

**REPORT NUMBER: NCAPCHILD-MGA-2004-005**

**NEW CAR ASSESSMENT PROGRAM  
FRONTAL BARRIER IMPACT TEST**

**Evenflo Vanguard 5  
Cosco Touriva**

**NHTSA NUMBER: M40204**

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



**Test Date: January 6, 2004**

**Report Date: February 13, 2004**

**FINAL REPORT**

**PREPARED FOR:  
U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
RULEMAKING  
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### Technical Report Documentation Page

| <b>1. Report No.</b><br>NCAPCHILD-MGA-2004-005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                             | <b>2. Government Accession No.</b>                                                |                                                                                                                                                                                                                                 | <b>3. Recipient's Catalog No.</b>             |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--|-------------------------|-------|------------|------------|------------------------------|-----|-----|-----|------------------------------|-----|-----|-----|---------------------------------|-----|----|----|
| <b>4. Title and Subtitle</b><br>Final Report of New Car Assessment Program Testing of Evenflo Vanguard 5 and Cosco Touriva Child Restraint Systems<br>NHTSA No.: M40204                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                             | <b>5. Report Date</b><br>February 13, 2004                                        |                                                                                                                                                                                                                                 | <b>6. Performing Organization Code</b><br>MGA |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                             |                                                                                   |                                                                                                                                                                                                                                 |                                               |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
| <b>7. Author(s)</b><br>Shefalika Agarwal, Project Engineer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                             | <b>8. Performing Organization Report No.</b><br>NCAPCHILD-MGA-2004-005            |                                                                                                                                                                                                                                 |                                               |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
| <b>9. Performing Organization Name and Address</b><br>MGA Research Corporation<br>5000 Warren Road<br>Burlington, WI 53105                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                             | <b>10. Work Unit No.</b>                                                          |                                                                                                                                                                                                                                 |                                               |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
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| <b>12. Sponsoring Agency Name and Address</b><br><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                                                                                                                                                                                                                                                                                                                                         |                                                             | <b>13. Type of Report and Period Covered</b><br>Final Report<br>1/6/04 to 2/13/04 |                                                                                                                                                                                                                                 |                                               |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
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| <b>15. Supplementary Notes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                             |                                                                                   |                                                                                                                                                                                                                                 |                                               |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
| <b>16. Abstract</b><br>The subjects CRS Evenflo Vanguard 5 and Cosco Touriva 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 6, 2004, in conjunction with frontal NCAP.                                                                                                                                                           |                                                             |                                                                                   |                                                                                                                                                                                                                                 |                                               |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
| <table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Measurement Description</th> <th style="text-align: left;">Units</th> <th style="text-align: left;">Pos. 3 ATD</th> <th style="text-align: left;">Pos. 4 ATD</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC36)</td> <td>N/A</td> <td>444</td> <td>445</td> </tr> <tr> <td>Head Injury Criteria (HIC15)</td> <td>N/A</td> <td>228</td> <td>224</td> </tr> <tr> <td>Max. Thorax Accel. (3msec Clip)</td> <td>G's</td> <td>38</td> <td>35</td> </tr> </tbody> </table> |                                                             |                                                                                   |                                                                                                                                                                                                                                 |                                               |  | Measurement Description | Units | Pos. 3 ATD | Pos. 4 ATD | Head Injury Criteria (HIC36) | N/A | 444 | 445 | Head Injury Criteria (HIC15) | N/A | 228 | 224 | Max. Thorax Accel. (3msec Clip) | G's | 38 | 35 |
| Measurement Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Units                                                       | Pos. 3 ATD                                                                        | Pos. 4 ATD                                                                                                                                                                                                                      |                                               |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
| Head Injury Criteria (HIC36)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N/A                                                         | 444                                                                               | 445                                                                                                                                                                                                                             |                                               |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
| Head Injury Criteria (HIC15)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | N/A                                                         | 228                                                                               | 224                                                                                                                                                                                                                             |                                               |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
| Max. Thorax Accel. (3msec Clip)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | G's                                                         | 38                                                                                | 35                                                                                                                                                                                                                              |                                               |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
| <b>17. Key Words</b><br><br>56.3 km/h NCAP Frontal Barrier Impact Test<br>New Car Assessment Program (NCAP)<br>Evenflo Vanguard 5<br>Cosco Touriva<br>NHTSA No: M40204                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                             |                                                                                   | <b>18. Distribution Statement</b><br>Copies of this report are available from:<br>National Highway Traffic Safety Admin., Technical Ref. Division,<br>Room 5108 (NPO-230)<br>400 Seventh Street, S.W.<br>Washington, D.C. 20590 |                                               |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |
| <b>19. Security Classif. (of this report)</b><br>Unclassified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>20. Security Classif. (of this page)</b><br>Unclassified | <b>21. No. of Pages</b><br>103                                                    | <b>22. Price</b>                                                                                                                                                                                                                |                                               |  |                         |       |            |            |                              |     |     |     |                              |     |     |     |                                 |     |    |    |

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## **SECTION 1**

### **PURPOSE AND SUMMARY OF TEST**

#### **PURPOSE**

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

This 56.5 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 40) and left rear (Position 4) child dummy (S/N 42) were calibrated previous to this test. Child dummy certification information is found in Appendix C.

The right rear child dummy's HIC36 was 443.9; maximum chest deceleration over 3 msec was 38.2 g's. The left rear child dummy's HIC36 was 445.3. The maximum chest deceleration over 3 msec was 35.3 g's. Position 3 and Position 4 were forward facing and used the vehicle LATCH and top tether for attachments.

#### **Test Notes**

There was no valid data collected for:  
LRP Pelvis Z

**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 / 40                   | HIII 3 Year Old / 42              |
| Number of Data Channels | 22                                     | 22                                |
| Restraint System        | Evenflo Vanguard 5<br>(Forward Facing) | Cosco Touriva<br>(Forward Facing) |

**CAMERA COVERAGE**

|            |    |
|------------|----|
| High Speed | 16 |
| Real Time  | 1  |
| Total      | 17 |

**POST TEST DOOR OPENING**

| Description           | Front                                                          | Rear                                                           |
|-----------------------|----------------------------------------------------------------|----------------------------------------------------------------|
| Locked/Unlocked Doors | Doors were unlocked                                            | Doors were unlocked                                            |
| Left Side Doors       | Door remained closed and latched;<br>Door opened without tools | Door remained closed and latched;<br>Door opened without tools |
| Right Side Doors      | Door remained closed and latched;<br>Door opened without tools | Door remained closed and latched;<br>Door opened without tools |
| Hatch/Other Door      | None                                                           | 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 40) | Position 4 CRS (S/N 42) |
|---------------------|-------------------------|-------------------------|
| Head Contact        | Back of head to CRS     | Back of head to CRS     |
| 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 Vanguard 5 (Forward Facing) |
| Child Restraint System (Position 4) | Cosco Touriva (Forward Facing)      |
| NHTSA No.                           | M40204                              |

**TARGET TEST WEIGHT CALCULATION**

| Measured Parameter                      | Units | Value  |
|-----------------------------------------|-------|--------|
| Total Delivered Weight (UVW)            | kg    | 2377.9 |
| Weight of 2 P572E ATDs                  | kg    | 156.0  |
| Rated Cargo/Luggage Weight (RCLW)       | kg    | 136.1  |
| Calculated Vehicle Target Weight (TVTW) | kg    | 2670.0 |

**TEST VEHICLE WEIGHTS**

|        | Units | As Tested (ATW) (Axle) |        |        |
|--------|-------|------------------------|--------|--------|
|        |       | Front                  | Rear   | Total  |
| Left   | kg    | 717.6                  | 609.2  |        |
| Right  | kg    | 725.8                  | 609.2  |        |
| Ratio  | %     | 54.2                   | 45.8   |        |
| Totals | kg    | 1443.4                 | 1218.4 | 2661.8 |

As tested weight of vehicle includes two 50<sup>th</sup> percentile ATDs, two 3 year old with CRS, cargo, equipment and instrumentation.

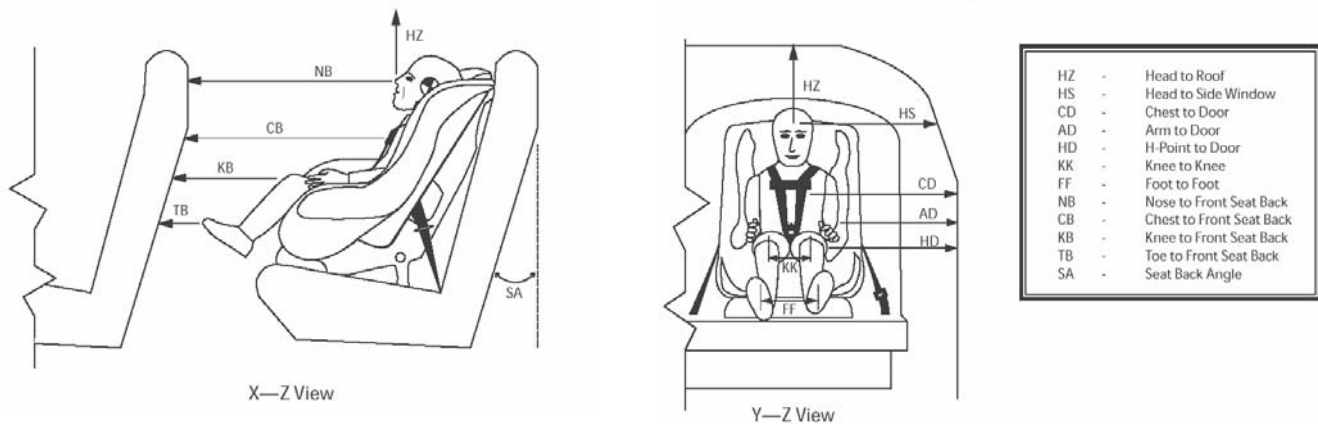
**CHEST CLIP DISPLACEMENT**

|                   | Units | Left | Right |
|-------------------|-------|------|-------|
| Right Child Dummy | mm    | 117  | 134   |
| Left Child Dummy  | mm    | 64   | 69    |

**SECTION 2... (continued)**  
**DATA SHEET NO. 3**  
**CHILD DUMMY POSITIONING IN VEHICLE**

|                                     |                                     |
|-------------------------------------|-------------------------------------|
| Child Restraint System (Position 3) | Evenflo Vanguard 5 (Forward Facing) |
| NHTSA No.                           | M40204                              |

Dummy Measurements for CRS Passengers



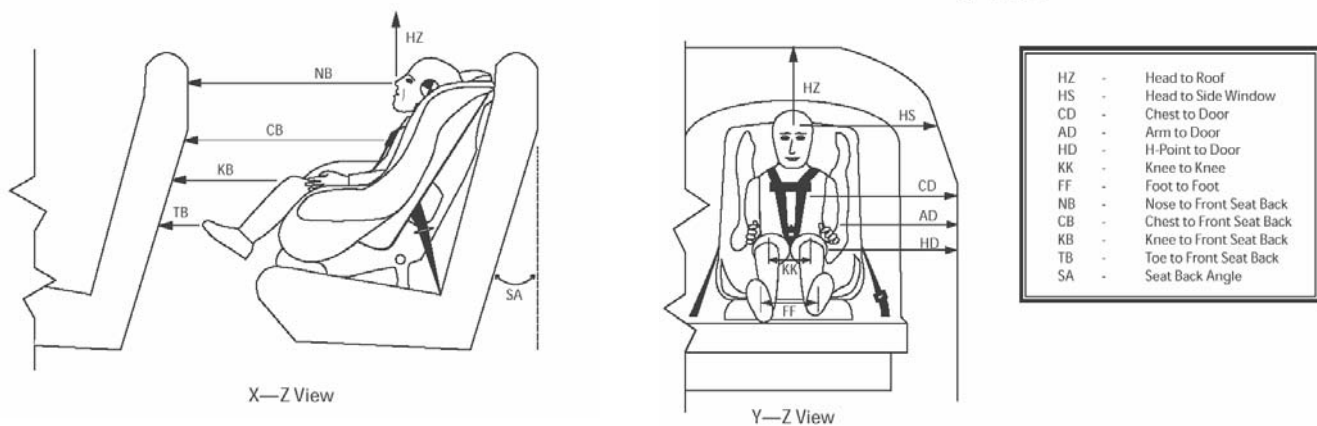
| Measurement | Pre-Test (mm) | Post-Test (mm) |
|-------------|---------------|----------------|
|             | P3 CRS (40)   | P3 CRS (40)    |
| SA (deg)    | 3.7           | 3.7            |
| HS          | 394           | 407            |
| CD          | 376           | 382            |
| AD          | 214           | 238            |
| HD          | 270           | 287            |
| HZ          | 386           | 395            |
| NB          | 597           | 591            |
| CB          | 579           | 584            |
| KK          | 152           | 176            |
| FF          | 151           | 185            |
| KB - LEFT   | 376           | 372            |
| KB - RIGHT  | 374           | 370            |
| TB - LEFT   | 116           | 103            |
| TB - RIGHT  | 118           | 108            |

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) | Cosco Touriva (Forward Facing) |
| NHTSA No.                           | M40204                         |

Dummy Measurements for CRS Passengers



| Measurement | Pre-Test (mm) | Post-Test (mm) |
|-------------|---------------|----------------|
|             | P4 CRS (42)   | P4 CRS (42)    |
| SA (deg)    | 3.7           | 3.7            |
| HS          | 416           | 445            |
| CD          | 385           | 401            |
| AD          | 249           | 262            |
| HD          | 308           | 306            |
| HZ          | 385           | 411            |
| NB          | 544           | 543            |
| CB          | 513           | 523            |
| KK          | 138           | 145            |
| FF          | 127           | 120            |
| KB - LEFT   | 337           | 346            |
| KB - RIGHT  | 338           | 348            |
| TB - LEFT   | 93            | 52             |
| TB - RIGHT  | 92            | 60             |

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) | Cosco Touriva      |
| NHTSA No.                           | M40204             |

**HEAD PEAK ACCELERATIONS**

| Location  | Axis | Units | Position 3 |      |       |      | Position 4 |      |       |      |
|-----------|------|-------|------------|------|-------|------|------------|------|-------|------|
|           |      |       | Max        | Time | Min   | Time | Max        | Time | Min   | Time |
| Head CG   | X    | G's   | 30.2       | 200  | -28.1 | 81   | 5.4        | 30   | -29.0 | 82   |
| Head CG   | Y    | G's   | 2.6        | 113  | -5.4  | 59   | 1.8        | 55   | -8.8  | 106  |
| Head CG   | Z    | G's   | 41.7       | 83   | -9.6  | 42   | 45.2       | 71   | -8.2  | 42   |
| Resultant | N/A  | G's   | 49.6       | 83   |       |      | 49.7       | 71   |       |      |

**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     | 49         | 183  | -774  | 79   | 16         | 177  | -218 | 78   |
| Neck Force  | Y    | N     | 41         | 116  | -120  | 67   | 8          | 51   | -34  | 96   |
| Neck Force  | Z    | N     | 1696       | 83   | -237  | 35   | 2491       | 79   | -325 | 41   |
| Resultant   | N/A  | N     | 1849       | 81   |       |      | 2501       | 79   |      |      |
| Neck Moment | X    | N•m   | 3.6        | 113  | -8.0  | 79   | 2.0        | 132  | -2.0 | 200  |
| Neck Moment | Y    | N•m   | 4.0        | 71   | -13.6 | 197  | 3.6        | 72   | -4.5 | 59   |
| Neck Moment | Z    | N•m   | 1.9        | 75   | -2.0  | 173  | 1.5        | 147  | -1.6 | 54   |
| Resultant   | N/A  | N•m   | 13.6       | 197  |       |      | 4.7        | 59   |      |      |

**CHEST PRIMARY PEAK ACCELERATIONS**

| Location  | Axis | Units | Position 3 |      |       |      | Position 4 |      |       |      |
|-----------|------|-------|------------|------|-------|------|------------|------|-------|------|
|           |      |       | Max        | Time | Min   | Time | Max        | Time | Min   | Time |
| Chest CG  | X    | G's   | 3.9        | 142  | -37.3 | 74   | 3.1        | 143  | -31.8 | 74   |
| Chest CG  | Y    | G's   | 1.5        | 166  | -7.0  | 74   | 2.0        | 200  | -4.1  | 76   |
| Chest CG  | Z    | G's   | 14.1       | 198  | -24.1 | 61   | 11.1       | 182  | -18.9 | 61   |
| Resultant | N/A  | G's   | 39.0       | 74   |       |      | 36.2       | 64   |       |      |

## 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) | Cosco Touriva      |
| NHTSA No.                           | M40204             |

#### TETHER FORCE

| Location     | Axis | Units | Position 3 |      |       |      | Position 4 |      |     |      |
|--------------|------|-------|------------|------|-------|------|------------|------|-----|------|
|              |      |       | Max        | Time | Min   | Time | Max        | Time | Min | Time |
| Tether Force | N/A  | N     | 1238       | 74   | -45.5 | 192  | 2233       | 76   | -58 | 187  |

#### PELVIC PEAK ACCELERATIONS

| Location  | Axis | Units | Position 3 |      |       |      | Position 4 |      |       |      |
|-----------|------|-------|------------|------|-------|------|------------|------|-------|------|
|           |      |       | Max        | Time | Min   | Time | Max        | Time | Min   | Time |
| Pelvis    | X    | G's   | 14.2       | 117  | -45.5 | 68   | 9.9        | 131  | -39.8 | 62   |
| Pelvis    | Y    | G's   | 3.8        | 184  | -9.4  | 69   | 5.0        | 184  | -6.0  | 32   |
| Pelvis    | Z    | G's   | 15.3       | 197  | -21.2 | 57   | **         | **   | **    | **   |
| Resultant | N/A  | G's   | 46.7       | 68   |       |      | **         | **   |       |      |

\*\* No valid data collected

#### HEAD PEAK REDUNDANT ACCELERATIONS

| Location  | Axis | Units | Position 3 |      |       |      | Position 4 |      |       |      |
|-----------|------|-------|------------|------|-------|------|------------|------|-------|------|
|           |      |       | Max        | Time | Min   | Time | Max        | Time | Min   | Time |
| Head CG   | X    | G's   | 29.3       | 200  | -29.6 | 78   | 0.5        | 9    | -28.5 | 81   |
| Head CG   | Y    | G's   | 2.4        | 118  | -5.3  | 68   | 2.0        | 51   | -8.8  | 106  |
| Head CG   | Z    | G's   | 41.3       | 84   | -9.0  | 35   | *          | *    | *     | *    |
| Resultant | N/A  | G's   | 50.0       | 84   |       |      | *          | *    |       |      |

\* No valid data after approximately 45 msec.

#### CHEST PEAK REDUNDANT ACCELERATIONS

| Location  | Axis | Units | Position 3 |      |       |      | Position 4 |      |       |      |
|-----------|------|-------|------------|------|-------|------|------------|------|-------|------|
|           |      |       | Max        | Time | Min   | Time | Max        | Time | Min   | Time |
| Chest CG  | X    | G's   | 3.9        | 147  | -37.2 | 74   | 3.0        | 143  | -32.7 | 73   |
| Chest CG  | Y    | G's   | 1.5        | 165  | -7.2  | 74   | 2.4        | 43   | -4.1  | 75   |
| Chest CG  | Z    | G's   | 14.2       | 197  | -23.7 | 60   | 11.0       | 182  | -18.7 | 64   |
| Resultant | N/A  | G's   | 39.1       | 74   |       |      | 36.8       | 64   |       |      |

**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) | Cosco Touriva      |
| NHTSA No.                           | M40204             |

**HEAD INJURY CRITERIA (HIC36)**

| Location           | HIC   | T <sup>1</sup> (msec) | T <sup>2</sup> (msec) | Average Acceleration (G's) |
|--------------------|-------|-----------------------|-----------------------|----------------------------|
| Position 3 - Right | 443.9 | 62.9                  | 98.9                  | 43.3                       |
| Position 4 – Left  | 445.3 | 61.1                  | 97.1                  | 43.3                       |

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 <sup>1</sup> (msec) | T <sup>2</sup> (msec) | Average Acceleration (G's) |
|--------------------|-------|-----------------------|-----------------------|----------------------------|
| Position 3 - Right | 227.9 | 75.7                  | 90.7                  | 47.1                       |
| Position 4 – Left  | 224.2 | 68                    | 83                    | 46.8                       |

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

**CLIP SUMMARY**

| Location           | CLIP | T <sup>1</sup> (msec) | T <sup>2</sup> (msec) |
|--------------------|------|-----------------------|-----------------------|
| Position 3 - Right | 38.2 | 73.2                  | 76.2                  |
| Position 4 – Left  | 35.3 | 62.3                  | 65.3                  |

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

**SECTION 2... (continued)****DATA SHEET NO. 5  
CRS PERFORMANCE DATA**

|                                     |                                     |
|-------------------------------------|-------------------------------------|
| Child Restraint System (Position 3) | Evenflo Vanguard 5 (Forward Facing) |
| Child Restraint System (Position 4) | Cosco Touriva (Forward Facing)      |
| NHTSA No.                           | M40204                              |

**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   |         |

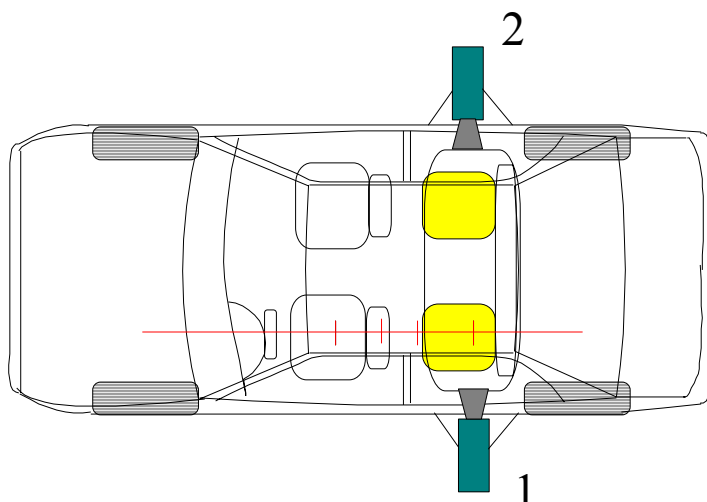
**POSITION 4 CRS POST-TEST INSPECTION**

| 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) | Cosco Touriva (Forward Facing)      |
| NHTSA No.                           | M40204                              |



| No. | Camera View                 | Location (mm) * |   |   | Angle (deg) | Lens (mm) | Speed (fps) |
|-----|-----------------------------|-----------------|---|---|-------------|-----------|-------------|
|     |                             | X               | Y | Z |             |           |             |
| 1   | Left Side CRS Lateral View  |                 |   |   |             | 13        | *           |
| 2   | Right Side CRS Lateral View |                 |   |   |             | 13        | 541         |

\*COORDINATES:

+X = film plane rearward of barrier

+Y = film plane to right of monorail centerline

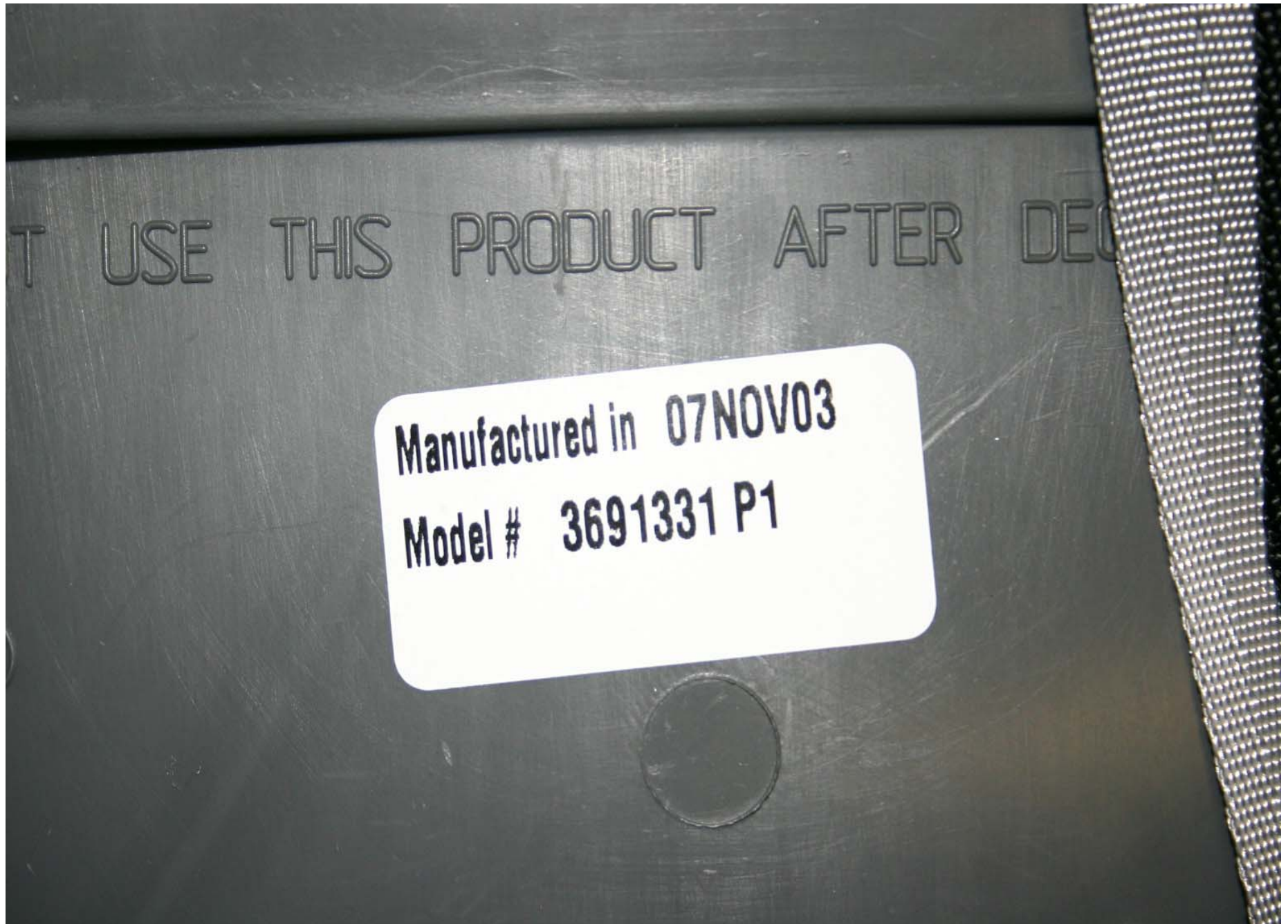
+Z = film plane above ground level

\* No timing marks

**APPENDIX A**  
**PHOTOGRAPHS**

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Close-up View of Position 3 CRS Label

A-2.



Pre-Test Front View of Position 3 CRS



Post-Test Front View of Position 3 CRS

A-4.



Pre-Test Rear View of Position 3 CRS



Post-Test Rear View of Position 3 CRS

A-6.



Pre-Test Left Side View of Position 3 CRS



Post-Test Left Side View of Position 3 CRS

A-8.



Pre-Test Right Side View of Position 3 CRS

A-9.



Post-Test Right Side View of Position 3 CRS



Close-up View of Position 4 CRS Label

A-11.



Pre-Test Front View of Position 4 CRS

A-12.



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

A-17.



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



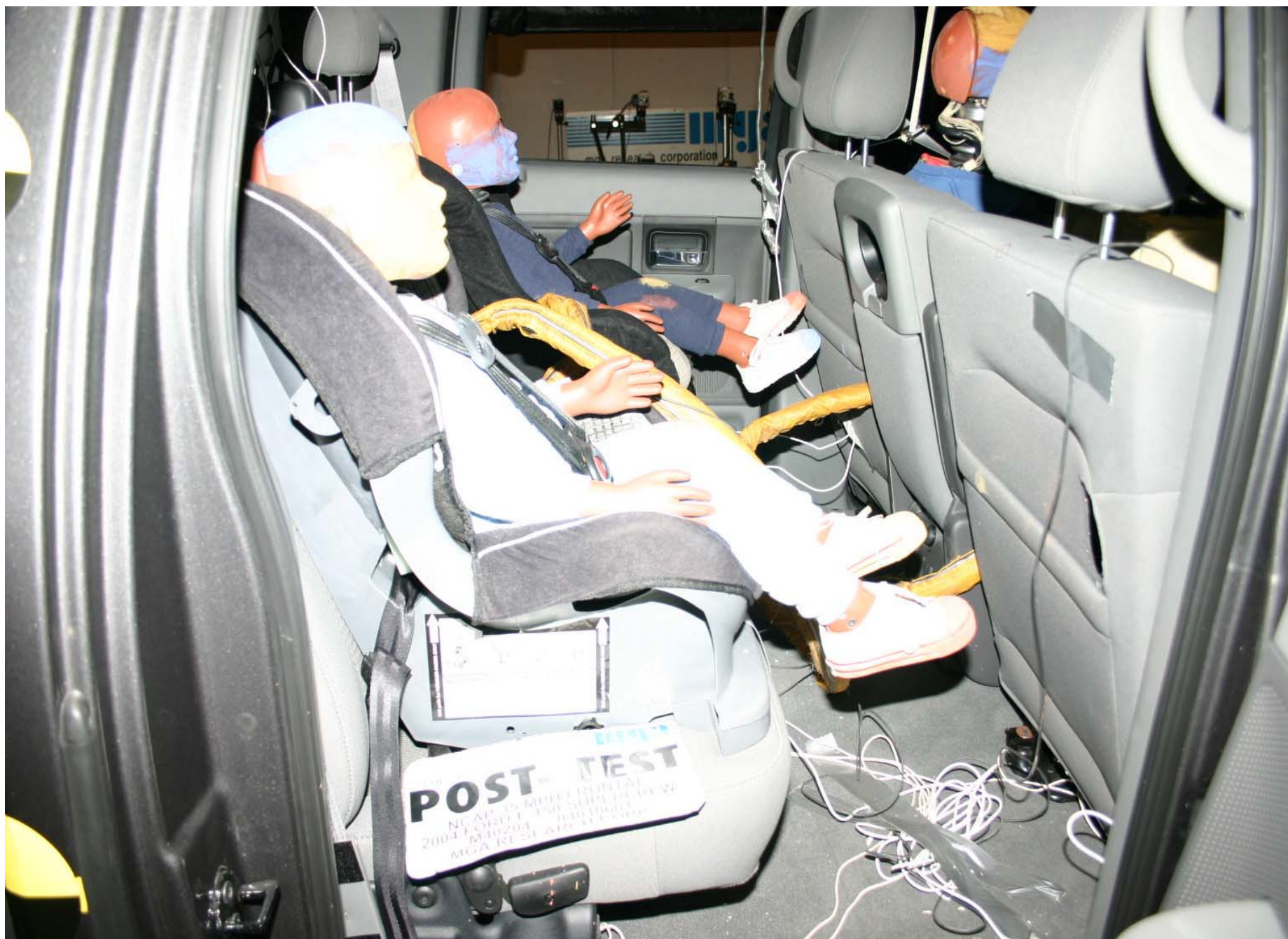
Pre-Test Position 4 Left Side View



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

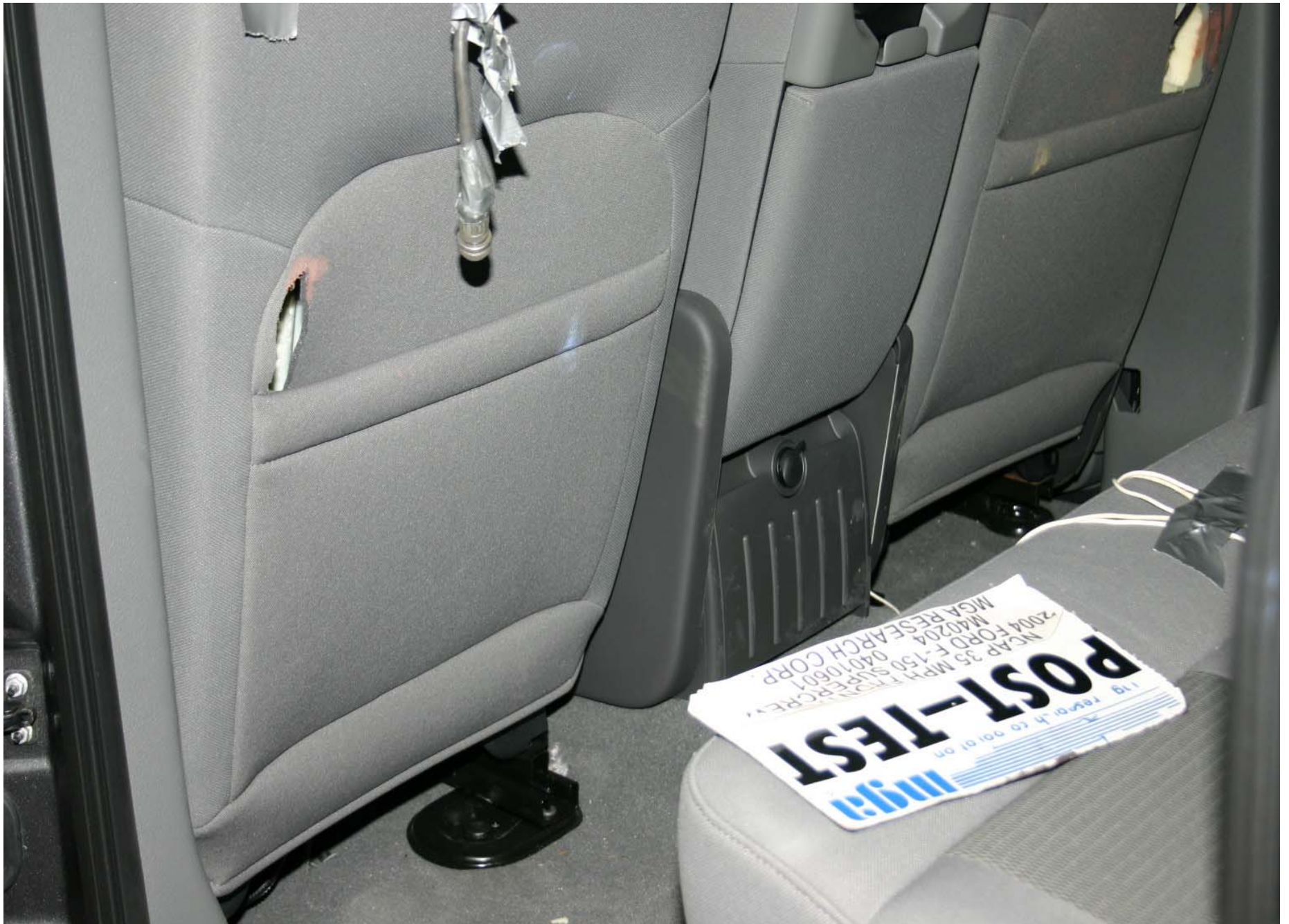


Post-Test Position 4 Right Side View

A-27.



