P4 – Left Rear Passenger (Forward facing)

DATA SHEET NO. 4
CHILD DUMMY INJURY CRITERIA VALUES

Child Restraint System (Position 3)	Evenflo Titan 5
Child Restraint System (Position 4)	Graco Turbo Booster
NHTSA No.	M55900

HEAD PEAK ACCELERATIONS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Head CG	X	G's	49.4	202	-35.0	113	10.3	233	-52.5	108
Head CG	Y	G's	4.5	79	-7.7	113	2.2	121	-7.6	108
Head CG	Z	G's	59.8	89	-7.6	45	73.4	87	-1.3	20
Resultant	N/A	G's	65.7	202			82.1	87		

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	45	268	-797	112	65	224	-1399	108
Neck Force	Y	N	130	79	-27	272	121	70	-133	105
Neck Force	Z	N	1955	88	-309	204	2589	89	-193	23
Resultant	N/A	N	2041	88			2887	89		
Neck Moment	X	N•m	3.5	75	-7.6	117	19.5	110	-9.7	91
Neck Moment	Y	N•m	4.9	147	-19.1	209	35.7	103	-44.0	86
Neck Moment	Z	N•m	1.4	65	-1.0	117	1.1	101	-5.6	80
Resultant	N/A	N•m	19.2	209			44.3	86		

CHEST PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Chest CG	X	G's	8.3	210	-47.5	82	2.7	109	-47.7	63
Chest CG	Y	G's	10.0	78	-1.3	212	2.4	90	-8.3	60
Chest CG	Z	G's	18.1	202	-31.0	65	15.0	106	-23.0	75
Resultant	N/A	G's	51.5	82			51.6	63		

CHEST PEAK DISPLACEMENTS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Chest	X	mm			-17.1	116			-28.7	93

SECTION 2… (continued)
DATA SHEET NO. 4… (continued)
CHILD DUMMY INJURY CRITERIA VALUES

Child Restraint System (Position 3)	Evenflo Titan 5
Child Restraint System (Position 4)	Graco Turbo Booster
NHTSA No.	M55900

TETHER FORCE

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Left Tether Force	N/A	N								
Right Tether Force	N/A	N	815	87						

PELVIC PEAK ACCELERATIONS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Pelvis	X	G's	13.4	129	-60.9	62	8.0	127	-51.6	63
Pelvis	Y	G's	15.6	73	-6.3	90	14.3	78	-7.5	49
Pelvis	Z	G's	19.5	202	-31.3	60	7.7	108	-47.4	73
Resultant	N/A	G's	66.9	61			62.7	63		

FEMUR FORCES

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Left Femur	N/A	N					1611	68	-146	146
Right Femur	N/A	N					1094	68	-557	147

BELT FORCES

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Shoulder Belt	N/A	N					5618	84		
Lap Belt	N/A	N					4885	66		

LUMBAR FORCES AND MOMENTS

Location	Axis	Units	Position 3				Position 4			
			Max	Time	Min	Time	Max	Time	Min	Time
Lumbar Force	X	N					*	*	*	*
Lumbar Force	Y	N					32	300	-593	96
Lumbar Force	Z	N					775	107	-2571	65
Resultant	N/A	N					*	*		
Lumbar Moment	X	N•m					7.9	300	-87.3	69
Lumbar Moment	Y	N•m					67.3	123	-64.8	246
Lumbar Moment	Z	N•m					38.2	58	-3.2	300
Resultant	N/A	N•m					93.1	69		

* No valid data collected after 80ms

SECTION 2… (continued)

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

Child Restraint System (Position 3)	Evenflo Titan 5
Child Restraint System (Position 4)	Graco Turbo Booster
NHTSA No.	M55900

HEAD INJURY CRITERIA (HIC36)

Location	HIC	T^1 (msec)	T^2 (msec)	Average Acceleration (G's)
Position 3 - Right	685.1	71.3	107.3	51.5
Position 4 – Left	1019.4	75.9	111.9	60.4

HIC 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	440.5	79.6	94.6	61.3
Position 4 – Left	724.8	81.8	96.8	74.8

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	48.3	79.9	82.9
Position 4 – Left	50.4	61.5	64.5

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

DATA SHEET NO. 5
CRS PERFORMANCE DATA

Child Restraint System (Position 3)	Evenflo Titan 5 (Forward Facing)
Child Restraint System (Position 4)	Graco Turbo Booster(Forward Facing)
NHTSA No.	M55900

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	

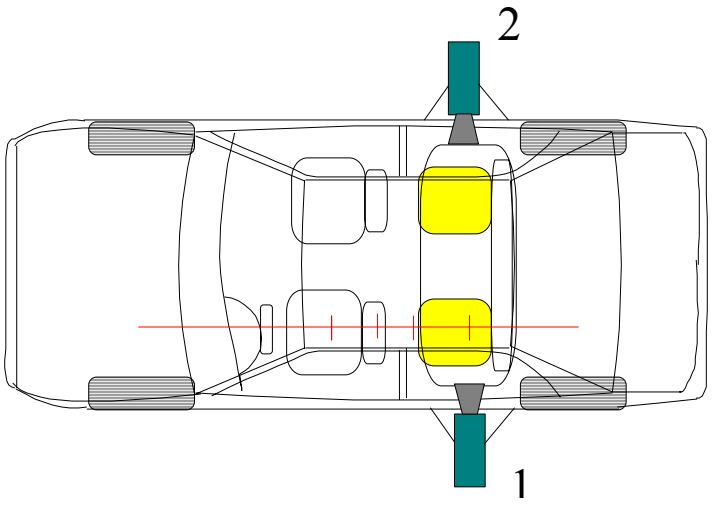
POSITION 4 CRS POST-TEST INSPECTION

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	None	
Vehicle Seat Fabric Tears	None	
Child Dummy	None	

SECTION 2… (continued)

DATA SHEET NO. 6
CRS CAMERA DATA

Child Restraint System (Position 3)	Evenflo Titan 5 (Forward Facing)
Child Restraint System (Position 4)	Graco Turbo Booster (Forward Facing)
NHTSA No.	M55900



No.	Camera View	Location (mm) *			Angle (deg)	Lens (mm)	Speed (fps)
		X	Y	Z			
1	Left Side CRS Lateral View					8	500
2	Right Side CRS Lateral View					8	500

*COORDINATES:

+X = forward of impact plane

+Y = right of monorail centerline

+Z = above ground level

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Close-up View of Position 3 CRS Label

Pre-Test Front 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 Front 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 Front ¾ View

Post-Test Position 4 Front ¾ View

Post-Test Position 3 Feet Contact

Post-Test Position 4 Feet Contact

Post-Test Position 4 Head Contact

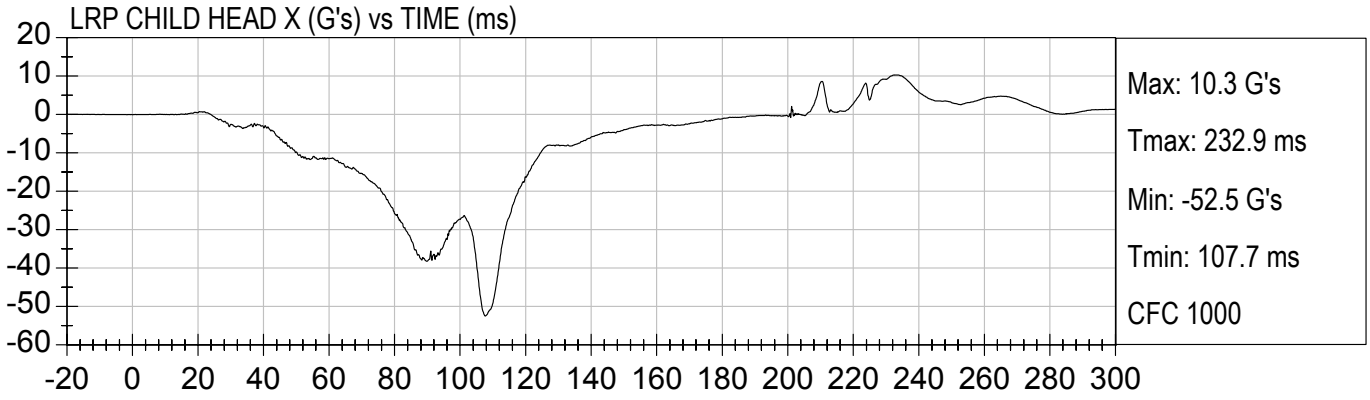
APPENDIX B

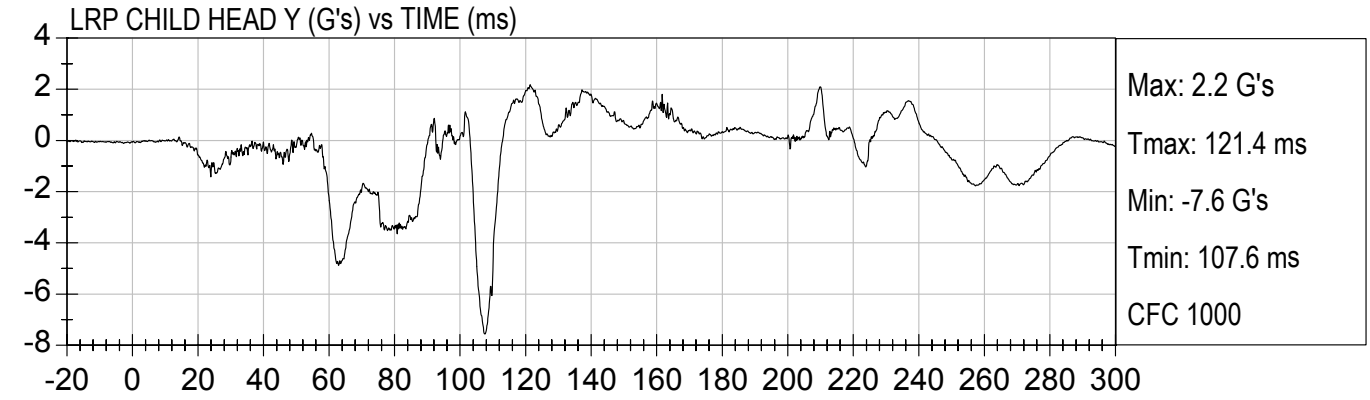
CHILD DUMMY RESPONSE DATA TRACES

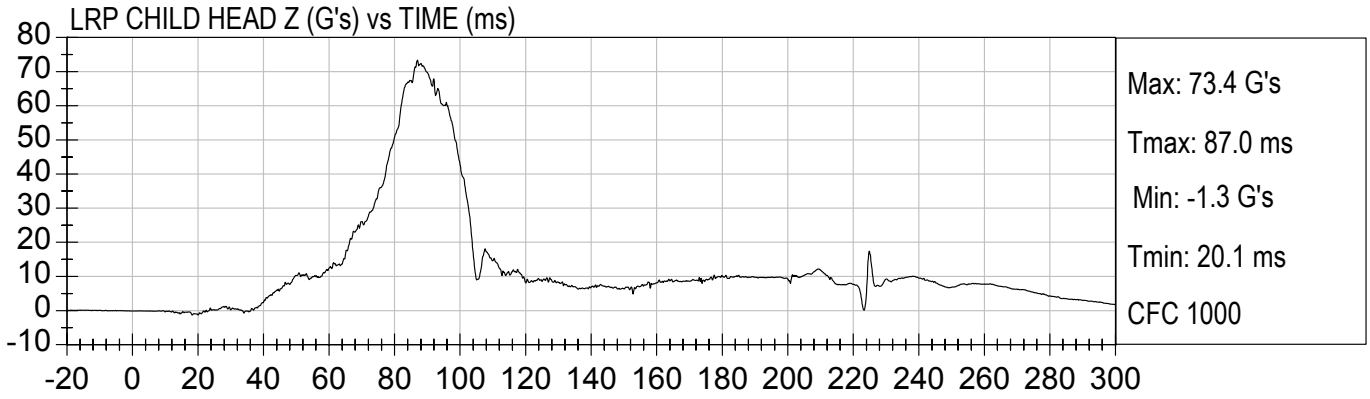
TABLE OF DATA PLOTS

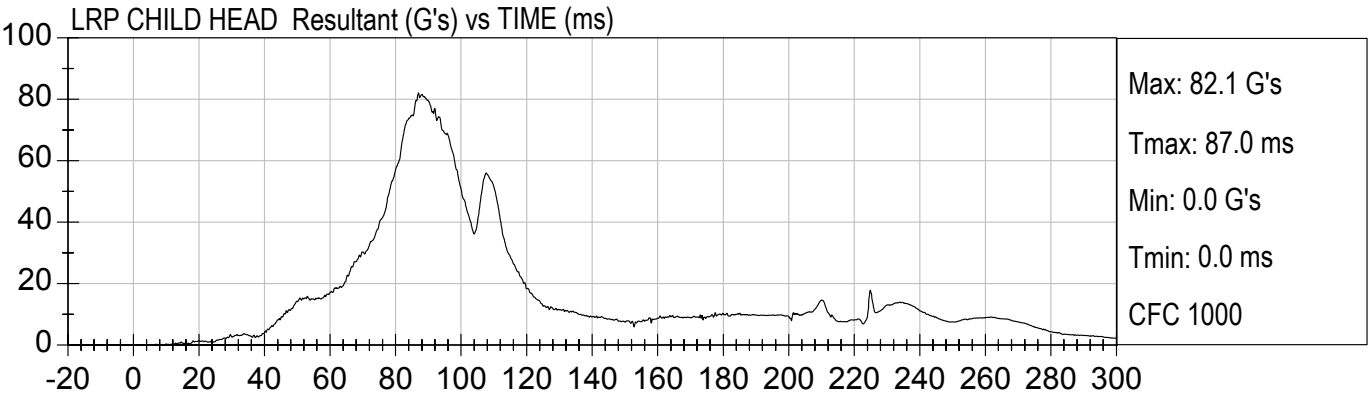
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

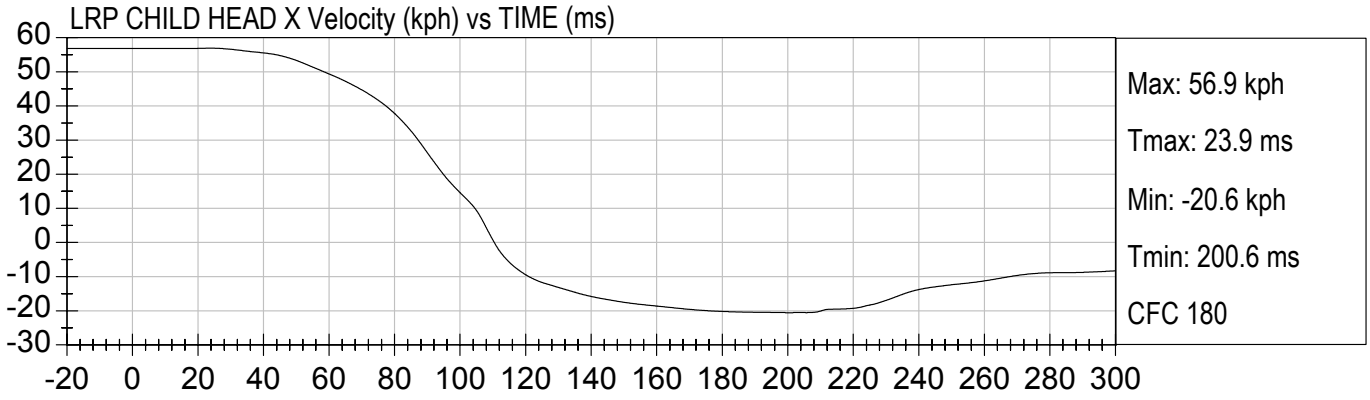
Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

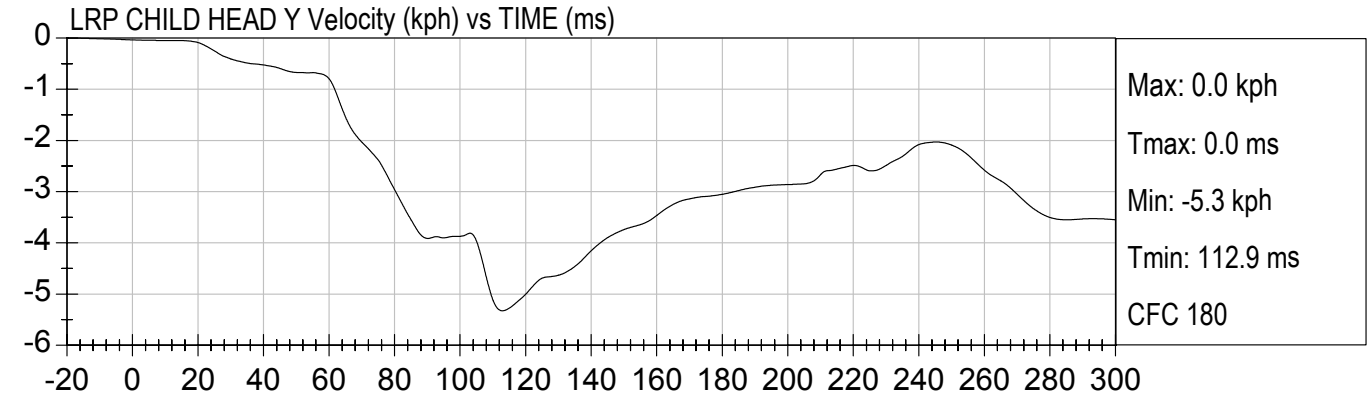


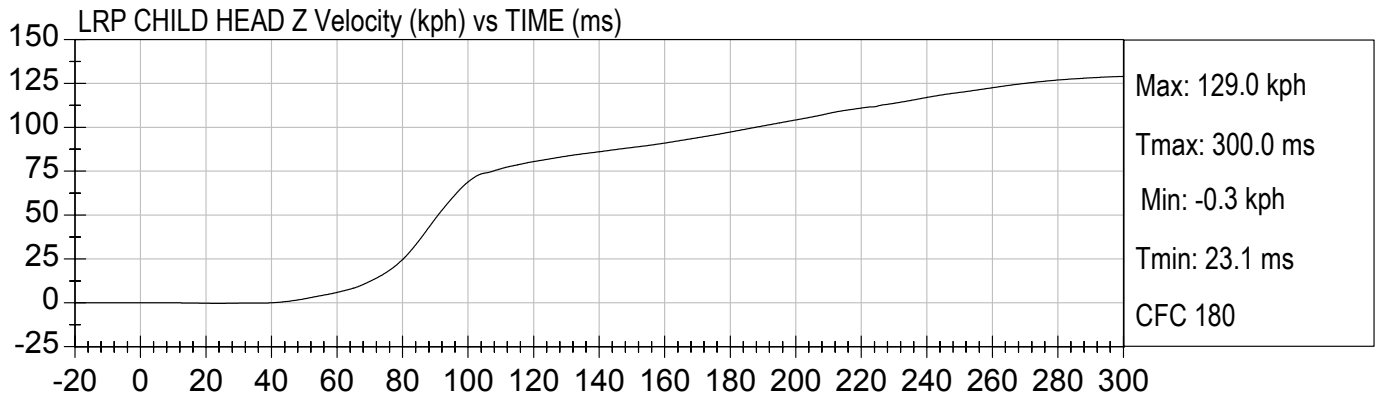






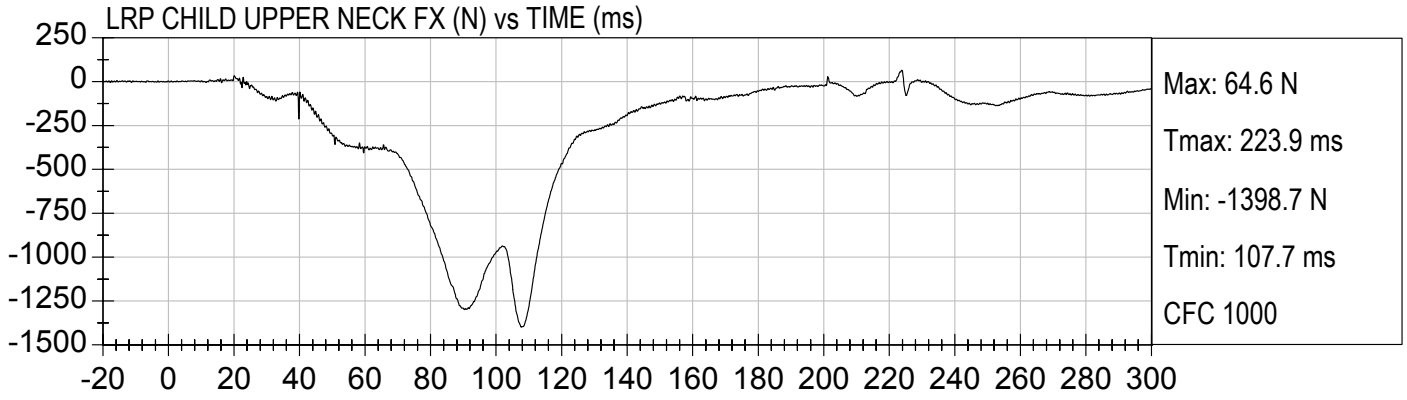

LRP CHILD HEAD X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
-30
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.9 kph
Tmax: 23.9 ms
Min: -20.6 kph
Tmin: 200.6 ms
CFC 180

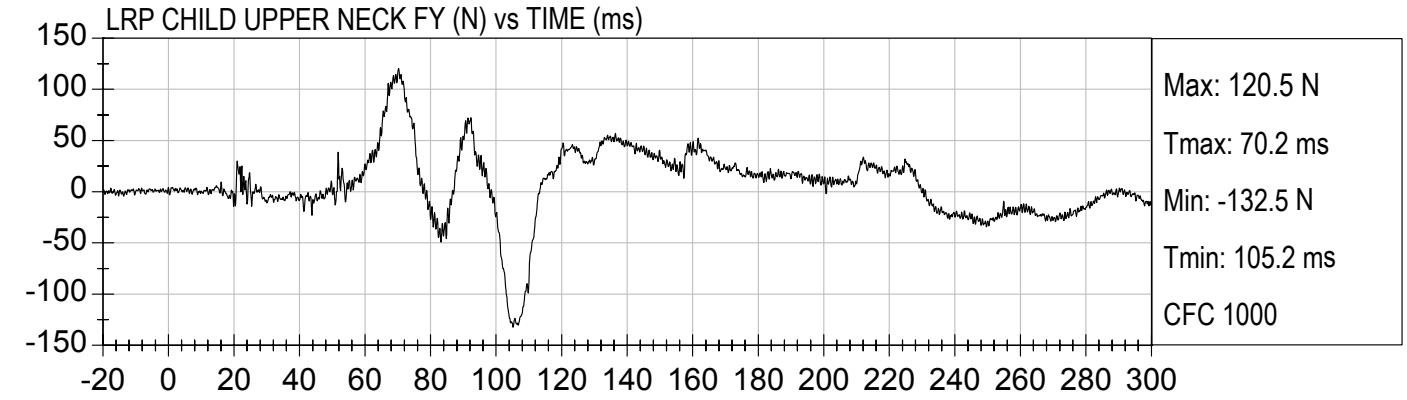

LRP CHILD HEAD Y Velocity (kph) vs TIME (ms)
0
-1
-2
-3
-4
-5
-6
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.0 kph
Tmax: 0.0 ms
Min: -5.3 kph
Tmin: 112.9 ms
CFC 180

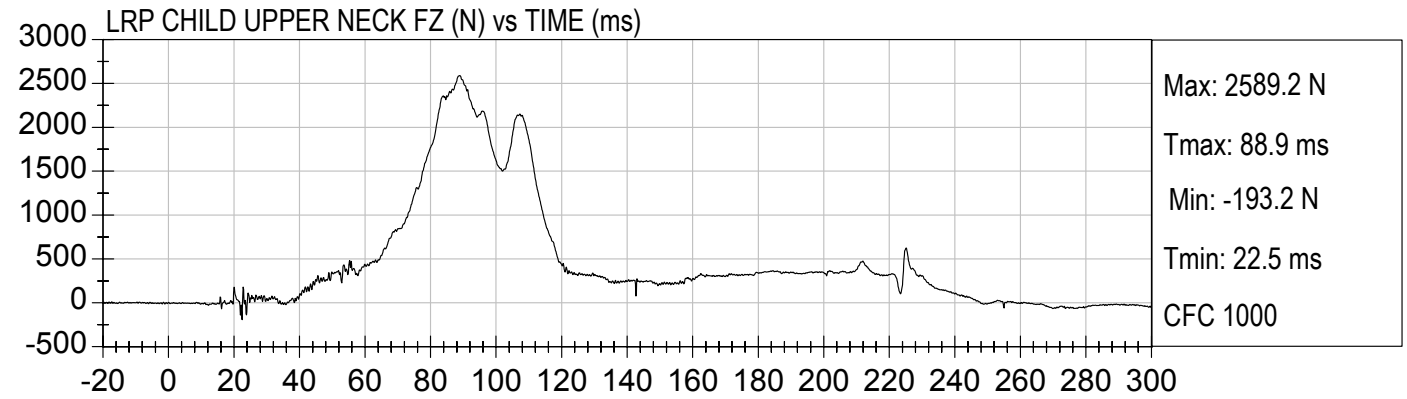

LRP CHILD HEAD Z Velocity (kph) vs TIME (ms)
150
125
100
75
50
25
0
-25
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 129.0 kph
Tmax: 300.0 ms
Min: -0.3 kph
Tmin: 23.1 ms
CFC 180

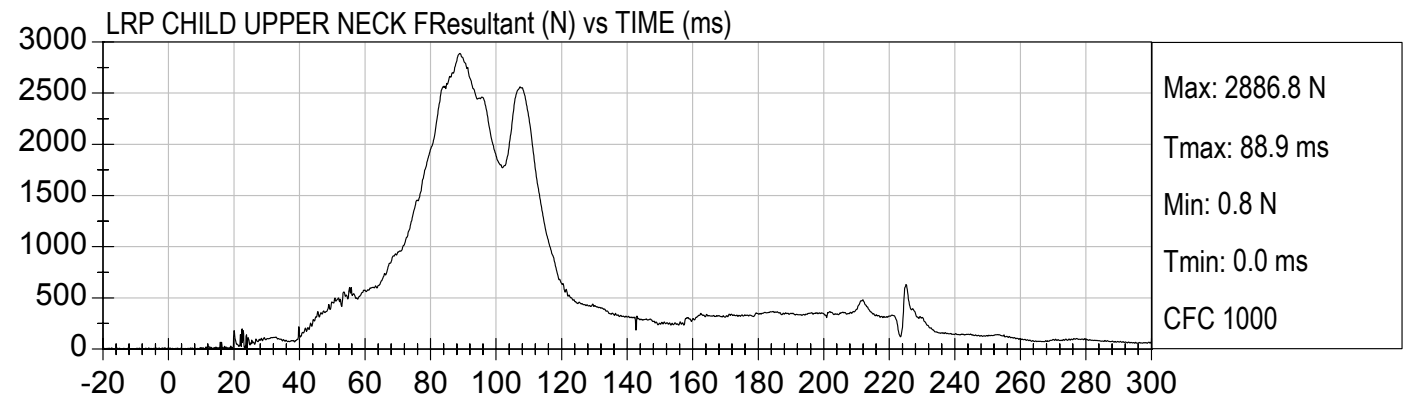
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

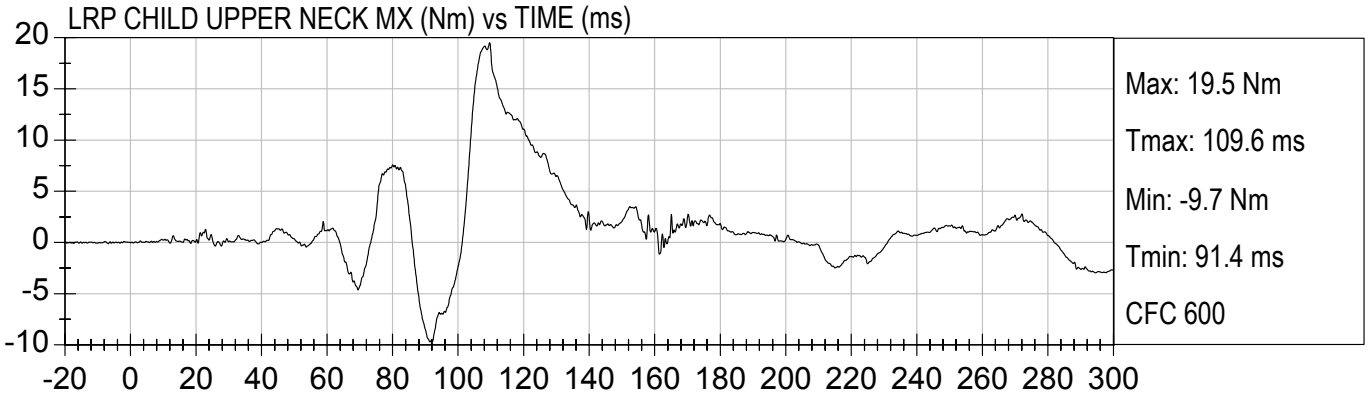
Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

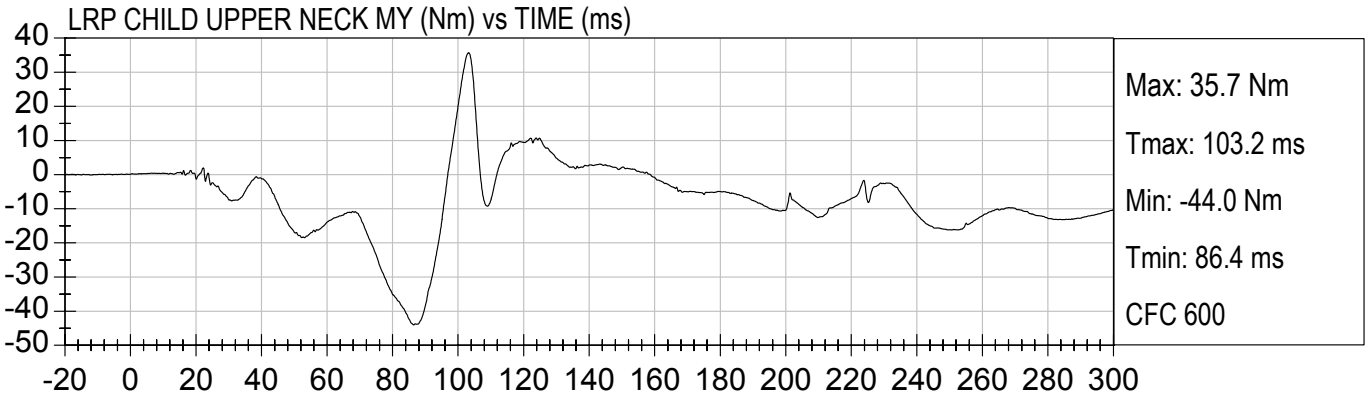


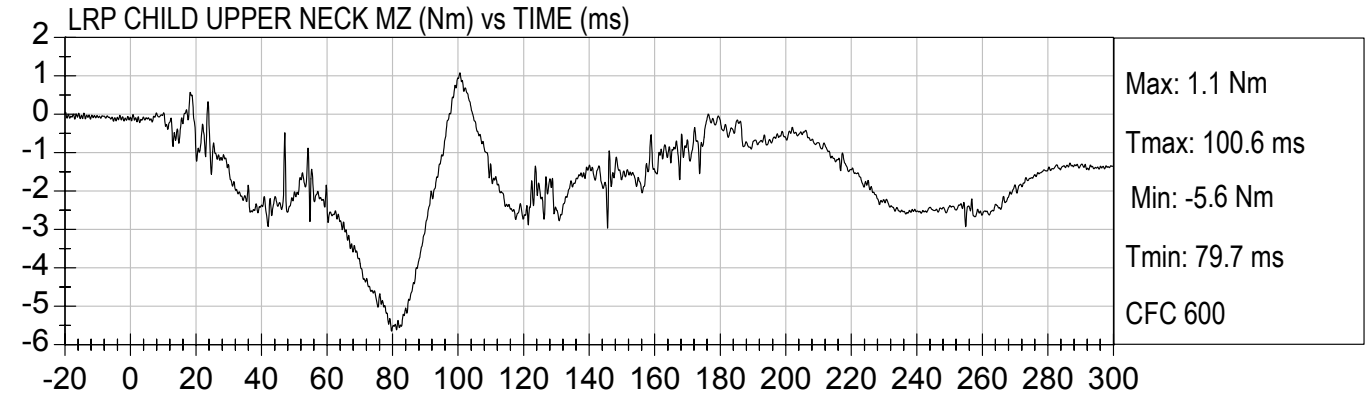


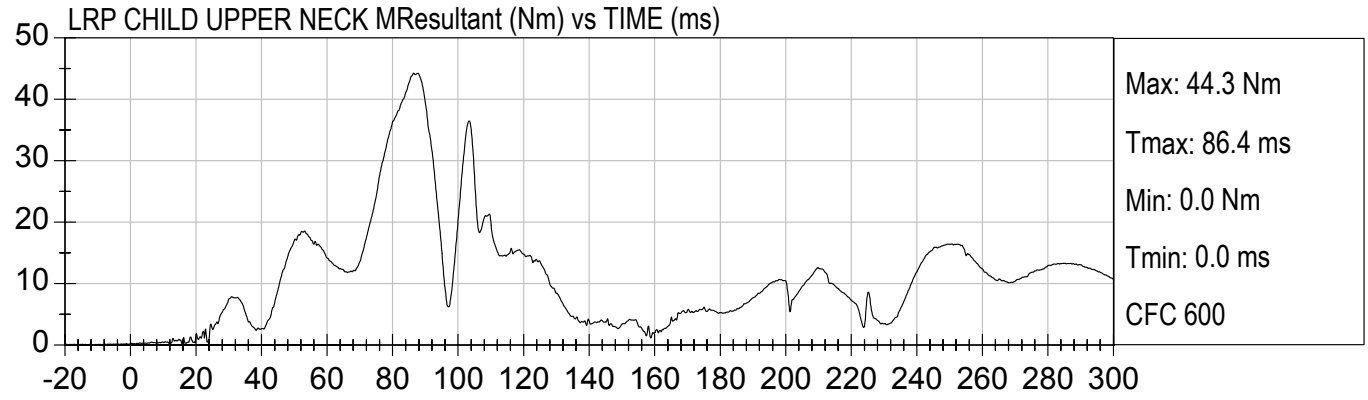





LRP CHILD UPPER NECK MX (Nm) vs TIME (ms)
Max: 19.5 Nm
Tmax: 109.6 ms
Min: -9.7 Nm
Tmin: 91.4 ms
CFC 600

