**REPORT NUMBER TR-P23106-05-A**

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

**FORD MOTOR COMPANY**
**2003 LINCOLN TOWN CAR**
**4 DOOR SEDAN**

**NHTSA NUMBER: M30203TWG2**

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

**JANUARY 15, 2004**

**FINAL REPORT**

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

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_____
COTR, NCAP Frontal Impact Program

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Date of Acceptance

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**15. Supplementary Notes**

**16. Abstract**

A static side airbag deployment was conducted on a 2003 Lincoln Town Car 4 Door Sedan at KARCO Engineering, LLC on 1/15/2004. This test was conducted to obtain data indicant of TWG Side Airbag Out-of-Position Injury criteria.

| Measurement Description | Units | Threshold | Hybrid III 3 Year Old ATD | |
|---|---|---|---|---|
| Head Injury Criteria (HIC) | N/A | 723 | 57.7 | |
| Max. Thorax Accel. (3 msec clip) | G's | 60 | 33.2 | |

| 17. Key Words | 18. Distribution Statement |
|---|---|
| TWG Occupant Out-of-Position Test Section 3.1.10.1<br>New Car Assessment Program (NCAP)<br>2003 Lincoln Town Car 4 Door Sedan<br>NHTSA No. M30203TWG2 | 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 M30203TWG2

### 1.1 PURPOSE

This occupant out-of-position injury test is part of the Occupant Injury Risk from Deploying Side Airbags Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-01-D-02005. 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 side airbag deployment in a 2003 Lincoln Town Car 4-Door Sedan with an out-of-position Hybrid III 3 Year-Old Child dummy were evaluated. The test was performed at Karco Engineering, LLC on January 15, 2004. Pre- and post-test photographs of the vehicle and dummy can be found in Appendix A.

Two high-speed film cameras were used to document the side airbag deployment event. 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 3 Year-Old child anthropomorphic test device (ATD), was placed in the front passenger seat oriented in an inboard facing position as according to the dummy placement instructions in the July 2003 Revision of the Technical Working Group's 'Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags'.

The ATD was instrumented with head, chest and pelvis triaxial accelerometers, chest displacement potentiometer and a six-axis upper and lower neck transducer.

Twenty-two (22) 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 passenger side doors remained closed during side air bag deployment and were operable after the impact.

The Hybrid III 3 Year-Old Child Dummy's visible contact points were as follows: The ATD's head contacted the airbag. This contact point can be observed dynamically on the high-speed video recording of the event.

Occupant of Position Occupant injury data is contained in table below.

**OUT OF POSITION OCCUPANT DATA SUMMARY**

| ATD Position | HIC | Clip (g) | Chest Disp (mm) |
|---|---|---|---|
| Passenger | 57.7 | 33.2 | -4.1 |

Orientation of the Hybrid III 3 Year-Old Child Dummy was in the forward facing position leaning against door. The dummy was placed in a seated position on a booster block along the outboard edge of the seat bolster to maximize the head/neck interaction with the seat-mounted side airbag module. The top of the neck was aligned with the top of the side airbag module to maximize contact. The dummy's head was placed between the seat bolster and B-pillar. This orientation complies with section 3.1.10.1 of the Technical Working Group (TWG) recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

## SECTION 2

## OCCUPANT AND VEHICLE INFORMATION/DATA SHEETS

Test Vehicle: 2003 Lincoln Town Car 4 Door Sedan NHTSA No.: M30203TWG2

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.) Test Date: 1/15/04

### 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: 2003 Lincoln Town Car 4 Door Sedan NHTSA No.: M30203TWG2

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.) Test Date: 1/15/04

### TEST DUMMY INFORMATION

| Description | Driver Seat Inboard Facing |
|---|---|
| Dummy Type / Serial No. | Hybrid III 3 Year Old / 082 |
| Head Contact | Airbag |
| Chest Contact | None |
| Abdomen Contact | None |
| Pelvis | None |
| Left Knee Contact | None |
| Right Knee Contact | None |

### 16mm MOVIE COVERAGE

| | |
|---|---|
| High Speed Film | 1 |
| High Speed Digital | 1 |
| Total | 2 |

### DATA CHANNELS

| | |
|---|---|
| Child ATD Sensors | 22 |
| Belt Assessment Sensors | 0 |
| Vehicle Structure Accelerometers | 0 |
| Total | 22 |

## DATA SHEET NO. 2

## GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2003 Lincoln Town Car 4 Door Sedan NHTSA No.: M30203TWG2

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.) Test Date: 1/15/04

### TEST VEHICLE INFORMATION

| | |
|---|---|
| Make | Lincoln |
| Model | Town Car |
| Body Style | 4- Door Sedan |
| NHTSA No. | M30203 |
| VIN | 1LNHM81W93Y622249 |
| Color | Silver |
| Delivery Date | 9/12/02 |
| Odometer Reading (mile) | 204 |
| Dealer | Soutars |
| Transmission | 4-Speed Automatic |
| Final Drive | Rear |
| Type/Number Cylinders | V8 |
| Engine Displacement (L) | 4.6 |
| Engine Placement | Longitudinal |

### TEST VEHICLE OPTIONS

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

### DATA FROM CERTIFICATION LABEL

| | |
|---|---|
| Manufactured By | Ford Motor Company |
| Date of Manufacture | June-02 |

| | |
|---|---|
| GVWR (kg) | 2599 |
| GAWR Front (kg) | 1249 |
| GAWR Rear (kg) | 1353 |

### DATA FROM TIRE PLACARD

| Measured Parameter | Front | Rear |
|---|---|---|
| Maximum Tire Pressure (kPa) | 221 | 241 |
| Cold Pressure (kPa) | 221 | 241 |
| Recommend Tire Size | P225/60R17 | P225/60R17 |
| Tire Size on Vehicle | P225/60R17 | P225/60R17 |
| Tire Manufacturer | Michelin | Michelin |

| Measured Parameter | Front | Rear | Third | Total |
|---|---|---|---|---|
| Type of Seats | Split Bench | Bench | None | |
| Number of Occupants | 3 | 3 | 0 | 6 |
| Capacity Wt. (VCW) (kg) | | | | 499 |
| Cargo Weight (RCLW) (kg) | | | | 91 |

* Vehicle had undergone New Car Assessment Program Side Impact Test on November 14, 2004

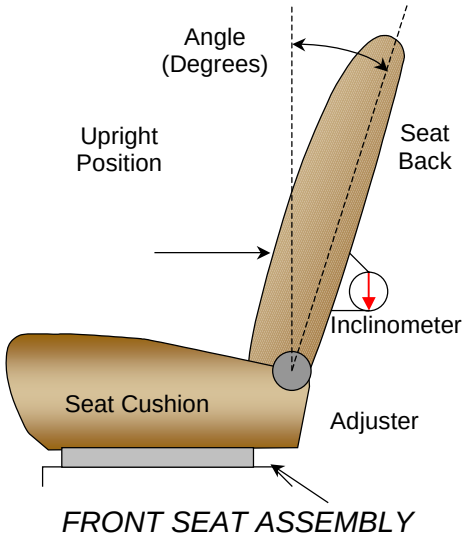
## DATA SHEET NO. 3

## TEST VEHICLE INFORMATION

Test Vehicle: 2003 Lincoln Town Car 4 Door Sedan NHTSA No.: M30203TWG2
Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.) Test Date: 1/15/04

### NOMINAL DESIGN RIDING POSITION

The front passenger seat back is positioned to the manufacturers designated angle. The procedure is as follows: A special application tool with pointed probes is inserted through the fabric to make contact with the rigid portion of the lower seat frame assembly, approximately 13 inches above the pivot point of the seat back. An inclinometer is placed against the flat surface of the tool and the seat back angle is measured directly from the dial face.



*FRONT SEAT ASSEMBLY*

**SEAT BACK ANGLES**

| Position | Deg. |
|---|---|
| Passenger w/ Dummy | 25 |

### 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 driver seat.

**SEAT FORE/AFT POSITIONING**

| | Total Fore/Aft Travel | Placed in Position # |
|---|---|---|
| Passenger Seat | 253 mm | 126 mm |

**DATA SHEET NO. 4**

**DUMMY POSITIONING INFORMATION**

Test Vehicle: 2003 Lincoln Town Car 4 Door Sedan NHTSA No.: M30203TWG2

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.) Test Date: 1/15/04

**TEST DUMMY POSITION MEASUREMENTS**

| Code | Measurement Description | Hybrid III 3-Year-Old Child Dummy | |
|---|---|---|---|
| | | Length (mm) | Angle ($^{o}$) |
| SA | Seat Back Angle | | 25 |
| AMW | Airbag Module Width | 85 | |
| ABW | Airbag Width | 355 | |
| AML | Airbag Module Length | 220 | |
| ABL | Airbag Length | 635 | |
| HD | Head CG to Door Panel/ Window | 165 | |
| HSC | Head to Seat Back Centerline | 55 | |
| HB | Head to B-Pillar | 210 | |
| HZ | Head to Roof (Z) | 360 | 90 |
| HHD | Head to Header | 245 | 82 |
| CD | Chest to Dash | 700 | 9 |
| CS | Chest to Seatback | 180 | |
| RACL | Right Arm to Seatback Centerline | 100 | |
| RA | Right Arm to Door Panel | 10 | |
| KK | Knee to Knee | 125 | |
| TT | Toe to Toe | 115 | |
| KSCR | Right Knee to Seat Cushion Centerline | 105 | |
| TSCR | Right Toe to Seat Cushion Centerline | 50 | |

## DATA SHEET NO. 5 - 3 YEAR OLD HYBRID III ATD INJURY CRITERIA AND SENSOR DATA

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan NHTSA No.: M30203TWG2

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.) Test Date: 1/15/04

### HEAD PRIMARY PEAK ACCELERATIONS

| Location | Axis | Units | Pass. Max | Time | Min | Time |
|---|---|---|---|---|---|---|
| Head CG | X | G's | 49.0 | 6.7 | -2.3 | 118.1 |
| Head CG | Y | G's | 6.9 | 4.8 | -20.4 | 10.3 |
| Head CG | Z | G's | 10.5 | 2.1 | -17.5 | 7.3 |
| Head CG Resultant | N/A | G's | 52.4 | 7.7 | | |

### PRIMARY HEAD INJURY CRITERAS (HIC)

| Location | Pass. HIC | $T^1$ | $T^2$ | Avg G |
|---|---|---|---|---|
| Head CG Primary (HIC15) | 57.7 | 5.4 | 11.2 | 39.4 |

### CHEST PRIMARY PEAK ACCELERATIONS

| Location | Axis | Units | Pass. Max | Time | Min | Time |
|---|---|---|---|---|---|---|
| Chest CG | X | G's | 79.7 | 4.4 | -6.9 | 8.5 |
| Chest CG | Y | G's | 16.9 | 3.7 | -16.5 | 5.9 |
| Chest CG | Z | G's | 22.4 | 5.1 | -8.9 | 10.1 |
| Chest CG Resultant | N/A | G's | 81.9 | 4.5 | | |

### PRIMARY CHEST CLIP (3MSEC)

| Location | Pass. CLIP | $T^1$ | $T^2$ |
|---|---|---|---|
| Chest CG Primary | 34.4 | 3.4 | 6.4 |

### CHEST PEAK DISPLACEMENTS

| Location | Axis | Units | Pass. Max | Time | Min | Time |
|---|---|---|---|---|---|---|
| Chest CG | X | MM | 0.5 | 15.0 | -4.1 | 9.1 |

### PELVIC PEAK ACCELERATIONS

| Location | Axis | Units | Pass. Max | Time | Min | Time |
|---|---|---|---|---|---|---|
| Pelvis | X | G's | 6.1 | 31.5 | -4.8 | 15.1 |
| Pelvis | Y | G's | 3.1 | 11.9 | -5.5 | 26.7 |
| Pelvis | Z | G's | 15.7 | 5.7 | -12.5 | 9.9 |
| Pelvis Resultant | N/A | G's | 15.7 | 5.7 | | |

**DATA SHEET NO. 5…(continued)**

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan NHTSA No.: M30203TWG2

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.) Test Date: 1/15/04

**UPPER NECK PEAK FORCES AND MOMENTS**

| Location | Axis | Units | Pass. | | | |
|---|---|---|---|---|---|---|
| | | | Max | Time | Min | Time |
| Neck Force | X | Newtons | 546.9 | 7.6 | -56.7 | 118.1 |
| Neck Force | Y | Newtons | 144.2 | 10.8 | -105.6 | 25.0 |
| Neck Force | Z | Newtons | 463.2 | 10.1 | -348.0 | 6.1 |
| Neck Force Resultant | N/A | Newtons | 630.3 | 6.1 | | |
| Neck Moment | X | Nm | 4.9 | 54.8 | -11.8 | 13.0 |
| Neck Moment | Y | Nm | 28.7 | 6.3 | -4.9 | 20.2 |
| Neck Moment | Z | Nm | 6.9 | 95.1 | -13.3 | 30.8 |
| Neck Moment Resultant | N/A | Nm | 28.8 | 6.4 | | |

**LOWER NECK PEAK FORCES AND MOMENTS**

| Location | Axis | Units | Pass. | | | |
|---|---|---|---|---|---|---|
| | | | Max | Time | Min | Time |
| Neck Force | X | Newtons | 813.5 | 4.1 | -41.2 | 128.7 |
| Neck Force | Y | Newtons | 301.4 | 4.1 | -63.5 | 23.0 |
| Neck Force | Z | Newtons | 380.6 | 10.1 | -368.5 | 5.4 |
| Neck Force Resultant | N/A | Newtons | 871.2 | 4.1 | | |
| Neck Moment | X | Nm | 10.1 | 5.8 | -12.6 | 23.9 |
| Neck Moment | Y | Nm | 8.7 | 119.3 | -34.6 | 7.0 |
| Neck Moment | Z | Nm | 7.1 | 5.2 | -12.2 | 34.7 |
| Neck Moment Resultant | N/A | Nm | 35.3 | 7.0 | | |

**DATA SHEET NO. 6**

**CAMERA LOCATIONS**

Test Vehicle: 2003 Lincoln Town Car 4 Door Sedan NHTSA No.: M30203TWG2

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.) Test Date: 1/15/04

| No. | Camera View | Location (mm) | | | Angle (Deg.) | Lens (mm) | Speed (fps) |
|---|---|---|---|---|---|---|---|
| | | X | Y | Z | | | |
| 1 | High Speed Film Side View | 450 | 2550 | 170 | 1.4 | 24 | 1020 |
| 2 | High Speed Film Front View | 1520 | 80 | 875 | 33.5 | 9 | 970 |

* Cameras aligned to center of seat back as reference.

