

**REPORT NUMBER KAR22001-19**

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

**HYUNDAI MOTOR COMPANY  
2002 HYUNDAI SONATA  
4 DOOR SEDAN**

**NHTSA NUMBER: M20505**

**PREPARED BY:  
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**JULY 5, 2002**

**FINAL REPORT**

**PREPARED FOR:  
U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
SAFETY PERFORMANCE STANDARDS  
OFFICE OF CRASHWORTHINESS STANDARDS  
MAIL CODE: NPS-10  
400 SEVENTH STREET, SW, ROOM 5313  
WASHINGTON, D.C. 20590**

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-01-D-02005.

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## Technical Report Documentation Page

<b>1. Report No.</b> KAR22001-19	<b>2. Government Accession No.</b>	<b>3. Recipients Catalog No.</b>			
<b>4. Title and Subtitle</b> Final Report of New Car Assessment Program Testing of a 2002 Hyundai Sonata 4 Door Sedan NHTSA No. M20505		<b>5. Report Date</b> July 5, 2002			
		<b>6. Performing Organization Code</b> KAR			
<b>7. Author(s)</b> Mr. James E Gorth, Project Engineer, Karco Mr. Frank Richardson, Project Manager, Karco		<b>8. Performing Organization Report No.</b> KAR22001-19			
<b>9. Performing Organization Name and Address</b> KARCO Engineering, LLC 9270 Holly Road Adelanto, CA 92301		<b>10. Work Unit No.</b>			
		<b>11. Contract or Grant No.</b> DTNH22-01-D-02005			
<b>12. Sponsoring Agency Name and Address</b> U.S. Department of Transportation National Highway Traffic Safety Administration Safety Performance Standards Office of Crashworthiness Standards Mail Code: NPS-10 400 Seventh Street, SW, Room 5313 Washington, D.C. 20590		<b>13. Type of Report and Period Covered</b> Final Test Report Option Year 1			
		<b>14. Sponsoring Agency Code</b> DOT/NHTSA/NRM/OCS			
<b>15. Supplementary Notes</b>					
<b>16. Abstract</b>  A 35 mph (56.3 km/h) frontal barrier impact was conducted on a 2002 Hyundai Sonata 4 Door Sedan at KARCO Engineering, LLC on 6/13/02. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and footwell intrusion performance. The impact velocity is 55.82 km/h. The ambient temperature at the barrier face at the time of impact is 32.8 degrees Celcius. The vehicle's maximum post test static crush is 453 mm at the vehicle centerline. The test vehicle is equipped with a 3-point continuous belt system and second generation supplemental airbags in both front outboard seating positions. With respect to FMVSS 208 "Occupant Crash Protection", the occupant injury criteria summary is as follows:					
Measurement Description		Units	Threshold	Driver ATD	Passenger ATD
Head Injury Criteria (HIC)		N/A	1000	552.6	428.3
Max. Thorax Accel. (3 msec Clip)		G's	60	50.2	45.8
Left Femur force		Newtons	10000	-4517.3	-5563.9
Right Femur Force		Newtons	10000	-5326.4	-4672.1
<b>17. Key Words</b> 56.3 km/h NCAP Frontal Barrier Impact Test New Car Assessment Program (NCAP) 2002 Hyundai Sonata 4 Door Sedan NHTSA No. M20505			<b>18. Distribution Statement</b> Copies of this report available from: NHTSA Technical Reference Division National Highway Traffic Safety Admin. 400 Seventh St., SW, Room 5108 Washington, DC 20590		
<b>19. Security Classification(this report)</b> Unclassified	<b>20. Security Classification(this page)</b> Unclassified	<b>21. No. of Pages</b> 343	<b>22. Price</b>		

Form DOT F1700.7 (8-72)

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## **SECTION 1**

### **PURPOSE AND SUMMARY OF TEST M20505**

#### **1.1 PURPOSE**

This 35 mph (56.3 km/h) frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-01-D-02005. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact speed in excess of the current 30 mph (48.3 km/h) requirements.

The 35 mph (56.3 km/h) frontal barrier impact test was conducted in accordance with the Office of Crashworthiness Standards Laboratory Test procedure.

#### **1.2 SUMMARY**

A load cell barrier consisting of 24 load cells was impacted by a 2002 Hyundai Sonata 4 Door Sedan at a velocity of 55.82 km/h. The test was performed at Karco Engineering, LLC on June 13, 2002. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time and 16 high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

Two Part 572E, 50<sup>th</sup> percentile male anthropomorphic test devices (ATDs), were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

Both ATDs were fully instrumented with nine accelerometer array head, chest and pelvis triaxial accelerometers, chest displacement potentiometers, six-axis upper neck transducers, right/left femur load cells, and lower leg instrumentation. Seat belt load cells were also placed on the driver's and passenger's lap and shoulder belts to measure dummy torso and pelvic section loading. The driver (position 1) ATD (Serial No. 34) and the right-front passenger (position 2) ATD (Serial No. 35) were calibrated one test prior to this test.

One Hundred and Nine (109) channels of data were recorded using an on-board data acquisition system. Appendix B contains the vehicle and dummy response data traces. Appendix C contains Load Cell Barrier information. Appendix D contains the Instrumentation Data Channel assignments. Appendix E contains the Dummy Calibration data and Appendix F contains the owner's manual instructions for the occupant and restraint systems. Appendix G contains the Nine Accelerometer Head Array data.

There was 100 percent windshield retention and no intrusion into the protected zone of the windshield during the impact event. There was no Stoddard solvent leakage after the event or during any phase of the static rollover.

The maximum static crush of the vehicle was 453 mm and both the driver and the passenger side doors remained closed and latched during the impact event and were operable without the aid of tools after the impact.

The driver's visible contact points were as follows: The driver ATD head contacted the airbag, its chest contacted the airbag/belt and the abdomen contacted the seat belt, and both knees contacted the knee bolster/steering column.

The passenger's visible contact points were as follows: The passenger ATD head contacted the airbag, its chest contacted the airbag/belt and the abdomen contacted the belt. Both knees contacted the glove box.

Occupant injury data is contained in table below.

**OCCUPANT DATA SUMMARY**

ATD Position	HIC	Clip (g)	Chest Disp (mm)	Left Femur (N)	Right Femur (N)	Belt Spool (mm)
Driver	552.6	50.2	-32.0	-4517.3	-5326.4	*
Passenger	428.3	45.8	-31.6	-5563.9	-4672.1	243.0

\* Driver channel failed, no data.

**SECTION 2**  
**OCCUPANT AND VEHICLE INFORMATION/DATA SHEETS**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

**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 <sup>2</sup>	kPa	7.0
Volume	Liquid	gal	liter	3.785
Temperature	General Use	°F	°C	=(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  
CRASH TEST SUMMARY**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

**PRIMARY IMPACT DATA**

Measured Parameter	Units	Value
Velocity at Impact	km/h	55.82
Test Weight	kg	1678
Impact Angle	degrees	0
Average Rebound	mm	699
Maximum Static Crush	mm	453

**DOOR OPENING AND SEAT TRACK INFORMATION**

Description	Driver	Passenger
Front Door Opening	Remained closed & latched, opened w/o the aid of tools	Remained closed & latched, opened w/o the aid of tools
Rear Door Opening	Remained closed & latched, opened w/o the aid of tools	Remained closed & latched, opened w/o the aid of tools
Seat Track Shift (mm)	None	None
Seat Back Failure	None	None

**TEST DUMMY INFORMATION**

Description	Driver	Passenger
Dummy Type / Serial No.	50% Male Hybrid III / No. 34	50% Male Hybrid III / No. 35
Head Contact	Airbag	Airbag
Chest Contact	Airbag/Belt	Airbag/Belt
Abdomen Contact	Belt	Belt
Left Knee Contact	Knee Bolster/Steering Column	Glove Box
Right Knee Contact	Knee Bolster/Steering Column	Glove Box

**16mm MOVIE COVERAGE**

High Speed	16
Real Time	1
Total	17

**DATA CHANNELS**

Driver ATD Sensors	46
Passenger ATD Sensors	46
Belt Assessment Sensors	8
Vehicle Structure Accelerometers	9
Rigid Barrier Load Cells	24
Total	133

**DATA SHEET NO. 2**  
**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

**TEST VEHICLE INFORMATION**

Make	Hyundai
Model	Sonata
Body Style	4 Door Sedan
NHTSA No.	M20505
VIN	KMHWF25S52A641524
Color	Black
Delivery Date	6/6/02
Odometer Reading (mi.)	54
Dealer	Sunrise Hyundai
Transmission	5 Speed Automatic
Final Drive	Front
Type/No. Cylinders	In-Line 4
Engine Displacement (L)	2.4
Engine Placement	Transverse
Front Seat Side Airbag	No

**TEST VEHICLE OPTIONS**

Driver Front Airbag	Yes
Pass. Front Airbag	Yes
Power Windows	Yes
Pre-Tensioners	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Air Conditioning	Yes
Power Brakes	Yes
Disc Brakes, Front	Yes
Disc Brakes, Rear	No
Anti-lock Brakes	No
Head Airbag	No
Load Limiter	Yes
Cruise Control	Yes
Bucket Seats	Yes

**DATA FROM CERTIFICATION LABEL**

Manufactured By	Hyundai Motor Company	GVWR (kg)	1920
Date of Manufacture	March-02	GAWR Front (kg)	1060
		GAWR Rear (kg)	915

**DATA FROM TIRE PLACARD**

Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	210	210
Cold Pressure (kPa)	210	210
Recommend Tire Size	205/65R15	205/65R15
Tire Size on Vehicle	205/65R15	205/65R15
Tire Manufacturer	Michelin	Michelin

**VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION**

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench	None	
Number of Occupants	2	3	0	5
Capacity Wt. (VCW) (kg)				198
Cargo Weight (RCLW) (kg)				50

**DATA SHEET NO. 2...(CONTINUED)**  
**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

**TEST VEHICLE WEIGHTS**

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	456	288		490	353	
Right	kg	460	279		491	345	
Ratio	%	61.8	38.2		58.4	41.6	
Totals	kg	916	567	1483	981	698	1679

**TARGET TEST WEIGHT CALCULATION**

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1483
Weight of 2 P572 ATD's	kg	152
Rated Cargo/Luggage Weight (RCLW)	kg	50
Calculated Vehicle Target Weight (TVT <sub>W</sub> )	kg	1685

**TEST VEHICLE ATTITUDE AND CG**

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	684	692	694	696	1031
As Tested	mm	672	673	667	671	1123

Vehicle Wheel base (mm): 2700

Weight of Ballast secured in cargo area (kg): 13

Vehicle Components Removed: \_\_\_\_\_

\* Ballast weight does not include cameras, instrumentation, and brake abort system.

**FUEL SYSTEM DATA**

Fuel System Capacity From Owner's Manual (L): 65.1

Usable Capacity Figure Furnished by COTR (L): 65.1

Actual Test Volume with entire fuel System Filled (L): 60.2

Test Fluid Type: Stoddard Solvent ; Specific Gravity: 0.764

Kinematic Viscosity: as per ASTM Standard D484-71 ; Color: Purple

Is Vehicle Fuel Pump Electric or Mechanical?: Electric

If electric, does pump operate with ignition switch "ON" & engine "OFF"? Yes

Fuel System Particulars: Driver side filler door, tank mounted at rear.

**DATA SHEET NO. 3  
POST IMPACT DATA**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

**SPEED TRAP DATA**

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	55.51 to 57.12	55.82
Trap No. 1 Entry Distance	mm	< 1524	1524
Trap No. 1 Exit Distance	mm	< 1524	305
Trap No. 2 Velocity (Redundant)	km/h	55.51 to 57.12	55.85
Trap No. 2 Entry Distance	mm	< 1524	1524
Trap No. 2 Exit Distance	mm	< 1524	305

**VEHICLE STATIC CRUSH**

Measured Parameter	Units	Pre-Test	Post-Test	Difference
Left Side	mm	4608	4251	-357
Center	mm	4742	4289	-453
Right Side	mm	4608	4262	-346

**VEHICLE REBOUND FROM BARRIER**

Measured Parameter	Units	Value
Left Side	mm	730
Center	mm	652
Right Side	mm	716
Average	mm	699

**DATA SHEET NO. 4**  
**TEST VEHICLE INFORMATION**

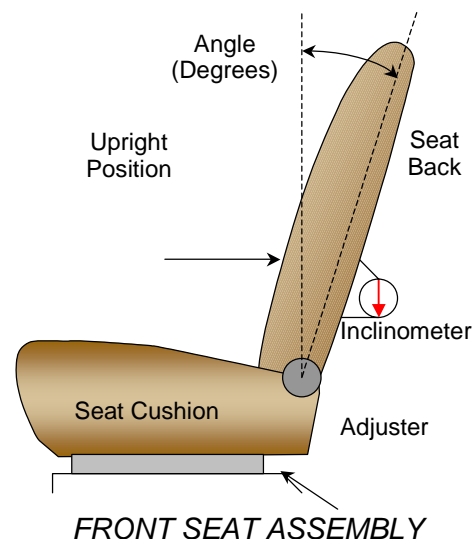
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
Test Date: 6/13/02

**NOMINAL DESIGN RIDING POSITION**

The driver and passenger seat backs are 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.

Driver seat back angle: 26° with a seated dummy  
Passenger seat back angle: 26° with a seated dummy



**SEAT FORE/AFT POSITIONS**

Both driver and passenger seats have 20 positions or detents. The first or forward most position is counted as number one (1). The fore/aft position is set aft of the middle position for both driver and passenger.

Driver seat fore/aft total travel: 20 seating positions or detents  
Driver seat fore/aft position: 11th detent from forward most  
Passenger seat fore/aft total travel: 20 seating positions or detents  
Passenger seat fore/aft position: 11th detent from forward most

**SEAT BELT UPPER ANCHORAGE**

The test vehicle is equipped with adjustable anchorages for both driver and passenger seat positions. There are 4 positions or detents. Both the driver and the passenger anchorages are placed in the 2nd position from the uppermost.

**DATA SHEET NO. 4...(CONTINUED)  
TEST VEHICLE INFORMATION**

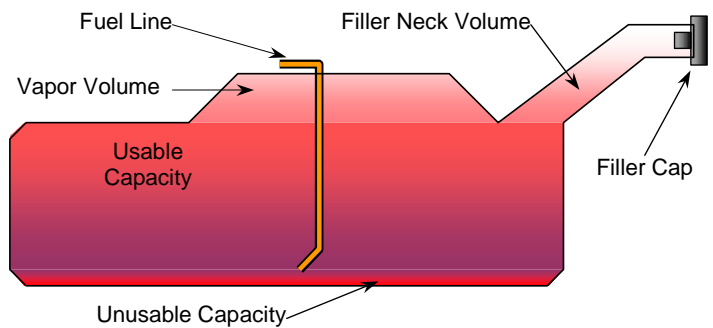
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

**FUEL TANK CAPACITY DATA**

The "Usable Capacity" of the standard equipment fuel tank is: 65.1 liters  
 The "Usable Capacity" of any optional equipment fuel tank is: N/A liters  
 "Usable Capacity" used for certification tests FMVSS 301 requirements: 59.8 to 60.9 liters  
 Actual amount of Stoddard solvent added to vehicle for certification test: 60.2 liters

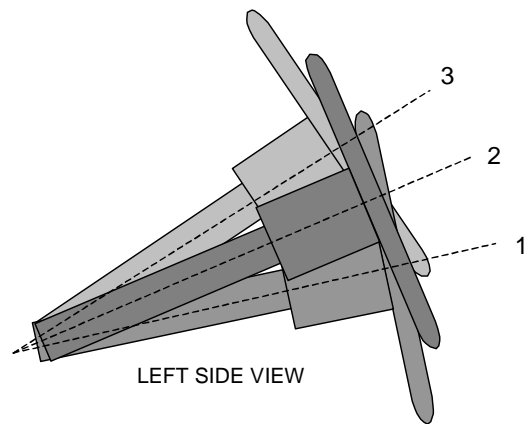
The test vehicle is equipped with an electric fuel pump. The fuel pump operates for approximately two seconds after the ignition is placed in the "ON" position, after which the fuel pump automatically shuts off. The fuel filler door is located on the left rear fender. The standard fuel tank occupies the area under the rear seat. Fuel lines run inside the frame rail to the engine compartment.



VEHICLE FUEL TANK ASSEMBLY

**STEERING COLUMN ADJUSTMENT**

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. An aluminum plate is placed across the rim of the steering wheel, an inclinometer is placed on the plate and the angle is measured. The steering column has seven (7) positions or detents and is set in the fourth (4) detent as indicated by the diagram at right and the angle below.



STEERING COLUMN ASSEMBLY

Lowermost; position 1: 20°  
 Geometric center; position 2: 26°  
 Uppermost position 3: 31°

**DATA SHEET NO. 5**  
**DUMMY POSITIONING IN VEHICLE**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
Test Date: 6/13/02

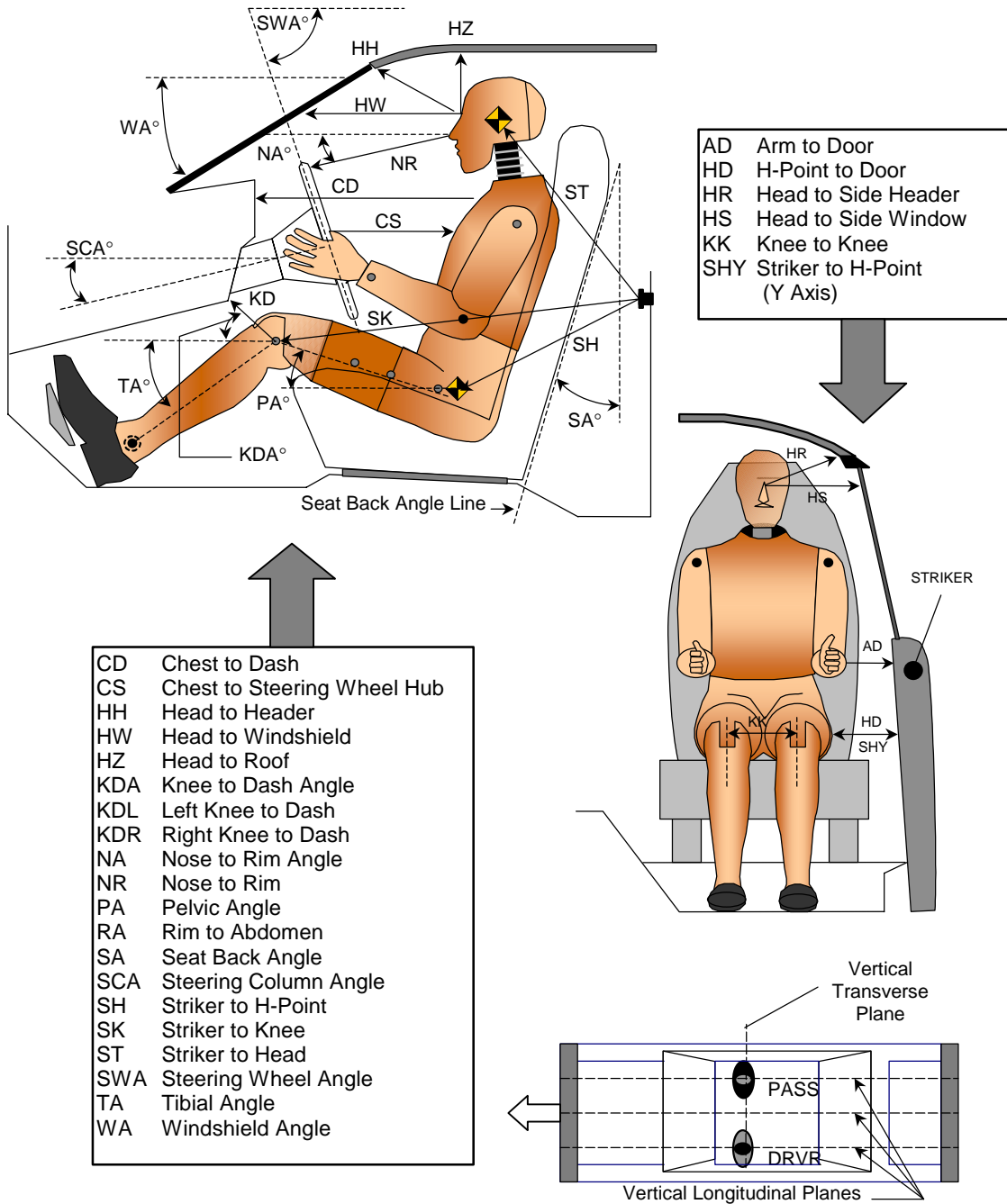
**TEST DUMMY POSITION MEASUREMENTS**

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA	Windshield Angle		29		
SWA	Steering Wheel Angle		64		
SCA	Steering Column Angle		26		
SA	Seat Back Angle		26		26
HZ	Head to Roof (Z)	176	90	180	90
HH	Head to Header	337		335	
HW	Head to Windshield	545		597	
HR	Head to Side Header (Y)	230		224	
NR	Nose to Rim	426	12		
CD	Chest to Dash	548		574	
CS	Chest to Steering Hub	325			
RA	Rim to Abdomen	220			
KDL	Left Knee to Dash	180	28	181	
KDR	Right Knee to Dash	183		174	21
PA	Pelvic Angle		22		23
TA	Tibia Angle		36		28
KK	Knee to Knee (Y)	325		270	
ST	Striker to Head	614	5	683	8
SK	Striker to Knee	520	78	518	80
SH	Striker to H-Point	255	38	276	36
SHY	Striker to H-Point (Y)	229		230	
HS	Head to Side Window	314		300	
HD	H-Point to Door (Y)	190		200	
AD	Arm to Door (Y)	131		40	

**DATA SHEET NO. 5...(CONTINUED)**  
**DUMMY POSITIONING IN VEHICLE**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

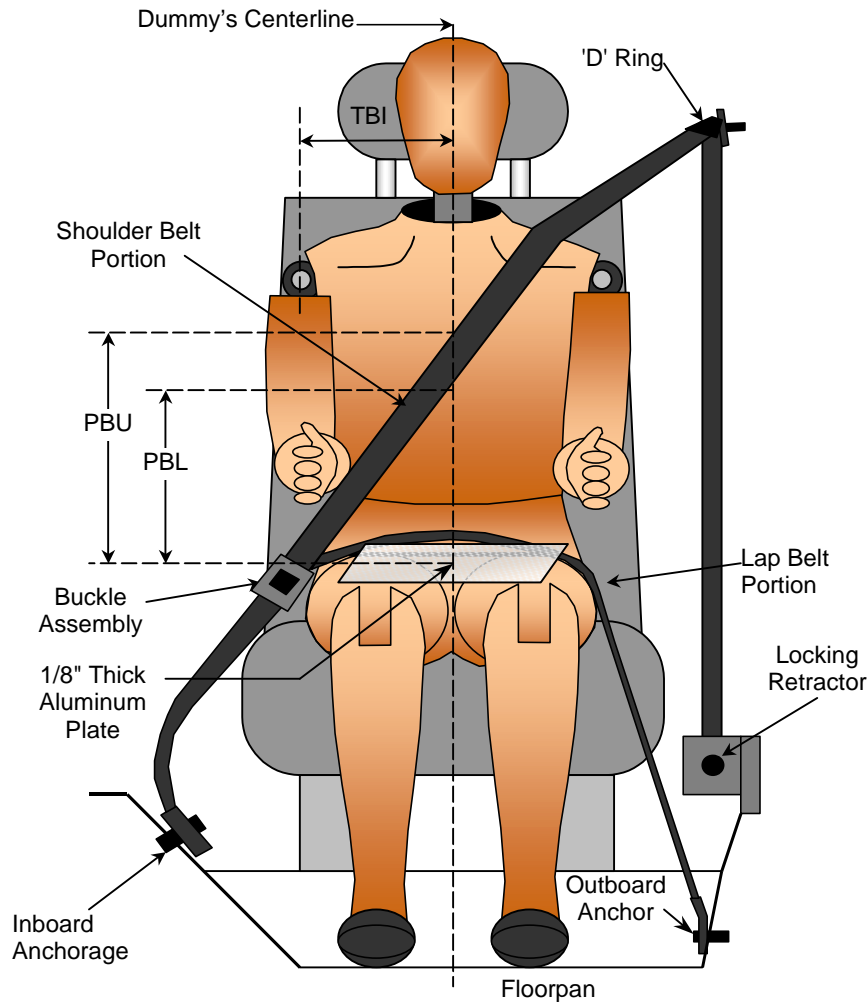


**DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS**

**DATA SHEET NO. 6  
SEATBELT POSITIONING DATA**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02



**SEAT BELT POSITIONING MEASUREMENTS**

Measurement Description	Units	Driver	Passenger
TBI - Dummy C/L to Lap/Shoulder Belt Intersect	mm	175	190
PBU - Top surface of reference to belt upper edge	mm	335	340
PBL - Top surface of reference to belt lower edge	mm	260	260
Lap Belt tension	Newton's	10	10
Shoulder Belt tension	N/A	Retractor	Retractor

**DATA SHEET NO. 7 - VEHICLE ACCELEROMETER LOCATION AND DATA SUMMARY**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

NHTSA No.: M20505

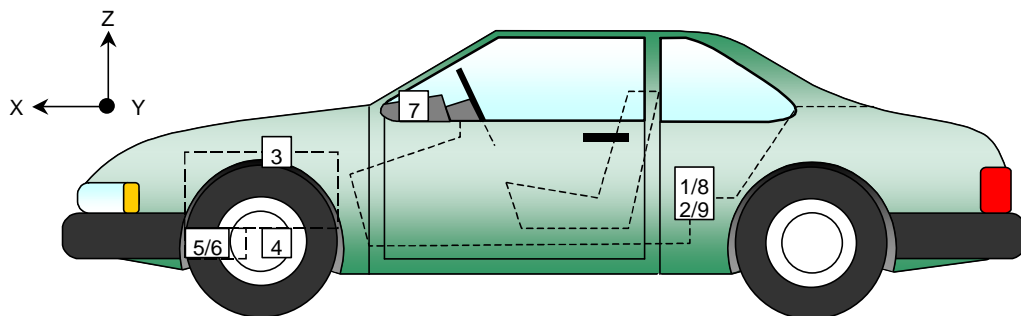
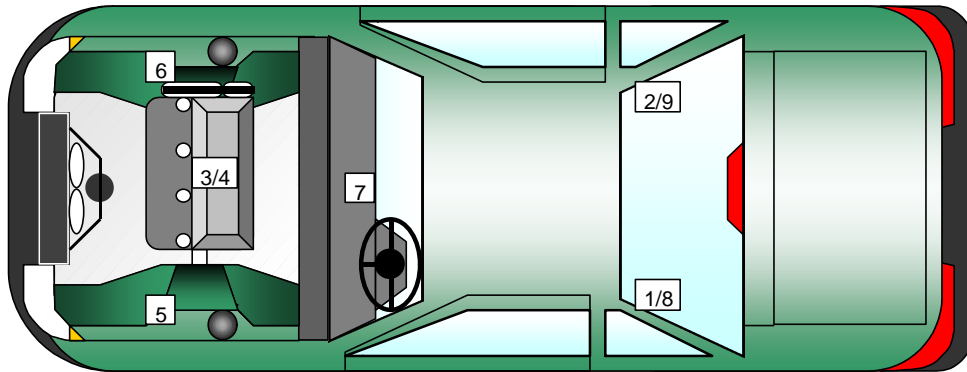
Test Program: 2002 NHTSA 35mph NCAP

Test Date: 6/13/02

**VEHICLE ACCELEROMETER PEAK DATA AND PRE-TEST LOCATIONS**

No.	Accelerometer Location	Measurements (mm)			Peak Values				
		X	Y	Z	Units	Max	Time	Min	Time
1	Left Rear X-Member	1810	-665	355	G's	2.3	124.7	-39.1	37.0
2	Right Rear X-Member	2020	680	265	G's	1.6	122.9	-40.2	55.3
3	Engine Top	3950	30	815	G's	30.4	39.5	-146.2	32.0
4	Engine Bottom	3930	270	150	G's	69.5	40.7	-175.3	28.1
5	Left Brake Caliper	3920	-730	260	G's	48.6	33.5	-140.9	41.0
6	Right Brake Caliper	3920	730	260	G's	36.1	64.4	-90.3	20.5
7	Instrument Panel	3110	0	975	G's	47.5	30.2	-90.7	35.0
8	Left Rear X-Member (Z-Axis)	1780	-640	355	G's	14.2	46.1	-9.3	35.8
9	Right Rear X-Member (Z-Axis)	1780	640	355	G's	9.2	48.7	-7.2	38.3

Reference Planes: X=From Rear Surface of Vehicle, Y=Vehicle Centerline, Z=Ground Plane



**DATA SHEET NO. 8 - HYBRID III ATD INJURY CRITERIA AND SENSOR DATA**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

NHTSA No.: M20505

Test Program: 2002 NHTSA 35mph NCAP

Test Date: 6/13/02

**HEAD PRIMARY PEAK ACCELERATIONS**

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Head CG	X	G's	8.2	272.1	-57.7	79.2	7.0	281.1	-54.6	72.6
Head CG	Y	G's	3.3	129.7	-14.9	82.1	4.3	55.2	-11.9	74.0
Head CG	Z	G's	25.3	47.5	-1.2	121.8	25.0	48.5	-3.3	91.0
Head CG Resultant	N/A	G's	61.9	80.1			56.6	72.6		

**CHEST PRIMARY PEAK ACCELERATIONS**

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Chest CG	X	G's	3.1	299.4	-50.7	77.3	1.8	141.4	-50.9	69.7
Chest CG	Y	G's	3.8	94.6	-8.7	76.1	2.7	78.0	-3.5	54.3
Chest CG	Z	G's	14.3	46.7	-5.8	100.4	12.3	47.4	-9.1	103.0
Chest CG Resultant	N/A	G's	51.4	77.3			50.9	69.7		

**FEMUR PEAK FORCES**

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Left Femur	Z	Newtons	1019.6	46.6	-4517.3	54.5	826.4	48.3	-5563.9	55.7
Right Femur	Z	Newtons	341.7	97.4	-5326.4	53.9	1010.2	48.6	-4672.1	55.9

**SEAT BELT SENSOR PEAK VALUES**

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Shoulder Belt Pullout	N/A	MM	0.0	0.0	0.0	0.0	243.0	84.3	-0.1	11.8
Shoulder Belt Stretch	N/A	MM/CM	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Lap Belt Force	N/A	Newtons	7840.1	54.1	-11.9	4.0	7225.1	57.0	11.6	0.0
Shoulder Belt Force	N/A	Newtons	4799.8	48.1	-7.4	296.8	5338.3	79.4	-23.2	185.4

1.) Driver channel failed, no data

2.) Not used with pre-tensioner

**PRIMARY HEAD INJURY CRITERIA (HIC)**

Location	Driver				Passenger			
	HIC	T <sup>1</sup>	T <sup>2</sup>	Avg G	HIC	T <sup>1</sup>	T <sup>2</sup>	Avg G
Head CG Primary	552.6	64.2	98.6	48.1	428.3	54.1	90.0	42.7

**PRIMARY CHEST CLIP (3MSEC)**

Location	Driver			Passenger		
	CLIP	T <sup>1</sup>	T <sup>2</sup>	CLIP	T <sup>1</sup>	T <sup>2</sup>
Chest CG Primary	50.2	76.4	79.4	45.8	68.3	71.3

**DATA SHEET NO. 8...(continued)**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

NHTSA No.: M20505

Test Program: 2002 NHTSA 35mph NCAP

Test Date: 6/13/02

**PELVIC PEAK ACCELERATIONS**

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Pelvis	X	G's	3.2	120.8	-90.2	54.0	3.2	109.8	-85.5	55.1
Pelvis	Y	G's	6.6	71.8	-18.0	43.3	3.7	43.3	-6.4	65.0
Pelvis	Z	G's	7.2	43.8	-29.5	71.6	2.9	232.9	-28.2	71.3
Pelvis Resultant	N/A	G's	91.7	54.0			87.2	55.1		

**UPPER NECK PEAK FORCES AND MOMENTS**

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Neck Force	X	Newtons	568.4	77.1	-475.4	106.0	495.2	69.8	-495.2	139.4
Neck Force	Y	Newtons	136.5	288.0	-94.5	38.5	275.1	78.6	-116.4	133.8
Neck Force	Z	Newtons	1448.4	73.5	-295.7	98.0	1288.7	58.6	-218.4	132.0
Neck Force Resultant	N/A	Newtons	1535.6	73.5			1305.5	62.2		
Neck Moment	X	N•m	7.6	134.1	-17.9	94.3	17.8	94.2	-4.6	136.9
Neck Moment	Y	N•m	34.6	120.2	-20.5	48.6	36.8	135.2	-20.8	49.9
Neck Moment	Z	N•m	12.1	85.8	-6.1	131.2	12.6	90.3	-5.1	145.6
Neck Moment Resultant	N/A	N•m	35.1	120.2			37.2	135.2		

**FOOT PEAK ACCELERATIONS**

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Left Foot Aft	X	G's	2.3	90.1	-22.7	25.5	29.2	81.7	-75.5	42.4
Left Foot Aft	Z	G's	3.0	233.9	-68.7	39.5	19.0	70.2	-59.4	44.2
Left Foot Fore	Z	G's	7.0	29.1	-113.1	39.2	32.0	69.8	-88.0	41.1
Right Foot Aft	X	G's	31.2	93.2	-191.3	42.4	15.6	83.8	-49.9	38.7
Right Foot Aft	Z	G's	21.7	63.5	-213.9	42.6	6.7	69.2	-60.6	41.6
Right Foot Fore	Z	G's	24.1	56.7	-212.8	42.3	19.7	71.7	-92.3	41.7

**UPPER AND LOWER TIBIA PEAK FORCES AND MOMENTS**

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Left Upper Moment	X	N•m	35.1	58.1	-14.3	46.3	28.3	69.3	-46.0	44.1
Left Upper Moment	Y	N•m	29.2	143.9	-129.9	58.0	90.4	56.7	-108.9	39.8
Right Upper Moment	X	N•m	49.0	53.9	-67.4	45.8	23.3	114.2	-10.0	29.3
Right Upper Moment	Y	N•m	128.8	52.0	-305.3	43.6	91.5	54.3	-85.1	42.1
Left Lower Moment	X	N•m	47.8	58.7	-14.4	86.7	43.9	83.3	-19.1	42.3
Left Lower Moment	Y	N•m	42.6	84.5	-30.6	51.7	56.3	80.1	-33.8	50.0
Left Lower Force	Z	Newtons	134.5	130.9	-2821.4	26.2	108.4	289.1	-3050.9	41.8
Right Lower Moment	X	N•m	11.1	188.7	-238.4	45.3	39.2	44.4	-5.4	28.6
Right Lower Moment	Y	N•m	64.3	93.9	-31.0	41.1	37.0	80.3	-29.5	49.5
Right Lower Force	Z	Newtons	174.4	119.1	-12387.8	43.4	137.6	163.2	-3362.0	41.7

**DATA SHEET NO. 8...(continued)**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

NHTSA No.: M20505

Test Program: 2002 NHTSA 35mph NCAP

Test Date: 6/13/02

**CHEST PEAK DISPLACEMENTS**

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Chest CG	X	MM	0.2	12.1	-32.0	84.4	0.3	13.9	-31.6	63.9

**HEAD REDUNDANT PEAK ACCELERATIONS**

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Head CG	X	G's	8.7	268.8	-56.3	79.6	6.0	266.8	-53.5	72.7
Head CG	Y	G's	2.5	25.7	-15.6	82.0	3.7	55.1	-13.9	59.3
Head CG	Z	G's	26.1	47.5	-1.9	16.7	25.2	48.5	-3.7	92.2
Head CG Resultant	N/A	G's	61.0	79.8			55.8	72.9		

**CHEST REDUNDANT PEAK ACCELERATIONS**

Location	Axis	Units	Driver				Passenger			
			Max	Time	Min	Time	Max	Time	Min	Time
Chest CG	X	G's	2.8	299.4	-51.4	77.2	1.2	156.1	-51.2	69.8
Chest CG	Y	G's	3.4	94.4	-9.0	76.0	3.1	78.0	-2.8	54.4
Chest CG	Z	G's	13.5	46.6	-5.9	100.7	13.2	47.4	-8.8	95.1
Chest CG Resultant	N/A	G's	52.1	77.2			51.2	69.8		

**REDUNDANT HEAD INJURY CRITERIA (HIC)**

Location	Driver				Passenger			
	HIC	T <sup>1</sup>	T <sup>2</sup>	Avg G	HIC	T <sup>1</sup>	T <sup>2</sup>	Avg G
Head CG Redundant	542.3	63.9	98.7	47.5	423.6	54.0	89.7	42.6

**REDUNDANT CHEST CLIP (3MSEC)**

Location	Driver			Passenger		
	CLIP	T <sup>1</sup>	T <sup>2</sup>	CLIP	T <sup>1</sup>	T <sup>2</sup>
Chest CG Redundant	50.7	76.3	79.3	46.2	68.2	71.2

**DATA SHEET NO. 9  
SEATBELT ASSESSMENT TEST DATA**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

**SEAT BELT PLACEMENT MEASUREMENTS**

Measurement Description	Units	Driver	Passenger
TBI - Dummy C/L to Lap/Shoulder Belt Intersect	mm	175	190
PBU - Top surface of reference to belt upper edge	mm	335	340
PBL - Top surface of reference to belt lower edge	mm	260	260
Lap Belt tension	Newton's	10	10
Shoulder Belt tension	N/A	Retractor	Retractor

**BELT LENGTH DATA**

Measurement Description	Units	Driver	Passenger
Retractor reel to 'D' ring	mm	680	680
Shoulder belt length as measured on ATD	mm	800	830
Lap belt length as measured on ATD	mm	755	770
Remainder of belt on reel	mm	750	750
Total belt length for continuous webbing systems	mm	2985	3030

**SHOULDER BELT SPOOL-OFF DATA**

Measurement Description	Units	Driver	Passenger
As determined mechanically	mm	285.0	210.0
As determined electronically	mm	*	243.0
As determined by photography	mm	unk.	unk.

\* Driver channel failed, no data

**BELT STRETCH DATA**

Measurement Description	Units	Driver	Passenger
Electronically between shoulder belt load cell and "D" ring	mm/cm	*	*
Mechanically	mm/cm	None	None

\*Not used with shoulder belt pre-tensioner systems.

**DATA SHEET NO. 10**  
**SUMMARY OF FMVSS 212 DATA**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

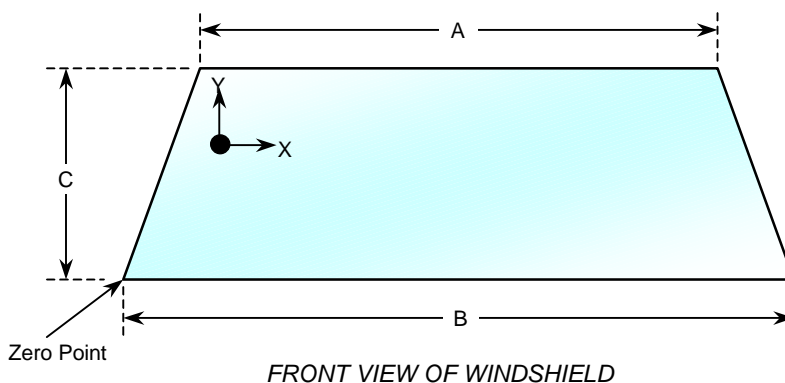
Windshield Mounting Details: Windshield glass is secured to the vehicle frame with a rubber type adhesive. No molding covers the windshield periphery at any point.

The standard requires that the posttest retention measurement be a minimum of 75 percent of the pretest total periphery measurement for vehicles not equipped with occupant passive restraints and 50 percent for each side of the windshield for vehicles that are equipped with occupant passive restraints.

Temperature of windshield molding during test: 21.1 °C

**WINDSHIELD PERIPHERY MEASUREMENTS**

Measurement	Pre-Test(mm)	Post-Test (mm)	% of Retention
Left Side	2095	2095	100
Right Side	2095	2095	100
Total	4189	4189	100



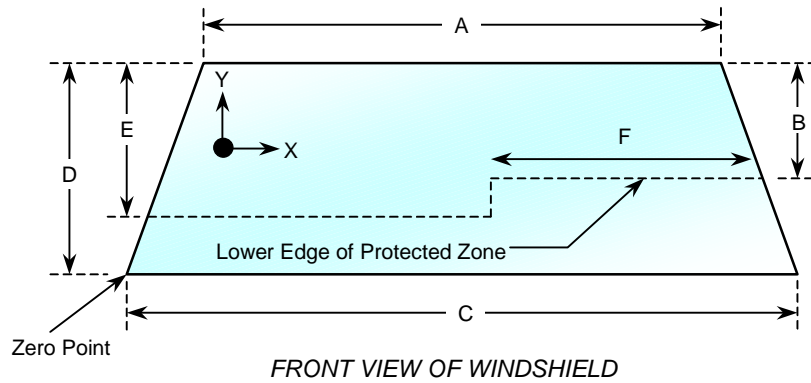
**WINDSHIELD DIMENSIONS**

Item	Units	Segment Length	Molding Width
A	mm	1160	19
B	mm	1543	10
C	mm	743	19

**DATA SHEET NO. 11**  
**WINDSHIELD ZONE INTRUSION FMVSS 219 DATA (PARTIAL)**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02



**WINDSHIELD AND  
 PROTECTED ZONE**

Item	Units	Value
A	mm	1160
B	mm	465
C	mm	1543
D	mm	743
E	mm	450
F	mm	510

**AREA OF PROTECTED ZONE FAILURES**

- A. Provide coordinates of the area that the protected zone was penetrated more than 0.25 in. by a vehicle component other than one that is normally in contact with the windshield.

X	Y
N/A	N/A
N/A	N/A
N/A	N/A
N/A	N/A

- B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component.

X	Y
N/A	N/A
N/A	N/A
N/A	N/A
N/A	N/A

**DATA SHEET NO. 12**  
**FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
Test Date: 6/13/02

Test Time: 11:48 A.M.

Temperature at Time of Impact 32.7 Deg. C

**STODDARD SOLVENT SPILLAGE MEASUREMENTS**

A. From impact until vehicle motion ceases: 0.0 oz.  
(Maximum Allowable = 1 ounce)

B. For the 5 minute period after motion ceases: 0.0 oz.  
(Maximum Allowable = 5 ounces)

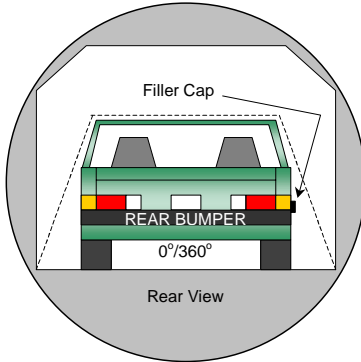
C. For the following 25 minutes: 0.0 oz.  
(Maximum Allowable = 1 oz./minute)

D. Spillage Location Details: No leakage occurred

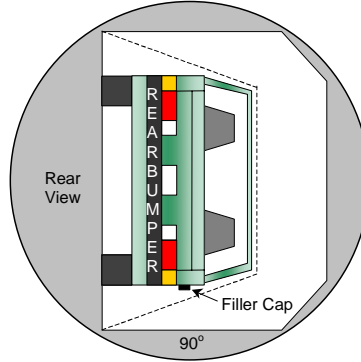
**DATA SHEET NO. 13**  
**FMVSS 301 STATIC ROLLOVER DATA**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

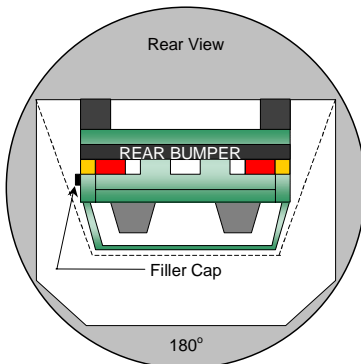
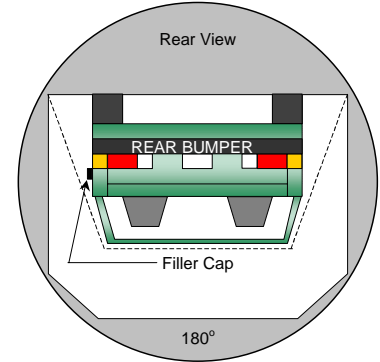
NHTSA No.: M20505  
 Test Date: 6/13/02



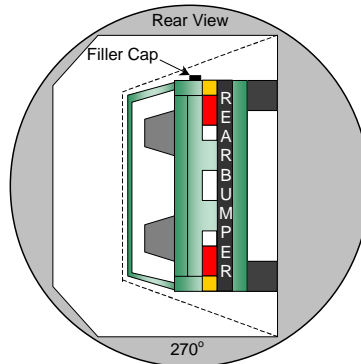
**0° to 90°**



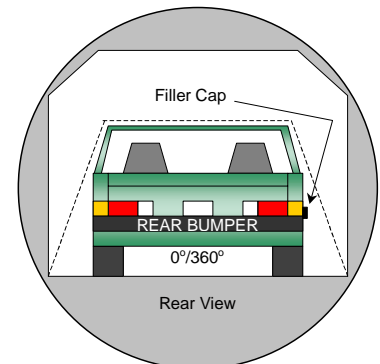
**90° to 180°**



**180° to 270°**



**270° to 360°**



1. The specified fixture rollover rate for each 90° of rotation is 60 to 120 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. No solvent leakage occurred during rollover.

Test Phase	Rotation Time (sec.)	Hold Time (sec.)	Spillage (oz.)
0° to 90°	82	300	0
90° to 180°	85	300	0
180° to 270°	76	300	0
270° to 360°	82	300	0

**DATA SHEET NO. 14**  
**VEHICLE MEASUREMENTS**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
Test Program: 2002 NHTSA 35mph NCAP

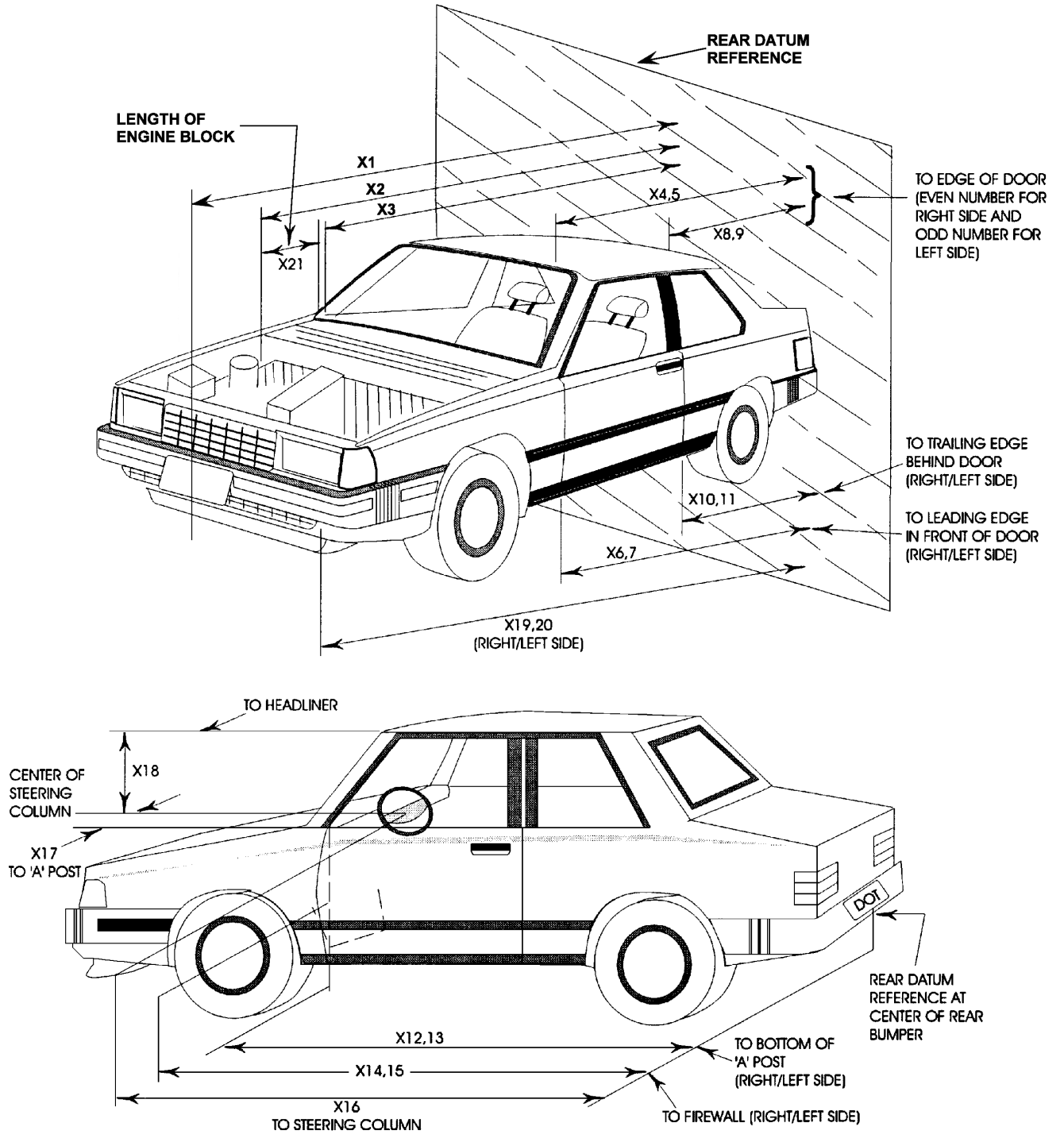
NHTSA No.: M20505  
Test Date: 6/13/02

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total length of vehicle at centerline	mm	4742	4289	-453
2	RSOV to front of engine	mm	4123	3942	-181
3	RSOV to firewall centerline	mm	3588	3467	-121
4	RSOV to leading edge of right door	mm	3201	3190	-11
5	RSOV to leading edge of left door	mm	3200	3191	-9
6	RSOV to lower leading edge of right door	mm	3247	3245	-2
7	RSOV to lower leading edge of left door	mm	3249	3248	-1
8	RSOV to upper trailing edge of right door	mm	2169	2162	-7
9	RSOV to upper trailing edge of left door	mm	2171	2161	-10
10	RSOV to lower trailing edge of right door	mm	2164	2160	-4
11	RSOV to lower trailing edge of left door	mm	2164	2163	-1
12	RSOV to bottom of right 'A' pillar	mm	3221	3209	-12
13	RSOV to bottom of left 'A' pillar	mm	3221	3209	-12
14	RSOV to firewall on right side	mm	3578	3492	-86
15	RSOV to firewall of left side	mm	3577	3522	-55
16	RSOV to steering column	mm	2838	2900	62
17	Center of steering column to left 'A' pillar	mm	407	410	3
18	Center of steering column to headlining	mm	425	455	30
19	RSOV to right side of front bumper	mm	4608	4262	-346
20	RSOV to left side of front bumper	mm	4608	4251	-357
21	Length of engine block	mm	300	300	0
RD	RSOV to right side of dash panel	mm	3019	3005	-14
CD	RSOV to center of dash panel	mm	3023	2943	-80
LD	RSOV to left side of dash panel	mm	3023	3011	-12

**DATA SHEET NO. 14...(CONTINUED)**  
**VEHICLE MEASUREMENTS**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02



**DATA SHEET NO. 15**  
**CAMERA LOCATIONS**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
Test Date: 6/13/02

No.	Camera View	Location (mm)			Angle (Deg.)	Film Plane to Head	Lens (mm)	Speed (fps)
		X	Y	Z				
1	Right Side, Real Time	3454	10973	1245	0	1651	Zoom	24
2	Left Side, No. 1	2000	-8250	1270	0	7900	13	1030
3	Left Side, No. 2	1060	-6370	1630	-1	6173	25	1010
4	Left Side, No. 3	6500	-10580	4640	-16	11549	65	990
5	Left Side, No. 4	1460	-8250	3340	-17	8236	19	1000
6	Left Side, No. 5	1460	-8250	2970	-16	8146	19	900
7	Right Side, No. 1	2400	8150	1590	-2	7801	19	N/A
8	Right Side, No. 2	1000	7180	1590	0	6973	35	1020
9	Right Side, No. 3	7860	8900	2800	-9	10272	80	970
10	Right Side, No. 4	2750	9600	1520	0	9254	50	Failed
11	Overhead Overall	250	0	4460	-86	N/A	13	1020
12	Front View, Driver	2970	-380	1330	-36	N/A	12	840
13	Front View, Passenger	2970	380	1330	-37	N/A	13	1010
14	Pit Camera, Engine	650	0	-1360	-90	N/A	10	N/A
15	Pit Camera, Fuel Tank	3760	0	-1820	-55	N/A	10	1090
16	Driver Belt	Not used in this test.						
17	Passenger Belt	Not used in this test.						
18	Left Side Extra	Not used in this test.						

X - Barrier Face    Y - Monorail Centerline    Z - Ground

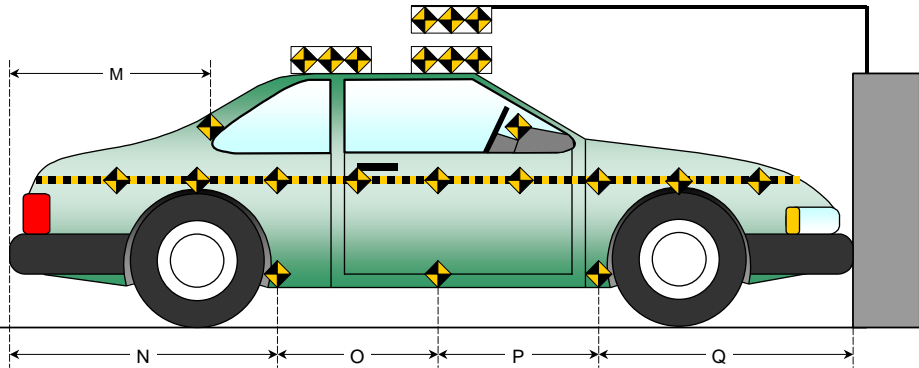
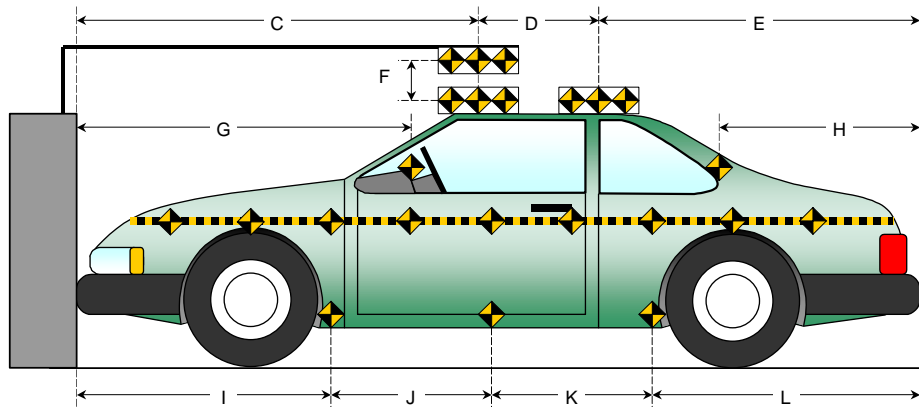
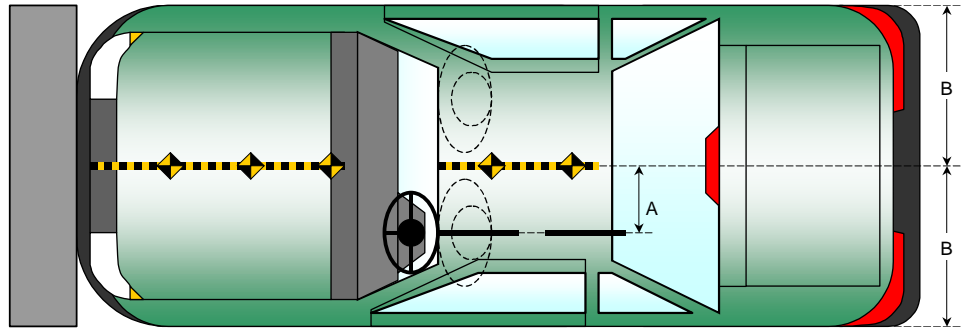
**DATA SHEET NO. 16**  
**PHOTOGRAPHIC REFERENCE TARGET LOCATIONS**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

All Dimensions  
 in mm

Item	Value
A	369
B	889
C	2374
D	612
E	1778
F	155
G	1798
H	1187
I	1445
J	890
K	890
L	1533
M	1184
N	1534
O	890
P	890
Q	1441



**DATA SHEET NO. 17**  
**VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

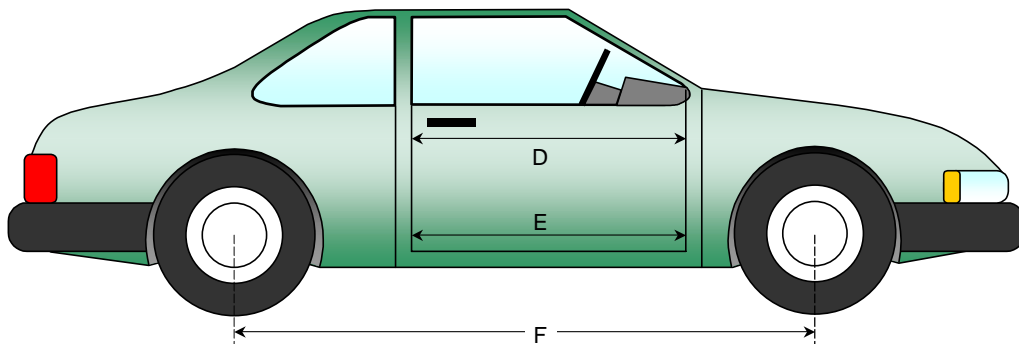
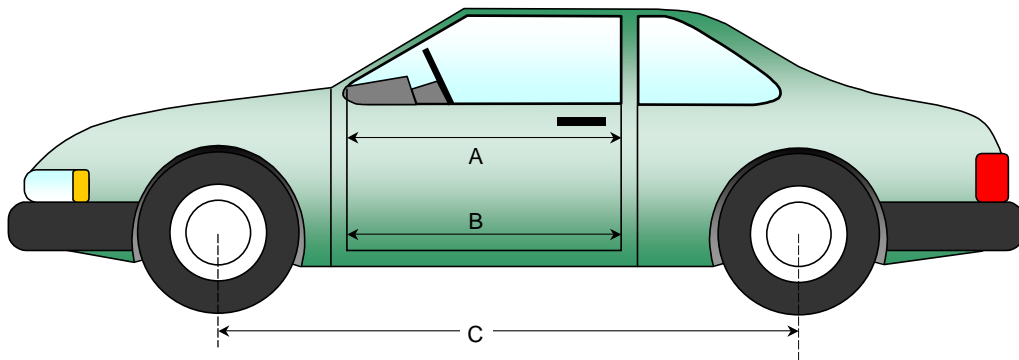
NHTSA No.: M20505  
 Test Date: 6/13/02

**DOOR OPENING WIDTH**

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	986	976	-10
B	Left Side Lower	mm	944	942	-2
D	Right Side Upper	mm	984	974	-10
E	Right Side Lower	mm	942	939	-3

**WHEELBASE MEASUREMENTS**

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheel base	mm	2700	2600	-100
F	Right Side Wheel base	mm	2700	2625	-75



**DATA SHEET NO. 17...(CONTINUED)**  
**VEHICLE INTRUSION MEASUREMENTS**

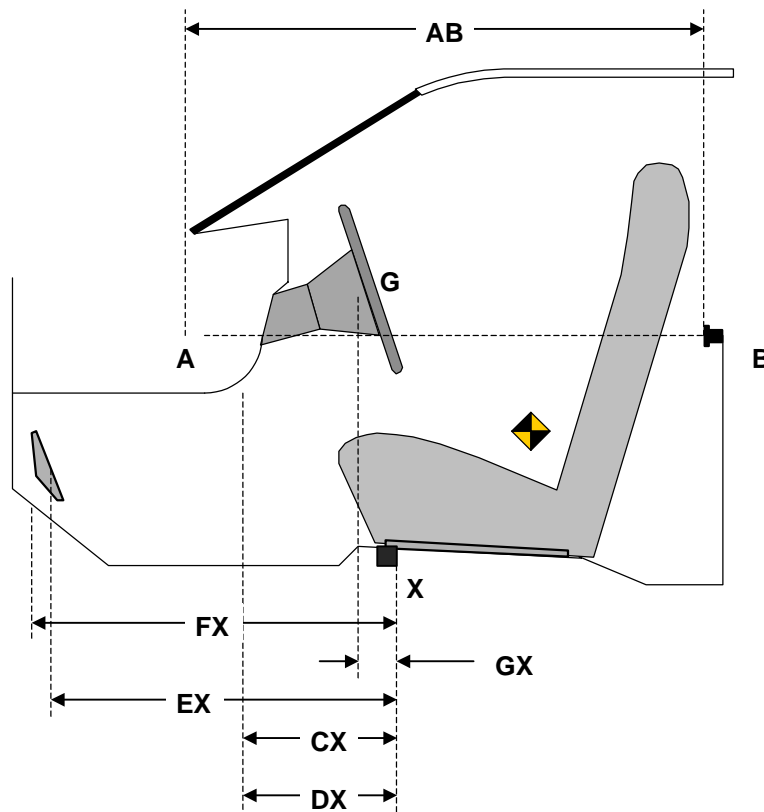
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

**DRIVER COMPARTMENT INTRUSION**

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside window jam)	mm	986	976	-10
CX	Left Knee Bolster to X	mm	288	273	-15
DX	Right Knee Bolster to X	mm	335	271	-64
EX	Brake Pedal to X	mm	593	567	-26
FX	Foot Rest to X	mm	588	565	-23
GX	Center of Steering Wheel Hub to X	mm	85	140	55

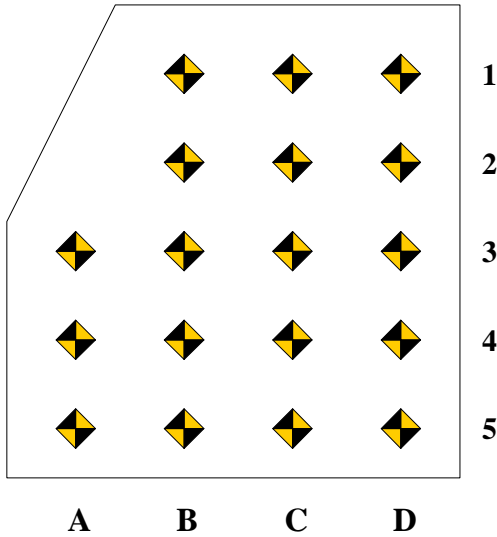
X = Left Front Seat Outboard Anchor Bolt Head



**DATA SHEET NO. 17...(CONTINUED)  
VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02



Measurement reference point for X and Z-axis is the forward outboard seat mounting bolt.

Columns A through D are evenly spaced.

Rows 1 and 2 are on the toe kick portion of the floor pan. Rows 3,4 and 5 are located on the most level portion of the floor pan.

Row 3 will be at the intersection of the toe kick and the level sections of the floor pan.

**DRIVER FLOOR PAN X-AXIS**

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1		709	709	708		613	602	596		-96	-107	-112
2		635	632	640		572	544	543		-63	-88	-97
3	540	536	537	534	506	503	493	479	-34	-33	-44	-55
4	438	436	434	432	404	405	395	389	-34	-31	-39	-43
5	339	335	333	330	305	300	295	294	-34	-35	-38	-36

**DRIVER FLOOR PAN Z-AXIS**

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1		-27	-14	-15		19	19	27		46	33	42
2		-83	-73	-76		-47	-47	-42		36	26	34
3	-101	-98	-98	-100	-98	-110	-113	-113	3	-12	-15	-13
4	-94	-99	-96	-101	-98	-114	-119	-113	-4	-15	-23	-12
5	-99	-98	-94	-101	-98	-107	-112	-135	1	-9	-18	-34

**DATA SHEET NO. 17...(CONTINUED)  
VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
Test Program: 2002 NHTSA 35mph NCAP

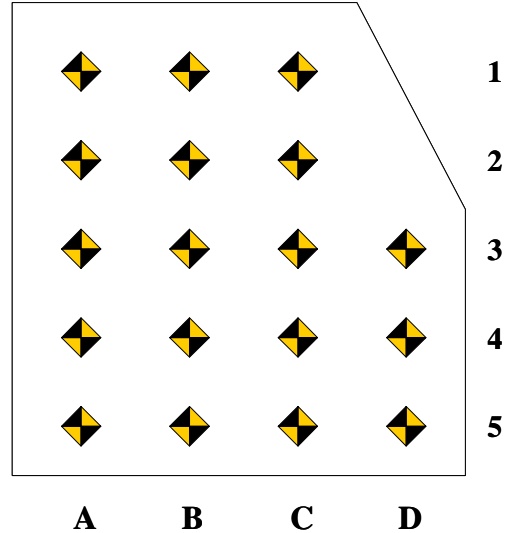
NHTSA No.: M20505  
Test Date: 6/13/02

Measurement reference point for X and Z axis is the forward outboard seat mounting bolt.

Columns A through D are evenly spaced.

Rows 1 and 2 are on the toe kick portion of the floor pan. Rows 3,4, and 5 are located on the most level portion of the floor pan.

Row 3 will be at the intersection of the toe kick and the level sections of the floor pan.



**PASSENGER FLOOR PAN X-AXIS**

	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	693	691	693		597	613	622		-96	-78	-71	
2	625	620	619		564	575	581		-61	-45	-38	
3	522	519	520	518	464	480	494	498	-58	-39	-26	-20
4	421	417	417	416	377	385	394	395	-44	-32	-23	-21
5	324	318	317	316	293	294	294	298	-31	-24	-23	-18

**PASSENGER FLOOR PAN Z-AXIS**

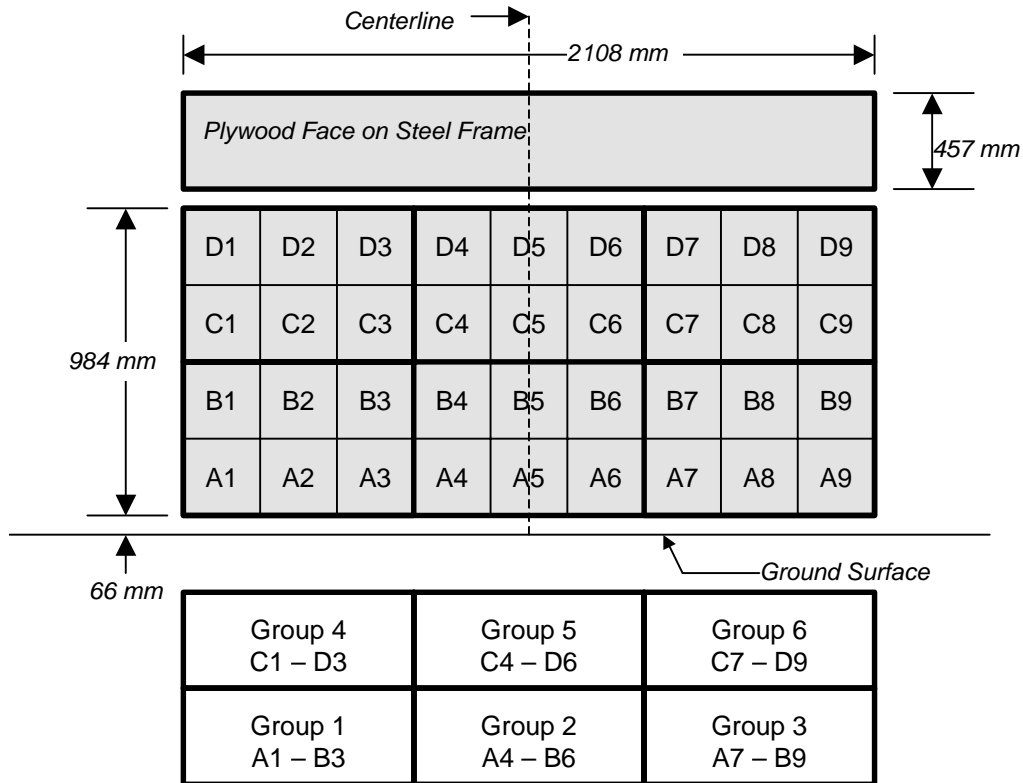
	Pre-Test				Post-Test				Difference			
	A	B	C	D	A	B	C	D	A	B	C	D
1	-22	-27	-18		20	2	4		42	29	22	
2	-84	-87	-73		-82	-90	-80		2	-3	-7	
3	-84	-92	-95	-94	-89	-115	-110	-115	-5	-23	-15	-21
4	-94	-98	-92	-95	-70	-118	-115	-112	24	-20	-23	-17
5	-97	-97	-93	-100	-115	-130	-112	-110	-18	-33	-19	-10

**DATA SHEET NO. 18**  
**FIXED BARRIER LOAD CELL LOCATIONS**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

**36 Load Cell Rigid Barrier (NHTSA Standard)**  
**Load Cell Locations on Fixed Barrier**



6 Groups of 6 Load Cells Each

The Data is presented in Appendix C with the following requirements:

- 1.) Data from 36 individual load cells
- 2.) Sum data from 6 groupings shown above (6 cells/group)
- 3.) Total or sum of all 36 individual load cells
- 4.) Sum of all 36 individual load cells vs. vehicle dynamic crush

**DATA SHEET NO. 19**  
**ACCIDENT INVESTIGATION DIVISION DATA**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
 Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
 Test Date: 6/13/02

**VEHICLE INFORMATION**

VIN: KMHWF25S52A641524 Wheel base (mm): 2700  
 Vehicle Size Category: 4 Door Sedan Test Weight (kg): 1678

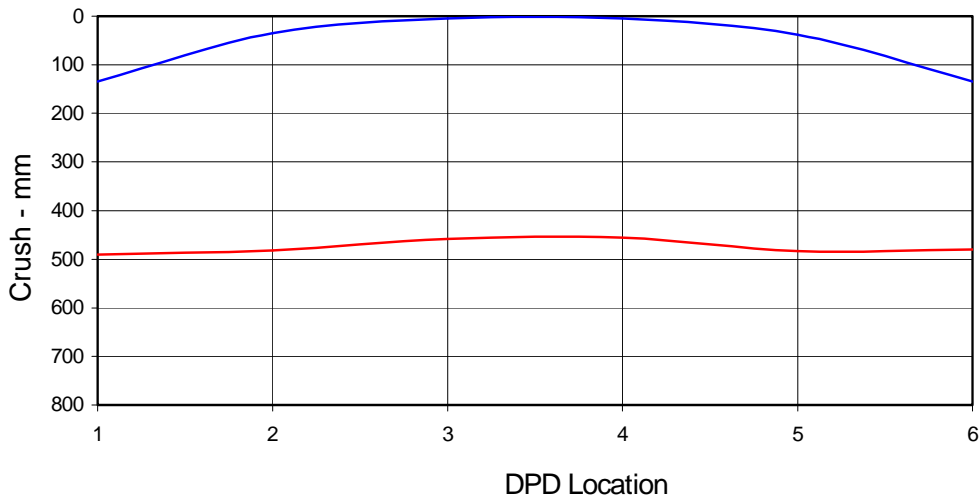
**ACCELEROMETER DATA**

Accelerometer Location: Left rear floor pan  
 Cal. Procedure/Interval: 6 months / drop test  
 Integration Algorithm: NHTSA Standard Linearity: Good  
 Impact Velocity (km/h): 55.82  
 Velocity Change (km/h): 64.62 Time of Separation (msec): 66.7

**CRUSH PROFILE**

Collision Deformation Classification: 12FDEW6 Midpoint of Damage: Vehicle Centerline  
 Damage Region Length (mm): 1319 Impact Mode: Full Frontal

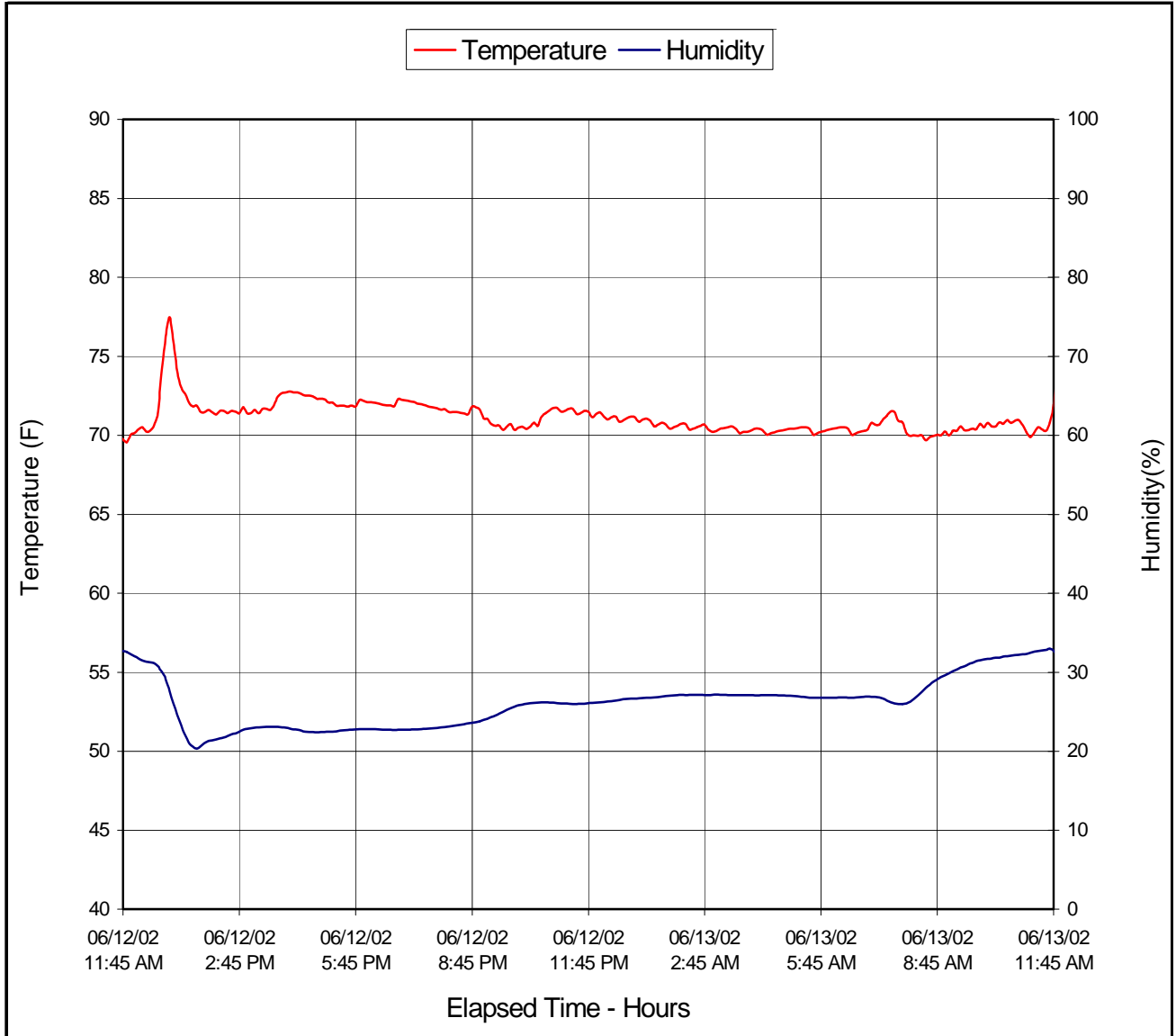
No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	134	491	-357
C2	Crush zone 2 on left side	mm	35	482	-447
C3	Crush zone 3 on left side	mm	5	458	-453
C4	Crush zone 4 on right side	mm	5	456	-451
C5	Crush zone 5 on right side	mm	38	483	-445
C6	Crush zone 6 at right side	mm	134	480	-346



**DATA SHEET NO. 20**  
**DUMMY/VEHICLE TEMPERATURE STABILIZATION**

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan  
Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505  
Test Date: 6/13/02



**APPENDIX A**

**PHOTOGRAPHS**

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Figure A-1: Right Front, as Received



Figure A-2: Left Rear, as Received

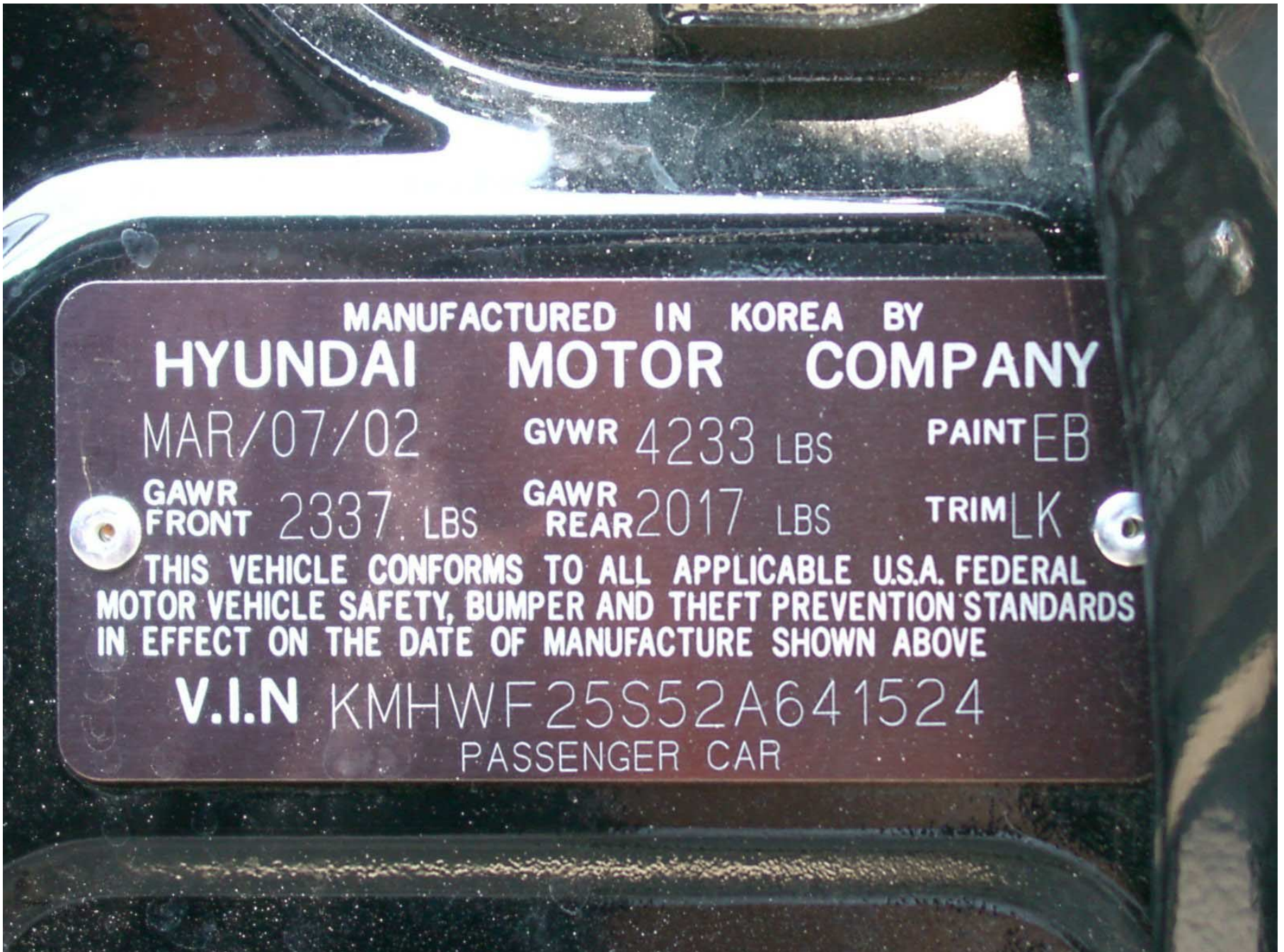


Figure A-3: Vehicle Certification Label

0 RECOMMENDED INFLATION PRESSURE-COLD

VEHICLE CAPACITY WEIGHT . LBS:860  
 SEATING CAPACITY:TOTAL 5 FRONT 2 REAR 3

TIRE PRESSURE-COLD.KPA(PSI):

TIRE SIZE	LOAD UP TO 2 PERSONS		MAX. VEHICLE WEIGHT LIMIT	
	FRONT	REAR	FRONT	REAR
P205/65 R15, P205/60 R16	210 (30)	210 (30)	230 (33)	230 (33)
T125/70 D15, T125/70 R15	420 (60)	420 (60)	420 (60)	420 (60)

Figure A-4: Vehicle Tire Label



Figure A-5: Front View, Pre-Test

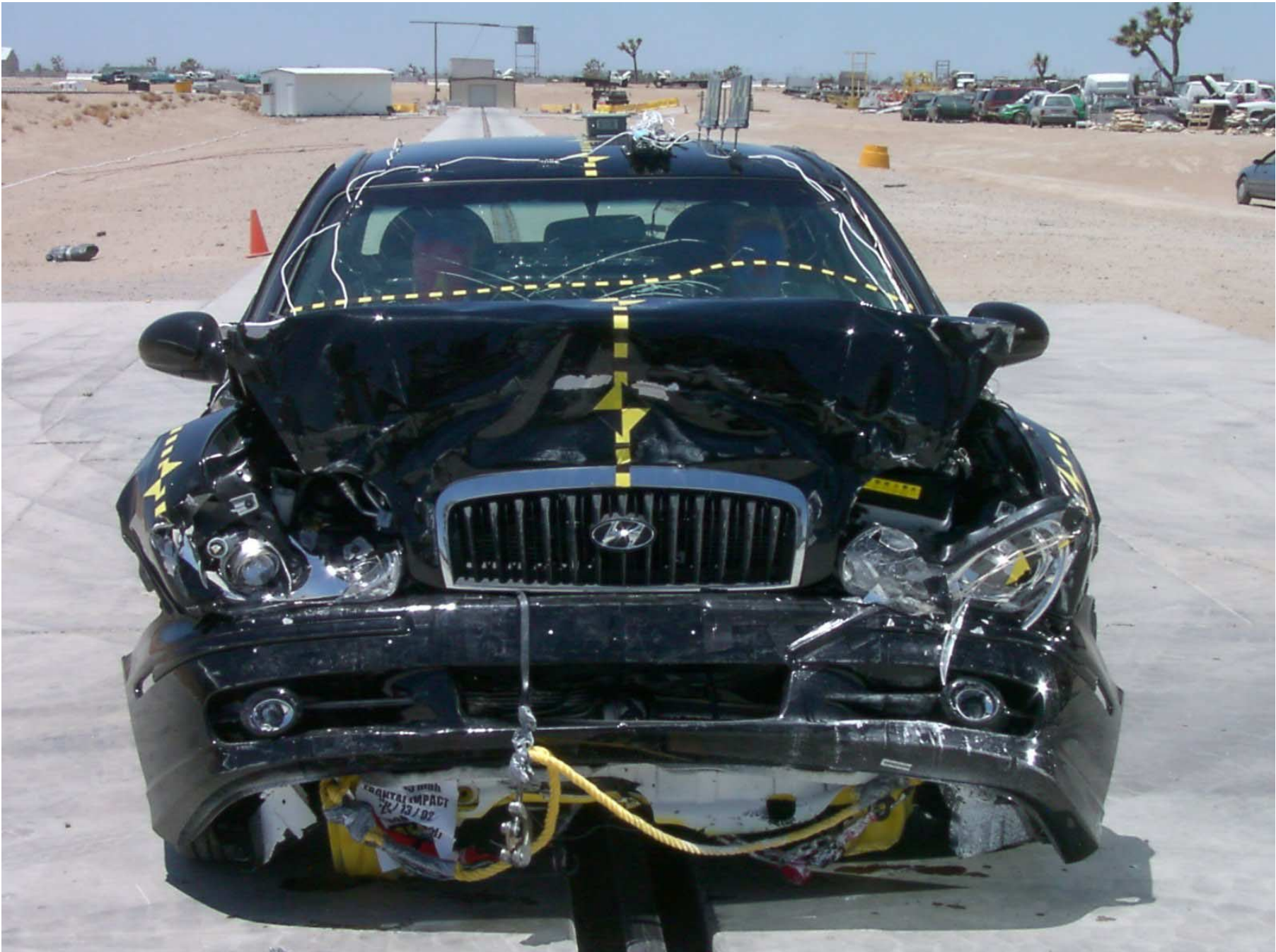


Figure A-6: Front View, Post-Test



Figure A-7: Left Side View, Pre-Test



Figure A-8: Left Side View, Post-Test



Figure A-9: Right Side View, Pre-Test



Figure A-10: Right Side View, Post-Test



Figure A-11: Right Front View, Pre-Test



Figure A-12: Right Front View, Post-Test (Vehicle moved and door opened by hand)



Figure A-13: Left Rear View, Pre-Test



Figure A-14: Left Rear View, Post-Test

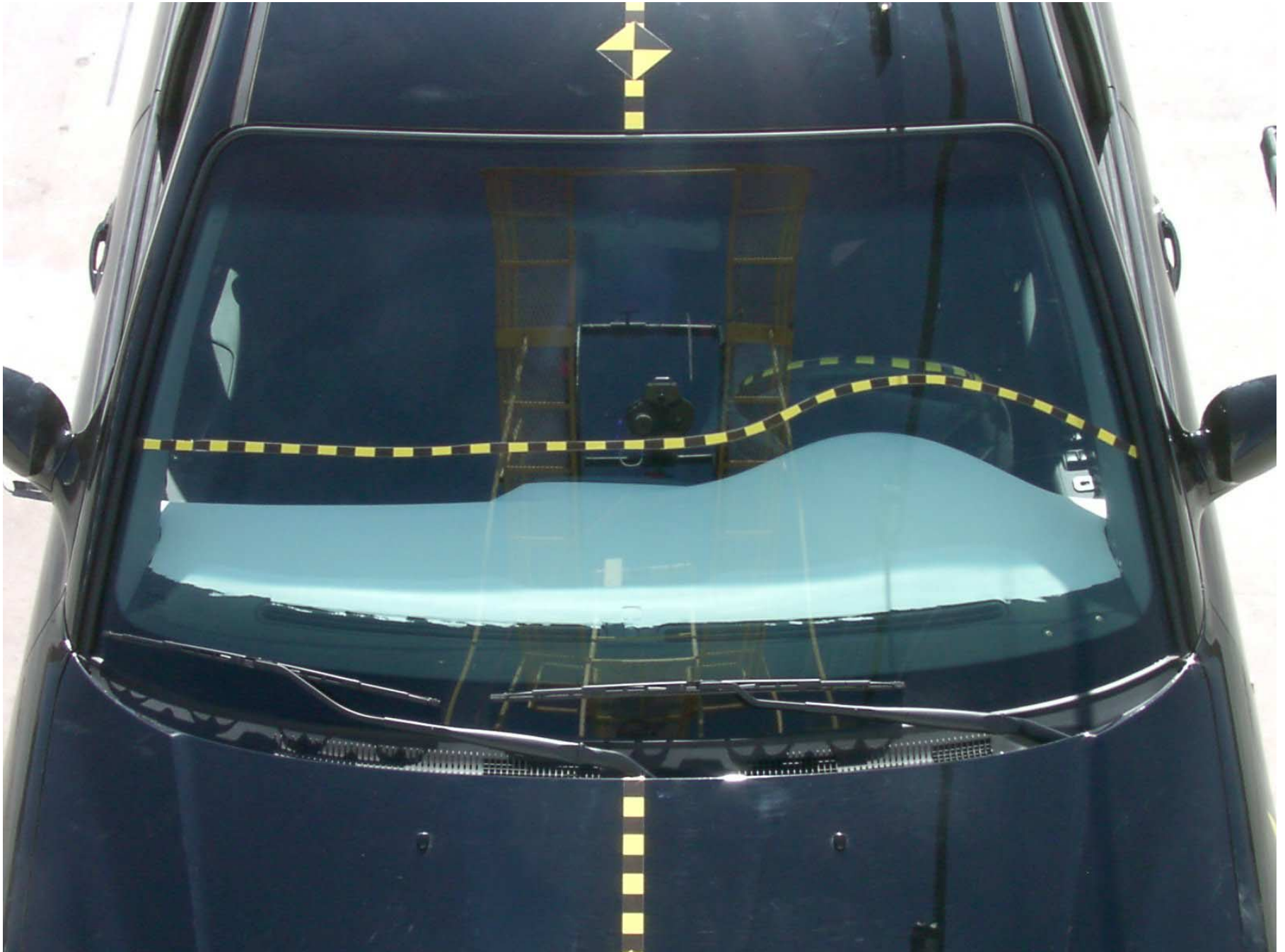


Figure A-15: Windshield, Pre-Test

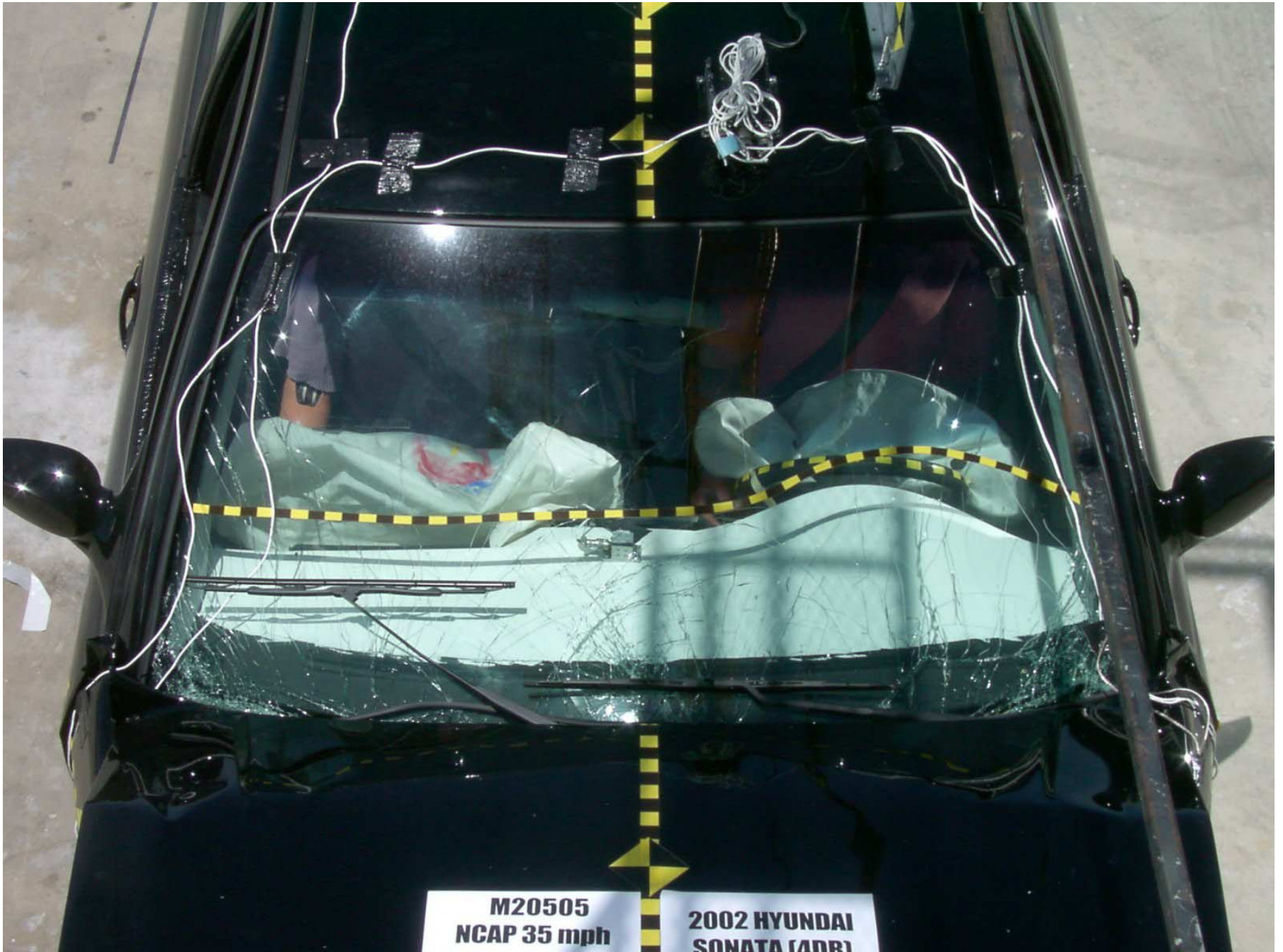


Figure A-16: Windshield, Post-Test



Figure A-17: Engine Compartment, Pre-Test



Figure A-18: Engine Compartment, Post-Test



Figure A-19: Fuel Cap, Pre-test



Figure A-20: Fuel Cap, Post-Test

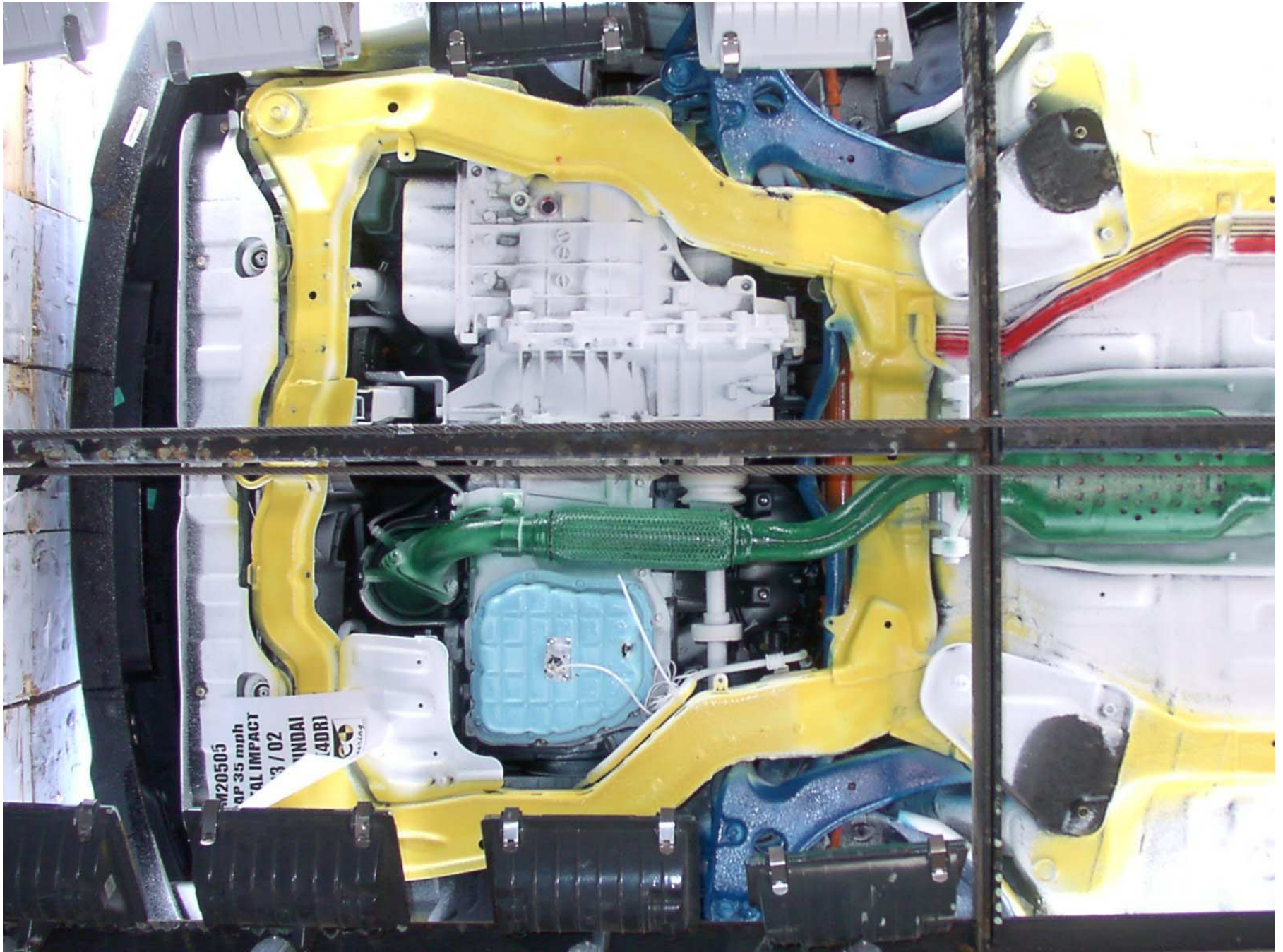


Figure A-21: Front Underside, Pre-Test

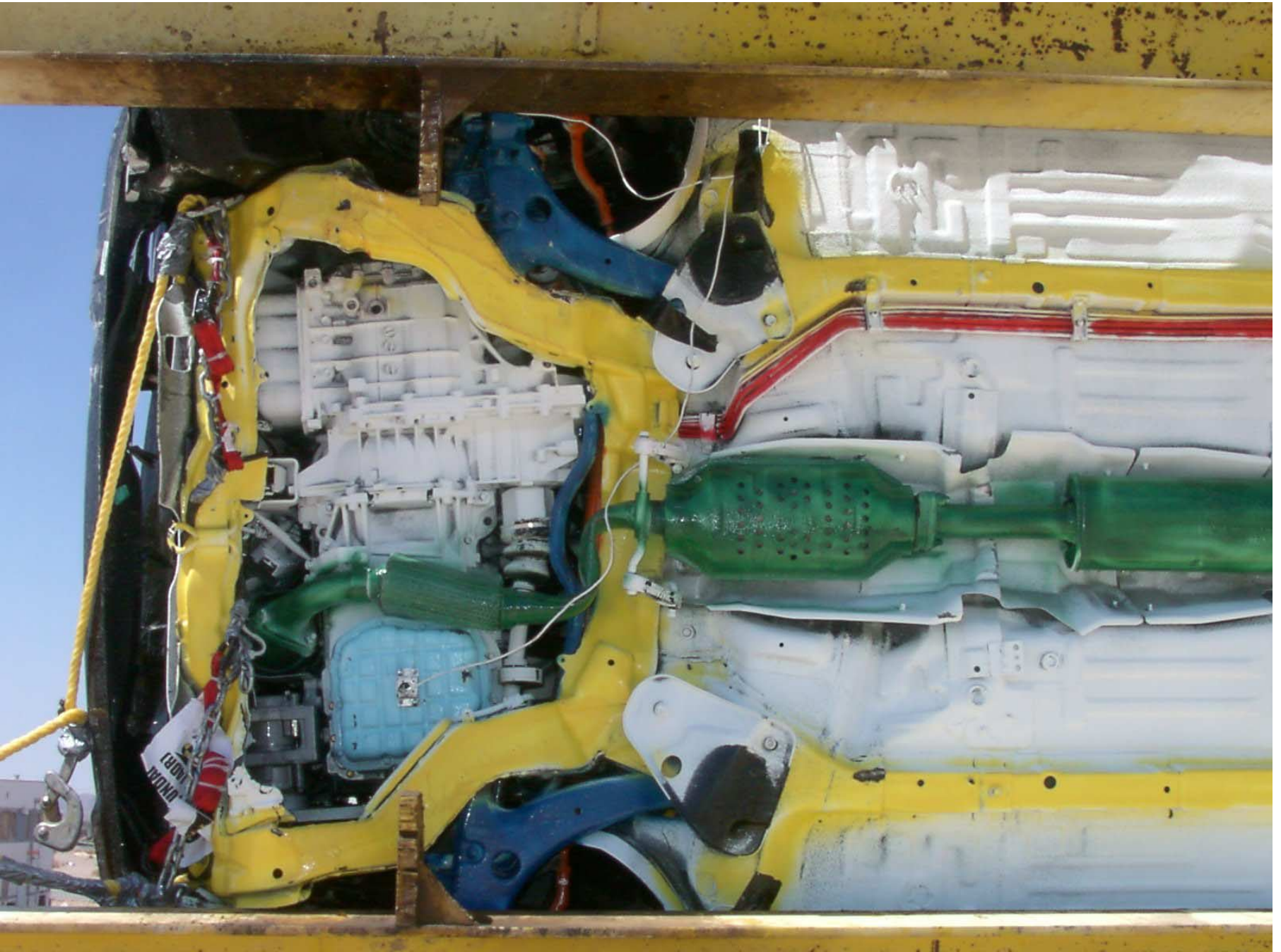


Figure A-22: Front Underside, Post-Test

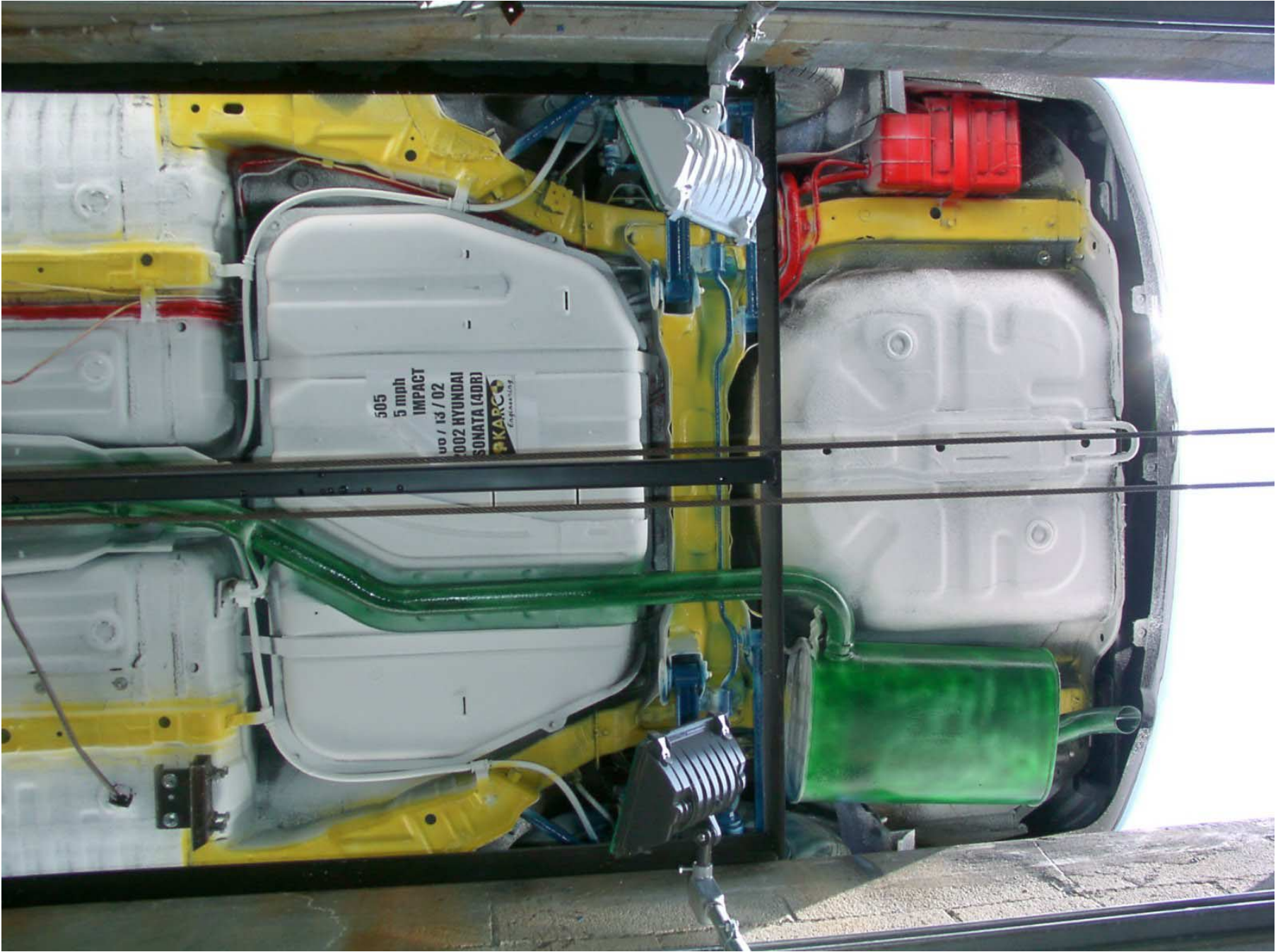


Figure A-23: Rear Underside, Pre-Test



Figure A-24: Rear Underside, Post-Test

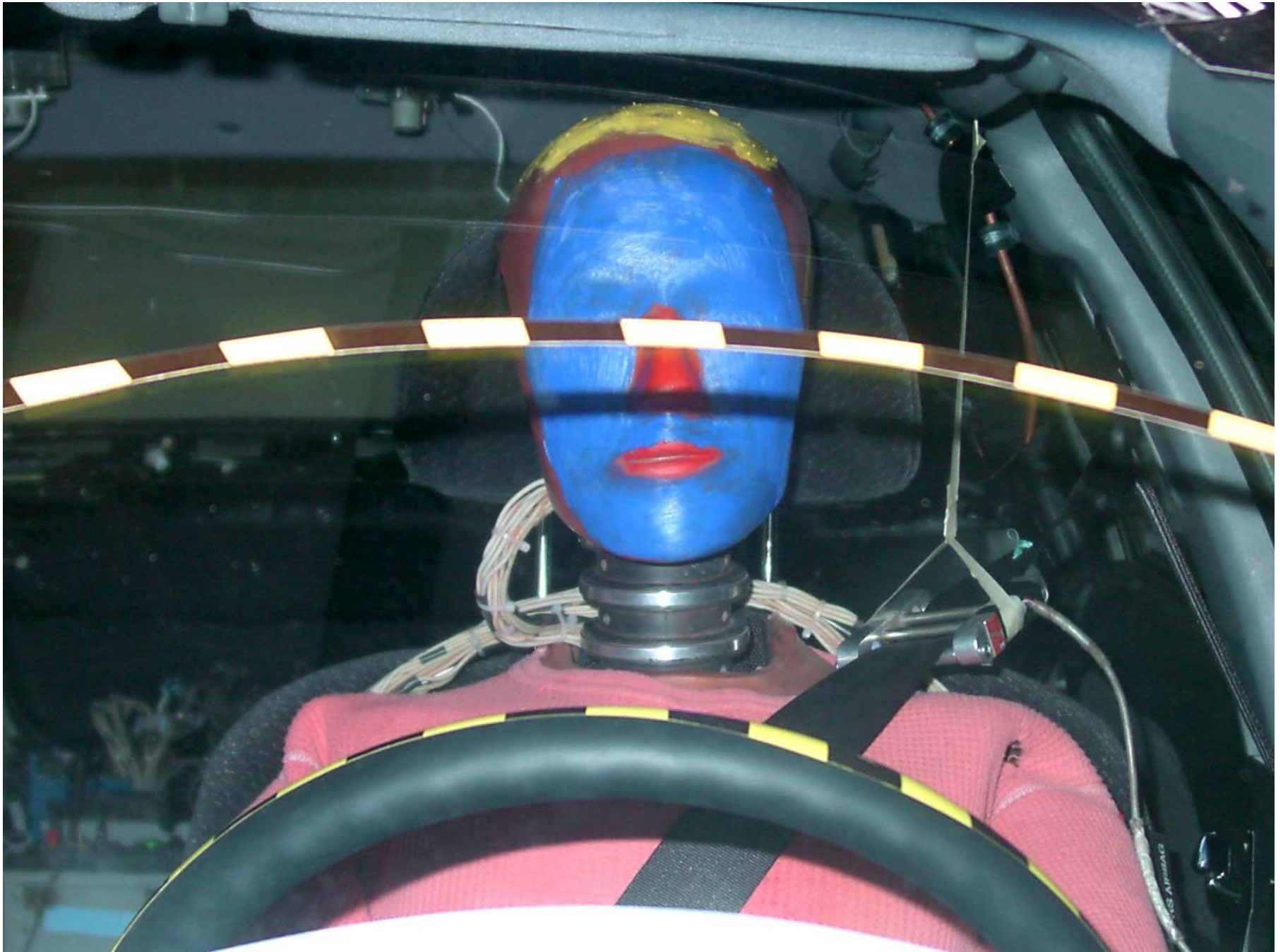


Figure A-25: Driver Dummy Front View, Pre-Test



Figure A-26: Driver Dummy Front View, Post-Test



Figure A-27: Driver Dummy Through Window, Pre-Test



Figure A-28: Driver Dummy Through Window, Post-Test



Figure A-29: Driver Dummy Door Open, Pre-Test



Figure A-30: Driver Dummy Door Open, Post-Test



Figure A-31: Driver Dummy 90° To Vehicle, Pre-Test



Figure A-32: Driver Dummy 90° To Vehicle, Post-Test

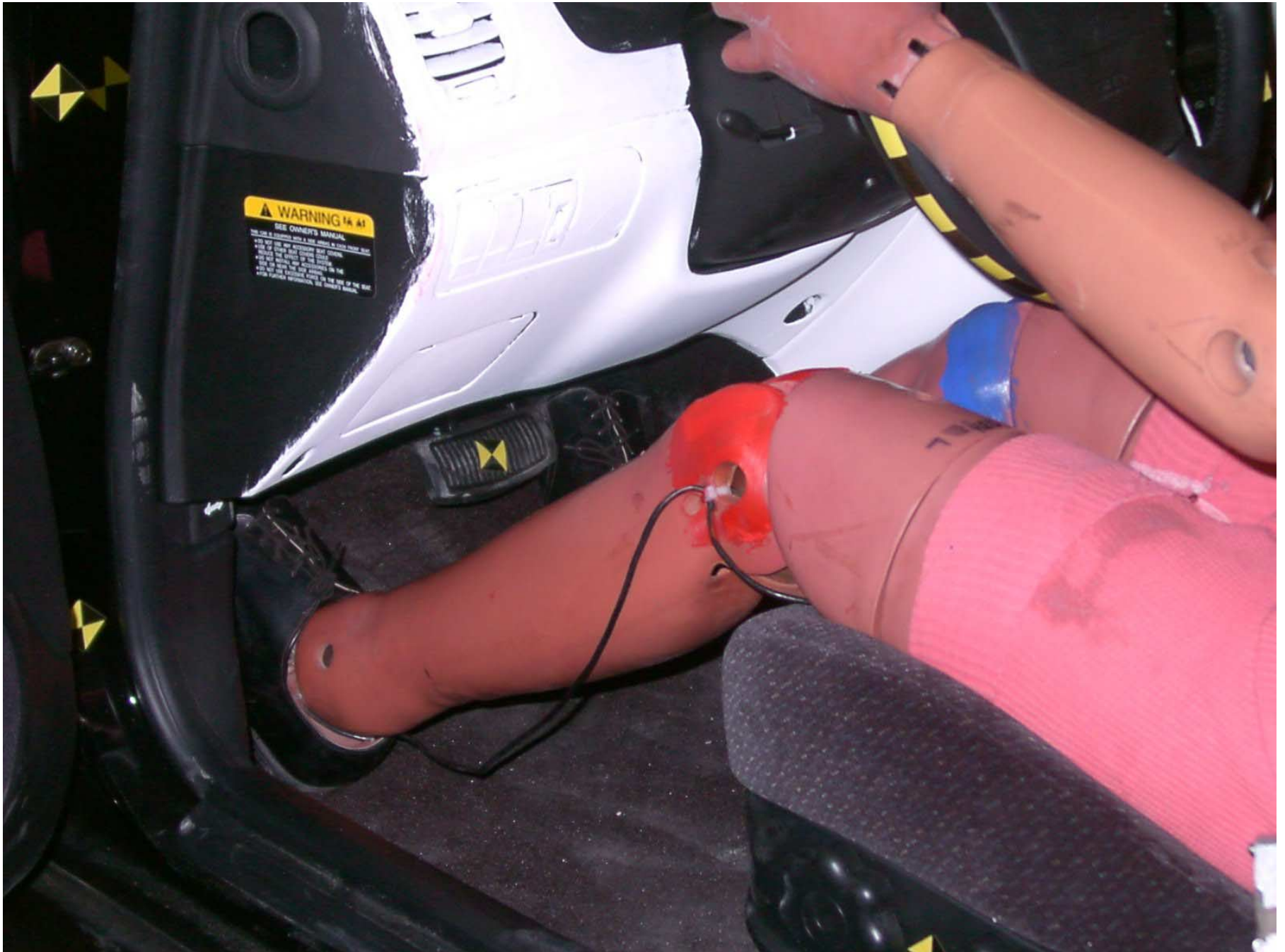


Figure A-33: Driver Dummy Feet, Pre-Test



Figure A-34: Driver Dummy Feet and Knee Contact, Post-Test



Figure A-35: Driver Side Knee Bolster, Pre-Test



Figure A-36: Driver Side Knee Bolster, Post-Test



Figure A-37: Driver Side Floor Pan, Pre-Test



Figure A-38: Driver Side Floor Pan, Post-Test



Figure A-39: Driver Dummy Head, Post-Test



Figure A-40: Driver Dummy Contact, Post-Test



Figure A-41: Passenger Dummy Front View, Pre-Test



Figure A-42: Passenger Dummy Front View, Post-Test



Figure A-43: Passenger Dummy Through Window, Pre-Test



Figure A-44: Passenger Dummy Through Window, Post-Test

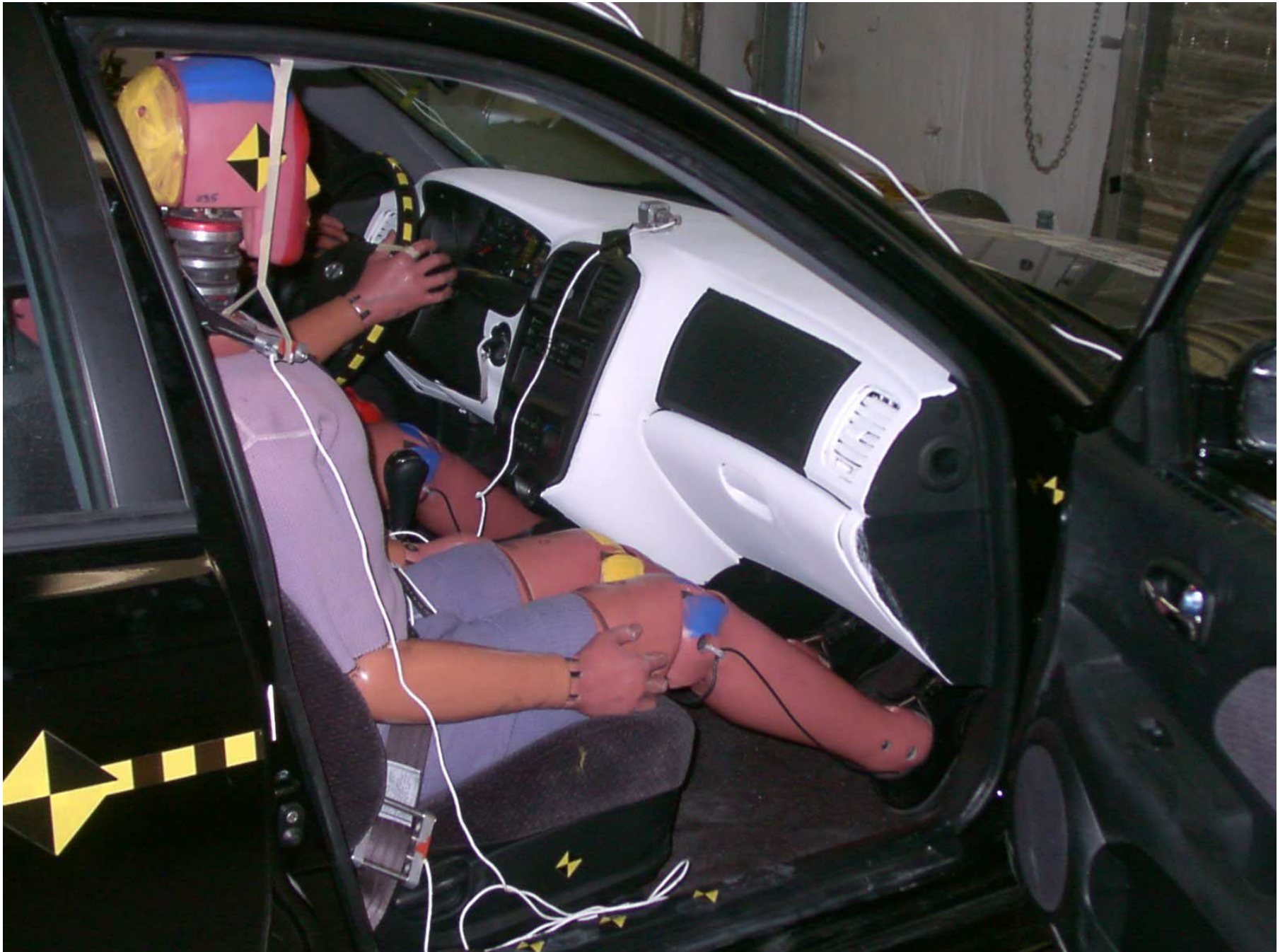


Figure A-45: Passenger Dummy Door Open, Pre-Test



Figure A-46: Passenger Dummy Door Open, Post-Test



Figure A-47: Passenger Dummy 90° To Vehicle, Pre-Test



Figure A-48: Passenger Dummy 90° To Vehicle, Post-Test



Figure A-49: Passenger Dummy Feet, Pre-Test



Figure A-50: Passenger Dummy Feet and Knee Contact, Post-Test

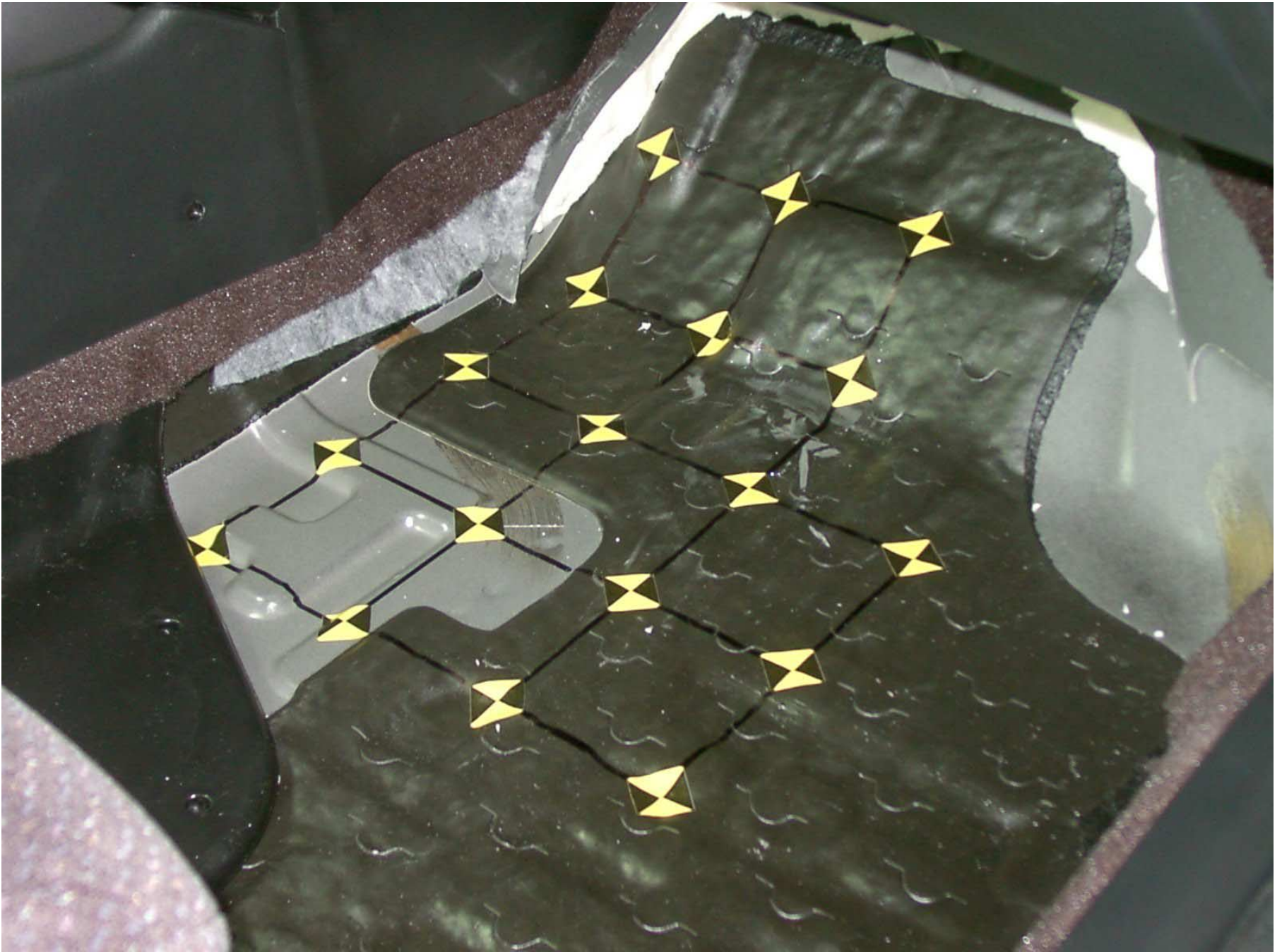


Figure A-51: Passenger Side Floor Pan, Pre-Test



Figure A-52: Passenger Side Floor Pan, Post-Test



Figure A-53: Passenger Side Knee Bolster, Pre-Test



Figure A-54: Passenger Side Knee Bolster, Post-Test



Figure A-55: Passenger Head, Post-Test



Figure A-56: Passenger Dummy Contact, Post-Test



Figure A-57: Left Rear View of Doors After Impact



Figure A-58: 3/4 Right Rear View of Doors After Impact



Figure A-59: Vehicle on Rollover Device



Figure A-60: Vehicle During Impact

## **APPENDIX B**

### **DATA PLOTS**

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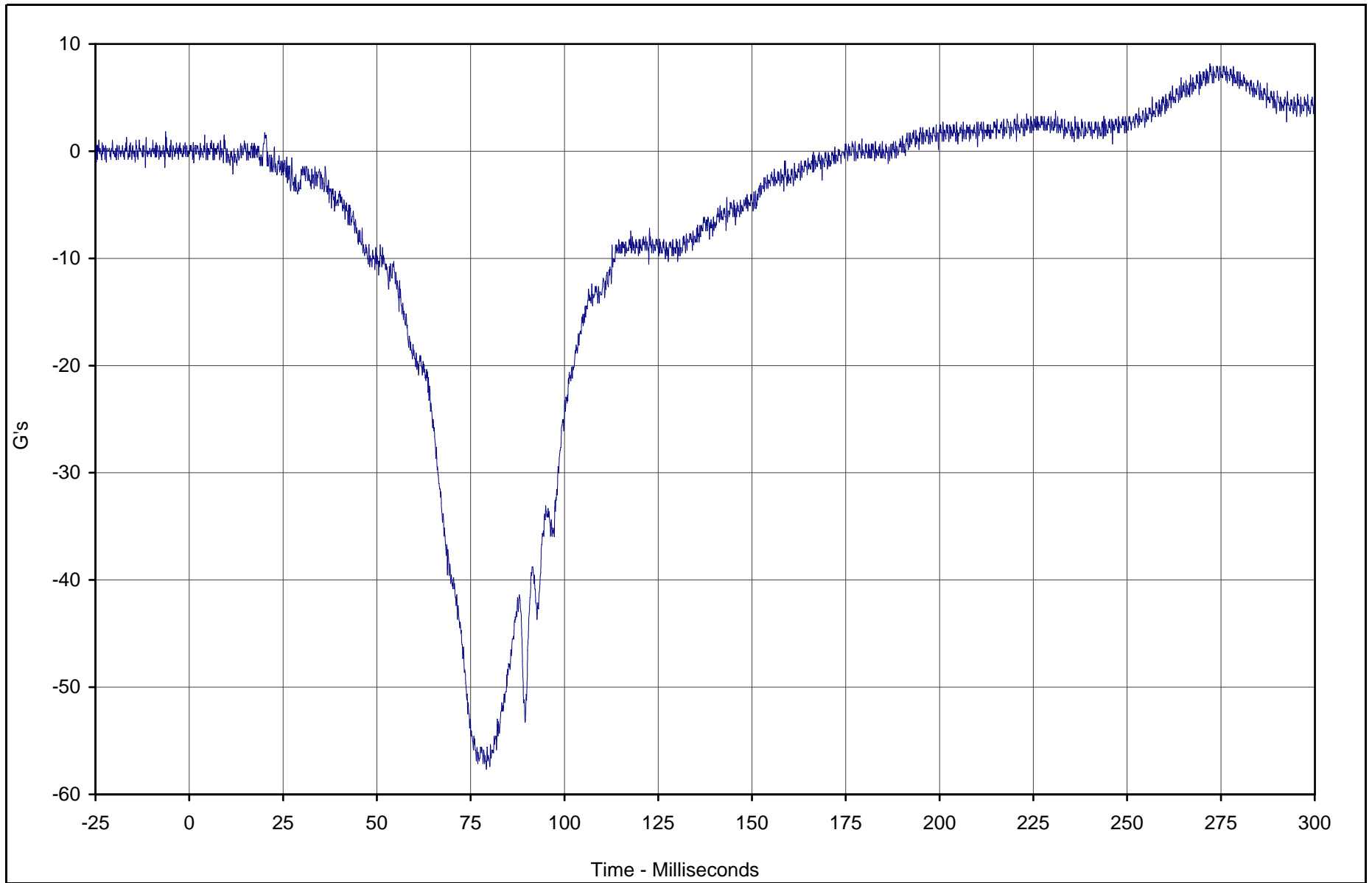
## LIST OF DATA PLOTS...(Continued)

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B-1



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Primary X	001	FIL	G's	8.2	272.1	-57.7	79.2	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

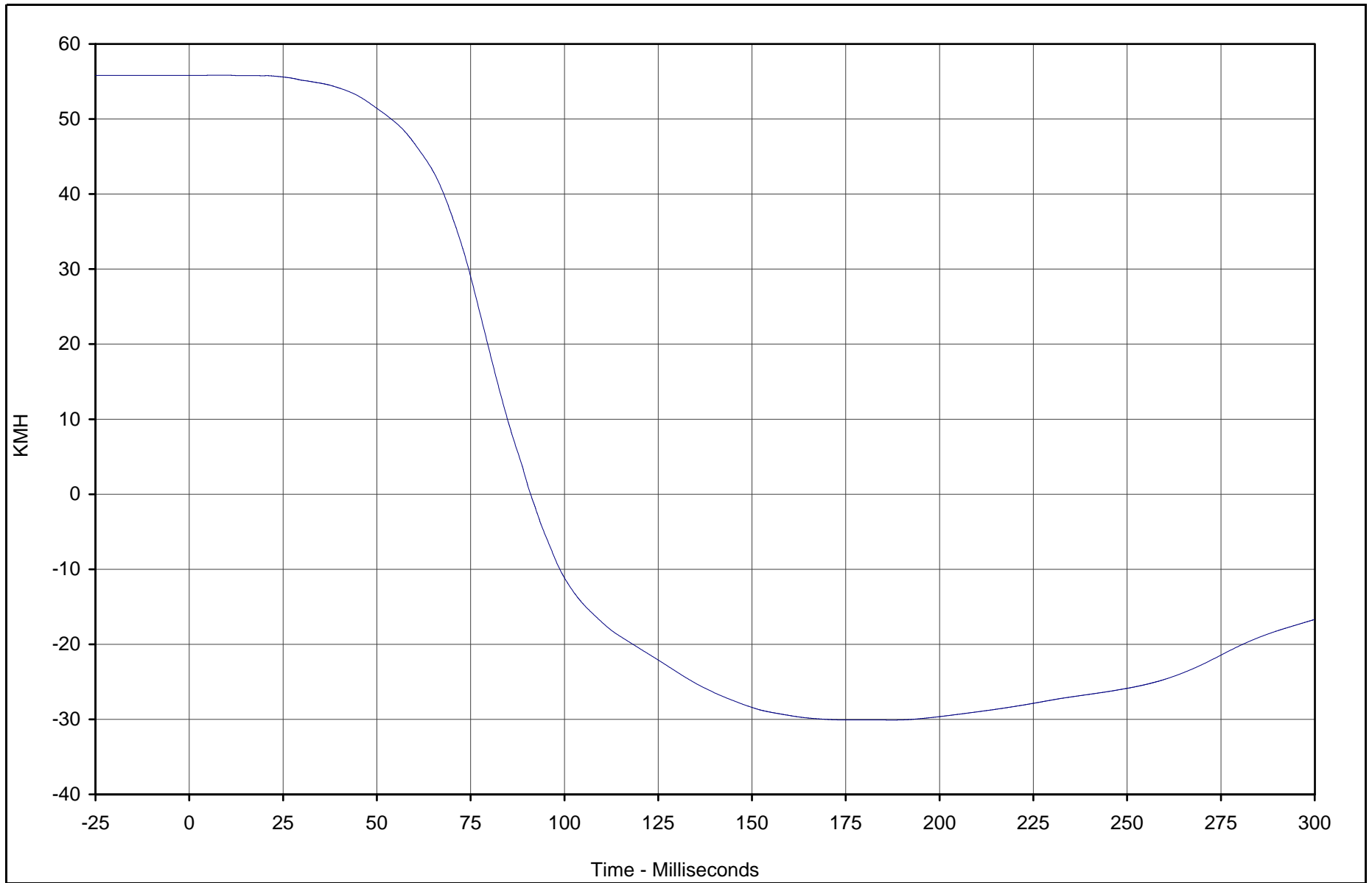
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-2