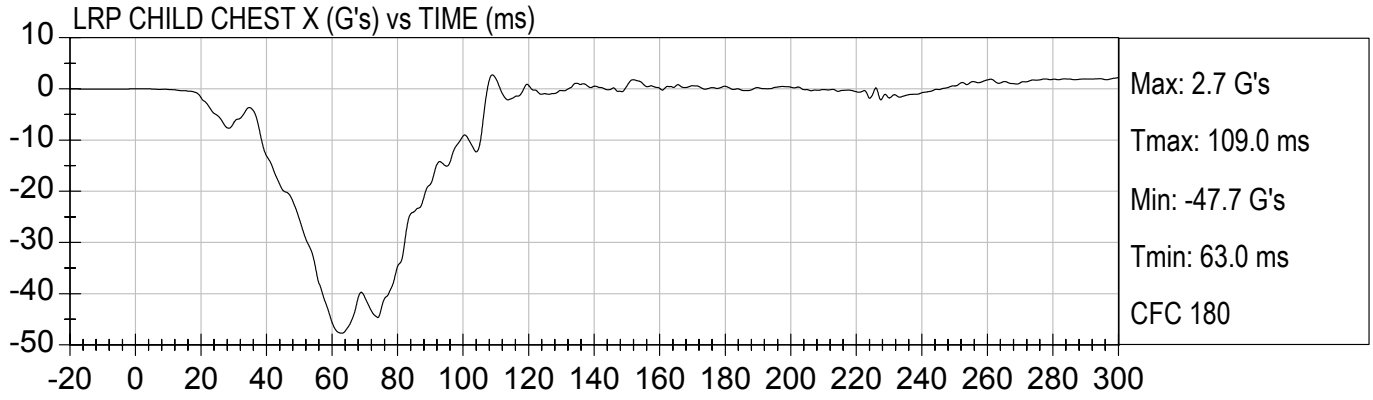

LRP CHILD UPPER NECK MY (Nm) vs TIME (ms)
Max: 35.7 Nm
Tmax: 103.2 ms
Min: -44.0 Nm
Tmin: 86.4 ms
CFC 600

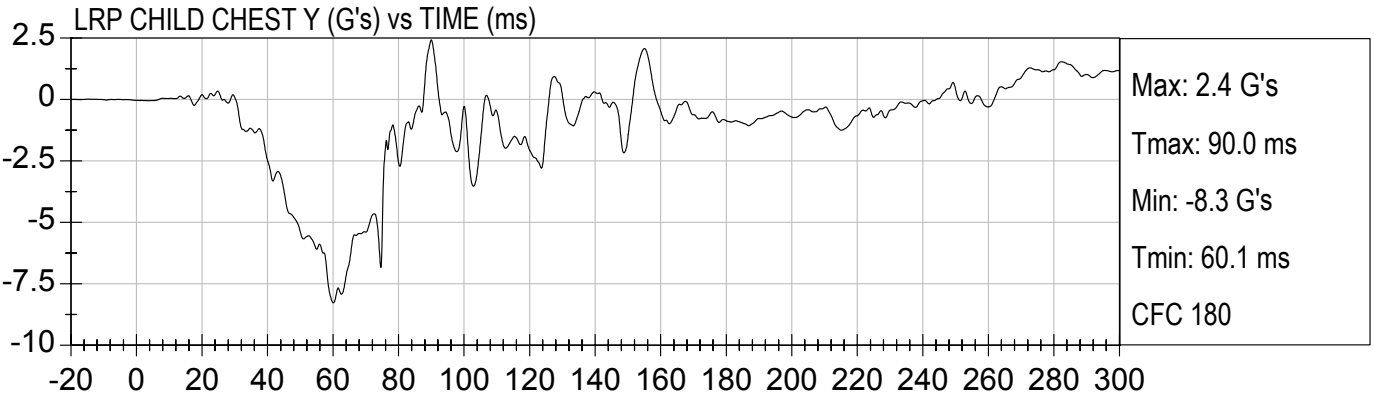

LRP CHILD UPPER NECK MZ (Nm) vs TIME (ms)
Max: 1.1 Nm
Tmax: 100.6 ms
Min: -5.6 Nm
Tmin: 79.7 ms
CFC 600

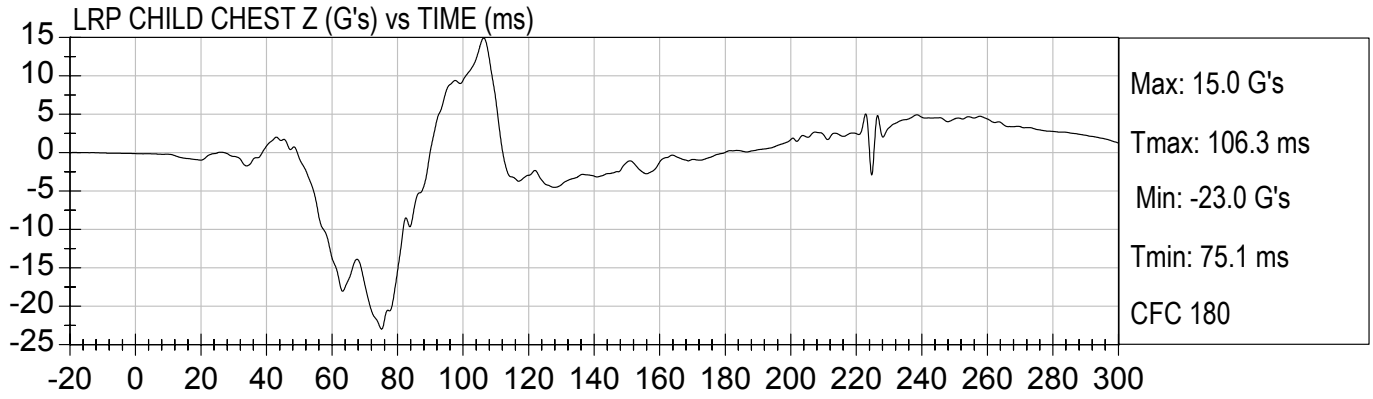

LRP CHILD UPPER NECK MResultant (Nm) vs TIME (ms)
Max: 44.3 Nm
Tmax: 86.4 ms
Min: 0.0 Nm
Tmin: 0.0 ms
CFC 600

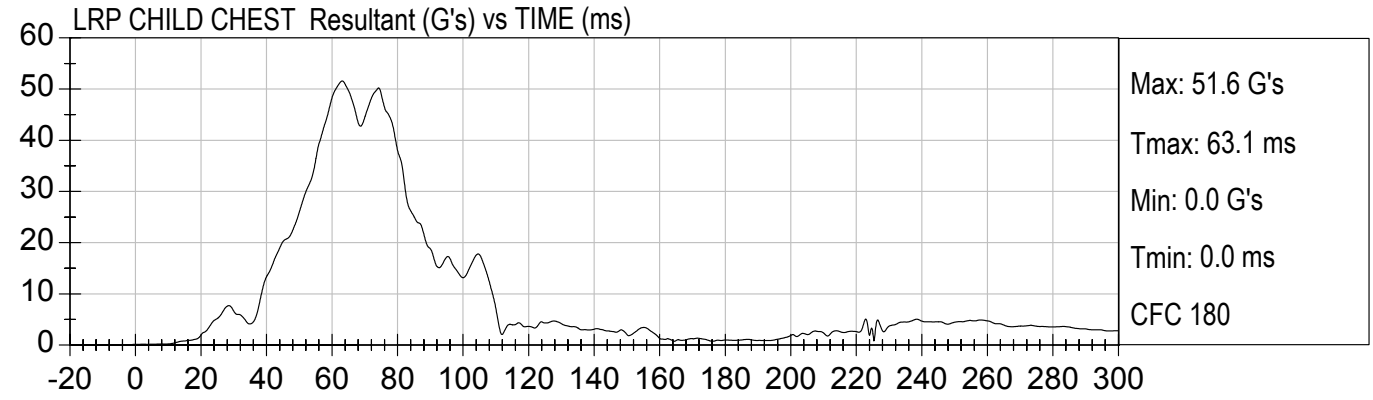
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)



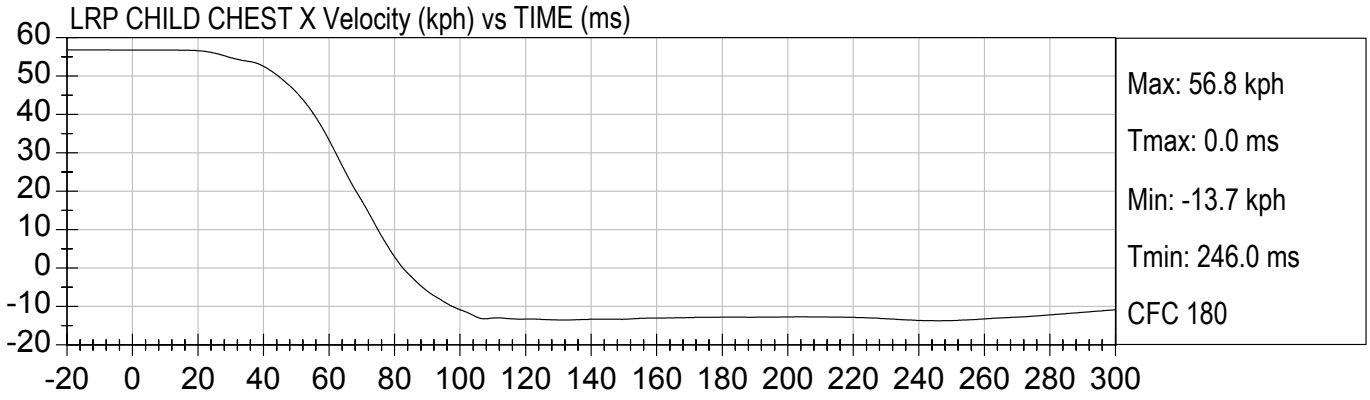


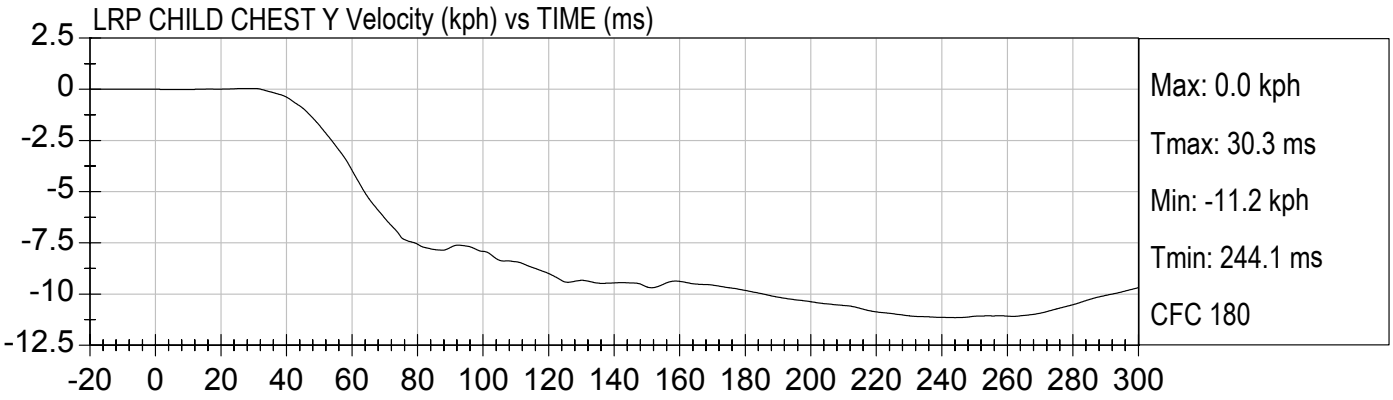


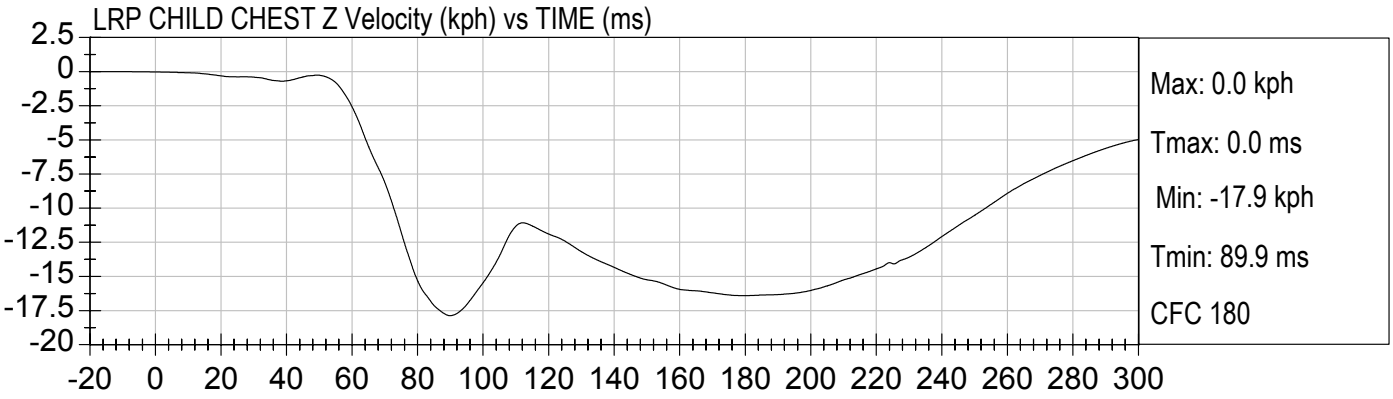


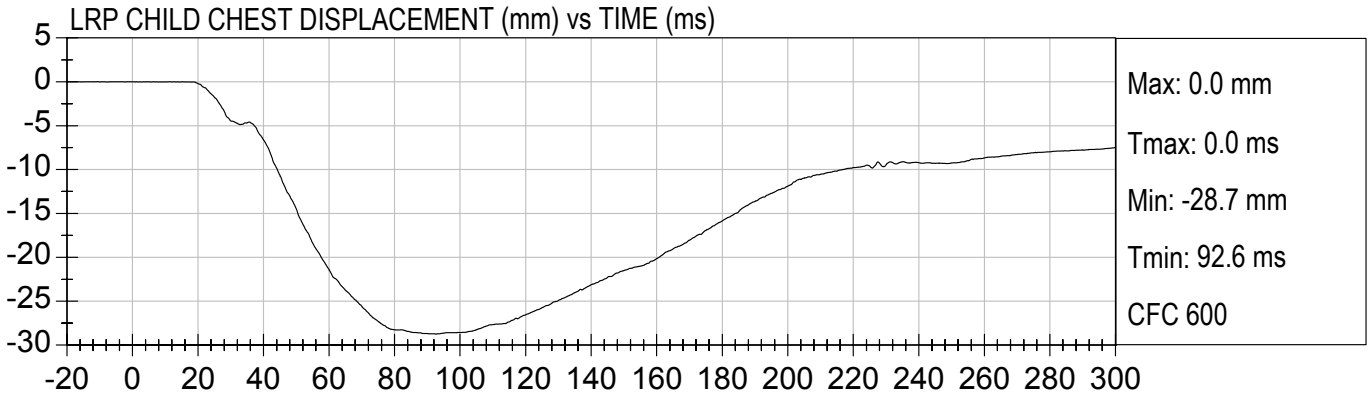
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)



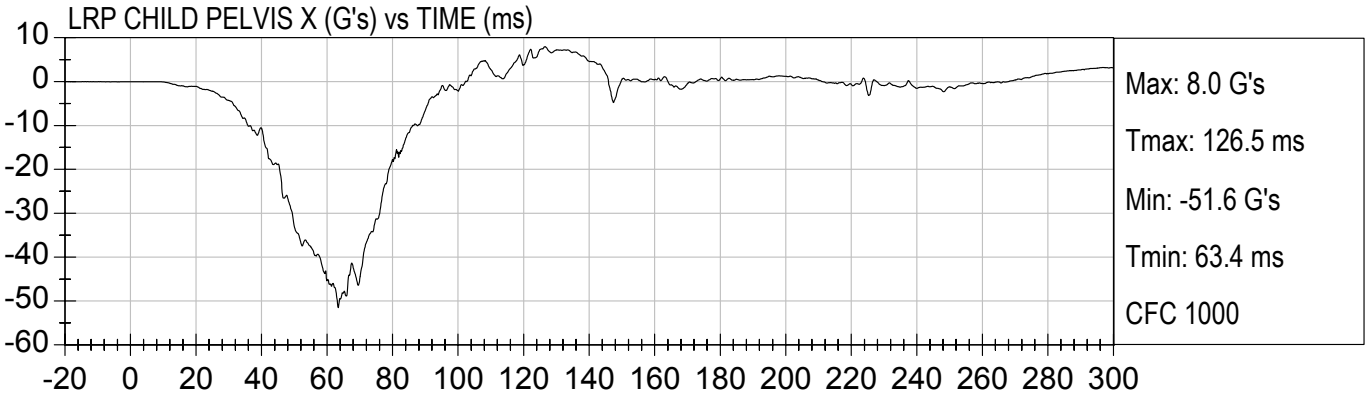


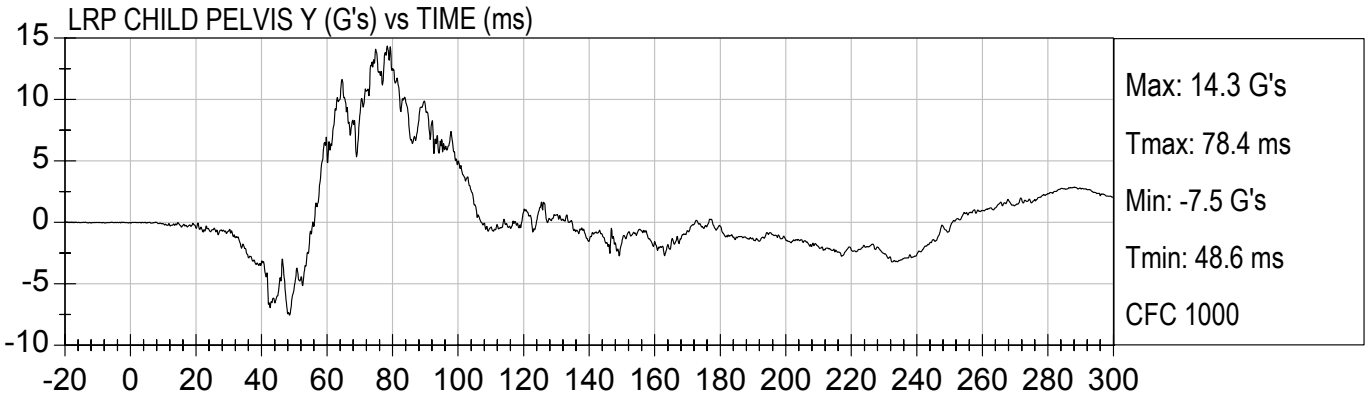


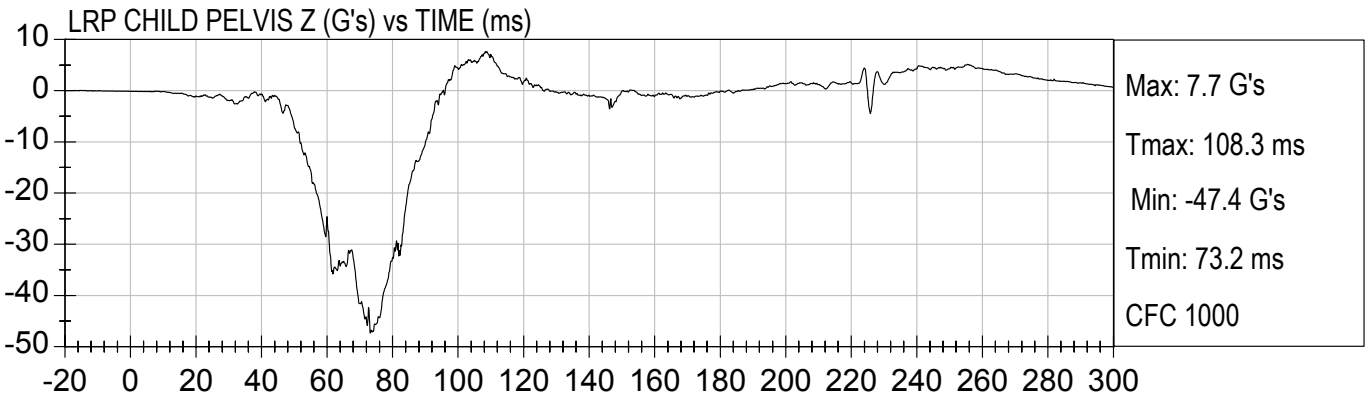


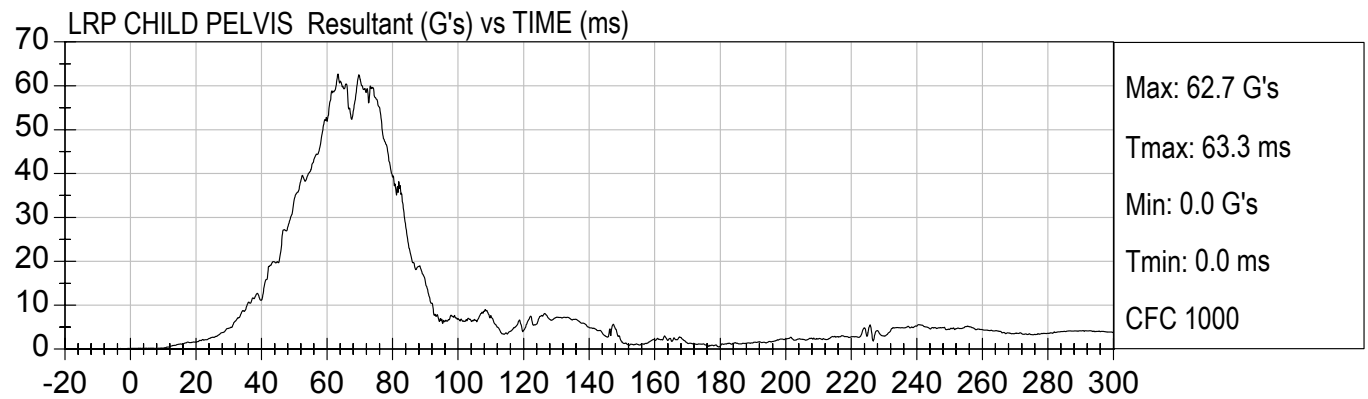
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

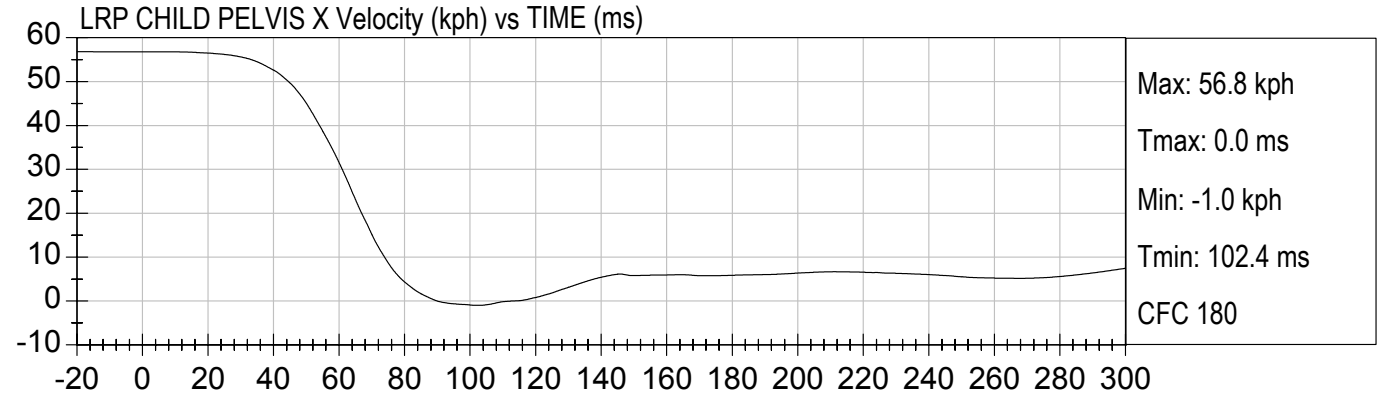
Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

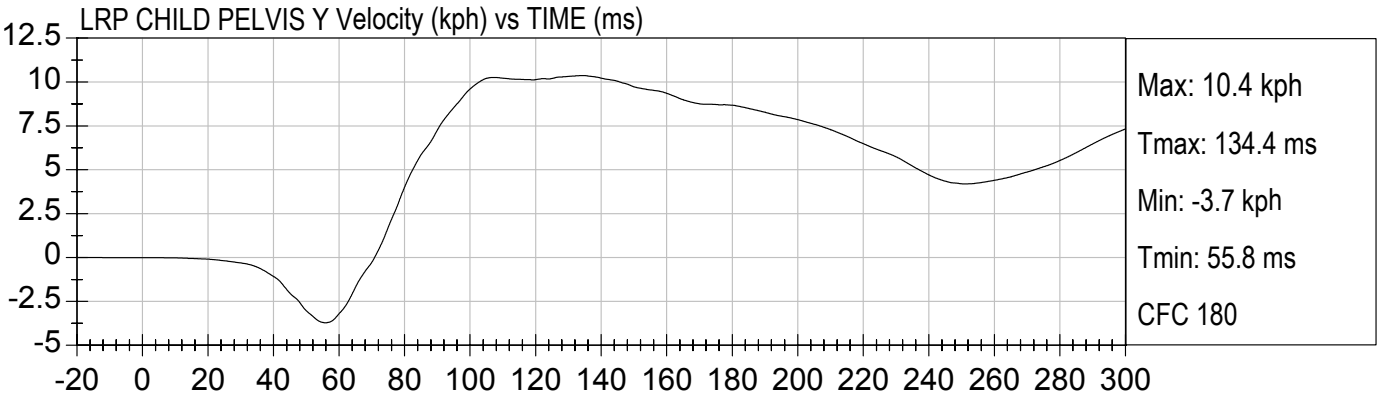


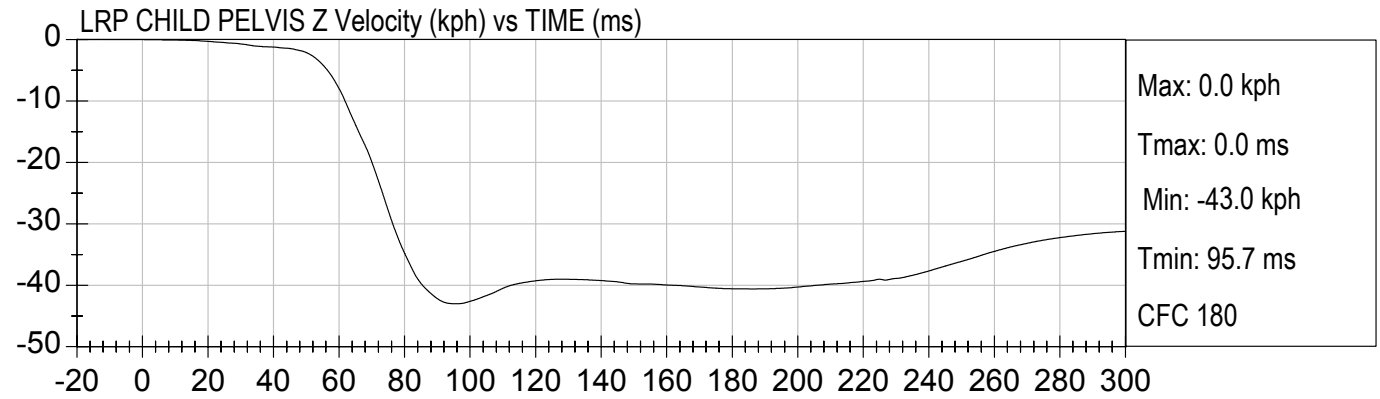






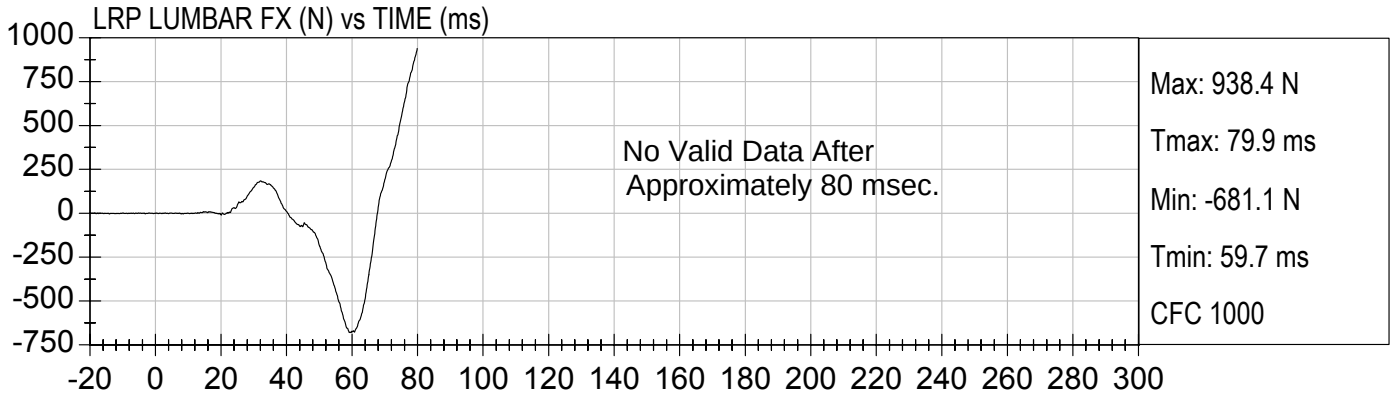

LRP CHILD PELVIS X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.8 kph
Tmax: 0.0 ms
Min: -1.0 kph
Tmin: 102.4 ms
CFC 180

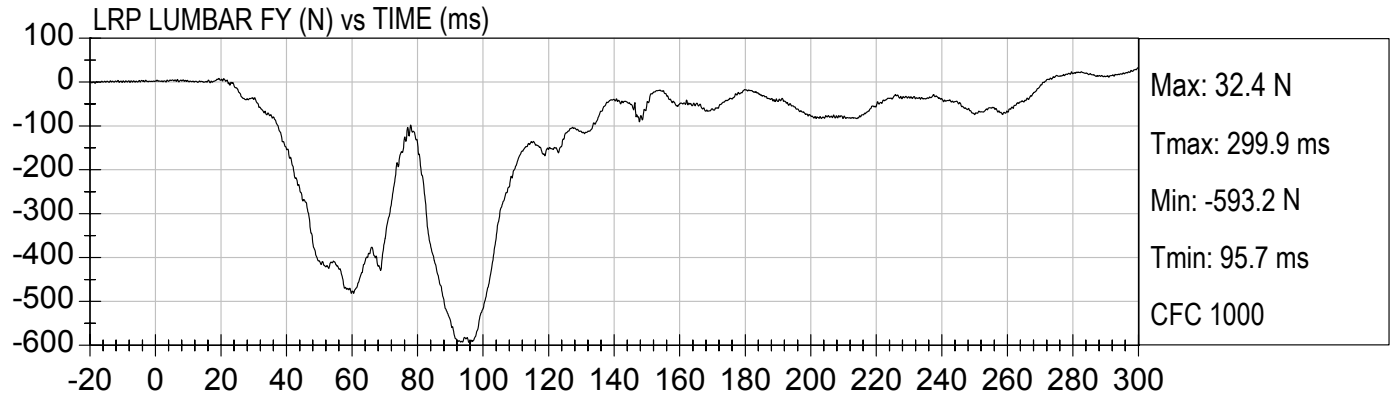

LRP CHILD PELVIS Y Velocity (kph) vs TIME (ms)
12.5
10
7.5
5
2.5
0
-2.5
-5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 10.4 kph
Tmax: 134.4 ms
Min: -3.7 kph
Tmin: 55.8 ms
CFC 180

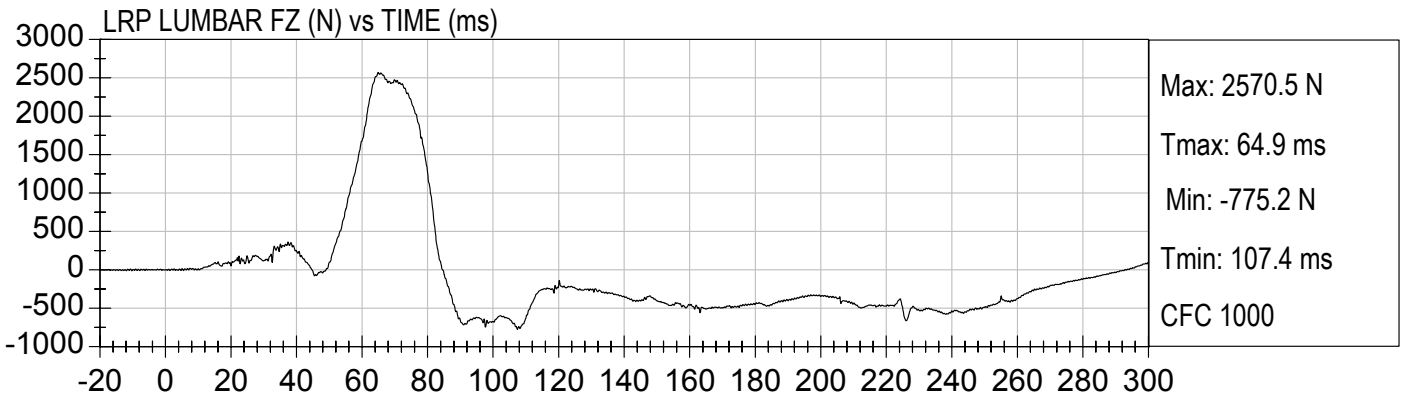

LRP CHILD PELVIS Z Velocity (kph) vs TIME (ms)
0
-10
-20
-30
-40
-50
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.0 kph
Tmax: 0.0 ms
Min: -43.0 kph
Tmin: 95.7 ms
CFC 180

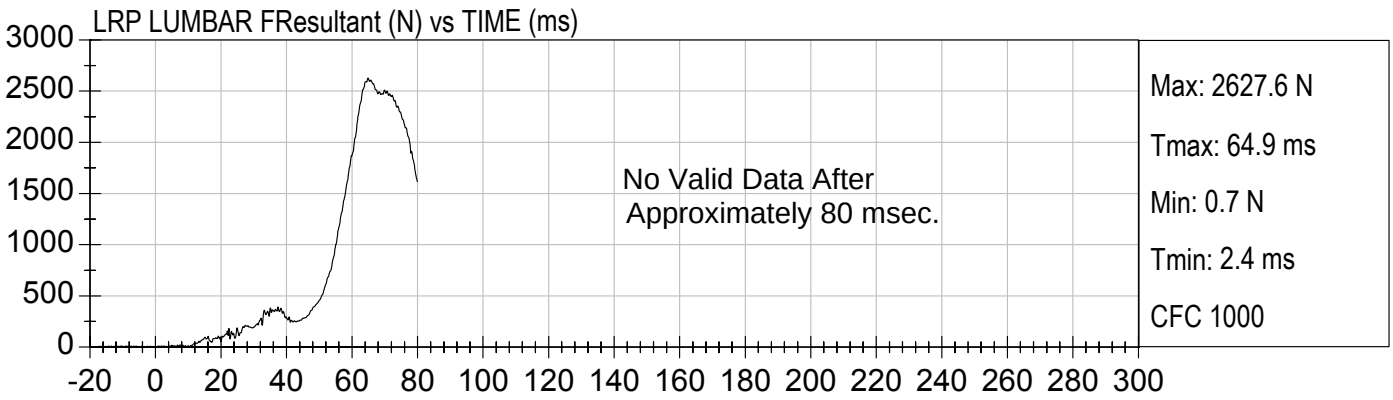
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