APPENDIX A

PHOTOGRAPHS

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

Figure A-2: Vehicle Certification Label

Figure A-3: Post-Test Left Front ¾ View of Prior Test

Figure A-4: Post-Test Left Side View of Prior 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, Full Front View

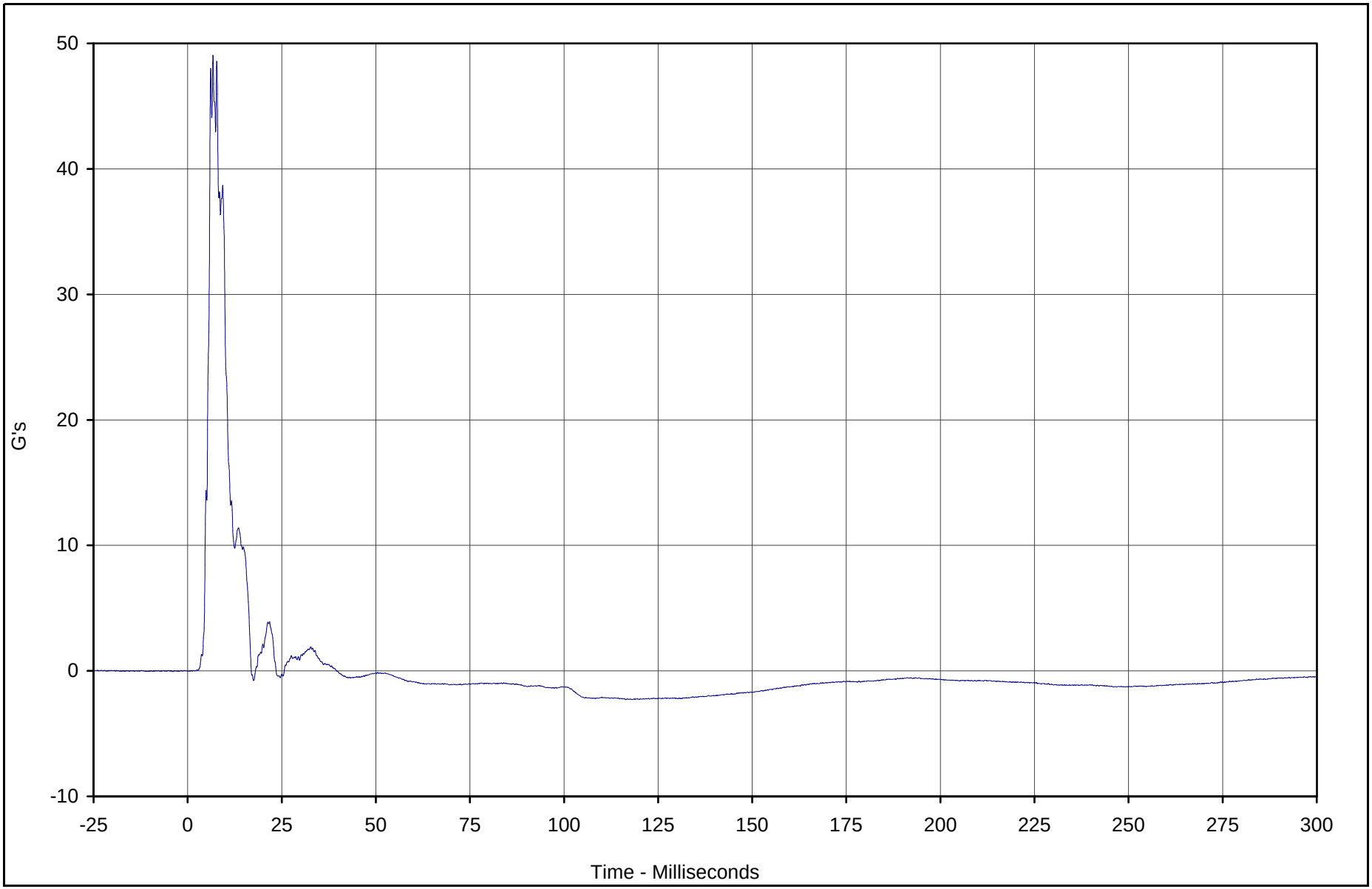
Figure A-8: Post-Test Dummy Position and Airbag, Left View

Figure A-9: Post-Test Airbag, ¾ view

Figure A-10: Post-Test Airbag, Rear View

# APPENDIX B

# DATA PLOTS




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Head X | 001 | FIL | G's | 49.0 | 6.7 | -2.3 | 118.1 | 1000 |

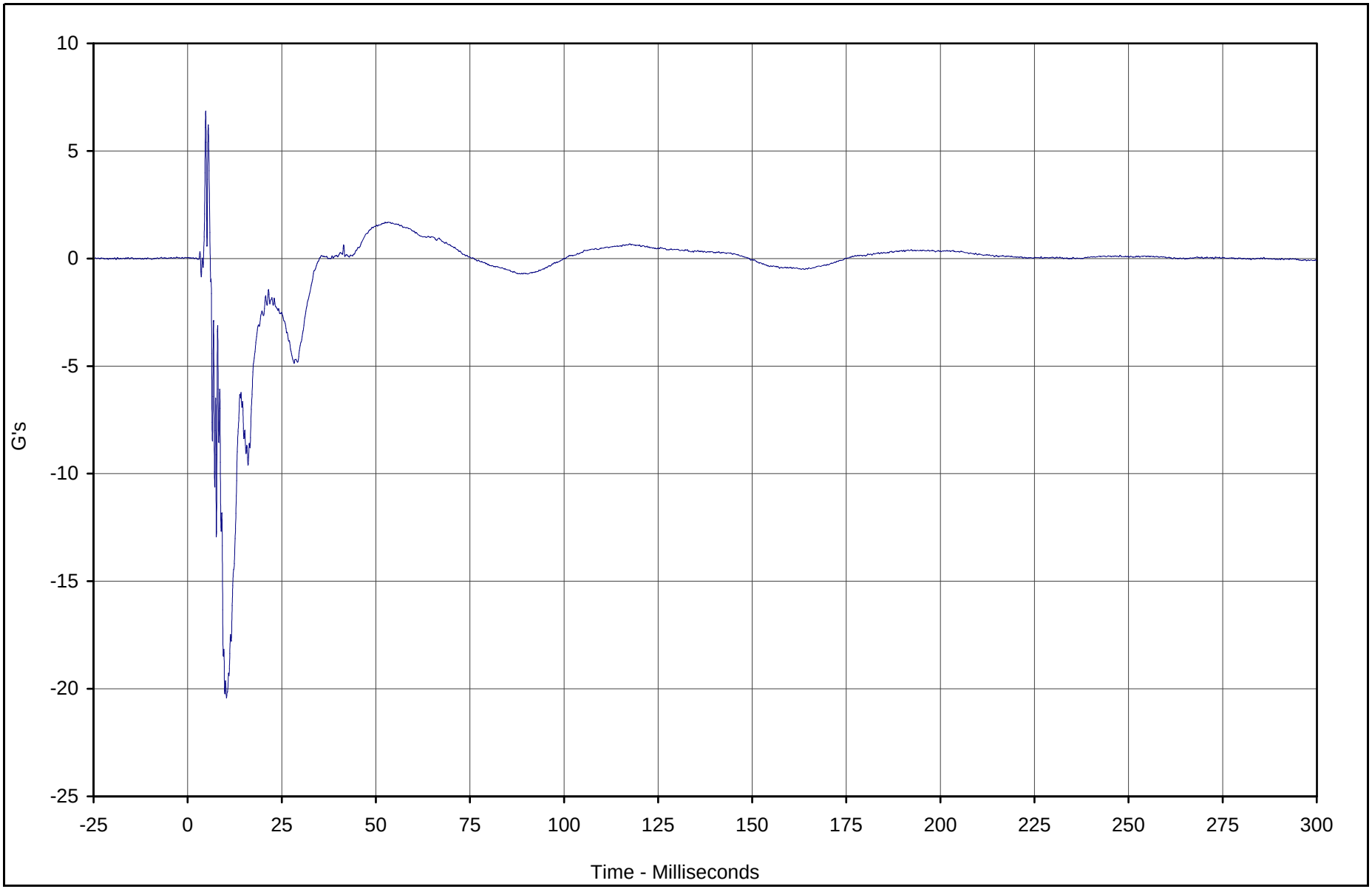
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



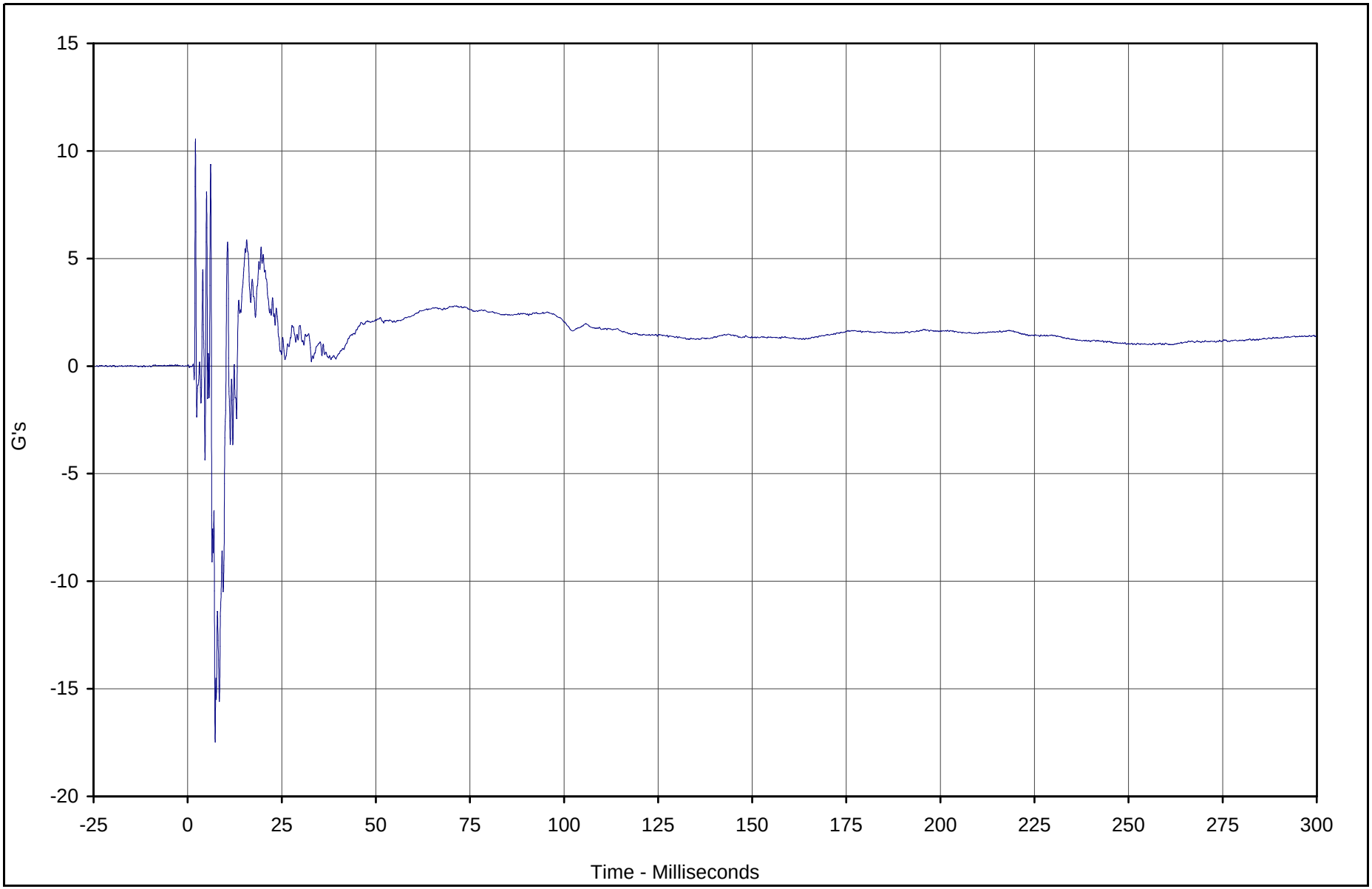

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Head Y | 002 | FIL | G's | 6.9 | 4.8 | -20.4 | 10.3 | 1000 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



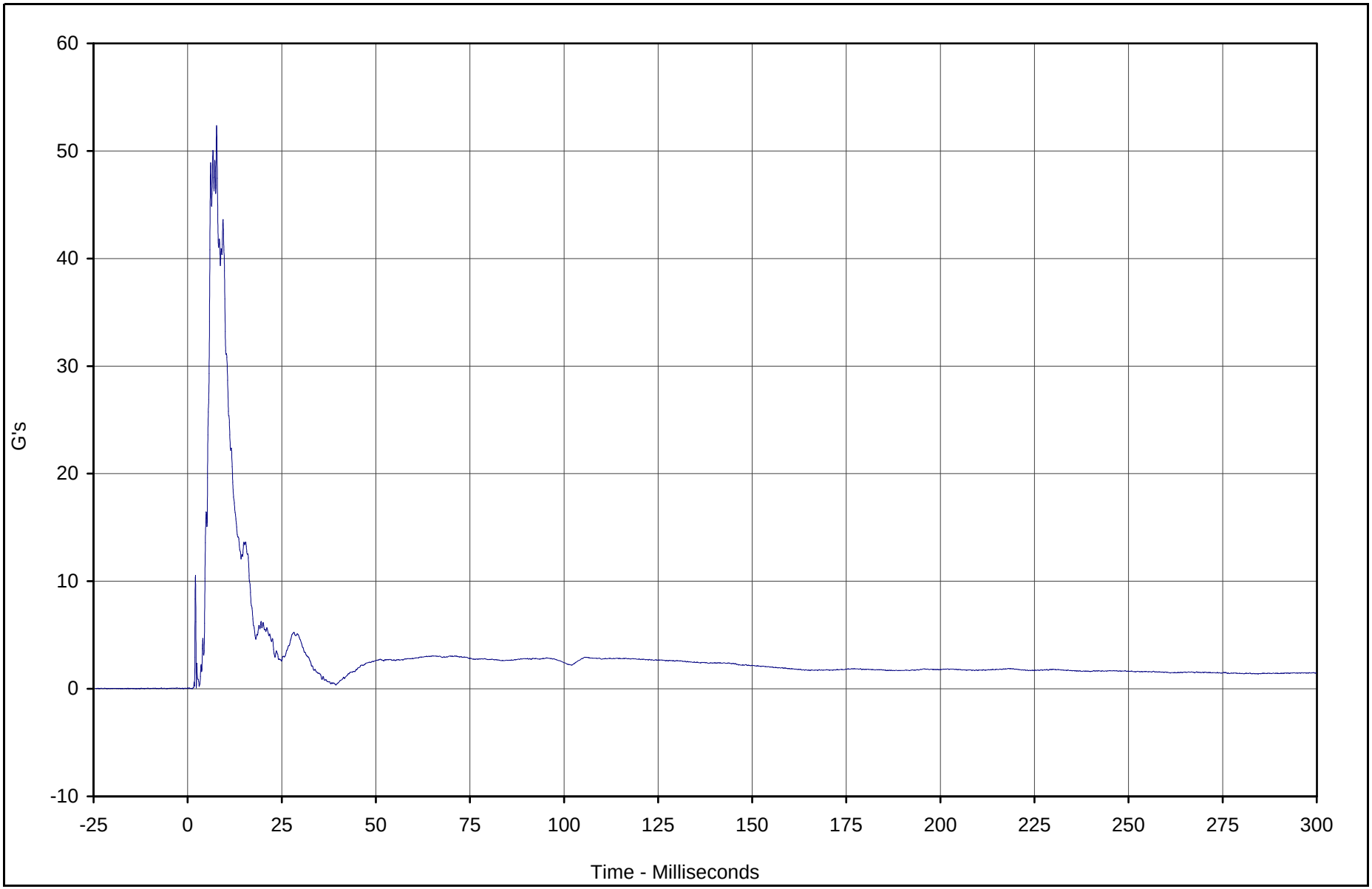

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Head Z | 003 | FIL | G's | 10.5 | 2.1 | -17.5 | 7.3 | 1000 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



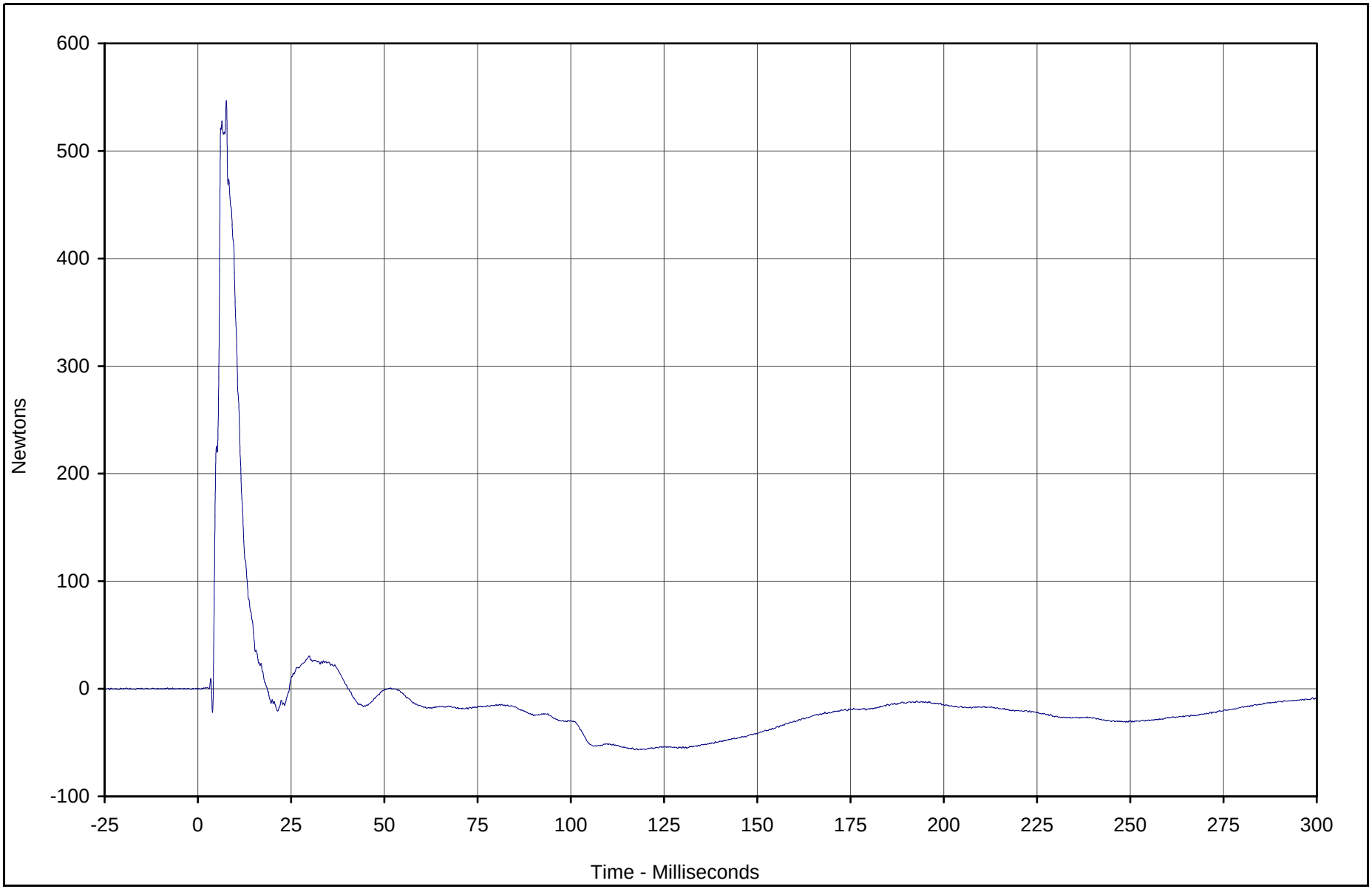

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Head Resultant | 001 | RES | G's | 52.4 | 7.7 | 0.0 | 1.3 | 1000 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Upper Neck Force X | 004 | FIL | Newtons | 546.9 | 7.6 | -56.7 | 118.1 | 1000 |