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Primary X Velocity	001	IN1	KMH	55.8	9.7	-30.1	187.2	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

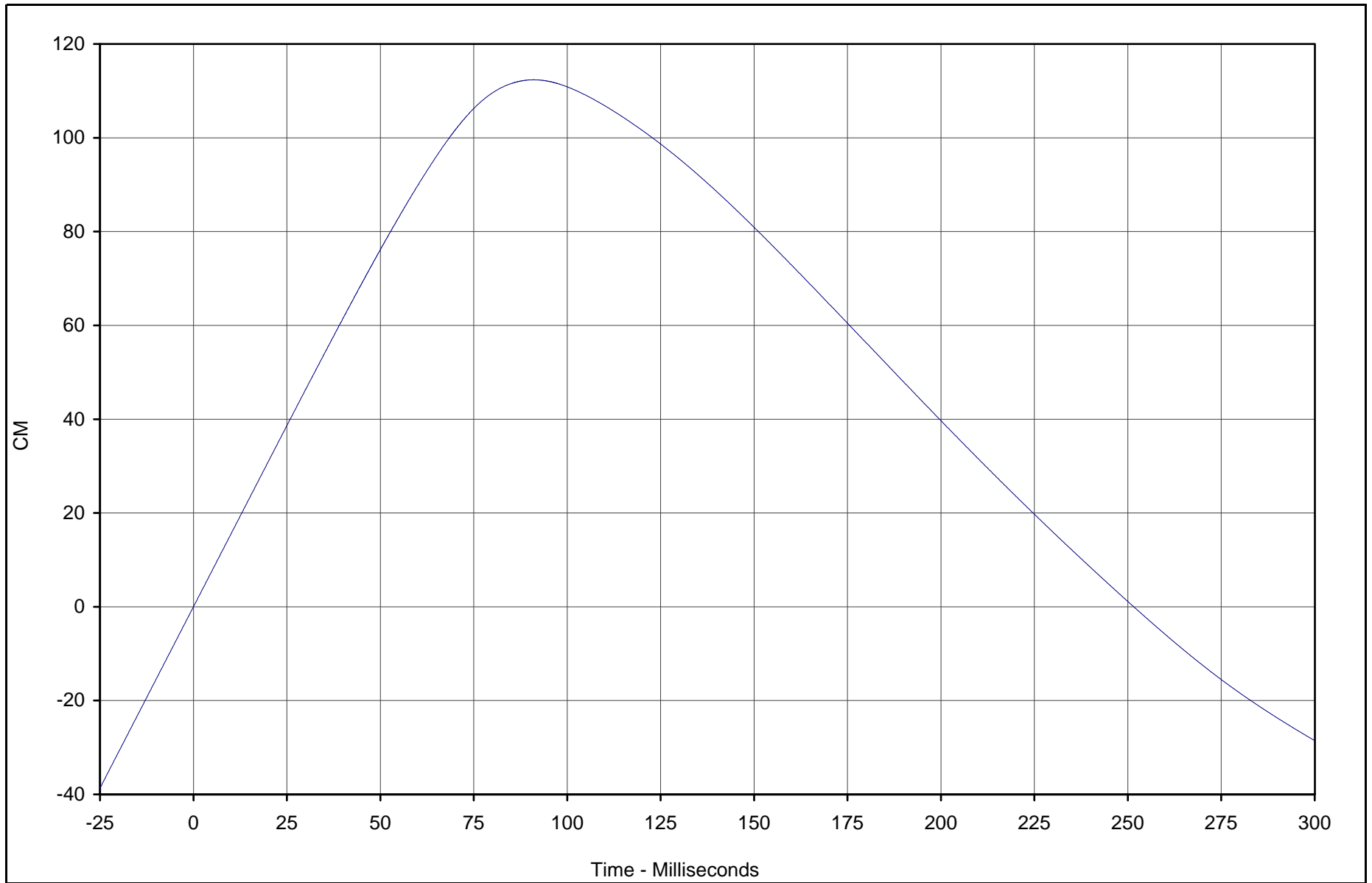
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-3



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Primary X Displ.	001	IN2	CM	112.4	91.0	-28.5	299.9	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

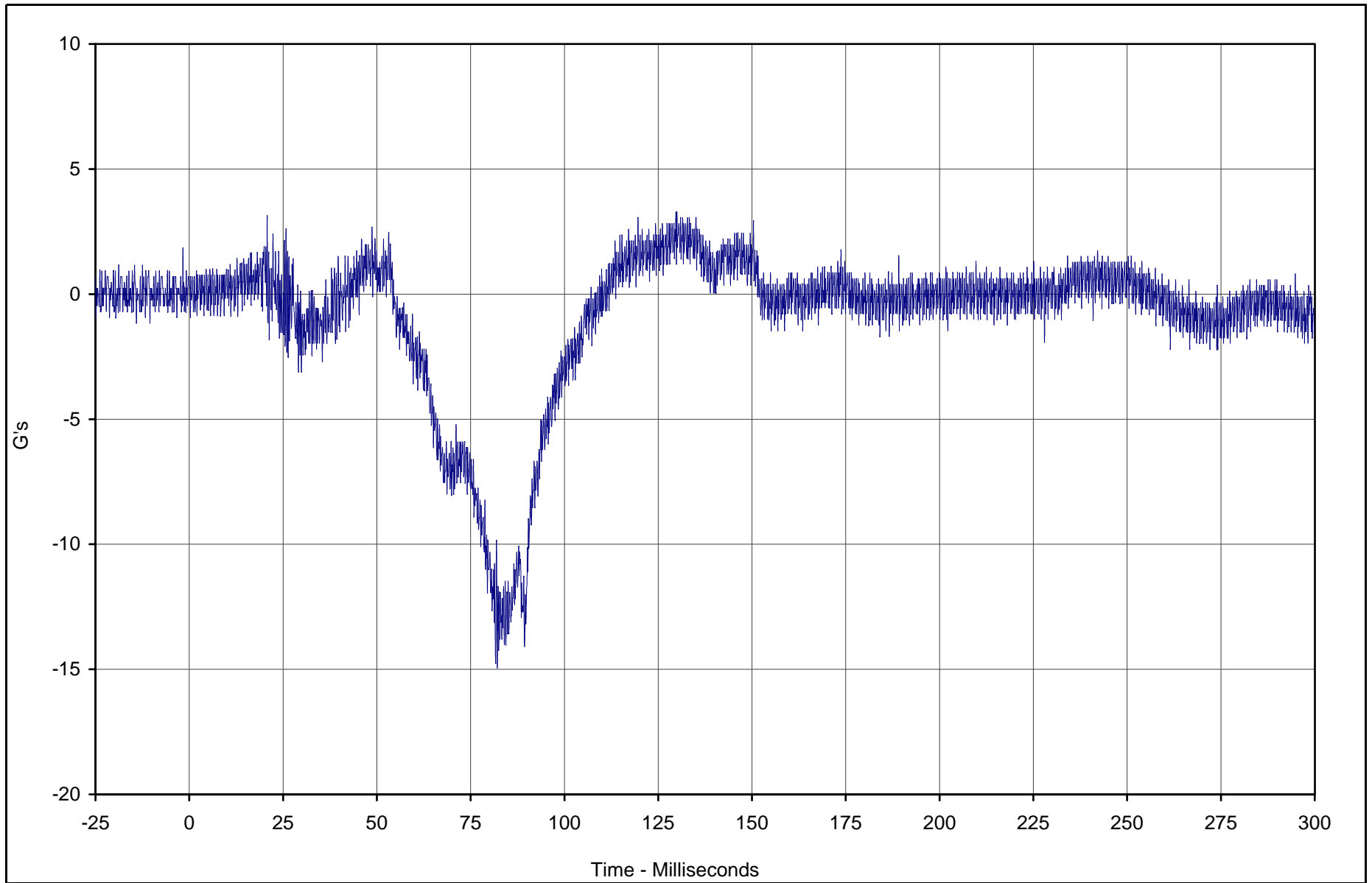
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-4



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Primary Y	002	FIL	G's	3.3	129.7	-14.9	82.1	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

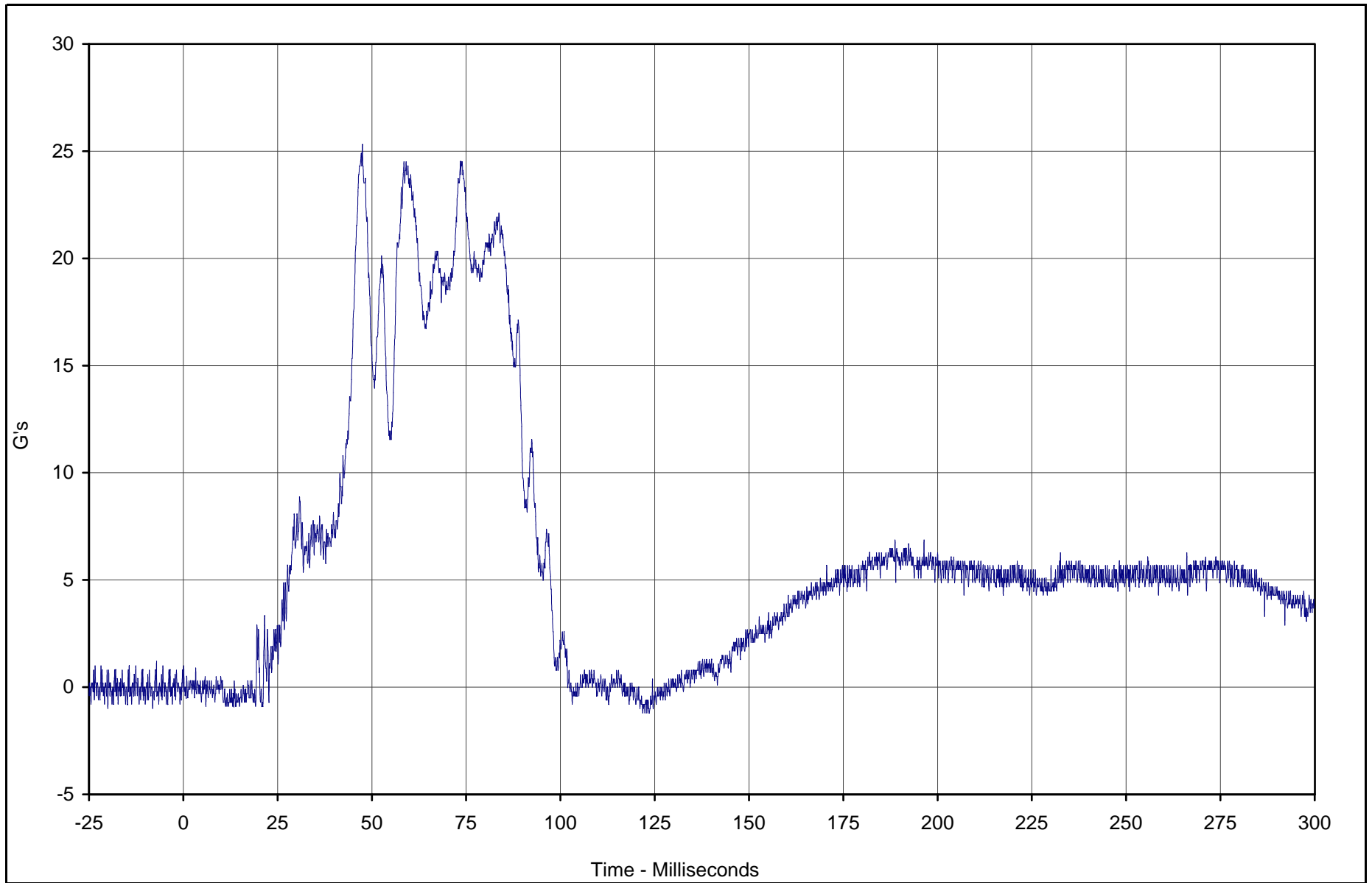
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-5



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Primary Z	003	FIL	G's	25.3	47.5	-1.2	121.8	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

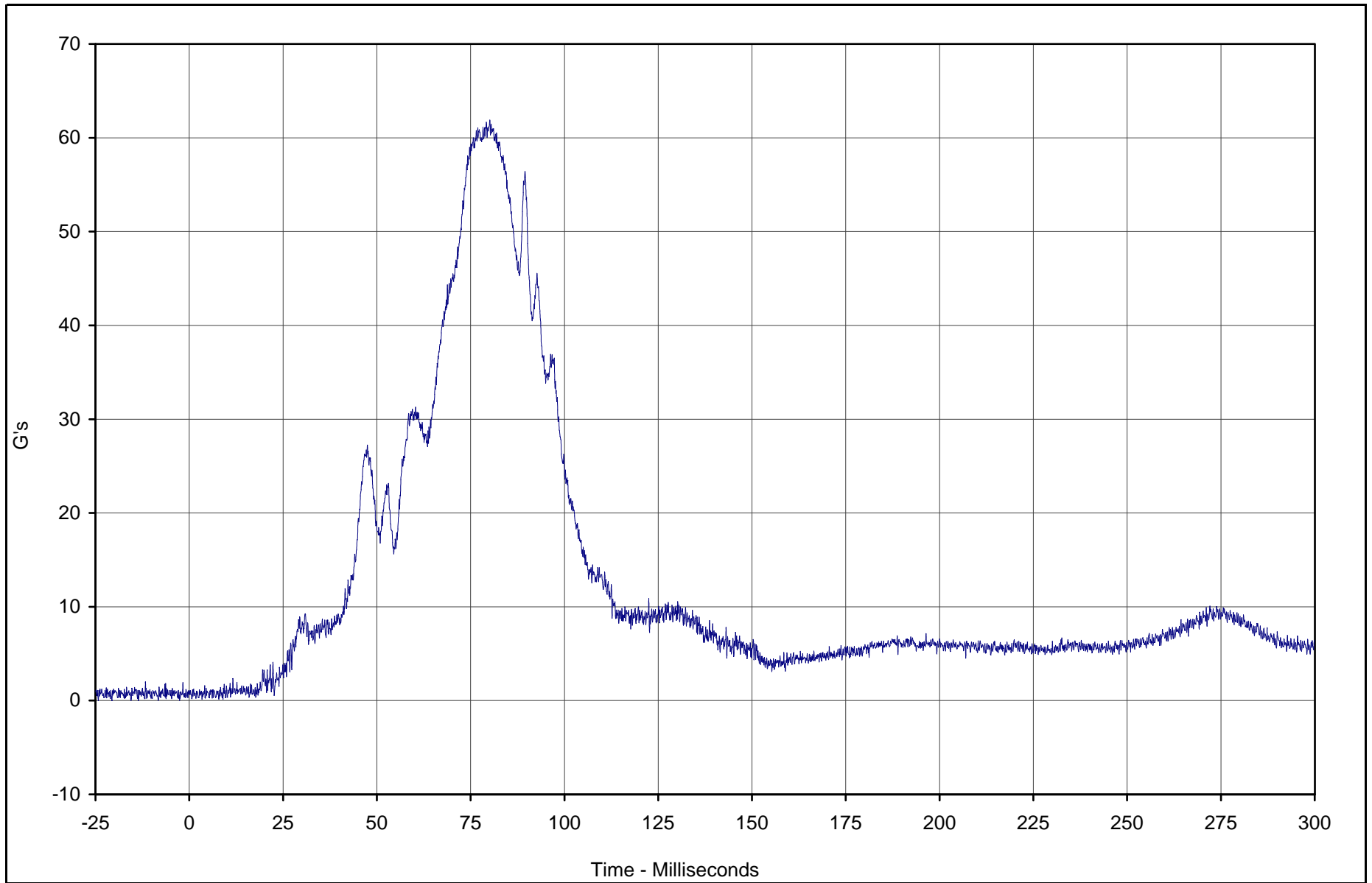
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-6



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Resultant Primary	001	RES	G's	61.9	80.1	0.1	3.4	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

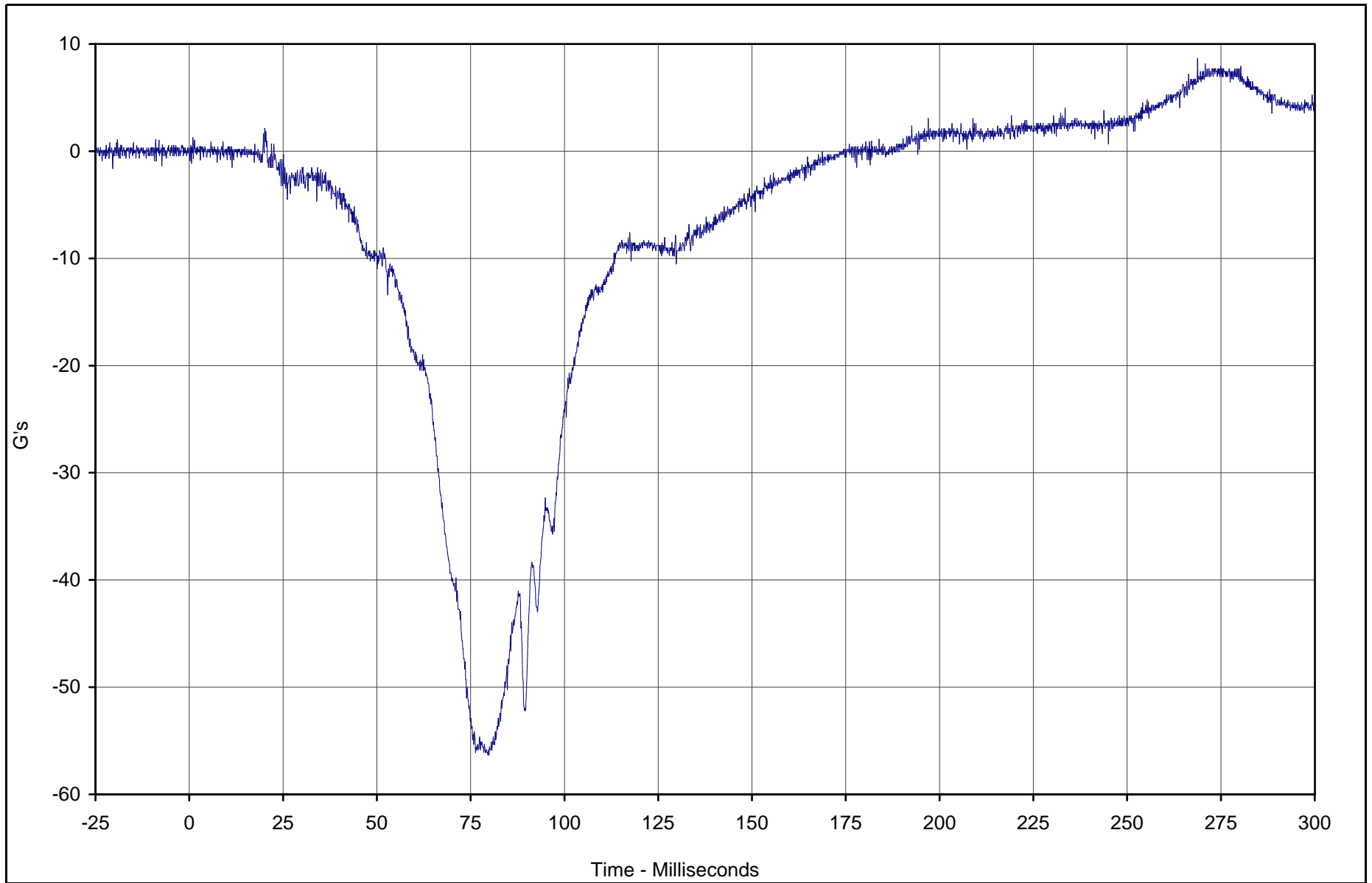
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-7



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Redundant X	004	FIL	G's	8.7	268.8	-56.3	79.6	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

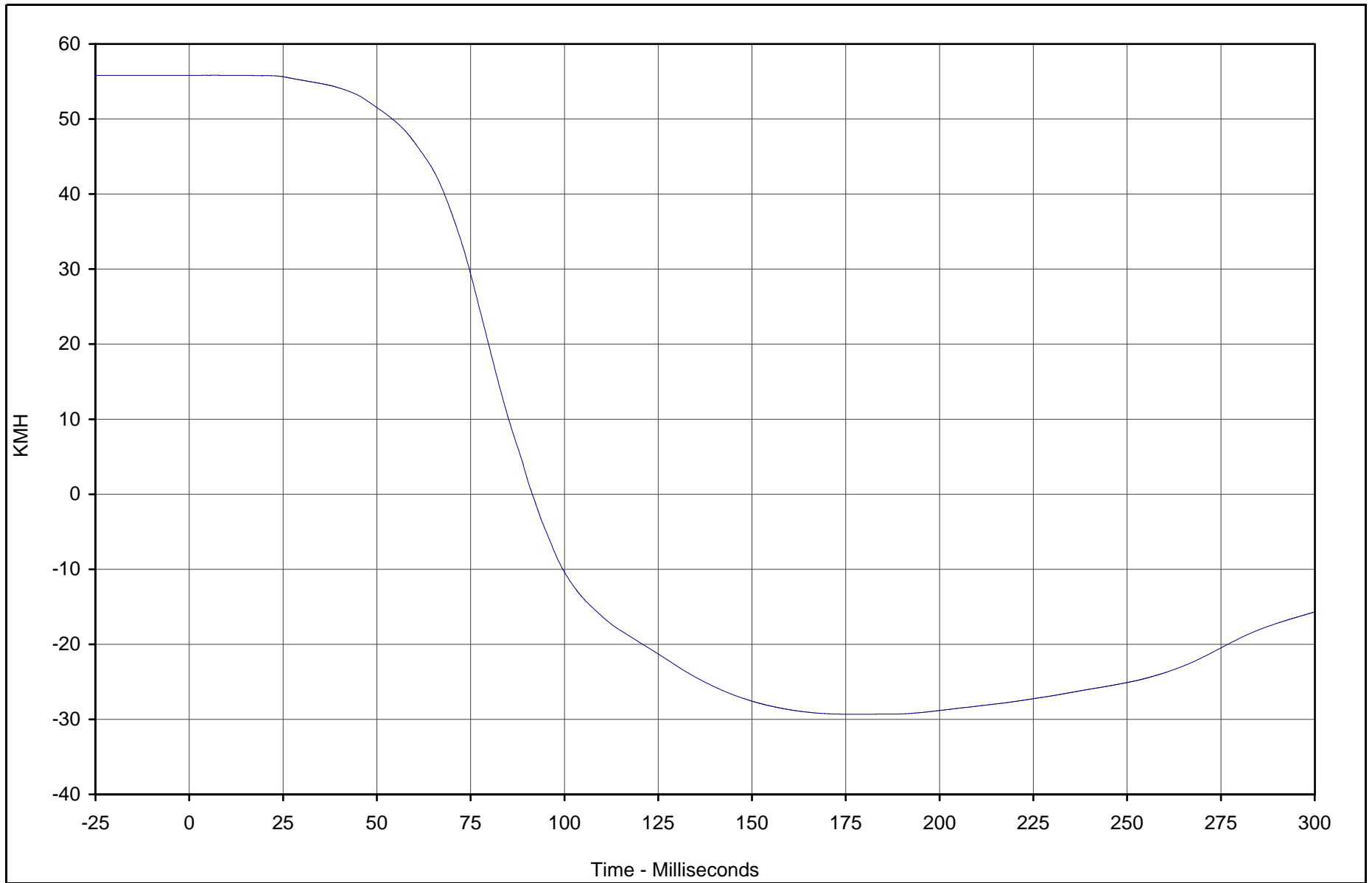
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-8



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Redundant X Velocity	004	IN1	KMH	55.8	6.9	-29.3	178.6	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

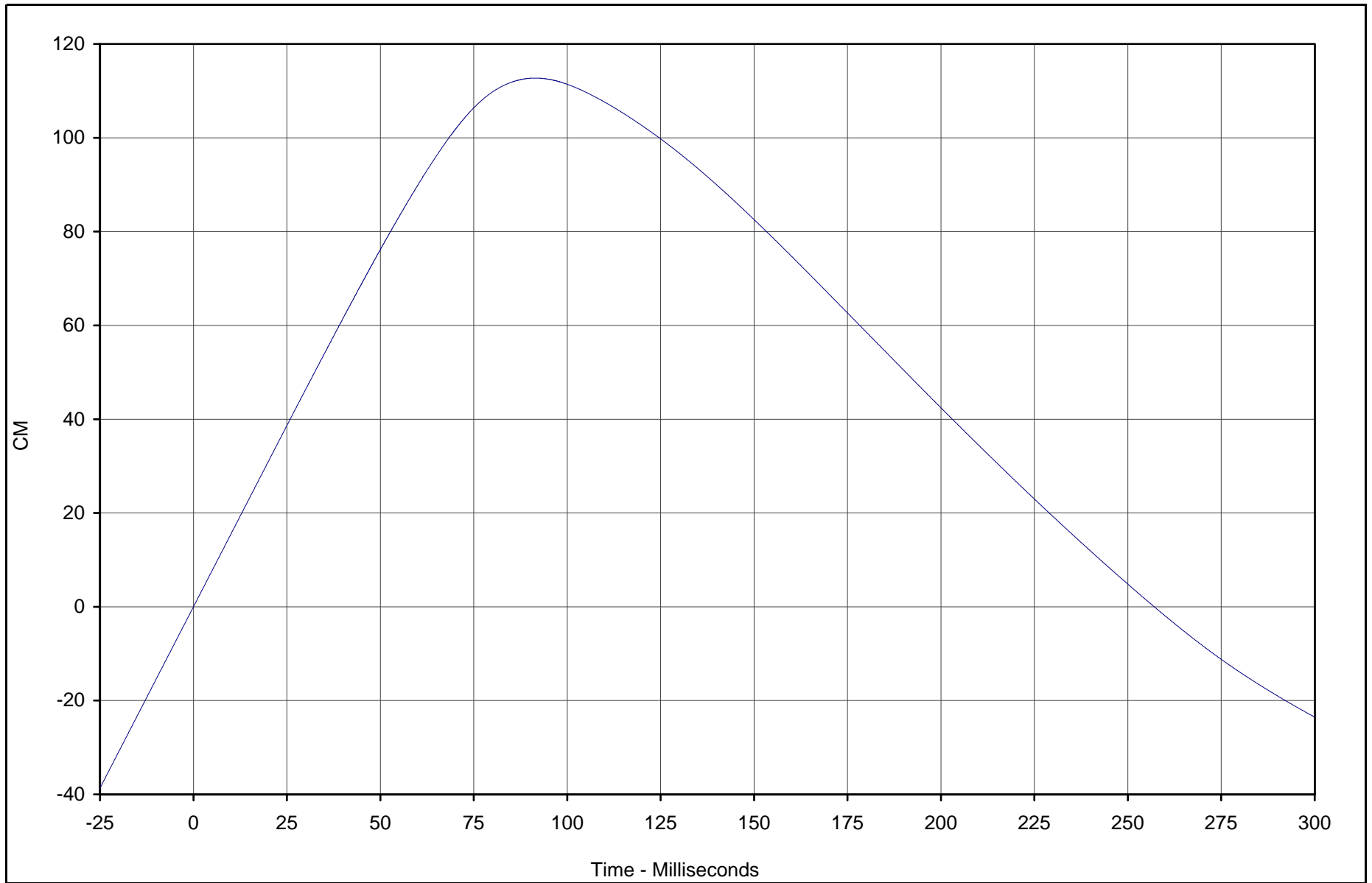
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-9



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Redundant X Displ.	004	IN2	CM	112.7	91.4	-23.5	299.9	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

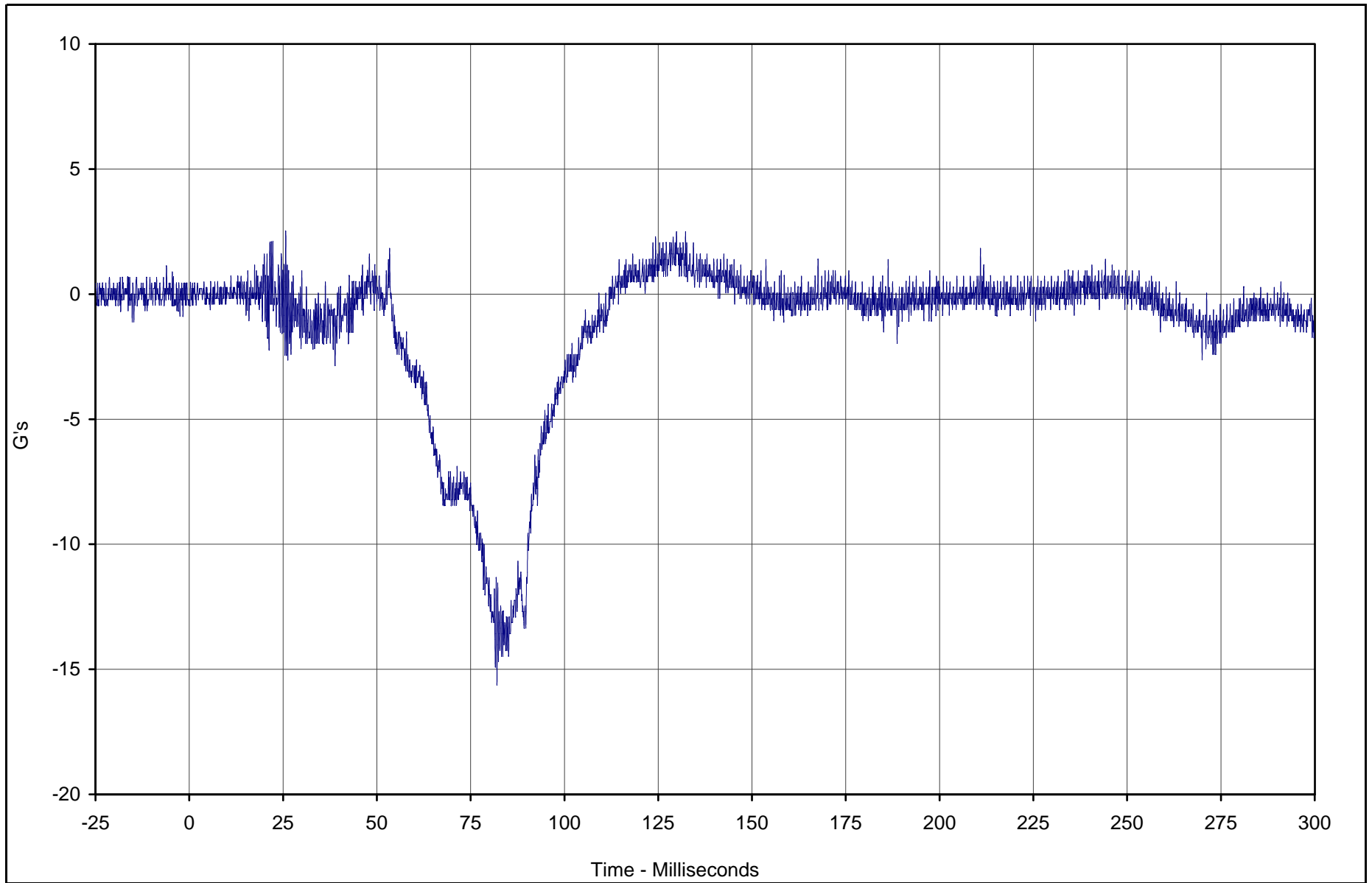
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-10



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Redundant Y	005	FIL	G's	2.5	25.7	-15.6	82.0	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

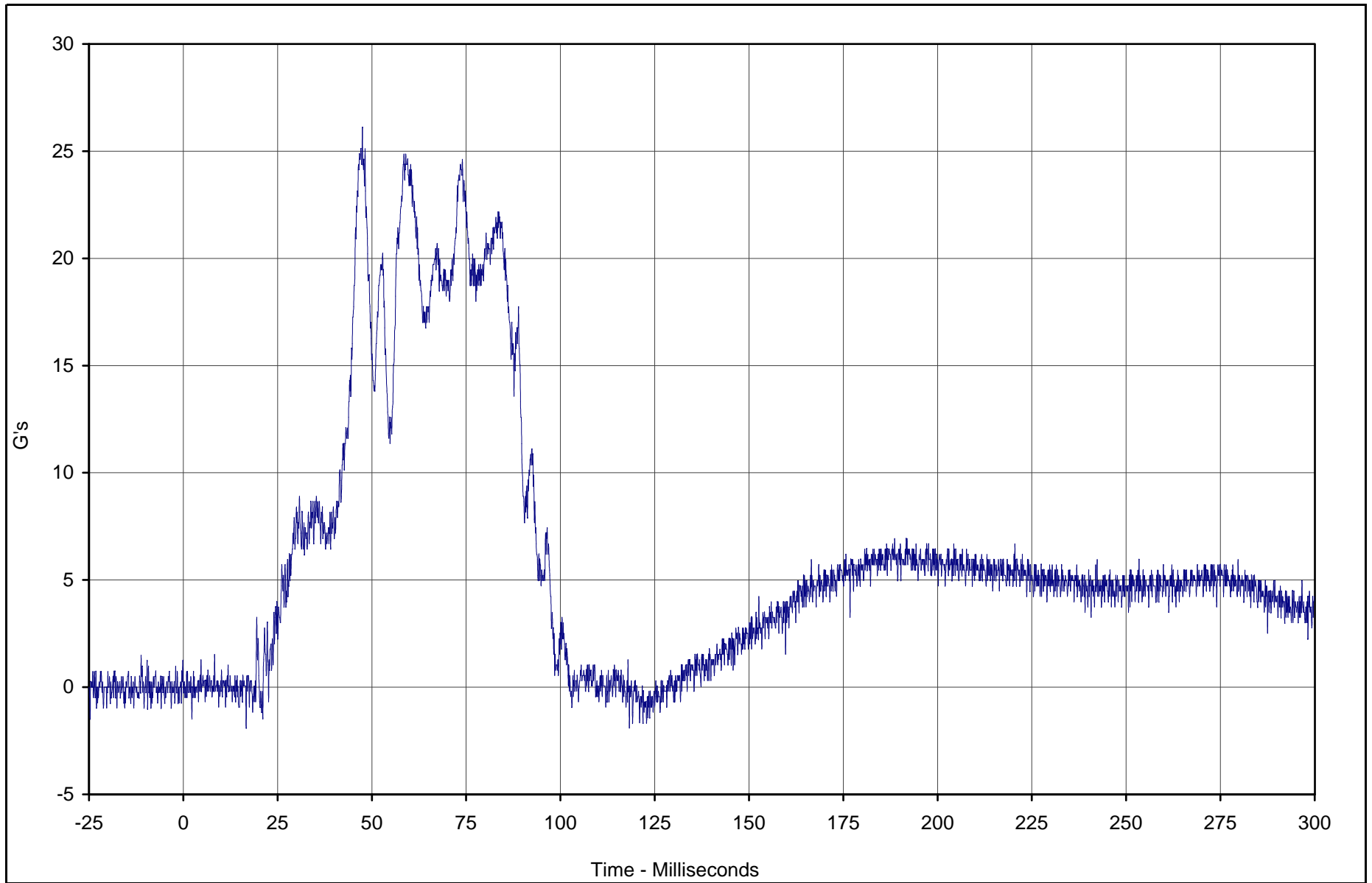
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-11



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Redundant Z	006	FIL	G's	26.1	47.5	-1.9	16.7	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

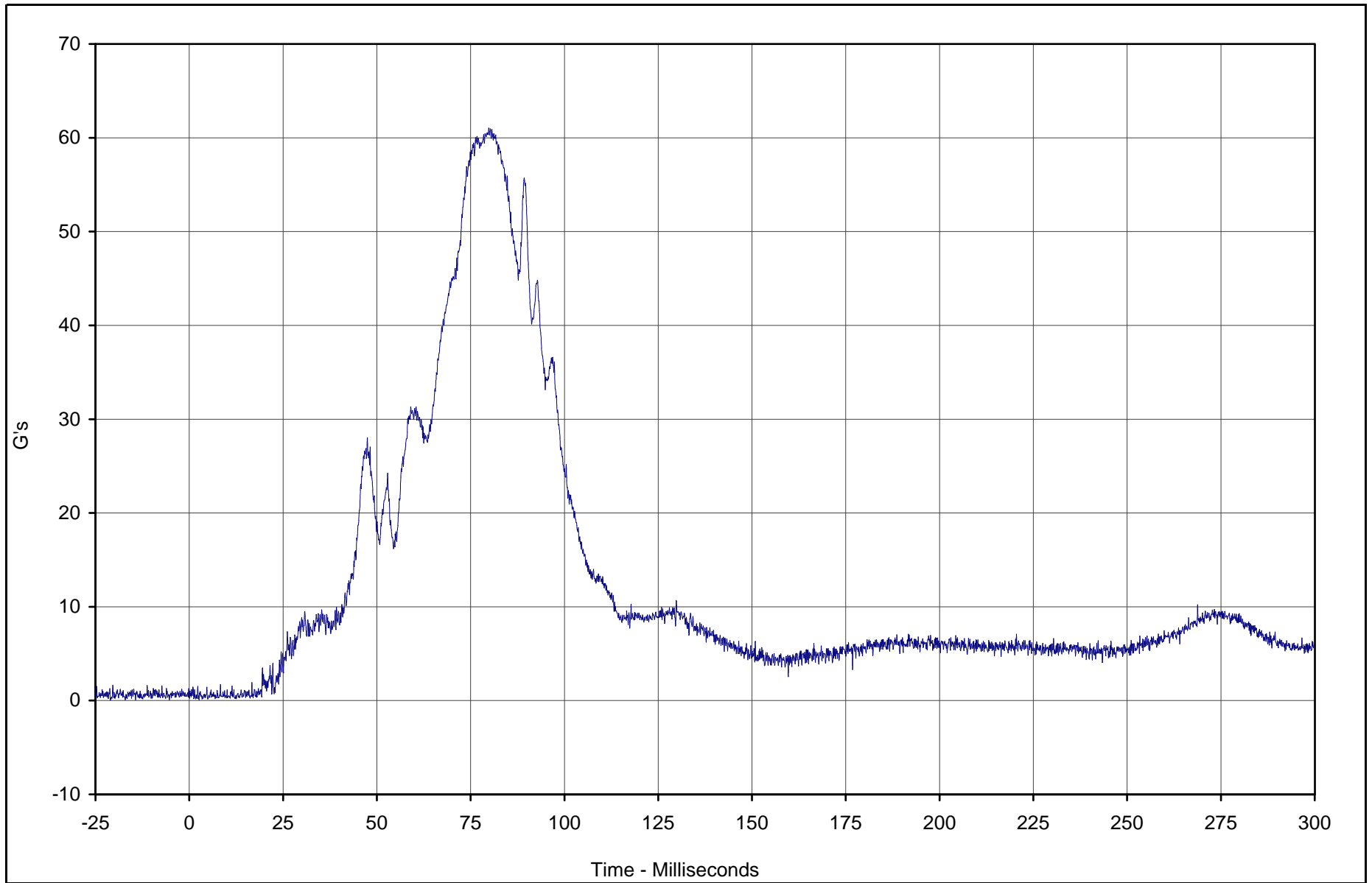
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-12



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Resultant Redundant	004	RES	G's	61.0	79.8	0.1	2.6	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

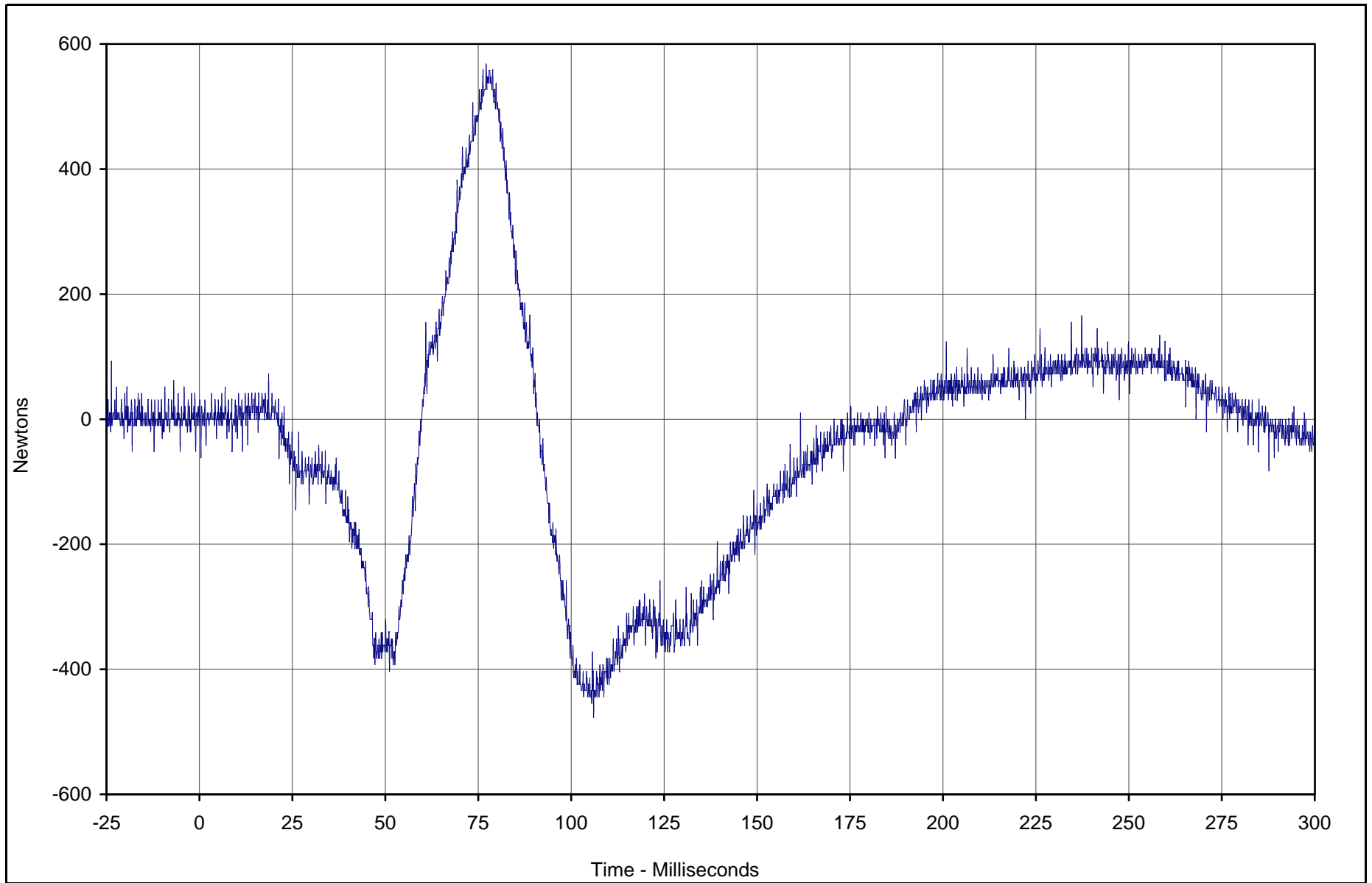
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-13



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Neck Force X	007	FIL	Newtons	568.4	77.1	-475.4	106.0	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

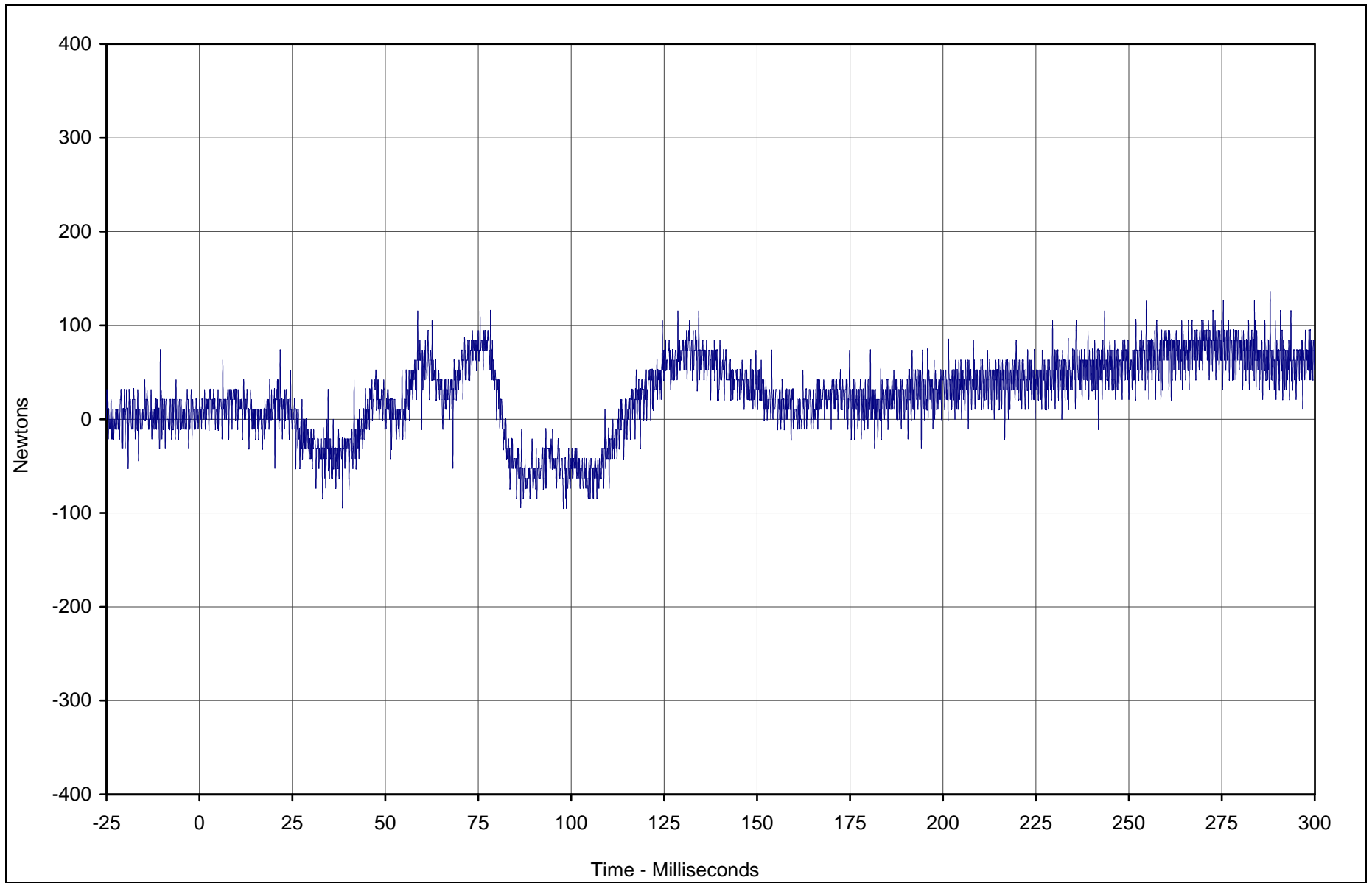
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-14



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Neck Force Y	008	FIL	Newtons	136.5	288.0	-94.5	38.5	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

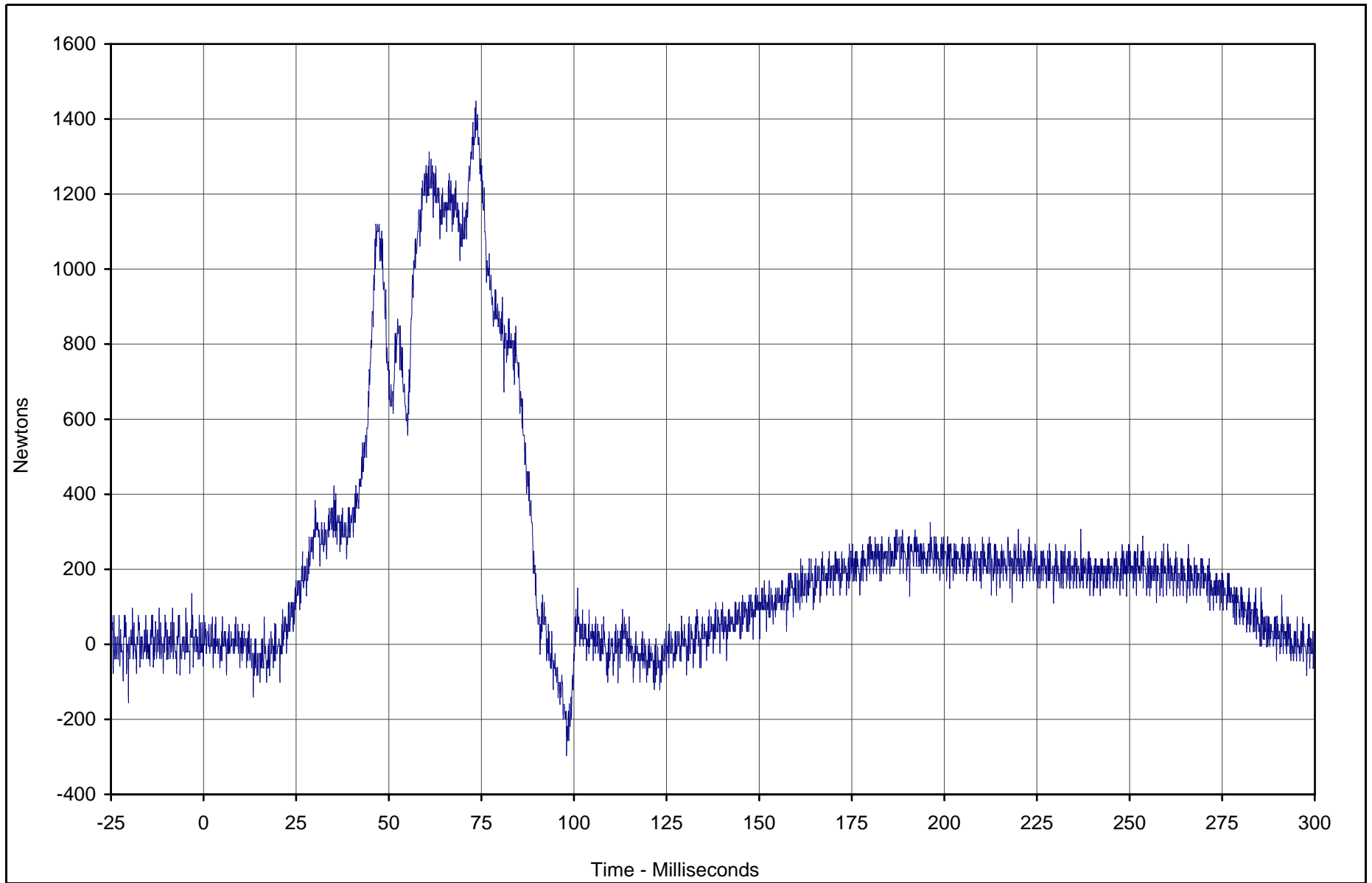
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-15



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Neck Force Z	009	FIL	Newtons	1448.4	73.5	-295.7	98.0	1000



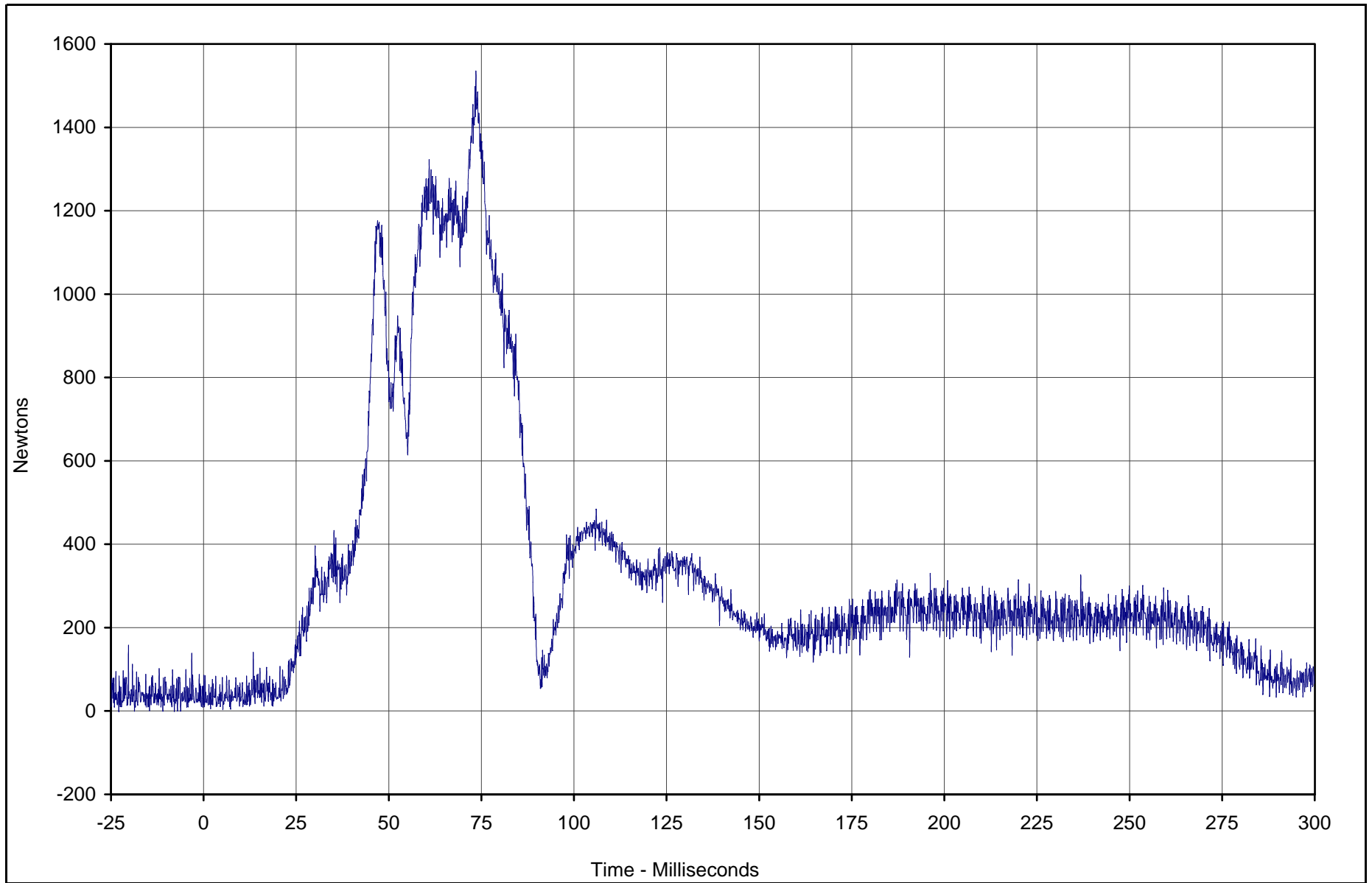
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Neck Force Resultant	007	RES	Newtons	1535.6	73.5	5.0	1.9	1000



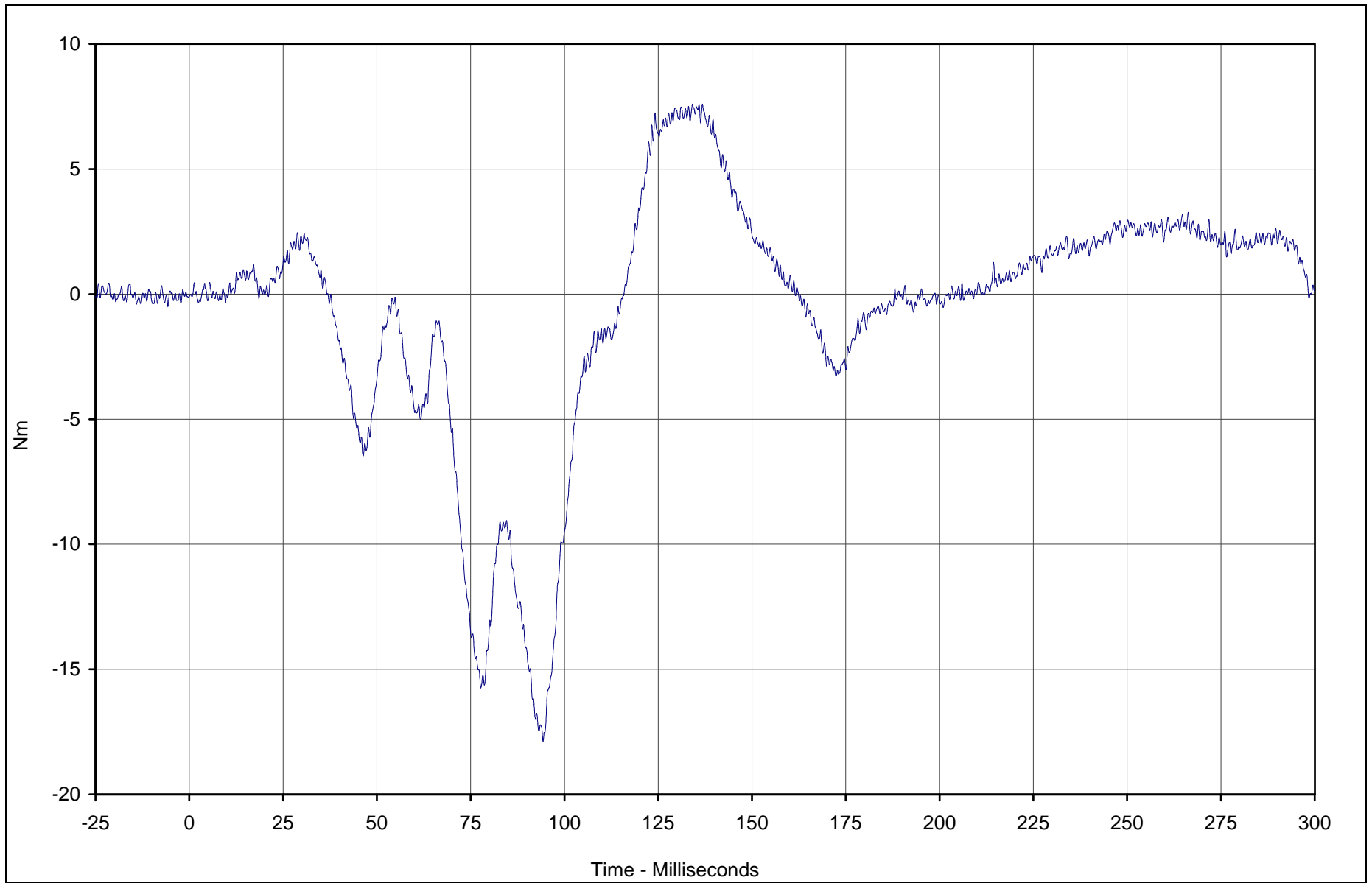
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-17



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Neck Moment X	010	FIL	Nm	7.6	134.1	-17.9	94.3	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

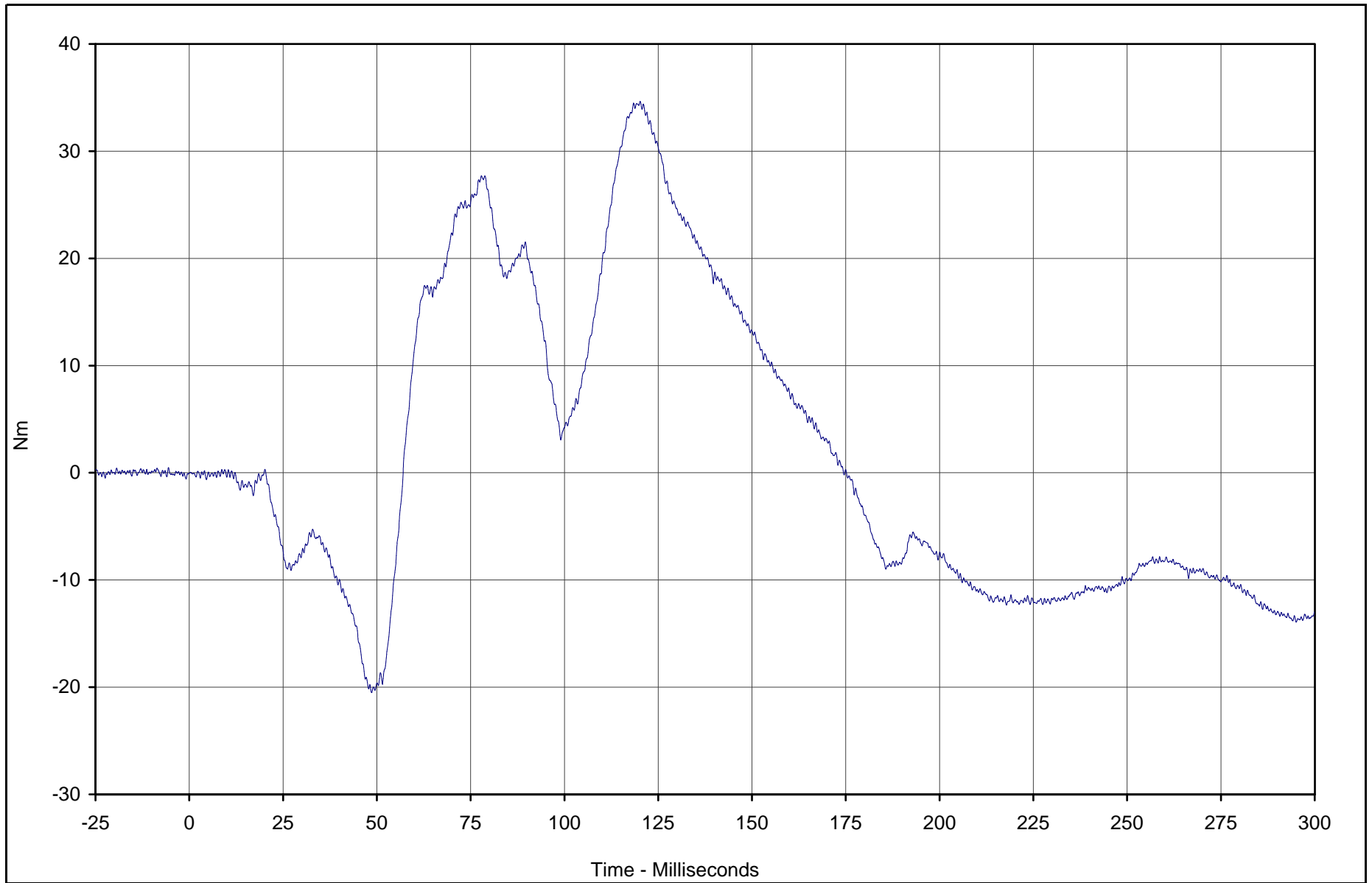
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-18



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Neck Moment Y	011	FIL	Nm	34.6	120.2	-20.5	48.6	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

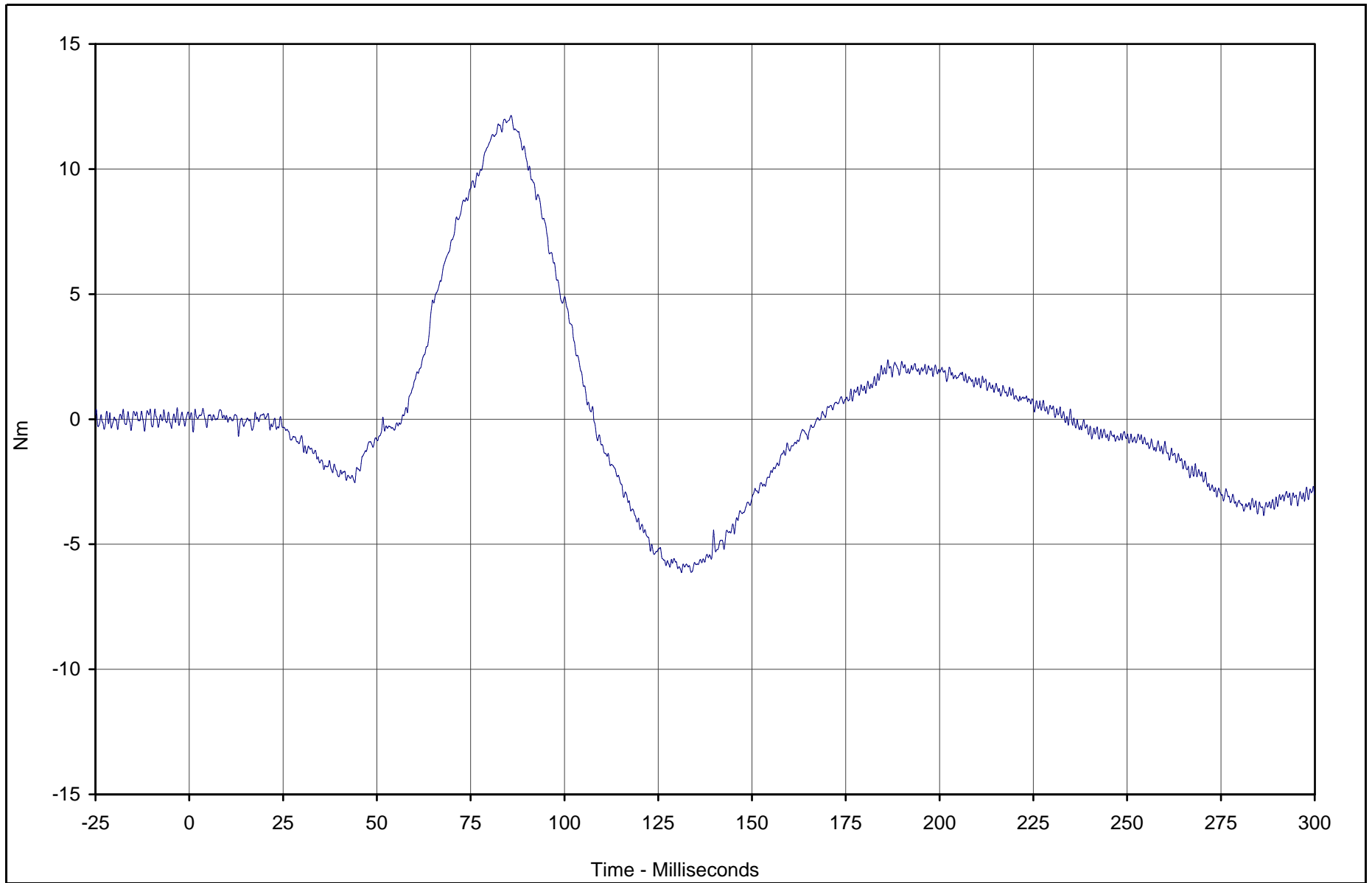
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-19



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Neck Moment Z	012	FIL	Nm	12.1	85.8	-6.1	131.2	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

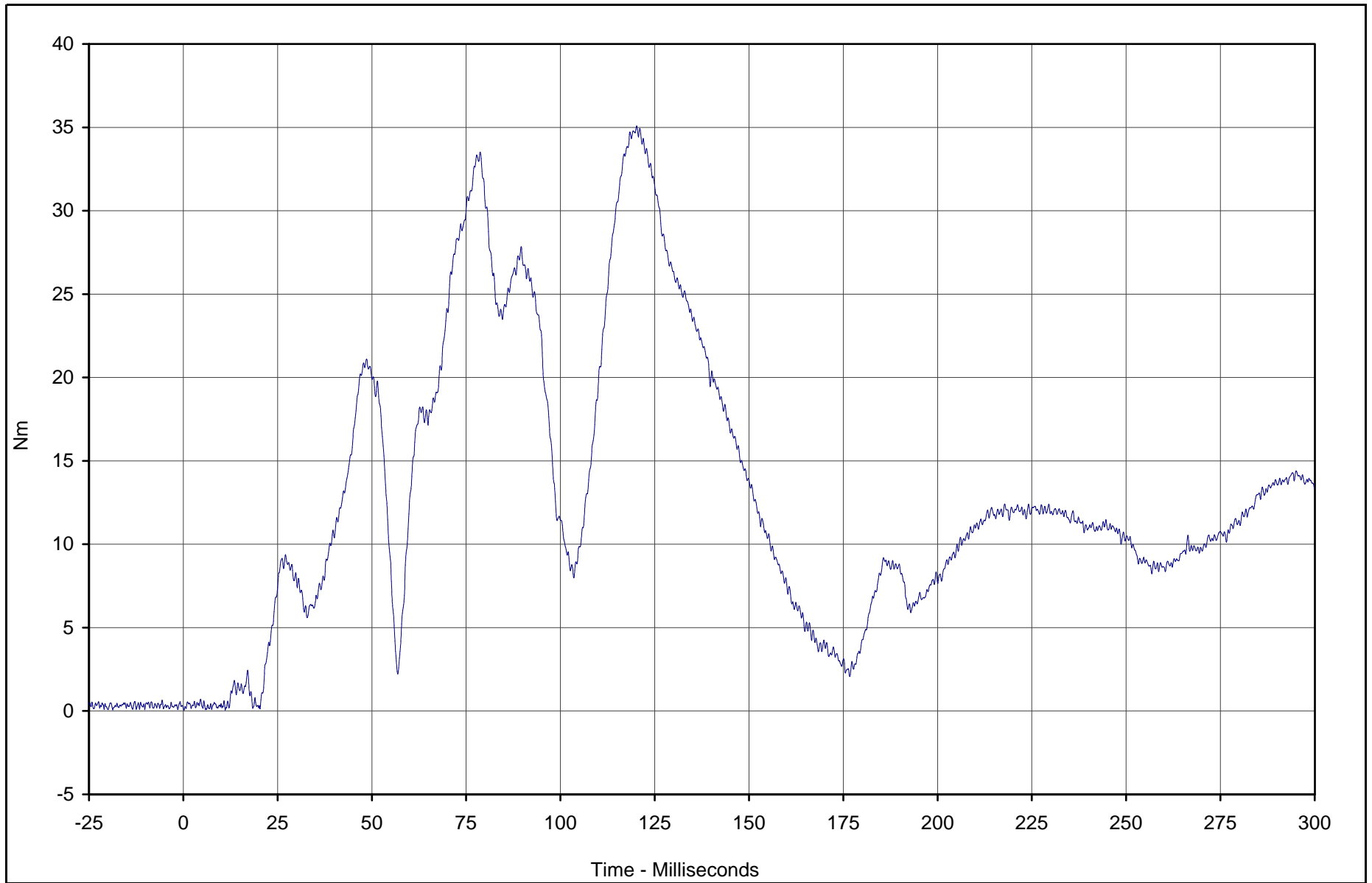
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-20



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Neck Moment Resultant	010	RES	Nm	35.1	120.2	0.1	11.1	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

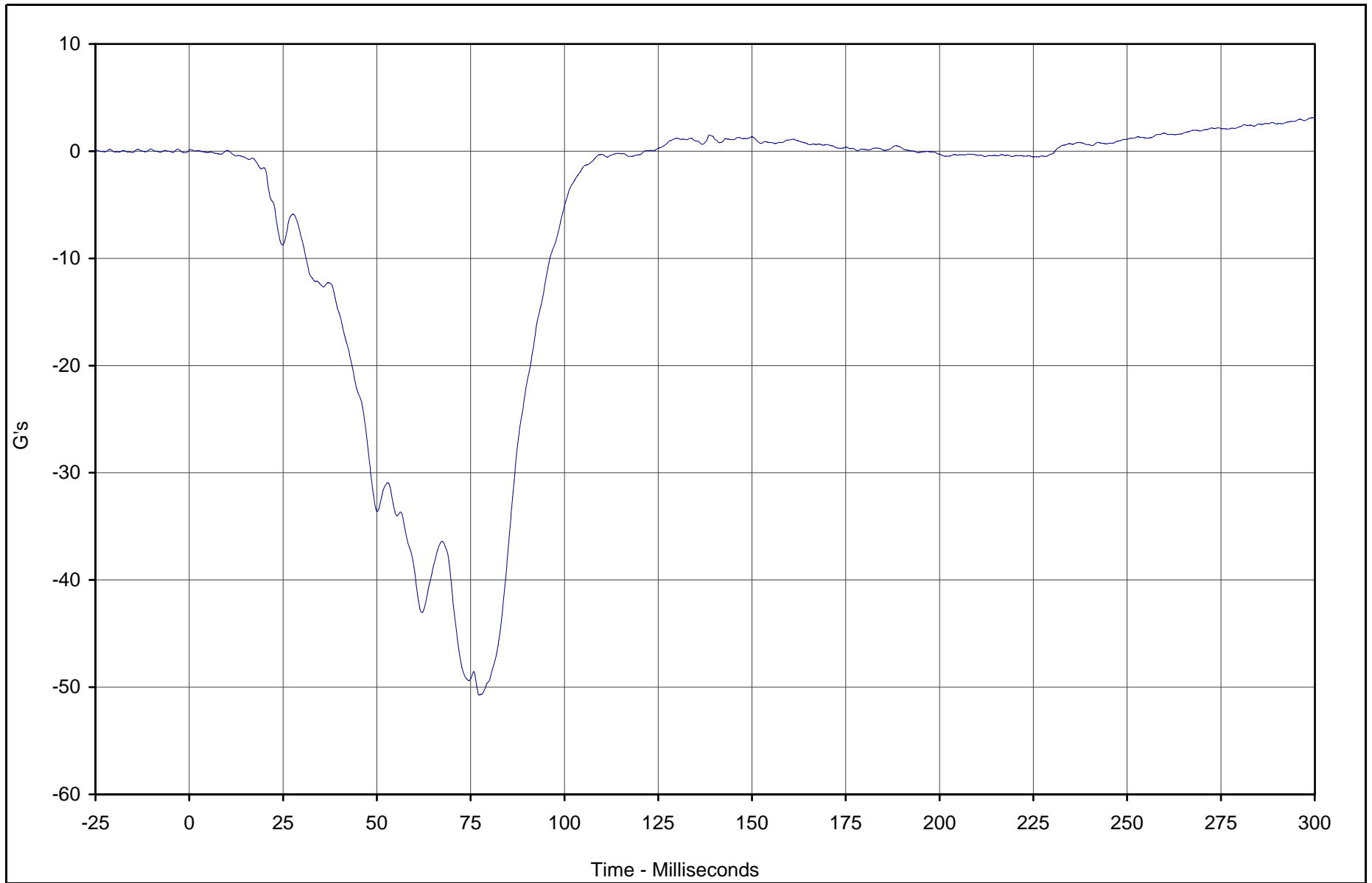
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-21



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Primary X	013	FIL	G's	3.1	299.4	-50.7	77.3	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

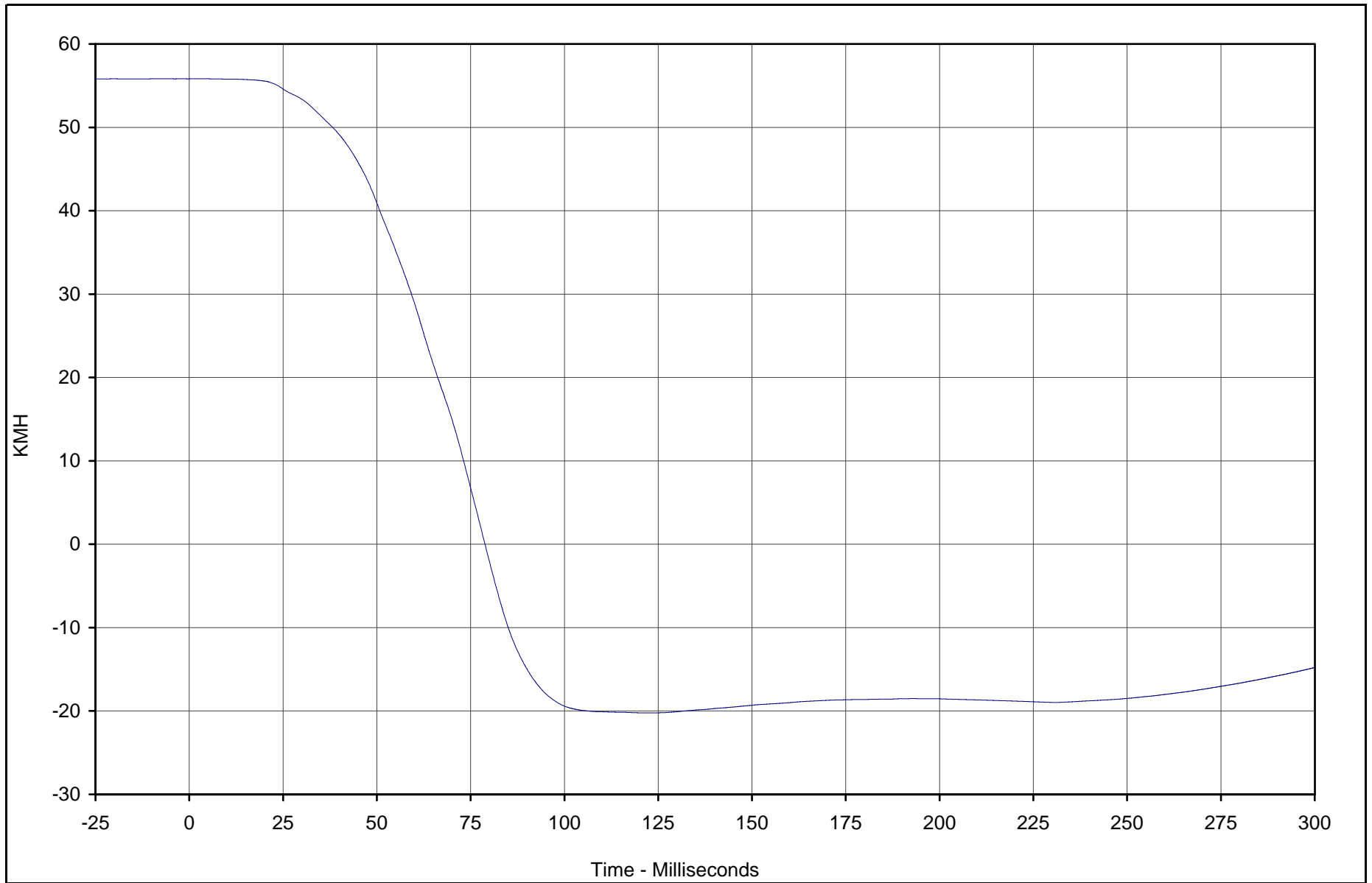
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-22



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Primary X Velocity	013	IN1	KMH	55.8	3.1	-20.2	121.3	180



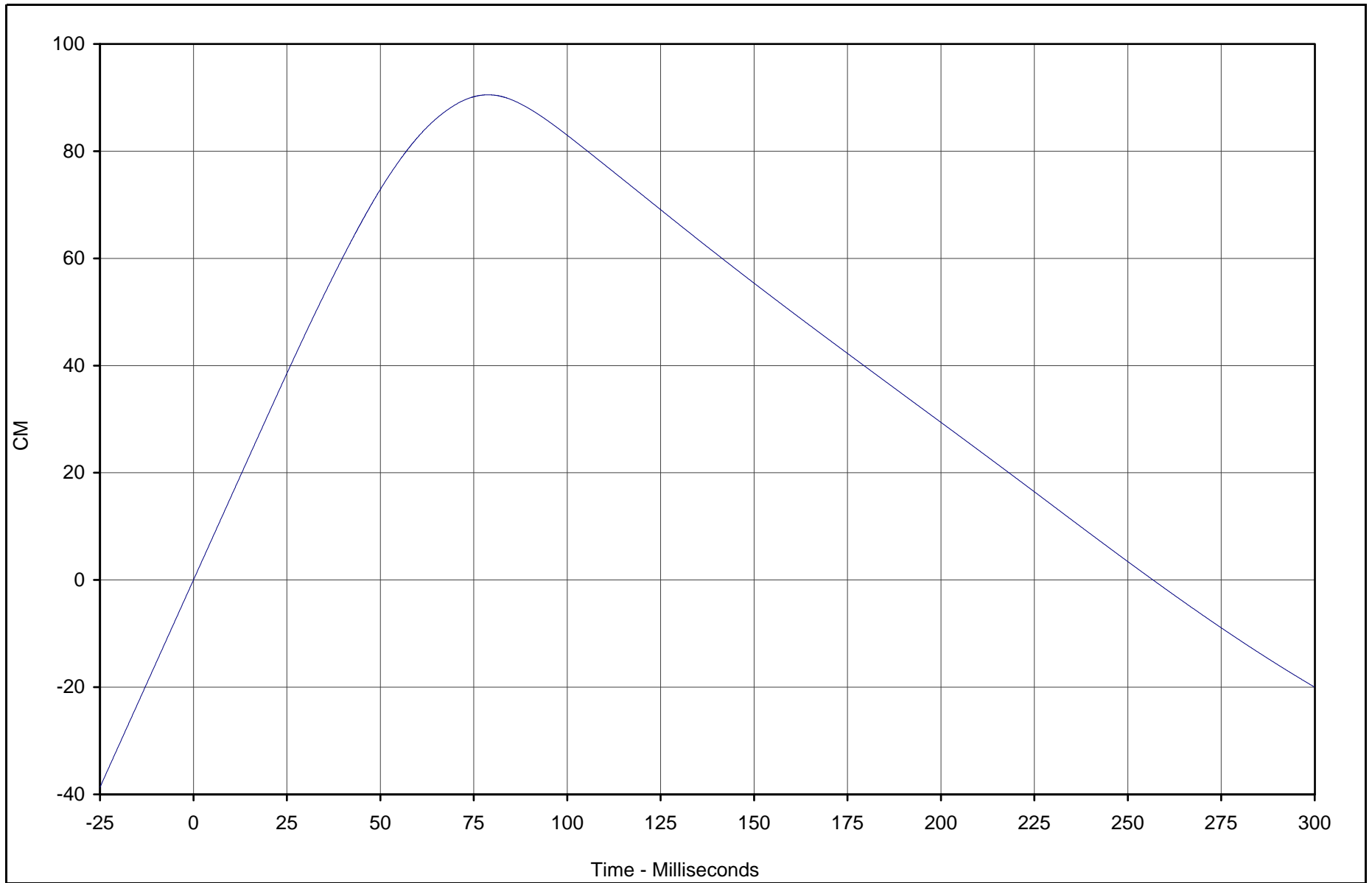
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-23



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Primary X Displ.	013	IN2	CM	90.5	78.8	-20.0	299.9	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

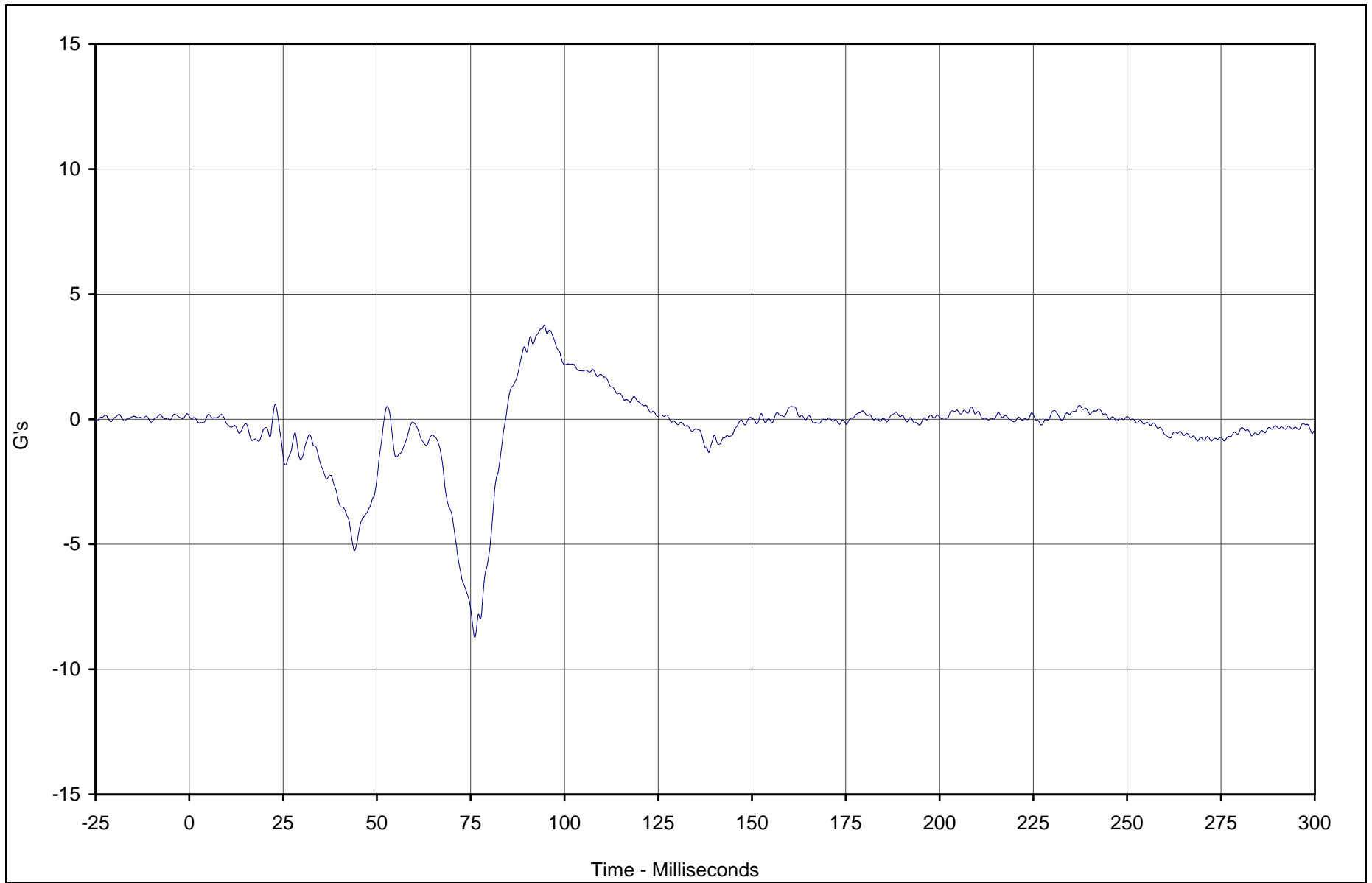
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-24



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Primary Y	014	FIL	G's	3.8	94.6	-8.7	76.1	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

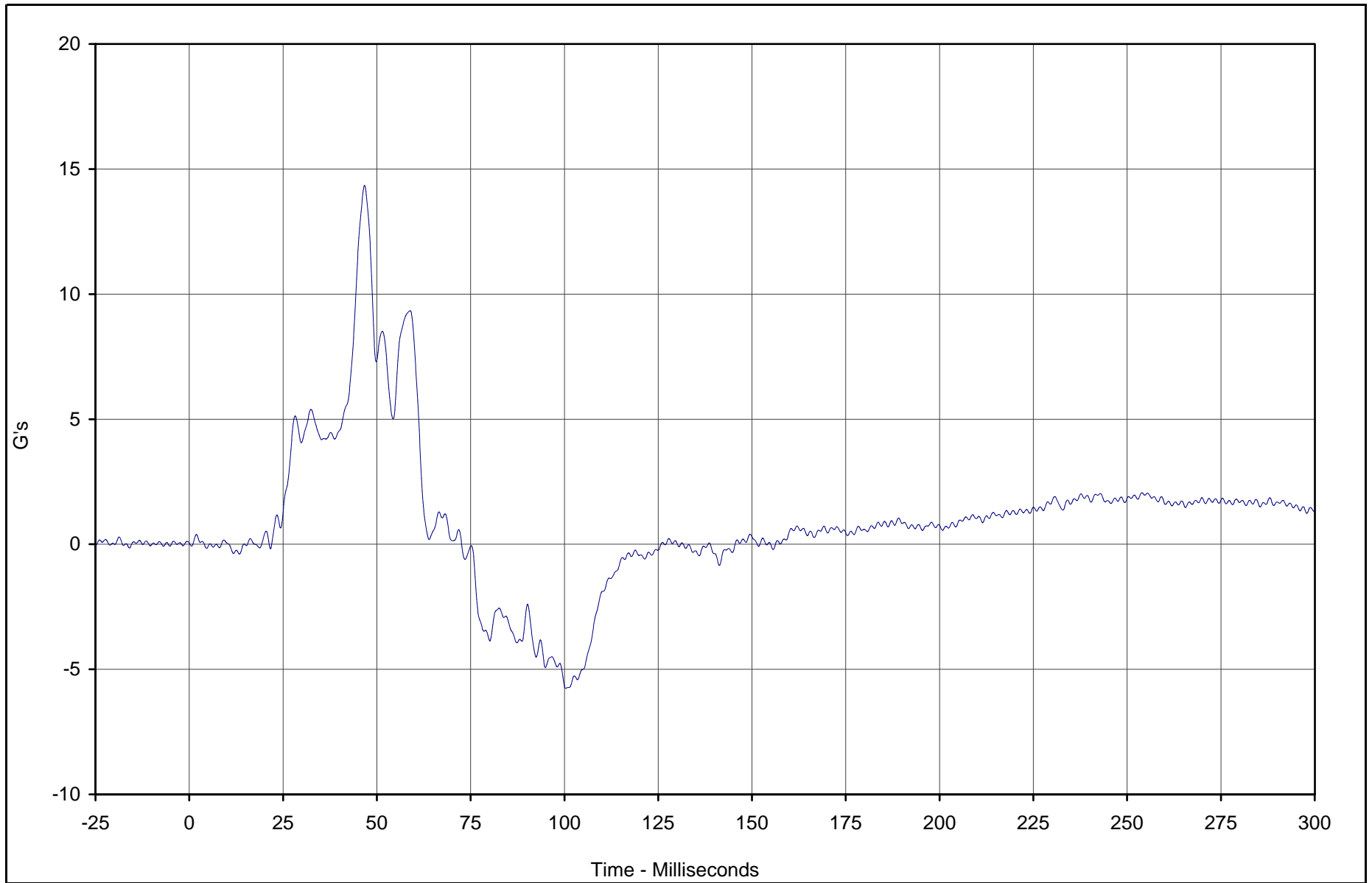
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-25



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Primary Z	015	FIL	G's	14.3	46.7	-5.8	100.4	180



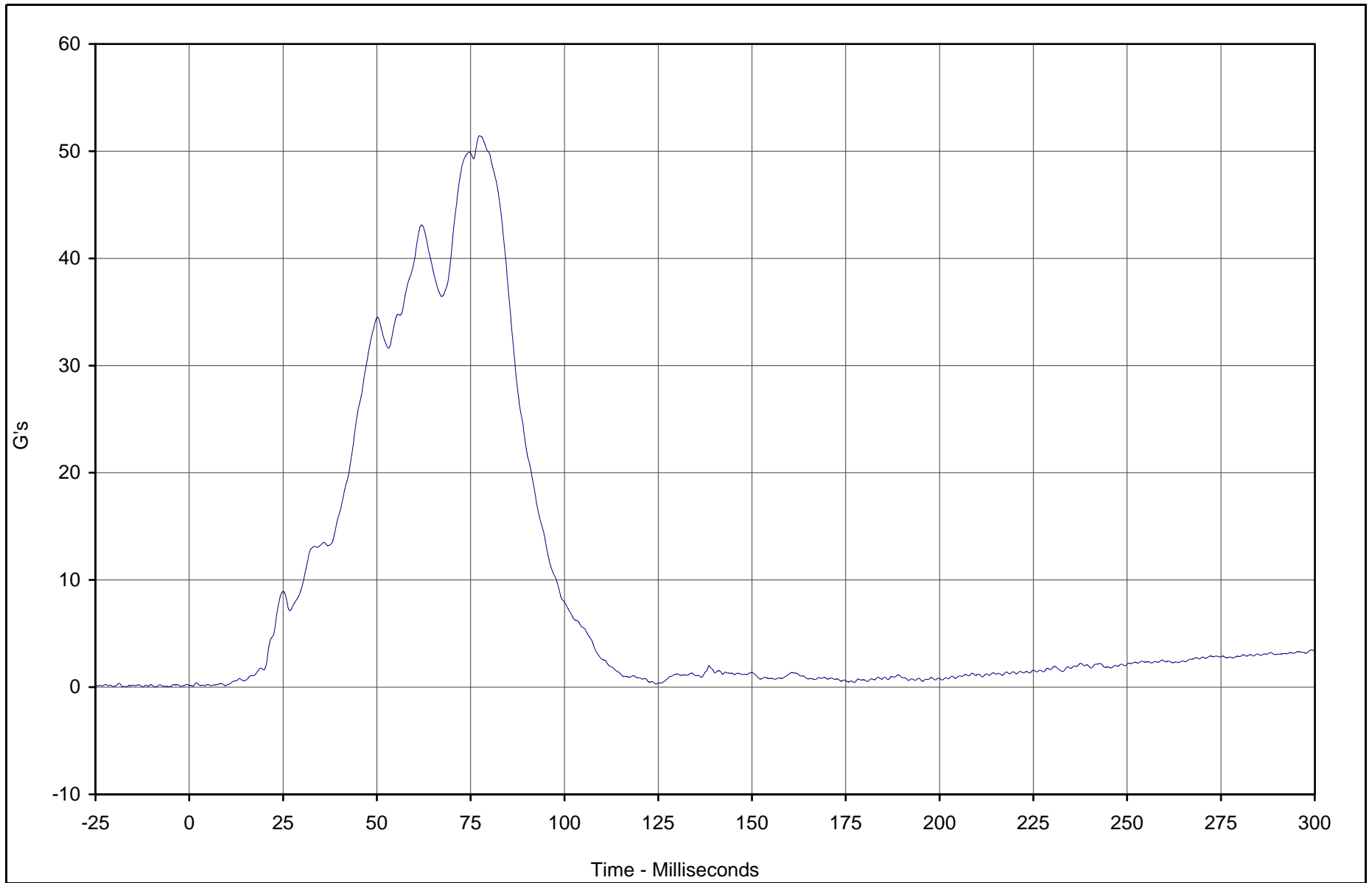
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Resultant Primary	013	RES	G's	51.4	77.3	0.1	1.0	180



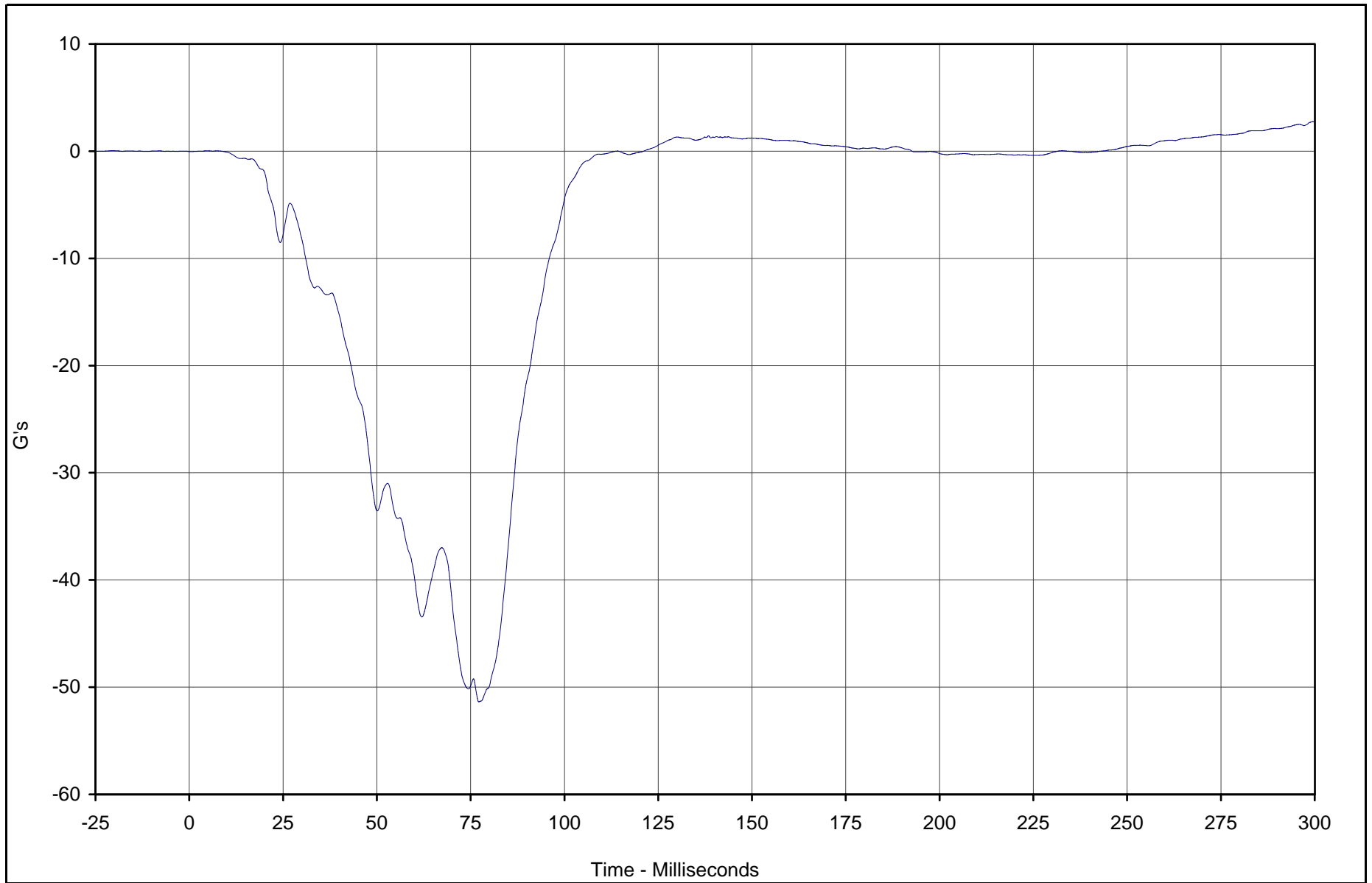
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-27



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Redundant X	016	FIL	G's	2.8	299.4	-51.4	77.2	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

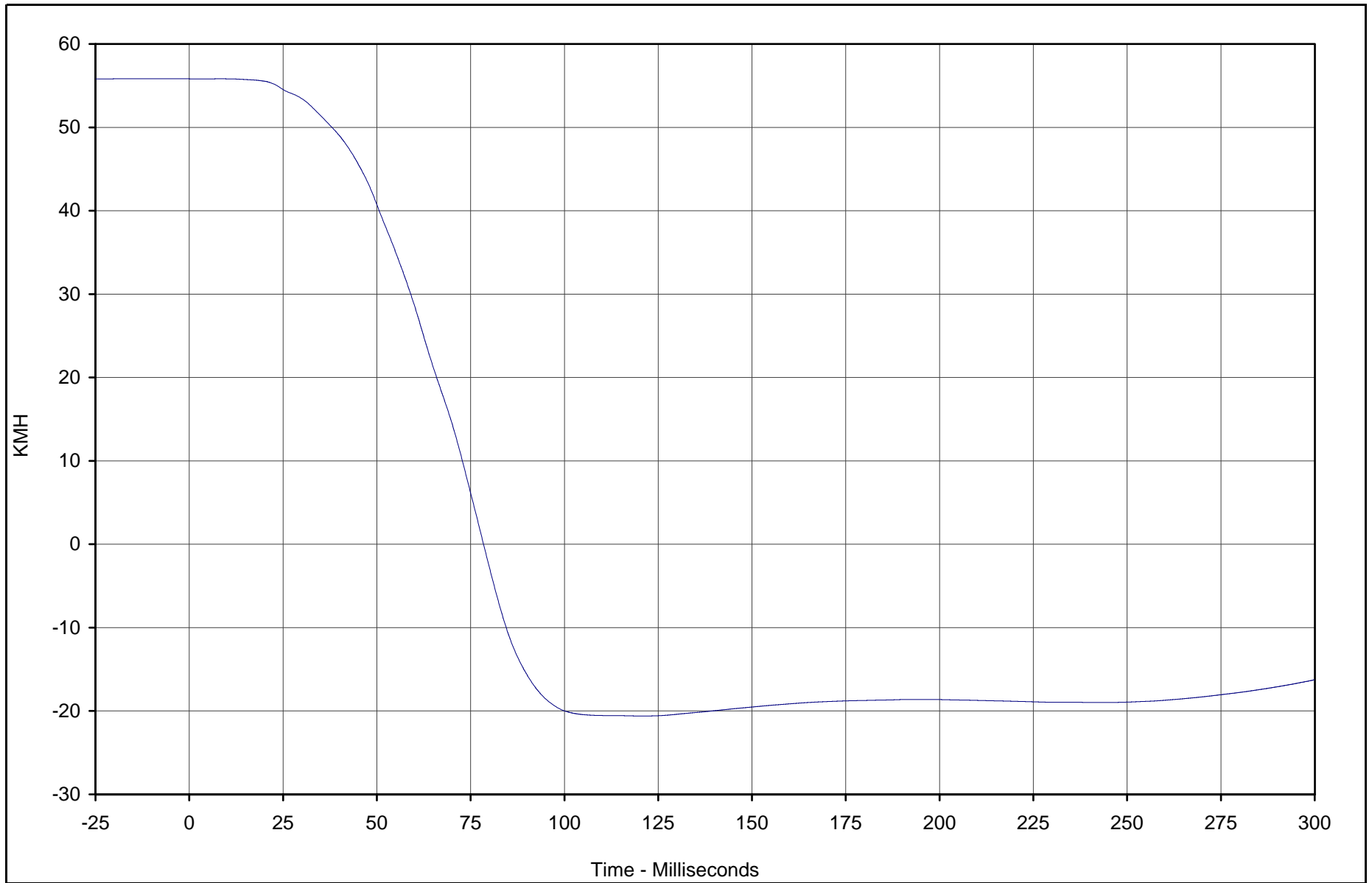
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-28



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Redundant X Velocity	016	IN1	KMH	55.8	8.6	-20.6	121.1	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

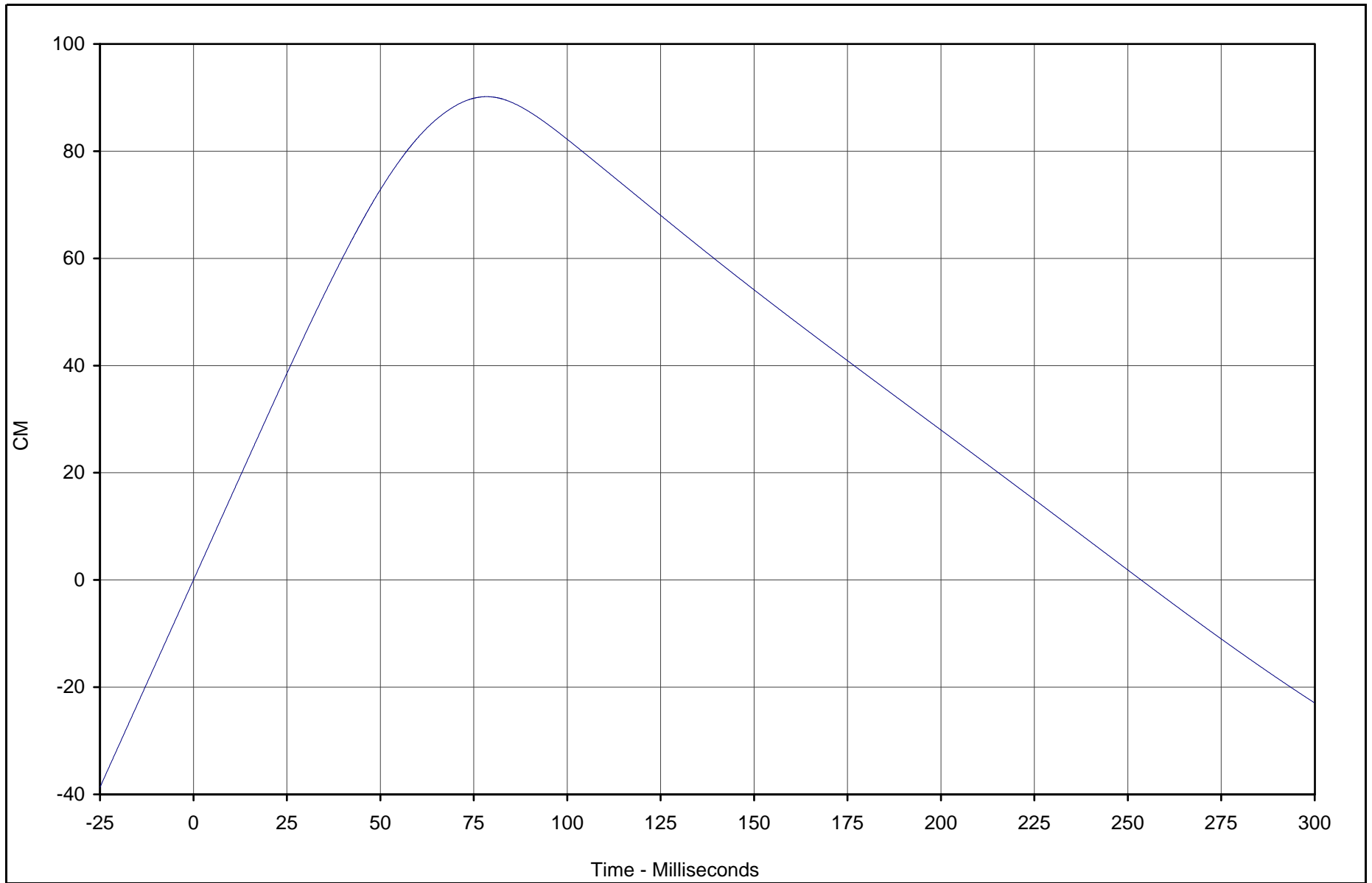
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-29



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Redundant X Displ.	016	IN2	CM	90.2	78.4	-22.9	299.9	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

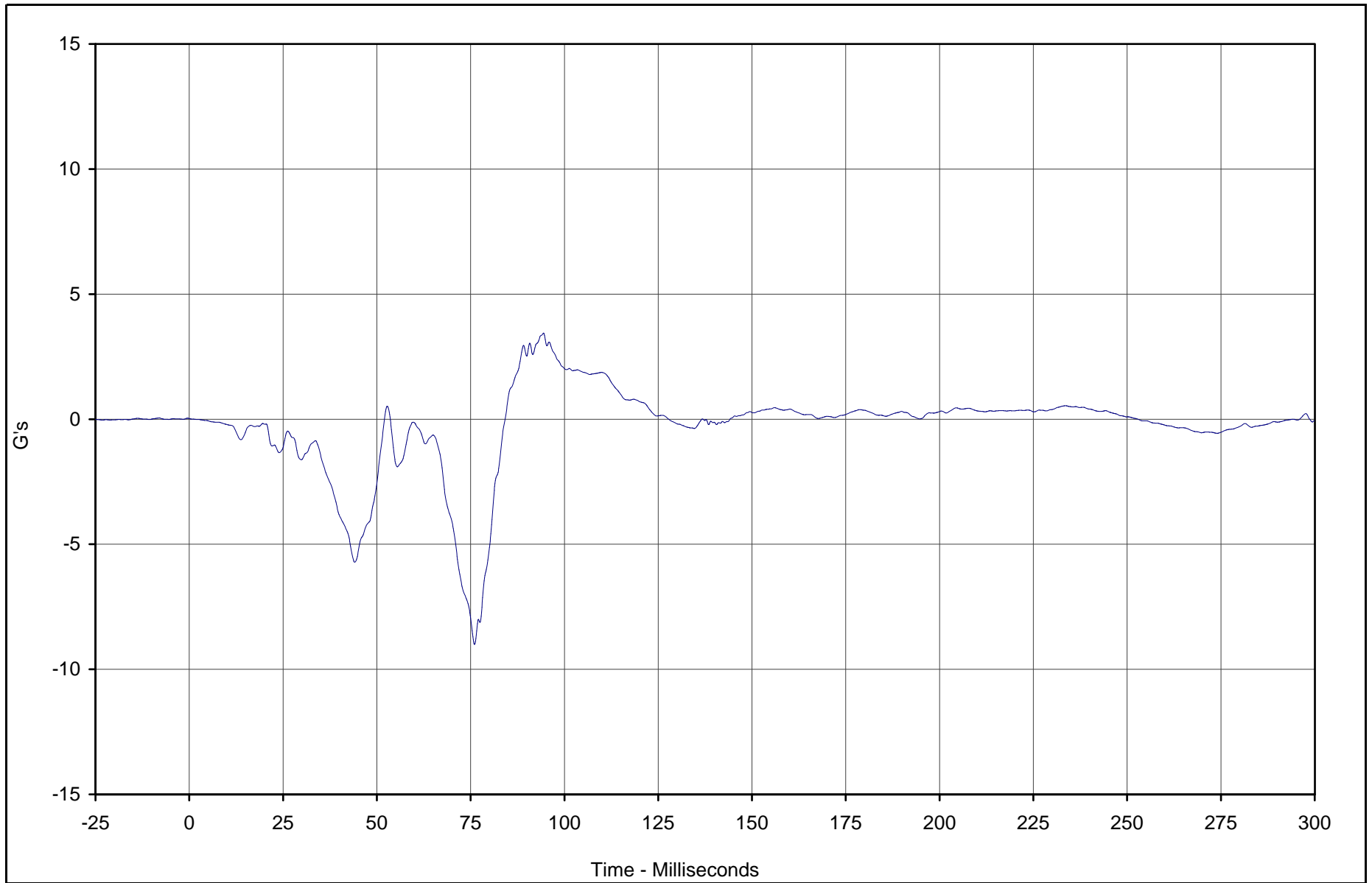
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-30



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Redundant Y	017	FIL	G's	3.4	94.4	-9.0	76.0	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

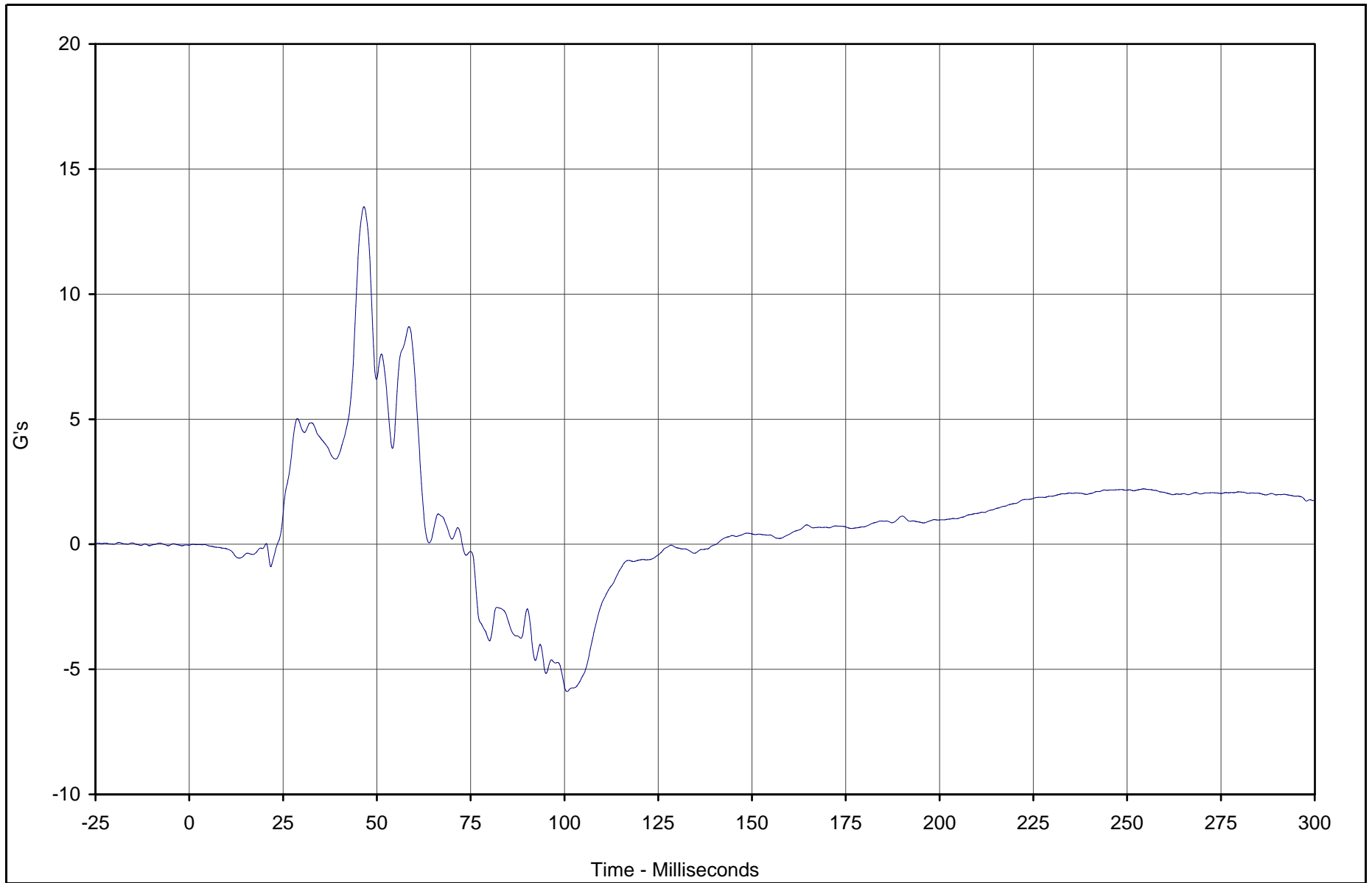
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-31



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Redundant Z	018	FIL	G's	13.5	46.6	-5.9	100.7	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

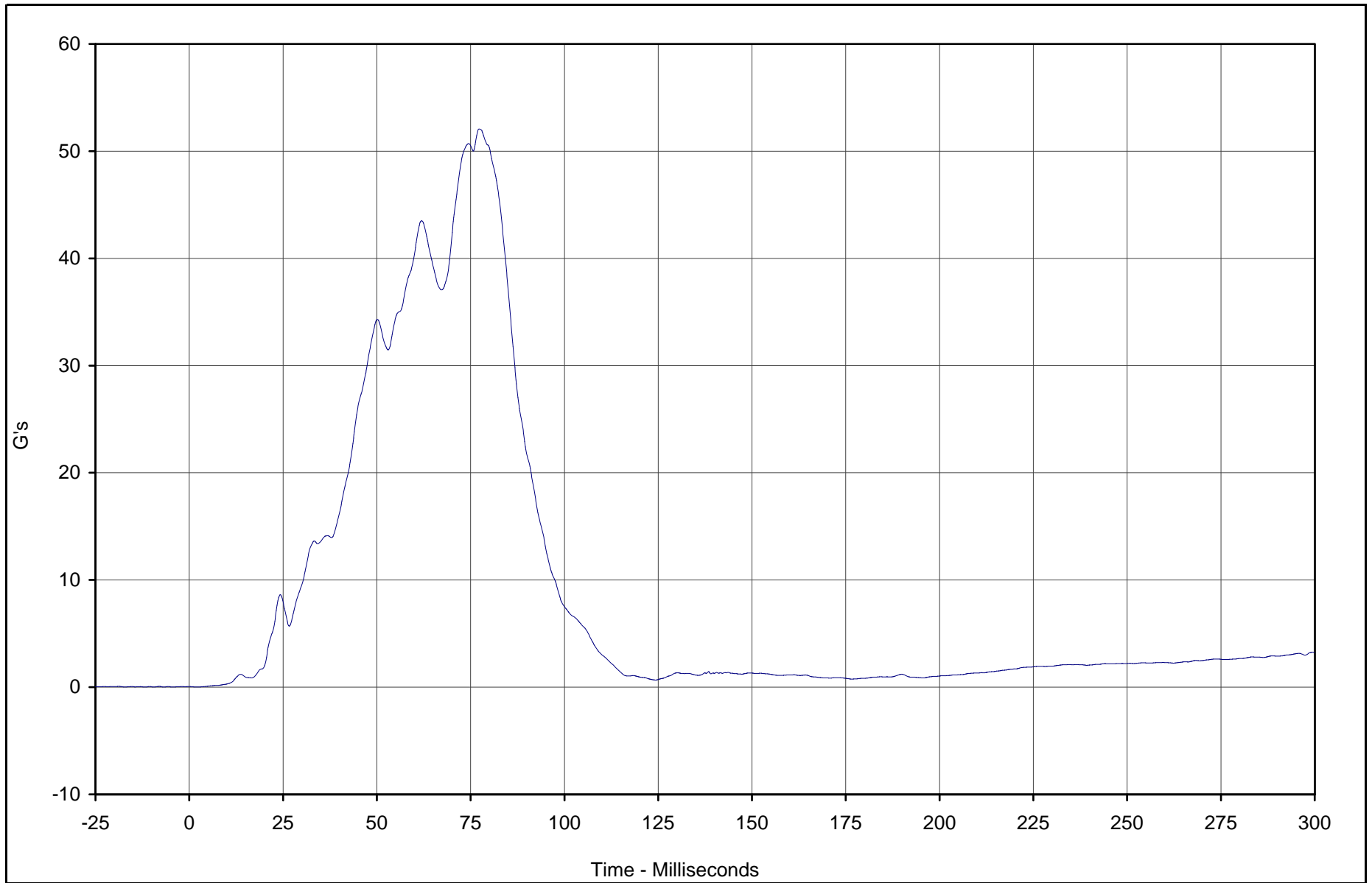
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-32



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Resultant Redundant	016	RES	G's	52.1	77.2	0.0	2.7	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

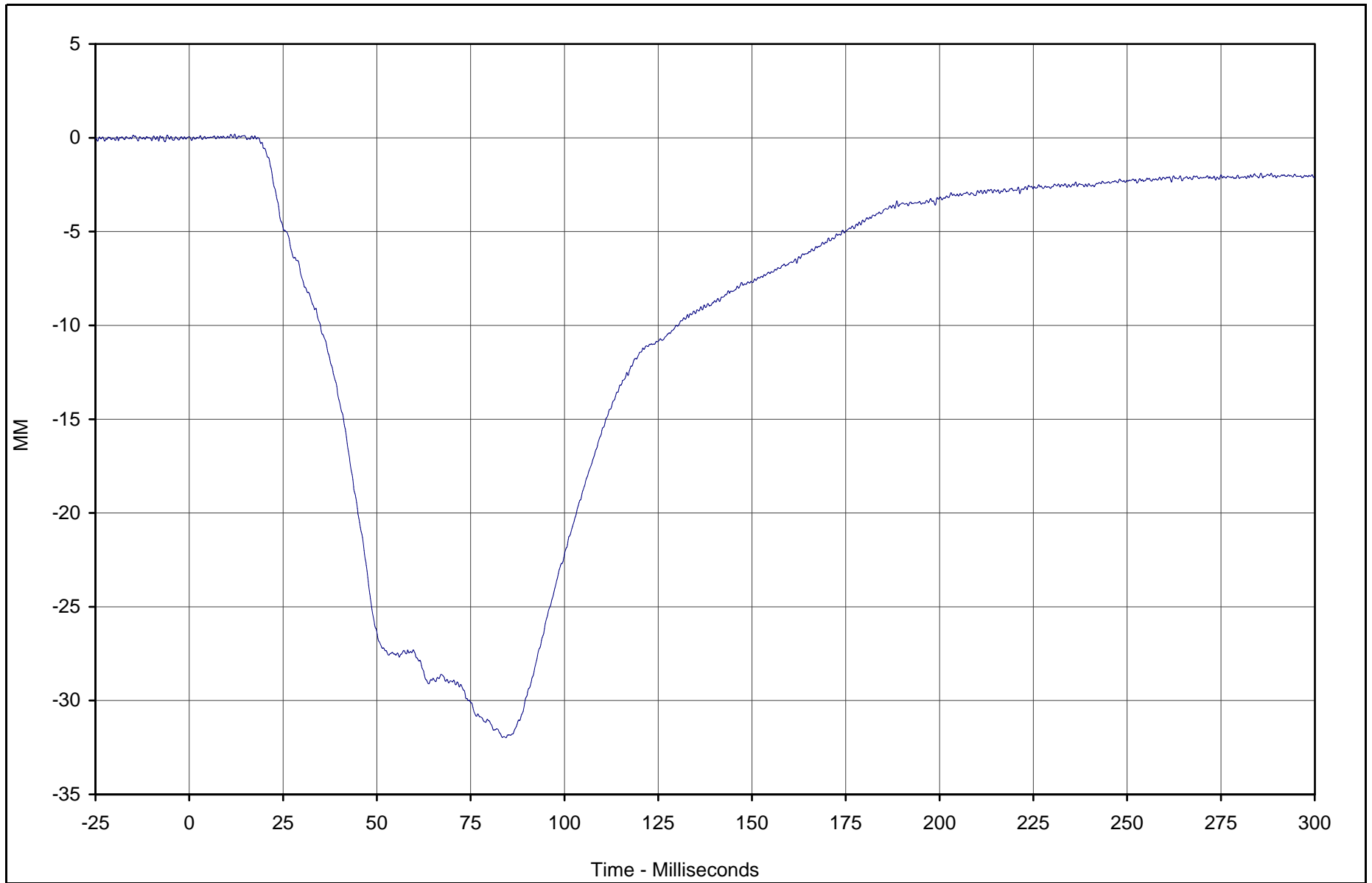
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-33



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Chest Displacement X	019	FIL	MM	0.2	12.1	-32.0	84.4	600



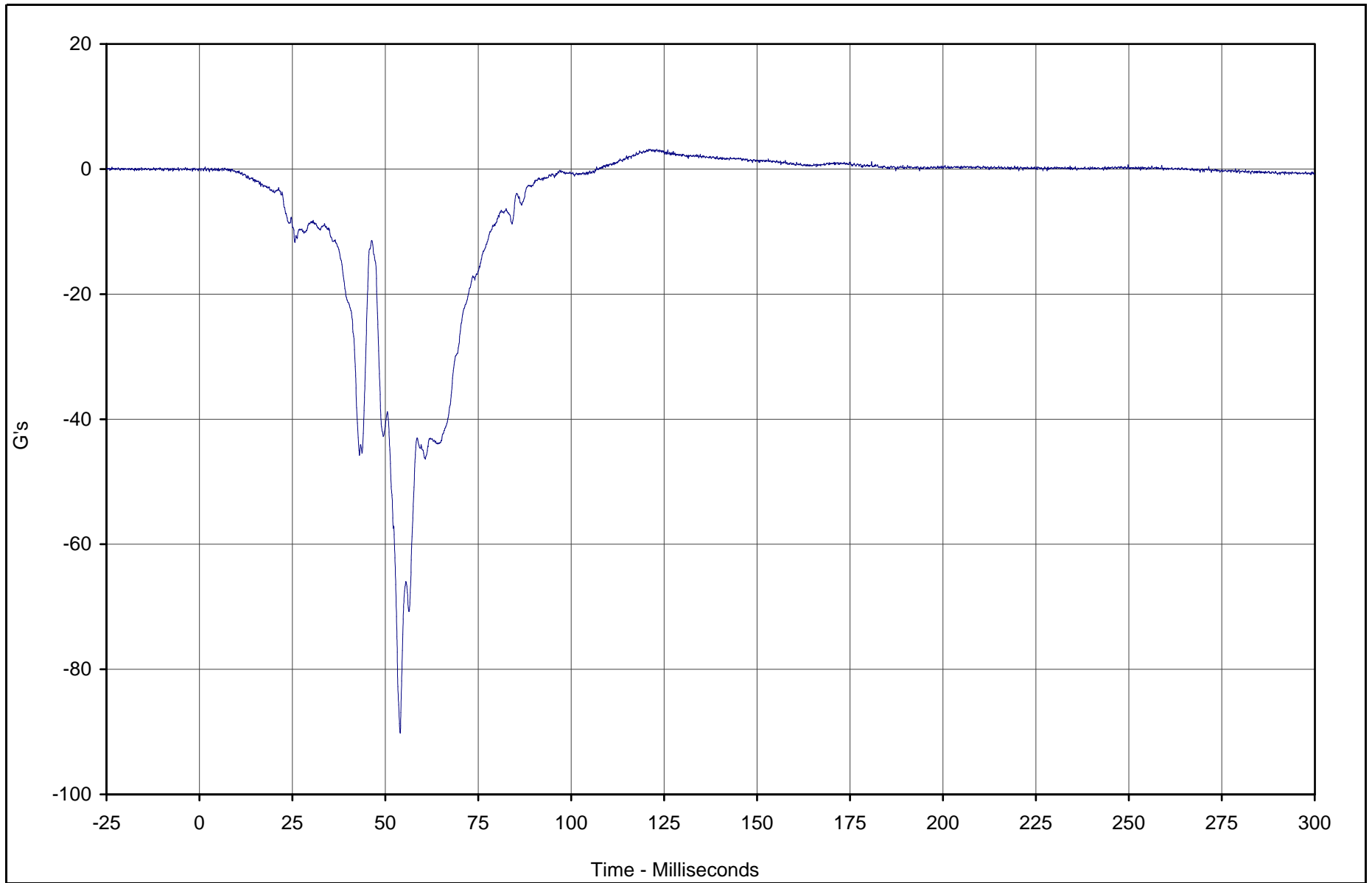
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-34



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Pelvis X	020	FIL	G's	3.2	120.8	-90.2	54.0	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