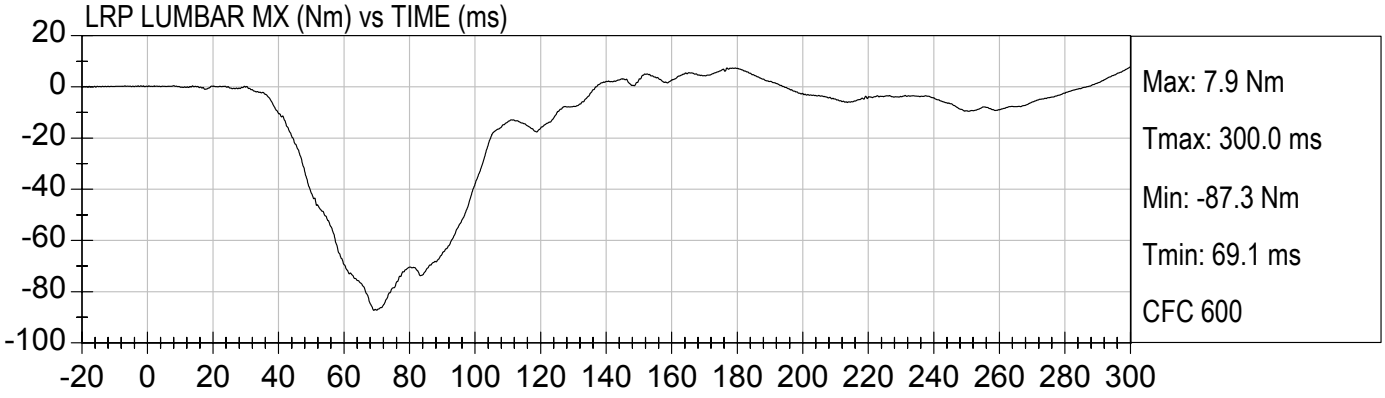
Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

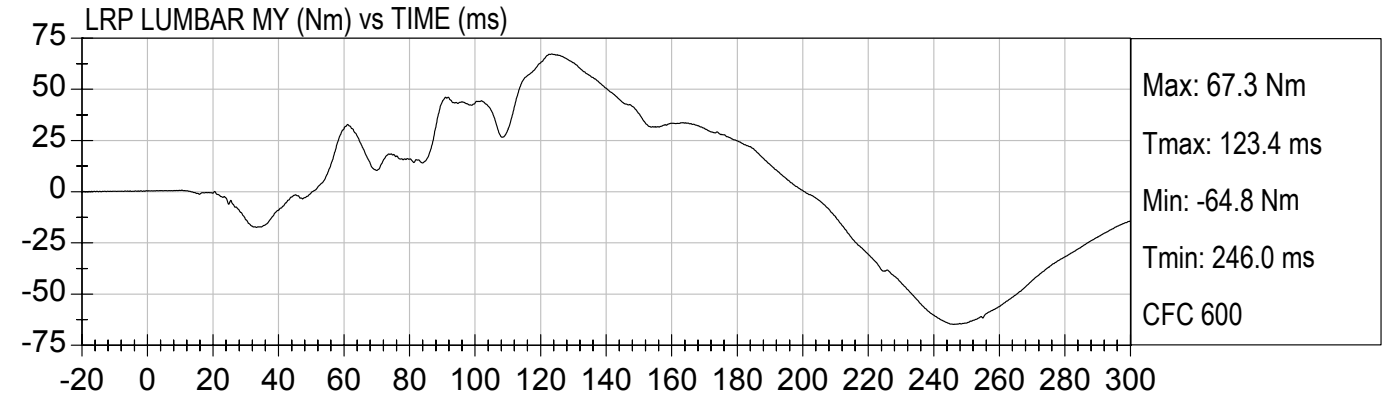


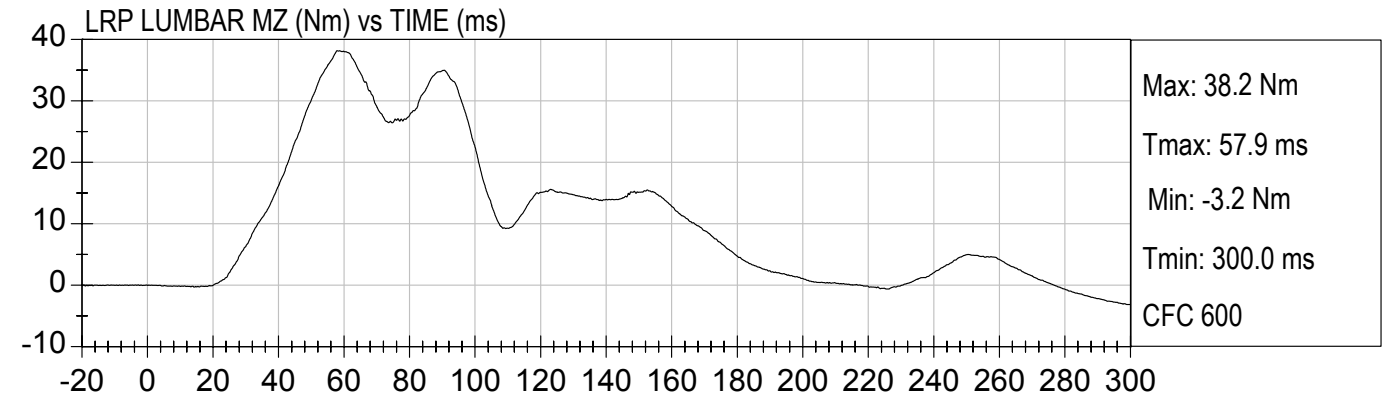


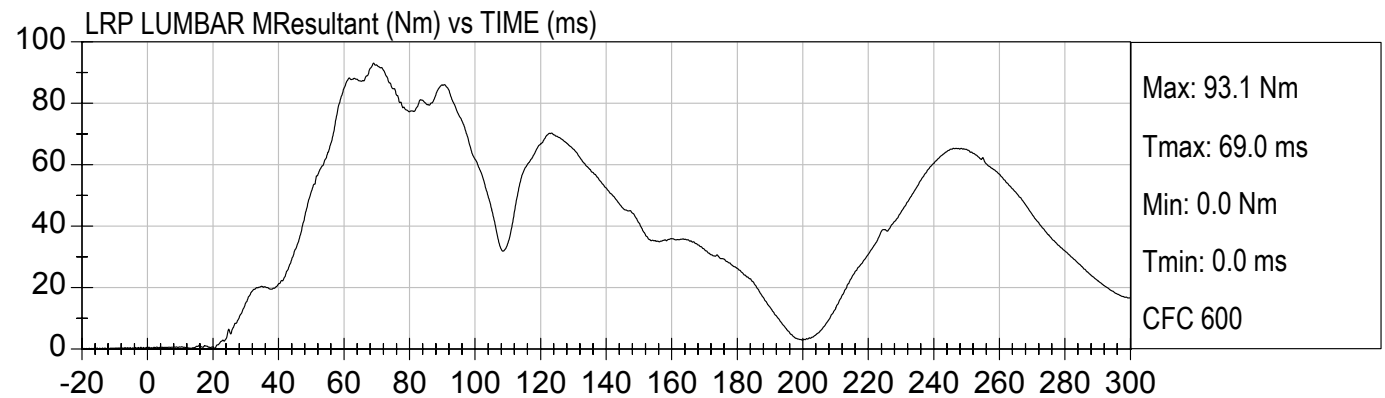





LRP LUMBAR MX (Nm) vs TIME (ms)
20
0
-20
-40
-60
-80
-100
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 7.9 Nm
Tmax: 300.0 ms
Min: -87.3 Nm
Tmin: 69.1 ms
CFC 600

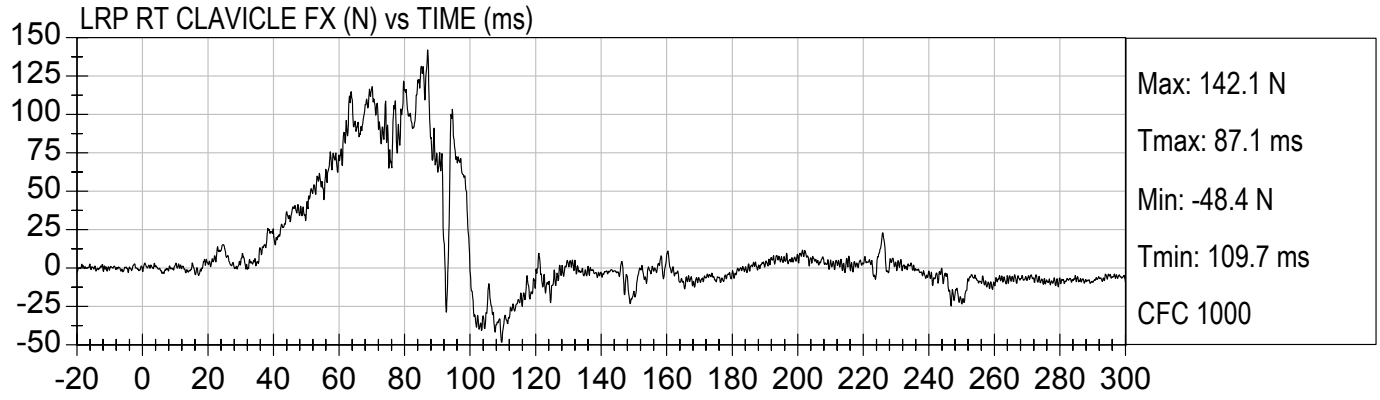

LRP LUMBAR MY (Nm) vs TIME (ms)
75
50
25
0
-25
-50
-75
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 67.3 Nm
Tmax: 123.4 ms
Min: -64.8 Nm
Tmin: 246.0 ms
CFC 600

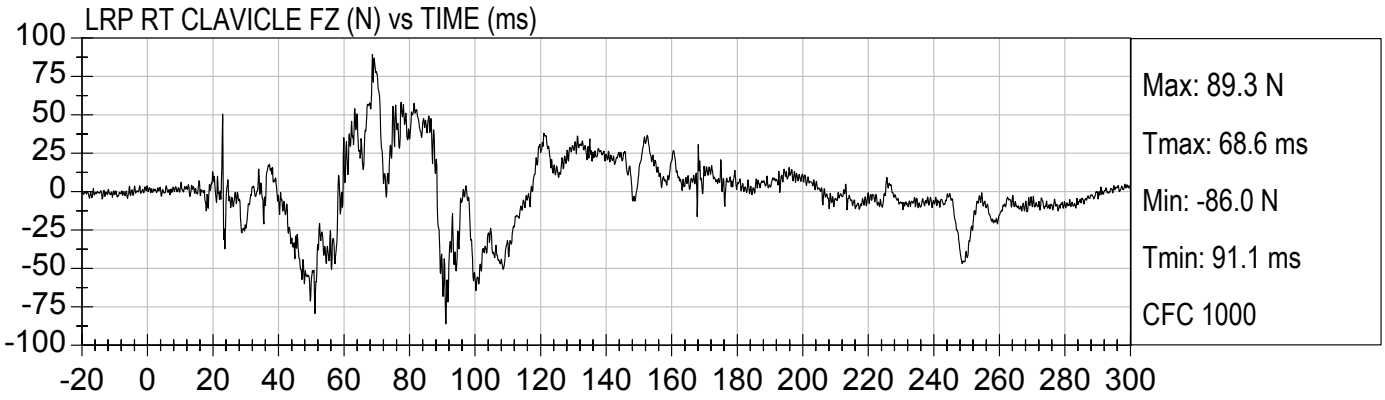

LRP LUMBAR MZ (Nm) vs TIME (ms)
40
30
20
10
0
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 38.2 Nm
Tmax: 57.9 ms
Min: -3.2 Nm
Tmin: 300.0 ms
CFC 600

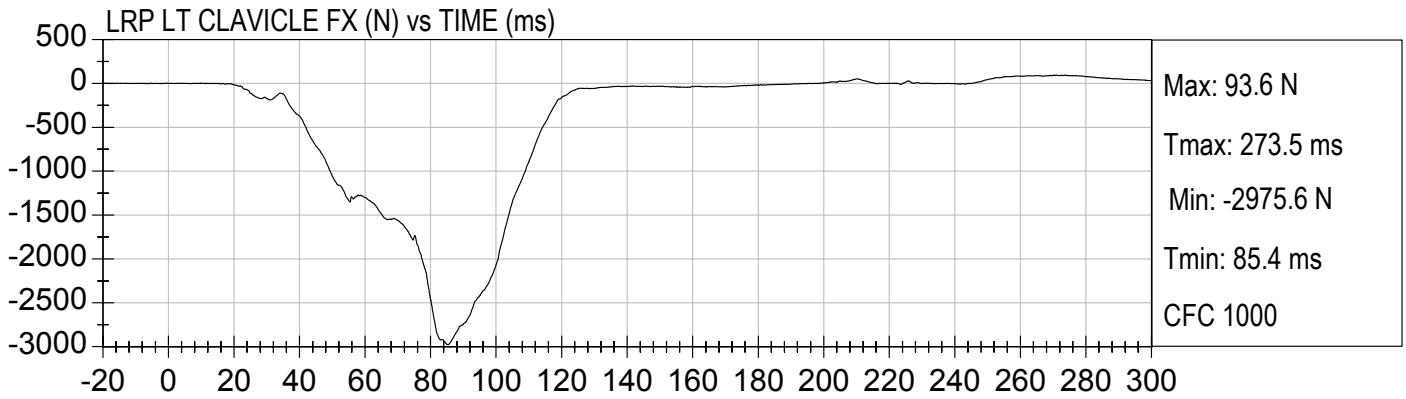

LRP LUMBAR MResultant (Nm) vs TIME (ms)
100
80
60
40
20
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 93.1 Nm
Tmax: 69.0 ms
Min: 0.0 Nm
Tmin: 0.0 ms
CFC 600

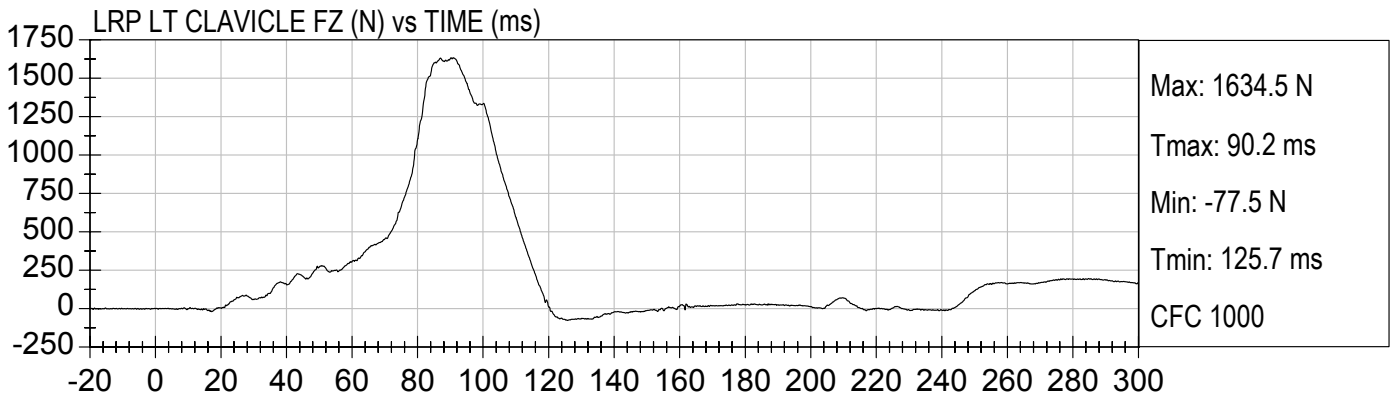
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)



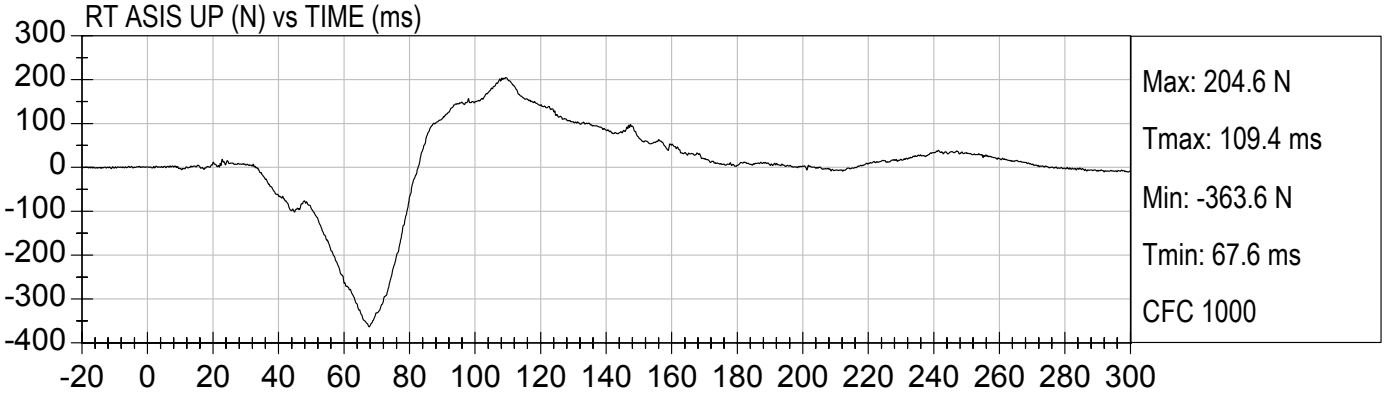


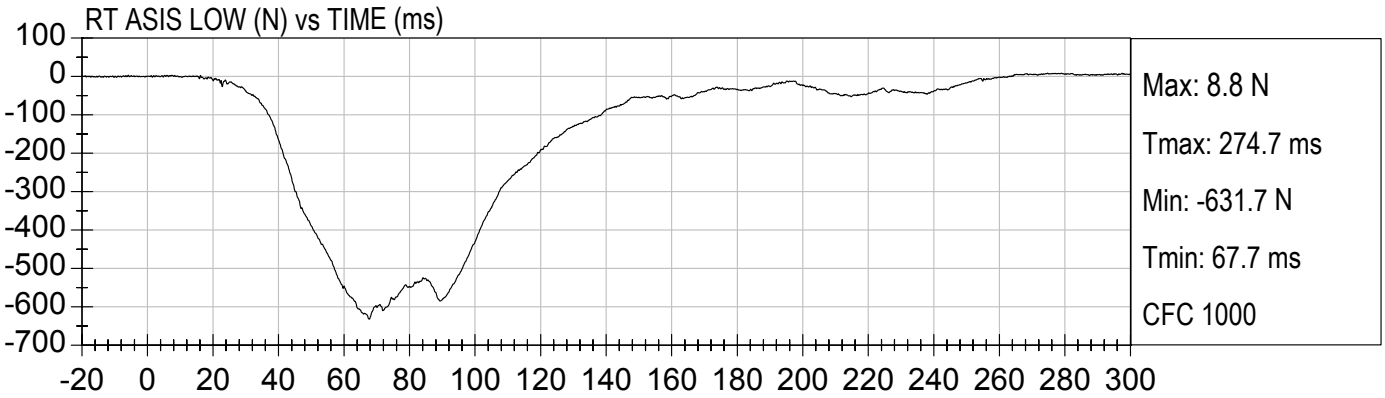


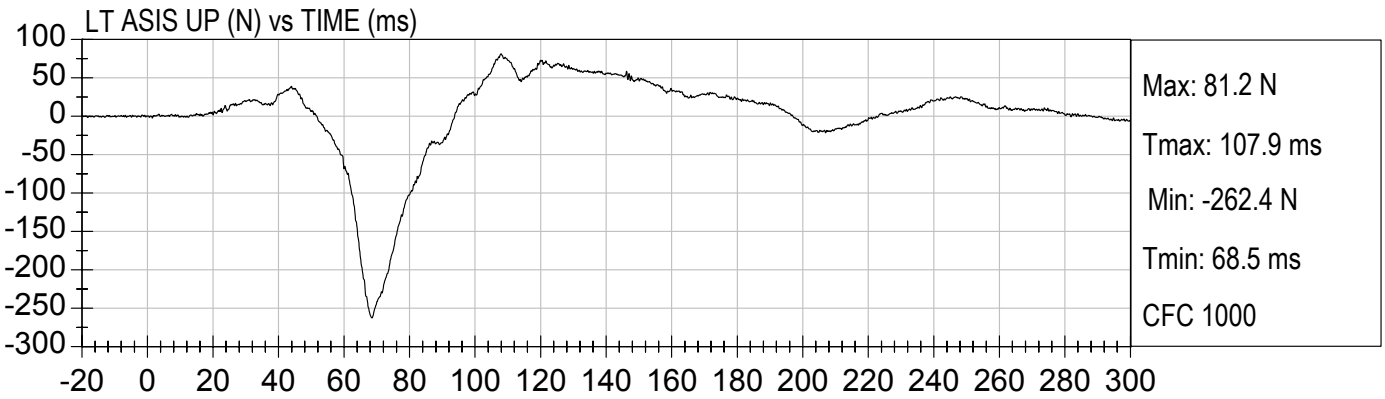


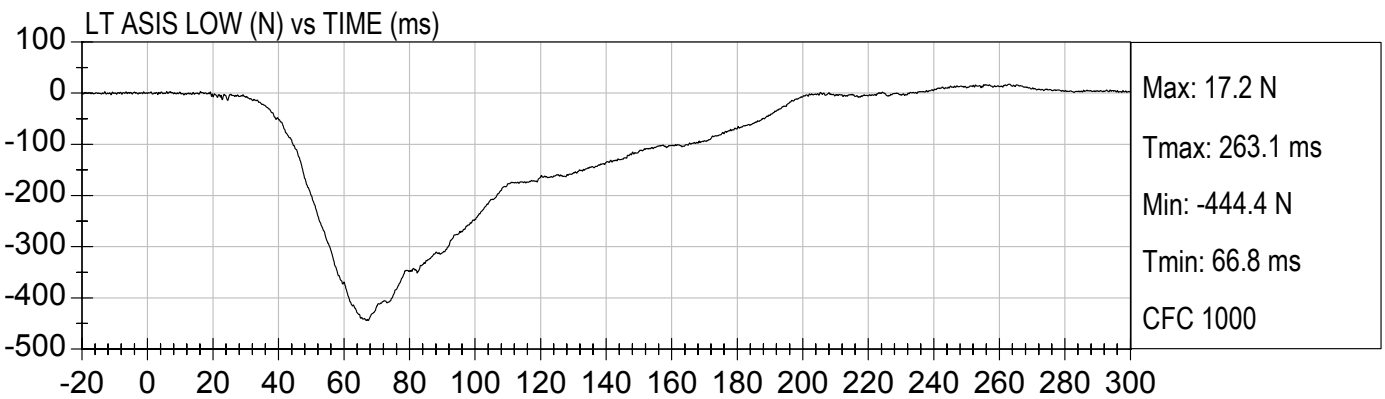
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

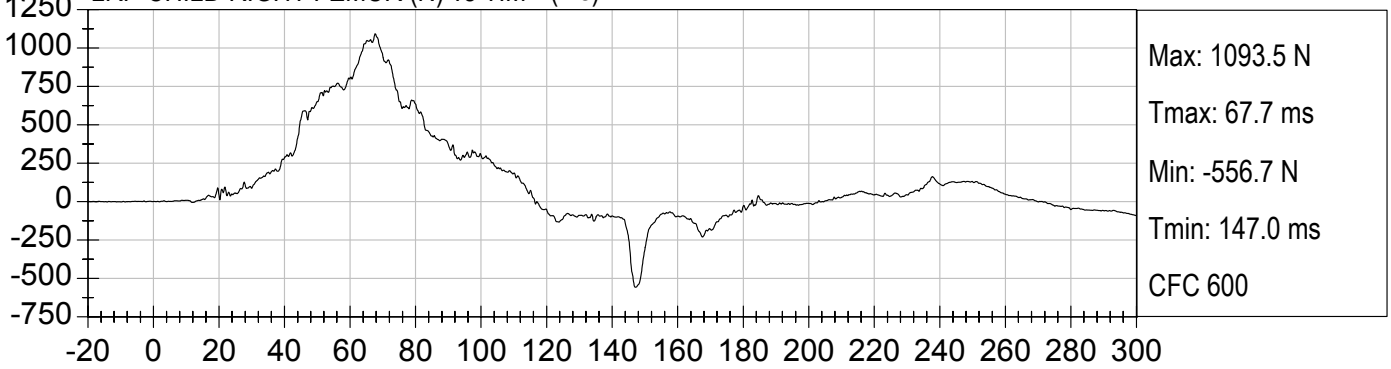




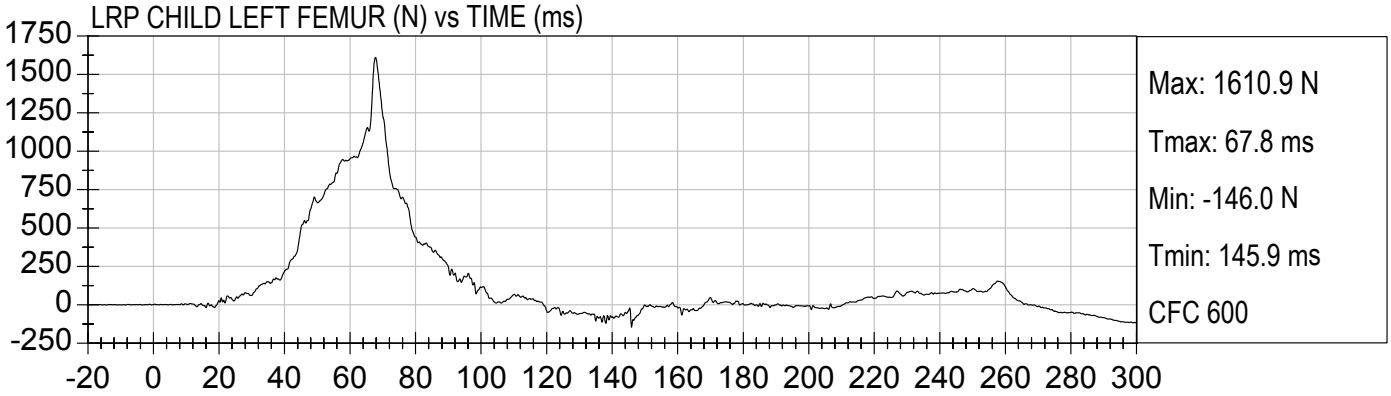




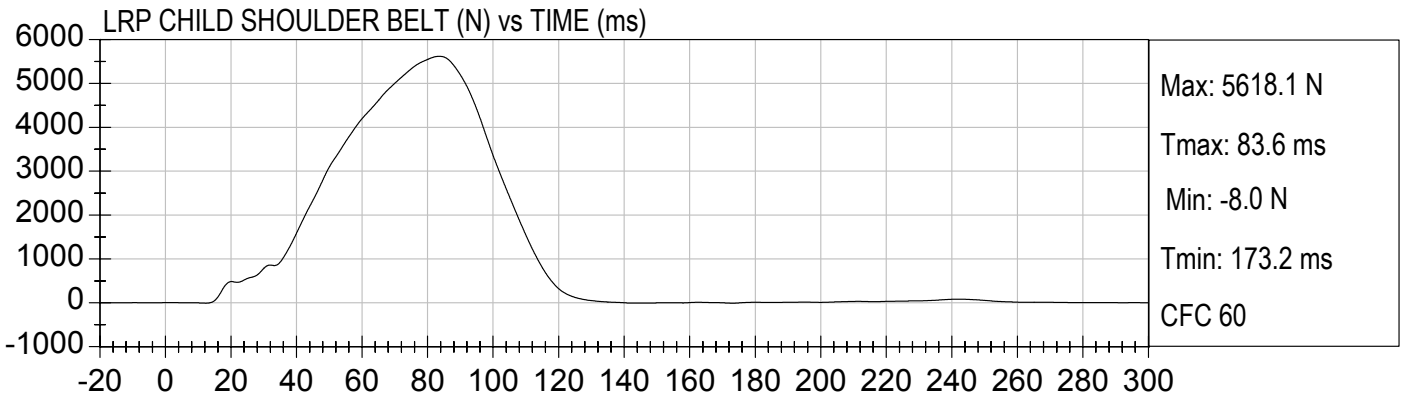
LRP CHILD RIGHT FEMUR (N) vs TIME (ms)



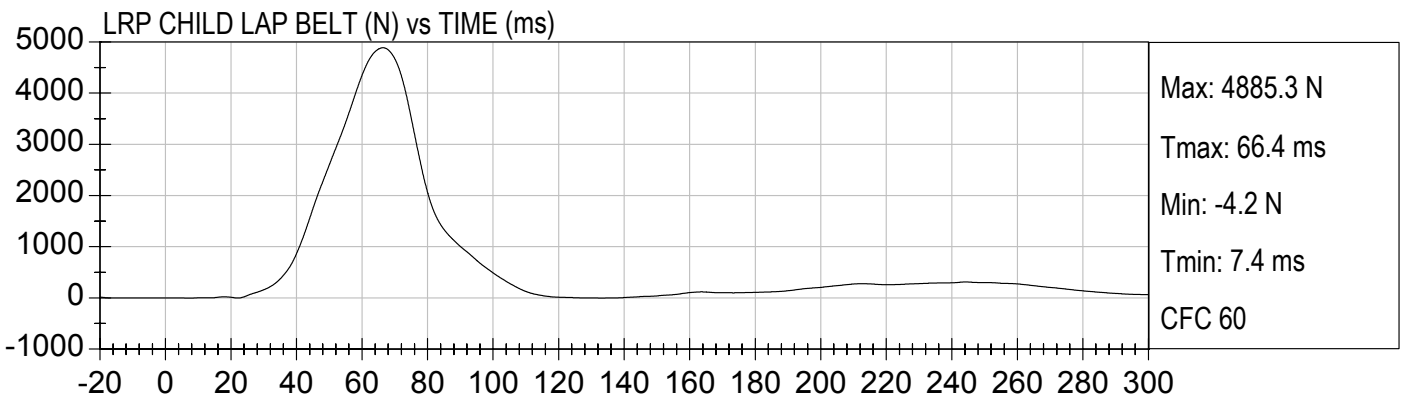
LRP CHILD LEFT FEMUR (N) vs TIME (ms)

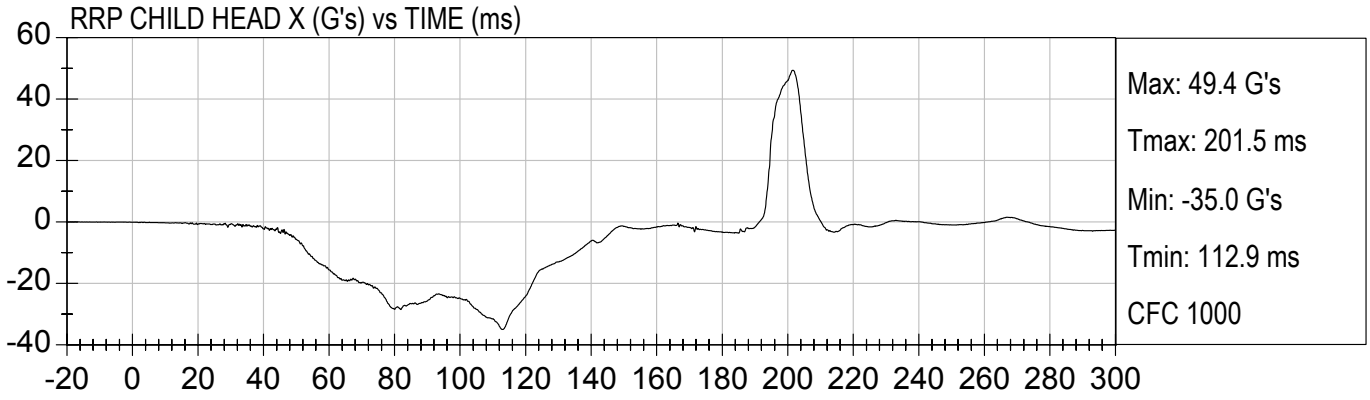


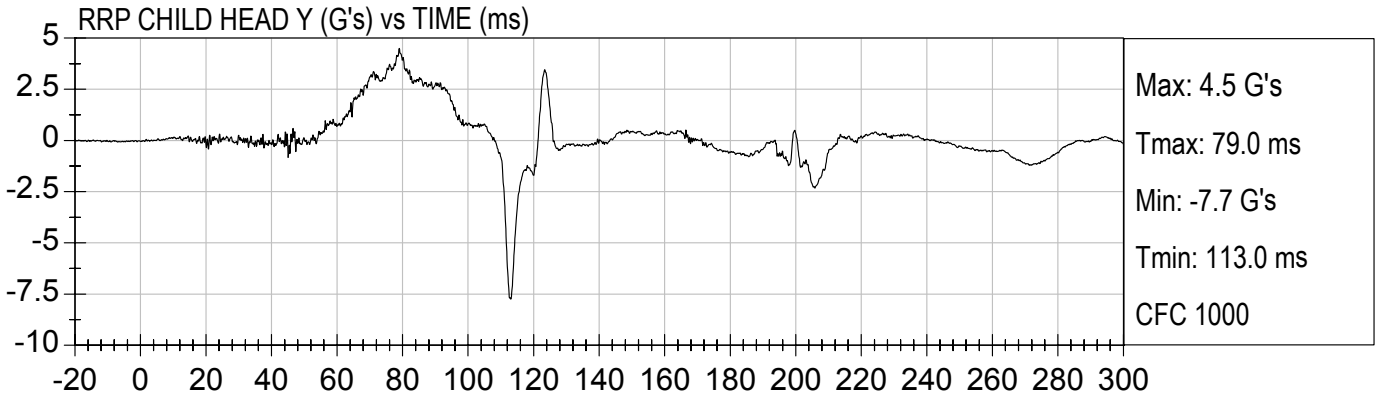
LRP CHILD SHOULDER BELT (N) vs TIME (ms)

