REPORT NUMBER TR-P23106-06-NC

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

TOYOTA MOTOR CORPORATION
2004 LEXUS ES 330
4 DOOR SEDAN

NHTSA NUMBER: M45111TWG2

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

MAY 26, 2004

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
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15. Supplementary Notes

16. Abstract

A static side airbag deployment was conducted on a 2004 Lexus ES 330 Car 4 Door Sedan at KARCO Engineering, LLC on 5/26/2004. 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)	N/A	723	14.2
Max. Thorax Accel. (3 msec clip)	G's	60	7.7

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PURPOSE AND SUMMARY OF TEST M45111TWG2

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 deploying the roof-rail and seat mounted side airbags in a 2004 Lexus ES 330 Car 4-Door Sedan with an out-of-position Hybrid III 6 Year-Old Child dummy were evaluated. The test was performed at Karco Engineering, LLC on May 26, 2004. Pre- and post-test photographs of the vehicle and dummy can be found in Appendix A.

Two high-speed film and one high-speed digital 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 6 Year-Old child anthropomorphic test device (ATD), was placed in the front passenger seat, positioned facing inboard, 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 neck transducer.

Sixteen (16) 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 6 Year-Old Child Dummy's visible contact points were as follows: The roof mounted airbag contacted top of ATD’s head. 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	14.2	7.7	2.0

Orientation of the Hybrid III 6Year-old Child Dummy was in the inboard facing position leaning against the passenger door. The dummy's back was placed against the door with its head touching the window. The knees were extended. Synthetic foam was used to raise the dummy. This orientation complies with section 3.3.5.1 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: 2004 Lexus ES 330 4 Door Sedan NHTSA No.: M45111TWG2

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.) Test Date: 5/26/04

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. 5 - 6 YEAR OLD HYBRID III ATD INJURY CRITERIA AND SENSOR DATA

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan NHTSA No.: M45111TWG2

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.) Test Date: 5/26/04

HEAD PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	Pass. Max	Pass. Time	Pass. Min	Pass. Time
Head CG	X	G's	32.5	164.4	-3.2	32.9
Head CG	Y	G's	9.7	31.3	-10.9	25.7
Head CG	Z	G's	11.6	25.6	-6.8	92.3
Head CG Resultant	N/A	G's	33.3	164.3		

PRIMARY HEAD INJURY CRITERAS (HIC)

Location	Pass. HIC	Pass. T^1	Pass. T^2	Pass. Avg G
Head CG Primary (HIC15)	14.2	162.9	166.7	26.6

CHEST PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	Pass. Max	Pass. Time	Pass. Min	Pass. Time
Chest CG	X	G's	14.5	8.1	-4.3	38.6
Chest CG	Y	G's	28.6	8.3	-5.6	10.2
Chest CG	Z	G's	3.1	28.6	-5.9	10.0
Chest CG Resultant	N/A	G's	32.0	8.2		

PRIMARY CHEST CLIP (3MSEC)

Location	Pass. CLIP	Pass. T^1	Pass. T^2
Chest CG Primary	7.7	6.5	9.5

CHEST PEAK DISPLACEMENTS

Location	Axis	Units	Pass. Max	Pass. Time	Pass. Min	Pass. Time
Chest CG	X	MM	2.0	12.4	-0.7	97.8

PELVIC PEAK ACCELERATIONS

Location	Axis	Units	Pass. Max	Pass. Time	Pass. Min	Pass. Time
Pelvis	X	G's	3.2	9.3	-0.7	60.6
Pelvis	Y	G's	7.0	7.2	-1.7	64.0
Pelvis	Z	G's	3.7	30.0	-4.0	8.4
Pelvis Resultant	N/A	G's	7.3	9.3		

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan NHTSA No.: M45111TWG2

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.) Test Date: 5/26/04

UPPER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	Pass. Max	Pass. Time	Pass. Min	Pass. Time
Neck Force	X	Newtons	57.5	172.4	-67.8	86.2
Neck Force	Y	Newtons	164.4	34.6	-23.5	8.1
Neck Force	Z	Newtons	88.8	16.2	-533.3	38.8
Neck Force Resultant	N/A	Newtons	548.3	37.0		
Neck Moment	X	Nm	11.1	79.2	-9.7	12.8
Neck Moment	Y	Nm	14.7	94.6	-3.1	163.8
Neck Moment	Z	Nm	2.8	9.2	-1.0	4.0
Neck Moment Resultant	N/A	Nm	17.5	93.0		

DATA SHEET NO. 1

TEST SUMMARY

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan NHTSA No.: M45111TWG2

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.) Test Date: 5/26/04

TEST DUMMY INFORMATION

Description	Passenger Seat Inboard Facing
Dummy Type / Serial No.	027
Head Contact	Yes - Top of Head
Chest Contact	No Contact
Abdomen Contact	No Contact
Pelvis	No Contact
Left Knee Contact	No Contact
Right Knee Contact	No Contact

16mm MOVIE COVERAGE

High Speed Film	2
High Speed Digital	1
Total	3

DATA CHANNELS

Child ATD Sensors	16
Belt Assessment Sensors	0
Vehicle Structure Accelerometers	0
Total	16

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan NHTSA No.: M45111TWG2

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.) Test Date: 5/26/04

TEST VEHICLE INFORMATION

Make	Lexus
Model	ES 330
Body Style	4- Door Sedan
NHTSA No.	M45111
VIN	JTHBA30G945021750
Color	Tan
Delivery Date	1/20/04
Odometer Reading (mile)	66
Dealer	Crown Lexus
Transmission	5 Speed Automatic
Final Drive	Front
Type/Number Cylinders	V-6
Engine Displacement (L)	3.3
Engine Placement	Transverse

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	Toyota Motor Corporation
Date of Manufacture	December-03

GVWR (kg)	2034
GAWR Front (kg)	1211
GAWR Rear (kg)	1211

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	357	357
Cold Pressure (kPa)	200	200
Recommend Tire Size	P215/60R16	P215/60R16
Tire Size on Vehicle	P215/R6016	P215/60R16
Tire Manufacturer	Bridgestone	Michelin

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bucket	None	
Number of Occupants	2	3	0	5
Capacity Wt. (VCW) (kg)				408
Cargo Weight (RCLW) (kg)				68

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

DATA SHEET NO. 3

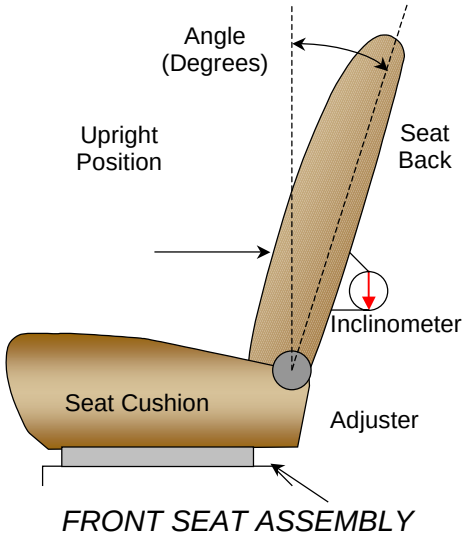
TEST VEHICLE INFORMATION

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan NHTSA No.: M45111TWG2

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.) Test Date: 5/26/04

NOMINAL DESIGN RIDING POSITION

The 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	3

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	240 mm	120 mm

DATA SHEET NO. 4

DUMMY POSITIONING INFORMATION

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan NHTSA No.: M45111TWG2

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.) Test Date: 5/26/04

TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Hybrid III 3-Year-Old Child Dummy	
		Length (mm)	Angle (^{o})
SA	Seat Back Angle		3
AMW	Airbag Module Width	50	
ABW	Airbag Width	450	
AML	Airbag Module Length	205	
ABL	Airbag Length	370	
HD	Head CG to Door Panel/ Window	160	
HSC	Head to Seat Back Centerline	400	
HB	Head to B-Pillar	290	
HZ	Head to Roof (Z)		
HHD	Head to Header	125	
CD	Chest to Dash	500	
CS	Chest to Seatback	230	
RACL	Right Arm to Seatback Centerline		
RA	Right Arm to Door Panel		
KK	Kne to Knee	110	
TT	Toe to Toe	85	
KSCR	Right Knee to Seat Cuhion Centerline		
TSCR	Right Toe to Seat Cushion Centerline		

DATA SHEET NO. 6

CAMERA LOCATIONS

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan NHTSA No.: M45111TWG2

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.) Test Date: 5/26/04

No.	Camera View	Location (mm)			Angle (Deg.)	Lens (mm)	Speed (fps)
		X	Y	Z			
1	High Speed Film Side View	200	2730	80	0.0	24	900
2	High Speed Film Front View	50	1490	520	1.0	8.75	1020
3	High Speed Digital Side View	320	2960	100	16.0	25	1000

* Cameras aligned to center of seat back as reference.