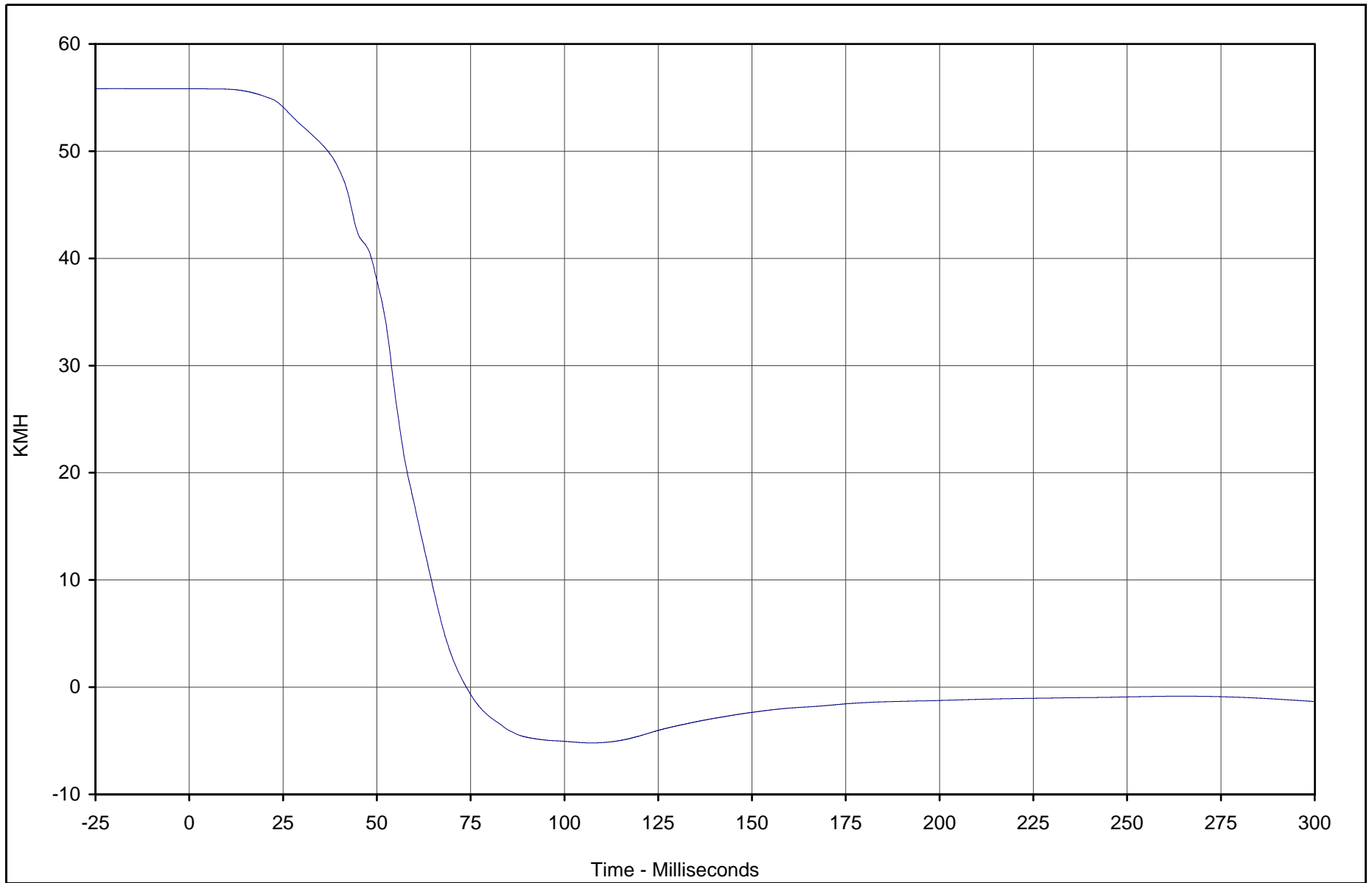
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-35



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Pelvis X Velocity	020	IN1	KMH	55.8	0.0	-5.2	107.1	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

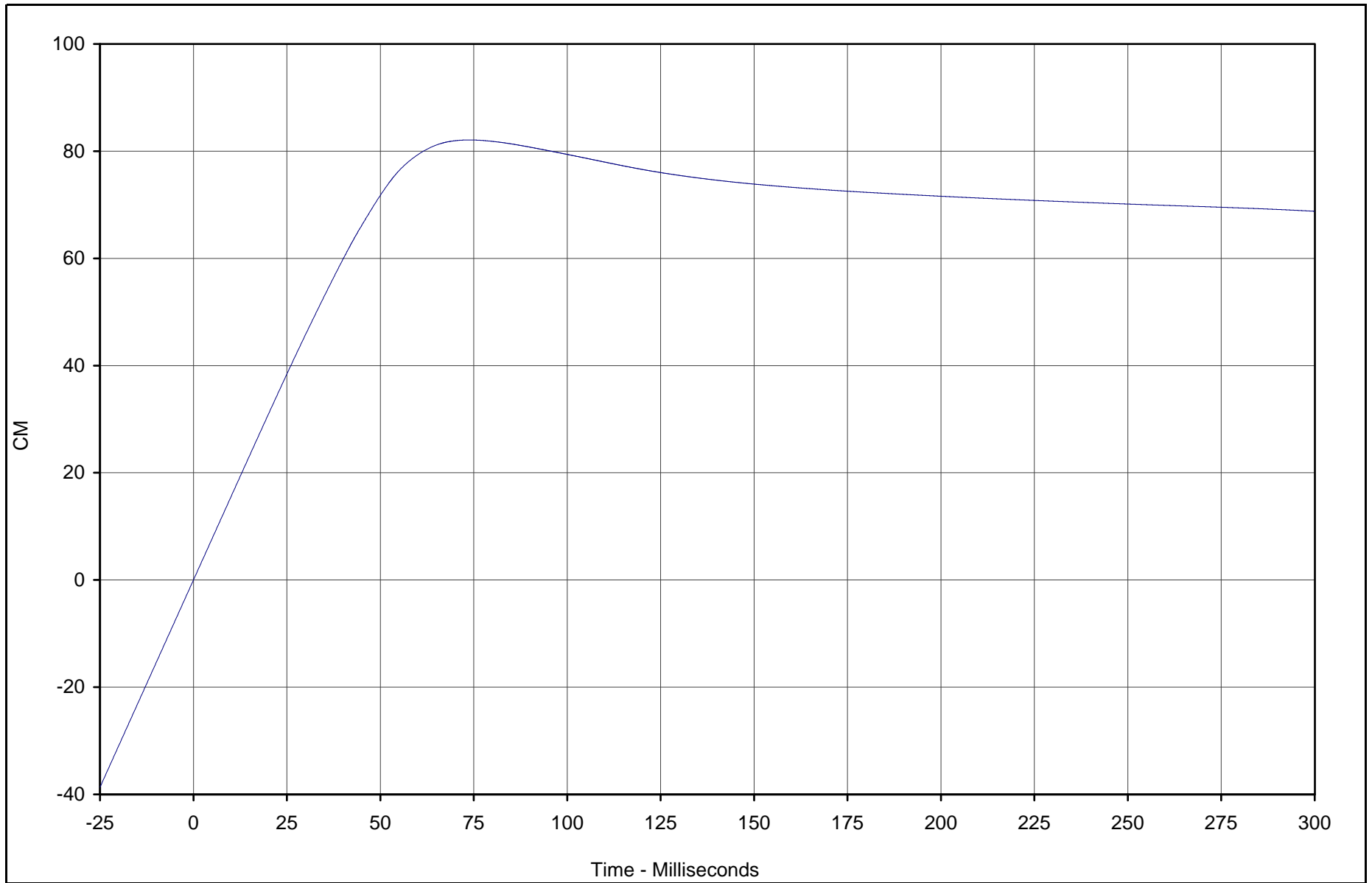
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-36



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Pelvis X Displ.	020	IN2	CM	82.1	73.9	0.0	0.0	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

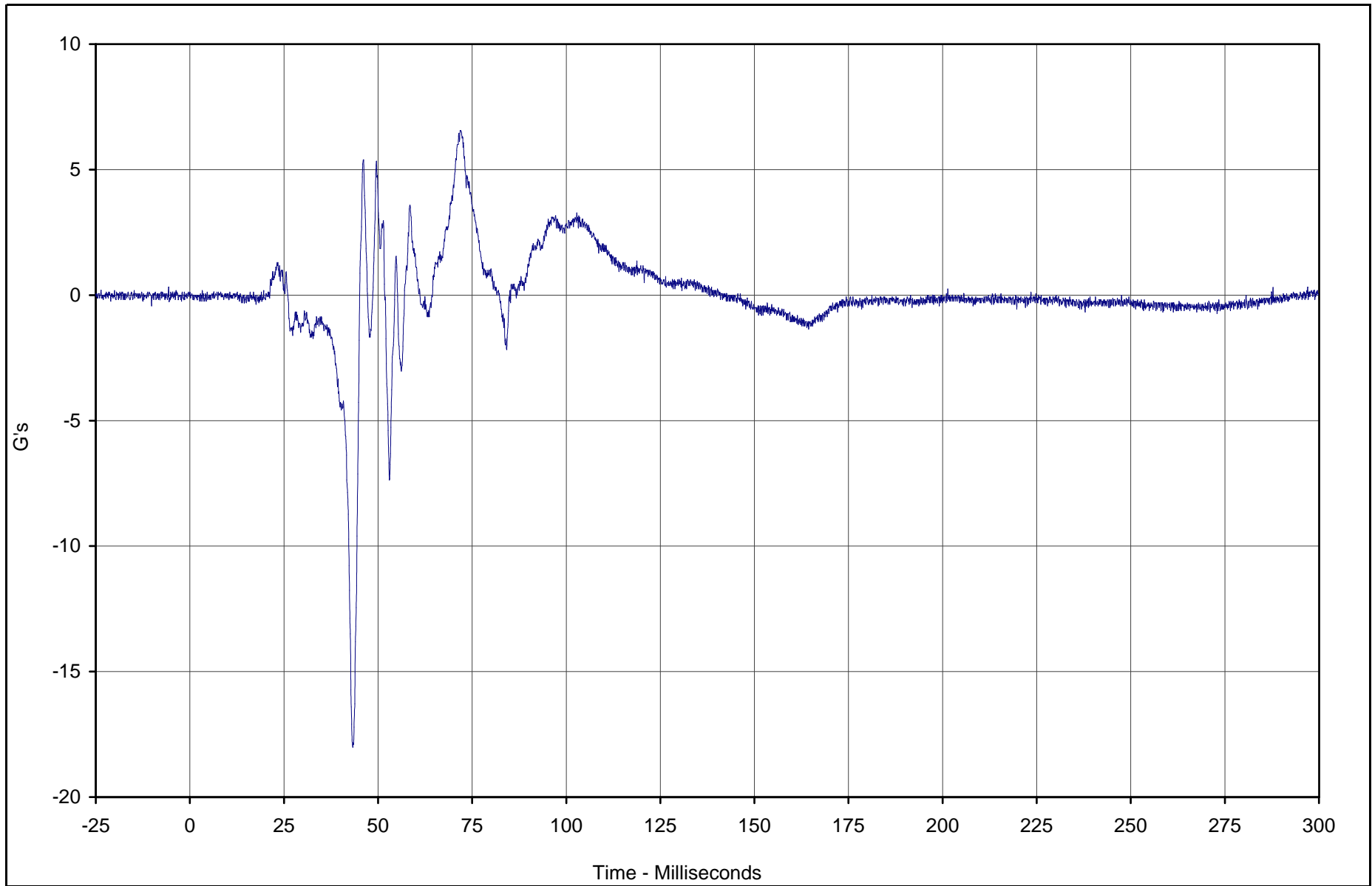
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-37



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Pelvis Y	021	FIL	G's	6.6	71.8	-18.0	43.3	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

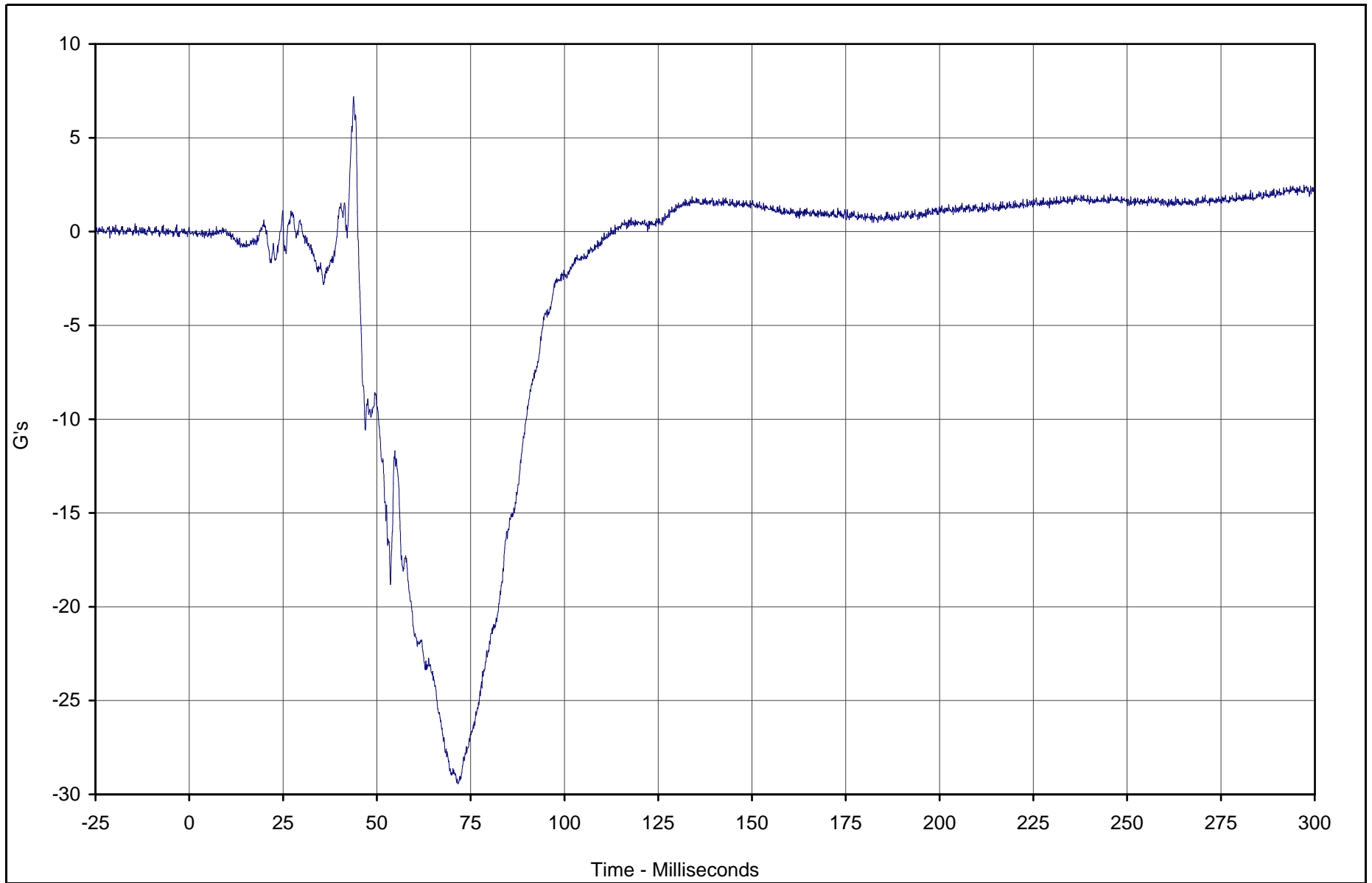
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-38



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Pelvis Z	022	FIL	G's	7.2	43.8	-29.5	71.6	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

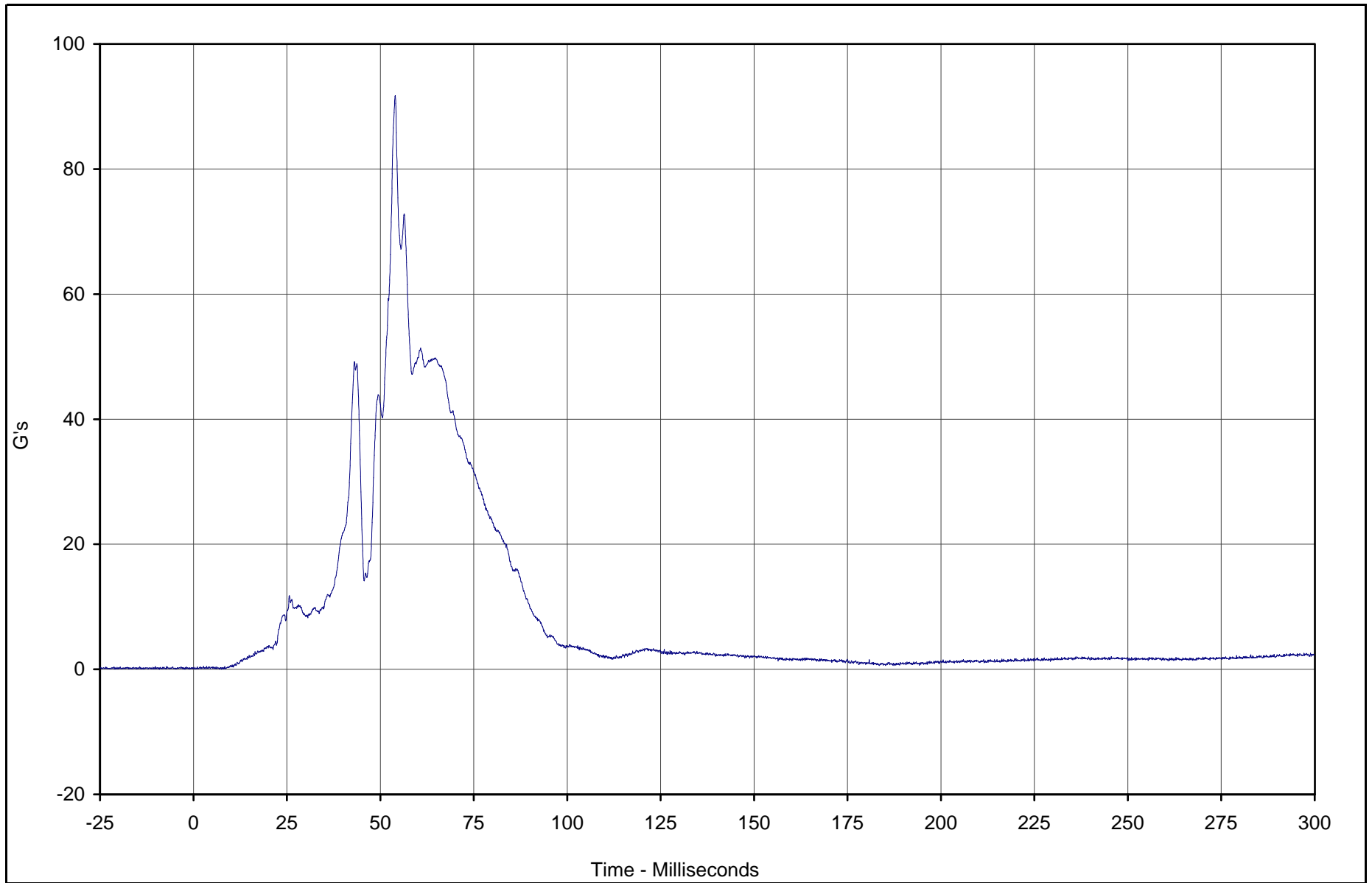
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-39



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Pelvis Resultant	023	RES	G's	91.7	54.0	0.0	7.0	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

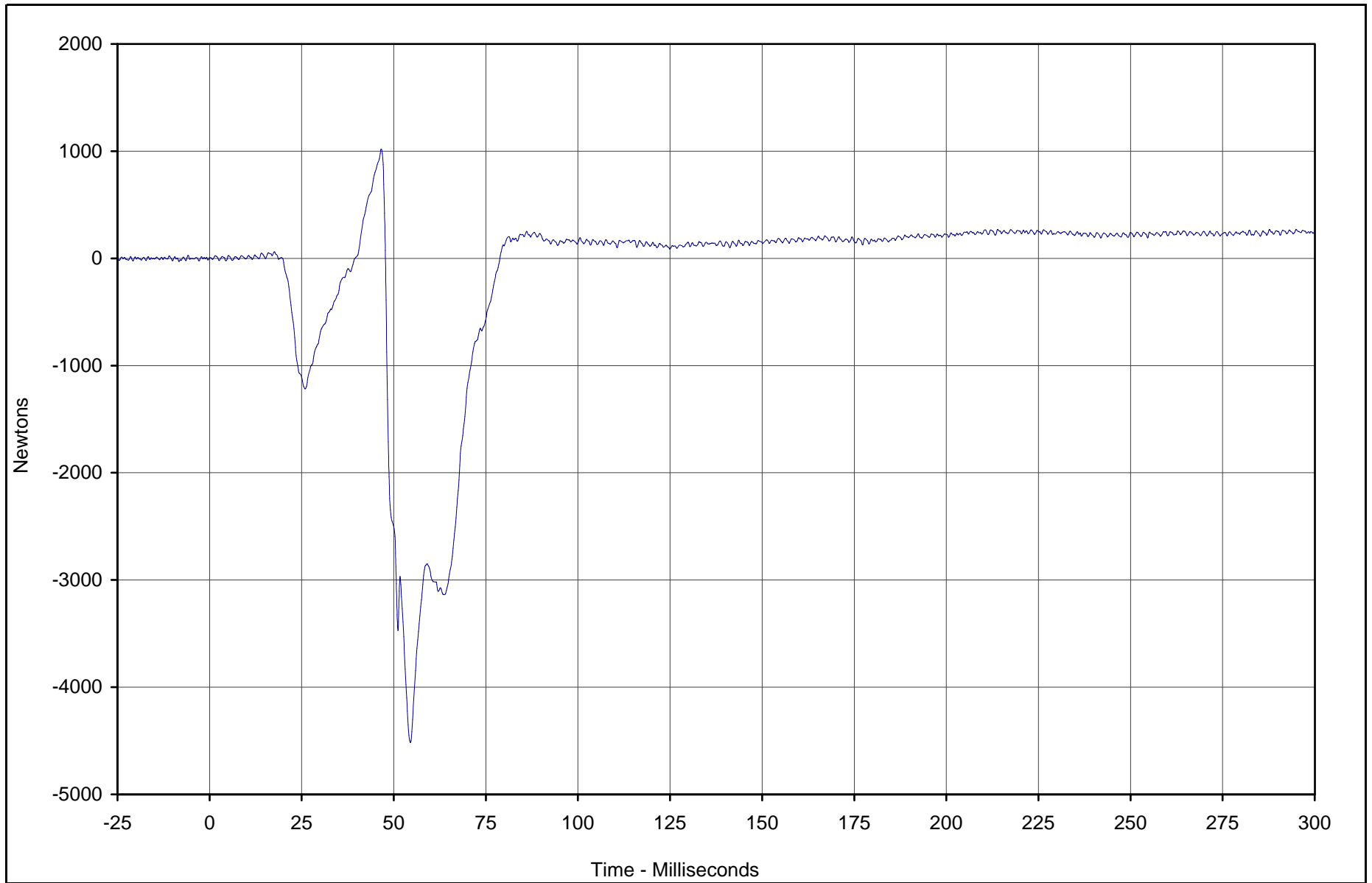
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-40



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Left Femur Force	023	FIL	Newtons	1019.6	46.6	-4517.3	54.5	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

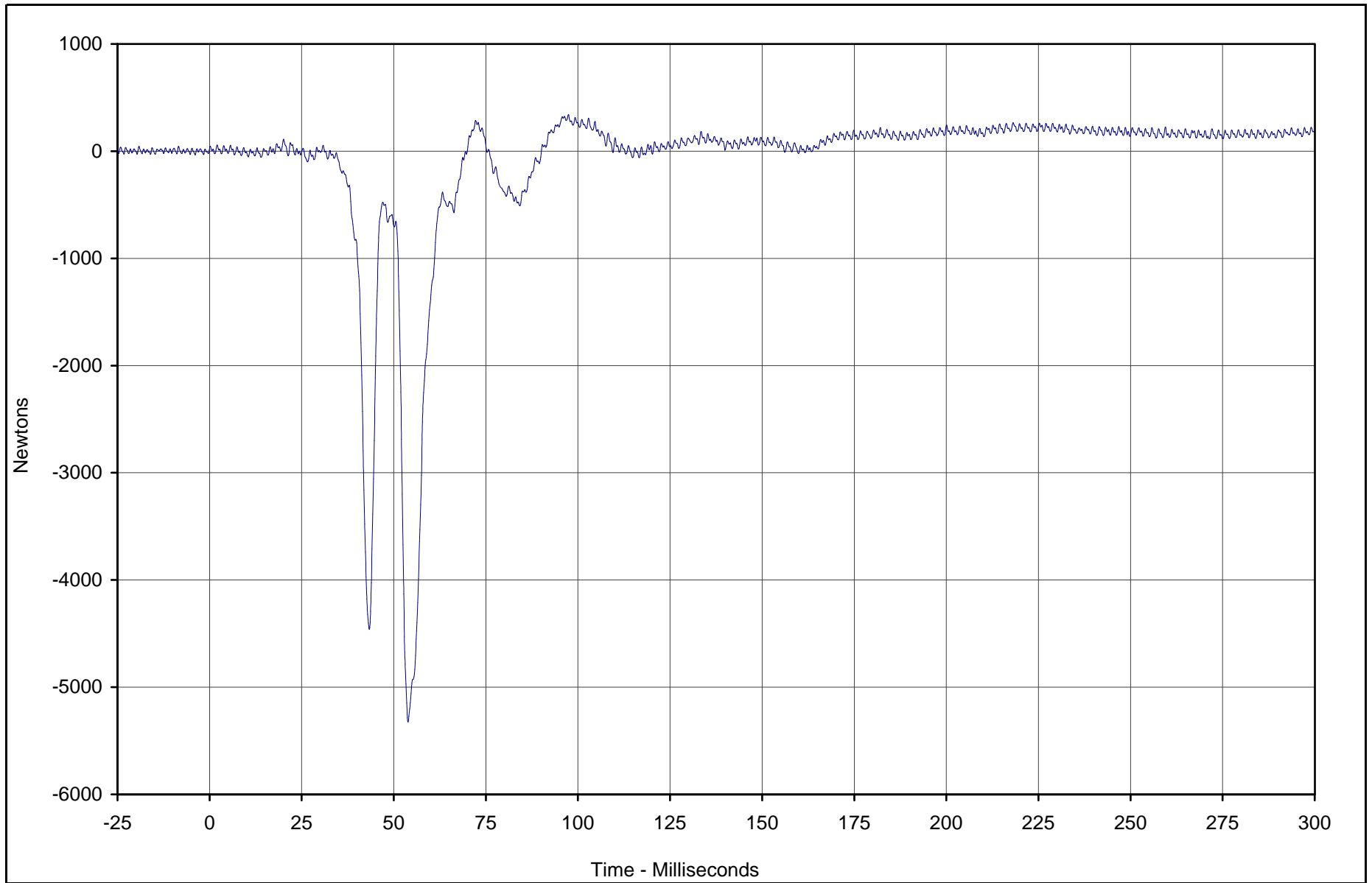
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-41



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Right Femur Force	024	FIL	Newtons	341.7	97.4	-5326.4	53.9	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

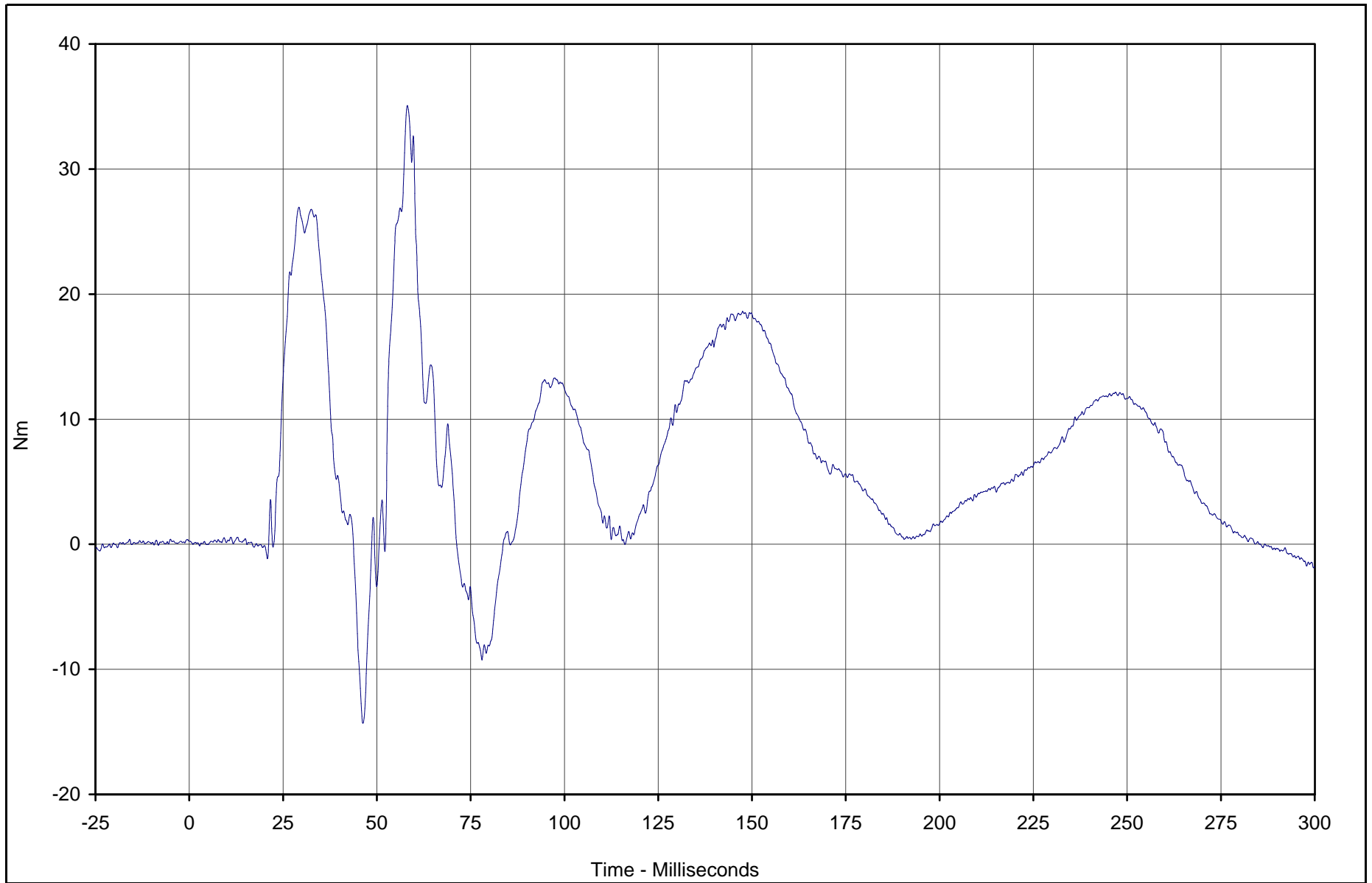
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-42



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Left Upper Tibia Moment X	025	FIL	Nm	35.1	58.1	-14.3	46.3	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

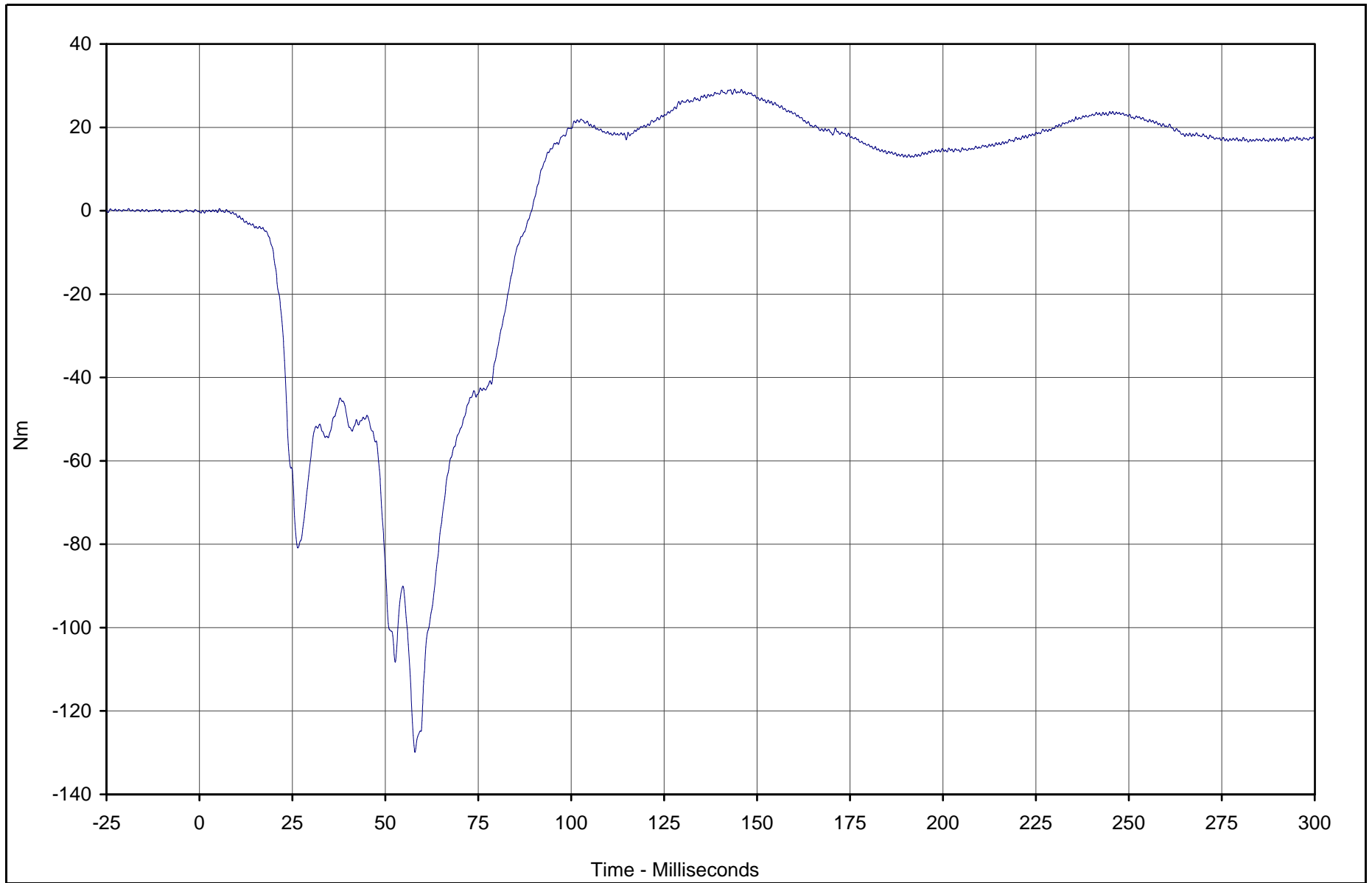
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-43



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Left Upper Tibia Moment Y	026	FIL	Nm	29.2	143.9	-129.9	58.0	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

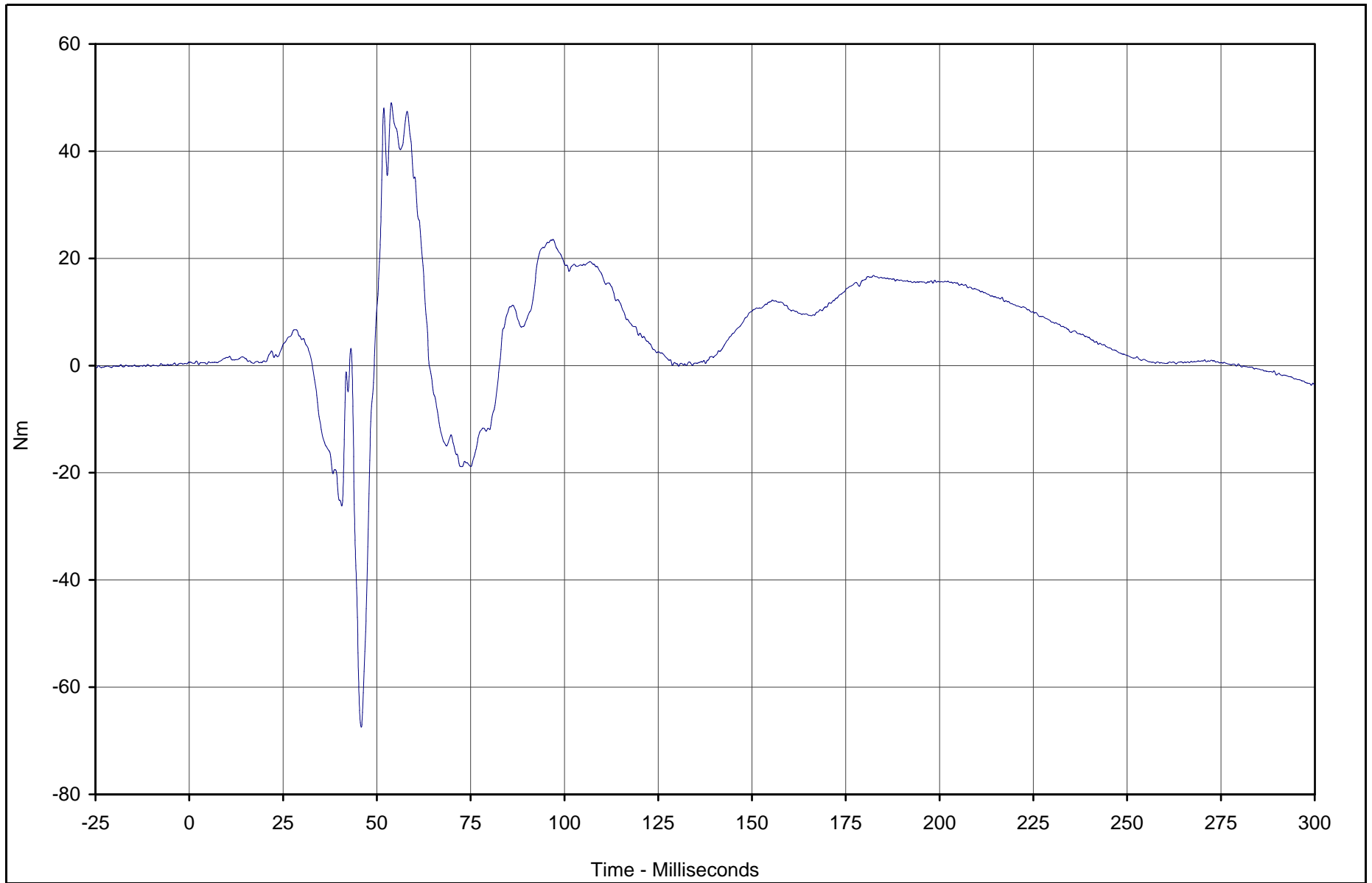
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-44



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Right Upper Tibia Moment X	027	FIL	Nm	49.0	53.9	-67.4	45.8	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

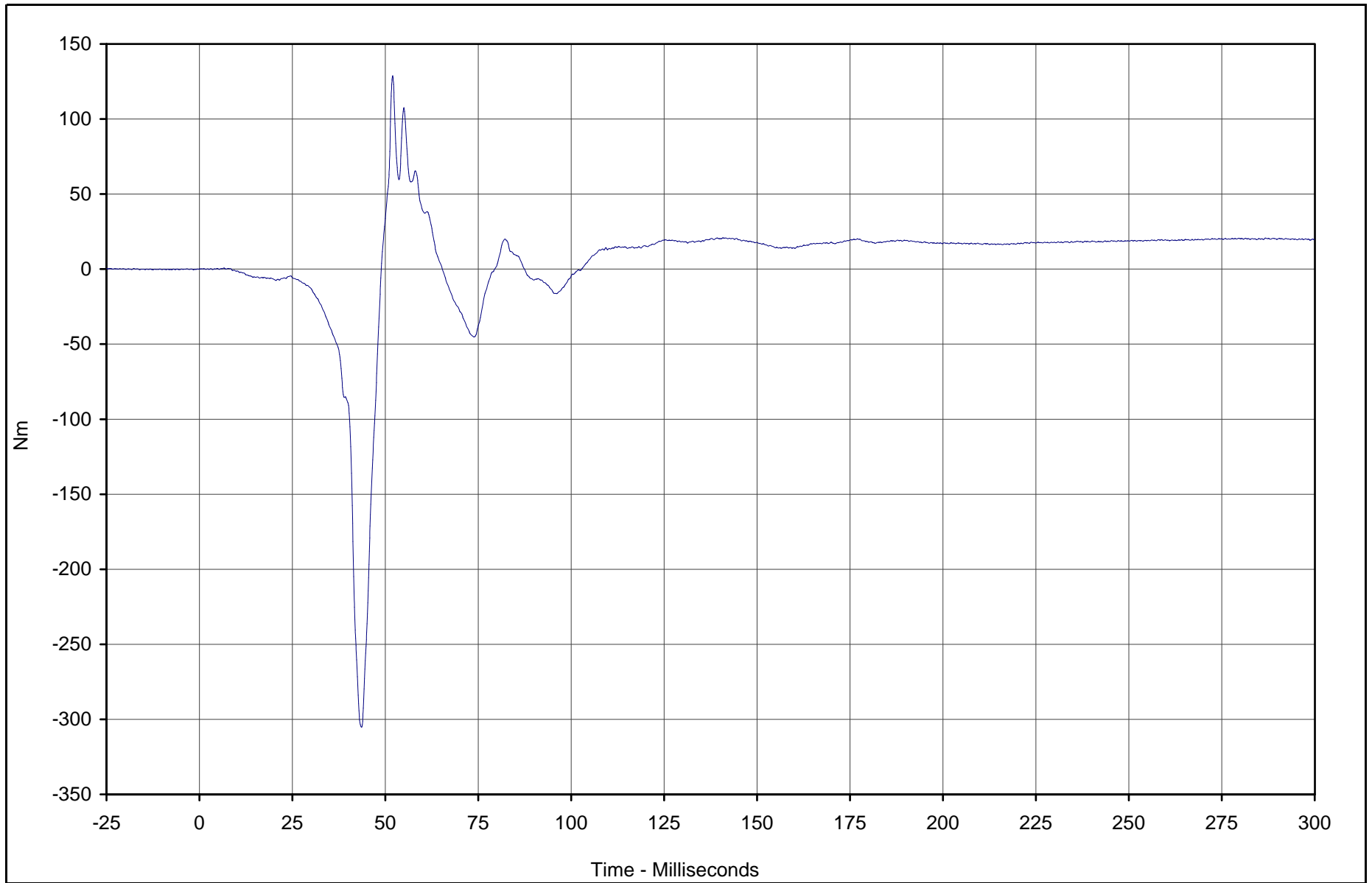
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-45



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Right Upper Tibia Moment Y	028	FIL	Nm	128.8	52.0	-305.3	43.6	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

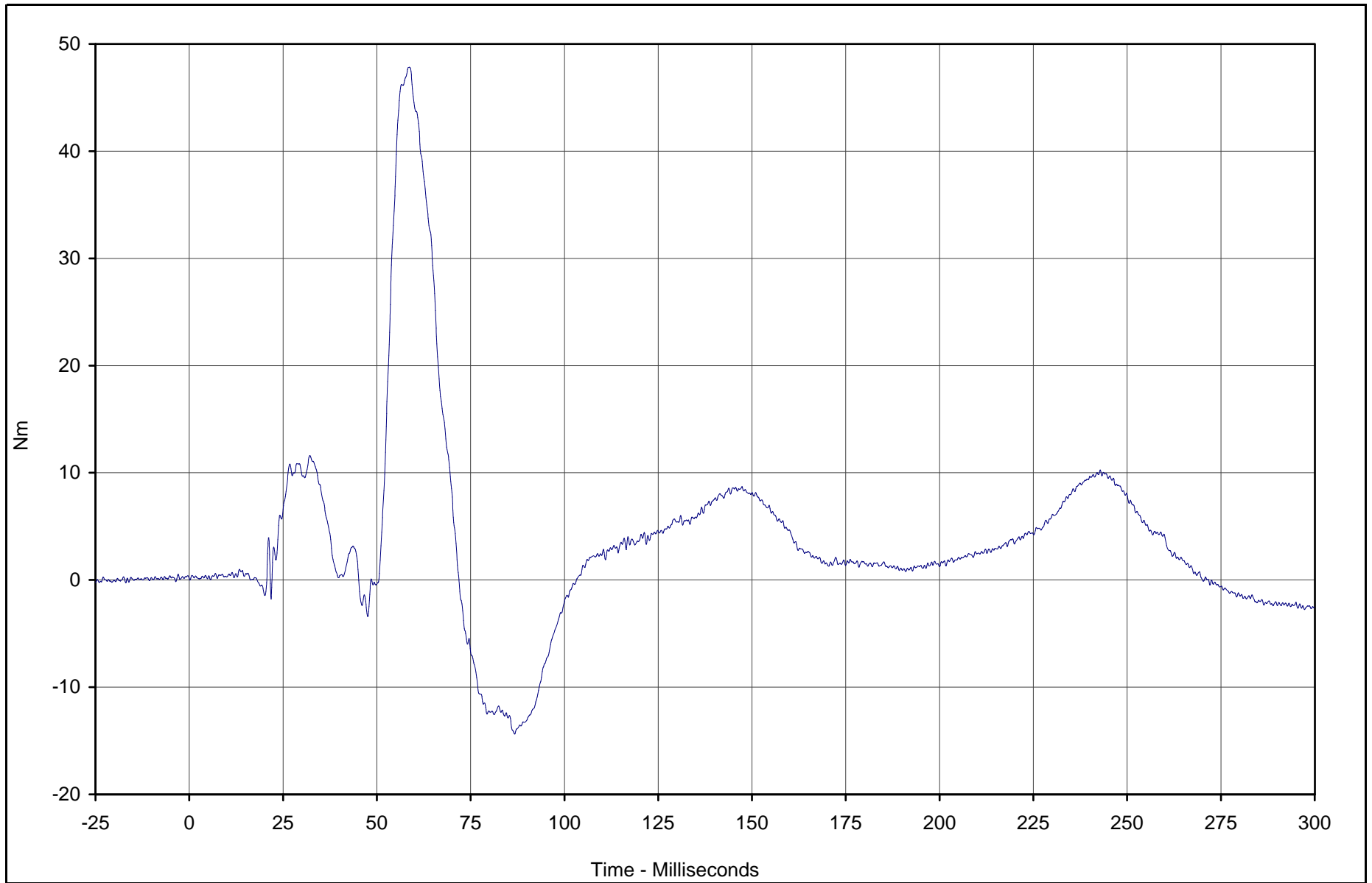
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-46



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Left Lower Tibia Moment X	029	FIL	Nm	47.8	58.7	-14.4	86.7	600



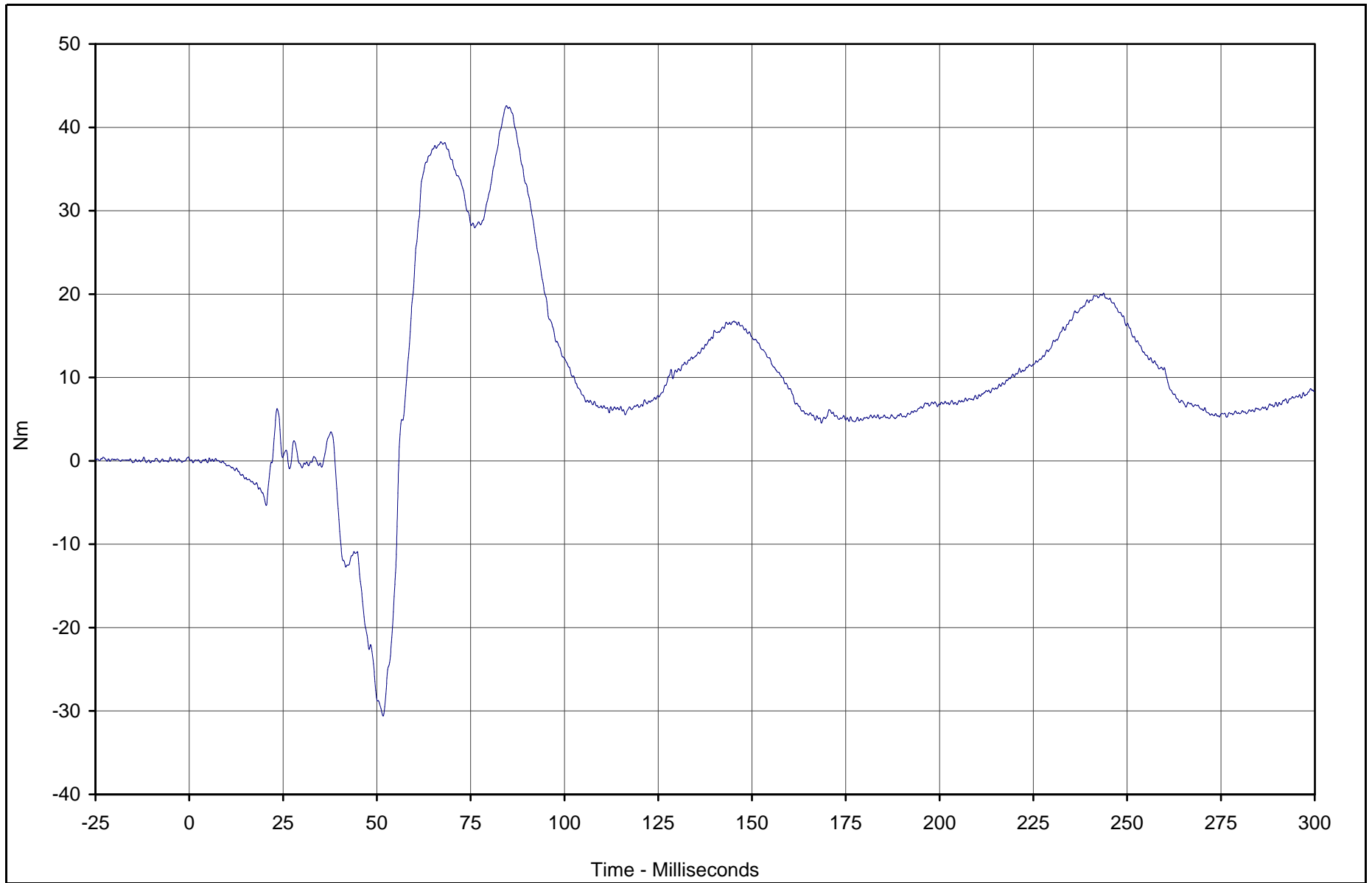
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-47



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Left Lower Tibia Moment Y	030	FIL	Nm	42.6	84.5	-30.6	51.7	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

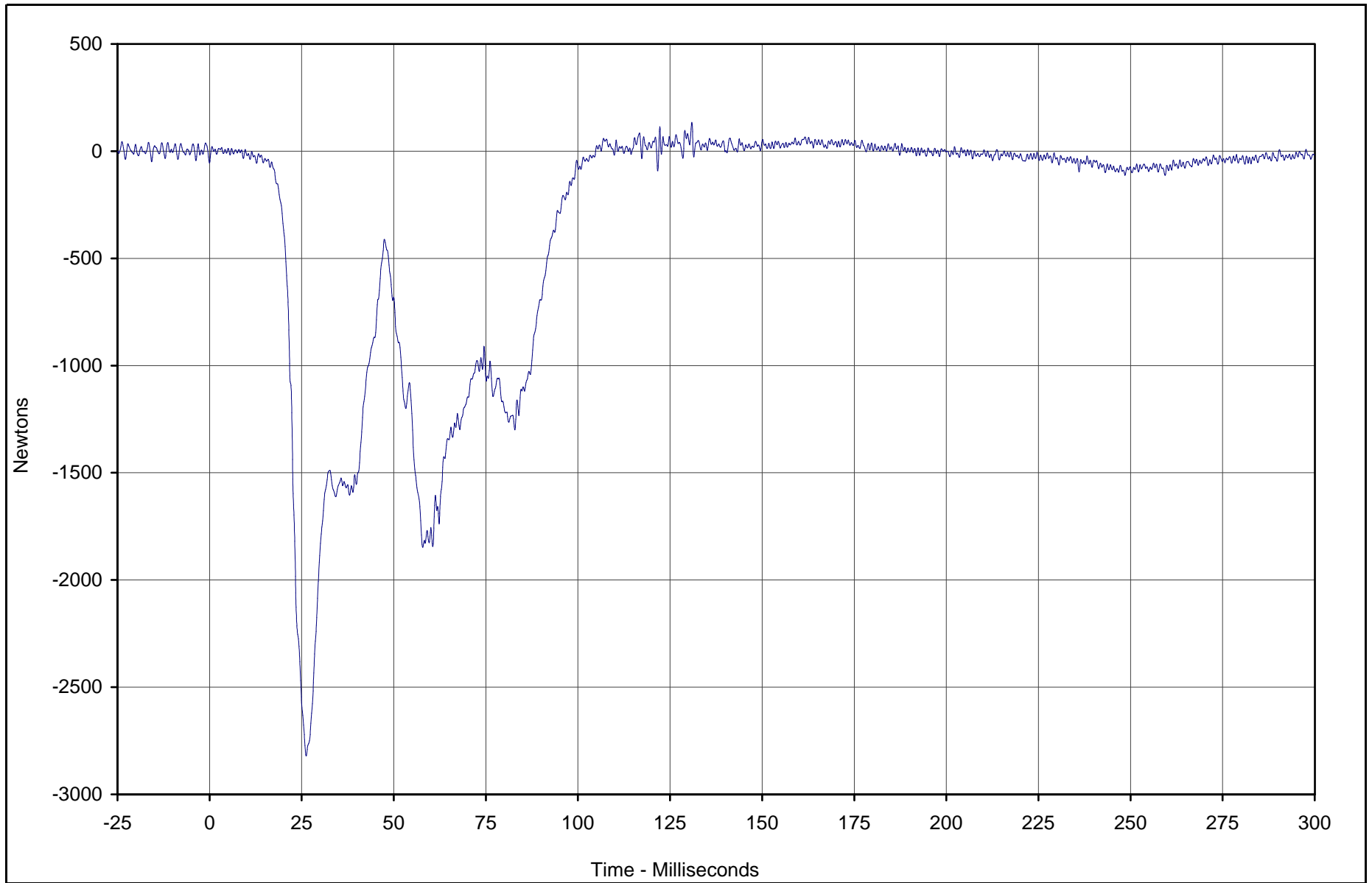
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-48



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Left Lower Tibia Force Z	031	FIL	Newtons	134.5	130.9	-2821.4	26.2	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

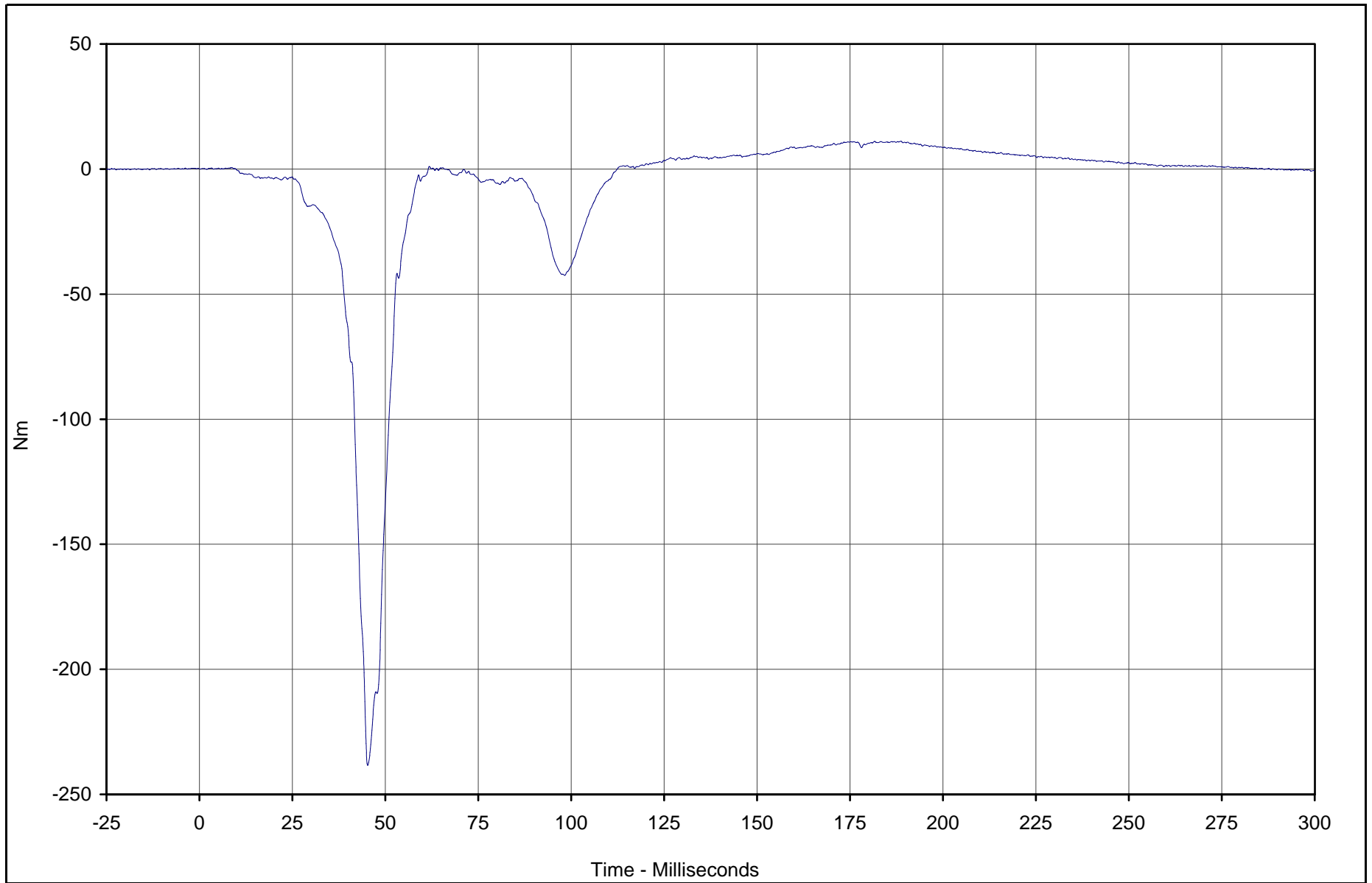
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-49



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Right Lower Tibia Moment X	032	FIL	Nm	11.1	188.7	-238.4	45.3	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

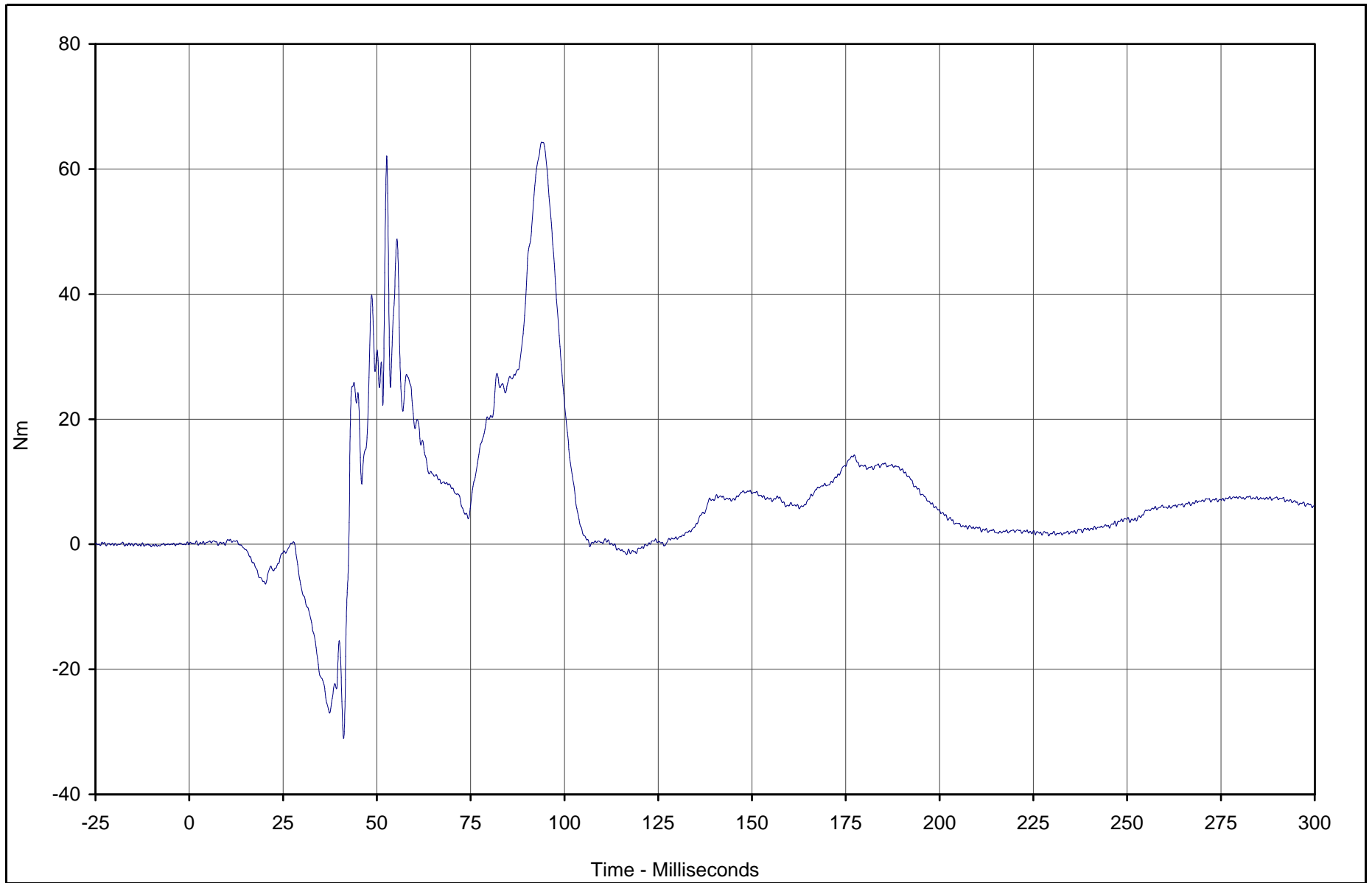
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-50



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Right Lower Tibia Moment Y	033	FIL	Nm	64.3	93.9	-31.0	41.1	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

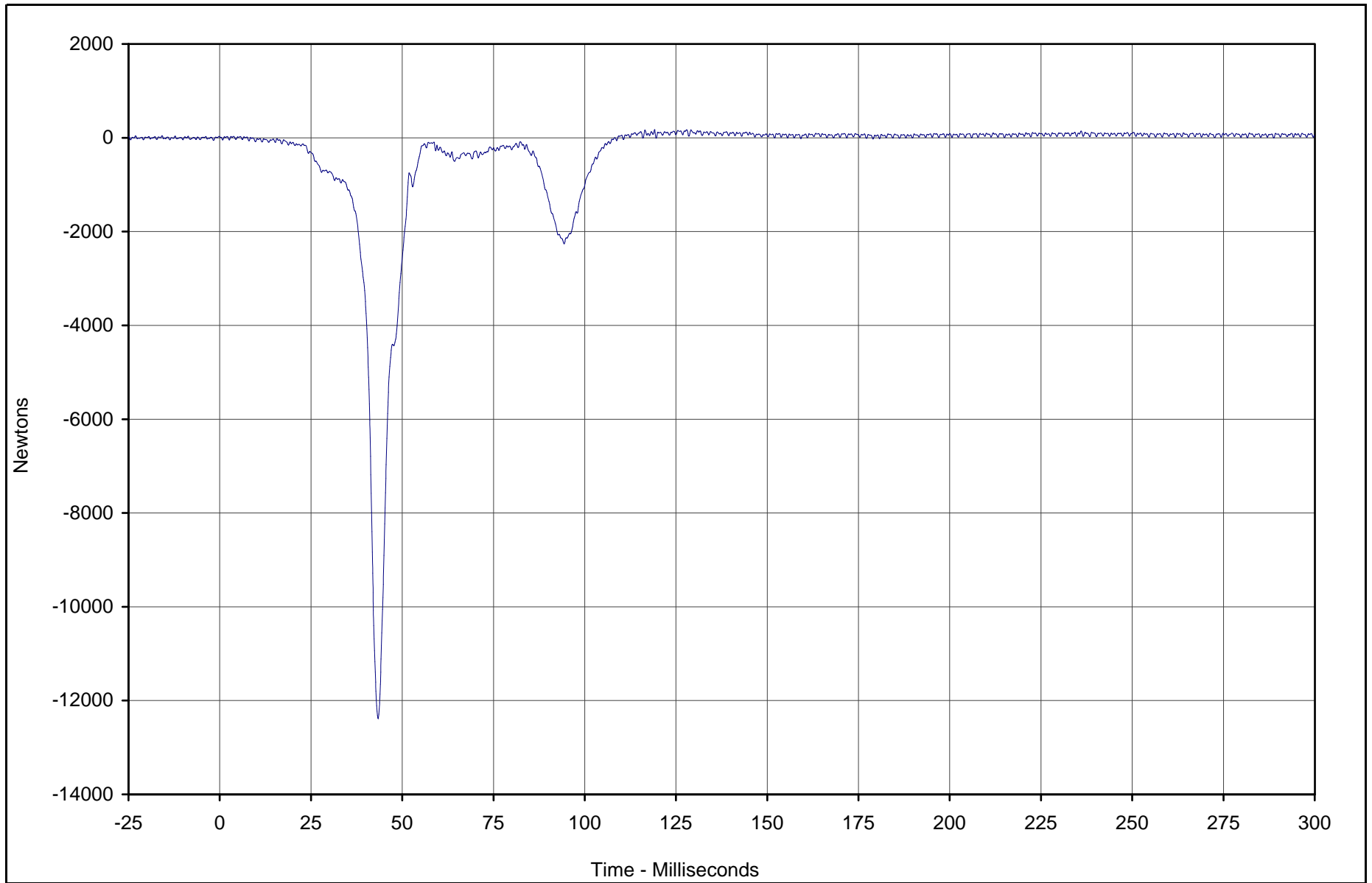
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-51



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Right Lower Tibia Force Z	034	FIL	Newtons	174.4	119.1	-12387.8	43.4	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

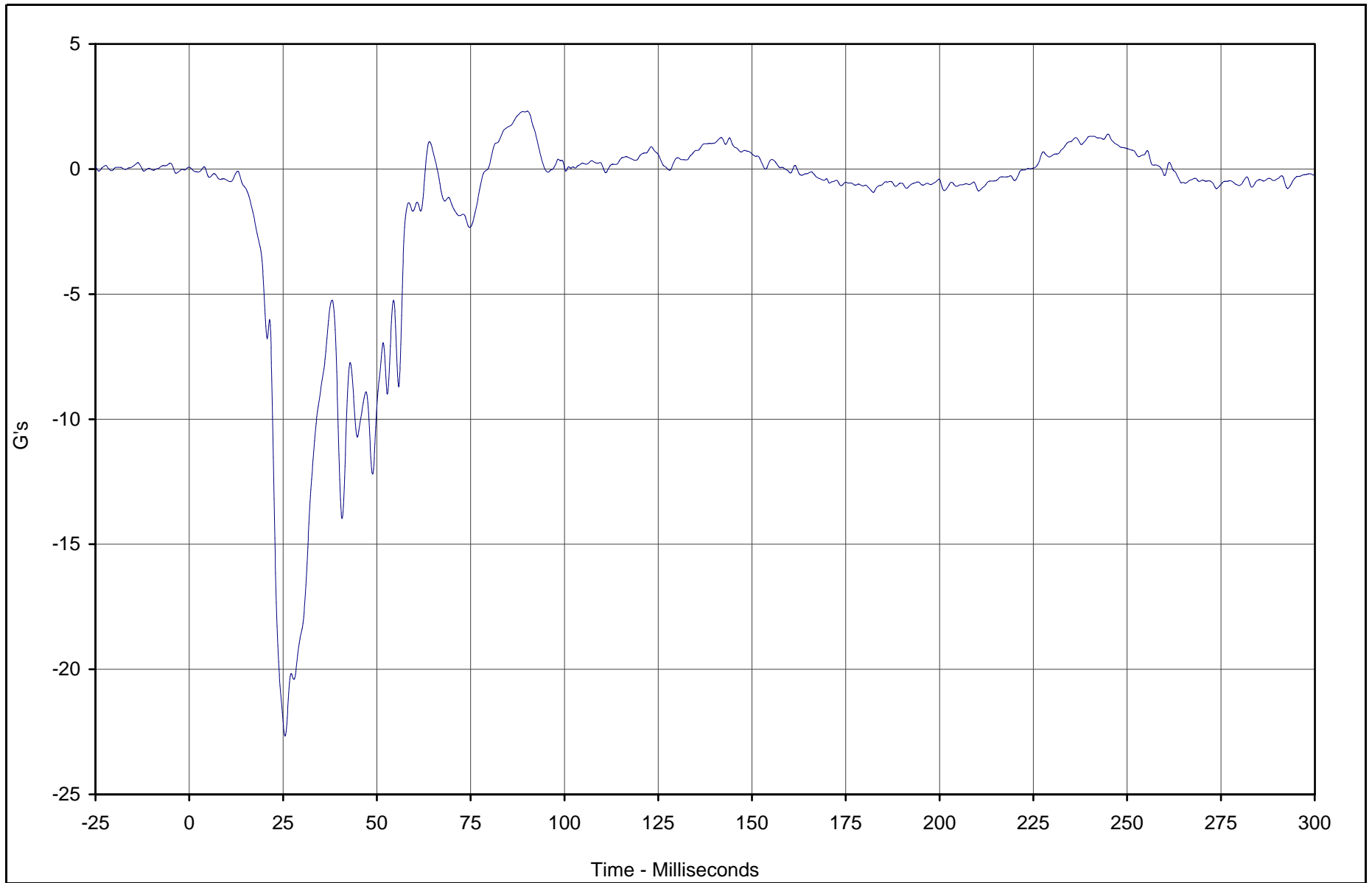
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-52



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Left Foot Aft X	035	FIL	G's	2.3	90.1	-22.7	25.5	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

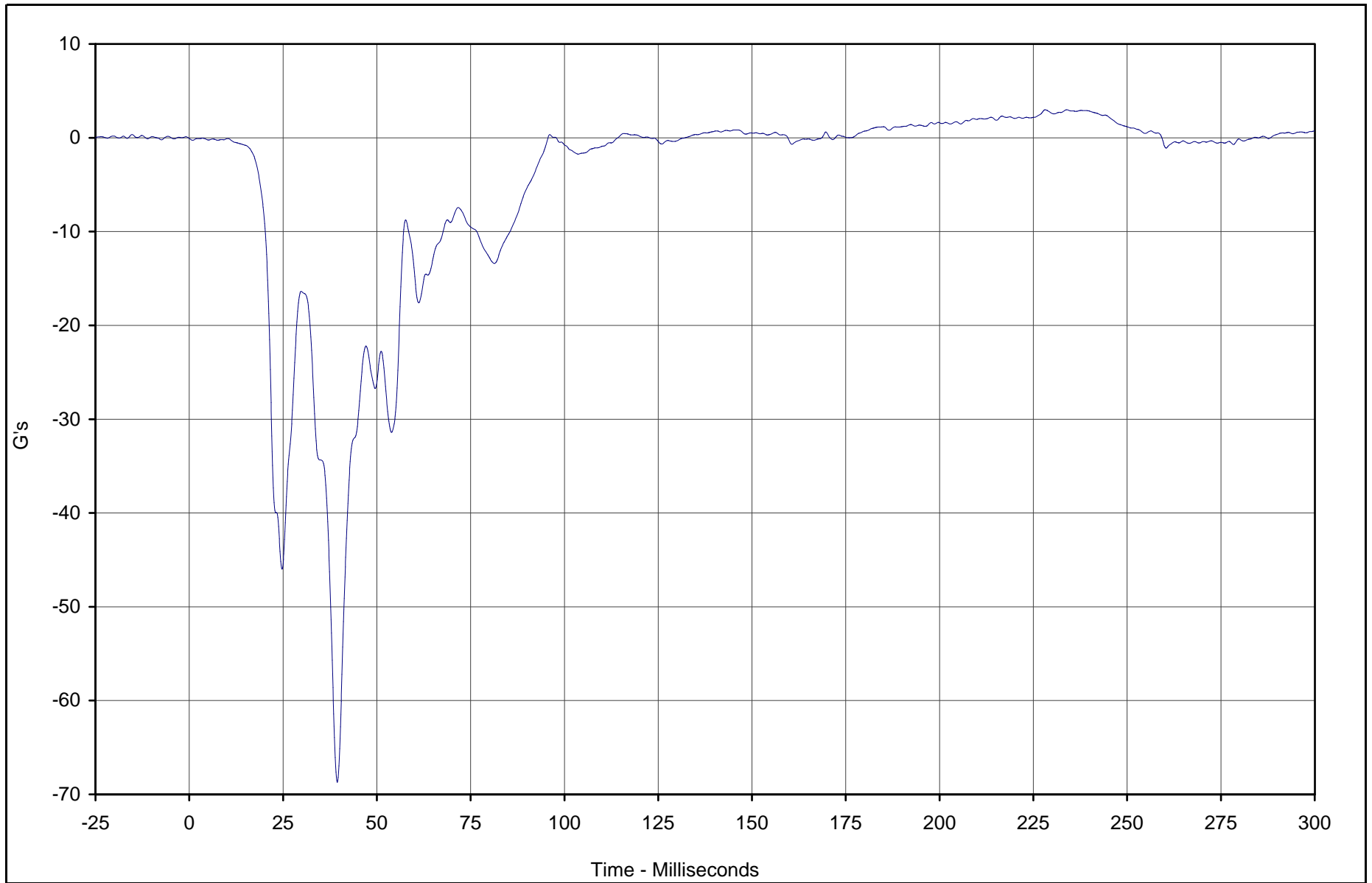
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-53



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Left Foot Aft Z	036	FIL	G's	3.0	233.9	-68.7	39.5	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

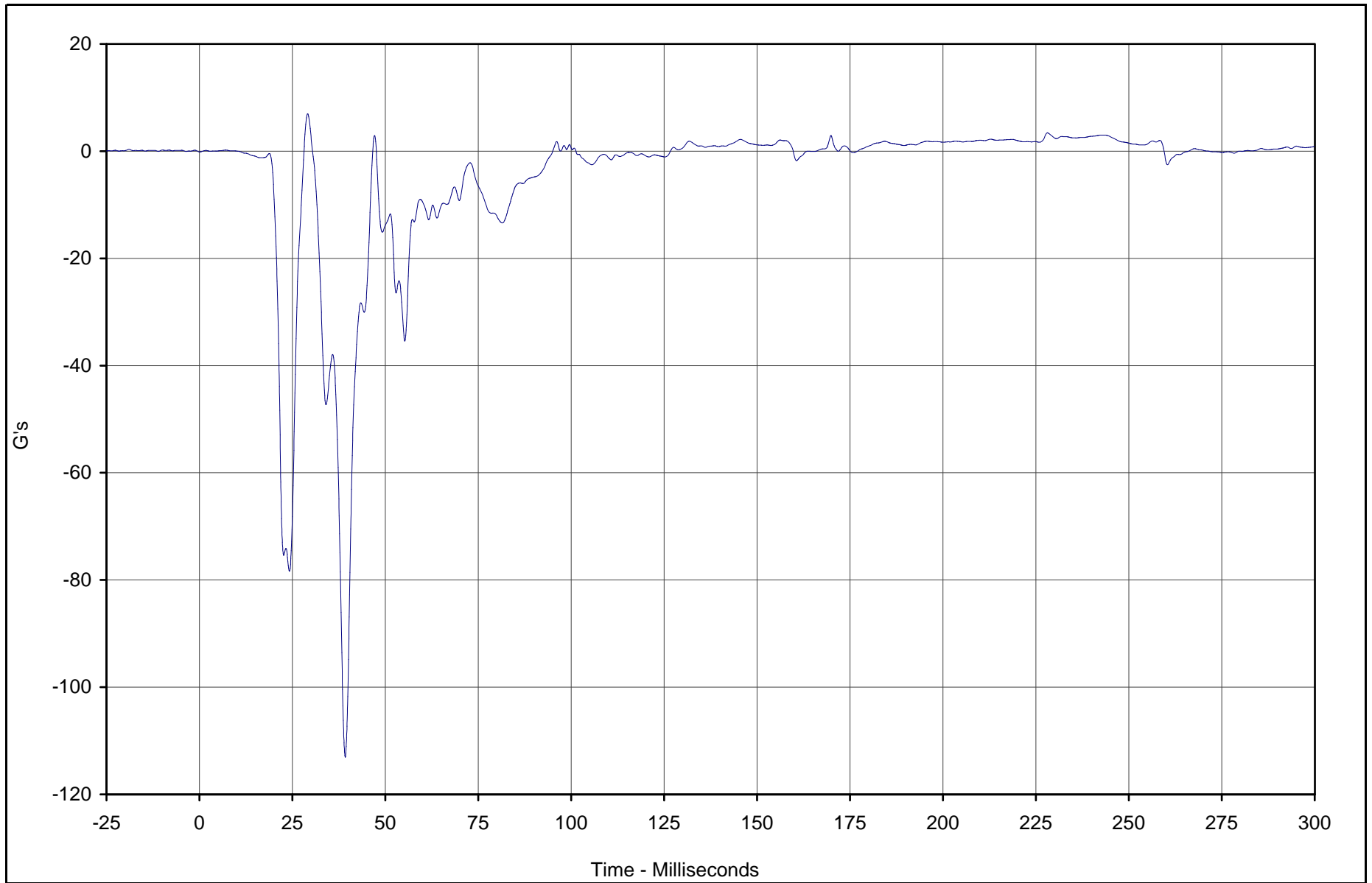
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-54



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Left Foot Fore Z	037	FIL	G's	7.0	29.1	-113.1	39.2	180



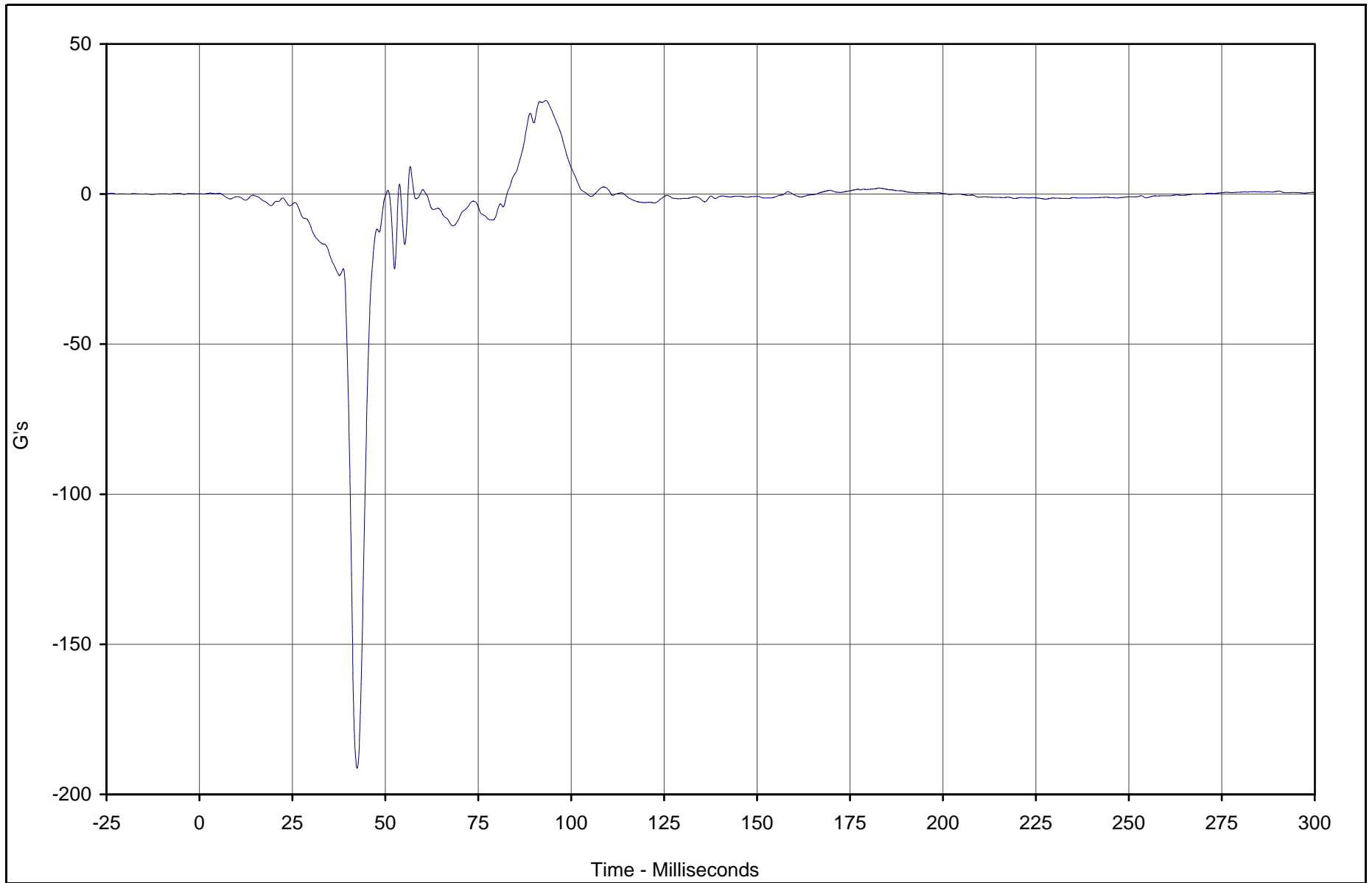
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-55



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Right Foot Aft X	038	FIL	G's	31.2	93.2	-191.3	42.4	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

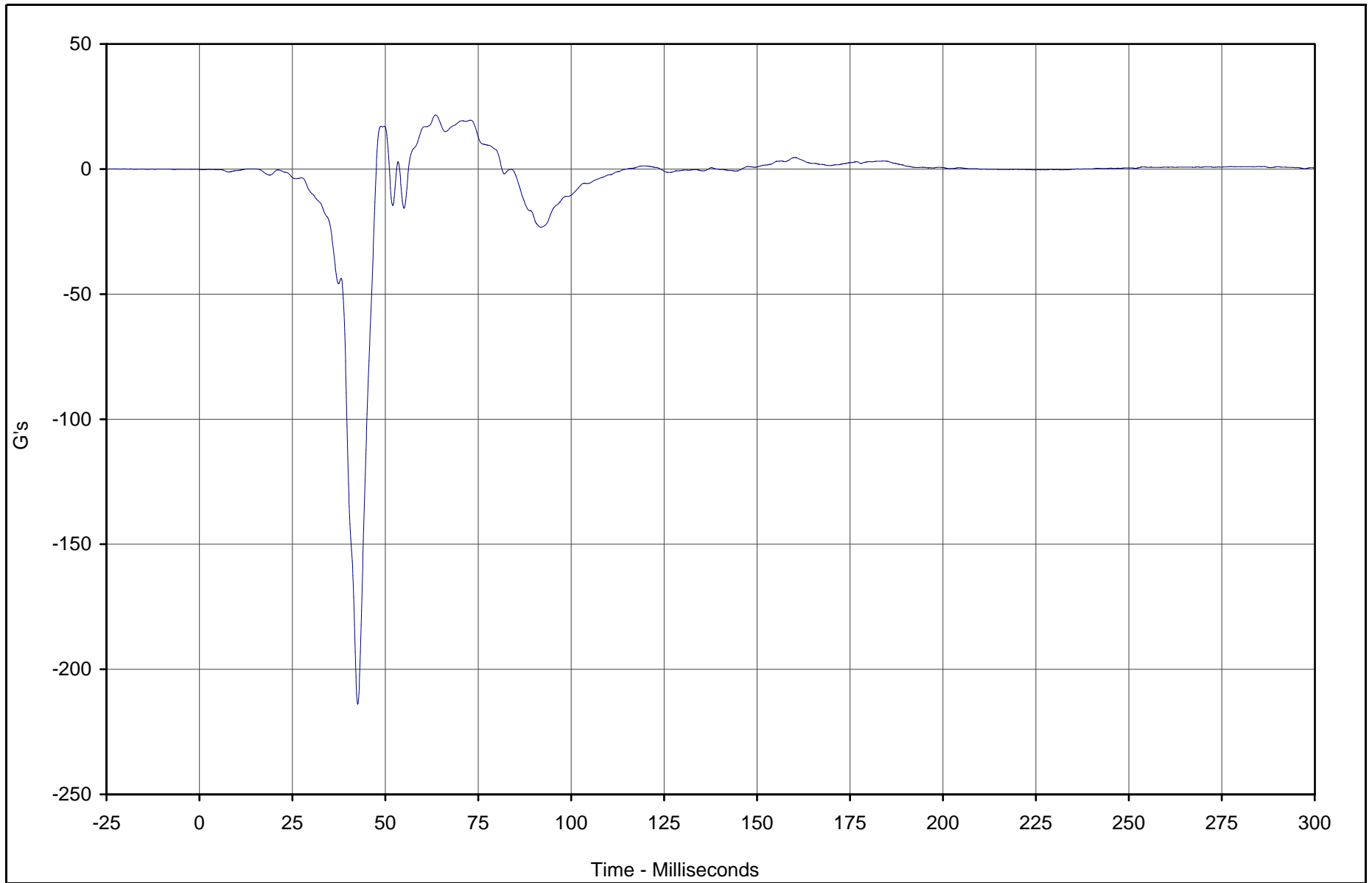
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-56



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Right Foot Aft Z	039	FIL	G's	21.7	63.5	-213.9	42.6	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

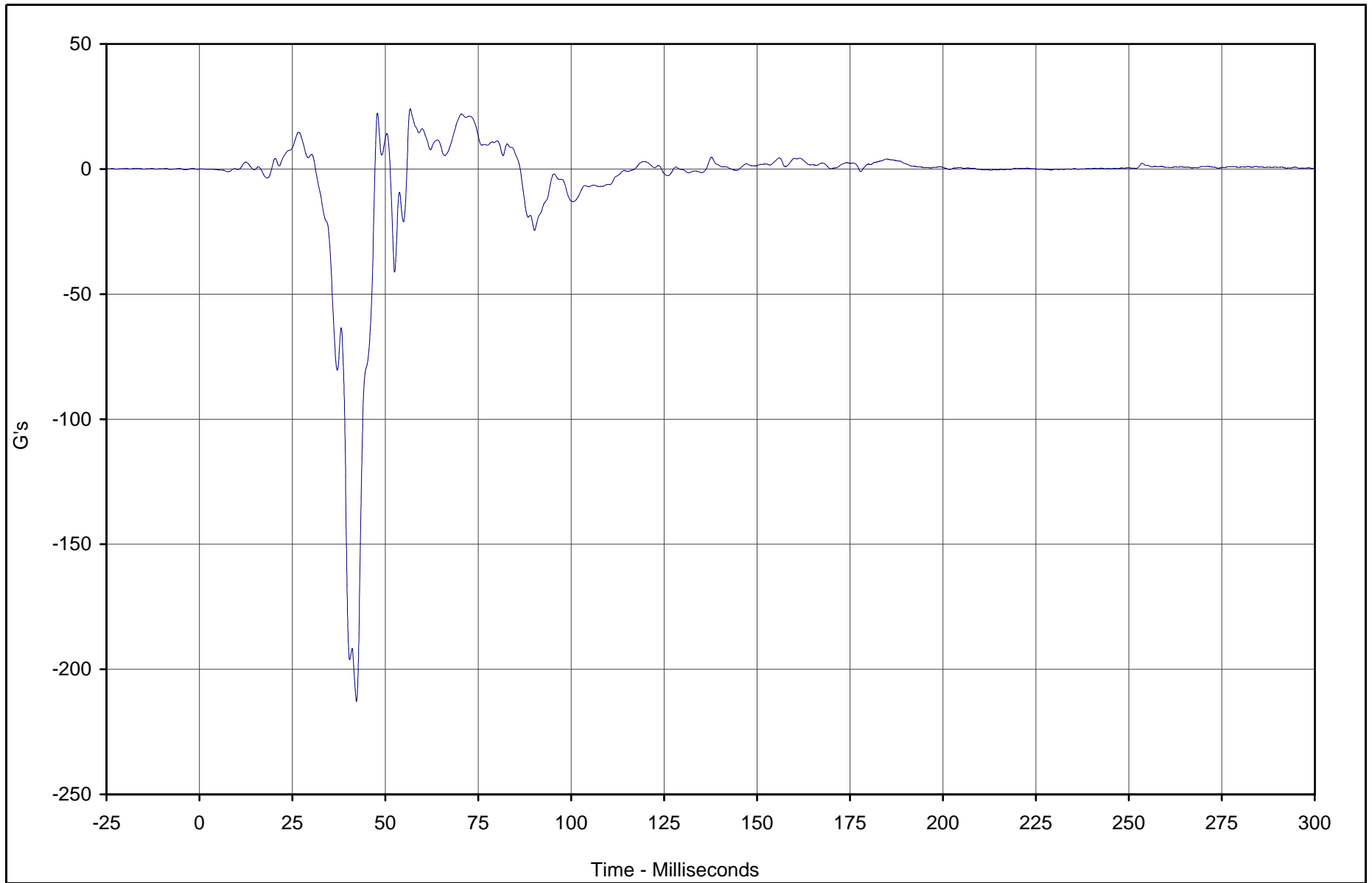
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-57



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Right Foot Fore Z	040	FIL	G's	24.1	56.7	-212.8	42.3	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

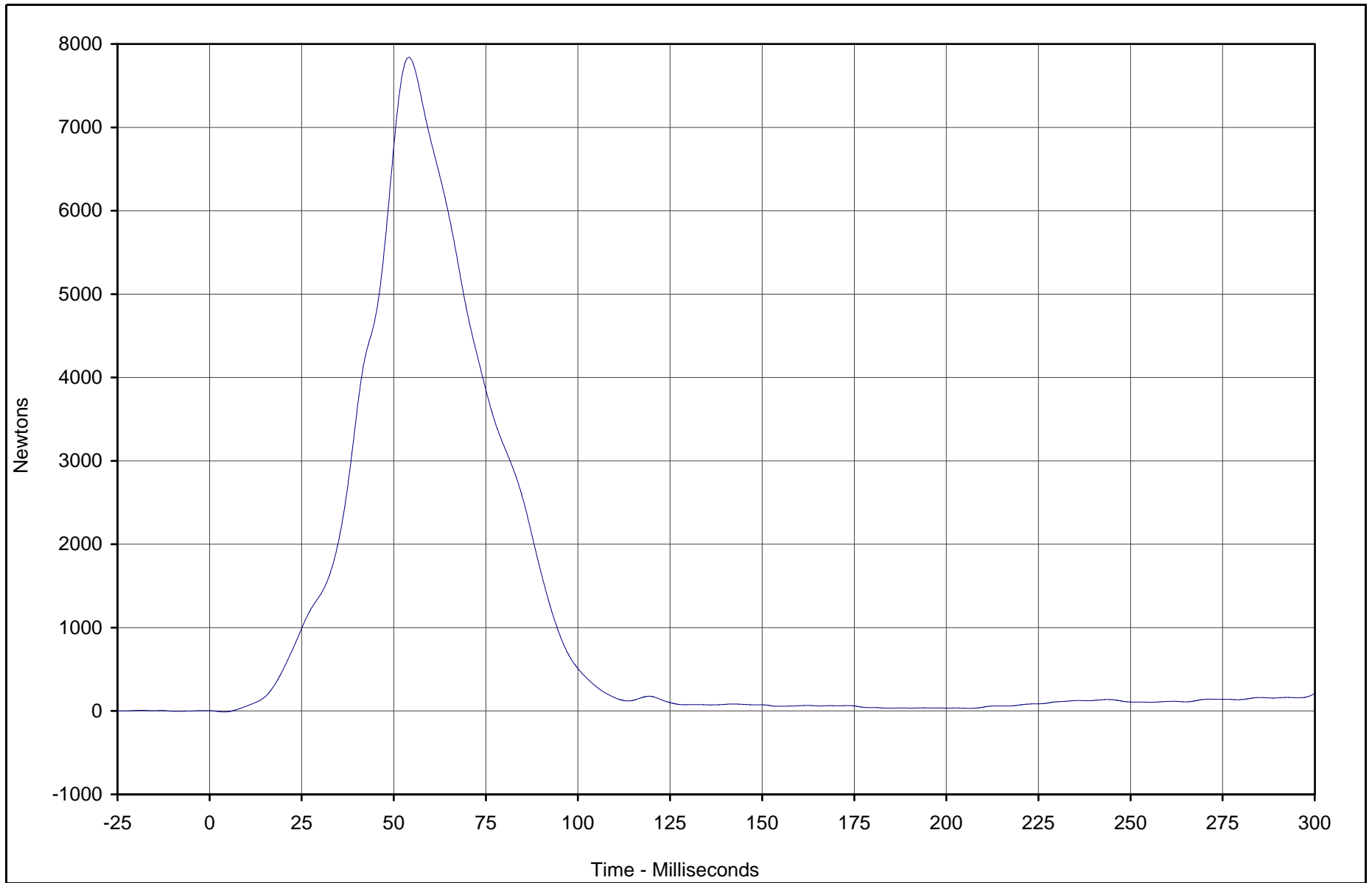
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-58



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Lap Belt Force	041	FIL	Newtons	7840.1	54.1	-11.9	4.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

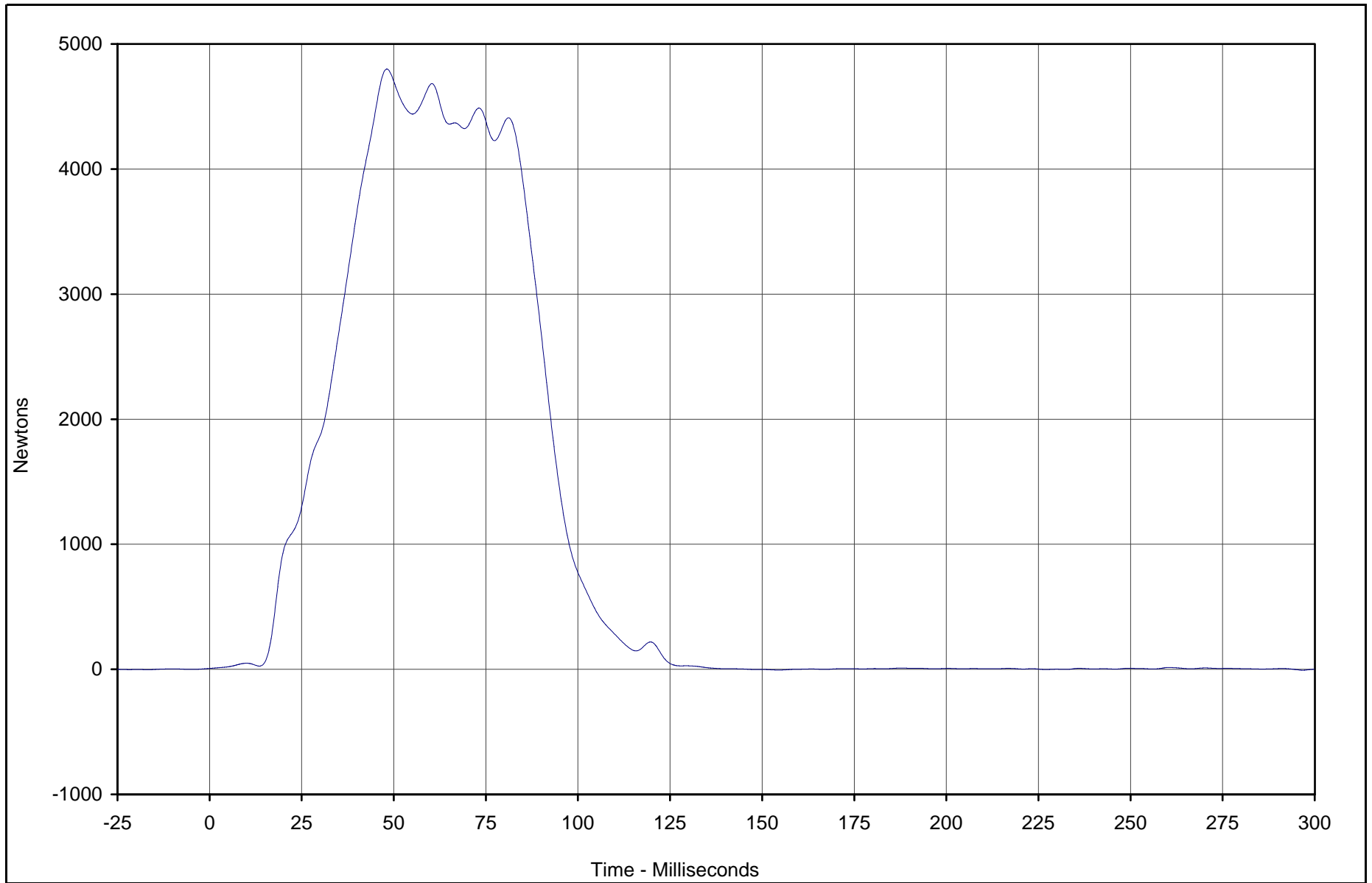
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-59



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Shoulder Belt Force	042	FIL	Newtons	4799.8	48.1	-7.4	296.8	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

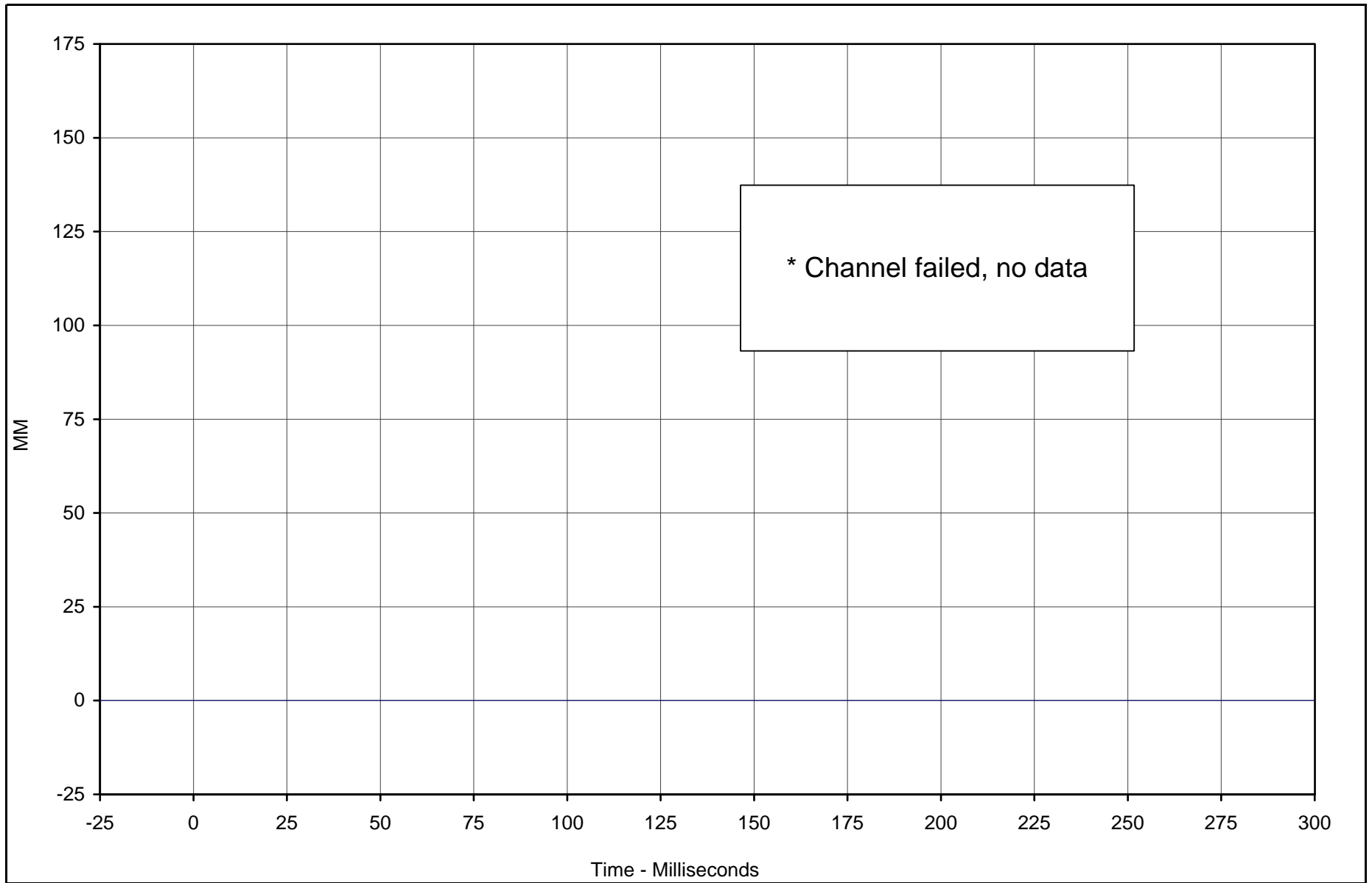
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-60



\* Channel failed, no data

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Shoulder Belt Pullout	043	FIL	MM	0.0	0.0	0.0	0.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

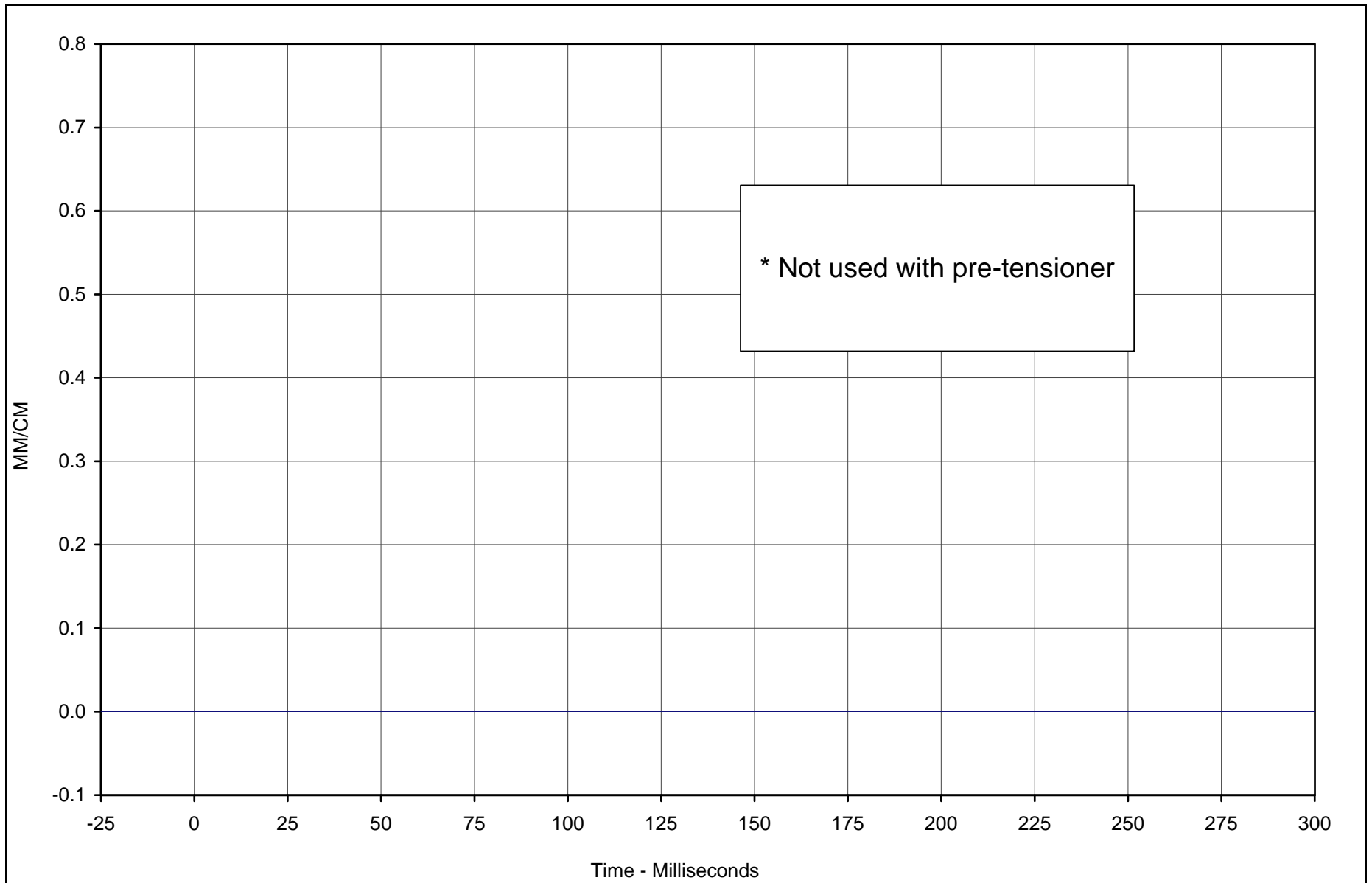
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-61



\* Not used with pre-tensioner

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Shoulder Belt Elongation	044	FIL	MM/CM	0.00	0.0	0.00	0.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

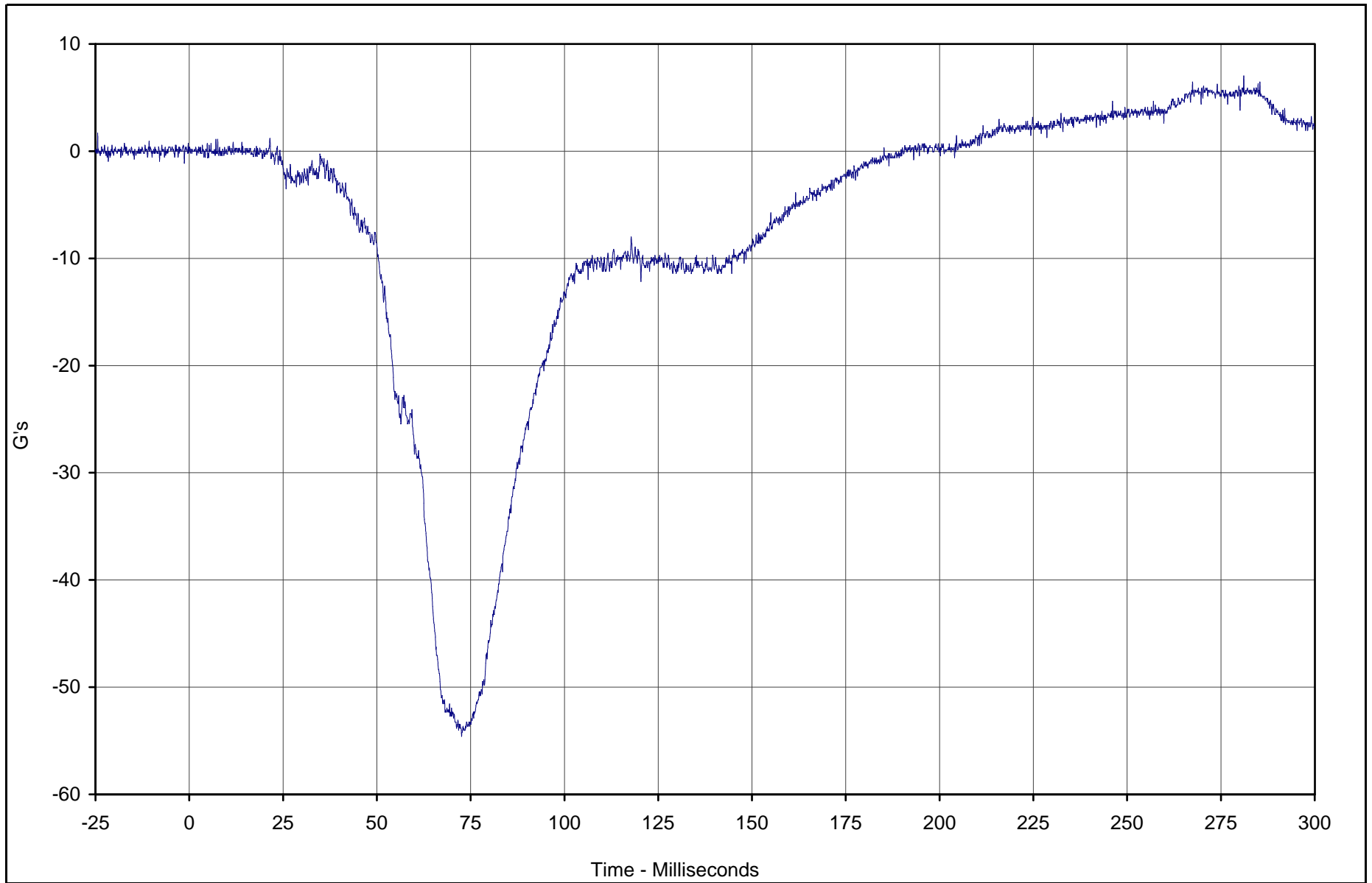
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-62



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Primary X	045	FIL	G's	7.0	281.1	-54.6	72.6	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

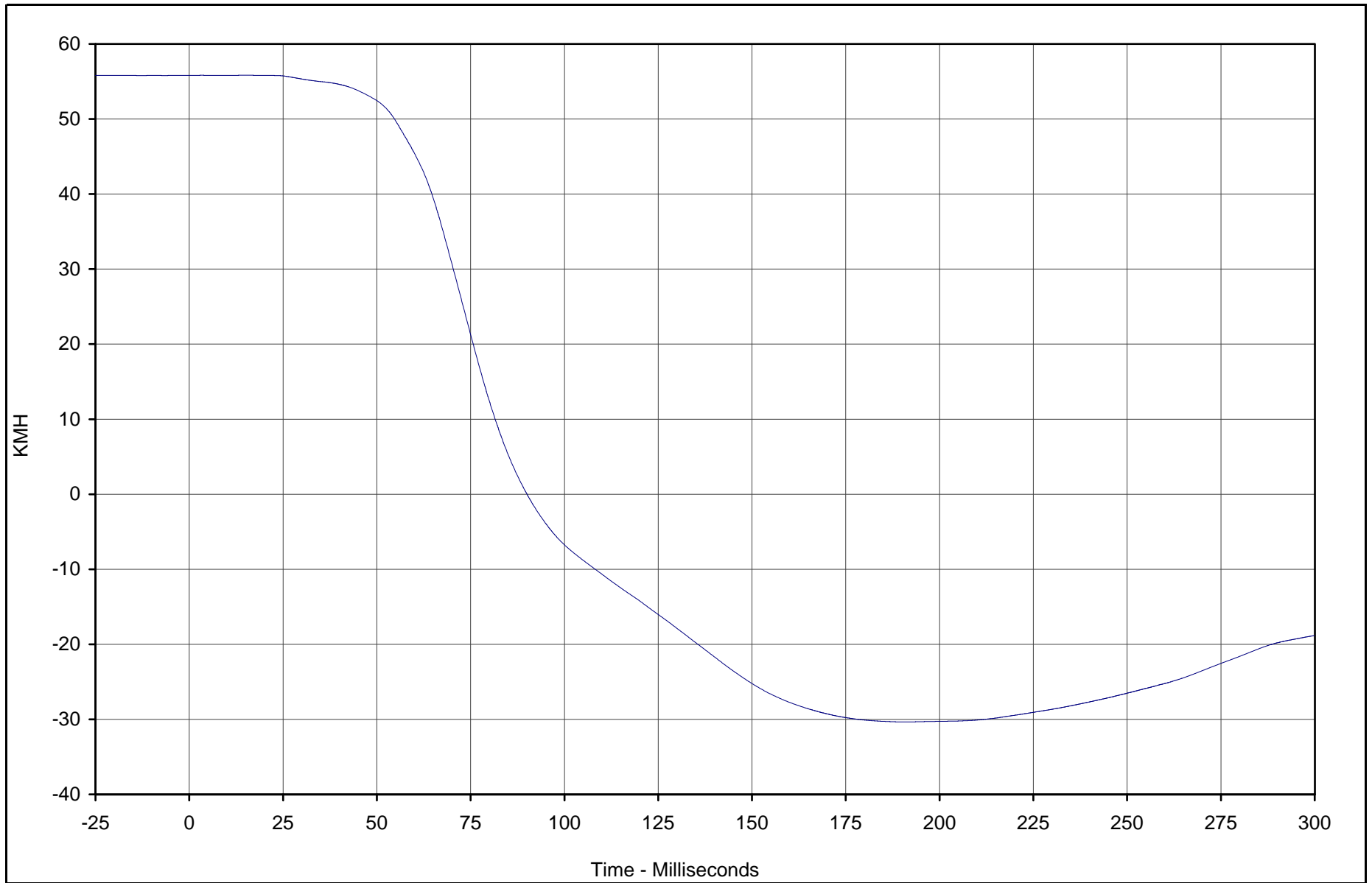
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-63



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Primary X Velocity	045	IN1	KMH	55.8	15.8	-30.3	190.2	180



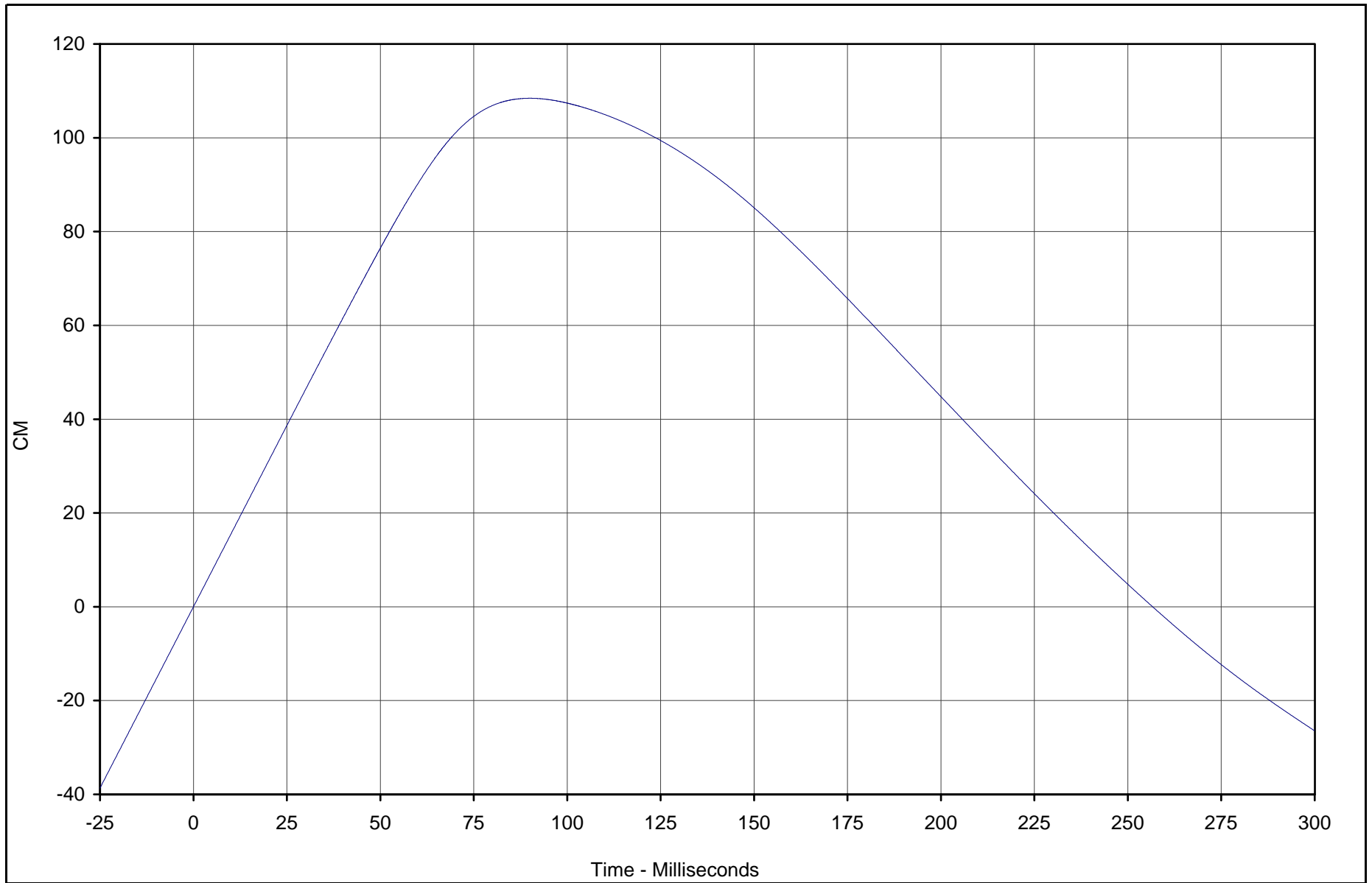
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-64



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Primary X Displ.	045	IN2	CM	108.4	90.0	-26.4	299.9	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

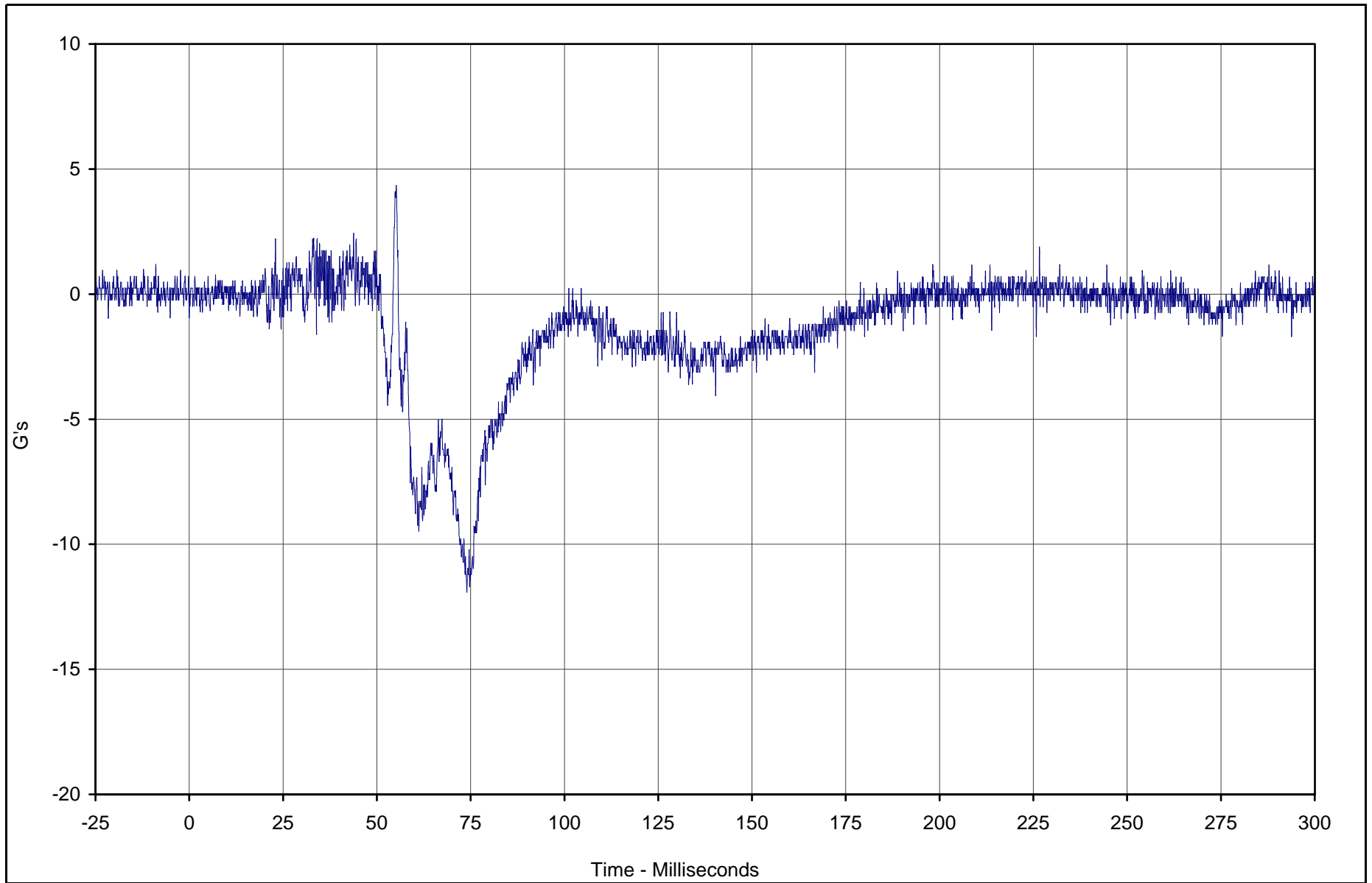
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-65



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Primary Y	046	FIL	G's	4.3	55.2	-11.9	74.0	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

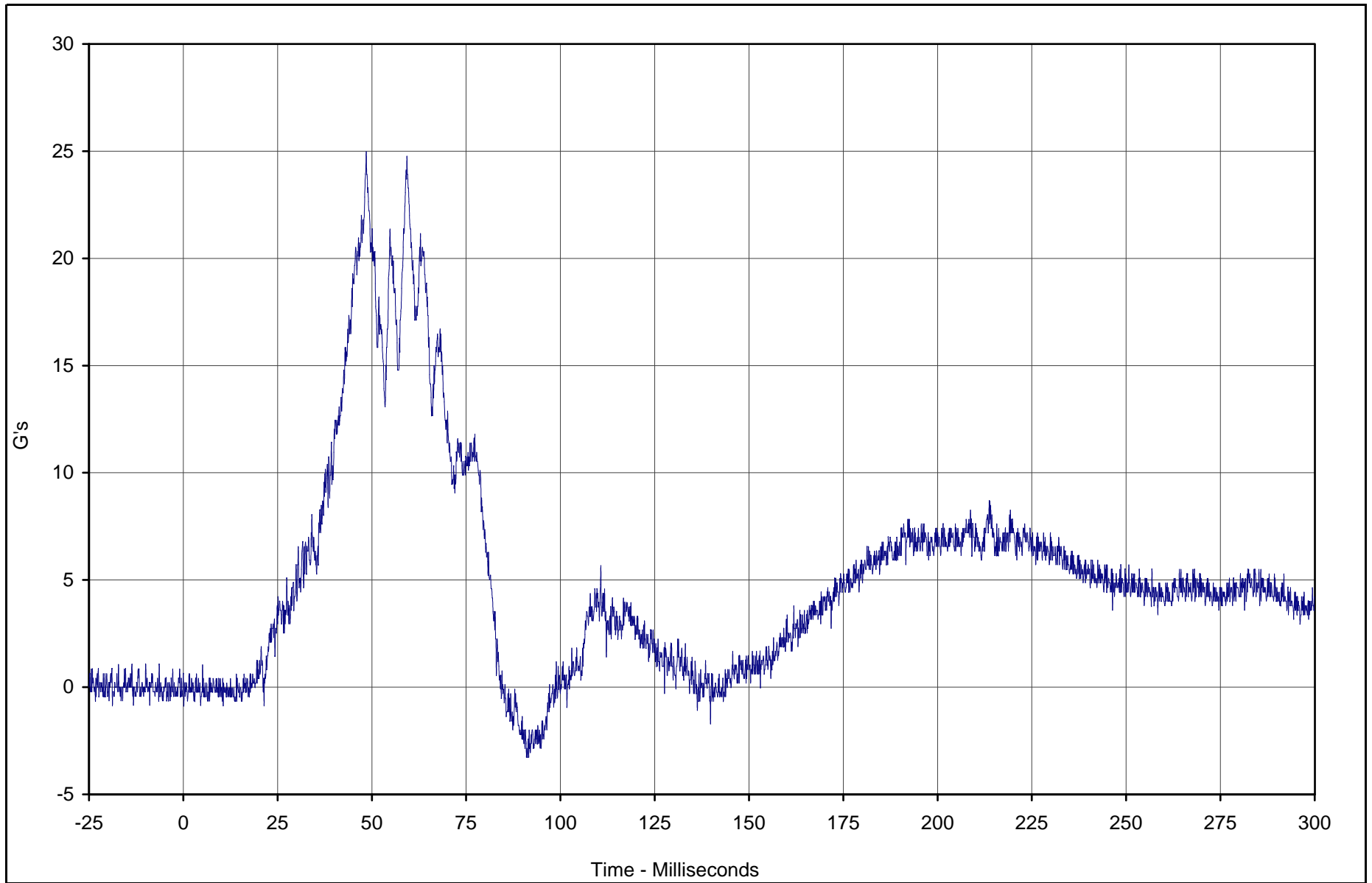
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-66



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Primary Z	047	FIL	G's	25.0	48.5	-3.3	91.0	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

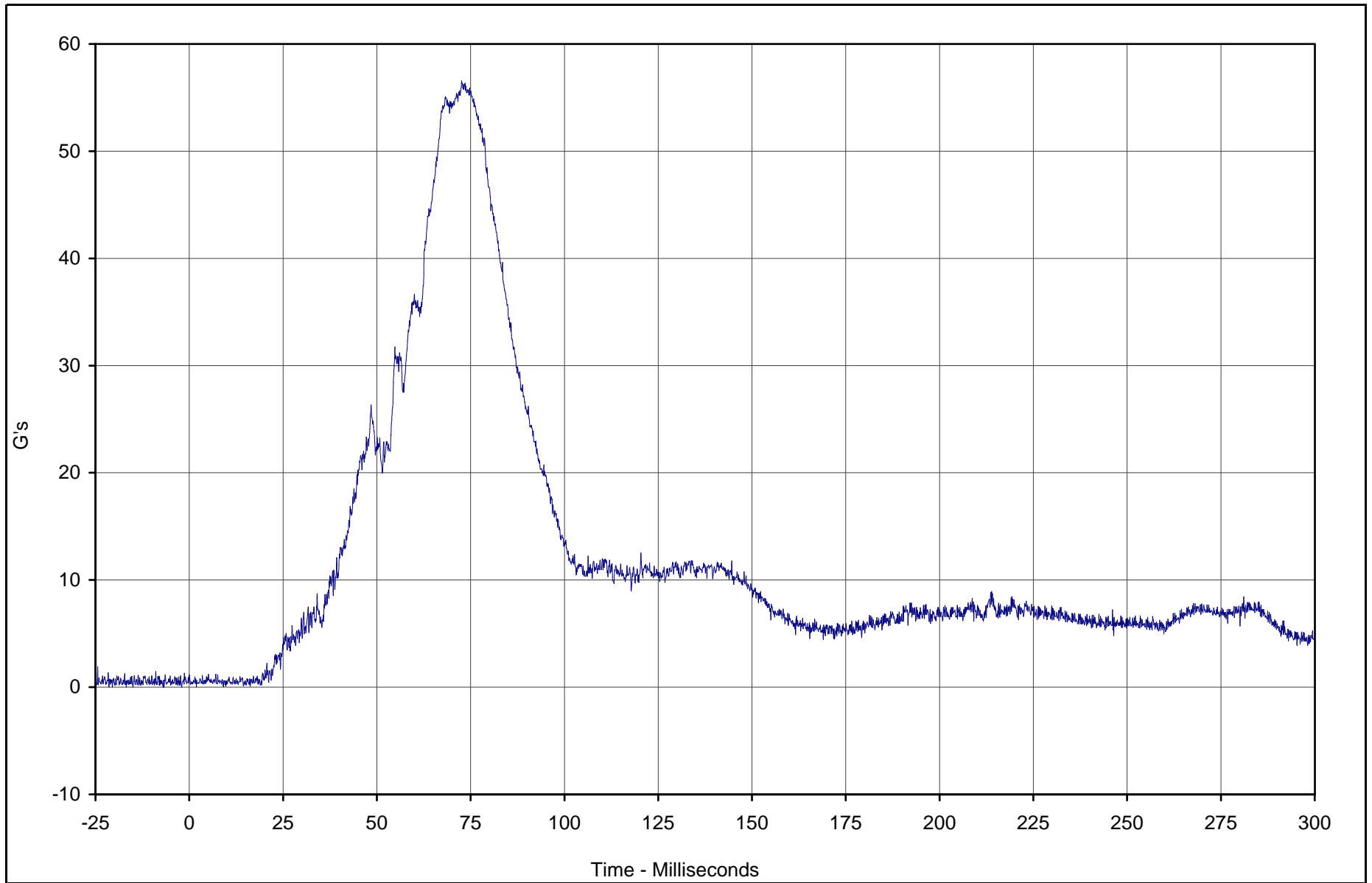
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-67



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Resultant Primary	045	RES	G's	56.6	72.6	0.0	1.9	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

