**REPORT NUMBER TR-P27082-05-NC**

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

**NISSAN MOTOR CORPORATION**
**2007 NISSAN VERSA 1.8S**
**5-DOOR HATCHBACK**

**NHTSA NUMBER: M75200TWG2**

**PREPARED BY:**
**KARCO ENGINEERING, LLC**
**9270 HOLLY ROAD**
**ADELANTO, CALIFORNIA 92301**

**MAY 1, 2007**

**FINAL REPORT**

**PREPARED FOR:**
**U.S. DEPARTMENT OF TRANSPORTATION**
**NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION**
**RULEMAKING**
**OFFICE OF CRASHWORTHINESS STANDARDS**
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**WASHINGTON, D.C. 20590**

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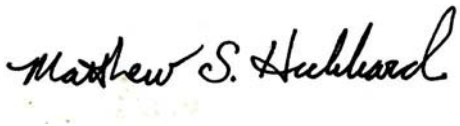

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Date of Acceptance

# Technical Report Documentation Page

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**15. Supplementary Notes**

**16. Abstract**

A static side airbag deployment was conducted on a 2007 Nissan Versa 1.8S 5-Door Hatchback at KARCO Engineering, LLC on 5/1/2007. This test was conducted to obtain data indicant of TWG Side Airbag Out-of-Position Injury criteria.

| Measurement Description | Units | Threshold | Hybrid III 6 Year Old ATD | |
|---|---|---|---|---|
| Head Injury Criteria ($HIC_{15}$) | | 700 | 11.6 | |

| 17. Key Words | 18. Distribution Statement |
|---|---|
| TWG Occupant Out-of-Position Test Section 3.3.3.5<br>New Car Assessment Program (NCAP)<br>2007 Nissan Versa 1.8S 5-Door Hatchback<br>NHTSA NO. M75200TWG2 | Copies of this report available from:<br>NHTSA Technical Reference Division<br>National Highway Traffic Safety Admin.<br>400 Seventh St., SW, Room 5111<br>Washington, D.C. 20590 |

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## SECTION 1

## PURPOSE AND SUMMARY OF TEST M75200TWG2

### 1.1 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 the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-03-D-32005. The purpose of this test was to obtain occupant injury data for a side airbag deployment.

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

### 1.2 SUMMARY

The effects of a seat mounted torso airbag and a roof mounted curtain airbag deployment in a 2007 Nissan Versa 1.8S 5-Door Hatchback with an out-of-position Hybrid III 6 Year-Old Child dummy were evaluated. The test was performed at Karco Engineering, LLC on May 1, 2007. Pre- and post-test photographs of the vehicle and dummy can be found in Appendix A.

Two high-speed digital cameras were used to document the torso and curtain airbag deployment. Camera locations and other pertinent camera information can be found on Data Sheet No.1 and Data Sheet No.6.

One Part 572N, Hybrid III 6-Year old child anthropomorphic test device (ATD) was placed in the right front passenger seating position facing forward according to the dummy placement instructions (3.3.3.5) in the July 2003 Revision of the Technical Working Group's 'Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags'.

The Hybrid III 6-Year old ATD was instrumented with head tri-axial accelerometers, and upper neck transducers.

Nine (9) channels of data were recorded using an on-board data acquisition system. Appendix A contains Photographs. Appendix B contains dummy response data traces. Appendix C contains the Instrumentation Data Channel assignments.

The front passenger side door remained closed during the deployment and was operable after the deployment.

The Hybrid III 6-Year-Old Child Dummy's visible contact points were as follows: The torso airbag contacted the ATD’s back. The curtain airbag contacted the ATD’s head.

## OUT OF POSITION OCCUPANT DATA SUMMARY

| ATD Position | $HIC_{15}$ |
|---|---|
| Passenger | 11.6 |

Orientation of the Hybrid III 6 Year-old Child Dummy was in the inboard facing position leaning against the front passenger door. The dummy's spine was aligned with the deploying trajectory of the torso airbag. The lower legs were extended. Synthetic foam was used to raise the dummy. This orientation complies with section 3.3.3.5 of the Technical Working Group (TWG) recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

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## SECTION 2

## OCCUPANT AND VEHICLE INFORMATION/DATA SHEETS

Test Vehicle: 2007 Nissan Versa 1.8S 5-Door Hatchback NHTSA No.: M75200TWG2
Test Program: TWG 3.3.3.5. Test Date: 05/01/07