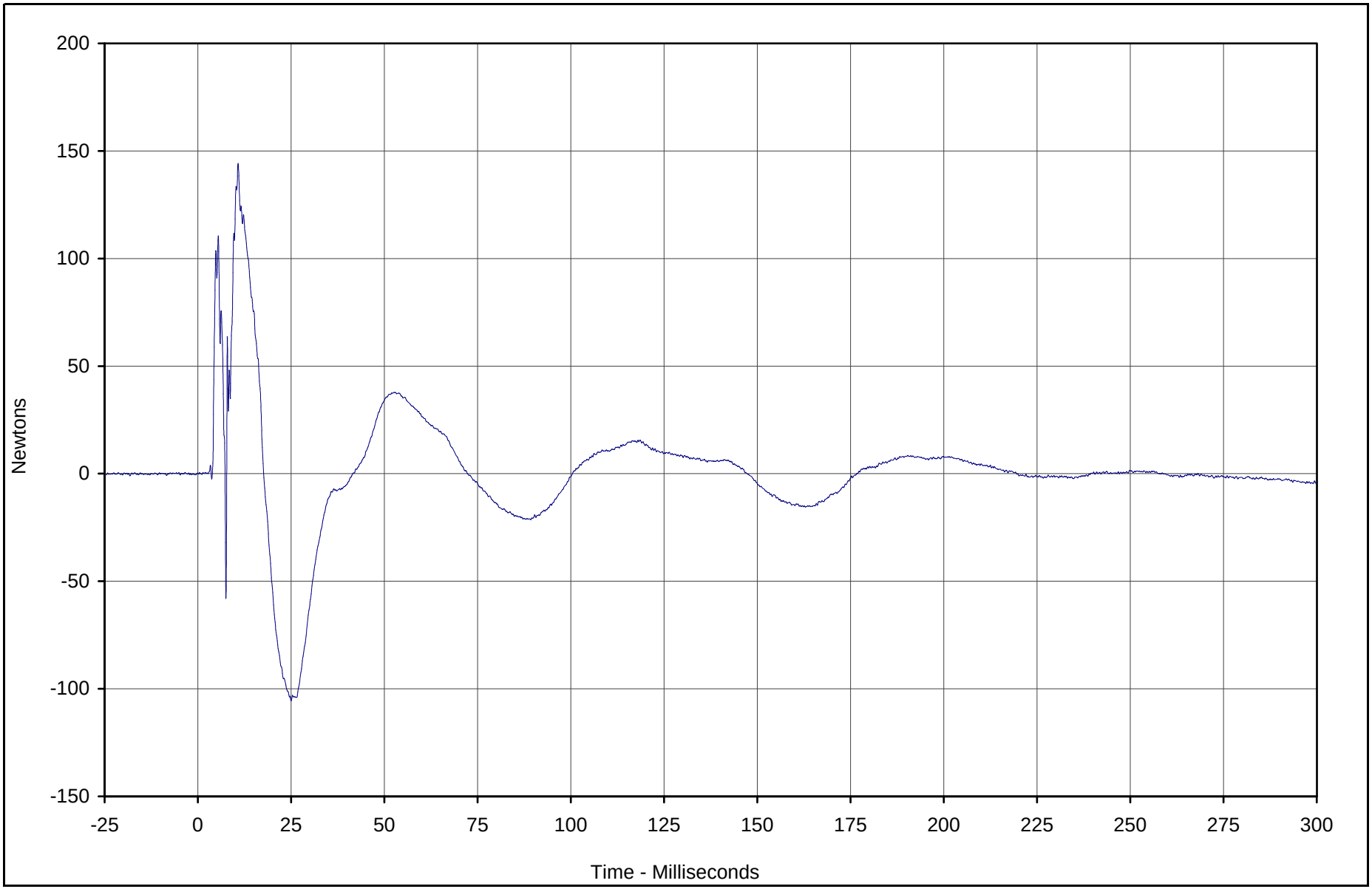
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Upper Neck Force Y | 005 | FIL | Newtons | 144.2 | 10.8 | -105.6 | 25.0 | 1000 |

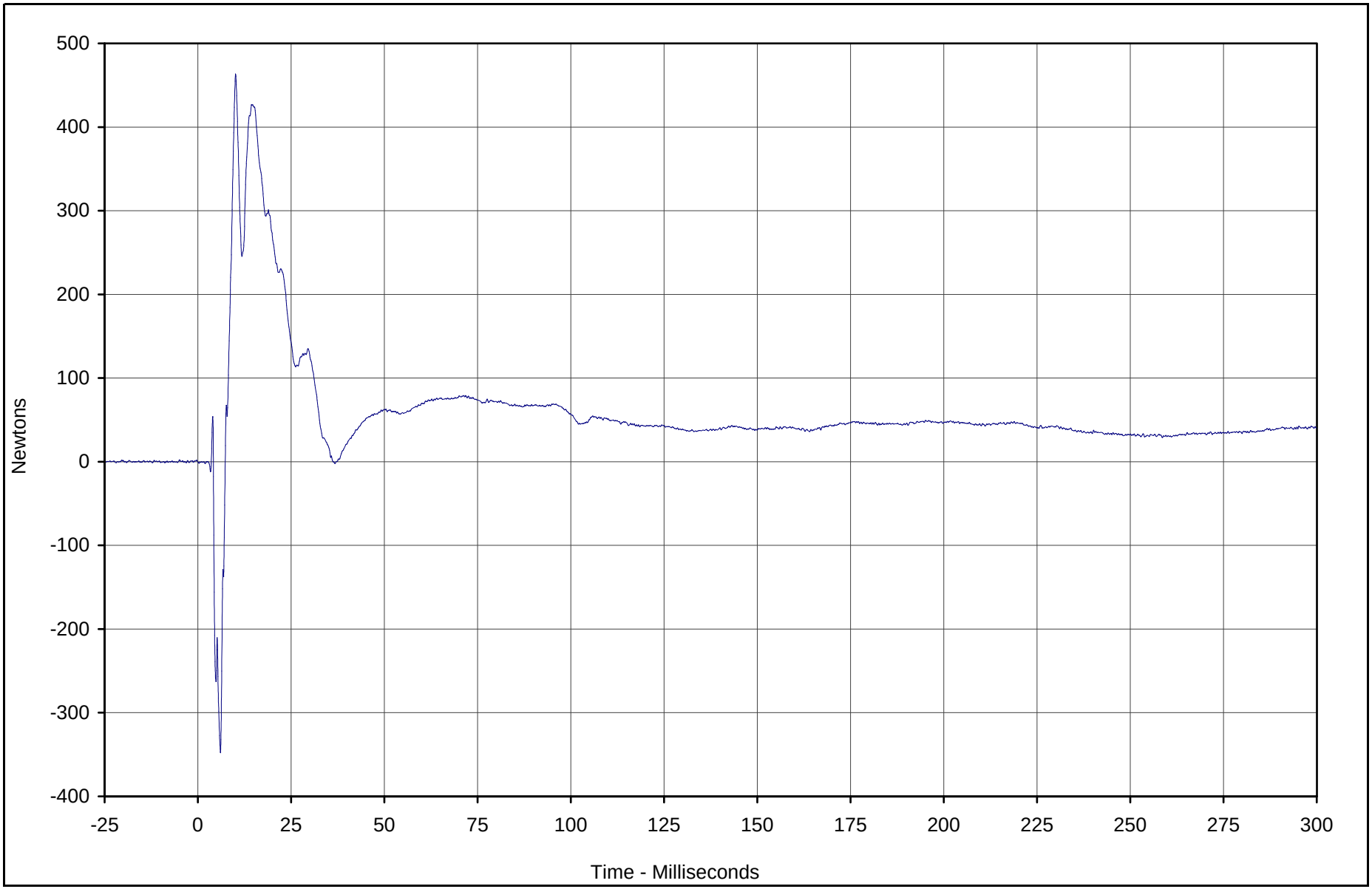
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



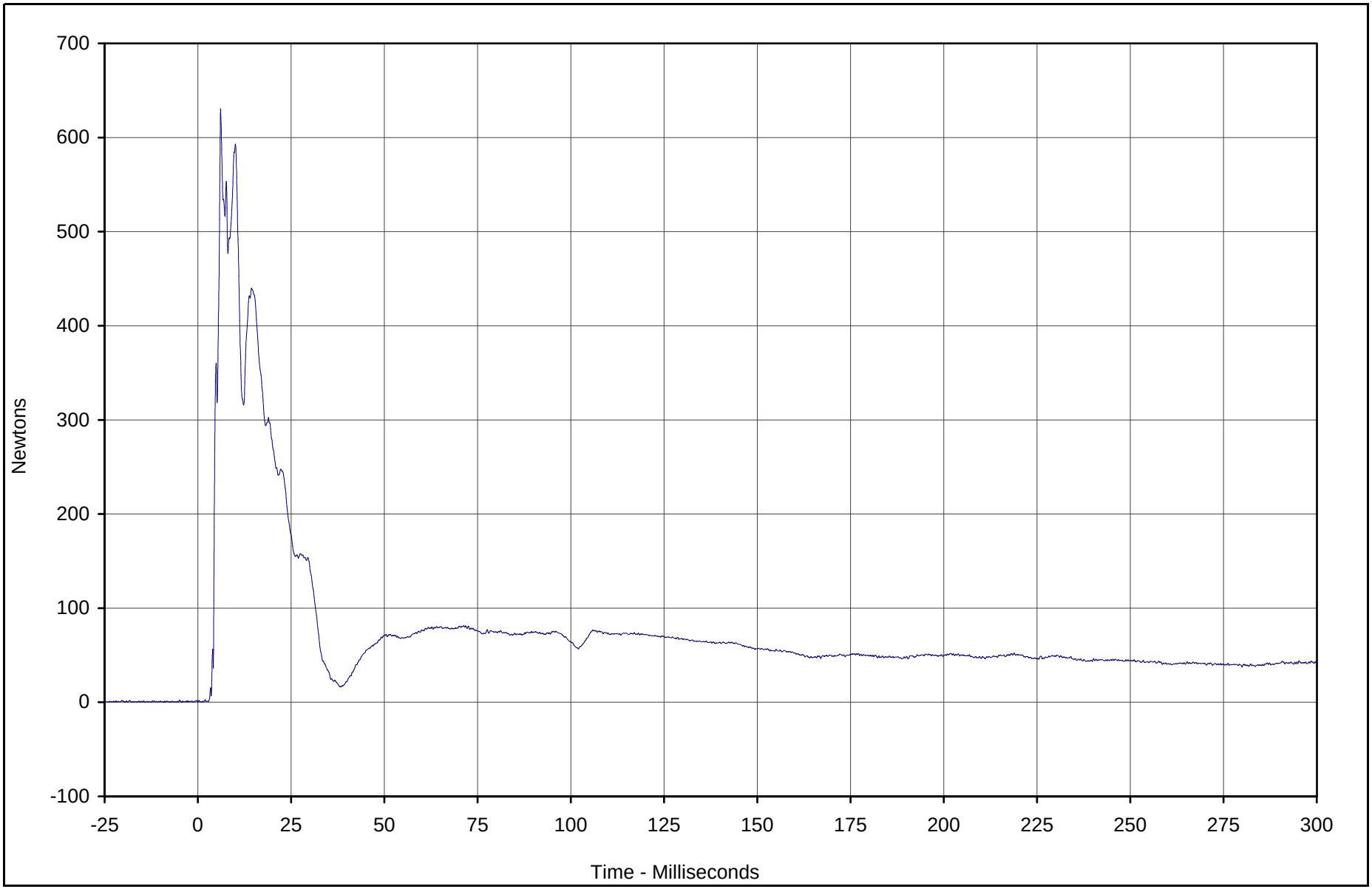

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Upper Neck Force Z | 006 | FIL | Newtons | 463.2 | 10.1 | -348.0 | 6.1 | 1000 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Upper Neck Force Resultant | 004 | RES | Newtons | 630.3 | 6.1 | 0.2 | 0.9 | 1000 |

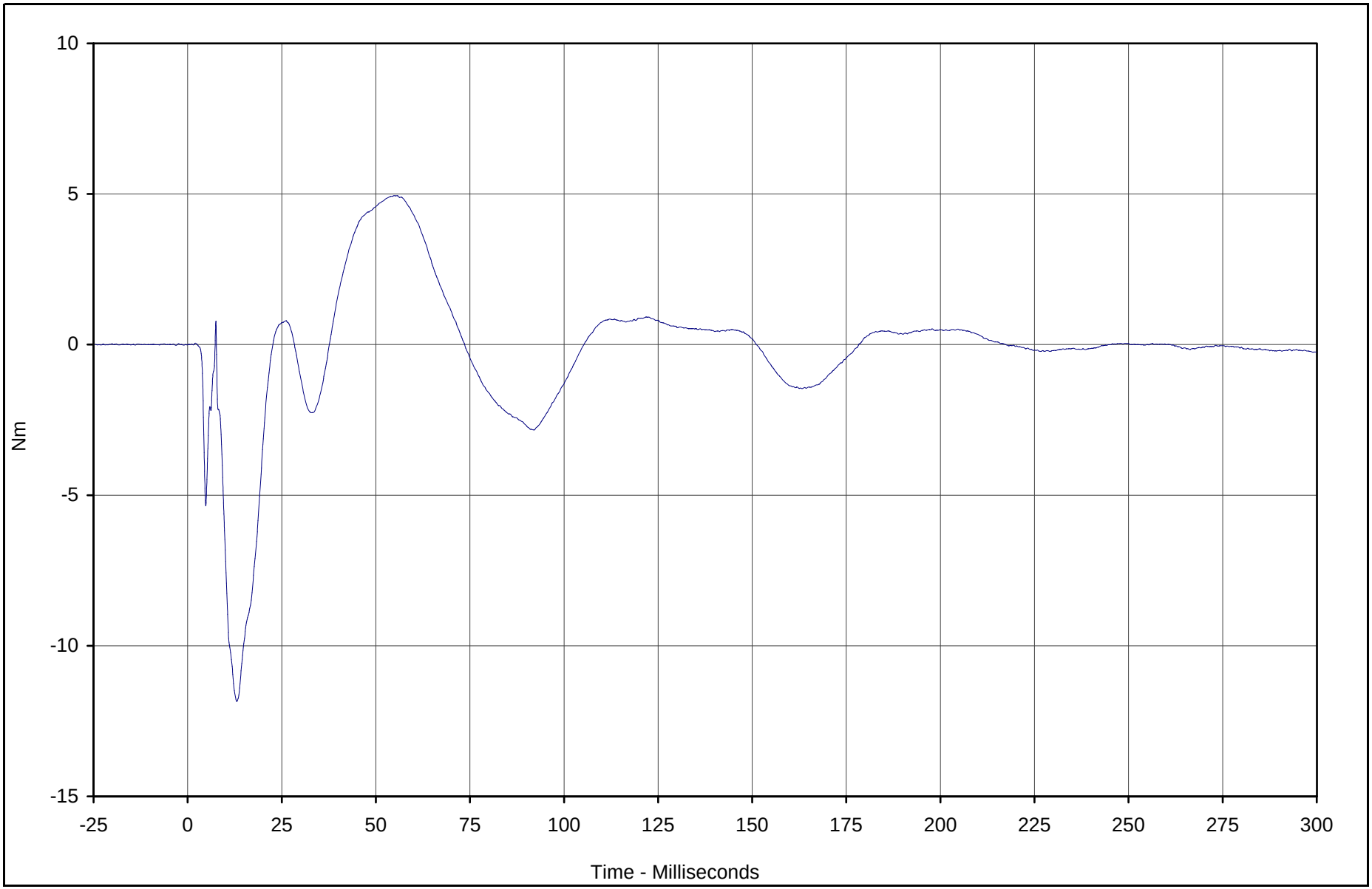
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