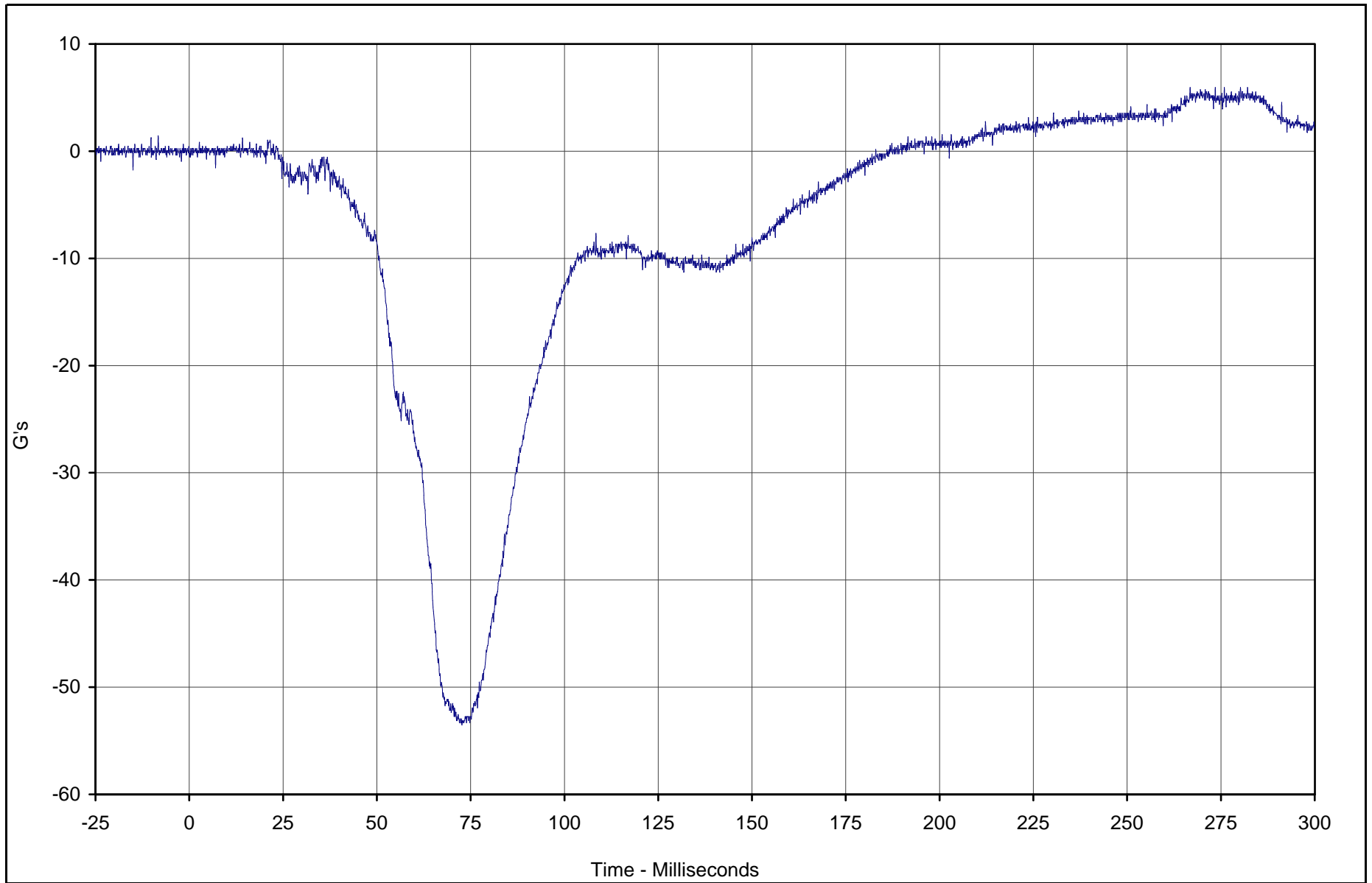
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-68



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Redundant X	048	FIL	G's	6.0	266.8	-53.5	72.7	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

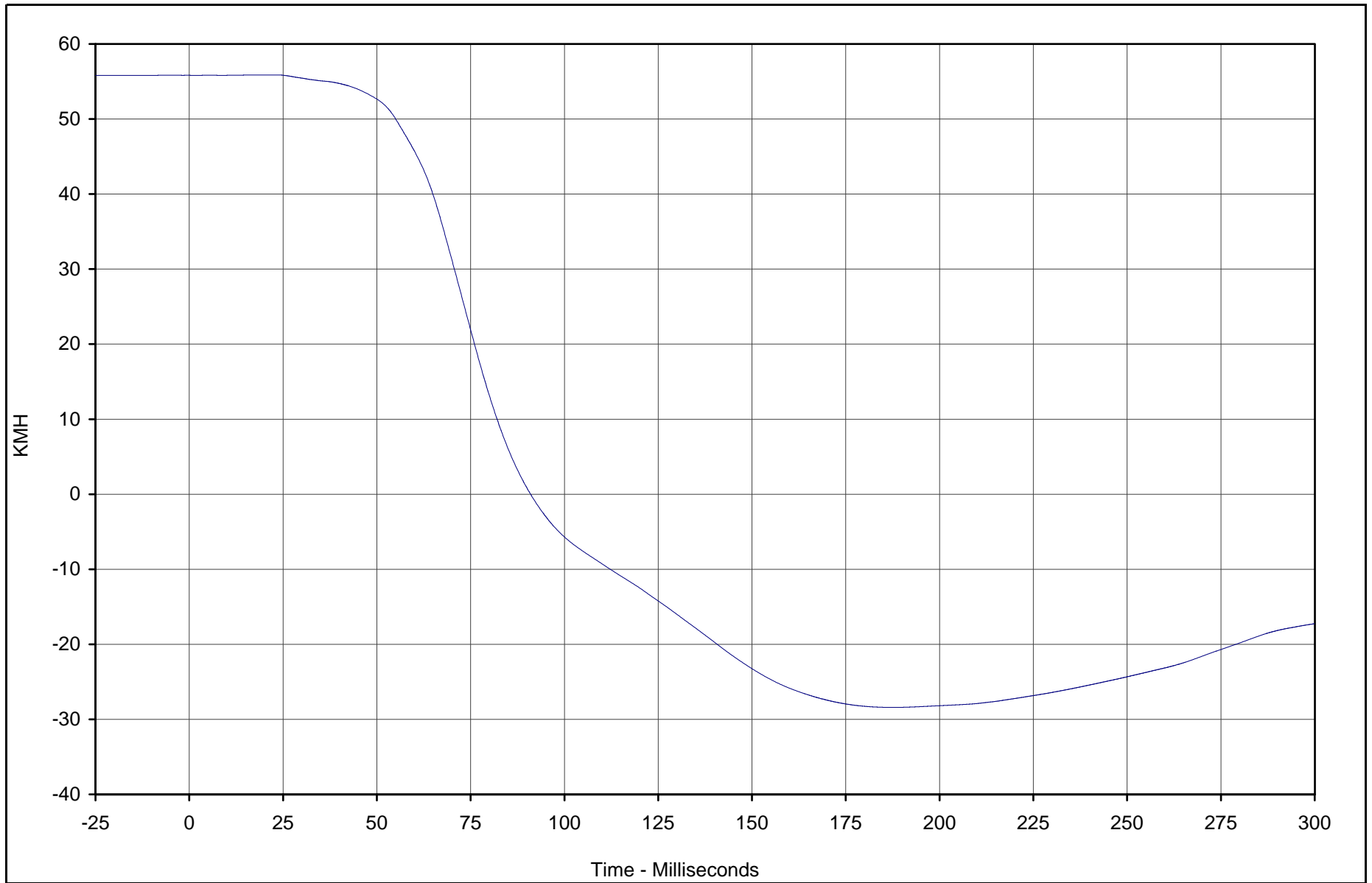
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-69



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Redundant X Velocity	048	IN1	KMH	55.9	23.2	-28.4	186.7	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

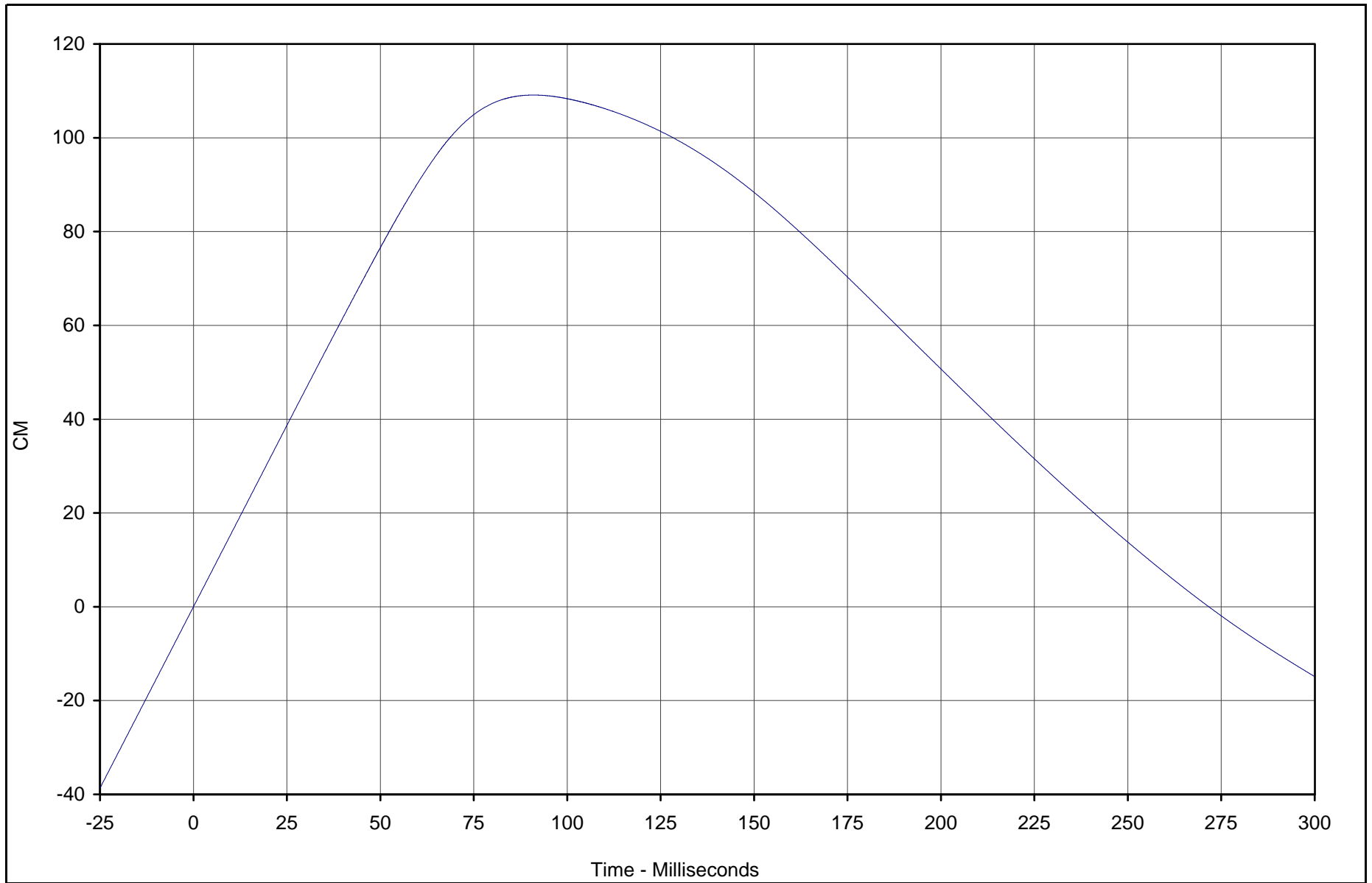
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-70



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Redundant X Displ.	048	IN2	CM	109.1	91.0	-14.8	299.9	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

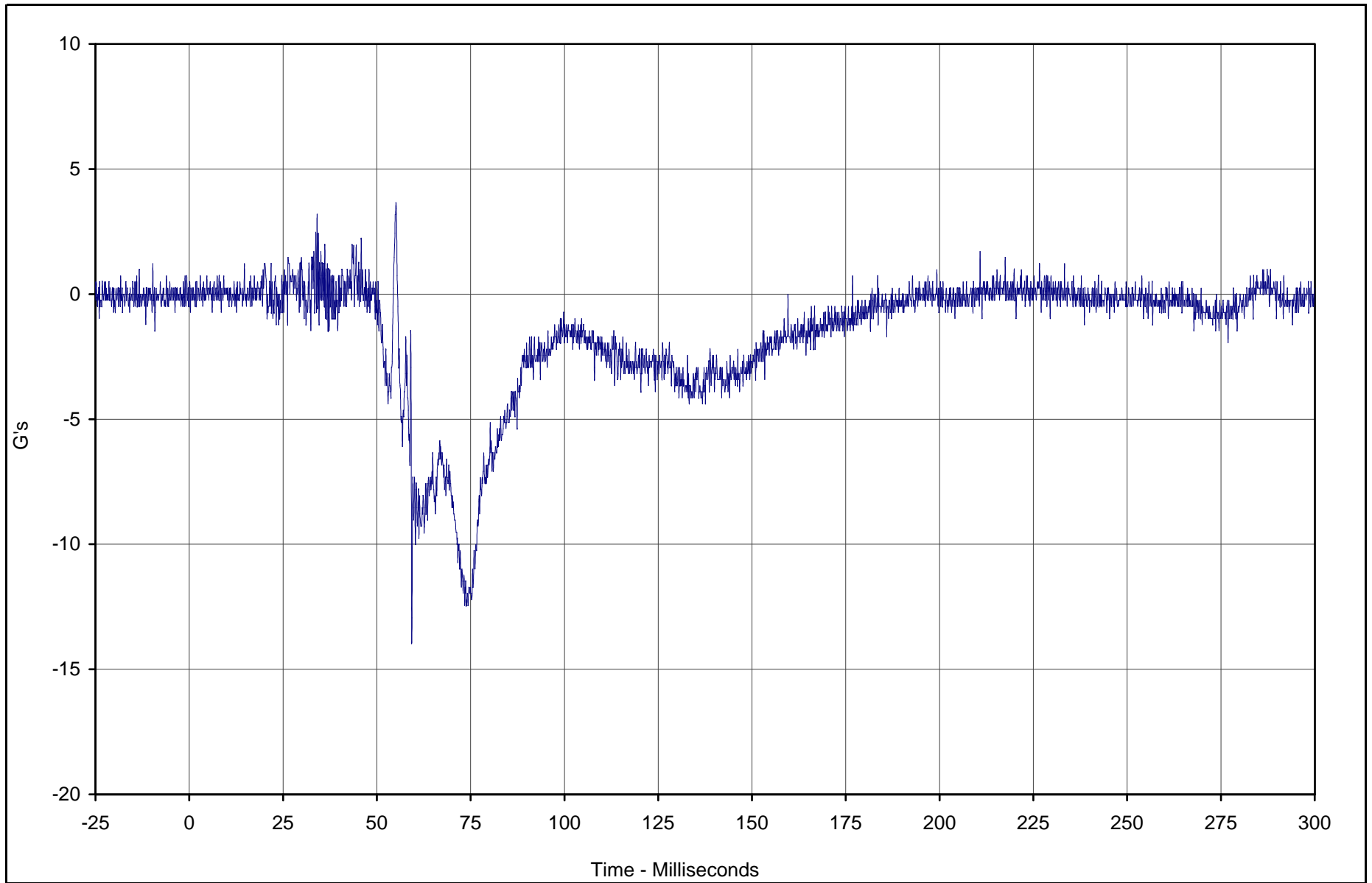
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-71



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Redundant Y	049	FIL	G's	3.7	55.1	-13.9	59.3	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

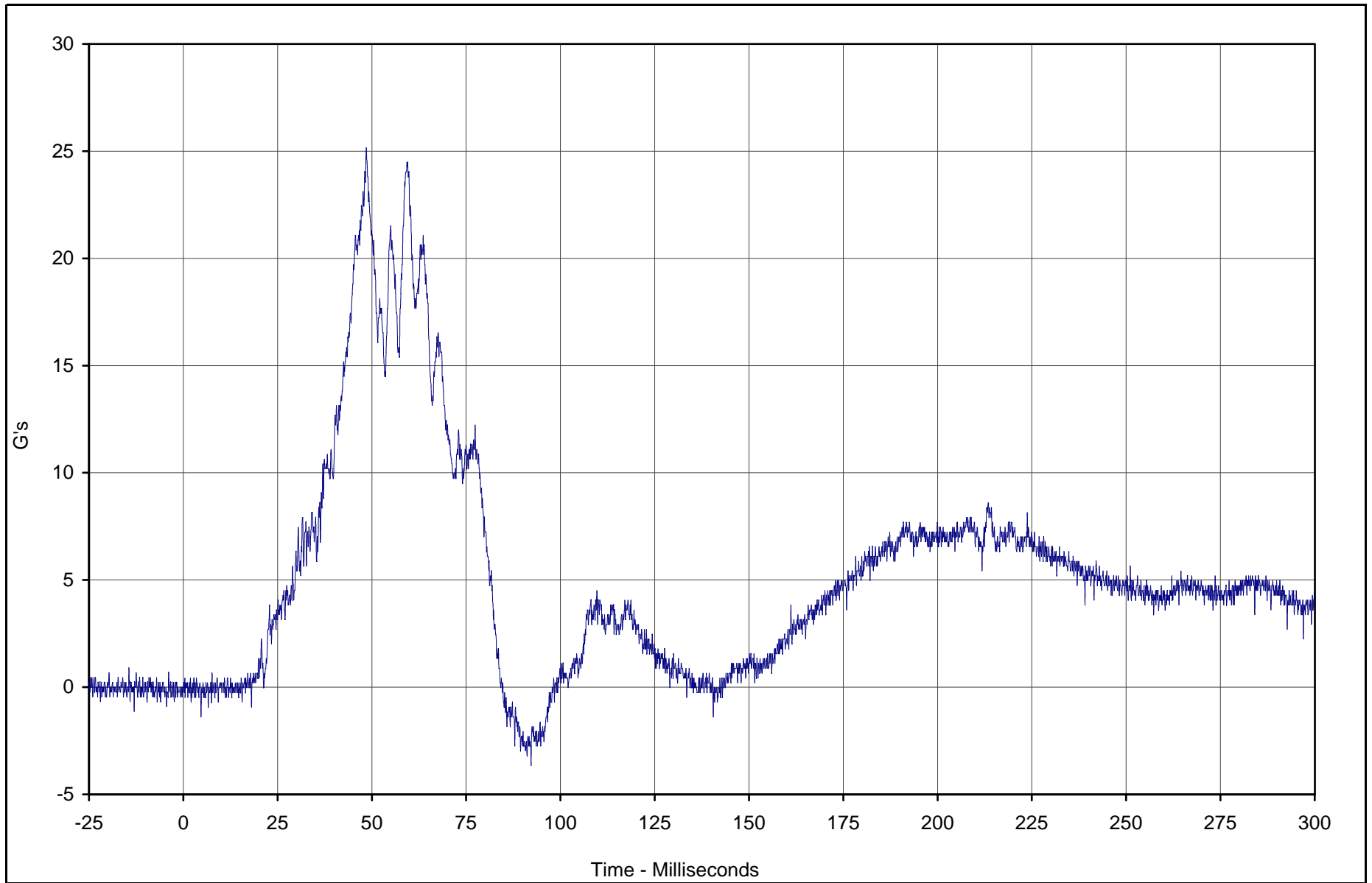
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-72



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Redundant Z	050	FIL	G's	25.2	48.5	-3.7	92.2	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

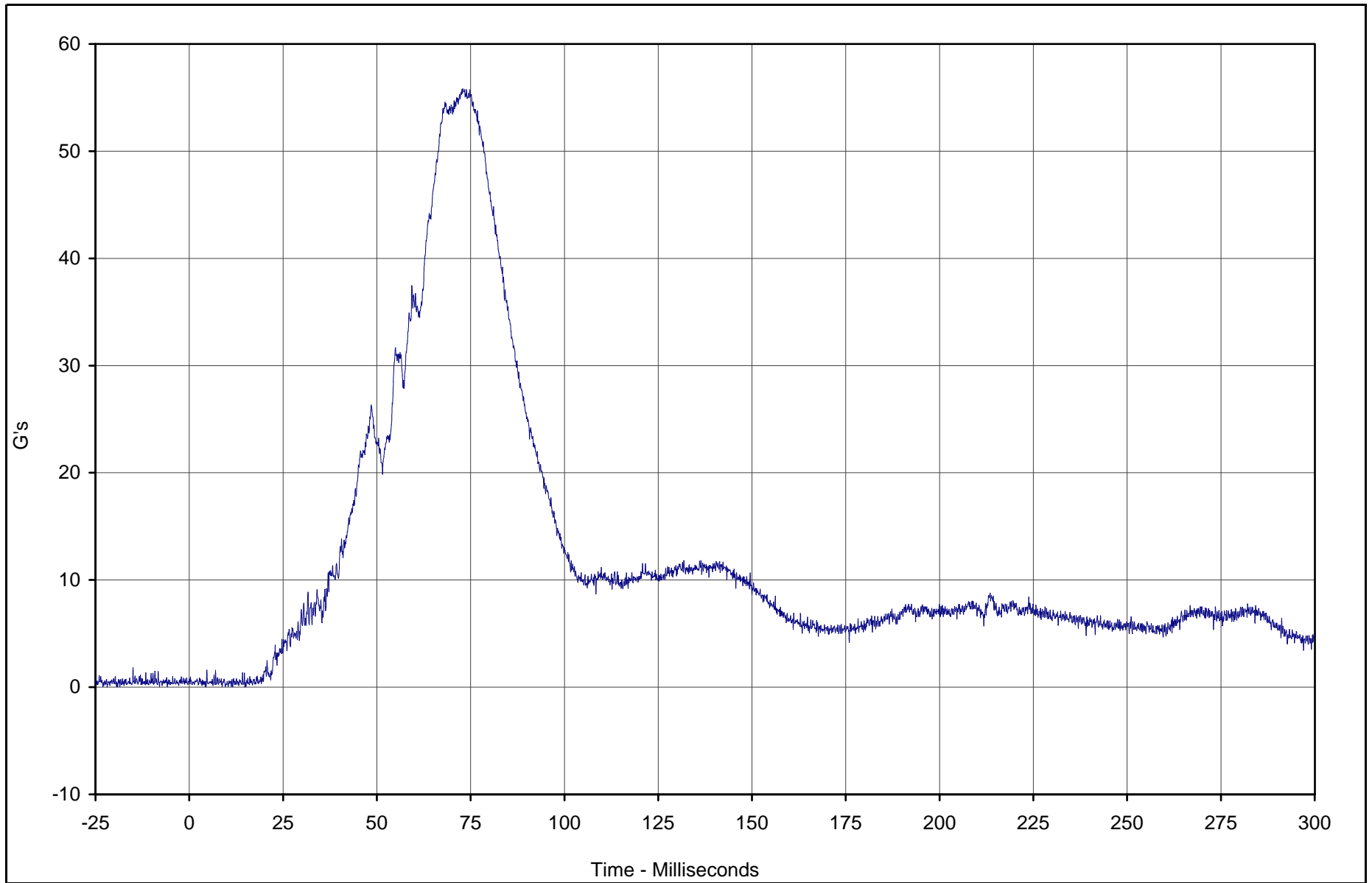
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-73



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Resultant Redundant	048	RES	G's	55.8	72.9	0.1	4.3	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

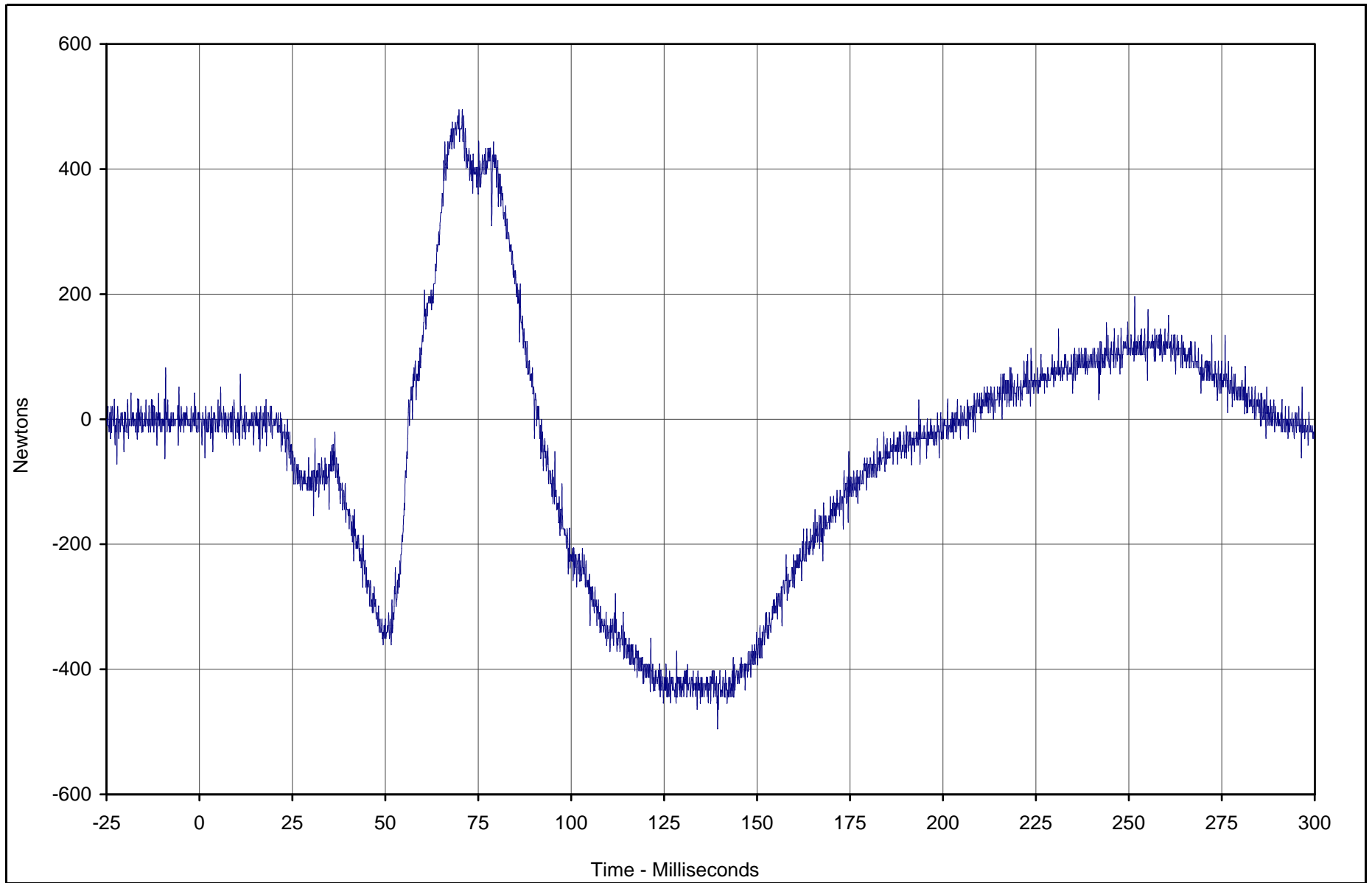
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-74



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Neck Force X	051	FIL	Newtons	495.2	69.8	-495.2	139.4	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

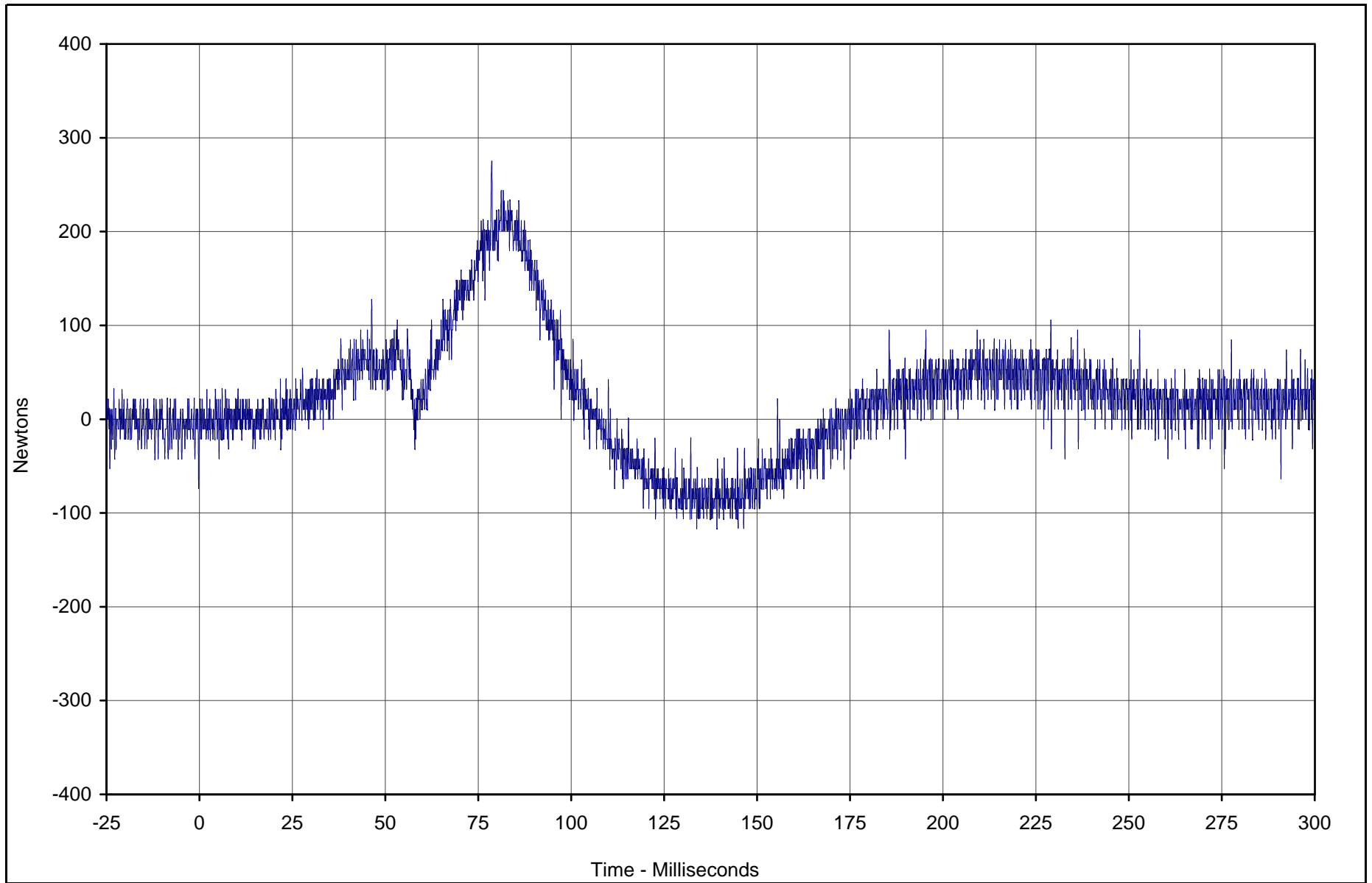
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-75



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Neck Force Y	052	FIL	Newtons	275.1	78.6	-116.4	133.8	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

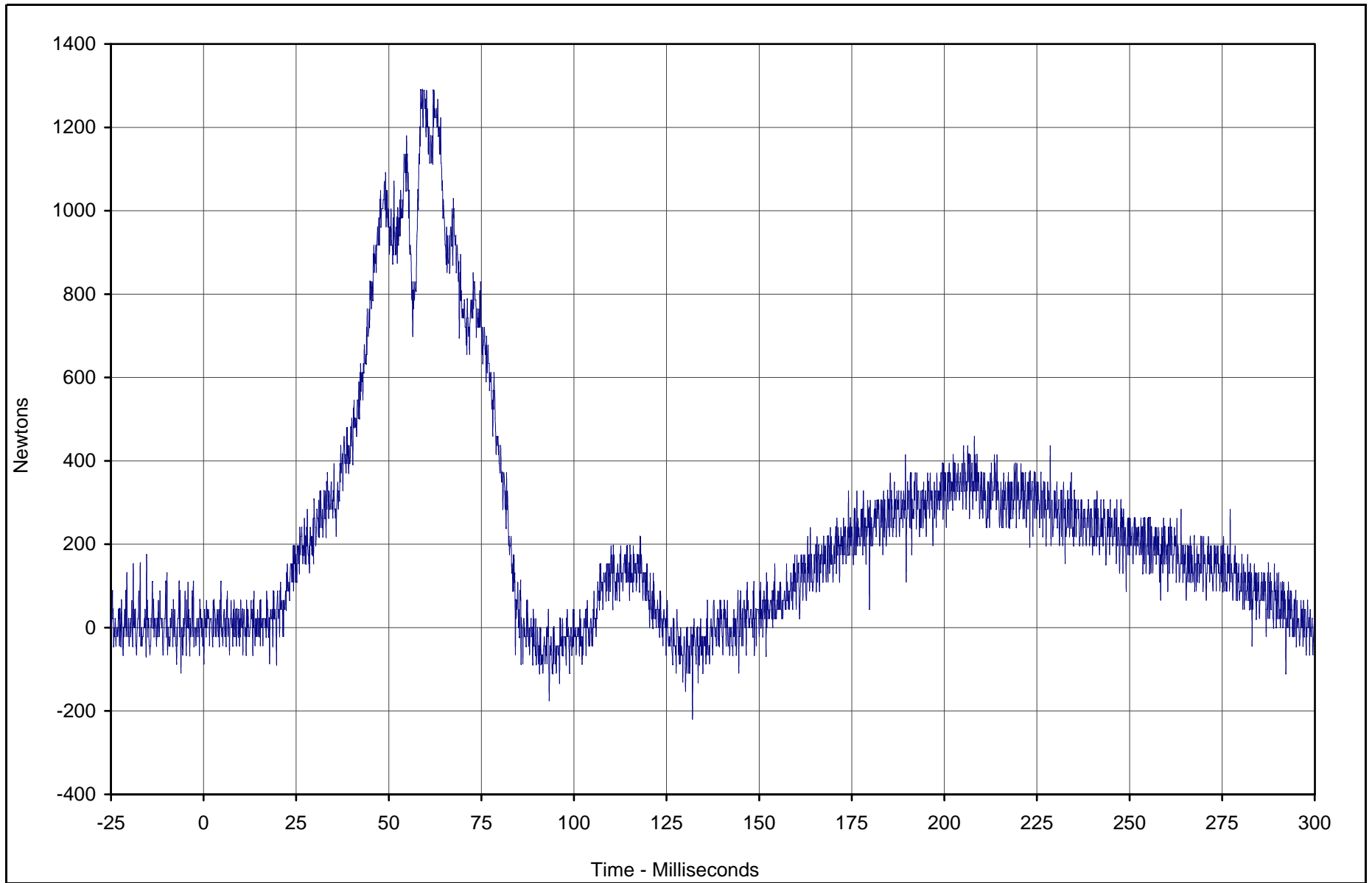
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-76



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Neck Force Z	053	FIL	Newtons	1288.7	58.6	-218.4	132.0	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

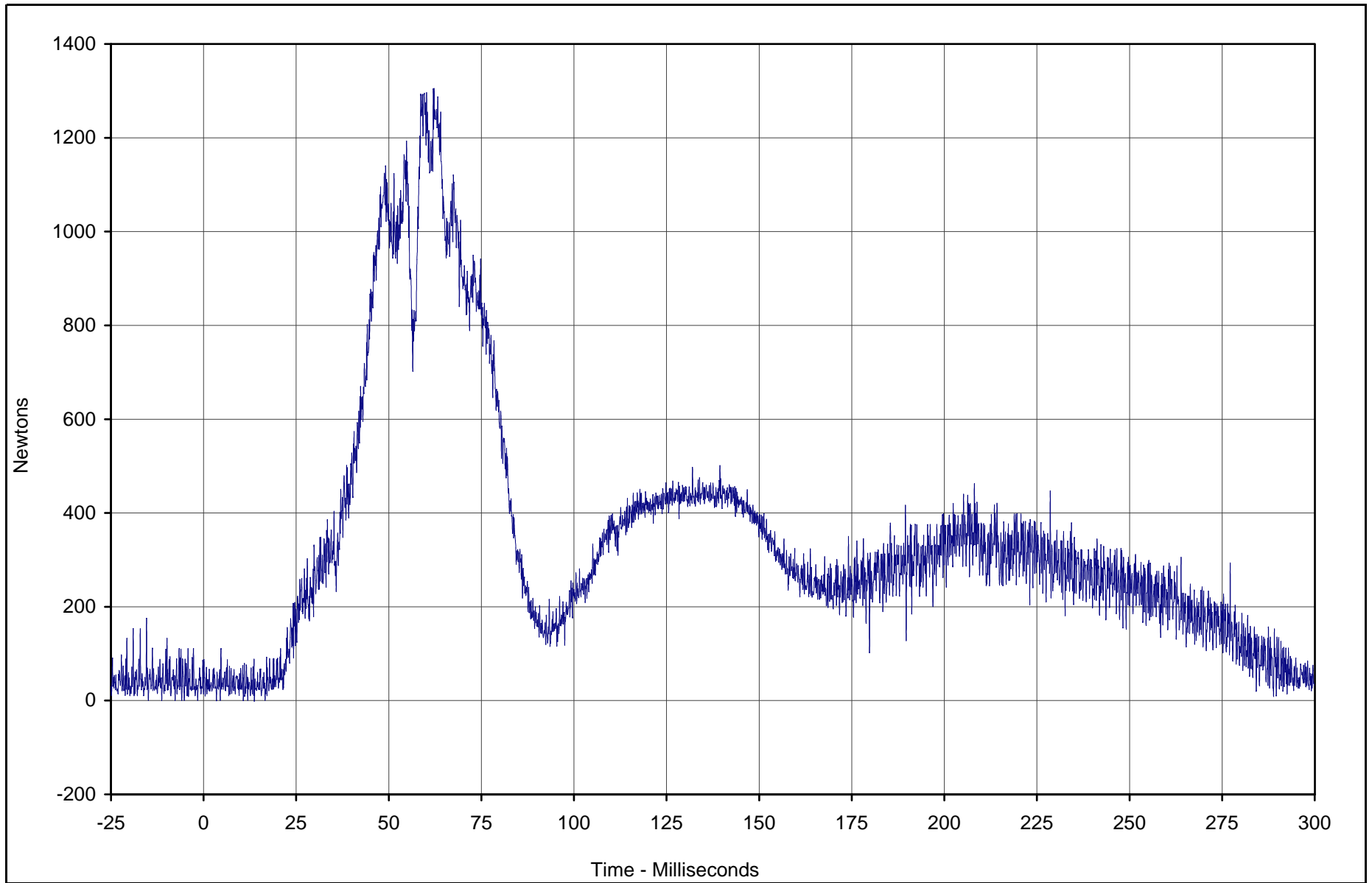
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-77



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Neck Force Resultant	051	RES	Newtons	1305.5	62.2	0.0	3.5	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

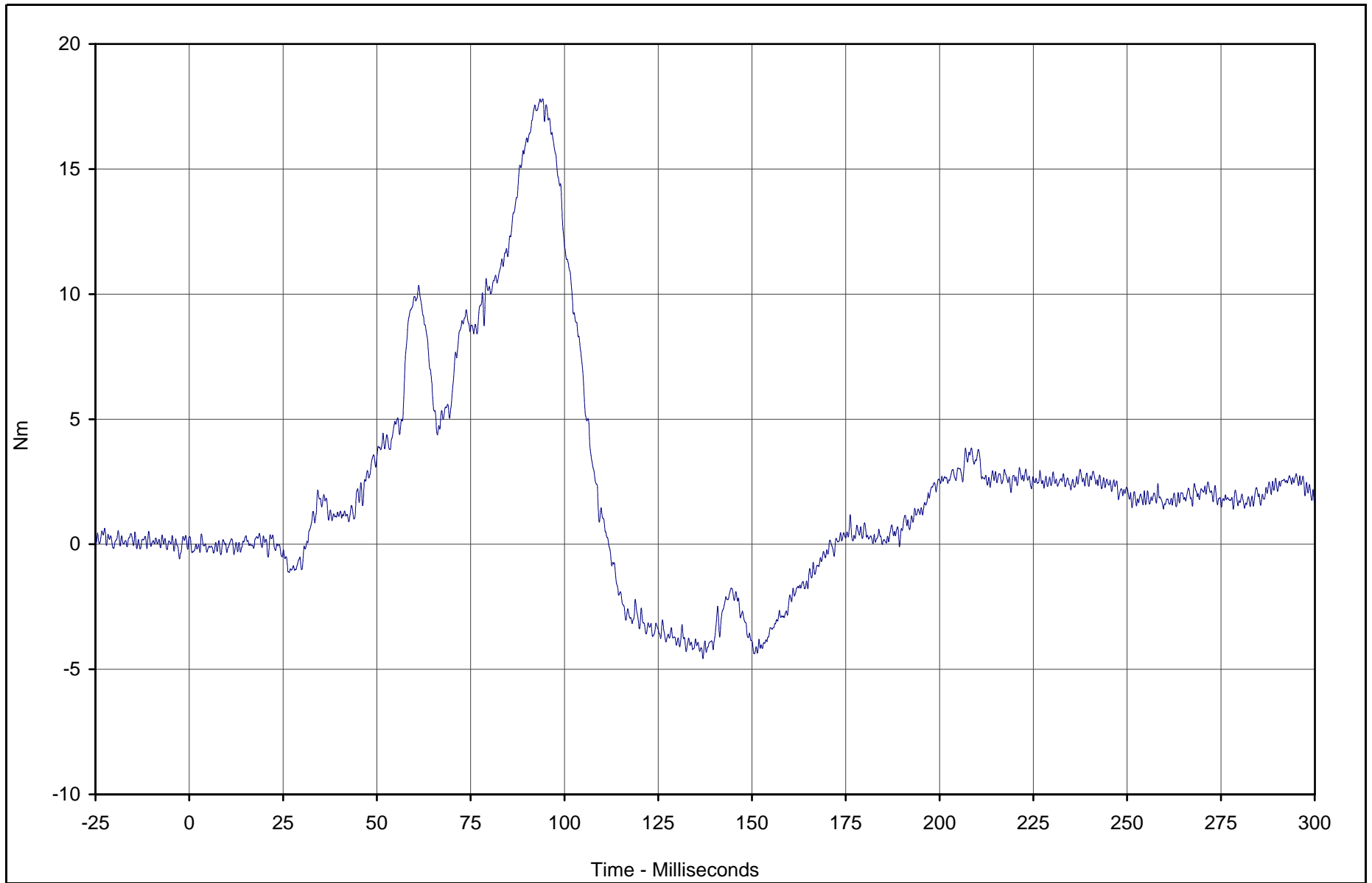
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-78



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Neck Moment X	054	FIL	Nm	17.8	94.2	-4.6	136.9	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

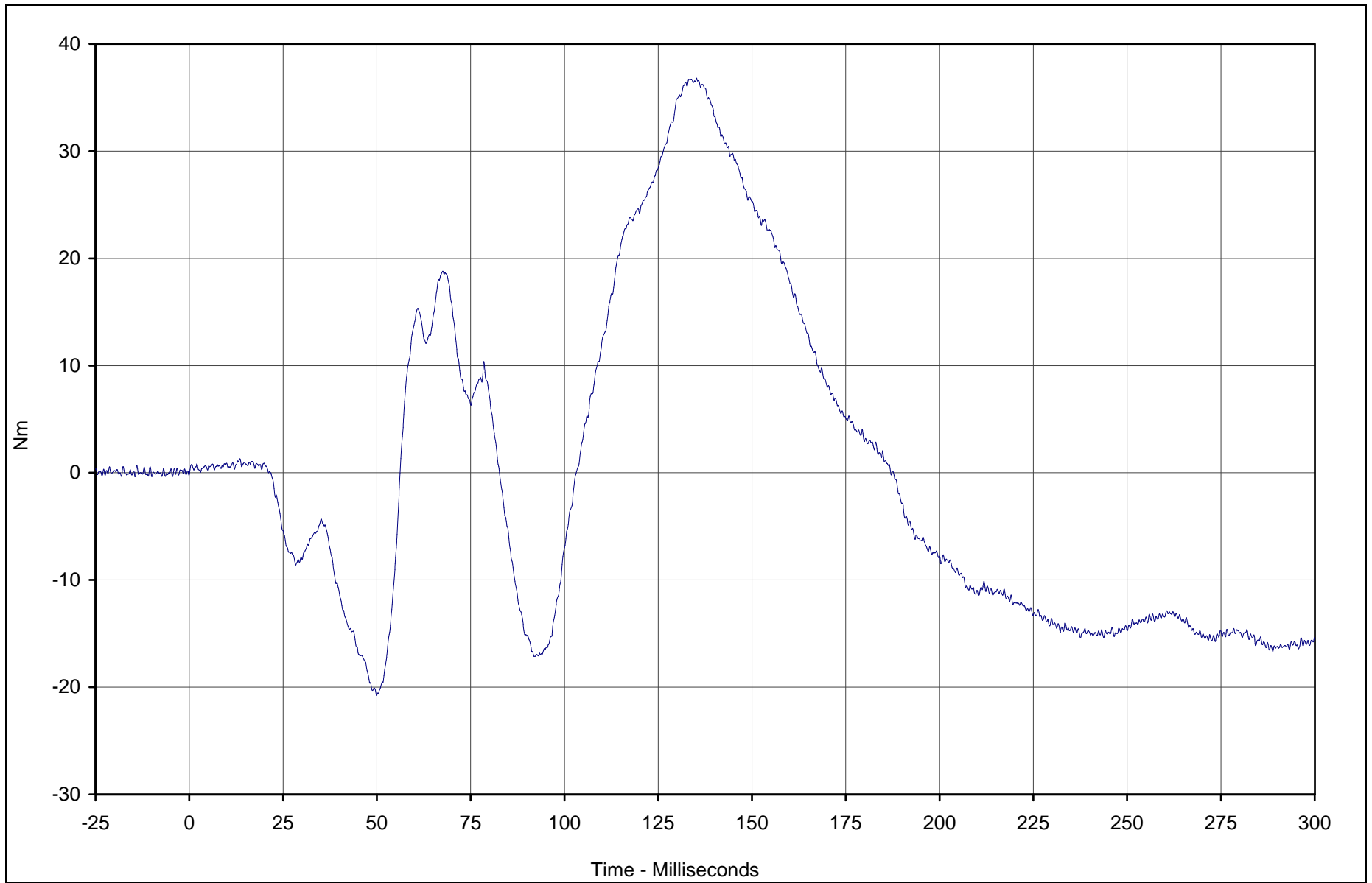
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-79



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Neck Moment Y	055	FIL	Nm	36.8	135.2	-20.8	49.9	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

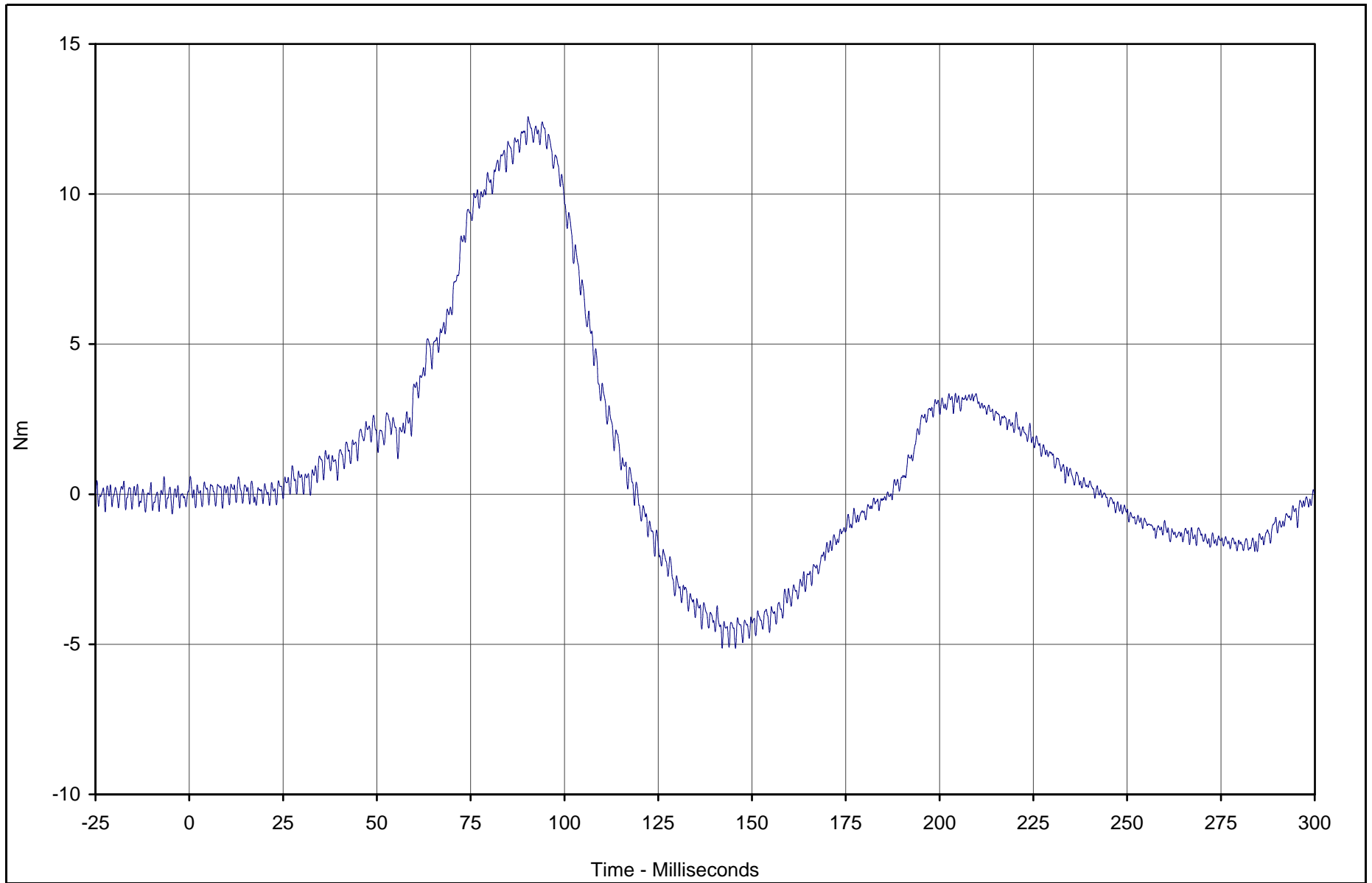
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-80



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Neck Moment Z	056	FIL	Nm	12.6	90.3	-5.1	145.6	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

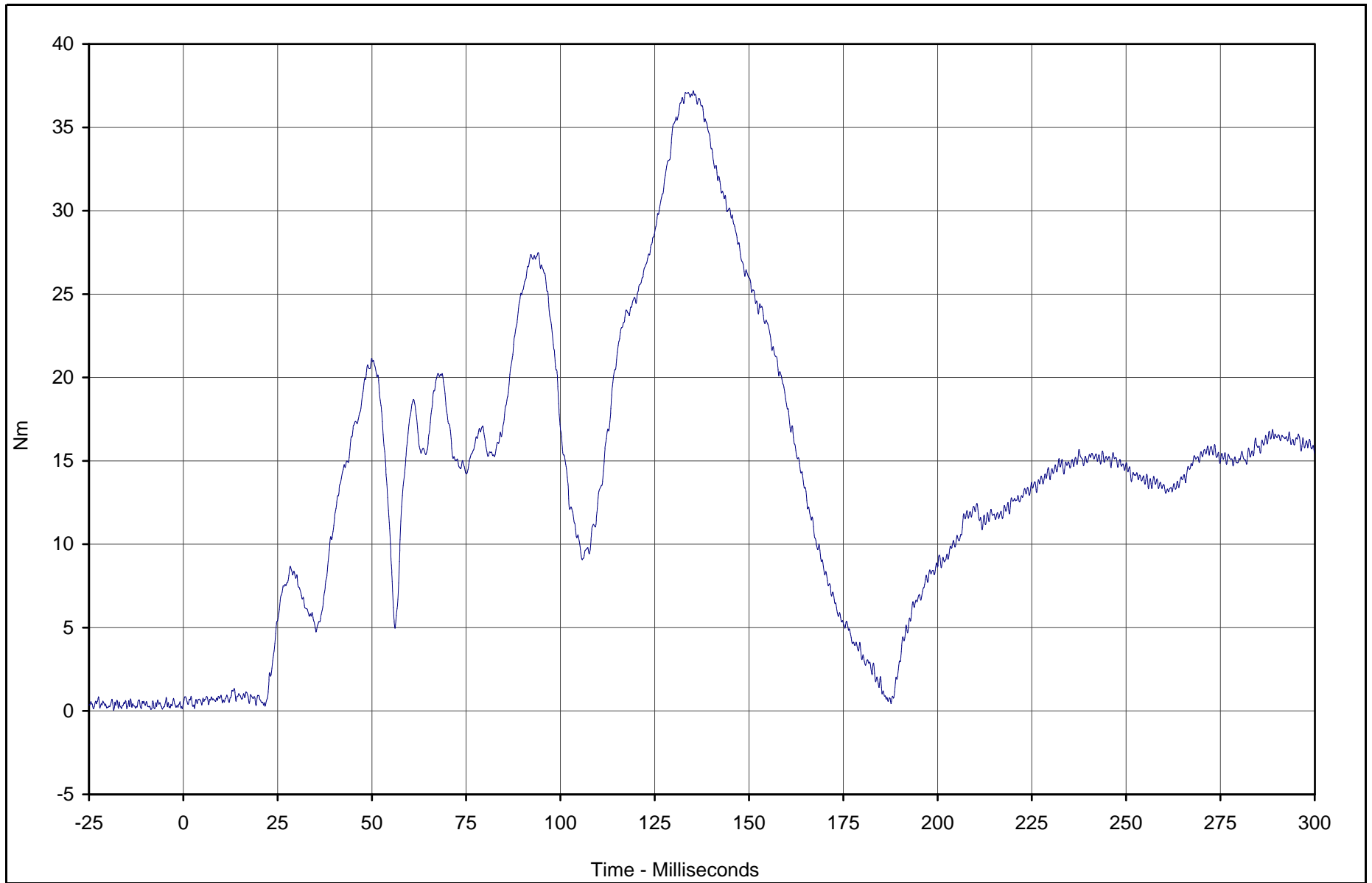
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-81



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Neck Moment Resultant	054	RES	Nm	37.2	135.2	0.2	3.0	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

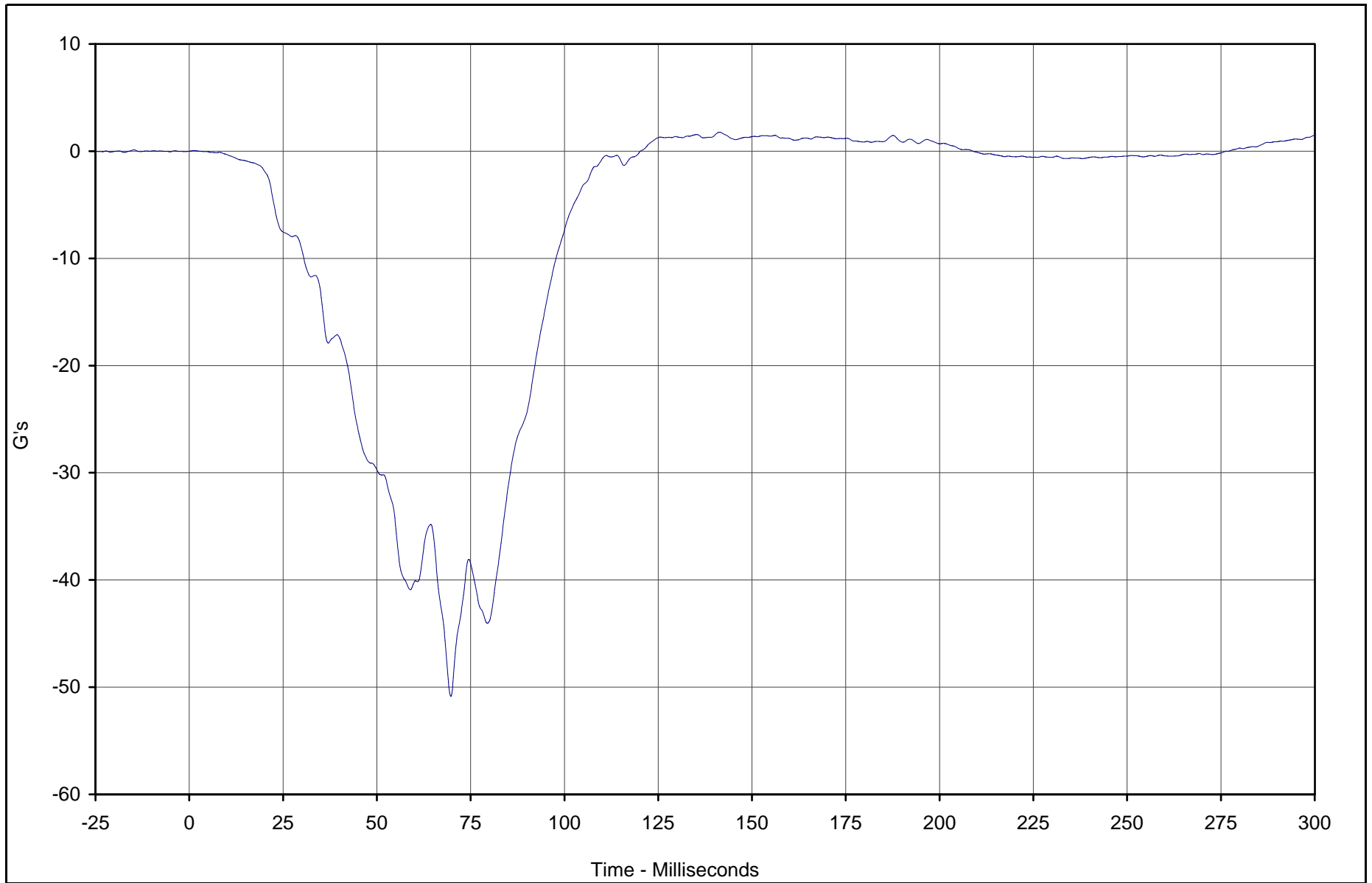
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-82



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Primary X	057	FIL	G's	1.8	141.4	-50.9	69.7	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

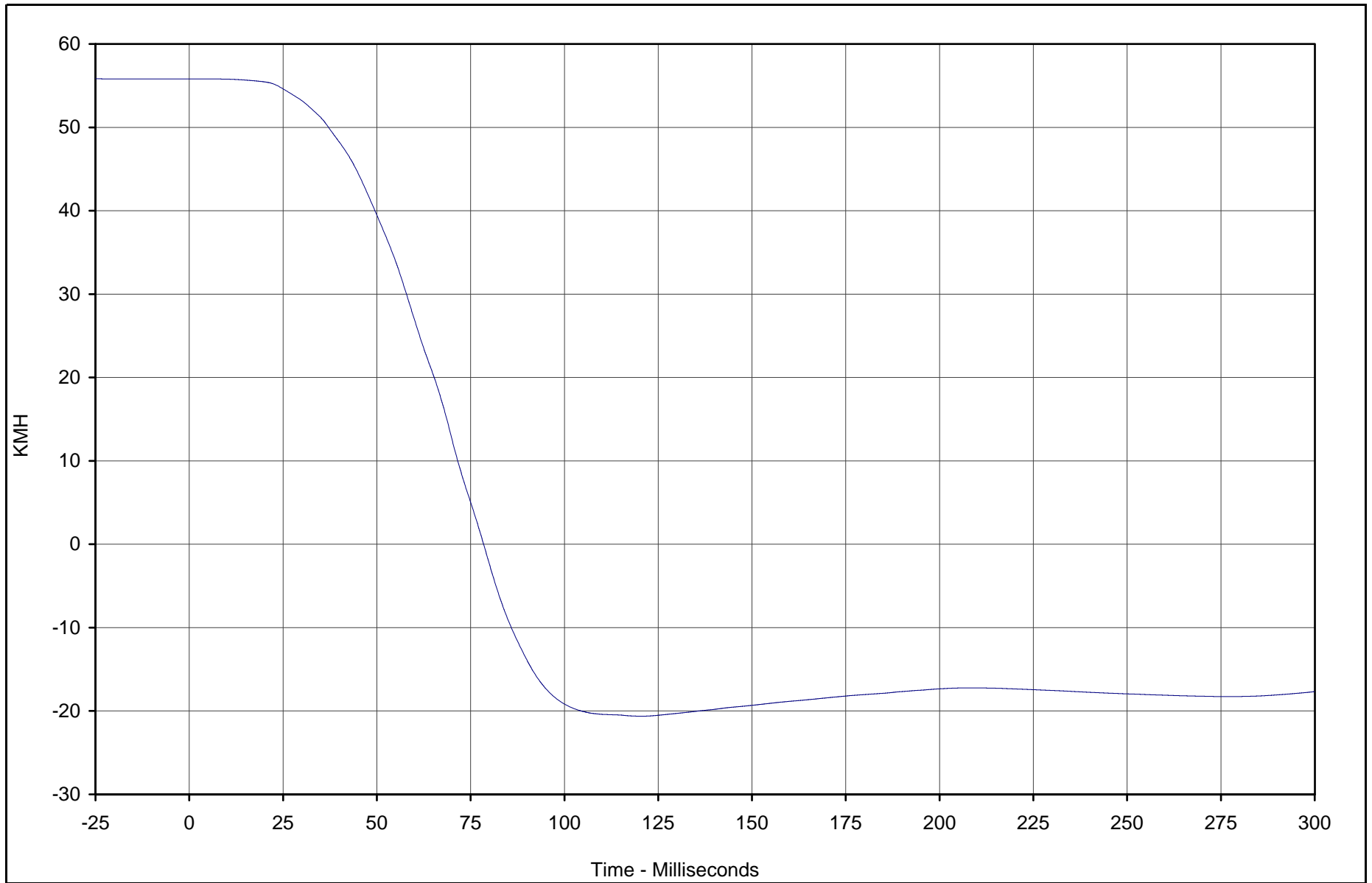
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-83



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Primary X Velocity	057	IN1	KMH	55.8	2.7	-20.6	120.3	180



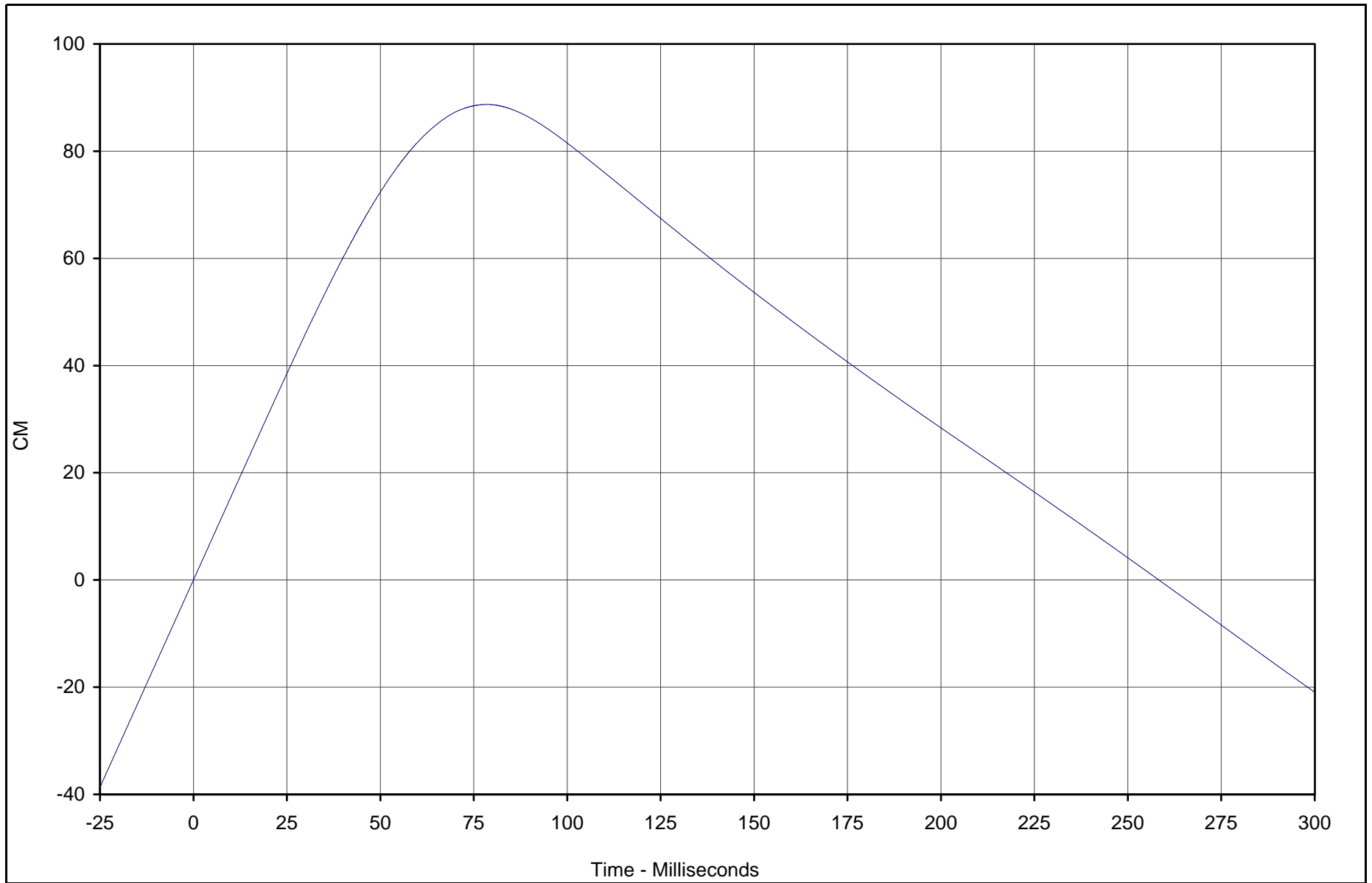
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-84



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Primary X Displ.	057	IN2	CM	88.7	78.5	-20.9	299.9	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

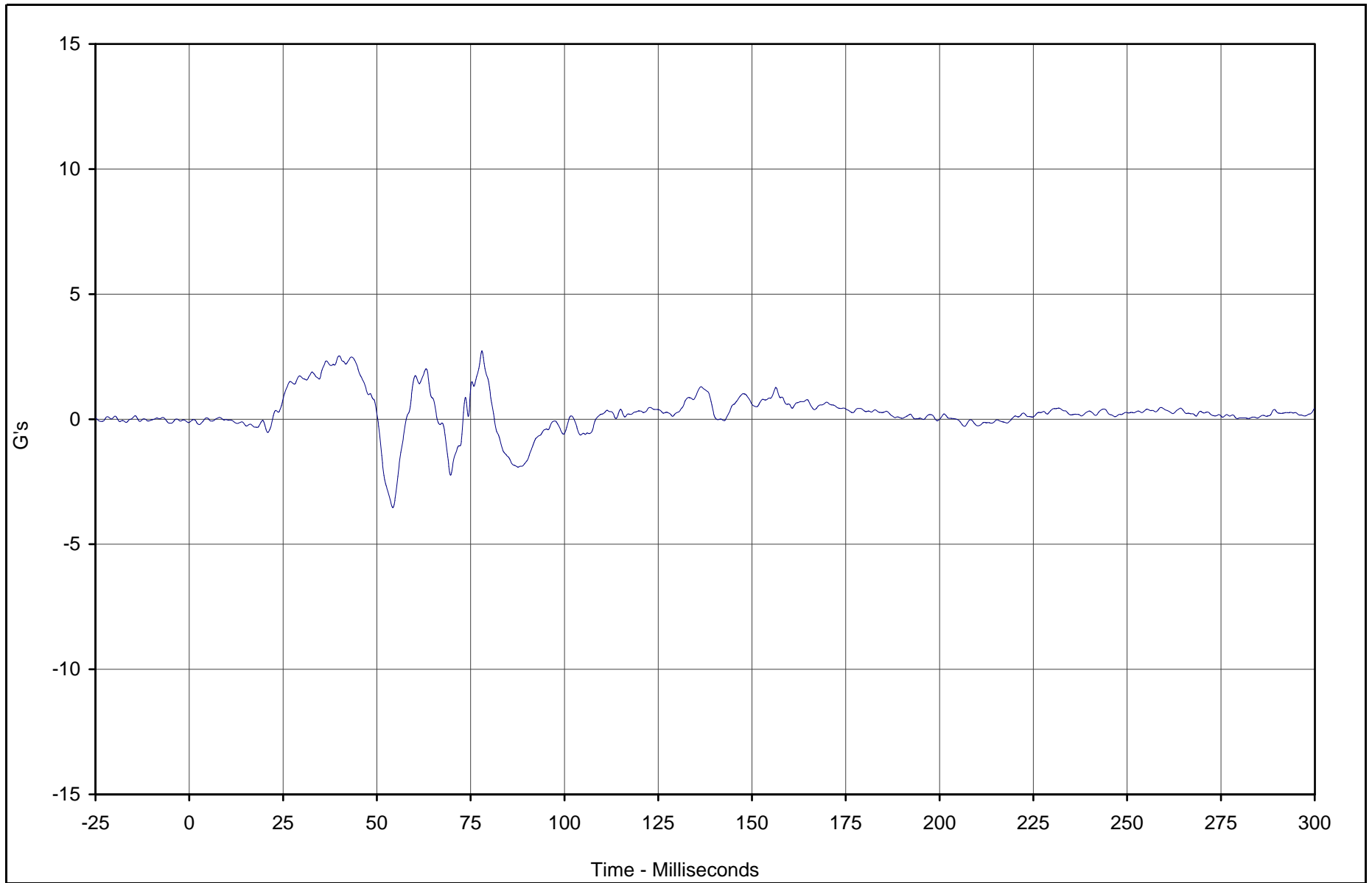
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-85



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Primary Y	058	FIL	G's	2.7	78.0	-3.5	54.3	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

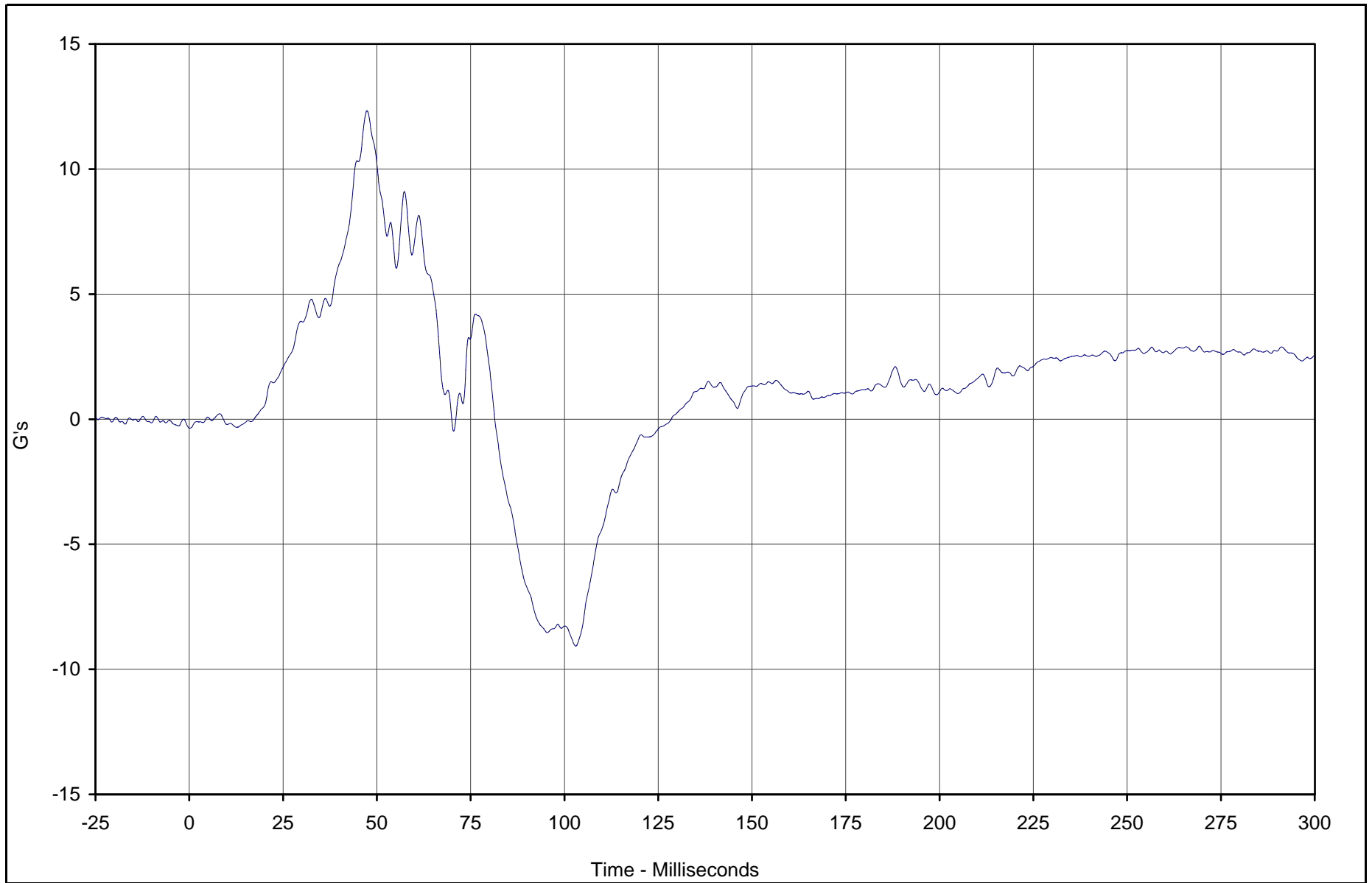
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-86



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Primary Z	059	FIL	G's	12.3	47.4	-9.1	103.0	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

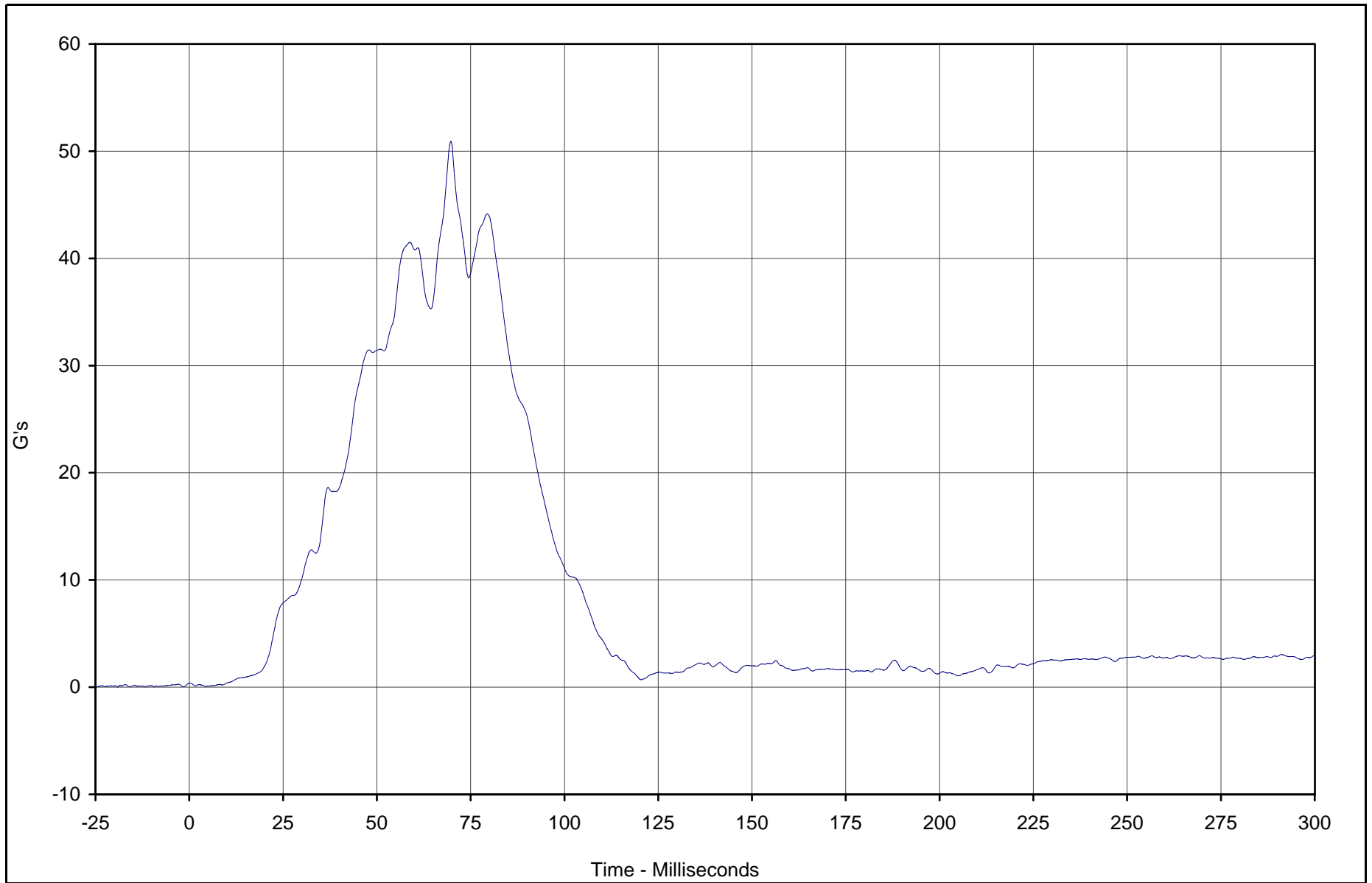
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-87



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Resultant Primary	057	RES	G's	50.9	69.7	0.1	4.4	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

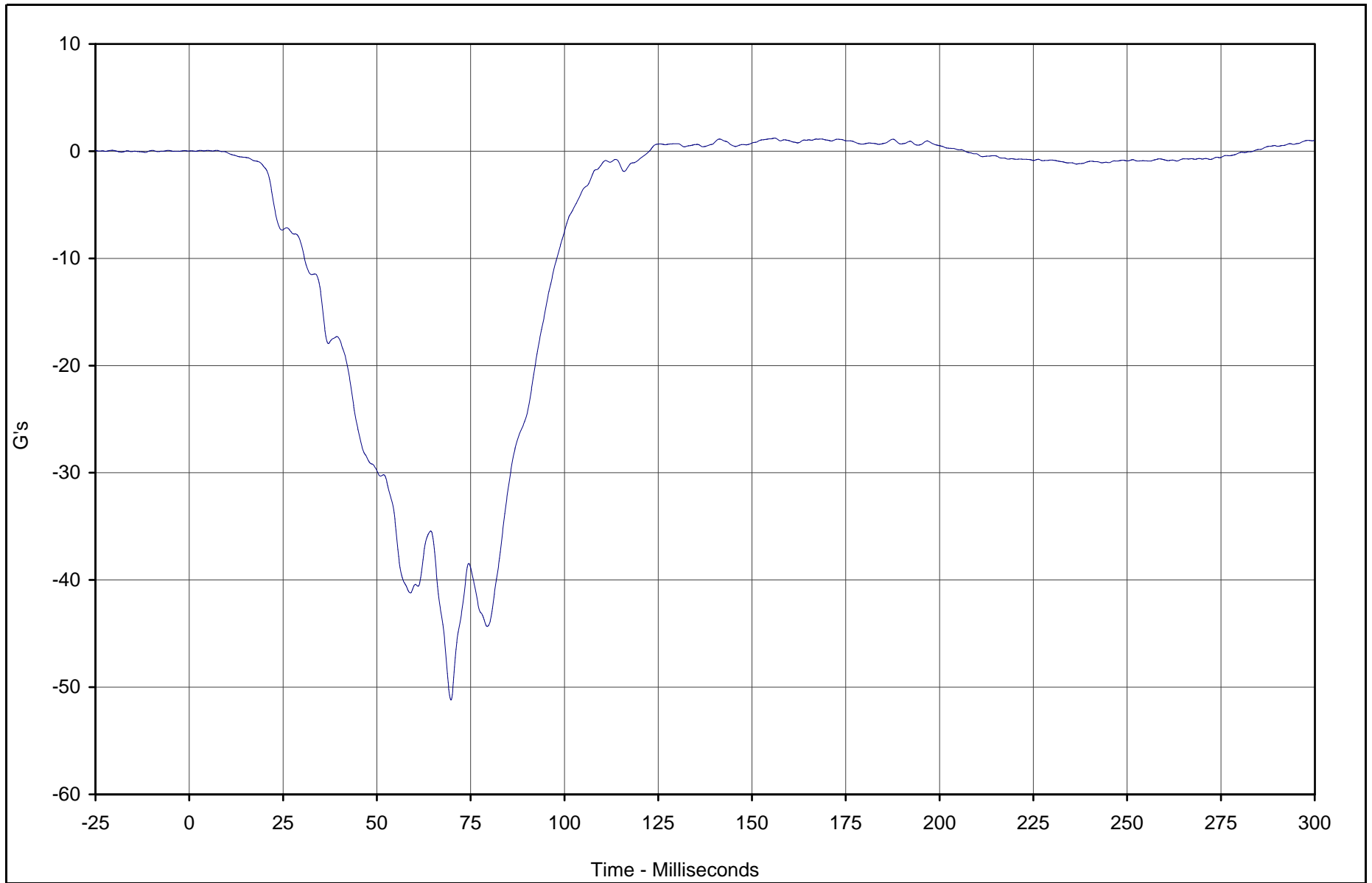
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-88



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Redundant X	060	FIL	G's	1.2	156.1	-51.2	69.8	180



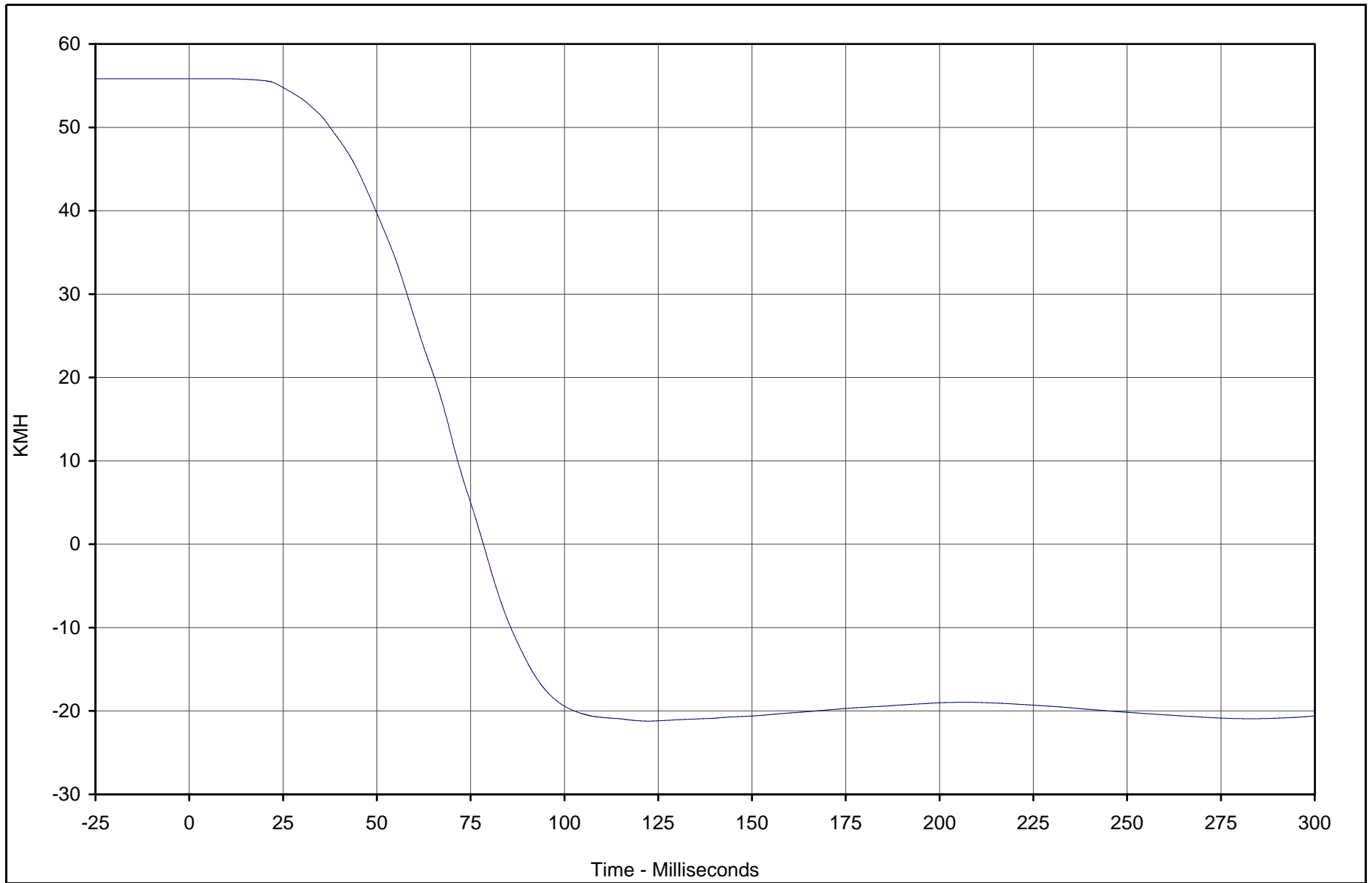
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-89



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Redundant X Velocity	060	IN1	KMH	55.8	8.1	-21.2	122.6	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

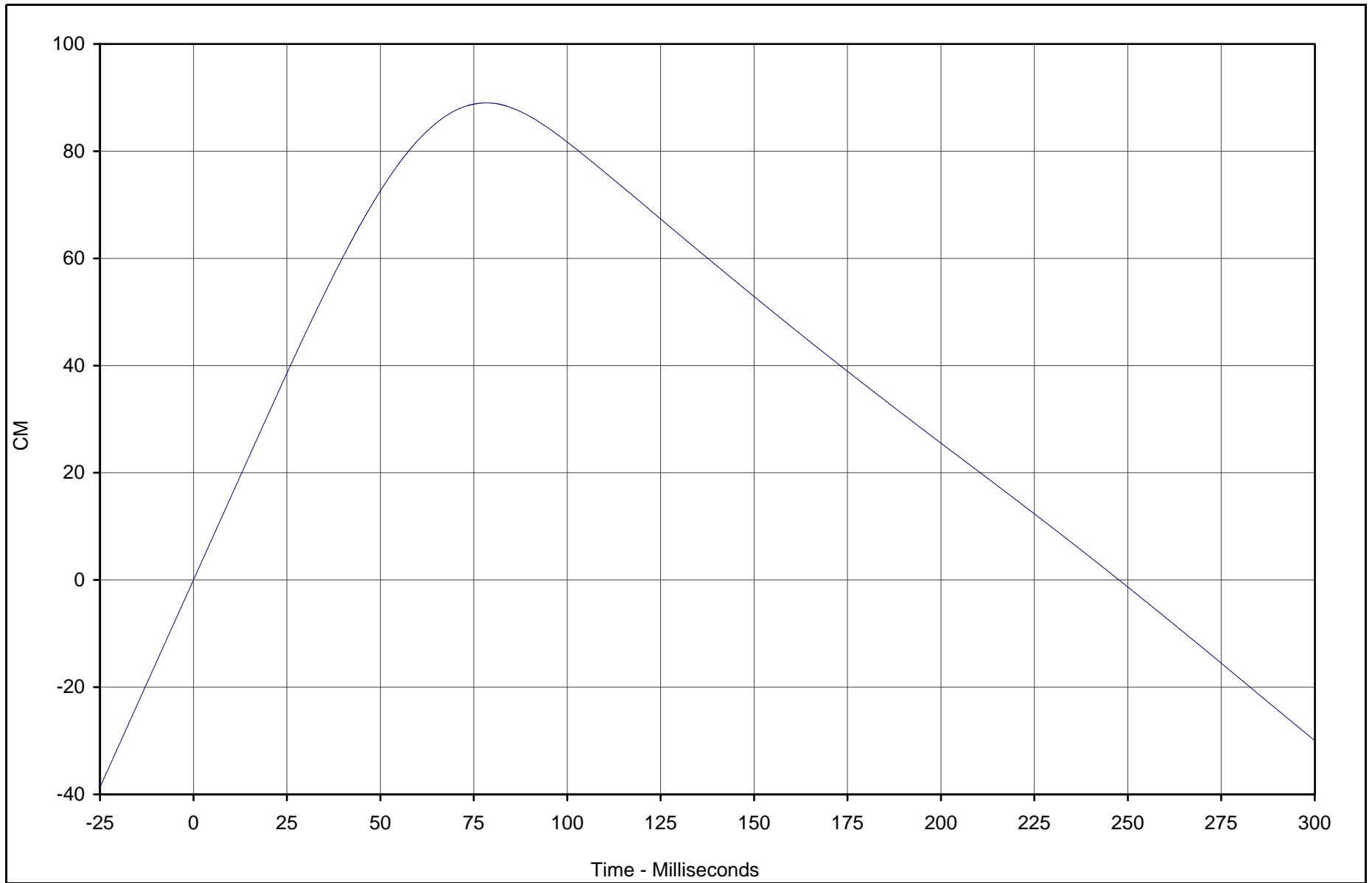
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-90



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Redundant X Displ.	060	IN2	CM	89.0	78.4	-29.9	299.9	180



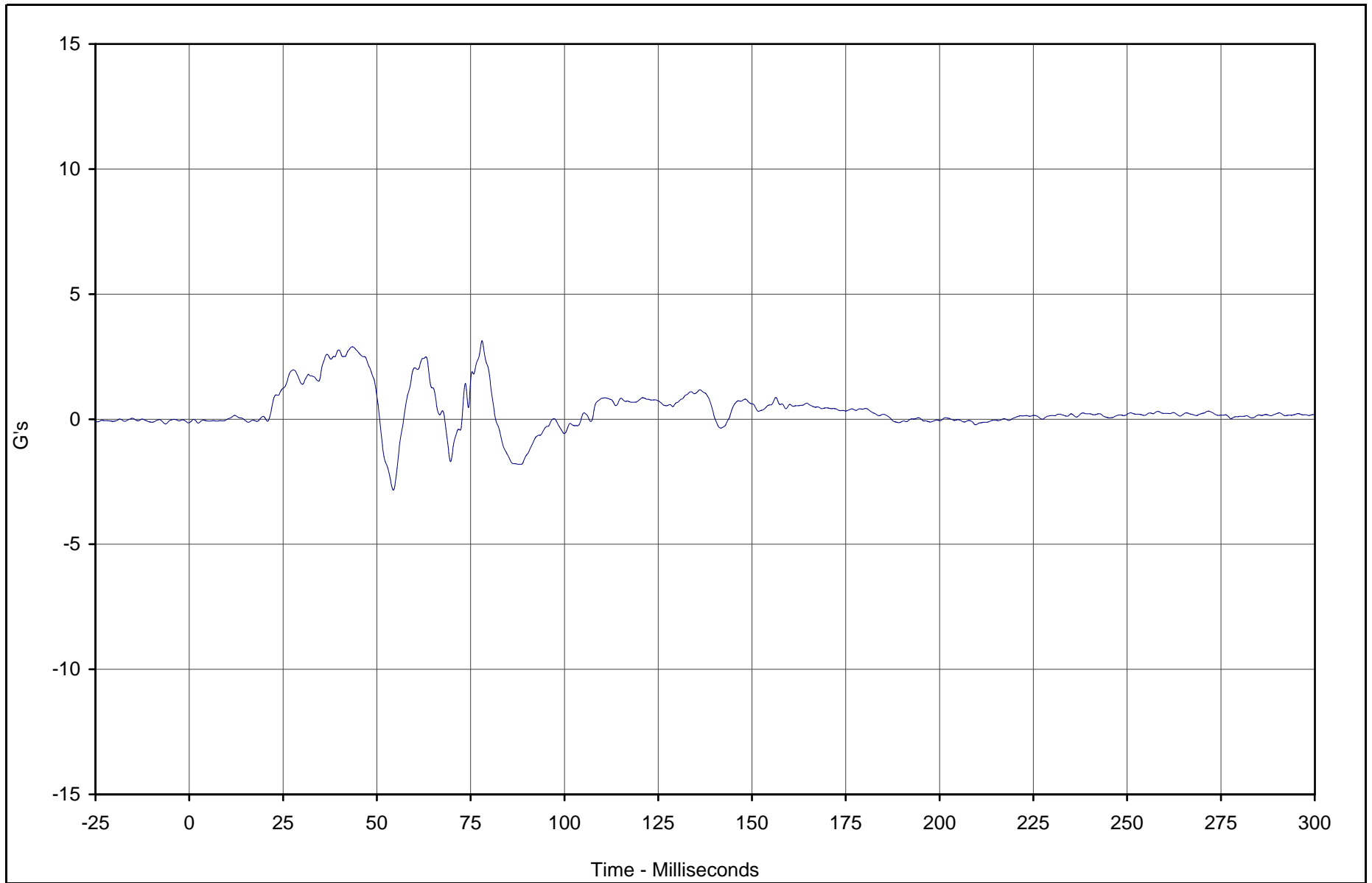
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-91



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Redundant Y	061	FIL	G's	3.1	78.0	-2.8	54.4	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

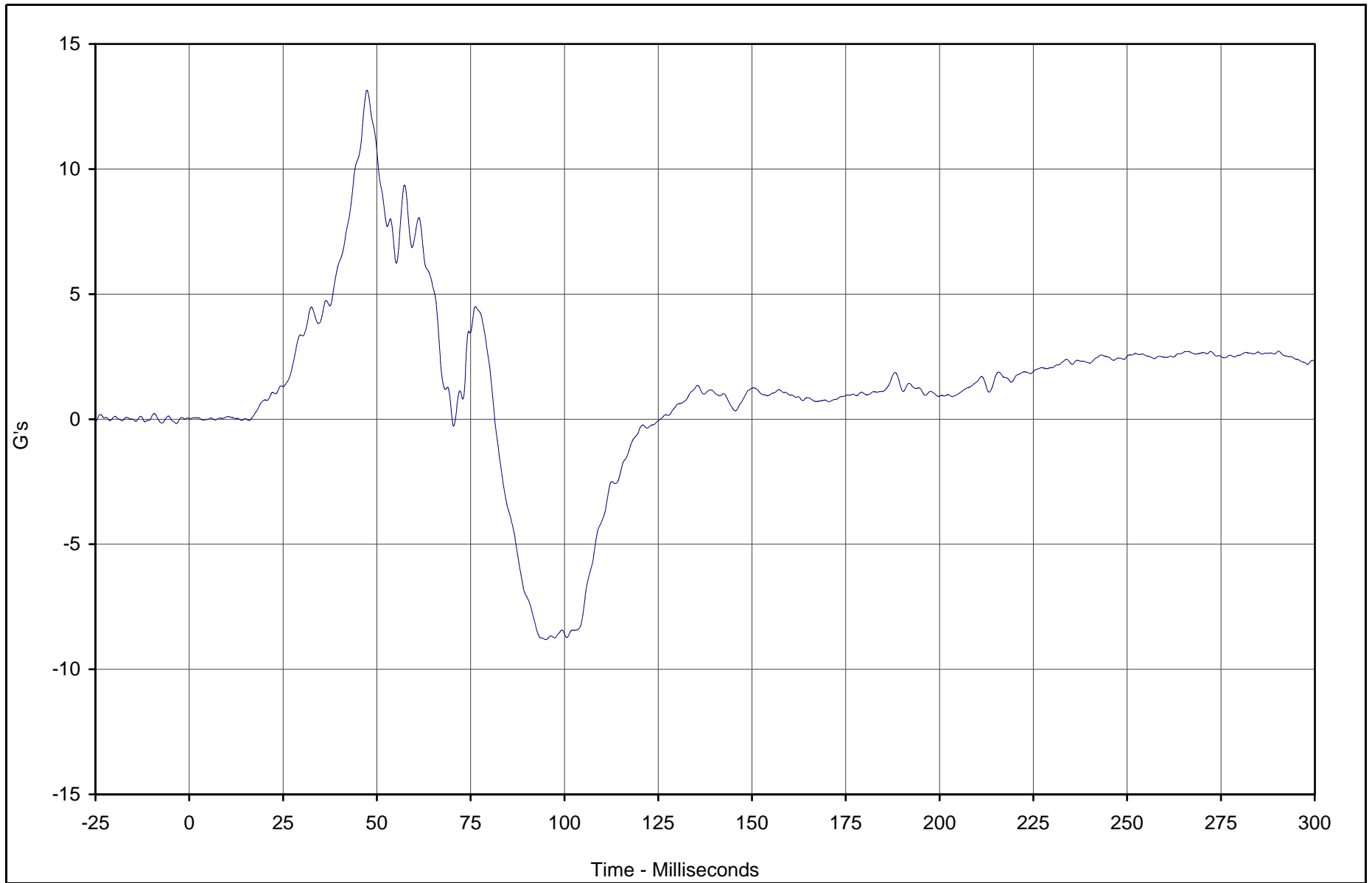
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-92



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Redundant Z	062	FIL	G's	13.2	47.4	-8.8	95.1	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

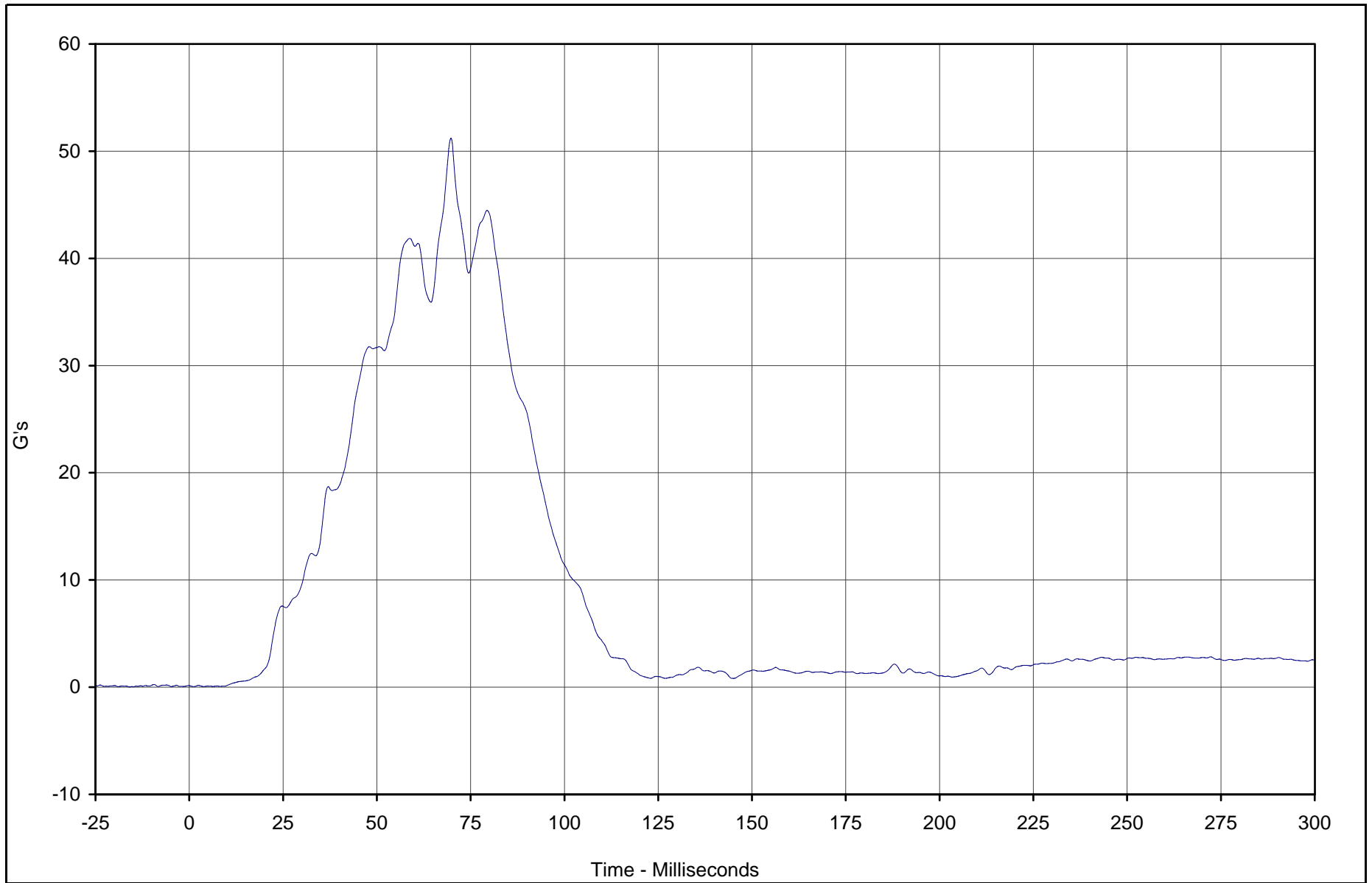
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-93



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Resultant Redundant	060	RES	G's	51.2	69.8	0.1	3.9	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

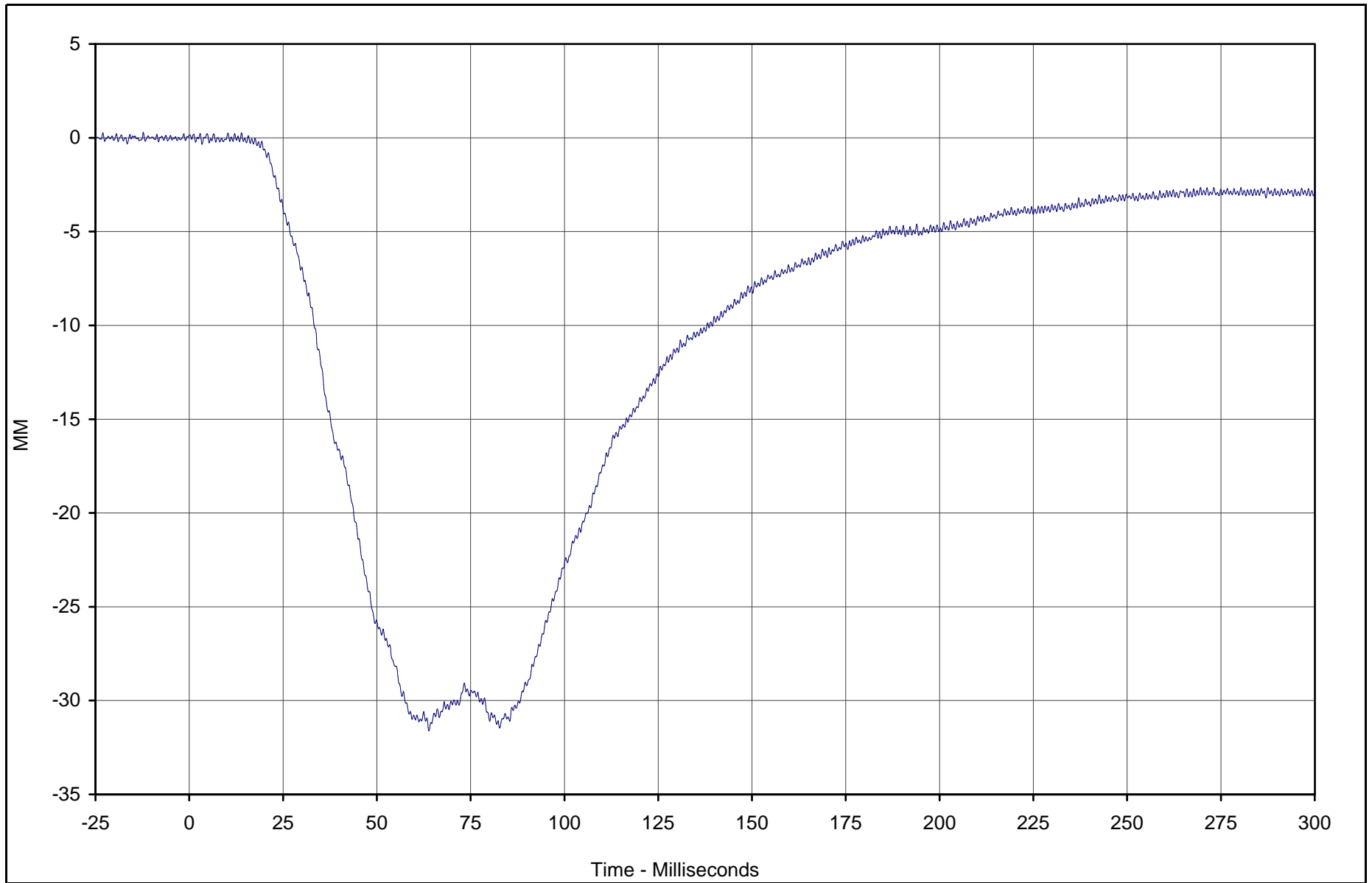
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-94



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Chest Displacement X	063	FIL	MM	0.3	13.9	-31.6	63.9	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

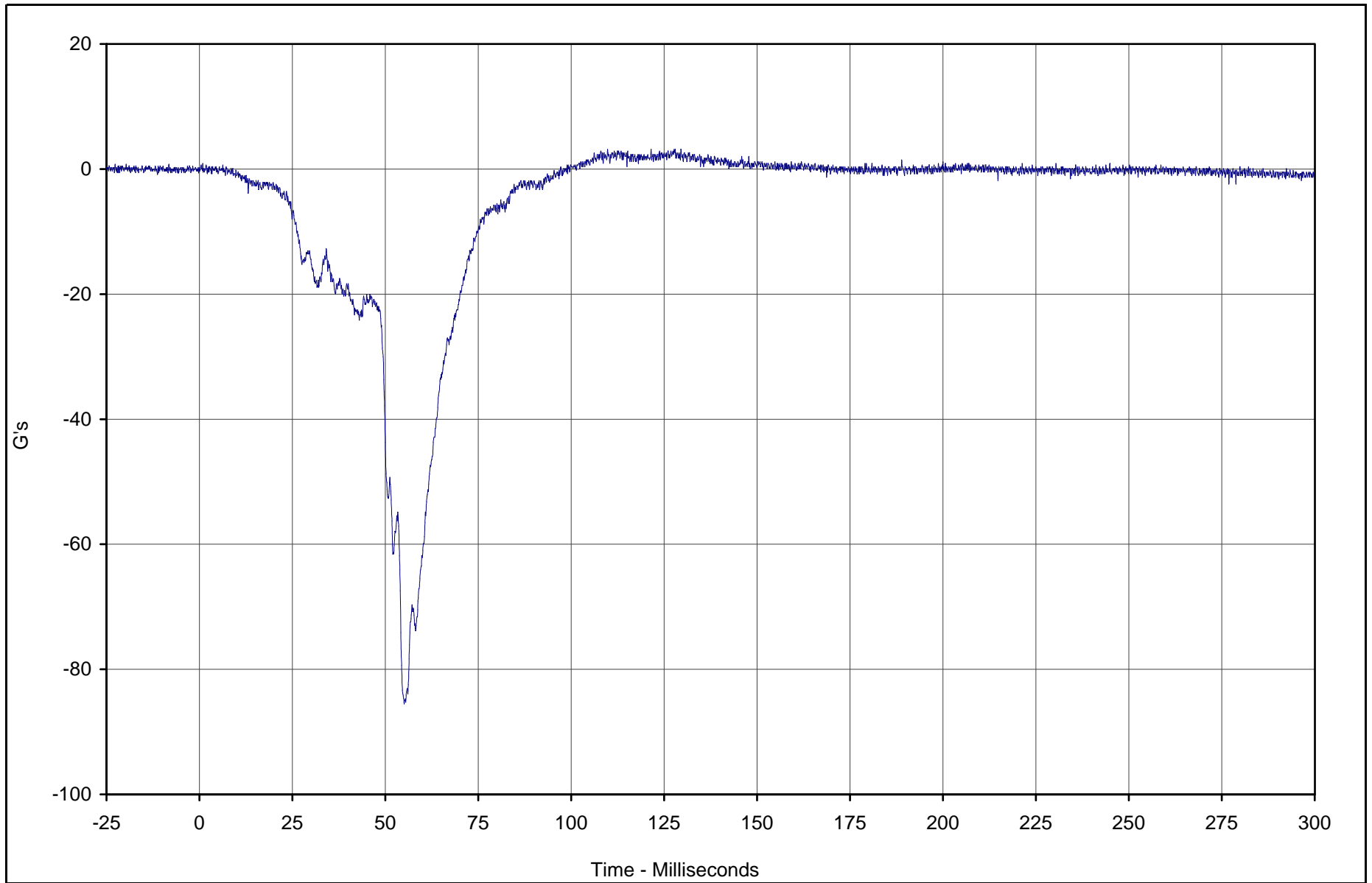
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-95



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Pelvis X	064	FIL	G's	3.2	109.8	-85.5	55.1	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

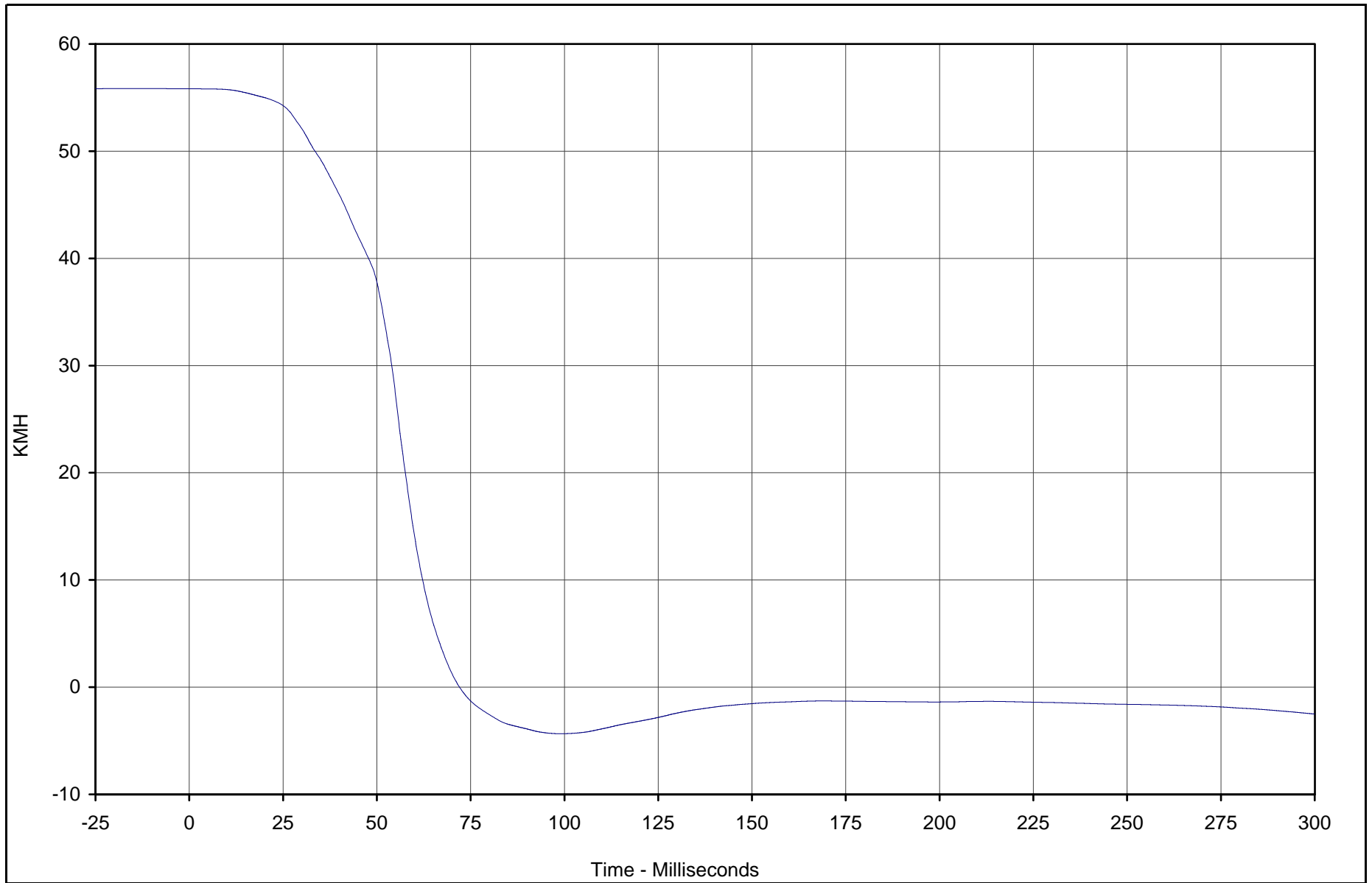
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-96



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Pelvis X Velocity	064	IN1	KMH	55.8	1.3	-4.3	99.0	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

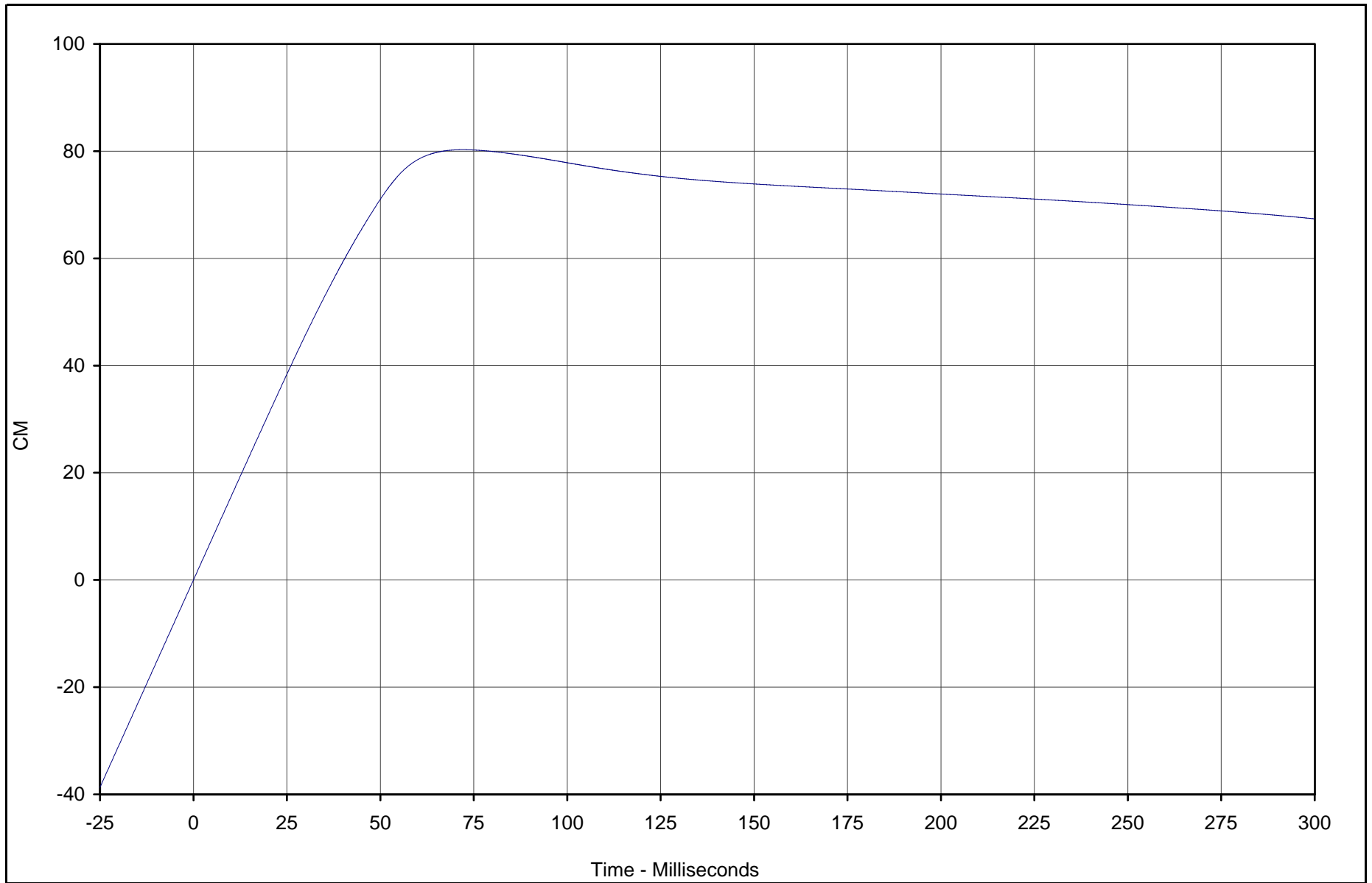
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-97



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Pelvis X Displ.	064	IN2	CM	80.3	72.0	0.0	0.0	180



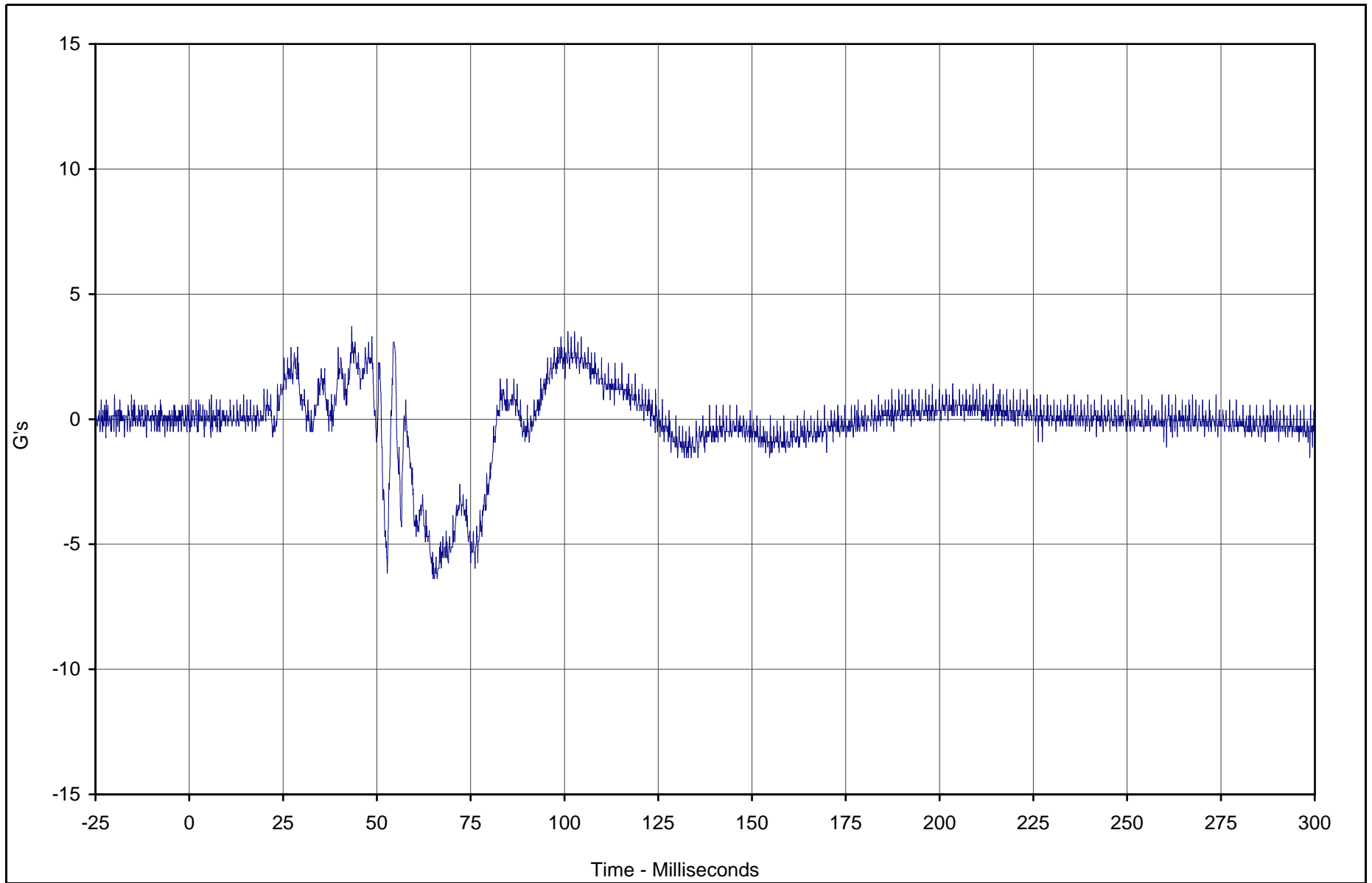
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-98



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Pelvis Y	065	FIL	G's	3.7	43.3	-6.4	65.0	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

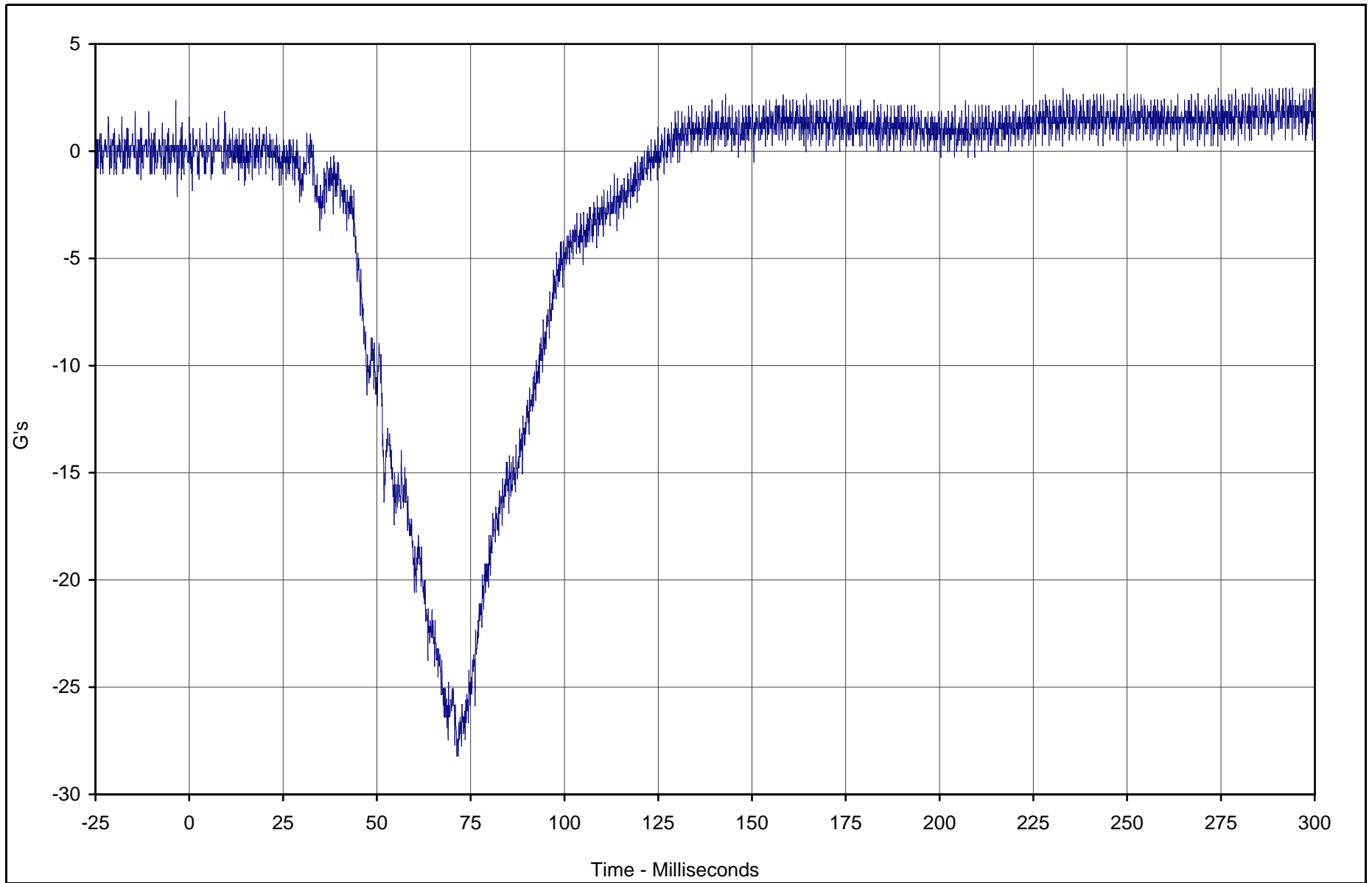
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-99



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Pelvis Z	066	FIL	G's	2.9	232.9	-28.2	71.3	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

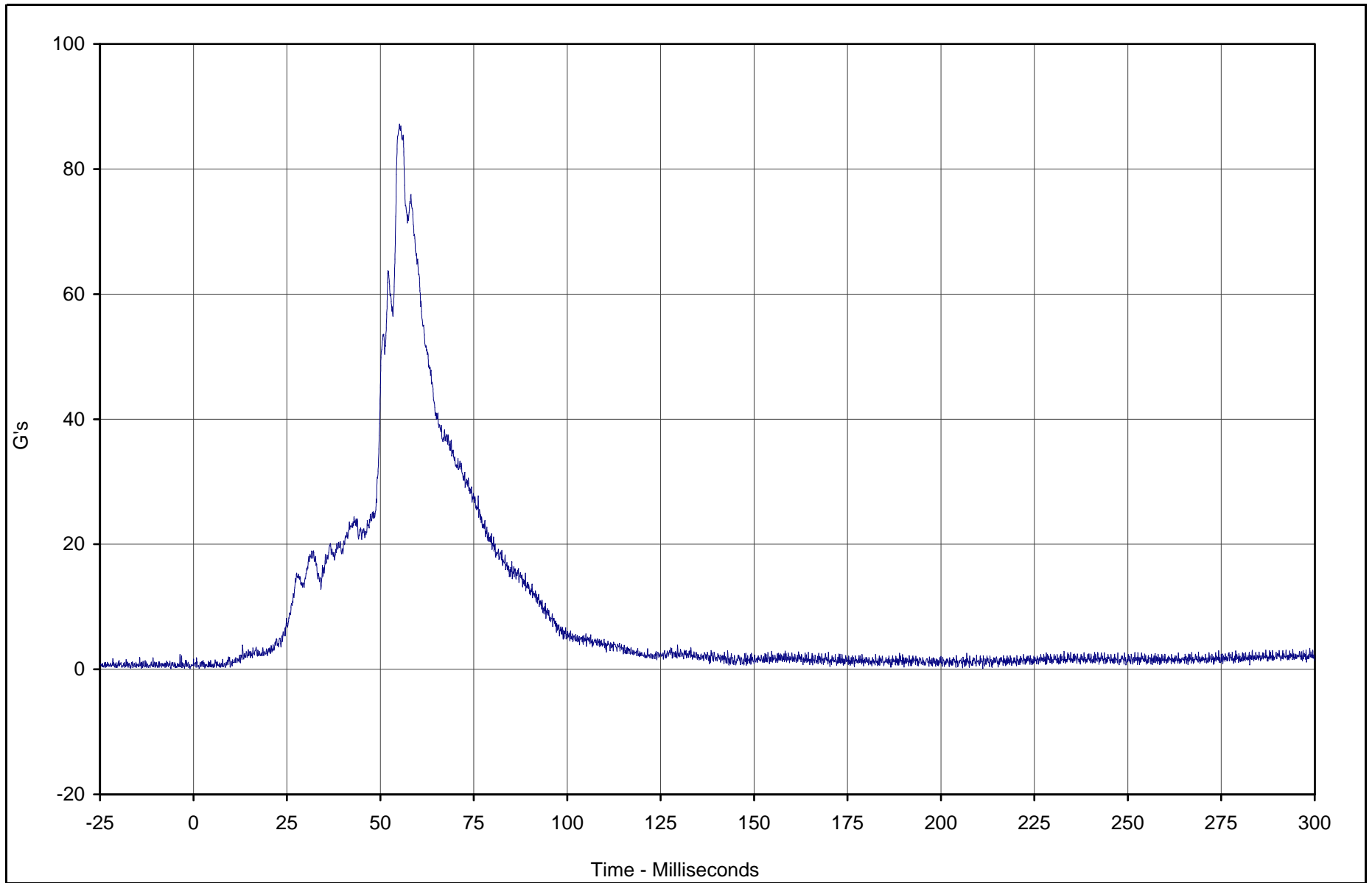
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-100



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Pelvis Resultant	066	RES	G's	87.2	55.1	0.2	1.5	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

