**REPORT NUMBER: NCAPCHILD-MGA-2005-011**

# NEW CAR ASSESSMENT PROGRAM
# FRONTAL BARRIER IMPACT TEST

**Evenflo Vanguard 5**
**Graco Turbo Booster**

**NHTSA NUMBER: M50307**

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

**Test Date: January 31, 2005**

**Final Report Date: March 21, 2005**

**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: _____ Date: 03/21/05
Jay Nutting, Project Engineer

Reviewed by: _____ Date: 03/21/05
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

| | | |
|---|---|---|
| *1. Report No.*<br>NCAPCHILD-MGA-2005-011 | *2. Government Accession No.* | *3. Recipient's Catalog No.* |
| *4. Title and Subtitle*<br>Final Report of New Car Assessment Program Testing of Evenflo Vanguard 5 and Graco Turbo Booster Child Restraint Systems<br>NHTSA No.: M50307 | | *5. Report Date*<br>March 21, 2005<br>*6. Performing Organization Code*<br>MGA |
| *7. Author(s)*<br>Jay Nutting, Project Engineer | | *8. Performing Organization Report No.*<br>NCAPCHILD-MGA-2005-011 |
| *9. Performing Organization Name and Address*<br>MGA Research Corporation<br>5000 Warren Road<br>Burlington, WI 53105 | | *10. Work Unit No.*<br>*11. Contract or Grant No.*<br>DTNH22-01-D-12005 |
| *12. Sponsoring Agency Name and Address*<br>U.S. Department of Transportation<br>National Highway Traffic Safety Administration<br>Rulemaking, Office of Crashworthiness Standards<br>400 Seventh Street, SW, Room 5311<br>Washington, D.C. 20590 | | *13. Type of Report and Period Covered*<br>Final Report<br>01/31/05 to 03/21/05<br>*14. Sponsoring Agency Code*<br>NVS-111 |

*15. Supplementary Notes*

*16. Abstract*

The subjects CRS Evenflo Vanguard 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 January 11, 2005, in conjunction with frontal NCAP.

| Measurement Description | Units | Pos. 3 ATD | Pos. 4 ATD |
|---|---|---|---|
| Head Injury Criteria (HIC36) | N/A | 809 | 956 |
| Head Injury Criteria (HIC15) | N/A | 392 | 557 |
| Max. Thorax Accel. (3msec Clip) | G's | 37 | 41 |

| | | | |
|---|---|---|---|
| *17. Key Words*<br>56.8 km/h NCAP Frontal Barrier Impact Test<br>New Car Assessment Program (NCAP)<br>Evenflo Vanguard 5<br>Graco Turbo Booster<br>NHTSA No: M50307 | | *18. Distribution Statement*<br>Copies of this report are available from:<br>National Highway Traffic Safety Admin., Technical Ref. Division, Room 5108 (NPO-230)<br>400 Seventh Street, S.W.<br>Washington, D.C. 20590 | |
| *19. Security Classif. (of this report)*<br>Unclassified | *20. Security Classif. (of this page)*<br>Unclassified | *21. No. of Pages*<br>107 | 22. Price |

Form DOT F1700.7 (8-72)

TABLE OF CONTENTS

## 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 56.8 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 right rear (Position 3) child dummy (S/N 42) and left rear (Position 4) child dummy (S/N 144) were calibrated previous to this test. Child dummy certification information is found in Appendix C.

The right rear child dummy's HIC36 was 809.2; maximum chest deceleration over 3 msec was 36.6 g's. The left rear child dummy's HIC36 was 955.9. The maximum chest deceleration over 3 msec was 41.4 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

There was no valid data collected for the following channel:

Right Rear Passenger Tether Force

## 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 6 Year Old / 144 |
| Number of Data Channels | 22 | 24 |
| Restraint System | Evenflo Vanguard 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 | None | |

### 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 144) |
|---|---|---|
| Head Contact | Back of head to CRS and headrest, Dummy chest | Back of head to CRS, Dummy chest |
| Upper Torso Contact | None | None |
| Lower Torso Contact | None | None |
| Left Foot Contact | None | Driver seat back |
| Right Foot Contact | None | Driver seat back |

**SECTION 2… (continued)**

**DATA SHEET NO. 2**
**CRS PARAMETER DATA**

| | |
|---|---|
| Child Restraint System (Position 3) | Evenflo Vanguard 5 (Forward Facing) |
| Child Restraint System (Position 4) | Graco Turbo Booster (Forward Facing) |
| NHTSA No. | M50307 |

**TARGET TEST WEIGHT CALCULATION**

| Measured Parameter | Units | Value |
|---|---|---|
| Total Delivered Weight (UVW) | kg | 2037.9 |
| Weight of 2 P572E ATDs | kg | 156.0 |
| Rated Cargo/Luggage Weight (RCLW) | kg | 136.1 |
| Calculated Vehicle Target Weight (TVTW) | kg | 2330.0 |

**TEST VEHICLE WEIGHTS**

| | Units | As Tested (ATW) (Axle) | | |
|---|---|---|---|---|
| | | Front | Rear | Total |
| Left | kg | 597.8 | 595.1 | |
| Right | kg | 577.9 | 550.2 | |
| Ratio | % | 50.7 | 49.3 | |
| Totals | kg | 1175.7 | 1145.3 | 2321.0 |

As tested weight of vehicle includes two 50$^{th}$ percentile ATDs, one 3 year old with CRS, one 6 year old with CRS, cargo, equipment and instrumentation.

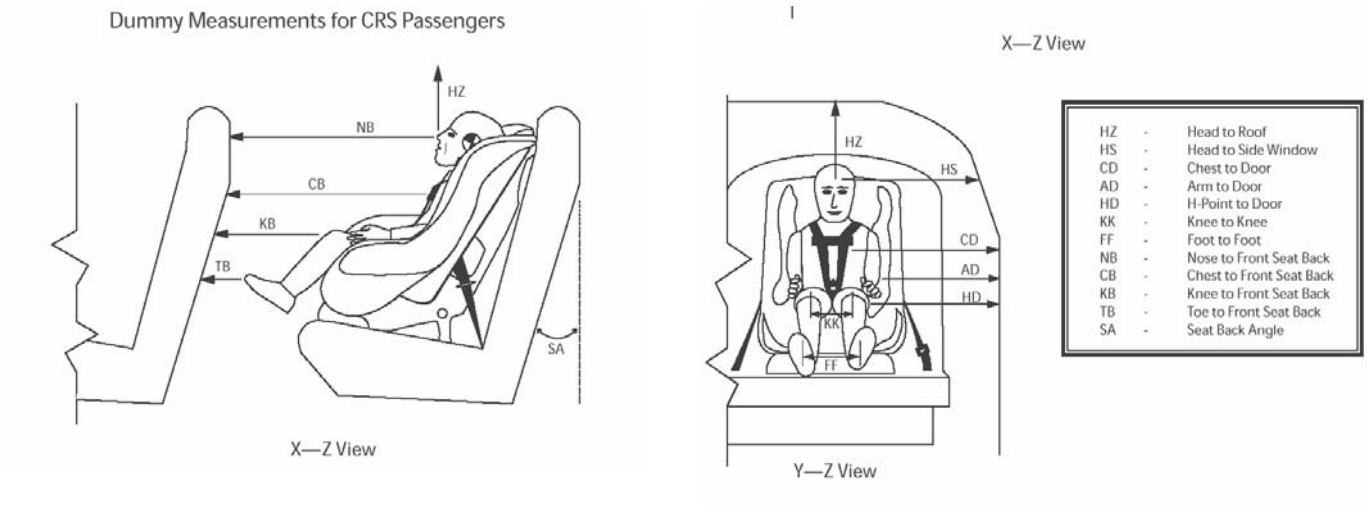
**CHEST CLIP DISPLACEMENT**

| | Units | Left | Right |
|---|---|---|---|
| Right Child Dummy | mm | 47 | 55 |
| Left Child Dummy | mm | | |

**SECTION 2… (continued)**

**DATA SHEET NO. 3**
**CHILD DUMMY POSITIONING IN VEHICLE**

| | |
|---|---|
| Child Restraint System (Position 3) | Evenflo Vanguard 5 (Forward Facing) |
| NHTSA No. | M50307 |



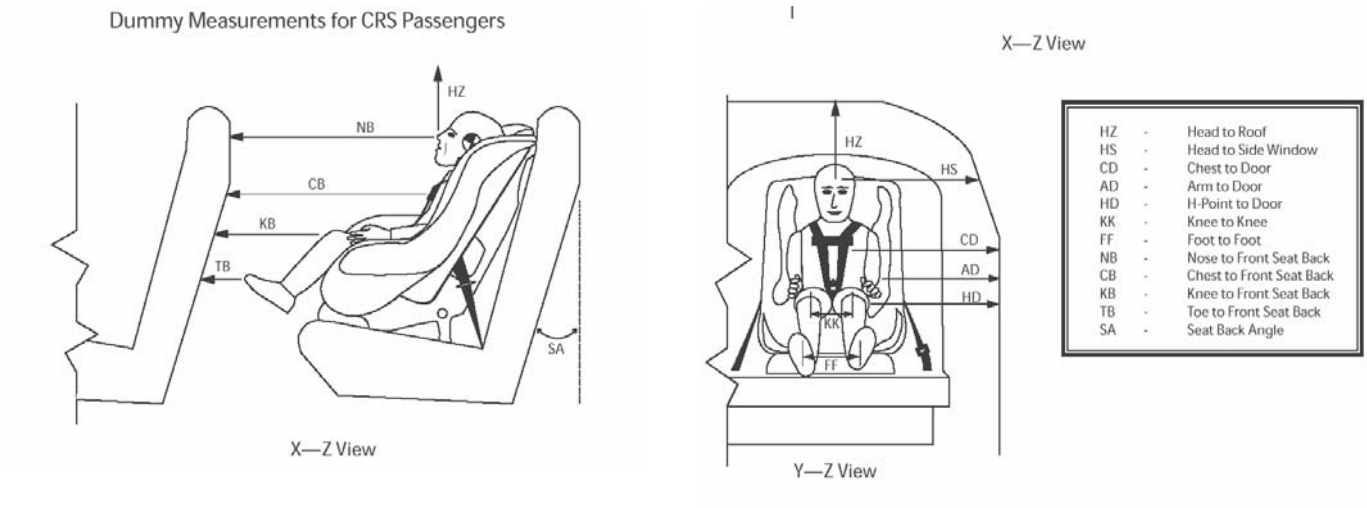

| Measurement | Pre-Test (mm) | Post-Test (mm) |
|---|---|---|
| | P3 CRS (42) | P3 CRS (42) |
| SA (deg) | 20.4 | 20.4 |
| HS | 399 | 420 |
| CD | 341 | 362 |
| AD | 188 | 223 |
| HD | 242 | 285 |
| HZ | 390 | 384 |
| NB | 459 | 508 |
| CB | 439 | 485 |
| KK | 151 | 181 |
| FF | 162 | 195 |
| KB - LEFT | 226 | 250 |
| KB – RIGHT | 224 | 300 |
| TB - LEFT | 0 | 22 |
| TB - RIGHT | 0 | 36 |

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. | M50307 |




| Measurement | Pre-Test (mm) | Post-Test (mm) |
|---|---|---|
| | P4 CRS (144) | P4 CRS (144) |
| SA (deg) | 20.4 | 20.4 |
| HS | 405 | 356 |
| CD | 352 | 311 |
| AD | 206 | 0 |
| HD | 222 | 183 |
| HZ | 329 | 356 |
| NB | 462 | 410 |
| CB | 448 | 443 |
| KK | 157 | 146 |
| FF | 128 | 128 |
| KB - LEFT | 231 | 280 |
| KB – RIGHT | 230 | 288 |
| TB - LEFT | 65 | 65 |
| TB - RIGHT | 60 | 50 |

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 Vanguard 5 |
| Child Restraint System (Position 4) | Graco Turbo Booster |
| NHTSA No. | M50307 |

**HEAD PEAK ACCELERATIONS**

| Location | Axis | Units | Position 3 | | | | Position 4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Time | Min | Time | Max | Time | Min | Time |
| Head CG | X | G's | 68.0 | 190 | -35.3 | 102 | 15.0 | 252 | -24.3 | 58 |
| Head CG | Y | G's | 2.7 | 209 | -3.9 | 193 | 2.5 | 125 | -9.9 | 85 |
| Head CG | Z | G's | 57.8 | 79 | -5.2 | 38 | 77.4 | 74 | -4.4 | 32 |
| Resultant | N/A | G's | 85.0 | 190 | | | 79.4 | 74 | | |

**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 | 6 | 281 | -904 | 102 | 54 | 36 | -587 | 58 |
| Neck Force | Y | N | 32 | 243 | -63 | 105 | 38 | 276 | -283 | 87 |
| Neck Force | Z | N | 1811 | 97 | -393 | 214 | 2537 | 74 | -79 | 32 |
| Resultant | N/A | N | 2005 | 98 | | | 2580 | 74 | | |
| Neck Moment | X | N•m | 2.6 | 80 | -12.4 | 107 | 4.6 | 127 | -11.9 | 77 |
| Neck Moment | Y | N•m | 4.5 | 300 | -29.1 | 198 | 20.9 | 97 | -42.3 | 54 |
| Neck Moment | Z | N•m | 4.3 | 233 | -3.5 | 296 | 8.2 | 93 | -9.3 | 258 |
| Resultant | N/A | N•m | 29.1 | 198 | | | 42.5 | 54 | | |

**CHEST PRIMARY PEAK ACCELERATIONS**

| Location | Axis | Units | Position 3 | | | | Position 4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Time | Min | Time | Max | Time | Min | Time |
| Chest CG | X | G's | 16.2 | 198 | -34.0 | 81 | 3.7 | 182 | -41.9 | 53 |
| Chest CG | Y | G's | 5.4 | 62 | -7.6 | 88 | 3.2 | 73 | -12.1 | 83 |
| Chest CG | Z | G's | 17.6 | 191 | -25.4 | 55 | 18.5 | 76 | -10.5 | 47 |
| Resultant | N/A | G's | 37.4 | 65 | | | 42.5 | 53 | | |

**CHEST PEAK DISPLACEMENTS**

| Location | Axis | Units | Position 3 | | | | Position 4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Time | Min | Time | Max | Time | Min | Time |
| Chest | X | mm | | | -15.4 | 111 | | | -33.9 | 83 |

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

| | |
|---|---|
| Child Restraint System (Position 3) | Evenflo Vanguard 5 |
| Child Restraint System (Position 4) | Graco Turbo Booster |
| NHTSA No. | M50307 |

**TETHER FORCE**

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

* No valid data collected

**PELVIC PEAK ACCELERATIONS**

| Location | Axis | Units | Position 3 | | | | Position 4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Time | Min | Time | Max | Time | Min | Time |
| Pelvis | X | G's | 10.1 | 228 | -43.6 | 58 | 7.8 | 175 | -39.4 | 54 |
| Pelvis | Y | G's | 4.9 | 62 | -5.7 | 76 | 14.2 | 85 | -5.6 | 55 |
| Pelvis | Z | G's | 19.1 | 192 | -24.8 | 54 | 7.2 | 76 | -20.4 | 48 |
| Resultant | N/A | G's | 46.2 | 57 | | | 42.1 | 53 | | |

**FEMUR FORCES**

| Location | Axis | Units | Position 3 | | | | Position 4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Time | Min | Time | Max | Time | Min | Time |
| Left Femur | N/A | N | | | | | 749 | 56 | -24.0 | 197 |
| Right Femur | N/A | N | | | | | 679 | 54 | -43.0 | 130 |

**BELT FORCES**

| Location | Axis | Units | Position 3 | | | | Position 4 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Max | Time | Min | Time | Max | Time | Min | Time |
| Shoulder Belt | N/A | N | | | | | 5367 | 76 | | |
| Lap Belt | N/A | N | | | | | 2432 | 55 | | |

**SECTION 2… (continued)**

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

| | |
|---|---|
| Child Restraint System (Position 3) | Evenflo Vanguard 5 |
| Child Restraint System (Position 4) | Graco Turbo Booster |
| NHTSA No. | M50307 |

**HEAD INJURY CRITERIA (HIC36)**

| Location | HIC | $T^1$ (msec) | $T^2$ (msec) | Average Acceleration (G's) |
|---|---|---|---|---|
| Position 3 - Right | 809.2 | 69.0 | 105.0 | 55.0 |
| Position 4 – Left | 955.9 | 53.9 | 89.6 | 59.0 |

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 | 392.3 | 72.4 | 87.4 | 58.5 |
| Position 4 – Left | 557.1 | 67.7 | 82.7 | 67.3 |

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 | 36.6 | 63.9 | 66.9 |
| Position 4 – Left | 41.4 | 50.8 | 53.8 |

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 Vanguard 5 (Forward Facing) |
| Child Restraint System (Position 4) | Graco Turbo Booster (Forward Facing) |
| NHTSA No. | M50307 |

### 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 | |

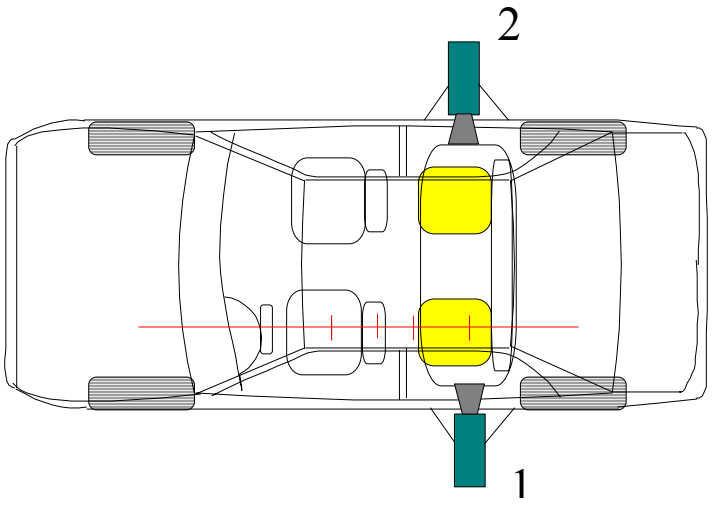
### POSITION 4 CRS POST-TEST INSPECTION

| 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 Vanguard 5 (Forward Facing) |
| Child Restraint System (Position 4) | Graco Turbo Booster (Forward Facing) |
| NHTSA No. | M50307 |




| 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


A-1.

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

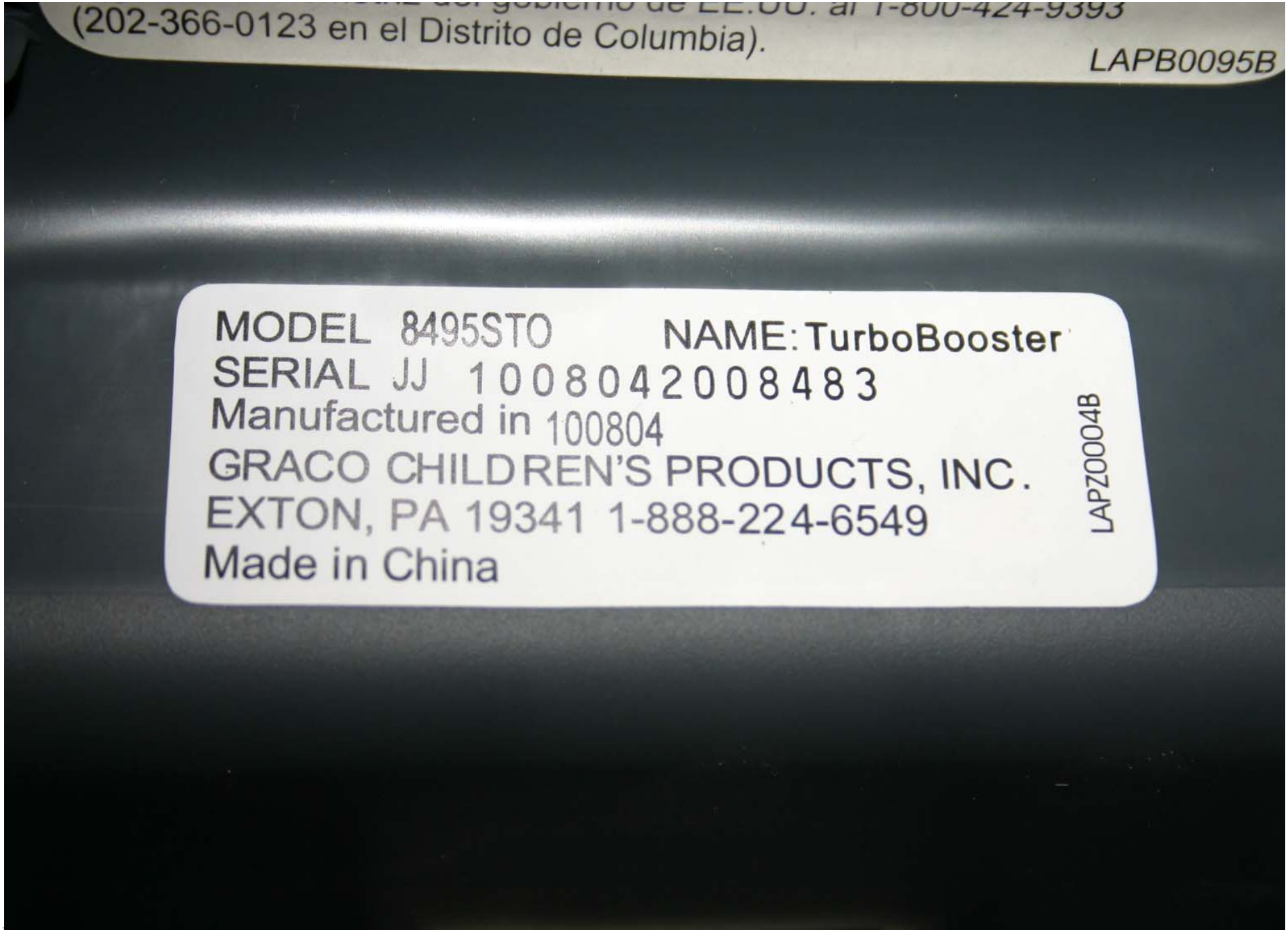

Post-Test Rear View of Position 3 CRS


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 ¾ Front View


Pre-Test Position 4 Rear View


Post-Test Position 4 ¾ Front View


Post-Test Position 4 Feet Contact

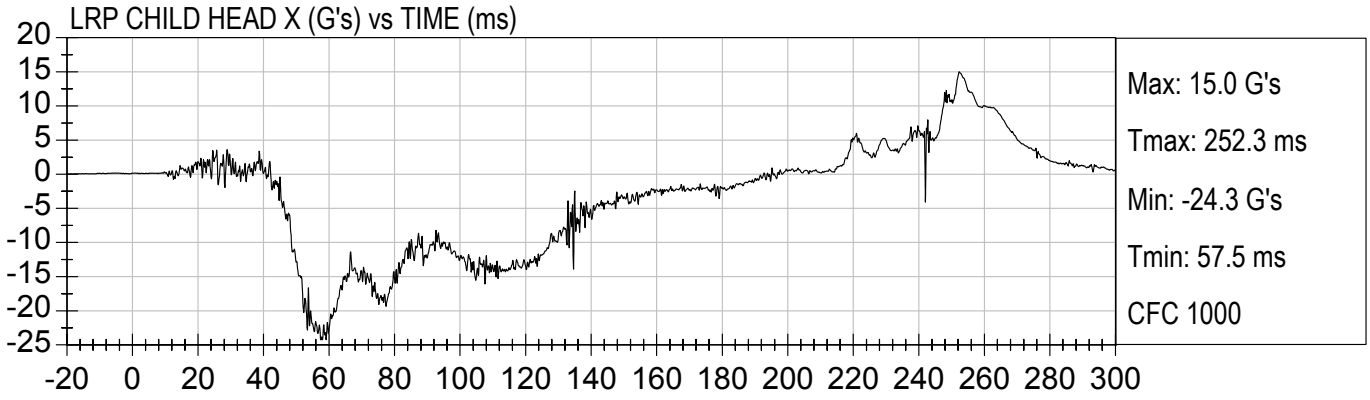
# APPENDIX B

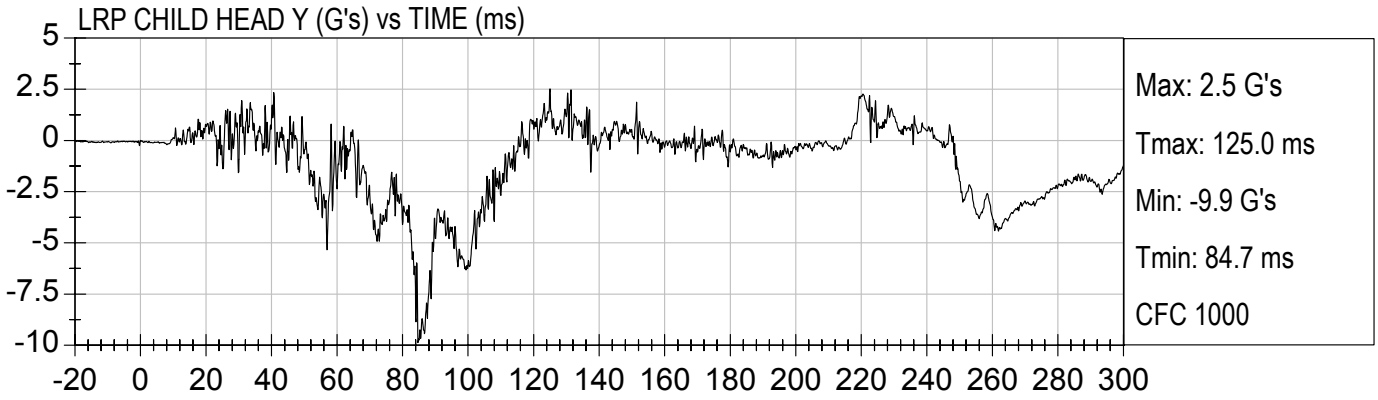
# CHILD DUMMY RESPONSE DATA TRACES

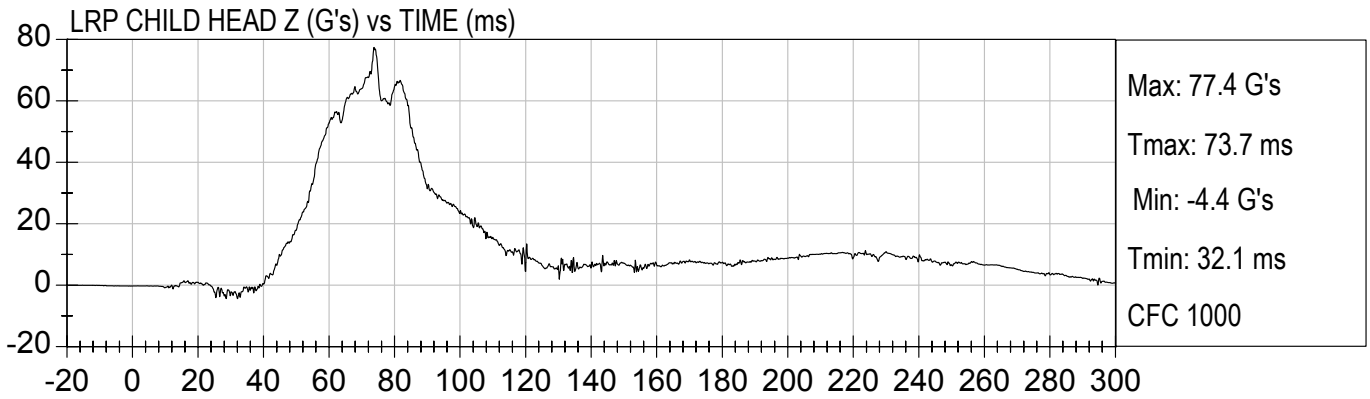
## TABLE OF DATA PLOTS

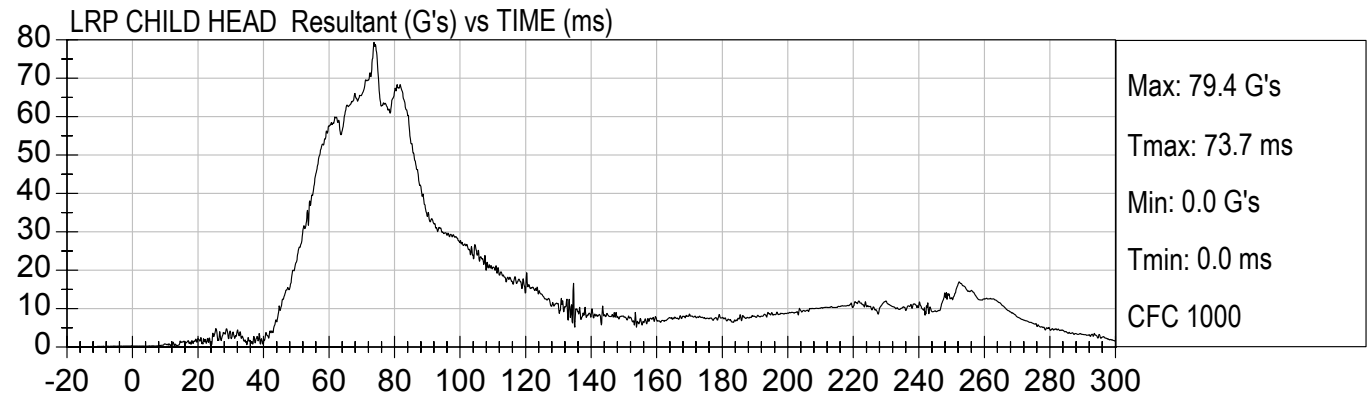
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)



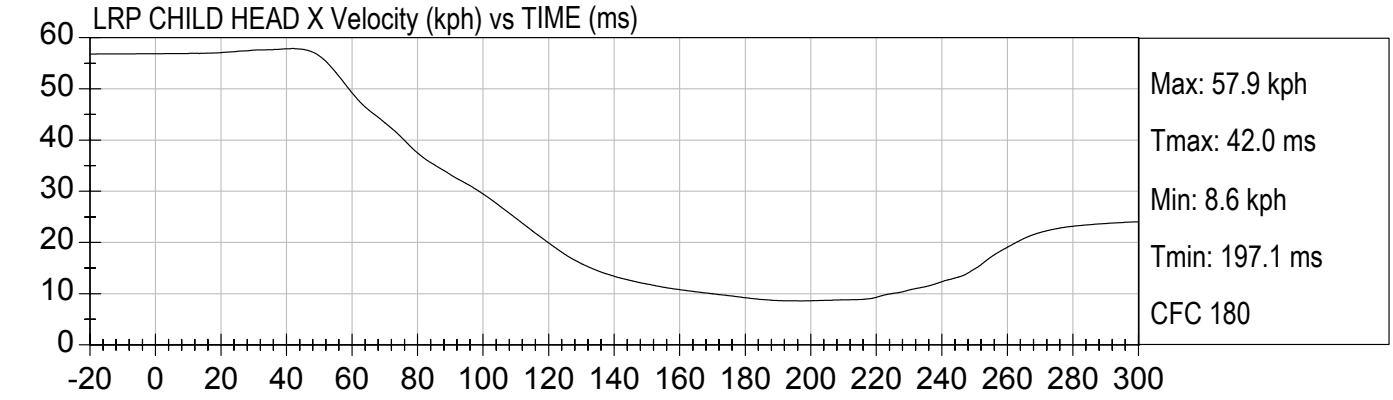



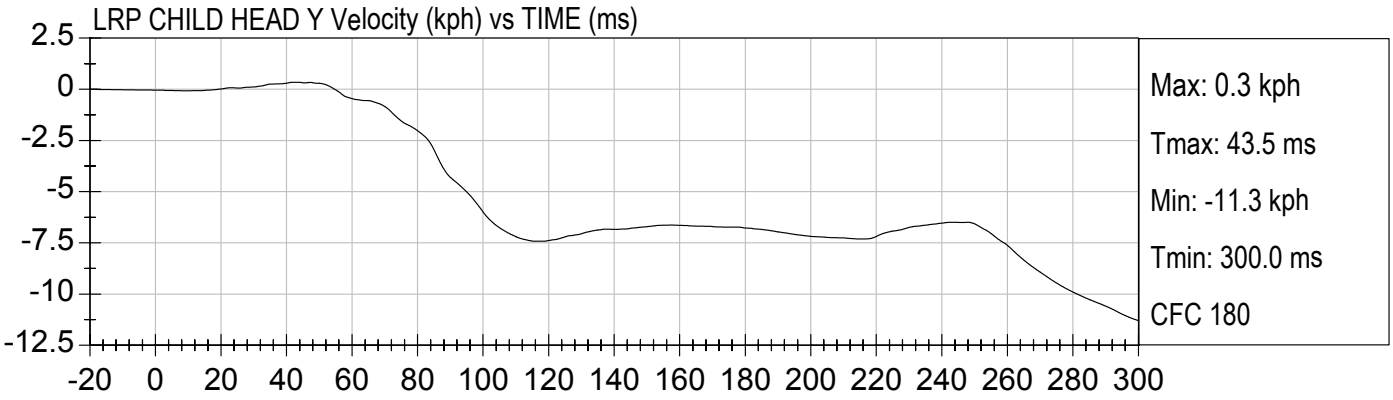



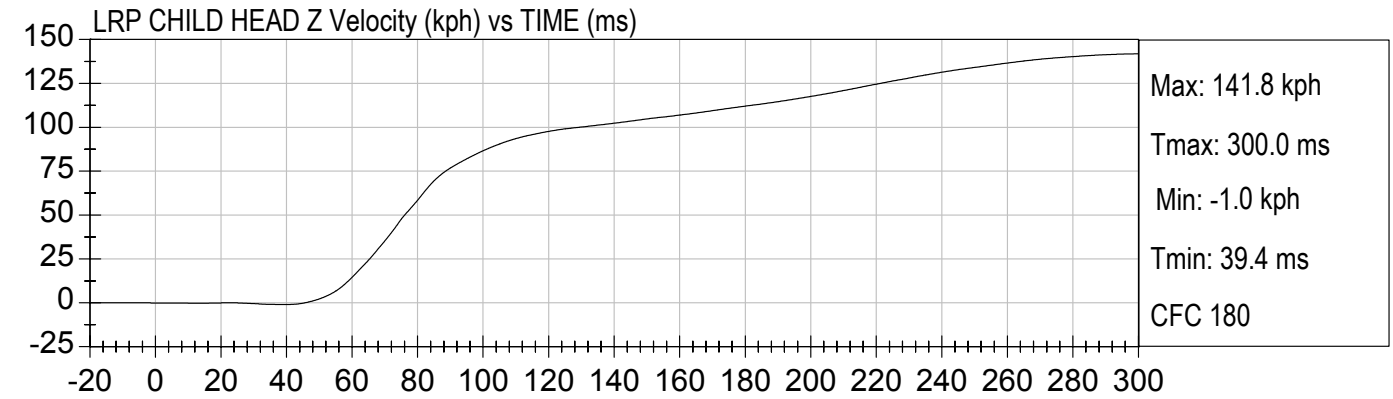



NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)