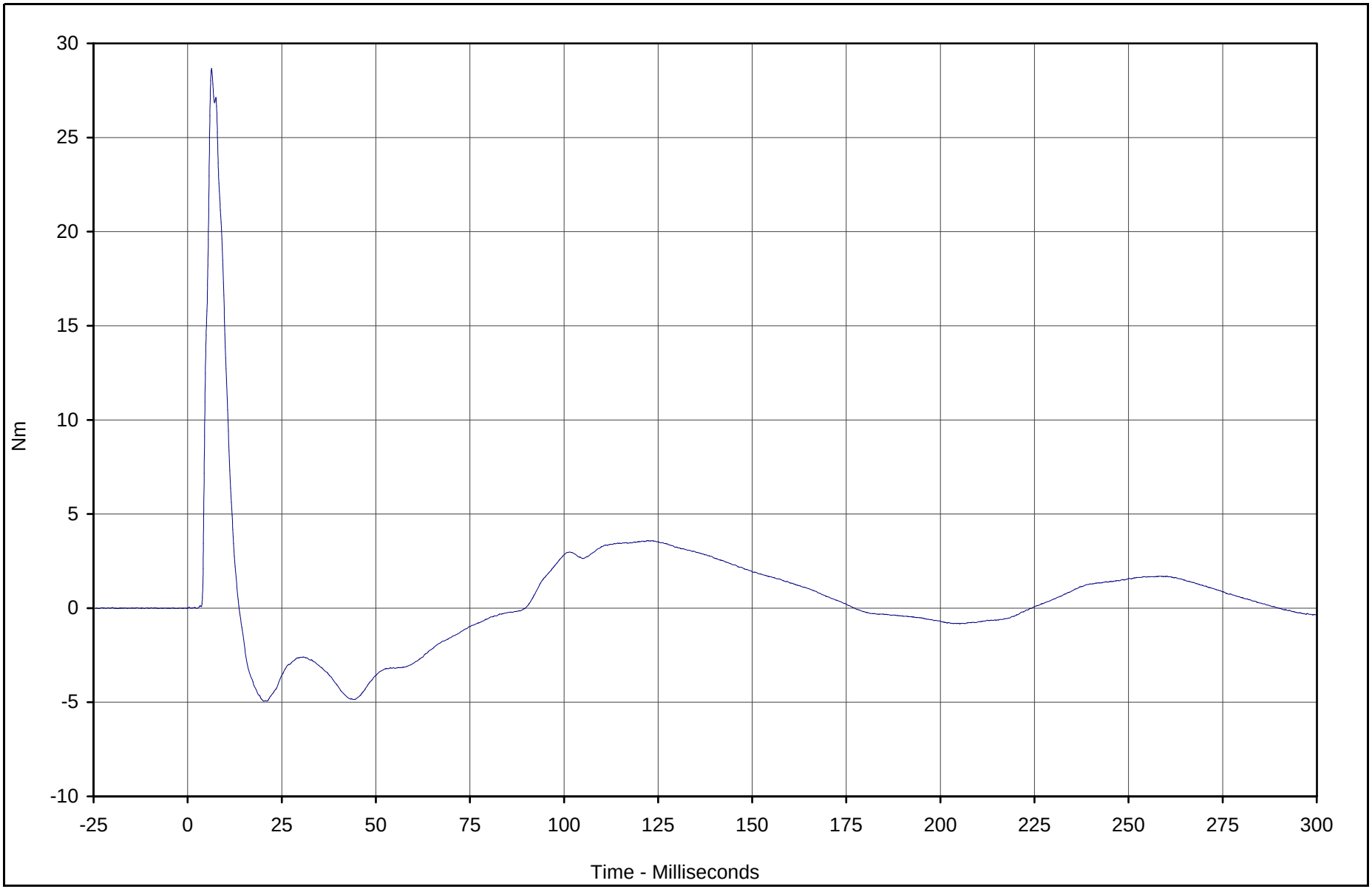

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Upper Neck Moment X | 007 | FIL | Nm | 4.9 | 54.8 | -11.8 | 13.0 | 600 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Upper Neck Moment Y | 008 | FIL | Nm | 28.7 | 6.3 | -4.9 | 20.2 | 600 |

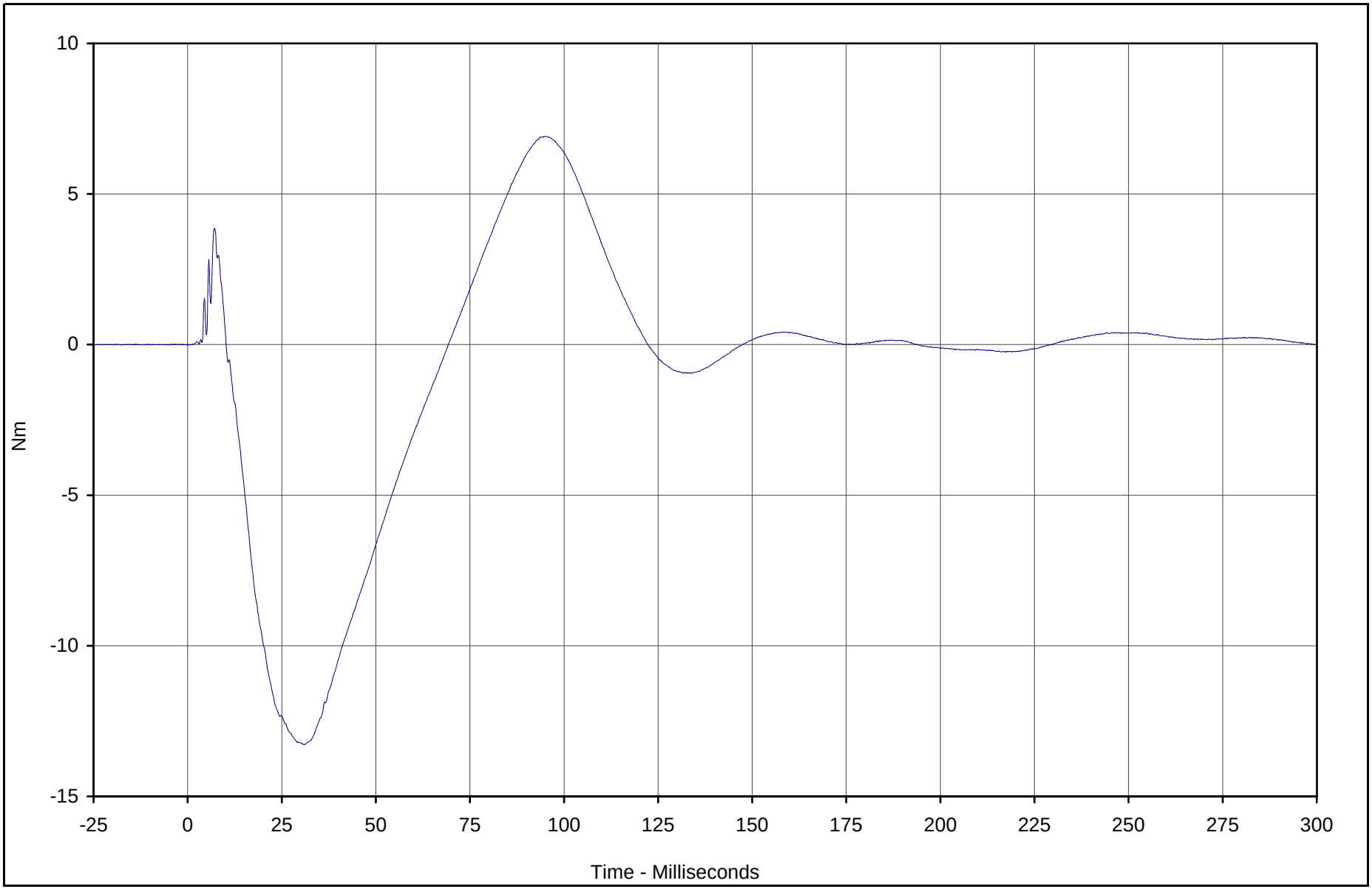
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



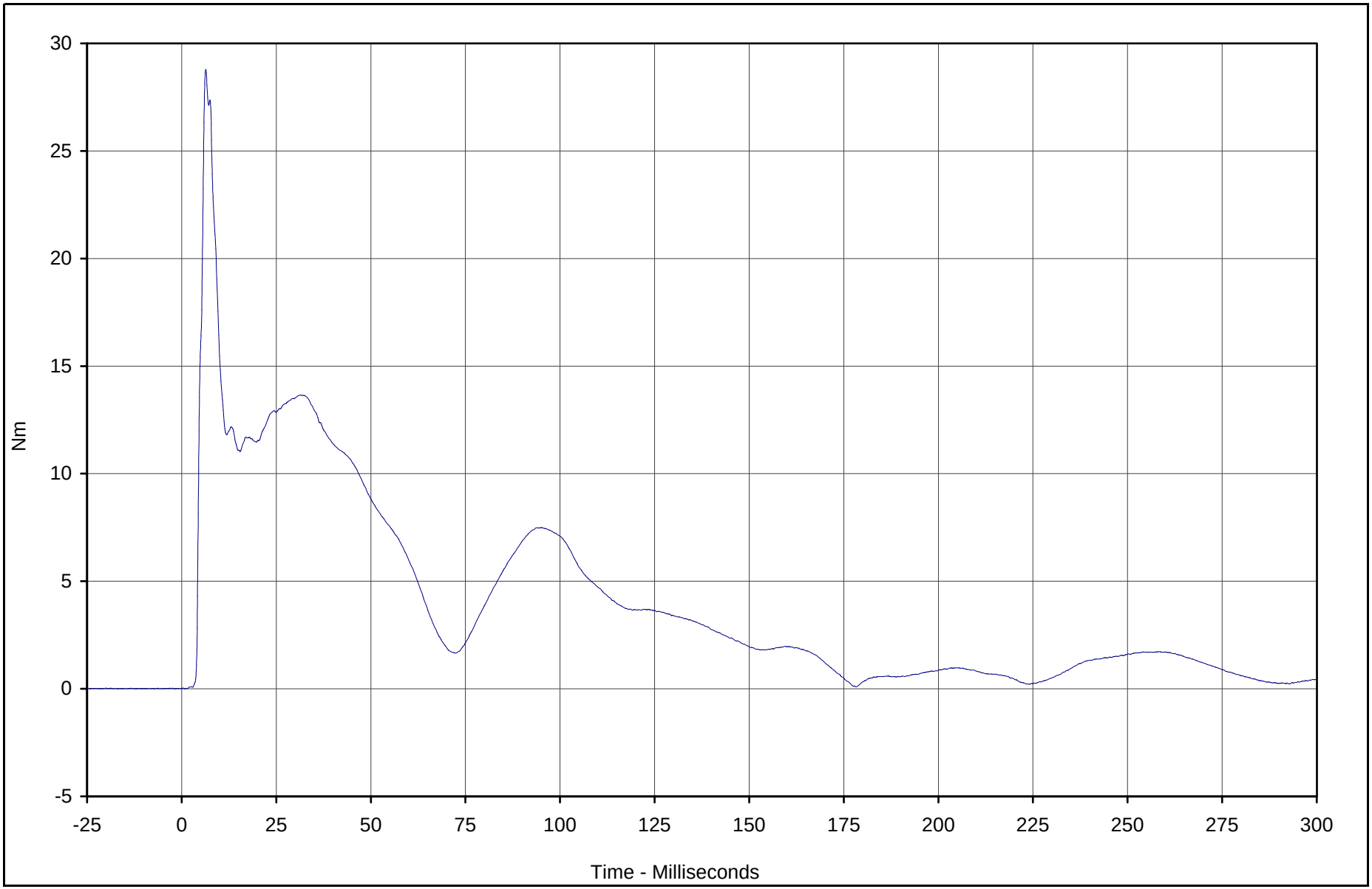

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Upper Neck Moment Z | 009 | FIL | Nm | 6.9 | 95.1 | -13.3 | 30.8 | 600 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Upper Neck Moment Resultant | 007 | RES | Nm | 28.8 | 6.4 | 0.0 | 0.8 | 600 |

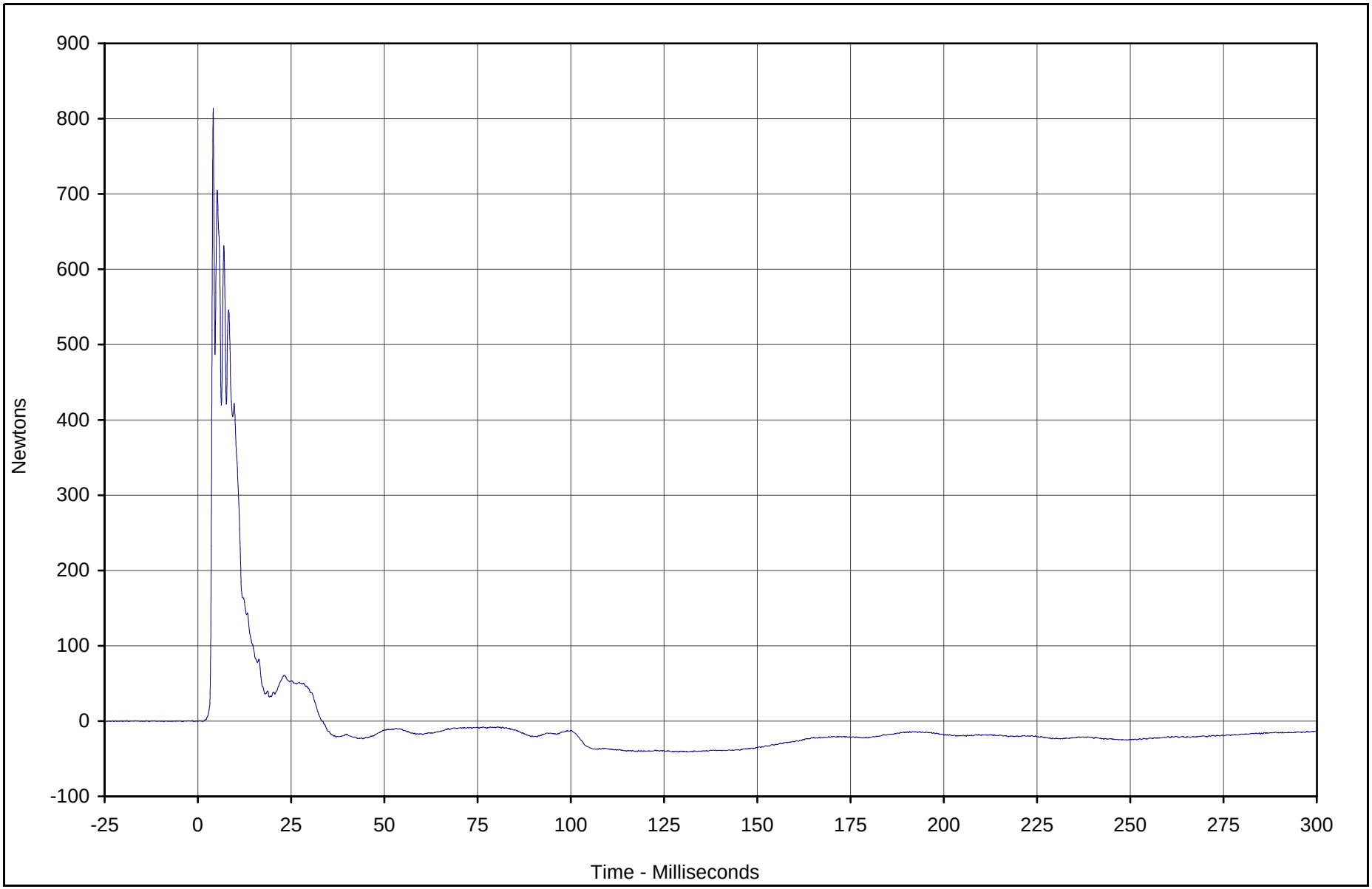
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