Pre-Test Position 3 Foot Contact View



Pre-Test Position 4 Foot Contact View



Post-Test Positions 3 and 4 Rear Views

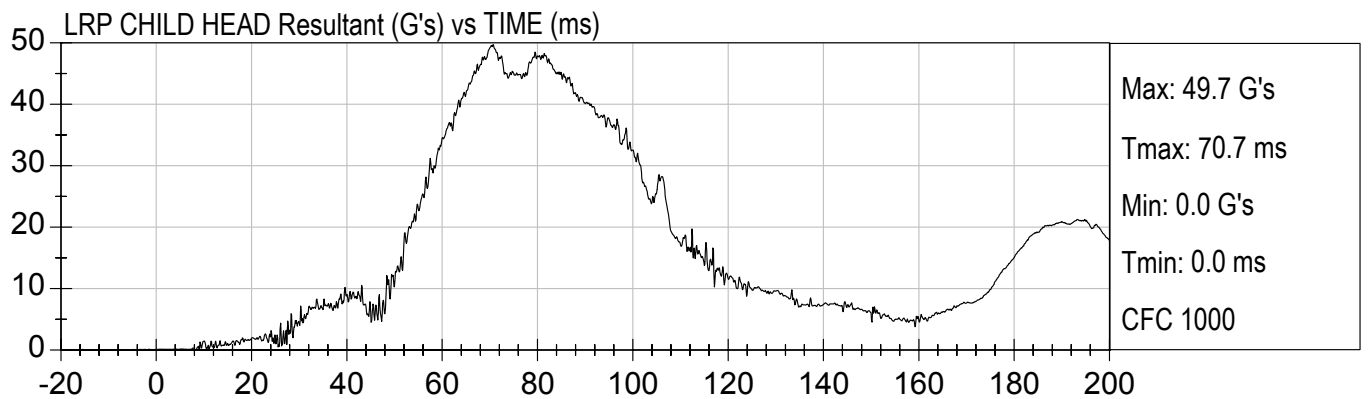
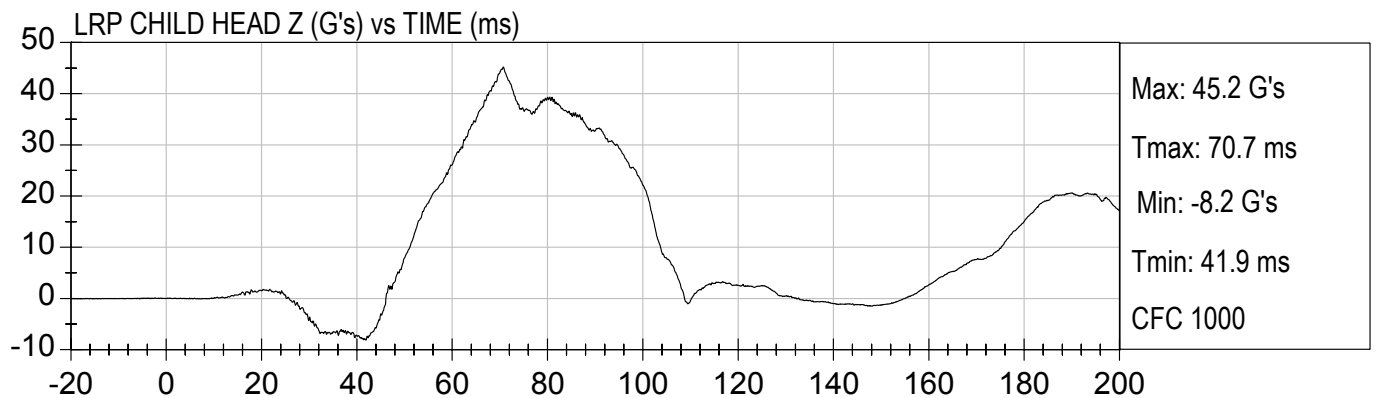
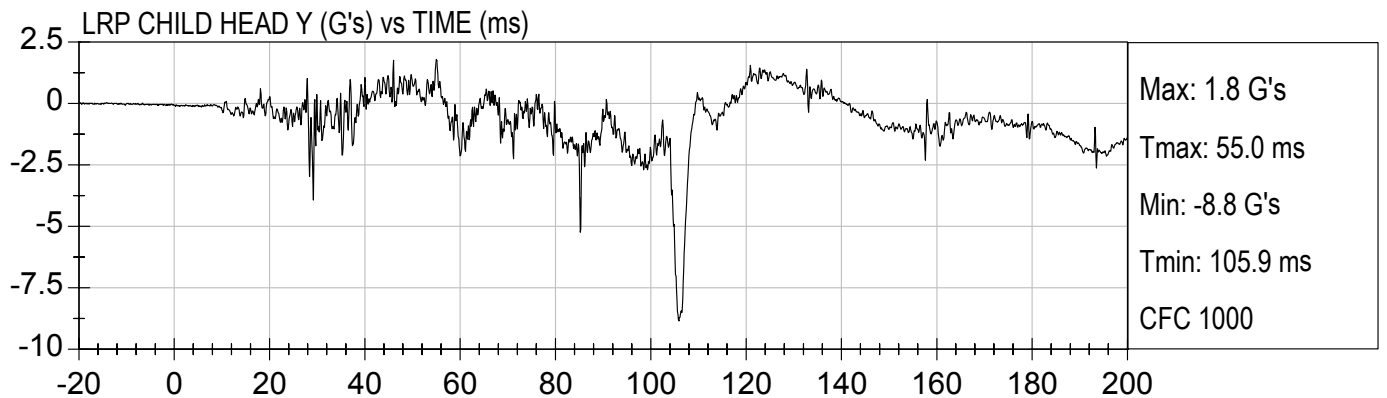
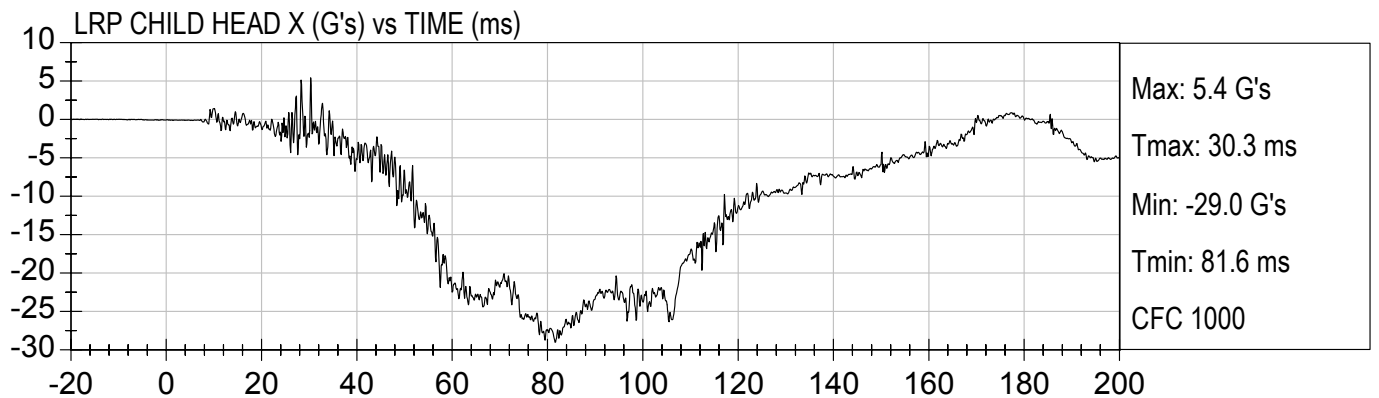
**APPENDIX B**  
**CHILD DUMMY RESPONSE DATA TRACES**

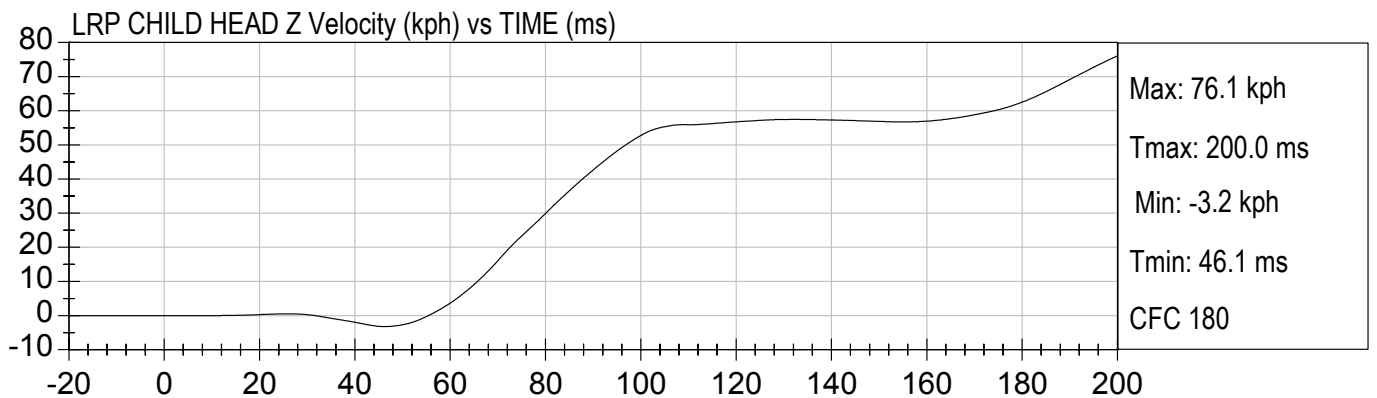
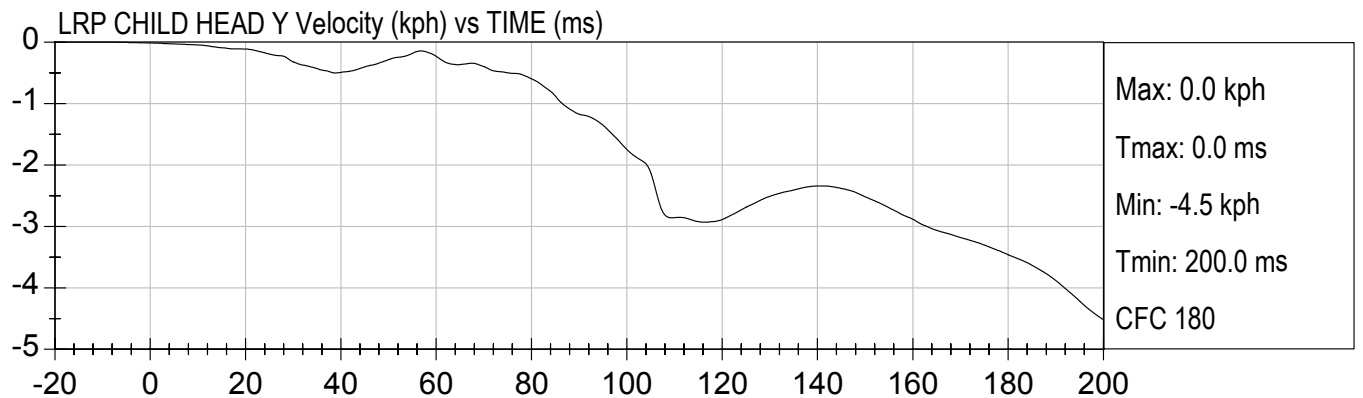
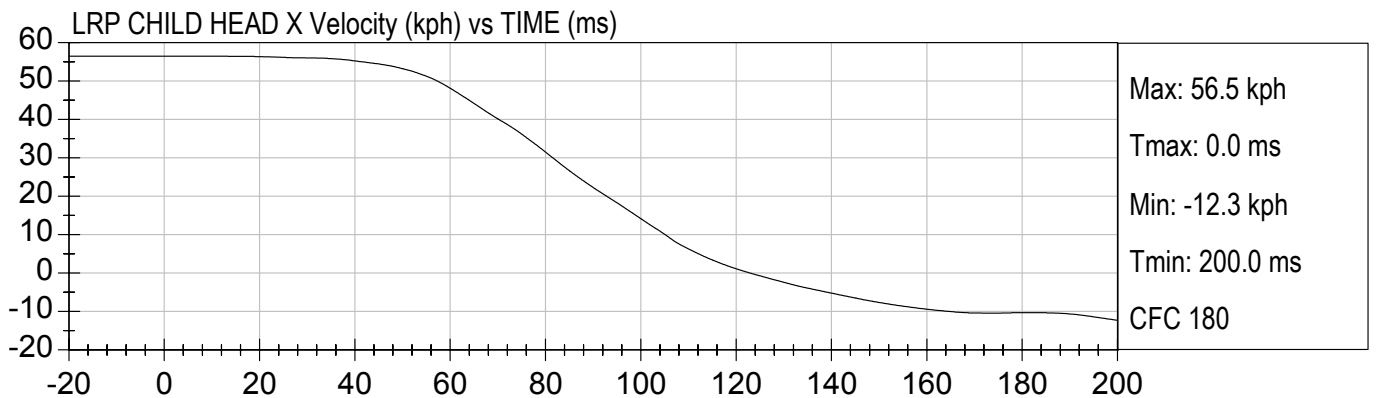
## TABLE OF DATA PLOTS

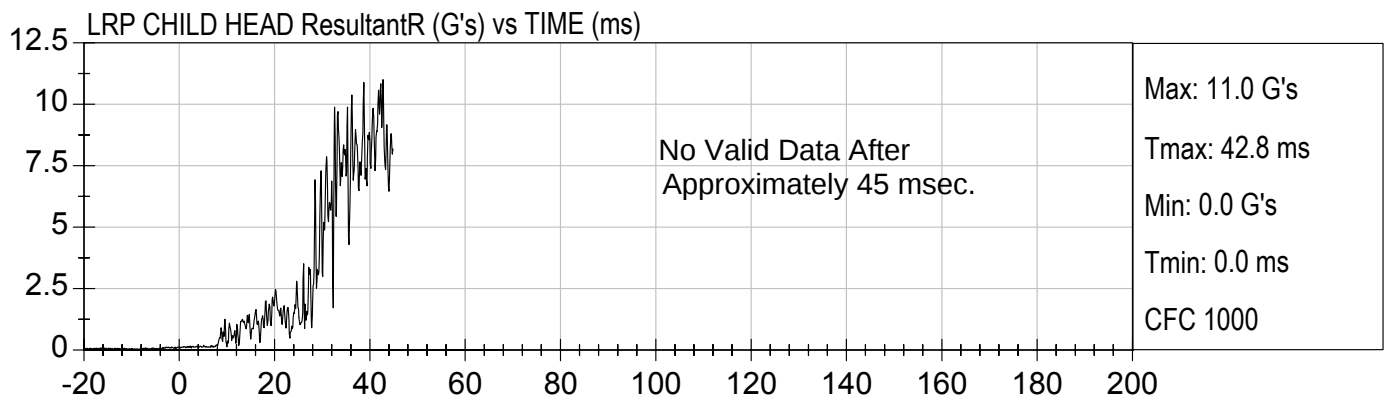
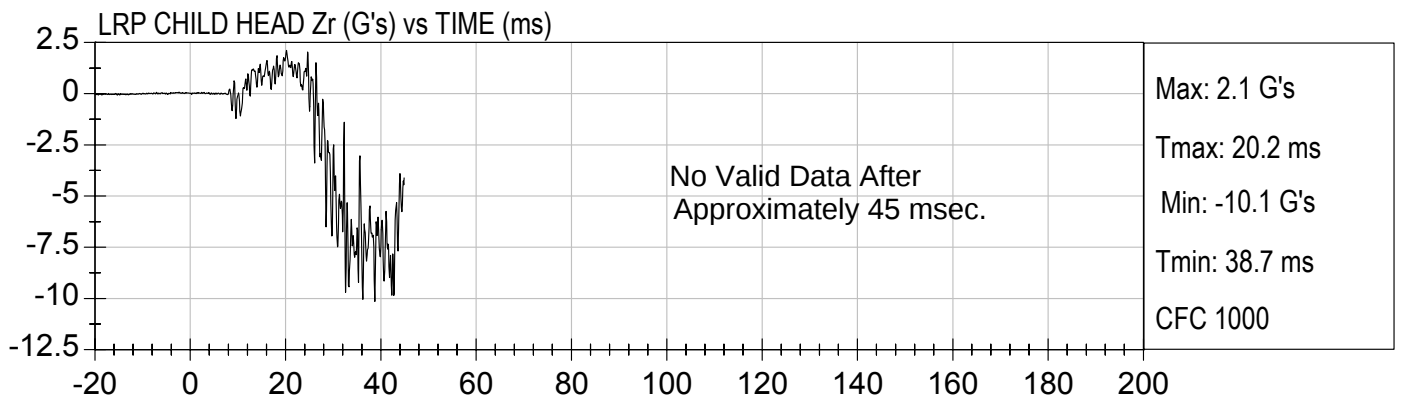
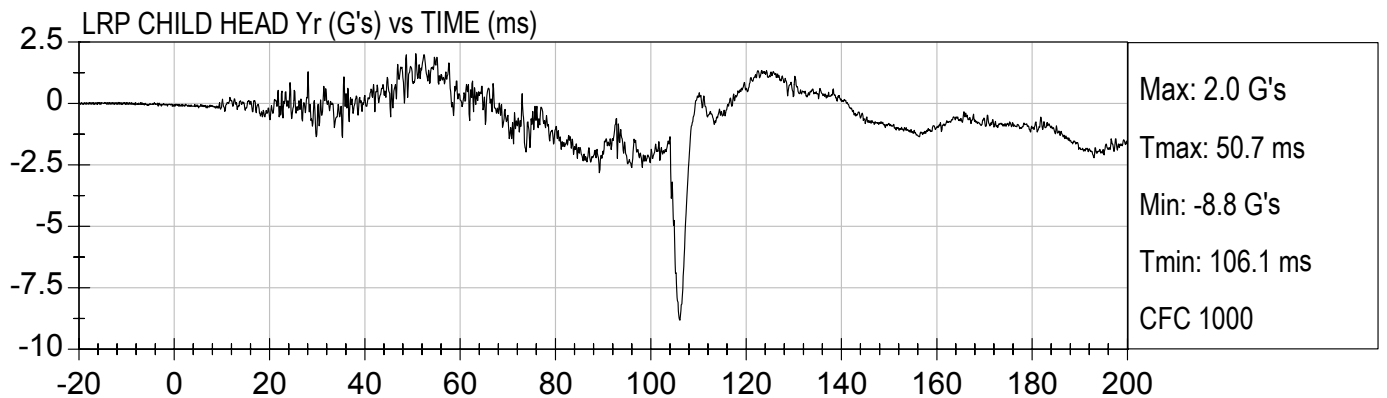
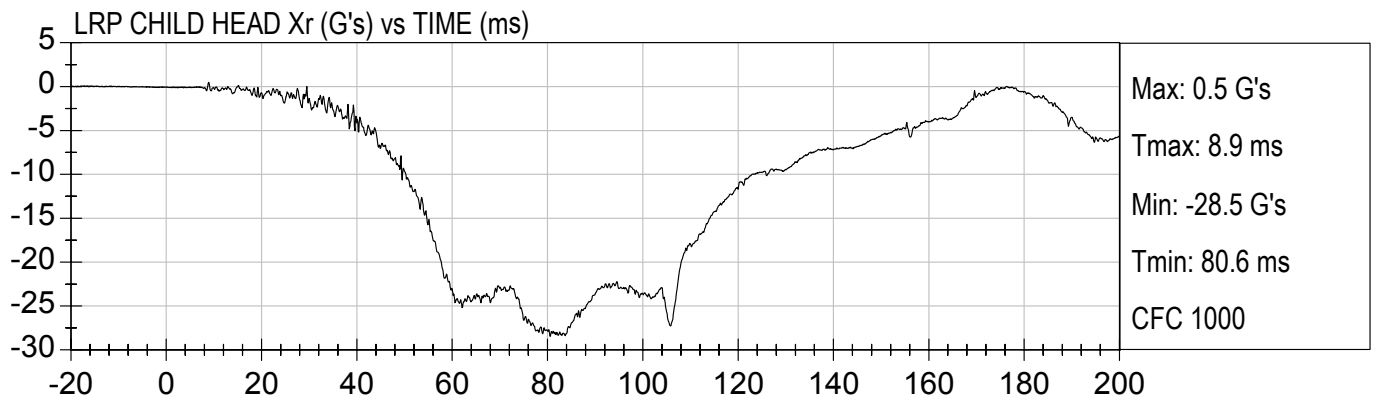
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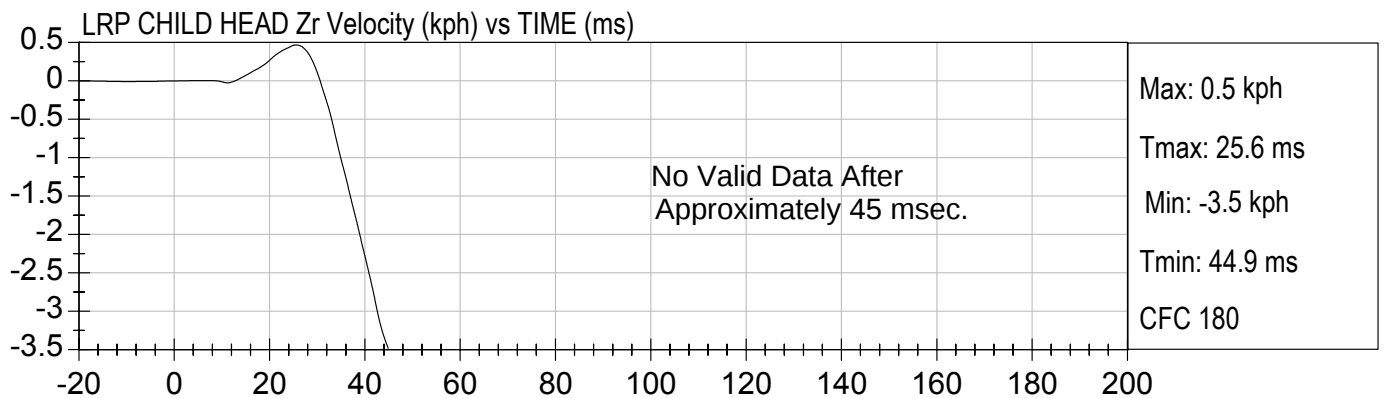
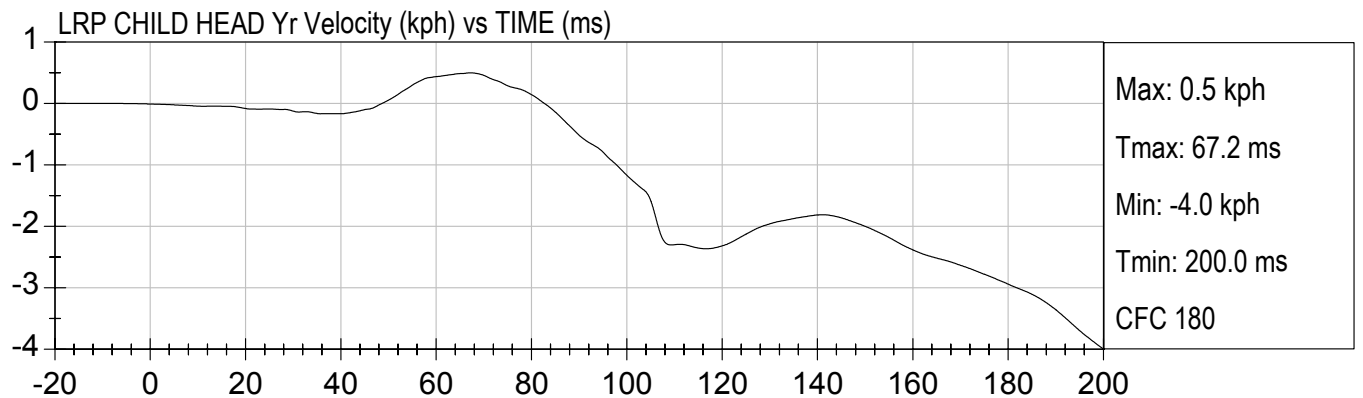
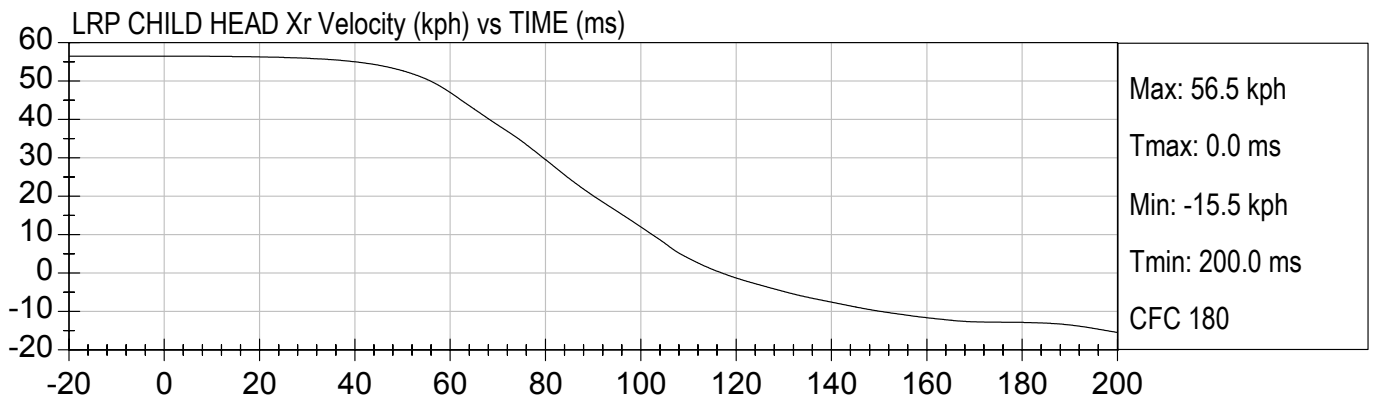
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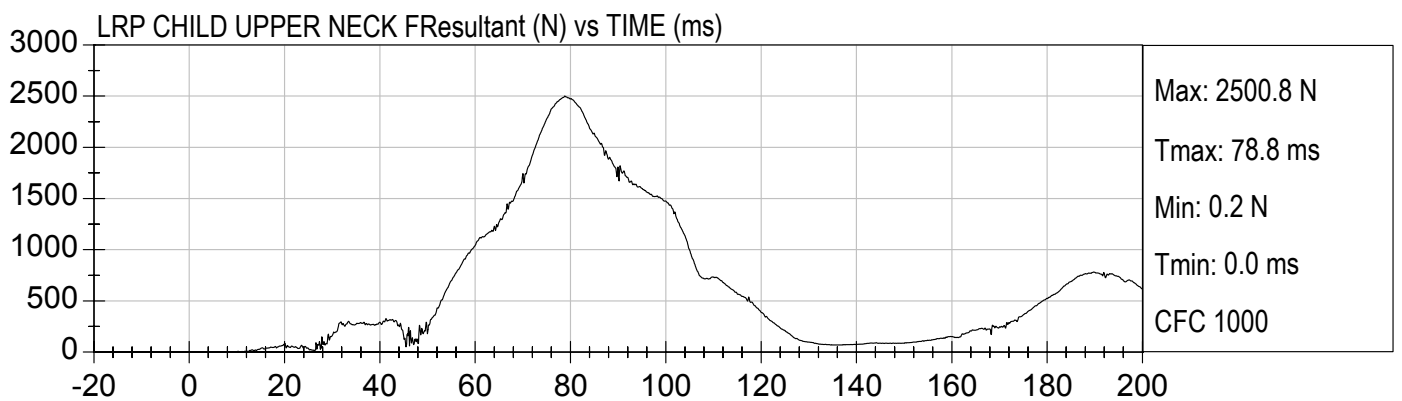
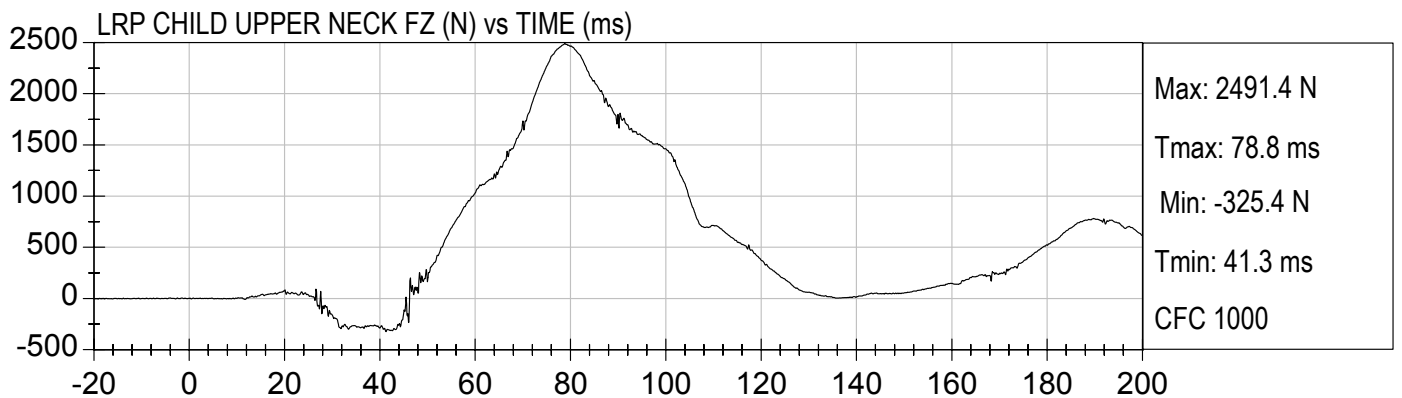
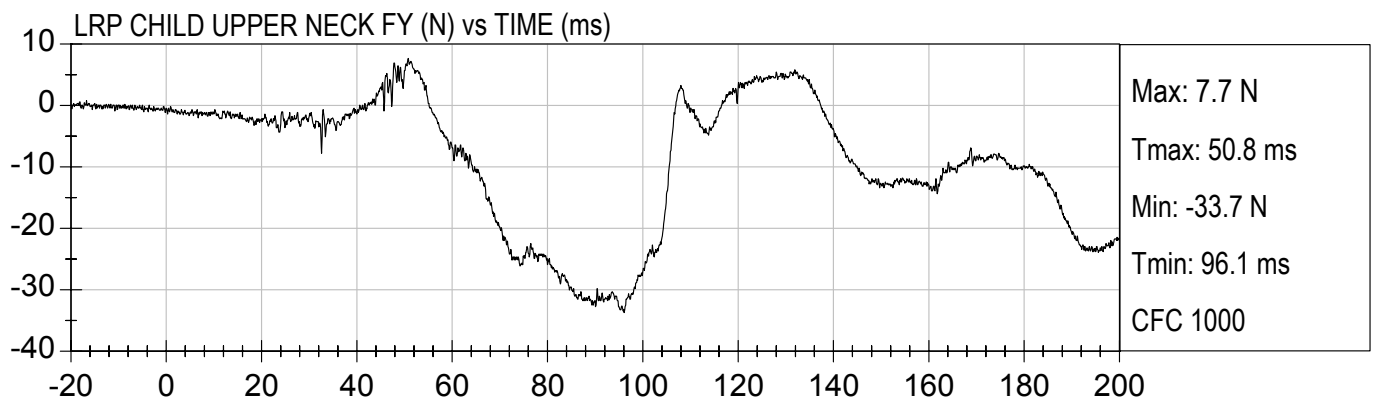
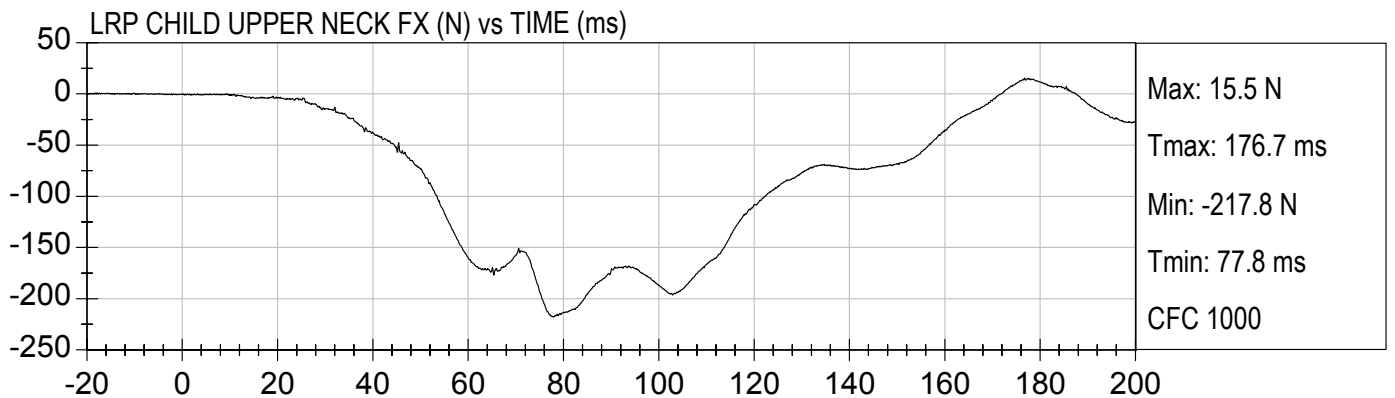
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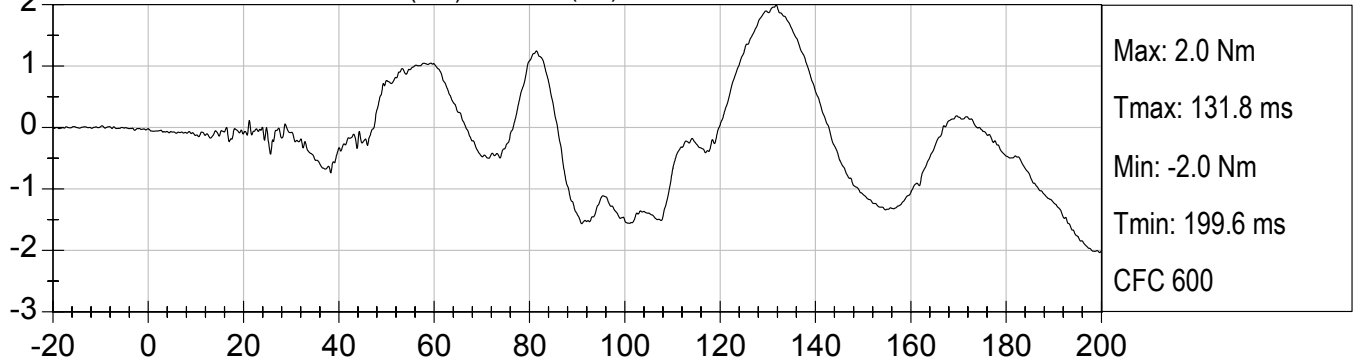