APPENDIX A

PHOTOGRAPHS

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

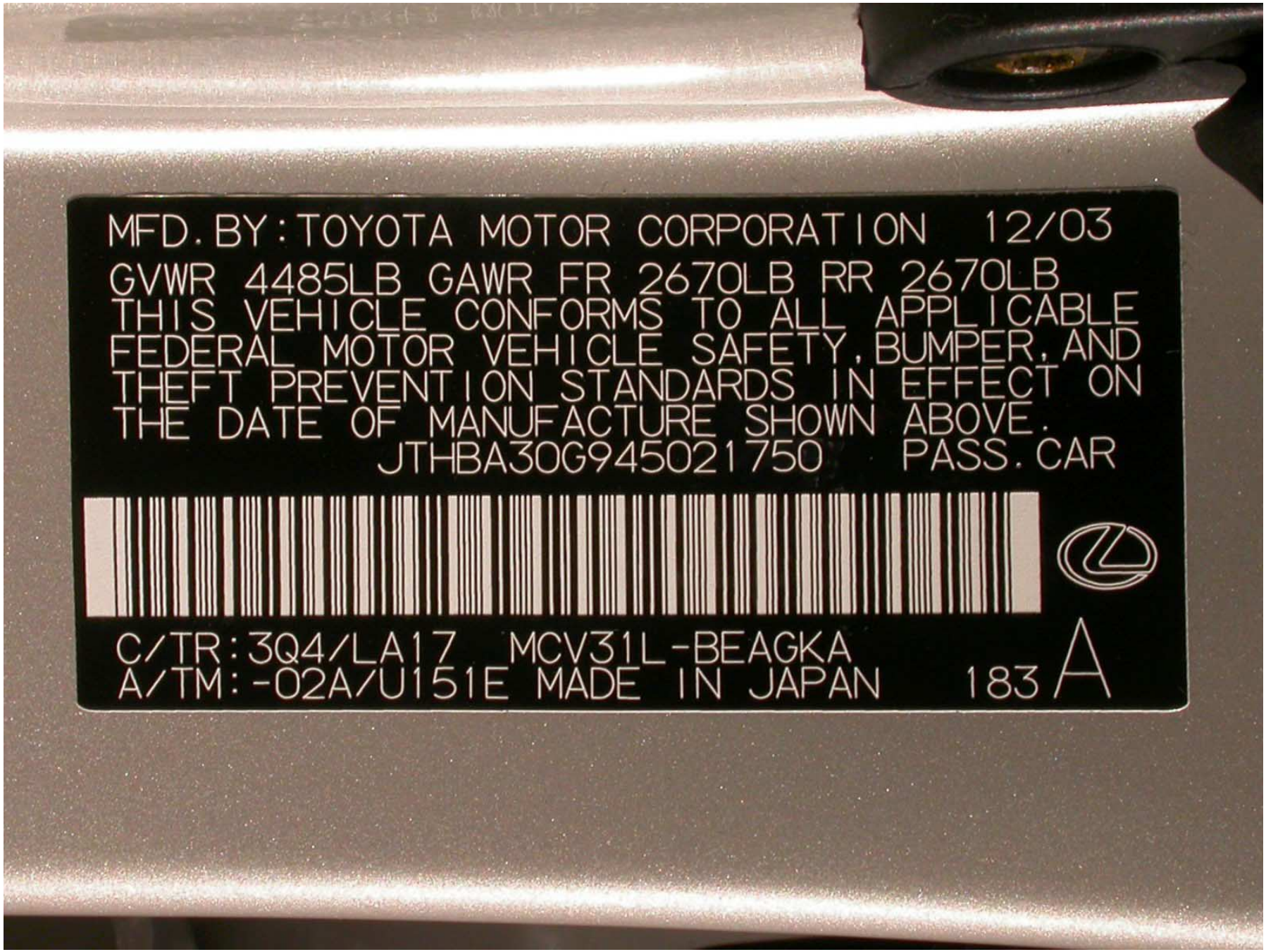


Figure A-2: Vehicle Certification Label

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

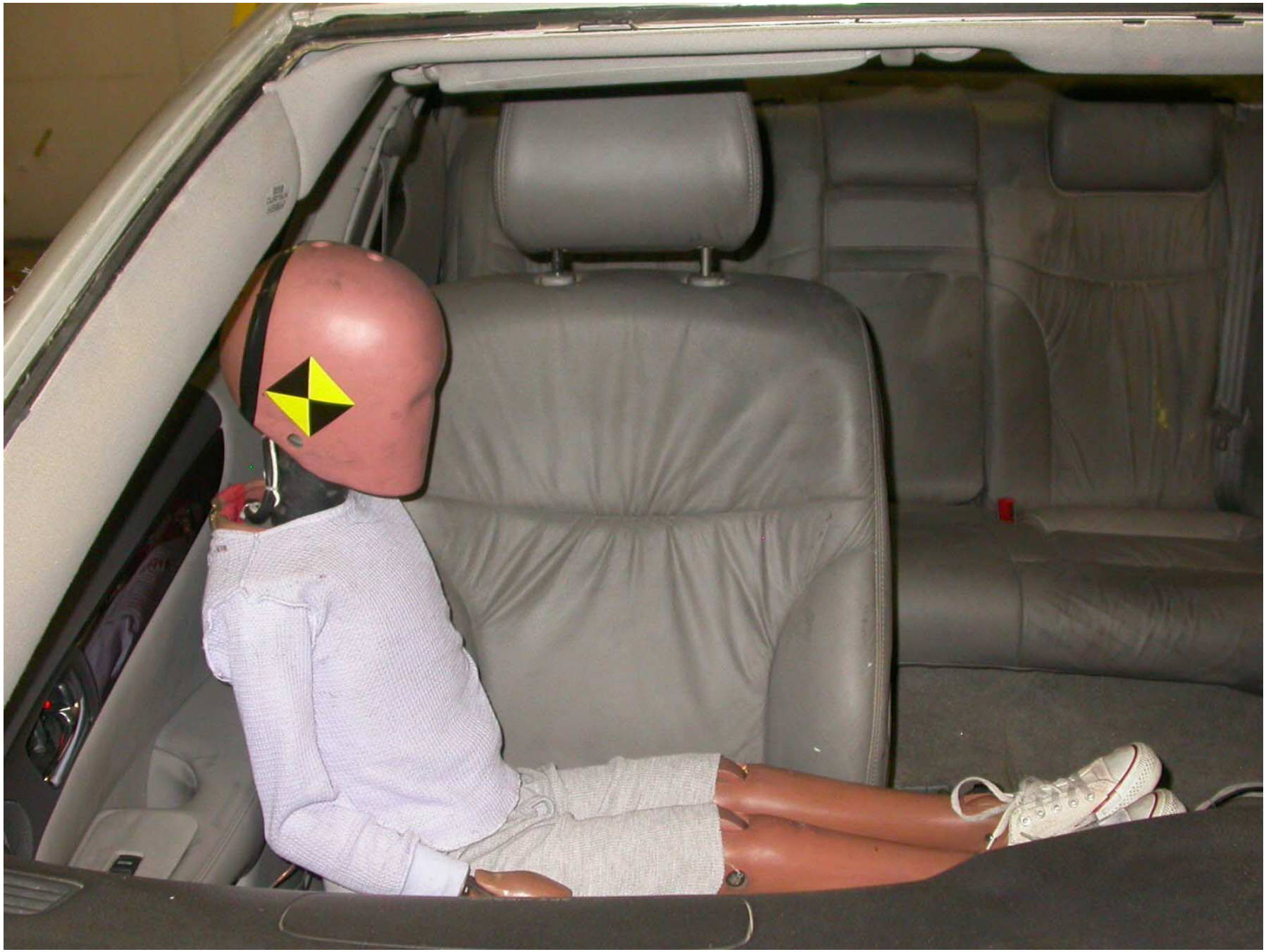


Figure A-7: Pre-Test Dummy Position, Full Front View

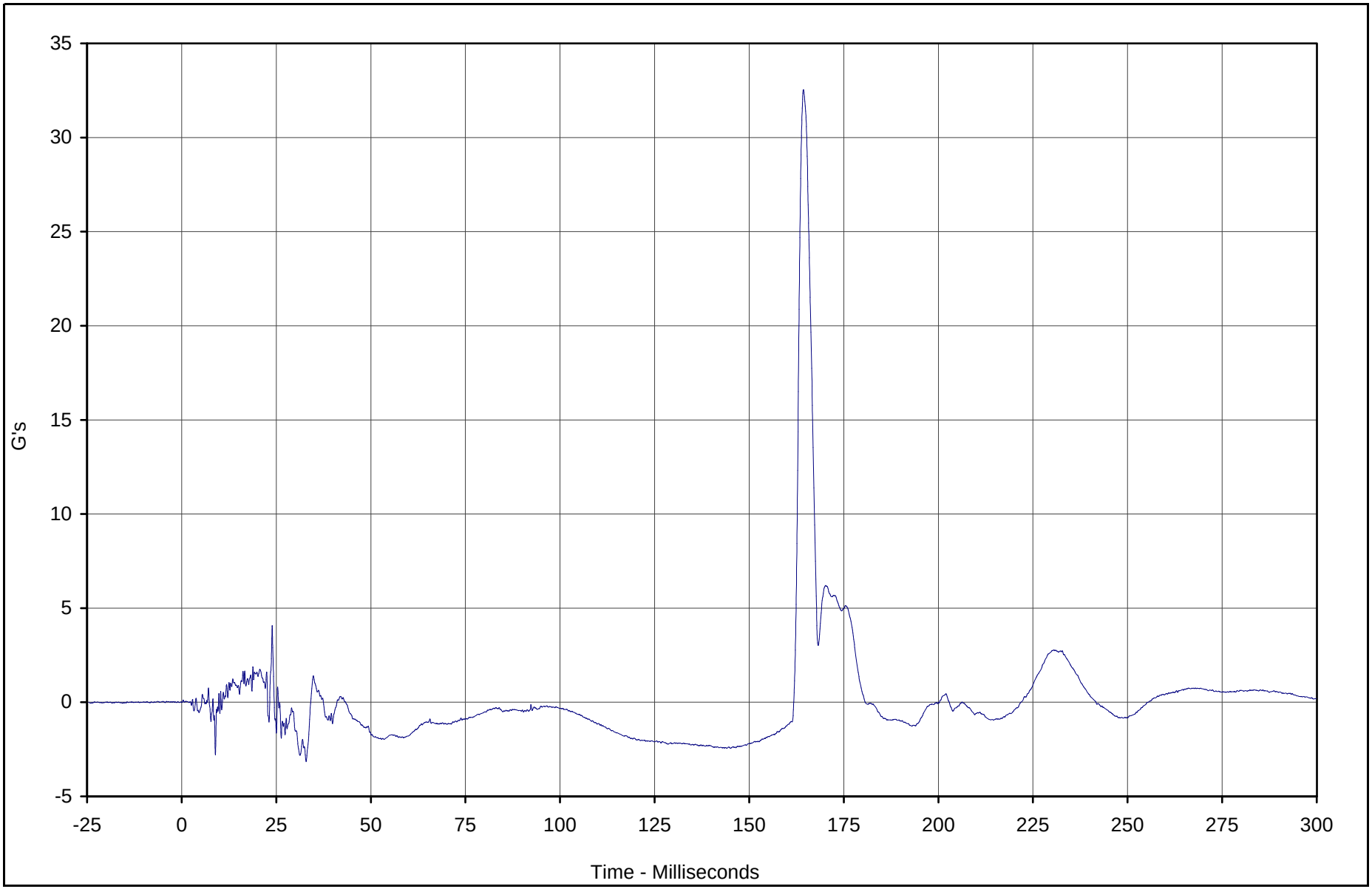
Figure A-8: Post-Test Dummy Position and Airbag, Left View

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

Figure A-10: Post-Test Airbag, Left Side Close-up View

APPENDIX B

DATA PLOTS



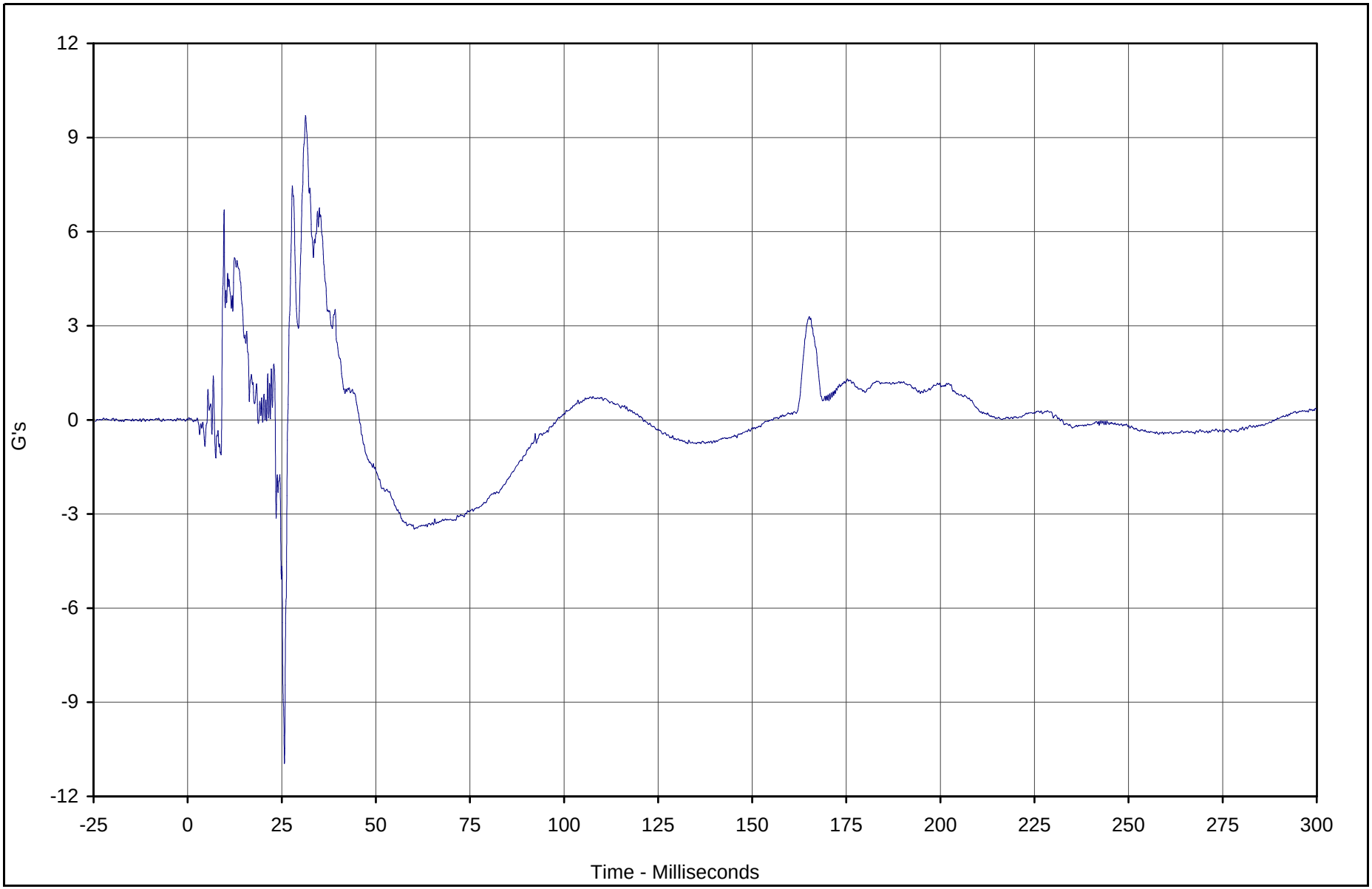
Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Head X	001	FIL	G's	32.5	164.4	-3.2	32.9	1000