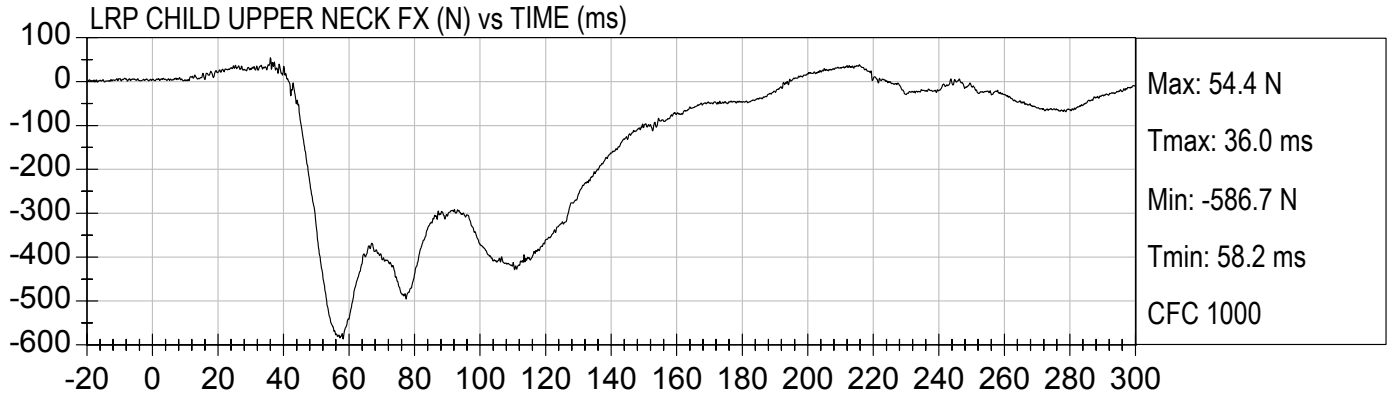


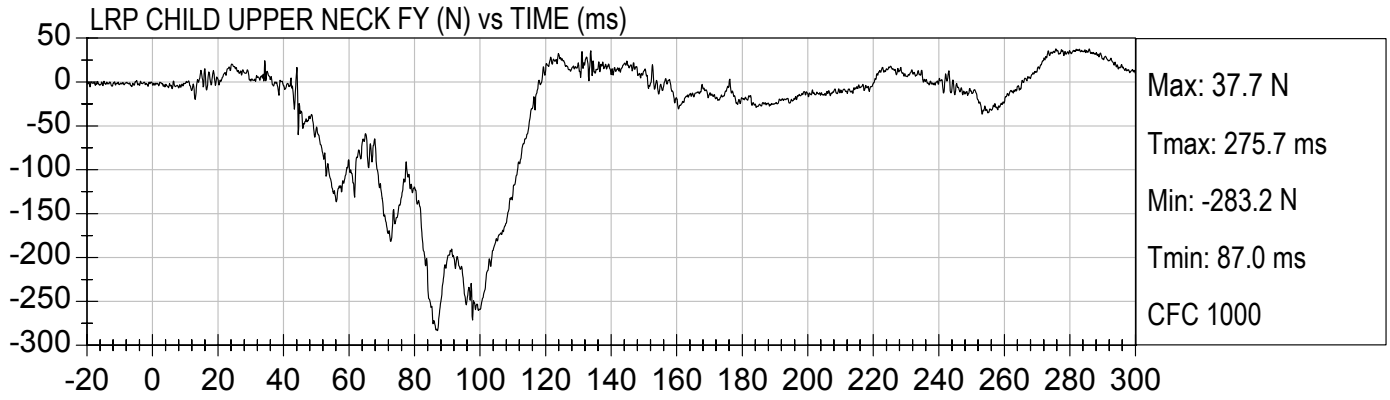



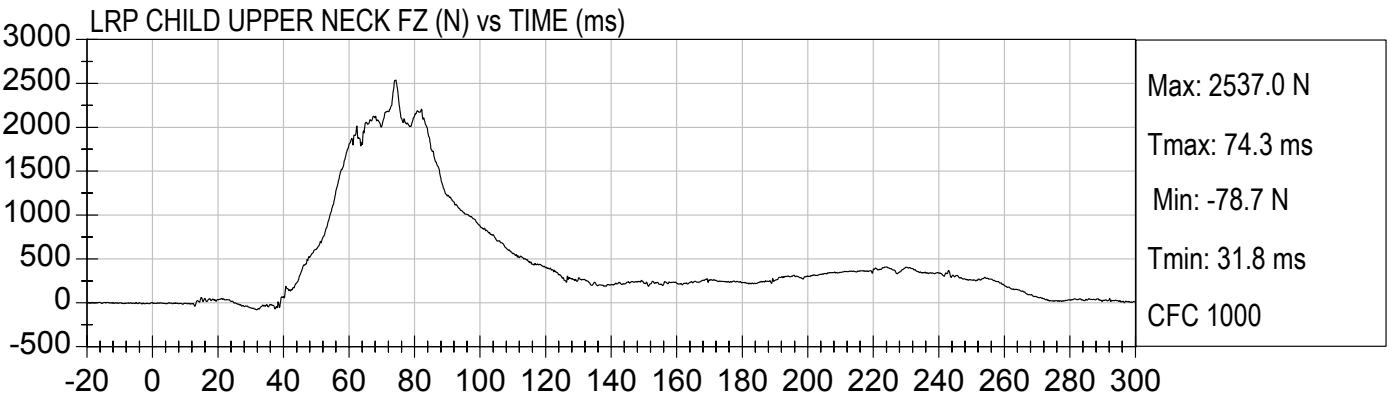



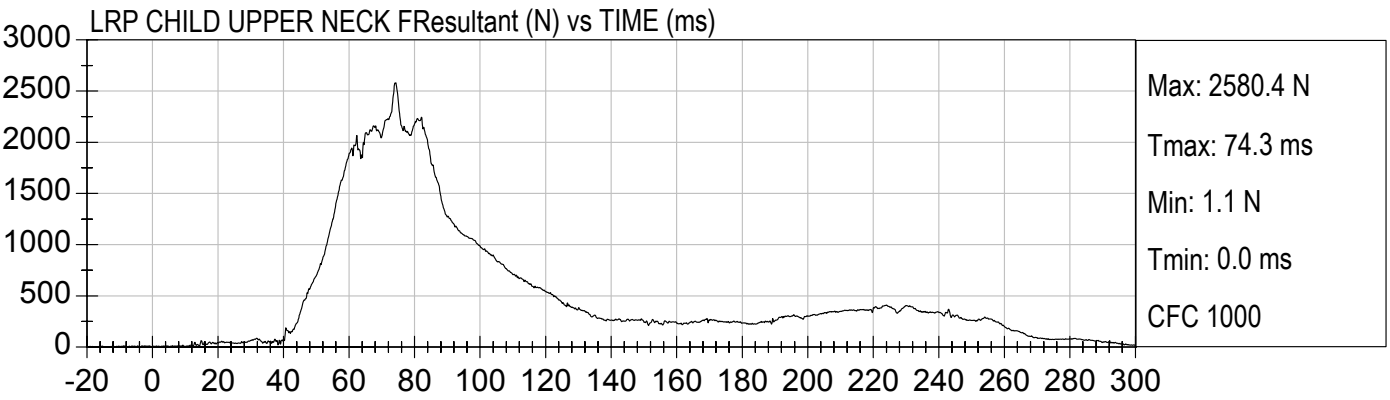
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)



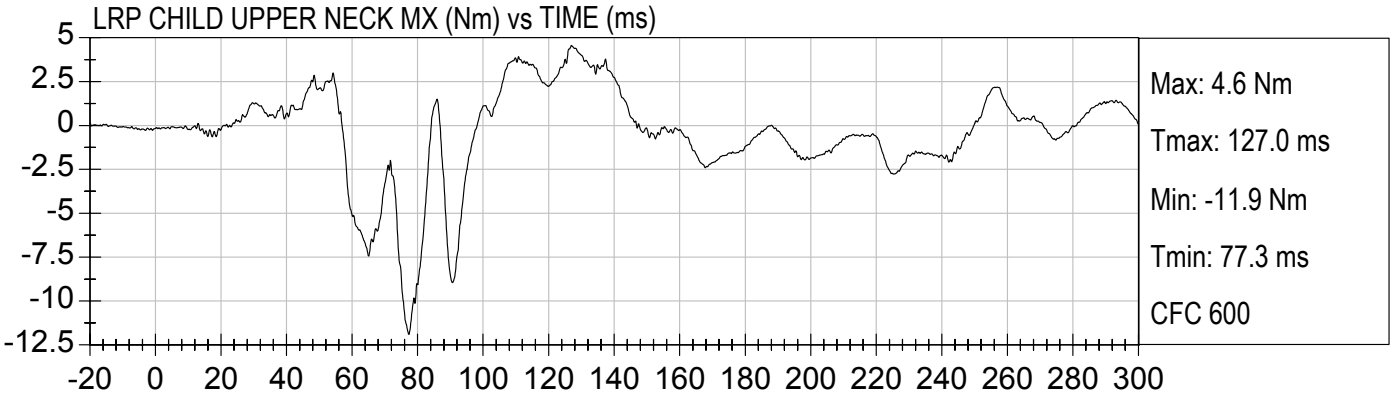



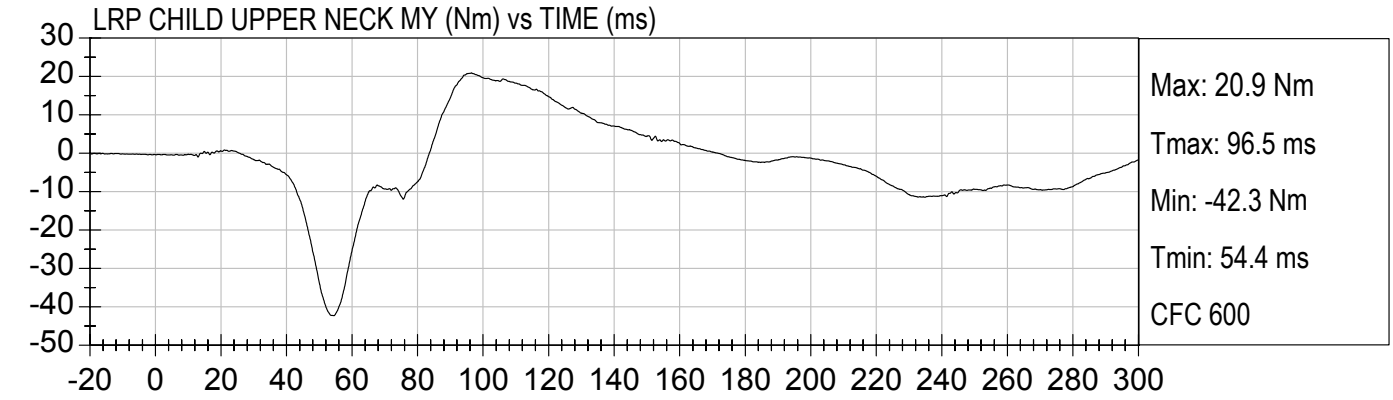



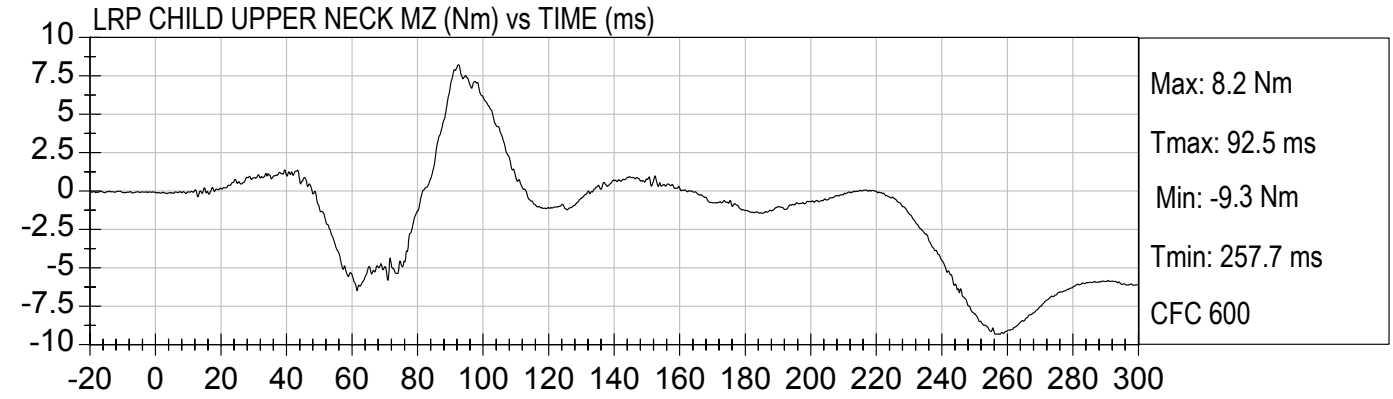



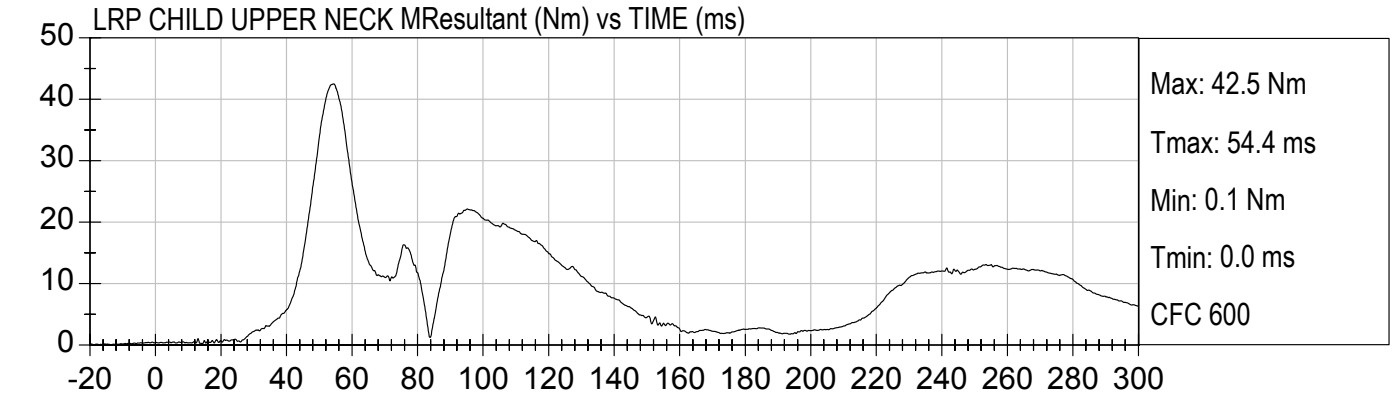
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)



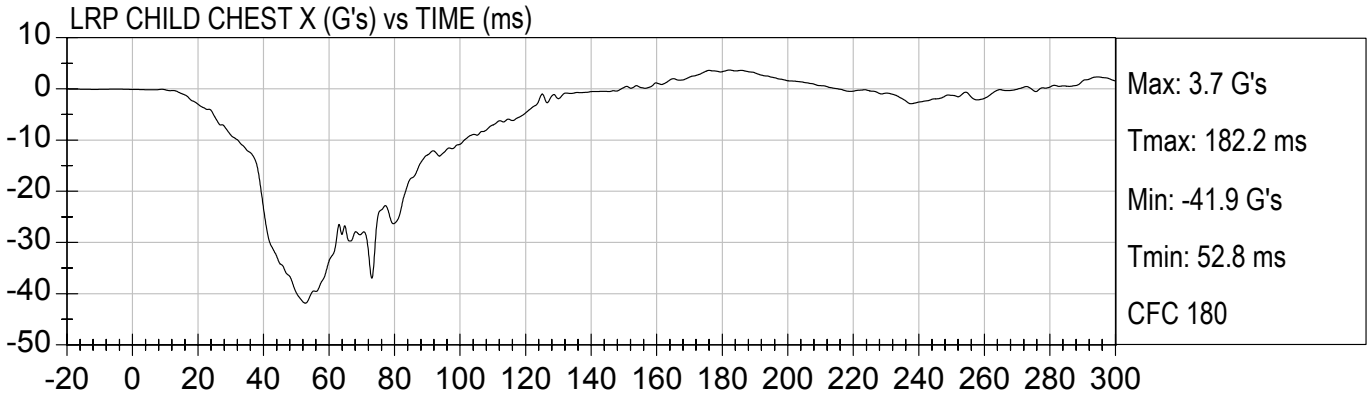



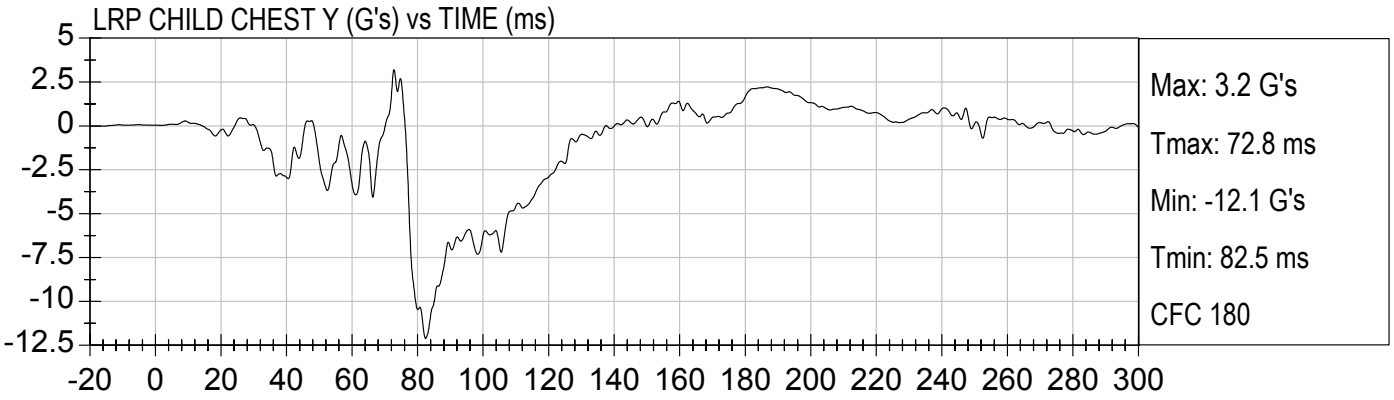



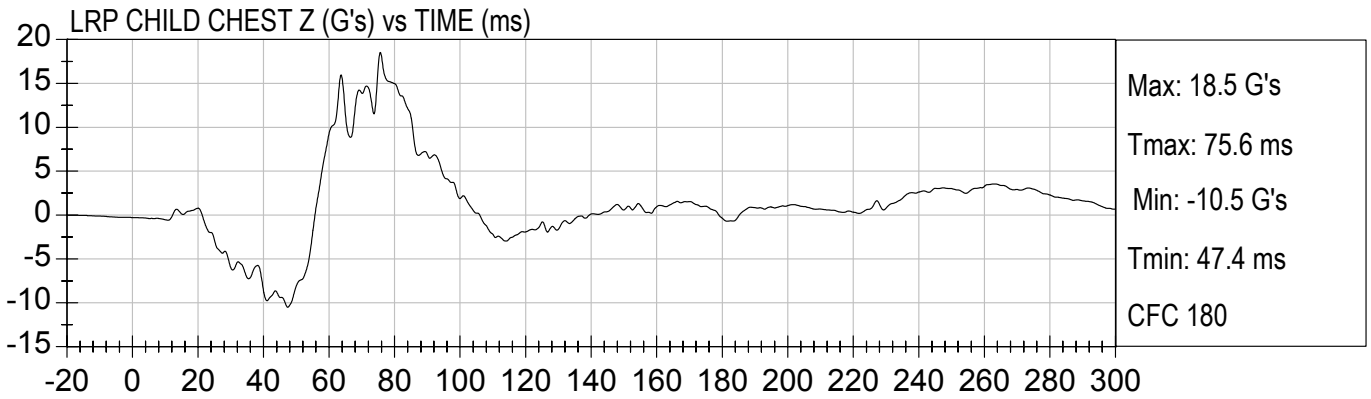



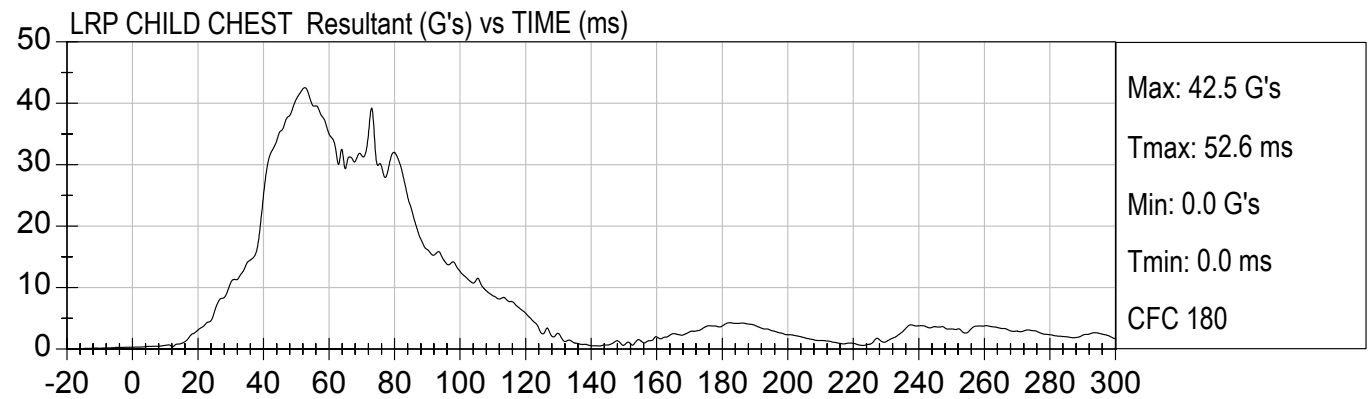
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)



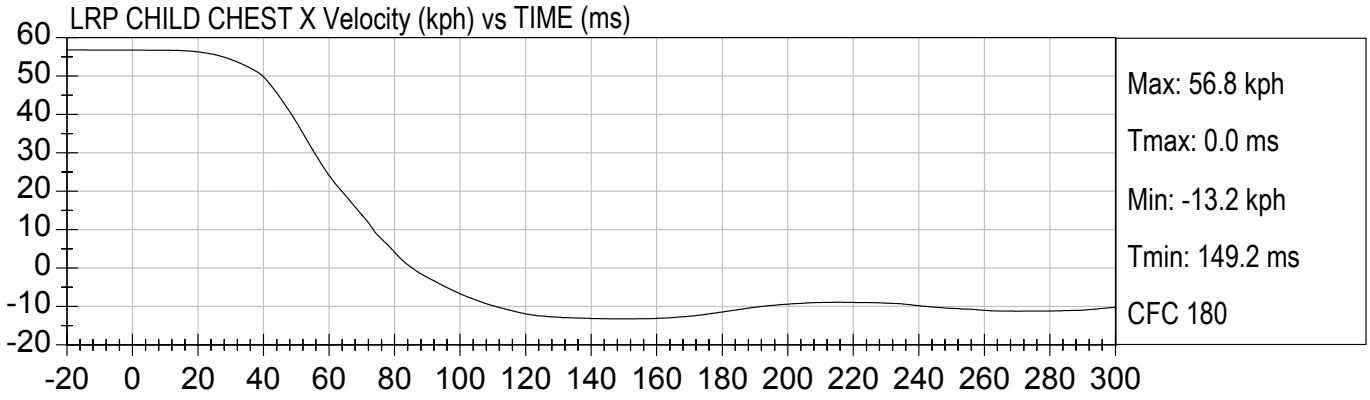



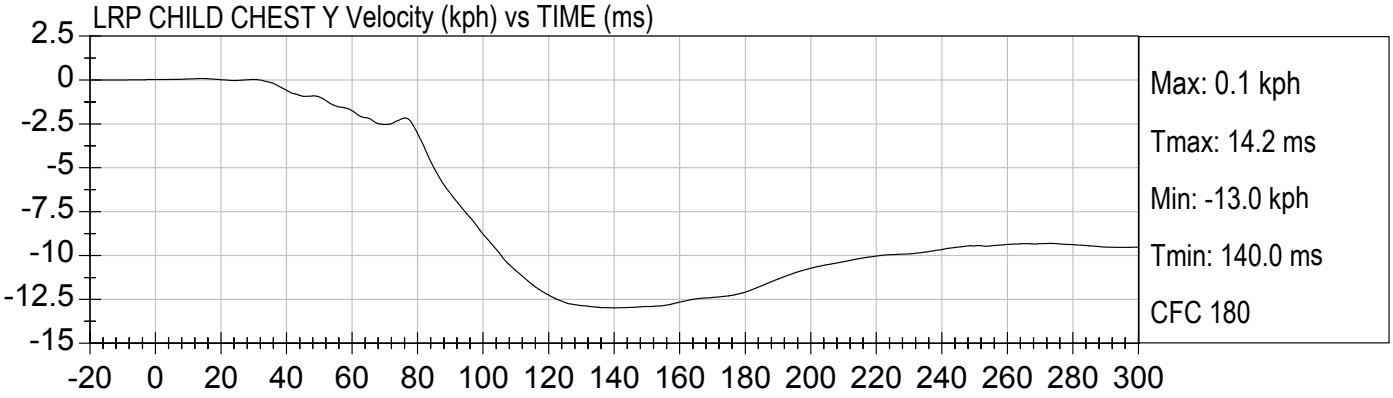



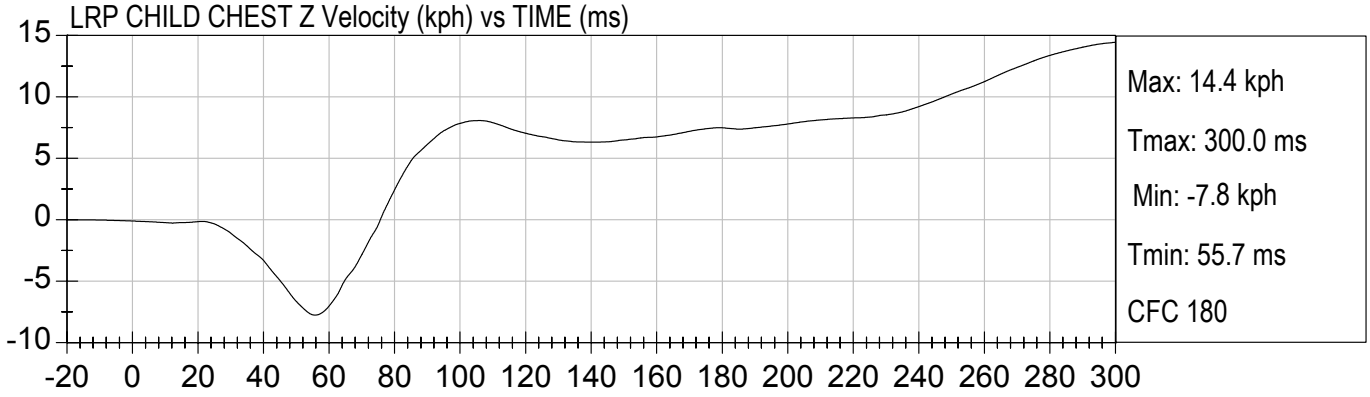



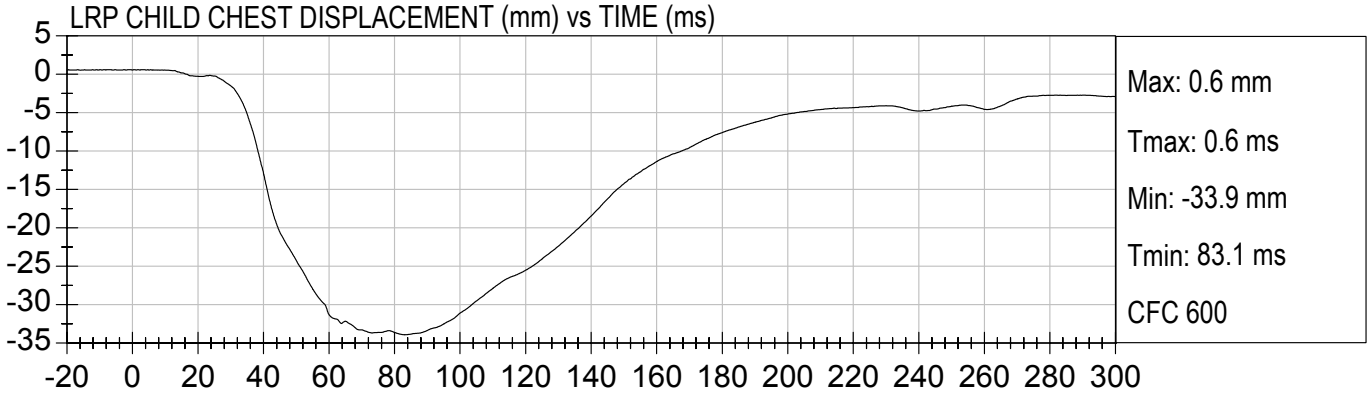
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)



