DOT HS-805 867

ARS RESEARCH SAFETY VEHICLE TO 1979 DODGE ENGER CRASH TEST REPORT – FRONTAL ALIGNED IMPACT AT 86.52 MPH CLOSING SPEED

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TEST REPORT

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Test 3108-1

16. Abstract

This report presents the results of an 86.52 mph Frontal Aligned Impact crash test between the Minicars RSV M5-11 and a production 1979 Dodge Challenger. The objective of this test was to obtain data to evaluate the crashworthiness of the Minicars RSV by providing a comparison between the occupant protection capability of the Minicars RSV and a production car in a frontal collision mode.

For this test, two calibrated 50th percentile dummies were placed in the driver and front passenger positions in each car. The Minicars RSV occupant restraint system consisted of air bags and knee restraints. The Dodge Challenger occupant restraints consisted of a production three-point belt system with emergency locking retractors (ELR-INERTIA).

The dummy occupants in the Minicars RSV did not exceed the injury criteria of FMVSS 208, but it appeared the right front passenger's right hand was not contained within the vehicle due to opening of the right side door. Both dummies in the Dodge Challenger injury levels for the head and chest exceeded the injury criteria of FMVSS 208.

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METRIC CONVERSION FACTORS

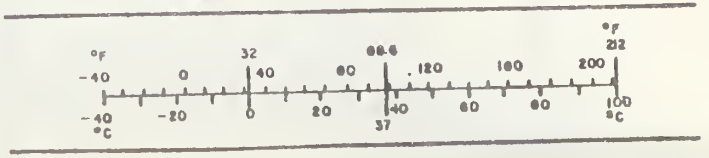
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	6	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.96	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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1.0 INTRODUCTION

1.1 BACKGROUND

The National Highway Traffic Safety Administration's Research Safety Vehicle (RSV) Program was initiated to develop advanced, State-of-the-Art vehicles which provide improved safety performance, efficient energy utilization, and environmental protection. This program has resulted in the design, development, and fabrication of two distinctive prototype vehicles made by two different contractors - Calspan and Minicars.

The Minicars RSV Program is currently in its fourth and final phase - Vehicle Test and Evaluation. Under this phase, a number of tests have been planned to evaluate the RSV's performance in terms of its crashworthiness, crash avoidance, ergometrics, fuel economy and emissions, etc. Many of these tests are being performed abroad under existing bilateral agreements between the United States Government and governments in Europe and Japan. However, some of the testing is being conducted in the United States.

Dynamic Science, Inc. was contracted by NHTSA to perform tests to evaluate the crashworthiness of the Minicars RSV using a production 1979 Dodge Challenger as the crash partner. The testing matrix is presented in Table 1-1.

TABLE 1-1. MINICARS RSV CRASHWORTHINESS TEST MATRIX

DSI Test Number	Test Date	Description	RSV M5-11 Speed (mph)	Challenger Speed (mph)
3108-1	9/10/80	Frontal Aligned Crash	43.26	43.26
3108-2	TBD	Rear Impact Crash	0.0	(45.00)

This report presents the results of Test 3108-1, a vehicle-to-vehicle Frontal Aligned Crash Test.

1.2 TEST OBJECTIVE

The objective of this test was to obtain data to evaluate the crashworthiness of the Minicars RSV by providing a comparison between the occupant protection capability of the Minicars RSV and a production car in a frontal collision mode as close to the RSV design speed as possible.

1.3 TEST CONDITIONS

Both vehicles were instrumented with structural accelerometers and other instrumentation to measure and record vehicle responses. Each vehicle contained calibrated, certified, Alderson Part 572 50th percentile dummies in the driver and right front passenger positions. High-speed motion pictures of the crash were recorded on 16 mm color film.

The Minicars RSV M5-11 was equipped with air bags for both the driver and right front passenger seating positions. The dummies were otherwise unrestrained. The dummies in the Dodge Challenger were restrained by the production three-point belt systems with emergency locking inertia retractors.

1.4 SUMMARY OF OCCUPANT TEST RESULTS

The front seat occupant's air bag restraint systems in the Minicars RSV inflated and deployed during impact. Both RSV occupant's head, chest, and femur injury levels did not exceed the

criteria as specified in Federal Motor Vehicle Safety Standard FMVSS 208. However, because the right door opened during the crash event, the right front passenger dummy's right hand appeared not to be contained within the outer surface of the passenger compartment, violating one of the requirements of FMVSS 208*. The right front door opened due to failure of the mounting rivets securing the lower door latching mechanism to the door structure. This subject is further discussed in Section 4.2 of this report.

The three-point belt restraint with emergency locking retractors provided for the front seat occupants in the Dodge Challenger appeared to operate satisfactorily. The HIC values and chest accelerations for the Dodge driver and right front passenger exceeded FMVSS 208 Occupant Injury Criteria. The femur injury levels were below the FMVSS criteria for both occupants.

The complete test results are presented in Section 4.0 of this report.

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*The applicable FMVSS 208 standard states that: "All portions of the test device shall be contained within the outer surfaces of the vehicle passenger compartment throughout the test."

2.0 TEST METHODOLOGY

The Minicars RSV M5-11-to-Dodge Challenger frontal aligned crash test was conducted at the midrange impact site with impact occurring over the camera pit (see Figure 2-1).

The test vehicles were prepared in accordance with the requirements of the approved test plan (portions reproduced in Appendix D) and placed at opposite ends of the test track (RSV at barrier end, Dodge Challenger at rollover site end) where they were attached to the tow and guidance system. The dummies in the Dodge Challenger were positioned according to FMVSS 208 procedures. The dummies in the Minicars RSV were positioned according to published Minicars Phase IV procedures. Upon completion of the pretest checkout of vehicles' instrumentation and the RSV air bag firing circuitry, the vehicles were towed to the specified speed and released within three feet of the designated impact point. The data from the test vehicles were transmitted to the data acquisition center via umbilical cable with telemetry backup.

2.1 DATA ACQUISITION METHODS

The overall plan for obtaining the test data is outlined in Table 2-1, which defines the test parameters, measurement method, and recording method used during the preparation and conduct of the test. Table 2-2 describes the test equipment and its function as it applies to the test parameters. All electronic data were processed in accordance with Dynamic Science, Inc. procedures and filtered according to SAE J211b.

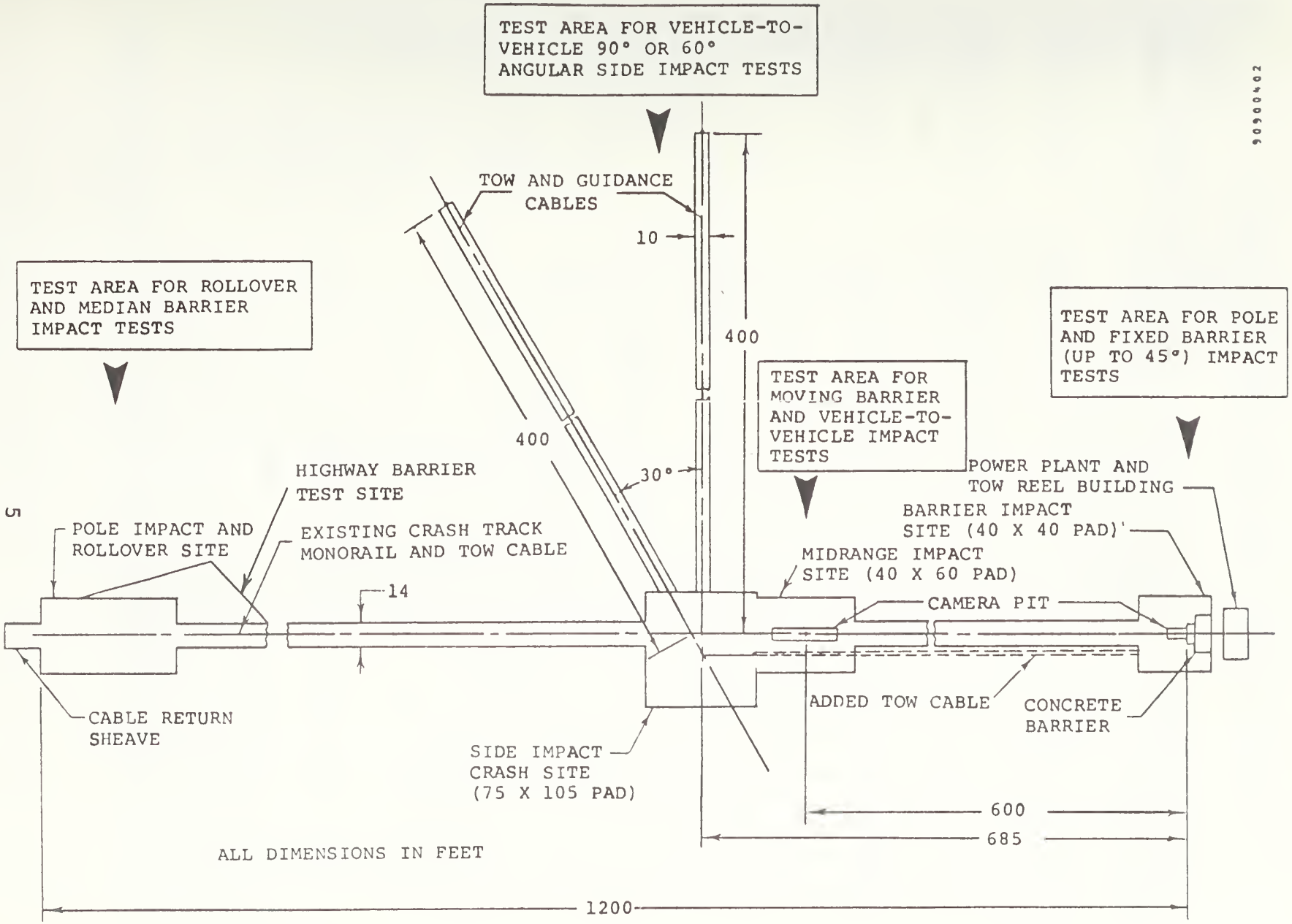


FIGURE 2-1. DYNAMIC SCIENCE IMPACT FACILITY.

TABLE 2-1. DATA REQUIREMENTS

Test Parameter	Measurement Method	Magnetic Tape	Written Log	Photographic Analysis
Impact time	Contact switch signal impressed on millisecond time base	X		
Approach Velocity	Tow cable velocity sensor	X		
Impact Velocity	Speed trap entrance and exit signals from speed trap	X*		
Rebound Velocity	Integration of accelerometer Data	X		
Vehicle Acceleration Measurements	Accelerometers, unbound strain gage type	X		
Occupant Acceleration Measurements	Accelerometers, unbound strain gage type	X		
Vehicle Structural Deformation	Direct linear measurement		X	
Vehicle Static Crush	Direct linear measurement		X	
Vehicle Dynamic Crush	Film Analysis, Integration of accelerometer data	X		X
Rebound Distance	Direct linear measurement and high-speed film analysis		X	X
Occupant Compartment Intrusion	Direct linear measurement		X	
Occupant Dynamic Displacement	High-speed film analysis			X
Vehicle Weight by Wheel	Direct pre-test measurement using balance scales		X	
Air bag Sensor Event	Monitored switch signal	X		
Passenger Diffuser and Air bag Pressure	Pressure Transducer	X		
Steering Column Dynamic Collapse	Displacement Transducer	X		

*Velocity is also measured by electronic counter.

TABLE 2-2. TEST EQUIPMENT LIST AND FUNCTION

Item	Manufacturer	Model	Purpose
Timing Trap	Dynamic Science	None	Determine impact speed by furnishing a start and stop signal to recording oscillograph.
Tape Switch			Records start of event.
Oscillograph	Bell and Howell	5-134	Records timing start and stop signals from timing traps, cable drive drum rpm, and impact switch.
Speed Control	Dynamic Science	None	Precision control of cable drive drum rpm.
Beam Scales	Western	WP2000	Used to determine vehicle test weights.
High-speed Motion Picture Cameras	Photosonic Milliken Locam	16-1B DBM-5A 51-0003	Used for side, overhead, pit and on-board film coverage as required
Motion Picture Camera	Canon Scoopic		Panning and documentation.
Still Camera	Mamiya	RB67	Documentary photo coverage.
100 and 100 Hz Time Code Generators	Dynamic Science	None	Furnish timing signal for high-speed cameras and a 1-millisecond timing for velocity determination.
Calibrated Steel Rue	Starret	48 in.	Precision measurement of velocity trap spacing.
Anthropomorphic Dummies	Anderson (GFE)	Part 572	To ballast the vehicle and to observe occupant dynamic movement.
Vehicle Engine Accelerometers	Statham	A69TC-250	Measure engine accelerations.
Vehicle Frame Accelerometers	Statham	A69TC-200	Measures vehicle acceleration.
Dummy Head & Chest (Redundant) & Pelvis Accelerometers	Endevco	2264-2000	Measure head and chest accelerations.
Dummy (Primary) Head & Chest Accelerometers	Endevco	7233C-750	Measures head and chest accelerations.
Tape Recorder	Sangamo	Sabre III	Records instrumentation signals.
Oscillograph	Bell and Howell	5-134	Records real-time quick-look data
Signal Conditioner	Ectron	M140	Conditions instrument output signal for recording.

3.0 INSTRUMENTATION REQUIREMENTS

3.1 MINICARS RSV INSTRUMENTATION

The Minicars RSV was instrumented with structural accelerometers, passenger air bag pressure sensors, an air bag time of deployment sensor, and a string potentiometer to measure steering column collapse per Figure 3-1 and Table 3-1. In addition, contact switches were placed at the point of initial impact on the bumper to record the time of the event and to trigger the impact correlation bulbs for the high-speed cameras.

3.2 DODGE CHALLENGER INSTRUMENTATION

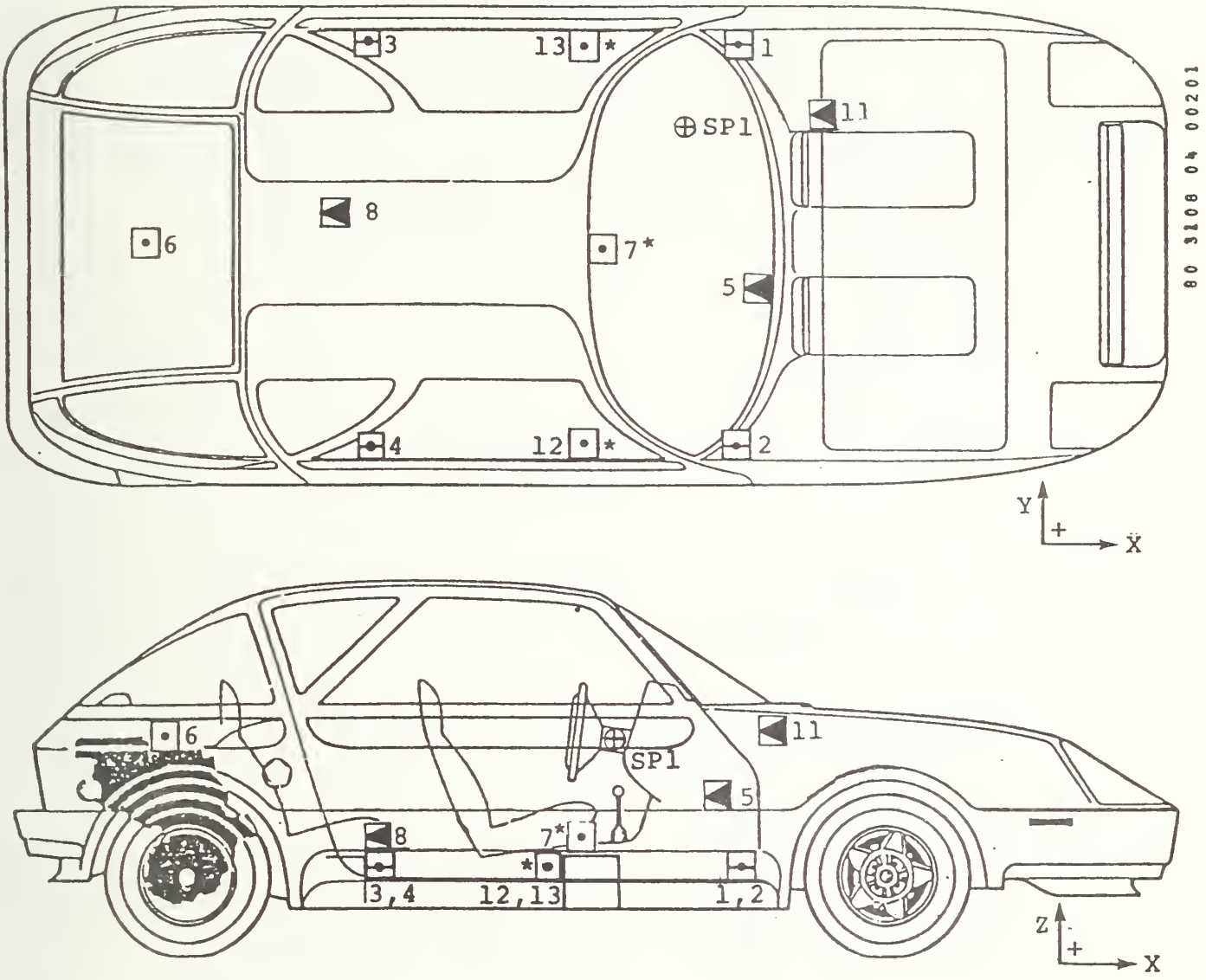
The Dodge Challenger was instrumented with structural accelerometers per Figure 3-2 and Table 3-2. Contact switches were also placed on the initial bumper contact point of the Challenger.

3.3 DUMMY INSTRUMENTATION

Two instrumented, Part 572, 50th percentile dummies were positioned in the driver and right front passenger locations in each vehicle. Prior to and after test use, the dummies were calibrated according to FMVSS 208 procedures, inspected, and adjusted to meet the torque and characteristic requirements for these devices.

The following test dummy instrumentation was installed for the driver and right front passenger positions:

1. A primary and redundant triaxial accelerometer mount located in the head to measure its acceleration.



Triaxial Accelerometer (X,Y,Z)

Biaxial Accelerometer (X,Z)

Uniaxial Accelerometer (X)

String Potentiometer

See Table 3-1 for further information.

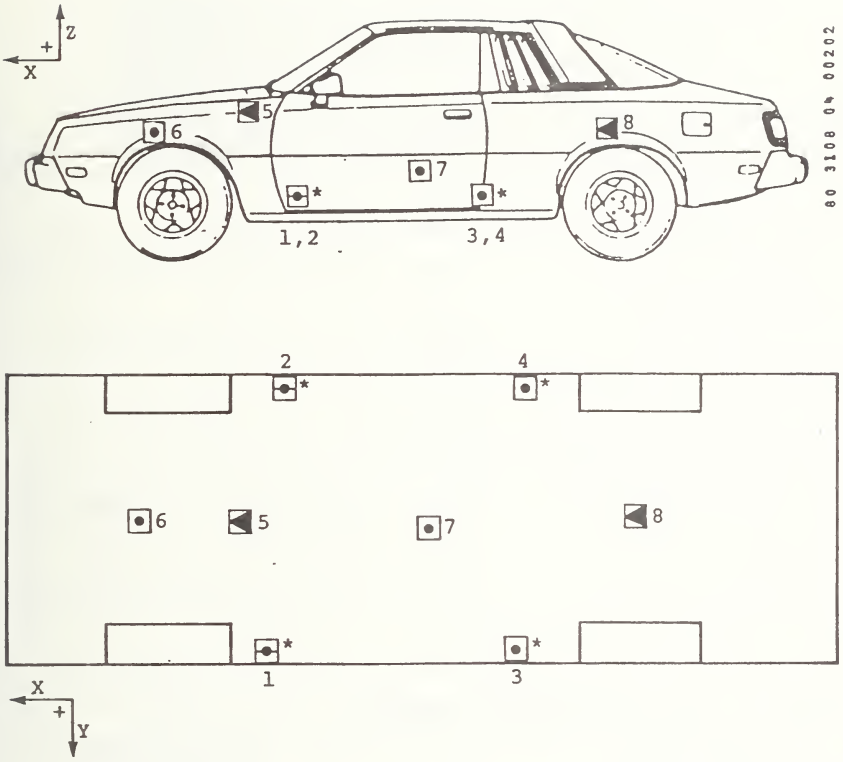
*Indicates a location requiring a redundant accelerometer(s).

FIGURE 3-1. MINICARS RSV INSTRUMENTATION.

TABLE 3-1. MINICARS RSV INSTRUMENTATION

Vehicle Accelerometer		Coordinates (in.)			Maximum Expected Range (g's)			Data
No.	Location	X	Y	Z	X	Y	Z	Channels
1	Left A-Pillar	-68.0	26.5	28.0	100			1
2	Right A-Pillar	-68.0	-26.5	28.0	100			1
3	Below Left B-Pillar, Inside Sill	-117.6	23.0	13.8	100			1
4	Below Right B-Pillar, Inside Sill	-117.6	-23.0	13.8	100			1
5	Front Wall, Inside Compartment, Right of Center Tunnel	-57.2	-6.0	24.0	100		100	2
6	Engine	Top Center of Block, Valve Cover Removed			200	200	200	3
7	Nominal Center of Gravity	-99.8	-1.4	16.0	100	25	25	3
7R	Nominal Center of Gravity	-97.5	-1.4	16.0	100	25	25	3
8	Rear Seat Crossmember, Left of Fuel Cell Tunnel	-119.3	7.0	13.3	100		25	2
11	Over Steering Wheel Inside Luggage Compartment	-56.8	12.1	37.0	100		100	2
12	Behind LF Seat Crossmember Inside Sill	-94.8	-23.0	13.0	100	25	25	3
12R	Behind LF Seat Crossmember Inside Sill	-94.8	-23.0	9.0	100			1
13	Behind RF Seat Crossmember Inside Sill	-94.8	23.0	13.0	100	25	25	3
13R	Behind RF Seat Crossmember Inside Sill	-94.8	23.0	9.0	100			1
								27
Occupant Instrumentation (Two Occupants)								
Head Accelerometers					200*	200*	200*	12
Chest Accelerometers					100*	100*	100*	12
Pelvis Accelerometer					100	100	100	6
Femur Load Cells					3000 lb			4
								34
Other Instrumentation								
String Pot-Steering Wheel								1
Passenger Diffuser Pressure								1
Passenger Air Bag Pressure								1
Time of Air Bag Fire								1
								4

Coordinate reference: X- Front Bumper ℄, Y-℄, Z - Ground.
*Redundant accelerometers.



Triaxial Accelerometer (X,Y,Z)

Biaxial Accelerometer (X,Z)

Uniaxial Accelerometer (X)

See Table 3-2 for further information

*Indicates a location requiring a redundant accelerometer(s)

FIGURE 3-2. DODGE CHALLENGER INSTRUMENTATION.

TABLE 3-2. DODGE CHALLENGER INSTRUMENTATION

Vehicle Accelerometer		Coordinates (in.)			Maximum Expected Range (g's)			Data Channels
No.	Location	X	Y	Z	X	Y	Z	
1	Left A-Pillar	-59.9	27.0	16.0	100			1
1R	Left A-Pillar	-59.9	27.0	19.0	100			1
2	Right A-Pillar	-59.9	-27.0	16.0	100			1
2R	Right A-Pillar	-59.9	-27.0	19.0	100			1
3	Left B-Pillar	-101.3	25.0	12.0	100	25	25	3
3R	Below Left B-Pillar	-107.8	22.0	10.4	100			1
4	Right B-Pillar	-101.3	-25.0	12.0	100	25	25	3
4R	Below Right B-Pillar	-107.8	-22.0	10.4	100			1
5	Front Firewall	-48.5	0.0	33.0	100		100	2
6	Engine	-38.4	7.0	26.3	250	250	250	3
7	Nominal Center of Gravity	-86.3	0.0	15.5	100	25	25	3
8	Rear Deck	-134.8	0.0	21.5	100		25	2
								22
Occupant Instrumentation (Two Occupants)								
Head Accelerometers					300*	300*	300*	12
Chest Accelerometers					150*	150*	150*	12
Pelvis Accelerometer					150	150	150	6
Femur Load Cells					3000 lb			4
								34

Total Data Channels Required = 56

Coordinate reference: X - Front Bumper ℄, Y - ℄, Z - Ground.
*Redundant accelerometers.

2. A primary and redundant triaxial accelerometer mount located in the chest cavity to measure chest acceleration.

3. A triaxial accelerometer mount located in the pelvic cavity to measure pelvis acceleration.

4. A femur load cell mounted in the femur of each upper leg to measure femur loads.

The instrumentation requirements for the dummy occupants are given in Tables 3-1 and 3-2.

3.4 PHOTO-INSTRUMENTATION REQUIREMENTS

Seventeen high-speed cameras and one panning (24 fps) camera were used as shown in Table 3-3 to document the test. In addition, black-and-white stills and color slides were taken.

3.5 VEHICLE STRUCTURAL DEFORMATION DATA

Pre-test and post-test measurements of the test vehicles (exterior and interior) were recorded. Data obtained from these measurements were used to determine frontal crush and occupant compartment intrusion.

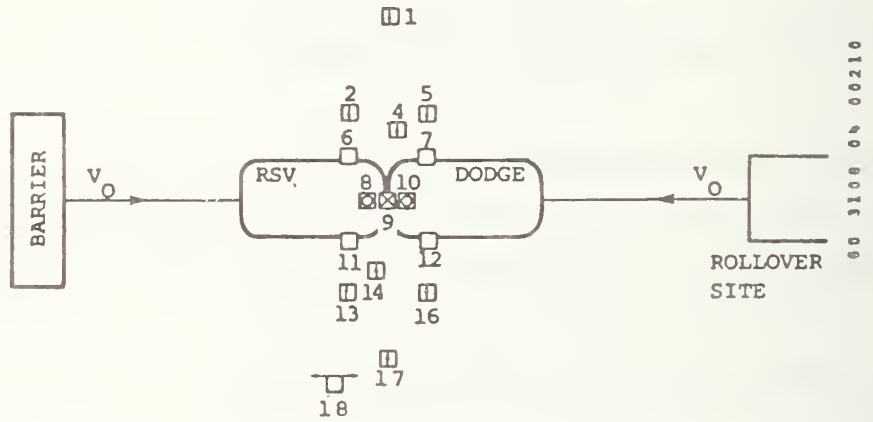
TABLE 3-3. MINICARS RSV-TO-DODGE CHALLENGER PHOTO-INSTRUMENTATION (TEST 3108-1)

Test No: 3108-1 Test Date: September 10, 1980

Vehicle A (Away): Dodge Test Type: Vehicle-to-Vehicle Frontal Aligned Impact

Vehicle B (Barrier): RSV Comments: Both vehicles moving head-on-impact.

CAMERA	YES	CAMERA SYMBOLS	FRAME RATE (f/s)	TIMING LIGHT SPEED
Stills	X	Pit	1. 100	1. 100 HZ (10 msec/light)
Slides	X	Ground	2. 200	2. 200 HZ (5 msec/light)
Movie	X	Barrier	3. Other 24	3. Other
Polaroid	X	Overhead	4. 400	
Video		On-Board	5. 500	
		Panning		



Loc No.	Location	Field of View	Camera Type	Lens Size (mm)	Nominal Frm Rate	Actual Tmng Spd(hz)
1	North Side	Overall	LoCam	28	4	None
2	North Side	RSV Driver Dummy Kinematics	Millikens	16	4	*
3	North Side	Closeup-Vehicles Interface	Millikens	16	4	None
4	North Side	Closeup-Vehicles Interface	Photosonics	25	1	100
5	North Side	Dodge Passenger Dummy Kinematics	Millikens	16	4	100
6	RSV-DS On-Board	RSV Driver Dummy Kinematics	Photosonics	8	1	100
7	Dodge-PS On-Board	Dodge Passenger Dummy Kinematics	Photosonics	8	1	101
8	Pit	Underside Front End of RSV	Photosonics	15	1	100
9	Overhead	Vehicles Interface	Millikens	10	4	101
10	Pit	Underside Front End of Dodge	Photosonics	15	1	102
11	RSV PS On-Board	RSV Passenger Dummy Kinematics	Photosonics	8	1	100
12	Dodge DS On-Board	Dodge Driver Dummy Kinematics	Photosonics	8	1	99
13	South Side	RSV Passenger Dummy Kinematics	Millikens	16	4	None
14	South Side	Closeup-Vehicles Interface	Photosonics	25	1	106
15	South Side	Closeup-Vehicles Interface	Millikens	25	4	57
16	South Side	Dodge Driver Dummy Kinematics	Millikens	35-75	4	101
17	South Side	Overall	LoCam	25	4	None
18	TBD	Panning-Test and Results		-	3	-

*Camera 2 did not run.

4.0 TEST RESULTS

This section of the report presents the results of the crash test in the form of a comparison of the data from both vehicles.

The complete body of data obtained during the test is presented in the following appendices:

- Appendix A - Minicars RSV M5-11 occupant and vehicle data plots.
- Appendix B - 1979 Dodge Challenger occupant and vehicle data plots.
- Appendix C - Additional photographs of the crash test.
- Appendix D - Pre-test acceptance certificate and vehicle information documentation.
- Appendix E - Pre-test and post-test dummy calibration data.

Tables 4-1 and 4-2 present a summary of the test conditions and post-test observations.

4.1 VEHICLE TEST RESULTS

A summary of the vehicles' accelerometer data is shown in Table 4-3. The Minicars and Dodge Challenger maximum occupant compartment acceleration was 39 g and 37 g, respectively. These are based on the average of locations 12X and 13X channels for the Minicars compartment, and of locations 3X and 4X channels for the Dodge compartment. As noted in Table 4-1 and 4-2, the static crush measured at the centerline of the vehicle at bumper level for the Minicars RSV was 40 inches and 28.8 inches for the Challenger. The mutual dynamic crush of both vehicles obtained from film analysis was 77 inches (see Figure 4-1). The mutual crush

TABLE 4-1. CRASH TEST SUMMARY - MINICARS RSV

Test No. 3108-1 Date: 9/10/80 Time: 14:46
Vehicle: RSV M5-11 Test Speed: 43.26 mph Amb. Temp: 94 °F
Test Weight (lb): 3087 LF: 733 RF: 679 LR: 838 RR: 837

Maximum Static Crush (in.) - 40.0 (℄ of vehicle at bumper height)

Maximum Rebound Velocity - 3 mph

Dummies
Type Part 572, 50th Percentile Male (Alderson)
Location LF and RF
Restraint System Driver: air bag mounted on steering wheel
Passenger: air bag mounted in dash

Number of Data Channels 65
Number of On-Board Cameras One on each door

Post-Test Observations

Glazing: Windshield cracked completely. Retention loss from a point 11.5 inches right of ℄ at top, down right side, and across bottom to bottom corner on left side, except for 2 inches retained on right side bottom rear right corner. Right side door main window cracked over entire surface.

Doors: Right side door opened during crash due to failure of the five rivets holding the latching mechanism to the door. Left side door required tools to open after test, and opened when the corresponding five rivets failed.

Roof: No observable damage.

Steering Column and Wheel: No observable damage. Minimal observable steering column intrusion.

Seats: No observable failure in seat backs or tracks.

Restraint System: Both air bags inflated and deployed.

Dummies: No head or chest contacts other than air bags. Knee contacts at knee restraints.

Miscellaneous: No fuel system leakage. Coolant leakage observed. Hood flew off. Rear view mirror came off. Moderate floor pan intrusion.

TABLE 4-2. CRASH TEST SUMMARY - DODGE CHALLENGER

Test No. 3108-1 Date: 9/10/80 Time: 14:46

Vehicle: Dodge Challenger Test Speed: 43.26 mph Amb. Temp: 94°F

Test Weight (lb): 3082 LF: 742 RF: 672 LR: 831 RR: 837

Maximum Static Crush (in.) - 28.8 (℄ of vehicle at bumper height)

Maximum Rebound Velocity - 8 mph

Dummies

Type Part 572, 50th Percentile Male (Alderson), calibrated, certified

Location LF and RF

Restraint System Driver: production 3-point belt with ELR
Passenger: production 3-point belt with ELR

Number of Data Channels 56

Number of On-Board Cameras One on each door

Post-Test Observations

Glazing: Windshield cracked over entire surface and shattered near bottom. Retention loss approx. 3 inches on bottom near left corner.

Doors: Both doors opened with difficulty

Roof: No damage.

Steering Column and Wheel: Extensive bending of rim caused by dummy head and chest contact. Apparent sizeable intrusion of column. Column remained attached to all under-dash structures.

Seats: Passenger side seat back adjusting mechanism slipped during impact, so that the seat ended up in the full reclining position. The adjusting mechanism and seat back operated satisfactorily post-test. Driver seat back angled more toward rear than pre-test.

Restraint System: Both driver and passenger belt systems showed approximately three inches of static extension from retractor housing.

Dummies: Driver: head contact at top of steering wheel (forehead) and top of steering wheel hub (chin). Chest contact at bottom of steering wheel. Knees contacted underside of dash. Passenger: head contact top of dash above glove box. Knees contacted underside of dash below glove box.

Miscellaneous: Extensive damage to dashboard and center console. Severe toeboard intrusion both sides. Coolant leakage. Fluid leakage from RR shock absorber. No fuel system leakage.

TABLE 4-3. SUMMARY OF VEHICLE ACCELEROMETER DATA (TEST 3108-1)

Accelerometer Number	Minicars RSV Maximum Acceleration A (g)	Minicars RSV Maximum Acceleration Time (msec)	Dodge Challenger Maximum Acceleration A (g)	Dodge Challenger Maximum Acceleration Time (msec)
1X	-64.5	63	-45.4	58
1XR	--	--	-41.9	57
2X	-89.8	61	-45.2	57
2XR	--	--	-48.1	48
3X	-36.4	69	-38.4	59
3XR	--	--	-41.3	56
3Y	--	--	7.3	73
3Z	--	--	16.1	71
4X	Instrumentation Failure		-38.7	47
4XR	--	--	-39.9	56
4Y	--	--	-13.8	48
4Z	--	--	15.7	62
5X	-92.5	52	69.7	67
5Z	43.5	59	-53.8	50
6X	-62.7	74	-100.8	31
6Y	10.7	34	-28.4	43
6Z	7.7	24	32.1	69
7X*	-55.2	52	-49.0	68
7XR*	-36.2	65	--	--
7Y*	-12.7	28	-15.1	32
7YR*	20.3	80	--	--
7Z*	40.0	89	46.2	67
7ZR*	-15.8	47	--	--
8X	-50.2	26	-39.1	66
8Z	16.6	30	25.4	66
11X	-56.8	65	--	--
11Z	15.1	43	--	--
12X	-43.3	27	--	--
12XR	-40.8	25	--	--
12Y	14.9	31	--	--
12Z	29.4	72	--	--
13X	-35.0	27	--	--
13XR	-38.7	27	--	--
13Y	13.6	27	--	--
13Z	14.4	60	--	--
Average of 1X & 2X	-66.0	62	-40.2	58
Average of 1XR & 2XR	--	--	-41.2	57
Average of 3X & 4X	--	--	-37.0	56
Average of 3XR & 4XR	--	--	-40.6	56
Average of 12X & 13X	-39.2	27	--	--
Average of 12XR & 13XR	-36.5	26	--	--

*Data for RSV location 7 and 7R are questionable. Accelerometer mounts came loose during crash.

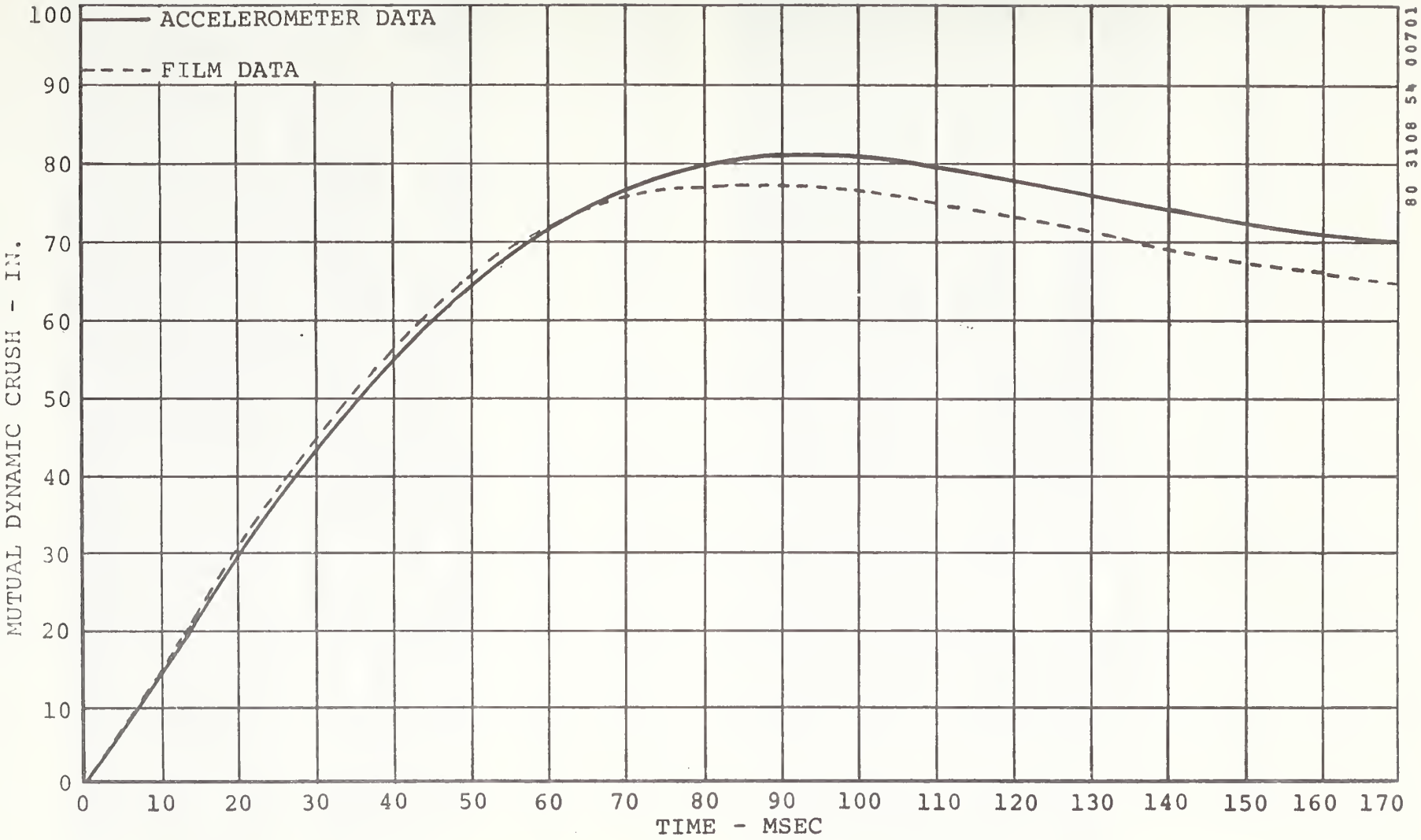


FIGURE 4-1. COMPARISON OF MUTUAL DYNAMIC CRUSH FROM ACCELEROMETER DATA AND FILM DATA (TEST 3108-1).

obtained from integration of vehicle accelerometer data shown on this plot is not considered as accurate as film analysis due to the change in accelerometer orientation with respect to ground during the crash. Pre-test and post-test views of the vehicles are shown in Figures 4-2 through 4-5.

Because of the significant effect on the vehicle force path due to the front bumper interface, measurements were taken to assure bumper match within satisfactory tolerance. These dimensions are documented in Appendix D (page D-2).

The vehicle exterior frontal and occupant compartment interior profiles are presented in Tables 4-4 through 4-7. Photographs of the occupant compartment intrusion are shown in Figures 4-6 and 4-7.

A list of the pre-test conditions for the test vehicles documented just prior to test are shown in Tables 4-8 and 4-9.

4.2 OCCUPANT TEST RESULTS

A summary of the occupant accelerations data and injury criteria for the head, chest and femurs for both vehicles are presented in Tables 4-10 and 4-11. The pre- and post-test photographs of the occupants are shown in Figures 4-8 through 4-11.

The air bag sensor closure occurred at 16 ms and both air bags subsequently deployed. Plots of the air bag sensor fire, steering wheel collapse, passenger diffuser pressure, and passenger air bag pressure are presented in Appendix A. The RSV dummy responses were well within the injury criteria requirements of

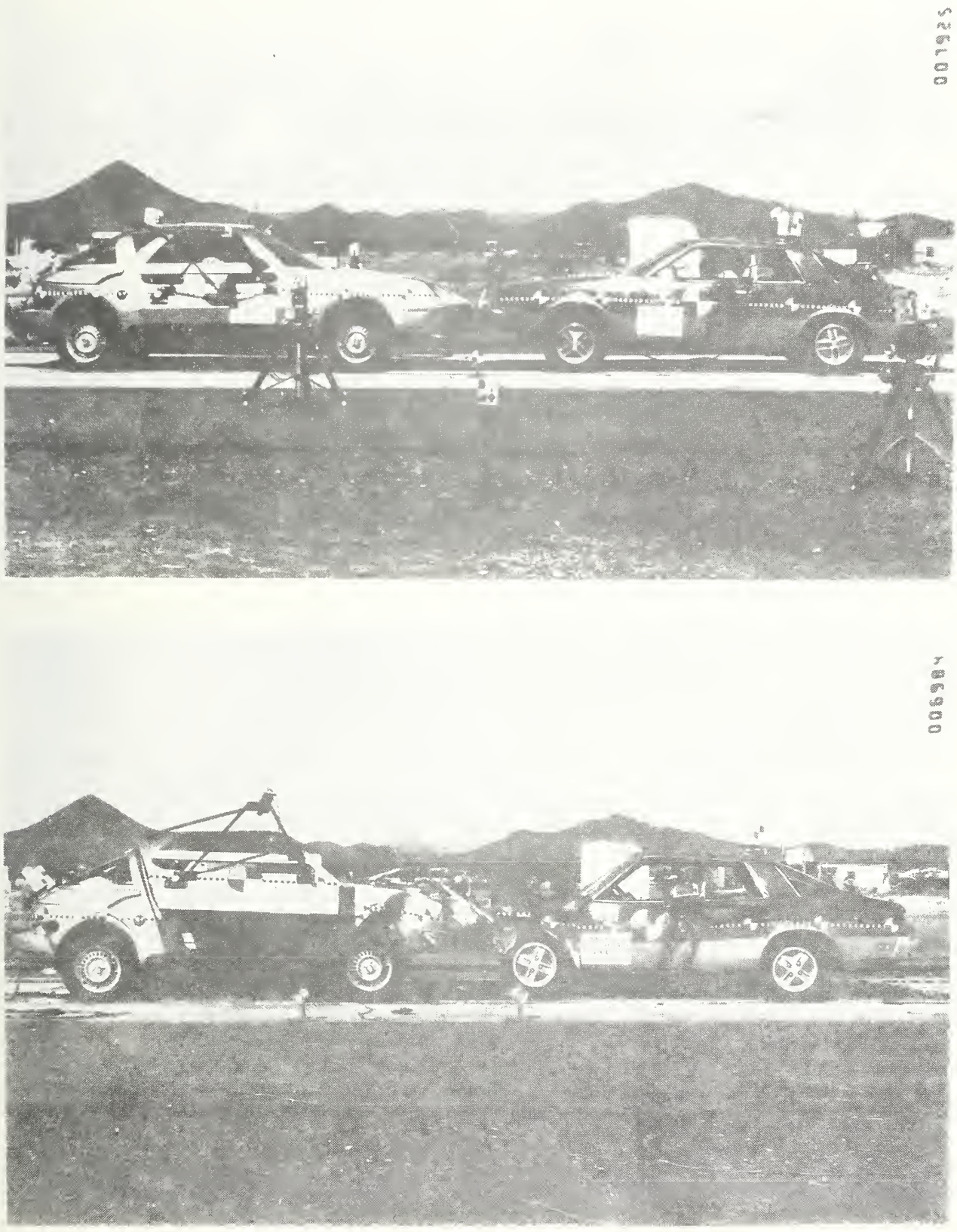


FIGURE 4-2. PRE- AND POST-TEST OVERALL VIEW.

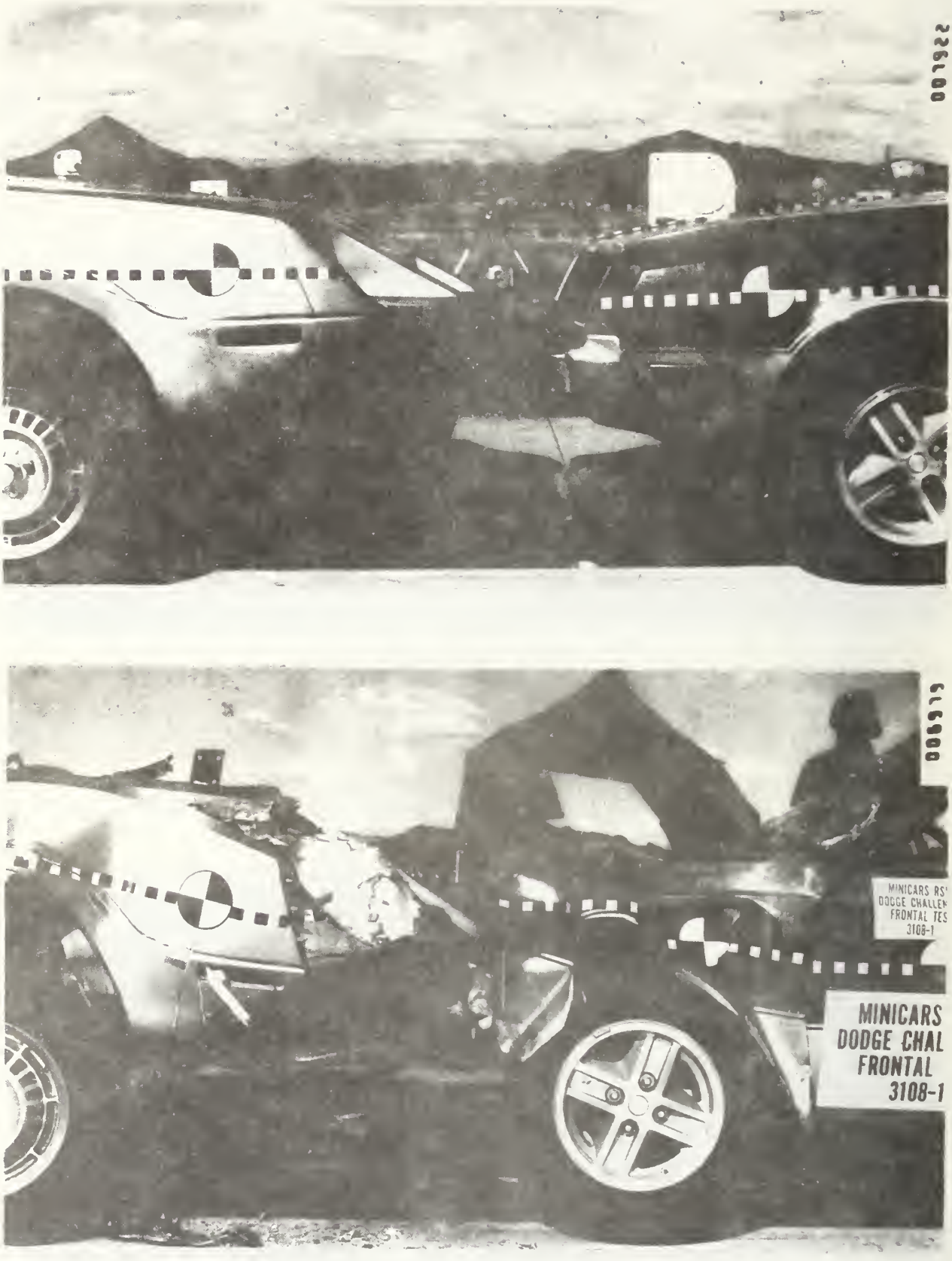


FIGURE 4-3. PRE-AND POST-TEST SIDE VIEW OF VEHICLE FRONT.

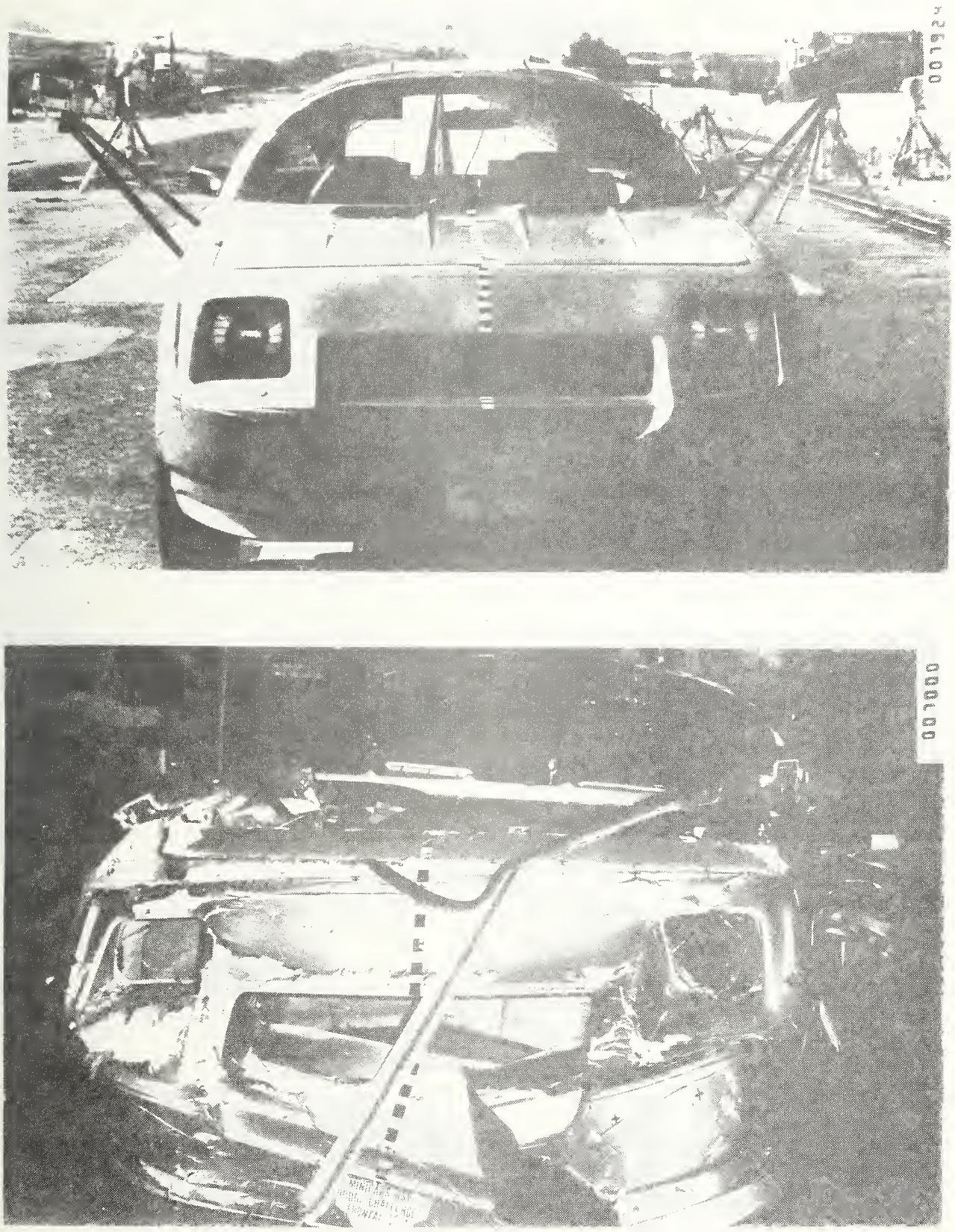


FIGURE 4-4. PRE- AND POST-TEST FRONTAL VIEW OF MINICARS RSV.

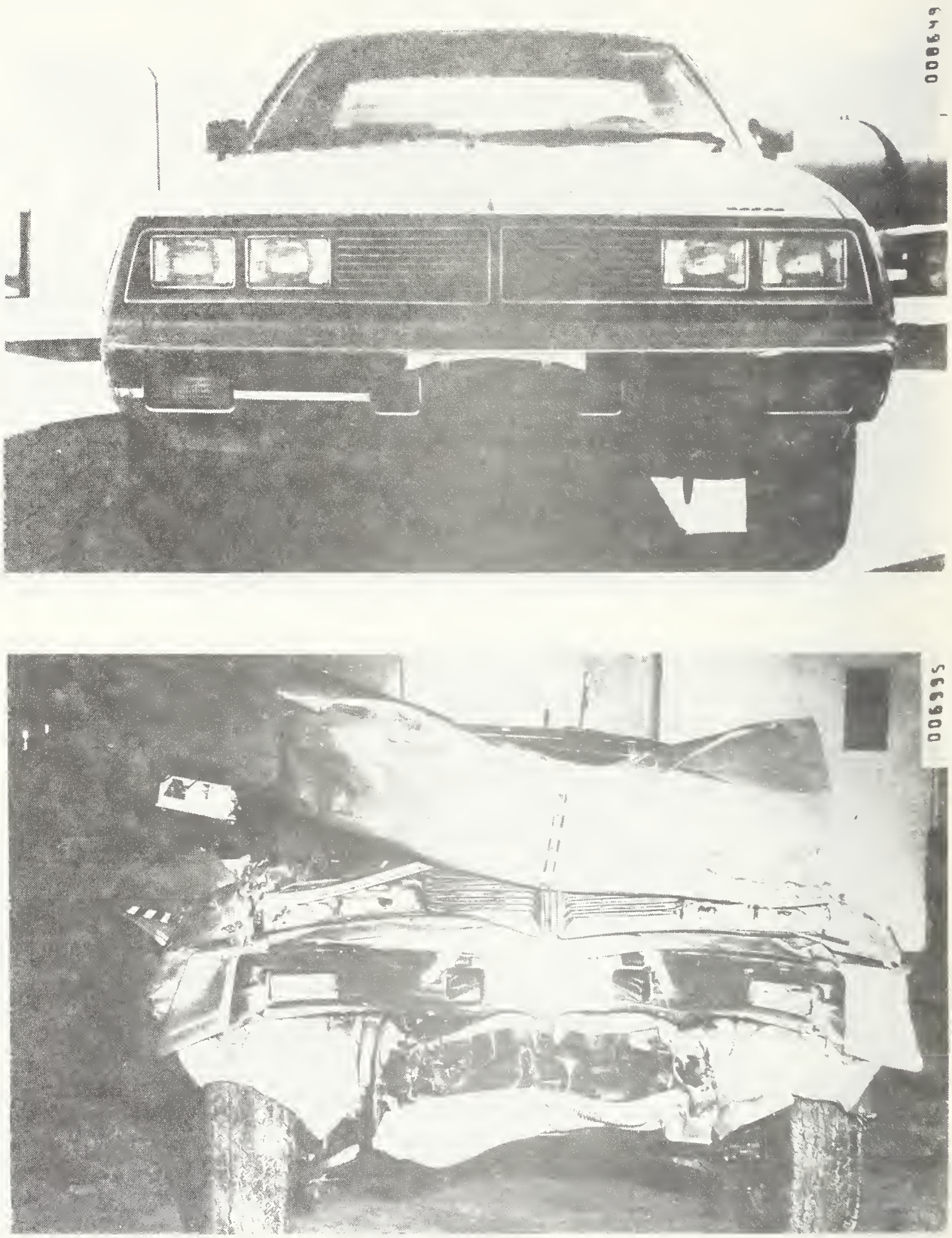


FIGURE 4-5. PRE- AND POST-TEST FRONTAL VIEW OF DODGE CHALLENGER.

TABLE 4-4. SUMMARY OF MINICARS RSV M5-11 FRONTAL STATIC CRUSH (IN.)

Level	Passenger Side						Driver Side				
	Inches From Centerline										
	30	24	18	12	6	0	6	12	18	24	30
Top of Bumper	27.4	34.8	38.6	41.2	41.1	40.0	38.4	34.4	30.6	27.6	20.4

TABLE 4-5. SUMMARY OF DODGE CHALLENGER FRONTAL STATIC CRUSH (IN.)

Level	Passenger Side						Driver Side				
	Inches From Centerline										
	27	24	18	12	6	0	6	12	18	24	27
Hood	23.4	23.7	24.6	25.1	21.3	19.8	20.4	21.9	22.6	23.5	22.5
Grille Bottom	29.6	29.0	28.5	27.1	25.5	23.2	25.1	26.5	27.7	27.7	28.1
Bumper	32.9	33.1	32.1	31.0	29.8	28.8	30.3	30.5	31.2	32.1	32.1

TABLE 4-6. SUMMARY OF MINICARS RSV M5-11 STATIC INTERIOR INTRUSION (IN.)

Level	Driver Side				Passenger Side			
	Toeboard Intrusion (in.) Inches From Center Tunnel							
Ht. Above Floor (in.)	16.8	12	6	0	0	6	12	15.5
10.1	4.1	4.1	4.4	3.8	4.9	5.8	7.3	7.8
	17.0	12	6	0	0	6	12	17.0
5.6	1.6	2.8	1.8	0.6	1.9	3.5	4.9	5.0
	18.0	12	6	0	0	6	12	17.9
0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.8

NOTE: Steering Column Dynamic Collapse - 4.6 in.
Lower dash intrusion measurements could not be taken for the RSV.

TABLE 4-7. SUMMARY OF DODGE CHALLENGER STATIC INTERIOR INTRUSION (IN.)

Level	Driver Side				Passenger Side				
	Lower Dash Intrusion (in.) Inches From Centerline								
Ht. Above Floor (in.)	24	18	12	6	℄	6	12	18	24
16.8	1.6	1.5	5.2	3.9	4.2	4.5	1.0	0.5	2.4
	Toeboard Intrusion (in.) Inches From Center Tunnel								
Ht. Above Floor (in.)	17	12	6	0	0	6	12	17	
7.5	4.4	7.5	9.6	7.6	6.7	7.6	5.5	4.0	
3.5	5.3	9.4	10.9	7.8	4.5	6.4	4.9	3.6	
0.0	5.0	7.1	8.2	7.0	0.4	2.1	1.3	0.5	

NOTE: Steering Column Static Intrusion - 4.1 in. (X Direction)

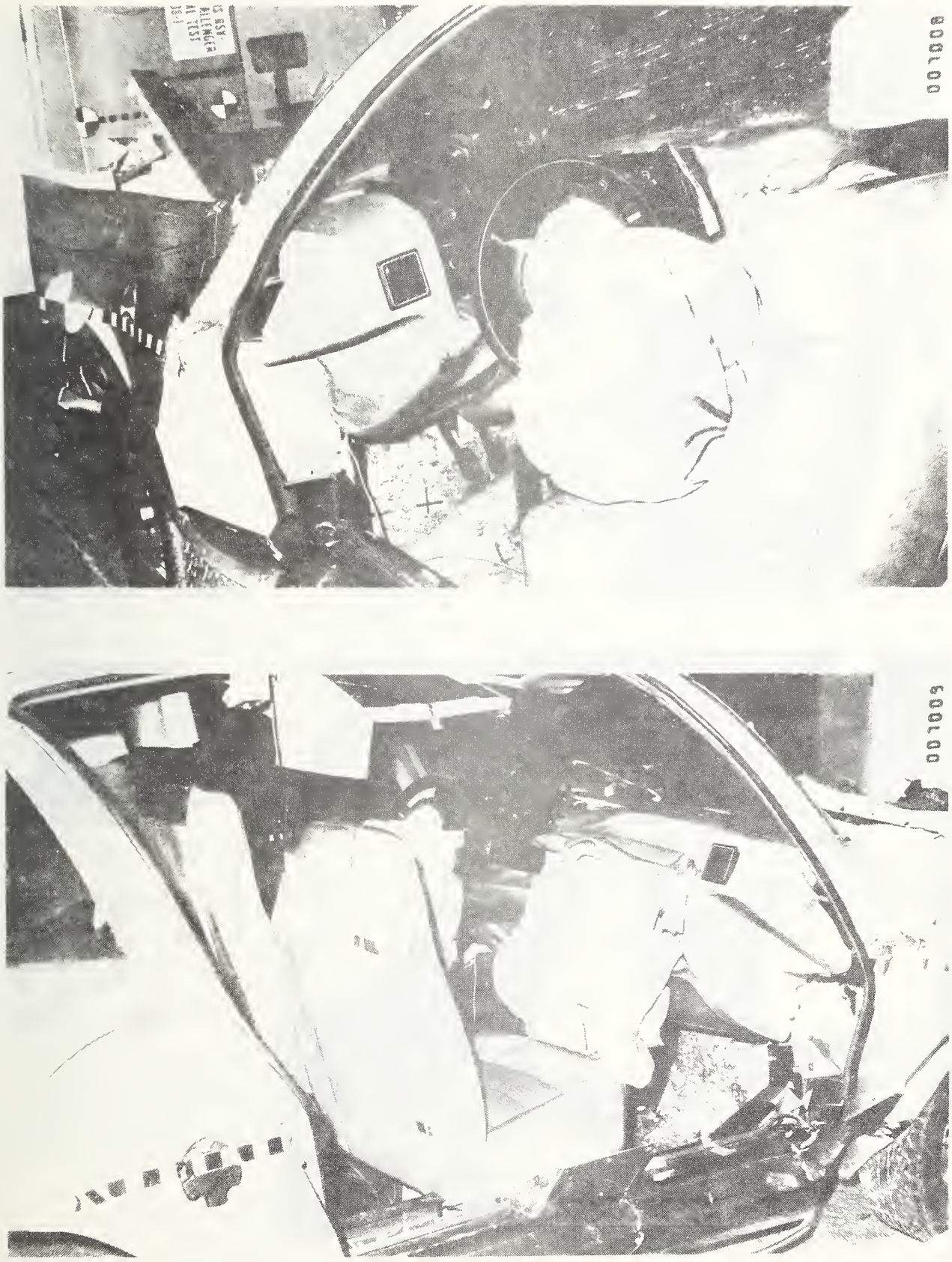


FIGURE 4-6. MINICARS RSV DRIVER AND PASSENGER COMPARTMENT DEFORMATION.

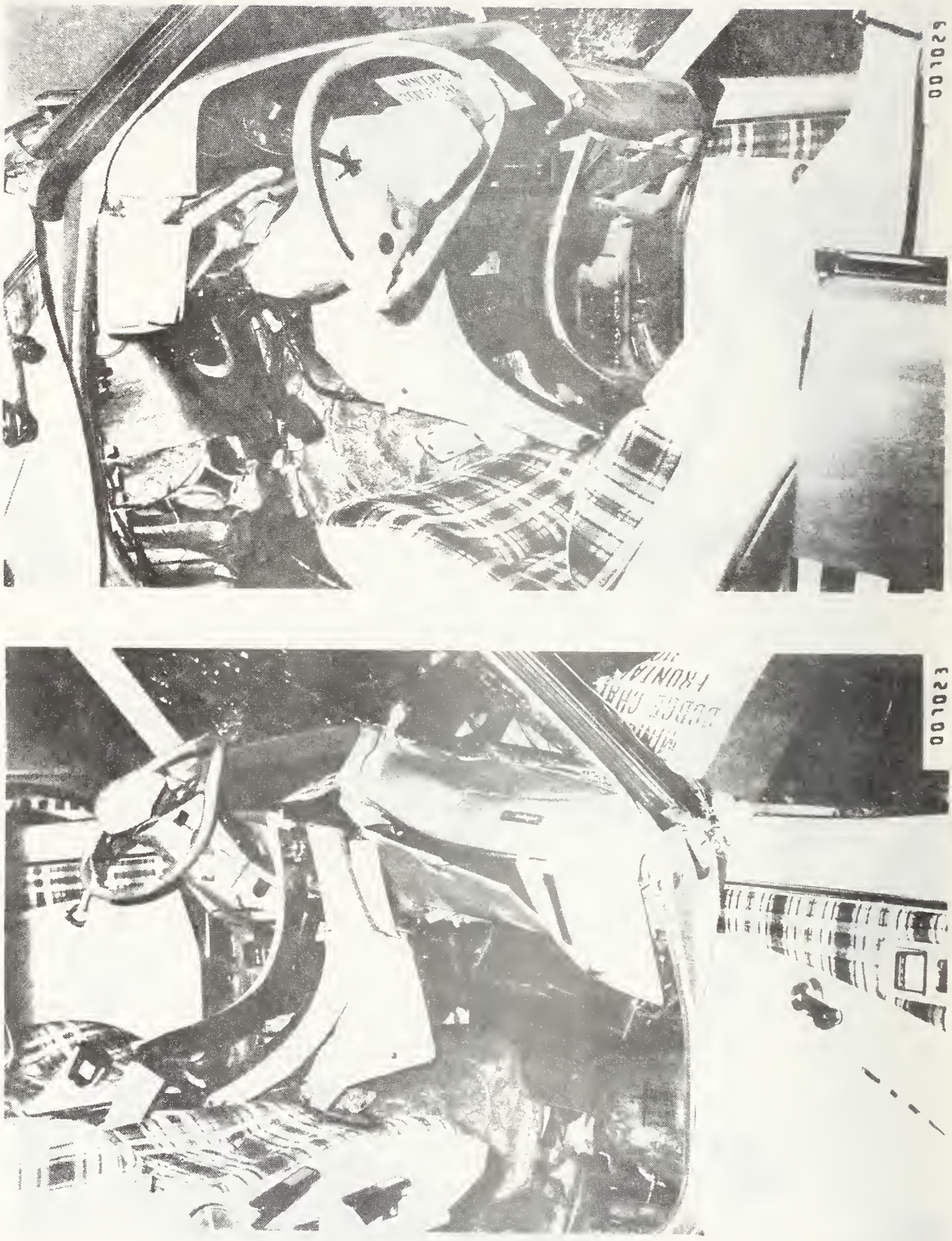


FIGURE 4-7. DODGE CHALLENGER DRIVER AND PASSENGER COMPARTMENT DEFORMATION.

TABLE 4-8. VEHICLE PRE-TEST CONDITIONS

TEST NO. 3108-1 VEHICLE: RSV M5-11 TEST DATE: 9/10/80

HEAD RESTS - up down other fixed
FRONT SEAT - forward midpoint rearward latched welded
per Minicars procedures
FRONT SEAT TILT - forward midpoint back other fixed none
REAR SEAT - in place removed
STEERING WHEEL - up midpoint down not ajustable
SUN VISORS - up down removed
GLOVE COMPARTMENT - locked closed none
SEAT BELTS - fastened unfastened removed none
SHOULDER HARNESSES - fastened unfastened removed passenger only
VENT WINDOWS - closed open removed none
LEFT FRONT WINDOW - up down removed stationary
RIGHT FRONT WINDOW - up down removed stationary
LEFT REAR WINDOW - up down removed none stationary
RIGHT REAR WINDOW - up down removed none stationary
BACKLIGHT - in place removed
LEFT FRONT DOOR - closed locked removed
RIGHT FRONT DOOR - closed locked removed
LEFT REAR DOOR - closed locked removed none
RIGHT REAR DOOR - closed locked removed none
ENGINE - in place removed mounts modified - parts removed
TRANSMISSION - neutral other _____ removed
DRIVESHAFT - in place removed
PARKING BRAKE - off on disconnected
FRONT BUMPER - in place removed none
REAR BUMPER - in place removed none
HOOD - in place removed
WINDSHIELD WIPERS - in place removed
FUEL TANK - 95% full empty other Stoddard Solvent
RADIATOR - full empty none removed partially drained
BATTERY - in place removed (fully charged)
SPARE TIRE - in place removed none
JACK - in place removed none
WHEEL COVERS - in place removed none
BALLAST - none _____ lb @ _____
AIR BAG CHECK TIME - Less than 9 sec no air bags
DUMMY LOCATIONS - LF CF RF LR CR RR none
DUMMY POSITIONING CRITERIA - FMVSS 208 other (Minicars) N/A

TABLE 4-9. VEHICLE PRE-TEST CONDITIONS

TEST NO. 3108-1 VEHICLE: Challenger TEST DATE: 9/10/80

HEAD RESTS - up down other fixed
FRONT SEAT - forward midpoint rearward latched welded
FRONT SEAT TILT* - forward midpoint back other fixed none
REAR SEAT - in place removed
STEERING WHEEL - up midpoint down not ajustable
SUN VISORS - up down removed
GLOVE COMPARTMENT - locked closed none
SEAT BELTS - fastened unfastened removed none
SHOULDER HARNESSES - fastened unfastened removed passenger only
VENT WINDOWS - closed open removed none
LEFT FRONT WINDOW - up down removed
RIGHT FRONT WINDOW - up down removed
LEFT REAR WINDOW - up down removed none stationary
RIGHT REAR WINDOW - up down removed none stationary
BACKLIGHT - in place removed
LEFT FRONT DOOR - closed locked removed
RIGHT FRONT DOOR - closed locked removed
LEFT REAR DOOR - closed locked removed none
RIGHT REAR DOOR - closed locked removed none
ENGINE - in place removed mounts modified parts removed
TRANSMISSION - neutral other_____ removed
DRIVESHAFT - in place removed
PARKING BRAKE - off on disconnected
FRONT BUMPER - in place removed none
REAR BUMPER - in place removed none
HOOD - in place removed
WINDSHIELD WIPERS - in place removed
FUEL TANK - 95% full empty other Stoddard Solvent
RADIATOR - full empty none removed partially drained
BATTERY - in place removed (fully charged)
SPARE TIRE - in place removed none
JACK - in place removed none
WHEEL COVERS - in place removed none
BALLAST - none _____lb @ _____
AIR BAG CHECK TIME - Less than 10 sec no air bags
DUMMY LOCATIONS - LF CF RF LR CR RR none
DUMMY POSITIONING CRITERIA - FMVSS 208 other N/A

*Seat back only.

TABLE 4-10. SUMMARY OF MINICARS RSV OCCUPANT RESPONSE DATA (TEST 3108-1)

Response Parameter		Filter (Hz)	Injury[1] Criteria	Left Front Dummy (Driver) Maximum Value A (G)	Left Front Dummy (Driver) Maximum Value T (msec)	Right Front Dummy (Passenger) Maximum Value A (G)	Right Front Dummy (Passenger) Maximum Value T (msec)
Head	X	1600		-52 (-55)	80 (75)	-69 (-74)	69 (69)
	Y	1600		-8 (15)	69 (76)	-12 (-7)	132 (132)
	Z	1600		-31 (-33)	69 (72)	-33 (-31)	68 (68)
	R	1600		56 (62)	76 (75)	75 (81)	69 (68)
SI				815 (908)	200 (200)	871 (1039)	200 (200)
HIC			<1000	703 (834)	52/106 (54/103)	705 (914)	56/86 (56/86)
Chest	X	315		-42 (-38)	50 (51)	-40 (-50)	39 (38)
	Y	315		9 (15)	104 (34)	7 (14)	109 (38)
	Z	315		18 (-40)	99 (204)	18 (38)	42 (38)
	R	315		42 (43)	50 (98)	43 (64)	39 (38)
SI				395 (426)	200 (200)	364 (348)	200 (200)
Chest Acceler-[2] ation	R	315	<60 For 3 MS	>40 For 3 MS (>41 For 3 MS)		>38 For 3 MS (>42 For 3 MS)	
Femur Loads[3] (lb)	L	1000	<2250	-1409	67	-1016	82
	R	1000	<2250	-1427	79	-957	97
Pelvis	X	315		-68	71	-38	32
	Y	315		20	52	-13	31
	Z	315		30	67	-36	34
	R	315		71	71	44	87

(1) Injury criteria levels defined in FMVSS 208.
(2) G level defined as value for cumulative duration of 3 msec.
(3) Negative loads are compression; positive loads are tension.
NOTE: Values in parentheses were obtained from redundant head and chest accelerometers.

TABLE 4-11. SUMMARY OF DODGE CHALLENGER OCCUPANT RESPONSE DATA (TEST 3108-1)

Response Parameter		Filter (Hz)	Injury[1] Criteria	Left Front Dummy (Driver) Maximum Value A (G)	Left Front Dummy (Driver) Maximum Value T (msec)	Right Front Dummy (Passenger) Maximum Value A (G)	Right Front Dummy (Passenger) Maximum Value T (msec)
Head	X	1600		-163 (-147)	78 (73)	-161 (-204)	85 (85)
	Y	1600		-41 (-44)	75 (73)	46 (-61)	85 (84)
	Z	1600		104 (-57)	75 (126)	-159 (-141)	92 (92)
	R	1600		172 (168)	75 (73)	169 (212)	85 (85)
SI				2688 (4435)	200 (200)	4617 (5273)	200 (200)
HIC			<1000	1690 (3434)	69/94 (11/130)	3630 (4375)	83/103 (83/104)
Chest	X	315		-89 (-79)	79 (79)	-74 (-72)	83 (83)
	Y	315		15 (21)	89 (95)	-43 (-56)	97 (97)
	Z	315		24 (22)	79 (84)	-21 (-19)	66 (66)
	R	315		92 (79)	79 (79)	77 (74)	83 (97)
SI				980 (944)	200 (200)	905 (953)	200 (200)
Chest Acceler-ation[2]	R	315	<60 For 3 MS	>60 For 11 MS (>60 For 11 MS)		>60 For 10 MS (>60 For 12 MS)	
Femur Loads[3] (lb)	L	1000	<2250	-983	61	-796	67
	R	1000	<2250	-917	61	-1434	80
Pelvis	X	315		-78	60	-56	79
	Y	315		-26	68	55	82
	Z	315		47	83	56	92
	R	315		85	61	76	32

(1) Injury criteria levels defined in FMVSS 208.
(2) G level defined as value for cumulative duration of 3 msec.
(3) Negative loads are compression; positive loads are tension.
NOTE: Values in parentheses were obtained from redundant head and chest accelerometers.

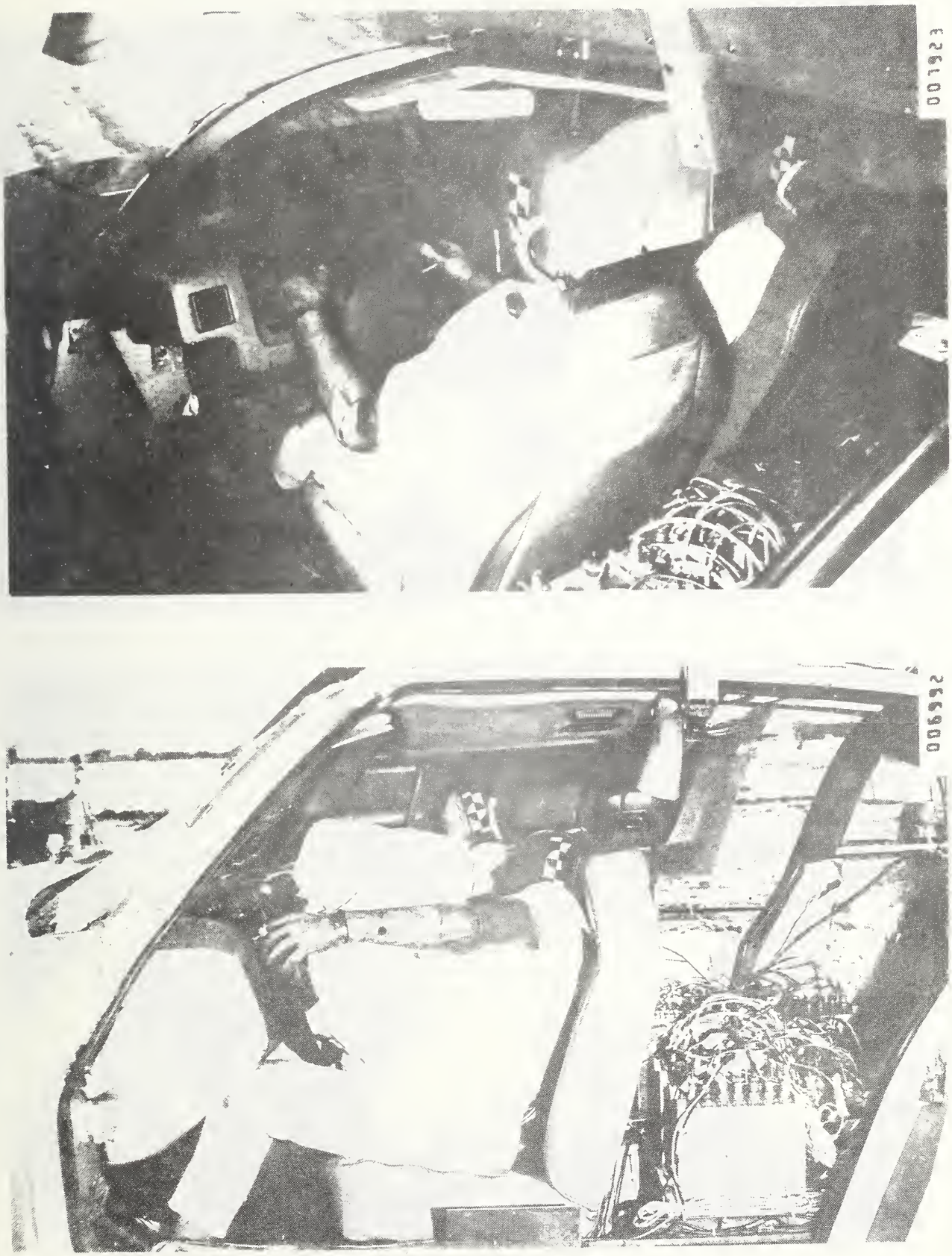


FIGURE 4-8. PRE- AND POST-TEST VIEW OF DRIVER DUMMY IN MINICARS RSV.

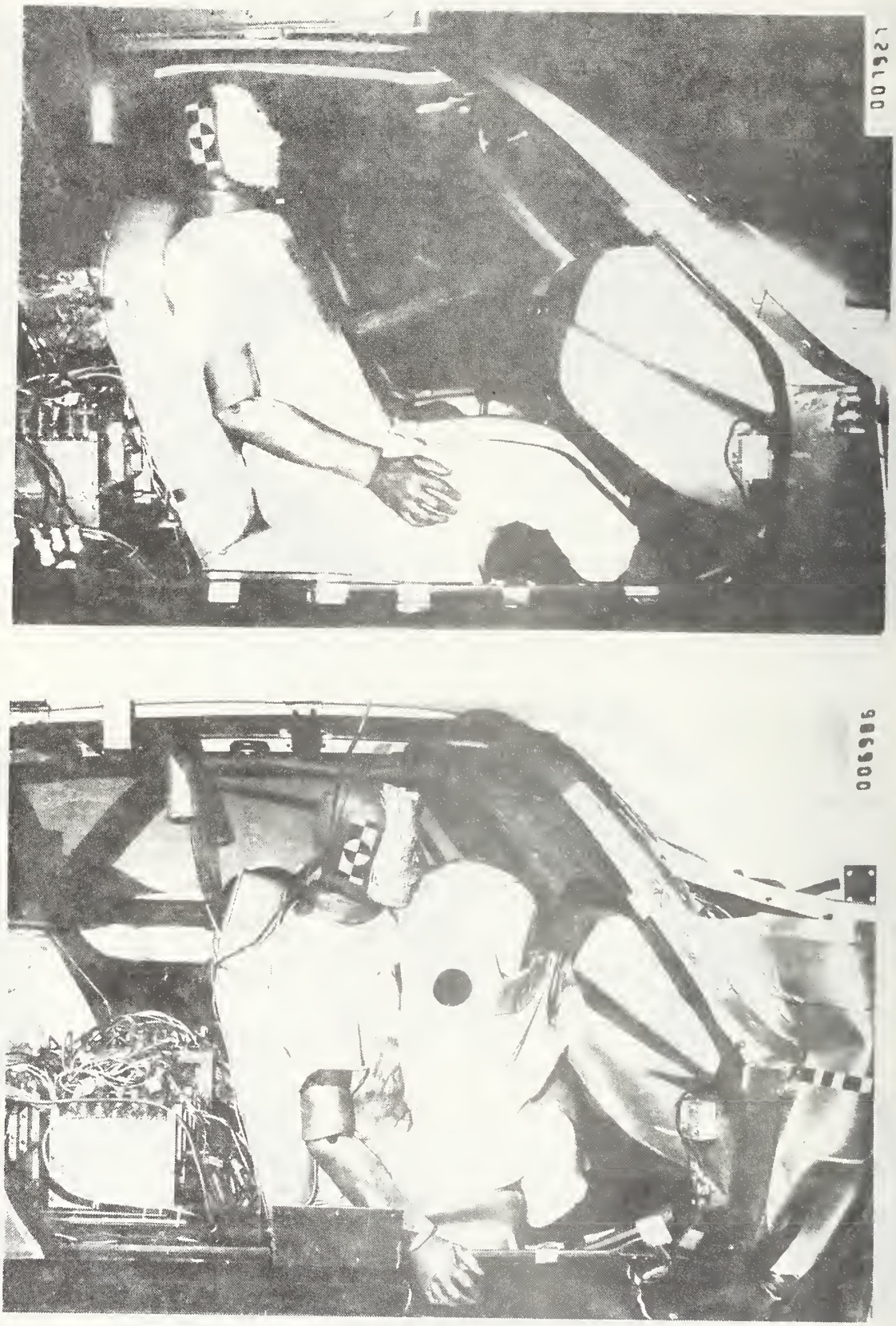


FIGURE 4-9. PRE- AND POST-TEST VIEW OF PASSENGER DUMMY IN MINICARS RSV.