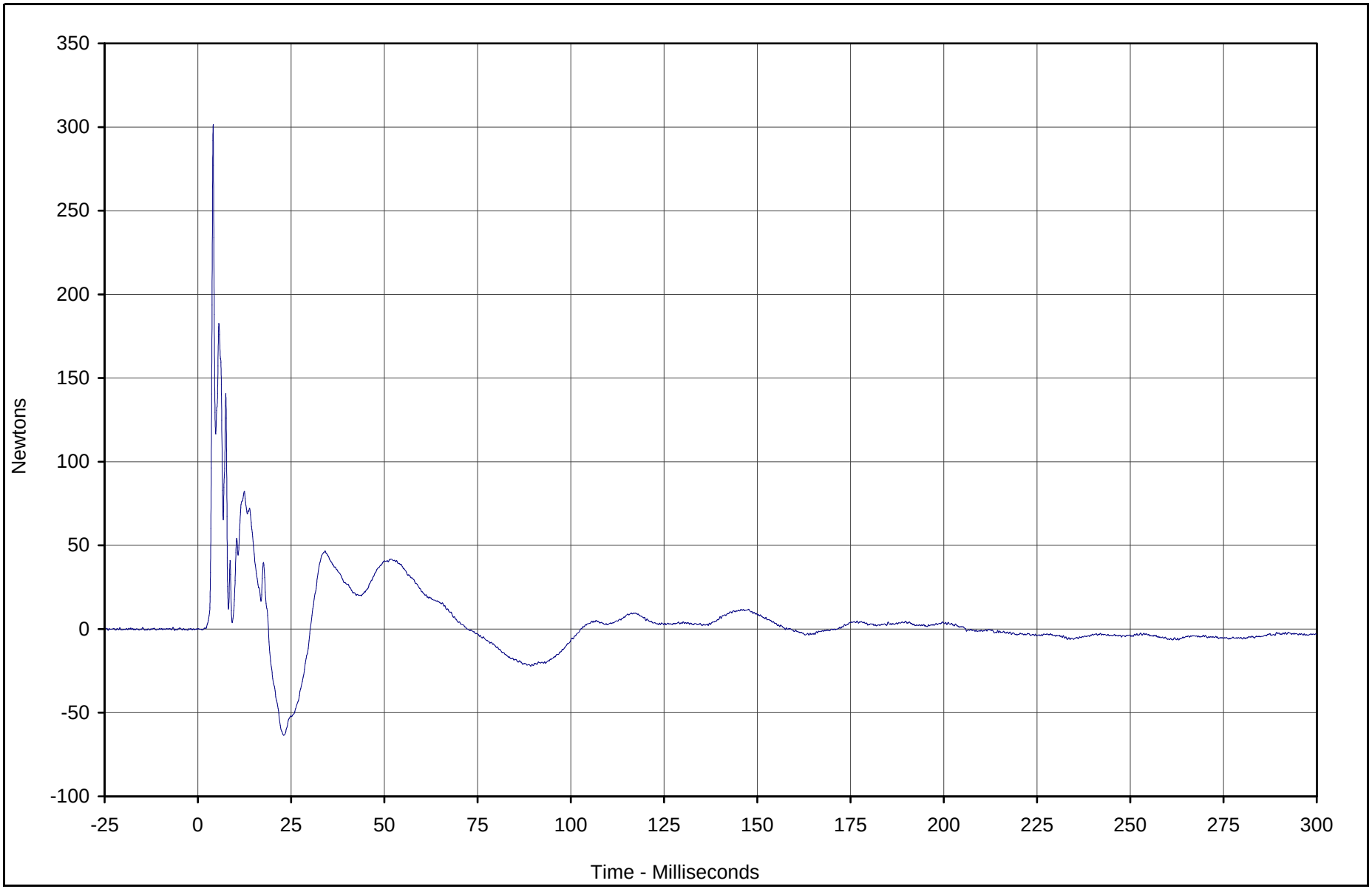

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Lower Neck Force X | 010 | FIL | Newtons | 813.5 | 4.1 | -41.2 | 128.7 | 1000 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Lower Neck Force Y | 011 | FIL | Newtons | 301.4 | 4.1 | -63.5 | 23.0 | 1000 |

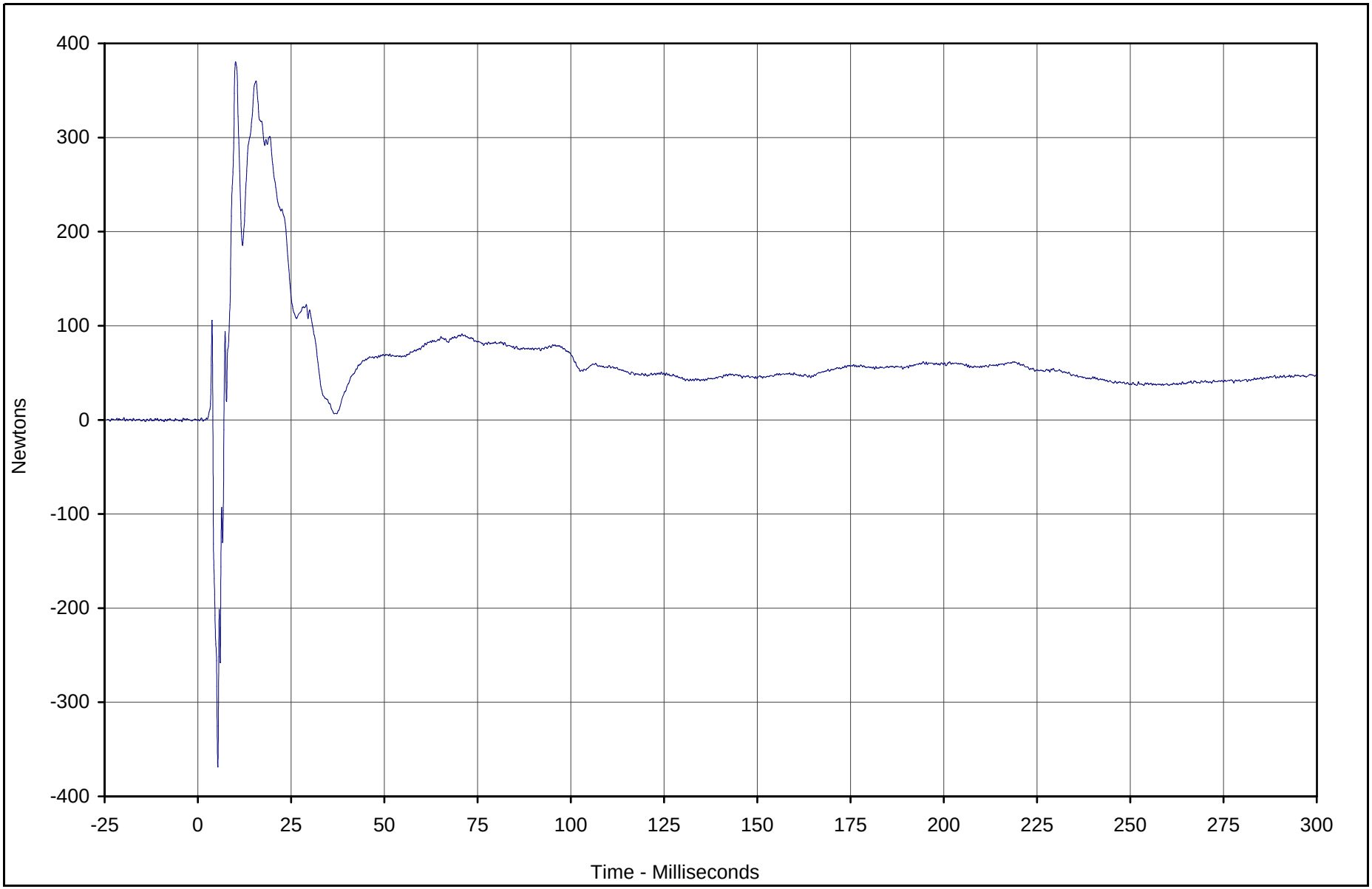
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Lower Neck Force Z | 012 | FIL | Newtons | 380.6 | 10.1 | -368.5 | 5.4 | 1000 |

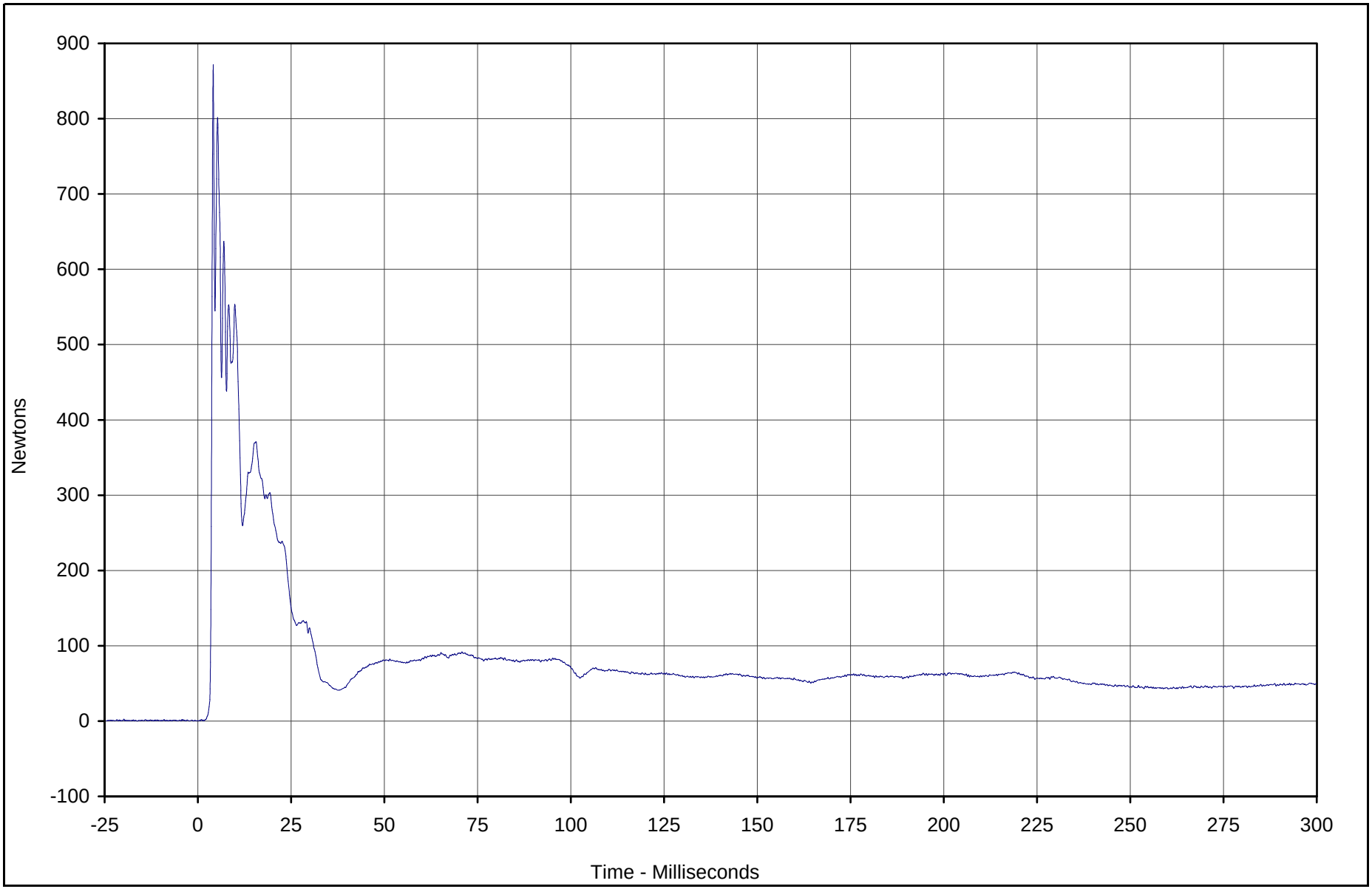
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



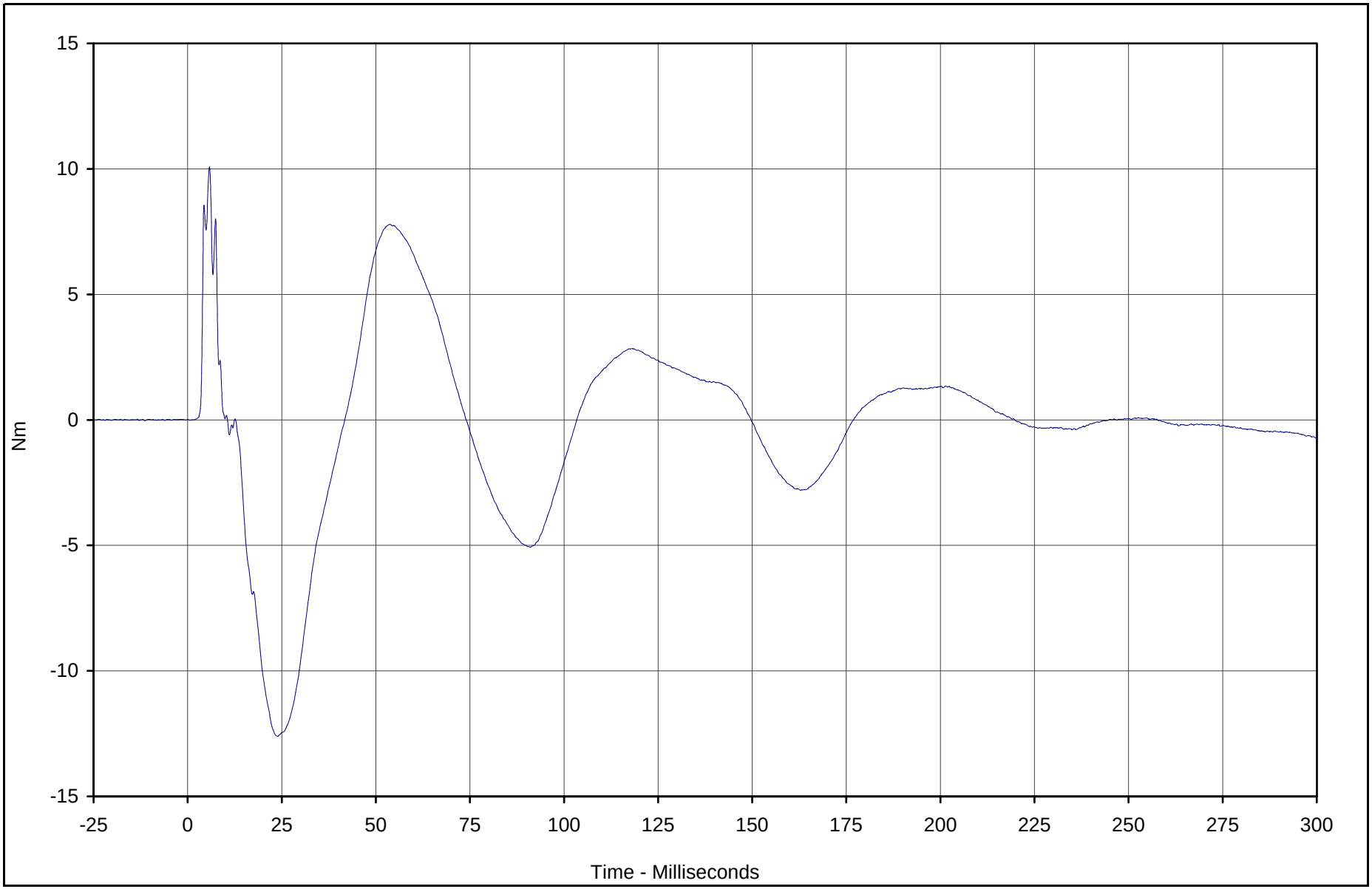

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Lower Neck Force Resultant | 010 | RES | Newtons | 871.2 | 4.1 | 0.2 | 0.0 | 1000 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