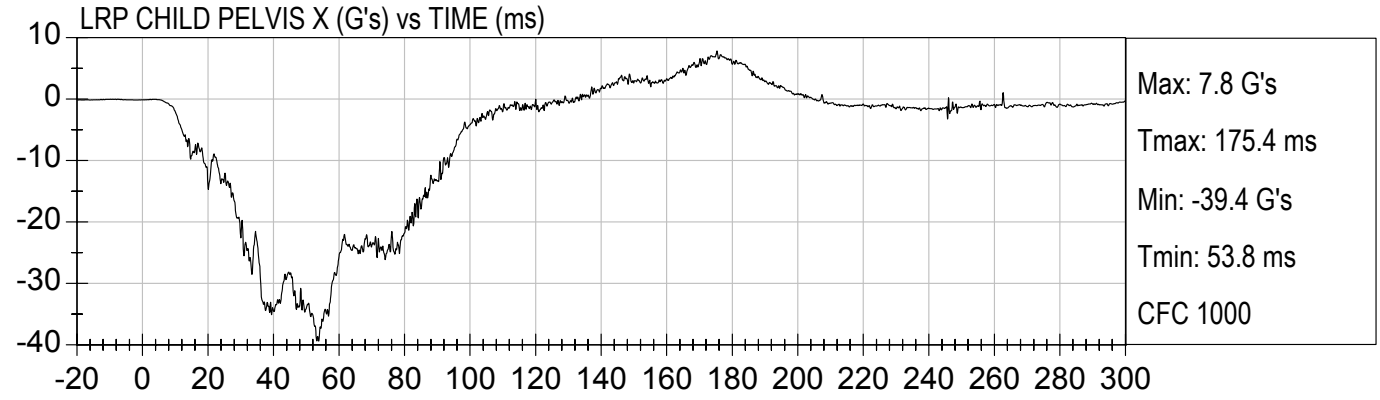



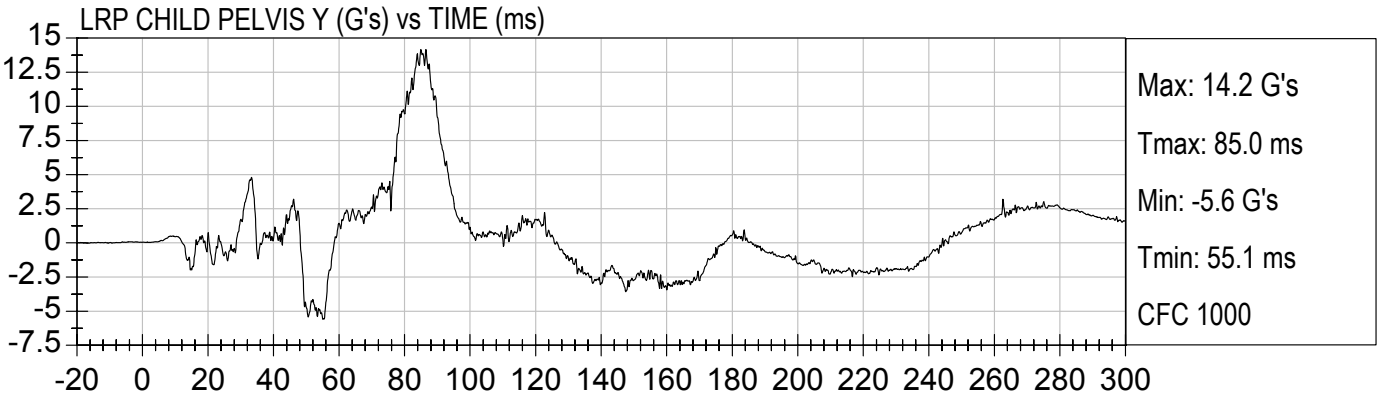



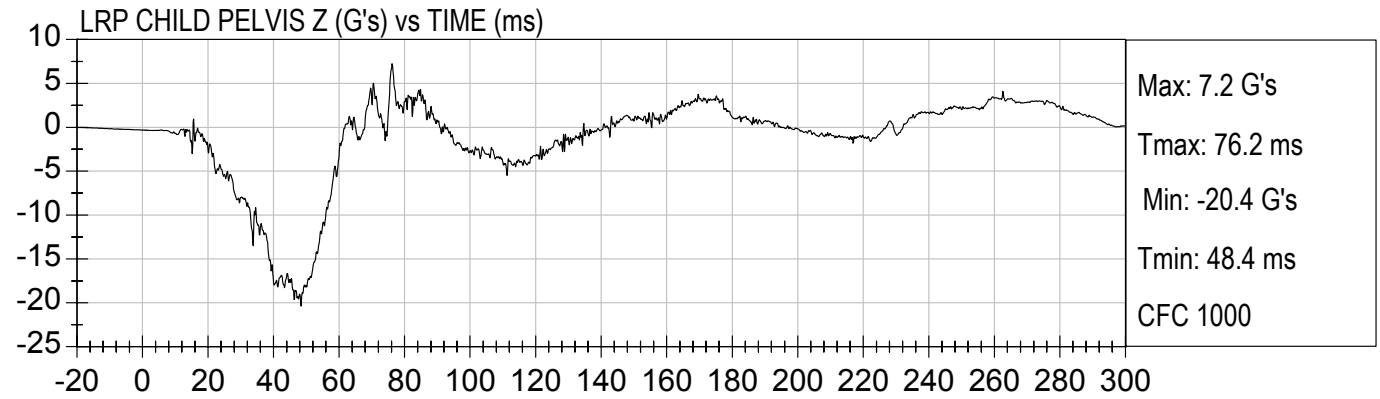



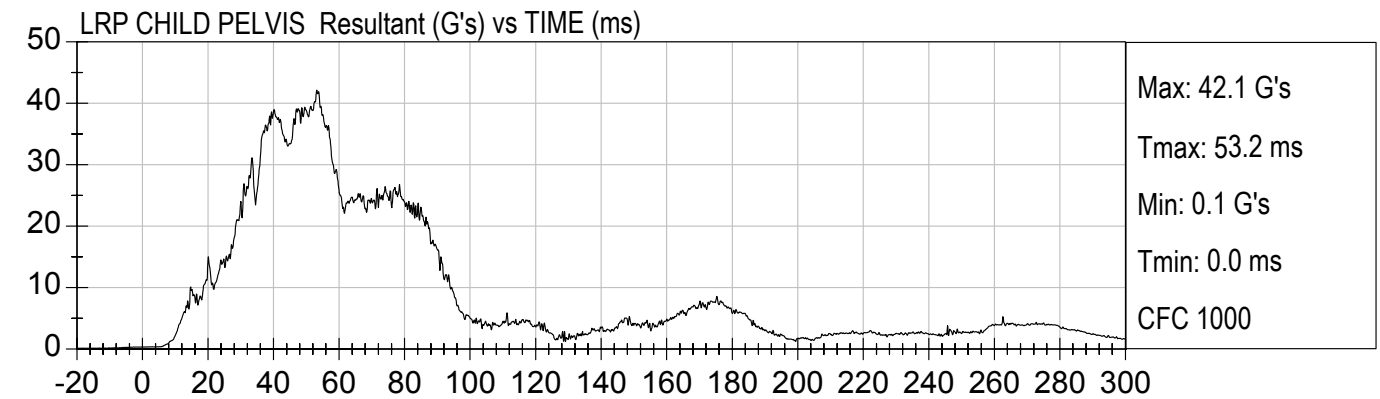
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

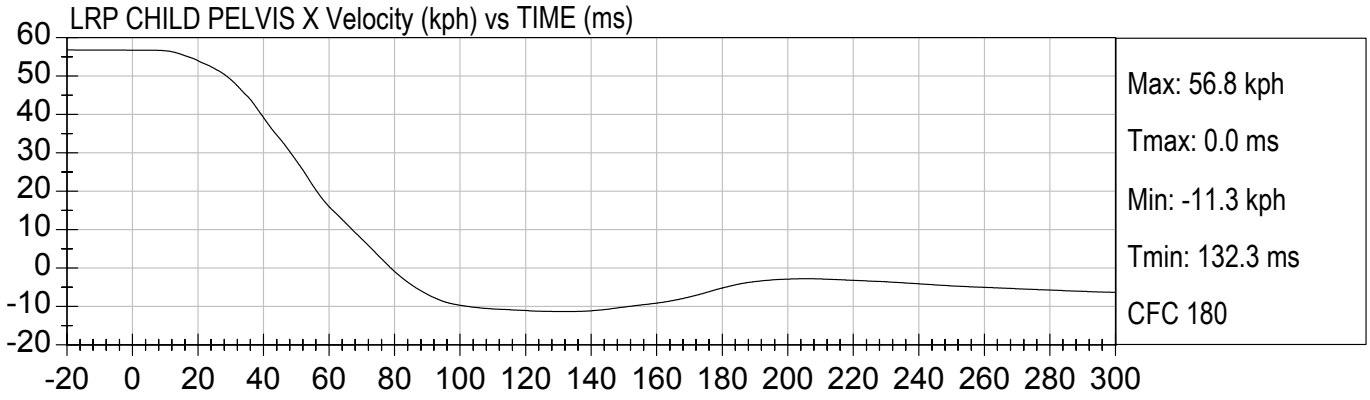
Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)

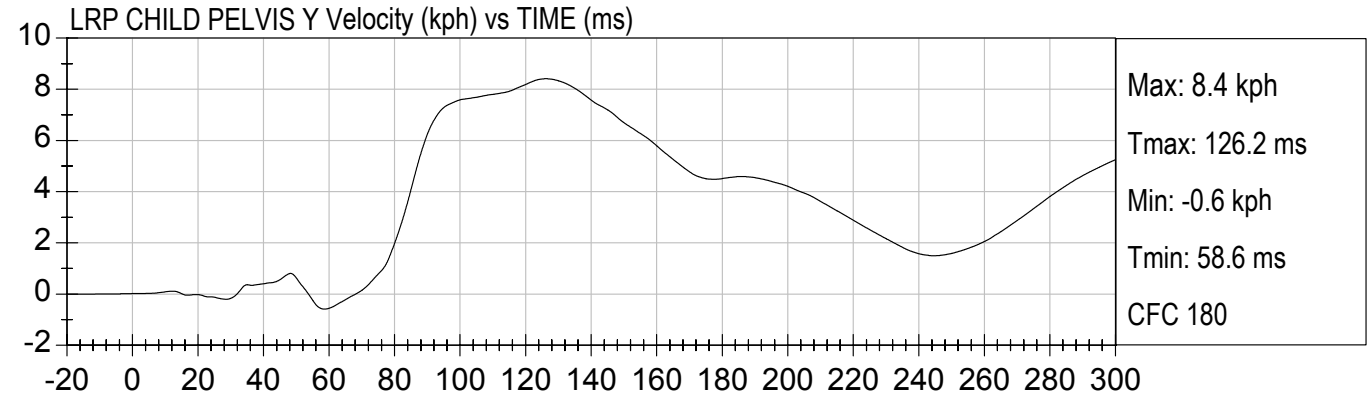


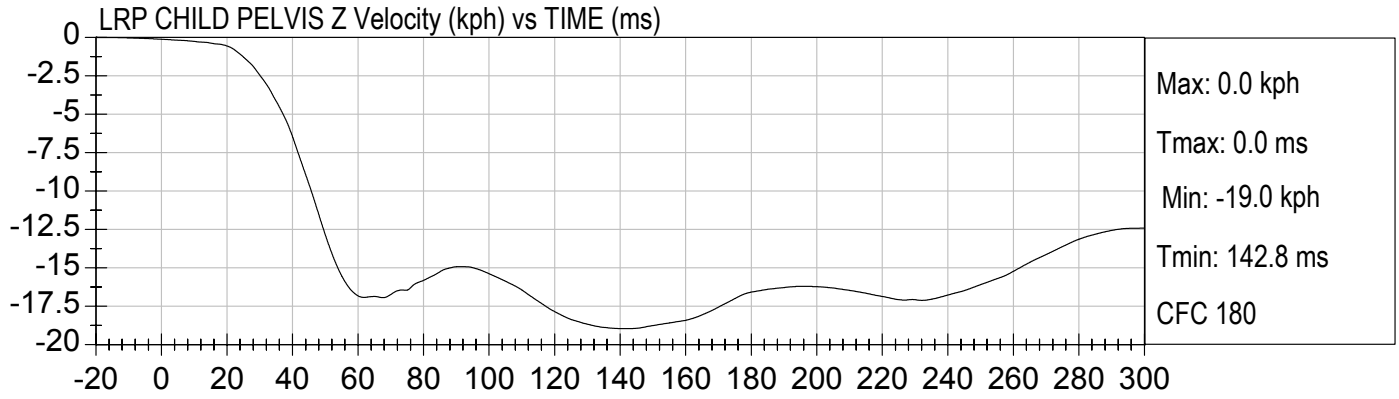



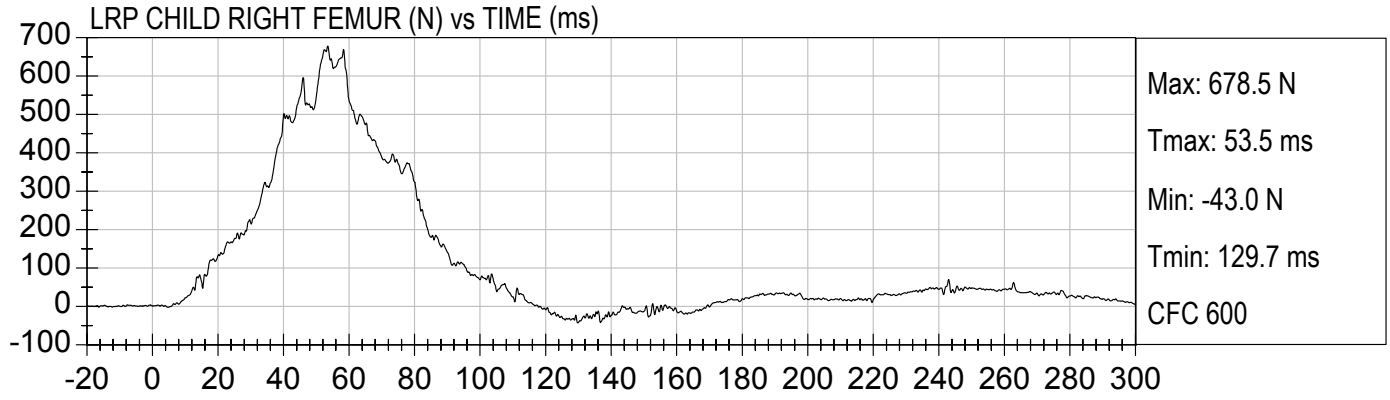

LRP CHILD PELVIS X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.8 kph
Tmax: 0.0 ms
Min: -11.3 kph
Tmin: 132.3 ms
CFC 180

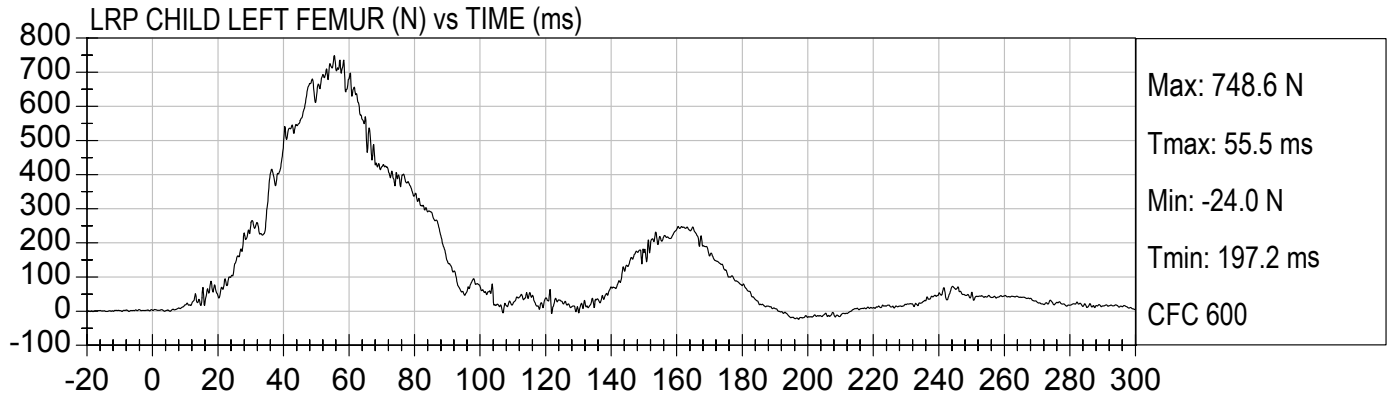

LRP CHILD PELVIS Y Velocity (kph) vs TIME (ms)
10
8
6
4
2
0
-2
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 8.4 kph
Tmax: 126.2 ms
Min: -0.6 kph
Tmin: 58.6 ms
CFC 180

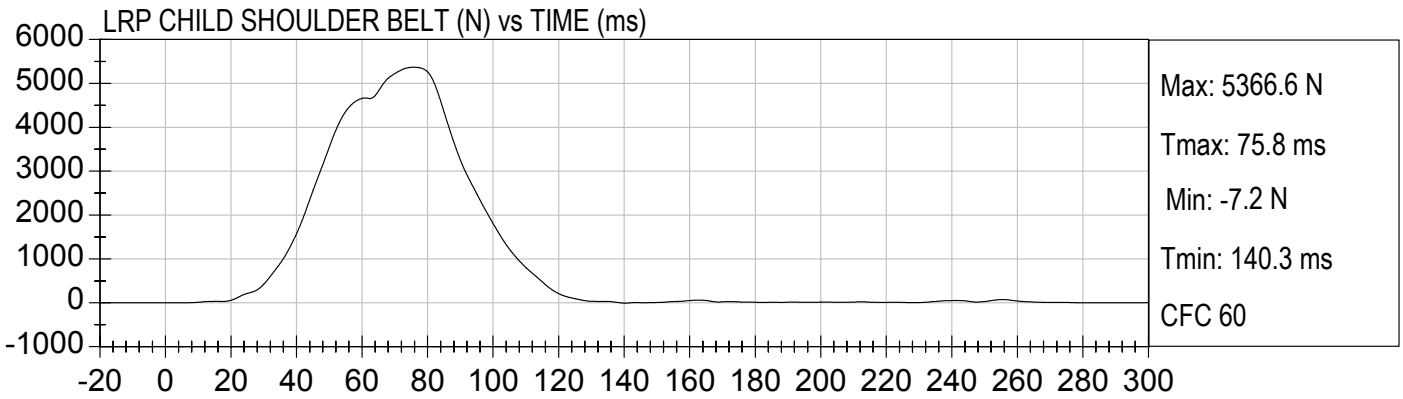

LRP CHILD PELVIS Z Velocity (kph) vs TIME (ms)
0
-2.5
-5
-7.5
-10
-12.5
-15
-17.5
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.0 kph
Tmax: 0.0 ms
Min: -19.0 kph
Tmin: 142.8 ms
CFC 180

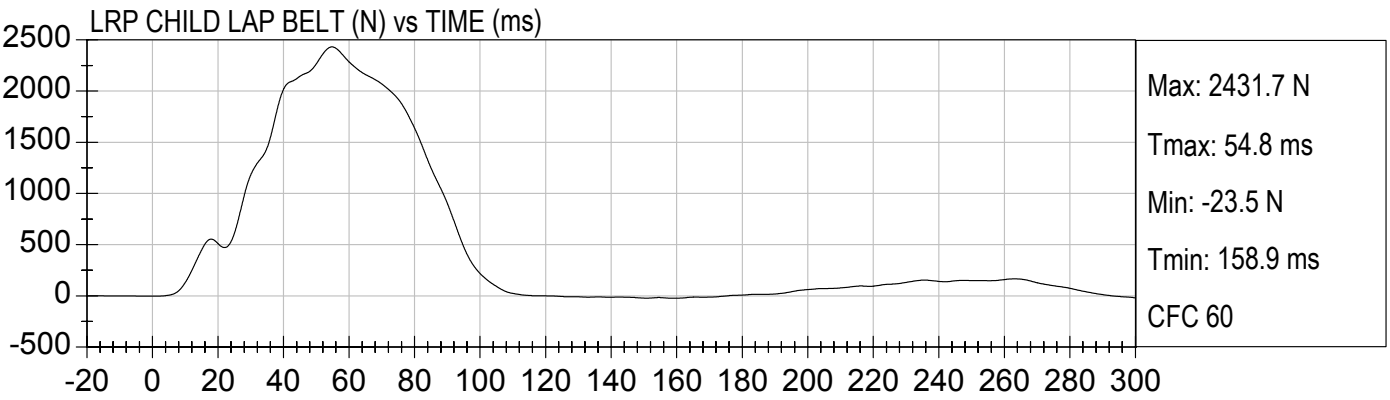
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)



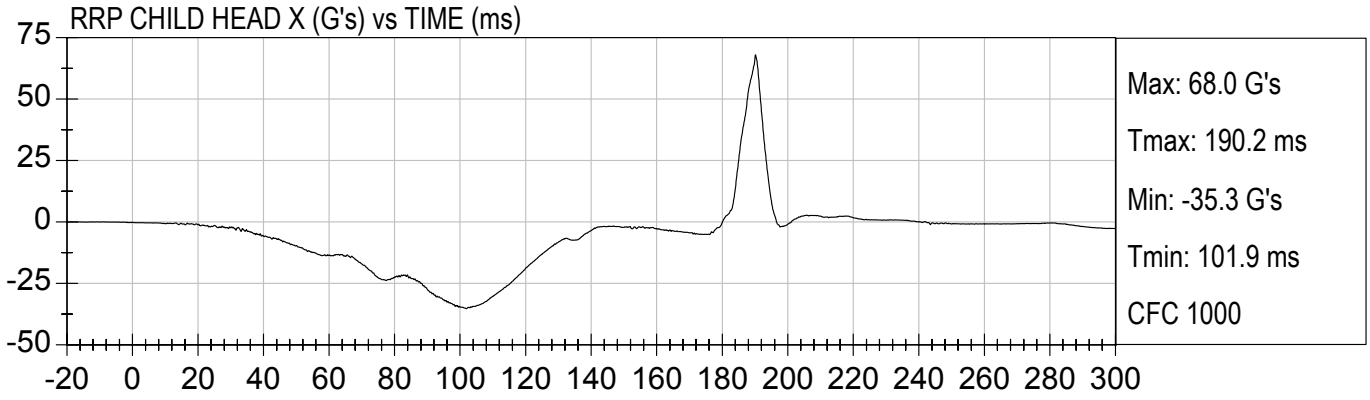



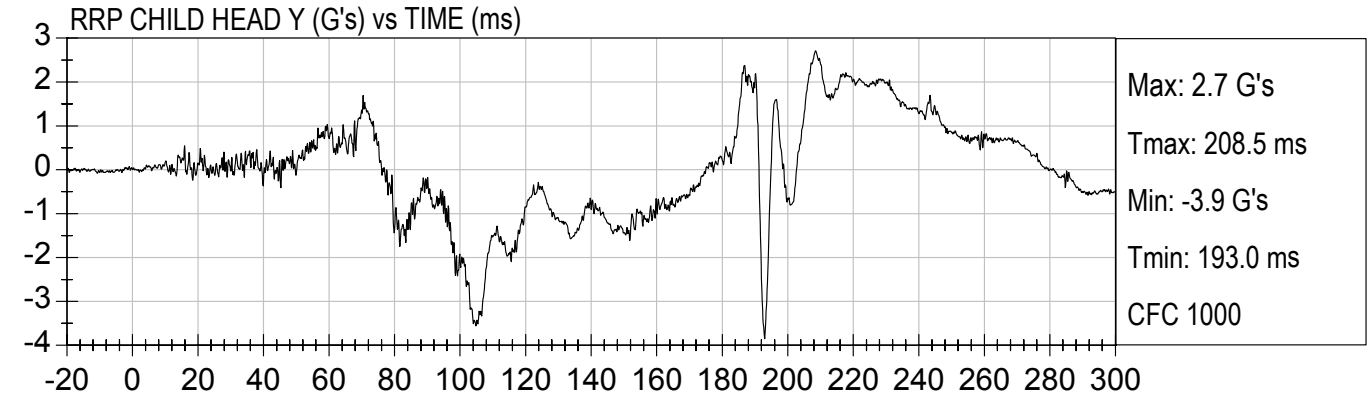



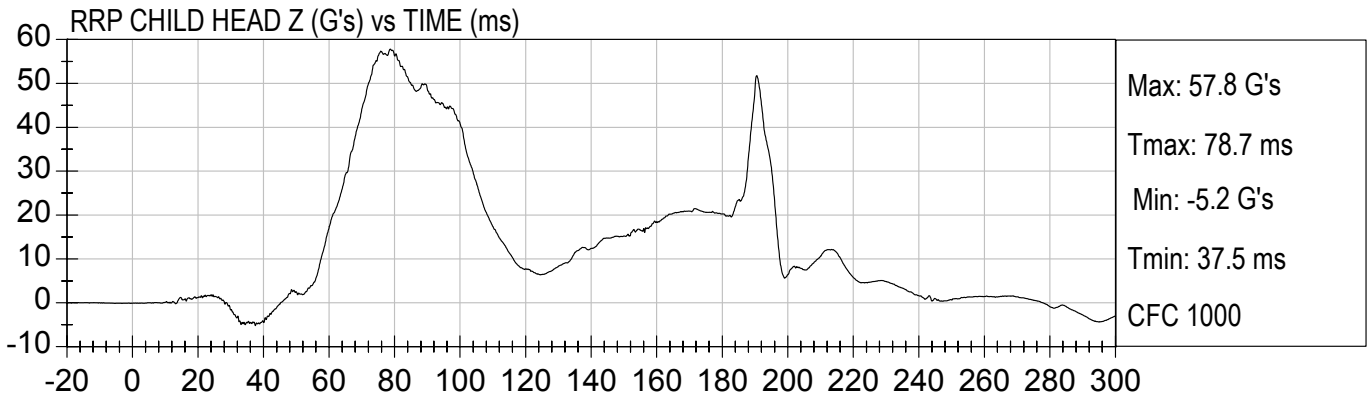



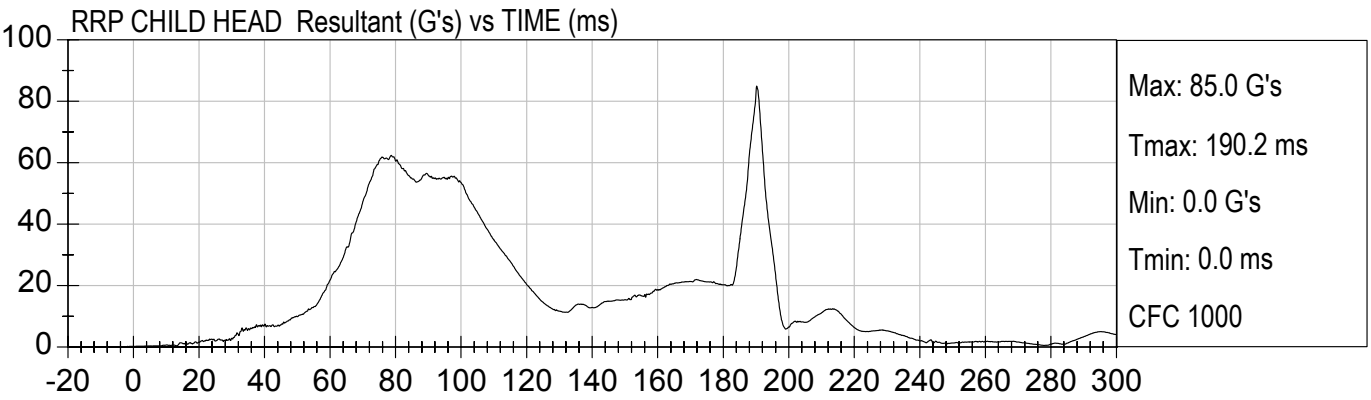
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

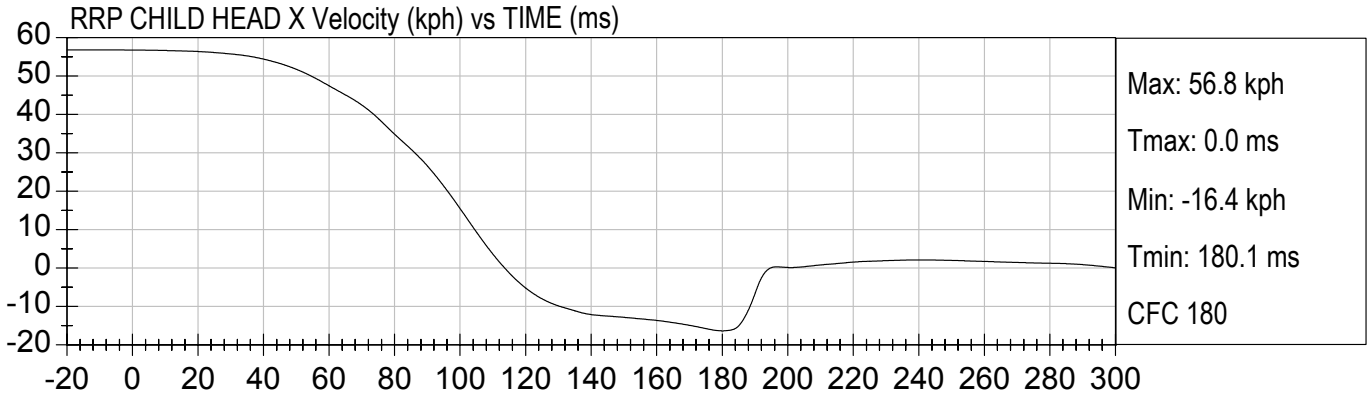
Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)

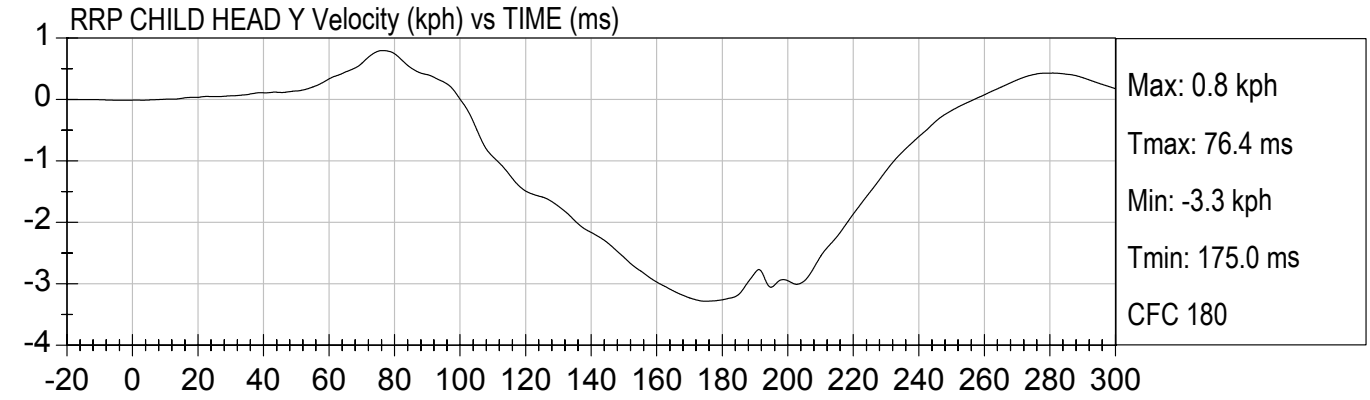


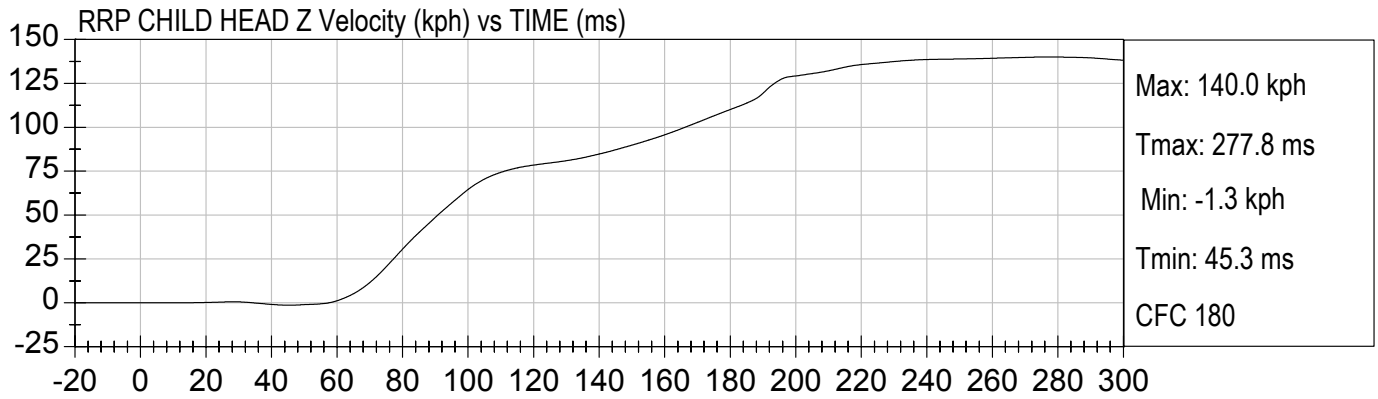



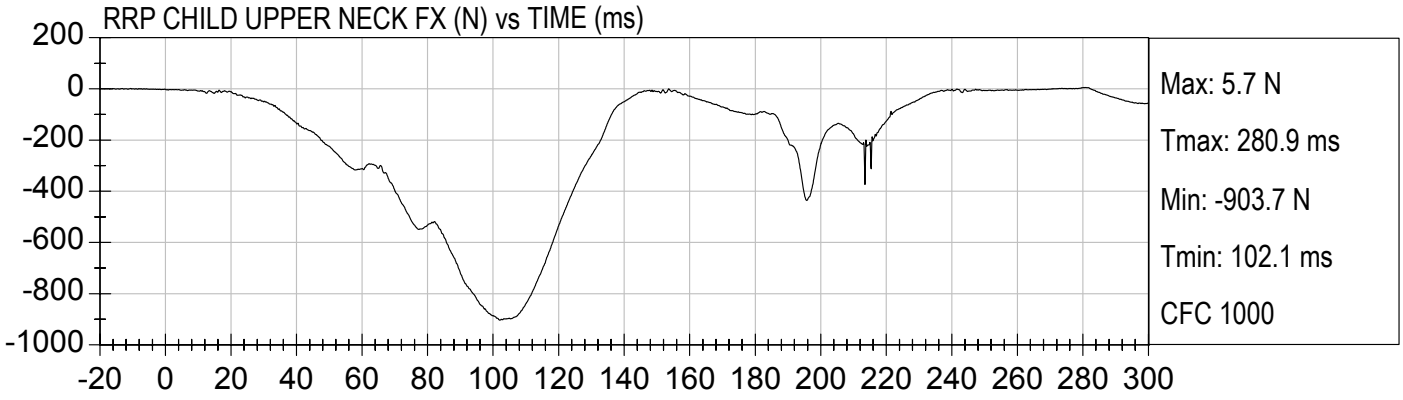

RRP CHILD HEAD X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.8 kph
Tmax: 0.0 ms
Min: -16.4 kph
Tmin: 180.1 ms
CFC 180

