

**REPORT NUMBER: TR-P34007-05-NC**

**SIDE AIRBAG OCCUPANT RISK PROGRAM  
OCCUPANT OUT-OF-POSITION TESTS**

**TOYOTA MOTOR CORPORATION  
2015 LEXUS RX 350  
5-DOOR MPV**

**NHTSA NUMBER: M20155301TWG3**

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**December 23, 2014**

**FINAL REPORT**

**PREPARED FOR:  
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Approval Date: December 23, 2014

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## **SECTION 1**

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

#### **PURPOSE**

This occupant out-of-position static side airbag deployment test is part of the Technical Working Group Occupant Injury Risk from Deploying Side Airbags Testing Program sponsored by Alpha Technology Associate, Inc. under Contract No. DTNH22-09-D-00122. The purpose of this test was to obtain out-of-position occupant injury data for a side airbag deployment.

The occupant out-of-position (OOP) side airbag test was conducted in accordance with the Technical Working Group Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

#### **SUMMARY**

The effects of a roof mounted curtain airbag and a seat mounted torso airbag deployment in a 2015 Lexus RX 350 5-door MPV with an out-of-position 3-year old dummy were evaluated. The test was performed at KARCO Engineering, LLC. on December 9, 2014. Pre- and post-test photographs of the vehicle and dummy can be found in Appendix A.

Two (2) high-speed digital cameras and one (1) real time camera were used to document the deployment of the airbags. Camera locations and other pertinent camera information can be found on Data Sheet No.1 and Data Sheet No.6.

A 3-year old anthropomorphic test device (ATD) was placed in the right rear passenger seating position facing rearward according to the dummy placement instructions (3.3.3.2) in the July 2003 Revision of the Technical Working Group's 'Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags'.

The 3-year old ATD was instrumented with head tri-axial accelerometers and upper and lower neck force transducers.

Fifteen (15) channels of data were recorded using an on-board data acquisition system. Appendix B contains dummy response data traces. Appendix C contains the instrumentation data channel assignments. Appendix D contains the ATD calibration data.

Orientation of the 3-year old dummy was in the rearward facing position. The dummy was placed on its knees on the seat cushion and the dummy's sternum was aligned with the seat mounted side airbag module. This orientation complies with section 3.3.3.2 of the Technical Working Group (TWG) recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

The rear passenger side door remained closed during the test, and was operable after the airbag deployed.

The 3-year old dummy's visible contact points were as follows: The curtain airbag contacted the ATD's head and right shoulder. The torso airbag contacted the ATD's left arm, chest and abdomen.

The occupant data is summarized below:

| ATD Position | HIC <sub>15</sub> | T <sup>1</sup> | T <sup>2</sup> | Avg G | Ntf  | Nte  | Ncf  | Nce  |
|--------------|-------------------|----------------|----------------|-------|------|------|------|------|
| Passenger    | 2.5               | 235.0          | 242.3          | 10.2  | 0.12 | 0.40 | 0.12 | 0.23 |

## SECTION 2

### OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

Test Vehicle: 2015 Lexus RX 350 5-Door MPV NHTSA No.: M20155301TWG3  
Test Program: TWG 3.3.3.2 Test Date: 12/09/14

#### CONVERSION FACTORS

| Quantity           | Typical Application | Std Units           | Metric Unit | Multiply By       |
|--------------------|---------------------|---------------------|-------------|-------------------|
| Mass               | Vehicle Weight      | lb                  | kg          | 0.4536            |
| Linear Velocity    | Impact Velocity     | miles/hr            | km/hr       | 1.609344          |
| Length or Distance | Measurements        | in                  | mm          | 25.4              |
| Volume             | Fuel Systems        | gal                 | liter       | 3.785             |
| Volume             | Small Fluids        | oz                  | mL          | 29.574            |
| Pressure           | Tire Pressures      | lbf/in <sup>2</sup> | kPa         | 6.895             |
| Temperature        | General Use         | °F                  | °C          | $=(T_f - 32)/1.8$ |
| Force              | Dynamic Forces      | lbf                 | N           | 4.448             |
| Moment             | Torque              | lbf-ft              | N•m         | 1.355             |

**DATA SHEET NO. 1****TEST SUMMARY**

Test Vehicle: 2015 Lexus RX 350 5-Door MPV NHTSA No.: M20155301TWG3  
Test Program: TWG 3.3.3.2 Test Date: 12/09/14

**TEST DUMMY INFORMATION**

| Description             | Passenger Seat   |
|-------------------------|------------------|
| Dummy Type / Serial No. | 3-Year Old / 044 |
| Head Contact            | Curtain Airbag   |
| Chest Contact           | Torso Airbag     |
| Abdomen Contact         | Torso Airbag     |
| Pelvis Contact          | None             |
| Left Knee Contact       | None             |
| Right Knee Contact      | None             |

**VIDEO COVERAGE**

| Description        | Quantity |
|--------------------|----------|
| High Speed Digital | 2        |
| Real Time          | 1        |
| Total              | 3        |

**DATA CHANNELS**

| Description                      | Quantity |
|----------------------------------|----------|
| 3 Year Old ATD Sensors           | 15       |
| Belt Assessment Sensors          | 0        |
| Vehicle Structure Accelerometers | 0        |
| Total                            | 15       |

## DATA SHEET NO. 2

### GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2015 Lexus RX 350 5-Door MPV NHTSA No.: M20155301TWG3  
 Test Program: TWG 3.3.3.2 Test Date: 12/09/14

### TEST VEHICLE INFORMATION AND OPTIONS

|                            |                      |
|----------------------------|----------------------|
| NHTSA Number               | M20155301TWG3        |
| Model Year                 | 2015                 |
| Make                       | Lexus                |
| Model                      | RX 350               |
| Body Style                 | 5-Door MPV           |
| VIN                        | JTJZK1BA1F2420115    |
| Body Color                 | Satin Cashmere Metal |
| Odometer Reading (km / mi) | 31 / 19              |
| Engine Displacement (L)    | 3.5                  |
| Type / No. of Cylinders    | V6                   |
| Engine Placement           | Transverse           |
| Transmission Type          | Automatic            |
| Transmission Speeds        | 6                    |
| Overdrive                  | Yes                  |
| Final Drive                | Front                |
| Roof Rack                  | Yes                  |
| Sunroof / T-Top            | Yes                  |
| Running Boards             | No                   |
| Tilt Steering Wheel        | Yes                  |
| Power Seats                | Yes                  |
| Anti-Lock Brakes (ABS)     | Yes                  |

|                                   |     |
|-----------------------------------|-----|
| Traction Control System (TCS)     | Yes |
| Auto-Leveling System              | No  |
| Automatic Door Locks              | Yes |
| Power Window Auto-Reverse         | Yes |
| Other Optional Feature            | No  |
| Driver Front Airbag               | Yes |
| Driver Curtain Airbag             | Yes |
| Driver Head/Torso Airbag          | No  |
| Driver Torso Airbag               | No  |
| Driver Torso/Pelvis Airbag        | Yes |
| Driver Pelvis Airbag              | No  |
| Driver Knee Airbag                | Yes |
| Rear Pass. Curtain Airbag         | Yes |
| Rear Pass. Head/Torso Airbag      | No  |
| Rear Pass. Torso Airbag           | Yes |
| Rear Pass. Torso/Pelvis Airbag    | No  |
| Rear Pass. Pelvis Airbag          | No  |
| Driver Seat Belt Pretensioner     | Yes |
| Rear Pass. Seat Belt Pretensioner | No  |
| Driver Load Limiter               | Yes |
| Rear Pass. Load Limiter           | No  |
| Other Safety Restraint            | No  |

Does Owner's Manual provide instructions to turn off automatic door locks?

Yes

### DATA FROM CERTIFICATION LABEL

|                     |                          |
|---------------------|--------------------------|
| Manufactured By     | Toyota Motor Corporation |
| Date of Manufacture | Mar-14                   |
| Vehicle Type        | MPV                      |

|                 |      |
|-----------------|------|
| GVWR (kg)       | 2520 |
| GAWR Front (kg) | 1360 |
| GAWR Rear (kg)  | 1385 |

### VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

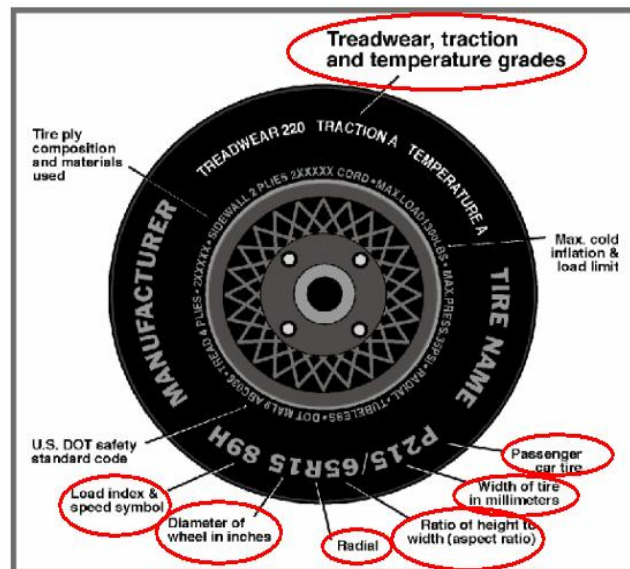
| Measured Parameter          | Front | Rear | Third | Total |
|-----------------------------|-------|------|-------|-------|
| Designated Seating Capacity | 2     | 3    |       | 5     |
| Capacity Weight (VCW) (kg)  |       |      |       | 395.0 |
| DSC x 68.04 (kg)            |       |      |       | 340.2 |
| Cargo Weight (RCLW) (kg)    |       |      |       | 54.8  |

\*Vehicle underwent New Car Assessment Program Side Impact Testing on June 6, 2014.