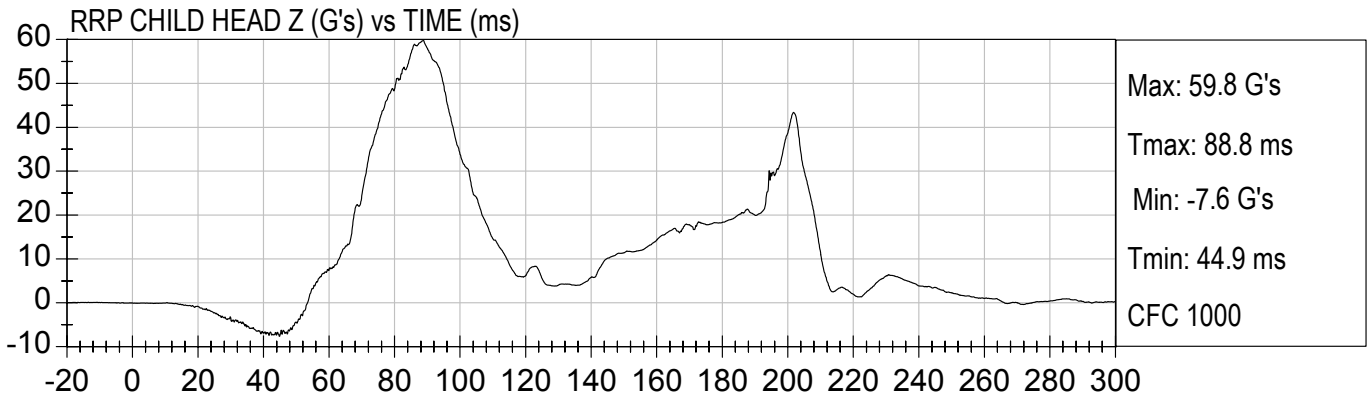


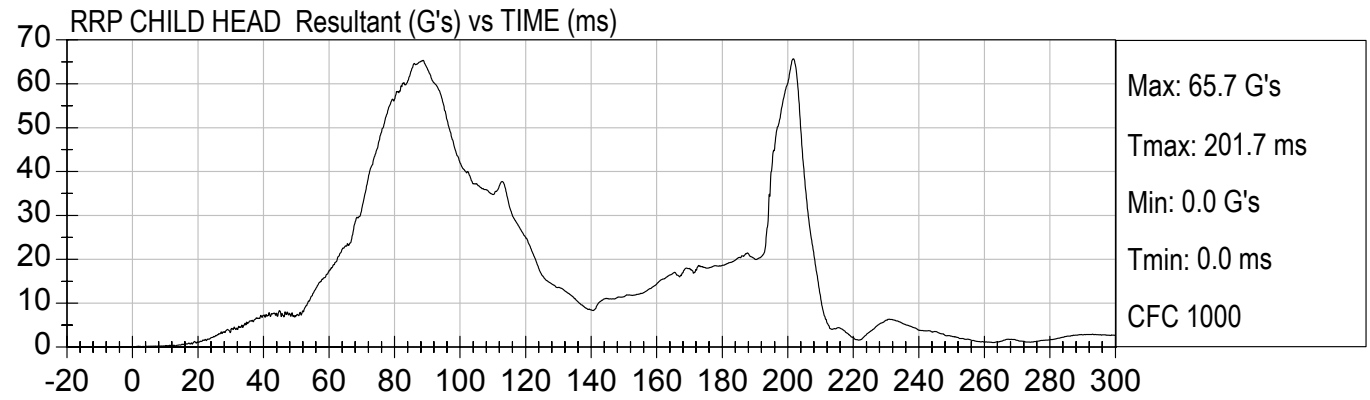
LRP CHILD LAP BELT (N) vs TIME (ms)

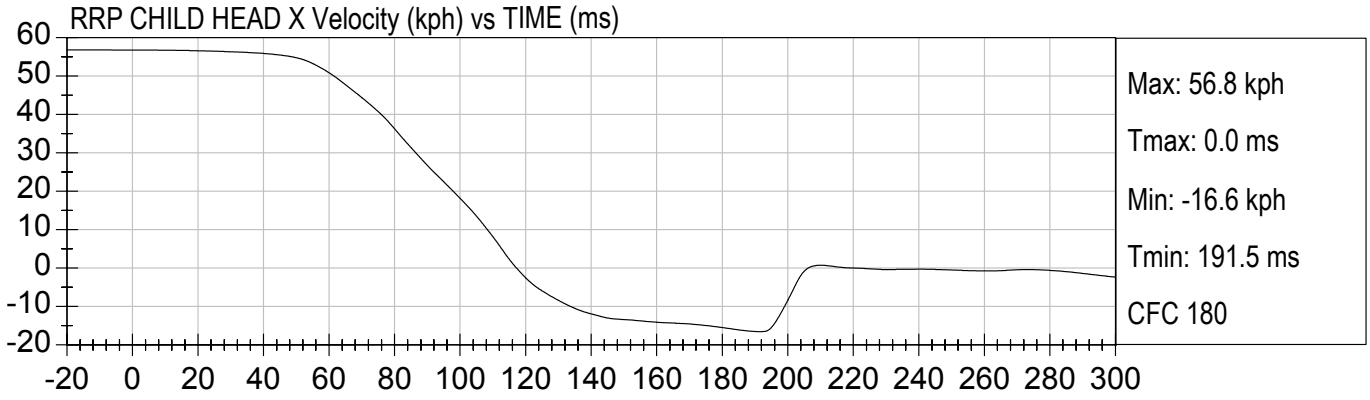


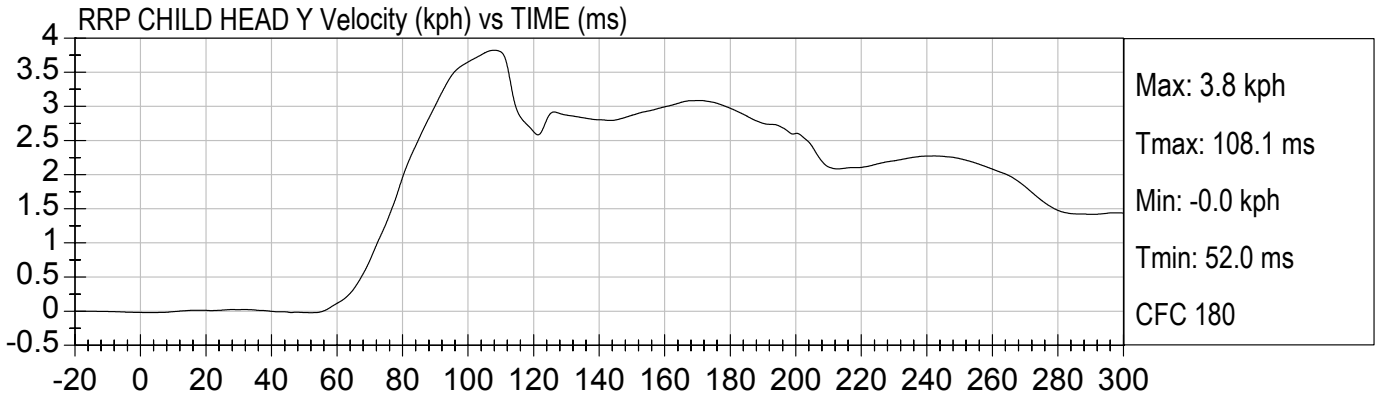

RRP CHILD HEAD X (G's) vs TIME (ms)
60
40
20
0
-20
-40
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 49.4 G's
Tmax: 201.5 ms
Min: -35.0 G's
Tmin: 112.9 ms
CFC 1000

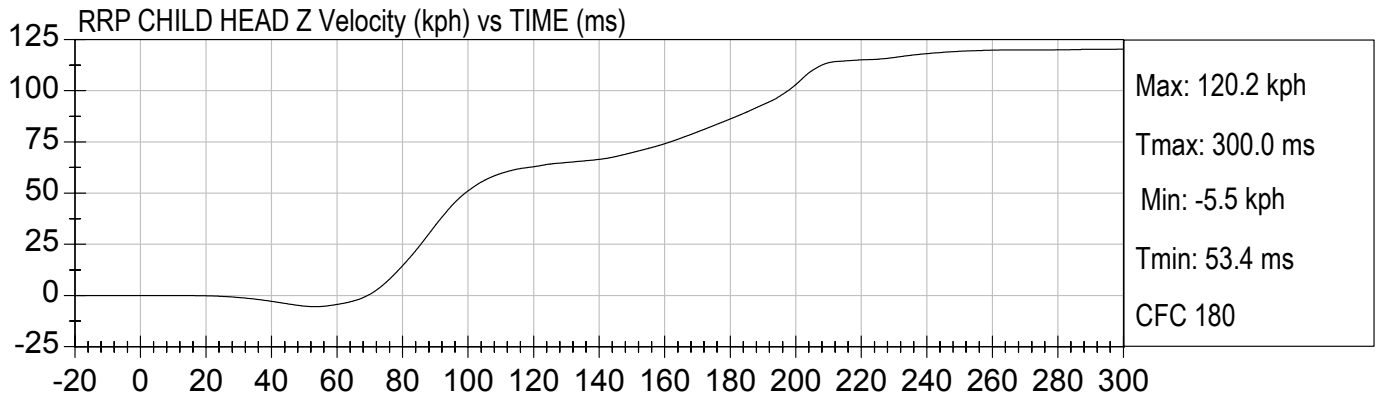

RRP CHILD HEAD Y (G's) vs TIME (ms)
5
2.5
0
-2.5
-5
-7.5
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 4.5 G's
Tmax: 79.0 ms
Min: -7.7 G's
Tmin: 113.0 ms
CFC 1000


RRP CHILD HEAD Z (G's) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 59.8 G's
Tmax: 88.8 ms
Min: -7.6 G's
Tmin: 44.9 ms
CFC 1000


RRP CHILD HEAD Resultant (G's) vs TIME (ms)
70
60
50
40
30
20
10
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 65.7 G's
Tmax: 201.7 ms
Min: 0.0 G's
Tmin: 0.0 ms
CFC 1000

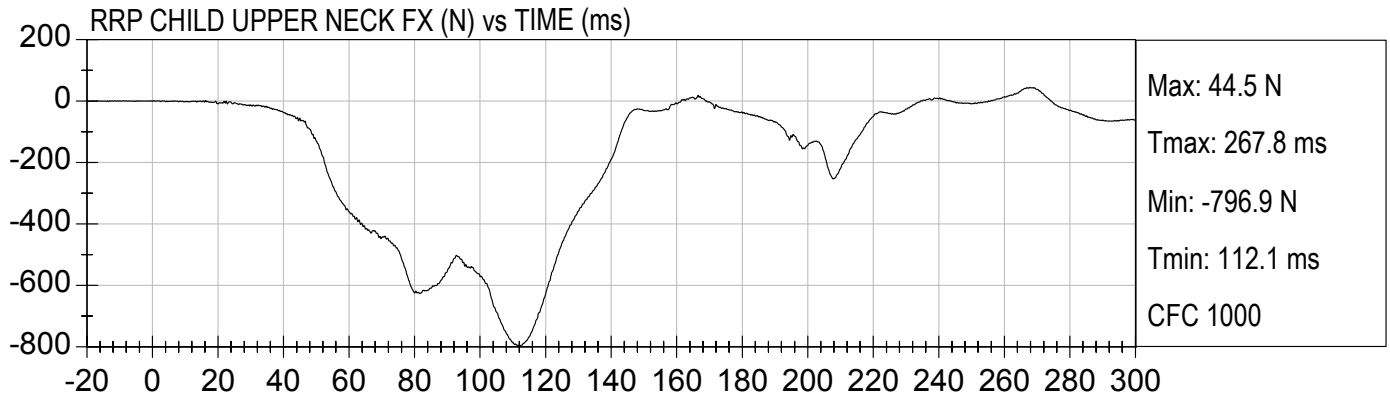

RRP CHILD HEAD X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.8 kph
Tmax: 0.0 ms
Min: -16.6 kph
Tmin: 191.5 ms
CFC 180

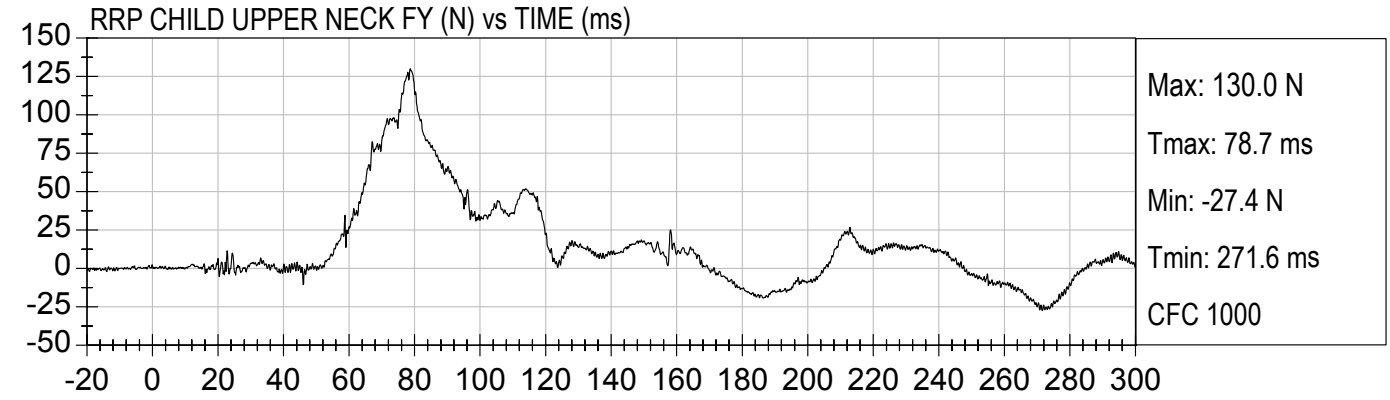

RRP CHILD HEAD Y Velocity (kph) vs TIME (ms)
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 3.8 kph
Tmax: 108.1 ms
Min: -0.0 kph
Tmin: 52.0 ms
CFC 180

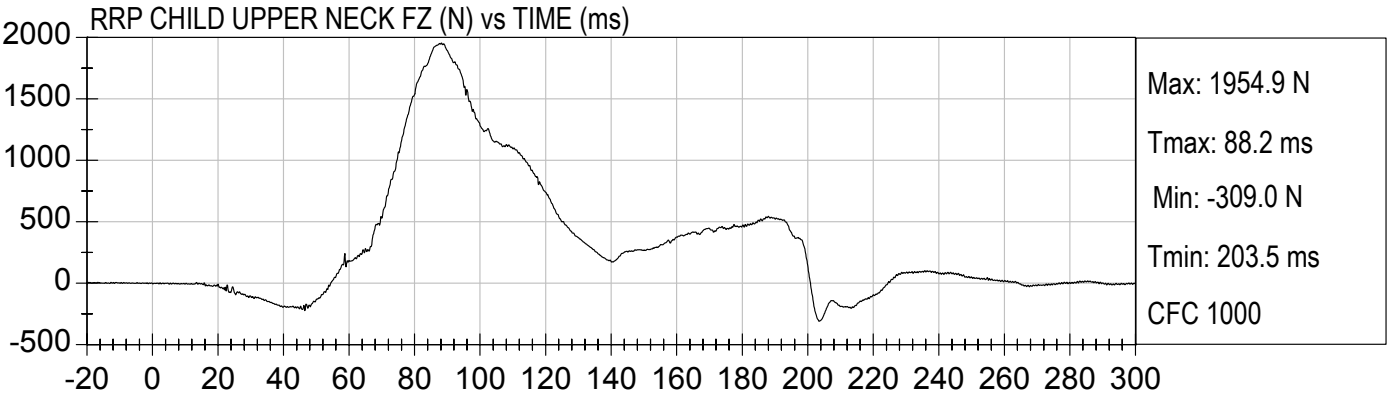

RRP CHILD HEAD Z Velocity (kph) vs TIME (ms)
125
100
75
50
25
0
-25
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 120.2 kph
Tmax: 300.0 ms
Min: -5.5 kph
Tmin: 53.4 ms
CFC 180

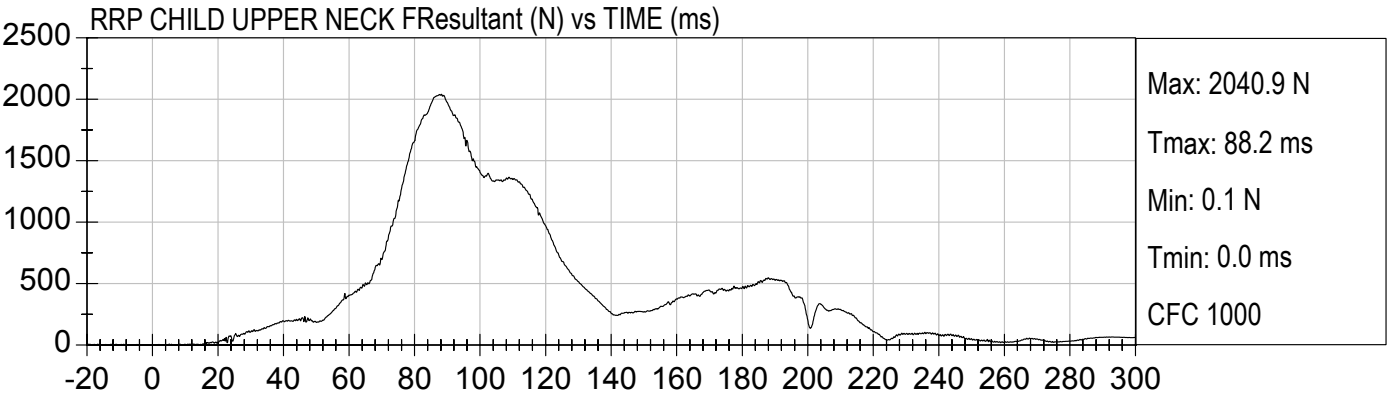
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

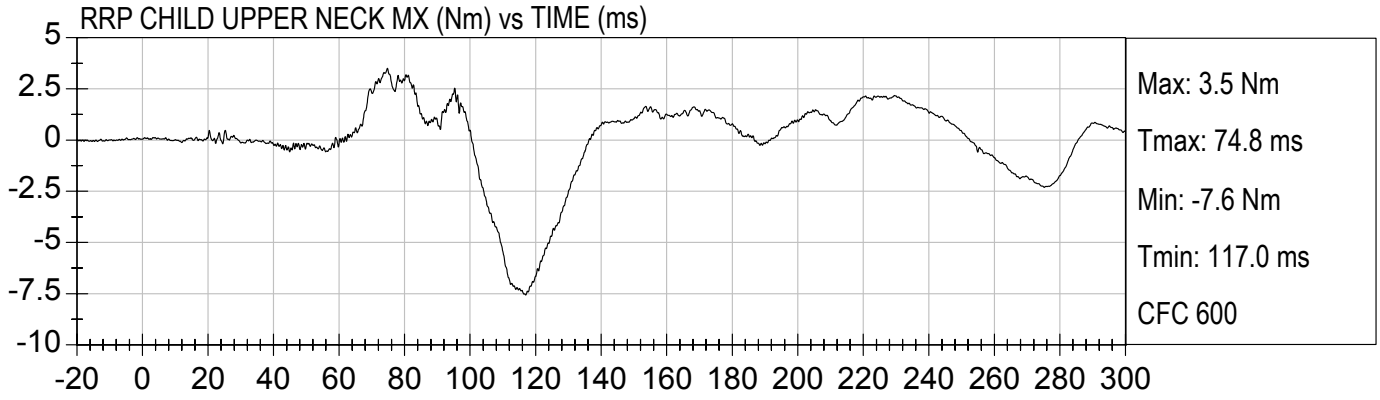
Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

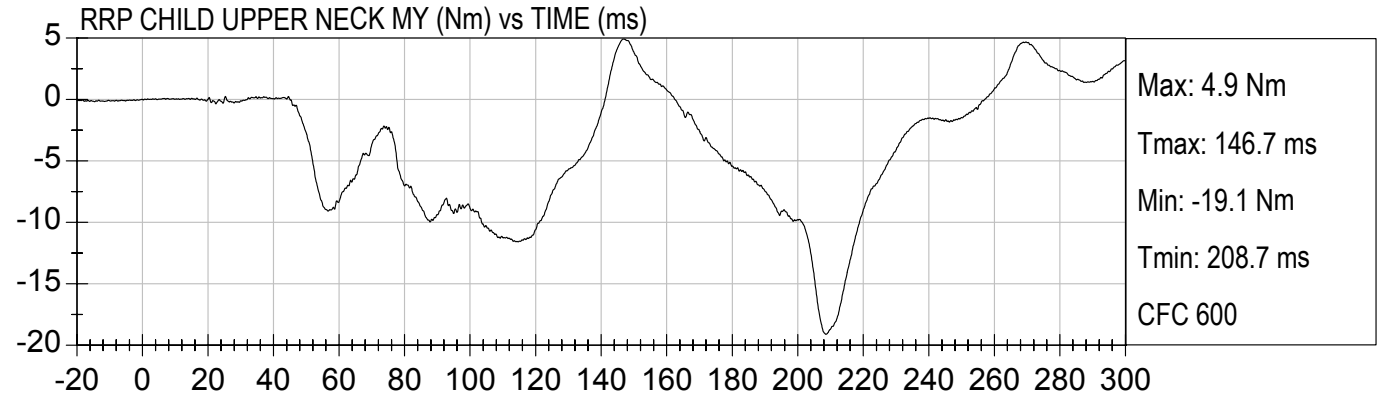


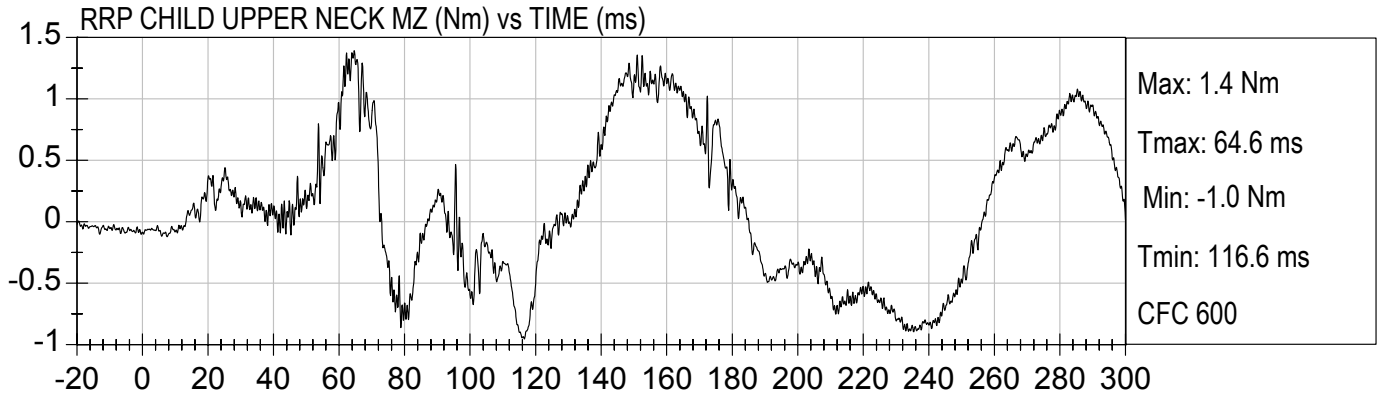


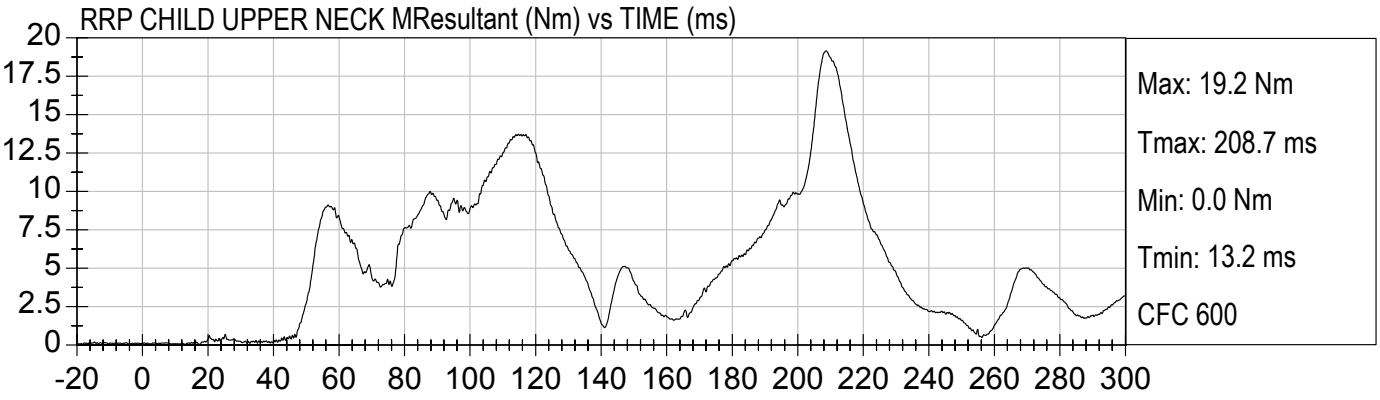





RRP CHILD UPPER NECK MX (Nm) vs TIME (ms)
5
2.5
0
-2.5
-5
-7.5
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 3.5 Nm
Tmax: 74.8 ms
Min: -7.6 Nm
Tmin: 117.0 ms
CFC 600

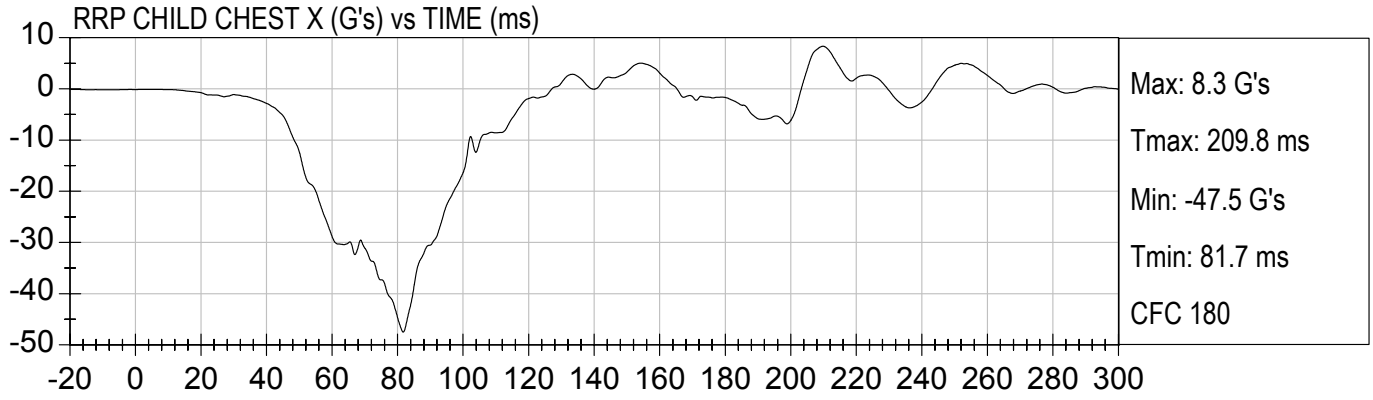

RRP CHILD UPPER NECK MY (Nm) vs TIME (ms)
5
0
-5
-10
-15
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 4.9 Nm
Tmax: 146.7 ms
Min: -19.1 Nm
Tmin: 208.7 ms
CFC 600

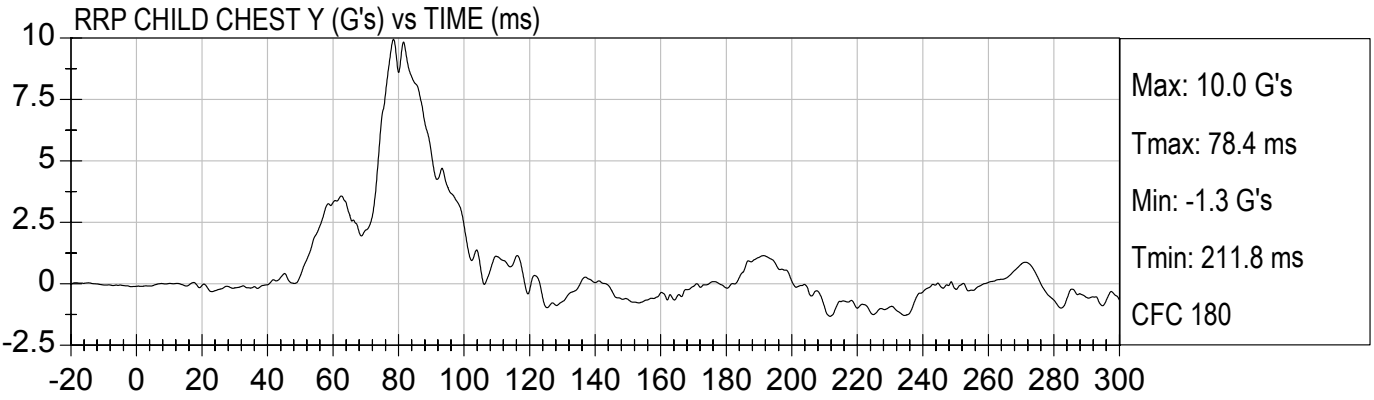

RRP CHILD UPPER NECK MZ (Nm) vs TIME (ms)
1.5
1
0.5
0
-0.5
-1
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 1.4 Nm
Tmax: 64.6 ms
Min: -1.0 Nm
Tmin: 116.6 ms
CFC 600

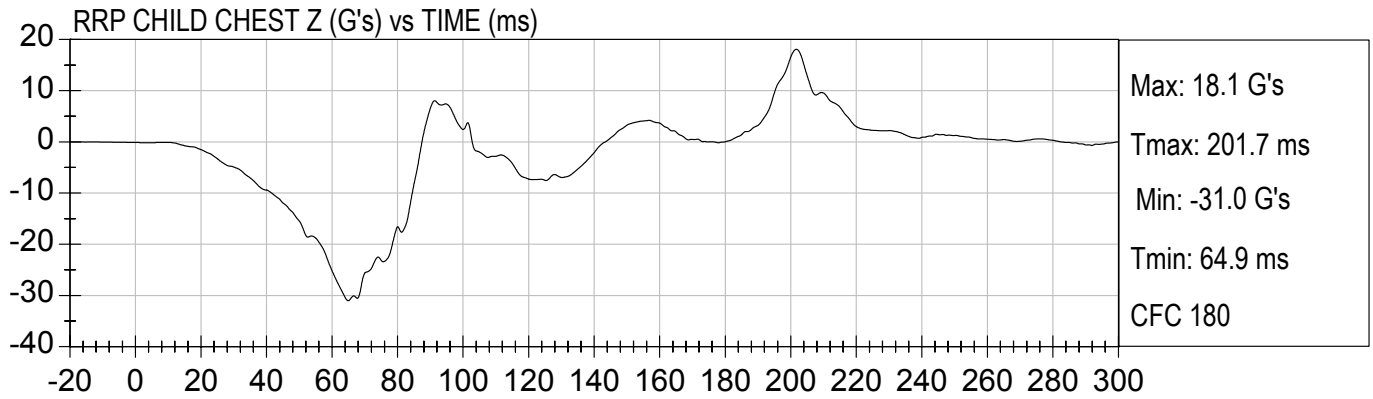

RRP CHILD UPPER NECK MResultant (Nm) vs TIME (ms)
20
17.5
15
12.5
10
7.5
5
2.5
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 19.2 Nm
Tmax: 208.7 ms
Min: 0.0 Nm
Tmin: 13.2 ms
CFC 600

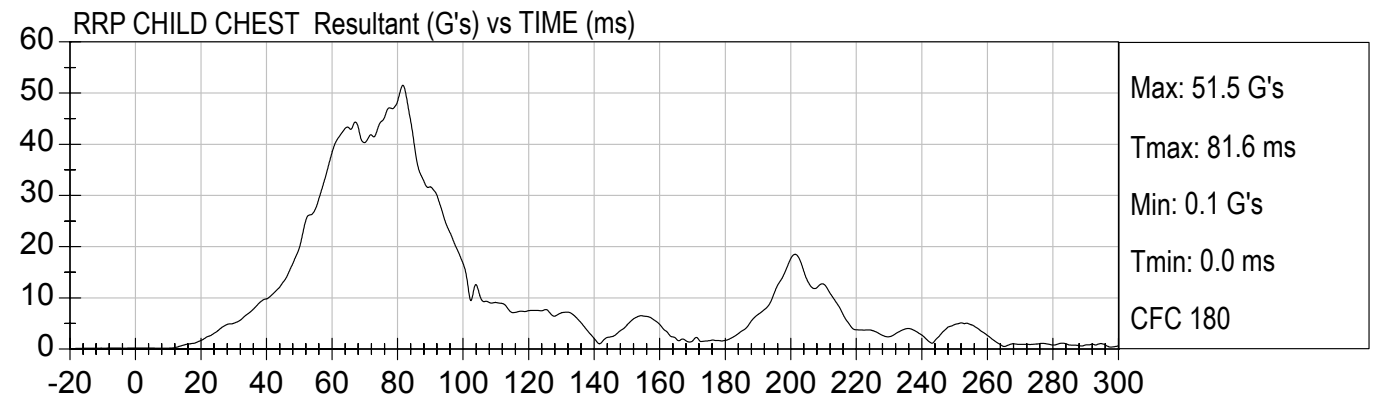
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

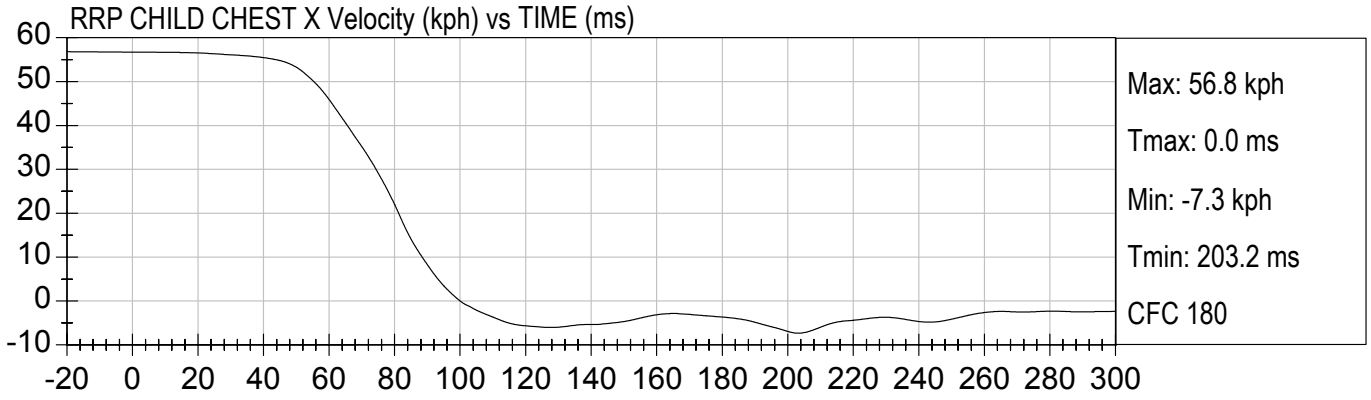
Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