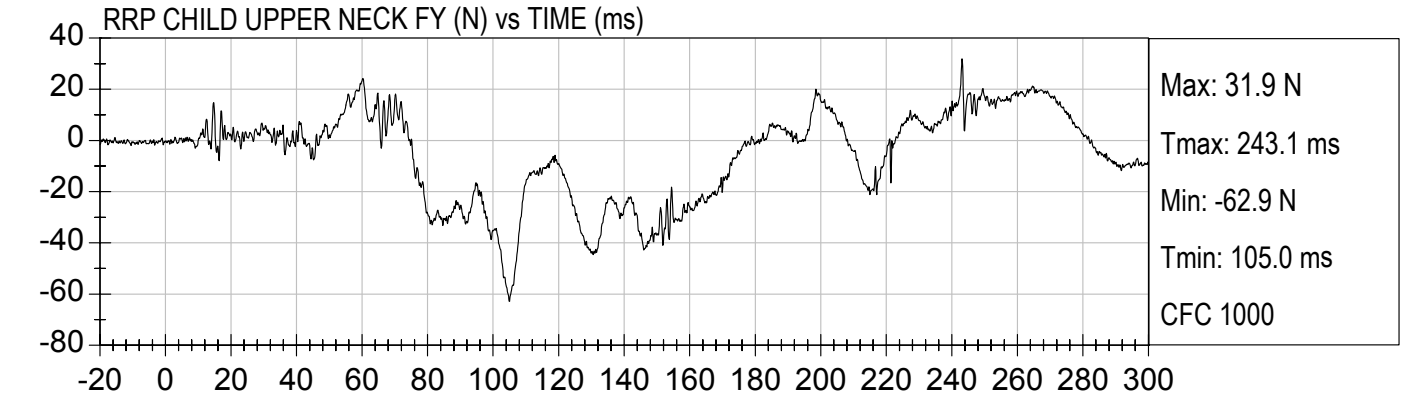

RRP CHILD HEAD Y Velocity (kph) vs TIME (ms)
1
0
-1
-2
-3
-4
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.8 kph
Tmax: 76.4 ms
Min: -3.3 kph
Tmin: 175.0 ms
CFC 180

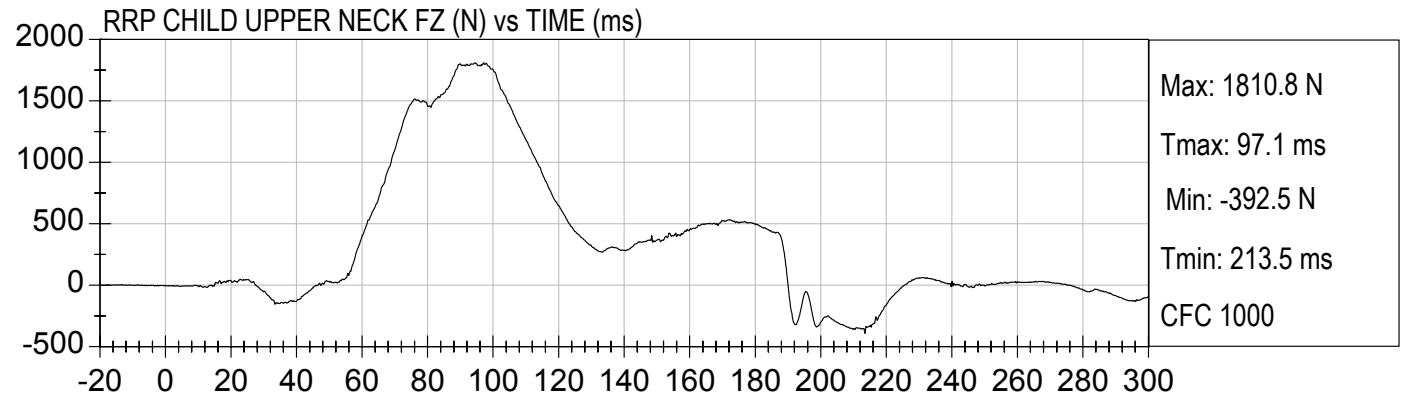

RRP CHILD HEAD Z Velocity (kph) vs TIME (ms)
150
125
100
75
50
25
0
-25
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 140.0 kph
Tmax: 277.8 ms
Min: -1.3 kph
Tmin: 45.3 ms
CFC 180

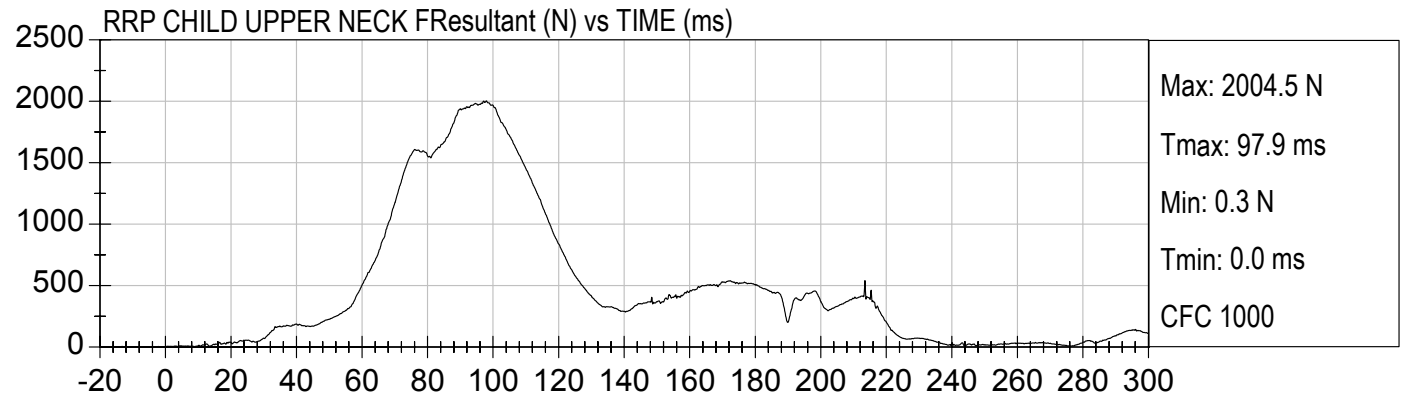
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)



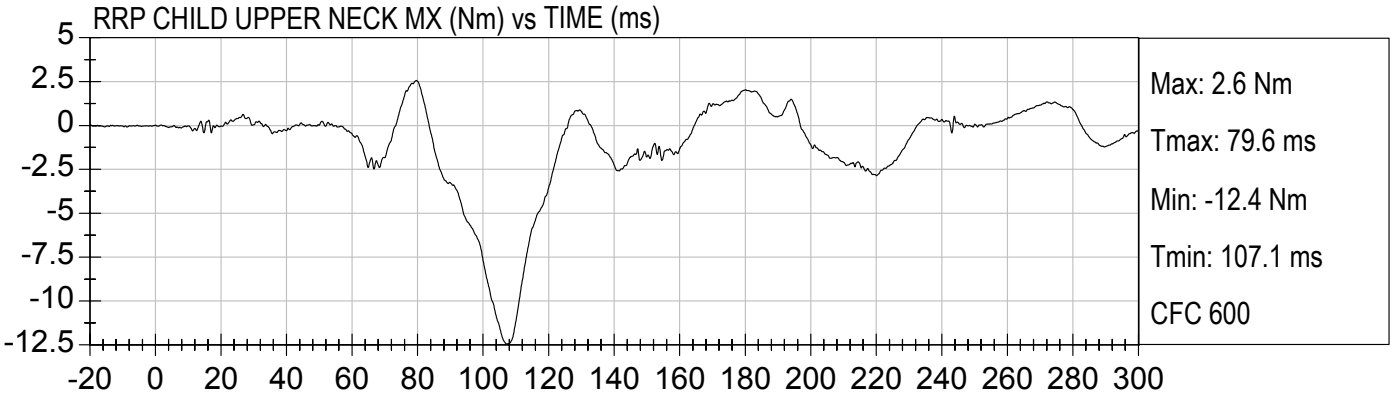



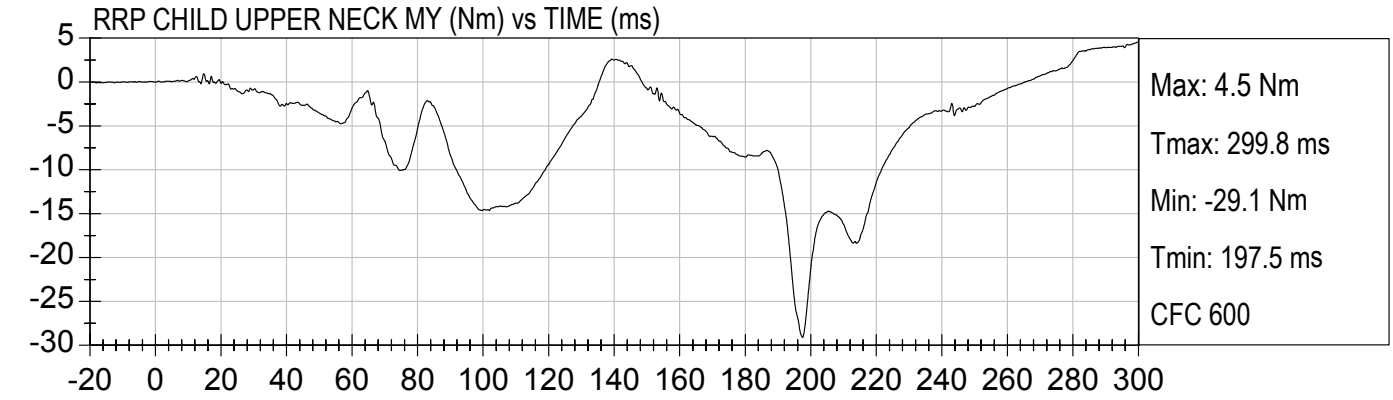



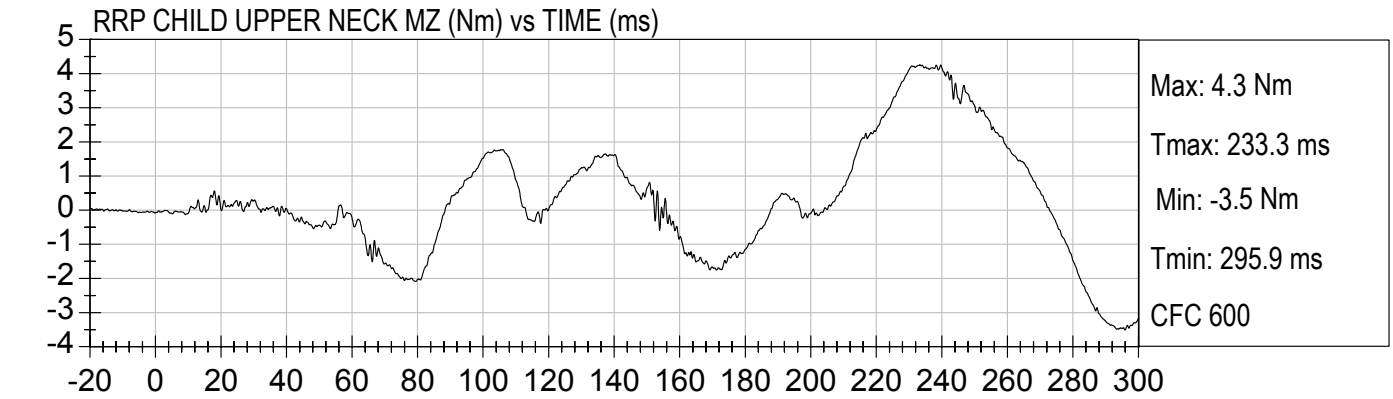



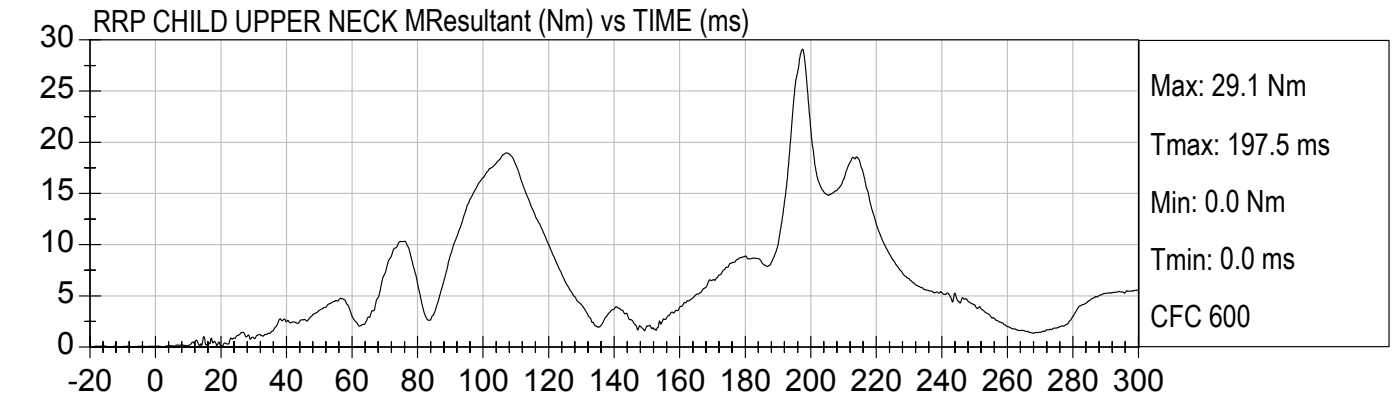
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)



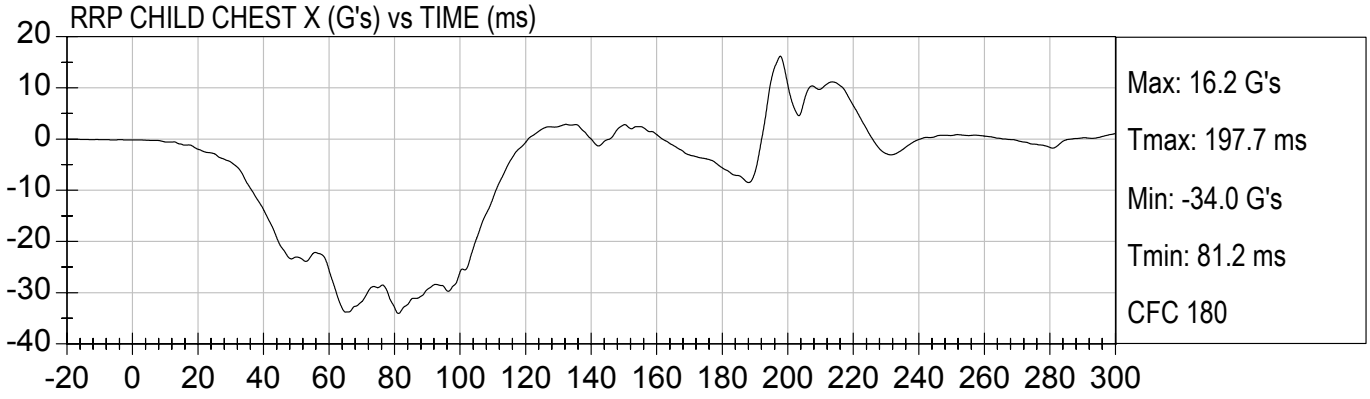



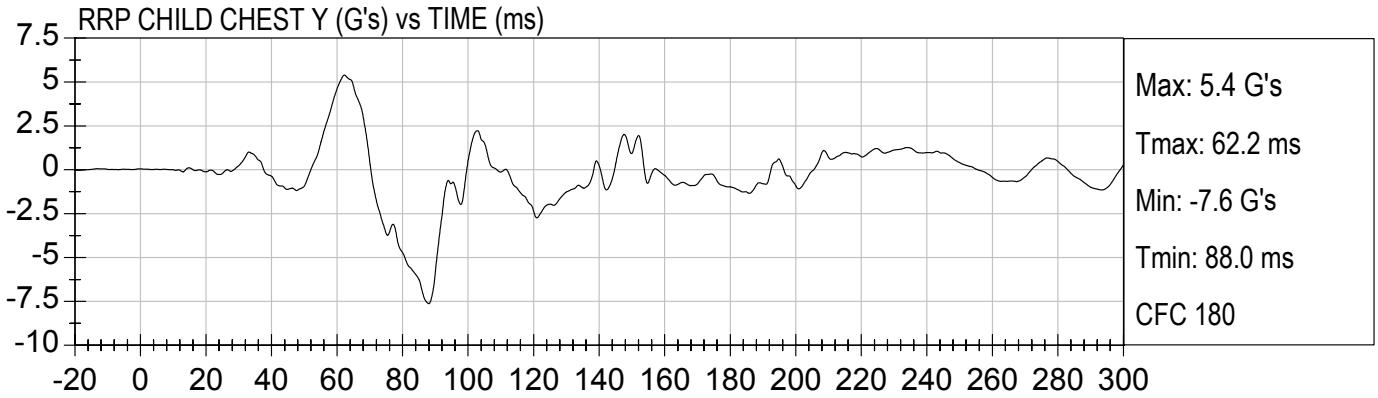



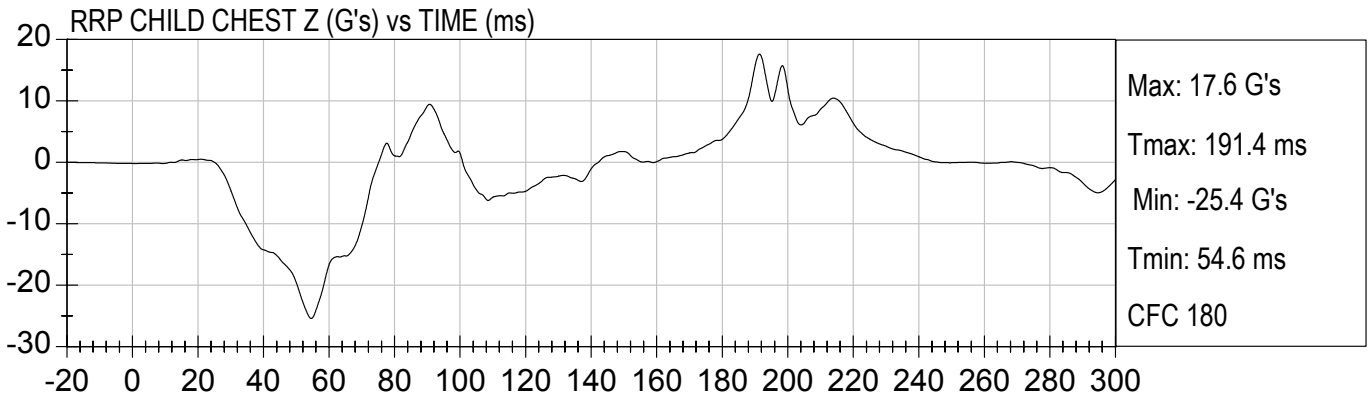



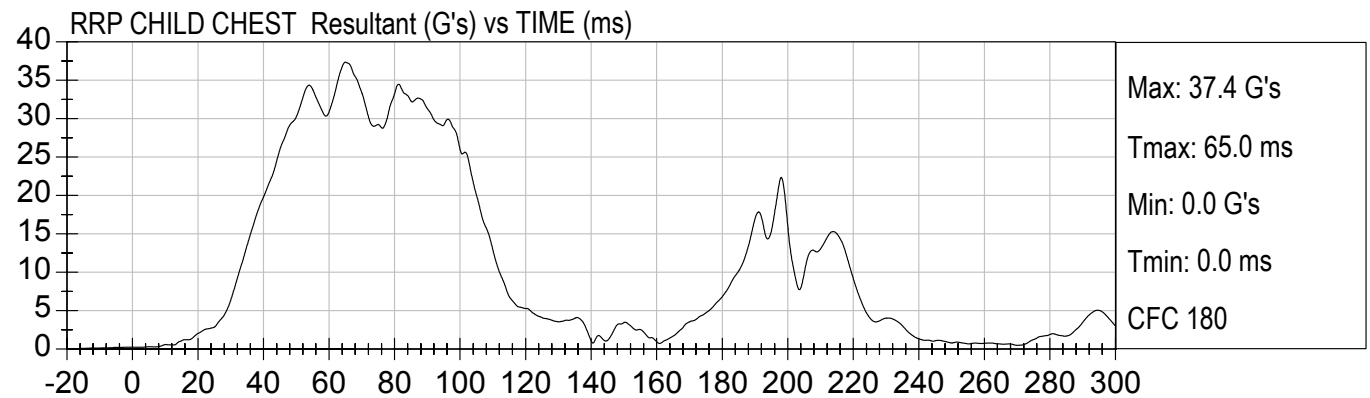
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)



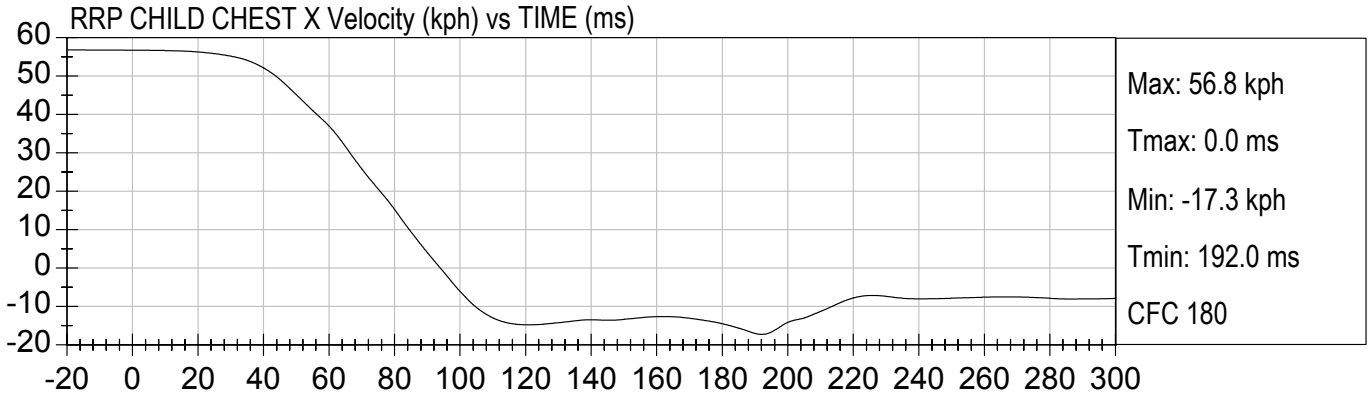



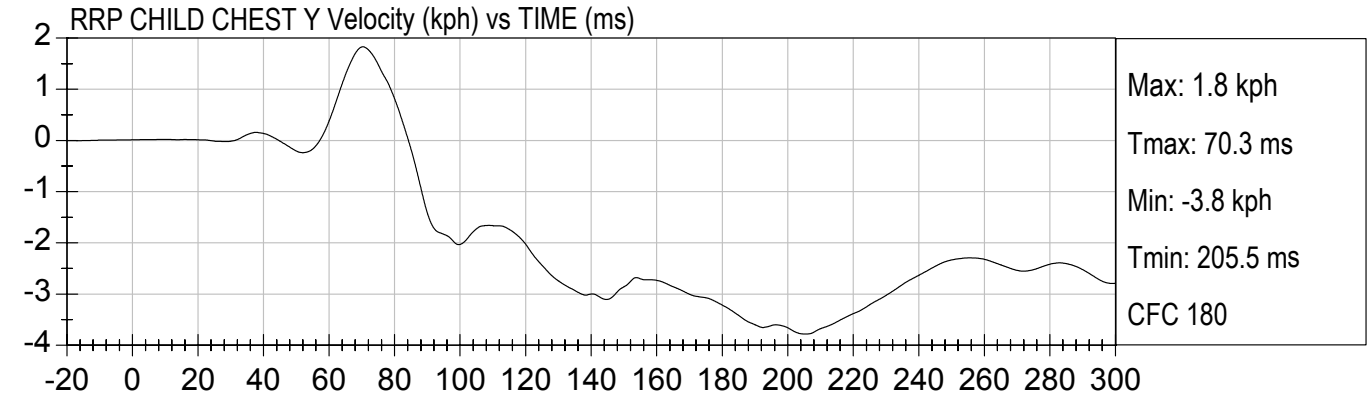



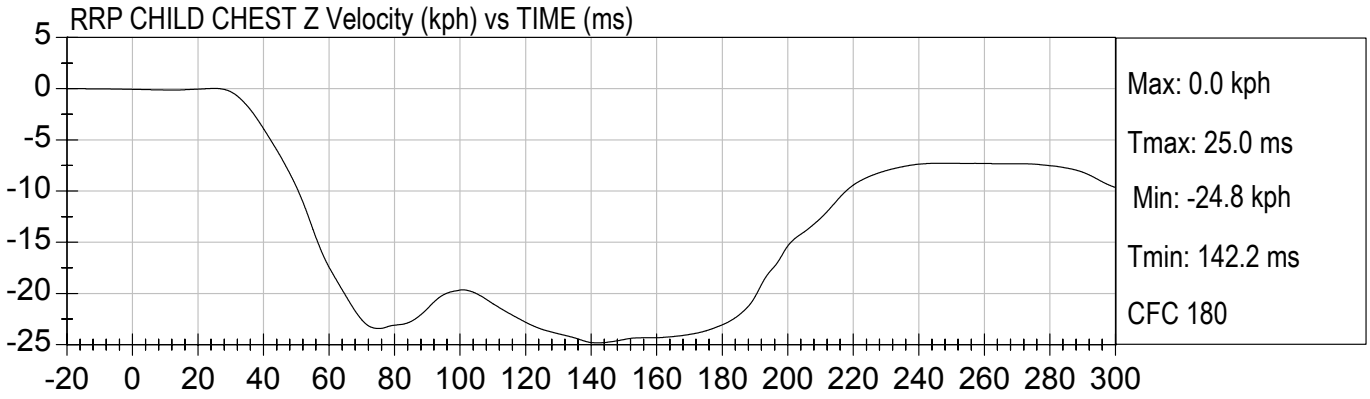



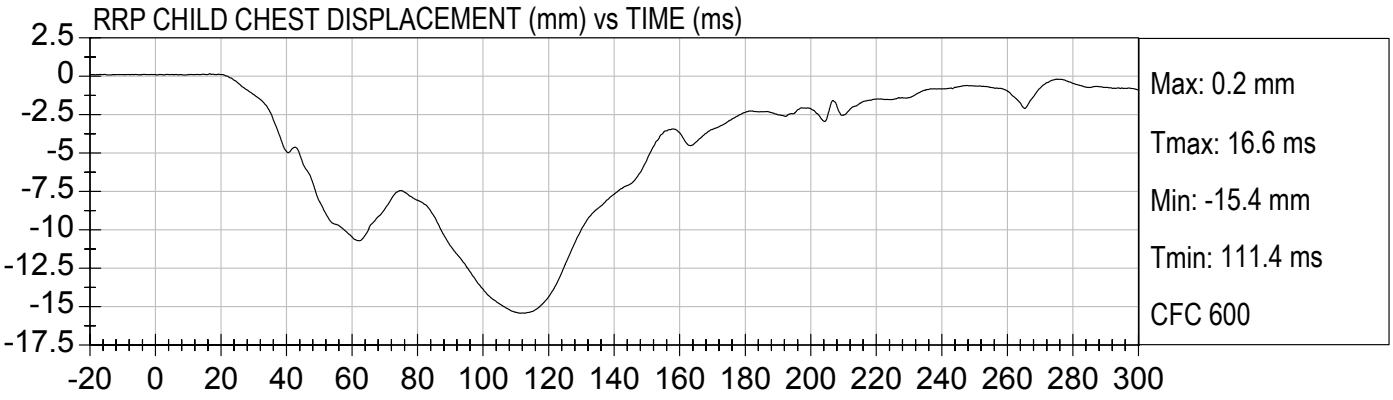
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)



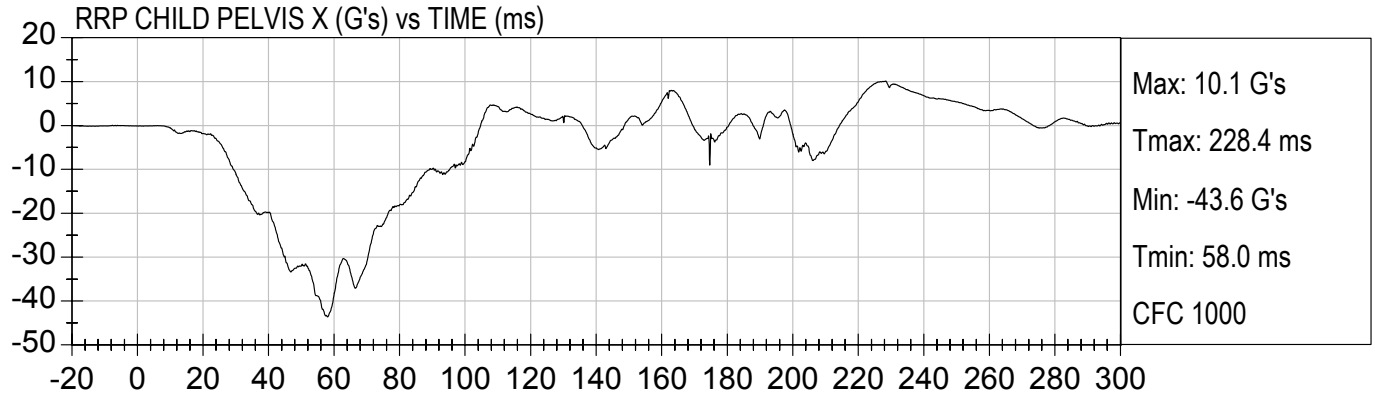



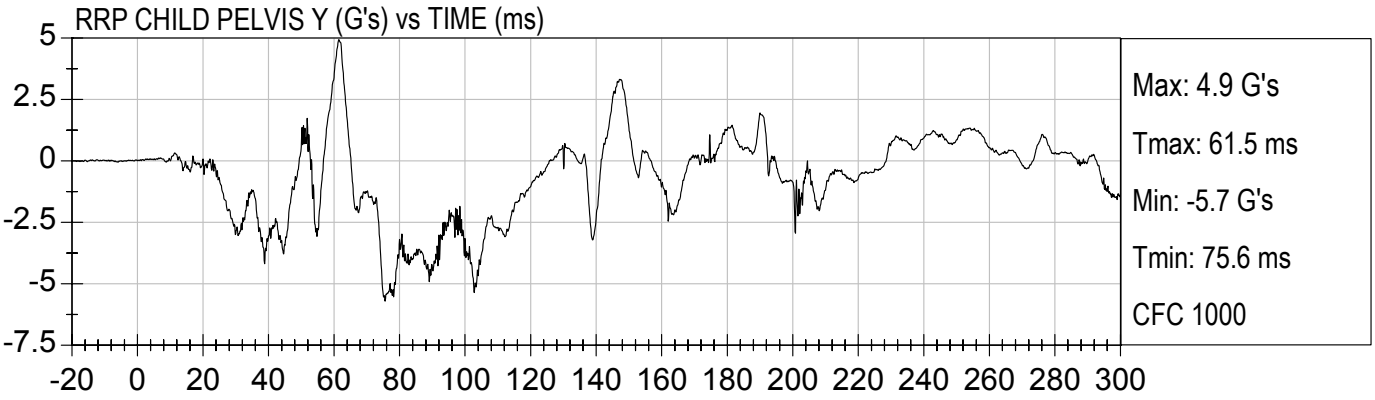



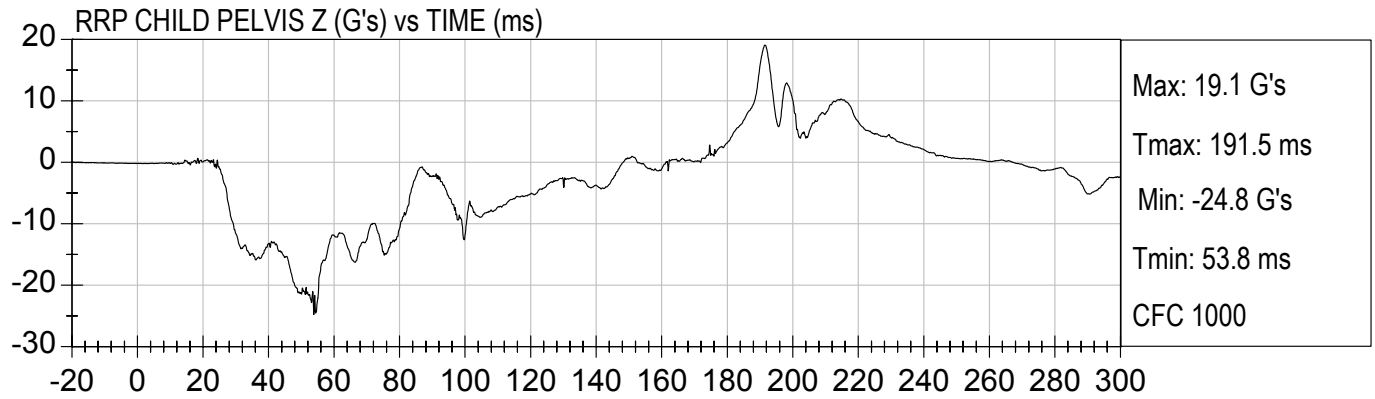



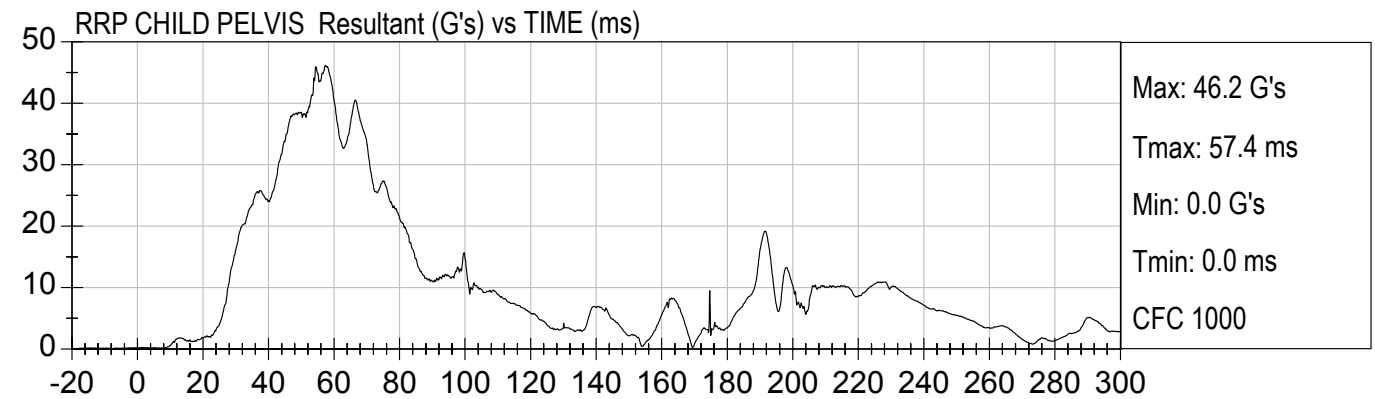
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)