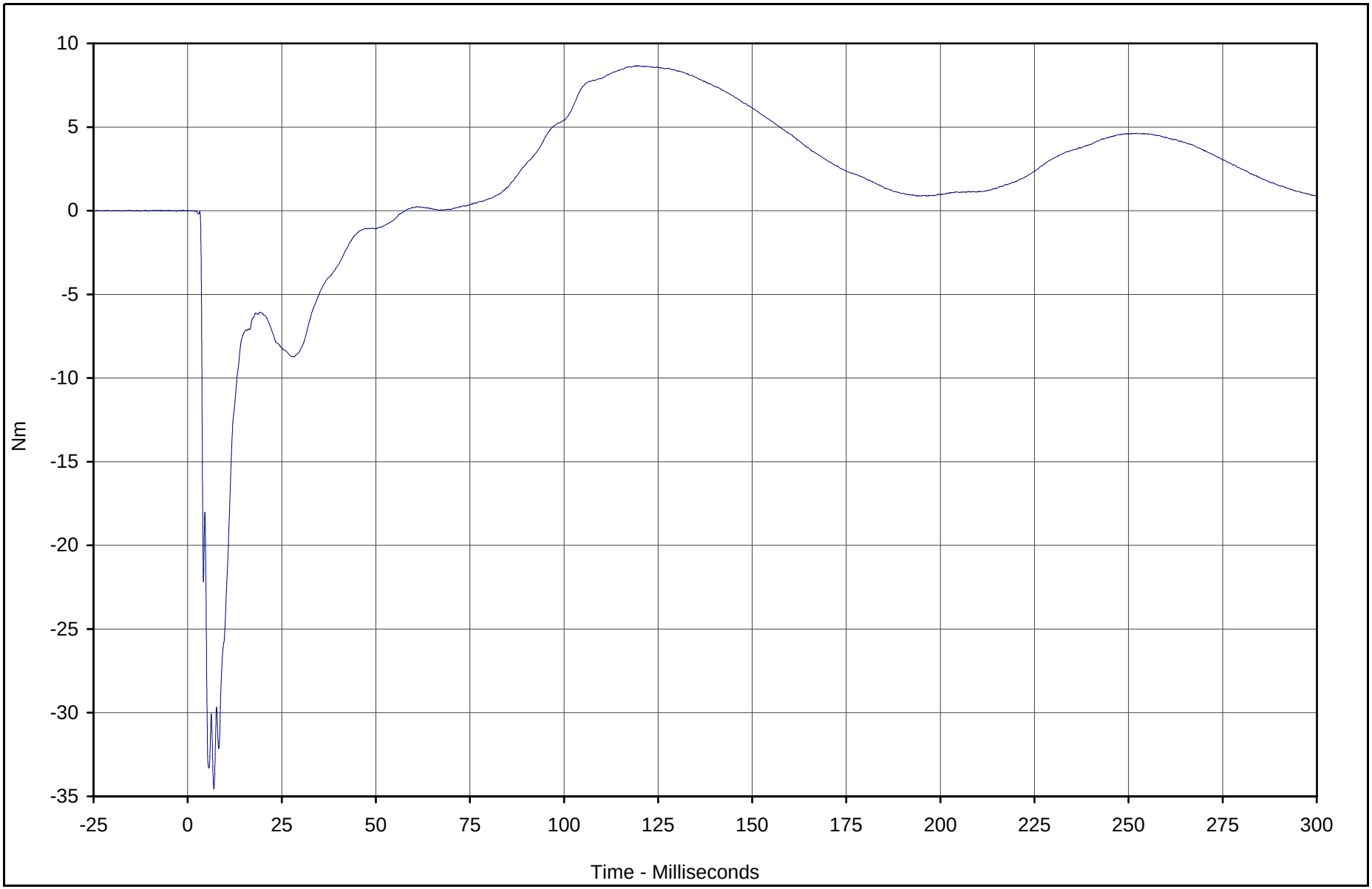

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Lower Neck Moment X | 013 | FIL | Nm | 10.1 | 5.8 | -12.6 | 23.9 | 600 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Lower Neck Moment Y | 014 | FIL | Nm | 8.7 | 119.3 | -34.6 | 7.0 | 600 |

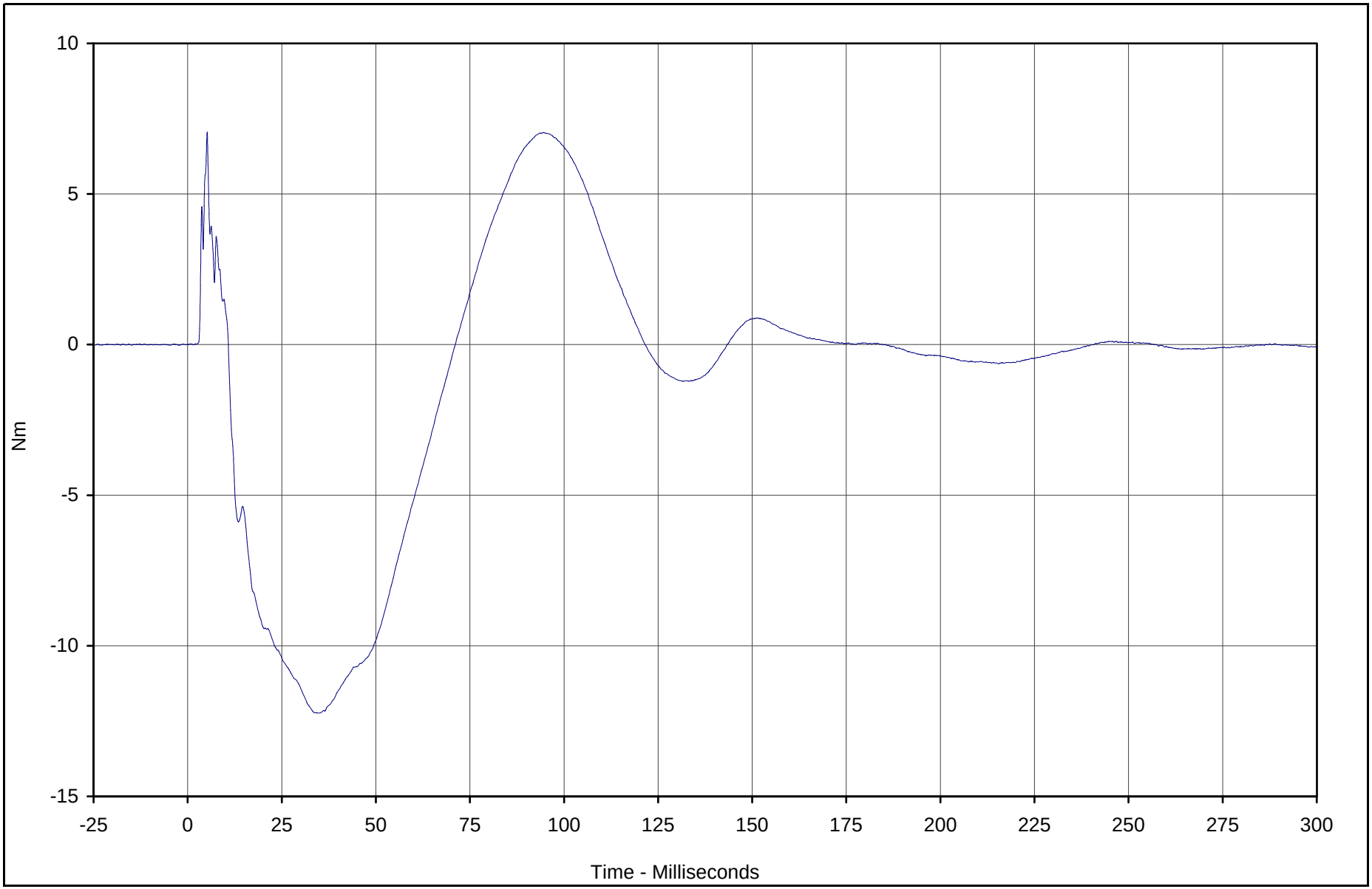
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



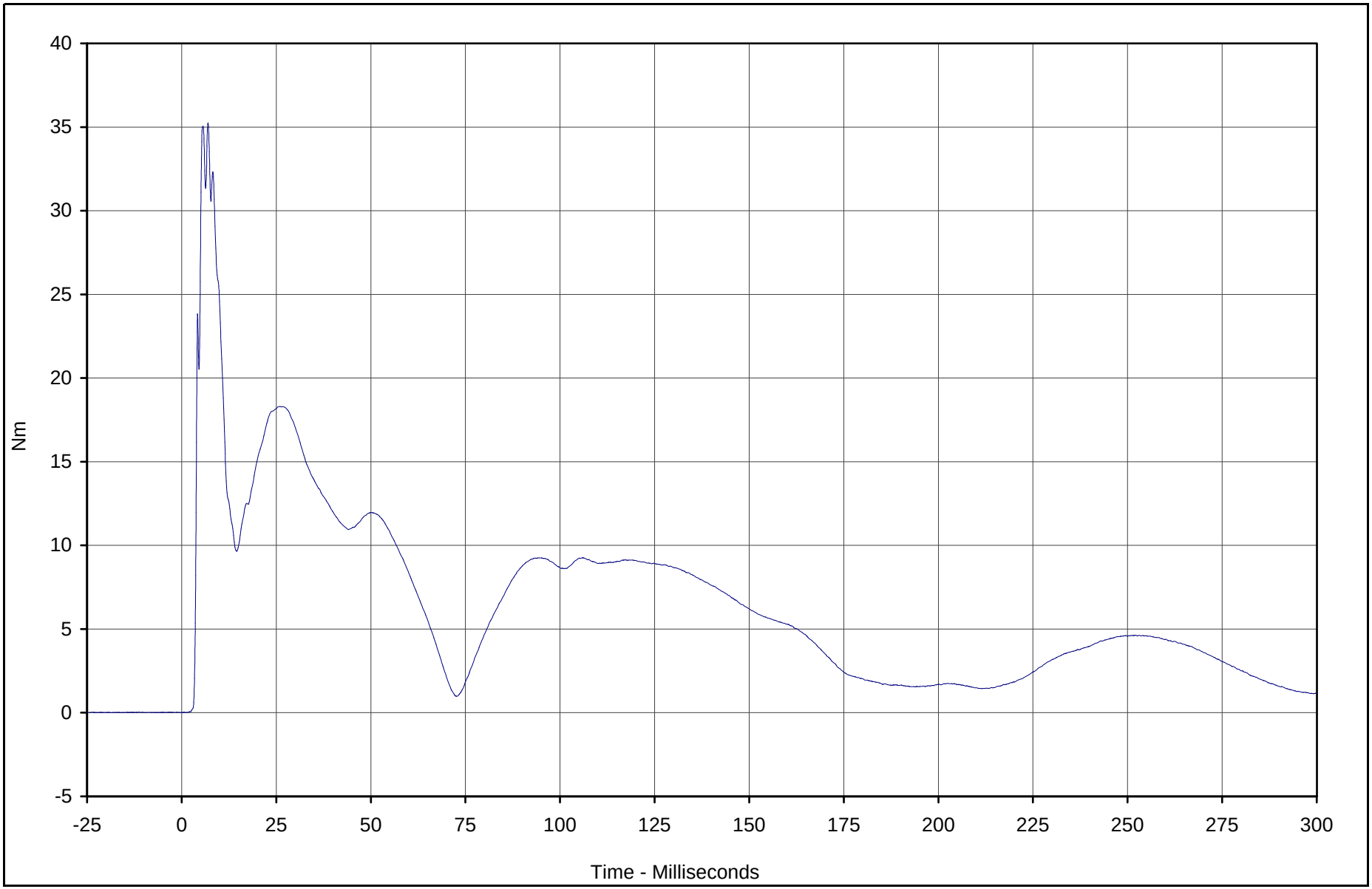

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Lower Neck Moment Z | 015 | FIL | Nm | 7.1 | 5.2 | -12.2 | 34.7 | 600 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Lower Neck Moment Resultant | 013 | RES | Nm | 35.3 | 7.0 | 0.0 | 1.3 | 600 |

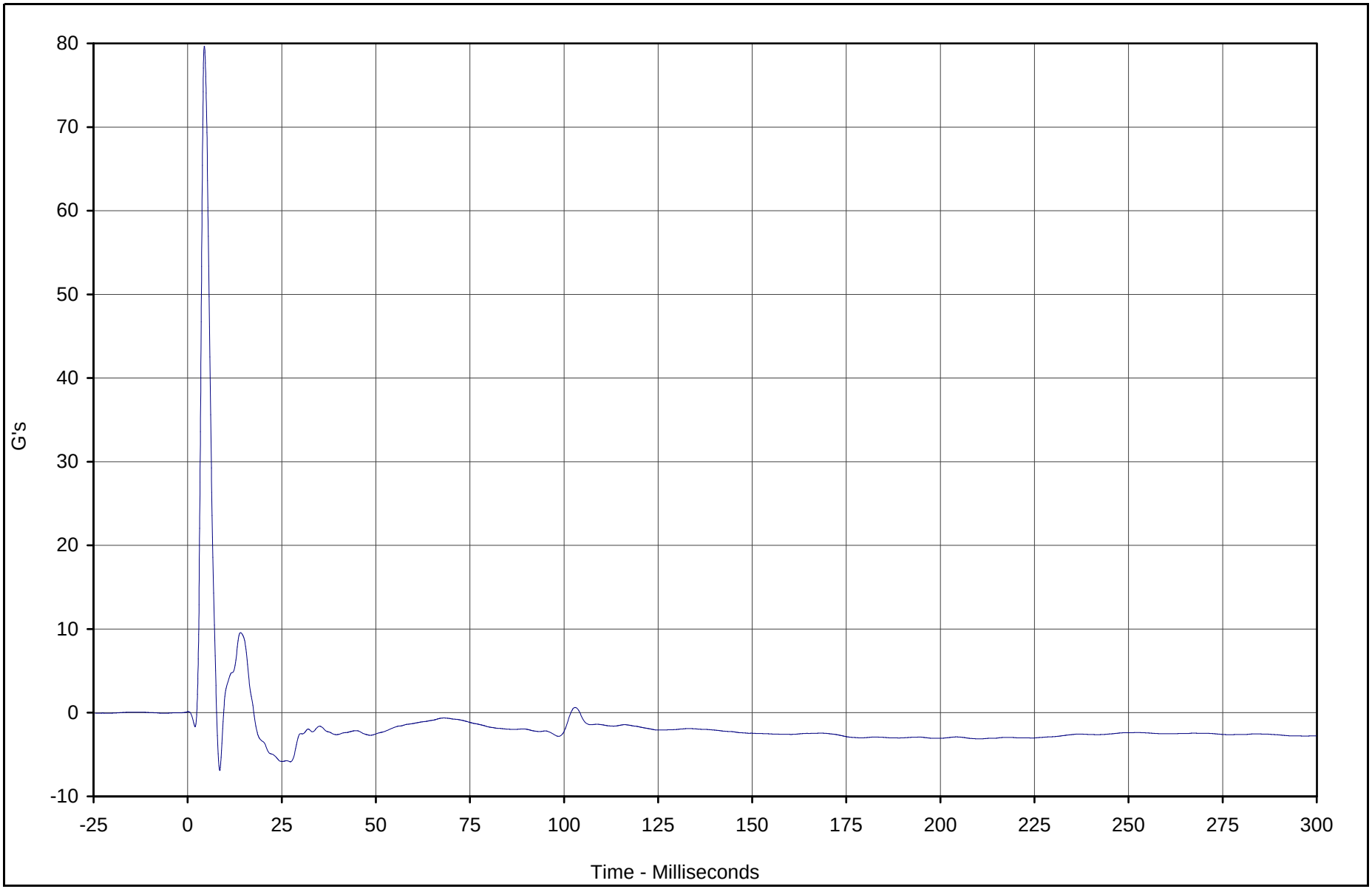
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



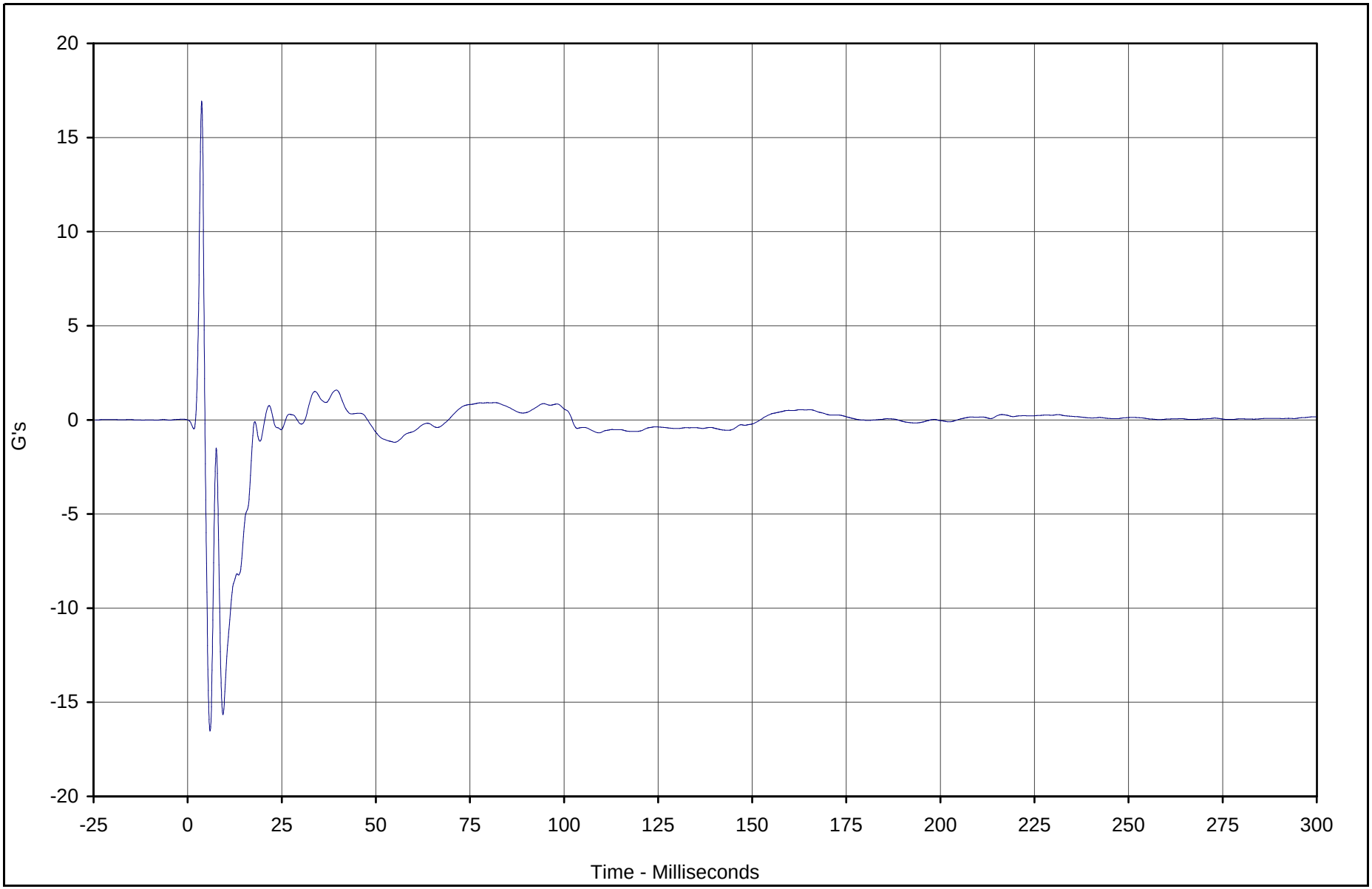

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Chest X | 016 | FIL | G's | 79.7 | 4.4 | -6.9 | 8.5 | 180 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