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



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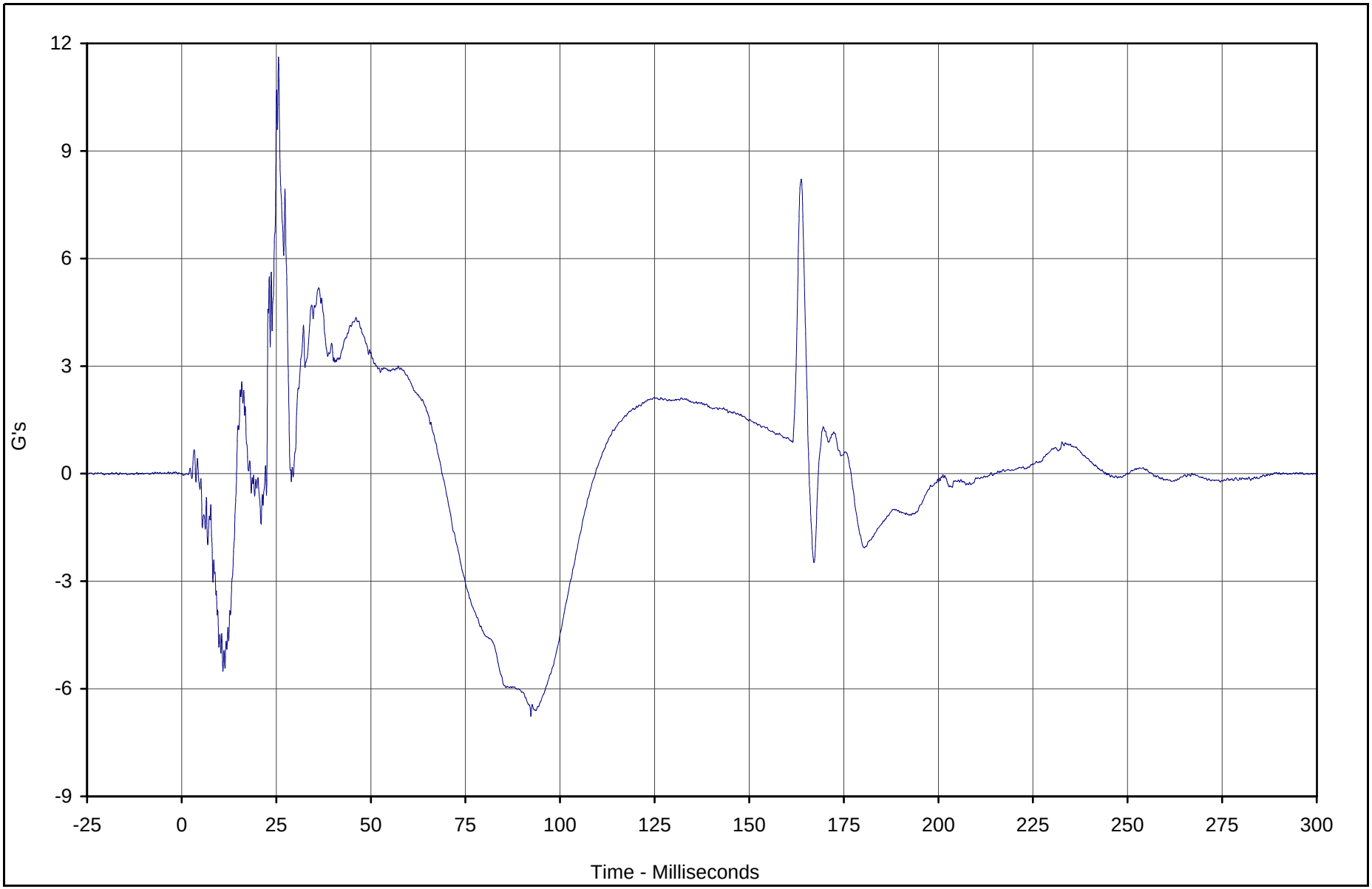
Pass. Head Y	002	FIL	G's	9.7	31.3	-10.9	25.7	1000

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



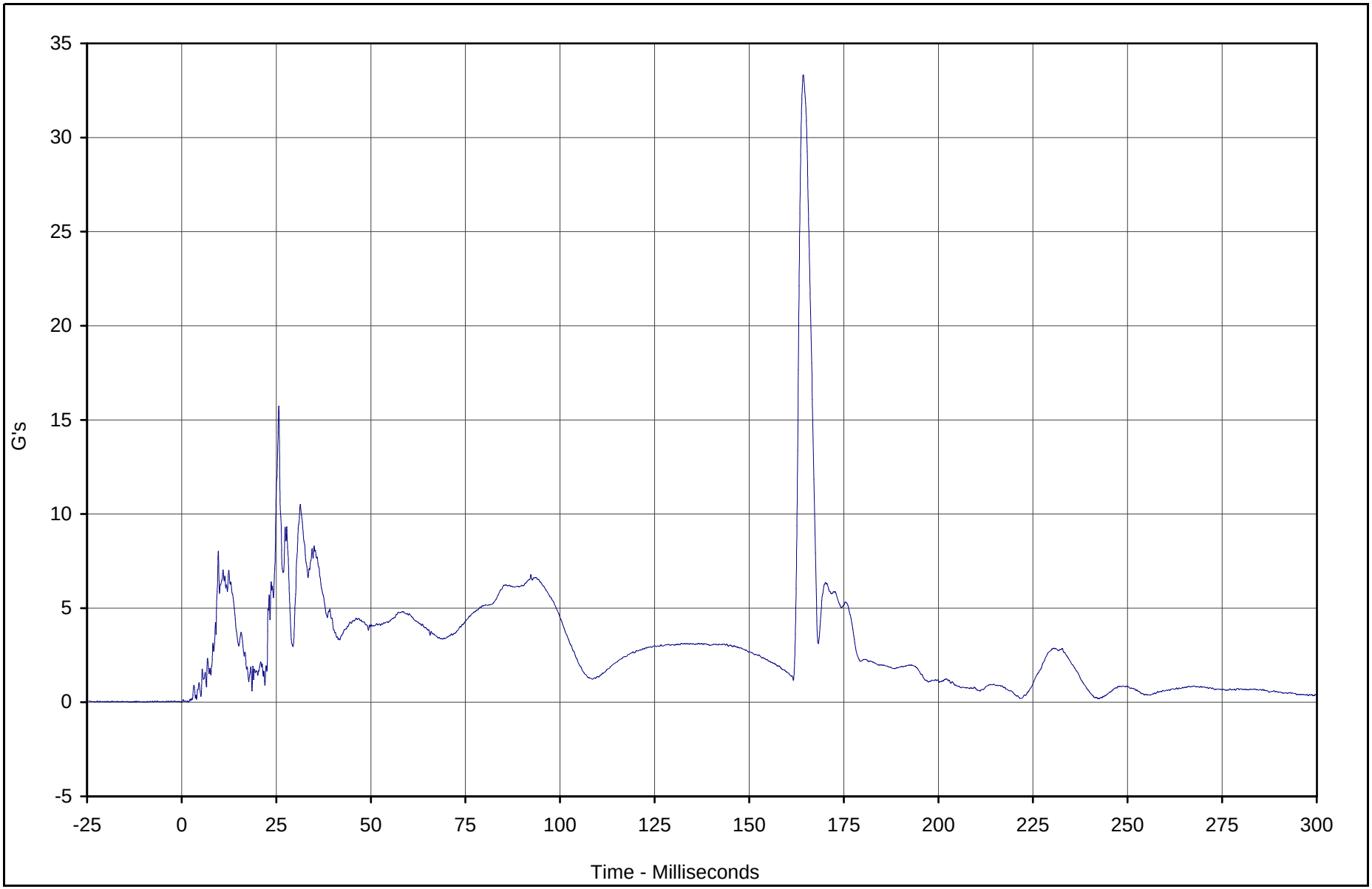
Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Head Z	003	FIL	G's	11.6	25.6	-6.8	92.3	1000

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



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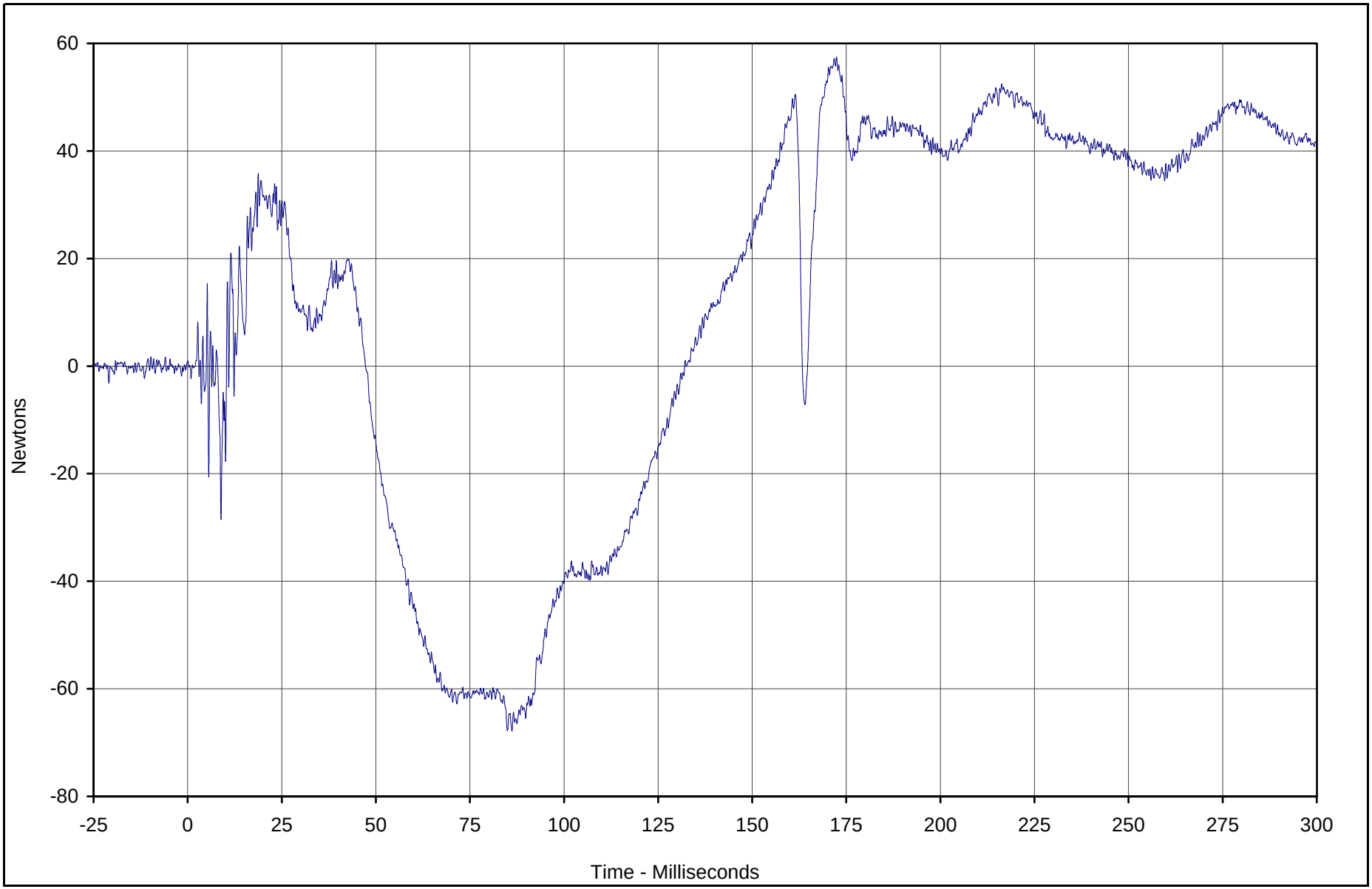
Pass. Head Resultant	001	RES	G's	33.3	164.3	0.0	0.1	1000