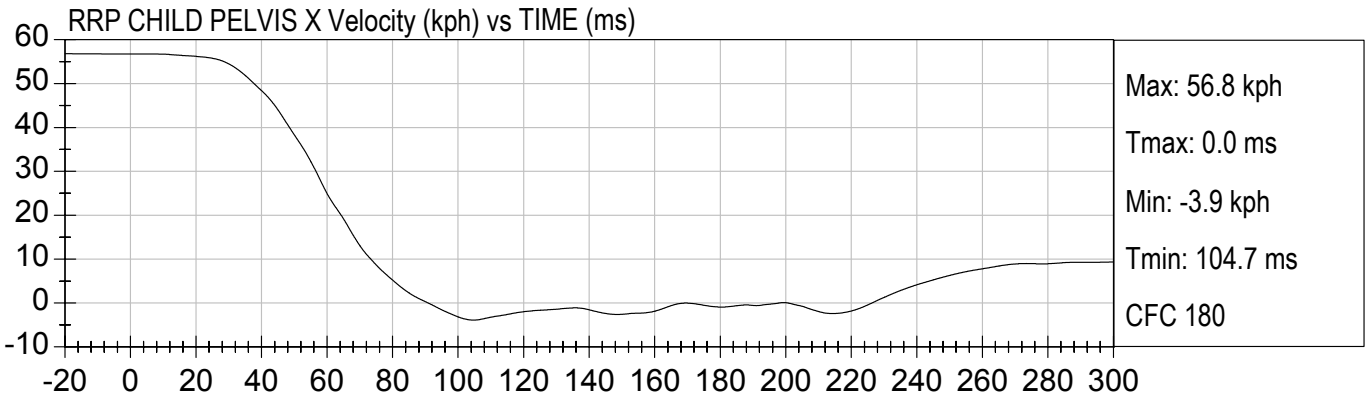



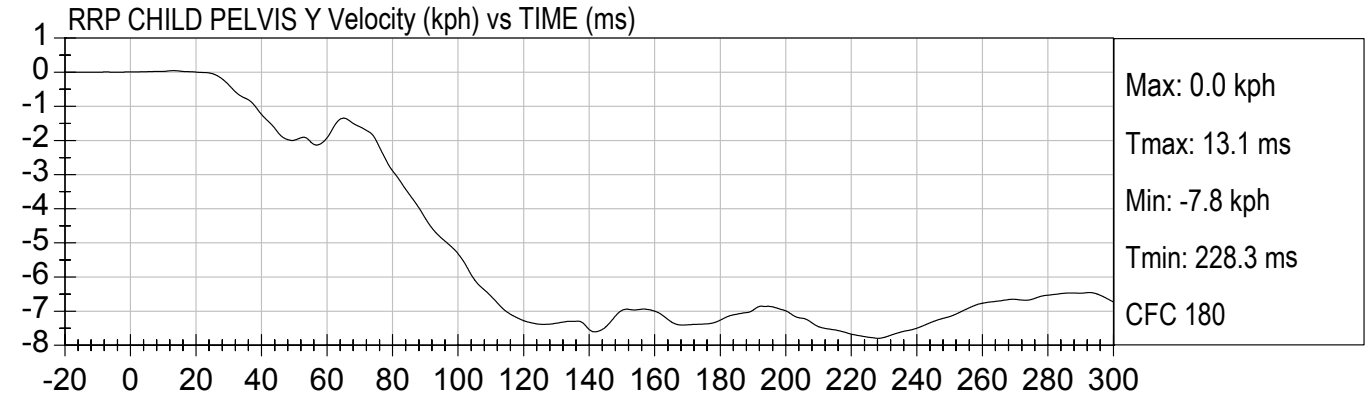



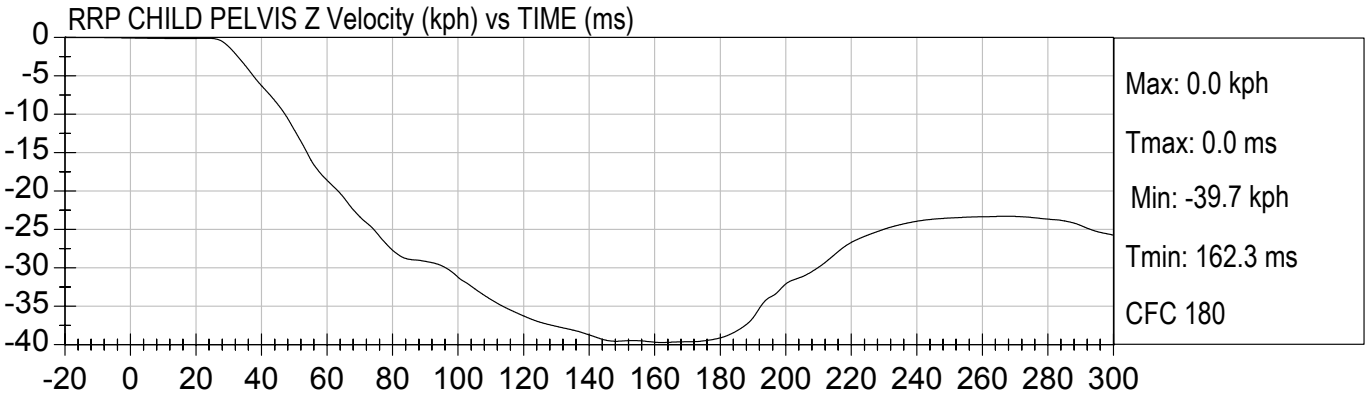



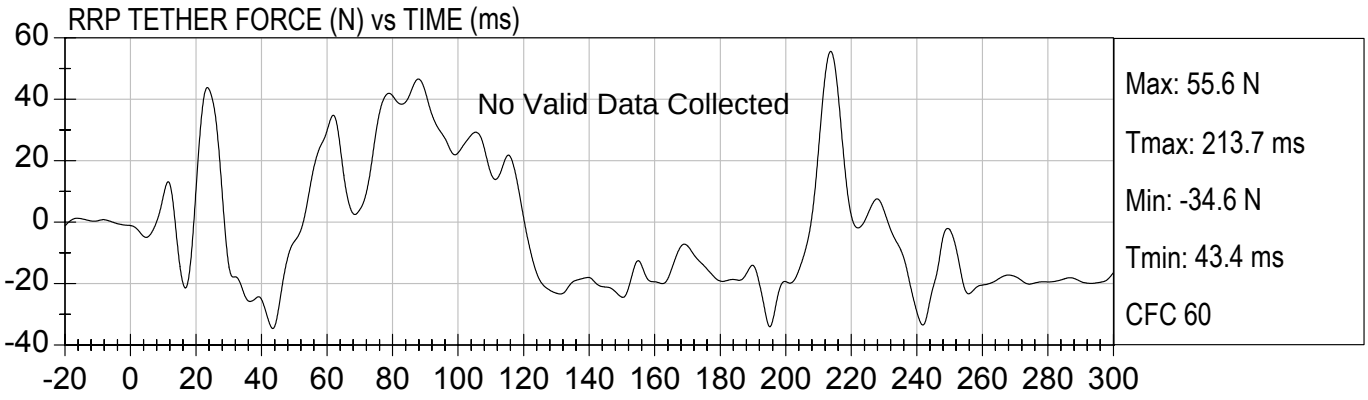
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)



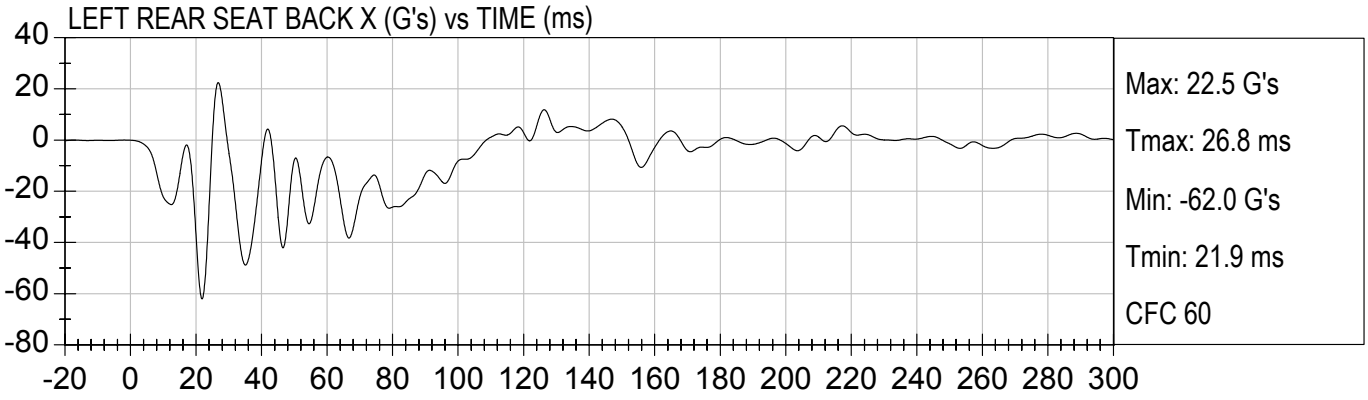



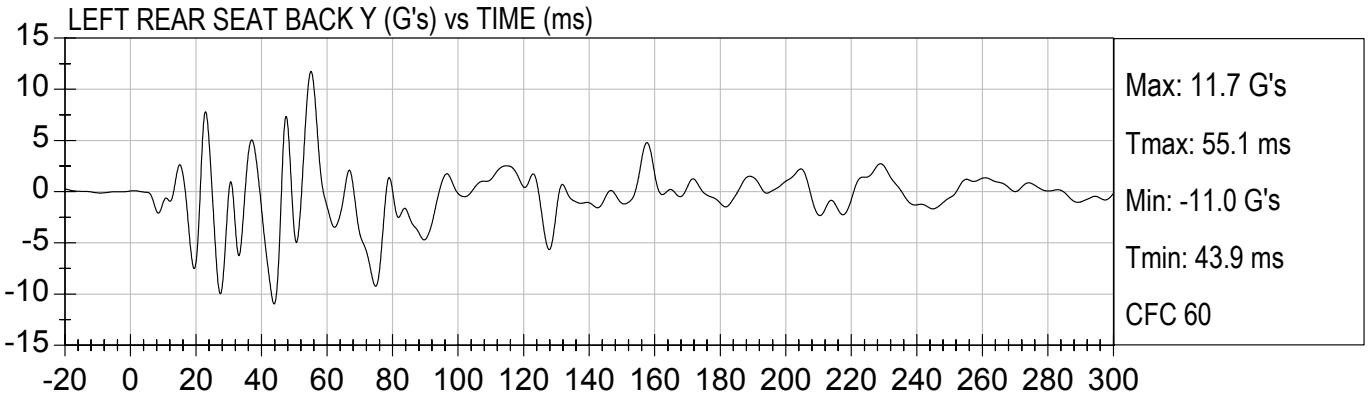



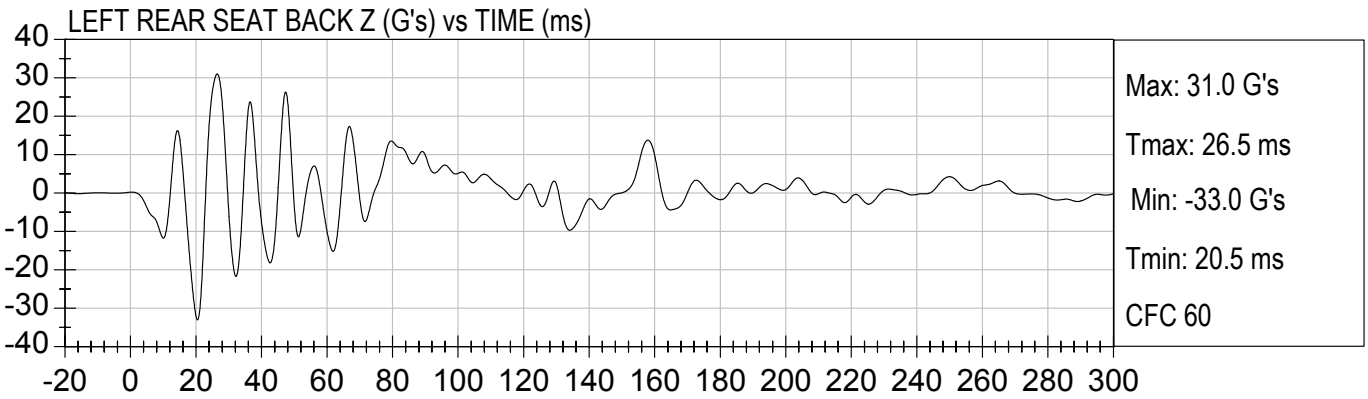



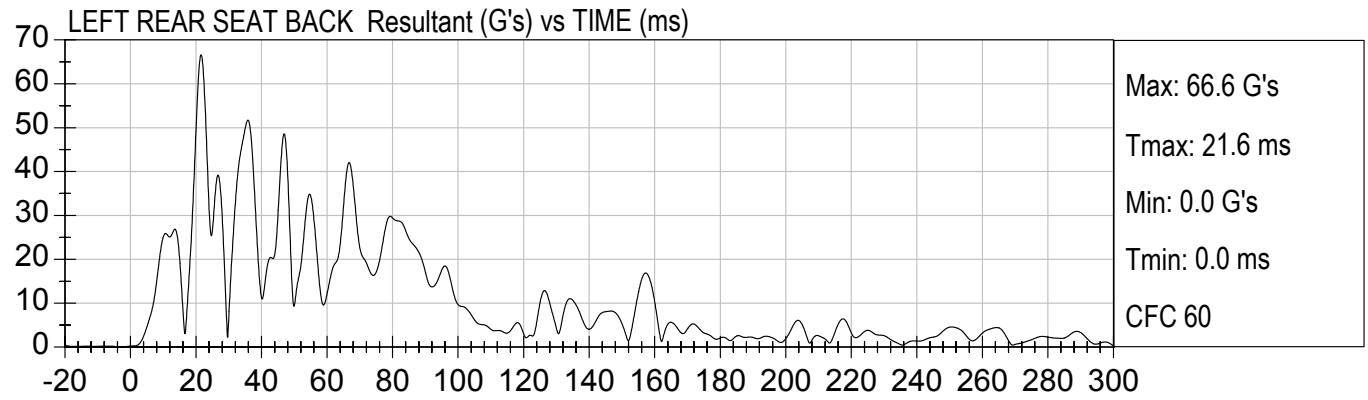
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

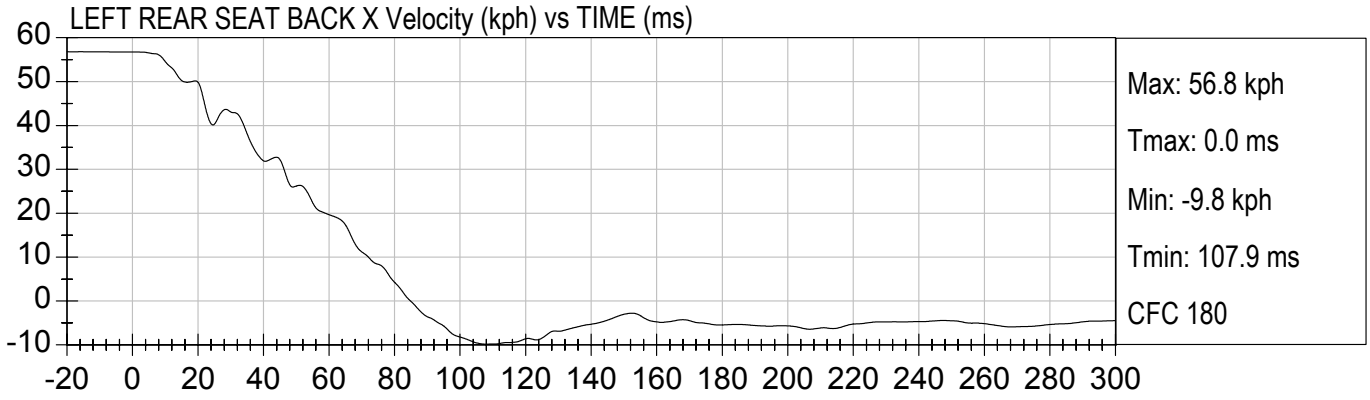
Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)

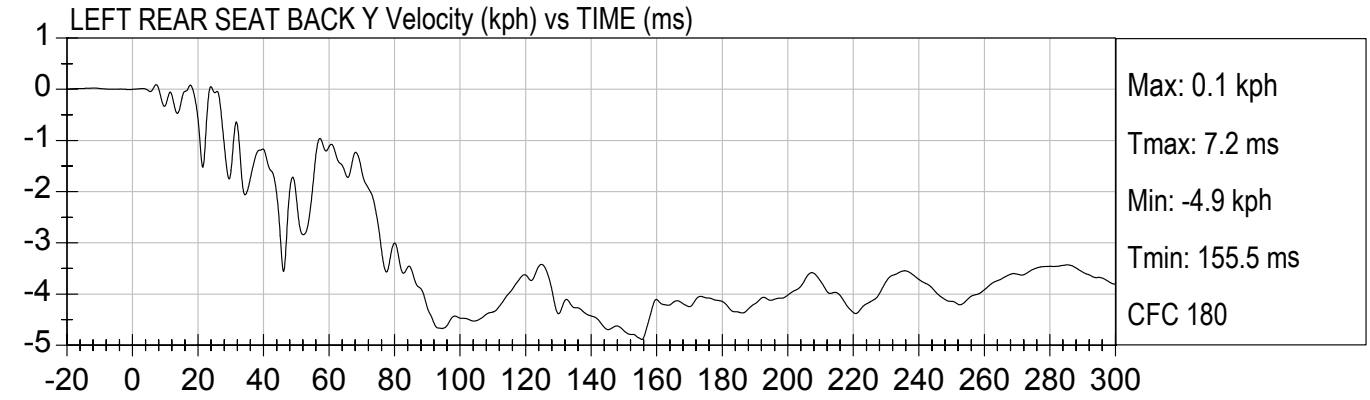


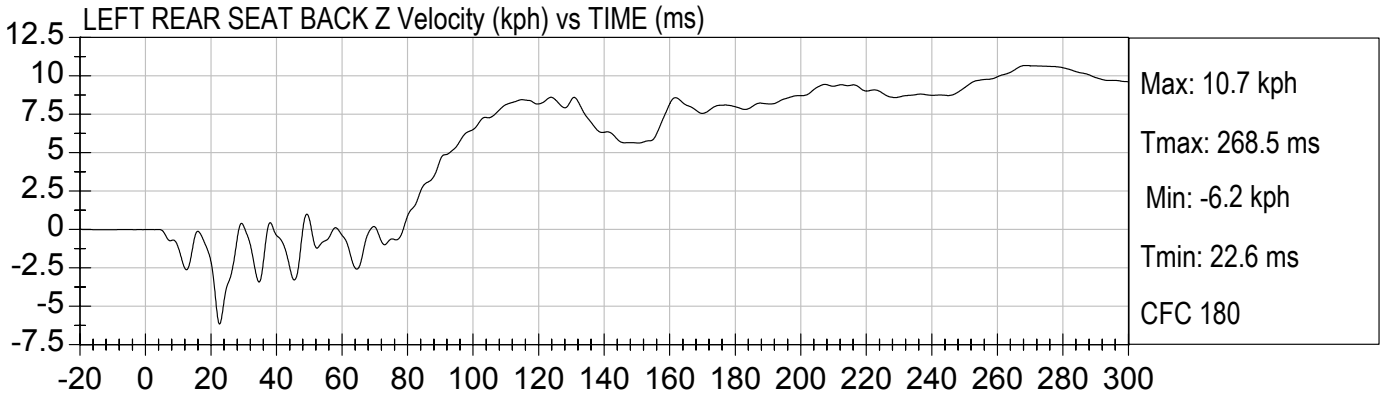



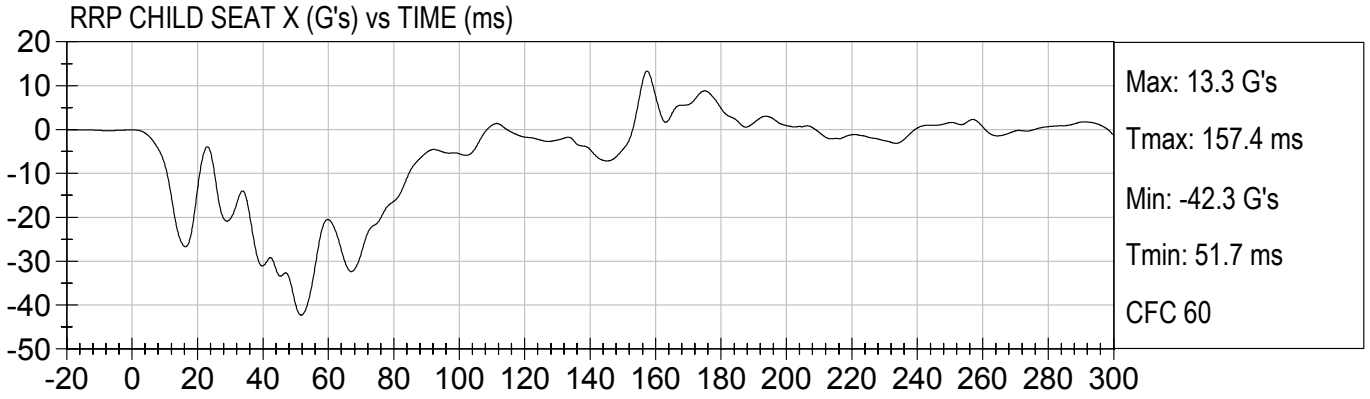

LEFT REAR SEAT BACK X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.8 kph
Tmax: 0.0 ms
Min: -9.8 kph
Tmin: 107.9 ms
CFC 180

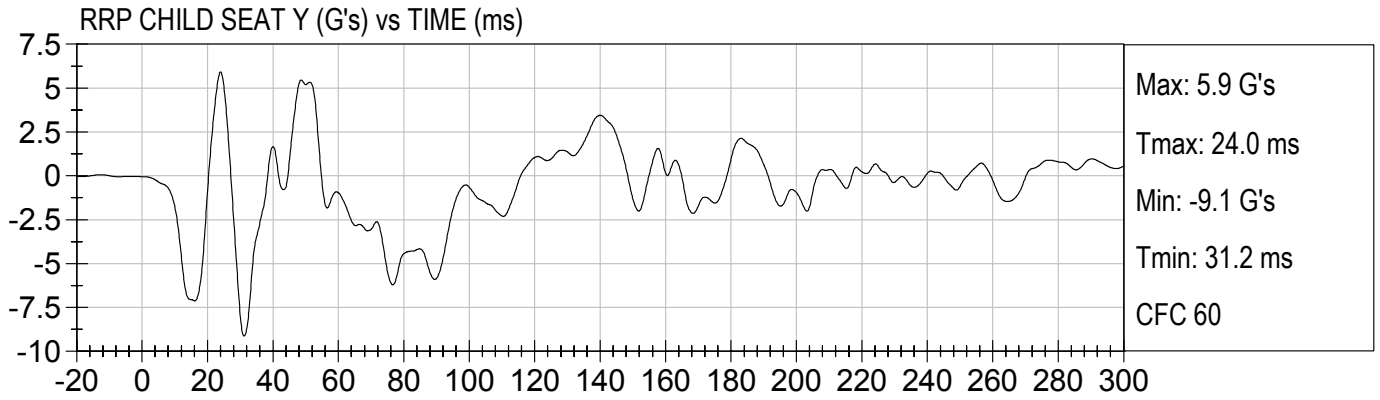

LEFT REAR SEAT BACK Y Velocity (kph) vs TIME (ms)
1
0
-1
-2
-3
-4
-5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.1 kph
Tmax: 7.2 ms
Min: -4.9 kph
Tmin: 155.5 ms
CFC 180

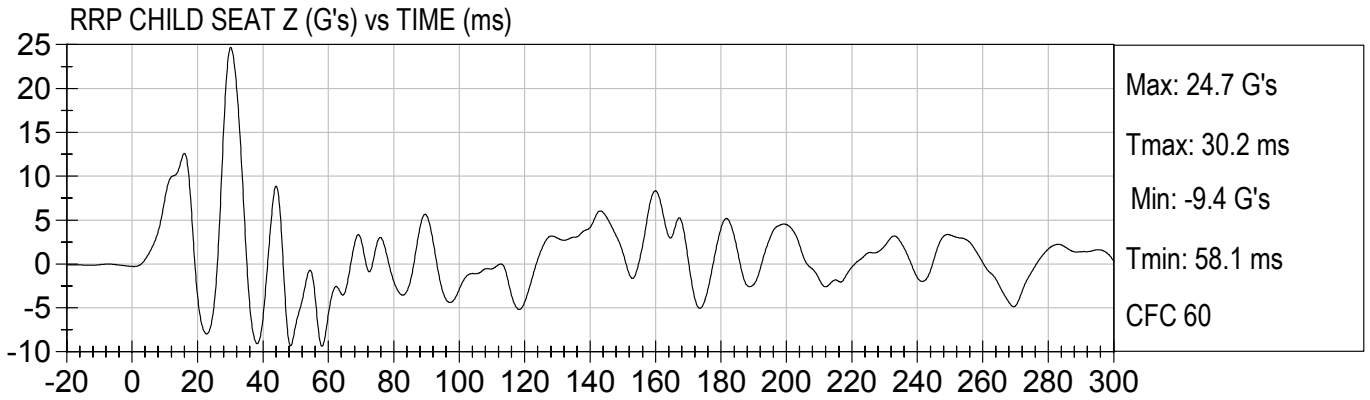

LEFT REAR SEAT BACK Z Velocity (kph) vs TIME (ms)
12.5
10
7.5
5
2.5
0
-2.5
-5
-7.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 10.7 kph
Tmax: 268.5 ms
Min: -6.2 kph
Tmin: 22.6 ms
CFC 180

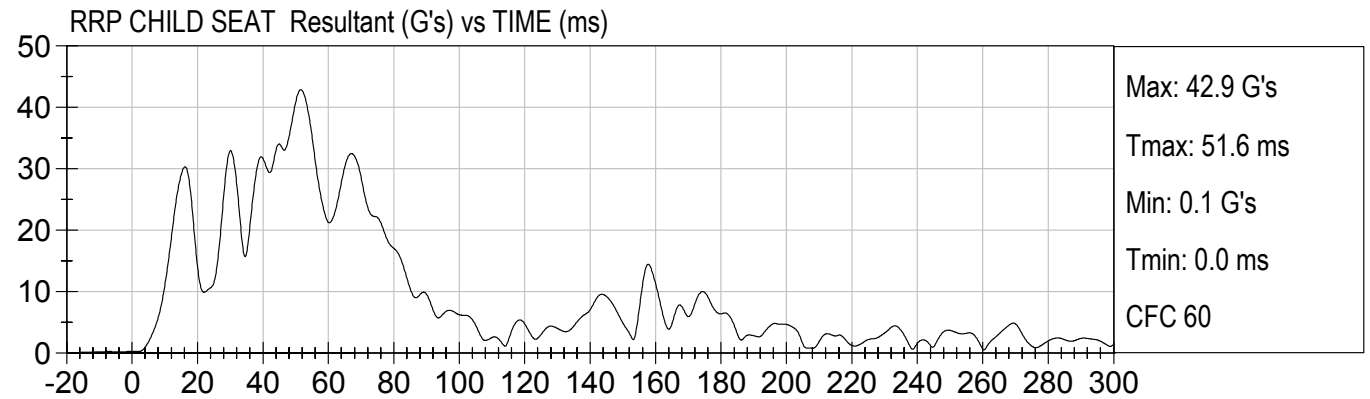
NCAP 35MPH FRONTAL
2005 JEEP CHEROKEE (M50307)

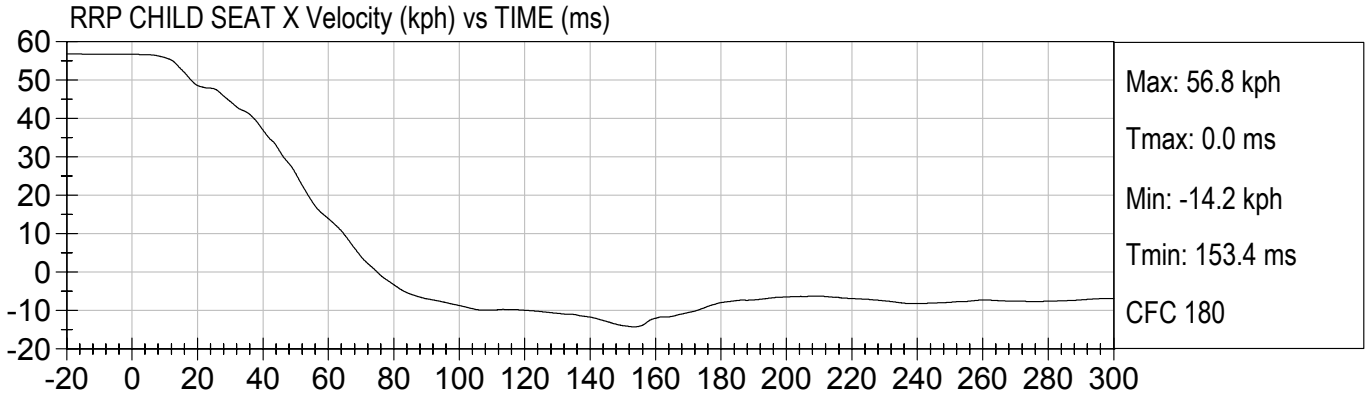
Test Date: 1/31/05
Speed: 35.3 mph (56.8 km/h)