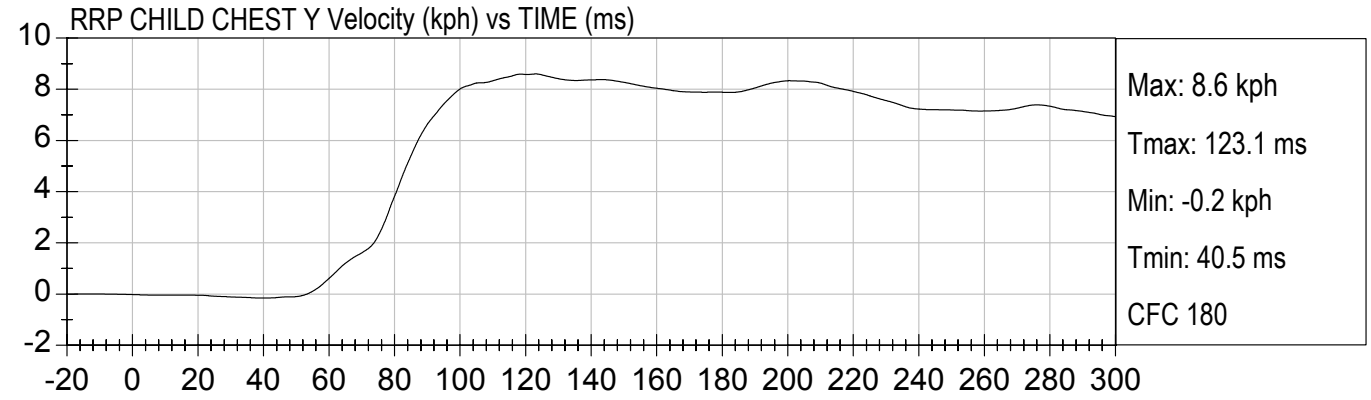


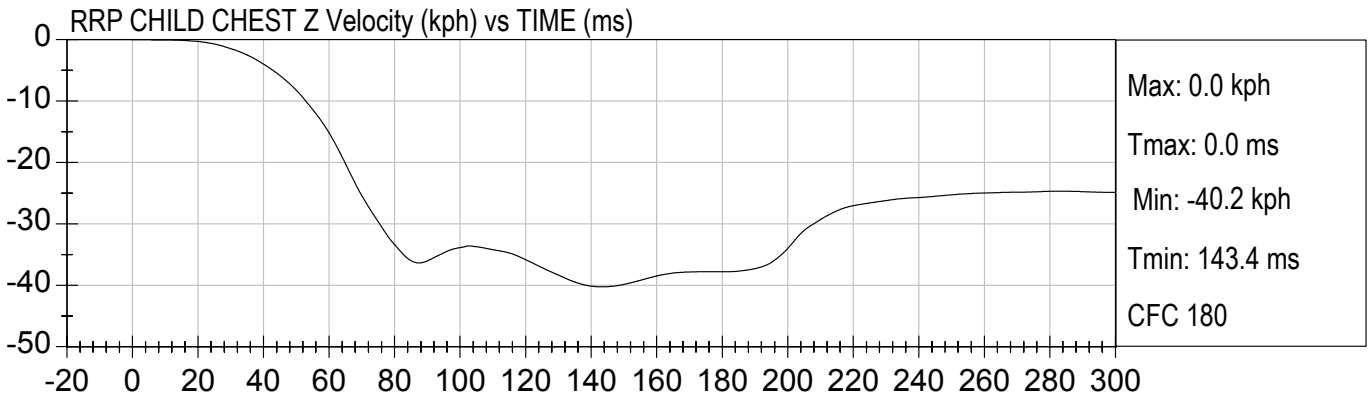


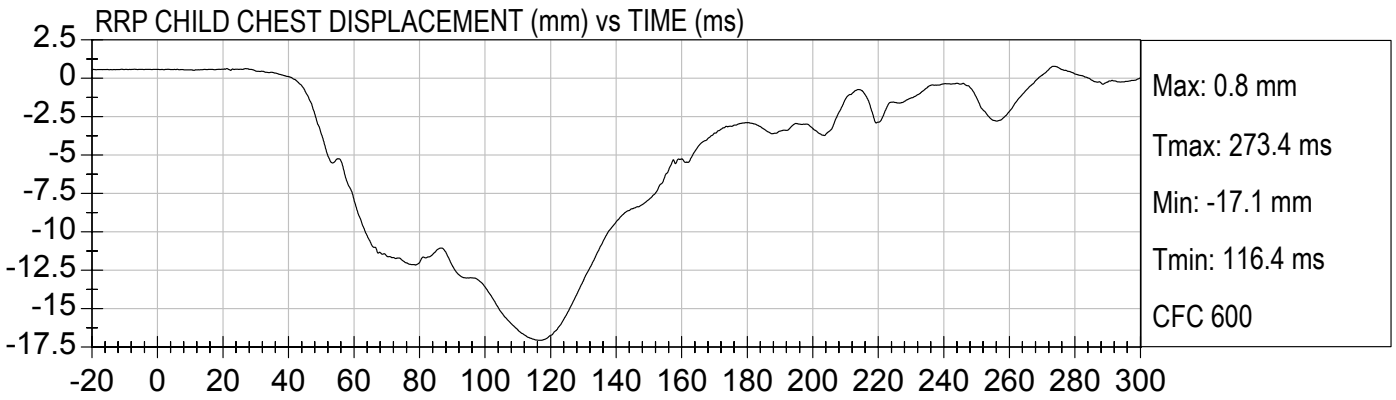





RRP CHILD CHEST X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.8 kph
Tmax: 0.0 ms
Min: -7.3 kph
Tmin: 203.2 ms
CFC 180

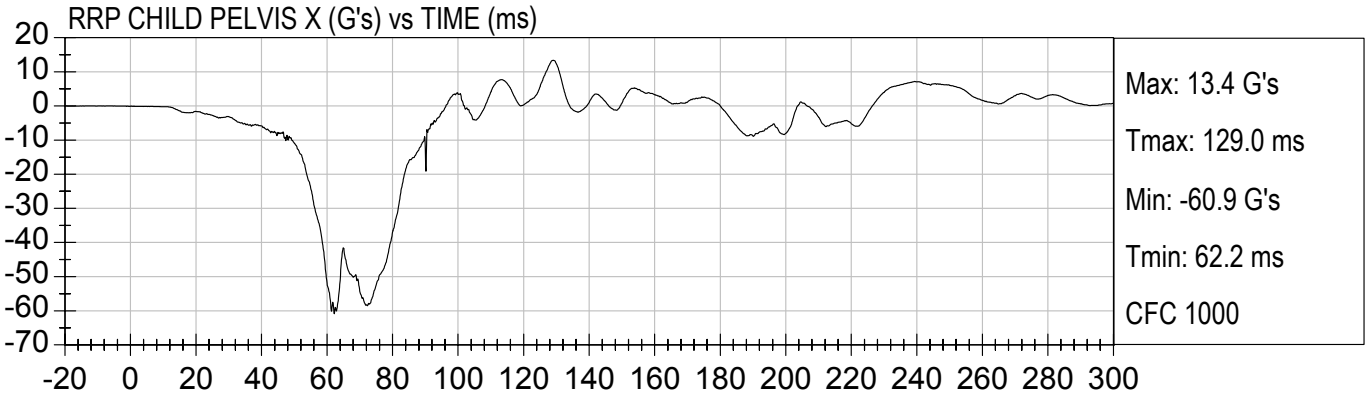

RRP CHILD CHEST Y Velocity (kph) vs TIME (ms)
10
8
6
4
2
0
-2
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 8.6 kph
Tmax: 123.1 ms
Min: -0.2 kph
Tmin: 40.5 ms
CFC 180

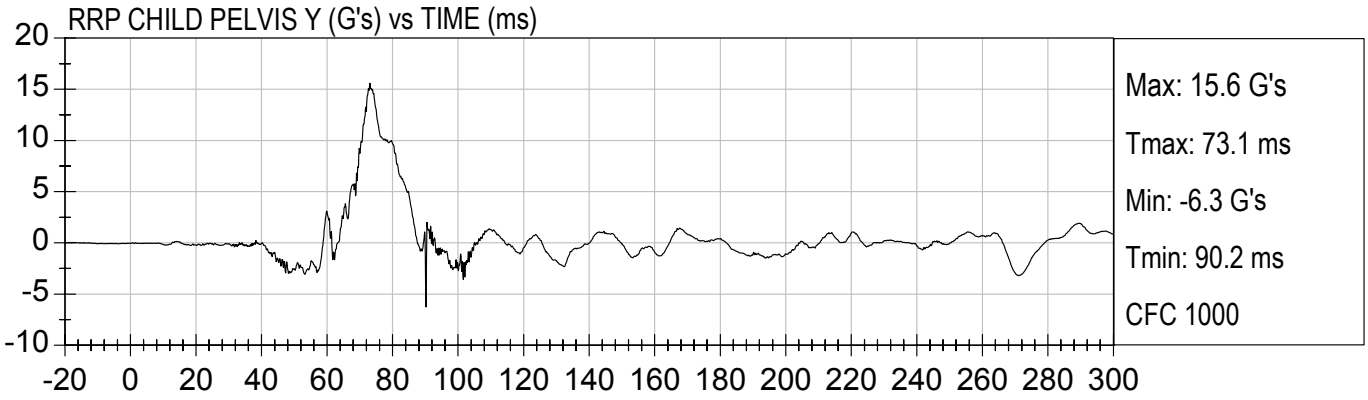

RRP CHILD CHEST Z Velocity (kph) vs TIME (ms)
0
-10
-20
-30
-40
-50
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.0 kph
Tmax: 0.0 ms
Min: -40.2 kph
Tmin: 143.4 ms
CFC 180

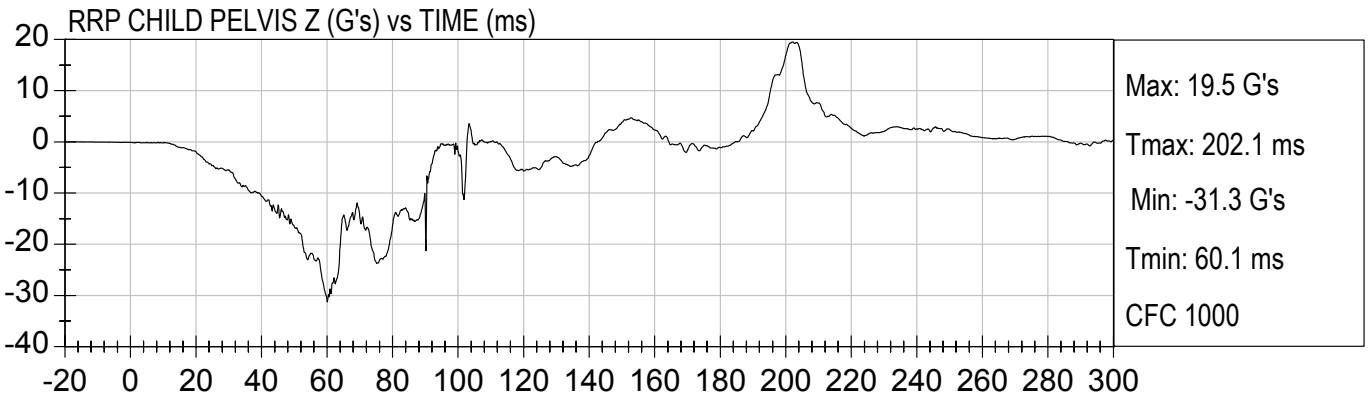

RRP CHILD CHEST DISPLACEMENT (mm) vs TIME (ms)
2.5
0
-2.5
-5
-7.5
-10
-12.5
-15
-17.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.8 mm
Tmax: 273.4 ms
Min: -17.1 mm
Tmin: 116.4 ms
CFC 600

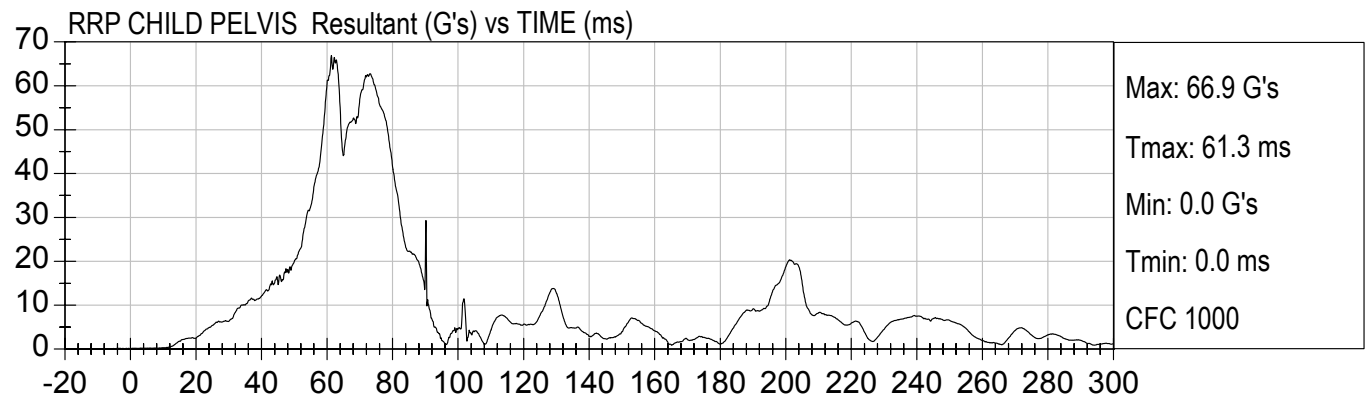
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

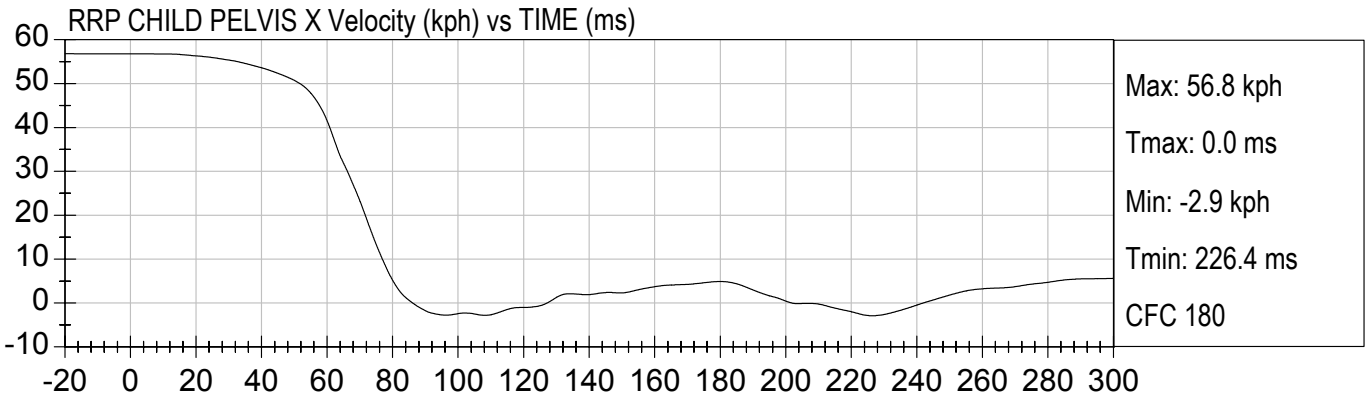
Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

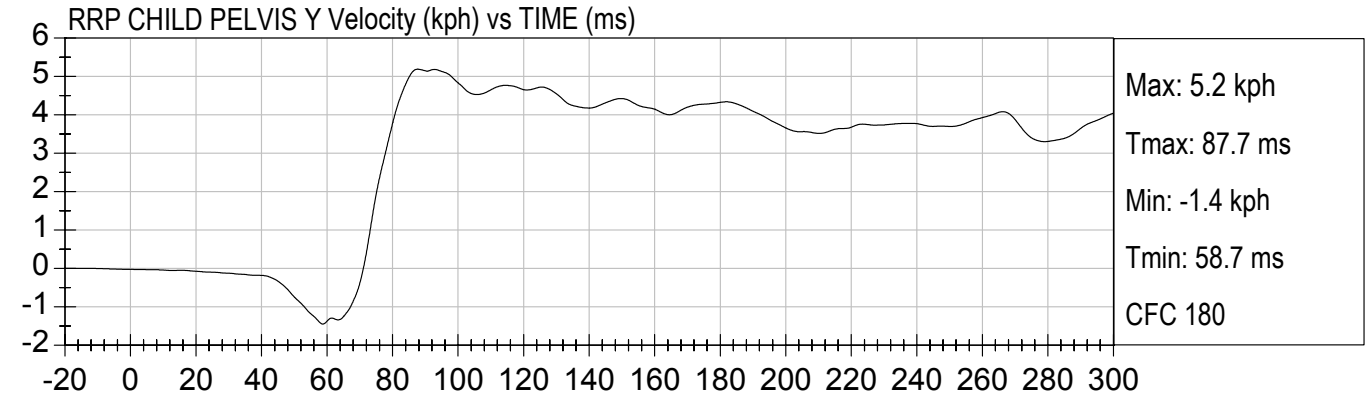


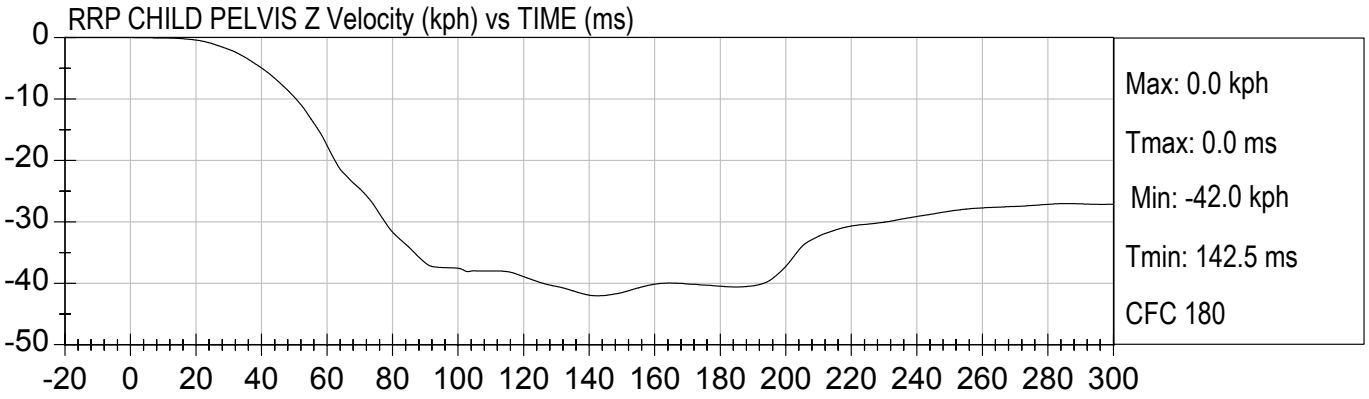


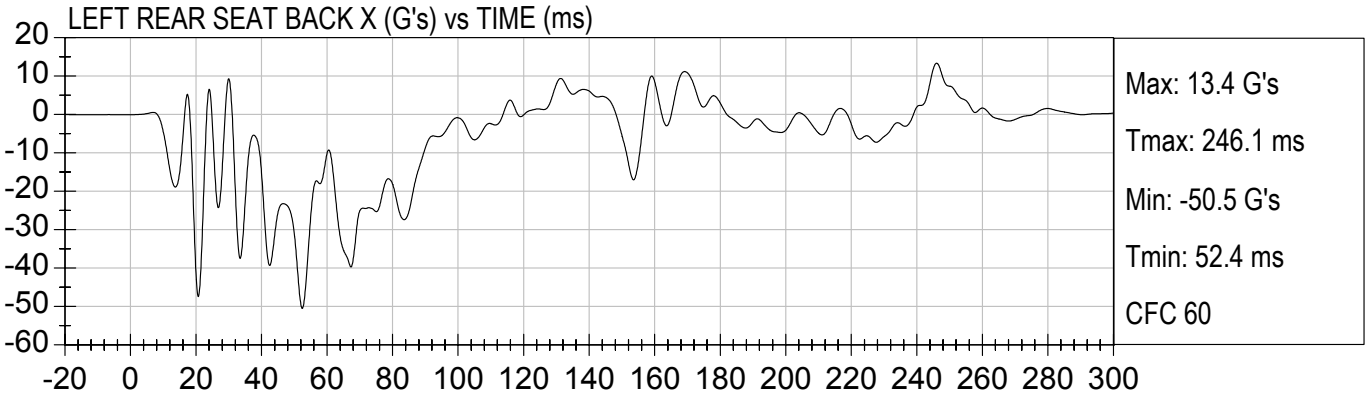


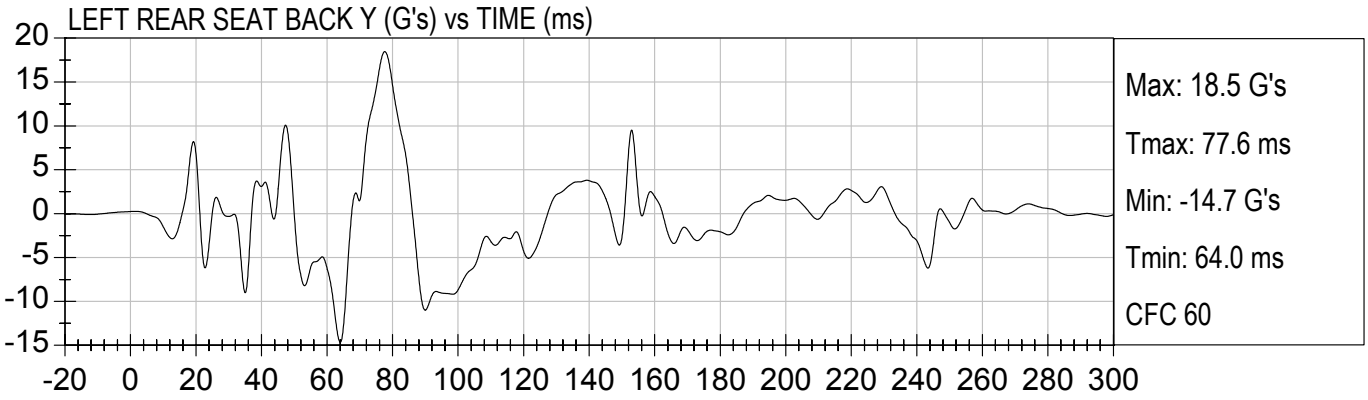


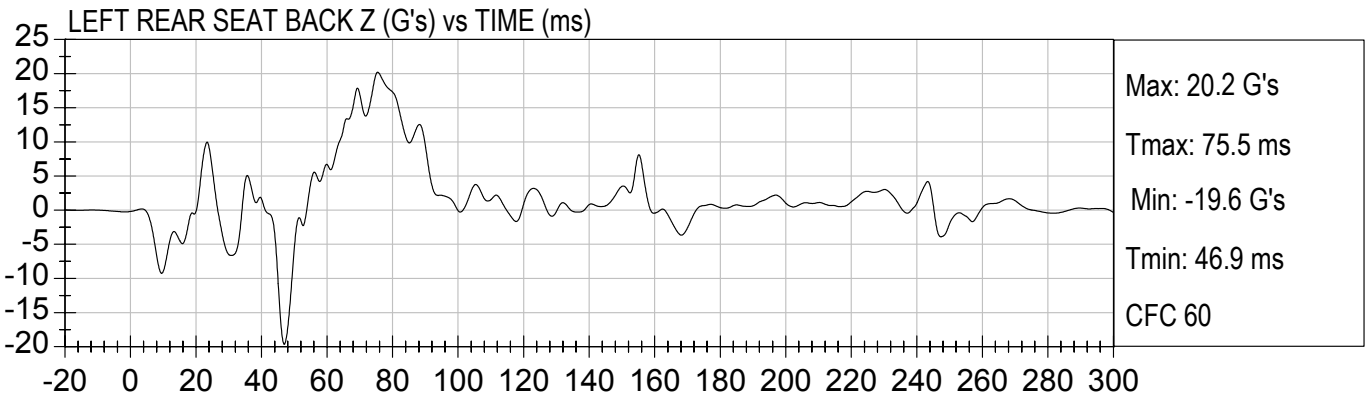

RRP CHILD PELVIS X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.8 kph
Tmax: 0.0 ms
Min: -2.9 kph
Tmin: 226.4 ms
CFC 180

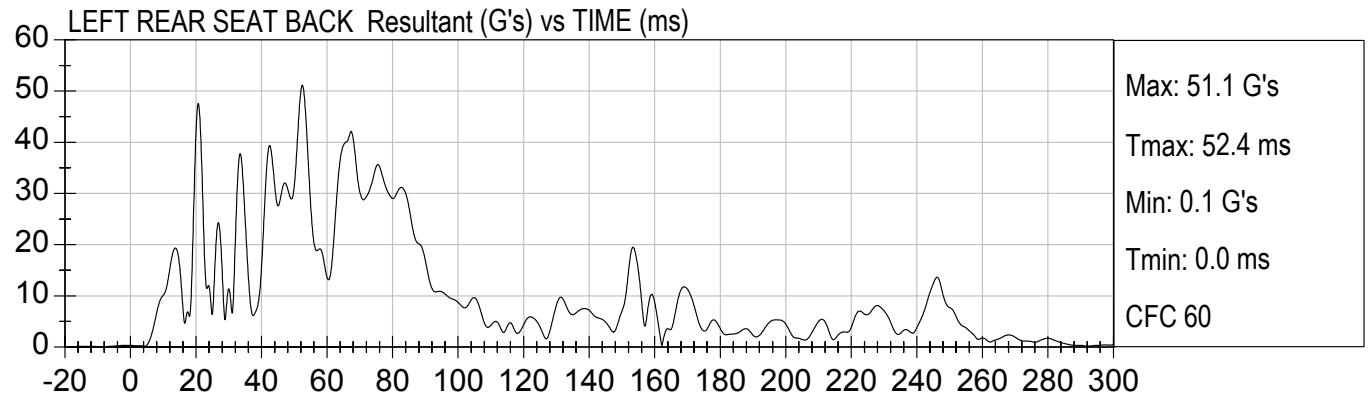

RRP CHILD PELVIS Y Velocity (kph) vs TIME (ms)
6
5
4
3
2
1
0
-1
-2
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 5.2 kph
Tmax: 87.7 ms
Min: -1.4 kph
Tmin: 58.7 ms
CFC 180

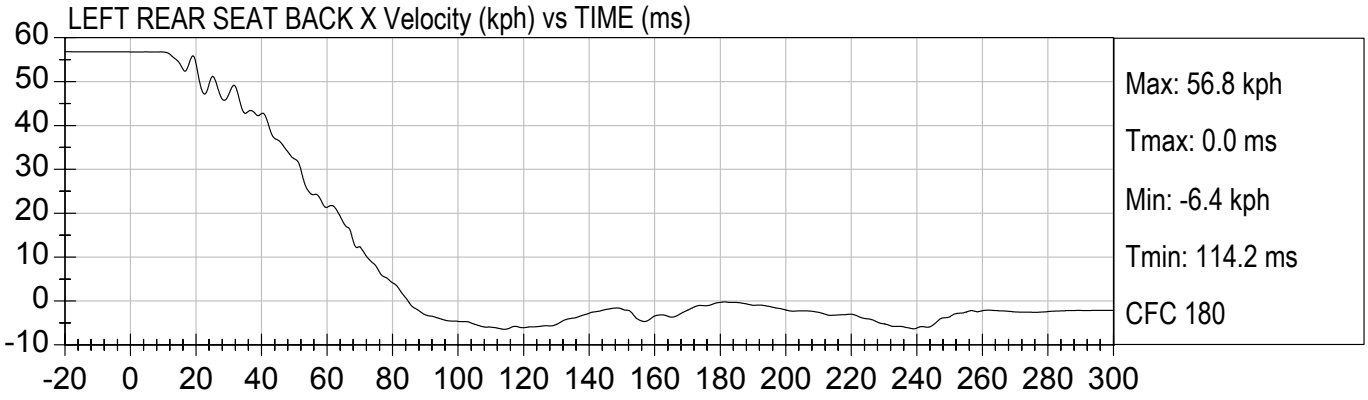

RRP CHILD PELVIS Z Velocity (kph) vs TIME (ms)
0
-10
-20
-30
-40
-50
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.0 kph
Tmax: 0.0 ms
Min: -42.0 kph
Tmin: 142.5 ms
CFC 180

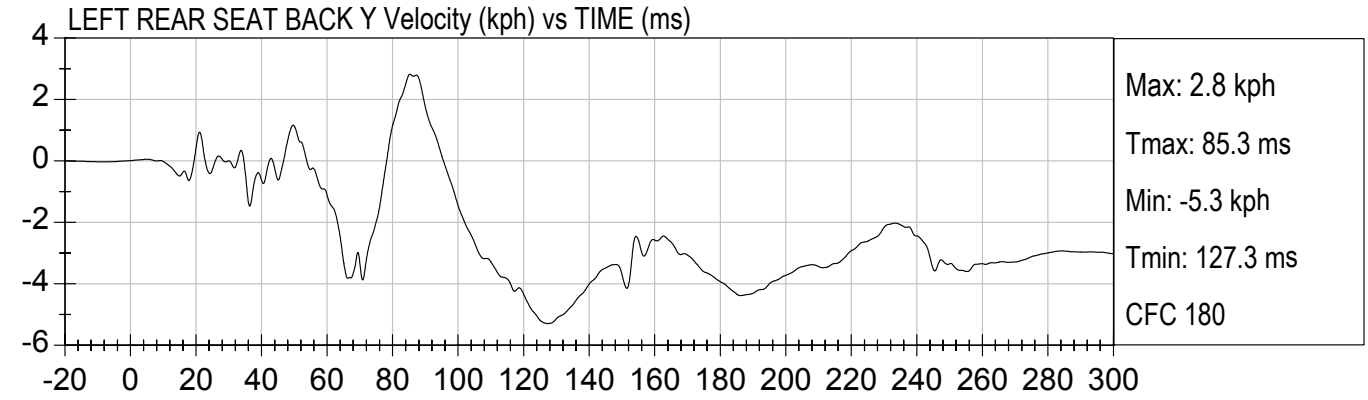

LEFT REAR SEAT BACK X (G's) vs TIME (ms)
Max: 13.4 G's
Tmax: 246.1 ms
Min: -50.5 G's
Tmin: 52.4 ms
CFC 60

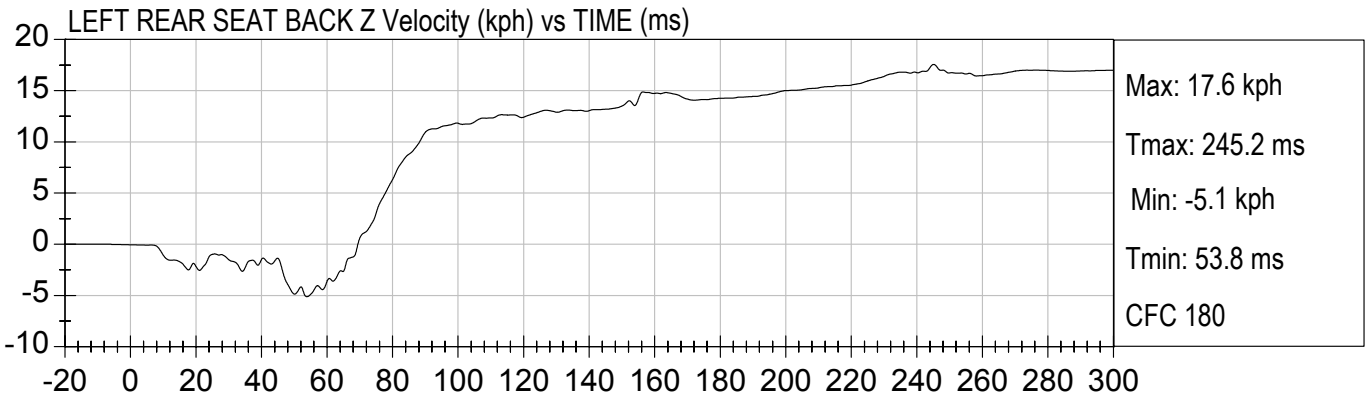

LEFT REAR SEAT BACK Y (G's) vs TIME (ms)
Max: 18.5 G's
Tmax: 77.6 ms
Min: -14.7 G's
Tmin: 64.0 ms
CFC 60


LEFT REAR SEAT BACK Z (G's) vs TIME (ms)
Max: 20.2 G's
Tmax: 75.5 ms
Min: -19.6 G's
Tmin: 46.9 ms
CFC 60


LEFT REAR SEAT BACK Resultant (G's) vs TIME (ms)
Max: 51.1 G's
Tmax: 52.4 ms
Min: 0.1 G's
Tmin: 0.0 ms
CFC 60

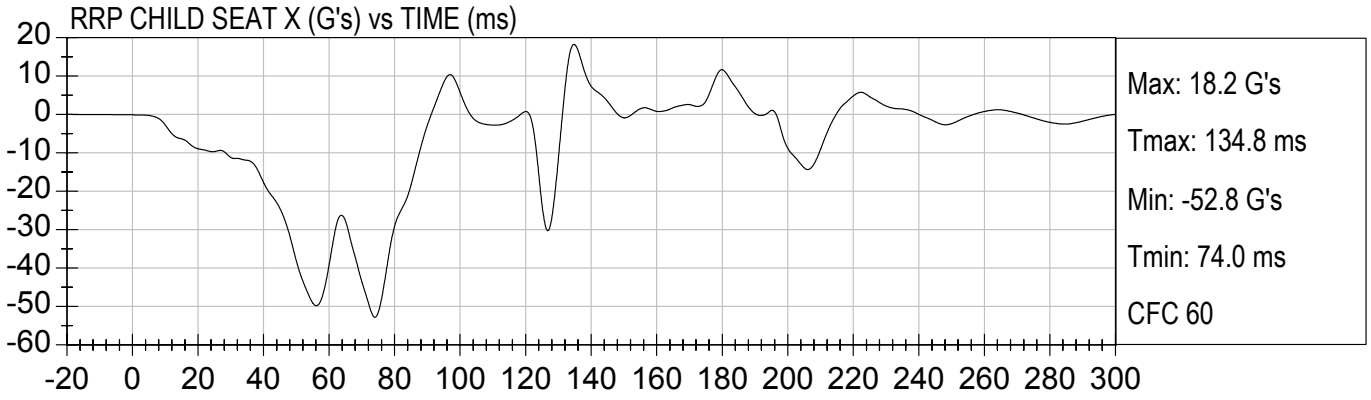

LEFT REAR SEAT BACK X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.8 kph
Tmax: 0.0 ms
Min: -6.4 kph
Tmin: 114.2 ms
CFC 180