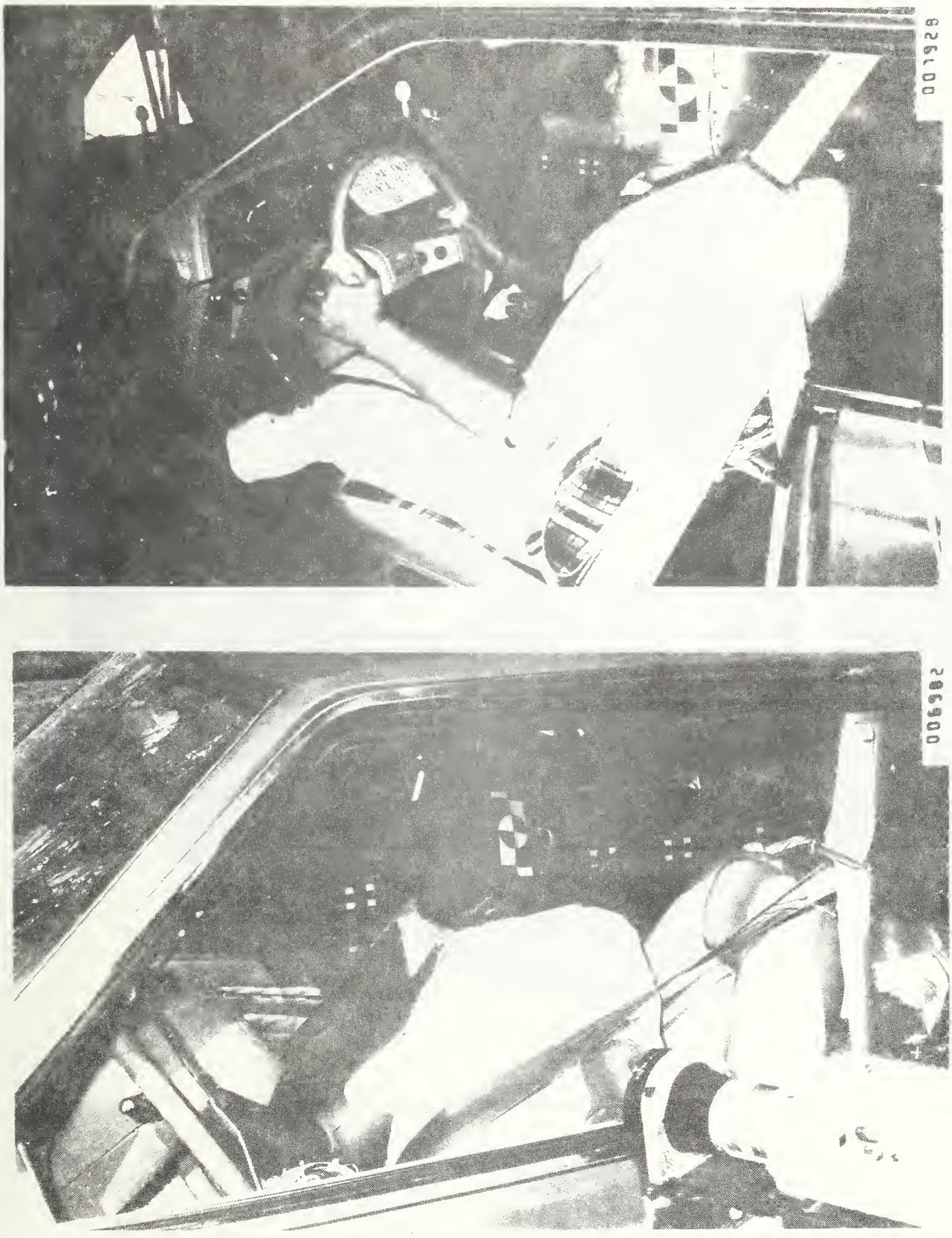


FIGURE 4-10. PRE- AND POST-TEST VIEW OF DRIVER DUMMY IN DODGE CHALLENGER.

FIGURE 4-11A. PRE-TEST VIEW OF PASSENGER DUMMY IN DODGE CHALLENGER.

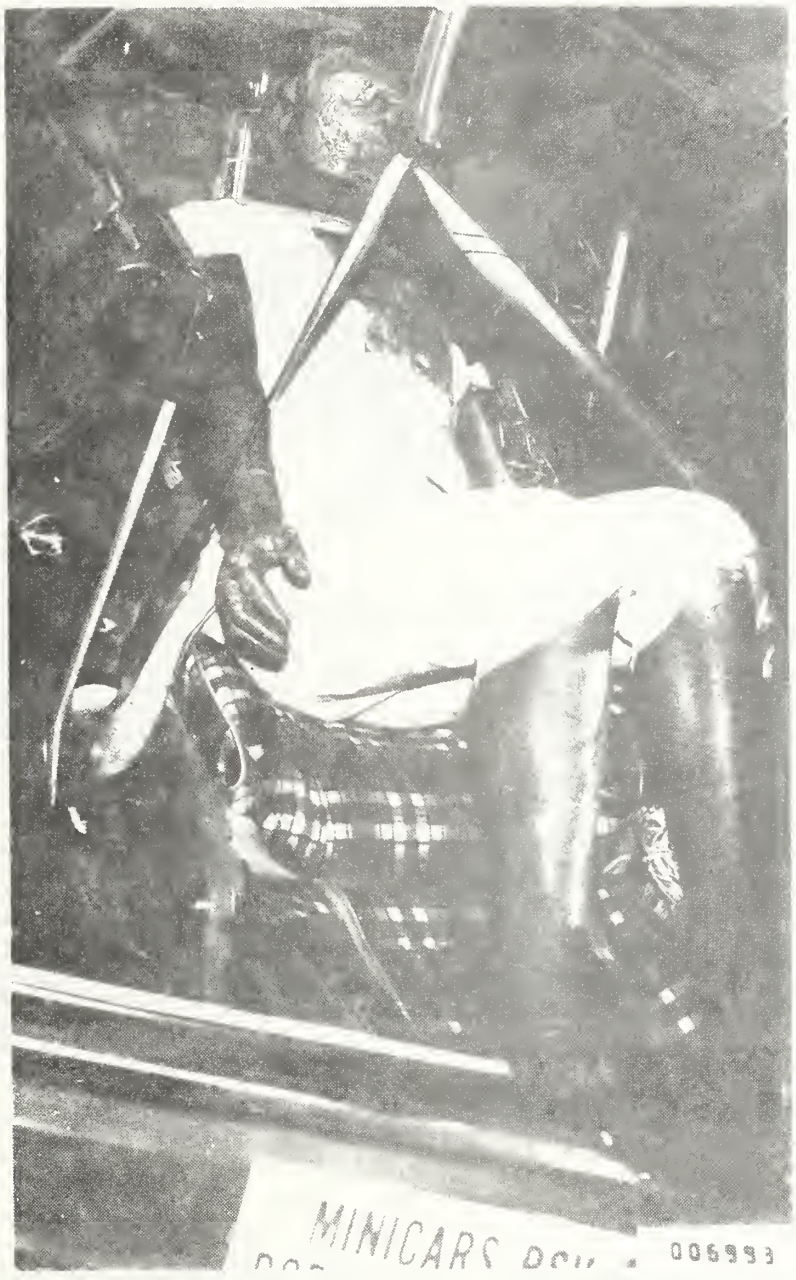


FIGURE 4-11B. POST-TEST VIEW OF PASSENGER DUMMY IN DODGE CHALLENGER.

FMVSS 208. During the crash event, the mounting rivets securing the lower door latching mechanism to the vehicle structure failed due to a fabrication defect causing the right door to open. This allowed the right hand of the passenger dummy to protrude momentarily outside the passenger compartment (see Figures 4-9 and 4-12). The door in these photographs was opened to facilitate the viewing of the final position of the dummy. The actual post-test position of the door is shown in Figure 4-2. High-speed films showed no other or greater protrusion or ejection of the dummy torso during the crash. There appeared to be no dummy head or chest contact with the vehicle interior. The chronology of crash events obtained from high-speed film analysis is presented in Table 4-12.

The driver and right front passenger in the Dodge Challenger were restrained by the production three-point belt system with emergency locking retractors (ELR). Both dummies exceeded the injury criteria levels for the head and chest as defined by FMVSS 208. The femur loads for both dummies appear to be well within the allowable FMVSS 208 load levels.

The driver dummy head and chest impacted the steering wheel rim and the neck contacted the steering wheel hub. The passenger dummy head (nose and chin area) contacted the upper surface of the dash panel.

Prior to the crash test, the dummies in the Minicars RSV were positioned in accordance with the recommended Minicars positioning procedure. The Dodge Challenger dummies were positioned to the current positioning procedure defined in the FMVSS 208 procedure provided by NHTSA. The initial positions of the dummies in both

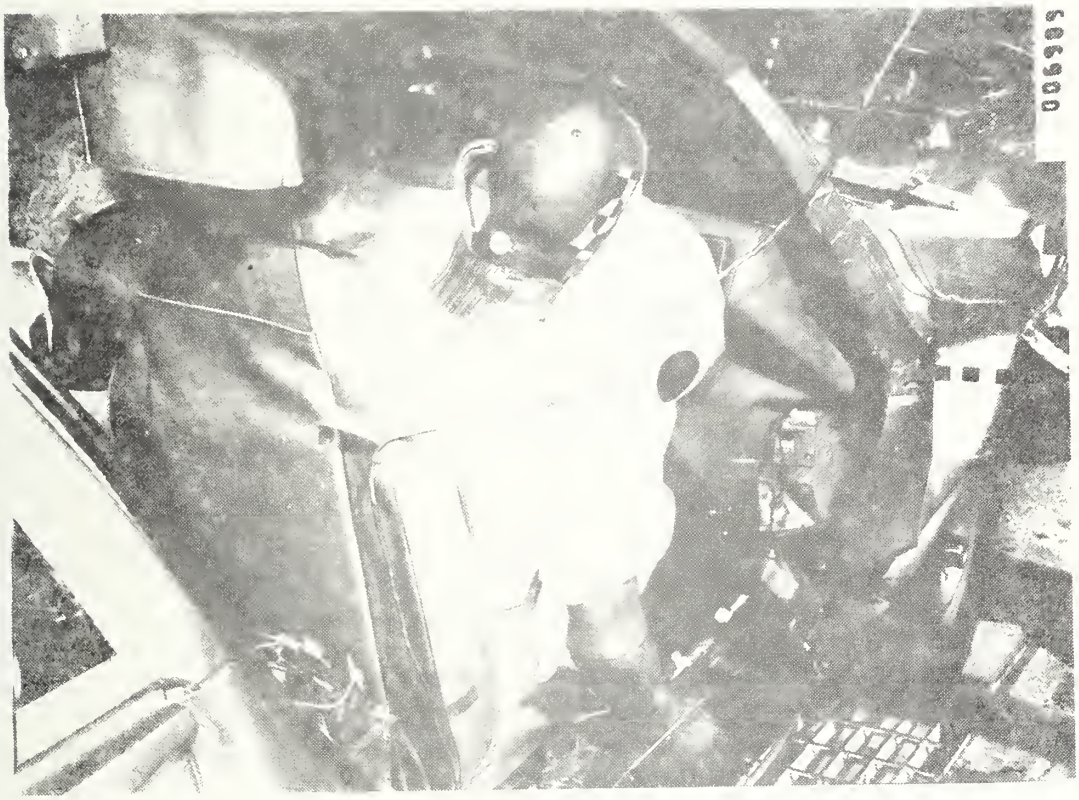


FIGURE 4-12. POST-TEST VIEW OF PASSENGER DUMMY IN MINICARS RSV

TABLE 4-12. FILM CHRONOLOGY OF CRASH EVENTS FOR MINICARS RSV M5-11 TO DODGE CHALLENGER FRONTAL ALIGNED IMPACT (TEST 3108-1)

Time(ms)	Event
0	Impact (visual).
2.5	Challenger hood and dash impact strobes fire.
7	RSV inboard strobe fires.
14	Challenger LF tire contacted by fender.
21	RSV Passenger air bag starts to deploy.
25	RSV hood starts to separate, RSV driver air bag starts to deploy.
27	RSV passenger air bag contacts dummy (stomach).
28	RSV passenger air bag contacts dummy (chest).
31	RSV RF tire contacted by fender.
34	RSV passenger air bag contacts dummy (chin), RSV hood completely separated from hinges.
40	Challenger front fenders push into tires, locking up wheels.
48	RSV driver air bag hits dummy chin, challenger steering wheel begins rearward intrusion.
51	RSV passenger air bag fully deployed, RSV passenger dummy full face contacts air bag.
53	Challenger tires hit RSV tires, RSV front wheels begin to crush rearward.
55	Challenger passenger dummy left knee hits dash.
58	Challenger passenger dummy right knee hits dash.
60	Challenger windshield begins to crack.
63	RSV driver dummy full face contacts air bag.
64	RSV driver air bag fully inflated, Challenger driver dummy chest hits steering wheel.
65	RSV RF tire hits front of passenger side door.
71	RSV passenger door starts to open, Challenger driver forehead hits steering wheel.
72	RSV windshield cracks.
77	Challenger driver neck contacts steering wheel hub.
85	Challenger passenger dummy's nose and chin contact dash.
88	Maximum forward motion of RSV driver's head.
89	Maximum Challenger steering wheel hub intrusion.
91	Maximum mutual dynamic crush.
94	Maximum Challenger driver's head forward motion.
96	RSV passenger side door window shatters.
101	Vehicles begin to rebound.
103	Maximum Challenger passenger's head forward motion.
186	Challenger passenger head contacts seat on rebound.
221	Challenger passenger seat back latch fails.
486	Challenger passenger's head hits rear deck area.
718	RSV passenger side door fully open.

cars were measured and are documented in Figure 4-13 (Minicars RSV) and Tables 4-13 and 4-14 (Dodge Challenger).

4.3 SUMMARY AND CONCLUSIONS

The primary objective of this test was to determine the vehicle crashworthiness and occupant response of the Minicars RSV and similar size current production vehicle in a frontal car-to-car impact.

The following factors were used to compare the vehicle crashworthiness and occupant response to the crash event.

- Occupant compartment peak acceleration and velocity change
- Occupant compartment intrusion
- Restraint system performance

The test results show similar occupant compartment peak accelerations (37-39 g's) for both vehicles. However, the RSV and Dodge Challenger velocity change during the crash event was 46.4 mph (see velocity plot of RSV locations 12 and 13 averaged) and 51.1 mph (see velocity plot of Dodge locations 3 and 4 averaged), respectively.

The occupant compartment intrusion in the RSV was well maintained with moderate toe-board and floor pan deformation. The Challenger forward compartment and steering column intrusion was quite severe.

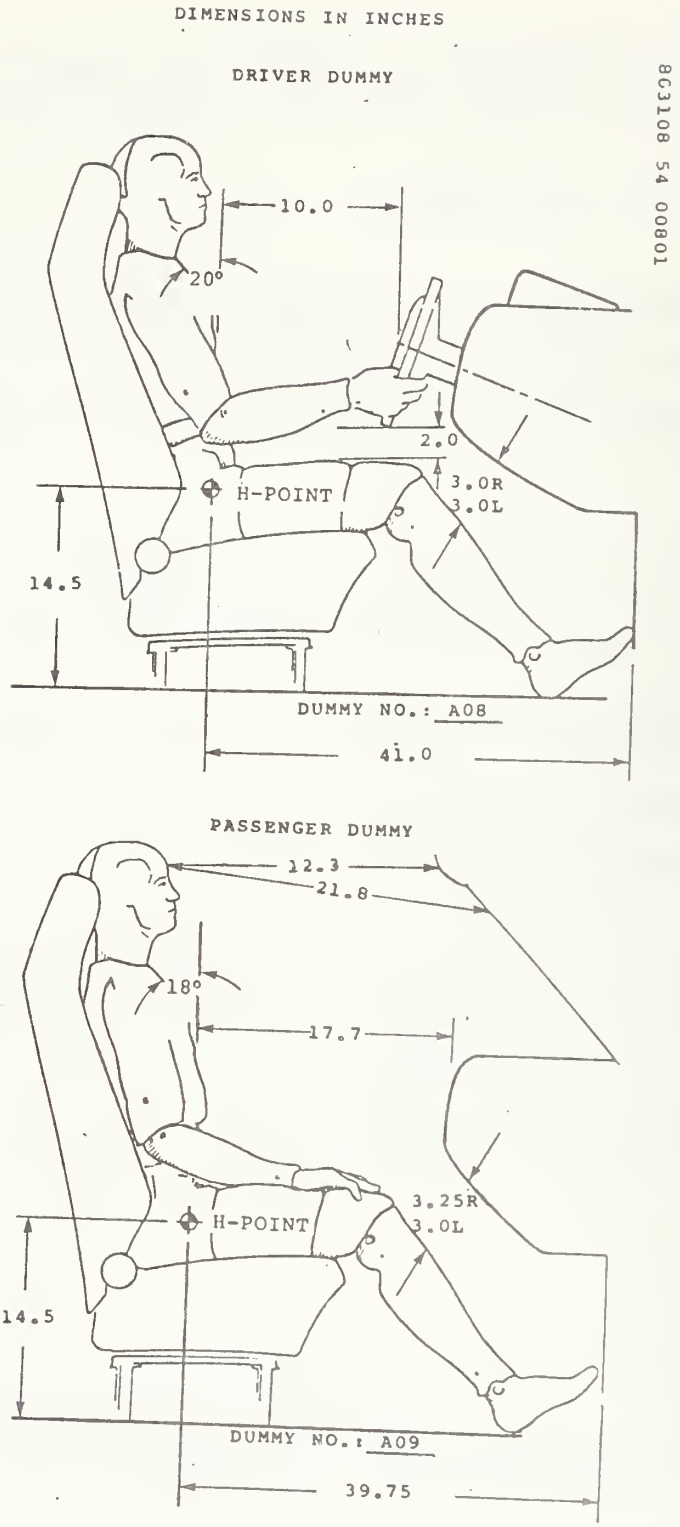


FIGURE 4-13. MINICARS RSV M5-11 PRE-TEST DUMMY POSITIONS (TEST 3108-1).

TABLE 4-13. DODGE CHALLENGER DUMMY POSITIONING (TEST 3108-1)

Measurement	Pre-test Dummy Position Driver (in.)	Passenger (in.)
Dummy Centerline to Vehicle Centerline	13.0	14.0
Nose to Upper Rim Steering Wheel	17.0	N/A
Nose to Windshield (Horizontal Distance)	17.3	16.7
Left Knee to Closest Point on Lower Panel	6.3 to dash 4.4 to column	5.0
Right Knee to Closest Point on Lower Panel	6.5 to dash 4.3 to column	5.5
Ankle Distance	10 inches	10
Knee Distance	9 inches	9
Head to Windshield Header	12.2	11.2
Chest to Dash	22.2	19.6
Chest to Steering Wheel	12.5	N/A
Head to Side Header	4.7	4.5
Arm to Door	3.0	3.4
Hip to Door	4.3	4.8

Additional dummy positioning information is presented in the PART 572 DUMMY IN-VEHICLE POSITION RECORDING SHEET which follows.

TABLE 4-14. PART 572 DUMMY IN-VEHICLE POSITION RECORDING SHEET (TEST 3108-1)

NHTSA No.: (R&D) Manufacturer: Mitsubishi Motors Corp

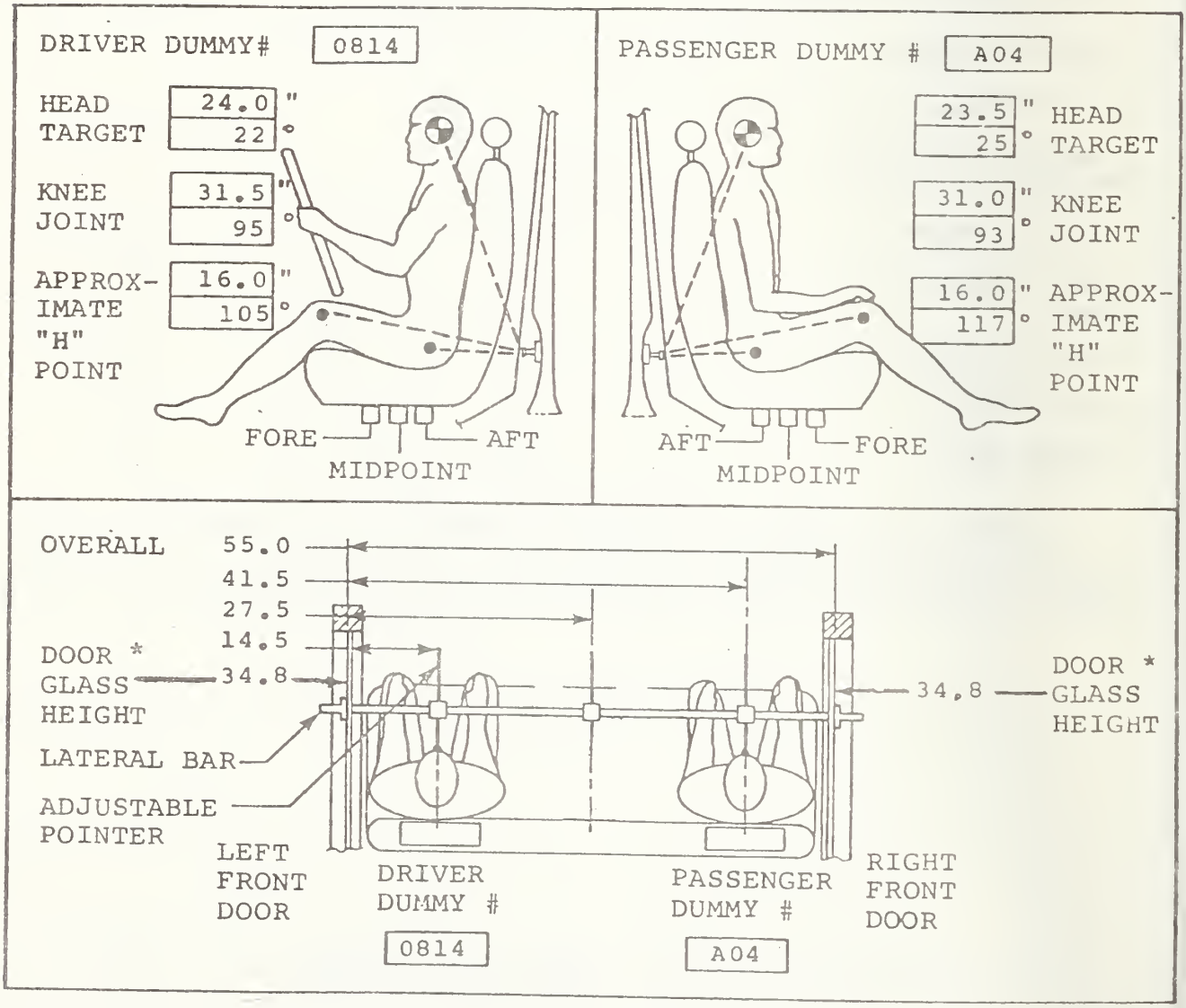
Make/Model: Dodge Challenger Model Year: 1979

SEAT TYPE:	ADJUSTER TYPE:	BUCKET SEAT BACK TYPE:
___ Bench	X Manual	X Adjustable
X Bucket	___ Power	Reclining
___ Split Bench		___ Fixed

AMBIENT TEMPERATURE: 89 °F; TIME: 11:00 AM

POSITION DATE: 9/10/80 TECHNICIANS: 1. Terry Bjork
2. Mark Pozzi

All front seat dummies are positioned according to the procedure "OSE RECOMMENDED PROCEDURE FOR POSITIONING PART 572 DUMMIES IN TEST VEHICLE."



*Door glass height is equal on the right and left side of vehicle.

The comparison of the restraint system performance is quite apparent in that there was no contact of either of the dummies in the RSV with the vehicle interior. Both dummies in the Challenger severely impacted the forward occupant compartment. Further evidence of the restraint system performance is shown by the much lower occupant injury criteria for the RSV compared to the Dodge Challenger (see Tables 4-10 and 4-11).

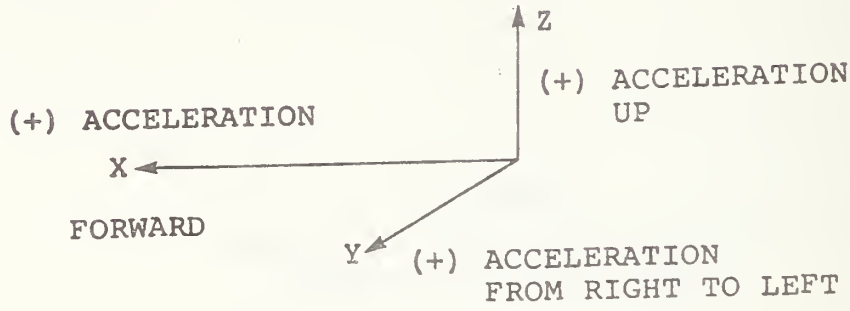
It is apparent from the above documentation that the RSV frontal structure and restraint system response was quite satisfactorily compared to the Dodge Challenger.

APPENDIX A

MINICARS RSV M5-11 OCCUPANT AND VEHICLE DATA PLOTS

The sign convention used on this test is presented below:

(1) Vehicle and dummy accelerations



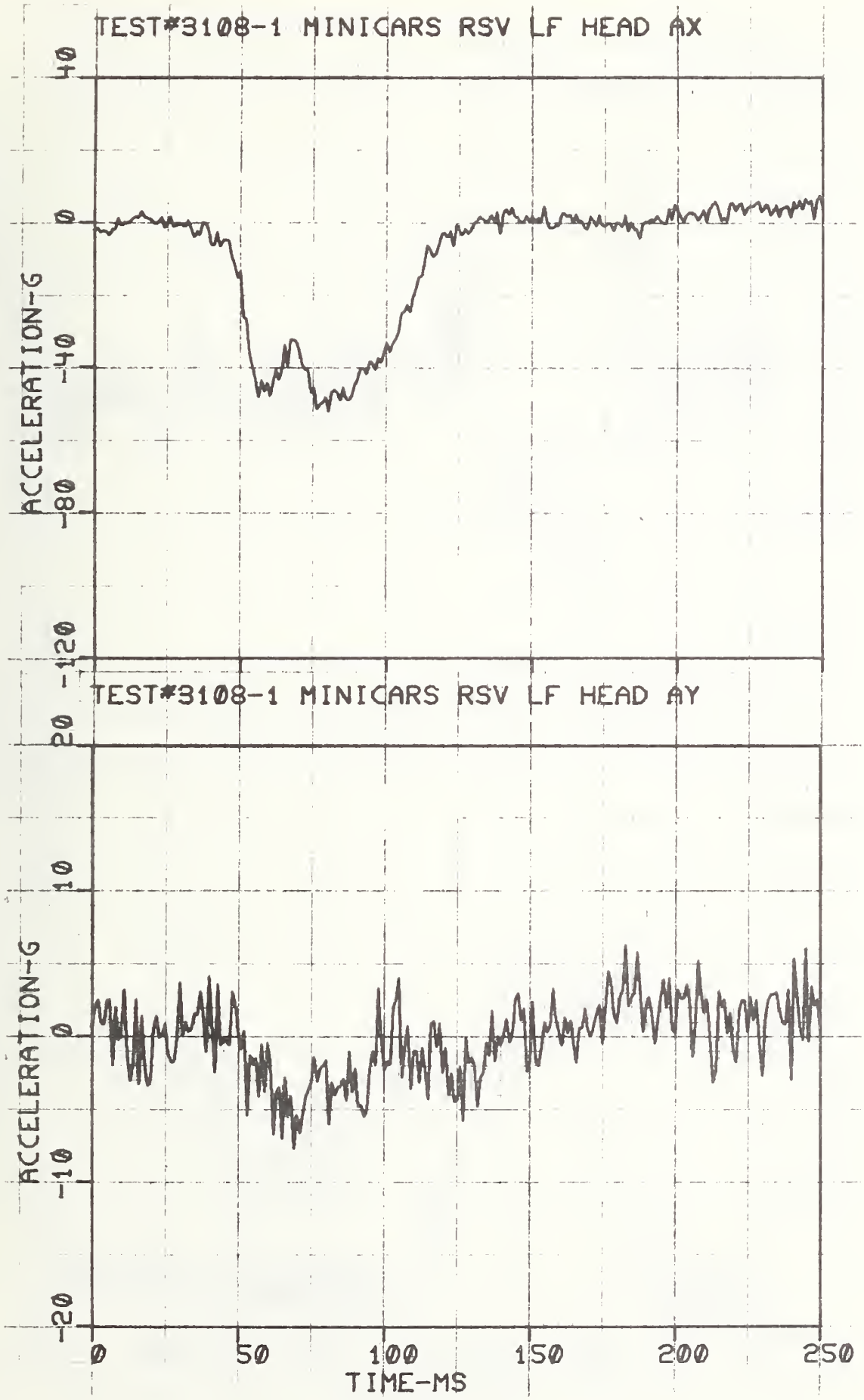
(Minicars Sign Convention)

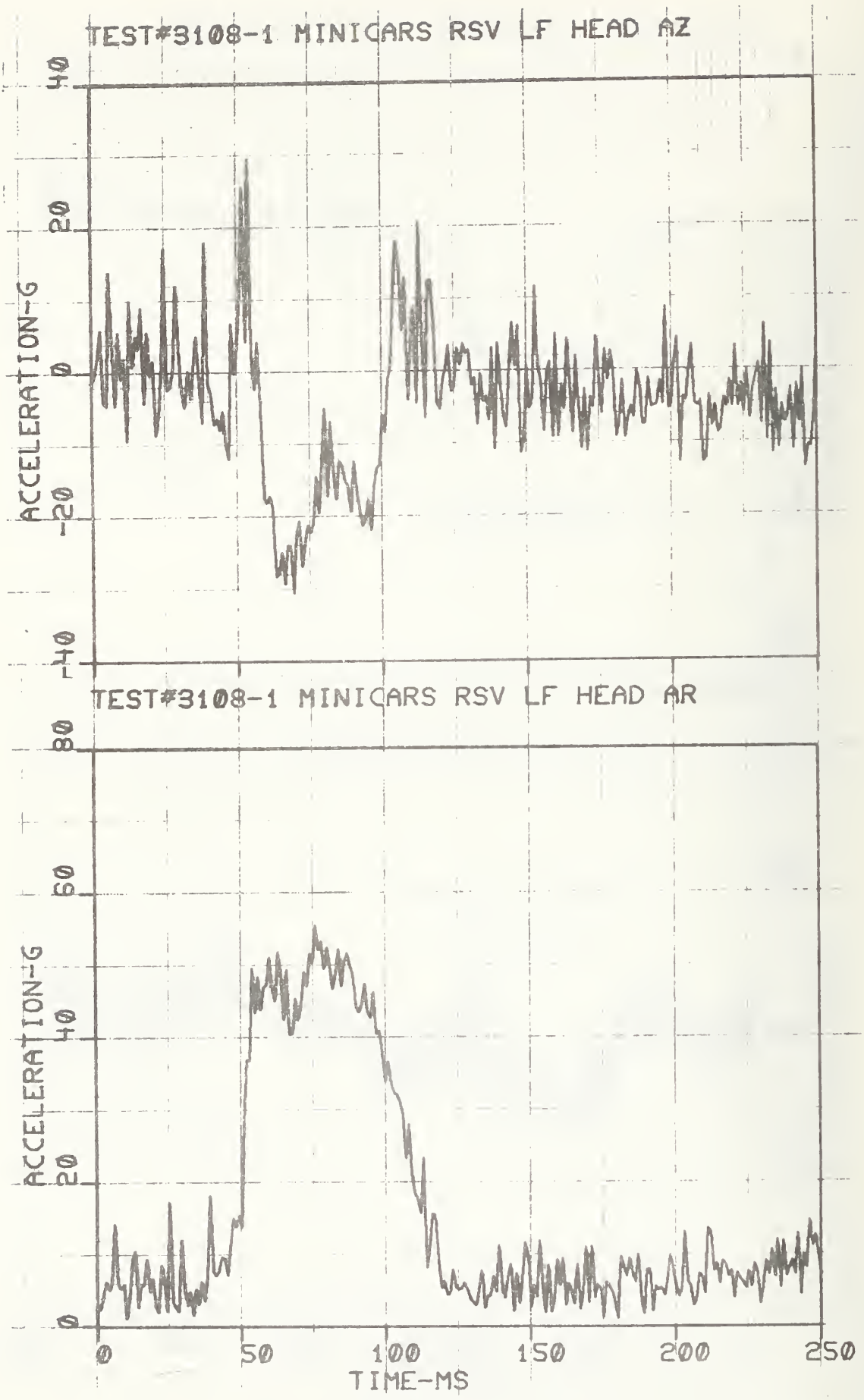
(2) Velocity and displacement agree with the above convention.

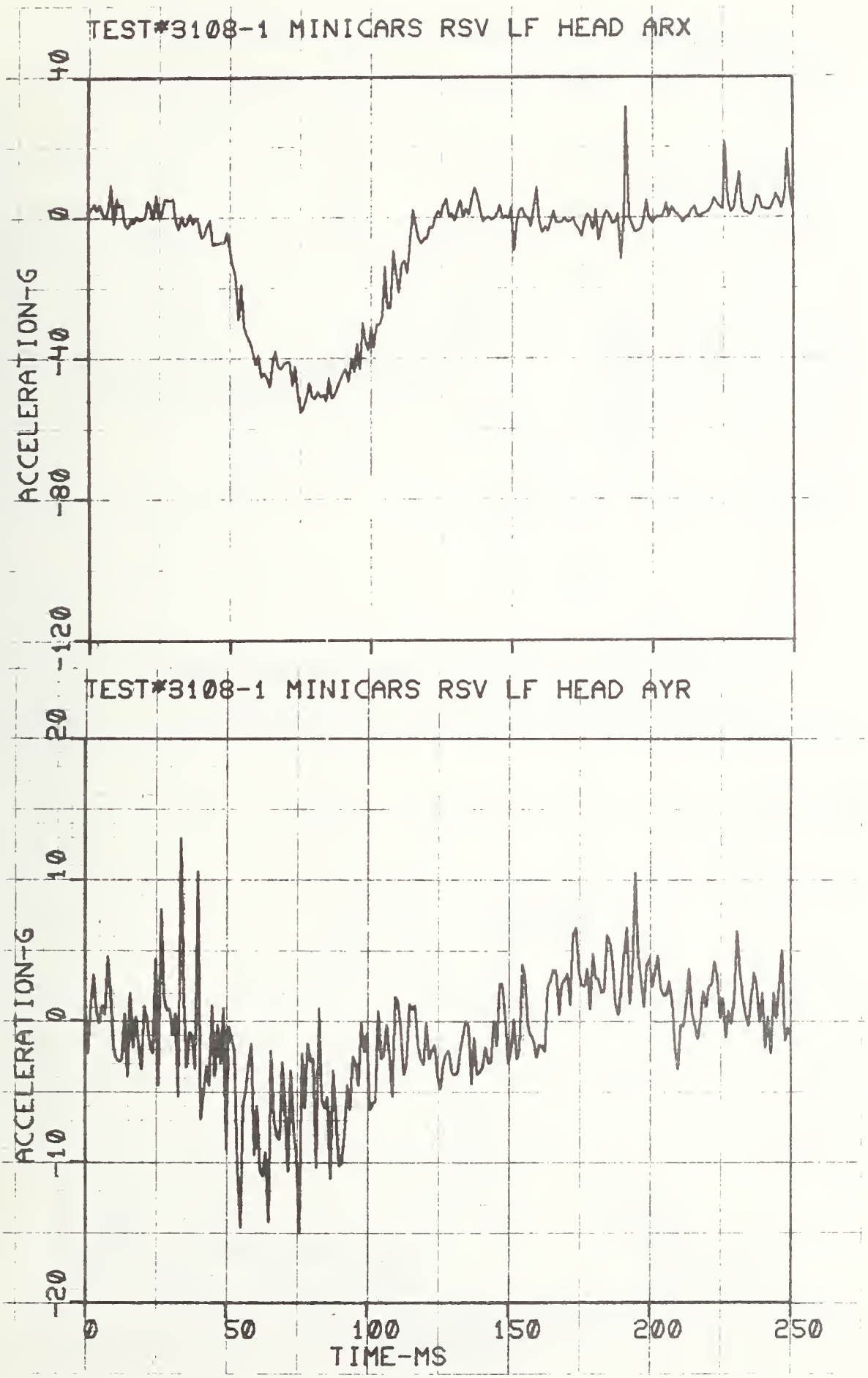
NOTE: All Y and Z channel data was reversed in polarity in order to conform with the above sign convention used by Minicars.

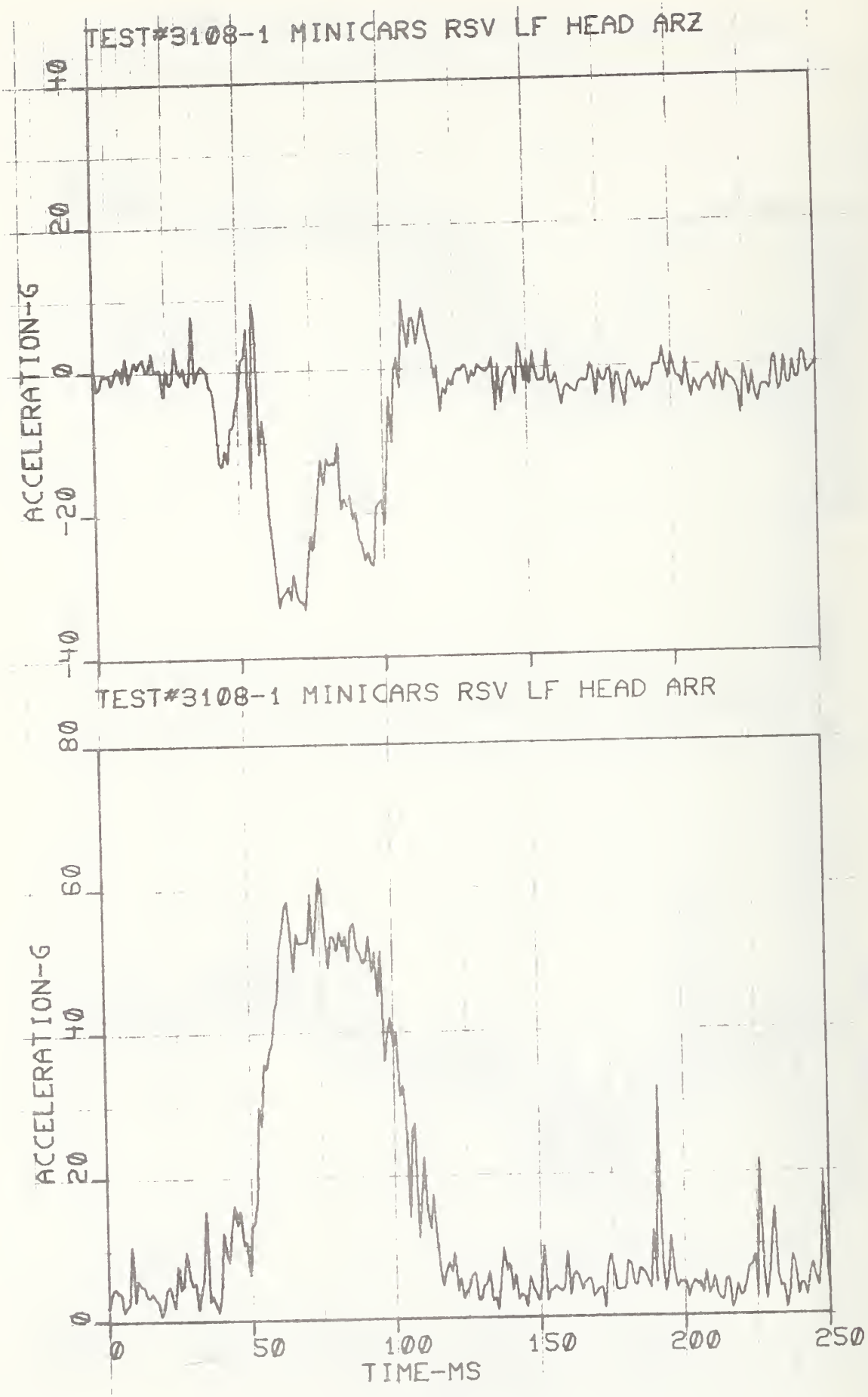
Data filtered per SAE recommended practice J211b as follows:

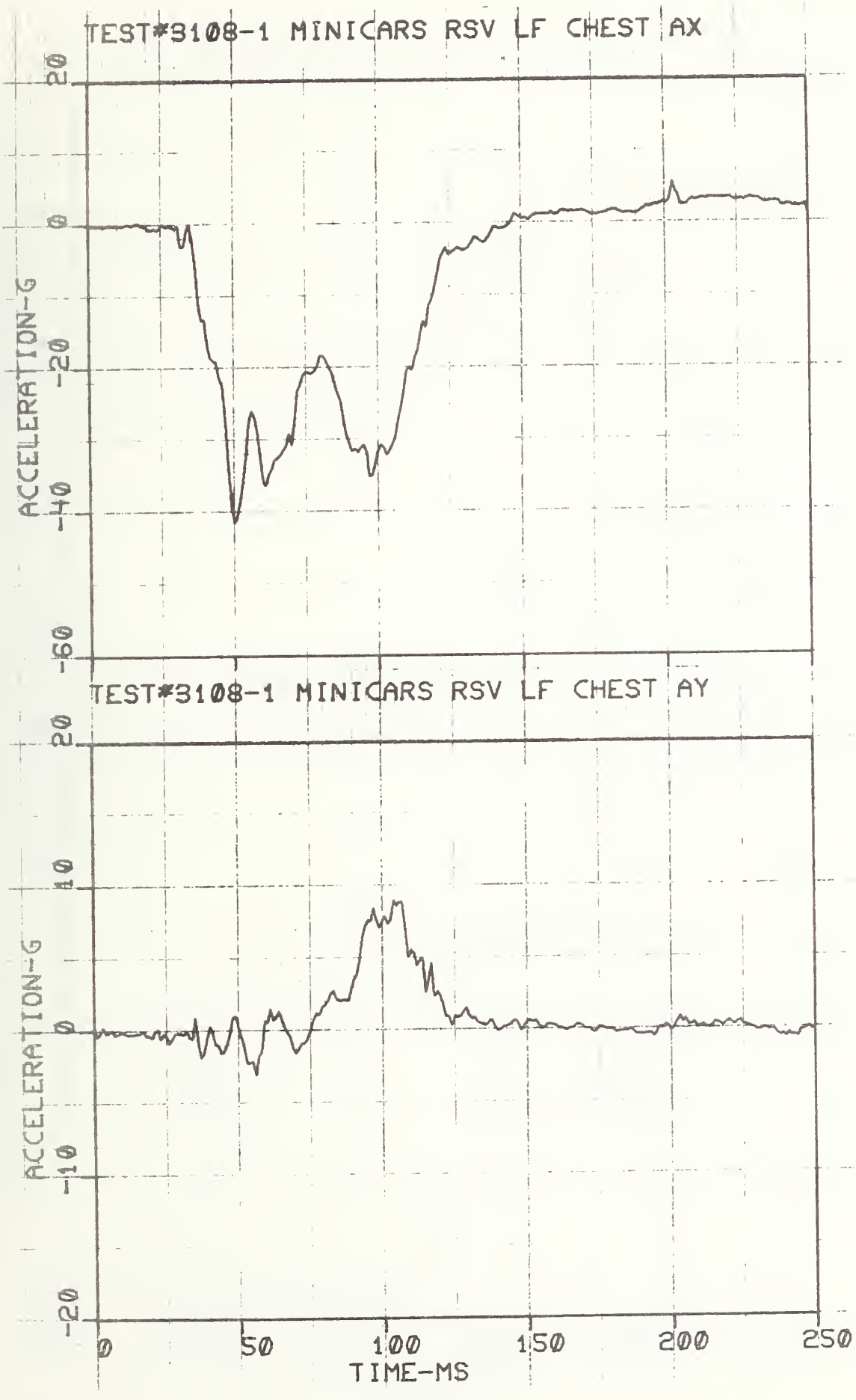
Test Measurement	Channel Class
Dummy Head	1000
Dummy Chest	180
Dummy Pelvis	180
Dummy Femurs	600
Vehicle Structure	60

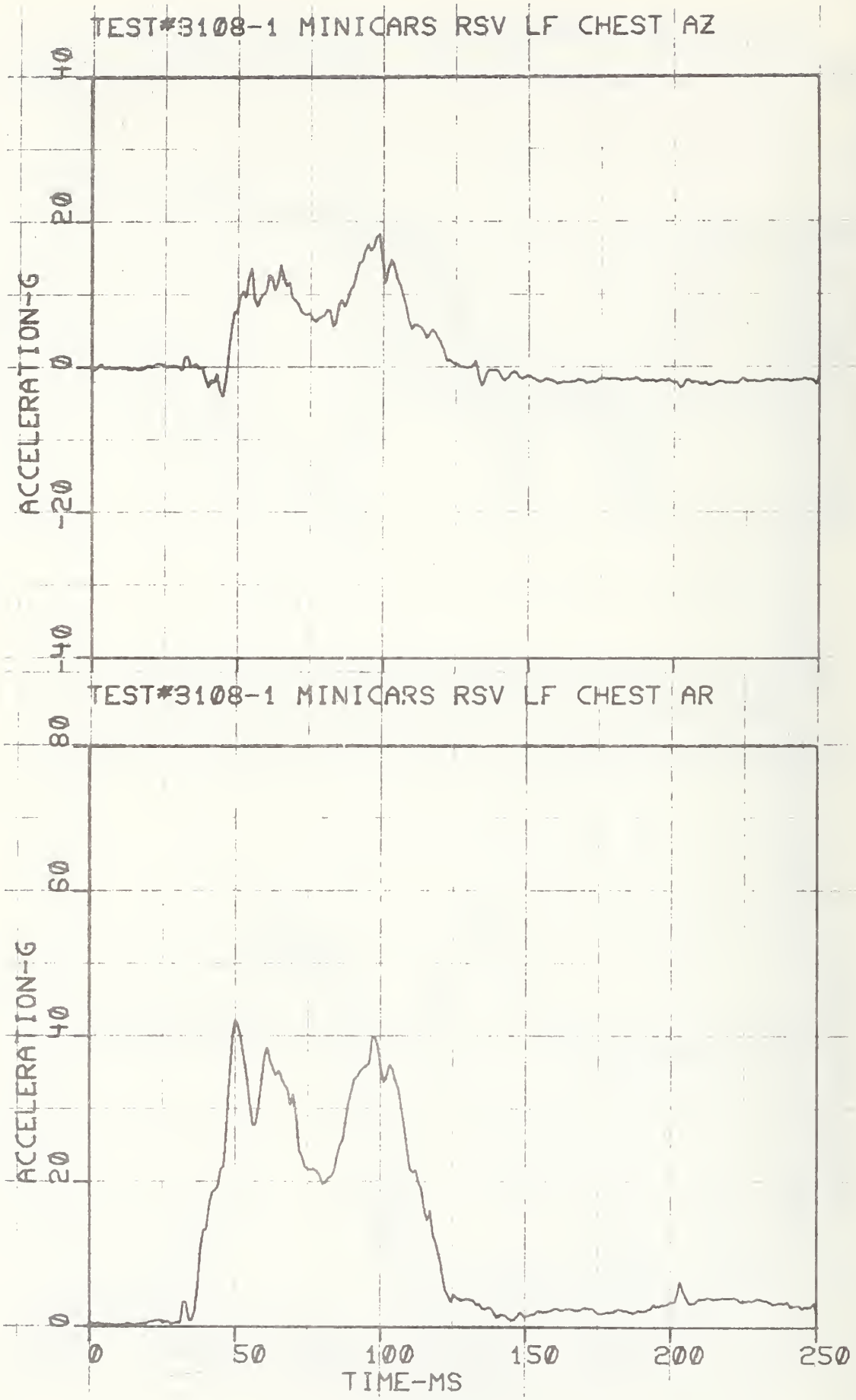

TEST#3108-1 MINICARS RSV LF HEAD AX
40
0
-40
-80
-120
ACCELERATION-G
TEST#3108-1 MINICARS RSV LF HEAD AY
20
10
0
-10
-20
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

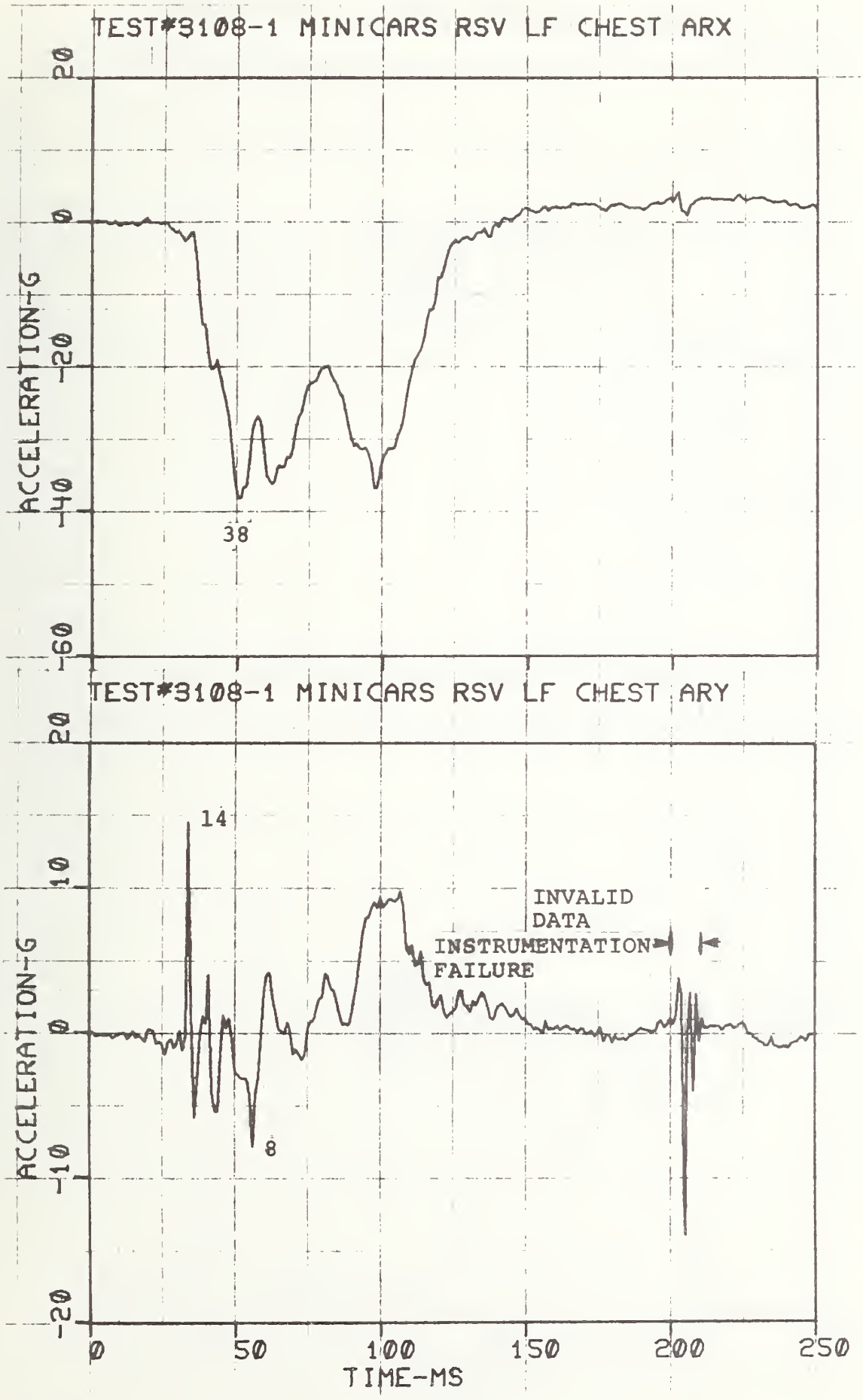

TEST#3108-1 MINICARS RSV LF HEAD AZ
ACCELERATION-G
40
20
0
-20
-40
TEST#3108-1 MINICARS RSV LF HEAD AR
ACCELERATION-G
80
60
40
20
0
0
50
100
150
200
250
TIME-MS

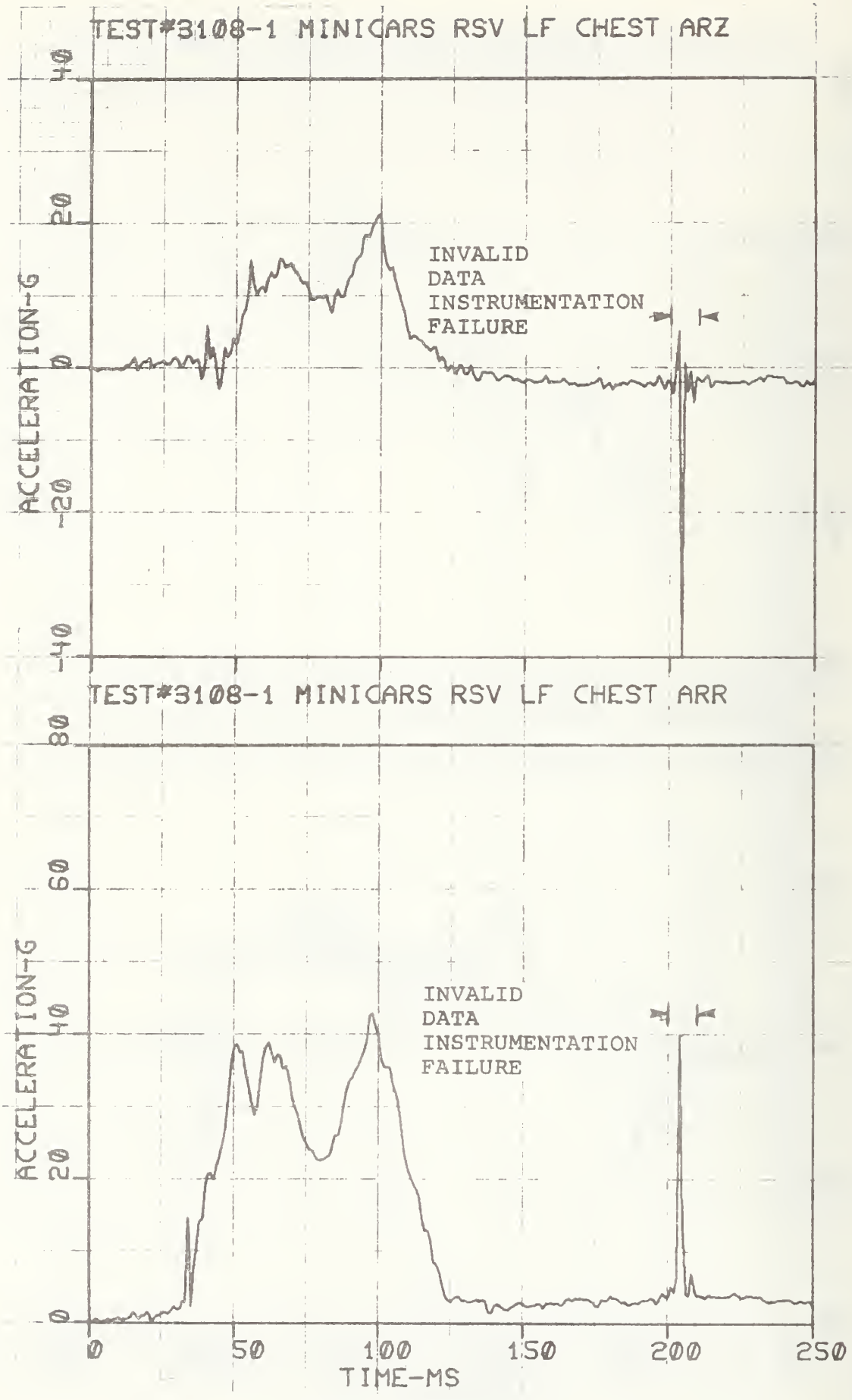

TEST*3108-1 MINICARS RSV LF HEAD ARX
40
0
-40
-80
-120
ACCELERATION-G
TEST*3108-1 MINICARS RSV LF HEAD AYR
20
10
0
-10
-20
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

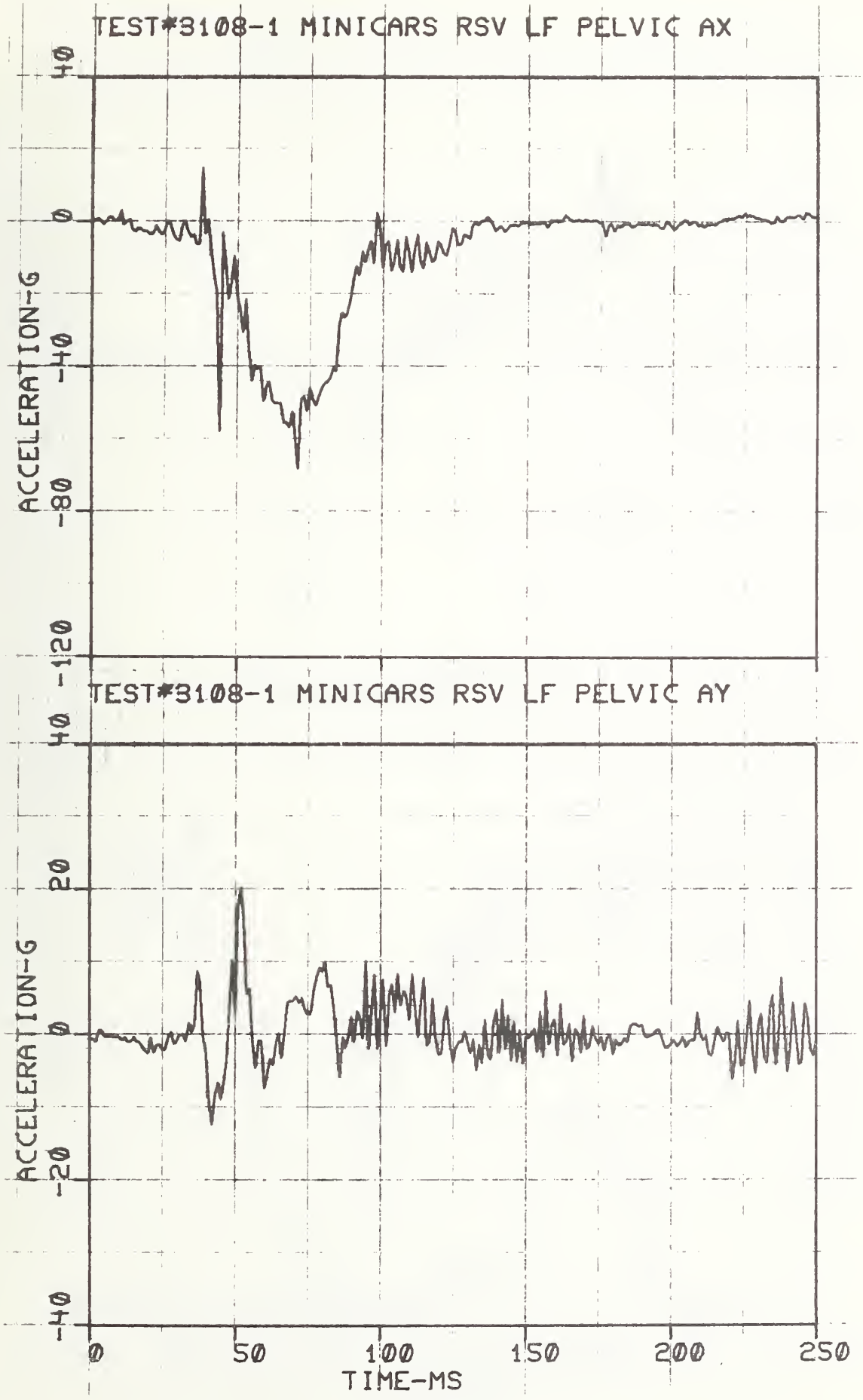

TEST#3108-1 MINICARS RSV LF HEAD ARZ
ACCELERATION-G
40
20
0
-20
-40
TEST#3108-1 MINICARS RSV LF HEAD ARR
ACCELERATION-G
80
60
40
20
0
0
50
100
150
200
250
TIME-MS

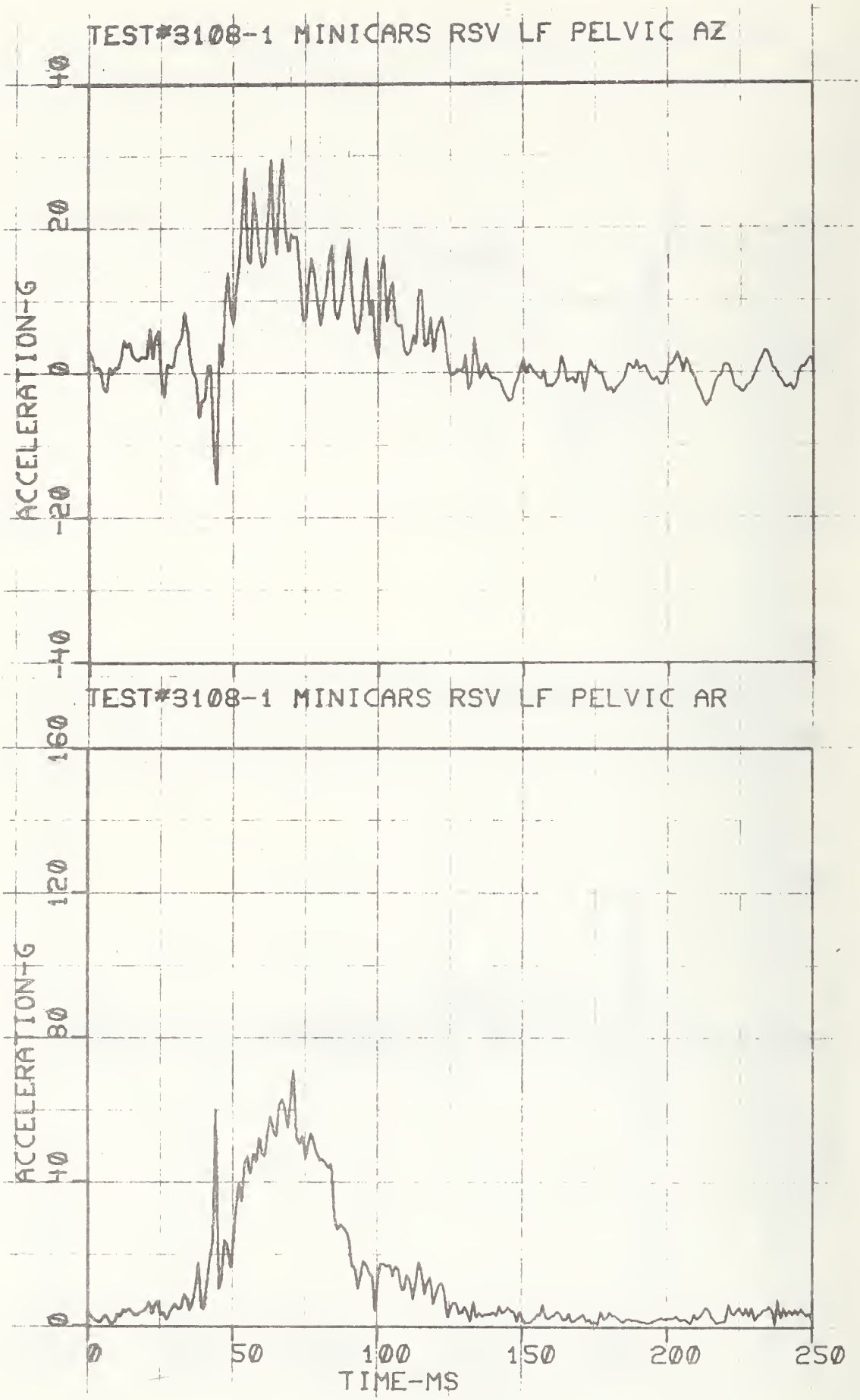

TEST#3108-1 MINICARS RSV LF CHEST AX
20
0
-20
-40
-60
ACCELERATION-G
TEST#3108-1 MINICARS RSV LF CHEST AY
20
10
0
-10
-20
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

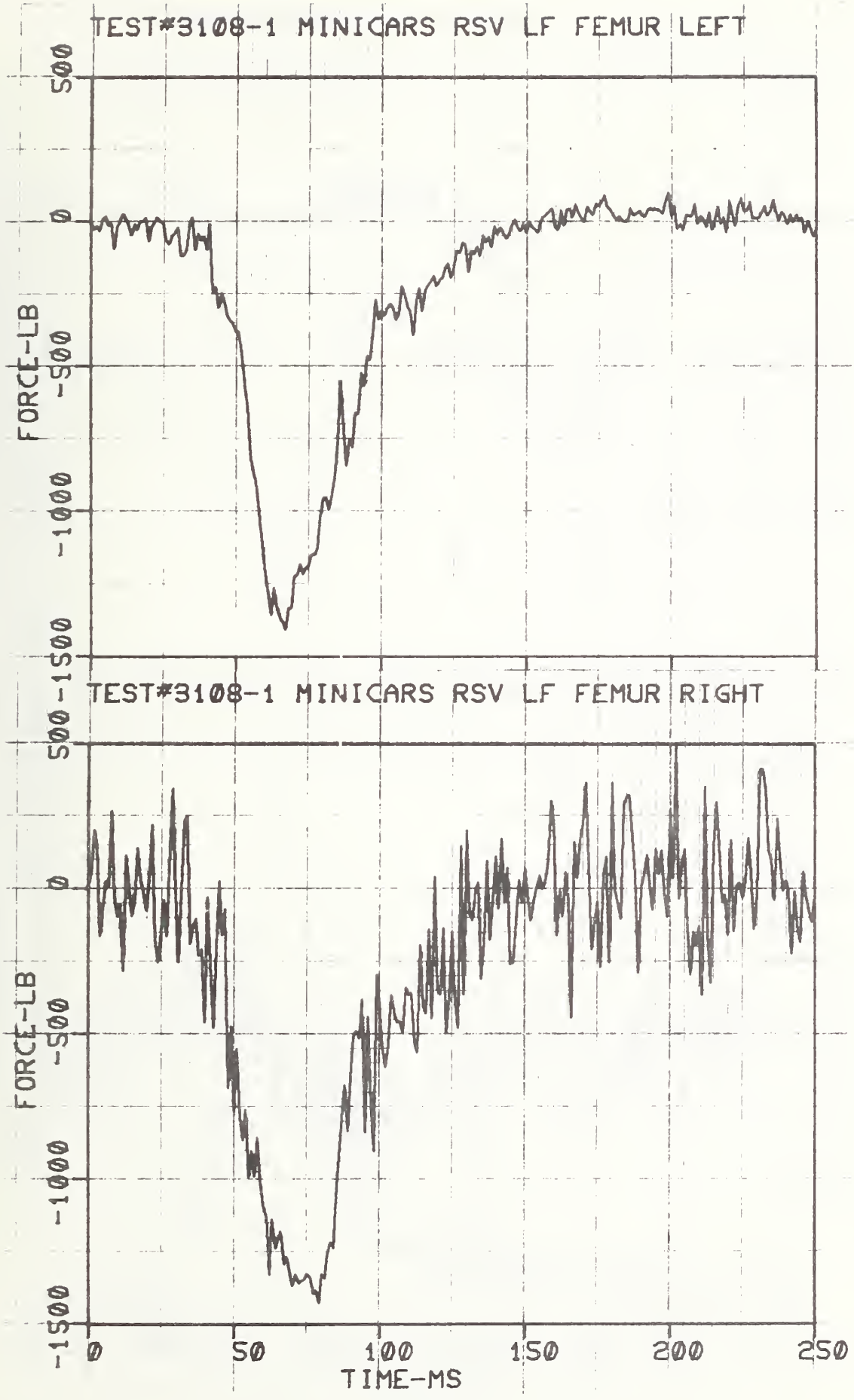

TEST#3108-1 MINICARS RSV LF CHEST AZ
40
20
0
-20
-40
ACCELERATION-G
TEST#3108-1 MINICARS RSV LF CHEST AR
80
60
40
20
0
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

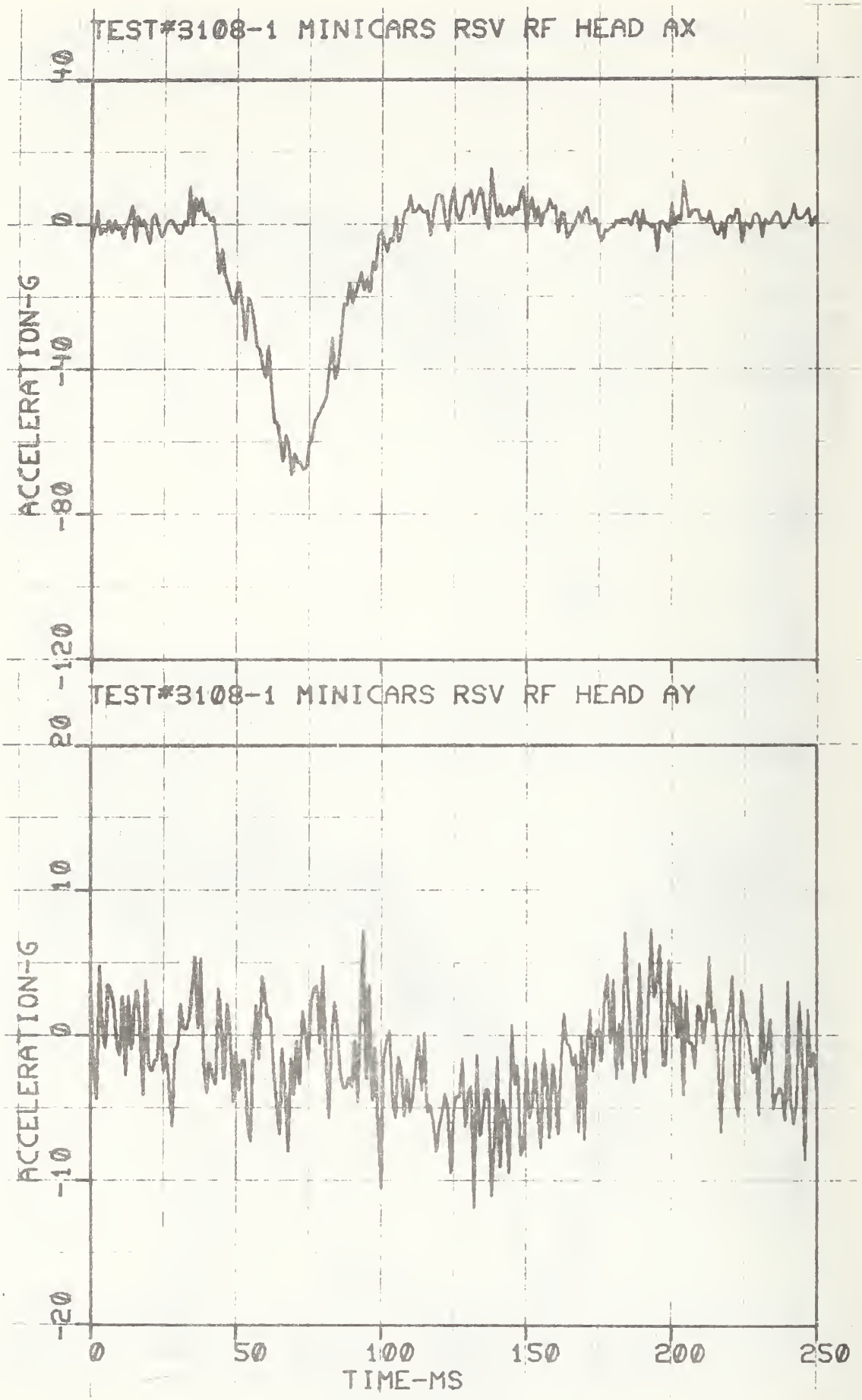

TEST*3108-1 MINICARS RSV LF CHEST ARX
ACCELERATION-G
20
0
-20
-40
-60
38
TEST*3108-1 MINICARS RSV LF CHEST ARY
ACCELERATION-G
20
10
0
-10
-20
14
8
INVALID
DATA
INSTRUMENTATION
FAILURE
0
50
100
150
200
250
TIME-MS

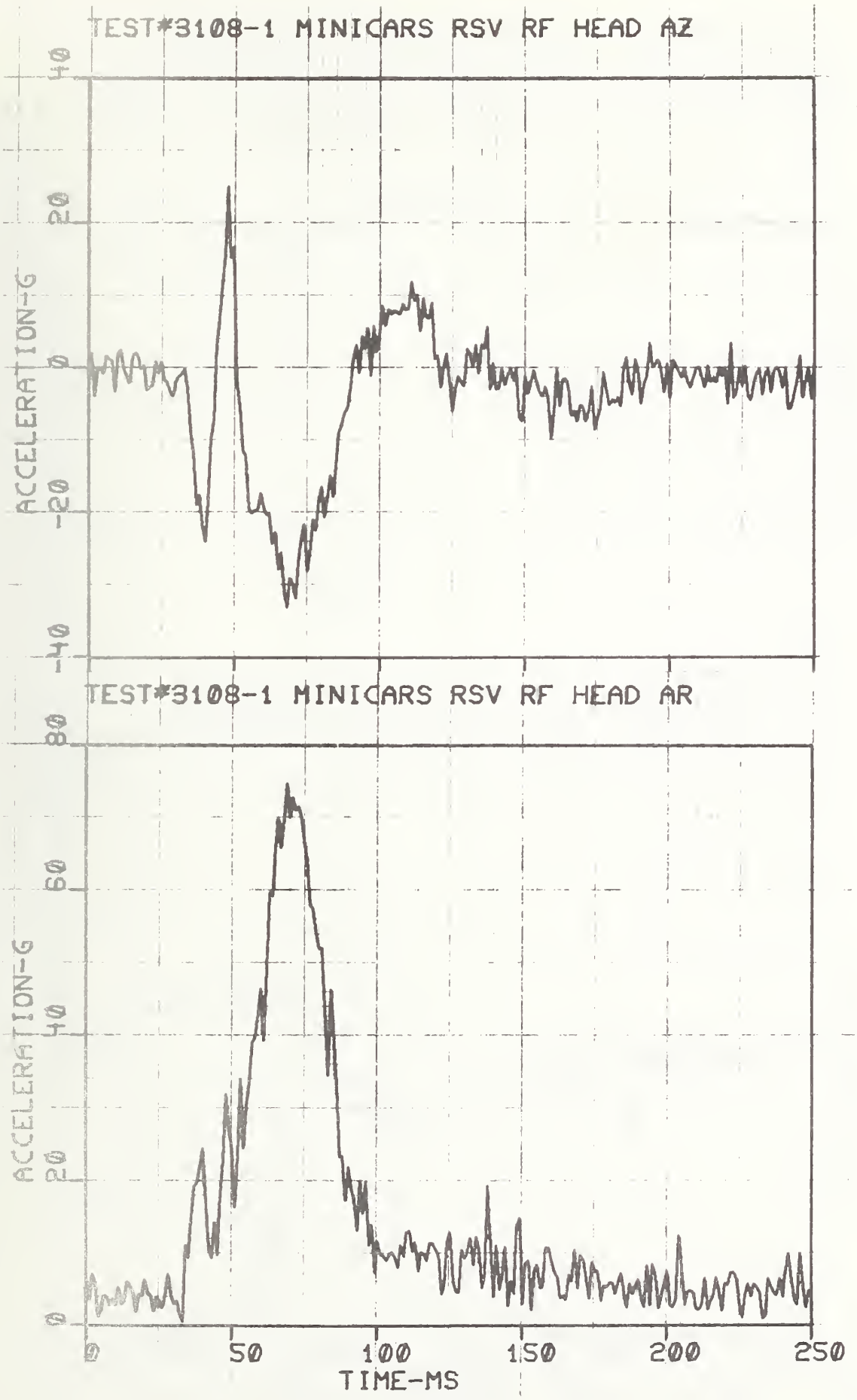

TEST*3108-1 MINICARS RSV LF CHEST ARZ
ACCELERATION-G
40
20
0
-20
-40
INVALID
DATA
INSTRUMENTATION
FAILURE
TEST*3108-1 MINICARS RSV LF CHEST ARR
ACCELERATION-G
80
60
40
20
0
INVALID
DATA
INSTRUMENTATION
FAILURE
0
50
100
150
200
250
TIME-MS

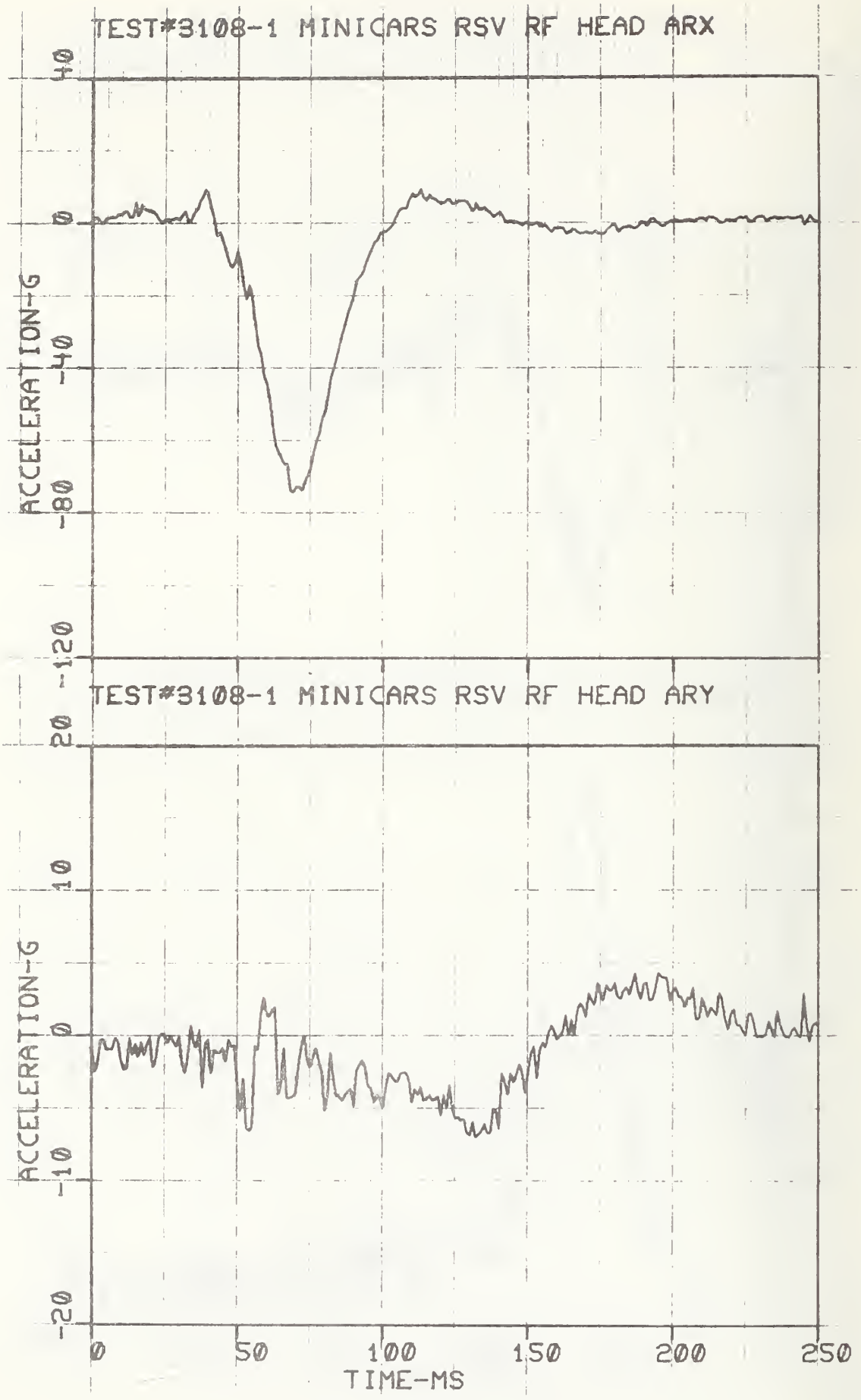

TEST*3108-1 MINICARS RSV LF PELVIC AX
40
0
-40
-80
-120
ACCELERATION-G
TEST*3108-1 MINICARS RSV LF PELVIC AY
40
20
0
-20
-40
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

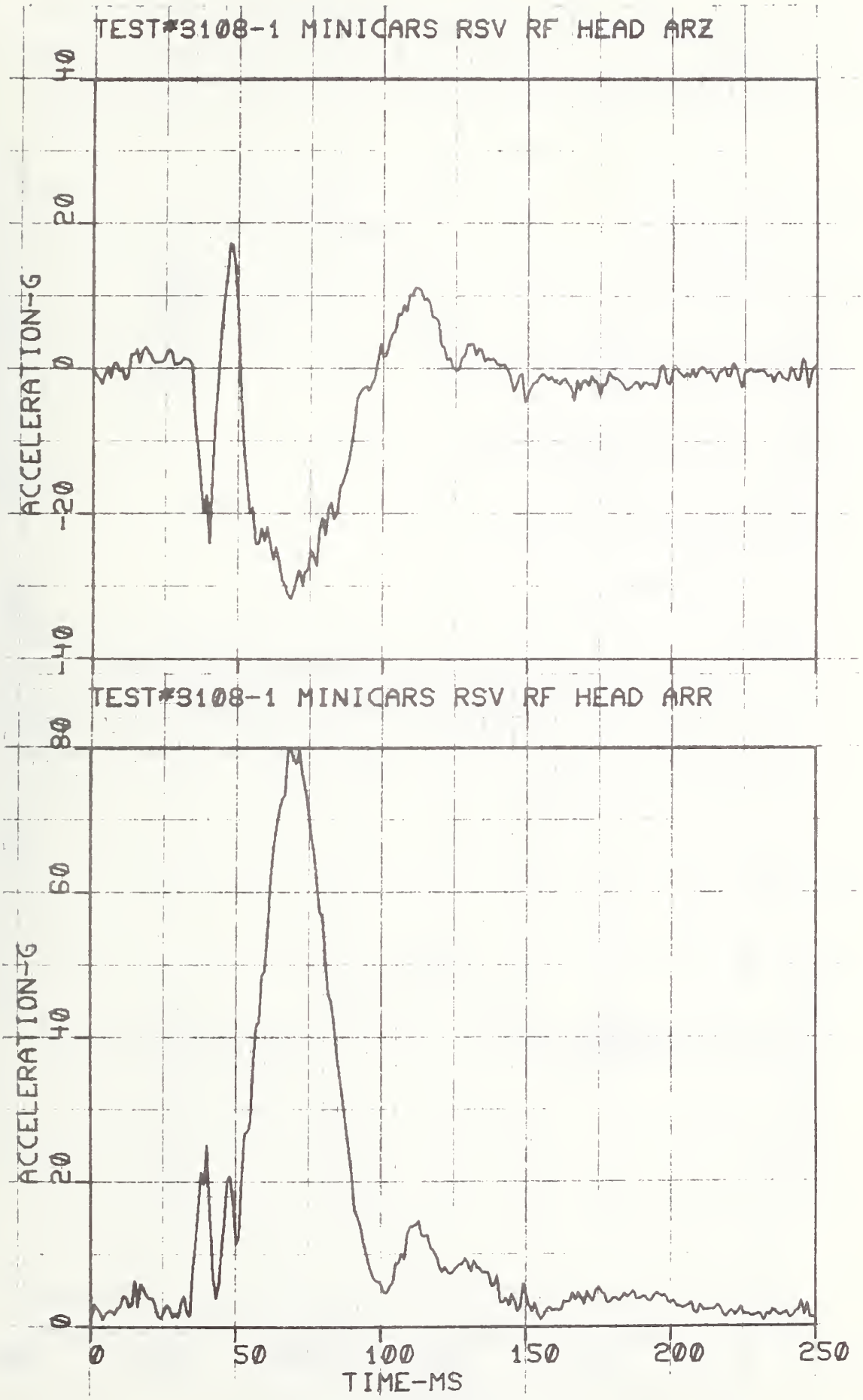

TEST#3108-1 MINICARS RSV LF PELVIC AZ
ACCELERATION-G
40
20
0
-20
-40
TEST#3108-1 MINICARS RSV LF PELVIC AR
ACCELERATION-G
160
120
80
40
0
0
50
100
150
200
250
TIME-MS