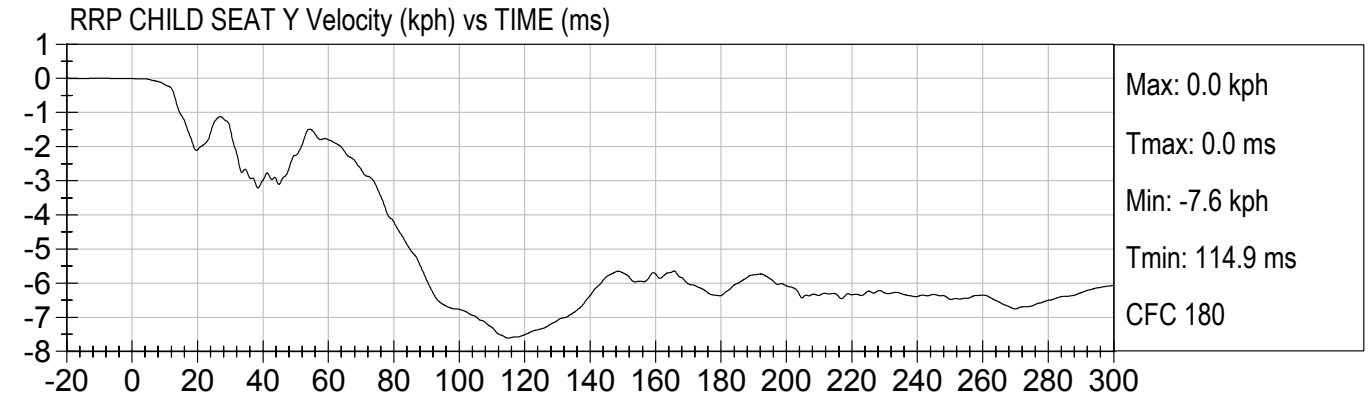


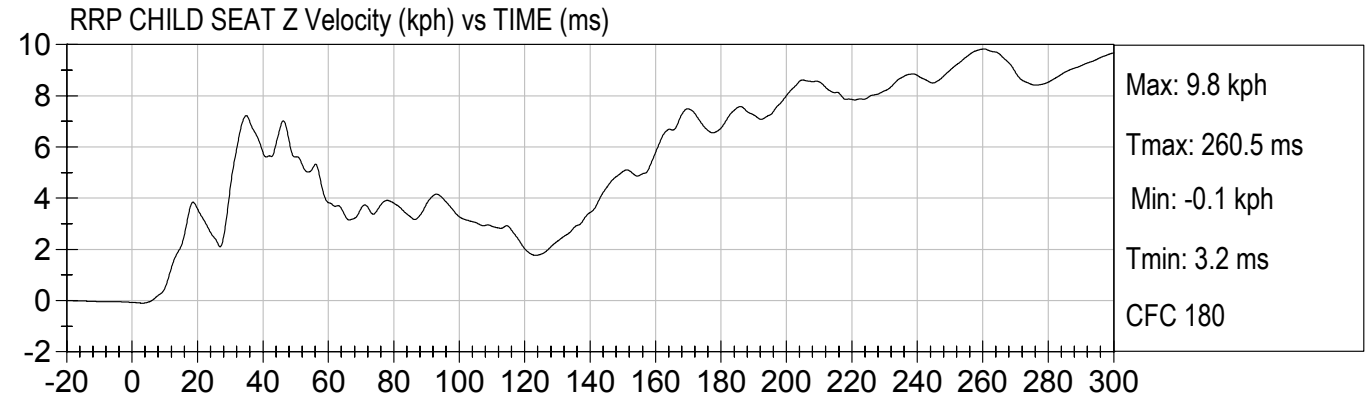



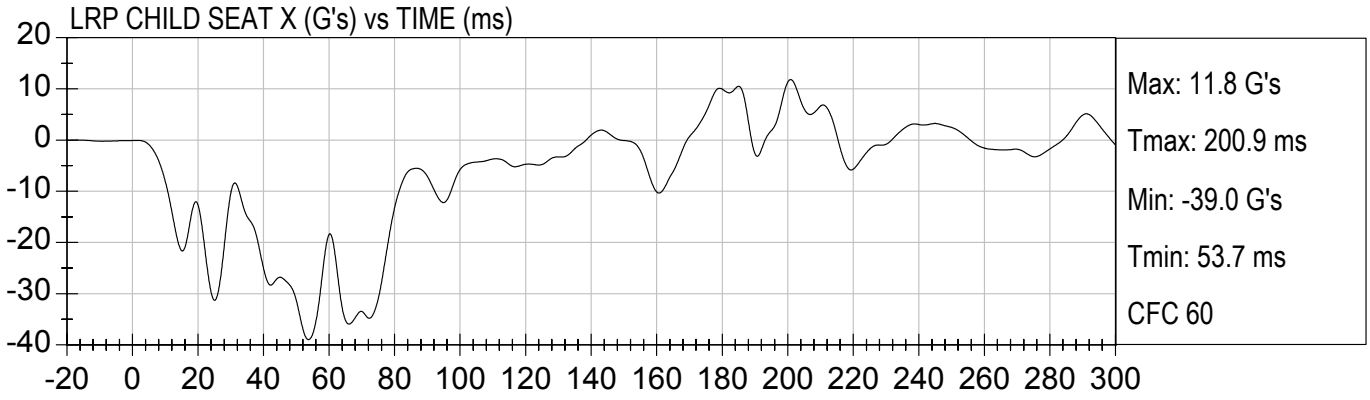



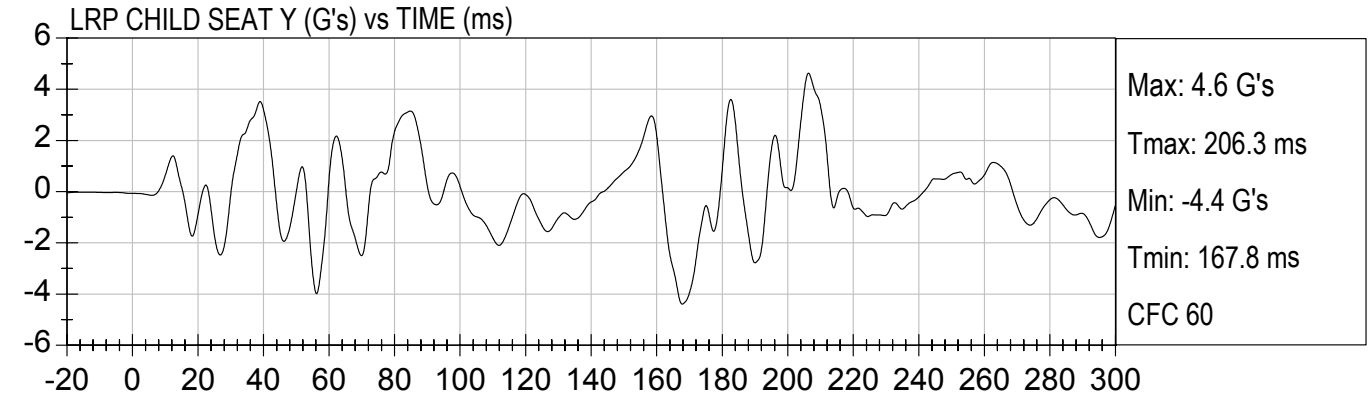



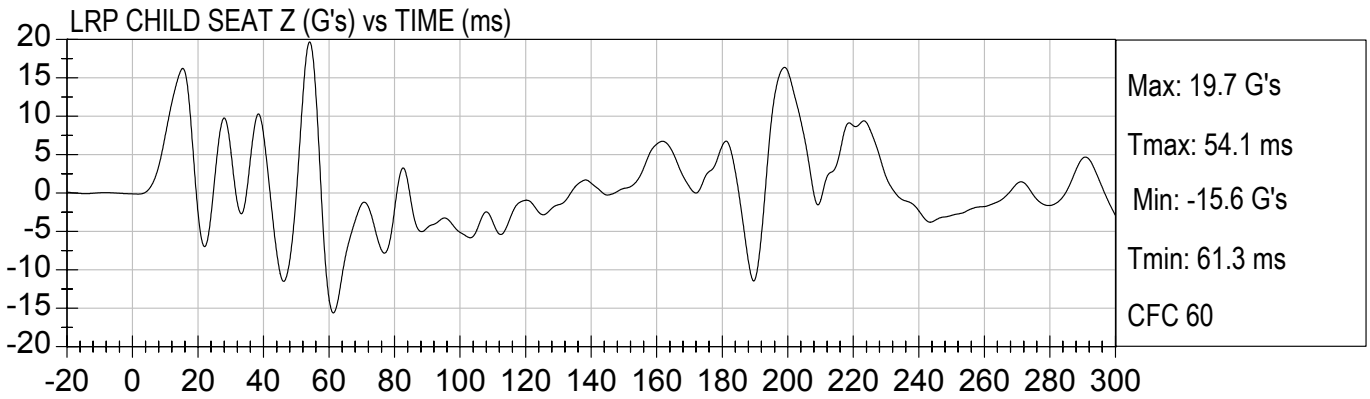

RRP CHILD SEAT X Velocity (kph) vs TIME (ms)
60
50
40
30
20
10
0
-10
-20
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 56.8 kph
Tmax: 0.0 ms
Min: -14.2 kph
Tmin: 153.4 ms
CFC 180

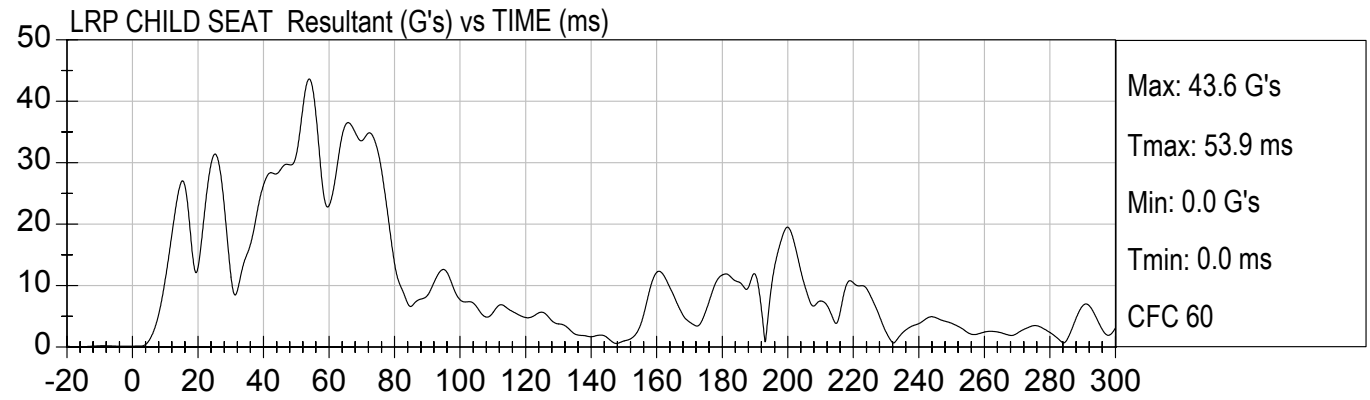

RRP CHILD SEAT Y Velocity (kph) vs TIME (ms)
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.0 kph
Tmax: 0.0 ms
Min: -7.6 kph
Tmin: 114.9 ms
CFC 180

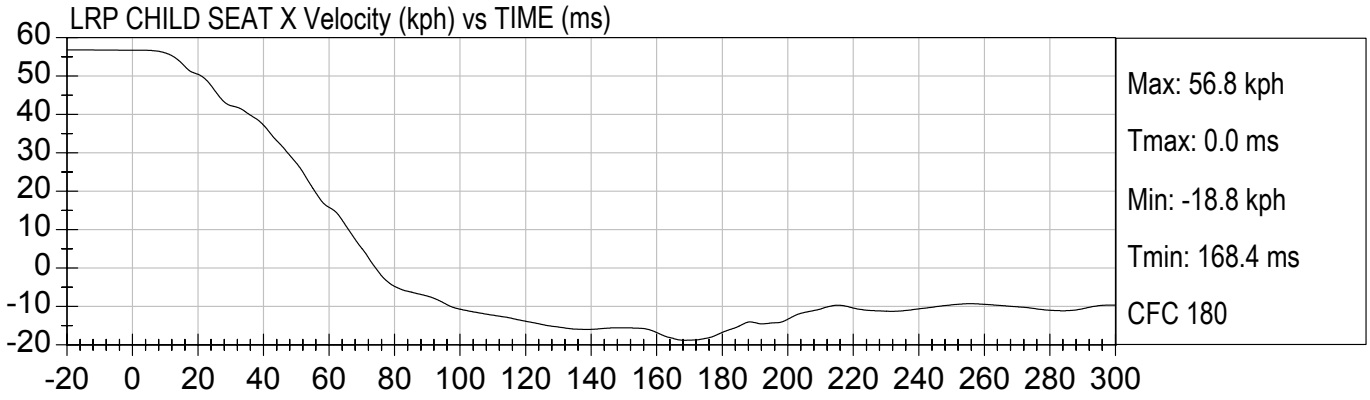

RRP CHILD SEAT Z Velocity (kph) vs TIME (ms)
10
8
6
4
2
0
-2
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 9.8 kph
Tmax: 260.5 ms
Min: -0.1 kph
Tmin: 3.2 ms
CFC 180

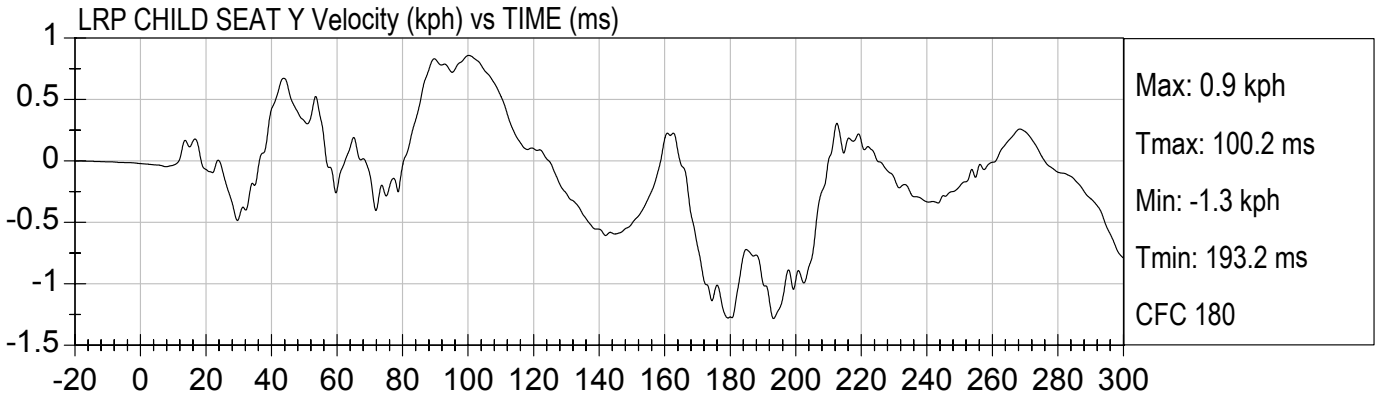

LRP CHILD SEAT X (G's) vs TIME (ms)
Max: 11.8 G's
Tmax: 200.9 ms
Min: -39.0 G's
Tmin: 53.7 ms
CFC 60

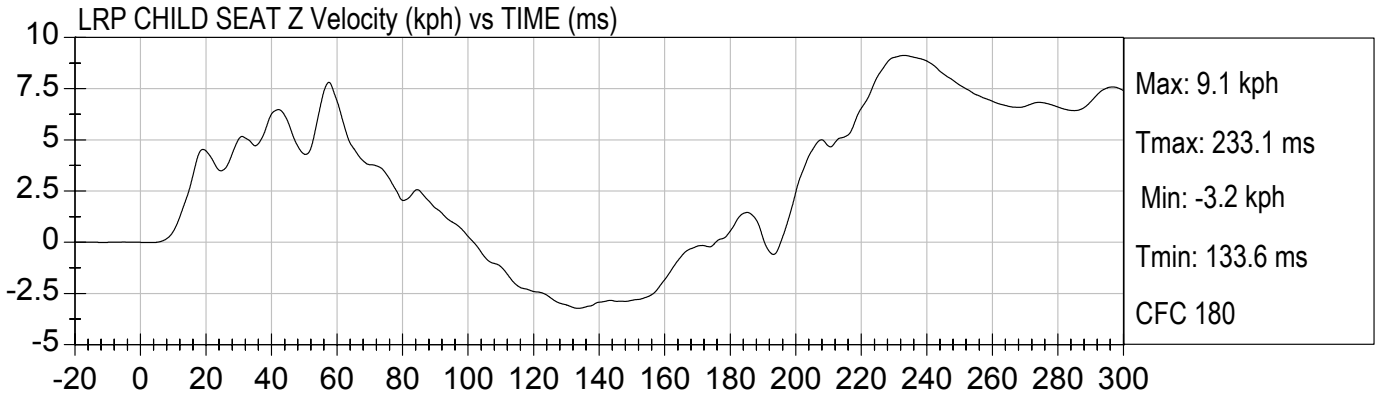

LRP CHILD SEAT Y (G's) vs TIME (ms)
Max: 4.6 G's
Tmax: 206.3 ms
Min: -4.4 G's
Tmin: 167.8 ms
CFC 60


LRP CHILD SEAT Z (G's) vs TIME (ms)
Max: 19.7 G's
Tmax: 54.1 ms
Min: -15.6 G's
Tmin: 61.3 ms
CFC 60


LRP CHILD SEAT Resultant (G's) vs TIME (ms)
Max: 43.6 G's
Tmax: 53.9 ms
Min: 0.0 G's
Tmin: 0.0 ms
CFC 60


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: -18.8 kph
Tmin: 168.4 ms
CFC 180


LRP CHILD SEAT Y Velocity (kph) vs TIME (ms)
1
0.5
0
-0.5
-1
-1.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 0.9 kph
Tmax: 100.2 ms
Min: -1.3 kph
Tmin: 193.2 ms
CFC 180


LRP CHILD SEAT Z Velocity (kph) vs TIME (ms)
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: 9.1 kph
Tmax: 233.1 ms
Min: -3.2 kph
Tmin: 133.6 ms
CFC 180

# 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

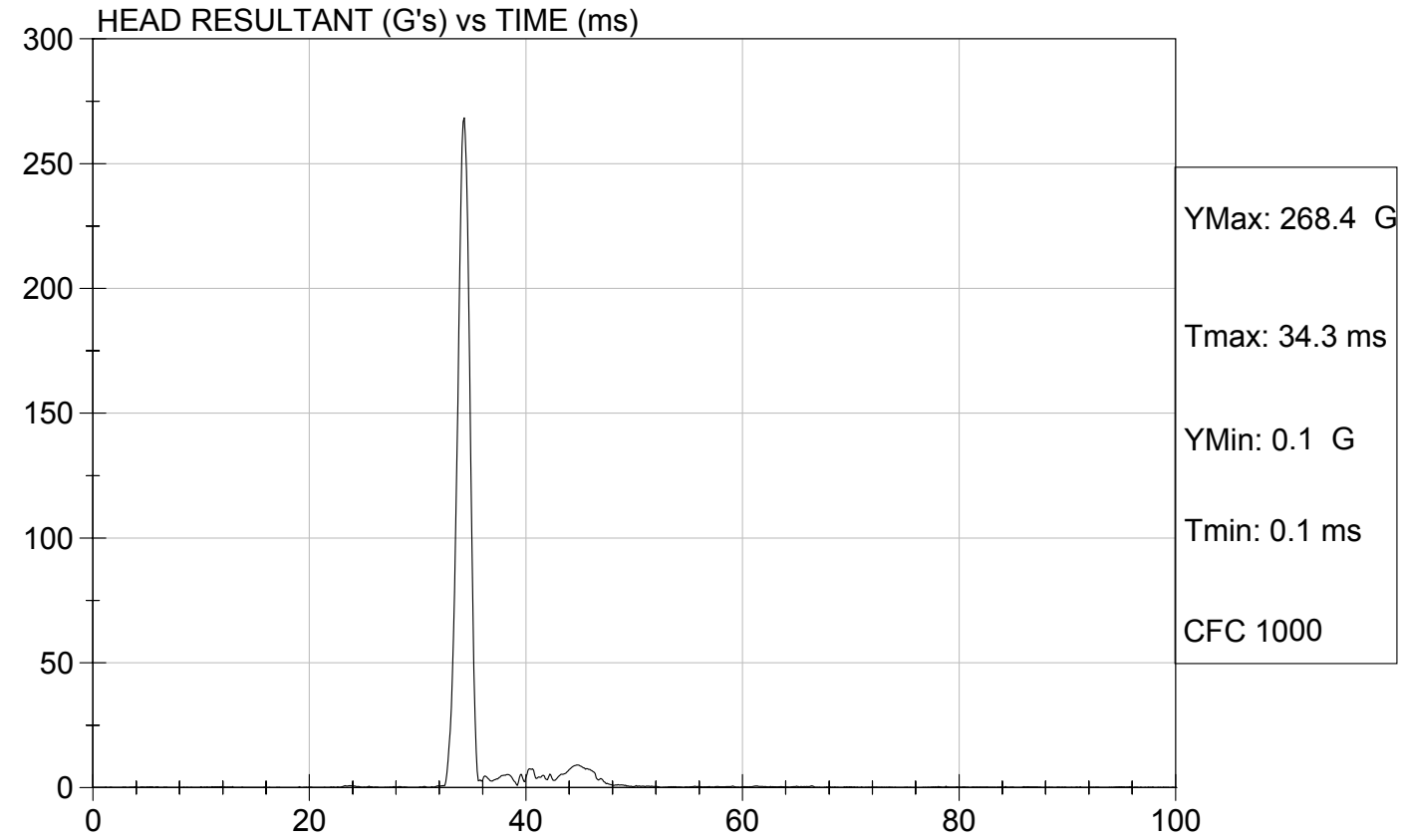
| Tested Parameter | Units | Specification | Result | Pass/Fail |
|---|---|---|---|---|
| Laboratory Temperature | deg C | 18.9 to 25.5 | 21.7 | Pass |
| Laboratory Relative Humidity | % | 10 to 70 | 46 | Pass |
| Peak Resultant Acceleration | G's | 250.0 to 280.0 | 268.4 | Pass |
| Peak Lateral Acceleration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

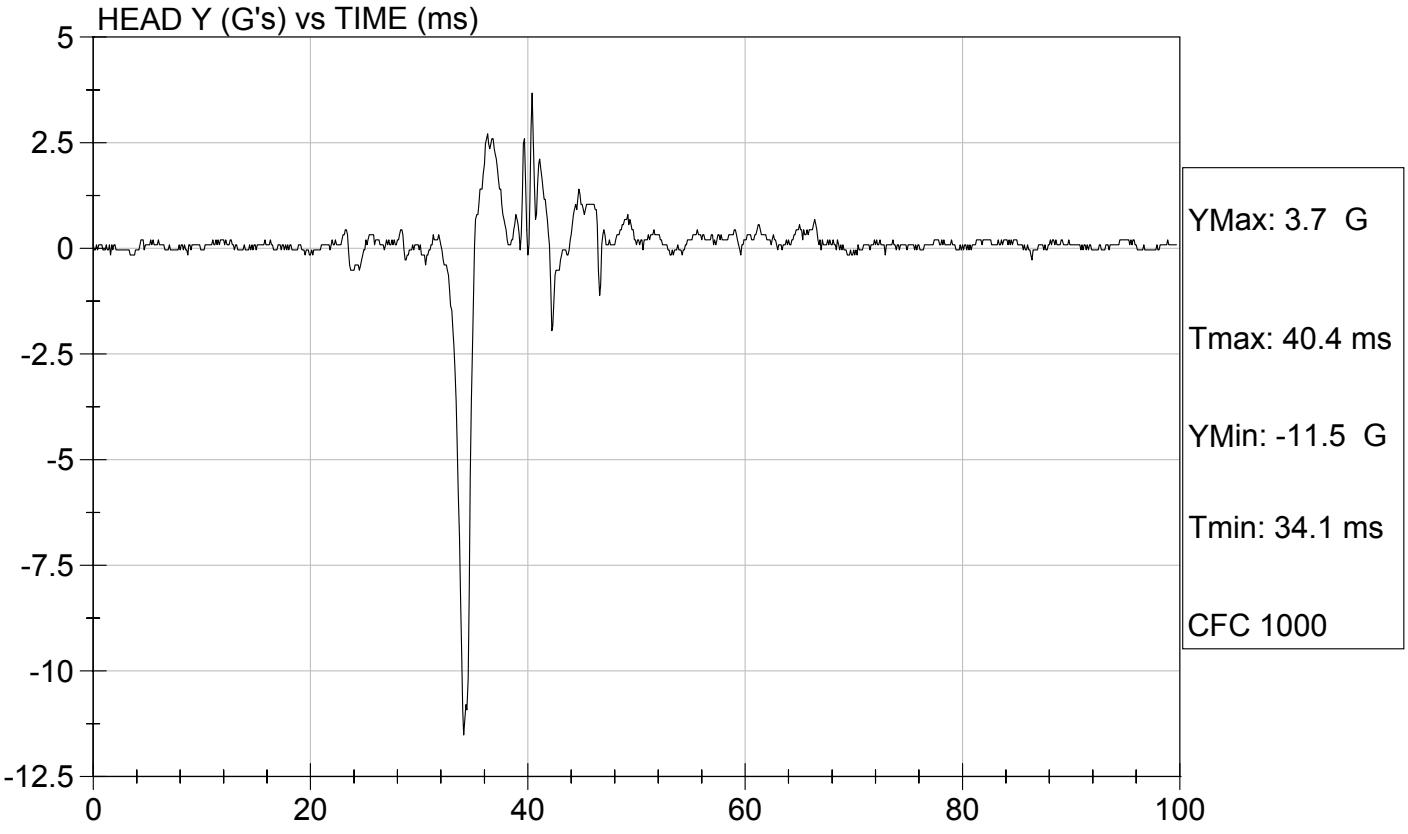
Jessica Hall
Laboratory Technician

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 |

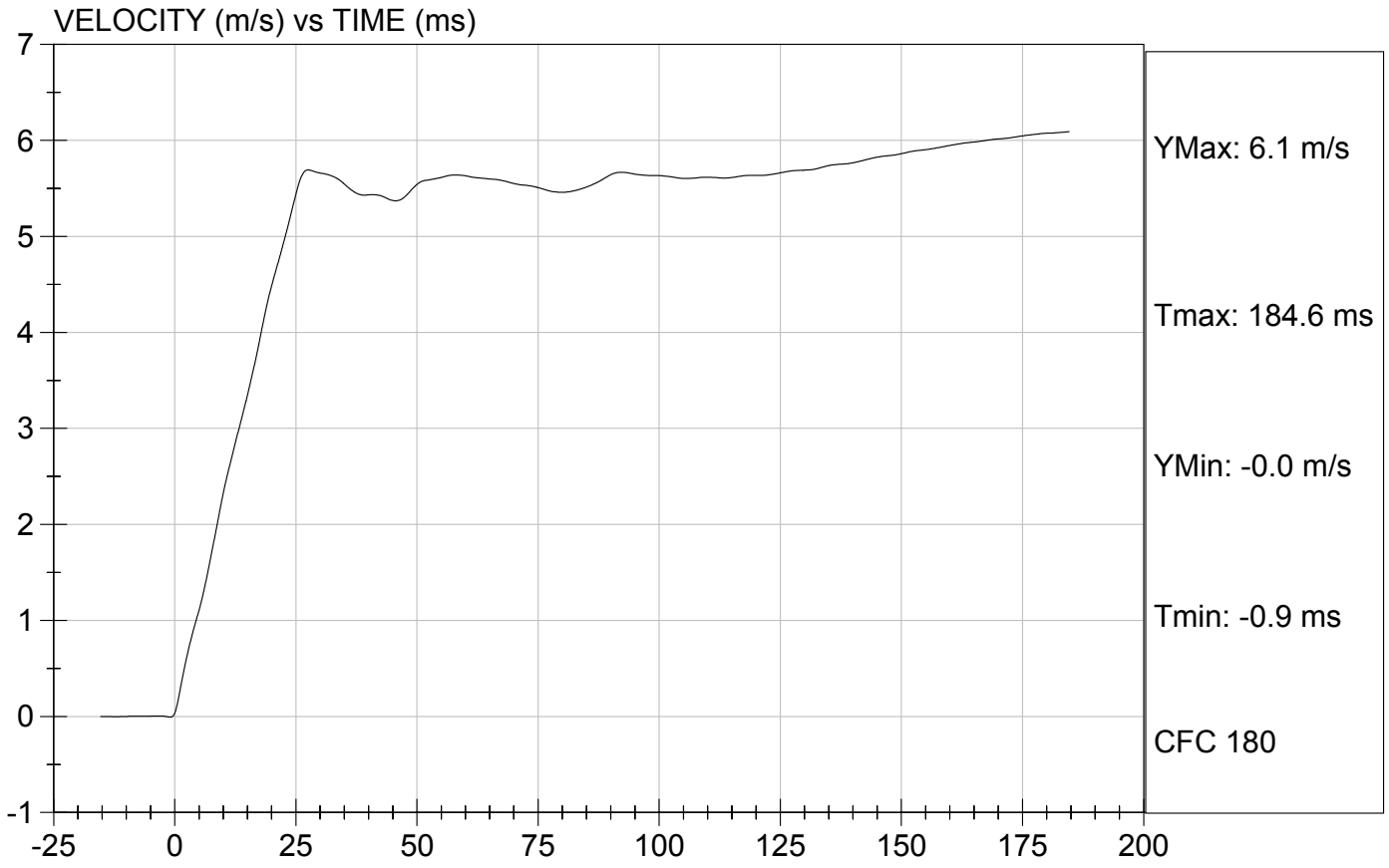
Jessica Hall
Laboratory Technician

08/06/2004
Test Date

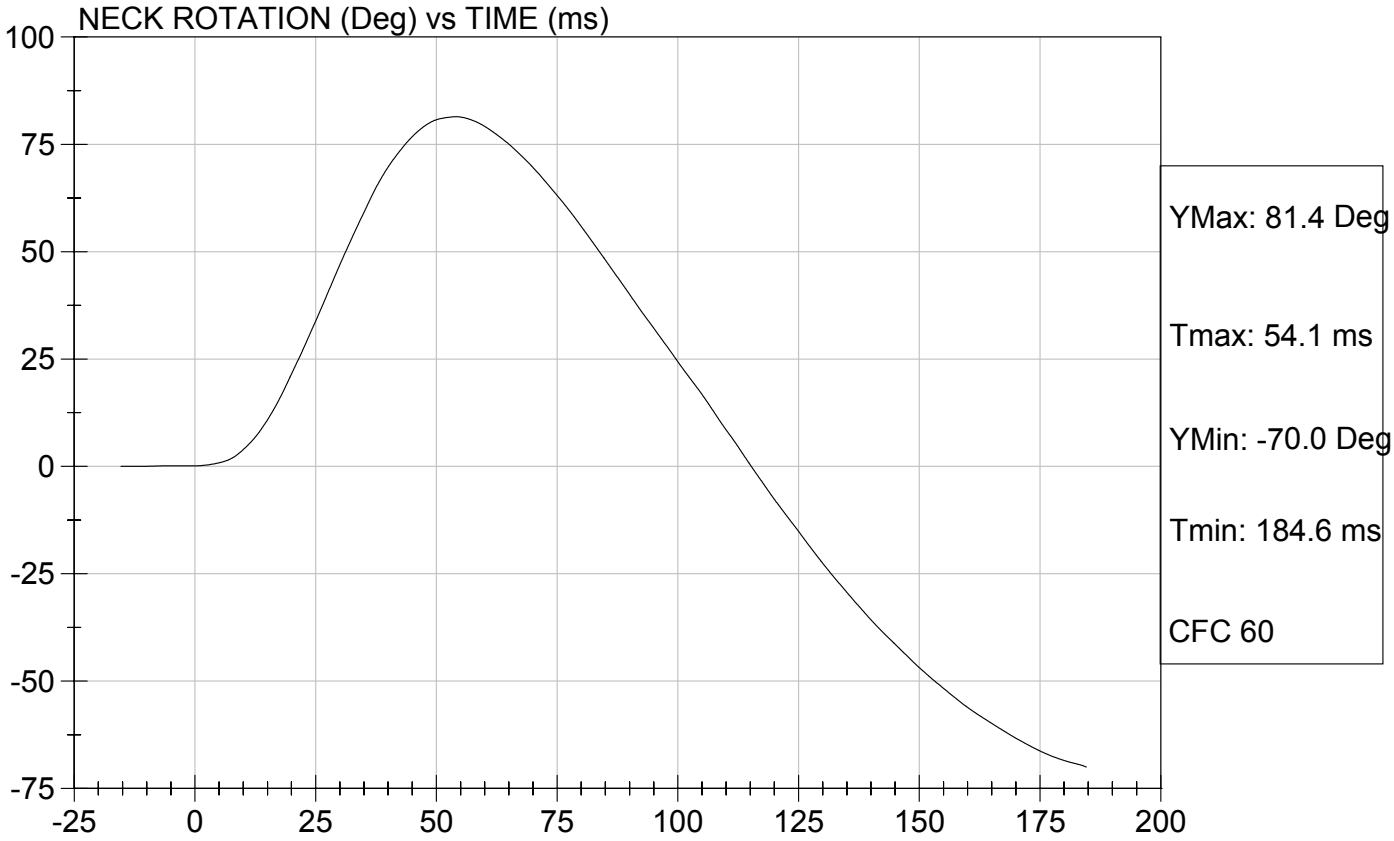
David Winkelbauer
Approved By

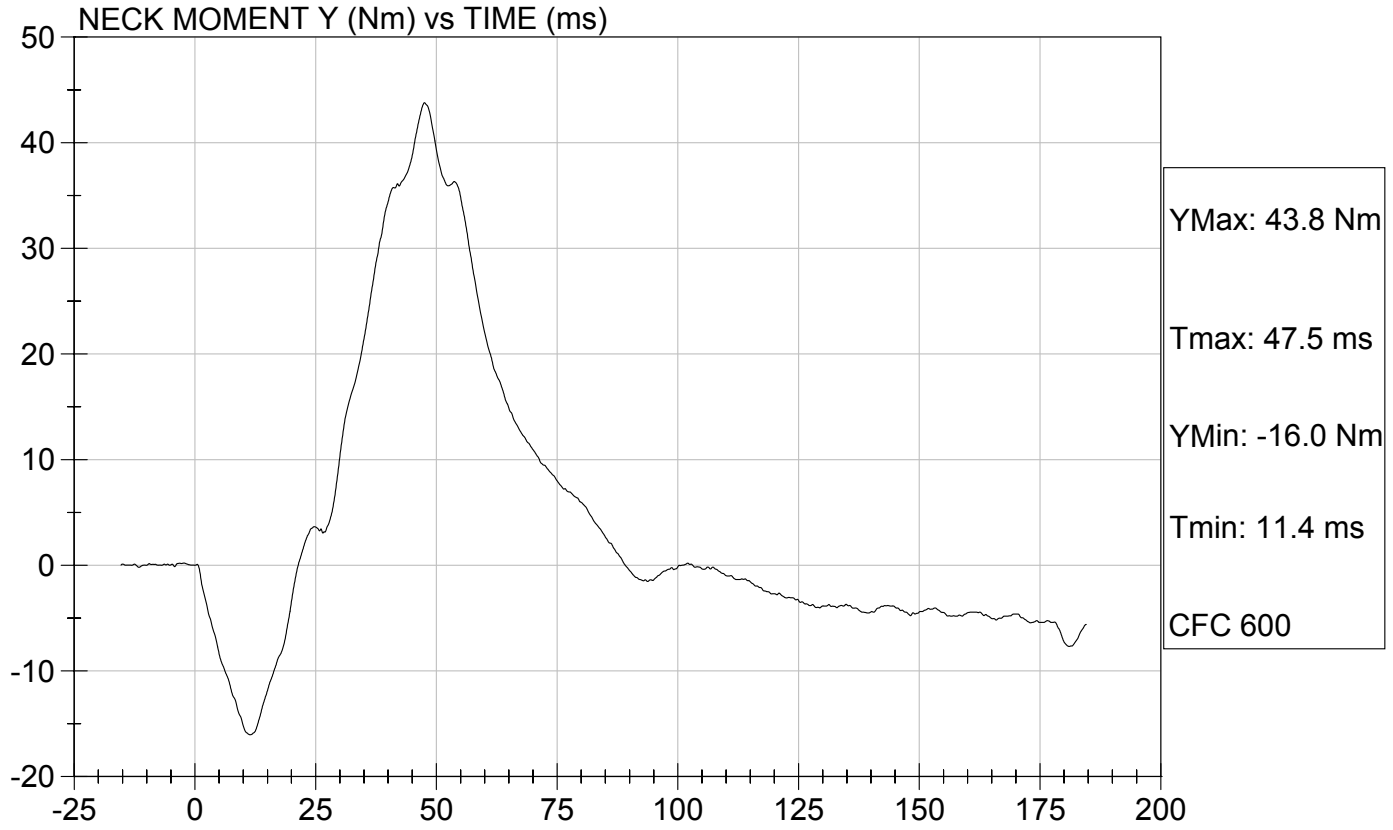
Test Description: Neck Flexion | Test Date: 08/06/2004