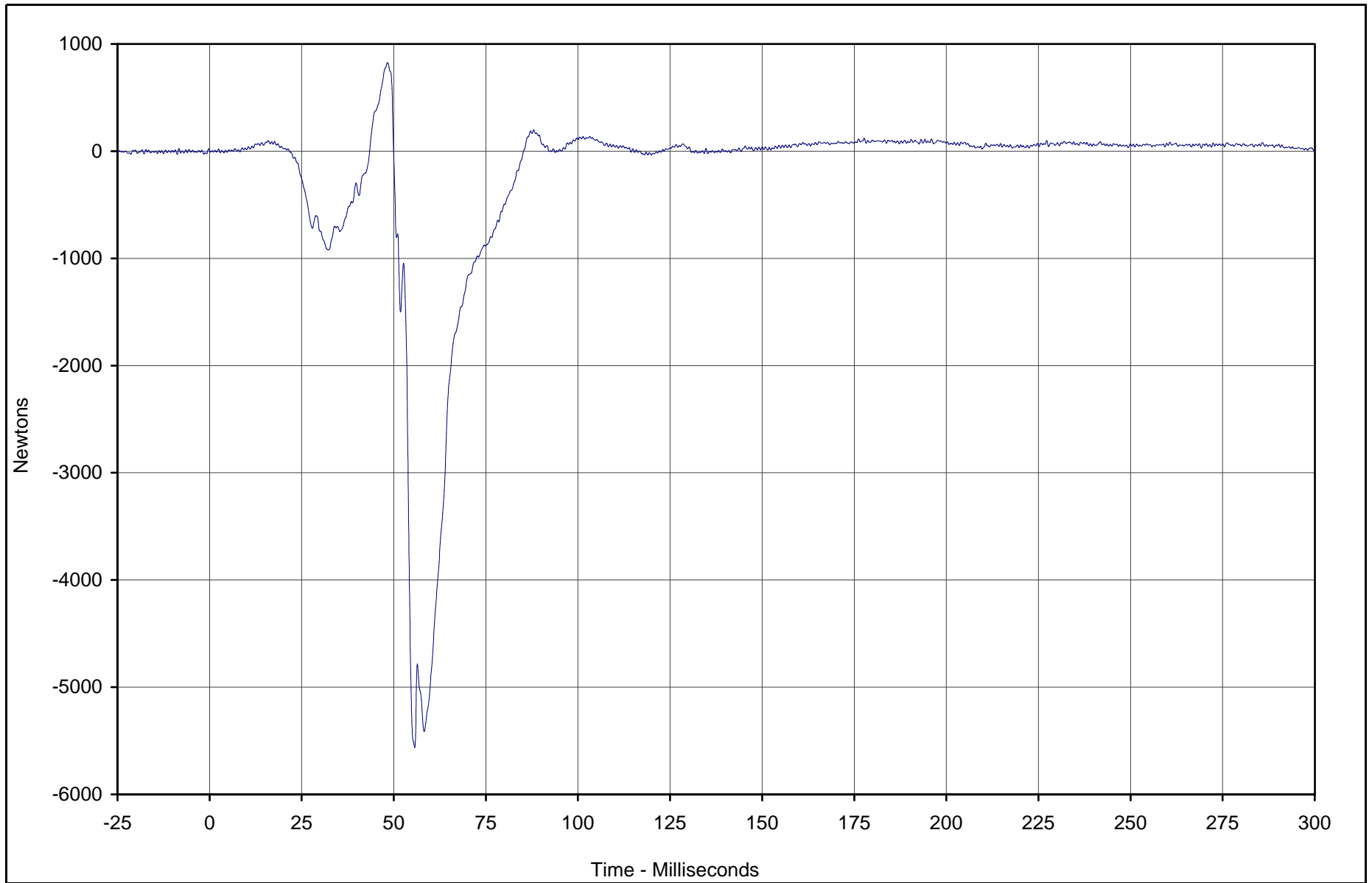
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-101



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Left Femur Force	067	FIL	Newtons	826.4	48.3	-5563.9	55.7	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

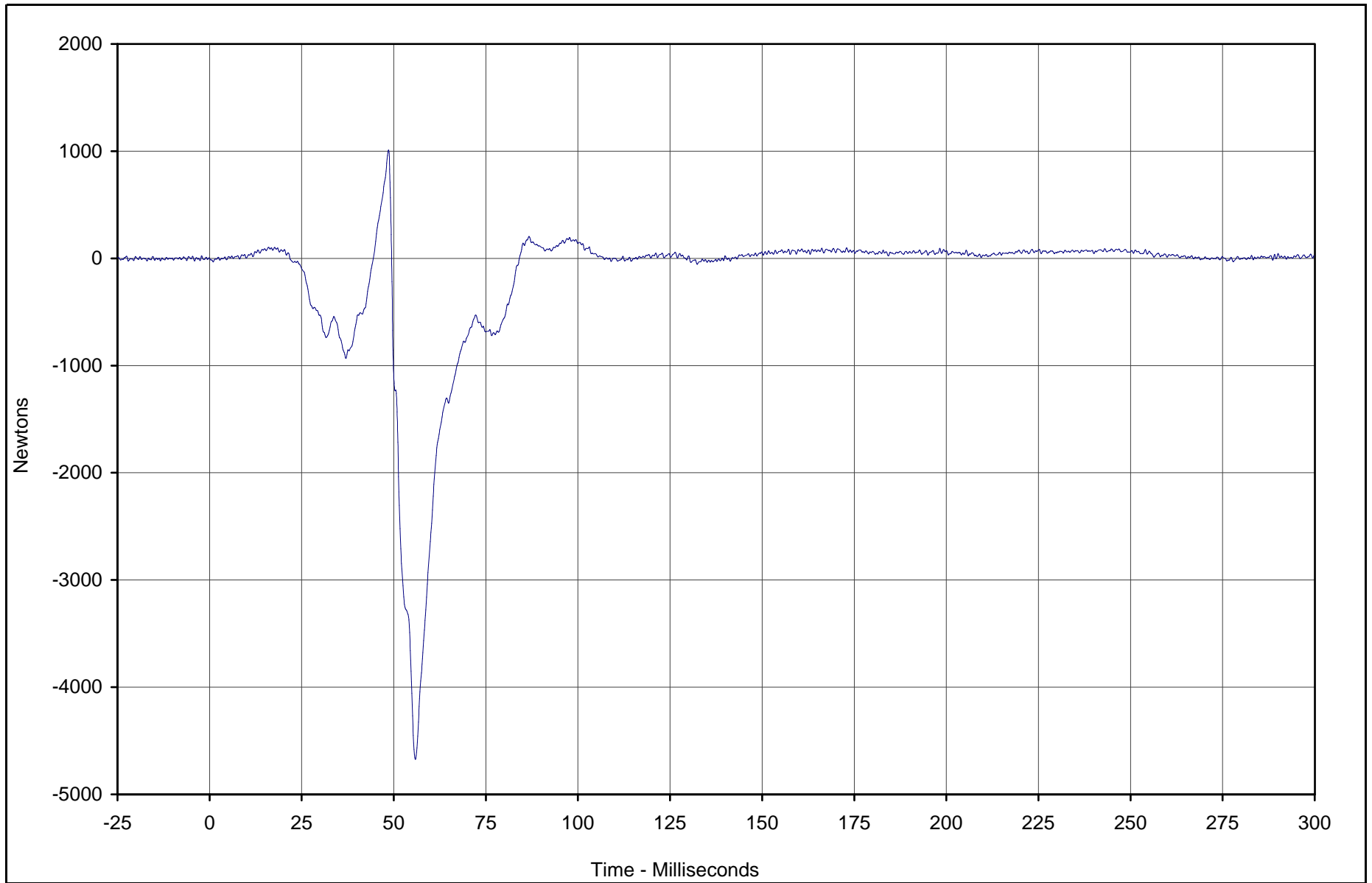
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-102



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Right Femur Force	068	FIL	Newtons	1010.2	48.6	-4672.1	55.9	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

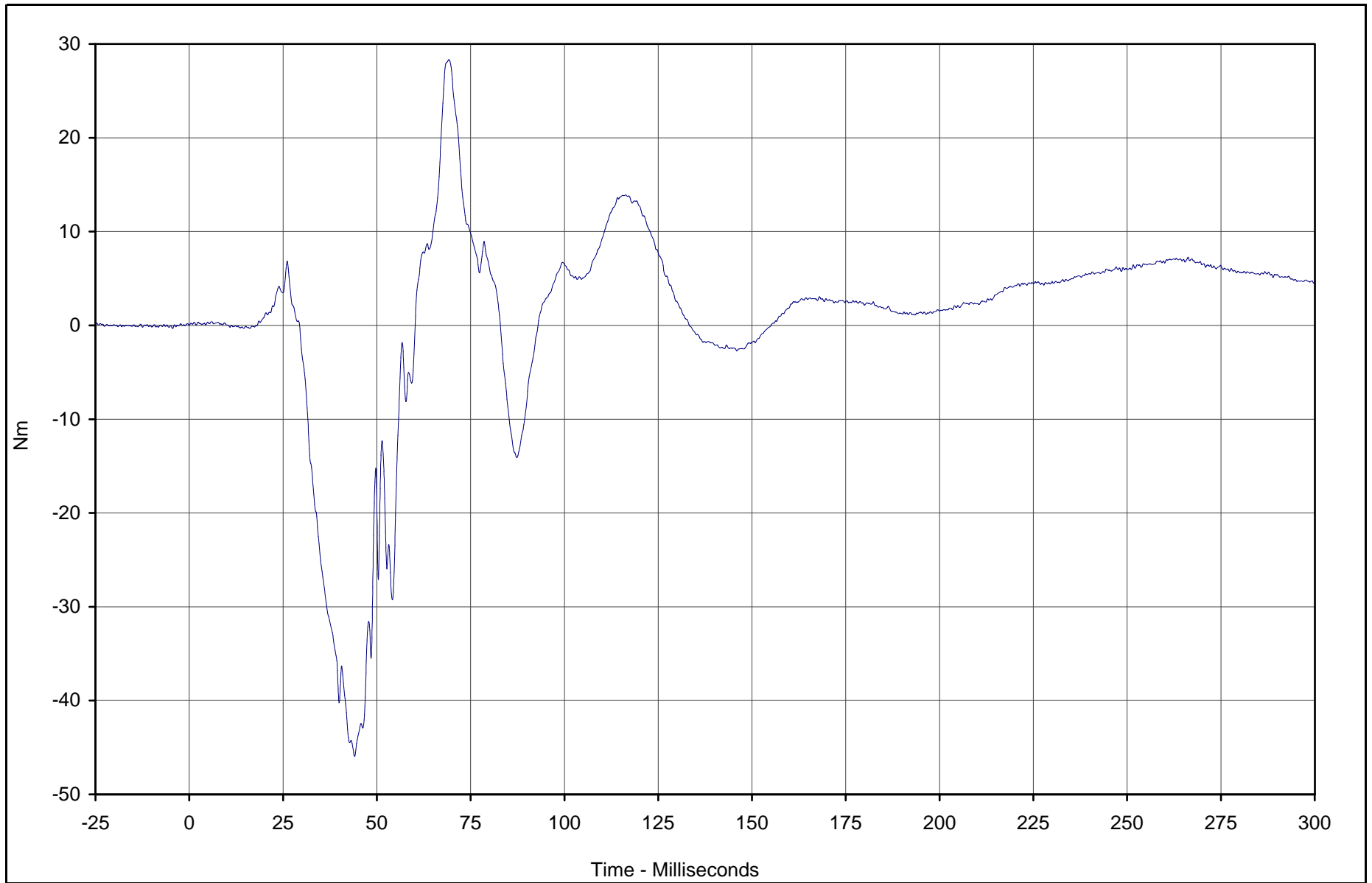
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-103



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Left Upper Tibia Moment X	069	FIL	Nm	28.3	69.3	-46.0	44.1	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

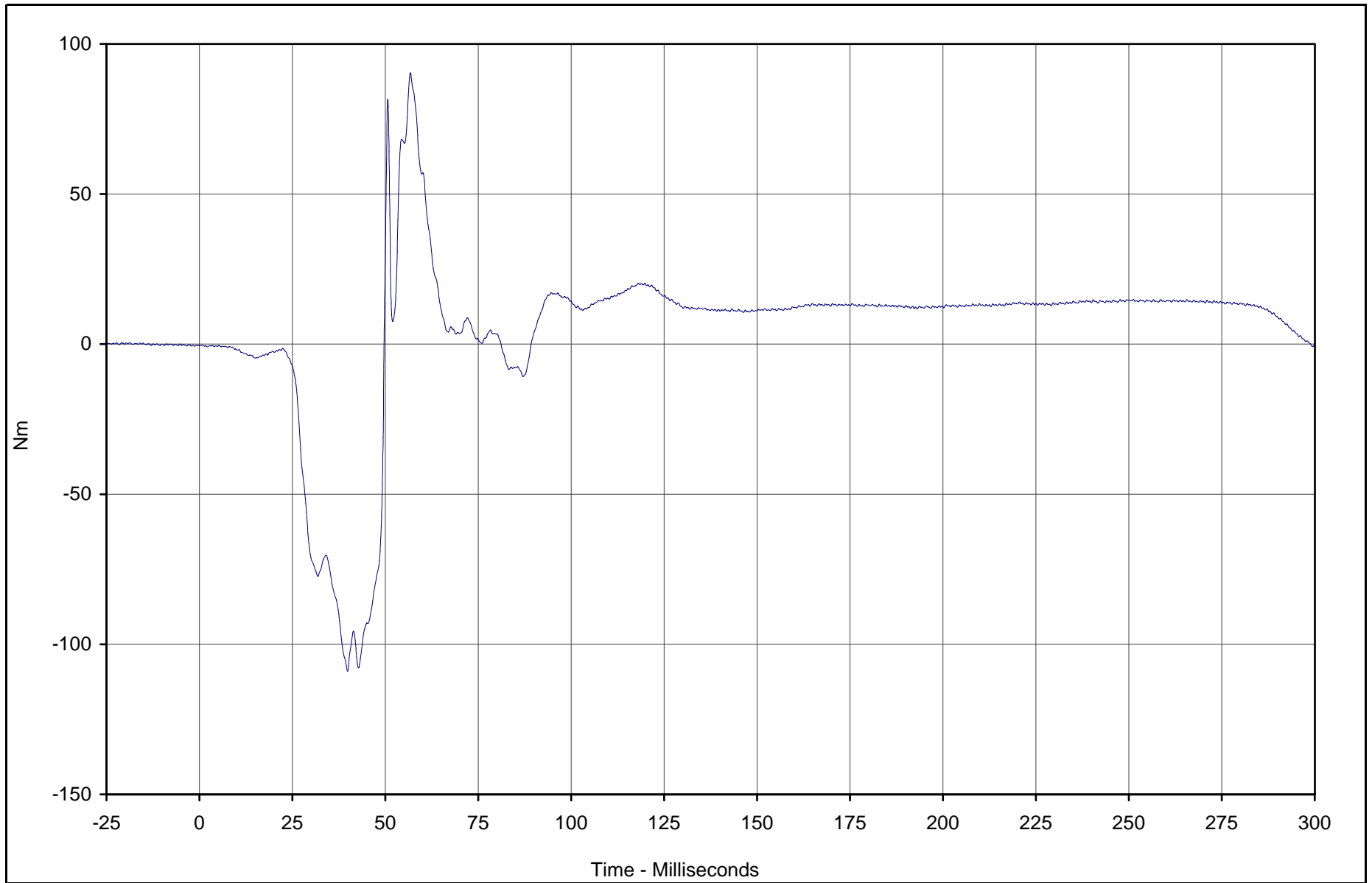
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-104



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Left Upper Tibia Moment Y	070	FIL	Nm	90.4	56.7	-108.9	39.8	600



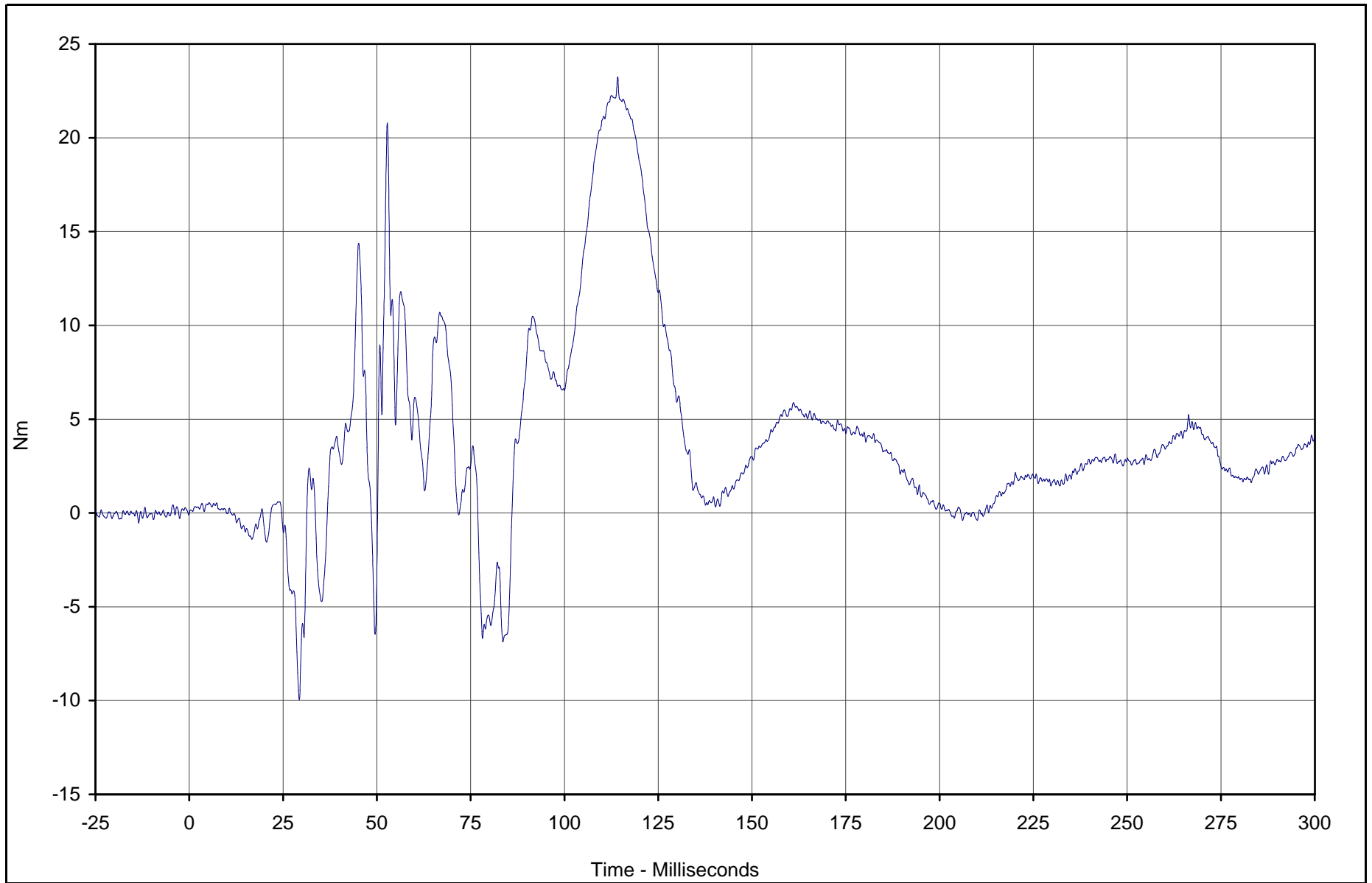
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-105



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Right Upper Tibia Moment X	071	FIL	Nm	23.3	114.2	-10.0	29.3	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

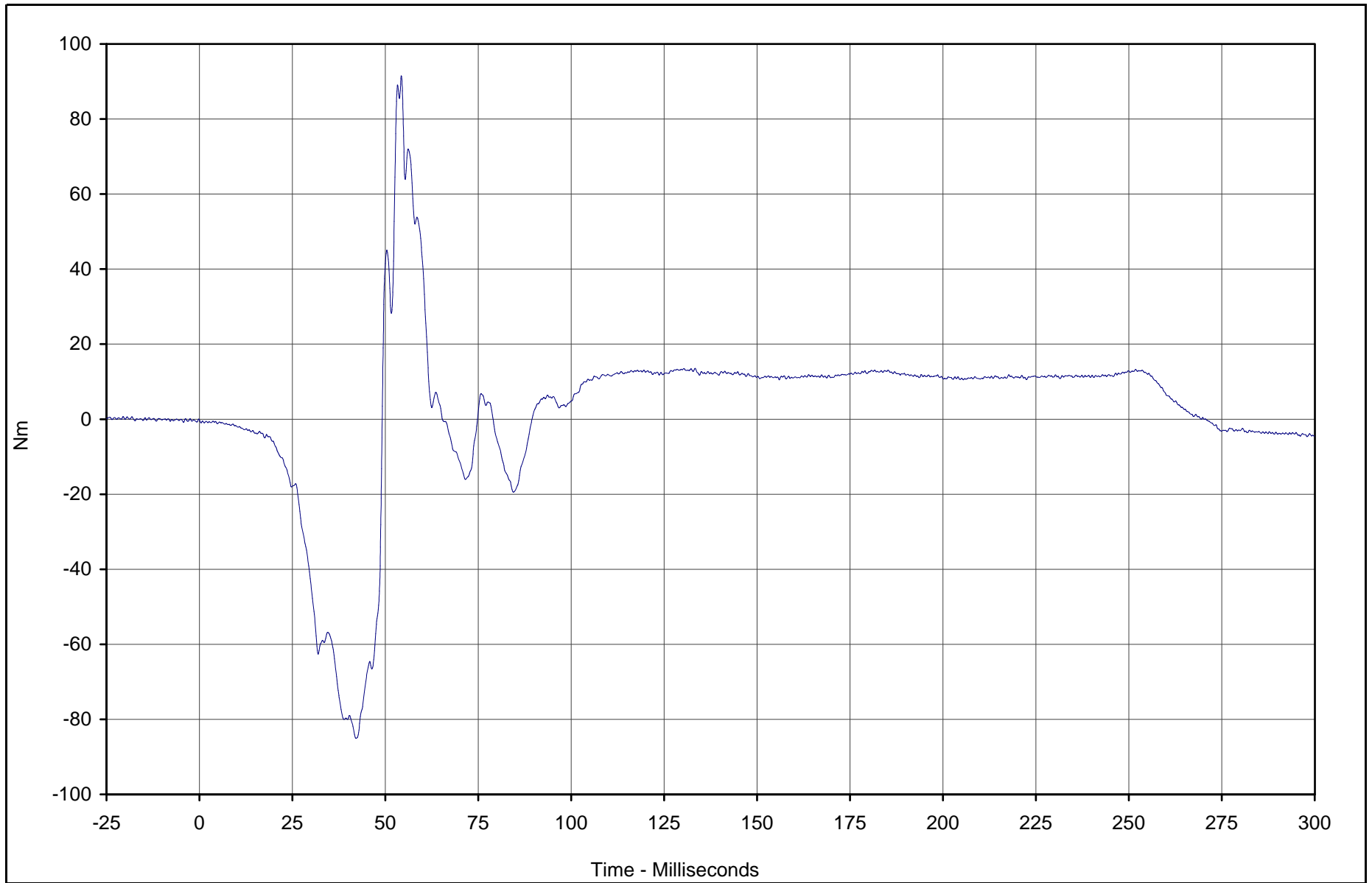
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-106



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Right Upper Tibia Moment Y	072	FIL	Nm	91.5	54.3	-85.1	42.1	600



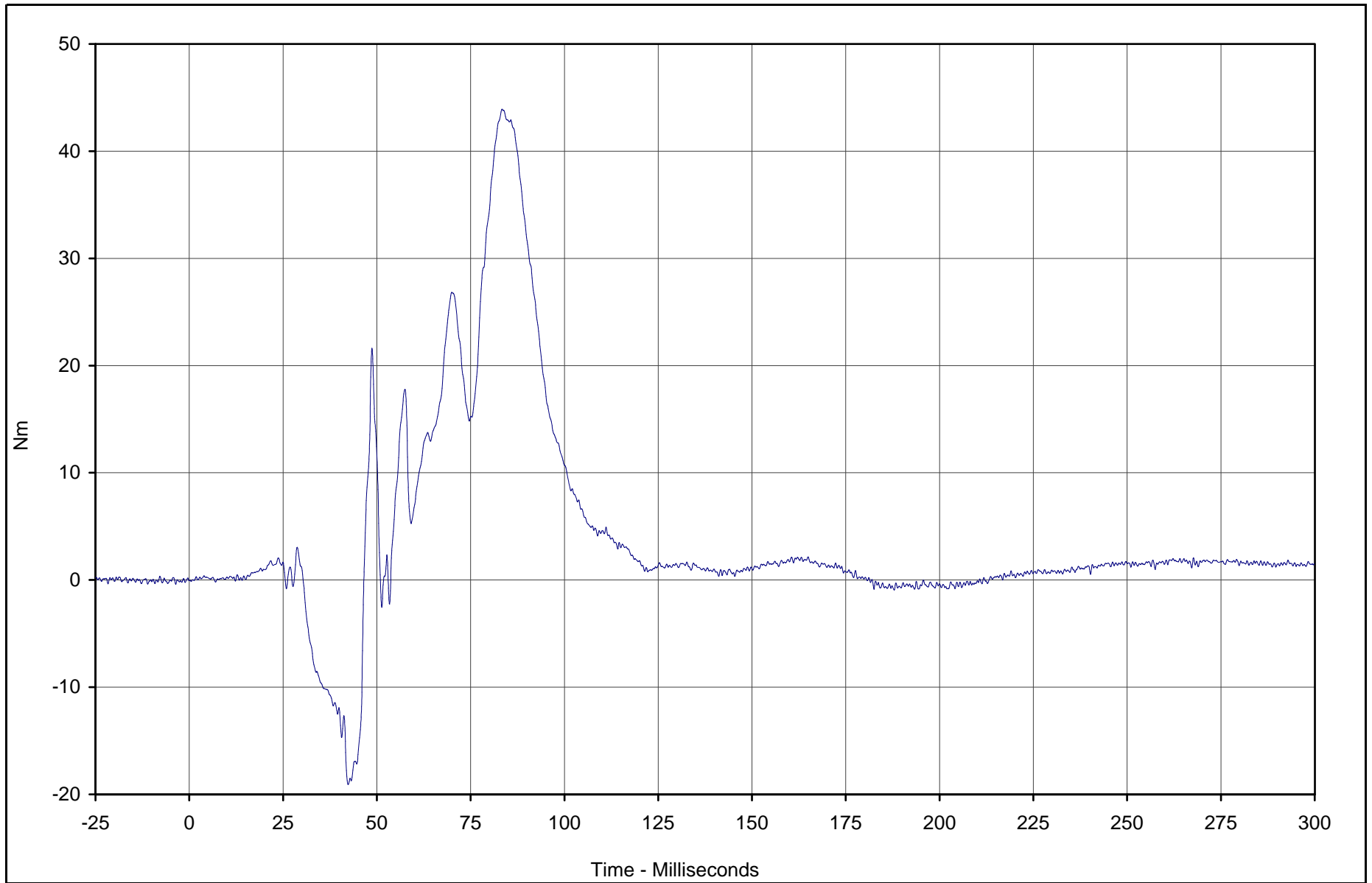
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-107



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Left Lower Tibia Moment X	073	FIL	Nm	43.9	83.3	-19.1	42.3	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

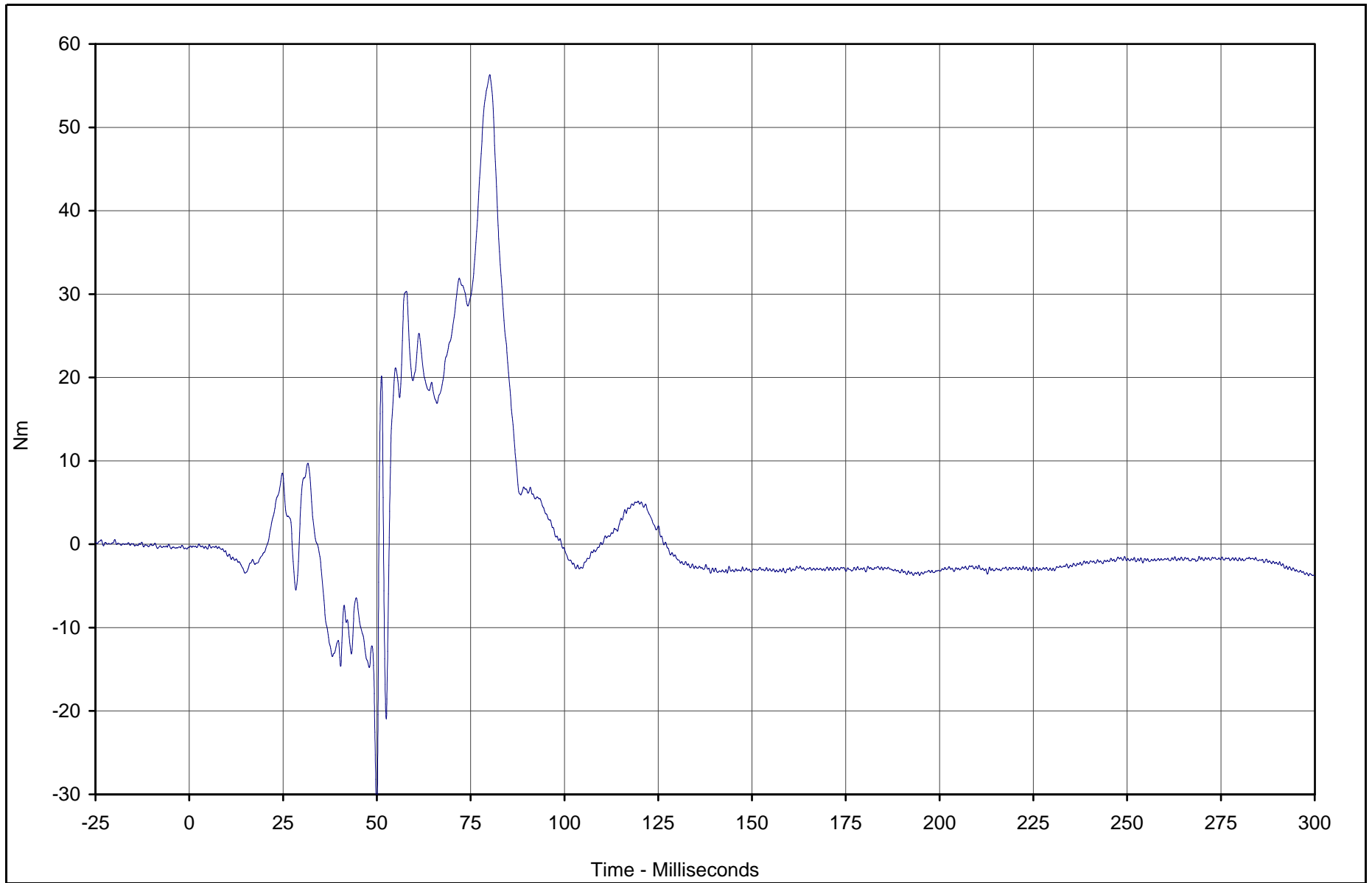
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-108



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Left Lower Tibia Moment Y	074	FIL	Nm	56.3	80.1	-33.8	50.0	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

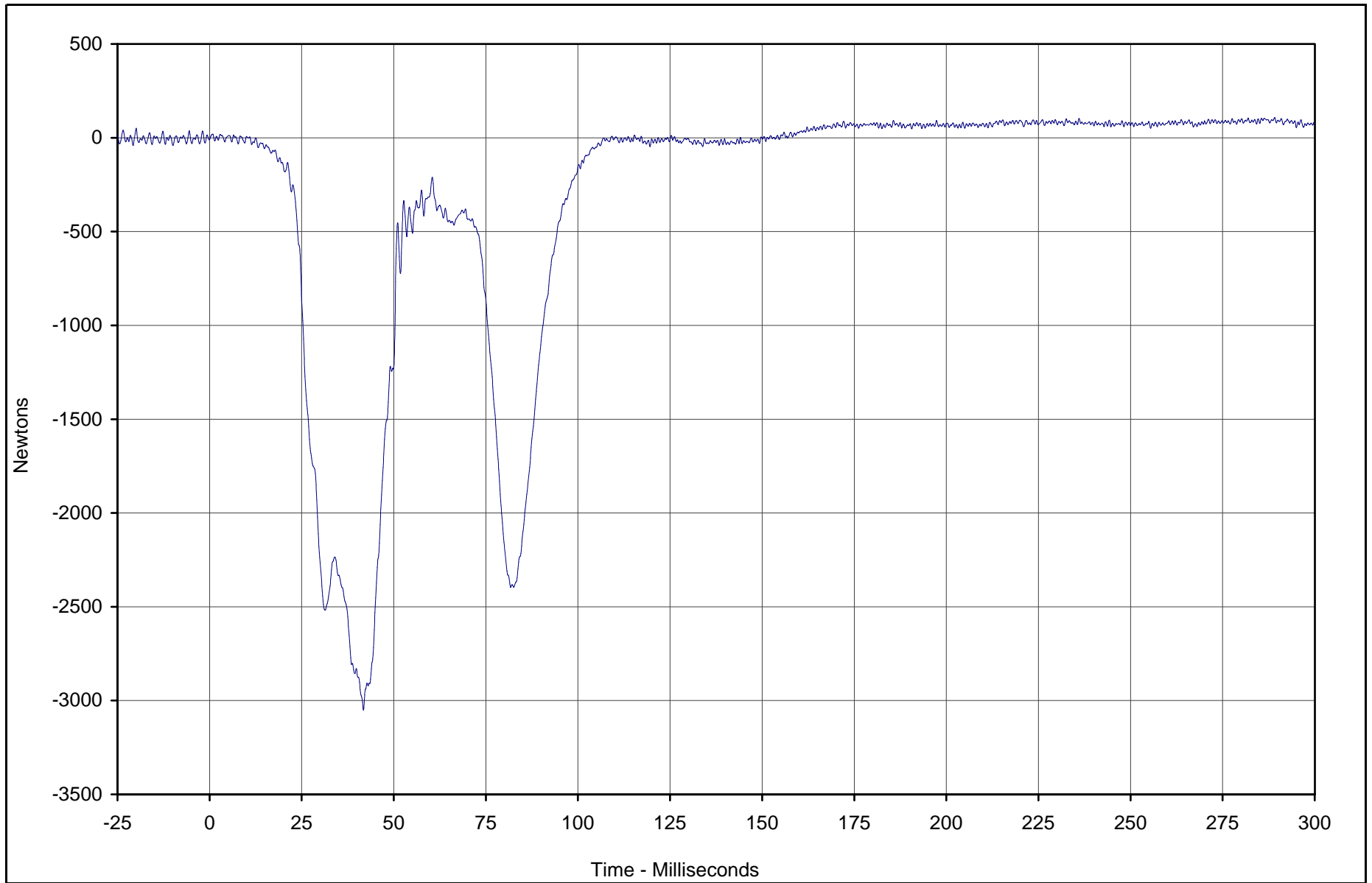
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-109



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Left Lower Tibia Force Z	075	FIL	Newtons	108.4	289.1	-3050.9	41.8	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

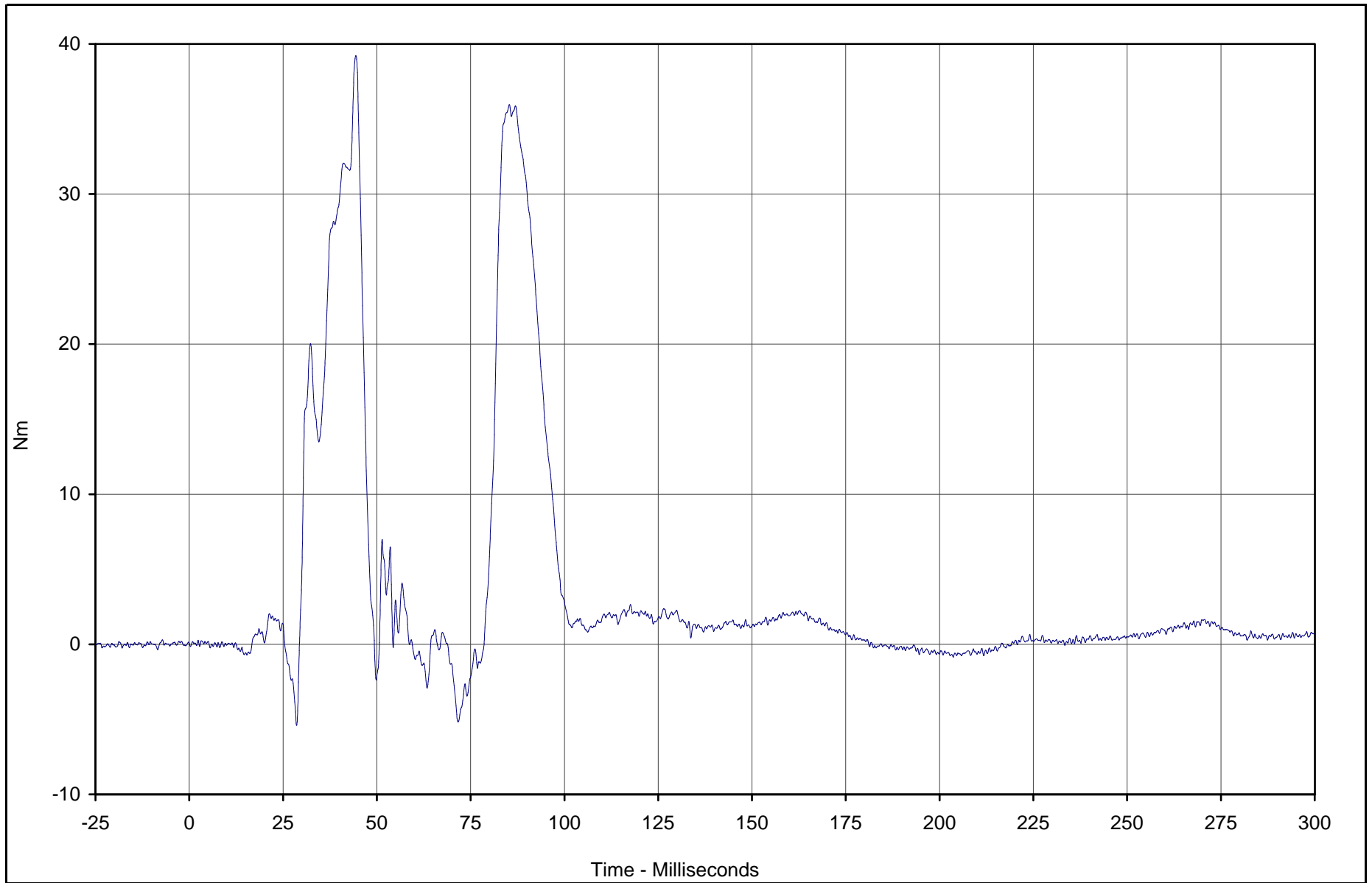
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-110



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Right Lower Tibia Moment X	076	FIL	Nm	39.2	44.4	-5.4	28.6	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

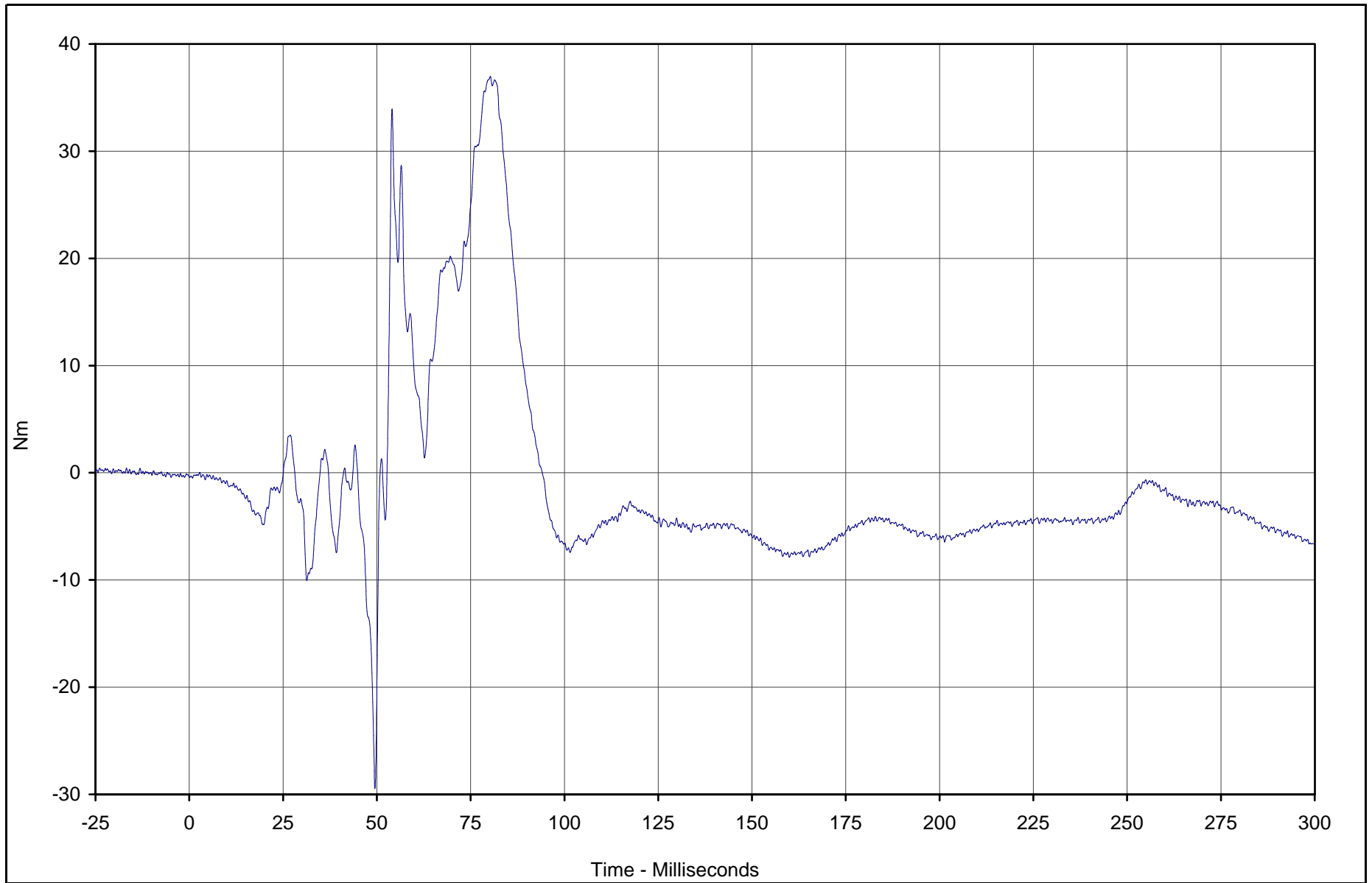
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-111



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Right Lower Tibia Moment Y	077	FIL	Nm	37.0	80.3	-29.5	49.5	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

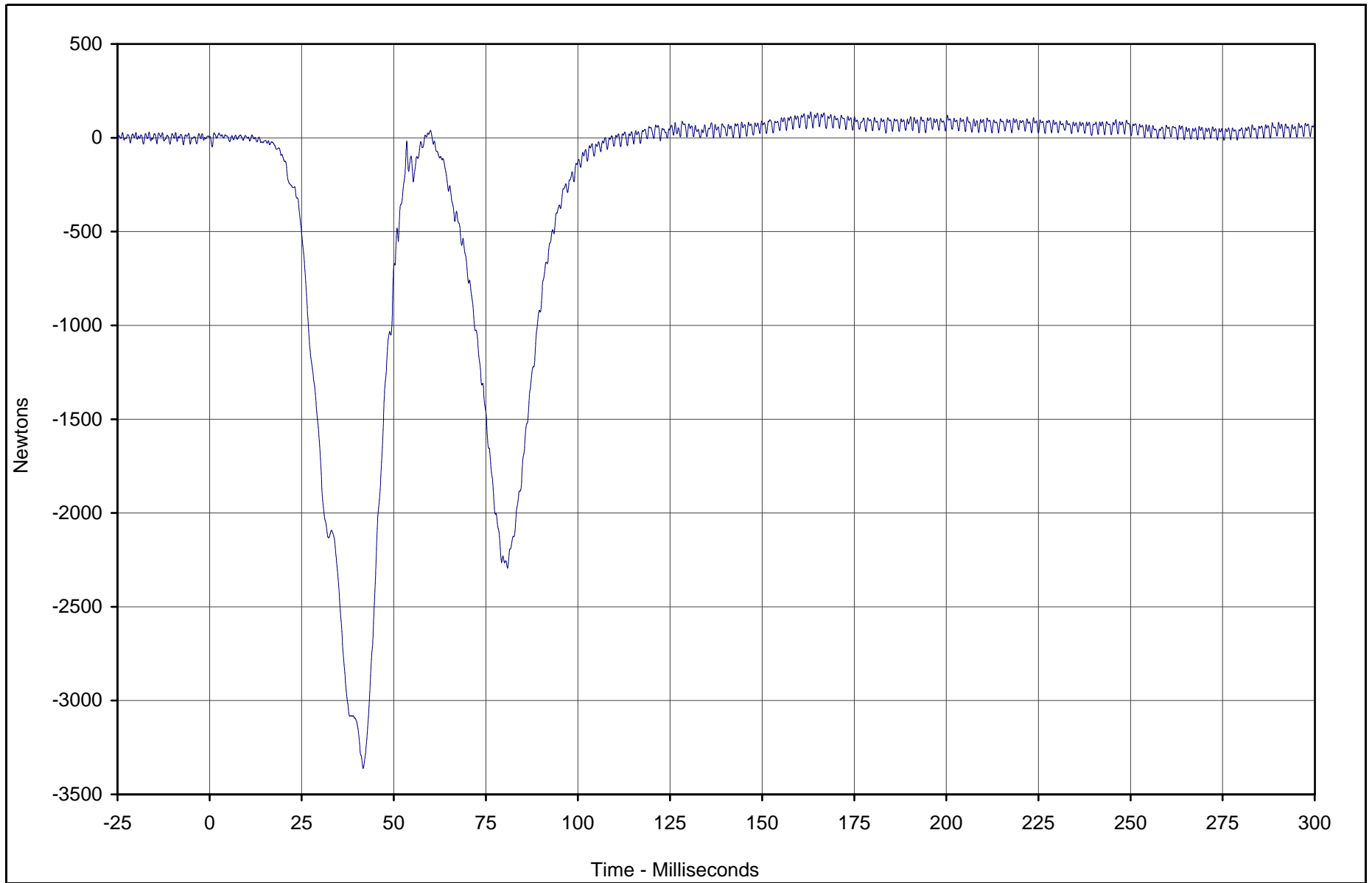
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-112



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Right lower Tibia Force Z	078	FIL	Newtons	137.6	163.2	-3362.0	41.7	600



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

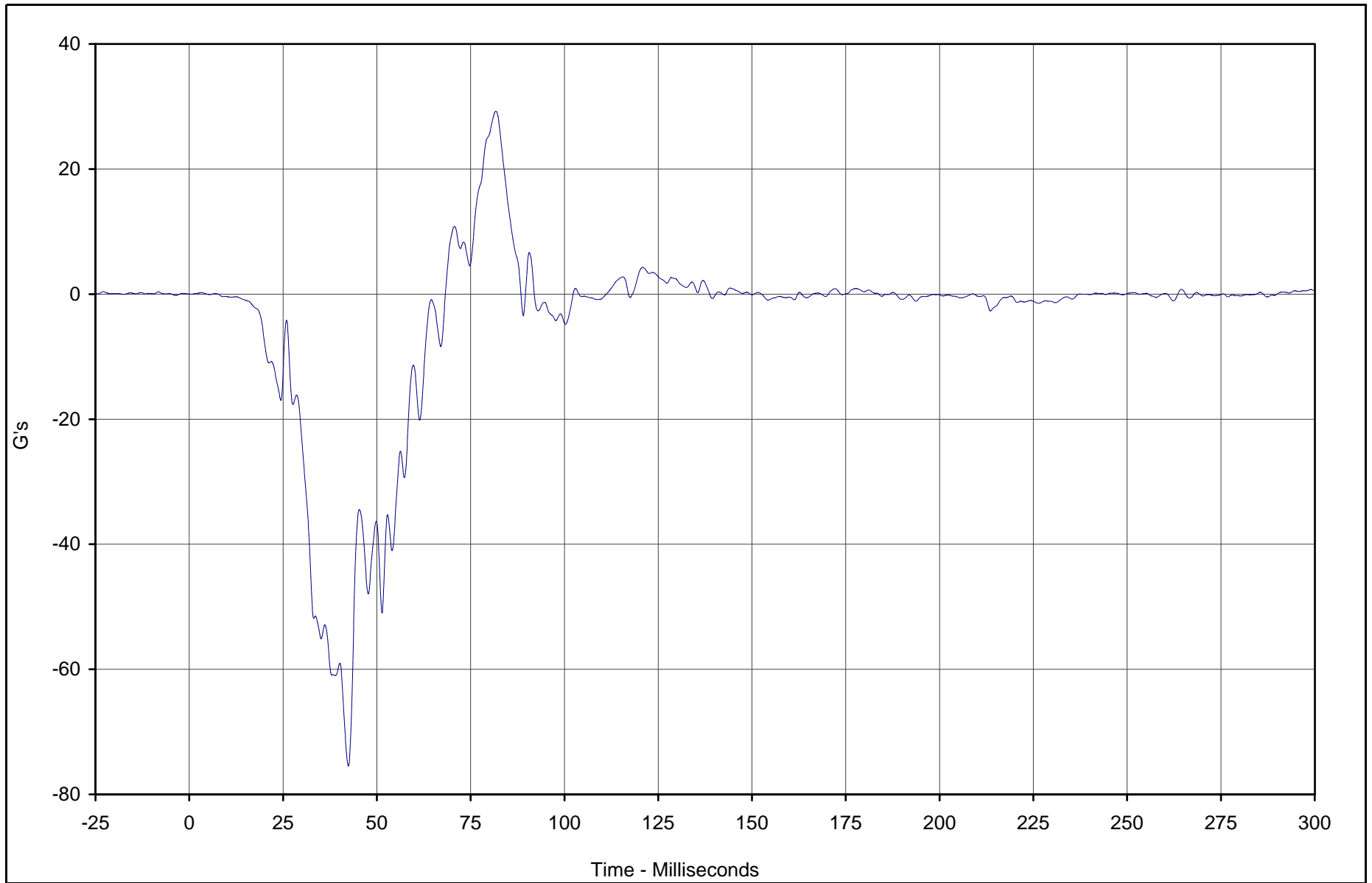
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-113



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Left Foot Aft X	079	FIL	G's	29.2	81.7	-75.5	42.4	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

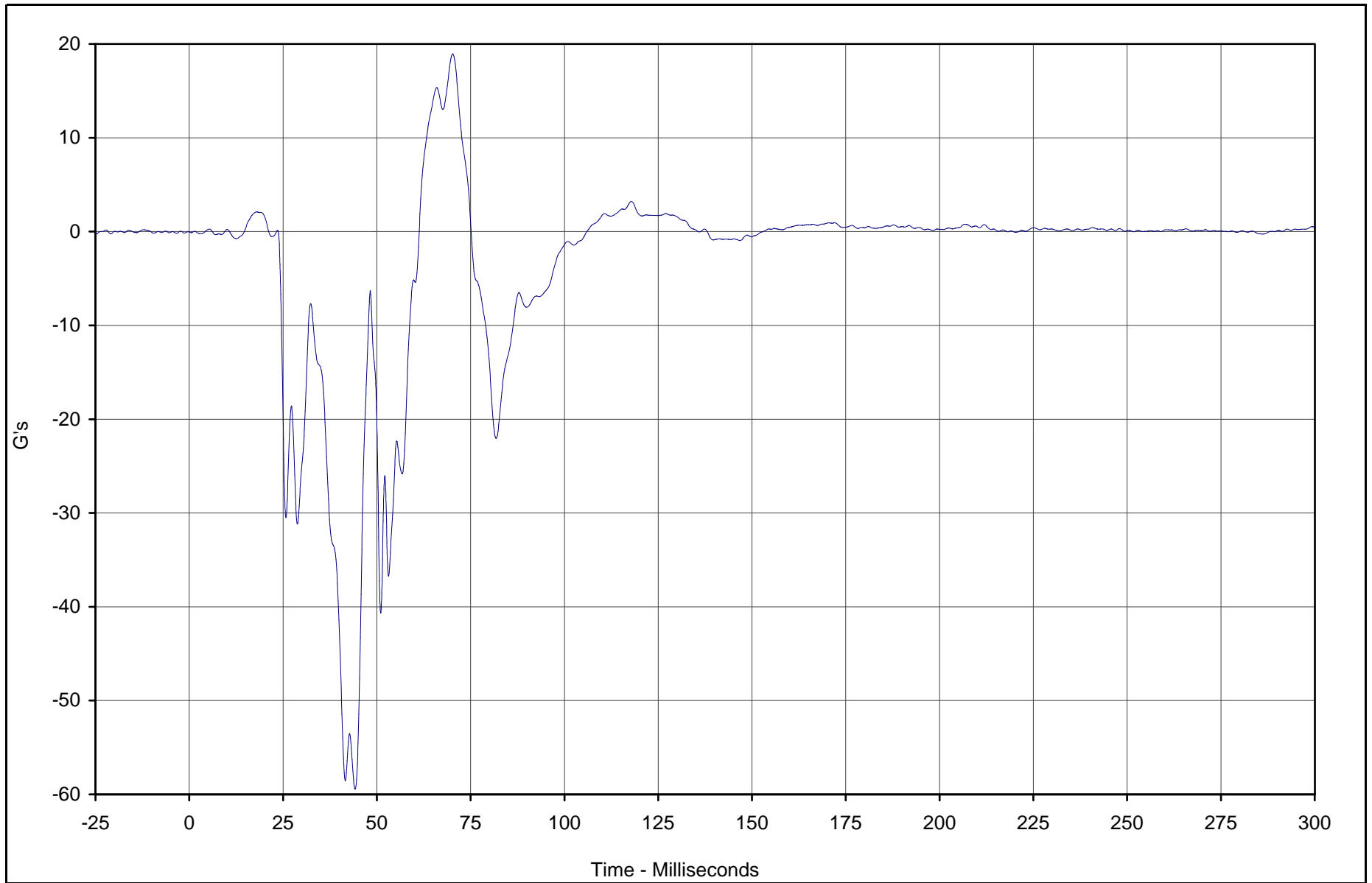
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-114



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Left Foot Aft Z	080	FIL	G's	19.0	70.2	-59.4	44.2	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

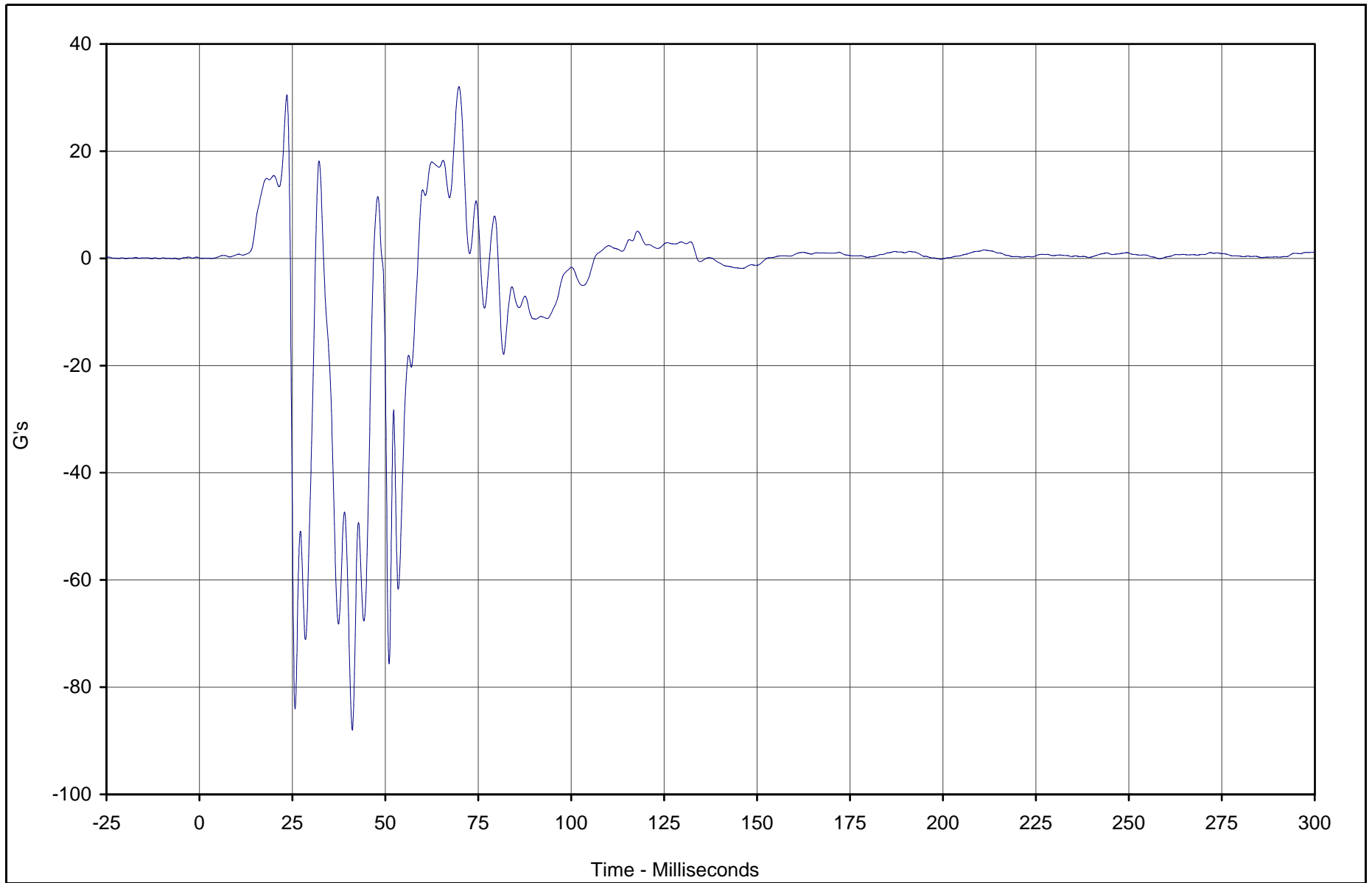
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-115



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Left Foot Fore Z	081	FIL	G's	32.0	69.8	-88.0	41.1	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

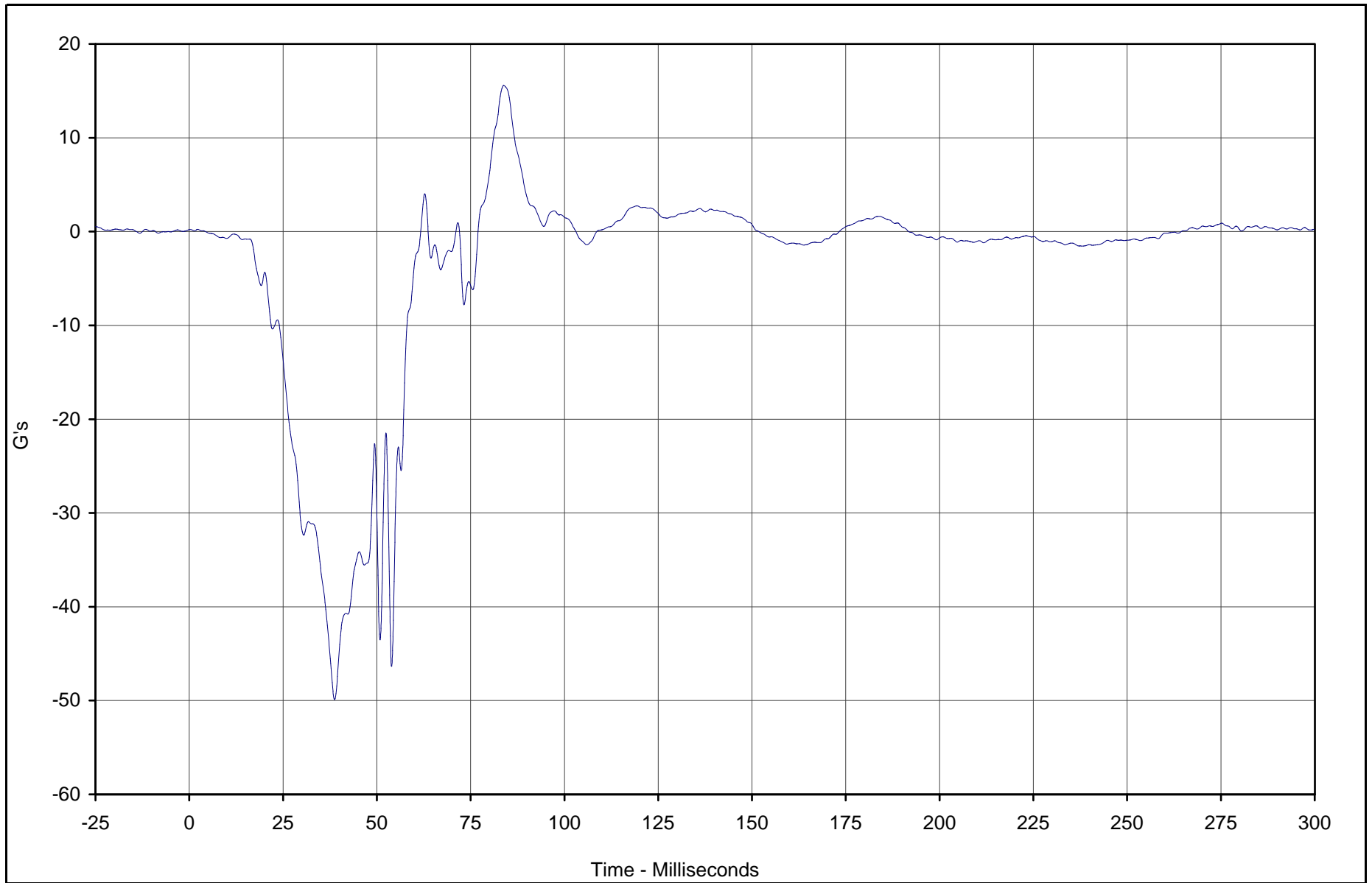
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-116



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Right Foot Aft X	082	FIL	G's	15.6	83.8	-49.9	38.7	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

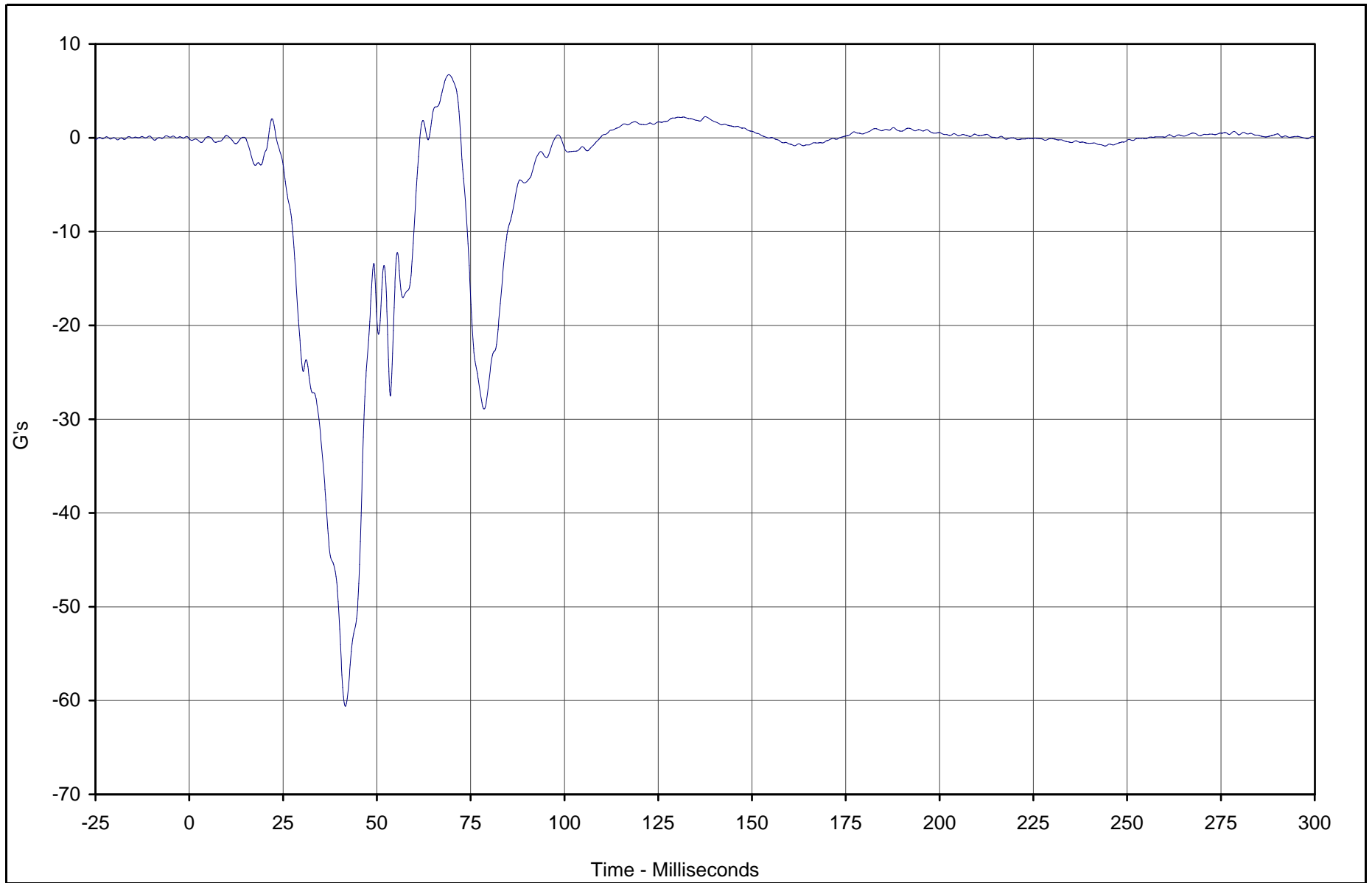
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-117



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Right Foot Aft Z	083	FIL	G's	6.7	69.2	-60.6	41.6	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

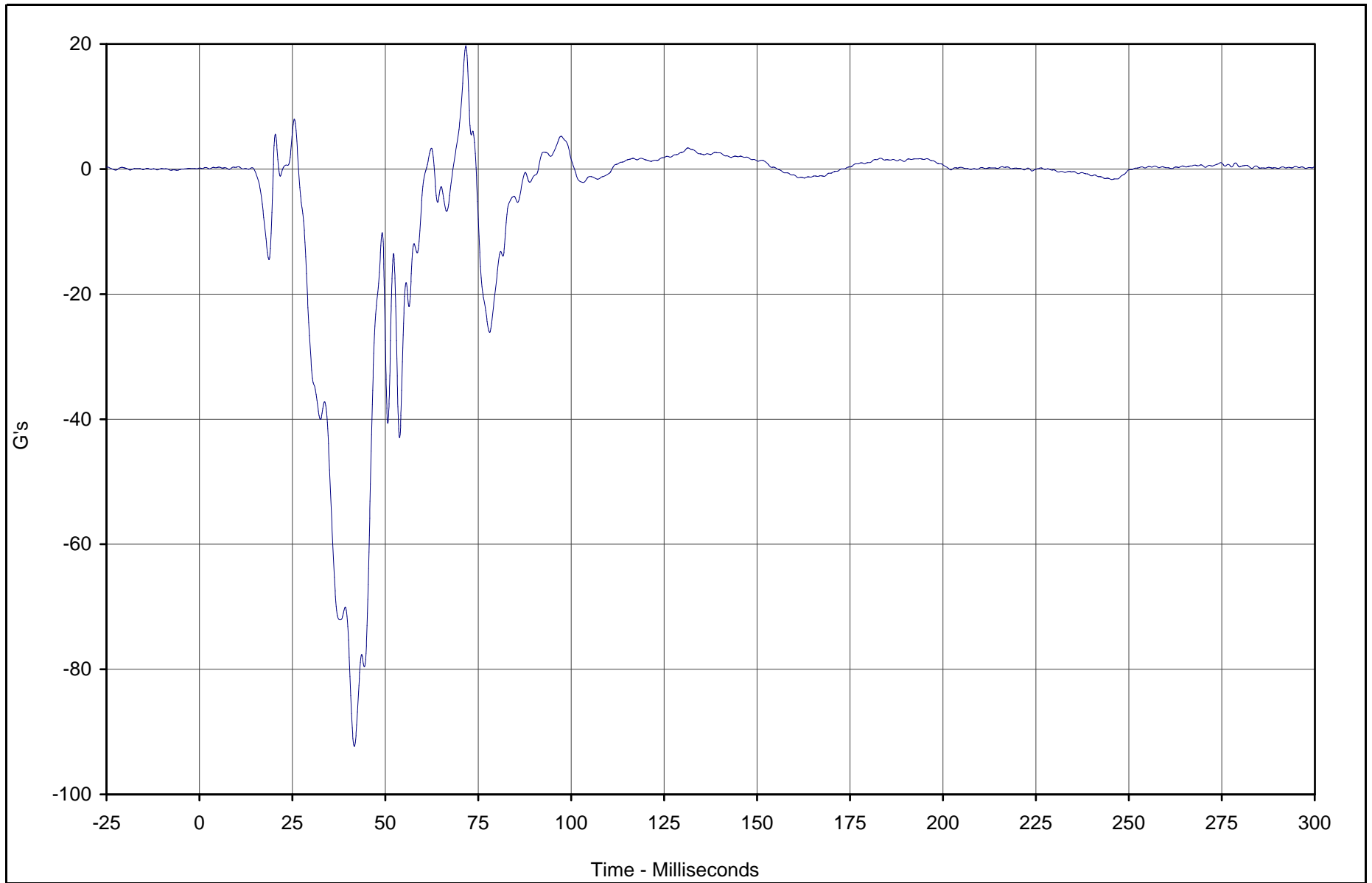
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-118



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Right Foot Fore Z	084	FIL	G's	19.7	71.7	-92.3	41.7	180



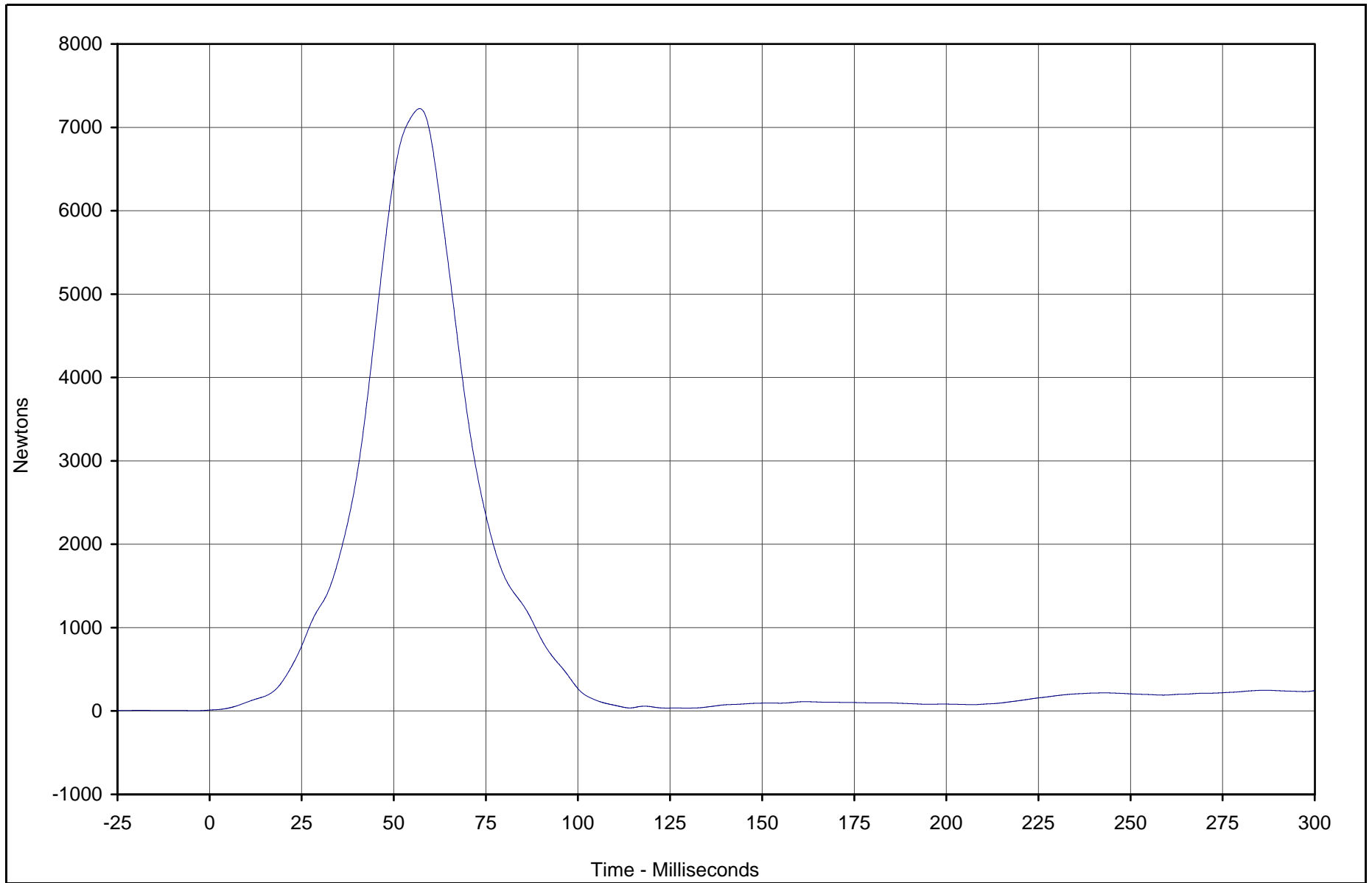
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-119



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Lap Belt Force	085	FIL	Newtons	7225.1	57.0	11.6	0.0	60



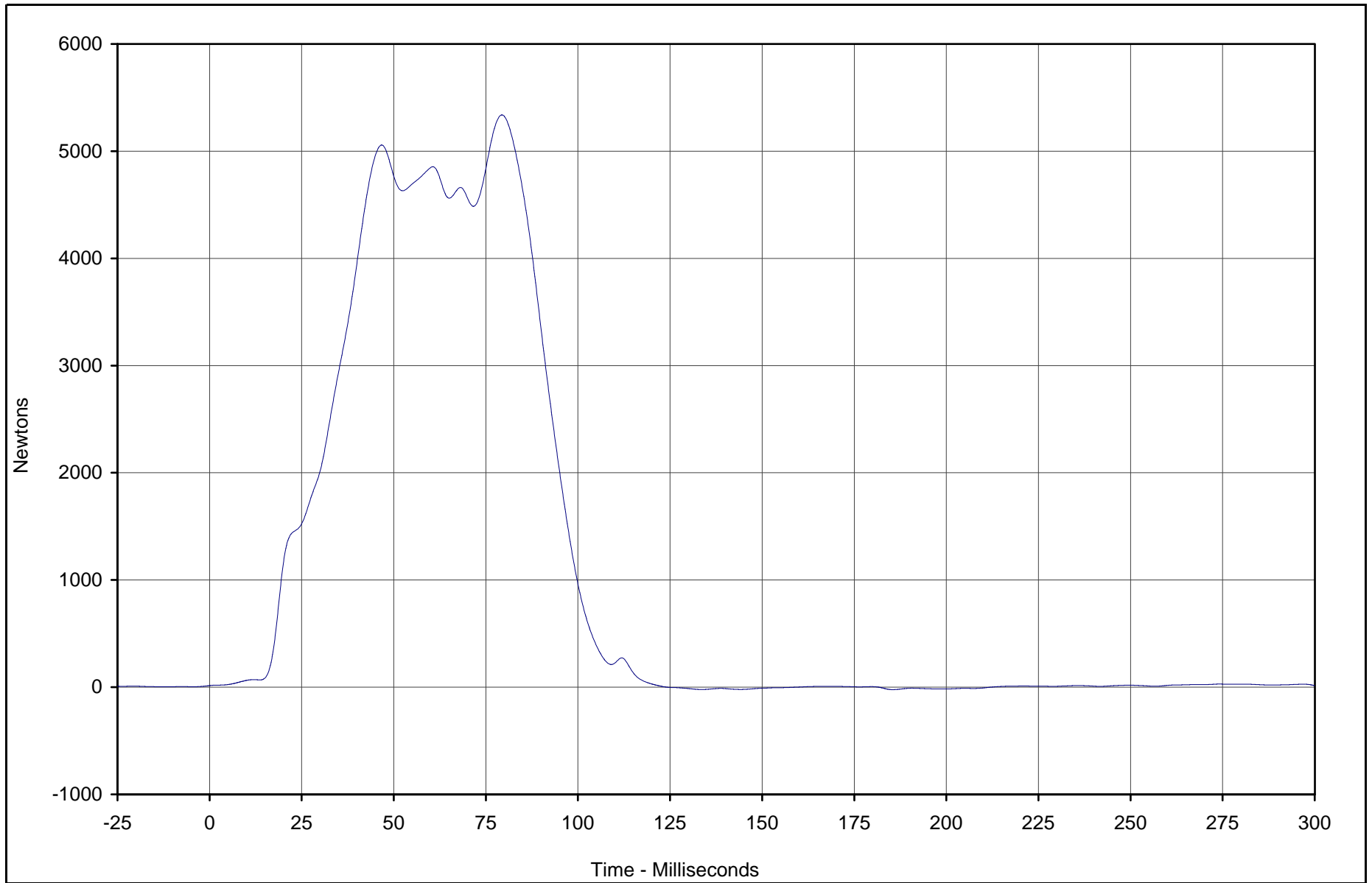
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-120



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Shoulder Belt Force	086	FIL	Newtons	5338.3	79.4	-23.2	185.4	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

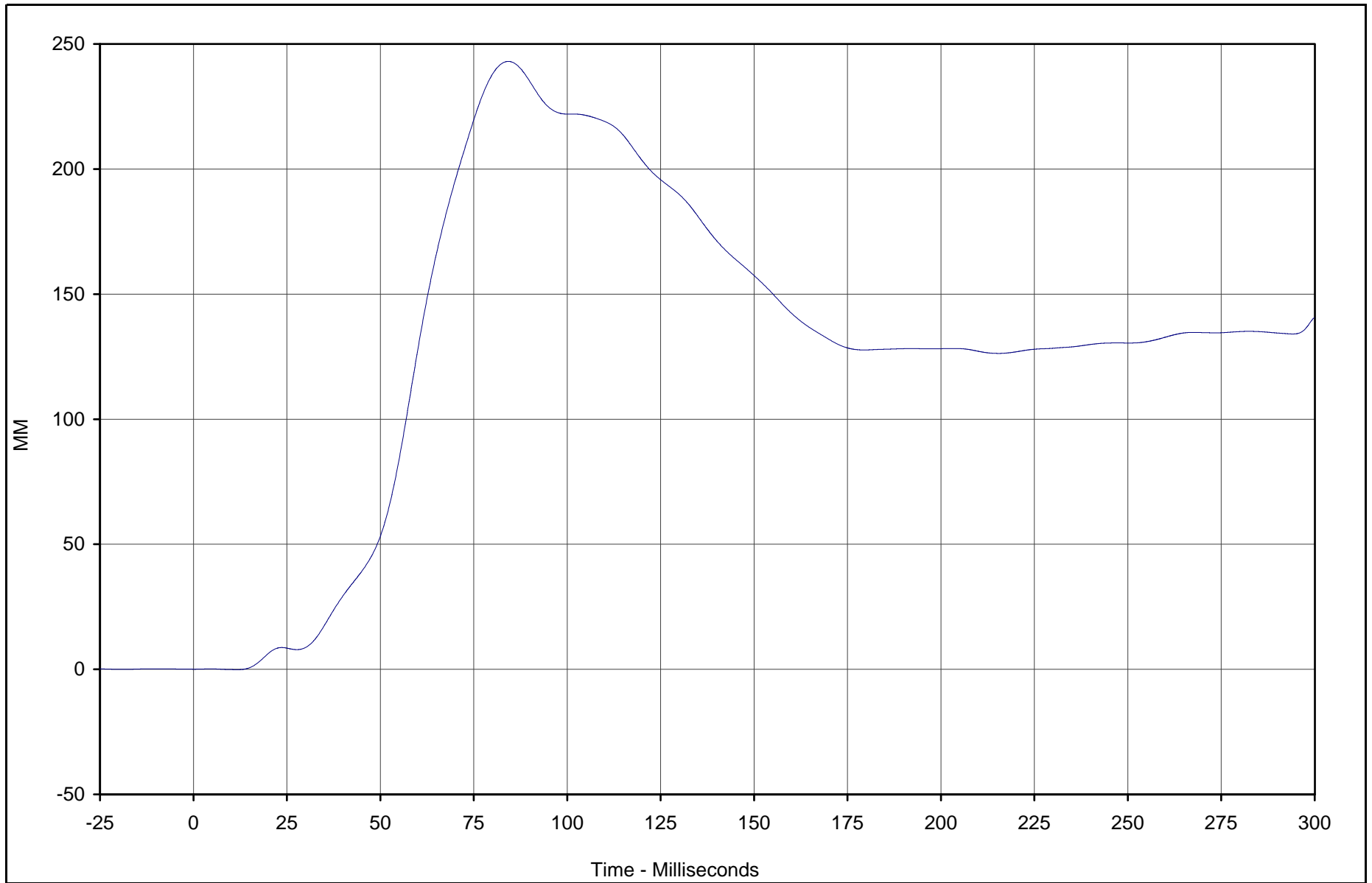
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-121



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Shoulder Belt Pullout	087	FIL	MM	243.0	84.3	-0.1	11.8	60



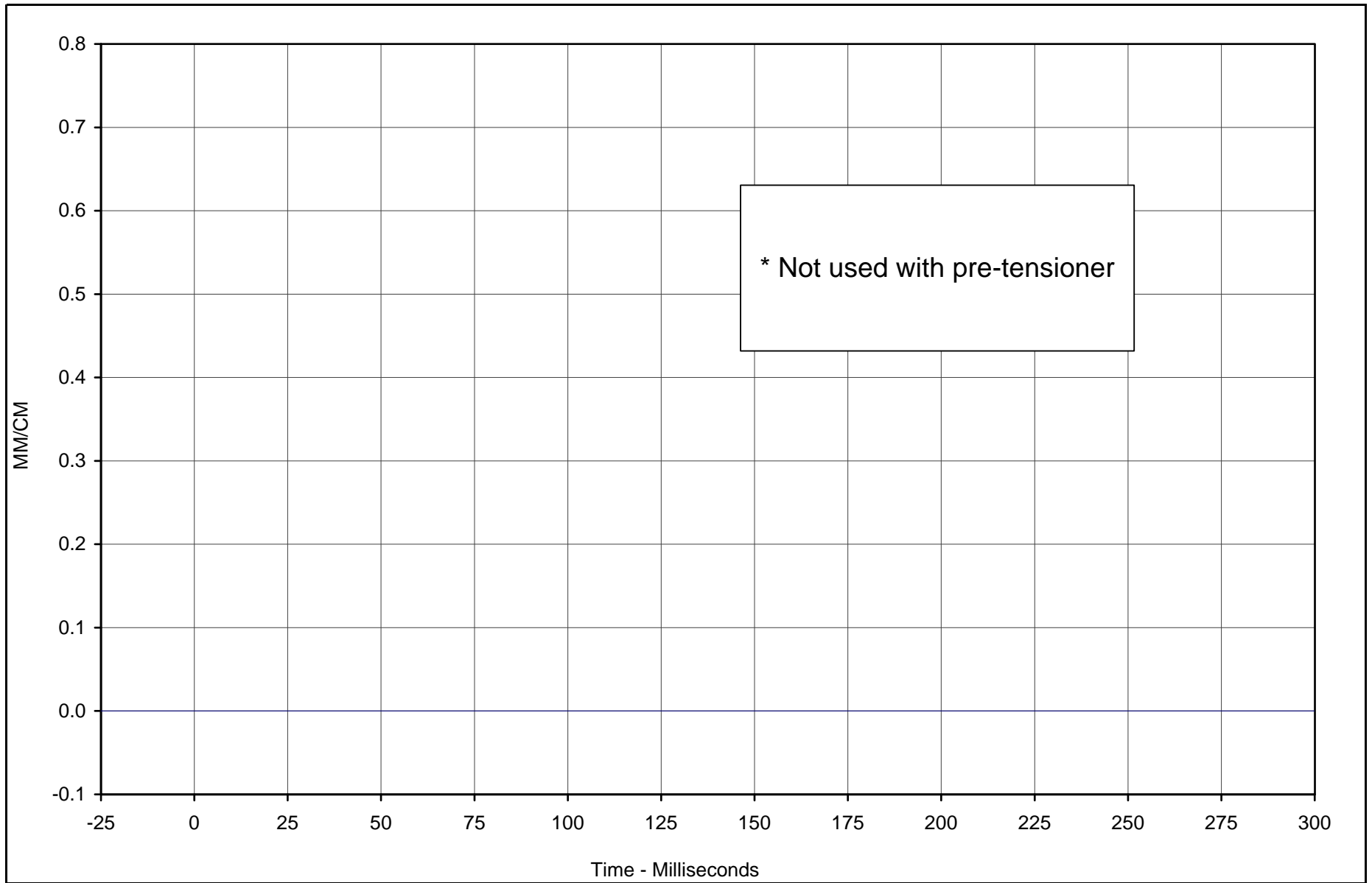
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-122



\* Not used with pre-tensioner

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Shoulder Belt Elongation	088	FIL	MM/CM	0.00	0.0	0.00	0.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

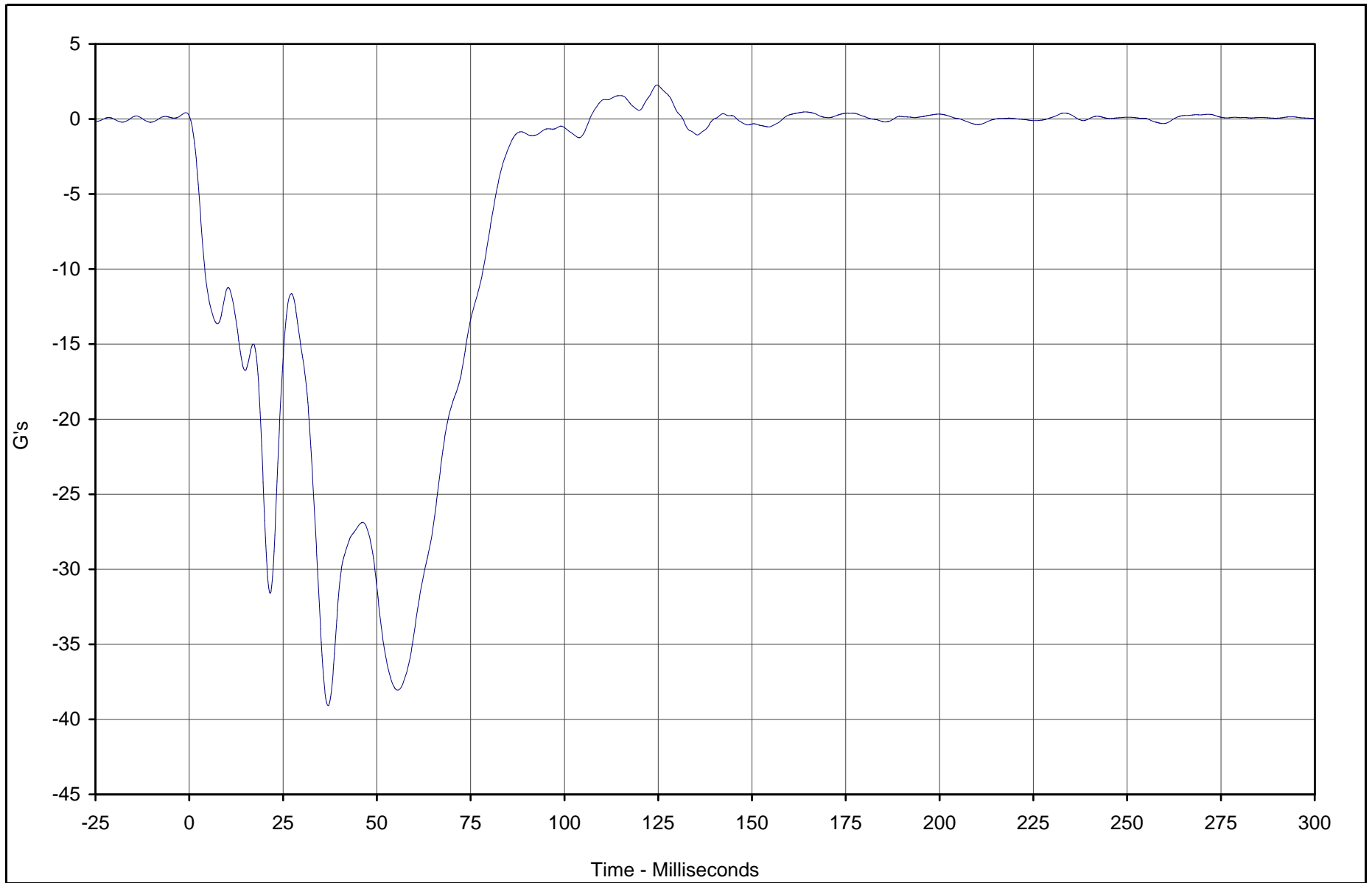
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-123



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Left Rear X	089	FIL	G's	2.3	124.7	-39.1	37.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

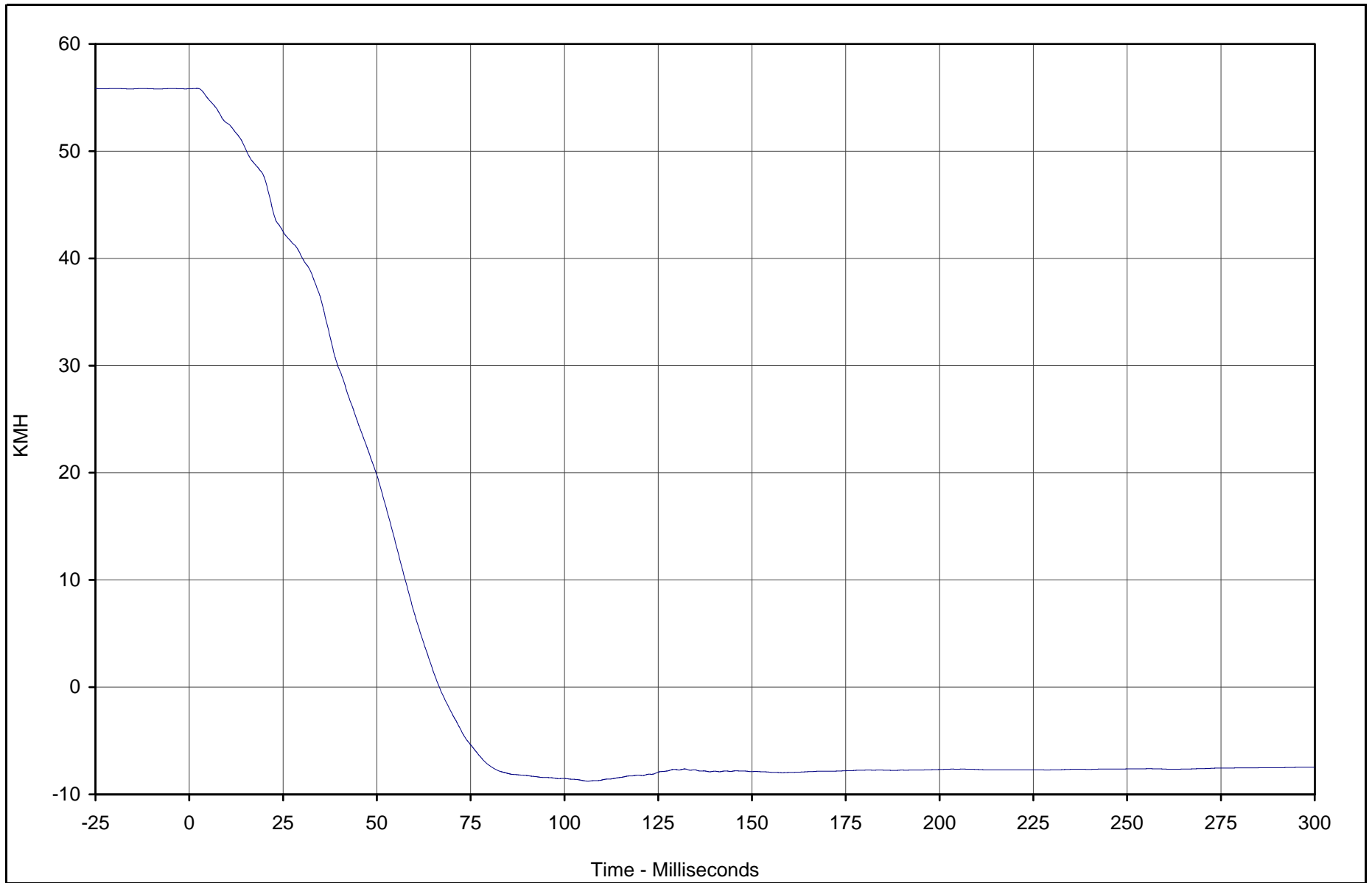
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-124



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Left Rear X Velocity	089	IN1	KMH	55.9	2.0	-8.8	106.3	180



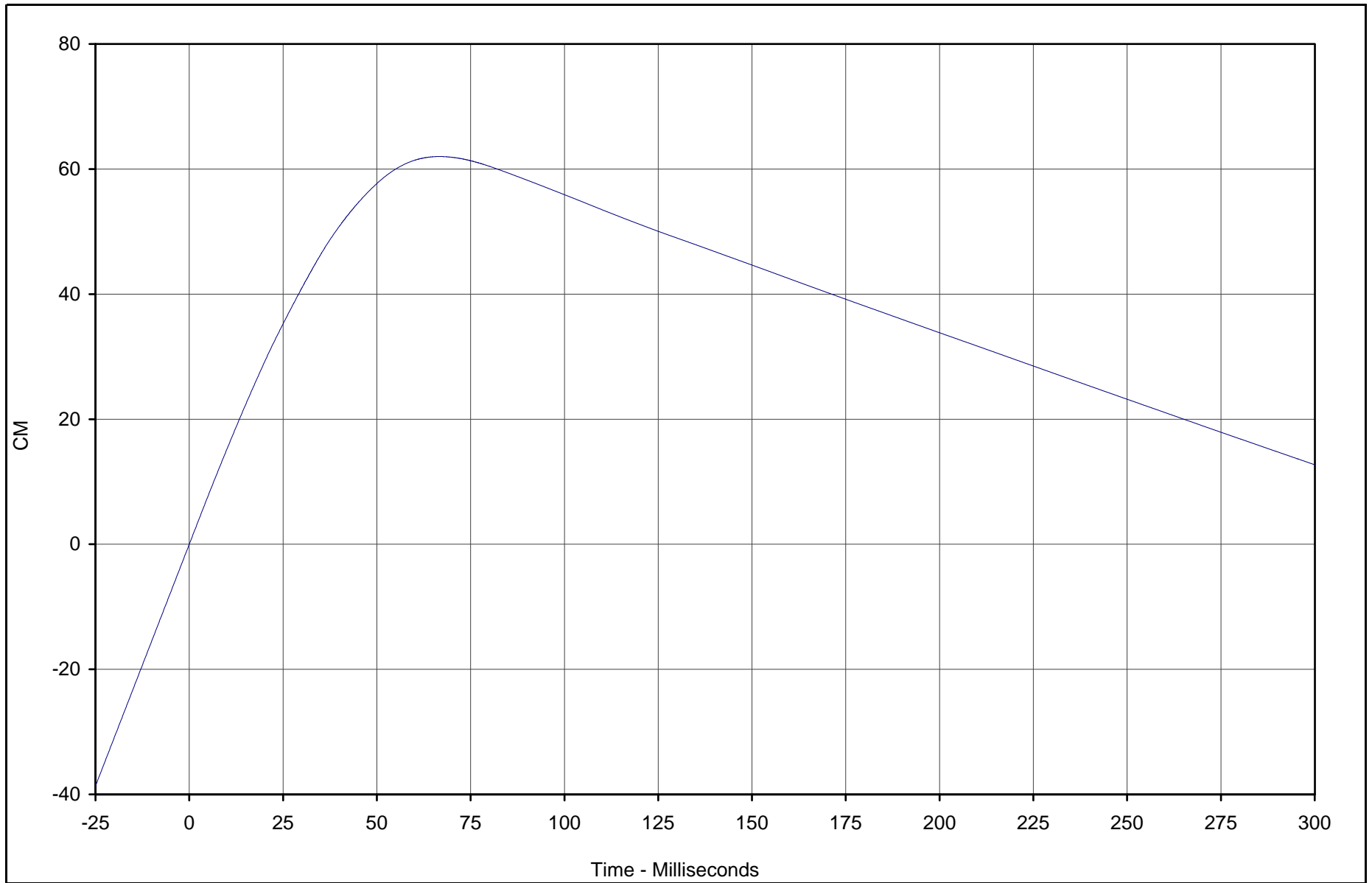
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-125



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Left Rear X Displ.	089	IN2	CM	62.0	66.7	0.0	0.0	180



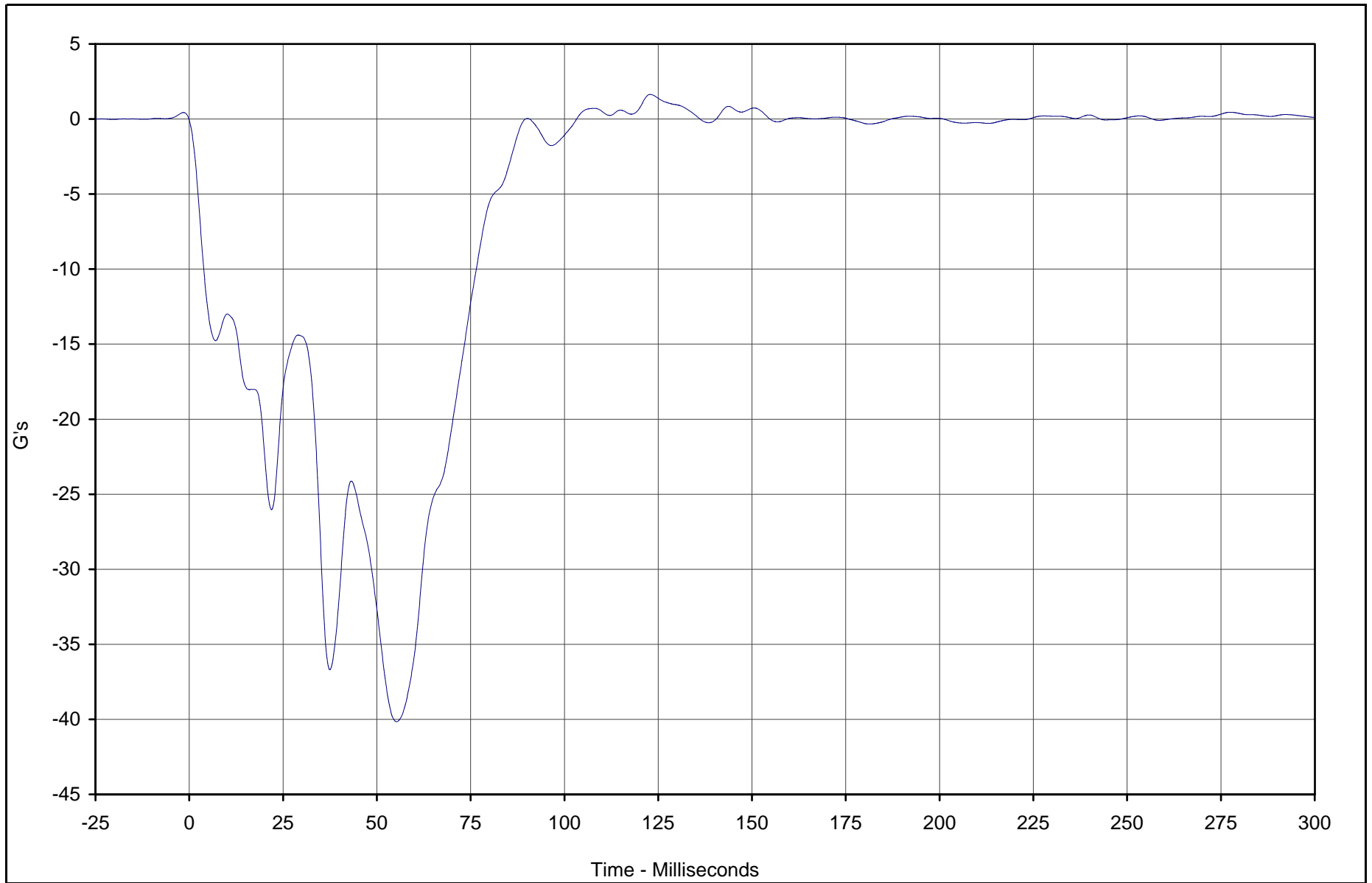
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-126



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Right Rear X	090	FIL	G's	1.6	122.9	-40.2	55.3	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

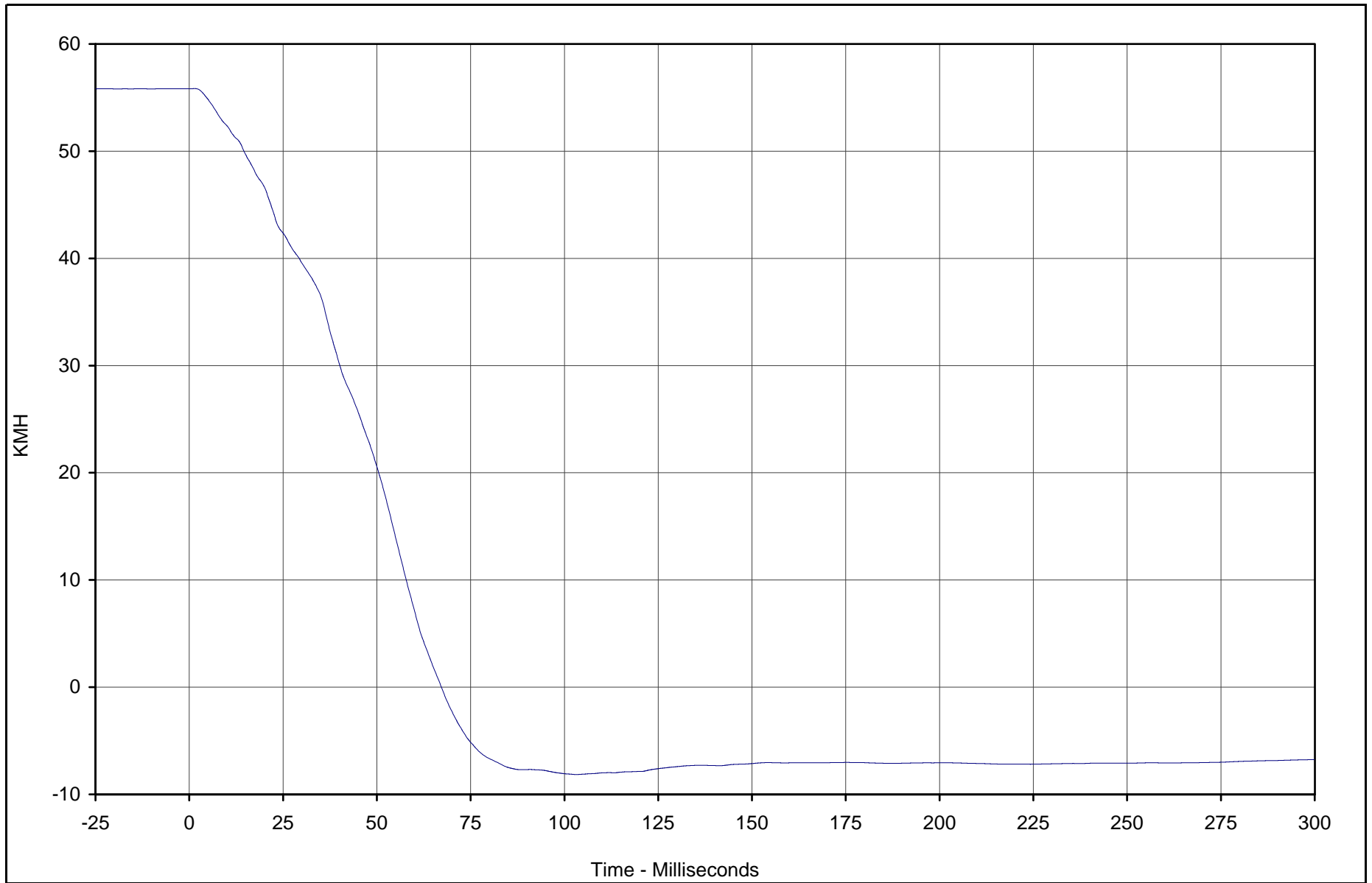
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-127



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Right Rear X Velocity	090	IN1	KMH	55.8	1.5	-8.1	103.1	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

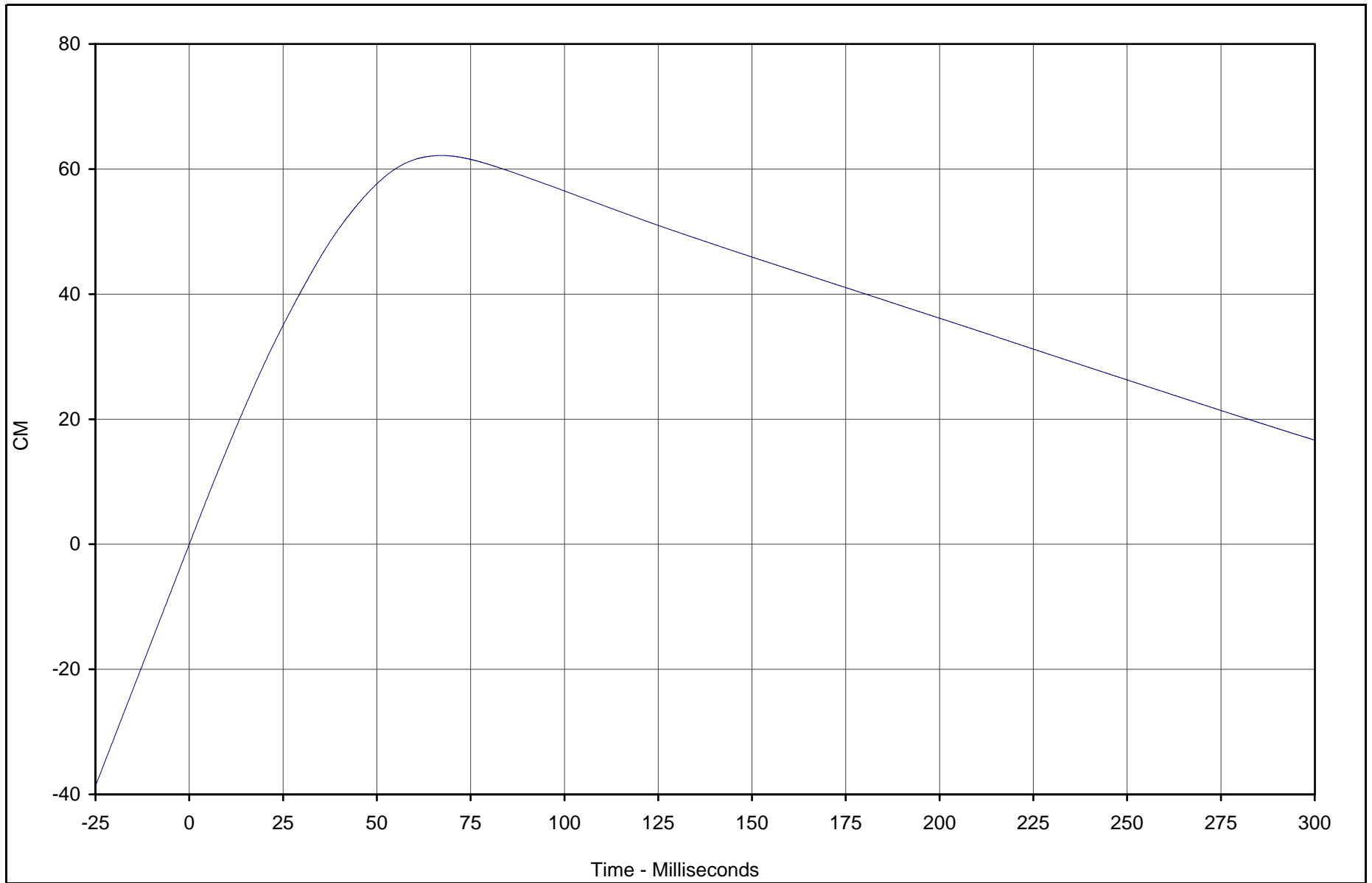
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-128



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Right Rear X Displ.	090	IN2	CM	62.2	67.2	0.0	0.0	180



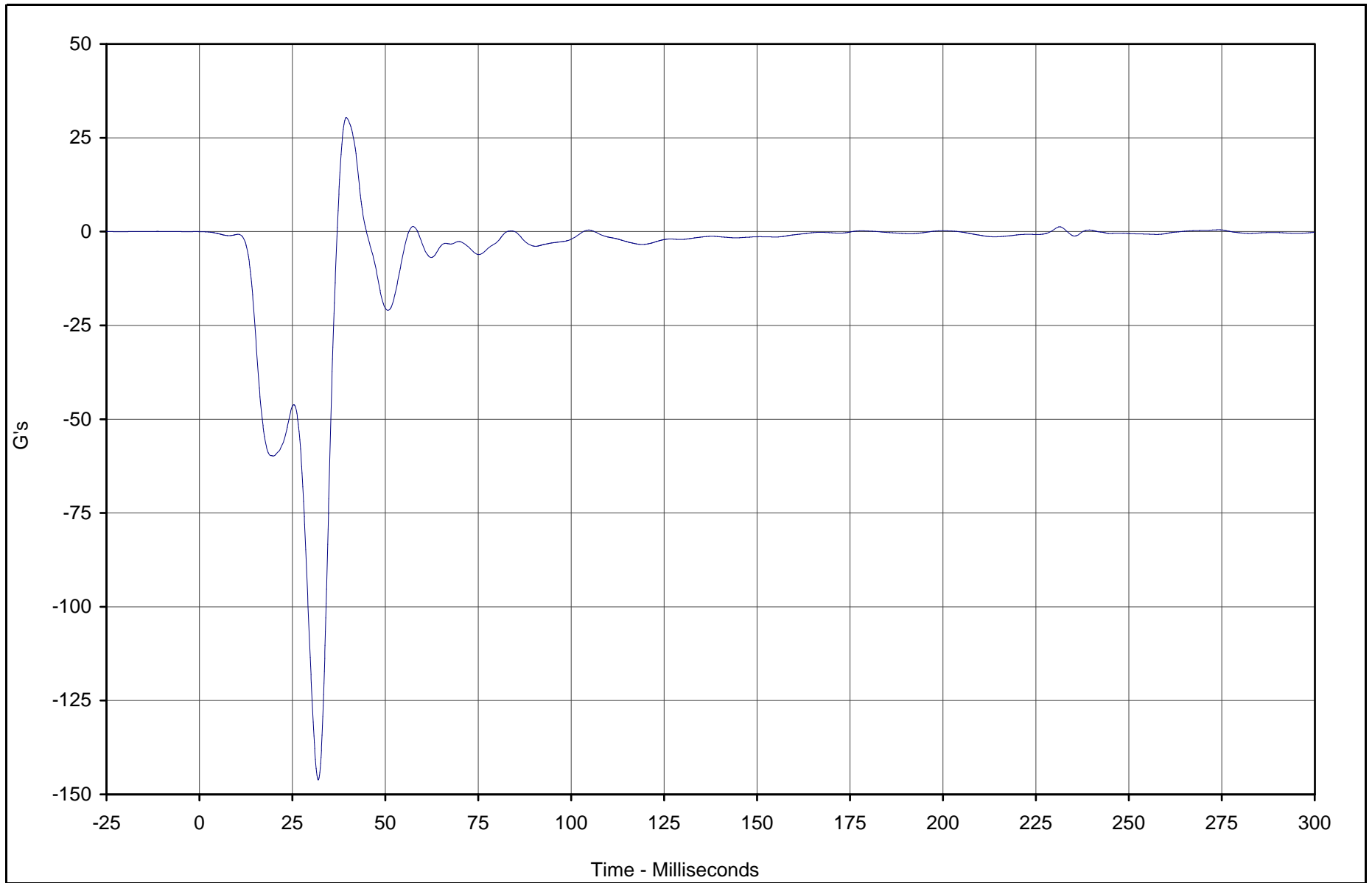
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-129



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Engine Top	091	FIL	G's	30.4	39.5	-146.2	32.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

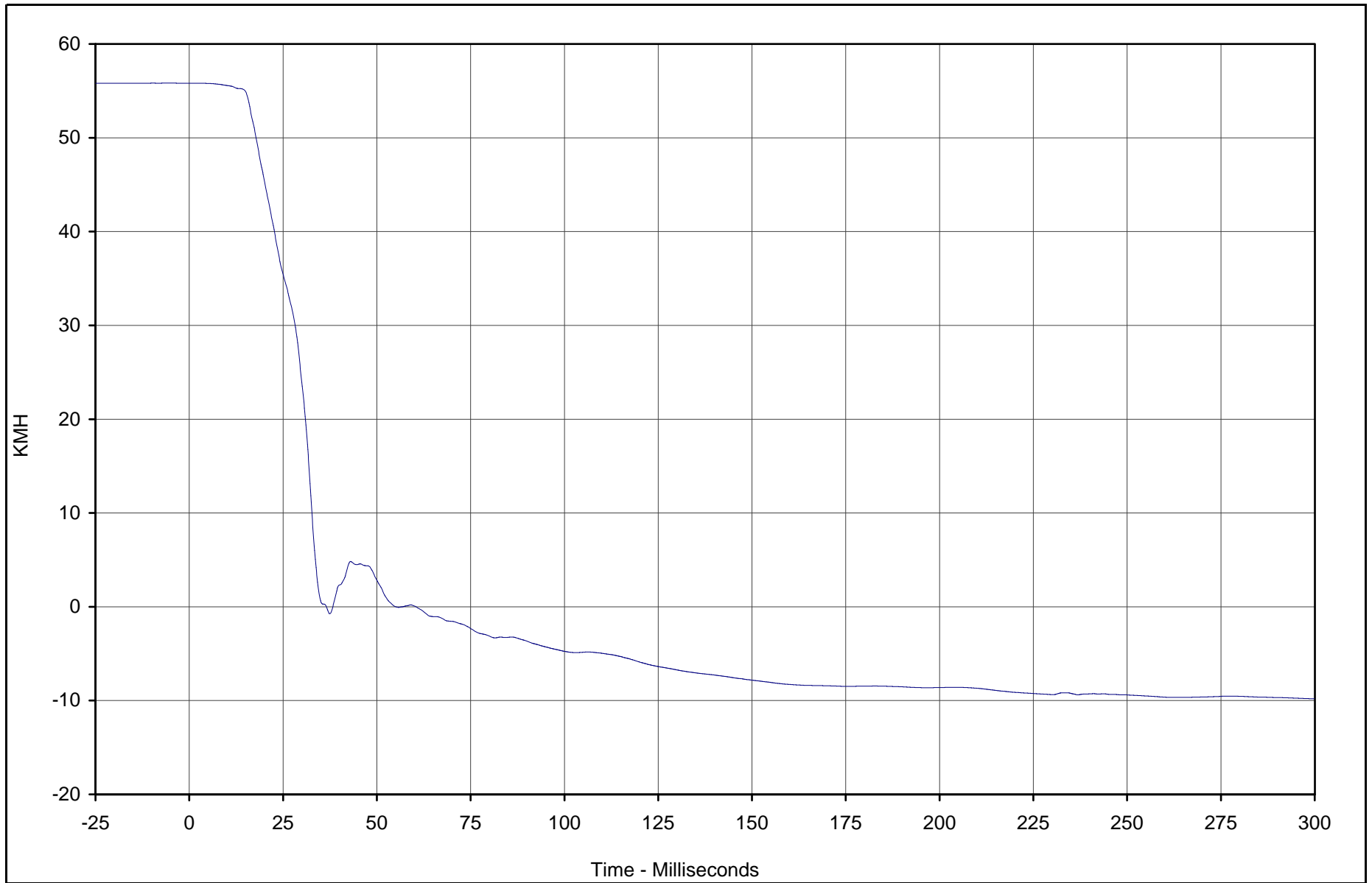
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-130



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Engine Top Velocity	091	IN1	KMH	55.8	0.0	-9.8	299.9	180



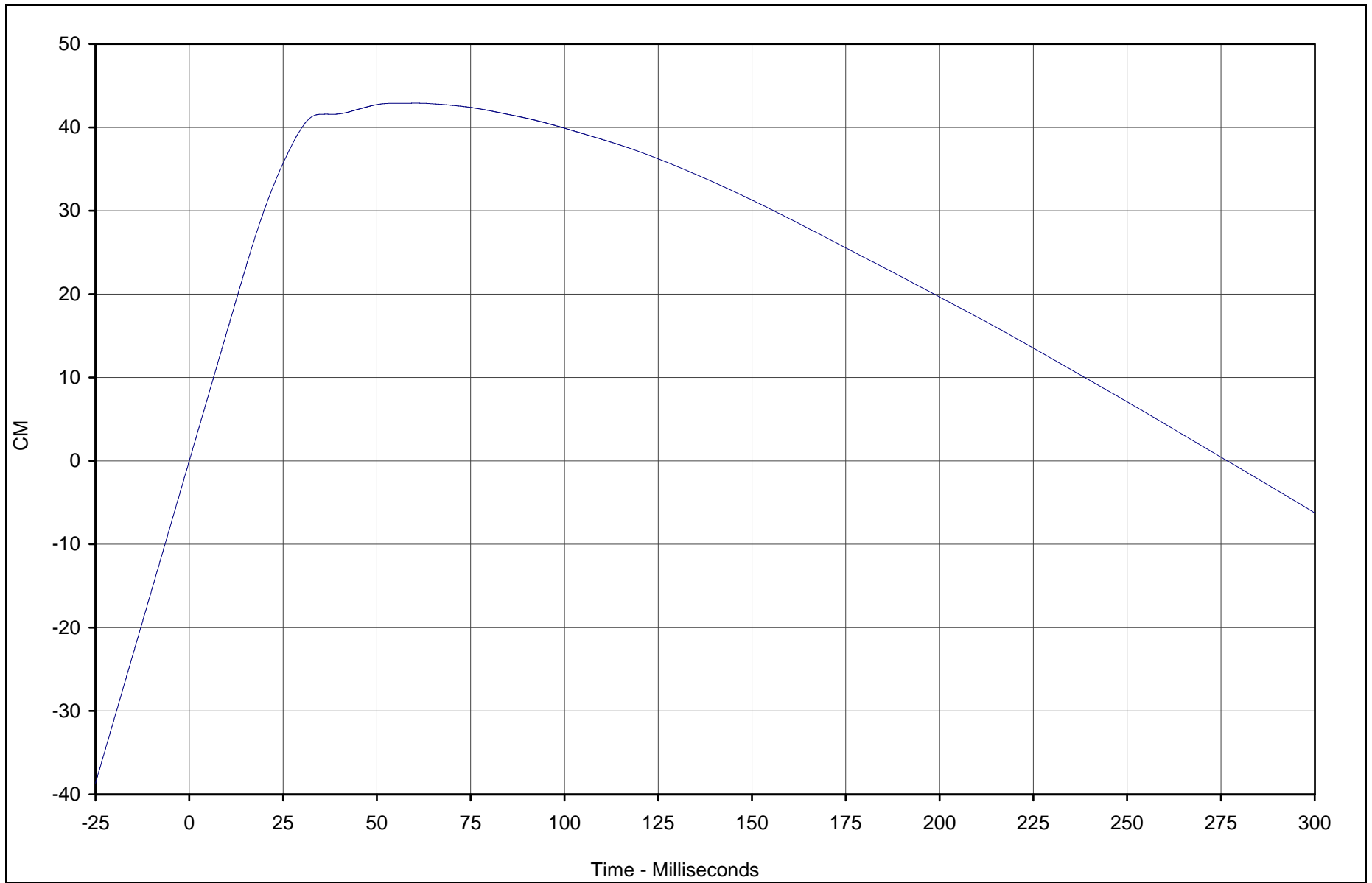
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-131



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Engine Top Displacement	091	IN2	CM	42.9	60.5	-6.2	299.9	180



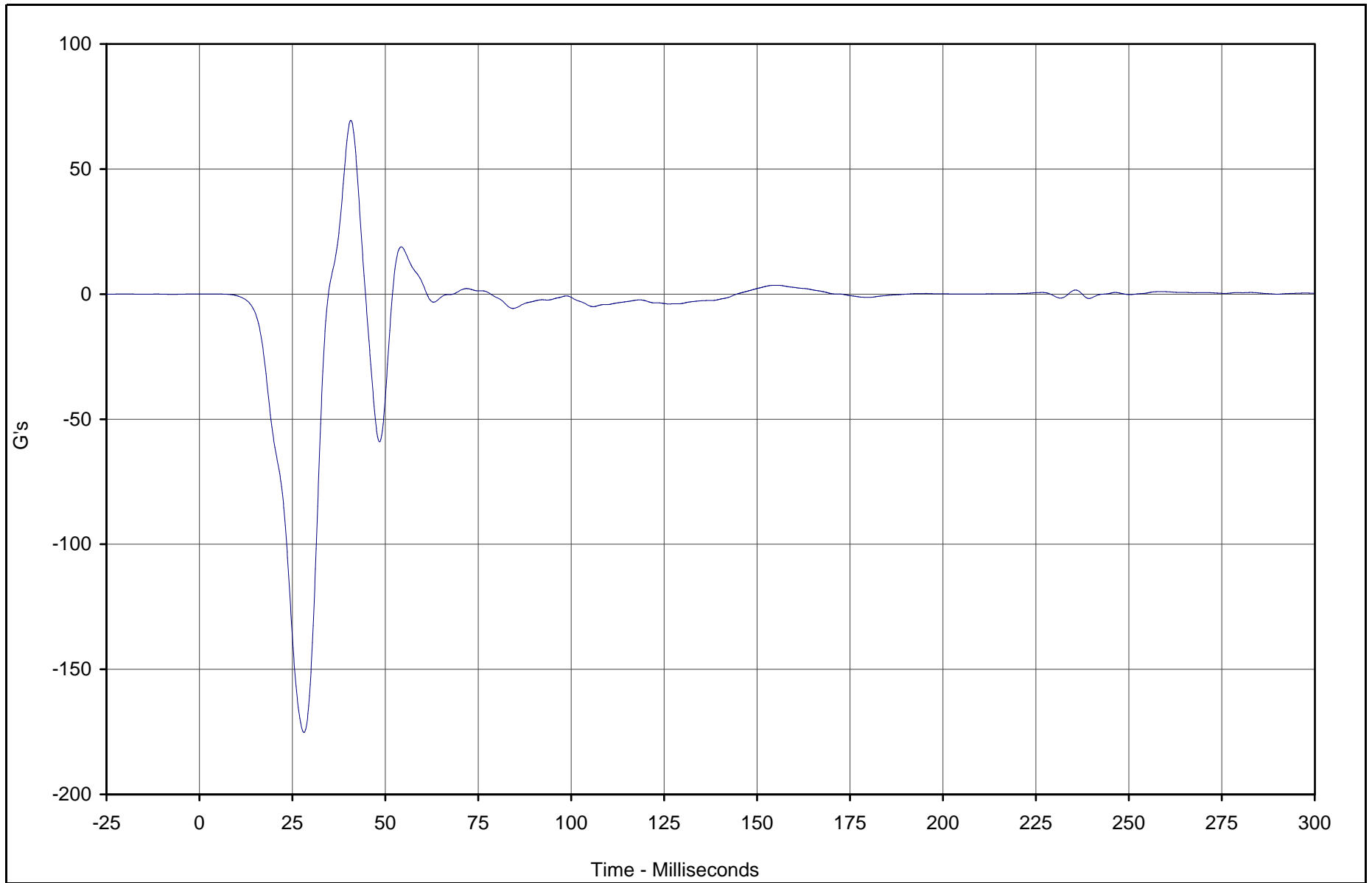
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-132



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Engine Bottom	092	FIL	G's	69.5	40.7	-175.3	28.1	60



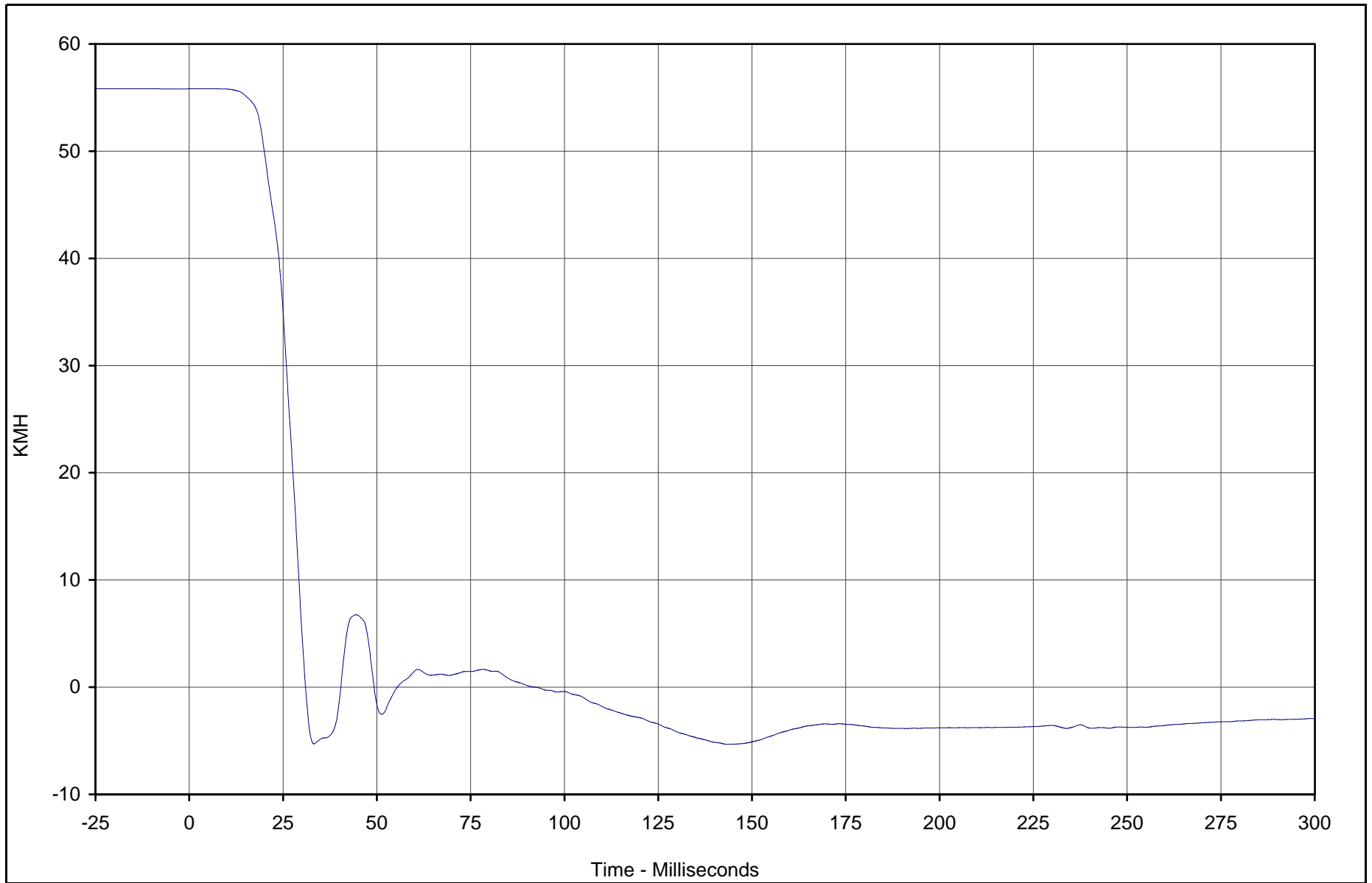
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-133