## DATA SHEET NO. 2 ... (CONTINUED)

### GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2015 Lexus RX 350 5-Door MPV NHTSA No.: M20155301TWG3  
 Test Program: TWG 3.3.3.2 Test Date: 12/09/14



### VEHICLE TIRE INFORMATION

| Measured Parameter       | Front                         | Rear                          |
|--------------------------|-------------------------------|-------------------------------|
| Max. Tire Pressure (kpa) | 350                           | 350                           |
| Cold Pressure (kPa)      | 220                           | 220                           |
| Recommended Tire Size    | P235/60R18                    | P235/60R18                    |
| Tire Size on Vehicle     | P235/60R18                    | P235/60R18                    |
| Tire Manufacturer        | Dunlop                        | Dunlop                        |
| Tire Model               | GrandTrek Touring A/S         | GrandTrek Touring A/S         |
| Treadware                | 280                           | 280                           |
| Traction Grade           | A                             | A                             |
| Temperature Grade        | A                             | A                             |
| Tire Plies Sidewall      | 2 Polyester                   | 2 Polyester                   |
| Tire Plies Body          | 2 Polyester, 2 Steel, 1 Nylon | 2 Polyester, 2 Steel, 1 Nylon |
| Load Index/Speed Symbol  | 102V                          | 102V                          |
| Tire Material            | Polyester, Steel, Nylon       | Polyester, Steel, Nylon       |
| DOT Safety Code Left     | V4DC 4M0R0814                 | V4DC 4M0R0814                 |
| DOT Safety Code Right    | V4DC 4M0R0814                 | V4DC 4M0R0814                 |

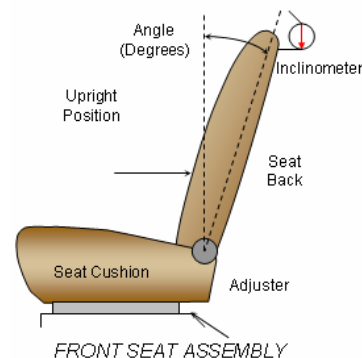
## DATA SHEET NO. 3

### SEAT ADJUSTMENTS

Test Vehicle: 2015 Lexus RX 350 5-Door MPV NHTSA No.: M20155301TWG3  
 Test Program: TWG 3.3.3.2 Test Date: 12/09/14

#### SEAT BACK ANGLE

The passenger seat back is positioned per section 3.3.3.2 of the TWG recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags. Seat back angle is measured at the headrest post.

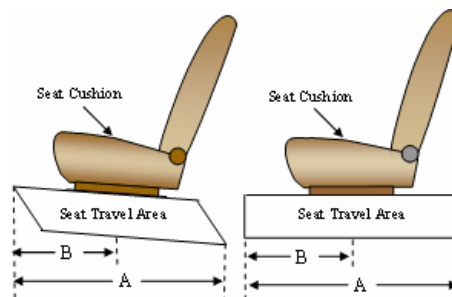


| Seating Position | Degrees | Detent* |
|------------------|---------|---------|
| Passenger Seat   | 1.8     | 0       |

\*Detent zero (0) is the forward most detent

#### SEAT FORE / AFT POSITIONING

The passenger seat track travel is set per section 3.3.3.2 of the TWG recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags. The first or forward most position is counted as zero (0)



| Seating Position | Total Fore-Aft Travel |         | Placed in Position |         |
|------------------|-----------------------|---------|--------------------|---------|
|                  | mm                    | Detents | mm                 | Detent* |
| Passenger Seat   | 123                   | 9       | 0                  | 0       |

\*Detent zero (0) is the forward most detent

#### SEAT BELT UPPER ANCHORAGE

The seat belt upper anchorage is positioned to the uppermost position. Position "H" is the uppermost position, followed by position "M<sub>1</sub>". Position "L" is the lowermost position.

| Seating Position | Total No. of Positions | Placed in Position |
|------------------|------------------------|--------------------|
| Passenger Seat   | Fixed                  | Fixed              |

\*

## DATA SHEET NO. 4

### DUMMY POSITIONING AND AIRBAG DIMENSIONS

Test Vehicle: 2015 Lexus RX 350 5-Door MPV NHTSA No.: M20155301TWG3  
 Test Program: TWG 3.3.3.2 Test Date: 12/09/14

#### DUMMY POSITIONING

| Code | Measurement Description                            | Passenger   |           |
|------|----------------------------------------------------|-------------|-----------|
|      |                                                    | Length (mm) | Angle (°) |
| SA   | Seat Back Angle                                    |             | 1.8       |
| AN   | Top of Airbag Module to Head/Neck Junction         | 285         | 90.0      |
| HD   | Head CG to Door Panel/ Window                      | 86          | 0.0       |
| HSC  | Head to Seat Back Centerline                       | 235         | 0.0       |
| HB   | Head to B-Pillar (C-Pillar)                        | 65          | 0.0       |
| HZ   | Head to Roof (Z)                                   | 263         | 90.0      |
| HH   | Head to Header (Back of Head)                      | 1295        | 9.4       |
| ND   | Nose to Dash (Back of Head to Front Seat Seatback) | 603         | 4.7       |
| NS   | Nose to Seat Back                                  | 603         | 0.0       |
| NR   | Nose to Header (Back of Head)                      | 1295        | 9.4       |
| CD   | Chest to Dash (Back to Front seat seatback)        | 515         | 0.0       |
| CS   | Chest to Seat Back                                 | 22          | 0.0       |
| RACL | Right Arm to Seat Back Centerline                  | 65          | 0.0       |
| LACL | Left Arm to Seat Back Centerline                   | 340         | 0.0       |
| RA   | Right Arm to Door Panel                            | 338         | 0.0       |
| LA   | Left Arm to Door Panel                             | 66          | 0.0       |
| KK   | Knee to Knee                                       | 107         | 0.0       |
| TT   | Toe to Toe                                         | 103         | 0.0       |
| KSCR | Right Knee to Seat Cushion Centerline              | 122         | 0.0       |
| KSCL | Left Knee to Seat Cushion Centerline               | 225         | 0.0       |
|      | Head Angle (X Direction)                           |             | 29.4      |
|      | Head Angle (Y Direction)                           |             | 4.3       |

#### AIRBAG DIMENSIONS

| Code | Measurement Description        | Airbag      |
|------|--------------------------------|-------------|
|      |                                | Length (mm) |
| AMW  | Curtain Airbag Module Diameter | 30          |
| AML  | Curtain Airbag Module Length   | 370         |
| ABL  | Curtain Airbag Length          | 1965        |
| ABW  | Curtain Airbag Width           | 510         |
| AMW  | Torso Airbag Module Diameter   | 25          |
| AML  | Torso Airbag Module Length     | 105         |
| ABL  | Torso Airbag Length            | 455         |
| ABW  | Torso Airbag Width             | 345         |

# DATA SHEET NO. 5

## HYBRID III ATD INJURY CRITERIA AND SENSOR DATA

Test Vehicle: 2015 Lexus RX 350 5-Door MPV NHTSA No.: M20155301TWG3  
 Test Program: TWG 3.3.3.2 Test Date: 12/09/14

### HEAD PEAK ACCELERATIONS

| Location          | Axis | Units | Pass. 3 YO |       |      |       |
|-------------------|------|-------|------------|-------|------|-------|
|                   |      |       | Max        | Time  | Min  | Time  |
| Head CG           | X    | G's   | 5.6        | 20.9  | -9.5 | 237.9 |
| Head CG           | Y    | G's   | 9.0        | 236.6 | -7.1 | 20.9  |
| Head CG           | Z    | G's   | 12.5       | 8.2   | -2.0 | 101.5 |
| Head CG Resultant | N/A  | G's   | 13.0       | 237.3 |      |       |

### UPPER NECK PEAK FORCES AND MOMENTS

| Location              | Axis | Units   | Pass. 3 YO |       |        |       |
|-----------------------|------|---------|------------|-------|--------|-------|
|                       |      |         | Max        | Time  | Min    | Time  |
| Neck Force            | X    | Newtons | 41.2       | 8.1   | -183.3 | 13.4  |
| Neck Force            | Y    | Newtons | 57.1       | 244.8 | -170.5 | 27.3  |
| Neck Force            | Z    | Newtons | 311.6      | 8.8   | -193.4 | 241.8 |
| Neck Force Resultant  | N/A  | Newtons | 313.4      | 9.7   |        |       |
| Neck Moment           | X    | Nm      | 4.9        | 19.2  | -5.9   | 46.2  |
| Neck Moment           | Y    | Nm      | 6.3        | 35.9  | -8.0   | 13.3  |
| Neck Moment           | Z    | Nm      | 6.4        | 57.9  | -6.8   | 19.2  |
| Neck Moment Resultant | N/A  | Nm      | 9.5        | 13.4  |        |       |

### LOWER NECK PEAK FORCES AND MOMENTS

| Location              | Axis | Units   | Pass. 3 YO |      |        |       |
|-----------------------|------|---------|------------|------|--------|-------|
|                       |      |         | Max        | Time | Min    | Time  |
| Neck Force            | X    | Newtons | 261.2      | 12.5 | -50.4  | 6.1   |
| Neck Force            | Y    | Newtons | 143.6      | 7.9  | -182.4 | 34.8  |
| Neck Force            | Z    | Newtons | 367.5      | 9.3  | -167.9 | 241.2 |
| Neck Force Resultant  | N/A  | Newtons | 417.2      | 8.9  |        |       |
| Neck Moment           | X    | Nm      | 17.4       | 27.8 | -4.3   | 300.0 |
| Neck Moment           | Y    | Nm      | 15.3       | 12.5 | -2.0   | 6.2   |
| Neck Moment           | Z    | Nm      | 7.3        | 58.7 | -7.4   | 8.7   |
| Neck Moment Resultant | N/A  | Nm      | 19.7       | 27.8 |        |       |

### HEAD INJURY CRITERIA (HIC 15)

| Location | Pass. 3 YO |                |                |       |
|----------|------------|----------------|----------------|-------|
|          | HIC15      | T <sup>1</sup> | T <sup>2</sup> | Avg G |
| Head CG  | 2.5        | 235.0          | 242.3          | 10.2  |

### UPPER NECK NIJ VALUES

| Location   | Pass. 3 YO |      |      |      |
|------------|------------|------|------|------|
|            | Ntf        | Nte  | Ncf  | Nce  |
| Upper Neck | 0.12       | 0.40 | 0.12 | 0.23 |