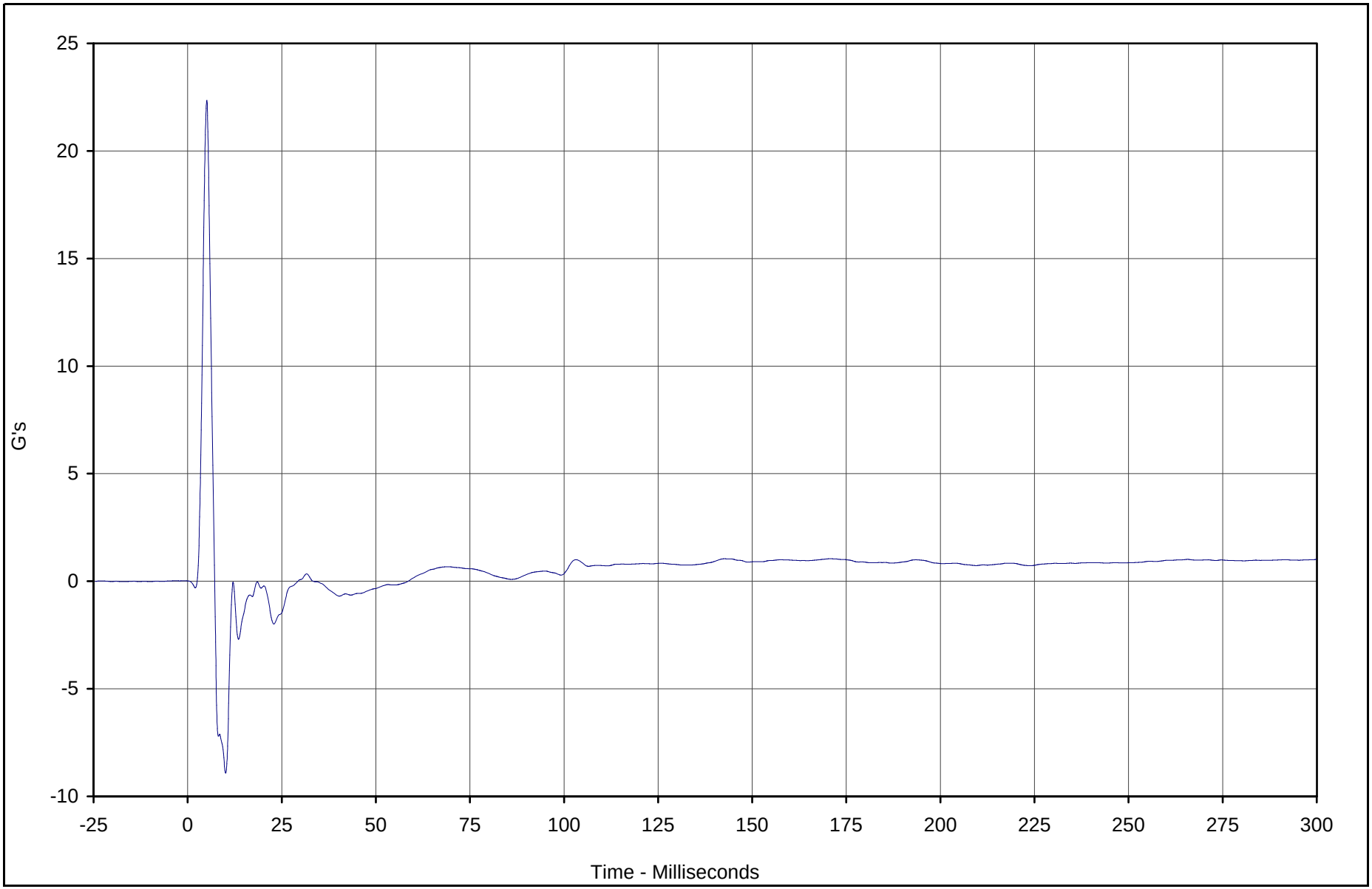

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Chest Y | 017 | FIL | G's | 16.9 | 3.7 | -16.5 | 5.9 | 180 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Chest Z | 018 | FIL | G's | 22.4 | 5.1 | -8.9 | 10.1 | 180 |

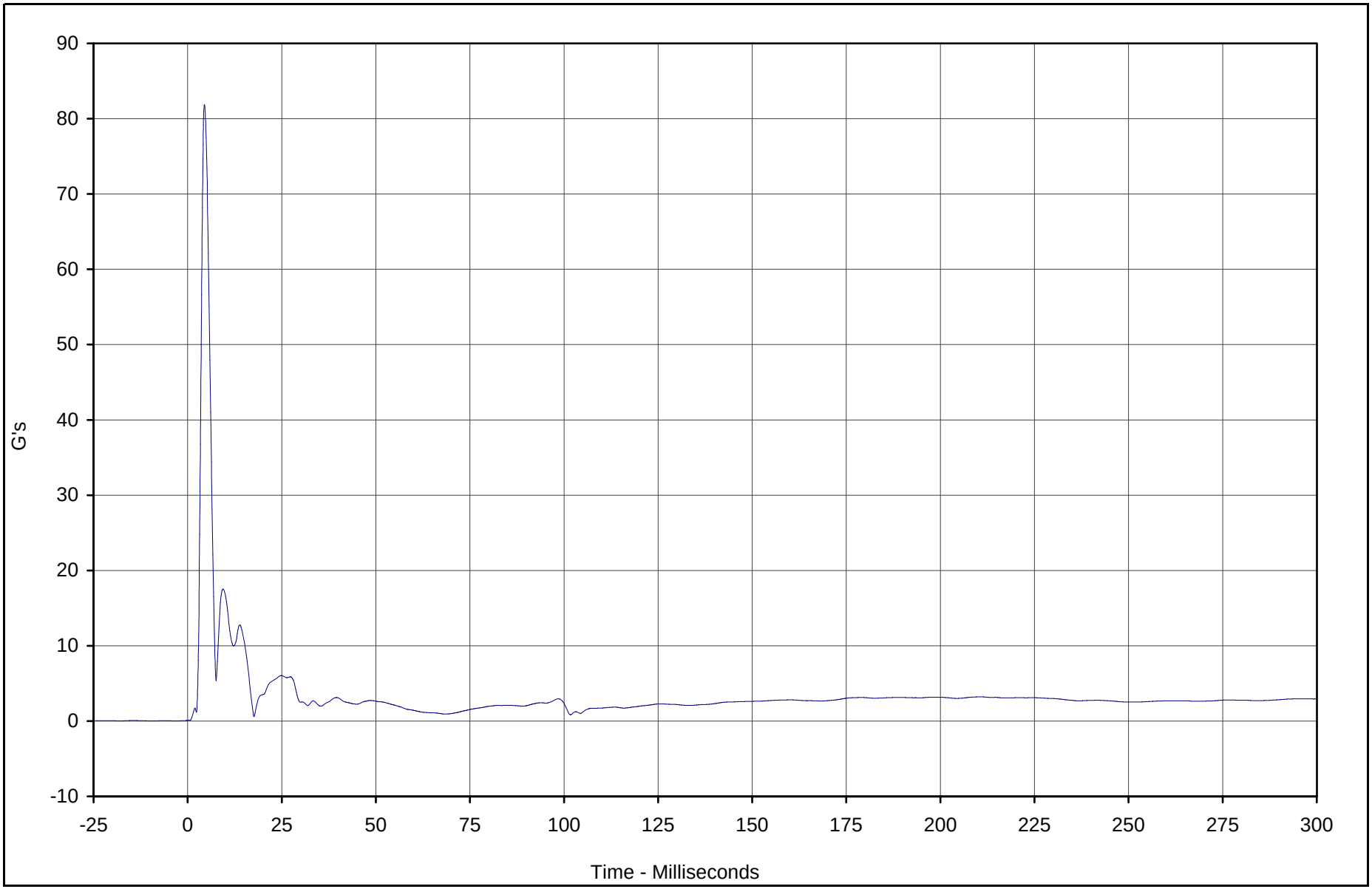
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



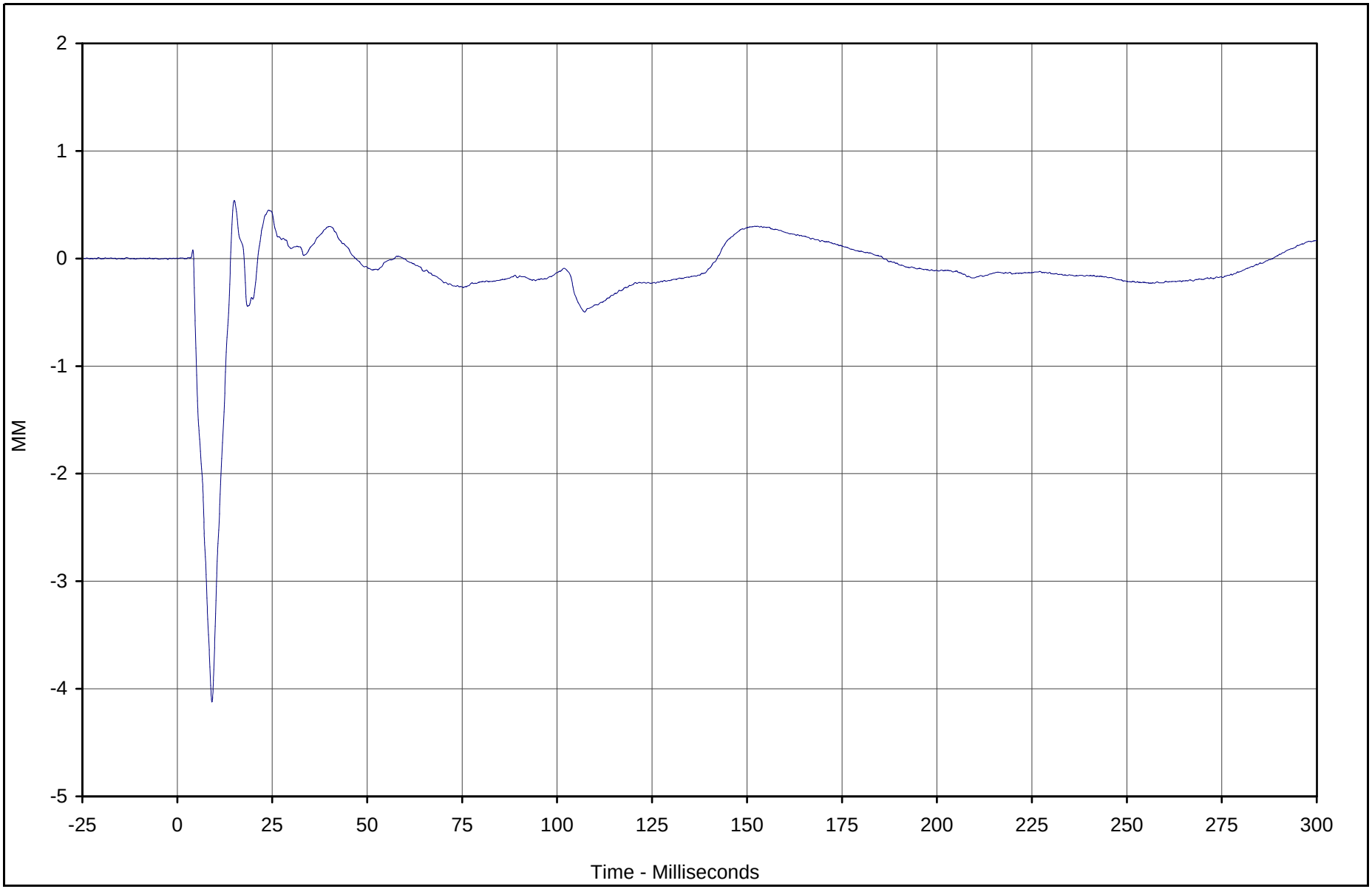

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Chest Resultant | 016 | RES | G's | 81.9 | 4.5 | 0.1 | 0.6 | 180 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Chest Displacement | 019 | FIL | MM | 0.5 | 15.0 | -4.1 | 9.1 | 600 |

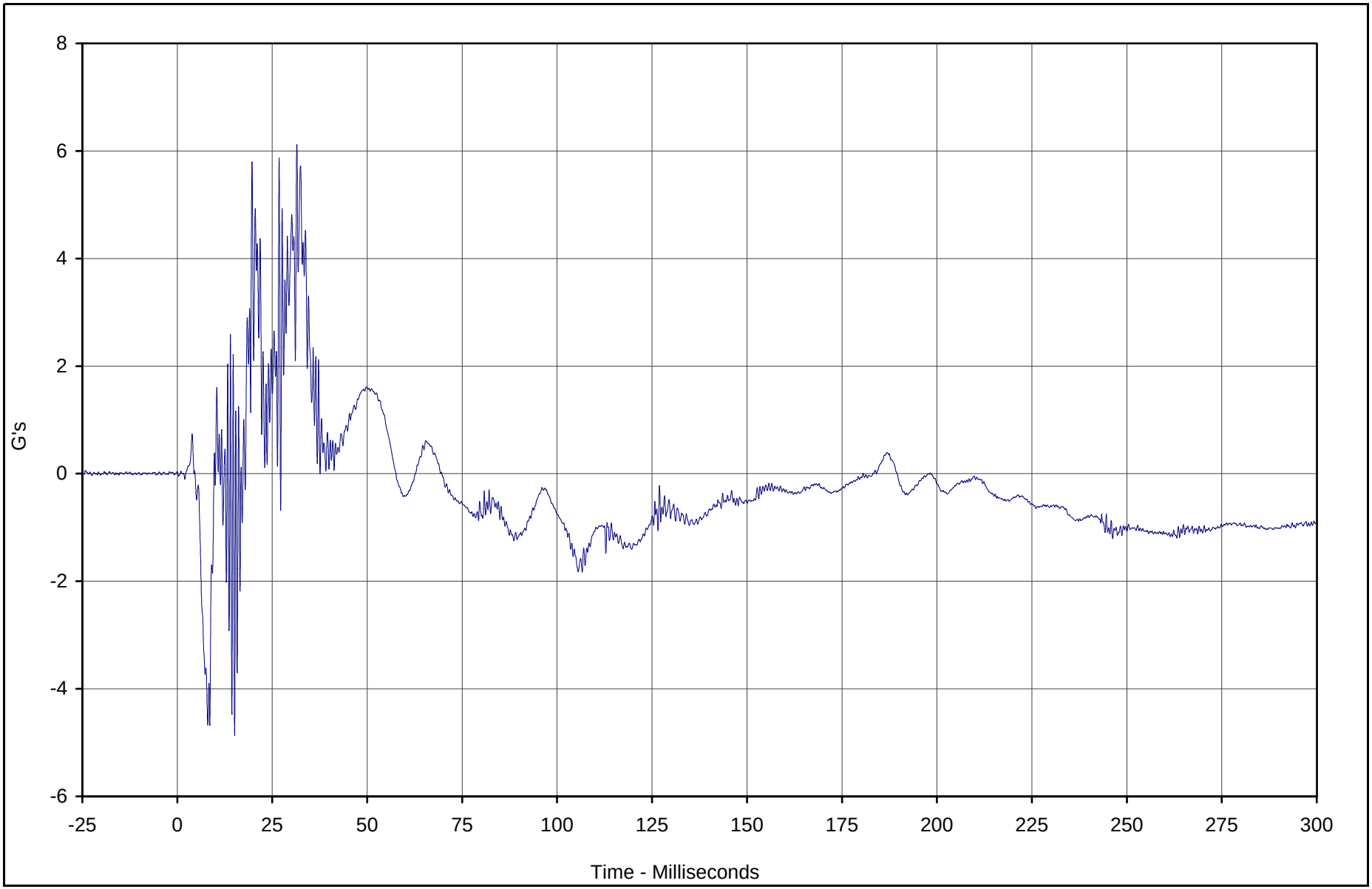
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Pelvis X | 020 | FIL | G's | 6.1 | 31.5 | -4.8 | 15.1 | 1000 |