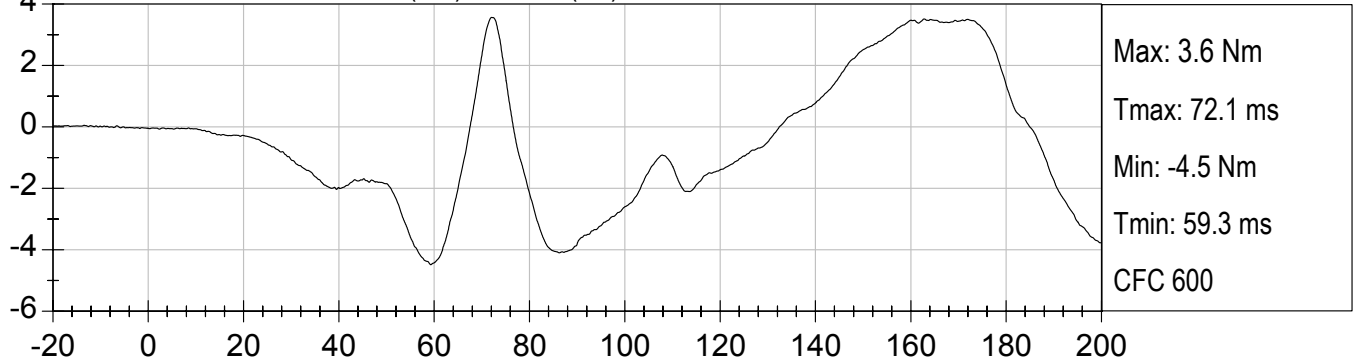




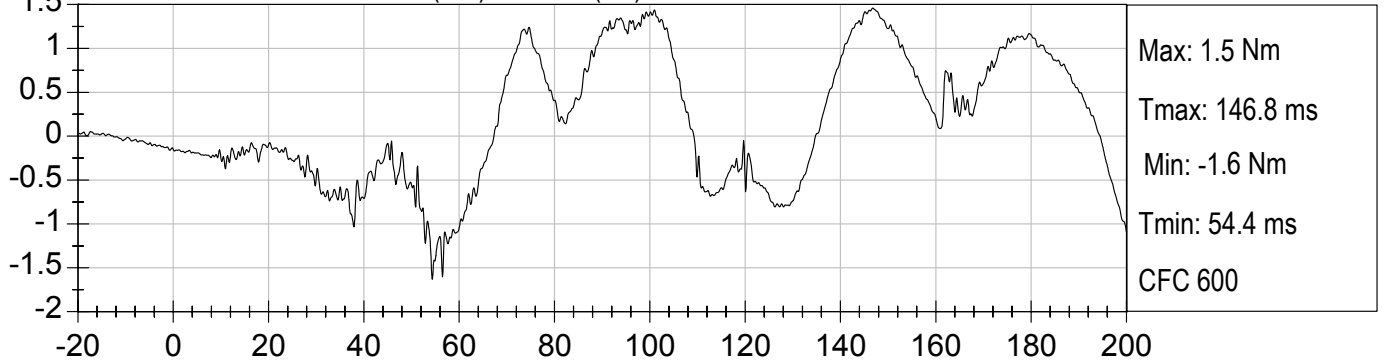
LRP CHILD UPPER NECK MX (Nm) vs TIME (ms)



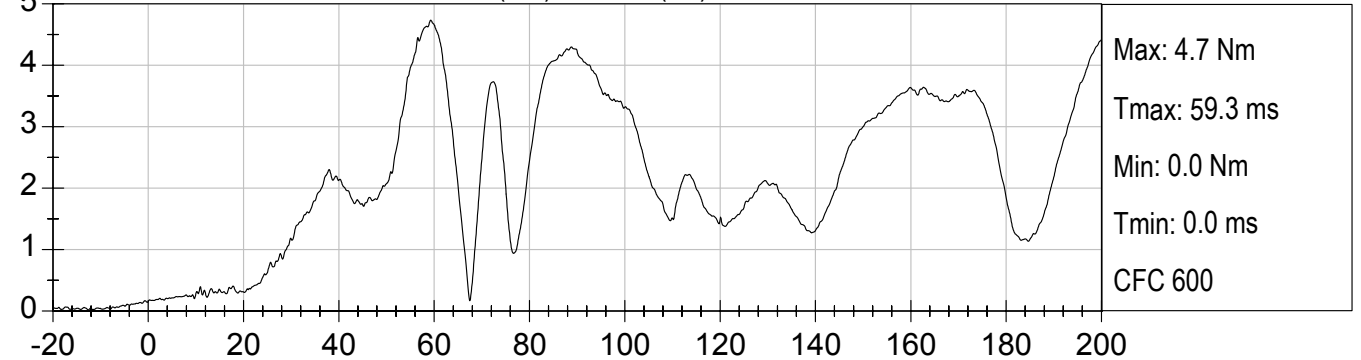
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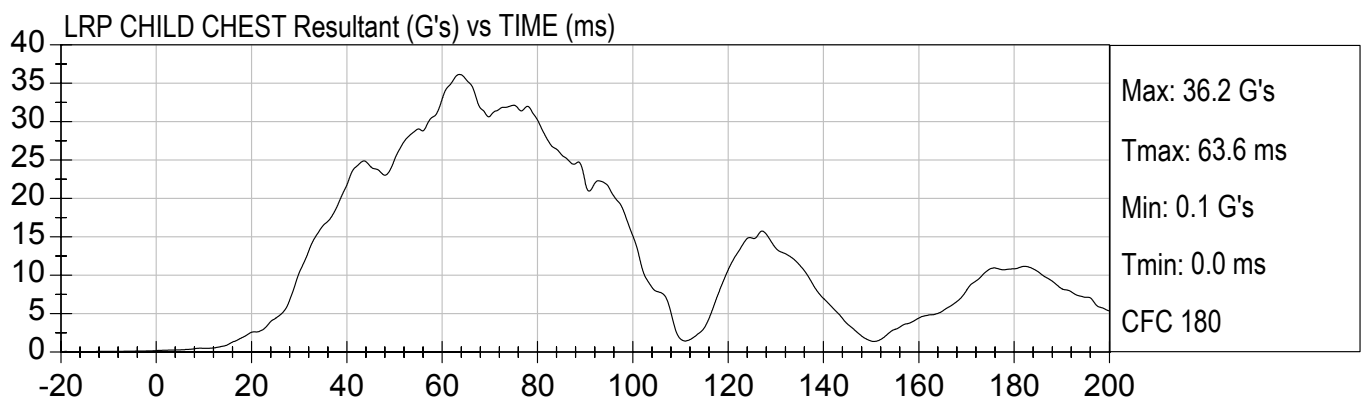
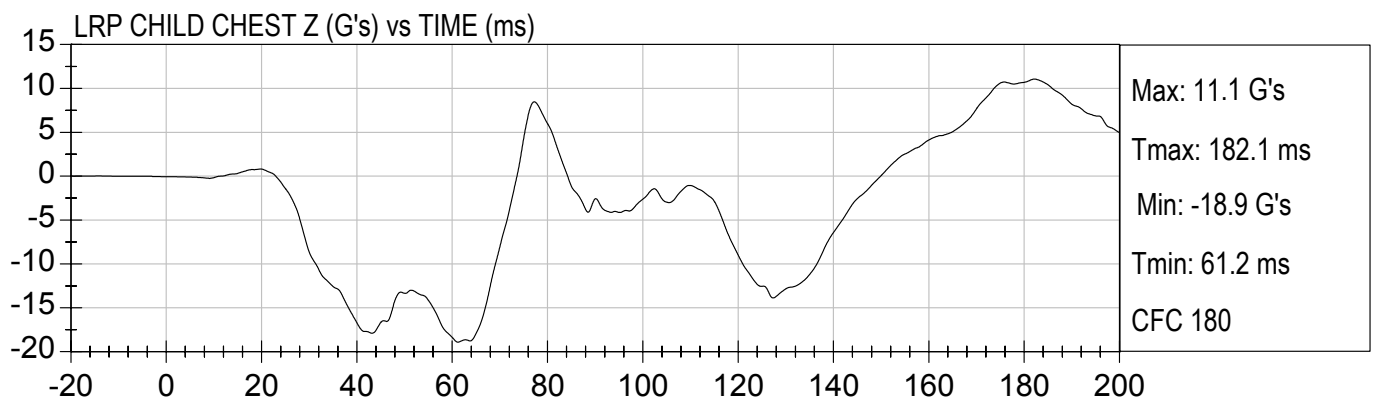
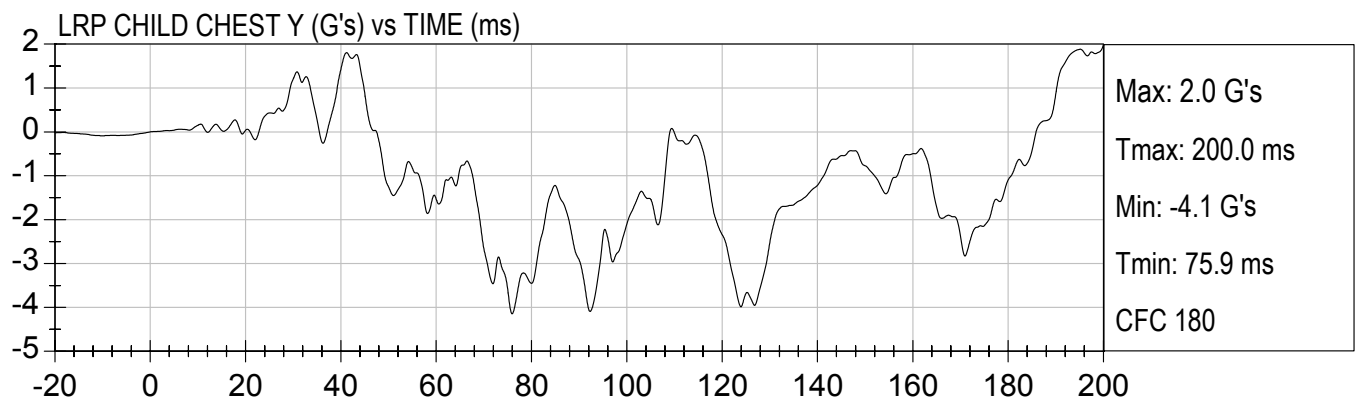
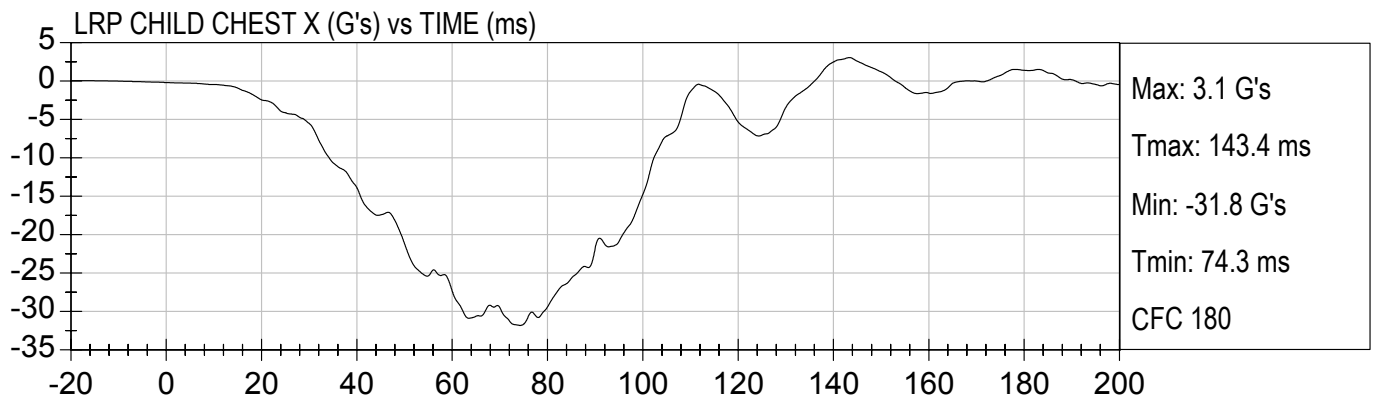


LRP CHILD UPPER NECK MZ (Nm) vs TIME (ms)



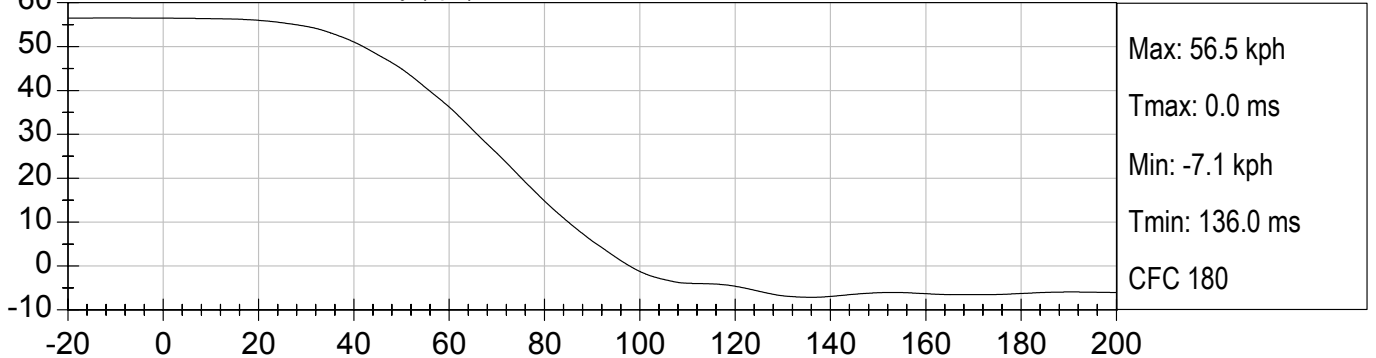
LRP CHILD UPPER NECK MResultant (Nm) vs TIME (ms)



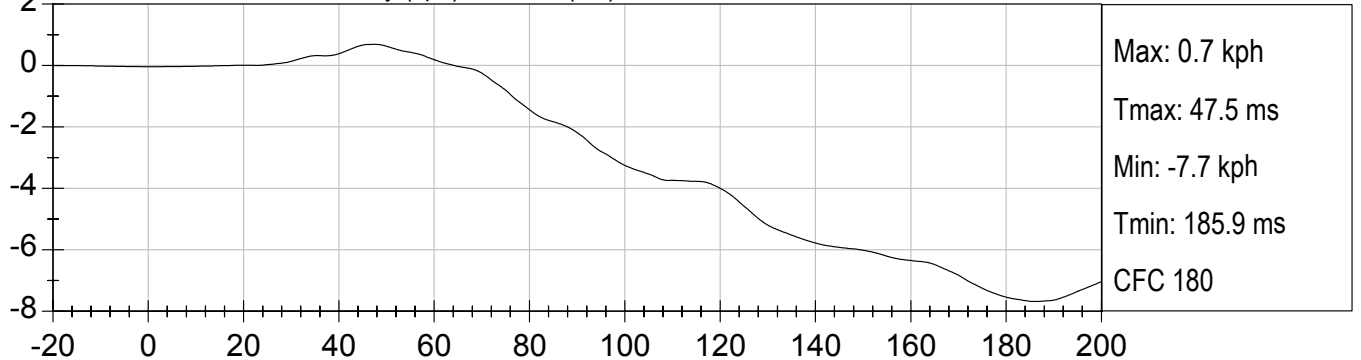




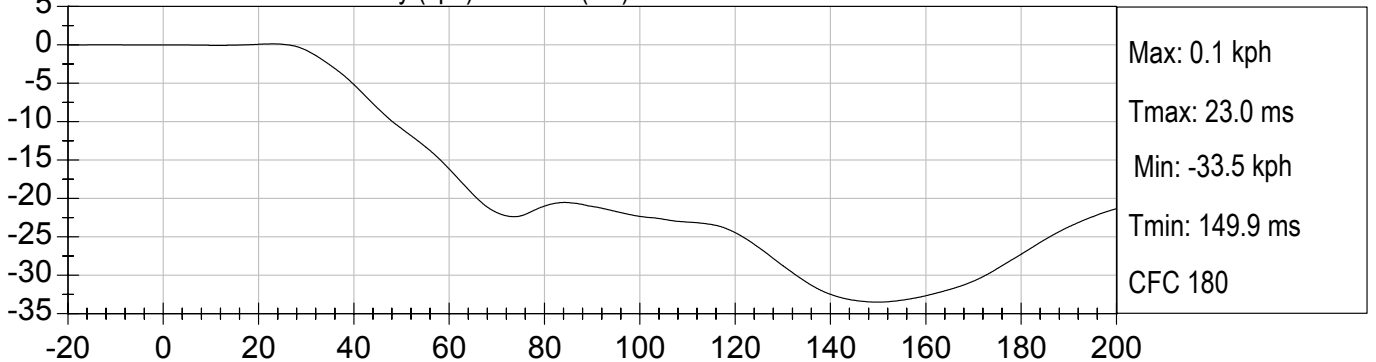
LRP CHILD CHEST X Velocity (kph) vs TIME (ms)



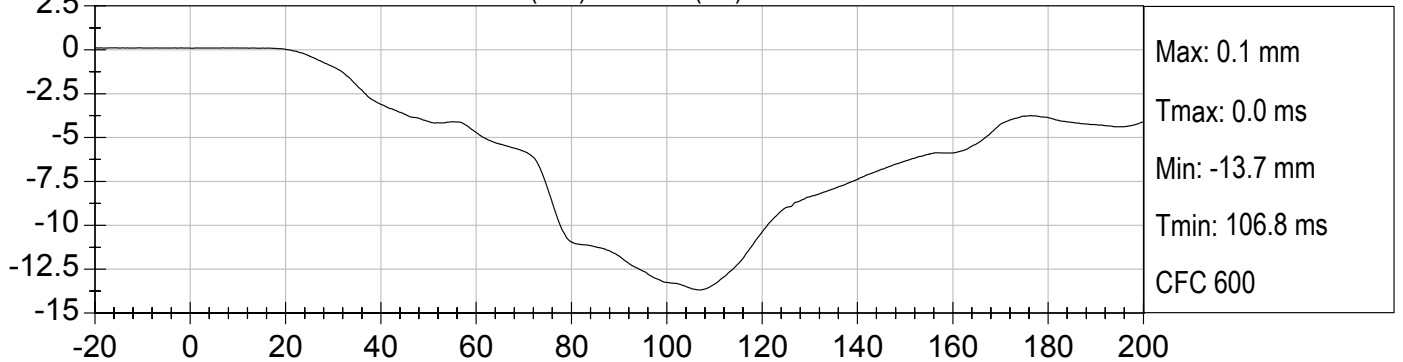
LRP CHILD CHEST Y Velocity (kph) vs TIME (ms)

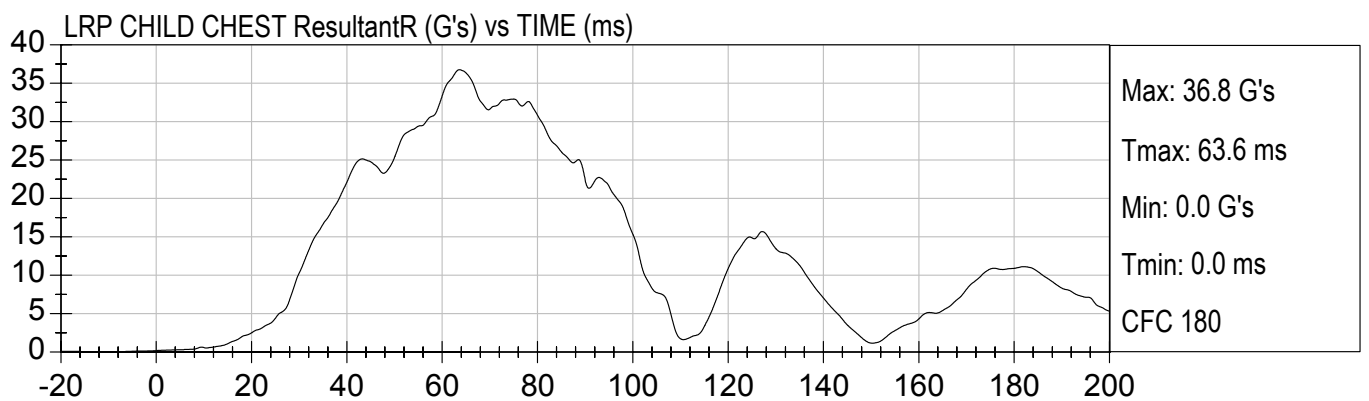
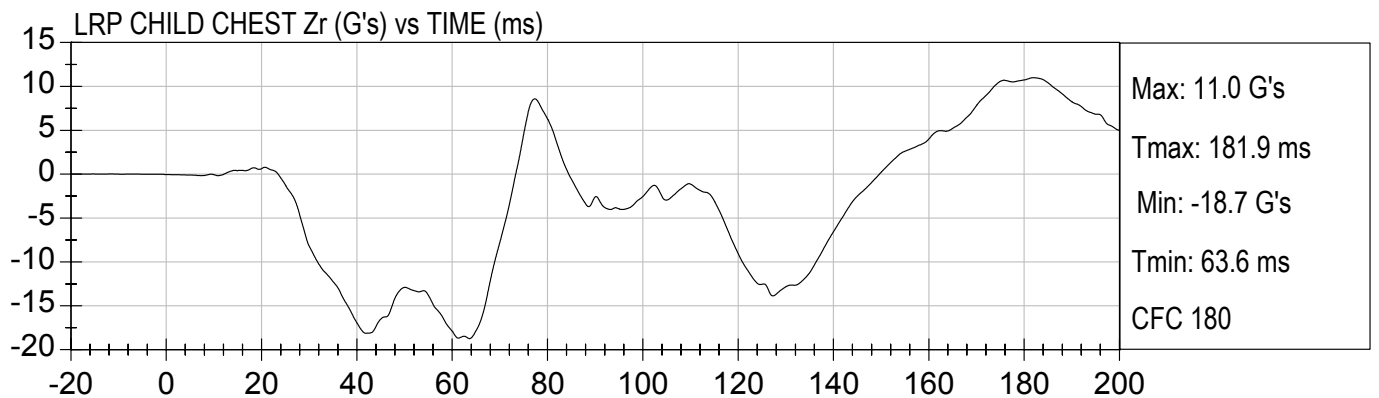
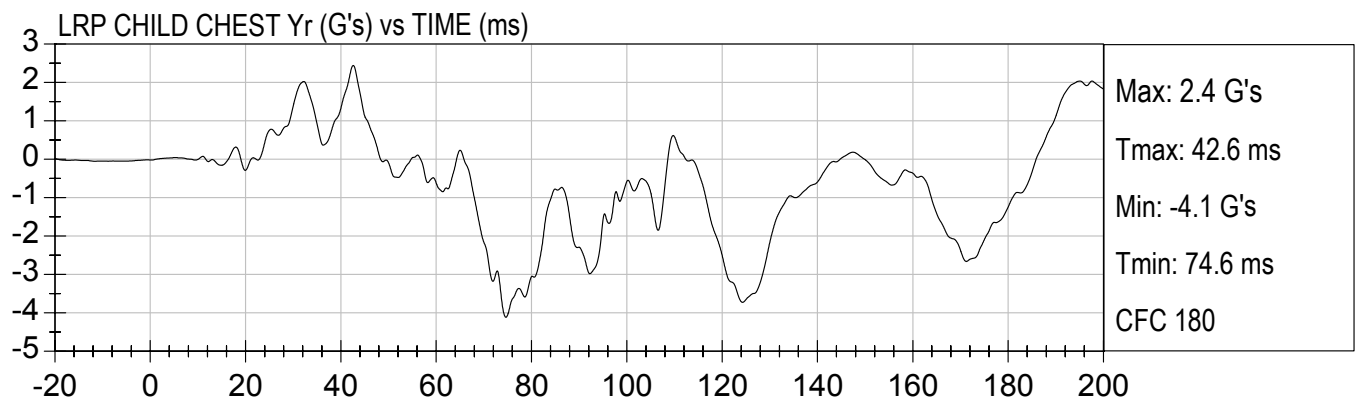
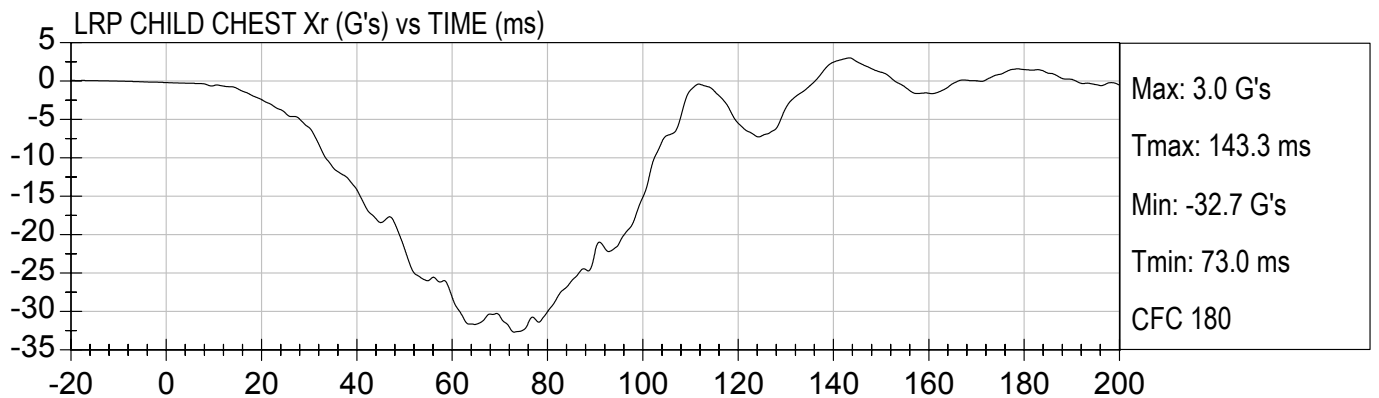


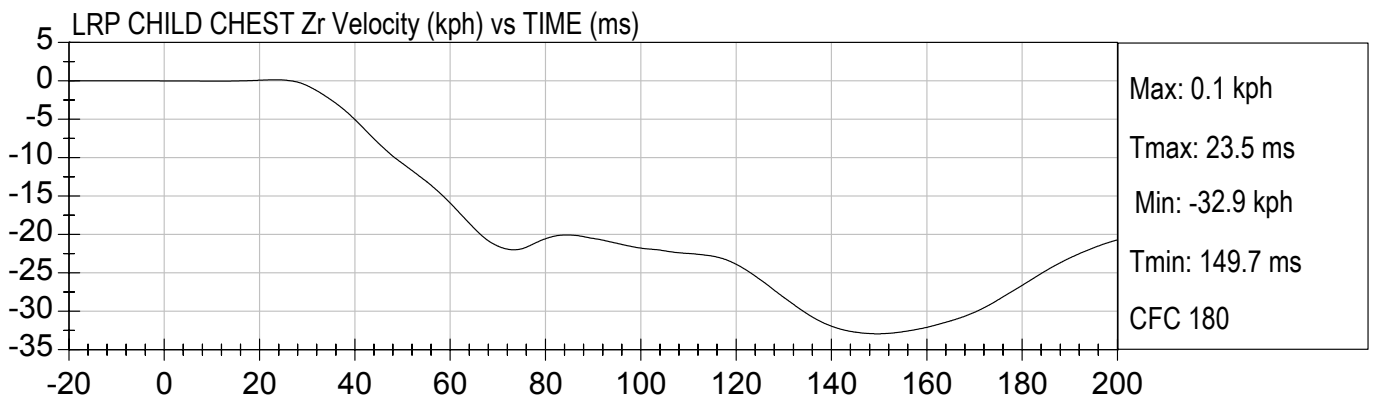
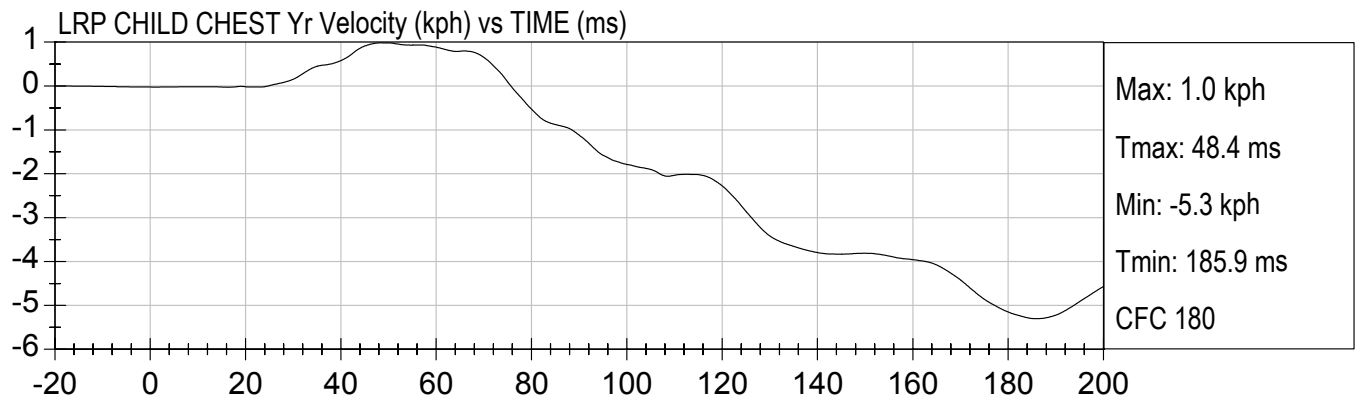
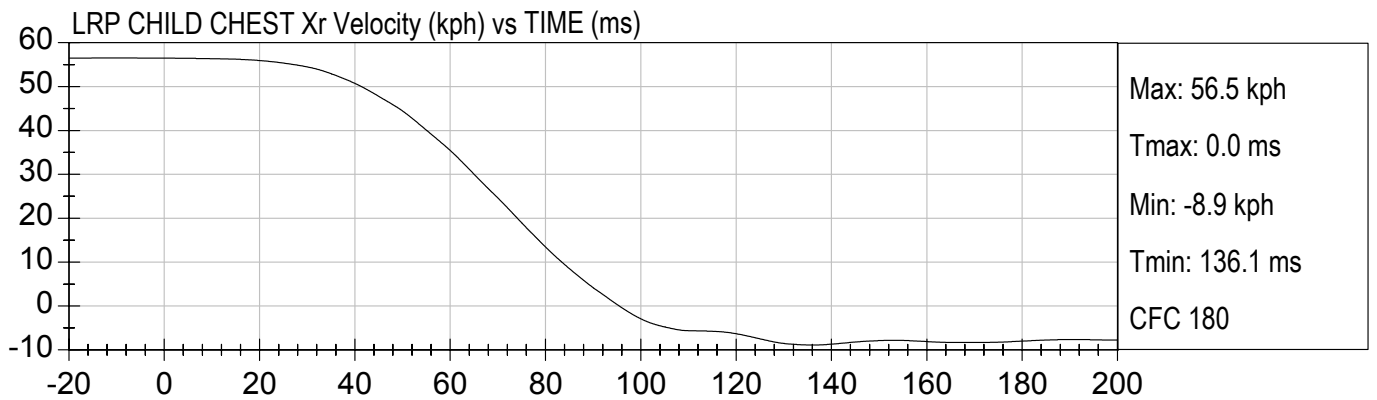
LRP CHILD CHEST Z Velocity (kph) vs TIME (ms)