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 |

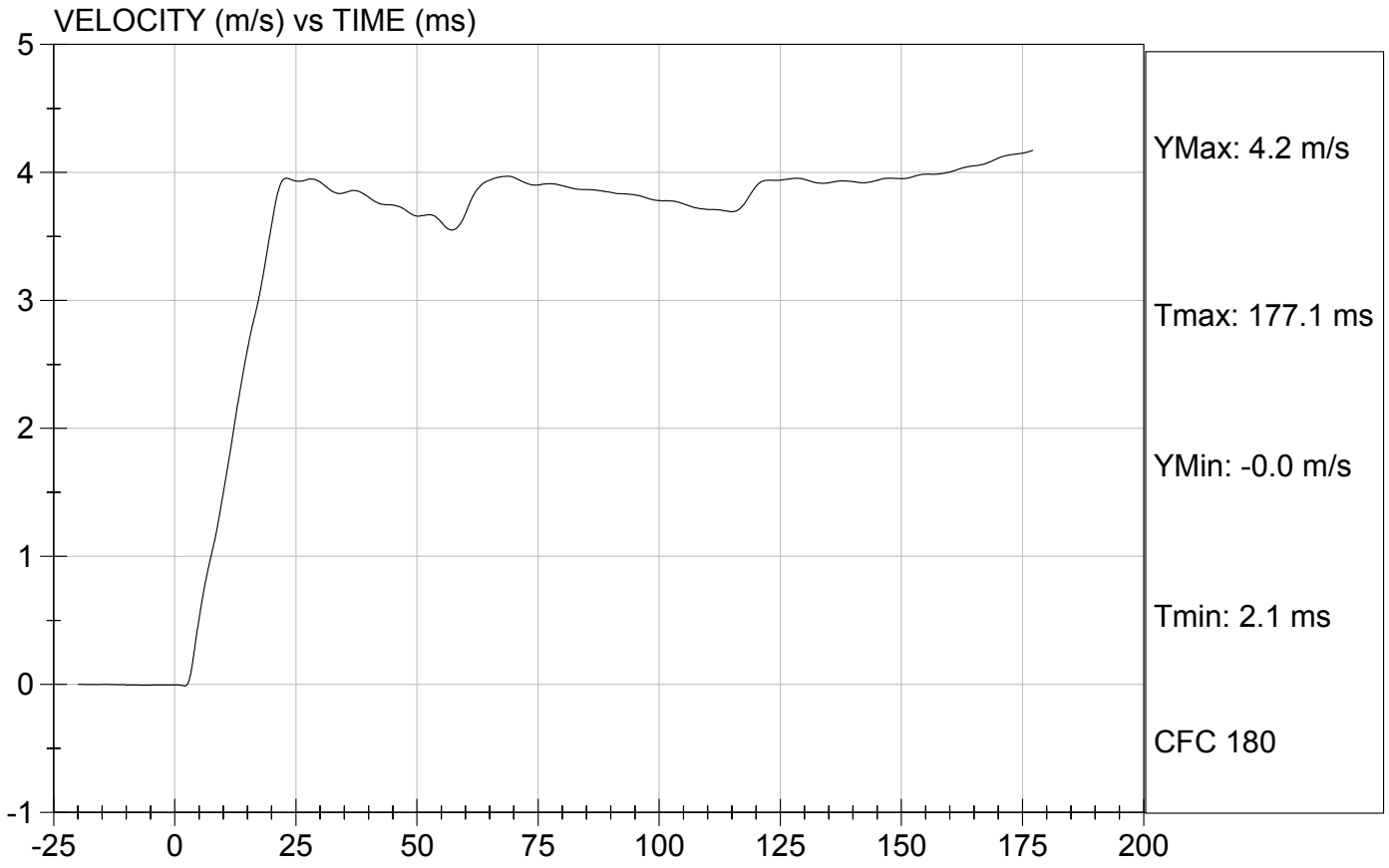
Jessica Hall
Laboratory Technician

08/06/2004
Test Date

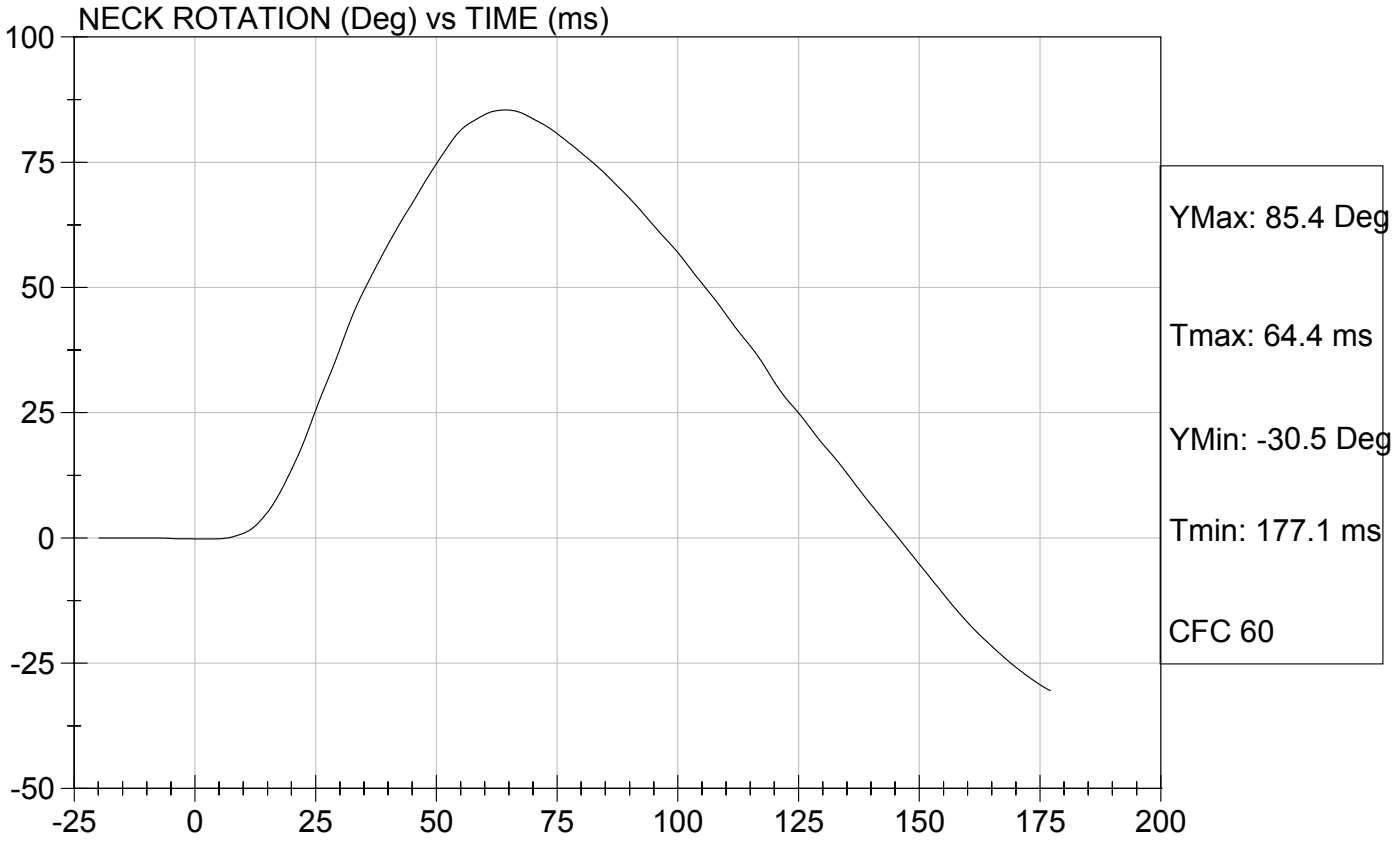
David Winkelbauer
Approved By

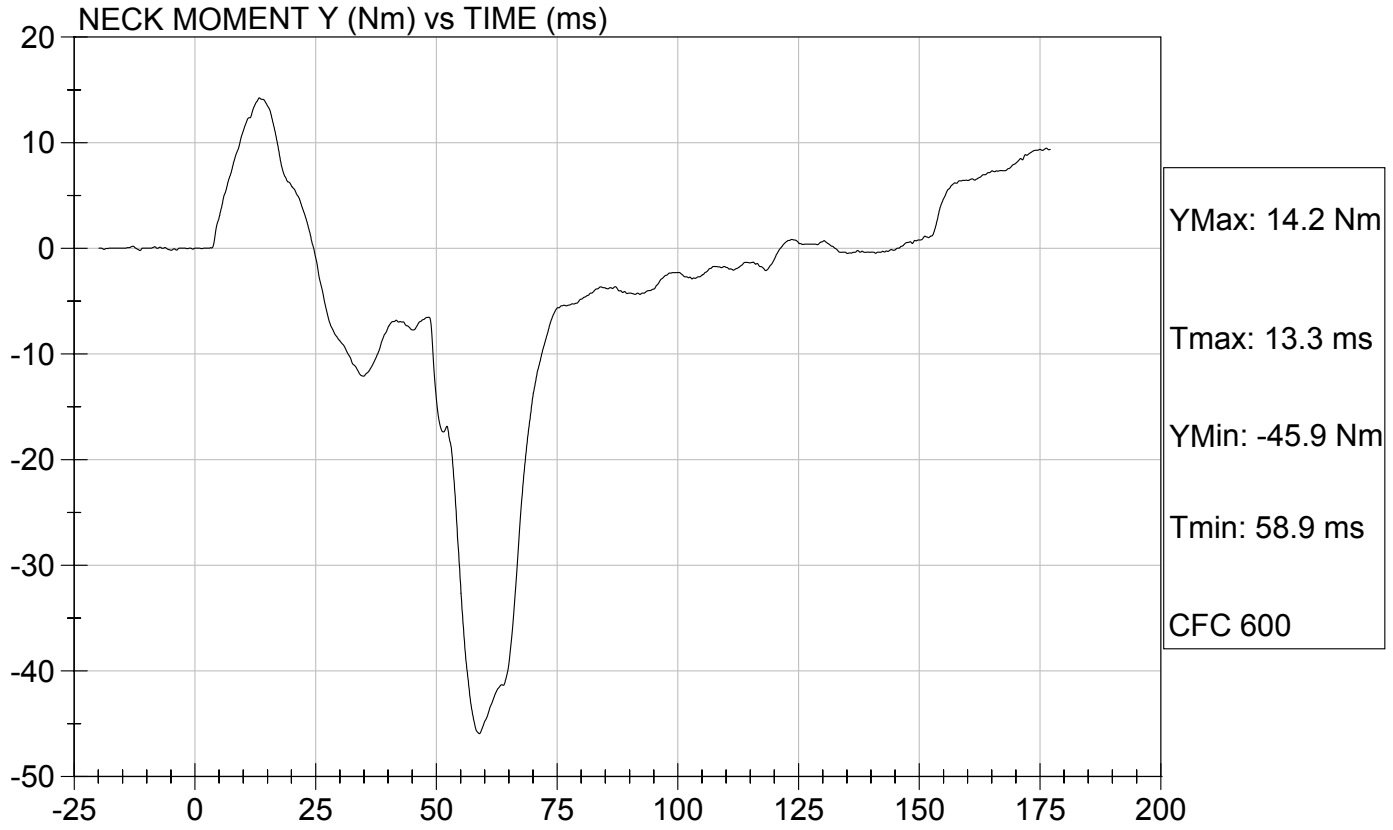
Test Description: Neck Extension  Test Date: 08/06/2004

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 |

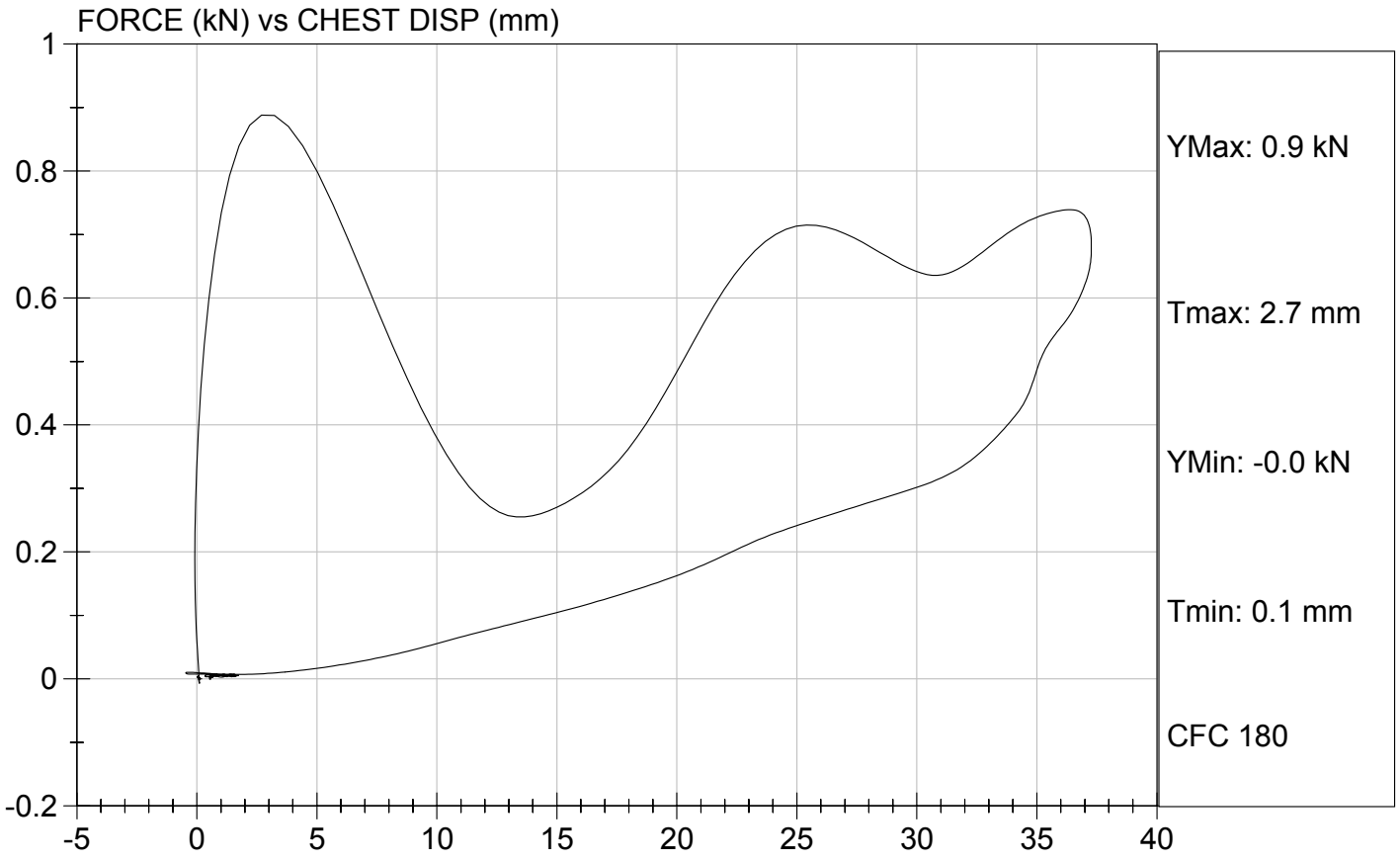
Jessica Hall
Laboratory Technician

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 6 Year Old Serial No. 144 Calibration No. 05


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

# Transportation Research Center Inc.
## 572N HIII 6 Year Old Dummy
## External Dimensions
## Serial No. 144 Calibration No. 05

| Test Parameter | Dimension | Specification | Results | Pass |
|---|---|---|---|---|
| Total Sitting Height | A | 622.3 - 647.7 mm | 643 mm | Yes |
| Shoulder Pivot Height | B | 348.0 - 363.2 mm | 358 mm | Yes |
| Hip Pivot Height | C | 63.5 - 73.7 mm | 73 mm | Yes |
| Hip Pivot from Backline | D | 88.9 - 99.1 mm | 98 mm | Yes |
| Shoulder Pivot from Backline | E | 53.3 - 63.5 mm | 57 mm | Yes |
| Thigh Clearance | F | 88.9 - 104.1 mm | 95 mm | Yes |
| Back of Elbow to Wrist Pivot | G | 182.9 - 198.1 mm | 189 mm | Yes |
| Head Back to Backline | H | 17.8 - 22.8 mm | 22 mm | Yes |
| Shoulder to Elbow Length | I | 215.9 - 231.1 mm | 225 mm | Yes |
| Elbow Rest Height | J | 157.4 - 177.8 mm | 172 mm | Yes |
| Buttock to Knee Length | K | 370.8 - 391.2 mm | 375 mm | Yes |
| Popliteal Height | L | 269.2 - 289.6 mm | 276 mm | Yes |
| Knee to Floor Height | M | 307.4 - 322.6 mm | 313 mm | Yes |
| Buttock Popliteal Height | N | 320.0 - 340.4 mm | 332 mm | Yes |
| Chest Depth without Jacket | O | 129.6 - 144.8 mm | 138 mm | Yes |
| Foot Length | P | 170.2 - 184.6 mm | 175 mm | Yes |
| Buttock to Knee Pivot Length | R | 342.9 - 363.2 mm | 354 mm | Yes |
| Head Breadth | S | 137.1 - 147.3 mm | 139 mm | Yes |
| Head Depth | T | 167.6 - 177.8 mm | 170 mm | Yes |
| Hip Breadth | U | 208.3 - 223.5 mm | 215 mm | Yes |
| Shoulder Breadth | V | 259.1 - 274.3 mm | 270 mm | Yes |
| Foot Breadth | W | 62.3 - 77.5 mm | 66 mm | Yes |
| Head Circumference | X | 510.5 - 530.9 mm | 519 mm | Yes |
| Chest Circumference with Jacket | Y | 596.9 - 622.3 mm | 613 mm | Yes |
| Waist Circumference | Z | 558.8 - 584.2 mm | 571 mm | Yes |
| Reference Location for Chest Circumference | AA | 325.1 - 335.3 mm | 330 mm | Yes |
| Reference Location for Waist Circumference | BB | 153.7 - 163.9 mm | 158 mm | Yes |

Technician

Approved

# Transportation Research Center Inc.

572N Head Drop Test

HIII 6 Year Old Serial No. 144 Calibration No. 05 - 3

Test Date 07/23/2004

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 18.9 - 25.6 °C | 21.9 °C | Yes |
| Relative Humidity | 10 - 70 % | 51 % | Yes |
| Peak Resultant Acceleration | 245 - 300 g | 299.8 g | Yes |
| Peak Lateral Acceleration | 15 g Max | 4.9 g | Yes |
| Is Acceleration Curve Unimodal? | Yes | Yes | Yes |

**Test meets specifications.**

**Comments:**

Technician

Approved

07.23.2004 16:03:07 614

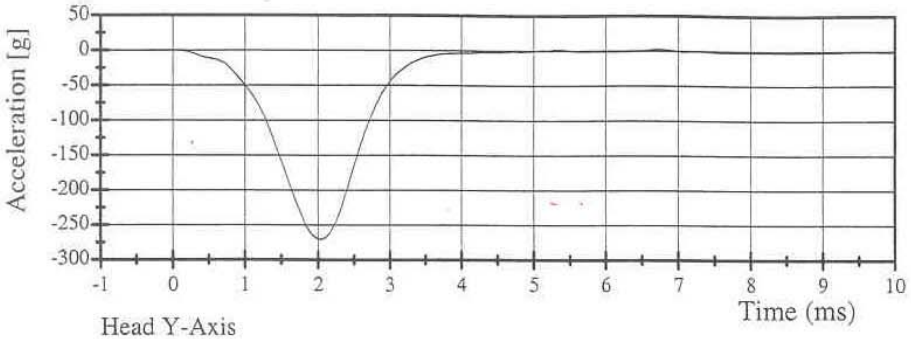
# Transportation Research Center Inc.

572N Head Drop Test

HIII 6 Year Old Serial No. 144 Calibration No. 05 - 3

Test Date 07/23/2004

Head X-Axis

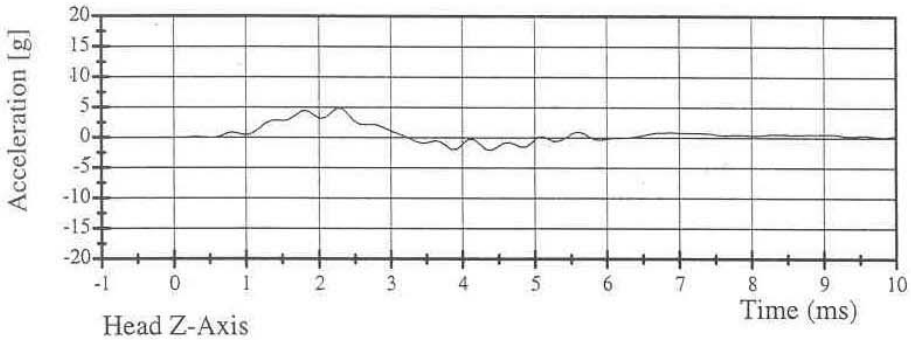



Filter Class: 1000

Max: 2.8 g at 6.7 ms

Min: -270.8 g at 2.0 ms

Head Y-Axis

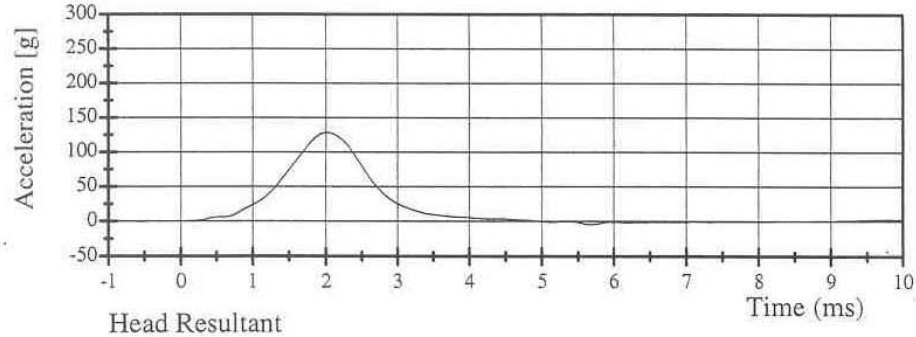



Filter Class: 1000

Max: 4.9 g at 2.3 ms

Min: -2.1 g at 4.4 ms

Head Z-Axis

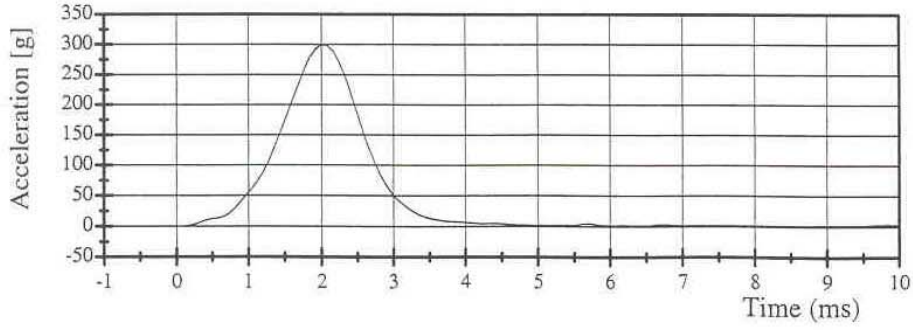



Filter Class: 1000

Max: 128.6 g at 2.0 ms

Min: -4.7 g at 5.7 ms

Head Resultant




Filter Class: 1000

Max: 299.8 g at 2.0 ms

Min: 0.0 g at 0.9 ms

07.23.2004 16:03:09 614

# Transportation Research Center Inc.

572N Neck Flexion Test - 6 Channel Transducer

HIII 6 Year Old Serial No. 144 Calibration No. 05 - 3

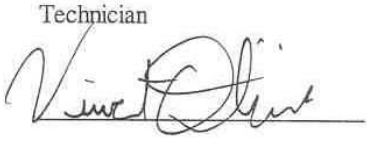
Test Date 07/26/2004

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 20.6 - 22.2 °C | 21.9 °C | Yes |
| Relative Humidity | 10 - 70 % | 58 % | Yes |
| Impact Velocity | 4.83 - 5.07 m/s | 5.04 m/s | Yes |
| Integrated Pendulum Velocity | | | |
| 10 ms | 1.20 - 1.60 m/s | 1.56 m/s | Yes |
| 20 ms | 2.40 - 3.40 m/s | 3.00 m/s | Yes |
| 30 ms | 3.80 - 5.00 m/s | 4.35 m/s | Yes |
| Peak D Plane Rotation | 74 - 92 ° | 75.9 ° | Yes |
| Peak Moment About Occipital Condyles (During time interval rotation is within specified corridors) | 27.0 - 33.0 N·m | 30.69 N·m | Yes |
| Positive Moment Decay Time To 5 N·m | 103 - 123 ms | 111.36 ms | Yes |

**Test meets specifications.**

**Comments:**

Technician



Approved

07.26.2004 12:55:37 713

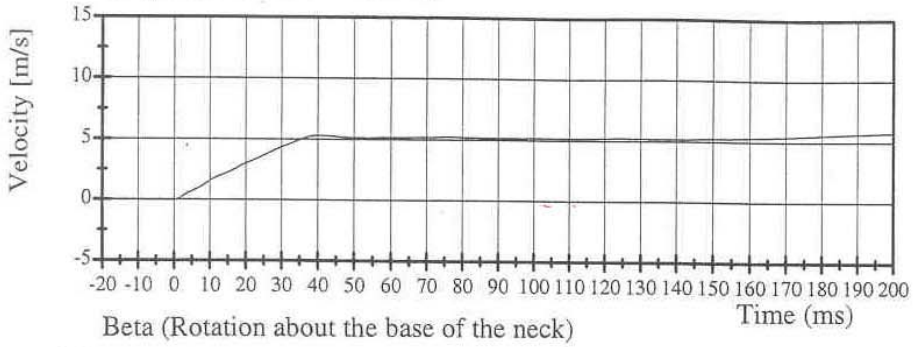
# Transportation Research Center Inc.

572N Neck Flexion Test

HIII 6 Year Old Serial No. 144 Calibration No. 05 - 3

Test Date 07/26/2004

Integrated Pendulum Velocity

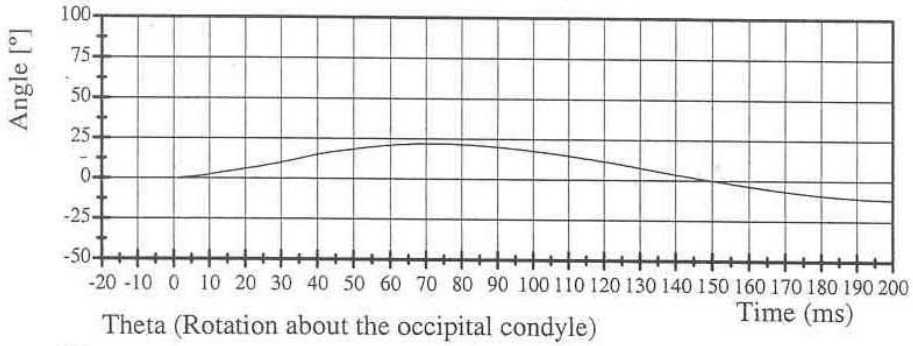



Filter Class: 180

Max: 6.3 m/s at 282.9 ms

Min: -0.0 m/s at -0.1 ms

Beta (Rotation about the base of the neck)

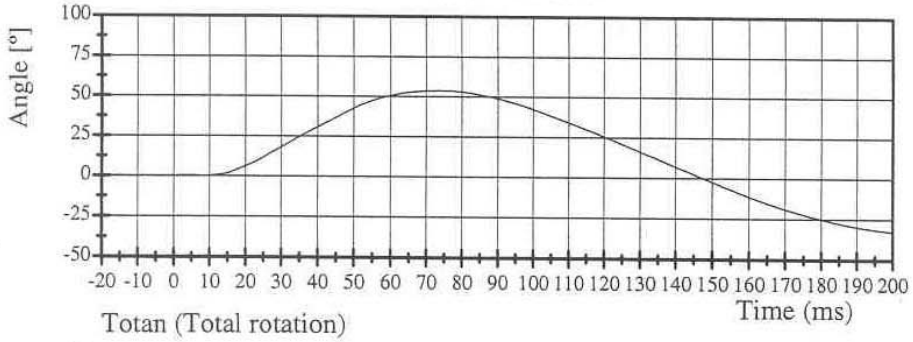



Filter Class: 60

Max: 22.1 ° at 71.1 ms

Min: -12.2 ° at 210.6 ms

Theta (Rotation about the occipital condyle)

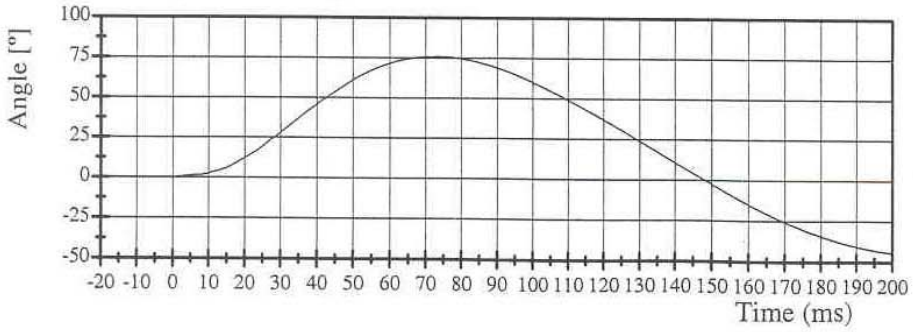



Filter Class: 60

Max: 53.8 ° at 73.7 ms

Min: -33.9 ° at 213.2 ms

Totan (Total rotation)




Filter Class: 60

Max: 75.9 ° at 73.4 ms

Min: -46.0 ° at 212.6 ms

07.26.2004 12:55:38 713

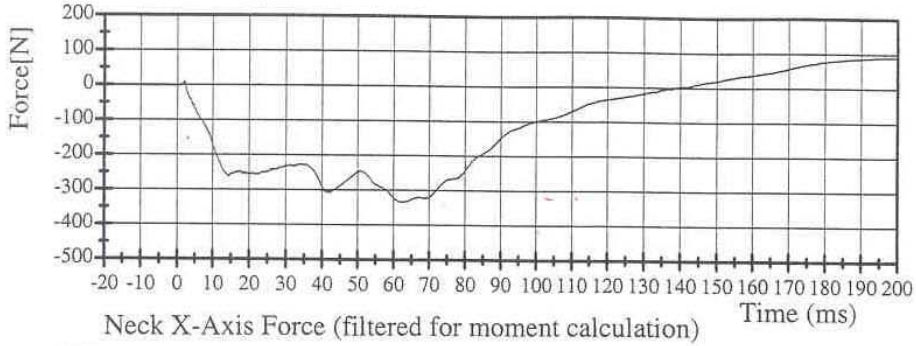
# Transportation Research Center Inc.