### CONVERSION FACTORS USED IN THIS REPORT*

| Quantity | Typical Application | Std Units | Metric Unit | Multiply By |
|---|---|---|---|---|
| Mass | Vehicle Weight | lb | kg | 0.4536 |
| Linear Velocity | Impact Velocity | mile/h | km/h | 1.609 |
| Length or Distance | Measurements | in | mm | 25.4 |
| Volume | Fuel Systems | gal | liter | 3.785 |
| Volume | Small Fluids | oz | mL | 29.573 |
| Pressure | Tire Pressures | $lbf/in^2$ | kPa | 7.0 |
| Volume | Liquid | gal | liter | 3.785 |
| Temperature | General Use | $^oF$ | $^oC$ | =(tf -32)/1.8 |
| Force | Dynamic Forces | lbf | N | 4.448 |
| Moment | Torque | lbf/ft | Nm | 1.355 |

* Based on the Recommended Practice in SAE J916, May 85

## DATA SHEET NO. 1

## TEST SUMMARY

Test Vehicle: 2007 Nissan Versa 1.8S 5-Door Hatchback NHTSA No.: M75200TWG2

Test Program: TWG 3.3.3.5. Test Date: 05/01/07

### TEST DUMMY INFORMATION

| Description | Passenger Seat Forward Facing |
|---|---|
| Dummy Type / Serial No. | Hybrid III 6 year old / 144 |
| Head Contact | Yes |
| Chest Contact | None |
| Abdomen Contact | None |
| Pelvis | Yes |
| Left Knee Contact | None |
| Right Knee Contact | None |

### MOVIE COVERAGE

| | |
|---|---|
| High Speed Digital | 2 |
| Total | 2 |

### DATA CHANNELS

| | |
|---|---|
| Child ATD Sensors | 9 |
| Belt Assessment Sensors | 0 |
| Vehicle Structure Accelerometers | 0 |
| Total | 9 |

## DATA SHEET NO. 2

## GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2007 Nissan Versa 1.8S 5-Door Hatchback NHTSA No.: M75200TWG2

Test Program: TWG 3.3.3.5. Test Date: 05/01/07

### TEST VEHICLE INFORMATION

| | |
|---|---|
| Make | Nissan |
| Model | Versa 1.8S |
| Body Style | 5-Door Hatchback |
| NHTSA No. | M75200TWG2 |
| VIN | 3N1BC13E77L354854 |
| Color | Gray |
| Delivery Date | August 7, 2006 |
| Odometer Reading (mile) | 122 |
| Dealer | Victorville Nissan |
| Transmission | 6-Speed Manual |
| Final Drive | Front |
| Type/Number Cylinders | Inline 4 |
| Engine Displacement (L) | 1.8 |
| Engine Placement | Transverse |

### TEST VEHICLE OPTIONS

| | |
|---|---|
| Driver Front Airbag | Yes |
| Driver Side Airbag | Yes |
| Driver Side Curtain Airbag | Yes |
| Pass. Front Airbag | Yes |
| Pass.Side Airbag | Yes |
| Pass. Curtain Airbag | Yes |
| Power Brakes | Yes |
| Power Steering | Yes |
| Disc Brakes, Front | Yes |
| Disc Brakes, Rear | No |
| Anti-lock Brakes | No |
| Tilt Steering Wheel | Yes |
| Power Windows | Yes |
| Power Seats | No |

### DATA FROM CERTIFICATION LABEL

| | |
|---|---|
| Manufactured By | Nissan Motor Corporation |
| Date of Manufacture | Jun. 06 |

| | |
|---|---|
| GVWR (kg) | 1710 |
| GAWR Front (kg) | 904 |
| GAWR Rear (kg) | 814 |

### DATA FROM TIRE PLACARD

| Measured Parameter | Front | Rear |
|---|---|---|
| Maximum Tire Pressure (kPa) | 280 | 280 |
| Cold Pressure (kPa) | 230 | 230 |
| Recommend Tire Size | P185/65R15 | P185/65R15 |
| Tire Size on Vehicle | P185/65R15 | P185/65R15 |
| Tire Manufacturer | Continental | Continental |

| Measured Parameter | Front | Rear | Third | Total |
|---|---|---|---|---|
| Type of Seats | Bucket | Bench | | |
| Number of Occupants | 2 | 3 | | 5 |
| Capacity Wt. (VCW) (kg) | | | | 390 |