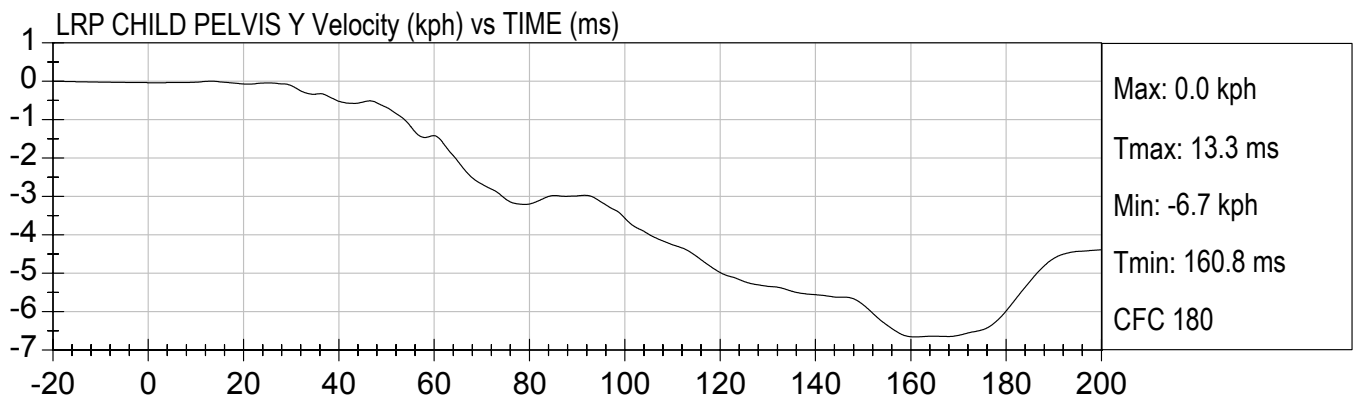
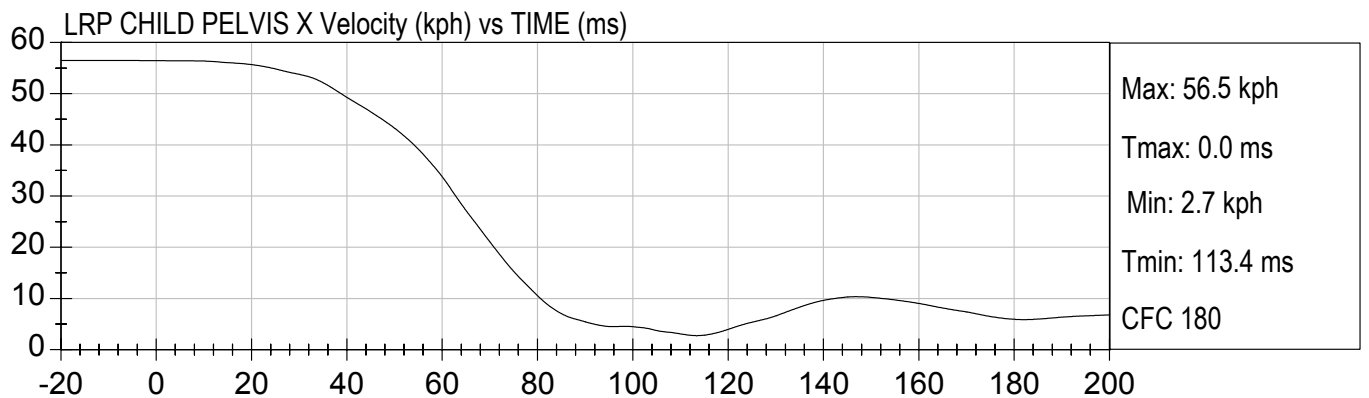
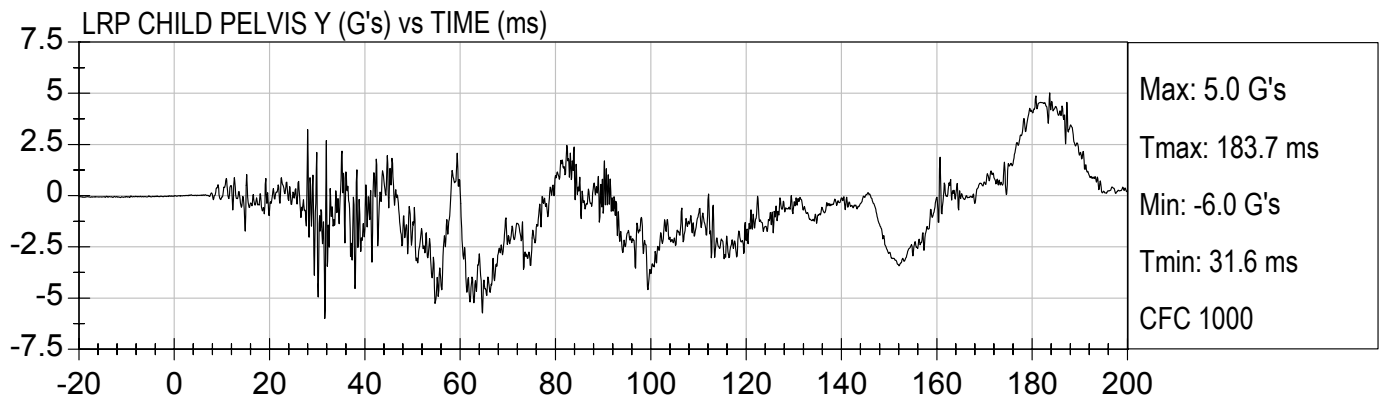
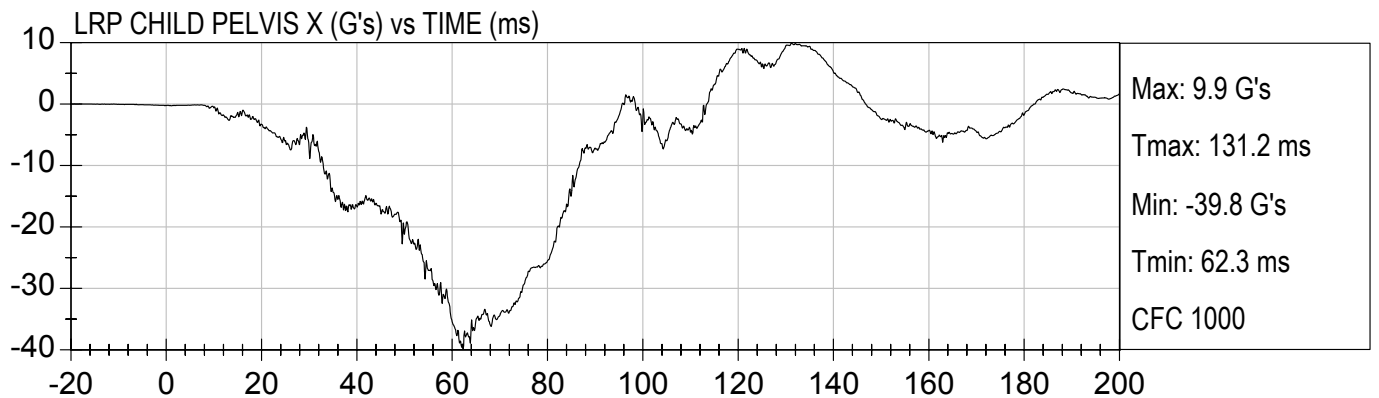


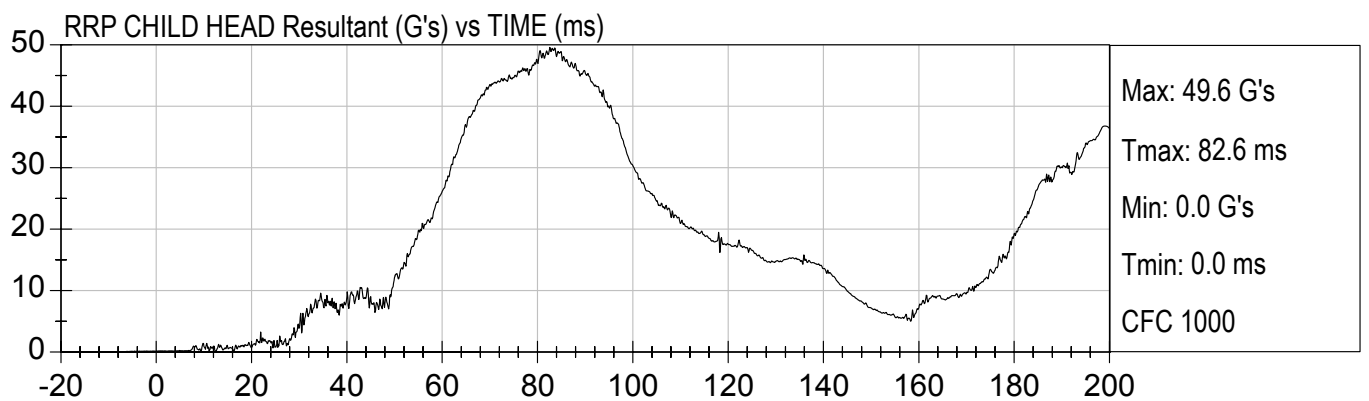
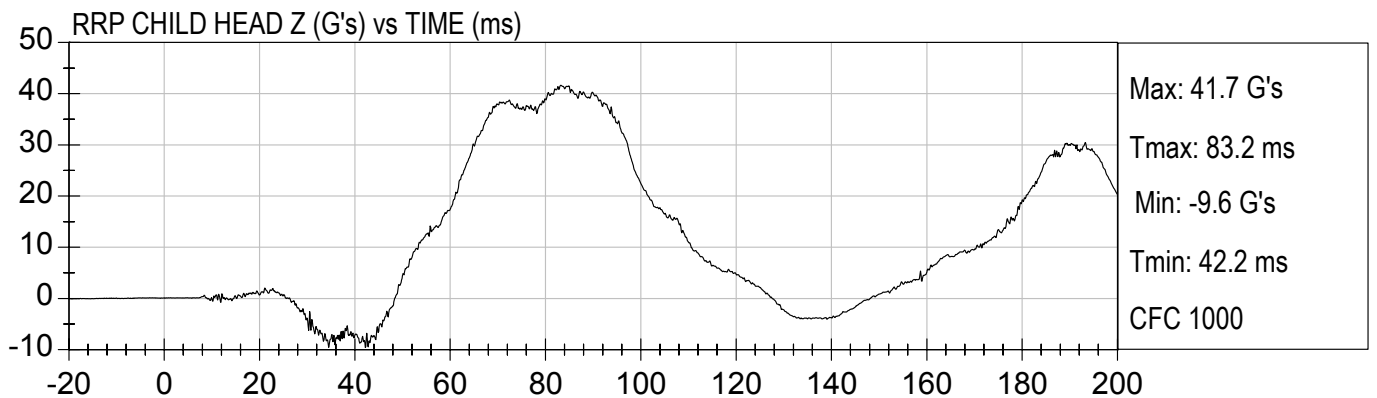
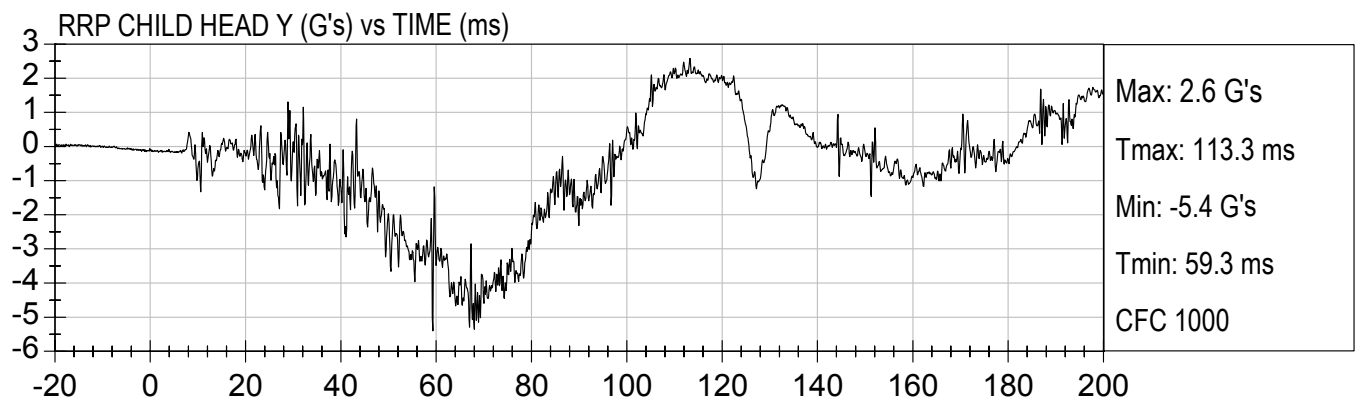
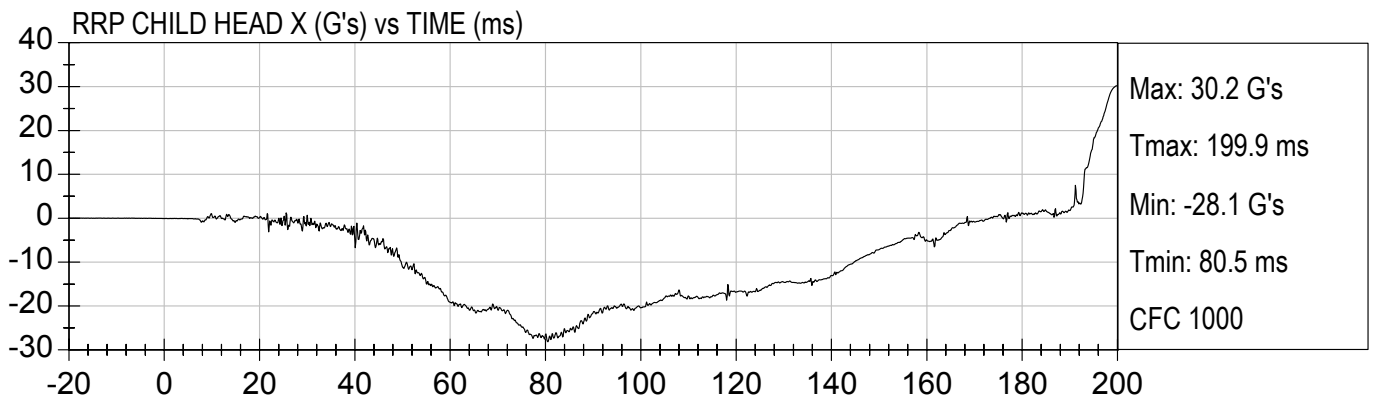
LRP CHILD CHEST DISPLACEMENT (mm) vs TIME (ms)

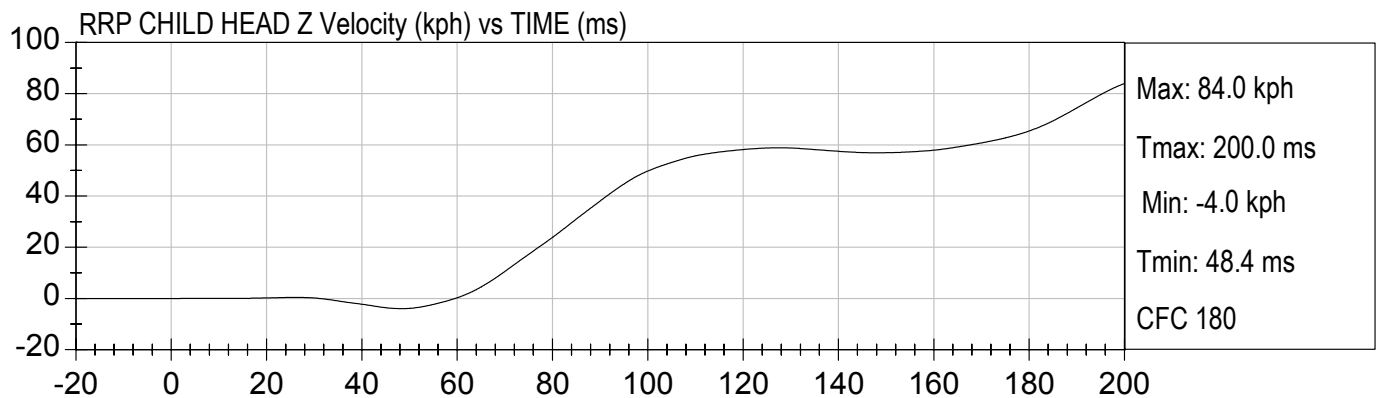
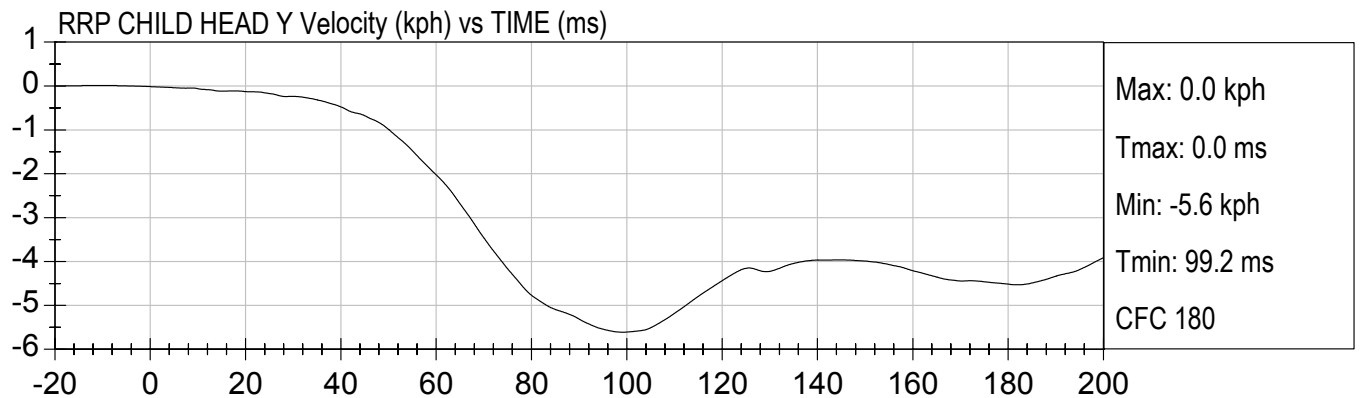
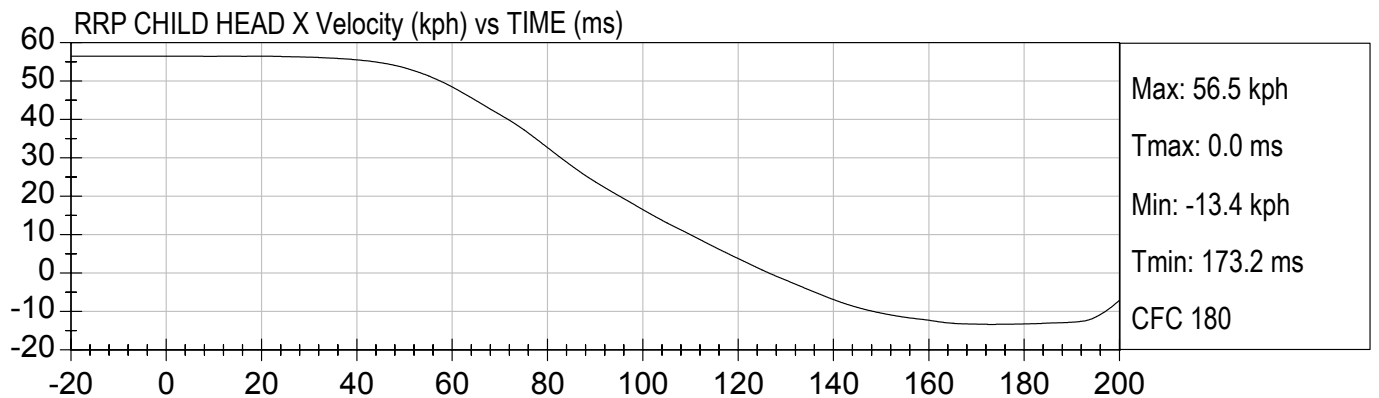


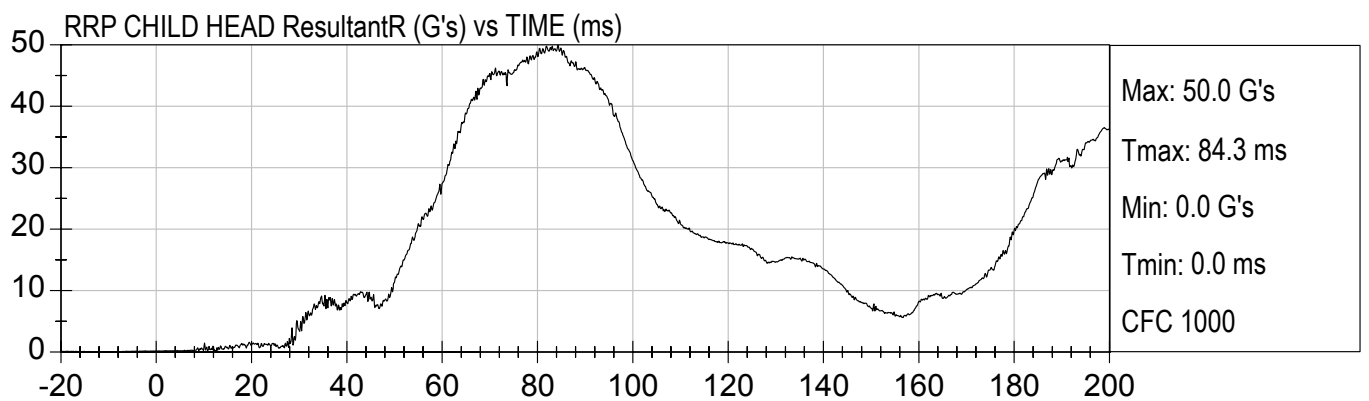
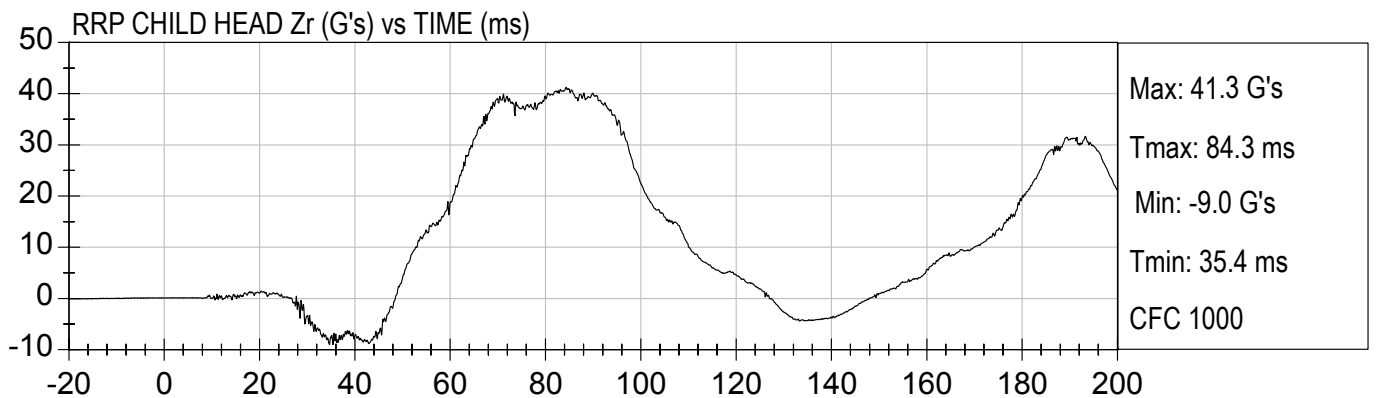
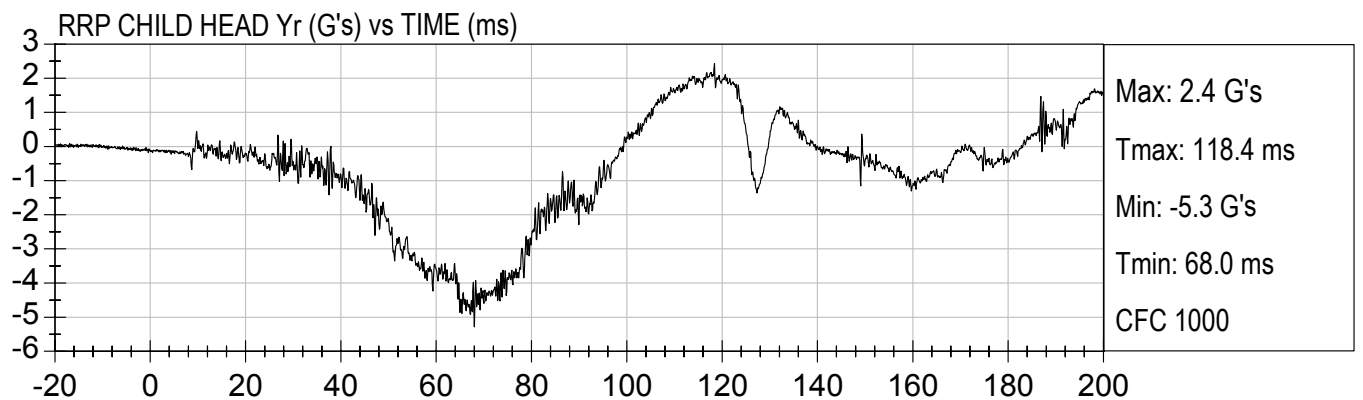
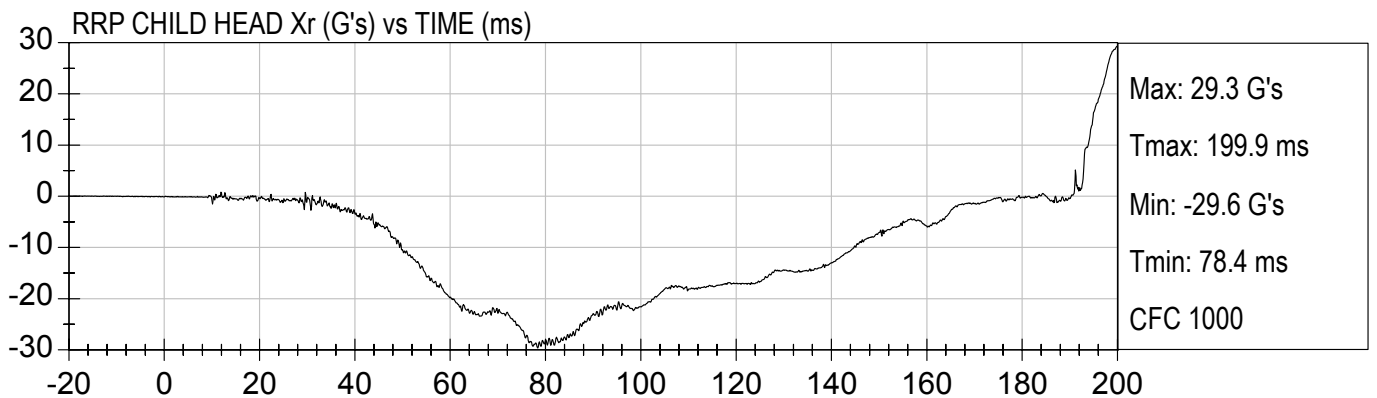


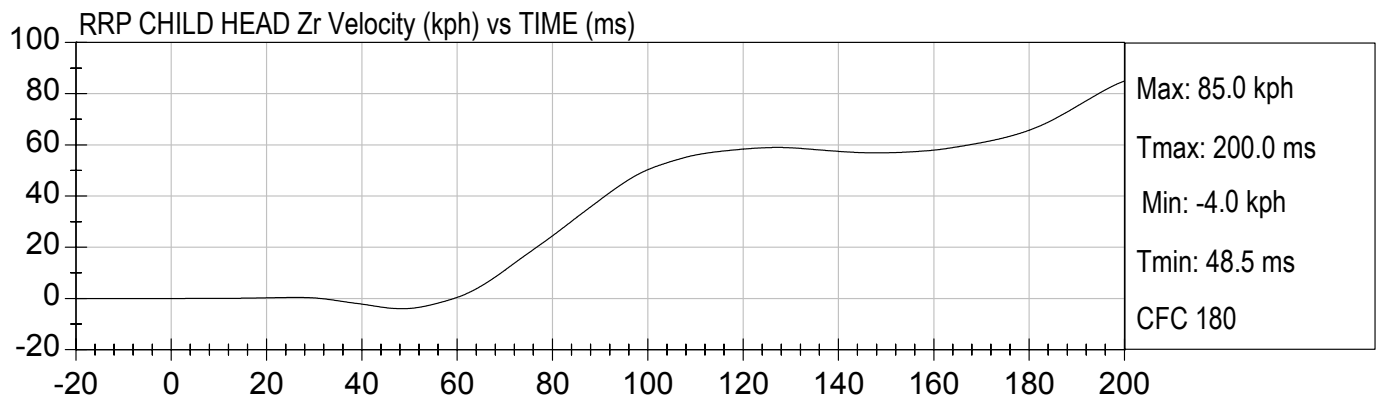
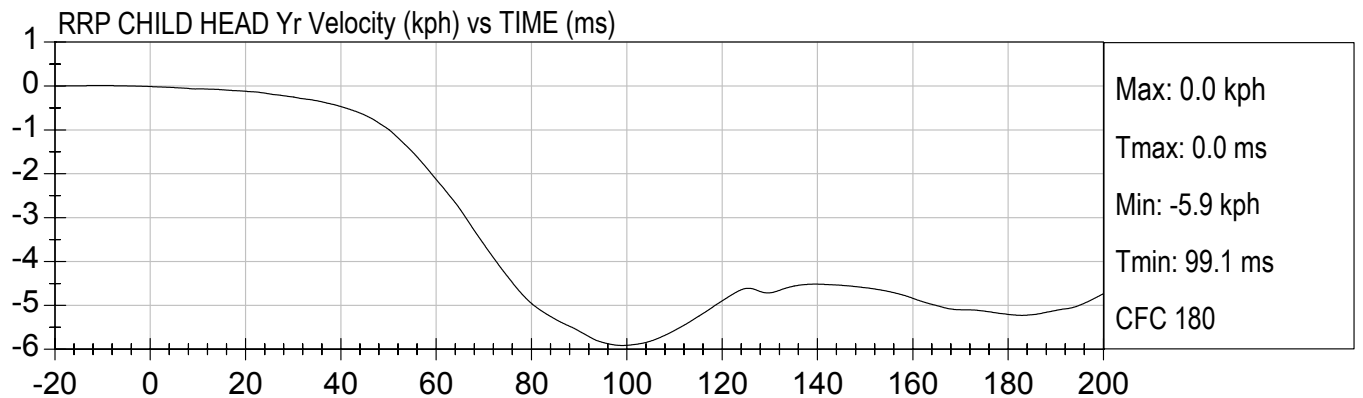
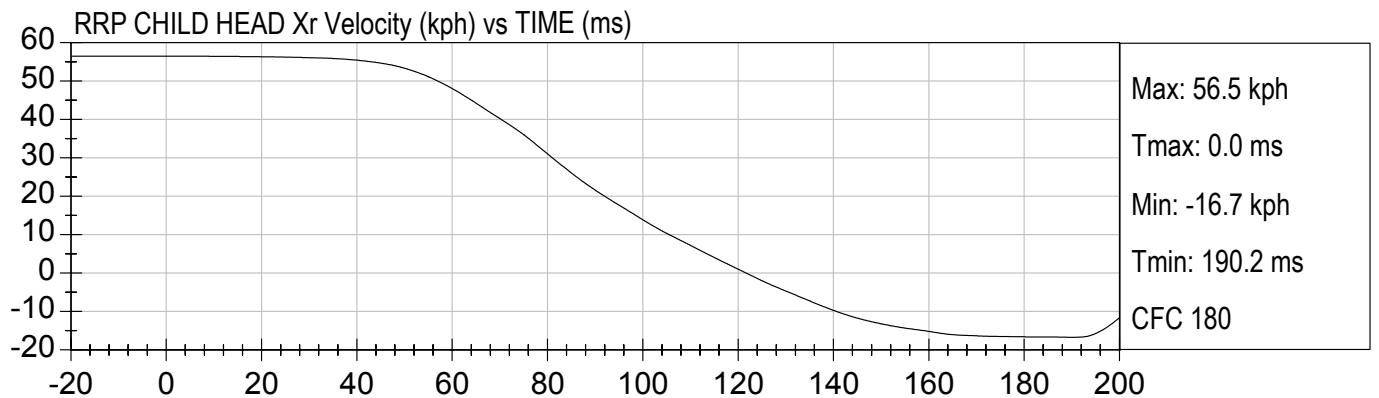