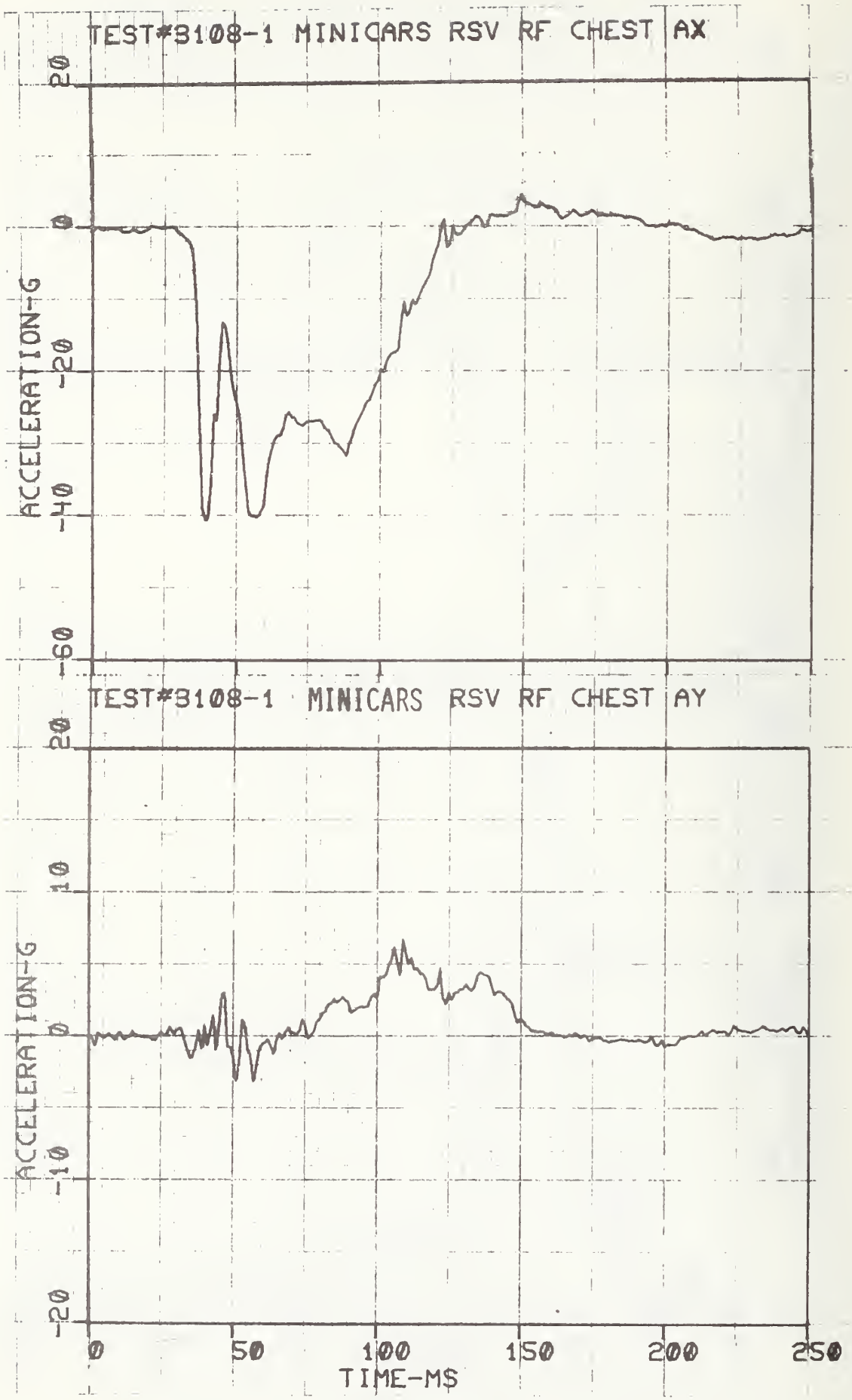

TEST#3108-1 MINICARS RSV LF FEMUR LEFT
500
0
-500
-1000
-1500
FORCE-LB
TEST#3108-1 MINICARS RSV LF FEMUR RIGHT
500
0
-500
-1000
-1500
FORCE-LB
0
50
100
150
200
250
TIME-MS

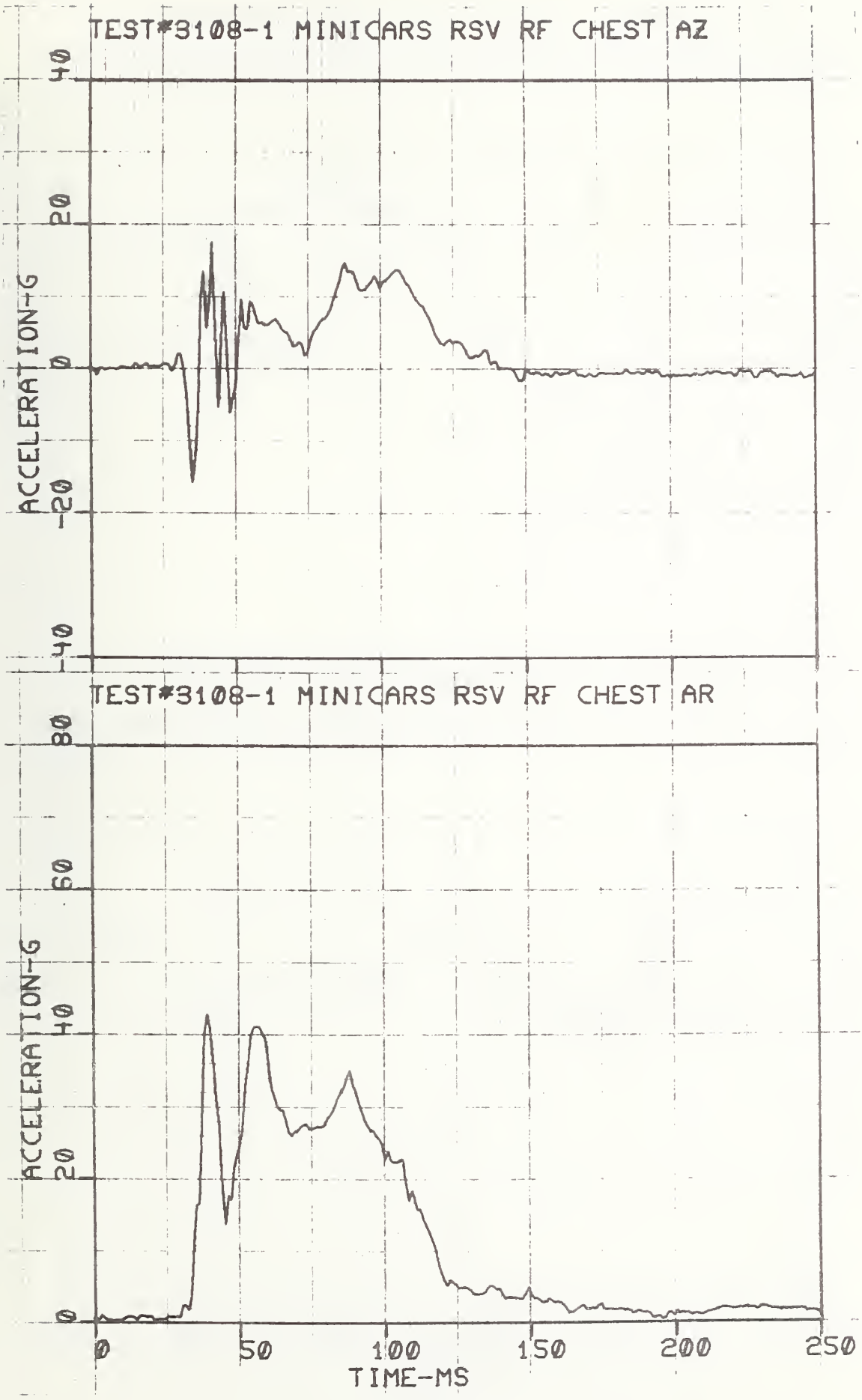

TEST#3108-1 MINICARS RSV RF HEAD AX
40
0
-40
-80
-120
ACCELERATION-G
TEST#3108-1 MINICARS RSV RF HEAD AY
20
10
0
-10
-20
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

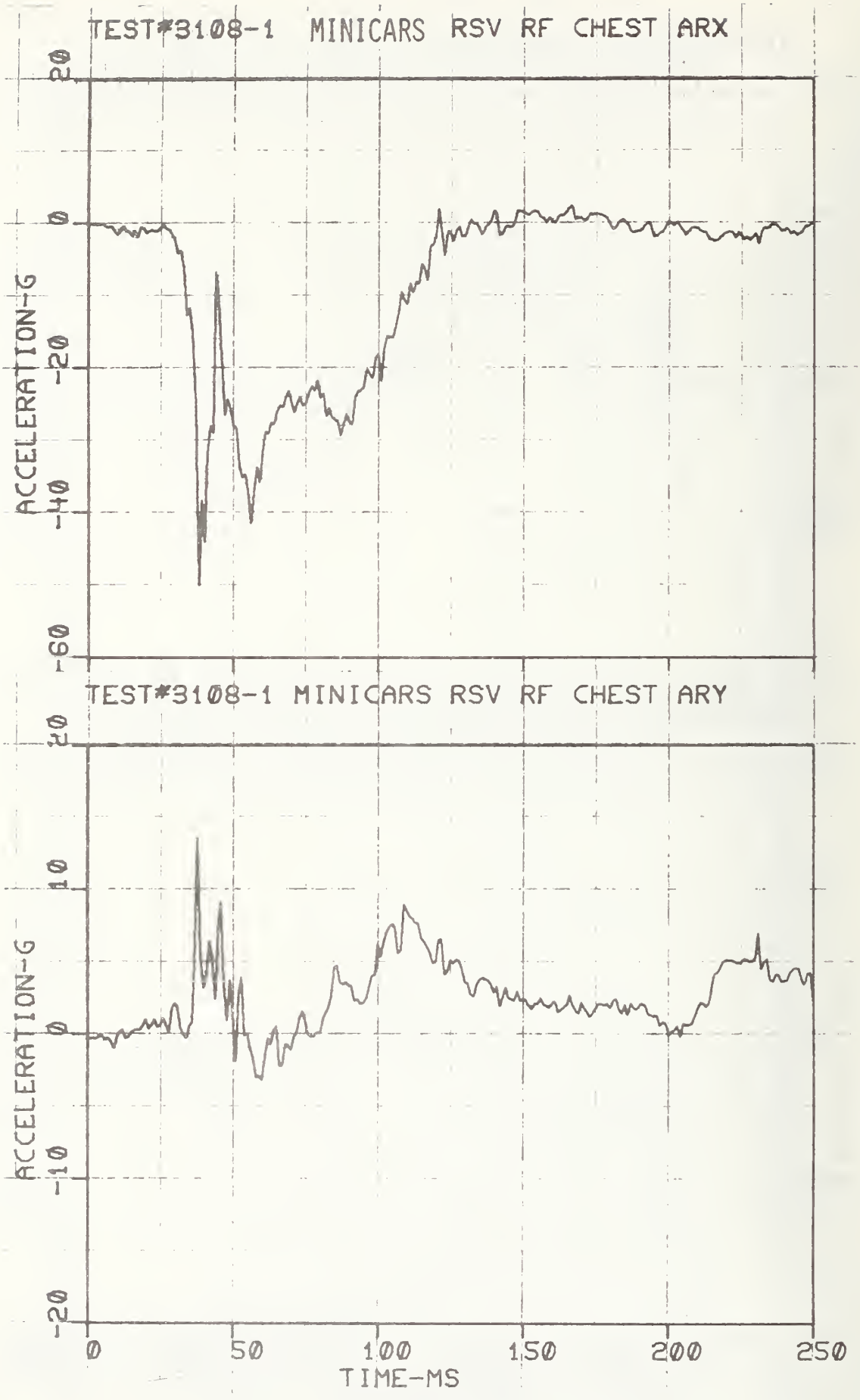

TEST#3108-1 MINICARS RSV RF HEAD AZ
ACCELERATION-G
40
20
0
-20
-40
TEST#3108-1 MINICARS RSV RF HEAD AR
ACCELERATION-G
80
60
40
20
0
0
50
100
150
200
250
TIME-MS

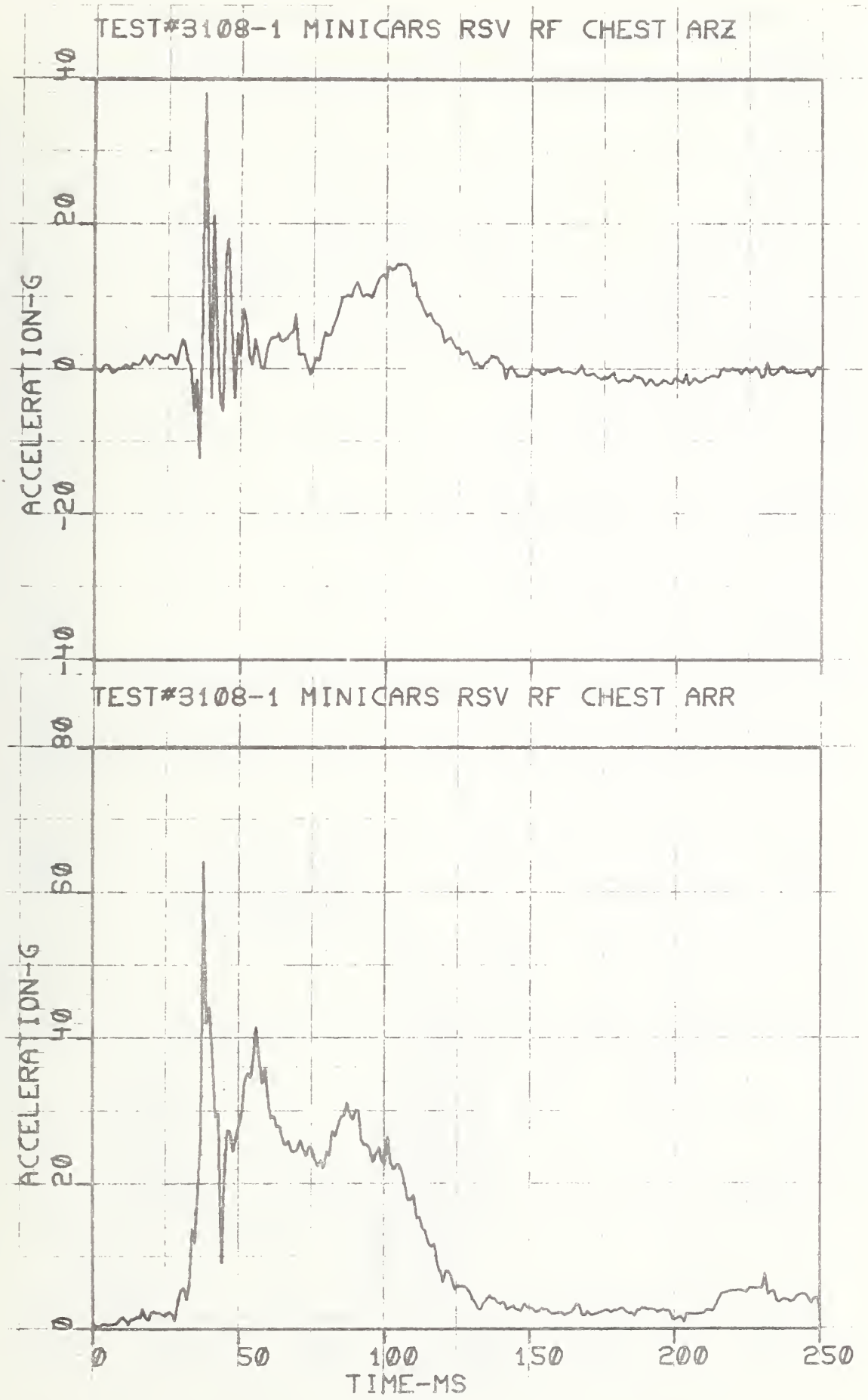

TEST#3108-1 MINICARS RSV RF HEAD ARX
ACCELERATION-G
40
0
-40
-80
-120
TEST#3108-1 MINICARS RSV RF HEAD ARY
ACCELERATION-G
20
10
0
-10
-20
0
50
100
150
200
250
TIME-MS

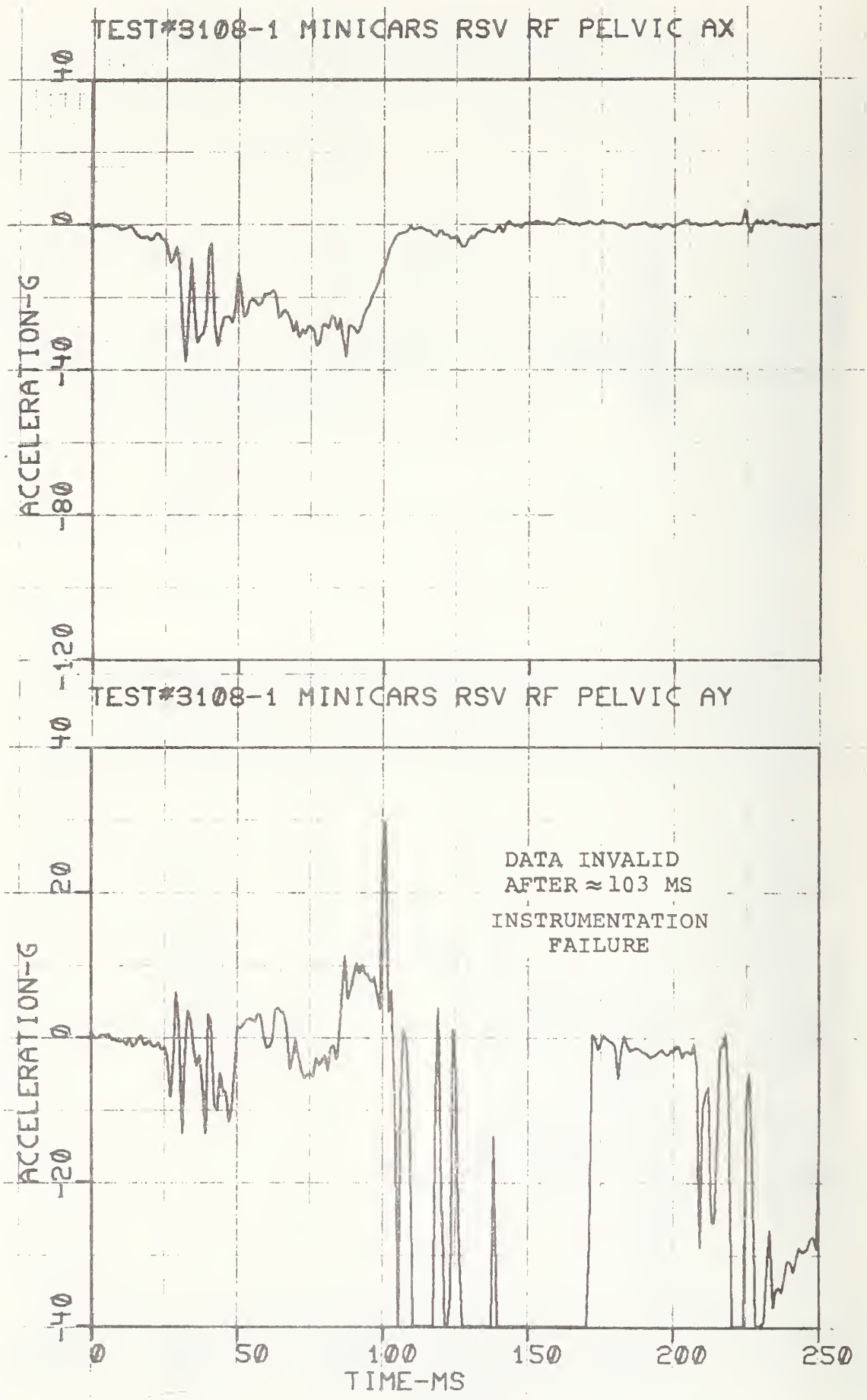

TEST#3108-1 MINICARS RSV RF HEAD ARZ
ACCELERATION-G
40
20
0
-20
-40
TEST#3108-1 MINICARS RSV RF HEAD ARR
ACCELERATION-G
80
60
40
20
0
0
50
100
150
200
250
TIME-MS

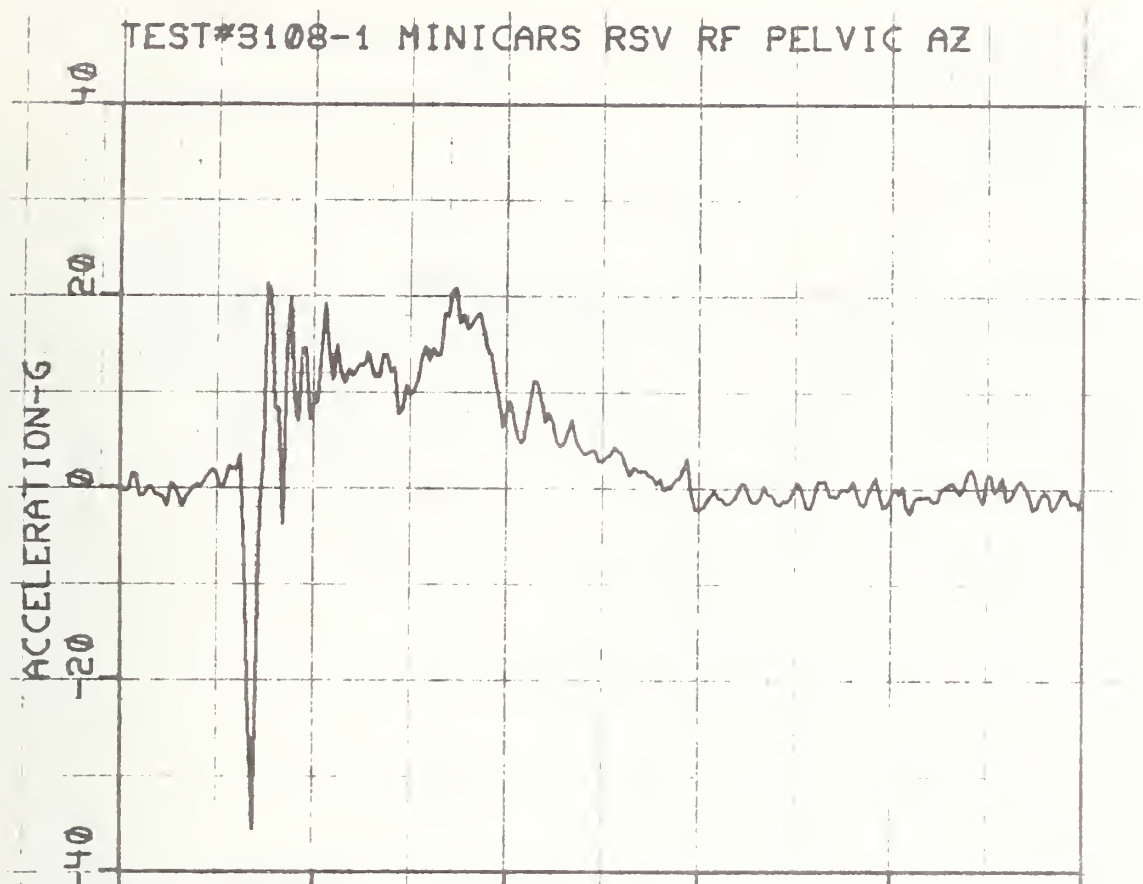

TEST#3108-1 MINICARS RSV RF CHEST AX
20
0
-20
-40
-60
ACCELERATION-G
TEST#3108-1 MINICARS RSV RF CHEST AY
20
10
0
-10
-20
ACCELERATION-G
0
50
100
150
200
250
TIME-M$

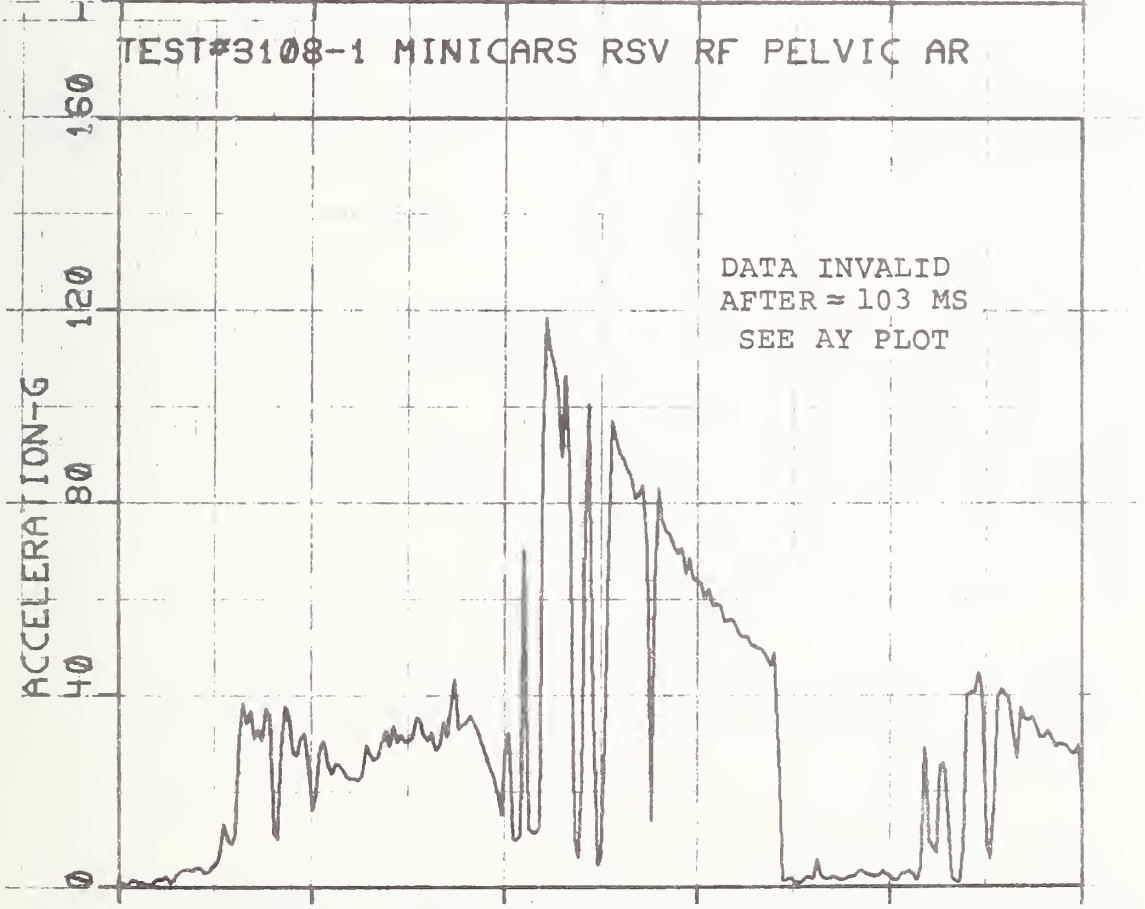

TEST*3108-1 MINICARS RSV RF CHEST AZ
40
20
0
-20
-40
ACCELERATION-G
TEST*3108-1 MINICARS RSV RF CHEST AR
80
60
40
20
0
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

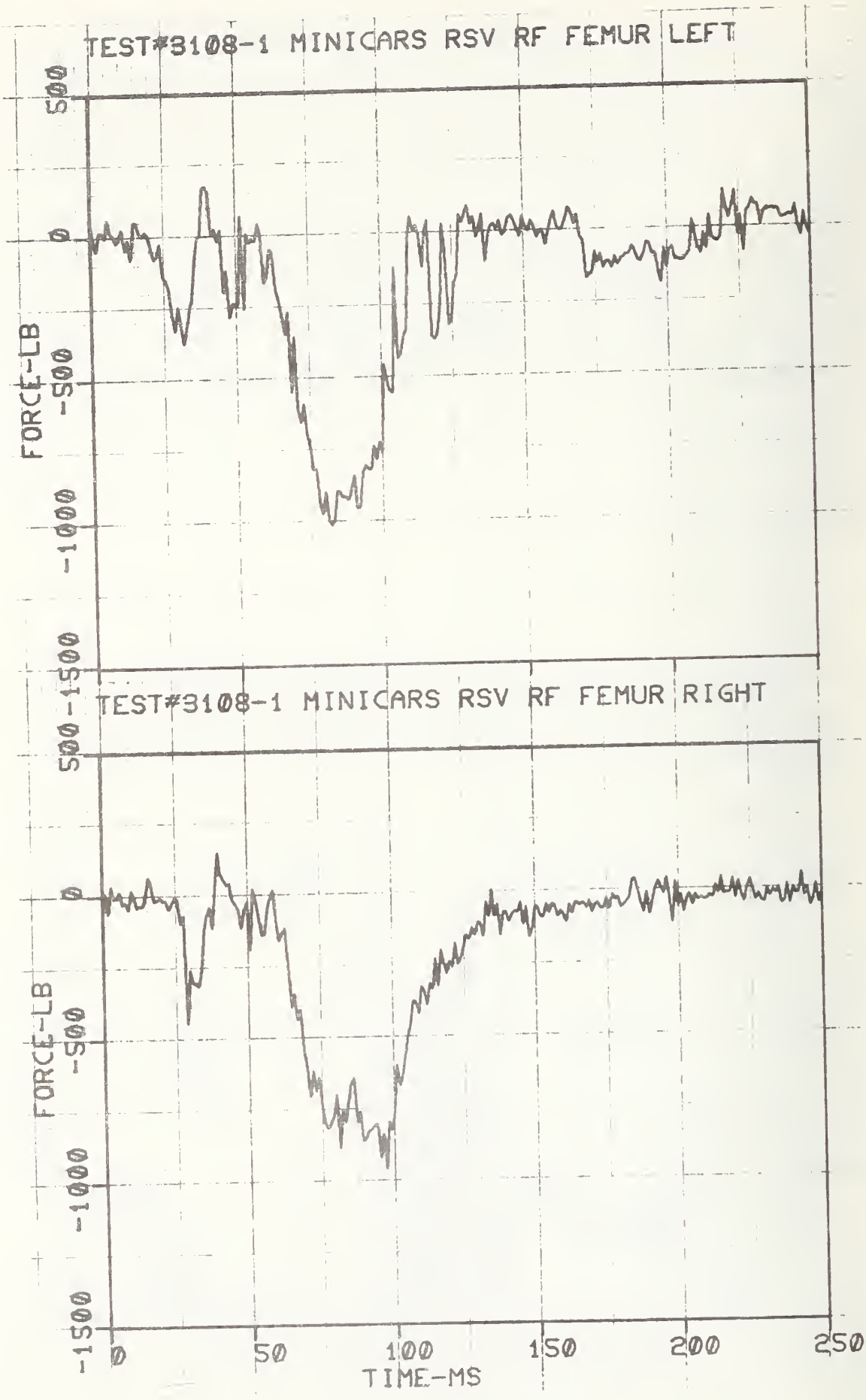

TEST#3108-1 MINICARS RSV RF CHEST ARX
20
0
-20
-40
-60
ACCELERATION-G
TEST#3108-1 MINICARS RSV RF CHEST ARY
20
10
0
-10
-20
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

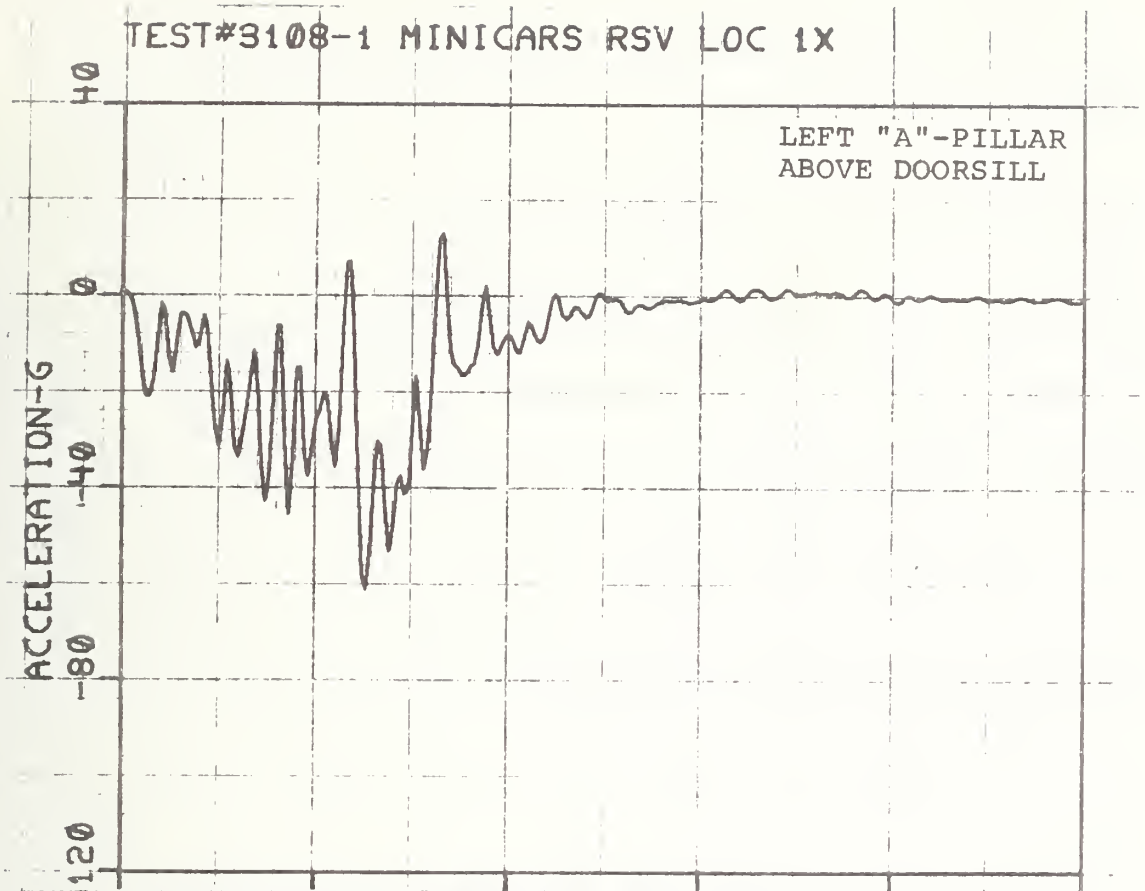

TEST#3108-1 MINICARS RSV RF CHEST ARZ
40
20
0
-20
-40
ACCELERATION-G
TEST#3108-1 MINICARS RSV RF CHEST ARR
80
60
40
20
0
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

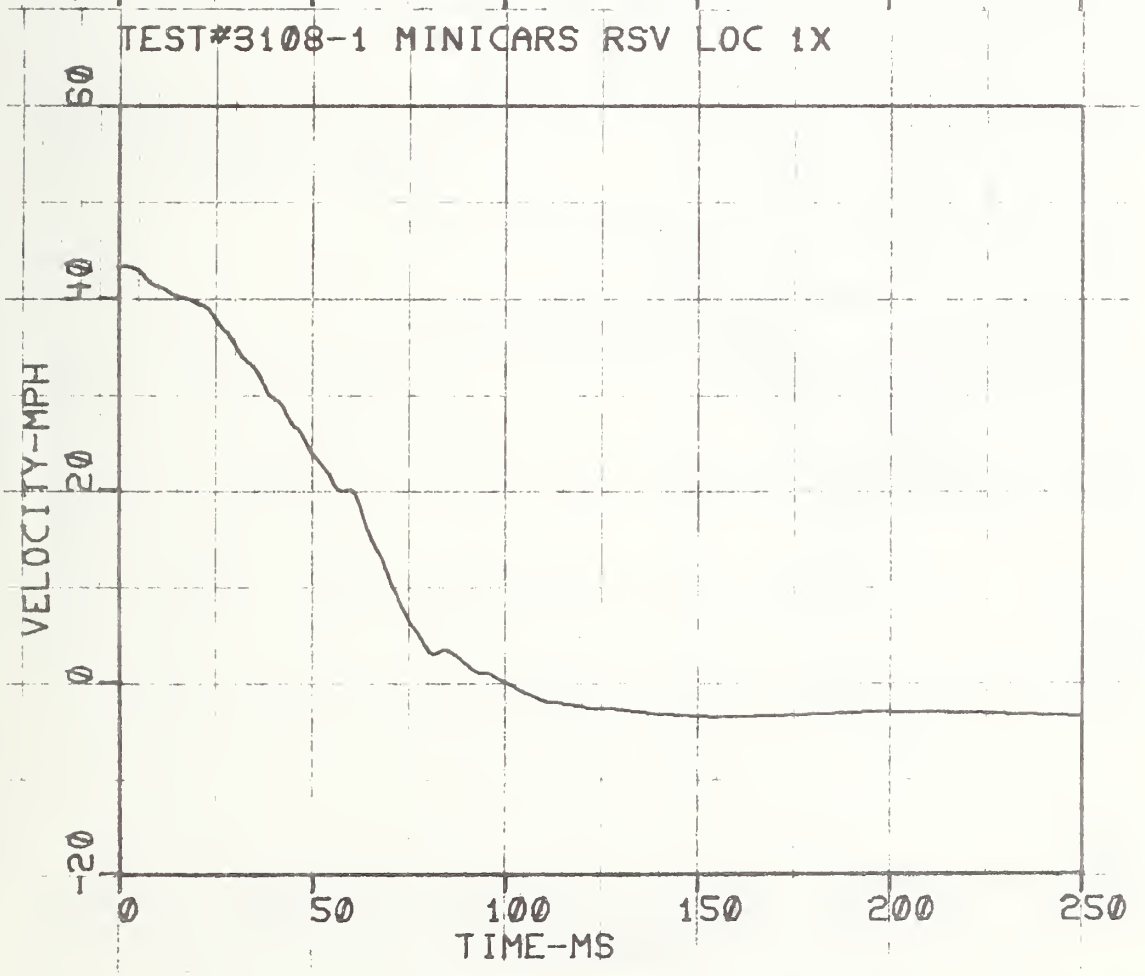

TEST#3108-1 MINICARS RSV RF PELVIC AX
ACCELERATION-G
40
0
-40
-80
-120
TEST#3108-1 MINICARS RSV RF PELVIC AY
ACCELERATION-G
40
20
0
-20
-40
DATA INVALID
AFTER ≈ 103 MS
INSTRUMENTATION
FAILURE
0
50
100
150
200
250
TIME-MS

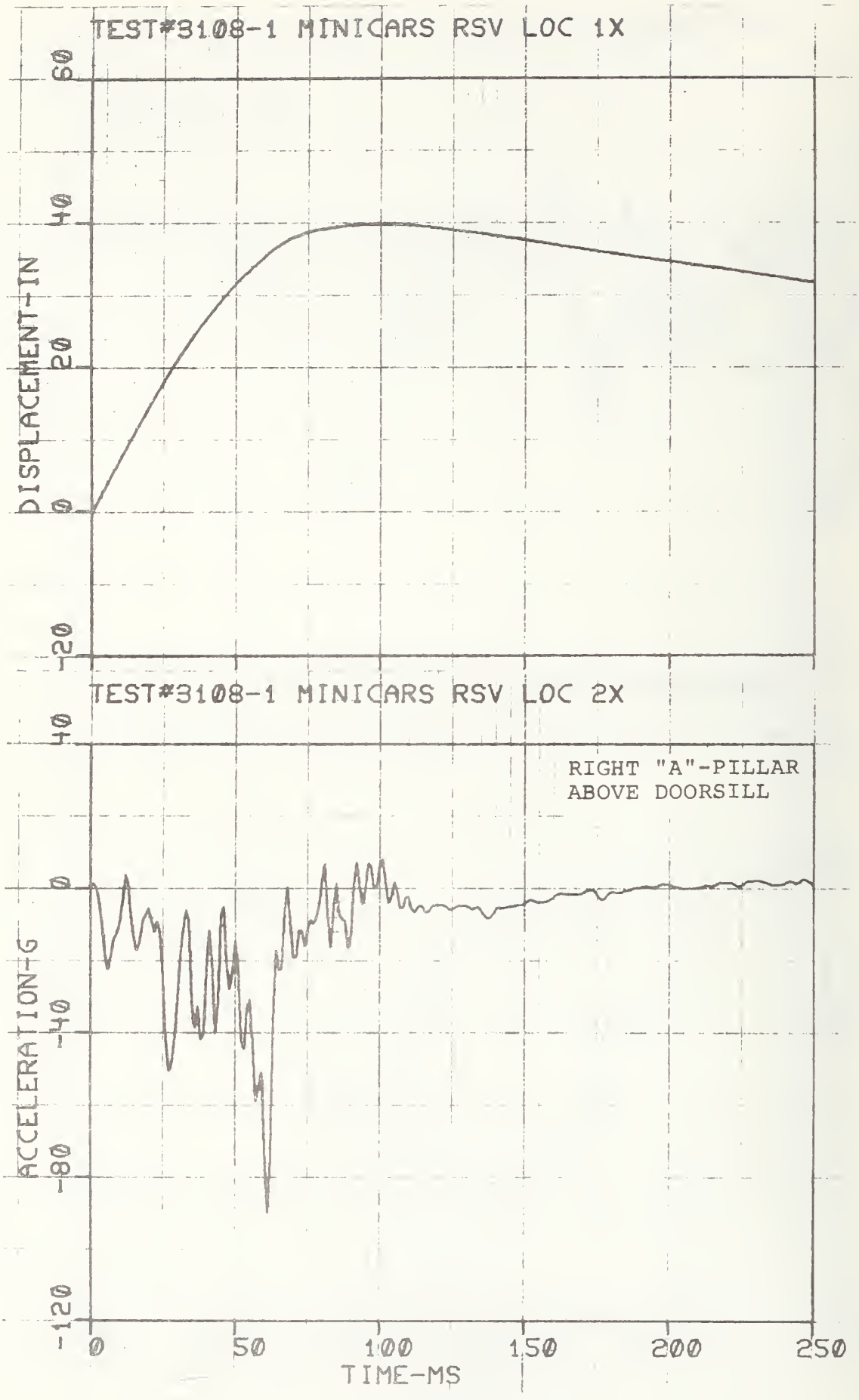

TEST#3108-1 MINICARS RSV RF PELVIC AZ
ACCELERATION-G
40
20
0
-20
-40

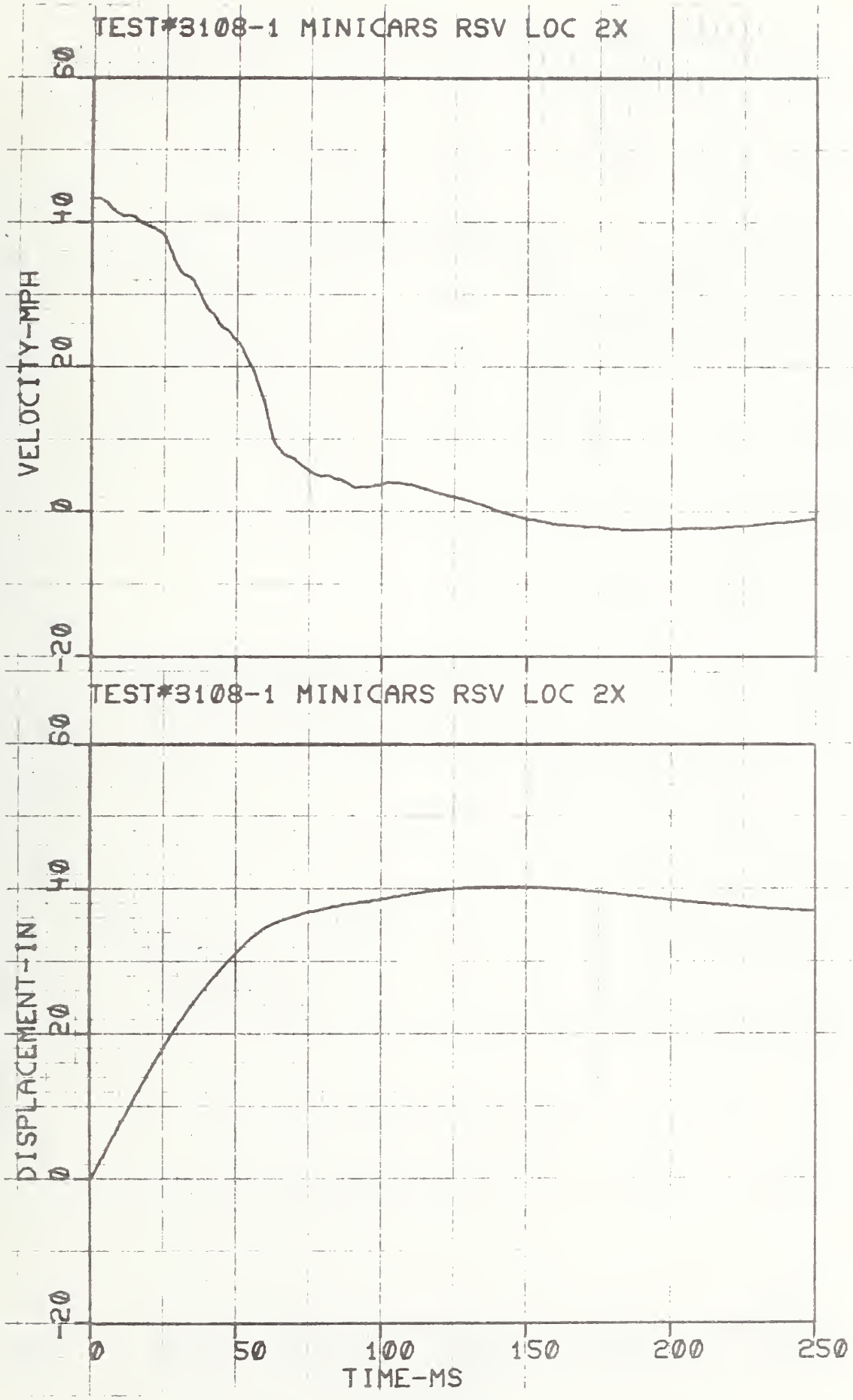

TEST#3108-1 MINICARS RSV RF PELVIC AR
ACCELERATION-G
160
120
80
40
0
DATA INVALID
AFTER ≈ 103 MS
SEE AY PLOT

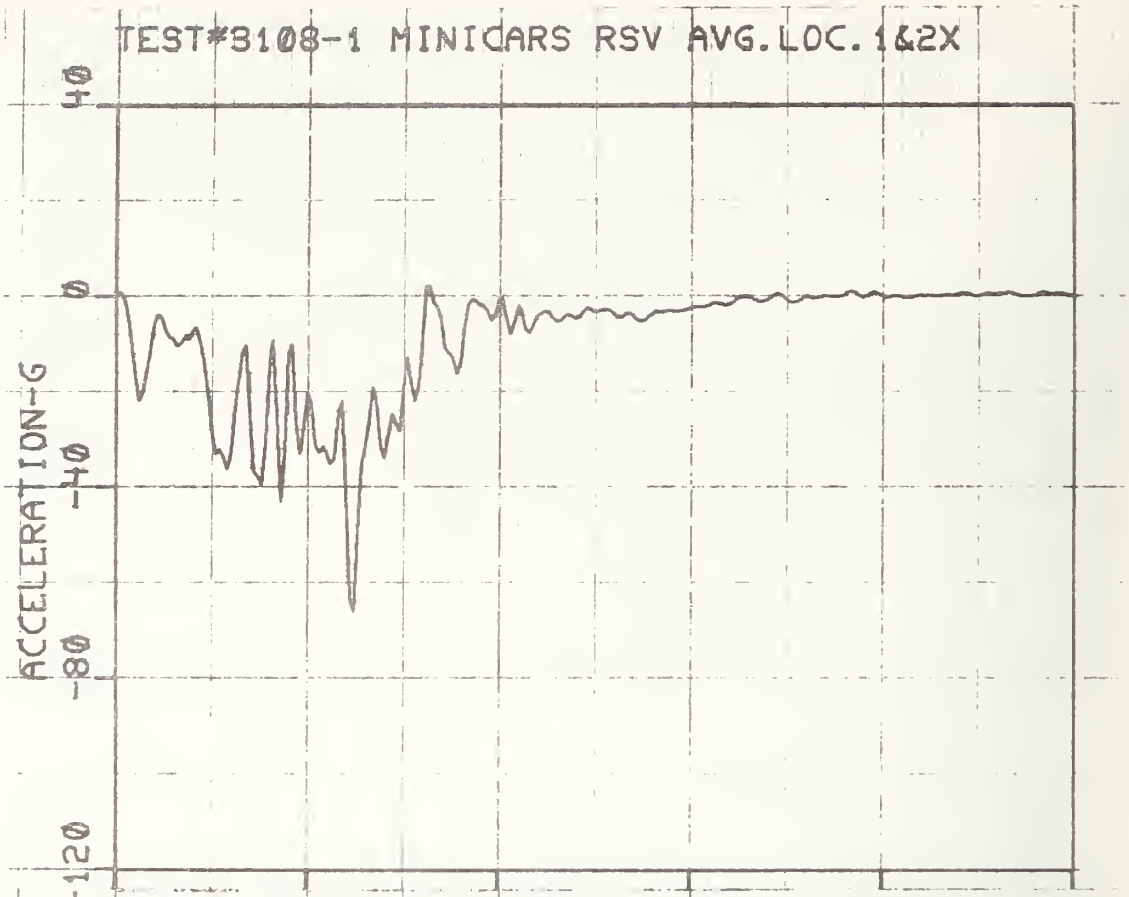

TEST#3108-1 MINICARS RSV RF FEMUR LEFT
500
0
-500
-1000
-1500
FORCE-LB
TEST#3108-1 MINICARS RSV RF FEMUR RIGHT
500
0
-500
-1000
-1500
FORCE-LB
0
50
100
150
200
250
TIME-MS

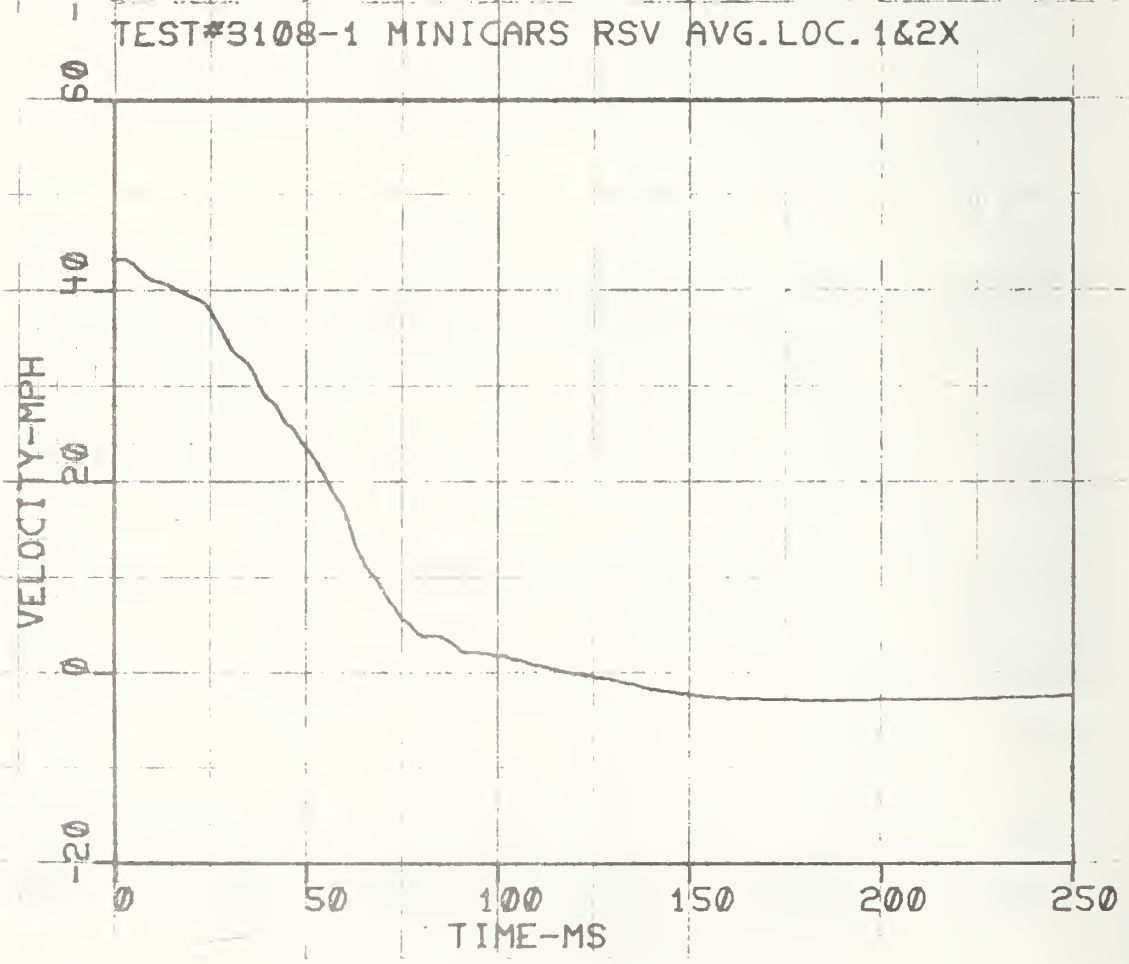

TEST#3108-1 MINICARS RSV LOC 1X
LEFT "A"-PILLAR
ABOVE DOORSILL
ACCELERATION-G
40
0
-40
-80
-120

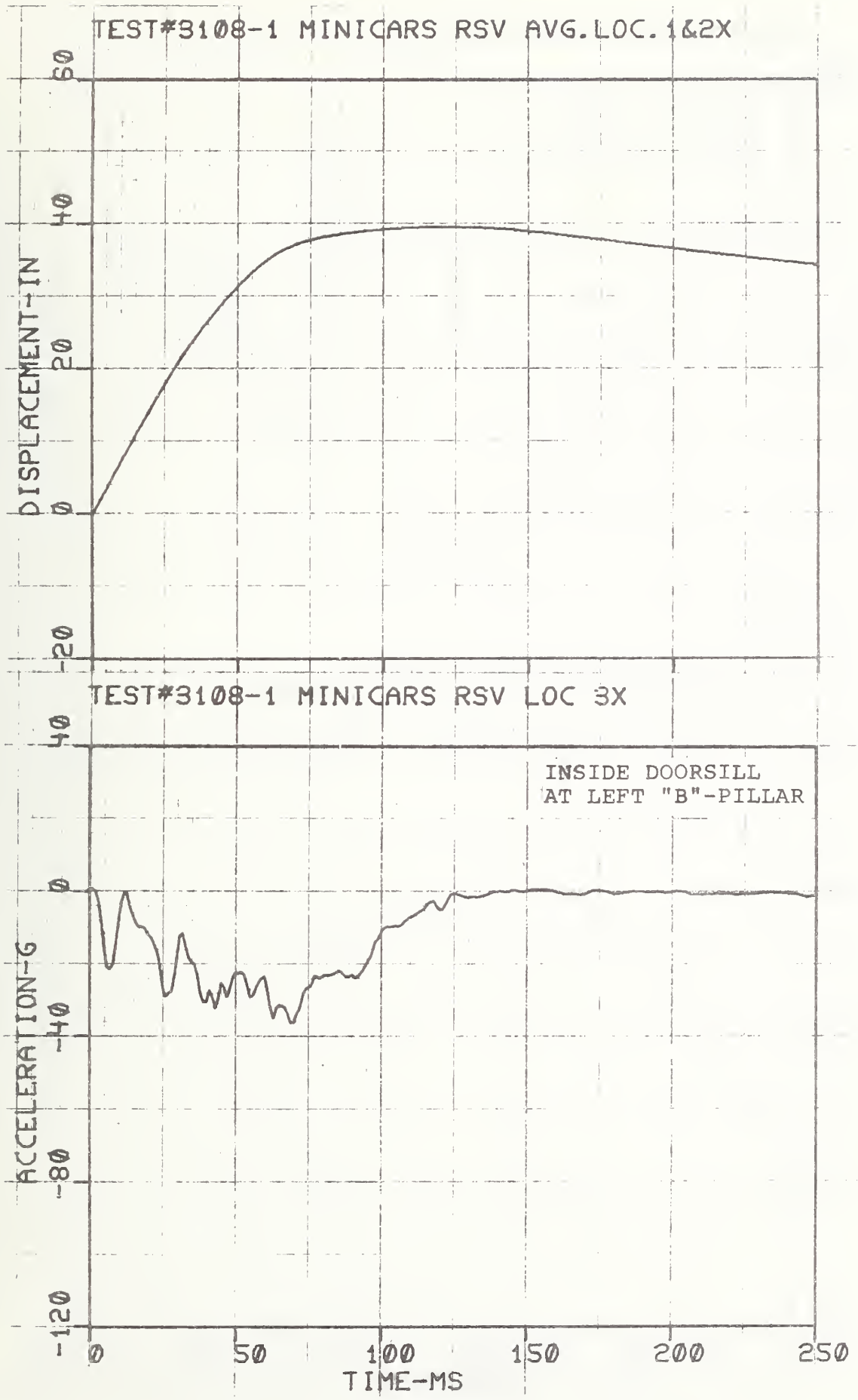

TEST#3108-1 MINICARS RSV LOC 1X
VELOCITY-MPH
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

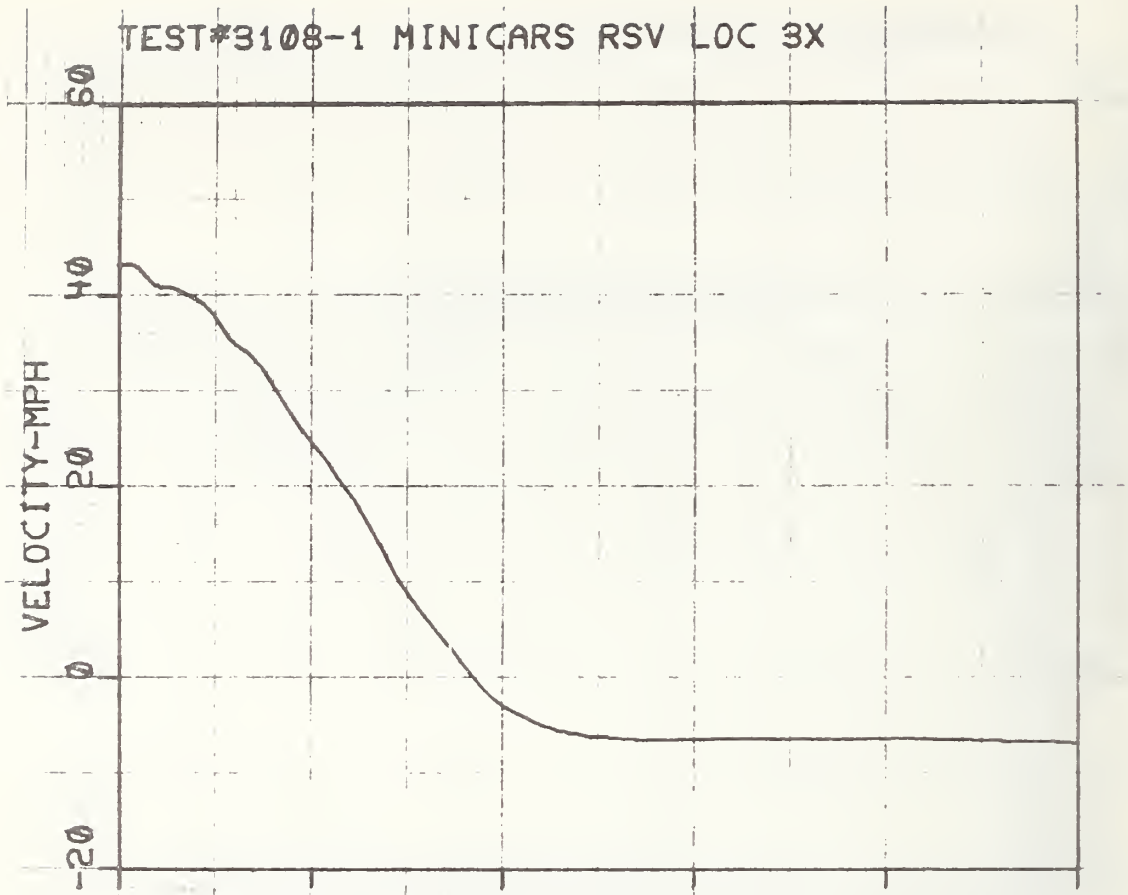

TEST#3108-1 MINICARS RSV LOC 1X
60
40
20
0
-20
DISPLACEMENT-IN
TEST#3108-1 MINICARS RSV LOC 2X
RIGHT "A"-PILLAR
ABOVE DOORSILL
40
0
-40
-80
-120
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

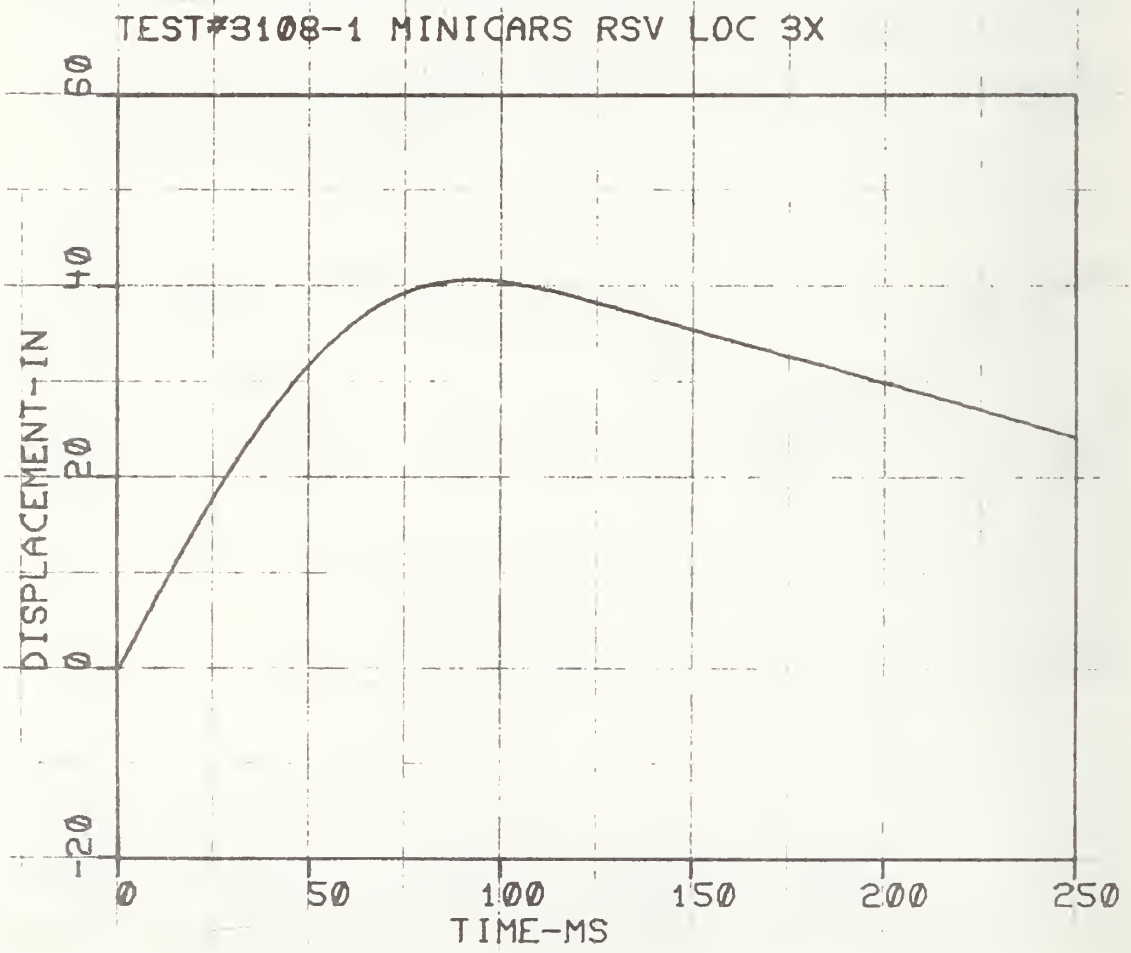

TEST*3108-1 MINICARS RSV LOC 2X
VELOCITY-MPH
60
40
20
0
-20
TEST*3108-1 MINICARS RSV LOC 2X
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

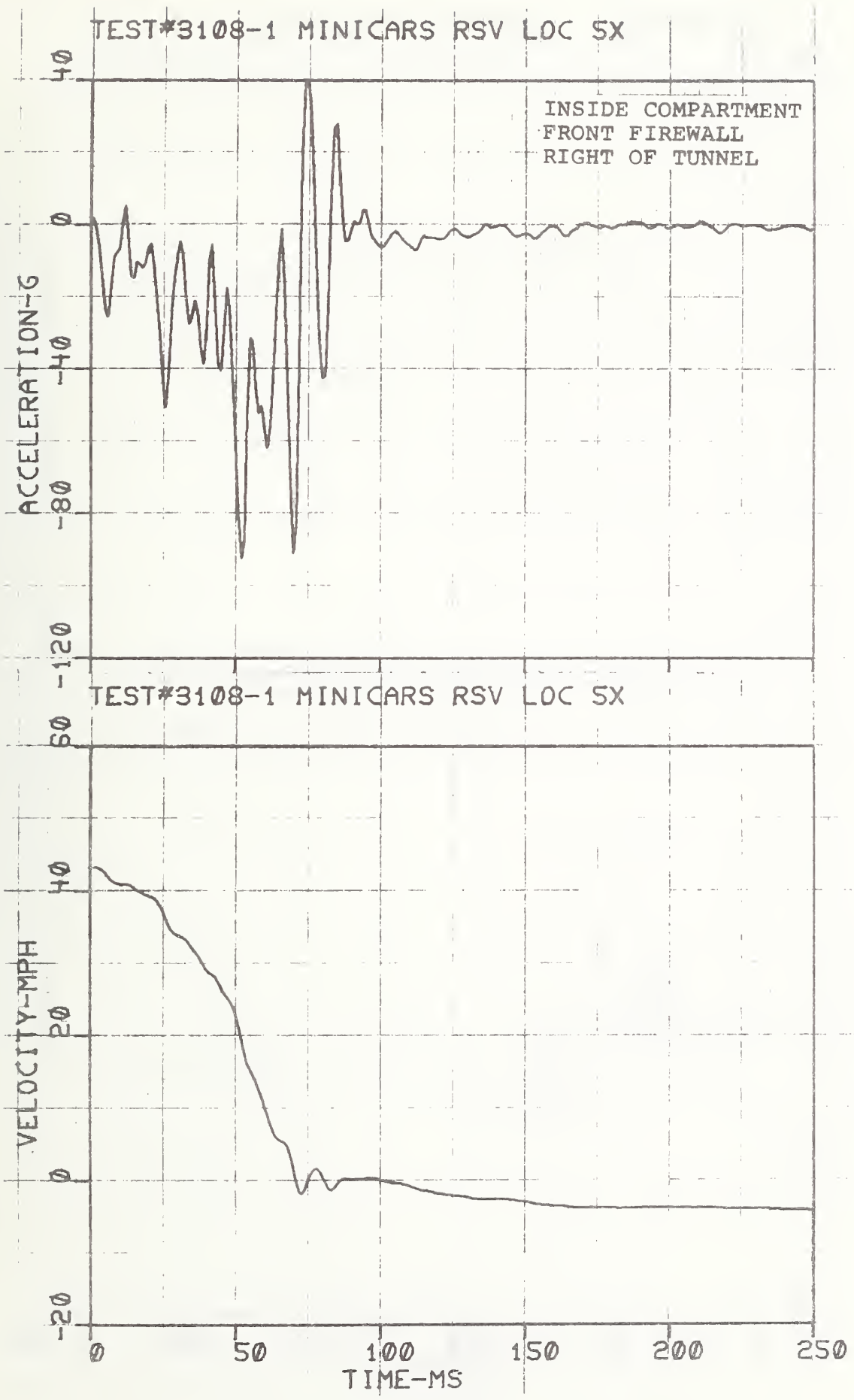

TEST#3108-1 MINICARS RSV AVG.LOC.1&2X
ACCELERATION-G
40
0
-40
-80
-120

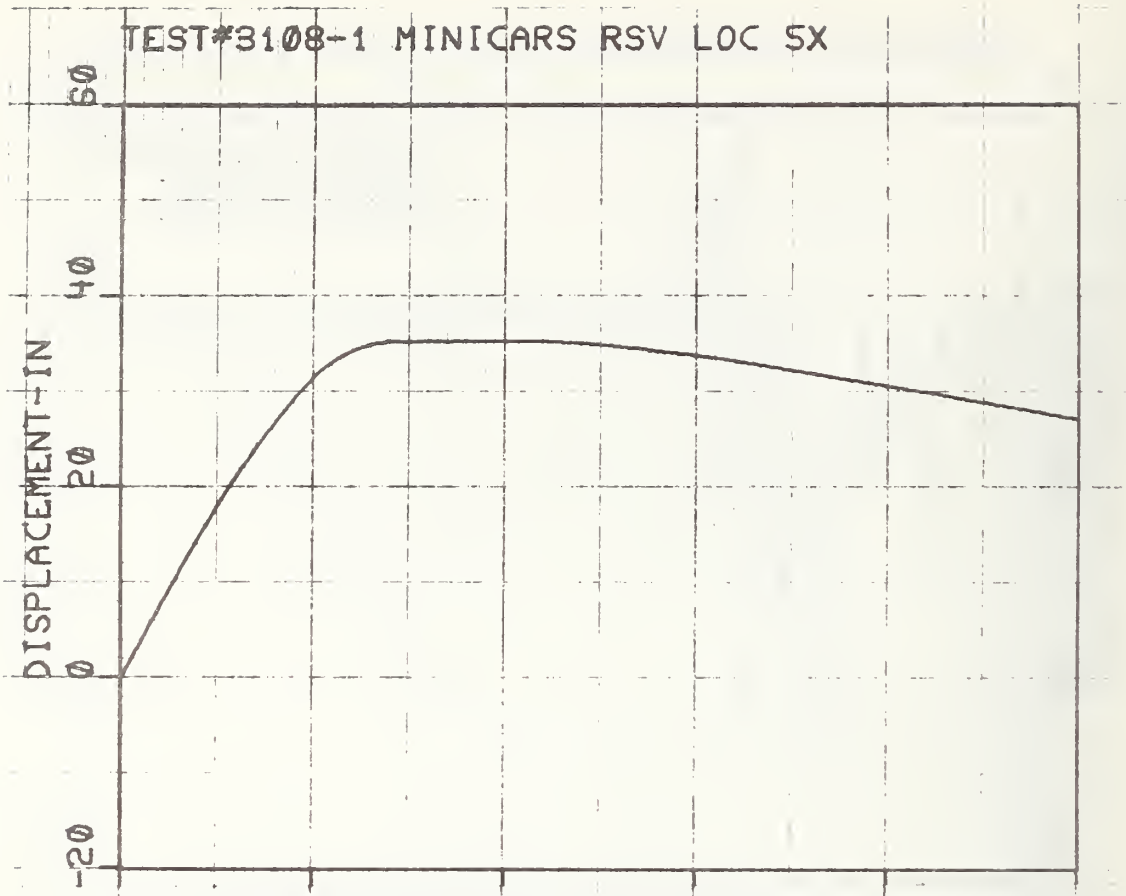

TEST#3108-1 MINICARS RSV AVG.LOC.1&2X
VELOCITY-MPH
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

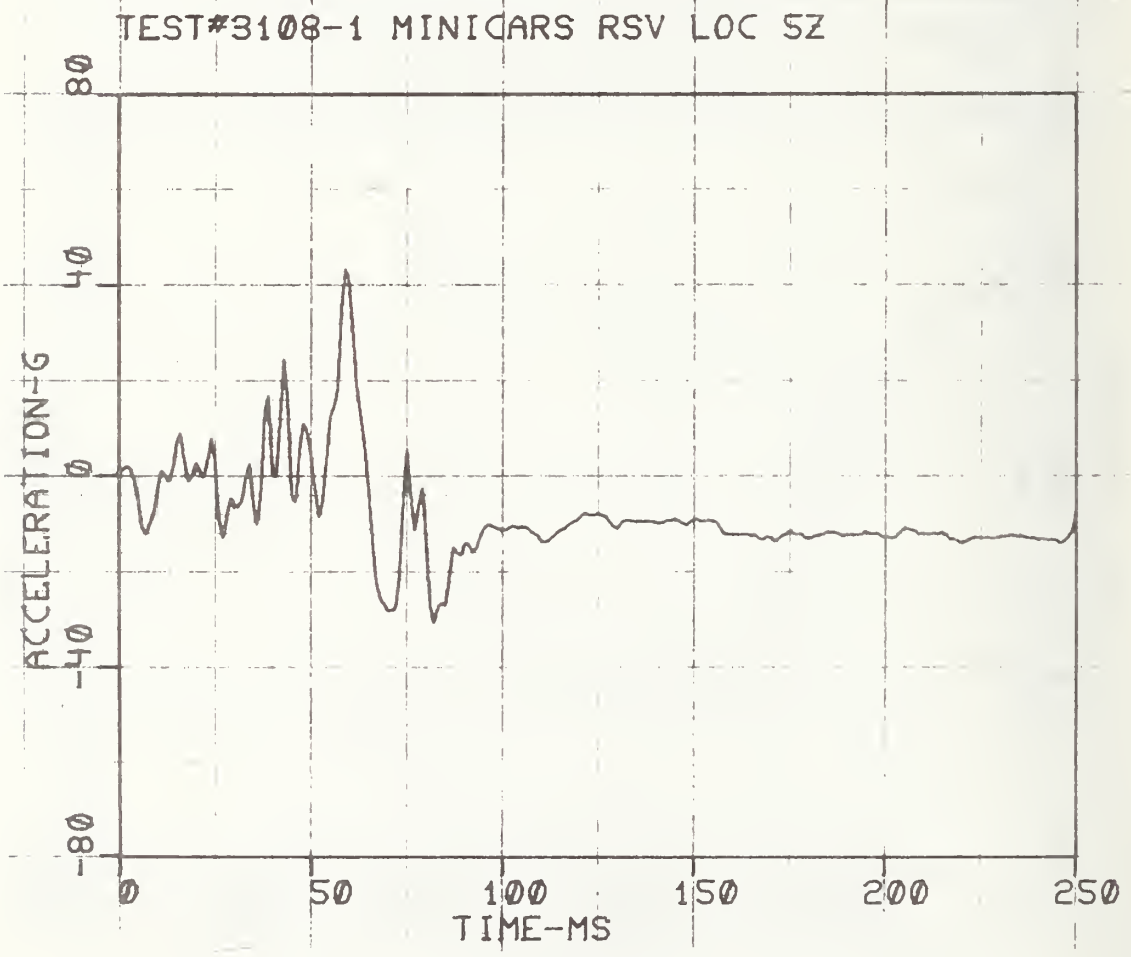

TEST#3108-1 MINICARS RSV AVG.LOC.1&2X
60
40
20
0
-20
DISPLACEMENT-IN
TEST#3108-1 MINICARS RSV LOC 3X
INSIDE DOORSILL
AT LEFT "B"-PILLAR
40
0
-40
-80
-120
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

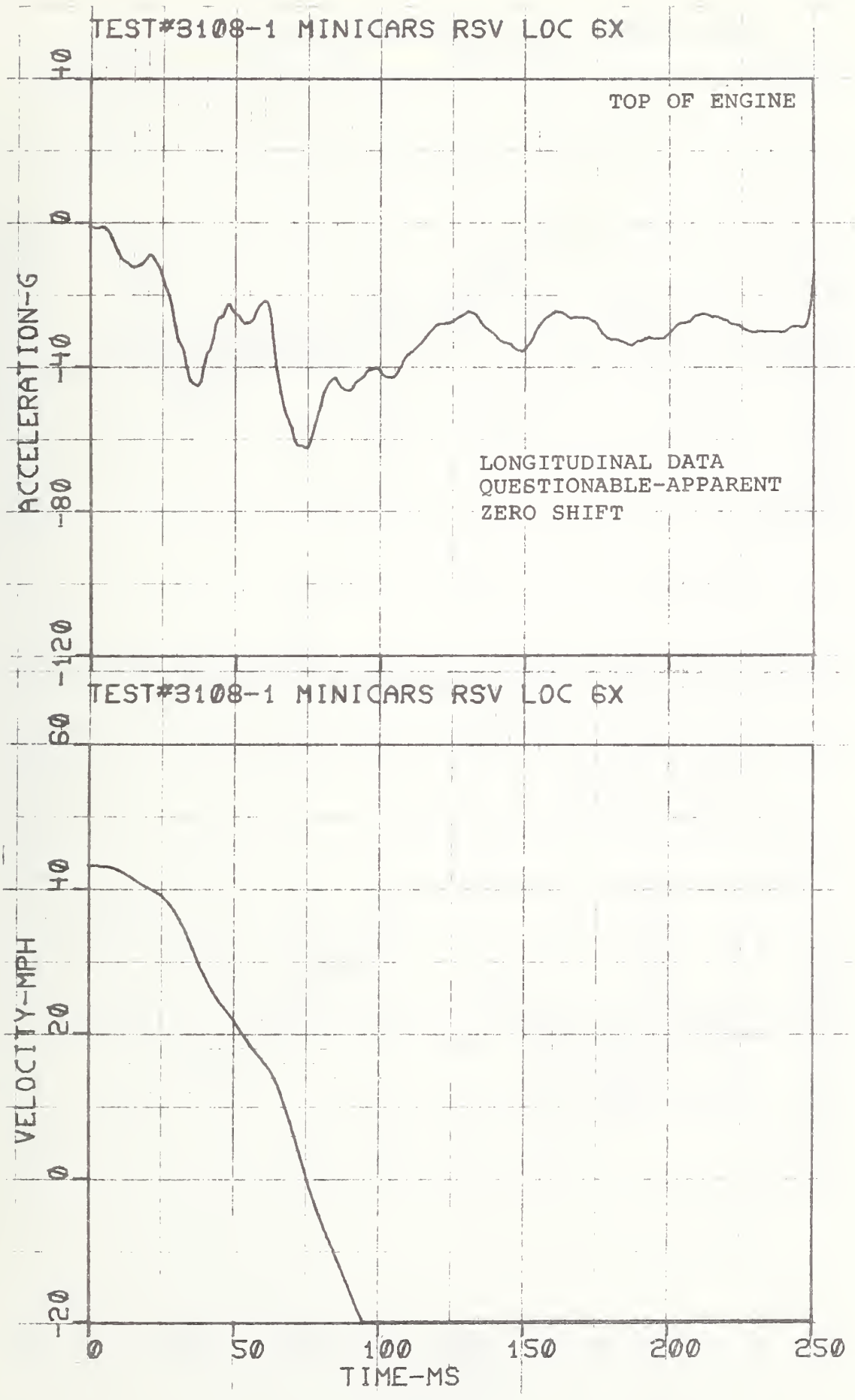

TEST#3108-1 MINICARS RSV LOC 3X
VELOCITY-MPH
60
40
20
0
-20

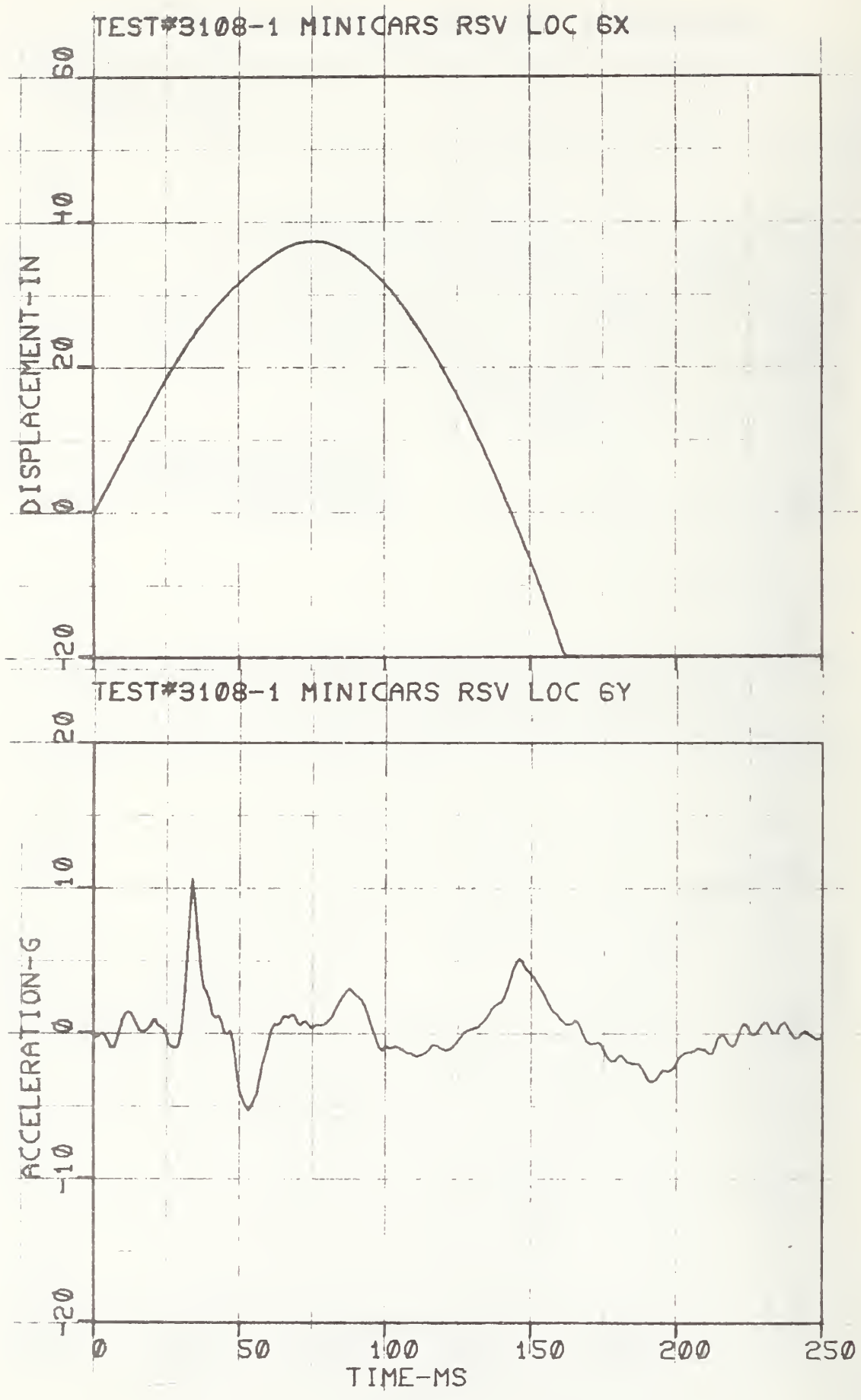

TEST#3108-1 MINICARS RSV LOC 3X
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