* Vehicle had undergone New Car Assessment Program Frontal Impact Testing on August 15, 2006

## DATA SHEET NO. 3

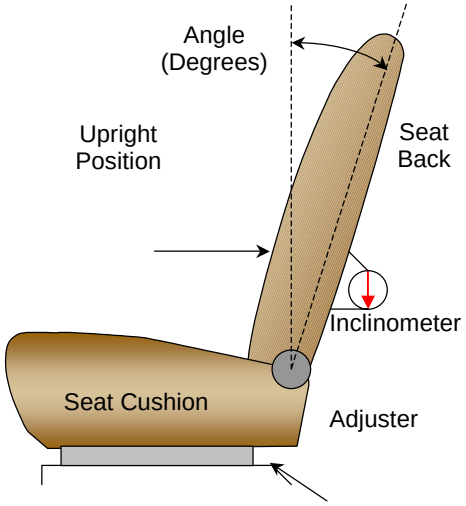
## TEST VEHICLE INFORMATION

Test Vehicle: 2007 Nissan Versa 1.8S 5-Door Hatchback NHTSA No.: M75200TWG2

Test Program: TWG 3.3.3.5. Test Date: 05/01/07

### NOMINAL DESIGN RIDING POSITION

The passenger seat back is positioned to section 3.3.3.5. of the Technical Working Group (TWG) recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.



*FRONT SEAT ASSEMBLY*

**SEAT BACK ANGLES**

| Position | Deg. |
|---|---|
| Passenger w/ Dummy | 10.8* |

* Measurement taken at headrest

### SEAT FORE/AFT POSITIONS

The first or forward most position is counted as number one (1). The fore/aft position is set aft of the middle position for the passenger seat.

**SEAT FORE/AFT POSITIONING**

| | Total Fore/Aft Travel | Placed in Position # |
|---|---|---|
| Passenger Seat | 24 | 13 |

**DATA SHEET NO. 4**

**DUMMY POSITIONING INFORMATION**

Test Vehicle: 2007 Nissan Versa 1.8S 5-Door Hatchback NHTSA No.: M75200TWG2

Test Program: TWG 3.3.3.5. Test Date: 05/01/07

**TEST DUMMY POSITION MEASUREMENTS**

| Code | Measurement Description | Hybrid III 6-Year-Old Child Dummy | |
|---|---|---|---|
| | | Length (mm) | Angle ($^{o}$) |
| SA | Seat Back Angle | | 10.8 |
| AMW | Side Airbag Module Width (Torso / Curtain) | 85 / 35 | |
| ABW | Side Airbag Width (Torso / Curtain) | 270 / 410 | |
| AML | Side Airbag Module Length (Torso / Curtain) | 165 / 1500 | |
| ABL | Side Airbag Length (Torso / Curtain) | 250 / 1540 | |
| AN | Top of Airbag Module to Head/Neck Junction (Curtain) | 106 | |
| HD | Head CG to Door Panel/ Window | 136 | |
| HSC | Head to Seat Back Centerline | 163 | |
| HB | Head to B-Pillar (first contact) | 45 | |
| HZ | Head to Roof (Z) | 230 | |
| HHD | Head to Header | 494 | |
| ND | Nose to Dash | 631 | |
| NS | Nose to Seat Back | 263 | |
| NR | Nose to Header | 543 | |
| CD | Chest to Dash | 568 | |
| CS | Chest to Seat Back | 225 | |
| RACL | Right Arm to Seat Back Centerline | 328 | |
| LACL | Left Arm to Seat Back Centerline | 66 | |
| RA | Right Arm to Door Panel | 0 | |
| LA | Left Arm to Door Panel | 270 | |
| KK | Knee to Knee | 108 | |
| TT | Toe to Toe | 110 | |
| KSCR | Right Knee to Seat Cushion Centerline | 95 | |
| KSCL | Left Knee to Seat Cushion Centerline | -20 | |
| TSCR | Right Toe to Seat Cushion Centerline | -70 | |
| TSCL | Left Toe to Seat Cushion Centerline | -180 | |