**DATA SHEET NO. 6****HIGH SPEED CAMERA LOCATIONS AND DATA**Test Vehicle: 2015 Lexus RX 350 5-Door MPV NHTSA No.: M20155301TWG3Test Program: TWG 3.3.3.2 Test Date: 12/09/14**CAMERA LOCATIONS**

| No. | Camera View           | Location (mm) |       |       | Angle<br>(Deg.) | Lens<br>(mm) | Speed<br>(fps) |
|-----|-----------------------|---------------|-------|-------|-----------------|--------------|----------------|
|     |                       | X             | Y     | Z     |                 |              |                |
| 1   | High Speed Front View |               |       |       |                 |              |                |
| 2   | High Speed 3/4 View   | 2450          | -2940 | -1030 | 4.3             | 50           | 1000           |
| 3   | High Speed Side View  | 250           | -2730 | -1030 | 2.7             | 35           | 1000           |
| 4   | Real Time Camera      | 250           | -2730 | -1145 | 2.7             | N/A          | 30             |

Reference Point: ATD Head CG

+X = Toward Front of Vehicle  
+Y = Toward Passenger Side of Vehicle  
+Z = Down

**APPENDIX A**  
**PHOTOGRAPHS**

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FIGURE 1. Right Front ¾ View, As Received



FIGURE 2. Vehicle Certification Label



FIGURE 3. Post-Test Left Front  $\frac{3}{4}$  View of NCAP Side Impact Test



FIGURE 4. Post-Test Left Side View of NCAP Side Impact Test



FIGURE 5. Post-Test Left Rear  $\frac{3}{4}$  View of NCAP Side Impact Test



FIGURE 6. Post-Test Right Side View of NCAP Side Impact Test



FIGURE 7. Pre-Test Dummy Position, Left Side View



FIGURE 8. Post-Test Dummy Position, Left Side View



FIGURE 9. Pre-Test Dummy Position,  $\frac{3}{4}$  View



FIGURE 10. Post-Test Dummy Position,  $\frac{3}{4}$  View



FIGURE 11. Pre-Test Dummy Position, Front View



FIGURE 12. Post-Test Dummy Position, Front View



FIGURE 13. Post-Test Airbags, Left Side View



FIGURE 14. Post-Test Airbags, Left Front  $\frac{3}{4}$  View

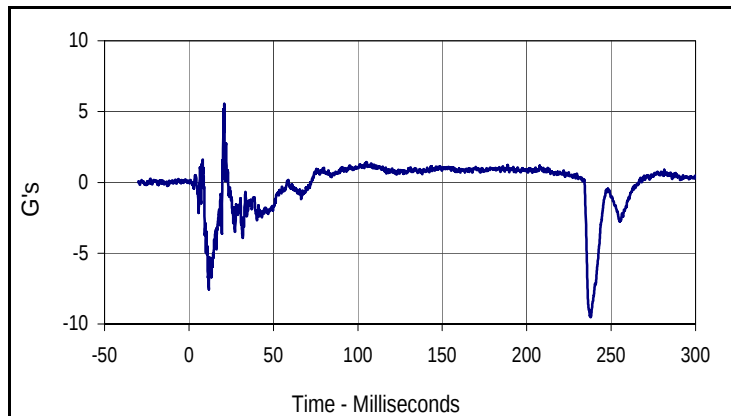
**APPENDIX B**  
**DUMMY RESPONSE DATA TRACES**

## TABLE OF DATA PLOTS

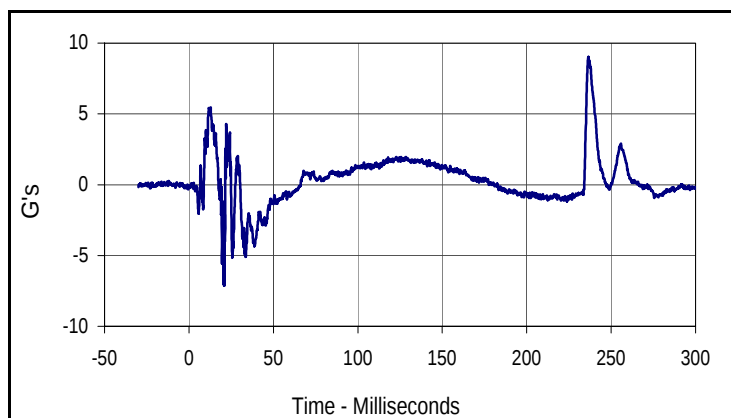
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Test Vehicle: 2015 Lexus RX 350 5-Door Hatchback  
 Test Program: TWG 3.3.3.2

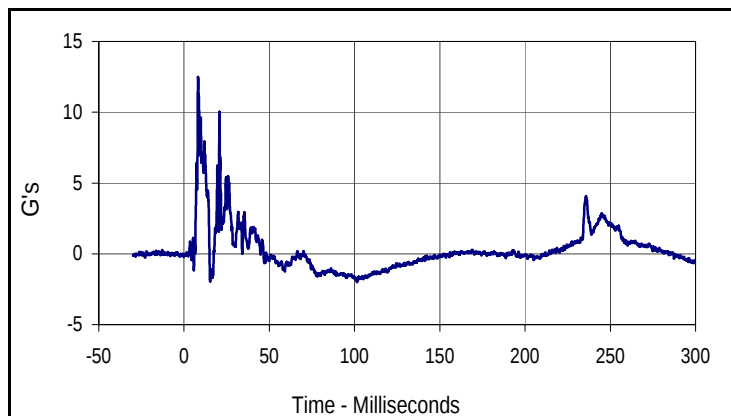
Test Date: 12/9/14  
 NHTSA No.: M20155301TWG3



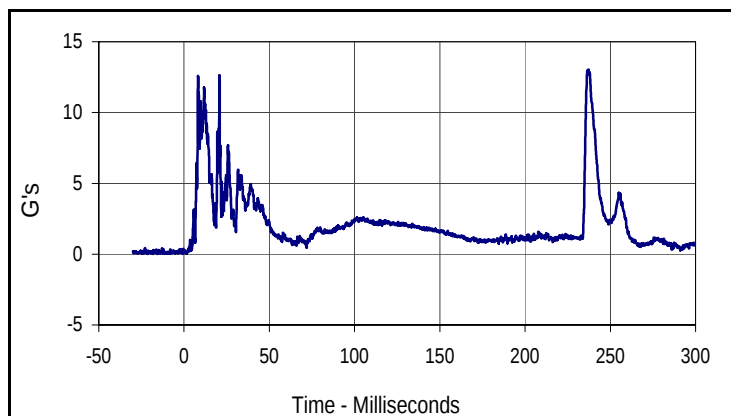
| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| 3 Yr. Old Head X  |      |           |       |
| Plot No.          | Type | SAE Class | Units |
| 001               | FIL  | 1000      | G's   |
| Max               | Time | Min       | Time  |
| 5.6               | 20.9 | -9.5      | 237.9 |



| Curve Description |       |           |       |
|-------------------|-------|-----------|-------|
| 3 Yr. Old Head Y  |       |           |       |
| Plot No.          | Type  | SAE Class | Units |
| 002               | FIL   | 1000      | G's   |
| Max               | Time  | Min       | Time  |
| 9.0               | 236.6 | -7.1      | 20.9  |



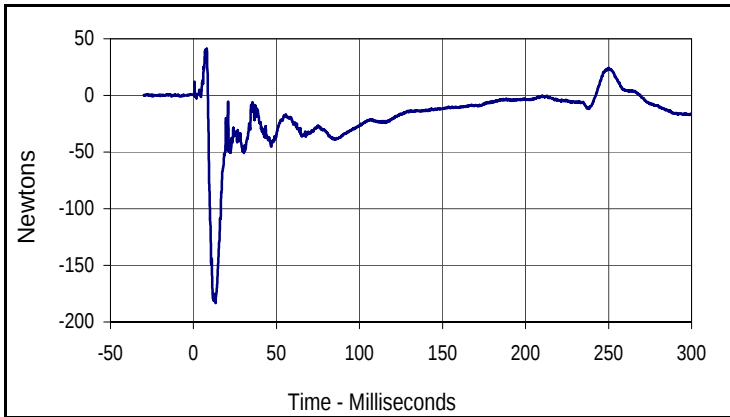
| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| 3 Yr. Old Head Z  |      |           |       |
| Plot No.          | Type | SAE Class | Units |
| 003               | FIL  | 1000      | G's   |
| Max               | Time | Min       | Time  |
| 12.5              | 8.2  | -2.0      | 101.5 |



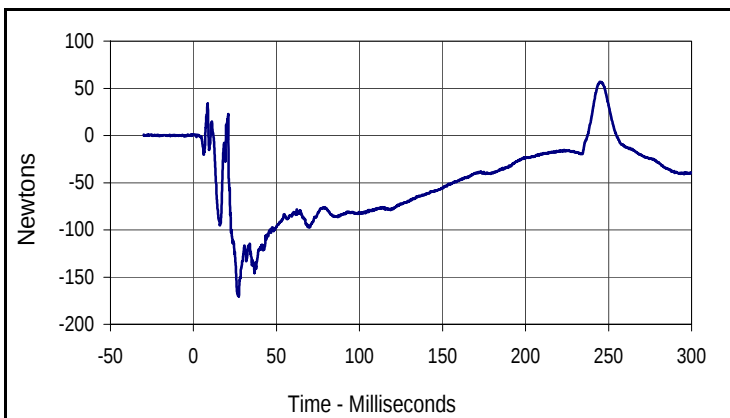
| Curve Description        |       |           |       |
|--------------------------|-------|-----------|-------|
| 3 Yr. Old Head Resultant |       |           |       |
| Plot No.                 | Type  | SAE Class | Units |
| 004                      | RES   | 1000      | G's   |
| Max                      | Time  | Min       | Time  |
| 13.0                     | 237.3 | 0.0       | 1.4   |