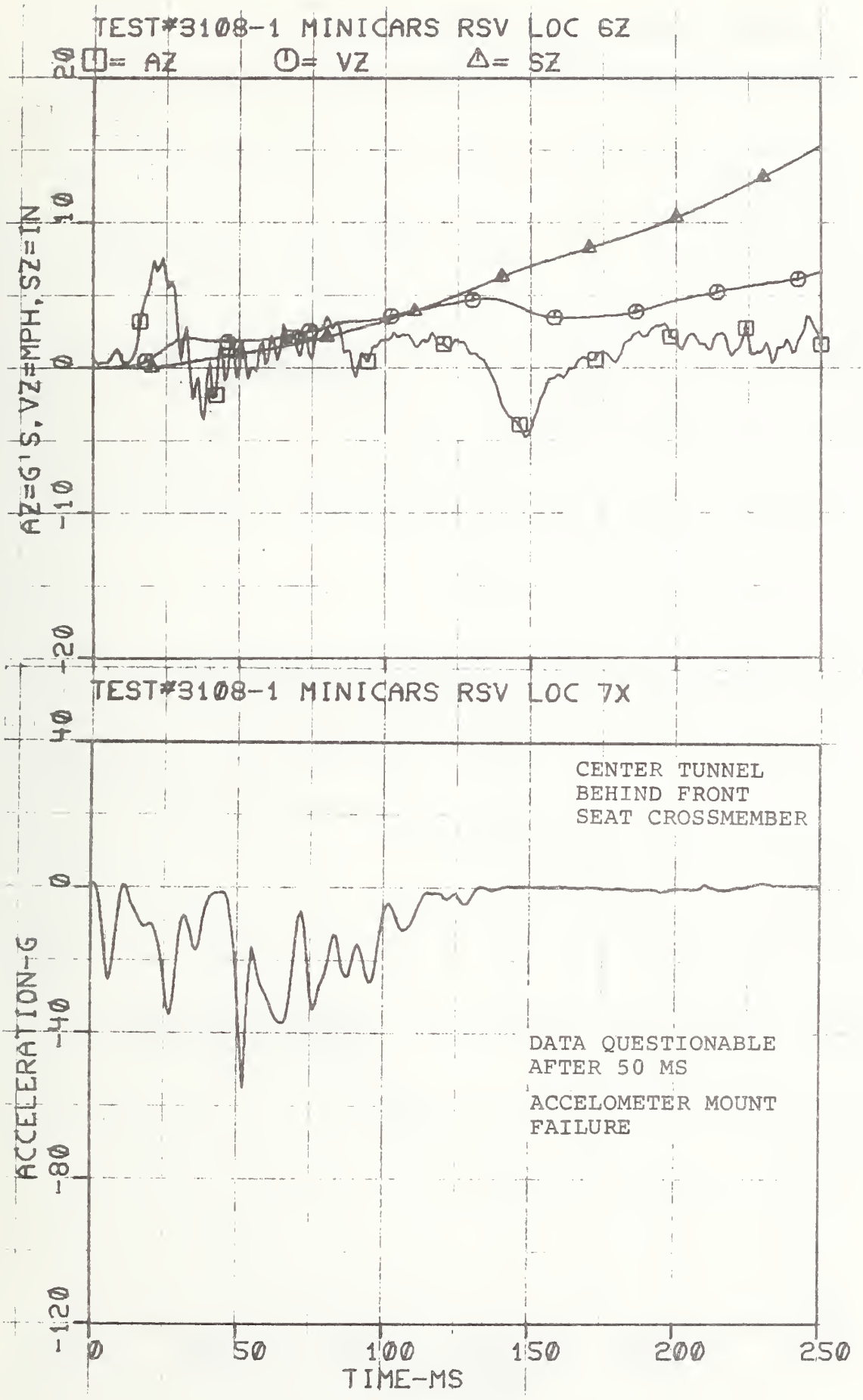

TEST#3108-1 MINICARS RSV LOC SX
INSIDE COMPARTMENT
FRONT FIREWALL
RIGHT OF TUNNEL
ACCELERATION-G
40
0
-40
-80
-120
TEST#3108-1 MINICARS RSV LOC SX
60
40
20
0
-20
VELOCITY-MPH
0
50
100
150
200
250
TIME-MS

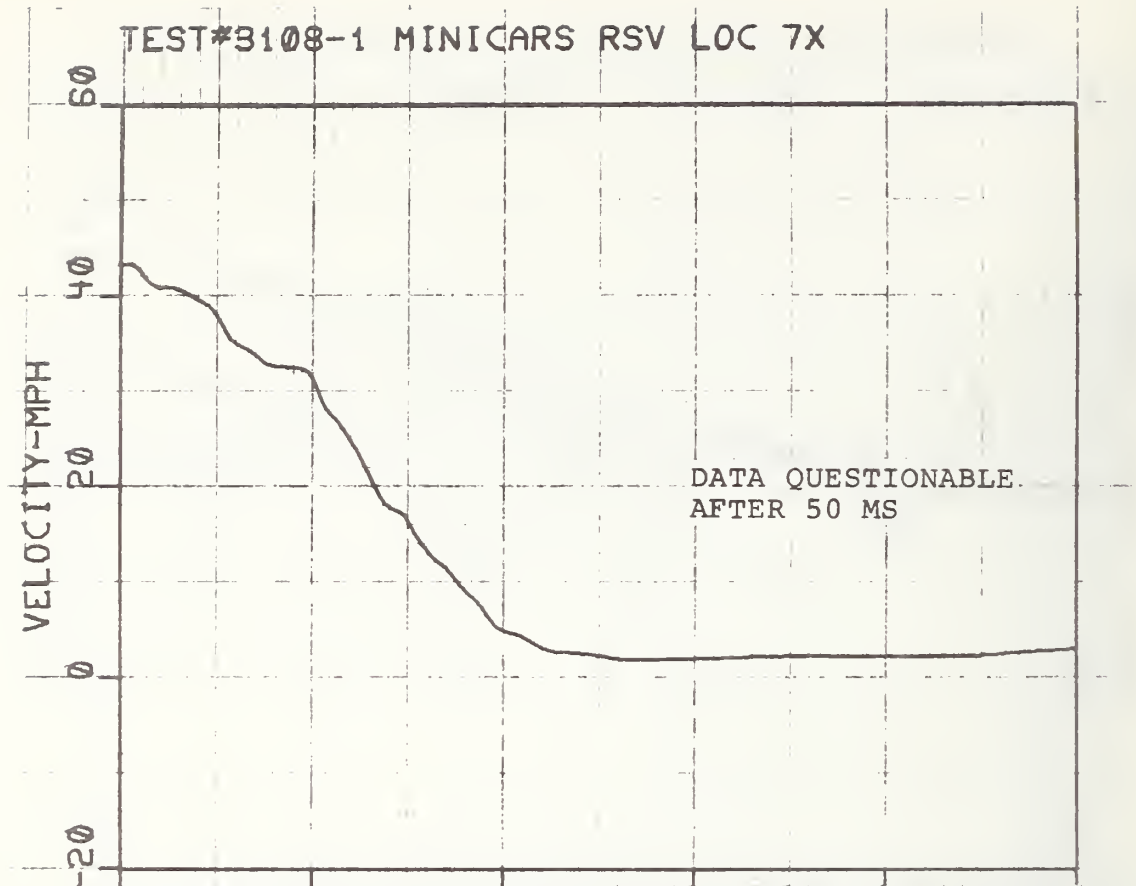

TEST#3108-1 MINICARS RSV LOC 5X
DISPLACEMENT-IN
60
40
20
0
-20

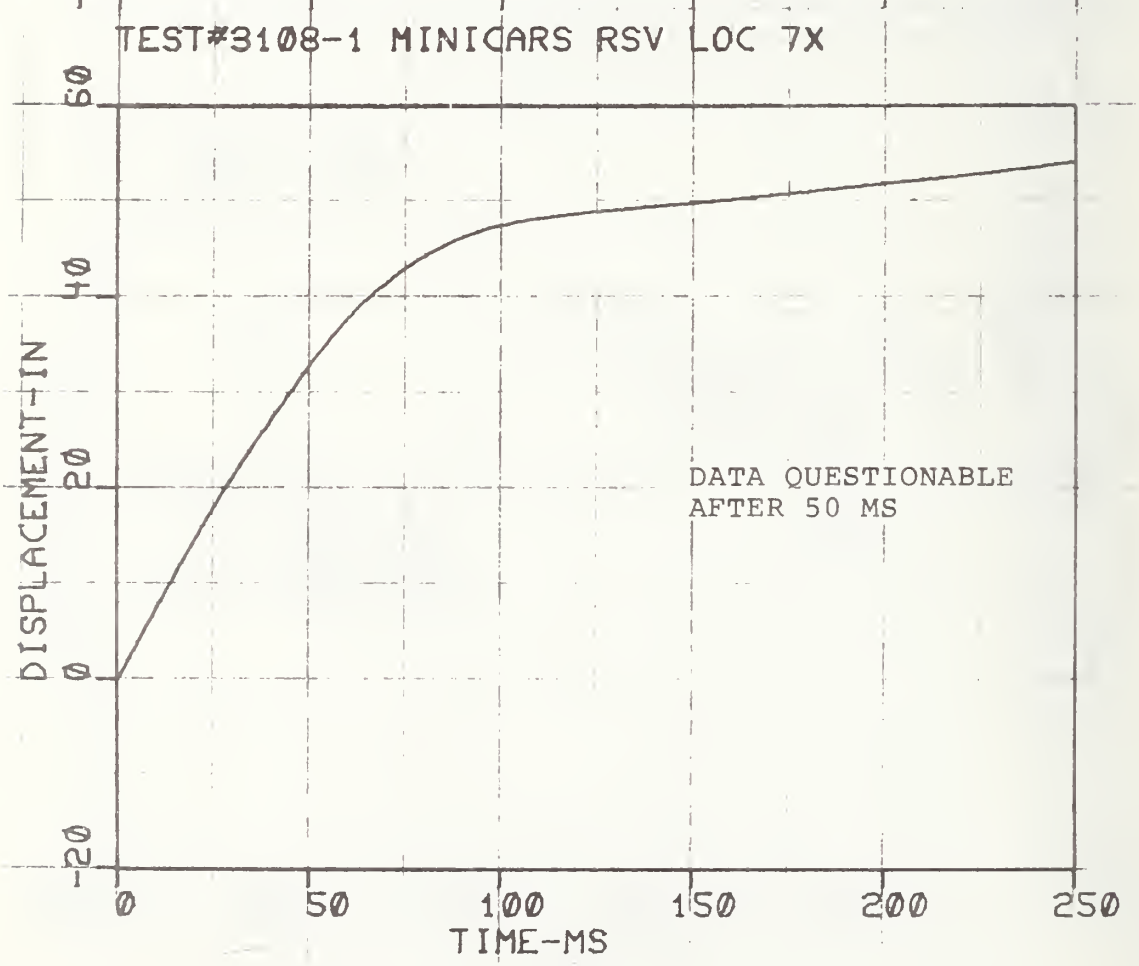

TEST#3108-1 MINICARS RSV LOC 5Z
ACCELERATION-G
80
40
0
-40
-80
0
50
100
150
200
250
TIME-MS

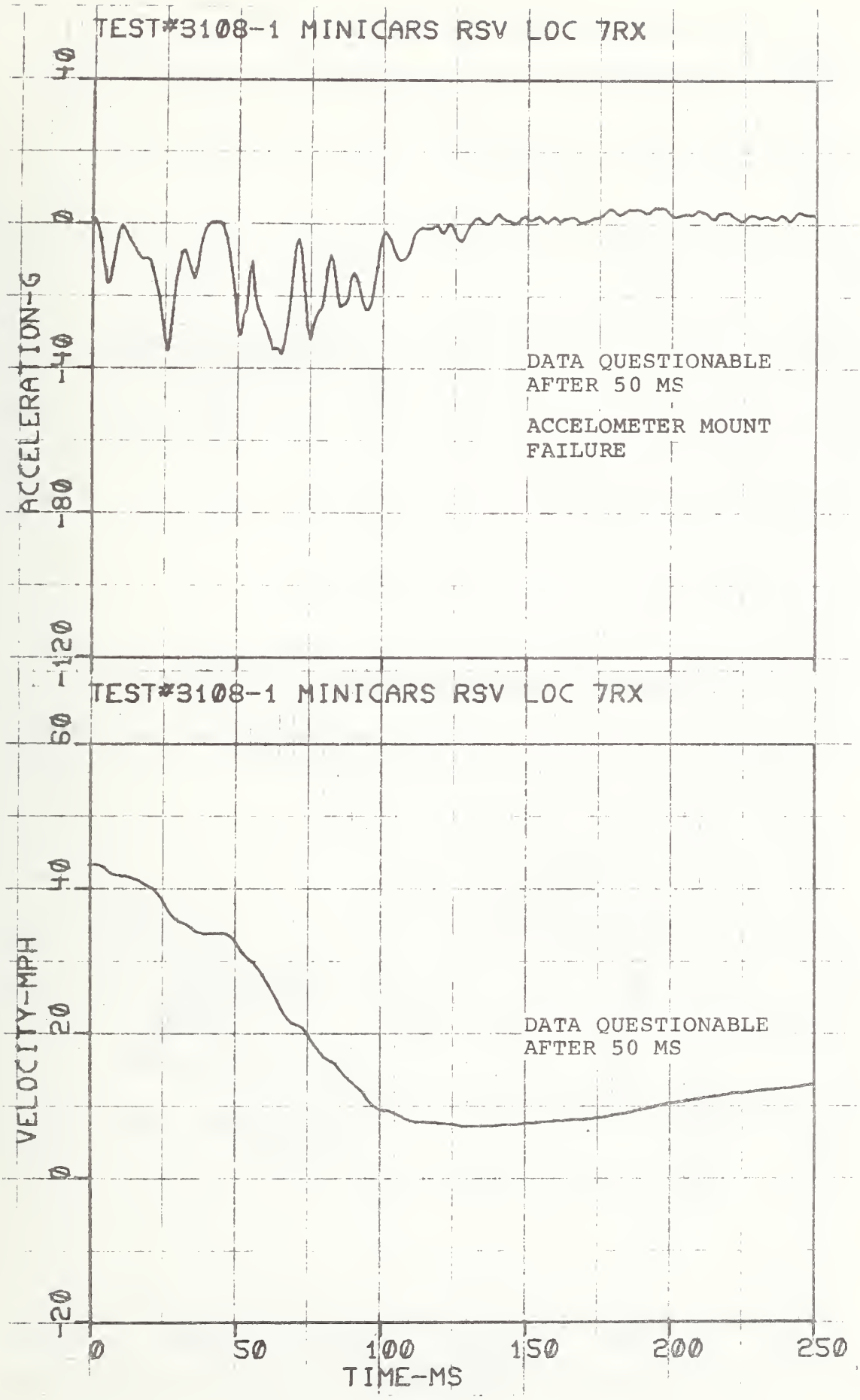

TEST#3108-1 MINICARS RSV LOC 6X
TOP OF ENGINE
ACCELERATION-G
40
0
-40
-80
-120
LONGITUDINAL DATA
QUESTIONABLE-APPARENT
ZERO SHIFT
TEST#3108-1 MINICARS RSV LOC 6X
60
40
20
0
-20
VELOCITY-MPH
0
50
100
150
200
250
TIME-MS

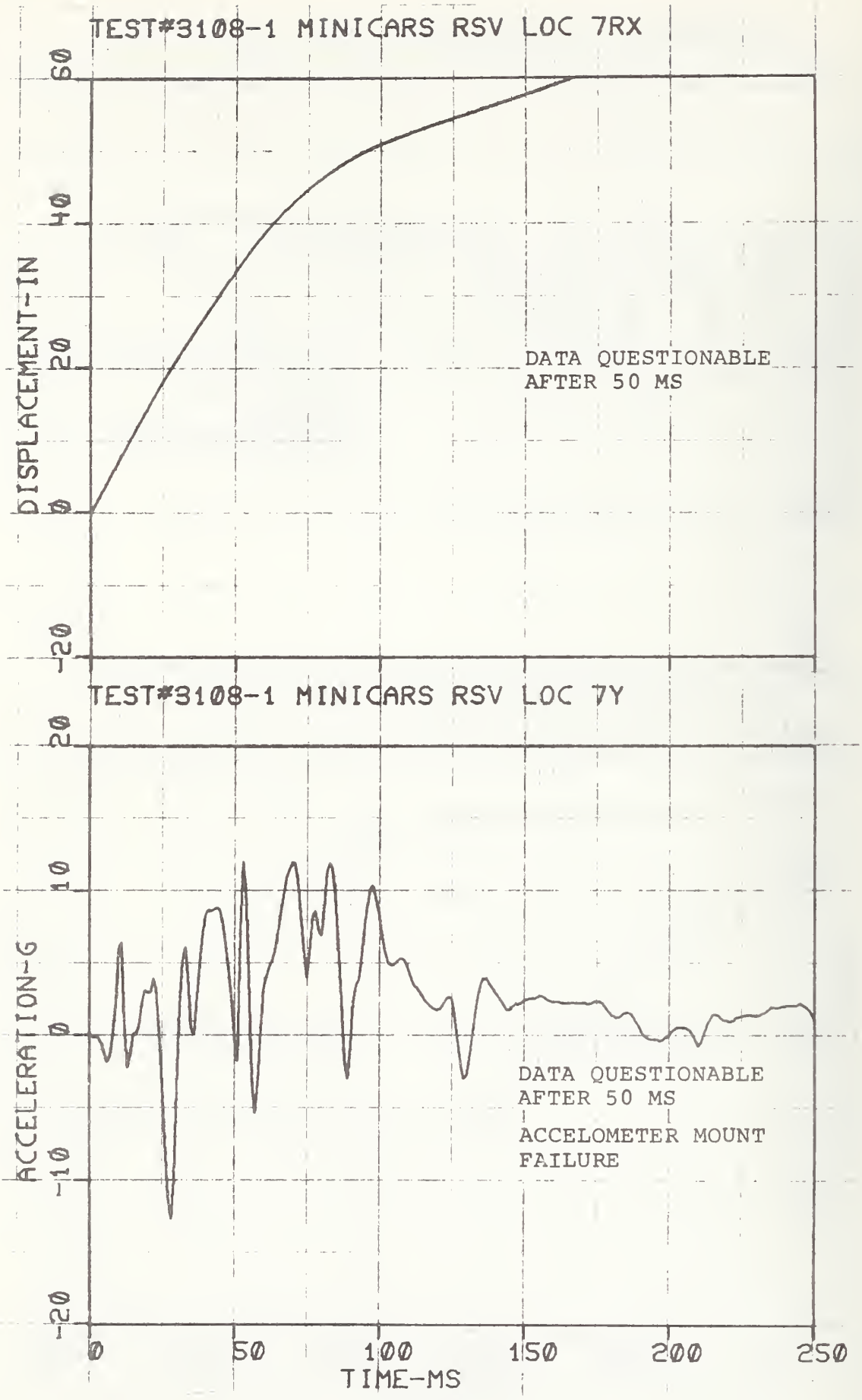

TEST#3108-1 MINICARS RSV LOC 6X
DISPLACEMENT-IN
60
40
20
0
-20
TEST#3108-1 MINICARS RSV LOC 6Y
ACCELERATION-G
20
10
0
-10
-20
0
50
100
150
200
250
TIME-MS

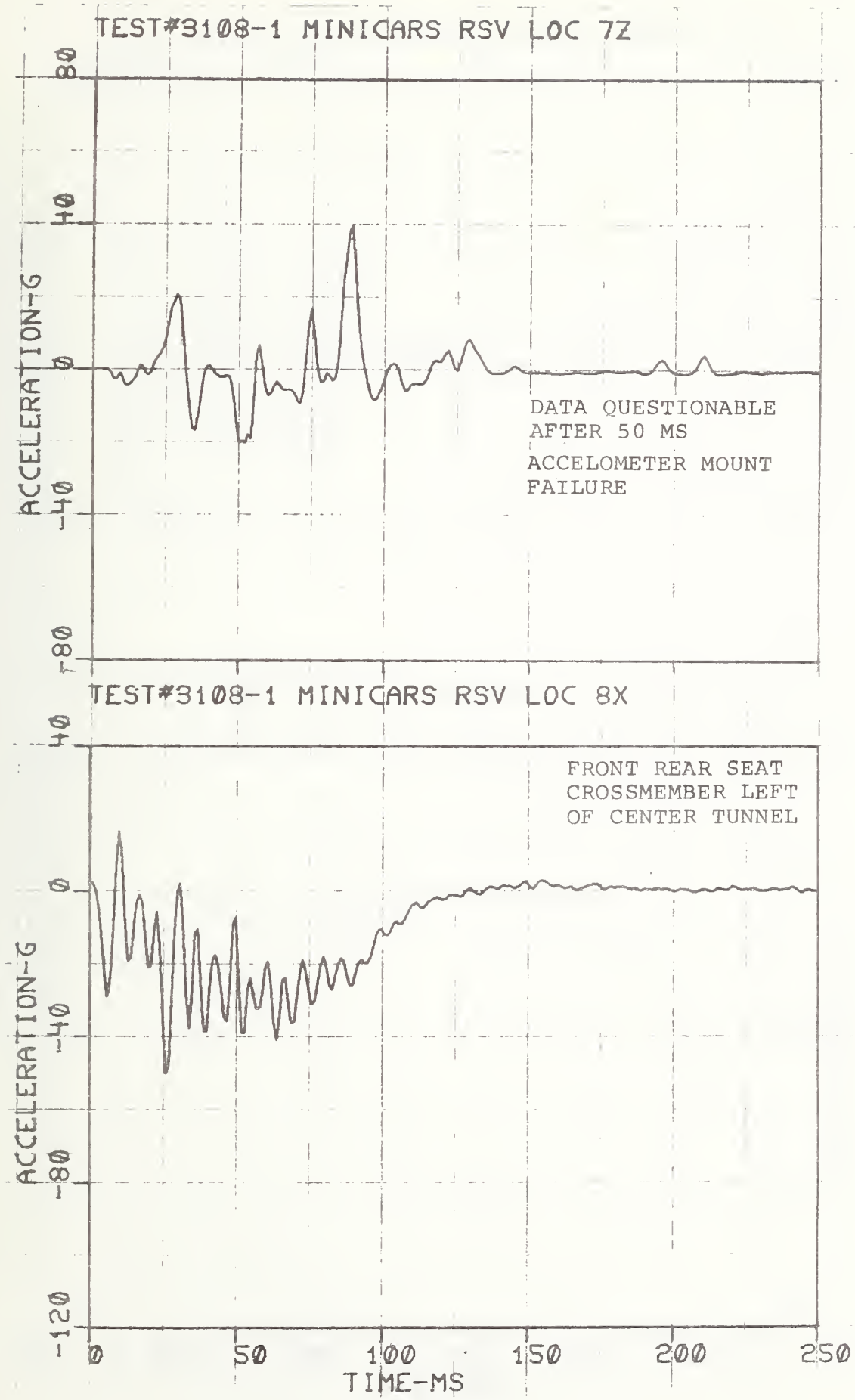

TEST#3108-1 MINICARS RSV LOC 6Z
□= AZ
○= VZ
△= SZ
AZ=G'S, VZ=MPH, SZ=IN
20
10
0
-10
-20
TEST#3108-1 MINICARS RSV LOC 7X
CENTER TUNNEL
BEHIND FRONT
SEAT CROSSMEMBER
DATA QUESTIONABLE
AFTER 50 MS
ACCELOMETER MOUNT
FAILURE
ACCELERATION-G
40
0
-40
-80
-120
0
50
100
150
200
250
TIME-MS

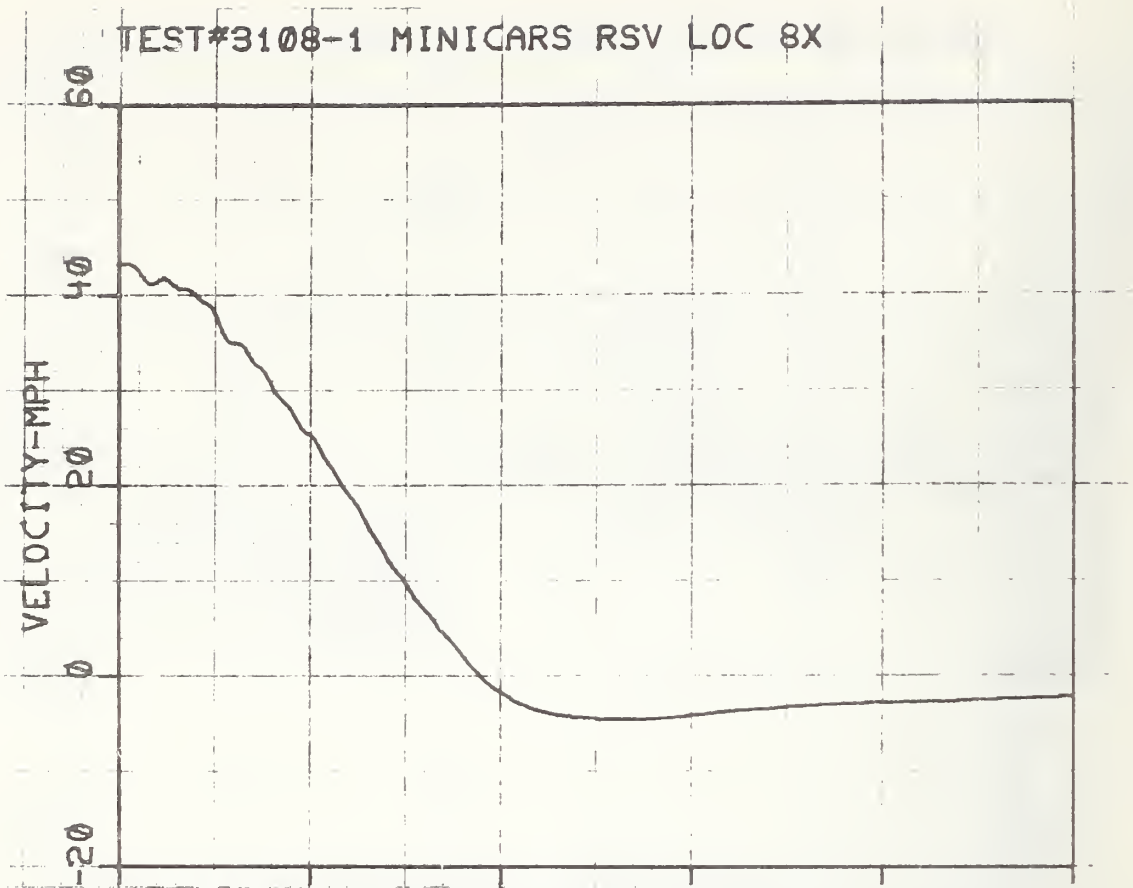

TEST#3108-1 MINICARS RSV LOC 7X
VELOCITY-MPH
60
40
20
0
-20
DATA QUESTIONABLE
AFTER 50 MS

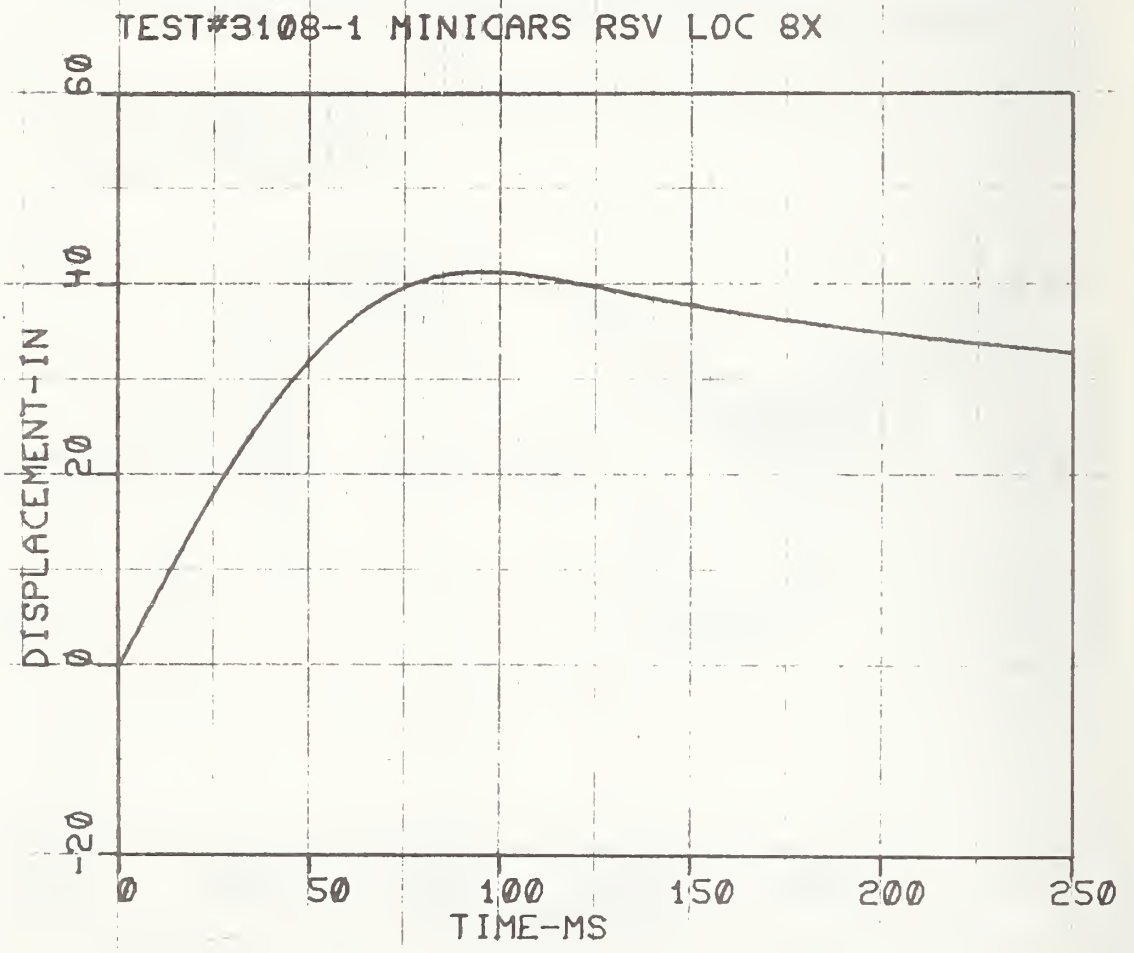

TEST#3108-1 MINICARS RSV LOC 7X
DISPLACEMENT-IN
60
40
20
0
-20
DATA QUESTIONABLE
AFTER 50 MS
0
50
100
150
200
250
TIME-MS

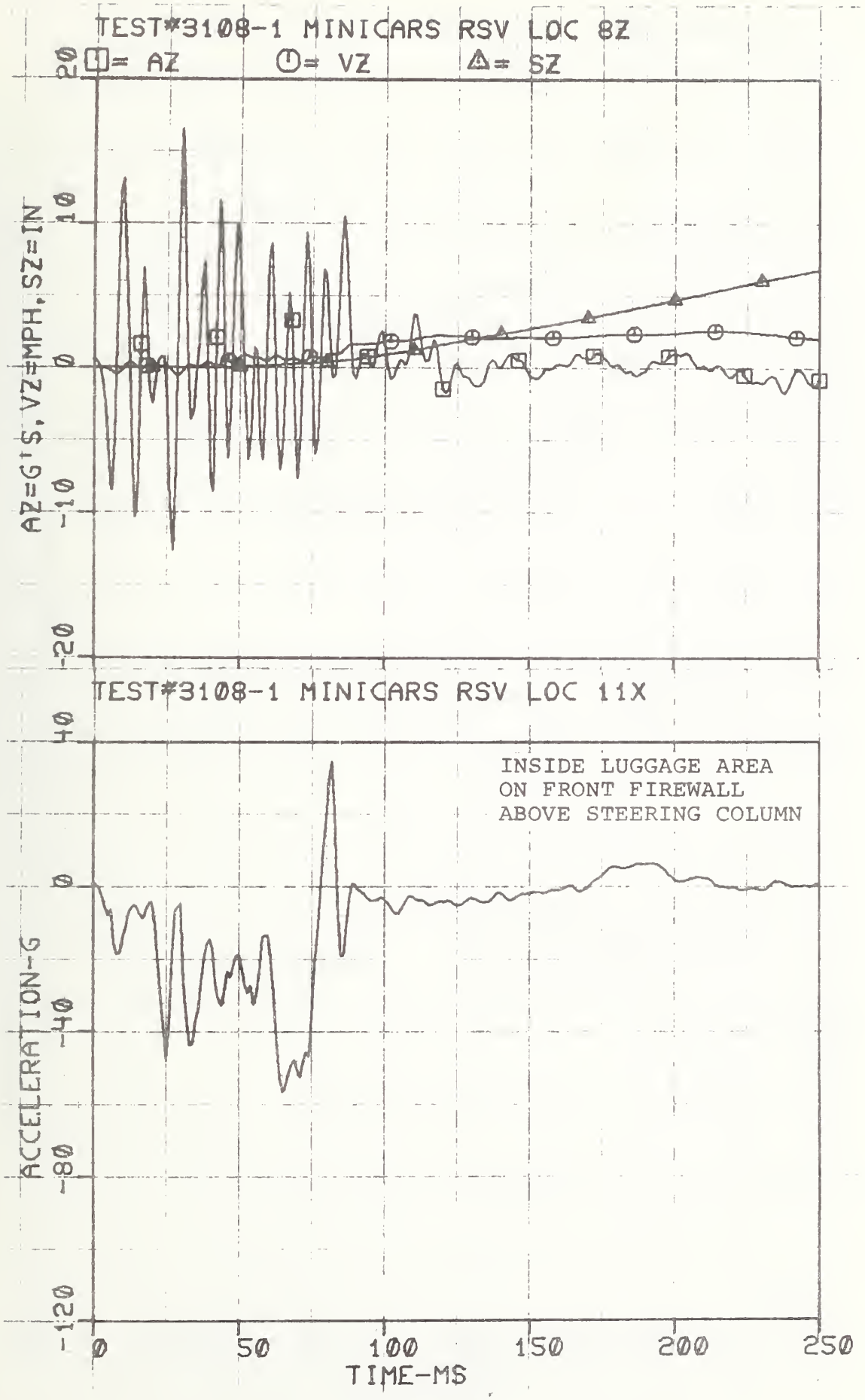

TEST#3108-1 MINICARS RSV LOC 7RX
40
0
-40
-80
-120
ACCELERATION-G
DATA QUESTIONABLE
AFTER 50 MS
ACCELOMETER MOUNT
FAILURE
TEST#3108-1 MINICARS RSV LOC 7RX
60
40
20
0
-20
VELOCITY-MPH
DATA QUESTIONABLE
AFTER 50 MS
0
50
100
150
200
250
TIME-MS

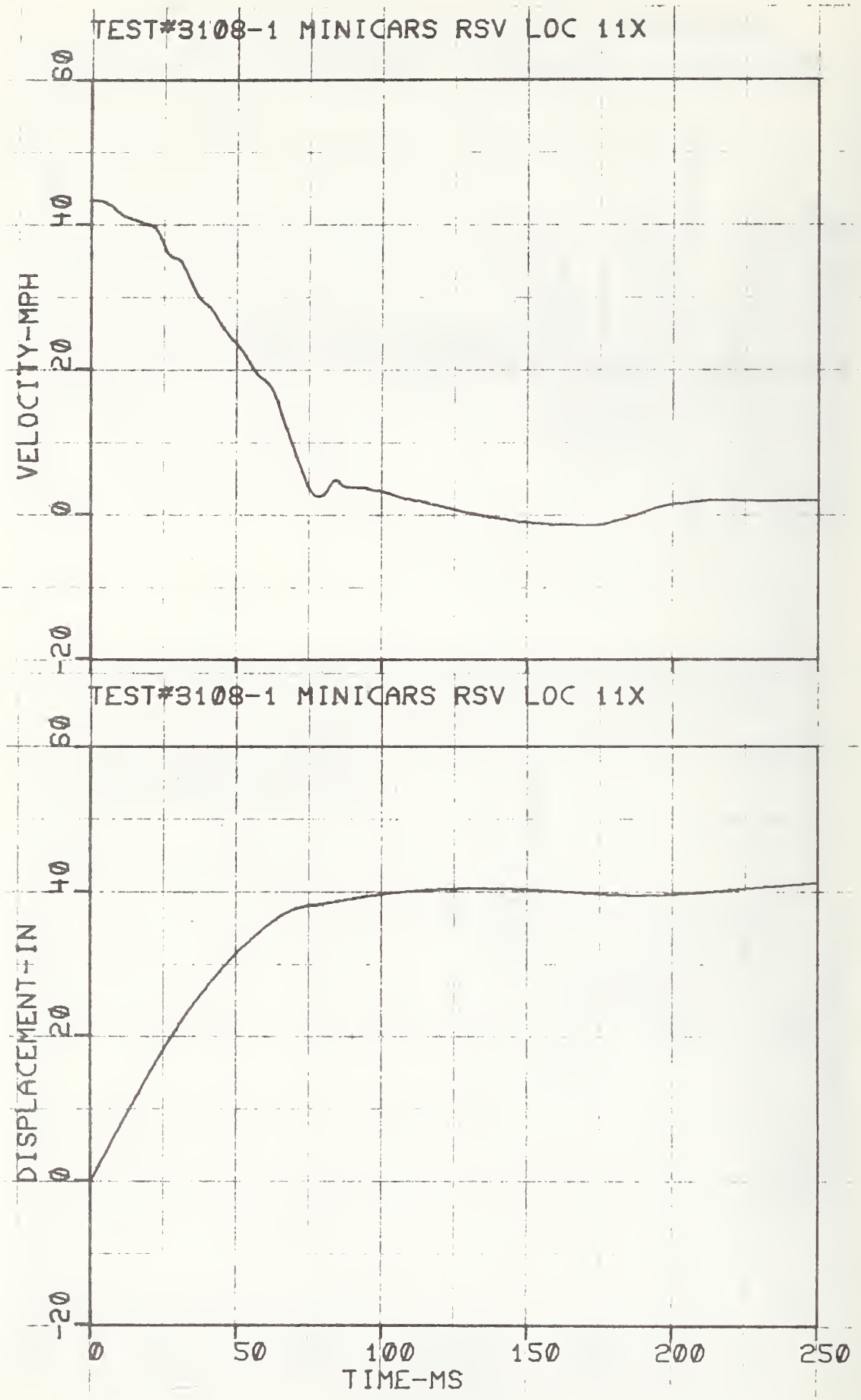

TEST#3108-1 MINICARS RSV LOC 7RX
DISPLACEMENT-IN
60
40
20
0
-20
DATA QUESTIONABLE
AFTER 50 MS
TEST#3108-1 MINICARS RSV LOC 7Y
ACCELERATION-G
20
10
0
-10
-20
DATA QUESTIONABLE
AFTER 50 MS
ACCELOMETER MOUNT
FAILURE
0
50
100
150
200
250
TIME-MS

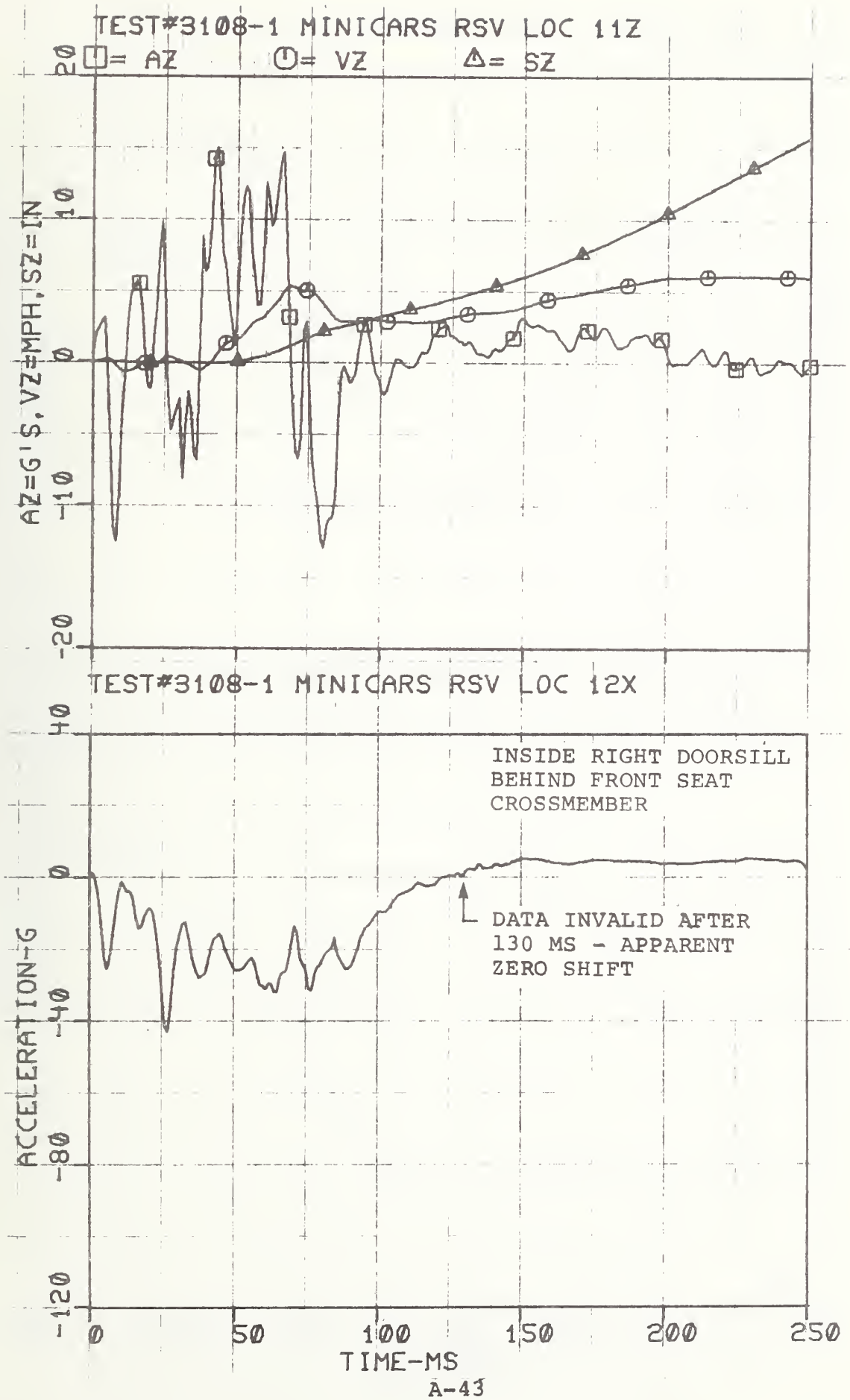

TEST#3108-1 MINICARS RSV LOC 7Z
80
40
0
-40
-80
ACCELERATION-G
DATA QUESTIONABLE
AFTER 50 MS
ACCELOMETER MOUNT
FAILURE
TEST#3108-1 MINICARS RSV LOC 8X
40
0
-40
-80
-120
ACCELERATION-G
FRONT REAR SEAT
CROSSMEMBER LEFT
OF CENTER TUNNEL
0
50
100
150
200
250
TIME-MS

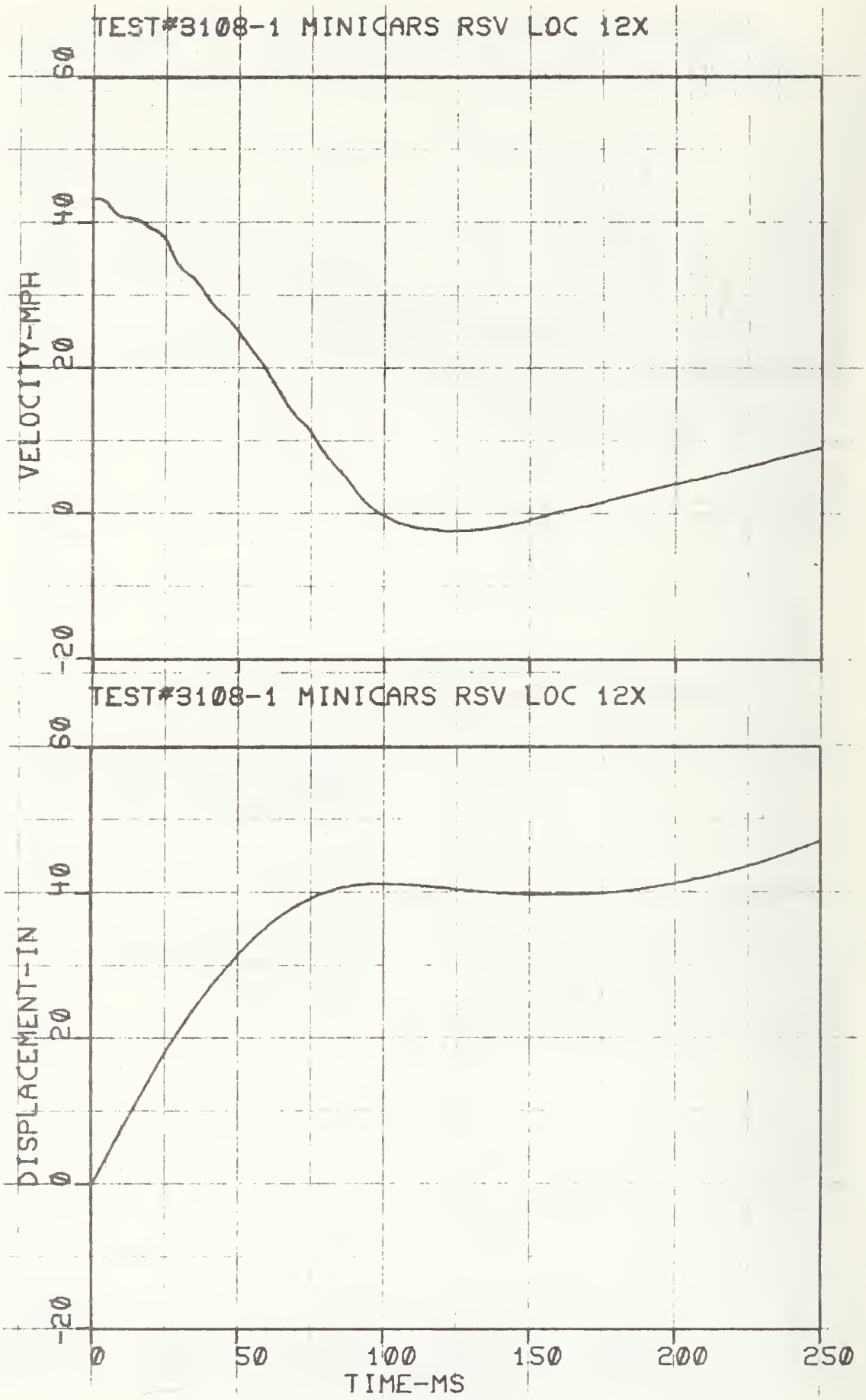

TEST#3108-1 MINICARS RSV LOC 8X
VELOCITY-MPH
60
40
20
0
-20

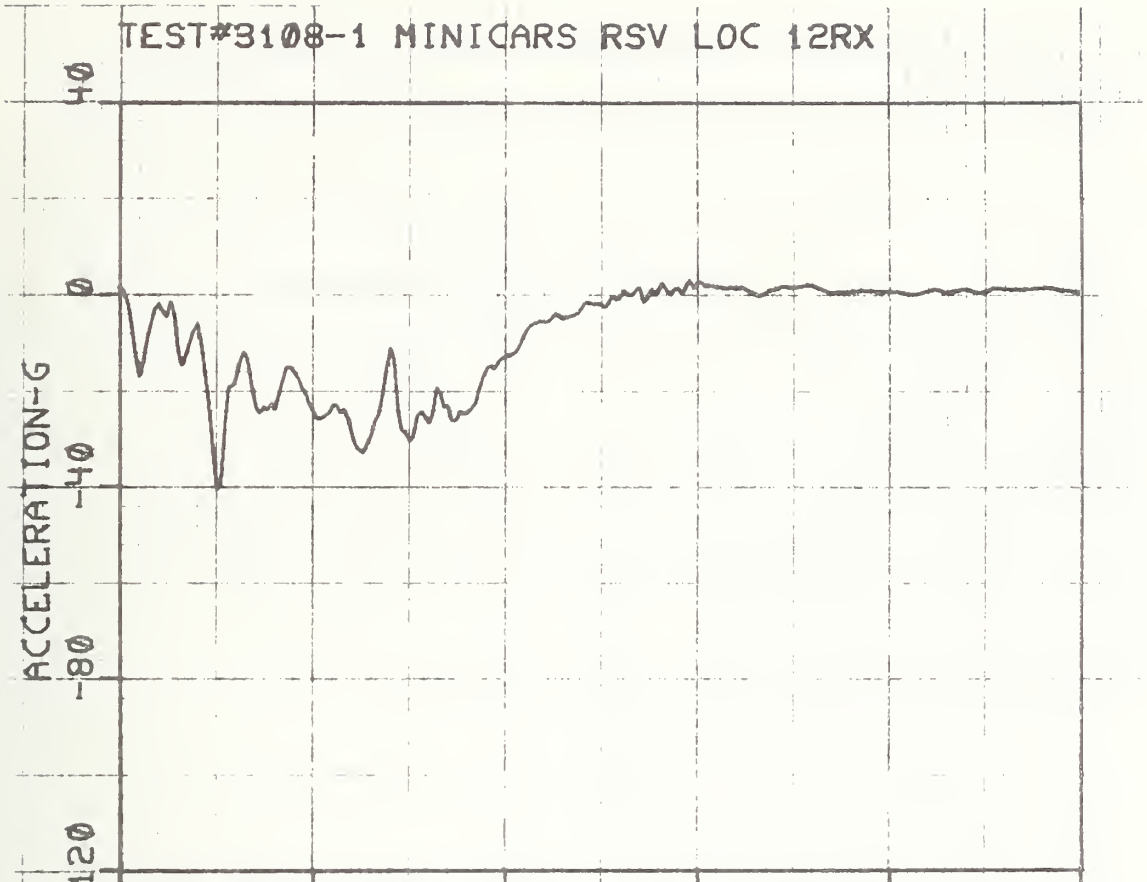

TEST#3108-1 MINICARS RSV LOC 8X
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

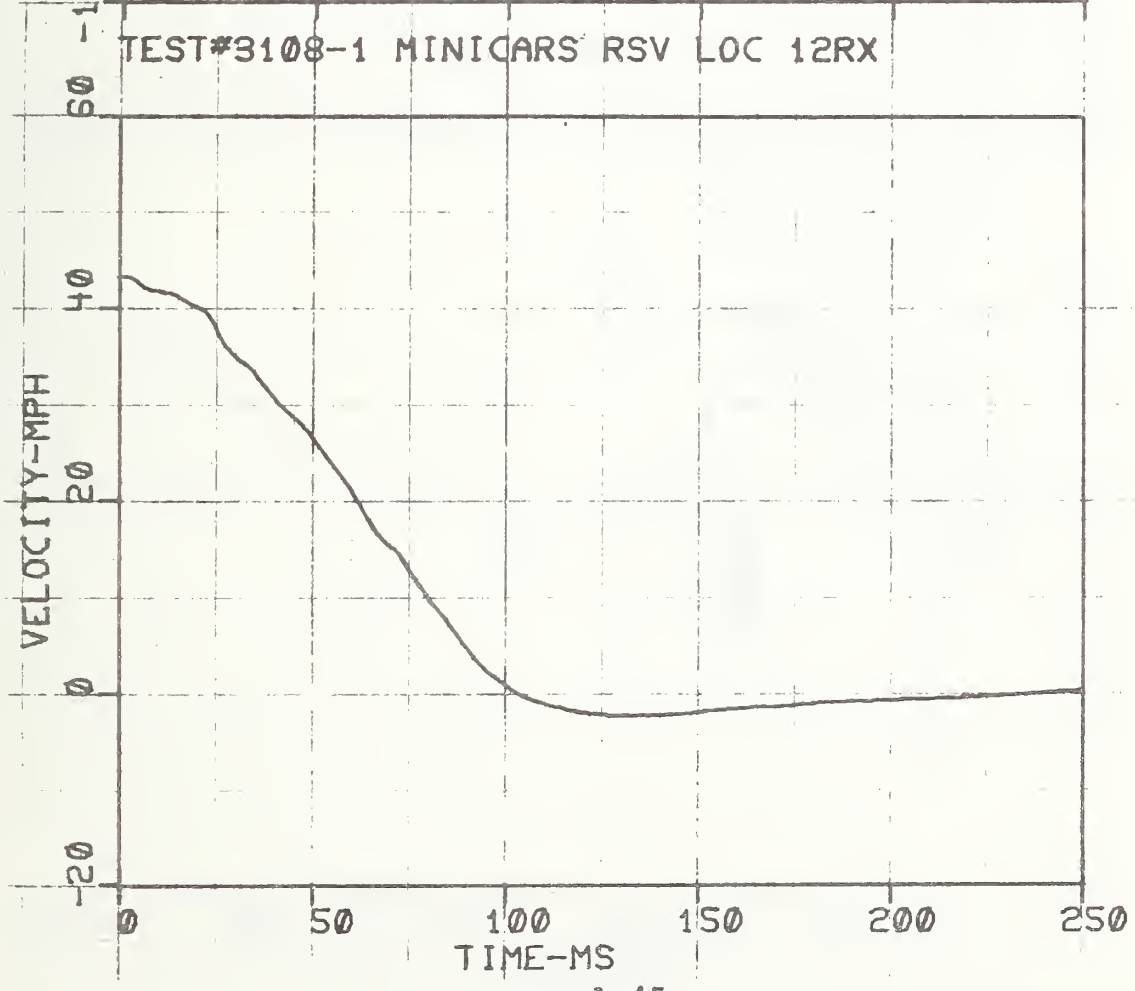

TEST#3108-1 MINICARS RSV LOC 8Z
□= AZ
①= VZ
△= SZ
AZ=G'S, VZ=MPH, SZ=IN
20
10
0
-10
-20
TEST#3108-1 MINICARS RSV LOC 11X
INSIDE LUGGAGE AREA
ON FRONT FIREWALL
ABOVE STEERING COLUMN
ACCELERATION-G
40
0
-40
-80
-120
0
50
100
150
200
250
TIME-MS

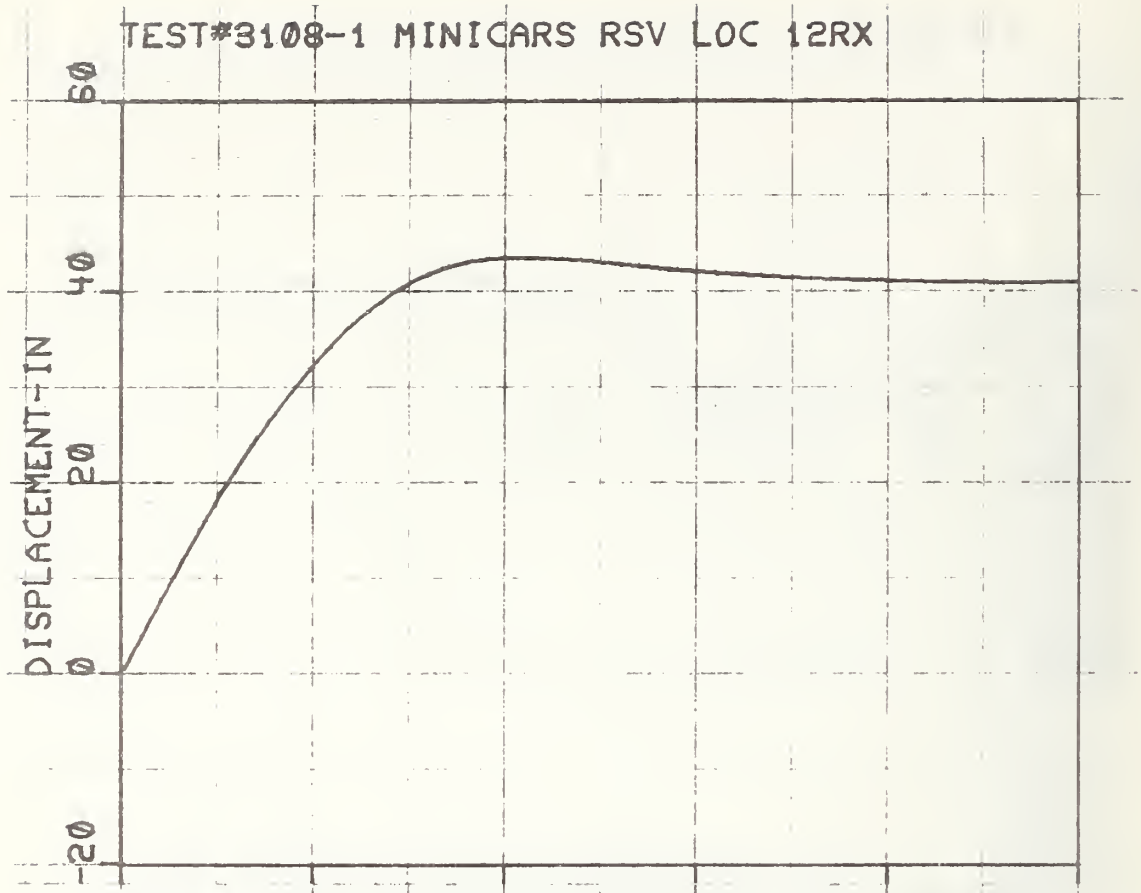

TEST#3108-1 MINICARS RSV LOC 11X
VELOCITY-MPH
60
40
20
0
-20
TEST#3108-1 MINICARS RSV LOC 11X
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

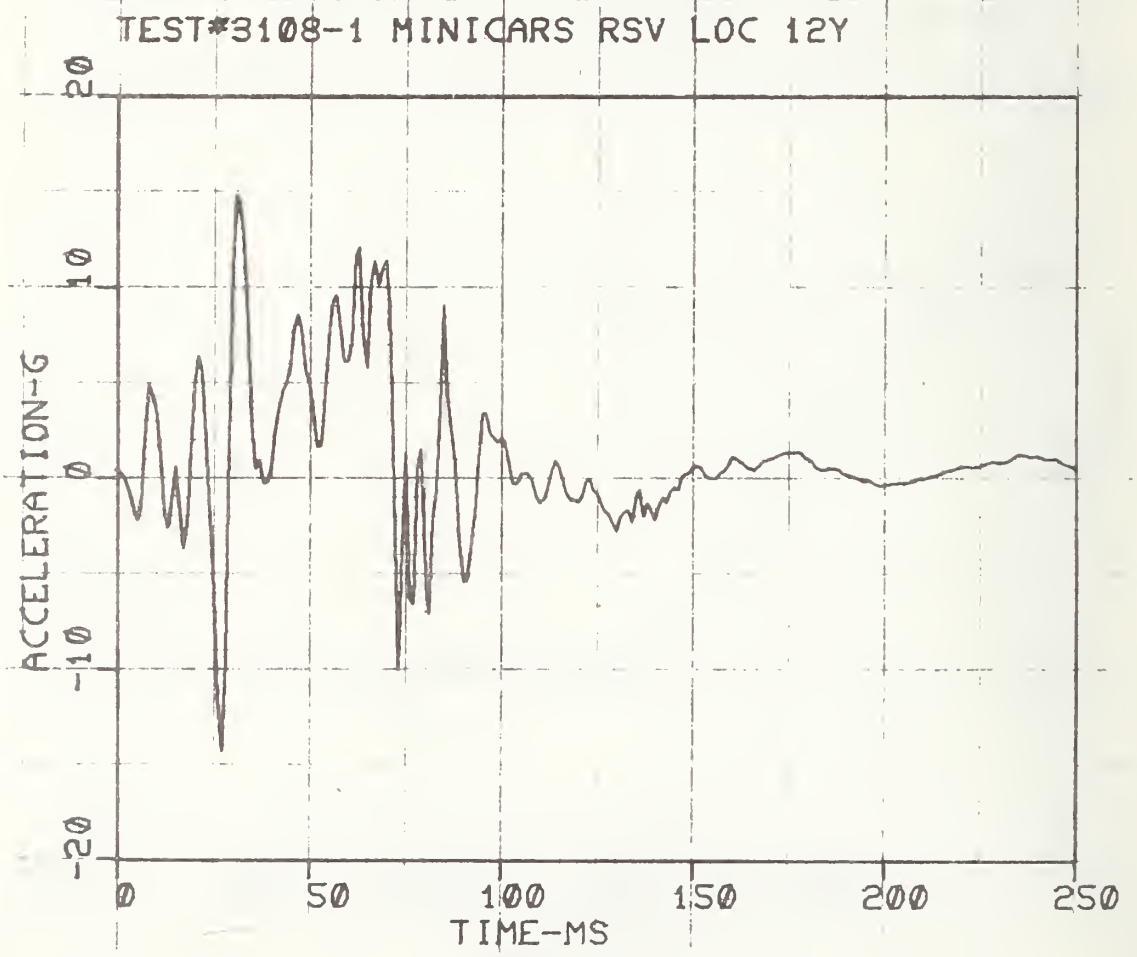

TEST#3108-1 MINICARS RSV LOC 11Z
□= AZ
○= VZ
△= SZ
AZ=G'S, VZ=MPH, SZ=IN
20
10
0
-10
-20
TEST#3108-1 MINICARS RSV LOC 12X
INSIDE RIGHT DOORSILL
BEHIND FRONT SEAT
CROSSMEMBER
DATA INVALID AFTER
130 MS - APPARENT
ZERO SHIFT
ACCELERATION-G
40
0
-40
-80
-120
0
50
100
150
200
250
TIME-MS

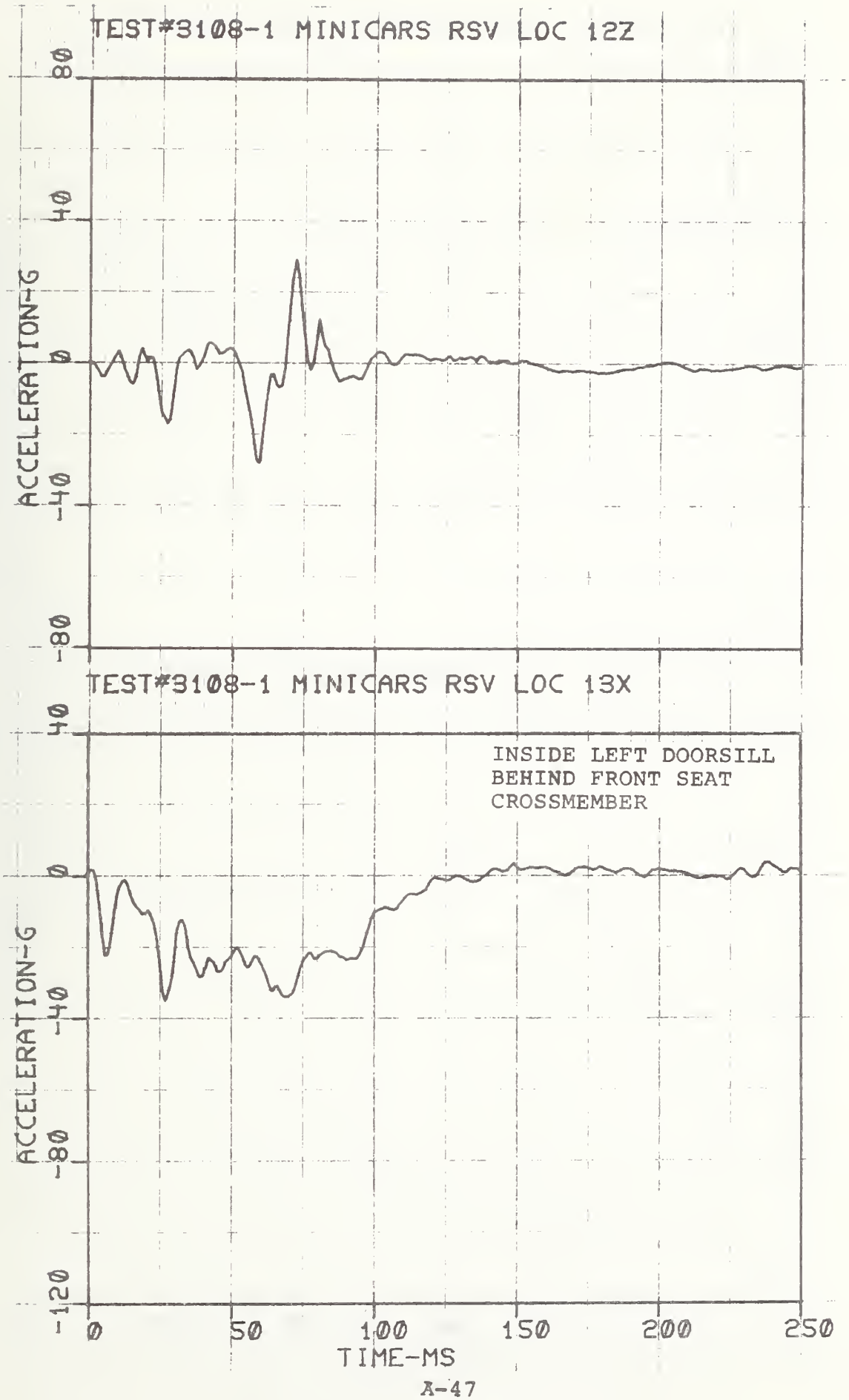

TEST#3108-1 MINICARS RSV LOC 12X
VELOCITY-MPH
60
40
20
0
-20
TEST#3108-1 MINICARS RSV LOC 12X
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

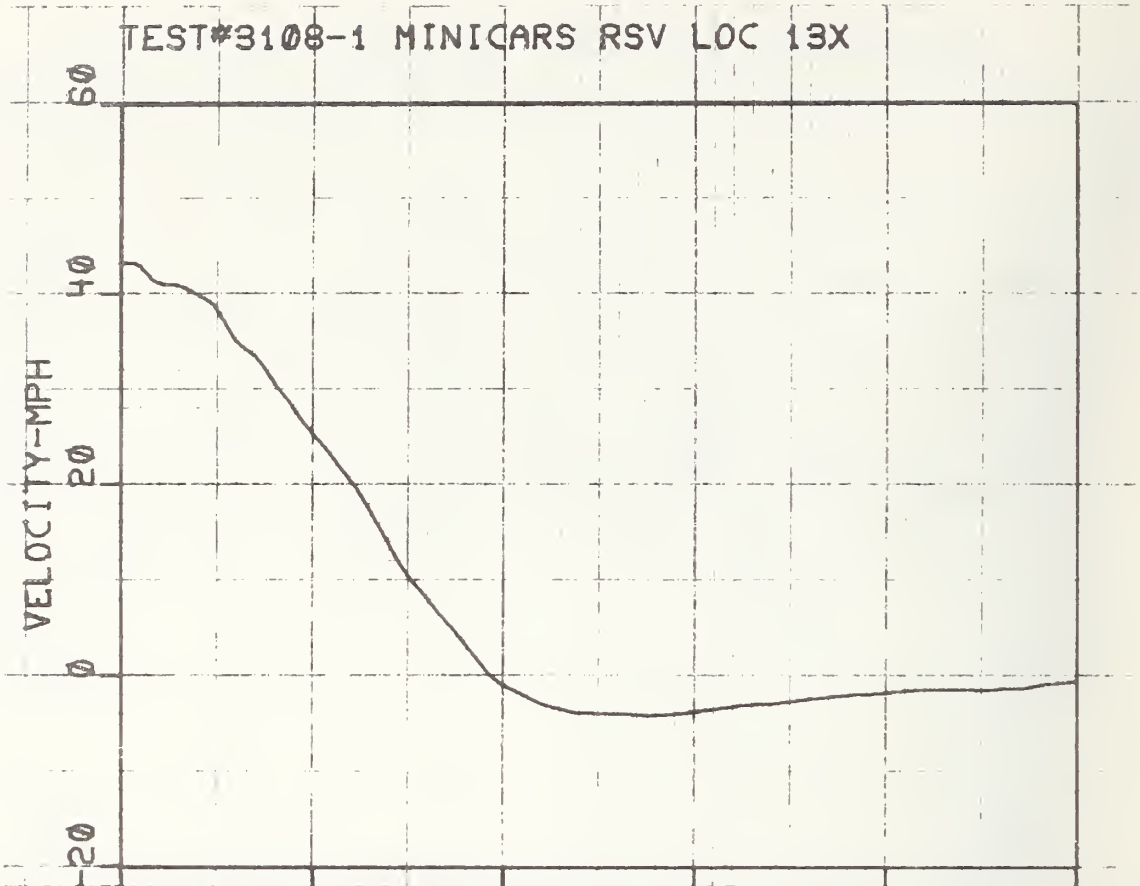

TEST#3108-1 MINICARS RSV LOC 12RX
40
0
-40
-80
-120
ACCELERATION-G

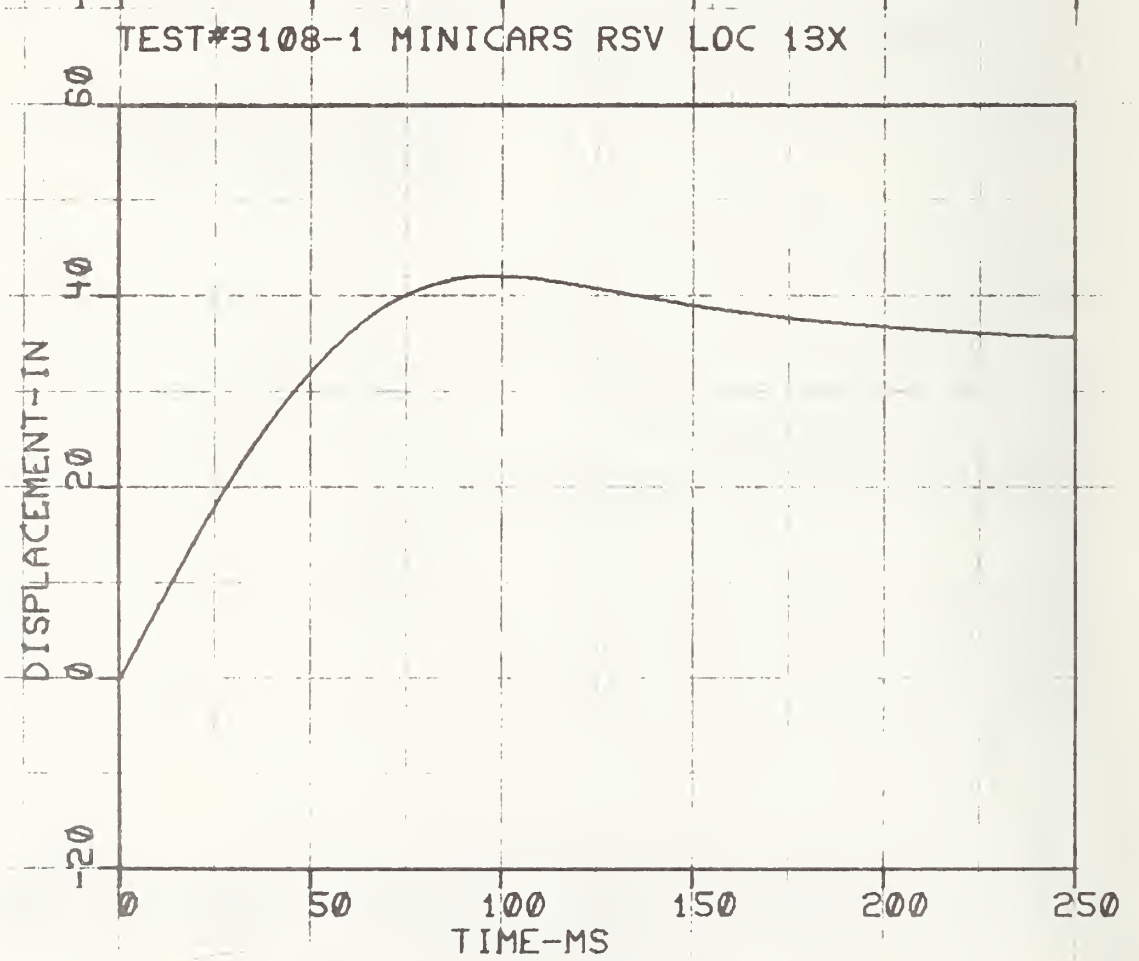

TEST#3108-1 MINICARS RSV LOC 12RX
60
40
20
0
-20
VELOCITY-MPH
0
50
100
150
200
250
TIME-MS

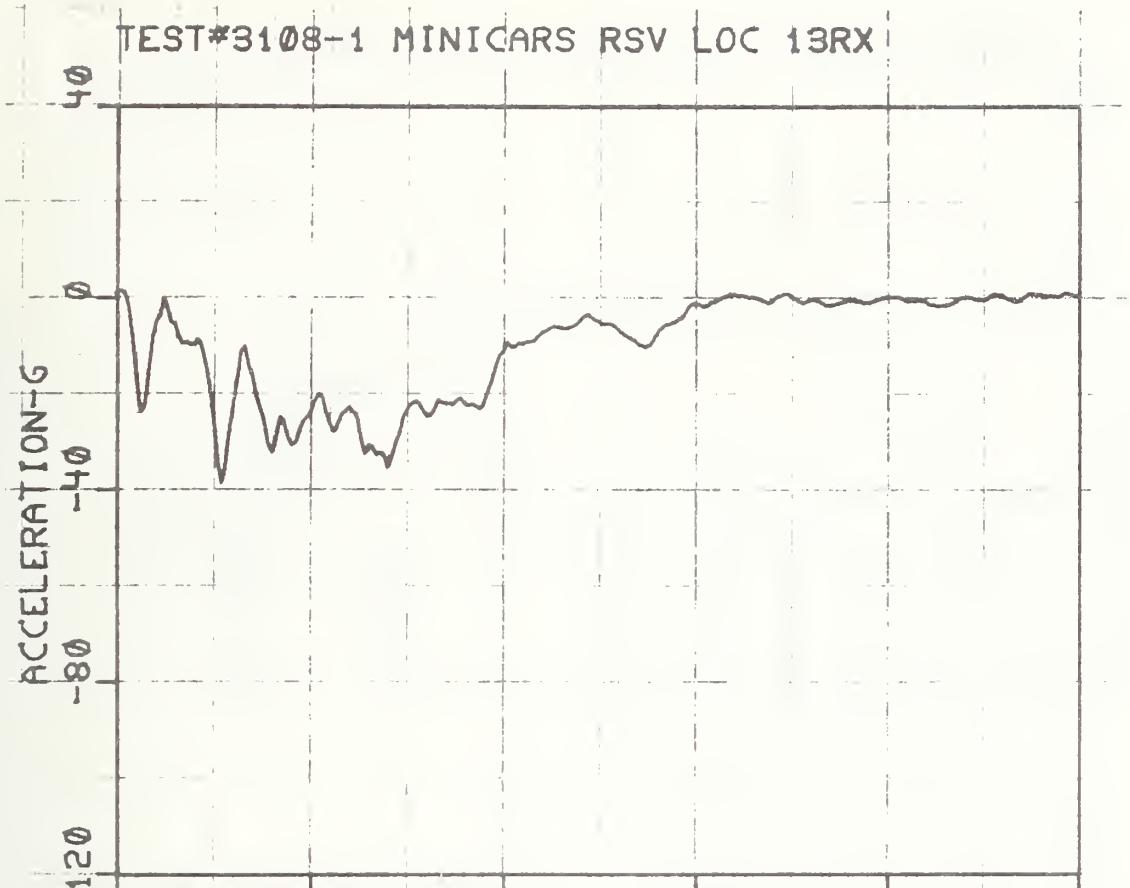

TEST#3108-1 MINICARS RSV LOC 12RX
DISPLACEMENT-IN
60
40
20
0
-20

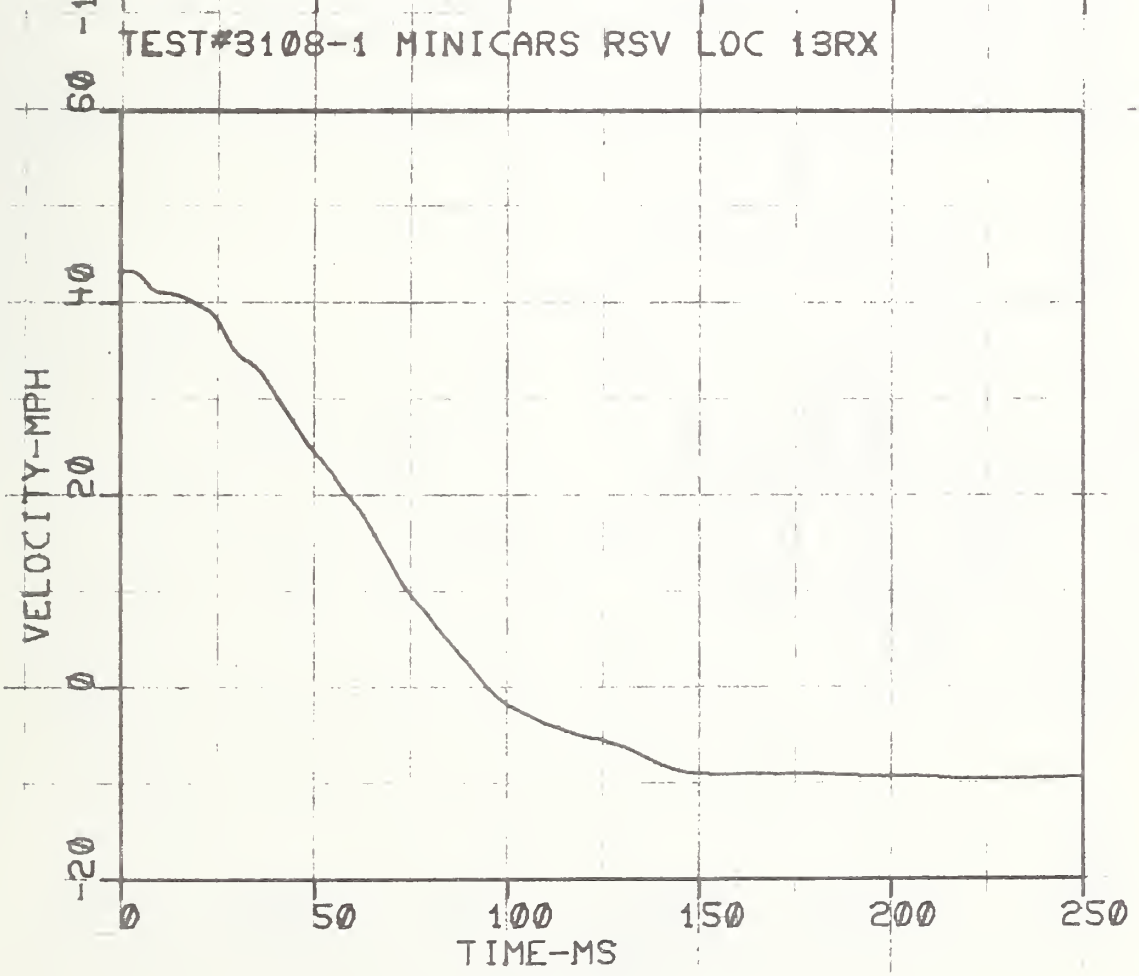

TEST#3108-1 MINICARS RSV LOC 12Y
ACCELERATION-G
20
10
0
-10
-20
0
50
100
150
200
250
TIME-MS

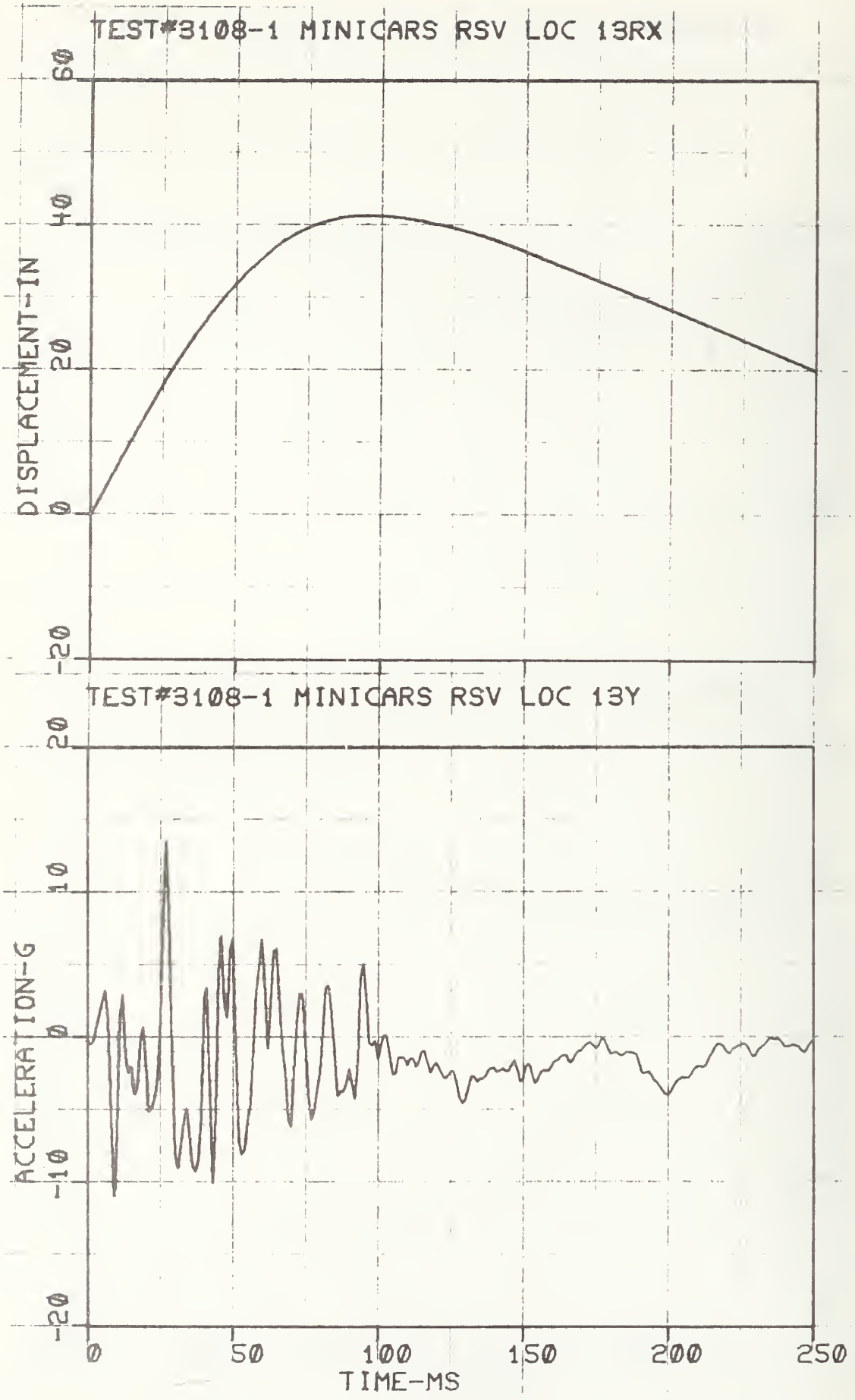

TEST#3108-1 MINICARS RSV LOC 12Z
80
40
0
-40
-80
ACCELERATION-G
TEST#3108-1 MINICARS RSV LOC 13X
INSIDE LEFT DOORSILL
BEHIND FRONT SEAT
CROSSMEMBER
40
0
-40
-80
-120
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