**DATA SHEET NO. 5**
**HYBRID III ATD INJURY CRITERIA AND SENSOR DATA**

Test Vehicle: 2007 Nissan Versa 1.8 S 5-Door Hatchback NHTSA No.: M75200TWG2

Test Program: TWG 3.3.3.5 Test Date: 5/1/07

**HEAD PEAK ACCELERATIONS**

| Location | Axis | Units | Pass. (6 Yr.) Max | Time | Min | Time |
|---|---|---|---|---|---|---|
| Head CG | X | G's | 21.5 | 20.3 | -12.6 | 31.6 |
| Head CG | Y | G's | 12.2 | 20.6 | -9.0 | 32.9 |
| Head CG | Z | G's | 37.9 | 20.0 | -14.3 | 20.3 |
| Head CG Resultant | N/A | G's | 38.9 | 20.0 | | |

**UPPER NECK PEAK FORCES AND MOMENTS**

| Location | Axis | Units | Pass. (6 Yr.) Max | Time | Min | Time |
|---|---|---|---|---|---|---|
| Neck Force | X | Newtons | 319.2 | 14.6 | -54.0 | 235.4 |
| Neck Force | Y | Newtons | 23.3 | 225.5 | -184.2 | 12.7 |
| Neck Force | Z | Newtons | 304.3 | 20.3 | -225.3 | 9.6 |
| Neck Force Resultant | N/A | Newtons | 378.8 | 12.7 | | |
| Neck Moment | X | Nm | 12.1 | 11.1 | -20.0 | 24.9 |
| Neck Moment | Y | Nm | 26.3 | 13.4 | -23.9 | 35.0 |
| Neck Moment | Z | Nm | 2.4 | 195.4 | -8.8 | 79.8 |
| Neck Moment Resultant | N/A | Nm | 28.3 | 12.2 | | |

## DATA SHEET NO. 5…(CONTINUED)

Test Vehicle: 2007 Nissan Versa 1.8 S 5-Door Hatchback NHTSA No.: M75200TWG2

Test Program: TWG 3.3.3.5 Test Date: 5/1/07

### HEAD INJURY CRITERIA (HIC 15)

| Location | Pass. (6 Yr.) | | | |
|---|---|---|---|---|
| | HIC15 | $T^1$ | $T^2$ | Avg G |
| Head CG | 11.6 | 9.7 | 24.7 | 13.6 |

### UPPER NECK NIJ VALUES

| Location | Pass. (6 Yr.) | | | |
|---|---|---|---|---|
| | Ntf | Nte | Ncf | Nce |
| Upper Neck | 0.18 | 0.68 | 0.27 | 0.63 |

**DATA SHEET NO. 6**

**CAMERA LOCATIONS**

Test Vehicle: 2007 Nissan Versa 1.8S 5-Door Hatchback NHTSA No.: M75200TWG2

Test Program: TWG 3.3.3.5. Test Date: 05/01/07

.

| No. | Camera View | Location (mm) | | | Angle (Deg.) | Lens (mm) | Speed (fps) |
|---|---|---|---|---|---|---|---|
| | | X | Y | Z | | | |
| 1 | High Speed Digital Side View | -330 | -3235 | -20 | 2.5 | 50 | 1000 |
| 2 | High Speed Digital Front View | -1720 | -230 | 390 | 16.4 | 35 | 1000 |

* Cameras aligned to the CG of dummy's head as reference.

# APPENDIX A

# PHOTOGRAPHS

Figure A-1: Right Front ¾ View, As Received


Figure A-2: Vehicle Certification Label


Figure A-3: Post-Test Right Front ¾ View of Frontal NCAP Test


Figure A-4: Post-Test Right Side View of Frontal NCAP Test


Figure A-5: Pre-Test Dummy Position, Left Side View


Figure A-6: Pre-Test Dummy Position, ¾ View

Figure A-7: Pre-Test Dummy Position, Front View

Figure A-8: Post-Test Dummy Position and Airbags, Left Side View

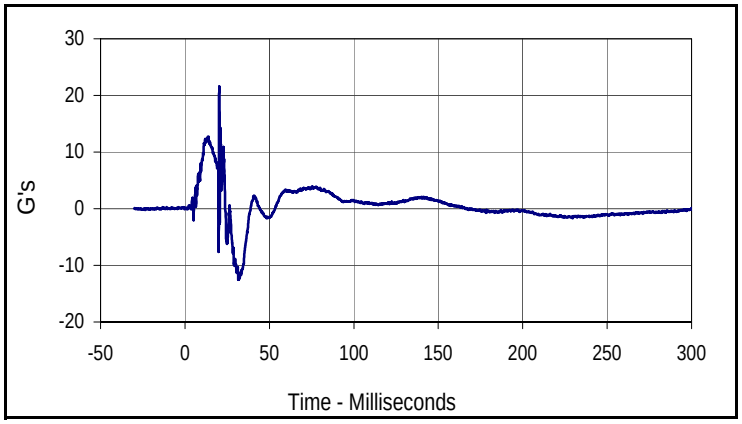
Figure A-9: Post-Test Airbags, Left Side View