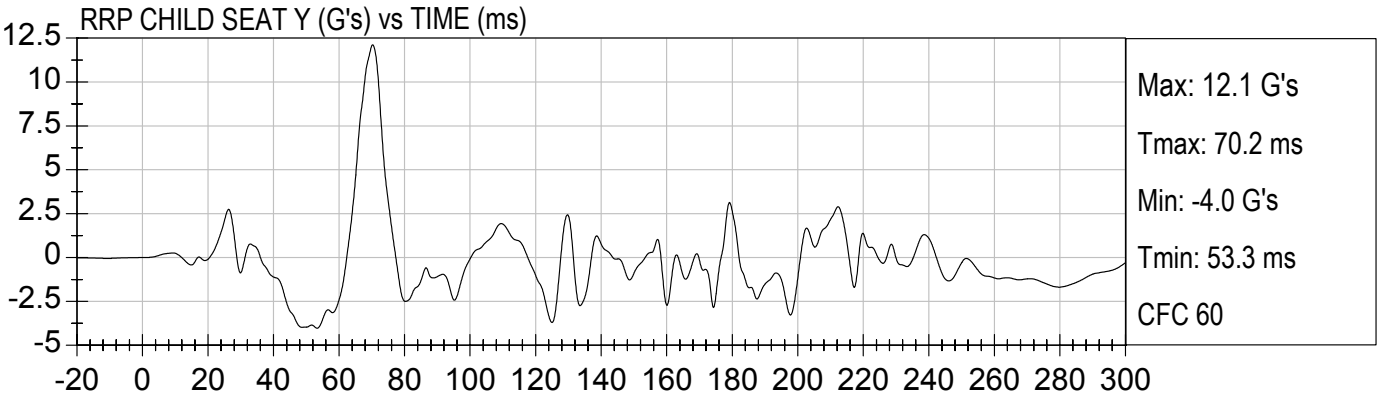

LEFT REAR SEAT BACK Y Velocity (kph) vs TIME (ms)
4
2
0
-2
-4
-6
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 2.8 kph
Tmax: 85.3 ms
Min: -5.3 kph
Tmin: 127.3 ms
CFC 180

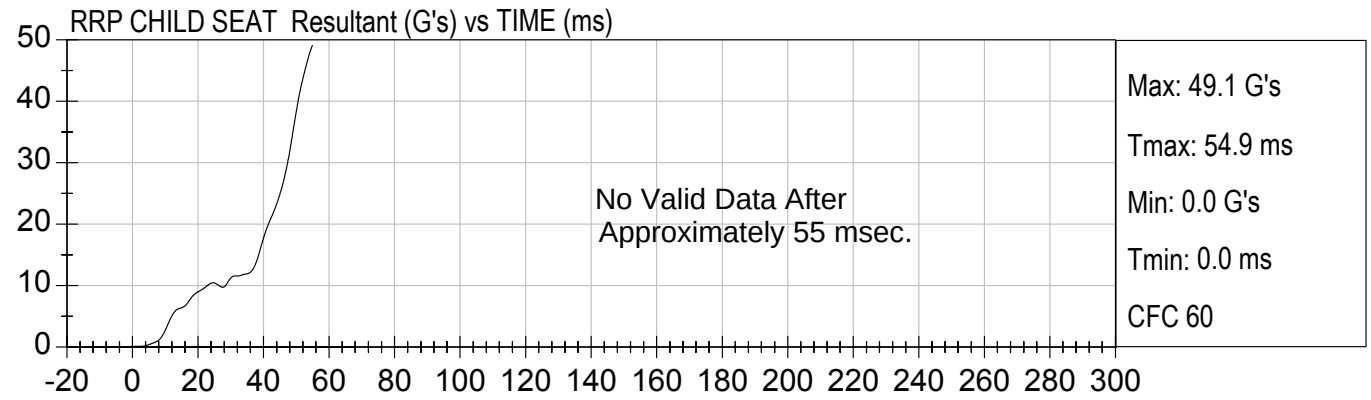

LEFT REAR SEAT BACK Z Velocity (kph) vs TIME (ms)
20
15
10
5
0
-5
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 17.6 kph
Tmax: 245.2 ms
Min: -5.1 kph
Tmin: 53.8 ms
CFC 180

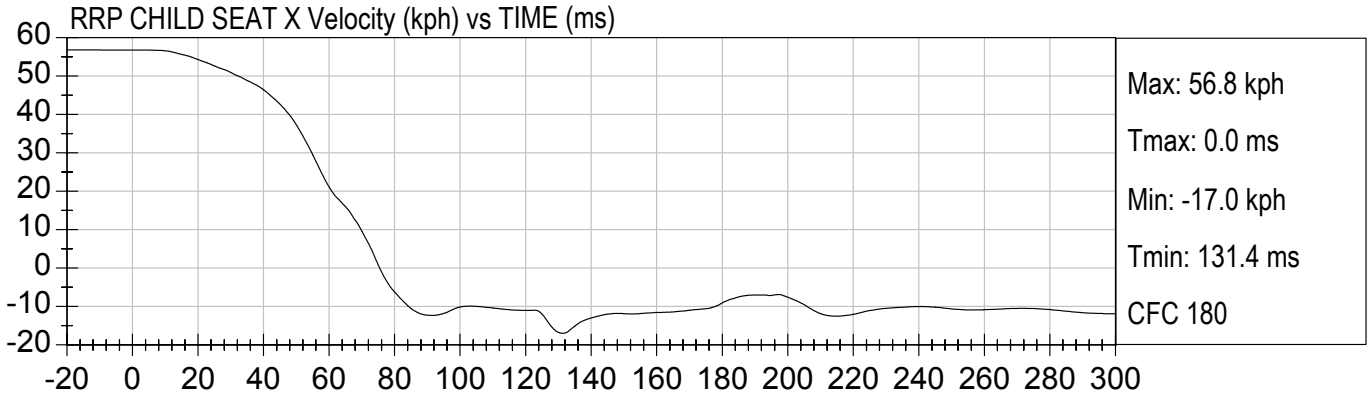
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

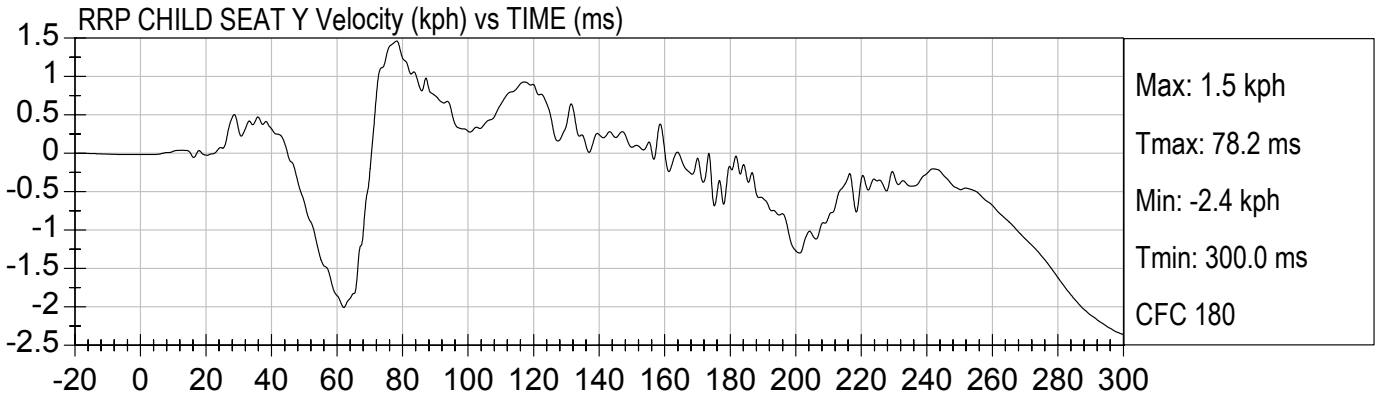
Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

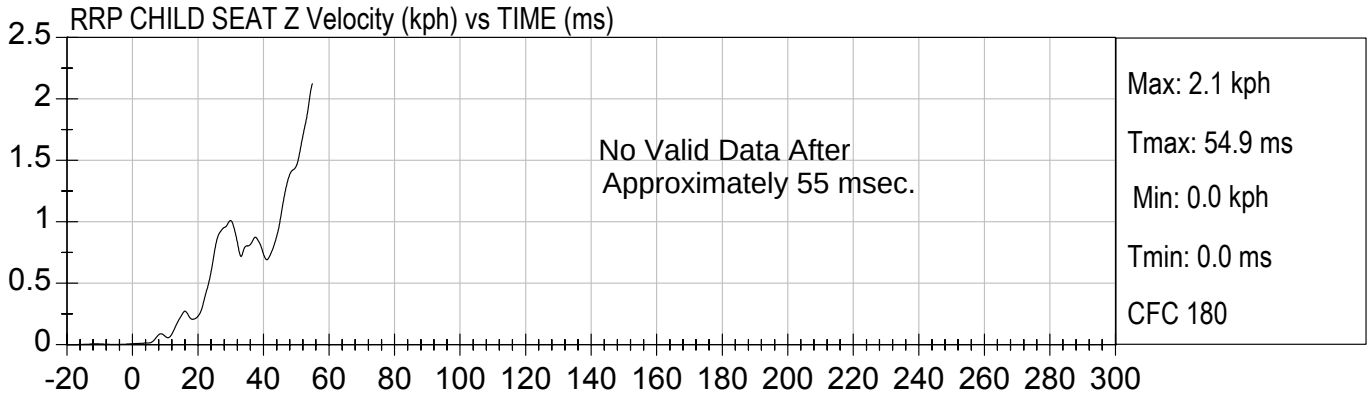






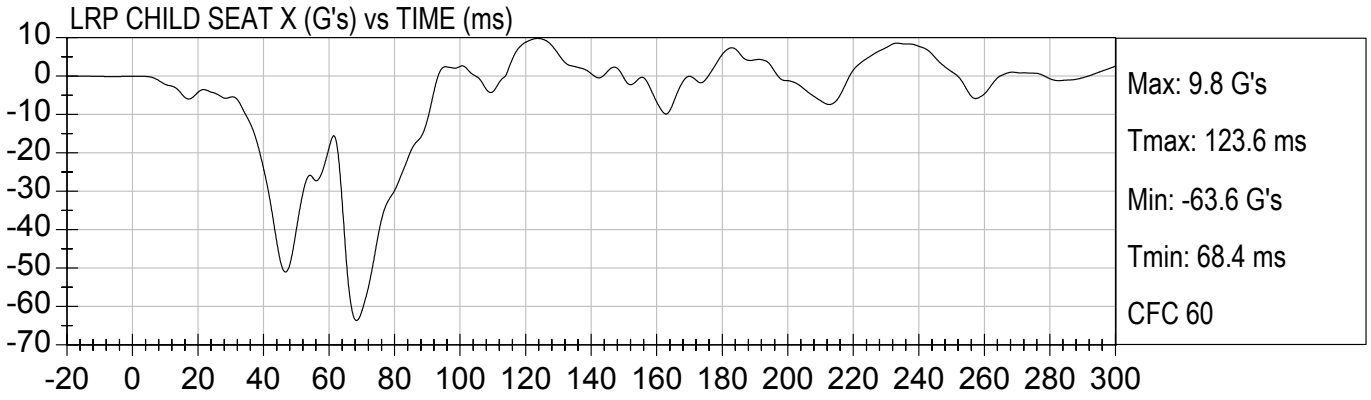

RRP CHILD SEAT X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.8 kph
Tmax: 0.0 ms
Min: -17.0 kph
Tmin: 131.4 ms
CFC 180

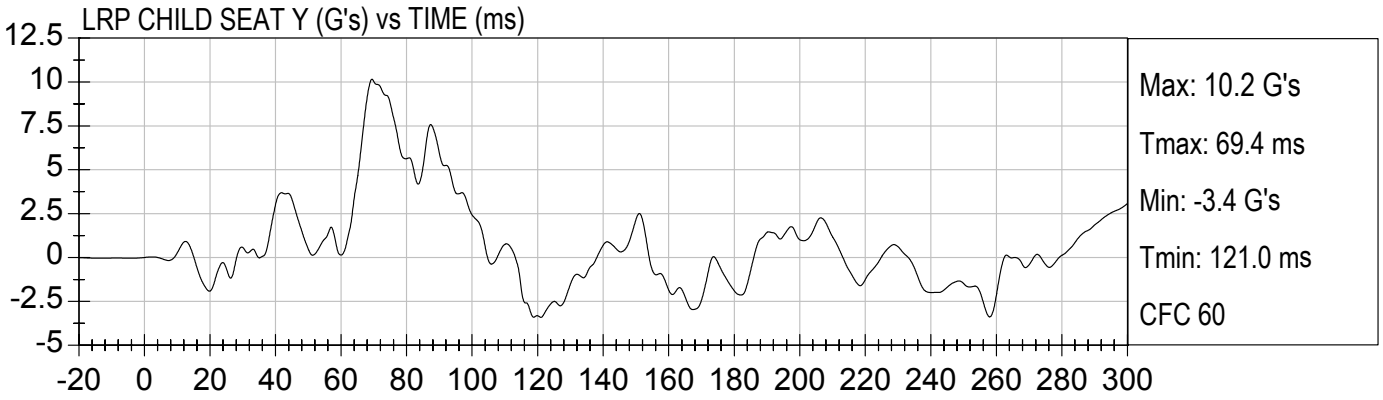

RRP CHILD SEAT Y Velocity (kph) vs TIME (ms)
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 1.5 kph
Tmax: 78.2 ms
Min: -2.4 kph
Tmin: 300.0 ms
CFC 180

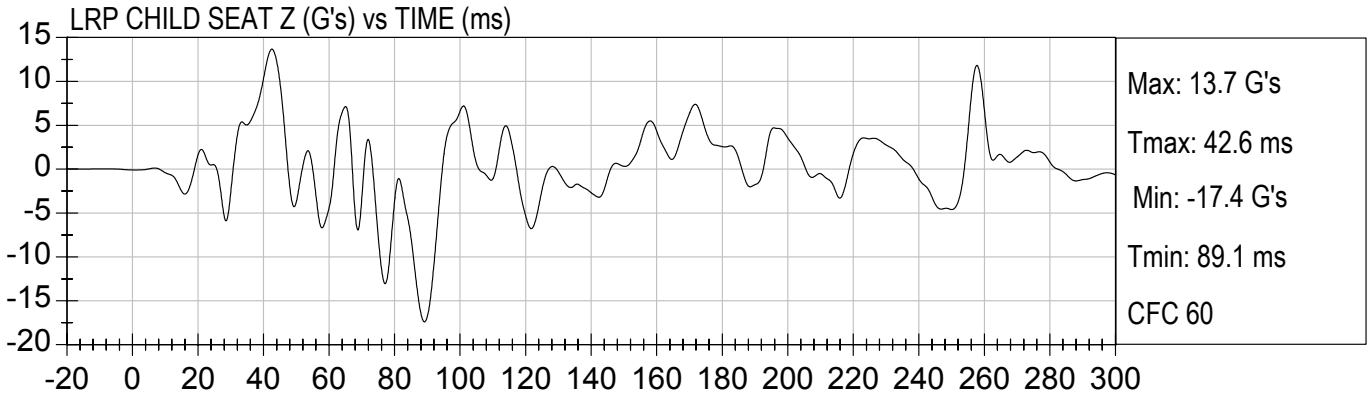

RRP CHILD SEAT Z Velocity (kph) vs TIME (ms)
2.5
2
1.5
1
0.5
0
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
No Valid Data After
Approximately 55 msec.
Max: 2.1 kph
Tmax: 54.9 ms
Min: 0.0 kph
Tmin: 0.0 ms
CFC 180

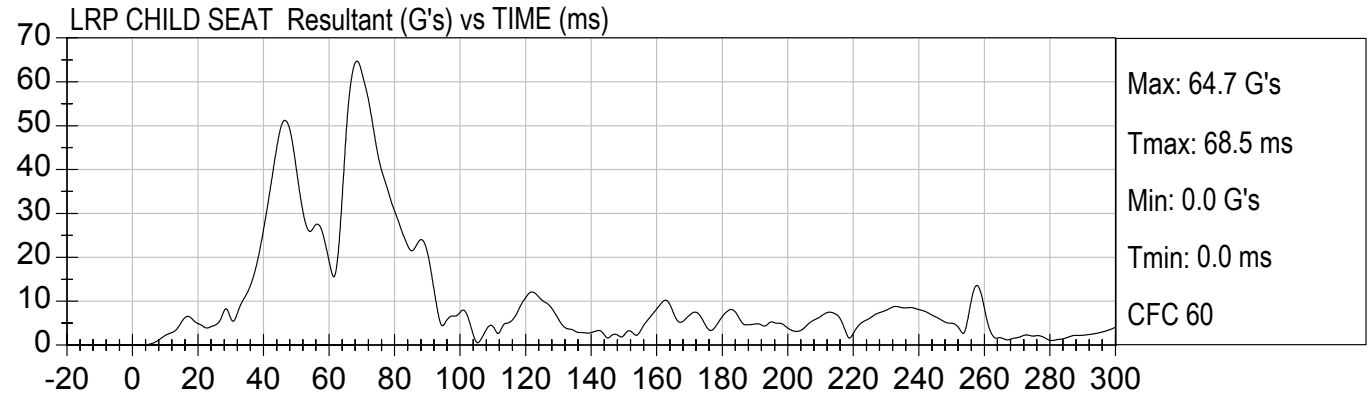
35MPH FRONTAL IMPACT
2005 VOLVO V70 STATION WAGON (M55900)

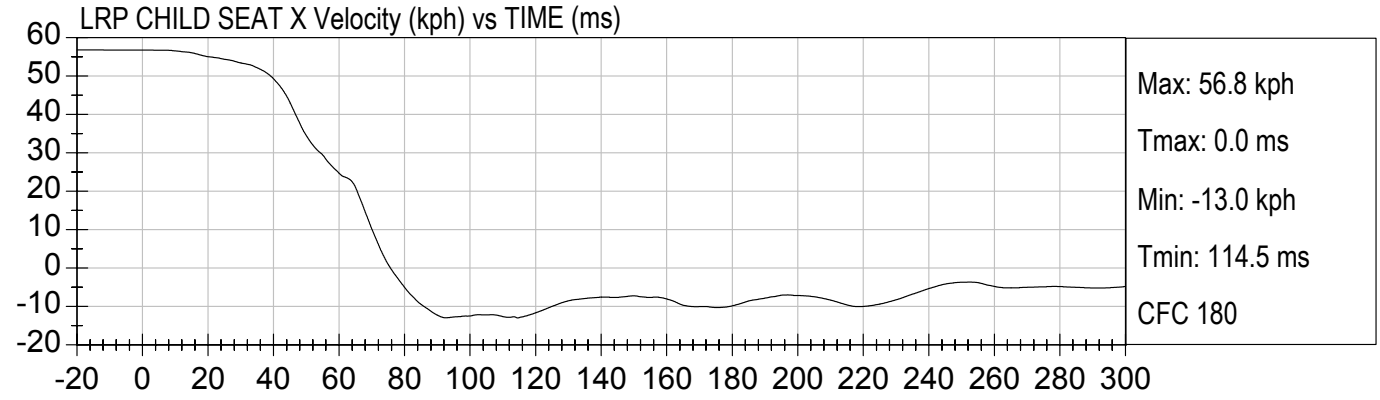
Test Date: 10/19/2004
Speed: 35.3 mph (56.8 km/h)

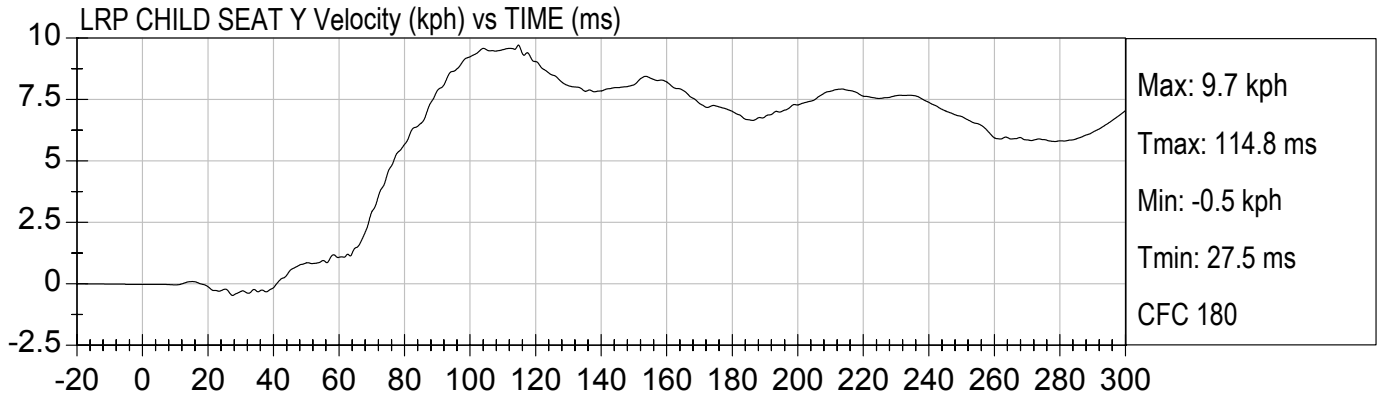


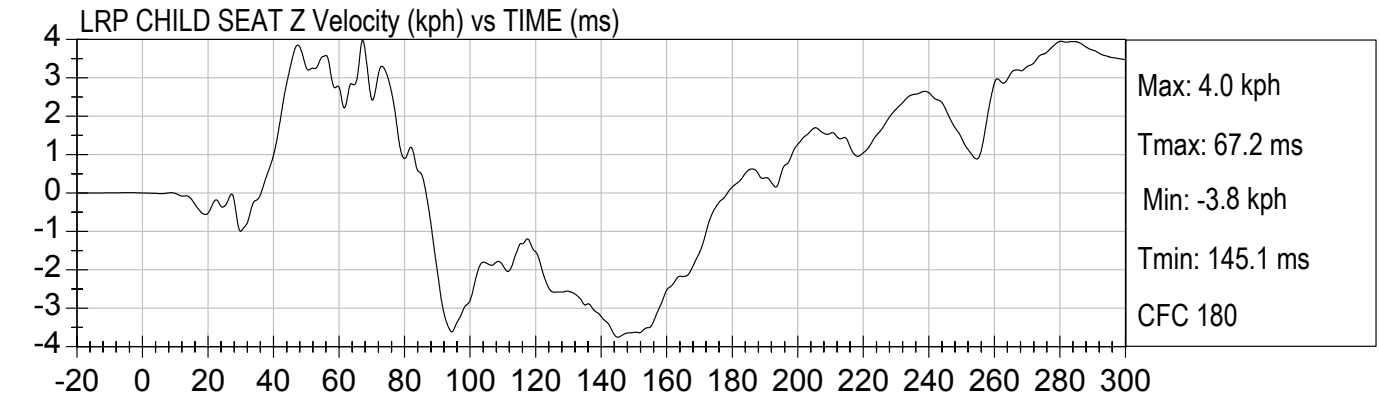


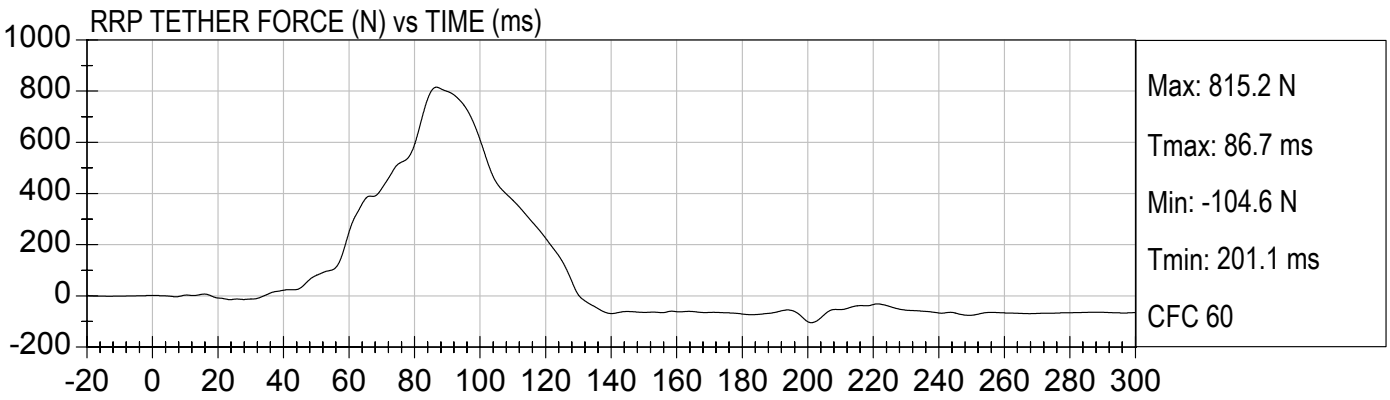





LRP CHILD SEAT X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.8 kph
Tmax: 0.0 ms
Min: -13.0 kph
Tmin: 114.5 ms
CFC 180


LRP CHILD SEAT Y Velocity (kph) vs TIME (ms)
10
7.5
5
2.5
0
-2.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 9.7 kph
Tmax: 114.8 ms
Min: -0.5 kph
Tmin: 27.5 ms
CFC 180


LRP CHILD SEAT Z Velocity (kph) vs TIME (ms)
4
3
2
1
0
-1
-2
-3
-4
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 4.0 kph
Tmax: 67.2 ms
Min: -3.8 kph
Tmin: 145.1 ms
CFC 180


RRP TETHER FORCE (N) vs TIME (ms)
1000
800
600
400
200
0
-200
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 815.2 N
Tmax: 86.7 ms
Min: -104.6 N
Tmin: 201.1 ms
CFC 60

APPENDIX C

CHILD DUMMY CALIBRATION INFORMATION

Hybrid III Calibration Data Sheet

3 Year Old

Head Drop Calibration

ATD Serial No: 042 **Test I.D:** D041811

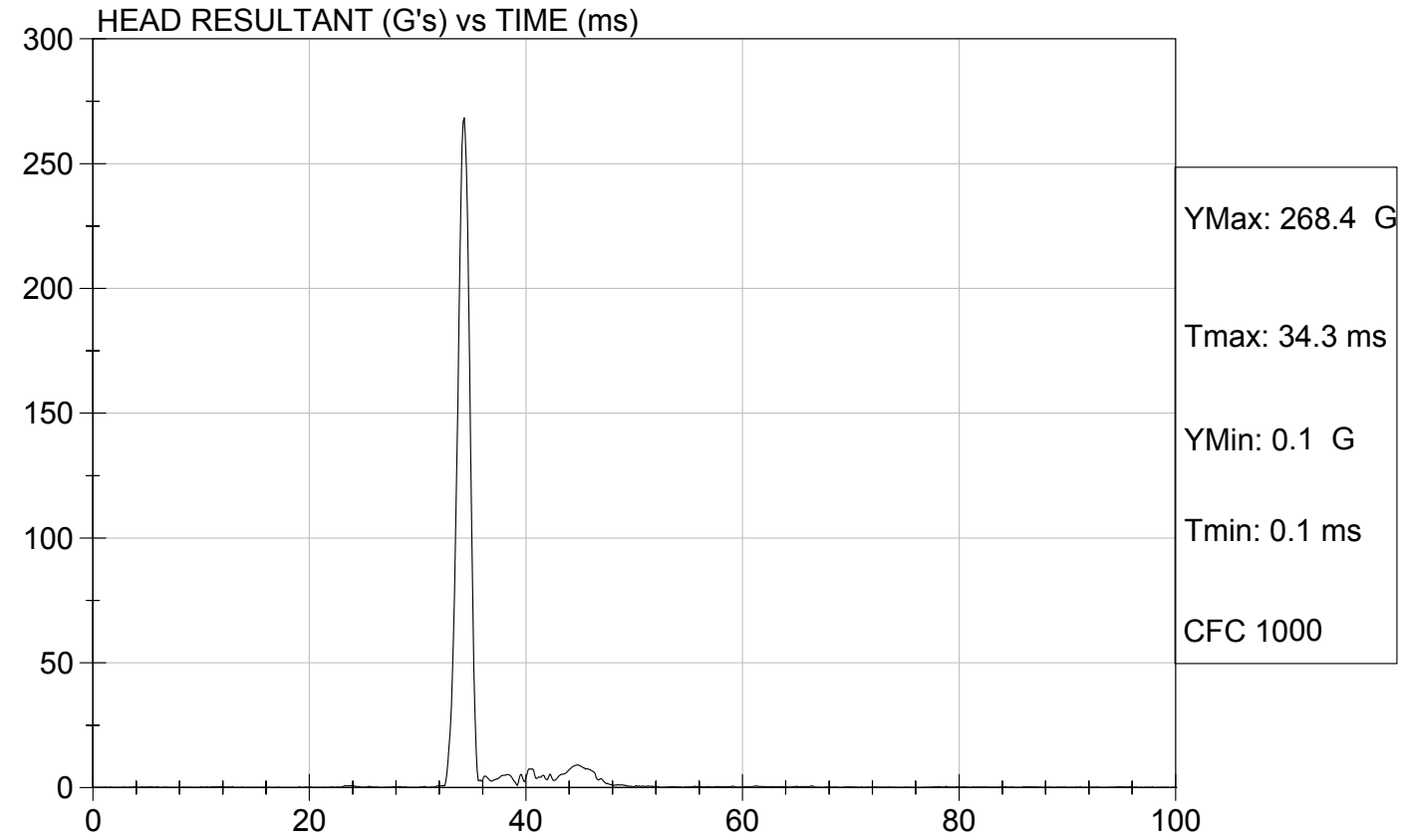
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Peak Resultant Acceleration	G's	250.0 to 280.0	268.4	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-11.5	Pass
Is Acceleration Unimodal?	Yes/No	< 10% Peak	Yes	Pass
		Overall Test Results		Pass

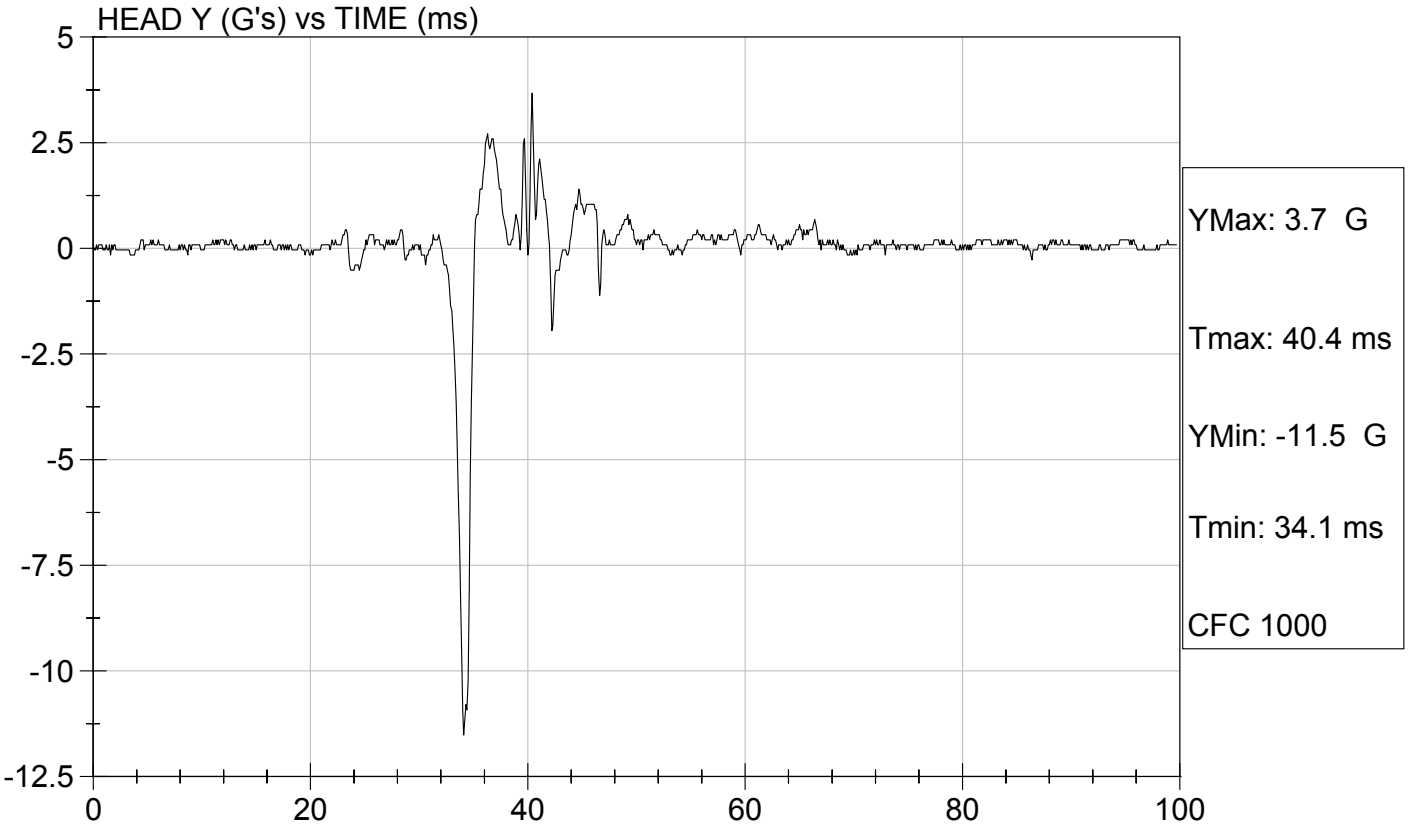
Jessica Hall
Laboratory Technician

08/06/2004
Test Date

David Winkelbauer
Approved By

	Test Description: Head Drop	Test Date: 08/06/2004
	Component: D041811	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:** D041812

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity		%	10 to 70	46	Pass
Pendulum Speed		m/s	5.4 to 5.6	5.5	Pass
Pendulum Deceleration	10 msec	m/s	2.0 - 2.7	2.3	Pass
	15 msec	m/s	3.0 - 4.0	3.3	Pass
	20 msec	m/s	4.0 - 5.1	4.5	Pass
D Plane Rotation		deg	70 - 82	81	Pass
Peak Moment within Deflection Corridor		Nm	42.0 - 53.0	43.8	Pass
Positive Moment - Time Curve Decay to 10 Nm		msec	60.0 - 80.0	71.5	Pass
			Overall Test Results		Pass