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



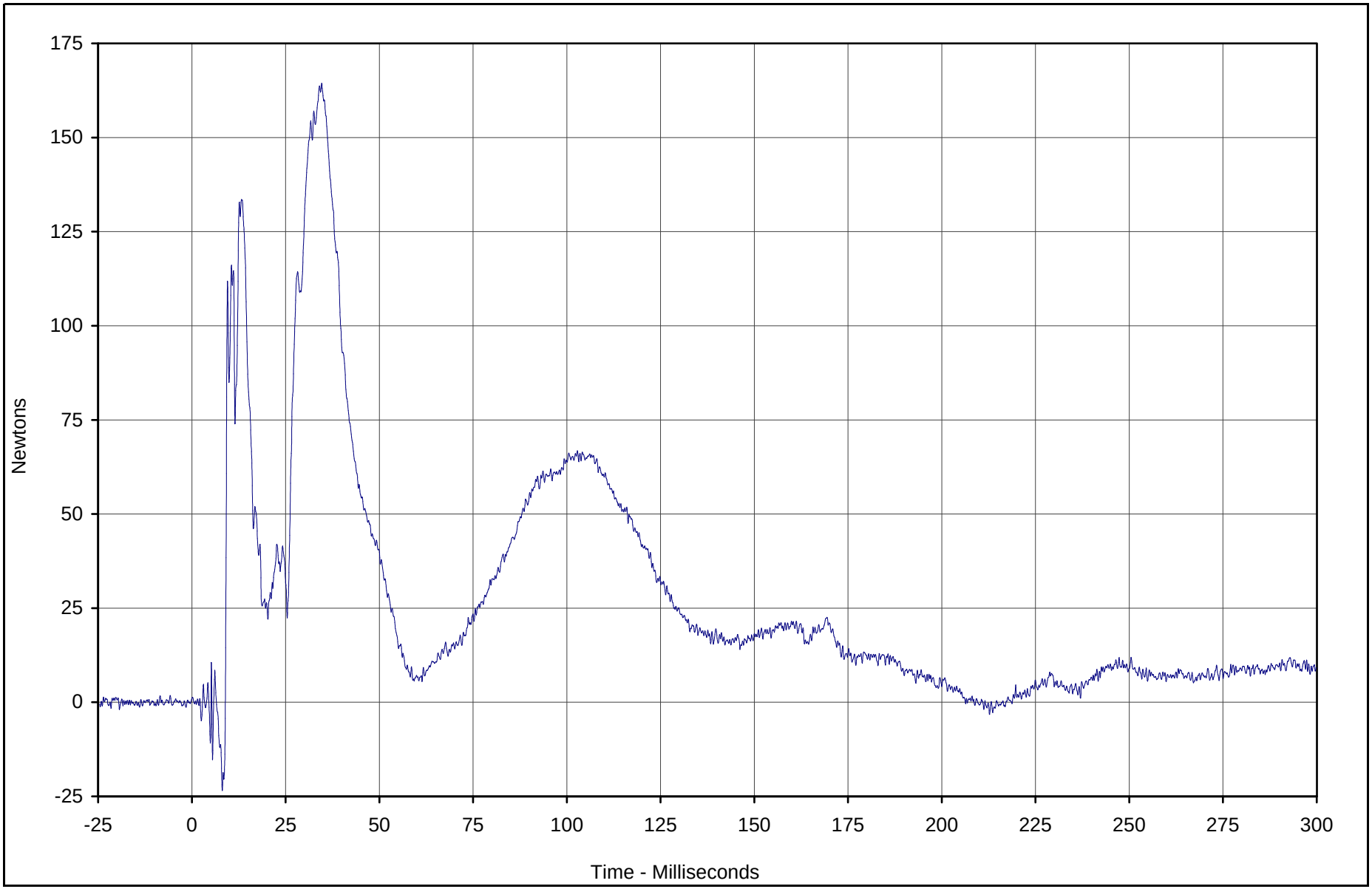
Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Upper Neck Force X	004	FIL	Newtons	57.5	172.4	-67.8	86.2	1000

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Upper Neck Force Y	005	FIL	Newtons	164.4	34.6	-23.5	8.1	1000

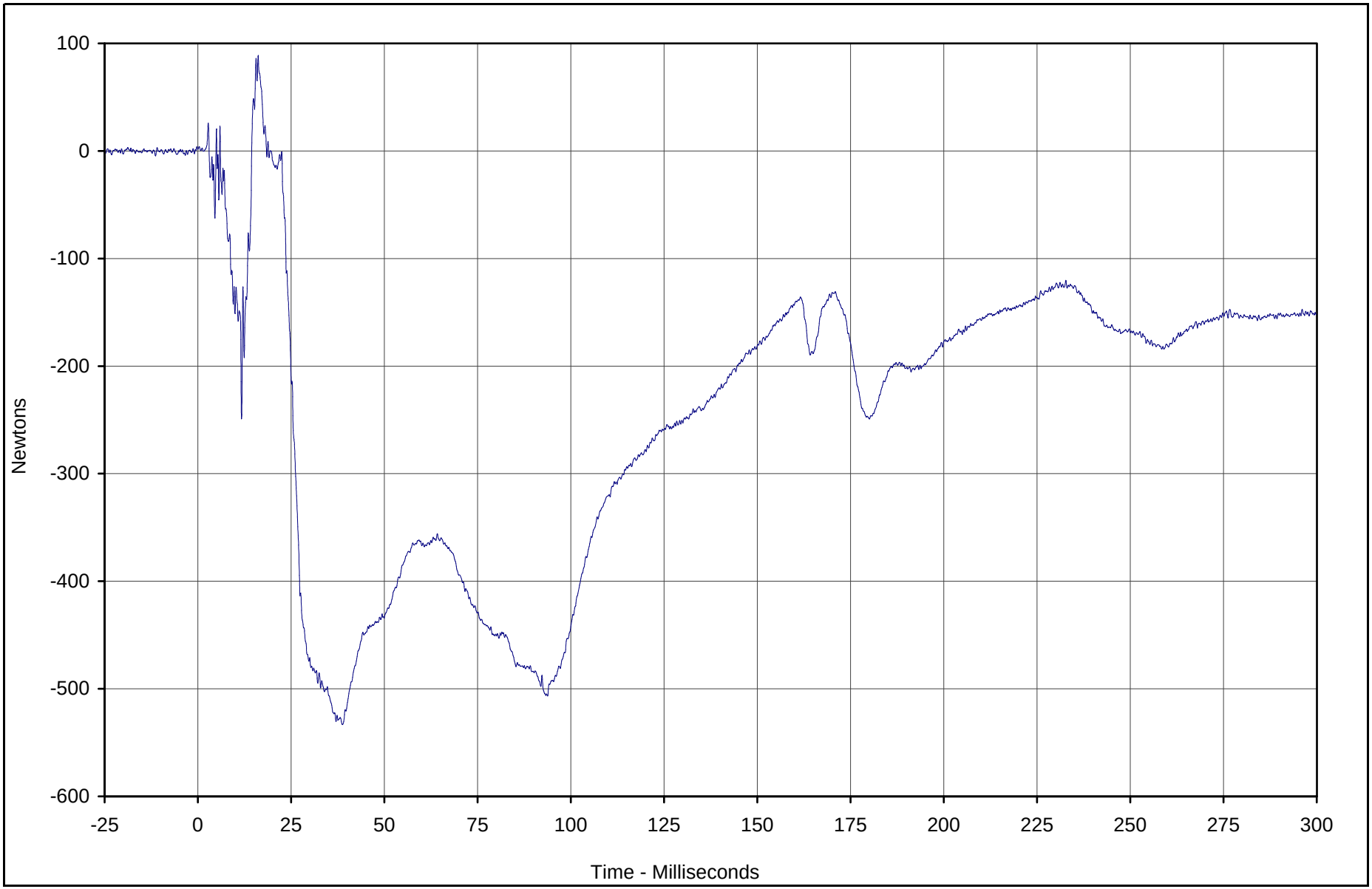
KARCO Engineering

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



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Pass. Upper Neck Force Z	006	FIL	Newtons	88.8	16.2	-533.3	38.8	1000

KARCO Engineering

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

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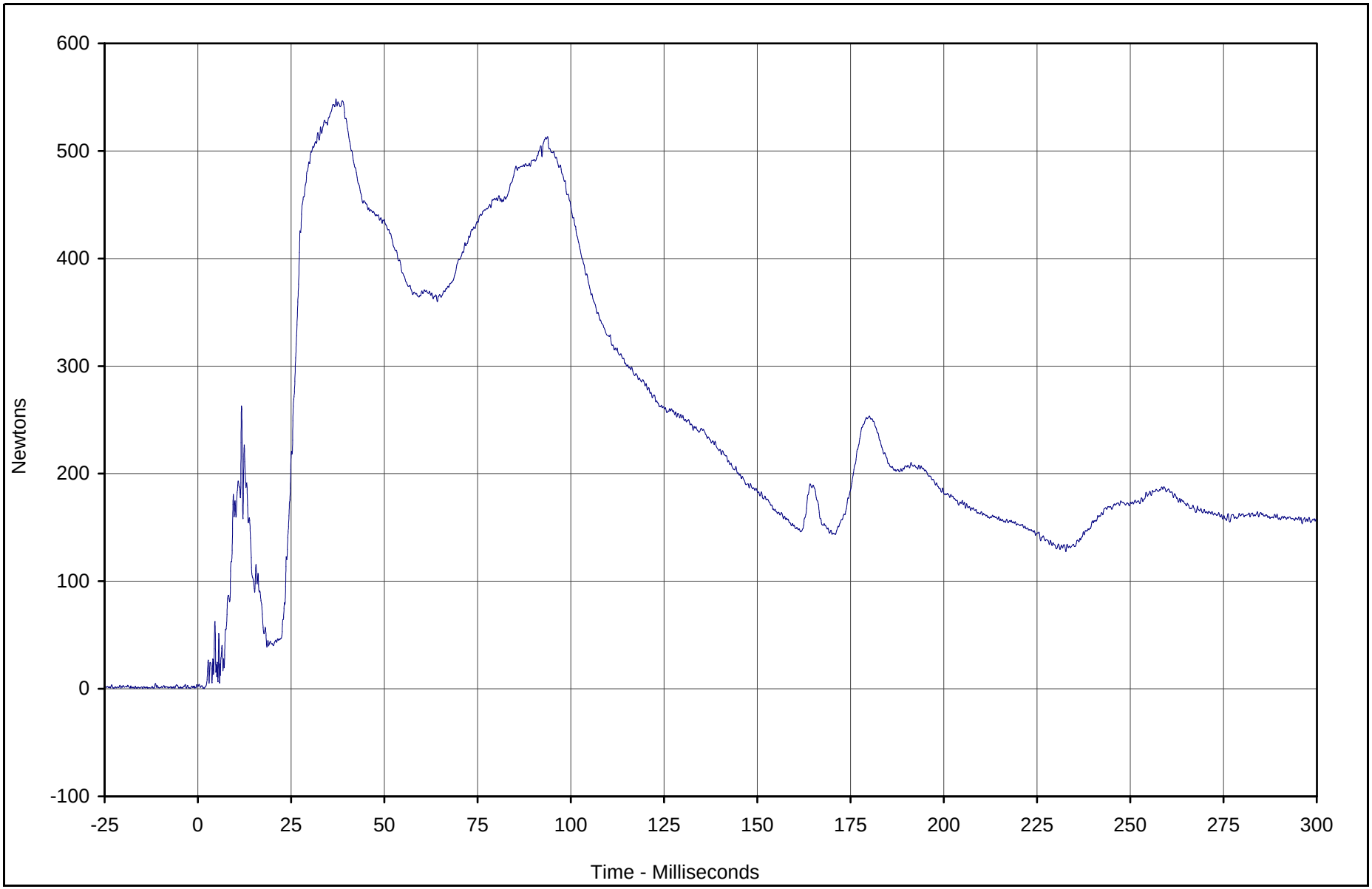

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Upper Neck Force Res.	004	RES	Newtons	548.3	37.0	0.2	1.7	1000

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

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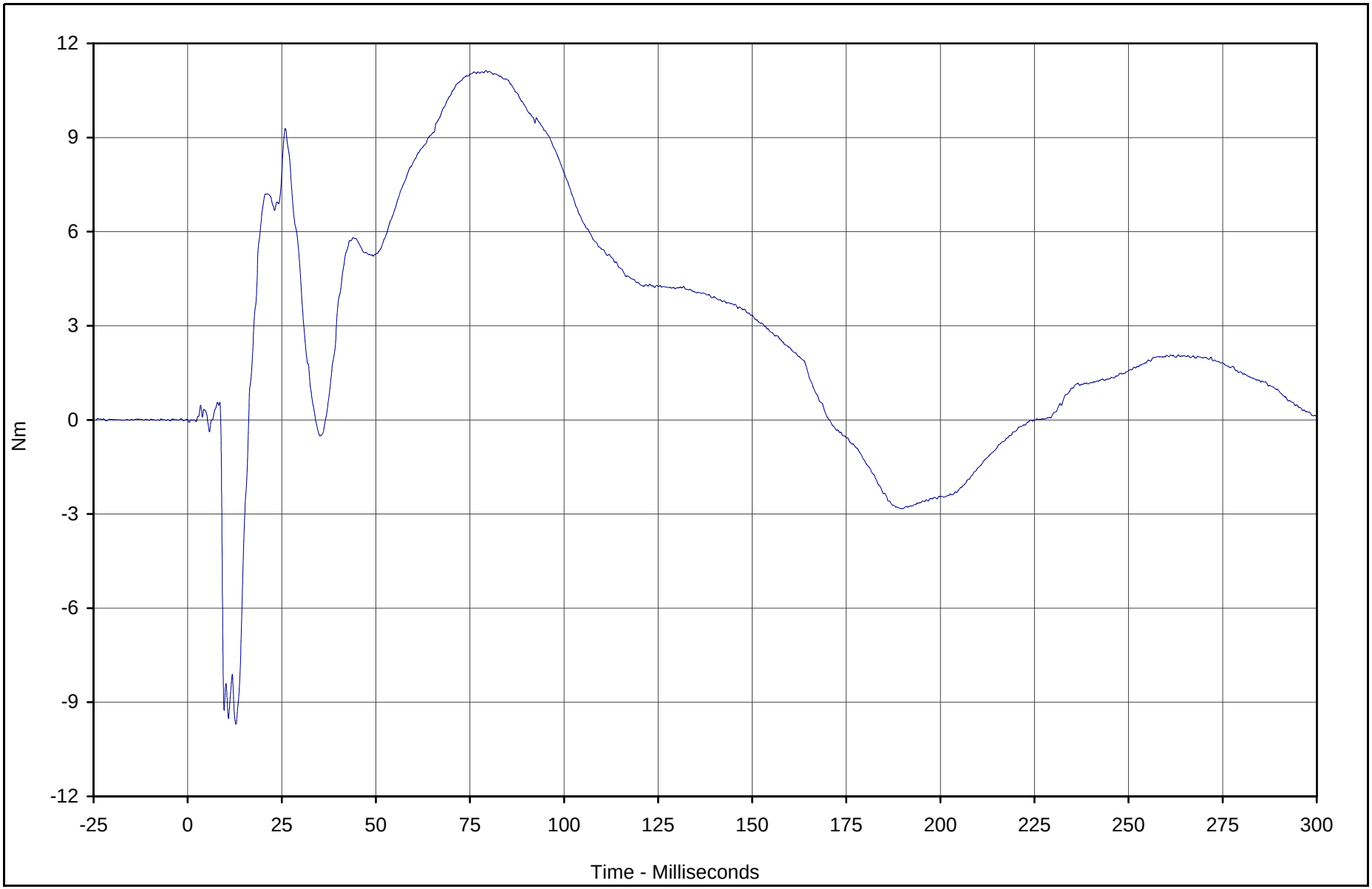