Figure A-10: Post-Test Airbags, Close-up View

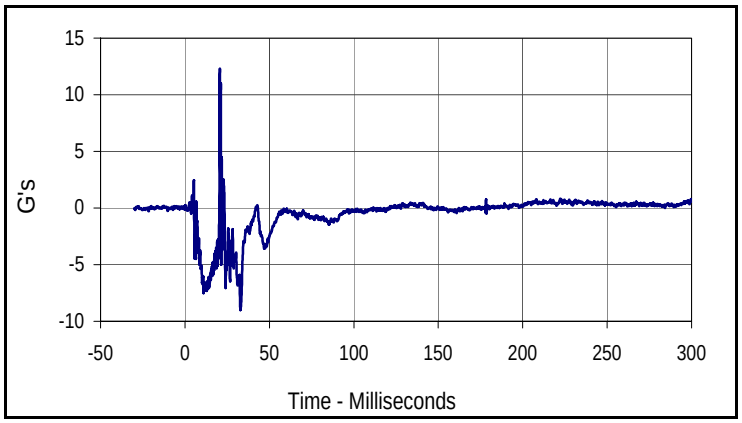
# APPENDIX B

# DATA PLOTS

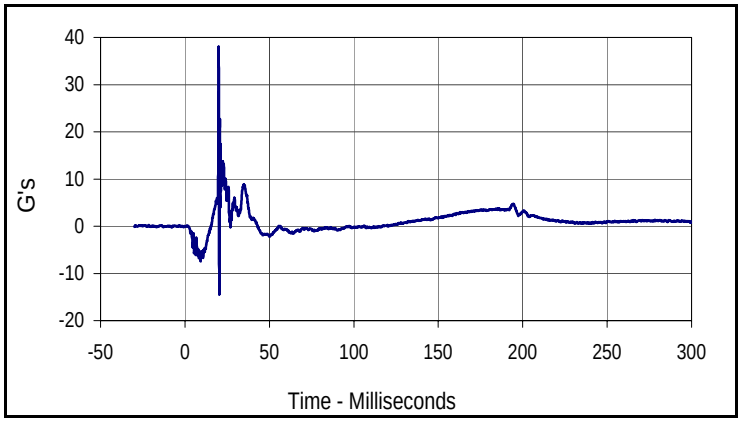
| | | | |
|---|---|---|---|
| Test Vehicle: | 2007 Nissan Versa 1.8 S 5-Door Hatchback | Test Date: | 5/1/07 |
| Test Program: | TWG 3.3.3.5 | NHTSA No.: | M75200TWG2 |



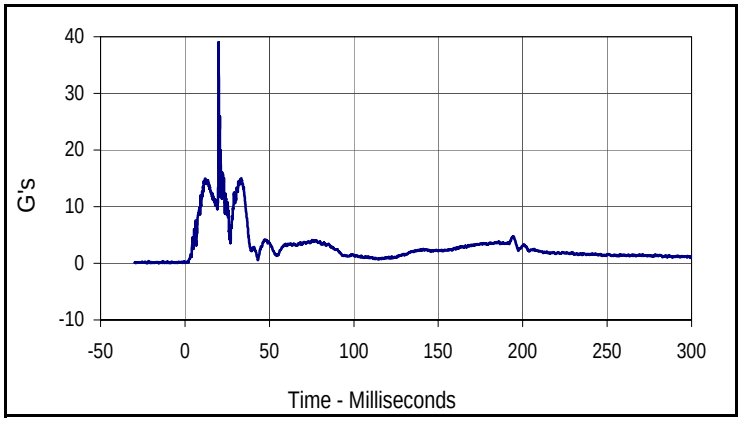

| Curve Description | | | |
|---|---|---|---|
| Pass. (6 Yr.) Head X | | | |
| CURNO | Type | SAE Class | Units |
| 001 | FIL | 1000 | G's |
| Max | Time | Min | Time |
| 21.5 | 20.3 | -12.6 | 31.6 |




| Curve Description | | | |
|---|---|---|---|
| Pass. (6 Yr.) Head Y | | | |
| CURNO | Type | SAE Class | Units |
| 002 | FIL | 1000 | G's |
| Max | Time | Min | Time |
| 12.2 | 20.6 | -9.0 | 32.9 |