Test Vehicle: 2015 Lexus RX 350 5-Door Hatchback  
 Test Program: TWG 3.3.3.2

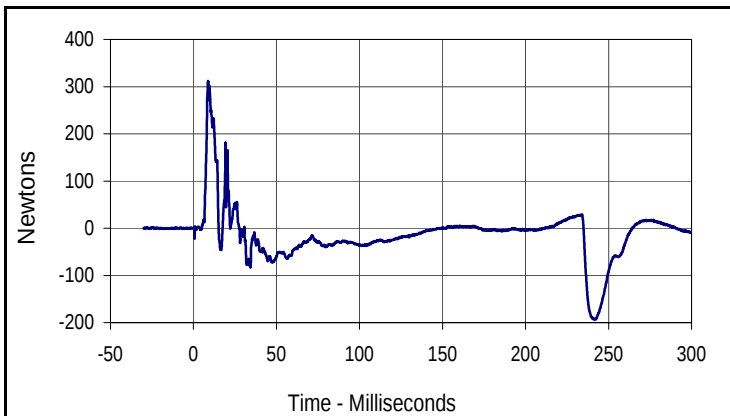
Test Date: 12/9/14  
 NHTSA No.: M20155301TWG3



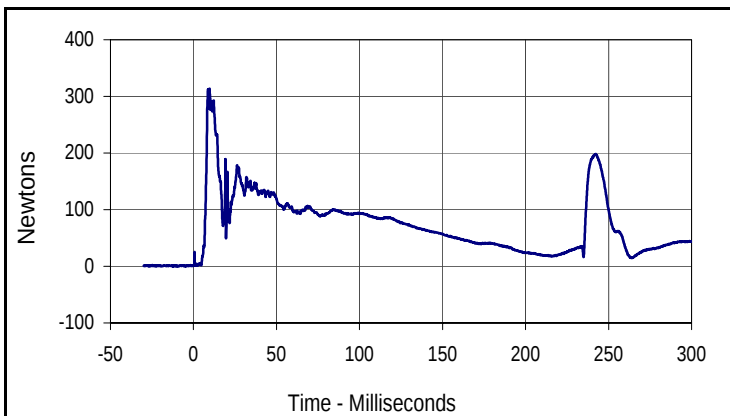
| Curve Description            |      |           |         |
|------------------------------|------|-----------|---------|
| 3 Yr. Old Upper Neck Force X |      |           |         |
| Plot No.                     | Type | SAE Class | Units   |
| 005                          | FIL  | 1000      | Newtons |
| Max                          | Time | Min       | Time    |
| 41.2                         | 8.1  | -183.3    | 13.4    |



| Curve Description            |       |           |         |
|------------------------------|-------|-----------|---------|
| 3 Yr. Old Upper Neck Force Y |       |           |         |
| Plot No.                     | Type  | SAE Class | Units   |
| 006                          | FIL   | 1000      | Newtons |
| Max                          | Time  | Min       | Time    |
| 57.1                         | 244.8 | -170.5    | 27.3    |



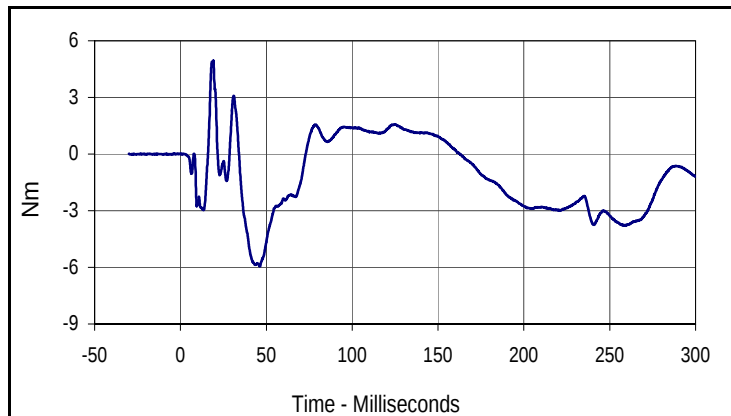
| Curve Description            |      |           |         |
|------------------------------|------|-----------|---------|
| 3 Yr. Old Upper Neck Force Z |      |           |         |
| Plot No.                     | Type | SAE Class | Units   |
| 007                          | FIL  | 1000      | Newtons |
| Max                          | Time | Min       | Time    |
| 311.6                        | 8.8  | -193.4    | 241.8   |



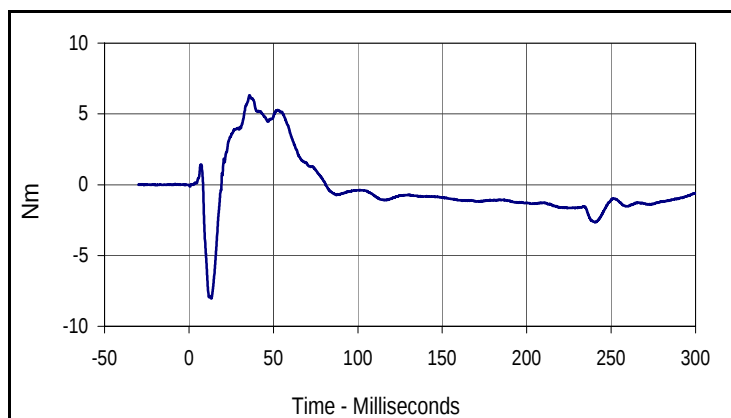
| Curve Description                    |      |           |         |
|--------------------------------------|------|-----------|---------|
| 3 Yr. Old Upper Neck Force Resultant |      |           |         |
| Plot No.                             | Type | SAE Class | Units   |
| 008                                  | RES  | 1000      | Newtons |
| Max                                  | Time | Min       | Time    |
| 313.4                                | 9.7  | 0.9       | 1.6     |

Test Vehicle: 2015 Lexus RX 350 5-Door Hatchback  
 Test Program: TWG 3.3.3.2

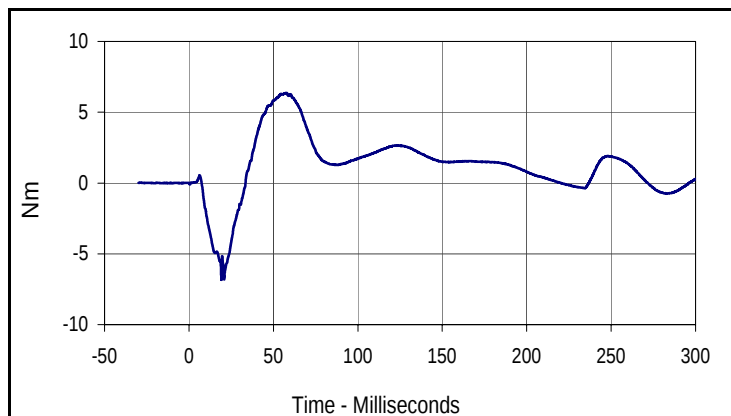
Test Date: 12/9/14  
 NHTSA No.: M20155301TWG3



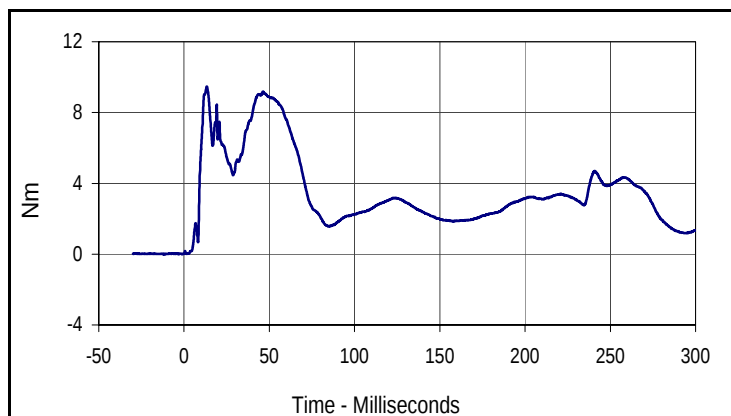
| Curve Description             |      |           |       |
|-------------------------------|------|-----------|-------|
| 3 Yr. Old Upper Neck Moment X |      |           |       |
| Plot No.                      | Type | SAE Class | Units |
| 009                           | FIL  | 600       | Nm    |
| Max                           | Time | Min       | Time  |
| 4.9                           | 19.2 | -5.9      | 46.2  |



| Curve Description             |      |           |       |
|-------------------------------|------|-----------|-------|
| 3 Yr. Old Upper Neck Moment Y |      |           |       |
| Plot No.                      | Type | SAE Class | Units |
| 010                           | FIL  | 600       | Nm    |
| Max                           | Time | Min       | Time  |
| 6.3                           | 35.9 | -8.0      | 13.3  |



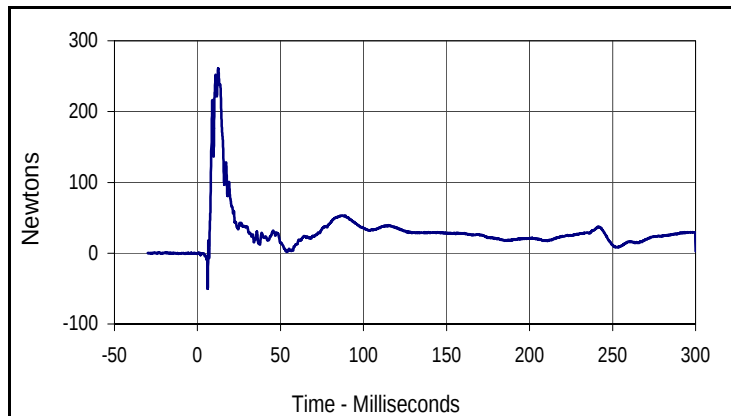
| Curve Description             |      |           |       |
|-------------------------------|------|-----------|-------|
| 3 Yr. Old Upper Neck Moment Z |      |           |       |
| Plot No.                      | Type | SAE Class | Units |
| 011                           | FIL  | 600       | Nm    |
| Max                           | Time | Min       | Time  |
| 6.4                           | 57.9 | -6.8      | 19.2  |