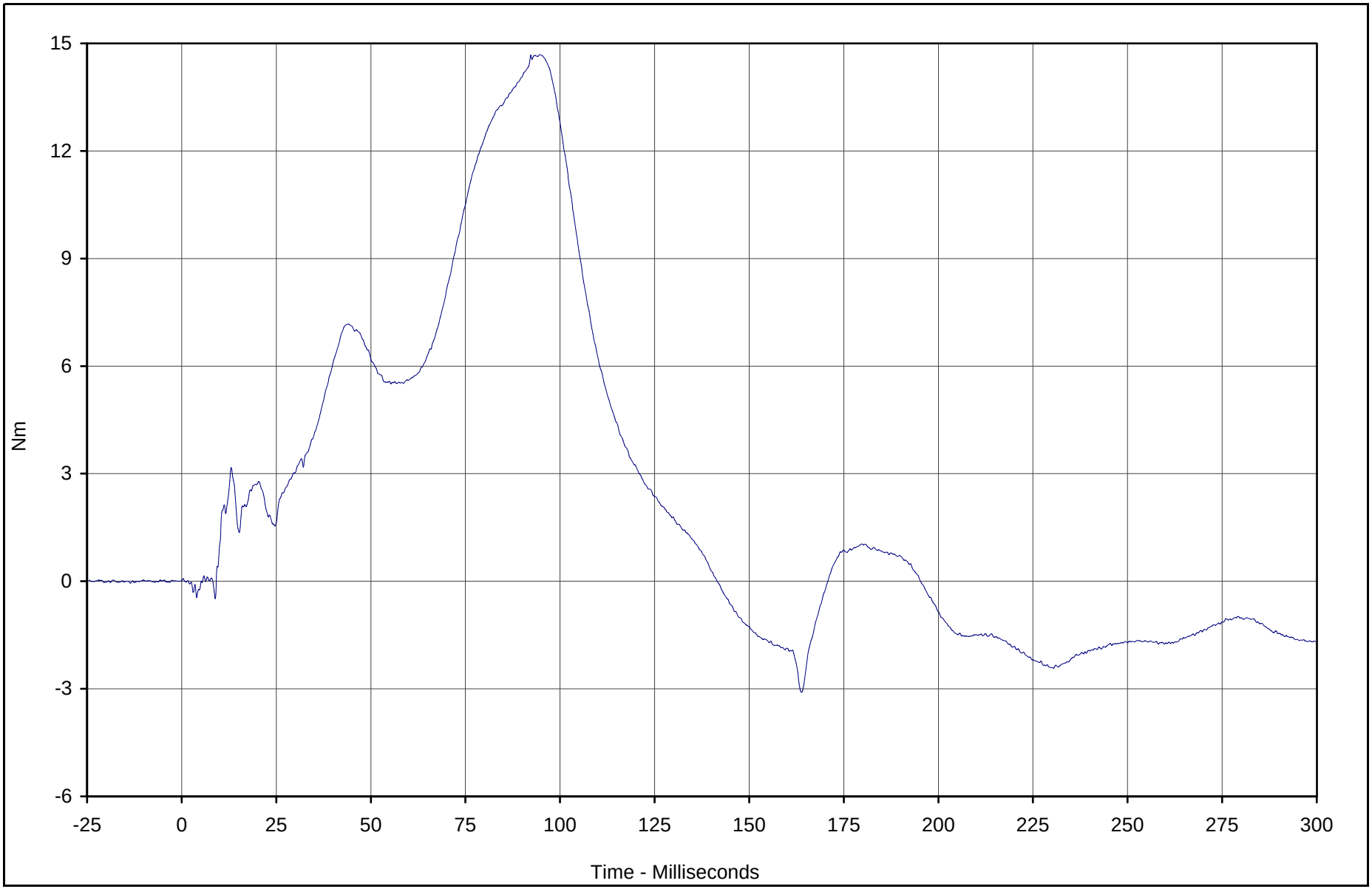
Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Upper Neck Moment X	007	FIL	Nm	11.1	79.2	-9.7	12.8	600

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



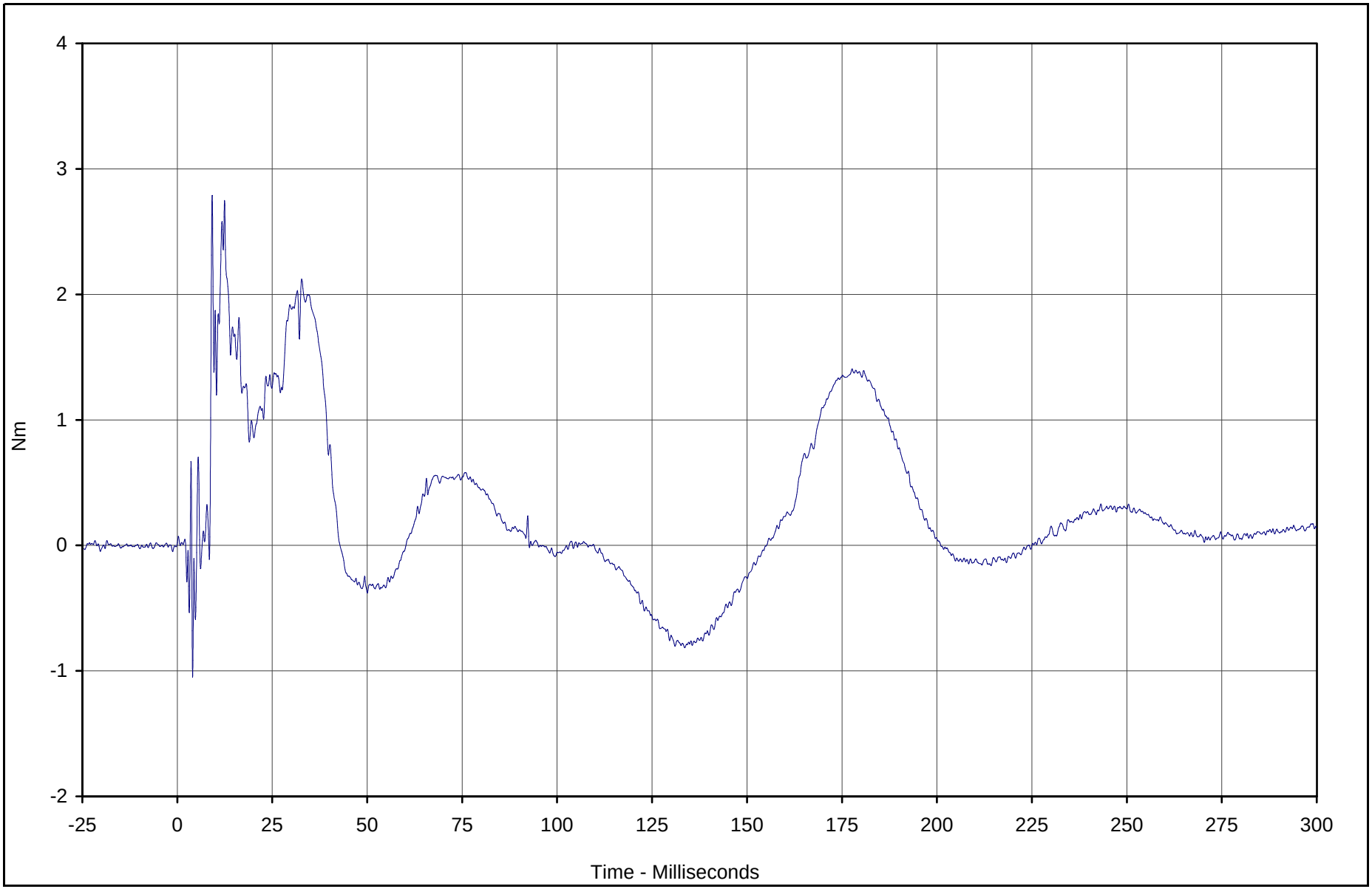
Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Upper Neck Moment Y	008	FIL	Nm	14.7	94.6	-3.1	163.8	600

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Upper Neck Moment Z	009	FIL	Nm	2.8	9.2	-1.0	4.0	600

KARCO Engineering

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

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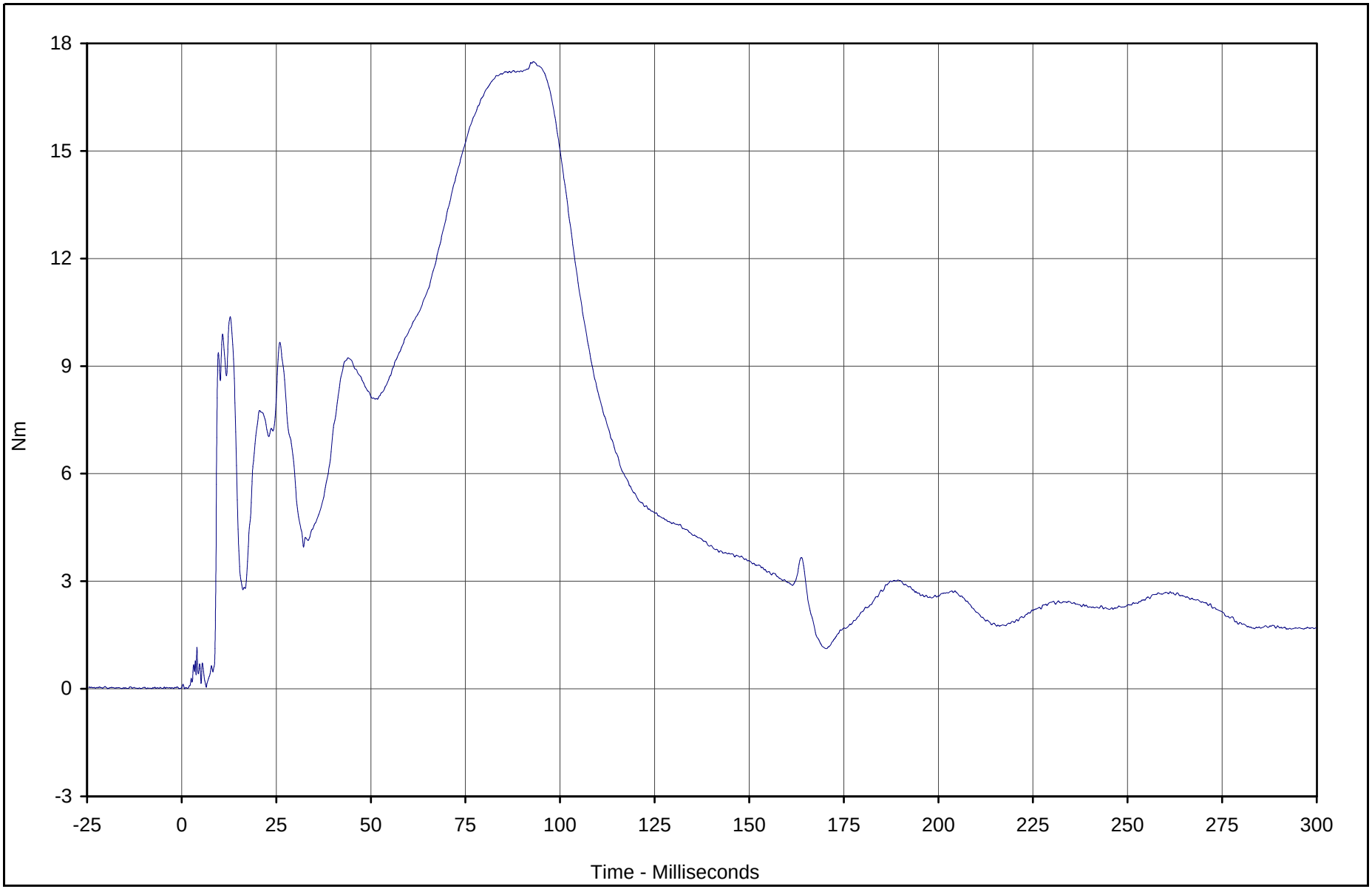
NHTSA No.: M45111TWG2