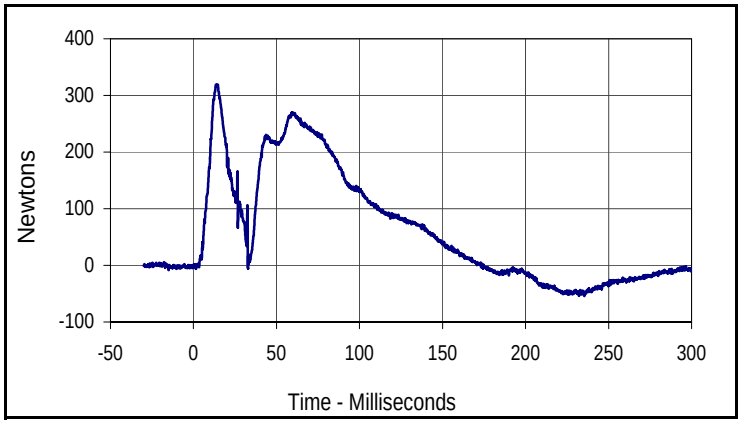



| Curve Description | | | |
|---|---|---|---|
| Pass. (6 Yr.) Head Z | | | |
| CURNO | Type | SAE Class | Units |
| 003 | FIL | 1000 | G's |
| Max | Time | Min | Time |
| 37.9 | 20.0 | -14.3 | 20.3 |

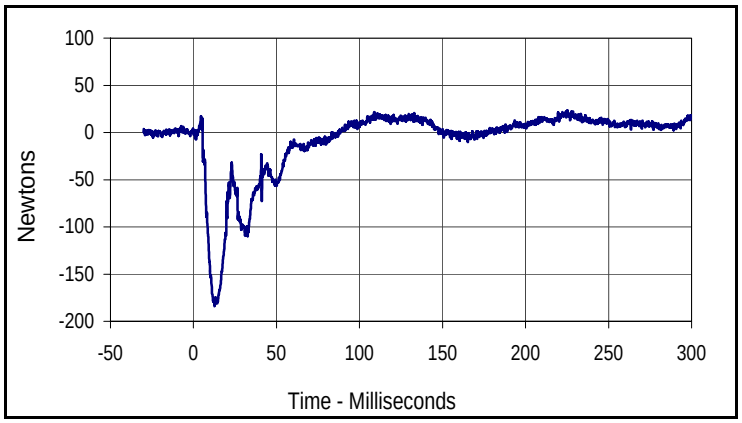



| Curve Description | | | |
|---|---|---|---|
| Pass. (6 Yr.) Head Resultant | | | |
| CURNO | Type | SAE Class | Units |
| 001 | RES | 1000 | G's |
| Max | Time | Min | Time |
| 38.9 | 20.0 | 0.1 | 0.0 |

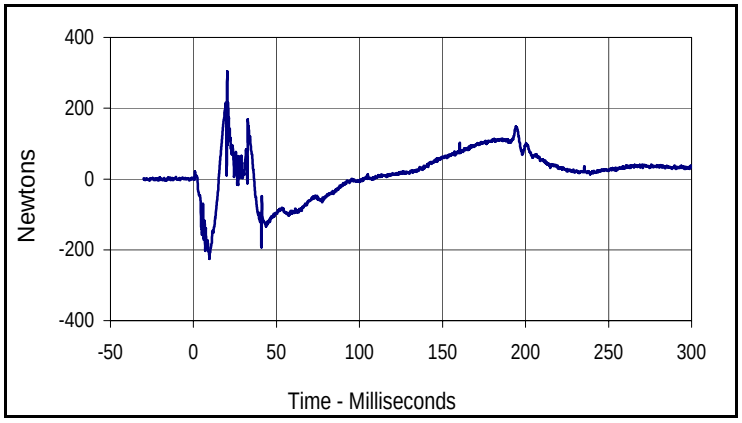
| | | | |
|---|---|---|---|
| Test Vehicle: | 2007 Nissan Versa 1.8 S 5-Door Hatchback | Test Date: | 5/1/07 |
| Test Program: | TWG 3.3.3.5 | NHTSA No.: | M75200TWG2 |