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Engine Bottom Velocity	092	IN1	KMH	55.8	6.6	-5.3	143.6	180



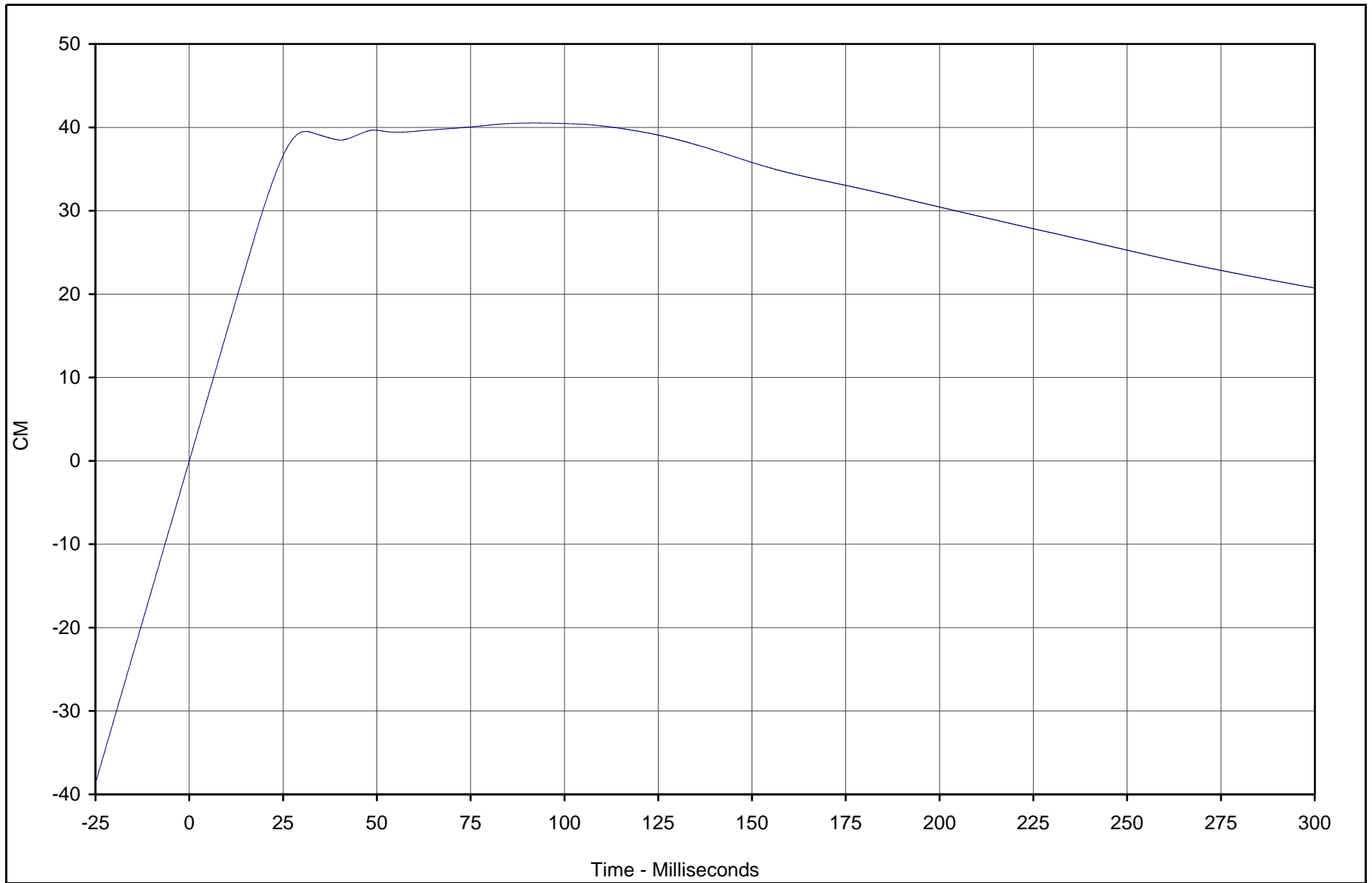
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-134



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Engine Bottom Displacement	092	IN2	CM	40.5	92.2	0.0	0.0	180



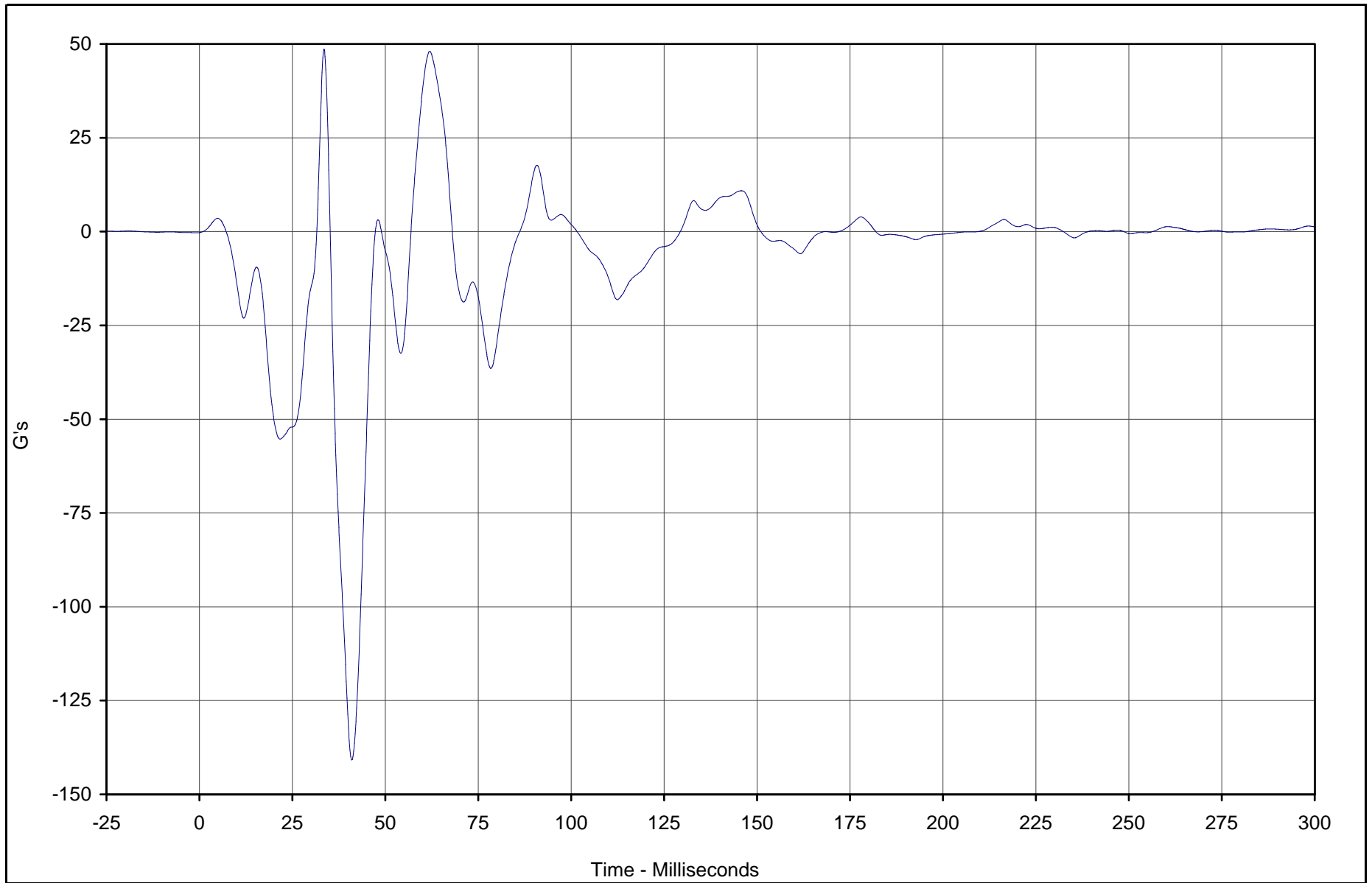
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-135



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Left Brake Caliper	093	FIL	G's	48.6	33.5	-140.9	41.0	60



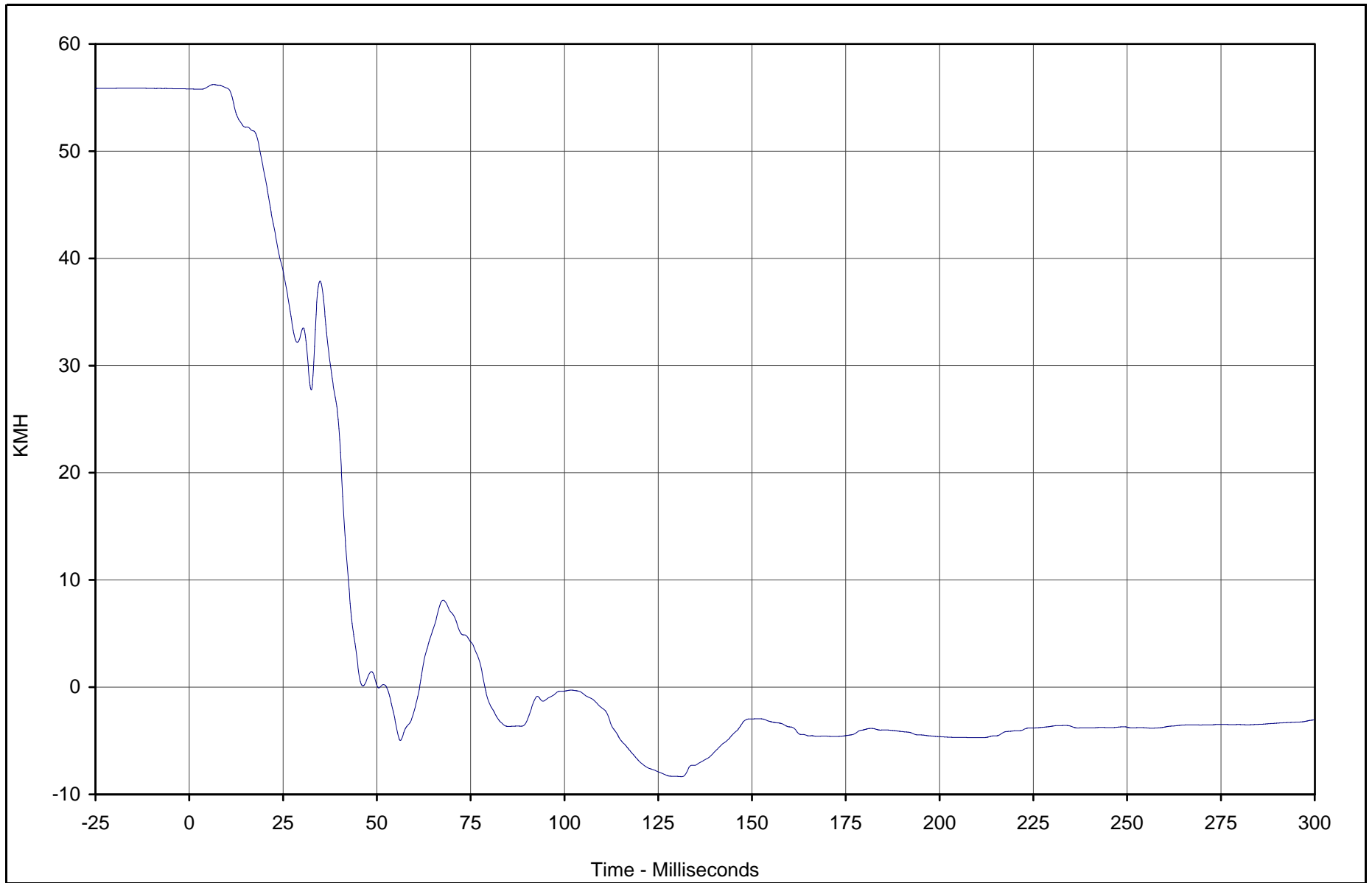
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-136



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Left Brake Caliper Velocity	093	IN1	KMH	56.2	6.5	-8.3	131.2	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

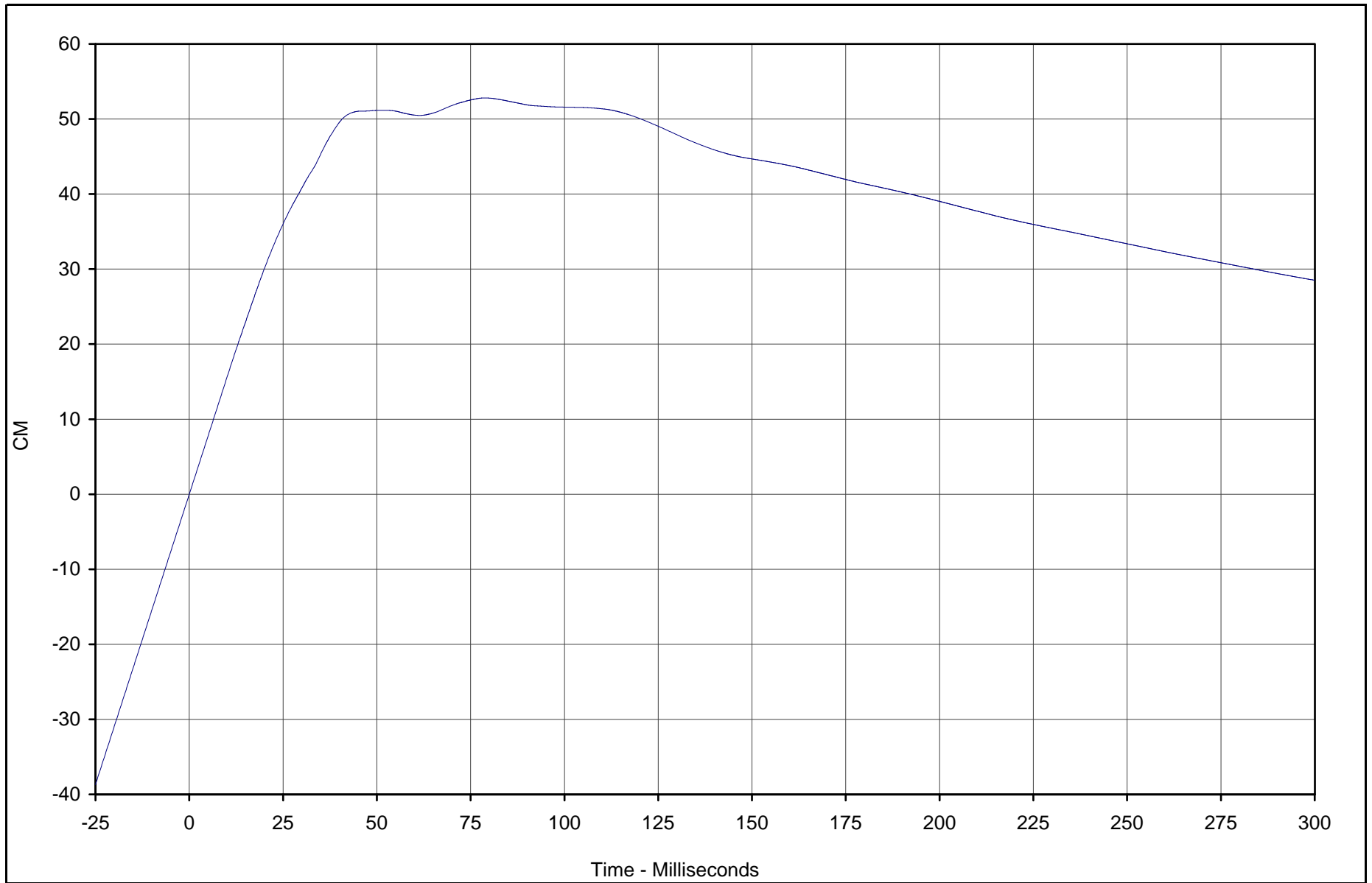
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-137



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Left Brake Caliper Displ.	093	IN2	CM	52.8	78.8	0.0	0.0	180



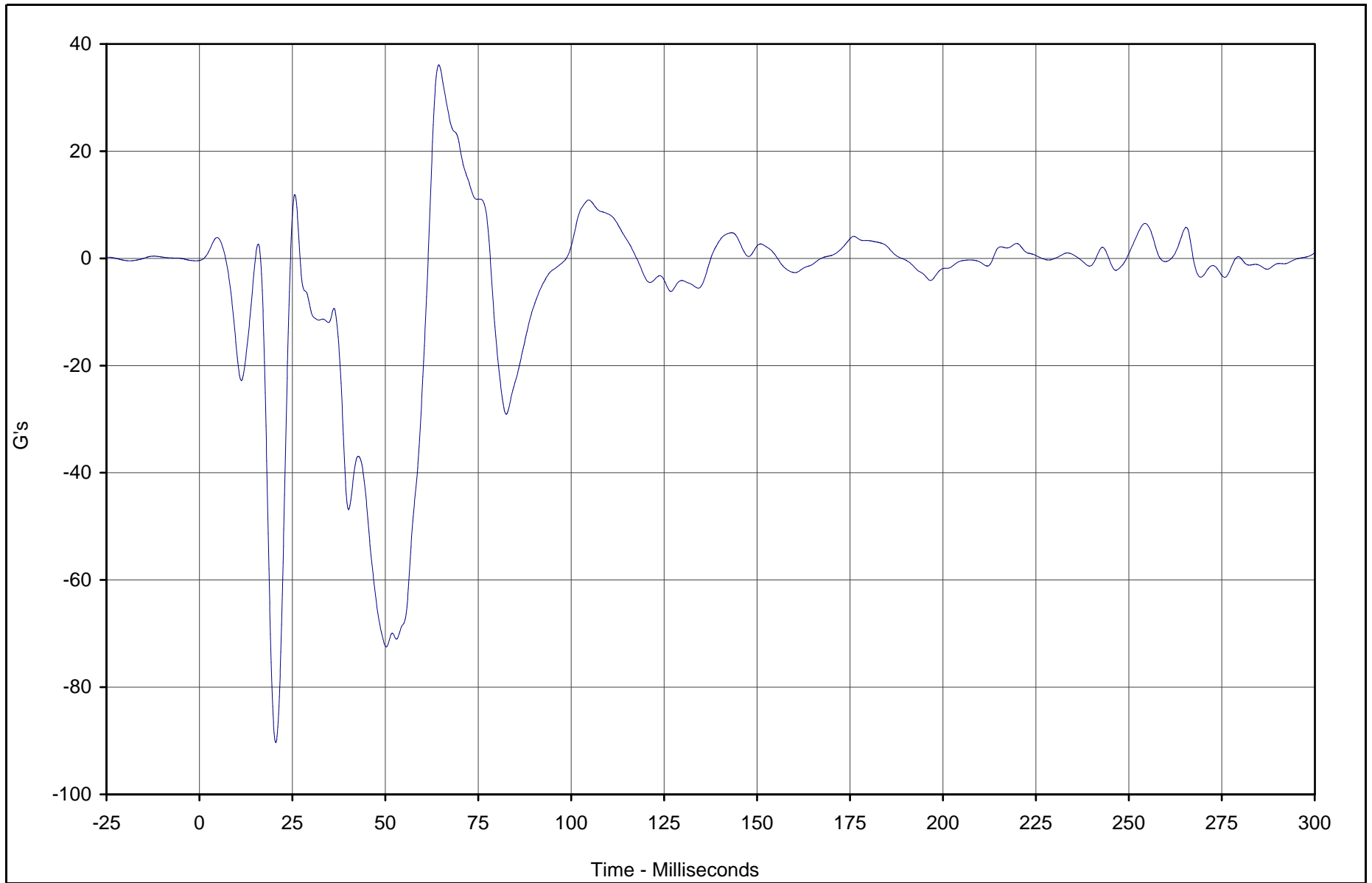
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

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Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Right Brake Caliper	094	FIL	G's	36.1	64.4	-90.3	20.5	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

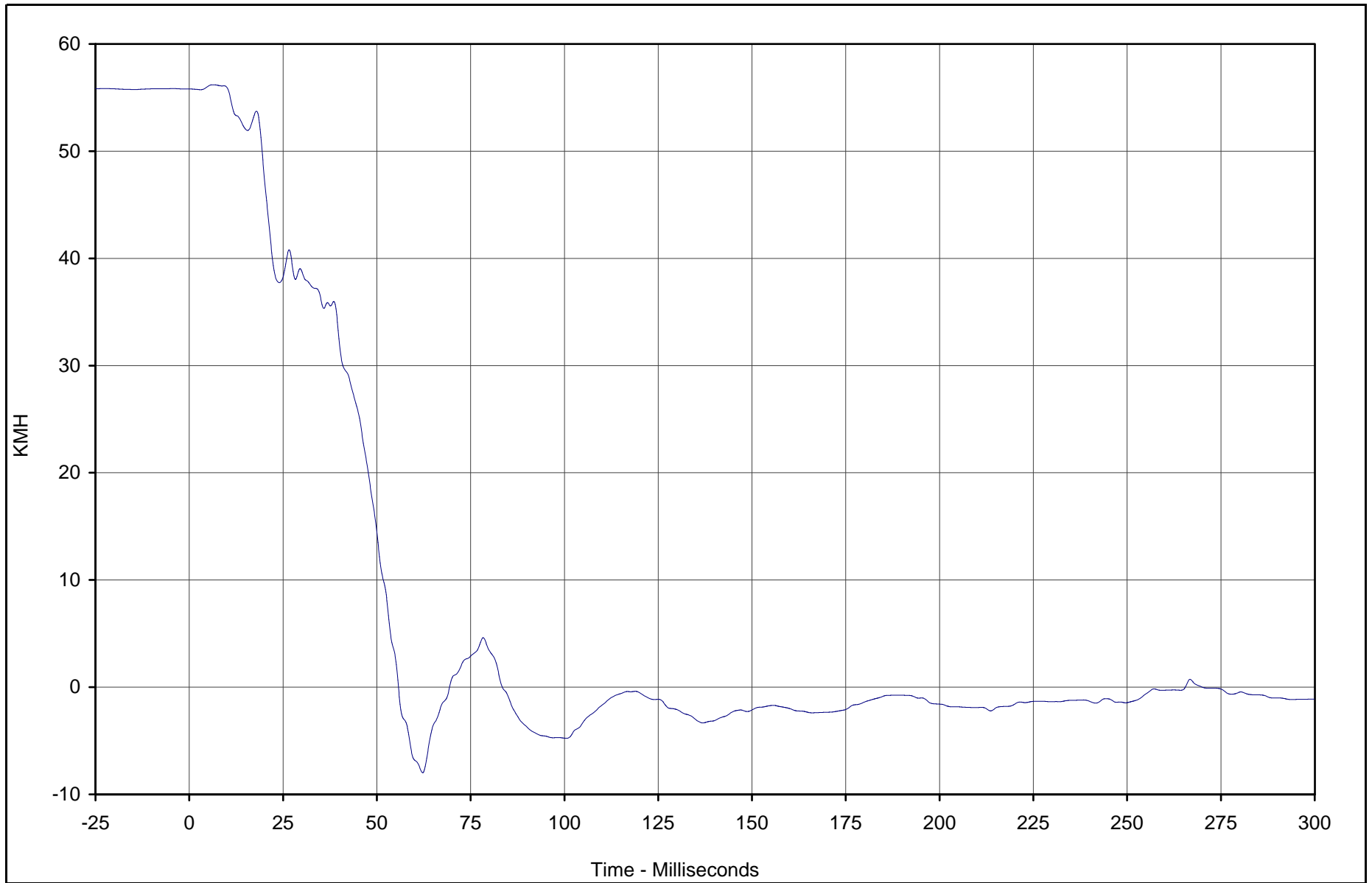
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-139



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Right Brake Caliper Velocity	094	IN1	KMH	56.2	6.2	-8.0	62.2	180



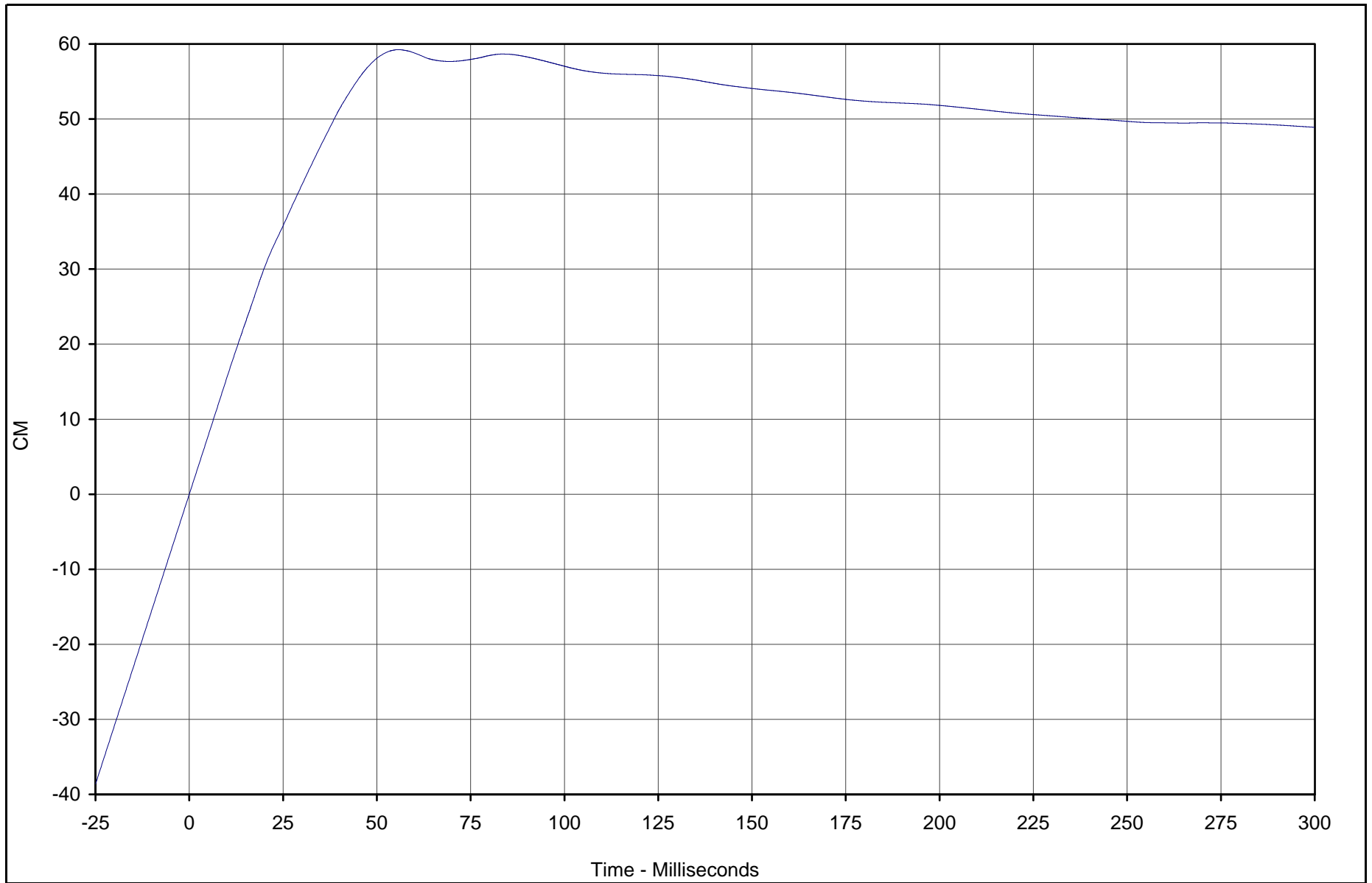
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-140



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Right Brake Caliper Displ.	094	IN2	CM	59.3	55.8	0.0	0.0	180



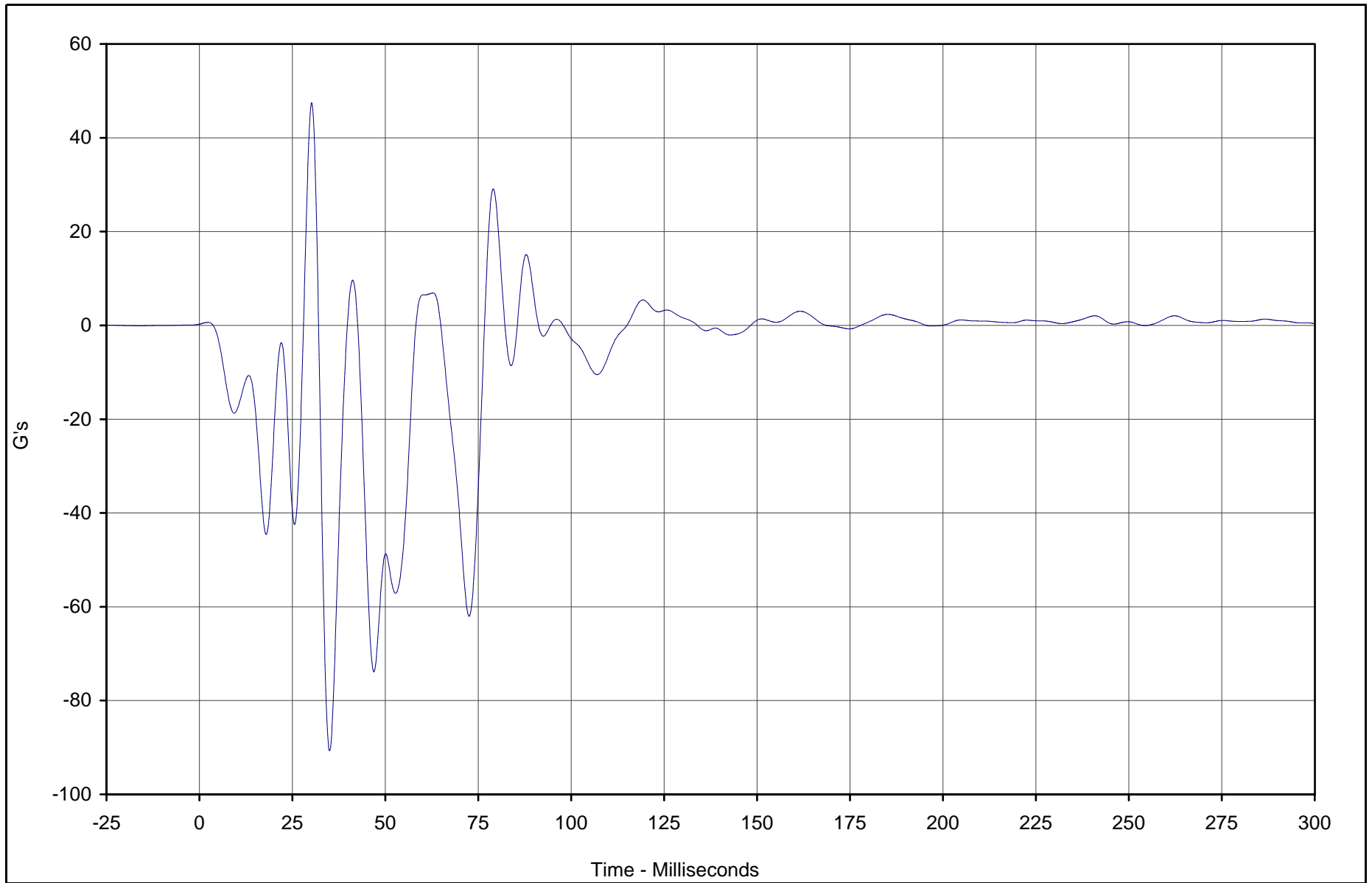
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-141



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Instrument Panel	095	FIL	G's	47.5	30.2	-90.7	35.0	60



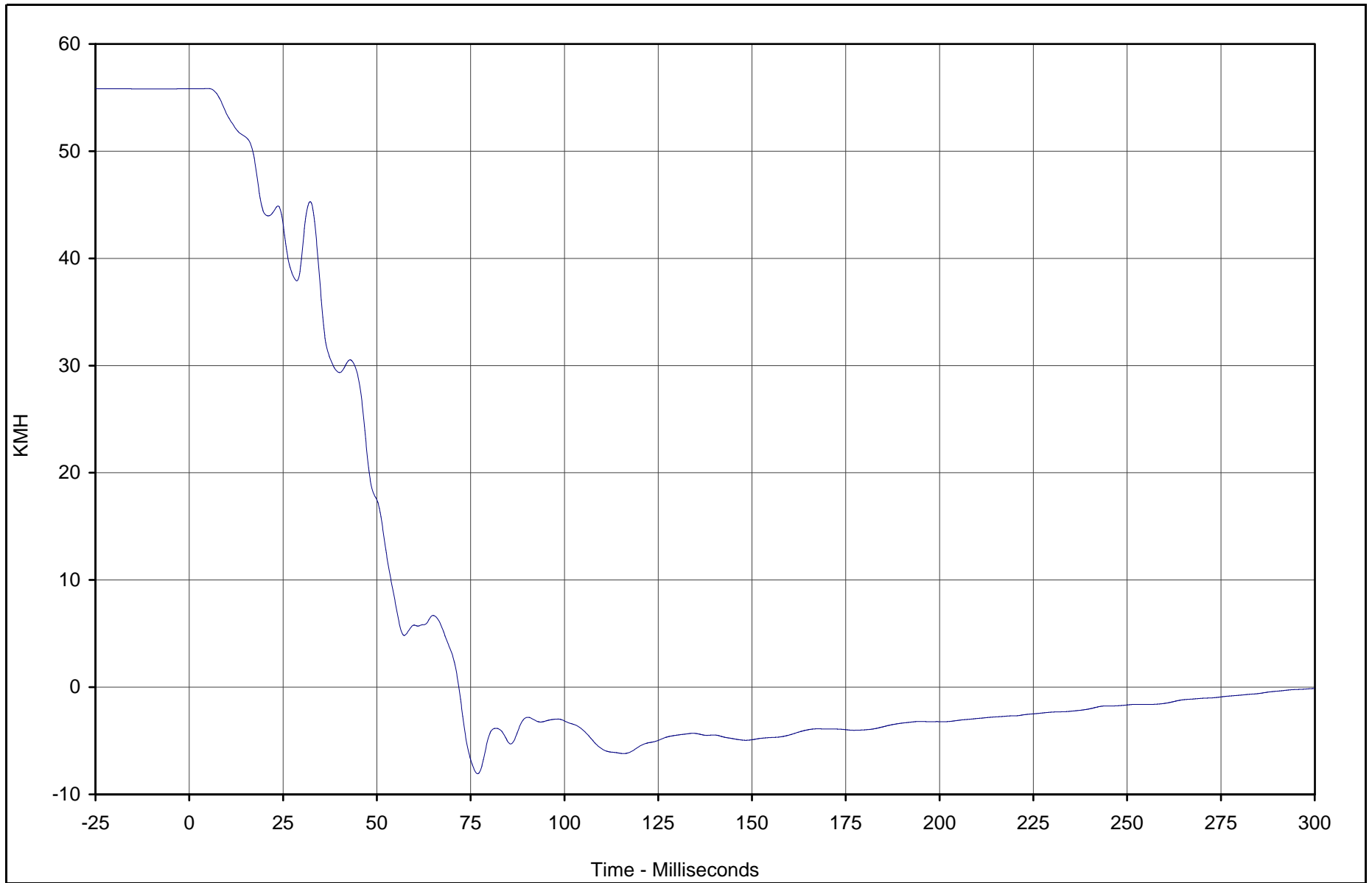
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-142



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Instrument Panel Velocity	095	IN1	KMH	55.8	5.0	-8.1	76.9	180



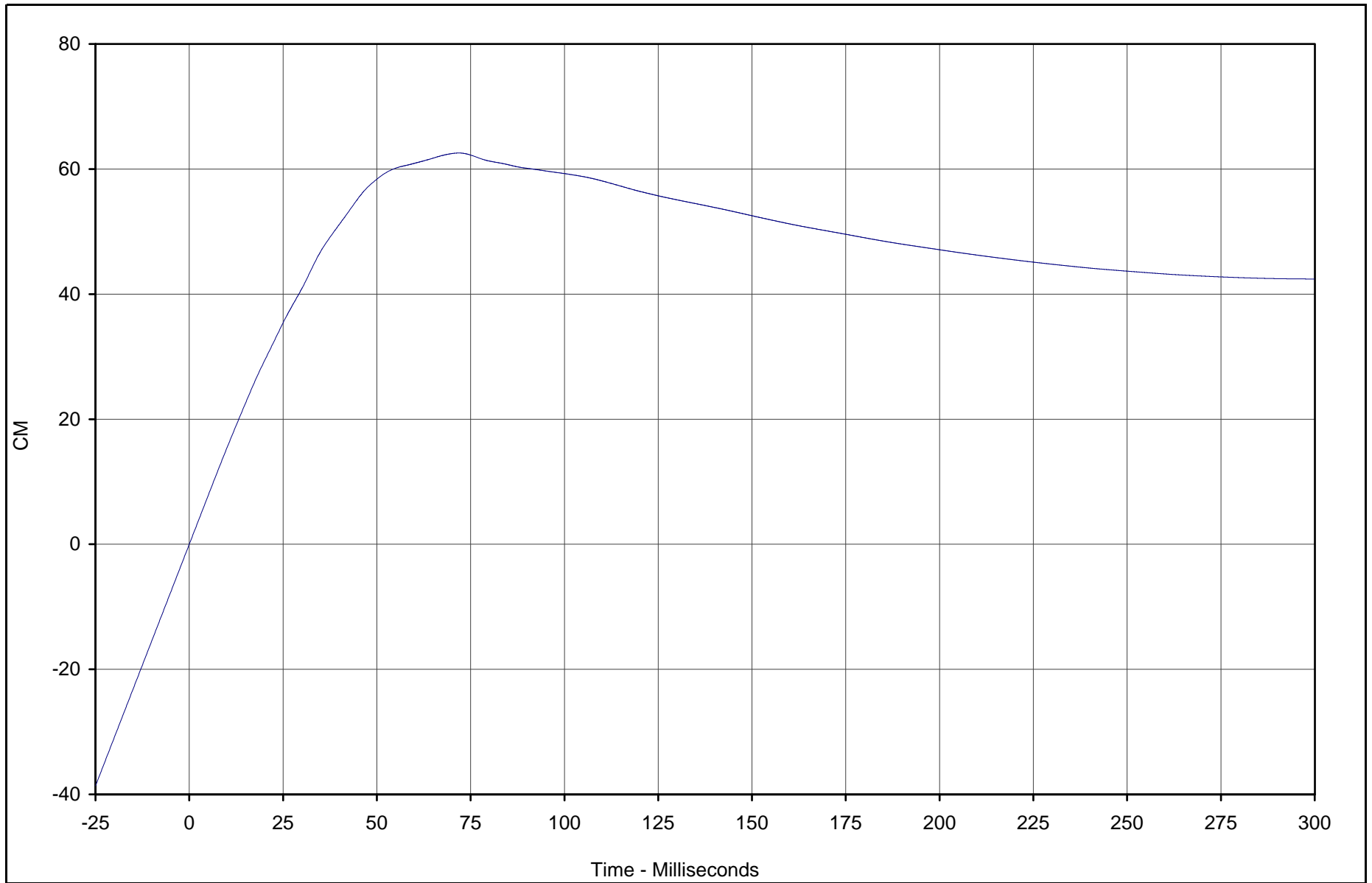
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-143



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Instrument Panel Displacement	095	IN2	CM	62.6	71.9	0.0	0.0	180



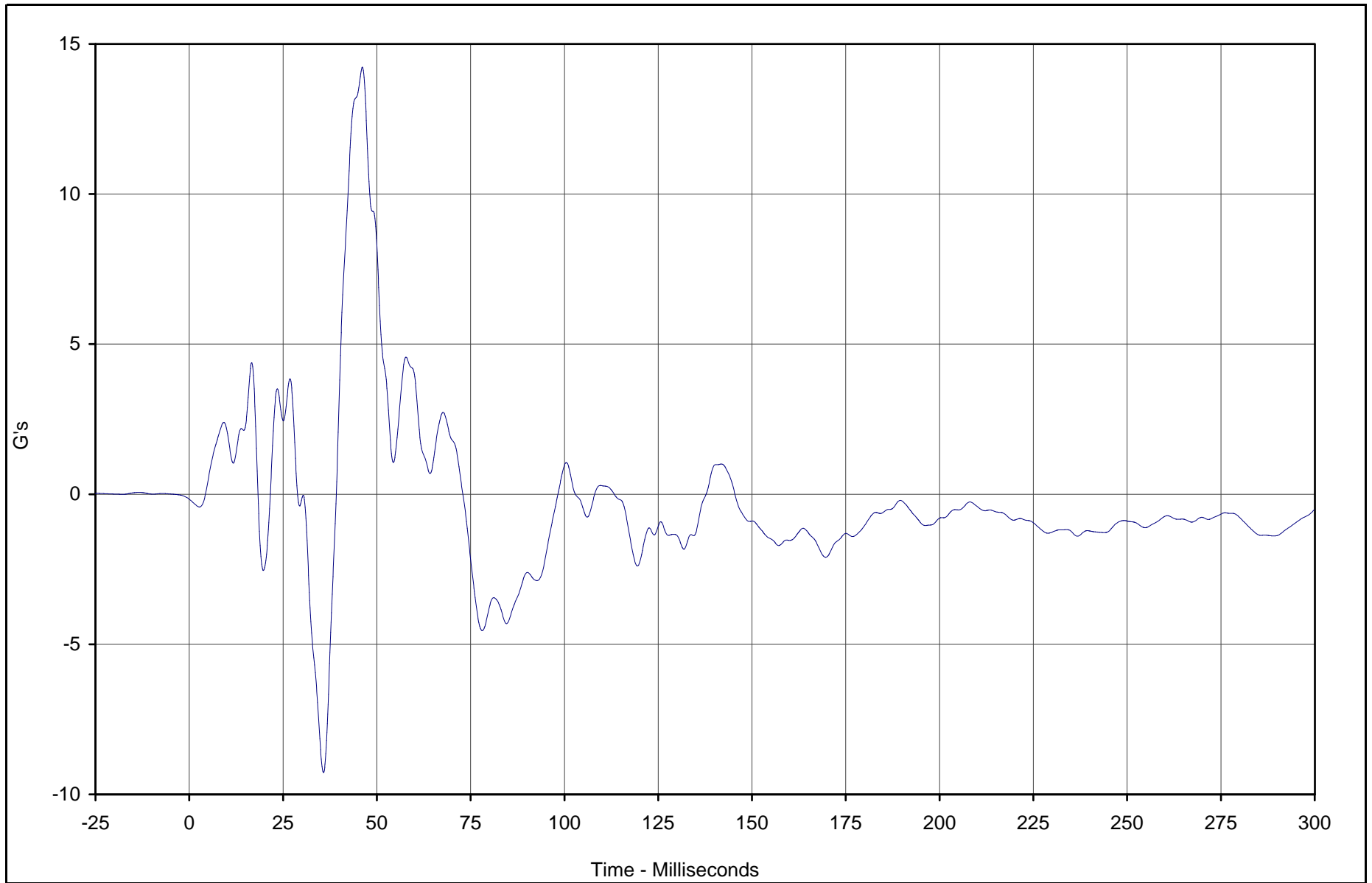
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-144



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Left Rear Z	096	FIL	G's	14.2	46.1	-9.3	35.8	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

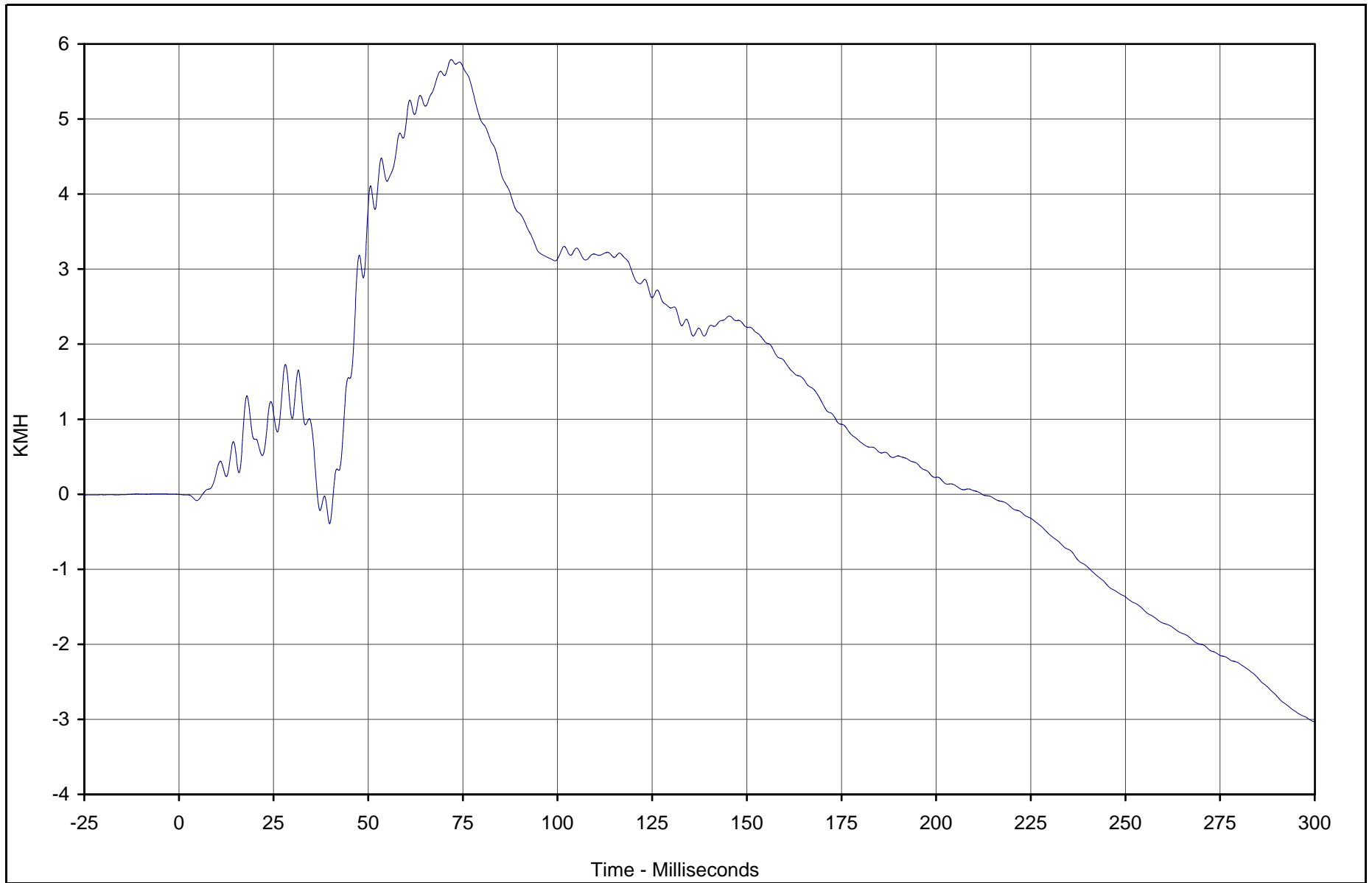
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-145



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Left Rear Z Velocity	096	IN1	KMH	5.8	71.9	-3.0	299.9	180



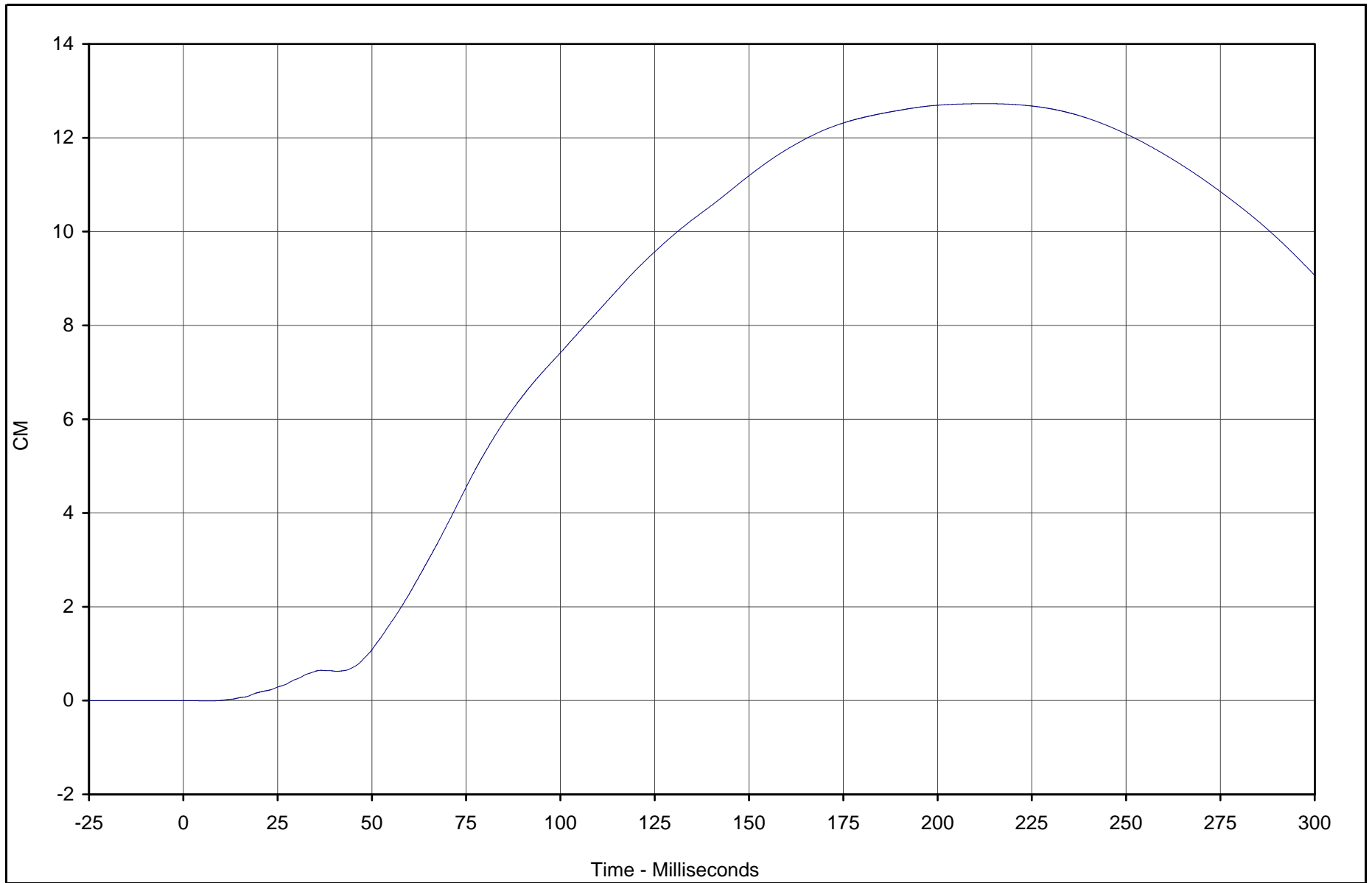
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-146



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Left Rear Z Displ.	096	IN2	CM	12.7	212.1	0.0	6.3	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

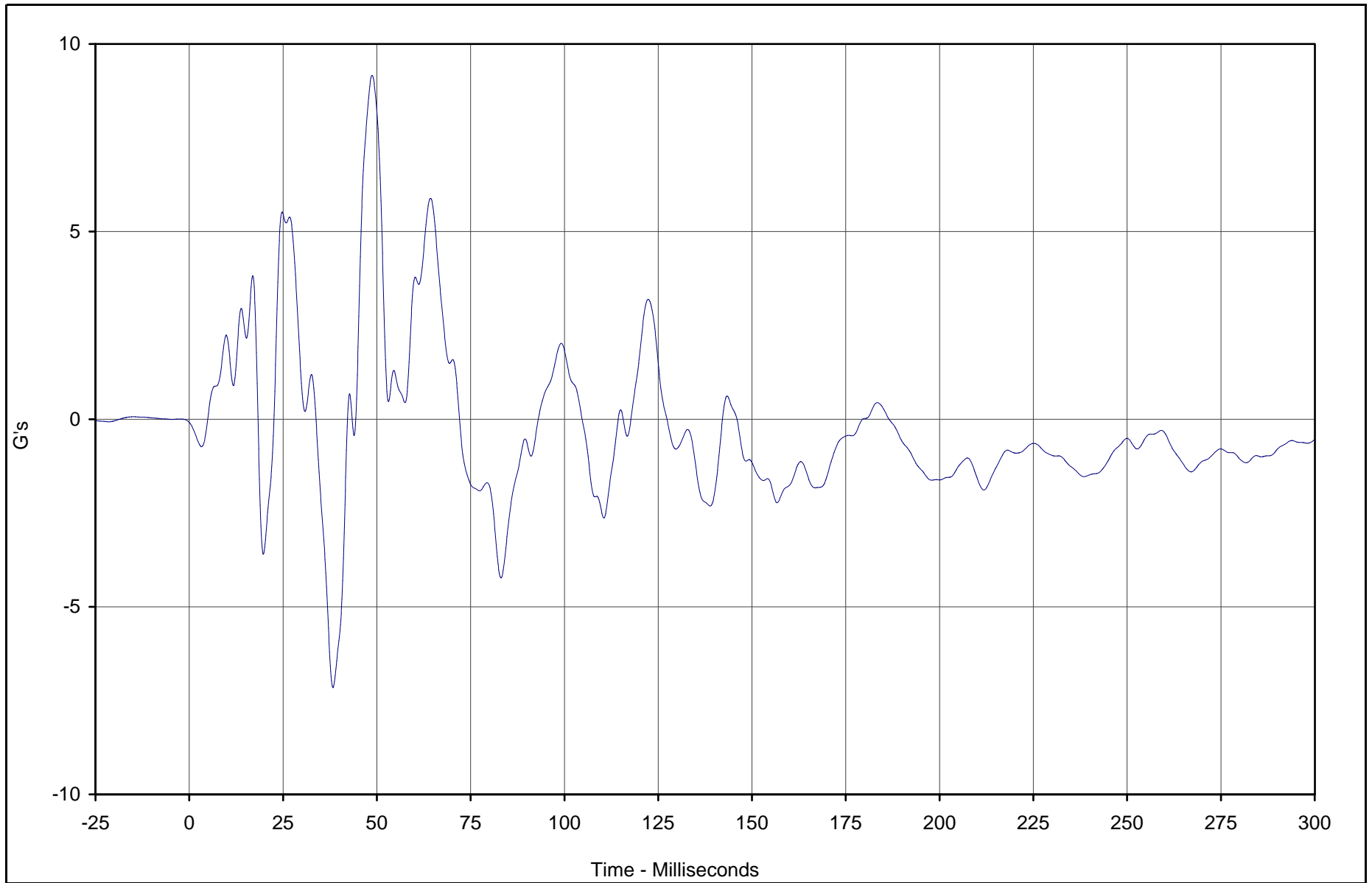
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

B-147



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Right Rear Z	097	FIL	G's	9.2	48.7	-7.2	38.3	60



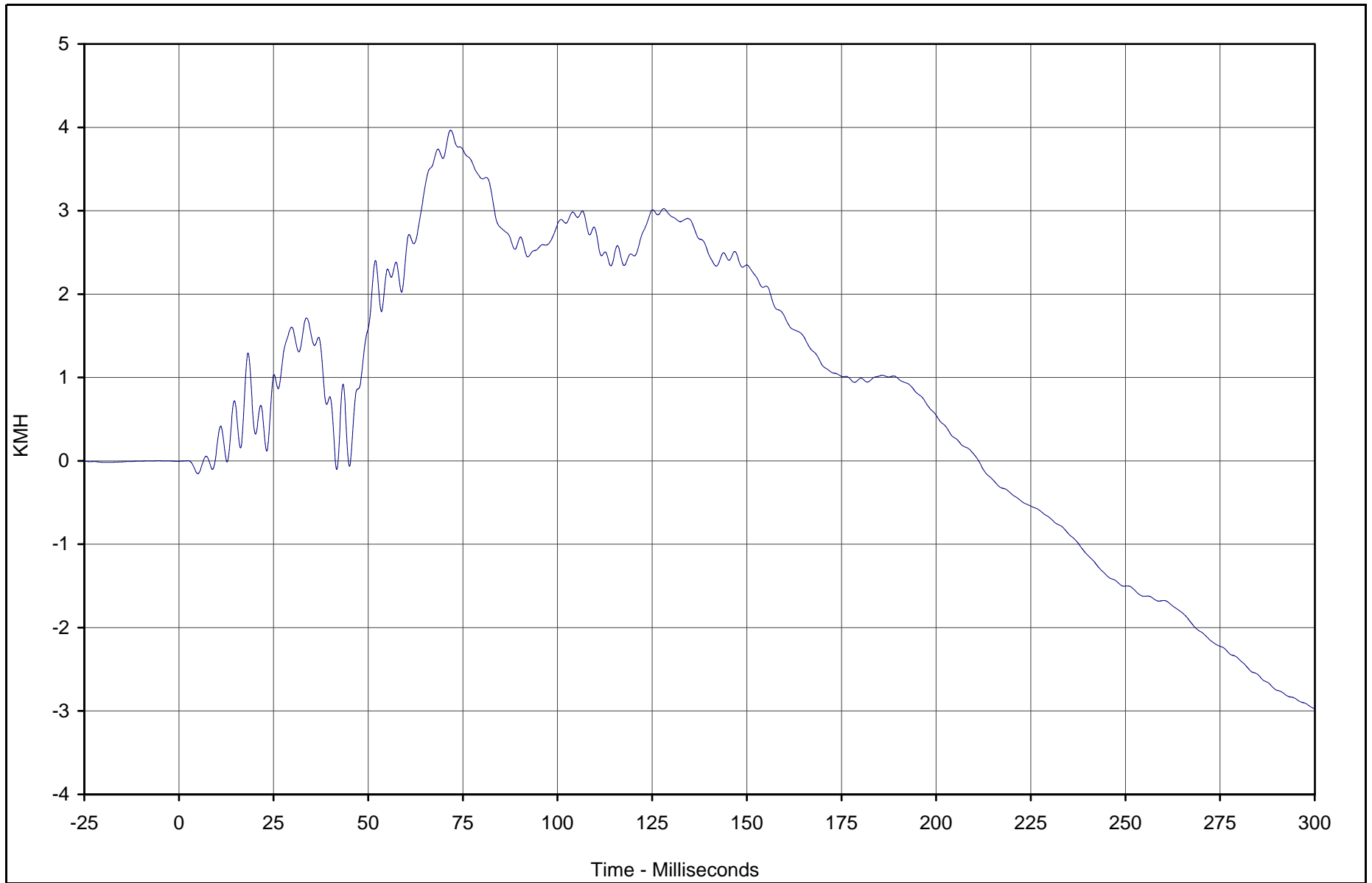
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-148



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Right Rear Z Velocity	097	IN1	KMH	4.0	71.8	-3.0	299.9	180



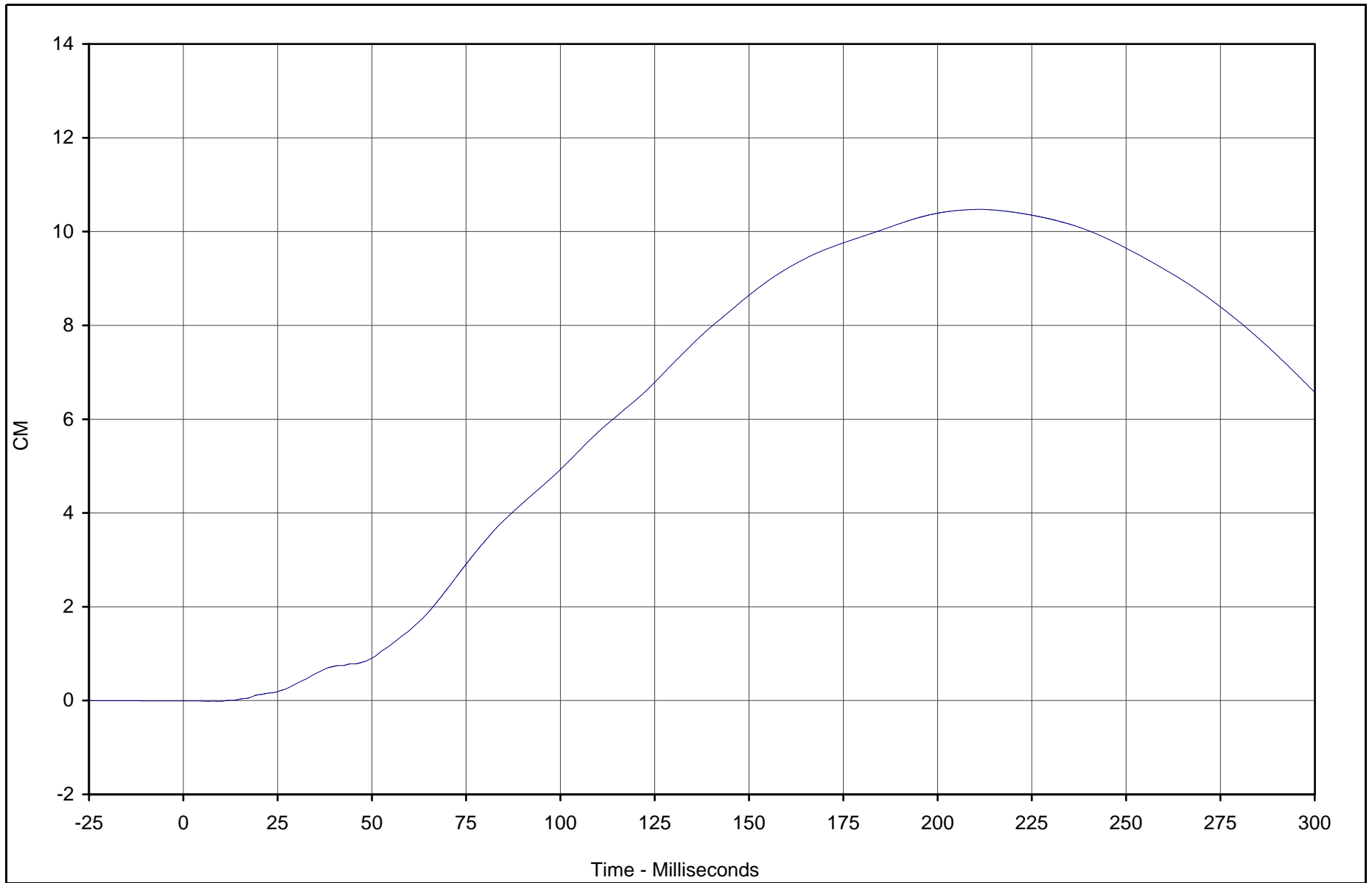
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

B-149



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Vehicle Right Rear Z Displ.	097	IN2	CM	10.5	211.2	0.0	9.5	180



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

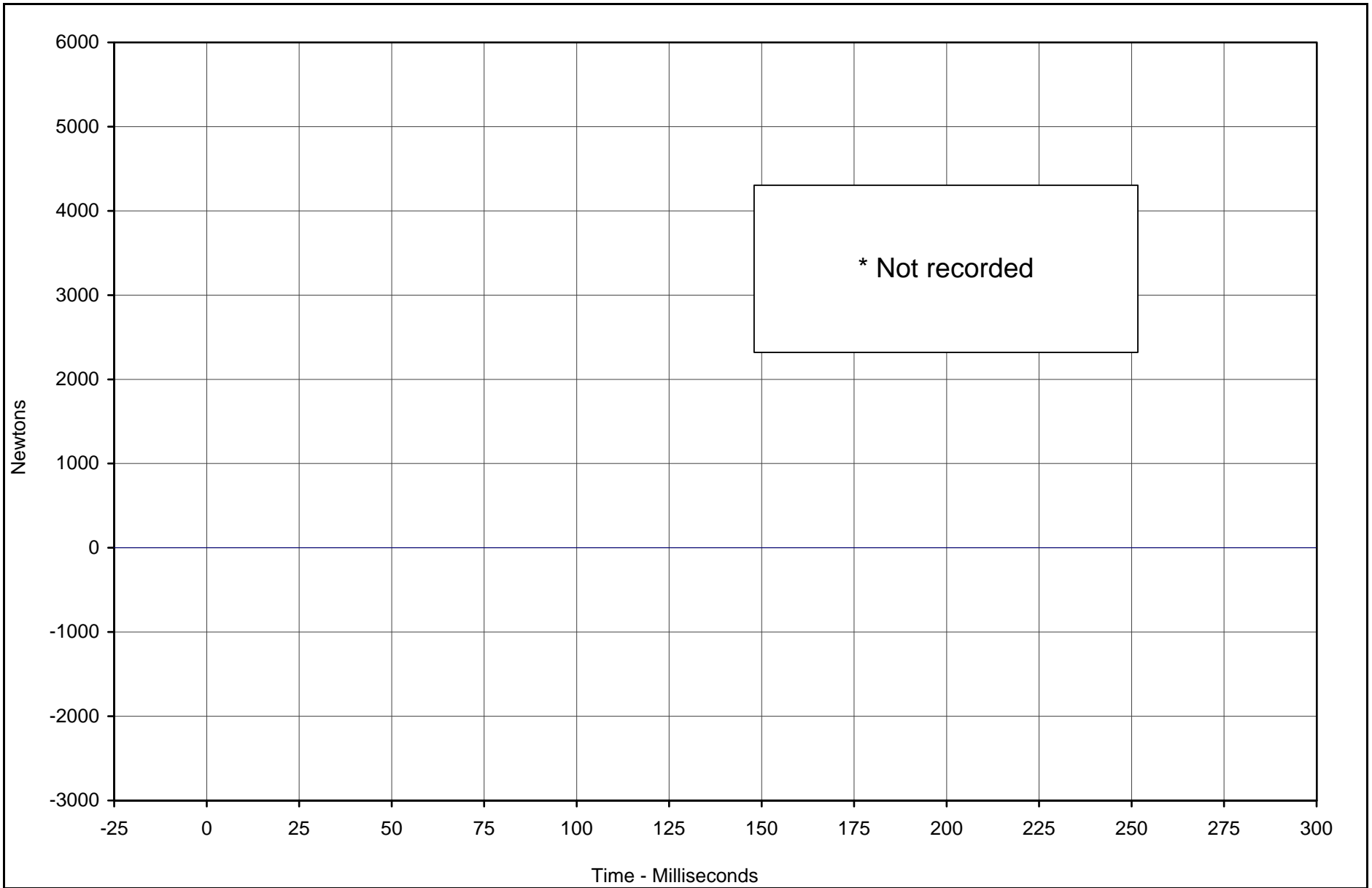
NHTSA No.: M20505

KAR22001-19

## **APPENDIX C**

### **LOAD CELL BARRIER DATA PLOTS**

C-1



\* Not recorded

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force A1	098	FIL	Newtons	0.0	0.0	0.0	0.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

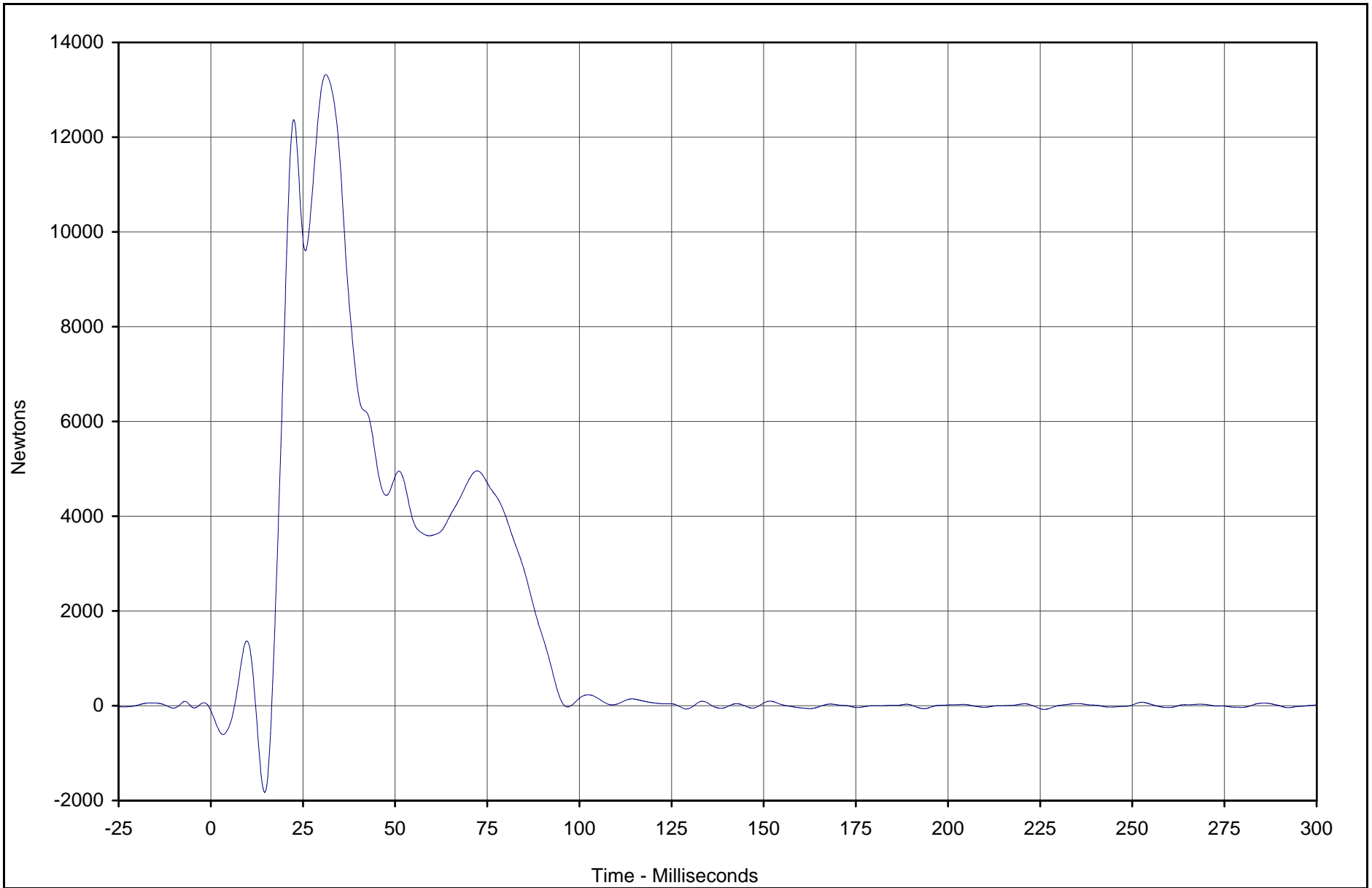
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-2



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force A2	099	FIL	Newtons	13318.1	31.2	-1829.8	14.6	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

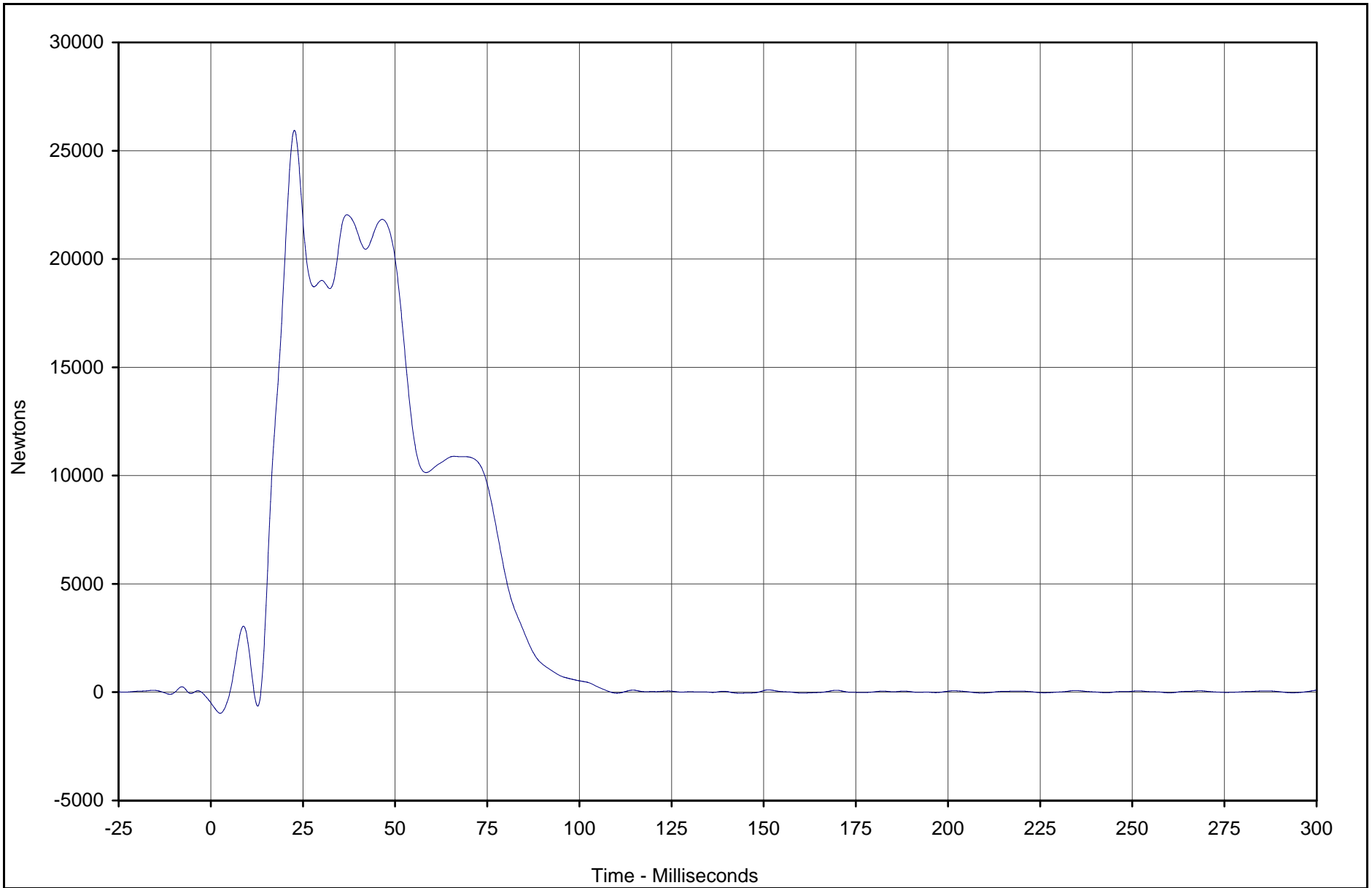
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-3



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force A3	100	FIL	Newtons	25938.3	22.7	-973.0	2.6	60



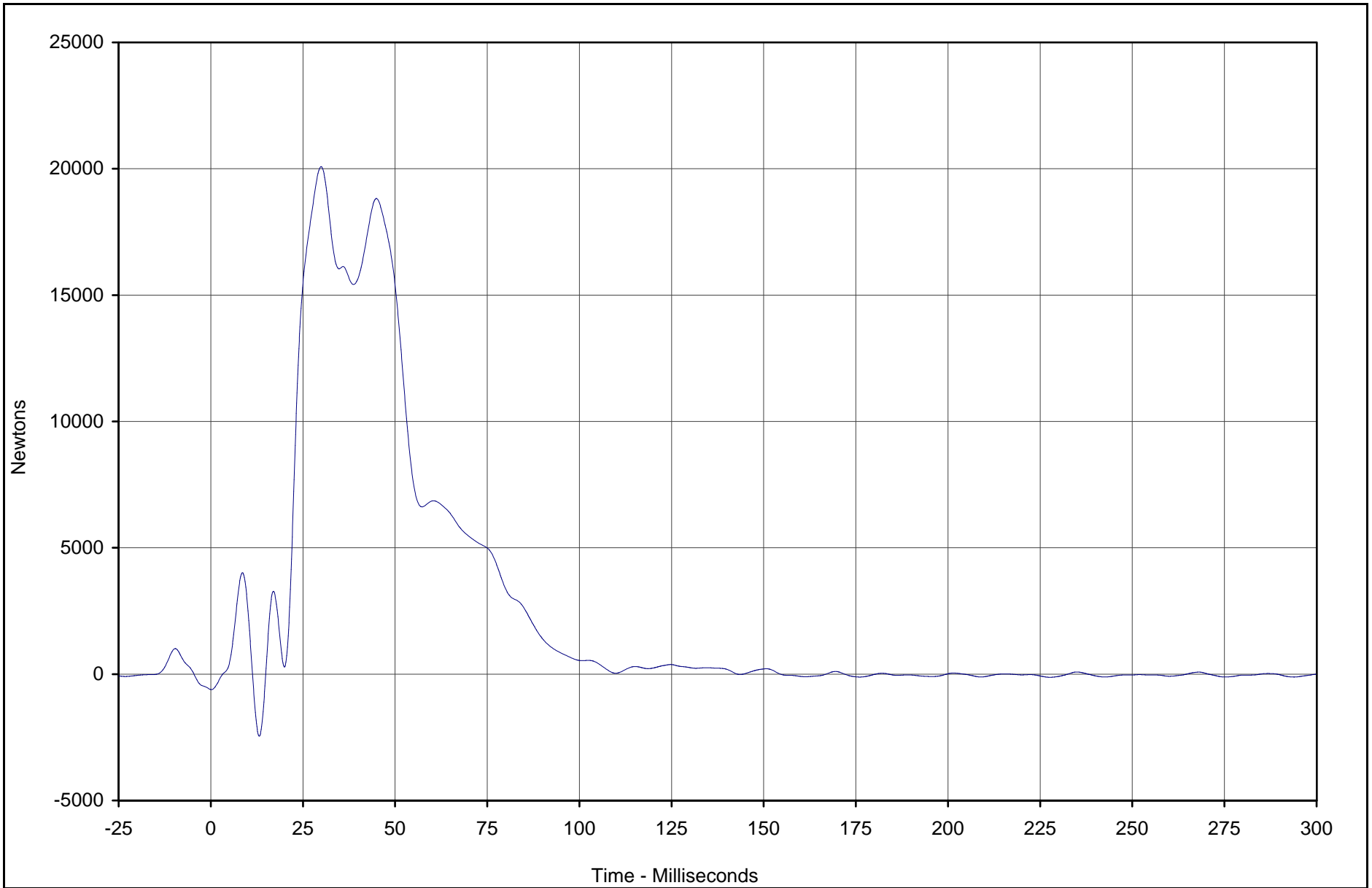
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-4



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force A4	101	FIL	Newtons	20084.9	29.9	-2454.7	13.1	60



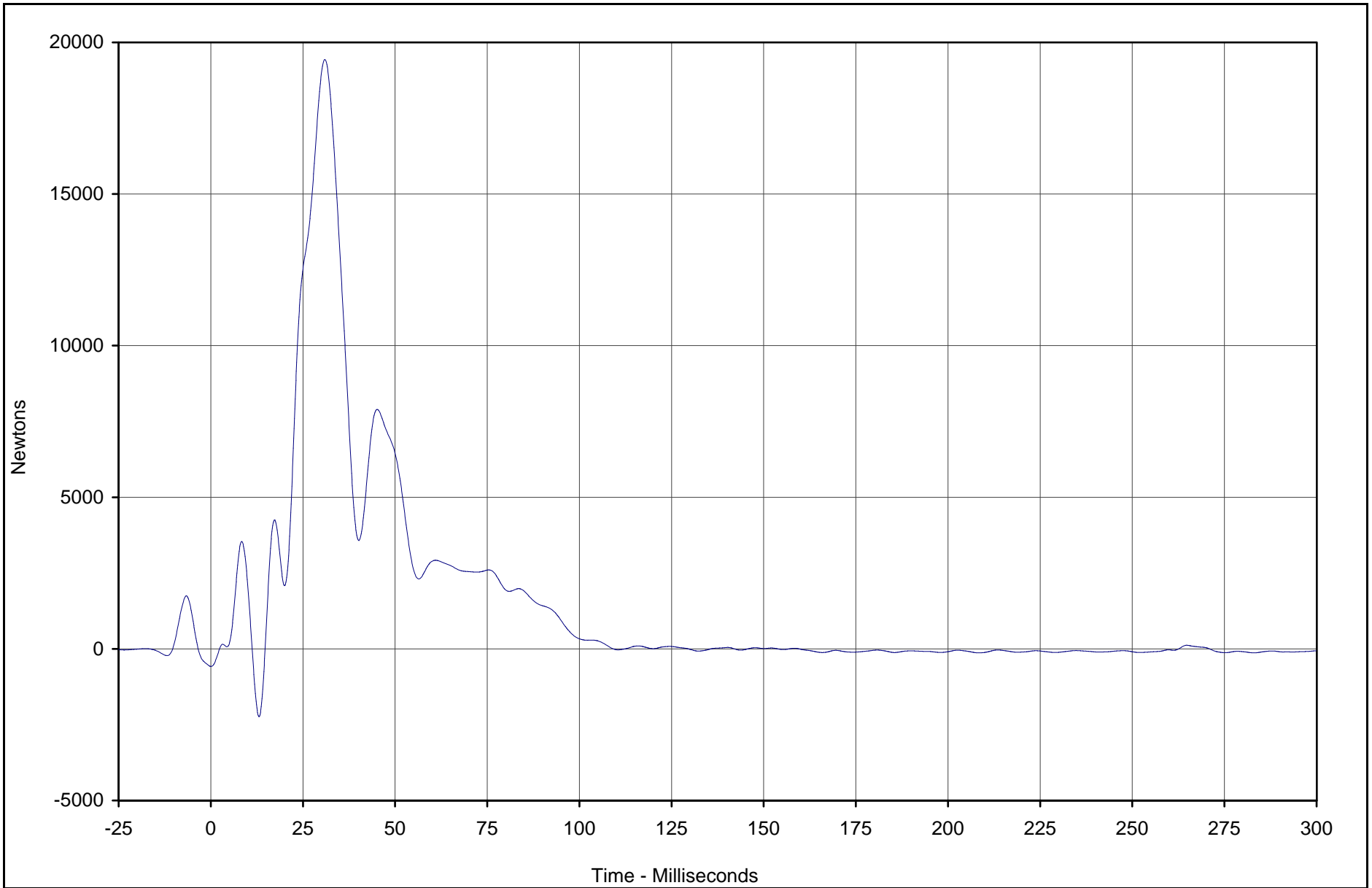
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-5



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force A5	102	FIL	Newtons	19437.3	30.9	-2236.2	13.1	60



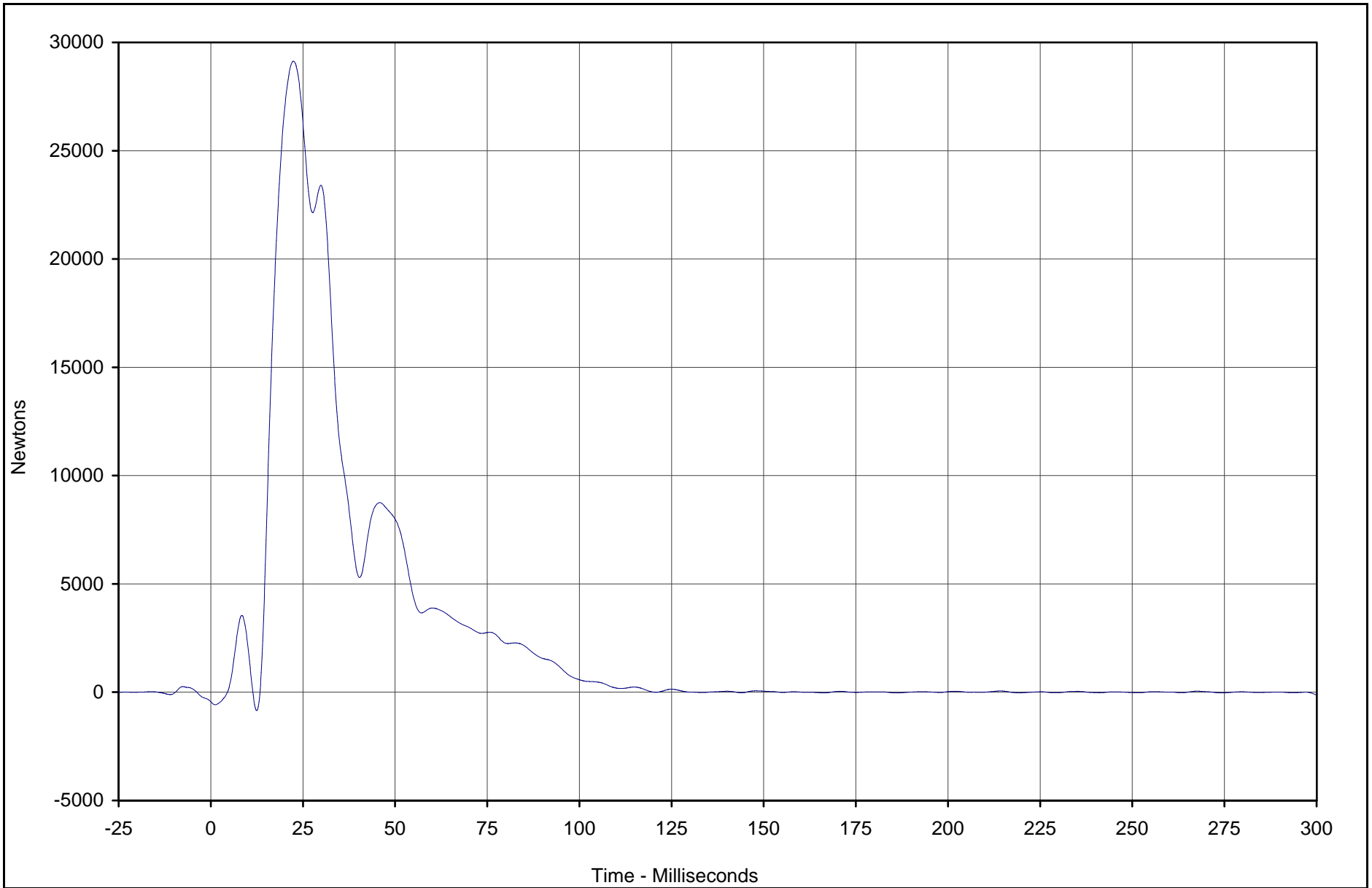
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-6



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force A6	103	FIL	Newtons	29129.3	22.4	-852.9	12.5	60



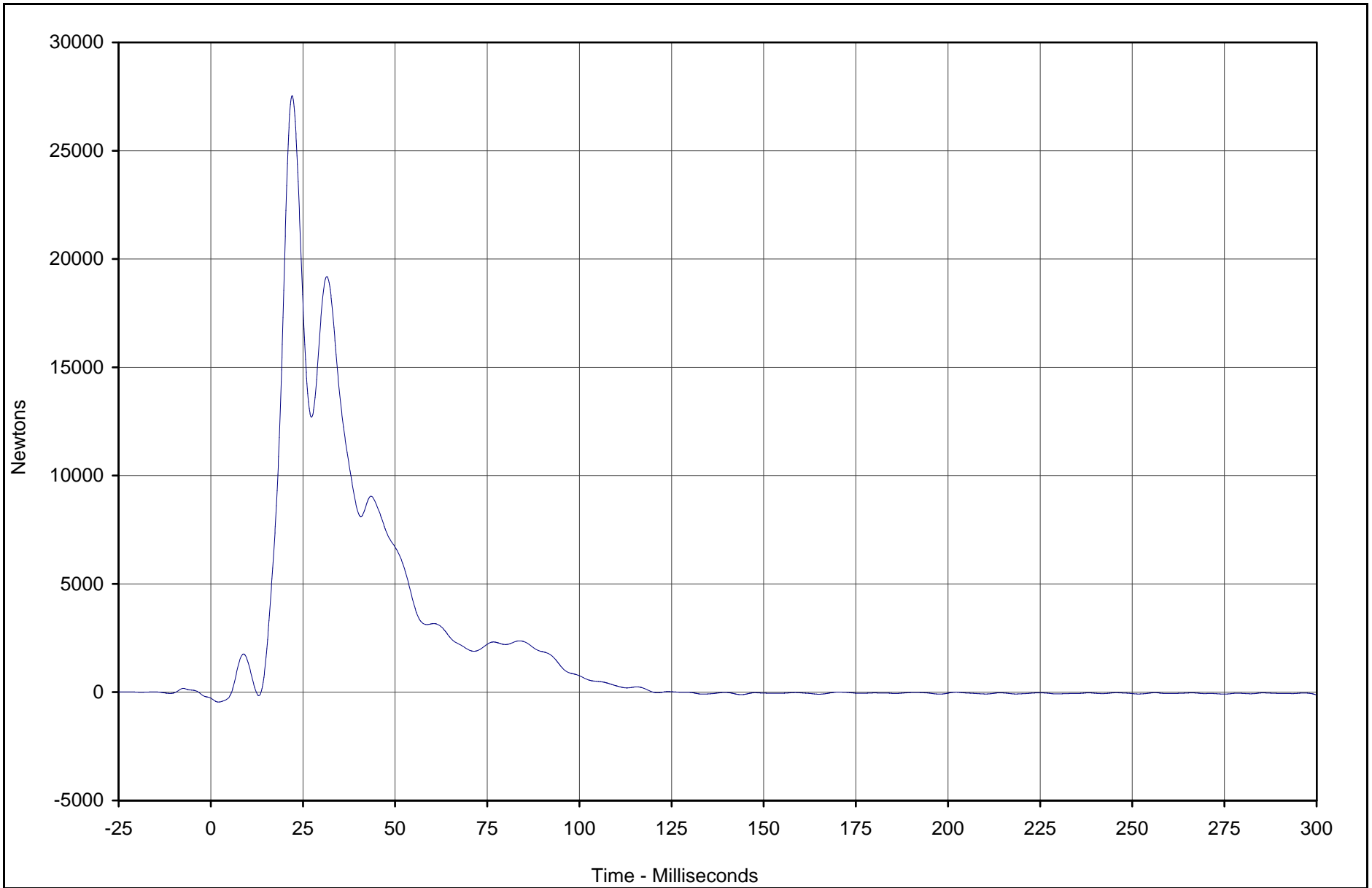
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-7



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force A7	104	FIL	Newtons	27542.4	22.1	-456.9	2.1	60



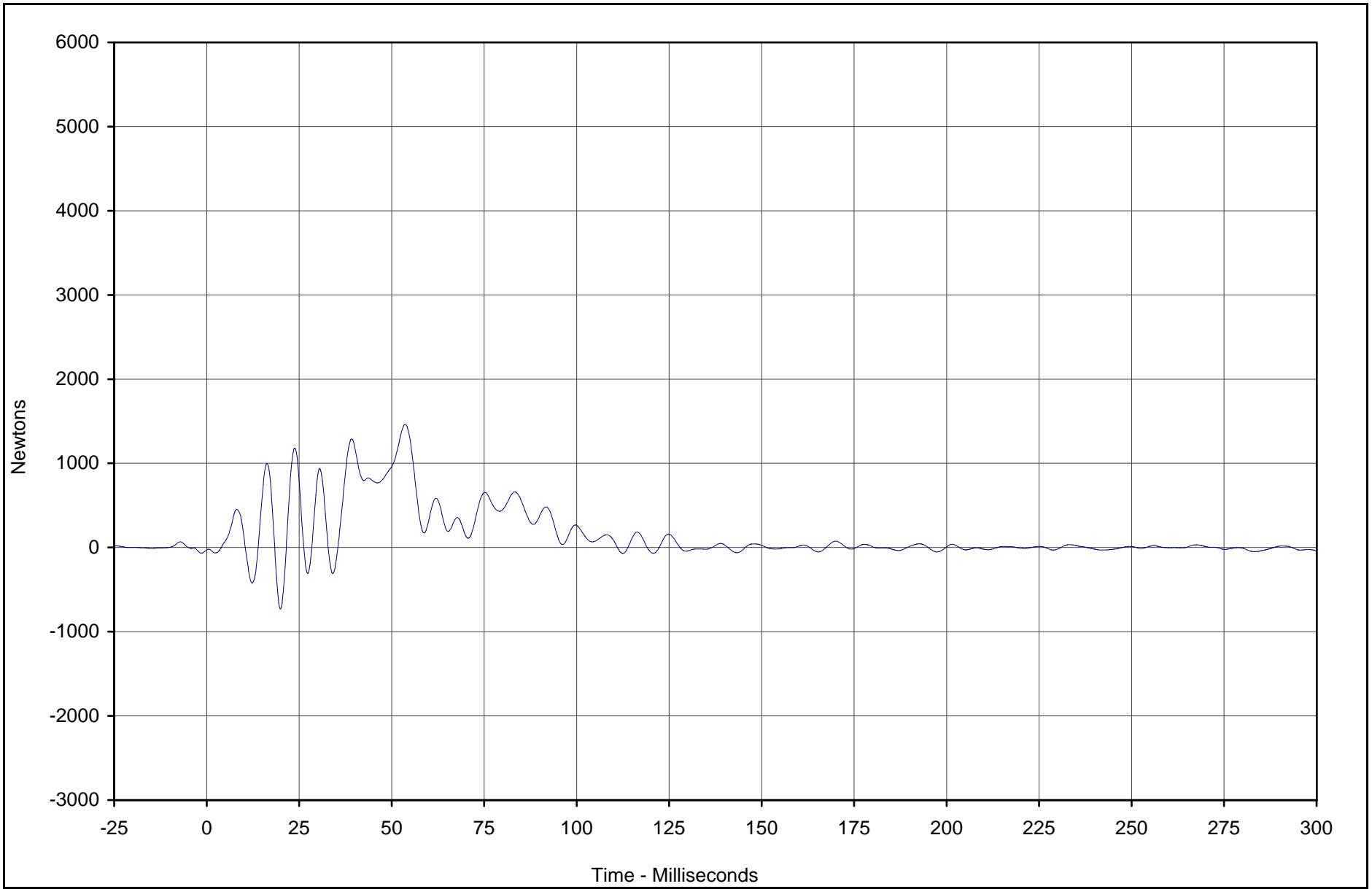
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-8



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force A8	105	FIL	Newtons	1462.3	53.6	-728.5	19.9	60



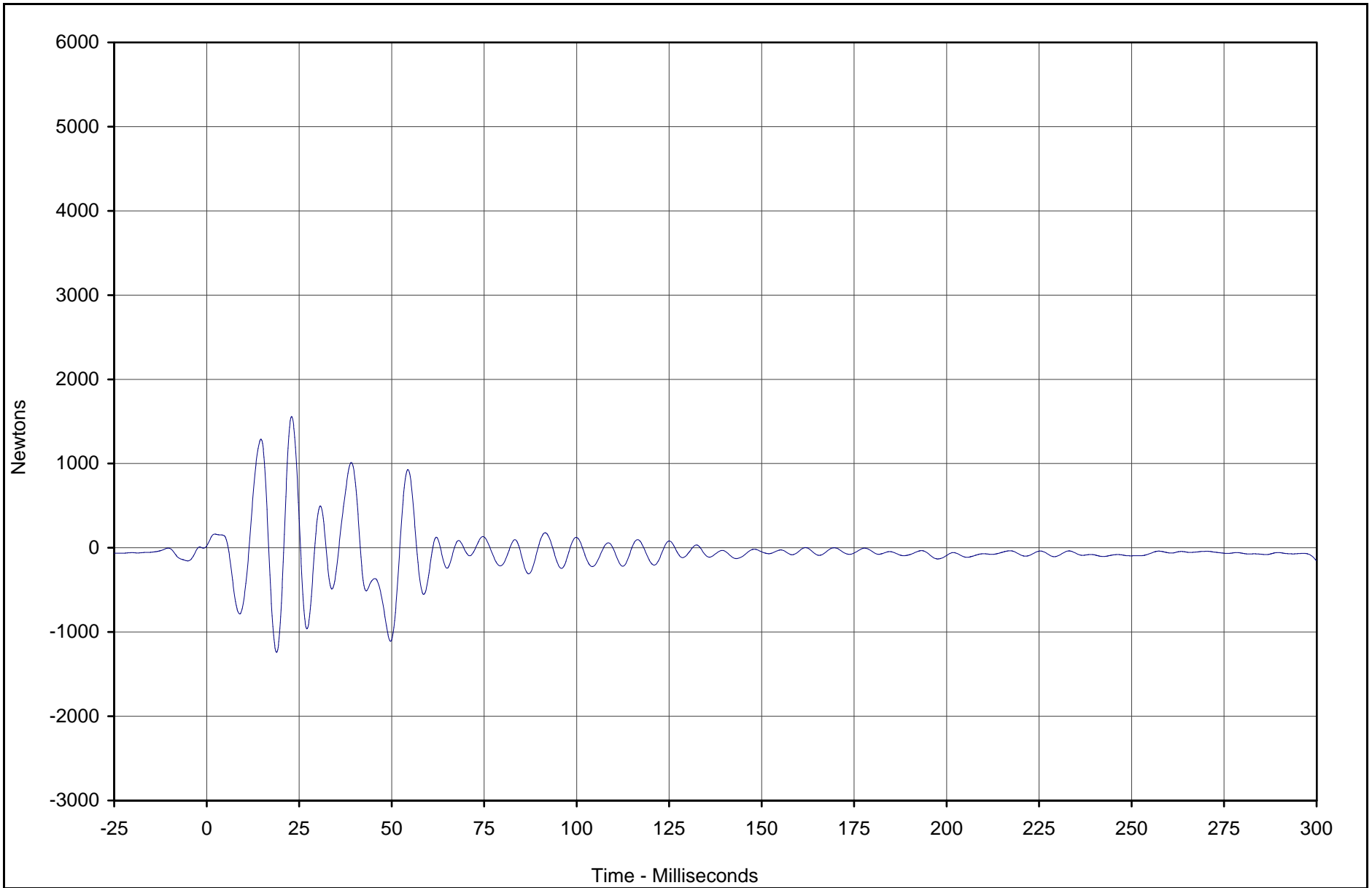
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-9



KARR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force A9	106	FIL	Newtons	1557.1	23.0	-1241.1	18.9	60



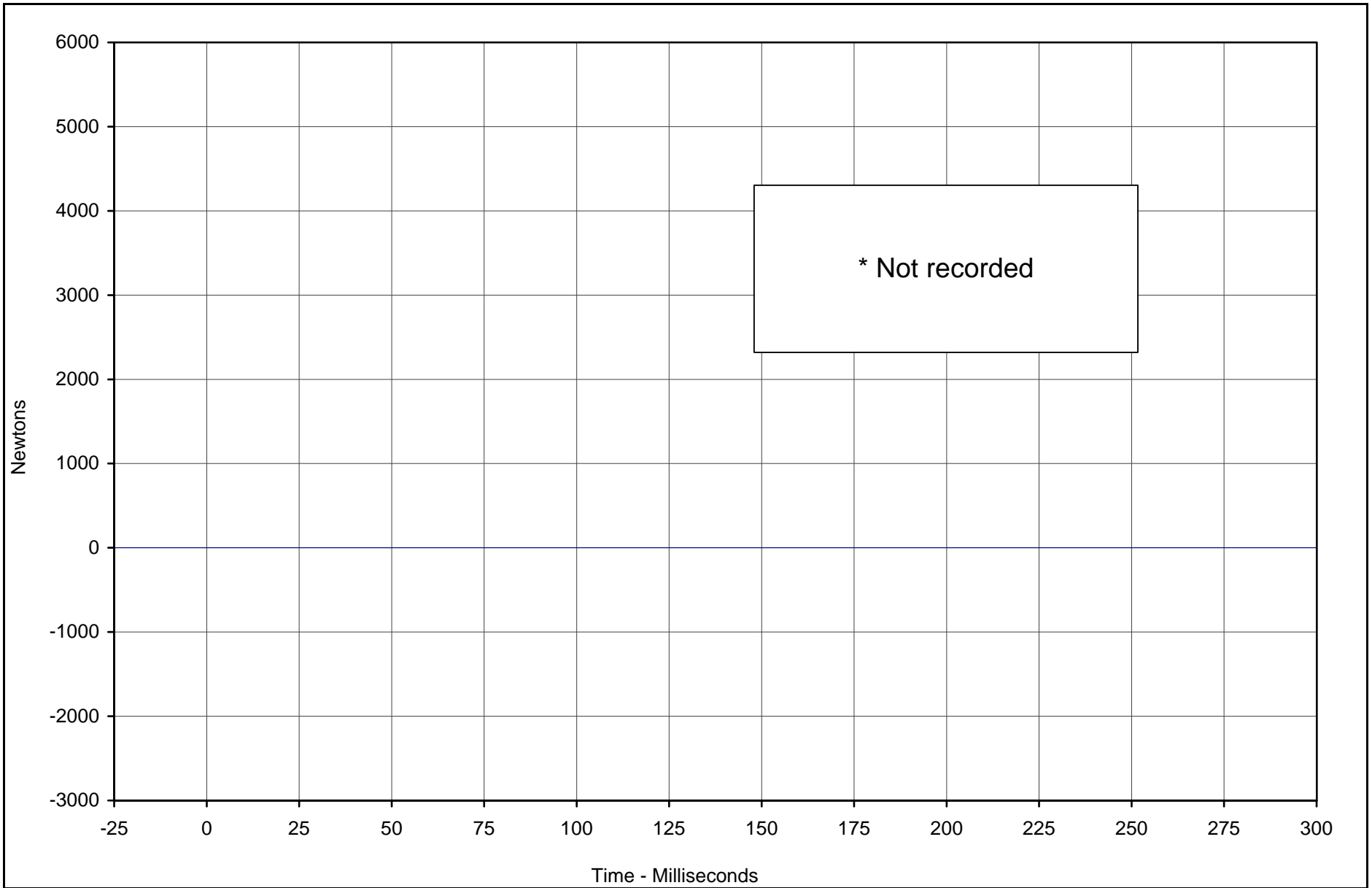
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-10



\* Not recorded

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force B1	107	FIL	Newtons	0.0	0.0	0.0	0.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

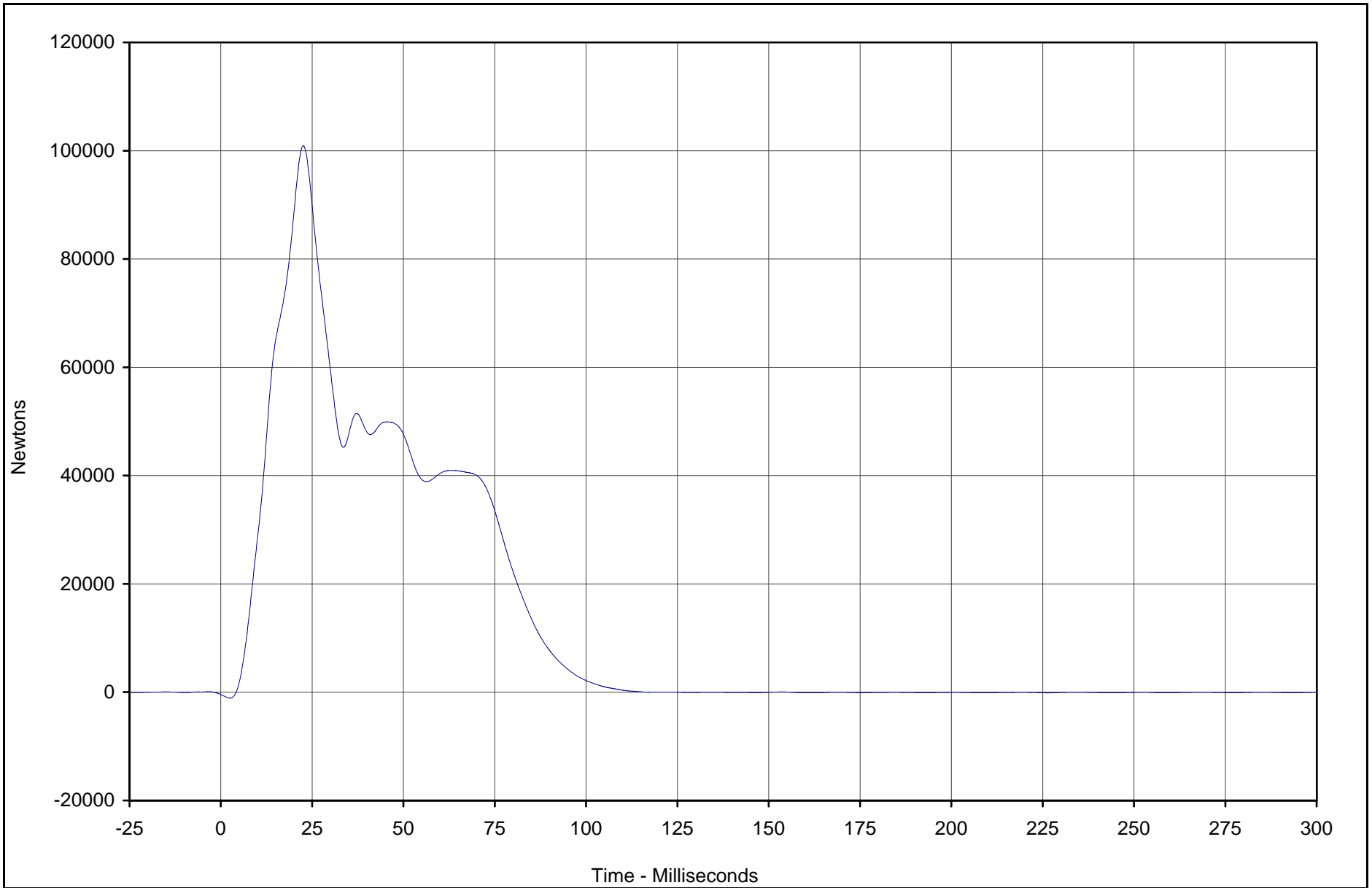
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-11



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force B2	108	FIL	Newtons	100912.4	22.6	-1099.4	2.5	60



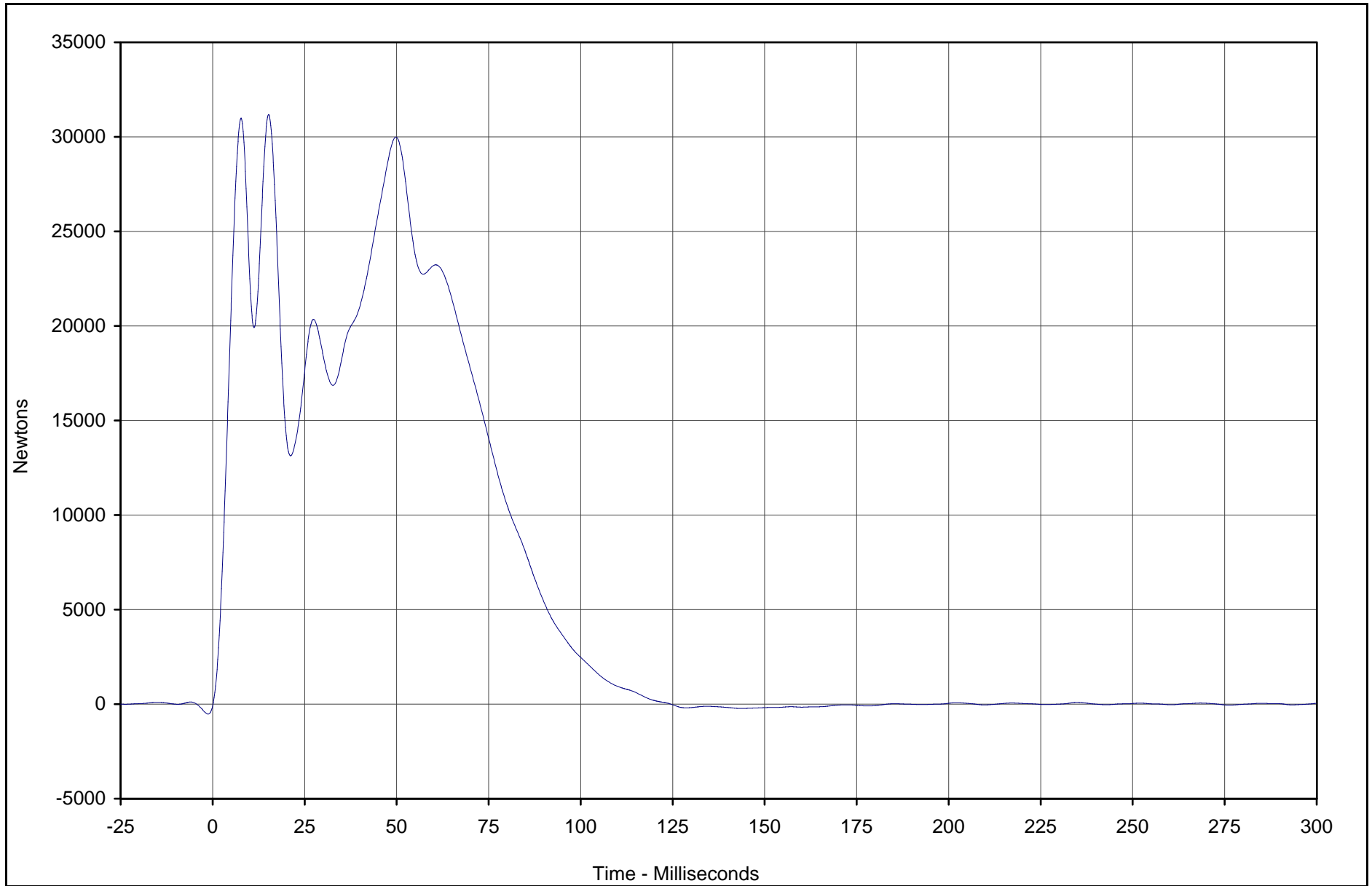
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-12



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force B3	109	FIL	Newtons	31181.7	15.2	-227.2	143.7	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

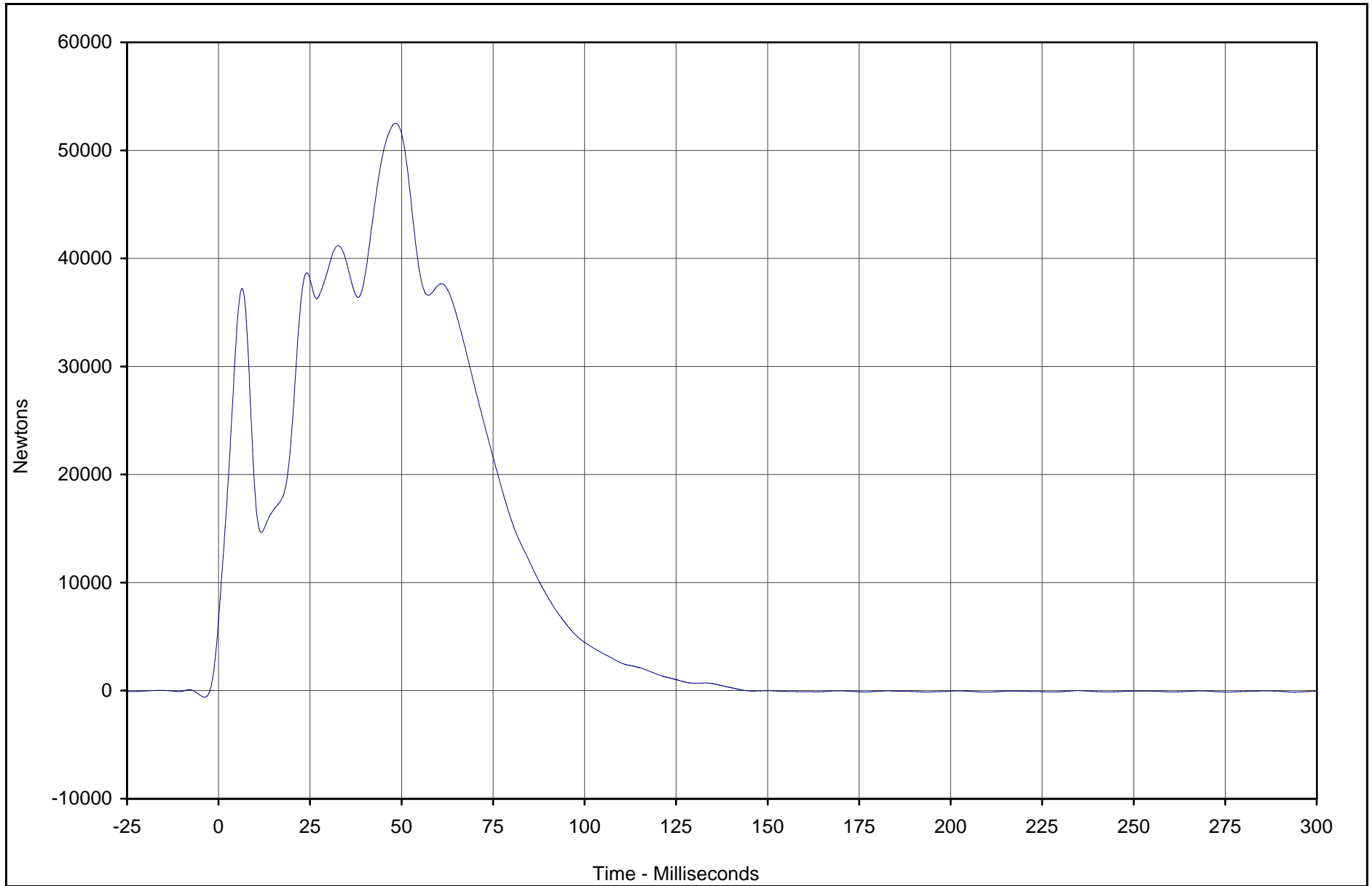
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-13



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force B4	110	FIL	Newtons	52509.8	48.4	-145.6	293.9	60



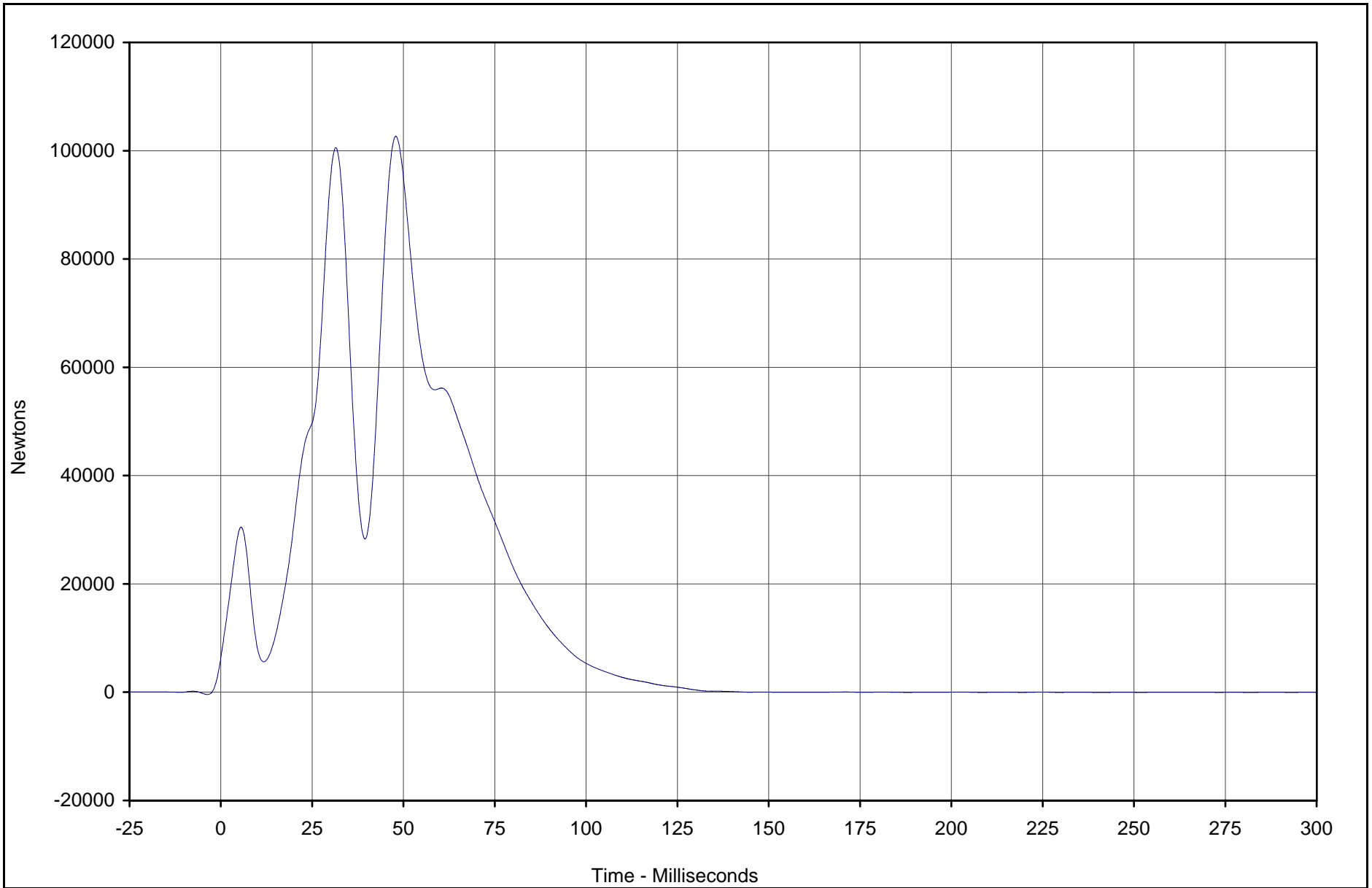
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-14



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force B5	111	FIL	Newtons	102655.6	47.9	-61.0	241.3	60



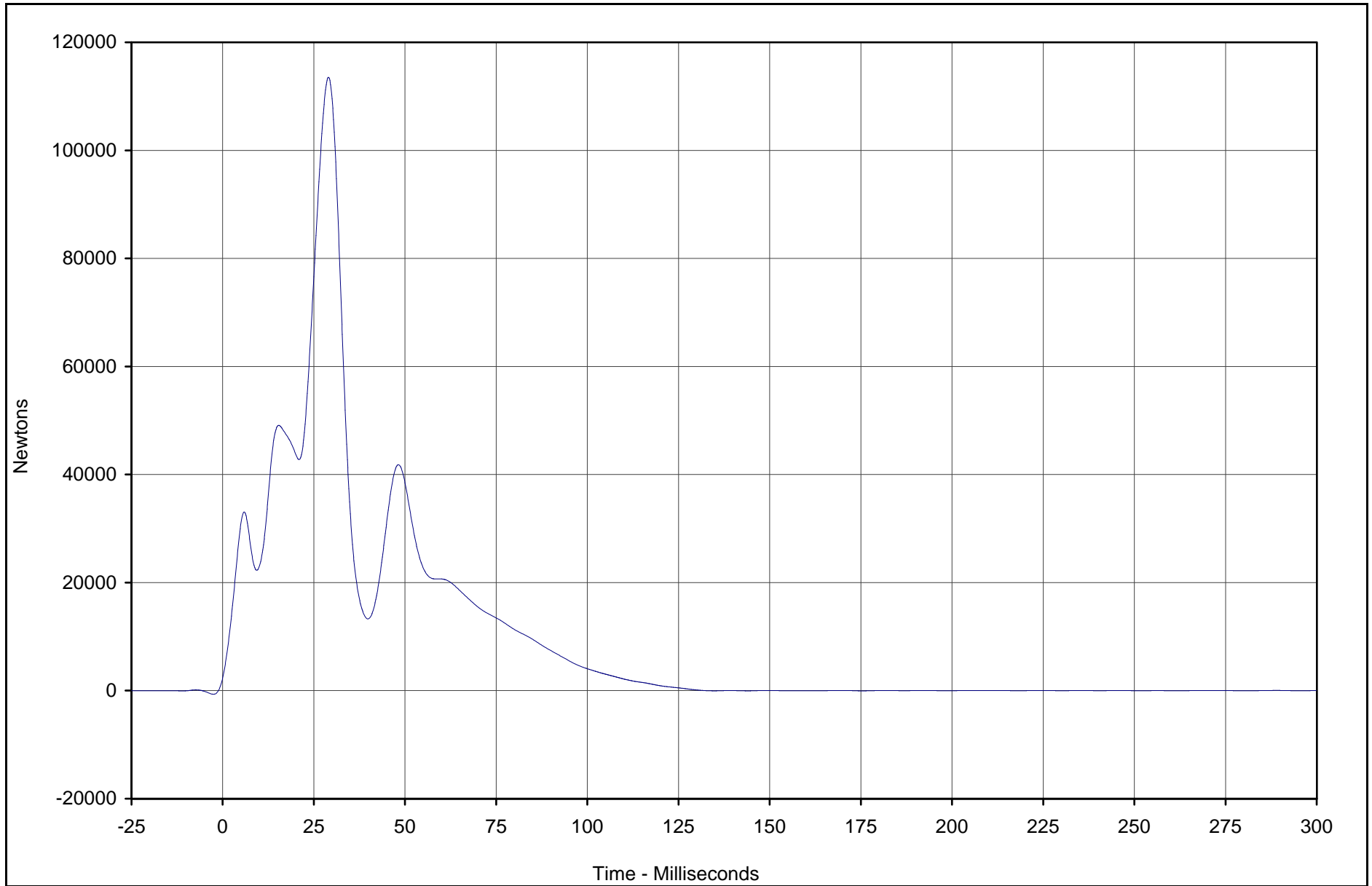
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-15



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force B6	112	FIL	Newtons	113544.9	29.0	-47.3	175.3	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

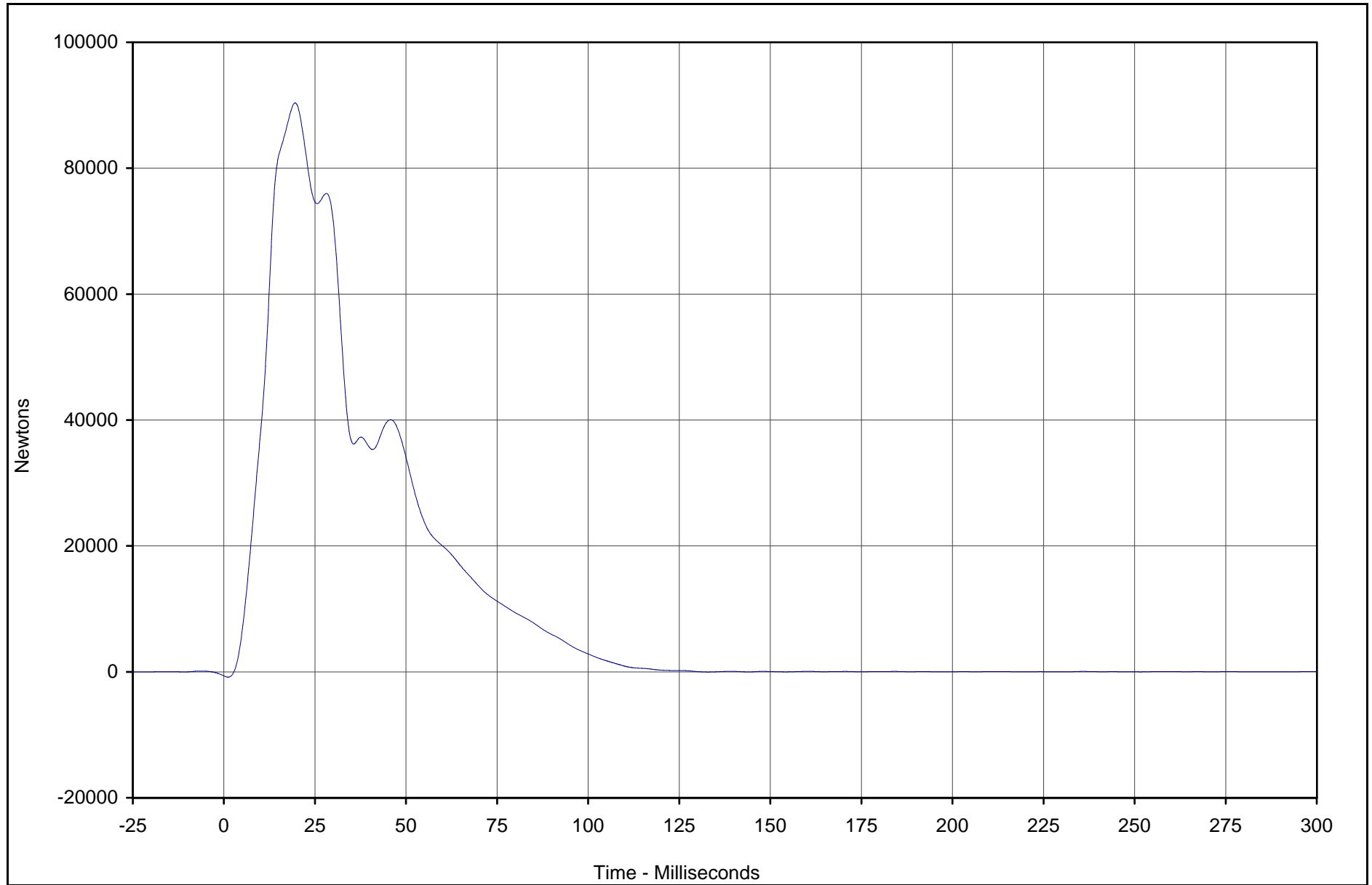
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-16



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force B7	113	FIL	Newtons	90374.3	19.6	-834.4	1.1	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

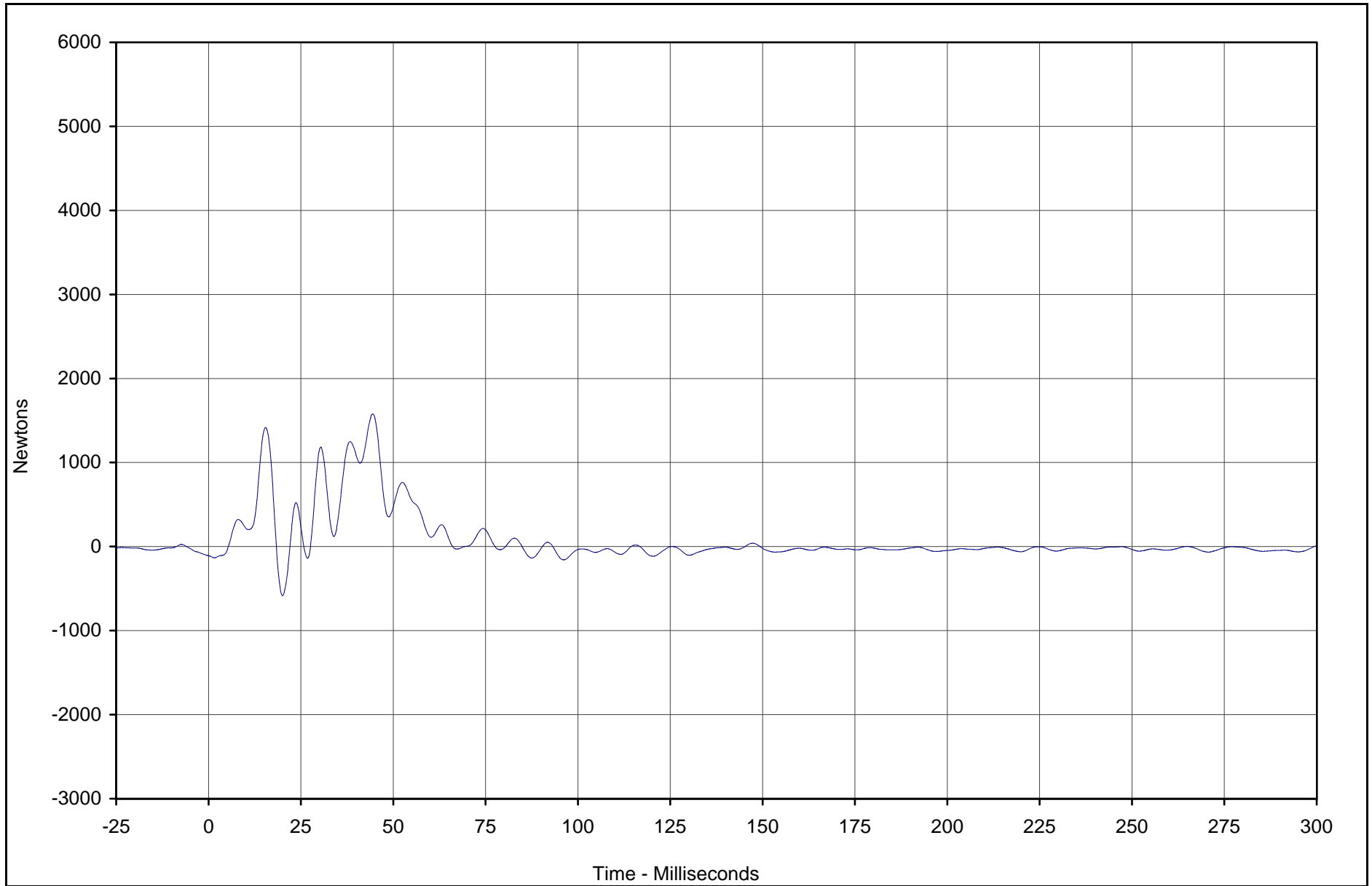
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-17