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Upper Neck Moment Res.	007	RES	Nm	17.5	93.0	0.0	0.8	600

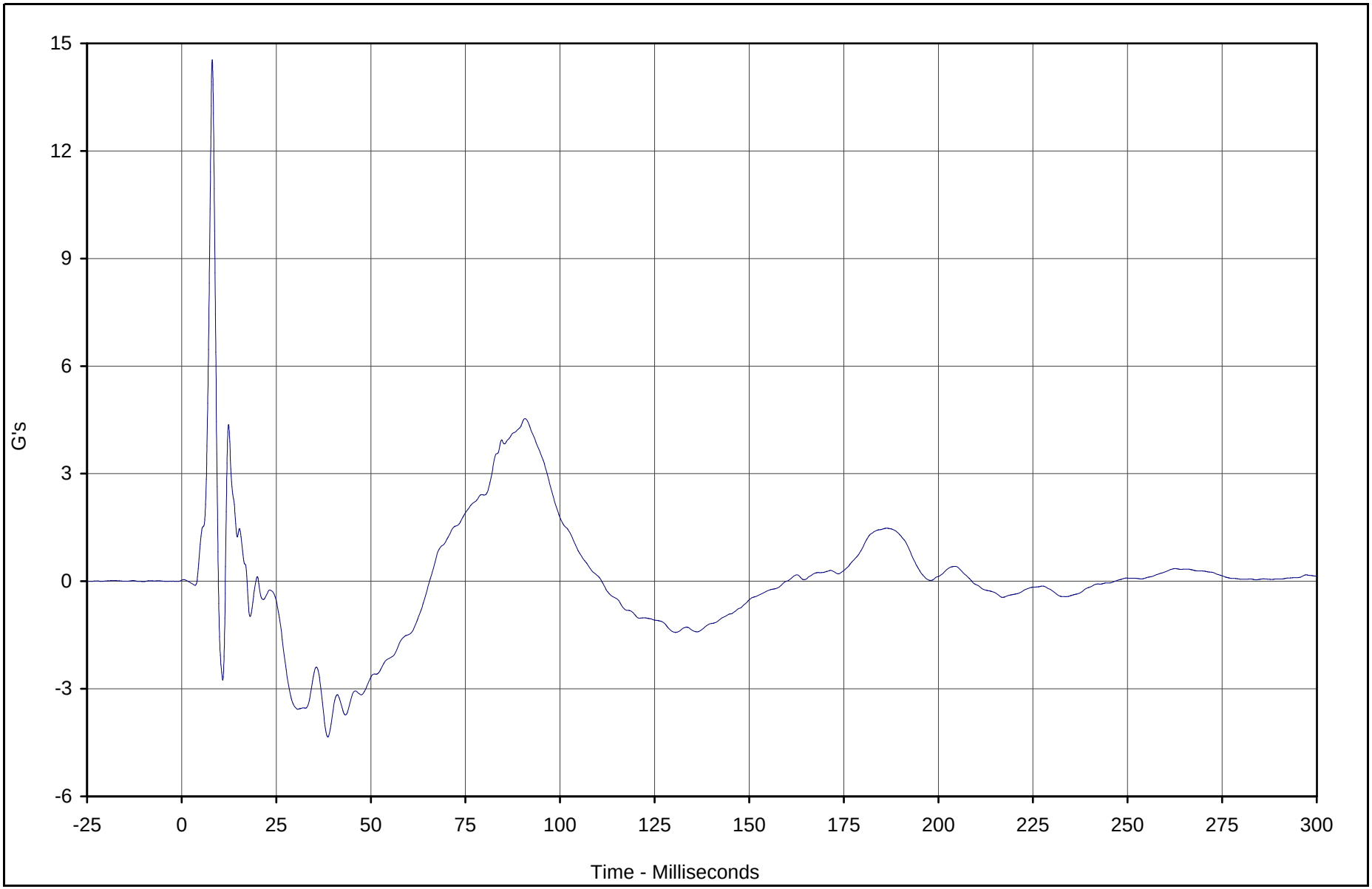
KARCO Engineering

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



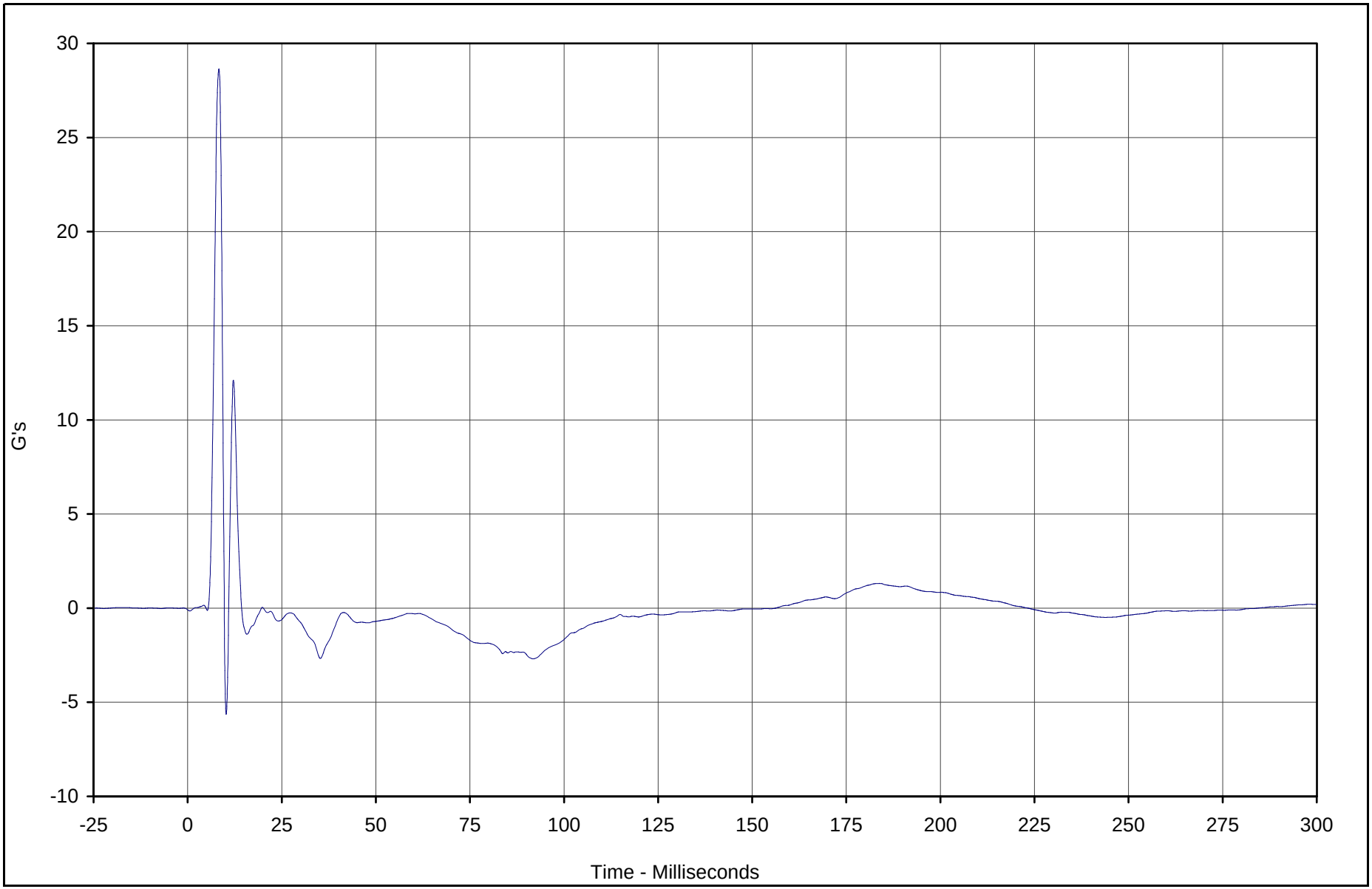
Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Chest X	010	FIL	G's	14.5	8.1	-4.3	38.6	180

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Chest Y	011	FIL	G's	28.6	8.3	-5.6	10.2	180

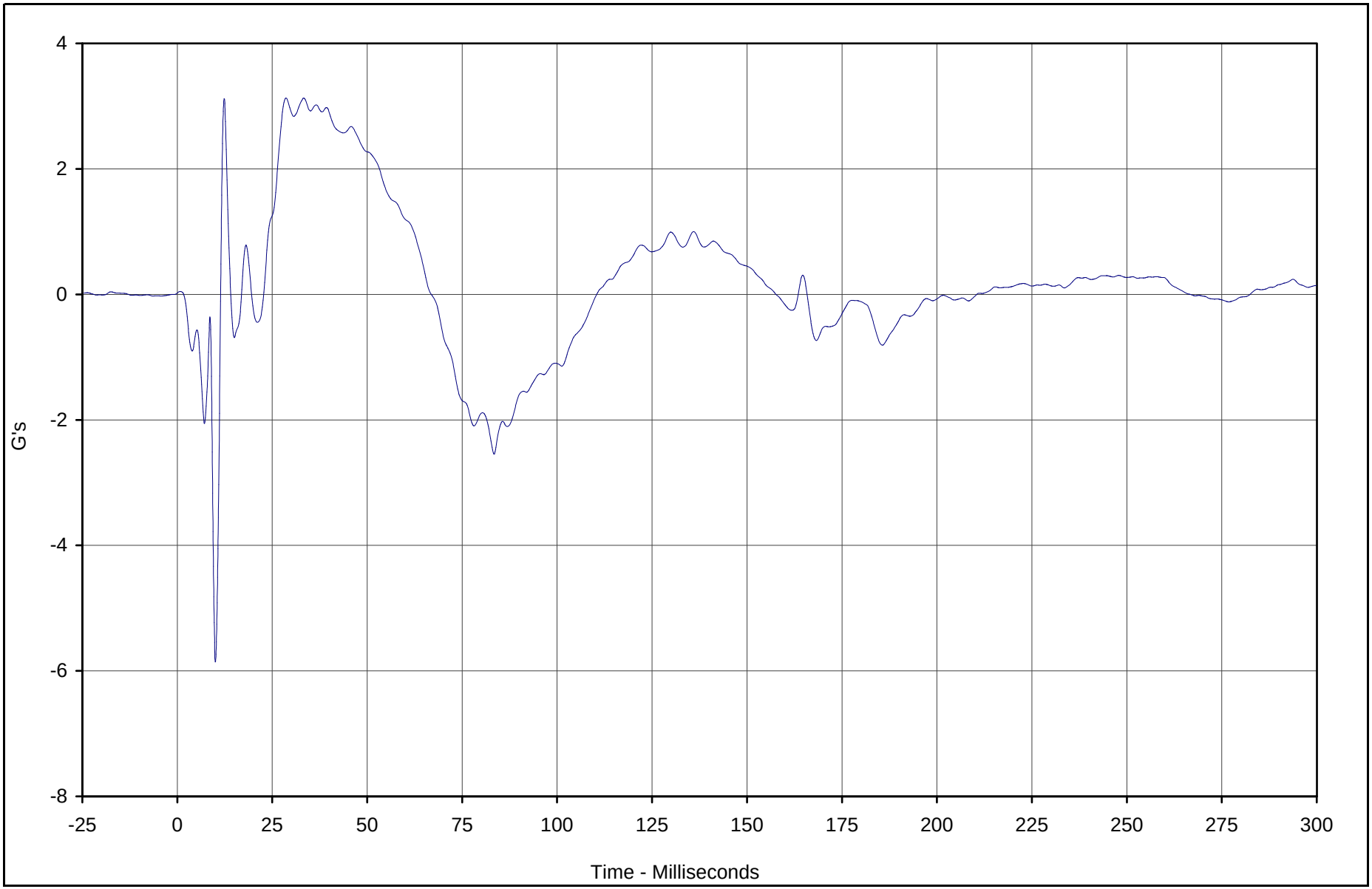
KARCO Engineering

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Chest Z	012	FIL	G's	3.1	28.6	-5.9	10.0	180