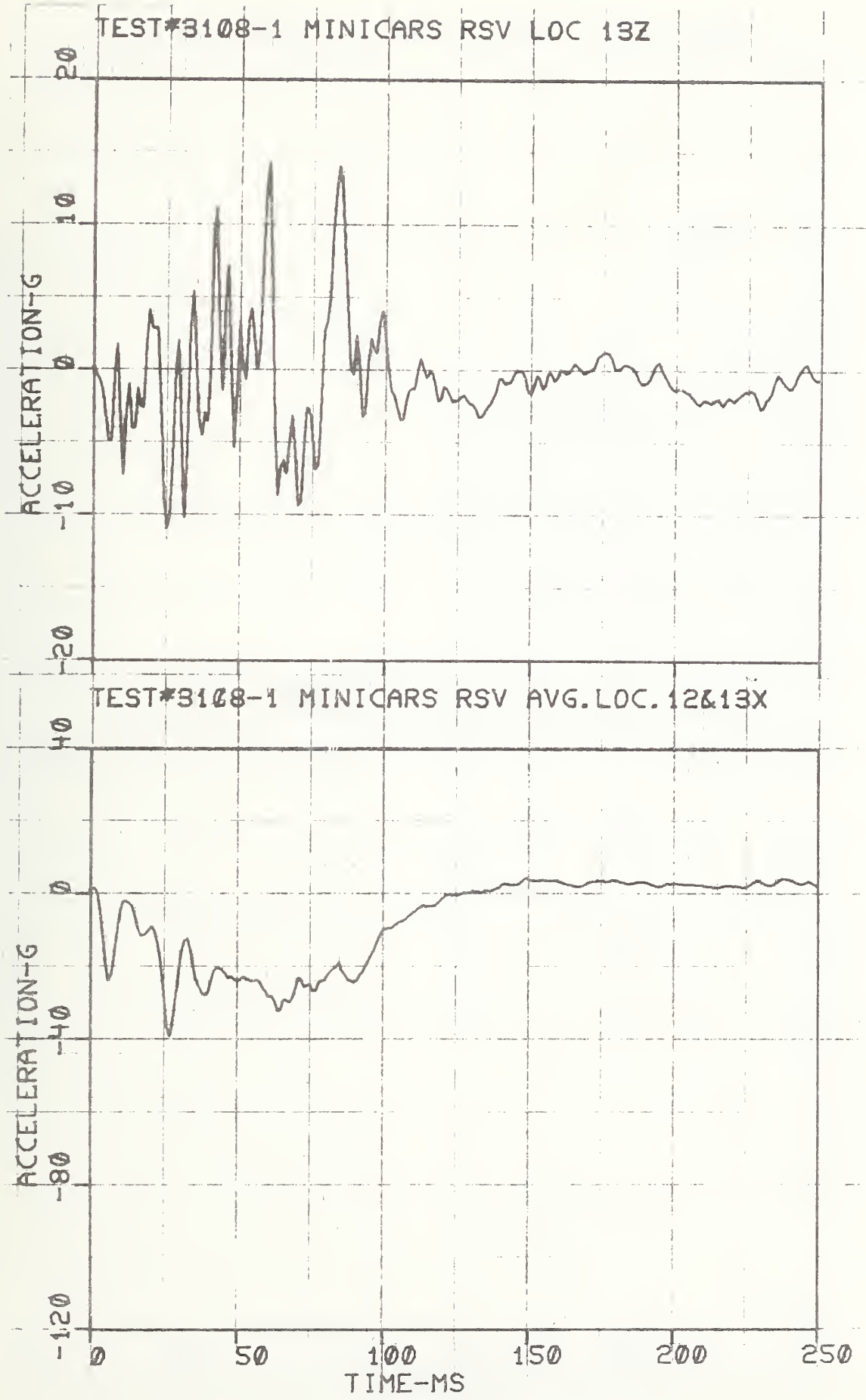

TEST#3108-1 MINICARS RSV LOC 13X
60
40
20
0
-20
VELOCITY-MPH

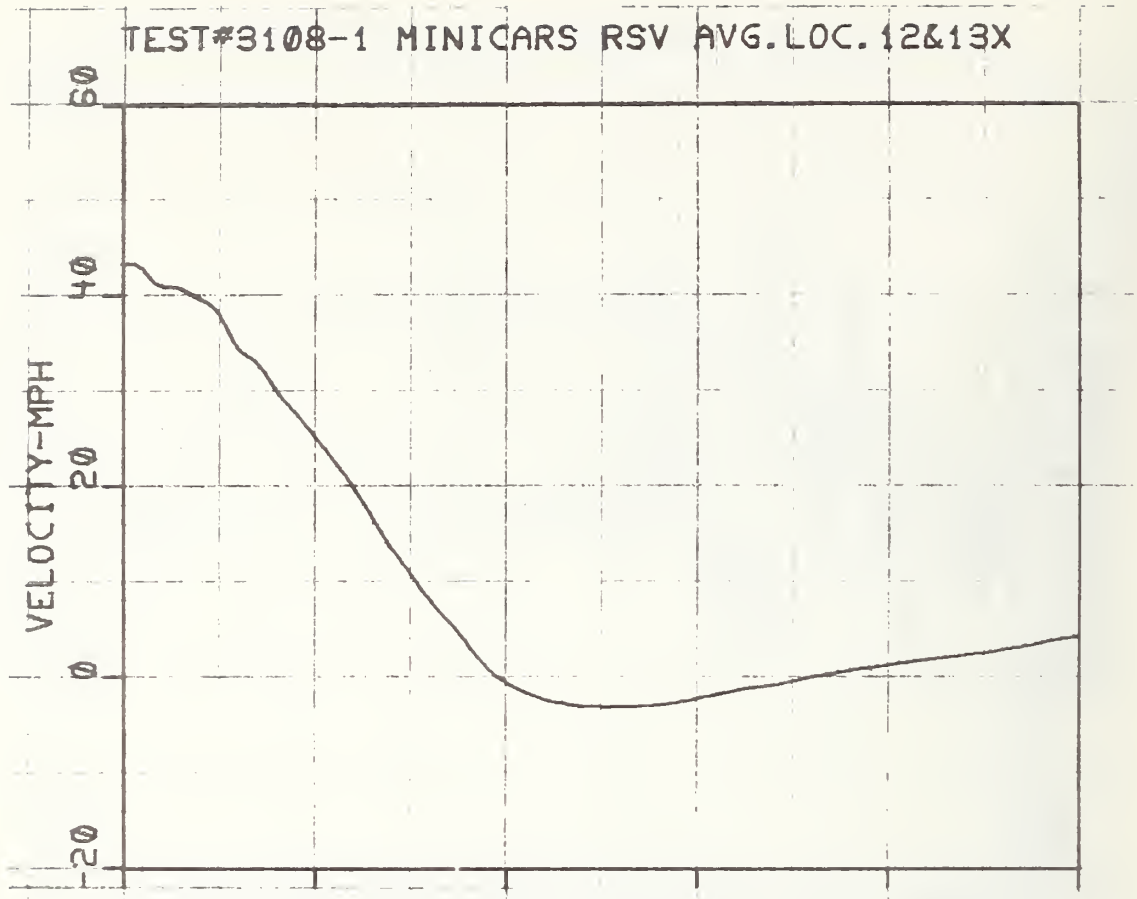

TEST#3108-1 MINICARS RSV LOC 13X
60
40
20
0
-20
DISPLACEMENT-IN
0
50
100
150
200
250
TIME-MS

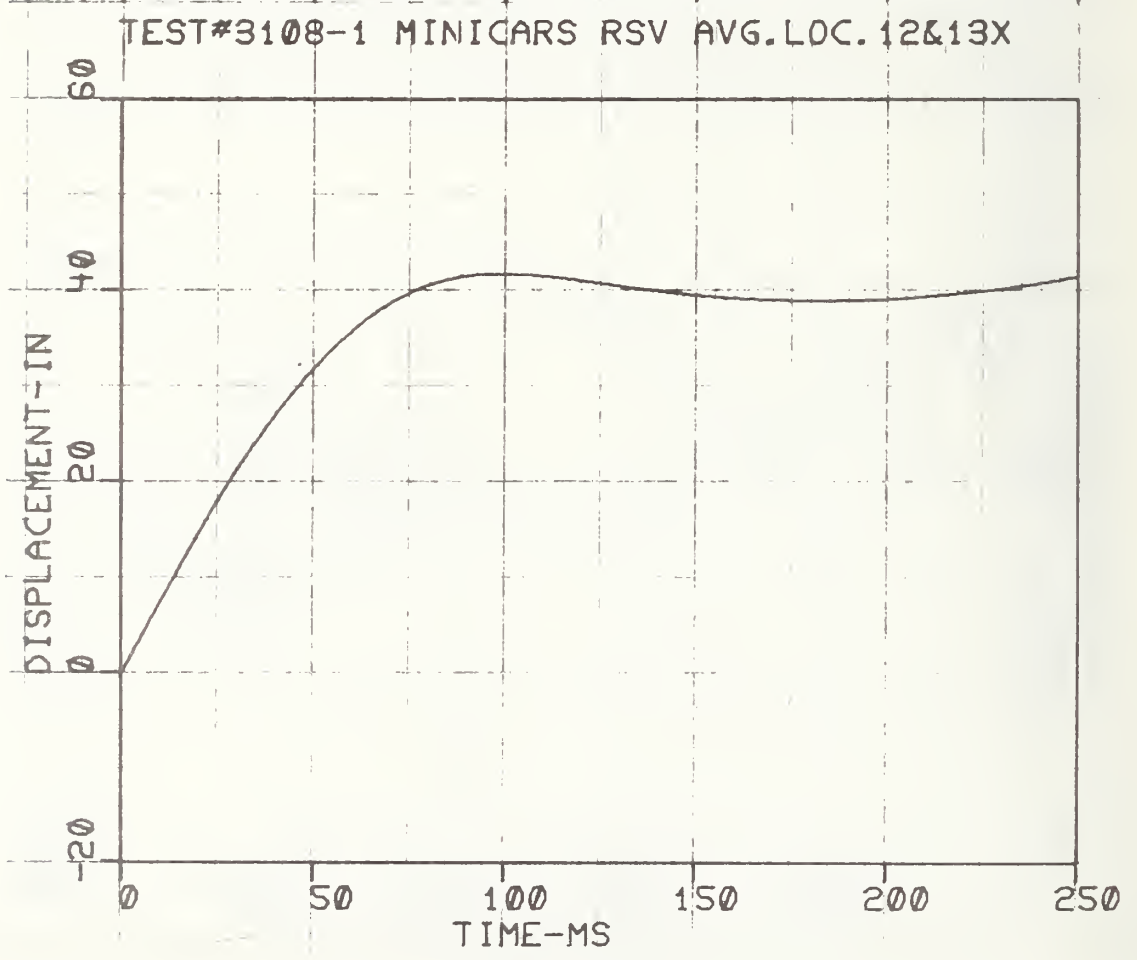

TEST#3108-1 MINICARS RSV LOC 13RX
40
0
-40
-80
-120
ACCELERATION-G

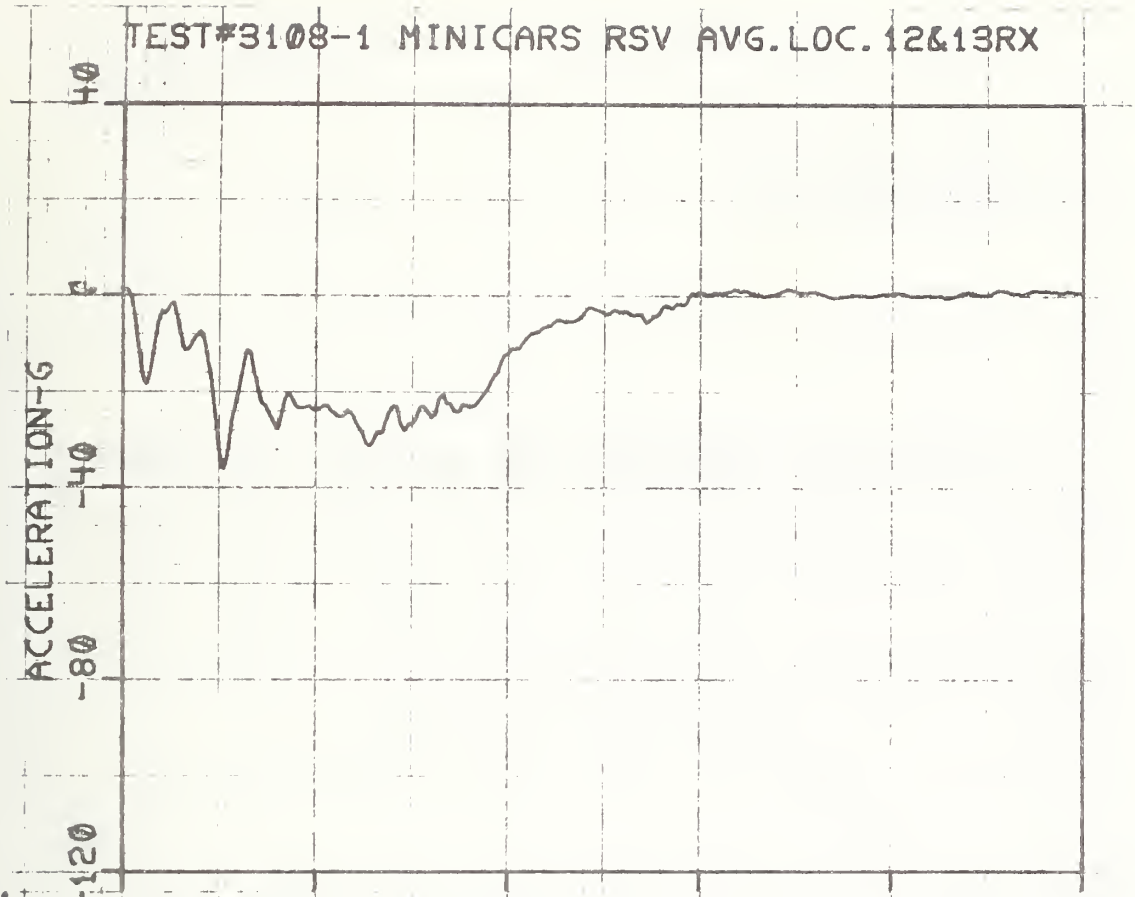

TEST#3108-1 MINICARS RSV LOC 13RX
60
40
20
0
-20
VELOCITY-MPH
0
50
100
150
200
250
TIME-MS

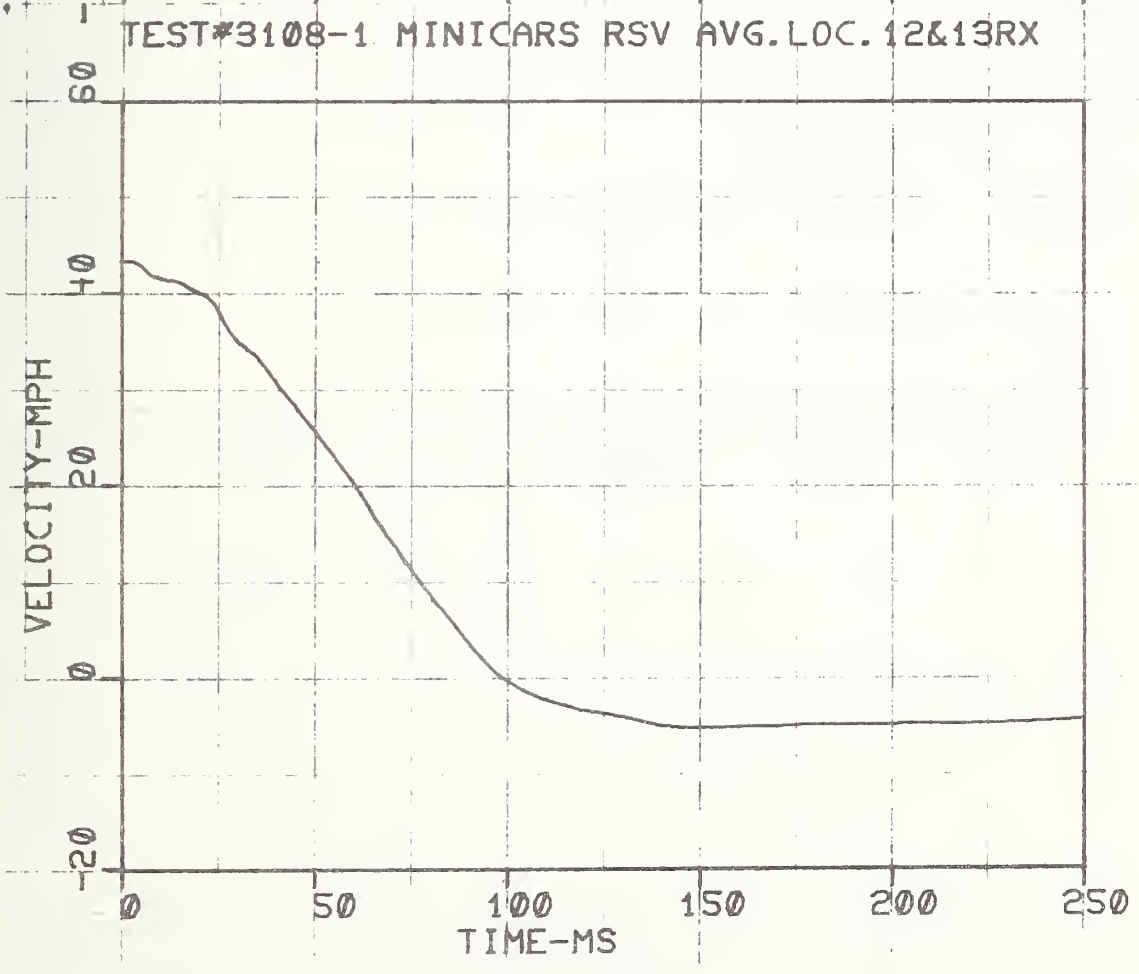

TEST#3108-1 MINICARS RSV LOC 13RX
DISPLACEMENT-IN
60
40
20
0
-20
TEST#3108-1 MINICARS RSV LOC 13Y
ACCELERATION-G
20
10
0
-10
-20
0
50
100
150
200
250
TIME-MS

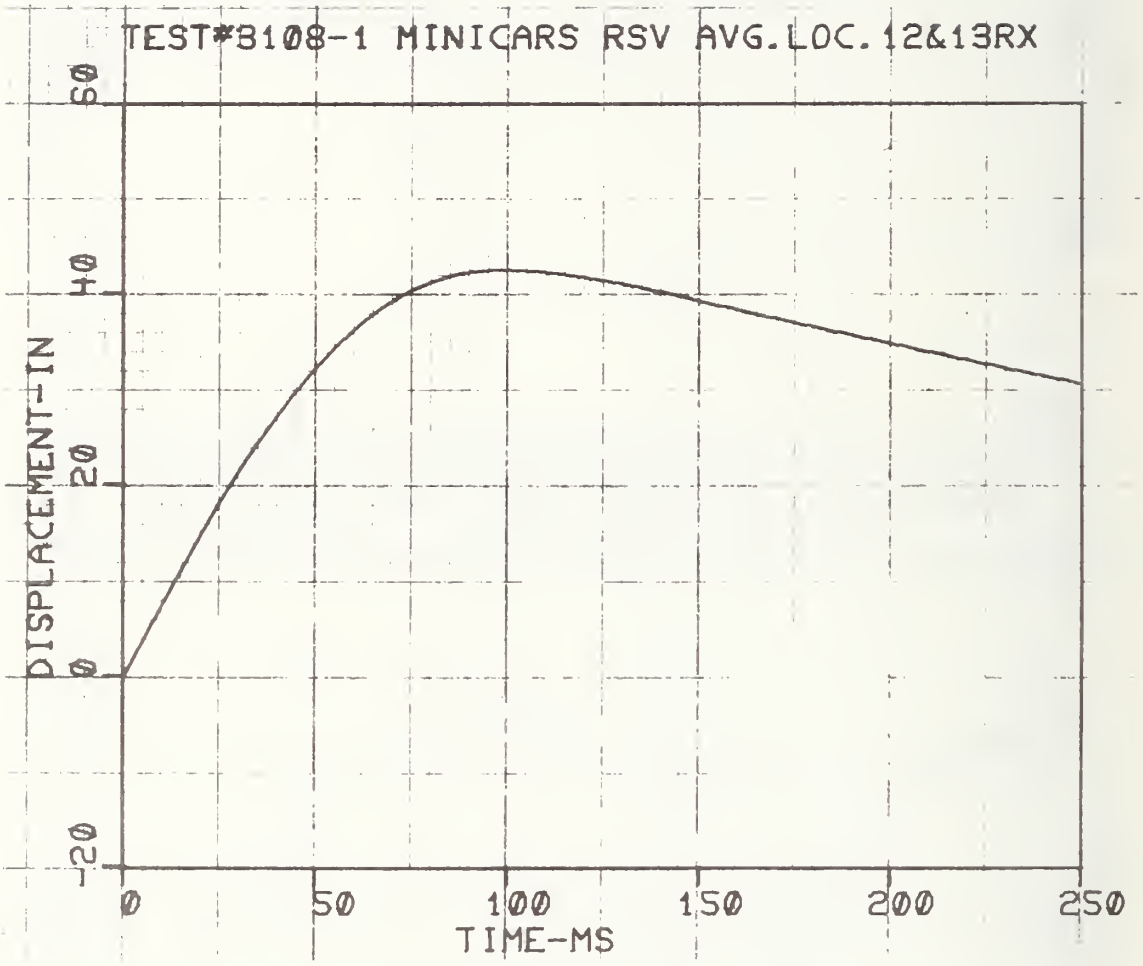

TEST*3108-1 MINICARS RSV LOC 13Z
20
10
0
-10
-20
ACCELERATION-G
TEST*3108-1 MINICARS RSV AVG.LOC.12&13X
40
0
-40
-80
-120
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

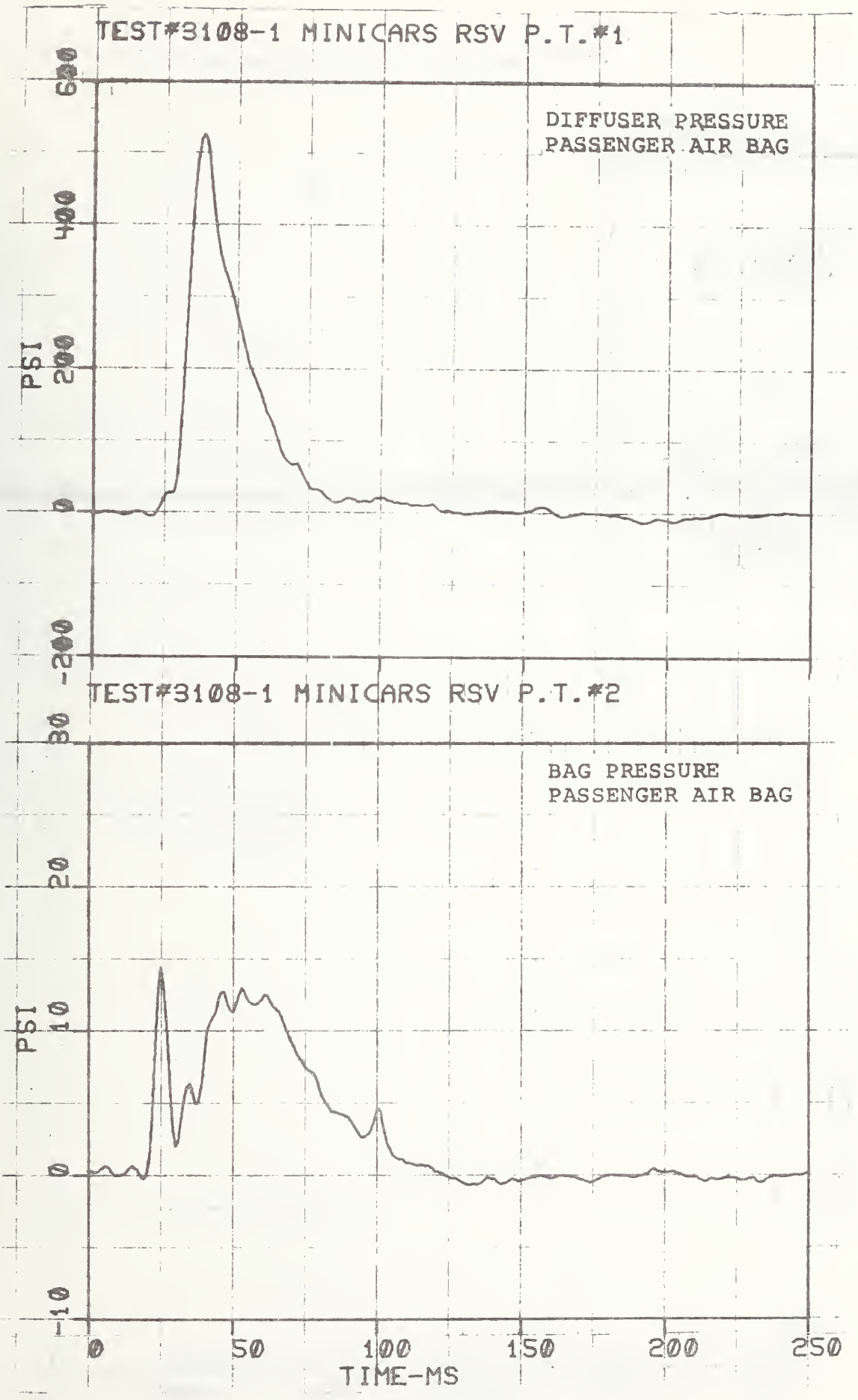

TEST#3108-1 MINICARS RSV AVG.LOC.12&13X
VELOCITY-MPH
60
40
20
0
-20

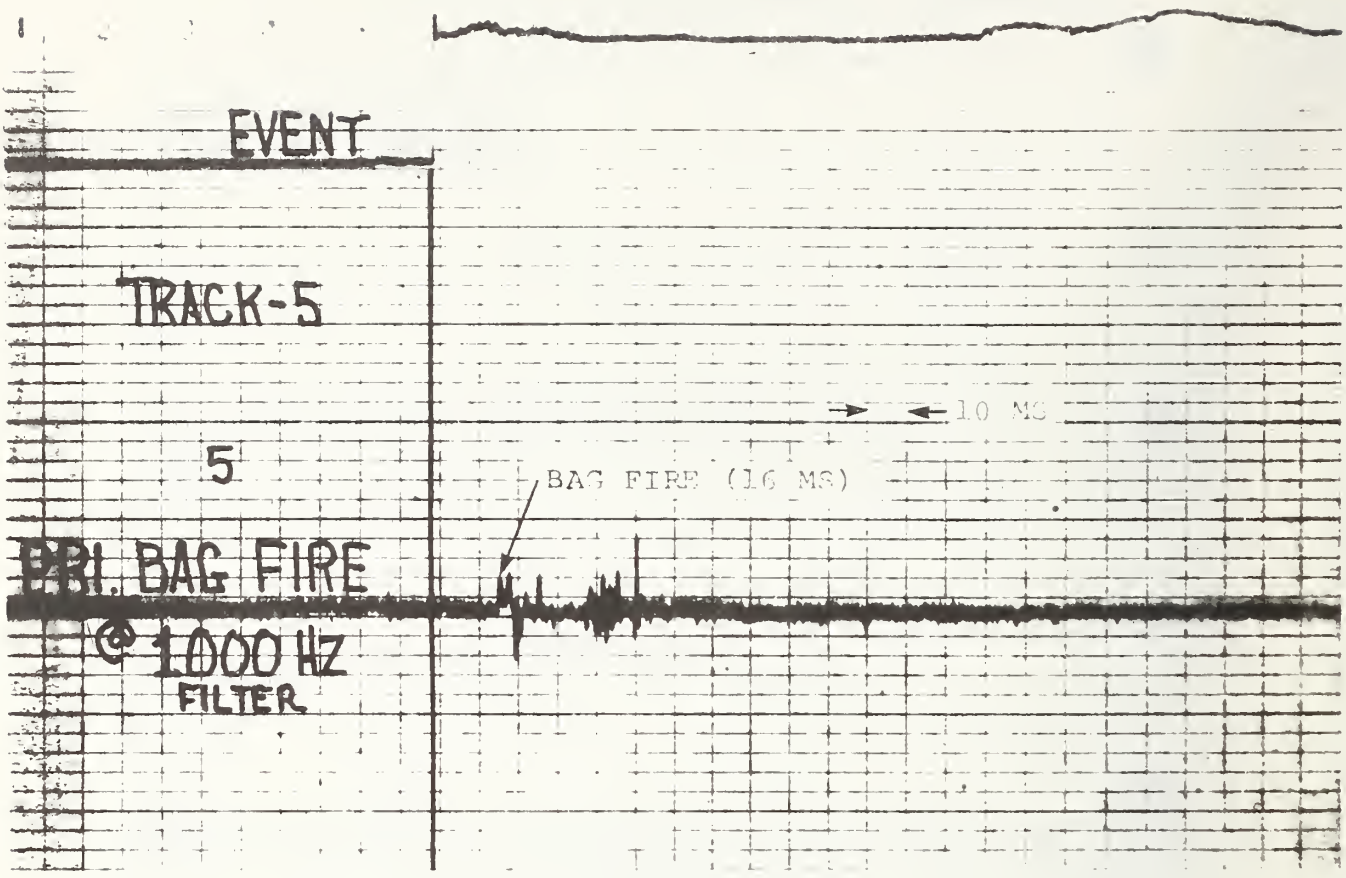

TEST#3108-1 MINICARS RSV AVG.LOC.12&13X
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS


TEST#3108-1 MINICARS RSV AVG.LOC.12&13RX
ACCELERATION-G
0
-40
-80
-120

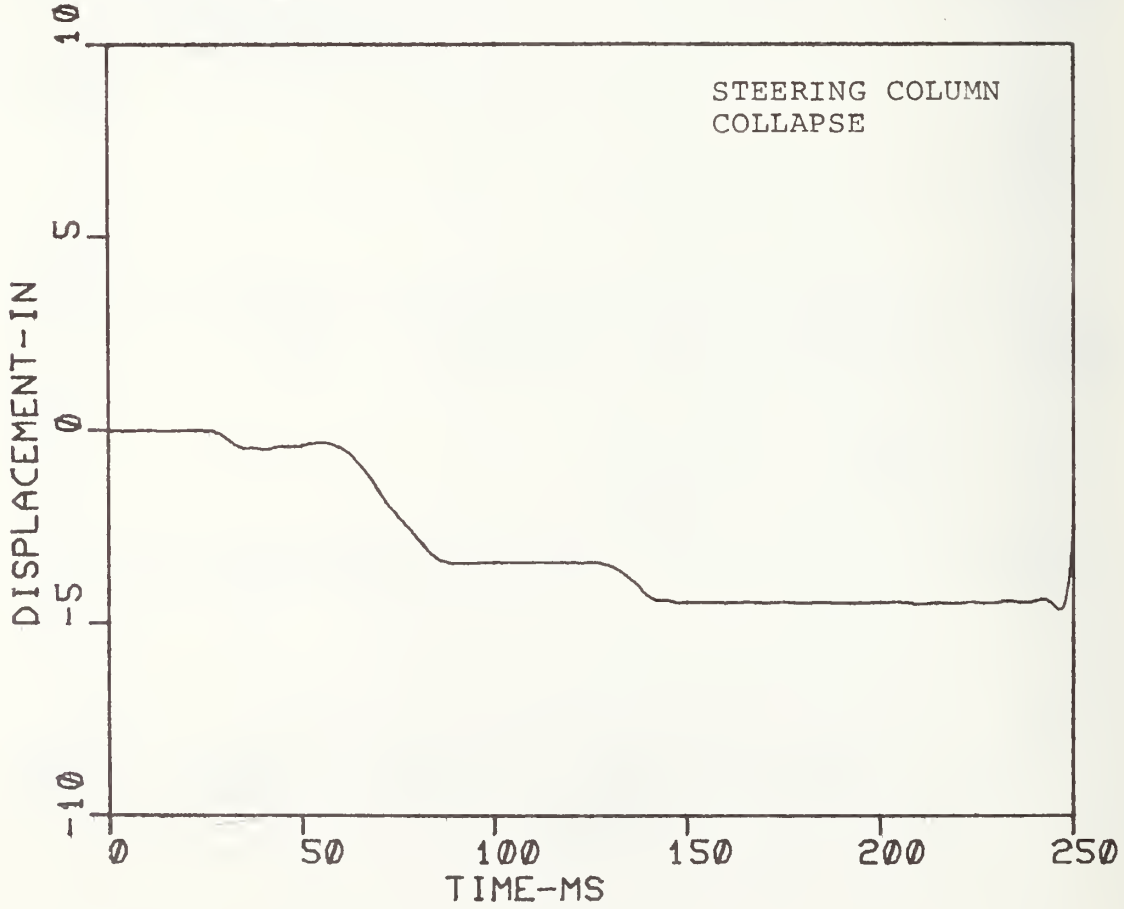

TEST#3108-1 MINICARS RSV AVG.LOC.12&13RX
VELOCITY-MPH
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS


TEST#B108-1 MINICARS RSV AVG.LOC.12&13RX
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS


TEST#3108-1 MINICARS RSV P.T.#1
DIFFUSER PRESSURE
PASSENGER AIR BAG
PSI
600
400
200
0
-200
TEST#3108-1 MINICARS RSV P.T.#2
BAG PRESSURE
PASSENGER AIR BAG
PSI
30
20
10
0
-10
0
50
100
150
200
250
TIME-MS



TEST#3108-1 MINICARS RSV S.P.#1

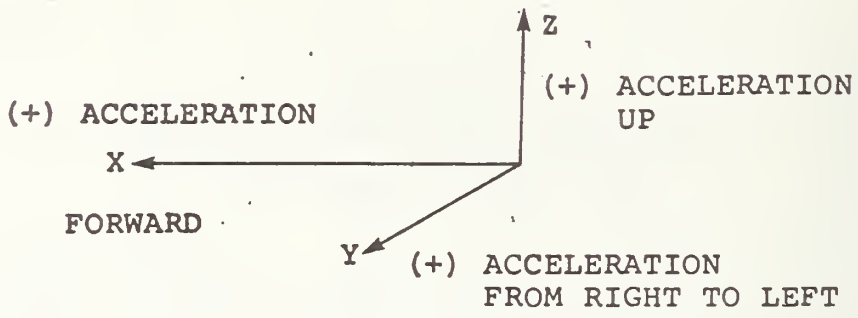


APPENDIX B

1979 DODGE CHALLENGER OCCUPANT AND VEHICLE DATA PLOTS

The sign convention used on this test is presented below:

(1) Vehicle and dummy accelerations



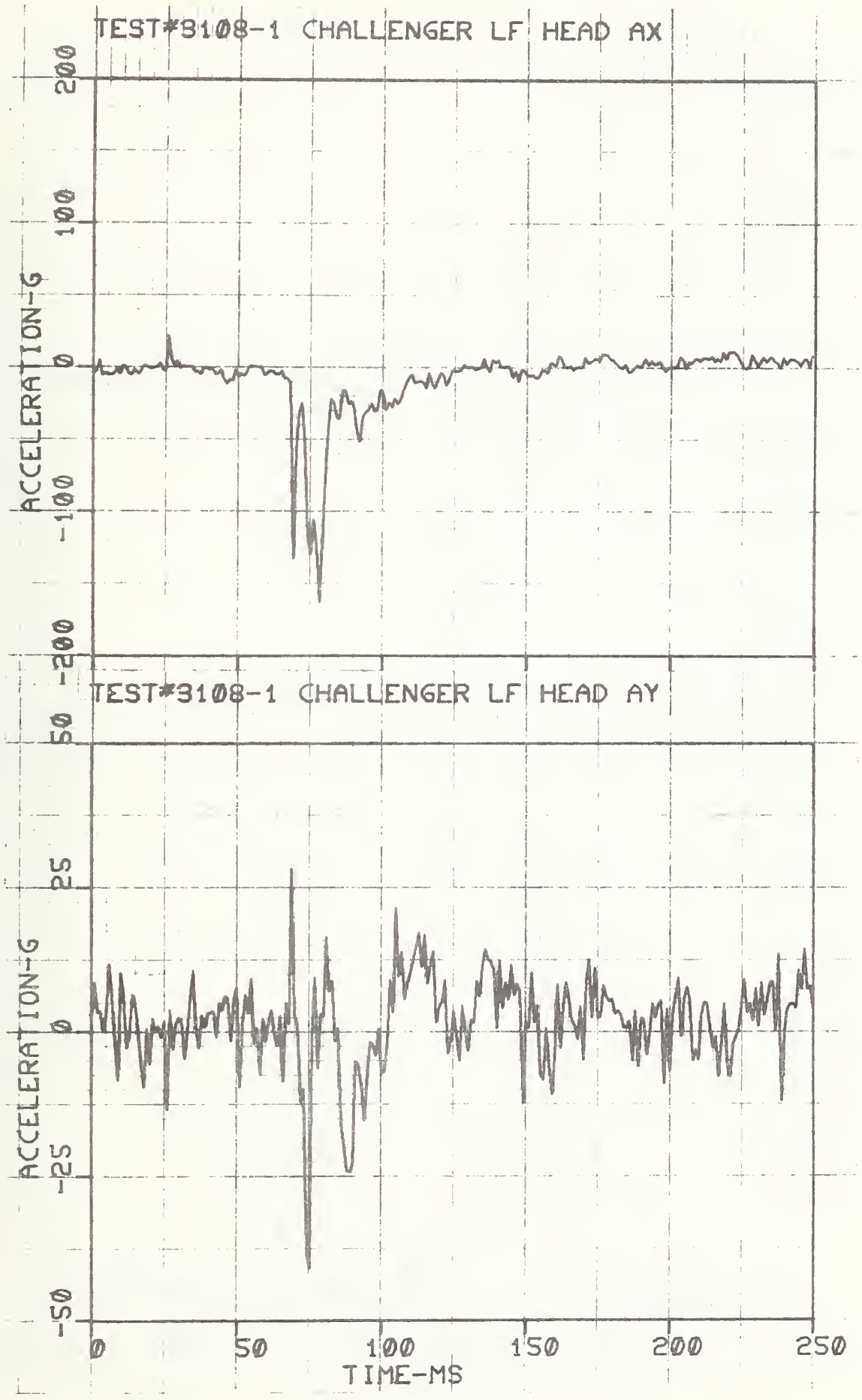
(Minicars Sign Convention)

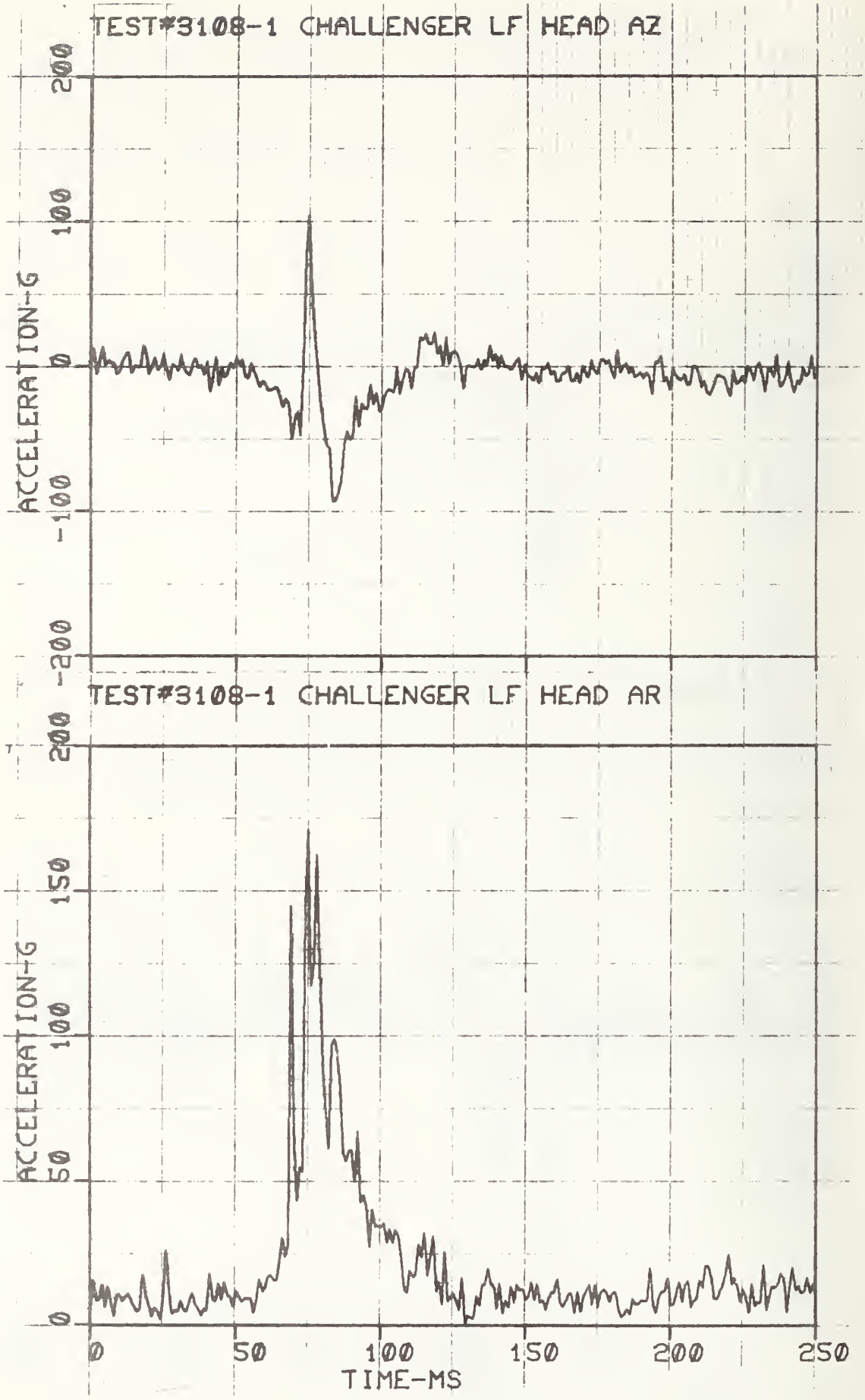
(2) Velocity and displacement agree with the above convention.

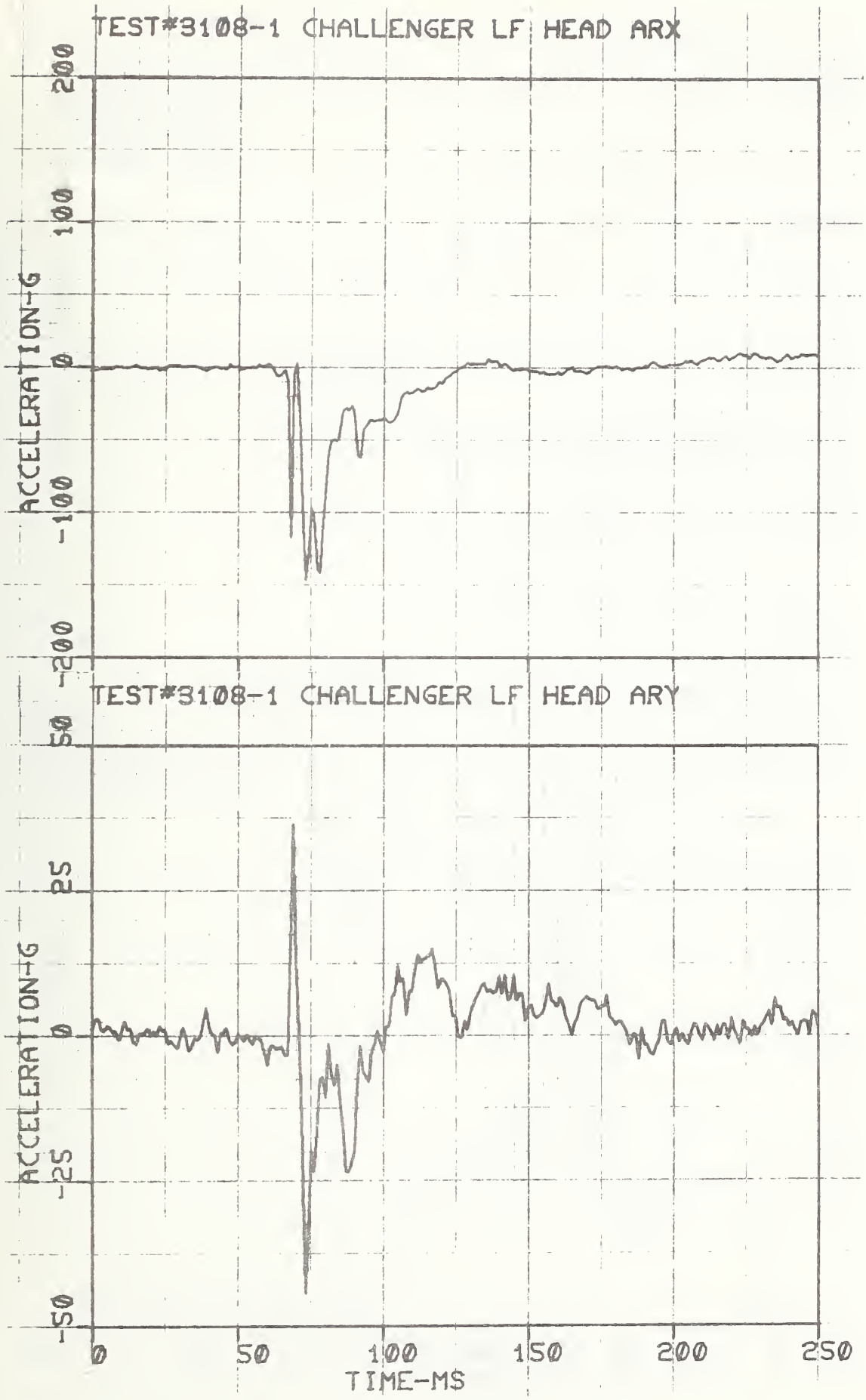
NOTE: All Y and Z channel data was reversed in polarity in order to conform with the above sign convention used by Minicars.

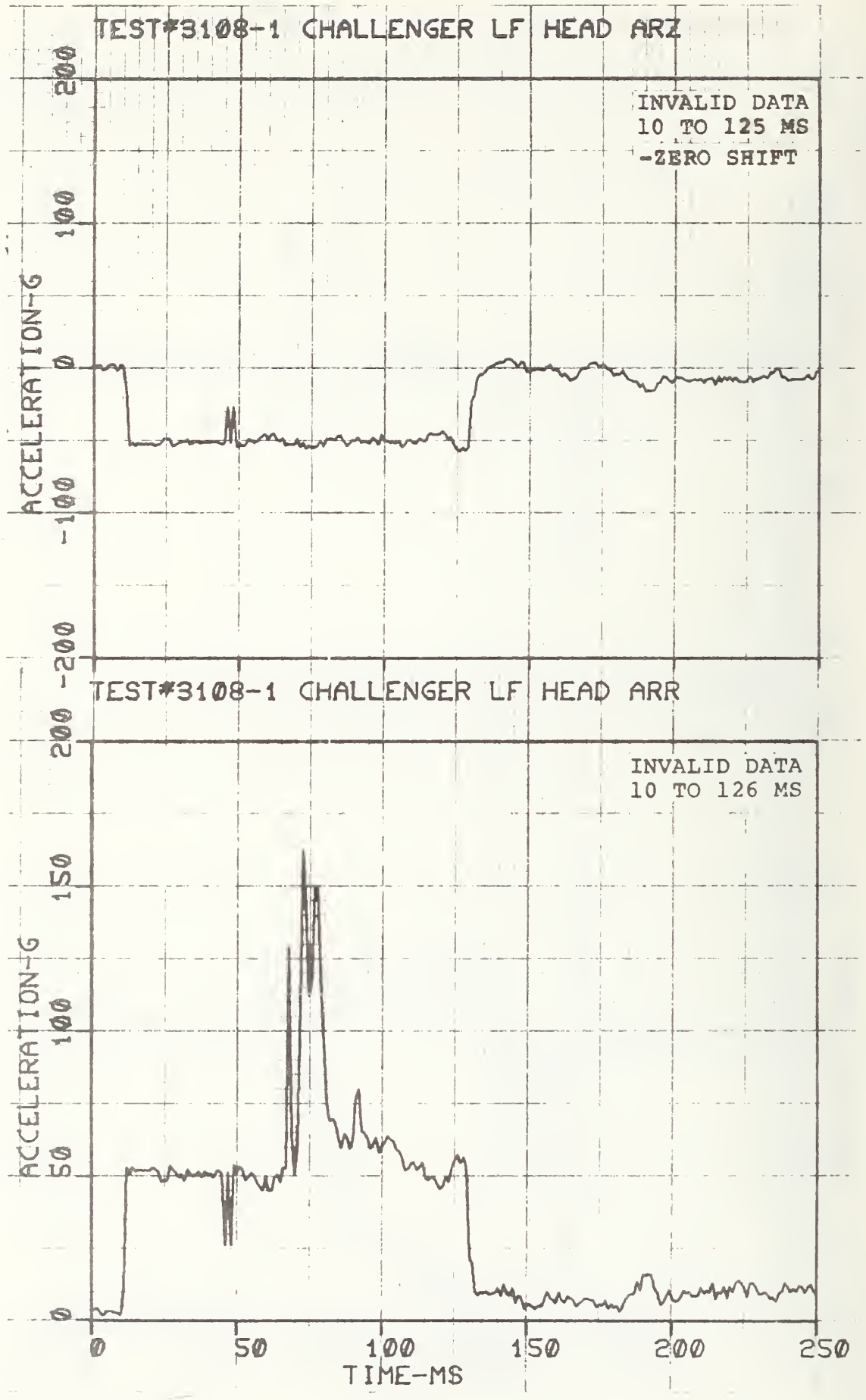
Data filtered per SAE recommended practice J211b as follows:

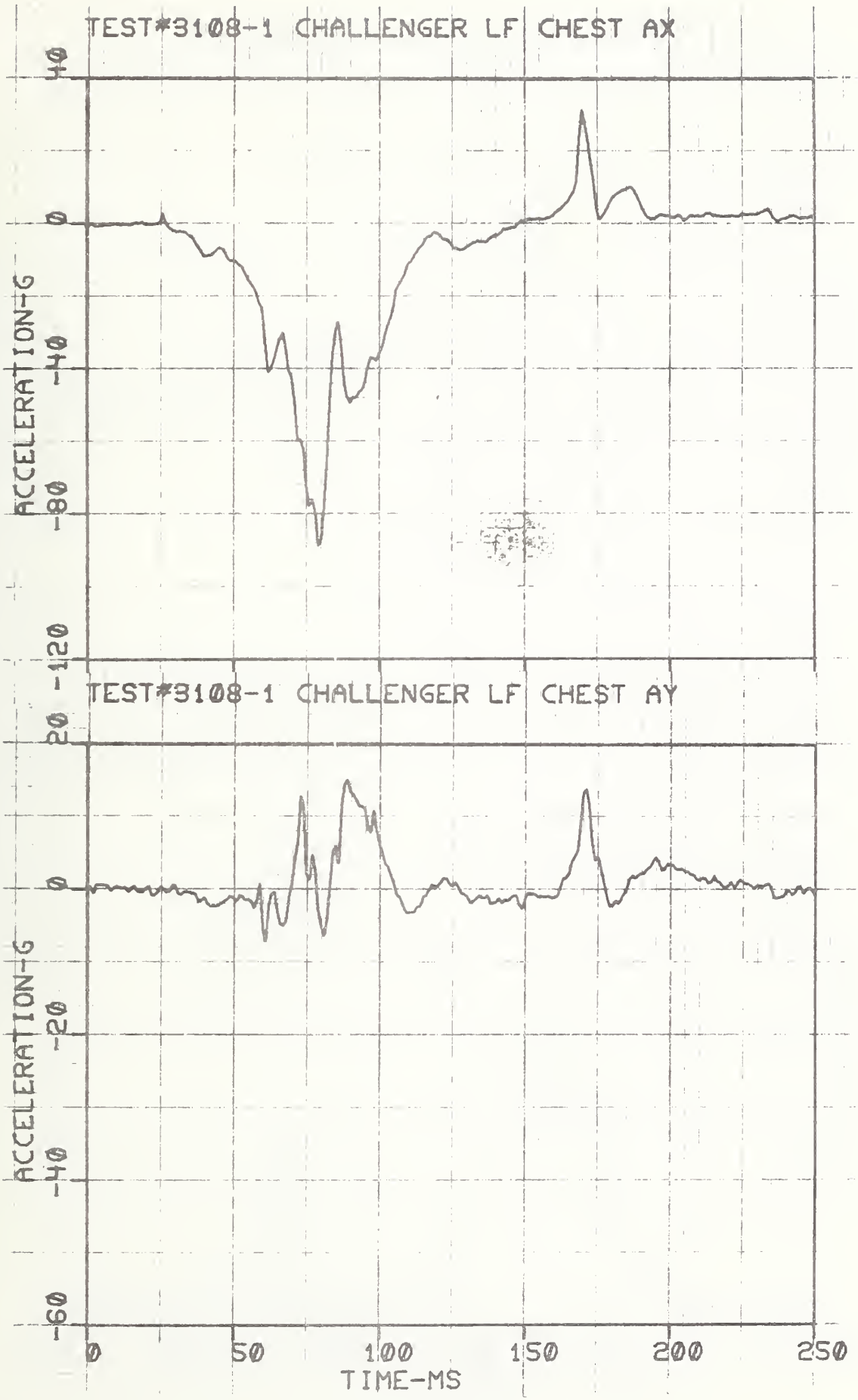
Test Measurement	Channel Class
Dummy Head	1000
Dummy Chest	180
Dummy Pelvis	180
Dummy Femurs	600
Vehicle Structure	60

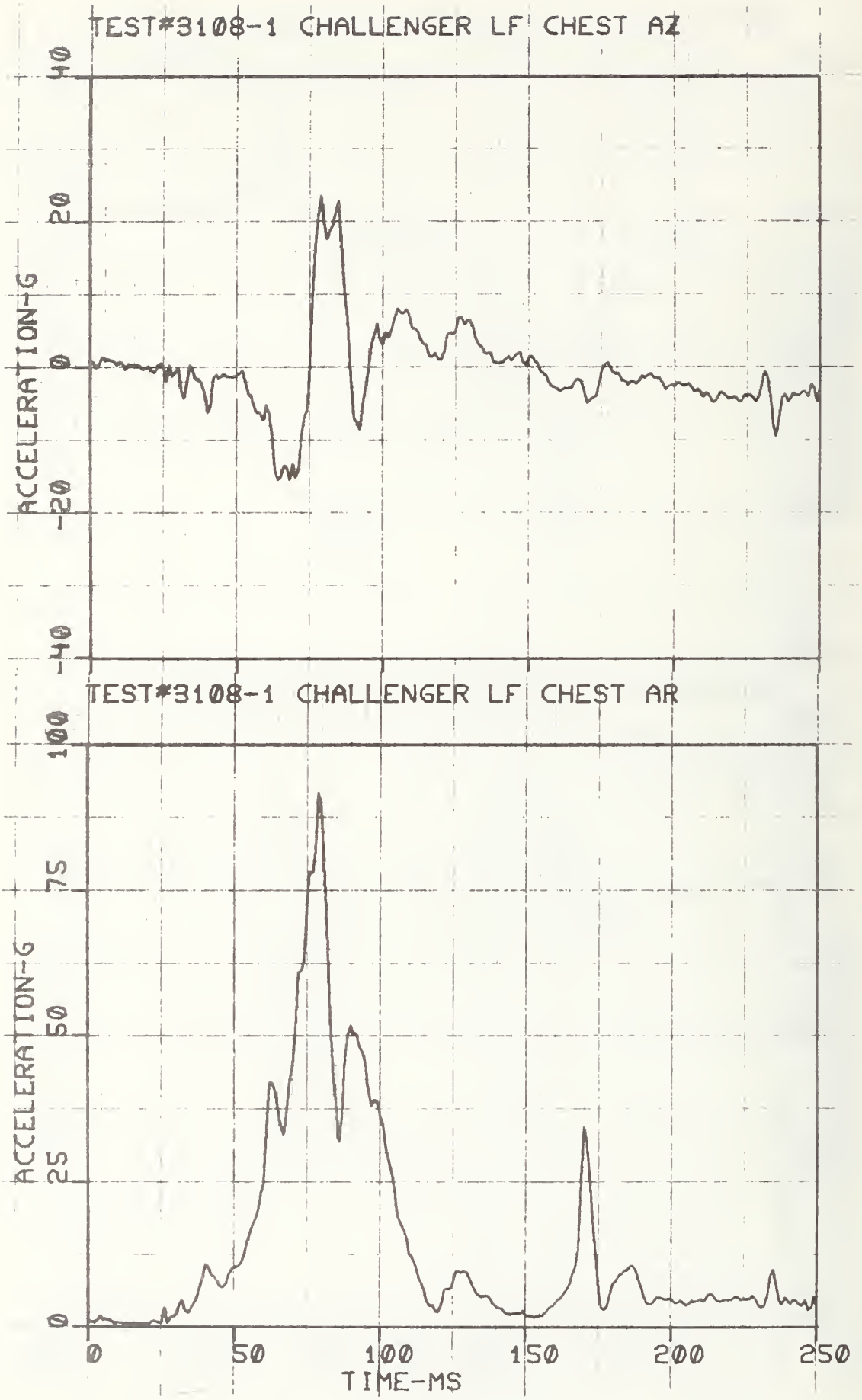

TEST#3108-1 CHALLENGER LF HEAD AX
200
100
0
-100
-200
ACCELERATION-G
TEST#3108-1 CHALLENGER LF HEAD AY
50
25
0
-25
-50
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

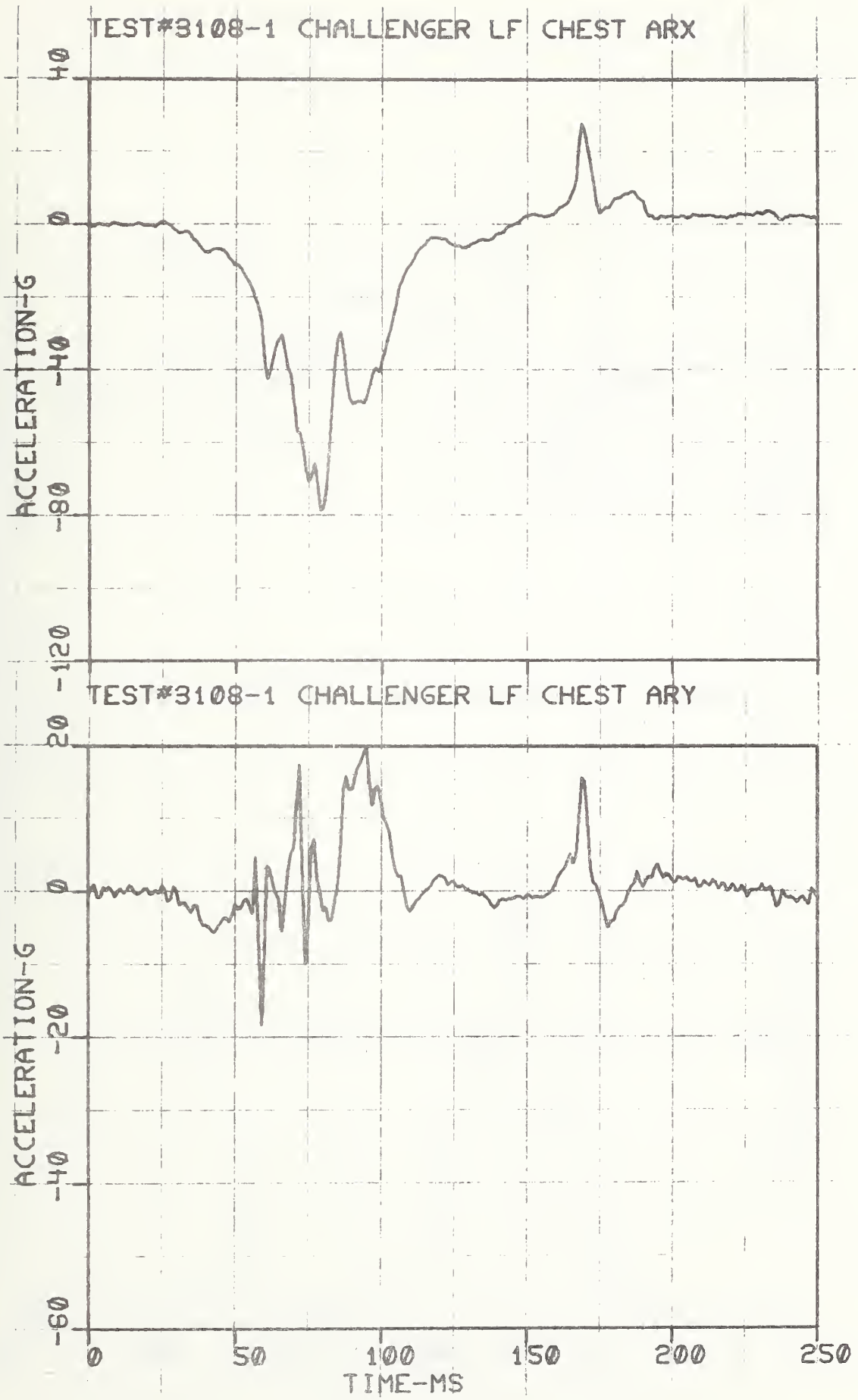

TEST#3108-1 CHALLENGER LF HEAD AZ
ACCELERATION-G
200
100
0
-100
-200
TEST#3108-1 CHALLENGER LF HEAD AR
ACCELERATION-G
200
150
100
50
0
0
50
100
150
200
250
TIME-MS

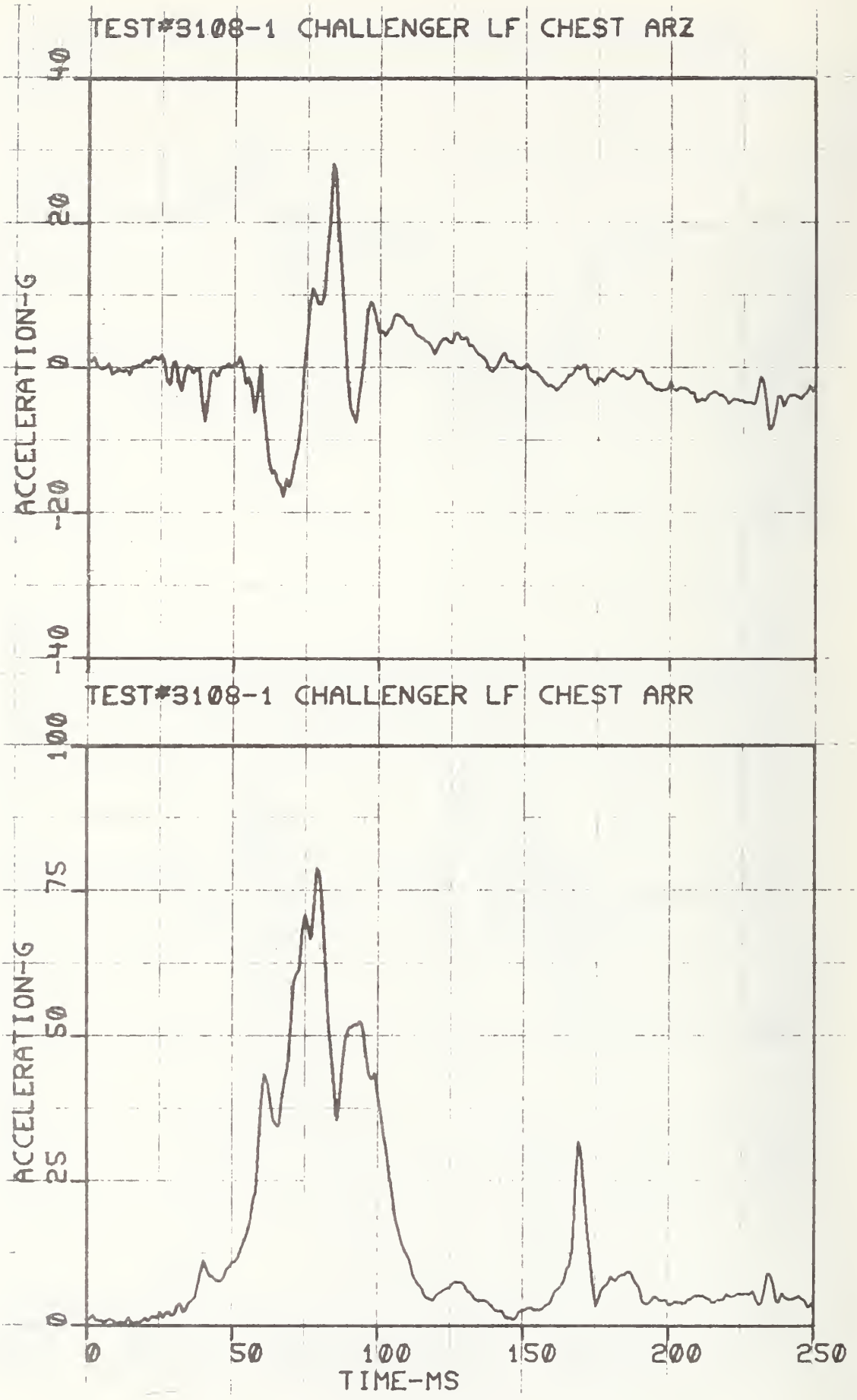

TEST#3108-1 CHALLENGER LF HEAD ARX
200
100
0
-100
-200
ACCELERATION-G
TEST#3108-1 CHALLENGER LF HEAD ARY
50
25
0
-25
-50
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

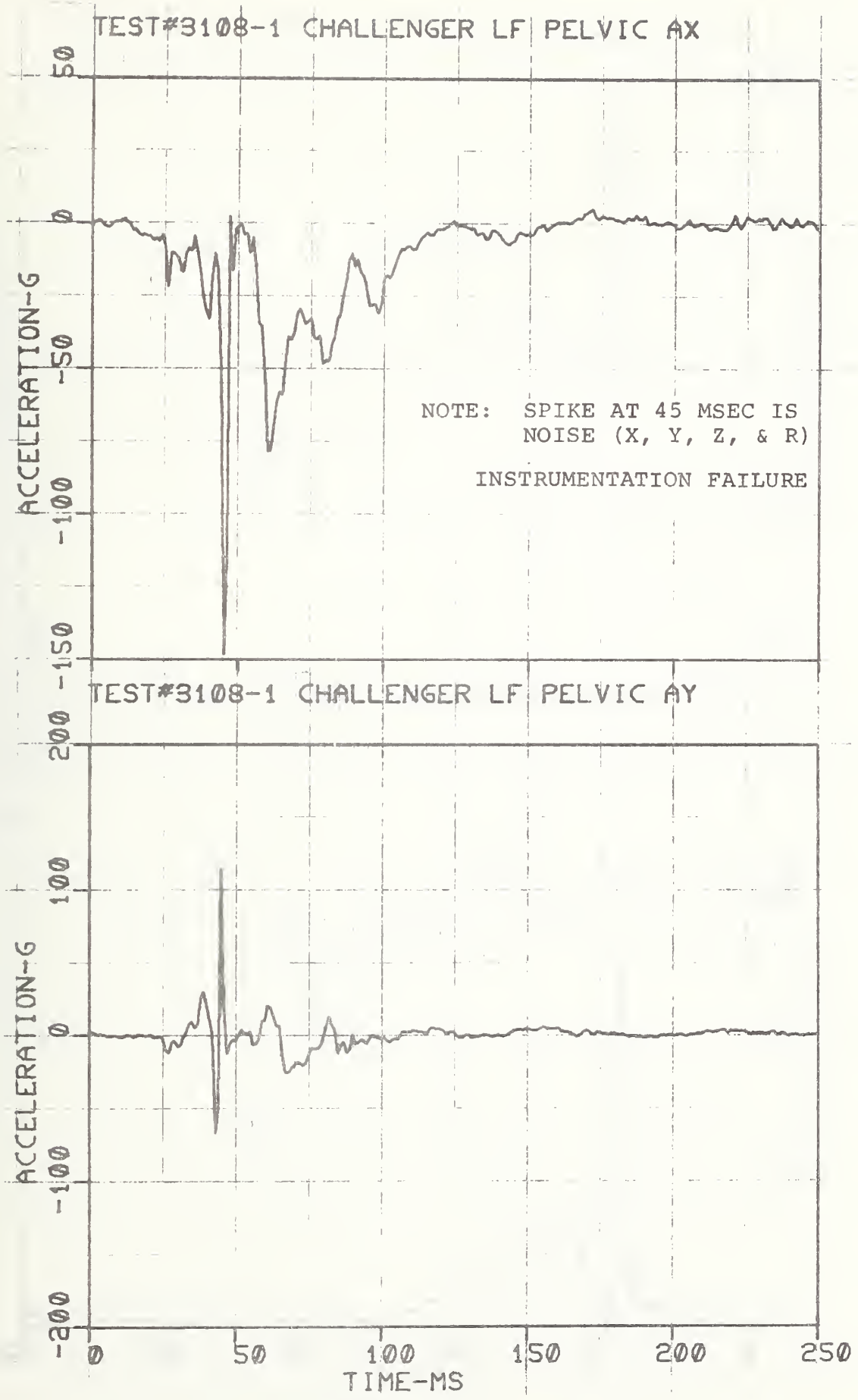

TEST#3108-1 CHALLENGER LF HEAD ARZ
INVALID DATA
10 TO 125 MS
-ZERO SHIFT
ACCELERATION-G
200
100
0
-100
-200
TEST#3108-1 CHALLENGER LF HEAD ARR
INVALID DATA
10 TO 126 MS
ACCELERATION-G
200
150
100
50
0
0
50
100
150
200
250
TIME-MS

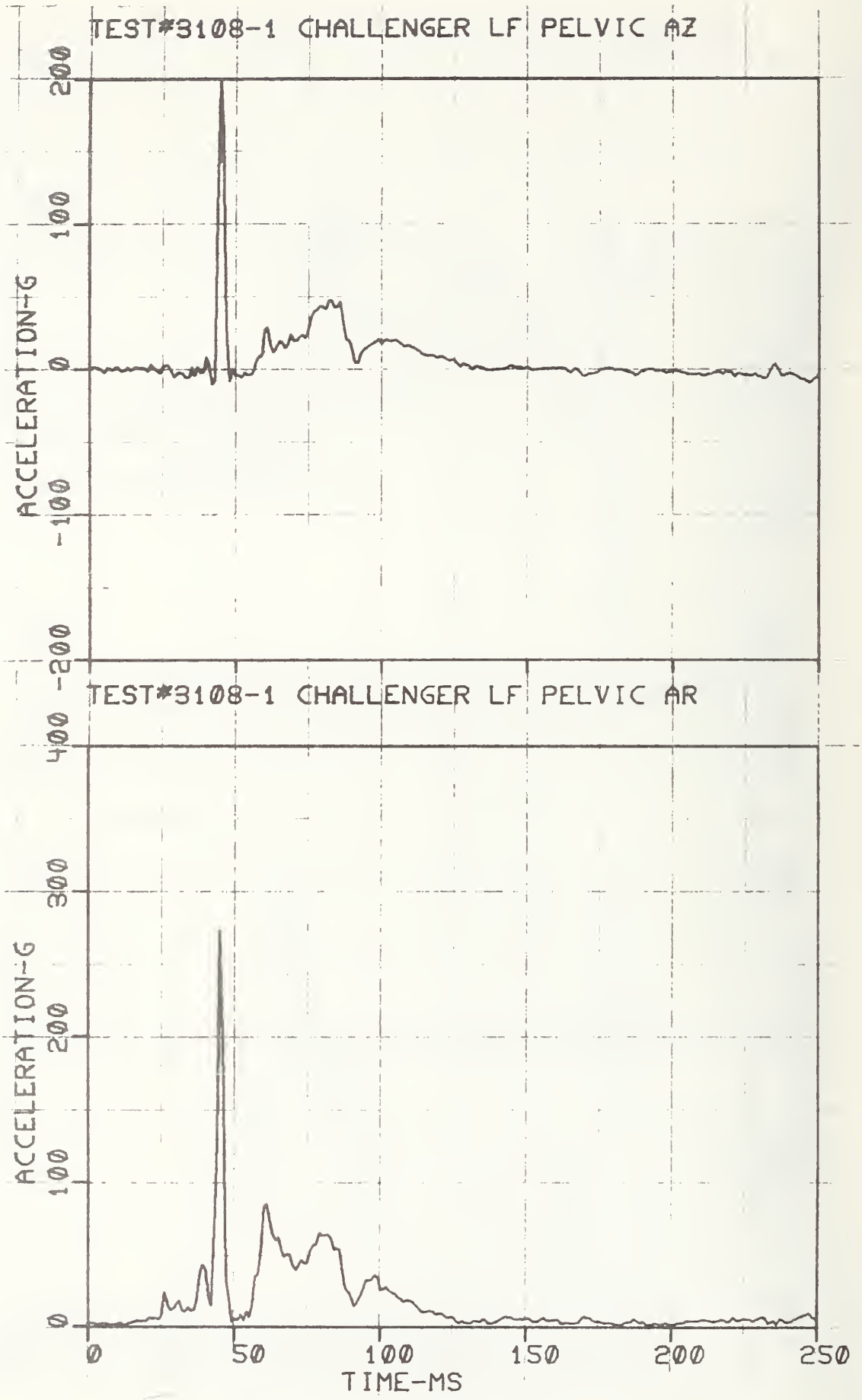

TEST#3108-1 CHALLENGER LF CHEST AX
40
0
-40
-80
-120
ACCELERATION-G
TEST#3108-1 CHALLENGER LF CHEST AY
20
0
-20
-40
-60
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

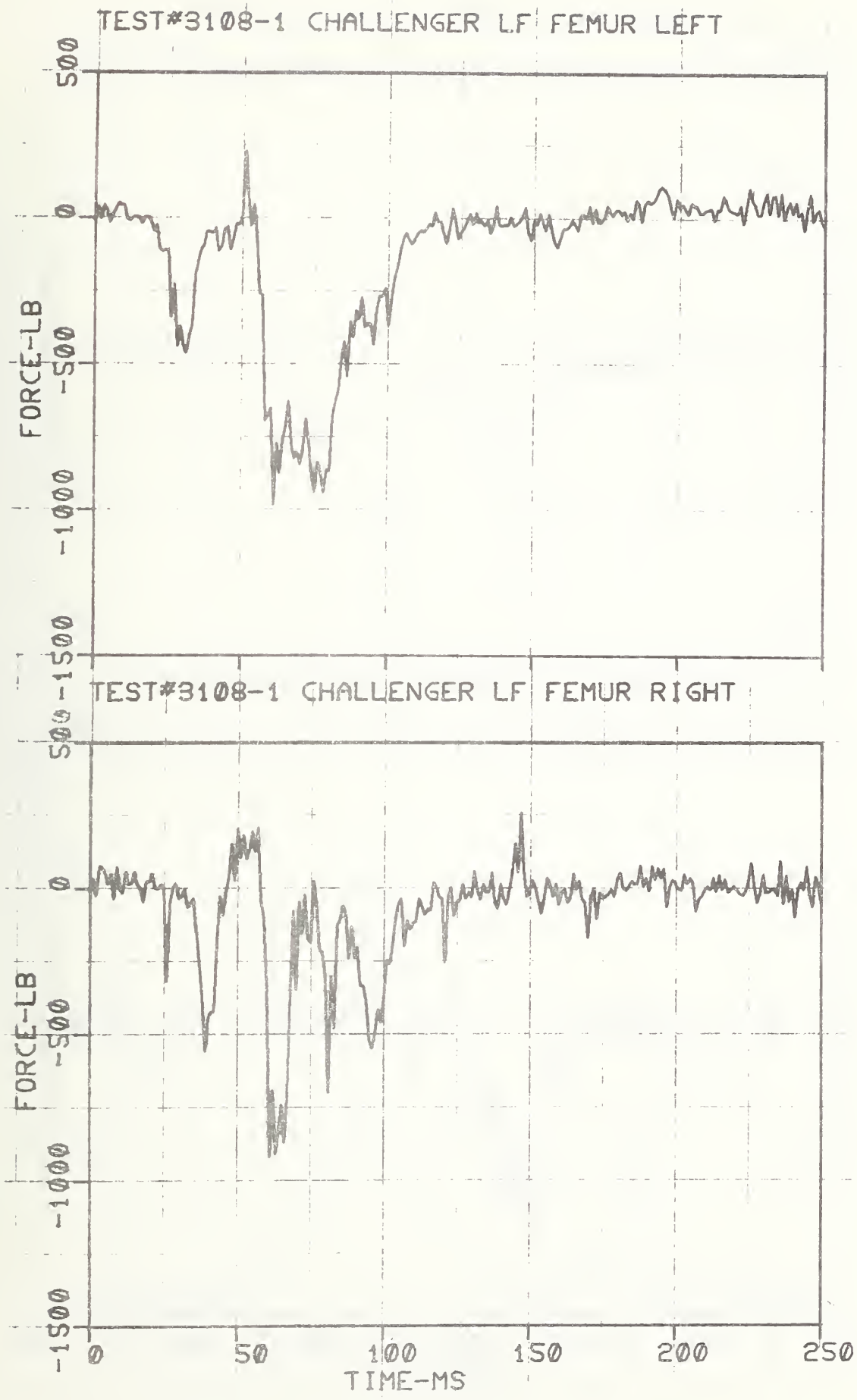

TEST#3108-1 CHALLENGER LF CHEST AZ
ACCELERATION-G
40
20
0
-20
-40
TEST#3108-1 CHALLENGER LF CHEST AR
ACCELERATION-G
100
75
50
25
0
0
50
100
150
200
250
TIME-MS

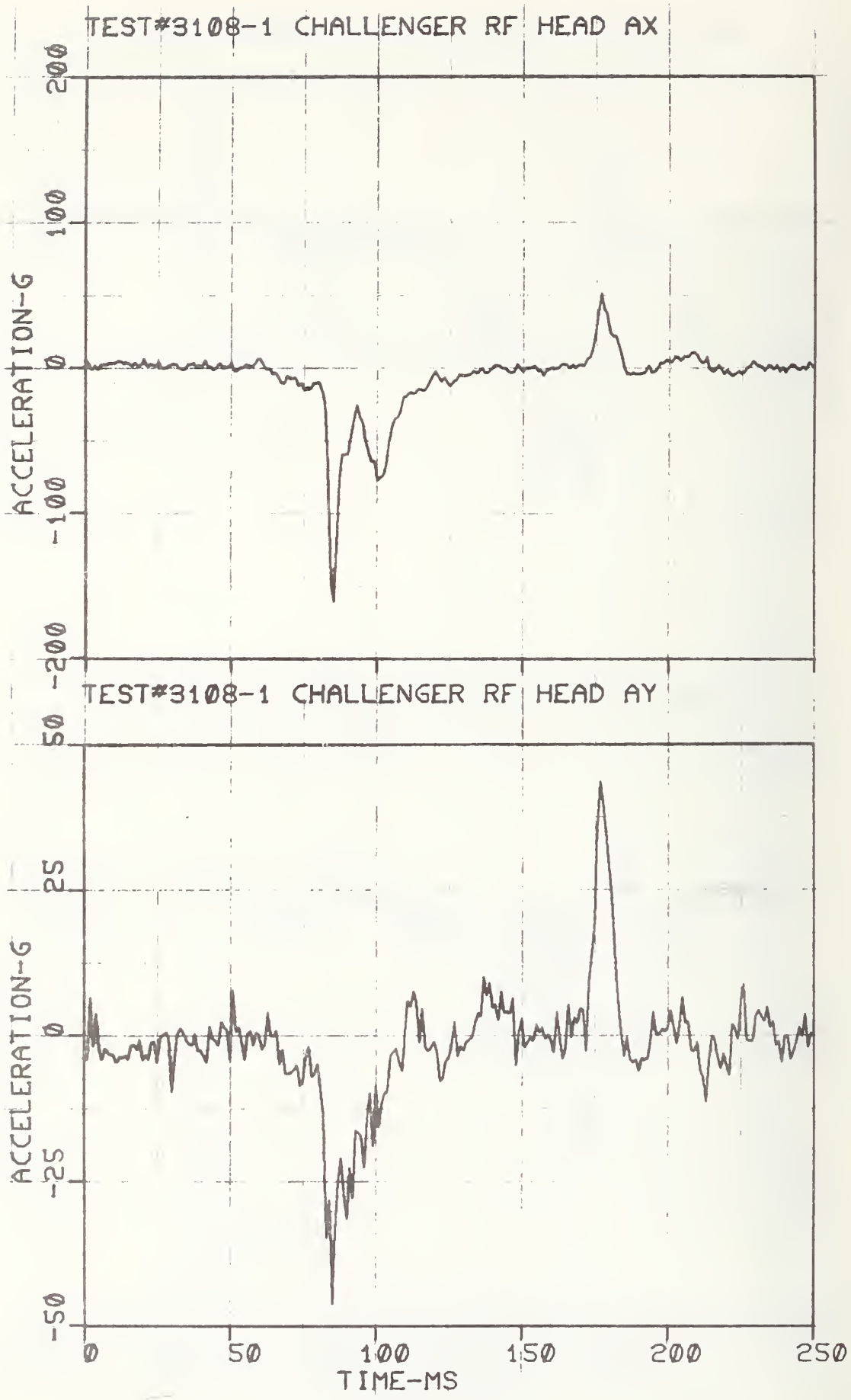

TEST#3108-1 CHALLENGER LF CHEST ARX
40
0
-40
-80
-120
ACCELERATION-G
TEST#3108-1 CHALLENGER LF CHEST ARY
20
0
-20
-40
-60
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