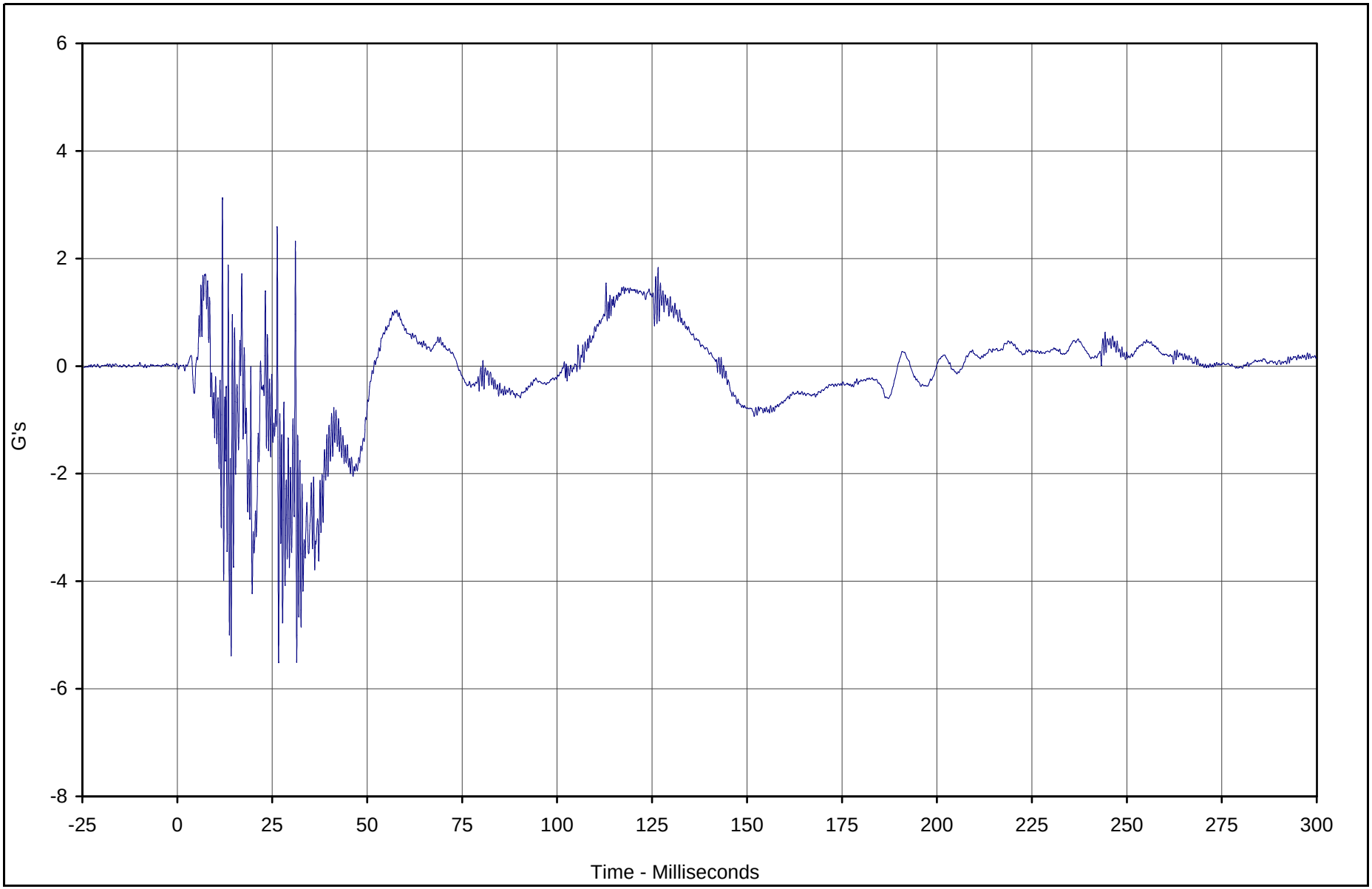
KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



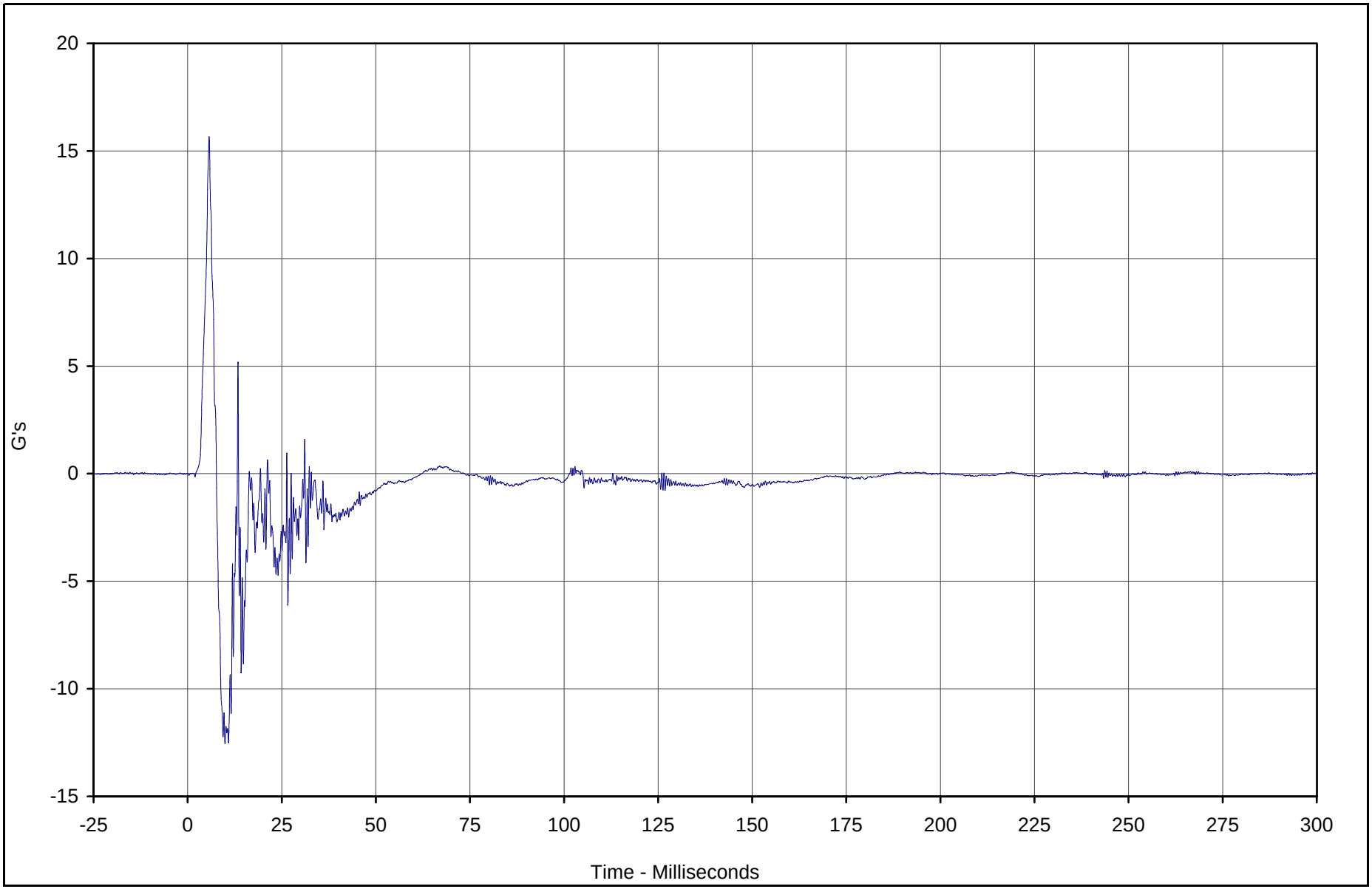

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Pelvis Y | 021 | FIL | G's | 3.1 | 11.9 | -5.5 | 26.7 | 1000 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2



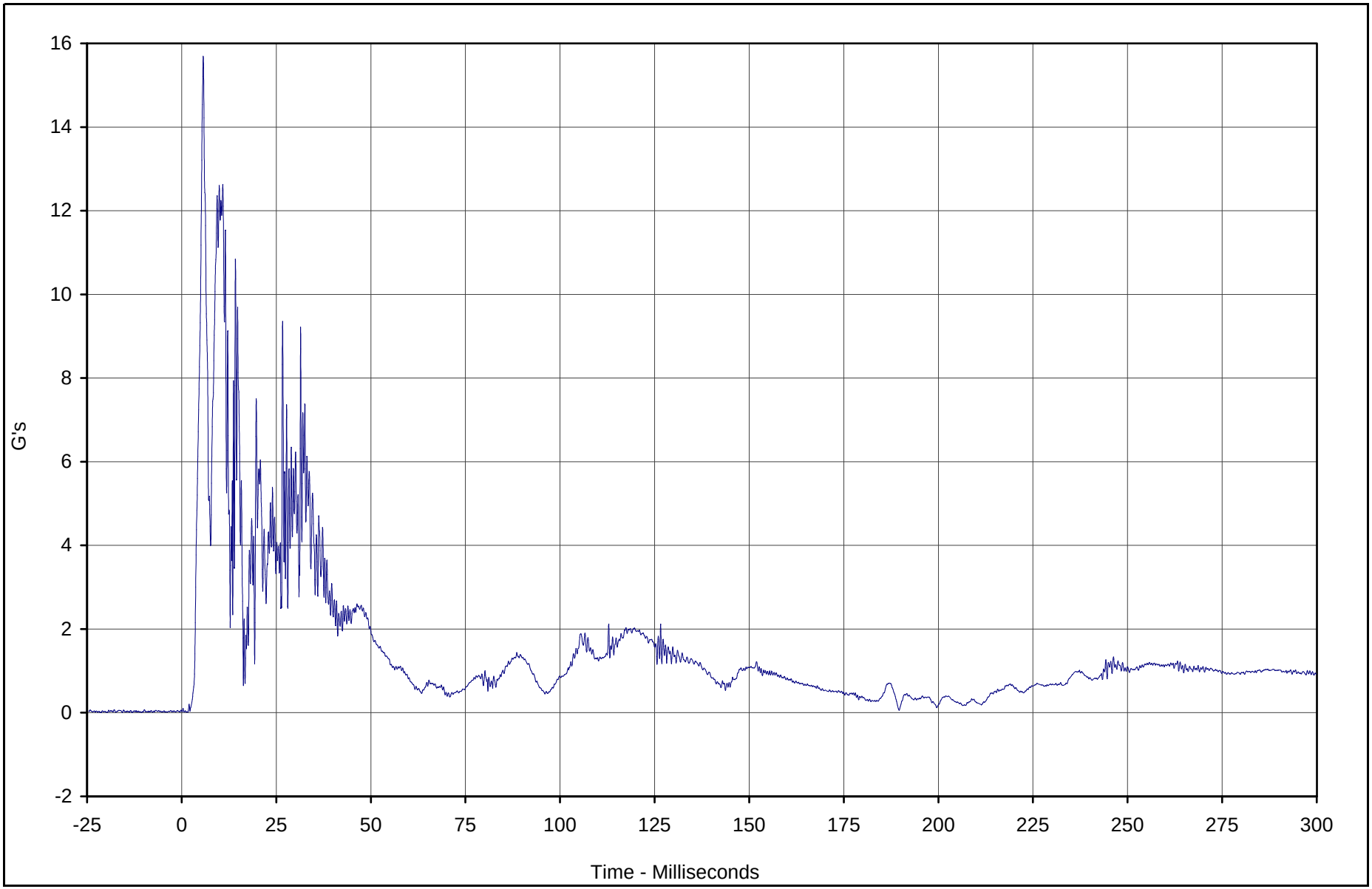

| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Pelvis Z | 022 | FIL | G's | 15.7 | 5.7 | -12.5 | 9.9 | 1000 |

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2




| Curve Description | CURNO | Type | Units | Max | Time | Min | Time | SAE Class |
|---|---|---|---|---|---|---|---|---|
| Pass. Pelvis Resultant | 020 | RES | G's | 15.7 | 5.7 | 0.0 | 1.2 | 1000 |

KARCO Engineering

Test Vehicle: 2004 Lincoln Towncar 4 Door Sedan

Test Date: 1/15/04

Test Program: TWG Testing (Forward Facing Hybrid III 3 Yr.)

NHTSA No.: M30203TWG2

# APPENDIX C

# INSTRUMENTATION DATA CHANNEL ASSIGNMENTS

**TWG Testing (Forward Facing Hybrid III 3 Yr.)**
**Instrumentation Data Channel Assignments**
**A.T.D. Serial Number 082**
**1/15/04**
**2004 Lincoln Towncar 4 Door Sedan**

| CH. | LOCATION | AXIS | IDENT. NO. | DESCRIPTION | MFR | MODEL | UNITS |
|---|---|---|---|---|---|---|---|
| 1 | HEAD, PRIMARY | X | GPAC050 | Accel.,1/2 bridge | Endevco | 7264-2000 | G |
| 2 | HEAD, PRIMARY | Y | GPAC051 | Accel.,1/2 bridge | Endevco | 7264-2000 | G |
| 3 | HEAD, PRIMARY | Z | GPAC052 | Accel.,1/2 bridge | Endevco | 7264-2000 | G |
| 4 | UPPER NECK FORCE | X | 082UNFX | Load cell, six axis neck | R. A. Denton | IF-234 | N |
| 5 | UPPER NECK FORCE | Y | 082UNFY | Load cell, six axis neck | R. A. Denton | IF-234 | N |
| 6 | UPPER NECK FORCE | Z | 082UNFZ | Load cell, six axis neck | R. A. Denton | IF-234 | N |
| 7 | UPPER NECK MOMENT | X | 082UNMX | Load cell, six axis neck | R. A. Denton | IF-234 | Nm |
| 8 | UPPER NECK MOMENT | Y | 082UNMY | Load cell, six axis neck | R. A. Denton | IF-234 | Nm |
| 9 | UPPER NECK MOMENT | Z | 082UNMZ | Load cell, six axis neck | R. A. Denton | IF-234 | Nm |
| 10 | LOWER NECK FORCE | X | 082LNFX | Load cell, six axis neck | R. A. Denton | 3303 | N |
| 11 | LOWER NECK FORCE | Y | 082LNFY | Load cell, six axis neck | R. A. Denton | 3303 | N |
| 12 | LOWER NECK FORCE | Z | 082LNFZ | Load cell, six axis neck | R. A. Denton | 3303 | N |
| 13 | LOWER NECK MOMENT | X | 082LNMX | Load cell, six axis neck | R. A. Denton | 3303 | Nm |
| 14 | LOWER NECK MOMENT | Y | 082LNMY | Load cell, six axis neck | R. A. Denton | 3303 | Nm |
| 15 | LOWER NECK MOMENT | Z | 082LNMZ | Load cell, six axis neck | R. A. Denton | 3303 | Nm |
| 16 | CHEST , PRIMARY | X | 2116-A11 | Accel., Full Bridge | Entran | 2000JF | G |
| 17 | CHEST , PRIMARY | Y | 2116-A14 | Accel., Full Bridge | Entran | 2000JF | G |
| 18 | CHEST , PRIMARY | Z | 2116-A23 | Accel., Full Bridge | Entran | 2000JF | G |
| 19 | CHEST DISPLACEMENT | X | 082CP | Rotary Pot Chest | Servo | 14CBI | MM |
| 20 | PELVIS, PRIMARY | X | 2116-A12 | Accel., Full Bridge | Entran | 2000JF | G |
| 21 | PELVIS, PRIMARY | Y | 2116-A19 | Accel., Full Bridge | Entran | 2000JF | G |
| 22 | PELVIS, PRIMARY | Z | 2116-A17 | Accel., Full Bridge | Entran | 2000JF | G |