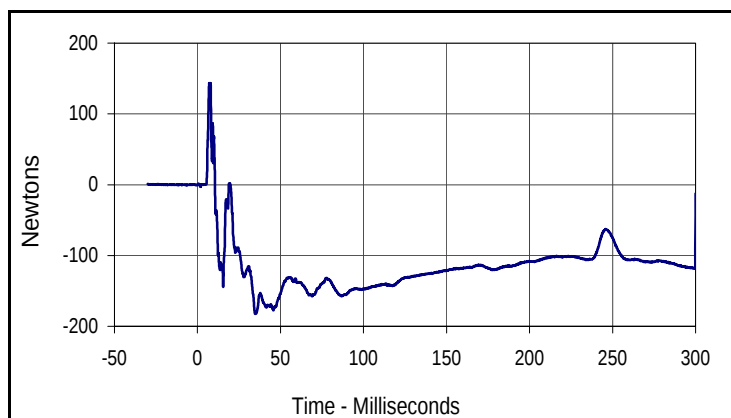
| Curve Description                     |      |           |       |
|---------------------------------------|------|-----------|-------|
| 3 Yr. Old Upper Neck Moment Resultant |      |           |       |
| Plot No.                              | Type | SAE Class | Units |
| 012                                   | RES  | 600       | Nm    |
| Max                                   | Time | Min       | Time  |
| 9.5                                   | 13.4 | 0.0       | 0.1   |

Test Vehicle: 2015 Lexus RX 350 5-Door Hatchback  
 Test Program: TWG 3.3.3.2

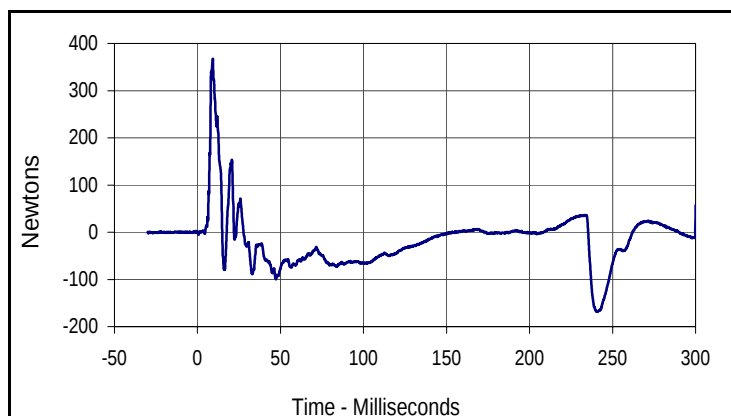
Test Date: 12/9/14  
 NHTSA No.: M20155301TWG3



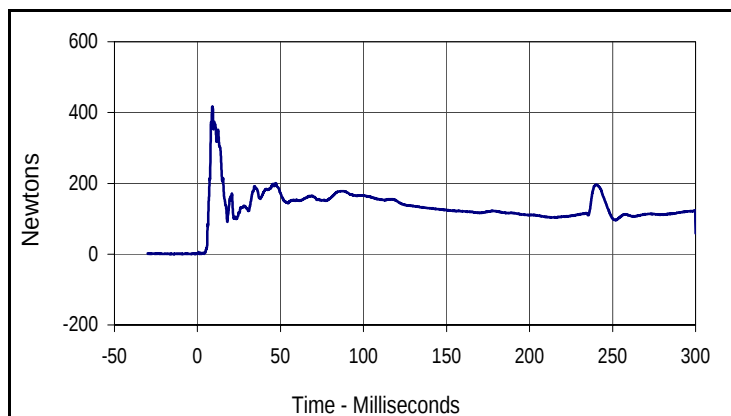
| Curve Description            |      |           |         |
|------------------------------|------|-----------|---------|
| 3 Yr. Old Lower Neck Force X |      |           |         |
| Plot No.                     | Type | SAE Class | Units   |
| 013                          | FIL  | 1000      | Newtons |
| Max                          | Time | Min       | Time    |
| 261.2                        | 12.5 | -50.4     | 6.1     |



| Curve Description            |      |           |         |
|------------------------------|------|-----------|---------|
| 3 Yr. Old Lower Neck Force Y |      |           |         |
| Plot No.                     | Type | SAE Class | Units   |
| 014                          | FIL  | 1000      | Newtons |
| Max                          | Time | Min       | Time    |
| 143.6                        | 7.9  | -182.4    | 34.8    |



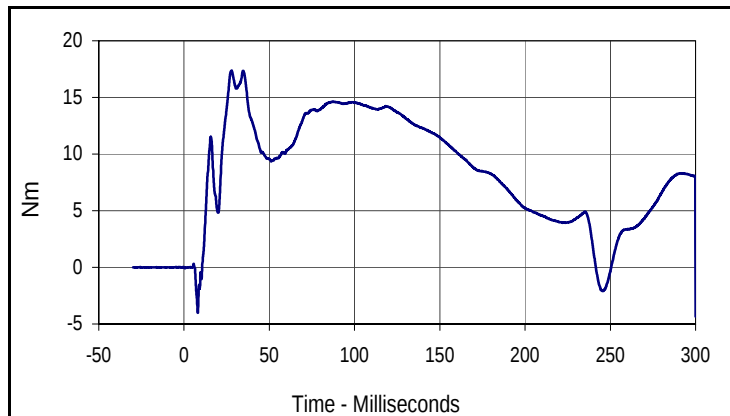
| Curve Description            |      |           |         |
|------------------------------|------|-----------|---------|
| 3 Yr. Old Lower Neck Force Z |      |           |         |
| Plot No.                     | Type | SAE Class | Units   |
| 015                          | FIL  | 1000      | Newtons |
| Max                          | Time | Min       | Time    |
| 367.5                        | 9.3  | -167.9    | 241.2   |



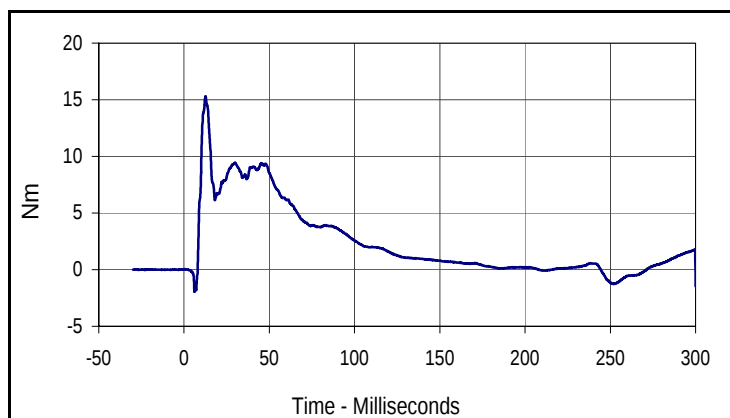
| Curve Description                    |      |           |         |
|--------------------------------------|------|-----------|---------|
| 3 Yr. Old Lower Neck Force Resultant |      |           |         |
| Plot No.                             | Type | SAE Class | Units   |
| 016                                  | RES  | 1000      | Newtons |
| Max                                  | Time | Min       | Time    |
| 417.2                                | 8.9  | 0.2       | 2.2     |

Test Vehicle: 2015 Lexus RX 350 5-Door Hatchback  
 Test Program: TWG 3.3.3.2

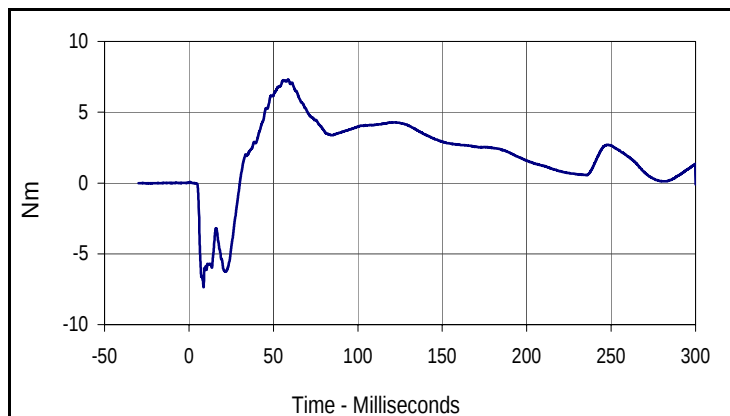
Test Date: 12/9/14  
 NHTSA No.: M20155301TWG3



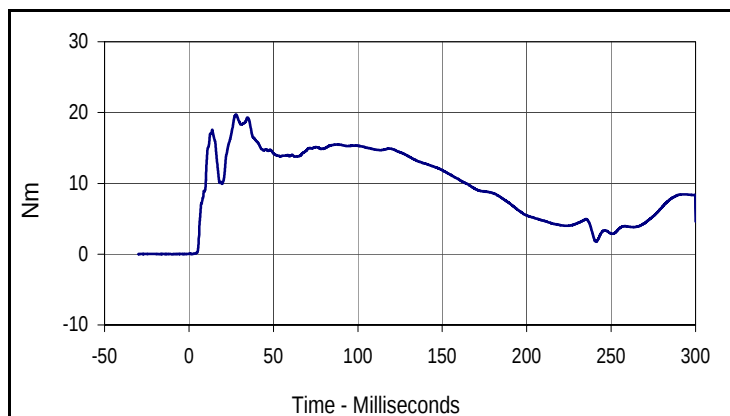
| Curve Description             |      |           |       |
|-------------------------------|------|-----------|-------|
| 3 Yr. Old Lower Neck Moment X |      |           |       |
| Plot No.                      | Type | SAE Class | Units |
| 017                           | FIL  | 600       | Nm    |
| Max                           | Time | Min       | Time  |
| 17.4                          | 27.8 | -4.3      | 300.0 |



| Curve Description             |      |           |       |
|-------------------------------|------|-----------|-------|
| 3 Yr. Old Lower Neck Moment Y |      |           |       |
| Plot No.                      | Type | SAE Class | Units |
| 018                           | FIL  | 600       | Nm    |
| Max                           | Time | Min       | Time  |
| 15.3                          | 12.5 | -2.0      | 6.2   |



| Curve Description             |      |           |       |
|-------------------------------|------|-----------|-------|
| 3 Yr. Old Lower Neck Moment Z |      |           |       |
| Plot No.                      | Type | SAE Class | Units |
| 019                           | FIL  | 600       | Nm    |
| Max                           | Time | Min       | Time  |
| 7.3                           | 58.7 | -7.4      | 8.7   |



| Curve Description                     |      |           |       |
|---------------------------------------|------|-----------|-------|
| 3 Yr. Old Lower Neck Moment Resultant |      |           |       |
| Plot No.                              | Type | SAE Class | Units |
| 020                                   | RES  | 600       | Nm    |
| Max                                   | Time | Min       | Time  |
| 19.7                                  | 27.8 | 0.0       | 1.6   |