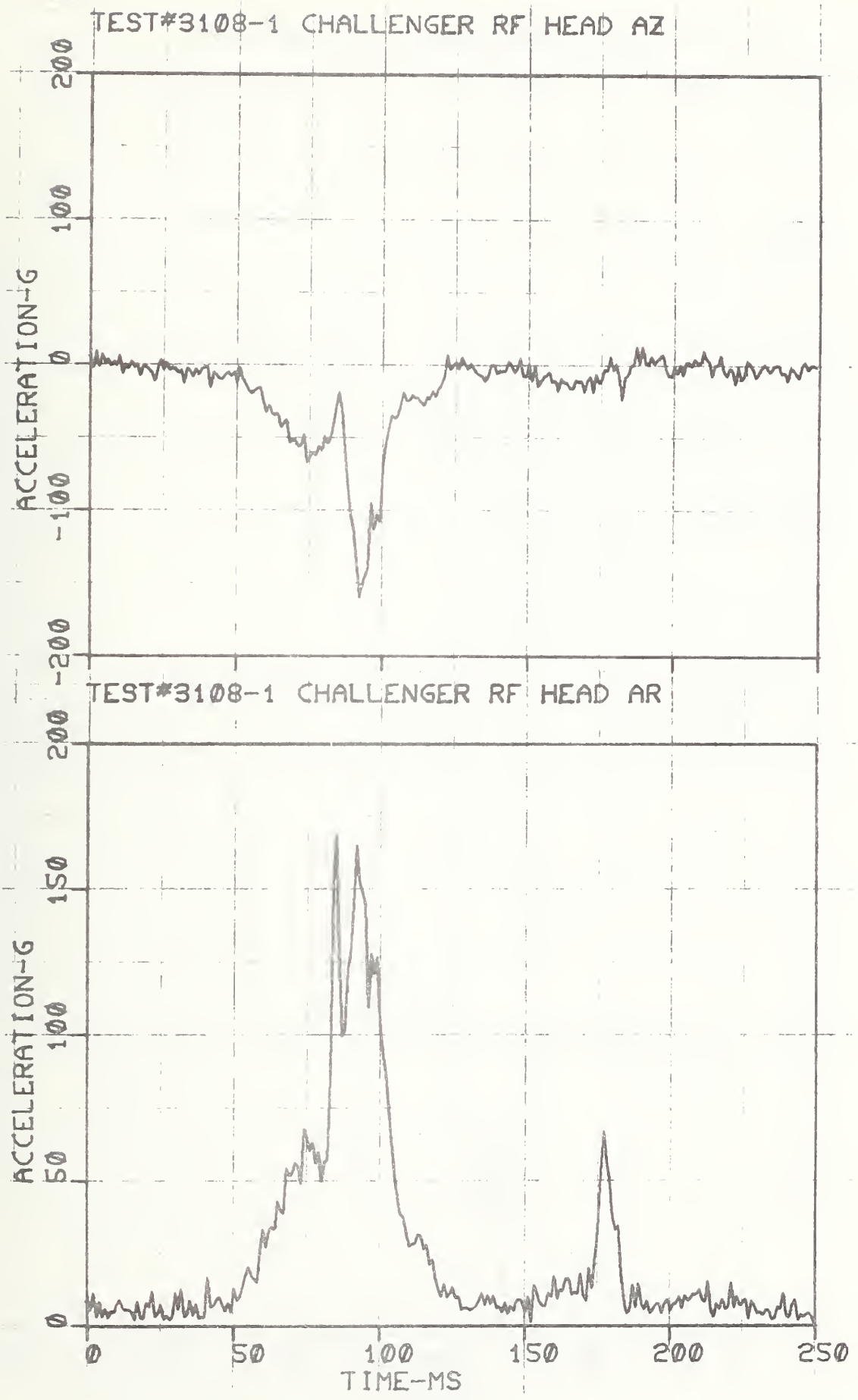

TEST#3108-1 CHALLENGER LF CHEST ARZ
40
20
0
-20
-40
ACCELERATION-G
TEST#3108-1 CHALLENGER LF CHEST ARR
100
75
50
25
0
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

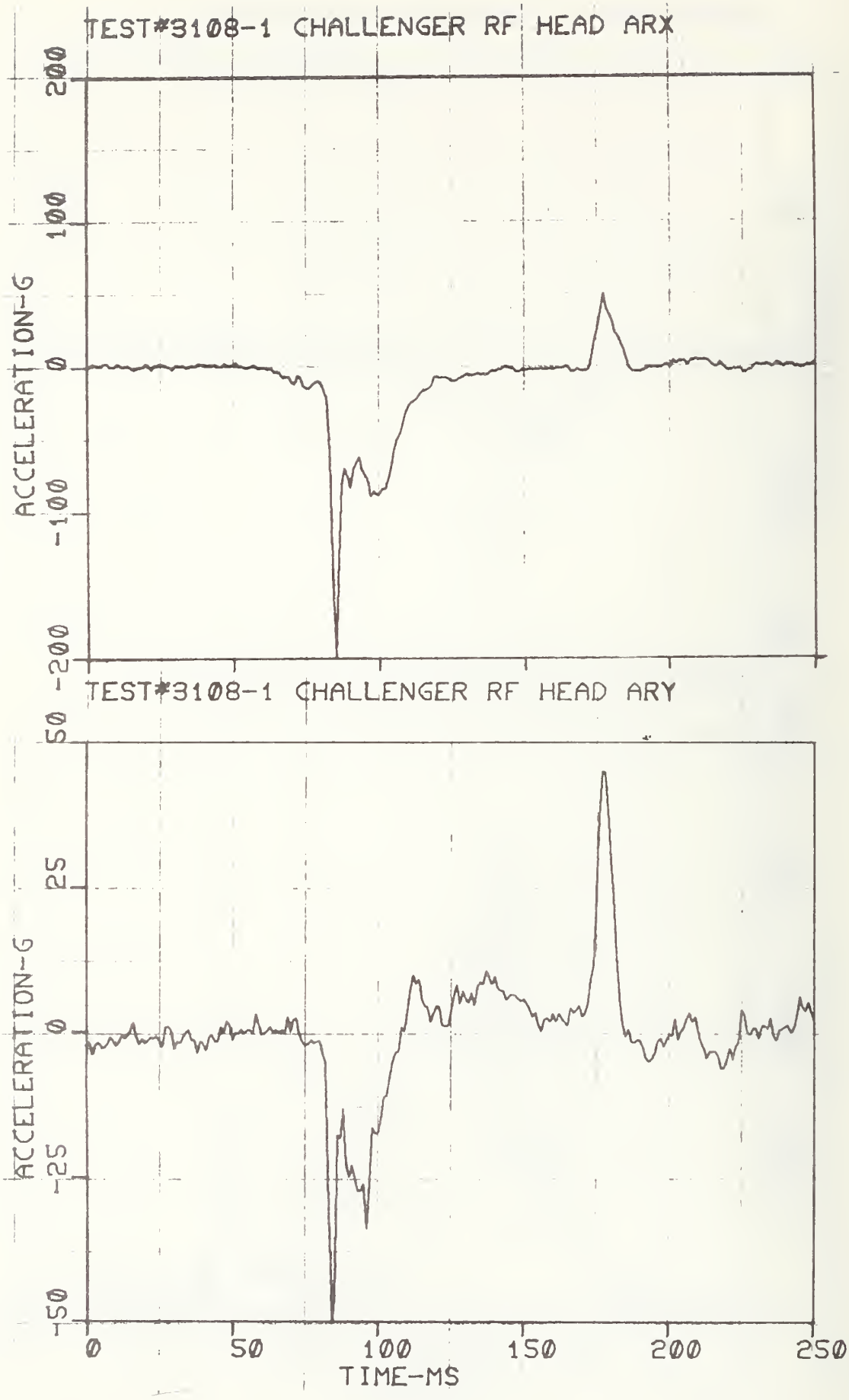

TEST#3108-1 CHALLENGER LF PELVIC AX
50
0
-50
-100
-150
ACCELERATION-G
NOTE: SPIKE AT 45 MSEC IS NOISE (X, Y, Z, & R)
INSTRUMENTATION FAILURE
TEST#3108-1 CHALLENGER LF PELVIC AY
200
100
0
-100
-200
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

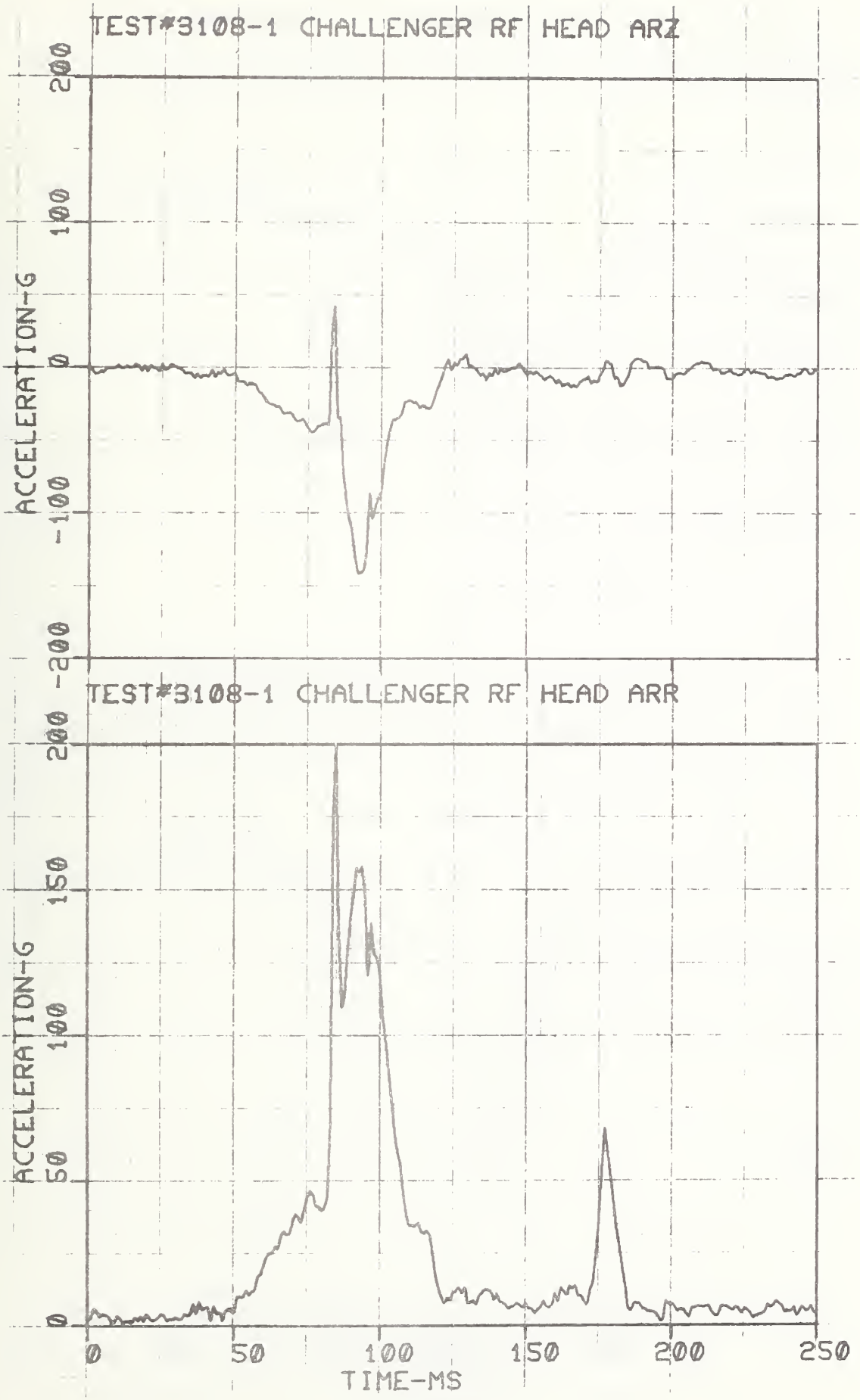

TEST#3108-1 CHALLENGER LF PELVIC AZ
ACCELERATION-G
200
100
0
-100
-200
TEST#3108-1 CHALLENGER LF PELVIC AR
ACCELERATION-G
400
300
200
100
0
0
50
100
150
200
250
TIME-MS

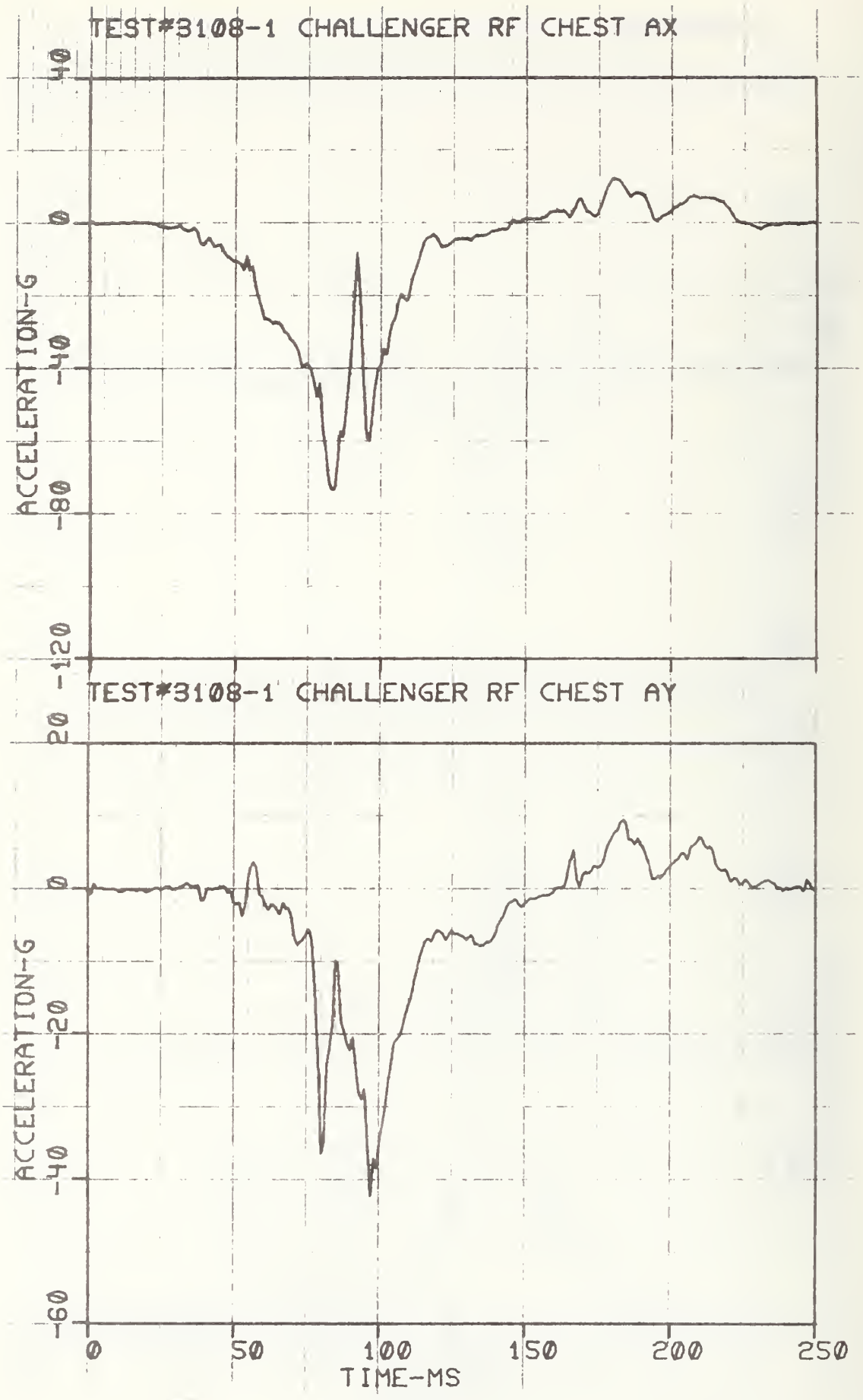

TEST#3108-1 CHALLENGER LF FEMUR LEFT
500
0
-500
-1000
-1500
FORCE-LB
TEST#3108-1 CHALLENGER LF FEMUR RIGHT
500
0
-500
-1000
-1500
FORCE-LB
0
50
100
150
200
250
TIME-MS

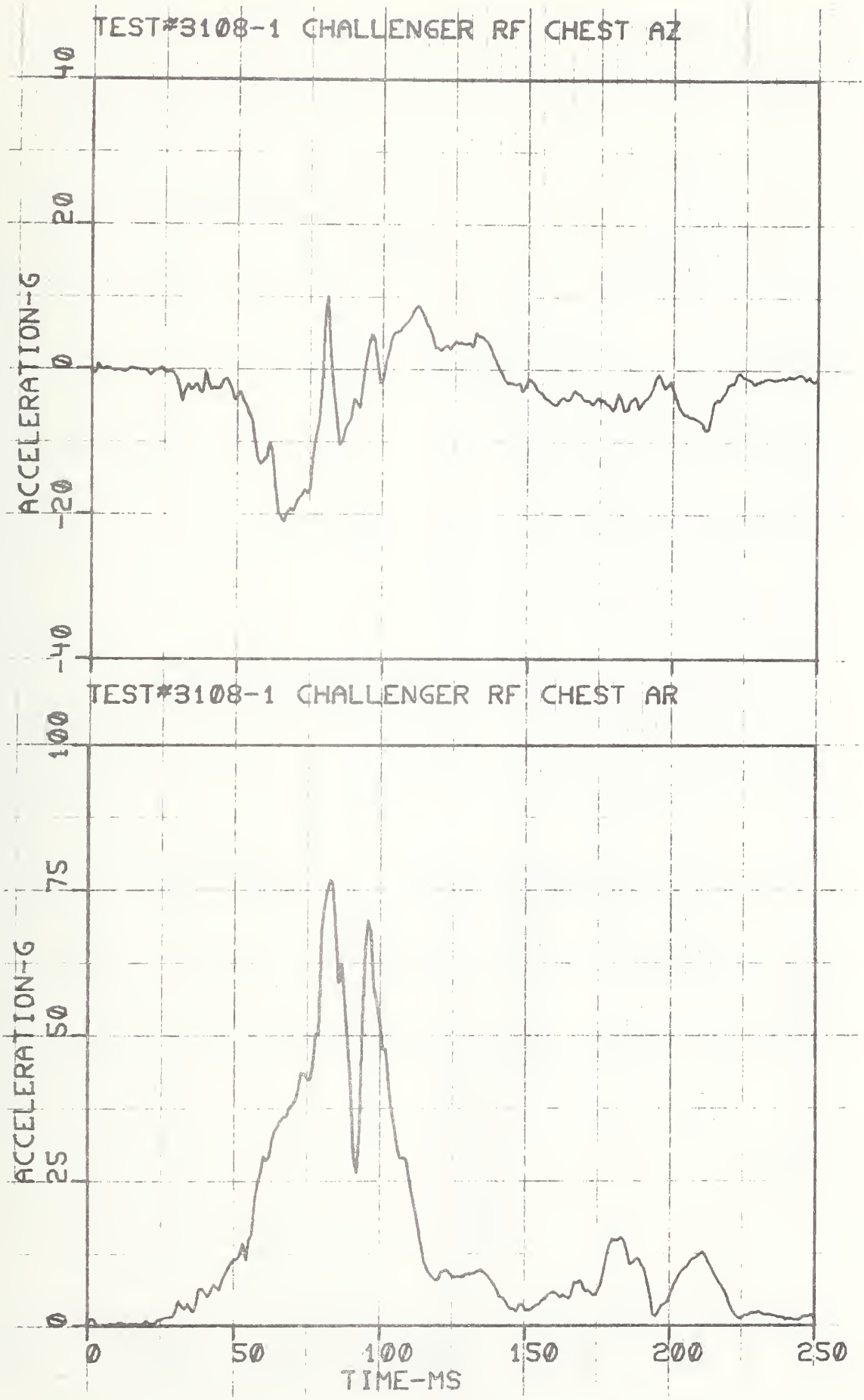

TEST#3108-1 CHALLENGER RF HEAD AX
200
100
0
-100
-200
ACCELERATION-G
TEST#3108-1 CHALLENGER RF HEAD AY
50
25
0
-25
-50
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

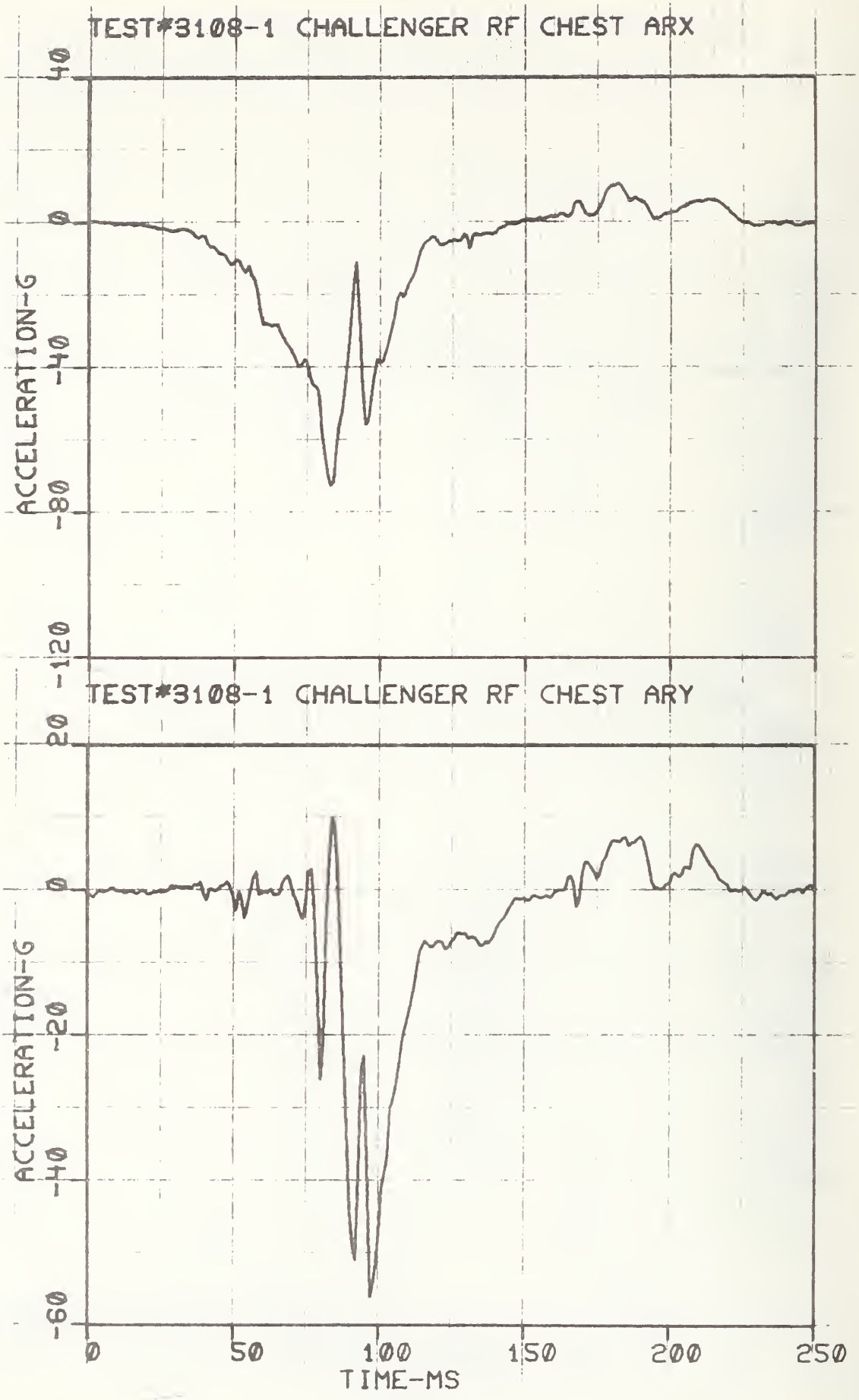

TEST#3108-1 CHALLENGER RF HEAD AZ
ACCELERATION-G
200
100
0
-100
-200
TEST#3108-1 CHALLENGER RF HEAD AR
ACCELERATION-G
200
150
100
50
0
0
50
100
150
200
250
TIME-MS

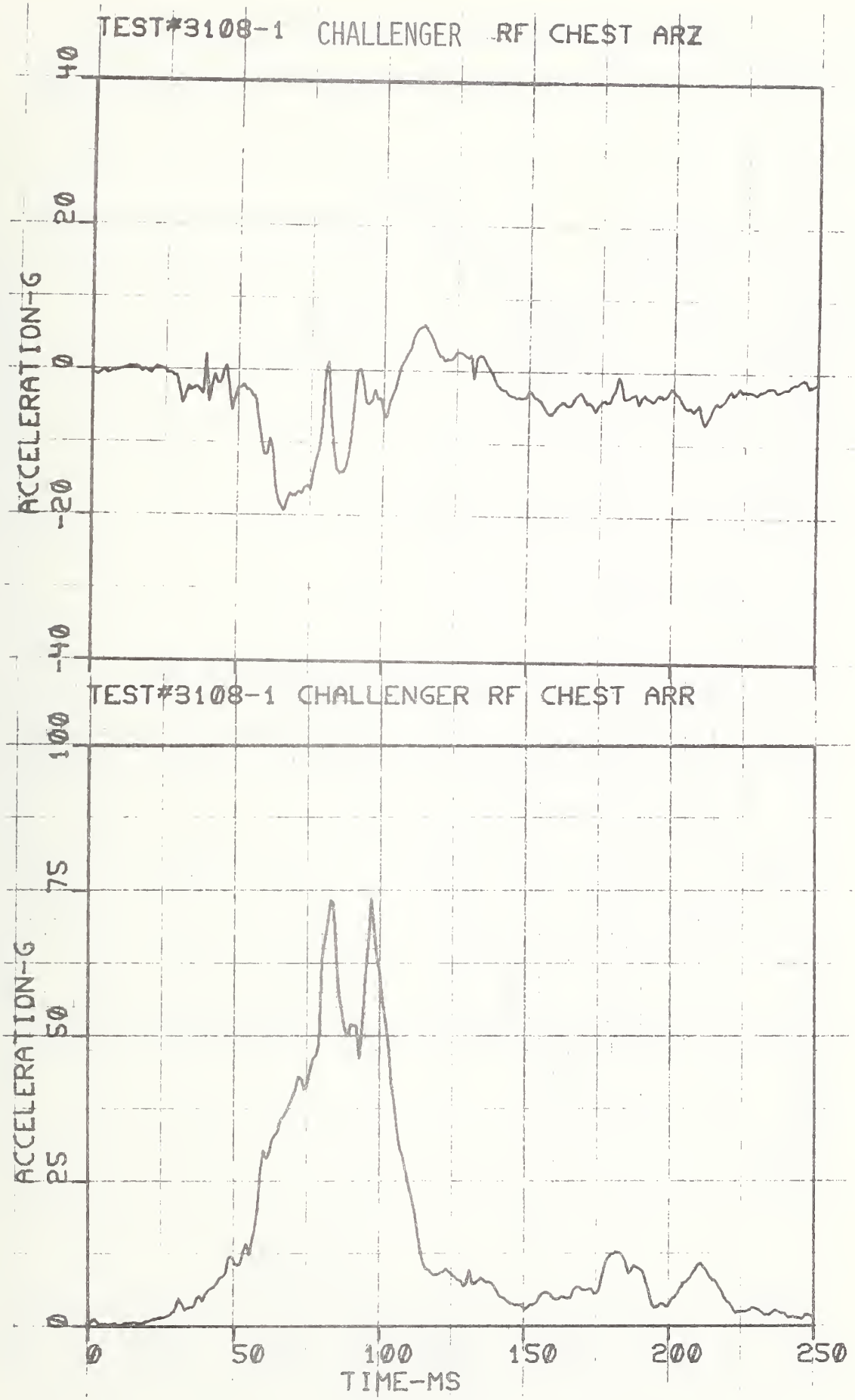

TEST*3108-1 CHALLENGER RF HEAD ARX
ACCELERATION-G
200
100
0
-100
-200
TEST*3108-1 CHALLENGER RF HEAD ARY
ACCELERATION-G
50
25
0
-25
-50
0
50
100
150
200
250
TIME-MS

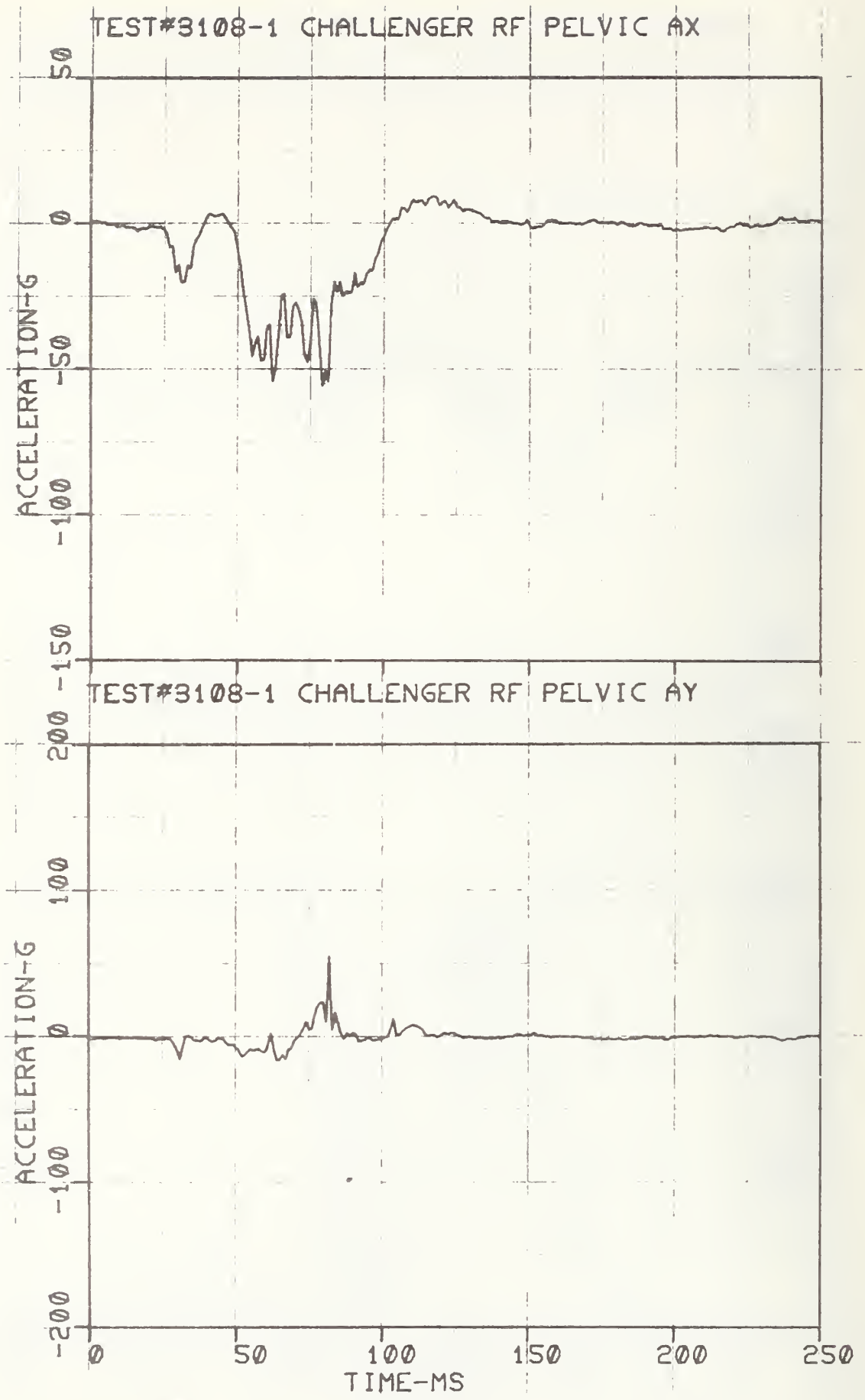

TEST#3108-1 CHALLENGER RF HEAD ARZ
ACCELERATION-G
200
100
0
-100
-200
TEST#3108-1 CHALLENGER RF HEAD ARR
ACCELERATION-G
200
150
100
50
0
0
50
100
150
200
250
TIME-MS

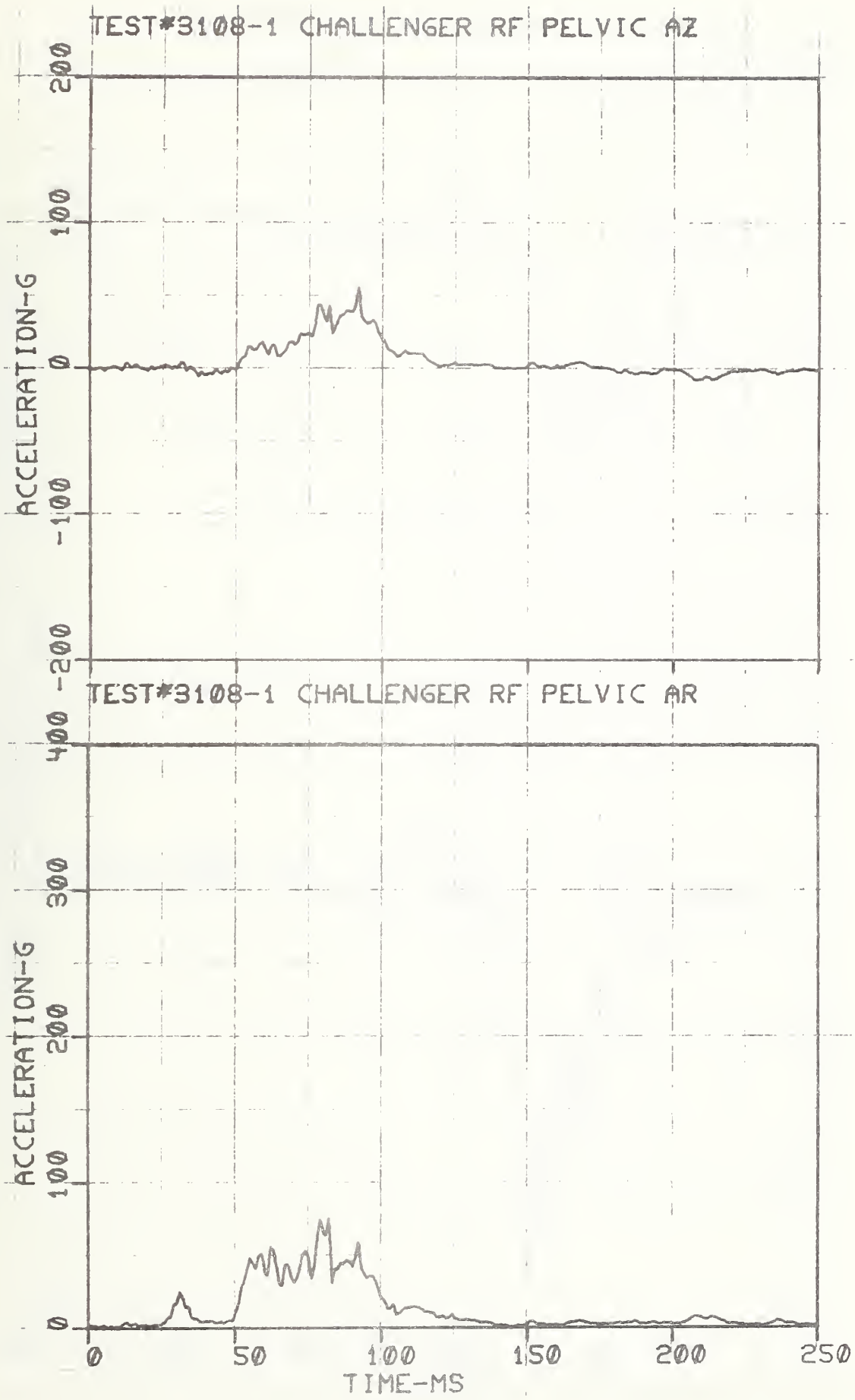

TEST#3108-1 CHALLENGER RF CHEST AX
40
0
-40
-80
-120
ACCELERATION-G
TEST#3108-1 CHALLENGER RF CHEST AY
20
0
-20
-40
-60
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

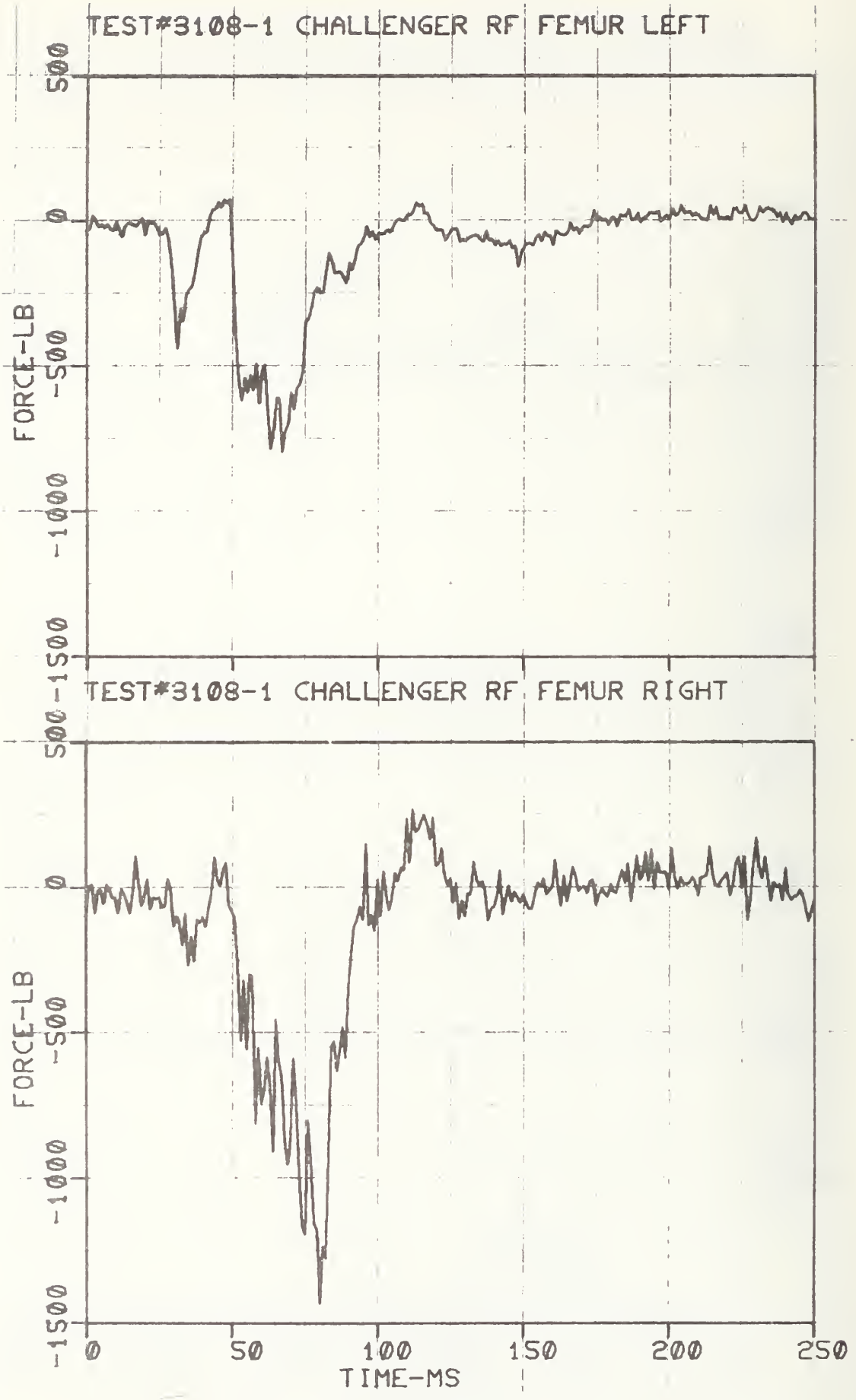

TEST#3108-1 CHALLENGER RF CHEST AZ
40
20
0
-20
-40
ACCELERATION-G
TEST#3108-1 CHALLENGER RF CHEST AR
100
75
50
25
0
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

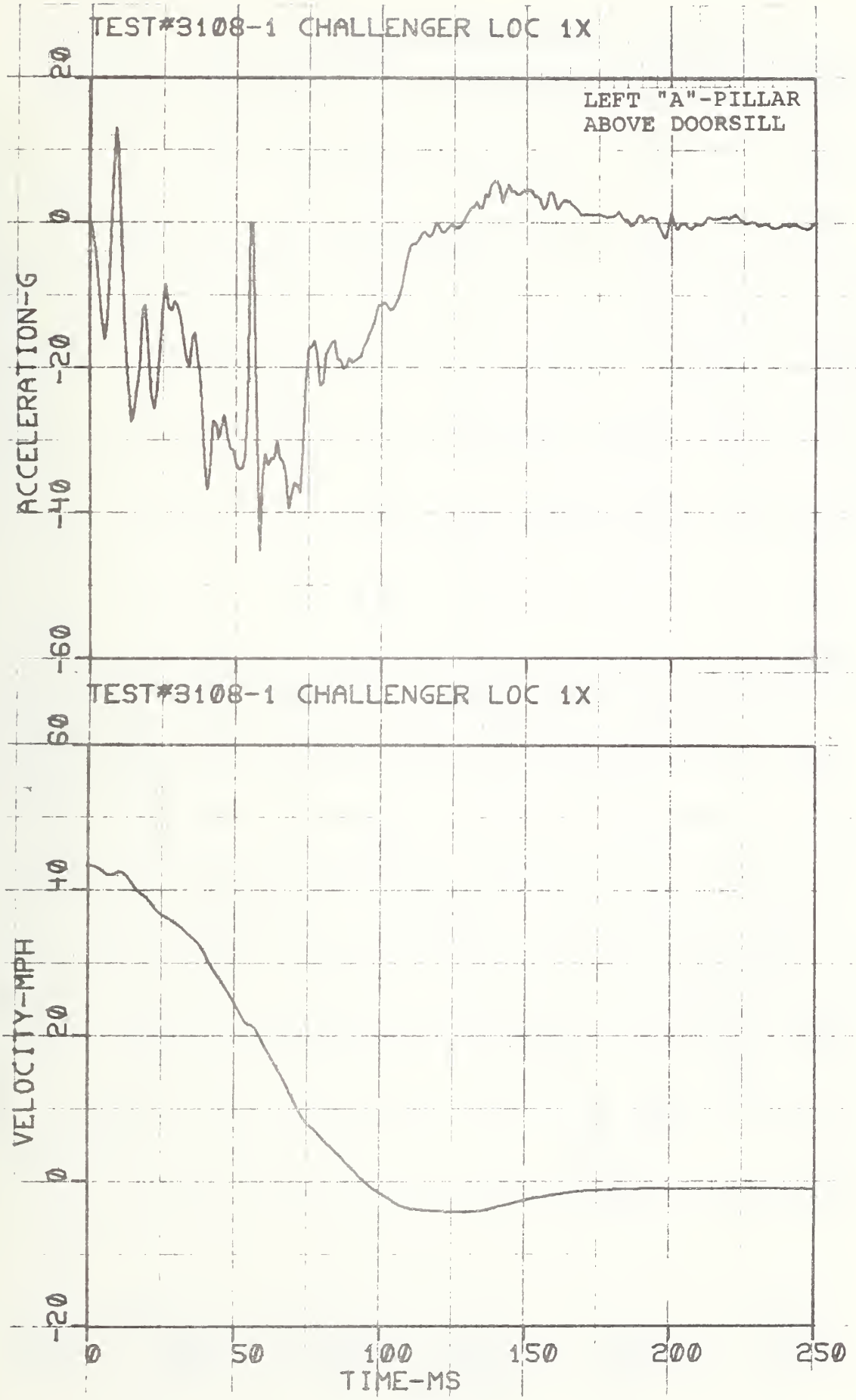

TEST*3108-1 CHALLENGER RF CHEST ARX
40
0
-40
-80
-120
ACCELERATION-G
TEST*3108-1 CHALLENGER RF CHEST ARY
20
0
-20
-40
-60
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

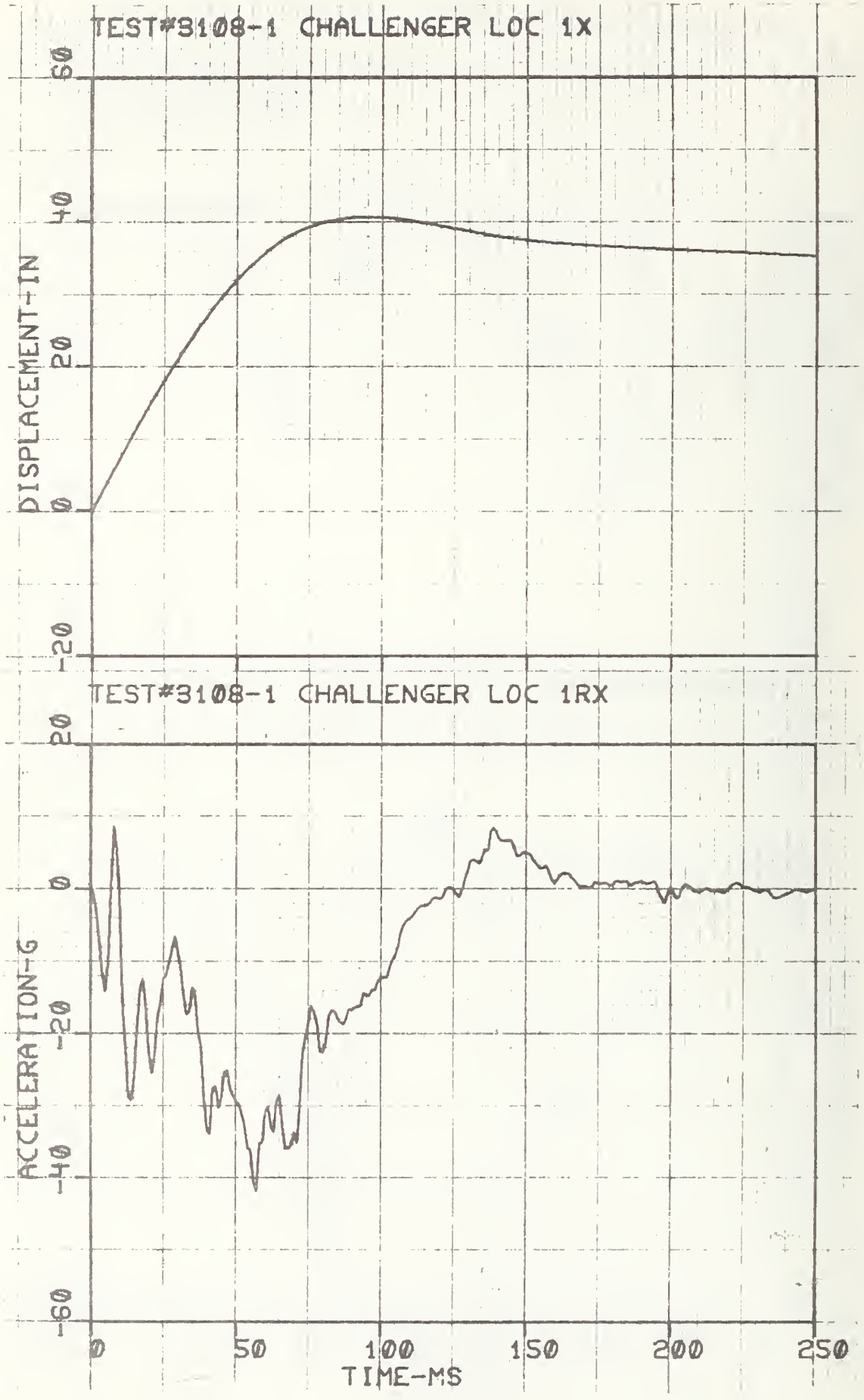

TEST#3108-1 CHALLENGER RF CHEST ARZ
ACCELERATION-G
40
20
0
-20
-40
TEST#3108-1 CHALLENGER RF CHEST ARR
ACCELERATION-G
100
75
50
25
0
0
50
100
150
200
250
TIME-MS

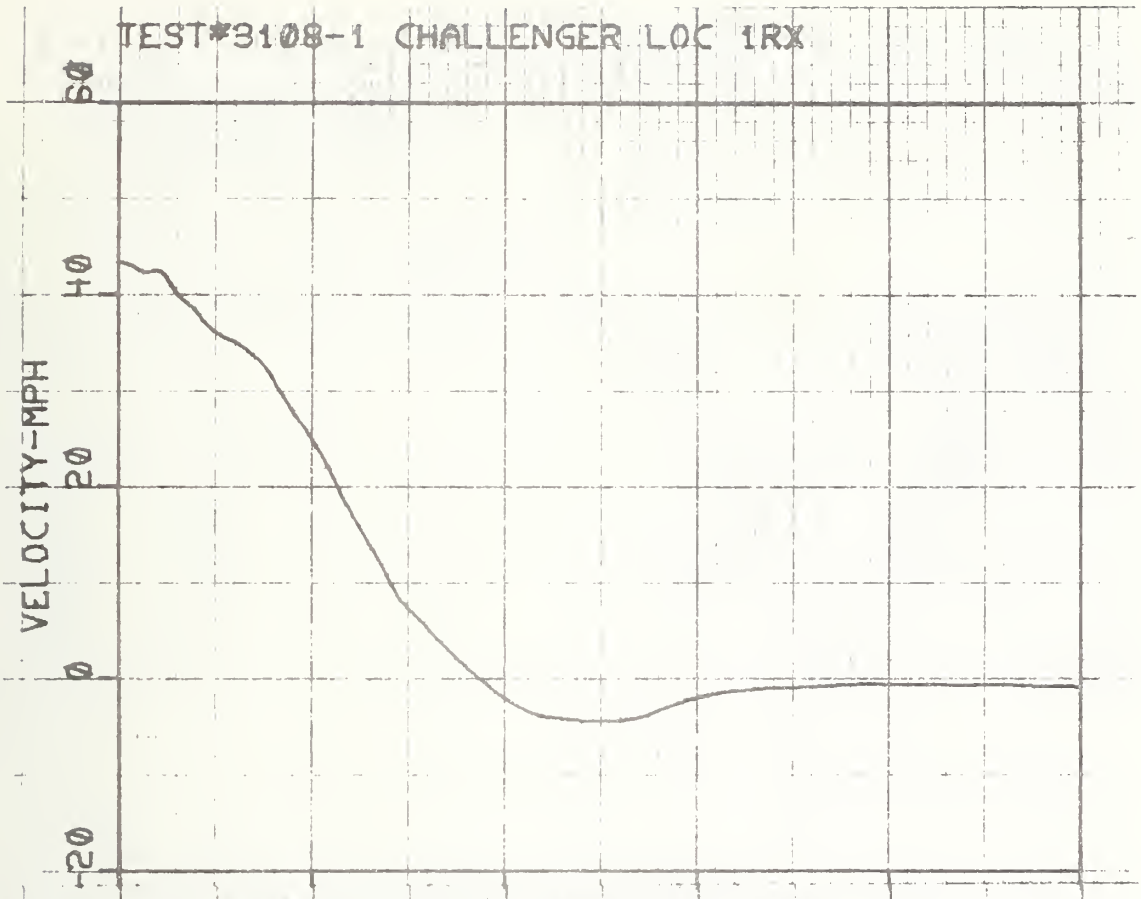

TEST#3108-1 CHALLENGER RF PELVIC AX
50
0
-50
-100
-150
ACCELERATION-G
TEST#3108-1 CHALLENGER RF PELVIC AY
200
100
0
-100
-200
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

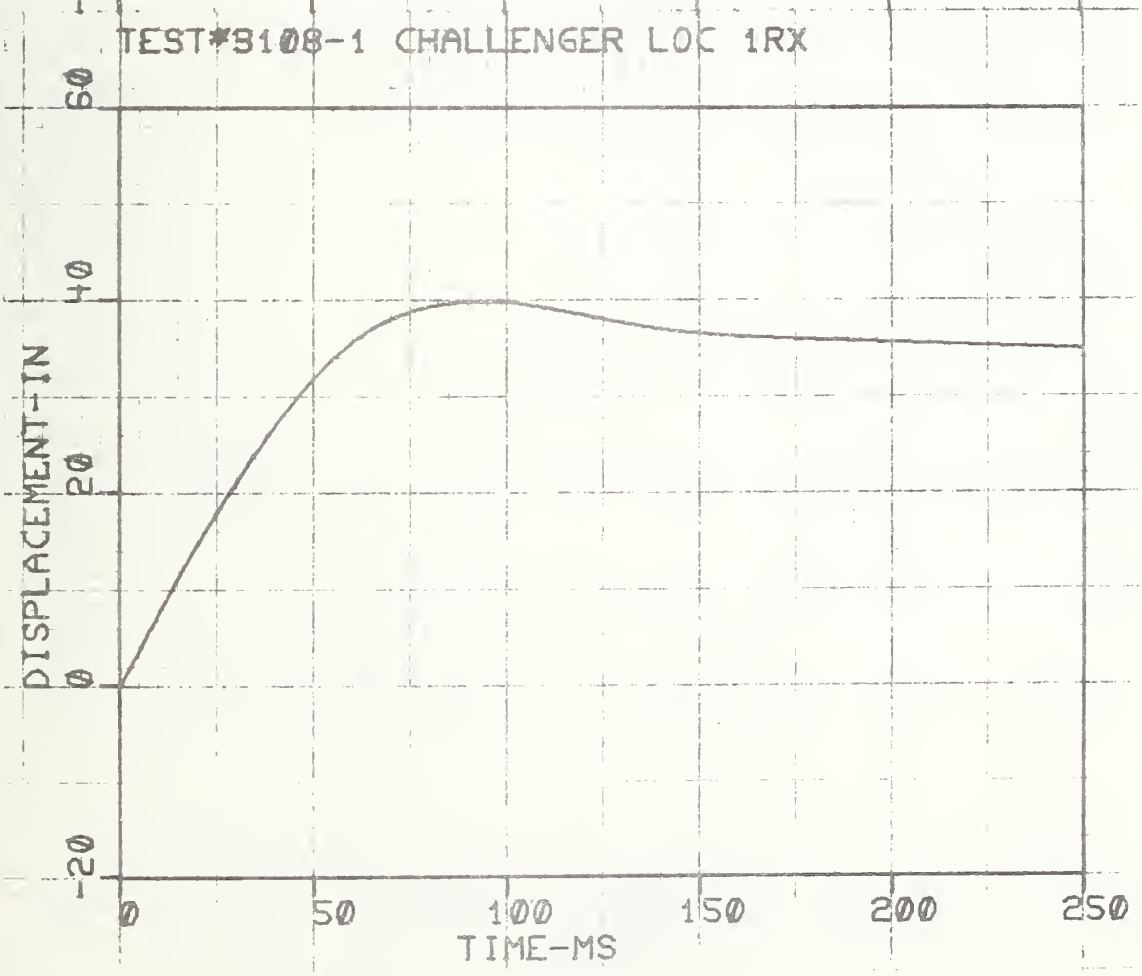

TEST#3108-1 CHALLENGER RF PELVIC AZ
ACCELERATION-G
200
100
0
-100
-200
TEST#3108-1 CHALLENGER RF PELVIC AR
ACCELERATION-G
400
300
200
100
0
0
50
100
150
200
250
TIME-MS

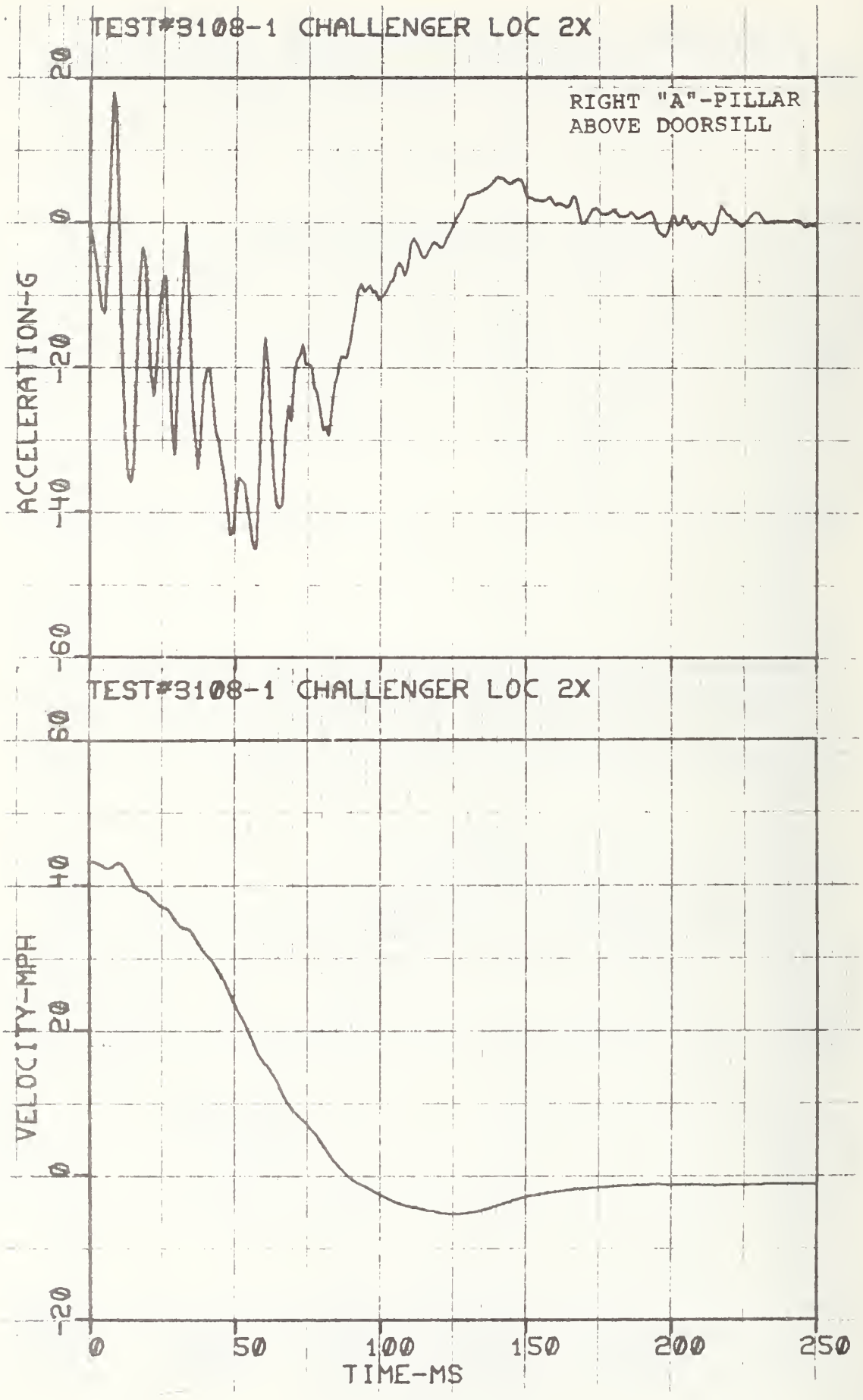

TEST#3108-1 CHALLENGER RF FEMUR LEFT
500
0
-500
-1000
-1500
FORCE-LB
TEST#3108-1 CHALLENGER RF FEMUR RIGHT
500
0
-500
-1000
-1500
FORCE-LB
0
50
100
150
200
250
TIME-MS

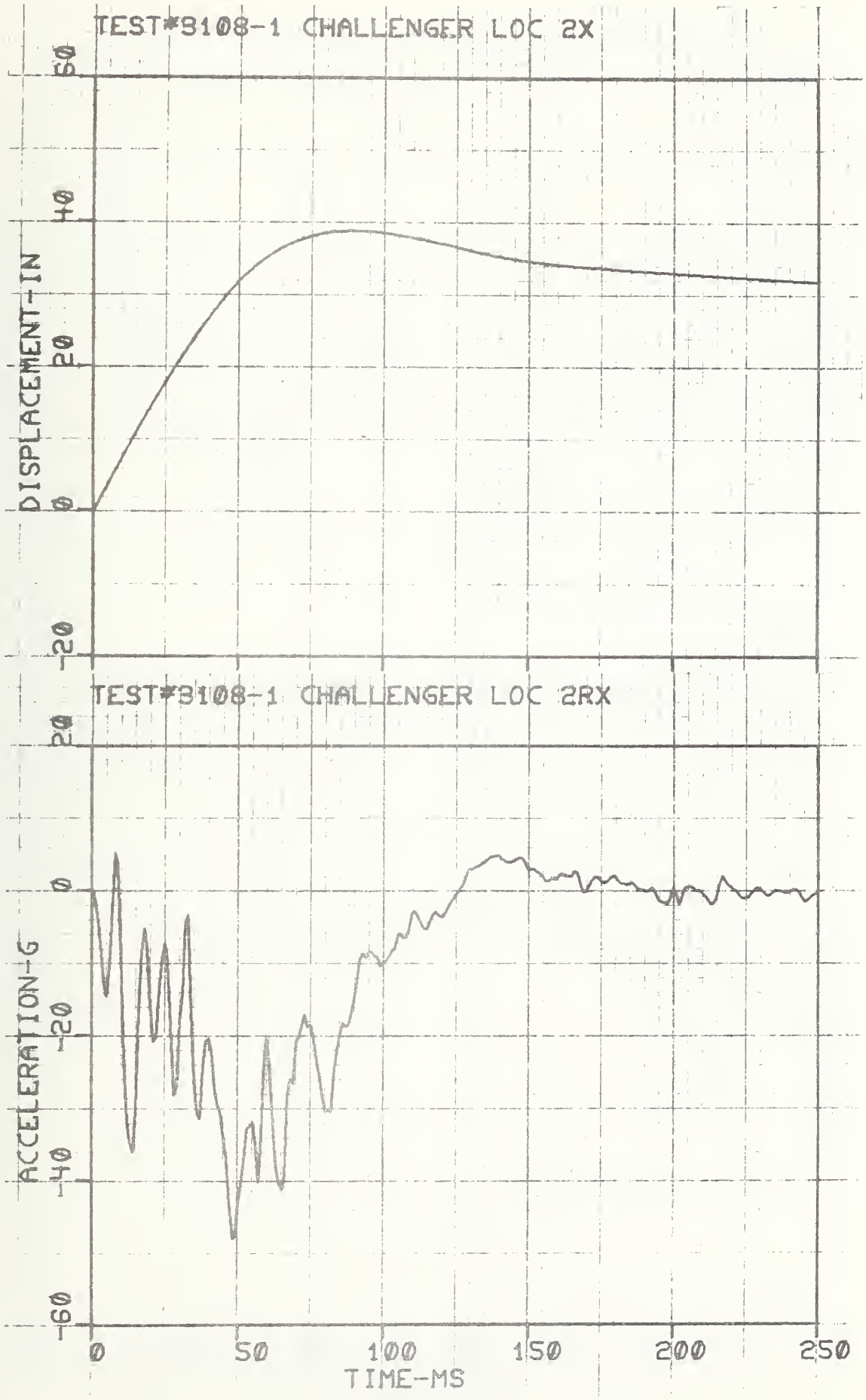

TEST#3108-1 CHALLENGER LOC 1X
LEFT "A"-PILLAR
ABOVE DOORSILL
ACCELERATION-G
20
0
-20
-40
-60
TEST#3108-1 CHALLENGER LOC 1X
VELOCITY-MPH
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

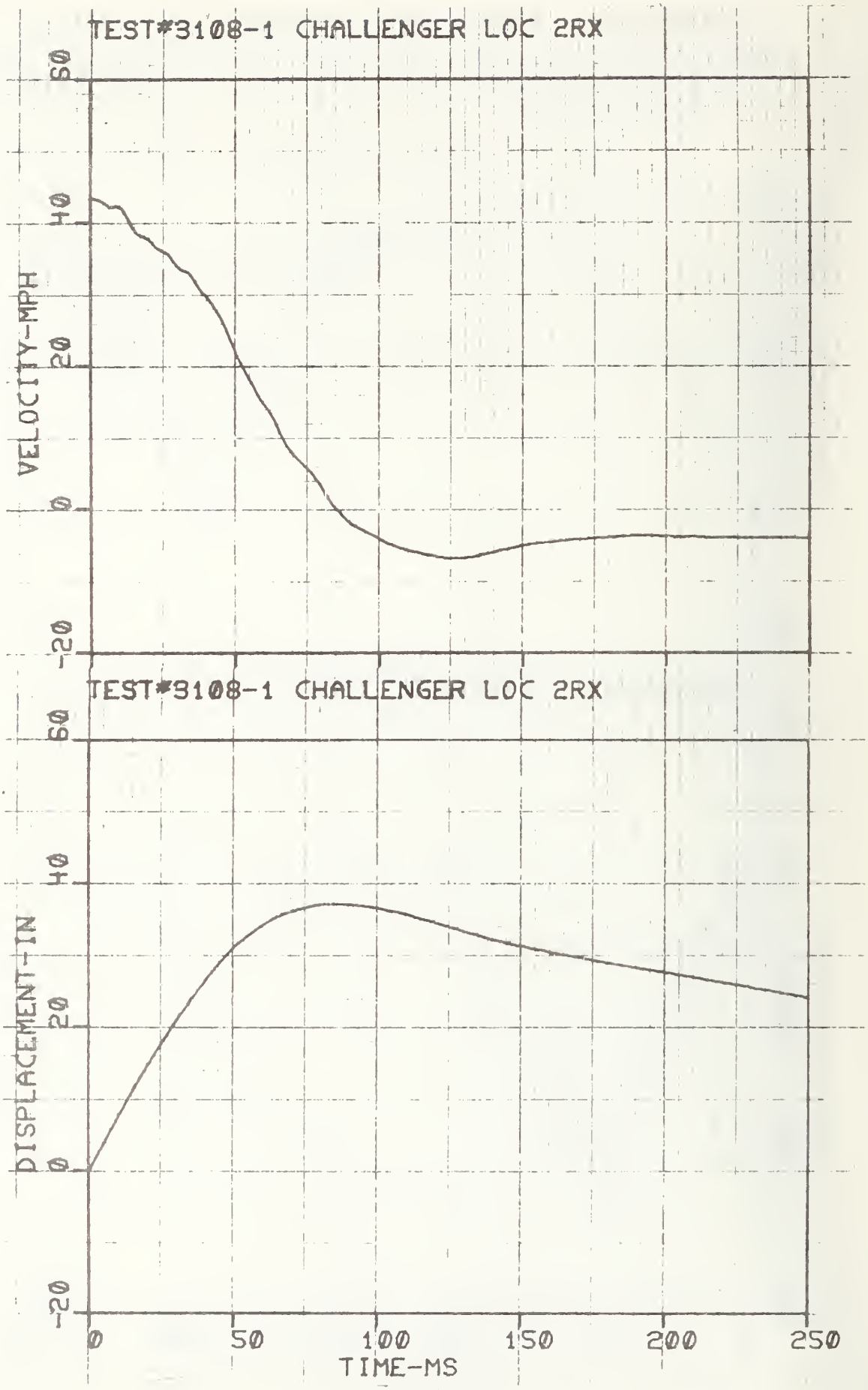

TEST#3108-1 CHALLENGER LOC 1X
DISPLACEMENT-IN
60
40
20
0
-20
TEST#3108-1 CHALLENGER LOC 1RX
ACCELERATION-G
20
0
-20
-40
-60
0
50
100
150
200
250
TIME-MS

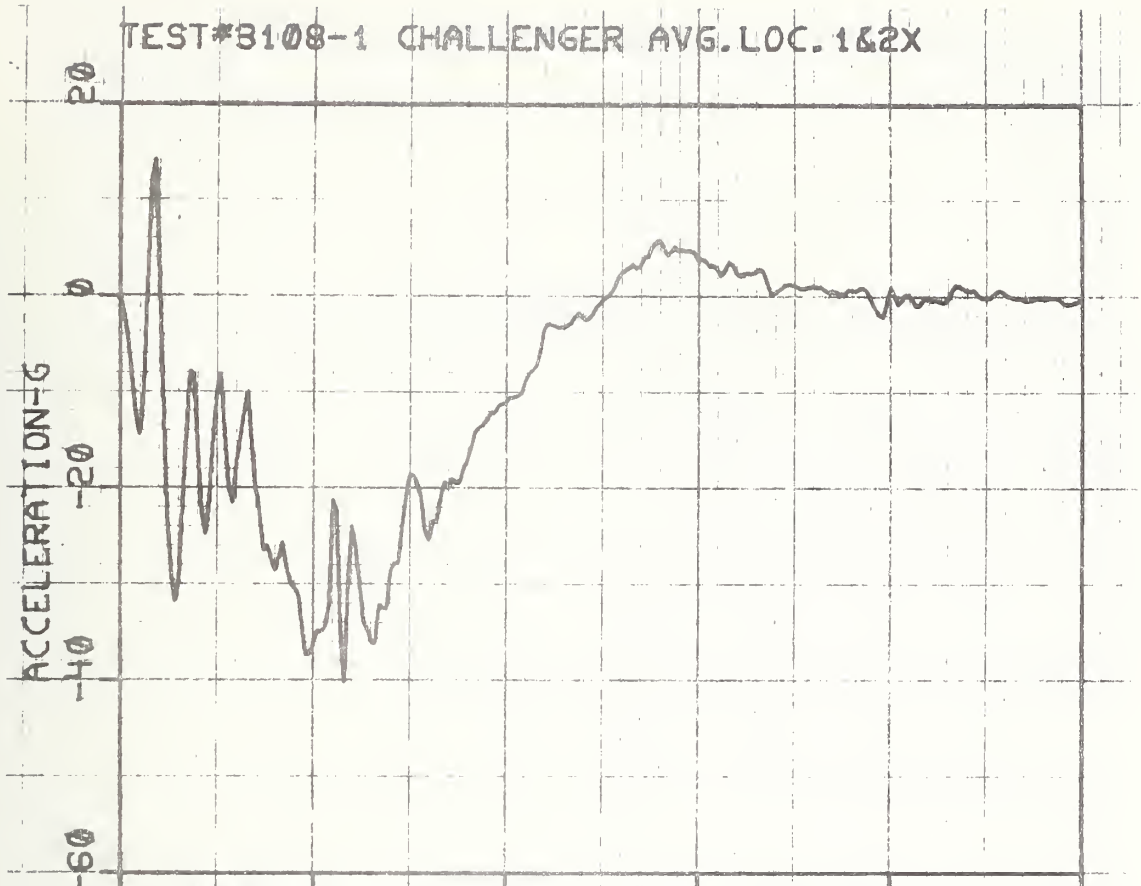

TEST*3108-1 CHALLENGER LOC 1RX
VELOCITY-MPH
60
40
20
0
-20

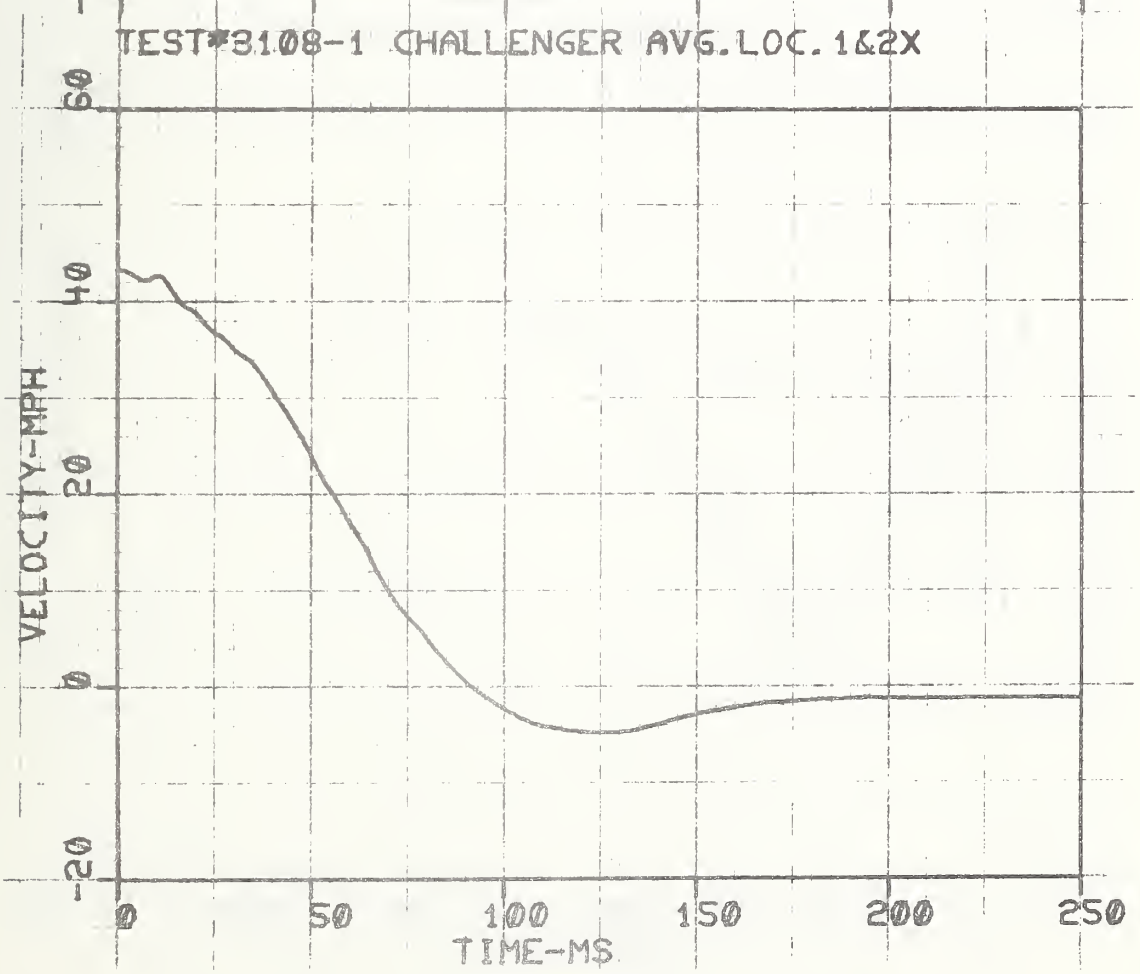

TEST*3108-1 CHALLENGER LOC 1RX
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

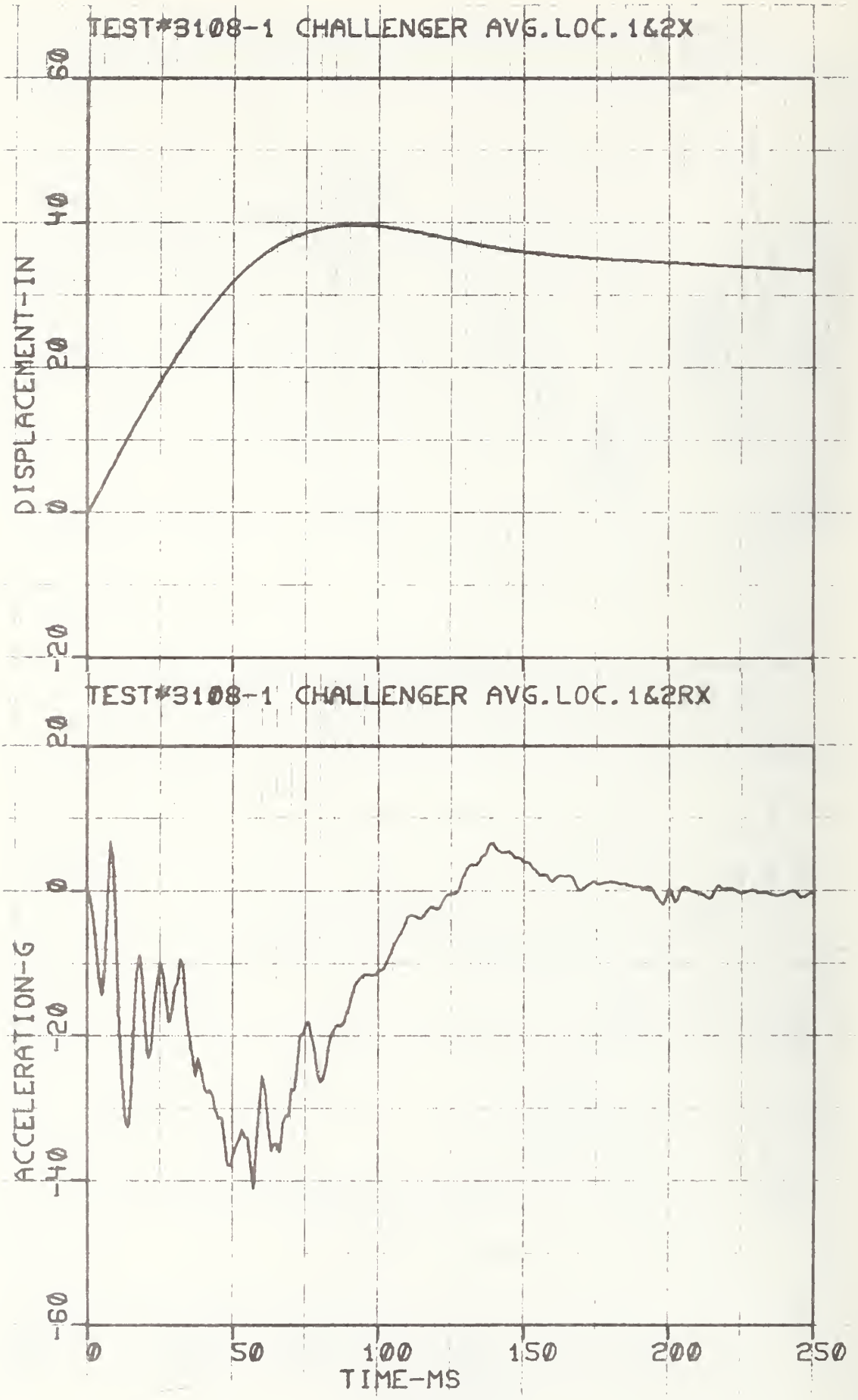

TEST#3108-1 CHALLENGER LOC 2X
RIGHT "A"-PILLAR
ABOVE DOORSILL
ACCELERATION-G
20
0
-20
-40
-60
TEST#3108-1 CHALLENGER LOC 2X
VELOCITY-MPH
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

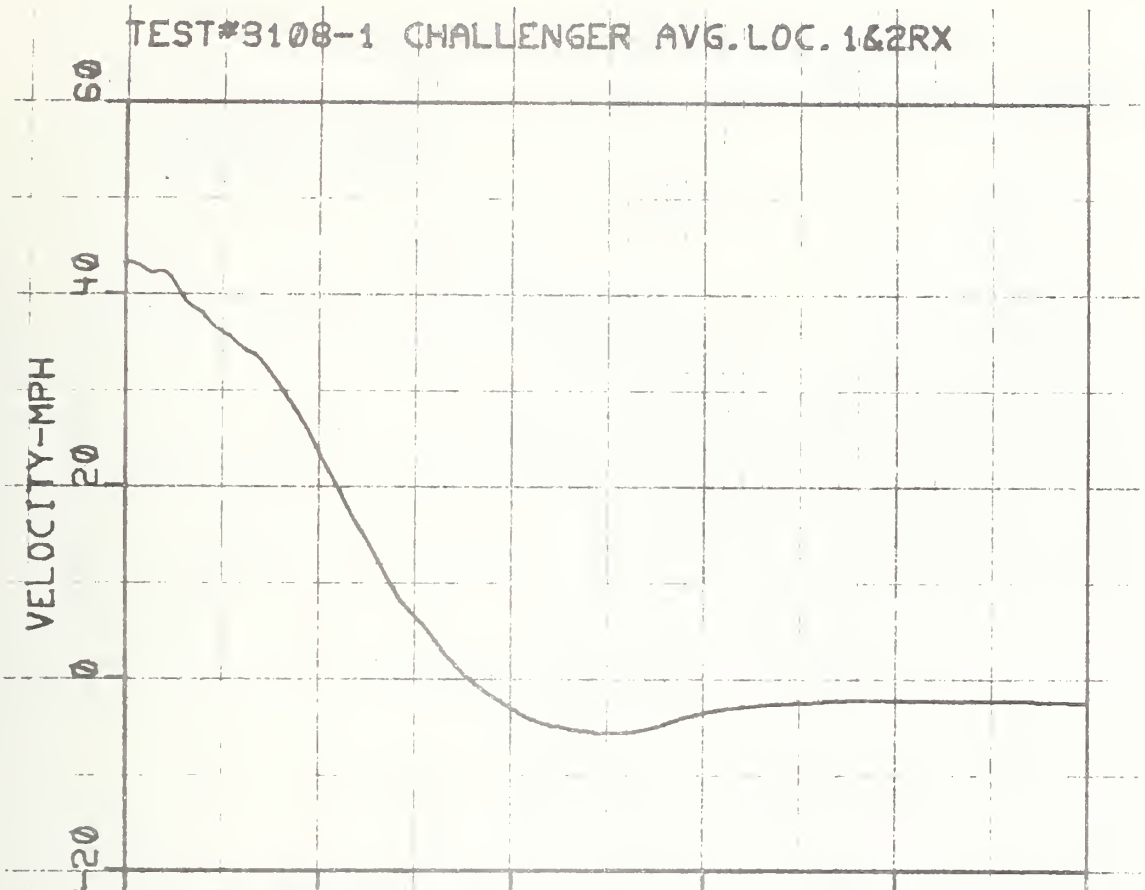

TEST*3108-1 CHALLENGER LOC 2X
DISPLACEMENT-IN
60
40
20
0
-20
TEST*3108-1 CHALLENGER LOC 2RX
ACCELERATION-G
20
0
-20
-40
-60
0
50
100
150
200
250
TIME-MS