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force B8	114	FIL	Newtons	1578.7	44.5	-583.5	20.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

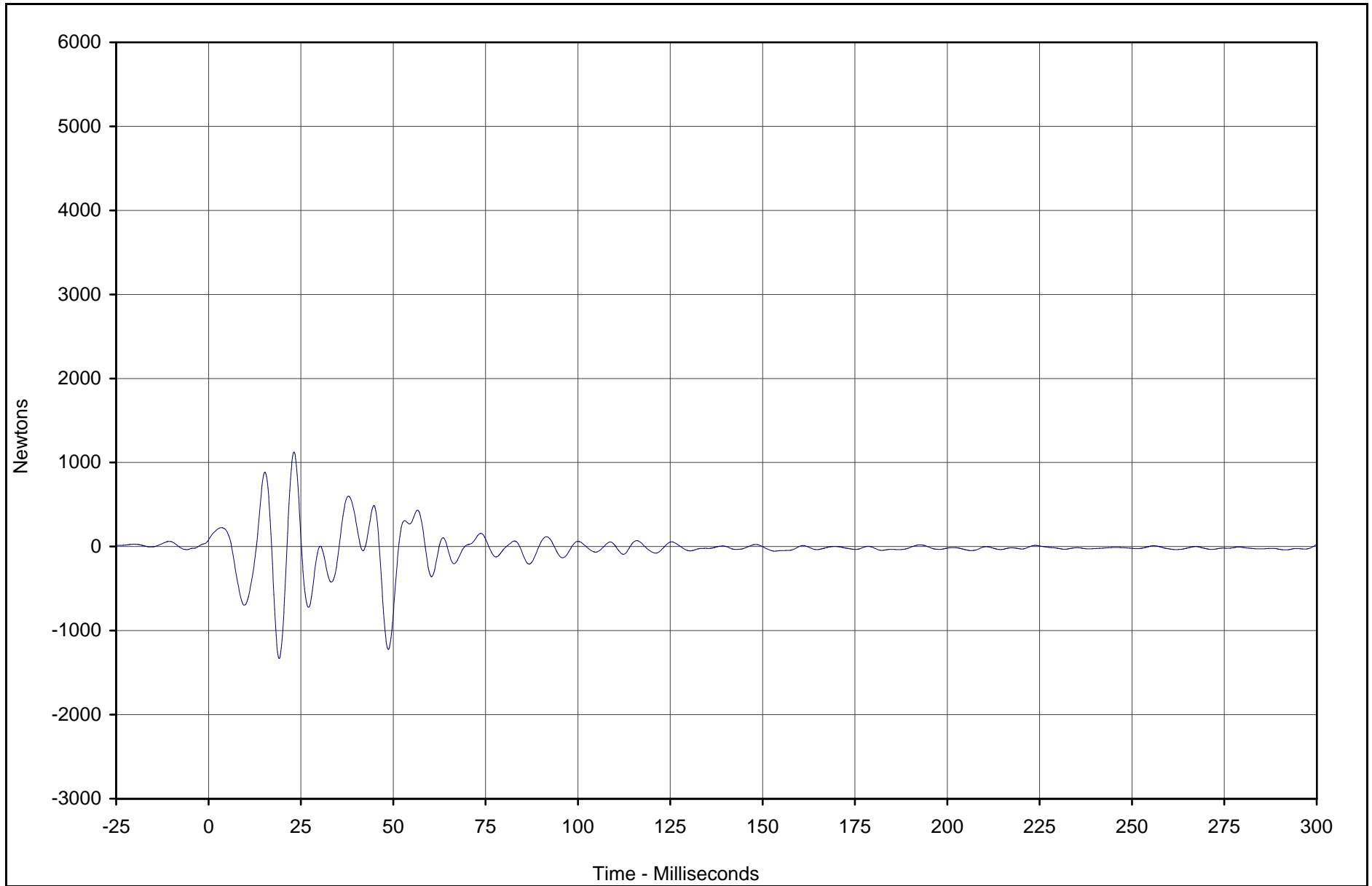
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-18



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force B9	115	FIL	Newtons	1123.6	23.1	-1332.2	19.1	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

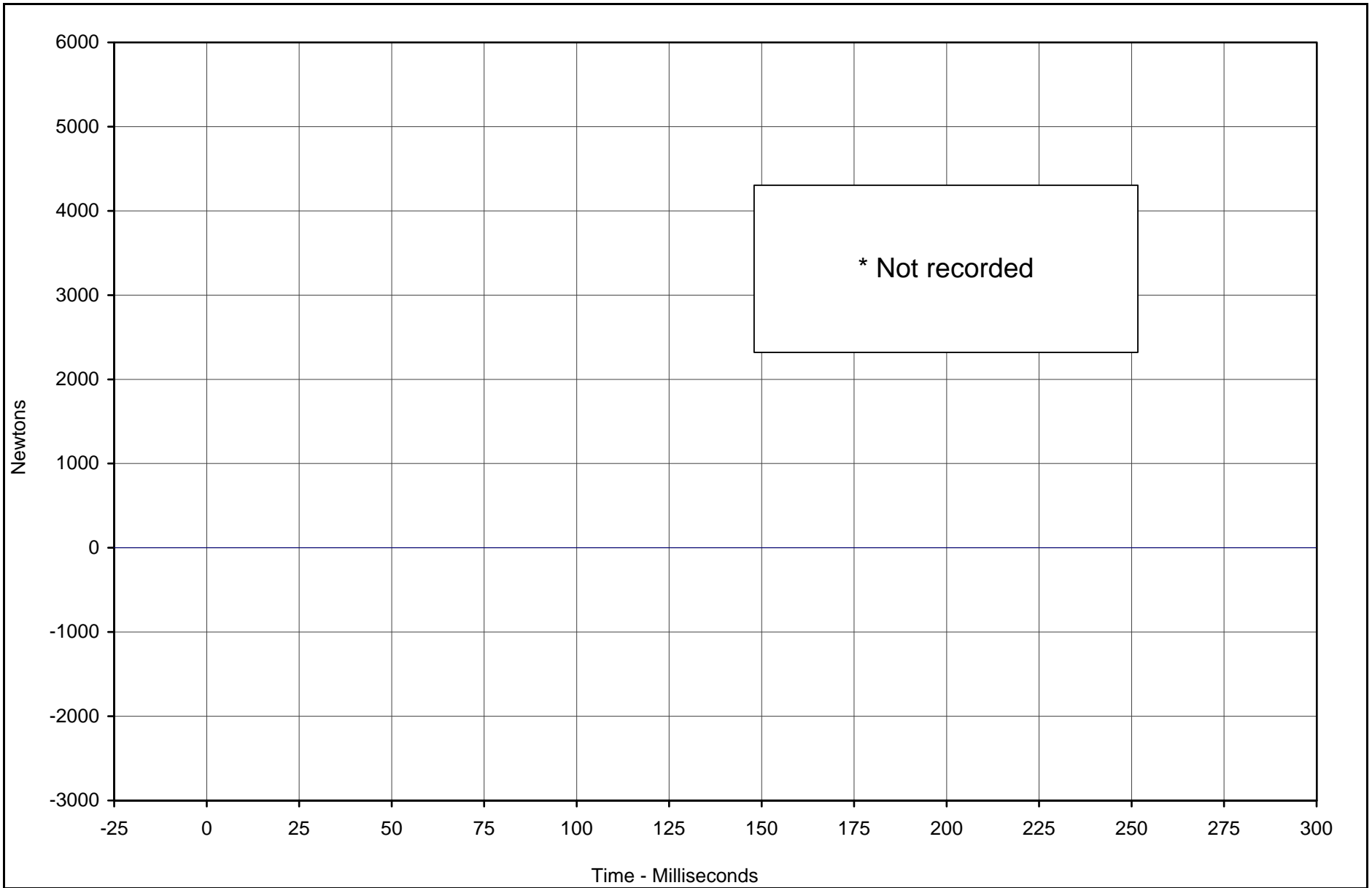
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KARR2001-19

C-19



\* Not recorded

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force C1	116	FIL	Newtons	0.0	0.0	0.0	0.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

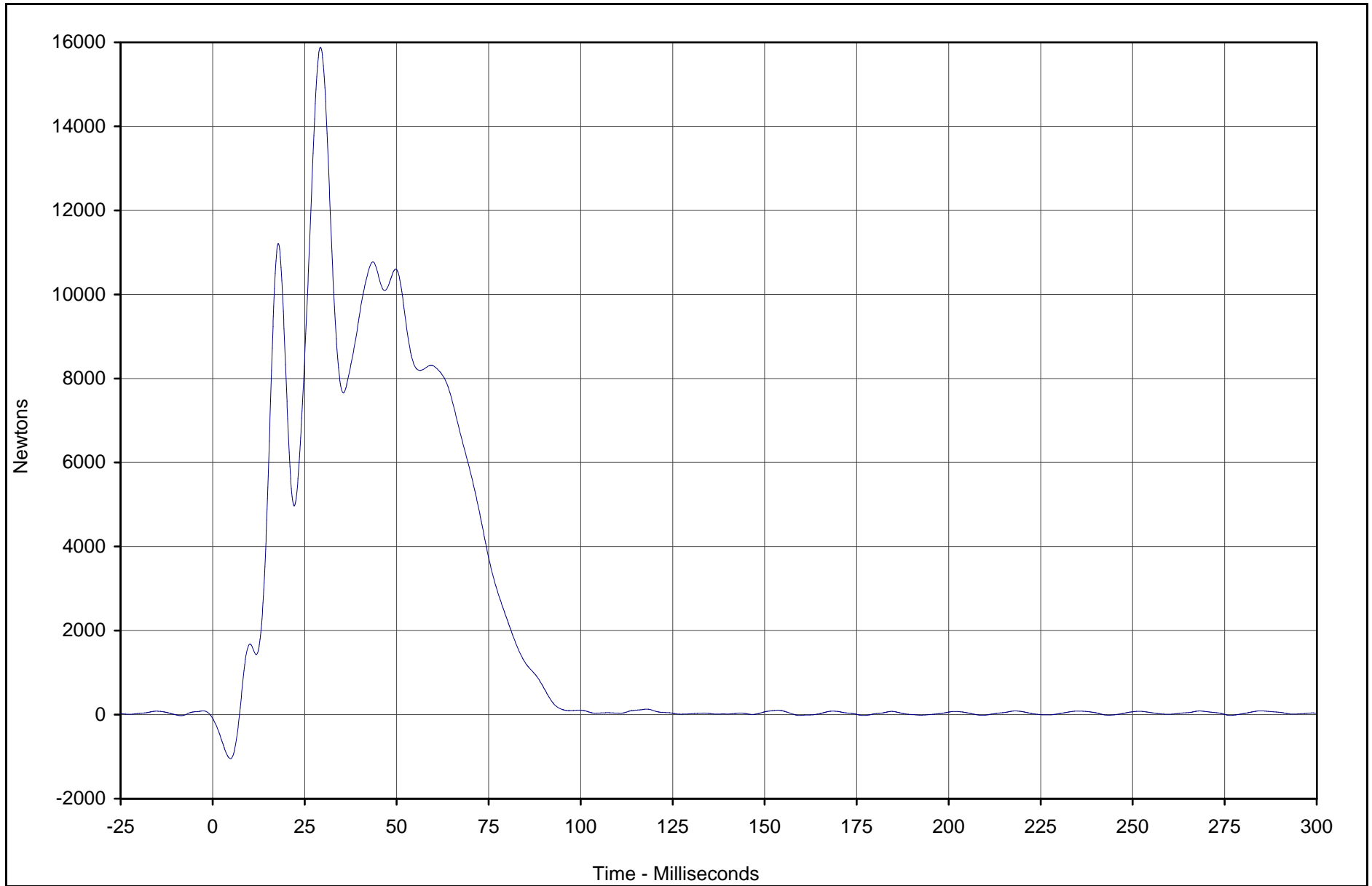
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-20



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force C2	117	FIL	Newtons	15880.7	29.3	-1046.5	4.9	60



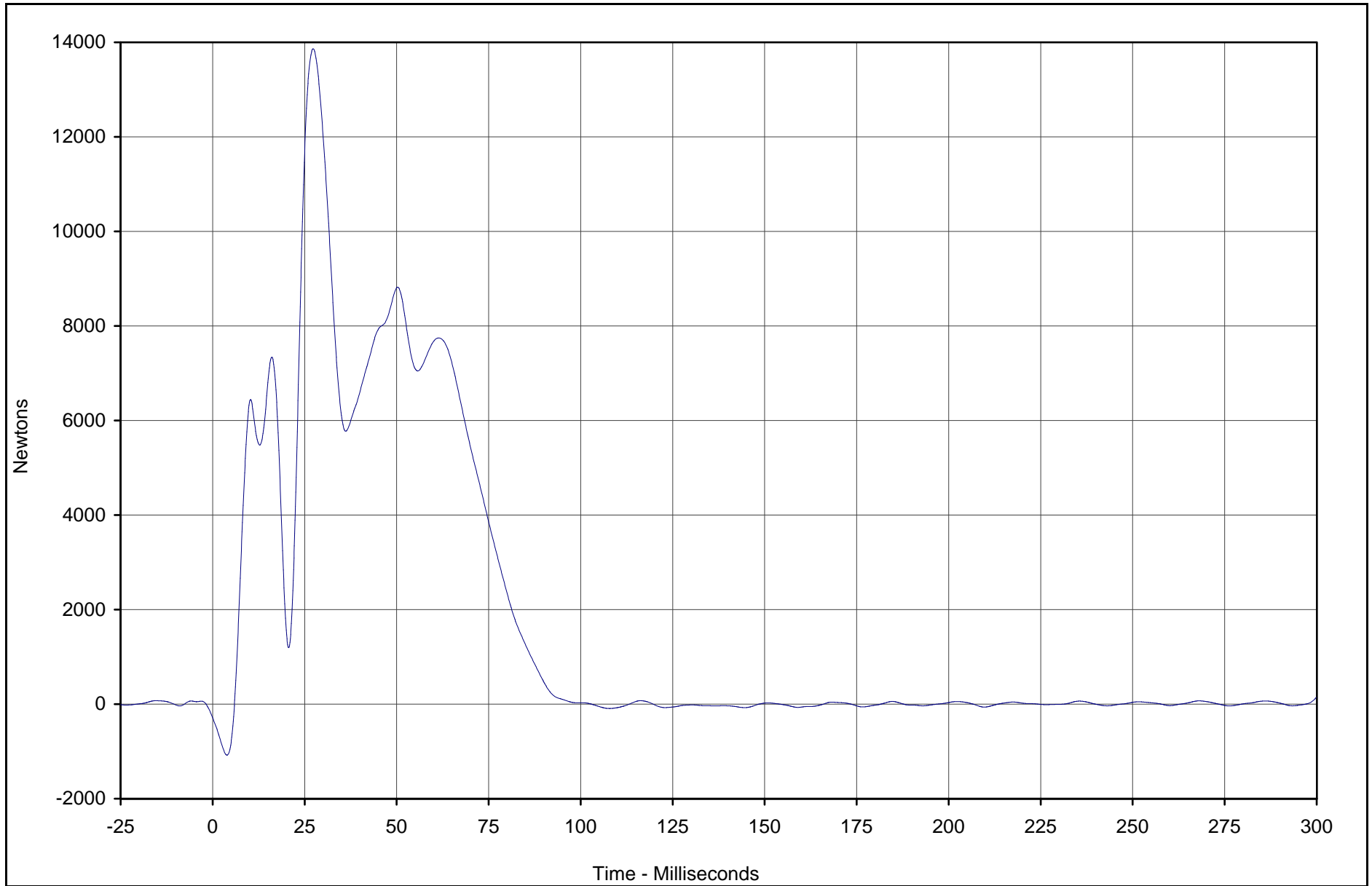
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-21



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force C3	118	FIL	Newtons	13864.4	27.3	-1079.6	3.9	60



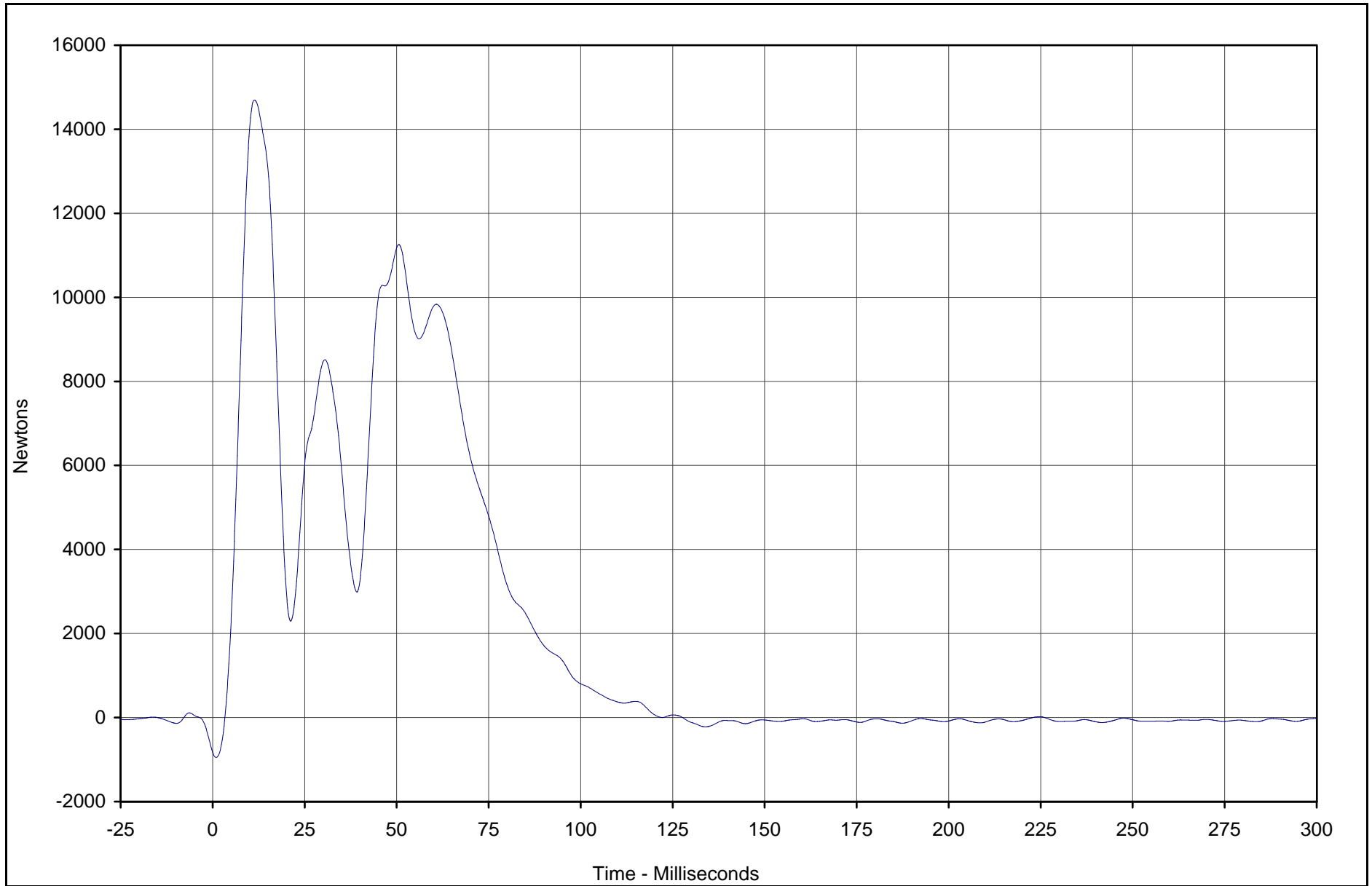
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-22



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force C4	119	FIL	Newtons	14693.3	11.4	-947.8	0.9	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

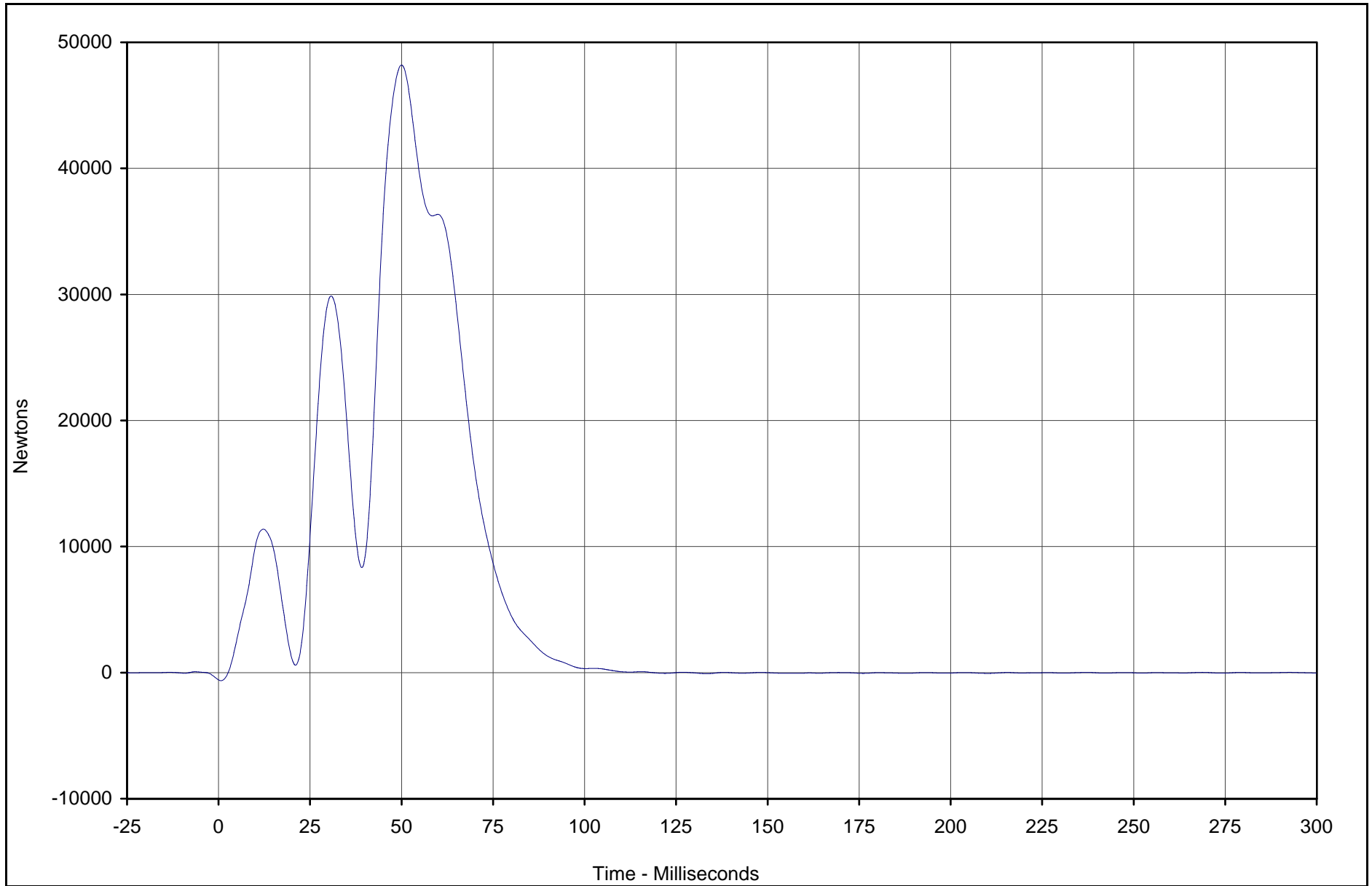
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-23



KARR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force C5	120	FIL	Newtons	48201.5	50.0	-639.8	0.7	60



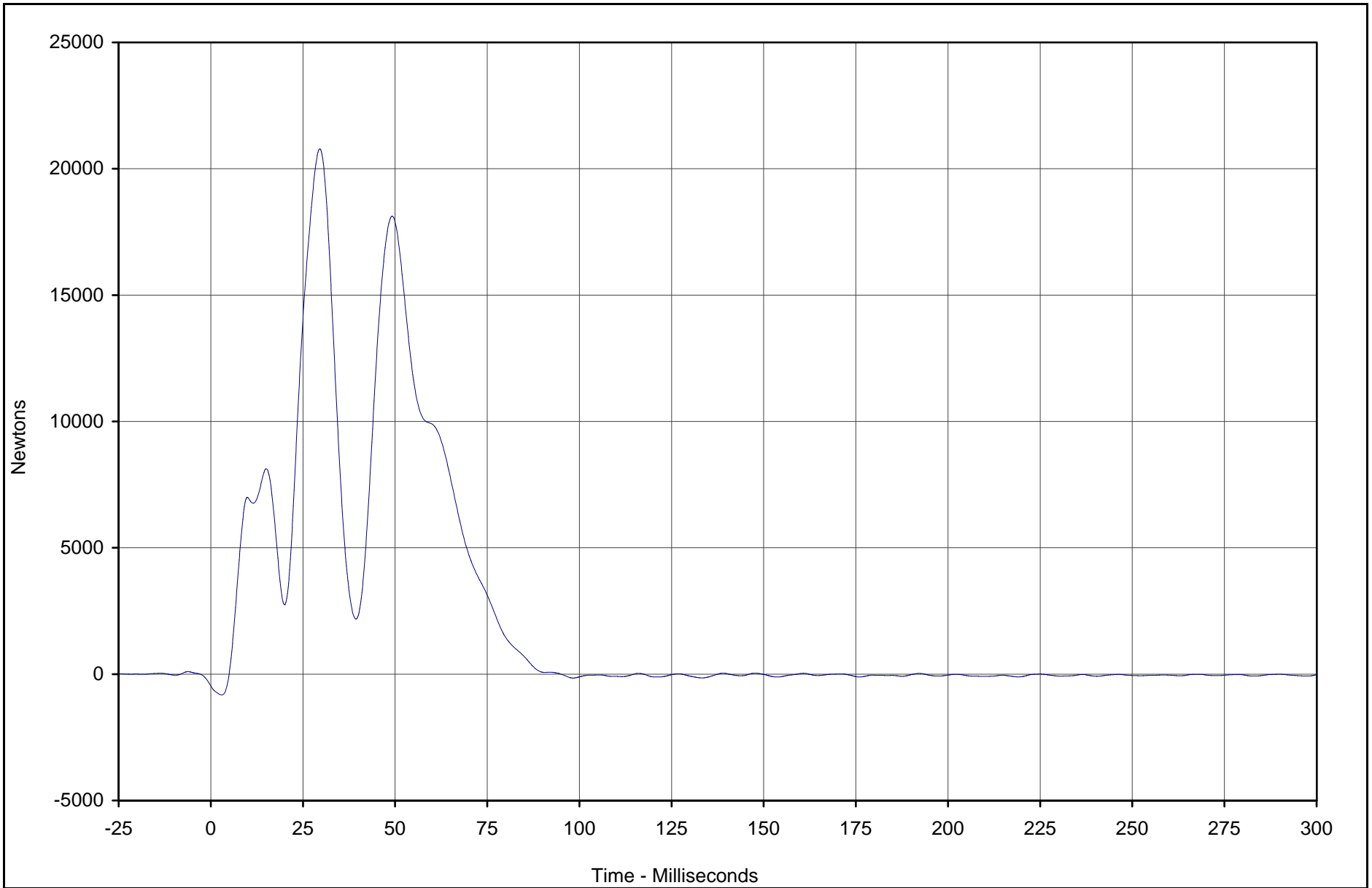
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-24



KARR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force C6	121	FIL	Newtons	20791.4	29.6	-821.0	3.0	60



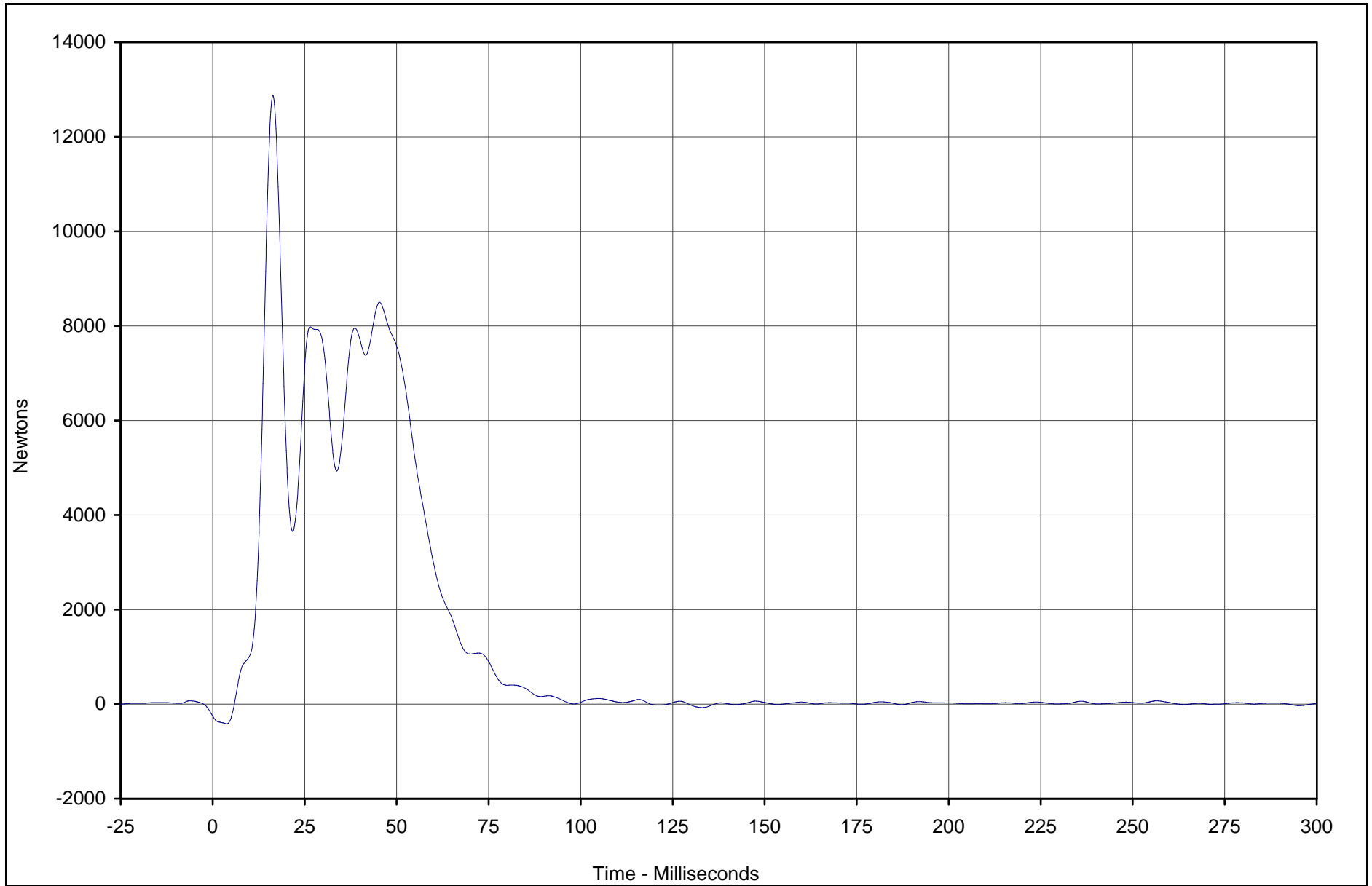
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-25



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force C7	122	FIL	Newtons	12880.2	16.4	-417.3	3.9	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

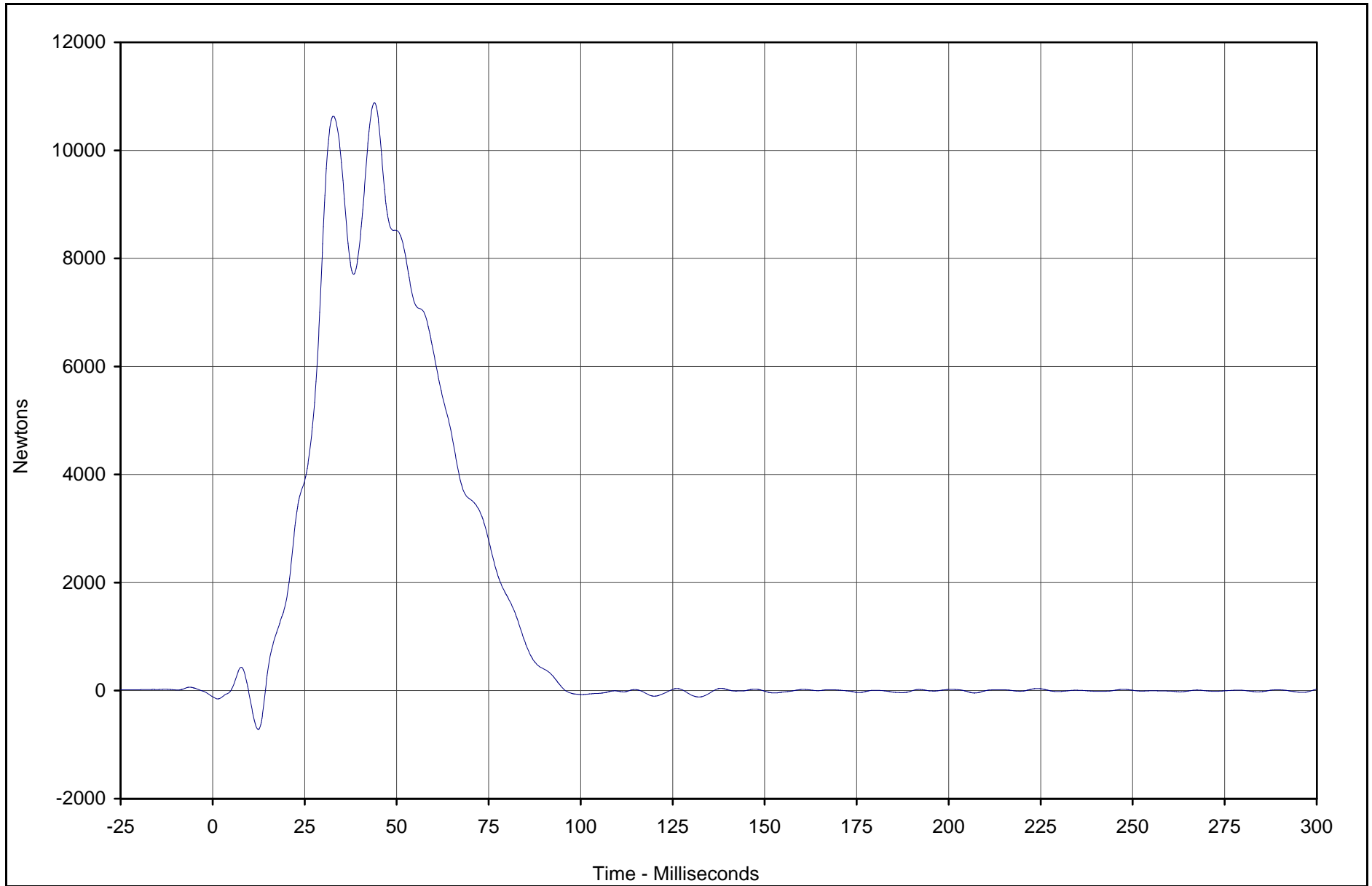
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-26



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force C8	123	FIL	Newtons	10882.7	44.0	-718.3	12.4	60



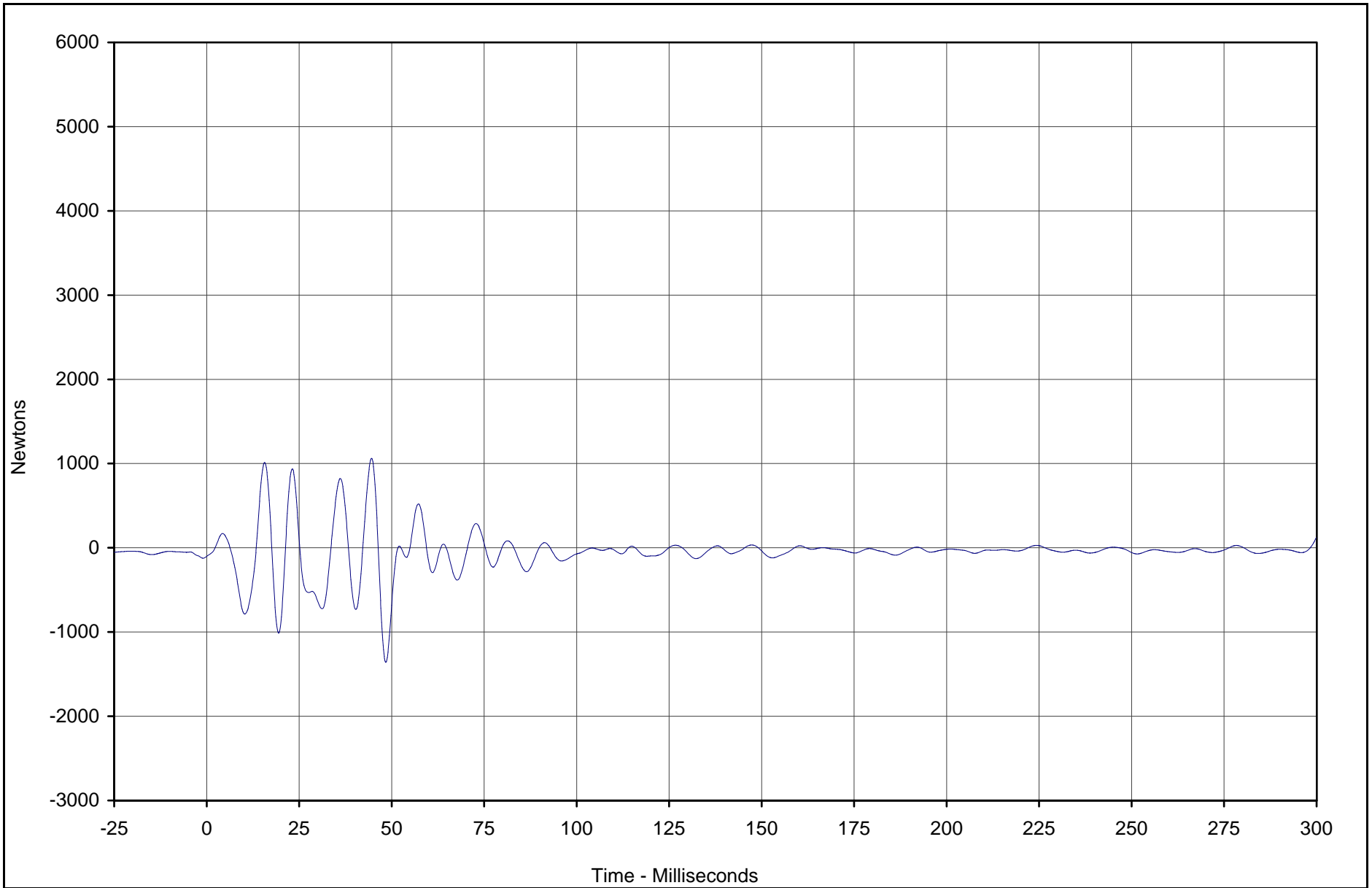
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-27



KARR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force C9	124	FIL	Newtons	1061.9	44.6	-1359.3	48.4	60



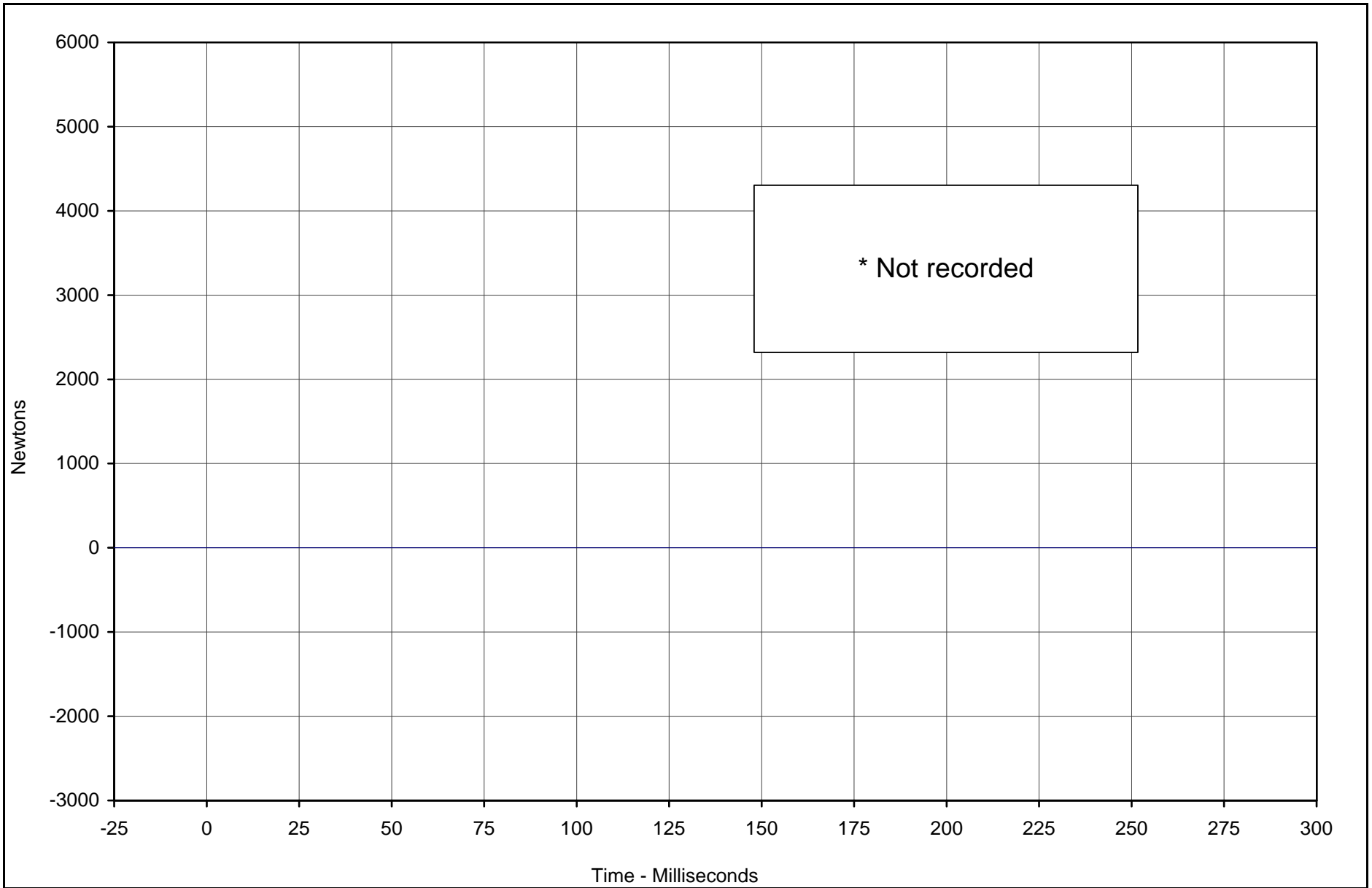
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-28



\* Not recorded

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force D1	125	FIL	Newtons	0.0	0.0	0.0	0.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

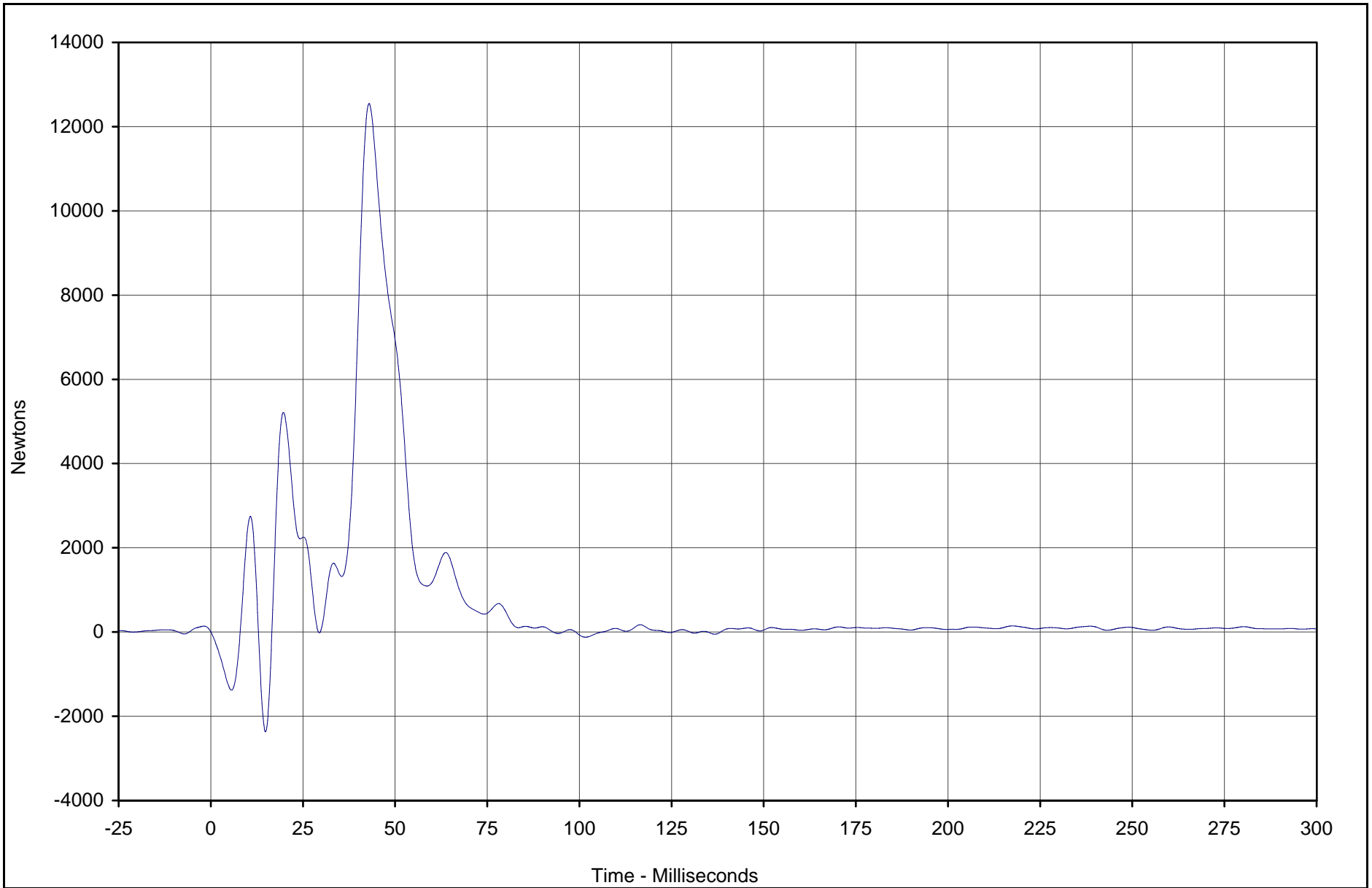
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-29



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force D2	126	FIL	Newtons	12548.6	42.9	-2367.7	14.8	60



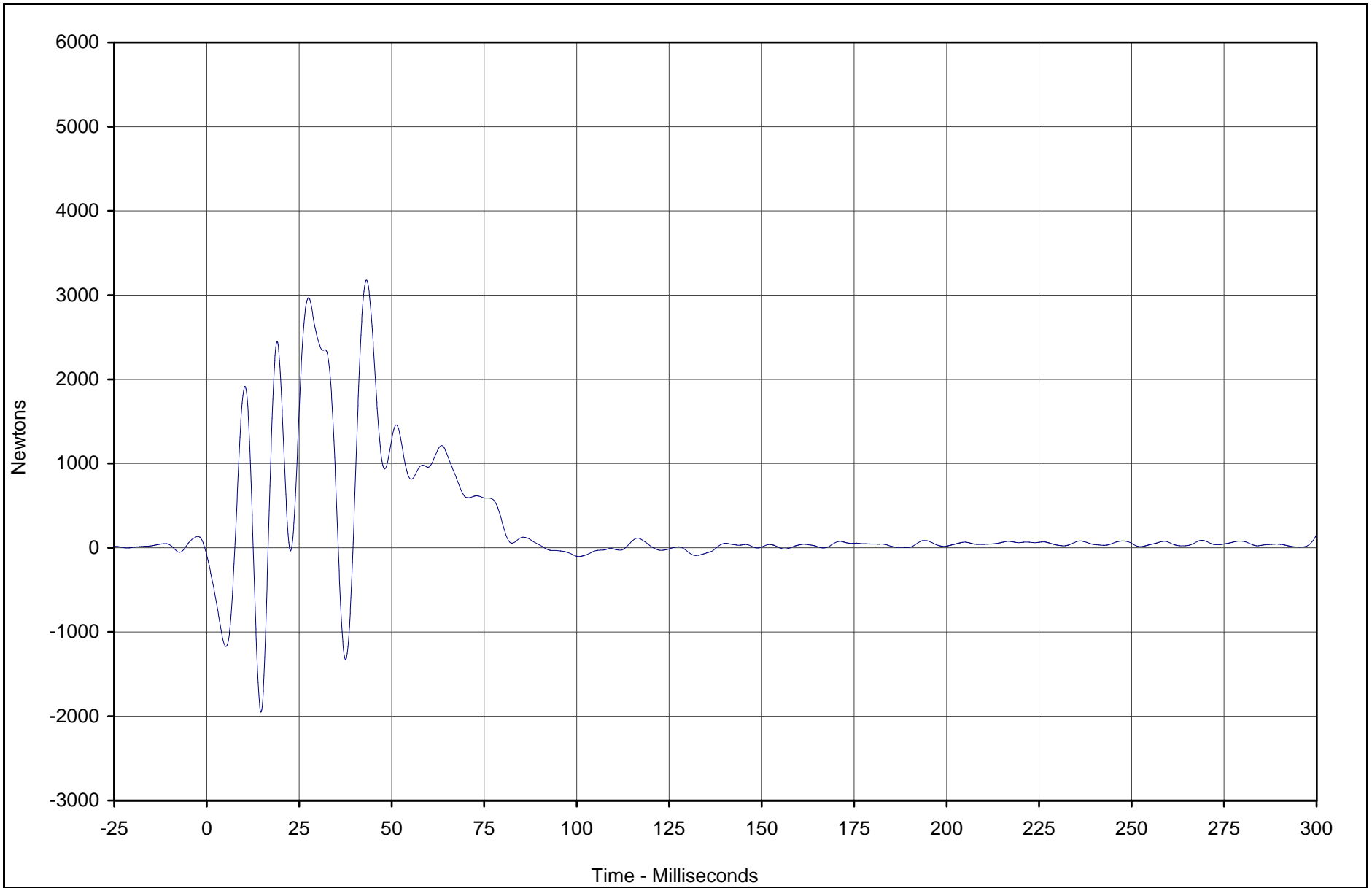
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-30



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force D3	127	FIL	Newtons	3177.9	43.2	-1951.0	14.7	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

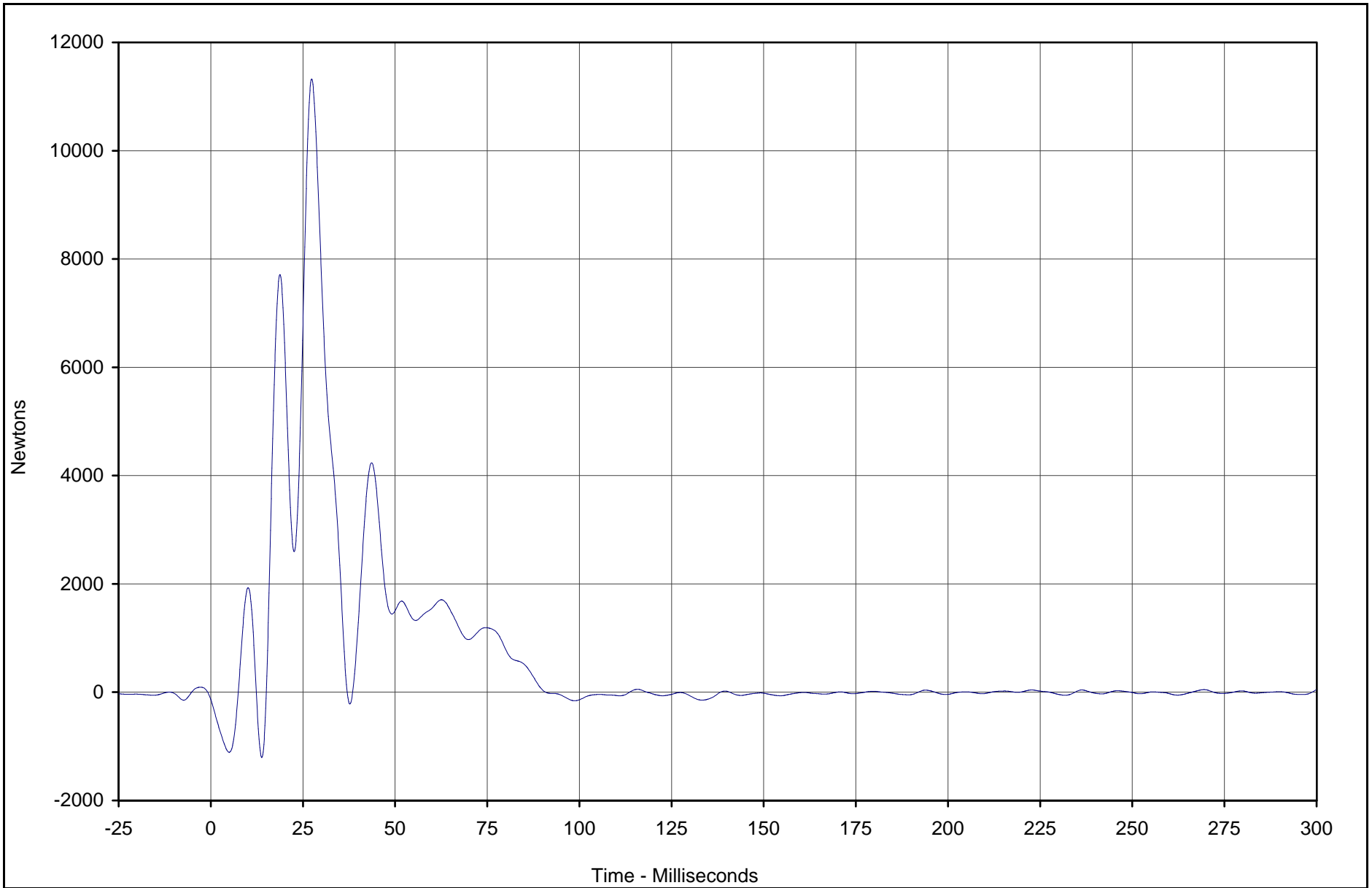
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KARR22001-19

C-31



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force D4	128	FIL	Newtons	11325.3	27.4	-1205.0	13.8	60



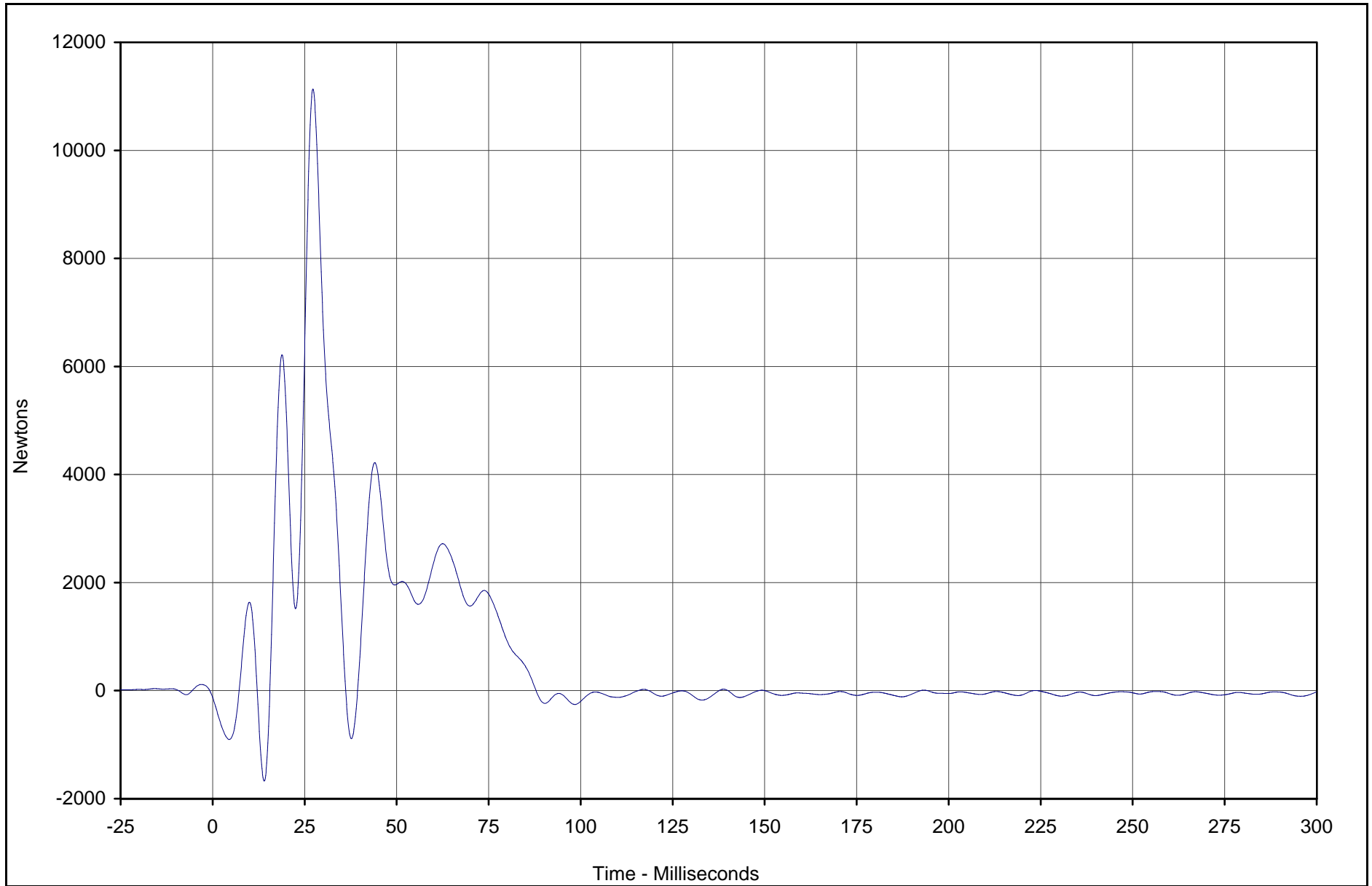
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-32



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force D5	129	FIL	Newtons	11134.1	27.3	-1673.5	14.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

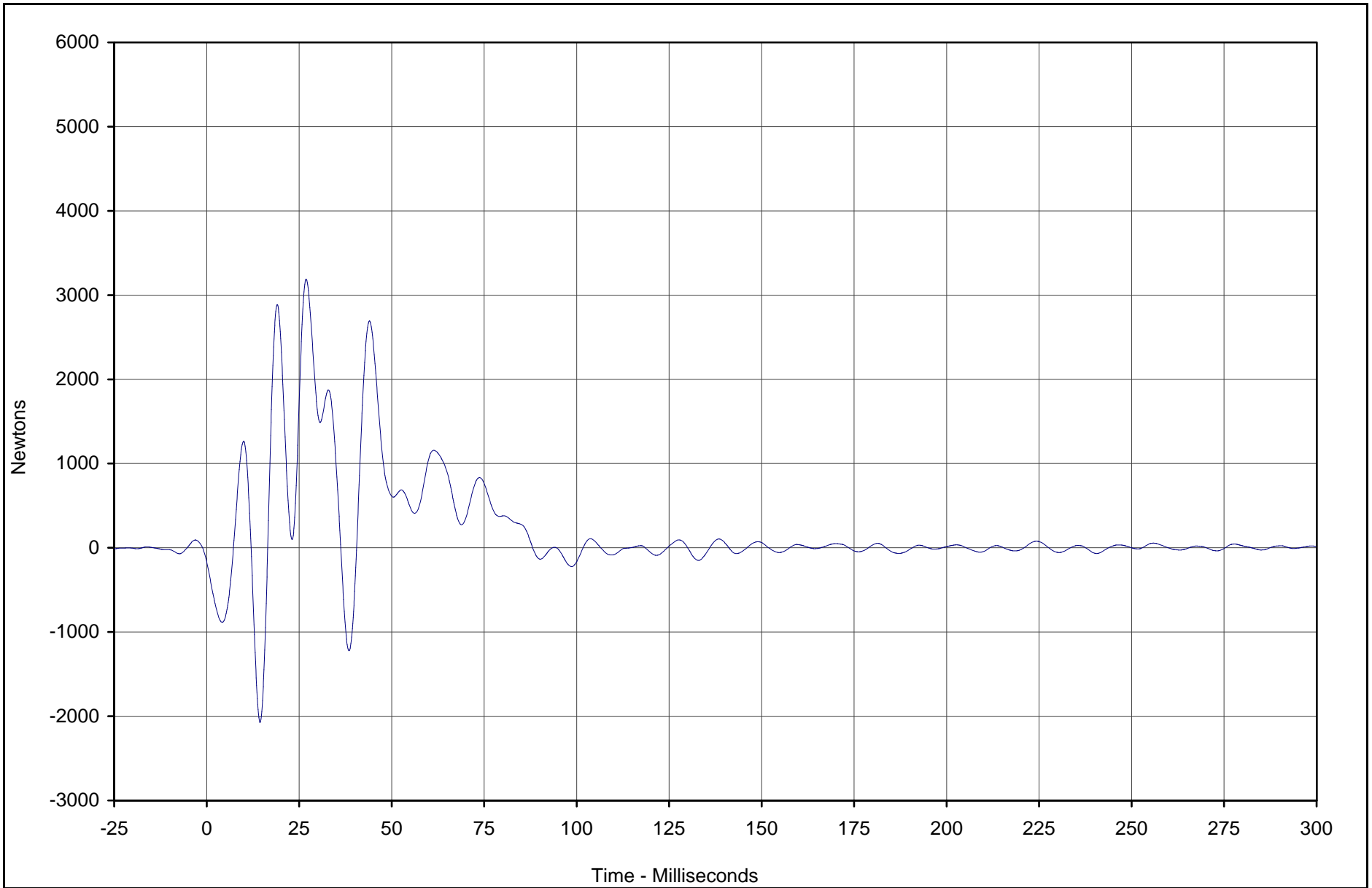
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-33



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force D6	130	FIL	Newtons	3188.8	26.9	-2074.4	14.4	60



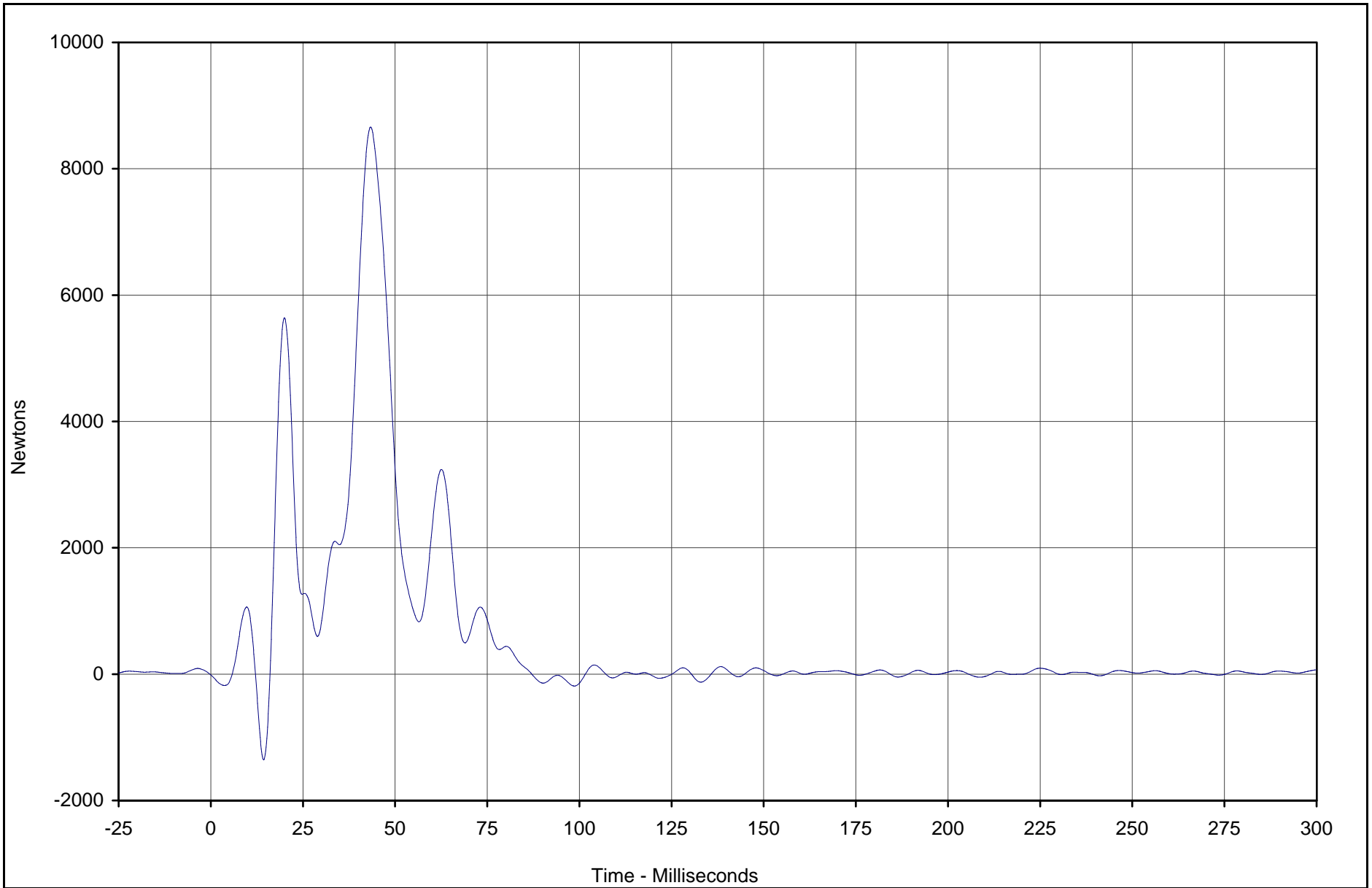
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-34



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force D7	131	FIL	Newtons	8660.5	43.4	-1355.3	14.3	60



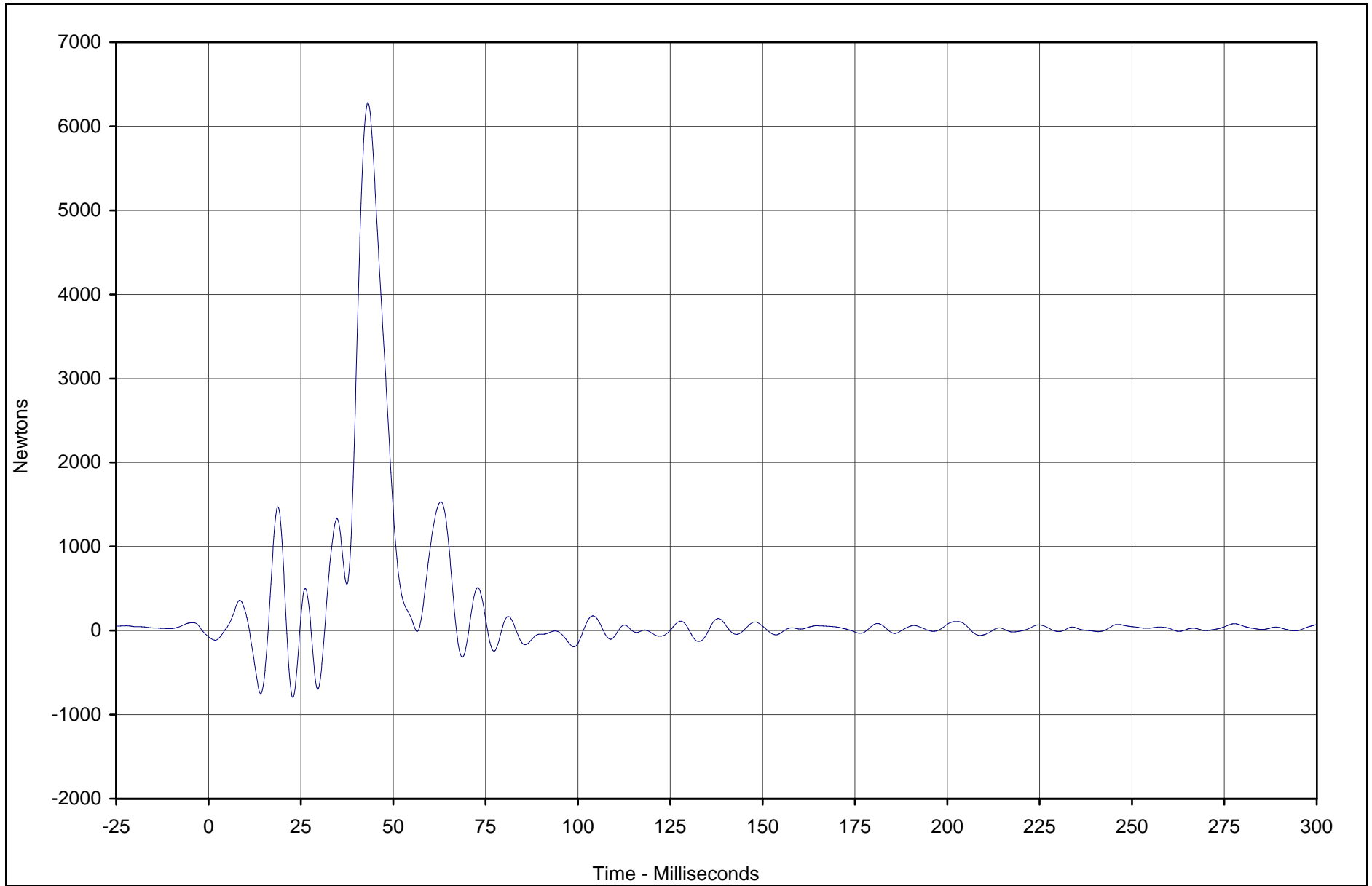
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-35



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force D8	132	FIL	Newtons	6280.7	43.2	-794.4	22.8	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

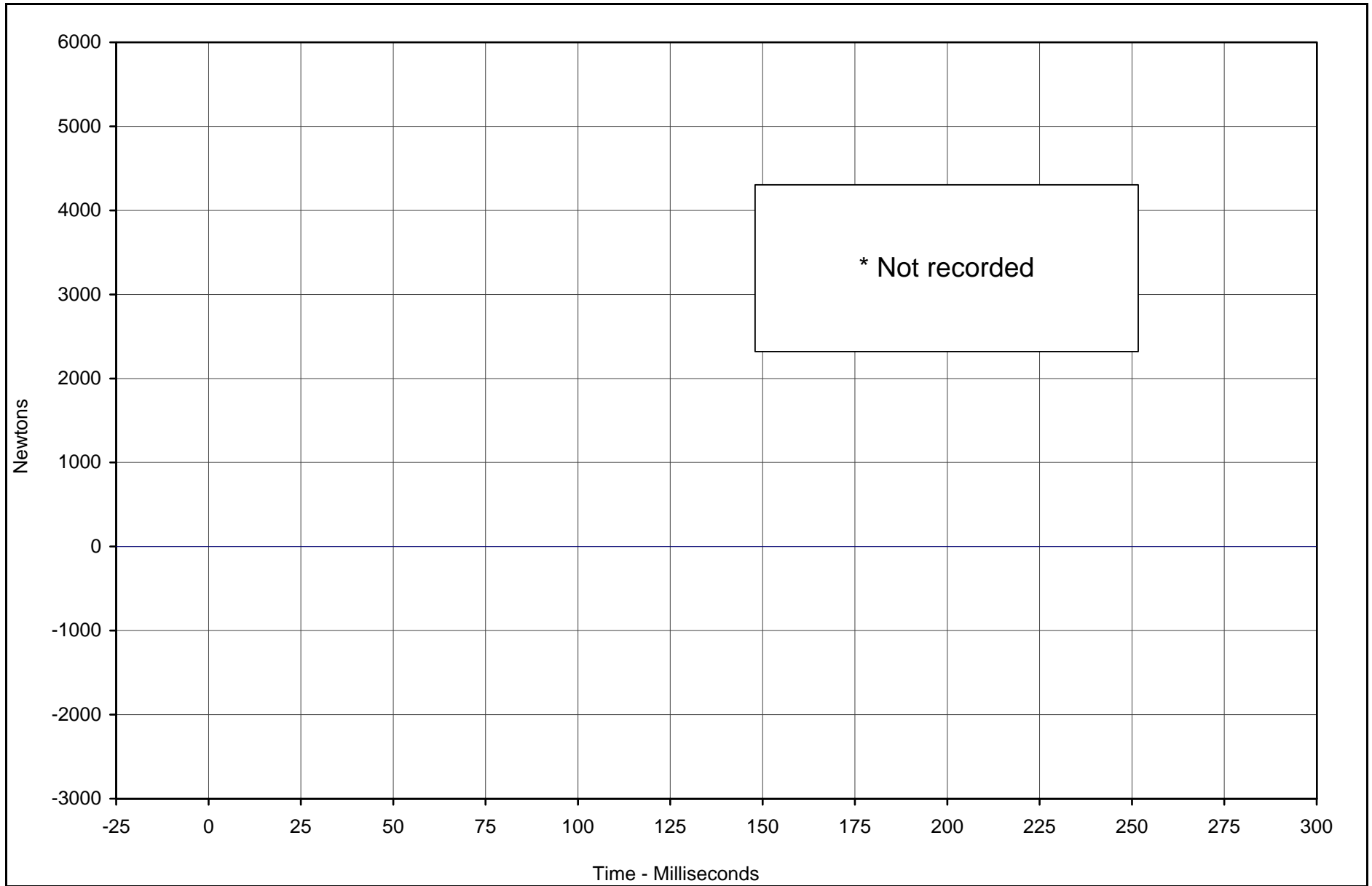
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KARR22001-19

C-36



\* Not recorded

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force D9	133	FIL	Newtons	0.0	0.0	0.0	0.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

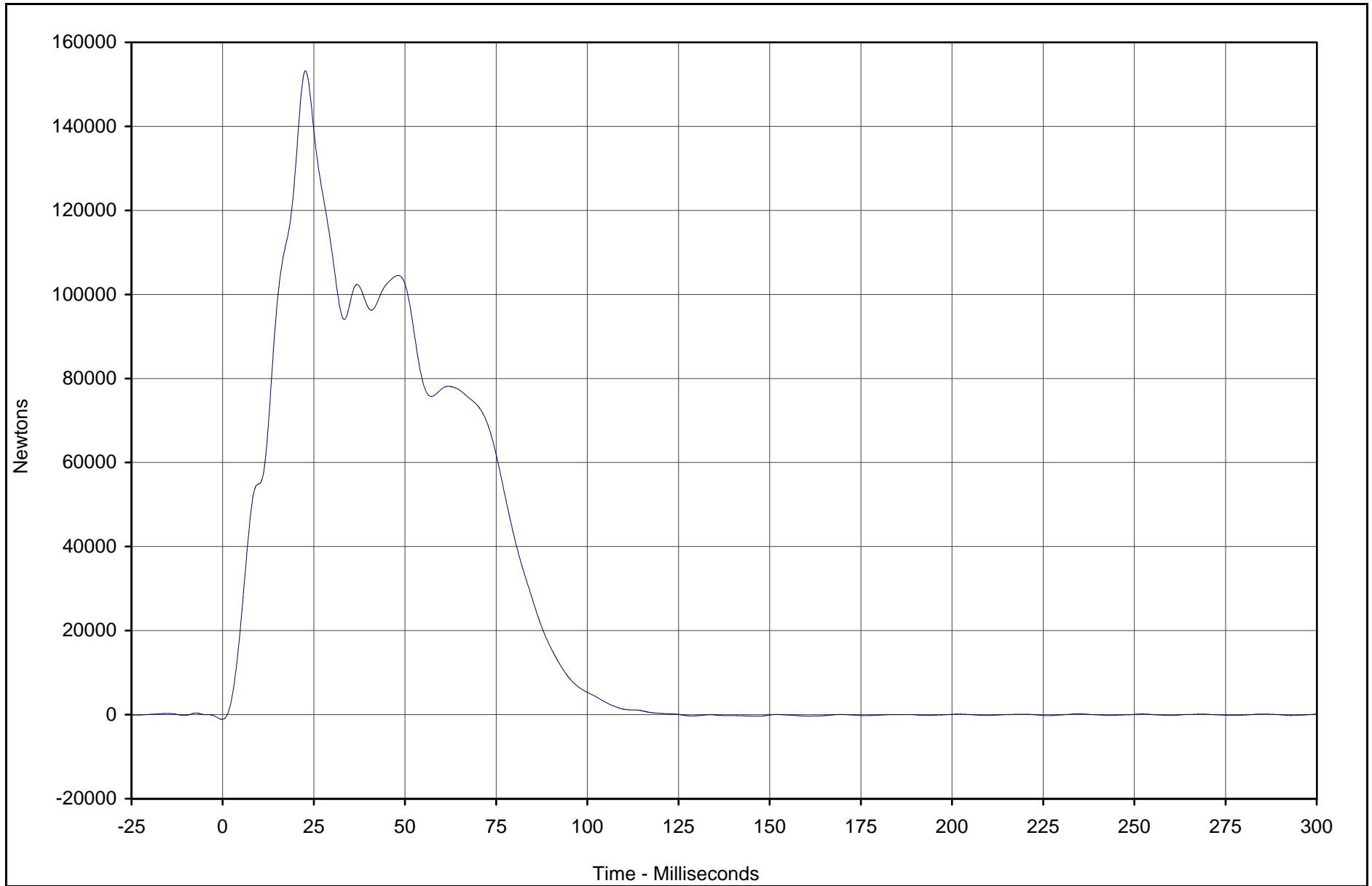
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-37



KARR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force Sum Group 1	001	SUM	Newtons	153221.2	22.7	-1112.9	0.0	60



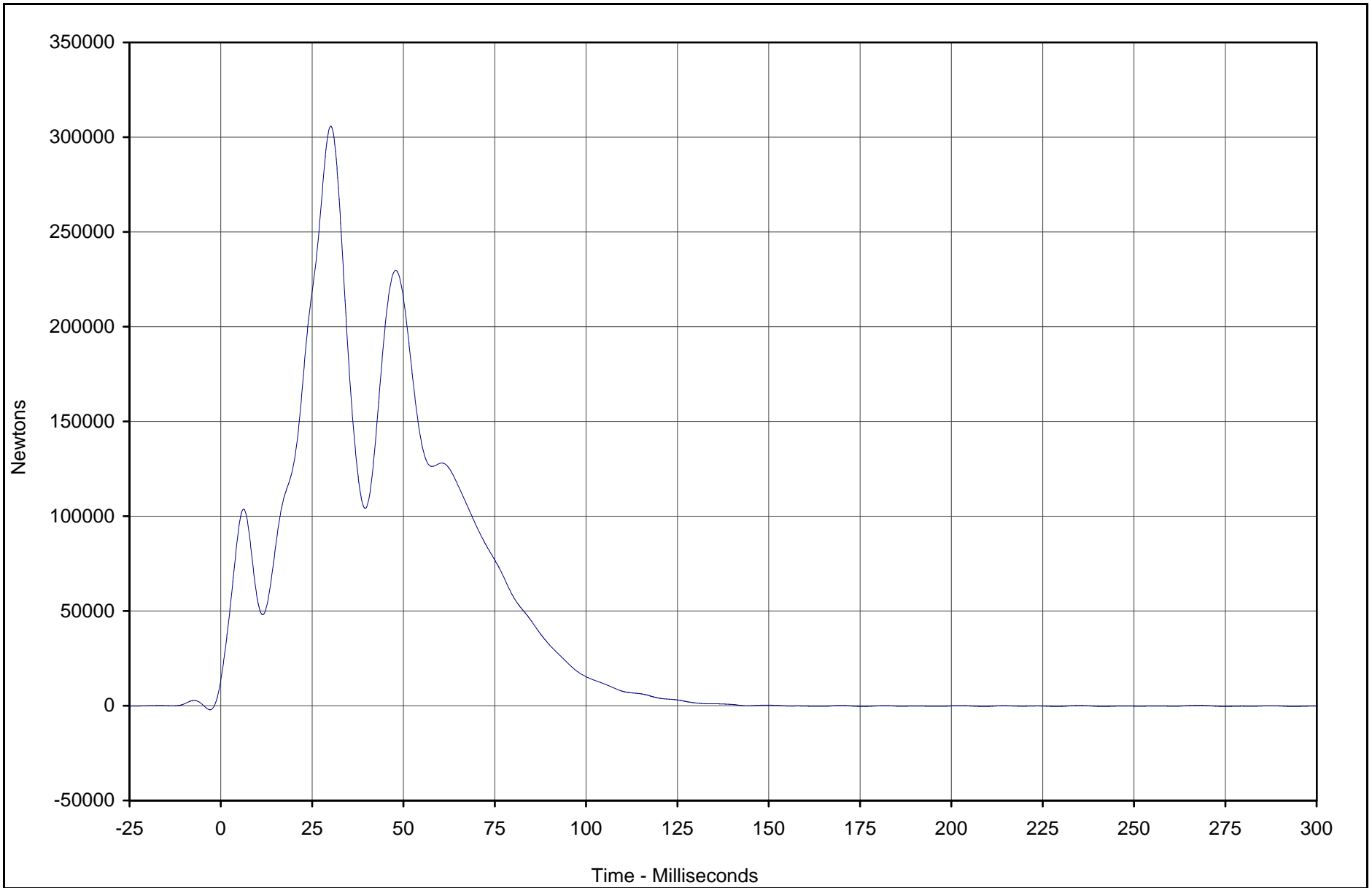
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-38



KARR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force Sum Group 2	002	SUM	Newtons	305834.9	30.1	-448.0	293.8	60



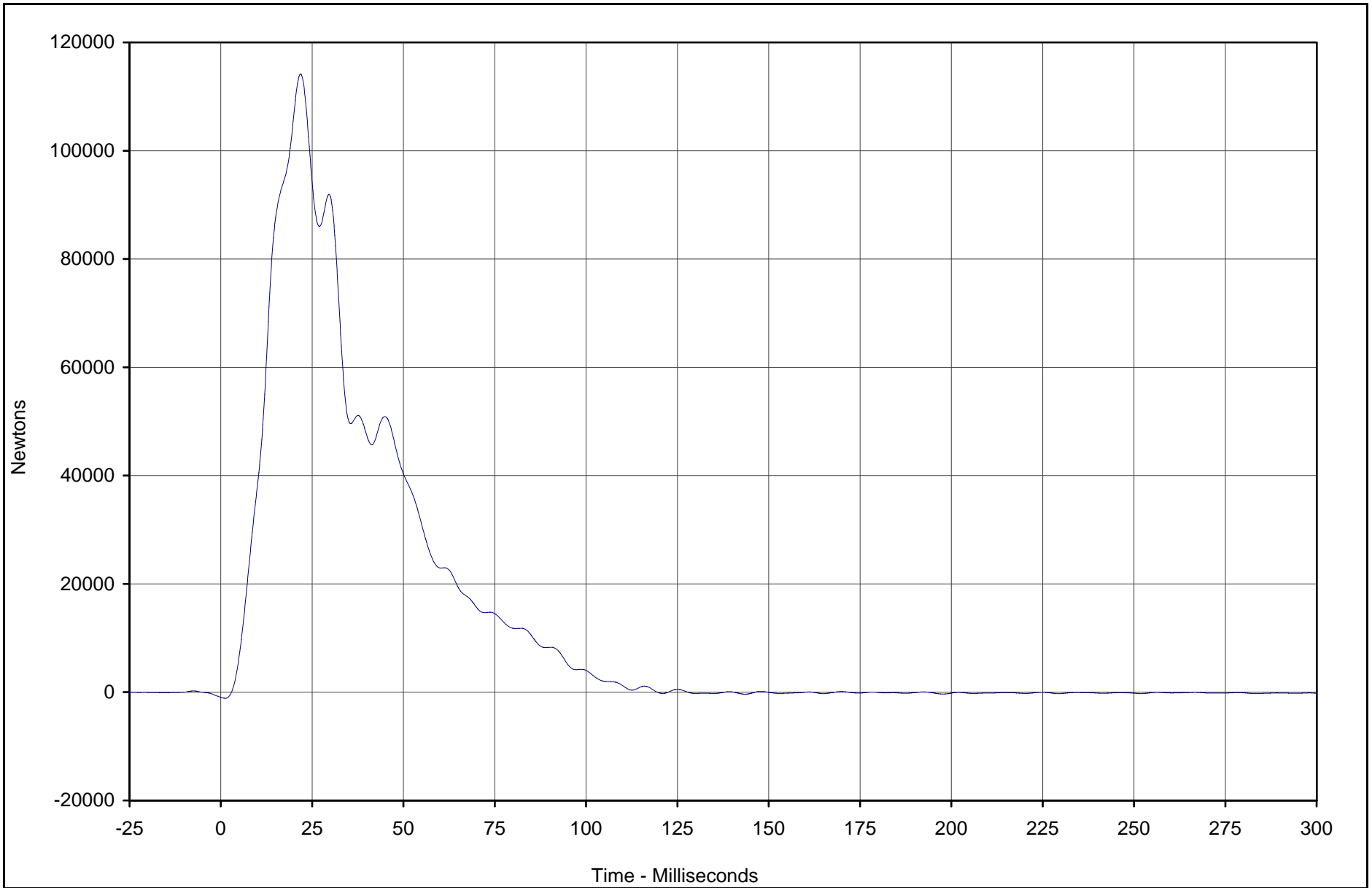
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-39



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force Sum Group 3	003	SUM	Newtons	114166.8	21.8	-1130.2	1.2	60



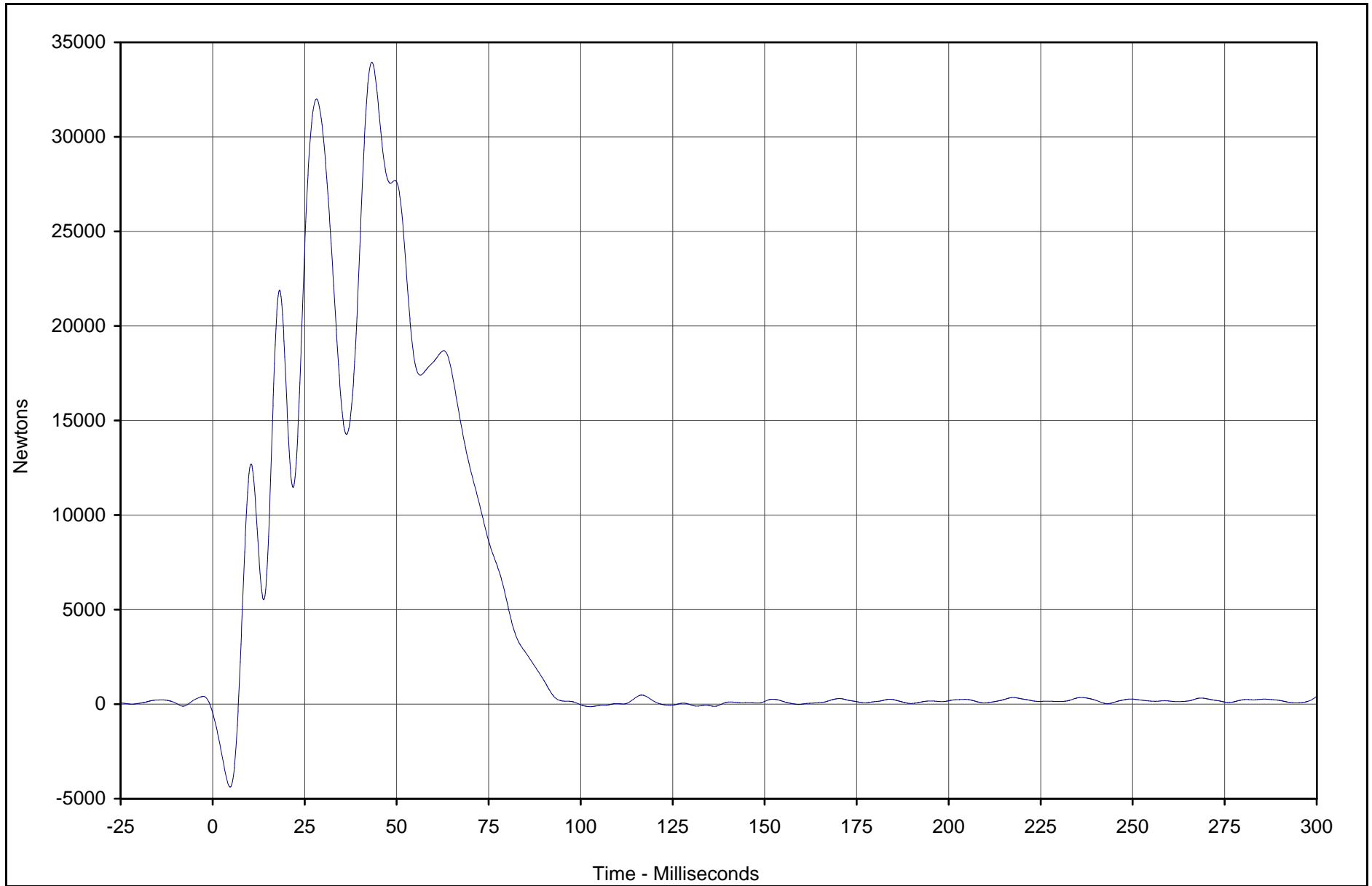
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-40



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force Sum Group 4	004	SUM	Newtons	33949.7	43.3	-4380.3	4.7	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

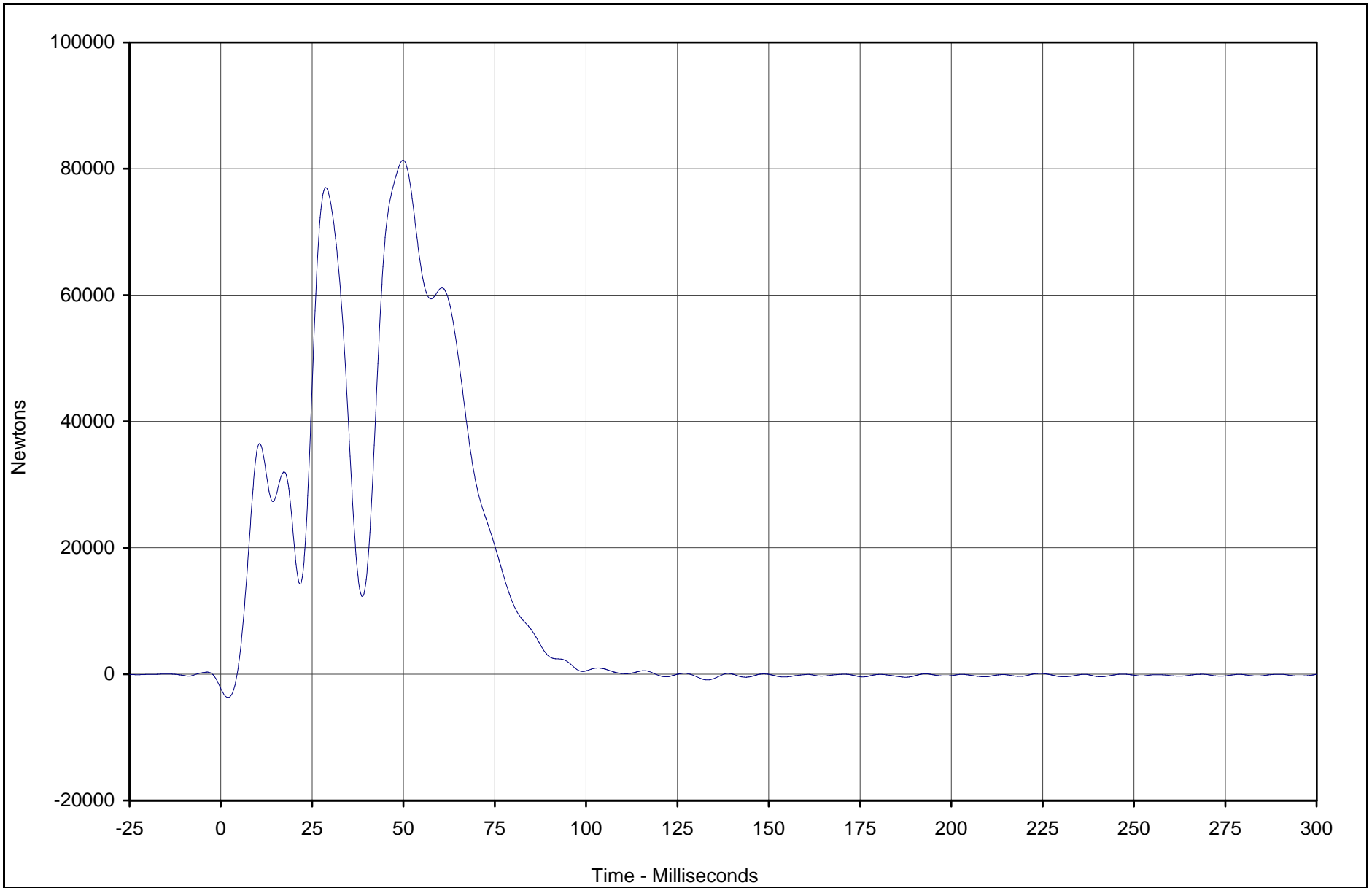
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-41



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force Sum Group 5	005	SUM	Newtons	81368.3	49.9	-3695.4	2.0	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

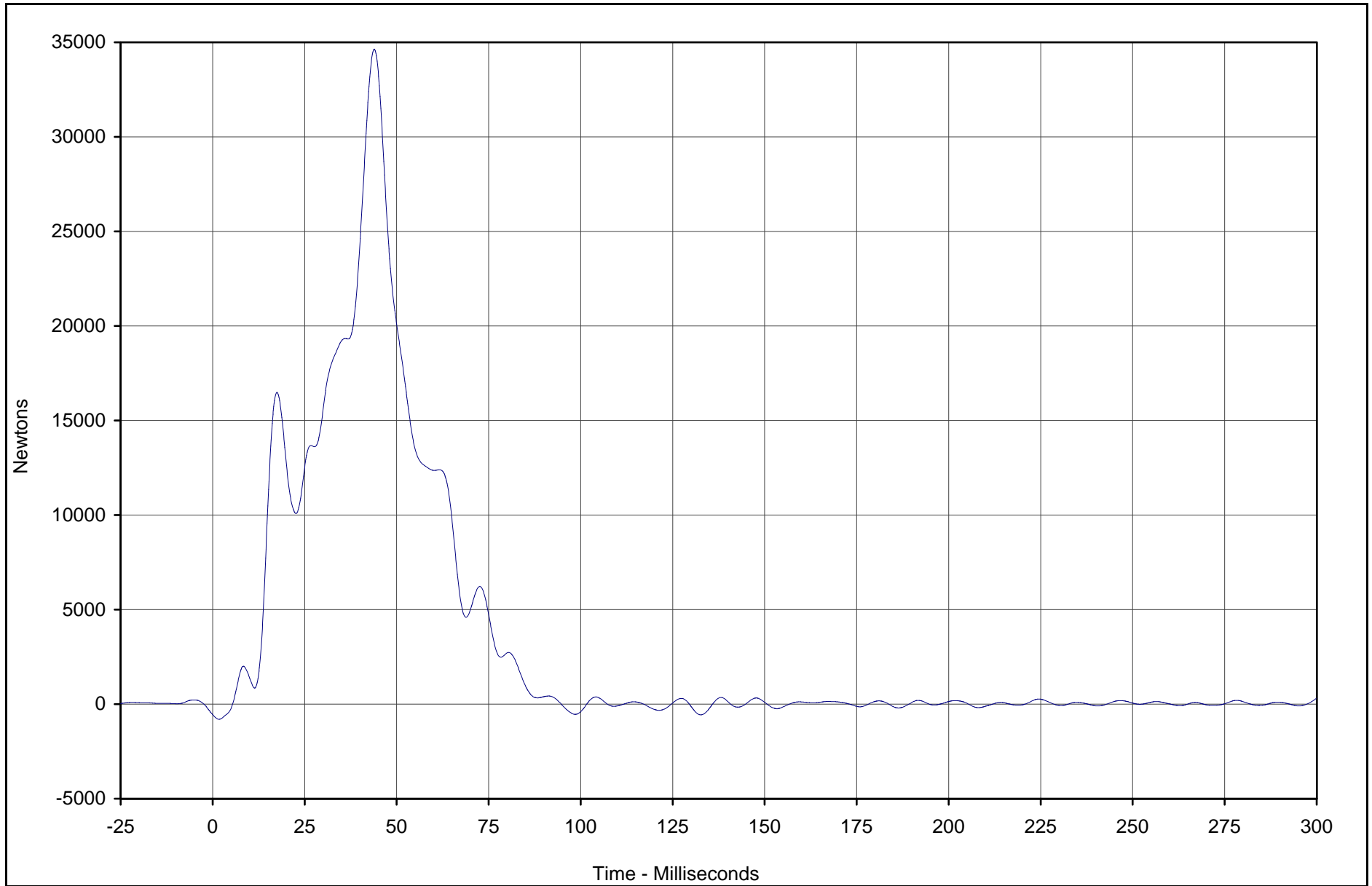
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-42



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force Sum Group 6	006	SUM	Newtons	34636.3	43.9	-802.6	1.7	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

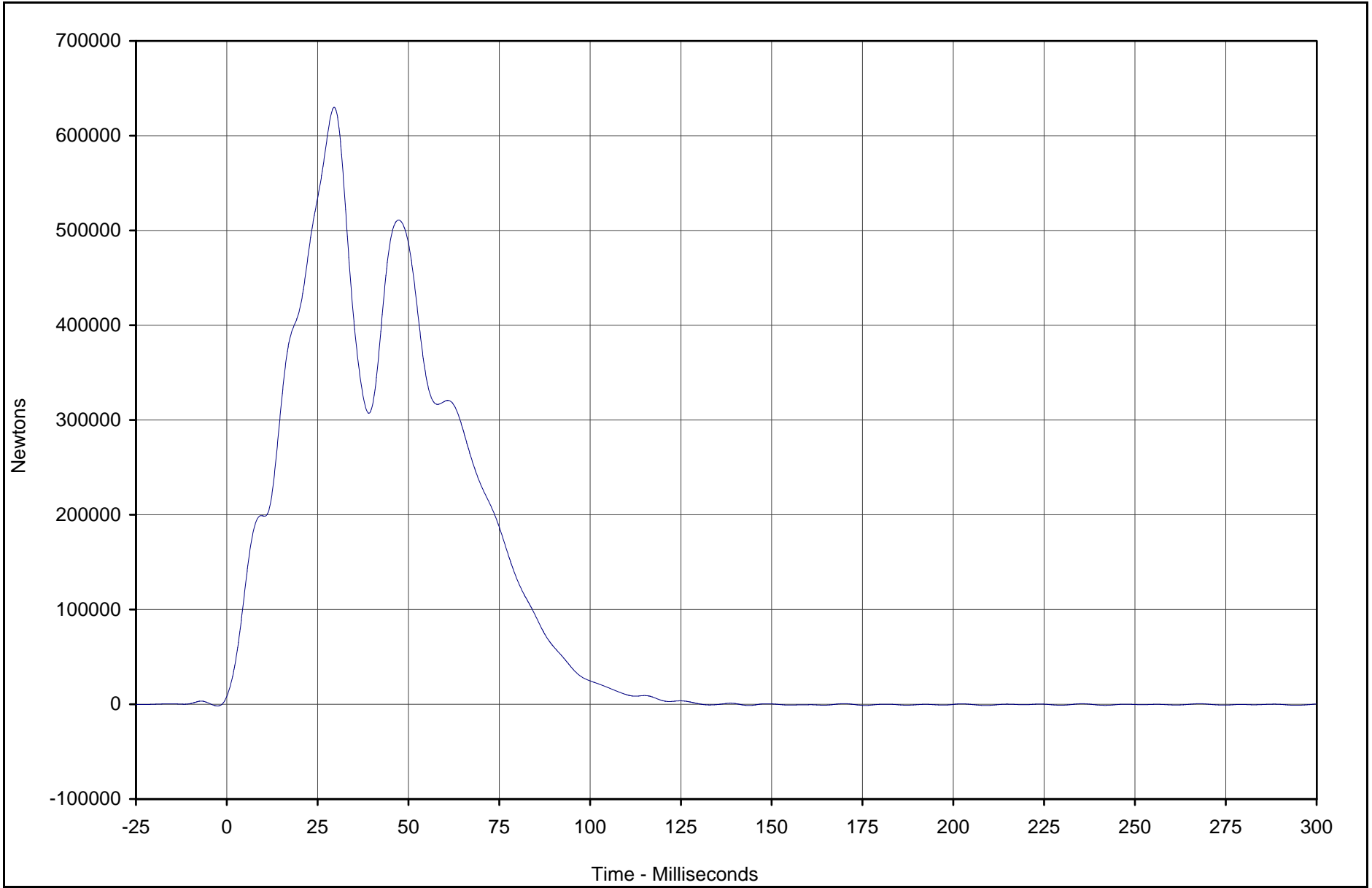
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

C-43



KAR22001-19

Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Barrier Force Total Sum	007	SUM	Newtons	629926	29.6	-1330.3	143.7	60



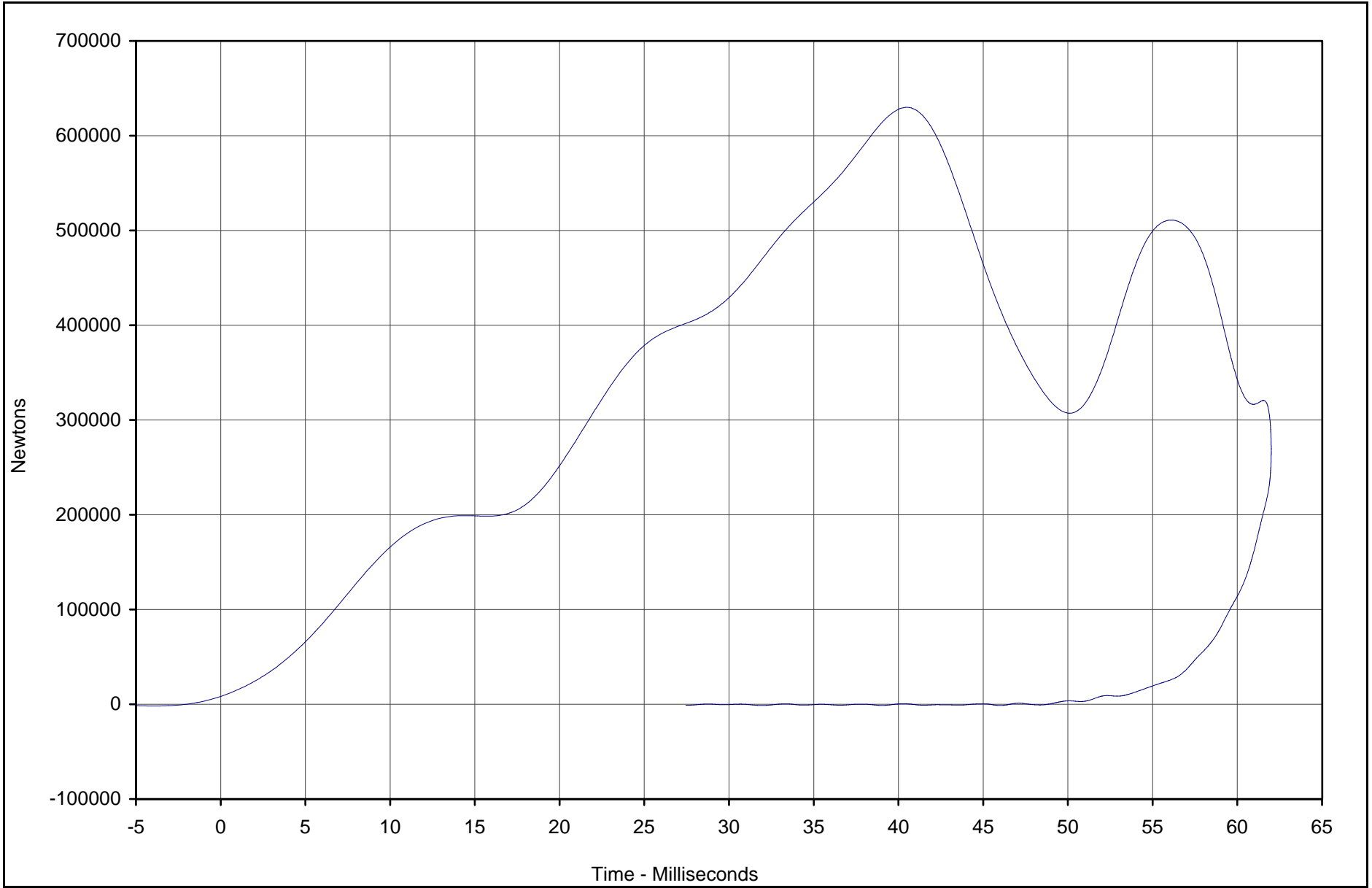
Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

C-44



KAR22001-19

Curve Description	CURNO	Type	Units	Max	CM	Energy (Joules)	SAE Class
Barrier Force Total Sum vs. Displ.	001	XVY	Newtons	629926	40.5	206515	60



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

## BARRIER LOAD CELL SUMMARY DATA

Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

NHTSA No.: M20505

Test Program: 2002 NHTSA 35mph NCAP

Test Date: 6/13/02

Location	Units	Max	Time	Min	Time
Barrier Force A1	Newtons	0.0	0.0	0.0	0.0
Barrier Force A2	Newtons	13318.1	31.2	-1829.8	14.6
Barrier Force A3	Newtons	25938.3	22.7	-973.0	2.6
Barrier Force A4	Newtons	20084.9	29.9	-2454.7	13.1
Barrier Force A5	Newtons	19437.3	30.9	-2236.2	13.1
Barrier Force A6	Newtons	29129.3	22.4	-852.9	12.5
Barrier Force A7	Newtons	27542.4	22.1	-456.9	2.1
Barrier Force A8	Newtons	1462.3	53.6	-728.5	19.9
Barrier Force A9	Newtons	1557.1	23.0	-1241.1	18.9
Barrier Force B1	Newtons	0.0	0.0	0.0	0.0
Barrier Force B2	Newtons	100912.4	22.6	-1099.4	2.5
Barrier Force B3	Newtons	31181.7	15.2	-227.2	143.7
Barrier Force B4	Newtons	52509.8	48.4	-145.6	293.9
Barrier Force B5	Newtons	102655.6	47.9	-61.0	241.3
Barrier Force B6	Newtons	113544.9	29.0	-47.3	175.3
Barrier Force B7	Newtons	90374.3	19.6	-834.4	1.1
Barrier Force B8	Newtons	1578.7	44.5	-583.5	20.0
Barrier Force B9	Newtons	1123.6	23.1	-1332.2	19.1
Barrier Force C1	Newtons	0.0	0.0	0.0	0.0
Barrier Force C2	Newtons	15880.7	29.3	-1046.5	4.9
Barrier Force C3	Newtons	13864.4	27.3	-1079.6	3.9
Barrier Force C4	Newtons	14693.3	11.4	-947.8	0.9
Barrier Force C5	Newtons	48201.5	50.0	-639.8	0.7
Barrier Force C6	Newtons	20791.4	29.6	-821.0	3.0
Barrier Force C7	Newtons	12880.2	16.4	-417.3	3.9
Barrier Force C8	Newtons	10882.7	44.0	-718.3	12.4
Barrier Force C9	Newtons	1061.9	44.6	-1359.3	48.4
Barrier Force D1	Newtons	0.0	0.0	0.0	0.0
Barrier Force D2	Newtons	12548.6	42.9	-2367.7	14.8
Barrier Force D3	Newtons	3177.9	43.2	-1951.0	14.7
Barrier Force D4	Newtons	11325.3	27.4	-1205.0	13.8
Barrier Force D5	Newtons	11134.1	27.3	-1673.5	14.0
Barrier Force D6	Newtons	3188.8	26.9	-2074.4	14.4
Barrier Force D7	Newtons	8660.5	43.4	-1355.3	14.3
Barrier Force D8	Newtons	6280.7	43.2	-794.4	22.8
Barrier Force D9	Newtons	0.0	0.0	0.0	0.0
Barrier Force Sum Group 1	Newtons	153221.2	22.7	-1112.9	0.0
Barrier Force Sum Group 2	Newtons	305834.9	30.1	-448.0	293.8
Barrier Force Sum Group 3	Newtons	114166.8	21.8	-1130.2	1.2
Barrier Force Sum Group 4	Newtons	33949.7	43.3	-4380.3	4.7
Barrier Force Sum Group 5	Newtons	81368.3	49.9	-3695.4	2.0
Barrier Force Sum Group 6	Newtons	34636.3	43.9	-802.6	1.7
Barrier Force Total Sum	Newtons	629925.8	29.6	-1330.3	143.7

\* Not recorded, no data

## **APPENDIX D**

### **INSTRUMENTATION DATA CHANNEL ASSIGNMENTS**

**2002 NHTSA 35mph NCAP  
Instrumentation Data Channel Assignments  
Driver A.T.D. Serial Number 34  
6/13/02  
2002 Hyundai Sonata 4 Door Sedan**

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
1	HEAD, PRIMARY	X	KEAC039	Accel.,1/2 bridge	Endevco	7264-2000	G
2	HEAD, PRIMARY	Y	KEAC038	Accel.,1/2 bridge	Endevco	7264-2000	G
3	HEAD, PRIMARY	Z	KEAC027	Accel.,1/2 bridge	Endevco	7264-2000	G
4	HEAD, REDUNDANT	X	KEAC031	Accel.,1/2 bridge	Endevco	7264-2000	G
5	HEAD, REDUNDANT	Y	KEAC032	Accel.,1/2 bridge	Endevco	7264-2000	G
6	HEAD, REDUNDANT	Z	KEAC026	Accel.,1/2 bridge	Endevco	7264-2000	G
7	NECK FORCE	X	GPUN02FX	Load cell, six axis neck	R. A. Denton	1716A	N
8	NECK FORCE	Y	GPUN02FY	Load cell, six axis neck	R. A. Denton	1716A	N
9	NECK FORCE	Z	GPUN02FZ	Load cell, six axis neck	R. A. Denton	1716A	N
10	NECK MOMENT	X	GPUN02MX	Load cell, six axis neck	R. A. Denton	1716A	Nm
11	NECK MOMENT	Y	GPUN02MY	Load cell, six axis neck	R. A. Denton	1716A	Nm
12	NECK MOMENT	Z	GPUN02MZ	Load cell, six axis neck	R. A. Denton	1716A	Nm
13	CHEST , PRIMARY	X	GPAC031	Accel., 1/2 bridge	Endevco	7264-2000	G
14	CHEST , PRIMARY	Y	GPAC024	Accel., 1/2 bridge	Endevco	7264-2000	G
15	CHEST , PRIMARY	Z	GPAC029	Accel., 1/2 bridge	Endevco	7264-2000	G
16	CHEST , REDUNDANT	X	KEAC023	Accel.,1/2 bridge	Endevco	7264-200	G
17	CHEST , REDUNDANT	Y	KEAC022	Accel.,1/2 bridge	Endevco	7264-200	G
18	CHEST , REDUNDANT	Z	KEAC024	Accel.,1/2 bridge	Endevco	7264-200	G
19	CHEST DISPLACEMENT	X	GPCP001	Rotary Pot Chest	Servo	14CBI	MM
20	PELVIS, PRIMARY	X	KEAC019	Accel.,1/2 bridge	Endevco	7264-200	G
21	PELVIS, PRIMARY	Y	KEAC020	Accel.,1/2 bridge	Endevco	7264-200	G
22	PELVIS, PRIMARY	Z	KEAC021	Accel.,1/2 bridge	Endevco	7264-200	G
23	LEFT FEMUR FORCE	Z	KEFF001	Load cell, Femur	R.A. Denton	2121	N
24	RIGHT FEMUR FORCE	Z	KEFF002	Load cell, Femur	R.A. Denton	2121	N

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**2002 NHTSA 35mph NCAP  
Instrumentation Data Channel Assignments  
Driver A.T.D. Serial Number 34  
6/13/02  
2002 Hyundai Sonata 4 Door Sedan**

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
25	UP. TIBIA LEFT MOM.	X	GPUT09MX	2 ch., Upper tibia gage	R. A. Denton	1583	Nm
26	UP. TIBIA LEFT MOM.	Y	GPUT09MY	2 ch., Upper tibia gage	R. A. Denton	1583	Nm
27	UP. TIBIA RIGHT MOM.	X	GPUT09MX	2 ch., Upper tibia gage	R. A. Denton	1583	Nm
28	UP. TIBIA RIGHT MOM.	Y	GPUT09MY	2 ch., Upper tibia gage	R. A. Denton	1583	Nm
29	LWR. TIBIA LEFT MOM.	X	GPLT09MX	3 ch., lower tibia gage	R. A. Denton	3093	Nm
30	LWR. TIBIA LEFT MOM.	Y	GPLT09MY	3 ch., lower tibia gage	R. A. Denton	3093	Nm
31	LWR. TIBIA LEFT FORCE	Z	GPLT09FZ	3 ch., lower tibia gage	R. A. Denton	3093	N
32	LWR. TIBIA RIGHT MOM.	X	GPLT09MX	3 ch., lower tibia gage	R. A. Denton	3093	Nm
33	LWR. TIBIA RIGHT MOM.	Y	GPLT09MY	3 ch., lower tibia gage	R. A. Denton	3093	Nm
34	LWR. TIBIA RIGHT FORCE	Z	GPLT09FZ	3 ch., lower tibia gage	R. A. Denton	3093	N
35	FOOT LEFT, AFT	X	KEIC003X	Accel., Foot Triax	I.C. Sensor	3031-500	G
36	FOOT LEFT, AFT	Z	KEIC003Y	Accel., Foot Triax	I.C. Sensor	3031-500	G
37	FOOT LEFT, FORE	Z	KEIC003Z	Accel., Foot Triax	I.C. Sensor	3031-500	G
38	FOOT RIGHT, AFT	X	KEIC004X	Accel., Foot Triax	I.C. Sensor	3031-500	G
39	FOOT RIGHT, AFT	Z	KEIC004Y	Accel., Foot Triax	I.C. Sensor	3031-500	G
40	FOOT RIGHT, FORE	Z	KEIC004Z	Accel., Foot Triax	I.C. Sensor	3031-500	G
41	LAP BELT FORCE	X	KELC003	Load cell, Seat belt	Lebow	3371	N
42	SHOULDER BELT FORCE	X	KELC004	Load cell, Seat belt	Lebow	3371	N
43	SHOULDER BELT SPOOL	X	KEPP001	Pullout pot	Celesco	PTX101-0030	CM
44	SHOULDER BELT ELONG.	X	KEEP001	Linear pot., belt stretch	E.T.I.	LCP8-10 10K	MM/CM

**2002 NHTSA 35mph NCAP  
Instrumentation Data Channel Assignments  
Passenger A.T.D. Serial Number 35  
6/13/02  
2002 Hyundai Sonata 4 Door Sedan**

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
45	HEAD, PRIMARY	X	GPAC027	Accel., 1/2 bridge	Endevco	7264-2000	G
46	HEAD, PRIMARY	Y	GPAC002	Accel., 1/2 bridge	Endevco	7264-2000	G
47	HEAD, PRIMARY	Z	GPAC003	Accel., 1/2 bridge	Endevco	7264-2000	G
48	HEAD, REDUNDANT	X	GPAC032	Accel., 1/2 bridge	Endevco	7264-2000	G
49	HEAD, REDUNDANT	Y	GPAC021	Accel., 1/2 bridge	Endevco	7264-2000	G
50	HEAD, REDUNDANT	Z	GPAC026	Accel., 1/2 bridge	Endevco	7264-2000	G
51	NECK FORCE	X	GPUN01FX	Load cell, six axis neck	R. A. Denton	1716A	N
52	NECK FORCE	Y	GPUN01FY	Load cell, six axis neck	R. A. Denton	1716A	N
53	NECK FORCE	Z	GPUN01FZ	Load cell, six axis neck	R. A. Denton	1716A	N
54	NECK MOMENT	X	GPUN01MX	Load cell, six axis neck	R. A. Denton	1716A	Nm
55	NECK MOMENT	Y	GPUN01MY	Load cell, six axis neck	R. A. Denton	1716A	Nm
56	NECK MOMENT	Z	GPUN01MZ	Load cell, six axis neck	R. A. Denton	1716A	Nm
57	CHEST , PRIMARY	X	GPAC005	Accel., 1/2 bridge	Endevco	7264-2000	G
58	CHEST , PRIMARY	Y	GPAC011	Accel., 1/2 bridge	Endevco	7264-2000	G
59	CHEST , PRIMARY	Z	GPAC010	Accel., 1/2 bridge	Endevco	7264-2000	G
60	CHEST , REDUNDANT	X	GPAC034	Accel., 1/2 bridge	Endevco	7264-2000	G
61	CHEST , REDUNDANT	Y	GPAC023	Accel., 1/2 bridge	Endevco	7264-2000	G
62	CHEST , REDUNDANT	Z	GPAC020	Accel., 1/2 bridge	Endevco	7264-2000	G
63	CHEST DISPLACEMENT	X	GPCP002	Rotary Pot Chest	Servo	14CBI	MM
64	PELVIS, PRIMARY	X	GPAC025	Accel., 1/2 bridge	Endevco	7264-2000	G
65	PELVIS, PRIMARY	Y	GPAC022	Accel., 1/2 bridge	Endevco	7264-2000	G
66	PELVIS, PRIMARY	Z	GPAC019	Accel., 1/2 bridge	Endevco	7264-2000	G
67	LEFT FEMUR FORCE	Z	KEFF003	Load cell, Femur	R.A. Denton	2121	N
68	RIGHT FEMUR FORCE	Z	KEFF004	Load cell, Femur	R.A. Denton	2121	N

**2002 NHTSA 35mph NCAP  
Instrumentation Data Channel Assignments  
Passenger A.T.D. Serial Number 35  
6/13/02  
2002 Hyundai Sonata 4 Door Sedan**

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
69	UP. TIBIA LEFT MOM.	X	GPUT09MX	2 ch., Upper tibia gage	R. A. Denton	1583	Nm
70	UP. TIBIA LEFT MOM.	Y	GPUT09MY	2 ch., Upper tibia gage	R. A. Denton	1583	Nm
71	UP. TIBIA RIGHT MOM.	X	GPUT09MX	2 ch., Upper tibia gage	R. A. Denton	1583	Nm
72	UP. TIBIA RIGHT MOM.	Y	GPUT09MY	2 ch., Upper tibia gage	R. A. Denton	1583	Nm
73	LWR. TIBIA LEFT MOM.	X	GPLT09MX	3 ch., lower tibia gage	R. A. Denton	3093	Nm
74	LWR. TIBIA LEFT MOM.	Y	GPLT09MY	3 ch., lower tibia gage	R. A. Denton	3093	Nm
75	LWR. TIBIA LEFT FORCE	Z	GPLT09FZ	3 ch., lower tibia gage	R. A. Denton	3093	N
76	LWR. TIBIA RIGHT MOM.	X	GPLT09MX	3 ch., lower tibia gage	R. A. Denton	3093	Nm
77	LWR. TIBIA RIGHT MOM.	Y	GPLT09MY	3 ch., lower tibia gage	R. A. Denton	3093	Nm
78	LWR. TIBIA RIGHT FORCE	Z	GPLT09FZ	3 ch., lower tibia gage	R. A. Denton	3093	N
79	FOOT LEFT, AFT	X	KEIC002X	Accel., Foot Triax	I.C. Sensor	3031-500	G
80	FOOT LEFT, AFT	Z	KEIC002Y	Accel., Foot Triax	I.C. Sensor	3031-500	G
81	FOOT LEFT, FORE	Z	KEIC002Z	Accel., Foot Triax	I.C. Sensor	3031-500	G
82	FOOT RIGHT, AFT	X	KEIC001X	Accel., Foot Triax	I.C. Sensor	3031-500	G
83	FOOT RIGHT, AFT	Z	KEIC001Y	Accel., Foot Triax	I.C. Sensor	3031-500	G
84	FOOT RIGHT, FORE	Z	KEIC001Z	Accel., Foot Triax	I.C. Sensor	3031-500	G
85	LAP BELT FORCE	X	KELC001	Load cell, Seat belt	Lebow	3371	N
86	SHOULDER BELT FORCE	X	KELC002	Load cell, Seat belt	Lebow	3371	N
87	SHOULDER BELT SPOOL	X	KEPP001	Pullout pot	Celesco	PTX101-0030	MM
88	SHOULDER BELT ELONG.	X	KEEP001	Linear pot., belt stretch	E.T.I.	LCP8-10 10K	MM/CM

**2002 NHTSA 35mph NCAP  
Instrumentation Data Channel Assignments  
Vehicle Accelerometers  
6/13/02  
2002 Hyundai Sonata 4 Door Sedan**

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
89	Left Rear	X	KEVA002	Accel., Pre-Amp	I.C.S/Karco	3031-500	G
90	Right Rear	X	KEVA006	Accel., Vehicle block	I.C. Sensor	3031-200	G
91	Engine Top	X	KEVA009	Accel., Vehicle block	I.C. Sensor	3031-500	G
92	Engine Bottom	X	KEVA008	Accel., Vehicle block	I.C. Sensor	3031-500	G
93	Left Brake Caliper	X	KEVA007	Accel., Vehicle block	I.C. Sensor	3031-500	G
94	Right Brake Caliper	X	KEVA012	Accel., Vehicle block	I.C. Sensor	3031-500	G
95	Instrument Panel	X	KEVA011	Accel., Vehicle block	I.C. Sensor	3031-200	G
96	Left Rear	Z	KEVA005	Accel., Vehicle block	I.C. Sensor	3031-500	G
97	Right Rear	Z	KEVA010	Accel., Vehicle block	I.C. Sensor	3031-200	G

**2002 NHTSA 35mph NCAP  
Instrumentation Data Channel Assignments  
Rigid Load Cell Barrier  
6/13/02  
2002 Hyundai Sonata 4 Door Sedan**

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
98	BARRIER FORCE A1	X	BARRIER	Not Used	N/A	N/A	N/A
99	BARRIER FORCE A2	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
100	BARRIER FORCE A3	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
101	BARRIER FORCE A4	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
102	BARRIER FORCE A5	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
103	BARRIER FORCE A6	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
104	BARRIER FORCE A7	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
105	BARRIER FORCE A8	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
106	BARRIER FORCE A9	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
107	BARRIER FORCE B1	X	BARRIER	Not Used	N/A	N/A	N/A
108	BARRIER FORCE B2	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
109	BARRIER FORCE B3	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
110	BARRIER FORCE B4	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
111	BARRIER FORCE B5	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
112	BARRIER FORCE B6	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
113	BARRIER FORCE B7	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
114	BARRIER FORCE B8	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
115	BARRIER FORCE B9	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N

**2002 NHTSA 35mph NCAP  
Instrumentation Data Channel Assignments  
Rigid Load Cell Barrier  
6/13/02  
2002 Hyundai Sonata 4 Door Sedan**

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
116	BARRIER FORCE C1	X	BARRIER	Not Used	N/A	N/A	N/A
117	BARRIER FORCE C2	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
118	BARRIER FORCE C3	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
119	BARRIER FORCE C4	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
120	BARRIER FORCE C5	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
121	BARRIER FORCE C6	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
122	BARRIER FORCE C7	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
123	BARRIER FORCE C8	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
124	BARRIER FORCE C9	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
125	BARRIER FORCE D1	X	N/A	Not Used	N/A	N/A	N/A
126	BARRIER FORCE C8	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
127	BARRIER FORCE C8	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
128	BARRIER FORCE C8	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
129	BARRIER FORCE C8	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
130	BARRIER FORCE C8	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
131	BARRIER FORCE C8	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
132	BARRIER FORCE C8	X	BARRIER	Load Cell, LCB	Lebow	1220-FS	N
133	BARRIER FORCE D9	X	N/A	Not Used	N/A	N/A	N/A

**2002 NHTSA 35mph NCAP  
Instrumentation Data Channel Assignments  
Nine Accelerometer Head Array Channels  
6/13/02  
2002 Hyundai Sonata 4 Door Sedan**

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
134	Driver Head CG	X	KEAC039	Accel., 1/2 bridge	Endevco	7264-2000	G *
135	Driver Head CG	Y	KEAC038	Accel., 1/2 bridge	Endevco	7264-2000	G *
136	Driver Head CG	Z	KEAC027	Accel., 1/2 bridge	Endevco	7264-2000	G *
137	Driver Y-arm	Z	GPAC016	Accel., 1/2 bridge	Endevco	7264-2000	G
138	Driver Y-arm	X	GPAC015	Accel., 1/2 bridge	Endevco	7264-2000	G
139	Driver X-arm	Z	GPAC004	Accel., 1/2 bridge	Endevco	7264-2000	G
140	Driver X-arm	Y	GPAC018	Accel., 1/2 bridge	Endevco	7264-2000	G
141	Driver Z-arm	X	GPAC006	Accel., 1/2 bridge	Endevco	7264-2000	G
142	Driver Z-arm	Y	GPAC007	Accel., 1/2 bridge	Endevco	7264-2000	G
143	Passenger Head CG	X	GPAC027	Accel., 1/2 bridge	Endevco	7264-2000	G *
144	Passenger Head CG	Y	GPAC002	Accel., 1/2 bridge	Endevco	7264-2000	G *
145	Passenger Head CG	Z	GPAC003	Accel., 1/2 bridge	Endevco	7264-2000	G *
146	Passenger Y-arm	Z	GPAC012	Accel., 1/2 bridge	Endevco	7264-2000	G
147	Passenger Y-arm	X	GPAC001	Accel., 1/2 bridge	Endevco	7264-2000	G
148	Passenger X-arm	Z	GPAC036	Accel., 1/2 bridge	Endevco	7264-2000	G
149	Passenger X-arm	Y	GPAC014	Accel., 1/2 bridge	Endevco	7264-2000	G
150	Passenger Z-arm	X	GPAC030	Accel., 1/2 bridge	Endevco	7264-2000	G
151	Passenger Z-arm	Y	GPAC037	Accel., 1/2 bridge	Endevco	7264-2000	G