**APPENDIX C**  
**INSTRUMENTATION DATA CHANNEL ASSIGNMENTS**

**TWG 3.3.3.2**  
**Instrumentation Data Channel Assignments**  
**A.T.D. Serial Number 044**  
**12/9/14**  
**2015 Lexus RX 350 5-Door Hatchback**

| CH. | LOCATION          | AXIS | IDENT. NO. | DESCRIPTION              | MFR          | MODEL      | UNITS |
|-----|-------------------|------|------------|--------------------------|--------------|------------|-------|
| 1   | HEAD              | X    | P58808     | Accel.,full bridge       | ENDEVCO      | 7264C-2000 | G     |
| 2   | HEAD              | Y    | P49189     | Accel.,full bridge       | ENDEVCO      | 7264C-2000 | G     |
| 3   | HEAD              | Z    | P58861     | Accel.,full bridge       | ENDEVCO      | 7264C-2000 | G     |
| 4   | UPPER NECK FORCE  | X    | 93         | Load cell, six axis neck | R. A. Denton | 3303       | N     |
| 5   | UPPER NECK FORCE  | Y    | 93         | Load cell, six axis neck | R. A. Denton | 3303       | N     |
| 6   | UPPER NECK FORCE  | Z    | 93         | Load cell, six axis neck | R. A. Denton | 3303       | N     |
| 7   | UPPER NECK MOMENT | X    | 93         | Load cell, six axis neck | R. A. Denton | 3303       | Nm    |
| 8   | UPPER NECK MOMENT | Y    | 93         | Load cell, six axis neck | R. A. Denton | 3303       | Nm    |
| 9   | UPPER NECK MOMENT | Z    | 93         | Load cell, six axis neck | R. A. Denton | 3303       | Nm    |
| 10  | LOWER NECK FORCE  | X    | 213        | Load cell, six axis neck | R. A. Denton | 3303       | N     |
| 11  | LOWER NECK FORCE  | Y    | 213        | Load cell, six axis neck | R. A. Denton | 3303       | N     |
| 12  | LOWER NECK FORCE  | Z    | 213        | Load cell, six axis neck | R. A. Denton | 3303       | N     |
| 13  | LOWER NECK MOMENT | X    | 213        | Load cell, six axis neck | R. A. Denton | 3303       | Nm    |
| 14  | LOWER NECK MOMENT | Y    | 213        | Load cell, six axis neck | R. A. Denton | 3303       | Nm    |
| 15  | LOWER NECK MOMENT | Z    | 213        | Load cell, six axis neck | R. A. Denton | 3303       | Nm    |

**APPENDIX D**  
**PRE-TEST AND POST-TEST HYBRID III CONFIGURATION AND PERFORMANCE**  
**VERIFICATION DATA**

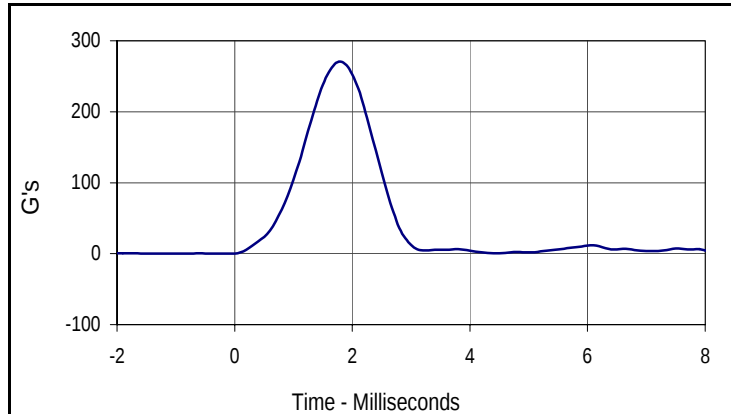
**APPENDIX D**  
**PRE-TEST / HIII CONFIGURATION AND PERFORMANCE VERIFICATION DATA**

Test Program: Hybrid III 3 Yr Old Head Drop Test  
 ATD Serial No.: 044

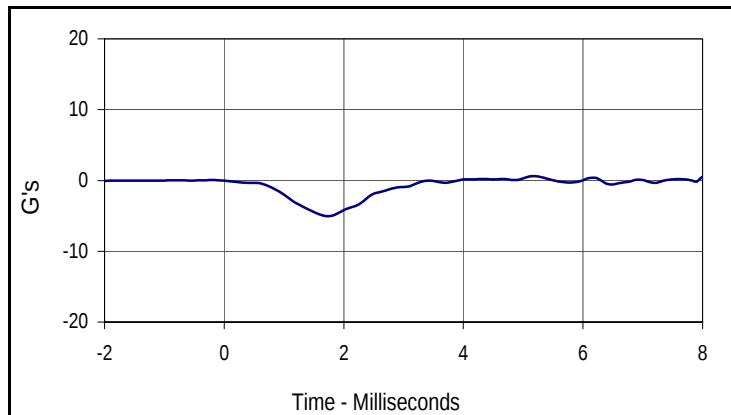
Test Date: 12/5/14  
 Test I.D.: 044HD007



| Tested Parameter             | Units  | Specification  | Result | Pass/Fail |
|------------------------------|--------|----------------|--------|-----------|
| Laboratory Temperature       | °C     | 18.9 to 25.6   | 21.4   | Pass      |
| Laboratory Relative Humidity | %      | 10 to 70       | 23     | Pass      |
| Peak Resultant Acceleration  | G's    | 250.0 to 280.0 | 270.7  | Pass      |
| Peak Lateral Acceleration    | G's    | ≤15.0          | 5.1    | Pass      |
| Is Acceleration Unimodal?    | Yes/No | Yes            | Yes    | Pass      |
| Overall Test Results         |        |                |        | Pass      |



| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Head Resultant    |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 001               | RES  | 1000      | G's   |
| Max               | Time | Min       | Time  |
| 270.7             | 1.8  | 0.1       | -1.1  |



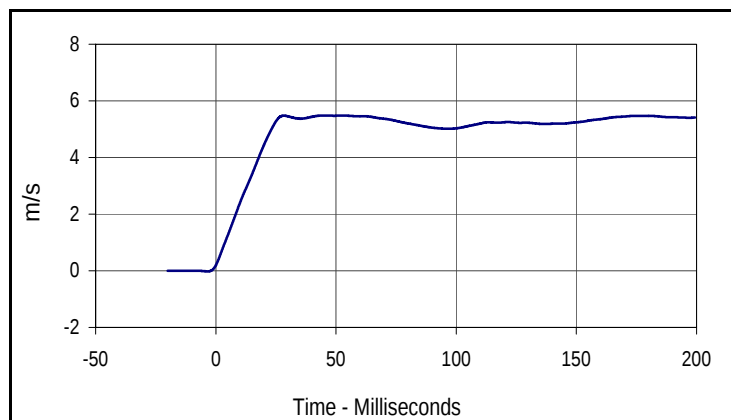
| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Head Y            |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 002               | FIL  | 1000      | G's   |
| Max               | Time | Min       | Time  |
| 0.6               | 5.2  | -5.1      | 1.7   |

Test Program: Hybrid III 3 Yr Old Neck Flexion Test  
 ATD Serial No.: 044

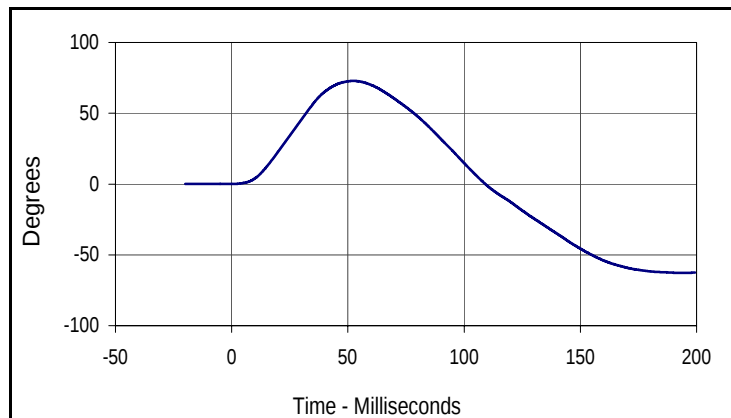
Test Date: 12/5/14  
 Test I.D.: 044NF007



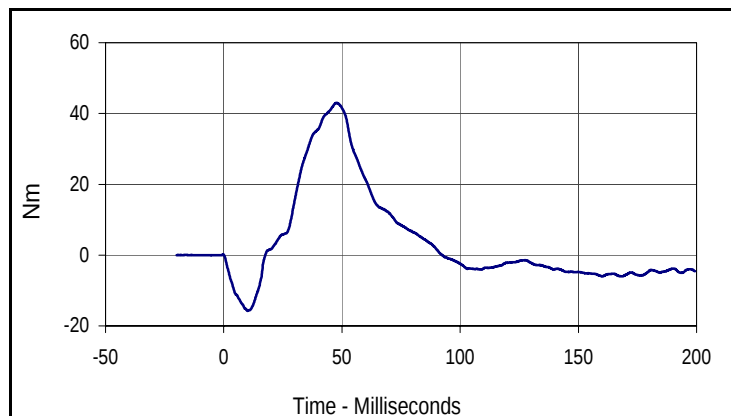
| Tested Parameter                     |          | Units   | Specification        | Result | Pass/Fail |
|--------------------------------------|----------|---------|----------------------|--------|-----------|
| Laboratory Temperature               |          | °C      | 20.6 to 22.2         | 21.4   | Pass      |
| Laboratory Relative Humidity         |          | %       | 10 to 70             | 22     | Pass      |
| Pendulum Velocity                    |          | m/s     | 5.40 to 5.60         | 5.55   | Pass      |
| Pendulum Deceleration                | 10 Msec. | m/s     | 2.0 to 2.7           | 2.2    | Pass      |
|                                      | 15 Msec. | m/s     | 3.0 to 4.0           | 3.3    | Pass      |
|                                      | 20 Msec. | m/s     | 4.0 to 5.1           | 4.3    | Pass      |
| "D" Plane Rotation                   | Max      | Degrees | 70.0 to 82.0         | 72.8   | Pass      |
| Peak Moment in Rotation              | Max      | Nm      | 42.0 to 53.0         | 43.0   | Pass      |
| Positive Moment Decay, Time To 10 Nm |          | Msec.   | 60.0 to 80.0         | 73.0   | Pass      |
|                                      |          |         | Overall Test Results |        | Pass      |



| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Pendulum Velocity |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 001               | FIL  | 180       | m/s   |
| Max               | Time | Min       | Time  |
| 5.5               | 45.0 | 0.0       | -3.4  |



| Curve Description |      |           |         |
|-------------------|------|-----------|---------|
| D Plane Rotation  |      |           |         |
| CURNO             | Type | SAE Class | Units   |
| 002               | FIL  | 60        | Degrees |
| Max               | Time | Min       | Time    |
| 72.8              | 52.3 | -62.7     | 194.2   |