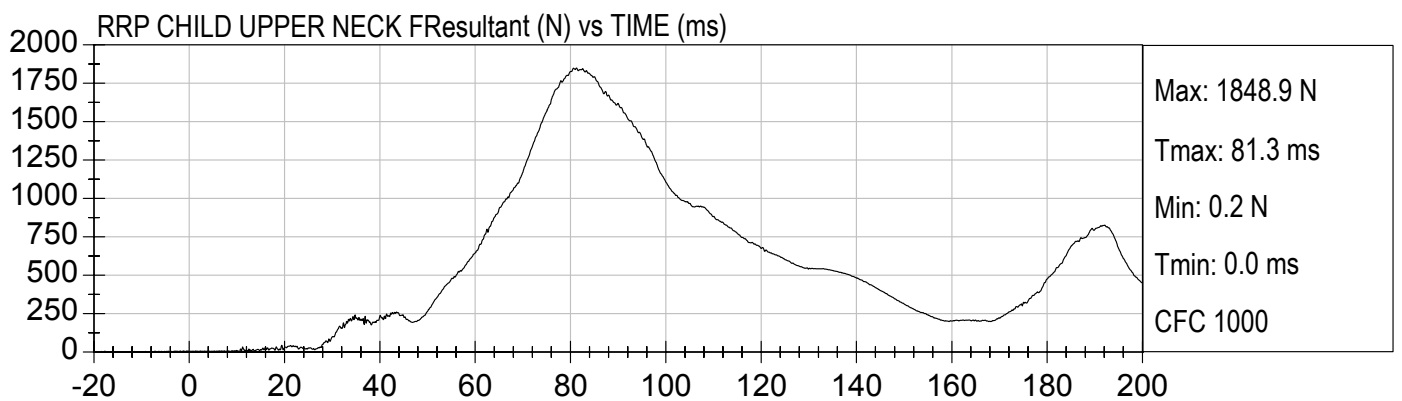
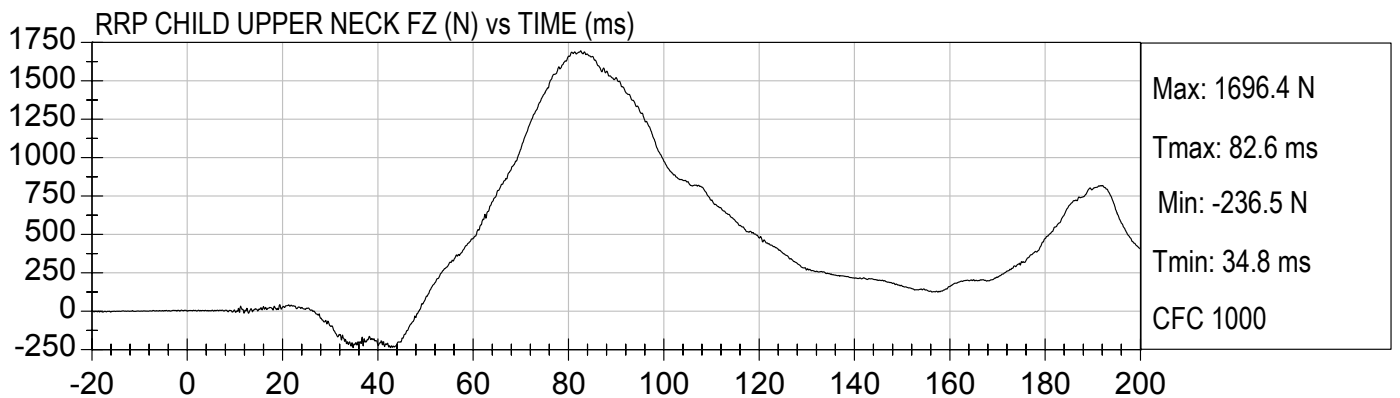
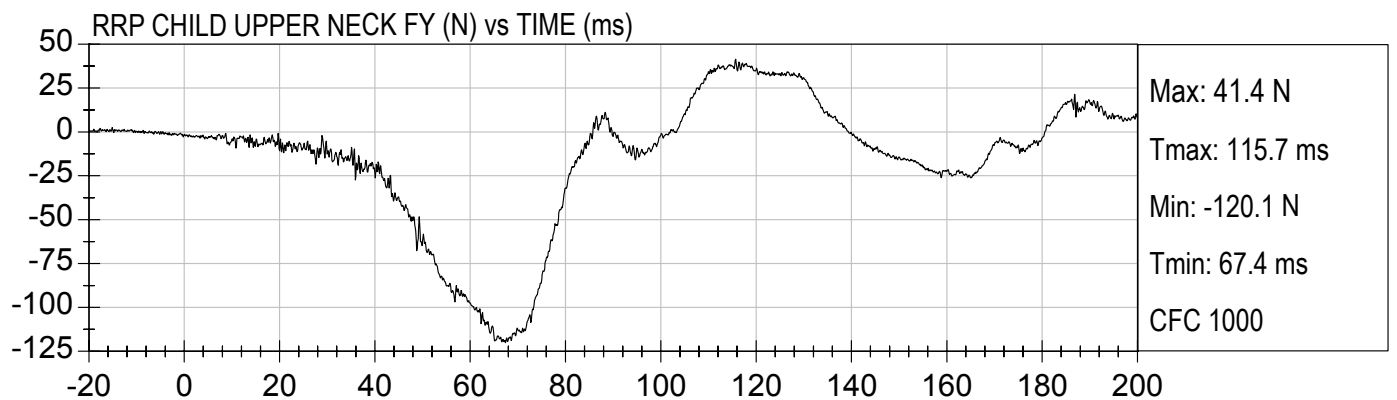
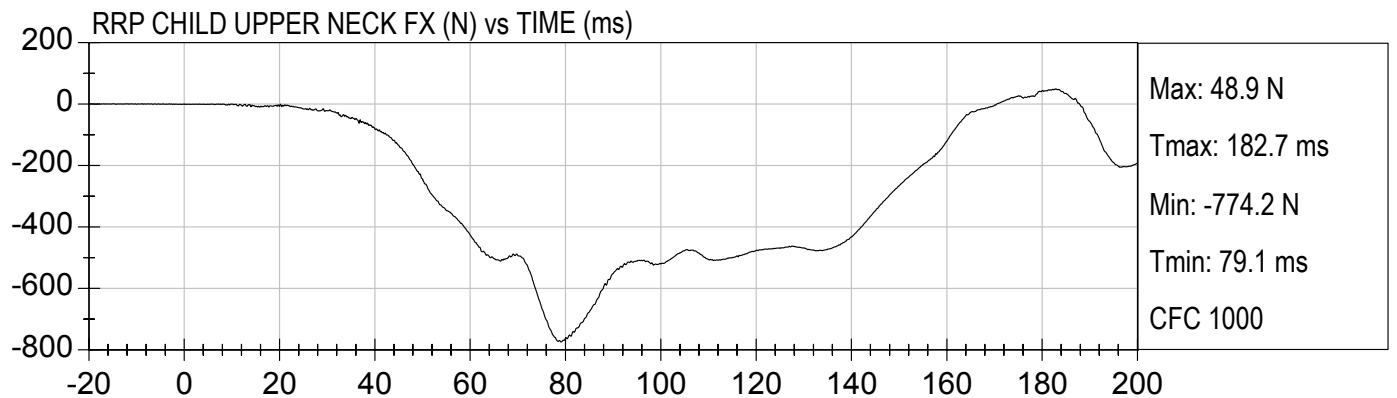


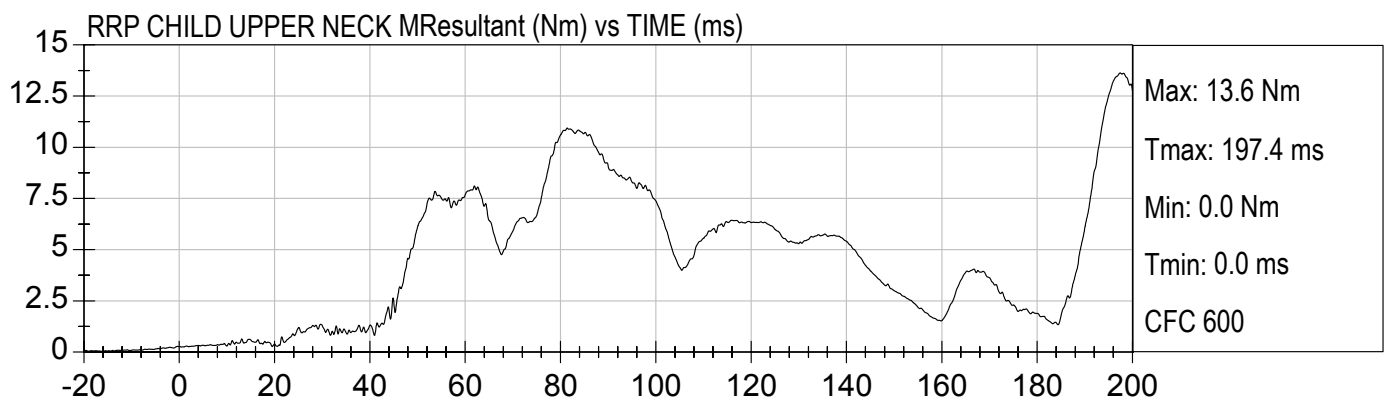
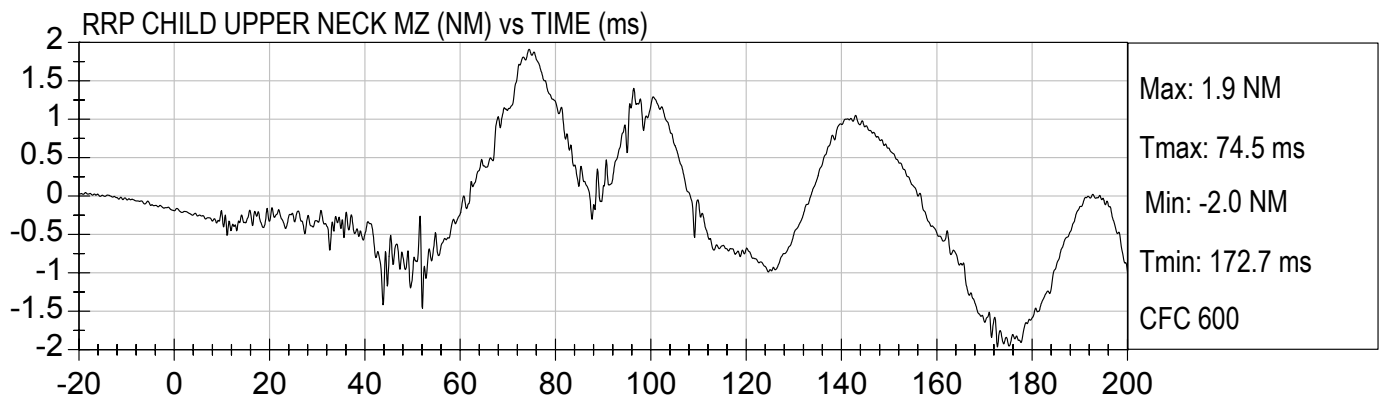
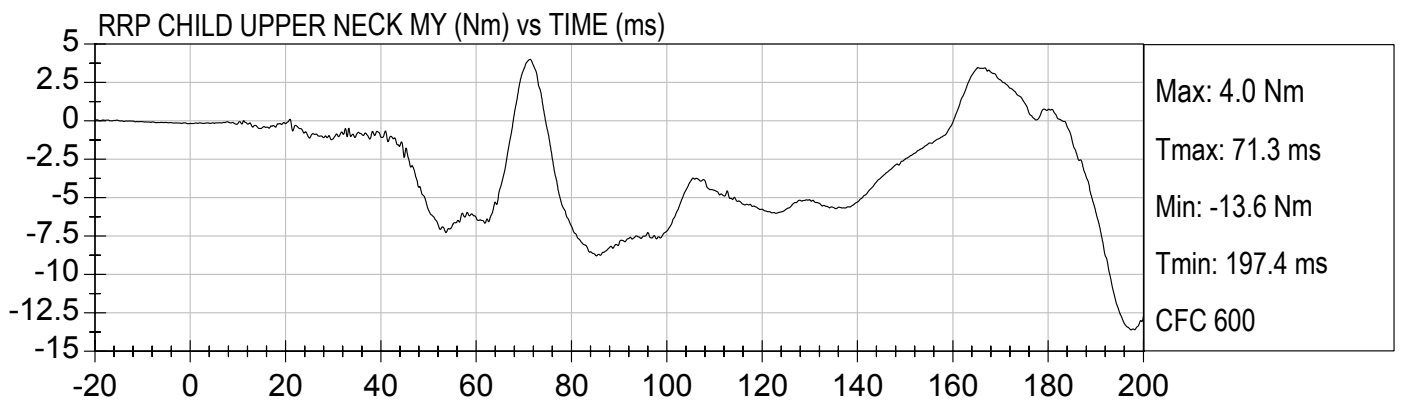
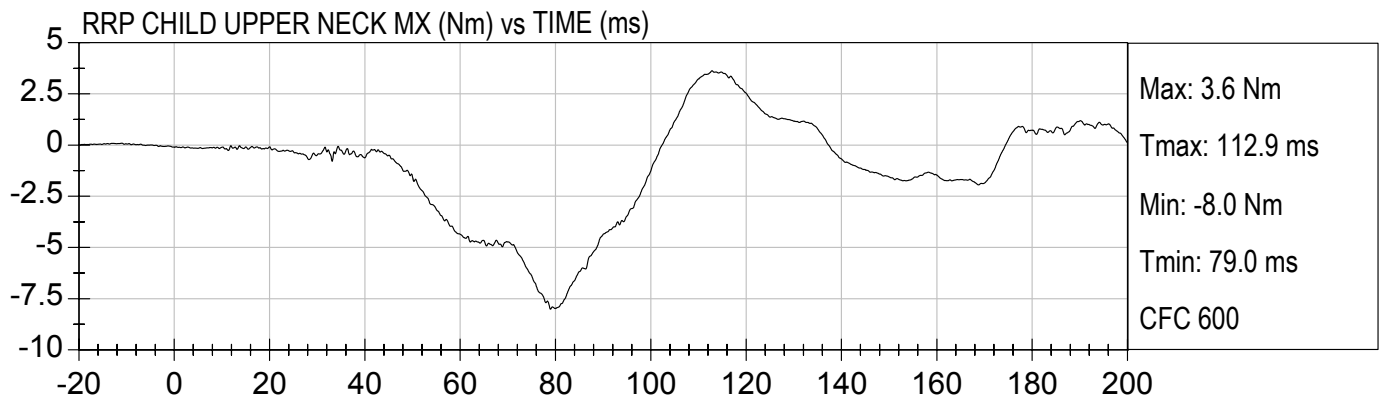


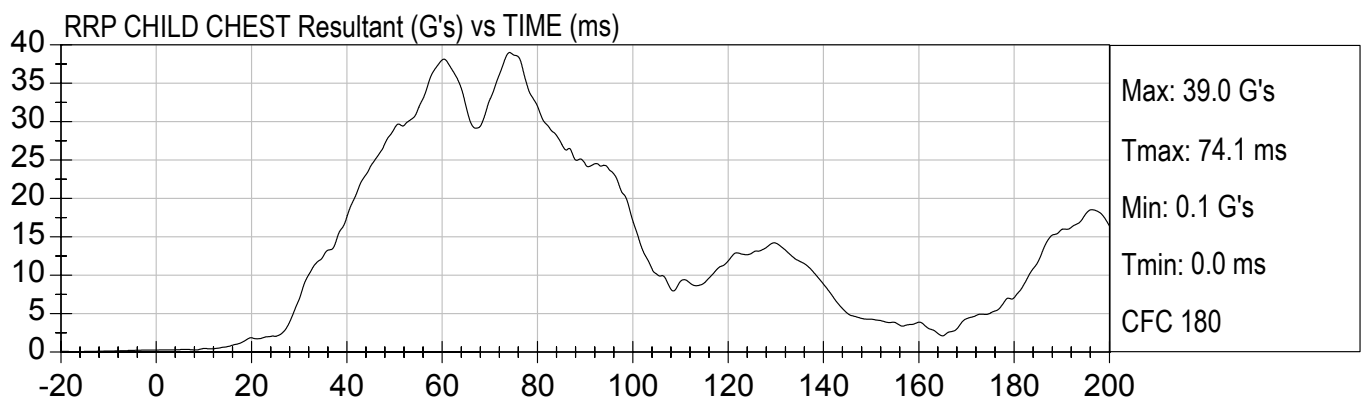
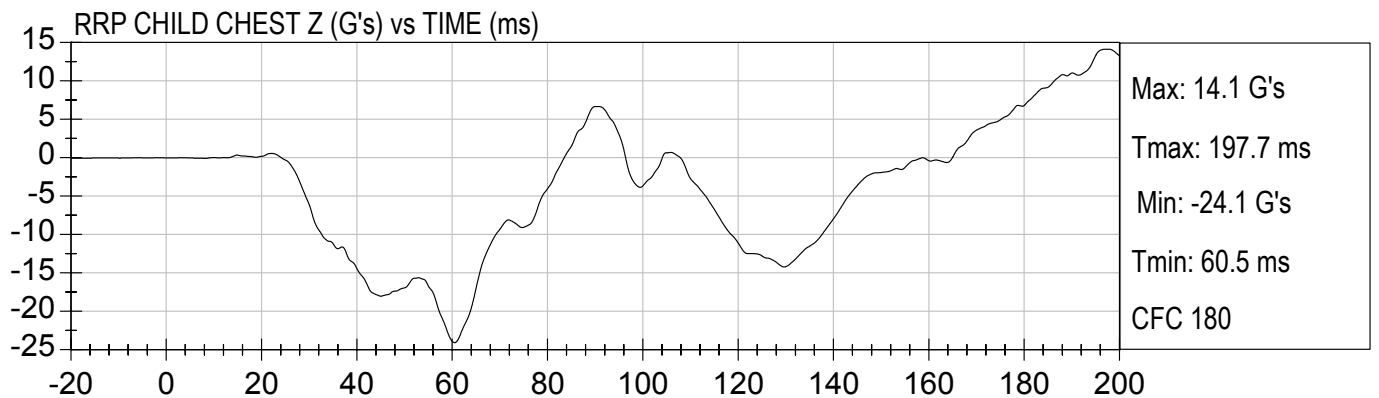
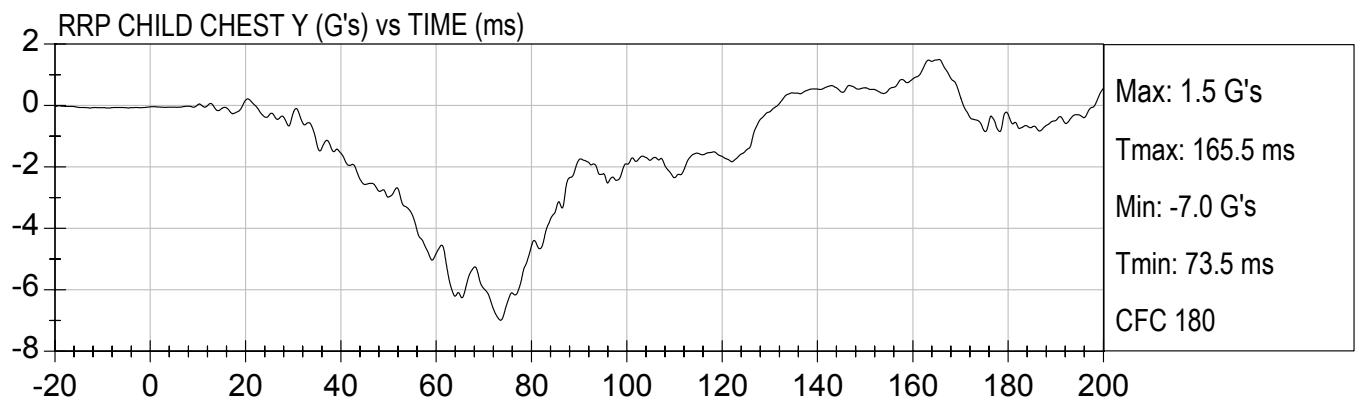
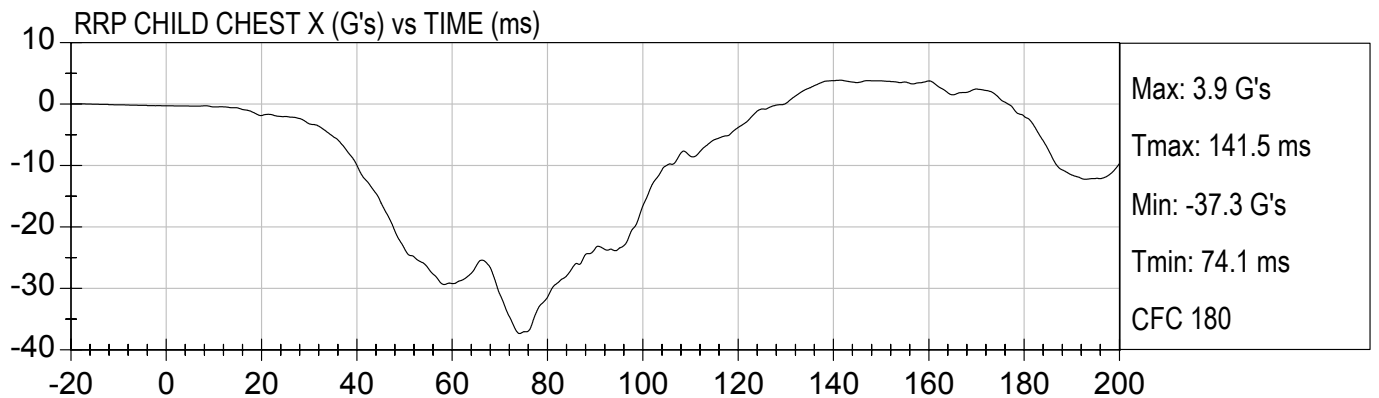






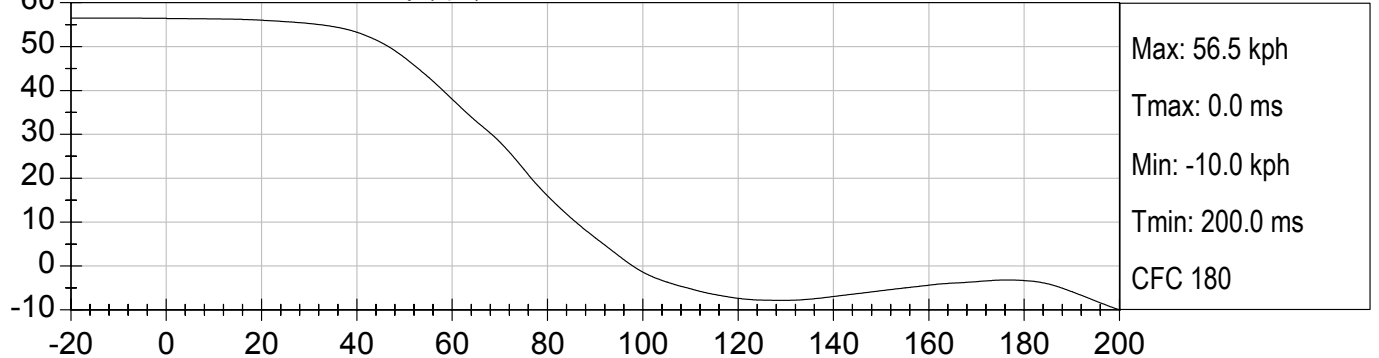




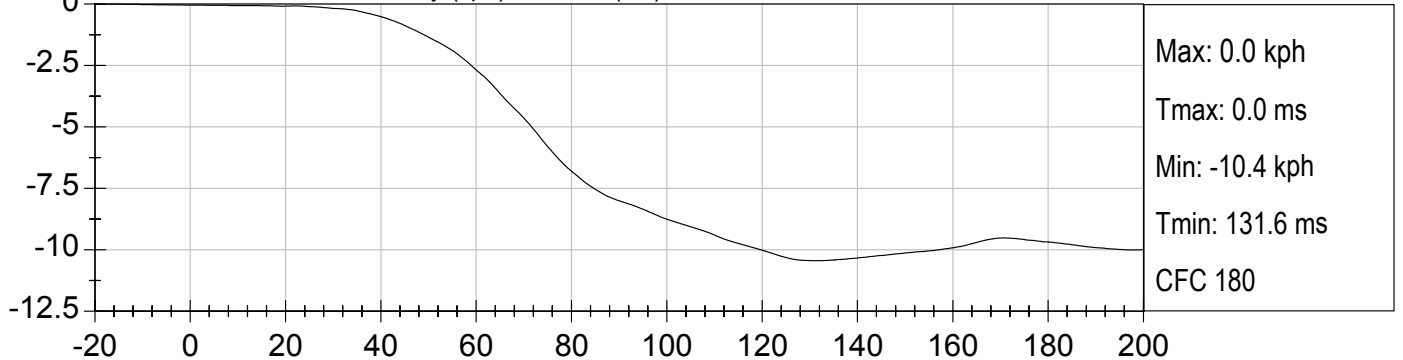




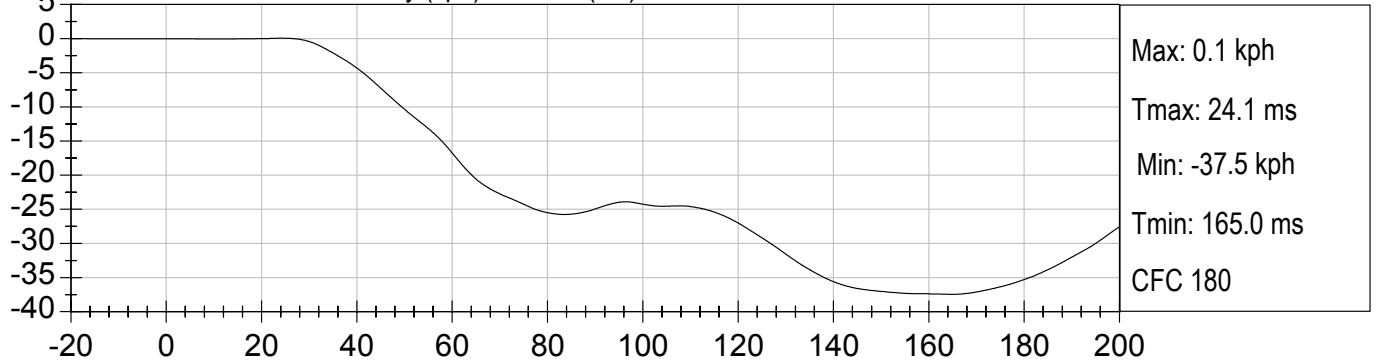
RRP CHILD CHEST X Velocity (kph) vs TIME (ms)



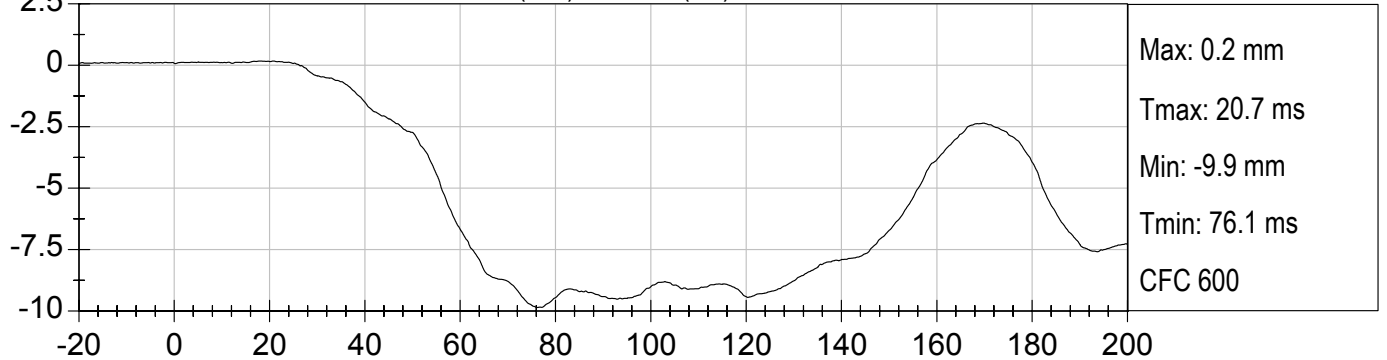
RRP CHILD CHEST Y Velocity (kph) vs TIME (ms)



RRP CHILD CHEST Z Velocity (kph) vs TIME (ms)