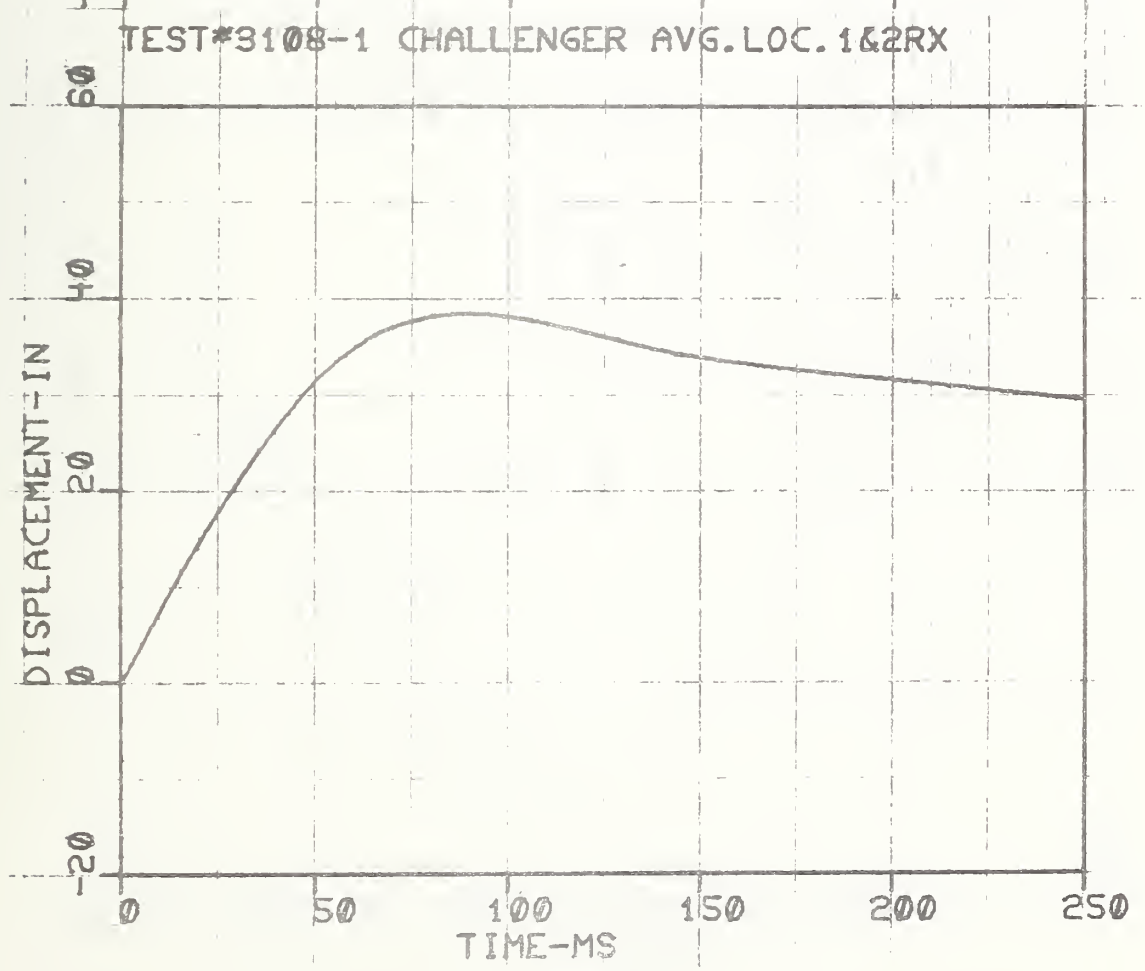

TEST#3108-1 CHALLENGER LOC 2RX
VELOCITY-MPH
60
40
20
0
-20
TEST#3108-1 CHALLENGER LOC 2RX
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

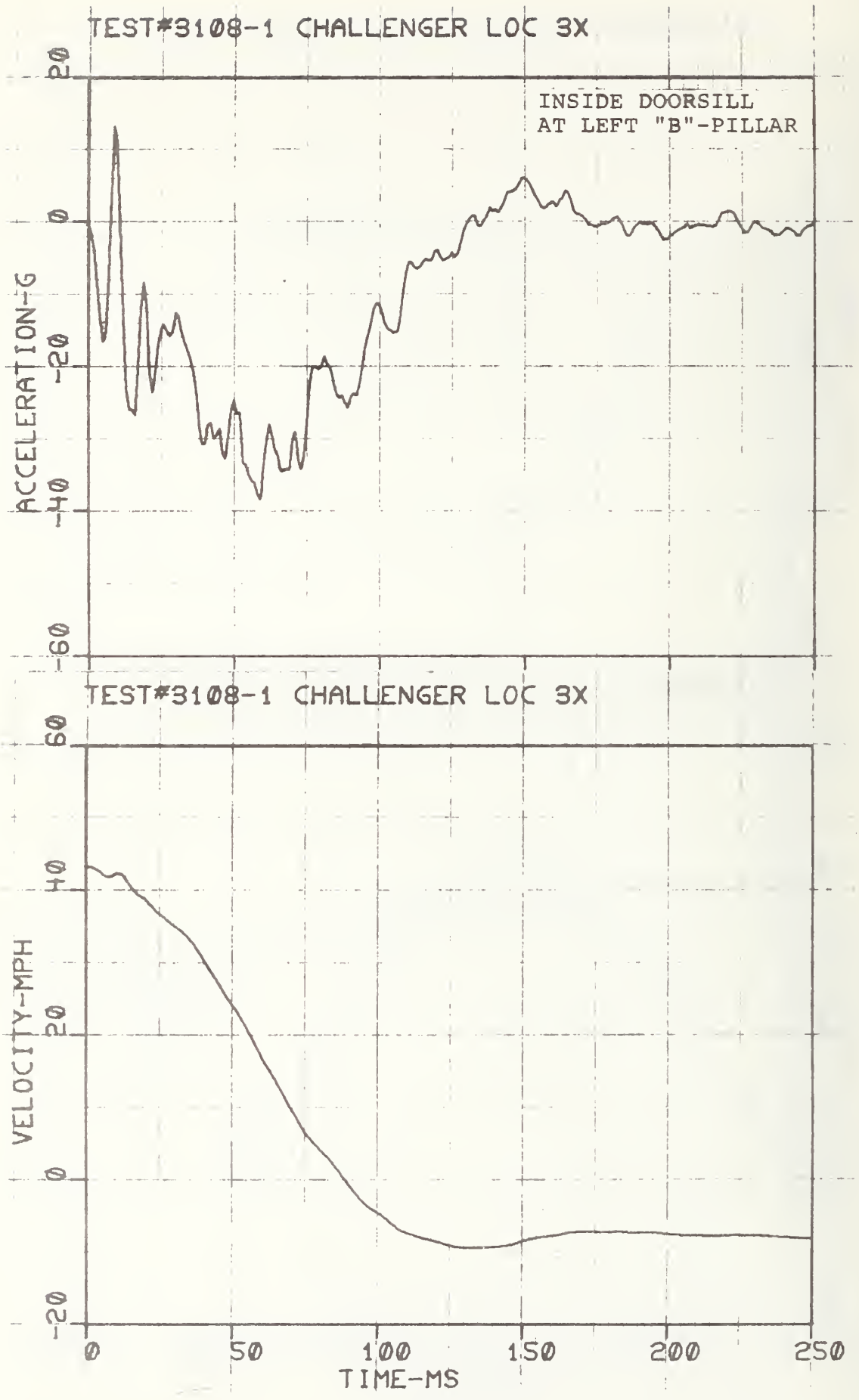

TEST#3108-1 CHALLENGER AVG.LOC.1&2X
ACCELERATION-G
20
0
-20
-40
-60

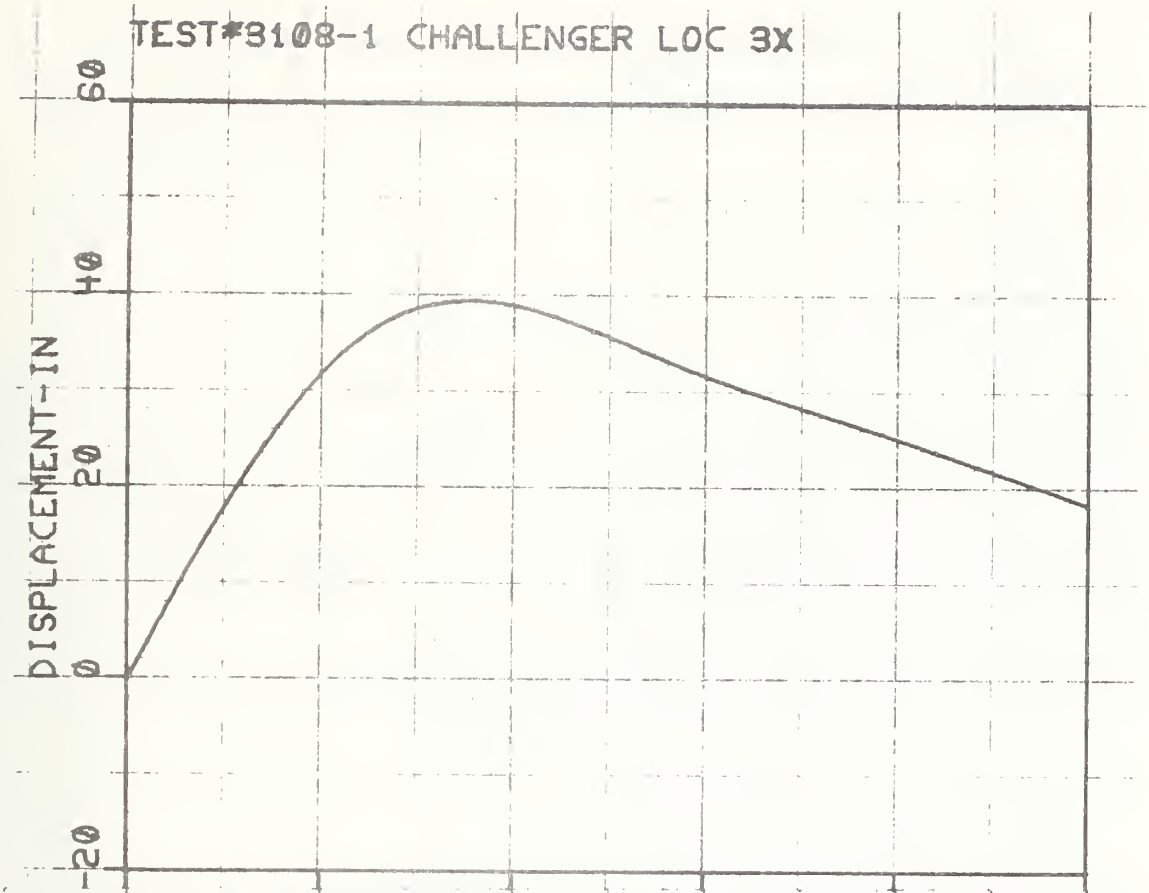

TEST#3108-1 CHALLENGER AVG.LOC.1&2X
VELOCITY-MPH
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

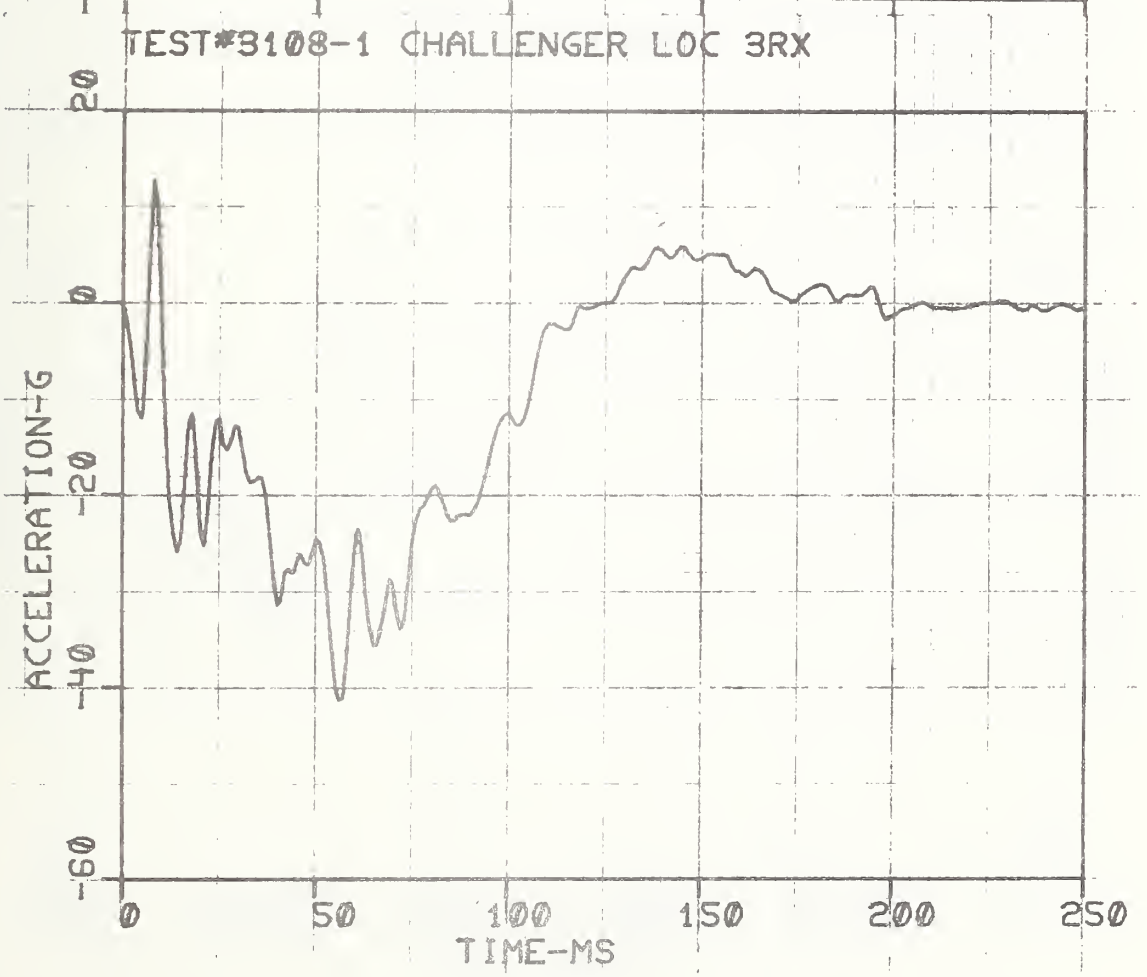

TEST*3108-1 CHALLENGER AVG.LOC.1&2X
DISPLACEMENT-IN
60
40
20
0
-20
TEST*3108-1 CHALLENGER AVG.LOC.1&2RX
ACCELERATION-G
20
0
-20
-40
-60
0
50
100
150
200
250
TIME-MS

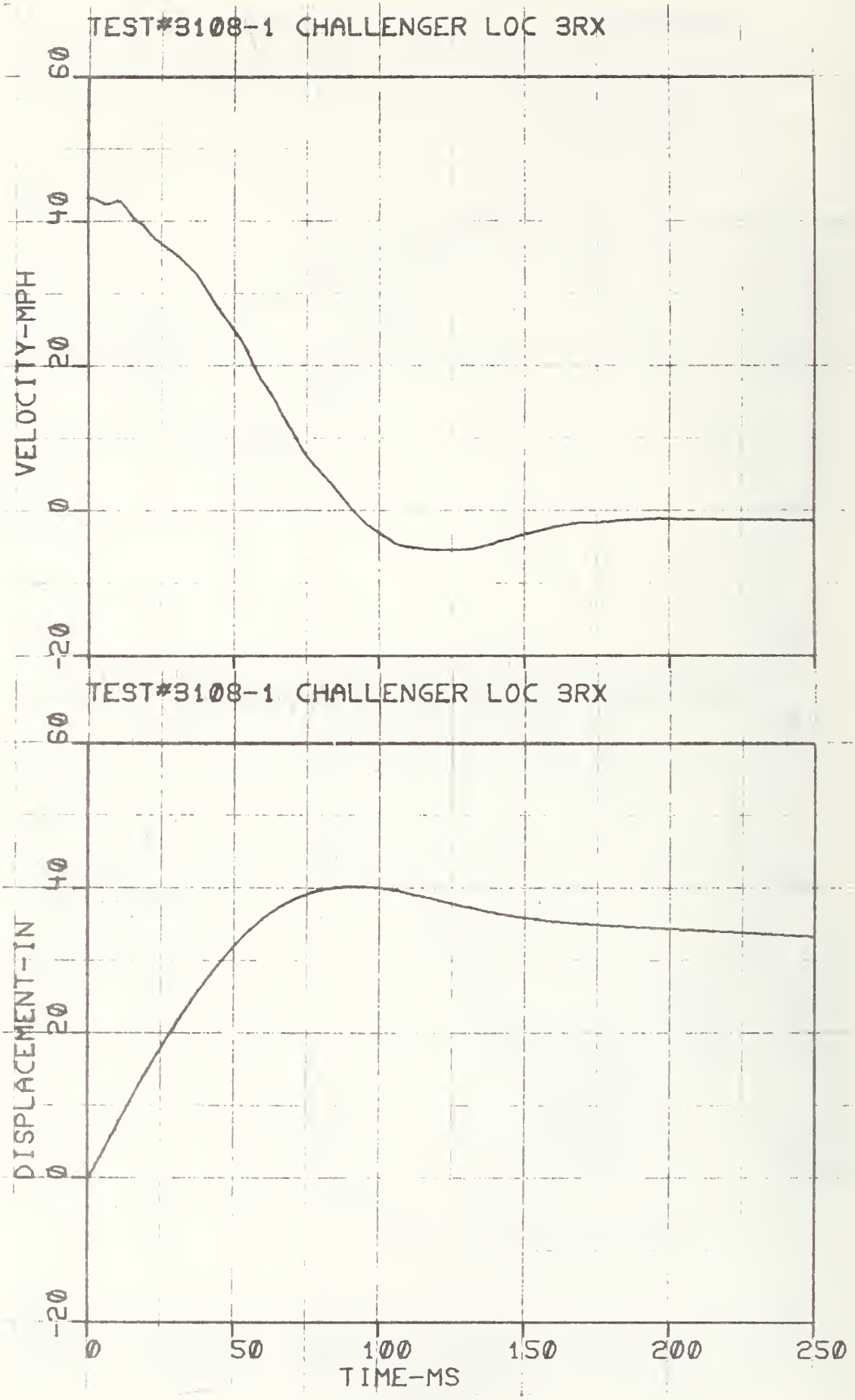

TEST*3108-1 CHALLENGER AVG.LOC.1&2RX
VELOCITY-MPH
60
40
20
0
-20

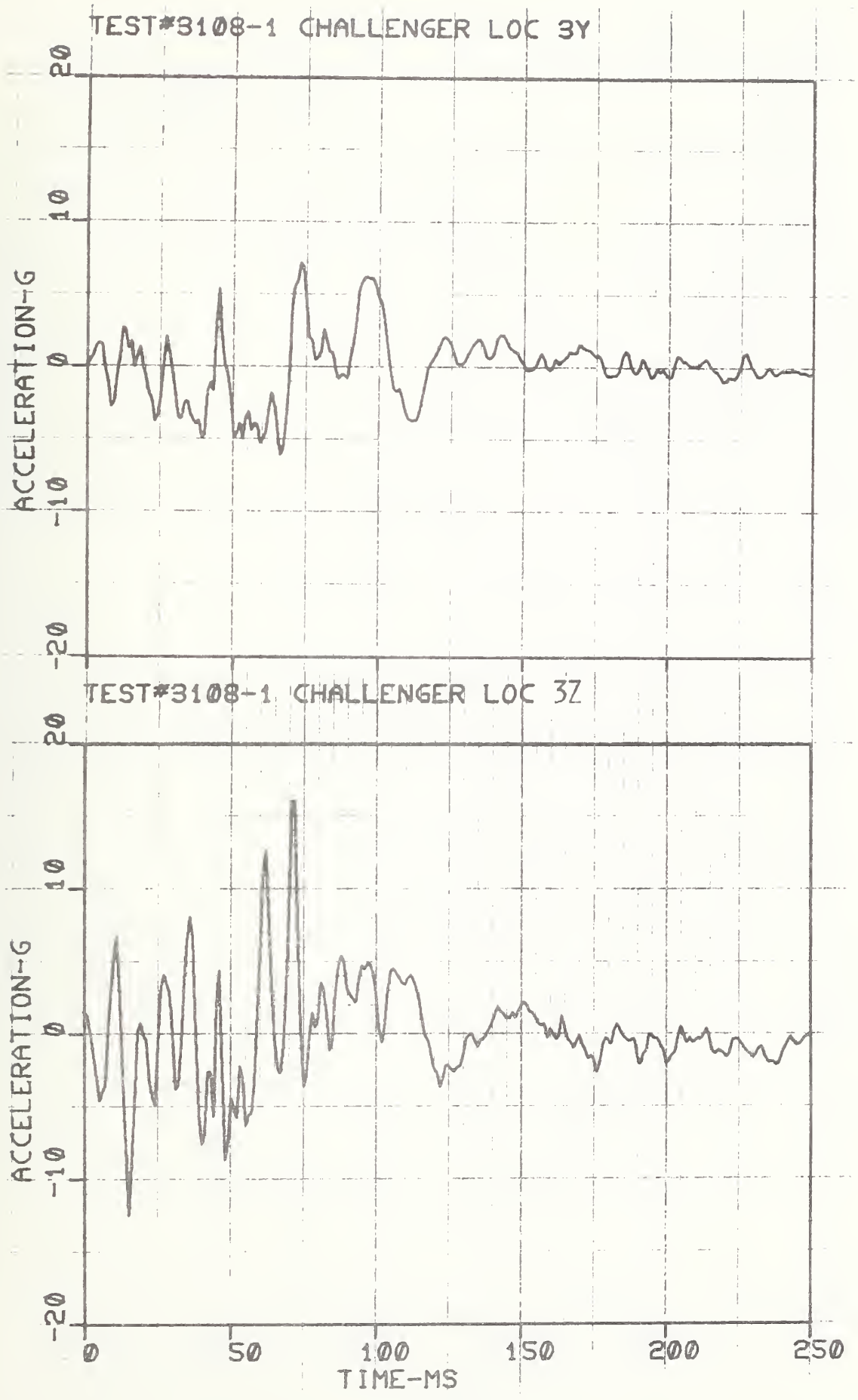

TEST*3108-1 CHALLENGER AVG.LOC.1&2RX
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

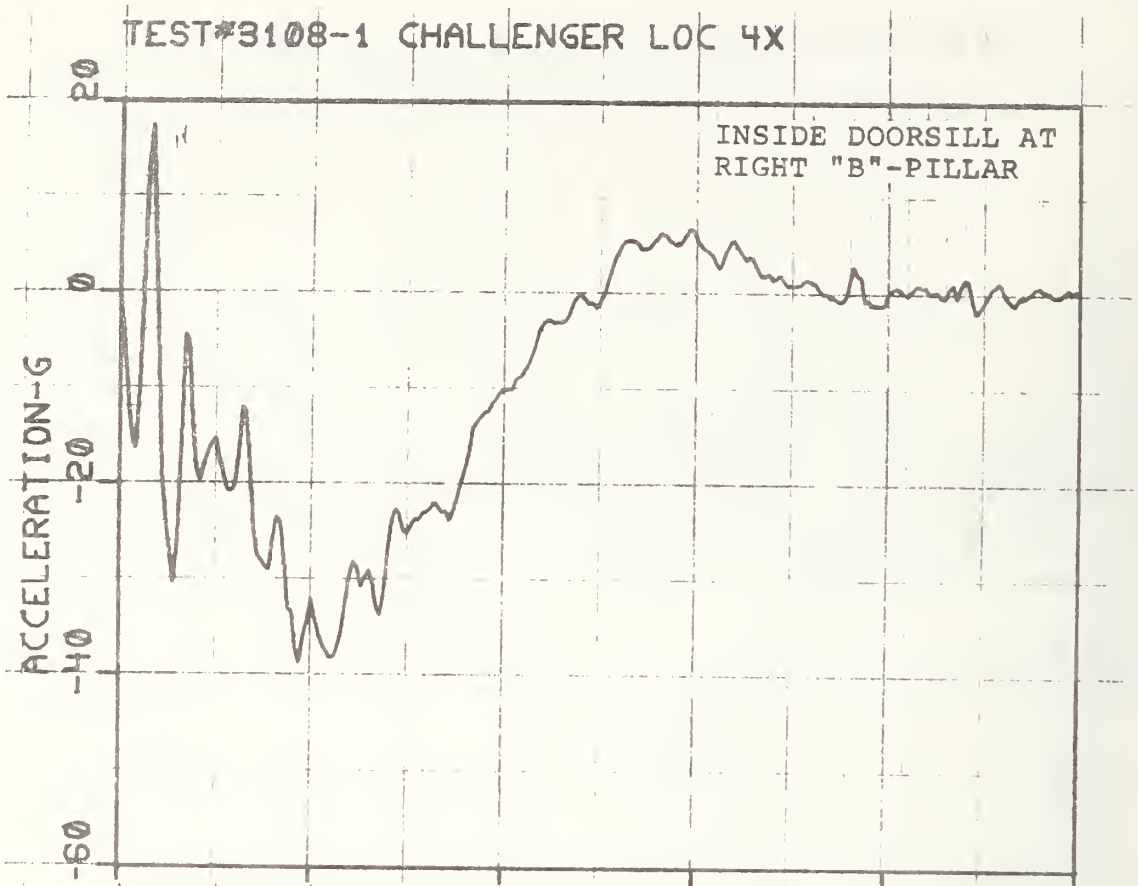

TEST#3108-1 CHALLENGER LOC 3X
INSIDE DOORSILL
AT LEFT "B"-PILLAR
ACCELERATION-G
20
0
-20
-40
-60
TEST#3108-1 CHALLENGER LOC 3X
VELOCITY-MPH
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

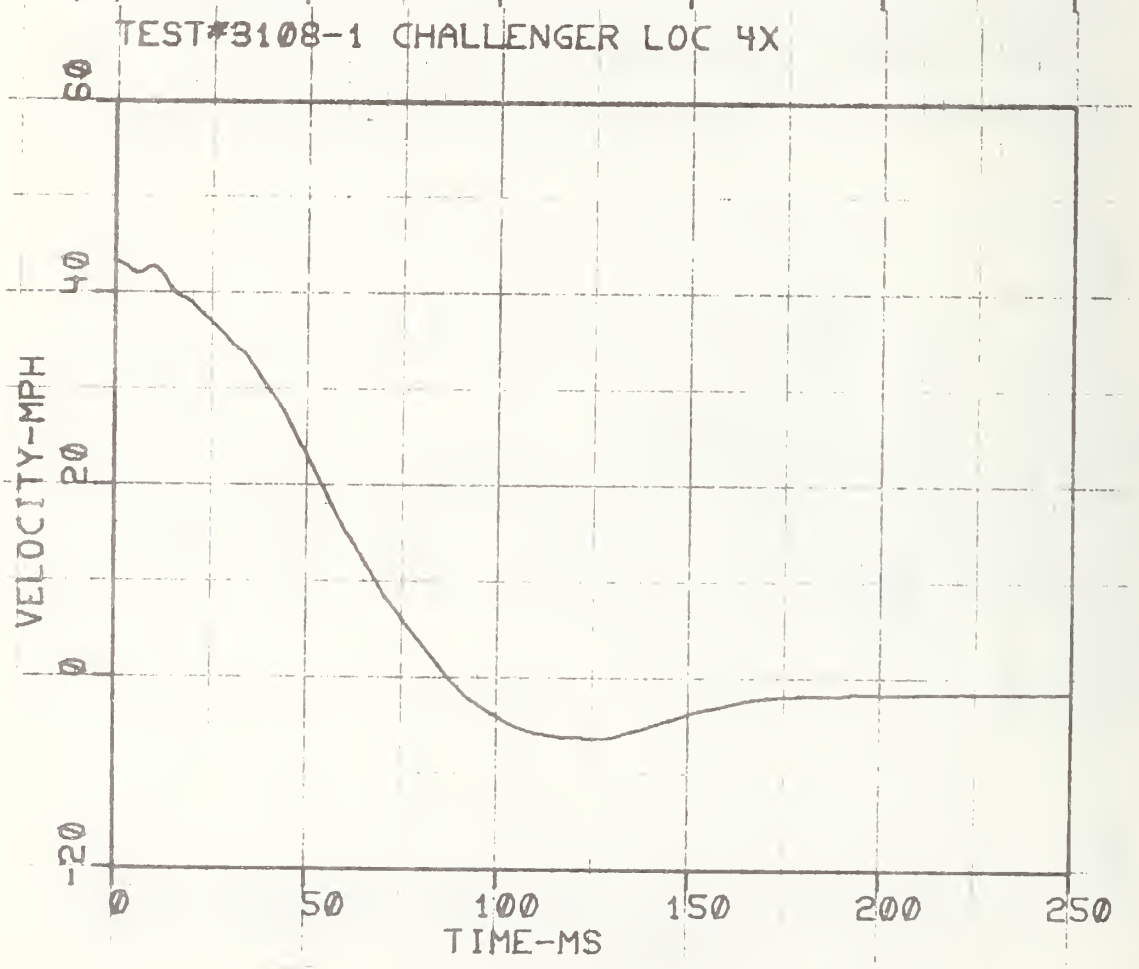

TEST*3108-1 CHALLENGER LOC 3X
DISPLACEMENT-IN
60
40
20
0
-20

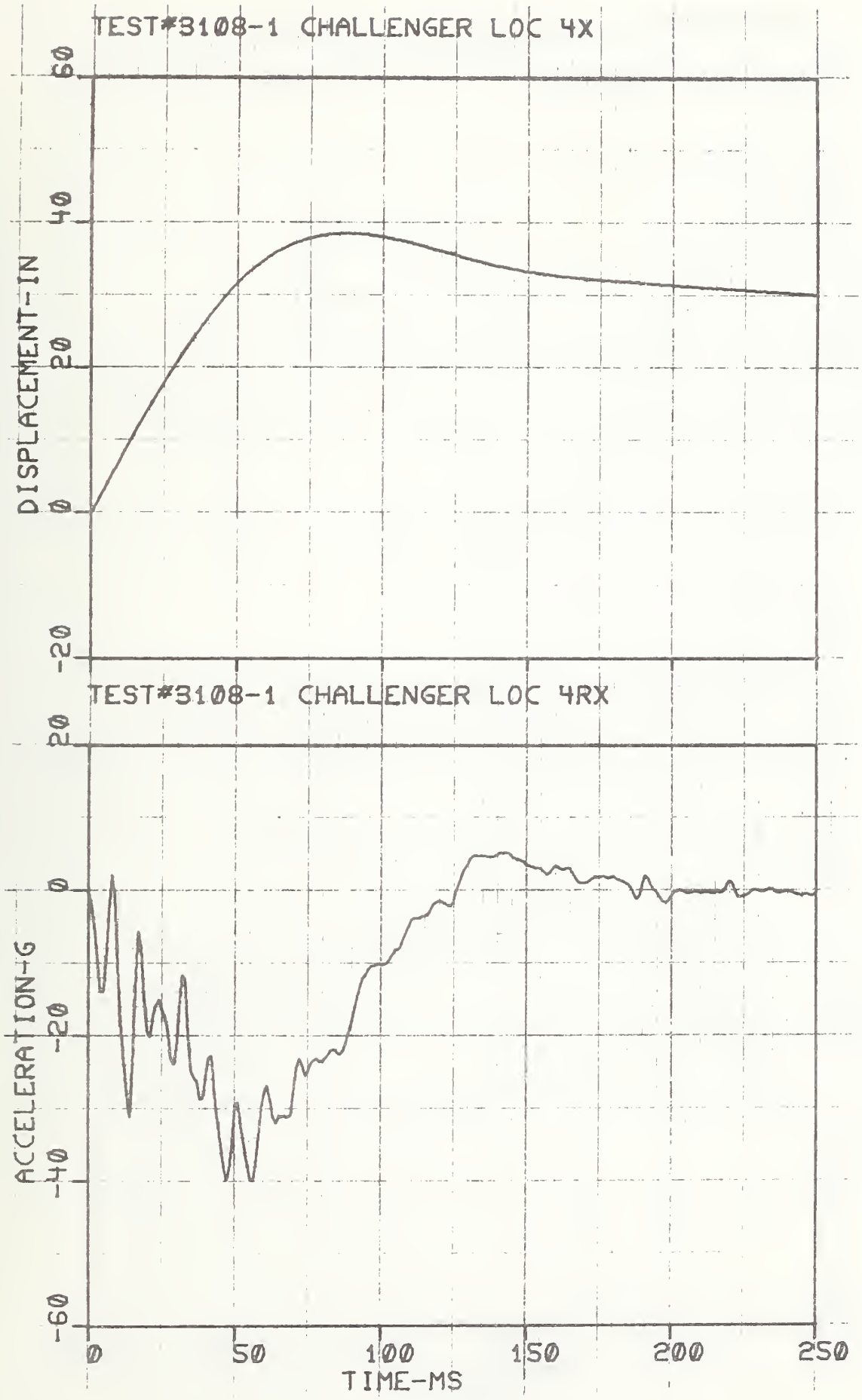

TEST*3108-1 CHALLENGER LOC 3RX
ACCELERATION-G
20
0
-20
-40
-60
0
50
100
150
200
250
TIME-MS

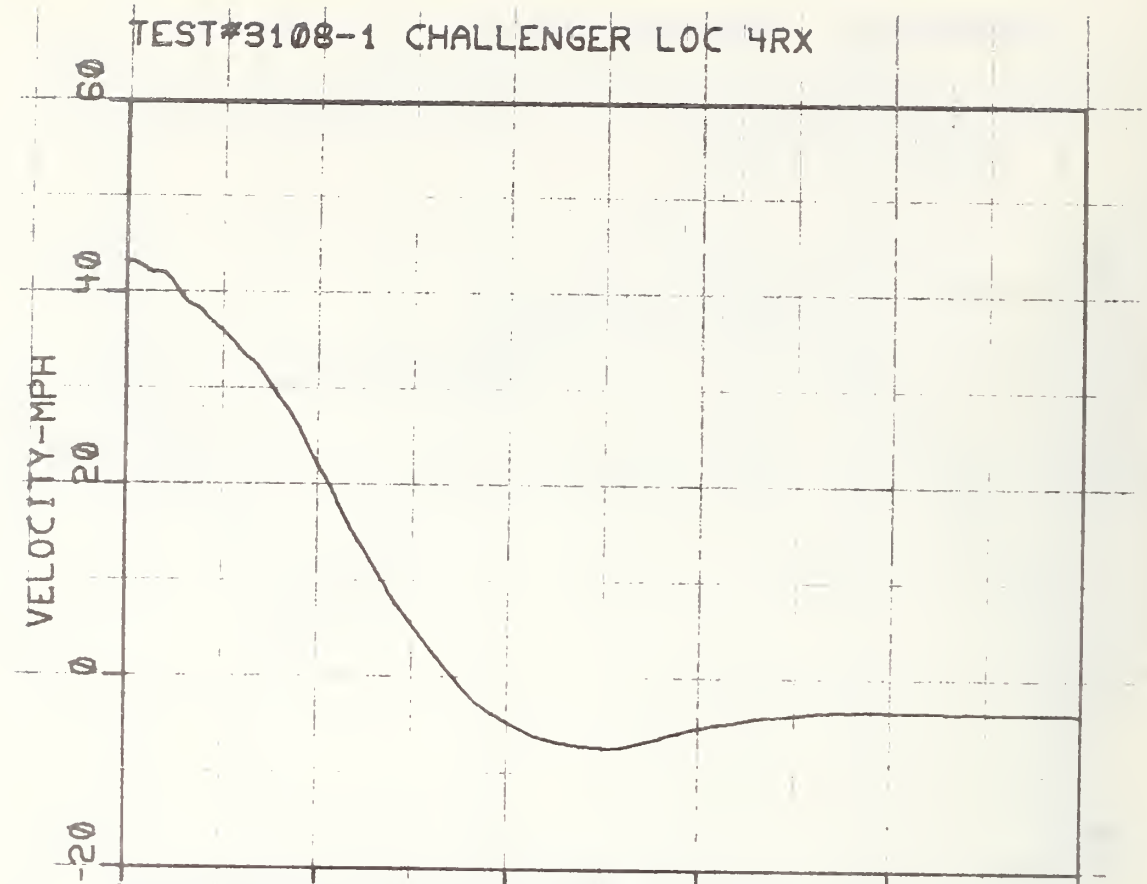

TEST#3108-1 CHALLENGER LOC 3RX
VELOCITY-MPH
60
40
20
0
-20
TEST#3108-1 CHALLENGER LOC 3RX
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

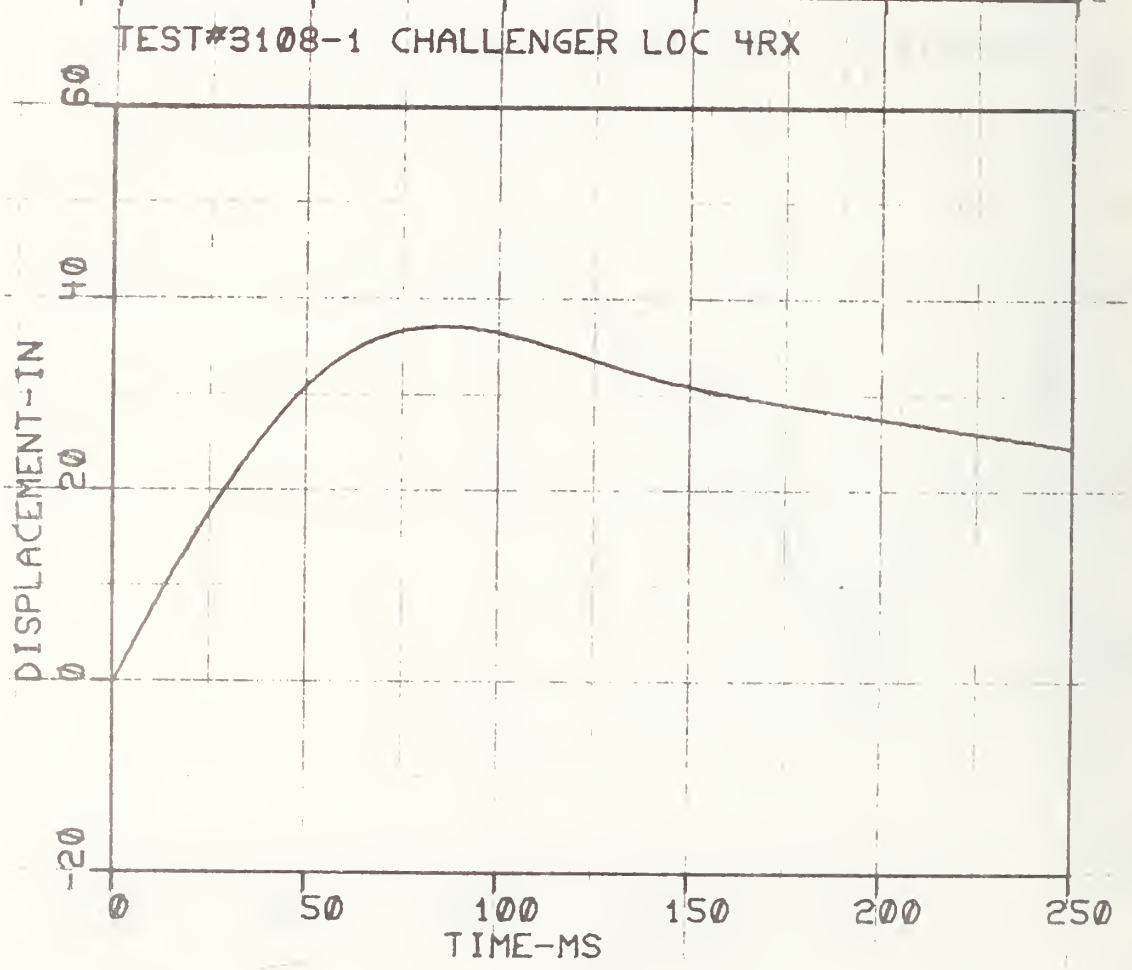

TEST#3108-1 CHALLENGER LOC 3Y
20
10
0
-10
-20
ACCELERATION-G
TEST#3108-1 CHALLENGER LOC 3Z
20
10
0
-10
-20
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

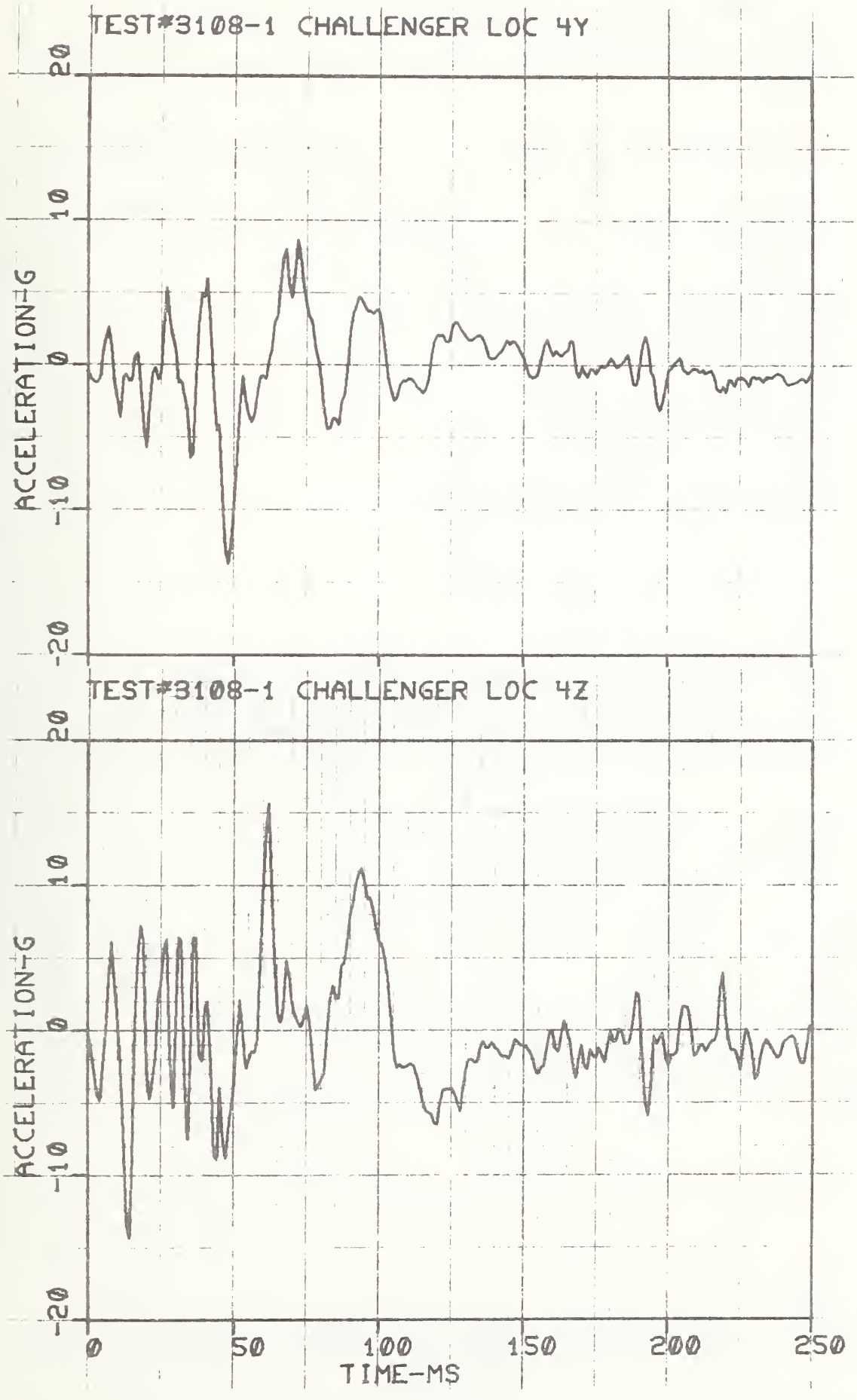

TEST#3108-1 CHALLENGER LOC 4X
INSIDE DOORSILL AT
RIGHT "B"-PILLAR
ACCELERATION-G
20
0
-20
-40
-60

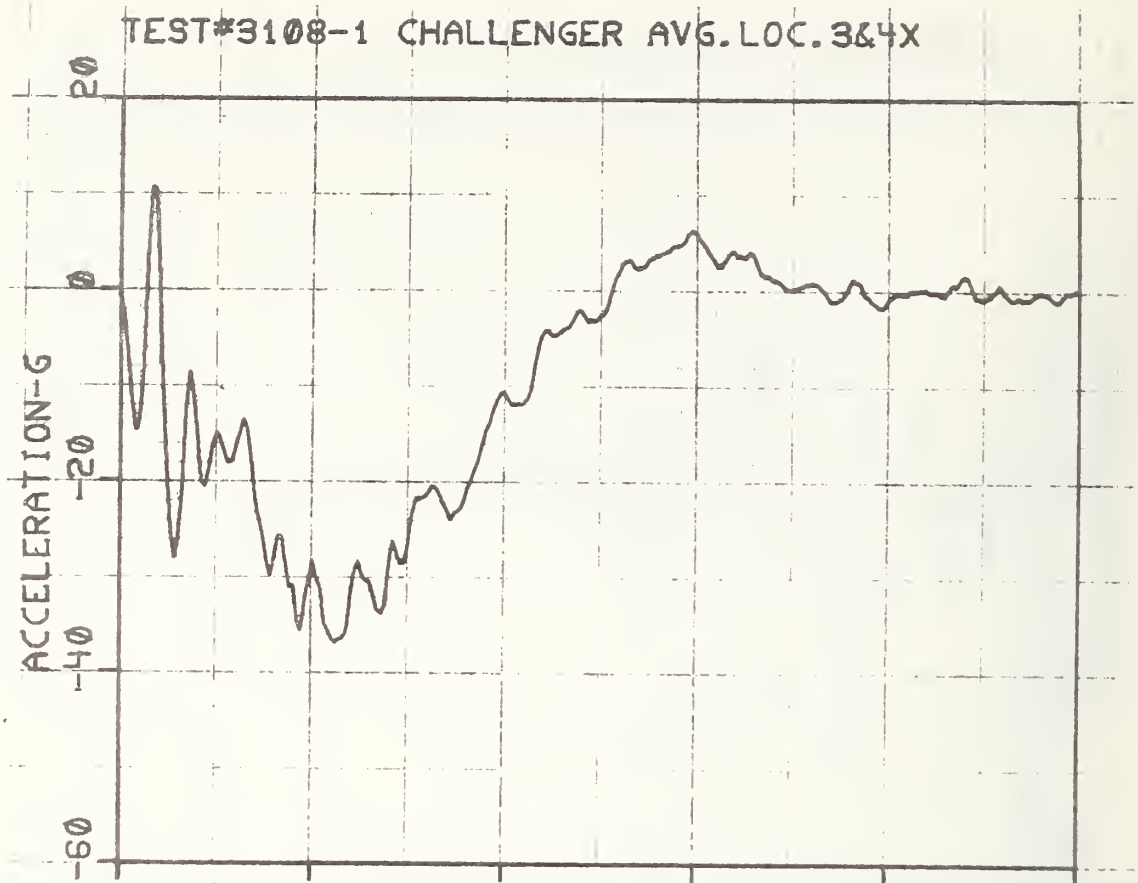

TEST#3108-1 CHALLENGER LOC 4X
VELOCITY-MPH
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

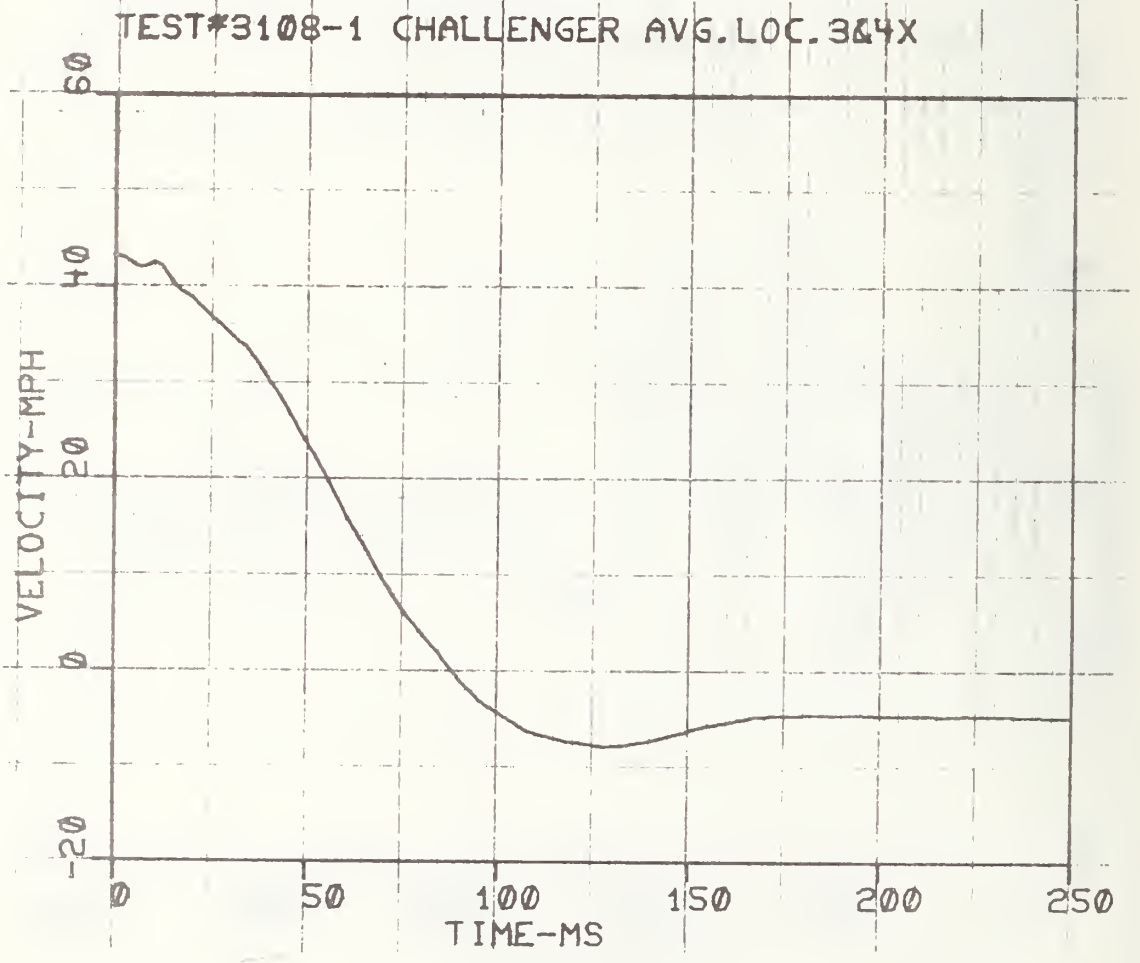

TEST#3108-1 CHALLENGER LOC 4X
60
40
20
0
-20
DISPLACEMENT-IN
TEST#3108-1 CHALLENGER LOC 4RX
20
0
-20
-40
-60
ACCELERATION-G
0
50
100
150
200
250
TIME-MS

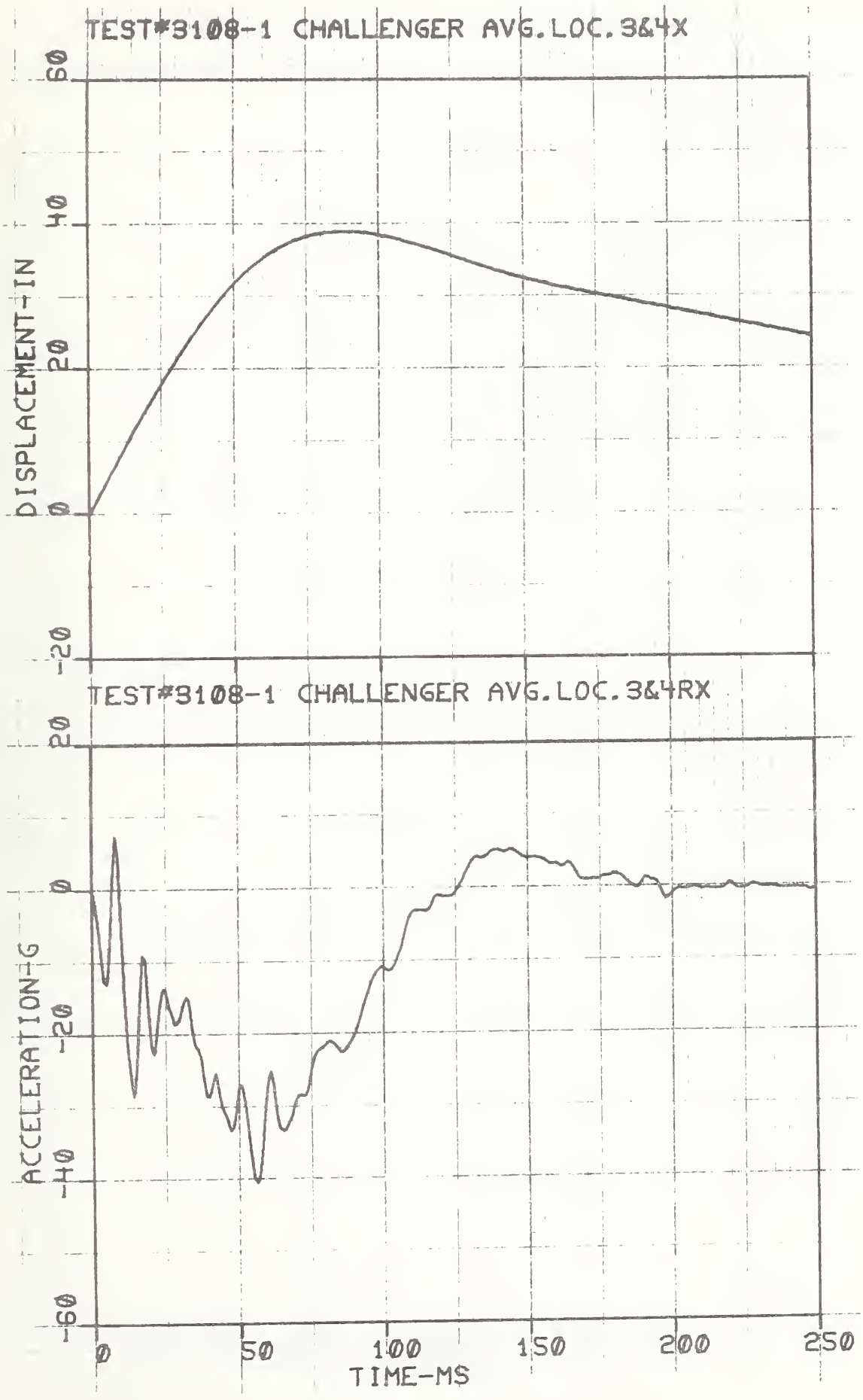

TEST#3108-1 CHALLENGER LOC 4RX
60
40
20
0
-20
VELOCITY-MPH

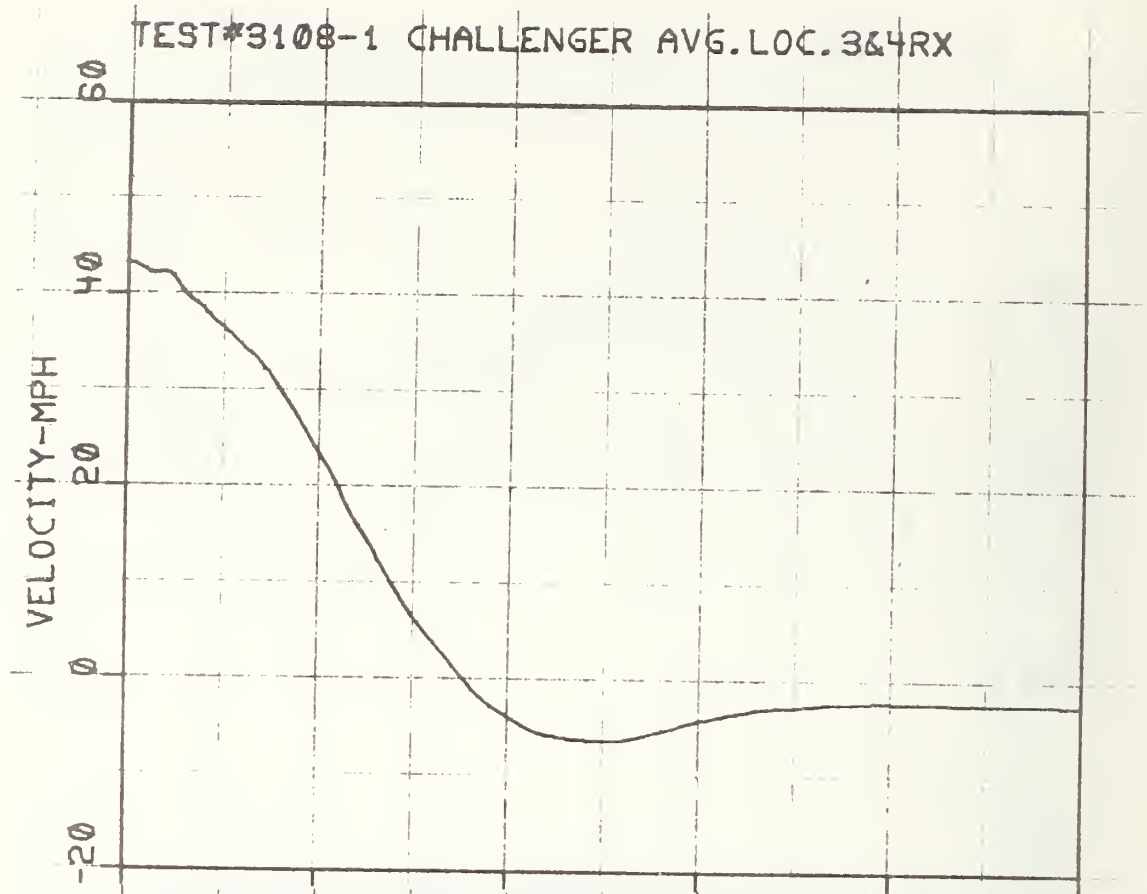

TEST#3108-1 CHALLENGER LOC 4RX
60
40
20
0
-20
DISPLACEMENT-IN
0
50
100
150
200
250
TIME-MS

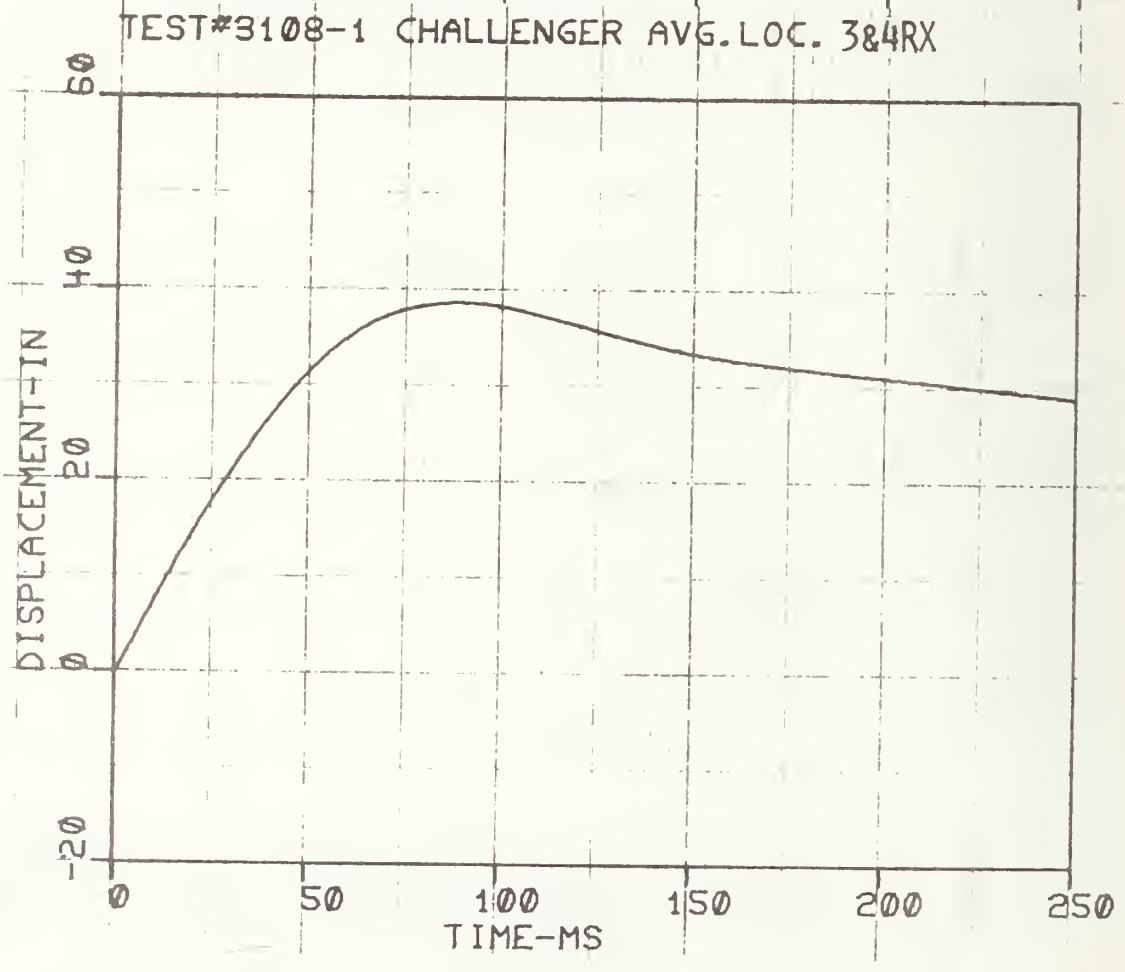

TEST#3108-1 CHALLENGER LOC 4Y
ACCELERATION-G
20
10
0
-10
-20
TEST#3108-1 CHALLENGER LOC 4Z
ACCELERATION-G
20
10
0
-10
-20
0
50
100
150
200
250
TIME-MS

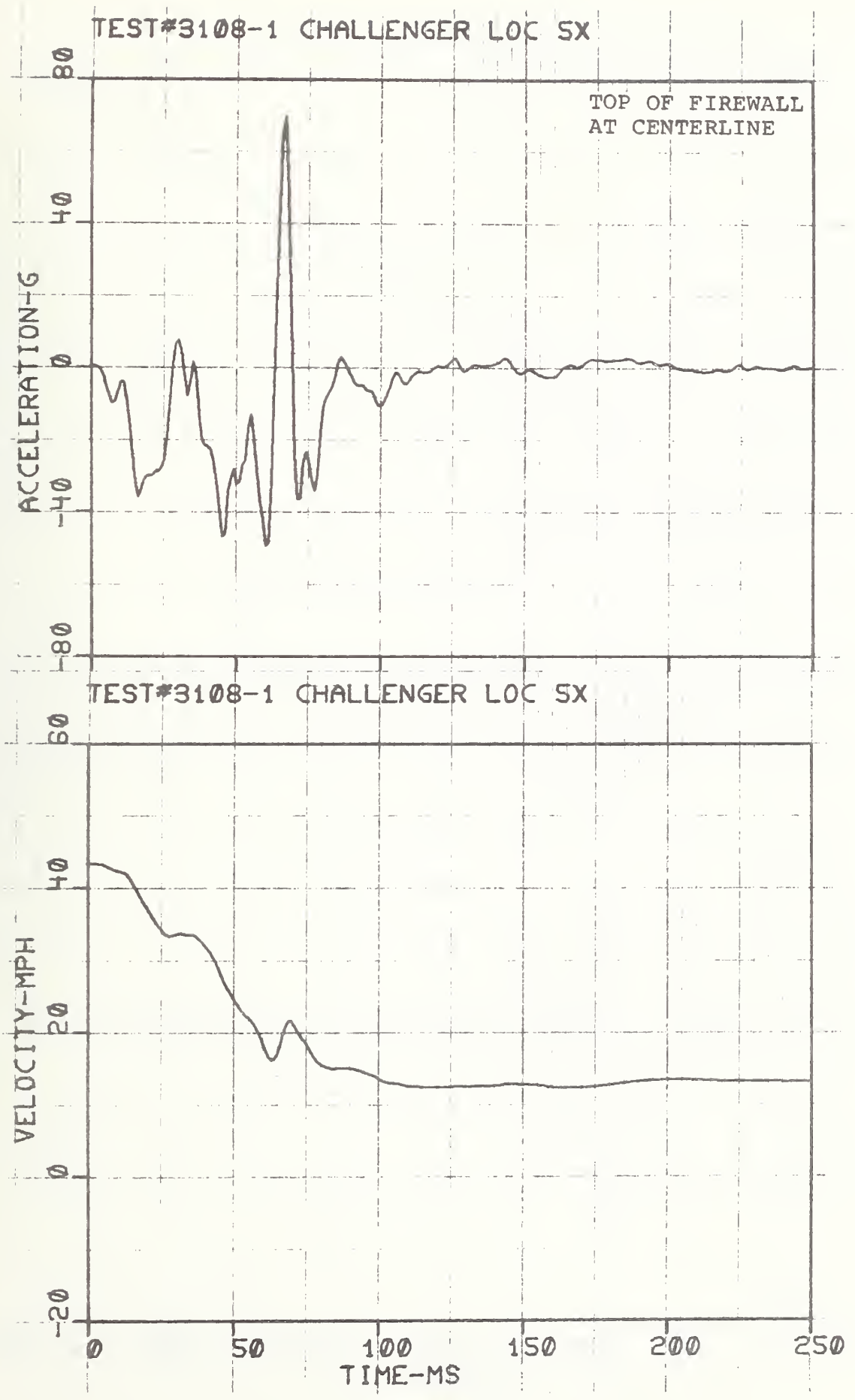

TEST#3108-1 CHALLENGER AVG.LOC.3&4X
ACCELERATION-G
20
0
-20
-40
-60

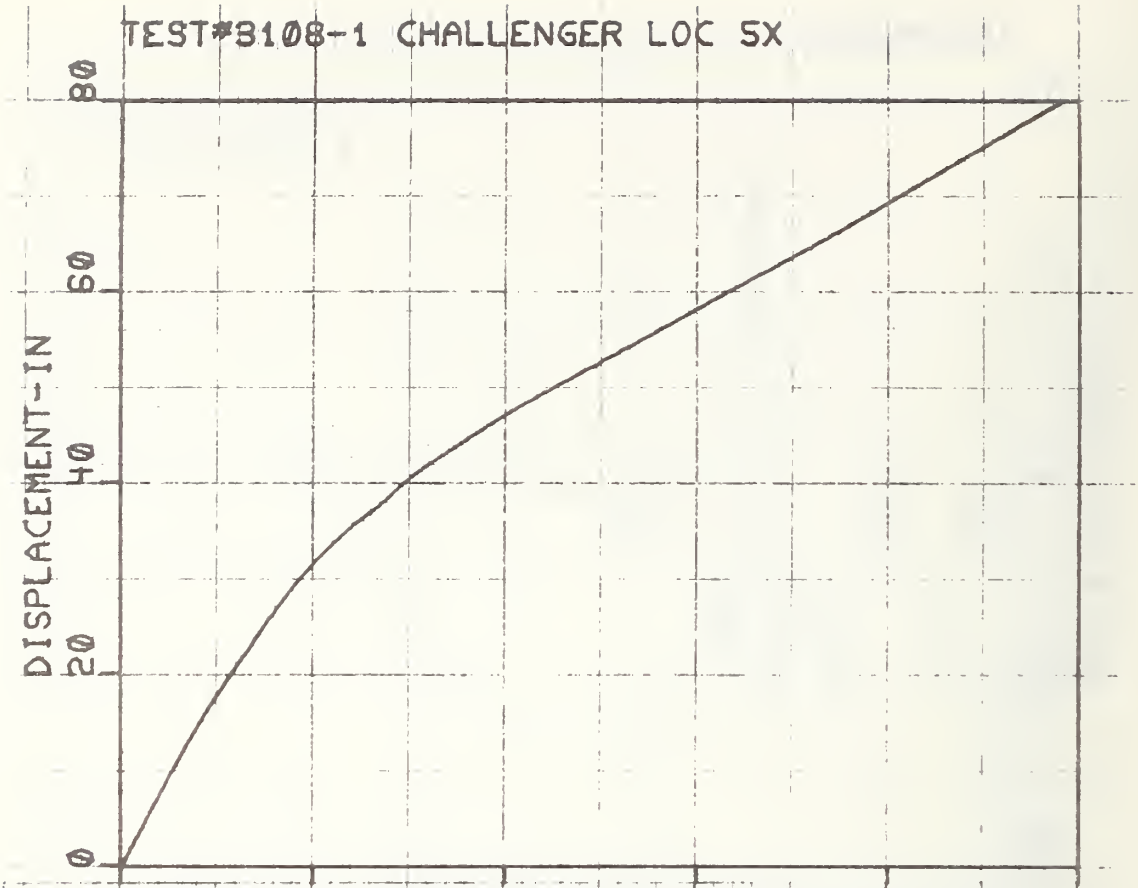

TEST#3108-1 CHALLENGER AVG.LOC.3&4X
VELOCITY-MPH
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

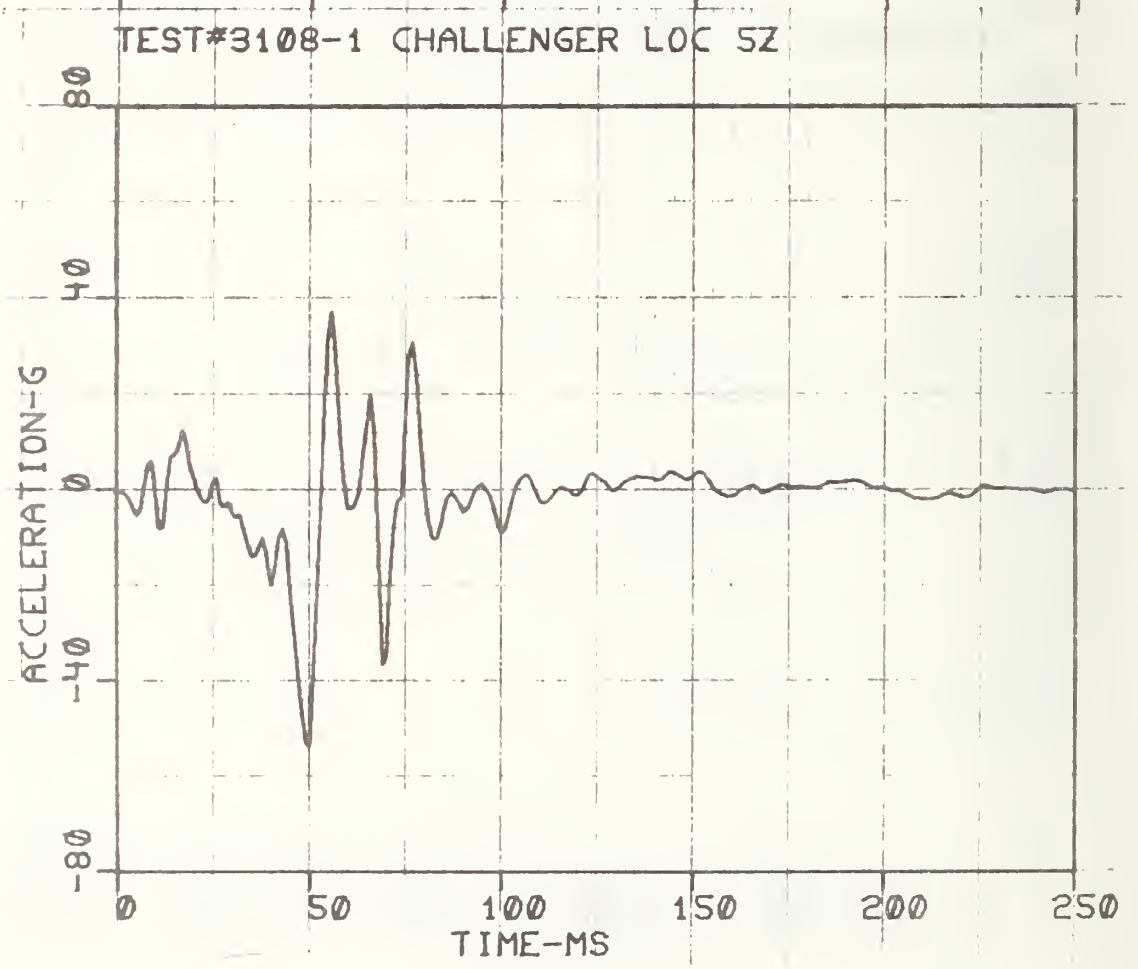

TEST*3108-1 CHALLENGER AVG.LOC.3&4X
DISPLACEMENT-IN
60
40
20
0
-20
TEST*3108-1 CHALLENGER AVG.LOC.3&4RX
ACCELERATION-G
20
0
-20
-40
-60
0
50
100
150
200
250
TIME-MS

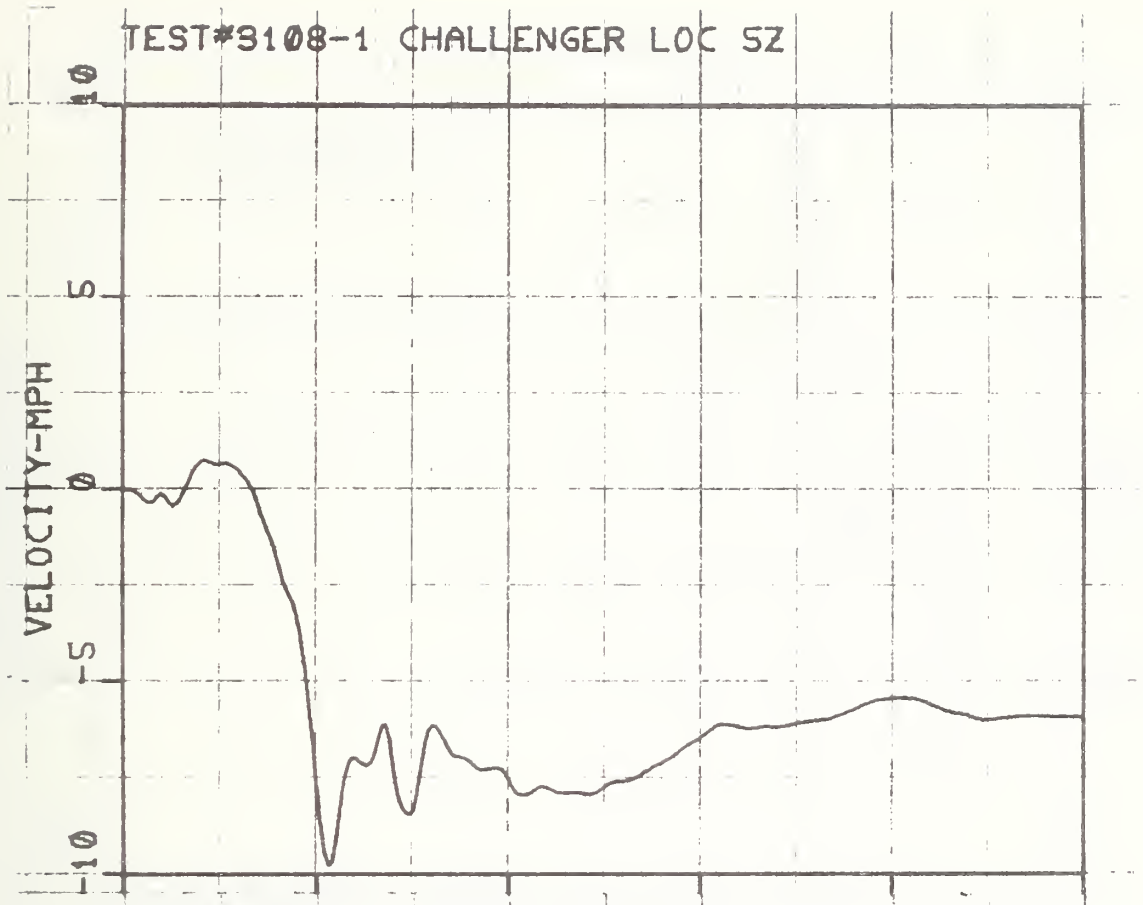

TEST*3108-1 CHALLENGER AVG.LOC.3&4RX
VELOCITY-MPH
60
40
20
0
-20

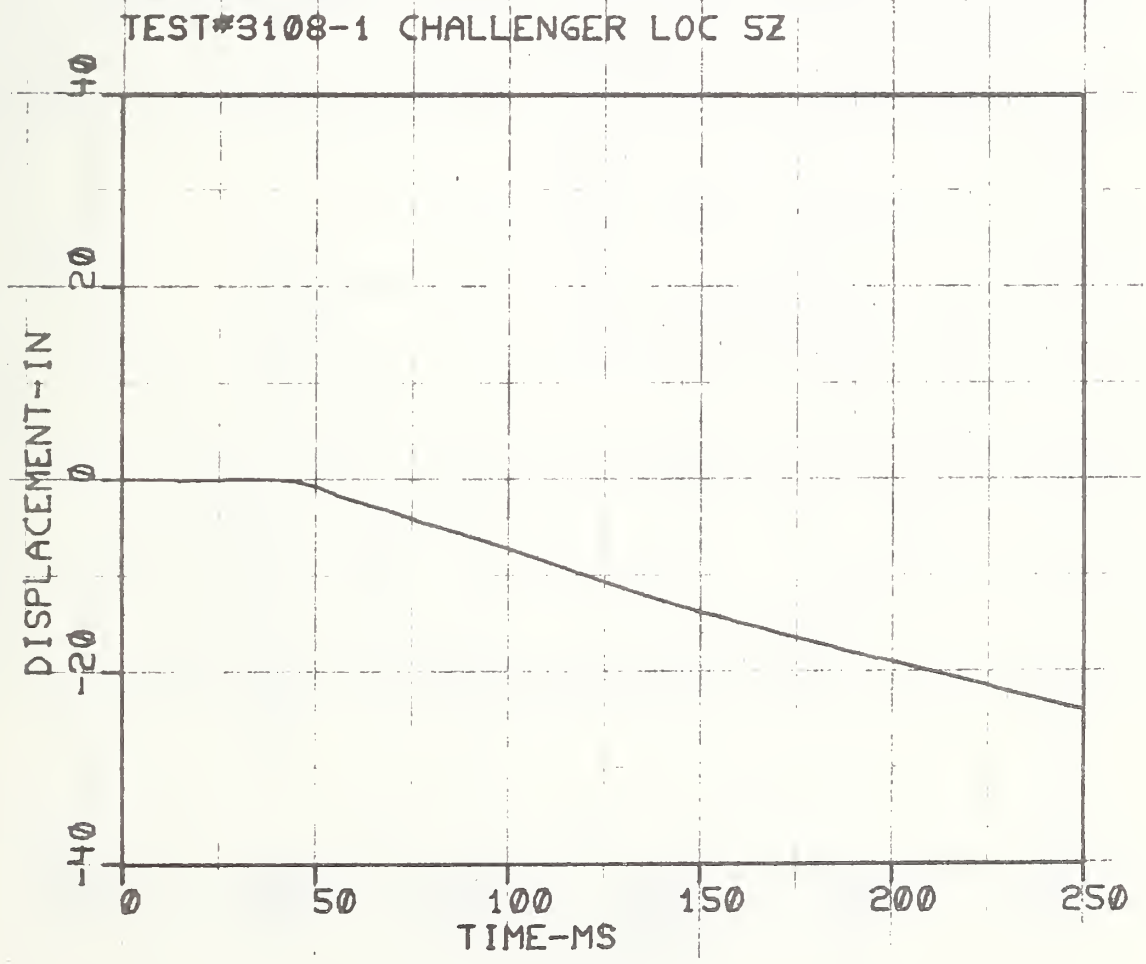

TEST*3108-1 CHALLENGER AVG.LOC. 3&4RX
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

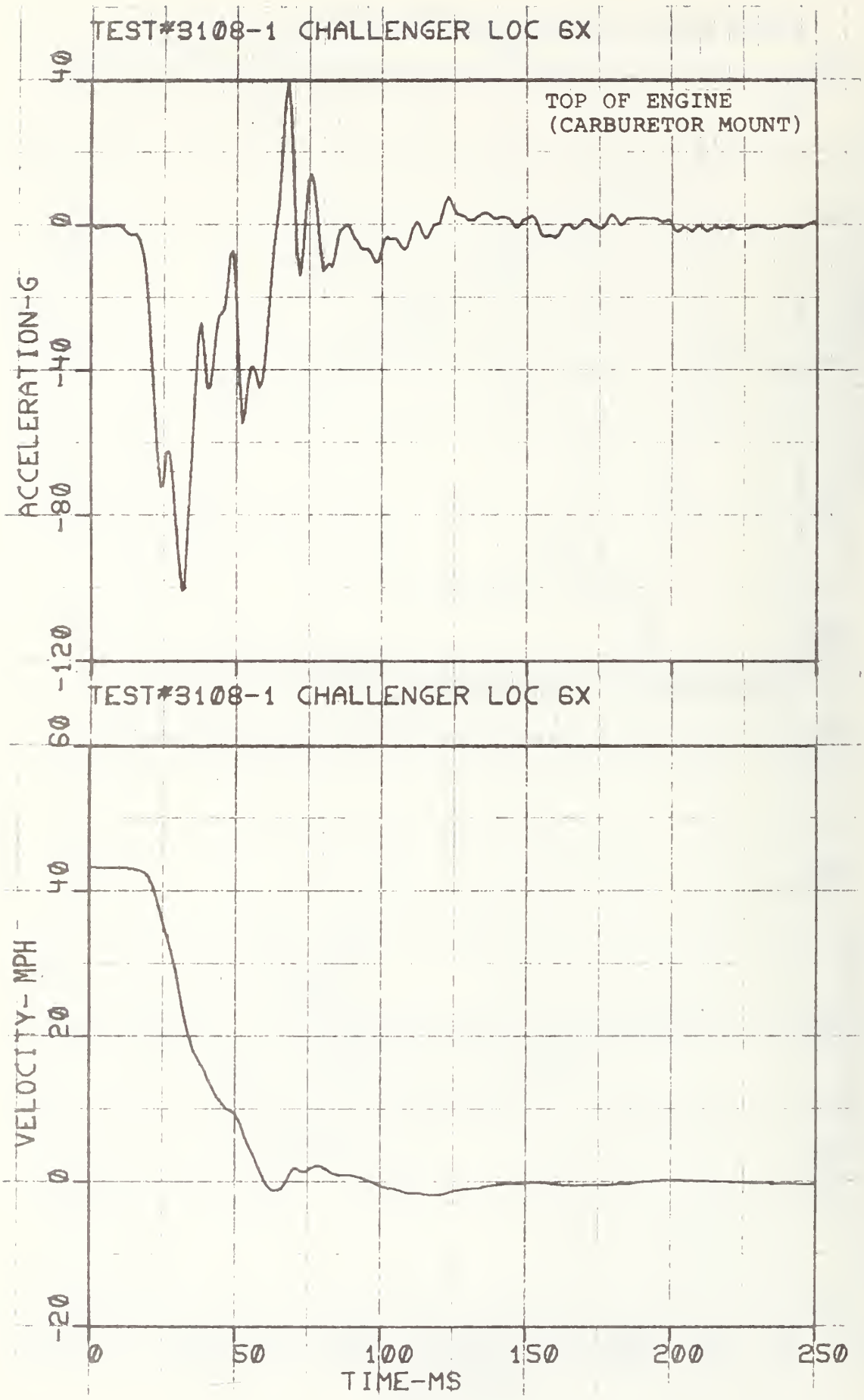

TEST#3108-1 CHALLENGER LOC SX
TOP OF FIREWALL
AT CENTERLINE
ACCELERATION-G
80
40
0
-40
-80
TEST#3108-1 CHALLENGER LOC SX
VELOCITY-MPH
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS

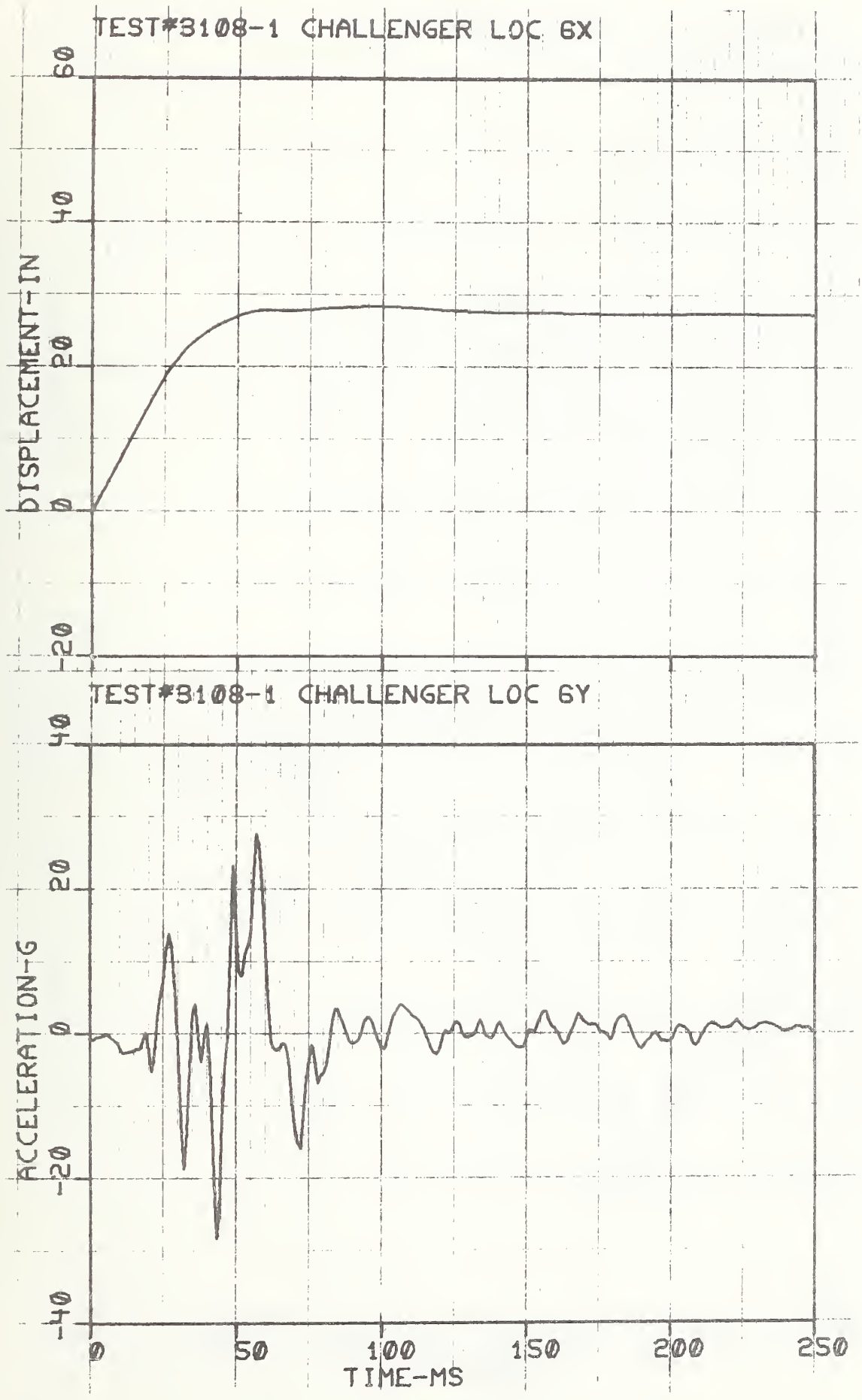

TEST#3108-1 CHALLENGER LOC 5X
DISPLACEMENT-IN
0
20
40
60
80

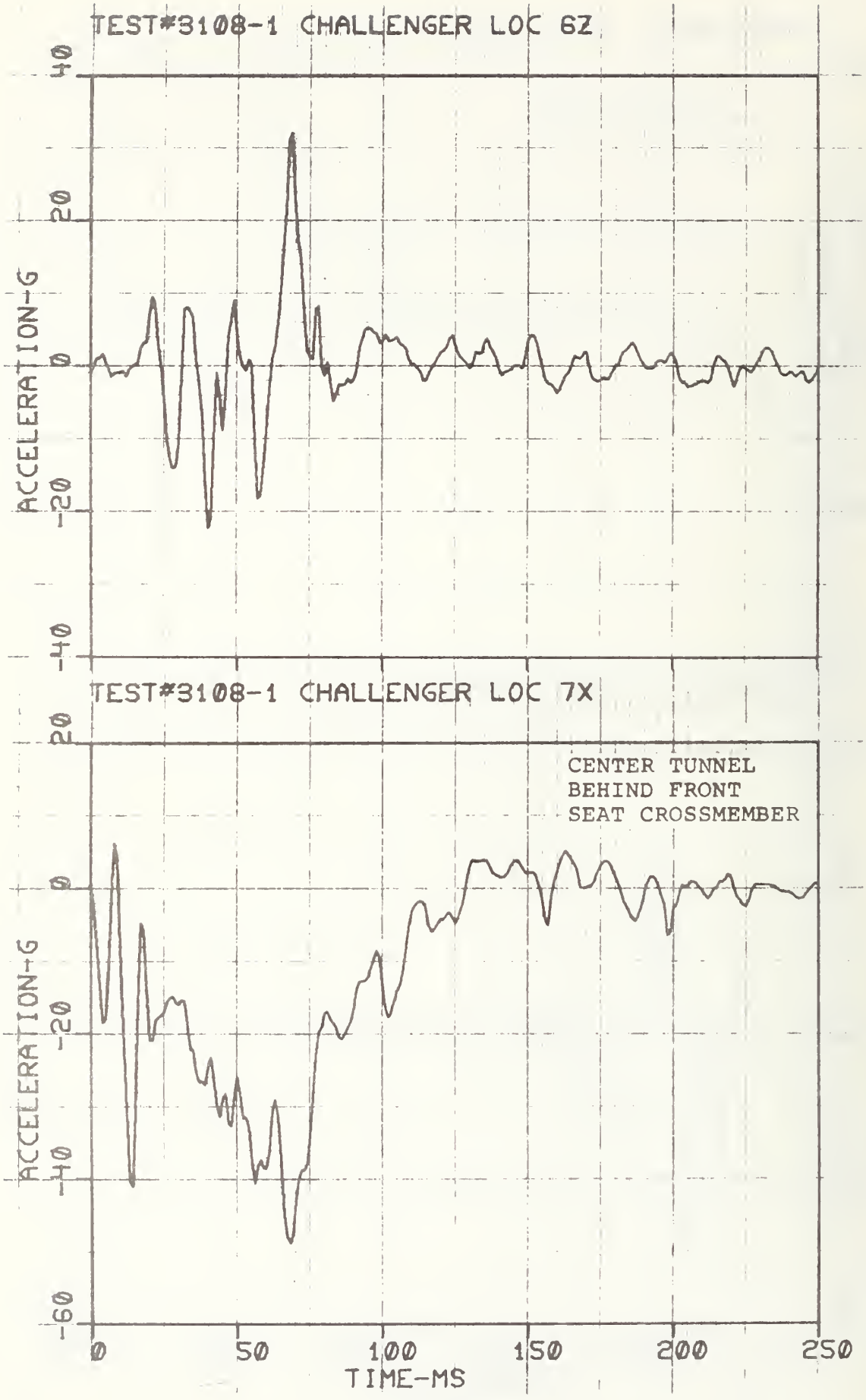

TEST#3108-1 CHALLENGER LOC 5Z
ACCELERATION-G
80
40
0
-40
-80
0
50
100
150
200
250
TIME-MS

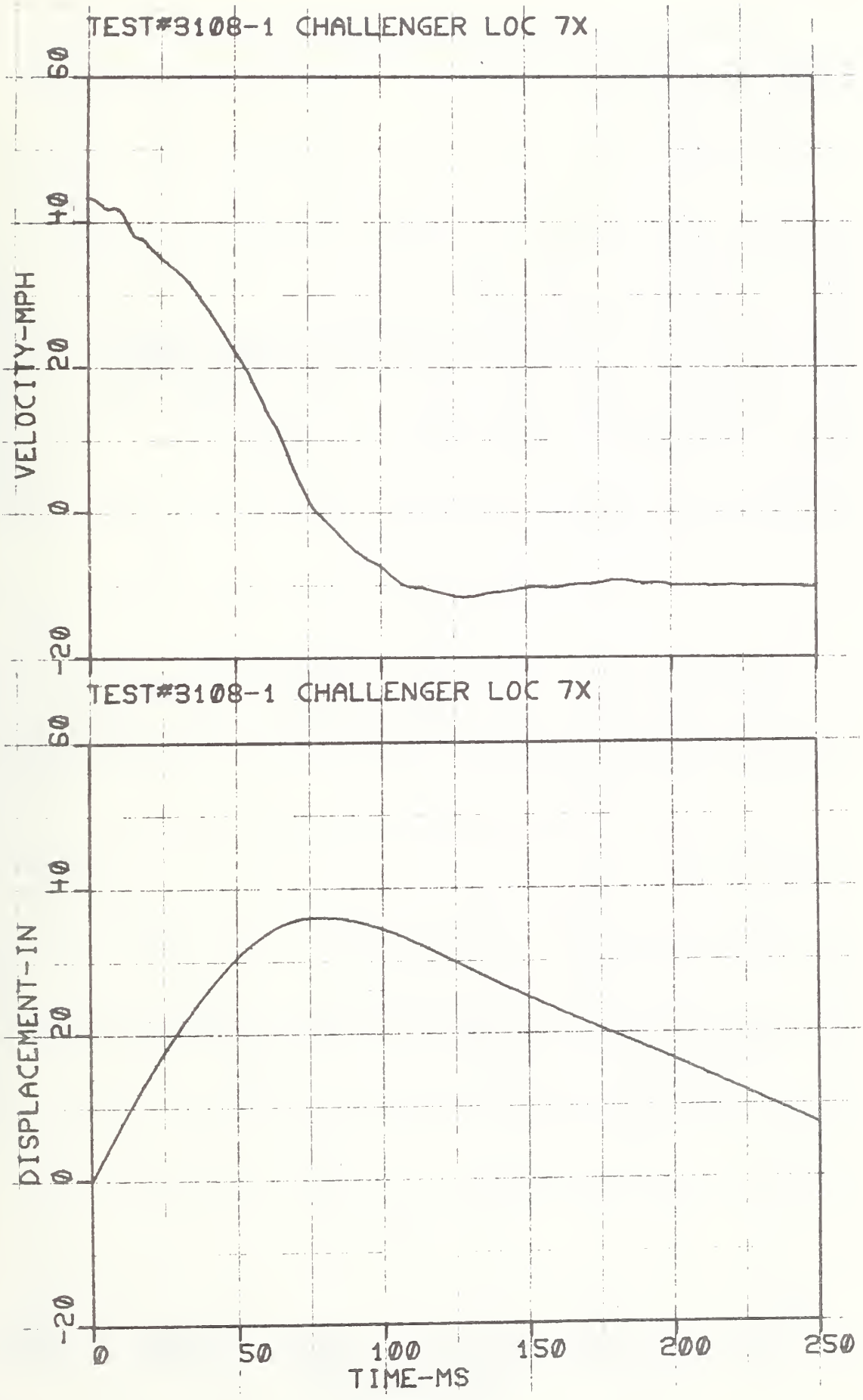

TEST#3108-1 CHALLENGER LOC SZ
VELOCITY-MPH
10
5
0
-5
-10

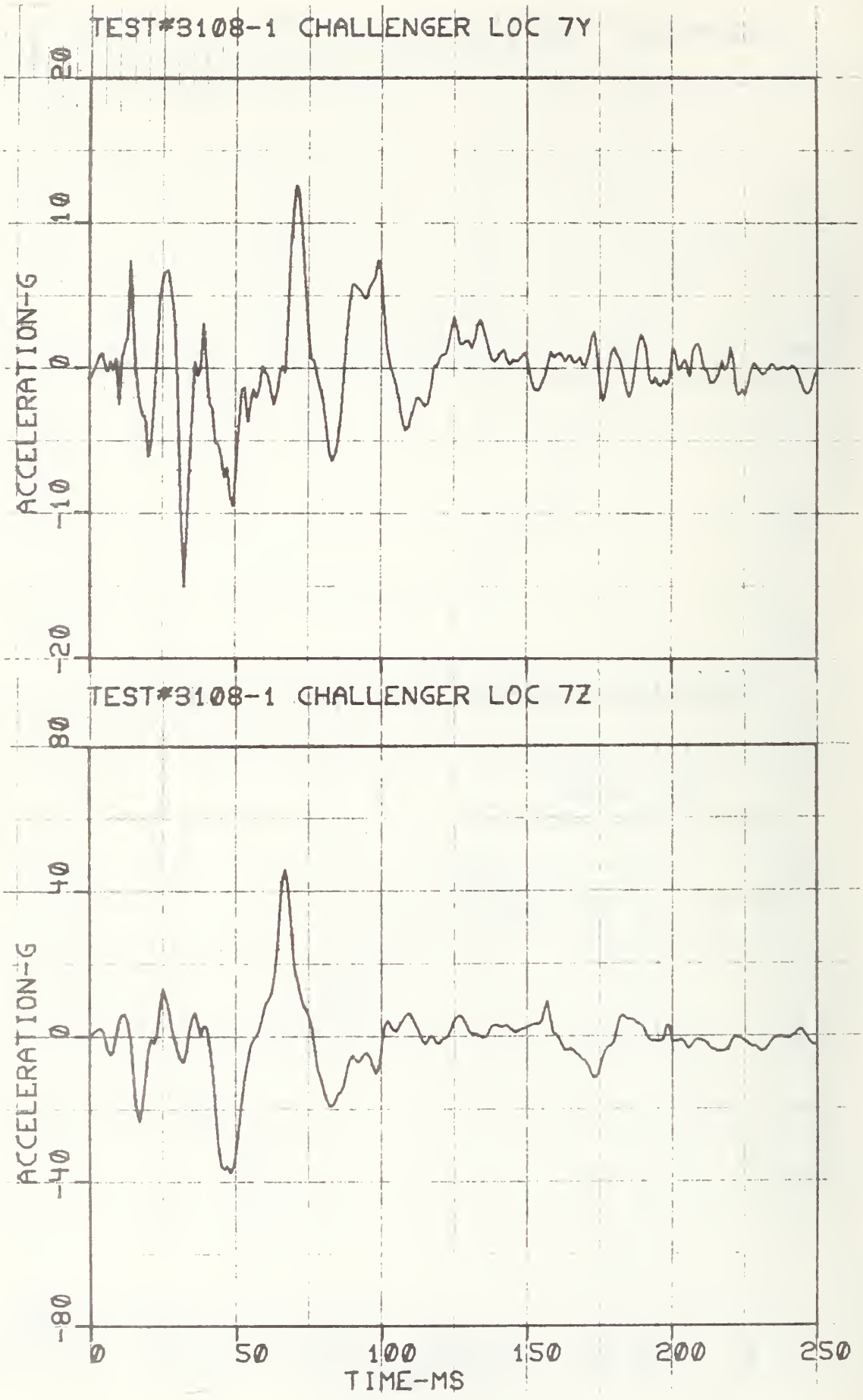

TEST#3108-1 CHALLENGER LOC SZ
DISPLACEMENT-IN
40
20
0
-20
-40
0
50
100
150
200
250
TIME-MS

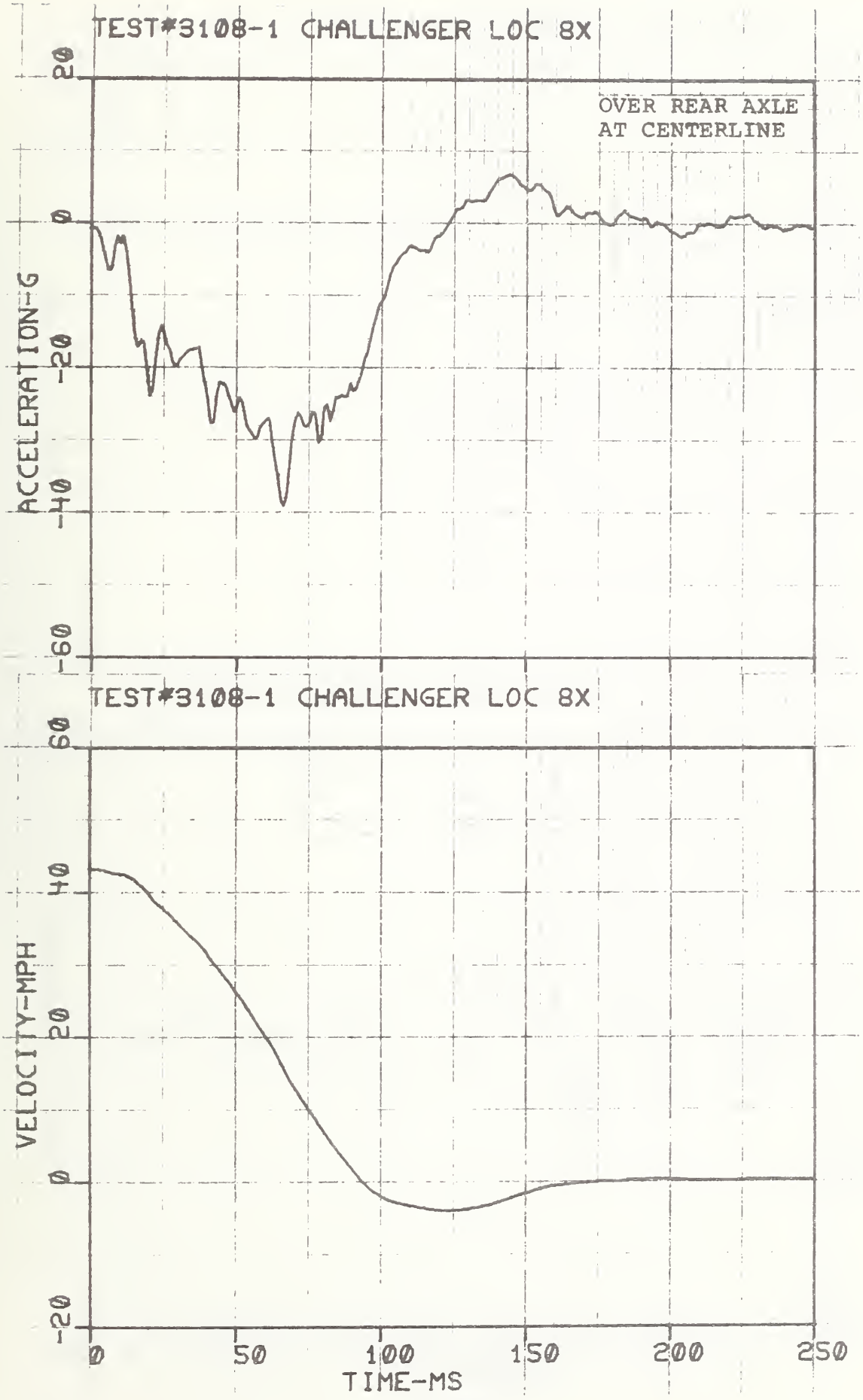

TEST*3108-1 CHALLENGER LOC 6X
TOP OF ENGINE
(CARBURETOR MOUNT)
ACCELERATION-G
40
0
-40
-80
-120
TEST*3108-1 CHALLENGER LOC 6X
60
40
20
0
-20
VELOCITY- MPH
0
50
100
150
200
250
TIME-MS

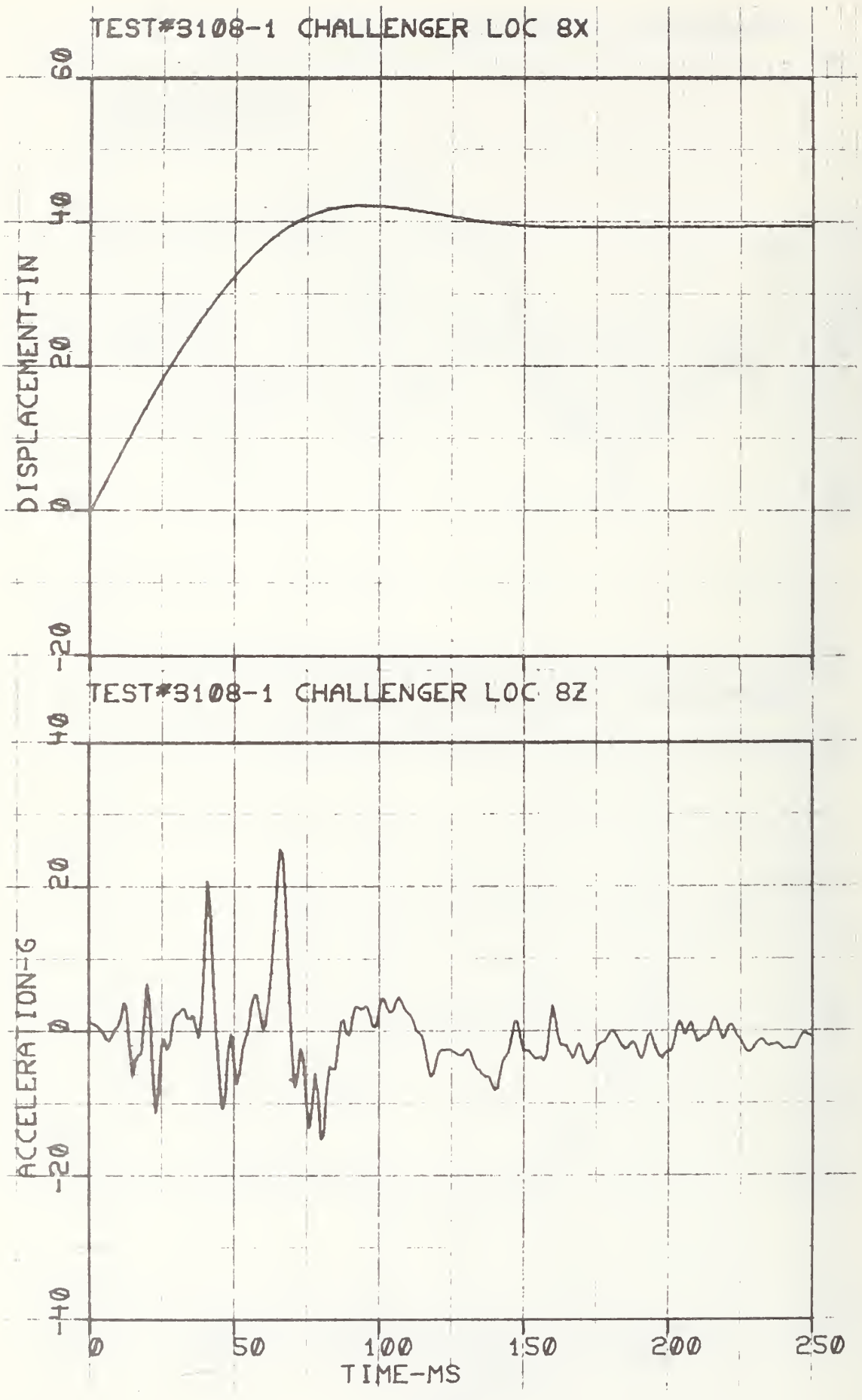

TEST*3108-1 CHALLENGER LOC 6X
DISPLACEMENT-IN
60
40
20
0
-20
TEST*3108-1 CHALLENGER LOC 6Y
ACCELERATION-G
40
20
0
-20
-40
0
50
100
150
200
250
TIME-MS

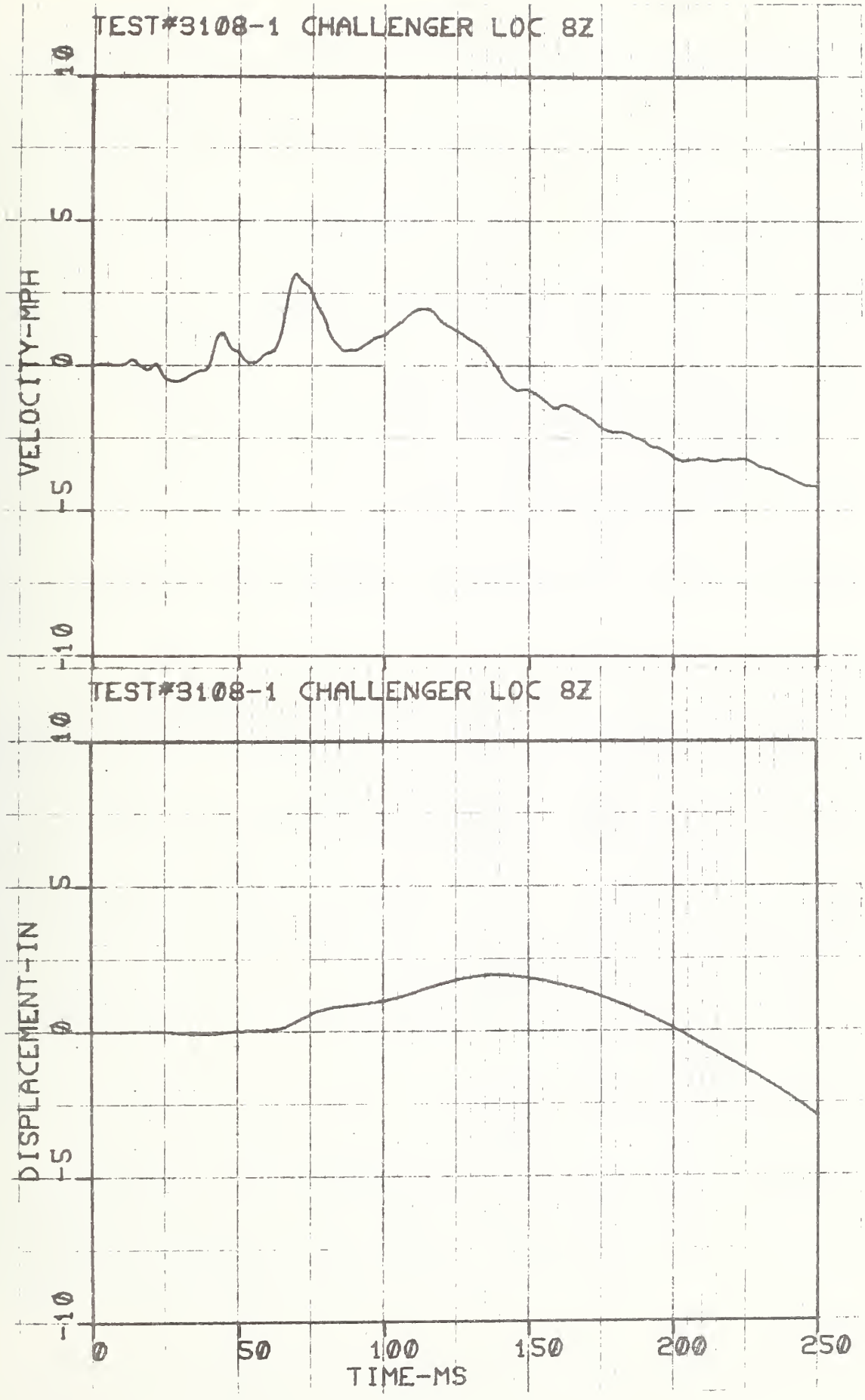

TEST#3108-1 CHALLENGER LOC 6Z
40
20
0
-20
-40
ACCELERATION-G
TEST#3108-1 CHALLENGER LOC 7X
CENTER TUNNEL
BEHIND FRONT
SEAT CROSSMEMBER
20
0
-20
-40
-60
ACCELERATION-G
0
50
100
150
200
250
TIME-MS


TEST#3108-1 CHALLENGER LOC 7X
VELOCITY-MPH
60
40
20
0
-20
TEST#3108-1 CHALLENGER LOC 7X
DISPLACEMENT-IN
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS


TEST*3108-1 CHALLENGER LOC 7Y
20
10
0
-10
-20
ACCELERATION-G
TEST*3108-1 CHALLENGER LOC 7Z
80
40
0
-40
-80
ACCELERATION-G
0
50
100
150
200
250
TIME-MS


TEST#3108-1 CHALLENGER LOC 8X
OVER REAR AXLE
AT CENTERLINE
ACCELERATION-G
20
0
-20
-40
-60
TEST#3108-1 CHALLENGER LOC 8X
VELOCITY-MPH
60
40
20
0
-20
0
50
100
150
200
250
TIME-MS


TEST#3108-1 CHALLENGER LOC 8X
DISPLACEMENT-IN
60
40
20
0
-20
TEST#3108-1 CHALLENGER LOC 8Z
ACCELERATION-G
40
20
0
-20
-40
0
50
100
150
200
250
TIME-MS


TEST#3108-1 CHALLENGER LOC 8Z
VELOCITY-MPH
10
5
0
-5
-10
TEST#3108-1 CHALLENGER LOC 8Z
DISPLACEMENT-IN
10
5
0
-5
-10
0
50
100
150
200
250
TIME-MS

APPENDIX C

ADDITIONAL PHOTOGRAPHS OF THE CRASH TEST

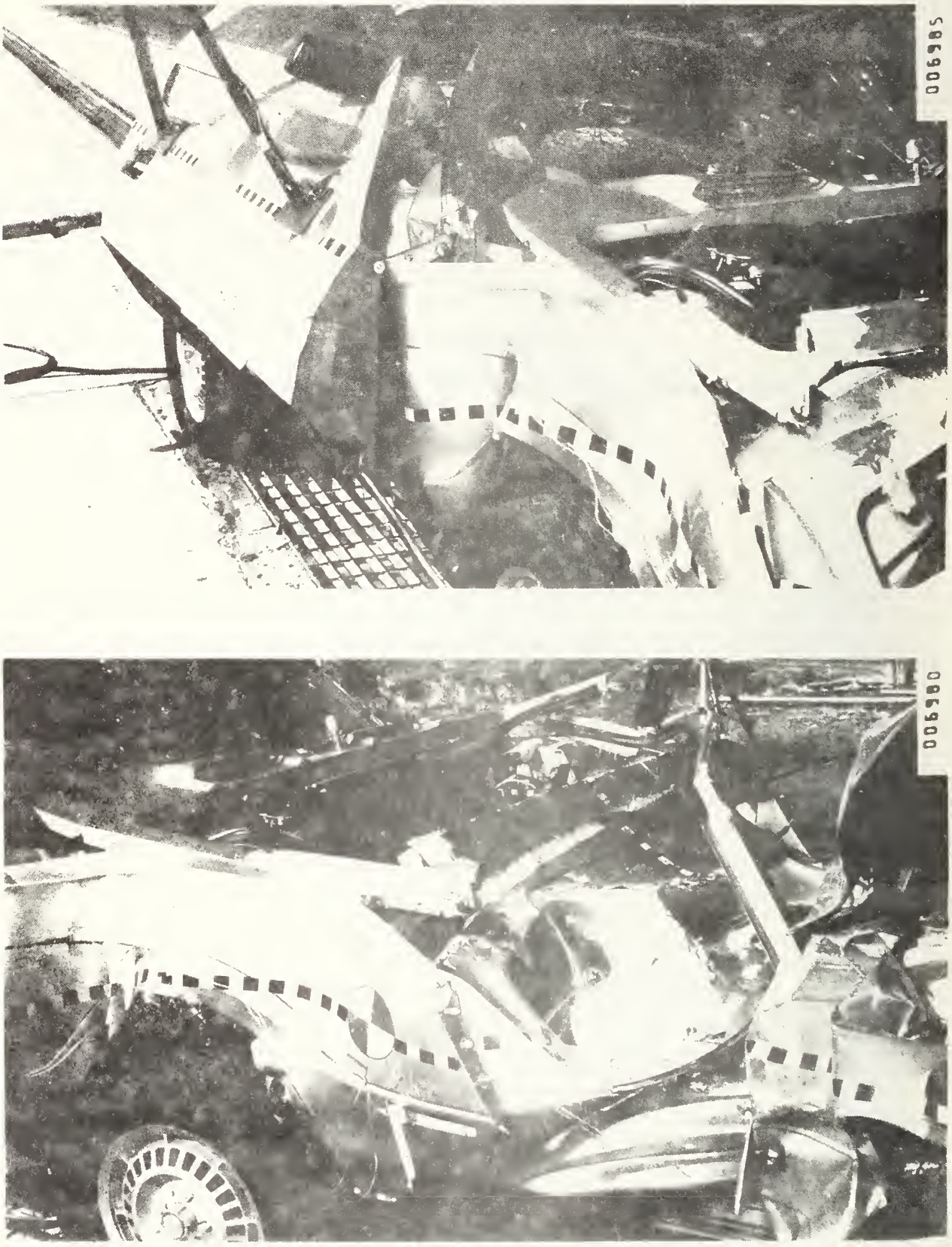


FIGURE C-1. POST-TEST VIEW OF MINICARS RSV RIGHT FRONTAL AND SIDE DAMAGE.

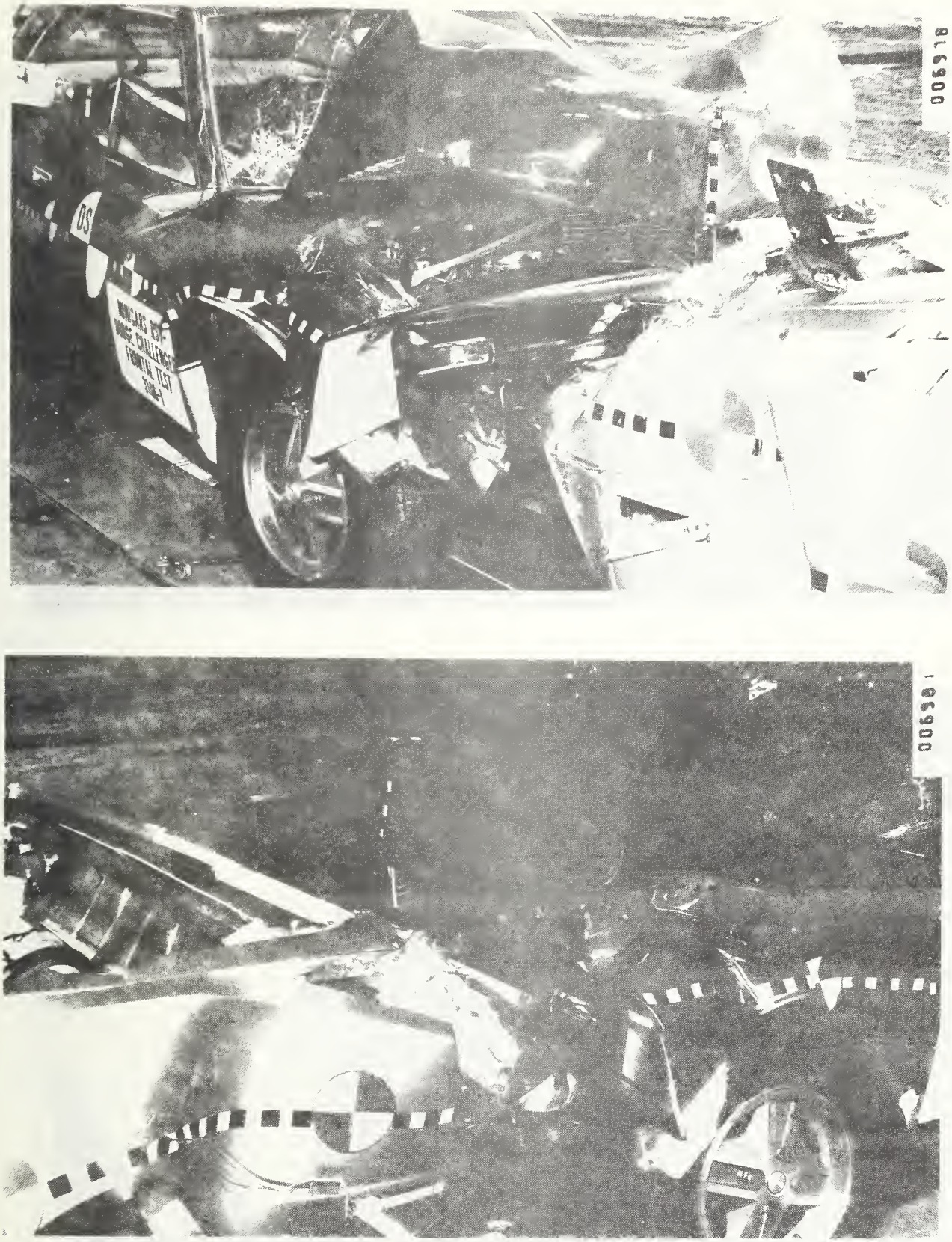


FIGURE C-2. POST-TEST VIEW OF DODGE CHALLENGER RIGHT AND LEFT FRONTAL DAMAGE.

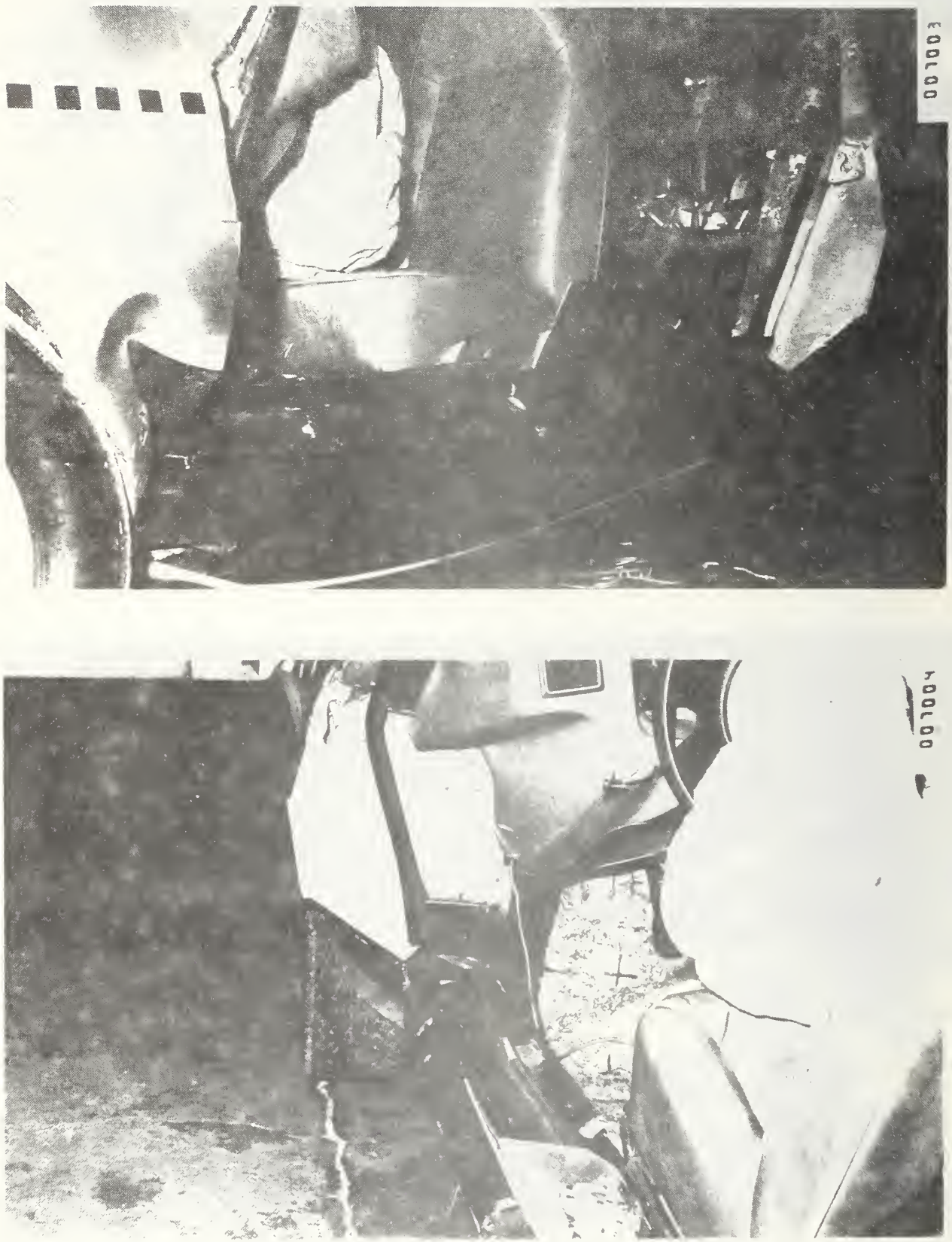


FIGURE C-3. POST-TEST VIEWS OF MINICARS RSV DRIVER SIDE ROCKER SILL DEFORMATION.

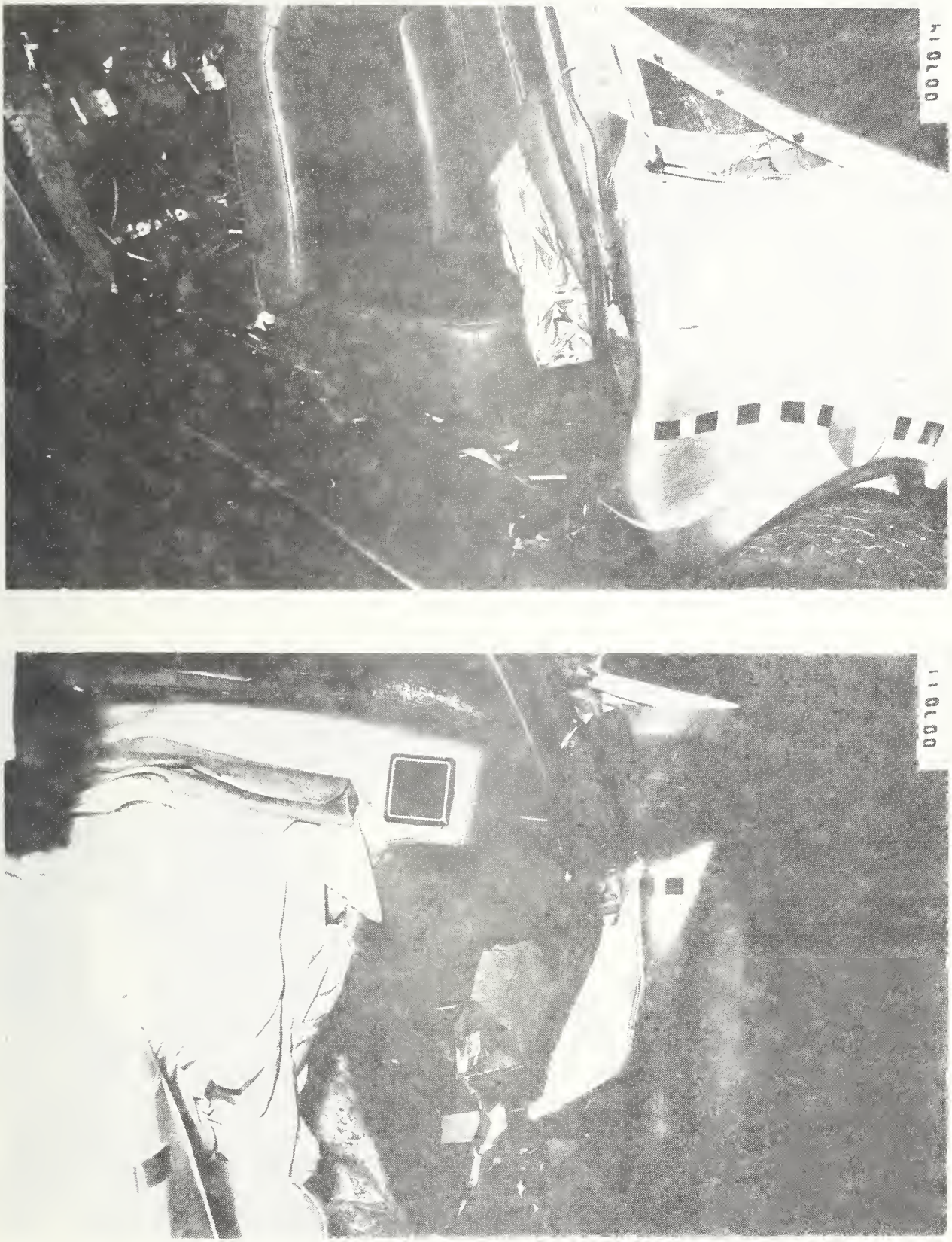


FIGURE C-4. POST-TEST VIEW OF MINICARS RSV PASSENGER SIDE ROCKER SILL DEFORMATION.

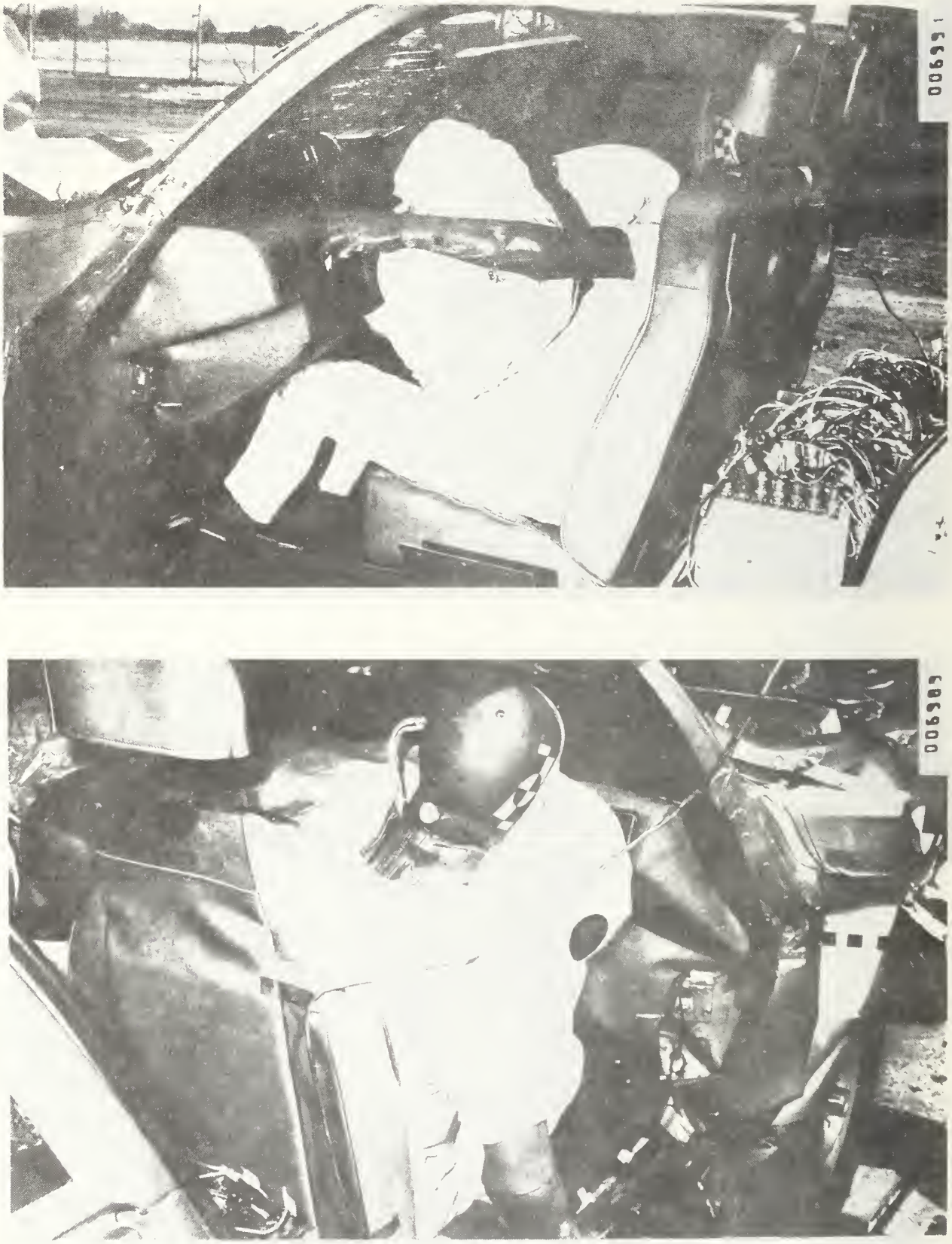


FIGURE C-5. POST-TEST VIEW OF MINICARS RSV DRIVER AND PASSENGER DUMMIES.

FIGURE C-6. POST-TEST SIDE VIEWS OF MINICARS RSV OCCUPANT COMPARTMENT.

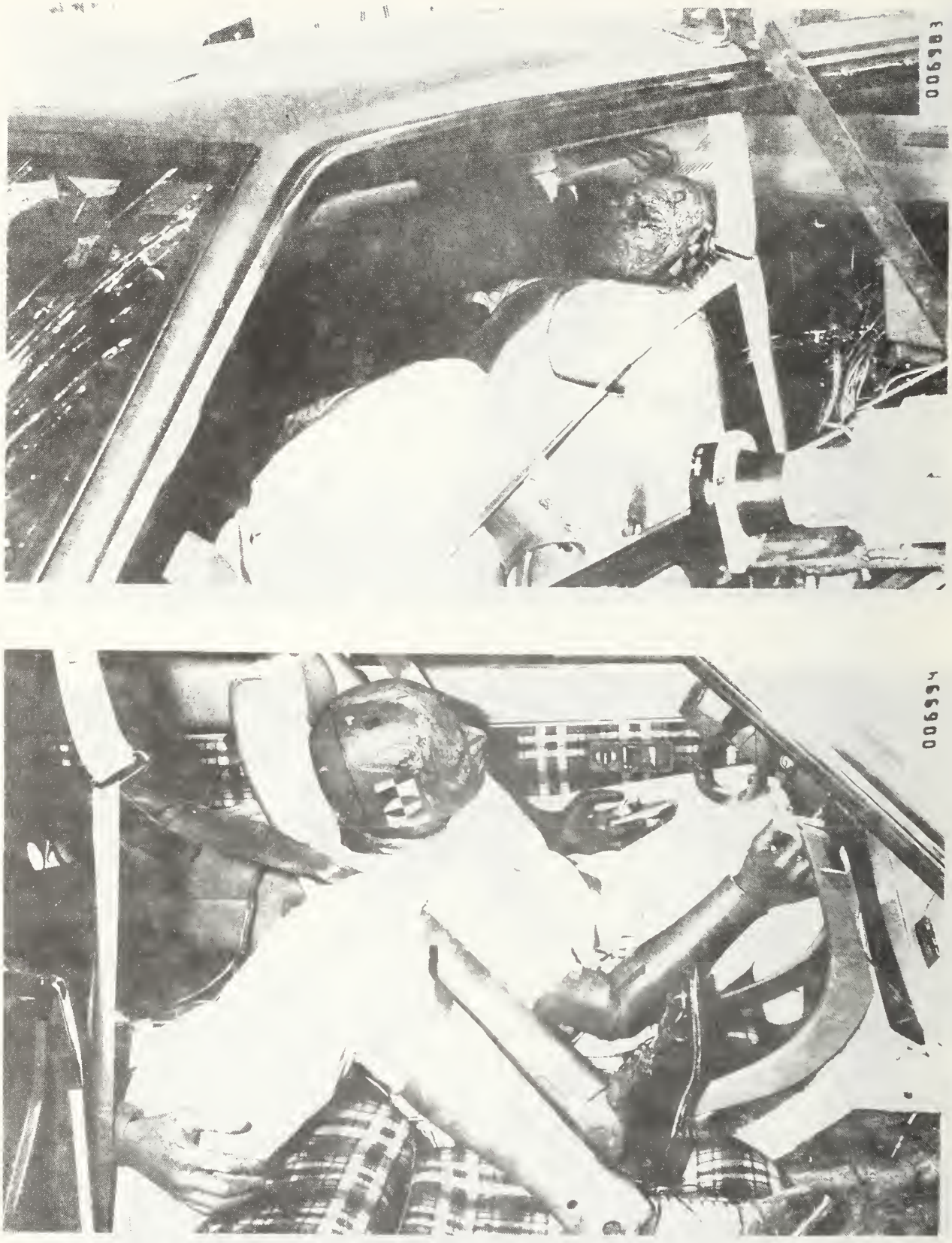


FIGURE C-7. POST-TEST VIEW OF DODGE CHALLENGER DRIVER AND PASSENGER DUMMIES.

FIGURE C-8. POST-TEST VIEW OF DODGE CHALLENGER RESTRAINT SYSTEM ANCHORAGES.

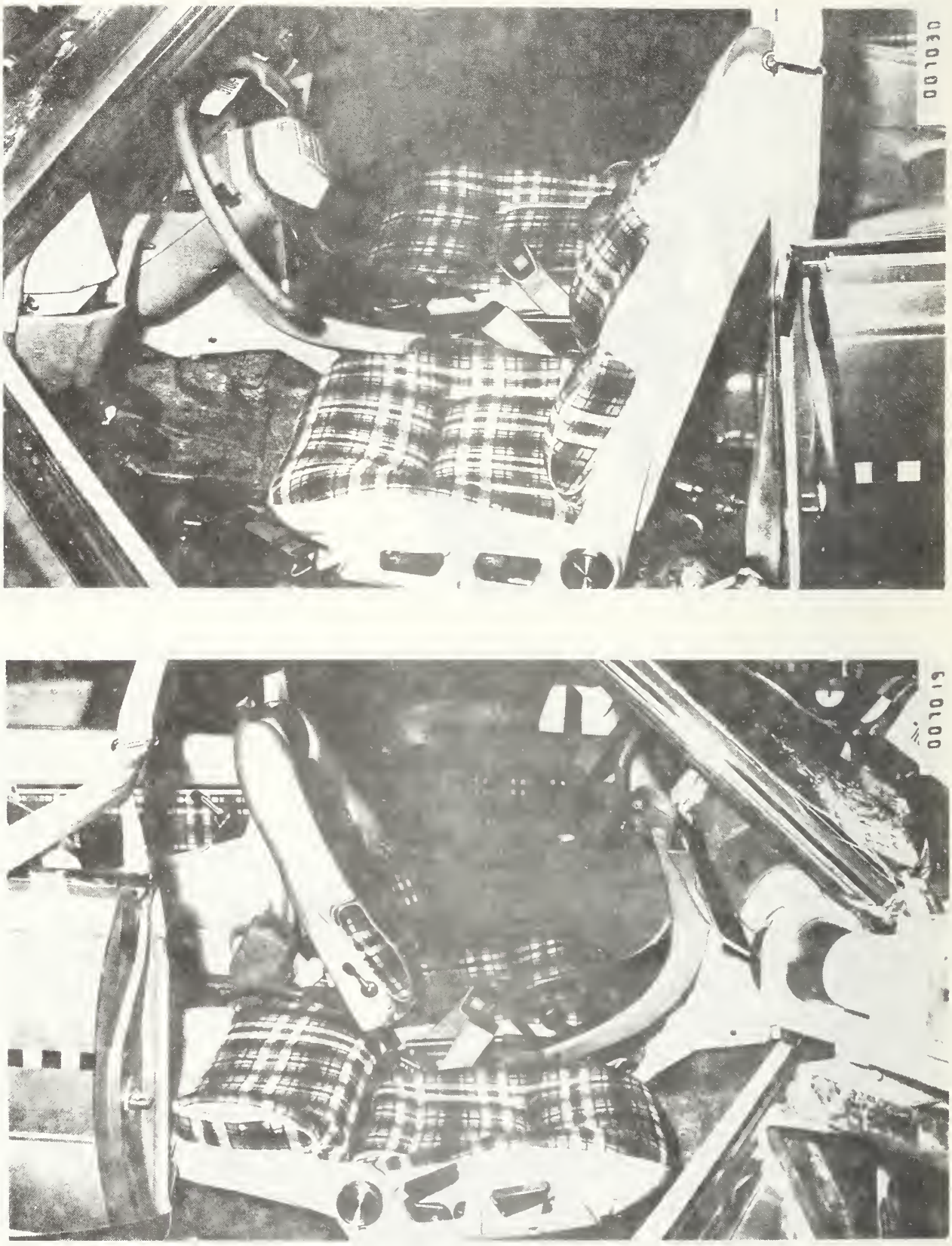


FIGURE C-9. POST-TEST SIDE VIEW OF DODGE CHALLENGER OCCUPANT COMPARTMENT.

APPENDIX D

PRE-TEST ACCEPTANCE CERTIFICATE AND VEHICLE INFORMATION DOCUMENTATION

TEST ACCEPTANCE CERTIFICATE

Date: 9/10/80 Test Number: 3108-1

Vehicle Number: Minicars RSV M5-11 & 1979 Dodge Challenger

Test Description: Car-to-Car Frontal Impact

The following items have been inspected and found acceptable for running the vehicle test:

	Minicars	Dynamic Science	NHTSA
Dummy Calibration:	N/A	RCB	FAD
RSV Ignition "ON"	TZ	RCB	N/A
Dummy Location:	TZ	RCB**	FAD
Vehicle Inspection	N/A	RCB**	FAD
Dummy Instrumentation:	N/A	RCB	FAD
Vehicle Preparation:	TZ*	RCB**	FAD
Test Conditions (Speed & Vehicle Wts)	TZ	RCB	FAD
Vehicle Instrumentation:	N/A	RCB	FAD
Bumper Match of Vehicles	LH	RCB	FAD
Restraint System:	TZ	RCB**	FAD
Air Bag Monitor Circuit	LH	RCB	FAD
Test Site:	TZ	RCB	FAD
RSV Camera Mounts:	TZ	RCB	FAD

The following items have been noted and may have detrimental effects on the test results:

Item Description	Action Taken
1. Height from ground to bottom of RSV Front Rubrics is 15.85 inches.	None
2. Height from ground to top of Dodge Challenger Bumper is 21.8 inches	None

Minicars Representative: Ted Zinke, Larry Howes

NHTSA Representative: Francis DiLorenzo

DSI Representative: R. C. Baczynski

*The following sections of Minicars Report No. 5010 FI for the RSV are approved for tests: Section 2.6 through 2.16.

**In addition to the test plan prepared by Dynamic Science, Dynamic Science personnel complied with Section 2.2 and 3.0 of Minicars Report 5010 FI and Sections 2.2 through 2.5 of Minicars Report 5010 SI.

TABLE D-1. VEHICLE INFORMATION

	Vehicle 1	Vehicle 2
VIN No:	MIRS3SSH9M0M5011	2H29K95311382
Make:	Minicars	Dodge
Model:	RSV	Challenger
Year:	1980	1979
Engine Type:	1978 Honda CVCC 4 CYL In-Line OHC - Transv. Rear Mtd	Front Mounted 4 CYL In-Line OHC
Engine Displacement:	1600 CC	1600 CC
Transmission Type:	1978 Honda 5 Speed Manual	5 Speed Manual
Body Type:	2 Door Sedan	2 Door Coupe
Wheelbase:	104 Inches	99.2 Inches
Width:	71 Inches	63.7 Inches
Steering Column Attachment:	Modified Shear Capsule	Adjustable - up/ down no shear capsule
Steering Column Collapse Mechanism:	Embedded Ball	Telescope - up high
Restraint System Type:	3 Pt belts, F&R, Air Bags Front	3 Pt belts "D" Ring, ELR
Knee Restraint:	Special Knee Bars	None - Dash
Describe Vehicle Modifications:	Ground-up Research Safety Vehicle	None

TABLE D-2. INCOMING VEHICLE INSPECTION.

Contractor: DYNAMIC SCIENCE, INC. Contract No.: DOT-HS-8-01942

VIN No.: M5-11 Make: Minicars

NHTSA No.: R&D (D.S.No.1101)

Year: 1980 Color: Silver Model: RSV 2-Door Sedan

Auto Trans: yes [ ] no [X]	Pwr Steering: yes [ ] no [X]	Seats: (front)	Bench:		
Pwr Brakes: yes [X] no [ ]	Auto Speed Cont: yes [ ] no [X]		Bucket: X		
Pwr Seats: yes [ ] no [X]	Anti Skid Brake: yes [ ] no [X]		Split Bench:		
Pwr Windows: yes [ ] no [X]	Air Conditioning: yes [ ] no [X]				
Tinted Glass: yes [X] no [ ]	Rear Window Def.: yes [ ] no [X]		Split Back Bench:		
Radio: yes [X] no [ ]	Brakes: drum: ____ disc: F&R				
Clock: yes [ ] no [X]					

Tire Size: 200/65 HR 370 Ply Rating: Runflat Mfg. & Line: Dunlop Denovo 2

Bias Ply: ____ Belted: ____ Radial: X /Eng.HP: ____ Cylinders: 4 Total Displ: 1600 cc.

Trans, # Fwd. Speeds: 5 Shipping Weight: ____ Odometer: 280.4

Dealer (name, address, and phone number)

Minicars

Remarks (list additional accessories not listed above)

Date of Manufacture Unknown

Date Received 8/21/80

Tilting Steering Wheel:	Yes [ ]	No [X]
Telescoping Steering Wheel	Yes [ ]	No [X]
Fuel Capacity: ____ Gallons (from owner's manual)		
"Space Saver" Spare tire	Yes [ ]	No [X]

(Government Use Only)

NHTSA Req. No.: ____ Purchase Team: ____

Date Purchased: ____ Purchase Order No.: ____ Purchase Price: ____

O.S.E.-NHTSA No.: ____ Wholesale Price: ____ Suggested Est. Price: ____

Photos: yes [ ] no [ ] Tax Exemption Cert. No.: ____ Amount of Tax: ____

Wholesale Invoice: yes [ ] no [ ] Consumer Info: yes [ ] no [ ] Warranty Card: yes [ ] no [ ]

Cert. of Origin: yes [ ] no [ ] Date Mfg: ____ Assy. Plant: ____

DOT License: ____ Accident Rpt. Kit: yes [ ] no [ ] Belt Decal: yes [ ] no [ ]

TABLE D-3. INCOMING VEHICLE INSPECTION.

Contractor: DYNAMIC SCIENCE, INC. Contract No.: DOT-HS-8-01942

VIN No.: 2H29K95311382 Make: Dodge

NHTSA No.: R&D (D.S. No.1093)

Year: 1979 Color: Silver/Red Model: Challenger

Auto Trans: yes [ ] no [ ]	Pwr Steering: yes [ ] no [X]	Seats: (front)	Bench:	
Pwr Brakes: yes [X] no [ ]	Auto Speed Cont: yes [ ] no [X]		Bucket: X	
Pwr Seats: yes [ ] no [X]	Anti Skid Brake: yes [ ] no [X]		Split Bench:	
Pwr Windows: yes [ ] no [X]	Air Conditioning: yes [X] no [ ]			
Tinted Glass: yes [X] no [ ]	Rear Window Def.: yes [X] no [ ]		Split Back Bench:	
Radio: yes [X] no [ ]	Brakes: drum: R disc: F			
Clock: yes [X] no [ ]				

Tire Size: 195/70R14 Ply Rating: 4 Mfg. & Line: B.F. Goodrich

Bias Ply: Belted: Steel Radial: X /Eng.HP: Cylinders: 4 Total Displ: 1600 cc.

Trans, # Fwd. Speeds: 5 Shipping Weight: Odometer: 348.1

Dealer (name, address, and phone number)
Riverside Chrysler Plymouth
7979 Auto Drive
Riverside, California

Remarks (list additional accessories not listed above)

Date of Manufacture 9/78

Date Received 7/28/80

Tilting Steering Wheel: Yes [X] No [ ]

Telescoping Steering Wheel Yes [ ] No [X]

Fuel Capacity: _____ Gallons
(from owner's manual)

"Space Saver" Spare tire Yes [ ] No [X]

(Government Use Only)

NHTSA Req. No.: Purchase Team:

Date Purchased: Purchase Order No.: Purchase Price:

O.S.E.-NHTSA No.: Wholesale Price: Suggested Est. Price:

Photos: yes [ ] no [ ] Tax Exemption Cert. No.: Amount of Tax:

Wholesale Invoice: yes [ ] no [ ] Consumer Info: yes [ ] no [ ] Warranty Card: yes [ ] no [ ]

Cert. of Origin: yes [ ] no [ ] Date Mfg: Assy. Plant:

DOT License: Accident Rpt. Kit: yes [ ] no [ ] Belt Decal: yes [ ] no [ ]

APPENDIX E

PRE- AND POST-TEST DUMMY CALIBRATIONS

PART 572 DUMMY CALIBRATION TEST DATA

NHTSA Dummy I.D. No.: A 0 8 Driver - RSV M5-11

Laboratory Technician: Rex Bishop

Inst. Engineer: David Hyatt

		Pre-test Calibration	Post-test Calibration*
Date of Dummy Calibration		6/20/80	9/18/80
Calibration Sequential Number for Dummy		32	33
Temperature in Lab. (Spec. = 66 to 78 °F)		73	72
Relative Humidity in Lab. (Spec. = 10 to 70%)			48
Test Parameter	**Specification**		
1. Head Drop Test:			
a. Peak Resultant Accel	210 - 260G	228.06	224.62
b. Peak Lateral Accel	$\leq$ 10G	6.26	3.10
c. Time above 100G (Resultant)	0.9 - 1.5 ms	1.45	1.25
2. Neck Bending Test:			
a. Pendulum Speed	21.5 - 25.5 fps	21.87	22.45
b. Pendulum Avg Decel (over $t_3 - t_2$)	20 - 24G	23.70	22.71
c. Peak Resultant Head Acceleration	26G Maximum	23.76	20.90
d. Pendulum Decel ($t_2 - t_1$)	$\leq$ 3 ms	2.00	2.00
e. Pendulum Decel ($t_3 - t_2$)	25 - 30 ms	26.50	26.00
f. Pendulum Decel ($t_4 - t_3$)	$\leq$ 10 ms	3.25	6.00
g. Pendulum Direction Reversal Time		-	-
h. Maximum Head Rotation	63 to 73°	72.67	66.65
i. Chordal Displacement:			
Head Rotation Angle			
0° Time	-2.0 -+2 ms	0	0
0° Displ	-0.5 - 0.5 in.	0	0
30° Time	25.6 - 34.4 ms	31.50	27.50
30° Displ	2.1 - 3.1 in.	2.30	2.43
60° Time	40.3 - 51.7 ms	47.75	45.00
60° Displ	4.3 - 5.3 in.	4.45	4.40
Maximum (73°) Time	53.2 - 66.8 ms	65.25	60.00
Maximum (73°) Displ	5.0 - 6.0 in.	5.27	4.97

PART 572 DUMMY CALIBRATION TEST DATA (CONTINUED)

NHTSA Dummy I.D. No.: A 0 8

Test Parameter		Specification	Pre-test Calibration	Post-test Calibration
2. Neck Bending Test: (Continued)				
Head Rotation Angle				
60°	Time	67.0 - 83.0 ms	80.75	73.00
	Displ	4.3 - 5.3 in.	4.45	4.24
30°	Time	85.4 - 104.6 ms	98.75	89.00
	Displ	2.1 - 3.1 in.	2.29	2.20
0°	Time	101.0 - 123.0 ms	112.25	102.50
	Displ	-0.5 - 0.5 in.	0.0	0.00
3. Abdominal Compression Test: (Preload = 10 pounds)				
a. Force at 0.5 in.		14 - 26 lb	18.52	18.50
b. Force at 0.75 in.		27 - 40 lb	28.36	28.90
c. Force at 1.0 in.		40 - 53 lb	42.25	42.80
d. Force at 1.3 in.		63 - 78 lb	63.67	64.80
4. Lumbar Flexion Test:				
a. Force at 20°		22 - 34 lb	27.78	26.60
b. Force at 30°		34 - 46 lb	43.99	42.80
c. Force at 40°		46 - 58 lb	46.88	48.00
d. Return Angle		12° Maximum	3.60	1.80
5. Chest Impact Tests:				
a. High Speed				
1) Probe Speed		21.78-22.22 fps	22.13	22.04
2) Peak Deflection		1.7 in. Maximum	1.549	1.539
3) Peak Resistive Force		2250 lb Maximum	1769.15	2066.39
4) Internal Hysteresis		50 - 70%	60.60	63.40
a. Low Speed				
1) Probe Speed		13.86-14.14 fps	13.92	13.98
2) Peak Deflection		1.1 in. Maximum	1.032	1.072
3) Peak Resistive Force		1450 lb Maximum	1089.61	1333.99
4) Internal Hysteresis		50 - 70%	67.40	61.60

PART 572 DUMMY CALIBRATION TEST DATA (CONTINUED)

NHTSA Dummy I.D. No.: A 0 8

Test Parameter	Specification	Pre-test Calibration	Post-test Calibration
6. Knee Impact Tests:			
a. Right Side			
1) Probe Speed	6.76 - 7.04 fps	6.84	6.87
2) Maximum Force	1850 - 2500 lb	2136.96	2136.55
3) Time >1000 lb	1.7 ms Minimum	1.95	1.90
a. Left Side			
1) Probe Speed	6.76 - 7.04 fps	6.84	6.86
2) Maximum Force	1850 - 2500 lb	2389.14	2270.66
3) Time >1000 lb	1.7 ms Minimum	1.90	2.00

PART 572 DUMMY CALIBRATION TEST DATA

NHTSA Dummy I.D. No.: A 0 9 Driver - RSV M5-11

Laboratory Technician: Rex Bishop

Inst. Engineer: David Hyatt

		Pre-test Calibration	Post-test Calibration*
Date of Dummy Calibration		6/20/80	9/18/80
Calibration Sequential Number for Dummy		30	31
Temperature in Lab. (Spec. = 66 to 78 °F)		73	72
Relative Humidity in Lab. (Spec. = 10 to 70%)			48
Test Parameter	**Specification**		
1. Head Drop Test:			
a. Peak Resultant Accel	210 - 260G	251.10	230.20
b. Peak Lateral Accel	$\leq$ 10G	8.34	7.70
c. Time above 100G (Resultant)	0.9 - 1.5 ms	1.25	1.20
2. Neck Bending Test:			
a. Pendulum Speed	21.5 - 25.5 fps	22.21	22.40
b. Pendulum Avg Decel (over $t_3 - t_2$)	20 - 24G	22.77	22.40
c. Peak Resultant Head Acceleration	26G Maximum	21.03	20.00
d. Pendulum Decel ($t_2 - t_1$)	$\leq$ 3 ms	2.00	2.50
e. Pendulum Decel ($t_3 - t_2$)	25 - 30 ms	28.50	28.00
f. Pendulum Decel ($t_4 - t_3$)	$\leq$ 10 ms	3.75	4.00
g. Pendulum Direction Reversal Time		-	-
h. Maximum Head Rotation	63 to 73°	72.77	71.84
i. Chordal Displacement:			
Head Rotation Angle			
0° Time	-2 - 2 ms	0	0
0° Displ	-0.5 - 0.5 in.	0	0
30° Time	25.6 - 34.4 ms	30.25	26.70
30° Displ	2.1 - 3.1 in.	2.31	2.50
60° Time	40.3 - 51.7 ms	47.75	43.70
60° Displ	4.3 - 5.3 in.	4.44	4.42
Maximum (73°) Time	53.2 - 66.8 ms	63.00	60.00
Maximum (73°) Displ	5.0 - 6.0 in.	5.29	5.06

PART 572 DUMMY CALIBRATION TEST DATA (CONTINUED)

NHTSA Dummy I.D. No.: A 0 9

Test Parameter		Specification	Pre-test Calibration	Post-test Calibration
2. Neck Bending Test: (Continued)				
Head Rotation Angle				
60°	Time	67.0 - 83.0 ms	81.50	76.30
	Displ	4.3 - 5.3 in.	4.45	4.60
30°	Time	85.4 - 104.6 ms	98.00	90.10
	Displ	2.1 - 3.1 in.	2.30	2.30
0°	Time	101.0 - 123.0 ms	113.75	104.00
	Displ	-0.5 - 0.5 in.	0.0	0.00
3. Abdominal Compression Test: (Preload = 10 pounds)				
a. Force at 0.5 in.		14 - 26 lb	20.26	18.52
b. Force at 0.75 in.		27 - 40 lb	31.26	28.94
c. Force at 1.0 in.		40 - 53 lb	49.20	42.83
d. Force at 1.3 in.		63 - 78 lb	76.40	67.14
4. Lumbar Flexion Test:				
a. Force at 20°		22 - 34 lb	26.62	28.40
b. Force at 30°		34 - 46 lb	39.94	41.70
c. Force at 40°		46 - 58 lb	48.62	50.40
d. Return Angle		12° Maximum	7.61	3.10
5. Chest Impact Tests:				
a. High Speed				
1) Probe Speed		21.78-22.22 fps	21.97	22.01
2) Peak Deflection		1.7 in. Maximum	1.644	1.495
3) Peak Resistive Force		2250 lb Maximum	1581.69	2014.08
4) Internal Hysteresis		50 - 70%	59.40	65.87
a. Low Speed				
1) Probe Speed		13.86-14.14 fps	13.95	13.99
2) Peak Deflection		1.1 in. Maximum	1.097	0.954
3) Peak Resistive Force		1450 lb Maximum	1031.03	1347.08
4) Internal Hysteresis		50 - 70%	59.10	62.30

PART 572 DUMMY CALIBRATION TEST DATA (CONTINUED)

NHTSA Dummy I.D. No.: A 0 9

Test Parameter	Specification	Pre-test Calibration	Post-test Calibration
6. Knee Impact Tests:		30	31
a. Right Side			
1) Probe Speed	6.76 - 7.04 fps	6.83	6.86
2) Maximum Force	1850 - 2500 lb	1869.84	2091.60
3) Time >1000 lb	1.7 ms Minimum	2.15	1.80
a. Left Side			
1) Probe Speed	6.76 - 7.04 fps	6.97	6.86
2) Maximum Force	1850 - 2500 lb	2043.34	1853.60
3) Time >1000 lb	1.7 ms Minimum	2.10	2.00

PART 572 DUMMY CALIBRATION TEST DATA

NHTSA Dummy I.D. No.: 8 1 4 Driver - Dodge Challenger

Laboratory Technician: Rex Bishop

Inst. Engineer: Vinit Agnihotri

		Pre-test Calibration	Post-test Calibration*
Date of Dummy Calibration		8/06/80	9/12/80
Calibration Sequential Number for Dummy		1	2
Temperature in Lab. (Spec. = 66 to 78 °F)		75	72
Relative Humidity in Lab. (Spec. = 10 to 70%)		48	50
Test Parameter	**Specification**		
1. Head Drop Test:			
a. Peak Resultant Accel	210 - 260G	213.40	238.20
b. Peak Lateral Accel	$\leq$ 10G	7.70	5.40
c. Time above 100G (Resultant)	0.9 - 1.5 ms	1.25	1.25
2. Neck Bending Test:			
a. Pendulum Speed	21.5 - 25.5 fps	21.91	21.90
b. Pendulum Avg Decel (over $t_3 - t_2$)	20 - 24G	21.40	21.80
c. Peak Resultant Head Acceleration	26G Maximum	21.30	20.70
d. Pendulum Decel ($t_2 - t_1$)	$\leq$ 3 ms	2.50	2.00
e. Pendulum Decel ($t_3 - t_2$)	25 - 30 ms	25.00	26.00
f. Pendulum Decel ($t_4 - t_3$)	$\leq$ 10 ms	6.50	6.00
g. Pendulum Direction Reversal Time		-	-
h. Maximum Head Rotation	63 to 73°	71.80	71.60
i. Chordal Displacement:			
Head Rotation Angle			
0° Time	-2 - 2 ms	0	0
0° Displ	-0.5 - 0.5 in.	0	0
30° Time	25.6 - 34.4 ms	30.00	28.00
30° Displ	2.1 - 3.1 in.	2.42	2.30
60° Time	40.3 - 51.7 ms	48.00	45.00
60° Displ	4.3 - 5.3 in.	4.67	4.45
Maximum (73°) Time	53.2 - 66.8 ms	66.00	60.00
Maximum (73°) Displ	5.0 - 6.0 in.	5.52	5.17

PART 572 DUMMY CALIBRATION TEST DATA (CONTINUED)

NHTSA Dummy I.D. No.: 8 1 4

Test Parameter		Specification	Pre-test Calibration	Post-test Calibration
2. Neck Bending Test: (Continued)				
Head Rotation Angle				
60°	Time	67.0 - 83.0 ms	82.00	78.0
	Displ	4.3 - 5.3 in.	4.66	4.43
30°	Time	85.4 - 104.6 ms	102.00	95.0
	Displ	2.1 - 3.1 in.	2.41	2.29
0°	Time	101.0 - 123.0 ms	118.00	110.00
	Displ	-0.5 - 0.5 in.	0.00	0.00
3. Abdominal Compression Test: (Preload = 10 pounds)				
a. Force at 0.5 in.		14 - 26 lb	20.80	22.60
b. Force at 0.75 in.		27 - 40 lb	34.20	40.00
c. Force at 1.0 in.		40 - 53 lb	52.00	61.00
d. Force at 1.3 in.		63 - 78 lb	78.10	93.00
4. Lumbar Flexion Test:				
a. Force at 20°		22 - 34 lb	28.90	28.90
b. Force at 30°		34 - 46 lb	43.40	38.80
c. Force at 40°		46 - 58 lb	50.90	46.30
d. Return Angle		12° Maximum	7.00	5.00
5. Chest Impact Tests:				
a. High Speed				
1) Probe Speed		21.78-22.22 fps	22.00	21.96
2) Peak Deflection		1.7 in. Maximum	1.645	1.744
3) Peak Resistive Force		2250 lb Maximum	1961.80	1909.50
4) Internal Hysteresis		50 - 70%	59.90	56.50
a. Low Speed				
1) Probe Speed		13.86-14.14 fps	13.96	13.97
2) Peak Deflection		1.1 in. Maximum	1.025	1.185
3) Peak Resistive Force		1450 lb Maximum	1307.80	1307.80
4) Internal Hysteresis		50 - 70%	60.65	60.30

PART 572 DUMMY CALIBRATION TEST DATA (CONTINUED)

NHTSA Dummy I.D. No.: 8 1 4

Test Parameter	Specification	Pre-test Calibration	Post-test Calibration
6. Knee Impact Tests:			
a. Right Side			
1) Probe Speed	6.76 - 7.04 fps	6.84	6.80
2) Maximum Force	1850 - 2500 lb	2230.80	2284.80
3) Time >1000 lb	1.7 ms Minimum	1.75	1.75
a. Left Side			
1) Probe Speed	6.76 - 7.04 fps	6.84	6.84
2) Maximum Force	1850 - 2500 lb	2352.70	2234.80
3) Time >1000 lb	1.7 ms Minimum	1.75	1.75

PART 572 DUMMY CALIBRATION TEST DATA

NHTSA Dummy I.D. No.: A 0 4 Passenger - Dodge Challenger

Laboratory Technician: Rex Bishop

Inst. Engineer: David Hyatt

		Pre-test Calibration	Post-test Calibration*
Date of Dummy Calibration		6/05/80	9/12/80
Calibration Sequential Number for Dummy		17	18
Temperature in Lab. (Spec. = 66 to 78 °F)		72	76
Relative Humidity in Lab. (Spec. = 10 to 70%)			52
Test Parameter	**Specification**		
1. Head Drop Test:			
a. Peak Resultant Accel	210 - 260G	257.71	268.50
b. Peak Lateral Accel	$\leq$ 10G	3.96	3.10
c. Time above 100G (Resultant)	0.9 - 1.5 ms	1.50	1.00
2. Neck Bending Test:			
a. Pendulum Speed	21.5 - 25.5 fps	21.90	21.65
b. Pendulum Avg Decel (over $t_3 - t_2$)	20 - 24G	23.31	22.40
c. Peak Resultant Head Acceleration	26G Maximum	20.12	21.30
d. Pendulum Decel ($t_2 - t_1$)	$\leq$ 3 ms	2.10	2.00
e. Pendulum Decel ($t_3 - t_2$)	25 - 30 ms	29.60	26.00
f. Pendulum Decel ($t_4 - t_3$)	$\leq$ 10 ms	3.20	5.00
g. Pendulum Direction Reversal Time		-	-
h. Maximum Head Rotation	63 to 73°	72.14	70.00
i. Chordal Displacement:			
Head Rotation Angle			
0° Time	-2 - 2 ms	0	0
0° Displ	-0.5 - 0.5 in.	0	0
30° Time	25.6 - 34.4 ms	30.75	29.00
30° Displ	2.1 - 3.1 in.	2.38	2.46
60° Time	40.3 - 51.7 ms	49.75	45.00
60° Displ	4.3 - 5.3 in.	4.58	4.69
Maximum (73°) Time	53.2 - 66.8 ms	63.00	61.00
Maximum (73°) Displ	5.0 - 6.0 in.	5.40	5.43

PART 572 DUMMY CALIBRATION TEST DATA (CONTINUED)

NHTSA Dummy I.D. No.: A 0 4

Test Parameter		Specification	Pre-test Calibration	Post-test Calibration
2. Neck Bending Test: (Continued)				
Head Rotation Angle				
60°	Time	67.0 - 83.0 ms	80.75	74.00
	Displ	4.3 - 5.3 in.	4.57	4.68
30°	Time	85.4 - 104.6 ms	100.75	91.00
	Displ	2.1 - 3.1 in.	2.36	2.44
0°	Time	101.0 - 123.0 ms	109.50	108.00
	Displ	-0.5 - 0.5 in.	0.00	0.00
3. Abdominal Compression Test: (Preload = 10 pounds)				
a. Force at 0.5 in.		14 - 26 lb	21.99	22.60
b. Force at 0.75 in.		27 - 40 lb	34.73	35.90
c. Force at 1.0 in.		40 - 53 lb	50.93	52.10
d. Force at 1.3 in.		63 - 78 lb	74.09	73.00
4. Lumbar Flexion Test:				
a. Force at 20°		22 - 34 lb	28.94	27.80
b. Force at 30°		34 - 46 lb	42.83	38.20
c. Force at 40°		46 - 58 lb	51.51	40.50
d. Return Angle		12° Maximum	6.70	6.10
5. Chest Impact Tests:				
a. High Speed				
1) Probe Speed		21.78-22.22 fps	22.03	21.91
2) Peak Deflection		1.7 in. Maximum	1.663	1.603
3) Peak Resistive Force		2250 lb Maximum	1546.55	1883.30
4) Internal Hysteresis		50 - 70%	64.8	63.80
a. Low Speed				
1) Probe Speed		13.86-14.14 fps	13.88	13.92
2) Peak Deflection		1.1 in. Maximum	1.034	1.092
3) Peak Resistive Force		1450 lb Maximum	1066.18	1307.80
4) Internal Hysteresis		50 - 70%	64.00	63.13

PART 572 DUMMY CALIBRATION TEST DATA (CONTINUED)

NHTSA Dummy I.D. No.: A 0 4

Test Parameter	Specification	Pre-test Calibration	Post-test Calibration
6. Knee Impact Tests:			
a. Right Side			
1) Probe Speed	6.76 - 7.04 fps	6.85	6.84
2) Maximum Force	1850 - 2500 lb	2136.96	1877.90
3) Time >1000 lb	1.7 ms Minimum	1.50	2.00
a. Left Side			
1) Probe Speed	6.76 - 7.04 fps	6.86	6.84
2) Maximum Force	1850 - 2500 lb	1917.60	1910.90
3) Time >1000 lb	1.7 ms Minimum	1.85	1.75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