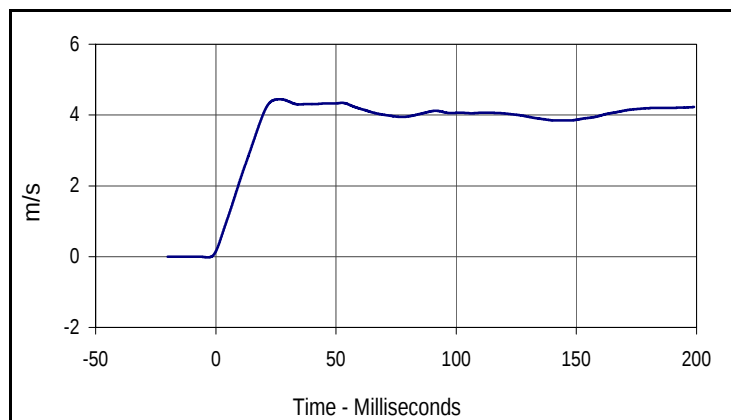
| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Neck Moment Y     |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 003               | FIL  | 600       | Nm    |
| Max               | Time | Min       | Time  |
| 43.0              | 47.7 | -15.7     | 10.1  |

Test Program: Hybrid III 3 Yr Old Neck Extension Test  
 ATD Serial No.: 044

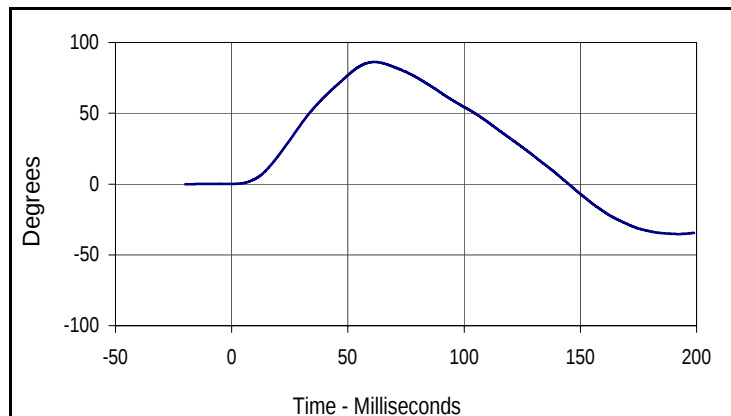
Test Date: 12/5/14  
 Test I.D.: 044NE007



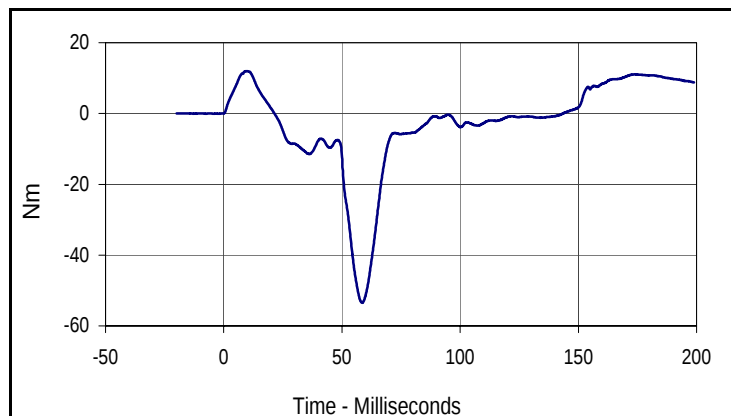
| Tested Parameter                      |          | Units   | Specification        | Result | Pass/Fail |
|---------------------------------------|----------|---------|----------------------|--------|-----------|
| Laboratory Temperature                |          | °C      | 20.6 to 22.2         | 21.4   | Pass      |
| Laboratory Relative Humidity          |          | %       | 10 to 70             | 23     | Pass      |
| Pendulum Velocity                     |          | m/s     | 3.55 to 3.75         | 3.69   | Pass      |
| Pendulum Deceleration                 | 6 Msec.  | m/s     | 1.0 to 1.4           | 1.3    | Pass      |
|                                       | 10 Msec. | m/s     | 1.9 to 2.5           | 2.1    | Pass      |
|                                       | 14 Msec. | m/s     | 2.8 to 3.5           | 2.9    | Pass      |
| "D" Plane Rotation                    | Max      | Degrees | 83.0 to 93.0         | 86.2   | Pass      |
| Peak Moment in Rotation               | Max      | Nm      | -43.7 to -53.3       | -46.5  | Pass      |
| Positive Moment Decay, Time To -10 Nm |          | Msec.   | 60.0 to 80.0         | 69.0   | Pass      |
|                                       |          |         | Overall Test Results |        | Pass      |



| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Pendulum Velocity |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 001               | FIL  | 180       | m/s   |
| Max               | Time | Min       | Time  |
| 4.4               | 26.6 | 0.0       | -3.3  |



| Curve Description |      |           |         |
|-------------------|------|-----------|---------|
| D Plane Rotation  |      |           |         |
| CURNO             | Type | SAE Class | Units   |
| 002               | FIL  | 60        | Degrees |
| Max               | Time | Min       | Time    |
| 86.2              | 61.3 | -35.3     | 192.4   |



| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Neck Moment Y     |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 003               | FIL  | 600       | Nm    |
| Max               | Time | Min       | Time  |
| 12.0              | 10.0 | -53.5     | 58.5  |

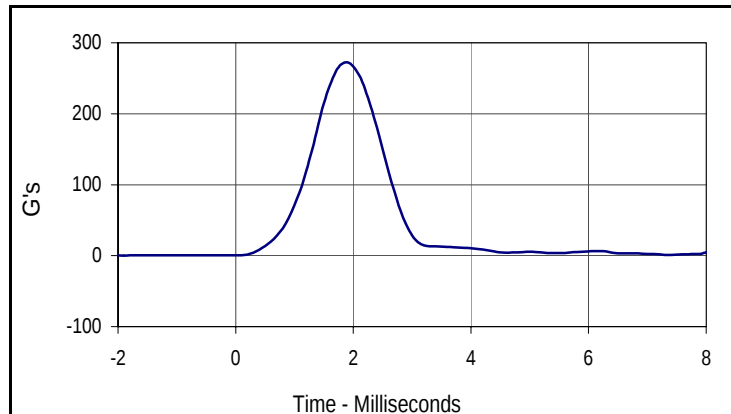
**APPENDIX D**  
**POST-TEST / HIII CONFIGURATION AND PERFORMANCE VERIFICATION DATA**

Test Program: Hybrid III 3 Yr Old Head Drop Test  
 ATD Serial No.: 044

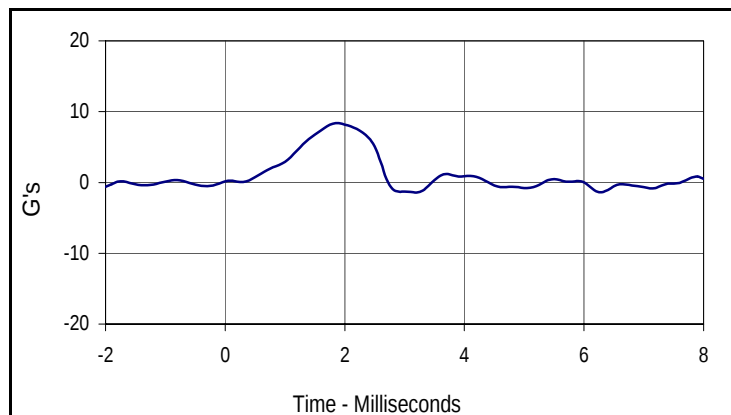
Test Date: 12/11/14  
 Test I.D.: 044HD008



| Tested Parameter             | Units  | Specification  | Result | Pass/Fail |
|------------------------------|--------|----------------|--------|-----------|
| Laboratory Temperature       | °C     | 18.9 to 25.6   | 21.6   | Pass      |
| Laboratory Relative Humidity | %      | 10 to 70       | 23     | Pass      |
| Peak Resultant Acceleration  | G's    | 250.0 to 280.0 | 272.3  | Pass      |
| Peak Lateral Acceleration    | G's    | ≤15.0          | 8.4    | Pass      |
| Is Acceleration Unimodal?    | Yes/No | Yes            | Yes    | Pass      |
| Overall Test Results         |        |                | Pass   |           |



| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Head Resultant    |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 001               | RES  | 1000      | G's   |
| Max               | Time | Min       | Time  |
| 272.3             | 1.9  | 0.3       | -1.9  |