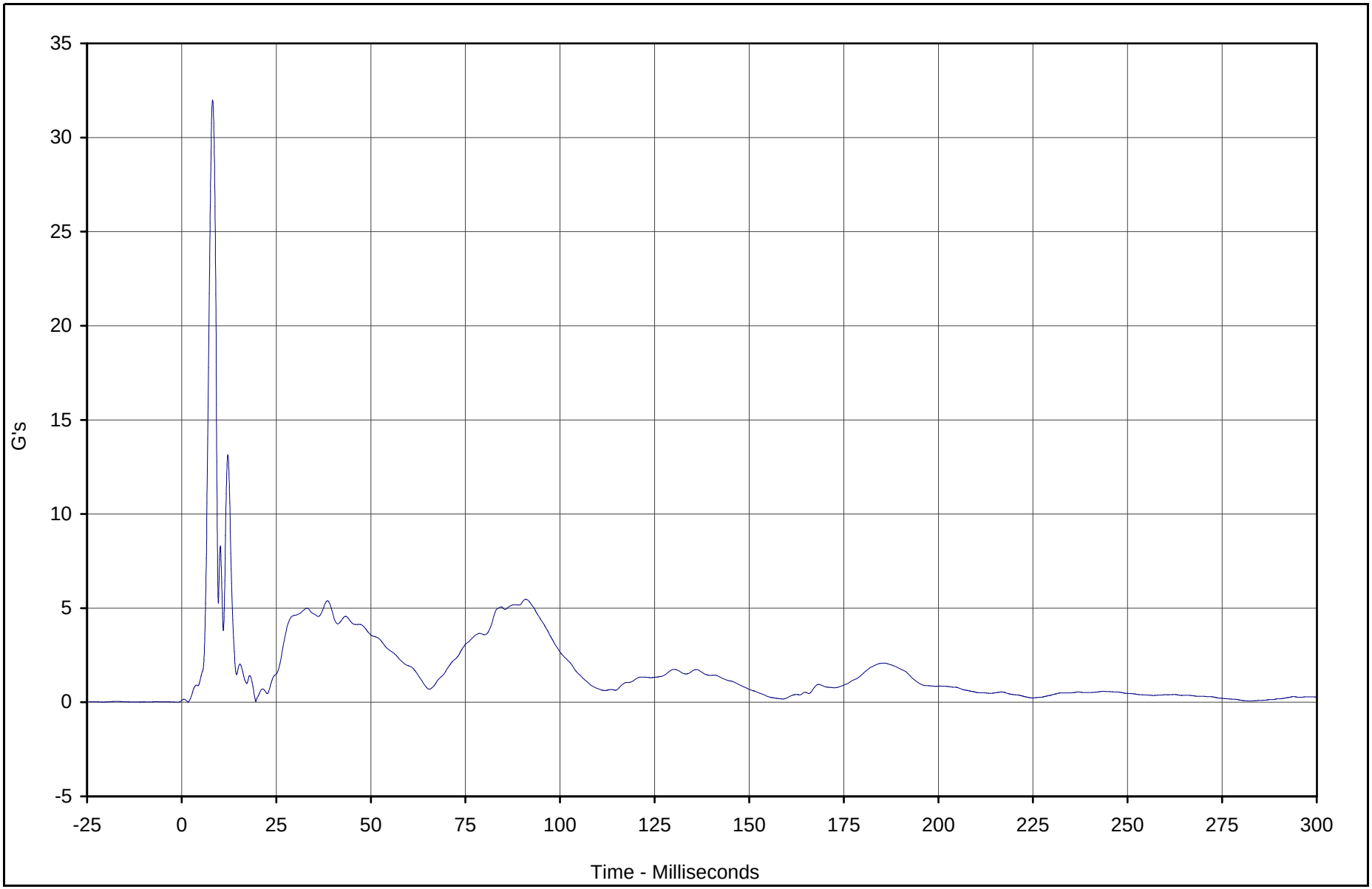
KARCO Engineering

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Chest Resultant	010	RES	G's	32.0	8.2	0.0	1.7	180

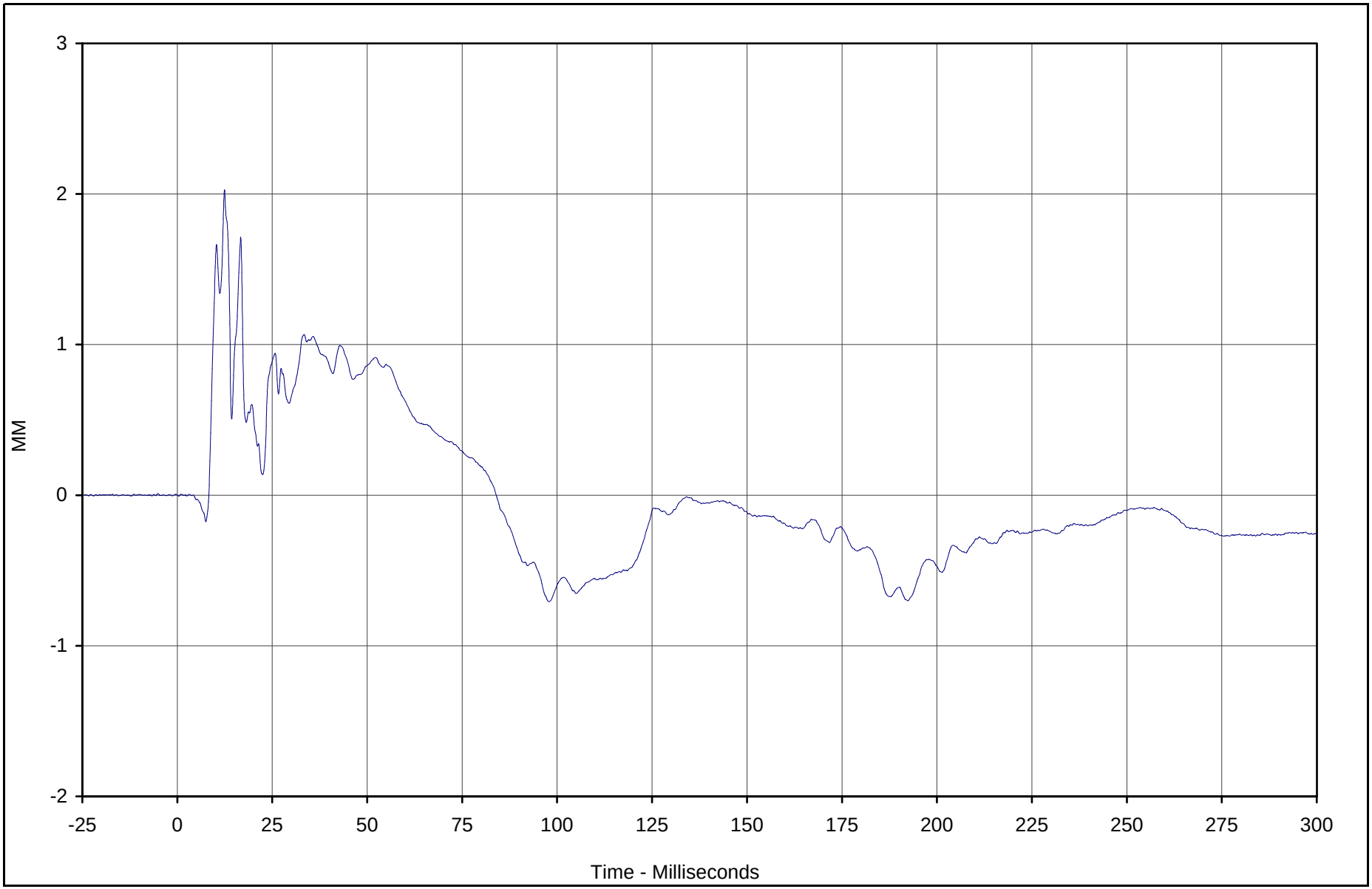
KARCO Engineering

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



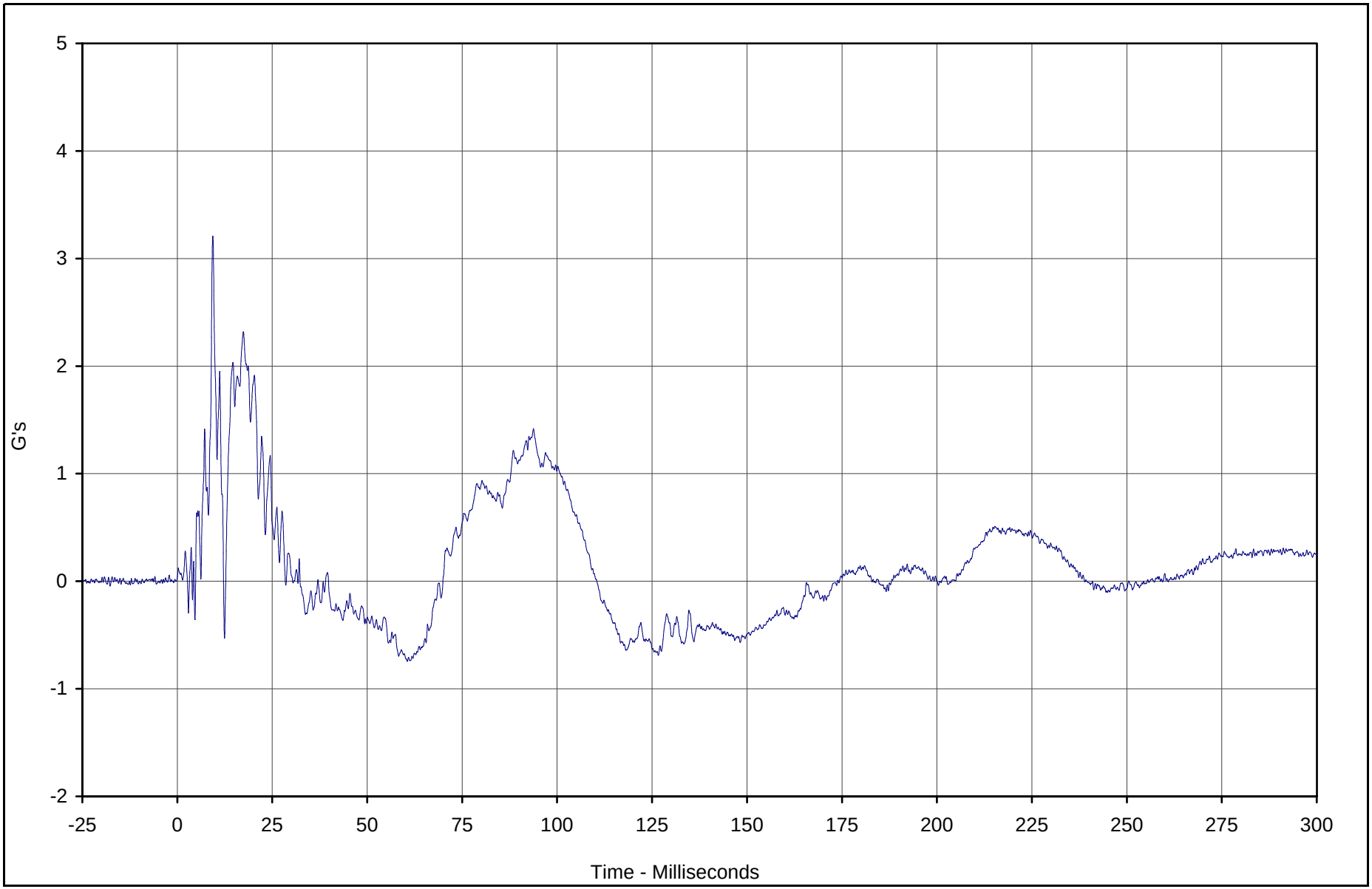
Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Chest Deflection	013	FIL	MM	2.0	12.4	-0.7	97.8	600