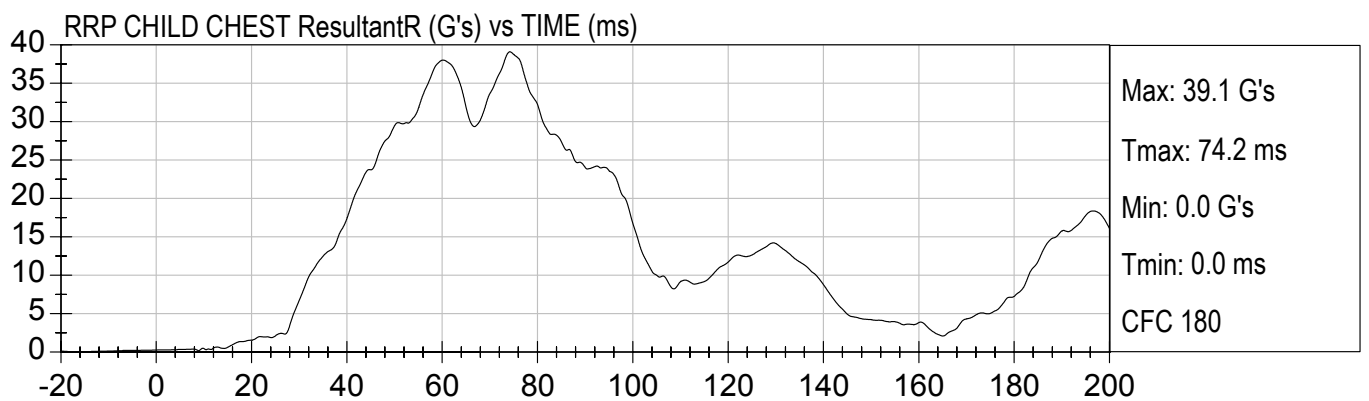
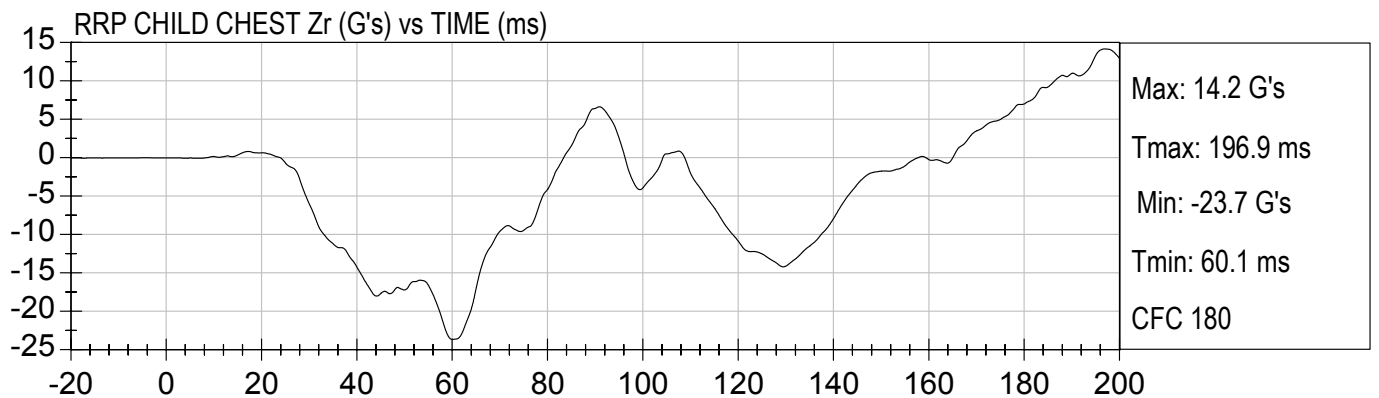
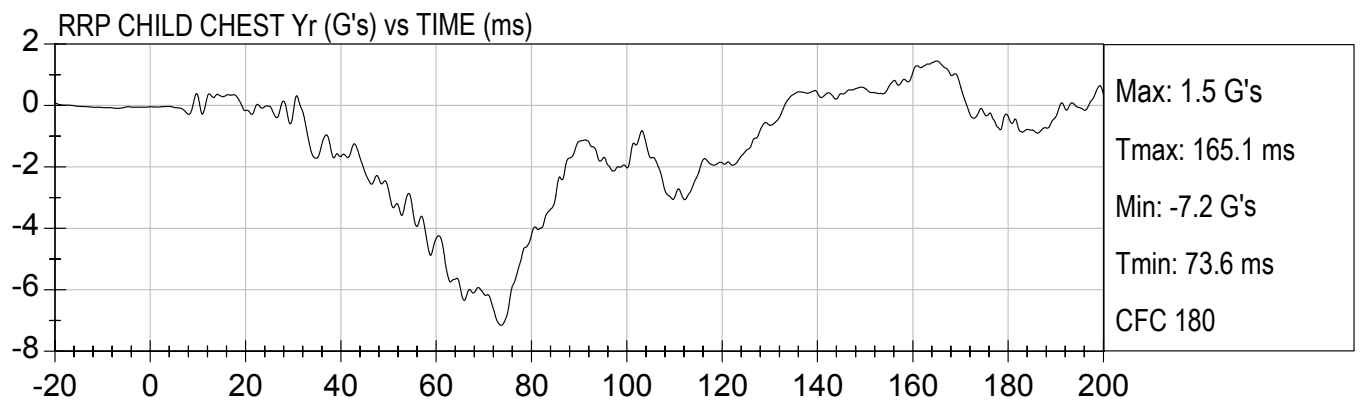
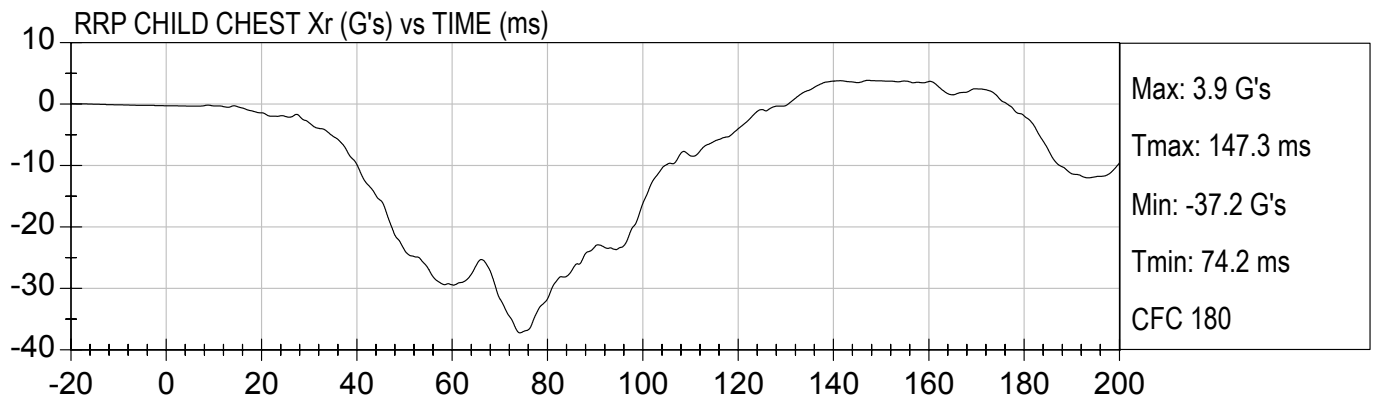
RRP CHILD CHEST DISPLACEMENT (mm) vs TIME (ms)

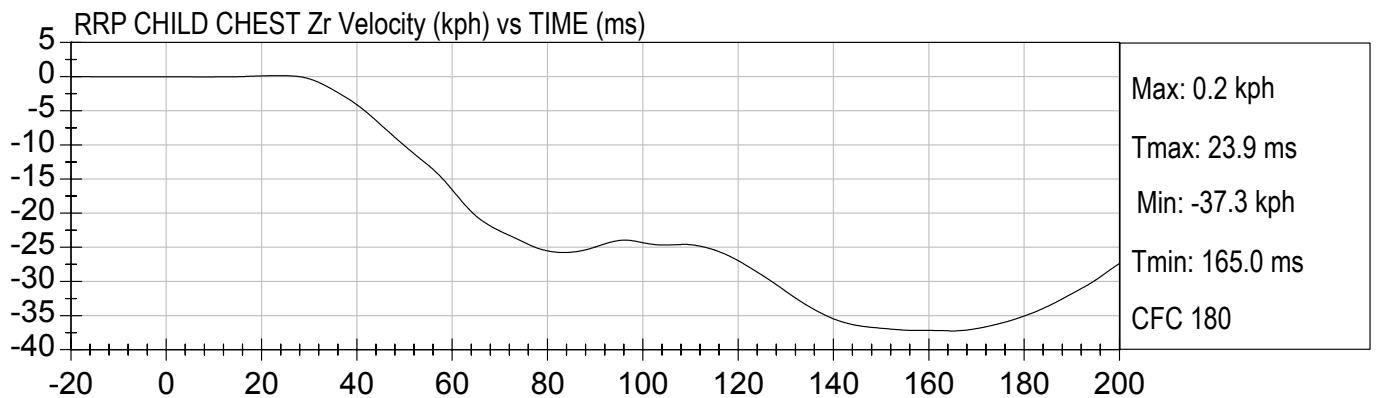
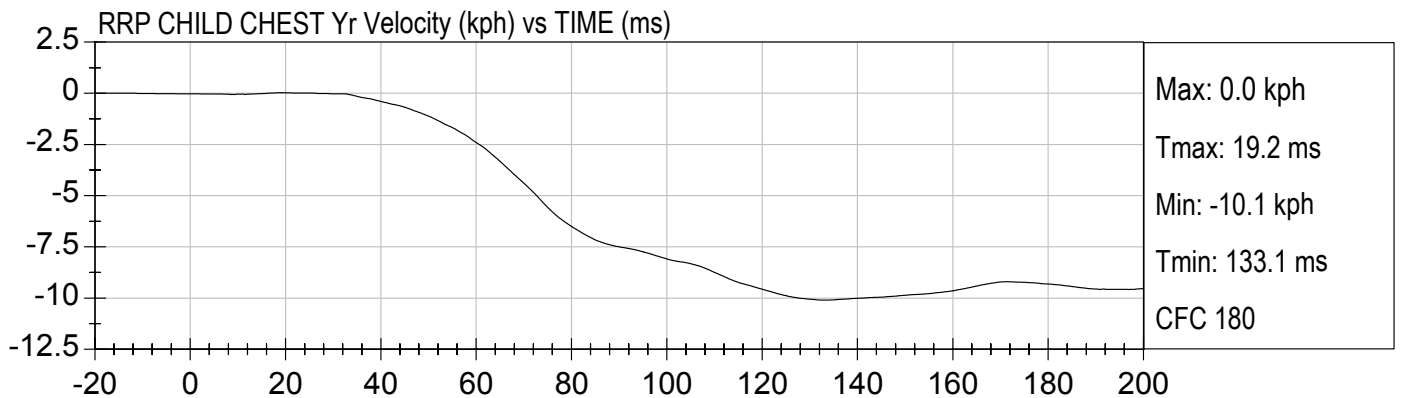
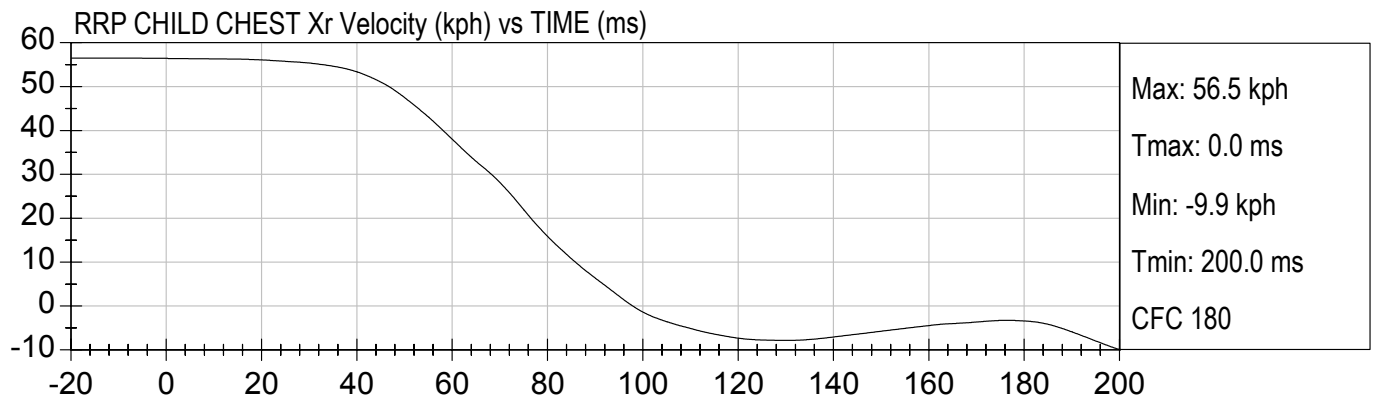


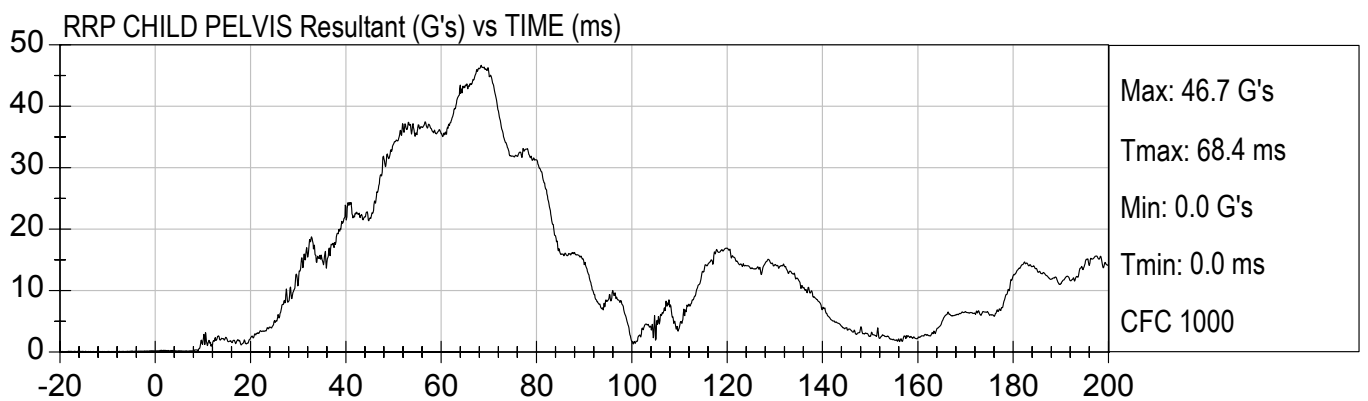
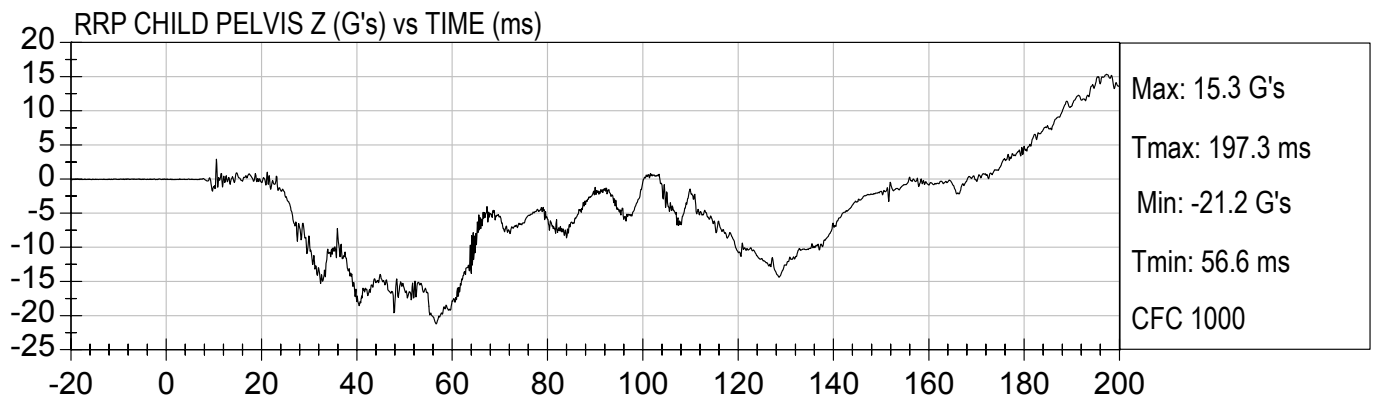
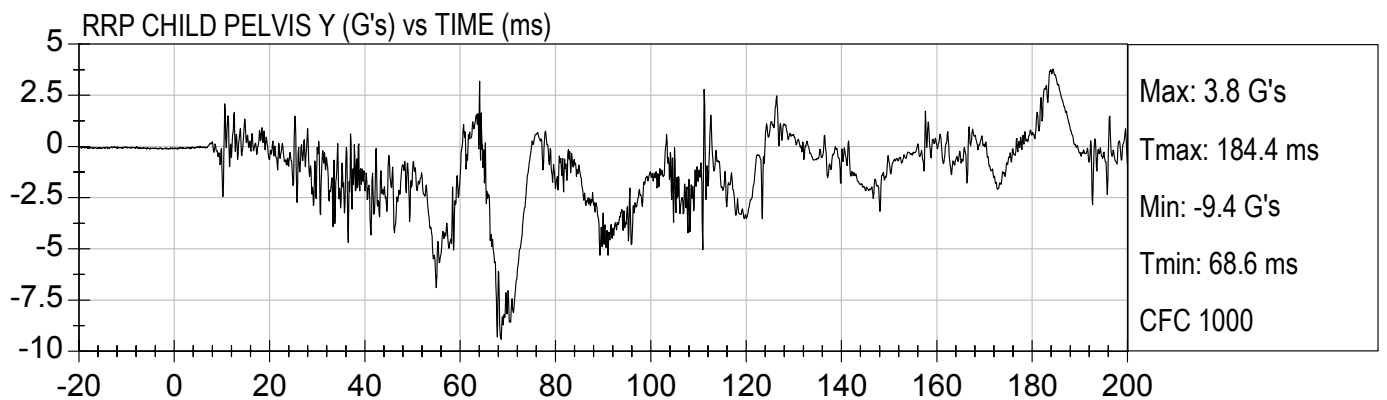
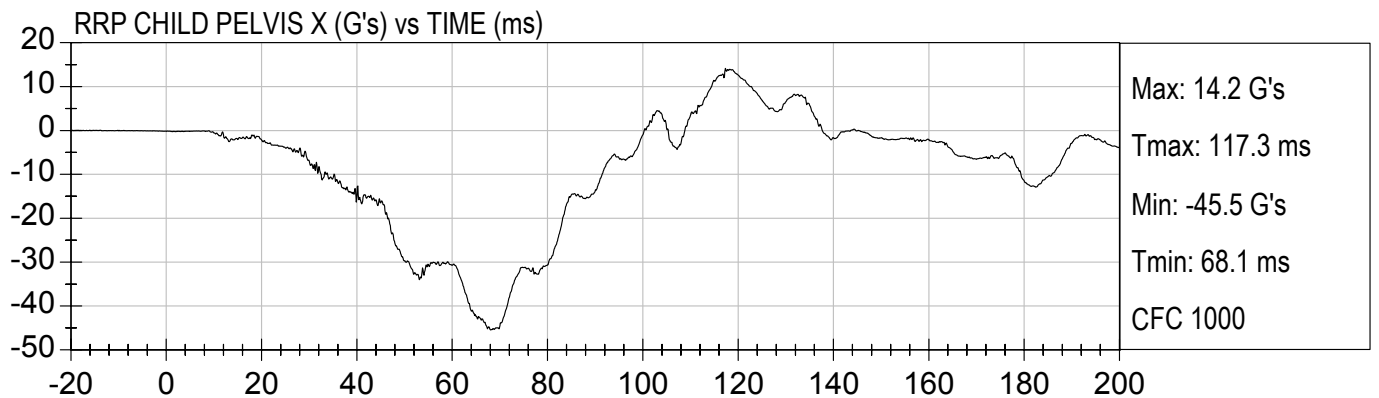


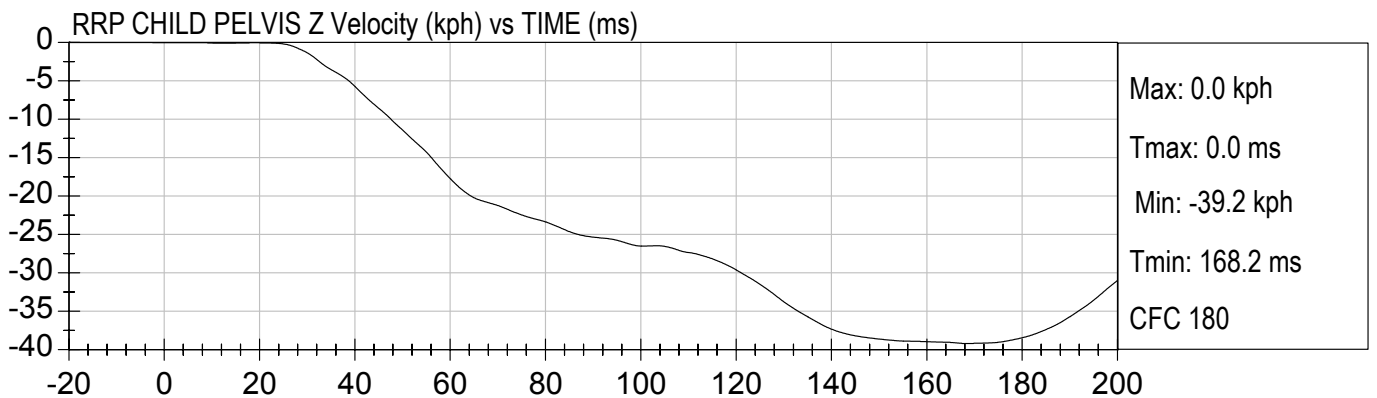
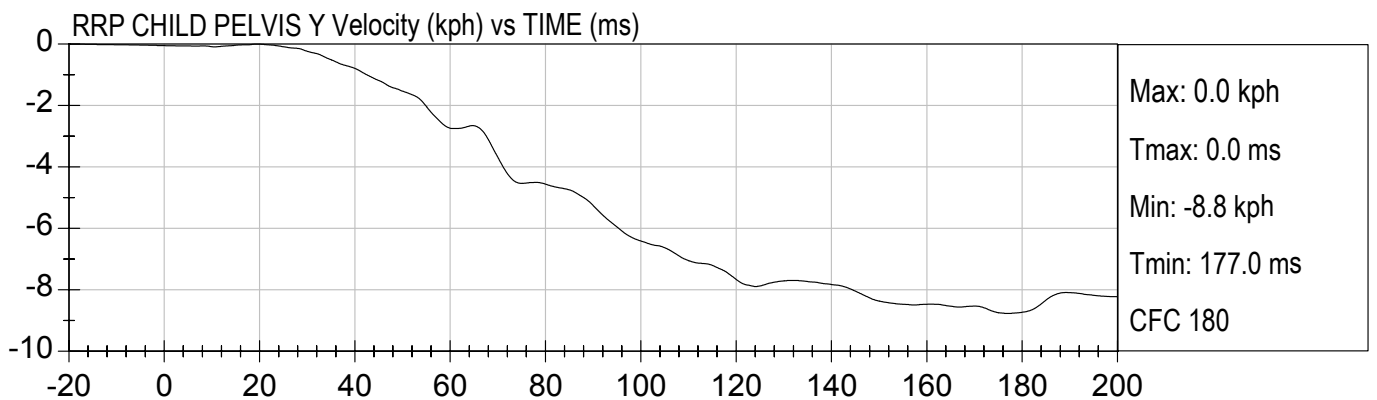
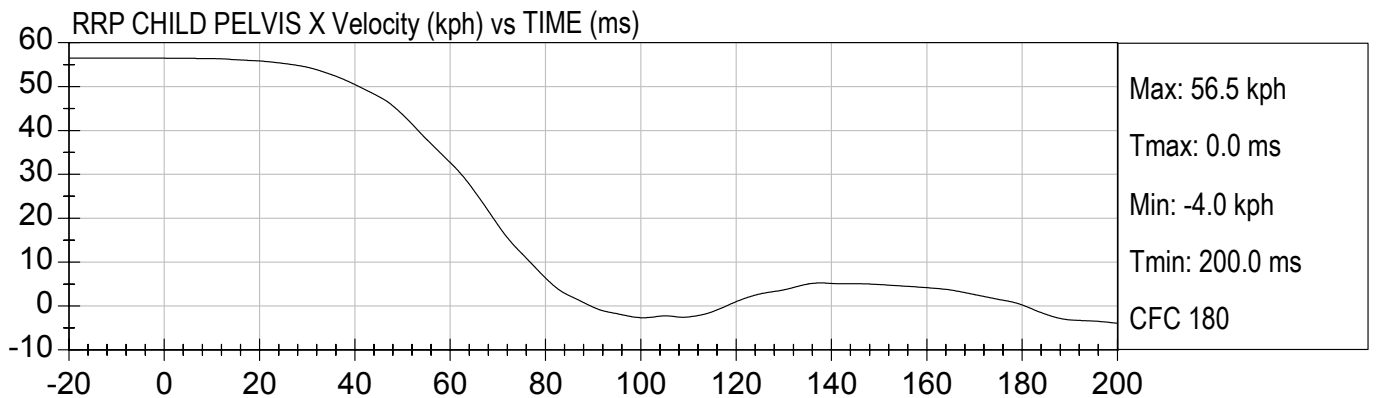
NCAP 35MPH FRONTAL (M40204)  
2004 FORD F-150 SUPERCREW

Test Date: 01/06/04  
Speed: 35.1 mph (56.5 km/h)



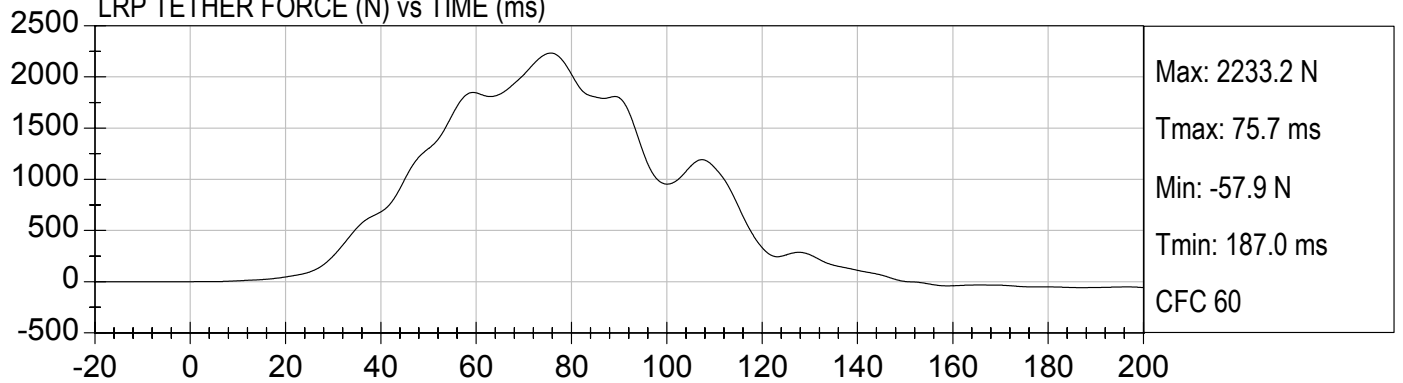




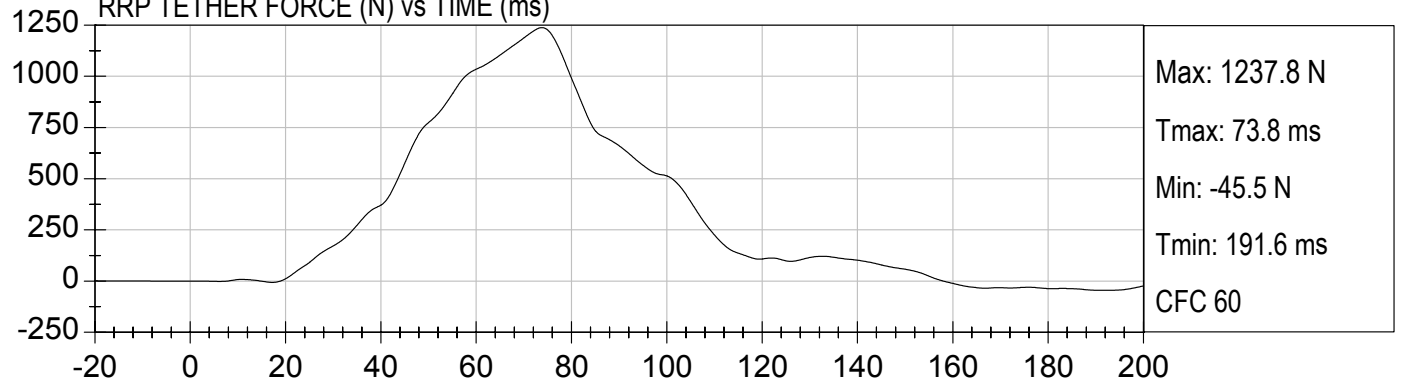




LRP TETHER FORCE (N) vs TIME (ms)



RRP TETHER FORCE (N) vs TIME (ms)



**APPENDIX C**  
**CHILD DUMMY CALIBRATION INFORMATION**

**Transportation Research Center  
Inc.**

# **ATD Calibration Report**

**for**

**VRTC**

**HIII 3 Year Old Serial No. 040  
Calibration No. 02**



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

**Transportation Research Center Inc.**  
**572P HIII 3 Year Old Dummy**  
**External Dimensions**  
**Serial No. 040 Calibration No. 02**

| Test Parameter                             | Dimension | Specification    | Results | Pass |
|--------------------------------------------|-----------|------------------|---------|------|
| Total Sitting Height                       | A         | 538.5 - 553.7 mm | 550 mm  | Yes  |
| Shoulder Pivot Height                      | B         | 307.3 - 322.6 mm | 315 mm  | Yes  |
| Hip Pivot Height                           | C         | 33.0 - 43.2 mm   | 40 mm   | Yes  |
| Hip Pivot from Backline                    | D         | 56.9 - 67.1 mm   | 60 mm   | Yes  |
| Shoulder Pivot from Backline               | E         | 58.4 - 68.6 mm   | 64 mm   | Yes  |
| Thigh Clearance                            | F         | 81.0 - 91.2 mm   | 86 mm   | Yes  |
| Back of Elbow to Wrist Pivot               | G         | 247.4 - 262.6 mm | 251 mm  | Yes  |
| Head Back to Backline                      | H         | 48.3 - 58.4 mm   | 55 mm   | Yes  |
| Shoulder to Elbow Length                   | I         | 185.0 - 200.7 mm | 196 mm  | Yes  |
| Elbow Rest Height                          | J         | 133.6 - 148.8 mm | 139 mm  | Yes  |
| Buttock to Knee Length                     | K         | 287.3 - 302.5 mm | 297 mm  | Yes  |
| Popliteal Height                           | L         | 221.0 - 236.2 mm | 229 mm  | Yes  |
| Knee to Floor Height                       | M         | 241.6 - 256.8 mm | 254 mm  | Yes  |
| Buttock Popliteal Height                   | N         | 217.9 - 233.2 mm | 225 mm  | Yes  |
| Chest Depth without Jacket                 | O         | 134.6 - 149.9 mm | 145 mm  | Yes  |
| Foot Length                                | P         | 137.7 - 147.8 mm | 140 mm  | Yes  |
| Stature                                    | Q         | 932.2 - 957.6 mm | 950 mm  | Yes  |
| Buttock to Knee Pivot Length               | R         | 251.5 - 261.6 mm | 254 mm  | Yes  |
| Head Breadth                               | S         | 128.3 - 143.5 mm | 138 mm  | Yes  |
| Head Depth                                 | T         | 167.4 - 182.6 mm | 178 mm  | Yes  |
| Hip Breadth                                | U         | 200.7 - 215.9 mm | 204 mm  | Yes  |
| Shoulder Breadth                           | V         | 236.5 - 251.7 mm | 239 mm  | Yes  |
| Foot Breadth                               | W         | 53.6 - 63.8 mm   | 57 mm   | Yes  |
| Head Circumference                         | X         | 500.4 - 515.6 mm | 503 mm  | Yes  |
| Chest Circumference with Jacket            | Y         | 527.1 - 552.5 mm | 531 mm  | Yes  |
| Waist Circumference                        | Z         | 527.1 - 552.5 mm | 540 mm  | Yes  |
| Reference Location for Chest Circumference | AA        | 248.9 - 259.1 mm | 254 mm  | Yes  |
| Reference Location for Waist Circumference | BB        | 160.0 - 170.2 mm | 165 mm  | Yes  |

Technician



Approved




## Transportation Research Center Inc.

572P Head Drop Test

HIII 3 Year Old Serial No. 040 Calibration No. 02 - 1

Test Date 10/09/2003

| Test Parameter                  | Specification  | Test Results | Pass |
|---------------------------------|----------------|--------------|------|
| Temperature                     | 18.9 - 25.6 °C | 21.1 °C      | Yes  |
| Relative Humidity               | 10 - 70 %      | 47 %         | Yes  |
| Peak Resultant Acceleration     | 250 - 280 g    | 262.1 g      | Yes  |
| Peak Lateral Acceleration       | 15 g Max       | -4.5 g       | Yes  |
| Is Acceleration Curve Unimodal? | Yes            | Yes          | Yes  |

Comments:

Technician



Approved



10.09.2003 09:57:28 607

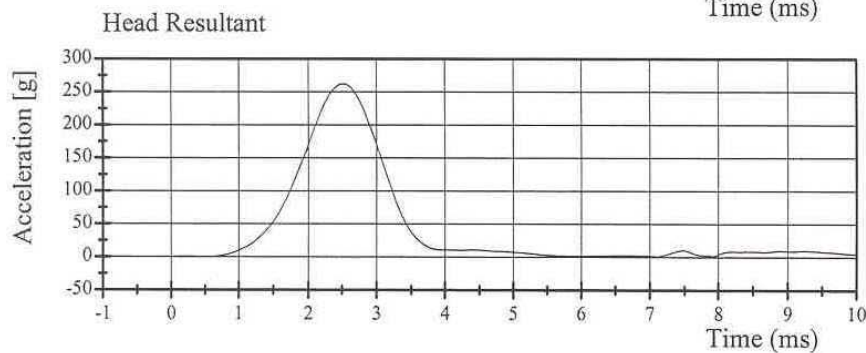
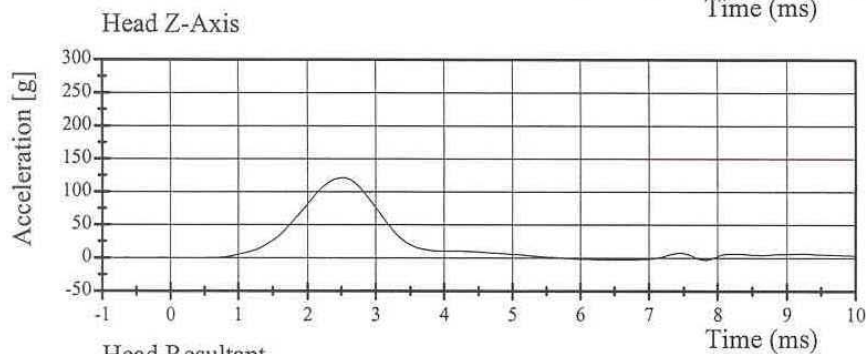
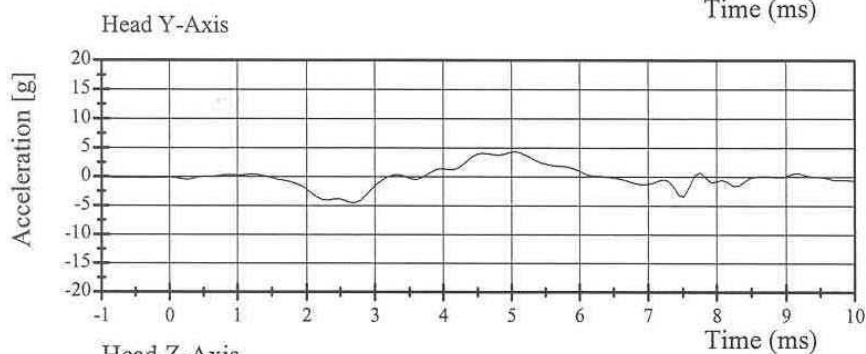
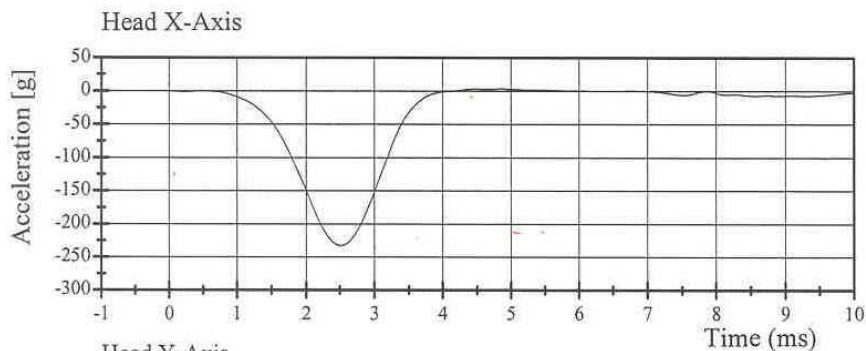


# Transportation Research Center Inc.

572P Head Drop Test

HIII 3 Year Old Serial No. 040 Calibration No. 02 - 1

Test Date 10/09/2003



10.09.2003 09:57:30 607



## Transportation Research Center Inc.

572P Neck Flexion Test - 6 Channel Transducer

HIII 3 Year Old Serial No. 040 Calibration No. 02 - 3

Test Date 10/09/2003

| Test Parameter                                                                                              | Specification   | Test Results | Pass |
|-------------------------------------------------------------------------------------------------------------|-----------------|--------------|------|
| Temperature                                                                                                 | 20.6 - 22.2 °C  | 21.1 °C      | Yes  |
| Relative Humidity                                                                                           | 10 - 70 %       | 44 %         | Yes  |
| Impact Velocity                                                                                             | 5.40 - 5.60 m/s | 5.58 m/s     | Yes  |
| Integrated Pendulum Velocity                                                                                |                 |              |      |
| 10 ms                                                                                                       | 2.00 - 2.70 m/s | 2.60 m/s     | Yes  |
| 15 ms                                                                                                       | 3.00 - 4.00 m/s | 3.71 m/s     | Yes  |
| 20 ms                                                                                                       | 4.00 - 5.10 m/s | 5.03 m/s     | Yes  |
| Peak D Plane Rotation                                                                                       | 70 - 82 °       | 71.8 °       | Yes  |
| Peak Moment About Occipital<br>Condyles<br>(During time interval rotation is<br>within specified corridors) | 42.0 - 53.0 N·m | 46.29 N·m    | Yes  |
| Positive Moment Decay Time<br>To 10 N·m                                                                     | 60 - 80 ms      | 69.12 ms     | Yes  |

### Comments:

Technician



Approved



10.09.2003 08:57:58 637



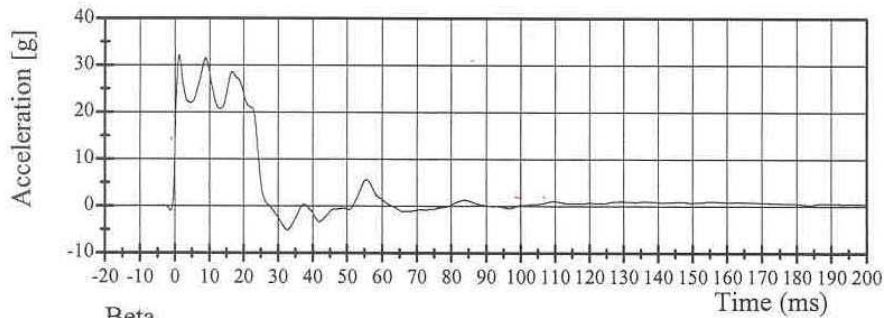
# Transportation Research Center Inc.