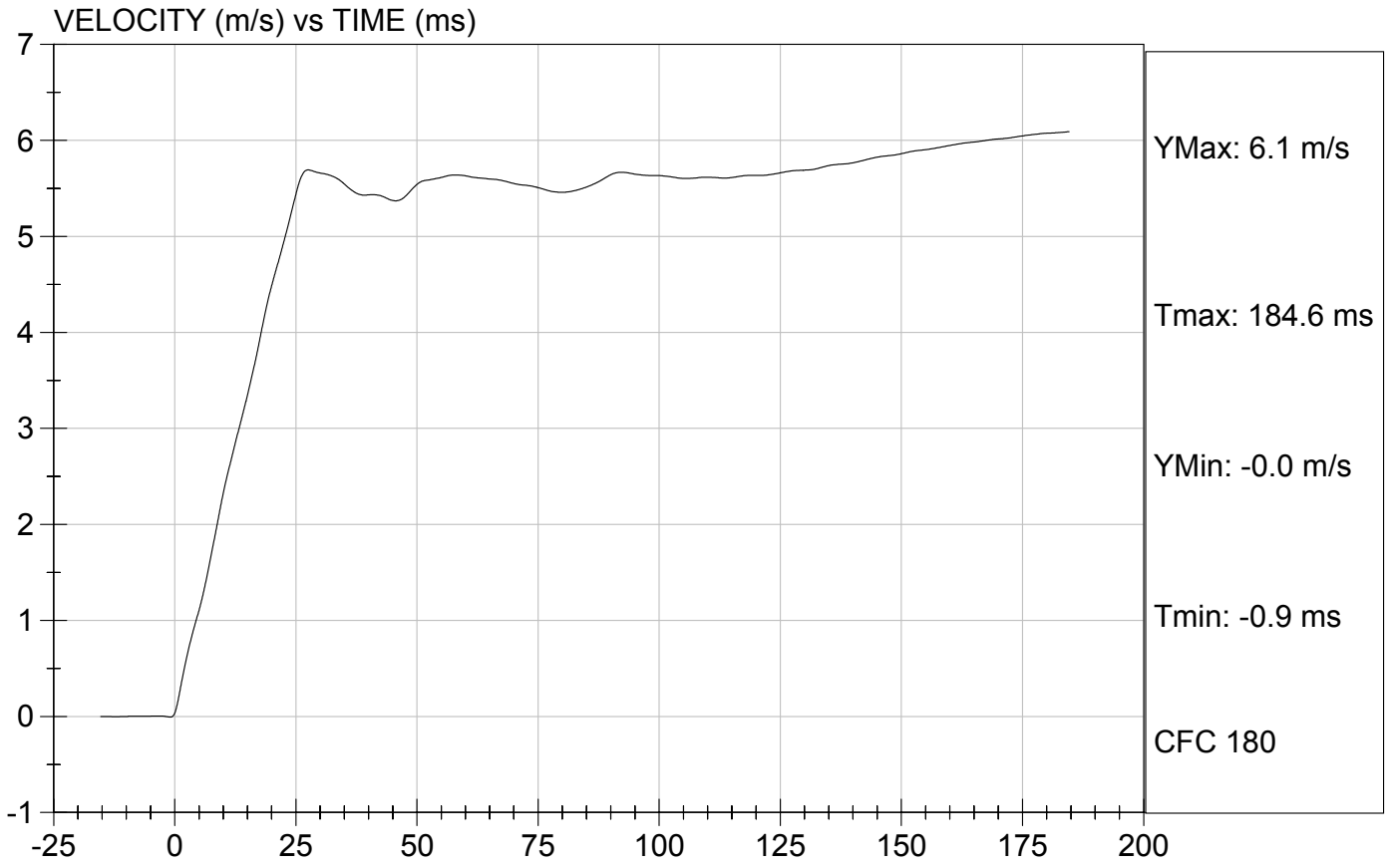
Jessica Hall
Laboratory Technician

08/06/2004
Test Date

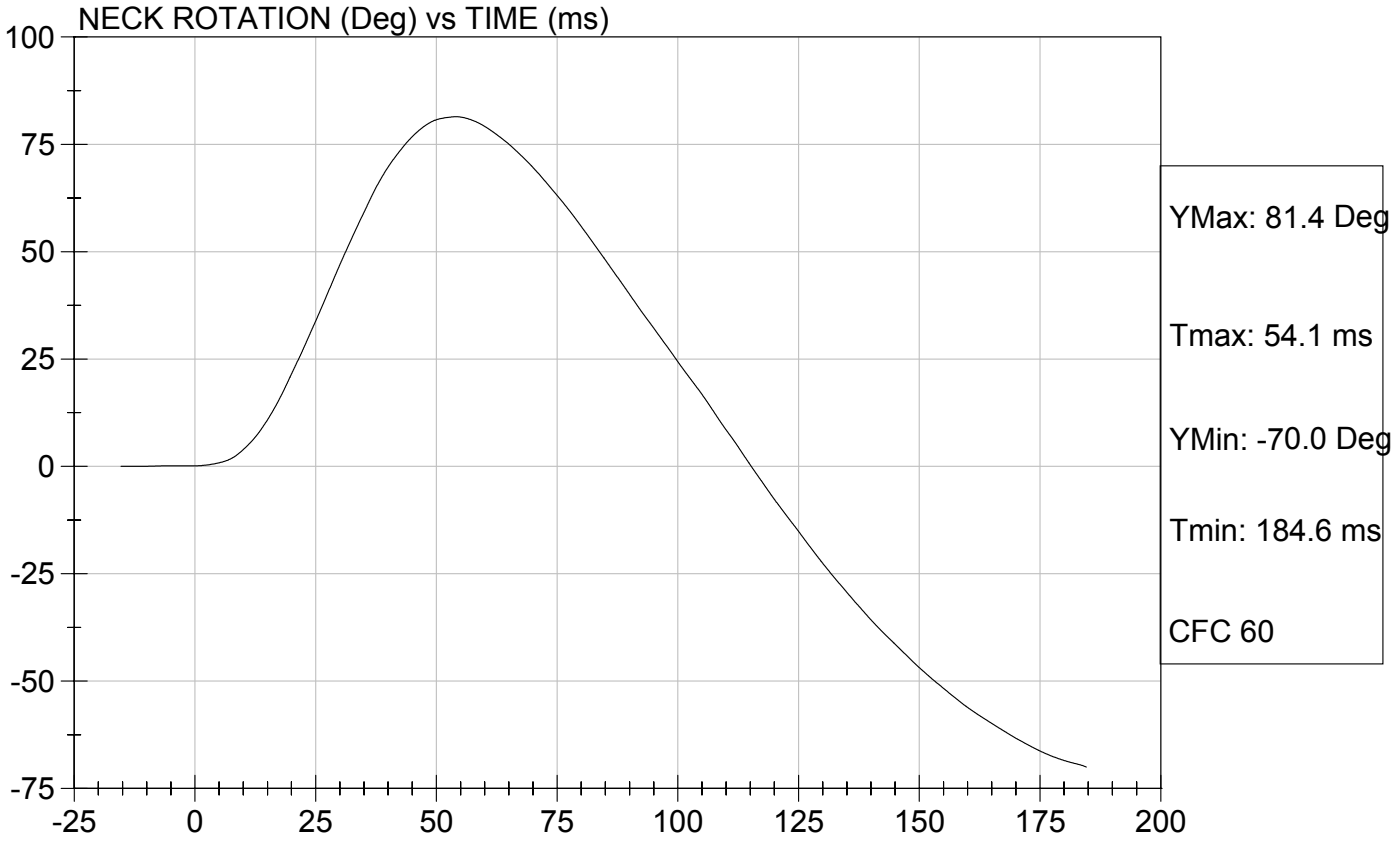
David Winkelbauer
Approved By

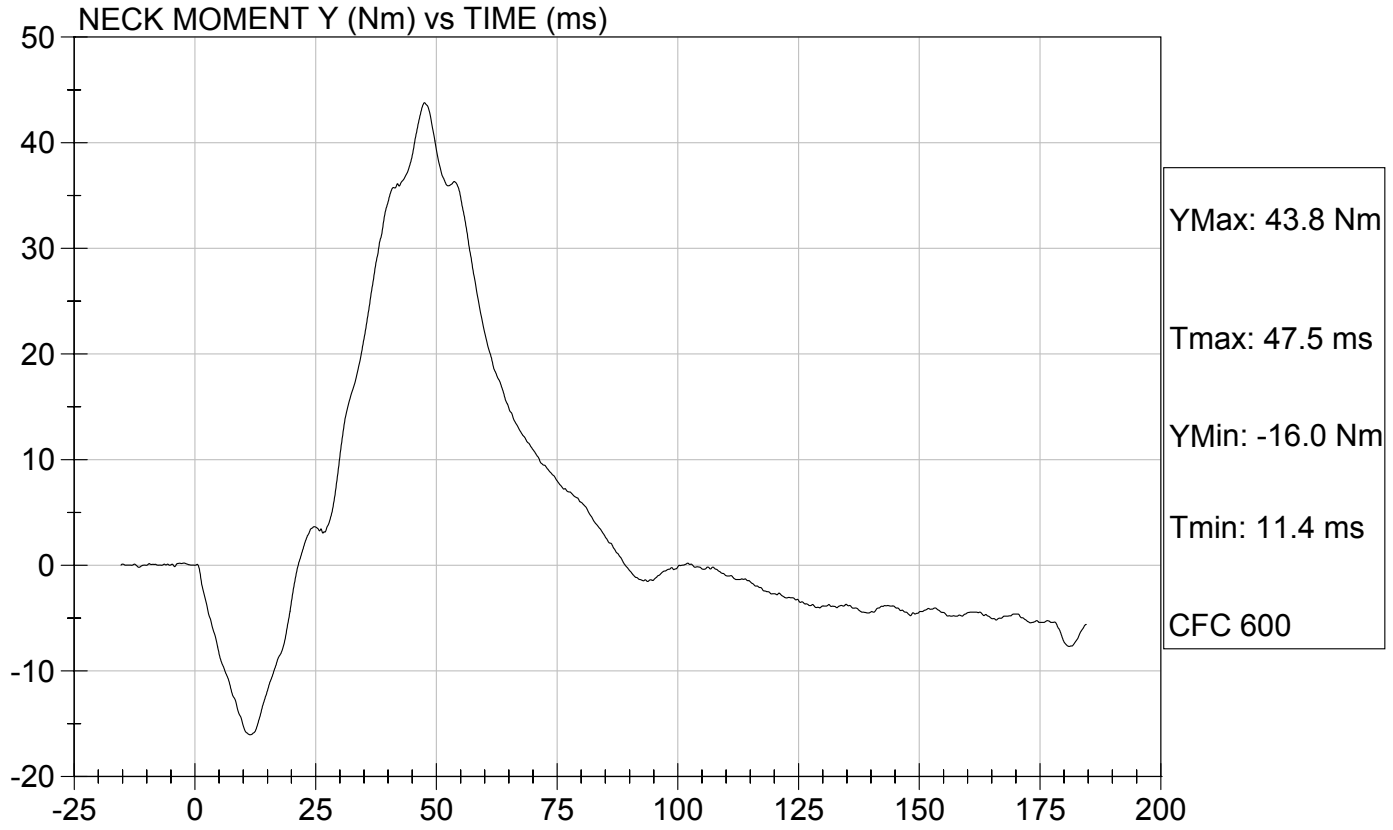
Test Description: Neck Flexion | Test Date: 08/06/2004

Component: D041812 | Speed: 17.98 ft/sec, 5.48 m/sec



	Test Description: Neck Flexion	Test Date: 08/06/2004
	Component: D041812	Speed: 17.98 ft/s, 5.48 m/s





Hybrid III Calibration Data Sheet

3 Year Old

Neck Extension Test

ATD Serial No: 042 **Test I.D:** D041813

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	44	Pass
Pendulum Speed		m/s	3.55 to 3.75	3.75	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	2.9	Pass
D Plane Rotation		deg	83 - 93	85	Pass
Peak Moment within Deflection Corridor		Nm	-53.3 - -43.7	-45.9	Pass
Negative Moment - Time Curve Decay to -10 Nm		msec	60.0 - 80.0	69.1	Pass
			Overall Test Results		Pass

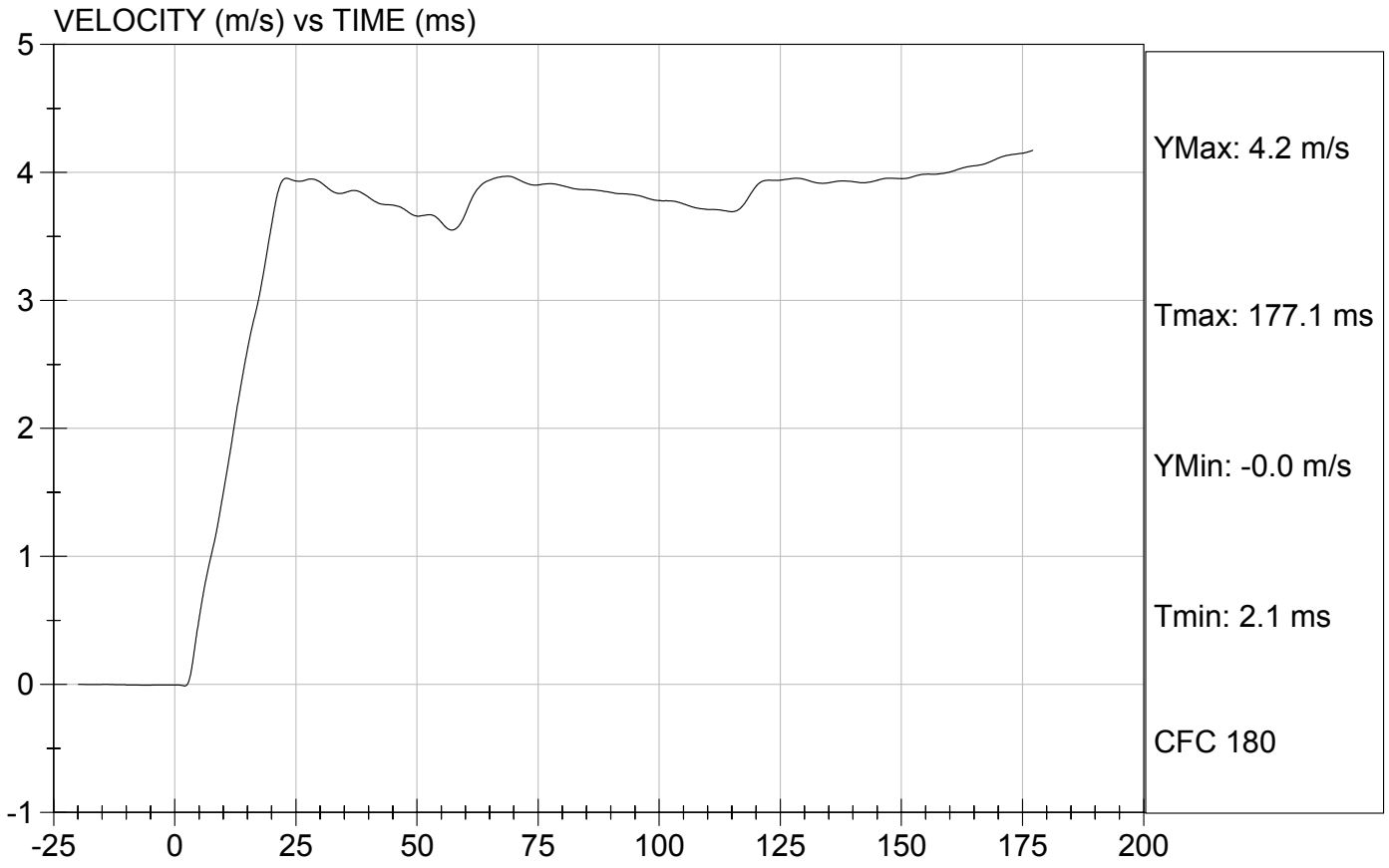
Jessica Hall
Laboratory Technician

08/06/2004
Test Date

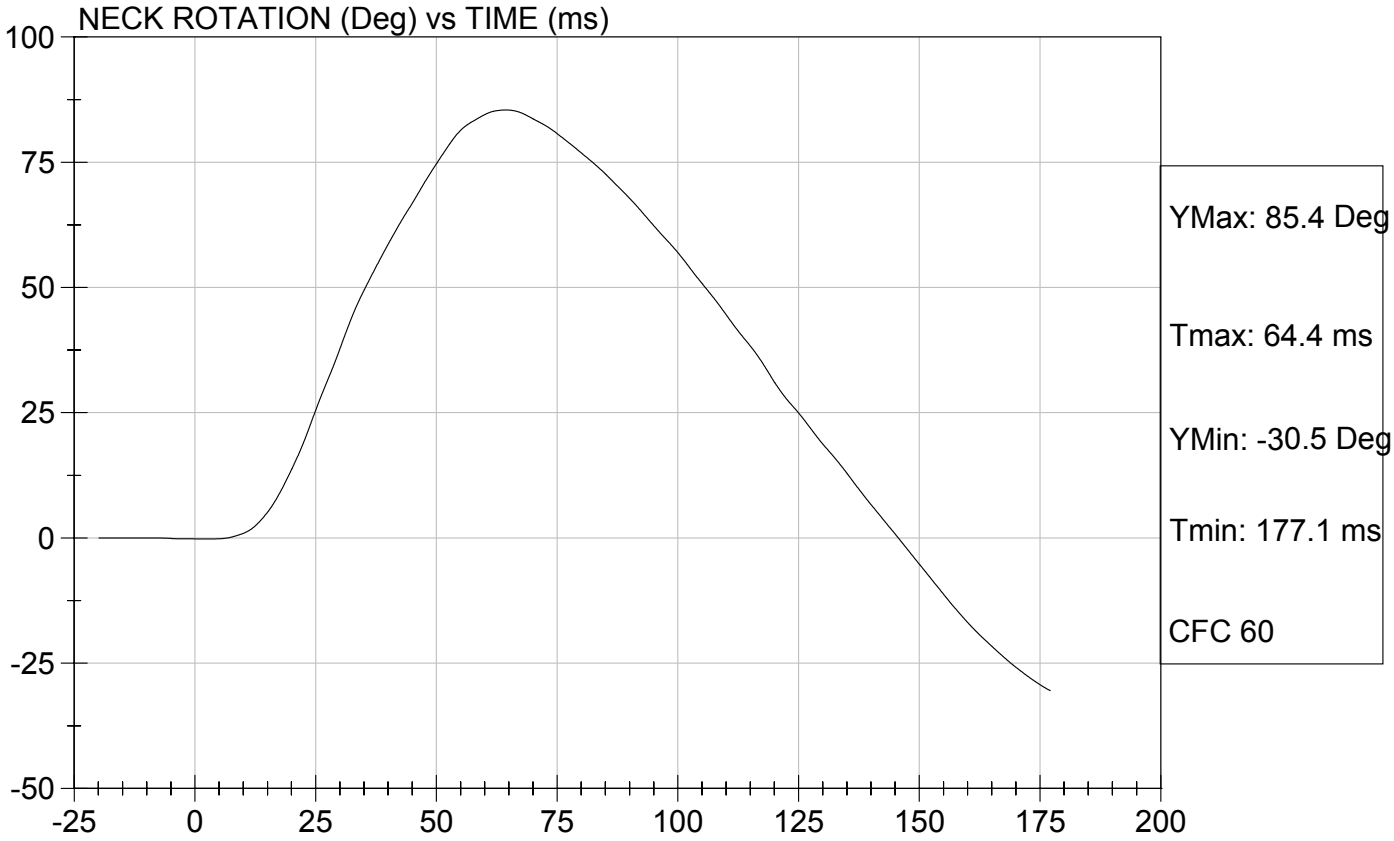
David Winkelbauer
Approved By

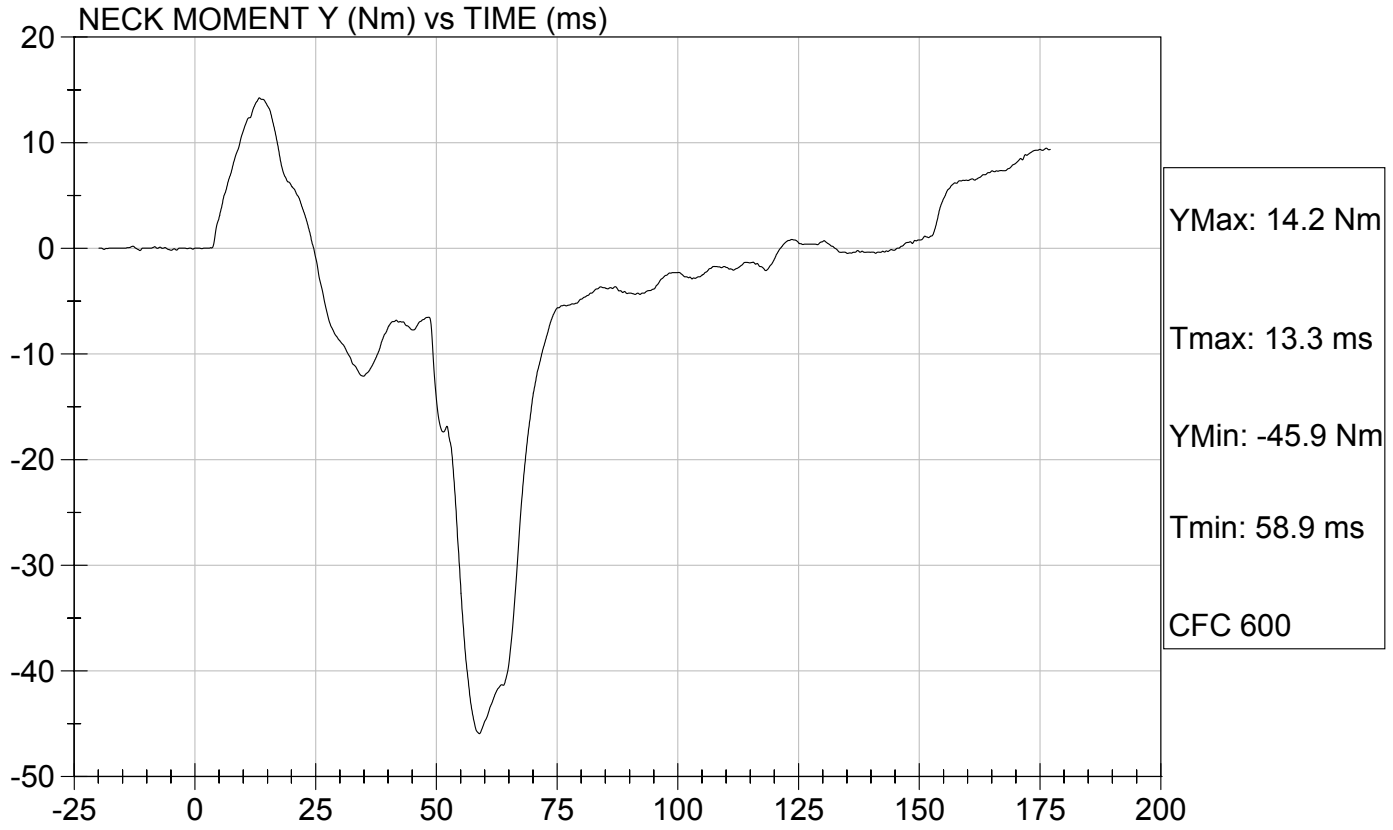
Test Description: Neck Extension Test Date: 08/06/2004

Component: D041813 Speed: 12.29 ft/sec, 3.75 m/sec



	Test Description: Neck Extension	Test Date: 08/06/2004
	Component: D041813	Speed: 12.29 ft/s, 3.75 m/s





Hybrid III Calibration Data Sheet

3 Year Old

Thorax Impact Test

ATD Serial No: 042 **Test I.D:** D041814

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Velocity	m/s	5.9 to 6.1	5.9	Pass
Peak Deflection	mm	32 - 38	37	Pass
Peak Force w/in Deflection Corridor	kN	0.68 - 0.81	0.74	Pass
Internal Hysteresis	%	65 to 85	69	Pass
Max Force 12.5 mm - 32 mm Deflection	kN	Max 0.86	0.48	Pass
		Overall Test Results		Pass

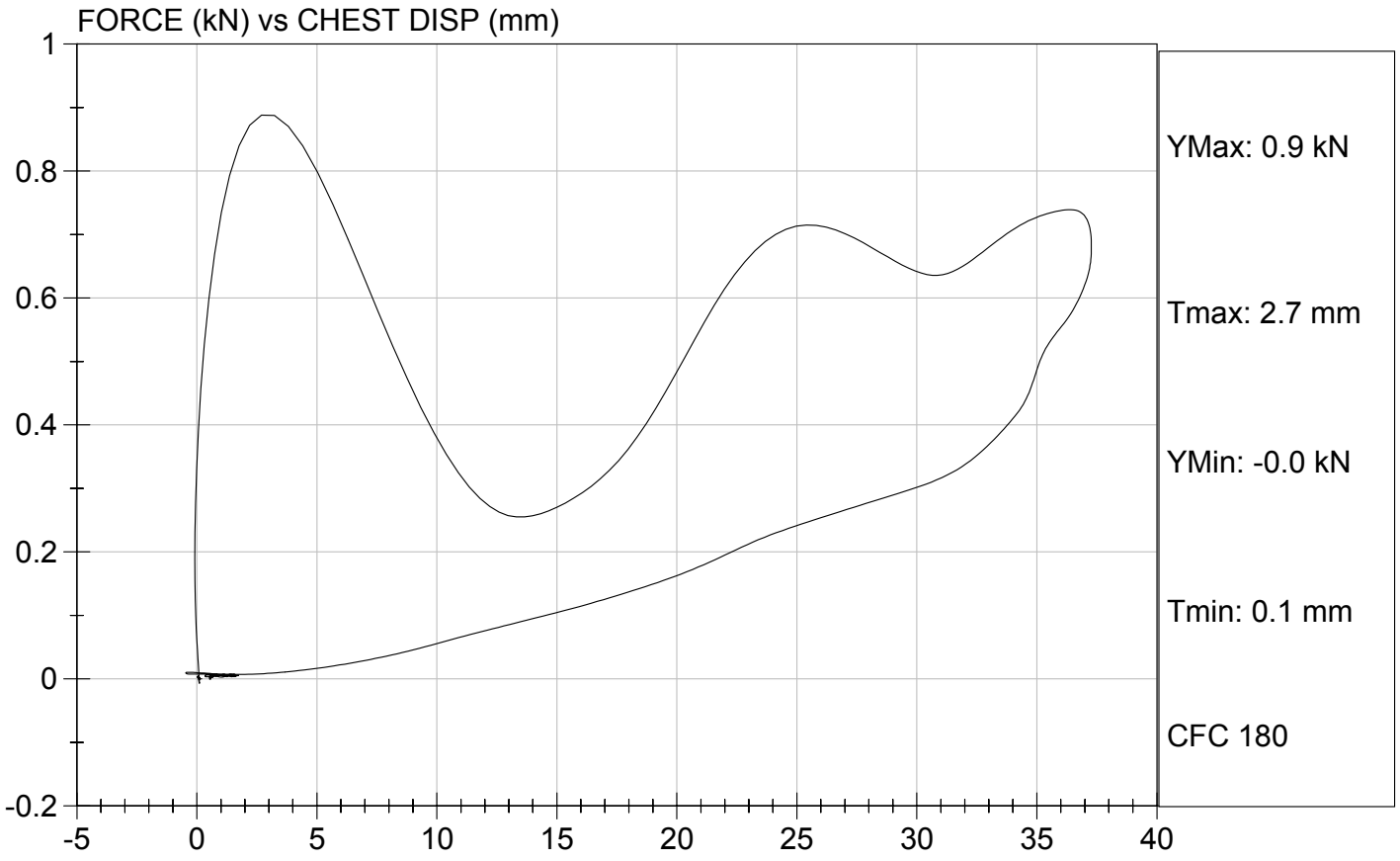
Jessica Hall
Laboratory Technician

08/06/2004
Test Date

David Winkelbauer
Approved By

Test Description: Thorax Impact Test Date: 08/06/2004

Component: D041814 Speed: 19.42 ft/sec, 5.92 m/sec



Hybrid III Calibration Data Sheet

3 Year Old

Torso Lumbar Flexion

ATD Serial No: 042 **Test I.D:** D041817

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Force At 45 deg.	N	130 - 180	172	Pass
Initial Angle	deg	0 - 15	4	Pass
Return Angle	deg	0 - 10	4	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

08/06/2004
Test Date

David Winkelbauer
Approved By

Transportation Research Center Inc.

ATD Calibration Report

for

VRTC

HIII 10 Year Old
Serial No. D009
Calibration No. 01

Transportation Research Center Inc.
P.O. Box B-67
10820 St. Rt. 347
East Liberty, OH 43319-0367

Transportation Research Center Inc.
572N HIII 10 Year Old Dummy
External Dimensions
Serial No. D009 Calibration No. 01
Date: 8/02/04

Symbol	Description	Specification*	Results	Pass
		mm	mm	
A	Total Sitting Height	710.3 - 736.6	726	Yes
B	Shoulder Pivot Height	384.8 - 405.1	395	Yes
C	Hip Pivot Height	77.5 - 87.6	84	Yes
D	Hip Pivot from Backline	133.1 - 143.3	142	Yes
E	Shoulder Pivot from Backline	80.0 - 90.2	85	Yes
F	Thigh Clearance	105.4 - 120.6	112	Yes
G	Back of Elbow to Wrist Pivot	227.4 - 242.6	233	Yes
H	Head Back to Backline	45.8 - 50.8	48	Yes
I	Shoulder to Elbow Length	269.2 - 284.5	271	Yes
J	Elbow Rest Height	137.2 - 157.5	145	Yes
K	Buttock to Knee Length	463.6 - 483.9	475	Yes
L	Popliteal Height	321.3 - 341.6	335	Yes
M	Knee to Floor Height	370.4 - 388.6	380	Yes
N	Buttock Popliteal Height	367.0 - 387.4	375	Yes
O	Chest Depth without Jacket	157.5 - 172.7	163	Yes
P	Foot Length	188.0 - 203.2	194	Yes
Q	Standing Height (A-C+R-D+M)	1296.7 REF	1299	
R	Buttock to Knee Pivot Length	414.0 - 434.3	419	Yes
S	Head Breadth	137.1 - 147.3	142	Yes
T	Head Depth	177.8 - 188.0	182	Yes
U	Hip Breadth	256.6 - 271.8	264	Yes
V	Shoulder Breadth	307.4 - 322.6	315	Yes
W	Foot Breadth	68.6 - 83.8	75	Yes
X	Head Circumference	528.3 - 548.7	538	Yes
Y	Chest Circumference with Jacket	690.9 - 716.3	704	Yes
Z	Waist Circumference	696.0 - 721.4	706	Yes
AA	Reference Location for Chest Circumference	337.8 - 348.0	342	Yes
BB	Reference Location for Waist Circumference	* *	182	

* With specification revisions provided by VRTC 08/02/04

** Measured 1 cm below top rear surface of pelvis flesh, parallel to pelvis rim

Technician

Approved

Revised 8/2/2004

Transportation Research Center Inc.

Thorax Test

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 8

Test Date 08/02/2004

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	52 %	Yes
Pendulum Velocity	5.88 - 6.12 m/s	5.88	Yes
Maximum Chest Deflection	-47.0 - (-39.0) mm	-42.5 mm	Yes
Peak Impact Probe Force Within Compression Corridor	1830 - 2330 N	2312 N	Yes
Internal Hysteresis	65 - 85 %	83.6 %	Yes

Test Meets Specifications.

Comments:

New rib stiffeners and replacement rib set # 22030024A installed.

Technician

Approved

08.02.2004 15:21:42 1166

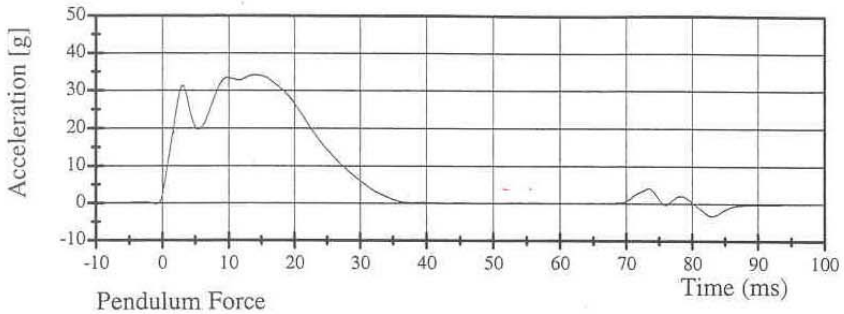
Transportation Research Center Inc.

Thorax Test

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 8

Test Date 08/02/2004

Pendulum Deceleration

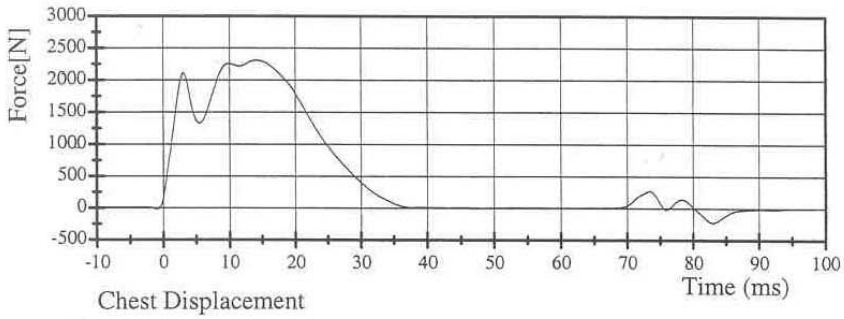


Filter Class: 180

Max: 34.2 g at 14.1 ms

Min: -3.3 g at 83.0 ms

Pendulum Force

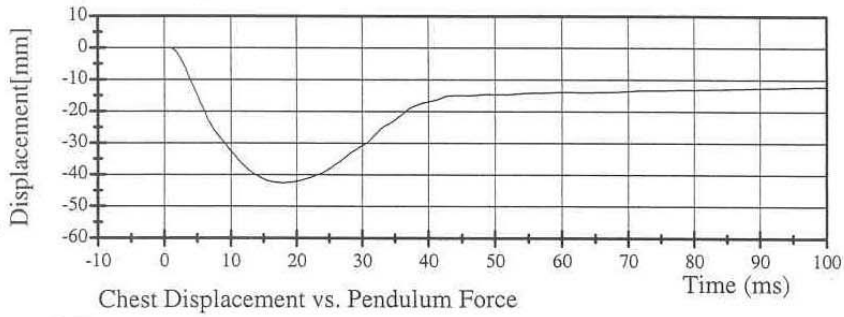


Filter Class: 180

Max: 2312.4 N at 14.1 ms

Min: -221.4 N at 83.0 ms

Chest Displacement

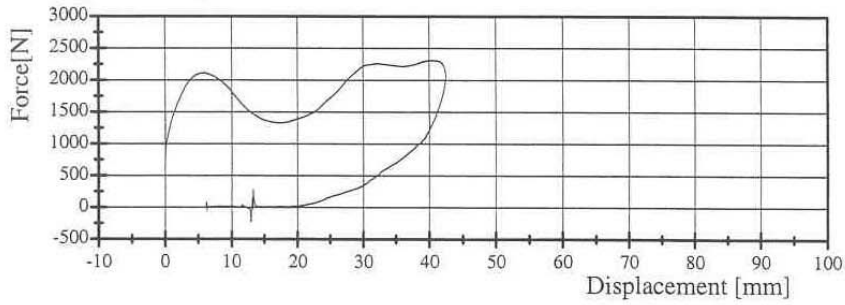


Filter Class: 600

Max: 0.0 mm at 0.8 ms

Min: -42.5 mm at 18.0 ms

Chest Displacement vs. Pendulum Force



08.02.2004 15:21:43 1166

TRANSPORTATION RESEARCH CENTER INC.