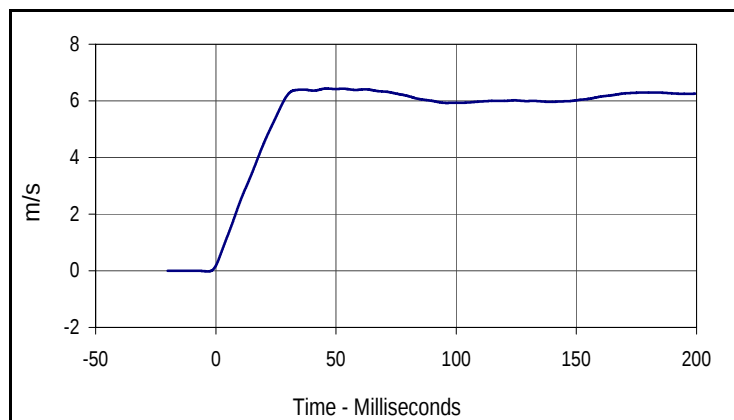
| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Head Y            |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 002               | FIL  | 1000      | G's   |
| Max               | Time | Min       | Time  |
| 8.4               | 1.9  | -1.4      | 3.2   |

Test Program: Hybrid III 3 Yr Old Neck Flexion Test  
 ATD Serial No.: 044

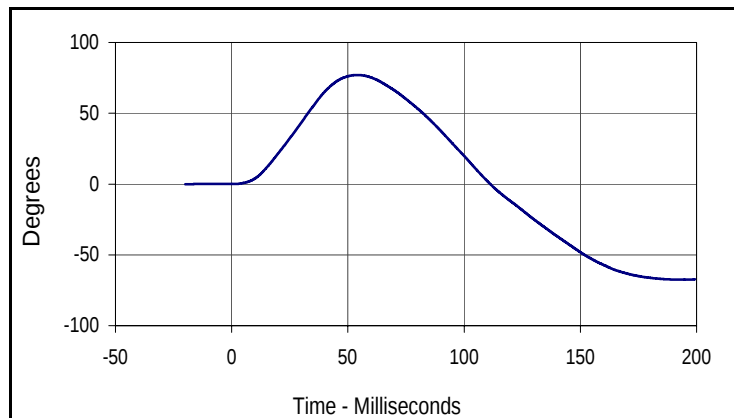
Test Date: 12/11/14  
 Test I.D.: 044NF008



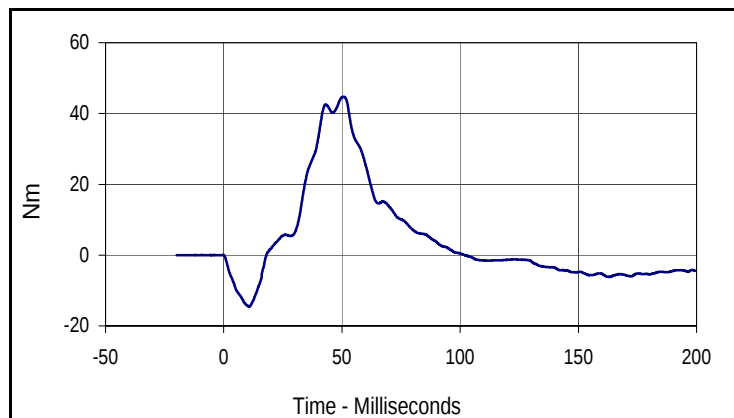
| Tested Parameter                     |          | Units   | Specification        | Result | Pass/Fail |
|--------------------------------------|----------|---------|----------------------|--------|-----------|
| Laboratory Temperature               |          | °C      | 20.6 to 22.2         | 21.4   | Pass      |
| Laboratory Relative Humidity         |          | %       | 10 to 70             | 23     | Pass      |
| Pendulum Velocity                    |          | m/s     | 5.40 to 5.60         | 5.52   | Pass      |
| Pendulum Deceleration                | 10 Msec. | m/s     | 2.0 to 2.7           | 2.3    | Pass      |
|                                      | 15 Msec. | m/s     | 3.0 to 4.0           | 3.3    | Pass      |
|                                      | 20 Msec. | m/s     | 4.0 to 5.1           | 4.4    | Pass      |
| "D" Plane Rotation                   | Max      | Degrees | 70.0 to 82.0         | 77.0   | Pass      |
| Peak Moment in Rotation              | Max      | Nm      | 42.0 to 53.0         | 44.7   | Pass      |
| Positive Moment Decay, Time To 10 Nm |          | Msec.   | 60.0 to 80.0         | 76.1   | Pass      |
|                                      |          |         | Overall Test Results |        | Pass      |



| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Pendulum Velocity |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 001               | FIL  | 180       | m/s   |
| Max               | Time | Min       | Time  |
| 6.4               | 46.1 | 0.0       | -3.3  |



| Curve Description |      |           |         |
|-------------------|------|-----------|---------|
| D Plane Rotation  |      |           |         |
| CURNO             | Type | SAE Class | Units   |
| 002               | FIL  | 60        | Degrees |
| Max               | Time | Min       | Time    |
| 77.0              | 54.1 | -67.5     | 194.0   |



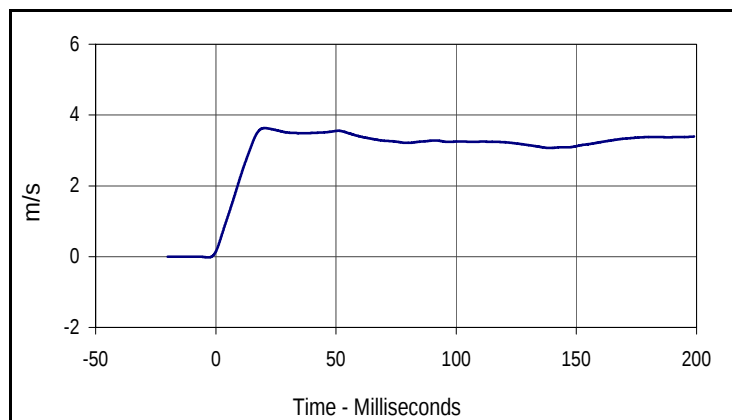
| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Neck Moment Y     |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 003               | FIL  | 600       | Nm    |
| Max               | Time | Min       | Time  |
| 44.7              | 50.4 | -14.7     | 10.8  |

Test Program: Hybrid III 3 Yr Old Neck Extension Test  
 ATD Serial No.: 044

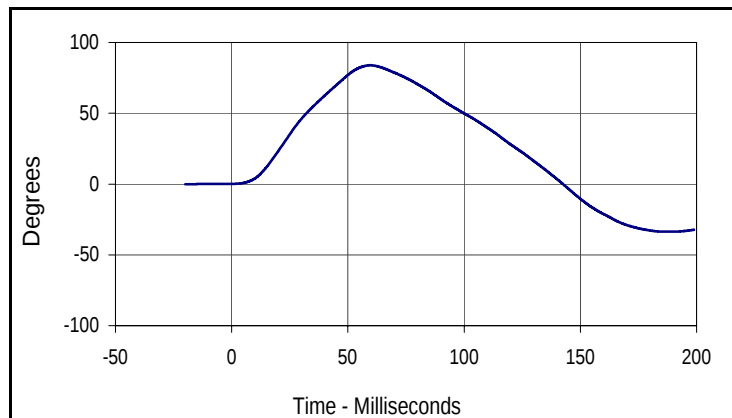
Test Date: 12/11/14  
 Test I.D.: 044NE008



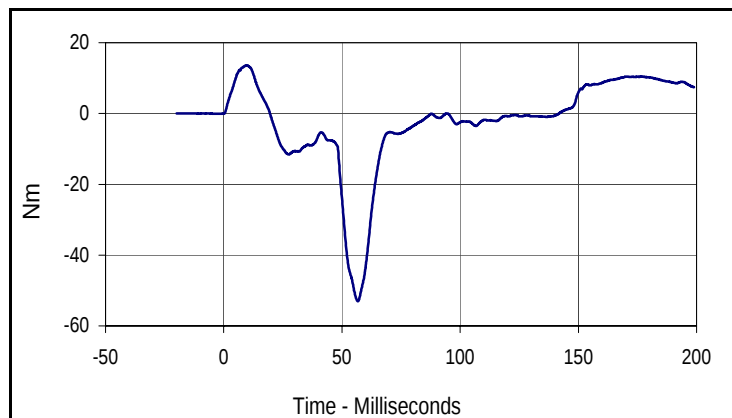
| Tested Parameter                      |          | Units   | Specification        | Result | Pass/Fail |
|---------------------------------------|----------|---------|----------------------|--------|-----------|
| Laboratory Temperature                |          | °C      | 20.6 to 22.2         | 21.4   | Pass      |
| Laboratory Relative Humidity          |          | %       | 10 to 70             | 23     | Pass      |
| Pendulum Velocity                     |          | m/s     | 3.55 to 3.75         | 3.72   | Pass      |
| Pendulum Deceleration                 | 6 Msec.  | m/s     | 1.0 to 1.4           | 1.3    | Pass      |
|                                       | 10 Msec. | m/s     | 1.9 to 2.5           | 2.2    | Pass      |
|                                       | 14 Msec. | m/s     | 2.8 to 3.5           | 3.0    | Pass      |
| "D" Plane Rotation                    | Max      | Degrees | 83.0 to 93.0         | 83.9   | Pass      |
| Peak Moment in Rotation               | Max      | Nm      | -43.7 to -53.3       | -44.9  | Pass      |
| Positive Moment Decay, Time To -10 Nm |          | Msec.   | 60.0 to 80.0         | 66.6   | Pass      |
|                                       |          |         | Overall Test Results |        | Pass      |



| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Pendulum Velocity |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 001               | FIL  | 180       | m/s   |
| Max               | Time | Min       | Time  |
| 3.6               | 20.3 | 0.0       | -3.2  |



| Curve Description |      |           |         |
|-------------------|------|-----------|---------|
| D Plane Rotation  |      |           |         |
| CURNO             | Type | SAE Class | Units   |
| 002               | FIL  | 60        | Degrees |
| Max               | Time | Min       | Time    |
| 83.9              | 59.6 | -33.6     | 190.8   |



| Curve Description |      |           |       |
|-------------------|------|-----------|-------|
| Neck Moment Y     |      |           |       |
| CURNO             | Type | SAE Class | Units |
| 003               | FIL  | 600       | Nm    |
| Max               | Time | Min       | Time  |
| 13.6              | 9.5  | -53.0     | 56.7  |