\* Duplicate of Head CG Primary Channels

**APPENDIX E**

**DUMMY CALIBRATION DATA**



## Calibration Data Sheet Hybrid III 50th Percentile Male Knee Impact Test

ATD Serial No.: 034

Location: Left Knee

Test I.D.: LK07B

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Pendulum Velocity at T=0	m/sec	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	5027	Pass
Overall Test Results				Pass

ATD Serial No.: 034

Location: Right Knee

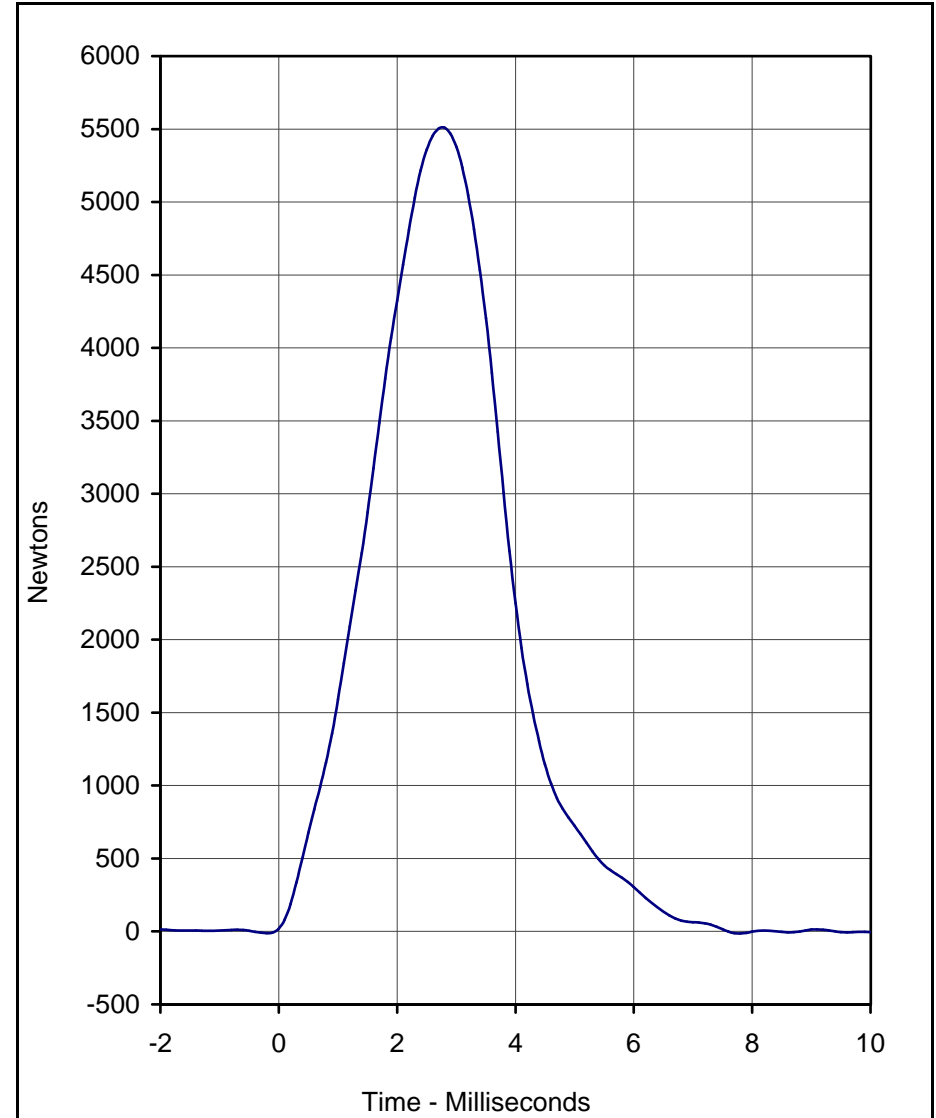
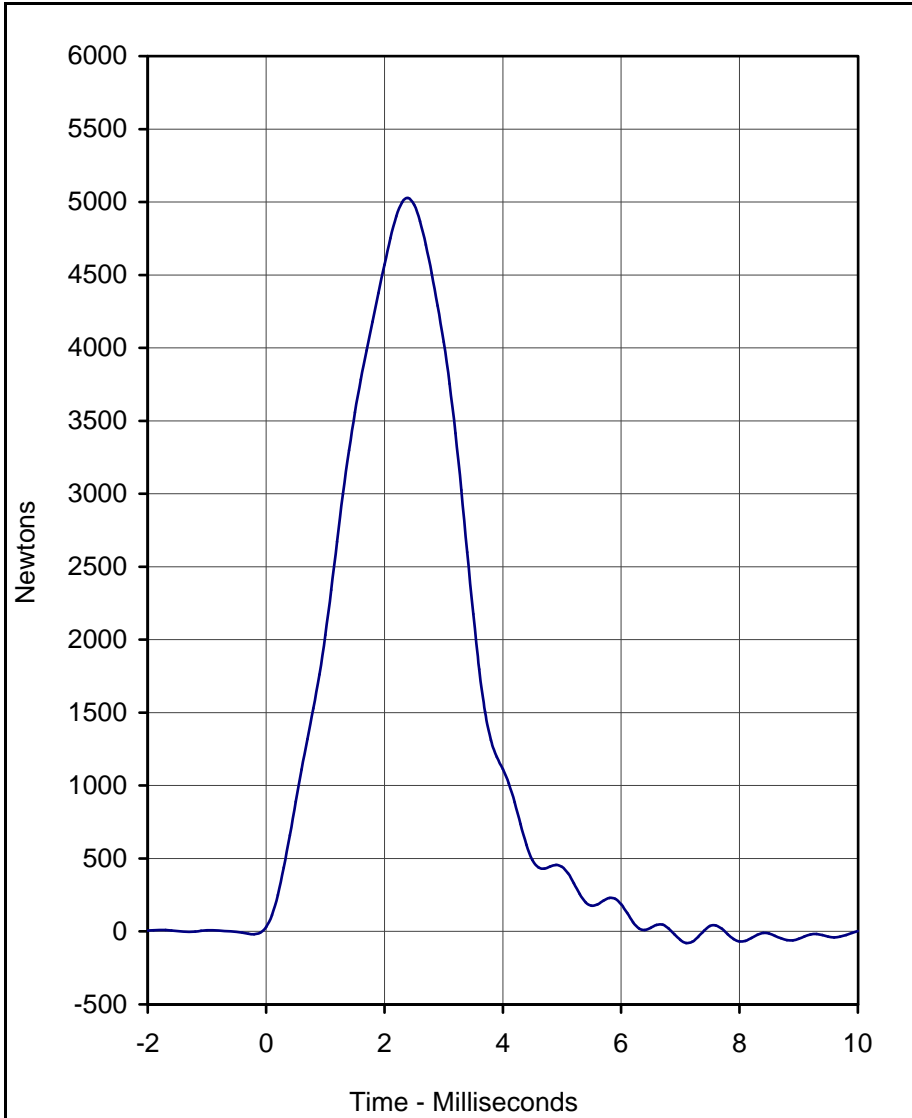
Test I.D.: RK07B

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Pendulum Velocity at T=0	m/sec	2.07 to 2.13	2.11	Pass
Peak Probe Force	N	4715 to 5782	5509	Pass
Overall Test Results				Pass

\_\_\_\_\_  
Laboratory Technician

June 11, 2002

\_\_\_\_\_  
Test Date



Curve Description	Location	Test I.D.	CURNO	Type
Probe Force	Left Knee	LK07B	001	FIL

Curve Description	Location	Test I.D.	CURNO	Type
Probe Force	Right Knee	RK07B	002	FIL

Units	Max	Time	Min	Time	SAE Class
Newtons	5027.1	2.4	-79.0	7.1	600

Units	Max	Time	Min	Time	SAE Class
Newtons	5509.3	2.8	-14.6	7.8	600

Test Program: Hybrid III 50th Percentile Male Knee Impact Test  
 Test Date: 6/11/02

A.T.D. Serial No.: 034





## Calibration Data Sheet Hybrid III 50th Percentile Male Head Drop Test

ATD Serial No.: 034

Test I.D.: HD07B

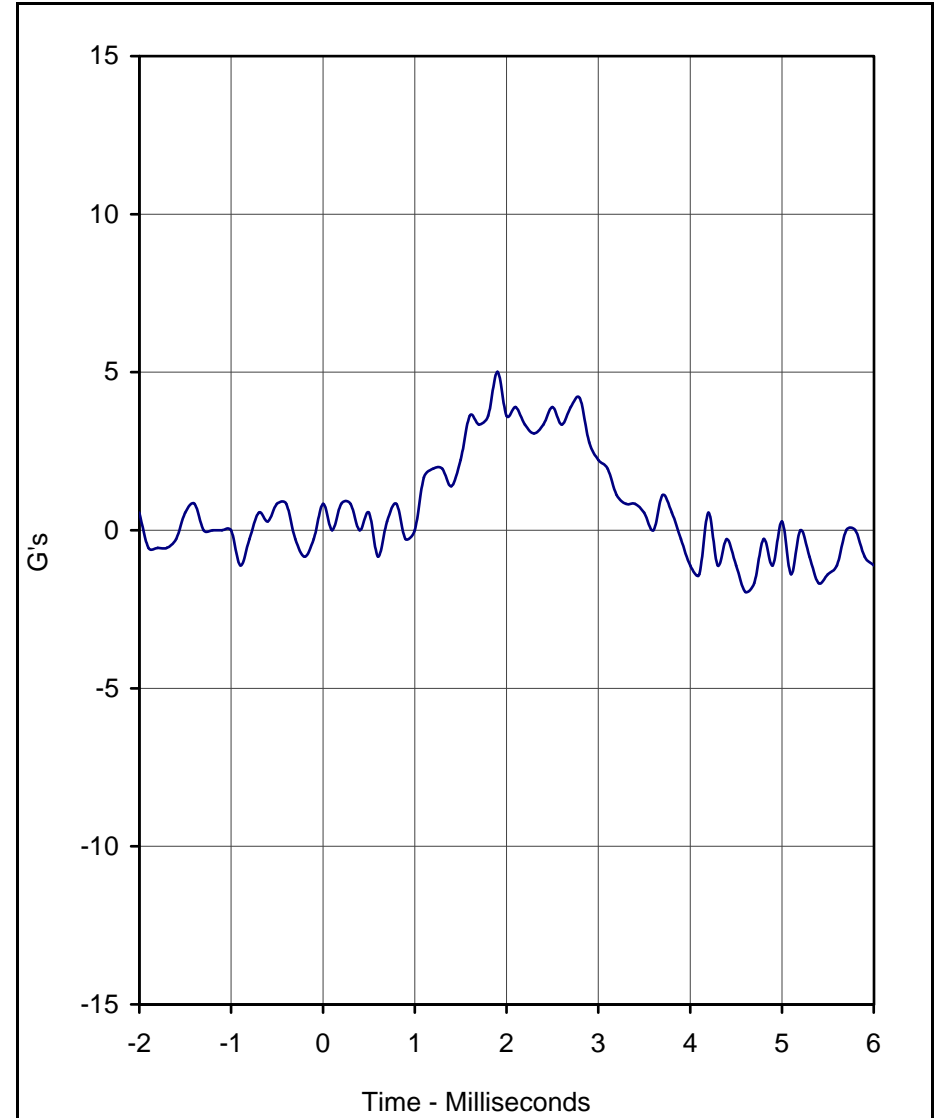
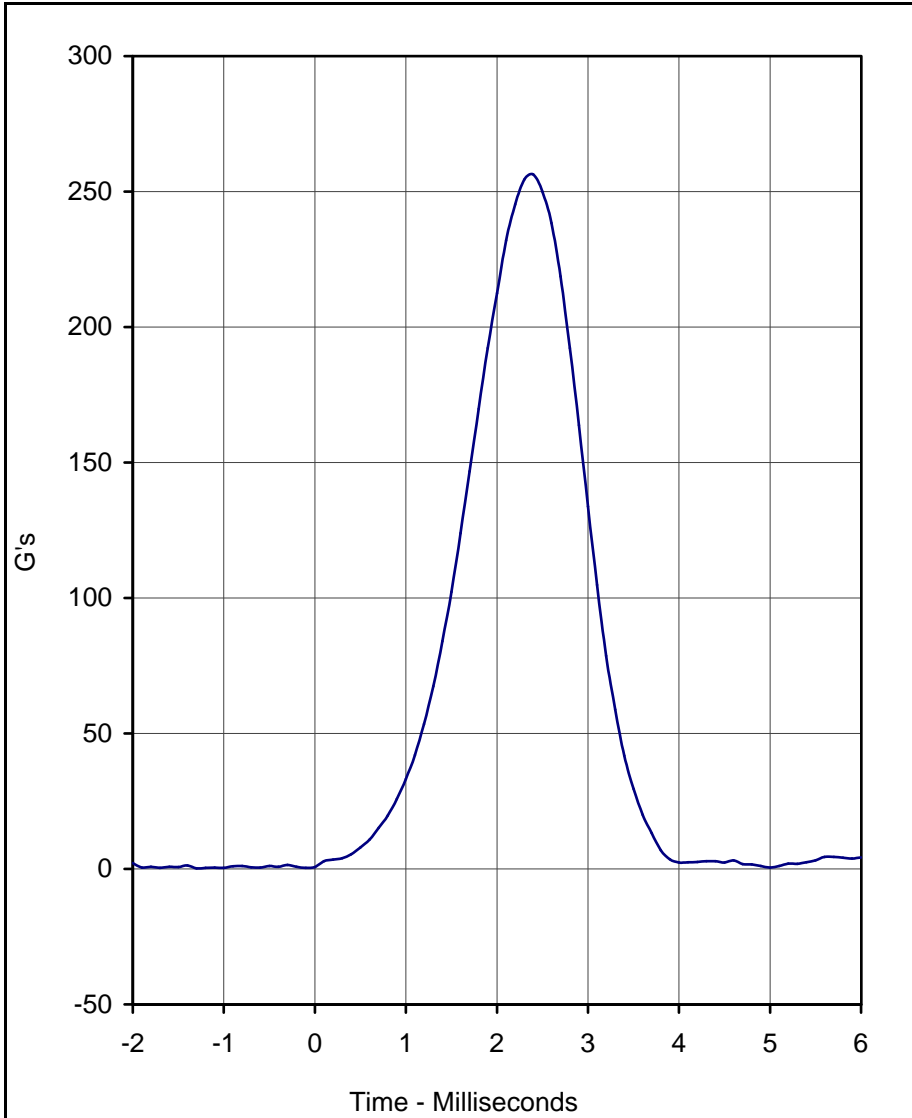
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	225.0 to 275.0	256.3	Pass
Peak Lateral Acceleration	G's	≤15.0	5.0	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
Overall Test Results				Pass

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KAR22001-19

\_\_\_\_\_  
Laboratory Technician

June 11, 2002  
\_\_\_\_\_  
Test Date



Curve Description	CURNO	Type
Head Resultant	001	RES

Curve Description	CURNO	Type
Head Y	002	FIL

Units	Max	Time	Min	Time	SAE Class
G's	256.3	2.4	0.2	-1.3	1000

Units	Max	Time	Min	Time	SAE Class
G's	5.0	1.9	-1.9	4.6	1000

Test Program: Hybrid III 50th Percentile Male Head Drop Test  
 Test Date: 6/11/02

A.T.D. Serial No.: 034  
 Test I.D.: HD07B





## Calibration Data Sheet Hybrid III 50th Percentile Male Thorax Impact Test

ATD Serial No.: 034

Test I.D.: CH07B

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Probe Velocity	m/s	6.58 to 6.82	6.64	Pass
Peak Probe Force	Newtons	5159 to 5893	5291	Pass
Peak Sternum Displacement	CM	6.35 to 7.26	6.71	Pass
Internal Hysteresis	%	69 to 85	78.5	Pass
Overall Test Results				Pass

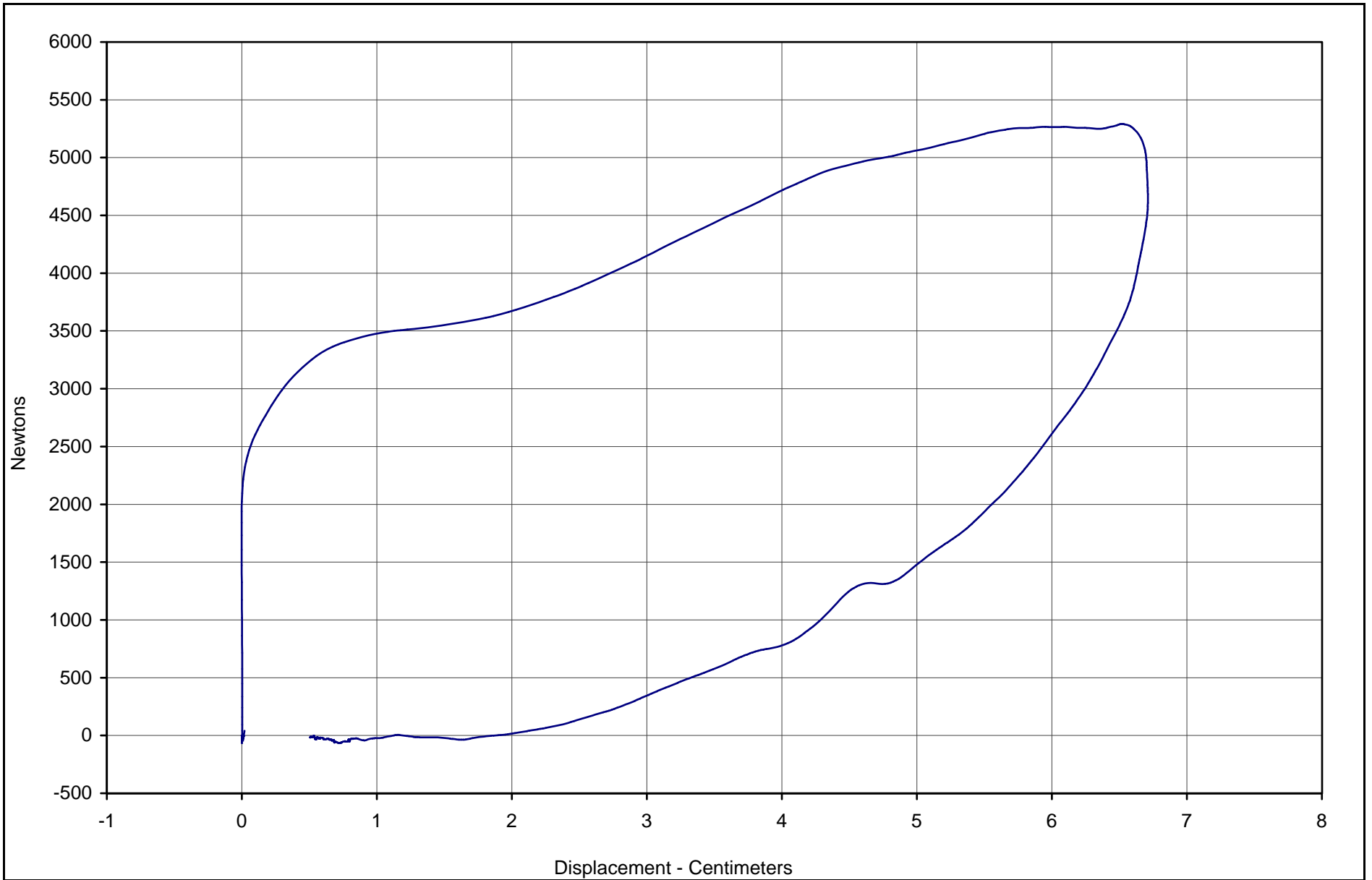
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Test Date

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KAR22001-19

Curve Description	CURNO	Type	Hysteresis	Peak Chest Displ.	Peak Probe Force	SAE Class
Probe Force vs. Chest Displacement	001	FIL	78.5	6.71	5291.5	180



Test Program: Hybrid III 50th Percentile Male Thorax Impact

A.T.D. Serial No.: 034

Test Date: 6/11/02

Test I.D.: CH07B



## Calibration Data Sheet Hybrid III 50th Percentile Male Neck Flexion Test

ATD Serial No.: 034

Test I.D.: NF07B

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.98	Pass
Pendulum Deceleration	10 Msec.	G's	22.5 to 27.5	23.5	Pass
	20 Msec.	G's	17.6 to 22.6	20.4	Pass
	30 Msec.	G's	12.5 to 18.5	13.5	Pass
Peak Pendulum Decel. after 30 Msec.		G's	≤ 29.0	13.5	Pass
Deceleration Decay, Time to Cross 5 G's		Msec.	34.0 to 42.0	38.4	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	70.2	Pass
	Time	Msec.	57.0 to 64.0	63.6	Pass
"D" Plane Rotation Decay, Time To Zero Crossing		Msec.	113.0 to 128.0	118.3	Pass
Moment About Occipital Condyle	Maximum	Nm	84.1 to 108.5	94.6	Pass
	Time	Msec.	47.0 to 58.0	54.7	Pass
Positive Moment Decay, Time To Zero Crossing		Msec.	97.0 to 107.0	98.0	Pass
Overall Test Results					Pass

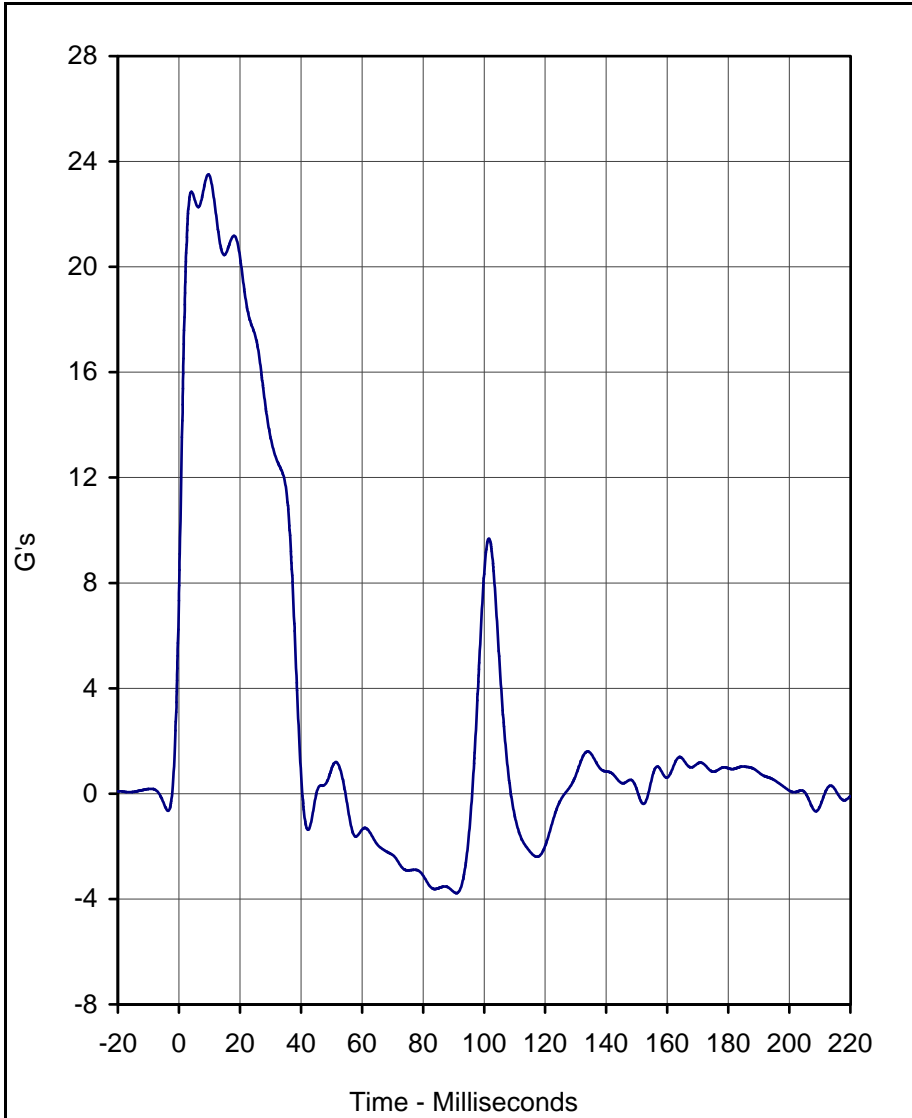
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Test Date

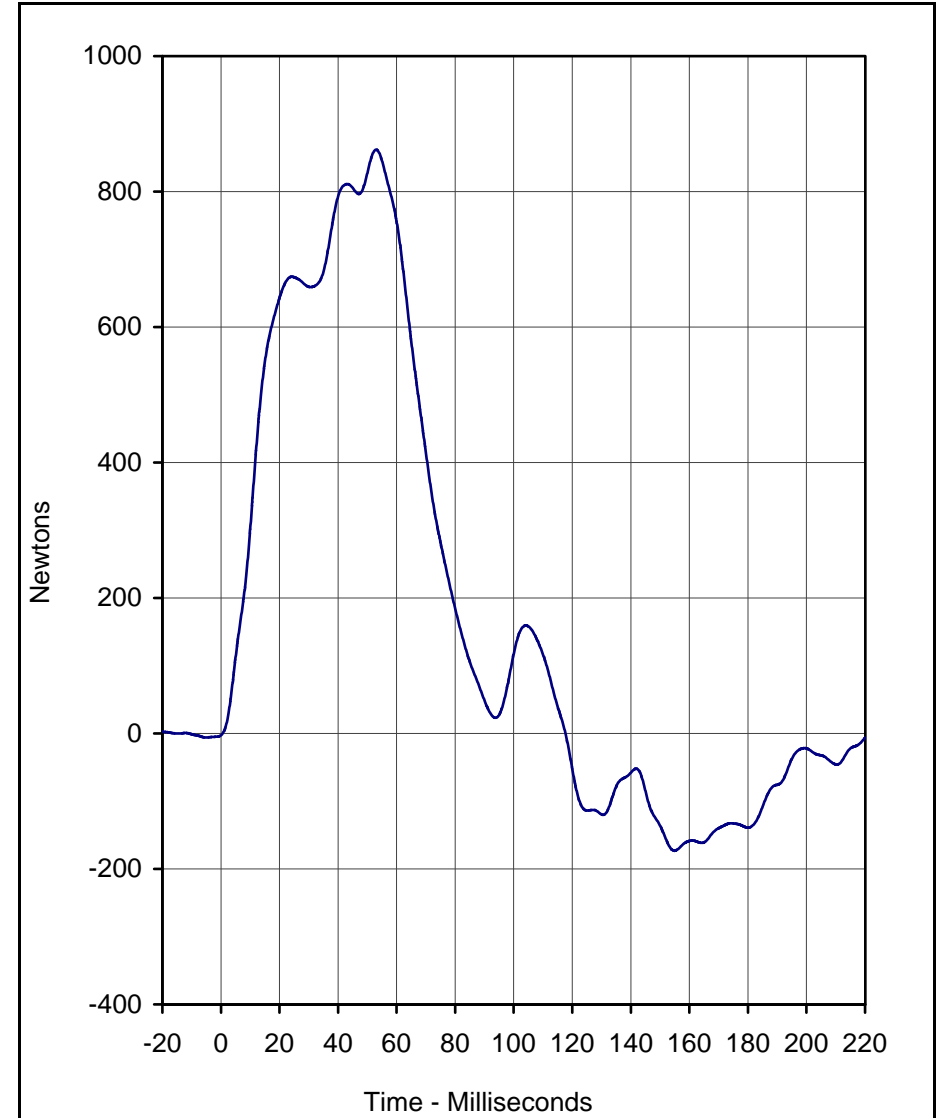
E-7

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Curve Description	CURNO	Type
Pendulum Deceleration	001	FIL

Units	Max	Time	Min	Time	SAE Class
G's	23.5	9.6	-3.8	90.9	60



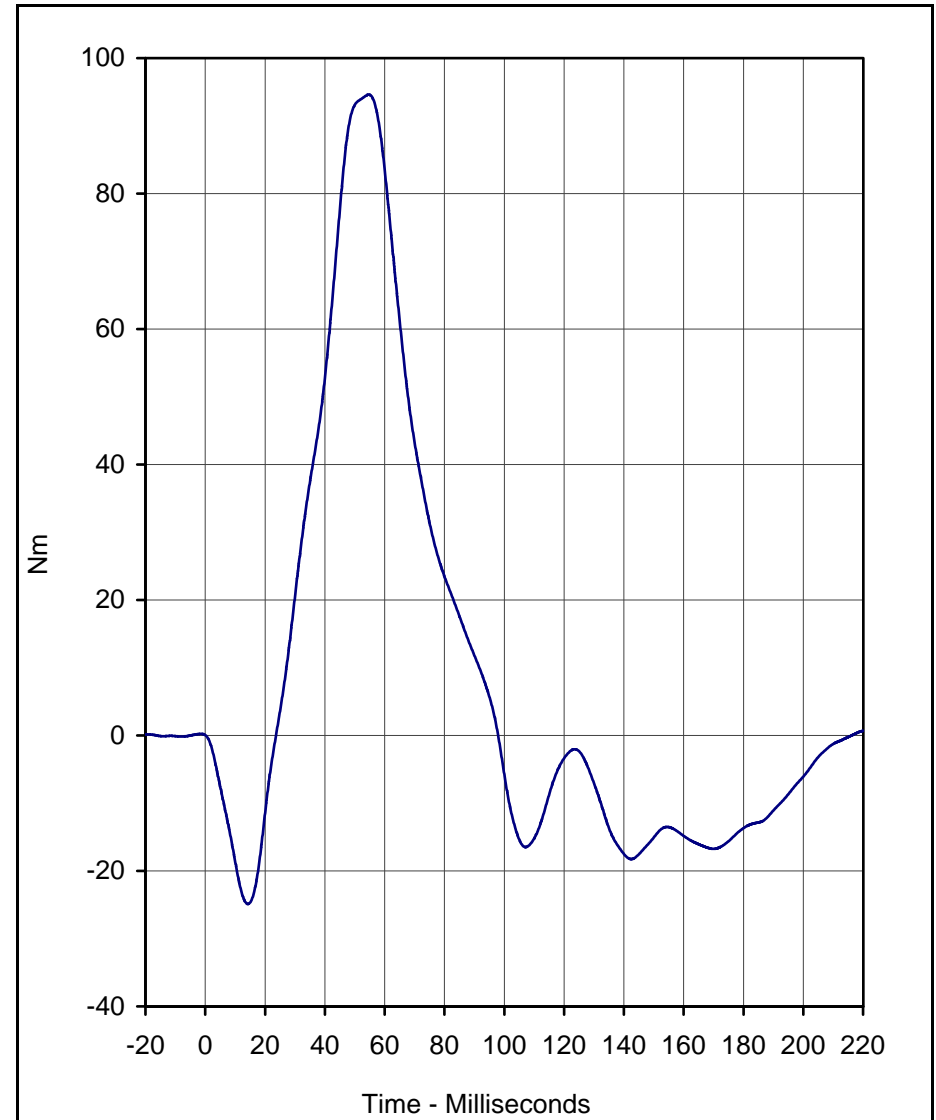
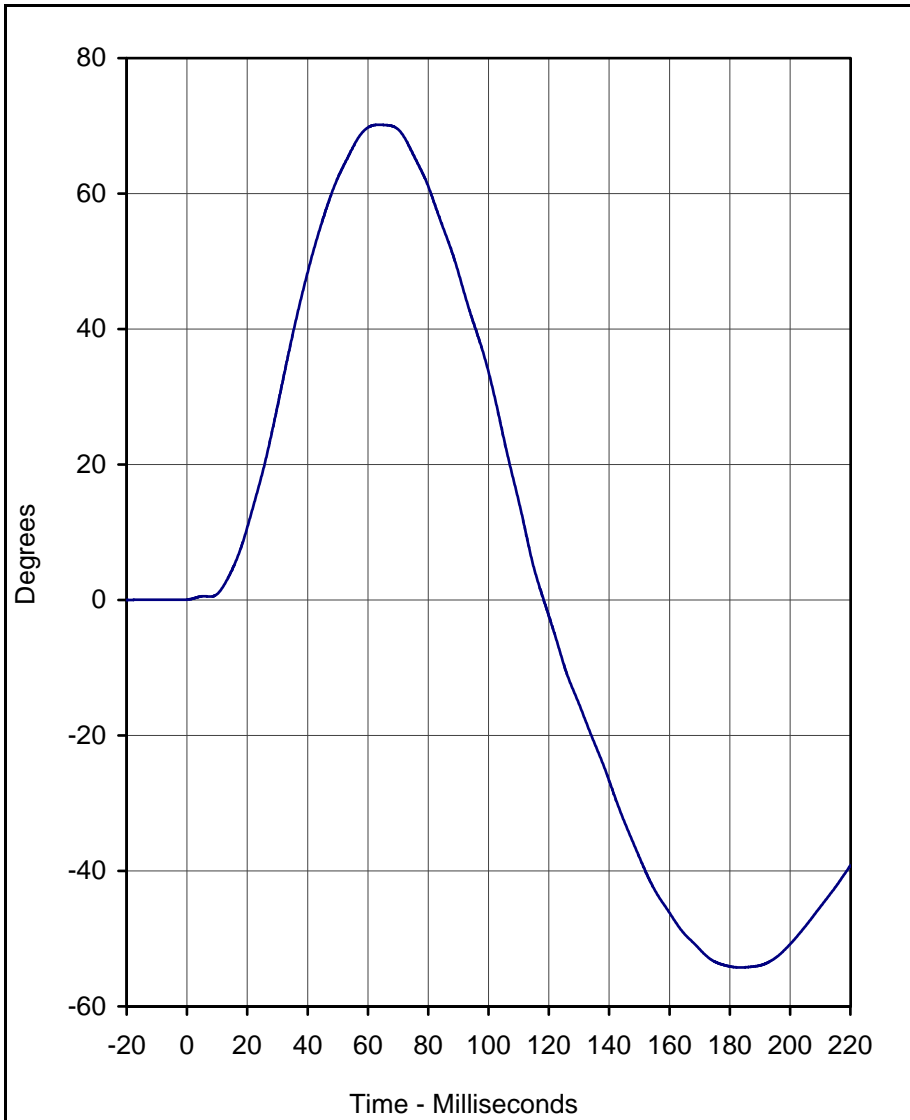
Curve Description	CURNO	Type
Neck Force X	002	FIL

Units	Max	Time	Min	Time	SAE Class
Newtons	861.9	53.0	-173.1	154.9	60

Test Program: Hybrid III 50th Percentile Male Neck Flexion Test  
 Test Date: 6/11/02

A.T.D. Serial No.: 034  
 Test I.D.: NF07B





Curve Description	CURNO	Type
"D" Plane Rotation	003	FIL

Curve Description	CURNO	Type
Moment About Occipital Condyle	004	FIL

Units	Max	Time	Min	Time	SAE Class
Degrees	70.2	63.6	-54.3	183.6	60

Units	Max	Time	Min	Time	SAE Class
Nm	94.6	54.7	-24.9	14.3	60

Test Program: Hybrid III 50th Percentile Male Neck Flexion Test  
 Test Date: 6/11/02

A.T.D. Serial No.: 034  
 Test I.D.: NF07B





## Calibration Data Sheet Hybrid III 50th Percentile Male Neck Extension Test

ATD Serial No.: 034

Test I.D.: NE07B

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	5.94 to 6.19	6.17	Pass
Pendulum Deceleration	10 Msec.	G's	17.2 to 21.2	18.3	Pass
	20 Msec.	G's	14.0 to 19.0	17.0	Pass
	30 Msec.	G's	11.0 to 16.0	15.3	Pass
Peak Pendulum Decel. after 30 Msec.		G's	≤ 22.0	15.3	Pass
Deceleration Decay, Time to Cross 5 G's		Msec.	38.0 to 46.0	44.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	95.5	Pass
	Time	Msec.	72.0 to 82.0	78.7	Pass
"D" Plane Rotation Decay, Time To Zero Crossing		Msec.	147.0 to 174.0	150.2	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to- 79.9	-68.4	Pass
	Time	Msec.	65.0 to 79.0	66.3	Pass
Positive Moment Decay, Time To Zero Crossing		Msec.	120.0 to 148.0	135.9	Pass
Overall Test Results					Pass

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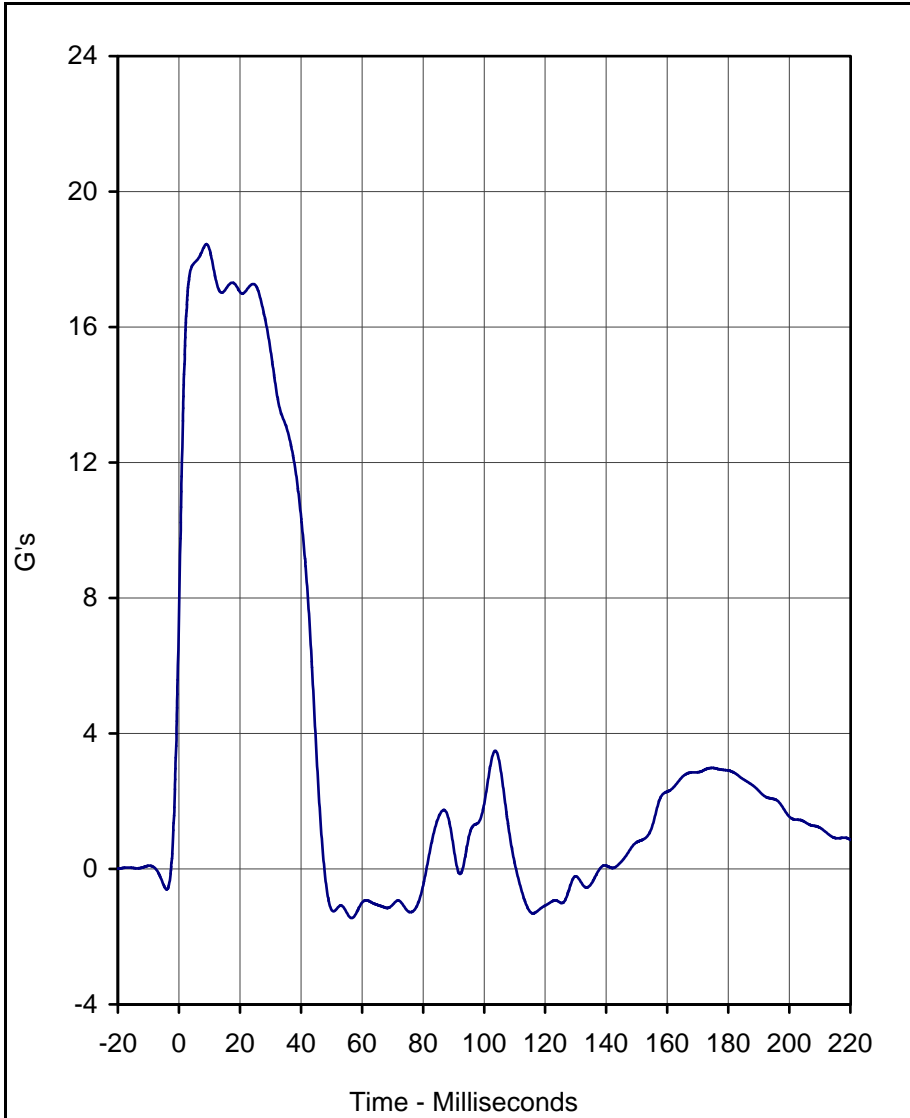
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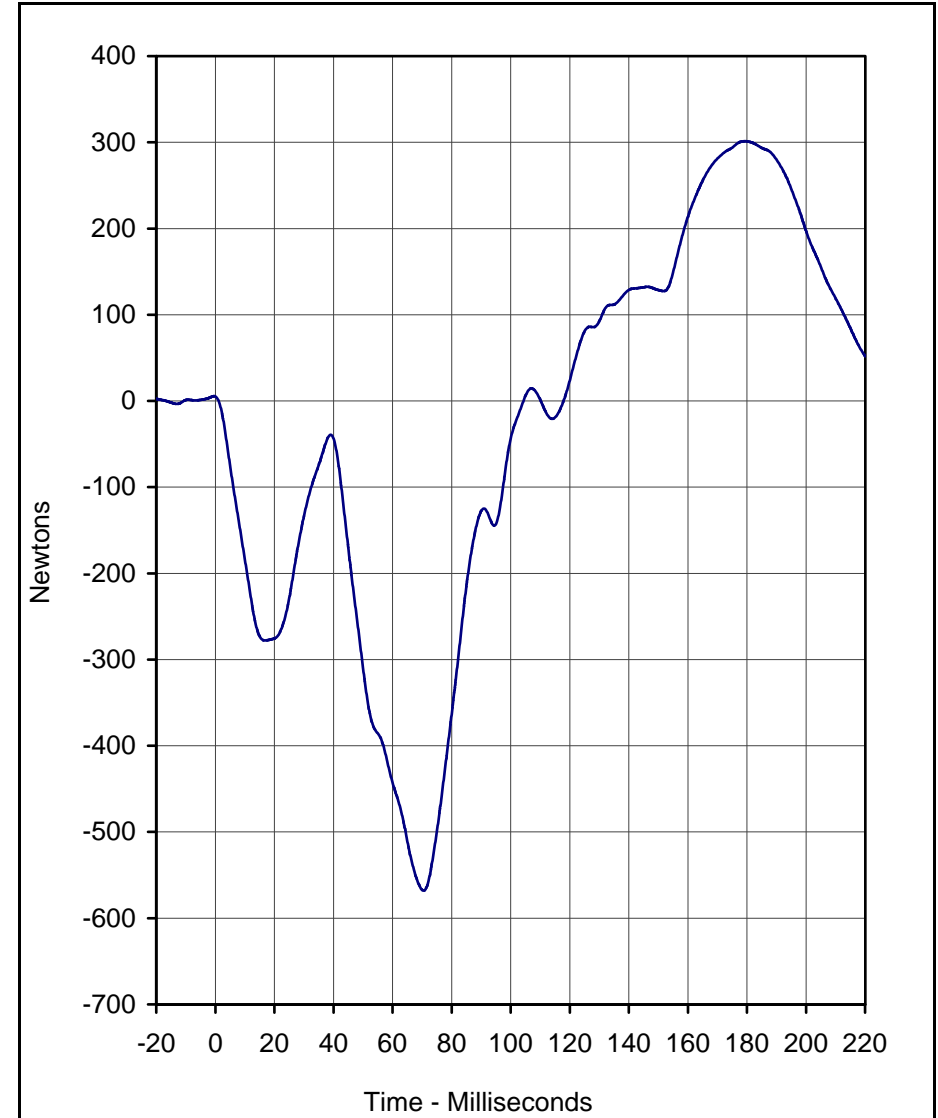
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Curve Description	CURNO	Type
Pendulum Deceleration	001	FIL

Units	Max	Time	Min	Time	SAE Class
G's	18.4	9.0	-1.5	56.6	60



Curve Description	CURNO	Type
Neck Force X	002	FIL

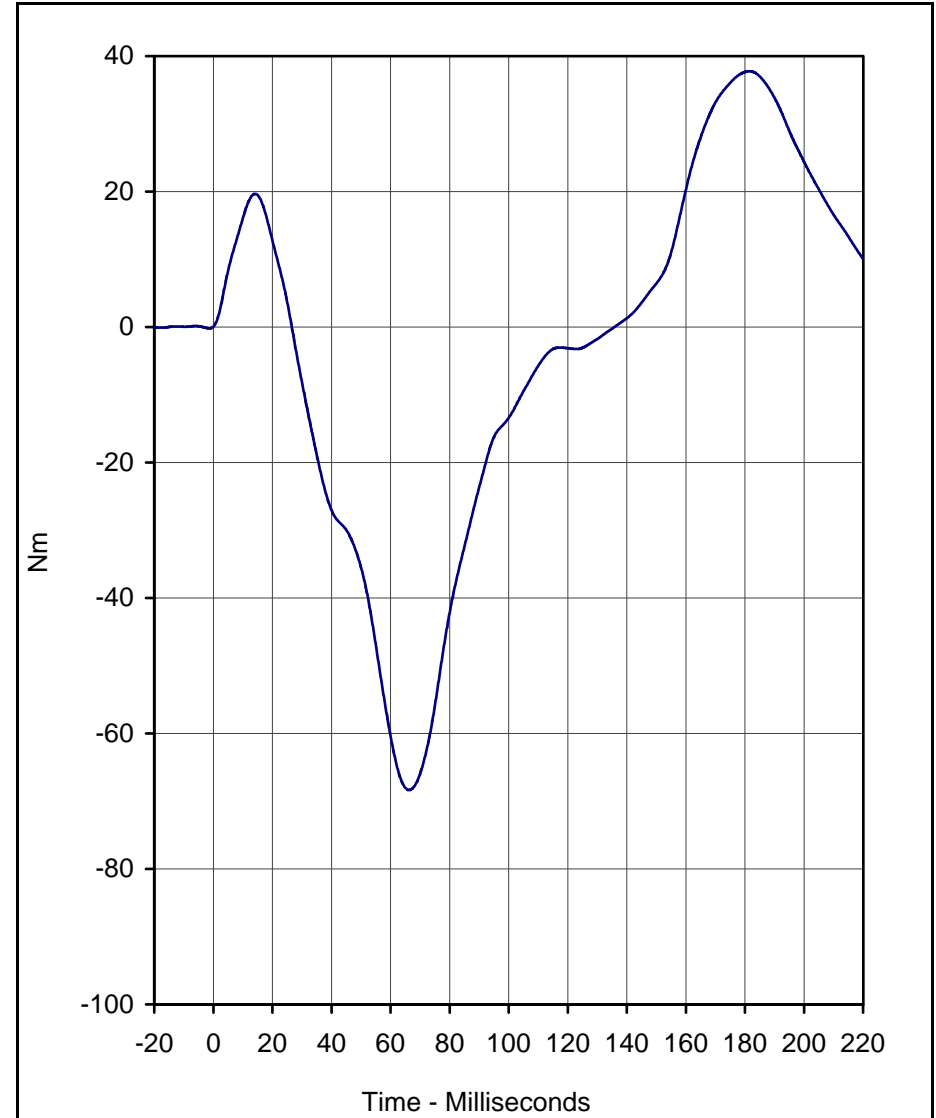
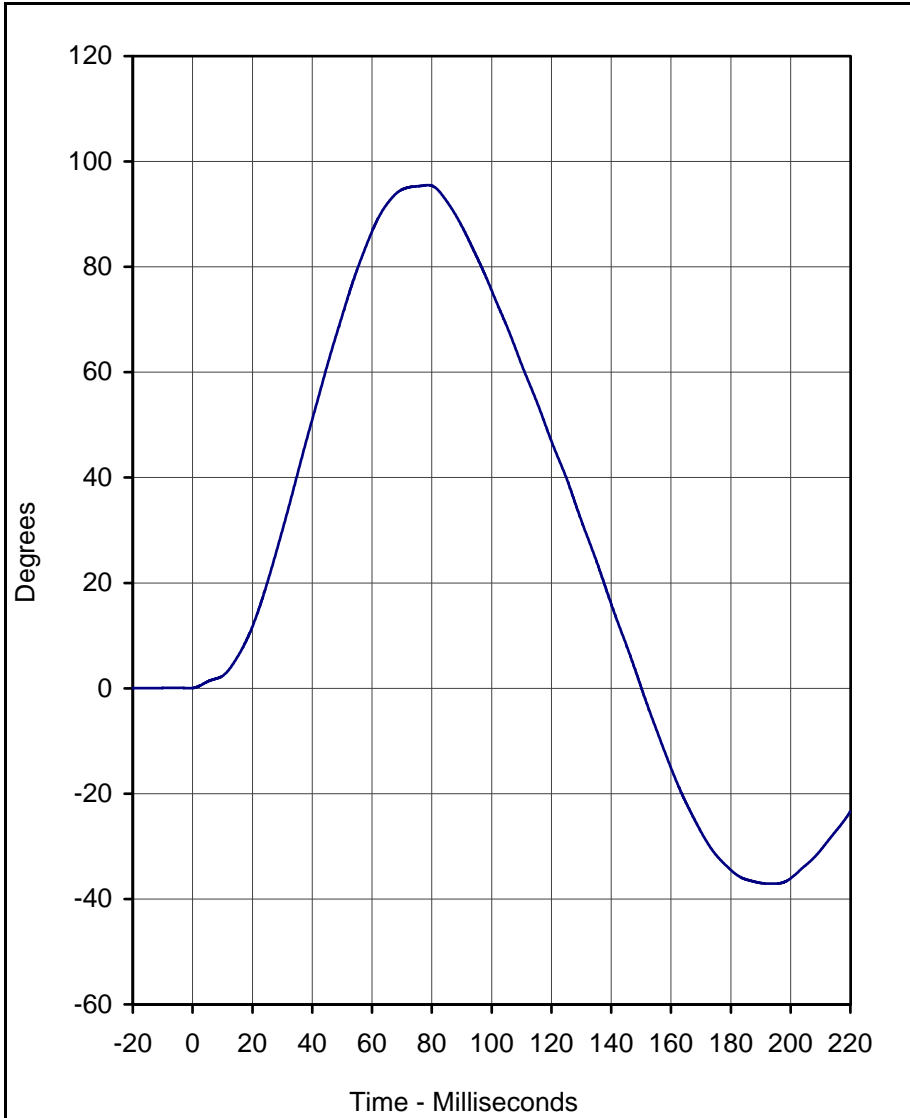
Units	Max	Time	Min	Time	SAE Class
Newtons	301.2	179.4	-568.0	70.5	60

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Test Program: Hybrid III 50th Percentile Male Neck Extension Test  
 Test Date: 6/11/02

A.T.D. Serial No.: 034  
 Test I.D.: NE07B





Curve Description	CURNO	Type
"D" Plane Rotation	003	FIL

Curve Description	CURNO	Type
Moment About Occipital Condyle	004	FIL

Units	Max	Time	Min	Time	SAE Class
Degrees	95.5	78.7	-37.1	193.5	60

Units	Max	Time	Min	Time	SAE Class
Nm	37.8	181.5	-68.4	66.3	60

Test Program: Hybrid III 50th Percentile Male Neck Extension Test  
 Test Date: 6/11/02

A.T.D. Serial No.: 034  
 Test I.D.: NE07B





## Calibration Data Sheet Hybrid III 50th Percentile Male External Measurements

ATD Serial No.: 034

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
A - Total sitting height	mm	879 to 889	885	Pass
B - Shoulder pivot height	mm	505 to 521	515	Pass
C - "H" point height	mm	84 to 89	85	Pass
D - "H" point from seat back	mm	135 to 140	135	Pass
E - Shoulder pivot from back	mm	84 to 94	90	Pass
F - Thigh clearance	mm	140 to 155	150	Pass
G - Elbow back to wrist pivot	mm	290 to 305	295	Pass
H - Skull cap to back line	mm	41 to 46	45	Pass
I - Shoulder to elbow length	mm	330 to 345	340	Pass
J - Elbow rest height	mm	190 to 211	195	Pass
K - Buttock to knee length	mm	579 to 604	600	Pass
L - Popliteal length	mm	429 to 455	440	Pass
M - Knee pivot height	mm	485 to 500	495	Pass
N - Buttock popliteal length	mm	452 to 477	475	Pass
O - Chest depth	mm	213 to 229	225	Pass
P - Foot length	mm	251 to 267	260	Pass
V - Shoulder breadth	mm	422 to 437	435	Pass
W - Foot breadth	mm	91 to 107	100	Pass
Y - Chest circumference	mm	970 to 1001	985	Pass
Z - Waist circumference	mm	836 to 866	840	Pass
AA - Location for chest circumference	mm	429 to 434	430	Pass
BB - Location for waist circumference	mm	226 to 231	230	Pass
<b>Overall Test Results</b>				<b>Pass</b>

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Test Date



## Calibration Data Sheet Hybrid III 50th Percentile Male Knee Impact Test

ATD Serial No.: 035

Location: Left Knee

Test I.D.: LK07A

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Pendulum Velocity at T=0	m/sec	2.07 to 2.13	2.08	Pass
Peak Probe Force	N	4715 to 5782	5434	Pass
Overall Test Results				Pass

ATD Serial No.: 035

Location: Right Knee

Test I.D.: RK07A

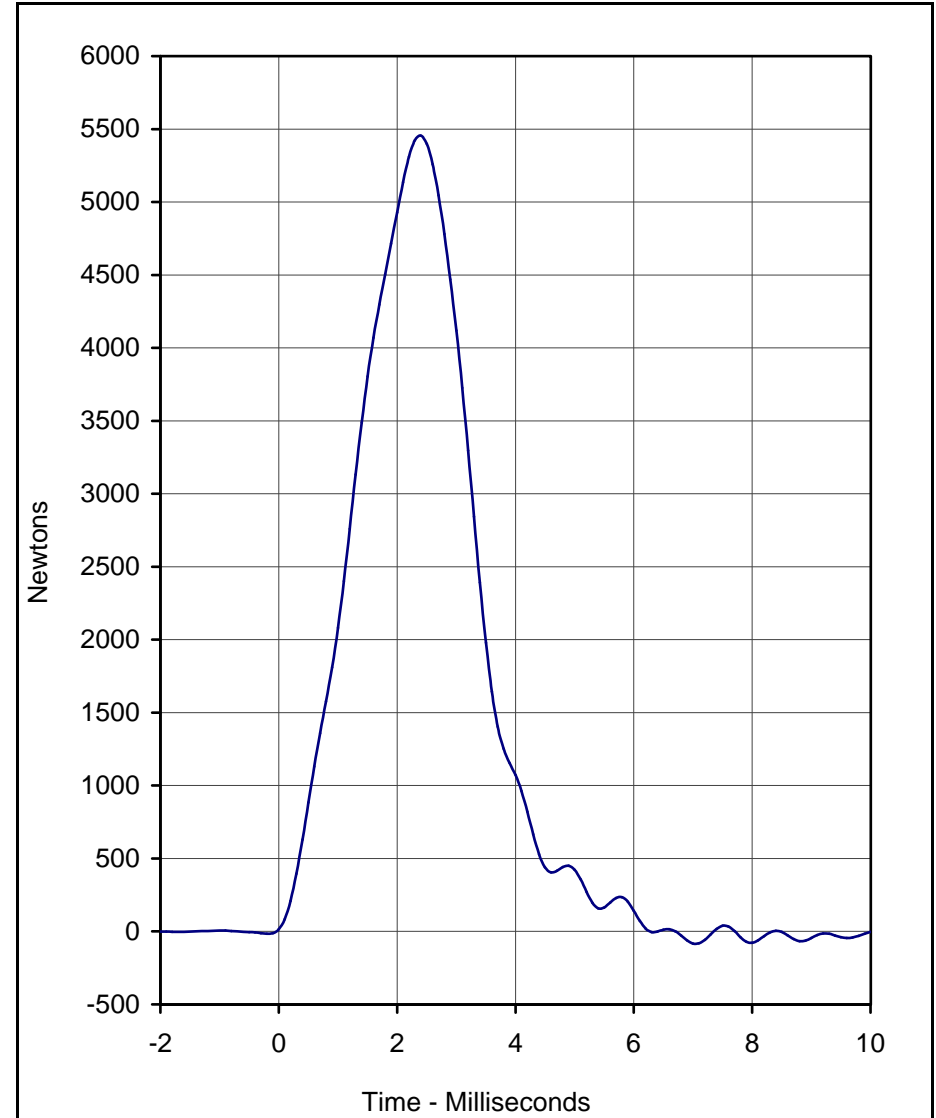
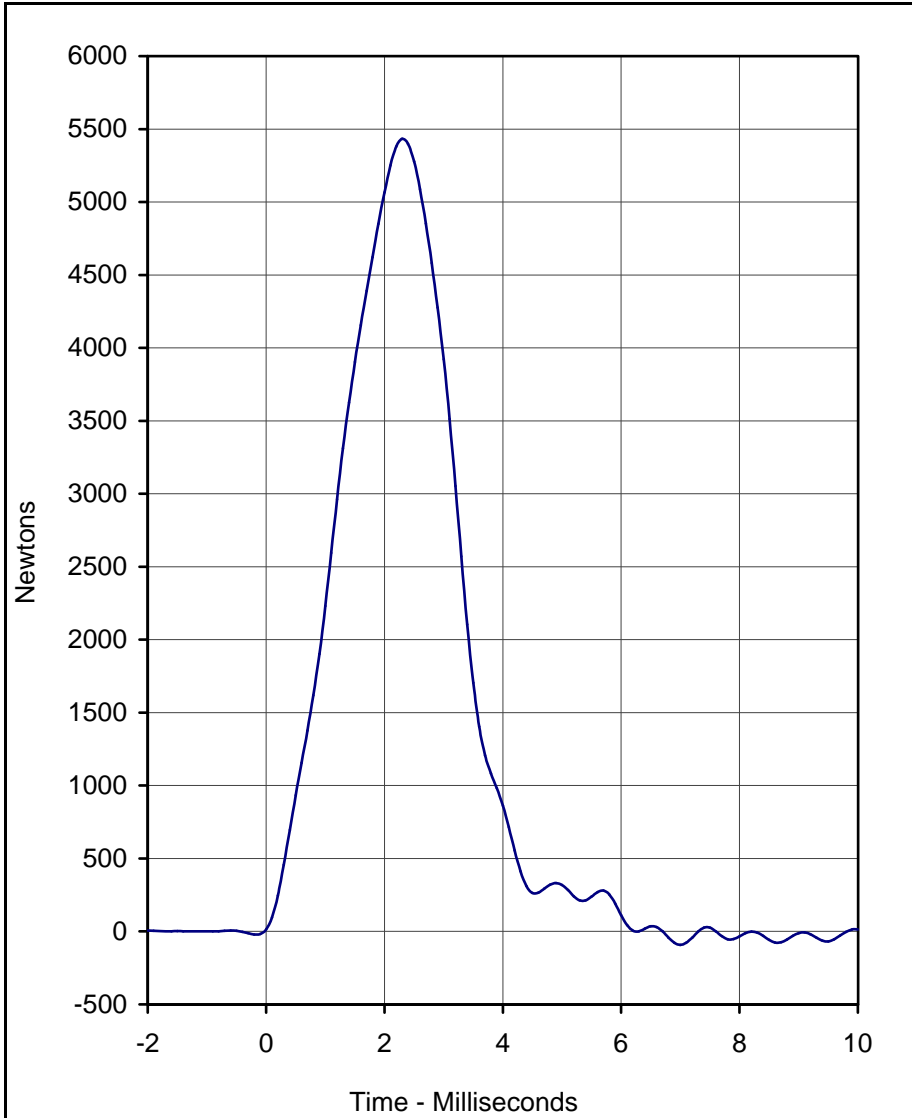
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Pendulum Velocity at T=0	m/sec	2.07 to 2.13	2.13	Pass
Peak Probe Force	N	4715 to 5782	5455	Pass
Overall Test Results				Pass

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Curve Description	Location	Test I.D.	CURNO	Type
Probe Force	Left Knee	LK07A	001	FIL

Curve Description	Location	Test I.D.	CURNO	Type
Probe Force	Right Knee	RK07A	002	FIL

Units	Max	Time	Min	Time	SAE Class
Newtons	5433.5	2.3	-92.8	7.0	600

Units	Max	Time	Min	Time	SAE Class
Newtons	5455.1	2.4	-82.9	7.0	600

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Test Program: Hybrid III 50th Percentile Male Knee Impact Test  
 Test Date: 6/11/02

A.T.D. Serial No.: 035





## Calibration Data Sheet Hybrid III 50th Percentile Male Head Drop Test

ATD Serial No.: 035

Test I.D.: HD07A

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	225.0 to 275.0	234.1	Pass
Peak Lateral Acceleration	G's	≤15.0	3.7	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
Overall Test Results				Pass

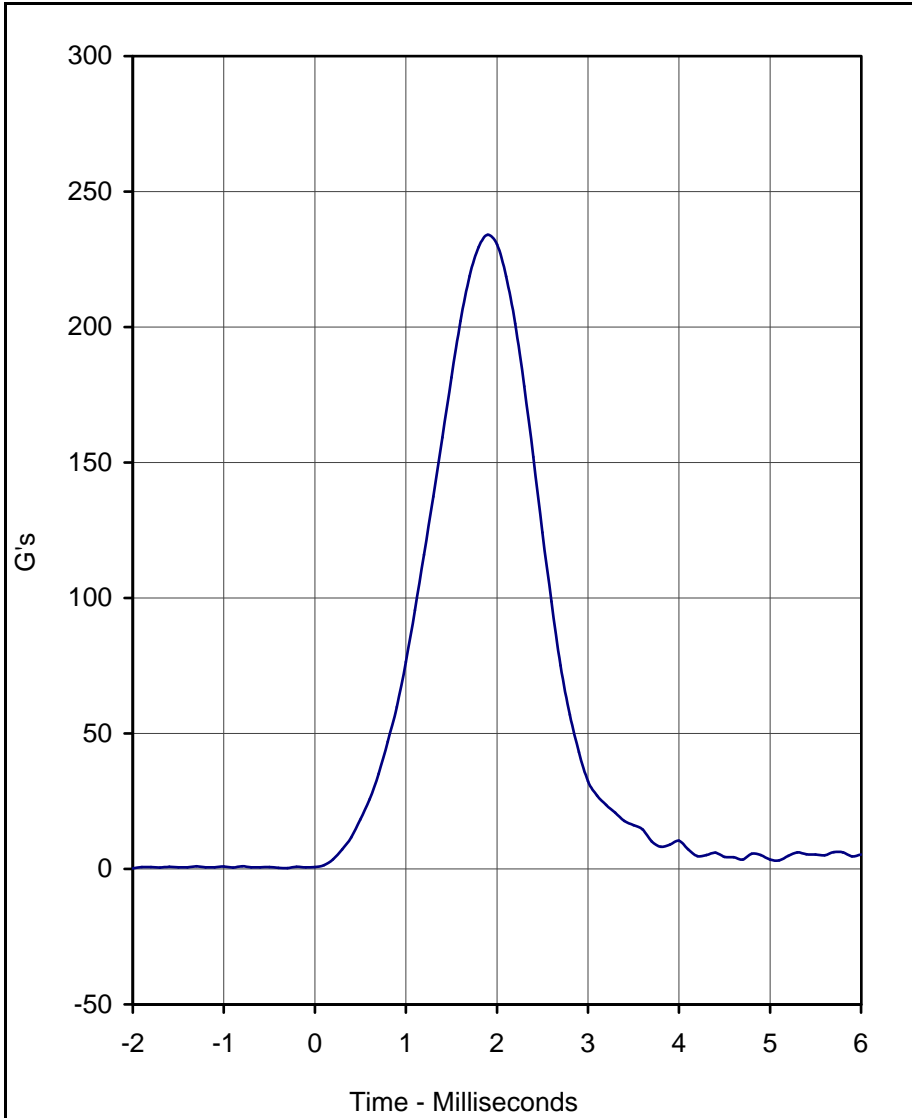
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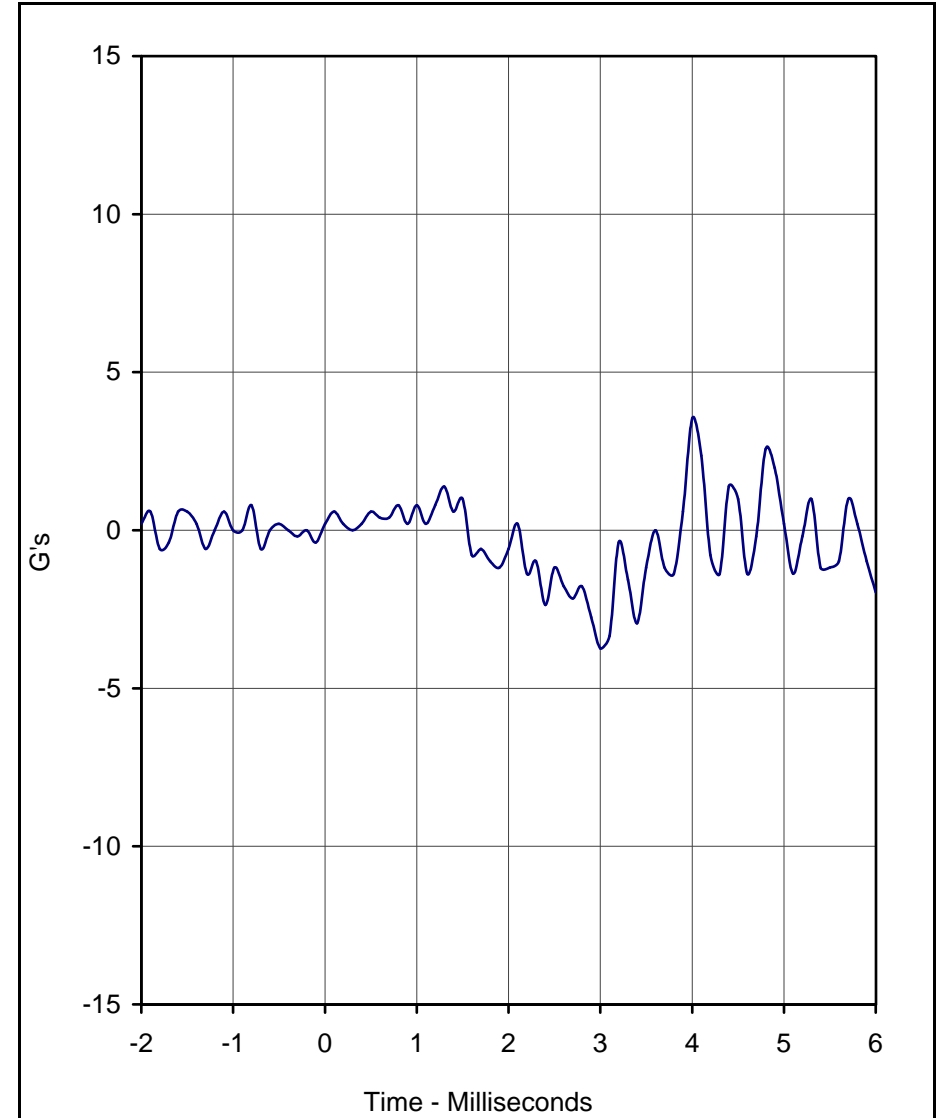
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Curve Description	CURNO	Type
Head Resultant	001	RES

Units	Max	Time	Min	Time	SAE Class
G's	234.1	1.9	0.2	-2.0	1000



Curve Description	CURNO	Type
Head Y	002	FIL

Units	Max	Time	Min	Time	SAE Class
G's	3.5	4.0	-3.7	3.0	1000

Test Program: Hybrid III 50th Percentile Male Head Drop Test  
 Test Date: 6/11/02

A.T.D. Serial No.: 035  
 Test I.D.: HD07A





# Calibration Data Sheet Hybrid III 50th Percentile Male Thorax Impact Test

ATD Serial No.: 035

Test I.D.: CH07A

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Probe Velocity	m/s	6.58 to 6.82	6.74	Pass
Peak Probe Force	Newtons	5159 to 5893	5291	Pass
Peak Sternum Displacement	CM	6.35 to 7.26	6.82	Pass
Internal Hysteresis	%	69 to 85	74.5	Pass
Overall Test Results				Pass

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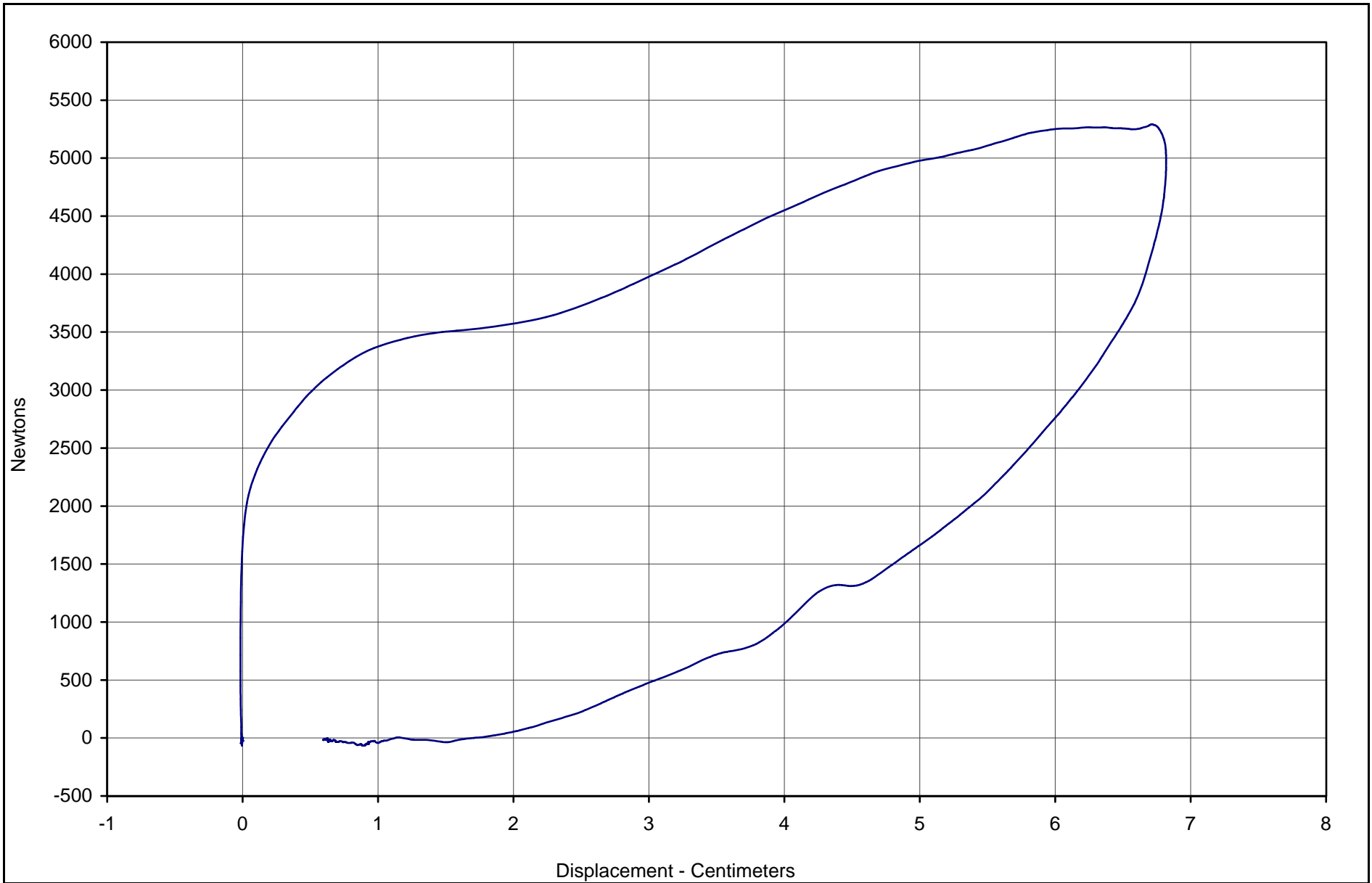
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Test Date

E-19



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Curve Description	CURNO	Type	Hysteresis	Peak Chest Displ.	Peak Probe Force	SAE Class
Probe Force vs. Chest Displacement	001	FIL	74.5	6.82	5291.5	180



Test Program: Hybrid III 50th Percentile Male Thorax Impact

A.T.D. Serial No.: 035

Test Date: 6/11/02

Test I.D.: CH07A



## Calibration Data Sheet Hybrid III 50th Percentile Male Neck Flexion Test

ATD Serial No.: 035

Test I.D.: NF07A

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.05	Pass
Pendulum Deceleration	10 Msec.	G's	22.5 to 27.5	23.8	Pass
	20 Msec.	G's	17.6 to 22.6	20.4	Pass
	30 Msec.	G's	12.5 to 18.5	18.5	Pass
Peak Pendulum Decel. after 30 Msec.		G's	≤ 29.0	18.5	Pass
Deceleration Decay, Time to Cross 5 G's		Msec.	34.0 to 42.0	38.4	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	69.0	Pass
	Time	Msec.	57.0 to 64.0	60.6	Pass
"D" Plane Rotation Decay, Time To Zero Crossing		Msec.	113.0 to 128.0	113.8	Pass
Moment About Occipital Condyle	Maximum	Nm	84.1 to 108.5	88.5	Pass
	Time	Msec.	47.0 to 58.0	57.9	Pass
Positive Moment Decay, Time To Zero Crossing		Msec.	97.0 to 107.0	102.8	Pass
Overall Test Results					Pass

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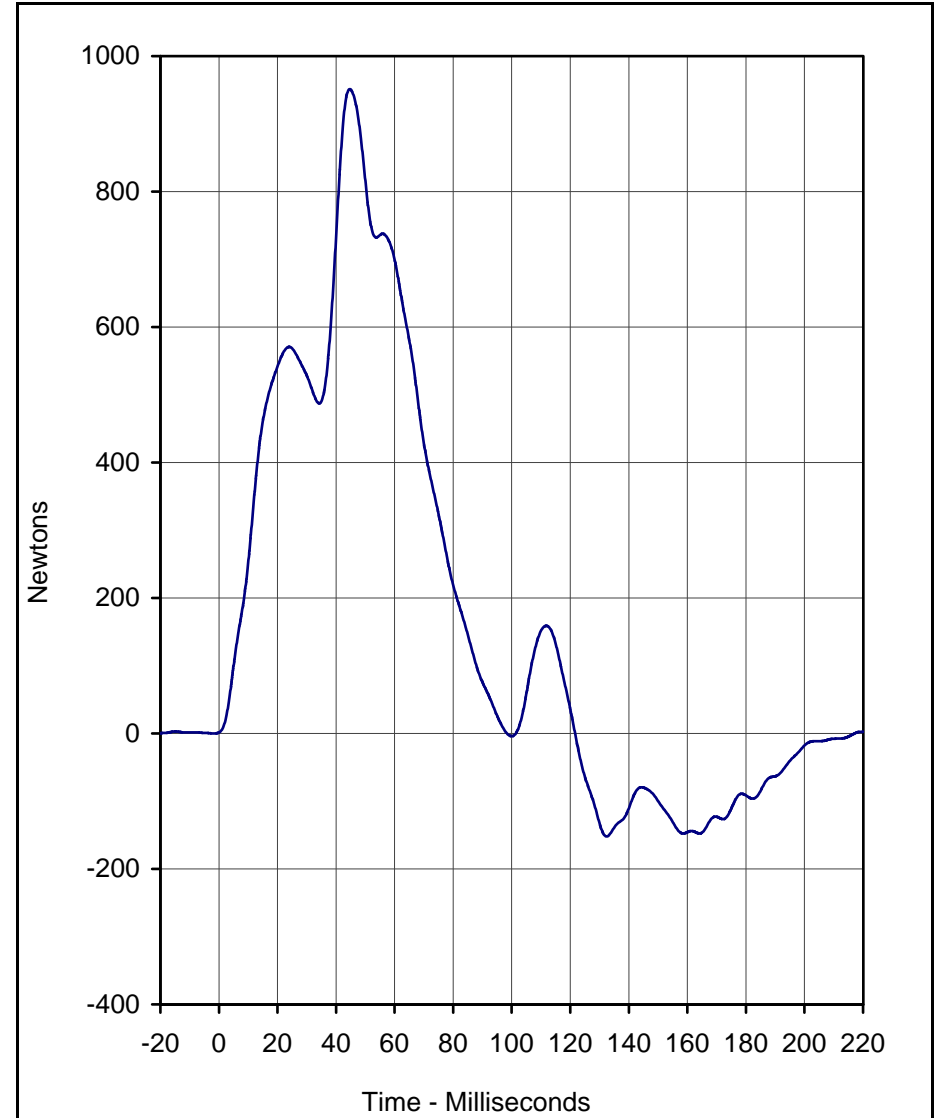
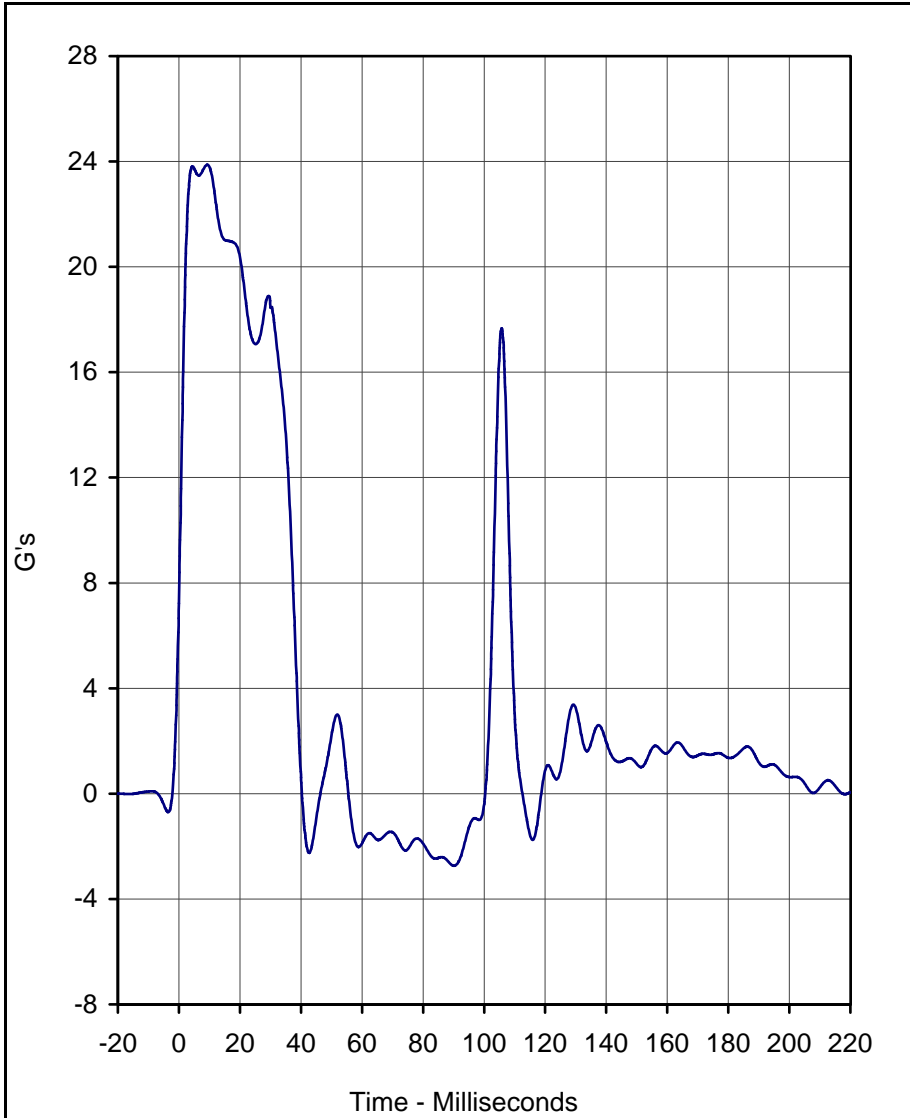
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Curve Description	CURNO	Type
Pendulum Deceleration	001	FIL

Curve Description	CURNO	Type
Neck Force X	002	FIL

Units	Max	Time	Min	Time	SAE Class
G's	23.9	9.3	-2.7	90.1	60

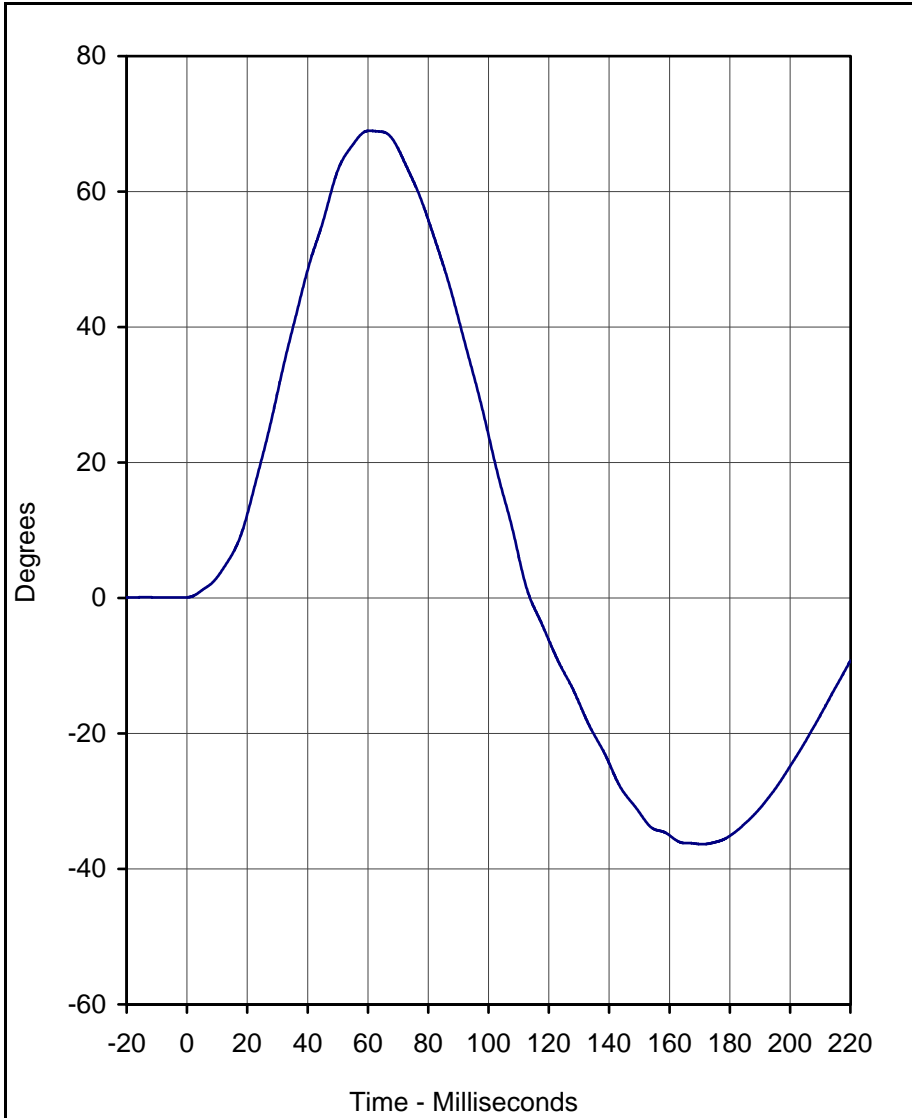
Units	Max	Time	Min	Time	SAE Class
Newtons	951.3	44.7	-152.1	132.4	60

Test Program: Hybrid III 50th Percentile Male Neck Flexion Test  
 Test Date: 6/11/02

A.T.D. Serial No.: 035  
 Test I.D.: NF07A

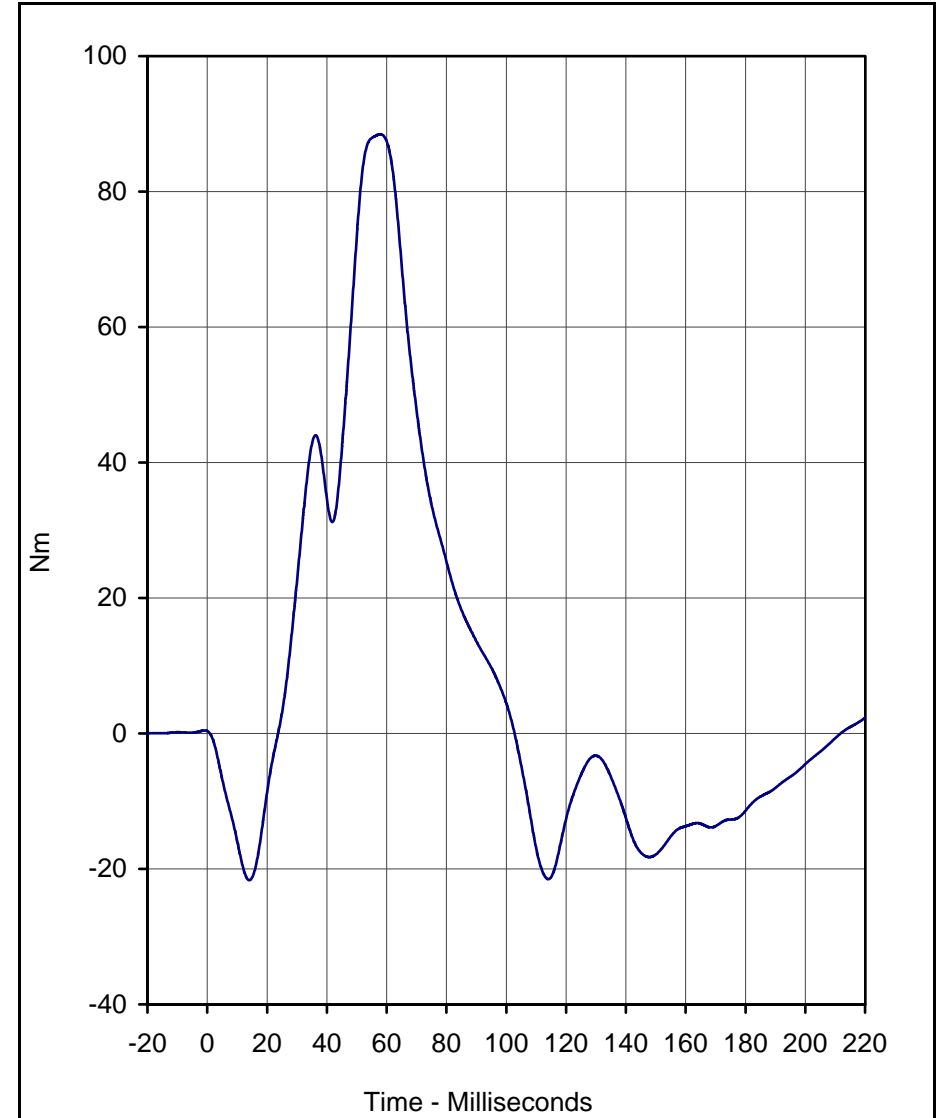


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Curve Description	CURNO	Type
"D" Plane Rotation	003	FIL

Units	Max	Time	Min	Time	SAE Class
Degrees	69.0	60.6	-36.4	170.9	60



Curve Description	CURNO	Type
Moment About Occipital Condyle	004	FIL

Units	Max	Time	Min	Time	SAE Class
Nm	88.5	57.9	-21.7	14.1	60

Test Program: Hybrid III 50th Percentile Male Neck Flexion Test  
 Test Date: 6/11/02

A.T.D. Serial No.: 035  
 Test I.D.: NF07A





## Calibration Data Sheet Hybrid III 50th Percentile Male Neck Extension Test

ATD Serial No.: 035

Test I.D.: NE07A

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	5.94 to 6.19	6.09	Pass
Pendulum Deceleration	10 Msec.	G's	17.2 to 21.2	18.1	Pass
	20 Msec.	G's	14.0 to 19.0	16.4	Pass
	30 Msec.	G's	11.0 to 16.0	12.0	Pass
Peak Pendulum Decel. after 30 Msec.		G's	≤ 22.0	12.0	Pass
Deceleration Decay, Time to Cross 5 G's		Msec.	38.0 to 46.0	43.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.4	Pass
	Time	Msec.	72.0 to 82.0	81.7	Pass
"D" Plane Rotation Decay, Time To Zero Crossing		Msec.	147.0 to 174.0	156.0	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to- 79.9	-77.8	Pass
	Time	Msec.	65.0 to 79.0	68.4	Pass
Positive Moment Decay, Time To Zero Crossing		Msec.	120.0 to 148.0	137.6	Pass
Overall Test Results					Pass

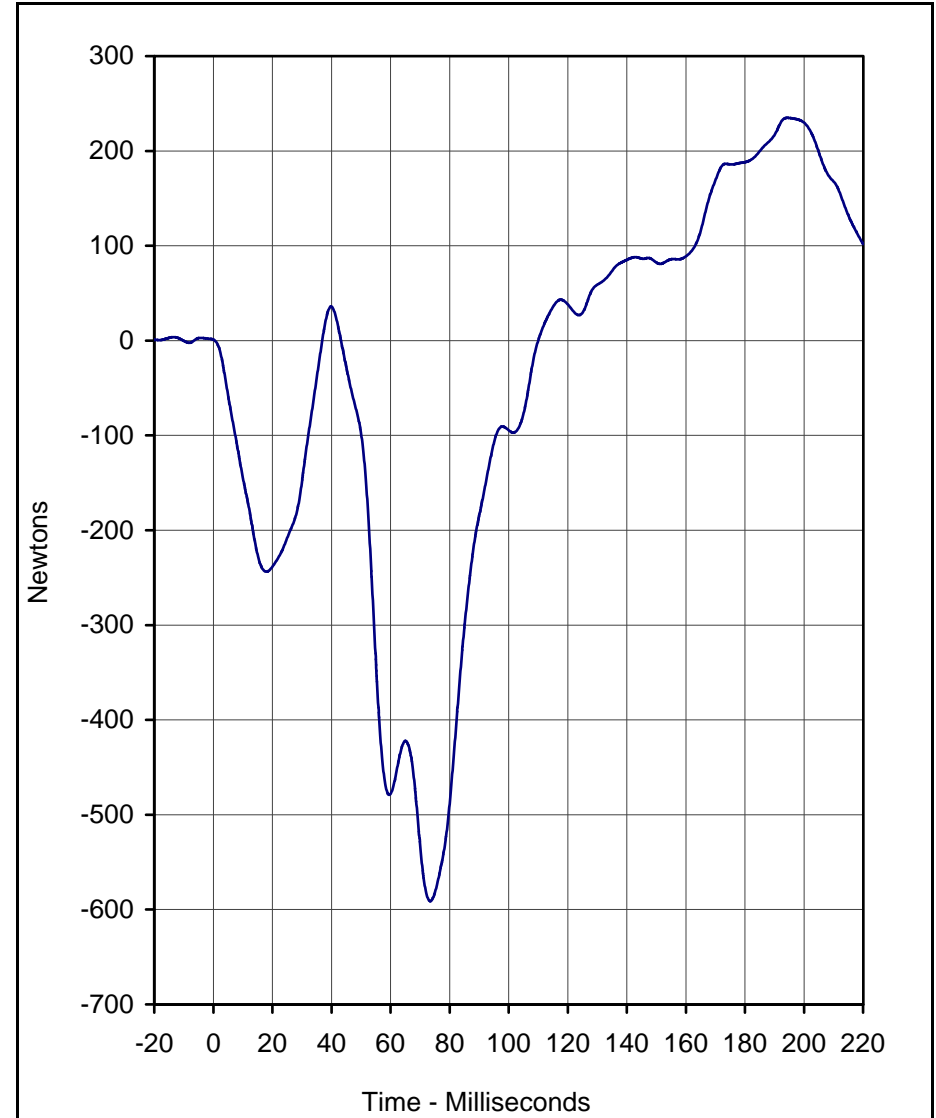
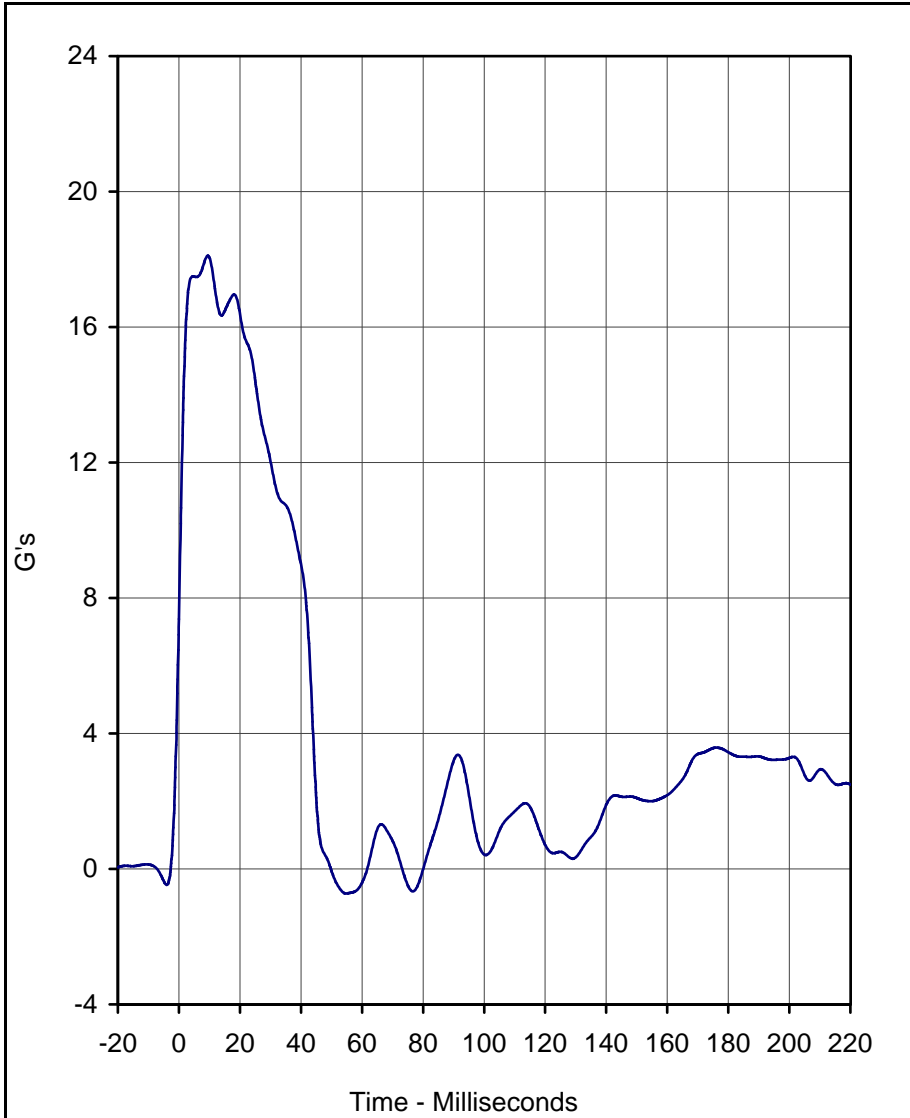
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Test Date



Curve Description	CURNO	Type
Pendulum Deceleration	001	FIL

Curve Description	CURNO	Type
Neck Force X	002	FIL

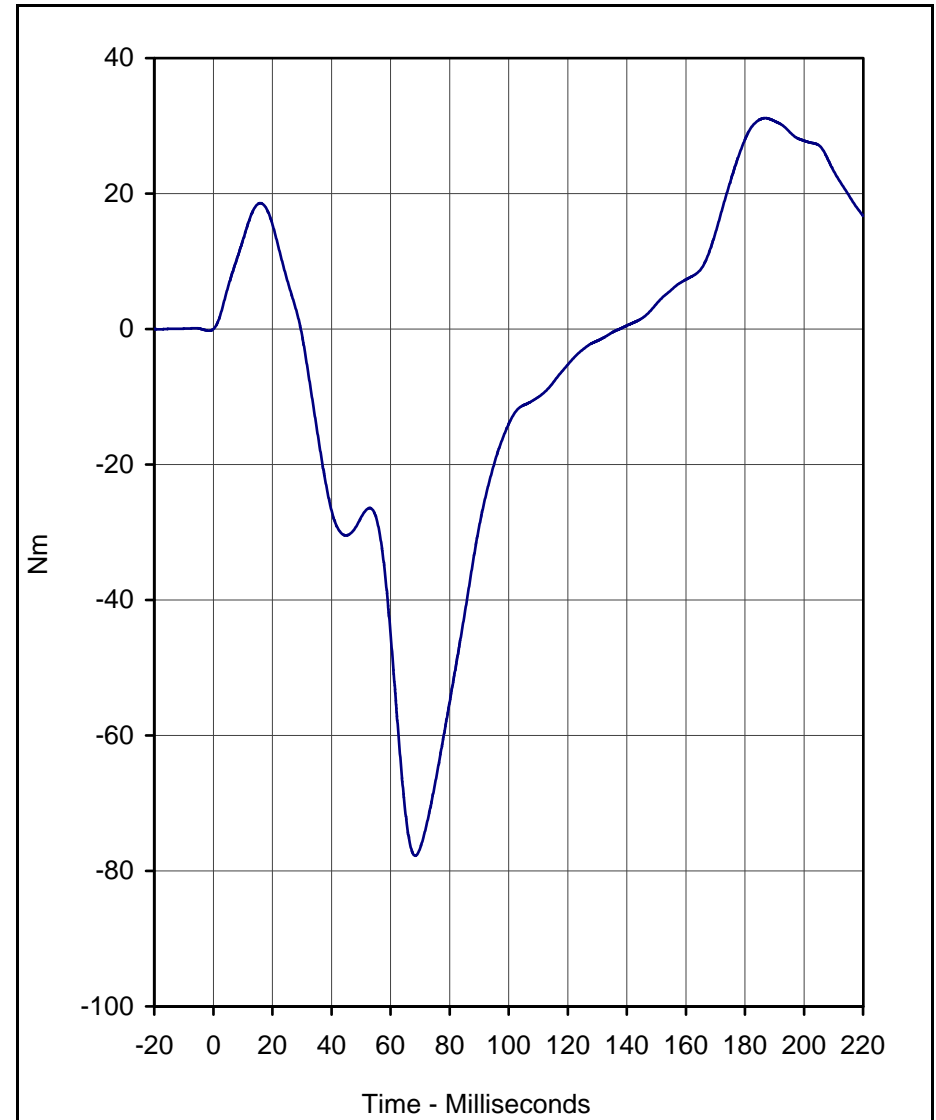
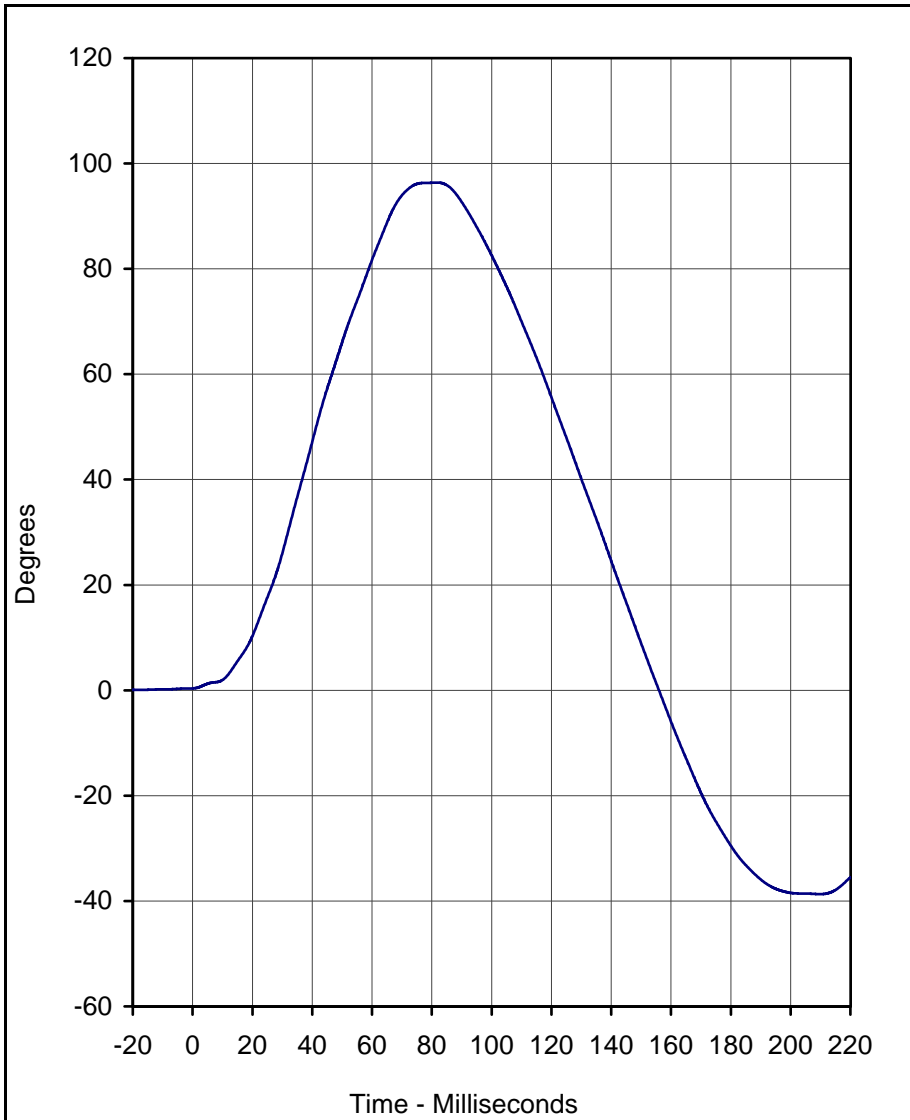
Units	Max	Time	Min	Time	SAE Class
G's	18.1	9.5	-0.7	54.8	60

Units	Max	Time	Min	Time	SAE Class
Newtons	234.9	194.4	-591.1	73.4	60

Test Program: Hybrid III 50th Percentile Male Neck Extension Test  
 Test Date: 6/11/02

A.T.D. Serial No.: 035  
 Test I.D.: NE07A





Curve Description	CURNO	Type
"D" Plane Rotation	003	FIL

Curve Description	CURNO	Type
Moment About Occipital Condyle	004	FIL

Units	Max	Time	Min	Time	SAE Class
Degrees	96.4	81.7	-38.7	209.9	60

Units	Max	Time	Min	Time	SAE Class
Nm	31.1	186.9	-77.8	68.4	60

Test Program: Hybrid III 50th Percentile Male Neck Extension Test  
 Test Date: 6/11/02

A.T.D. Serial No.: 035  
 Test I.D.: NE07A





## Calibration Data Sheet Hybrid III 50th Percentile Male External Measurements

ATD Serial No.: 035

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
A - Total sitting height	mm	879 to 889	885	Pass
B - Shoulder pivot height	mm	505 to 521	510	Pass
C - "H" point height	mm	84 to 89	85	Pass
D - "H" point from seat back	mm	135 to 140	135	Pass
E - Shoulder pivot from back	mm	84 to 94	85	Pass
F - Thigh clearance	mm	140 to 155	145	Pass
G - Elbow back to wrist pivot	mm	290 to 305	300	Pass
H - Skull cap to back line	mm	41 to 46	45	Pass
I - Shoulder to elbow length	mm	330 to 345	340	Pass
J - Elbow rest height	mm	190 to 211	195	Pass
K - Buttock to knee length	mm	579 to 604	595	Pass
L - Popliteal length	mm	429 to 455	435	Pass
M - Knee pivot height	mm	485 to 500	495	Pass
N - Buttock popliteal length	mm	452 to 477	470	Pass
O - Chest depth	mm	213 to 229	225	Pass
P - Foot length	mm	251 to 267	265	Pass
V - Shoulder breadth	mm	422 to 437	435	Pass
W - Foot breadth	mm	91 to 107	95	Pass
Y - Chest circumference	mm	970 to 1001	1000	Pass
Z - Waist circumference	mm	836 to 866	860	Pass
AA - Location for chest circumference	mm	429 to 434	430	Pass
BB - Location for waist circumference	mm	226 to 231	230	Pass
<b>Overall Test Results</b>				<b>Pass</b>

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Laboratory Technician

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June 11, 2002

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Test Date

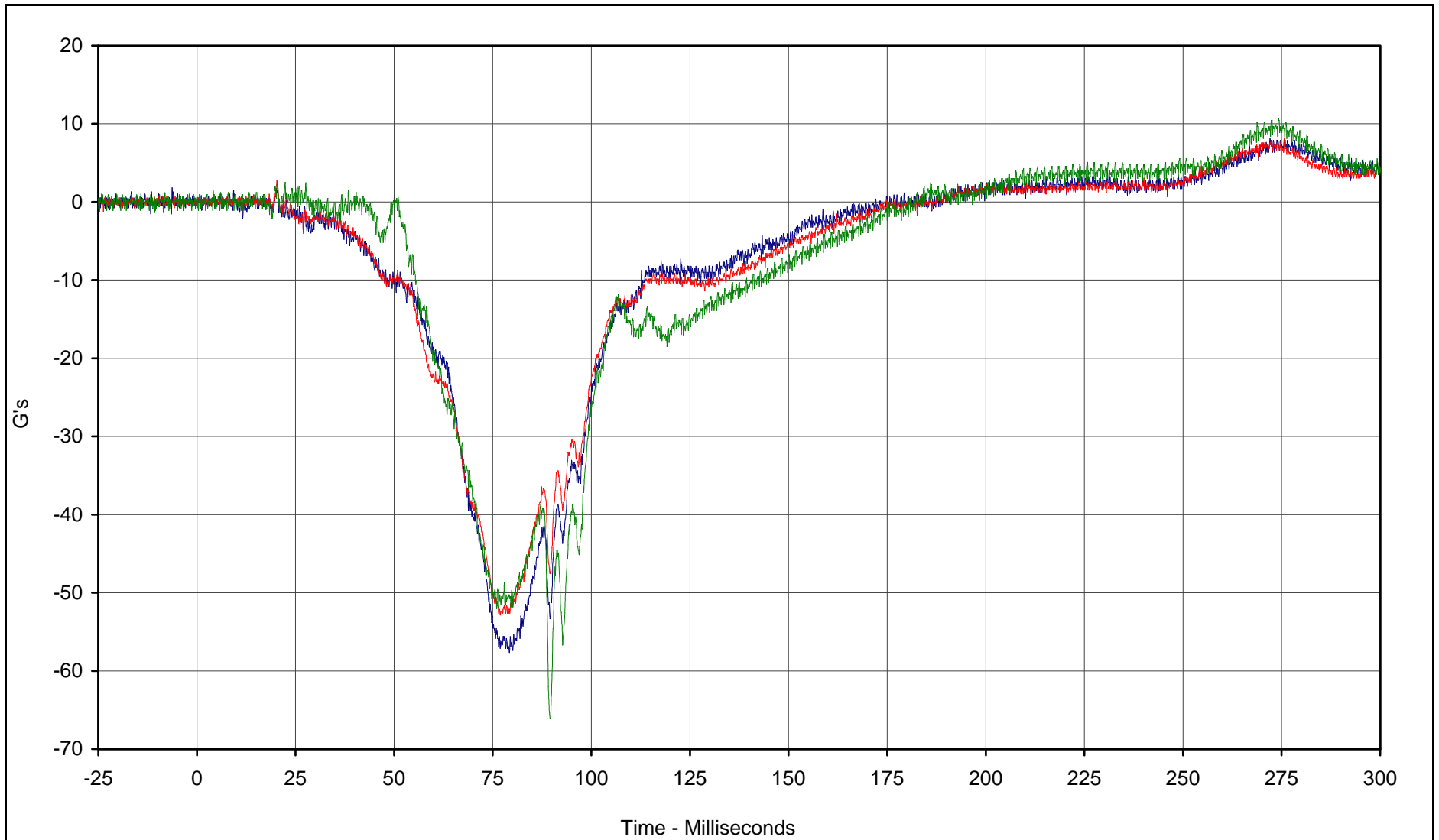
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**APPENDIX G**

**NINE ACCELEROMETER HEAD ARRAY DATA**

G-1



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Primary X	134	FIL	G's	8.2	272.1	-57.7	79.2	1000
Driver NAHA Yarm-X	138	FIL	G's	8.1	275.7	-52.9	76.9	1000
Driver NAHA Zarm-X	141	FIL	G's	10.7	274.2	-66.1	89.5	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

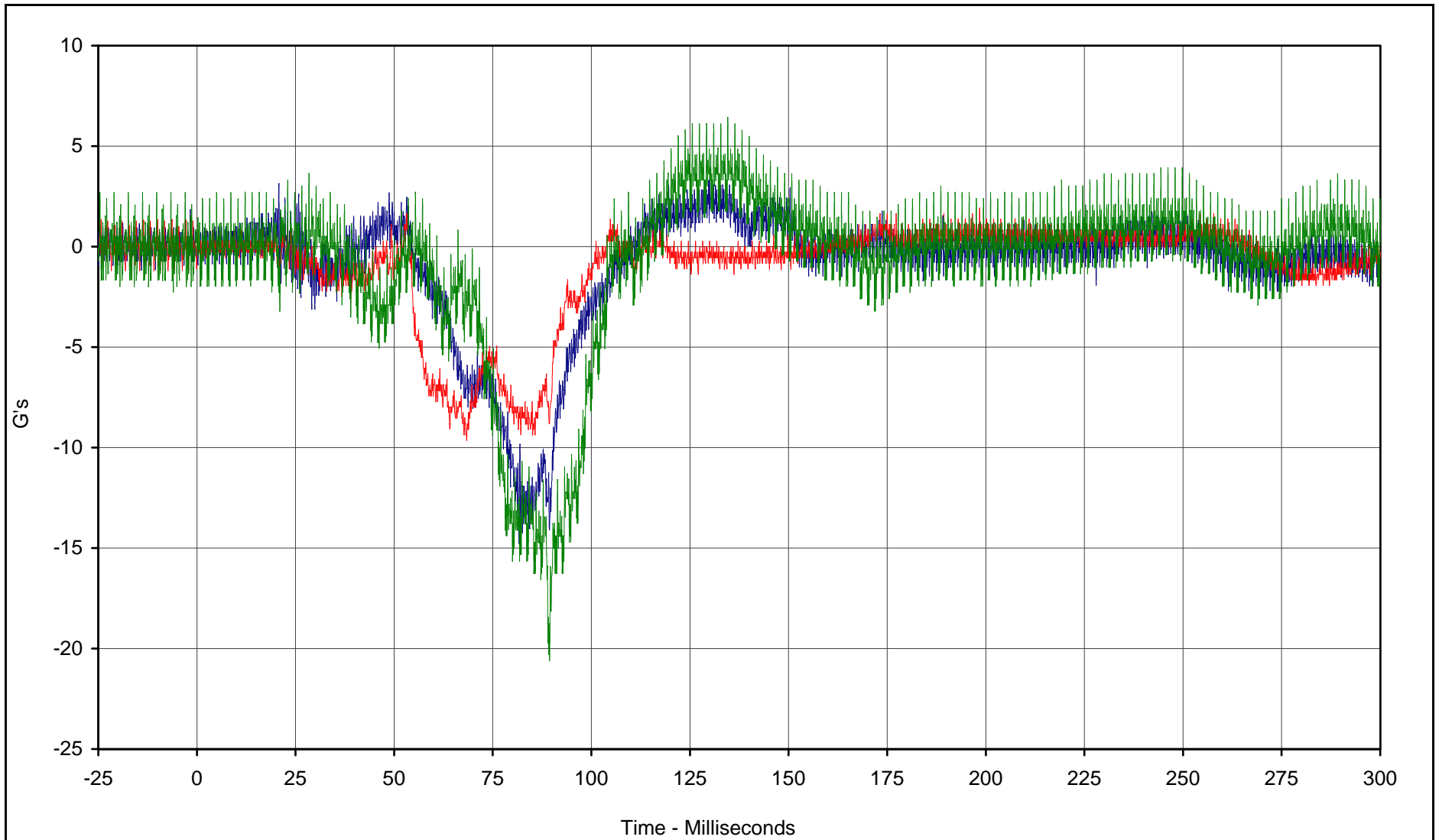
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

G-2



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Primary Y	135	FIL	G's	3.3	129.7	-14.9	82.1	1000
Driver NAHA Xarm-Y	140	FIL	G's	1.9	198.4	-9.6	68.4	1000
Driver NAHA Zarm-Y	142	FIL	G's	6.4	134.6	-20.6	89.4	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

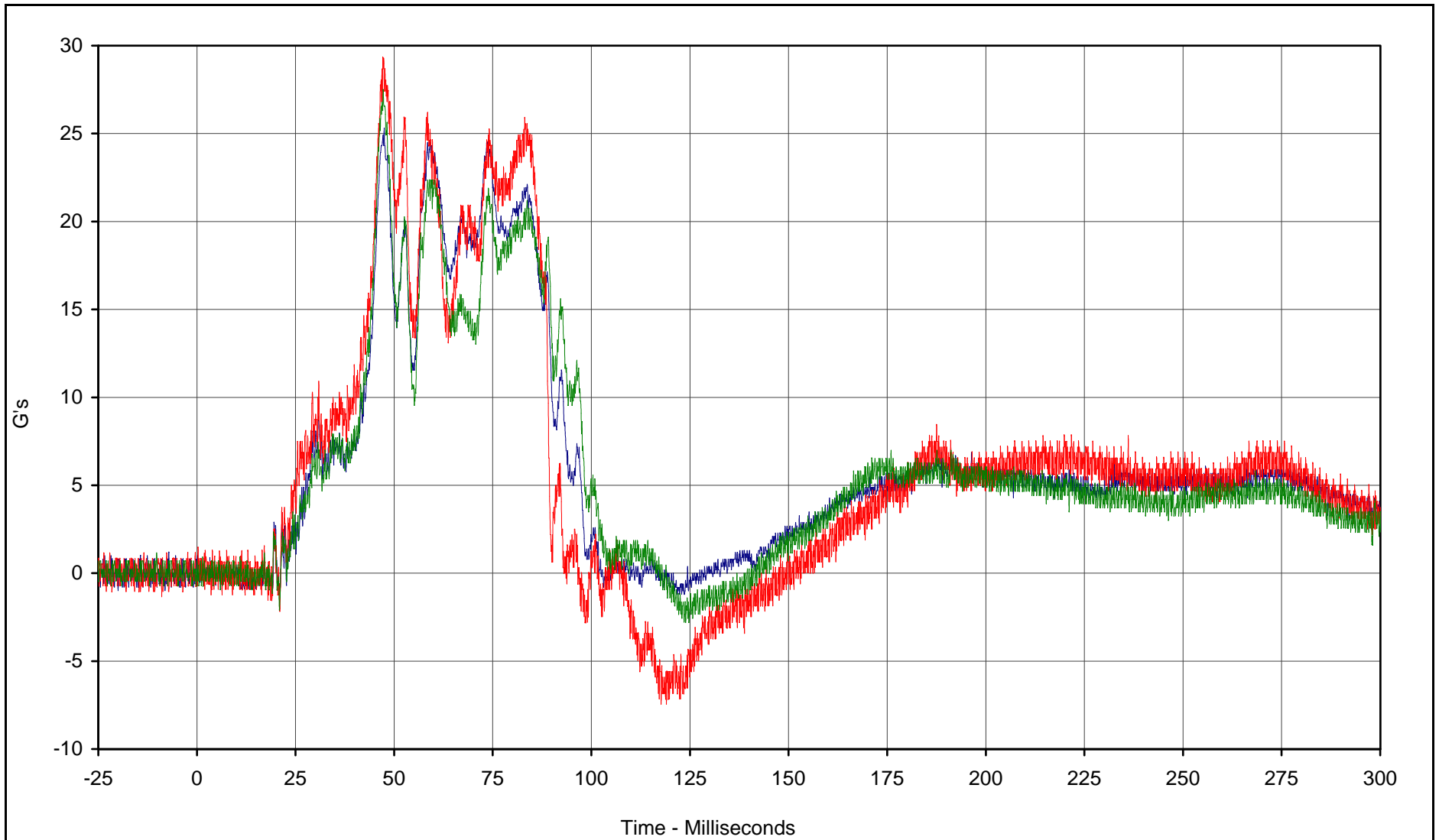
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

G-3



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Driver Head Primary Z	136	FIL	G's	25.3	47.5	-1.2	121.8	1000
Driver NAHA Xarm-Z	139	FIL	G's	29.3	47.1	-7.5	117.7	1000
Driver NAHA Yarm-Z	137	FIL	G's	27.5	47.2	-2.8	123.5	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

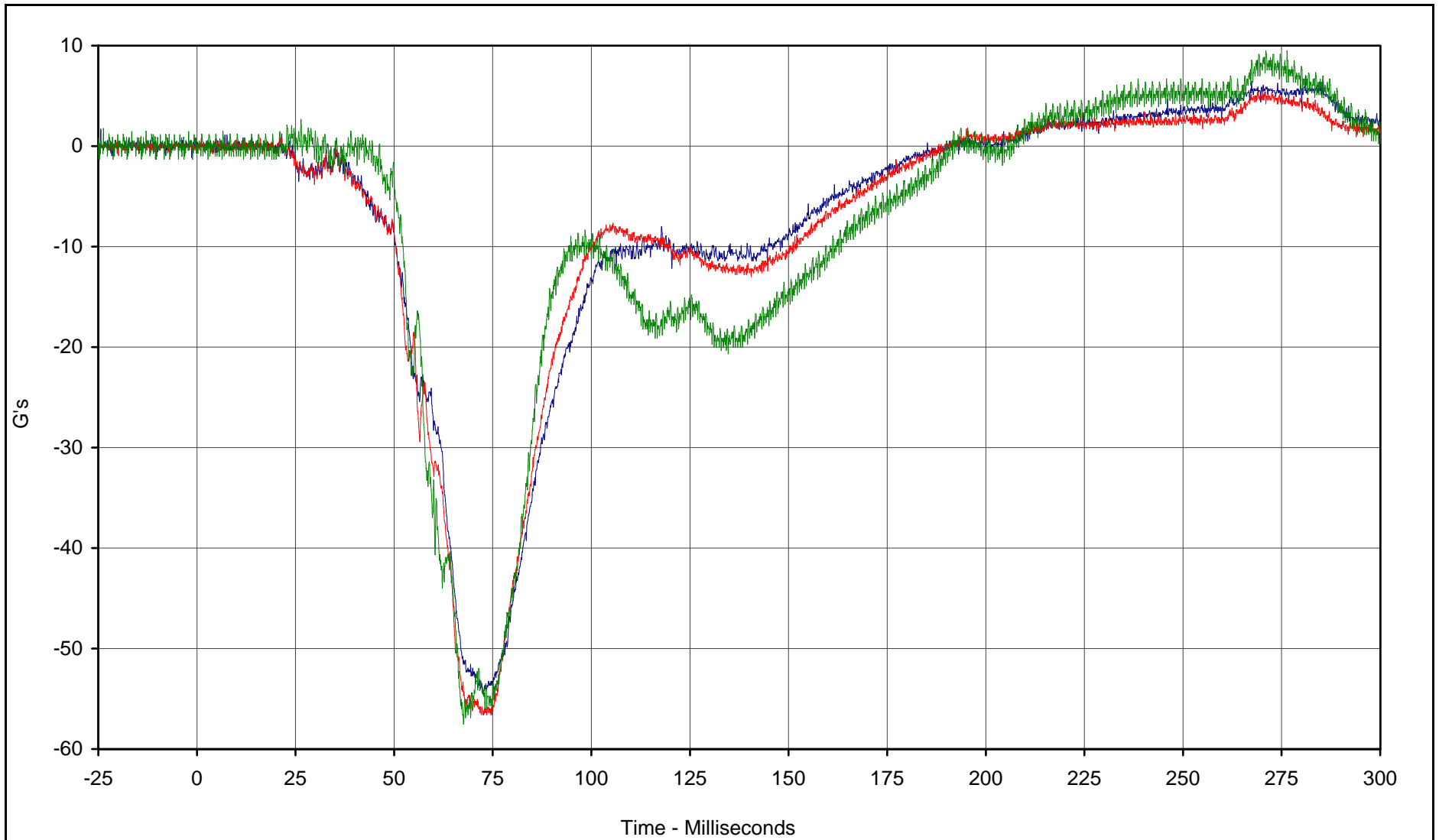
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

G-4



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Primary X	143	FIL	G's	7.0	281.1	-54.6	72.6	1000
Passenger NAHA Yarm-X	147	FIL	G's	5.4	268.9	-56.6	72.1	1000
Passenger NAHA Zarm-X	150	FIL	G's	9.4	271.0	-57.5	67.6	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

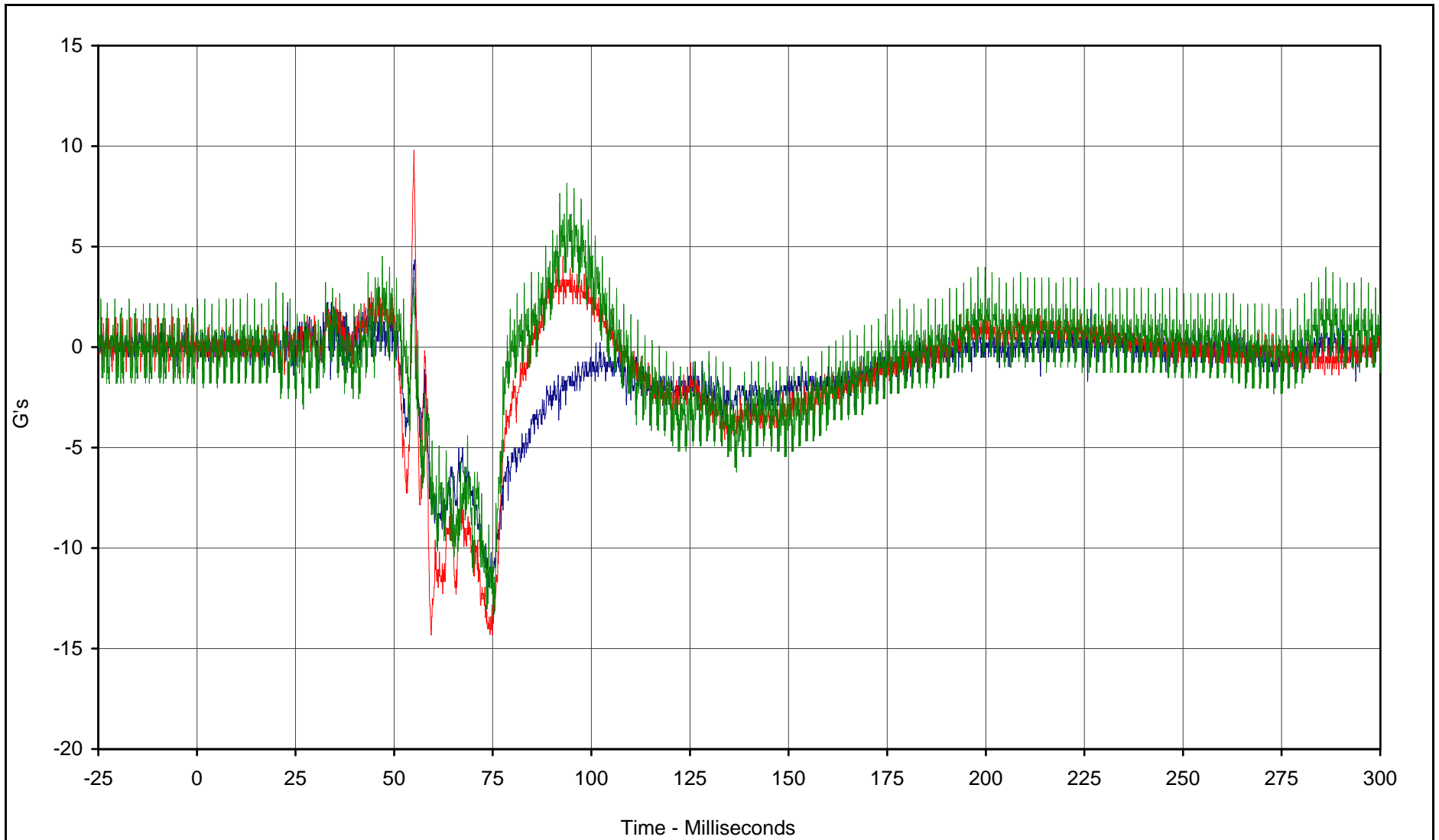
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

G-5



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Primary Y	144	FIL	G's	4.3	55.2	-11.9	74.0	1000
Passenger NAHA Xarm-Y	149	FIL	G's	9.8	55.0	-14.3	59.4	1000
Passenger NAHA Zarm-Y	151	FIL	G's	8.2	93.8	-13.6	75.2	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

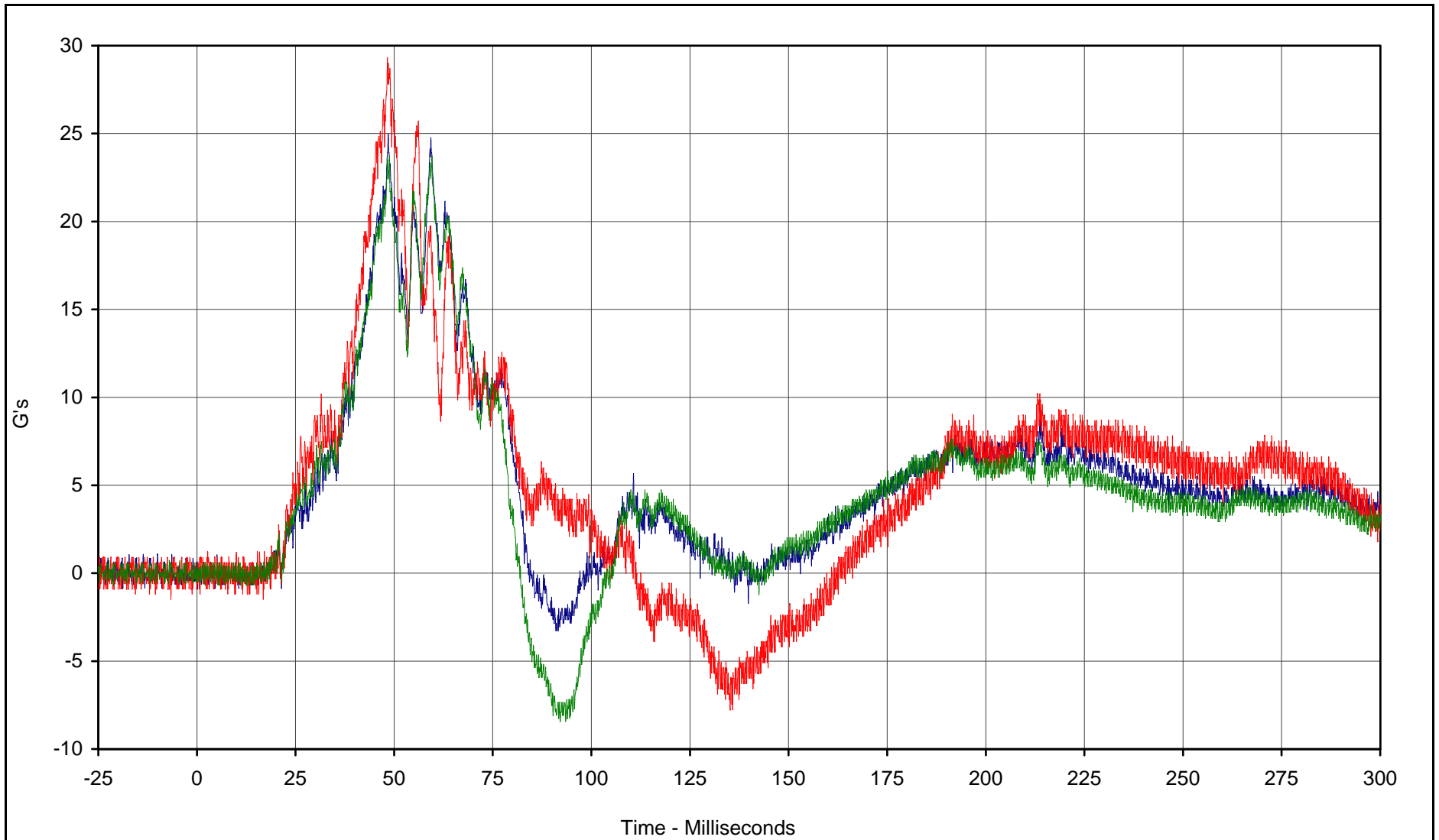
Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19

G-6



Curve Description	CURNO	Type	Units	Max	Time	Min	Time	SAE Class
Passenger Head Primary Z	145	FIL	G's	25.0	48.5	-3.3	91.0	1000
Passenger NAHA Xarm-Z	148	FIL	G's	29.3	48.3	-7.8	135.2	1000
Passenger NAHA Yarm-Z	146	FIL	G's	23.7	48.8	-8.4	92.1	1000



Test Vehicle: 2002 Hyundai Sonata 4 Door Sedan

Test Date: 6/13/02

Test Program: 2002 NHTSA 35mph NCAP

NHTSA No.: M20505

KAR22001-19