TORSO FLEXION TEST

HYBRID III TEN YEAR-OLD

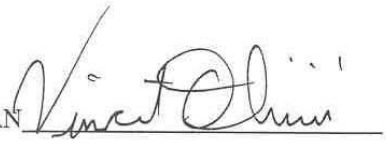
CAL DATE: 23-Jul-04

TRC, INC. TEST NO: D009C01TF8 SND009 TORSO FLEX CAL 01

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20.6 – 22.2° C	21.7 ° C
RELATIVE HUMIDITY	10 – 70 %	50 %
INITIAL ANGLE OF UNSUPPORRTED DUMMY	<= 20° REFERENCED TO VERTICAL	15.0 °
MAXIMUM FORCE AT 35 DEG. DURING 10 SECOND PERIOD	180 - 240 N	232.3 N
RETURN ANGLE		19.6 °
DIFFERENCE BETWEEN RETURN ANGLE & INTIAL ANGLE	+/- 8 ° OF INTIAL ANGLE	4.6 °
RATE	0.5° - 1.5°/sec	1.00 °/sec

TEST MEETS SPECIFICATIONS

Comments:

TECHNICIAN 

Transportation Research Center Inc.

Left Knee Test

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 1

Test Date 07/30/2004

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	55 %	Yes
Pendulum Velocity	2.07 - 2.13 m/s	2.09 m/s	Yes
Maximum Pendulum Force	2560 - 3140 N	2958 N	Yes

Test meets specifications.

Comments:

Technician

Approved

07.30.2004 15:10:53 1855

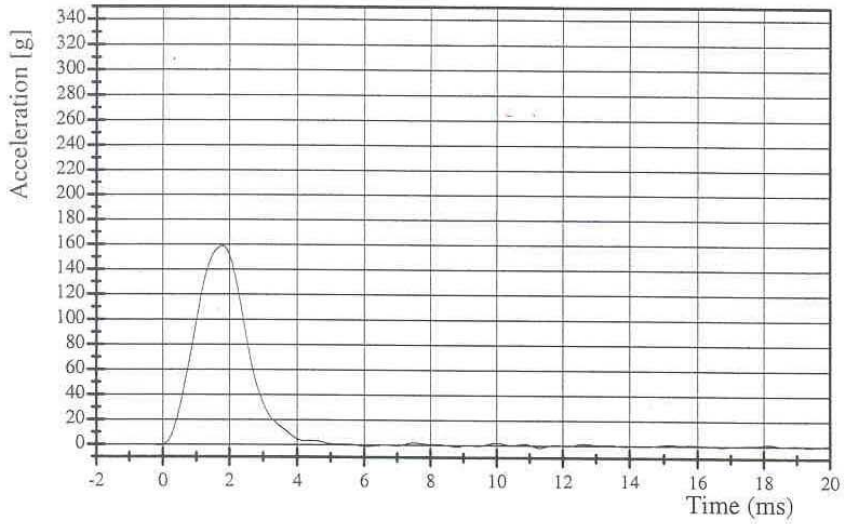
Transportation Research Center Inc.

Left Knee Test

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 1

Test Date 07/30/2004

Pendulum Deceleration

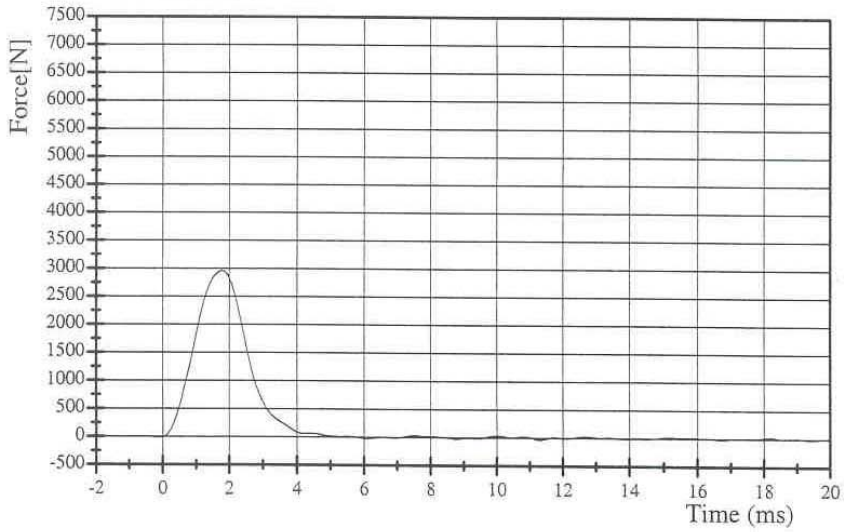


Filter Class: 600

Max: 158.8 g at 1.8 ms

Min: -1.9 g at 11.3 ms

Pendulum Force



Filter Class: 600

Max: 2958.4 N at 1.8 ms

Min: -34.8 N at 11.3 ms

07.30.2004 15:10:54 1855

Transportation Research Center Inc.

Right Knee Test

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 1

Test Date 07/30/2004

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	21.3 °C	Yes
Relative Humidity	10 - 70 %	55 %	Yes
Pendulum Velocity	2.07 - 2.13 m/s	2.09 m/s	Yes
Maximum Pendulum Force	2560 - 3140 N	3022 N	Yes

Test meets specifications.

Comments:

Technician

Approved

07.30.2004 15:24:00 1854

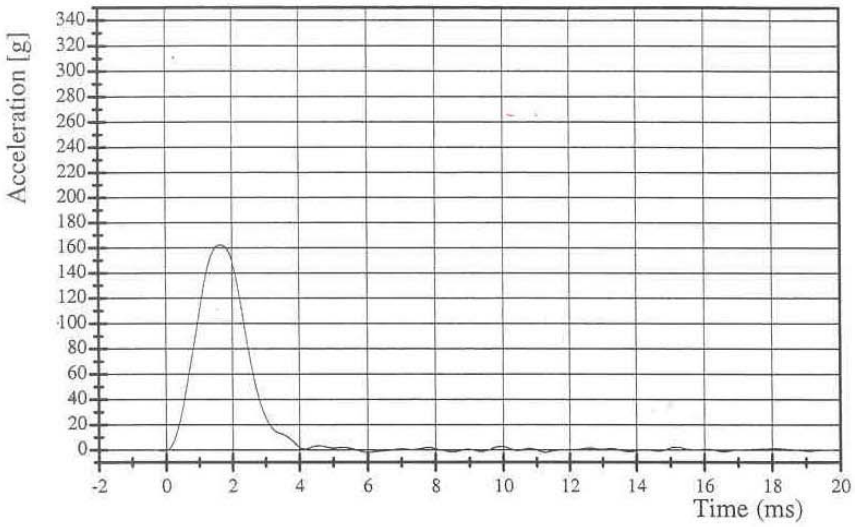
Transportation Research Center Inc.

Right Knee Test

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 1

Test Date 07/30/2004

Pendulum Deceleration

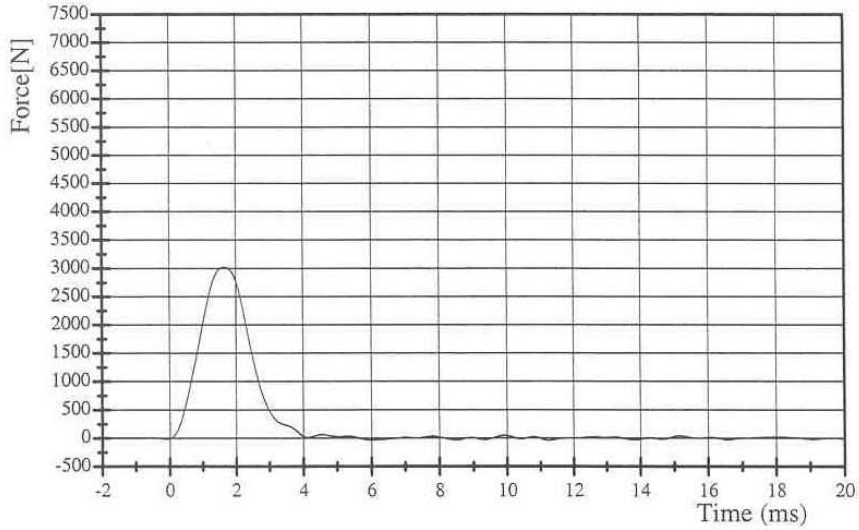


Filter Class: 600

Max: 162.2 g at 1.7 ms

Min: -2.2 g at 11.3 ms

Pendulum Force



Filter Class: 600

Max: 3022.0 N at 1.7 ms

Min: -40.4 N at 11.3 ms

07.30.2004 15:24:01 1854

Transportation Research Center Inc.

Head Drop Test

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 2

Test Date 07/26/2004

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	22.0 °C	Yes
Relative Humidity	10 - 70 %	52 %	Yes
Peak Resultant Acceleration	240 - 295 g	246.4 g	Yes
Peak Lateral Acceleration	15 g Max	-1.7 g	Yes
Oscillations After Main Pulse	Less Than 10% of Peak Resultant Acceleration?	Yes	Yes

Test meets specifications.

Comments:

Technician

Approved

07.26.2004 11:13:55 609

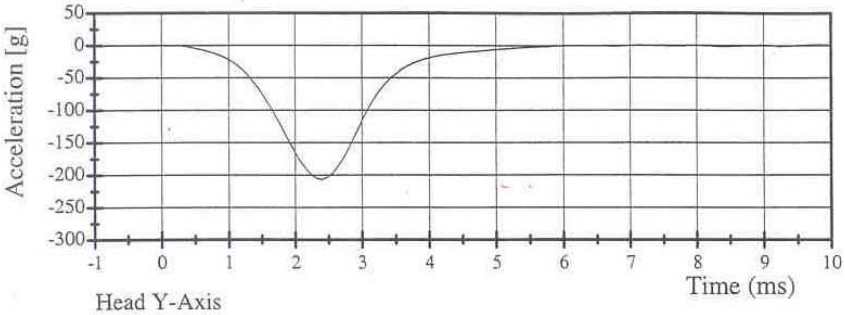
Transportation Research Center Inc.

Head Drop Test

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 2

Test Date 07/26/2004

Head X-Axis

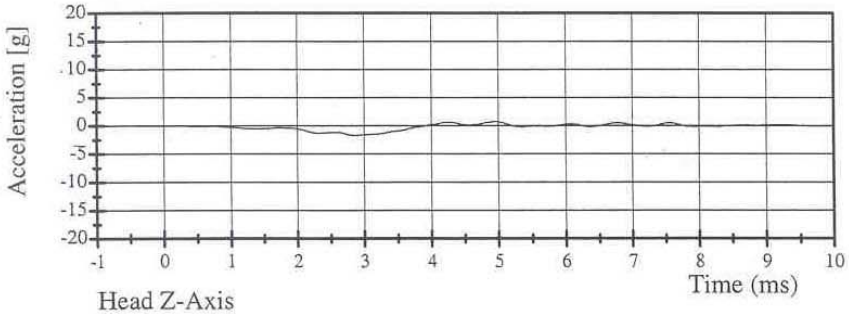


Filter Class: 1000

Max: 1.4 g at 9.8 ms

Min: -206.6 g at 2.4 ms

Head Y-Axis

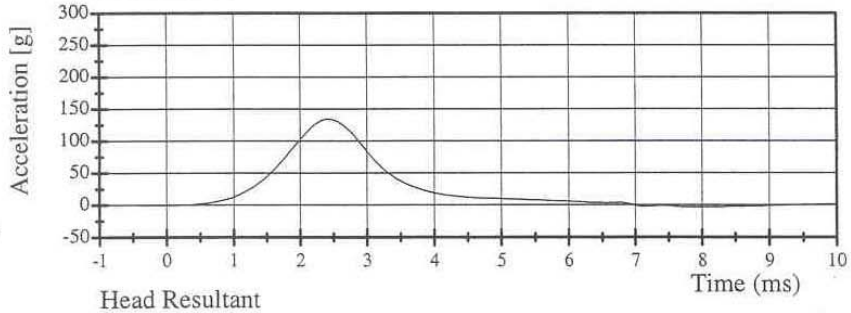


Filter Class: 1000

Max: 0.7 g at 5.0 ms

Min: -1.7 g at 2.9 ms

Head Z-Axis

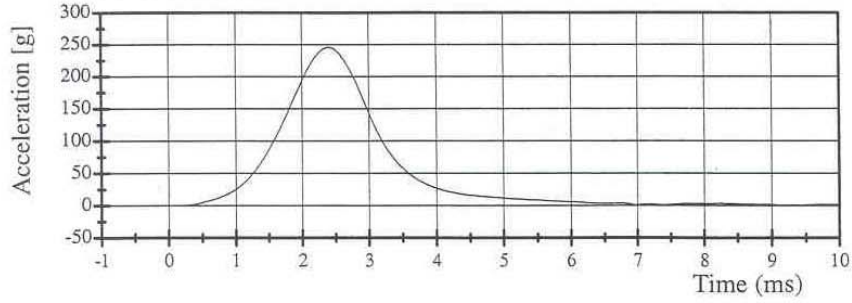


Filter Class: 1000

Max: 134.3 g at 2.4 ms

Min: -3.2 g at 8.2 ms

Head Resultant



Filter Class: 1000

Max: 246.4 g at 2.4 ms

Min: 0.0 g at 0.0 ms

07.26.2004 11:13:56 609

Transportation Research Center Inc.

Neck Flexion Test - 6 Channel Transducer

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 1

Test Date 07/29/2004

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.5 °C	Yes
Relative Humidity	10 - 70 %	50 %	Yes
Impact Velocity	5.98 - 6.22 m/s	6.11 m/s	Yes
Integrated Pendulum Velocity			
10 ms	1.64 - 2.04 m/s	1.90 m/s	Yes
20 ms	3.04 - 4.04 m/s	3.71 m/s	Yes
30 ms	4.45 - 5.65 m/s	5.35 m/s	Yes
Peak D Plane Rotation	74.0 - 88.0 °	78.4 °	Yes
Peak Moment About Occipital Condyles (During time interval rotation is within specified corridors)	51.0 - 65.0 N·m	52.85 N·m	Yes
Positive Moment Decay Time To 10 N·m	85 - 105 ms	95.84 ms	Yes

Test meets specifications.

Comments:

Technician

Approved

07.29.2004 13:28:39 593

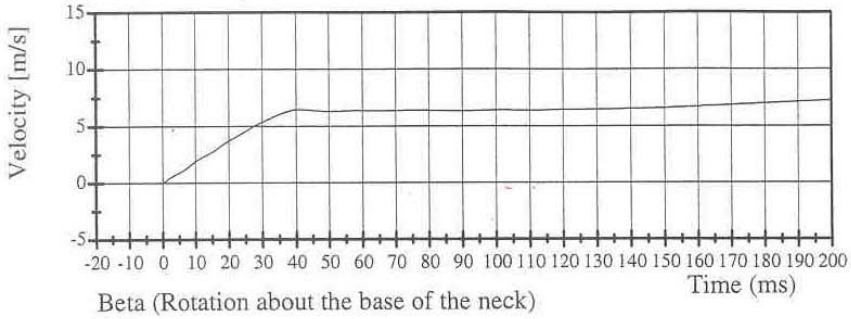
Transportation Research Center Inc.

Neck Flexion Test

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 1

Test Date 07/29/2004

Integrated Pendulum Velocity

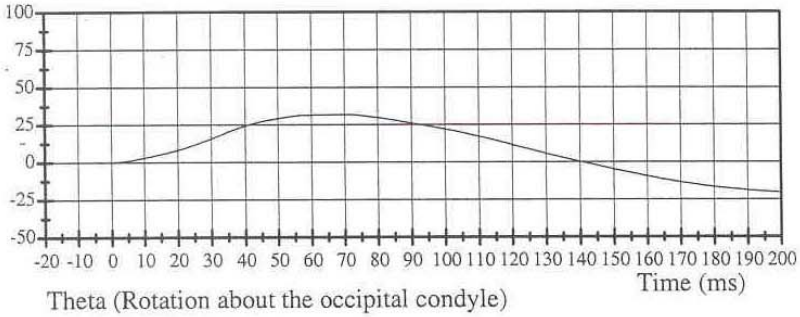


Filter Class: 180

Max: 7.95 m/s at 952.6 ms

Min: -0.00 m/s at -30.2 ms

Beta (Rotation about the base of the neck)

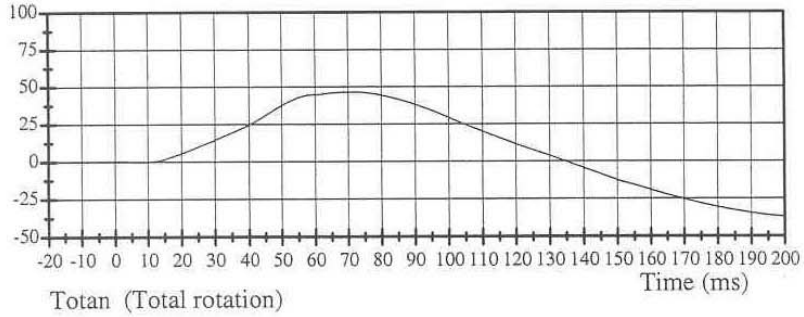


Filter Class: 60

Max: 32.0 ° at 68.8 ms

Min: -21.0 ° at 212.4 ms

Theta (Rotation about the occipital condyle)

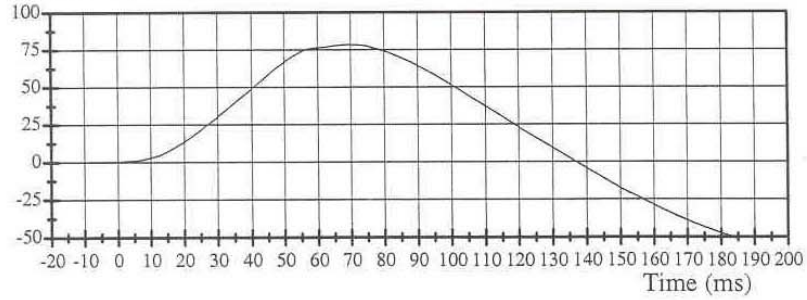


Filter Class: 60

Max: 46.4 ° at 71.0 ms

Min: -38.3 ° at 212.4 ms

Totan (Total rotation)



Filter Class: 60

Max: 78.4 ° at 69.7 ms

Min: -59.2 ° at 212.4 ms

07.29.2004 13:28:40 593

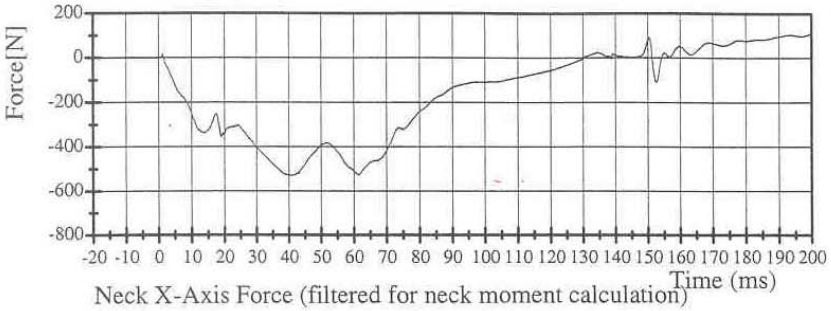
Transportation Research Center Inc.

Neck Flexion Test

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 1

Test Date 07/29/2004

Neck X-Axis Force

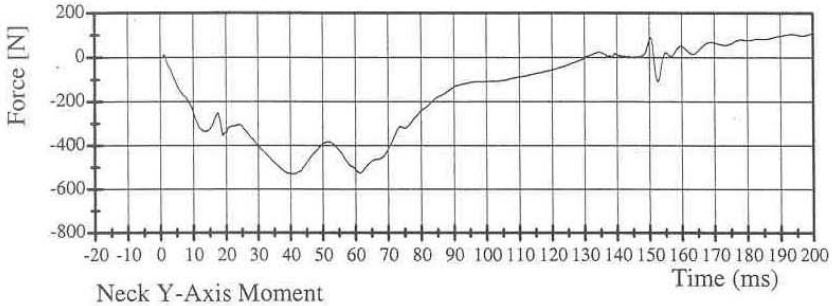


Filter Class: 1000

Max: 110.5 N at 201.4 ms

Min: -529.4 N at 40.5 ms

Neck X-Axis Force (filtered for neck moment calculation)

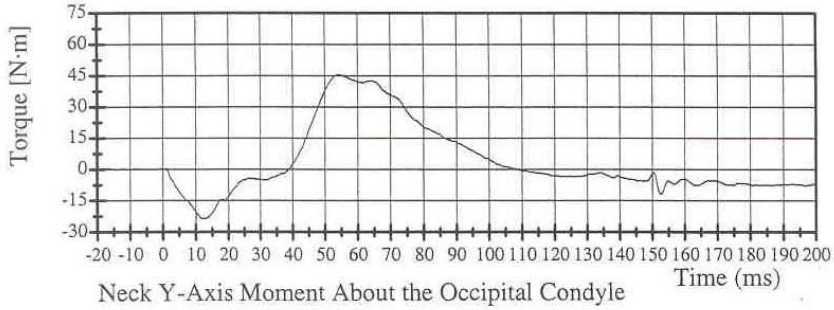


Filter Class: 600

Max: 110.2 N at 201.4 ms

Min: -529.2 N at 40.6 ms

Neck Y-Axis Moment

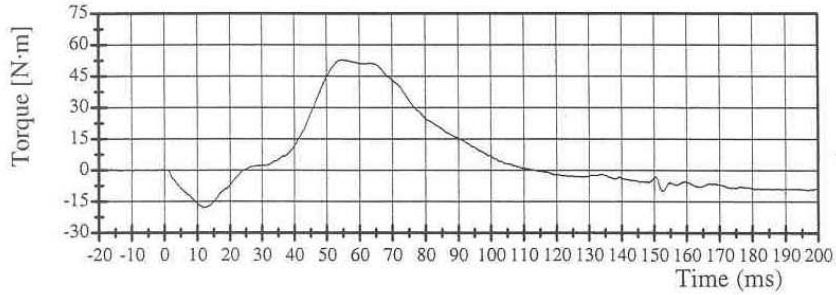


Filter Class: 600

Max: 45.5 N·m at 54.1 ms

Min: -23.6 N·m at 11.8 ms

Neck Y-Axis Moment About the Occipital Condyle



Filter Class: 600

Max: 52.9 N·m at 55.3 ms

Min: -18.0 N·m at 11.7 ms

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Transportation Research Center Inc.

Neck Extension Test - 6 Channel Transducer

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 1

Test Date 07/29/2004

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	48 %	Yes
Impact Velocity	4.91 - 5.15 m/s	5.01 m/s	Yes
Integrated Pendulum Velocity			
10 ms	1.49 - 1.89 m/s	1.62 m/s	Yes
20 ms	2.88 - 3.68 m/s	3.15 m/s	Yes
30 ms	4.20 - 5.20 m/s	4.60 m/s	Yes
Peak D Plane Rotation	98.5 - 113.5 °	104.2 °	Yes
Peak Moment About Occipital Condyles (During time interval rotation is within specified corridors)	(-47.0) - (-35.0) N·m	-40.40 N·m	Yes
Negative Moment Decay Time To -10 N·m	100 - 120 ms	107.36 ms	Yes

Test meets specifications.

Comments:

Technician

Approved

07.29.2004 14:22:22 724

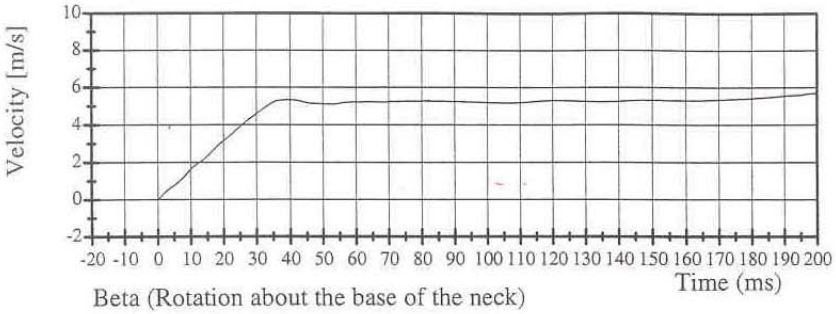
Transportation Research Center Inc.

Neck Extension Test

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 1

Test Date 07/29/2004

Integrated Pendulum Velocity

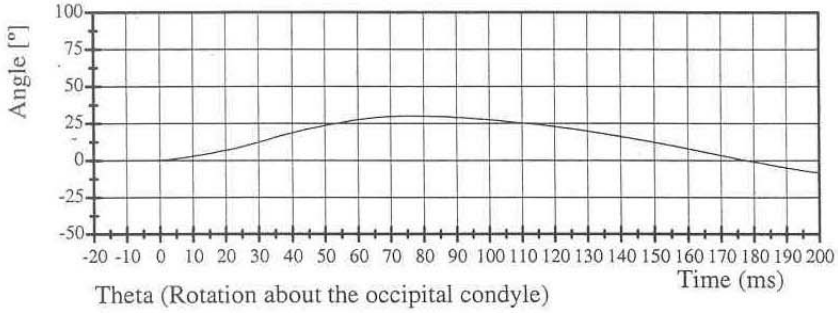


Filter Class: 180

Max: 6.7 m/s at 857.0 ms

Min: -0.0 m/s at -0.6 ms

Beta (Rotation about the base of the neck)

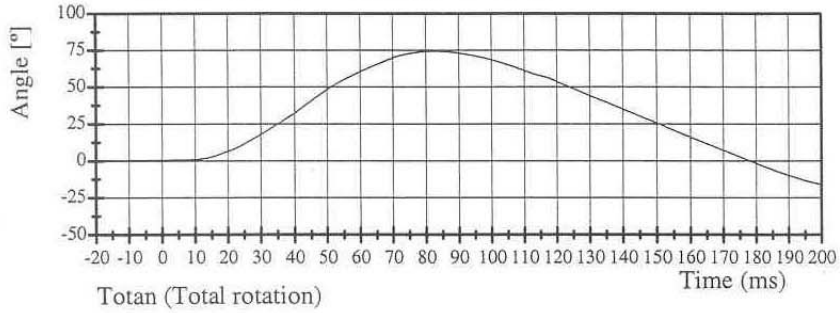


Filter Class: 60

Max: 30.0 ° at 73.8 ms

Min: -12.9 ° at 232.6 ms

Theta (Rotation about the occipital condyle)

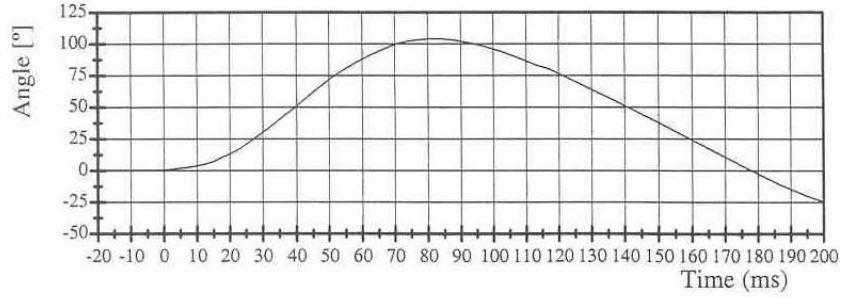


Filter Class: 60

Max: 74.3 ° at 82.9 ms

Min: -23.5 ° at 229.0 ms

Totan (Total rotation)



Filter Class: 60

Max: 104.2 ° at 82.5 ms

Min: -36.4 ° at 229.3 ms

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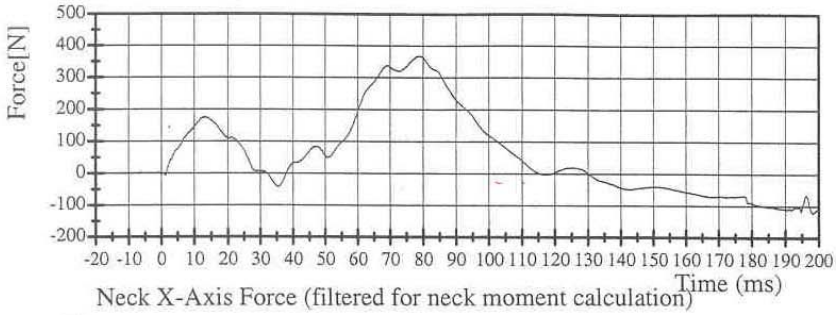
Transportation Research Center Inc.

Neck Extension Test

HIII 10 Year Old Serial No. D009 Calibration No. 01 - 1

Test Date 07/29/2004

Neck X-Axis Force

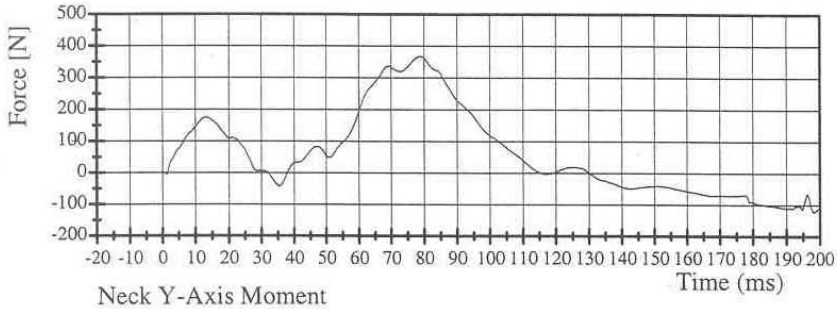


Filter Class: 1000

Max: 367.7 N at 78.9 ms

Min: -140.6 N at 211.0 ms

Neck X-Axis Force (filtered for neck moment calculation)

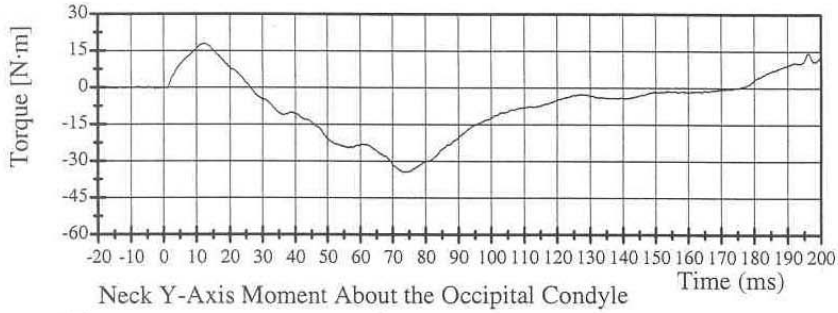


Filter Class: 600

Max: 367.4 N at 78.9 ms

Min: -140.3 N at 211.0 ms

Neck Y-Axis Moment

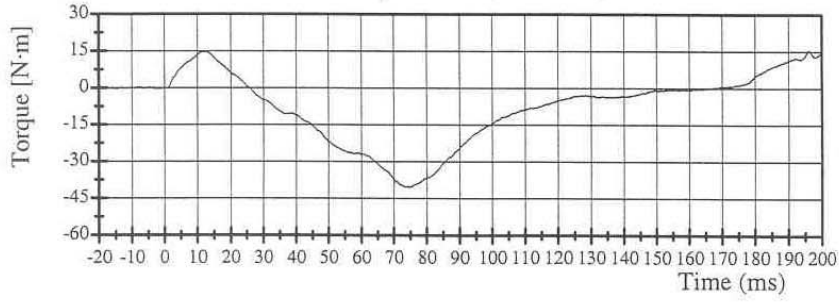


Filter Class: 600

Max: 17.9 N·m at 12.6 ms

Min: -34.6 N·m at 73.4 ms

Neck Y-Axis Moment About the Occipital Condyle



Filter Class: 600

Max: 16.8 N·m at 224.0 ms

Min: -40.4 N·m at 74.7 ms

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APPENDIX D

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

INSTRUMENTS FOR RRP CHILD DUMMY S/N: 042

	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	B05-J12	Entran	9/15/04
Head Y	B05-J19	Entran	9/15/04
Head Z	A27-Z11	Entran	9/15/04
Head X Redundant	B05-J16	Entran	9/15/04
Head Y Redundant	B10-Z23	Entran	9/15/04
Head Z Redundant	B05-J11	Entran	9/15/04
Upper Neck Load Cell	208	FTSS	5/13/04
Chest X	A27-Z23	Entran	9/15/04
Chest Y	A27-Z24	Entran	9/15/04
Chest Z	A27-Z13	Entran	9/15/04
Chest X Redundant	A12-Z06	Entran	9/15/04
Chest Y Redundant	A12-Z05	Entran	9/15/04
Chest Z Redundant	A12-Z02	Entran	9/15/04
Chest Deflection Gauge	042	Servo	8/06/04
Pelvis X	A27-Z19	Entran	9/15/04
Pelvis Y	A27-Z07	Entran	9/15/04
Pelvis Z	A27-Z16	Entran	9/15/04
Tether Force	172	FTSS	8/18/04

INSTRUMENTS FOR LRP CHILD DUMMY S/N: 144

	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Head X	AJ619	Endevco	9/17/04
Head Y	AN8L6	Endevco	9/17/04
Head Z	ALDD6	Endevco	9/17/04
Head X Redundant	APY13	Endevco	9/17/04
Head Y Redundant	J20392	Endevco	9/17/04
Head Z Redundant	AGT18	Endevco	9/17/04
Upper Neck Load Cell	1625	Denton	7/20/04
Chest X	ALBA7	Endevco	6/28/04
Chest Y	AMP82	Endevco	6/28/04
Chest Z	AP2C4	Endevco	6/28/04
Chest X Redundant	AKAA6	Endevco	6/28/04
Chest Y Redundant	J18953	Endevco	6/28/04
Chest Z Redundant	J18843	Endevco	6/28/04
Chest Deflection Gauge	D009	Servo	9/17/04
Pelvis X	P10162	Endevco	9/17/04
Pelvis Y	P27023	Endevco	9/17/04
Pelvis Z	P27012	Endevco	9/17/04
Right Femur	238	Denton	7/21/04
Left Femur	237	Denton	7/21/04
Shoulder Belt	199	Denton	6/08/04
Child Lap Belt	167	Denton	5/21/04
Lumbar Force	135	Denton	8/26/04
Right Clavicle Force	RCG75	Denton	8/26/04
Left Clavicle Force	LCG75	Denton	8/26/04
Right ASIS	IRG89	Denton	8/25/04
Left ASIS	ILG89	Denton	8/25/04

INTRUMENTS FOR REAR SEAT AND CHILD SEATS

	SERIAL NO.	MANUFACTURER	CALIBRATION DATE
Left Rear Seat Back X	L18-N14	Entran	8/24/04
Left Rear Seat Back Y	L20-B15	Entran	8/24/04
Left Rear Seat Back Z	E01-F03	Entran	8/24/04
RRP Child Seat X	L17-D06	Entran	8/24/04
RRP Child Seat Y	H21-N16	Entran	5/28/04
RRP Child Seat Z	A08-A11	Entran	8/25/04
LRP Child Seat X	F03-F12	Entran	7/01/04
LRP Child Seat Y	L18-N15	Entran	9/24/04
LRP Child Seat Z	L17-D39	Entran	8/25/04