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



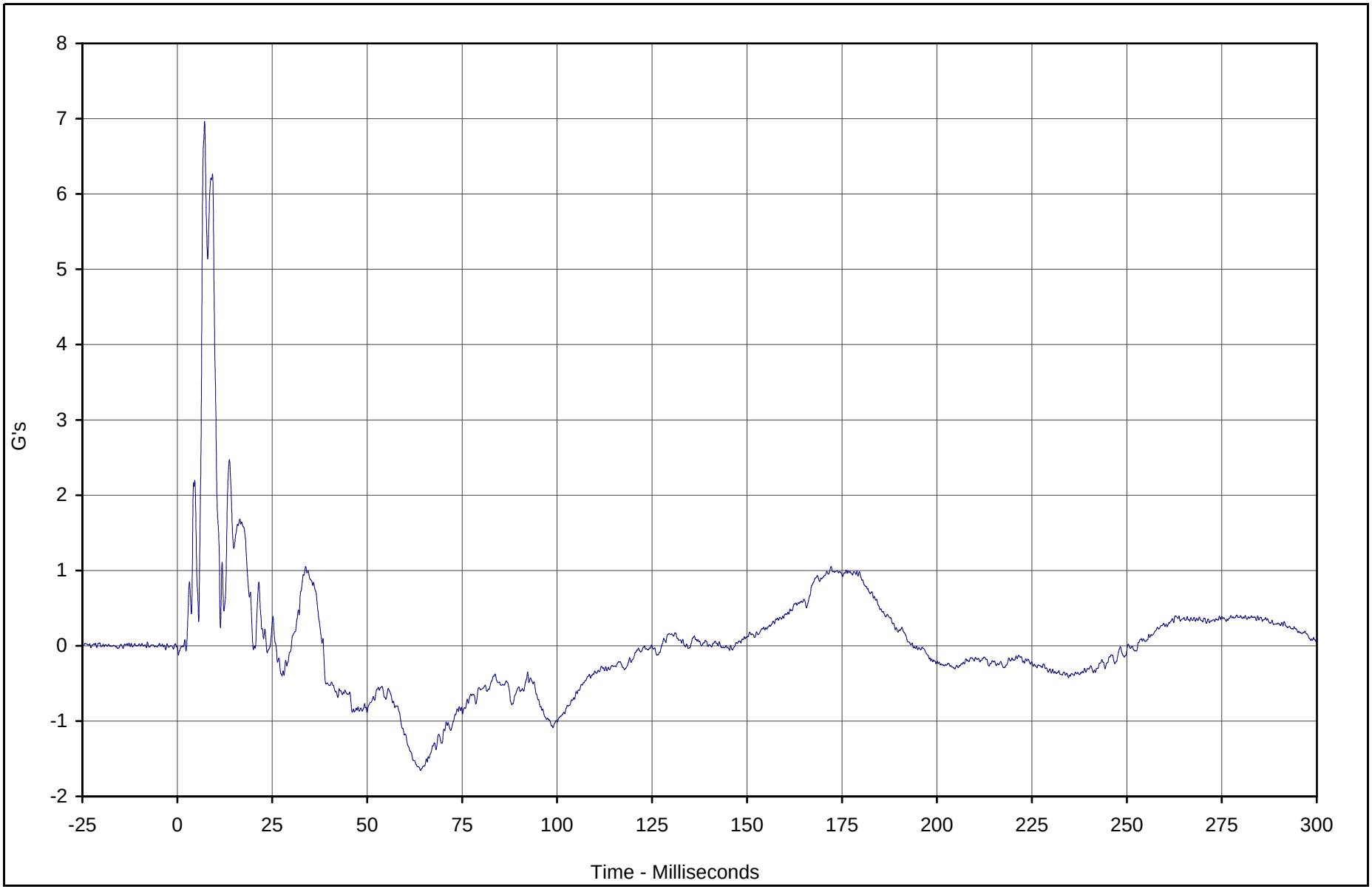
Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Pelvis X	014	FIL	G's	3.2	9.3	-0.7	60.6	1000

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



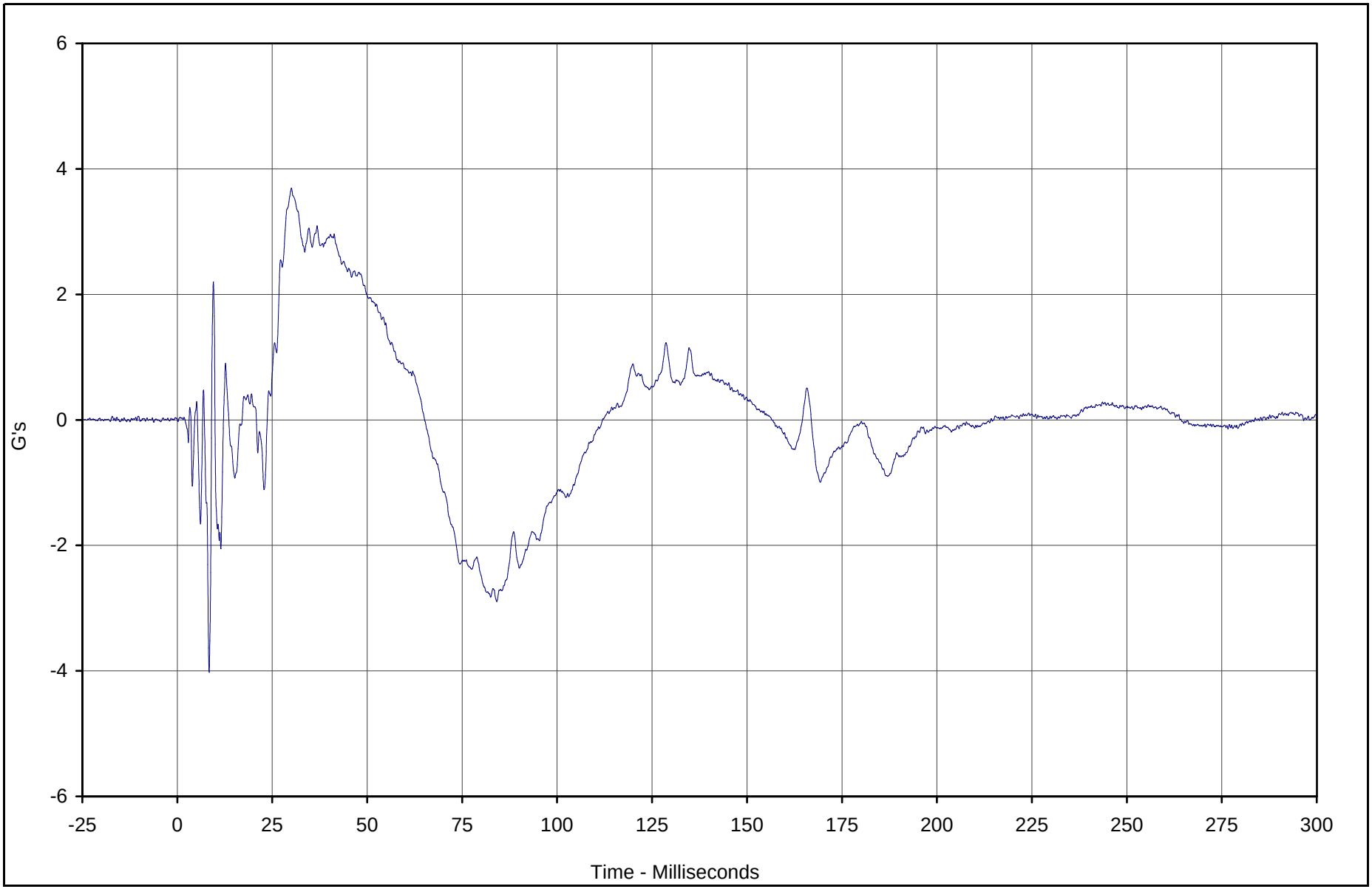
Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Pelvis Y	015	FIL	G's	7.0	7.2	-1.7	64.0	1000

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Pelvis Z	016	FIL	G's	3.7	30.0	-4.0	8.4	1000

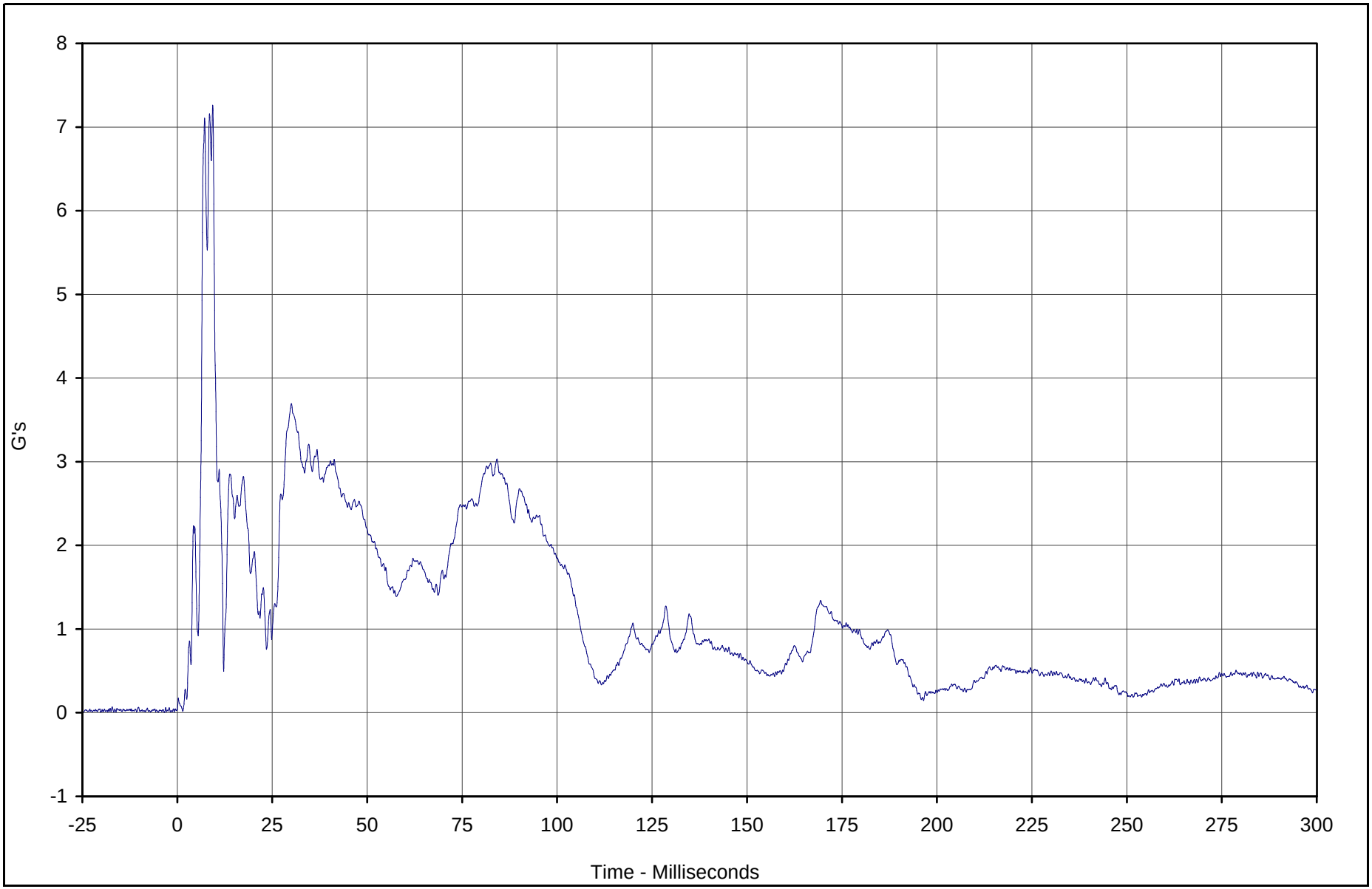
KARCO Engineering

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Pass. Pelvis Resultant	014	RES	G's	7.3	9.3	0.0	1.4	1000

KARCO Engineering

Test Vehicle: 2004 Lexus ES 330 4 Door Sedan

Test Date: 5/26/04

Test Program: TWG Testing (Inboard Facing Hybrid III 6 Yr.)

NHTSA No.: M45111TWG2

APPENDIX C

INSTRUMENTATION DATA CHANNEL ASSIGNMENTS

TWG Testing (Inboard Facing Hybrid III 6 Yr.)
Instrumentation Data Channel Assignments
A.T.D. Serial Number 027
5/26/04
2004 Lexus ES 330 4 Door Sedan

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
1	HEAD, PRIMARY	X	027HDX	Accel.,1/2 bridge	Endevco	7264-2000	G
2	HEAD, PRIMARY	Y	027HDY	Accel.,1/2 bridge	Endevco	7264-2000	G
3	HEAD, PRIMARY	Z	027HDZ	Accel.,1/2 bridge	Endevco	7264-2000	G
4	UPPER NECK FORCE	X	027UNFX	Load cell, six axis neck	R. A. Denton	IF-234	N
5	UPPER NECK FORCE	Y	027UNFY	Load cell, six axis neck	R. A. Denton	IF-234	N
6	UPPER NECK FORCE	Z	027UNFZ	Load cell, six axis neck	R. A. Denton	IF-234	N
7	UPPER NECK MOMENT	X	027UNMX	Load cell, six axis neck	R. A. Denton	IF-234	Nm
8	UPPER NECK MOMENT	Y	027UNMY	Load cell, six axis neck	R. A. Denton	IF-234	Nm
9	UPPER NECK MOMENT	Z	027UNMZ	Load cell, six axis neck	R. A. Denton	IF-234	Nm
10	CHEST , PRIMARY	X	027CHX	Accel., Full Bridge	Entran	2000JF	G
11	CHEST , PRIMARY	Y	027CHY	Accel., Full Bridge	Entran	2000JF	G
12	CHEST , PRIMARY	Z	027CHZ	Accel., Full Bridge	Entran	2000JF	G
13	CHEST DISPLACEMENT	X	027CP	Rotary Pot Chest	Servo	14CBI	MM
14	PELVIS, PRIMARY	X	027PELX	Accel., Full Bridge	Entran	2000JF	G
15	PELVIS, PRIMARY	Y	027PELY	Accel., Full Bridge	Entran	2000JF	G
16	PELVIS, PRIMARY	Z	027PELZ	Accel., Full Bridge	Entran	2000JF	G