572P Neck Flexion Test

HIII 3 Year Old Serial No. 040 Calibration No. 02 - 3

Test Date 10/09/2003

Pendulum Deceleration

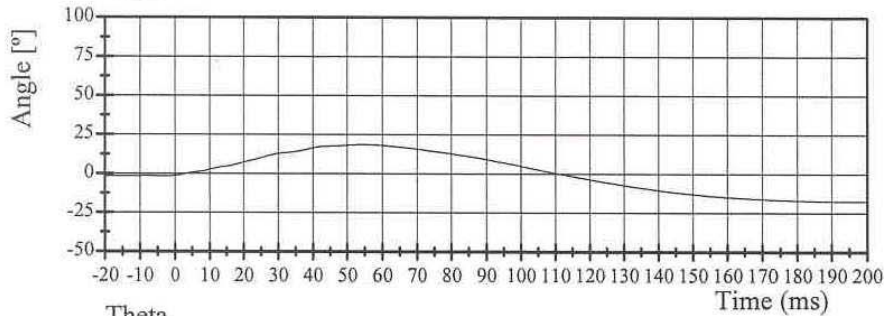


Filter Class: 180

Max: 32.1 g at 1.3 ms

Min: -5.1 g at 32.7 ms

Beta

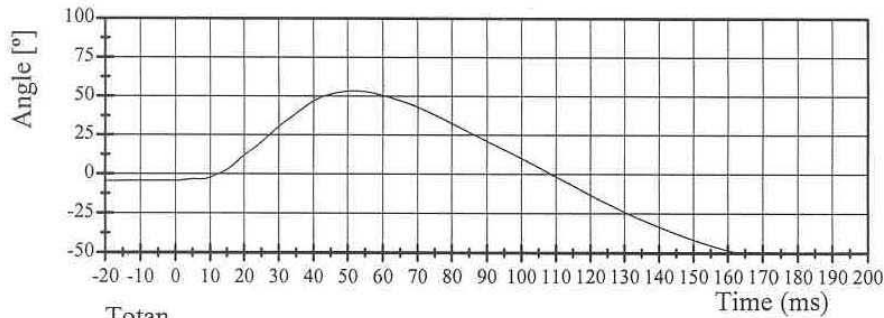


Filter Class: 60

Max: 18.5 ° at 55.1 ms

Min: -17.6 ° at 201.9 ms

Theta

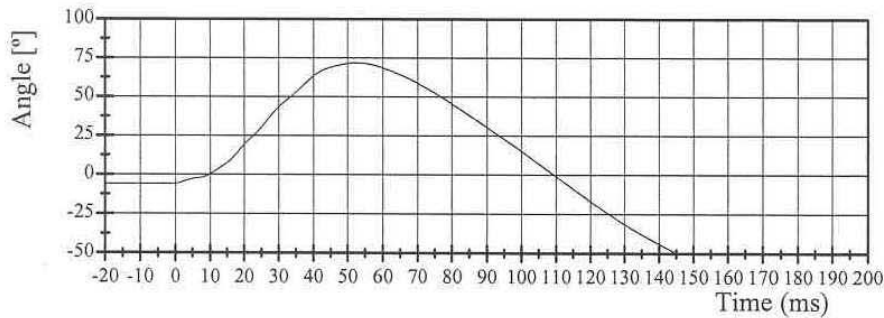


Filter Class: 60

Max: 53.4 ° at 51.7 ms

Min: -57.3 ° at 192.6 ms

Totan



Filter Class: 60

Max: 71.8 ° at 52.6 ms

Min: -74.9 ° at 192.9 ms

10.09.2003 08:57:59 637

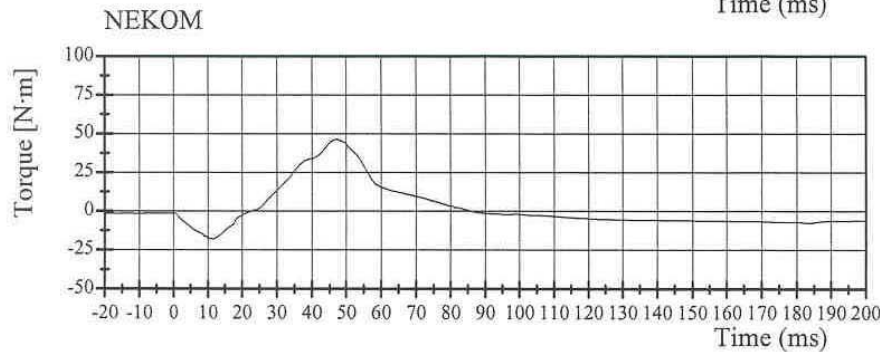
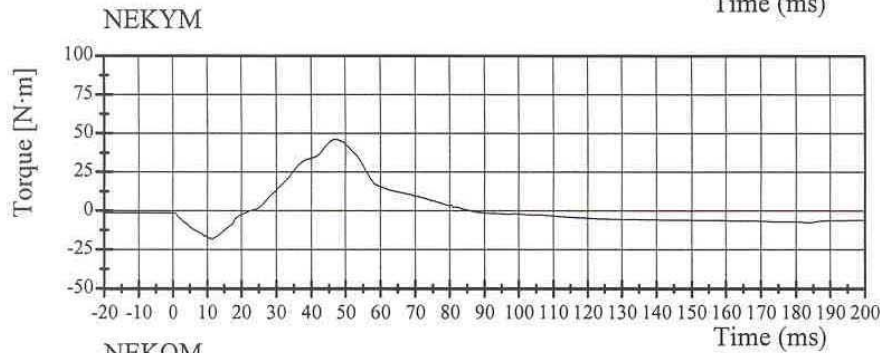
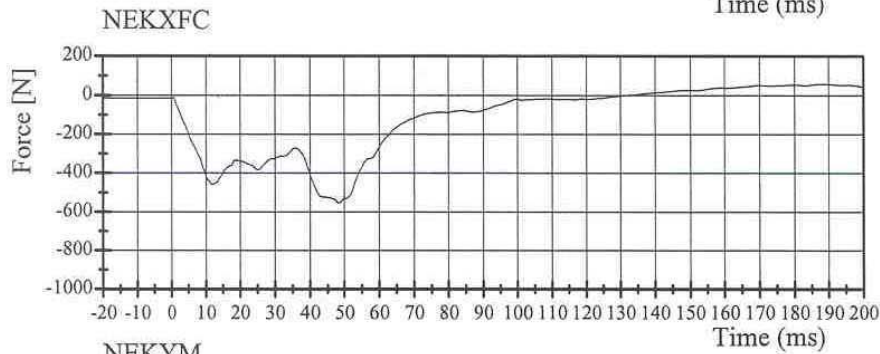
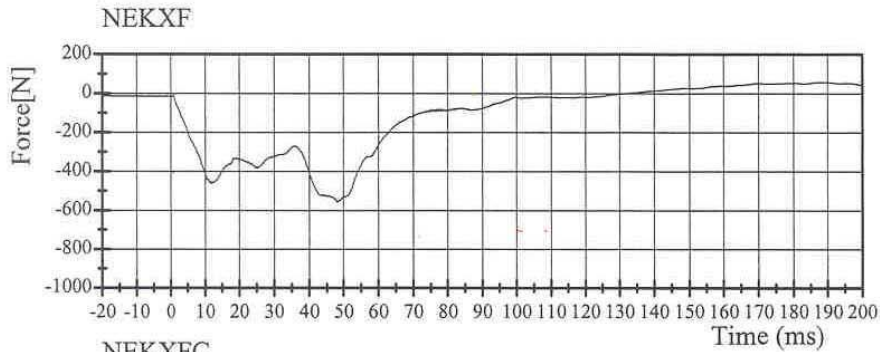


# Transportation Research Center Inc.

572P Neck Flexion Test

HIII 3 Year Old Serial No. 040 Calibration No. 02 - 3

Test Date 10/09/2003



10.09.2003 08:58:00 637



## Transportation Research Center Inc.

572P Neck Extension Test - 6 Channel Transducer

HIII 3 Year Old Serial No. 040 Calibration No. 02 - 2

Test Date 10/09/2003

| Test Parameter                                                                                              | Specification       | Test Results | Pass |
|-------------------------------------------------------------------------------------------------------------|---------------------|--------------|------|
| Temperature                                                                                                 | 20.6 - 22.2 °C      | 21.1 °C      | Yes  |
| Relative Humidity                                                                                           | 10 - 70 %           | 47 %         | Yes  |
| Impact Velocity                                                                                             | 3.55 - 3.75 m/s     | 3.71 m/s     | Yes  |
| Integrated Pendulum Velocity                                                                                |                     |              |      |
| 10 ms                                                                                                       | 1.00 - 1.40 m/s     | 1.38 m/s     | Yes  |
| 15 ms                                                                                                       | 1.90 - 2.50 m/s     | 2.44 m/s     | Yes  |
| 20 ms                                                                                                       | 2.80 - 3.50 m/s     | 3.32 m/s     | Yes  |
| Peak D Plane Rotation                                                                                       | 83 - 93 °           | 86.8 °       | Yes  |
| Peak Moment About Occipital<br>Condyles<br>(During time interval rotation is<br>within specified corridors) | -53.3 - (-43.7) N·m | -46.33 N·m   | Yes  |
| Positive Moment Decay Time<br>To -10 N·m                                                                    | 60 - 80 ms          | 66.16 ms     | Yes  |

### Comments:

Technician



Approved



10.09.2003 09:53:50 953



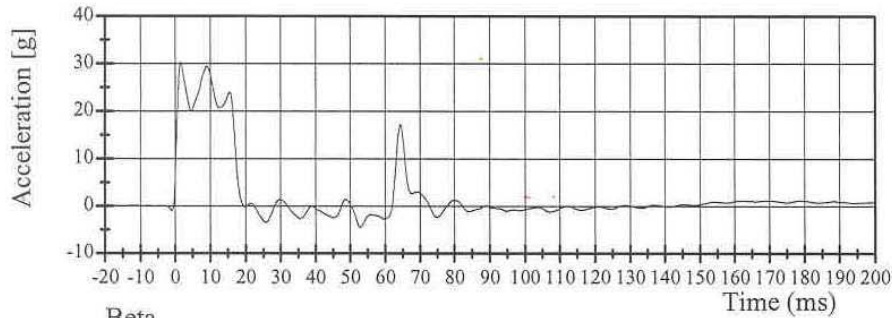
# Transportation Research Center Inc.

572P Neck Extension Test

HIII 3 Year Old Serial No. 040 Calibration No. 02 - 2

Test Date 10/09/2003

Pendulum Deceleration

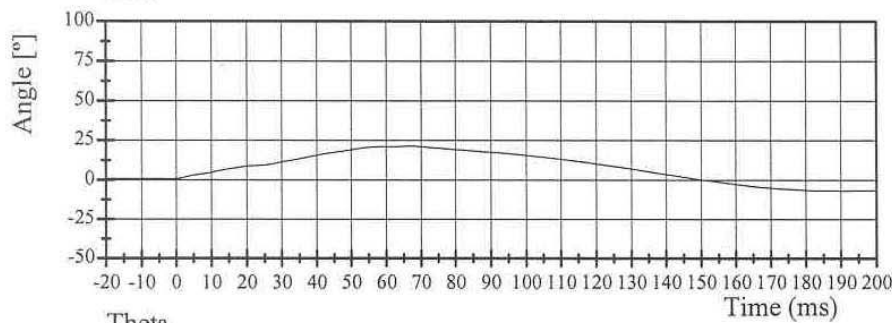


Filter Class: 180

Max: 30.2 g at 1.7 ms

Min: -4.5 g at 52.8 ms

Beta

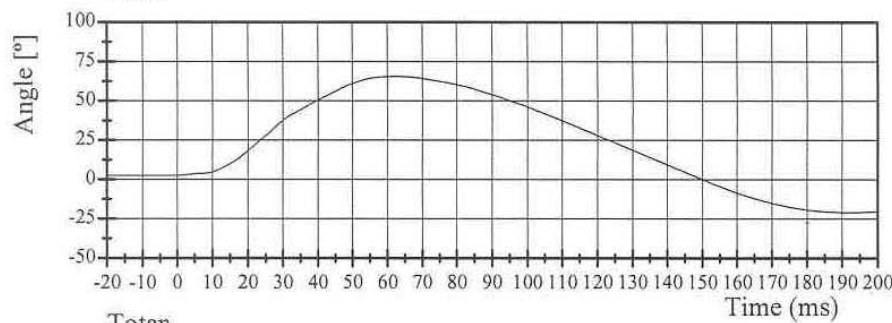


Filter Class: 60

Max: 21.4 ° at 67.0 ms

Min: -6.8 ° at 190.8 ms

Theta

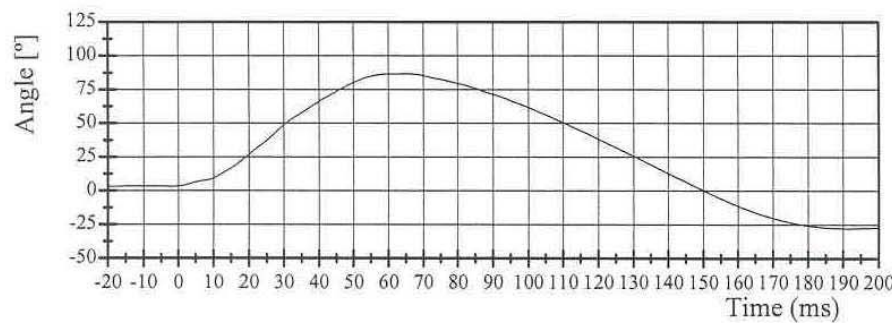


Filter Class: 60

Max: 65.5 ° at 62.4 ms

Min: -20.9 ° at 191.8 ms

Totan



Filter Class: 60

Max: 86.8 ° at 65.4 ms

Min: -27.8 ° at 191.6 ms

10.09.2003 09:53:51 953

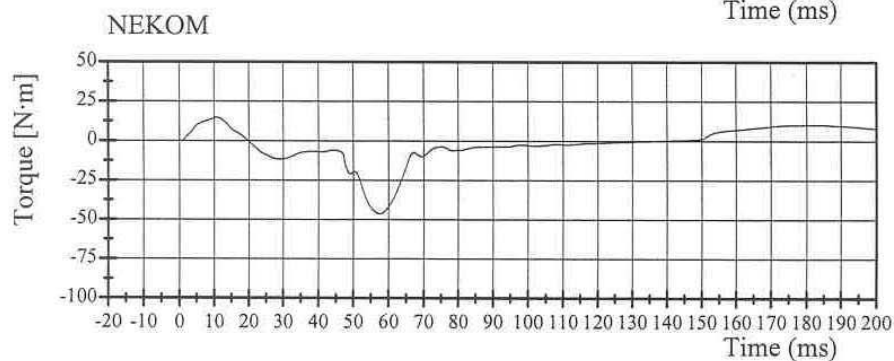
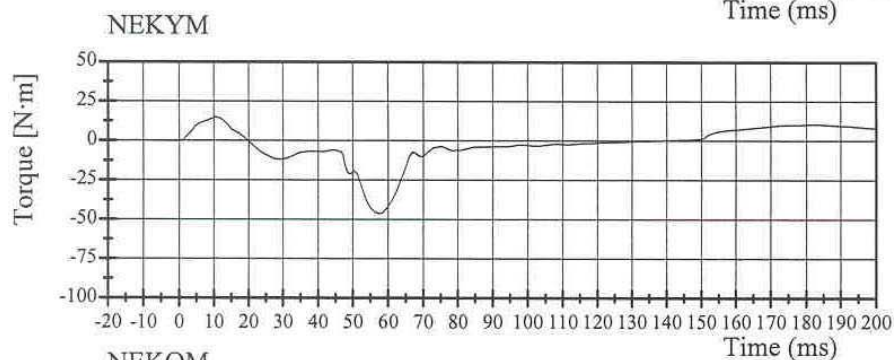
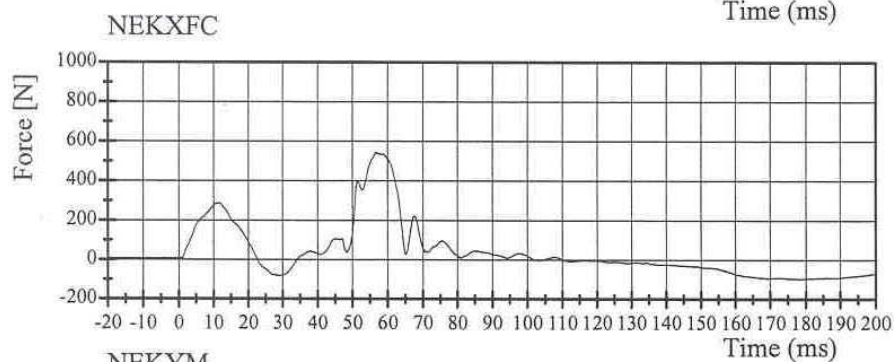
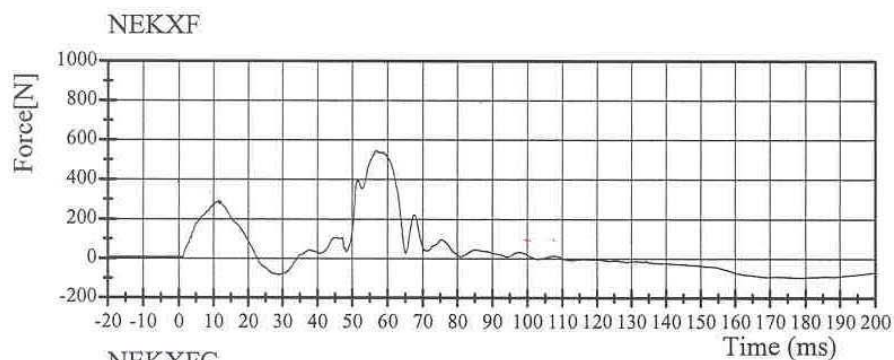


# Transportation Research Center Inc.

572P Neck Extension Test

HIII 3 Year Old Serial No. 040 Calibration No. 02 - 2

Test Date 10/09/2003



10.09.2003 09:53:52 953



## Transportation Research Center Inc.

572P Thorax Test

HIII 3 Year Old Serial No. 040 Calibration No. 02 - 3

Test Date 10/10/2003

| Test Parameter                                         | Specification      | Test Results | Pass |
|--------------------------------------------------------|--------------------|--------------|------|
| Temperature                                            | 20.6 - 22.2 °C     | 21.1 °C      | Yes  |
| Relative Humidity                                      | 10 - 70 %          | 62 %         | Yes  |
| Pendulum Velocity                                      | 5.90 - 6.10 m/s    | 6.05 m/s     | Yes  |
| Maximum Chest Deflection                               | -38.0 - (-32.0) mm | -32.5 mm     | Yes  |
| Peak Impact Probe Force<br>Within Compression Corridor | 680 - 810 N        | 715 N        | Yes  |
| Internal Hysteresis                                    | 65 - 85 %          | 71 %         | Yes  |
| Maximum Force Between<br>12.5 mm & 32 mm Of Deflection | <= 910             | 778          | Yes  |

### Comments:

Technician



Approved



10.10.2003 09:47:24 998



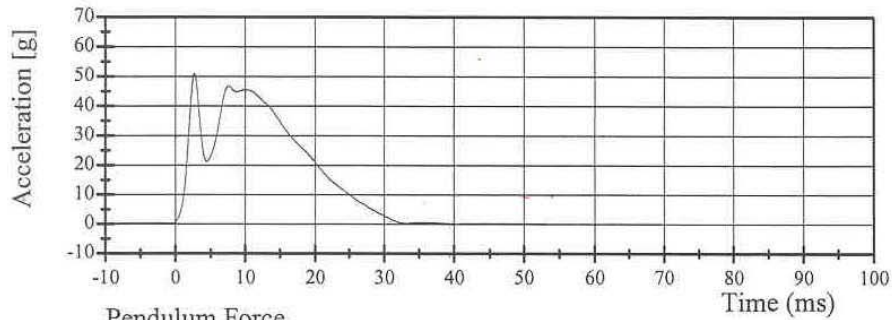
# Transportation Research Center Inc.

572P Thorax Test

HIII 3 Year Old Serial No. 040 Calibration No. 02 - 3

Test Date 10/10/2003

Pendulum Deceleration

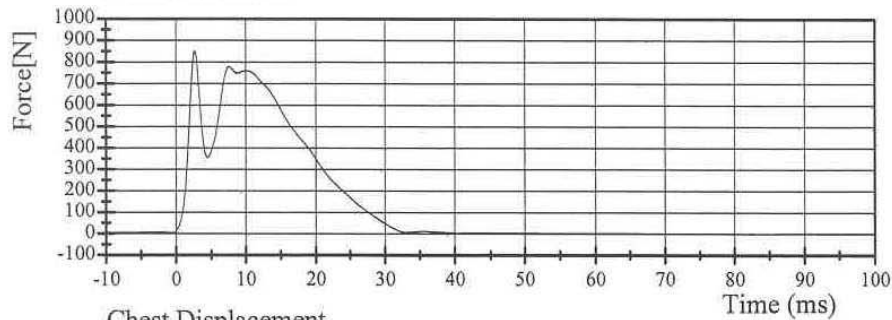


Filter Class: 180

Max: 51.0 g at 2.6 ms

Min: -0.4 g at 433.0 ms

Pendulum Force

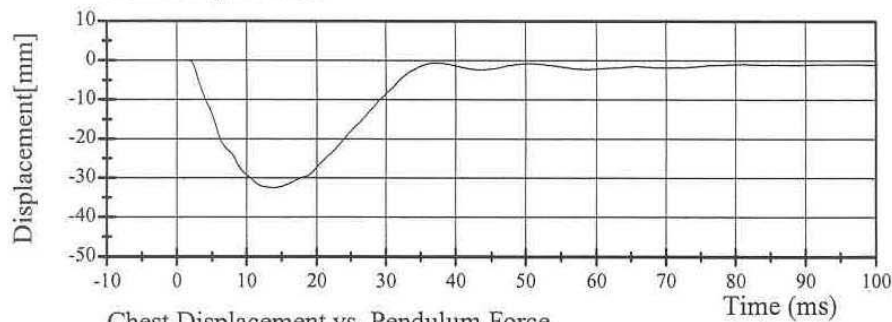


Filter Class: 180

Max: 850.3 N at 2.6 ms

Min: -7.0 N at 433.0 ms

Chest Displacement

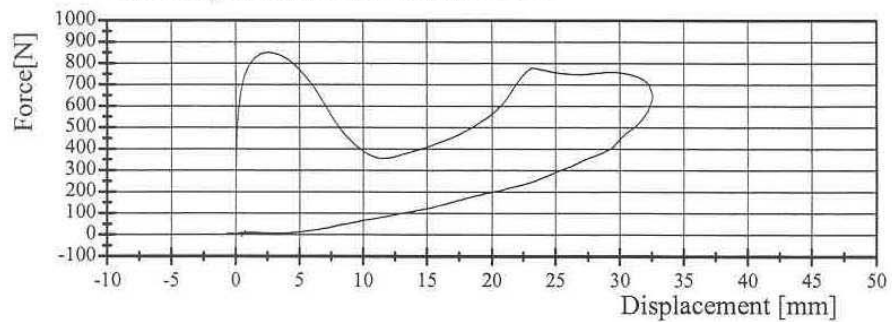


Filter Class: 600

Max: 0.7 mm at 725.3 ms

Min: -32.5 mm at 13.9 ms

Chest Displacement vs. Pendulum Force



10.10.2003 09:47:25 998



TRANSPORTATION RESEARCH CENTER INC.