572N Neck Flexion Test

HIII 6 Year Old Serial No. 144 Calibration No. 05 - 3

Test Date 07/26/2004

Neck X-Axis Force

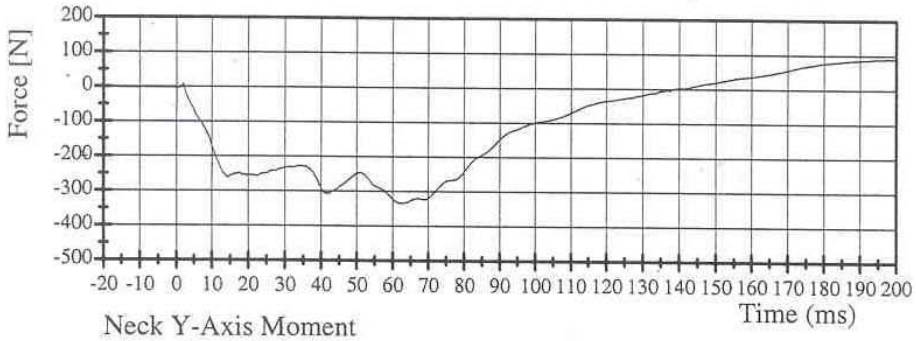



Filter Class: 1000

Max: 91.2 N at 197.5 ms

Min: -334.4 N at 61.8 ms

Neck X-Axis Force (filtered for moment calculation)

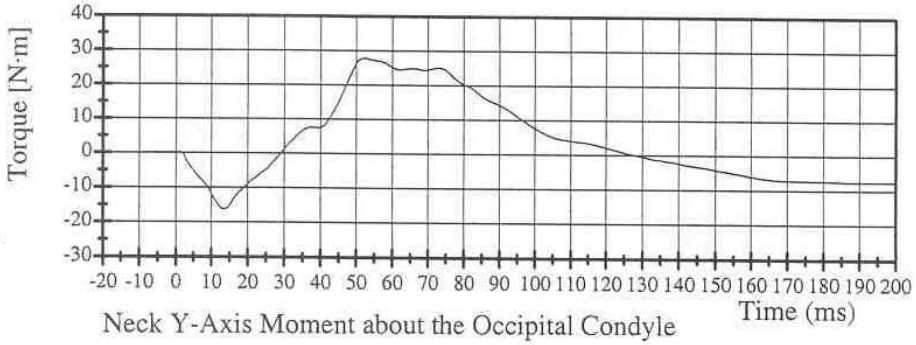



Filter Class: 600

Max: 90.7 N at 199.1 ms

Min: -334.2 N at 62.5 ms

Neck Y-Axis Moment

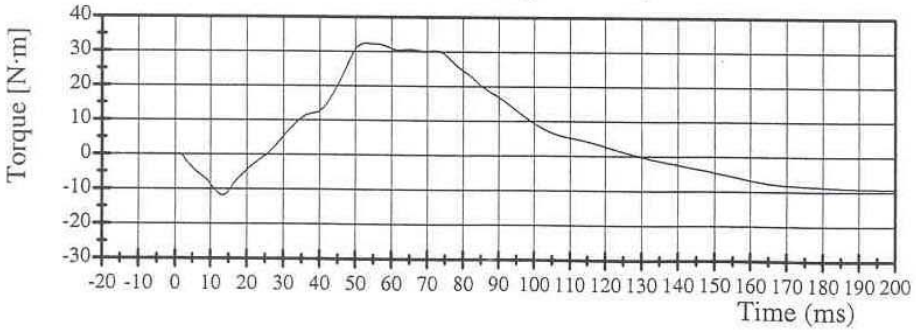



Filter Class: 600

Max: 27.8 N·m at 52.3 ms

Min: -16.2 N·m at 13.8 ms

Neck Y-Axis Moment about the Occipital Condyle




Filter Class: 600

Max: 32.4 N·m at 53.3 ms

Min: -11.7 N·m at 13.3 ms

07.26.2004 12:55:39 713

# Transportation Research Center Inc.

572N Neck Extension Test - 6 Channel Transducer

HIII 6 Year Old Serial No. 144 Calibration No. 05 - 5

Test Date 07/26/2004

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 20.6 - 22.2 °C | 22.0 °C | Yes |
| Relative Humidity | 10 - 70 % | 57 % | Yes |
| Impact Velocity | 4.18 - 4.42 m/s | 4.41 m/s | Yes |
| Integrated Pendulum Velocity | | | |
| 10 ms | 1.00 - 1.40 m/s | 1.26 m/s | Yes |
| 20 ms | 2.20 - 3.00 m/s | 2.36 m/s | Yes |
| 30 ms | 3.20 - 4.20 m/s | 3.48 m/s | Yes |
| Peak D Plane Rotation | 85 - 103 ° | 90.0 ° | Yes |
| Peak Moment About Occipital Condyles (During time interval rotation is within specified corridors) | -24.0 - (-19.0) N·m | -22.81 N·m | Yes |
| Negative Moment Decay Time To -5 N·m | 123 - 147 ms | 134.16 ms | Yes |

**Test meets specifications.**

**Comments:**

Technician

Approved

07.26.2004 16:15:00 829

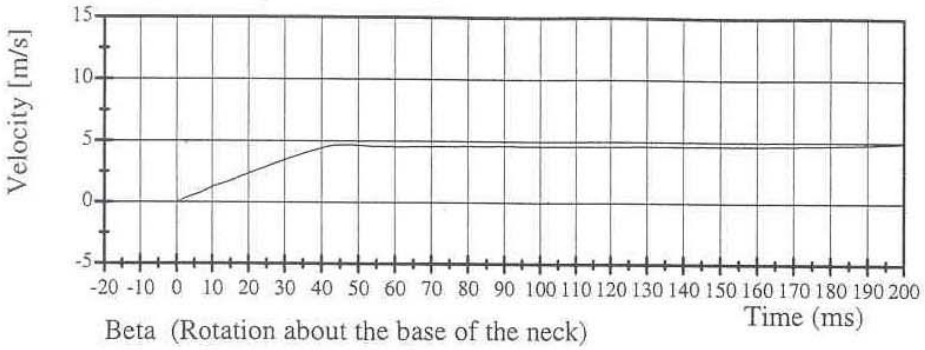
# Transportation Research Center Inc.

572N Neck Extension Test

HIII 6 Year Old Serial No. 144 Calibration No. 05 - 5

Test Date 07/26/2004

Integrated Pendulum Velocity

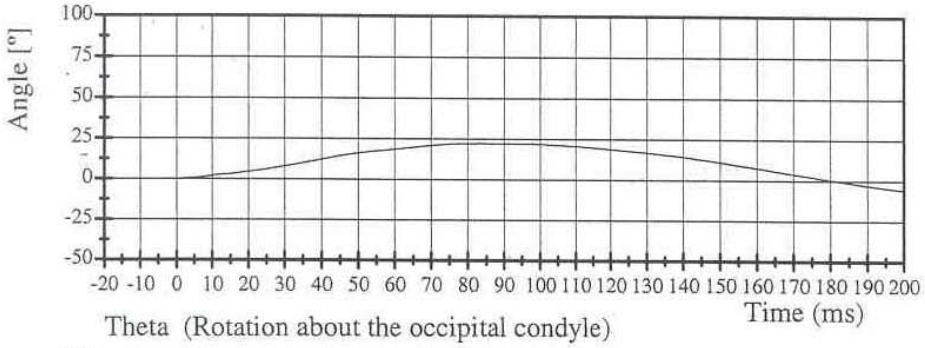



Filter Class: 180

Max: 5.8 m/s at 933.7 ms

Min: -0.0 m/s at -38.7 ms

Beta (Rotation about the base of the neck)

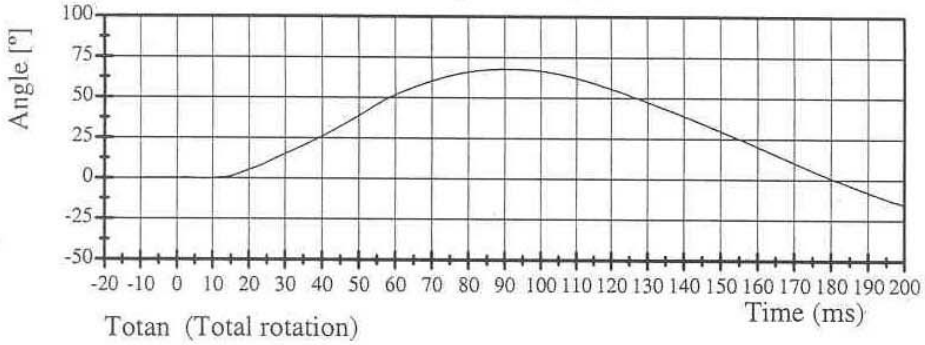



Filter Class: 60

Max: 22.3 ° at 83.7 ms

Min: -10.3 ° at 232.8 ms

Theta (Rotation about the occipital condyle)

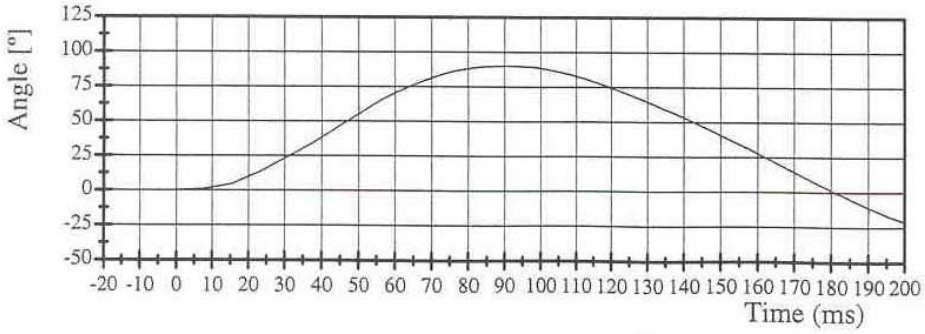



Filter Class: 60

Max: 67.7 ° at 91.1 ms

Min: -25.6 ° at 233.5 ms

Totan (Total rotation)




Filter Class: 60

Max: 90.0 ° at 90.5 ms

Min: -35.9 ° at 233.4 ms

07.26.2004 16:15:01 829

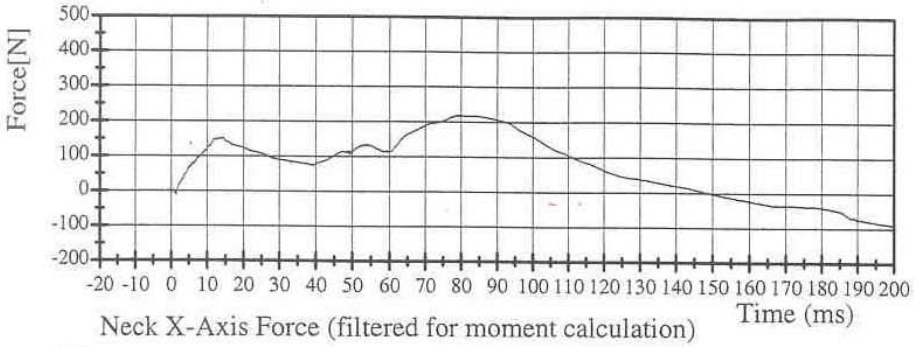
# Transportation Research Center Inc.

572N Neck Extension Test

HIII 6 Year Old Serial No. 144 Calibration No. 05 - 5

Test Date 07/26/2004

Neck X-Axis Force

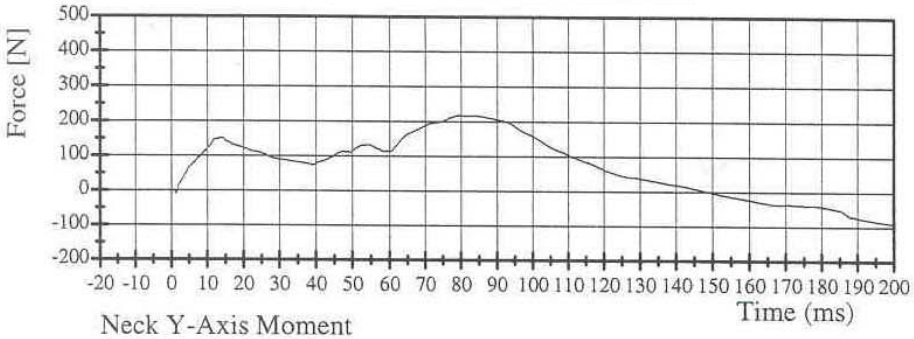



Filter Class: 1000

Max: 219.2 N at 79.5 ms

Min: -112.8 N at 221.4 ms

Neck X-Axis Force (filtered for moment calculation)

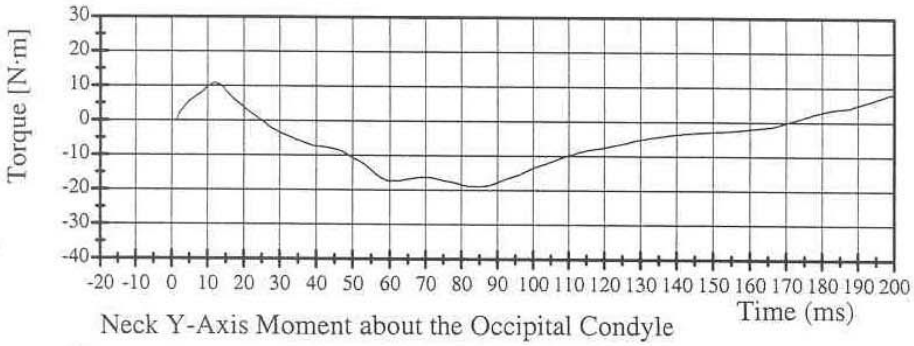



Filter Class: 600

Max: 218.6 N at 79.5 ms

Min: -112.3 N at 221.4 ms

Neck Y-Axis Moment

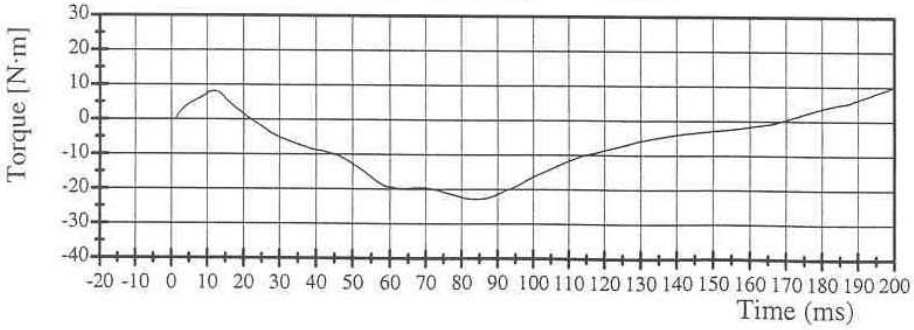



Filter Class: 600

Max: 11.3 N·m at 225.0 ms

Min: -18.9 N·m at 83.9 ms

Neck Y-Axis Moment about the Occipital Condyle




Filter Class: 600

Max: 13.2 N·m at 222.5 ms

Min: -22.8 N·m at 83.9 ms

07.26.2004 16:15:02 829

# Transportation Research Center Inc.

572N Thorax Test

HIII 6 Year Old Serial No. 144 Calibration No. 05 - 2

Test Date 07/29/2004

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 20.6 - 22.2 °C | 21.4 °C | Yes |
| Relative Humidity | 10 - 70 % | 52 % | Yes |
| Pendulum Velocity | 6.59 - 6.83 m/s | 6.61 m/s | Yes |
| Maximum Chest Deflection | -46.0 - (-38.0) mm | -46.0 mm | Yes |
| Peak Impact Probe Force Within Compression Corridor | 1150 - 1380 N | 1212 N | Yes |
| Internal Hysteresis | 65 - 85 % | 73 % | Yes |
| Maximum Force Between 12.5 mm & 38 mm Of Deflection | <= 1500 | 1222 | Yes |

**Test meets specifications.**

**Comments:**

Technician

Approved

07.29.2004 07:28:15 958

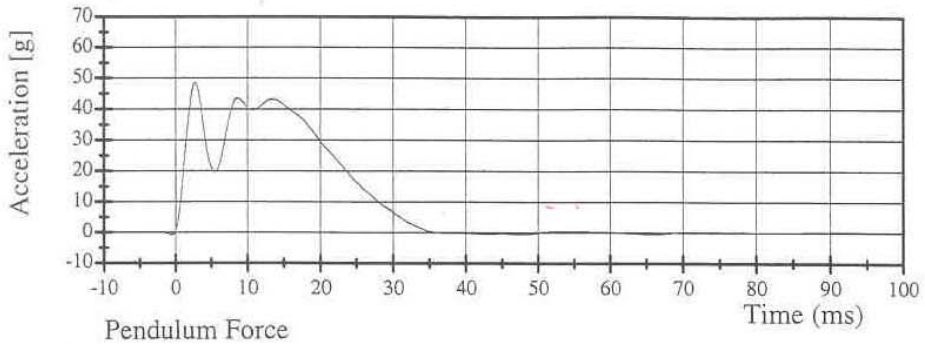
# Transportation Research Center Inc.

572N Thorax Test

HIII 6 Year Old  Serial No. 144  Calibration No. 05 - 2

Test Date 07/29/2004

Pendulum Deceleration

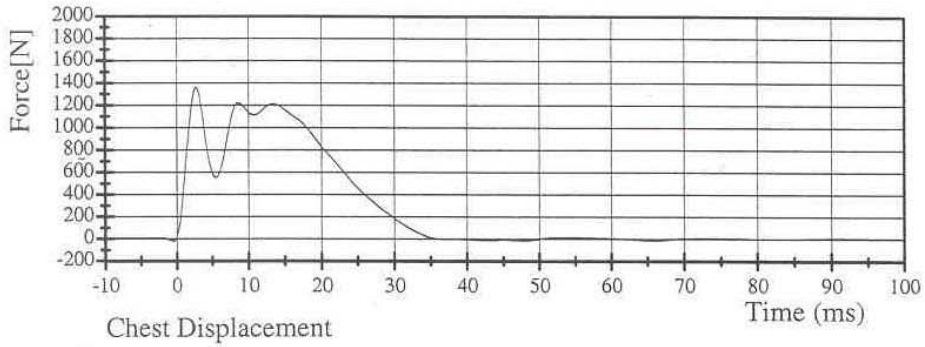



Filter Class: 180

Max: 48.6 g at 2.7 ms

Min: -0.7 g at -0.6 ms

Pendulum Force

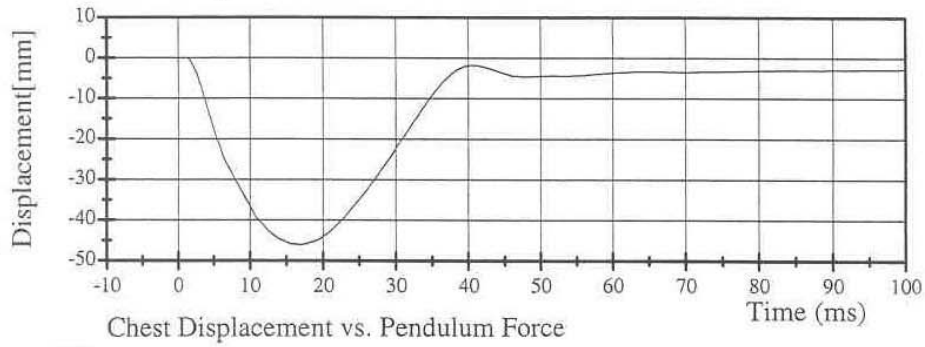



Filter Class: 180

Max: 1363.5 N at 2.7 ms

Min: -19.9 N at -0.6 ms

Chest Displacement

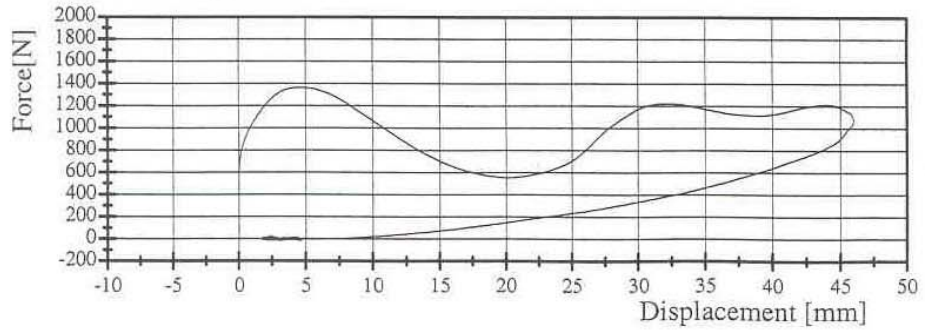



Filter Class: 600

Max: 0.0 mm at -48.2 ms

Min: -46.0 mm at 17.0 ms

Chest Displacement vs. Pendulum Force




07.29.2004 07:28:16 958

TRANSPORTATION RESEARCH CENTER INC.

TORSO FLEXION TEST

HYBRID III SIX-YEAR-OLD

CAL DATE: 29-Jul-04

TRC, INC. TEST NO: 144C05TF2 572 N SN144 TORSO FLEX CAL 05

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---|---|---|
| TEMPERATURE | 20.6 – 22.2 DEG. C | 21.3 DEG. C |
| RELATIVE HUMIDITY | 10 – 70 % | 49 % |
| INITIAL ANGLE OF UNSUPPORRTED DUMMY | <= 22 DEG. REFERENCED TO VERTICAL | 21.1 DEG. |
| MAXIMUM FORCE AT 45 DEG. DURING 10 SECOND PERIOD | 147 – 200 N | 160.9 N |
| RETURN ANGLE | | 24.6 DEG. |
| DIFFERENCE BETWEEN RETURN ANGLE & INTIAL ANGLE | +/- 8 DEG. OF INTIAL ANGLE | 3.5 DEG. |
| RATE | 0.5° - 1.5°/sec | 1.03 °/sec |

TEST MEETS SPECIFICATIONS

TECHNICIAN

# Transportation Research Center Inc.

572N Left Knee Test

HIII 6 Year Old Serial No. 144 Calibration No. 05 - 1

Test Date 07/23/2004

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 18.9 - 25.6 °C | 21.9 °C | Yes |
| Relative Humidity | 10 - 70 % | 49 % | Yes |
| Pendulum Velocity | 2.07 - 2.13 m/s | 2.10 m/s | Yes |
| Maximum Pendulum Force | 2000 - 3000 N | 2444 N | Yes |

**Test meets specifications.**

**Comments:**

Technician

Approved

07.23.2004 15:10:43 1688

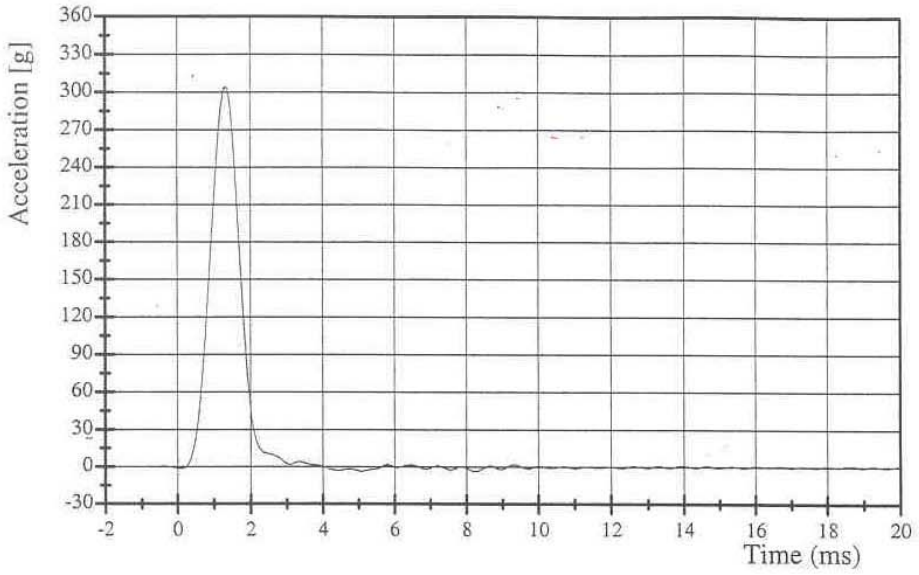
# Transportation Research Center Inc.

572N Left Knee Test

HIII 6 Year Old  Serial No. 144  Calibration No. 05 - 1

Test Date 07/23/2004

Pendulum Deceleration

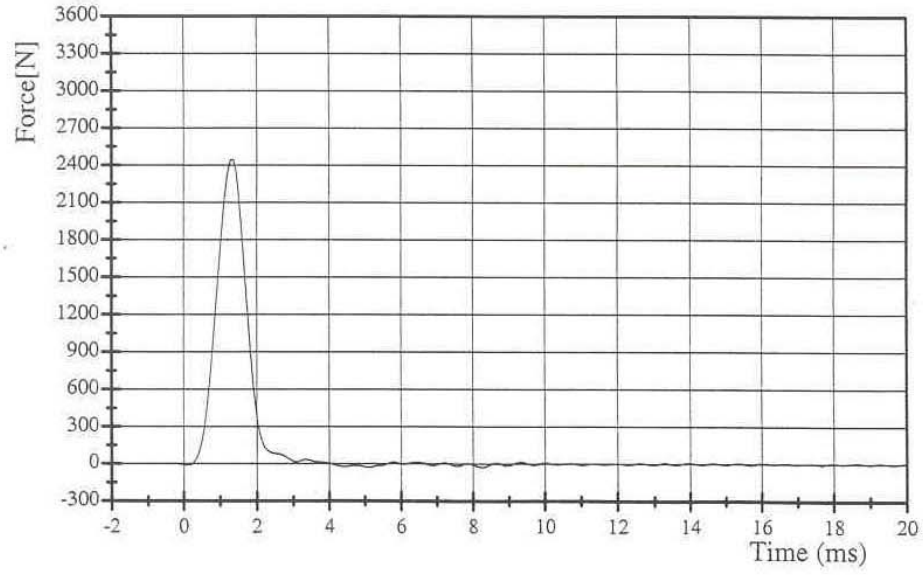



Filter Class: 600

Max: 303.9 g at 1.4 ms

Min: -3.7 g at 8.2 ms

Pendulum Force




Filter Class: 600

Max: 2444.2 N at 1.4 ms

Min: -30.0 N at 8.2 ms

07.23.2004 15:10:44 1688

# Transportation Research Center Inc.

572N Right Knee Test

HIII 6 Year Old Serial No. 144 Calibration No. 05 - 1

Test Date 07/23/2004

| Test Parameter | Specification | Test Results | Pass |
|---|---|---|---|
| Temperature | 18.9 - 25.6 °C | 21.8 °C | Yes |
| Relative Humidity | 10 - 70 % | 49 % | Yes |
| Pendulum Velocity | 2.07 - 2.13 m/s | 2.11 m/s | Yes |
| Maximum Pendulum Force | 2000 - 3000 N | 2293 N | Yes |

**Test meets specifications.**

**Comments:**

Technician

Approved

07.23.2004 14:58:07 1683

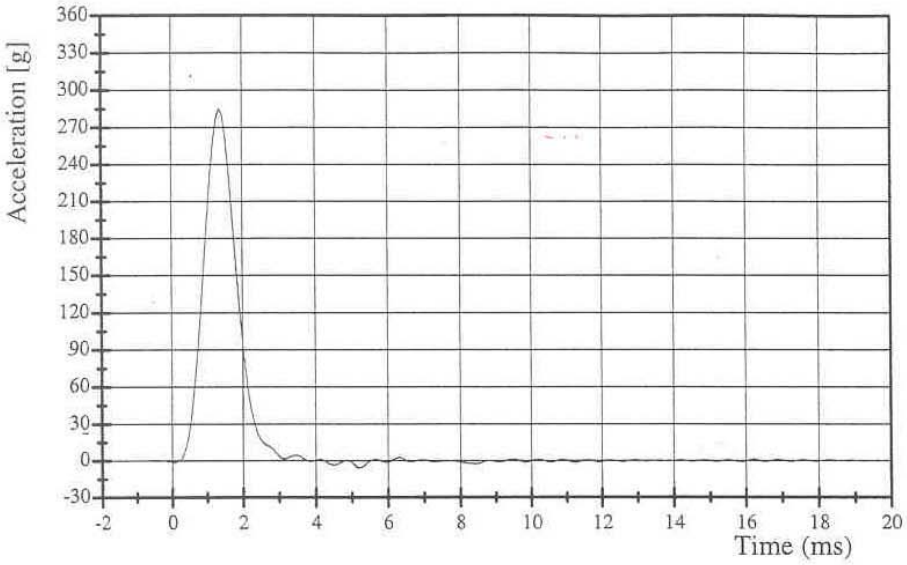
# Transportation Research Center Inc.

572N Right Knee Test

HIII 6 Year Old  Serial No. 144  Calibration No. 05 - 1

Test Date 07/23/2004

Pendulum Deceleration

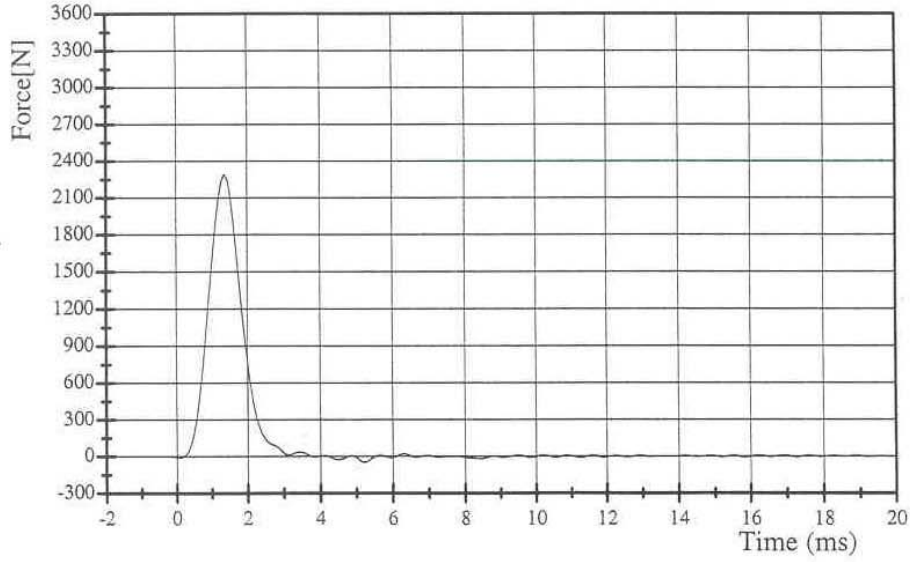



Filter Class: 600

Max: 285.2 g at 1.4 ms

Min: -6.0 g at 5.2 ms

Pendulum Force




Filter Class: 600

Max: 2293.4 N at 1.4 ms

Min: -48.0 N at 5.2 ms

07.23.2004 14:58:08 1683

# 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 | 09/15/04 |
| Head Y | B05-J19 | Entran | 09/15/04 |
| Head Z | A27-Z11 | Entran | 09/15/04 |
| Head X Redundant | B05-J16 | Entran | 09/15/04 |
| Head Y Redundant | B10-Z23 | Entran | 09/15/04 |
| Head Z Redundant | B05-J11 | Entran | 09/15/04 |
| Upper Neck Load Cell | 208 | FTSS | 05/13/04 |
| Chest X | A27-Z23 | Entran | 09/15/04 |
| Chest Y | A27-Z24 | Entran | 09/15/04 |
| Chest Z | A27-Z13 | Entran | 09/15/04 |
| Chest X Redundant | A12-Z06 | Entran | 09/15/04 |
| Chest Y Redundant | A12-Z05 | Entran | 09/15/04 |
| Chest Z Redundant | A12-Z02 | Entran | 09/15/04 |
| Chest Deflection Gauge | 042 | Servo | 08/06/04 |
| Pelvis X | A27-Z19 | Entran | 09/15/04 |
| Pelvis Y | A27-Z07 | Entran | 09/15/04 |
| Pelvis Z | A27-Z16 | Entran | 09/15/04 |
| RRP Tether Force | 172 | FTSS | 08/18/04 |

**INSTRUMENTS FOR LRP CHILD DUMMY S/N: 144**

| | SERIAL NO. | MANUFACTURER | CALIBRATION DATE |
|---|---|---|---|
| Head X | AMP82 | Endevco | 01/20/05 |
| Head Y | J18953 | Endevco | 01/20/05 |
| Head Z | J18843 | Endevco | 01/20/05 |
| Head X Redundant | J23-M13 | Entran | 11/23/04 |
| Head Y Redundant | J14-J11 | Entran | 11/23/04 |
| Head Z Redundant | J23-M09 | Entran | 11/23/04 |
| Upper Neck Load Cell | 1626 | FTSS | 07/20/04 |
| Chest X | P22695 | Endevco | 11/12/04 |
| Chest Y | L20-B14 | Entran | 11/12/04 |
| Chest Z | AJ621 | Endevco | 11/12/04 |
| Chest X Redundant | P22203 | Endevco | 11/12/04 |
| Chest Y Redundant | L20-B17 | Entran | 11/12/04 |
| Chest Z Redundant | AJ9F3 | Endevco | 11/12/04 |
| Chest Deflection Gauge | 144 | Servo | 08/09/04 |
| Pelvis X | J13653 | Endevco | 09/15/04 |
| Pelvis Y | J13649 | Endevco | 09/15/04 |
| Pelvis Z | J13713 | Endevco | 09/15/04 |
| Shoulder Belt | 199 | Denton | 12/07/04 |
| Lap Belt | 198 | Denton | 12/07/04 |
| Right Femur | 126 | Denton | 07/21/04 |
| Left Femur | 125 | Denton | 07/21/04 |

## INSTRUMENTS FOR VEHICLE AND CHILD SEAT

| | SERIAL NO. | MANUFACTURER | CALIBRATION DATE |
|---|---|---|---|
| Left Rear Seat Back X | K07-R18 | Entran | 08/25/04 |
| Left Rear Seat Back Y | H20-R06 | Entran | 08/25/04 |
| Left Rear Seat Back Z | L17-D09 | Entran | 08/24/04 |
| LRP Child Seat X | K18-D14 | Entran | 12/02/04 |
| LRP Child Seat Y | K18-J03 | Entran | 12/02/04 |
| LRP Child Seat Z | K18-D25 | Entran | 12/02/04 |
| RRP Child Seat X | J23-M14 | Entran | 12/01/04 |
| RRP Child Seat Y | J25-R16 | Entran | 12/01/04 |
| RRP Child Seat Z | J25-R14 | Entran | 12/01/04 |