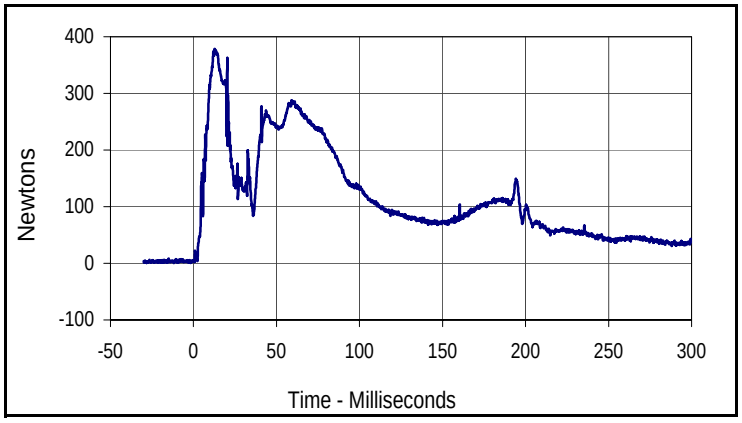

| Curve Description | | | |
|---|---|---|---|
| Pass. (6 Yr.) Upper Neck Force X | | | |
| CURNO | Type | SAE Class | Units |
| 001 | FIL | 1000 | Newtons |
| Max | Time | Min | Time |
| 319.2 | 14.6 | -54.0 | 235.4 |




| Curve Description | | | |
|---|---|---|---|
| Pass. (6 Yr.) Upper Neck Force Y | | | |
| CURNO | Type | SAE Class | Units |
| 002 | FIL | 1000 | Newtons |
| Max | Time | Min | Time |
| 78.1 | 0.0 | -184.2 | 12.7 |

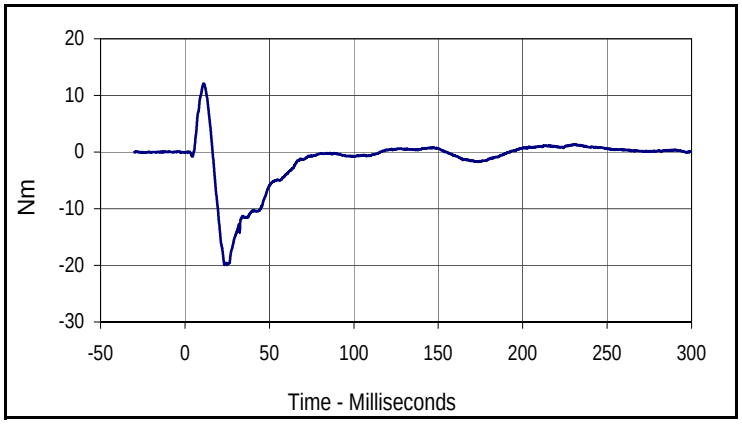



| Curve Description | | | |
|---|---|---|---|
| Pass. (6 Yr.) Upper Neck Force Z | | | |
| CURNO | Type | SAE Class | Units |
| 003 | FIL | 1000 | Newtons |
| Max | Time | Min | Time |
| 304.3 | 20.3 | -225.3 | 9.6 |



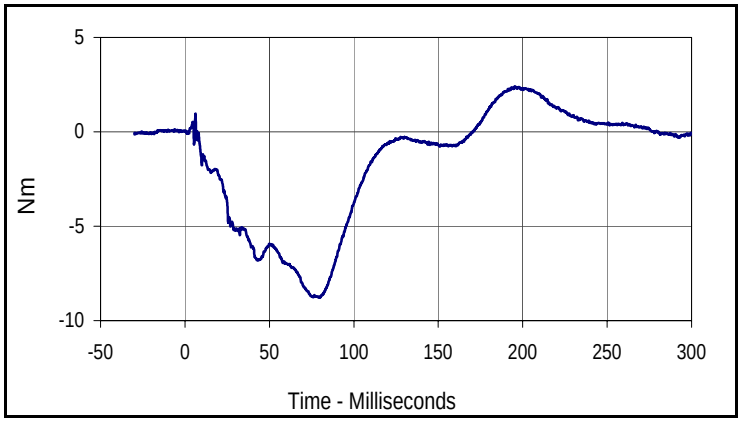

| Curve Description | | | |
|---|---|---|---|
| Pass. (6 Yr.) Upper Neck Force Resultant | | | |
| CURNO | Type | SAE Class | Units |
| 001 | RES | 1000 | Newtons |
| Max | Time | Min | Time |
| 378.8 | 12.7 | 2.5 | 0.4 |

| | | | |
|---|---|---|---|
| Test Vehicle: | 2007 Nissan Versa 1.8 S 5-Door Hatchback | Test Date: | 5/1/07 |
| Test Program: | TWG 3.3.3.5 | NHTSA No.: | M75200TWG2 |