TORSO FLEXION TEST

HYBRID III THREE-YEAR-OLD

CAL DATE: 09-Oct-03

TRC, INC. TEST NO: 040C02TF1 572 P SN 040 TORSO FLEX CAL 02

| TEST PARAMETER                                      | SPECIFICATION                               | TEST RESULTS |
|-----------------------------------------------------|---------------------------------------------|--------------|
| TEMPERATURE                                         | 18.9 – 25.6 DEG. C                          | 21.7 DEG. C  |
| RELATIVE HUMIDITY                                   | 10 – 70 %                                   | 44 %         |
| INITIAL ANGLE OF<br>UNSUPPORTRED DUMMY              | $\leq 15$ DEG.<br>REFERENCED<br>TO VERTICAL | 9.2 DEG.     |
| MAXIMUM FORCE AT 45 DEG.<br>DURING 10 SECOND PERIOD | 130 – 180 N                                 | 152.6 N      |
| RETURN ANGLE                                        |                                             | 14.8 °       |
| DIFFERENCE BETWEEN RETURN<br>ANGLE & INTIAL ANGLE   | $\pm 8$ ° OF<br>INTIAL ANGLE                | 5.6 °        |
| RATE                                                | 0.5° - 1.5°/sec                             | 1.0 °/sec    |

TEST MEETS SPECIFICATIONS

TECHNICIAN



**Transportation Research Center  
Inc.**

# **ATD Calibration Report**

**for**

**VRTC**

**HIII 3 Year Old Serial No. 042  
Calibration No. 02**



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

**Transportation Research Center Inc.**  
**572P HIII 3 Year Old Dummy**  
**External Dimensions**  
**Serial No. 042    Calibration No. 02**

| Test Parameter                             | Dimension | Specification    | Results | Pass |
|--------------------------------------------|-----------|------------------|---------|------|
| Total Sitting Height                       | A         | 538.5 - 553.7 mm | 546 mm  | Yes  |
| Shoulder Pivot Height                      | B         | 307.3 - 322.6 mm | 313 mm  | Yes  |
| Hip Pivot Height                           | C         | 33.0 - 43.2 mm   | 37 mm   | Yes  |
| Hip Pivot from Backline                    | D         | 56.9 - 67.1 mm   | 59 mm   | Yes  |
| Shoulder Pivot from Backline               | E         | 58.4 - 68.6 mm   | 63 mm   | Yes  |
| Thigh Clearance                            | F         | 81.0 - 91.2 mm   | 87 mm   | Yes  |
| Back of Elbow to Wrist Pivot               | G         | 247.4 - 262.6 mm | 253 mm  | Yes  |
| Head Back to Backline                      | H         | 48.3 - 58.4 mm   | 49 mm   | Yes  |
| Shoulder to Elbow Length                   | I         | 185.0 - 200.7 mm | 193 mm  | Yes  |
| Elbow Rest Height                          | J         | 133.6 - 148.8 mm | 136 mm  | Yes  |
| Buttock to Knee Length                     | K         | 287.3 - 302.5 mm | 293 mm  | Yes  |
| Popliteal Height                           | L         | 221.0 - 236.2 mm | 228 mm  | Yes  |
| Knee to Floor Height                       | M         | 241.6 - 256.8 mm | 249 mm  | Yes  |
| Buttock Popliteal Height                   | N         | 217.9 - 233.2 mm | 229 mm  | Yes  |
| Chest Depth without Jacket                 | O         | 134.6 - 149.9 mm | 137 mm  | Yes  |
| Foot Length                                | P         | 137.7 - 147.8 mm | 141 mm  | Yes  |
| Stature                                    | Q         | 932.2 - 957.6 mm | 936 mm  | Yes  |
| Buttock to Knee Pivot Length               | R         | 251.5 - 261.6 mm | 258 mm  | Yes  |
| Head Breadth                               | S         | 128.3 - 143.5 mm | 136 mm  | Yes  |
| Head Depth                                 | T         | 167.4 - 182.6 mm | 176 mm  | Yes  |
| Hip Breadth                                | U         | 200.7 - 215.9 mm | 209 mm  | Yes  |
| Shoulder Breadth                           | V         | 236.5 - 251.7 mm | 243 mm  | Yes  |
| Foot Breadth                               | W         | 53.6 - 63.8 mm   | 57 mm   | Yes  |
| Head Circumference                         | X         | 500.4 - 515.6 mm | 510 mm  | Yes  |
| Chest Circumference with Jacket            | Y         | 527.1 - 552.5 mm | 536 mm  | Yes  |
| Waist Circumference                        | Z         | 527.1 - 552.5 mm | 543 mm  | Yes  |
| Reference Location for Chest Circumference | AA        | 248.9 - 259.1 mm | 254 mm  | Yes  |
| Reference Location for Waist Circumference | BB        | 160.0 - 170.2 mm | 165 mm  | Yes  |

Technician



Approved




## Transportation Research Center Inc.

572P Head Drop Test

HIII 3 Year Old Serial No. 042 Calibration No. 02 - 1

Test Date 10/15/2003

| Test Parameter                  | Specification  | Test Results | Pass |
|---------------------------------|----------------|--------------|------|
| Temperature                     | 18.9 - 25.6 °C | 21.1 °C      | Yes  |
| Relative Humidity               | 10 - 70 %      | 32 %         | Yes  |
| Peak Resultant Acceleration     | 250 - 280 g    | 259.5 g      | Yes  |
| Peak Lateral Acceleration       | 15 g Max       | -8.0 g       | Yes  |
| Is Acceleration Curve Unimodal? | Yes            | Yes          | Yes  |

### Comments:

Technician



Approved



10.15.2003 14:25:05 611

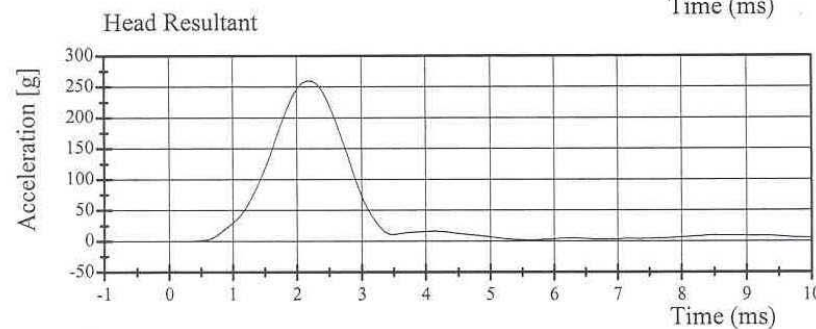
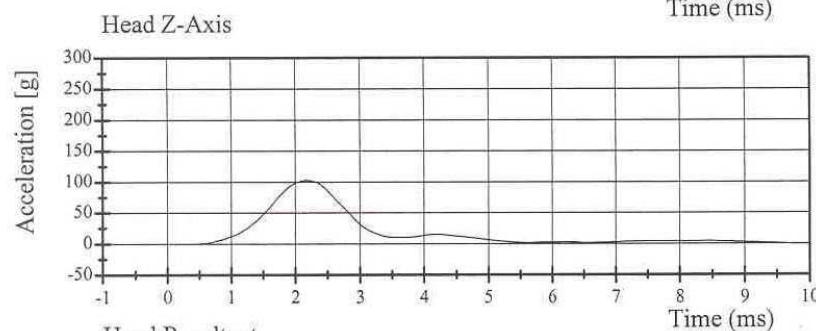
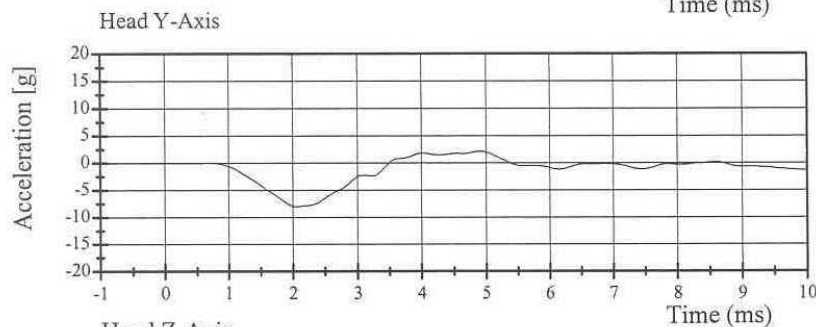
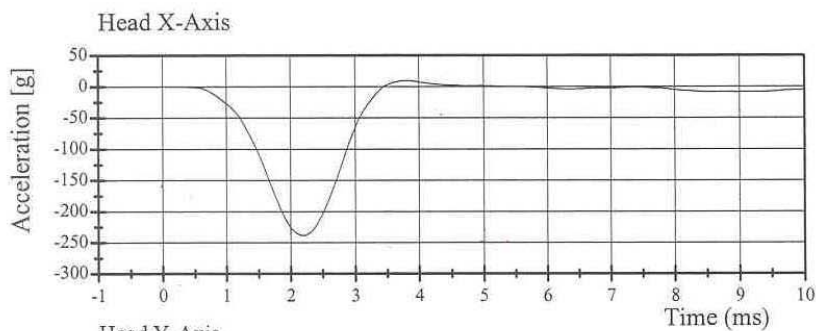


# Transportation Research Center Inc.

572P Head Drop Test

HIII 3 Year Old Serial No. 042 Calibration No. 02 - 1

Test Date 10/15/2003



10.15.2003 14:25:05 611



## Transportation Research Center Inc.

572P Neck Flexion Test - 6 Channel Transducer

HIII 3 Year Old Serial No. 042 Calibration No. 02 - 2

Test Date 10/15/2003

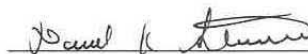
| Test Parameter                                                                                              | Specification   | Test Results | Pass |
|-------------------------------------------------------------------------------------------------------------|-----------------|--------------|------|
| Temperature                                                                                                 | 20.6 - 22.2 °C  | 21.1 °C      | Yes  |
| Relative Humidity                                                                                           | 10 - 70 %       | 31 %         | Yes  |
| Impact Velocity                                                                                             | 5.40 - 5.60 m/s | 5.47 m/s     | Yes  |
| Integrated Pendulum Velocity                                                                                |                 |              |      |
| 10 ms                                                                                                       | 2.00 - 2.70 m/s | 2.36 m/s     | Yes  |
| 15 ms                                                                                                       | 3.00 - 4.00 m/s | 3.41 m/s     | Yes  |
| 20 ms                                                                                                       | 4.00 - 5.10 m/s | 4.62 m/s     | Yes  |
| Peak D Plane Rotation                                                                                       | 70 - 82 °       | 73.7 °       | Yes  |
| Peak Moment About Occipital<br>Condyles<br>(During time interval rotation is<br>within specified corridors) | 42.0 - 53.0 N·m | 42.46 N·m    | Yes  |
| Positive Moment Decay Time<br>To 10 N·m                                                                     | 60 - 80 ms      | 71.36 ms     | Yes  |

### Comments:

Technician



Approved



10.15.2003 15:21:00 640

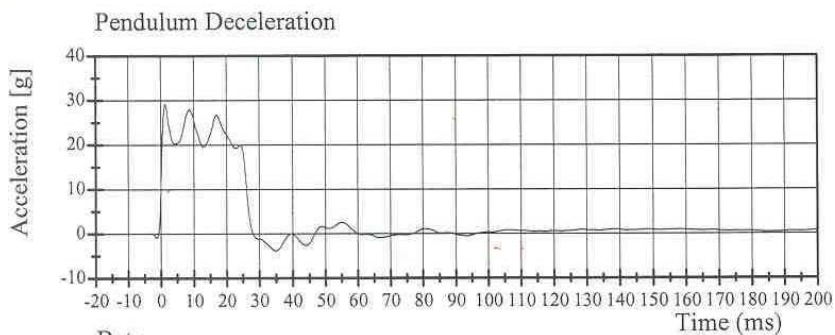


# Transportation Research Center Inc.

572P Neck Flexion Test

HIII 3 Year Old Serial No. 042 Calibration No. 02 - 2

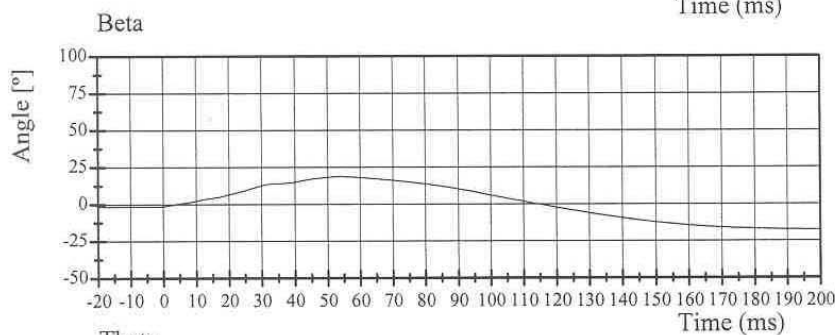
Test Date 10/15/2003



Filter Class: 180

Max: 29.2 g at 1.4 ms

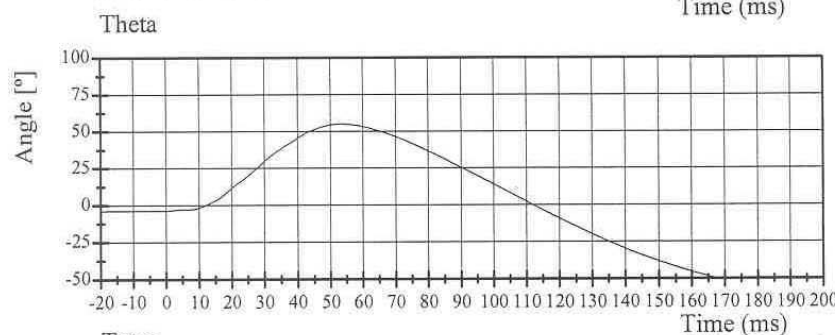
Min: -3.8 g at 35.0 ms



Filter Class: 60

Max: 18.7 ° at 53.9 ms

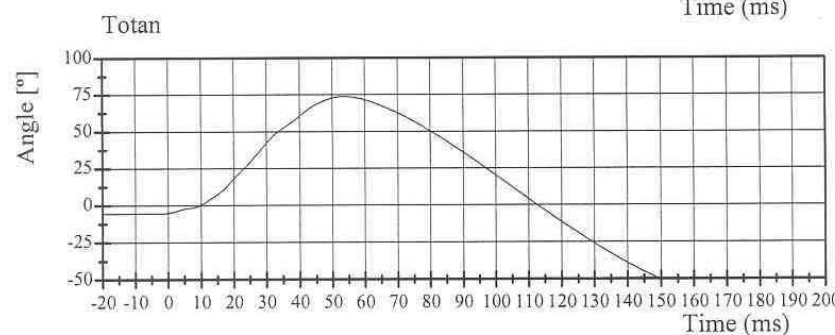
Min: -17.6 ° at 214.3 ms



Filter Class: 60

Max: 55.0 ° at 53.4 ms

Min: -56.8 ° at 200.0 ms



Filter Class: 60

Max: 73.7 ° at 53.6 ms

Min: -74.4 ° at 201.8 ms

10.15.2003 15:21:01 640

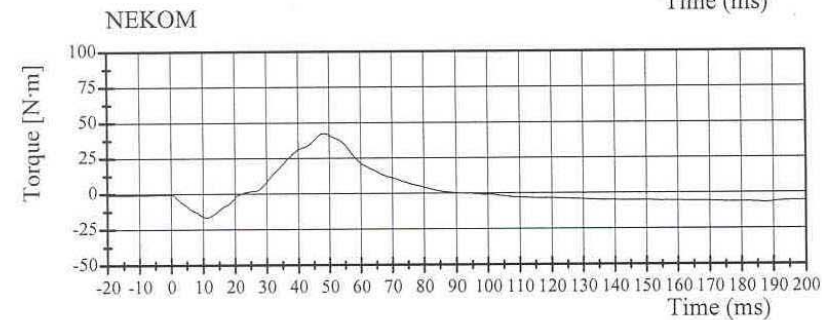
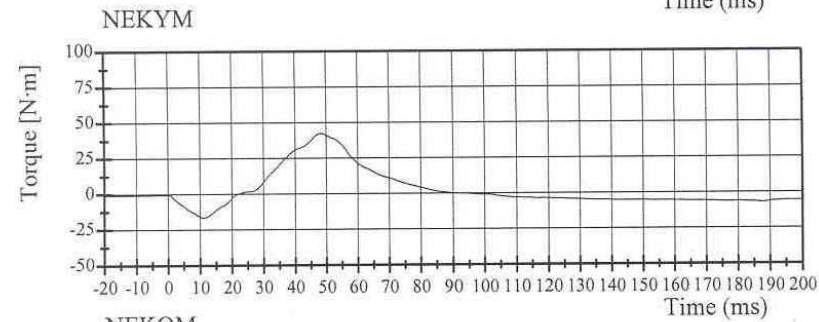
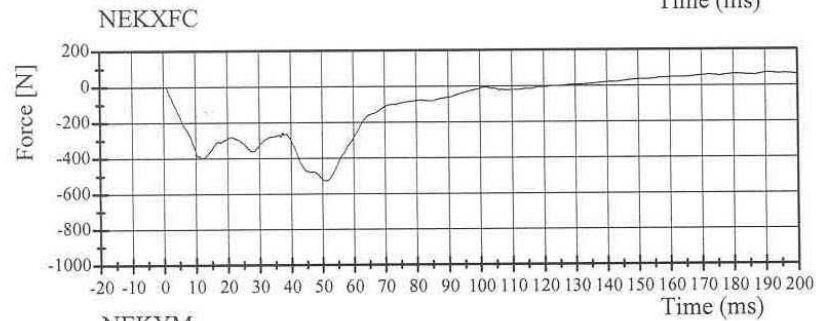
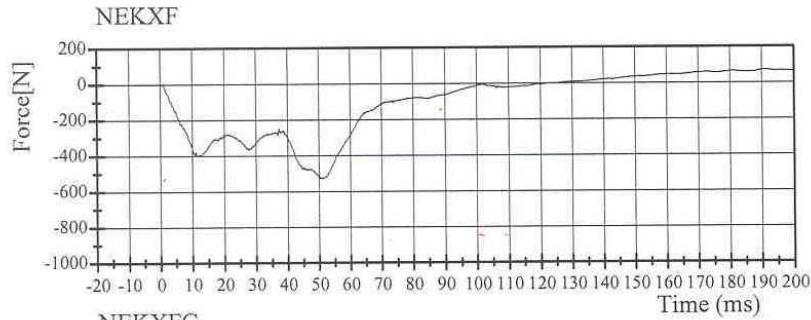


# Transportation Research Center Inc.

572P Neck Flexion Test

HIII 3 Year Old Serial No. 042 Calibration No. 02 - 2

Test Date 10/15/2003



10.15.2003 15:21:02 640



## Transportation Research Center Inc.

572P Neck Extension Test - 6 Channel Transducer

HIII 3 Year Old Serial No. 042 Calibration No. 02 - 3

Test Date 10/16/2003

| Test Parameter                                                                                              | Specification       | Test Results | Pass |
|-------------------------------------------------------------------------------------------------------------|---------------------|--------------|------|
| Temperature                                                                                                 | 20.6 - 22.2 °C      | 21.1 °C      | Yes  |
| Relative Humidity                                                                                           | 10 - 70 %           | 32 %         | Yes  |
| Impact Velocity                                                                                             | 3.55 - 3.75 m/s     | 3.72 m/s     | Yes  |
| Integrated Pendulum Velocity                                                                                |                     |              |      |
| 10 ms                                                                                                       | 1.00 - 1.40 m/s     | 1.37 m/s     | Yes  |
| 15 ms                                                                                                       | 1.90 - 2.50 m/s     | 2.44 m/s     | Yes  |
| 20 ms                                                                                                       | 2.80 - 3.50 m/s     | 3.29 m/s     | Yes  |
| Peak D Plane Rotation                                                                                       | 83 - 93 °           | 87.0 °       | Yes  |
| Peak Moment About Occipital<br>Condyles<br>(During time interval rotation is<br>within specified corridors) | -53.3 - (-43.7) N·m | -47.07 N·m   | Yes  |
| Positive Moment Decay Time<br>To -10 N·m                                                                    | 60 - 80 ms          | 72.08 ms     | Yes  |

### Comments:

Technician



Approved



10.16.2003 08:30:06 942



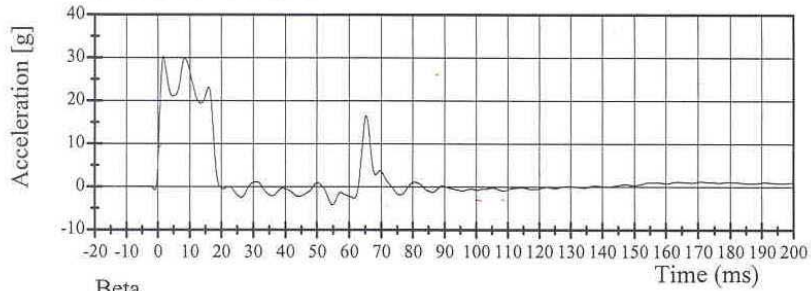
# Transportation Research Center Inc.

572P Neck Extension Test

HIII 3 Year Old Serial No. 042 Calibration No. 02 - 3

Test Date 10/16/2003

Pendulum Deceleration

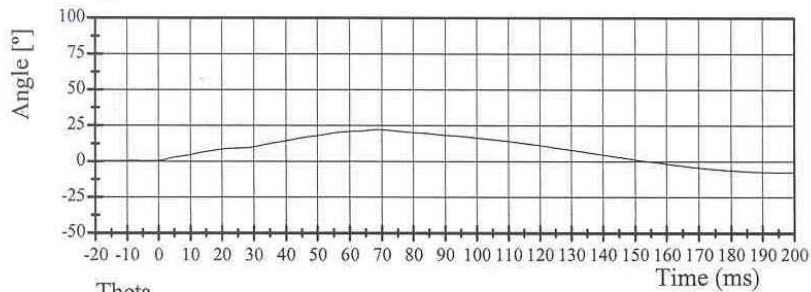


Filter Class: 180

Max: 30.4 g at 1.7 ms

Min: -4.2 g at 54.8 ms

Beta

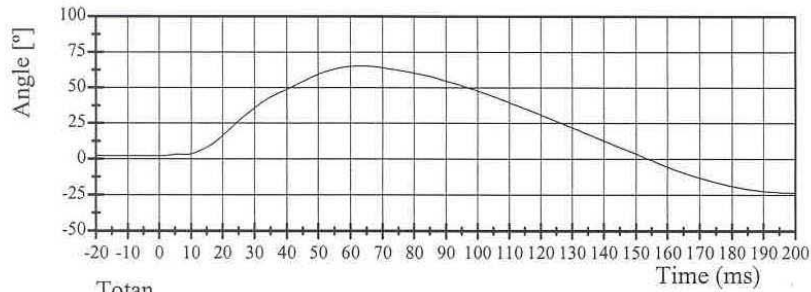


Filter Class: 60

Max: 22.2 ° at 68.8 ms

Min: -7.6 ° at 200.0 ms

Theta

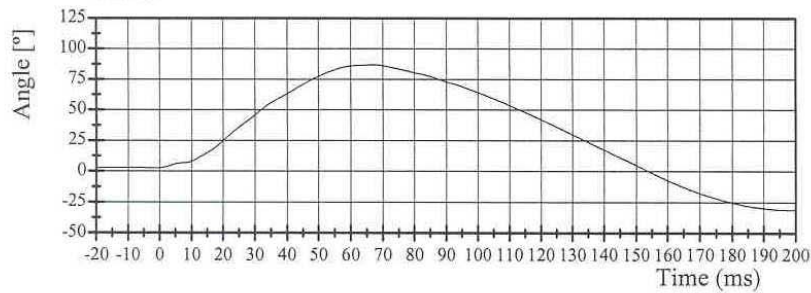


Filter Class: 60

Max: 65.3 ° at 63.4 ms

Min: -23.5 ° at 199.6 ms

Totan



Filter Class: 60

Max: 87.0 ° at 67.0 ms

Min: -31.1 ° at 199.6 ms

10.16.2003 08:30:07 942

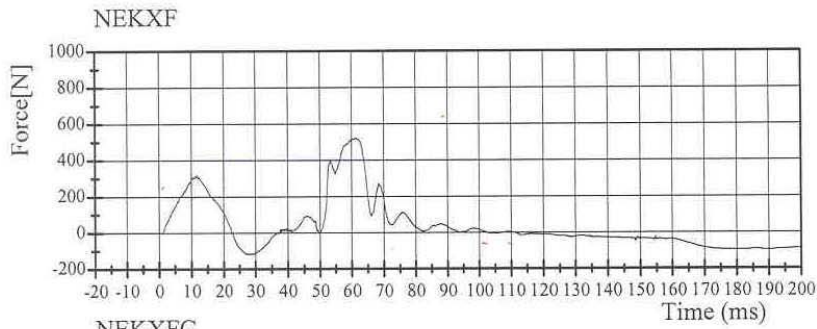


# Transportation Research Center Inc.

572P Neck Extension Test

HIII 3 Year Old Serial No. 042 Calibration No. 02 - 3

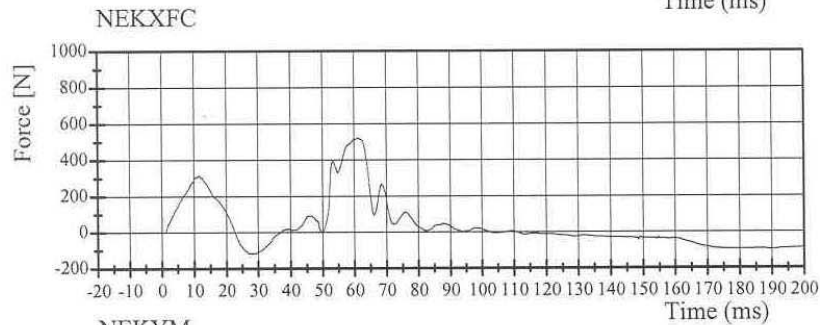
Test Date 10/16/2003



Filter Class: 1000

Max: 521.6 N at 61.4 ms

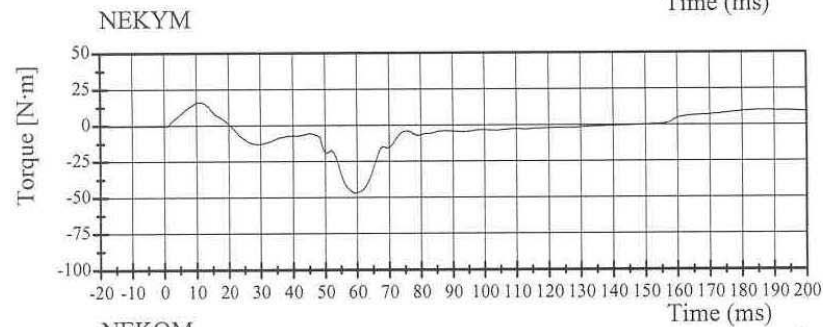
Min: -119.7 N at 28.4 ms



Filter Class: 600

Max: 520.8 N at 61.3 ms

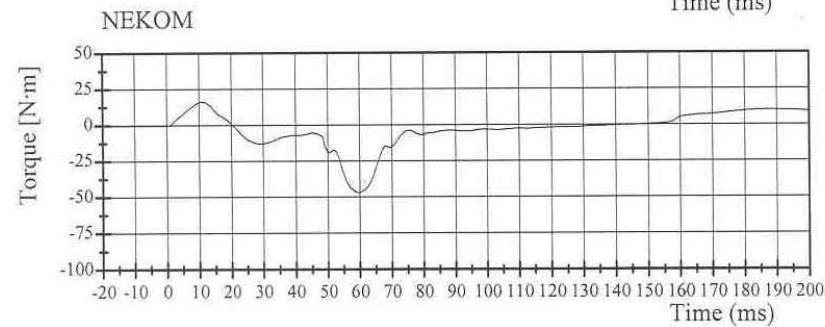
Min: -119.0 N at 28.3 ms



Filter Class: 600

Max: 16.2 N·m at 11.3 ms

Min: -47.1 N·m at 59.7 ms



Filter Class: 600

Max: 16.2 N·m at 11.3 ms

Min: -47.1 N·m at 59.7 ms

10.16.2003 08:30:08 942



## Transportation Research Center Inc.

572P Thorax Test

HIII 3 Year Old Serial No. 042 Calibration No. 02 - 1

Test Date 10/17/2003

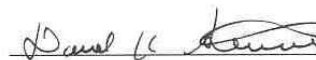
| Test Parameter                                         | Specification      | Test Results | Pass |
|--------------------------------------------------------|--------------------|--------------|------|
| Temperature                                            | 20.6 - 22.2 °C     | 21.7 °C      | Yes  |
| Relative Humidity                                      | 10 - 70 %          | 30 %         | Yes  |
| Pendulum Velocity                                      | 5.90 - 6.10 m/s    | 6.05 m/s     | Yes  |
| Maximum Chest Deflection                               | -38.0 - (-32.0) mm | -35.0 mm     | Yes  |
| Peak Impact Probe Force<br>Within Compression Corridor | 680 - 810 N        | 746 N        | Yes  |
| Internal Hysteresis                                    | 65 - 85 %          | 71 %         | Yes  |
| Maximum Force Between<br>12.5 mm & 32 mm Of Deflection | <= 910             | 795          | Yes  |

### Comments:

Technician



Approved



10.17.2003 13:12:32 991



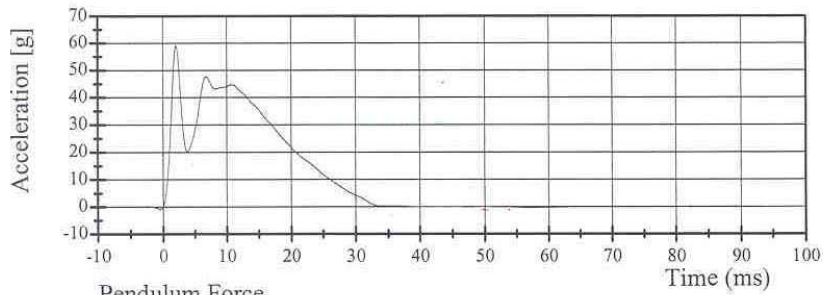
# Transportation Research Center Inc.

572P Thorax Test

HIII 3 Year Old Serial No. 042 Calibration No. 02 - 1

Test Date 10/17/2003

Pendulum Deceleration

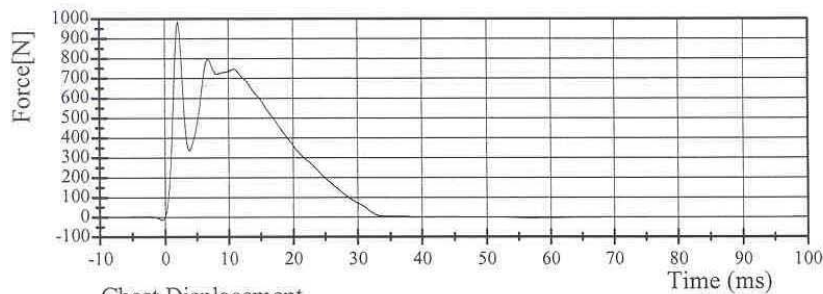


Filter Class: 180

Max: 59.1 g at 2.1 ms

Min: -0.9 g at -0.4 ms

Pendulum Force

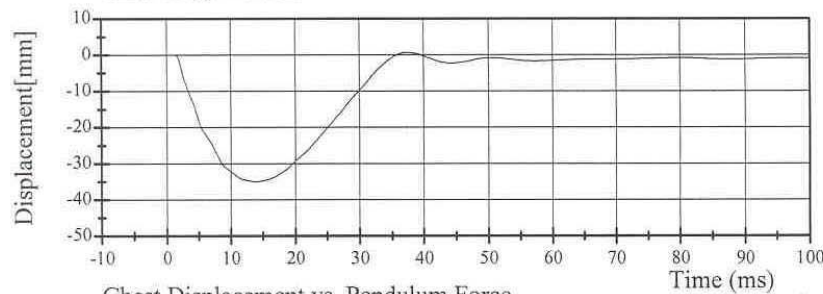


Filter Class: 180

Max: 984.8 N at 2.1 ms

Min: -15.2 N at -0.4 ms

Chest Displacement

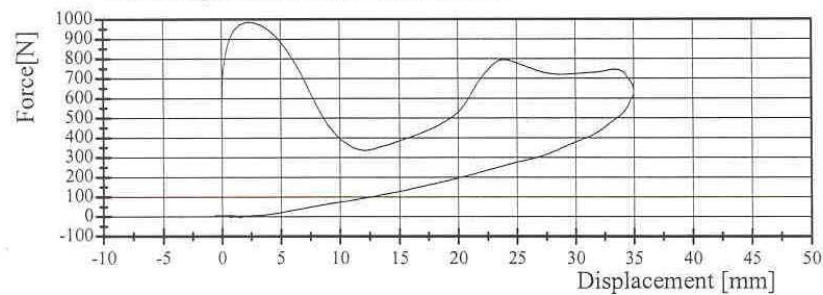


Filter Class: 600

Max: 0.7 mm at 37.3 ms

Min: -35.0 mm at 14.0 ms

Chest Displacement vs. Pendulum Force



10.17.2003 13:12:33 991



TRANSPORTATION RESEARCH CENTER INC.

TORSO FLEXION TEST

HYBRID III THREE-YEAR-OLD

CAL DATE: 16-Oct-03

TRC, INC. TEST NO: 042C02TF1 572 P SN 042 TORSO FLEX CAL 02

| TEST PARAMETER                                      | SPECIFICATION                           | TEST RESULTS |
|-----------------------------------------------------|-----------------------------------------|--------------|
| TEMPERATURE                                         | 18.9 – 25.6 DEG. C                      | 21.7 DEG. C  |
| RELATIVE HUMIDITY                                   | 10 – 70 %                               | 36 %         |
| INITIAL ANGLE OF<br>UNSUPPORTTED DUMMY              | <= 15 DEG.<br>REFERENCED<br>TO VERTICAL | 4.9 DEG.     |
| MAXIMUM FORCE AT 45 DEG.<br>DURING 10 SECOND PERIOD | 130 – 180 N                             | 179.8 N      |
| RETURN ANGLE                                        |                                         | 2.5 DEG.     |
| DIFFERENCE BETWEEN RETURN<br>ANGLE & INTIAL ANGLE   | +/- 10° OF<br>INTIAL ANGLE              | 7.4 °        |
| RATE                                                | 0.5° - 1.5°/sec                         | 1.0 °/sec    |

TEST MEETS SPECIFICATIONS

TECHNICIAN 

## **APPENDIX D**

### **TEST EQUIPMENT LIST AND CALIBRATION INFORMATION**

# INSTRUMENTS FOR RRP CHILD DUMMY S/N: 040

|                        | SERIAL NO. | MANUFACTURER | CALIBRATION DATE |
|------------------------|------------|--------------|------------------|
| Head X                 | AP1Y1      | Endevco      | 8/07/03          |
| Head Y                 | ACC81      | Endevco      | 8/07/03          |
| Head Z                 | AHY71      | Endevco      | 8/07/03          |
| Head X Redundant       | P22190     | Endevco      | 9/04/03          |
| Head Y Redundant       | P22180     | Endevco      | 9/04/03          |
| Head Z Redundant       | P22805     | Endevco      | 9/04/03          |
| Upper Neck Load Cell   | 210        | Denton       | 8/25/03          |
| Chest X                | J13649     | Endevco      | 10/06/03         |
| Chest Y                | ANBP7      | Endevco      | 9/04/03          |
| Chest Z                | J13422     | Entran       | 10/06/03         |
| Chest X Redundant      | J13653     | Endevco      | 10/06/03         |
| Chest Y Redundant      | AP1C6      | Endevco      | 9/04/03          |
| Chest Z Redundant      | J13713     | Endevco      | 10/06/03         |
| Chest Deflection Gauge | 040        | Servo        | 10/14/03         |
| Pelvis X               | AMTG3      | Endevco      | 8/06/03          |
| Pelvis Y               | AMTL6      | Endevco      | 8/06/03          |
| Pelvis Z               | ALC37      | Endevco      | 8/06/03          |
| Tether Force           | 104        | FTSS         | 11/04/03         |

# INSTRUMENTS FOR LRP CHILD DUMMY S/N: 042

|                        | SERIAL NO. | MANUFACTURER | CALIBRATION DATE |
|------------------------|------------|--------------|------------------|
| Head X                 | AKAH1      | Entran       | 8/06/03          |
| Head Y                 | J17709     | Entran       | 8/06/03          |
| Head Z                 | AJ412      | Endevco      | 8/06/03          |
| Head X Redundant       | J18260     | Endevco      | 8/06/03          |
| Head Y Redundant       | J20298     | Endevco      | 8/06/03          |
| Head Z Redundant       | J20473     | Endevco      | 8/06/03          |
| Upper Neck Load Cell   | 94         | FTSS         | 9/02/03          |
| Chest X                | J12449     | Endevco      | 8/07/03          |
| Chest Y                | J12425     | Endevco      | 8/07/03          |
| Chest Z                | J12462     | Endevco      | 8/07/03          |
| Chest X Redundant      | P24154     | Endevco      | 12/05/03         |
| Chest Y Redundant      | P23012     | Endevco      | 8/06/03          |
| Chest Z Redundant      | P23059     | Endevco      | 12/05/03         |
| Chest Deflection Gauge | 042        | Servo        | 10/23/03         |
| Pelvis X               | AGTT3      | Endevco      | 8/07/03          |
| Pelvis Y               | AC913      | Endevco      | 8/07/03          |
| Pelvis Z               | J11630     | Entran       | 8/07/03          |
| Tether Force           | 157        | Denton       | 8/21/03          |