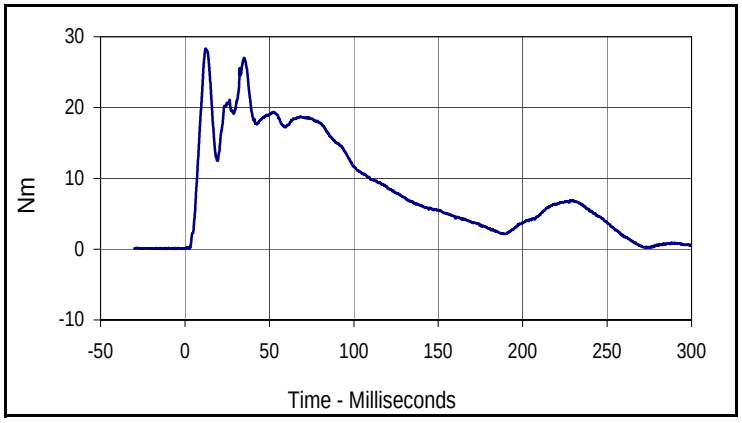



| Curve Description | | | |
|---|---|---|---|
| Pass. (6 Yr.) Upper Neck Moment X | | | |
| CURNO | Type | SAE Class | Units |
| 004 | FIL | 600 | Nm |
| Max | Time | Min | Time |
| 12.1 | 11.1 | -20.0 | 24.9 |


| Curve Description | | | |
|---|---|---|---|
| Pass. (6 Yr.) Upper Neck Moment Y | | | |
| CURNO | Type | SAE Class | Units |
| 005 | FIL | 600 | Nm |
| Max | Time | Min | Time |
| 26.3 | 13.4 | -23.9 | 35.0 |




| Curve Description | | | |
|---|---|---|---|
| Pass. (6 Yr.) Upper Neck Moment Z | | | |
| CURNO | Type | SAE Class | Units |
| 006 | FIL | 600 | Nm |
| Max | Time | Min | Time |
| 2.4 | 195.4 | -8.8 | 79.8 |




| Curve Description | | | |
|---|---|---|---|
| Pass. (6 Yr.) Upper Neck Moment Resultant | | | |
| CURNO | Type | SAE Class | Units |
| 004 | RES | 600 | Nm |
| Max | Time | Min | Time |
| 28.3 | 12.2 | 0.0 | 0.1 |

# APPENDIX C

# INSTRUMENTATION DATA CHANNEL ASSIGNMENTS

**TWG 3.3.3.5**

**Instrumentation Data Channel Assignments**

**A.T.D. Serial Number 144**

**5/1/07**

**2007 Nissan Versa 1.8 S 5-Door Hatchback**

| CH. | LOCATION | AXIS | IDENT. NO. | DESCRIPTION | MFR | MODEL | UNITS |
|---|---|---|---|---|---|---|---|
| 1 | HEAD | X | J32884 | Accel.,full bridge | ENDEVCO | 7264-2000 | G |
| 2 | HEAD | Y | J19925 | Accel.,full bridge | ENDEVCO | 7264-2000 | G |
| 3 | HEAD | Z | J35560 | Accel.,full bridge | ENDEVCO | 7264-2000 | G |
| 4 | UPPER NECK FORCE | X | 810 FX | Load cell, six axis neck | R. A. Denton | IF-234 | N |
| 5 | UPPER NECK FORCE | Y | 810 FY | Load cell, six axis neck | R. A. Denton | IF-234 | N |
| 6 | UPPER NECK FORCE | Z | 810 FZ | Load cell, six axis neck | R. A. Denton | IF-234 | N |
| 7 | UPPER NECK MOMENT | X | 810 MX | Load cell, six axis neck | R. A. Denton | IF-234 | Nm |
| 8 | UPPER NECK MOMENT | Y | 810 MY | Load cell, six axis neck | R. A. Denton | IF-234 | Nm |
| 9 | UPPER NECK MOMENT | Z | 810 MZ | Load cell, six axis neck | R. A. Denton | IF-234 | Nm |